Stantec

Report of Geotechnical Exploration

Dry Fly Ash Stack and Gypsum Disposal Complex
Cumberland Fossil Plant
Stewart County, Tennessee

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Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

June, 2010

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June 11, 2010
File: 175539009R01

Mr. Michael. S. Turnbow
Tennessee Valley Authority
1101 Market Street, LP 2G-C
Chattanooga, Tennessee 37402-2801

Re: Report of Geotechnical Exploration
Dry Fly Ash Stack and Gypsum Disposal Complex
Cumberland Fossil Plant
Stewart County, Tennessee

Dear Mr. Turnbow:

Stantec Consulting Services Inc. (Stantec) has completed a geotechnical exploration of the Dry Fly Ash Stack and Gypsum Disposal Complex at the Cumberland Fossil Plant. Our final report includes discussions of general site conditions, scope of work performed, subsurface conditions, and results of laboratory testing and our engineering analyses. The report also includes a review of historical documentation provided by TVA, and our conclusions and recommendations relative to future use of the facility. These services were performed under Engineering Service Request ESR/TAO 700 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, please contact our office.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Daniel B. Rogers lfb

Daniel B. Rogers, PE
Project Engineer

Stan A. Harris

Stan A. Harris, PE
Principal

/lfb

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Executive Summary

Stantec Consulting Services Inc. (Stantec) has completed a Geotechnical Exploration of the Dry Fly Ash Stack and Gypsum Disposal Complex at Cumberland Fossil Plant. This study was performed to evaluate slope stability and seepage for existing conditions of the disposal areas and surrounding dikes.

Background Information

The Gypsum Disposal Complex is approximately 100 acres in area. It was constructed in 1995-1996 over Area No.1, which was the original ash pond. Approximately 1,000,000 tons of gypsum is produced each year. Roughly, 75 percent of the gypsum is marketed to the adjacent wallboard company and the remaining 25 percent is sent to the Gypsum Disposal Complex. The complex is formed by a series of earth dikes around its perimeter and an upper gypsum dike. The total height of the facility is approximately 50 feet. Dike slopes generally vary from 2H:1V to 3H:1V.

TVA has classified the Gypsum Disposal Complex as a "high hazard" facility due to the consequences of failure relative to potential damage to the adjoining wallboard plant. Currently, Stantec and TVA are in the early stages of preparing a 5 to 7 year operation plan for the facility while a new dry disposal facility is being designed, permitted and constructed. Modifications being considered include constructing two small lined ponds on top of the gypsum stack and significantly reducing the amount of water which could be impounded.

A small landslide occurred on the facility in 2005 and temporary stabilization measures were implemented by TVA. Stantec has developed construction drawings for permanent repairs, which include the construction of a seepage collection system and the placement of a more substantial rock buttress. Other historical geotechnical issues on the gypsum disposal complex include seepage at various locations around the stack. Since May 2009, TVA has not been sending gypsum sluice to the stack except when the dewatering plant experiences outages.

The Dry Fly Ash stack is approximately 110 acres in size. It is also built over the original ash pond. Its current height is about 35 feet and slopes generally vary from 2.5H:1V to 3H:1V. A small dredge cell within the Dry Fly Ash Stack was filled with dredged coal fines from the Coal Yard Drainage Basin in 2007. Stantec performed an analysis of this area in early 2009 and concluded that is presence would not have a detrimental effect on the long-term stability of the stack. It was recommended that TVA excavate parallel trenches across the area and backfill the trenches with more permeable bottom ash. This work was completed on April 24, 2009.

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. The exploration consisted of drilling soil test/sample borings at 74 locations and advancing cone penetrometer test borings at 17 locations. Piezometers were installed at 19 locations and slope inclinometer casings at eight locations. Drilling locations were positioned along fifteen cross sections around the Dry Fly Ash Stack and the Gypsum Disposal Complex. Laboratory testing included moisture content, classification, permeability and shear strength testing to establish key index properties and strength parameters.

Results of Exploration and Engineering Analyses

Thirteen primary soil horizons were identified from the field and laboratory program. These primary horizons generally fall into one of three categories: 1) natural foundation soils, which included alluvial clay and alluvial sands and gravels, 2) dikes constructed with natural clays and varying amounts of gravel, and 3) coal combustion byproducts including fly ash, bottom ash and gypsum.

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 conditions since the dikes have been in their current configuration for a long time. Analyses were performed on fifteen sections. Factors of safety for slope stability were computed using Spencer's method of analysis, optimized curved failure surfaces, and search routines that help to identify the critical (minimum factor of safety) failure surface. The slope stability models were evaluated using phreatic surfaces based on piezometric readings and field observations. In their new Master Programmatic Document, TVA has adopted a minimum target factor of safety of 1.5 against slope failure based on U. S. Army Corps of Engineers (USACE) criteria. Factors of safety ranged from approximately 1.0 to 2.5. Lower than acceptable values were determined for eight of the fifteen sections analyzed. For the most part, the lower factors of safety correspond to sloughing shallow disturbance, not massive dike failures.

Selected cross sections were also analyzed for short-term (undrained) conditions. Acceptable factors of safety were obtained for these analyses. Furthermore, undrained analyses were performed for future increases in stack heights. These analyses were performed assuming instantaneous loading of the stack and no pore pressure dissipation. Acceptable results were obtained for the Gypsum Stack. The analyses for the Dry Ash Stack indicate that 12.5 to 20.0 feet of material can be placed quickly before FS values fall below acceptable levels.

Conclusions and Recommendations

Work Plans should be developed to improve the long-term slope stability factor of safety at Sections A, B and F on the Dry Ash Stack. Re-grading only is needed at Sections A and B. At Section F, a toe buttress and slope flattening are needed.

A Work Plan has been developed for slope repair at Section H of the Gypsum Disposal Complex. This Work Plan has been issued for construction and should be implemented as soon as practical.

A Work Plan should be developed to construct toe buttresses below the bottom ash road dike around the Gypsum Disposal Complex. This work should be coordinated with re-grading of the perimeter ditch system to promote improved surface drainage and reduce ponding of water.

Stantec recommends that full time sluicing of gypsum slurry to the Gypsum Disposal Complex not be resumed until lined ponds are constructed on top of the stack. These lined ponds will prevent the sluice water from infiltrating the stack.

A study should be performed of the Dry Ash Stack to determine if it is in full compliance with the existing permit. If not, a study should be performed to determine if it would be preferable to redesign the stack or to re-grade it so that it is in compliance.

Additional piezometers are recommended for the Dry Ash Stack to provide for better definition of phreatic levels and to monitor pore pressures during future fill placement.

Fill material should not be placed over phragmites or other vegetation. Fine ash or gypsum dipped from ponds should not be placed near the toe of slopes or concentrated at any one location. Fines should be dispersed evenly across the interior of the active stacks and not be placed near the edges.

Operations and Maintenance Manuals should be developed or updated for each facility. Elements of a maintenance program should include elimination of animal burrows, a mowing program, repair of erosion areas and a regular inspection program. A program should be established to develop record (as-built) drawings and construction records for future maintenance and construction activities.

An instrumentation program should be developed for the site. The program should include regular collection and analysis of various data including phreatic levels, rainfall and slope movements.

Report of Geotechnical Exploration

Dry Fly Ash Stack and Gypsum Disposal Complex
Cumberland Fossil Plant
Stewart County, Tennessee

1. Introduction

1.1. General

Tennessee Valley Authority (TVA) retained Stantec Consulting Services Inc. (Stantec) to perform facility assessments at eleven (11) active and one inactive (closed) electricity-generating fossil plants. Specifically, Stantec was requested to assess the coal combustion product (CCP) disposal facilities at these generating plants. In general, the facilities consisted of ash ponds, scrubber sludge (gypsum) ponds, wet ash dredge cells, dry ash stacks and gypsum stacks. A number of facilities were abandoned (having completed their design life), while a majority of them were actively receiving combustion by-products at the time of this project.

1.2. Facilities Assessment Project

Stantec's scope of work for the facilities assessment project is divided into four main phases, with Phase 1 divided into two sub-phases, 1A and 1B. Brief descriptions of Stantec's scope of work for each phase are presented in the following paragraphs.

- Phase 1A – Review most recent TVA inspection reports, observe critical disposal features while accompanied by TVA personnel, develop a list of primary concerns and recommend immediate action or engineering assessment as considered necessary.

- Phase 1B – Review available historical documentation, re-visit sites for more detailed observations and measurements, complete dam safety checklists adapted from standard dam safety protocols, recommend immediate action as judged necessary and recommend sites/features that should undergo further evaluation.

- Phase 2 – Evaluate TVA facilities based on current dam safety criteria adopted by the state in which the plant is located, conduct geotechnical explorations and engineering analyses at sites recommended in Phase 1B, and complete conceptual and final repair designs and budget level costs estimates.

- Phase 3 – Design repairs for sites recommended in Phase 2 and prepare construction plans and specifications as well as permit/planning documents.

- Phase 4 – Provide dam safety training for TVA staff and prepare operation manuals.

At the time of this report, Phase 1 of the assessment is complete. Phase 2 is being implemented at several facilities located within the different plants. The Phase 1 report recommended that Phase 2 evaluations include geotechnical explorations and hydraulic/hydrologic assessments. This document reports the results of a geotechnical exploration of the Dry Ash and Gypsum Stacking Facility within the Cumberland Fossil Plant.

2. Cumberland Fossil Plant

2.1. Location

The Cumberland Fossil Plant (CUF) is located in western Tennessee west-southwest of Clarksville, Tennessee on the south shore of Barkley Reservoir. The plant is adjacent to the town of Cumberland City, Tennessee. The plant can be accessed by state Highway 233, which connects to TVA-owned roads.

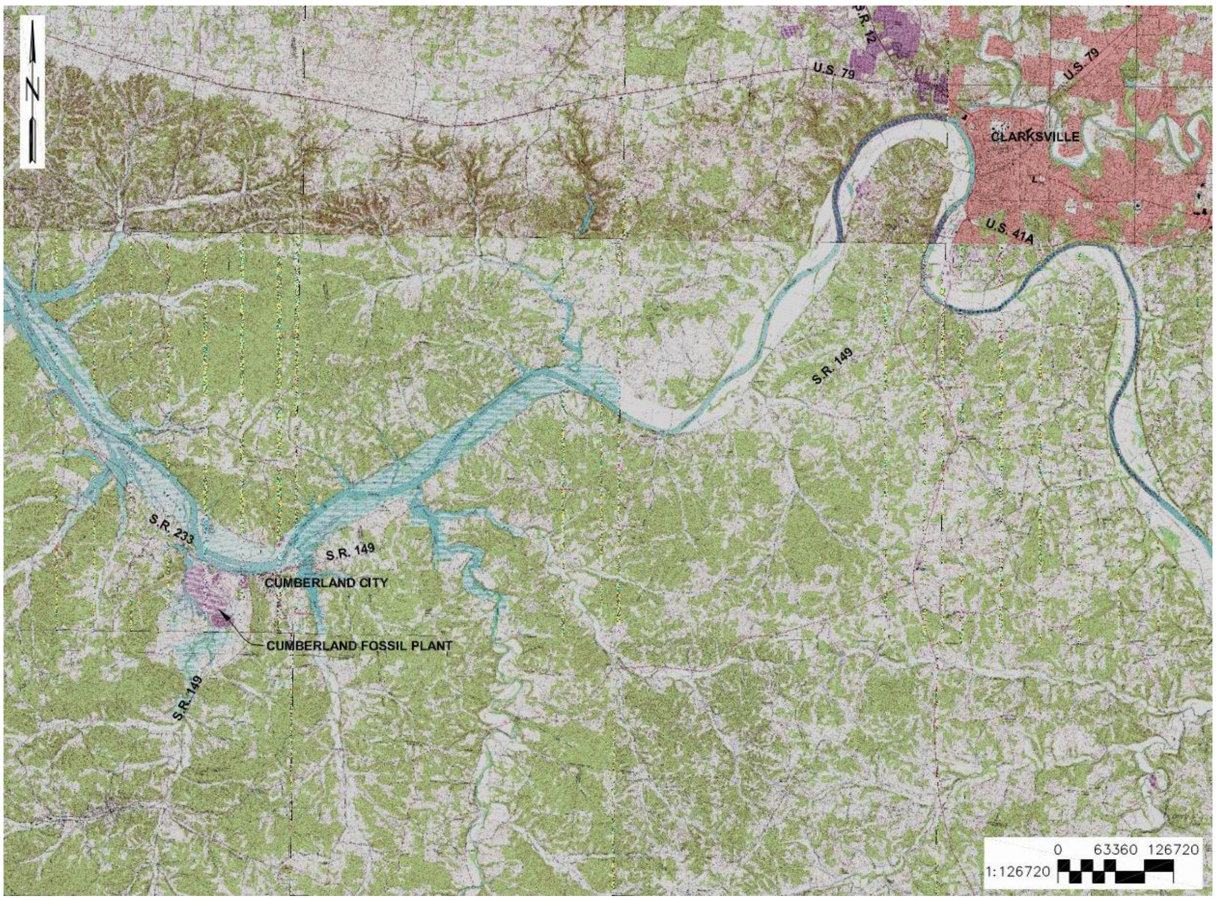


Figure 1. Portions of 7 ½-minute U.S.G.S. topographic maps (Cumberland City and Clarksville quadrangles) showing the vicinity of the Cumberland Fossil Plant near Cumberland City.

2.2. Power Generation

Cumberland Fossil Plant has two coal-fired generating units. The plant was constructed between 1968 and 1973. The winter net dependable generating capacity is about 2,530 megawatts. The plant consumes approximately 20,000 tons of coal a day and produces roughly 750,000 tons of combustion byproducts in the forms of fly ash and bottom ash each year.

Sulfur dioxide scrubbers for both coal-fired generating units were installed in 1994. The process generates a synthetic gypsum byproduct. Approximately 1,000,000 tons of gypsum is produced each year, depending upon the actual amount of coal burned. The gypsum is marketed as a building material.

2.3. Previous Work Plans

Three work plans have been issued by Stantec during Phase 1 work. The first plan was issued March 16, 2009 for the Bottom Ash Stack and Bottom Ash Drains (TVA Reference No. CUF-WP-090316). It was completed April 24, 2009. The second work plan was also issued March 16, 2009 for Gypsum Stack – Slurry Outfall Routing (TVA Reference No. CUF-LT-090316). It was completed May 11, 2009. The third was issued August 12, 2009 for Gypsum Stack – South Cell B Temporary Grading (TVA Reference No. CUF-WP-090812). It was completed on August 17, 2009.

3. Dry Fly Ash Stack and Gypsum Disposal Complex

3.1. General

The Dry Fly Ash Stack and Gypsum Disposal Complex are located in the southern and southwestern areas of the plant (see Figure 2). They consist of above-ground cellular systems for dry fly ash, sluiced bottom ash and sluiced gypsum disposal. The facilities cover approximately 340 acres. The facility also includes the Retention (Ash) Pond and the Stilling Pond. The Gypsum Complex consists of the North Cell and South Cell separated by the Divider Dike. A settling pond (also known as the Duck Pond) exists at the west end of the Divider Dike. A general layout of the waste disposal areas is shown in Figure 3.

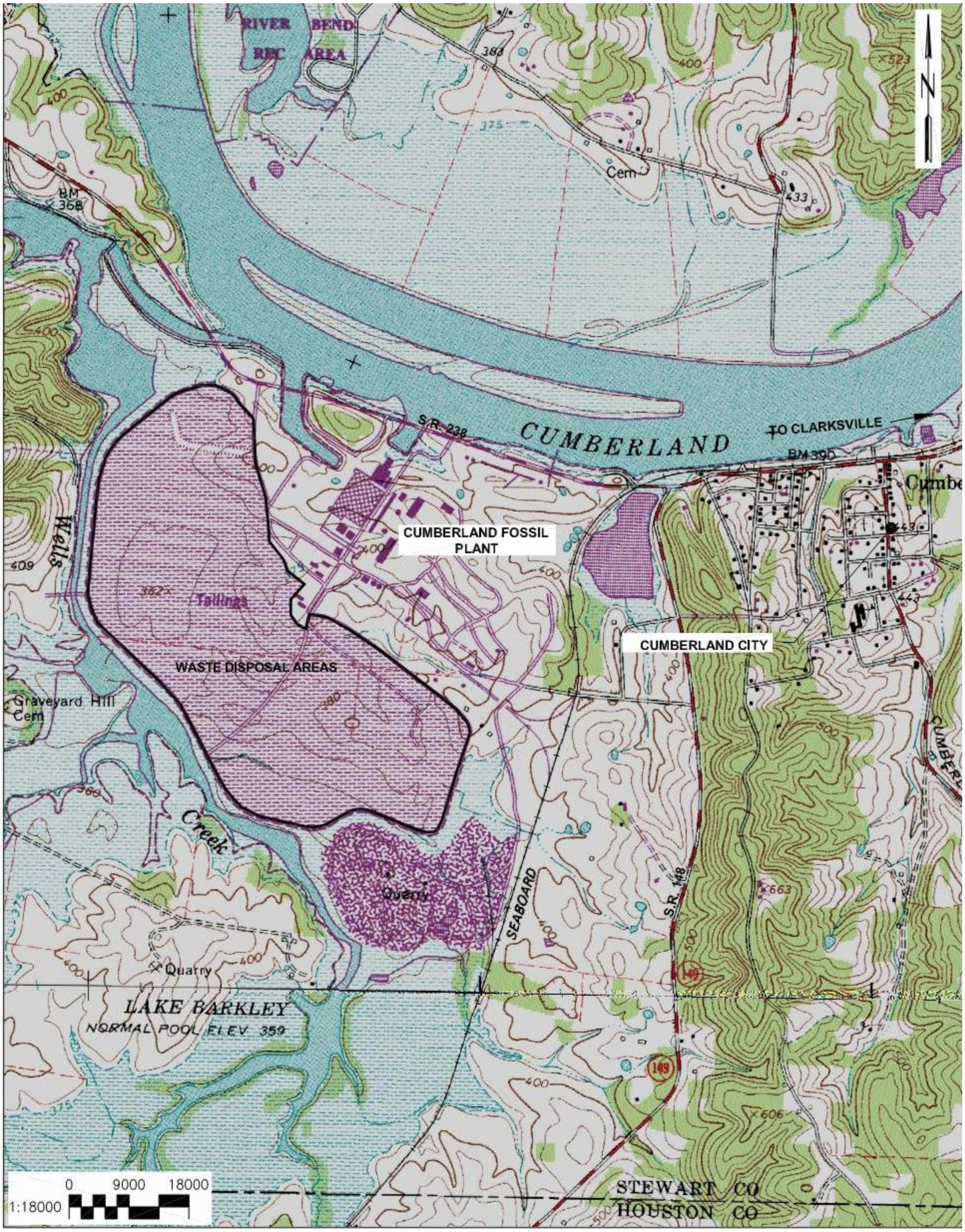


Figure 2. Portion of 7 ½-minute U.S.G.S. topographic map (Cumberland City quadrangle) showing Cumberland Fossil Plant.

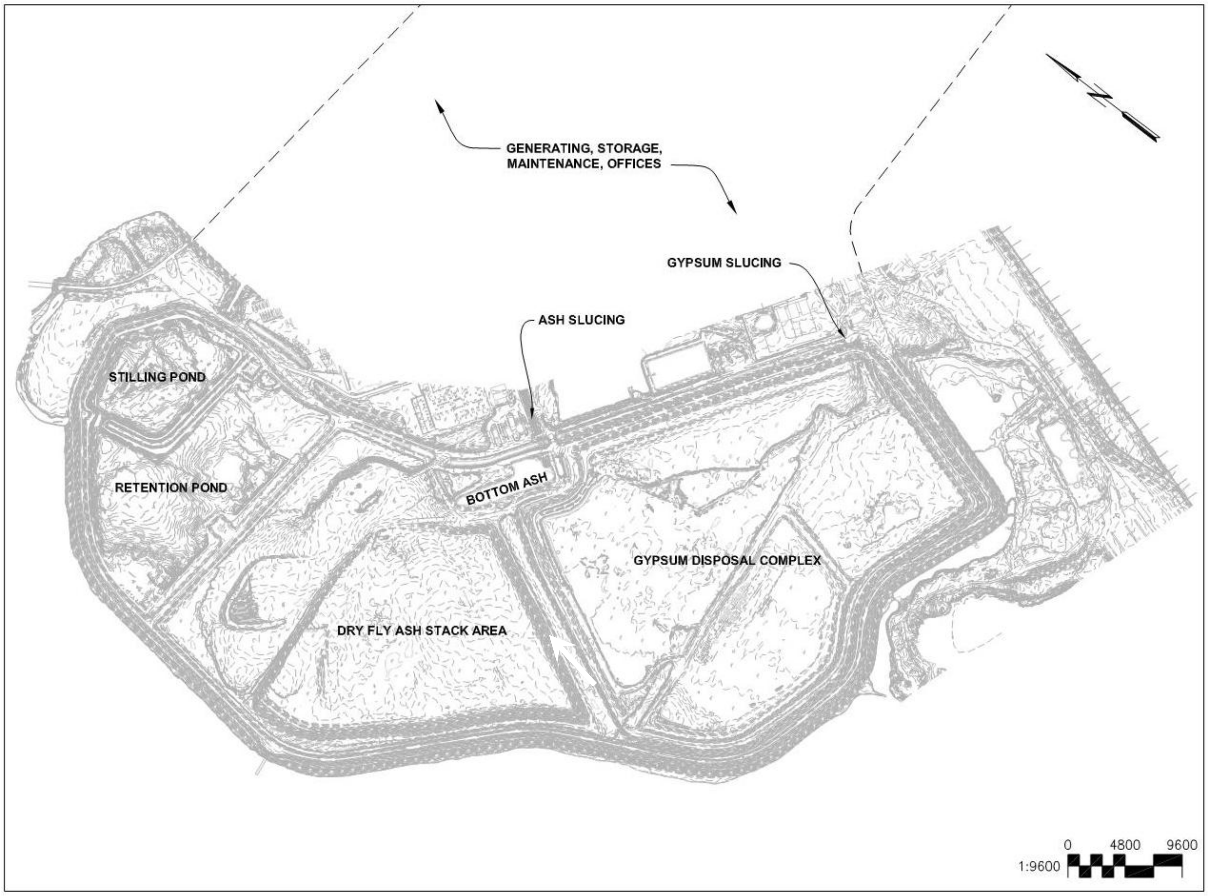


Figure 3. General layout of the Cumberland Fossil Plant showing the Dry Fly Ash Stack and Gypsum Disposal Complex

The entire CCP disposal area was originally constructed in 1969 as one large ash pond. Wells Creek was relocated in order to construct what was initially known as Disposal Area 1. Area 1 was located within the perimeter dikes that now include a majority of the current ash and gypsum disposal areas. In 1977, the divider dike for the stilling pond to the north (interior divider dike) was constructed. In 1979, the dikes around the Ash Pond were raised to elevation 395 feet with clay. In 1986, approximately 300 feet of the west portion of the divider dike between the Ash Pond and the Dry Ash Stack was constructed. In 1995-96, the current divider dike between the Ash Pond and Dry Stack was constructed (exterior divider dike) to form the current configuration. In 1996, stacking within the Dry Fly Ash Stack began. Appendix A contains a timeline of development of the disposal complex as well as a plan view that shows the locations of Area 1 and Area 2.

The gypsum storage area was constructed during 1995-96. It was built over Area No. 1, the original ash pond. The pond was constructed in several stages beginning with construction of a rock drainage blanket to collect and divert water away from the base. It is surrounded by a lower earth dike capped with bottom ash, and an upper gypsum dike. Table 1 presents key details of the Complex.

Table 1. Details of Complex

Item	Value
Original Construction Completed	1972
Scrubber Construction Completed	1994
Elevation of Initial Ash Dike	380 feet
Elevation of Perimeter Ash Dike	395 feet
Current Ash Stack Elevation	430 +/-feet
Planned Maximum Ash Elevation	600 feet
Elevation of Initial Gypsum Dike	380 feet
Elevation of Perimeter Gypsum Dike	395 feet
Current Gypsum Stack Elevation	418 +/-feet
Planned Maximum Height (Gypsum)	570 feet
Current Overall Dike Length	17,200 feet
Current Total Area	337 acres

3.2. Disposal Operations

The plant currently generates fly ash, bottom ash and synthetic gypsum wastes in addition to other Coal Combustion Products (CCPs) such as calcium silicate thermal insulation, boiler sandblasting residue, spent resin and activated alumina.

Scrubbers are installed on both generating units. According to the introduction of the current operations manual of the facility (Operations Manual, Dry Ash and Gypsum Stacking Facility, Permit IDL 81-102-0082, Tennessee Valley Authority Fossil Engineering Services, September 2003):

> Fly ash is collected in a dry state, conditioned with moisture and then spread and compacted. Bottom ash is sluiced to a processing area, reclaimed, and then placed on the ash stack. The gypsum is sluiced into the gypsum stack area. Gypsum can also be diverted at a valve station into the gypsum processing plant operated by Synthetic Materials, Inc (SynMat). SynMat dewaters gypsum slurry using vacuum filter presses and the filtrate is returned to the gypsum stack area where any remaining fines can settle. During unit outages SynMat may also reclaim gypsum from the gypsum stack area either by direct excavation and truck hauling or by dredging using a small portable hydraulic dredge.

TVA operates the gypsum disposal complex using the elevated rim ditching method. Dozers and excavators are used to construct rim ditches and to raise the perimeter gypsum dike. TVA augments the method with a riser and spillway decant system on the west end of the gypsum disposal complex. Water is allowed to pool around the decant structure, then the clearest water at the top of the pool is captured with the riser pipe. The pipe spillway from the riser conveys water to a small settling pond where it then flows to the perimeter ditch and eventually to the retention and stilling ponds. The perimeter ditch collects runoff and seepage from both the gypsum disposal complex and the ash stacks.

Due to concerns about elevated piezometric levels in the Gypsum Stack and surrounding dikes, TVA elected to cease regular pumping of gypsum slurry to the gypsum stack in May,

2009. Since May, SynMat operates its gypsum processing plant full time. Dewatered gypsum is either conveyed to Temple Inland for use in dry wall production or stockpiled and later hauled by truck to the gypsum disposal area.

After the gypsum slurry from the plant scrubbers is screened at SynMat the resultant low-concentration mix of gypsum “fines” is pumped to a small collection pond adjacent to the existing bottom ash pond. The mix is allowed to settle and the gypsum is regularly excavated then trucked to the gypsum stacking area. “Rejects” or the unwanted fractions of the screening process from SynMat are also regularly trucked to the stacking area.

The only exceptions to the process described above are when the SynMat filter plant must shut down temporarily due to power outages or mechanical problems. At those times, the full gypsum slurry flow is diverted to the gypsum stack. Over the past six months, full gypsum slurry flow has been diverted to the stack on 70 occasions, for an average duration of approximately 1 hour each occasion.

4. Scope of Work

The scope of the geotechnical exploration was divided into the following tasks.

a. Review of Available Information

b. Review of General Site Geology

c. Subsurface Exploration

d. Field Instrumentation and Monitoring

e. Surveying

f. Laboratory Testing

g. Review of Existing Conditions and Previous Repairs

h. Engineering Analyses

i. Conceptual Design of Repairs

The work performed as part of these tasks is described in the following paragraphs

5. Review of Available Information

5.1. General

As part of the facilities assessment (Phase 1) project, Stantec reviewed documents provided by TVA pertaining to the waste disposal area.

5.2. Reviewed Documents

Below is a summary of the documents reviewed for the geotechnical exploration.

Table 2. List of Documents Reviewed for Geotechnical Exploration

Reference No. (1)	Document Name	Type of Document	Dated	Agency	TVA Reference No.
1	Ash Dike Raising, Borrow Areas B & D	Memo	June 16, 1981	TVA	CDB 81 0619 005
2	Ash Pond Pressure Grouting Records	Grouting Records	3/1991 – 8/1991	TVA	
3	Ash Pond Dikes - Chronological Events	Memo	January 17, 1992	TVA	N/A(2)
4	Recommendations for Stability Improvement	Letter	March 13, 1992	Law Engrg	N/A(2)
5	Evaluation of Water Resource Impacts from Proposed Disposal Facilities at CUF	Report	August, 1992	TVA & GeoTrans	WR28-2-46-106
6	Stacking Plan Scopes	Scope Memos	April 12, 2000	TVA	N/A(2)
7	Operations Manual	Manual	September, 2003	TVA	IDL811020082
8	Dry Ash and Gypsum Stacking Areas	Drawings	October 10, 2003	TVA	10W302-1 to 27
9	Wastewater Flow Schematic – NPDES Permit No. TN0005789	Schematic	May, 2005	TVA	N/A(2)
10	Project Updates	Memos	May, October, 2007	Geosyntec	N/A(2)
11	Report of Geotechnical Exploration, Gypsum Area Seepage Study	Report	May 1, 2007	Mactec	N/A(2)
12	Notebook of Kelly E. Evans: Gypsum Stack Seep Next to Ash Sluice Discharge	Notebook	November 5, 2008ff	TVA	N/A(2)
13	2009 Annual Inspection of Waste Disposal Areas(3)	Report	February 11, 2009	TVA	N/A(2)
14	Reports of Annual Waste Area Inspections	Reports	1972 - 2008	TVA	Various

(1) Presented as attachment in Appendix A
(2) TVA Reference Number Not Applicable
(3) Copies of annual reports received from TVA are not included with the report due to space constraints

Contained in Appendix A is a chronological list of geotechnical reports of explorations performed at the Cumberland Fossil Plant waste disposal area. The list was compiled during the review of TVA documents. A short summary of each item in Table 2 appears below.

Item No. 1 Ash Dike Raising, Borrow Areas B & D – This memo from the chief of the Construction Services Branch reports borrow area soil boring and laboratory soil testing results for soil used in raising the original perimeter dike of the ash disposal area.

Item No. 2 Ash Pond Pressure Grouting Records – Daily records of the pressure grouting of over 5,000 feet of the foundation of the ash pond dike in 1991.

Item No. 3 Ash Pond Dikes – Chronological Events – A brief history is given by K.W. Burnett, manager, Civil Section One, Fossil Engineering, of the ash pond dikes from construction in 1969 to the October, 1991 pressure grouting of the dike foundation in a memo to Gary Nuyt.

Item No. 4 Recommendations for Stability Improvements, Ash Pond Dike System – The letter from a consulting firm is an addendum to a 2003 geotechnical exploration they performed. Additional information was provided and more stability analyses were performed. Recommendations for increasing dike stability were also given in the letter.

Item No. 5 Evaluation of Water Resource Impacts from Proposed Disposal Facilities – The report states results of analyses performed to determine the impact of leachate generation from the waste disposal facilities on the water quality of the Cumberland River. A geologic buffer was also modeled to determine its effectiveness in minimizing leachate generation. Design alternatives for the gypsum complex, the dry ash stack and closure of the facilities were considered.

Item No. 6 Stacking Plan Scopes – This document outlines the preparations to be made in developing the dry ash stack and gypsum complex. Major scope items include: document preparation, exploration, dredging plan, sampling, analysis of stacking materials, cost estimation and scheduling.

Item No. 7 Operations Manual, Dry Ash and Gypsum Stacking Facility – The manual contains sections on site information, description of the solid waste, general site preparation, daily operations, surface water management and geologic buffer system. It also contains sections on the gas control system, groundwater monitoring, environmental protection, closure and post closure and quality assurance/quality control. Appendices contain specifications, calculations, studies, regulations, policies, and miscellaneous information.

Item No. 8 Dry Ash and Gypsum Stacking drawings. These drawings are for construction of the disposal facilities of the Flue Gas Desulfurization Retrofit Project of 2003. They show existing conditions, boring layout and the proposed construction in eight stages. Final grading, cross-sections and details are also shown in the drawings.

Item No. 9 Wastewater Flow Schematic for NPDES Permit No. TN0-005789 – This one-page schematic flow diagram shows amounts and sources of drainage and process water flows in millions of gallons per day. The schematic shows intake of 2096.877 MGD gallons with 2097.062 MGD flowing out to the Cumberland River.

Item No. 10 Project Updates – This document is a hard copy of a slideshow presented in May, 2007. Results of soil borings and groundwater monitoring program of 2006/2007 were presented. The results of stability and seepage analyses were also discussed. A design of remedial measures was proposed.

Item No. 11 Report of Geotechnical Exploration, Gypsum Area Seepage Study – This report contains findings from a geotechnical exploration conducted at a seepage area in the southwest corner of the gypsum complex in 2005. Boring, laboratory test and well installation results are discussed.

Item No. 12 Notebook of Kelly E. Evans: Gypsum Stack Seep Next to Ash Sluice Discharge - This volume includes field notes of observations and events of a seep observed in November/December, 2008. It also contains messages, action lists, photographs and drawings. The results of slope stability analyses are also included in the binder.

Item No. 13 2009 Annual Inspection of Waste Disposal Areas – Prepared by Stantec, the report contains the results of an annual inspection of the waste disposal areas at Cumberland Fossil Plant. The pages contain descriptions, observations and recommendations for the Coal Yard Drainage Basin, Chemical Treatment Pond, Active Ash Pond, Dry Ash Stack, Wet Gypsum Stacking Area and the slough beside Highway 233, including associated ditches, dikes, roads and effluent points.

Item No. 14 Reports of Annual Waste Area Inspections, 1972-2008 – These annual reports were prepared by various persons within TVA. The reports contain the results of an annual inspection of the waste disposal areas (as they existed at the time of the inspection) at Cumberland Fossil (or Steam) Plant. Also included is the 2007 (performed 2006) Annual Ash Pond Dike Stability Report and Quarterly Red Water Seep Inspections as well as the 2008 (performed 2007) Quarterly Red Water Seep Inspections. A copy of the Dredge Report for the Coal Yard Runoff Pond is also included in the binder.

5.3. **Design Drawings**

The Dry Ash and Gypsum Stack were originally designed in 1993. TVA cannot locate the original drawings but obtained a scanned copy of the proposed final stack configuration from TDEC. This drawing was used as the basis for the analysis of future buildout conditions discussed in Section 12.2.10.

One set of reduced-sized drawings were included in the documents obtained from TVA during Phase 1. The drawings were entitled “Dry Ash and Gypsum Stacking Area, Stages 1 through 8, TVA Fossil and Hydro Engineering" dated October 10, 2003 and included Drawing Nos. 10W302-1 through 10W302-27. The drawings were part of Law Engineering’s 1992 geotechnical exploration report on the FGD Retrofit Project for Units 1 and 2 and were used in the TVA Operations Manual revised in 2003. Copies of the drawings are contained in Appendix A. It is understood that these drawings were not approved by TDEC.

The 2003 drawings show 8 stages of disposal area development ending in final preparation of areas for total build-out of both the gypsum and fly ash stacks. The drawings show the construction within Ash Disposal Areas Nos. 1A (inactive), 2 and 2B (sluicing operations). Modifications also included the construction of the Retention Pond out of Area 2 with no modification of the Stilling Pond, which has remained unchanged.

Copies of a few of the original construction drawings of the waste disposal area were found with miscellaneous memorandums and with a few of the annual reports. Sheets 10N212 through -214, 10N218, 10N224 and 10N225 were used to show particular aspects of the facilities and are contained in Appendix A. No drawings marked "As-Built" or similar were found.

5.3.1. **Proposed Design of Ash Disposal Area**

Portions of the Ash Disposal Area were to be built during Stages 2, 4, 7 and 8. During Stage 2 and within Ash Disposal Area 2 the Structural Dike (Top Elev. 394.5 feet) between the Retention Pond and the Fly Ash Stacking area was to be built. The Bottom Ash Dredge Cells, Wastewater Ditch and a 10-acre Dry Fly Ash Disposal Area were to be constructed during Stage 4. Preparation for a 20-acre Dry Fly Ash Disposal Area was planned for Stage 7. The preparation for a 60-acre Dry Fly Ash Disposal Area was to occur in Stage 8. Improvements in Stages 4, 7 and 8, the preparation for the 10-, 20-, and 60-acre Ash Disposal Areas lie within what is now called the Dry Fly Ash Stack.

However, a note on the drawings states "Dry ash stages were not constructed in the sequence shown. Dry ash disposal area has proceeded east to west as a continual development." This note was likely added to the drawings for use in the Operations Manual.

The Operations Manual indicates the Disposal Area was prepared by constructing a bottom ash blanket drain 4 feet thick. As the stack expanded the blanket was extended as needed. Ash is reclaimed from settling basins then stacked in lifts. Side slopes of the stack are to be 3H:1V and have intermediate 15 feet wide benches every 30 vertical feet for drainage control.

5.3.2. **Proposed Design of Gypsum Disposal Complex**

The Gypsum Stacking Area improvements were scheduled for Stages 1, 2, 3, 5 and 6. During Stage 1 the 80-acre Gypsum Stacking Area including Separator Dike and Spillway was to be constructed. The construction of the north and west dikes were scheduled for Stage 2. During Stage 3 the southern dike construction was planned. Placement of dredged material up to Elevation 400.0 in the south end of the stacking area (in the former wastewater holding basin) was to occur in Stage 5 to expand the stacking area to 132 acres. Stage 6 included the completion of the Drainage Trenches and Blankets and the Blanket Drain Ditch around the perimeter of the stacking area.

Stacking was to be accomplished by use of the rim ditch method after sluicing gypsum slurry to the stack. The coarser fraction of the gypsum was to be placed and compacted toward the outer edge of the stack. The finer fraction was to be placed and compacted toward an interior area.

Side slopes of the stack were to be 3H:1V and have intermediate 15 feet wide benches every 30 vertical feet for drainage control.

6. Site Geology

6.1. General

The Physiographic Regions of Tennessee Map (Tennessee Department of Environment and Conservation (TDEC)) indicates that the project site is located in the Western Highland Rim of Middle Tennessee. Underlying bedrock of the region is chiefly Mississippian limestone, chert, shale, and sandstone with exposures of Devonian, Silurian, Ordovician, and Cambrian limestone, chert, and shale. In the northern part of the Western Highland Rim, caves and other karst features may be present. The ground surface elevation in the vicinity of the project ranges from approximately 360 feet to 650 feet above mean sea level.

The Generalized Geologic Map of Tennessee (Tennessee Department of Environment and Conservation, 2009) indicates that the areas surrounding the project site are underlain by rock of Mississippian age. In the immediate vicinity of the project site, rock of Ordovician age predominates.

6.2. Soils

The soil survey (Web Soil Survey of Stewart County, Tennessee, United States Department of Agriculture (USDA), 2009) indicates that the soils surrounding the Cumberland Fossil Plant are Silt-Loams or Silty Clay-Loams of the Nolen, Sengtown, Bodine, Egam, Maury, Lindside, Melvinville, Byler and Wolftever Associations. These soils are described as moderately deep to deep, moderately well to well drained, moderately sloped soils that formed from the weathering of interbedded sedimentary rock. These soils generally range from silt loam to clay loam in texture. Typical USCS soil classifications of these soil types are CL, CL-ML, SM, GC and GM.

6.3. Bedrock Geology

The Cumberland Fossil Plant is underlain by bedrock primarily of Ordovician age, with smaller amounts of Silurian and Devonian aged rock. The plant is situated in an ancient meteorite impact crater just north of the impact zone. This event has produced a large variation in the contour of the bedrock below the facility as well as several mapped faults.

According to the Geologic Map of the Cumberland City Quadrangle (USGS 1968, revised 1986), the complex site is predominantly underlain by bedrock belonging to the Mannie Shale, Fernvale Limestone, Hermitage, Carters, Lebanon, Ridley, Pierce and Murfreesboro Limestone Formations, in general order of descending geology. Each of these formations is of Ordovician age and is comprised of limestones that may be described as thin to thick bedded, greenish-gray to gray, coarse to crystalline grained, argillaceous and hard. The Hermitage Formation also contains thin bedded to laminated gray sandy shale and the Mannie Shale Formation contains shale and limestone interbedded.

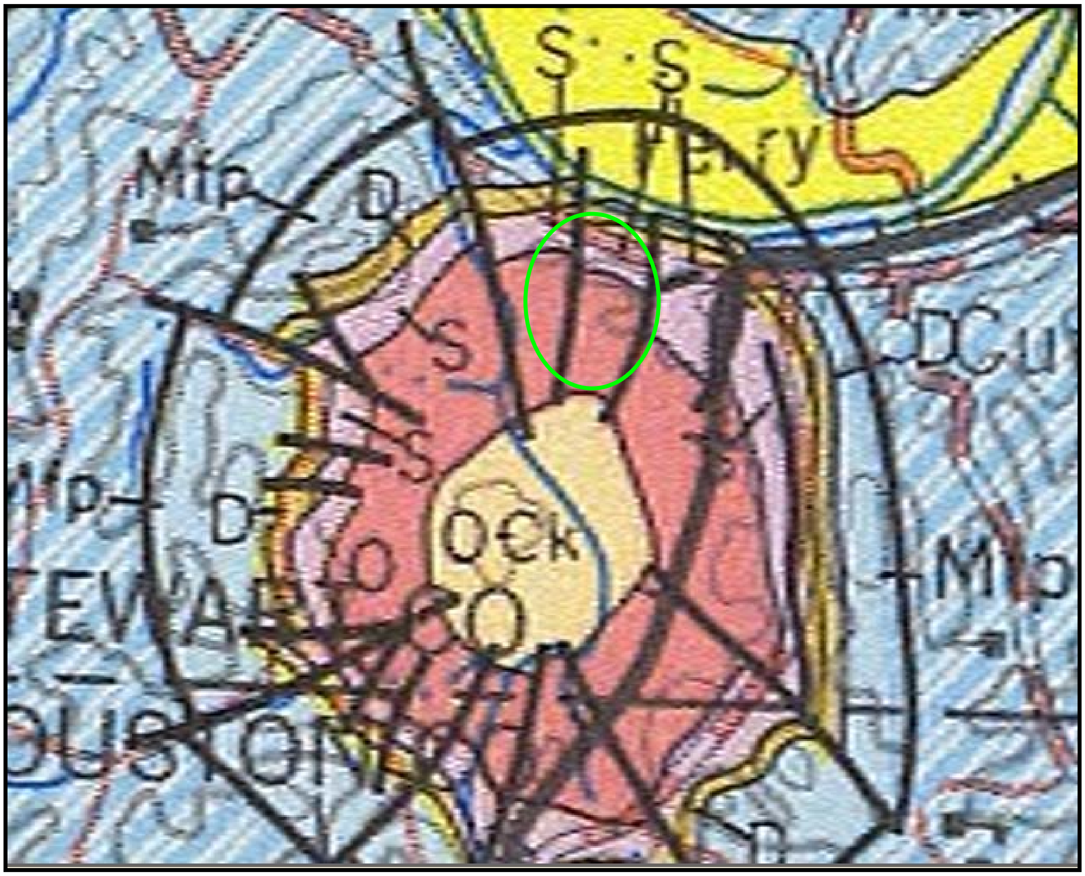


Figure 4. Portion of Geologic Map with Approximate Location of Cumberland Fossil Plant Indicated (USGS Geologic Map of the Cumberland City Quadrangle (1966, revised 1986).

6.4. **Hydrology and Hydrogeology**

Surface water migrates along natural drainage swales and diversions along local hillsides. The Cumberland River and Wells Creek, which bound the project area, together with their respective tributaries collect the surface water and drain the groundwater from this area. The water levels in the Cumberland River and Wells Creek are generally maintained between 357 feet and 360 feet elevation. These bodies of water flow generally northward and are part of the Lake Barkley watershed.

Groundwater migrates through both primary and secondary porosity at the site. Groundwater seeps into the alluvium, residual soils and/or unconsolidated material within the project area. Some of that water migrates along the top of bedrock, saturating the interface between the top of bedrock and unconsolidated material, until the groundwater seeps into the bedrock or finds a fracture or joint to follow. Below top of bedrock, the water migrates through the fractures, joints, bedding planes and other voids in the bedrock. The groundwater eventually intercepts the existing groundwater in the area and/or eventually flows to the surface at a lower elevation. Water levels encountered in borings are discussed in Section 7.4 of this report.

7. Subsurface Exploration

7.1. General

Stantec performed the fieldwork for the geotechnical exploration from April through July, 2009. The exploration consisted of test borings, sampling, rock coring, instrumentation and backfilling. The work was performed around and on the Dry Fly Ash Stack and Gypsum Disposal Complex. Borings to explore conditions around the Retention and Stilling Ponds were performed as part of a separate project and the results will be presented in a separate document later. Stantec drilled 74 soil test borings and advanced 17 cone penetrometer test (CPT) borings mainly atop the dike system of the two waste areas. The locations were chosen by Stantec to be along pre-determined cross-section alignments and at locations where dike materials were believed to be deepest. The boring locations were surveyed by TVA after drilling. The locations are shown on the boring layout in Appendix B.

The borings were drilled using both 3¼- and 4¼-inch inside diameter hollow-stemmed augers powered by a truck-mounted drill rig. A 6-inch diameter roller bit was also used with a mud-rotary technique to drill certain borings in order to obtain undisturbed tube samples with fewer disturbances.

In the soil test borings continuous standard penetration tests (SPT's) were performed in accordance with ASTM D1586 until natural materials were encountered, after which SPTs were continued at 2.5-foot intervals. The results of SPT testing are presented on the boring logs included in Appendix C.

After soil borings with SPT samples were drilled and an understanding of the subsurface profile at a particular location was obtained, offset borings were advanced. The offset borings were used to obtain undisturbed, thin-walled (Shelby) tube samples in particular materials at specific depths. Thin-walled (Shelby) tube samples were obtained in accordance with ASTM D 1587. Sample depths and percent of recovery are presented on the boring logs.

In addition to the samples described above, disturbed bag samples of soils, typically consisting of auger cuttings obtained from the borehole during the drilling process, were also taken for laboratory testing. The samples consisted of gypsum, gypsum rejects, fly ash, bottom ash, original dike material and "raised dike" material.

A Stantec geotechnical engineer or geologist directed the drill crews, logged the subsurface materials encountered during the exploration and collected soil samples. During field logging particular attention was given to the material's color, texture, moisture content and consistency or relative density.

Rock coring was performed in selected borings using NQ2-size (2-inch diameter) wire-line coring equipment. Core runs began at top of weathered rock and were either 5 or 10 feet in length. Upon retrieval, the core was extracted and sequentially placed in a core storage box and labeled.

CPT borings were conducted at offset locations to borings as shown in the list of borings in Table 3 and the site plan in Appendix B. Cone penetration testing was performed by advancing an integrated electronic seismic piezo cone within the soil-like overburden materials to measure tip resistance, sleeve friction and dynamic pore pressure at roughly one-inch intervals. In addition, pore pressure dissipation testing was performed at selected intervals. The logs and correlations of the CPT borings are included in Appendix D.

The onsite representative then logged the core noting its physical appearance, integrity and bedding characteristics. The amount of core recovered from the operation was also noted and expressed in the log as a percentage recovered. The Rock Quality Designation (RQD) value, a simple, quantitative indication of rock competency, was determined for each coring run by adding the length of all naturally occurring pieces in a run greater than 4 inches and dividing by the length of the total run. The resultant is expressed as a percentage.

Upon completion of drilling, the boreholes without instrumentation were backfilled using a mixture of Portland cement and bentonite clay. Boreholes with piezometers received a quartz sand filter pack around the piezometer, a bentonite seal above the sand then backfill with the cement and bentonite mixture. Boreholes with slope inclinometers were backfilled with high-solids cement-bentonite grout placed by tremie pipe to displace cuttings and drilling fluid. Soil auger cuttings were disposed of by plant personnel.

Following the field exploration, the SPT samples, Shelby tubes and bag samples were transported to Stantec's (or certified vendor's) laboratory for testing. The remnant samples will be available for review up to thirty (30) days following testing and the submittal of the final version of this report, at which time the samples will be discarded unless prior arrangements have been made with Stantec.

7.2. Summary of Borings

A boring layout drawing is presented on a drawing included in Appendix B. Typed boring logs are presented in Appendix C. A summary of boring information is presented in Table 3, where all measurements are expressed in feet.

Table 3. Summary of Borings

Boring No.(1)	Northing(2)	Easting(2)	Top of Hole (Elevation)	Bottom of Hole (Elevation)	Bottom of Hole (Feet)
STN-1	731,972.89	1,510,623.03	392.6	362.6	30.0
STN-2	731,620.35	1,510,594.16	406.5	302.6	103.9
STN-3	732,139.24	1,509,478.38	394.8	322.8	72.0
STN-3A	732,139.24	1,509,474.38	394.8	356.8	38.0
STN-4	731,897.61	1,509,866.05	393.9	314.6	79.3
STN-5	731,525.23	1,509,330.56	377.9	328.2	49.7
STN-6	731,522.23	1,509,376.77	394.3	329.3	65.0
STN-7	731,468.66	1,509,521.56	402.7	322.8	79.9
STN-8	730,646.60	1,509,359.17	380.8	337.5	43.3
STN-9	730,659.51	1,509,396.49	394.7	337.9	56.8
STN-9 A	730,655.56	1,509,398.56	394.7	335.7	59.0
STN-9 B	730,663.13	1,509,394.84	394.7	378.7	16.0
STN-10	730,721.30	1,509,488.66	397.1	336.9	60.2
STN-11	730,171.02	1,509,771.93	378.8	313.7	65.1
STN-12	730,206.65	1,509,805.16	394.8	311.5	83.3
STN-13	730,257.53	1,509,873.48	396.5	321.3	75.2

Boring No.[1]	Northing[2]	Easting[2]	Top of Hole (Elevation)	Bottom of Hole (Elevation)	Bottom of Hole (Feet)
STN-14	729,668.17	1,510,309.27	379.0	312.2	66.8
STN-15	729,710.31	1,510,333.99	395.0	312.8	82.2
STN-15 A	729,713.11	1,510,331.12	395.0	355.0	40.0
STN-15 B	729,715.91	1,510,328.25	395.0	312.7	82.3
STN-16	729,763.04	1,510,385.22	397.8	313.3	84.5
STN-17	729,839.12	1,510,498.97	428.4	311.0	117.4
STN-17 A	729,842.82	1,510,494.59	428.4	356.4	72.0
STN-18	729,626.30	1,511,020.93	401.2	335.6	65.6
STN-19	729,567.00	1,511,146.57	410.9	359.4	51.5
STN-19 C	729,562.64	1,511,144.49	410.9	388.9	22.0
STN-20	729,545.69	1,511,210.45	419.3	363.8	55.5
STN-21	728,813.36	1,510,875.59	395.1	351.6	43.5
STN-21 A	728,808.93	1,510,877.54	410.2	362.2	48.0
STN-21 B	728,804.50	1,510,879.50	410.2	332.2	78.0
STN-22	728,838.52	1,510,961.21	410.2	318.2	92.0
STN-22 A	728,829.60	1,510,964.76	395.1	334.4	60.7
STN-22 C	728,834.06	1,510,962.99	395.1	371.1	24.0
STN-23	728,291.47	1,511,590.83	420.7	321.2	99.5
STN-24	728,215.90	1,511,562.59	410.4	319.9	90.5
STN-24 C	728,217.51	1,511,558.03	410.4	392.4	18.0
STN-25	728,130.72	1,511,539.43	395.4	318.1	77.3
STN-26	728,079.09	1,511,517.81	380.6	320.2	60.4
STN-27	728,342.65	1,512,519.26	422.2	334.3	87.9
STN-28	728,264.15	1,512,555.40	410.6	339.4	71.2
STN-28 A	728,265.77	1,512,559.91	410.6	356.6	54.0
STN-28 B	728,262.26	1,512,550.95	410.6	391.1	19.5
STN-28 C	728,260.38	1,512,546.50	410.6	394.1	16.5
STN-29	728,179.37	1,512,587.54	395.2	334.9	60.3
STN-29 A	728,181.10	1,512,591.60	395.2	338.3	56.9
STN-29 B	728,177.54	1,512,583.48	395.2	378.7	16.5
STN-30	728,119.63	1,512,564.49	379.7	340.0	39.7
STN-31	728,180.44	1,513,622.99	422.5	351.6	70.9
STN-32	728,155.57	1,513,707.59	410.7	350.3	60.4
STN-33	728,122.27	1,513,797.59	395.4	341.1	54.3
STN-34	728,103.27	1,513,844.16	378.7	354.0	24.7
STN-35	728,903.76	1,513,833.70	425.7	357.8	67.9
STN-35 A	728,899.92	1,513,832.70	425.7	377.7	48.0
STN-36	728,879.61	1,513,930.45	411.2	359.5	51.7
STN-36 A	728,875.02	1,513,928.98	411.2	365.2	46.0
STN-36 B	728,883.94	1,513,932.09	411.2	390.2	21.0
STN-37	728,853.00	1,514,022.47	395.2	356.9	38.3
STN-37 A	728,848.41	1,514,021.00	395.2	360.2	35.0
STN-37 B	728,857.33	1,514,024.11	395.2	377.7	17.5
STN-38	728,840.42	1,514,066.12	380.0	359.8	20.2
STN-39	729,874.75	1,513,445.67	395.9	376.7	19.2
STN-40	729,801.23	1,513,385.97	411.3	379.4	31.9
STN-41	729,715.15	1,513,343.22	422.6	376.6	46.0
STN-42	730,342.74	1,512,760.25	396.2	353.6	42.6
STN-43	730,394.20	1,512,495.22	411.3	349.3	62.0

Boring No.(1)	Northing(2)	Easting(2)	Top of Hole (Elevation)	Bottom of Hole (Elevation)	Bottom of Hole (Feet)
STN-43 A	730,397.50	1,512,491.36	411.3	345.6	65.7
STN-44	730,328.91	1,512,450.02	419.5	345.6	73.9
STN-45	730,351.51	1,511,970.28	411.6	348.4	63.2
STN-45A	730,351.38	1,511,965.25	411.66	391.66	20.0
STN-45B	730,346.02	1,512,020.28	411.6	396.6	15.0
STN-45C	730,345.72	1,512,070.28	411.6	396.6	15.0
STN-46	730,307.77	1,511,950.82	420.3	346.7	73.6
STN-46A	730,309.78	1,511,946.44	420.3	399.3	21.0
STN-63	730,171.50	1,509,773.10	379.0	359.0	20.0
Cone Penetrometer Test Borings					
STN-64	729,396.89	1,510,532.03	379.3	353.8	25.5
STN-65	729,791.10	1,510,179.24	379.8	355.1	24.7
STN-66	730,179.49	1,509,764.23	379.0	346.3	32.7
STN-67	731,487.75	1,509,327.79	378.4	345.4	33.0
STN-68	731,848.23	1,510,340.93	396.1	357.0	39.1
STN-69	731,860.16	1,509,967.60	392.4	324.2	68.2
STN-70	730,986.46	1,509,851.43	428.1	330.2	97.9
STN-71	729,958.36	1,510,375.99	427.2	324.4	102.8
STN-72	729,727.44	1,511,067.07	401.4	368.0	33.4
STN-73	729,588.29	1,511,238.50	419.3	351.9	67.4
STN-74	730,325.68	1,512,461.37	419.9	395.0	24.9
STN-75	730,184.63	1,512,659.31	420.6	382.1	38.5
STN-76	728,563.33	1,513,742.62	424.5	352.8	71.7
STN-77	728,286.09	1,513,112.60	421.8	347.1	74.7
STN-78	728,161.70	1,512,113.05	421.7	371.8	49.9
STN-79	728,475.41	1,511,251.81	418.1	365.7	52.4
STN-80	729,115.32	1,512,685.30	423.4	363.2	60.2

7.3. Subsurface Soil Conditions

Thirteen primary soil horizons have been identified using soil boring results and available historical documents from TVA archives. Below are brief descriptions of the horizons. Two-letter classification codes (CL, SM, SP, etc.) in the descriptions refer to the Unified Soil Classification System (USCS).

Coal Combustion Products:

- Fly Ash – Classifies as silt (ML) or silt with sand/silty sand. Light gray to black or gray brown, silt to clay-sized grains, dry to wet. Soft to very stiff. Lenses of bottom ash or lean clay may be present.
  - Fly Ash (Sluiced) or Fly Ash/Bottom Ash (Sluiced) – Saturated fly ash, bottom ash, or a laminated zone of both that is wet to saturated, probably hydraulically placed, soft to medium stiff. Fly ash alone classifies as silt (ML). The fly ash/bottom ash (sluiced) was visually classified as silty sand with gravel (SP), silty sand (SM), and sandy lean clay (CL). For purposes of slope stability analyses, a distinction was not drawn between sluiced fly ash and a combination material of

sluiced fly ash and bottom ash. Definite zones were unclear. Sluiced fly ash properties were conservatively assumed for both materials.

- Fly Ash (Stacked) – Distinct from sluiced fly ash based on higher blow counts, lower moisture contents, and stronger cone penetrometer test (CPT) results. It appears some compactive effort was used during placement of this material.

- Bottom Ash – Segregated and stacked bottom ash. Classifies as a silty sand with gravel (SP) or silty sand (SM). Dark gray to black, coarse grained, damp to wet, very loose to very dense with occasional interbedded layers of fly ash and clay. Medium sand to gravel-sized grains with some fines. It appears some compactive effort was used during placement of this material. Sluiced bottom ash intermixed with fly ash is modeled as sluiced material (see above).

- Gypsum – Classifies as silt (ML), white to gray brown or tan, medium stiff to very stiff, damp to wet. Material has been placed both by stacking and slucing. Where placed by stacking, it appears some compactive effort was used.

Natural Soils Used In Dike Construction:

- Dike 1 – The original perimeter dike. A lean clay (CL), red brown to gray brown, moist to wet, very soft to very stiff. Occasional gray mottling, with areas of sand or gravel, chert fragments, few organics and manganese concretions. Approximate top of dike elevation is 380 feet.

  Stantec (2009a) identified this zone in most borings surrounding the Dry Fly Ash Stack and Gypsum Stack Complex just above natural ground. It was not found in the borings on the northeast perimeter on the Gypsum Stack Complex near the Coal Yard Runoff Pond and Metal Cleaning Pond. Here, the initial surface topography appeared to be at a higher elevation than the rest of the initial dike structure.

- Dike 2 – The raised dike uphill of the original perimeter dike. It has a crushed stone surface between 0.5 and 1.0 feet deep. Dike 2 was identified by Stantec (2009a) along the outside perimeter of the Dry Fly Ash Stack and Gypsum Stack Complex. It is not found in the divider dikes between the Gypsum Stack Complex, Dry Fly Ash Stack, and Retention Pond. The approximate top of dike elevation is 395 feet. The raised dike has two distinct soil horizons:

  - Dike 2 (Lean Clay) – Lean clay (CL) to lean clay with gravel, some cobbles, light brown to brown, some gray mottling, moist to wet, soft to very stiff.

  - Dike 2 (Fat Clay) – Fat clay (CH) to fat clay with gravel, dark brown to reddish brown, damp to wet, firm to very stiff. This layer is typically near the top of Dike 2 or may compose the complete Dike 2 zone.

- Dike 3 –The starter dike for stacking gypsum. Classifies as clayey gravel with sand (GC) or clayey sand with gravel (SC) with just greater than 50% retained on the No. 200 sieve. Reddish brown to light gray, moist to wet, loose to dense, angular grains. The clay tends to be lean with some borderline fat clay present with manganese concretions. A bottom ash road (from 1.1 to 4.0 feet thick) is located along the dike's crest. The top of Dike 3 is at approximate elevation 410 feet.

Stantec (2009a) identified this zone in borings along the embankment crest surrounding the Gypsum Stack Complex. One exception was Boring 45 located next to the small pond at the northwestern tip of the complex.

- Divider Dike – Located between the Retention Pond and the Dry Fly Ash Stack, this dike has a distinct composition of riprap or boulder zones with a reddish brown silty clay matrix. The clay matrix is light brown to reddish or grayish brown, stiff to very stiff, and moist to wet. Typically, the clay was field-classified as lean with some fat clay present.

Natural Foundation Soils:

- Alluvial (Clay) – Lean clay (CL), silty grading to sandy, manganese concretions, reddish brown to light gray, some gray mottling, soft to very stiff, moist to wet, with rock fragments. Few organics and wood fragments, but typically has a faint organic odor near the suspected natural ground interface.
    - Alluvial (Clay – Soft) – Historical reports denote a separate soft alluvial clay zone.
- Alluvial (Granular) – Varying between silty sand with gravel (SM), (yellowish brown to light gray, moist to wet, very loose to compact, medium to coarse grained, poorly sorted with increasing gravel size) and gravel with clay to silt and sand (GP-GC or GM) (gray, wet, angular, loose to very dense). Some wood fragments with a slight organic odor near the suspected natural ground interface.

Bedrock:

- Interbedded Limestone and Shale – Limestone is light gray, hard, and thick bedded. Shale is light gray, calcareous, moderately hard and laminated. Core recovery ranged from 94 to 100 percent. RQD ranged from 56 to 100 percent. When core was obtained, limestone comprised approximately 50 to 90 percent of the recovery.

7.4. **Subsurface Water**

Subsurface water was encountered in most of the borings advanced during this exploration. The water level reading was taken after the boring had been drilled but before the installation of instrumentation. Typically, subsurface water was not found in borings advanced purposely to a shallow depth to obtain undisturbed samples. The depths to water noted immediately after drilling are shown on the boring logs presented in Appendix C.

The elevation at which subsurface water was encountered generally varied based on the offset distance from the disposal operations. The borings advanced at the crest of the original dike (Dike 1, elevation 380) encountered subsurface water between elevations 370 feet and 378 feet with a few exceptions. The exceptions were believed to have occurred because of the slow response time of the cohesive soils when compared to the granular deposits in other borings. The borings that were advanced at the crest of Dike 2 (approximately elevation 395 feet) encountered subsurface water at elevations varying from 375 feet to 392 feet. The borings that encountered subsurface water at higher elevations were on the south side of the facility in Sections F and H. Generally, it appears that subsurface water flows in a northeast to southwest direction; following the slope of the bedrock surface. Additional water level readings were and are being obtained from piezometers installed in some of the borings, as discussed in the following section of this report.

8. Field Instrumentation and Monitoring

8.1. General

Stantec's exploration included the installation and monitoring of geotechnical instrumentation. Piezometers and slope inclinometer casings were installed in some of the boreholes to provide data about existing conditions and to provide a baseline for future monitoring efforts. Initial or baseline readings preceded a regular and on-going instrumentation monitoring program.

8.2. Instrumentation

Two types of instruments were installed as part of the geotechnical exploration. These include standpipe piezometers (PZ) and slope inclinometer (SI) casings.

Standpipe piezometers, installed in a borehole, consist of a screened interval of pipe (generally 10-ft) joined to a 1-inch diameter riser pipe. The screened interval was placed in a sand pack and a bentonite seal was placed above the sand to isolate the target pore water pressure reading zone. The annular space between the riser pipe and the borehole was backfilled to the surface with bentonite grout to prevent vertical migration of water. The riser pipe was terminated above ground and protected with either a lockable metal cover or a flush-mounted 6" diameter manhole.

Slope inclinometer casings consist of 2.75-inch outside diameter PVC casing with interior vertical grooves also installed in a borehole. The annular space between the casing and borehole was backfilled to the surface with cement bentonite grout. The casing was terminated above ground and protected with either a lockable metal cover or a flush-mounted 6" diameter manhole. (Lockable covers used in typical installation are shown in Figure 5.) Table 4 provides a summary of the instruments installed. Appendix E presents the PZ and SI instrumentation logs.

Figure 5. Typical Instrumentation (Slope Inclinometers, Piezometers) Installation

Table 4. Summary of Instrumentation

Boring No.	Instrument	Surface Elevation	Tip Elevation
STN-3	SI	394.80	323.8
STN-3A	PZ	394.80	357.3
STN-4	PZ	393.92	354.8
STN-9	PZ	394.68	338.2
STN-9A	SI	394.68	336.7
STN-10	PZ	397.09	357.9
STN-15A	PZ	395.03	356.5
STN-15B	SI	395.03	313.0
STN-16	PZ	397.80	340.8
STN-21	PZ	395.13	356.0
STN-21A	SI	395.13	347.1
STN-21B	SI	395.13	318.1
STN-22A	PZ	410.19	350.8
STN-27	PZ	422.15	355.3
STN-28	PZ	410.57	341.8
STN-29	PZ	395.17	341.2
STN-29A	SI	395.17	338.3
STN-35	PZ	425.65	367.2
STN-36	PZ	411.16	363.2
STN-37	PZ	395.22	367.2
STN-37A	SI	395.22	360.2
STN-42	PZ	396.20	357.2
STN-43	PZ	411.27	374.3
STN-43A	SI	411.27	345.6
STN-44	PZ	419.48	382.5
STN-45A	PZ	411.60	392.9
STN-46A	PZ	420.30	400.3

8.3. Monitoring of Dike Slope Conditions

Stantec is monitoring the instruments installed during the exploration. Water level readings (from PZs) and slope movement data (from SIs) are obtained on a monthly basis and the results are included in Appendix F. PZ readings are taken using a water level indicator and SI readings are obtained using a portable traversing inclinometer designed for this purpose. The first SI survey established the initial profile of the casing and subsequent surveys measure changes in the profile of the casing if movement of the slope has occurred.

Instrumentation readings are currently obtained on a monthly schedule. Future reading schedules may be modified in response to detection of any significant variation in readings. Depending on factors such as the magnitude, location and circumstances of the reading variation, the schedule may be adjusted to read the instruments more often, say, weekly or daily.

Generally, water levels across the site have been steady and varied by a few tenths of a foot between monthly readings. Around the Gypsum Stack Complex, the instruments that are monitoring the water levels in the fly ash show that water levels are at the upper limits of the fly ash strata. The water levels of the remaining instruments around the gypsum stack show lower water levels in the foundation soils and no static water accumulated in the gypsum.

The piezometers along the south side of the dry fly ash stack show the same trends as the piezometers around the gypsum stack. However, three exceptions should be noted. PZ-15 and PZ-21 are showing elevated pore pressure levels that are within five to seven feet of the ground surface. This correlates with the seep that was observed below PZ-21. In addition, PZ-16 appears to be a non-responsive piezometer. Stantec has attempted to develop the well with no change in the reading levels.

Slope Inclinometers have been installed around the perimeter of the site and are being monitored for slope movement. No significant lateral movements have been detected to date.

9. Surveying

9.1. General

Topographic mapping of the Dry Fly Ash Disposal Area and Gypsum Stack Complex was developed from aerial photography provided by TVA. Contour mapping of the bottom of the stilling and retention ponds was developed from a hydrographic field survey, also provided by TVA.

9.2. Aerial Survey

Topographic mapping and aerial photogrammetry were created by Tuck Mapping Solutions Inc., Big Stone Gap, Virginia. The project site was flown April 17, 2009. The base mapping was completed May 19, 2009. Horizontal datum is NAD27 and vertical datum is NGVD29. The coordinate system is Tennessee State Plane and the contour interval of the mapping is one foot. The limits of the topographic mapping as well as control points referenced to the State Plane Coordinates system were established by TVA. The results of aerial survey can be seen on the boring layout presented in Appendix B.

9.3. Topographic Survey

Topographic surveying was performed by TVA to locate the soil and CPT borings. Field cross sections were also taken to provide a check on the aerial mapping.

9.4. Hydrographic Survey

TVA performed a hydrographic survey of the retention and stilling ponds in September of 2008. The results (contour lines) of the hydrographic survey of the ponds are shown on the boring layout Appendix A.

10. Laboratory Testing

10.1. General

Soil and rock samples from the field exploration were returned to a Stantec (or certified vendor's) materials laboratory for inventory and testing. The laboratory tests were performed in accordance with ASTM standard testing procedures. Detailed results of laboratory testing are presented in Appendix G.

10.2. Laboratory Tests Performed

Each soil sample was visually classified and tested for natural moisture content. Engineering classification tests were performed on samples reflecting the main soil horizons. The represented horizons are: gypsum, fly ash, bottom ash, “bottom ash” dike, “raised” dike, “original” dike and foundation soils. A summary of laboratory tests and the corresponding testing standard are presented in Table 5. Not all tests were performed on all samples.

Table 5. Laboratory Tests

Test	Standard
Natural Moisture Content	ASTM D 2216
Particle Size Analysis	ASTM D 422
Dry Density	ASTM D 2166
Shear Strength	ASTM D 4767
Permeability	ASTM D 5084
Atterberg Limits	ASTM D 4318
Specific Gravity	ASTM D 422
Particle Size Analysis	ASTM D 854

10.3. Natural Moisture Content

Natural moisture content tests were performed on all SPT, bag and Shelby tube samples. The results of moisture content determinations are presented in Appendix G.

10.4. Particle Size Analyses, Atterberg Limits and Specific Gravity, Classification

Particle size analyses and Atterberg limits tests were performed on 4 samples of gypsum, 7 of fly ash, 4 of bottom ash, 5 samples from the “bottom ash” dike, 1 from the “raised” dike, 1 sample from the “original” dike and 8 samples from the foundation soils.

Many of the test samples were composite SPT samples. Composite SPT samples consist of materials from different depths but of the same material, as determined through visual classification.

The particle size analyses were performed in accordance with ASTM D-422, “Particle Size Analysis of Soils,” using sieve analysis for the soil fraction greater than 0.074mm (No. 200 sieve size) and hydrometer analysis for the fraction smaller than 0.074mm. The individual grain size distribution curves generated from these tests are presented in Appendix G.

Atterberg limits tests were conducted in accordance with ASTM D 4318 Method A. The liquid limit, plastic limit and plasticity index are reported in Appendix G. The samples were also tested for specific gravity in accordance with ASTM D 854. The results of particle size analyses and Atterberg limits tests were used to classify the soil samples.

The samples were classified in accordance with the Unified Soil Classification Soil System (USCS) and the American Association of State Highway and Transportation Officials (AASHTO) method. The results of the classification testing are contained in Appendix G. Table 6 summarizes the classification testing results.

Table 6. Summary of Classification Testing Results

Material Type		w_0 (%)	G_s	Atterberg Limits LL	PL	PI	Particle Size Analysis (ASTM) (%) Gravel (3"- 4.75 mm) (> No. 4)	Coarse Sand (4.75-2 mm) (No. 4- No. 10)	Medium Sand (2-0.425 mm) (No. 10-No. 40)	Fine Sand (0.425 - 0.075 mm) (No. 40-	Silt (0.075- 0.005 mm) (<No. 200)	Clay (<0.005 mm)	USCS	AASHTO
Dike 1	*max*	31.1	2.68	56.0	20.0	36.0	42.5	6.3	8.5	4.9	49.0	36.6	GC	A-7-6 (8)
	min	15.8	2.64	36.0	16.0	17.0	1.3	0.8	7.4	2.2	15.0	25.5	CL	A-6 (14)
	average	23.9	2.65	42.2	18.3	23.9	21.9	3.6	8.0	3.6	32.0	31.1		
Dike 2	*max*	91.1	2.81	58.0	22.0	37.0	10.8	4.3	7.9	13.9	34.3	65.0	CH	A-7-6 (23-35)
	min	12.6	2.54	44.0	17.0	25.0	0.3	0.3	2.1	3.2	21.2	37.5	CL	A-7-6 (19-20)
	average	24.6	2.659	50.8	18.7	32.1	5.2	2.6	5.8	8.3	28.4	49.8	CH-CL	A-7-6 (21-27)
Dike 3	*max*	29.7	2.78	48.0	19.0	29.0	44.6	7.9	12.7	8.8	22.5	35.8	GC	A-7-6 (10)
	min	6.5	2.51	36.0	17.0	18.0	23.2	6.6	9.1	6.4	11.7	16.7	GC	A-2-6 (1)
	average	17.9	2.66	39.8	18.0	21.8	31.4	7.1	10.3	7.6	18.3	25.4	GC	A-6 (5-6)
													SC	A-6 (5)
Alluvial Clay	*max*	33.1	2.67	49.0	24.0	31.0	8.0	1.7	4.9	10.7	59.3	46.0	CL	A-6 (8-19)
	min	20.2	2.53	35.0	18.0	12.0	0.0	0.0	1.3	3.1	42.8	28.0	CL	A-7-6 (17)
	average	25.8	2.6125	39.7	20.4	19.3	3.0	0.6	3.3	4.7	49.7	38.7		
Alluvial Granular														
	max	23.4	2.7		NP		54.2	15.4	36.9	18.9	14.3	7.2	GM	A-1-b (0)
	min	19.8	2.62		NP		18.8	8.6	12.7	5.1	5.7	4.1	SM	A-1-b (0)
	average	21.5	2.67		NP		42.9	10.7	20.2	10.1	10.3	5.8	GP-GC	A-1-a (0)
Fly Ash (Sluiced)														
	max	57.1	2.71	45.0	18.0	27.0	8.3	9.4	17.0	23.4	69.7	45.3	ML	A-4 (0)
	min	23.1	2.42	45.0	NP	27.0	0.2	0.1	4.3	4.7	25.3	9.6	CL	A-7-6 (24)
	average	39.4	2.516364	45.0	NP	27.0	2.9	2.2	9.8	12.7	53.9	18.5	SM	A-4 (0)
BA-FA (Sluiced)	*max*	33.6	2.62		NP		20.6	16.5	28.4	18.1	46.5	9.5	SM	A-2-4 (0)
	min	14.4	2.55		NP		7.6	5.4	14.3	16.7	12.8	3.8	SM	A-4 (0)
	average	21.7	2.5975		NP		13.0	10.5	22.3	17.7	30.4	6.1	SM	A-1-b (0)
													ML	A-4 (0)
Gypsum	*max*	22.1	2.94		NP		0.4	0.2	11.1	7.2	83.2	24.1	ML	A-4 (0)
	min	7.2	2.31		NP		0.0	0.0	2.0	5.4	67.5	3.9		
	average	14.3	2.48		NP		0.2	0.1	5.4	6.3	74.4	13.7		
Gypsum Rejects			2.73	33.0	32.0	1.0	0.0	7.4			86.1	6.5	ML	A-4 (0)

10.5. Shear Strength and Unit Weight

Once the Shelby tube samples were extruded, suitable portions representative of selected soil horizons were trimmed for testing. The natural moisture content and both the unit weight wet and unit weight dry was determined for each sample. The test results are presented in Appendix G. Table 7 summarizes the unit weight test results.

Table 7. Summary of Unit Weight Test Results

Material	Boring Number	Test Interval (ft)	g_{w0} (pcf)	w_0 (%)	g_{d0} (pcf)
Dike 1	B-5	18.0-18.5	119.1	24.3	95.8
	B-5	18.6-19.1	121.5	27.2	95.5
	B-9A	25.5-26.0	126.9	24.9	101.6
	B-29A	29.2-29.7	124.3	23.8	100.3
	B-29A	29.7-30.2	125.6	20.1	104.6
	B-63A	8.0-8.5	125.2	27.1	98.5
	B-63A	8.6-9.1	126.3	20.4	104.8
	B-63A	5.5-6.0	120.2	22.1	98.5
			123.6	**23.7**	**100.0**
Dike 2	B-3A	8.5-9.0	127.4	19.4	106.7
	B-3A	14.5-15.0	125.2	25.1	100.1
	B-3A	14.0-14.5	115.9	28.8	90.0
	B-9B	6.0-6.5	129.6	22.2	106.0
	B-9B	10.1-10.6	131.4	20.9	108.7
	B-21B	20.0-20.5	128.1	24.6	102.8
	B-29A	17.6-18.1	123.4	25.8	98.1
	B-29B	12.0-12.5	124.6	20.0	103.8
	B-29B	12.5-13.0	131.3	21.4	108.2
	B-29B	14.8-15.3	127.5	18.3	107.7
	B-37A	19.5-20.0	117.1	30.0	90.1
	B-37B	8.0-8.5	128.4	22.1	105.2
	B-37B	11.4-11.9	133.1	18.5	112.3
	B-37B	11.9-12.4	127.8	18.9	107.5
			126.5	**22.6**	**103.4**
Dike 3	B-19C	17.5-18.0	128.7	12.4	114.5
	B-19C	10.8-11.3	125.9	17.5	107.1
	B-19C	20.0-20.5	127.3	13.8	111.8
	B-28C	14.5-15.0	121.9	20.0	101.6
	B-36A	13.0-13.5	128.7	14.9	112.0
	B-36B	19.0-19.5	123.3	29.7	95.1
			126.0	**18.1**	**107.0**
Alluvial Clay	B-15B	46.3-46.8	120.3	26.5	95.1
	B-15B	46.9-47.4	121.4	26.9	95.6
	B-29A	50.2-50.7	110.0	33.1	82.7
	B-29A	50.8-51.3	112.9	30.3	86.6
	B-43A	47.5-48.0	128.0	20.2	106.4
	B-43A	50.2-50.7	123.7	25.6	98.5
	B-43A	50.7-51.2	125.0	24.2	100.6
			120.2	**26.7**	**95.1**
Sluiced Ash	B-17A	32.7-33.2	106.2	27.4	83.4
	B-17A	70.0-70.5	104.1	41.1	73.8
	B-28	52.0-52.5	97.4	57.1	62.0
	B-28A	50.0-50.5	100.7	41.4	71.2
	B-28A	52.6-53.1	101.9	52.3	66.9
	B-36A	44.7-45.2	102.8	40.5	73.2
	B-43A	29.0-29.5	104.6	32.0	79.3
	B-43A	29.5-30.3	100.6	39.7	72.0
	B-35A	46.0-46.5	104.8	46.0	71.8

Consolidated-undrained triaxial compression tests were performed on the trimmed samples. All shear strength tests were conducted in accordance with ASTM D 4767. The test results are presented in Appendix G. Table 8 summarizes the consolidated-undrained triaxial compression test results.

Table 8. Summary of Consolidated-Undrained Triaxial Testing

Boring	Depth (ft)	Material Type	Visual Description	γ_{w0} (pcf)	w_0 (%)	c' (psf)	ϕ' (deg)
B-5	18.0-20.0	Dike 1	Lean Clay (CL), brown, moist, soft	119.2	24.3	320	28.7
B-5	18.0-20.0			121.5	25.2		
B-29A	29.0-31.0	Dike 1	Fat Clay (CH), gray brown, moist, firm	125.4	22.5	16.4	36.8
B-29A	29.0-31.0			128.3	21.4		
B-63A	5.0-7.0	Dike 1	Fat Clay with Gravel (CH), red brown, moist, firm	120.0	21	1000	17.7
B-63A	8.0-10.0			125.2	23.1		
B-63A	8.0-10.0			126.4	23.6		
B-29B	12.0-13.4	Dike 2	Lean Clay (CL), red brown, moist, firm	126.4	25.6	0	36.5
B-29B	12.0-13.4			132.8	18.8		
B-29B	14.5-16.5			134.6	17		
B-19C	17.5-19.5	Dike 3	Gravelly Fat Clay (CH), brown, moist, firm	128.6	18	0	31
B-19C	14.5-15.0			123.5	23.6		
B-19C	10.5-12.5			124.8	20.9		
B-43A	50.0-52.0	Alluvial Clay	Lean Clay (CL), dark brown, moist, firm	125.0	24.3	440	30.3
B-43A	50.0-52.0			123.9	24.6		
B-43A	29.0-31.0	Fly Ash (Sluiced)	Silt (ML), gray brown, moist, firm, fly ash	104.5	44.8	0	39.6
B-43A	29.0-31.0			100.9	48		
B-35A	46.0-48.0			104.6	47.6		
Gypsum Bulk			Silt (ML), white to gray brown.	104.5	29.1	90.9	42.5
				103.3	28.9		
				103.9	29.2		
Gypsum Rejects Bulk			Silt (ML), white to gray brown.	102.7	27.2	0.0	44
				102.5	26.9		
				102.5	26.9		
Bottom Ash Bulk			Silty sand with gravel (SP) or silty sand (SM). Dark gray to black, coarse grained.	102.1	16.5	261	41
				102.3	16.1		
Fly Ash Bulk			Silt (ML) or silt with sand/silty sand. Light gray to black or gray brown, silt to clay-sized grains.	87.8	33.6	14.3	36
				88.4	33.8		
				89.0	34.4		

10.6. **Moisture-Density (Proctor) Testing**

The moisture-density relationship (Proctor) of the soils observed in the “bottom ash” dike and the “raised” dike were determined. One sample from the bottom ash dike and two from the raised dike were tested in accordance with ASTM D 698, Method ‘A’. Table 9 summarizes the moisture-density relationships of the samples.

Table 9. Summary of Moisture-Density Relationship (Proctor) Test Results

Material	Boring	w_{opt} (%)	g_d (pcf)
Dike 2 (Lean Clay)	B-25	18.4	104.4
	B-37	16.6	112.0
Dike 3	B-28	11.0	124.3
Stacked Ash	Bulk Sample	32.7	83.6

Once these values were obtained, they were compared to the unit weights of the Shelby tube samples that were obtained in the same vicinity from where the proctor samples were taken. In Dike 2, the unit weights of the samples ranged from as low as 80 percent to over 100 percent of maximum Standard Proctor. The high unit weights may be attributed to the significant gravel content. The unit weights ranged between 77 and 92 percent maximum standard proctor for Dike 3.

The unit weights of the sampled fly ash were also compared to the Proctor results for the dry stacked fly ash. The unit weights generally ranged between 74 and 92 percent of the maximum Standard Proctor value. Also, the unit weights were generally inversely related to the depth at which the sample was taken. This may be due to the ability of the material near the top of the hydraulically placed fly ash to drain and consolidate under the weight of the added fill material.

11. Review of Existing Conditions and On-Going Repairs

11.1. General

This discussion is limited to the existing conditions of the Fly Ash Stack and the Gypsum Disposal Complex. It does not include discussion of the Detention Pond and the Settling Pond.

This discussion reflects the status of the facilities as of February 2009, except as noted. Since May 2009, all gypsum slurry is being diverted to the Synthetic Materials (SynMat) gypsum processing facility. The only exceptions to this are the fine particulates that are returned to a small pond adjacent to the existing bottom ash pond and slurry pumped onto the stack during fairly brief outages at the SynMat plant as previously described in Section 3.2. For a more detailed description of the existing conditions of the waste disposal facilities refer to the 2009 "Annual Inspection of Waste Disposal Areas" by Stantec and dated February 11, 2009.

Stantec's Phase 1 Coal Combustion Product Disposal Facility Summaries for the Dry Ash Stack (DS-1) and the Gypsum Storage Area (GSA) contain detailed information about conditions in early 2009. The entire summaries are contained in Appendix H.

A chronology of events from 1969 to 1991 related to the Ash Pond Dikes is contained in a TVA memorandum dated January 17, 1992. The memorandum has been included in Appendix A of this report.

11.2. **Dry Fly Ash Stack**

According to the 2009 annual inspection report by Stantec, the construction of the stack is expanding northward from its present configuration. The current Operation Manual states that filling consists of density-controlled vertical lifts of bottom and fly ash in a manner that controls storm water runoff to prevent erosion. The side slopes are constructed at 3H:1V with intermediate benches at 30-foot vertical increments. The slopes are vegetated using cover soil, mulch and seed. Storm water runoff from the stack is conveyed to the retention pond by way of the perimeter ditch.

A flat-bottomed perimeter ditch is located near the toe of the Ash Stack. It was formed behind Dike 2 (approximate Elevation 395 feet) and varies in width from about 6 to 20 feet. It conveys storm water and seepage runoff to the Detention Pond at the north end of the disposal facility. The gradient of the ditch is slight. One to several feet of water stands in the bottom of the ditch most of the year.

Further, the report states that erosion of slopes and roads and the lack of vegetation in some areas are ongoing problems. In addition, the perimeter ditch flows slowly and is choked with vegetation in stretches. Good stands of vegetation cover the facility for the most part. Stantec observed that overgrowth and tree removal was stepped up during 2009 over previous years. The dike faces in some areas are devoid of topsoil and vegetation and show some signs of erosion. The bare areas are scheduled for re-soiling and re-vegetation.

A letter (Item 4 of Section 5.2 of this report) states that excavated rock from precipitator construction in 1992 was placed in the Ash Pond. The rock was reported to have been placed "adjacent to the interior face of the impoundment dike along the southwestern and western sides of the dike system." New, compacted fill was placed on top of the rock when the dike was raised. Though possessing strength, the rock, the author of the letter states, provides a ready seepage path to the original dike.

Prior to being converted to a dry fly ash stack, the ash disposal area contained sluiced ash. Historic documents show that seepage through the original dike of the ash disposal area was observed in 1973. In a letter dated August 7, 1974, Gene Farmer of TVA 's Construction Services Branch reports the results of a geotechnical exploration. The exploration, consisting of 9 borings, was located at the site of observed dike seepage.

A boring layout accompanying the letter shows the seepage site to be located about 1,000 feet south of the divider dike between the present Detention Pond and Dry Fly Ash Stack. The main cluster of borings at the seepage site can also be described as being about 300 feet north of the construction bridge and at Station 30+00 (on a baseline along the original ash pond dike) on some plans contained in TVA historic drawings.

Surface elevations of some of the borings indicate that the top of the dike was at Elevation 381 feet at the time of drilling. Mainly, a layer of soft, saturated topsoil was encountered from Elevations 360 to 363 feet and was suspected of being the medium for seepage of ash pond water. Reportedly, a stabilizing layer of gravel that was used in some soft areas during construction of the original dike was not encountered. The water level in the ash pond was at Elevation 367.5 feet and Wells Creek was at Elevation 359.9 feet at the time of the exploration.

According to a January 17, 1992 TVA memorandum by K.W. Burnett, Fossil Engineering, a project was submitted in FY 1991 for pressure grouting the ash pond dike in order to stabilize it and address seepage. Historical field records of the grouting were reviewed by Stantec.

A summary sheet accompanying copies of the reports given to Stantec indicates that grouting with cement began January 3, 1991 and ended August 29, 1991. Holes were drilled between Stations 0+00 and 54+26, centerline original ash dike (Elevation 380 feet). Grout "takes" ranged between 1 and 304 cubic feet.

The field reports also indicate that the grout holes were usually spaced 7 feet apart in known seepage areas and 14 feet apart elsewhere, with density of the grouting holes increased in areas of larger takes. Holes usually ranged from 30 to 40 feet deep, but a few were up to 55 feet deep.

11.2.1. **Dredge Cell for Coal Yard Drainage Basin Fines on Dry Ash Stack**

The 2007 annual TVA report on dike stability of the waste area recommended that the Coal Yard Drainage Basin should be dredged of fines. The 2008 TVA report stated that this was done and the fines deposited in a dredge cell on the Dry Ash Stack. Approximately 50,000 cubic yards of coal fines were sluiced to a cell on the stack. As reported in a letter to TVA dated February 9, 2009, Stantec evaluated the stack to determine whether the placement of the coal fines would significantly affect the stability of the slopes of the final stack configuration.

Stantec's slope stability analysis using assumed parameters and boundary conditions found the coal fines did not have a significant impact on the overall slope stability and did not have to be removed from the stack. To ensure free drainage and meet the drained condition assumption, Stantec recommended that parallel trenches be excavated across the dredge cell. The trenches would be filled with more permeable bottom ash to drain pore water from the fines. The work plan was issued on March 16, 2009 (TVA Reference No. CUF-WP-090316) and completed on April 24, 2009.

11.3. **Gypsum Disposal Complex**

Gypsum slurry has been rerouted from the stack as described previously. Dewatered gypsum is hauled to and spread on the stack. In addition, gypsum fines that make it to the small pond next to the bottom ash pond, are removed by excavators every few days and disposed of on top of the stack. Gypsum slurry is only routed to the stack when the SynMat plant must be taken off line for a limited time.

As with the Dry Fly Ash Stack, the Complex is ringed with the flat-bottom perimeter ditch. It was also formed behind Dike 2 (Elevation 395 feet) and varies in width from about 6 to 20 feet. It conveys storm water and seepage runoff to the perimeter ditch of the Dry Fly Ash Stack.

The gradient of the ditch is slight to non-existent. One to several feet of water stands in the bottom of the ditch most of the year. Some stretches of the ditch are choked with vegetation and some areas of the clay dikes below the ditch are eroded. Vegetation removal efforts have been significantly increased during the course of the past year. The outside face of the gypsum perimeter dike has not been covered with topsoil and re-vegetated.

Perimeter clay dikes, trapezoidal in cross section, are used to contain gypsum slurry on the gypsum disposal complex. Three clay dikes have been constructed. Initially, the dikes contained sluiced ash, before the area was converted to a gypsum disposal area.

In this report the lowest and first dike constructed is referred to as Dike 1. The approximate crest elevation for Dike 1 is 380 feet. Once sluiced bottom and fly ash reached a particular elevation against Dike 1, Dike 2 was constructed upon Dike 1 and sluiced ash to enable more waste product to be sluiced and contained. The approximate crest elevation of Dike 2 is 395 feet. The outside toe of Dike 2 abuts the inside top of Dike 1 allowing contact between dike materials, thus creating a hydraulic barrier to contain the sluiced ash.

Above Dike 2 is Dike 3, with an approximate crest elevation of 410 feet. Due to its surface layer of bottom ash, Dike 3 is commonly referred to as the “Bottom Ash Road Dike”. It is built upon sluiced ash deposits. The toe of Dike 3 does not abut Dike 2. The perimeter ditch is constructed at the toe of Dike 3. So, Dike 3 is “set back” from Dike 2, not allowing contact between the materials of Dike 2 and 3. In some locations ash can be seen in the perimeter ditch because of the lack of contact between the materials of Dikes 2 and 3. The exposed ash layer is an active seepage path.

Uphill from Dike 3 is the Gypsum Dike. The Gypsum Dike is founded upon sluiced ash deposits. In several of Stantec’s borings, a granular drainage layer, approximately 2 feet thick, was observed between the gypsum and the underlying sluiced ash. The crest of the Gypsum Dike is at approximate elevation 420-422 feet.

A relatively small landslide occurred in Dike 1 and Dike 2 below the southwest corner of the gypsum stack sometime in 2005. The failure was confined to the surrounding earth dikes and no CCP’s were released to Wells Creek. Seepage was noted in the slide area. The area was reinforced with riprap and numerous borings were performed by others. Piezometers were also installed in this area and are monitored weekly by TVA personnel. A summary of the piezometer data is presented in Appendix I. Based on the material encountered during the explorations and the continued high piezometer readings, Stantec recommended that a permanent repair be constructed in this area. Several meetings were held to discuss the repair approach that best fit the failed area and it was decided by TVA and Stantec that a seepage collection system and rock toe buttress should be constructed. Stantec then prepared construction plans for the installation of a seepage collection system and rock toe buttress in this area. Construction is scheduled to begin in June 2010.

The slope repair will consist of a buried seepage collection system and rock toe buttress. The collection system will consist of a perforated pipe bedded in sand and connected to an outlet pipe to Wells Creek. A temporary sump will collect seepage from the outlet pipe and convey it to the perimeter ditch until an NPDES permit is obtained for a new discharge point.

Dual electric pumps will empty the sump. A natural gas-powered generator placed nearby will power the pumps. A nearby control panel will contain an automatic telephone dialer system to notify TVA of sump system failure. The rock toe will include crushed limestone arranged in a toe buttress and blanket to counter gravity forces acting on the soil mass of the slope. Some existing piezometers and slope inclinometers must be destroyed by the construction. Other instrumentation is to be protected during the excavation and crushed rock placement.

Drawings (Item 7 in Section 5.2 of this report) show that the wet gypsum stacking area originally was limited to the northern three-quarters of Ash Disposal Area 1A. The southern quarter contained, at one time, a wastewater holding basin. A 4-acre pond with a water surface elevation of 387.6 is shown to have existed in the southwest corner of Area 1A, the same general vicinity as the 2005 dike slope failure.

A figure (contained in Appendix A) from a leachate modeling report purportedly by GeoTrans (unavailable, year unknown) shows that the dike slope failure area was also the site of "boiler wash" dumping. Boiler wash is taken to be hardened ash removed from boilers during long-term maintenance. The material may not have been properly placed (uncompacted, end-dumped) and may exist as a porous layer near the perimeter dike of Ash Disposal Area 1. The figure was with a chronological history created by MACTEC for its 2007 geotechnical exploration. The history is contained in Appendix A.

12. Engineering Analyses

12.1. General

Engineering analyses of the Dry Fly Ash Stack and the Gypsum Disposal Complex consists of examining slope stability and seepage of ground water through in-situ materials. The analyses were performed using available historic information, results of the geotechnical field exploration and the results of the laboratory testing. Multiple cross-sections were analyzed for slope stability and one cross-section on the Gypsum Stack Complex was analyzed for seepage.

Cross-section locations and extents to use for analyses were chosen according to several factors. The cross-sections were selected because they are representative of the facilities as a whole, are along the most critical slopes and are at regular intervals along the dike alignment. The cross-sections are named using letters 'A' through 'O'. Figure 6 shows the cross-section locations and orientations for the Gypsum Disposal Complex. Figure 7 shows the cross-section locations and orientations for the Dry Fly Ash Stack.

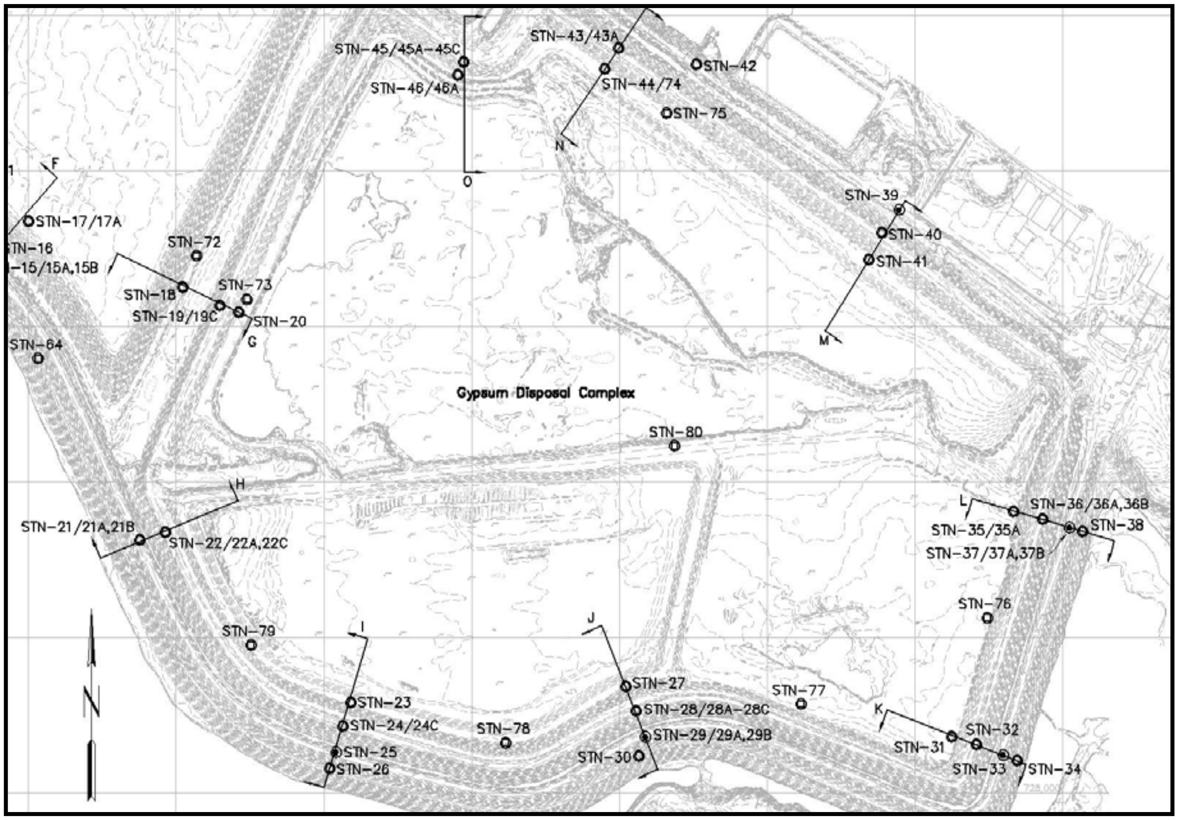


Figure 6. Plan View of the Gypsum Stack Complex and the Stability Cross Sections

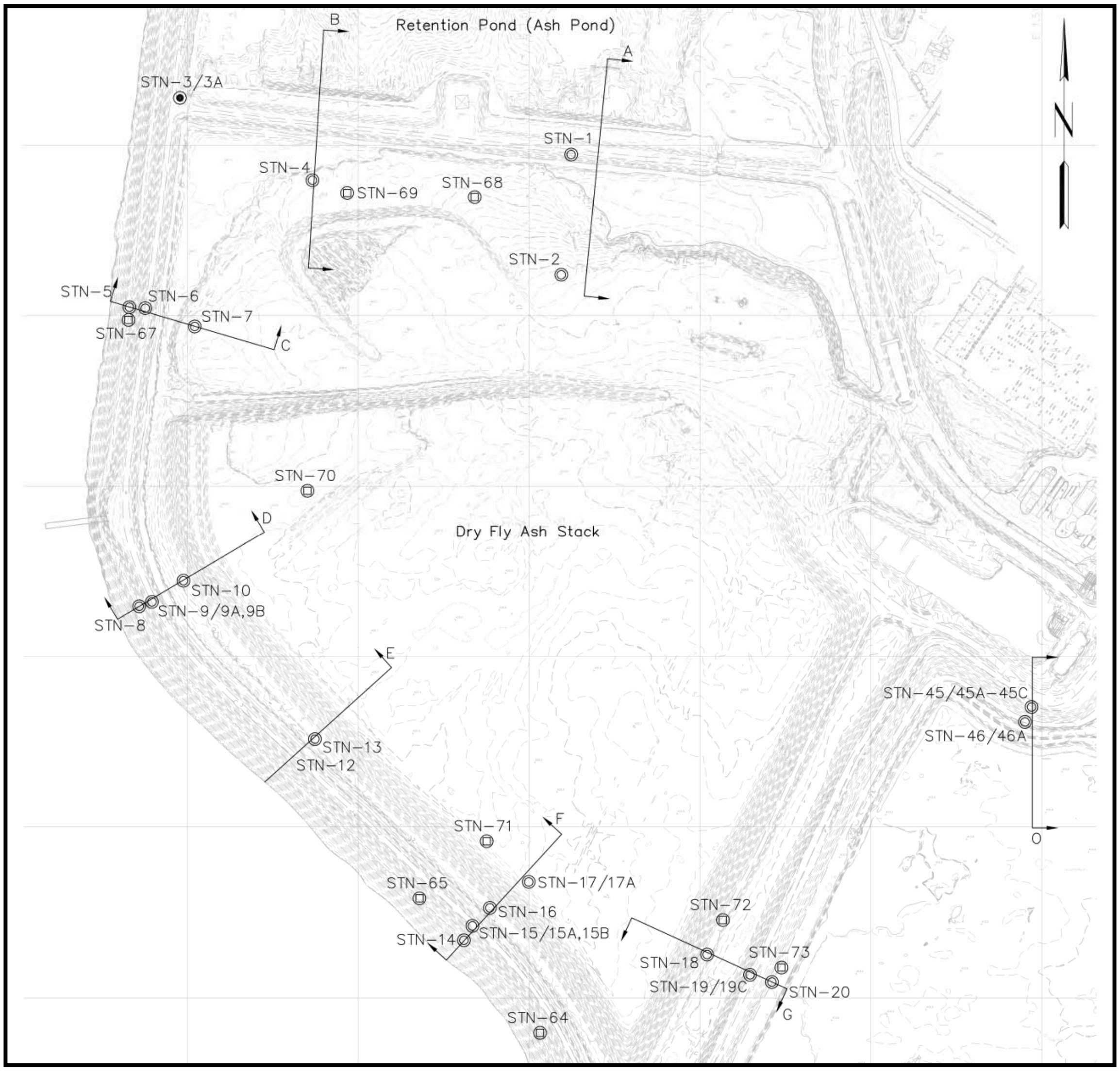


Figure 7. Plan View of the Dry Fly Ash Stack and the Stability Cross-Sections

12.2. Slope Stability Analysis

The stability of the slopes of the "original" and "raised" perimeter dikes, the "bottom ash" dike, the dry fly ash stack and the gypsum stack were analyzed using limit equilibrium methods. Analyses were performed for static, long-term conditions with steady-state seepage conditions and also for undrained conditions within the saturated ash materials.

The slopes were analyzed using both SLOPE/W and UTEXAS4 software. SLOPE/W which is available from GEO-SLOPE International, Ltd., of Calgary, Alberta, Canada (www.geo-slope.com), is a special-purpose computer program designed to analyze the stability of earth slopes using two-dimensional, limit equilibrium methods. UTEXAS4, which is available from Shinoak Software of Austin, Texas, was used to evaluate slope stability in the event of the sudden development of undrained loading conditions 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). With both software packages, the distribution of pore water pressures within the earth mass can be determined using a defined piezometric line. SLOPE/W also has the capability to directly incorporate a SEEP/W solution.

In this study, steady-state pore pressures were obtained from a defined piezometric line. The line was established by using the borehole water levels observed at the time of drilling, piezometer readings, the normal pool level of Wells Creek and visual observations of free water in surface ditches. The piezometer levels used were the highest average water levels observed after allowing the dissipation of excess drilling fluid from the borehole. Seepage analysis was not used to establish phreatic levels since ponds do not exist on either area. The unit weight and shear strength properties used in the stability analyses are summarized in Tables 7 and 8.

In addition to the long-term stability analysis, stability analyses were conducted for a partially undrained condition. Saturated fly ash typically exhibits an undrained peak shearing resistance at small strain, followed by a rapid loss in strength to a smaller, residual value. To guard against slope failures developing from undrained conditions within the CCP disposal areas, even when no specific triggering mechanism has been identified, slope stability analyses were completed where the static driving stresses were compared to the both drained and undrained shearing resistance of the saturated materials. The drained stability was evaluated as previously explained (using SLOPE/W). These results were compared to a criteria value of **FSd > 1.5**. Next, for current conditions and slope geometry, the undrained stability was evaluated using the three-stage calculation method available in UTEXAS4. In these calculations, the undrained strength capacity at points along the failure surface is estimated for the existing, anisotropic consolidation stresses, and the computed safety factor is compared to a criteria value of **FSu > 1.3**. In a third set of calculations, the undrained capacity is compared to the stresses imposed when additional lifts of embankment are placed. The acceptability of these conditions is judged based on a safety factor identified as FSul. The minimum FSul value is defined by equation 1.

$$FS_{UL} = \frac{2 * \mathrm{FS_U}}{(1 + (\mathrm{FS_U})} \qquad \textbf{Eqn. 1}$$

The calculation procedure and FS criteria will be further explained in a forthcoming memorandum being prepared be Stantec.

12.2.1. Limit Equilibrium Methods in SLOPE/W and UTEXAS4

The limit equilibrium method for analyzing slope stability evaluates 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 split into vertical slices and stresses are evaluated along the sides and base of each slice. The factor of safety against a slope failure (FS_{slope}) is defined as:

$$FS_{slope} = \frac{\text{shear strength of soil}}{\text{shear stress required for equilibrium}} \qquad \textbf{Eqn. 2}$$

where the strengths and stresses are computed along a defined failure surface, on the base of the vertical slices. The shearing resistance at locations along the potential slip surface are 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 curved and noncircular potential failure surfaces can be evaluated.

12.2.2. Slope Stability of the Dry Fly Ash Stack and Gypsum Stack Complex

The outslope of each cross-section was analyzed for slope stability using SLOPE/W 2007. SLOPE/W incorporates various search routines to locate the critical slip surface. For the analyses presented here, the "Entrance and Exit" method was employed. Once the potential failure surface with the lowest factor of safety was identified, the optimization routine was run.

Optimization allows the failure surface geometry to be modified based on the properties of the material through which the surface penetrates. The minimum and maximum range for the entrance and exit points of the failure surface was parametrically varied over a wide range to determine the likely solution region for the critical surface. In subsequent runs, the search was refined by narrowing the range and spacing for the candidate points. In addition, the entrance and exit ranges were also specified so that each "structure" was investigated individually. This allows for a comparison of the factors of safety of each portion of the slope within the cross-section.

Where the surface slope is composed of cohesionless (c' = 0) materials, an infinite slope failure (shallow sliding parallel to the surface) will be critical. While solutions were initially obtained for this case, these shallow sloughs were deemed to be minor and would be able to be repaired before any additional instabilities occurred. To force the search routine to evaluate deeper failure mechanisms, a minimum failure depth of at least 10 feet was specified for each section. Where the minimum factor of safety was found for shallow failure surfaces, additional analyses were performed for "deep seated" failure surfaces. This was done to demonstrate the factors of safety against large, catastrophic failures.

12.2.3. Slope Stability Parameters

Tables 10 and 11 summarize the parameters selected for each of the soil horizons used in the analyses. Specifics of how the parameters were selected are provided in Appendix J (Material Property Calculation). Further information on the selection of strength parameters and the derivation of the properties used in the UTEXAS4 calculations will be explained in a forthcoming document to be issued by Stantec.

Table 10. Slope Stability Shear Strength Parameters (Drained Conditions)

Material Type	Unit Weight, γ' (pcf)	Effective Stress	
		Cohesion, c' (psf)	Friction Angle, φ' (deg)
Clay Dike 1	124	100	25
Clay Dike 2 - Lean Clay	128	100	28
Clay Dike 2 - Fat Clay	127	200	19
Clay Dike 3	126	50	30
Fly Ash – Stacked	100	0	32
Bottom Ash or Fly Ash - Sluiced	100	0	22
Bottom Ash - Stacked	105	0	35
Gypsum	105	0	38
Alluvial – Clay	121	200	30
Alluvial – Granular	130	0	32
Matrix (gravel, clay & boulder)	130	0	35
Bedrock	Impenetrable		

Table 11. Slope Stability Shear Strength Parameters (Undrained Conditions)

Material Type	Unit Weight, γ (pcf)	Effective Stress	
		Cohesion, c (psf)	Friction Angle, φ (deg)
Fly Ash – Stacked (Saturated)	100	140	11
Bottom Ash or Fly Ash - Sluiced	100	140	11

12.2.4. **Long Term (Drained) Slope Stability Results**

Using the strength parameters selected (c' and ϕ') listed in Table 10, the existing dike configuration was analyzed at each of the fifteen cross sections. Geo-Slope's Slope/W computer program was used for the analyses with pore pressures calculated from the defined piezometric line. Long term (effective stress), steady state seepage conditions were analyzed using Spencer's method. For the Spencer's method analyses, curved failure surfaces with optimization were analyzed. Minor details of the geometry, such as various small riprap zones and limited clay cover, were not represented in the stability model.

The stability analyses focused on the potential for failure of the dike outslopes. SLOPE/W failure surfaces from these analyses are presented on the drawings in Appendix B. The results are summarized in Table 12. Results are presented for two cases, "Global (Dee-Seated)" and "Non-Global (Minimum)". The "Non-Global (Minimum)" factors for safety for Sections A, B, J, K, L and M represent very shallow failure surfaces that would not be considered global in nature.

Table 12. Summary of Computed Factors of Safety (As Found) for Long Term Slope Stability

Section*	Global (Deep-Seated)	Non-Global (Minimum)
A	2.6	1.0
B	2.8	1.3
C	1.5	--
D	1.6	--
E	1.9	--
F	1.4	--
G	1.7	--
H	1.4	--
I	1.6	--
J	1.7	1.3
K	2.0	1.2
L	2.0	1.3
M	2.5	1.2
N	1.5	--
O	2.5	--

*Refer to Figures 6 and 7 for plan view of site with section locations
-- Minimum FS is considered a Global Failure for this section

The Tennessee Department of Environment and Conservation (TDEC) "Rules and Regulations Applied to the Safe Dams Act of 1973" provides guidance and standards with regards to existing dams. The standards do not specifically address target factors of safety for slope stability, but instead merely indicate that the dam shall be "stable". Based on discussions with TVA and to be in accordance with current prevailing practice, a minimum factor of safety of 1.5 was adopted for long-term conditions using the guidelines presented in USACE Manual EM 1110-2-1902 “Slope Stability”.

Considering only potential failure mechanisms that would immediately compromise the system of dikes or the stacked material itself, the slope stability results show that there are several areas of concern. These areas can be divided into four groups:

- Potential failure of the “Bottom Ash Road” Dike (Sections H, J, K, L, and M)
- Potential failure of the “Original and Raised” Dikes (Section H)
- Potential failure of the stacked fly ash slope (Section F)
- Potential failure of the divider dike bottom ash slope (Sections A and B)

The lowest factors of safety (FS) in the “Bottom Ash Road” Dike ranged between 1.2 and 1.4 for the sections listed above. The potential failure of this dike generally initiated mid-slope of the dike, followed an optimized surface and terminated into the perimeter ditch. Although the geometry of each section varied slightly, the main factor that reduced the FS of sections J through N was the setback of the dike. This setback does not allow the dike to “key into” the original dike structure for additional support. The potential failure in section H may be attributed to elevated water levels.

Section H is the location of the slope movement that occurred in 2005. Slope stability analyses performed by Geosyntec Consultants in early 2009 indicated that FS values were being adversely affected by rising phreatic levels. Factors of Safety as low as 1.2 were determined in this area. Soon after being informed of this, TVA decided to halt regular slurry pumping to the stack. A plan for bypassing the slurry flow around the stack was developed by Stantec on March 16, 2009 (TVA Reference No. CUF-CT-090316). It was completed on May 11, 2009. The current FS value computed for Section H by Stantec is 1.4. Phreatic levels in the area of Section H are monitored weekly.

The FS of Section F in the stacked fly ash slope was 1.4. The potential failure surface in this section initiated at the existing crest of the stacked fly ash, followed an optimized curved path into the sluiced fly ash and terminated into the perimeter ditch. The main factor that reduced the FS of section F was the surface slope. The design slope on the permit drawings indicated a maximum slope of 3H:1V and the actual surveyed slope in Section F was 2.8H:1V. Elevated piezometric levels also contributed to the lower factor of safety in this section.

The FS in Sections A and B ranged between 1.0 and 1.3. The potential failure surfaces in these sections begin in the visible bottom ash bench north of the divider dike and follow an optimized curved path into the sluiced fly ash in the retention pond. The hydrographic survey provided by TVA indicates that the slopes below the water surface are very steep (almost 1H:1V).

A rapid drawdown analysis of the divider dike was performed using Slope/W. During rapid drawdown, the stabilizing effect of the water on the pond face of the dike is lost, but the pore-water pressures within the dike may remain high. As a result, the stability of the pond face of the dike can be much reduced. The dissipation of pore-water pressure in the embankment is largely influenced by the permeability of the dike materials. Highly permeable materials drain quickly during rapid drawdown, but low permeability materials take longer to drain. Sections A and B both achieved a FS of 1.7 against rapid drawdown failure.

There was no indication in the slope stability analyses that a translational (noncircular) failure surface would give a factor of safety lower than obtained for optimized curved 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 results in Table 11 and Appendix B represent factors of safety computed from the optimized, curved slip surface routine.

12.2.5. **Remedial Improvements**

A review of the stability analyses results indicates that while most of the minimum factor of safety failure surfaces do not represent true global failures of the dike system, it is likely that some of the modeled shallow failures could subsequently lead to an eventual breach. The smaller failures were generally located from the middle to the toe of the slope. If one of these shallow failures occurred, it would leave a steep slope that would then likely fail again; thus producing a progressive failure that may compromise the crest and possibly release CCPs. Therefore, remedial improvements at selected locations are needed to increase the dike slope stability to meet TVA Programmatic design criteria. The conceptual improvements are shown in Appendix K.

Improvements to slope stability factors of safety can generally be obtained most efficiently by flattening slopes, adding toe support, lowering phreatic levels, or some combination thereof. Typically, flattening of slopes is the least costly of these approaches, followed by adding toe support and lowering of phreatic levels. For each of the stability sections, these remediation methods were considered. The remediation alternatives presented were based on engineering judgment and past experience taking into account effectiveness and cost.

12.2.6. "Bottom Ash Road" Dike (Sections H, J, K, L, M, and N)

To raise the minimum factor of safety to 1.5 or greater, a toe buttress can be added below the bottom ash road dike. Conceptually, the toe buttress could consist of compacted clay, possibly with a layer of rock at the surface to discourage overexcavation during maintenance. The slope protection is to be installed at the toe of the slope; filling the existing ditch. The new ditch itself must be relatively impervious in order to prevent surface water infiltration into the dikes. This repair must be completed in conjunction with the site-wide regrading of the perimeter ditch.

These repairs will add structural support to the toe of the slope and help reduce the amount of ponded water in the ditch above Dikes 1 and 2; both improving the slope stability factor of safety.

Slope stability analyses were performed for this repair scenario and the results are presented in Table 13. The analyses were performed for Sections J and M, but the results would be typical for all sections.

Table 13. Summary of Long Term Stability Analyses – Bottom Ash Road Dike

Section	Original Factor of Safety (Non-Global, Minimum F.S.)	Repair Factor of Safety (Non-Global, Minimum F.S.)	Original Factor of Safety (Global, Deep-seated F.S.)	Repair Factor of Safety (Global, Deep-seated F.S.)
J	1.3	1.6	1.8	1.8
M	1.2	1.6	2.5	2.8

12.2.7. "Original and Raised" Dikes (Section H)

A past slope failure of the downstream face of the "Original and Raised" Dikes in the vicinity of Section H was reported in the project records. This slope failure was temporarily repaired by TVA by removing disturbed soil and placing riprap. A permanent repair is currently being designed by Stantec for this area. This repair includes two primary features, a trench drain to control the phreatic (water) surface within the dikes and a more substantial toe buttress constructed using riprap.

For Section H, the trench drain has been designed to intercept seepage flowing from the Gypsum Stack towards the face of the slope. It will be installed along the length of the instability on the crest of Dike 2 and extend to a depth of at least 16 feet where it will penetrate the sluiced ash layer. The trench will be filled with granular material to allow free flow of water to enter a pipe located two feet above the bottom of the excavated trench. The water will be transferred through the piping to a single collection point and then either pumped into the perimeter collection ditch or allowed to flow into Wells Creek when the necessary permits are obtained.

The toe buttress includes the installation of slope protection consisting of geotextile fabric, bedding stone (TDOT No. 2 stone) and riprap (Class A). The slope protection is to be installed at the toe of the slope and along the face of the slope. The lower part of the buttress will be constructed at a 2H:1V slope up to elevation 375 feet, where there will be a 35-foot wide bench. Above the bench, the rock will be placed at a 3H:1V slope with a thickness of five feet.

These repairs will help keep the phreatic (water) surface lowered and will add structural support to the toe of the slope, both improving the slope stability factor of safety.

Slope stability analyses were performed for this repair scenario and the results are presented in Table 14.

Table 14. Summary of Long Term Stability Analyses – Original and Raised Dikes

Section	Original Factor of Safety (Non-Global, Minimum F.S.)	Repair Factor of Safety (Non-Global, Minimum F.S.)	Original Factor of Safety (Global, Deep-seated F.S.)	Repair Factor of Safety (Global, Deep-seated F.S.)
H	*(1)*	*(1)*	1.4	1.8

(*1*) Minimum FS is considered a Global Failure for this section

12.2.8. **Stacked Fly Ash Slope (Section F)**

The main factors that reduced the factor of safety of section F were the surface slope and the setback of the fly ash slope from Dike 2. The design slope on the permit drawings indicated a maximum slope of 3:1 (H:V) and the actual surveyed slope in Section F was 2.8:1 (H:V). The repair for this section consists of re-grading the existing slope to the design grade and placing a toe buttress at the toe of the stacked fly ash slope.

Slope stability analyses were performed for this repair scenario and the results are presented in Table 15.

Table 15. Summary of Long Term Stability Analyses –

Stacked Fly Ash Slope (Section F)

Section	Original Factor of Safety (Non-Global, Minimum F.S.)	Repair Factor of Safety (Non-Global, Minimum F.S.)	Original Factor of Safety (Global, Deep-seated F.S.)	Repair Factor of Safety (Global, Deep-seated F.S.)
F	*(1)*	*(1)*	1.4	1.5

(*1*) Minimum FS is considered a Global Failure for this section

12.2.9. **Stacked Divider Dike Bottom Ash Slope (Sections A and B)**

The main factor that reduced the factor of safety of sections A and B was the surface slope. The design slope on the permit drawings indicated a maximum slope of 3:1 (H:V) and the actual surveyed slope in Section A was 1.2:1 (H:V) and in Section B was 1.3:1 (H:V). The repair for this section consists of re-grading the existing slope to the design grade.

Slope stability analyses were performed for this repair scenario for Section A and the results are presented in Table 16.

Table 16. Summary of Long Term Stability Analyses – Stacked Bottom Ash Slope (Section A)

Section	Original Factor of Safety (Non-Global, Minimum F.S.)	Repair Factor of Safety (Non-Global, Minimum F.S.)	Original Factor of Safety (Global, Deep-seated F.S.)	Repair Factor of Safety (Global, Deep-seated F.S.)
A	1.0	1.6	2.6	2.8

12.2.10. **Buildout**

Once the analyses of the conceptual repair designs were completed, slope stability analyses of the completed "as permitted" Dry Fly Ash Stack and the Gypsum Disposal Complex were conducted. The geometry of each permitted facility, as shown on the permit drawings Stantec obtained from TVA, was used to compare against the surveyed cross-sections. Stantec compared the cross-sections against the permit drawings to check for conformance relative to maximum permitted slopes, heights and setbacks.

For the Dry Fly Ash Stack, Sections C, E and F were evaluated. Each section yielded a satisfactory FS

For the Gypsum Stack Complex, Sections J and M were evaluated. In addition to using the provided CADD files to create the cross sections, it was assumed that the existing dikes and perimeter ditches would remain as constructed in their current positions. Using the assumptions that the repairs discussed above were implemented and water is not allowed to pond on the stack; each section yielded acceptable factors of safety.

12.2.11. **Undrained Analysis**

After the drained factors of safety were obtained and required conceptual repairs were made, the model was transferred to UTEXAS4 to complete the undrained analysis. Stantec conducted an undrained slope stability analysis on four selected sections at CUF. Two of these sections were located through the Dry Fly Ash Stack and two were located through the Gypsum Disposal Complex. The selected sections were chosen where the lowest factors of safety were realized for the drained analysis and the thickness of the sluiced fly ash deposits was generally greater. Table 17 summarizes the factors of safety as found by SLOPE/W and UTEXAS4 for drained and undrained conditions. The target factor of safety for the undrained analysis (Existing-Repaired Conditions) has been set at 1.3. Each section modeled for both the Dry Fly Ash Stack and the Gypsum Disposal Area meet this criteria and these sections are acceptable for the modeled conditions.

Table 17 – Undrained Factors of Safety for Selected Sections

Section	Undrained Factor of Safety (Existing-Repaired Conditions) (FS_U) **Target Value = 1.3 or Greater**
C	1.6
F	1.4
J	1.6
M	1.6

To continue the analysis, the same sections were modeled with an additional load placed over the existing section representing a lift of material. The analysis was repeated with varying lift thicknesses until a lift was found that met the final factor of safety criteria. The results of these additional analyses are presented in Table 18.

Table 18 – Factors of Safety for Additional Loading

Section	**Target Factor of Safety**	**Factor of Safety (FS_{UL})**	**Lift Thickness (feet)**
C	1.23	1.28	12.5
F	1.16	1.19	20.0
J	1.24	1.32	Full Buildout
M	1.23	1.61	Full Buildout

12.3. **Seepage Analysis**

12.3.1. **Background**

The plant is not currently sluicing gypsum slurry to the Gypsum Stack Complex on a regular basis. All slurry is being sent to the SynMat plant except during plant outages. TVA has made the decision that in the future all gypsum disposal will be converted to a dry operation. A 5- to 7-year operation plan that will include lined ponds on the existing complex is currently in the early planning stages**.** Based on the fact that water is not being ponded on the gypsum disposal complex, a seepage analysis is not appropriate for existing conditions and was not used to establish phreatic surfaces for slope stability analyses. However, a seepage analysis was performed to explore the effects of active sluicing and ponded water on the stability of the gypsum complex.

The objective of this seepage analysis was to observe the effect of active sluicing on the stability of the Gypsum Stack Complex. Seepage was examined in terms of total head (and pore water pressure) distribution within a given cross section of the dike assuming steady-state water conditions were achieved.

The seepage analysis was performed using SEEP/W, a numerical software tool developed by Geo-Slope International Inc. SEEP/W is a finite element software product for analyzing groundwater seepage and excess pore water pressure dissipation problems within porous materials such as soil and rock.

12.3.2. **Cross Sections**

The first step in the seepage analysis was to select a typical cross section for the Gypsum Stack Complex. From the stability analyses, Section H (the cross section through borings STN 21, 21A, 21B, 22, 22A, and 22C) was selected. Figure 6 shows Section H in the plan view of the Gypsum Stack Complex. Two geometrics were analyzed for Section H; existing conditions and the planned repairs. The cross sections are shown in Figure 8.

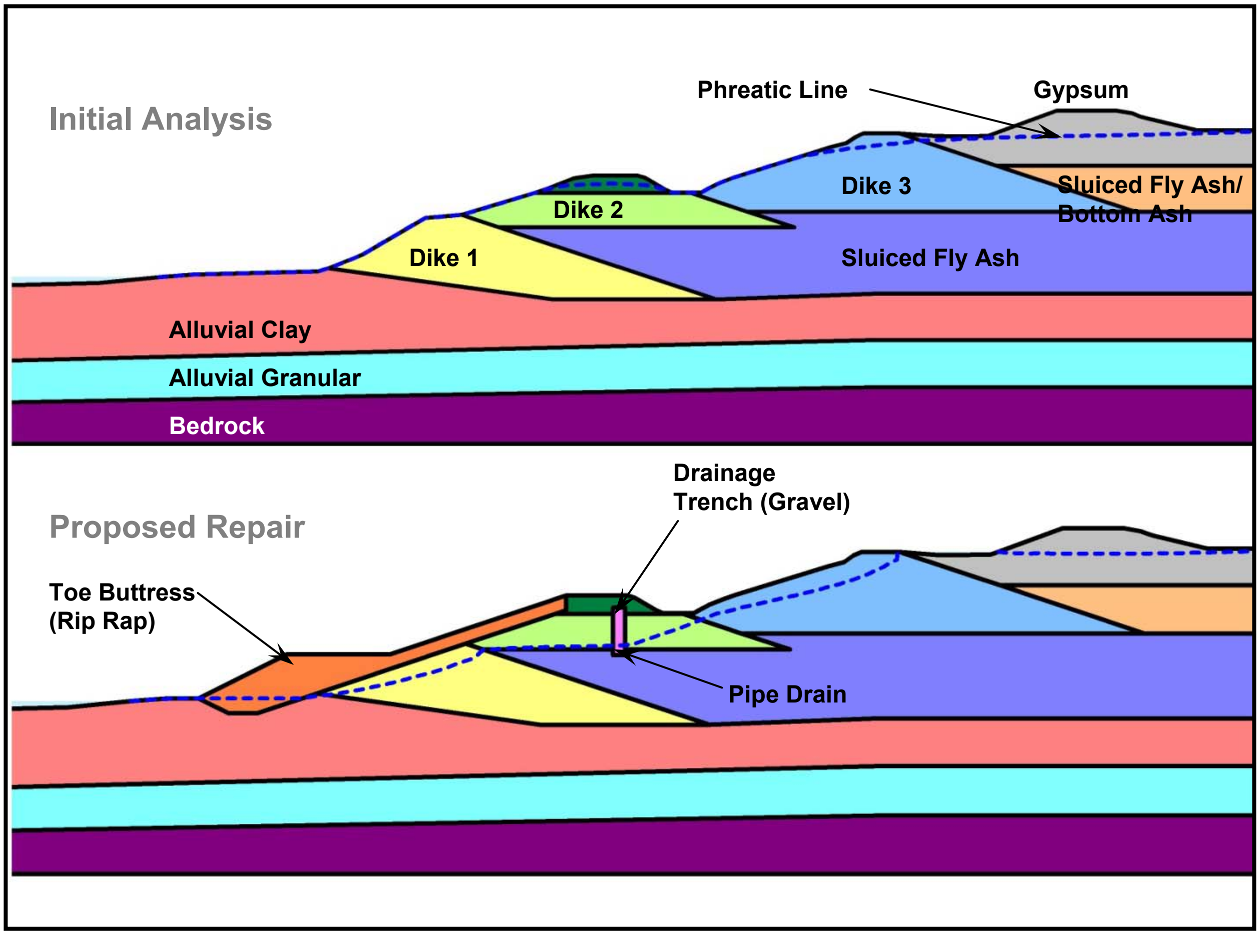


Figure 8. Section H (Existing Layout and Proposed Repair, Assuming Active Sluicing)

SEEP/W uses the concept of regions and points to define the geometry of a problem and to facilitate discretization (or meshing) of the problem. Section H's subsurface model was defined based on a combination of boring logs from the 2009 Stantec geotechnical exploration, piezometer data, historic drawings, and topographic survey information to estimate the dimensions of the cross section and build its geometry.

Piezometric data was available from the instrumentation installed during the 2009 Stantec field activities. Table 19 lists the installed piezometers referenced for Section H.

Table 19. Instrumentation at Seepage Analysis Cross-Sections

Cross Section	Boring	Type	Surface Elevation (ft)	Casing Depth (ft)	Tip Elevation (ft)
H	STN-21	Piezometer	395.13	39.1	356.0
	STN-22A	Piezometer	410.19	59.4	350.8

The average piezometer levels for STN-21 and 22A were 390.5 and 389.5 feet, respectively, between June 13, 2009 and September 15, 2009. However, these elevations do not reflect active sluicing and were lower than the model's suggested phreatic surface. The model's groundwater conditions were limited by the water level in Wells Creek and the water level in the stack at the top of the placed gypsum layer. No pooled water was assumed above the gypsum stratum.

12.3.3. **Material Properties**

Upon defining the geometry of the model (with automatic mesh generation) material properties were assigned using the *Saturated/Unsaturated Model* offered in SEEP/W. Only bedrock was modeled as *Saturated Only Model* conditions. The hydraulic conductivities and material properties estimated for the seepage analyses are presented in Tables 20 and 21. Locally at the Cumberland Fossil Plant, Dike 1 is commonly referred to as the original perimeter dike, Dike 2 is the raised dike, and Dike 3 is the bottom ash (gypsum stacking) dike.

Table 20. Hydraulic Conductivity Estimates for Seepage Analysis

Material	K_v/K_h	K_h/K_v	k_{sat} (K_h) (ft/sec)	k_{sat} (K_h) (cm/sec)	K_v (cm/sec)
Dike 1 (Clay)	0.10	10	9.27E-08	2.83E-06	2.83E-07
Dike 2 (Lean Clay)	0.10	10	9.28E-08	2.83E-06	2.83E-07
Dike 2 (Fat Clay)	0.10	10	9.28E-08	2.83E-06	2.83E-07
Dike 3 (Clay)	0.10	10	1.37E-06	4.17E-05	4.17E-06
Alluvial (Clay)	0.05	20	2.82E-08	8.60E-07	4.30E-08
Alluvial (Granular)	0.05	20	2.36E-03	7.19E-02	3.60E-03
Gypsum (Stacked)	0.02	50	4.65E-06	1.42E-04	2.83E-06
Fly Ash (Stacked and/or Sluiced)	0.02	50	3.03E-06	9.24E-05	1.85E-06
Fly Ash/Bottom Ash (Sluiced)	0.02	50	3.03E-06	9.24E-05	1.85E-06
Toe Buttress (Rip Rap)	0.50	2	3.28	1.00E+02	5.00E+01
Drainage Trench (Gravel)	0.10	10	0.0328	1.00E+00	1.00E-01
Bedrock (saturated only)	0.10	10	1.00E-12	3.05E-11	3.05E-12

Table 21. Material Property Estimates for Seepage Analyses

Material	m_v /psf	n	LL (%)	Grain Size Data/ Sample Function D_{10} (mm)	D_{60} (mm)	Volumetric Water Content θ_{sat} cm^3/cm^3	θ_{res} cm^3/cm^3
Dike 1 (Clay)	0.000003	0.401	40.5	0.0001	2	0.399	0.060
Dike 2 (Lean Clay)	3.00E-06	0.357	46	0.0001	0.004	0.355	0.109
Dike 2 (Fat Clay)	1.44E-05	0.454	53	0.0001	0.007	0.444	0.090
Dike 3 (Clay)	4.79E-06	0.386	39.8	0.0001	1.1	0.384	0.109
Alluvial (Clay)	4.79E-05	0.443	39.7	0.0001	0.04	0.400	0.056
Alluvial (Granular)	2.39E-06	0.269	NP	0.018	8	0.270	0.041
Gypsum (Stacked)	4.79E-06	0.520	NP	0.0108	0.025	0.516	0.041
Fly Ash (Stacked and/or Sluiced)	7.18E-05	0.558	NP	0.004	0.033	0.543	0.015
Fly Ash/Bottom Ash (Sluiced)	6.22E-05	0.378	NP	0.004	0.049	0.355	0.027
Toe Buttress (Rip Rap)	2.00E-05	0.399	NP	Gravel		0.400	0.020
Drainage Trench (Gravel)	2.00E-05	0.399	NP	Gravel		0.400	0.020
Bedrock (saturated only)	0	N/A	NP	N/A		0.050	0.050

For these tables, the variables referenced are:

- K_v is the vertical hydraulic conductivity,
- K_h is the horizontal hydraulic conductivity,
- m_v is coefficient of volume compressibility,
- n is porosity,
- LL is liquid limit,
- D_{10} is the diameter passing 10% of the grain size distribution,
- D_{60} is the diameter passing 60% of the grain size distribution,
- θ_{sat} is the saturated volumetric water content, and
- θ_{res} is the residual volumetric water content.

Horizontal Hydraulic Conductivity (K_h): The K_h values for the in-situ materials (with the exception of bedrock) were estimated based on permeability test results on Shelby tube samples and CPT dissipation results. These estimates were compared to typical values from similar TVA projects, similar facility types, and technical literature. A tabular summary of the hydraulic conductivity information is included in Appendix L, Seepage Analysis.

The K_v values for gravel and rip rap were assumed based on typical values. A low K_v value was assigned to bedrock assuming some fractures would be present in the shale and limestone, allowing minimal flow.

Vertical Hydraulic Conductivity (K_v): The ratio of K_v to K_h was estimated based on permeability test results on Shelby tube samples and CPT dissipation results. These estimates were compared to typical values from similar TVA projects, similar facility types, and technical literature. This ratio was used to calculation the K_v.

The gravel and rip rap used for the repair section are assumed to be dumped into place, reducing anisotropy of the materials.

Coefficient of Volume Compressibility (m_v): Typical values after Head (1982) were used as a guideline for estimating these values.

Porosity (n): Porosity values were estimated based on an average of the void ratios from the geotechnical test results from the Stantec (2009) field investigation. Void ratio was converted to porosity using the equation:

$$n = \frac{e}{1+e}$$

Liquid limit (LL), D_{10}, D_{60}: Geotechnical test results from the Stantec (2009) field investigation were separated by approximate material type. The liquid limit used is an average of the available information. The grain size distributions for each material type were plotted together to estimate typical D_{10} and D_{60} values. A summary of the laboratory information used is included in Appendix L, Seepage Analysis.

Saturated Volumetric Water Content (θ_{sat}): The θ_{sat} values of all materials were estimated based on general material type using the article, "Estimation of Soil Water Properties" (Rawls et al. 1982).

Residual Water Content (θ_{res}): The θ_{res} values of all materials were estimated based on general material type using the article, "Estimation of Soil Water Properties" (Rawls et al. 1982).

12.3.4. **Drains**

There is documentation of an existing gravel drain placed on top of the sluiced ash prior to gypsum stacking. Underdrain outlet pipes daylight in several locations around the perimeter of the Gypsum Stack Complex. These drains are shown on the boring layout in Appendix B.

Observations of the drains made during Phase 1 site visits show that the flow rates of the outlet pipes differ from drain to drain. Since many of the underdrain pipe outlets exhibit no flow, the underdrain layer and pipe drains were neglected in the seepage analysis.

The proposed repair section includes a pipe drain in the gravel trench approximately one foot vertically into Dike 2. This is an estimate based on the repair cross sections (Appendix K). The pipe location will vary in the field as needed to promote drainage. However, this analysis suggests that the pipe drain should be maintained near the interface with the sluiced ash material.

12.3.5. **Boundary Conditions**

The next step in the process was to define boundary conditions. All boundary conditions were applied directly on geometry items such as region faces and region lines. Four boundary conditions were included in these models. First, water elevation in Wells Creek was assumed to be 359 feet, the ordinary water level. The gypsum stack was assumed to have water at the highest gypsum elevation in the model (ignoring gypsum dikes). For the models including the proposed repair section, a point boundary condition was added at elevation 378 feet to represent the pipe in the gravel trench drain. Potential seepage faces were allowed along the outboard sides of the dikes and the alluvial material.

12.3.6. **Results**

Upon defining the boundary conditions, the model was analyzed using *Steady State* seepage analysis option available in SEEP/W based on the assumption that the boundary conditions are constant over time. Detailed results of seepage analysis are presented in Appendix L. Figure 9 illustrates the total head contours for Section H for the three cases analyzed.

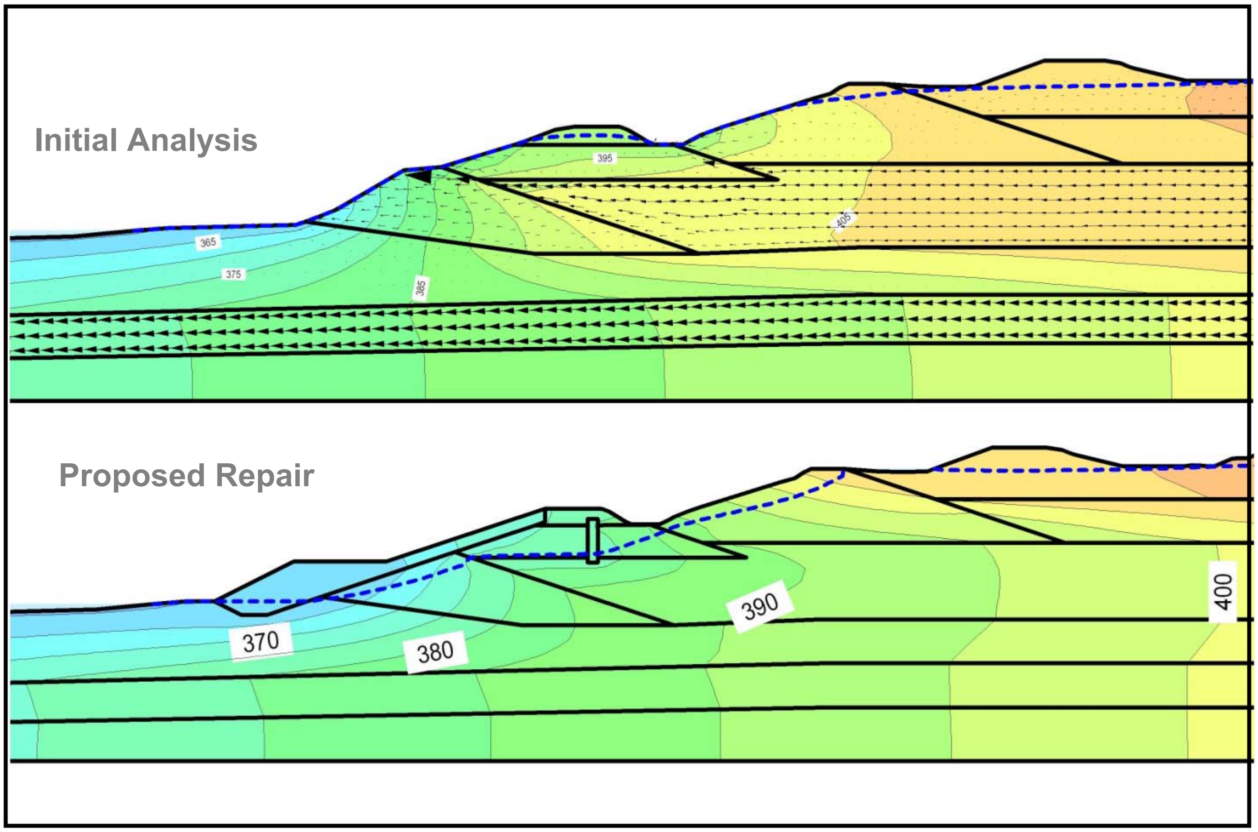


Figure 9. Section H Total Head Contours (Assuming Active Sluicing)

The results of the seepage model were then used as the water conditions for slope stability analyses similar to those performed for the entire complex. Table 22 summarizes the slope stability for the seepage conditions used for Section H. The graphical results are included in Appendix L, Seepage Analysis.

Table 22. Section H Slope Stability Results Incorporating Seepage and Active Sluicing

Condition	Factor of Safety	Failure Location	Seepage Location
Existing Conditions	0.7	Dike 2 above Dike 1	Dike 3 toe, Dike 2 toe, Dike 1 crest and face
Proposed Repair	1.6	Dike 2 into Alluvial to Wells Creek	Toe of Dike 1 to Wells Creek

For the Section H repair, careful placement and long-term maintenance of the drainage trench pipe is required to achieve a factor of safety of 1.5 during active sluicing. Control of the water level within the gypsum stack and seepage conditions from the complex to surrounding terrain is necessary for the gypsum stack complex based on the material properties and water conditions found during Stantec's 2009 field exploration.

12.3.7. **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 flows to the ground surface, can be evaluated to understand the potential severity of this problem.

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

$$FS_{piping} = \frac{i_{crit}}{i} \qquad \textbf{Eqn. 3}$$

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:

$$i_{crit} = \frac{\gamma_{sub}}{\gamma_w} = \frac{G_s - 1}{1 + e} \qquad \textbf{Eqn. 4}$$

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 1.0.

Where FS_{piping} = 1, the effective stress is zero and the near-surface soils are subject to piping or heaving. Note that Eqn. 2 is valid only for vertical seepage that exits to the ground surface. If the phreatic surface is buried, then the FS_{piping} will be greater than 1.0 even when $i=i_{crit}$.

12.3.8. **Seepage Gradients**

Contour plots of the hydraulic gradients computed from the SEEP/W solutions are shown for Section H's existing conditions, repair section, and repair section with build out to elevation 430 feet (assuming active sluicing) in Appendix L. Large gradients and significant seepage can be seen at various locations within the cross section, but the concern is for areas where these gradients can 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. Away from the ground surface, the potential movement of material due to seepage forces is arrested by the adjacent soil. Hence, the evaluation of seepage gradients within Section H is focused near the phreatic surface in Dikes 1 and 2 and the alluvial clay around the creek.

Considering the SEEP/W results in Appendix L, the predicted phreatic surface is observed to intersect the sloping ground surface below the top of Dike 3, the outer face of Dike 2, the exposed area of Dike 1, and the ground surface between the creek and the embankment. Groundwater seeping through the saturated dike materials may be flowing out to the ground surface, even though direct observations might be obscured by vegetation, evaporation, or the submerged ground surface. In these locations, the seepage forces associated with the hydraulic exit gradients are acting in the same direction as gravity. Because of the high potential for initiating the movement of soil particles and piping, a condition of groundwater seeping to the sloping surface of the downstream face is usually considered unacceptable in the evaluation of earth dams.

The potential for piping due to vertical seepage to the ground surface was also evaluated using the factor of safety defined in Equation 2. First, contour plots of vertical gradient (Appendix L) were examined to determine the general location of the maximum vertical exit gradient for each material type.

For the factor of safety calculations, average vertical gradients were determined over a depth of 3 to 5 feet just below the ground surface. The maximum computed gradients might occur at the very toe of the dikes. The model geometry converges to a sharp point at this location, such that the computed gradients in this small area are not reflective of the actual conditions in the field. However, to evaluate the potential for heaving of the dike toe in this area, gradients were taken across a thickness of no less than 3 feet.

Assuming active sluicing, the factors of safety against piping, computed based on the exit gradients from SEEP/W and the critical gradients determined from the soil properties, are summarized in Table 23. The lowest computed factor of safety of 1.2 is in the alluvial clay for the section build out to elevation 430 feet. According to TVA's newly adopted standard, the minimum acceptable factor of safety for piping is four (FS_{piping} = 4.0). Hence, Section H does not meet the design criteria for piping at the seepage exits, given continuous sluicing.

Table 23. Summary of Computed Exit Gradients and Factors of Safety against Piping (Assuming Active Sluicing)

Cross Section*	Vertical Gradient (i_v) at Critical Exit Point	Location of Critical Exit Point	Material	Critical Gradient (i_{crit})	FS_{piping}
H (Existing)	0.98	Top of Dike 1 near Dike 2 toe	Dike 1	1.02	1.04
	1.56	Toe of Dike 2	Dike 2	1.07	0.68
	1.32	Toe Dike 2 side of drainage channel	Dike 2	1.07	0.81
	0.92	Toe of Dike 1	Alluvial Clay	0.97	1.05
H Repair	0.77	Toe Dike 2 side of drainage channel	Dike 2	1.07	1.39
	0.72	20 ft into creek, 45 ft from toe of Dike 1	Alluvial Clay	0.97	1.35

Should active sluicing to the stack cease, the factor of safety against piping will improve with time. Three SEEP/W models were run to illustrate the falling water level within the stack. The first is the Section H (Existing) with a water elevation beginning at the top of the sluiced fly ash/bottom ash layer below the gypsum (elevation 399 ft). The second is the Section H Repair with a water elevation of 399 ft. The third is the Second H Repair pulls the water elevation level with the drainage trench pipe at elevation 378 ft. The results are summarized in Table 24. Graphical cross sections are included in Appendix L, Seepage Analysis.

The third SEEP/W model, assuming a water elevation of 378 feet at the collection trench pipe, still does not indicate acceptable factors of safety against piping. Since gypsum slurry is still sent to the stack on occasion, it is difficult to determine if dewatering will occur over time and produce a FS of 4.0 or greater. Mechanical means, such as a series of dewatering wells, may be required to lower the water level. Field pump tests would be required to determine the feasibility of this approach.

Table 24. Summary of Computed Exit Gradients and Factors of Safety against Piping (Without Active Sluicing, Stack Dewatering)

Cross Section*	Vertical Gradient (i_v) at Critical Exit Point	Location of Critical Exit Point	Material	Critical Gradient (i_{crit})	FS_{piping}
H (Existing) – Water El. 399 ft.	0.93	Toe of Dike 1	Alluvial Clay	0.97	1.04
H (Existing) – Water El. 399 ft.	0.57	Edge of creek, 60 ft from toe of Dike 1	Alluvial Clay	0.97	1.70
H Repair – Water El. 399 ft.	0.41	Toe Dike 2 side of drainage channel	Dike 2	1.07	2.61
H Repair – Water El. 399 ft.	0.43	20 ft into creek, 45 ft from toe of Dike 1	Alluvial Clay	0.97	2.26
H Repair – Water El. 378 ft.	0.33	Toe Dike 2 side of drainage channel	Dike 2	1.07	3.24
H Repair – Water El. 378 ft.	0.27	20 ft into creek, 45 ft from toe of Dike 1	Alluvial Clay	0.97	3.59

13. Conclusions and Recommendations

13.1. General

13.1.1. The conclusions and recommendations that follow are based upon Stantec's understanding of the facility as outlined in this report, and in TVA's plans for future operations. This understanding of the facility developed from reviews of historical information provided by TVA, discussions with TVA personnel throughout the course of this work and results of the geotechnical exploration and stability analysis.

13.1.2. It is recommended that the Operations and Maintenance Manual for each facility be reviewed and updated. The update should include information pertinent to any modifications made as a result of this study, routine monitoring and facility maintenance.

13.1.3. It is recommended that a program be established to develop record (as-built) drawings and construction records for future maintenance and construction activities.

13.1.4. Maintenance recommendations include: removal of trees that may cause instability of slopes, elimination of animal burrows in dikes, establish mowing program of ponds and disposal areas, regrade and repair eroded areas, and continue annual inspection program. A consistent maintenance program is a best management practice.

13.1.5. Water seeps on the slopes of dikes should be identified and observed at regular intervals. An accurate approximation of flow should be recorded along with photographs of the seep area. The seep area should be kept clear of vegetation in order to facilitate visual observation. Any rapid changes in the seep should be reported. This recommendation is supported by the TVA Master Programmatic Document in Section 3: Inspections, Monitoring and Reporting.

13.1.6. It is recommended that an instrumentation monitoring program be developed for the entire site. Best management practices suggest that routine monitoring of piezometric levels and precipitation allow for closer monitoring of the disposal facilities and quicker reaction to any problems that may arise. Additionally, if it is desired, remote monitoring of the instrumentation via the use of electronic piezometers and tiltmeters would reduce lag time associated with data entry and analysis and aid in developing accurate correlations between precipitation/releases and instrument response.

13.2. Dry Fly Ash Stack

13.2.1. The results of the slope stability analyses indicate that factors of safety against long-term failure are mostly greater than the target value of 1.5. Exceptions are the bottom ash divider dike at Sections A and B and the stacked fly ash slope at Section F. It is recommended that a work plan be developed for both of these areas to increase the minimum factors of safety. At Sections A and B, simply regrading the bottom ash slope to 3H:1V will increase the factor of safety above the required minimum value. At Section F, it is recommended that a toe buttress be constructed at the toe of the Dry Ash Stack and that the slope be flattened to 3H:1V as called for in the permit drawings. The design of the toe buttress at Section F should be coordinated with the pending redesign of the perimeter ditch system at the site. This recommendation is discussed in detail in Sections 12.2.5 thru 12.2.9 and is supported by Slope/W analyses.

13.2.2. Standing and slow-flowing water in the perimeter ditch likely contributes to saturation of the soil on the dike slopes. It is recommended that the ditches be cleared of dense stands of vegetation and the gradient of the invert improved to promote flow. The improvements should result in ditches that flow readily and not pool water. Ditches should be cleaned at regular intervals so that dense vegetation does not re-appear. Reducing pooled water and improving drainage is a best management practice.

13.2.3. During a recent site visit by Stantec, it was noted that fines removed from the bottom ash pond were being deposited at the northwest corner of the stack, near the toe of the future slope. This is undesirable because the toe of a slope is a critical location with regards to slope stability. The finer fractions of coal and ash should not be placed near the toe of slopes or concentrated in any one location. It is recommended that fines be dispersed evenly across the active stack and kept from being deposited near the edges of the stack. When possible, fines should be mixed with coarser material to reduce pore pressures and promote drainage. This is a best management practice.

13.2.4. To provide for better definition of phreatic levels, additional piezometer installations are recommended at the following locations:

- Section C – Top of Dikes 1 and 2 (elevations 380 and 395)
- Section D – Top of existing stack and crest of original dike (elevations 430 and 380)
- Section F – Top of existing stack and crest of original dike (elevations 430 and 380) and Replace PZ-16
- Section G – Along Base of dry fly ash stack (elevation 400)

The installation of these instruments will allow for better monitoring of slope stability and should be considered a best management practice.

13.2.5. It appears that bottom ash and fly ash are sometimes placed over phragmites. Best management practices dictate that fill should not be placed over vegetation; including phragmites. Over time, buried vegetation will decay and cause localized soft zones. Depending on the location, these soft zones may contribute to rutting, excessive settlement and slope failure. Vegetation should be removed prior to the placement of fill. This is a best management practice.

13.2.6. It appears that the stack is not conforming to the approved permit drawings in some areas, i.e., slopes and the presence of benches. Through discussions with TVA, Stantec also understands that they wish to modify the current design to provide for better drainage control and construction layout control. It is recommended that the

Dry Fly Ash Stack be redesigned and the Permit be modified to provide for these improvements.

13.2.7. If the water level in the ash pond is going to be lowered substantially (more than a few feet), it is recommended that it not be dropped more than 2 feet per week in order to minimize the potential for shallow failures in the bottom ash berm. Analyses in Slope/W show that the Divider Dike has an acceptable factor of safety against failure during rapid drawdown. However, this recommendation is made as a best management practice.

13.2.8. The results of the additional analyses conducted on the Dry Fly Ash Stack show that the maximum lift thickness that should be placed instantaneously within the facility is 12.5 feet. Further calculations show that if the amount of fly ash and bottom ash disposed of in 2009 (~348,500 cy) was placed evenly across the available disposal area (~69 acres), the resulting lift thickness would be approximately 3.2 feet. Knowing that it is more efficient to conduct operations in a concentrated area, Stantec also calculated the allowable time rate of construction. Using one-dimensional consolidation equations, it has been calculated that if the maximum lift thickness is placed instantaneously, no further fill should be placed in that area for a period of 2.5 years. This analysis does not account for the pore pressure dissipation that occurs as fill is being placed, and is therefore conservative. It is recommended that additional piezometers be installed around and in the Dry Fly Ash Stack so that the pore pressures generated by fill placement may be monitored. If increased piezometric levels are detected, additional slope stability analyses should be performed to verify that adequate factors of safety still exist.

13.3. Gypsum Disposal Complex

13.3.1. Less than adequate factors of safety against slope failure were obtained for most cross sections analyzed for the Gypsum Stack. These areas can be divided into two groups; the “Original and Raised” dike at Section H (site of the 2005 slope movement) and the lower part of the “Bottom Ash Road” dike. The toe drain/slope repair design prepared by Stantec for Section H should be implemented as soon as possible. This is supported by Slope/W analyses.

13.3.2. After the slope repair at Cross-section ‘H’ the repaired slope should continue to be monitored using inclinometers and piezometers. Following best management practices, the seepage effluent from the outlet pipe should be monitored for volume and visual clarity. The temporary sump pump system should be removed in its entirety once the NPDES permit is received.

13.3.3. The same conclusion and recommendation for the perimeter ditch around the Dry Fly Ash Stack is applicable to the perimeter ditch around the Gypsum Disposal Complex. Standing and slow-flowing water in the perimeter ditch likely contributes to saturation of the soil on the dike slopes. It is recommended that the ditches be cleared of dense stands of vegetation and the gradient of the invert improved to promote flow. The improvements should result in ditches that flow readily and not pool water. Ditches should be cleaned at regular intervals so that dense vegetation does not re-appear. Reducing pooled water and improving drainage is a best management practice.

13.3.4. It is recommended that the impoundment of water and gypsum sluicing operations atop the gypsum disposal facility not be resumed. Seep/W and Slope/W Analyses indicate that dike slope stability decreases with increased seepage through the stack material caused by sluicing gypsum. If sluicing occurs, factors of safety against piping are also unacceptably low. While sluicing gypsum slurry to the top of the existing stack is not recommended, sluicing gypsum slurry to lined ponds located atop the stack is practicable. Stantec is currently preparing a Work Plan which will include three small (about 5 acres) lined gypsum sluicing ponds. Pond features include a 60-mil geomembrane protected by 12 inches of gypsum. A 24-inch “marker” layer of crushed rock will overlie the protective gypsum layer. Each pond will be about 11 feet deep. Sluicing would alternate between ponds to allow for settlement of solids and subsequent removal. Stability analyses did not indicate placing a restriction on design stacking height of gypsum as long as it is “dry stacked”.

13.3.5. Toe buttresses should be constructed below the bottom ash road dike. This recommendation is supported by Slope/W analyses discussed in Section 12.2.6. This repair must be completed in conjunction with the site-wide re-grading of the perimeter ditch.

13.3.6. Additional piezometer installations are recommended at the following locations:

- Section G – Along the Bottom Ash Road Dike and the crest of the existing gypsum dike (elevations 410 and 420)
- Section M – Top of Gypsum Dike and Bottom Ash Road (elevations 420 and 410)

The installation of these instruments will allow for better monitoring of slope stability and should be considered a best management practice.

13.3.7. Exposed bare slopes should be covered with topsoil and vegetation per TVA slope vegetation specifications.

13.3.8. Fine gypsum that settles in the dipping pond next to the bottom ash pond is excavated and hauled to the gypsum stack every few days. After the material has a chance to dry, it appears to have similar characteristics to the “regular” gypsum. Due to its wet condition at the time of placement, we recommend that it be placed in the interior of the stack. A buffer distance of 100 feet from the outslope is recommended. This recommendation is based on engineering judgement and should be considered a best management practice.

13.3.9. The seep on the slope of Dike 3 that was discovered in the summer of 2009 near Section ‘J’ should be addressed. The seepage can be controlled and the slope stability increased through installation of a crushed rock blanket drain. The blanket drain should consist of a 12-inch blanket of TDOT 903.01 Concrete Sand followed by a 6-inch layer of #57 stone, a 6-inch layer of #1 stone and 12-18 inches of TDOT Class ‘A-1’ crushed limestone embedded into the slope after vegetation and topsoil is removed. Plans detailing the limits of the repair have been prepared and included in the Gypsum Stack Modification Project. This repair was evaluated using Slope/W.

14. Closure and Limitations of Study

14.1. The scope of this evaluation was limited to consider the potential risks of dike failure under long-term, steady-state seepage loading conditions and undrained loading conditions.

14.2. The recommendations presented herein are based on information gathered (from various sources) using that degree of care and skill ordinarily exercised under similar circumstances by competent members of the engineering profession. Subsurface profiles are generally based on straight-line interpolation between borings and no warranties can be made regarding the continuity of subsurface conditions between the borings.

14.3. 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.

Appendix A

Historic Documents

<u>Geotechnical Reports</u>
<u>Cumberland Fossil Plant</u>

1. "Cumberland Steam Plant – Ash Disposal Area – Soils Investigation", Memorandum from Gene Farmer to W.W.Engle, August 7, 1974.

2. "Cumberland Steam Plant – Ash Dike Raising – Borrow Area B Expansion and Proposed Borrow Area D", Memorandum from Frank Van Meter to G. L. Buchanan, June 16, 1981.

3. "Site Investigation – Cumberland Fossil Plant Soils Investigation for Ash Pond Dike and Borrow Areas", Hall, Blake and Associates, Inc., October 3, 1986.

4. "Ash Pond Dike – Recommended Engineering Properties for Slope Stability Analyses", TVA, December 12, 1986.

5. "Cumberland Fossil Plant – Chemical Treatment Point – Soils Test Report", Memorandum from R.E. Bruer to J.L. Golden, August 13, 1987.

6. "Cumberland Fossil Plant – Ash Disposal Area No. 1A", Power Engineering & Construction Calculations, K.W. Burnett, December 19, 1990.

7. "Report of Subsurface Exploration and Stability Analyses, Proposed Fly Ash / Scrubber Sludge Disposal Facility, Cumberland Fossil Plant, Cumberland City, Tennessee", Law Engineering and Environmental Services, Inc., January 27, 1992.

8. "Recommendations for Stability Improvement, Ash Pond Dike System, Cumberland Fossil Plant, Cumberland City, Tennessee", Law Engineering and Environmental Services, Inc., March 13, 1992.

9. "Results of Laboratory Testing, TVA Fly Ash & Gypsum Disposal Facilities, Cumberland Fossil Plant, United Engineers and Constructors Inc.", June 1992.

10. "Report of Hydrogeologic Evaluation, Proposed Dry Fly Ash and Gypsum Disposal Facility, TVA Cumberland Fossil Plant, Cumberland City, Tennessee", Law Engineering and Environmental Services, Inc., July 3, 1992.

11. "Geotechnical Investigation Report, Dry Ash Conversion Project, CUF 1 & 2", Raytheon Engineers and Constructors, July 7, 1993.

12. "TVA – Fly Ash, Bottom Ash, and Scrubber Gypsum Study", Law Engineering and Environmental Services, Inc., October 1995.

Geotechnical Reports
Cumberland Fossil Plant

13. "Report of Preliminary Geotechnical Exploration, Proposed Gypsum Wallboard Plant, TVA Cumberland Fossil Plant, Cumberland City, Tennessee", Law Engineering and Environmental Services, Inc., January 3, 1997.

14. "Operations Manual: Dry Ash and Gypsum Stacking Facility", TVA, October 10, 2003.

15. "Laboratory Test Results, Samples from Gypsum Pond at Cumberland Fossil Plant", MACTEC Engineering and Consulting, Inc., May 13, 2004.

16. "Report of Geotechnical Exploration, Gypsum Area Seepage Study, Cumberland Fossil Plant, Cumberland City Tennessee", MACTEC Engineering and Consulting, Inc., May 1, 2007.

17. "Project Update – Seepage Investigation and Repair, TVA Cumberland Fossil Plant", Geosyntec Consultants, May 2007, October 2007 and July 2008.

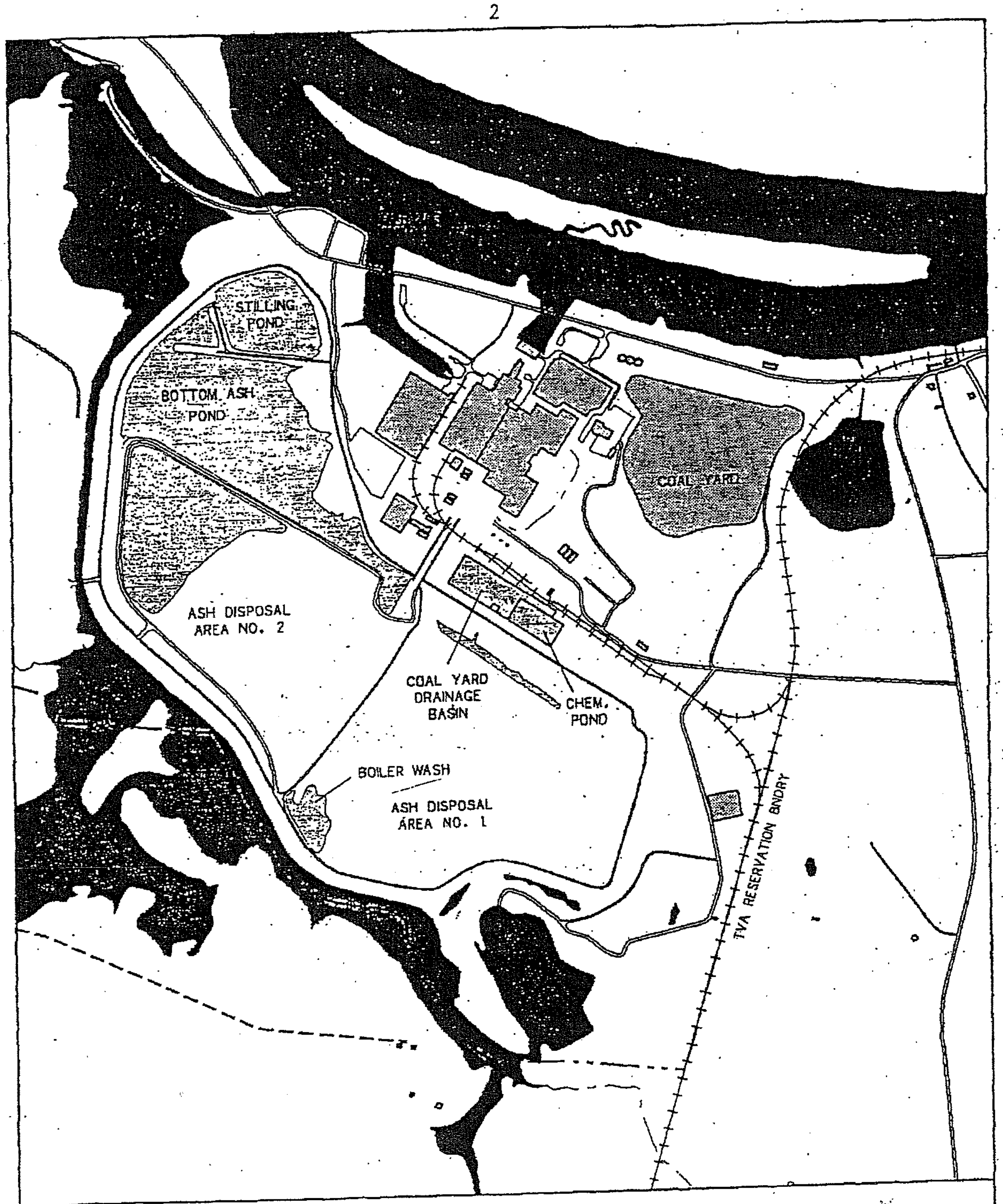


Figure 1. Existing Disposal Facilities at Cumberland Fossil Plant

TVA ENGINEERING LABORATORY NORRIS, TENNESSEE

- GEO TRANS Report - Leachate Modelling Report

TVA Cumberland Fossil Plant (CUF)
Assessment of Seepage Area

Background

- 1969 - Initial dikes (top elevation 380') constructed.
- 1973 - Seepage observed along relocated Wells Creek channel bank. Appeared that seepage was occurring through a "soft, saturated topsoil layer between el. 360 and el. 363."
- 1976 - Divider dike between Pond 1&2 constructed with bottom ash.
- 1981 - Initial dikes raised to top elevation 395'.
- 1986 - Discharge spillways raised to el. 372. This resulted in increased seepage along a portion of the Area 2 (western portion) perimeter dikes adjacent to Wells Creek. As a result, spillways were lowered to original elevation.
- 1987 - Because of the seepage below the exterior dikes in the Pond 2 area, interior dikes were constructed in the area (approximately 100 feet inside of exterior dike) with bottom ash.
- 1989 - New dredge cell constructed within Pond 1. Dike constructed using fly ash and bottom ash.
- 1991 - Pressure grouting of Pond 2 dike completed to reduce seepage.
- X - Pond 1 area converted to gypsum disposal in ? (permit documents dated 2003).
- 2004/2005 - Areas of seepage along toe of exterior dikes noted in 2005 Annual Ash Pond Dike Stability Inspection (inspection conducted in December 2004). Report states that same areas were noted in previous inspections.
- 2005 - Discovered slope failure in original ash pond dike below the gypsum area near where the ash/gypsum areas interface. The area was repaired by placing a drainage blanket consisting of a geotextile overlain by crushed stone and riprap. Geoprobes conducted within the failure area and outside the failure area did not indicate any noticeable changes in dike materials between the two areas. The 2006 Inspection indicates that standing water in the perimeter ditch may be contributing to the seeps.

Preliminary Review of Information

- GeoSyntec has spent two days reviewing available data and reports (one day at TVA's office in Chattanooga, TN and one day at GeoSyntec in Kennesaw, GA); key documents found to date include:
    - Hall, Blake, and Associates, *Site Investigation, Proposed Cumberland Fossil Project, Soils Investigation for Ash Pond Dike and Borrow Areas,* October 1986
        - 14 soil borings through perimeter dikes and 56 borings in borrow areas, associated laboratory testing
    - Law Engineering, Inc., *Report of Subsurface Exploration and Stability Analyses, Proposed Fly Ash/Scrubber Sludge Disposal Facility, Cumberland Fossil Fuel Plant,* January 1992
        - 15 soil borings through perimeter dikes, 6 dilatometer tests in ash areas, laboratory tests on remolded samples
    - Law Engineering, Inc., *Report of Hydrogeologic Evaluation, Proposed Dry Fly Ash and Gypsum Disposal Facility Site, Cumberland Fossil Fuel Plant,* July 1992 (part of the September 2003 O&M Manual)
        - 15 soil borings, well installations, slug testing

- GeoTrans, Inc. *Evaluation of Water Resource Impacts from Proposed Disposal Facilities at Cumberland Fossil Plant,* August 1992 (part of the September 2003 O&M Manual)
    - Boiler Wash Area on Figure 1 (see attached)
  - United Engineers and Constructors, Slope Stability Analysis, August 1992
  - Various Memorandums and Calculation Packages related to Slope Stability Assessments and Site Inspection Reports
- Mr. Neil Davies and Ms. Tamara Hebeler of GeoSyntec visited the site on 6 October 2006 with Mr. Randy Petty of TVA.
- Summary of Key Findings from Documents and Site Visit:
  - Generalized cross section through seepage area appears consistent with Figure 2 (see attached). Some variation in cross sections with respect to interior slope of original berm and width of berm between original and raised dikes (topography would help to confirm this).
  - Limited to no information regarding QA/QC associated with original dike construction has been located.
  - Discrepancies exist between various reports regarding detailed stratigraphy and material properties (e.g.., thickness of "soft layer" below original ground surface, questions posed concerning strength properties of natural materials below the dike).
  - Seeps in original dike observed/heard during site visit. Dike in area of previous slope failure has several "wet" spots.
  - Approximately 2 feet of standing water in perimeter ditch.
  - Water levels in piezometers located along the top of the perimeter dike were approximately 5 feet below ground surface (corresponding to the approximate elevation of the standing water in the perimeter ditch)

Objectives for Present Assessment

GeoSyntec understanding of TVA's current needs regarding this assessment is as follows:

- Assess current situation in terms of:
  - Slope stability (current FS, identify options for improvement if needed)
  - Seepage (attempt to quantify, identify possible causes, identify options for management of seepage water)
- Future conditions
  - Full-build out
    - Stability (identify options for improvements if needed)
    - Seepage – (estimate seepage after implementation of recommended fix, under full build-out conditions)
- Interim conditions
  - Is there an "interim condition" that is more likely than full build-out given the current success of marketing at CUF?

Geotechnical Investigation

Based on our review of currently available information, GeoSyntec recommends the following:

- Baseline Cross-section (in the vicinity of Boring Range B shown in Figure 2)
  - Drill 3 borings on existing dikes (existing roadway, bench of original dike, toe of slope)
  - Prepare boring logs indicating material description (visual classification) from ground surface to refusal (continuous sampling).

- Obtain disturbed samples of each material type or at 5 ft depths or each strata change
- Obtain undisturbed samples for triaxial and permeability testing at selected depths (assuming undisturbed samples can be recovered).
- Provide physical classification (grain size distribution, Atterberg Limits (clay samples only)) of major materials
- Install 2" ID temporary monitoring wells at locations and depths determined by TVA or their designated representatives. Actual locations and depths to be determined based on stratigraphy observed during drilling of borings. Allow 2-hours for development of each well, include blank section of casing at base of each well. Use surge block development with pumping (instructions to be forwarded by TVA). Assume two temporary wells per location. Temporary wells shall be installed in separate borings, offset approximately 5-ft from initial boring. [Each location: primary exploration hole; two offset holes (3 total, A, B, C per location)]. Protection of wells to be addressed by TVA. Use double density slotted screen; 5-ft. screen length; 2-in ID, schedule 40 PVC.
- Test pit down to "groundwater" in ash/gypsum disposal area
- Perform slug tests and provide estimates of in-situ hydraulic conductivity at selected temporary well locations.

- Failure Area (Boring Range A shown in Figure 2)
  - Essentially the same as for Range B, but locations and depths of piezometers may be adjusted based on baseline results
- Grouted Area (optional)
  - Consider installing a transect of 3 piezometers (toe of slope, original dike, existing roadway) to assess impact of grouting on phreatic surface. Compare to baseline and failure zone.

Analysis of Sections

- Current, Future, Interim conditions using:
  - SEEP/W –steady-state and transient seepage estimates
  - SLIDE – stability and steady-state seepage estimates

Data Needs

- Electronic Topography
- Available Aerial Photographs
- Groundwater Levels (requesting from Amos Smith)
- Documents (most likely with additional soil information)
  - TVA (CSB 78 1121 107)
  - Soil Schedule No. 70.1 (MED 811201 224)

Deliverable

- Sketches
- PowerPoint document with text, data, key output, figures

January 17, 1992

Gary Nuyt, BR 4A-C

CUMBERLAND FOSSIL PLANT- ASH POND DIKES-CHRONOLOGICAL EVENTS

This is a listing of events compiled primarily from design drawings, ash pond inspection reports, and memory. This information may BE incomplete.

A 295-acre pond was constructed in 1969 to provide ash disposal at Cumberland. The dikes were constructed to an elevation of 380 and compacted with sheepfoot roller to a 95% standard proctor maximum density. No foundation investigations were performed. The borrow material used to build the dikes came from inside the disposal area.

In October 1973, seepage along relocated Wells Creek channel bank was first observed by plant personnel. There was no apparent stability problem.

In December 1973, a limited investigation (drilled 2 or 3 holes in area of seepage where the original Wells Creek crosses the dike) to determined the cause of seepage through the ash dike at Cumberland Fossil Plant was performed. This investigation disclosed the presence of a continuous, soft, and saturated topsoil layer between el .360 and el. 363.

In February 1974, increased seepage under the dikes in the area where the original Wells Creek crosses the dike was reported by plant personnel.

In 1976 a divider dike (separate area into pond 1 & 2) was added by the plant. The interior dike was constructed out of bottom ash.

In late 1977 and early 1978, soils exploration of the dike foundation were performed in preparation of raising the ash dikes to el. 395 (existing top of dike elevation). This dike raising was completed in the fall of 1981.

In the fall of 1981, plant personnel raised the level of area 1 above the level of area 2.

In APRIL 1986 immediately after raising the discharge spillways four feet to an el. 372, an unacceptable amount of ash pond seepage began along a portion of the area 2 perimeter dike adjacent to Wells Creek. The seepage was inspected thoroughly by representatives of the plant, central staff, and engineering design, and a decision was make to lower the spillways four feet returning the ash pond water to its previous elevation. This was followed by an abatement of the seepage. Subsequent dike and foundation investigations revealed a thick soft layer of soil (by trenching with backhoe) below the original groundline under the dike with a potential for seepage and instability as water is raised in the pond.

In 1987, because of excessive seepage below the base of the exterior dike of pond 2b adjacent to Wells Creek, plant personnel constructed an internal dike approximately 100 feet inside of and parallel to the exterior dike. The dike was constructed with bottom ash.

In 1989, CSB (CONSTRUCTION SERVICES BRANCH) constructed a new dredge cell in fly ash pond 1 to elevation 401. This dike was constructed using fly ash and bottom ash. In October 1989, the dredge cell in area 1 was completed and dredging ash from area 2 into it began.

In January 1990, FHE prepared and submitted a cost estimate for repairing seeps and stabilizing ash pond 2 dike along Wells Creek and raise dikes around the stilling pond. This scheme would allow for the full ash pond capacity to be utilized at Cumberland.

In 1990, continued to dredge into fly ash no. 1 dredge cell.

In FY 1991 a project was submitted to correct the ash pond seepage problems (pressure grouting) and to provide sufficient dike stability (add riprap along toe of dike) to allow the full ash pond 2 capacity to be utilized at Cumberland.

In October 1991 the pressure grouting of ash pond 2 dike along Wells Creek was completed. The discharged spillway elevation was raised 4 feet to el. 372.

Riprapping along the toe of dike for dike stability has been delayed until the water level against the dike is raised to el. 378.

K. W. Burnett
Manager, Civil Section One
Fossil Engineering
MR 3B-C

KWB:PHF

6416J

TVA Disposal Facility Assessment
Phase 1 Coal Combustion Product Disposal Facility Summary
Cumberland Fossil Plant (CUF)
Dry Ash Stack (DS-1)

1. General Facility Information

Facility Status:	Active		
Surface Area:	110 acres (estimated)	**Maximum Height (toe to top of stack):**	35 feet Existing 200 feet Proposed

2. Site Visit Information

Stantec Assessment Team:	Stephen Bickel, PE, Nathan Bader, PE, Stan Harris, PE and Matthew Hoy, EIT
TVA Staff Present:	Stuart Harris and Carrie McCarty
Field Assessment Dates:	January 14, 2009 and February 3 - 4, 2009
Weather/Site Conditions:	Mid-30 degrees F, sunny, moist ground both days.

3. History/Description of Usage

History, Operation and Stacking Plan:

In 1972, Wells Creek was relocated in order to construct old Disposal Area 1. Old Area 1 was enclosed by the existing perimeter dike and contained sluiced ash. In the 1980s, sluicing operations ceased within Area 1 and began in the current Area 2 to the north. Divider dikes were constructed to separate the current pond from the gypsum and ash stacking operations. In 1995-96, the current divider dike between the Ash Pond and Dry Stack was constructed. In 1996, stacking within this area began. The Dry Stack is bordered by the Ash Pond to the north, by the bottom ash pond to the east, the Wet Gypsum Storage Area to the south, and by perimeter ditches and the old Area 1 perimeter dike to the west. There is a stacking plan available, and construction is currently proceeding to the north. The sequence consists of building the base and closing it, then moving up to the next level. The stack's maximum height is currently 35 feet. A small dredge cell was constructed within the northwest portion of the Dry Stack in 2007 to dispose of coal fines dredged to remove sediment build up in the Coal Yard Drainage Basin.

Stacking over Dredge Cells or CCB Ponds: Previous Area 1 (the original ash pond) is located beneath the Dry Ash Stack and was used as the original ash pond for the plant. This pond operated until the 1980s when sluicing to Area 2 (current active ash pond) began. The stack is being constructed over sluiced bottom and fly ash. It is unknown how much sluiced ash is beneath the stack. A small dredge cell within the Dry Ash Stack area was also filled with dredged coal fines from the Coal Yard Drainage Basin in 2007.

Past Failures/Releases: No failures or releases reported.

4. Owner's Operations, Maintenance and Inspection Information

TVA Maintenance: Mowing is performed every two years.

TVA Inspections: TVA Engineering performs annual dike inspections and prepares reports. Plant personnel recently started making daily observations, with documented inspections made weekly.

Problems Previously Identified During Past TVA Inspections: Lack of vegetation and erosion along stack, erosion along access road, seepage areas along Wells Creek, animal burrow on exterior perimeter dike, tree growth on exterior dike, standing water, sedimentation and heavy growth in perimeter ditch.

5. Documents Reviewed

See attached Document Log for complete list of documents provided by TVA for review. In particular, the following provided pertinent information for the assessment of this facility:

TVA Design Drawings: 10W288-1 through 5

TVA As-Built Drawings: None available.

TVA Construction Testing Records: None available.

TVA Annual Inspection Reports: TVA Annual Inspection Reports 1972-1984, 1986-1990, 1994-1995, 1997-2004, 2006-2008.

Geotechnical Data:

"Operations Manual: Dry Ash and Gypsum Stacking Facility", prepared by Tennessee Valley Authority, October 10, 2003.
"TVA-Fly Ash, Bottom Ash, and Scrubber Gypsum Study", Law Engineering, Inc., October 1995.

"Report of Subsurface Exploration and Stability Analyses, Proposed Fly Ash/Scrubber Sludge Disposal Facility, Cumberland Fossil Plant, Cumberland City, Tennessee", Law Engineering, January 27, 1992.

"Report of Hydrogeologic Evaluation, Proposed Dry Fly Ash and Gypsum Disposal Facility, TVA Cumberland Fossil Plant, Cumberland City, Tennessee", Law Engineering, July 3, 1992.

"Geotechnical Investigation Report, Dry Ash Conversion Project, CUF 1 & 2", Raytheon Engineers and Constructors, July 7, 1993.

Results of Laboratory Testing, TVA Fly Ash & Gypsum Disposal Facilities, Cumberland Fossil Plant, United Engineers and Constructors Inc., June 1992.

6. Stantec Field Observations

See attached Concerns/Photo Log, Photos, and Site Plan Drawing.

6.1. Exterior Slopes and Benches

Vegetation: Sparse to good vegetation coverage. Some areas of exposed soil present primarily along the southeast face and in areas to the north where the stack is just recently being constructed.

Trees: None observed.

Erosion: Several areas of erosion along the dry stack were noted where vegetation is sparse, primarily along the southeast face.

Instabilities: No evidence of instabilities were observed.

Uniform Appearance Good.

Benches:	None observed.
Slope:	Design: 3H:1V along Dry Ash Stack (from Drawing 10W288-4); 3H:1V along outer perimeter dike to west (from Drawing 10N213). Measured: 2.25H:1V along Dry Ash Stack at Section 4. 2.7H:1V along perimeter dike to west at Section 2.
Height:	35 feet along Dry Ash Stack at Section 4. 15 feet along perimeter dike to west at Section 2.
Other:	None.

6.2. Perimeter Drainage Ditches and Down-Drains

Vegetation:	Phragmites/tall grass along majority of west perimeter ditch.
Rip-Rap Channel Lining:	None observed.
Erosion:	Some scarping of the ditch side slopes was observed along west perimeter ditch. In addition, sedimentation had accumulated in ditch at several areas along the adjacent stack faces.
Siltation in Ditches:	Sedimentation observed throughout majority of west perimeter ditch.
Standing Water in Ditches or on Benches:	Standing water noted within the perimeter ditch to the west.
Silted/Impeded Drainage Pipes:	The drainage pipe for the perimeter ditch along the northwest corner of the stack area to the Ash Pond had signs of erosion around the inlet and outlet.
Other:	None.

7. Notable Observations and Concerns

- The area beneath the Dry Ash Stack was initially operated as a wet ash disposal pond. Constructing embankments over hydraulically placed ash is a potential slope stability concern and requires engineering analysis and geotechnical exploration.
- The southeast face of the stack consists of exposed soil cover which is eroded throughout. Other small areas of sparse vegetation or erosion were also observed. Further to the north, soil cover and vegetation have not yet been completed and the exposed ash slopes exhibit some erosion.
- Erosion was noted around the existing rock check within active portions of the stack.
- Areas of erosion and rutting were noted along the access road at the base of the stack.
- Eroded ash sedimentation, vegetation, poor drainage, and standing water were observed throughout the perimeter ditch. The side slopes of the ditch also exhibit shallow sloughs and scarps due to excavations made for cleaning of sedimentation.
- Vegetation has not yet been established where recent tree removal has occurred along the exterior west perimeter dike slope in the vicinity of the old bridge.
- Seepage was observed below the west perimeter dike along the banks of Wells Creek. The seepage does not appear to have changed from previous descriptions provided in inspection reports.
- The absence of an Emergency Action Plan, Operation and Maintenance Plan, as-built drawings and construction testing records is a concern.

8. Recommendations

8.1. Phase 2 Engineering and Programmatic Recommendations

- It is recommended that the Dry Ash Stack undergo further engineering study to evaluate the stacking plan and slope stability. This should include test borings, installation of piezometers, and installation of slope inclinometers; followed by laboratory testing and slope stability analysis of critical cross-sections.
- It is recommended that a program be established to develop as-built drawings and construction records for future maintenance and construction activities.
- Based on the findings of Phase 2 and designs from Phase 3, if performed, Stantec recommends that the existing O&M Manual be reviewed and updated. These updates may include sections on routine monitoring and facility maintenance.

8.2. Maintenance Recommendations

- CUF plant personnel should continue to monitor the seepage area below the west perimeter clay dike.
- Cut and maintain heavy/tall phragmite growth to allow better observation specifically in the perimeter ditches. Establish mowing program.
- Regrade and repair erosion areas where noted.
- Regrade, place new clay cover, and reseed the southeast face of the stack. Monitor other dry stack areas for erosion/sparse vegetation and repair as needed.
- Repair ruts and eroded areas along access road at base of stack if it is to remain in service.
- Clean sedimentation and phragmites from Dry Ash Stack perimeter ditches. Remove sedimentation, check grades and regrade the perimeter ditches as needed to promote positive drainage and alleviate standing water issues.
- Continue annual inspection program and execute recommendations.

1. General Facility Information

Facility Status:	Temporarily Inactive	**NID Identification:**	TN16110
Surface Area (inside dikes)	170 acres (estimated)	**Maximum Height (toe to top of dike):**	50 feet (estimated, current phase) 140 feet (Proposed)
Free Water Volume:	Currently drained	**Maximum Water Storage:**	Currently drained
Estimated CCB Storage:	1,825,579 CY	**Dike Length:**	9,000 feet (estimated)
Plant Discharge to Facility:	6,000 gpm when active	**Current Pool Elevation:**	Drained

2. Site Visit Information

Stantec Assessment Team:	Steve Bickel, PE, Nathan Bader, PE, Stan Harris, PE and Matthew Hoy, EIT
TVA Staff Present:	Stuart Harris and Carrie McCarty
Field Assessment Dates:	January 14, 2009 and February 3 - 4, 2009
Weather/Site Conditions:	Mid-30 degrees F, sunny, moist ground both days.

3. History/Description of Usage

History and Operation:

The gypsum storage area was constructed during 1995-1996. It was built over Area No. 1, which was the original ash pond. Approximately 1,100,000 tons of gypsum is produced each year. Roughly 75 percent of the gypsum is marketed to the adjacent wallboard company and the remaining 25 percent is wet-sluiced to the Gypsum Storage Area. The pond was constructed in several stages beginning with construction of a rock drainage blanket to collect and divert water away from the base. When gypsum is discharged to the pond intermittently, it is wet-sluiced to the northeast corner of the pond. Currently the pond is separated into a north and south area. The pond consists of an upper gypsum dike being constructed using rim-ditching operations, a lower perimeter ash dike, and an even lower clay dike which was the original perimeter dike for the disposal area. Discharge for the pond is through an RCP riser to outlet pipes in the northwest corner of the pond into the adjacent perimeter ditches. The perimeter ditches around the Gypsum Storage Area flow to the north along the neighboring Dry Stack and ultimately into the Ash Pond.

Past Failures/Releases: A slope slough along the perimeter clay dike in the northwest corner of the Gypsum Storage Area reportedly occurred in 2005. The slope was temporarily repaired using rip rap and Stantec is currently evaluating slope stability. Seepage has also been reported in this area and along the Gypsum Storage Area to the east. As a result, the pond has also been drained until Stantec's evaluation is complete.

4. Owner's Operations, Maintenance and Inspection Information

Emergency Action Plan: No EAP has been prepared for this facility.

Operations Manual: "Operations Manual: Dry Ash and Gypsum Stacking Facility", prepared by Tennessee Valley Authority, October 10, 2003.

TVA Maintenance: Exterior slopes mowed every two years.

TVA Inspections: TVA Engineering performs annual inspections and prepares reports. Plant personnel recently started making daily observations, with documented inspections made weekly.

Problems Previously Identified During Past TVA Inspections: Seepage areas around exterior dike, slope failure along northwest corner of perimeter dike.

5. Documents Reviewed

See attached Document Log for complete list of documents provided by TVA for review. In particular, the following provided pertinent information for the assessment of this facility:

TVA Design Drawings: 10W300-1 through 19, 6314-W-C110200 through 224, 6314-W-C110300 through 316.

TVA As-Built Drawings: None available.

TVA Construction Testing Records: None available.

TVA Annual Inspection Reports: TVA Annual Inspection Reports 1972-1984, 1986-1990, 1994-1995, 1997-2004, 2006-2008.

Geotechnical Data: "TVA-Fly Ash, Bottom Ash, and Scrubber Gypsum Study", Law Engineering, Inc., October 1995.

"Report of Geotechnical Exploration, Gypsum Area Seepage Study, Cumberland Fossil Plant, Cumberland City, Tennessee", prepared by MACTEC Engineering and Consulting, Inc., May 1, 2007.

"Report of Preliminary Geotechnical Exploration, Proposed Gypsum Wallboard Plant, TVA Cumberland Fossil Plant, Cumberland City, Tennessee", Law Engineering and Environmental Services, Inc., January 3, 1997.

"Report of Subsurface Exploration and Stability Analyses, Proposed Fly Ash/Scrubber Sludge Disposal Facility, Cumberland Fossil Plant, Cumberland City, Tennessee", Law Engineering, January 27, 1992.

"Report of Hydrogeologic Evaluation, Proposed Dry Fly Ash and Gypsum Disposal Facility, TVA Cumberland City, Tennessee", Law Engineering, March 13, 1992.

"Laboratory Test Results, Samples from Gypsum Pond at Cumberland Fossil Plant", MACTEC Engineering and Consulting, May 13, 2004.

Project Update - Seepage Investigation and Repair, TVA Cumberland Fossil Plant, presented by Geosyntec Consultants to TVA, October 2007, May 2007, and July 2008.

Results of Laboratory Testing, TVA Fly Ash & Gypsum Disposal Facilities, Cumberland Fossil Plant, United Engineers and Constructors Inc., June 1992.

6. Stantec Field Observations

See attached Concerns/Photo Log, Photos, and Site Plan Drawing.

6.1. Interior Slopes

Vegetation: None. Top dike consists of gypsum with no vegetation established.

Trees: None observed.

Wave Wash Protection: None observed.

Erosion: None observed.

Instabilities: Portions of the dike are currently being reconstructed using rim-ditching operations, but no evidence of instabilities were observed.

Animal Burrows: None observed.

Freeboard:
Measured: Pond drained.
Design: Not available on drawings.

Encroachments: None observed.

Slope:
Measured: Currently being constructed, not measured.
Design: Not available on drawings.

6.2. Crest

Crest Cover and Slope: Gypsum cover from rim-ditching operations.

Erosion: None observed.

Alignment: Alignment appeared to agree with design drawings. No problem.

Settlement/Cracking:	None observed.
Bare Spots/Rutting:	No rutting observed. Crest is bare with no vegetation established.
Width:	**Measured:** 23 feet at Section 5; 20 feet at Section 6 **Design:** Not available on drawings.

6.3. Exterior Slopes

Vegetation:	Upper Gypsum slopes are bare and lack vegetation. Phragmites and brush are present on the intermediate ash dike slopes. A grass cover is present along the lower perimeter dike slopes.
Trees:	Small trees were located in a few areas around the perimeter of the pond.
Erosion:	Areas of erosion were observed along the upper gypsum dike and the lower ash dike in several areas.
Instabilities:	A slope failure has been repaired in the northwest corner of the pond along the perimeter clay dike. Slope instability in the form of shallow sloughing was also observed along the ash dike along the northwest side of the pond.
Uniform Appearance:	Good.
Seepage:	Seepage observed in the past when pond was filled at the northernmost portion of the pond. Seepage was also observed at the southeast side of the perimeter clay dike.
Benches:	One bench that consists of the surrounding access road was observed along the toe of the upper gypsum dike. The bench is 20 feet wide at Section 5 and Section 6.
Foundations, Drains, Relief Wells, Instrumentation:	Drainage pipes extending from the base of the Gypsum Storage Area were reportedly installed on 200-foot intervals. These pipes outlet along the toe of the slope in the perimeter drainage ditches. Flow was observed in selected outlets similar to the flow reported in previous annual inspection reports.

Animal Burrows:	None observed.	
Slope:	**Measured:**	3H:1V along upper gypsum dike at Section 5 and 6; 1.5H:1V to 2.3H:1V along the intermediate ash dike slope at Sections 5 and 6; 2.7H1V along the perimeter clay dike at Section 5.
	Design:	3H:1V for the upper gypsum dikes, intermediate ash dike, and lower perimeter clay dike (from Drawing 10W300-16)
Height:	**Measured:**	Approximately 50 feet at current phase.
	Design:	Approximately 140 feet at final stage (from Drawing 10W300-16).

6.4. Spillway Weirs/Riser Inlets

Number:	One located at northwest end of pond.
Size, Type and Material:	Unknown size, RCP
Height of Riser Inlets:	10 feet or less (estimated)
Access:	None
Joints:	Unknown, unable to observe.
Mis-Alignment:	Unknown, unable to observe.
Closed/Abandoned Conduits:	None reported or observed.

6.5. Outlet Pipes

Number:	Four
Size, Type and Material:	Outlets vary in size and range from steel pipe to corrugated metal pipe.
Headwall:	None was observed.
Joint Separations:	Unknown, could not observe.
Mis-Alignment:	Unknown, could not observe.
Closed/Abandoned Conduits:	None reported or observed.

7. Notable Observations and Concerns

- The gypsum pond is formed by a lower perimeter clay dike, an intermediate ash perimeter dike above the lower clay dike, and an upper gypsum dike. The pond contains two active cells (north and south). Rim-ditching operations are currently on-going to construct the upper gypsum dike. Seepage areas and past slope failures have been noted. Some slopes are also relatively steep (1.5H:1V). Seepage, slope instability, and on-going rim-ditching operations are a concern for the Gypsum Storage Area.
- The absence of an Emergency Action Plan, Operation and Maintenance Plan, as-built drawings and construction testing records is a concern.
- Reconstructed upper gypsum dikes are lacking vegetation.
- Some trees were observed along the perimeter ash dike to the northeast of the Gypsum Storage Area.
- Erosion was observed along the crest and outslopes of the ash divider dike at several areas.
- The southwest and southeast sides of the perimeter ditch contain sediment build-up and standing water.
- Vegetation has not yet been re-established where trees have been removed from the downstream slope of the perimeter clay dike.
- Discharge pipes from interior pond drainage are elevated above a rip-rap channel. Over time, toe erosion will likely occur.

8. Recommendations

8.1. Phase 2 Engineering and Programmatic Recommendations

- It is recommended that the Gypsum Storage Area undergo further engineering study to evaluate the seepage, slope stability, and the on-going rim-ditching stacking plan. Remediation efforts to address these items will be developed based on the results. It is also recommended that a hydraulic and hydrologic analysis be performed to check freeboard and pond outlet adequacy relative to process flow and stormwater. The pond is scheduled to remain drained and temporarily inactive until Phase 2 studies and remedial construction activities, if needed, are performed.

- Based on the findings of Phase 2 and designs from Phase 3, if performed, Stantec recommends that the existing O&M Manual be reviewed and updated. These updates may include sections on routine monitoring and facility maintenance.
- It is recommended that a program be established to develop as-built drawings and construction records for future maintenance and construction activities.

8.2. Maintenance Recommendations

- The loosely stacked gypsum material around the perimeter of the Gypsum Storage Area should be spread in appropriate thicknesses and compacted properly wherever it is to be used as structural dike material. The material used for dikes at outlet areas should consist of coarser gypsum, which has higher strength. Efforts to establish vegetation on completed slopes should also be made.
- CUF plant personnel should continue to monitor the existing slope failure along the perimeter dike outslope at the northwest corner of the Gypsum Storage Area until Phase 2 evaluations are complete and permanent repairs executed.
- CUF plant personnel should continue to monitor the seepage area below the perimeter clay dike.
- CUF personnel have reported a seepage area along the north corner of the Gypsum Storage Area that could not be seen because the pond is currently drained. If this seep re-appears upon re-filling, a crushed stone French drain should be installed by excavating back to intercept the gravel drainage layer that underlies the gypsum disposal area.
- The discharge pipes that drain the interior portion of the Gypsum Storage Area should be extended to ground level and away from the toe of slope.
- Remove trees from noted locations.
- Cut and maintain heavy/tall phragmite growth on slopes and the perimeter drainage ditch to allow better inspection. Establish annual mowing program.
- Regrade and repair erosion areas where noted.
- Clean sedimentation and phragmites from Gypsum Storage Area perimeter ditches. Remove sedimentation, check grades and regrade the perimeter ditches as needed to promote positive drainage and alleviate standing water issues. Use of rip-rap to re-establish ditch side slopes should be considered.

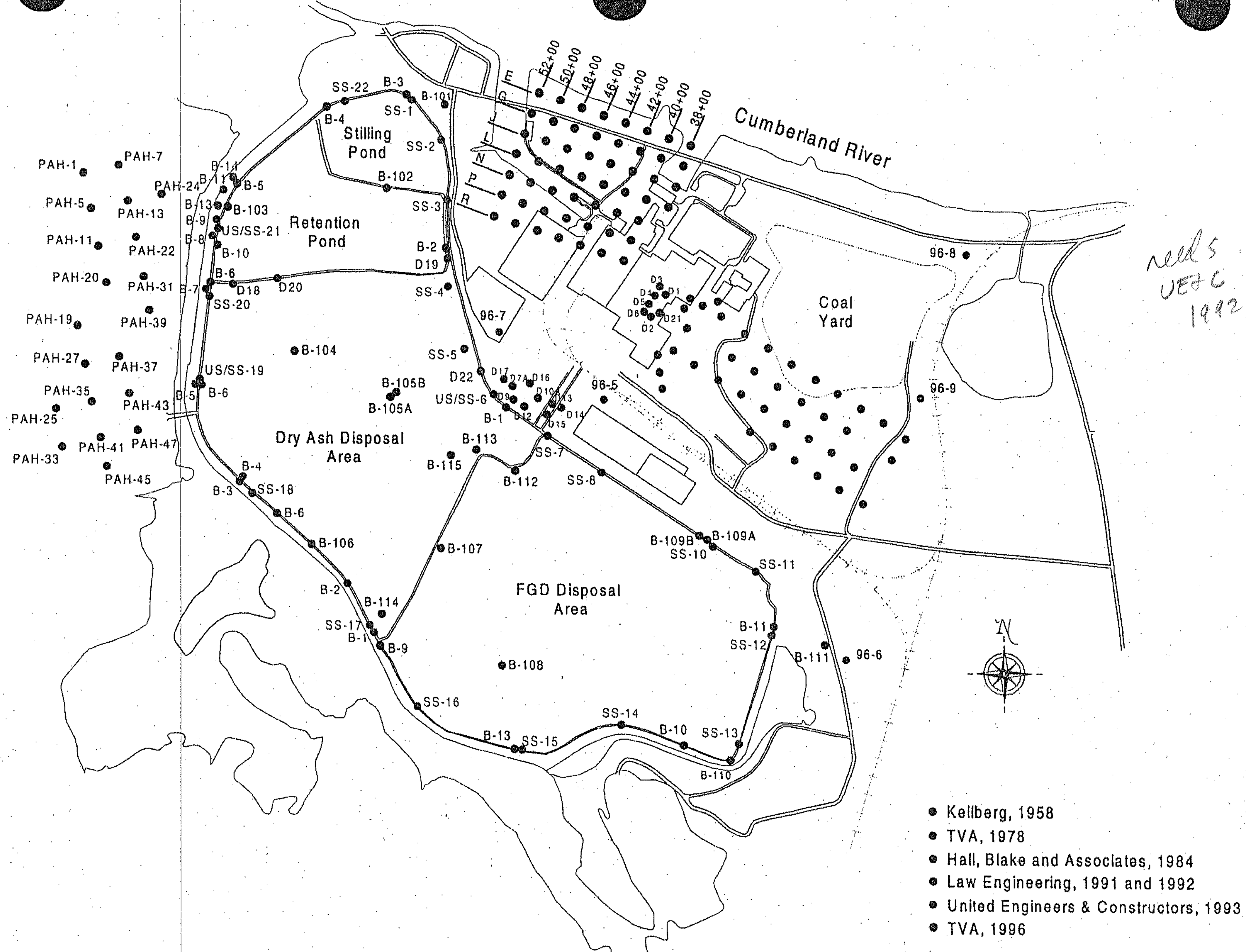


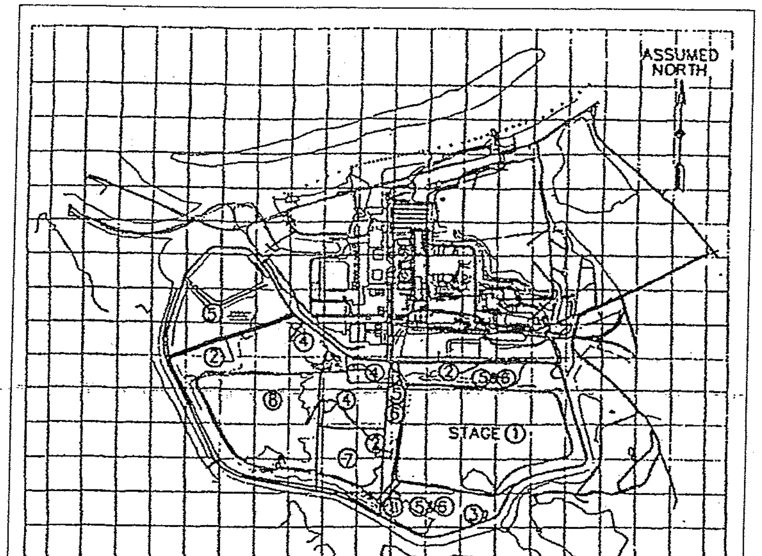
Figure 5.7 Site Map Showing the Locations of Known Exploratory Boreholes

needs UE&C 1992 hibs

46 C 10W302-1

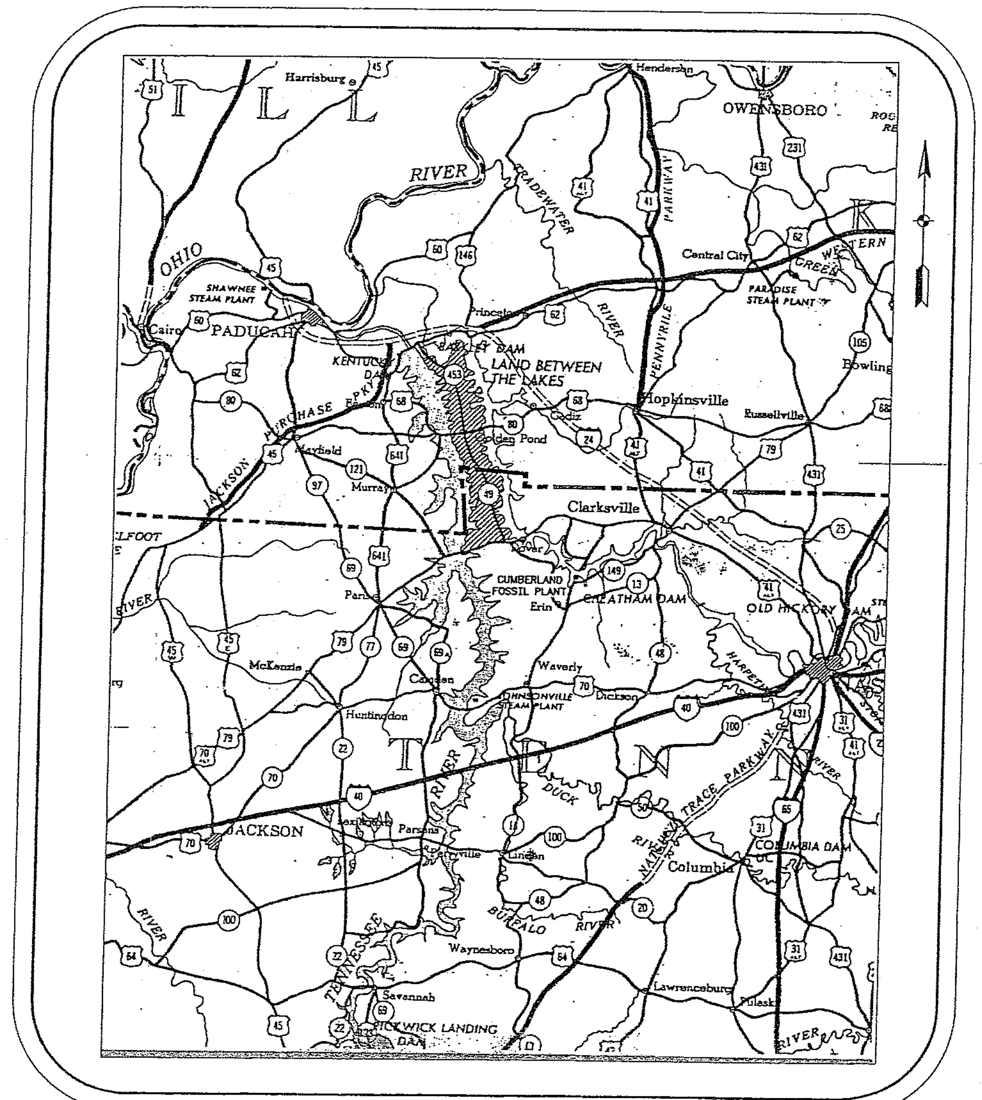
TENNESSEE VALLEY AUTHORITY
CUMBERLAND FOSSIL PLANT
DRY ASH AND GYPSUM STACKING AREA
STEWART COUNTY, TENNESSEE

REQUESTED MODIFICATION OF
IDL 811020082



STAGING PLAN

STAGE 1 – GYPSUM STACKING AREA & SPILLWAY
STAGE 2 – NORTH AND WEST DIKES OF GYPSUM STACKING AND STRUCTURAL DIKE BETWEEN RETENTION POND AND FLY ASH STACKING
STAGE 3 – SOUTHERN DIKE OF GYPSUM STACKING AREA
STAGE 4 – BOTTOM ASH DREDGE CELLS, WASTEWATER DITCH & DRY FLY ASH DISPOSAL AREA (10 ACRES)
STAGE 5 – RETENTION POND DREDGING & PLACEMENT OF DREDGED MATERIALS
STAGE 6 – COMPLETION OF GYPSUM STACKING AREA DRAINAGE BLANKETS
STAGE 7 – DRY FLY ASH DISPOSAL AREA PREPARATION (20 ACRES)
STAGE 8 – DRY FLY ASH DISPOSAL AREA PREPARATION (60 ACRES)



VICINITY MAP

INDEX OF DRAWINGS

DRAWING NO.	DESCRIPTION
10W302–1	INDEX
10W302–2	EXISTING SITE CONDITIONS (SHEET 1 OF 4)
10W302–3	EXISTING SITE CONDITIONS (SHEET 2 OF 4)
10W302–4	EXISTING SITE CONDITIONS (SHEET 3 OF 4)
10W302–5	EXISTING SITE CONDITIONS (SHEET 4 OF 4)
10W302–6	CONSTRUCTION SEQUENCE STAGE NO. 1
10W302–7	CONSTRUCTION SEQUENCE STAGE NO. 2 & 3 (SHEET 1 OF 3)
10W302–8	CONSTRUCTION SEQUENCE STAGE NO. 2 & 3 (SHEET 2 OF 3)
10W302–9	CONSTRUCTION SEQUENCE STAGE NO. 2 (SHEET 3 OF 3)
10W302–10	CONSTRUCTION SEQUENCE STAGE NO. 4 (SHEET 1 OF 2)
10W302–11	CONSTRUCTION SEQUENCE STAGE NO. 4 (SHEET 2 OF 2)
10W302–12	CONSTRUCTION SEQUENCE STAGE NO. 5 & 6 (SHEET 1 OF 2)
10W302–13	CONSTRUCTION SEQUENCE STAGE NO. 5 & 6 (SHEET 2 OF 2)
10W302–14	CONSTRUCTION SEQUENCE STAGE NO. 7
10W302–15	CONSTRUCTION SEQUENCE STAGE NO. 8
10W302–16	PROPOSED FINAL CONTOURS (SHEET 1 OF 4)
10W302–17	PROPOSED FINAL CONTOURS (SHEET 2 OF 4)
10W302–18	PROPOSED FINAL CONTOURS (SHEET 3 OF 4)
10W302–19	PROPOSED FINAL CONTOURS (SHEET 4 OF 4)
10W302–20	CROSS SECTION A–A' (SHEET 1 OF 4)
10W302–21	CROSS SECTION B–B' (SHEET 2 OF 4)
10W302–22	CROSS SECTION C–C' (SHEET 3 OF 4)
10W302–23	CROSS SECTION D–D' (SHEET 4 OF 4)
10W302–24	DETAILS (SHEET 1 OF 3)
10W302–25	DETAILS (SHEET 2 OF 3)
10W302–26	SECTIONS & DETAILS (SHEET 3 OF 3)
10W302–27	STORM DRAINS SECTIONS & DETAILS

HAROLD L. PETTY
10/10/03

R 0 | J.L.G | MGH | JGA | HLP | REP | JGA
INITIAL ISSUE: FOR DON CUF-03-536

SCALE: NONE — EXCEPT AS NOTED

VICINITY MAP

DRY ASH AND GYPSUM STACKING AREA
STEWART COUNTY, TENNESSEE

DESIGNED BY: J.L. GRAY | DRAWN BY: M.G. KRANEK | CHECKED BY: J.G. ALBRIGHT | SUPERVISED BY: H.L. PETTY | REVIEWED BY: R.E. PURKEY | ISSUED BY: J.G. ADAIR

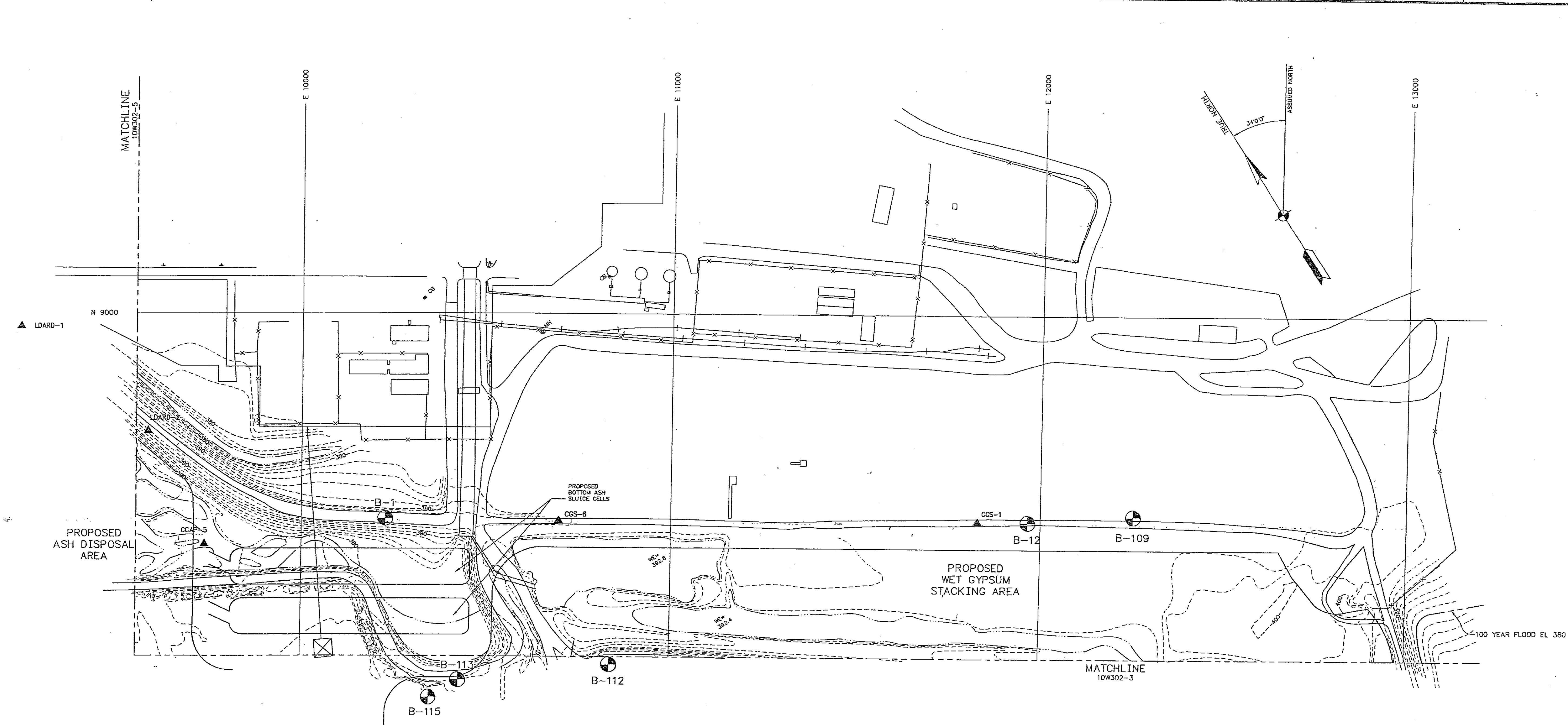
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K | 46 | C | 10W302–1 | R 0

PLOT FACTOR:1
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.



LEGEND

B-102 — BORING LOCATION

100-YR FLOOD PLAIN

DISPOSAL AREA BOUNDARY

CUF 93-1 — PROPOSED GROUNDWATER MONITOR WELL

EXISTING CONTOUR

BENCHMARK LOCATION

BORING COORDINATES

BORING NO.	TENNESSEE LAMBERT COORDINATES (FEET) NORTH	EAST	PLANT GRID * COORDINATES (FEET) NORTH	EAST	ELEV. (FEET)
1	730875.30	1511979.60	8446.70	10227.00	395.20
12	729900.20	1513418.70	8443.00	11965.40	395.40
109	729752.44	1513668.68	8460.28	12255.24	394.12
112	730211.62	1512265.76	8056.49	10835.38	394.06
113	730401.23	1511902.36	8010.47	10428.01	389.96
115	730406.33	1511811.59	7963.94	10349.97	388.56

* N10,000 PLANT COORDINATE COINCIDES WITH THE EXISTING E-W PLANT BASELINE (℄ OF EXISTING UNIT #1 CHIMNEY). E10,000 PLANT COORDINATE COINCIDES WITH THE EXISTING N-S PLANT BASELINE (EXISTING COLUMN LINE "A"). I.E. 10,000:10,000=TVA 0:0

BENCH MARK LOCATIONS

BENCH MARK NO. NO.	TENNESSEE LAMBERT COORDINATES (FEET) NORTH	EAST	PLANT GRID COORDINATES (FEET)		ELEV. (FEET)
178-D	727,926.48	1,513,693.70	S 3030.48	E 3297.03	395.21
CCAP-1	732,957.97	1,509,794.23	S 1048.75	W 2749.35	394.71
CCAP-2	732,295.18	1,509,469.16	S 1780.00	W 2648.22	395.18
CCAP-3	730,824.08	1,509,309.41	S 3088.93	W 1958.03	393.61
CCAP-4	730,235.80	1,509,772.02	S 3317.95	W 1245.55	394.91
CCAP-5	731,089.67	1,511,532.96	S 1625.35	W 263.14	399.35
CGS-1	729,975.39	1,513,304.73	S 1558.37	E 1828.82	395.64
CGS-2	729,645.42	1,511,188.50	S 3015.31	E 258.90	410.16
CGS-3	728,420.59	1,511,078.11	S 4092.47	E 852.30	395.30
CGS-4	728,064.78	1,512,362.32	S 3669.33	E 2115.92	395.26
CGS-5	727,951.74	1,513,734.10	S 2995.95	E 3316.39	395.30
CGS-6	730,607.17	1,512,364.68	S 1560.27	E 696.20	396.32
CGS-7	729,077.74	1,510,746.13	S 3733.31	E 209.60	395.19
LDARD-1	731,855.90	1,511,450.22	S 1036.39	W 760.21	393.87
LDARD-2	731,429.43	1,511,577.58	S 1318.73	W 416.14	393.67
PP-F-6 RESET	728,984.36	1,510,783.36	S 3789.94	E 292.62	394.86
T-1	734,549.93	1,509,921.94	N 342.46	W 3533.69	365.43

HAROLD L. PETTY — REGISTERED ENGINEER — No. 07557 — STATE OF TENNESSEE

10/10/03

SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWINGS LIST

R											
R 0		JLG	MGH	JGA	HLP	REP		JGA			D
INITIAL ISSUE: FOR DCN CUF-03-536											
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD

DISCIPLINE INTERFACE

SCALE: 1"=100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY EXISTING SITE CONDITIONS SHEET 1 OF 4

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

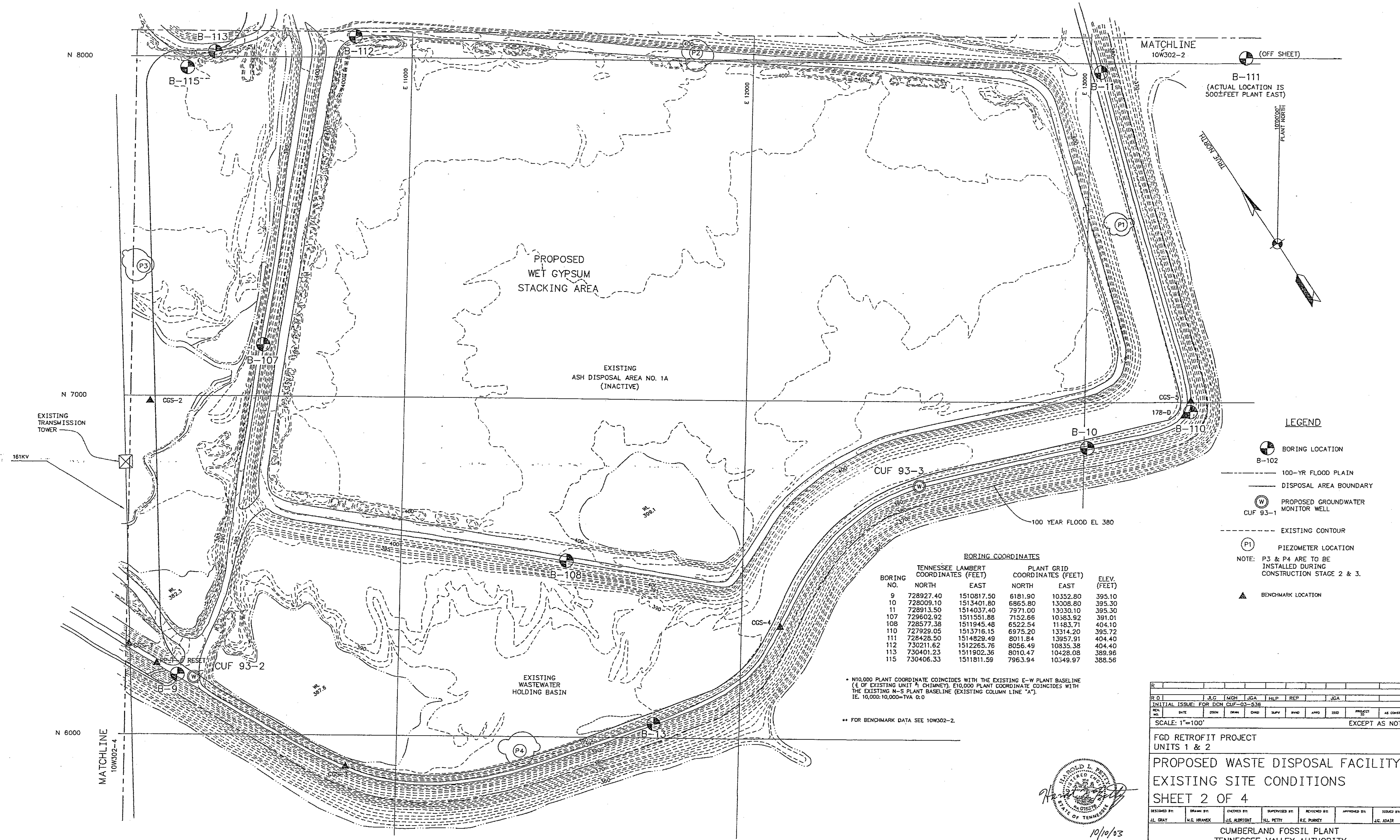
AUTOCAD R2K	DATE	46	C	10W302-2	R 0

PLOT FACTOR:1200
W_TVA

C.A.D. DRAWING DO NOT ALTER

TASK COMPLETED BY: | REV NO.

46 | C | 10W302-2



BORING COORDINATES

BORING NO.	TENNESSEE LAMBERT COORDINATES (FEET) NORTH	TENNESSEE LAMBERT COORDINATES (FEET) EAST	PLANT GRID COORDINATES (FEET) NORTH	PLANT GRID COORDINATES (FEET) EAST	ELEV. (FEET)
9	728927.40	1510817.50	6181.90	10352.80	395.10
10	728009.10	1513401.80	6865.80	13008.80	395.30
11	728913.50	1514037.40	7971.00	13030.10	395.30
107	729602.92	1511551.88	7152.66	10583.92	391.01
108	728577.38	1511945.48	6522.54	11483.71	404.10
110	727929.05	1513716.15	6975.20	13314.20	395.72
111	728428.50	1514829.49	8011.84	13957.91	404.40
112	730211.62	1512265.76	8056.49	10835.38	404.40
113	730401.23	1511902.36	8010.47	10428.08	389.96
115	730406.33	1511811.59	7963.94	10349.97	388.56

* N10,000 PLANT COORDINATE COINCIDES WITH THE EXISTING E-W PLANT BASELINE (℄ OF EXISTING UNIT 1 CHIMNEY). E10,000 PLANT COORDINATE COINCIDES WITH THE EXISTING N-S PLANT BASELINE (EXISTING COLUMN LINE "A"). IE. 10,000:10,000=TVA 0:0

** FOR BENCHMARK DATA SEE 10W302-2.

SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWINGS LIST

10/10/03

R 0 | JLG | MGH | JGA | HLP | REP | JGA | D
INITIAL ISSUE: FOR DCN CUF-03-536

REV. NO. | DATE | DSGN | DRWN | CHKD | SUPV | RVWD | APPD | ISSD | PROJECT ID | AS CONST | REV CD

DISCIPLINE INTERFACE

SCALE: 1"=100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY EXISTING SITE CONDITIONS SHEET 2 OF 4

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K | DATE | 46 | C | 10W302-3 | R 0

PLOT FACTOR:1200
W_TVA

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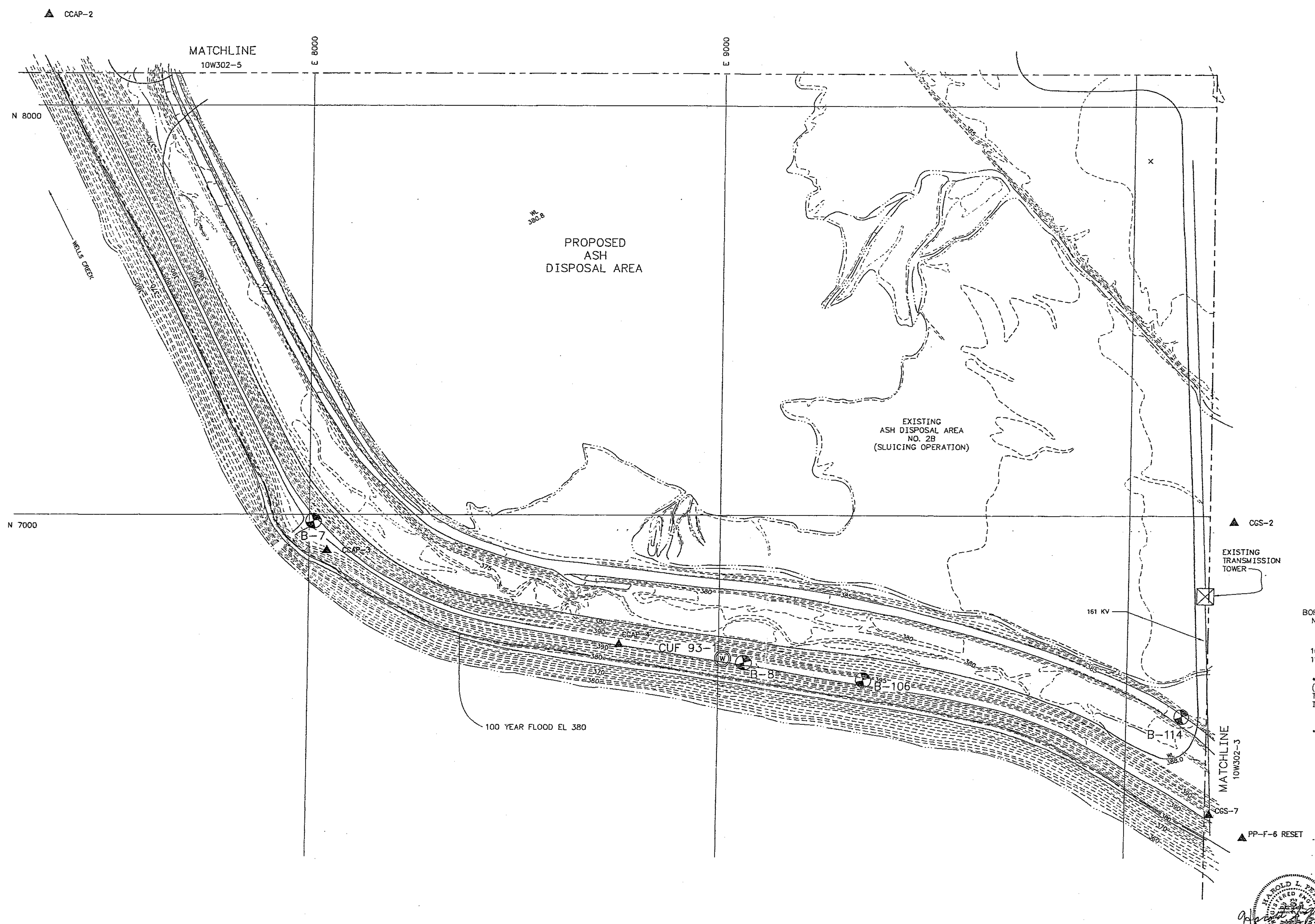
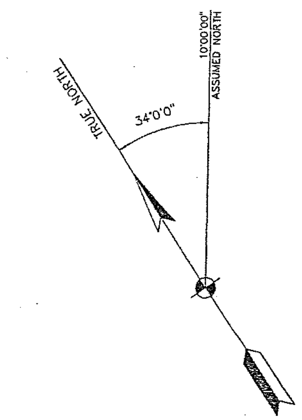
TASK COMPLETED BY: | REV NO.

46 C 10W302-3





LEGEND

- B-102 BORING LOCATION
- 100-YR FLOOD PLAIN
- DISPOSAL AREA BOUNDARY
- CUF 93-1 PROPOSED GROUNDWATER MONITOR WELL
- EXISTING CONTOUR
- BENCHMARK LOCATION

BORING COORDINATES

BORING NO.	TENNESSEE LAMBERT COORDINATES (FEET) NORTH	EAST	PLANT GRID * COORDINATES (FEET) NORTH	EAST	ELEV. (FEET)
7	730905.60	1509323.40	6986.50	8008.00	395.10
8	730031.50	1510003.20	6642.00	9060.30	395.30
106	729832.30	1510221.19	6598.71	9352.46	395.44
114	729321.98	1510823.53	6512.46	10137.19	384.24

* N10,000 PLANT COORDINATE COINCIDES WITH THE EXISTING E-W PLANT BASELINE (℄ OF EXISTING UNIT #1 CHIMNEY). E10,000 PLANT COORDINATE COINCIDES WITH THE EXISTING N-S PLANT BASELINE (EXISTING COLUMN LINE "A").
I.E. 10,000:10,000=TVA 0:0

** FOR BENCHMARK DATA SEE 10W302-2.

SEE 10W302-1
FOR DRAWING INDEX/COMPANION DRAWINGS LIST

10/10/03

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R											
R 0		JLG	MGH	JGA	HLP	REP		JGA			D

INITIAL ISSUE: FOR DCN CUF-03-536

DISCIPLINE INTERFACE

SCALE: 1"=100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY EXISTING SITE CONDITIONS SHEET 3 OF 4

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

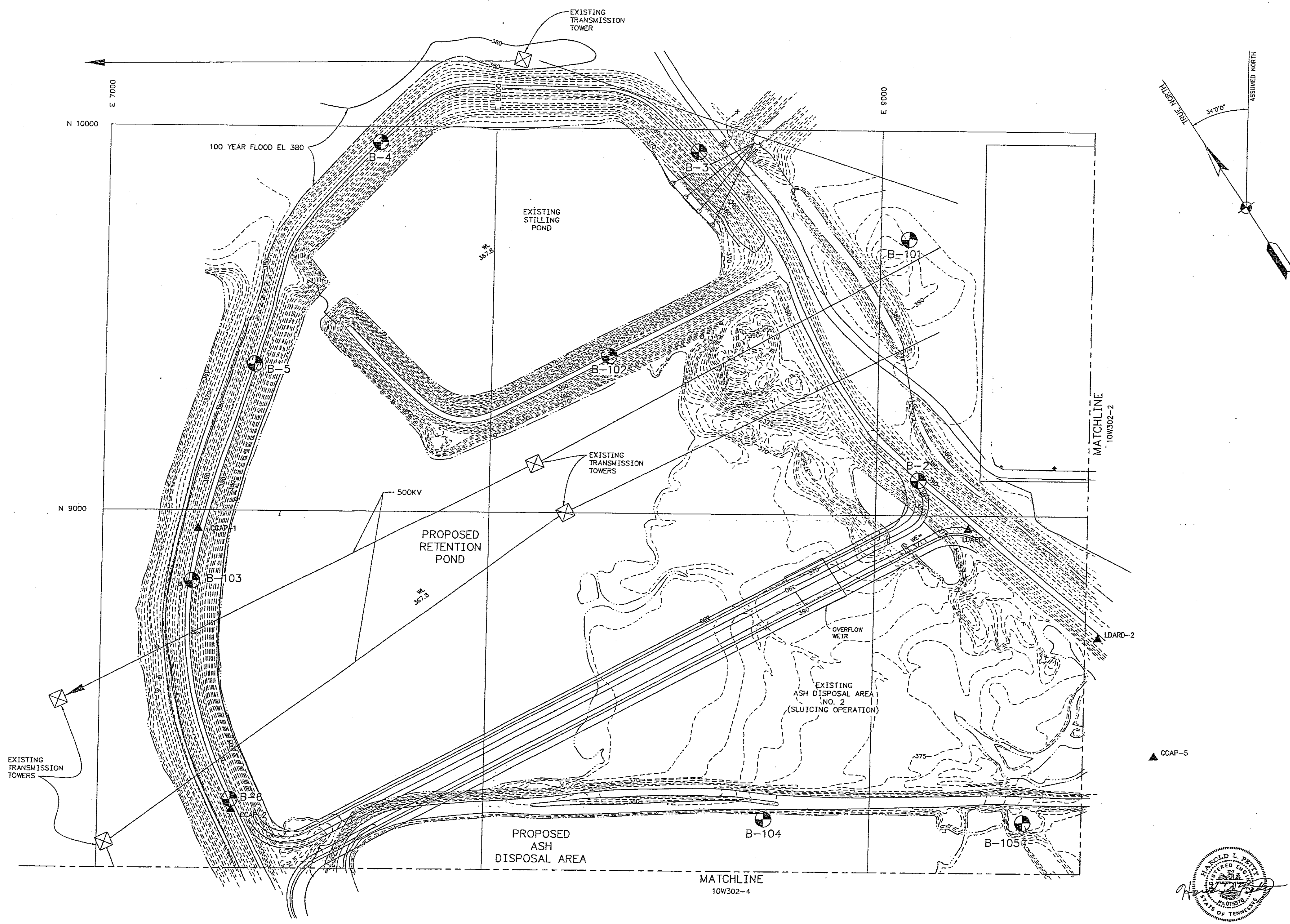
AUTOCAD R2K | DATE | 46 | C | 10W302-4 | R 0

PLOT FACTOR:1200
W_TVA

C.A.D. DRAWING
DO NOT ALTER

TASK COMPLETED BY: | REV NO.

46 C 10W302-5



LEGEND

B-102 BORING LOCATION

100-YR FLOOD PLAIN

DISPOSAL AREA BOUNDARY

CUF 93-1 PROPOSED GROUNDWATER MONITOR WELL

EXISTING CONTOUR

BENCHMARK LOCATION

BORING COORDINATES

BORING NO.	TENNESSEE LAMBERT COORDINATES (FEET) NORTH	EAST	PLANT GRID * COORDINATES (FEET) NORTH	EAST	ELEV. (FEET)
2	732035.90	1511415.10	9093.20	9110.00	394.70
3	733062.80	1511406.40	9939.60	8528.5	395.50
4	733539.90	1510732.50	9958.40	7703.10	395.40
5	733237.10	1510150.60	9382.00	7390.00	395.40
6	733237.10	1610160.60	8253.30	7346.40	396.40
101	732575.16	1511734.25	9718.74	9073.06	387.83
102	732750.06	1510926.12	9411.83	8305.29	394.96
103	732854.94	1509709.05	8818.21	7237.64	394.35
104	731516.81	1510607.21	8211.09	8730.52	383.53

* N10,000 PLANT COORDINATE COINCIDES WITH THE EXISTING E-W PLANT BASELINE (C OF EXISTING UNIT #1 CHIMNEY). E10,000 PLANT COORDINATE COINCIDES WITH THE EXISTING N-S PLANT BASELINE (EXISTING COLUMN LINE "A"). I.E. 10,000:10,000=TVA 0:0

** FOR BENCHMARK DATA SEE 10W302-2.

HAROLD L. PETTY REGISTERED ENGINEER STATE OF TENNESSEE

10/10/03

SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWINGS LIST

R											
R 0		JLG	MGH	JGA	HLP	REP		JGA			D
INITIAL ISSUE: FOR DCN CUF-03-536											
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD

DISCIPLINE INTERFACE

SCALE: 1"=100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY
EXISTING SITE CONDITIONS
SHEET 4 OF 4

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

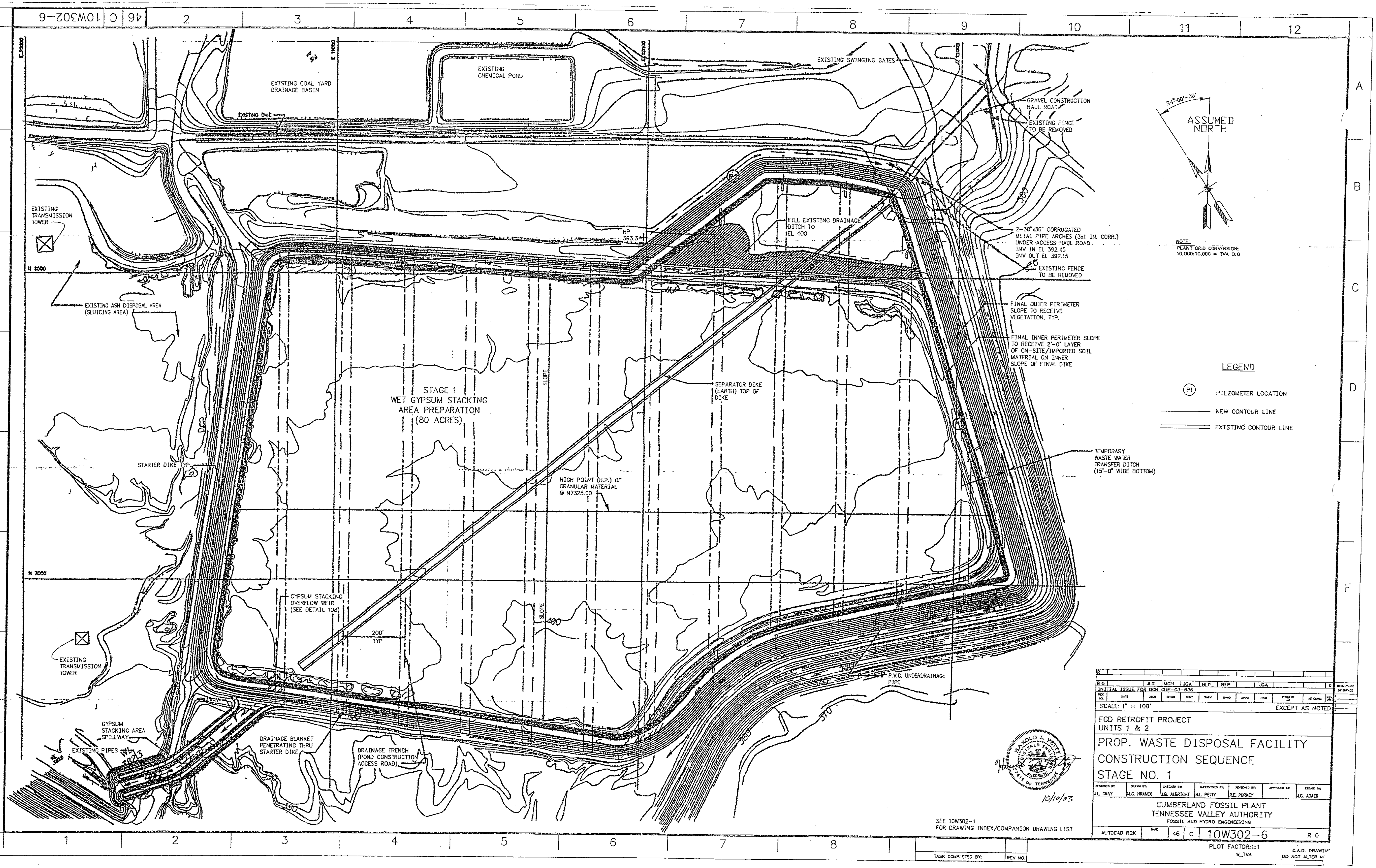
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K | DATE | 46 | C | 10W302-5 | R 0

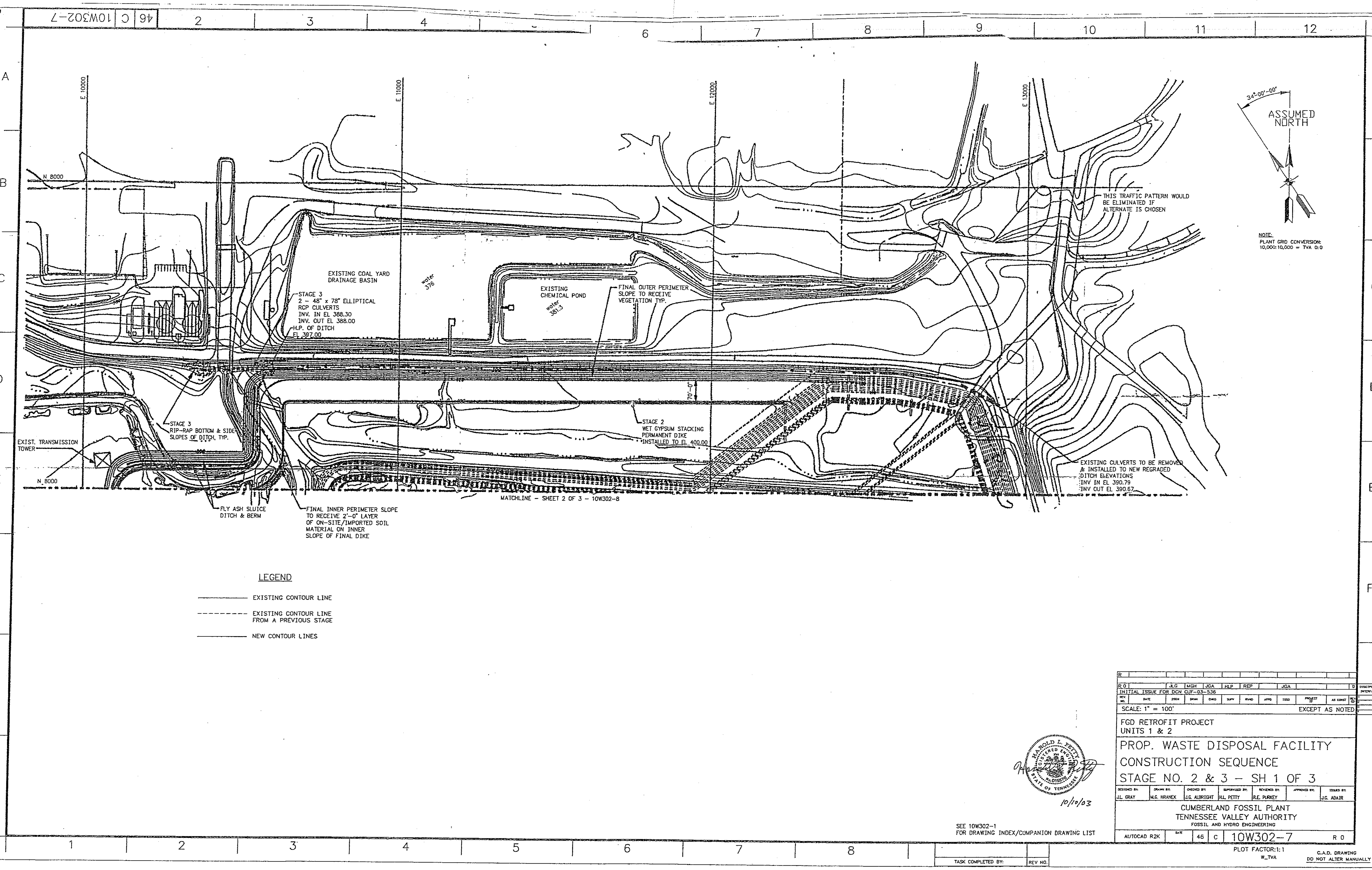
PLOT FACTOR:1200
W_TVA

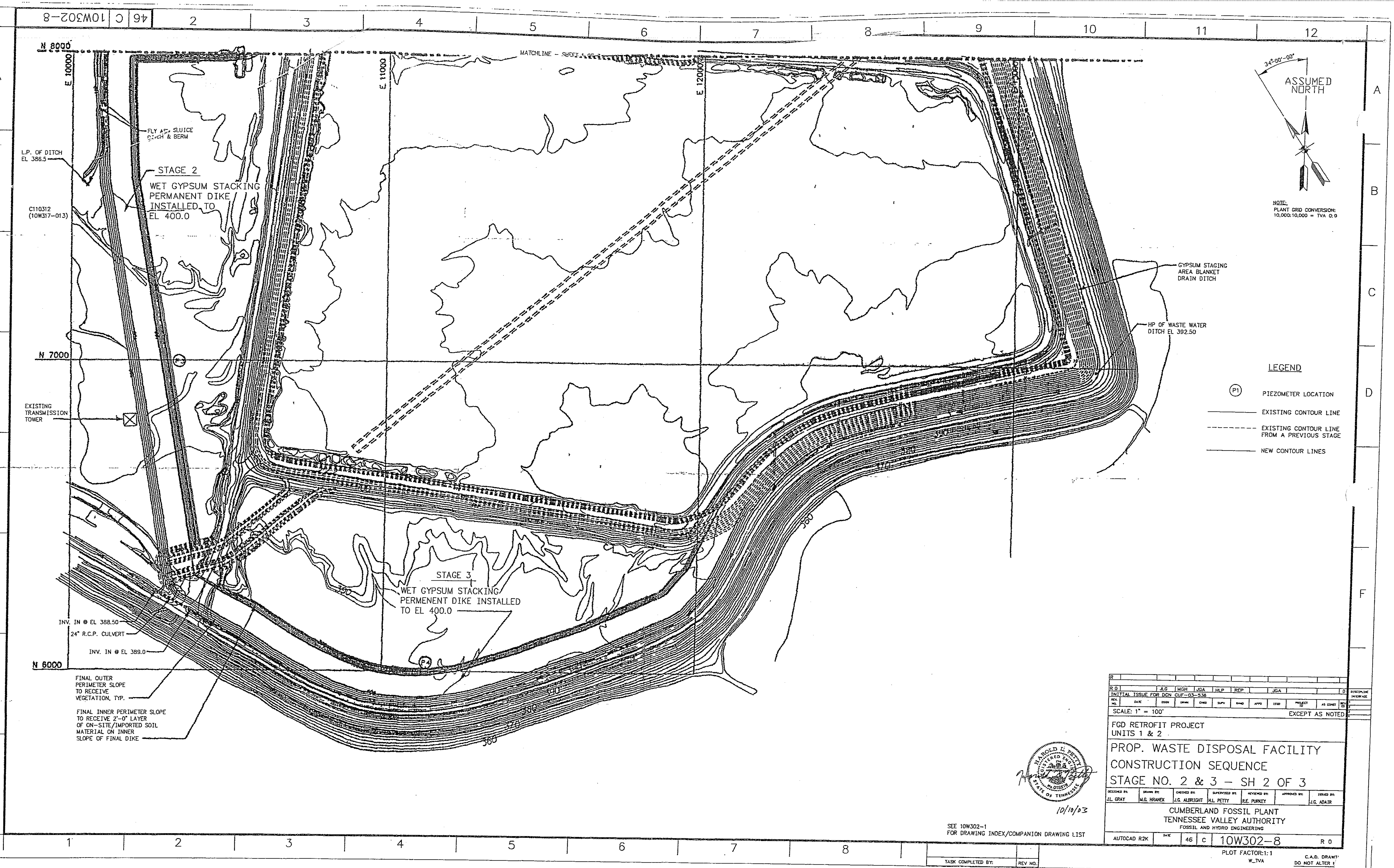
C.A.D. DRAWING DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.



46 | C | 10W302-6
EXISTING COAL YARD DRAINAGE BASIN
EXISTING DIKE
EXISTING CHEMICAL POND
EXISTING SWINGING GATES
GRAVEL CONSTRUCTION HAUL ROAD
EXISTING FENCE TO BE REMOVED
ASSUMED NORTH
34°-00'-00"
NOTE: PLANT GRID CONVERSION: 10,000:10,000 = TVA 0:0
EXISTING TRANSMISSION TOWER
EXISTING ASH DISPOSAL AREA (SLUICING AREA)
FILL EXISTING DRAINAGE DITCH TO EL 400
HP 393.3
2-30"x36" CORRUGATED METAL PIPE ARCHES (3x1 IN. CORR.) UNDER ACCESS HAUL ROAD INV IN EL 392.45 INV OUT EL 392.15
EXISTING FENCE TO BE REMOVED
FINAL OUTER PERIMETER SLOPE TO RECEIVE VEGETATION, TYP.
FINAL INNER PERIMETER SLOPE TO RECEIVE 2'-0" LAYER OF ON-SITE/IMPORTED SOIL MATERIAL ON INNER SLOPE OF FINAL DIKE
LEGEND
P1 PIEZOMETER LOCATION
NEW CONTOUR LINE
EXISTING CONTOUR LINE
STAGE 1 WET GYPSUM STACKING AREA PREPARATION (80 ACRES)
SLOPE
SEPARATOR DIKE (EARTH) TOP OF DIKE
STARTER DIKE TYP.
HIGH POINT (H.P.) OF GRANULAR MATERIAL @ N7325.00
TEMPORARY WASTE WATER TRANSFER DITCH (15'-0" WIDE BOTTOM)
GYPSUM STACKING OVERFLOW WEIR (SEE DETAIL 108)
200' TYP
EXISTING TRANSMISSION TOWER
P.V.C. UNDERDRAINAGE PIPE
GYPSUM STACKING AREA SPILLWAY
EXISTING PIPES
DRAINAGE BLANKET PENETRATING THRU STARTER DIKE
DRAINAGE TRENCH (POND CONSTRUCTION ACCESS ROAD)
N 8000
N 7000
400
380
370
R 0 INITIAL ISSUE FOR DCN CUF-03-536
SCALE: 1" = 100' EXCEPT AS NOTED
FGD RETROFIT PROJECT UNITS 1 & 2
PROP. WASTE DISPOSAL FACILITY
CONSTRUCTION SEQUENCE
STAGE NO. 1
DESIGNED BY: J.L. GRAY
DRAWN BY: M.G. HRANEK
CHECKED BY: J.G. ALBRIGHT
SUPERVISED BY: H.L. PETTY
REVIEWED BY: R.E. PURKEY
ISSUED BY: J.G. ADAIR
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING
AUTOCAD R2K
46 | C | 10W302-6 | R 0
SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWING LIST
10/10/03
HAROLD L. PETTY REGISTERED ENGINEER STATE OF TENNESSEE
PLOT FACTOR: 1:1
W_TVA
C.A.D. DRAWING DO NOT ALTER
TASK COMPLETED BY:
REV NO.


46 C 10W302-7
ASSUMED NORTH
34°-00'-00"
NOTE:
PLANT GRID CONVERSION:
10,000:10,000 = TVA 0:0
N 8000
E 10000
E 11000
E 12000
E 13000
EXISTING COAL YARD DRAINAGE BASIN
water 376
EXISTING CHEMICAL POND
water 381.3
STAGE 3
2 - 48" x 78" ELLIPTICAL RCP CULVERTS
INV. IN EL 388.30
INV. OUT EL 388.00
H.P. OF DITCH EL 397.00
FINAL OUTER PERIMETER SLOPE TO RECEIVE VEGETATION TYP.
THIS TRAFFIC PATTERN WOULD BE ELIMINATED IF ALTERNATE IS CHOSEN
STAGE 3
RIP-RAP BOTTOM & SIDE SLOPES OF DITCH, TYP.
EXIST. TRANSMISSION TOWER
STAGE 2
WET GYPSUM STACKING PERMANENT DIKE INSTALLED TO EL 400.00
70'-0"
EXISTING CULVERTS TO BE REMOVED & INSTALLED TO NEW REGRADED DITCH ELEVATIONS
INV IN EL 390.79
INV OUT EL 390.67
MATCHLINE - SHEET 2 OF 3 - 10W302-8
FLY ASH SLUICE DITCH & BERM
FINAL INNER PERIMETER SLOPE TO RECEIVE 2'-0" LAYER OF ON-SITE/IMPORTED SOIL MATERIAL ON INNER SLOPE OF FINAL DIKE
LEGEND
EXISTING CONTOUR LINE
EXISTING CONTOUR LINE FROM A PREVIOUS STAGE
NEW CONTOUR LINES
HAROLD L. PETTY
REGISTERED ENGINEER
STATE OF TENNESSEE
10/10/03
SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWING LIST
R 0
J.L.G MGH JGA HLP REP JGA
INITIAL ISSUE FOR DCN CUF-03-536
SCALE: 1" = 100'
EXCEPT AS NOTED
FGD RETROFIT PROJECT
UNITS 1 & 2
PROP. WASTE DISPOSAL FACILITY
CONSTRUCTION SEQUENCE
STAGE NO. 2 & 3 - SH 1 OF 3
J.L. GRAY
M.G. HRANEK
J.G. ALBRIGHT
H.L. PETTY
R.E. PURKEY
J.G. ADAIR
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING
AUTOCAD R2K
46 C 10W302-7 R 0
PLOT FACTOR:1:1
W_TVA
C.A.D. DRAWING
DO NOT ALTER MANUALLY
TASK COMPLETED BY:
REV NO.



R										
R 0		JLG	MGH	JGA	HLP	REP		JGA		D
INITIAL ISSUE FOR DCN CUF–03–536										
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD

SCALE: 1" = 100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

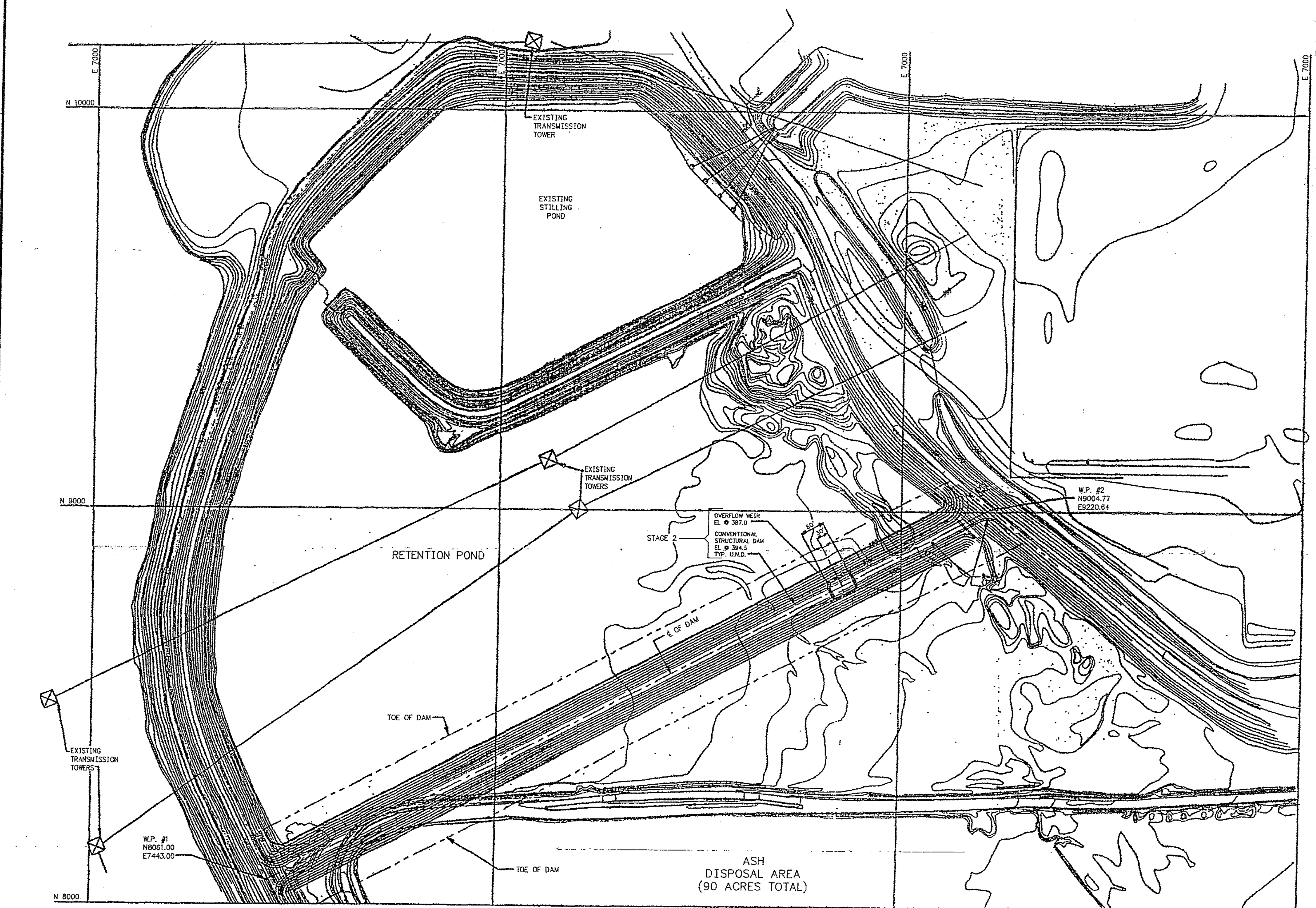
PROP. WASTE DISPOSAL FACILITY
CONSTRUCTION SEQUENCE
STAGE NO. 2 & 3 – SH 2 OF 3

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K | DATE | 46 | C | 10W302–8 | R 0

PLOT FACTOR:1:1
W_TVA
C.A.D. DRAWI
DO NOT ALTER



NOTE:
PLANT GRID CONVERSION:
10,000:10,000 = TVA 0:0

LEGEND

—400— PROPOSED CONTOURS
—380— EXISTING CONTOURS

NOTE: DRY ASH STAGES WERE NOT CONSTRUCTED IN THE SEQUENCE SHOWN. DRY ASH DISPOSAL AREA HAS PROCEEDED EAST TO WEST AS A CONTINUAL DEVELOPMENT

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R 0		JLG	MGH	JGA	HLP	REP		JGA			D
INITIAL ISSUE FOR DCN CUF-03-536											

DISCIPLINE INTERFACE

SCALE: 1" = 100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROP. WASTE DISPOSAL FACILITY
CONSTRUCTION SEQUENCE
STAGE NO. 2 – SHEET 3 OF 3

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

HAROLD L. PETTY REGISTERED ENGINEER STATE OF TENNESSEE

10/10/03

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

SEE 10W302-1
FOR DRAWING INDEX/COMPANION DRAWING LIST

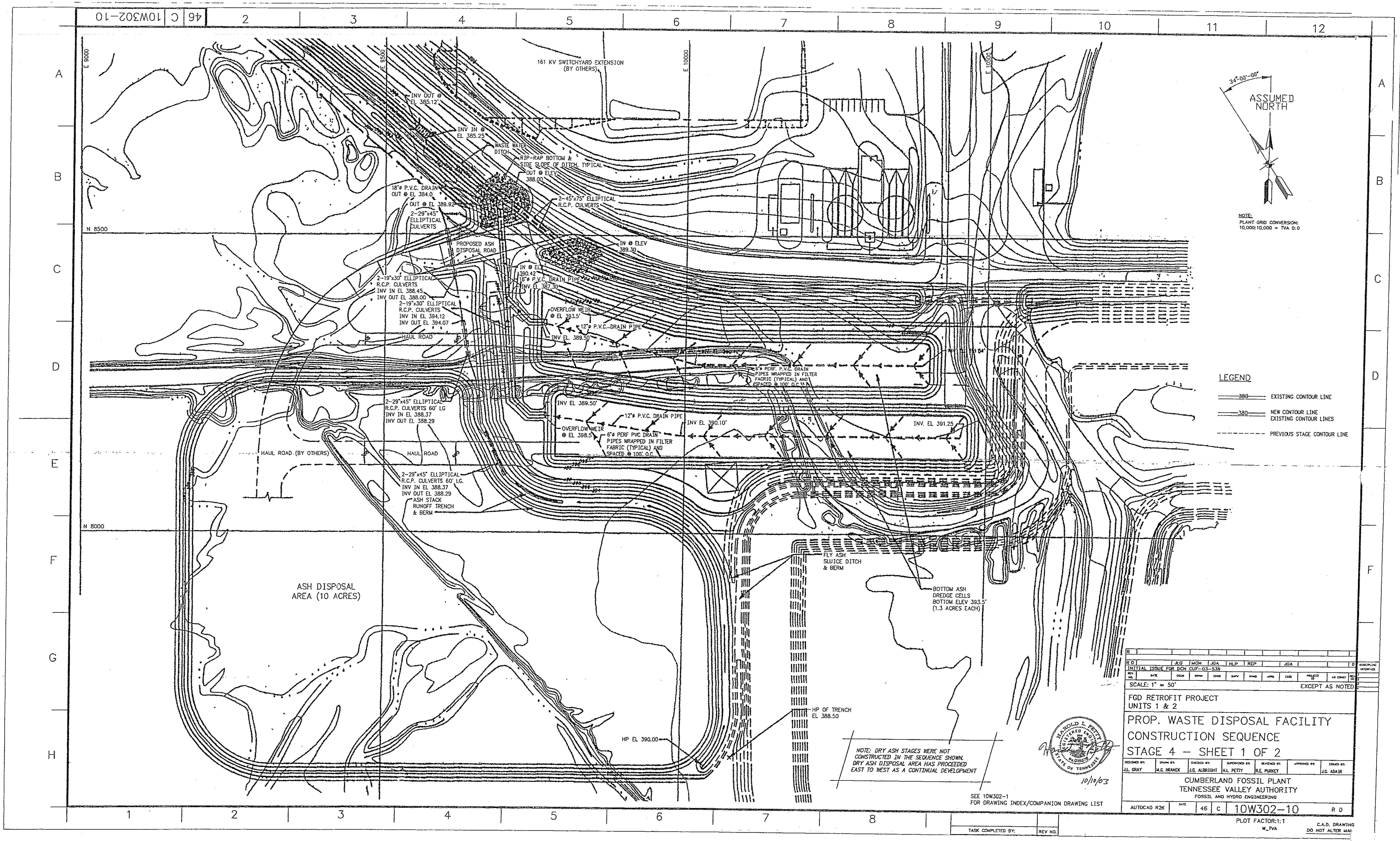
AUTOCAD R2K | DATE | 46 | C | 10W302-9 | R 0

PLOT FACTOR:1:1
W_TVA

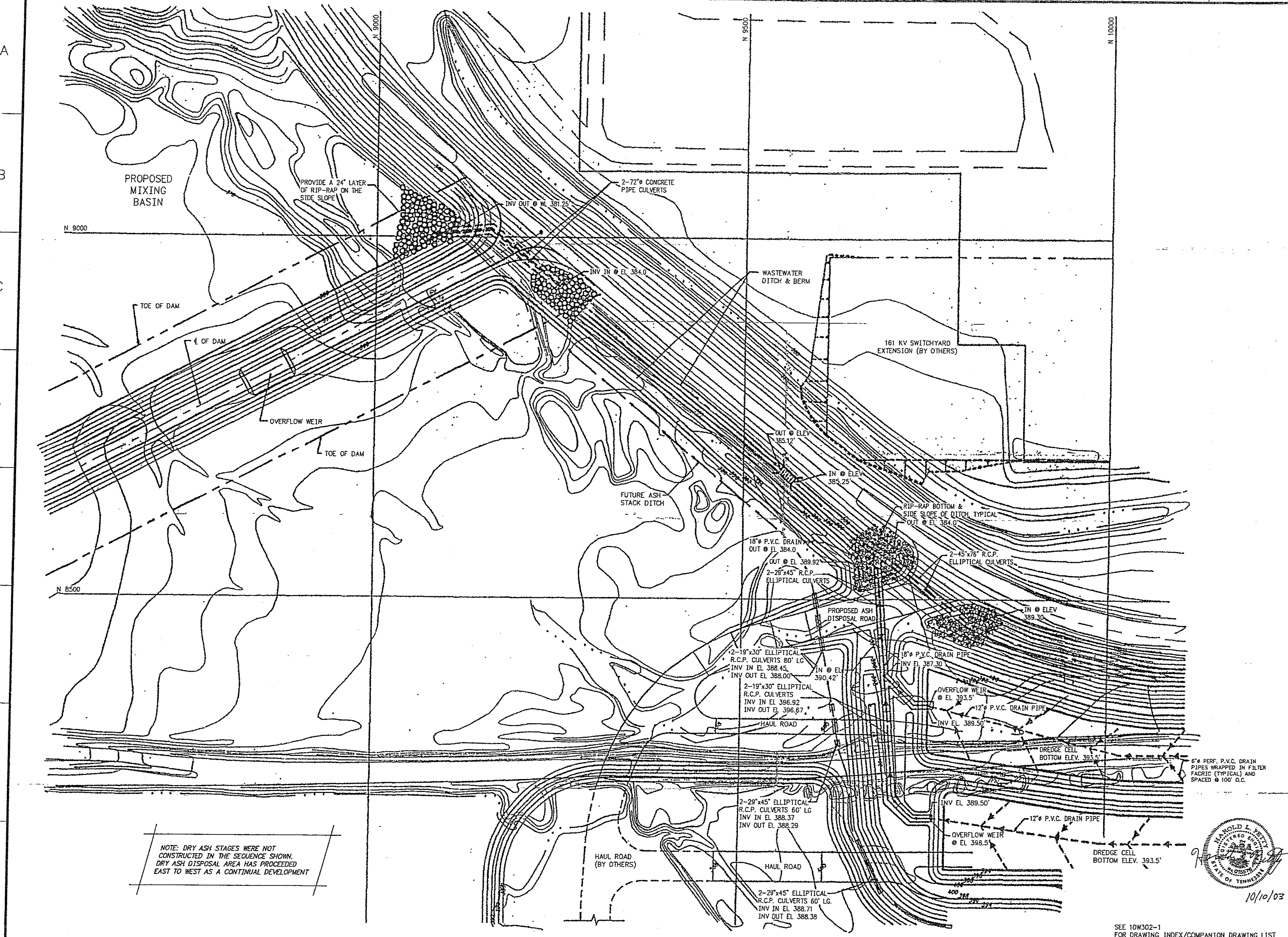
C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.

46 | C | 10W302-9



46 C 10W302-10
161 KV SWITCHYARD EXTENSION (BY OTHERS)
ASSUMED NORTH
34°-00'-00"
NOTE: PLANT GRID CONVERSION: 10,000:10,000 = TVA 0:0
INV OUT @ EL 385.12'
INV IN @ EL 385.25'
WASTE WATER DITCH
RIP-RAP BOTTOM & SIDE SLOPE OF DITCH, TYPICAL
OUT @ ELEV 388.00
18"ø P.V.C. DRAIN OUT @ EL 384.0
OUT @ EL 389.92
2-29"x45" ELLIPTICAL CULVERTS
2-45"x75" ELLIPTICAL R.C.P. CULVERTS
PROPOSED ASH DISPOSAL ROAD
IN @ ELEV 389.30
N 8500
N 8000
E 9000
E 9500
E 10000
E 10500
2-19"x30" ELLIPTICAL R.C.P. CULVERTS INV IN EL 388.45 INV OUT EL 388.00
2-19"x30" ELLIPTICAL R.C.P. CULVERTS INV IN EL 394.12 INV OUT EL 394.07
IN @ EL 390.42
18"ø P.V.C. DRAIN PIPE
INV EL 387.30
OVERFLOW WEIR @ EL 393.5'
12"ø P.V.C. DRAIN PIPE
INV EL 389.50
HAUL ROAD
6"ø PERF. P.V.C. DRAIN PIPES WRAPPED IN FILTER FABRIC (TYPICAL) AND SPACED @ 100' O.C.
2-29"x45" ELLIPTICAL R.C.P. CULVERTS 60' LG INV IN EL 388.37 INV OUT EL 388.29
INV EL 389.50'
12"ø P.V.C. DRAIN PIPE
INV EL 390.10'
INV. EL 391.25
OVERFLOW WEIR @ EL 398.5
6"ø PERF PVC DRAIN PIPES WRAPPED IN FILTER FABRIC (TYPICAL) AND SPACED @ 100' O.C.
HAUL ROAD (BY OTHERS)
HAUL ROAD
2-29"x45" ELLIPTICAL R.C.P. CULVERTS 60' LG. INV IN EL 388.37 INV OUT EL 388.29
ASH STACK RUNOFF TRENCH & BERM
FLY ASH SLUICE DITCH & BERM
BOTTOM ASH DREDGE CELLS BOTTOM ELEV 393.5' (1.3 ACRES EACH)
ASH DISPOSAL AREA (10 ACRES)
HP OF TRENCH EL 388.50
HP EL 390.00
NOTE: DRY ASH STAGES WERE NOT CONSTRUCTED IN THE SEQUENCE SHOWN. DRY ASH DISPOSAL AREA HAS PROCEEDED EAST TO WEST AS A CONTINUAL DEVELOPMENT
SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWING LIST
LEGEND
380 EXISTING CONTOUR LINE
380 NEW CONTOUR LINE EXISTING CONTOUR LINES
PREVIOUS STAGE CONTOUR LINE
HAROLD L. PETTY
STATE OF TENNESSEE
10/10/03
R 0 JLG MCH JGA HLP REP JGA
INITIAL ISSUE FOR DCN CUF-03-536
SCALE: 1" = 50' EXCEPT AS NOTED
FGD RETROFIT PROJECT UNITS 1 & 2
PROP. WASTE DISPOSAL FACILITY
CONSTRUCTION SEQUENCE
STAGE 4 - SHEET 1 OF 2
DESIGNED BY: J.L. GRAY
DRAWN BY: M.G. HRANEK
CHECKED BY: J.G. ALBRIGHT
SUPERVISED BY: H.L. PETTY
REVIEWED BY: R.E. PURKEY
ISSUED BY: J.G. ADAIR
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING
AUTOCAD R2K
46 C 10W302-10 R 0
PLOT FACTOR:1:1
W_TVA
C.A.D. DRAWING DO NOT ALTER MA
TASK COMPLETED BY:
REV NO.



NOTE: PLANT GRID CONVERSION: 10,000:10,000 = TVA 0:0

NOTE: DRY ASH STAGES WERE NOT CONSTRUCTED IN THE SEQUENCE SHOWN. DRY ASH DISPOSAL AREA HAS PROCEEDED EAST TO WEST AS A CONTINUAL DEVELOPMENT

HAROLD L. PETTY — REGISTERED ENGINEER — STATE OF TENNESSEE

10/10/03

SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWING LIST

R0 INITIAL ISSUE FOR DCN CUF-03-536 — JLG, MCH, JGA, HLP, REP, JGA

SCALE: 1" = 50' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROP. WASTE DISPOSAL FACILITY
CONSTRUCTION SEQUENCE
STAGE 4 – SHEET 2 OF 2

DESIGNED BY: J.L. GRAY; DRAWN BY: M.G. HRANEK; CHECKED BY: J.G. ALBRIGHT; SUPERVISED BY: H.L. PETTY; REVIEWED BY: R.E. PURKEY; ISSUED BY: J.G. ADAIR

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

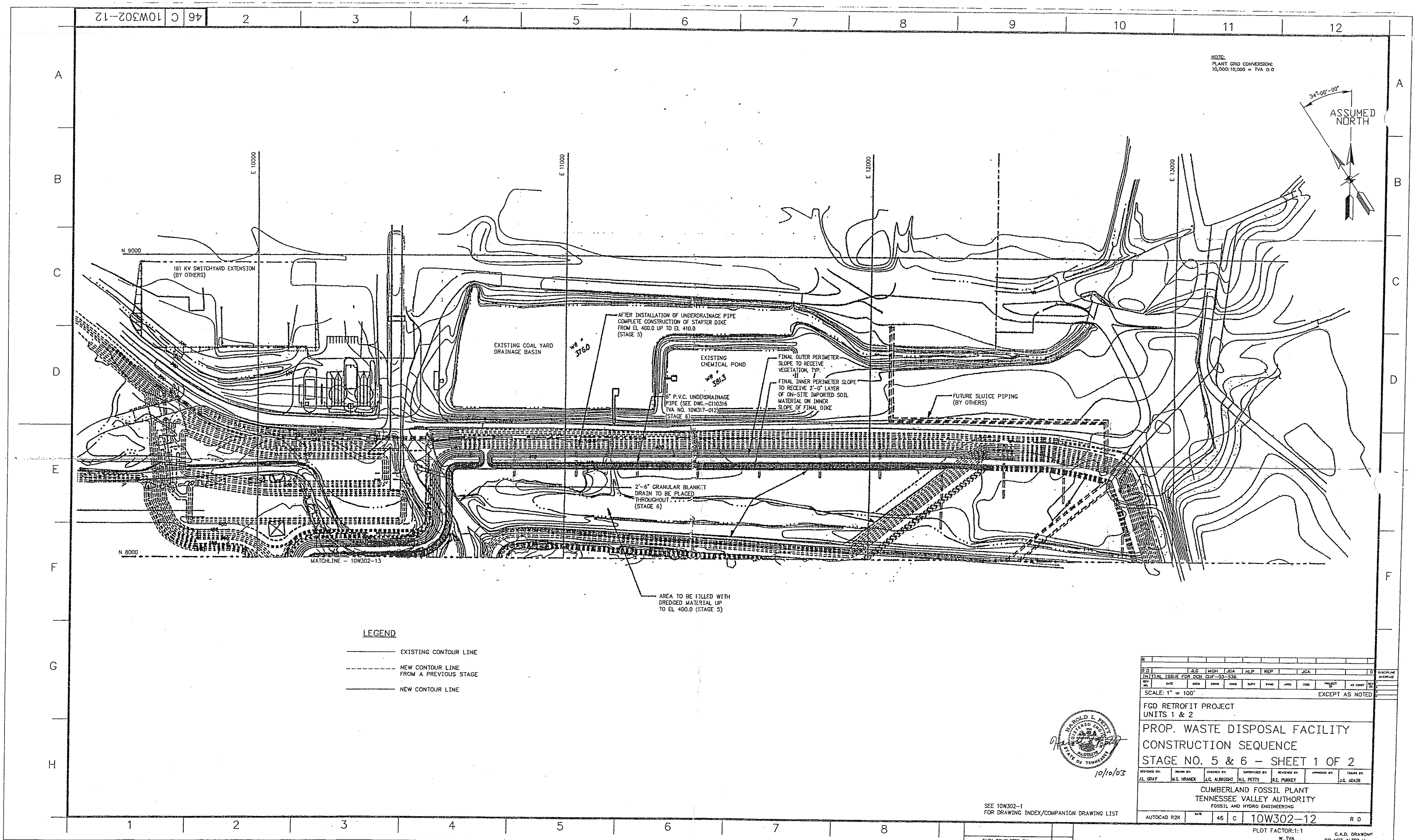
AUTOCAD R2K | 45 | C | 10W302-11 | R 0

PLOT FACTOR: 1:1
W_TVA

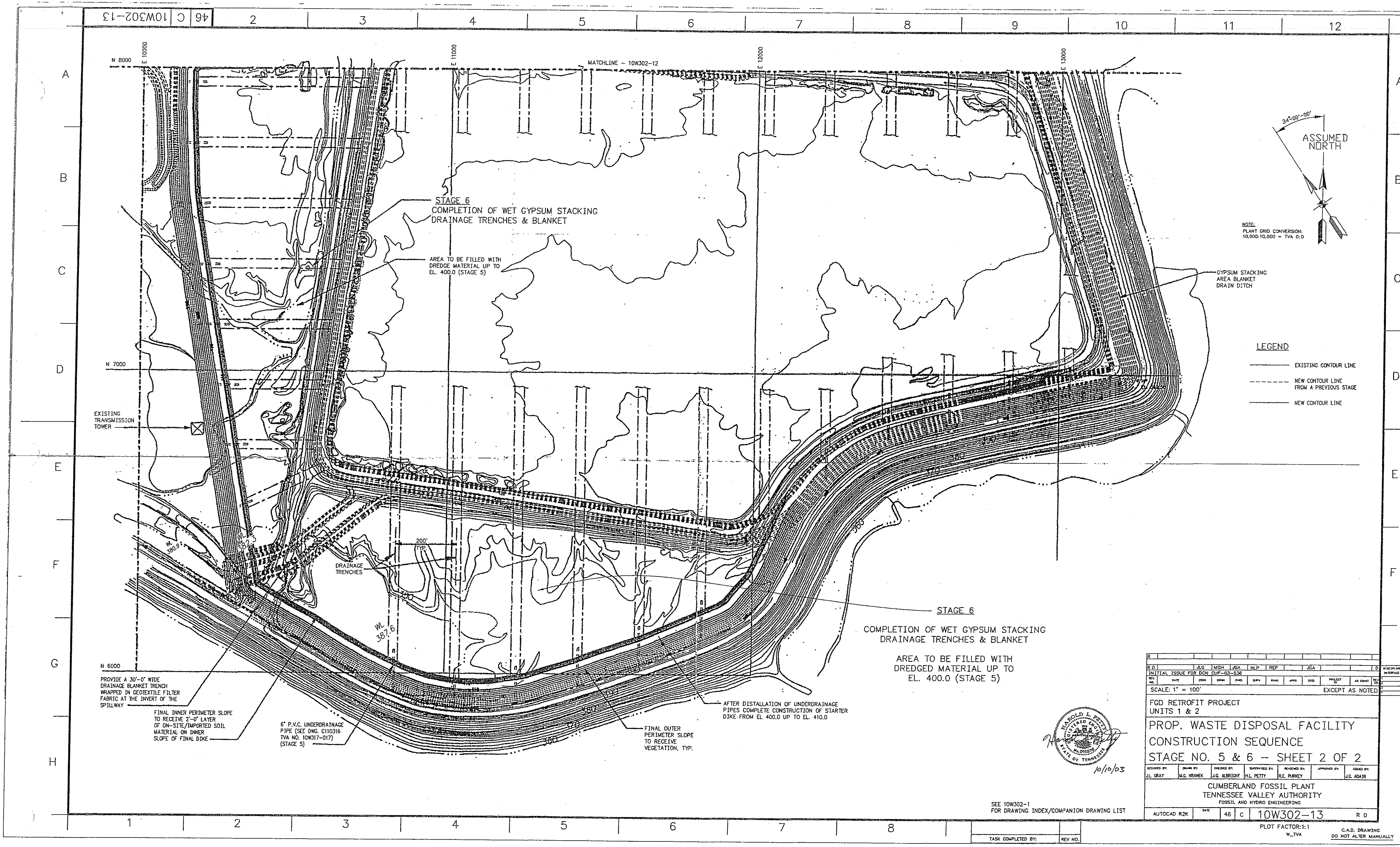
C.A.D. DRAWING DO NOT ALTER MANUALLY

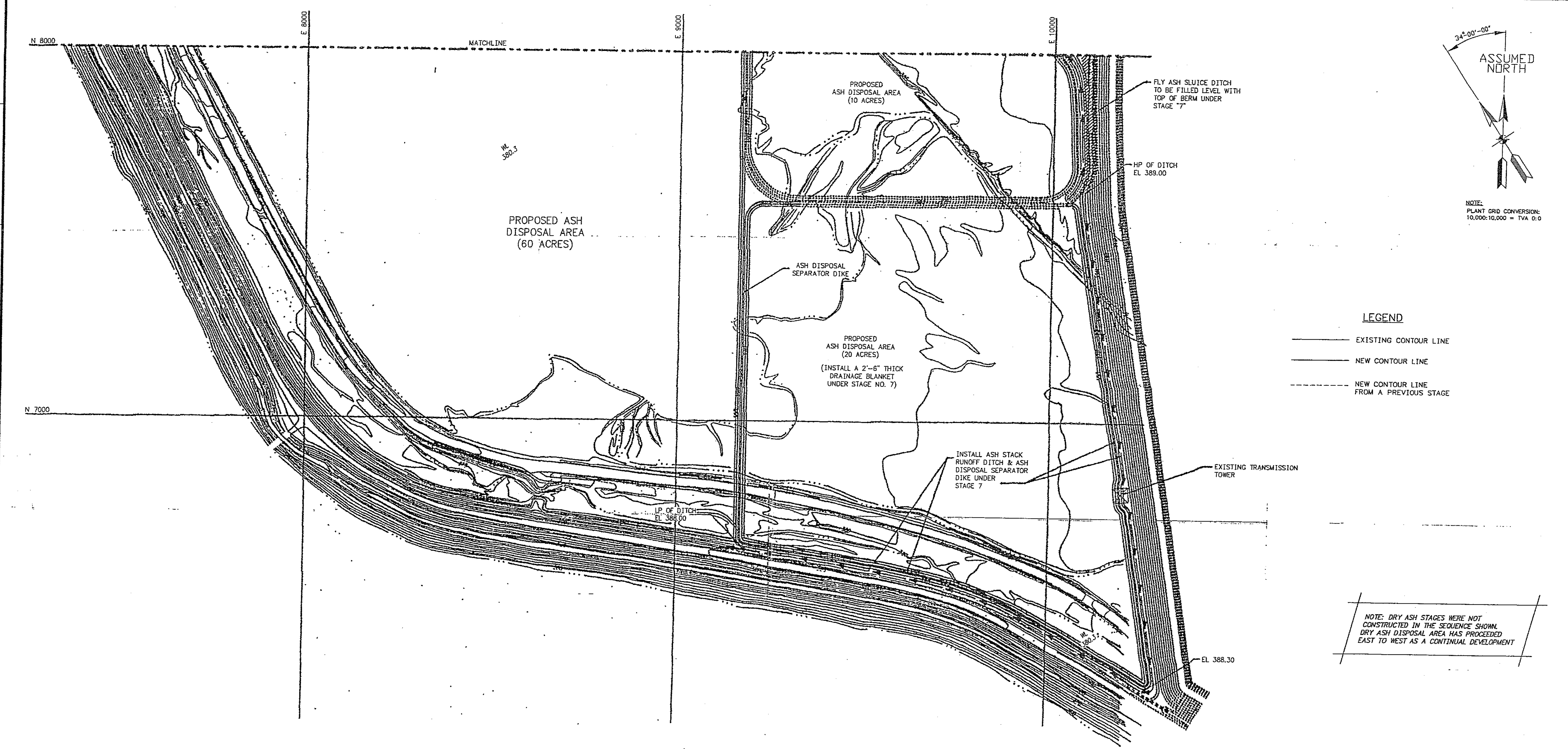
TASK COMPLETED BY: | REV NO.

46 C 10W302-11



NOTE:
PLANT GRID CONVERSION:
10,000:10,000 = TVA 0:0
34°-00'-00"
ASSUMED NORTH
E 10000
E 11000
E 12000
E 13000
N 9000
N 8000
161 KV SWITCHYARD EXTENSION (BY OTHERS)
EXISTING COAL YARD DRAINAGE BASIN
AFTER INSTALLATION OF UNDERDRAINAGE PIPE COMPLETE CONSTRUCTION OF STARTER DIKE FROM EL 400.0 UP TO EL 410.0 (STAGE 5)
EXISTING CHEMICAL POND
FINAL OUTER PERIMETER SLOPE TO RECEIVE VEGETATION, TYP.
FINAL INNER PERIMETER SLOPE TO RECEIVE 2'-0" LAYER OF ON-SITE IMPORTED SOIL MATERIAL ON INNER SLOPE OF FINAL DIKE
6" P.V.C. UNDERDRAINAGE PIPE (SEE DWG.-C110316 TVA NO. 10W317-012) (STAGE 6)
FUTURE SLUICE PIPING (BY OTHERS)
2'-6" GRANULAR BLANKET DRAIN TO BE PLACED THROUGHOUT (STAGE 6)
MATCHLINE - 10W302-13
AREA TO BE FILLED WITH DREDGED MATERIAL UP TO EL 400.0 (STAGE 5)
LEGEND
EXISTING CONTOUR LINE
NEW CONTOUR LINE FROM A PREVIOUS STAGE
NEW CONTOUR LINE
SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWING LIST
HAROLD L. PETTY
STATE OF TENNESSEE
10/10/03
R 0 INITIAL ISSUE FOR DCN CUF-03-536 JLG MGH JGA HLP REP JGA
SCALE: 1" = 100' EXCEPT AS NOTED
FGD RETROFIT PROJECT
UNITS 1 & 2
PROP. WASTE DISPOSAL FACILITY
CONSTRUCTION SEQUENCE
STAGE NO. 5 & 6 - SHEET 1 OF 2
DESIGNED BY: J.L. GRAY
DRAWN BY: M.G. HRANEK
CHECKED BY: J.G. ALBRIGHT
SUPERVISED BY: H.L. PETTY
REVIEWED BY: R.E. PURKEY
ISSUED BY: J.G. ADAIR
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING
AUTOCAD R2K
46 C 10W302-12 R 0
PLOT FACTOR:1:1
W_TVA
C.A.D. DRAWING DO NOT ALTER M
TASK COMPLETED BY:
REV NO.


46 C 10W302-13
MATCHLINE – 10W302-12
N 8000
N 7000
N 6000
E 10000
E 11000
E 12000
E 13000
ASSUMED NORTH
34°-00'-00"
NOTE: PLANT GRID CONVERSION: 10,000:10,000 = TVA 0:0
STAGE 6
COMPLETION OF WET GYPSUM STACKING DRAINAGE TRENCHES & BLANKET
AREA TO BE FILLED WITH DREDGE MATERIAL UP TO EL. 400.0 (STAGE 5)
GYPSUM STACKING AREA BLANKET DRAIN DITCH
LEGEND
EXISTING CONTOUR LINE
NEW CONTOUR LINE FROM A PREVIOUS STAGE
NEW CONTOUR LINE
EXISTING TRANSMISSION TOWER
WL 380.9
WL 382.3
WL 387.6
200' TYP.
DRAINAGE TRENCHES
STAGE 6
COMPLETION OF WET GYPSUM STACKING DRAINAGE TRENCHES & BLANKET
AREA TO BE FILLED WITH DREDGED MATERIAL UP TO EL. 400.0 (STAGE 5)
PROVIDE A 30'-0" WIDE DRAINAGE BLANKET TRENCH WRAPPED IN GEOTEXTILE FILTER FABRIC AT THE INVERT OF THE SPILLWAY
FINAL INNER PERIMETER SLOPE TO RECEIVE 2'-0" LAYER OF ON-SITE/IMPORTED SOIL MATERIAL ON INNER SLOPE OF FINAL DIKE
6" P.V.C. UNDERDRAINAGE PIPE (SEE DWG. C110316 TVA NO. 10W317-017) (STAGE 5)
FINAL OUTER PERIMETER SLOPE TO RECEIVE VEGETATION, TYP.
AFTER DISTALLATION OF UNDERDRAINAGE PIPES COMPLETE CONSTRUCTION OF STARTER DIKE FROM EL 400.0 UP TO EL. 410.0
380
370
360
10/10/03
SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWING LIST
R0 INITIAL ISSUE FOR DCN CUF-03-536
JLG MGH JGA HLP REP JGA
SCALE: 1" = 100' EXCEPT AS NOTED
FGD RETROFIT PROJECT UNITS 1 & 2
PROP. WASTE DISPOSAL FACILITY
CONSTRUCTION SEQUENCE
STAGE NO. 5 & 6 – SHEET 2 OF 2
J.L. GRAY
M.G. KRANEK
J.G. ALBRIGHT
H.L. PETTY
R.E. PURKEY
J.G. ADAIR
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING
AUTOCAD R2K
46 C 10W302-13 R 0
PLOT FACTOR:1:1
W_TVA
C.A.D. DRAWING DO NOT ALTER MANUALLY
TASK COMPLETED BY:
REV NO.



HAROLD L. PETTY — REGISTERED ENGINEER — STATE OF TENNESSEE

10/10/03

SEE 10W302-1
FOR DRAWING INDEX/COMPANION DRAWING LIST

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0		JLG	MCH	JGA	HLP	REP		JGA		D
INITIAL ISSUE FOR DCN CUF-03-536										

SCALE: 1" = 100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROP. WASTE DISPOSAL FACILITY CONSTRUCTION SEQUENCE STAGE NO. 7

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

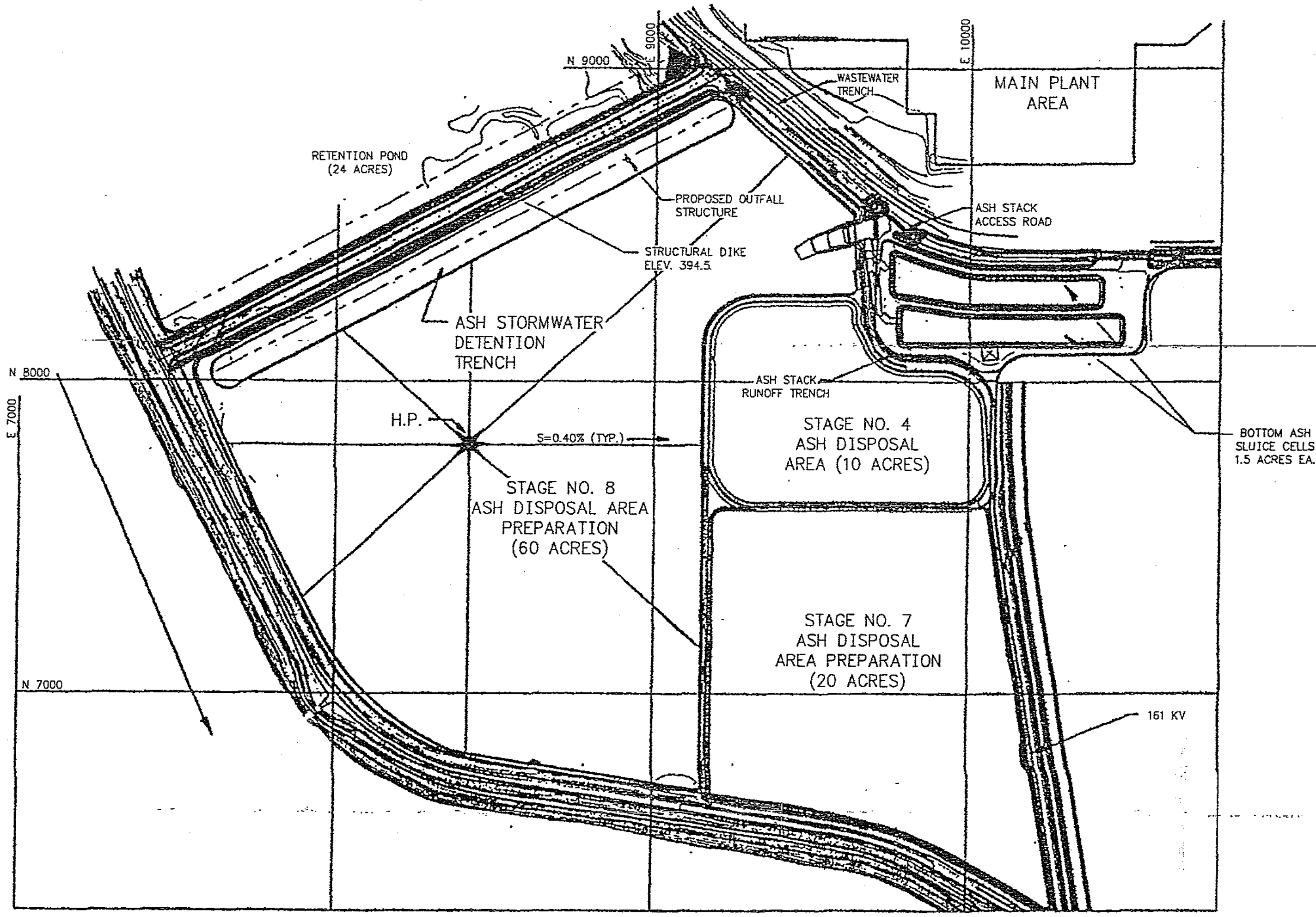
AUTOCAD R2K | DATE | 46 | C | 10W302-14 | R 0

PLOT FACTOR:1:1
W_TVA

C.A.D. DRAWING DO NOT ALTER M

TASK COMPLETED BY: | REV NO.

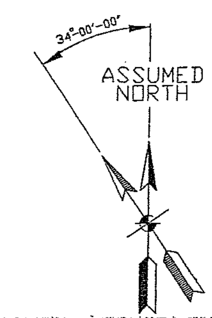
46 C 10W302-14



NOTES:
1. PREPARE STAGE 8 INTERIM CLOSURE FOR THE FLY ASH. PREPARATION WILL INCLUDE THE 60 ACRE SITE TO BE SLOPED .004'/FT. FROM THE CENTER OF THE DESIGNATED AREA. PROVIDE 1'-1.5' OF COVER (MIN. PERMEABILITY 1x10^{-3} CM/SEC) AND SEEDING.

PARTIAL PLAN

NOTE: DRY ASH STAGES WERE NOT CONSTRUCTED IN THE SEQUENCE SHOWN. DRY ASH DISPOSAL AREA HAS PROCEEDED EAST TO WEST AS A CONTINUAL DEVELOPMENT



NOTE:
PLANT GRID CONVERSION:
10,000:10,000 = TVA 0:0

LEGEND

380 — PROPOSED CONTOURS (3' INTERVALS ON STACK 2' INTERVAL ON STARTER DIKE)

— EXISTING CONTOURS

10/10/03

SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWING LIST

R											
R 0	INITIAL ISSUE FOR DCN CUF-03-536	JLG	MGH	JGA	HLP	REP		JGA			D
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD

SCALE: 1" = 100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROP. WASTE DISPOSAL FACILITY
CONSTRUCTION SEQUENCE
STAGE NO. 8

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K	DATE	46	C	10W302-15	R 0

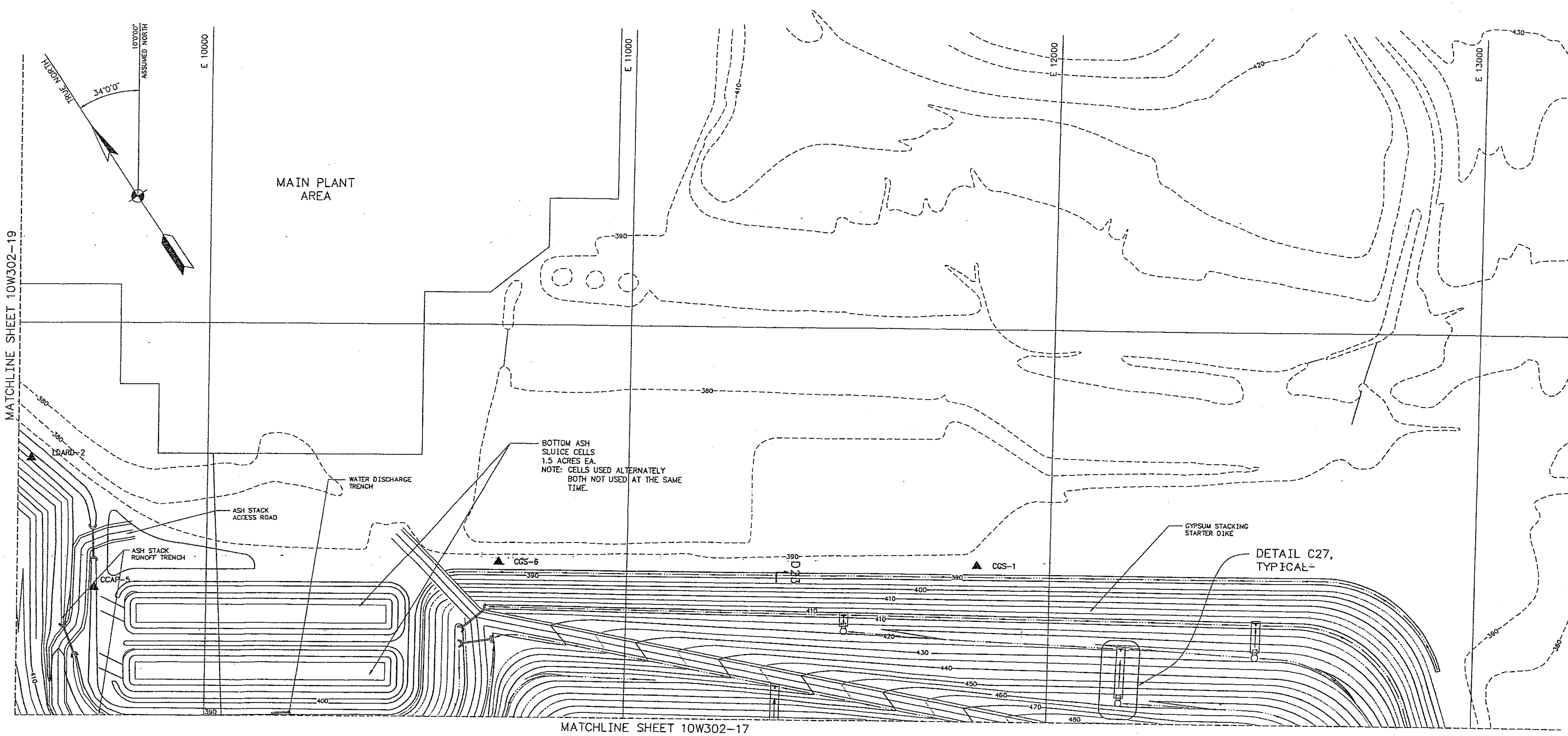
PLOT FACTOR:1:1
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.

DISCIPLINE INTERFACE

46 C 10W302-15



LEGEND

- —400— PROPOSED COUNTOURS
- ---380--- EXISTING CONTOURS
- CULVERT
- RIPRAP
- C# C# CROSS SECTION LOCATION
- ▲ BENCHMARK LOCATION

** FOR BENCHMARK DATA SEE 10W302-2.

REFER TO DWG. NO. 10W302-3 FOR CONVERSION FROM PLANT COORDINATES TO TENNESSEE STATE COORDINATE DATUM.

SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWINGS LIST

HAROLD L. PETTY REGISTERED ENGINEER No. 015578 STATE OF TENNESSEE

10/10/03

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R											
R 0		J.G	MGH	JGA	HLP	REP		JGA			D
INITIAL ISSUE: FOR DCN CUF-03-536											

SCALE: 1"=100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY
PROPOSED FINAL CONTOURS
SHEET 1 OF 4

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

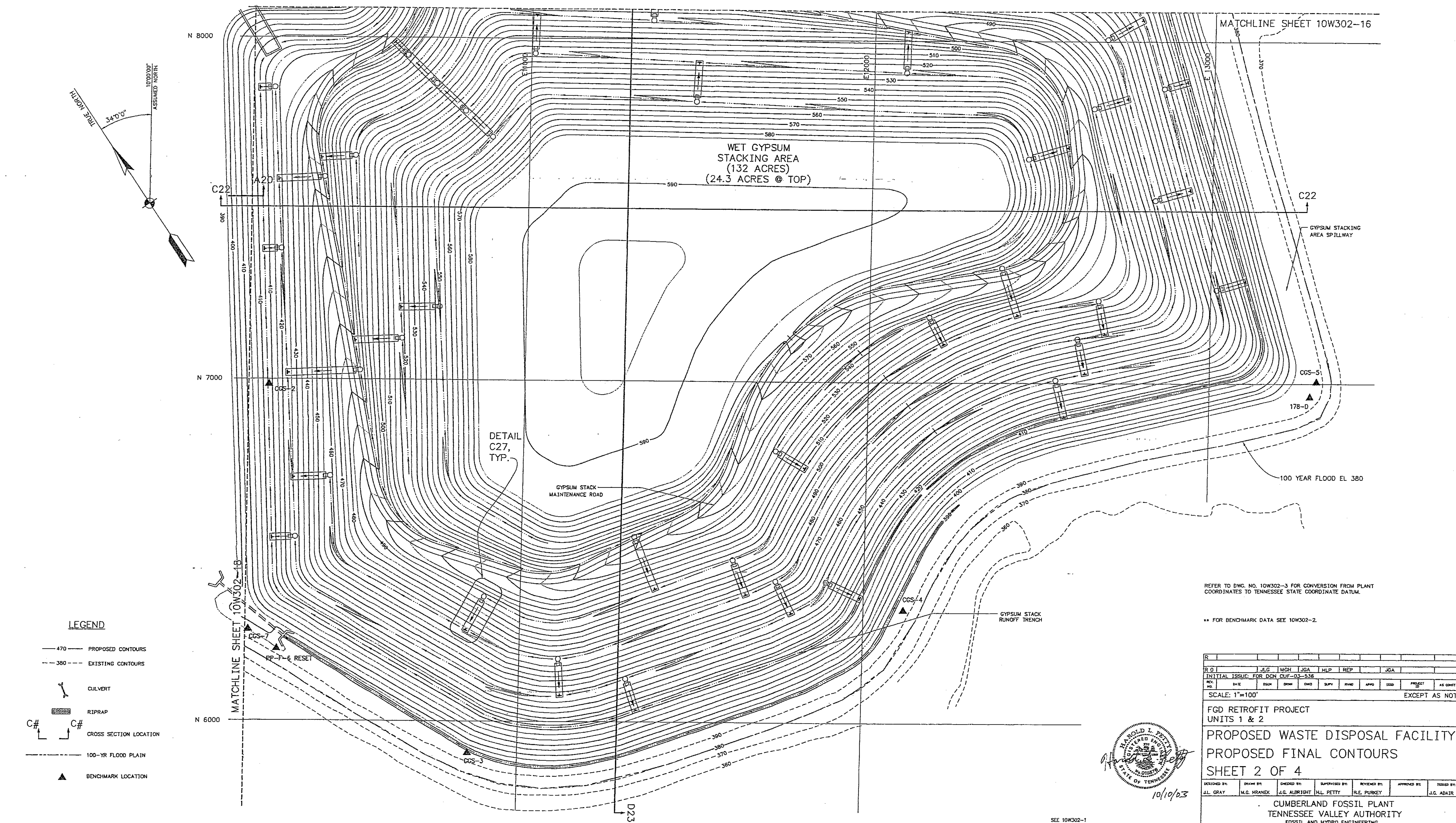
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K | DATE | 46 | C | 10W302-16 | R 0

PLOT FACTOR:1200
W_TVA

C.A.D. DRAWING DO NOT ALTER MA

TASK COMPLETED BY: | REV NO.



LEGEND

- 470 — PROPOSED CONTOURS
- 380 - - - EXISTING CONTOURS
- CULVERT
- RIPRAP
- C# CROSS SECTION LOCATION
- 100-YR FLOOD PLAIN
- BENCHMARK LOCATION

REFER TO DWG. NO. 10W302-3 FOR CONVERSION FROM PLANT COORDINATES TO TENNESSEE STATE COORDINATE DATUM.

** FOR BENCHMARK DATA SEE 10W302-2.

SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWINGS LIST

10/10/03

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R											
R 0		JLG	MGH	JGA	HLP	REP		JGA			D

INITIAL ISSUE: FOR DCN CUF-03-536

SCALE: 1"=100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY
PROPOSED FINAL CONTOURS
SHEET 2 OF 4

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

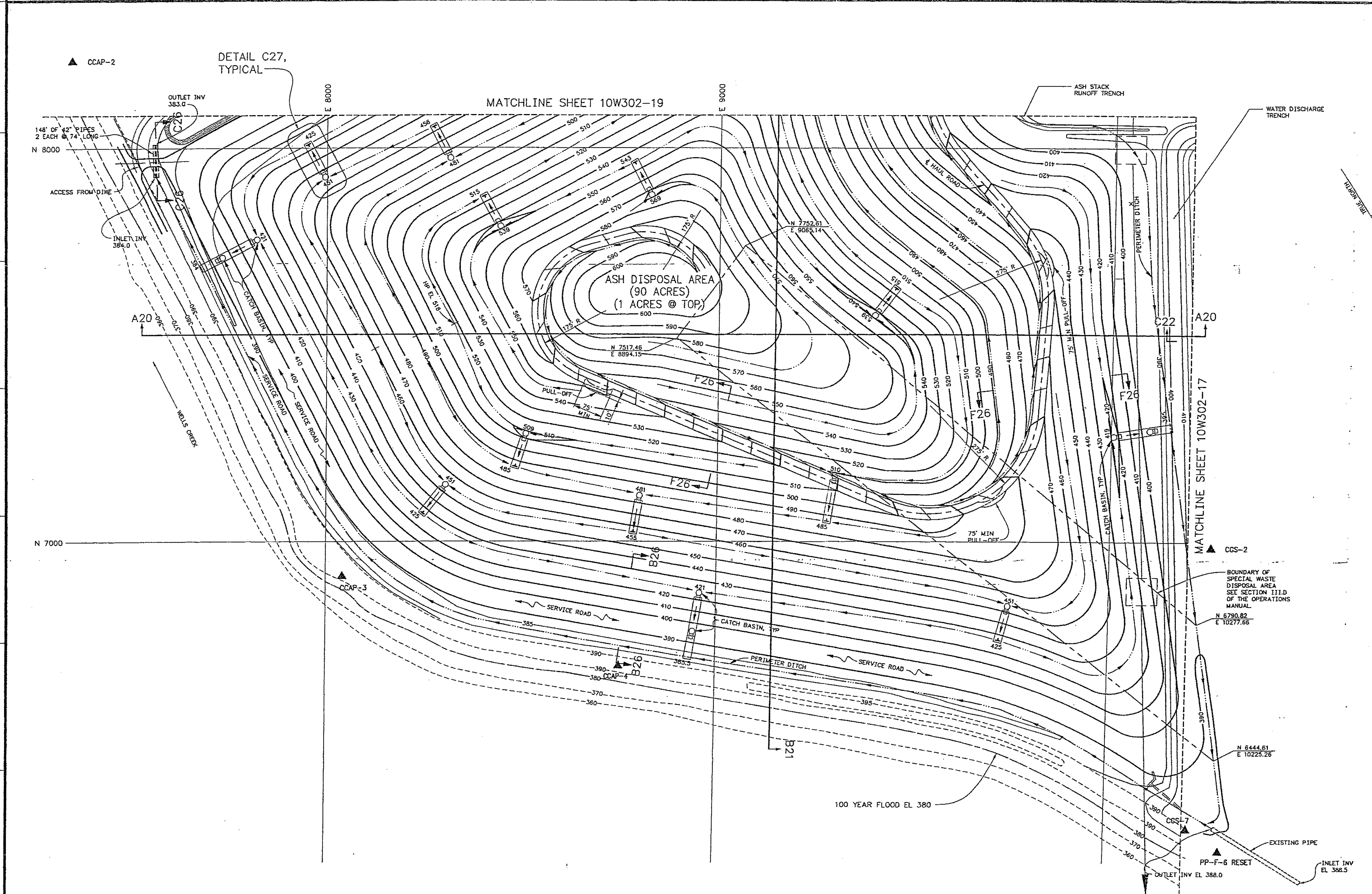
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K | DATE | 46 | C | 10W302-17 | R 0

PLOT FACTOR:1200
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.



LEGEND

—400— PROPOSED CONTOURS
- - 380 - - EXISTING CONTOURS
CULVERT
RIPRAP
C# C# CROSS SECTION LOCATION
100-YR FLOODPLAIN
BENCHMARK LOCATION

REFER TO DWG. NO. 10W302-3 FOR CONVERSION FROM PLANT COORDINATES TO TENNESSEE STATE COORDINATE DATUM.

** FOR BENCHMARK DATA SEE 10W302-2.

SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWINGS LIST

HAROLD L. PETTY REGISTERED ENGINEER STATE OF TENNESSEE

10/10/03

R												
R 0		JLG	MGH	JGA	HLP	REP		JGA			D	DISCIPLINE INTERFACE
INITIAL ISSUE: FOR DCN CUF-03-536												
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD	

SCALE: 1"=100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY
PROPOSED FINAL CONTOURS
SHEET 3 OF 4

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

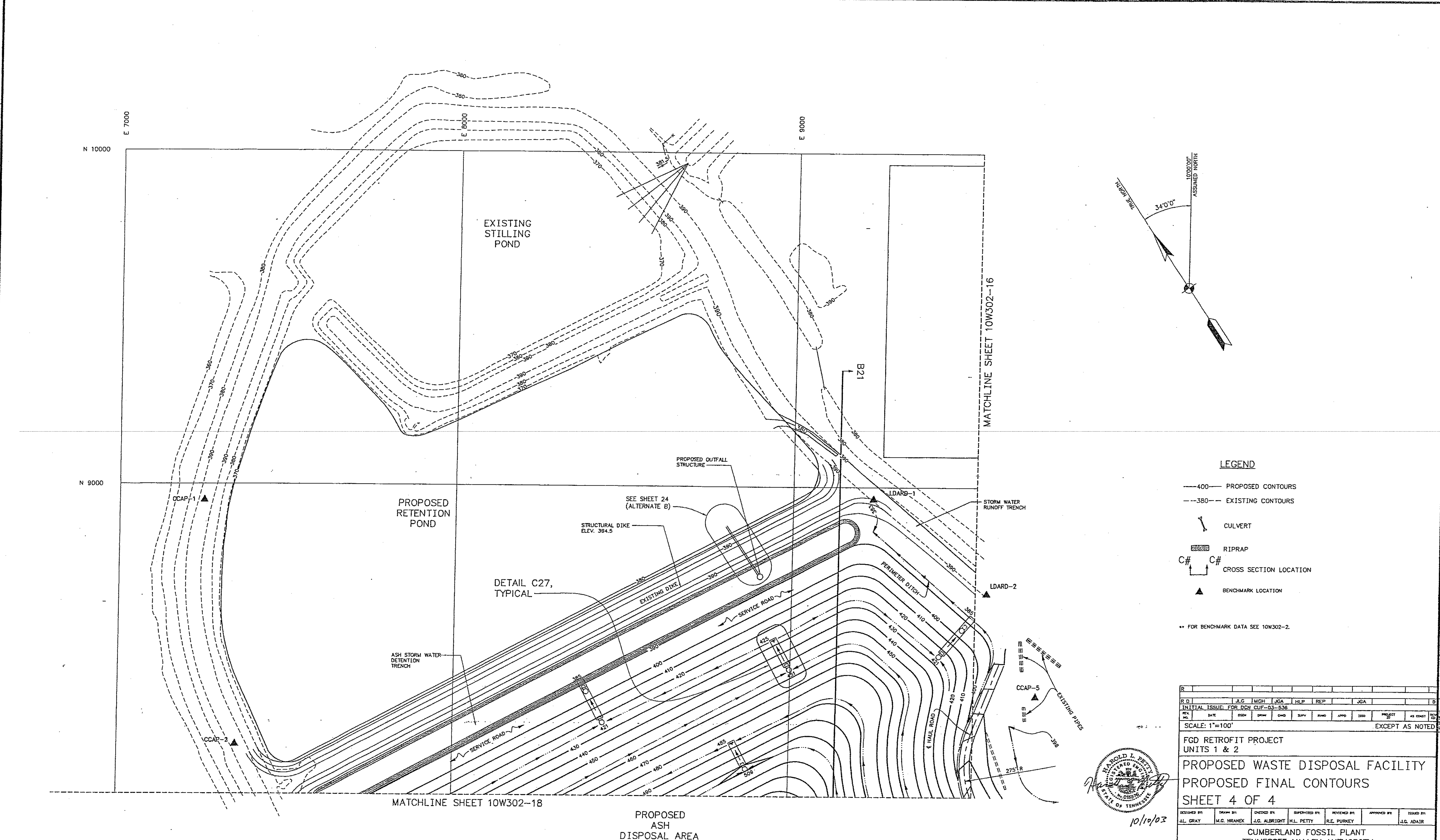
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K | DATE | 46 | C | 10W302-18 | R 0

PLOT FACTOR:1200
W_TVA

C.A.D. DRAWING DO NOT ALTER MA

TASK COMPLETED BY: | REV NO.



R											
R 0		JLG	MGH	JGA	HLP	REP		JGA			D
INITIAL ISSUE: FOR DCN CUF-03-536											
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD

SCALE: 1"=100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY
PROPOSED FINAL CONTOURS
SHEET 4 OF 4

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

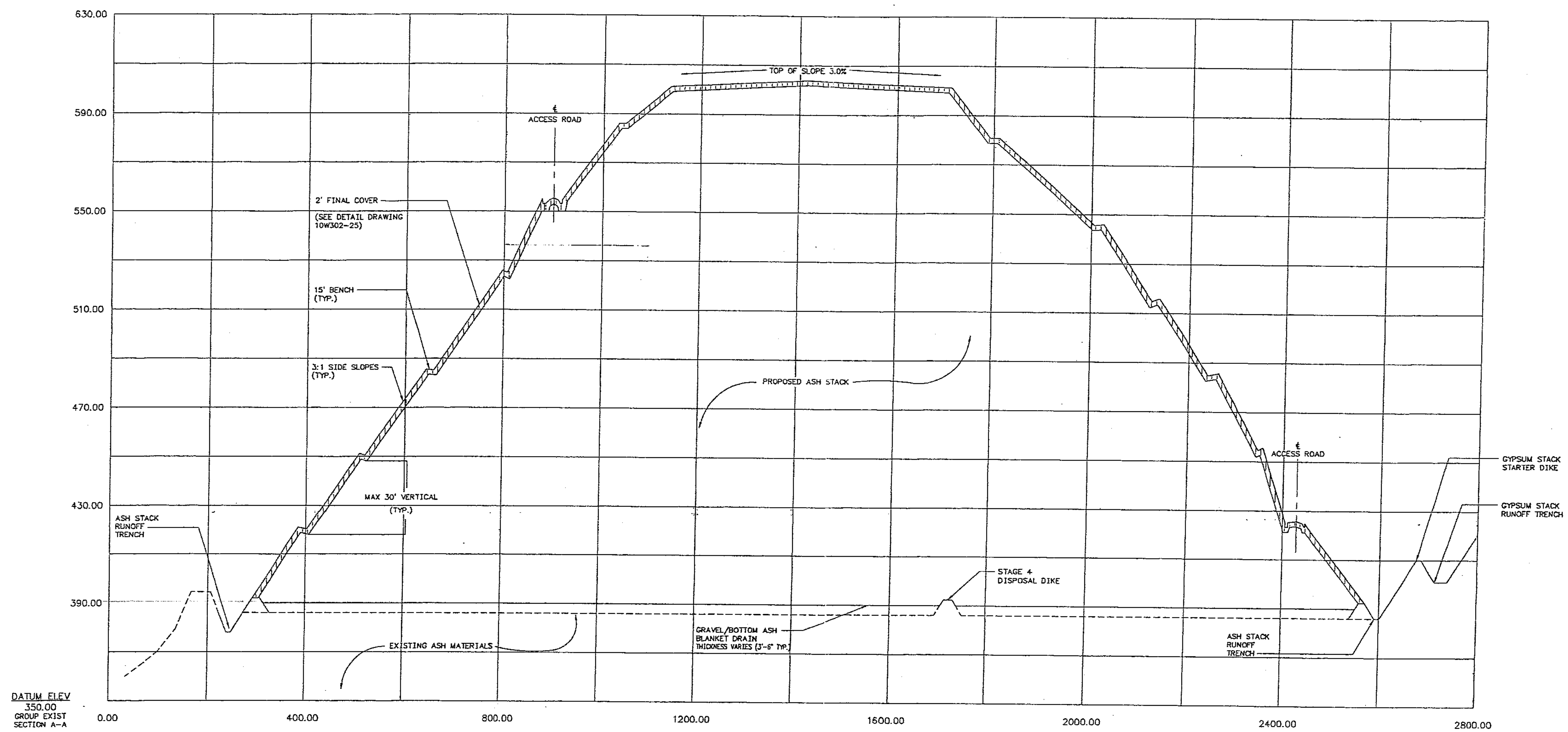
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K	DATE	46	C	10W302-19	R 0

PLOT FACTOR:1200
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: REV NO.



CROSS SECTION A20–A20

HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=20'

10/10/03

SEE 10W302-1
FOR DRAWING INDEX/COMPANION DRAWINGS LIST

R 0		JLG	MGH	JGA	HLP	REP		JGA			D
INITIAL ISSUE: FOR DCN CUF-03-536											
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD

SCALE: 1"=100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY
CROSS SECTION A20–A20

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

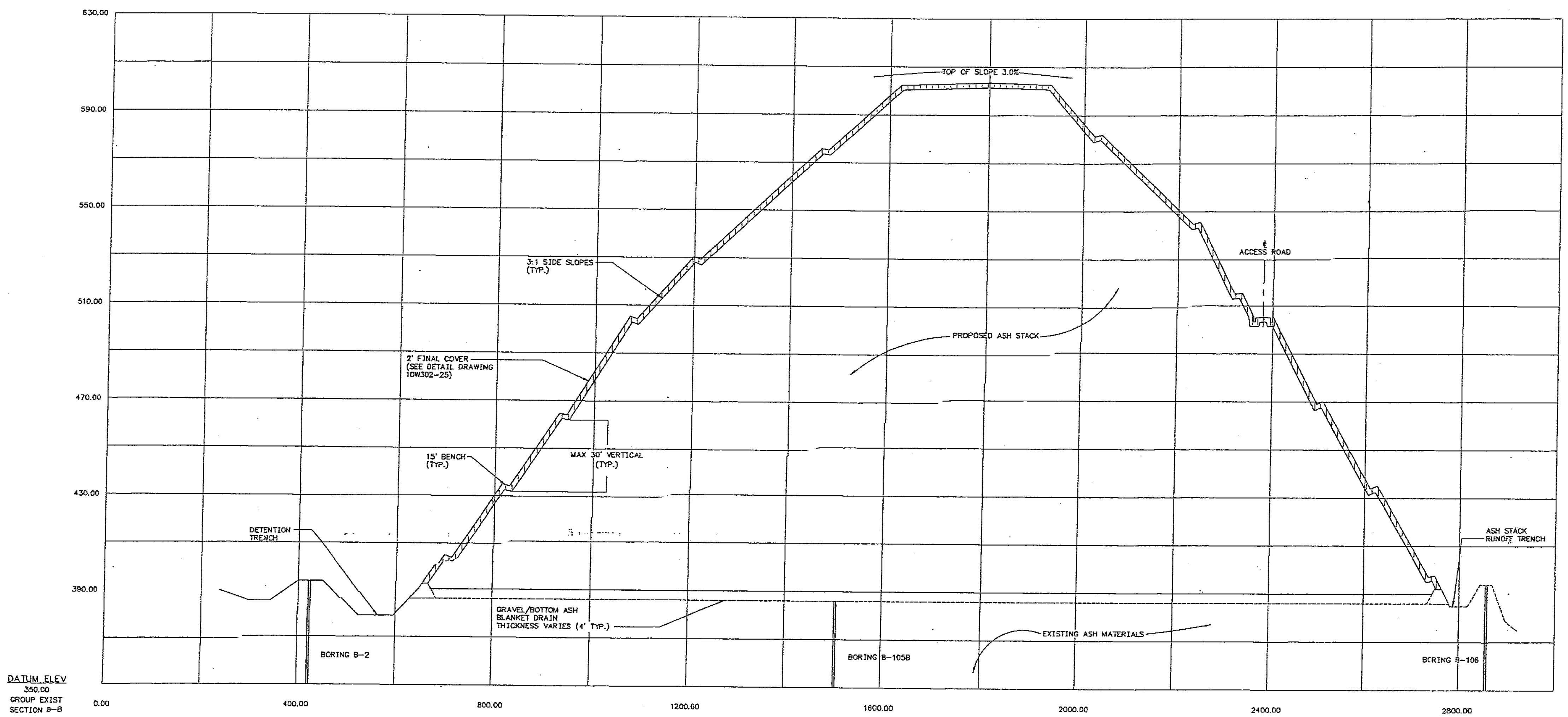
AUTOCAD R2K | DATE | 46 | C | 10W302-20 | R 0

PLOT FACTOR:1200
W_TVA

C.A.D. DRAWING
DO NOT ALTER MA

TASK COMPLETED BY: | REV NO.

46 | C | 10W302-20



CROSS SECTION B21–B21

HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=20'

SEE 10W302-1
FOR DRAWING INDEX/COMPANION DRAWINGS LIST

10/10/03

R											
R 0		JLG	MGH	JGA	HLP	REP		JGA			D
INITIAL ISSUE: FOR DCN CUF-03-536											
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD

SCALE: 1"=100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY CROSS SECTION B21–B21

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K | DATE | 46 | C | 10W302-21 | R 0

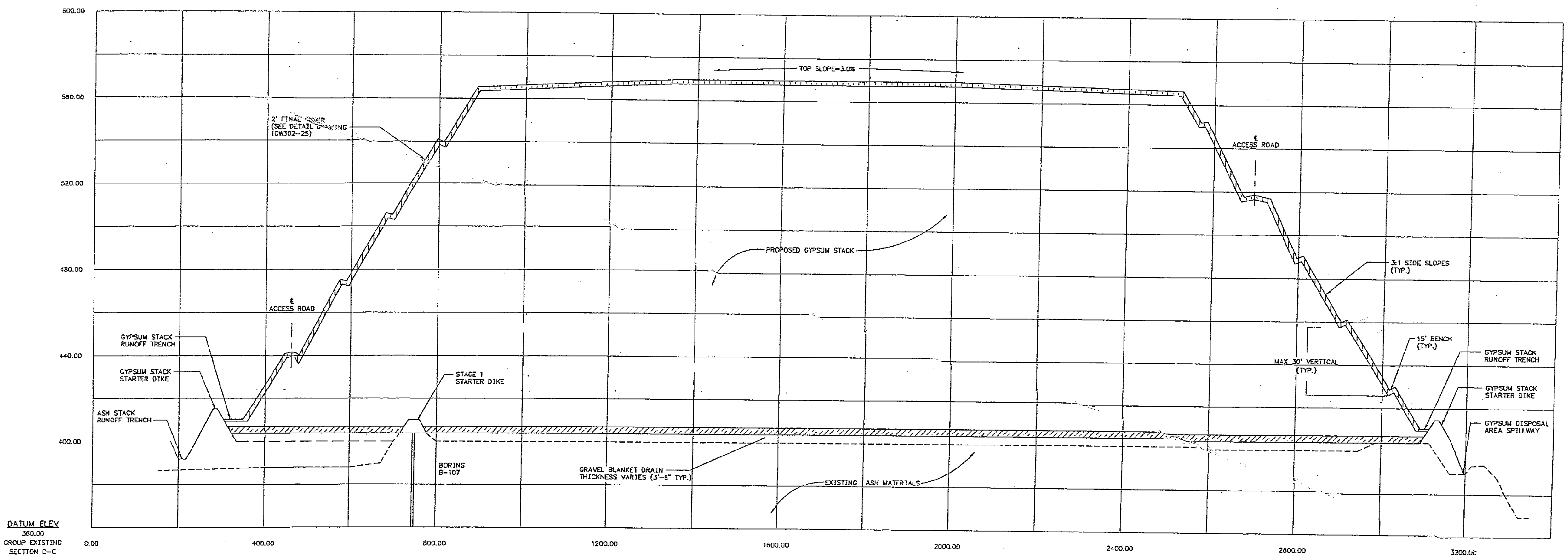
PLOT FACTOR:1200
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.

46 C 10W302-21

10W302-22 | C | 46



CROSS SECTION C22–C22

HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=20'

10/10/03

SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWINGS LIST

R 0	JLG	MCH	JGA	HLP	REP	JGA
INITIAL ISSUE; FOR DCN CUF-03-536						

SCALE: 1"=100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY CROSS SECTION C22–C22

DESIGNED BY	DRAWN BY	CHECKED BY	SUPERVISED BY	REVIEWED BY	APPROVED BY	ISSUED BY
J.L. GRAY	M.C. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

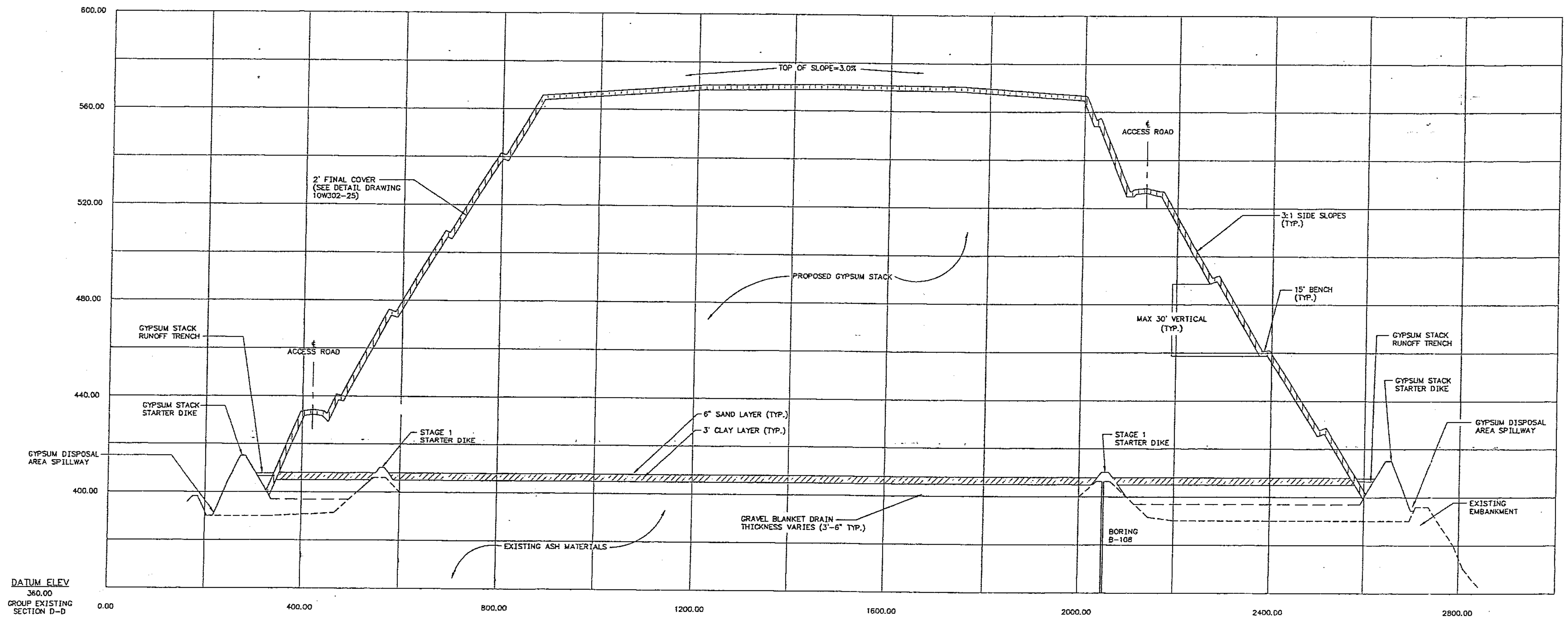
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K | 46 | C | 10W302-22 | R 0

PLOT FACTOR:1200
W_TVA

C.A.D. DRAWING DO NOT ALTER

TASK COMPLETED BY: | REV NO.



CROSS SECTION D23-D23

HORIZONTAL SCALE: 1"=100'

VERTICAL SCALE: 1"=20'

SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWINGS LIST

10/10/03

R 0	JLG	MGH	JGA	HLP	REP	JGA
INITIAL ISSUE: FOR DCN CUF-03-536						

SCALE: 1"=100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY CROSS SECTION D23-D23

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

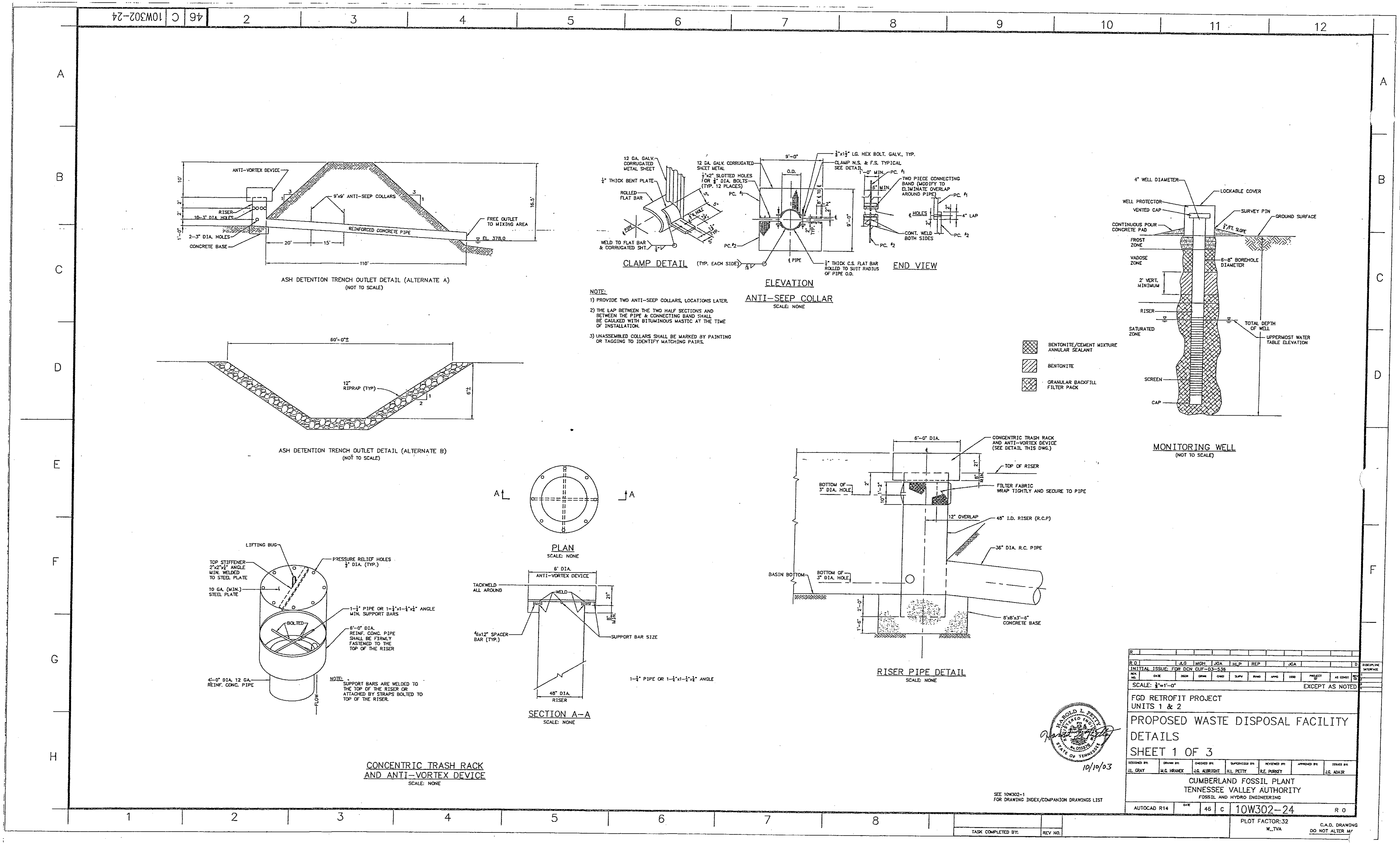
AUTOCAD R2K | 46 | C | 10W302-23 | R 0

PLOT FACTOR:1200
W_TVA

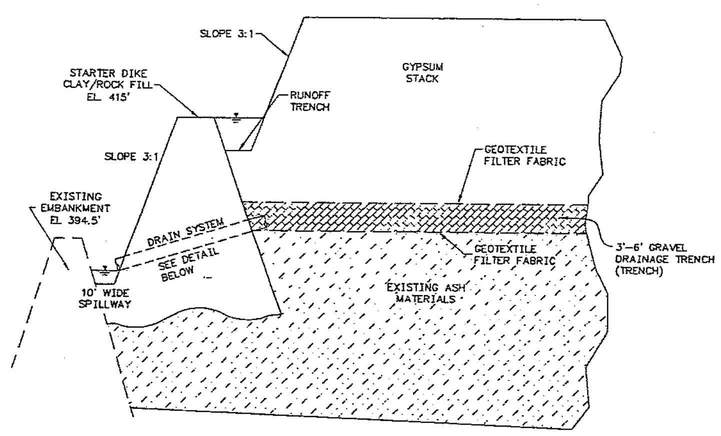
C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.

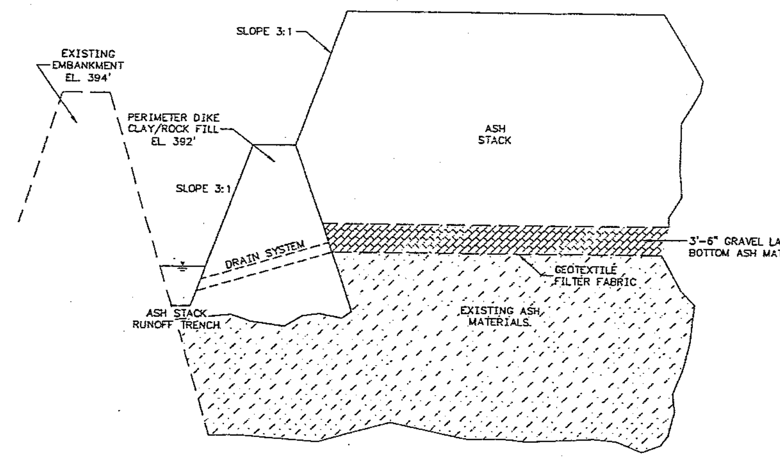
10W302-23 C 46



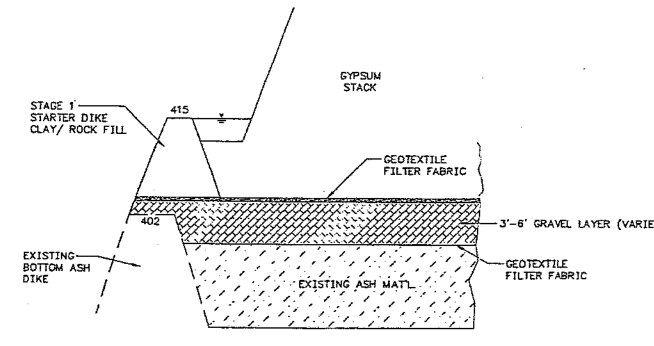
46 C 10W302-24
ANTI-VORTEX DEVICE
RISER
10-3" DIA. HOLES
2-3" DIA. HOLES
CONCRETE BASE
9'x9' ANTI-SEEP COLLARS
REINFORCED CONCRETE PIPE
FREE OUTLET TO MIXING AREA
EL. 378.0
16.5'
20'
15'
110'
ASH DETENTION TRENCH OUTLET DETAIL (ALTERNATE A)
(NOT TO SCALE)
60'-0"±
12" RIPRAP (TYP)
6'±
ASH DETENTION TRENCH OUTLET DETAIL (ALTERNATE B)
(NOT TO SCALE)
12 GA. GALV. CORRUGATED METAL SHEET
1/2" THICK BENT PLATE
ROLLED FLAT BAR
WELD TO FLAT BAR & CORRUGATED SHT.
12 GA. GALV. CORRUGATED SHEET METAL
3/4"x2" SLOTTED HOLES FOR 1/2" DIA. BOLTS (TYP. 12 PLACES)
CLAMP DETAIL
(TYP. EACH SIDE)
9'-0"
O.D.
1/2"x1 1/2" LG. HEX BOLT, GALV., TYP.
CLAMP N.S. & F.S. TYPICAL SEE DETAIL
TWO PIECE CONNECTING BAND (MODIFY TO ELIMINATE OVERLAP AROUND PIPE)
CONT. WELD BOTH SIDES
4" LAP
1/2" THICK C.S. FLAT BAR ROLLED TO SUIT RADIUS OF PIPE O.D.
ELEVATION
END VIEW
ANTI-SEEP COLLAR
SCALE: NONE
NOTE:
1) PROVIDE TWO ANTI-SEEP COLLARS, LOCATIONS LATER.
2) THE LAP BETWEEN THE TWO HALF SECTIONS AND BETWEEN THE PIPE & CONNECTING BAND SHALL BE CAULKED WITH BITUMINOUS MASTIC AT THE TIME OF INSTALLATION.
3) UNASSEMBLED COLLARS SHALL BE MARKED BY PAINTING OR TAGGING TO IDENTIFY MATCHING PAIRS.
BENTONITE/CEMENT MIXTURE ANNULAR SEALANT
BENTONITE
GRANULAR BACKFILL FILTER PACK
4" WELL DIAMETER
LOCKABLE COVER
WELL PROTECTOR
VENTED CAP
SURVEY PIN
GROUND SURFACE
CONTINUOUS POUR CONCRETE PAD
FROST ZONE
VADOSE ZONE
6-8" BOREHOLE DIAMETER
2' VERT. MINIMUM
RISER
SATURATED ZONE
TOTAL DEPTH OF WELL
UPPERMOST WATER TABLE ELEVATION
SCREEN
CAP
MONITORING WELL
(NOT TO SCALE)
PLAN
SCALE: NONE
6' DIA.
ANTI-VORTEX DEVICE
TACKWELD ALL AROUND
WELD
6x12" SPACER BAR (TYP.)
SUPPORT BAR SIZE
1-1/2" PIPE OR 1-1/2"x1-1/2"x1/4" ANGLE
48" DIA. RISER
SECTION A-A
SCALE: NONE
LIFTING BUG
TOP STIFFENER 2"x2"x1/4" ANGLE MIN. WELDED TO STEEL PLATE
10 GA. (MIN.) STEEL PLATE
PRESSURE RELIEF HOLES 1/2" DIA. (TYP.)
1-1/2" PIPE OR 1-1/2"x1-1/2"x1/4" ANGLE MIN. SUPPORT BARS
BOLTED
6'-0" DIA. REINF. CONC. PIPE SHALL BE FIRMLY FASTENED TO THE TOP OF THE RISER
4'-0" DIA. 12 GA. REINF. CONC. PIPE
NOTE: SUPPORT BARS ARE WELDED TO THE TOP OF THE RISER OR ATTACHED BY STRAPS BOLTED TO TOP OF THE RISER.
FLOW
CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE
SCALE: NONE
6'-0" DIA.
CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE (SEE DETAIL THIS DWG.)
TOP OF RISER
BOTTOM OF 3" DIA. HOLE
FILTER FABRIC WRAP TIGHTLY AND SECURE TO PIPE
12" OVERLAP
48" I.D. RISER (R.C.P)
36" DIA. R.C. PIPE
BASIN BOTTOM
8'x8'x3'-6" CONCRETE BASE
RISER PIPE DETAIL
SCALE: NONE
SCALE: 1/4"=1'-0" EXCEPT AS NOTED
R0 INITIAL ISSUE: FOR DCN CUF-03-536
FGD RETROFIT PROJECT
UNITS 1 & 2
PROPOSED WASTE DISPOSAL FACILITY
DETAILS
SHEET 1 OF 3
J.L. GRAY
M.G. HRANEK
J.G. ALBRIGHT
H.L. PETTY
R.E. PURKEY
J.G. ADAIR
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING
HAROLD L. PETTY
STATE OF TENNESSEE
10/10/03
SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWINGS LIST
AUTOCAD R14
46 C 10W302-24 R0
TASK COMPLETED BY:
REV NO.
PLOT FACTOR:32
W_TVA
C.A.D. DRAWING DO NOT ALTER MANUALLY



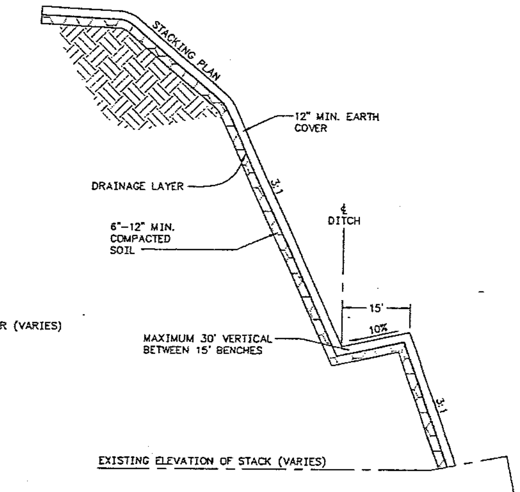
GYPSUM STACK STARTER DIKE
(NOT TO SCALE)



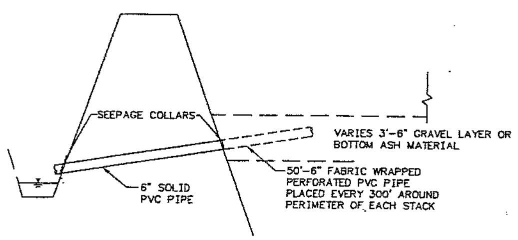
ASH STACK PERIMETER DIKE
(NOT TO SCALE)



GYPSUM STACK STAGE 1 STARTER DIKE
(NOT TO SCALE)

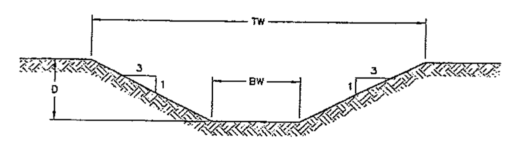


TYPICAL ASH OR GYPSUM STACKING AREA SECTION
(NOT TO SCALE)



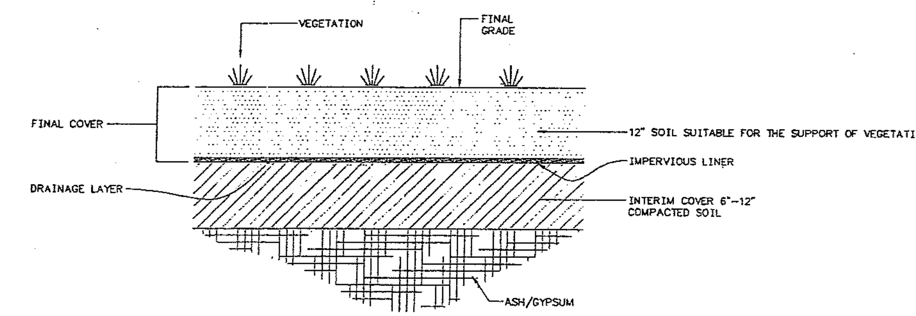
DRAIN SYSTEM (TYP.)
(NOT TO SCALE)

DITCH	DIMENSION BW	TW	D
GYPSUM STACK RUNOFF TRENCH	4'	19.0'	2.5'
GYPSUM STACK SPILLWAY	2'	8.0'	1.0'
ASH STACK RUNOFF TRENCH	4'	16.0'	2.0'



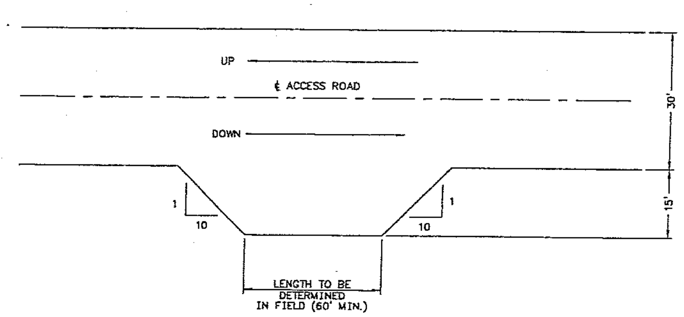
DITCH DIMENSIONS REFER TO UPSTREAM END OF DITCHES.

DRAINAGE DITCH DETAIL
(NOT TO SCALE)



TYPICAL INTERIM/FINAL COVER SECTION
(NOT. TO SCALE)

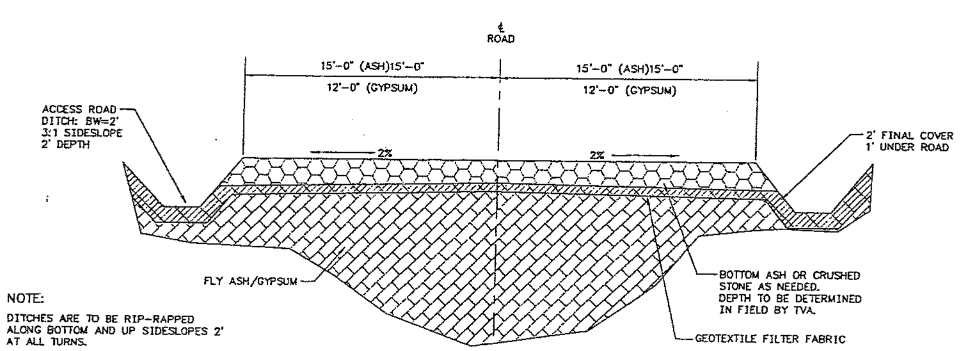
NOTE:
THE INTERIM COVER SHALL BE CONSTRUCTED INCREMENTALLY WITH THE ACTIVE ASH/GYPSUM STACKING AREA. THE FINAL COVER SHALL BE PLACED AT CLOSURE OF THE ACTIVE STACKING OPERATIONS.



NOTES:

1. NECESSITY OF USING TEMPORARY TRUCK TURNOUTS TO BE DETERMINED BY TVA PERSONNEL.
2. LOCATION, LENGTH AND DEPTH OF TEMPORARY TRUCK TURNOUTS TO BE DETERMINED BY TVA PERSONNEL.

TEMPORARY TRUCK TURNOUT
(NOT TO SCALE)



NOTE:
DITCHES ARE TO BE RIP-RAPPED ALONG BOTTOM AND UP SIDESLOPES 2' AT ALL TURNS.

TYPICAL ACCESS ROAD SECTION
(NOT TO SCALE)

10/10/03

SEE 10W302-1 FOR DRAWING INDEX/COMPANION DRAWINGS LIST

R										
R 0		JLG	MGH	JGA	HLP	REP		JGA		
INITIAL ISSUE: FOR DCN CUF-03-536										
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST

SCALE: $\frac{1}{4}$"=1'-0" EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY
DETAILS
SHEET 2 OF 3

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G. HRANEK	J.G. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

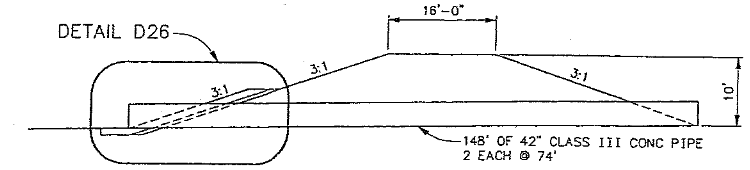
AUTOCAD R2K | DATE | 46 | C | 10W302-25 | R 0

PLOT FACTOR: 48
W_TVA

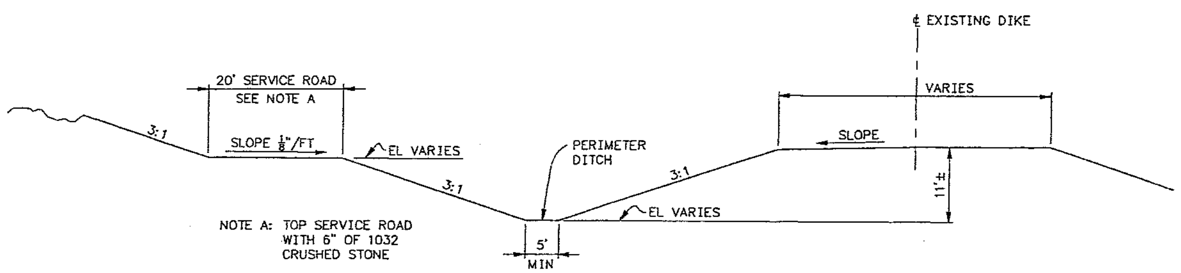
C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.

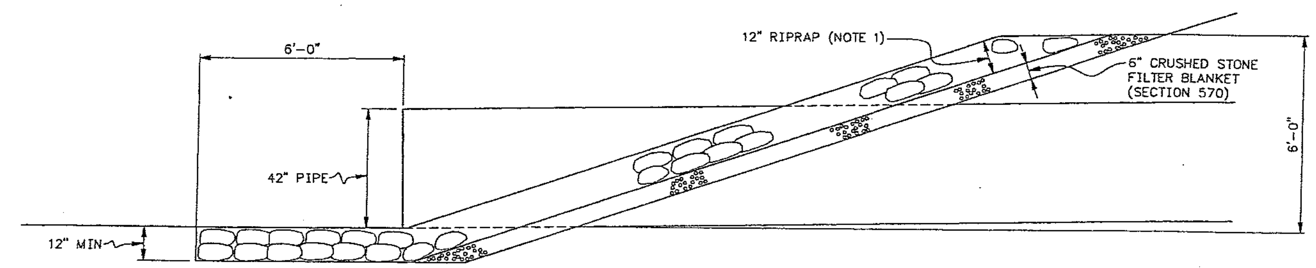
46 C 10W302-25



C26 – C26
10W302-12 & -13
1" = 10'



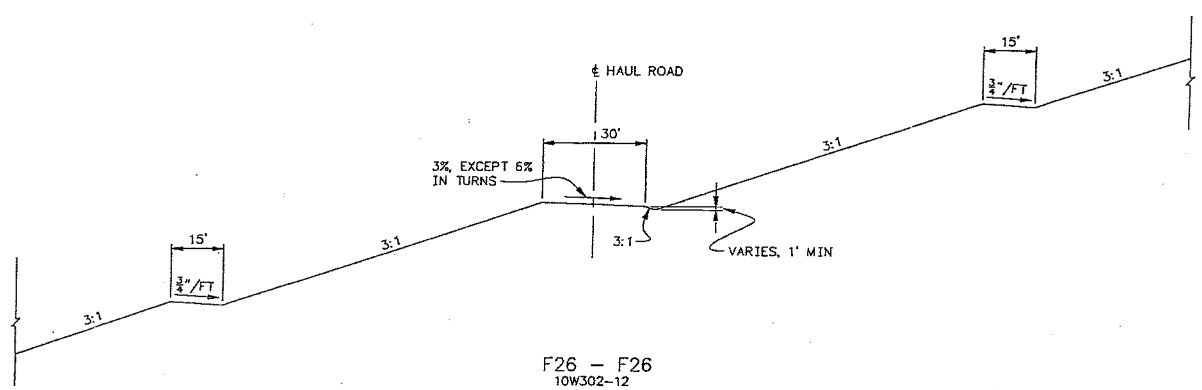
B26 – B26
TYPICAL SECTION AT
PERIMETER DITCH AND SERVICE ROAD
NTS



DETAIL D26
1/2" = 1'-0"

NOTES:

1. RIPRAP SHALL BE IN ACCORDANCE WITH SECTION 576. THE AVERAGE WEIGHT OF EACH STONE SHALL BE 100 POUNDS WITH A MINIMUM WEIGHT OF A STONE SHALL BE 60 POUNDS.



F26 – F26
10W302-12
1" = 20'

10/10/03

SEE 10W302-1
FOR DRAWING INDEX/COMPANION DRAWINGS LIST

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R											
R 0		JLG	MGH	JGA	HLP	REP		JGA			0
INITIAL ISSUE 2003 PERMIT REVISION DCN CUF-03-536											

DISCIPLINE INTERFACE

SCALE: 1" = 10' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY
DETAILS & SECTIONS
SHEET 3 OF 3

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G.HRANEK	J.G. ALBRIGHT	H.L. GLOVER	R.E. PURKEY		J.G. ADAIR

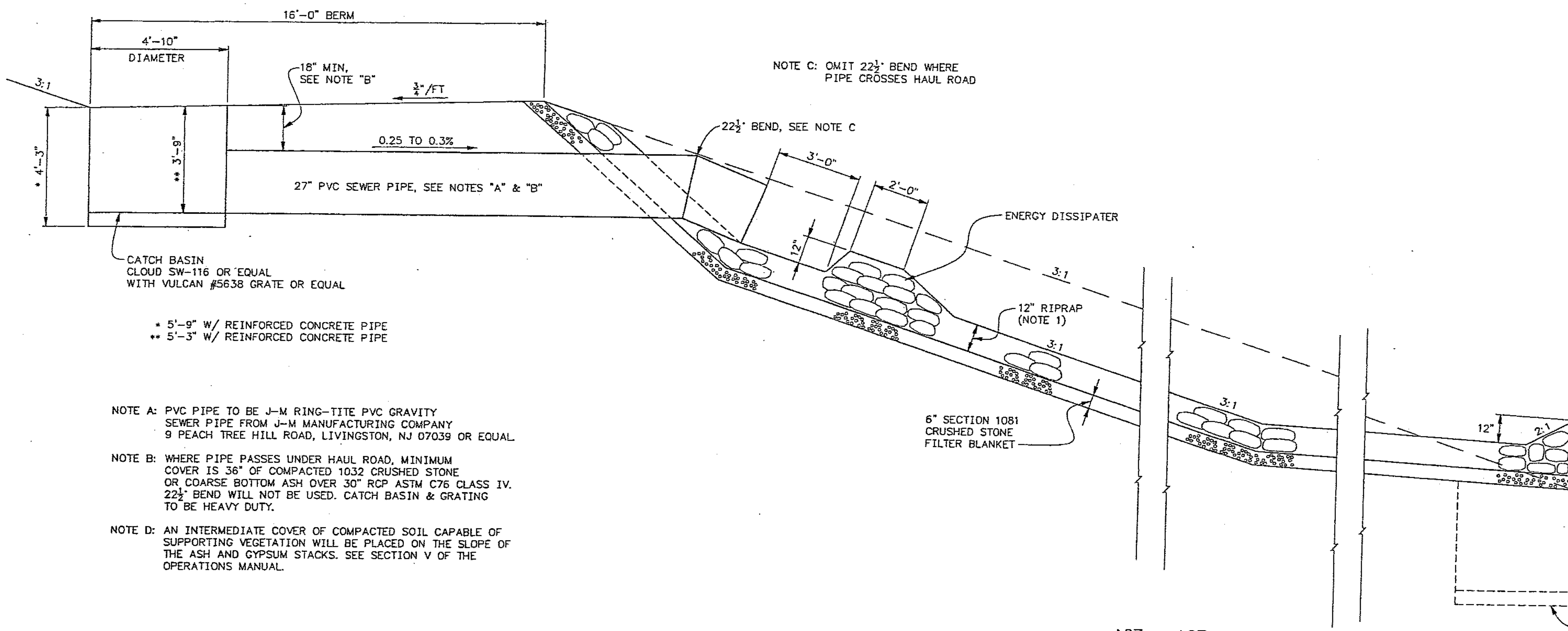
CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K | DATE | 46 | C | 10W302-26 | R 0

PLOT FACTOR:120
W_TVA

C.A.D. DRAWING
DO NOT ALTER MAN

TASK COMPLETED BY: | REV NO.

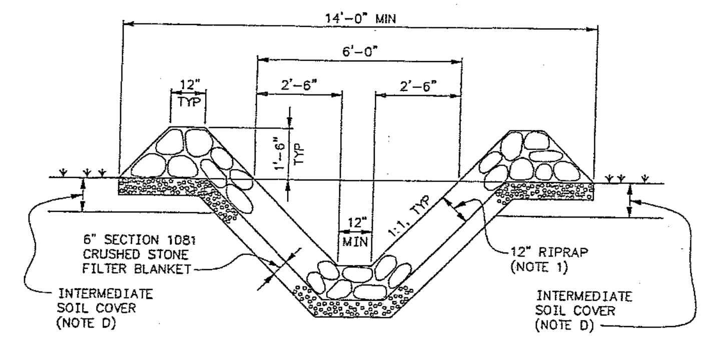


NOTE A: PVC PIPE TO BE J-M RING-TITE PVC GRAVITY SEWER PIPE FROM J-M MANUFACTURING COMPANY 9 PEACH TREE HILL ROAD, LIVINGSTON, NJ 07039 OR EQUAL.

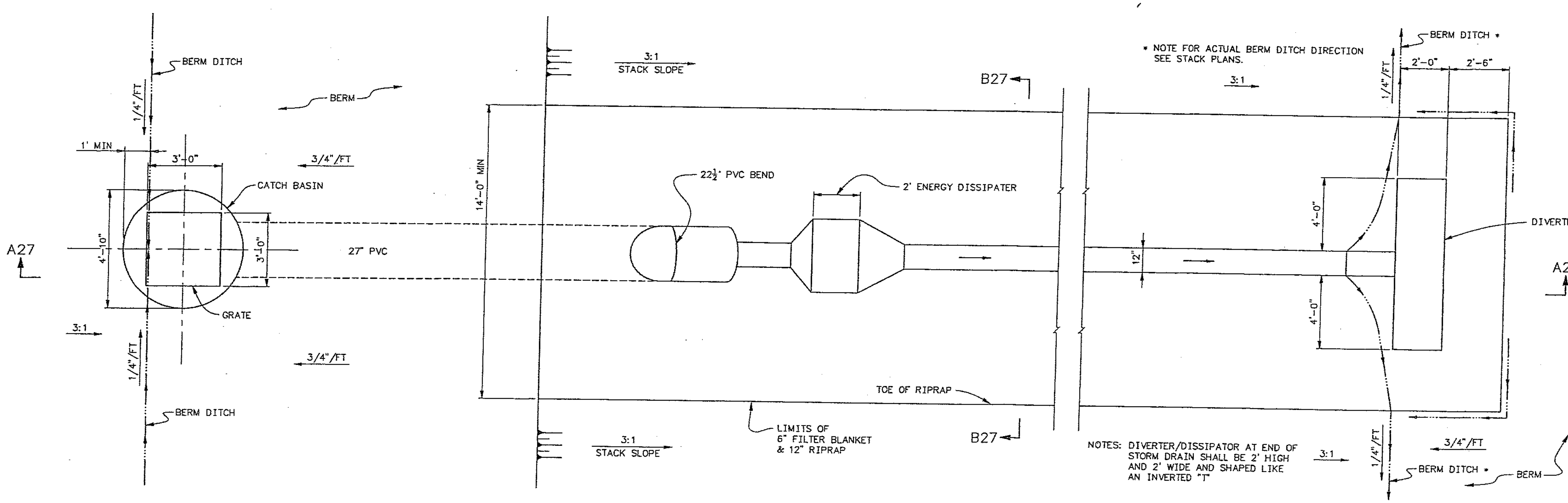
NOTE B: WHERE PIPE PASSES UNDER HAUL ROAD, MINIMUM COVER IS 36" OF COMPACTED 1032 CRUSHED STONE OR COARSE BOTTOM ASH OVER 30" RCP ASTM C76 CLASS IV. 22½° BEND WILL NOT BE USED. CATCH BASIN & GRATING TO BE HEAVY DUTY.

NOTE D: AN INTERMEDIATE COVER OF COMPACTED SOIL CAPABLE OF SUPPORTING VEGETATION WILL BE PLACED ON THE SLOPE OF THE ASH AND GYPSUM STACKS. SEE SECTION V OF THE OPERATIONS MANUAL.

A27 – A27
TYPICAL CROSS-SECTION OF CATCHBASIN IN STORMDRAINS DOWN FACE OF STACK
1/2" = 1'-0"



B27 – B27
1/2" = 1'-0"



NOTES: DIVERTER/DISSIPATOR AT END OF STORM DRAIN SHALL BE 2' HIGH AND 2' WIDE AND SHAPED LIKE AN INVERTED "T"

DETAIL C27
10W302-12 & -13
1/2" = 1'-0"

NOTES:
1. FOR GENERAL NOTES SEE 10W302-20.

HAROLD L. PETTY · REGISTERED ENGINEER · No. 05578 · STATE OF TENNESSEE
10/10/03

SEE 10W302-1
FOR DRAWING LIST/COMPANION DRAWINGS LIST

R								
R0		JLG	MGH	JGA	HLP	REP		JGA
INITIAL ISSUE 2003 PERMIT REVISION DCN CUF-03-536								

SCALE: 1/2" = 1'-0" EXCEPT AS NOTED

YARD

PROPOSED WASTE DISPOSAL FACILITY
STORM DRAINS
SECTIONS & DETAILS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J.L. GRAY	M.G.HRANEK	J.G.ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K | 46 | C | 10W302-27 | R 0

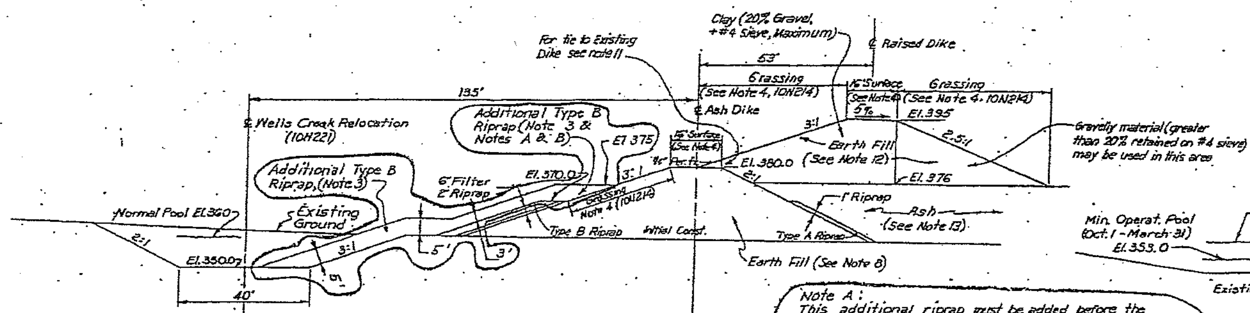
PLOT FACTOR: 24
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: | REV NO.

46 C 10W302-27

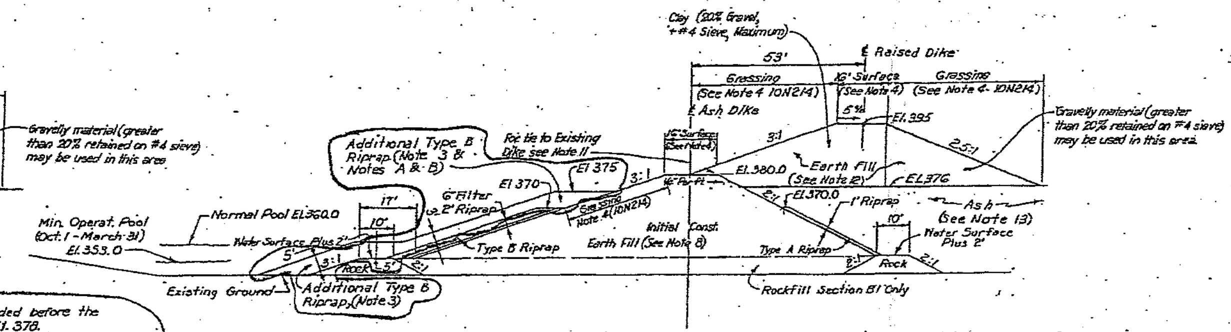
46 C 4 10N213



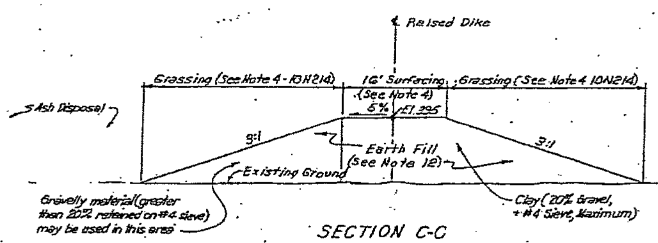
SECTION A
Dike where Exist. Ground is above water surface.
Scale: 1"=20'

Note A:
This additional riprap must be added before the ash pond water level is raised to El. 378.

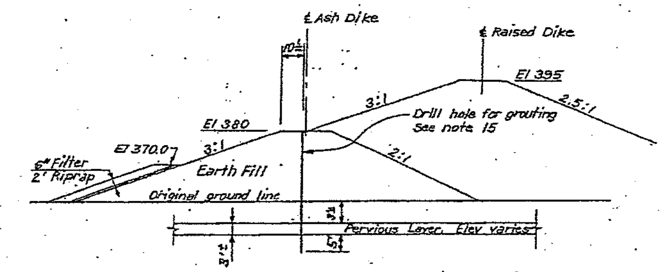
Note B:
This additional riprap is to be added only from Sta 0+00 to Sta 54+00 along Wells Creek as shown on dwg 10N212 R11



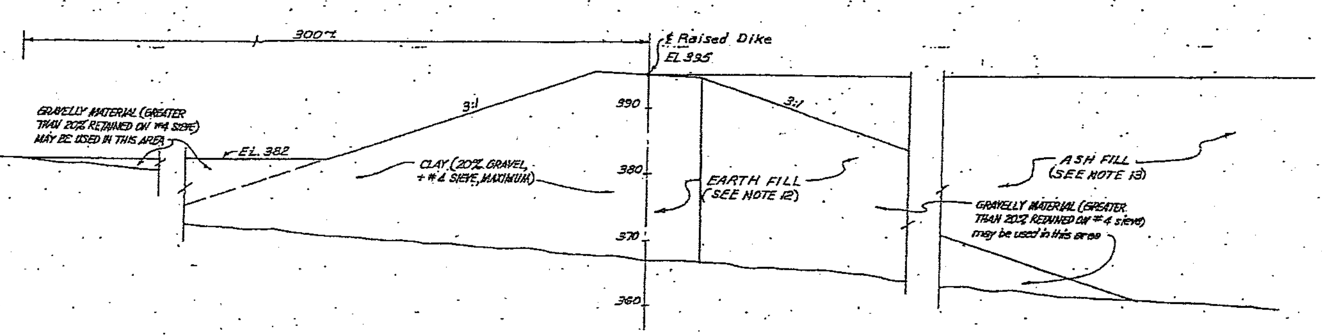
SECTION B & B1
Dike where Exist. Ground is below water surface.
Scale: 1"=20'



SECTION C-C
Scale: 1"=10'-0"
(10N212)



TYP. GROUTING SECTION
NTS



SECTION E-E
SCALE: 1"=10'
(10N212)

NOTES:

1. All work on the construction of these dikes shall be in accordance with the T-1 Specifications unless otherwise noted.
2. Embankments shall be compacted with sheepsfoot rollers. Two density tests per day shall be made to insure achivement of 95% of standard Proctor maximum density. Fill moisture shall be controlled to obtain optimum compaction (initial const).
3. Riprap shall consist of sound, durable limestone, section 575 Filter shall be crushed stone conforming to section 570
(a) Type A Riprap shall be 12 inches thick and at least 50% of the stone shall weigh 25 lb. or more. Riprap laid without filter.
(b) Type B Riprap shall be 24 inches thick and at least 50% of the stone shall weigh 150 lb. or more. Filter blanket shall be 6 inches thick.
4. Crushed stone surfacing, 4 inches thick, shall be applied for the full width of the top of the dike in accordance with section 305
5. Rockfill shall be sound, durable stone in accordance with section 124 and chocked with fines.
6. Where practical borrow shall be obtained from inside disposal areas.
7.
8. Initial ash dikes to be built by construction of earth to elevation shown on sections.
9. The results of the soil investigation for the raising of the dikes at the ash disposal area no. 2 are reported in a memorandum from Gene Farmer to G.L. Buchanan dated Nov. 20, 1978 Cumberland Steam Plant Ash Disposal Area Dikes Soils Investigation.
10. The minimum factor of safety for all loading conditions on ash disposal area dikes is 1.50.
11. When connecting the new dike to the old dike extreme care shall be used to insure an impervious and stable connection. The existing dikes shall be stripped of all vegetation, riprap, gravel, crushed stone, course ash and other pervious material on top of dike and above elevation 376 on inside slope. Benched and scarified to a minimum depth of 6 inches and compacted so as to form a bond with the new earth fill. The utmost caution shall be used in benching the existing dike slopes so as not to create an unstable condition. Small benches of minimum depth shall be used.
12. Earth fill for raised dikes shall be placed in accordance with all applicable sections of general construction specification G-9 for Rolled Earth Fill for Dams and Power Plants. Earth fill shall be obtained from designated borrow areas. The earth fill moisture content shall not exceed 3.0% above optimum moisture content and shall be placed and compacted to be at least 95% maximum dry density as determined by the TVA Materials Laboratory. At least one moisture-density assurance test shall be made on each 5000 cu. yd. of fill placed.
13. Placement of the underwater ash fill shall be by end dumping along the length of the dike. The top surface of the underwater dike just above the water shall be thoroughly compacted and scarified before placing the overlaying ash fill. Bottom ash for that portion of the divider dike above water shall be placed in not more than 9 inch layers, and well compacted with rubber tired hauling equipment.
14. Dike foundation shall have all weak surface soils removed to material that will easily bear the weight of loaded rubber-tired earth hauling equipment.
15. Refer to the memorandum J.H. Coulson to R.G. Haynes dated Nov. 28, 1990 (B65901120029), for specifications for grouting Ash Pond seep repair.

SUMMARY OF QUANTITIES

Area	Item No. / Location	Ash Fill Cu. Yd.	123 Earth Bor. Cu. Yd.	305 Surfacing Ton	580 Seeding Sq. Yd.	582 Mulching Sq. Yd.	600 Class III Reinf. Conc. Pipe - Lin. Ft. 18"	36"	48"	570 Filter Blanket Ton	575 Riprap - Cu. Yd. Type A	Type B	Rockfill Cu. Yd.
Ash Disposal Dike	A-B		54,900	810						520	600	1540	1060
(Initial Const)	B-C		75,800	310						880	915	2600	4015
	C-D		148,500	920						2195	2340	6485	6280
	D-E		104,850	580						1425	1485	4215	4125
	E-F		140,150	640						2375	2480	7020	1690
	F-G		28,850	440						885	720	2625	345
	G-H		5,000	200							515		
	H-I		12,050	440							1235		
	I-J		40,450	840							615		
Ash Disposal Dikes (Raising to EL 395)		95,300	310,200	3000	47,300	47,300		272					
Total		95,300	921,750	8280	47,300	47,300		272		8280	10,905	24485	17,515
Dike Stability												91,000	

CAPACITY OF DISPOSAL AREAS			
ACCUMULATION OF UNIT YEARS			
AREA NO. 1		AREA NO. 2	
Elevations	Unit Yrs.*	Elevations	Unit Yrs.*
345	0.2		
350	0.6		
355	1.5		
360	3.4	360	0.6
365	5.9	365	2.0
370	8.8	370	3.8
375	11.9	375	5.9
380	16.3	380	8.5
385	18.8	385	11.3
390	22.3	390	14.2

* Based on 1,300,000 KW unit. 80% Capacity.

Scale: As Noted

COMPANION DRAWINGS: 10N212, 214
10H221-229, 256

MAIN PLANT

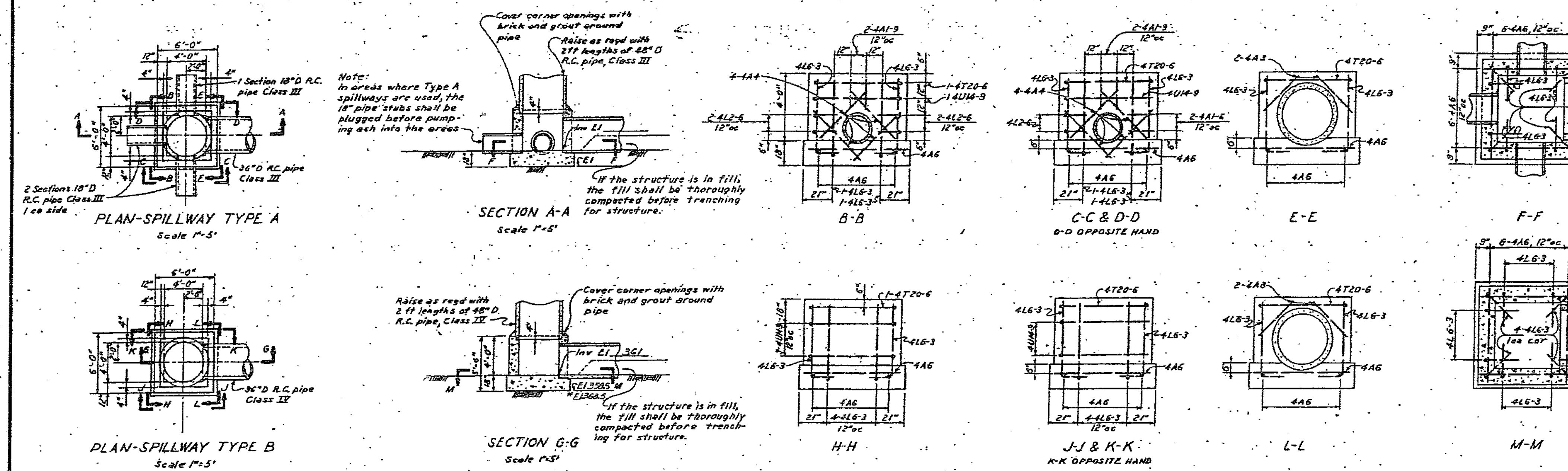
ASH DISPOSAL AREAS

SHEET NO. 2

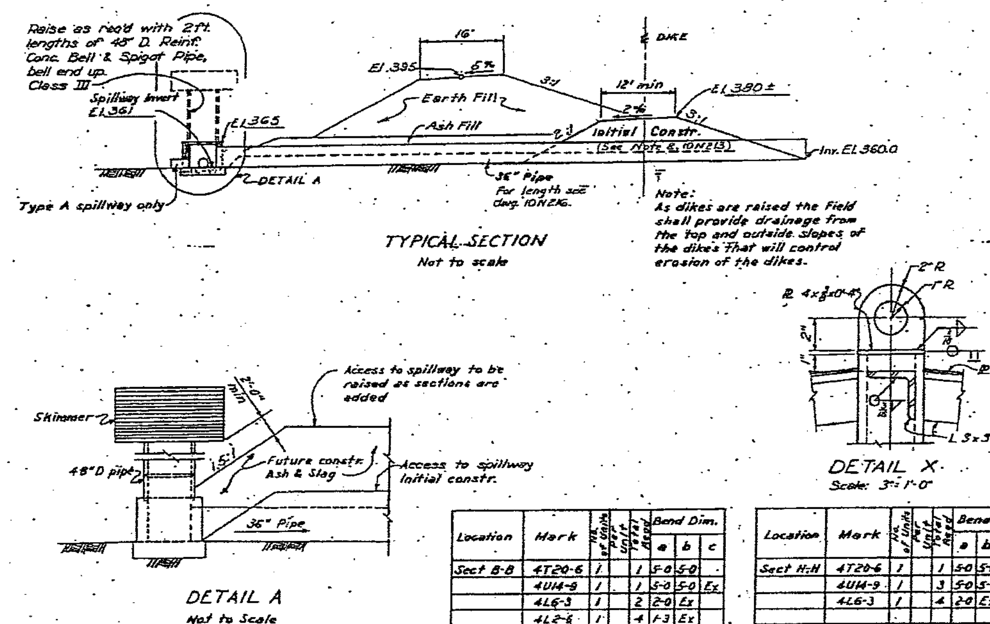
CUMBERLAND STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED | RECOMMENDED | APPROVED

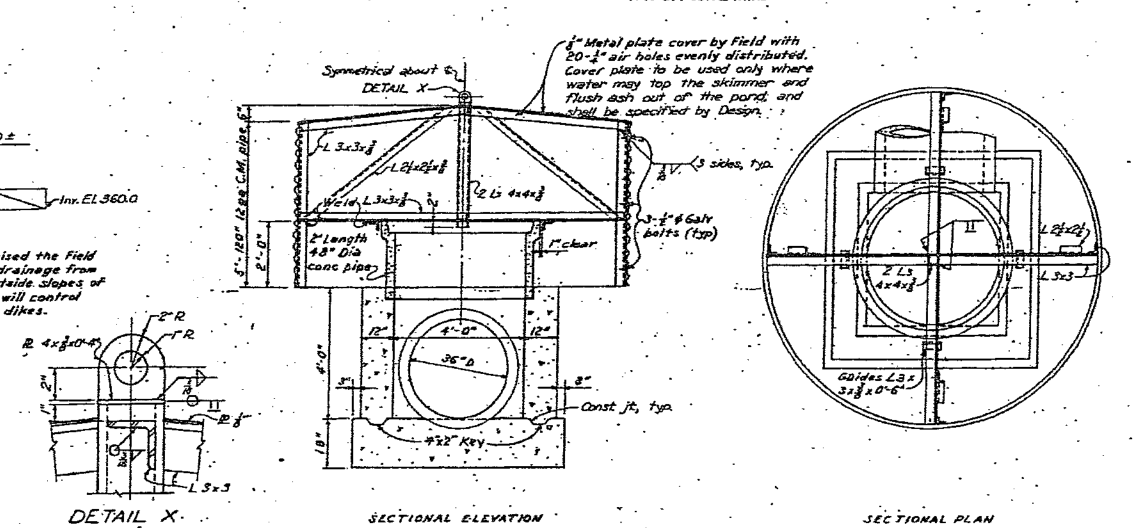
KNOXVILLE | 1-13-69 | 46 | C | 4 | 10N213 | R6



PLAN-SPILLWAY TYPE A — Scale 1"=5'
SECTION A-A — Scale 1"=5'
B-B
C-C & D-D — D-D OPPOSITE HAND
E-E
F-F
PLAN-SPILLWAY TYPE B — Scale 1"=5'
SECTION G-G — Scale 1"=5'
H-H
J-J & K-K — K-K OPPOSITE HAND
L-L
M-M



TYPICAL SECTION — Not to scale
DETAIL A — Not to Scale



DETAIL X — Scale: 3"=1'-0"
SECTIONAL ELEVATION
SECTIONAL PLAN

SKIMMER DETAILS
Scale ½"= 1'-0"

NOTES:

1. SPECIFICATIONS: All work shall be done in accordance with the T-1 Specifications.
2. All concrete shall be Class A in accordance with Section 400.
3. Where earth borrow can be obtained economically, for example, from disposal area, it may be used to raise dikes.
4. Vegetation shall be established on all earth slopes, inital and future construction. Seeding specifications to be furnished with drawings for each project. In general, Type G, Mixture E, Section 180 of T-1 Specifications is recommended.
5. Location and elevation of the spillways shall be selected so as to maintain the depth of water in the ash pond at an absolute minimum.
6. Use Type A spillways for ash areas not scheduled for immediate use.
7. A section of 120" corrugated metal pipe is recommended for skimmer device. If structural plates or other metal shapes are used for fabrication at the plant, special care shall be taken to seal all joints by welding or with asphalt paint.
8. One 2' section of 48" Dia pipe shall be installed during initial construction.
9. As additional sections of 48" pipe are added, grout the joint to form a stable and water-tight connection.

REFERENCE DRAWINGS:

30B519__REINFORCEMENT BENDING DIAGRAMS

Location	Mark	No. of Units	Per Unit	Total Reqd	Bend Dim. a	b	c
Sect B-B	4T20-6	1		1	5-0	5-0	
	4U14-9	1		1	5-0	5-0	Ex
	4L6-3	1		2	2-0	Ex	
	4L2-6	1		4	1-3	Ex	
	4A4	1		4			
	4A1-9	1		2			
Sect C-C & D-D	4L6-3	2	2	4	2-0	Ex	
	4A4	2	4	8			
	4A1-9	2	2	4			
	4A1-6	2	2	4			
Sect E-E	4A3	1		2			
Sect F-F	4L6-3	1		4	2-0	Ex	
	4A6	1		12			

TYPE A SPILLWAY

Location	Mark	No. of Units	Per Unit	Total Reqd	Bend Dim. a	b	c
Sect H-H	4T20-6	1		1	5-0	5-0	
	4U14-9	1		3	5-0	5-0	Ex
	4L6-3	1		4	2-0	Ex	
Sect J-J & K-K	4L6-3	2	4	8	2-0	Ex	
Sect L-L	4A3	1		2			
Sect M-M	4L6-3	1		4	2-0	Ex	
	4A6	1		12			

TYPE B SPILLWAY

REINFORCEMENT SCHEDULE

BILL OF MATERIAL

ITEM	DESCRIPTION	NO. of Splwys	PER SPLWY	TOTAL REQD
401	Class A Concrete	4	5 cu yd	20 cu yd
418	Reinforcing Steel	4	170 lb	680 lb
602	18"D Reinforced Concrete Pipe-Class III - Type A Only			
602	36"D Reinforced Concrete Pipe-Class IV	4		876 ft
602	48"D Reinforced Concrete Pipe-Class III (Bell & Spigot)	4	2 ft	8 ft
660	120"-12 Gage Corrugated Metal Pipe	4	5 ft	20 ft
	½" Ø Galvanized Bolt	4	12	48
	⅛" Metal cover (By field-see Skimmer Details)	4	1	4
	2½x2½x⅜ Angle	4	23 ft	92 ft
	3x3x⅜ Angle	4	67 ft	268 ft
	4x4x⅜ Angle	4	8 ft	32 ft

COMPANION DRAWING: 10N212,213,216,218

Scale ⅓"=1'-0"
Except as noted

STANDARD DRAWING

ASH DISPOSAL SPILLWAY

CUMBERLAND STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED
J. M. [signature]	W. M. [signature]	F. P. [signature]
KNOXVILLE	1-13-69	46 C 4 10N214 R2

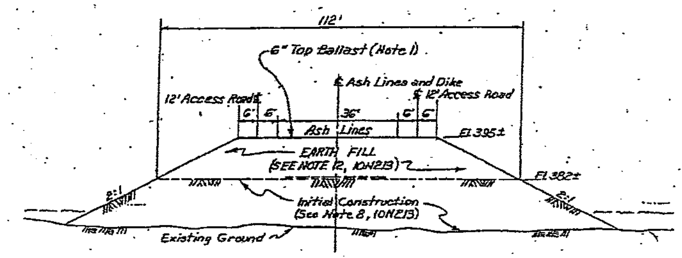
RECORD DRAWING AS CONSTRUCTED R2
[signature] 9-3-85

MF-
R0
R1
R2

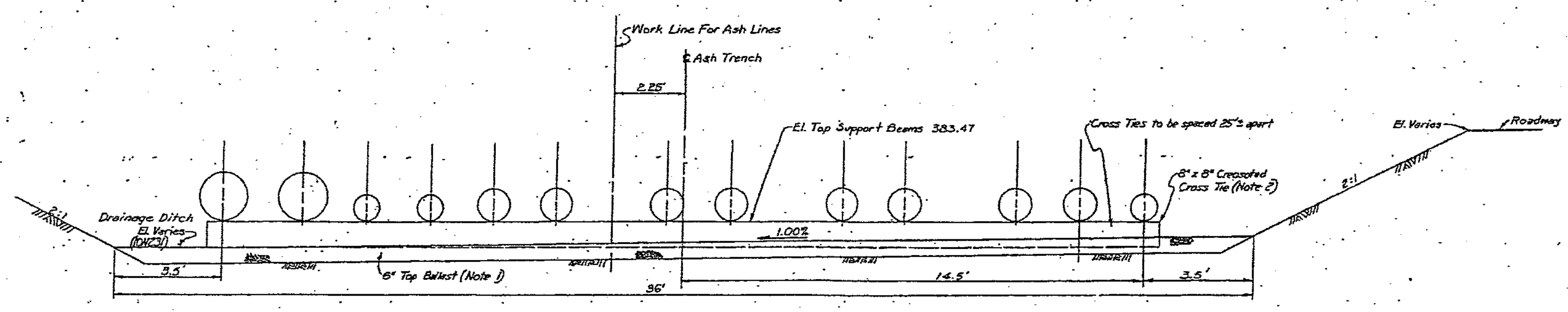
10N214

SUMMARY OF QUANTITIES

Item No.	Description	Quantities
	8"x8" Creosoted Cross Ties	1440 LF
1071	Top Ballast	1000 CY.



SECTION H-H
Scale: 1"=20'
(10N212)



SECTION G-G
Scale: 1"=2'

NOTES:

1. Top ballast shall be size No. 5 and shall conform in quality and gradation to Section 1071.
2. Timbers shall be creosoted cross ties 8"X8". Any length from 7' to 10' may be used end to end to obtain required 30' length per support. They shall be red oak, gum, or timber of similar texture, fiber, and treating conditions in accordance with current AREA Specification for cross ties. Treatment shall be in accordance with current AREA Specification for Wood Preservation, Rueping process, grade A creosote coal-tar solution, with initial air pressure of usually 60 psi and 80 psi for red oak ties and gum ties respectively with minimum retention of 6 pounds for red oak and 8 pounds for gum per cubic foot. White oak shall be treated to refusal.

4. For additional Notes see Dwg. 10N213.

Scale: As Noted

COMPANION DRAWINGS: 10N212, 213

MAIN PLANT
ASH DISPOSAL AREAS SHEET NO. 3
CUMBERLAND STEAM PLANT TENNESSEE VALLEY AUTHORITY DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED
J. M. Gilbert	W. M. Calvert	F. P. Lacy

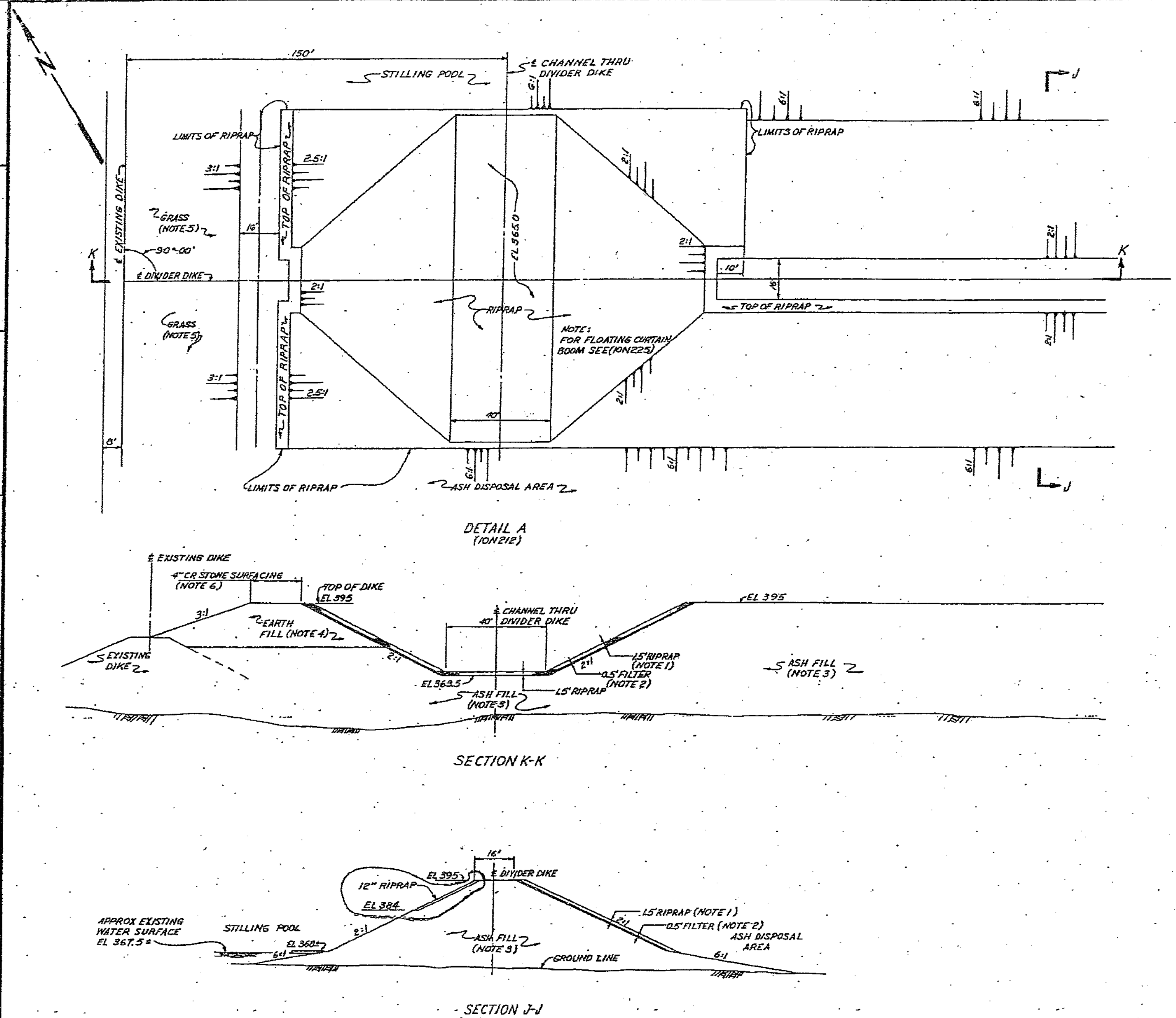
KNOXVILLE	1-13-69	46	C	4	10N218 R2

RECORD DRAWING AS CONSTRUCTED Clyde C. Potter 2-6-74

Frank Van Meter R2 9-3-85

46 C 4 10N218

1 2 3 4 5 6 7 8 9 10 11 12



NOTES:
1. RIPRAP ALONG THE CHANNEL THROUGH DIVIDER DIKE SHALL BE 18 INCHES THICK, WITH A MINIMUM OF 50%, BY WEIGHT, CONSISTING OF STONES AT LEAST 150 POUNDS EACH. RIPRAP SHALL CONFORM TO SECTION 575.
2. FILTER BLANKET, 6 INCHES THICK, SHALL CONFORM TO SECTION 570.
3. THE DIVIDER DIKE SHALL BE CONSTRUCTED OF COMPACTED BOTTOM ASH. PLACEMENT OF THE UNDERWATER ASH FILL SHALL BE BY END DUMPING ALONG THE LENGTH OF THE DIKE. THE TOP SURFACE OF THE UNDERWATER DIKE JUST ABOVE THE WATER SHALL BE THOROUGHLY COMPACTED AND SCARIFIED BEFORE PLACING THE OVERLAYING ASH FILL. BOTTOM ASH FOR THAT PORTION OF THE DIVIDER DIKE ABOVE WATER SHALL BE PLACED IN NOT MORE THAN 9-INCH LAYERS, AND WELL COMPACTED WITH RUBBER TIRED HAULING EQUIPMENT.
4. EARTH FILL COMPACTION SHALL BE DONE WITH SHEEPSFOOT ROLLERS AND SHALL BE AT LEAST 95% OF STANDARD PROCTOR MAXIMUM DENSITY. FILL MOISTURE SHALL BE CONTROLLED TO ACHIEVE OPTIMUM COMPACTION. (SEE NOTE 12-10N213)
5. ALL NEW EARTH DIKE SLOPES SHALL BE SEEDED WITH TYPE 6, MIXTURE E. ALL GRASSED AREAS TO BE FERTILIZED AND MULCHED IN ACCORDANCE WITH SECTIONS 580 & 582 RESPECTIVELY.
6. CRUSHED STONE SURFACING, 4" THICK, SHALL BE APPLIED IN ACCORDANCE WITH SECTION 305 OF THE T-1 SPECIFICATIONS.

SUMMARY OF QUANTITIES-DIVIDER DIKE

ITEM	DESCRIPTION	QUANTITY	UNIT
575	RIPRAP	3000±	C.Y.
570	FILTER	1415±	TONS
	ASH FILL	163,000±	C.Y.

SUMMARY OF QUANTITIES - RAISE DIVIDER DIKE

ITEM	DESCRIPTION	QUANTITY	UNIT
575	RIPRAP	2,700	C.Y.
570	FILTER	1,800	TONS
	ASH FILL	36,000	C.Y.
575	RIPRAP-EL 384 TO EL 395	1,400	TN

SCALE 1"=20'
COMPANION DRAWING 10N212

R4 5-20-81 ADD RIPRAP TO SECT J-J & REV SUM OF QUAN
R3 11-26-80 ADD SUMMARY OF QUAN FOR RAISING DIVIDER DIKE; REV SPEC NOS.
R2 7-11-79
R1 5-3-77 REV. DETAIL A SECTION K-K & SECTION J-J
RAISED DIVIDER DIKE FOR FLOATING CURTAIN BOOM

ENGINEER K.W. Burnett

MAIN PLANT

ASH DISPOSAL AREAS
SHEET NO. 3

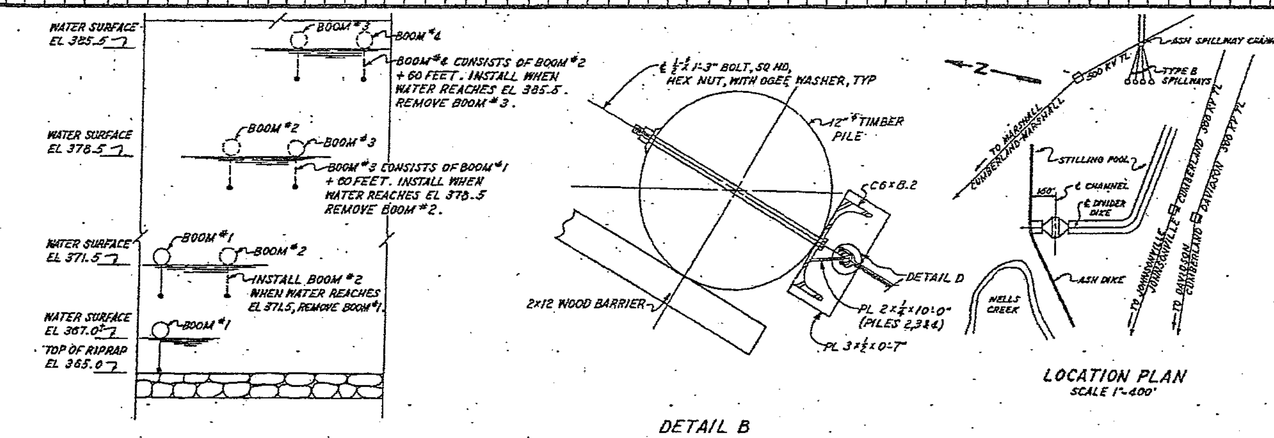
CUMBERLAND STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED Robert G. Bowman | RECOMMENDED | APPROVED

INSPECTED AND APPROVED FOR ISSUE

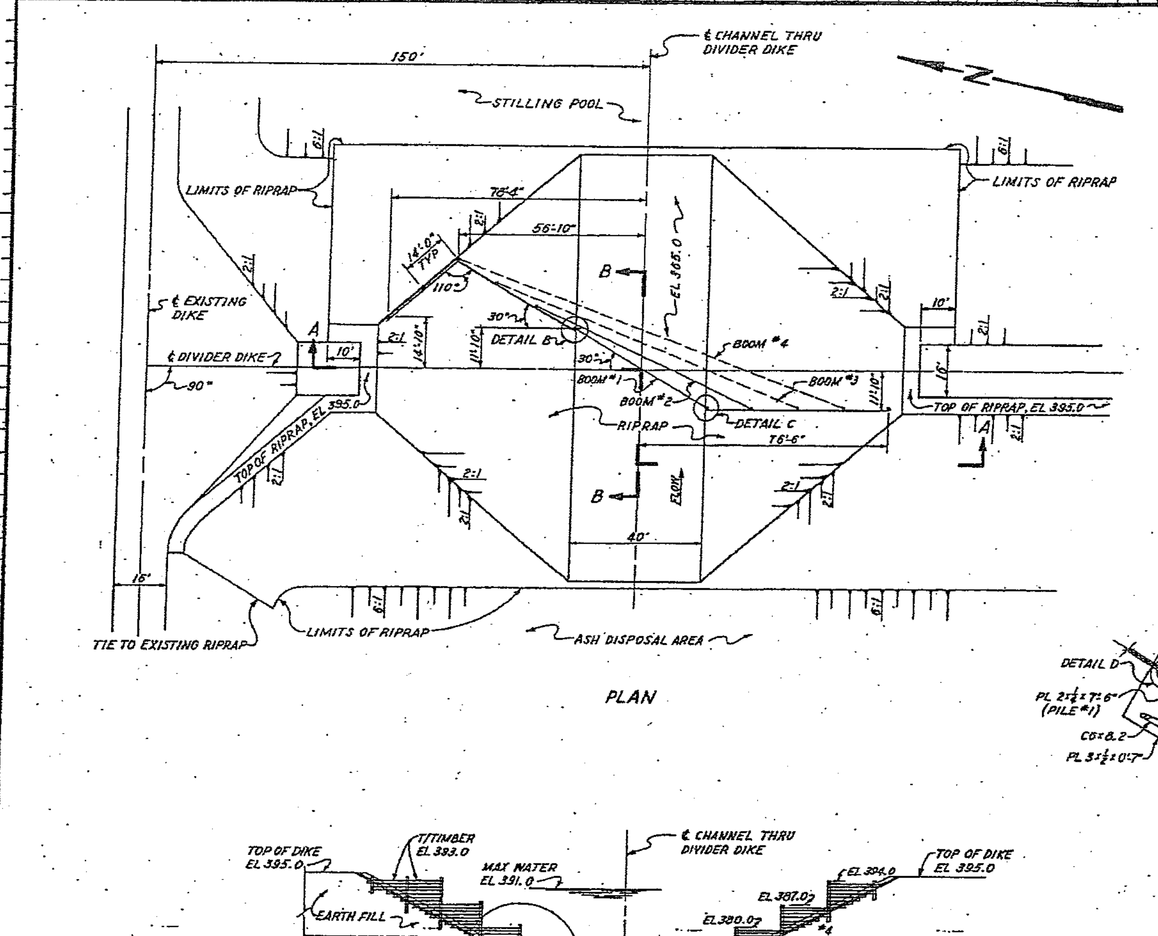
KNOXVILLE 6-18-75 46 C 10N224 R4

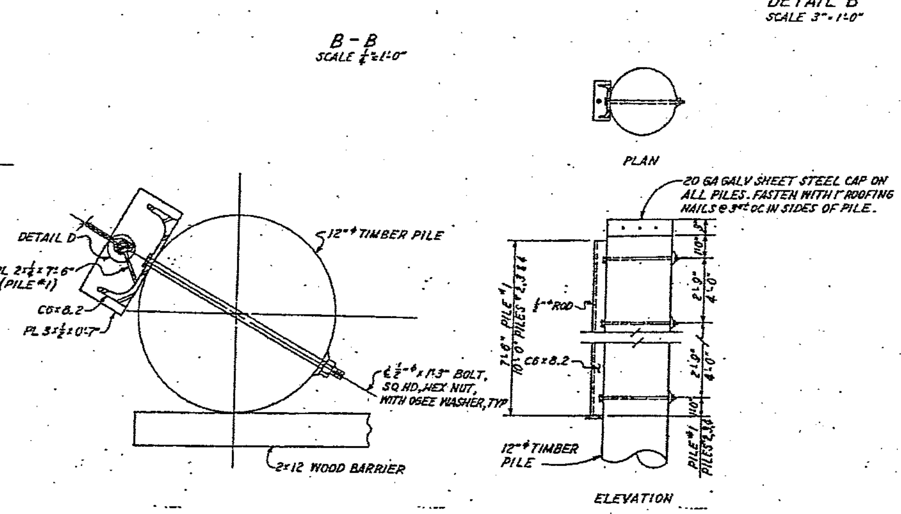
RECORD DRAWING AS CONSTRUCTED



DETAIL B
SCALE 3" = 1'-0"

LOCATION PLAN
SCALE 1" = 400'





PLAN

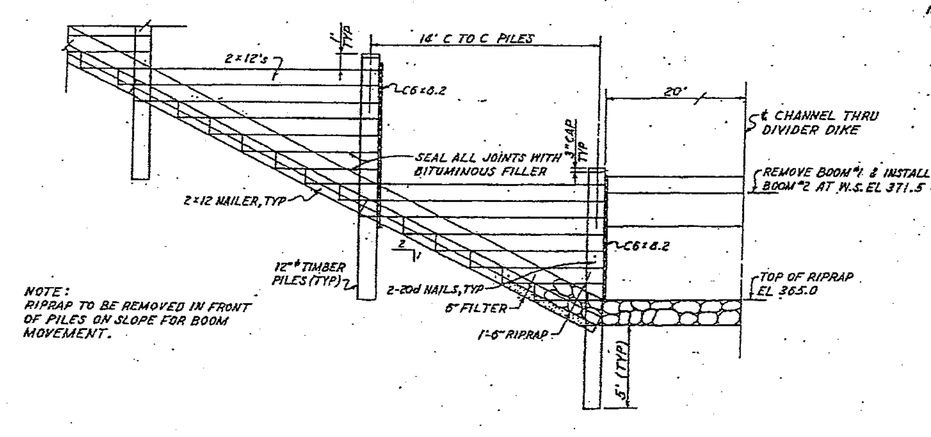
SECTION A-A

B - B
SCALE 1/4" = 1'-0"

DETAIL C
SCALE 3" = 1'-0"

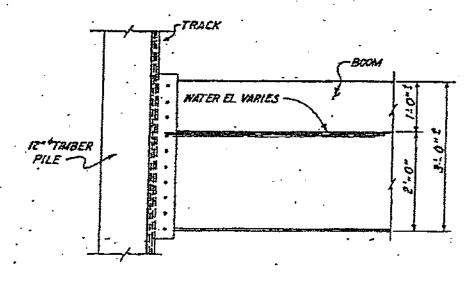
TRACK DETAIL
NTS

NOTE:
ALL TIMBER AND BOOM TRACKS TO BE INSTALLED DURING INITIAL CONSTRUCTION.

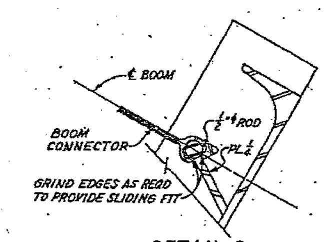


DETAIL A
SCALE 1/4" = 1'-0"

NOTE:
RIPRAP TO BE REMOVED IN FRONT OF PILES ON SLOPE FOR BOOM MOVEMENT.



FLOATING BOOM
(CONNECTION DETAIL)
SCALE 3/4" = 1'-0"



DETAIL D
(HALF SIZE)

FLOATING BOOM			
ITEM	NO	TOTAL LENGTH	REMARKS
BOOM # 1	1	50'-0"	
BOOM # 2	1	80'-0"	
BOOM # 3	1	110'-0"	BOOM #1 + 60'
BOOM # 4	1	140'-0"	BOOM #2 + 60'

BILL OF FIELD MATERIALS REQUIRED

ITEM	SIZE	NO	LENGTH	QUANTITY
TIMBER				
BARRIER	2×12 ROUGH	55	16'-0"	880 LF
PILING (CLASS B CREOSOTED)	12"ϕ	9	15'-0"	135 LF
	12"ϕ	2	8'-0"	16 LF
HARDWARE				
BOLTS-CHANNEL TO PILE	3/4"ϕ SQ HD, HEX NUT	24	1'-3"	17 LBS
ROOFING NAILS			0'-1"	4 LBS
OGEE WASHERS	FOR 3/4"ϕ BOLTS	24		12 LBS
NAILS	20 D COMMON			14 LBS
STEEL				
C6 × 8.2		6	10'-0"	492 LBS
C6 × 8.2		2	7'-6"	123 LBS
PL	3 × 1/2 × 0'-7"	8		24 LBS
PL	2 × 1/4 × 10'-0"	6		102 LBS
PL	2 × 1/4 × 7'-6"	2		26 LBS
GALV SHEET STEEL	20 GAGE			62 LBS
1/2"ϕ ROD		6	10'-0"	40 LBS
1/2"ϕ ROD		2	7'-6"	10 LBS

NOTES:
1. MATERIALS:
ALL MATERIALS TO BE FURNISHED AND FABRICATED BY TVA FIELD-EXCEPT FLOATING BOOM TO BE PROVIDED UNDER SPECIFICATION 822671.
2. BOLTS TO BE ASTM-A307.
3. ALL METAL PARTS FURNISHED BY TVA TO BE GALVANIZED.
4. TIMBER TO BE ROUGH SAWN PINE TREATED WITH COAL-TAR CREOSOTE @ 12# PCF OR AN EQUAL PRESERVATIVE.

FIRST ISSUE FOR PA 3076

REV NO.	ECN NO.	DATE	DSGN	DRWN	CHKD	SUPV	ENGR	INSP	SUBM	RECM	APPD
2	——	11-26-90	RWR	RWR	LCP	AOI	HOI	RJB	LAD	JRB	GLB
	REMOVED HOLD ON DETAILS B, C & D, TRACK DETAIL										
1	——	6-20-77	RWR	RWR	WSP	RJ	HOI	RJB	LAD	JRB	GLB
	REVISED PILES & BILL OF FIELD MATERIALS										

DSGN R.W. REEP
DRWN R.W. REEP
CHKD V.C. PARKS
SUPV E.R. JACKSON
INSP R.J. Bowman
ENGINEER H.C. Morris

SCALE: 1" = 20' EXCEPT AS NOTED

MAIN PLANT

ASH DISPOSAL AREA DIVIDER DIKE & FLOATING BOOM

CUMBERLAND STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

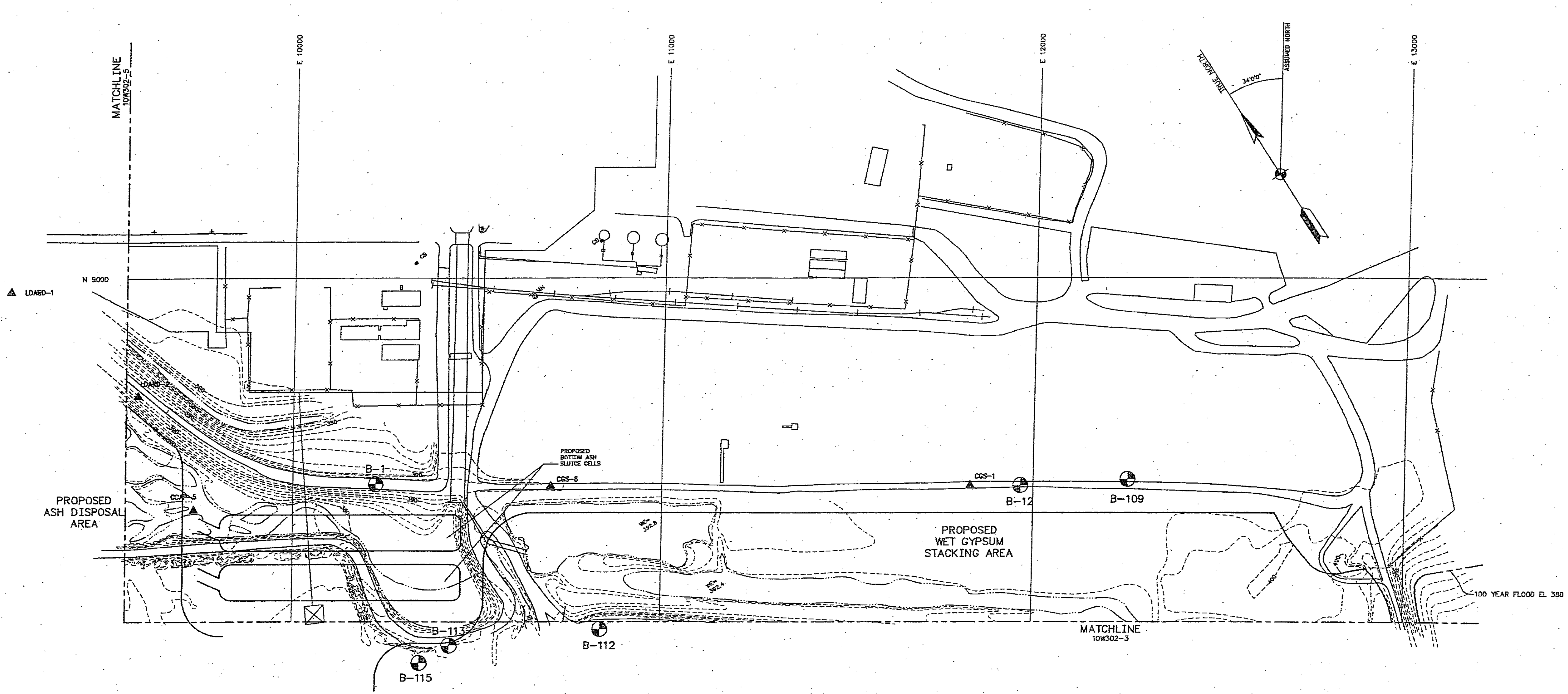
SUBMITTED R.A. Dorsch
RECOMMENDED
APPROVED

INSPECTED AND APPROVED FOR ISSUE

KNOXVILLE 5-16-77 46 C 10N225 R2

RECORD DRAWING AS CONSTRUCTED 2-14-79 R2

46 C 10N225



LEGEND

B-102	BORING LOCATION
	100-YR FLOOD PLAIN
	DISPOSAL AREA BOUNDARY
CUF 93-1	PROPOSED GROUNDWATER MONITOR WELL
	EXISTING CONTOUR
	BENCHMARK LOCATION

BORING COORDINATES

BORING NO.	TENNESSEE LAMBERT COORDINATES (FEET) NORTH	TENNESSEE LAMBERT COORDINATES (FEET) EAST	PLANT GRID * COORDINATES (FEET) NORTH	PLANT GRID * COORDINATES (FEET) EAST	ELEV. (FEET)
1	730875.30	1511979.60	8446.70	10227.00	395.20
12	729900.20	1513418.70	8443.00	11965.40	395.40
109	729752.44	1513668.88	8460.28	12255.24	394.12
112	730211.62	1512265.78	8056.49	10835.38	394.06
113	730401.23	1511902.36	8010.47	10428.01	389.96
115	730406.33	1511811.59	7963.94	10349.97	388.56

* N10,000 PLANT COORDINATE COINCIDES WITH THE EXISTING E-W PLANT BASELINE (℄ OF EXISTING UNIT #1 CHIMNEY). E10,000 PLANT COORDINATE COINCIDES WITH THE EXISTING N-S PLANT BASELINE (EXISTING COLUMN LINE "A").
I.E. 10,000:10,000—TVA 0:0

BENCH MARK LOCATIONS

BENCH MARK NO.	TENNESSEE LAMBERT COORDINATES (FEET) NORTH	TENNESSEE LAMBERT COORDINATES (FEET) EAST	PLANT GRID COORDINATES (FEET)		ELEV. (FEET)
178-D	727,926.48	1,513,693.70	S 3030.48	E 3297.03	395.21
CCAP-1	732,957.97	1,509,794.23	S 1048.75	W 2749.35	394.71
CCAP-2	732,295.18	1,509,469.16	S 1780.00	W 2648.22	395.18
CCAP-3	730,824.08	1,509,309.41	S 3088.93	W 1958.03	393.61
CCAP-4	730,235.80	1,509,772.02	S 3317.95	W 1245.55	394.91
CCAP-5	731,089.67	1,511,532.95	S 1625.35	W 263.14	399.35
CGS-1	729,975.39	1,513,304.73	S 1558.37	E 1828.82	395.64
CGS-2	729,645.42	1,511,188.50	S 3015.31	E 258.90	410.16
CGS-3	728,420.59	1,511,078.11	S 4092.47	E 852.30	395.30
CGS-4	728,064.78	1,512,362.32	S 3669.33	E 2115.92	395.26
CGS-5	727,951.74	1,513,734.10	S 2995.95	E 3316.39	395.30
CGS-6	730,607.17	1,512,364.68	S 1560.27	E 696.20	396.32
CGS-7	729,077.74	1,510,746.13	S 3733.31	E 209.60	395.19
LDARD-1	731,855.90	1,511,450.22	S 1036.39	W 760.21	393.87
LDARD-2	731,429.43	1,511,577.58	S 1318.73	W 416.14	393.67
PP-F-6 RESET	728,984.36	1,510,783.36	S 3789.94	E 292.62	394.86
T-1	734,549.93	1,509,921.94	N 342.46	W 3533.69	365.43

SEE 10W302-1
FOR DRAWING INDEX/COMPANION DRAWINGS LIST

R 0 | JLG | MGH | JGA | HLP | REP | JGA
INITIAL ISSUE; FOR DCN CUF-03-536

SCALE: 1"=100' EXCEPT AS NOTED

FGD RETROFIT PROJECT
UNITS 1 & 2

PROPOSED WASTE DISPOSAL FACILITY EXISTING SITE CONDITIONS SHEET 1 OF 4

DESIGNED BY	DRAWN BY	CHECKED BY	SUPERVISED BY	REVIEWED BY	APPROVED BY	ISSUED BY
J.L. GRAY	M.C. KRANEK	J.C. ALBRIGHT	H.L. PETTY	R.E. PURKEY		J.G. ADAIR

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R2K | DATE | 46 | C | 10W302-2 | R 0

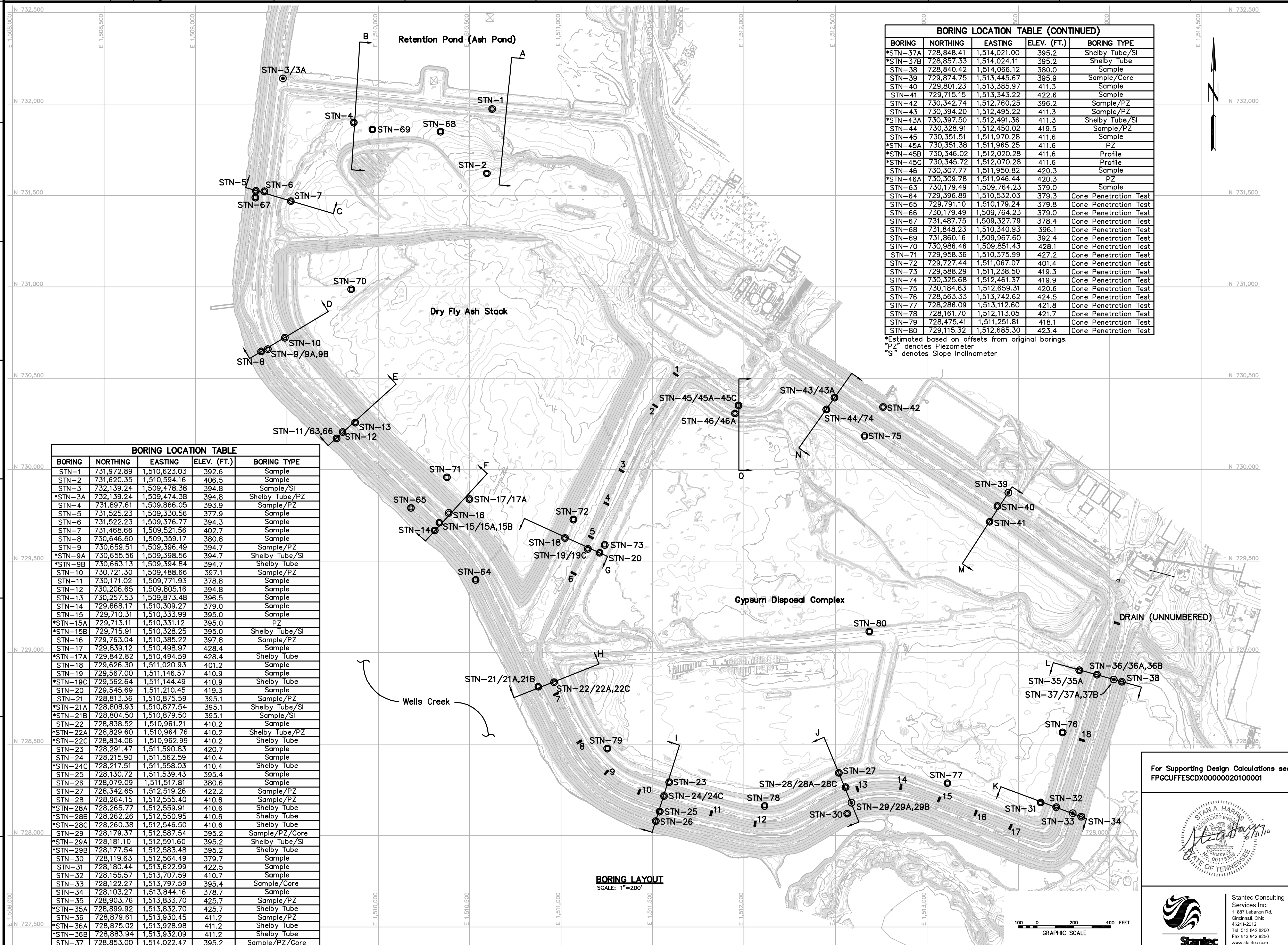
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:1200
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

Appendix B

Boring Layout and Existing Conditions Cross Sections



BORING LOCATION TABLE				
BORING	NORTHING	EASTING	ELEV. (FT.)	BORING TYPE
STN-1	731,972.89	1,510,623.03	392.6	Sample
STN-2	731,620.35	1,510,594.16	406.5	Sample
STN-3	732,139.24	1,509,478.38	394.8	Sample/SI
*STN-3A	732,139.24	1,509,474.38	394.8	Shelby Tube/PZ
STN-4	731,897.61	1,509,866.05	393.9	Sample/PZ
STN-5	731,525.23	1,509,330.56	377.9	Sample
STN-6	731,522.23	1,509,376.77	394.3	Sample
STN-7	731,468.66	1,509,521.56	402.7	Sample
STN-8	730,646.60	1,509,359.17	380.8	Sample
STN-9	730,659.51	1,509,396.49	394.7	Sample/PZ
*STN-9A	730,655.56	1,509,398.56	394.7	Shelby Tube/SI
*STN-9B	730,663.13	1,509,394.84	394.7	Shelby Tube
STN-10	730,721.30	1,509,488.66	397.1	Sample/PZ
STN-11	730,171.02	1,509,771.93	378.8	Sample
STN-12	730,206.65	1,509,805.16	394.8	Sample
STN-13	730,257.53	1,509,873.48	396.5	Sample
STN-14	729,668.17	1,510,309.27	379.0	Sample
STN-15	729,710.31	1,510,333.99	395.0	Sample
*STN-15A	729,713.11	1,510,331.12	395.0	PZ
*STN-15B	729,715.91	1,510,328.25	395.0	Shelby Tube/SI
STN-16	729,763.04	1,510,385.22	397.8	Sample/PZ
STN-17	729,839.12	1,510,498.97	428.4	Sample
*STN-17A	729,842.82	1,510,494.59	428.4	Shelby Tube
STN-18	729,626.30	1,511,020.93	401.2	Sample
STN-19	729,567.00	1,511,146.57	410.9	Sample
*STN-19C	729,562.64	1,511,144.49	410.9	Shelby Tube
STN-20	729,545.69	1,511,210.45	419.3	Sample
STN-21	728,813.36	1,510,875.59	395.1	Sample/PZ
*STN-21A	728,808.93	1,510,877.54	395.1	Shelby Tube/SI
*STN-21B	728,804.50	1,510,879.50	395.1	Sample/SI
STN-22	728,838.52	1,510,961.21	410.2	Sample
*STN-22A	728,829.60	1,510,964.76	410.2	Shelby Tube/PZ
*STN-22C	728,834.06	1,510,962.99	410.2	Shelby Tube
STN-23	728,291.47	1,511,590.83	420.7	Sample
STN-24	728,215.90	1,511,562.59	410.4	Sample
*STN-24C	728,217.51	1,511,558.03	410.4	Shelby Tube
STN-25	728,130.72	1,511,539.43	395.4	Sample
STN-26	728,079.09	1,511,517.81	380.6	Sample
STN-27	728,342.65	1,512,519.26	422.2	Sample/PZ
STN-28	728,264.15	1,512,555.40	410.6	Sample/PZ
*STN-28A	728,265.77	1,512,559.91	410.6	Shelby Tube
*STN-28B	728,262.26	1,512,550.95	410.6	Shelby Tube
*STN-28C	728,260.38	1,512,546.50	410.6	Shelby Tube
STN-29	728,179.37	1,512,587.54	395.2	Sample/PZ/Core
*STN-29A	728,181.10	1,512,591.60	395.2	Shelby Tube/SI
*STN-29B	728,177.54	1,512,583.48	395.2	Shelby Tube
STN-30	728,119.63	1,512,564.49	379.7	Sample
STN-31	728,180.44	1,513,622.99	422.5	Sample
STN-32	728,155.57	1,513,707.59	410.7	Sample
STN-33	728,122.27	1,513,797.59	395.4	Sample/Core
STN-34	728,103.27	1,513,844.16	378.7	Sample
STN-35	728,903.76	1,513,833.70	425.7	Sample/PZ
*STN-35A	728,899.92	1,513,832.70	425.7	Shelby Tube
STN-36	728,879.61	1,513,930.45	411.2	Sample/PZ
*STN-36A	728,875.02	1,513,928.98	411.2	Shelby Tube
*STN-36B	728,883.94	1,513,932.09	411.2	Shelby Tube
STN-37	728,853.00	1,514,022.47	395.2	Sample/PZ/Core

BORING LOCATION TABLE (CONTINUED)				
BORING	NORTHING	EASTING	ELEV. (FT.)	BORING TYPE
*STN-37A	728,848.41	1,514,021.00	395.2	Shelby Tube/SI
*STN-37B	728,857.33	1,514,024.11	395.2	Shelby Tube
STN-38	728,840.42	1,514,066.12	380.0	Sample
STN-39	729,874.75	1,513,445.67	395.9	Sample/Core
STN-40	729,801.23	1,513,385.97	411.3	Sample
STN-41	729,715.15	1,513,343.22	422.6	Sample
STN-42	730,342.74	1,512,760.25	396.2	Sample/PZ
STN-43	730,394.20	1,512,495.22	411.3	Sample/PZ
*STN-43A	730,397.50	1,512,491.36	411.3	Shelby Tube/SI
STN-44	730,328.91	1,512,450.02	419.5	Sample/PZ
STN-45	730,351.51	1,511,970.28	411.6	Sample
*STN-45A	730,351.38	1,511,965.25	411.6	PZ
*STN-45B	730,346.02	1,512,020.28	411.6	Profile
*STN-45C	730,345.72	1,512,070.28	411.6	Profile
STN-46	730,307.77	1,511,950.82	420.3	Sample
*STN-46A	730,309.78	1,511,946.44	420.3	PZ
STN-63	730,179.49	1,509,764.23	379.0	Sample
STN-64	729,396.89	1,510,532.03	379.3	Cone Penetration Test
STN-65	729,791.10	1,510,179.24	379.8	Cone Penetration Test
STN-66	730,179.49	1,509,764.23	379.0	Cone Penetration Test
STN-67	731,487.75	1,509,327.79	378.4	Cone Penetration Test
STN-68	731,848.23	1,510,340.93	396.1	Cone Penetration Test
STN-69	731,860.16	1,509,967.60	392.4	Cone Penetration Test
STN-70	730,986.46	1,509,851.43	428.1	Cone Penetration Test
STN-71	729,958.36	1,510,375.99	427.2	Cone Penetration Test
STN-72	729,727.44	1,511,067.07	401.4	Cone Penetration Test
STN-73	729,588.29	1,511,238.50	419.3	Cone Penetration Test
STN-74	730,325.68	1,512,461.37	419.9	Cone Penetration Test
STN-75	730,184.63	1,512,659.31	420.6	Cone Penetration Test
STN-76	728,563.33	1,513,742.62	424.5	Cone Penetration Test
STN-77	728,286.09	1,513,112.60	421.8	Cone Penetration Test
STN-78	728,161.70	1,512,113.05	421.7	Cone Penetration Test
STN-79	728,475.41	1,511,251.81	418.1	Cone Penetration Test
STN-80	729,115.32	1,512,685.30	423.4	Cone Penetration Test

*Estimated based on offsets from original borings.
"PZ" denotes Piezometer
"SI" denotes Slope Inclinometer

NOTE:

The topographic mapping provided is based on horizontal datum NAD27 and vertical datum NGV29 using State Plane Tennessee coordinate system. The site photography was performed on 4/17/2009.

LEGEND

- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests
- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests and Rock Core
- Cone Penetration Test
- Drain, Number

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

SCALE: 1"=200' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK AND GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION
BORING LAYOUT

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543-01 | R 0

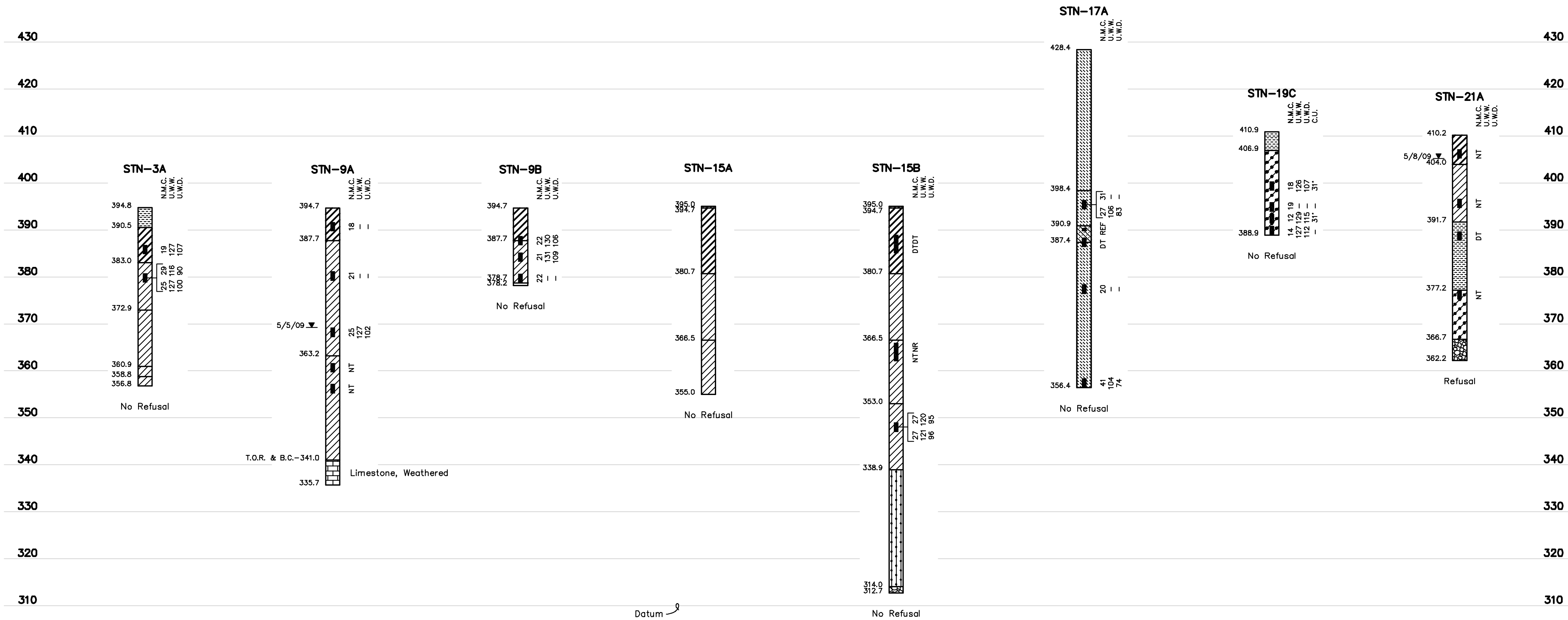
STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

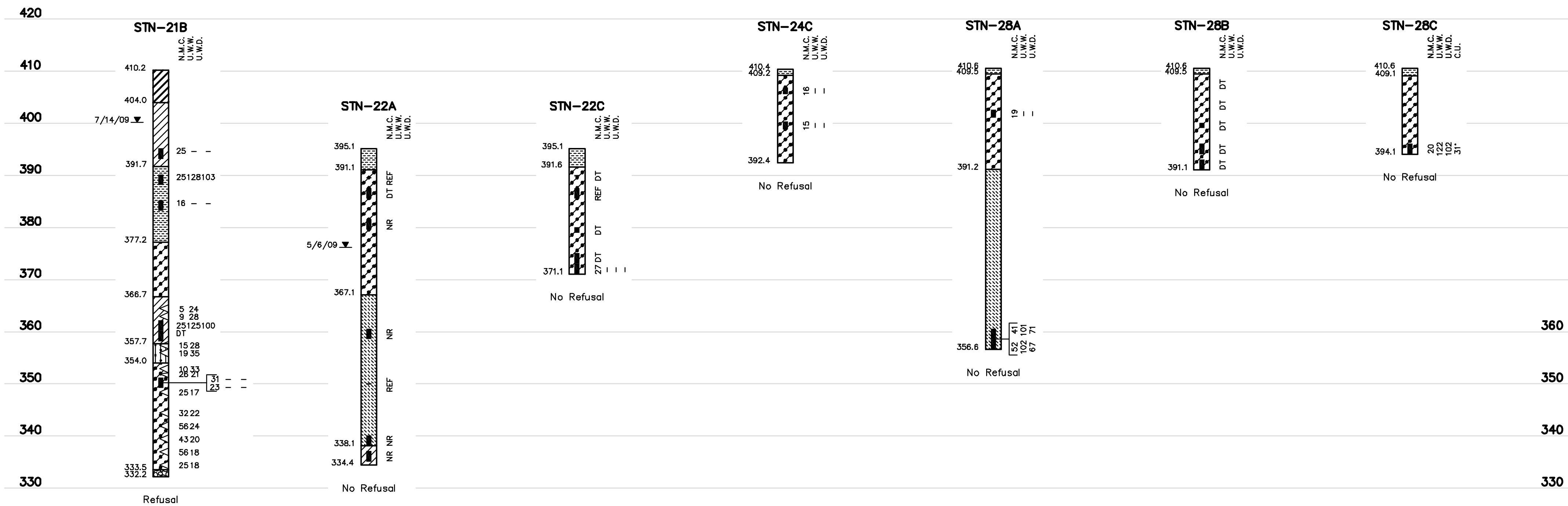
C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 06/10/2010 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\REV0_RECORD\R2000\10W543-01-R0.DWG

46 | C | 10W543-01



LOGS OF BORINGS
SCALE: 1"=10' (VERTICAL ONLY)



LOGS OF BORINGS
SCALE: 1"=10' (VERTICAL ONLY)

LEGEND

- Gypsum, white-tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
DT	Damaged Tube, No Specimen
REF	Tube Refused
NT	Not Tested
NR	Little to No Recovery
03/31/09 ▽	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide-tipped tooth auger bit
No Refusal	No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–
RECORD DRAWING											

DISCIPLINE INTERFACE 1 2 3 4

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
DRY FLY ASH STACK AND GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION LOGS OF BORINGS NOT ON CROSS SECTIONS

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 06/11/10	46	C	10W543–02	R 0

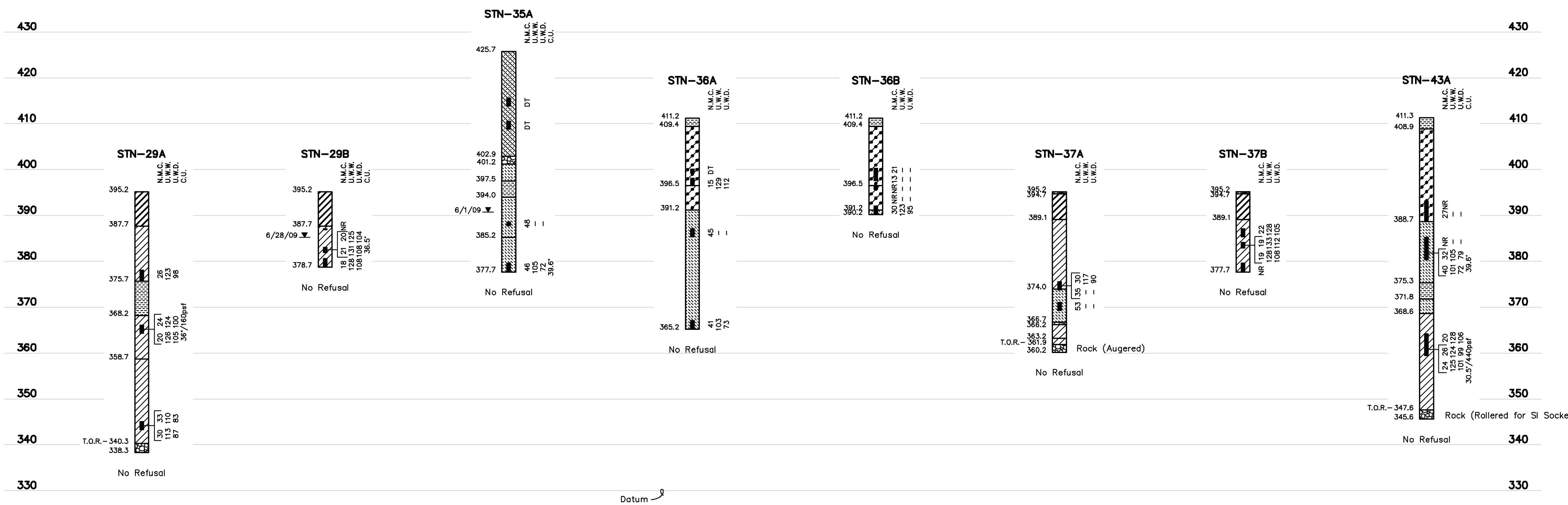
STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

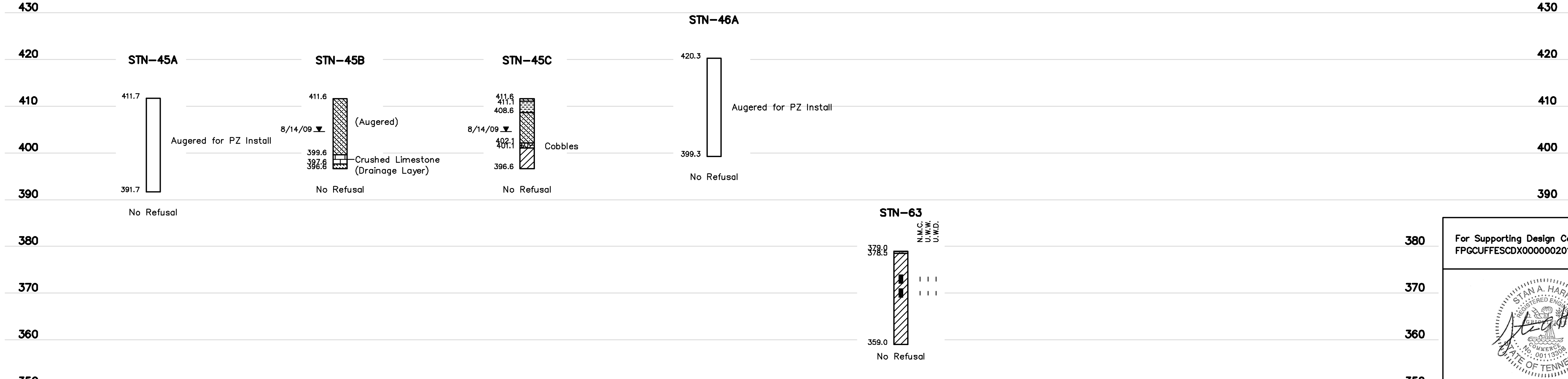
C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 06/10/2010

46 C 10W543–02



LOGS OF BORINGS
SCALE: 1"=10' (VERTICAL ONLY)



LOGS OF BORINGS
SCALE: 1"=10' (VERTICAL ONLY)

LEGEND

- Gypsum, white–tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red–brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin–Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
DT	Damaged Tube, No Specimen
REF	Tube Refused
NT	Not Tested
NR	Little to No Recovery
03/31/09 ▽	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock–like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide–tipped tooth auger bit
No Refusal	No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
DRY FLY ASH STACK AND GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION
LOGS OF BORINGS
NOT ON CROSS SECTIONS

STAN A. HARRIS
REGISTERED ENGINEER
AGRICULTURE COMMERCE
No. 00113308
STATE OF TENNESSEE
6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 06/11/10	46	C	10W543–03	R 0

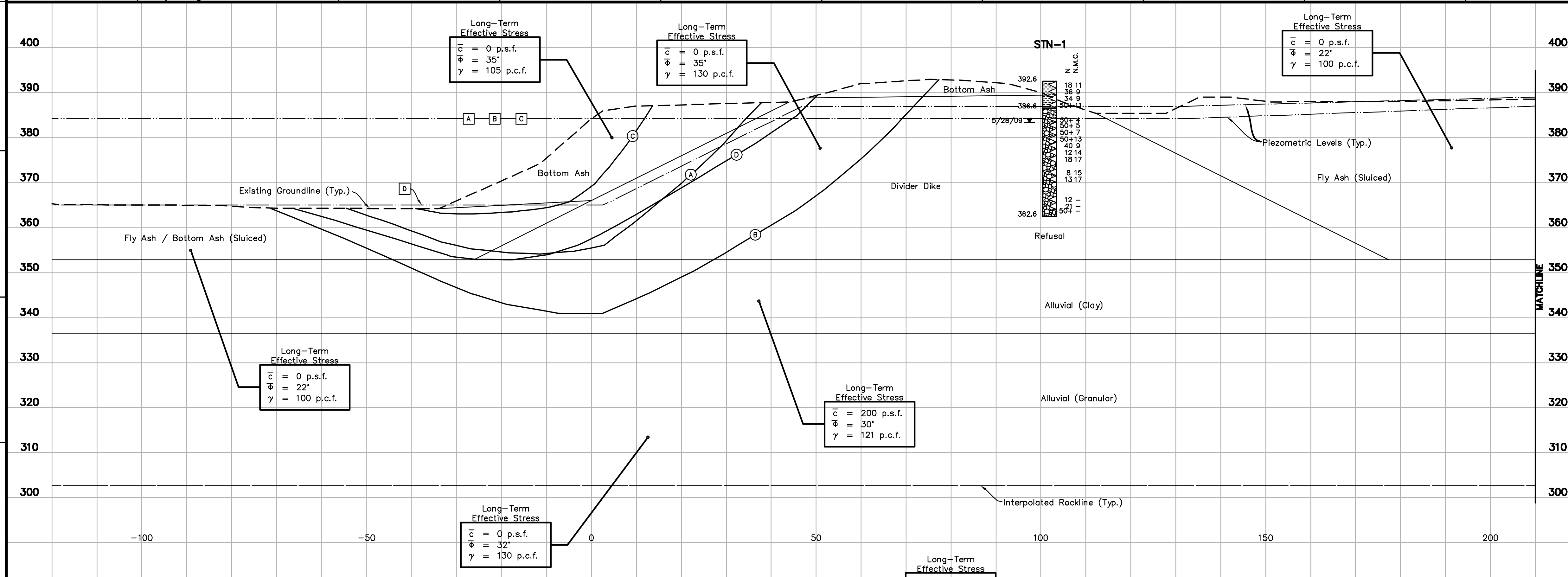
STANTEC	0
TASK COMPLETED BY:	REV NO.

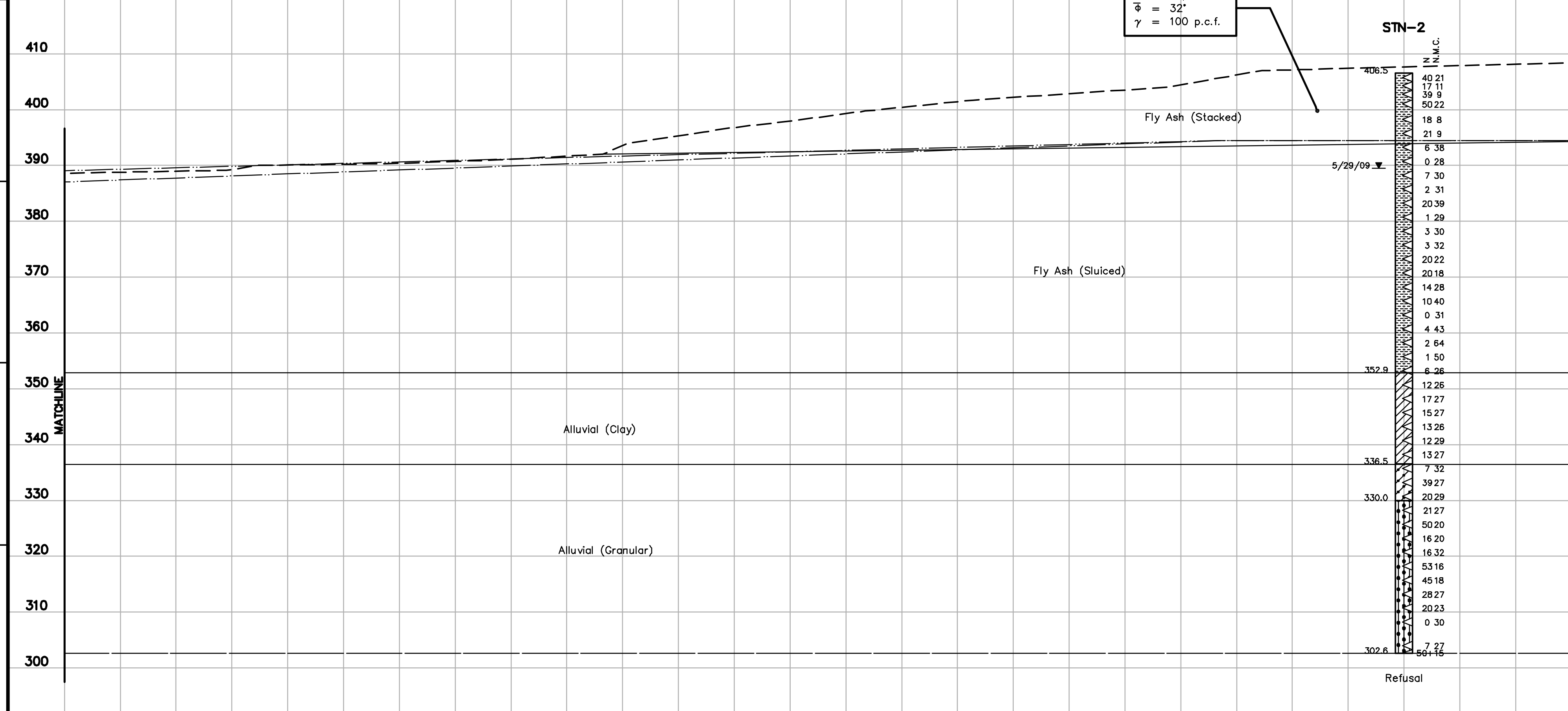
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

DISCIPLINE INTERFACE

46 C 10W543–03





SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	2.0
B	Spencer's Method (Optimized)	2.6
C	Spencer's Method (Optimized)	1.0
D	Spencer's Method (Optimized) Rapid Drawdown	1.7

LEGEND

- Gypsum, white–tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red–brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
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- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁ Standard Penetration Test Interval
■ Undisturbed Thin–Walled (Shelby) Tube Sample
N Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
03/31/09 ▽ Water Level and Date Recorded
T.O.R.– Top of Rock (Indicates the beginning of rock–like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.– Begin Rock Core
R.Q.D. Rock Quality Designation (%)
REC. Recovery (%)
Refusal Auger Refusal using a carbide–tipped tooth auger bit
No Refusal No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–
RECORD DRAWING											

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION DRY FLY ASH STACK STABILITY SECTION A – EX. CONDITIONS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

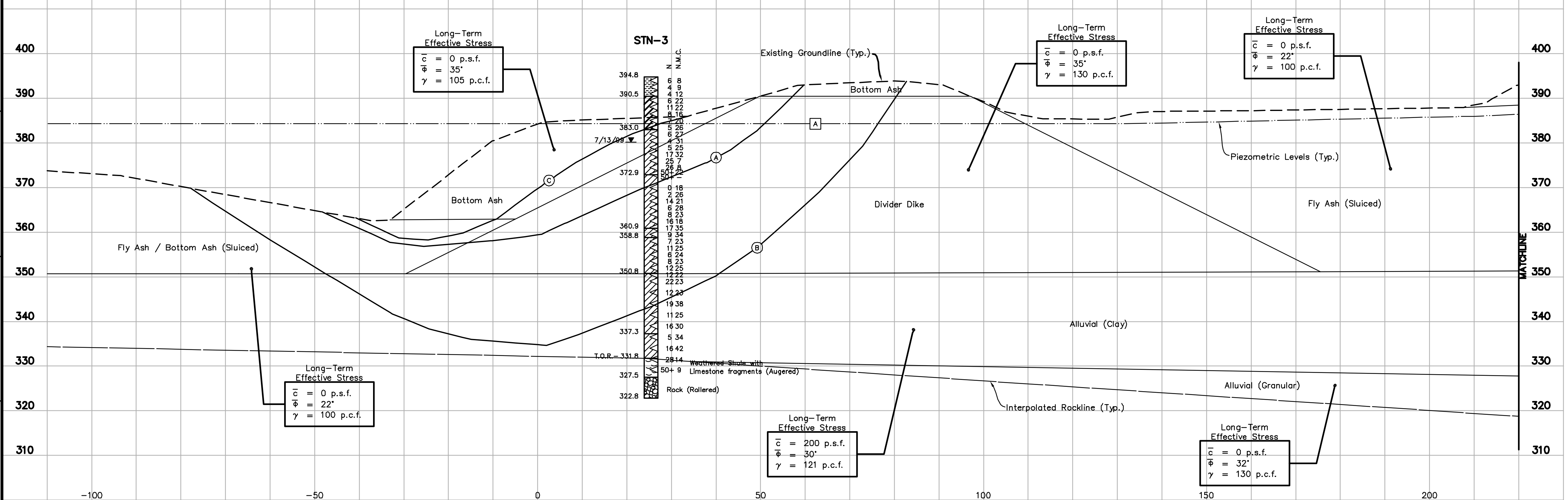
AUTOCAD R 2000	DATE 06/11/10	46	C	10W543–04	R 0

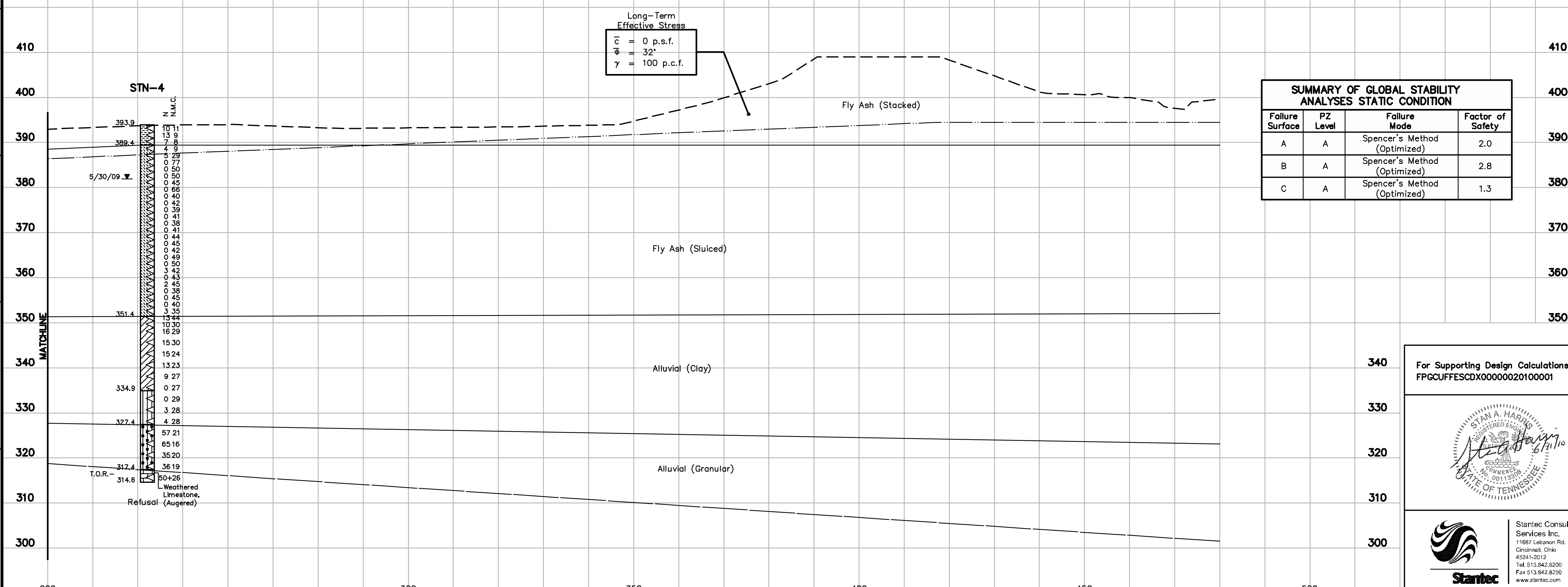
STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

46 C 10W543–04





NOTE:

1. STN-3 was used to determine depth to alluvial soils and bedrock. Upper portion of cross section was extrapolated from cross section A.

LEGEND

- Gypsum, white-tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
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- Limestone, very light gray to gray, weathered, hard.
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- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
03/31/09 ▽	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide-tipped tooth auger bit
No Refusal	No Refusal Encountered

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	PZ Level	Failure Mode	Factor of Safety
A	A	Spencer's Method (Optimized)	2.0
B	A	Spencer's Method (Optimized)	2.8
C	A	Spencer's Method (Optimized)	1.3

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

STAN A. HARRIS
REGISTERED ENGINEER
AGRICULTURE COMMERCE
No. 00113308
STATE OF TENNESSEE
6/11/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION
DRY FLY ASH STACK STABILITY
SECTION B – EX. CONDITIONS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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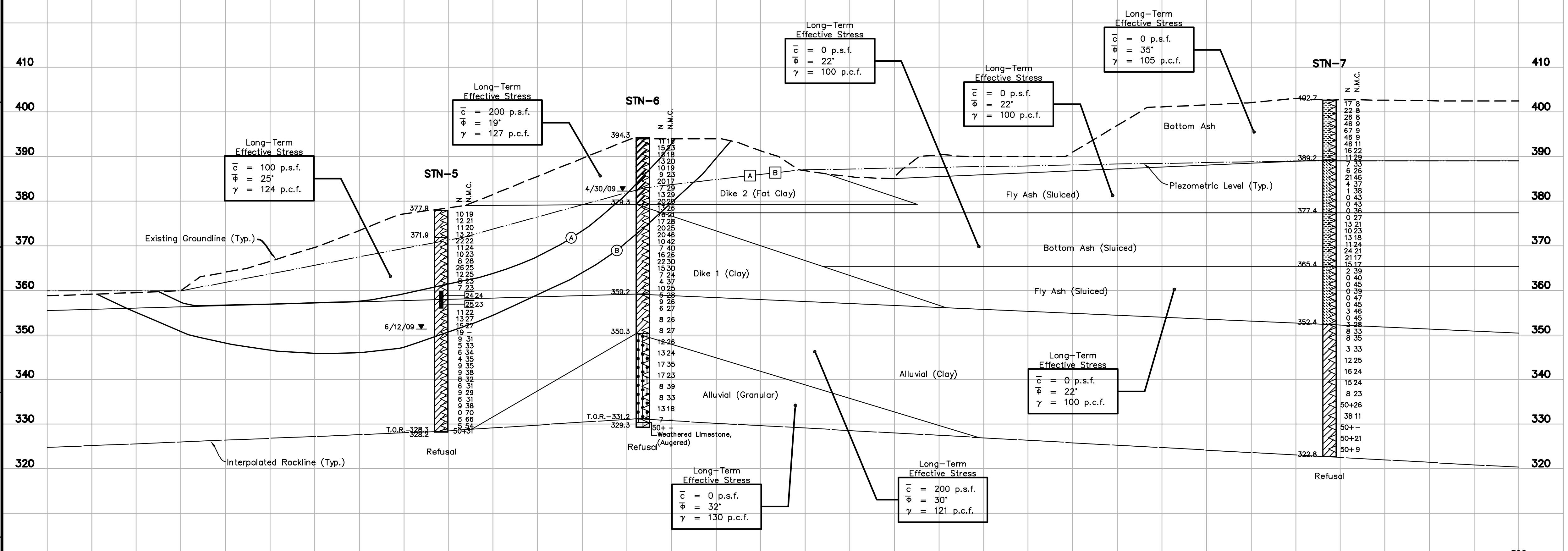
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543-05 | R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.5
B	Spencer's Method (Optimized)	1.8

LEGEND

- Gypsum, white-tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
03/31/09 ▽	Water Level and Date Recorded
T.O.R.-	Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.-	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide-tipped tooth auger bit
No Refusal	No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION
DRY FLY ASH STACK STABILITY
SECTION C – EX. CONDITIONS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543–06 | R 0

DISCIPLINE INTERFACE

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

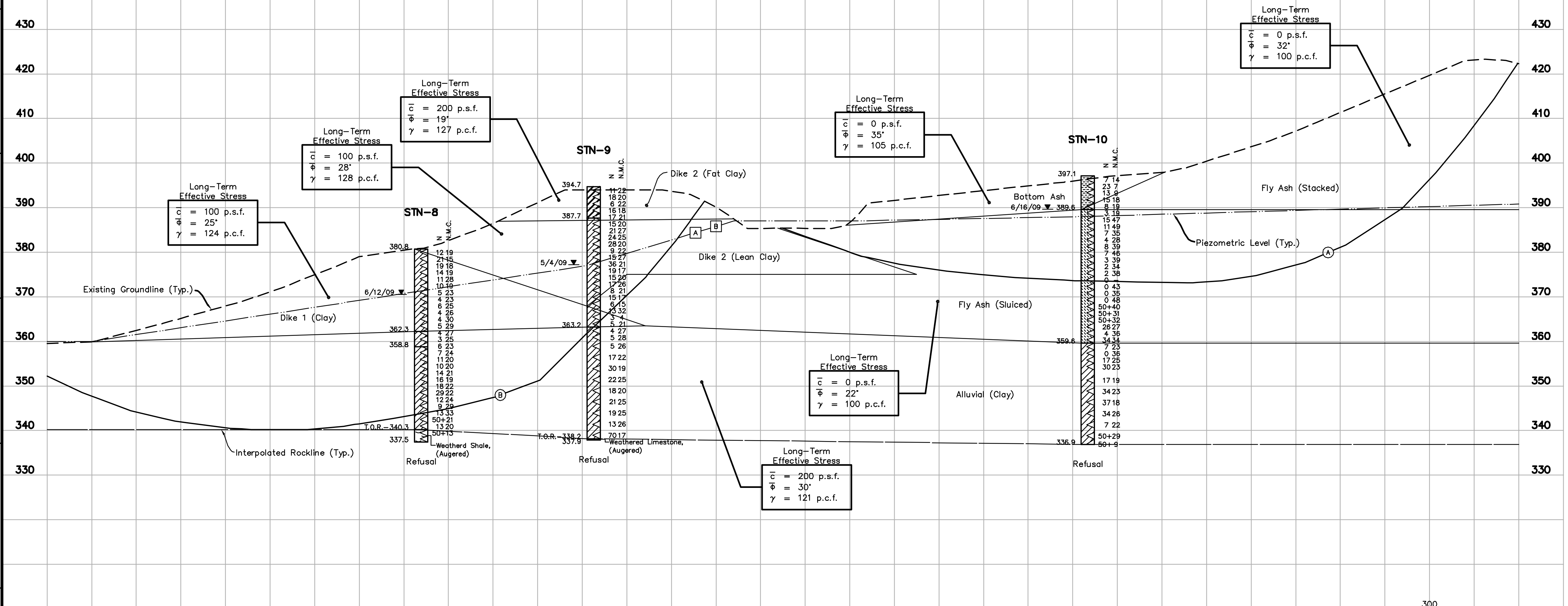
C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 06/10/2010

46	C	10W543-07

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.6
B	Spencer's Method (Optimized)	2.1



LEGEND

- Gypsum, white–tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red–brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin–Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
03/31/09	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock–like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide–tipped tooth auger bit
No Refusal	No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ

RECORD DRAWING

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION
DRY FLY ASH STACK STABILITY
SECTION D – EX. CONDITIONS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

STAN A. HARRIS · REGISTERED ENGINEER · STATE OF TENNESSEE · 6/11/10

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

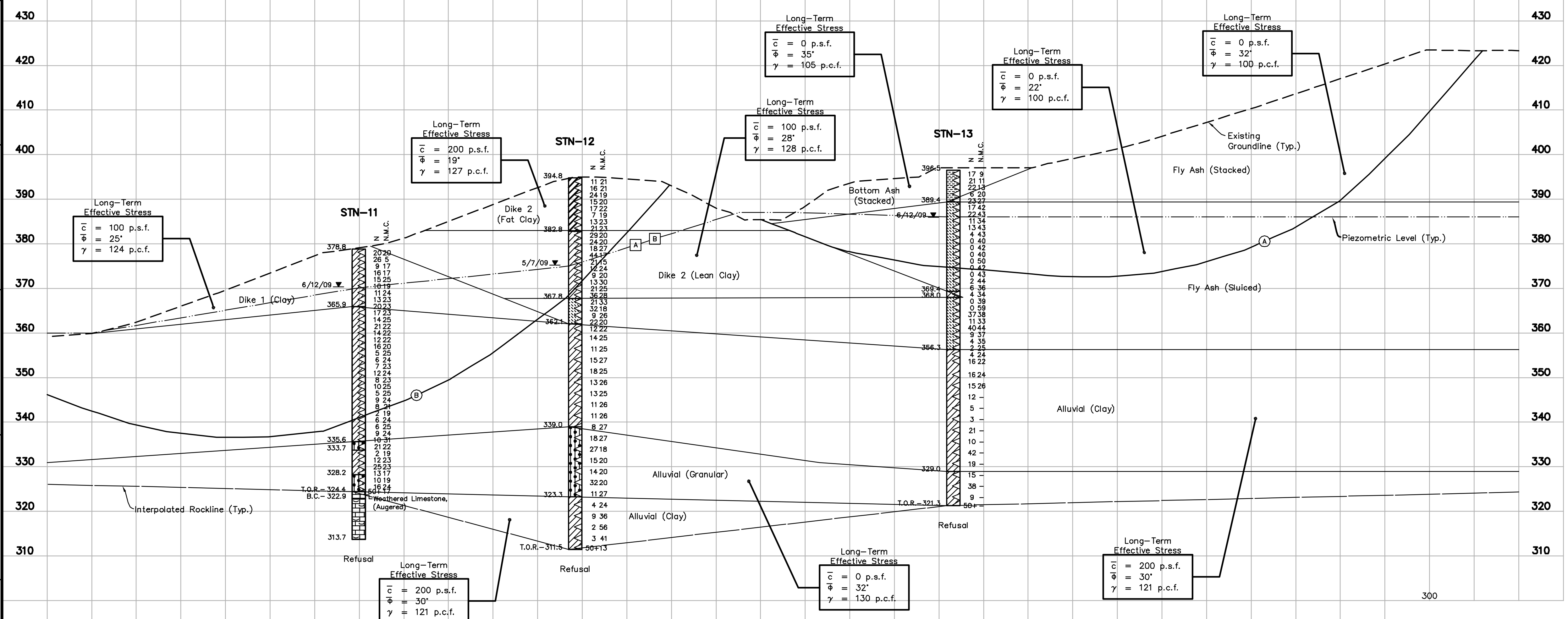
AUTOCAD R 2000	DATE 06/11/10	46	C	10W543-07	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

46 | C | 10W543-08



SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.9
B	Spencer's Method (Deep Failure)	2.0

LEGEND

- Gypsum, white–tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red–brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin–Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
03/31/09 ▽	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock–like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide–tipped tooth auger bit
No Refusal	No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION
DRY FLY ASH STACK STABILITY
SECTION E – EX. CONDITIONS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543–08 | R 0

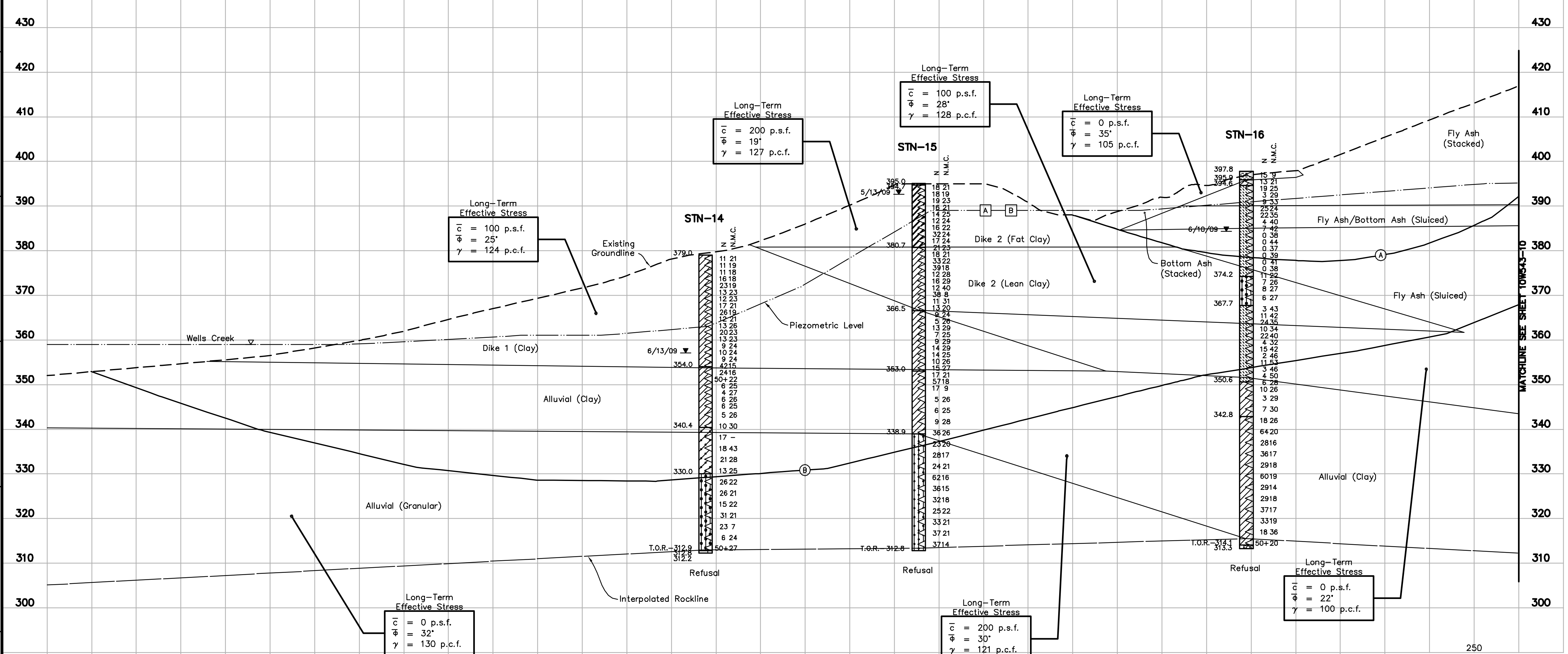
STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.4
B	Spencer's Method (Optimized)	2.0



LEGEND

- Gypsum, white-tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁ Standard Penetration Test Interval
■ Undisturbed Thin-Walled (Shelby) Tube Sample
N Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
03/31/09 ▽ Water Level and Date Recorded
T.O.R.- Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.- Begin Rock Core
R.Q.D. Rock Quality Designation (%)
REC. Recovery (%)
Refusal Auger Refusal using a carbide-tipped tooth auger bit
No Refusal No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION DRY FLY ASH STACK STABILITY SECTION F – EX. CONDITIONS

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE
6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 06/11/10	46	C	10W543-09	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

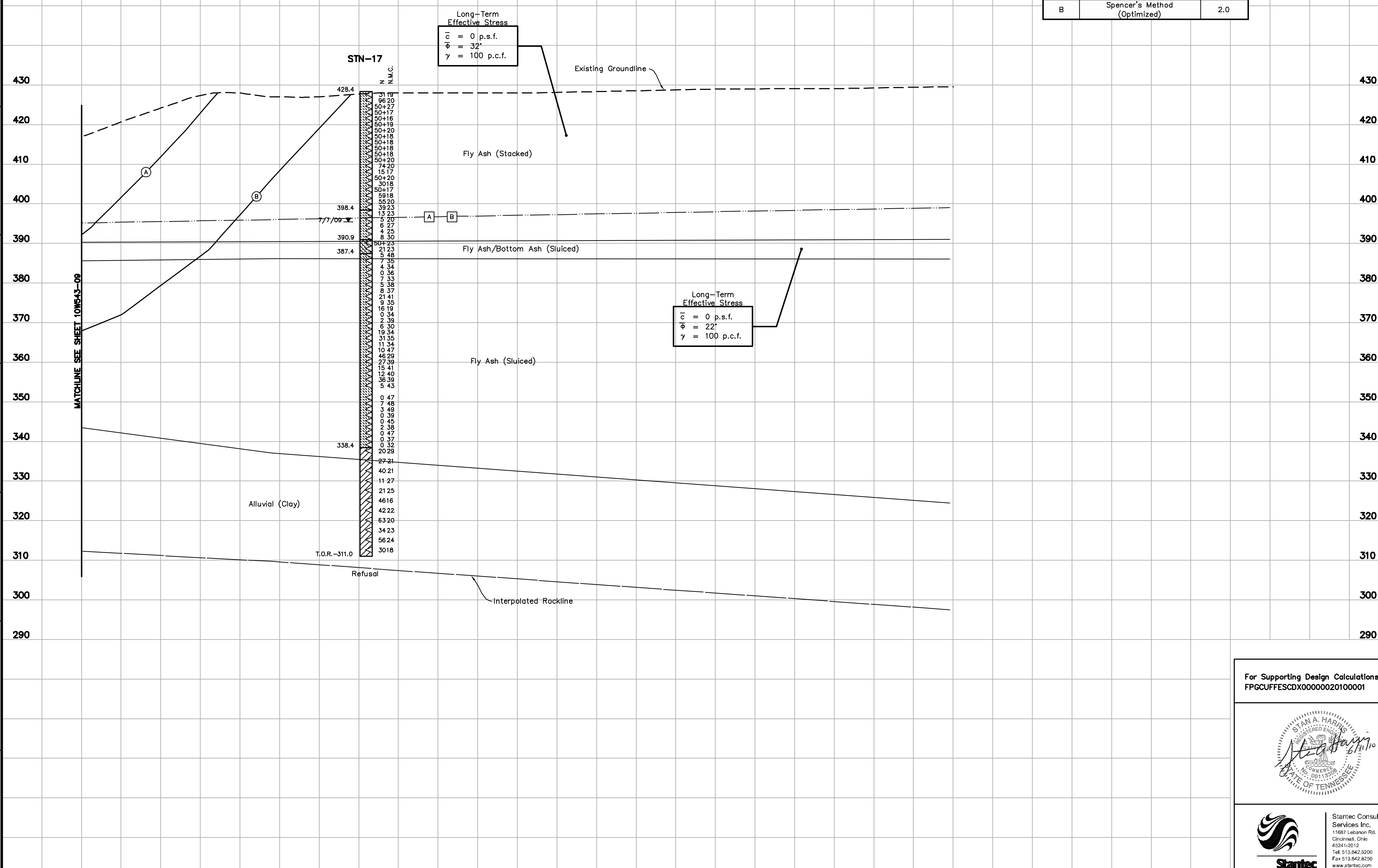
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

PLOT DATE: 06/10/2010 V:\1755\ACTIVE\175539009\

46 C 10W543-10

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.4
B	Spencer's Method (Optimized)	2.0



LEGEND

- Gypsum, white-tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
03/31/09 ▽	Water Level and Date Recorded
T.O.R.-	Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.-	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide-tipped tooth auger bit
No Refusal	No Refusal Encountered

RECORD DRAWING

PLOT DATE: 06/10/2010 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\REV_RECORD\R2000\10W543-10-R0.DWG

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
–											
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–
RECORD DRAWING											

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION
DRY FLY ASH STACK STABILITY
SECTION F – EX. CONDITIONS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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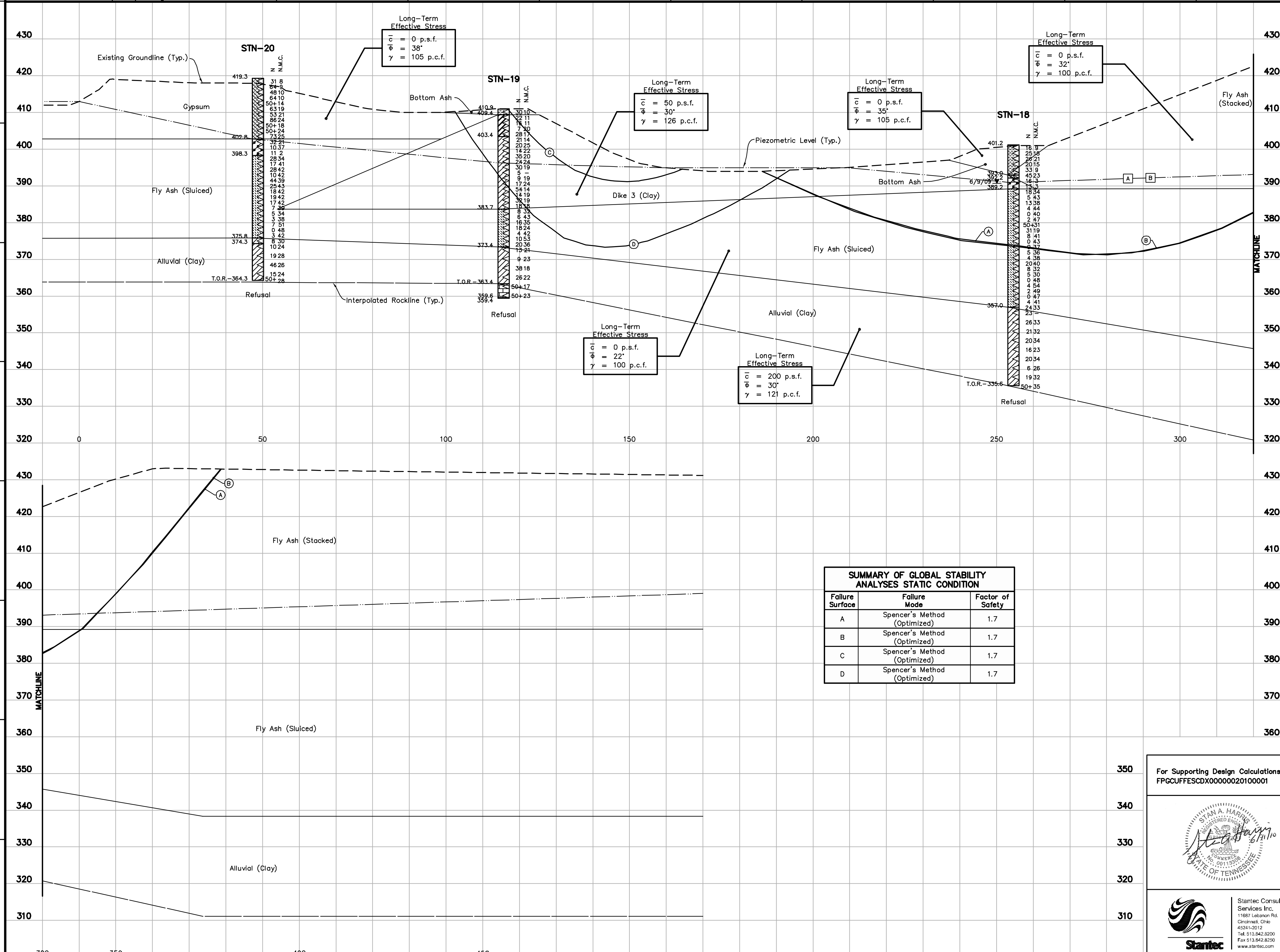
AUTOCAD R 2000	DATE 06/11/10	46	C	10W543-10	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.7
B	Spencer's Method (Optimized)	1.7
C	Spencer's Method (Optimized)	1.7
D	Spencer's Method (Optimized)	1.7

LEGEND

- Gypsum, white-tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
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- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁ Standard Penetration Test Interval
■ Undisturbed Thin-Walled (Shelby) Tube Sample
N Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
03/31/09 ▽ Water Level and Date Recorded
T.O.R.– Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.– Begin Rock Core
R.Q.D. Rock Quality Designation (%)
REC. Recovery (%)
Refusal Auger Refusal using a carbide-tipped tooth auger bit
No Refusal No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK AND GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION DRY FLY ASH STACK STABILITY SECTION G – EX. CONDITIONS

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

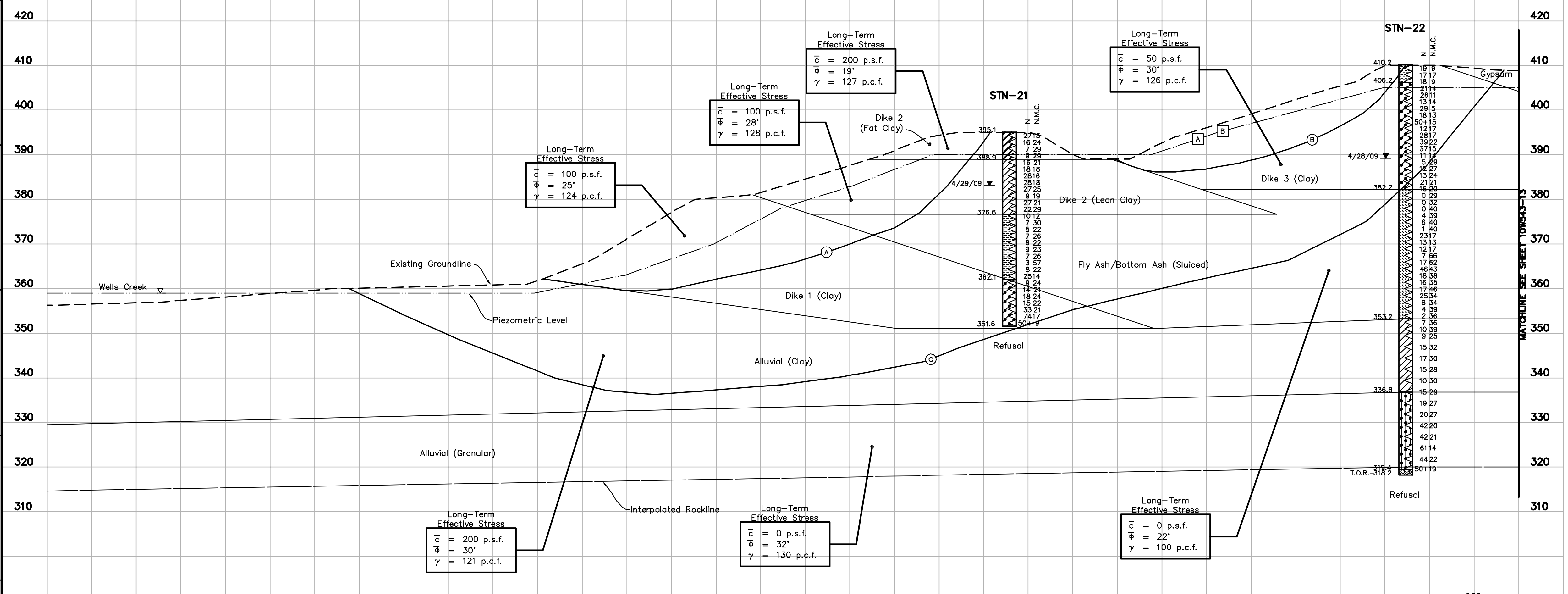
AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543-11 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.4
B	Spencer's Method (Optimized)	1.4
C	Spencer's Method (Optimized)	1.8



LEGEND

- Gypsum, white-tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
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- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁ Standard Penetration Test Interval
■ Undisturbed Thin-Walled (Shelby) Tube Sample
N Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
03/31/09 ▽ Water Level and Date Recorded
T.O.R.- Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.- Begin Rock Core
R.Q.D. Rock Quality Designation (%)
REC. Recovery (%)
Refusal Auger Refusal using a carbide-tipped tooth auger bit
No Refusal No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R–	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

SCALE: 1"=10' EXCEPT AS NOTED

YARD
GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION
GYPSUM DISPOSAL COMPLEX STABILITY
SECTION H – EX. CONDITIONS

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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Cincinnati, Ohio
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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543-12 | R 0

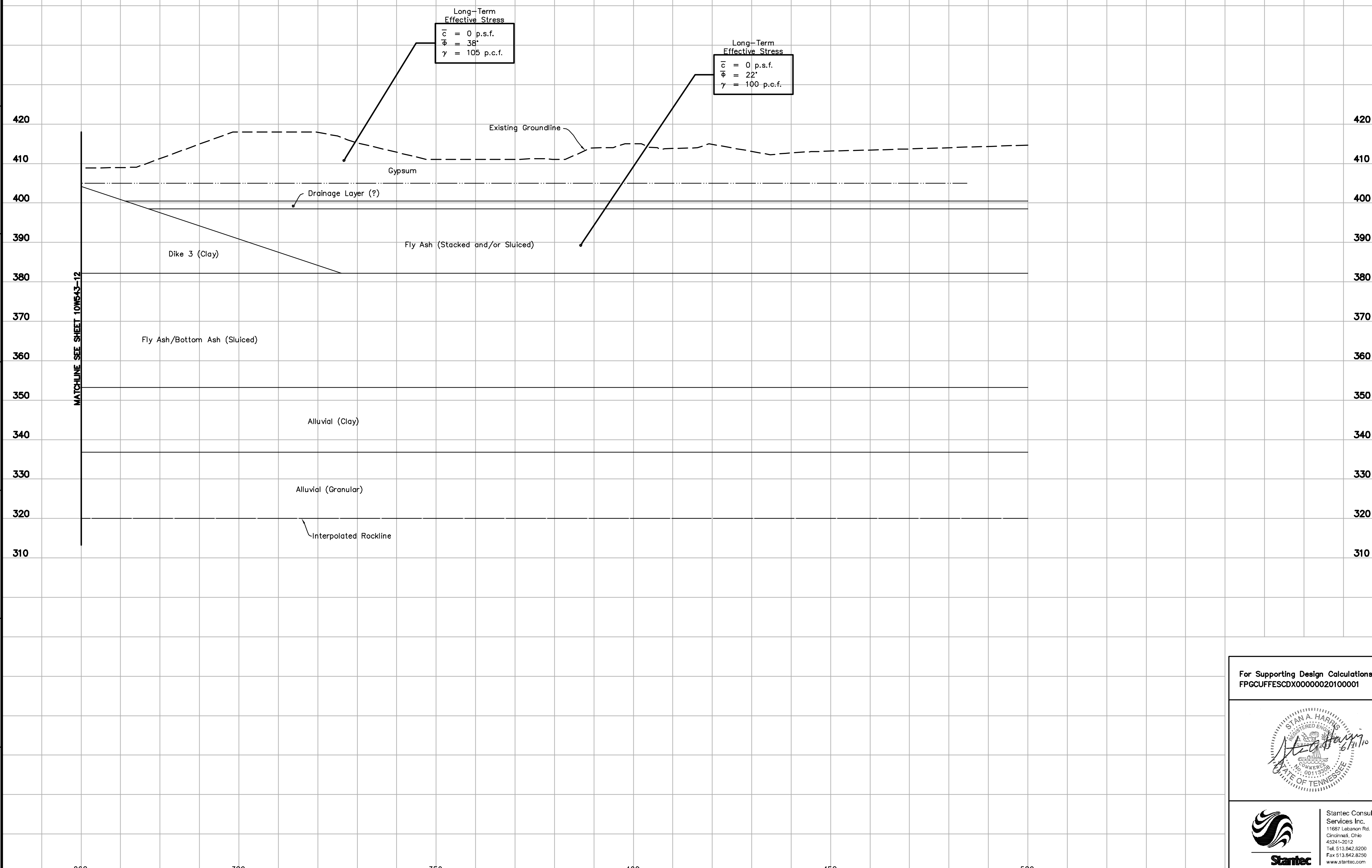
STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

DISCIPLINE INTERFACE

PLOT DATE: 06/10/2010



NOTE:

1. Presence of drainage layer beneath gypsum was ignored for the slope stability analysis.

LEGEND

- Gypsum, white–tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red–brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin–Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
03/31/09 ▽	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock–like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide–tipped tooth auger bit
No Refusal	No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=10' EXCEPT AS NOTED

YARD
GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION
GYPSUM DISPOSAL COMPLEX STABILITY
SECTION H – EX. CONDITIONS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543–13 | R 0

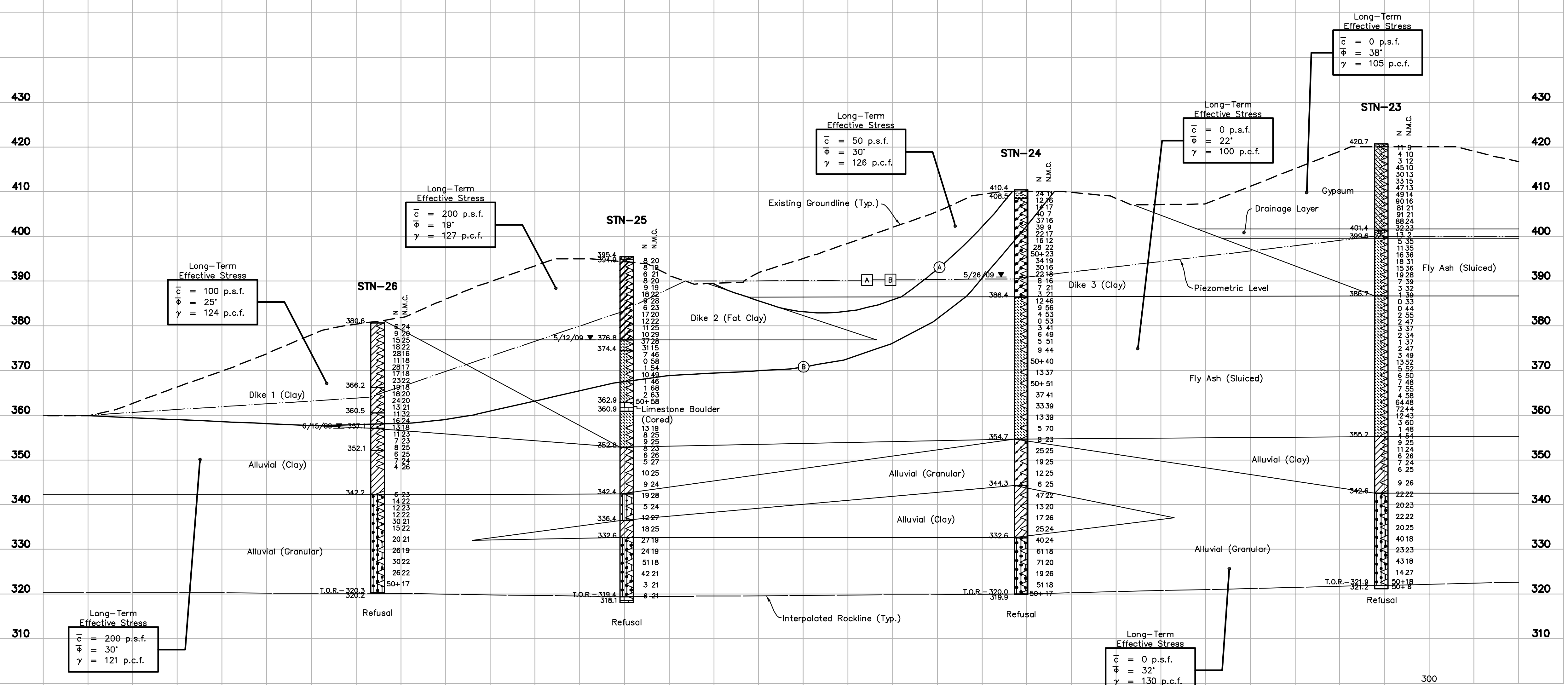
STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

46 C 10W543–13

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.6
B	Spencer's Method (Optimized)	1.8



NOTE:

1. Presence of drainage layer beneath gypsum was ignored for the slope stability analysis.

LEGEND

- Gypsum, white-tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
03/31/09 ▽	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide-tipped tooth auger bit
No Refusal	No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

SCALE: 1"=10' EXCEPT AS NOTED

YARD
GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION
GYPSUM DISPOSAL COMPLEX STABILITY
SECTION I – EX. CONDITIONS

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

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CUMBERLAND FOSSIL PLANT
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FOSSIL AND HYDRO ENGINEERING

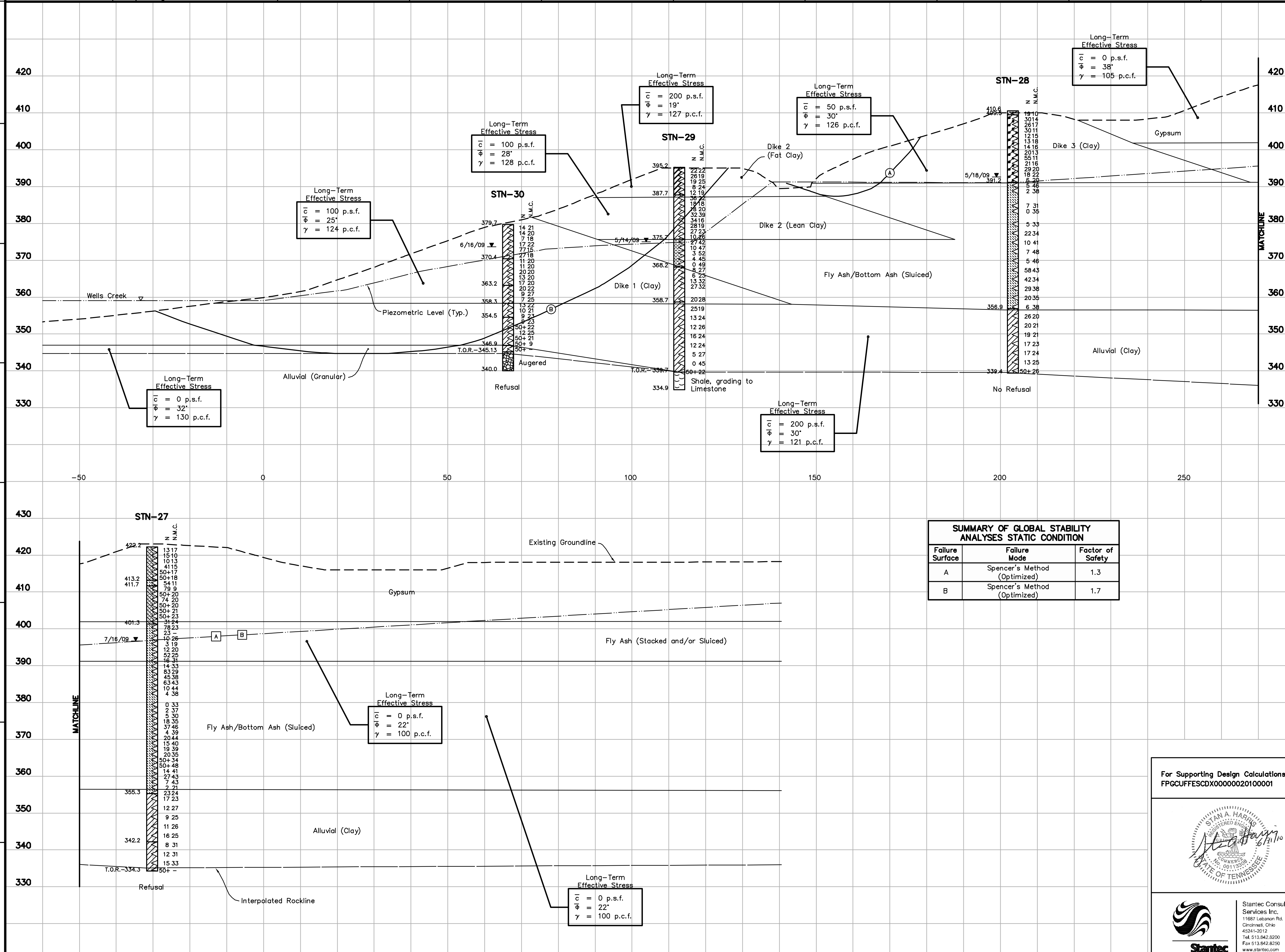
AUTOCAD R 2000	DATE 06/11/10	46	C	10W543–14	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

46 C 10W543-14



LEGEND

- Gypsum, white–tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red–brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
- Fat Clay, dark to reddish brown, damp to wet, soft to very stiff.
- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin–Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
03/31/09 ▽	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock–like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide–tipped tooth auger bit
No Refusal	No Refusal Encountered

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.3
B	Spencer's Method (Optimized)	1.7

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=10' EXCEPT AS NOTED

YARD
GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION GYPSUM DISPOSAL COMPLEX STABILITY SECTION J – EX. CONDITIONS

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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CUMBERLAND FOSSIL PLANT
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FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543–15 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

46 C 10W543–15

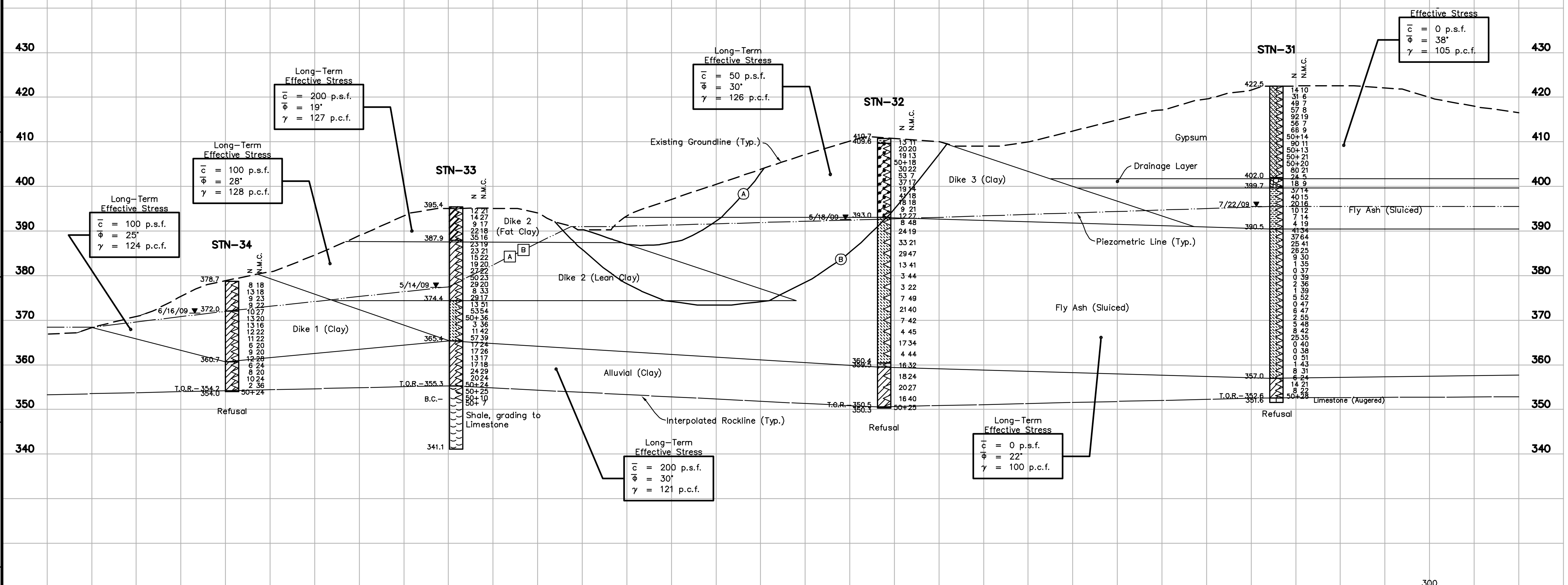
46 C 10W543-16

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.2
B	Spencer's Method (Optimized)	2.0

NOTE:

1. Presence of drainage layer beneath gypsum was ignored for the slope stability analysis.



LEGEND

- Gypsum, white-tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
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- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁ Standard Penetration Test Interval
■ Undisturbed Thin-Walled (Shelby) Tube Sample
N Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
03/31/09 ▽ Water Level and Date Recorded
T.O.R.– Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.– Begin Rock Core
R.Q.D. Rock Quality Designation (%)
REC. Recovery (%)
Refusal Auger Refusal using a carbide-tipped tooth auger bit
No Refusal No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE

SCALE: 1"=10' EXCEPT AS NOTED

YARD
GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION
GYPSUM DISPOSAL COMPLEX STABILITY
SECTION J – EX. CONDITIONS

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE
6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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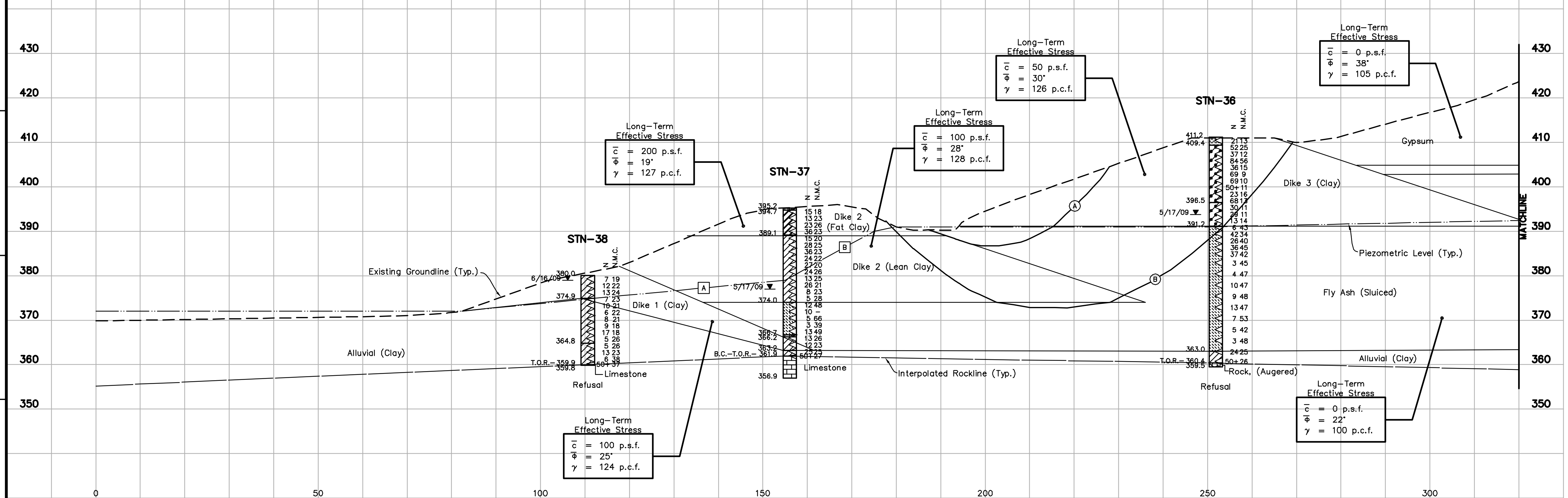
FOSSIL AND HYDRO ENGINEERING

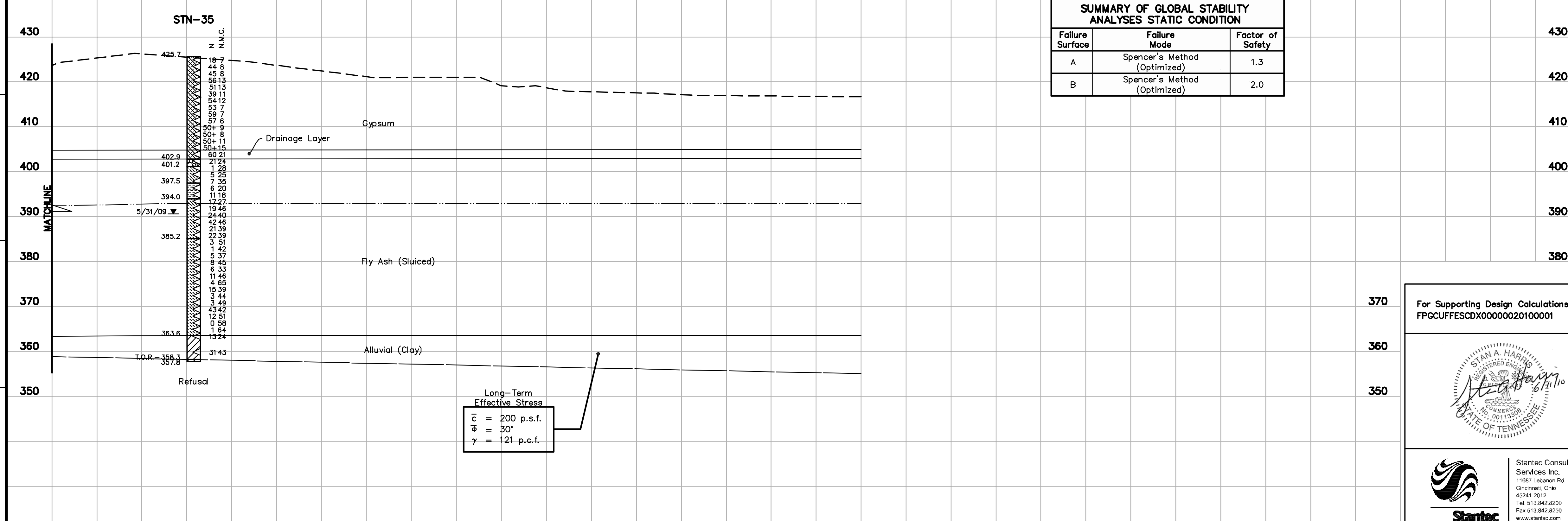
AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543-16 | R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY





NOTE:

1. Presence of drainage layer beneath gypsum was ignored for the slope stability analysis.

LEGEND

- Gypsum, white–tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
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- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁ Standard Penetration Test Interval
■ Undisturbed Thin–Walled (Shelby) Tube Sample
N Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
03/31/09 ▽ Water Level and Date Recorded
T.O.R.– Top of Rock (Indicates the beginning of rock–like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.– Begin Rock Core
R.Q.D. Rock Quality Designation (%)
REC. Recovery (%)
Refusal Auger Refusal using a carbide–tipped tooth auger bit
No Refusal No Refusal Encountered

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.3
B	Spencer's Method (Optimized)	2.0

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE

SCALE: 1"=10' EXCEPT AS NOTED

YARD
GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION
GYPSUM DISPOSAL COMPLEX STABILITY
SECTION L – EX. CONDITIONS

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

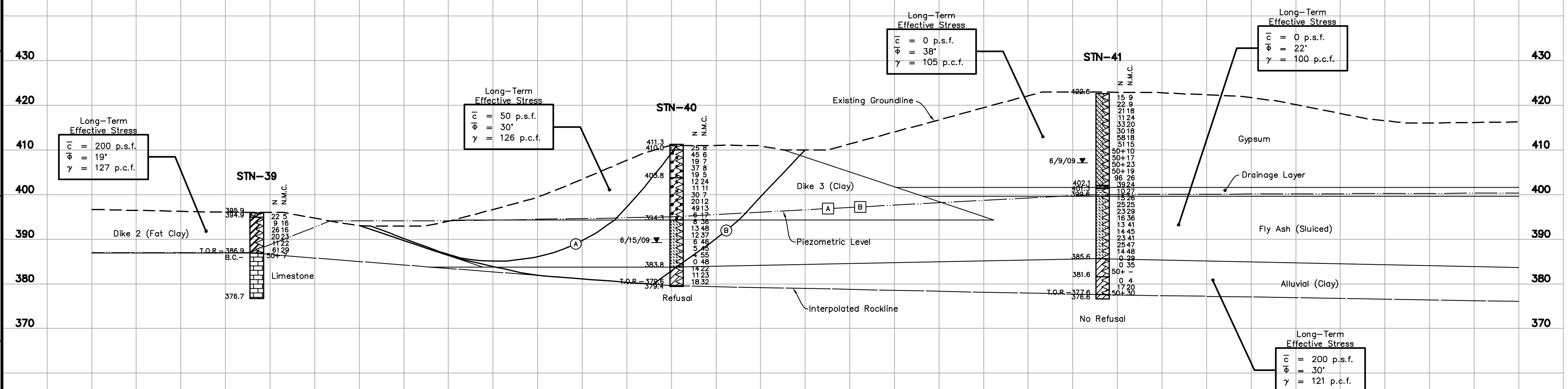
AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543–17 | R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

46 | C | 10W543–17



SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.2
B	Spencer's Method (Optimized)	2.5

NOTE:

1. Presence of drainage layer beneath gypsum was ignored for the slope stability analysis.

LEGEND

- Gypsum, white-tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red-brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
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- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
03/31/09 ▽	Water Level and Date Recorded
T.O.R.-	Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.-	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide-tipped tooth auger bit
No Refusal	No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R -	-	-	-	-	-	-	-	-	-	-	-
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	-	-	-

RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=10' EXCEPT AS NOTED

YARD
GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION
GYPSUM DISPOSAL COMPLEX STABILITY
SECTION M – EX. CONDITIONS

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 06/11/10	46	C	10W543-18	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

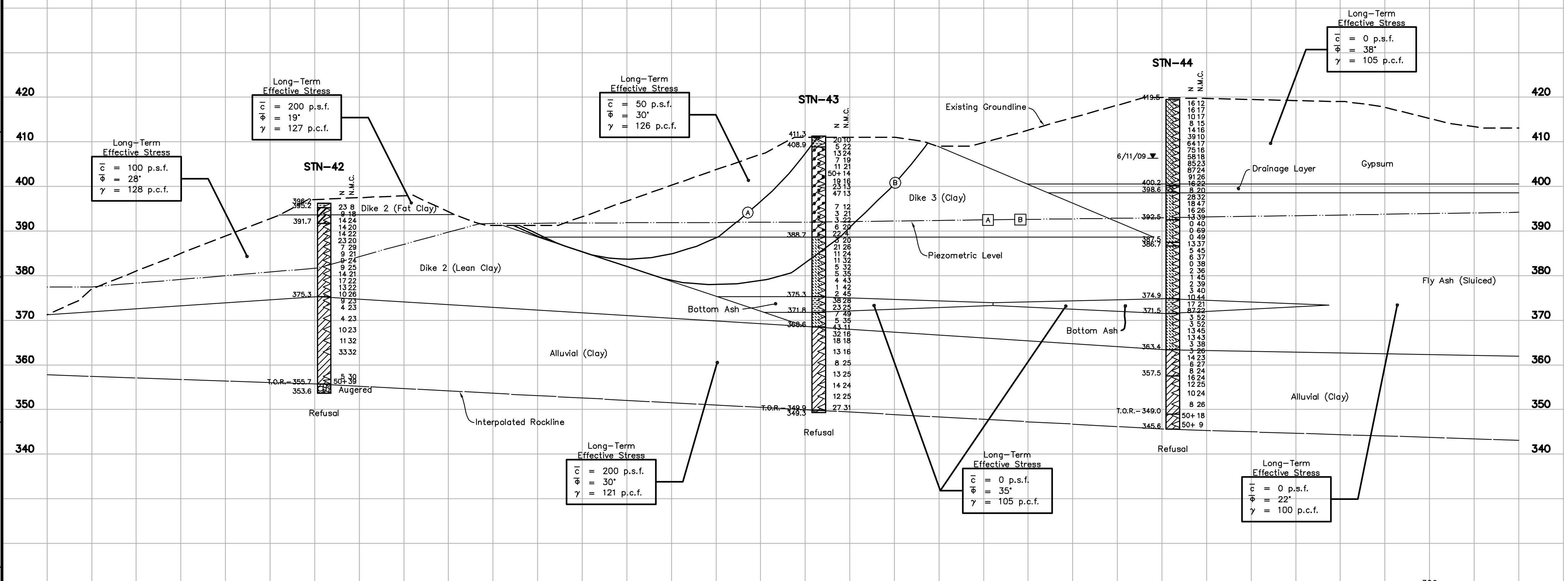
C.A.D. DRAWING DO NOT ALTER MANUALLY

PLOT DATE: 06/10/2010 ... V:\1755\ACTIVE\175539009\...10W543-18-R0.DWG

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.5
B	Spencer's Method (Optimized)	1.8

NOTE:

1. Presence of drainage layer beneath gypsum was ignored for the slope stability analysis.



LEGEND

- Gypsum, white-tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
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- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
03/31/09 ▽	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide-tipped tooth auger bit
No Refusal	No Refusal Encountered

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=10' EXCEPT AS NOTED

YARD
GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION GYPSUM DISPOSAL COMPLEX STABILITY SECTION N – EX. CONDITIONS

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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CUMBERLAND FOSSIL PLANT
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FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543–19 | R 0

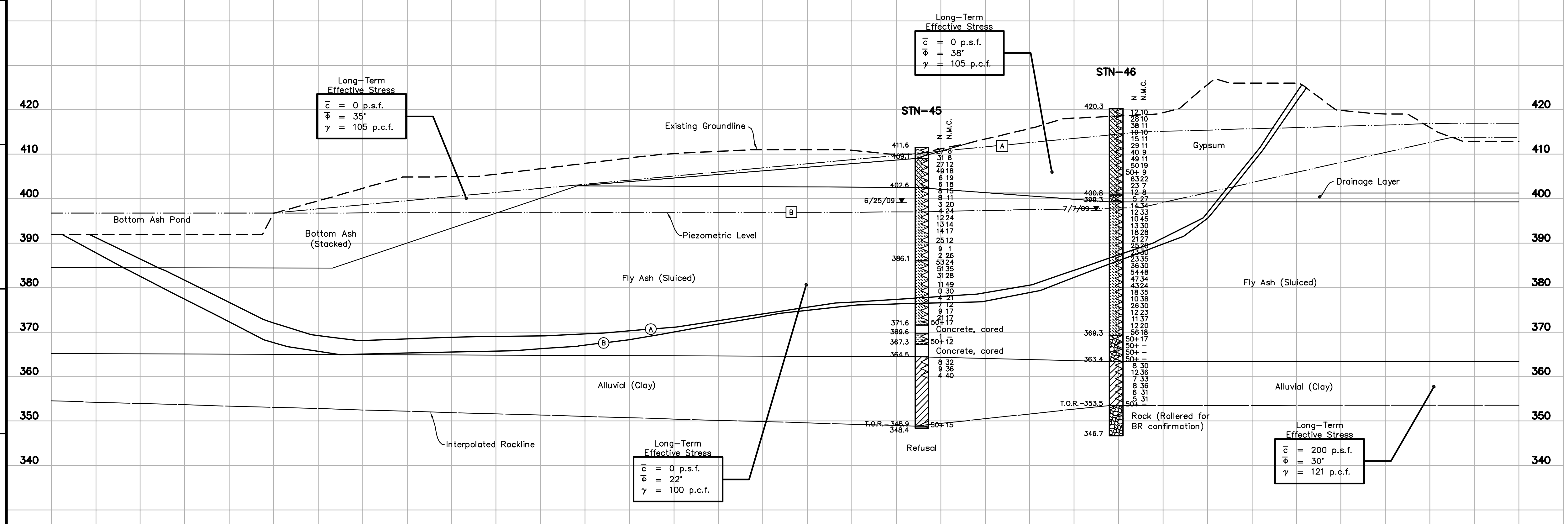
STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

PLOT DATE: 06/10/2010 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\REV0_RECORD\R2000\10W543-19-R0.DWG

46 C 10W543-20



SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	2.5
B	Spencer's Method (Optimized)	2.5

NOTE:

1. Presence of drainage layer beneath gypsum was ignored for the slope stability analysis.

LEGEND

- Gypsum, white–tan, damp to wet, stiff to very stiff.
- Bottom Ash, dark brown to black, damp to wet, loose to dense.
- Fly Ash, gray to dark gray, damp to wet, very soft to very stiff.
- Lean Clay, light brown, red–brown and gray (varies), damp to wet, very soft to very stiff, sometimes mottled.
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- Silty Sand, brown, wet, loose to very dense.
- Clayey Sand, reddish brown to gray, damp to wet, loose to very dense
- Silty Gravel, brown, wet, loose to dense.
- Clayey Gravel, reddish brown to brown, damp to wet, dense.
- Shale, gray to dark gray, soft, highly to completey weathered.
- Limestone, very light gray to gray, weathered, hard.
- Rock/Gravel
- Topsoil

◁	Standard Penetration Test Interval
■	Undisturbed Thin–Walled (Shelby) Tube Sample
N	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
03/31/09 ▽	Water Level and Date Recorded
T.O.R.–	Top of Rock (Indicates the beginning of rock–like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C.–	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide–tipped tooth auger bit
No Refusal	No Refusal Encountered

PLOT DATE: 06/10/2010 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\REVD_RECORD\R2000\10W543-20-R0.DWG

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK AND GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION DRY FLY ASH STACK STABILITY SECTION 0 – EX. CONDITIONS

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 06/11/10	46	C	10W543–20	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

Appendix C

Boring Logs

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SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-1**	Total Depth	30.0 ft
County	Stewart, TN	Surface Elevation	392.6 ft		
Project Type	HSA 4.25	Date Started	5/28/09	Completed	7/10/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	9.2 ft	Date/Time	5/28/09
Logged By	D. Rogers	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
392.6	0.0	Top of Hole							
		Bottom Ash, dark gray to black, damp, medium dense to very dense		SPT-1	0.0 - 1.5	1.1	5-7-11	11	
				SPT-2	1.5 - 3.0	1.4	16-17-19	9	
				SPT-3	3.0 - 4.5	1.5	17-17-17	9	
386.6	6.0			SPT-4	4.5 - 6.0	1.4	9-11-50+/.4	11	Lost Auger at 21.0' back filled B-1A with cuttings.
		Boulders, hard with silty clay, brown, very stiff, moist to wet							
				SPT-5	8.0 - 9.0	0.7	33-50+/.2	4	
				SPT-6	9.0 - 10.5	0.1	50+/.2	5	Moved 3 feet south along dike and bored B-1A to a depth of 8.0', encountered rock zone, back filled B-1A with cuttings, moved 3 feet south along dike from B-1A to B-1B, augered to a depth of 10.0' backfilled with cuttings.
				SPT-7	10.5 - 12.0	0.4	10-17-50+/.2	7	
				SPT-8	12.0 - 13.5	0.2	50+/.2	13	
				SPT-9	13.5 - 15.0	0.9	14-19-21	9	
				SPT-10	15.0 - 16.5	0.5	3-6-6	14	
				SPT-11	16.5 - 18.0	0.8	7-8-10	17	
				SPT-12	19.5 - 21.0	0.5	2-3-5	15	
				SPT-13	21.0 - 22.5	0.4	3-6-7	17	
									Redrilled with 4.25" HSA, broke augers @ 30 feet.
				SPT-14	25.5 - 27.0	0.6	5-6-6	--	
				SPT-15	27.0 - 28.5	1.5	5-12-9	--	
				SPT-16	28.5 - 28.9	0.4	50+/0.4	--	
362.6	30.0								
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

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SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-2** Total Depth 103.9 ft
County	Stewart, TN	Surface Elevation	406.5 ft
Project Type	HSA 3.25	Date Started	5/29/09 Completed 5/30/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	17.0 ft Date/Time 5/29/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
406.5	0.0	Top of Hole							
		Bottom Ash, dark gray to black, damp to wet, very dense to very loose, with occasional interbedded layers of fly ash and clay.		SPT-1	0.0 - 1.5	1.3	5-15-25	21	
				SPT-2	1.5 - 3.0	1.1	5-6-11	11	
				SPT-3	3.0 - 4.5	1.0	9-19-20	9	
				SPT-4	5.0 - 6.0	1.0	25-50	22	
				SPT-5	7.5 - 9.0	1.5	8-8-10	8	
				SPT-6	10.0 - 11.5	1.0	7-9-12	9	revert used from 17.0 to bottom of hole.
				SPT-7	12.5 - 14.0	1.3	1-2-4	38	
				SPT-8	15.0 - 16.5	1.4	WOR-WOR-WOR	28	
				SPT-9	17.5 - 19.0	1.2	2-4-3	30	
				SPT-10	20.0 - 21.5	0.4	WOH-1-1	31	strong organic odor from 12.5 to 16.5 in a clay layer
				SPT-11	22.5 - 24.0	1.1	WOH-7-13	39	
				SPT-12	25.0 - 26.5	1.5	WOR-WOR-1	29	
				SPT-13	27.5 - 29.0	1.5	1-1-2	30	
				SPT-14	30.0 - 31.5	0.3	1-1-2	32	strong hydrocarbon smell from 30.0 to 51.5
				SPT-15	32.5 - 34.0	1.1	4-10-10	22	
				SPT-16	35.0 - 36.5	1.0	5-7-13	18	Fly ash layers from 5.0-6.0, 25.0-29.0, 40.0-41.5,

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No. **STN-2**	Total Depth 103.9 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Bottom Ash, dark gray to black, damp to wet, very dense to very loose, with occasional interbedded layers of fly ash and clay. *(Continued)*		SPT-17	37.5 - 39.0	1.1	7-7-7	28	45.0-49.0
				SPT-18	40.0 - 41.5	1.0	3-5-5	40	
				SPT-19	42.5 - 44.0	1.1	WOH-WOH-WOH	31	
				SPT-20	45.0 - 46.5	1.4	WOR-2-2	43	
				SPT-21	47.5 - 49.0	1.5	WOH-1-1	64	
				SPT-22	50.0 - 51.5	1.5	WOR-WOH-1	50	
352.9	53.6			SPT-23	52.5 - 54.0	1.0	WOH-2-4	26	
		Lean Clay, brown to light gray, moist to wet, stiff to very stiff, (CL)		SPT-24	55.0 - 56.5	1.1	3-5-7	26	
				SPT-25	57.5 - 59.0	1.2	3-8-9	27	
				SPT-26	60.0 - 61.5	1.3	2-6-9	27	
				SPT-27	62.5 - 64.0	1.5	4-6-7	26	
				SPT-28	65.0 - 66.5	1.5	WOR-5-7	29	
				SPT-29	67.5 - 69.0	1.3	4-6-7	27	
336.5	70.0								
		Clayey Sand With Gravel, brown to light gray, wet, very loose to dense, (SC) (Visual)		SPT-30	70.0 - 71.5	0.5	2-3-4	32	
				SPT-31	72.5 - 74.0	0.9	11-14-25	27	
330.0	76.5			SPT-32	75.0 - 76.5	0.7	6-12-8	29	

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-2** Total Depth 103.9 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Gravel With Silt And Sand, gray, wet, medium dense to dense, (GM) *(Continued)*		SPT-33	77.5 - 79.0	0.9	11-9-12	27	
				SPT-34	80.0 - 81.5	0.6	19-26-24	20	
				SPT-35	82.5 - 84.0	0.7	5-4-12	20	
				SPT-36	85.0 - 86.5	0.9	8-8-8	32	
				SPT-37	87.5 - 89.0	1.1	31-26-27	16	
				SPT-38	90.0 - 91.5	1.1	19-25-20	18	
				SPT-39	92.5 - 94.0	0.6	12-13-15	27	
				SPT-40	95.0 - 96.5	1.2	13-15-5	23	
				SPT-41	97.5 - 99.0	0.3	WOR-WOR-WOR	30	
				SPT-42	102.0 - 103.0	0.5	WOR-2-5	27	Void from 100.0 to 102.0 no revert recovery, boring backfilled with 4 bags of Quikgrout and 4 bags of portland cement.
302.6	103.9			SPT-43	103.6 - 103.9	0.2	50+/0.3	15	
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-3** Total Depth 72.0 ft
County	Stewart, TN	Surface Elevation	394.8 ft
Project Type	HSA 4.25	Date Started	7/13/09 Completed 7/14/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	14.6 ft Date/Time 7/13/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
394.8	0.0	Top of Hole							
		Bottom Ash, dark brown gray, damp, loose, some flyash intermixed		SPT-1	0.0 - 1.5	1.0	1-3-3	8	
				SPT-2	1.5 - 3.0	1.1	1-2-2	9	
390.5	4.3			SPT-3	3.0 - 4.5	1.2	1-2-2	12	
		Fat Clay, dark brown, damp, medium stiff to stiff, (CH)		SPT-4	4.5 - 6.0	1.0	2-3-3	22	SI installed to 71.0'
				SPT-5	6.0 - 7.5	0.5	5-5-6	22	
				SPT-6	7.5 - 9.0	0.7	2-4-4	16	
				SPT-7	9.0 - 10.5	1.2	2-3-4	20	
383.0	11.8			SPT-8	10.5 - 12.0	0.7	1-2-3	26	
		Lean Clay, light brown, damp, soft to very stiff, (CL)		SPT-9	12.0 - 13.5	1.0	2-3-3	27	
				SPT-10	13.5 - 15.0	0.9	0-1-3	31	
				SPT-11	15.0 - 16.5	1.2	1-2-3	25	
				SPT-12	16.5 - 18.0	1.3	2-4-13	32	
				SPT-13	18.0 - 19.5	1.0	10-12-13	7	
				SPT-14	19.5 - 21.0	1.0	7-18-8	8	
372.9	21.9			SPT-15	21.0 - 21.9	0.5	0-50+	22	
		Lean Clay, light brown, very soft to stiff, with rock fragments, some boulders (CL)		SPT-16	22.5 - 22.5	0.0	50+	--	boulders 21.9-23.6 28-29
				SPT-17	24.0 - 25.5	0.4	1-0-0	18	
				SPT-18	25.5 - 27.0	0.6	1-1-1	26	
				SPT-19	27.0 - 28.5	0.9	33-7-7	21	
				SPT-20	28.5 - 30.0	0.9	0-3-3	28	
				SPT-21	30.0 - 31.5	0.3	4-7-1	23	rock fragment blocked spoon
				SPT-22	31.5 - 33.0	0.2	4-8-8	18	
360.9	33.9			SPT-23	33.0 - 34.5	1.3	7-14-3	35	
358.8	36.0	Lean Clay, red brown, wet, stiff, with coarse sand, some gravel (CL)		SPT-24	34.5 - 36.0	1.1	0-6-3	34	

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SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-3
		Total Depth	72.0 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, gray with brown, moist, very stiff to stiff, (CL) *(Continued)*		SPT-25	36.0 - 37.5	1.5	6-2-5	23	
				SPT-26	37.5 - 39.0	1.5	4-5-6	25	siltier zone
				SPT-27	39.0 - 40.5	1.5	1-2-4	24	trace organics 36.0-42.0
				SPT-28	40.5 - 42.0	1.5	2-2-6	23	
				SPT-29	42.0 - 43.5	1.5	2-4-8	25	with weathered shale fragments
350.8	44.0								
		Lean Clay, brown with gray, moist, very stiff, mottled (CL)		SPT-30	43.5 - 45.0	1.5	3-5-7	22	
				SPT-31	45.0 - 46.5	1.3	5-10-12	23	
				SPT-32	47.5 - 49.0	1.5	3-5-7	23	
				SPT-33	50.0 - 51.5	0.3	5-7-12	38	gravel block spoon
				SPT-34	52.5 - 54.0	1.0	4-5-6	25	
				SPT-35	55.0 - 56.5	0.1	2-7-9	30	
337.3	57.5								
		Lean Clay, green gray to light gray, moist, medium stiff, mottled (CL)		SPT-36	57.5 - 59.0	1.5	6-2-3	34	
				SPT-37	60.0 - 61.5	1.5	2-7-9	42	
331.8	63.0								
		Highly weathered shale interbedded with limestone fragments (Augered) (Refusal 67.3')		SPT-38	62.5 - 64.0	1.0	7-13-15	14	
				SPT-39	65.0 - 66.3	0.9	22-17-50+	9	
327.5	67.3								Began Core
		Roller Bit used (for Slope Inclinometer socket)							
322.8	72.0				4.7	0.0	0	72.0	

Bottom of Hole

Top of Rock = 63.0
Elevation (331.8)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-3A**
		Total Depth	38.0 ft
County	Stewart, TN	Surface Elevation	394.8 ft
Project Type	HSA	Date Started	7/15/09
		Completed	7/15/09
Supervisor	D. Rogers	Driller	J. Felts
Depth to Water	Dry	Date/Time	7/15/09
Logged By	D. Rogers	Depth to Water	N/A
		Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
394.8	0.0	Top of Hole							
390.5	4.3	Bottom Ash, dark brown-gray, damp, loose, some flyash intermixed							
383.0	11.8	Fat Clay, dark brown, damp, stiff, (CH)		ST-1	8.0 - 10.0	2.0		--	PZ installed screen 27.5-37.5
372.9	21.9	Lean Clay, light brown, damp, medium stiff, (CL)		ST-2	14.0 - 16.0	2.0		--	
360.9	33.9	Lean Clay, light brown, stiff, with rock fragments, some boulders (CL)							
358.8	36.0	Lean Clay, red brown, wet, very stiff, with coarse sand, some gravel (CL)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-3A
		Total Depth	38.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
356.8	38.0	Lean Clay, gray with brown, moist, stiff, (CL) *(Continued)*							
		No Refusal / Bottom of Hole							

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SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-4** Total Depth 79.3 ft
County	Stewart, TN	Surface Elevation	393.9 ft
Project Type	HSA 3.25	Date Started	5/30/09 Completed 5/31/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	12.0 ft Date/Time 5/30/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
393.9	0.0	Top of Hole						
		Bottom Ash, dark gray to black, moist, medium dense	SPT-1	0.0 - 1.5	0.9	4-4-6	11	
			SPT-2	1.5 - 3.0	1.5	6-6-7	9	
389.4	4.5		SPT-3	3.0 - 4.5	1.0	4-3-4	8	
		Fly Ash, gray to light gray, moist to wet, medium stiff to soft, from 6.0 to 7.5 a layer of light gray silt with organics.	SPT-4	4.5 - 6.0	0.9	3-2-2	9	
			SPT-5	6.0 - 7.5	0.5	3-4-1	29	
			SPT-6	7.5 - 9.0	1.4	WOH- WOH-	77	
			SPT-7	9.0 - 10.5	1.5	WOH WOH-	50	boring backfilled with 2 bags Quikgrout and 2 bags portland cement.
			SPT-8	10.5 - 12.0	1.5	WOH- WOH	50	
			SPT-9	12.0 - 13.5	1.5	WOR- WOH-	45	
			SPT-10	13.5 - 15.0	1.5	WOH WOR-	66	
			SPT-11	15.0 - 16.5	1.5	WOR- WOH	40	
			SPT-12	16.5 - 18.0	1.3	WOH- WOH-	42	
			SPT-13	18.0 - 19.5	1.4	WOH WOH-	39	
			SPT-14	19.5 - 21.0	1.5	WOH- WOH	41	
			SPT-15	21.0 - 22.5	1.5	WOH- WOH-	38	
			SPT-16	22.5 - 24.0	1.2	WOH WOR-	41	
			SPT-17	24.0 - 25.5	1.5	WOR- WOR	44	
			SPT-18	25.5 - 27.0	1.5	WOR- WOR-	45	
			SPT-19	27.0 - 28.5	1.5	WOR WOH-	42	
			SPT-20	28.5 - 30.0	1.5	WOH- WOH	49	
			SPT-21	30.0 - 31.5	1.5	WOR- WOR-	50	
			SPT-22	31.5 - 33.0	1.3	WOR WOR-	42	
			SPT-23	33.0 - 34.5	1.3	WOR- WOR	43	
			SPT-24	34.5 - 36.0	1.5	WOR- WOR-	45	

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-4** Total Depth 79.3 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fly Ash, gray to light gray, moist to wet, medium stiff to soft, from 6.0 to 7.5 a layer of light gray silt with organics. *(Continued)*		SPT-25	36.0 - 37.5	1.5	WOR	38	
				SPT-26	37.5 - 39.0	1.5	WOR- WOR-	45	
				SPT-27	39.0 - 40.5	1.5	WOH WOR-	40	
351.4	42.5			SPT-28	40.5 - 42.0	1.5	WOR- WOR	35	
		Silty Clay, gray to brown, moist to wet, soft to very soft, manganese concretions (CL)		SPT-29	42.0 - 43.5	1.5	WOR- WOR-	44	
				SPT-30	43.5 - 45.0	1.2	WOR WOR-	30	
				SPT-31	45.0 - 46.5	0.7	WOR- WOR WOR-	29	
				SPT-32	47.5 - 49.0	1.3	WOH-3 WOR- WOR-	30	
				SPT-33	50.0 - 51.5	0.7	WOR WOH-1-1 WOR-	24	
				SPT-34	52.5 - 54.0	1.1	WOR- WOR WOR- WOH-	23	
				SPT-35	55.0 - 56.5	1.2	WOH WOR- WOH-	27	
334.9	59.0			SPT-36	57.5 - 59.0	1.0	WOH WOR- WOR-3	27	
		Silt, gray, wet, stiff to soft, (ML) (Visual)		SPT-37	60.0 - 61.5	0.8	5-5-8 1-5-5 4-8-8 3-6-9	29	
				SPT-38	62.5 - 64.0	0.9	WOR-7-8 1-8-5 WOR-4-5	28	
327.4	66.5			SPT-39	65.0 - 66.5	1.2	WOH- WOH- WOH	28	
		Gravel With Silt And Sand, gray, wet, very stiff, (GM)		SPT-40	67.5 - 69.0	1.0	WOH- WOH-3 WOH- WOH-4	21	
				SPT-41	70.0 - 71.5	0.9	7-24-33 22-28-37	16	
				SPT-42	72.5 - 74.0	0.8	14-21-14	20	
317.4	76.5			SPT-43	75.0 - 76.5	0.6	WOH-14- 22	19	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-4**	Total Depth	79.3 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
314.6	79.3	Hightly weathered limestone *(Continued)*		SPT-44	77.5 - 78.3	0.3	WOR-WOR-50+/.3	26	
		Auger Refusal / Bottom of Hole Top of Rock = 77.5 Elevation (316.4)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-5**	Total Depth	49.7 ft
County	Stewart, TN	Surface Elevation	377.9 ft		
Project Type	HSA 3.25	Date Started	6/11/09	Completed	6/12/09
Supervisor	D. Rogers Driller Greg Thompson	Depth to Water	26.6 ft	Date/Time	6/12/09
Logged By	Russell Mehnert	Depth to Water	N/A	Date/Time	N/A

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
377.9	0.0	Top of Hole							
		Lean Clay, grayish brown, damp, stiff, with wood, roots, manganese concretions and chert fragments (CL)		SPT-1	0.0 - 1.5	1.0	4-4-6	19	
				SPT-2	1.5 - 3.0	0.8	3-5-7	21	Boring backfilled with (2) bags Quikgrout and (1) bag portland cement
				SPT-3	3.0 - 4.5	1.3	4-5-6	20	
371.9	6.0			SPT-4	4.5 - 6.0	1.3	2-5-8	21	
		Lean Clay, reddish brown to grayish brown, damp to wet, very soft to very stiff, with areas of sand, occasional gray mottling, manganese concretions and chert fragments (CL)		SPT-5	6.0 - 7.5	1.3	7-11-11	22	
				SPT-6	7.5 - 9.0	1.2	2-5-6	24	
				SPT-7	9.0 - 10.5	1.1	2-4-6	23	
				SPT-8	10.5 - 12.0	1.5	2-3-5	28	
				SPT-9	12.0 - 13.5	1.0	3-8-18	25	layer of gravel (13.2'-13.5')
				SPT-10	13.5 - 15.0	0.8	4-4-8	25	
				SPT-11	15.0 - 16.5	1.3	4-4-4	23	
				SPT-12	16.5 - 18.0	1.5	3-4-3	23	
				ST-1	18.0 - 20.0	1.9		--	
				ST-2	20.0 - 22.0	0.8		--	
				SPT-13	22.0 - 23.5	1.5	4-5-6	22	
				SPT-14	23.5 - 25.0	1.3	6-6-7	27	
				SPT-15	25.0 - 26.5	0.3	6-7-8	27	
				SPT-16	26.5 - 28.0	0.0	4-9-10	--	wet @ 26.6'
				SPT-17	28.0 - 29.5	1.5	3-4-5	31	
				SPT-18	29.5 - 31.0	1.0	3-3-2	33	
				SPT-19	31.0 - 32.5	1.3	4-2-4	34	
				SPT-20	32.5 - 34.0	0.5	2-2-2	35	
				SPT-21	34.0 - 35.5	1.5	2-4-5	35	
				SPT-22	35.5 - 37.0	1.4	2-5-4	38	

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-5
		Total Depth	49.7 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, reddish brown to grayish brown, damp to wet, very soft to very stiff, with areas of sand, occasional gray mottling, manganese concretions and chert fragments (CL) *(Continued)*		SPT-23	37.0 - 38.5	1.3	4-4-4	32	
				SPT-24	38.5 - 40.0	1.3	3-3-3	31	
				SPT-25	40.0 - 41.5	1.5	3-4-5	29	
				SPT-26	41.5 - 43.0	1.5	3-3-3	31	
				SPT-27	43.0 - 44.5	0.7	WOH-7-2	38	sandy zone stating @ 43.0' very silty fat clay starting @ 44.5'
				SPT-28	44.5 - 46.0	1.5	WOH-WOH-WOH	70	
				SPT-29	46.0 - 47.5	1.0	WOH-2-4	66	
				SPT-30	47.5 - 49.0	0.8	WOH-2-3	54	
328.3	49.6			SPT-31	49.0 - 49.7	0.3	10-50+/0.2	31	
328.2	49.7	Weathered limestone, gray to light gray, moderately hard.							

Auger Refusal / Bottom of Hole

Top of Rock = 49.7 Elevation (328.2)

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-6** Total Depth 65.0 ft
County	Stewart, TN	Surface Elevation	394.3 ft
Project Type	HSA 3.25	Date Started	4/30/09 Completed 4/30/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	12.0 ft Date/Time 4/30/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
394.3	0.0	Top of Hole							
		Fat Clay, reddish brown, plastic, moist, medium stiff to stiff, (CH)		SPT-1	0.0 - 1.5	1.3	4-5-6	18	
				SPT-2	1.5 - 3.0	1.0	6-7-8	23	
				SPT-3	3.0 - 4.5	1.5	5-9-9	18	
				SPT-4	4.5 - 6.0	1.2	5-6-7	20	
				SPT-5	6.0 - 7.5	0.8	6-5-5	19	
				SPT-6	7.5 - 9.0	1.2	10-4-5	23	
				SPT-7	9.0 - 10.5	1.4	9-9-11	17	
				SPT-8	10.5 - 12.0	0.8	2-3-4	29	
				SPT-9	12.0 - 13.5	1.4	3-6-7	29	
379.3	15.0			SPT-10	13.5 - 15.0	1.5	11-8-12	20	
		Lean Clay, brown, plastic, moist to wet, medium stiff to very stiff, (CL)		SPT-11	15.0 - 16.5	1.3	5-5-8	26	
				SPT-12	16.5 - 18.0	0.6	18-37-39	21	
				SPT-13	18.0 - 19.5	1.3	10-9-8	28	
				SPT-14	19.5 - 21.0	0.7	7-9-11	25	
				SPT-15	21.0 - 22.5	0.6	7-9-11	46	
				SPT-16	22.5 - 24.0	0.2	2-4-6	42	
				SPT-17	24.0 - 25.5	0.6	3-4-3	40	
				SPT-18	25.5 - 27.0	1.0	3-4-12	26	
				SPT-19	27.0 - 28.5	0.9	20-13-9	30	
				SPT-20	28.5 - 30.0	0.6	7-6-9	30	
				SPT-21	30.0 - 31.5	0.7	3-4-3	24	
				SPT-22	31.5 - 33.0	0.4	2-2-2	37	
				SPT-23	33.0 - 34.5	1.5	4-4-6	25	
359.2	35.1			SPT-24	34.5 - 36.0	1.2	0-3-2	28	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-6
		Total Depth	65.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Lean Clay, gray, slightly plastic, moist, medium stiff to stiff, organic odor 35'-38' (CL) *(Continued)*		SPT-25	36.0 - 37.5	0.7	2-6-3	26	
				SPT-26	37.5 - 39.0	1.3	3-2-4	27	
				SPT-27	40.0 - 41.5	1.5	3-3-5	26	
350.3	44.0			SPT-28	42.5 - 44.0	0.8	2-3-5	27	
		Gravel With Clay, brown, slightly plastic, wet, medium dense to loose, (GM)		SPT-29	45.0 - 46.5	1.3	5-5-7	26	
				SPT-30	47.5 - 49.0	1.5	4-5-8	24	
				SPT-31	50.0 - 51.5	1.5	8-8-9	35	
				SPT-32	52.5 - 54.0	1.5	8-9-8	23	
				SPT-33	55.0 - 56.5	1.5	5-4-4	39	
				SPT-34	57.5 - 59.0	1.5	9-4-4	33	
				SPT-35	60.0 - 61.5	1.5	5-5-8	18	
331.2	63.1			SPT-36	62.5 - 64.0	1.5	12-4-3	--	
329.3	65.0	Weathered limestone, gray to light gray, moderately hard.		SPT-37	65.0 - 65.1	0.0	50+/0.1	--	

Auger Refusal / Bottom of Hole

Top of Rock = 63.1 Elevation (331.2)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-7** Total Depth 79.9 ft
County	Stewart, TN	Surface Elevation	402.7 ft
Project Type	HSA 3.25	Date Started	6/18/09 Completed 6/19/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	Dry Date/Time 6/19/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
402.7	0.0	Top of Hole							
		Bottom Ash, dark gray to black, moist, medium dense to dense		SPT-1	0.0 - 1.5	1.2	2-7-10	8	
				SPT-2	1.5 - 3.0	1.1	2-11-11	8	
				SPT-3	3.0 - 4.5	9.0	7-11-15	8	
				SPT-4	4.5 - 6.0	1.1	12-19-27	9	
				SPT-5	6.0 - 7.5	1.2	37-36-31	9	
				SPT-6	7.5 - 9.0	1.2	16-21-25	9	
				SPT-7	9.0 - 10.5	1.1	21-22-24	11	
				SPT-8	10.5 - 12.0	1.2	9-9-7	22	flyash and bottom ash interlensed 10.5'-12.0'
389.2	13.5			SPT-9	12.0 - 13.5	1.3	6-6-5	29	
		Fly Ash, gray to light gray, moist to wet, soft to medium stiff		SPT-10	13.5 - 15.0	1.0	3-4-3	33	
				SPT-11	15.0 - 16.5	0.7	0-0-6	26	
				SPT-12	16.5 - 18.0	1.1	3-9-12	46	
				SPT-13	18.0 - 19.5	0.8	1-2-2	37	
				SPT-14	19.5 - 21.0	1.2	0-0-1	38	
				SPT-15	21.0 - 22.5	1.3	0-0-0	43	
				SPT-16	22.5 - 24.0	1.5	0-0-0	43	
377.4	25.3			SPT-17	24.0 - 25.5	1.5	0-0-0	36	
		Bottom Ash, dark gray to gray, wet, medium dense to dense		SPT-18	25.5 - 27.0	0.5	0-0-0	27	
				SPT-19	27.0 - 28.5	1.1	5-6-7	21	
				SPT-20	28.5 - 30.0	1.0	6-5-5	23	
				SPT-21	30.0 - 31.5	0.8	5-6-7	18	
				SPT-22	31.5 - 33.0	0.7	2-5-6	24	
				SPT-23	33.0 - 34.5	0.9	9-12-12	21	
				SPT-24	34.5 - 36.0	1.1	12-11-10	17	

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-7

Total Depth: 79.9 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
365.4	37.3			SPT-25	36.0 - 37.5	1.3	6-6-9	17	
		Fly Ash, gray to light gray, moist to wet, very soft		SPT-26	37.5 - 39.0	0.3	2-1-1	39	
				SPT-27	39.0 - 40.5	0.4	0-0-0	40	
				SPT-28	40.5 - 42.0	1.5	0-0-0	45	
				SPT-29	42.0 - 43.5	1.5	0-0-0	39	
				SPT-30	43.5 - 45.0	1.3	0-0-0	47	
				SPT-31	45.0 - 46.5	1.2	0-0-0	45	
				SPT-32	46.5 - 48.0	1.5	0-1-2	46	
				SPT-33	48.0 - 49.5	1.5	0-0-0	45	
352.4	50.3			SPT-34	49.5 - 51.0	1.5	0-0-3	28	
		Lean Clay, gray to brown, wet, soft to stiff, silty to sandy (CL)		SPT-35	51.0 - 52.5	0.7	3-4-4	33	
				SPT-36	52.5 - 54.0	1.4	4-4-4	35	
				SPT-37	55.0 - 56.5	1.5	1-1-2	33	
				SPT-38	57.5 - 59.0	0.9	8-7-5	25	
				SPT-39	60.0 - 61.5	0.8	5-7-9	24	
				SPT-40	62.5 - 64.0	1.2	5-7-8	24	
				SPT-41	65.0 - 66.5	1.0	3-4-4	23	silty to sandy transition 62.5'-68.5'
				SPT-42	67.5 - 68.3	0.5	7-50+/0.3	26	
				SPT-43	70.0 - 71.5	0.6	3-21-17	11	
				SPT-44	72.5 - 73.1	0.0	12-50+/0.1	--	
				SPT-45	75.0 - 75.6	0.1	34-50+/0.1	21	
				SPT-46	77.5 - 77.6	0.1	50+/0.1	9	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-7
		Total Depth	79.9 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
322.8	79.9								

Auger Refusal /
Bottom of Hole

Top of Rock = 79.9
Elevation (322.8)

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-8 — Total Depth 43.3 ft
County	Stewart, TN	Surface Elevation	380.8 ft
Project Type	HSA 3.25	Date Started	6/12/09 — Completed 6/12/09
Supervisor	D. Rogers — Driller Greg Thompson	Depth to Water	10.2 ft — Date/Time 6/12/09
Logged By	Russell Mehnert	Depth to Water	N/A — Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
380.8	0.0	Top of Hole						
		Lean Clay, grayish brown, damp to wet, stiff, with wood, roots, manganese concretions and chert fragments (CL)	SPT-1	0.0 - 1.5	0.6	2-4-8	19	
			SPT-2	1.5 - 3.0	0.8	8-10-11	15	Boring backfilled with (2) bags Quik Grout and (1) Portland Cement
			SPT-3	3.0 - 4.5	1.4	6-8-11	18	
			SPT-4	4.5 - 6.0	1.3	5-7-7	19	
			SPT-5	6.0 - 7.5	1.2	8-5-6	28	
			SPT-6	7.5 - 9.0	1.2	2-4-6	19	
			SPT-7	9.0 - 10.5	1.4	3-2-3	23	wet @ 10.2'
			SPT-8	10.5 - 12.0	0.8	1-2-2	23	
			SPT-9	12.0 - 13.5	1.5	3-2-4	25	
			SPT-10	13.5 - 15.0	1.4	1-2-2	26	
			SPT-11	15.0 - 16.5	1.1	1-2-2	30	
			SPT-12	16.5 - 18.0	1.3	2-2-3	29	
362.3	18.5		SPT-13	18.0 - 19.5	1.5	0-2-2	27	light organic smell (18.5'-22.0')
		Lean Clay, brown and gray, wet, soft to medium stiff, faint organic smell (CL)	SPT-14	19.5 - 21.0	1.5	0-1-2	25	
358.8	22.0		SPT-15	21.0 - 22.5	1.5	2-3-3	23	
		Lean Clay, brown and tan, moist to wet, medium stiff to very stiff, with areas of sand, occasional gray mottling, manganese concretions and chert fragments (CL)	SPT-16	22.5 - 24.0	1.5	1-3-4	24	
			SPT-17	24.0 - 25.5	1.5	2-5-6	20	
			SPT-18	25.5 - 27.0	1.5	2-4-6	20	
			SPT-19	27.0 - 28.5	1.5	5-7-7	21	
			SPT-20	28.5 - 30.0	0.5	8-9-7	19	
			SPT-21	30.0 - 31.5	0.5	5-8-10	22	
			SPT-22	31.5 - 33.0	0.7	11-14-15	22	
			SPT-23	33.0 - 34.5	1.5	3-5-7	24	
			SPT-24	34.5 - 36.0	1.5	3-4-5	29	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-8**	Total Depth	43.3 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	36.0 - 37.5	1.5	5-7-6	33	
				SPT-29	42.0 - 32.8	0.7	30-50+/0.3	16	
				SPT-26	37.5 - 39.0	1.4	1-5-8	21	
340.3	40.5			SPT-27	39.0 - 40.5	1.5	2-3-9	20	
337.5	43.3	Shale, brown, soft to moderately hard, thin bedded, highly weathered		SPT-28	40.5 - 41.9	1.2	0-30-50+/0.4	13	

Auger Refusal /
Bottom of Hole

Top of Rock = 40.5
Elevation (340.3)

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-9** Total Depth 56.8 ft
County	Stewart, TN	Surface Elevation	394.7 ft
Project Type	HSA 3.25	Date Started	5/4/09 Completed 5/5/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	17.5 ft Date/Time 5/4/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
394.7	0.0	Top of Hole							
		Fat Clay, reddish brown, plastic, moist, firm to very stiff, (CH)		SPT-1	0.0 - 1.5	1.0	3-5-6	22	
				SPT-2	1.5 - 3.0	1.2	7-8-10	20	
				SPT-3	3.0 - 4.5	1.4	4-3-3	22	
				SPT-4	4.5 - 6.0	1.5	5-8-8	18	
387.7	7.0			SPT-5	6.0 - 7.5	1.4	8-7-10	21	
		Lean Clay, brown, plastic, moist to wet, firm to very stiff, (CL)		SPT-6	7.5 - 9.0	0.8	9-8-7	20	
				SPT-7	9.0 - 10.5	1.2	7-9-12	27	PZ install 46.5-56.5 screened zone.
				SPT-8	10.5 - 12.0	1.2	9-11-13	25	
				SPT-9	12.0 - 13.5	1.4	13-14-14	20	
				SPT-10	13.5 - 15.0	0.9	4-3-6	22	
				SPT-11	15.0 - 16.5	1.1	4-6-9	27	
				SPT-12	16.5 - 18.0	1.5	11-17-19	21	
				SPT-13	18.0 - 19.5	1.2	8-9-10	17	
				SPT-14	19.5 - 21.0	0.9	7-6-9	20	Bulk samples from 0.0-6.0, 9.0-12.0
				SPT-15	21.0 - 22.5	0.5	12-7-10	26	
				SPT-16	22.5 - 24.0	0.7	5-4-4	21	
				SPT-17	24.0 - 25.5	0.6	2-3-12	17	
				SPT-18	25.5 - 27.0	0.5	3-3-3	15	
				SPT-19	27.0 - 28.5	0.8	2-6-7	32	
				SPT-20	28.5 - 30.0	0.1	8-2-1	4	
363.2	31.5			SPT-21	30.0 - 31.5	0.4	2-3-2	21	
		Lean Clay, gray, slightly plastic, moist, soft to very stiff, organic odor 31'-35' (CL)		SPT-22	31.5 - 33.0	0.8	1-2-2	27	
				SPT-23	33.0 - 34.5	1.1	1-2-3	28	
				SPT-24	35.0 - 36.5	1.1	0-3-2	26	

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-9**	Total Depth	56.8 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, gray, slightly plastic, moist, soft to very stiff, organic odor 31'-35' (CL) *(Continued)*	SPT-25	37.5 - 39.0	1.5	6-6-11	22	
			SPT-26	40.0 - 41.5	1.1	8-12-18	19	
			SPT-27	42.5 - 44.0	1.5	8-9-13	25	
			SPT-28	45.0 - 46.5	1.3	6-7-11	20	
			SPT-29	47.5 - 49.0	1.5	9-9-12	25	
			SPT-30	50.0 - 51.5	1.1	8-8-11	25	
			SPT-31	52.5 - 54.0	1.3	8-6-7	26	
338.2	56.5		SPT-32	55.0 - 56.5	1.0	14-21-49	17	
337.9	56.8	Weathered limestone, gray to light gray, moderately hard.						

Auger Refusal / Bottom of Hole

Top of Rock = 56.5
Elevation (338.2)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-9 A** Total Depth 59.0 ft
County	Stewart, TN	Surface Elevation	394.7 ft
Project Type	HSA 4.25	Date Started	5/5/09 Completed 5/5/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	25.5 ft Date/Time 5/5/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
394.7	0.0	Top of Hole							
		Fat Clay, reddish brown, moist, medium stiff to very stiff, (CH)		ST-1	3.0 - 5.0	0.3		--	
387.7	7.0	Lean Clay, brown, moist to wet, medium stiff to very stiff, (CL)		ST-2	13.5 - 15.5	1.3		--	SI Installed to 59.0'
				ST-3	25.5 - 27.5	0.9		--	
363.2	31.5	Lean Clay, gray, moist, soft to very stiff, organic odor (CL)		ST-4	33.0 - 35.0	0.5		--	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-9 A**	Total Depth	59.0 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, gray, moist, soft to very stiff, organic odor (CL) *(Continued)*		ST-5	37.5 - 39.5	1.1		--	
341.0	53.7								Began Core
		Weathered limestone, gray to light gray, moderately hard.							
335.7	59.0			8	5.3	2.7	51	59.0	

Bottom of Hole

Top of Rock = 53.7
Elevation (341.0)

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-9 B**
		Total Depth	16.0 ft
County	Stewart, TN	Surface Elevation	394.7 ft
Project Type	HSA 3.25	Date Started	6/27/09
		Completed	6/27/09
Supervisor	D. Rogers	Driller	J. Felts
Depth to Water	Dry	Date/Time	6/27/09
Logged By	James Felts	Depth to Water	N/A
		Date/Time	N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
394.7	0.0	Top of Hole							
		Fat Clay, reddish brown, moist, firm to very stiff, (CH)		BAG-1	0.5 - 8.5			--	
387.7	7.0			ST-1	6.0 - 8.0	1.7		--	
		Lean Clay, brown, moist to wet, firm to very stiff, (CL)		ST-2	9.5 - 11.5	1.5		--	
				ST-3	14.0 - 16.0	1.3		--	
378.7	16.0								
378.2	16.5	No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-10** — Total Depth 60.2 ft
County	Stewart, TN	Surface Elevation	397.1 ft
Project Type	HSA 3.25	Date Started	6/16/09 — Completed 6/17/09
Supervisor	D. Rogers — Driller Mark Martin	Depth to Water	7.5 ft — Date/Time 6/16/09
Logged By	Ryan J Riker	Depth to Water	N/A — Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
397.1	0.0	Top of Hole							
		Bottom Ash, dark gray, damp, loose to medium dense, Bottom Ash, dark gray, medium to coarse grained, damp, meduim dense		SPT-1	0.0 - 1.5	1.1	4-4-3	14	PZ Installed, screen 47.0'-57.0'
				SPT-2	1.5 - 3.0	0.7	9-12-11	7	
				SPT-3	3.0 - 4.5	1.1	9-7-6	9	
				SPT-4	4.5 - 6.0	1.2	8-8-7	18	
389.6	7.5			SPT-5	6.0 - 7.5	1.1	3-3-5	19	
		Fly Ash, dark gray, moist to wet, soft to very stiff, Flyash, dark gray, soft to very stiff, moist to wet		SPT-6	7.5 - 9.0	1.0	3-2-1	19	Revert used below 11 feet
				SPT-7	9.0 - 10.5	1.3	3-7-8	47	
				SPT-8	10.5 - 12.0	1.0	3-5-6	49	
				SPT-9	12.0 - 13.5	1.0	6-4-3	35	
				SPT-10	13.5 - 15.0	1.0	4-2-2	28	
				SPT-11	15.0 - 16.5	1.2	0-7-1	39	
				SPT-12	16.5 - 18.0	0.7	0-4-3	46	
				SPT-13	18.0 - 19.5	1.1	1-1-2	39	
				SPT-14	19.5 - 21.0	1.1	1-1-1	34	
				SPT-15	21.0 - 22.5	1.5	1-1-1	38	
				SPT-16	22.5 - 24.0	0.0	0-0-0	--	
				SPT-17	24.0 - 25.5	1.5	0-0-0	43	
				SPT-18	25.5 - 27.0	1.4	0-0-0	35	
				SPT-19	27.0 - 28.5	1.0	0-0-0	48	
				SPT-20	28.5 - 29.9	1.4	1-9-50+/0.4	40	
				SPT-21	30.0 - 30.9	0.9	17-50+/0.4	31	
				SPT-22	31.5 - 31.9	0.4	50+/0.4	32	
				SPT-23	33.0 - 34.5	1.5	17-17-9	27	
				SPT-24	34.5 - 36.0	1.5	1-1-3	36	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-10**
		Total Depth	60.2 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
359.6	37.5			SPT-25	36.0 - 37.5	1.5	10-17-17	34	
		Lean Clay, gray to brown, wet, soft to very stiff, mottled, zones sandy, some gravel (CL)		SPT-26	37.5 - 39.0	0.6	0-3-4	23	
				SPT-27	39.0 - 40.5	0.9	0-0-0	36	
				SPT-28	40.5 - 42.0	0.5	4-7-10	25	
				SPT-29	42.0 - 43.5	0.6	4-15-15	23	
				SPT-30	45.0 - 46.5	1.2	7-9-8	19	
				SPT-31	47.5 - 49.0	1.3	10-15-19	23	
				SPT-32	50.0 - 51.5	1.3	10-16-21	18	
				SPT-33	52.5 - 54.0	1.4	11-15-19	26	
				SPT-34	55.0 - 56.5	1.5	1-3-4	22	
				SPT-35	57.5 - 58.6	0.7	3-4-50+/0.1	29	
336.9	60.2			SPT-36	60.0 - 60.2	0.2	50+/0.2	9	
		Auger Refusal / Bottom of Hole Top of Rock = 60.2 Elevation (336.9)							

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-11**	Total Depth	65.1 ft
County	Stewart, TN	Surface Elevation	378.8 ft		
Project Type	HSA 3.25	Date Started	6/12/09	Completed	6/13/09
Supervisor	D. Rogers Driller Greg Thompson	Depth to Water	8.5 ft	Date/Time	6/12/09
Logged By	Russell Mehnert	Depth to Water	N/A	Date/Time	N/A

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
378.8	0.0	Top of Hole							
		Lean Clay, brown and reddish brown, damp to moist, stiff to stiff, with gravel/cobble, roots, shale fragments, occasional gray mottling and manganese concretions (CL)		SPT-1	0.0 - 1.5	1.4	3-7-13	20	
				SPT-2	1.5 - 3.0	0.1	13-13-13	5	boring backfilled w/ 2 bag of portland cement and 2 bags of quik grout
				SPT-3	3.0 - 4.5	0.5	2-4-5	17	
				SPT-4	4.5 - 6.0	1.2	5-11-5	17	
				SPT-5	6.0 - 7.5	1.3	3-6-9	25	
				SPT-6	7.5 - 9.0	1.0	2-3-7	19	wet @ 8'
				SPT-7	9.0 - 10.5	1.3	3-5-6	24	
				SPT-8	10.5 - 12.0	1.0	3-4-9	23	
365.9	12.9			SPT-9	12.0 - 13.5	1.1	6-9-11	23	organic clay (12.9'-13.1')
		Lean Clay, brown and gray, moist to wet, soft to very stiff, with gravel/cobble, roots, occasional gray mottling and manganese concretions (CL)		SPT-10	13.5 - 15.0	1.5	4-7-10	23	
				SPT-11	15.0 - 16.5	1.4	4-7-7	25	
				SPT-12	16.5 - 18.0	1.5	6-10-11	22	
				SPT-13	18.0 - 19.5	1.3	2-6-8	22	
				SPT-14	19.5 - 21.0	0.4	2-5-7	22	
				SPT-15	21.0 - 22.5	1.5	3-6-10	20	
				SPT-16	22.5 - 24.0	1.4	2-2-3	25	
				SPT-17	24.0 - 25.5	1.5	1-3-3	24	
				SPT-18	25.5 - 27.0	1.5	2-3-4	23	
				SPT-19	27.0 - 28.5	1.5	5-6-6	24	
				SPT-20	28.5 - 30.0	1.5	3-3-5	23	
				SPT-21	30.0 - 31.5	1.5	3-4-6	25	
				SPT-22	31.5 - 33.0	1.2	1-2-3	25	
				SPT-23	33.0 - 34.5	1.5	3-4-5	24	
				SPT-24	34.5 - 36.0	1.5	3-4-4	21	

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-11**
		Total Depth	65.1 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 very stiff, with gravel/cobble, roots, occasional gray mottling and manganese concretions (CL) *(Continued)*		SPT-25	36.0 - 37.5	1.2	1-1-1	19	
				SPT-26	37.5 - 39.0	1.5	3-3-3	24	
				SPT-27	39.0 - 40.5	1.2	1-3-3	25	
				SPT-28	40.5 - 42.0	1.5	2-5-4	24	
335.6	43.2			SPT-29	42.0 - 43.5	1.5	6-5-5	31	
333.7	45.1	Silty Gravel With Sand, gray and brown, wet, loose to very dense, with chert fragments and trace clay and silt (GM)		SPT-30	43.5 - 45.0	0.5	8-10-11	22	
				SPT-31	45.0 - 46.5	1.5	2-1-1	19	
		Lean Clay, grayish brown and gray, moist to wet, soft to very stiff, with zones of sand (CL)		SPT-32	46.5 - 48.0	1.4	8-5-7	23	
				SPT-33	48.0 - 49.5	1.2	8-13-12	23	
328.2	50.6			SPT-34	49.5 - 51.0	1.0	7-5-8	17	SPT-34 - .4 gravel w/ sand
		Silty Gravel With Sand, gray and brown, wet, medium dense, with chert fragment and zones of clay (GM)		SPT-35	51.0 - 52.5	0.8	7-6-4	19	
				SPT-36	52.5 - 54.0	0.9	5-10-6	24	
324.4	54.4			SPT-37	54.0 - 54.6	0.6	10-50+/0.1	17	
322.9	55.9	(AUGERED)							Began Core
313.7	65.1	Limestone(90%) interbedded with Shale(10%) Limestone is light gray, moderately hard, weathered Shale is gray, soft, highly to moderately weathered			9.2			65.1	

Bottom of Hole

Top of Rock = 54.4
Elevation (324.4)

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-12** Total Depth 83.3 ft
County	Stewart, TN	Surface Elevation	394.8 ft
Project Type	HSA 3.25	Date Started	5/7/09 Completed 5/8/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	19.5 ft Date/Time 5/7/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
394.8	0.0	Top of Hole							
		Fat Clay, reddish brown, moist, stiff to very stiff, with chert gravel (CH)		SPT-1	0.0 - 1.5	0.8	7-5-6	21	
				SPT-2	1.5 - 3.0	0.8	8-8-8	21	
				SPT-3	3.0 - 4.5	1.1	11-11-13	19	
				SPT-4	4.5 - 6.0	1.3	10-7-8	20	
				SPT-5	6.0 - 7.5	1.2	8-8-9	22	
				SPT-6	7.5 - 9.0	0.6	5-4-3	19	
				SPT-7	9.0 - 10.5	0.8	14-6-7	23	
382.8	12.0			SPT-8	10.5 - 12.0	1.0	13-12-9	23	
		Lean Clay, gray to brown, moist, stiff to very stiff, gravelly (CL)		SPT-9	12.0 - 13.5	0.9	13-11-18	20	
				SPT-10	13.5 - 15.0	0.8	14-12-12	20	
				SPT-11	15.0 - 16.5	1.0	8-8-10	27	
				SPT-12	16.5 - 18.0	1.3	23-21-23	17	
				SPT-13	18.0 - 19.5	0.8	12-12-9	15	
				SPT-14	19.5 - 21.0	0.7	7-4-8	24	
				SPT-15	21.0 - 22.5	0.4	6-5-4	20	
				SPT-16	22.5 - 24.0	0.8	4-7-6	30	
				SPT-17	24.0 - 25.5	1.2	12-12-9	25	
367.8	27.0			SPT-18	25.5 - 27.0	0.9	17-24-12	28	
		Fly Ash, gray, wet, stiff to very stiff		SPT-19	27.0 - 28.5	1.2	14-12-9	33	
				SPT-20	28.5 - 29.9	0.6	4-12-20	18	
				SPT-21	30.0 - 30.9	1.0	13-4-5	26	
362.1	32.7			SPT-22	31.5 - 31.9	1.1	4-13-9	20	
		Lean Clay, gray to dark gray, moist, stiff to very stiff, some organics (CL)		SPT-23	33.0 - 34.5	0.2	7-6-6	22	
				SPT-24	35.0 - 36.5	1.2	5-7-7	25	

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-12**	Total Depth	83.3 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, gray to dark gray, moist, stiff to very stiff, some organics (CL) *(Continued)*		SPT-25	37.5 - 39.0	1.5	4-5-6	25	
				SPT-26	40.0 - 41.5	1.5	5-6-9	27	
				SPT-27	42.5 - 44.0	1.5	7-8-10	25	
				SPT-28	45.0 - 46.5	1.5	5-5-8	26	
				SPT-29	47.5 - 49.0	1.4	6-6-7	25	
				SPT-30	50.0 - 51.5	1.5	5-5-6	26	
				SPT-31	52.5 - 54.0	1.5	6-6-5	26	
339.0	55.8			SPT-32	55.0 - 56.5	1.1	2-3-5	27	
		Brown to gray, medium dense to dense, angular (GM)		SPT-33	57.5 - 59.0	1.5	6-9-9	27	
				SPT-34	60.0 - 61.5	0.8	15-13-14	18	
				SPT-35	62.5 - 64.0	0.4	6-9-6	20	
				SPT-36	65.0 - 66.5	0.3	6-7-7	20	
				SPT-37	67.5 - 69.0	0.8	20-15-17	20	
323.3	71.5			SPT-38	70.0 - 71.5	0.8	5-4-7	27	
		Lean Clay, brown to gray, moist, stiff to soft, (CL)		SPT-39	72.5 - 74.0	0.9	2-2-2	24	
				SPT-40	75.0 - 76.5	0.6	4-4-5	36	

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-12** Total Depth 83.3 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 to gray, moist, stiff to soft, (CL) *(Continued)*		SPT-41	77.5 - 79.0	1.0	0-0-2	56	
				SPT-42	80.0 - 81.5	1.1	1-2-1	41	
311.5	83.3			SPT-43	82.5 - 83.3	0.8	20-50+/0.3	13	
		Auger Refusal / Bottom of Hole Top of Rock = 83.3 Elevation (311.5)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-13** Total Depth 75.2 ft
County	Stewart, TN	Surface Elevation	396.5 ft
Project Type	HSA 3.25	Date Started	6/12/09 Completed 6/16/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	10.5 ft Date/Time 6/12/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
396.5	0.0	Top of Hole							
		Bottom Ash, dark grayish brown, damp to moist, medium dense to medium dense		SPT-1	0.0 - 1.5	1.5	5-8-9	--	
				SPT-2	1.5 - 3.0	1.4	8-10-11	--	
				SPT-3	3.0 - 4.5	1.5	5-11-11	--	
				SPT-4	4.5 - 6.0	0.9	2-2-4	--	
389.4	7.1			SPT-5	6.0 - 7.5	1.4	5-5-18	--	
		Fly Ash, dark gray, moist to wet, soft to very stiff		SPT-6	7.5 - 9.0	1.2	8-5-12	--	
				SPT-7	9.0 - 10.5	1.5	12-10-12	--	Revert below 11 feet
				SPT-8	10.5 - 12.0	1.3	2-4-7	--	
				SPT-9	12.0 - 13.5	1.1	2-4-9	--	
				SPT-10	13.5 - 15.0	0.7	1-2-2	--	
				SPT-11	15.0 - 16.5	1.0	0-0-0	--	
				SPT-12	16.5 - 18.0	1.1	0-0-0	--	
				SPT-13	18.0 - 19.5	1.5	0-0-0	--	
				SPT-14	19.5 - 21.0	1.4	0-0-0	--	
				SPT-15	21.0 - 22.5	1.0	0-0-0	--	
				SPT-16	22.5 - 24.0	1.2	0-0-0	--	
				SPT-17	24.0 - 25.5	1.1	0-0-2	--	
369.4	27.1			SPT-18	25.5 - 27.0	0.8	1-2-4	--	
368.0	28.5	Lean Clay, brown gray, wet, soft, mottled, gravelly (CL)		SPT-19	27.0 - 28.5	1.0	2-2-2	--	
		Fly Ash, dark gray, moist to wet, soft to very stiff		SPT-20	28.5 - 29.9	1.0	0-0-0	--	
				SPT-21	30.0 - 30.9	0.6	0-0-0	--	
				SPT-22	31.5 - 31.9	1.5	8-16-21	--	
				SPT-23	33.0 - 34.5	1.5	3-5-6	--	
				SPT-24	34.5 - 36.0	1.5	7-17-23	--	

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-13
		Total Depth	75.2 ft

Lithology Elevation	Depth	Description	Overburden Rock Core	Sample # RQD	Depth Run	Rec. Ft. Rec. Ft.	Blows Rec. %	Mois.Cont. % Run Depth	Remarks
		Fly Ash, dark gray, moist to wet, soft to very stiff *(Continued)*		SPT-25	36.0 - 37.5	1.3	6-3-6	--	
				SPT-26	37.5 - 39.0	1.5	2-2-2	--	
356.3	40.2			SPT-27	39.0 - 40.5	1.5	0-0-2	--	
		Lean Clay, brown gray, wet, soft stiff, mottled, gravelly, sandy below 59' (CL)		SPT-28	40.5 - 42.0	0.5	7-2-2	--	
				SPT-29	42.0 - 43.5	1.5	5-8-8	--	
				SPT-30	45.0 - 46.5	1.5	1-7-9	--	
				SPT-31	47.5 - 49.0	0.7	7-7-8	--	
				SPT-32	50.0 - 51.5	0.8	5-6-6	--	
				SPT-33	52.5 - 54.0	1.1	2-2-3	--	
				SPT-34	55.0 - 56.5	0.8	0-0-3	--	
				SPT-35	57.5 - 59.0	0.7	9-12-9	--	
				SPT-36	60.0 - 61.5	0.6	0-5-5	--	
				SPT-37	62.5 - 64.0	1.3	19-20-22	--	
329.0	67.5			SPT-38	65.0 - 66.5	0.9	7-10-9	--	
		Silty Gravel, gray to brown, wet, medium dense, (GM)		SPT-39	67.5 - 69.0	1.0	3-7-8	--	
				SPT-40	70.0 - 71.5	1.1	17-21-17	--	
				SPT-41	72.5 - 74.0	1.0	7-5-4	--	
321.3	75.2			SPT-42	75.0 - 75.2	0.0	50+/0.2	--	
		Auger Refusal / Bottom of Hole							

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-13

Total Depth: 75.2 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		Top of Rock = 75.2 Elevation (321.3)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-14** Total Depth 66.8 ft
County	Stewart, TN	Surface Elevation	379.0 ft
Project Type	HSA 3.25	Date Started	6/13/09 Completed 6/14/09
Supervisor	D. Rogers Driller Greg Thompson	Depth to Water	21.6 ft Date/Time 6/13/09
Logged By	Russell Mehnert	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
379.0	0.0	Top of Hole							
		Lean Clay, reddish brown, moist to wet, soft to very stiff, occasional gray mottling, with chert fragments, silty zones (CL)		SPT-1	0.0 - 1.5	1.3	2-5-6	21	
				SPT-2	1.5 - 3.0	1.0	3-5-6	19	Boring backfilled with (2) bags Quik Grout and (1) Portland Cement
				SPT-3	3.0 - 4.5	1.5	2-5-6	18	
				SPT-4	4.5 - 6.0	1.5	5-7-9	18	
				SPT-5	6.0 - 7.5	1.4	9-10-13	19	
				SPT-6	7.5 - 9.0	1.3	4-6-7	23	
				SPT-7	9.0 - 10.5	0.6	3-5-7	23	
				SPT-8	10.5 - 12.0	1.4	4-7-10	21	
				SPT-9	12.0 - 13.5	1.1	10-13-13	19	
				SPT-10	13.5 - 15.0	1.1	3-6-6	21	
				SPT-11	15.0 - 16.5	0.9	3-5-8	26	
				SPT-12	16.5 - 18.0	1.5	5-8-12	23	
				SPT-13	18.0 - 19.5	1.0	2-5-8	23	
				SPT-14	19.5 - 21.0	1.4	3-4-5	24	
				SPT-15	21.0 - 22.5	1.5	5-5-5	24	wet @ 21.6'
				SPT-16	22.5 - 24.0	1.4	2-4-5	24	
354.0	25.0			SPT-17	24.0 - 25.5	0.9	4-20-22	15	area of gravel 24.9'-25.5'
		Lean Clay, reddish brown to dark brown, moist to wet, soft to very stiff, with occasional gray modeling, with gravel, organics 25'-29' (CL)		SPT-18	25.5 - 27.0	1.5	2-6-18	16	
				SPT-19	27.0 - 27.3	0.3	50+/.3	22	
				SPT-20	28.5 - 30.0	1.0	7-3-3	25	
				SPT-21	30.0 - 31.5	1.1	2-2-2	27	
				SPT-22	31.5 - 33.0	1.5	2-3-3	26	
				SPT-23	33.0 - 34.5	0.5	2-2-4	25	
				SPT-24	35.0 - 36.5	0.7	2-2-3	26	organic smell 35.0'-38.6'

SUBSURFACE LOG

Stantec

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-14**
		Total Depth	66.8 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
340.4	38.6			SPT-25	37.5 - 39.0	1.4	WOR-WOR-10	30	
		Sand With Gravel, light brown to brown, wet, medium dense, poorly sorted with increasing gravel size, wood and areas of clay (SC) (Visual)		SPT-26	40.0 - 41.5	0.0	3-5-12	--	
				SPT-27	42.5 - 44.0	1.5	6-8-10	43	
				SPT-28	45.0 - 46.5	1.5	4-7-14	28	
330.0	49.0			SPT-29	47.5 - 49.0	1.4	5-7-6	25	
		Silty Gravel, brown to gray, wet, medium dense to loose, with areas of clay (GM)		SPT-30	50.0 - 51.5	1.0	9-13-13	22	
				SPT-31	52.5 - 54.0	0.9	5-12-14	21	
				SPT-32	55.0 - 56.5	1.4	11-8-7	22	
				SPT-33	57.5 - 59.0	0.8	10-18-13	21	
				SPT-34	60.0 - 61.5	0.1	8-11-12	7	
				SPT-35	62.5 - 64.0	0.4	3-2-4	24	
312.9	66.1			SPT-36	65.0 - 66.2	0.7	4-8-50+/.2	27	
312.8	66.2	Weathered rock, limestone, gray to light gray, moderately hard.							
312.2	66.8	Augered							
		Auger Refusal / Bottom of Hole							

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-15** Total Depth 82.2 ft
County	Stewart, TN	Surface Elevation	395.0 ft
Project Type	HSA 3.25	Date Started	5/12/09 Completed 5/13/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	2.4 ft Date/Time 5/13/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.0	0.0	Top of Hole							
394.7	0.3	Crushed stone		SPT-1	0.0 - 1.5	0.7	12-10-8	21	
		Fat Clay, reddish brown, moist to wet, very stiff, some chert gravel (CH)		SPT-2	1.5 - 3.0	0.2	9-8-10	19	
				SPT-3	3.0 - 4.5	0.9	6-9-10	23	
				SPT-4	4.5 - 6.0	1.5	4-8-8	21	Bulk Sample 0-10.5
				SPT-5	6.0 - 7.5	1.1	4-6-8	25	
				SPT-6	7.5 - 9.0	1.5	4-4-8	24	
				SPT-7	9.0 - 10.5	1.5	4-8-8	22	
				SPT-8	10.5 - 12.0	1.3	5-13-19	24	
				SPT-9	12.0 - 13.5	0.6	8-8-9	24	
380.7	14.3			SPT-10	13.5 - 15.0	1.5	7-10-11	23	
		Lean Clay, brown, moist to wet, stiff, some gravel (CL)		SPT-11	15.0 - 16.5	1.5	4-5-13	21	
				SPT-12	16.5 - 18.0	1.0	7-13-20	22	
				SPT-13	18.0 - 19.5	1.2	11-9-30	18	
				SPT-14	19.5 - 21.0	1.1	7-6-6	28	
				SPT-15	21.0 - 22.5	0.9	5-7-9	29	
				SPT-16	22.5 - 24.0	1.0	3-5-7	40	
				SPT-17	24.0 - 25.5	0.1	16-19-19	8	
				SPT-18	25.5 - 27.0	0.6	17-6-5	31	
366.5	28.5			SPT-19	27.0 - 28.5	0.7	7-6-7	20	wet below 23 feet
		Lean Clay, brown to gray, wet, medium stiff to stiff, mottled, with some gravel (CL)		SPT-20	28.5 - 30.0	0.2	3-4-5	24	
				SPT-21	30.0 - 31.5	0.5	2-3-2	26	
				SPT-22	31.5 - 33.0	1.0	3-6-7	29	
				SPT-23	33.0 - 34.5	0.9	3-2-5	25	
				SPT-24	34.5 - 36.0	1.5	3-4-5	29	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-15** Total Depth 82.2 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 to gray, wet, medium stiff to stiff, mottled, with some gravel (CL) *(Continued)*		SPT-25	36.0 - 37.5	1.5	4-8-6	29	
				SPT-26	37.5 - 39.0	1.2	10-7-7	25	
				SPT-27	39.0 - 40.5	1.3	4-5-5	26	
353.0	42.0			SPT-28	40.5 - 42.0	1.1	6-7-8	27	
		Lean Clay, gray, wet, medium stiff to very stiff, trace sand (CL)		SPT-29	42.0 - 43.5	0.6	9-10-7	21	
				SPT-30	43.5 - 45.0	0.6	6-7-50	18	
				SPT-31	45.0 - 46.5	0.1	12-8-9	9	
				SPT-32	47.5 - 49.0	1.3	2-2-3	26	
				SPT-33	50.0 - 51.5	1.5	3-2-4	25	
				SPT-34	52.5 - 54.0	1.5	3-4-5	28	
338.9	56.1			SPT-35	55.0 - 56.5	1.5	16-20-16	26	
		Silty Sand, brown, wet, dense to very dense, medium to coarse grained (SM) (Visual)		SPT-36	57.5 - 59.0	0.6	13-13-10	20	
				SPT-37	60.0 - 61.5	0.6	7-14-14	17	
				SPT-38	62.5 - 64.0	0.5	4-5-19	21	
				SPT-39	65.0 - 66.5	1.0	21-37-25	16	
				SPT-40	67.5 - 69.0	0.6	9-19-17	15	
				SPT-41	70.0 - 71.5	0.7	9-13-19	18	
				SPT-42	72.5 - 74.0	0.9	9-13-12	22	
				SPT-43	75.0 - 76.5	0.7	9-12-21	21	

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-15**	Total Depth	82.2 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Silty Sand, brown, wet, dense to very dense, medium to coarse grained (SM) (Visual) *(Continued)*		SPT-44	77.5 - 79.0	1.1	14-20-17	21	
				SPT-45	80.0 - 81.5	1.1	14-21-16	14	
312.8	82.2								
		Auger Refusal / Bottom of Hole Top of Rock = 81.7 Elevation (313.3)							

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SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-15 A**	Total Depth	40.0 ft
County	Stewart, TN	Surface Elevation	395.0 ft		
Project Type	HSA 3.25	Date Started	5/13/09	Completed	5/13/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	Dry	Date/Time	5/13/09
Logged By	Ryan J Riker	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.0	0.0	Top of Hole							
394.7	0.3	Crushed stone							
		Fat Clay, reddish brown, moist to wet, very stiff, some chert gravel (CH)							PZ installed. Screen from 28.5'-38.5' sand placed from 39.9 to 26.6'
380.7	14.3	Lean Clay, brown, moist to wet, stiff, some gravel (CL)							
366.5	28.5	Lean Clay, brown to gray, wet, medium stiff to stiff, mottled, with some gravel (CL)							

Stantec

SUBSURFACE LOG

Project Number 175539009

Location Cumberland Fossil

Project Name CUF

Boring No. **STN-15 A**

Total Depth 40.0 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
355.0	40.0								

No Refusal /
Bottom of Hole

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-15 B** Total Depth 82.3 ft
County	Stewart, TN	Surface Elevation	395.0 ft
Project Type	Mud Rotary	Date Started	5/13/09 Completed 5/14/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	Dry Date/Time 5/14/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.0	0.0	Top of Hole							
394.7	0.3	Crushed stone							
		Fat Clay, reddish brown, moist to wet, very stiff, some chert gravel (CH)							SI installed 82'
				ST-1	6.0 - 8.0	0.6		--	gravel deform tube end
				ST-2	8.0 - 10.0	1.2		--	tube deformed
									boulder 12.7-14.2
380.7	14.3	Lean Clay, brown, moist to wet, stiff, some gravel (CL)							
									drill fluid loss @21.0 40gal
									boulder 22.1-23.8
366.5	28.5	Lean Clay, brown to gray, wet, medium stiff to stiff, mottled, with some gravel (CL)							
				ST-3	29.0 - 31.0	0.0		--	cobbles and boulders interspersed
				ST-4	31.0 - 33.0	1.4		--	

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-15 B** Total Depth 82.3 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, brown to gray, wet, medium stiff to stiff, mottled, with some gravel (CL) *(Continued)*							
353.0	42.0	Lean Clay, gray, wet, medium stiff to very stiff, trace sand (CL)		ST-5	46.0 - 48.0	2.0		--	less cobbles and boulders
338.9	56.1	Silty Sand, brown, wet, dense to very dense, medium to coarse grained (SM) (Visual)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-15 B** Total Depth 82.3 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
314.0	81.0								
312.7	82.3	Rock (Rollered)							

No Refusal /
Bottom of Hole

Top of Rock = 81.7
Elevation (313.3)

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-16** Total Depth 84.5 ft
County	Stewart, TN	Surface Elevation	397.8 ft
Project Type	HSA 3.25	Date Started	6/10/09 Completed 6/11/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	13.5 ft Date/Time 6/10/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
397.8	0.0	Top of Hole							
395.9	1.9	Bottom Ash, dark gray, damp, medium dense		SPT-1	0.0 - 1.5	1.1	5-7-8	9	
394.6	3.2	Lean Clay, brown, moist, stiff, (CL)		SPT-2	1.5 - 3.0	1.5	5-7-6	21	
		Fly Ash, dark gray, wet, stiff to very soft		SPT-3	3.0 - 4.5	1.3	5-10-9	25	
				SPT-4	4.5 - 6.0	1.5	3-2-1	29	
				SPT-5	6.0 - 7.5	1.0	5-4-5	33	
				SPT-6	7.5 - 9.0	0.7	6-15-10	24	
				SPT-7	9.0 - 10.5	0.6	6-11-11	35	
				SPT-8	10.5 - 12.0	0.6	3-1-3	40	
				SPT-9	12.0 - 13.5	1.0	5-4-3	42	
				SPT-10	13.5 - 15.0	1.4	WOH- WOH-	38	
				SPT-11	15.0 - 16.5	1.5	WOH WOH-	44	
				SPT-12	16.5 - 18.0	1.5	WOH- WOH	37	
				SPT-13	18.0 - 19.5	1.5	WOH- WOH-	39	
				SPT-14	19.5 - 21.0	1.5	WOH WOH-	41	
				SPT-15	21.0 - 22.5	1.5	WOH- WOH	38	
374.2	23.6			SPT-16	22.5 - 24.0	1.4	WOH- WOH-	22	
		Silty Gravel, brown, wet, very loose to loose, with little clay (GM) (Visual)		SPT-17	24.0 - 25.5	0.5	WOH WOH-	26	
				SPT-18	25.5 - 27.0	1.1	WOH- WOH	27	
				SPT-19	27.5 - 29.0	0.6	3-5-6 3-3-4 3-4-4	27	
367.7	30.1						2-3-3		
		Fly Ash, dark gray, wet, stiff to soft		SPT-20	30.0 - 31.5	1.5	1-2-1	43	
				SPT-21	31.5 - 33.0	1.5	2-3-8	42	
				SPT-22	33.0 - 34.5	1.5	3-9-15	35	
				SPT-23	34.5 - 36.0	1.5	2-4-6	34	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-16** Total Depth 84.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fly Ash, dark gray, wet, stiff to soft *(Continued)*		SPT-24	36.0 - 37.5	1.5	8-12-10	40	
				SPT-25	37.5 - 39.0	1.5	1-2-2	32	
				SPT-26	39.0 - 40.5	1.5	3-6-9	42	
				SPT-27	40.5 - 42.0	1.5	WOH-WOH-2	46	
				SPT-28	42.0 - 43.5	1.5	3-5-6	53	
				SPT-29	43.5 - 45.0	1.5	2-2-1	46	
				SPT-30	45.0 - 46.5	1.5	WOH-2-2	50	
350.6	47.2			SPT-31	46.5 - 48.0	1.0	2-3-3	28	
		Lean Clay, dark brownish gray, wet, medium stiff to stiff, mottled, with organics (CL)		SPT-32	48.0 - 49.5	0.9	2-5-5	26	
				SPT-33	50.0 - 51.5	1.2	WOH-WOH-3	29	
				SPT-34	52.5 - 54.0	1.5	3-3-4	30	
342.8	55.0								
		Lean Clay, brown, wet, very stiff, with gravel (CL)		SPT-35	55.0 - 56.5	1.5	4-9-9	26	
				SPT-36	57.5 - 59.0	1.1	24-32-32	20	
				SPT-37	60.0 - 61.5	0.7	3-12-16	16	
				SPT-38	62.5 - 64.0	1.0	22-20-16	17	
				SPT-39	65.0 - 66.5	0.7	9-12-17	18	
				SPT-40	67.5 - 69.0	0.9	3-21-39	19	
				SPT-41	70.0 - 71.2	0.7	7-11-18	14	
				SPT-42	72.5 - 74.0	1.0	14-14-15	18	
				SPT-43	75.0 - 76.5	0.8	16-21-16	17	

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-16** Total Depth 84.5 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, brown, wet, very stiff, with gravel (CL) *(Continued)*		SPT-44	77.5 - 79.0	1.2	12-13-20	19	
				SPT-45	80.0 - 81.5	0.9	7-8-10	36	
314.1	83.7			SPT-46	82.5 - 84.0	1.0	13-15-50+/.2	20	
313.3	84.5	Rock (Augered)							

Auger Refusal / Bottom of Hole

Top of Rock = 83.7 Elevation (314.1)

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-17** Total Depth 117.4 ft
County	Stewart, TN	Surface Elevation	428.4 ft
Project Type	HSA 3.25	Date Started	7/7/09 Completed 7/9/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	33.0 ft Date/Time 7/7/09
Logged By	Kurt Shellhause	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
428.4	0.0	Top of Hole							
		Fly Ash, grayish brown, dry to damp, medium stiff to very stiff		SPT-1	0.0 - 1.5	0.8	3-11-20	19	
				SPT-2	1.5 - 3.0	0.8	20-39-57	20	
				SPT-3	3.0 - 4.5	0.8	50+	27	water from auger got into sample
				SPT-4	4.5 - 6.0	0.8	44-50+	17	
				SPT-5	6.0 - 7.5	0.4	50+0.3	16	
				SPT-6	7.5 - 9.0	0.6	31-50+	19	
				SPT-7	9.0 - 10.5	0.6	20-50+	20	
				SPT-8	10.5 - 12.0	0.8	37-50+	18	
				SPT-9	12.0 - 13.5	0.3	50+	18	
				SPT-10	13.5 - 15.0	0.7	37-50+	18	
				SPT-11	15.0 - 16.5	0.8	37-50+	18	
				SPT-12	16.5 - 18.0	0.6	43-50+	20	
				SPT-13	18.0 - 19.5	0.8	15-36-38	20	
				SPT-14	19.5 - 21.0	0.8	8-5-10	17	
				SPT-15	21.0 - 22.5	0.8	24-50+	20	
				SPT-16	22.5 - 24.0	0.8	14-12-18	18	
				SPT-17	24.0 - 25.5	0.8	29-49-50+	17	
				SPT-18	25.5 - 27.0	0.8	17-26-33	18	
				SPT-19	27.0 - 28.5	0.8	20-27-28	20	
398.4	30.0			SPT-20	28.5 - 30.0	0.8	20-20-19	23	
		Fly Ash, grayish brown, wet, soft to very soft		SPT-21	30.0 - 31.5	0.8	5-7-6	23	Flyash becoming more moist and plastic
				SPT-22	31.5 - 33.0	0.6	2-3-2	20	
				SPT-23	33.0 - 34.5	0.8	1-1-5	27	Hit groundwater table, samples are wet and plastic
				SPT-24	34.5 - 36.0	0.8	1-1-3	25	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-17** Total Depth 117.4 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
390.9	37.5			SPT-25	36.0 - 37.5	0.8	1-2-6	30	Encountered gypsum
		Fly Ash And Gypsum, grayish brown with white, wet, stiff to very stiff		SPT-26	37.5 - 39.0	0.3	50+	23	0.7' gypsum present
				SPT-27	39.0 - 40.5	0.8	30-14-7	23	gypsum flyash mix/slurry
387.4	41.0			SPT-28	40.5 - 42.0	0.8	2-2-3	48	
		Fly Ash, grayish brown, wet, very soft		SPT-29	42.0 - 43.5	0.8	4-4-3	35	flyash with traces of red clay
				SPT-30	43.5 - 45.0	0.8	1-2-2	34	0.3' of flyash mixed with brown clay
				SPT-31	45.0 - 46.5	0.8	0-0-0	36	
				SPT-32	46.5 - 48.0	0.8	1-4-3	33	silty lines of black in flyash
				SPT-33	48.0 - 49.5	0.6	1-2-3	38	0.1' layer of black gravely bottom ash
				SPT-34	49.5 - 51.0	0.6	2-5-3	37	black gravely bottom ash present in sample
				SPT-35	51.0 - 52.5	0.8	5-8-13	41	
				SPT-36	52.5 - 54.0	0.8	3-4-5	35	
				SPT-37	54.0 - 55.5	0.8	5-7-9	19	
				SPT-38	55.5 - 57.0	0.8	0-0-0	34	weight of hammer
				SPT-39	57.0 - 58.5	0.8	2-1-1	39	
				SPT-40	58.5 - 60.0	0.8	1-3-3	30	
				SPT-41	60.0 - 61.5	0.8	0-12-7	34	weight of hammer
				SPT-42	61.5 - 63.0	0.8	13-15-16	35	
				SPT-43	63.0 - 64.5	0.8	4-4-7	34	
				SPT-44	64.5 - 66.5	0.8	2-3-7	47	
				SPT-45	66.0 - 67.5	0.8	9-16-30	29	
				SPT-46	67.5 - 69.0	0.8	5-10-17	39	
				SPT-47	69.0 - 70.5	0.8	3-5-10	41	
				SPT-48	70.5 - 72.0	0.8	2-4-8	40	
				SPT-49	72.0 - 73.5	0.8	4-16-20	39	
				SPT-50	73.5 - 76.5	0.8	1-2-3	43	weight of rod, no recovery
				SPT-51	76.5 - 78.0	0.0	0-0-0	47	weight of rod

SUBSURFACE LOG

Project Number 175539009 | Location Cumberland Fossil
Project Name CUF | Boring No. **STN-17** | Total Depth 117.4 ft

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fly Ash, grayish brown, wet, very soft *(Continued)*		SPT-52	78.0 - 79.5	0.8	0-3-4	48	weight of rod, weight of rod
				SPT-53	79.5 - 81.0	0.8	0-0-3	49	weight of rod
				SPT-54	81.0 - 82.5	0.8	0-0-0	39	weight of hammer
				SPT-55	82.5 - 84.0	0.8	0-0-0	45	weight of rod,
				SPT-56	84.0 - 85.5	0.8	0-0-2	38	WOR, soil more plastic
				SPT-57	85.5 - 87.0	0.8	0-0-0	47	WOR
				SPT-58	87.0 - 88.5	0.8	0-0-0	37	WOR
338.4	90.0			SPT-59	88.5 - 90.0	0.8	0-0-0	32	Begining of natural soils, gravely brown clay
		Lean Clay With Sand And Gravel, brown, wet, stiff to very stiff, (CL)		SPT-60	90.0 - 91.5	0.5	3-10-10	29	well graded angular gravel
				SPT-61	92.5 - 94.0	0.4	20-11-16	21	Gravel blocked spoon enterence
				SPT-62	95.0 - 96.5	0.3	4-20-20	21	
				SPT-63	97.5 - 99.0	0.8	0-5-6	27	Possible blowback in sample
				SPT-64	100.0 - 101.5	0.5	0-6-15	25	Possible blowback in sample
				SPT-65	102.5 - 104.0	0.3	14-23-23	16	
				SPT-66	105.0 - 106.5	0.6	30-30-12	22	Strains of red clay
				SPT-67	107.5 - 109.0	0.6	6-19-44	20	
				SPT-68	110.0 - 111.5	0.8	17-15-19	23	well rounded and angular gravel
				SPT-69	112.5 - 114.0	0.8	11-29-27	24	
311.0	117.4			SPT-70	115.0 - 116.5	0.8	13-16-14	18	Auger refusal
		Auger Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-18** Total Depth 65.6 ft
County	Stewart, TN	Surface Elevation	401.2 ft
Project Type	HSA 3.25	Date Started	6/9/09 Completed 6/9/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	10.5 ft Date/Time 6/9/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
401.2	0.0	Top of Hole							
		Bottom Ash, dark gray to black, damp to wet, medium dense to dense		SPT-1	0.0 - 1.5	1.0	4-8-8	9	
				SPT-2	1.5 - 3.0	1.1	4-10-15	18	
				SPT-3	3.0 - 4.5	1.3	11-14-12	21	
				SPT-4	4.5 - 6.0	1.1	4-6-14	15	
				SPT-5	6.0 - 7.5	1.4	15-15-18	9	
393.0	8.2			SPT-6	7.5 - 9.0	1.3	8-22-23	23	
392.2	9.0	Gypsum, white to tan, wet, very stiff		SPT-7	9.0 - 10.5	1.0	8-10-6	3	Revert used at 10.0' ground water encountered
389.2	12.0	Gravel With Clay, brown to brownish yellow, wet, medium dense, (GC)		SPT-8	10.5 - 12.0	0.7	6-7-6	3	
		Fly Ash, gray to dark gray, damp to wet, very soft to very stiff		SPT-9	12.0 - 13.5	0.3	10-11-7	34	
				SPT-10	13.5 - 15.0	0.7	6-3-2	43	
				SPT-11	15.0 - 16.5	1.0	WOH-WOH-13	38	
				SPT-12	16.5 - 18.0	1.2	1-2-2	44	
				SPT-13	18.0 - 19.5	1.5	WOH-WOH-WOH	40	
				SPT-14	19.5 - 21.0	0.2	2-1-1	47	
				SPT-15	21.0 - 22.5	0.9	1-1-50+/.3	31	
				SPT-16	22.5 - 24.0	0.9	31-23-8	19	
				SPT-17	24.0 - 25.5	1.0	3-4-4	41	
				SPT-18	25.5 - 27.0	1.5	WOR-WOR-WOR	43	
				SPT-19	27.0 - 28.5	1.4	WOR-WOR-WOR	37	
				SPT-20	28.5 - 30.0	1.4	WOR-1-4	36	
				SPT-21	30.0 - 31.5	1.4	3-1-3	38	
				SPT-22	31.5 - 33.0	1.4	3-11-9	40	
				SPT-23	33.0 - 34.5	1.4	3-4-4	32	
				SPT-24	34.5 - 36.0	0.4	4-3-2	30	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-18**
		Total Depth	65.6 ft

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fly Ash, gray to dark gray, damp to wet, very soft to very stiff *(Continued)*		SPT-25	36.0 - 37.5	0.9	WOH-WOH-WOH	48	
				SPT-26	37.5 - 39.0	1.5	WOR-2-2	54	
				SPT-27	39.0 - 40.5	1.5	WOR-1-1	49	
				SPT-28	40.5 - 42.0	1.5	WOH-WOH-WOH	47	
				SPT-29	42.0 - 43.5	1.5	WOR-2-2	41	
357.0	44.2			SPT-30	43.5 - 45.0	1.3	4-11-13	33	
		Lean Clay, brown, wet, firm to very stiff, (CL)		SPT-31	45.0 - 46.5	0.0	6-10-13	--	sample retainer broke, sample lost
				SPT-32	47.5 - 49.0	1.4	9-12-14	33	
				SPT-33	50.0 - 51.5	1.1	4-8-13	32	
				SPT-34	52.5 - 54.0	1.5	9-10-10	34	
				SPT-35	55.0 - 56.5	1.5	8-8-8	23	
				SPT-36	57.5 - 59.0	0.6	7-9-11	34	
				SPT-37	60.0 - 61.5	1.5	3-3-3	26	boring backfilled with 2 bags of bentonite grout and 2 bags of portland cement
				SPT-38	62.5 - 64.0	1.0	6-15-4	32	
335.6	65.6			SPT-39	65.0 - 66.5	0.5	22-50+/.1	35	
		Auger Refusal / Bottom of Hole Top of Rock = 65.6 Elevation (335.6)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-19 — Total Depth 51.5 ft
County	Stewart, TN	Surface Elevation	410.9 ft
Project Type	HSA 3.25	Date Started	6/2/09 — Completed 6/2/09
Supervisor	D. Rogers — Driller Mark Martin	Depth to Water	Dry — Date/Time 6/2/09
Logged By	Ryan J Riker	Depth to Water	N/A — Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
410.9	0.0	Top of Hole						
409.4	1.5	Bottom Ash, dark gray to black, damp, dense	SPT-1	0.0 - 1.5	0.9	7-13-17	10	
		Fat Clay, brown, damp to moist, firm to very stiff, (CH)	SPT-2	1.5 - 3.0	1.0	10-9-13	11	
			SPT-3	3.0 - 4.5	0.7	6-6-10	11	
			SPT-4	4.5 - 6.0	0.9	2-3-4	20	
403.4	7.5		SPT-5	6.0 - 7.5	1.0	13-14-14	17	
		Lean Clay, brown to light gray, moist to wet, soft to very stiff, Manganese concretions (CL)	SPT-6	7.5 - 9.0	0.8	6-8-13	14	
			SPT-7	9.0 - 10.5	1.1	9-10-10	25	
			SPT-8	10.5 - 12.0	0.7	5-5-9	22	
			SPT-9	12.0 - 13.5	0.7	13-14-21	20	
			SPT-10	13.5 - 15.0	0.7	13-12-12	24	
			SPT-11	15.0 - 16.5	0.8	6-20-10	19	Gravels common from 15.0 to 21.0
			SPT-12	16.5 - 18.0	0.1	2-2-3	--	
			SPT-13	18.0 - 19.5	0.8	WOR-3-6	19	
			SPT-14	19.5 - 21.0	0.3	2-6-11	24	
			SPT-15	21.0 - 22.5	1.1	8-22-32	14	
			SPT-16	22.5 - 24.0	1.2	8-6-8	19	
			SPT-17	24.0 - 25.5	1.0	9-17-15	19	
383.7	27.2		SPT-18	25.5 - 27.0	0.3	4-9-9	18	
		Fly Ash, gray to light gray, moist to wet, medium stiff to stiff	SPT-19	27.0 - 28.5	1.5	10-4-4	32	
			SPT-20	28.5 - 30.0	1.2	WOR-3-3	43	
			SPT-21	30.0 - 31.5	0.5	WOR-1-15	35	Auger lost at depth 50' backfilled boring with 3 bags of quikgrout and 3 bags of portland cement.
			SPT-22	31.5 - 33.0	0.6	20-10-8	24	
			SPT-23	33.0 - 34.5	1.5	2-2-2	42	
			SPT-24	34.5 - 36.0	1.5	4-5-5	53	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Stantec

SUBSURFACE LOG

Project Number 175539009
Location Cumberland Fossil
Project Name CUF
Boring No. **STN-19**
Total Depth 51.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
373.4	37.5			SPT-25	36.0 - 37.5	1.3	5-9-11	36	
		Lean Clay, brown with gray, wet, stiff, mottled (CL)		SPT-26	37.5 - 39.0	1.0	2-5-8	21	
				SPT-27	40.0 - 41.5	1.1	4-4-5	23	
				SPT-28	42.5 - 44.0	1.4	9-17-21	18	
				SPT-29	45.0 - 46.5	1.2	6-9-17	22	
363.4	47.5								
		Highly weathered limestone, light gray		SPT-30	47.5 - 49.0	0.2	7-50+/.2	17	
359.6	51.3			SPT-31	50.0 - 51.5	0.3	5-15-50+/.3	23	
359.4	51.5	Auger Refusal / Bottom of Hole Top of Rock = 47.5 Elevation (363.4)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-19 C** — Total Depth 22.0 ft
County	Stewart, TN	Surface Elevation	410.9 ft
Project Type	HSA 4.25	Date Started	8/14/09 — Completed 8/14/09
Supervisor	D. Rogers — Driller Mark Martin	Depth to Water	Dry — Date/Time 8/14/09
Logged By	D. Rogers	Depth to Water	N/A — Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
410.9	0.0	Top of Hole						
406.9	4.0	Bottom ash						
		Clayey Gravel with cobbles (GC)						
			ST-1	10.5 - 12.5	1.4		--	
								cobbles 12.6-14.9
			ST-2	15.0 - 16.0	0.9		--	tube refusal
								cobbles 16-17.4
			ST-3	17.5 - 19.5	0.7		--	pushed rock
388.9	22.0		ST-4	20.0 - 22.0	1.2		--	
		No Refusal / Bottom of Hole						

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-20** Total Depth 55.5 ft
County	Stewart, TN	Surface Elevation	419.3 ft
Project Type	HSA 3.25	Date Started	6/1/09 Completed 6/1/09
Supervisor	Daniel Rogers Driller Mark Martin	Depth to Water	Dry Date/Time 6/1/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
419.3	0.0	Top of Hole							
		Gypsum, white tan, damp to moist, very stiff to very stiff		SPT-1	0.0 - 1.5	0.9	4-12-19	8	
				SPT-2	1.5 - 3.0	1.3	14-32-32	9	
				SPT-3	3.0 - 4.5	1.3	14-23-25	10	
				SPT-4	4.5 - 6.0	1.1	9-18-46	10	
				SPT-5	6.0 - 7.5	0.8	46-50+/.4	14	
				SPT-6	7.5 - 9.0	1.4	18-32-31	19	
				SPT-7	9.0 - 10.5	1.5	10-18-35	21	
				SPT-8	10.5 - 12.0	1.5	19-36-50	24	
				SPT-9	12.0 - 13.5	0.8	39-50+/.3	18	
				SPT-10	13.5 - 15.0	1.3	17-49-50+/.3	24	
402.8	16.5			SPT-11	15.0 - 16.5	1.5	23-25-48	25	
		Gravel With Clay, gray, wet, medium dense to dense, (GC) (Visual)		SPT-12	16.5 - 18.0	1.0	15-13-19	21	
				SPT-13	18.0 - 19.5	0.2	4-4-6	37	
398.3	21.0			SPT-14	19.5 - 21.0	0.1	4-5-6	2	
		Fly Ash, dark gray to light brown, wet to saturated, soft to very stiff, laminated		SPT-15	21.0 - 22.5	0.5	3-12-16	34	
				SPT-16	22.5 - 24.0	1.5	3-6-11	41	
				SPT-17	24.0 - 25.5	1.1	8-10-18	42	
				SPT-18	25.5 - 27.0	0.5	3-4-6	42	
				SPT-19	27.0 - 28.5	1.2	7-19-25	39	
				SPT-20	28.5 - 30.0	0.6	7-10-15	43	
				SPT-21	30.0 - 31.5	1.4	2-6-12	42	
				SPT-22	31.5 - 33.0	0.8	3-9-10	42	
				SPT-23	33.0 - 34.5	0.6	5-7-10	42	
				SPT-24	34.5 - 36.0	0.5	2-2-5	39	

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-20** 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
		Fly Ash, dark gray to light brown, wet to saturated, soft to very stiff, laminated *(Continued)*		SPT-25	36.0 - 37.5	0.9	2-2-3	34	
				SPT-26	37.5 - 39.0	0.7	1-1-2	38	
				SPT-27	39.0 - 40.5	1.4	2-3-4	51	
				SPT-28	40.5 - 42.0	1.1	WOH-WOH-WOH	48	
375.8	43.5			SPT-29	42.0 - 43.5	1.3	2-1-2	42	
374.3	45.0	Lean Clay, dark gray to black, wet, stiff, with organics, few gravels (CL)		SPT-30	43.5 - 45.0	0.5	WOR-3-5	30	
		Lean Clay, red brown to light brown, moist, stiff to very stiff, (CL)		SPT-31	45.0 - 46.5	0.5	WOR-4-6	24	
				SPT-32	47.5 - 49.0	0.9	6-9-10	28	
				SPT-33	50.0 - 51.5	0.6	1-4-42	26	
				SPT-34	52.5 - 54.0	1.1	5-6-9	24	
363.8	55.5			SPT-35	55.0 - 56.5	0.6	9-50+/.1	28	
		Auger Refusal / Bottom of Hole Top of Rock = 55.0 Elevation (364.3)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-21** — Total Depth 43.5 ft
County	Stewart, TN	Surface Elevation	395.1 ft
Project Type	HSA 3.25	Date Started	4/29/09 — Completed 4/30/09
Supervisor	D. Rogers — Driller Mark Martin	Depth to Water	12.0 ft — Date/Time 4/29/09
Logged By	Ryan J Riker	Depth to Water	4.8 ft — Date/Time 4/30/09

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.1	0.0	Top of Hole							
		Fat Clay, reddish brown, moist, medium stiff to very stiff, (CH)		SPT-1	0.0 - 1.5	1.3	21-18-9	13	
				SPT-2	1.5 - 3.0	1.1	8-8-8	24	
				SPT-3	3.0 - 4.5	1.0	3-4-3	29	
388.9	6.2			SPT-4	4.5 - 6.0	0.9	2-5-4	29	
		Lean Clay, gray, moist to wet, stiff to very stiff, (CL)		SPT-5	6.0 - 7.5	1.0	5-5-11	21	
				SPT-6	7.5 - 9.0	1.5	4-7-11	18	
				SPT-7	9.0 - 10.5	1.2	8-11-17	16	
				SPT-8	10.5 - 12.0	1.5	10-14-14	18	
				SPT-9	12.0 - 13.5	1.1	15-14-13	25	
				SPT-10	13.5 - 15.0	1.4	4-5-4	19	
				SPT-11	15.0 - 16.5	1.3	12-12-15	21	
376.6	18.5			SPT-12	16.5 - 18.0	0.7	10-10-12	29	
		Bottom Ash, dark gray to gray, wet, loose, with fly ash below 25 feet		SPT-13	18.0 - 19.5	0.9	4-5-5	12	
				SPT-14	19.5 - 21.0	0.9	3-4-3	30	
				SPT-15	21.0 - 22.5	0.9	4-2-3	22	
				SPT-16	22.5 - 24.0	1.0	3-3-4	26	
				SPT-17	24.0 - 24.4	0.8	3-4-4	22	
				SPT-18	25.5 - 27.0	1.0	3-5-4	23	
				SPT-19	27.0 - 28.5	1.2	5-4-3	26	
				SPT-20	28.5 - 30.0	1.1	5-1-2	57	
				SPT-21	30.0 - 31.5	0.5	4-4-4	22	
362.1	33.0			SPT-22	31.5 - 33.0	0.4	24-17-8	14	
		Gravel With Clay, gray to brown, wet, meduim d to very dense, (GC)		SPT-23	33.0 - 34.5	0.7	3-4-5	24	
				SPT-24	34.5 - 36.0	0.1	2-6-8	21	

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-21** Total Depth 43.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Gravel With Clay, gray to brown, wet, meduim d to very dense, (GC) *(Continued)*		SPT-25	36.0 - 37.5	0.5	5-9-9	24	
				SPT-26	37.5 - 39.0	0.9	5-6-9	22	
				SPT-27	39.0 - 40.1	1.5	8-20-13	21	
				SPT-28	40.5 - 41.2	1.1	13-34-40	17	
351.6	43.5			SPT-29	42.0 - 43.5	0.5	12-33-50+	9	
		Auger Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

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SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-21 A** Total Depth 48.0 ft
County	Stewart, TN	Surface Elevation	395.1 ft
Project Type	HSA 4.25	Date Started	5/7/09 Completed 5/8/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	5.0 ft Date/Time 5/8/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.1	0.0	Top of Hole						
388.9	6.2	Fat Clay, reddish brown, moist, medium stiff to very stiff, (CH)	ST-1	3.0 - 5.0	0.8		--	SI Installed to 48.0'
376.6	18.5	Lean Clay, gray, moist to wet, stiff to very stiff, (CL)	ST-2	13.5 - 15.5	0.0		--	ST 2 Crushed
362.1	33.0	Bottom Ash, dark gray to gray, wet, loose, with fly ash below 25 feet	ST-3	20.5 - 22.5	1.3		--	
		Gravel With Clay, gray to brown, wet, medium dense to very dense, (GC)	ST-4	33.0 - 35.0	1.0		--	

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-21 A** Total Depth 48.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
351.6	43.5	Gravel With Clay, gray to brown, wet, medium dense to very dense, (GC) *(Continued)*							
347.1	48.0	Boulder (augered)							
		Auger Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-21 B** Total Depth 78.0 ft
County	Stewart, TN	Surface Elevation	395.1 ft
Project Type	HSA 4.25	Date Started	7/14/09 Completed 7/15/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	10.0 ft Date/Time 7/14/09
Logged By	Kurt Shellhause	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
395.1	0.0	Top of Hole							
		Fat Clay, reddish brown, moist, medium stiff to very stiff, (CH)							
388.9	6.2								
		Lean Clay, gray, moist to wet, stiff to very stiff, (CL)							Unable to push shelby tubes, encountered ground water
				ST-1	15.0 - 17.0	0.9		--	
376.6	18.5								
		Bottom Ash, dark gray to gray, wet, loose, with fly ash below 25 feet		ST-2	20.0 - 22.0	0.6		--	
				ST-3	25.0 - 27.0	1.0		--	
									30-32.5 Rollered through boulder
362.1	33.0								
		Gravel With Clay, gray to brown, wet, meduim d to very dense, (GC)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-21 B
		Total Depth	78.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
351.6	43.5	Gravel With Clay, gray to brown, wet, meduim d to very dense, (GC) *(Continued)*							41.5-44.1 Rollered through boulder
342.6	52.5	Clayey Silt with sand lenses, gray-brown, mottled, with traces of black, very soft, wet		SPT-1	45.0 - 46.5	1.2	2-2-3	24	Organics 45'-47'
				SPT-2	46.5 - 48.0	1.5	3-4-5	28	
				ST-4	48.0 - 50.0	1.3		--	
				ST-5	50.0 - 52.0	0.0		--	Shelby tube split, no recovery
338.9	56.2	Silty Sand, brown to light brown, medium dense to dense, wet (SM) (Visual)		SPT-3	52.0 - 53.5	1.2	5-8-7	28	
				SPT-4	53.5 - 55.0	1.1	5-7-12	35	
318.4	76.7	Gravelly Clay, brown, medium stiff, wet (GC)(Visual)		SPT-5	56.8 - 56.9	1.4	7-5-5	33	Attempted shelby tube sample (ST-6), refusal with no recovery, SPT -6 done on top of attempted shelby tube sample
				SPT-6	57.5 - 59.0	0.9	7-12-14	21	
				ST-7	59.0 - 61.0	1.0		--	
				SPT-7	61.0 - 62.5	0.9	16-16-9	17	
				SPT-8	65.0 - 66.5	1.0	7-10-22	22	
				SPT-9	67.5 - 69.0	1.4	26-29-27	24	
				SPT-10	70.0 - 71.5	1.5	13-19-24	20	Soil samples becoming lighter brown
				SPT-11	72.5 - 74.0	1.5	34-27-29	18	Presence of weathered limestone gravel
				SPT-12	75.0 - 76.5	1.0	9-9-16	18	Auger Refusal
317.1	78.0								

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SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-21 B** Total Depth 78.0 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		Rock (Rollered for SI Installation) *(Continued)*							bedrock rollered to install SI unit
		Auger Refusal / Bottom of Hole Top of Rock = 76.7 Elevation (318.4)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-22** Total Depth 92.0 ft
County	Stewart, TN	Surface Elevation	410.2 ft
Project Type	HSA 3.25	Date Started	4/28/09 Completed 4/29/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	21.0 ft Date/Time 4/28/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
410.2	0.0	Top of Hole							
		Bottom Ash, dark brown to gray, damp, medium dense		SPT-1	0.0 - 1.5	1.1	5-10-9	9	
				SPT-2	1.5 - 3.0	1.2	12-10-7	17	
406.2	4.0			SPT-3	3.0 - 4.5	1.0	13-11-7	9	
		Clayey Gravel, gray to dark gray, moist to wet, medium stiff to very stiff, (GC)		SPT-4	4.5 - 6.0	0.3	13-10-11	14	
				SPT-5	6.0 - 7.5	0.7	11-13-13	11	
				SPT-6	7.5 - 9.0	0.9	5-5-8	14	
				SPT-7	9.0 - 10.5	0.6	12-15-14	5	
				SPT-8	10.5 - 12.0	0.7	8-7-11	13	
				SPT-9	12.0 - 12.8	0.2	23-50+/0.3	15	
				SPT-10	13.5 - 15.0	0.4	4-6-6	17	
				SPT-11	15.0 - 16.5	0.8	9-9-19	17	
				SPT-12	16.5 - 18.0	1.0	12-18-21	22	
				SPT-13	18.0 - 19.5	0.7	11-19-18	15	
				SPT-14	19.5 - 21.0	0.7	16-5-6	14	
				SPT-15	21.0 - 22.5	0.4	3-2-3	29	
				SPT-16	22.5 - 24.0	0.6	15-8-4	27	
				SPT-17	24.0 - 25.5	0.9	5-5-8	24	
				SPT-18	25.5 - 27.0	0.9	5-13-8	21	
382.2	28.0			SPT-19	27.0 - 28.5	1.2	5-9-7	20	
		Fly Ash, dark brown to gray, wet, very soft to very stiff, few lenses of bottom ash		SPT-20	28.5 - 30.0	1.4	0-0-0	29	
				SPT-21	30.0 - 31.5	1.0	0-0-0	32	
				SPT-22	31.5 - 33.0	1.5	0-0-0	40	
				SPT-23	33.0 - 34.5	0.4	0-1-3	39	
				SPT-24	34.5 - 36.0	1.1	2-3-3	40	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-22**	Total Depth	92.0 ft

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fly Ash, dark brown to gray, wet, very soft to very stiff, few lenses of bottom ash *(Continued)*		SPT-25	36.0 - 37.5	1.3	0-0-1	40	
				SPT-26	37.5 - 39.0	1.3	5-12-11	17	
				SPT-27	39.0 - 40.5	0.7	9-7-6	13	
				SPT-28	40.5 - 42.0	0.9	5-6-6	17	
				SPT-29	42.0 - 43.5	1.1	4-3-4	66	
				SPT-30	43.5 - 45.0	1.0	5-6-11	62	
				SPT-31	45.0 - 46.5	1.3	12-13-33	43	
				SPT-32	46.5 - 48.0	1.2	9-10-8	38	
				SPT-33	48.0 - 49.5	1.1	4-6-10	35	
				SPT-34	49.5 - 51.0	1.4	5-6-11	46	
				SPT-35	51.0 - 52.5	1.5	14-14-11	34	
				SPT-36	52.5 - 54.0	1.3	3-3-3	34	
				SPT-37	54.0 - 55.5	1.5	1-2-2	39	
353.2	57.0			SPT-38	55.5 - 57.0	1.5	1-1-1	36	
		Lean Clay, gray to dark gray, moist to wet, medium stiff to stiff, few organics and wood fragments (CL)		SPT-39	57.0 - 58.5	1.3	2-3-4	36	
				SPT-40	58.5 - 60.0	0.5	3-4-6	39	
				SPT-41	60.0 - 61.5	1.4	4-4-5	25	
				SPT-42	62.5 - 64.0	1.2	5-8-7	32	
				SPT-43	65.0 - 66.5	1.4	5-8-9	30	
				SPT-44	67.5 - 69.0	1.5	4-6-9	28	
				SPT-45	70.0 - 71.5	1.4	5-5-5	30	
336.8	73.4			SPT-46	72.5 - 74.0	1.1	0-4-11	29	
		Gravel With Sand, brown to gray, wet, dense to very dense, angular (GM)		SPT-47	75.0 - 76.5	0.8	11-9-10	27	

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SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-22** Total Depth 92.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Gravel With Sand, brown to gray, wet, dense to very dense, angular (GM) *(Continued)*		SPT-48	77.5 - 79.0	0.9	14-9-11	27	
				SPT-49	80.0 - 81.5	0.5	21-21-21	20	
				SPT-50	82.5 - 84.0	1.1	21-17-25	21	
				SPT-51	85.0 - 86.5	1.1	24-40-21	14	
				SPT-52	87.5 - 89.0	0.8	25-23-21	22	
319.4	90.8			SPT-53	90.0 - 90.8	0.6	34-50+/0.3	19	
318.2	92.0	Rock (Augered)							

Auger Refusal /
Bottom of Hole

Top of Rock = 92.0
Elevation (318.2)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-22 A** Total Depth 60.7 ft
County	Stewart, TN	Surface Elevation	410.2 ft
Project Type	HSA 3.25	Date Started	5/5/09 Completed 5/6/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	18.9 ft Date/Time 5/6/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
410.2	0.0	Top of Hole							
406.2	4.0	Bottom Ash, dark brown to gray, damp, medium dense							
382.2	28.0	Clayey Gravel, gray to dark gray, moist to wet, medium stiff to very stiff, (GC)		ST-1	5.5 - 5.6	0.0		--	ST-1 Refused
				ST-2	7.5 - 9.5	0.0		--	ST-2 Crushed
				ST-3	13.5 - 15.5	0.0		--	Sample not recovered
		Fly Ash, dark brown to gray, wet, very soft to very stiff, few lenses of bottom ash							
				ST-4	34.5 - 36.5	0.0		--	Sample not recovered

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No. **STN-22 A**	Total Depth 60.7 ft

Lithology Elevation	Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fly Ash, dark brown to gray, wet, very soft to very stiff, few lenses of bottom ash *(Continued)*						
			ST-5	45.0 - 45.2	0.0		--	Refused
353.2	57.0		ST-6	55.0 - 57.0	0.0		--	Sample not recovered
349.5	60.7	Lean Clay, gray to dark gray, moist to wet, medium stiff to stiff, few organics and wood fragments (CL)	ST-7	58.0 - 60.0	0.0		--	Sample not recovered
		No Refusal / Bottom of Hole						

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-22 C**
		Total Depth	24.0 ft
County	Stewart, TN	Surface Elevation	410.2 ft
Project Type	HSA 4.25	Date Started	8/13/09
		Completed	8/13/09
Supervisor	D. Rogers	Driller	Mark Martin
Depth to Water	Dry	Date/Time	8/13/09
Logged By	D. Rogers	Depth to Water	N/A
		Date/Time	N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
410.2	0.0	Top of Hole						
		Bottom ash						
406.7	3.5							
		Clayey Gravel with cobbles (GC)						
			ST-1	5.0 - 5.3	0.0		--	tube destroyed
			ST-2	7.5 - 7.6	0.0		--	tube refused
								cobbles 7.6'-14.7'
			BAG-1 ST-3	10.1 - 20.0 15.0 - 16.1	0.0		-- --	tube split
			ST-4	20.0 - 22.0	0.0		--	tube crushed
			ST-5	22.0 - 24.0	1.4		--	trace flyash at bottom
386.2	24.0							
		No Refusal / Bottom of Hole						

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-23**	Total Depth	99.5 ft
County	Stewart, TN	Surface Elevation	420.7 ft		
Project Type	HSA 4.25	Date Started	7/17/09	Completed	7/21/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	Dry	Date/Time	7/21/09
Logged By	D. Rogers	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
420.7	0.0	Top of Hole							
		Gypsum, tan white, damp to moist, medium stiff		SPT-1	0.0 - 1.5	1.3	4-6-5	9	
				SPT-2	1.5 - 3.0	1.0	2-2-2	10	
				SPT-3	3.0 - 4.5	1.5	2-1-2	12	
				SPT-4	4.5 - 6.0	1.5	4-20-25	10	
				SPT-5	6.0 - 7.5	1.5	11-15-15	13	
				SPT-6	7.5 - 9.0	1.5	3-16-17	15	
				SPT-7	9.0 - 10.5	1.5	3-15-32	13	lense gypsum fines 8.7-9
				SPT-8	10.5 - 12.0	1.5	10-18-31	14	
				SPT-9	12.0 - 13.5	1.5	10-42-48	16	
				SPT-10	13.5 - 15.0	1.5	12-39-42	21	sample wet
				SPT-11	15.0 - 16.5	1.5	18-44-47	21	
				SPT-12	16.5 - 18.0	1.5	14-42-46	24	
401.4	19.3			SPT-13	18.0 - 19.5	1.4	10-14-18	24	
399.6	21.1	Gravel, gray, moist, medium, little silty sand		SPT-14	19.5 - 21.0	0.7	6-7-6	2	
		Flyash, dark brown gray, wet, medium stiff		SPT-15	21.0 - 22.5	0.6	3-3-2	35	
				SPT-16	22.5 - 24.0	0.9	4-8-3	35	
				SPT-17	24.0 - 25.5	0.8	3-6-10	36	
				SPT-18	25.5 - 27.0	1.3	2-8-10	31	
				SPT-19	27.0 - 28.5	1.0	5-6-9	36	
				SPT-20	28.5 - 30.0	1.3	3-5-14	28	
				SPT-21	30.0 - 31.5	1.5	2-3-4	39	
				SPT-22	31.5 - 33.0	1.5	1-1-2	32	
386.7	34.0			SPT-23	33.0 - 34.5	1.3	0-0-1	39	sample semiplastic trace organics 34.1
		Flyash, dark brown gray, wet, very soft, medium plasticity (poss hydraulic)		SPT-24	34.5 - 36.0	1.5	0-0-0	33	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-23** Total Depth 99.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Flyash, dark brown gray, wet, very soft, medium plasticity (poss hydraulic) *(Continued)*		SPT-25	36.0 - 37.5	1.5	0-0-0	44	
				SPT-26	37.5 - 39.0	1.5	0-0-2	55	
				SPT-27	39.0 - 40.5	1.5	0-1-1	47	
				SPT-28	40.5 - 42.0	1.5	0-1-2	37	micro-lensed 41.5-41.8 clay and ash
				SPT-29	42.0 - 43.5	1.5	0-1-1	34	
				SPT-30	43.5 - 45.0	1.5	0-0-1	37	very plastic
				SPT-31	45.0 - 46.5	1.5	0-1-1	47	
				SPT-32	46.5 - 48.0	1.5	0-1-2	49	non-plastic, fine sand sized grains 47-49.5
				SPT-33	48.0 - 49.5	1.4	3-3-10	52	
				SPT-34	49.5 - 51.0	1.5	3-2-3	52	nonplastic
				SPT-35	51.0 - 52.5	1.5	0-3-3	50	clayey lens 51.5-51.6
				SPT-36	52.5 - 54.0	1.3	0-3-4	48	
				SPT-37	54.0 - 55.5	1.1	3-4-3	55	
				SPT-38	55.5 - 57.0	1.5	2-2-2	58	
				SPT-39	57.0 - 58.5	1.5	3-23-41	48	coarse 57.5-60
				SPT-40	58.5 - 60.0	1.5	23-38-34	44	
				SPT-41	60.0 - 61.5	1.5	3-5-7	43	
				SPT-42	61.5 - 63.0	1.5	2-1-2	60	
				SPT-43	63.0 - 64.5	1.5	1-0-1	49	
355.2	65.5			SPT-44	64.5 - 66.0	1.5	0-0-4	54	
		Lean Clay, red brown, wet, medium stiff, trace sand, mottled (CL)		SPT-45	66.0 - 67.5	0.7	2-4-5	25	
				SPT-46	67.5 - 69.0	1.3	4-5-6	24	
				SPT-47	69.0 - 70.5	1.5	1-3-3	26	
				SPT-48	70.5 - 72.0	1.5	0-3-4	24	
				SPT-49	72.0 - 73.5	1.5	0-3-3	25	
				SPT-50	75.0 - 76.5	1.5	3-4-5	26	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-23**
		Total Depth	99.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
342.6	78.1	Gravelly Sand, red brown to brown, wet, medium to dense, medium to coarse grained, subangular, some clayey silt (GM)		SPT-51	77.5 - 79.0	1.5	8-8-14	22	
				SPT-52	80.0 - 81.5	0.9	10-10-10	23	
				SPT-53	82.5 - 84.0	0.8	13-10-12	22	
				SPT-54	85.0 - 86.5	1.0	3-8-12	25	
				SPT-55	87.5 - 89.0	0.8	16-22-18	18	
				SPT-56	90.0 - 91.5	0.5	12-14-9	23	
				SPT-57	92.5 - 94.0	1.0	12-21-22	18	
				SPT-58	95.0 - 96.5	0.4	12-4-10	27	
321.9	98.8			SPT-59	97.5 - 98.8	0.7	4-11-50+	18	
321.2	99.5	Rock (augered)		SPT-60	99.4 - 99.5		50+	8	

Auger Refusal /
Bottom of Hole

Top of Rock = 98.8
Elevation (321.9)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-24** Total Depth 90.5 ft
County	Stewart, TN	Surface Elevation	410.4 ft
Project Type	HSA 3.25	Date Started	5/26/09 Completed 5/27/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	19.5 ft Date/Time 5/26/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
410.4	0.0	Top of Hole							
408.5	1.9	Bottom Ash, dark gray to black, moist, dense		SPT-1	0.0 - 1.5	1.4	5-11-13	11	
386.4	24.0	Clayey Gravel, reddish brown to grayish brown, moist, medium dense to dense, (GC)		SPT-2	1.5 - 3.0	0.9	8-4-8	16	
				SPT-3	3.0 - 4.5	0.3	3-6-8	17	
				SPT-4	4.5 - 6.0	0.9	21-23-17	7	
				SPT-5	6.0 - 7.5	1.0	13-21-16	16	
				SPT-6	7.5 - 9.0	1.5	14-21-18	9	
				SPT-7	9.0 - 10.5	1.0	5-9-13	17	Used revert below 19.5 ft.
				SPT-8	10.5 - 12.0	0.7	5-7-9	12	
				SPT-9	12.0 - 13.5	1.1	9-14-14	22	
				SPT-10	13.5 - 15.0	1.4	5-7-50+/.4	23	
				SPT-11	15.0 - 16.5	0.7	12-16-18	19	
				SPT-12	16.5 - 18.0	1.0	10-16-14	16	
				SPT-13	18.0 - 19.5	1.0	7-12-10	18	
				SPT-14	19.5 - 21.0	0.7	4-4-4	16	
				SPT-15	21.0 - 22.5	0.6	29-3-4	21	
				SPT-16	22.5 - 24.0	0.7	3-2-1	21	
		Fly Ash, gray to light gray, moist to wet, soft to very stiff		SPT-17	24.0 - 24.4	0.9	2-5-7	46	
				SPT-18	25.5 - 27.0	1.3	6-8-1	56	
				SPT-19	27.0 - 28.5	1.1	2-2-2	53	
				SPT-20	28.5 - 30.0	1.4	WOR-WOR-WOR	53	
				SPT-21	30.0 - 31.5	1.5	WOR-WOH-3	41	
				SPT-22	31.5 - 33.0	1.2	1-2-4	49	
				SPT-23	33.0 - 34.5	1.3	2-2-1	51	
				SPT-24	35.0 - 36.5	1.0	5-7-2	44	

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-24** Total Depth 90.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fly Ash, gray to light gray, moist to wet, soft to very stiff *(Continued)*	SPT-25	37.5 - 39.0	1.0	11-50+/.5	40	
			SPT-26	40.0 - 41.5	1.5	4-5-8	37	
			SPT-27	42.5 - 44.0	0.9	17-50+/.4	51	
			SPT-28	45.0 - 46.5	0.9	8-20-17	41	
			SPT-29	47.5 - 49.0	1.4	4-18-15	39	
			SPT-30	50.0 - 51.5	1.5	5-6-7	39	
			SPT-31	52.5 - 54.0	1.5	2-2-3	70	
354.7	55.7		SPT-32	55.0 - 56.5	1.4	WOH-WOH-8	23	
		Clayey Sand, brown to yellowish brown, moist to wet, medium dense to dense, with cherty gravels(SC)	SPT-33	57.5 - 59.0	1.5	11-12-13	25	
			SPT-34	60.0 - 61.5	1.0	7-9-10	25	
			SPT-35	62.5 - 64.0	1.5	5-6-6	25	
344.3	66.1		SPT-36	65.0 - 66.5	1.2	WOR-4-2	25	
		Lean Clay, brown to yellowish brown, moist, stiff to very stiff, brown to yellowish brown, moist, stiff to very stiff (CL)	SPT-37	67.5 - 69.0	1.2	2-13-34	22	
			SPT-38	70.0 - 71.2	0.6	11-8-5	20	
			SPT-40	72.5 - 74.0	0.7	2-13-4	26	
			SPT-41	75.0 - 76.5	1.2	12-11-14	24	
332.6	77.8							

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-24** Total Depth 90.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Silty Gravel, brown, wet, dense, with sand (GM) *(Continued)*		SPT-42	77.5 - 79.0	1.3	16-18-22	24	Boring backfilled with 3 bags of quikgrout and 2 bags of portland cement.
				SPT-43	80.0 - 81.5	0.9	18-28-33	18	
				SPT-44	82.5 - 84.0	1.1	23-21-50	20	
				SPT-45	85.0 - 86.5	0.5	16-8-11	26	
				SPT-46	87.5 - 89.0	1.1	27-34-17	18	
320.0	90.4			SPT-47	90.0 - 90.4	0.4	50+/.4	17	
319.9	90.5	Rock (Augered)							

Auger Refusal /
Bottom of Hole

Top of Rock = 90.4
Elevation (320.0)

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-24 C** Total Depth 18.0 ft
County	Stewart, TN	Surface Elevation	410.4 ft
Project Type	HSA 4.25	Date Started	8/13/09 Completed 8/13/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	Dry Date/Time 8/13/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
410.4	0.0	Top of Hole							
409.2	1.2	Bottom ash							
		Clayey Gravel with cobbles (GC)		ST-1	3.5 - 4.8	1.1		--	Cobbles 5'-9.5'
				ST-2	10.0 - 11.6	0.9		--	Cobbles 11.5'-18.0'
392.4	18.0								
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-25** Total Depth 77.3 ft
County	Stewart, TN	Surface Elevation	395.4 ft
Project Type	HSA 3.25	Date Started	5/12/09 Completed 5/13/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	18.6 ft Date/Time 5/12/09
Logged By	James Felts	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.4	0.0	Top of Hole						
394.9	0.5	Gravel (Roadway)	SPT-1	0.0 - 1.5	1.0	6-4-4	20	
		Fat Clay, reddish brown, wet, stiff to very stiff, some chert gravel (CH)	SPT-2	1.5 - 3.0	0.6	4-4-4	19	
			SPT-3	3.0 - 4.5	1.1	2-2-4	21	
			SPT-4	4.5 - 6.0	0.9	2-4-4	20	
			SPT-5	6.0 - 7.5	0.9	4-4-5	19	
			SPT-6	7.5 - 9.0	0.7	5-10-8	22	
			SPT-7	9.0 - 10.5	1.1	5-4-5	28	
			SPT-8	10.5 - 12.0	1.1	2-3-3	23	
			SPT-9	12.0 - 13.5	1.0	3-7-10	20	
			SPT-10	13.5 - 15.0	1.2	3-5-7	22	
			SPT-11	15.0 - 16.5	1.4	3-5-6	25	
			SPT-12	16.5 - 18.0	1.3	4-5-5	29	
376.8	18.6		SPT-13	18.0 - 19.5	1.0	2-18-19	28	
		Fly Ash, dark gray, wet, stiff to very stiff, some bottom ash	SPT-14	19.5 - 21.0	1.0	18-16-15	15	
374.4	21.0	Fly Ash, dark gray, wet, medium stiff to soft, with lenses black bottom ash	SPT-15	21.0 - 22.5	1.5	8-3-4	46	
			SPT-16	22.5 - 24.0	1.5	1-0-0	58	
			SPT-17	24.0 - 25.5	1.5	1-0-1	54	
			SPT-18	25.5 - 27.0	1.5	3-4-6	49	
			SPT-19	27.0 - 28.5	1.5	1-0-1	46	
			SPT-20	28.5 - 30.0	1.5	1-0-1	68	
			SPT-21	30.0 - 31.5	1.5	1-0-2	63	
362.9	32.5		SPT-22	31.5 - 32.7	0.9	0-0-50+/0.2	58	
		Limestone boulder, hard, cored						
360.9	34.5	Fly Ash, brownish gray, wet, stiff, lensed (color)						

SUBSURFACE LOG

Stantec

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-25** Total Depth 77.3 ft

Lithology Elevation	Depth	Description	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fly Ash, brownish gray, wet, stiff, lensed (color) *(Continued)*	SPT-23	37.5 - 39.0	1.0	6-7-6	19	
			SPT-24	39.0 - 40.5	1.5	2-3-5	25	bottom ash fragments Clayey lenses 40.5 and 41.7-42.0 layered
			SPT-25	40.5 - 42.0	1.5	3-4-5	25	
352.8	42.6							
		Lean Clay, dark brown with gray, moist, stiff, mottled (CL)	SPT-26	42.0 - 43.5	1.0	3-3-5	23	
			SPT-27	43.5 - 45.0	1.5	2-3-3	26	
			SPT-28	45.0 - 46.5	1.5	2-2-3	27	
			SPT-29	47.5 - 49.0	1.5	3-5-5	25	
			SPT-30	50.0 - 51.5	1.5	2-4-5	24	
342.4	53.0							
		Silty Sand, brownish gray, wet, dense to loose, (SM) (Visual)	SPT-31	52.5 - 54.0	1.1	4-9-10	28	
			SPT-32	55.0 - 56.5	1.3	1-2-3	24	
336.4	59.0		SPT-33	57.5 - 59.0	1.5	6-7-5	27	Sample 33 SPLIT Lenses Silty Clay
		Lean Clay With Sand And Gravel, gray, wet, stiff, (CL)	SPT-34	60.0 - 61.5	1.5	1-3-15	25	
332.6	62.8							
		Silty Gravel With Sand, orangish brown, wet, loose to very dense, medium to course grained (GM)	SPT-35	62.5 - 64.0	1.1	13-15-12	19	
			SPT-36	65.0 - 66.5	1.3	10-12-12	19	
			SPT-37	67.5 - 69.0	0.9	17-22-29	18	
			SPT-38	70.0 - 71.5	1.2	15-20-22	21	
			SPT-39	72.5 - 74.0	0.4	6-2-1	21	Large Gravel Block Spoon
319.4	76.0		SPT-40	75.0 - 76.5	0.3	0-0-6	21	
318.1	77.3	Limestone, gray, hard, fragmented (Augered)						

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-25**	Total Depth	77.3 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Auger Refusal / Bottom of Hole Top of Rock = 76.0 Elevation (319.4)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-26** Total Depth 60.4 ft
County	Stewart, TN	Surface Elevation	380.6 ft
Project Type	HSA 3.25	Date Started	6/15/09 Completed 6/15/09
Supervisor	D. Rogers Driller Greg Thompson	Depth to Water	23.5 ft Date/Time 6/15/09
Logged By	Russell Mehnert	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
380.6	0.0	Top of Hole							
		Lean Clay, brown to reddish brown, moist, medium stiff to very stiff, with occasional gray mottling, with roots, chert and shale fragments (CL)		SPT-1	0.0 - 1.5	0.5	2-2-4	24	Boring backfilled with (2) bags Quik Grout and (1) Portland Cement
				SPT-2	1.5 - 3.0	0.9	3-4-5	20	
				SPT-3	3.0 - 4.5	1.5	4-7-8	25	
				SPT-4	4.5 - 6.0	1.1	7-8-10	22	
				SPT-5	6.0 - 7.5	1.0	9-12-16	16	
				SPT-6	7.5 - 9.0	1.3	4-5-6	18	
				SPT-7	9.0 - 10.5	0.8	7-16-12	17	
				SPT-8	10.5 - 12.0	1.3	5-7-10	18	
				SPT-9	12.0 - 13.5	1.4	6-10-13	22	
366.2	14.4			SPT-10	13.5 - 15.0	1.4	4-8-11	18	
		Lean Clay, brownish gray, moist, stiff to very stiff, with faint organic smell (CL)		SPT-11	15.0 - 16.5	1.3	7-9-9	20	
				SPT-12	16.5 - 18.0	1.2	10-11-13	20	
				SPT-13	18.0 - 19.5	1.0	4-6-7	21	
360.5	20.1			SPT-14	19.5 - 21.0	1.4	3-5-6	32	
		Lean Clay, brown to reddish brown, moist, stiff, brown to reddish brown with occasional gray modeling, moist, stiff with roots, chert, quartcite and shale fragments, and gravel (CL)		SPT-15	21.0 - 22.5	1.2	4-7-9	24	area of quartcite 21.1'-23.5'
357.1	23.5			SPT-16	22.5 - 24.0	0.6	3-6-7	18	wet @ 23.5'
				SPT-17	24.0 - 25.5	1.3	3-5-6	23	
		Lean Clay, brownish gray, moist to wet, medium stiff, with faint organic smell (CL)		SPT-18	25.5 - 27.0	1.5	2-4-3	23	
352.1	28.5			SPT-19	27.0 - 28.5	1.5	4-4-4	25	
		Lean Clay, brown with gray, moist to wet, soft to medium stiff, with occasional gray mottling and areas of silt, sand and gravel (CL)		SPT-20	28.5 - 30.0	1.5	2-3-3	25	
				SPT-21	30.0 - 31.5	1.5	2-3-4	24	
				SPT-22	31.5 - 32.7	1.5	WOH-2-2	26	

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-26**
		Total Depth	60.4 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
342.2	38.4			SPT-23	37.5 - 39.0	1.1	4-3-3	23	
		Silty Gravel, gray to brown, wet, medium dense to dense, with areas of clay (GM)		SPT-24	39.0 - 40.5	1.5	4-7-7	22	
				SPT-25	40.5 - 42.0	1.0	5-6-6	23	
				SPT-26	42.0 - 43.5	0.8	4-5-7	22	
				SPT-27	43.5 - 45.0	0.9	2-8-22	21	
				SPT-28	45.0 - 46.5	1.0	5-7-8	22	
				SPT-29	47.5 - 49.0	1.0	10-10-10	21	
				SPT-30	50.0 - 51.5	1.1	8-14-12	19	
				SPT-31	52.5 - 54.0	0.9	6-10-20	22	
				SPT-32	55.0 - 56.5	0.6	14-14-12	22	
				SPT-33	57.5 - 59.0	0.4	50+/0.4	17	
320.3	60.3								
320.2	60.4	Limestone, light gray to gray, hard (augered)							

Auger Refusal / Bottom of Hole

Top of Rock = 60.3 Elevation (320.3)

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-27** Total Depth 87.9 ft
County	Stewart, TN	Surface Elevation	422.2 ft
Project Type	HSA 3.25	Date Started	7/16/09 Completed 7/16/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	25.5 ft Date/Time 7/16/09
Logged By	Kurt Shellhause	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
422.2	0.0	Top of Hole							
		Gypsum, white to tan, damp, stiff to very stiff		SPT-1	0.0 - 1.5	1.4	4-7-6	17	
				SPT-2	1.5 - 3.0	1.0	10-9-6	10	
				SPT-3	3.0 - 4.5	0.9	3-5-5	13	
				SPT-4	4.5 - 6.0	1.5	13-15-26	15	Gypsum bag sample taken
				SPT-5	6.0 - 7.5	1.2	13-18-50+/0.2	17	
				BAG-1	5.0 - 10.0			19	
413.2	9.0			SPT-6	7.5 - 9.0	1.3	27-36-50+/0.3	18	
411.7	10.5	Fly Ash, grayish brown, moist, very stiff		SPT-7	9.0 - 10.5	1.5	27-27-27	11	
		Gypsum, white to tan, damp, very stiff		SPT-8	10.5 - 12.0	1.5	18-38-41	9	
				SPT-9	12.0 - 13.5	0.6	22-50+/0.2	20	
				SPT-10	13.5 - 15.0	1.5	22-34-40	20	
				SPT-11	15.0 - 16.5	1.0	18-50+/0.3	20	
				BAG-2	14.0 - 20.0			19	
				SPT-12	16.5 - 18.0	0.2	50+/0.2	21	
				SPT-13	18.0 - 19.5	1.0	29-50+/0.3	23	
401.3	20.9			SPT-14	19.5 - 21.0	1.5	18-14-17	24	Gypsum bag sample taken
		Fly Ash, grayish brown, dry to wet, very soft to very stiff		SPT-15	21.0 - 22.5	1.0	18-34-44	23	Bottom Ash lens
				SPT-16	22.5 - 24.0	1.5	7-11-12	--	
				SPT-17	24.0 - 25.5	1.5	4-4-6	26	
				SPT-18	25.5 - 27.0	0.0	1-1-2	19	Ground water, fly ash becoming very soft
				SPT-19	27.0 - 28.5	0.8	3-6-6	20	
				SPT-20	28.5 - 30.0	1.5	25-30-22	25	
				SPT-21	30.0 - 31.5	0.8	3-6-10	31	
				SPT-22	31.5 - 33.0	1.2	5-5-9	33	
				SPT-23	33.0 - 34.5	1.5	19-36-47	29	Bottom Ash lens
				SPT-24	34.5 - 36.0	1.5	15-21-24	38	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-27**	Total Depth	87.9 ft

Lithology: Elevation	Lithology: Depth	Description	Overburden: Sample # / Rock Core: RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fly Ash, grayish brown, dry to wet, very soft to very stiff *(Continued)*	SPT-25	36.0 - 37.5	1.0	15-24-39	43	
			SPT-26	37.5 - 39.0	1.5	2-4-6	44	WOR, 2, 2
			SPT-27	39.0 - 40.5	1.4	0-2-2	38	Fallout recovery from shelby tube sample, recovery placed in a jar.
			ST-28	42.0 - 43.5	0.0		33	WOH
			SPT-29	43.5 - 45.0	1.5	0-0-2	37	WOH, WOH, 2
			SPT-30	45.0 - 46.5	1.5	2-2-3	30	Black Bottom Ash lens in sample
			SPT-31	46.5 - 48.0	1.5	4-8-10	35	
			SPT-32	48.0 - 49.5	1.5	28-28-9	46	Black Bottom Ash silt lens in sample
			SPT-33	49.5 - 51.0	1.5	2-1-3	39	
			SPT-34	51.0 - 52.5	1.5	3-11-9	44	
			SPT-35	52.5 - 54.0	1.3	8-6-9	40	
			SPT-36	54.0 - 55.5	1.5	4-6-13	39	
			SPT-37	55.5 - 57.0	1.5	6-8-12	35	
			SPT-38	57.0 - 58.5	1.5	19-50+/0.2	34	
			SPT-39	58.5 - 60.0	1.5	13-50+/0.3	48	
			SPT-40	60.0 - 61.5	1.5	2-6-8	41	
			SPT-41	61.5 - 63.0	1.5	6-11-16	43	
			SPT-42	63.0 - 64.5	1.5	3-4-3	43	WOH, WOH, 2
			SPT-43	64.5 - 66.5	1.5	0-0-2	21	
355.3	66.9		SPT-44	66.0 - 67.5	1.5	6-11-12	24	
		Lean Clay With Gravel, brown, wet, stiff, (CL)	SPT-45	67.5 - 69.0	0.6	7-8-9	23	
			SPT-46	70.0 - 71.5	1.1	3-5-7	27	WOH, 4, 5
			SPT-47	72.5 - 74.0	1.1	0-4-5	25	WOH, 4, 7
			SPT-48	75.0 - 76.5	1.5	0-4-7	26	

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SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-27** Total Depth 87.9 ft

Lithology: Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
342.2	80.0	Lean Clay With Gravel, brown, wet, stiff, (CL) *(Continued)*		SPT-49	77.5 - 79.0	1.5	5-8-8	25	
		Lean Clay, gray, wet, stiff, (CL)		SPT-50	80.0 - 81.5	1.2	0-3-5	31	WOH, 3, 5
				SPT-51	82.5 - 84.0	1.3	3-6-6	31	
				SPT-52	85.0 - 86.5	1.5	6-7-8	33	Clay has changed in color to a very dark gray
334.3	87.9			SPT-53	87.5 - 87.9	1.3	50+/0.4	--	
		Auger Refusal / Bottom of Hole Top of Rock = 87.9 Elevation (334.3)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-28** Total Depth 71.2 ft
County	Stewart, TN	Surface Elevation	410.6 ft
Project Type	HSA 3.25	Date Started	5/18/09 Completed 5/19/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	18.0 ft Date/Time 5/18/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
410.6	0.0	Top of Hole							
409.5	1.1	Bottom Ash, dark gray to black, damp, medium dense		SPT-1	0.0 - 1.5	1.2	7-11-8	10	
				SPT-2	1.5 - 3.0	0.8	18-12-18	14	
		Clayey Gravel, reddish brown to brown, moist to wet, stiff to very stiff, (GC)		SPT-3	3.0 - 4.5	0.8	7-11-15	17	
				SPT-4	4.5 - 6.0	0.6	10-17-13	11	
				SPT-5	6.0 - 7.5	0.7	5-5-7	15	
				SPT-6	7.5 - 9.0	0.5	3-6-7	18	
				SPT-7	9.0 - 10.5	1.2	10-7-7	16	
				SPT-8	10.5 - 12.0	1.0	4-8-12	13	
				SPT-9	12.0 - 13.5	1.1	11-30-25	11	
				SPT-10	13.5 - 15.0	0.6	11-8-13	16	
				SPT-11	15.0 - 16.5	1.0	25-17-12	20	
				SPT-12	16.5 - 18.0	0.6	7-11-7	22	
391.2	19.4			SPT-13	18.0 - 19.5	0.6	4-3-3	20	
		Fly Ash, gray, wet, soft to very stiff		SPT-14	19.5 - 21.0	1.5	2-2-3	46	
				SPT-15	21.0 - 22.5	1.5	1-1-1	38	
				SPT-16	25.0 - 26.5	1.5	3-3-4	31	
				SPT-17	27.5 - 29.0	1.5	0-0-0	35	
				SPT-18	30.0 - 31.5	1.5	2-2-3	33	
				SPT-19	32.5 - 34.0	0.7	9-10-12	34	
				SPT-20	35.0 - 36.5	0.8	8-4-6	41	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No. **STN-28**	Total Depth 71.2 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fly Ash, gray, wet, soft to very stiff *(Continued)*	SPT-21	37.5 - 39.0	1.5	3-2-5	48	
			SPT-22	40.0 - 41.5	1.5	1-2-3	46	
			SPT-23	42.5 - 44.0	1.5	4-8-50	43	
			SPT-24	45.0 - 46.5	1.1	30-21-21	34	
			SPT-25	47.5 - 49.0	1.5	5-12-17	38	
			SPT-26	50.0 - 51.5	1.4	7-10-10	35	
356.9	53.7		SPT-27	52.5 - 54.0	1.5	1-1-5	38	
		Lean Clay, gray to brown, moist, stiff to very stiff, occasional gravel, zones brown mottled (CL)	SPT-28	55.0 - 56.5	0.8	8-11-15	20	
			SPT-29	57.5 - 59.0	1.2	4-9-11	21	
			SPT-30	60.0 - 61.5	1.3	5-8-11	21	sample 34 split into samples 34 and 35. sample 35 is 0.2' weathered rock.
			SPT-31	62.5 - 64.0	1.5	7-8-9	23	
			SPT-32	65.0 - 66.5	1.5	6-7-10	24	
			SPT-33	67.5 - 69.0	1.5	5-6-7	25	
339.4	71.2		SPT-34/35	70.0 - 71.2	1.2	4-17-50+	26	
		No Refusal / Bottom of Hole Top of Rock = 71.0 Elevation (339.6)						

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-28 A** Total Depth 54.0 ft
County	Stewart, TN	Surface Elevation	410.6 ft
Project Type	Mud Rotary	Date Started	5/29/09 Completed 5/30/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	Dry Date/Time 5/30/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
410.6	0.0	Top of Hole						
409.5	1.1	Bottom Ash, dark gray to black, very coarse grained.						
		Clayey Gravel, reddish brown to brown, moist to wet, stiff to very stiff, (GC)	ST-1	8.0 - 9.5	1.5		--	
391.2	19.4	Fly Ash, soft to very stiff, gray, silt to medium grained						

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SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-28 A
		Total Depth	54.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fly Ash, soft to very stiff, gray, silt to medium grained *(Continued)*							
				ST-2	50.0 - 52.0	2.0		--	
356.6	54.0			ST-3	52.0 - 54.0	2.0		--	
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Stantec

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-28 B** Total Depth 19.5 ft
County	Stewart, TN	Surface Elevation	410.6 ft
Project Type	HSA 3.25	Date Started	6/27/09 Completed 6/27/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	Dry Date/Time 6/27/09
Logged By	James Felts	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
410.6	0.0	Top of Hole							
409.5	1.1	Bottom Ash, dark gray to black, very coarse grained.							
		Clayey Gravel, reddish brown to brown, moist to wet, stiff to very stiff, (GC)		ST-1	3.0 - 3.1	0.0		--	Tube Crushed
				ST-2	7.0 - 7.1	0.0		--	Tube Bent
				ST-3	10.5 - 11.5	0.0		--	Tube Crushed
				ST-4	14.5 - 16.5	0.2		--	Tube Bent
				ST-5	17.5 - 19.5	0.6		--	Tube Bent
391.1	19.5								

No Refusal /
Bottom of Hole

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-28 C** Total Depth 16.5 ft
County	Stewart, TN	Surface Elevation	410.6 ft
Project Type	HSA 4.25	Date Started	8/13/09 Completed 8/13/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	Dry Date/Time 8/13/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden Rock Core	Sample # RQD	Depth Run	Rec. Ft. Rec. Ft.	Blows Rec. %	Mois.Cont. % Run Depth	Remarks
410.6	0.0	Top of Hole							
409.1	1.5	Bottom Ash							
394.1	16.5	Clayey Gravel with cobbles (GC)		ST-1	14.5 - 16.5	1.1		--	Cobbles and gravels 4'-13.5'
		No Refusal / Bottom of Hole							

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-29**	Total Depth	60.3 ft
County	Stewart, TN	Surface Elevation	395.2 ft		
Project Type	HSA 3.25	Date Started	5/14/09	Completed	5/15/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	20.2 ft	Date/Time	5/14/09
Logged By	Ryan J Riker	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
395.2	0.0	Top of Hole							
		Fat Clay, reddish brown, moist, stiff, some chert gravel (CH)		SPT-1	0.0 - 1.5	0.5	9-8-14	22	0.2 Crushed Stone
				SPT-2	1.5 - 3.0	0.8	11-13-13	19	
				SPT-3	3.0 - 4.5	1.5	5-8-11	25	
				SPT-4	4.5 - 6.0	0.8	6-3-5	24	PZ Installed Screen 44.0-54.0
387.7	7.5			SPT-5	6.0 - 7.5	0.5	5-7-5	19	
		Lean Clay, brown, moist to wet, stiff to very stiff, some gravel (CL)		SPT-6	7.5 - 9.0	1.1	5-13-23	22	
				SPT-7	9.0 - 10.5	0.6	11-11-7	18	
				SPT-8	10.5 - 12.0	0.7	4-5-13	20	
				SPT-9	12.0 - 13.5	1.4	14-13-19	39	
				SPT-10	13.5 - 15.0	0.9	18-17-17	16	
				SPT-11	15.0 - 16.5	1.5	9-14-14	19	Safety Hammer through SPT 12 Auto hammer afterwards
				SPT-12	16.5 - 18.0	0.9	11-12-15	23	
375.7	19.5			SPT-13	18.0 - 19.5	1.2	2-5-5	26	
		Bottom Ash, dark gray, moist to wet, dense to loose, Bottom Ash, dark blackish-gray, moist to wet, dense to loose, some fines		SPT-14	19.5 - 21.0	0.7	4-5-22	42	
				SPT-15	21.0 - 22.5	1.5	4-3-7	47	
				SPT-16	22.5 - 24.0	1.0	5-2-1	52	
				SPT-17	24.0 - 25.5	1.5	2-2-2	45	
368.2	27.0			SPT-18	25.5 - 27.0	1.5	0-0-0	49	
		Lean Clay With Gravel, brown to gray, wet, medium stiff to very stiff, mottled (CL)		SPT-19	27.0 - 28.5	0.8	13-5-3	27	
				SPT-20	28.5 - 30.0	0.7	2-2-4	23	
				SPT-21	30.0 - 31.5	0.3	3-7-6	32	
				SPT-22	31.5 - 33.0	0.3	7-12-15	32	
358.7	36.5			SPT-23	35.0 - 36.5	1.5	8-10-10	28	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-29**
		Total Depth	60.3 ft

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Lean Clay, gray, wet, very stiff to soft, trace sand (CL) *(Continued)*	SPT-24	37.5 - 39.0	1.3	8-13-12	19	
			SPT-25	40.0 - 41.5	1.5	7-6-7	24	
			SPT-26	42.5 - 44.0	1.5	5-5-7	26	
			SPT-27	45.0 - 46.5	1.5	6-6-10	24	
			SPT-28	47.5 - 49.0	1.5	5-6-6	24	
			SPT-29	50.0 - 51.5	1.1	3-3-2	27	
			SPT-30	52.5 - 54.0	1.0	0-0-0	45	
339.7	55.5		SPT-31	55.0 - 55.8	0.3	2-50+/0.3	22	Began Core
339.4	55.8	Shale (Augered)						
334.9	60.3	Shale interbedded with Limestone Shale is light gray, calcareous, moderately hard, laminated Limestone is light gray, hard, turbulent bedded	62	4.5	4.5	100	60.3	

Bottom of Hole

Top of Rock = 55.5
Elevation (339.7)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-29 A**
		Total Depth	56.9 ft
County	Stewart, TN	Surface Elevation	395.2 ft
Project Type	Mud Rotary	Date Started	5/27/09
		Completed	5/28/09
Supervisor	D. Rogers	Depth to Water	Dry
Driller	James Felts	Date/Time	5/28/09
Logged By	D. Rogers	Depth to Water	N/A
		Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.2	0.0	Top of Hole							
		Fat Clay, reddish brown, stiff, moist, some chert gravel (CH)							SI installed to 56.9
387.7	7.5								
		Lean Clay, brown, stiff to very stiff, moist to wet, some gravel (CL)							
				ST-1	17.0 - 19.0	2.0		--	
375.7	19.5								
		Bottom Ash, dark blackish-gray, moist to wet, dense to loose, some fines							
368.2	27.0								
		Lean Clay With Gravel, brown to gray mottled, medium stiff to stiff, wet (CL)		ST-2	29.0 - 31.0	2.0		--	
358.7	36.5								

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-29 A** Total Depth 56.9 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, gray, wet,very stiff to soft, trace sand (CL) *(Continued)*							
				ST-3	50.0 - 52.0	2.0		--	
340.3	54.9								
338.3	56.9	Rock (Augered)							

No Refusal /
Bottom of Hole

Top of Rock = 54.9
Elevation (340.3)

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-29 B** Total Depth 16.5 ft
County	Stewart, TN	Surface Elevation	395.2 ft
Project Type	HSA 3.25	Date Started	6/28/09 Completed 6/28/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	10.0 ft Date/Time 6/28/09
Logged By	James Felts	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
395.2	0.0	Top of Hole							
		Fat Clay, reddish brown, stiff, moist, some chert gravel (CH)		BAG-1	0.3 - 10.0			--	
387.7	7.5								
		Lean Clay, brown, stiff to very stiff, moist to wet, some gravel (CL)		ST-1	8.0 - 8.4	0.0		--	
				BAG-2 ST-2	10.0 - 14.5 12.0 - 13.4	1.1		-- --	
				ST-3	14.5 - 16.5	1.3		--	
378.7	16.5								
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-30** Total Depth 39.7 ft
County	Stewart, TN	Surface Elevation	379.7 ft
Project Type	HSA 3.25	Date Started	6/16/09 Completed 6/16/09
Supervisor	D. Rogers Driller Greg Thompson	Depth to Water	6.0 ft Date/Time 6/16/09
Logged By	Russell Mehnert	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
379.7	0.0	Top of Hole							
		Lean Clay, brown to reddish brown, moist to wet, medium stiff to very stiff, with gravel, roots and chert fragments (CL)		SPT-1	0.0 - 1.5	0.7	2-2-12	21	Low recovery in SPT's is due to gravel in samples Boring backfilled with (2) bags Quik Grout and (1) Portland Cement
				SPT-2	1.5 - 3.0	0.9	2-3-11	20	
				SPT-3	3.0 - 4.5	0.9	2-4-3	18	
				SPT-4	4.5 - 6.0	0.8	3-9-8	22	
				SPT-5	6.0 - 7.5	0.5	5-47-30	15	
370.4	9.3			SPT-6	7.5 - 9.0	0.7	13-15-12	18	
		Lean Clay, grayish brown to dark brown, moist, medium stiff to very stiff, with gray mottling, gravel, and faint organic smell (CL)		SPT-7	9.0 - 10.5	1.3	3-5-6	20	
				SPT-8	10.5 - 12.0	1.1	3-5-6	20	
				SPT-9	12.0 - 13.5	1.3	8-9-11	20	
				SPT-10	13.5 - 15.0	1.3	5-5-8	20	
363.2	16.5			SPT-11	15.0 - 16.5	1.3	7-8-9	20	
		Lean Clay, brown to reddish brown, moist, medium stiff to very stiff, with occasional gray mottling and chert fragments (CL)		SPT-12	16.5 - 18.0	1.5	7-9-11	22	
				SPT-13	18.0 - 19.5	1.0	2-4-5	27	
358.3	21.4			SPT-14	19.5 - 21.0	1.0	2-4-3	25	
		Lean Clay, grayish brown to dark brown, moist, medium stiff to very stiff, with gray mottling, gravel, and faint organic smell (CL)		SPT-15	21.0 - 22.5	1.2	4-4-9	22	
				SPT-16	22.5 - 24.0	1.4	3-5-5	21	
354.5	25.2			SPT-17	24.0 - 25.5	1.5	2-4-5	23	
		Lean Clay, brown, moist, medium stiff to very stiff, with occasional gray mottling and gravel, manganese concretions, silt and chert fragments (CL)		SPT-18	25.5 - 27.0	1.1	2-4-5	23	
				SPT-19	27.0 - 27.9	0.9	5-50+/0.4	22	SPT-19 rock fragment in tip of spt
				SPT-20	28.5 - 30.0	1.3	19-7-5	25	
				SPT-21	30.0 - 30.9	0.7	5-50+/0.4	21	
346.9	32.8			SPT-22	31.5 - 32.8	0.1	50+/0.3	9	SPT-22 - 0.1 recovery of gravel
		Augered to refusal @ 39.7'		SPT-23	33.0 - 36.5	0.0	50+	--	SPT-23 - 0.0 recovery - spoon refusal

Project Number	175539009	Location	Cumberland Fossil	
Project Name	CUF	Boring No.	**STN-30**	Total Depth 39.7 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
340.0	39.7	Augered to refusal @ 39.7' *(Continued)*							

Auger Refusal /
Bottom of Hole

Top of Rock = 35.0
Elevation (344.7)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-31** Total Depth 70.9 ft
County	Stewart, TN	Surface Elevation	422.5 ft
Project Type	HSA 4.25	Date Started	7/22/09 Completed 7/23/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	27.0 ft Date/Time 7/22/09
Logged By	D. Chapman	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
422.5	0.0	Top of Hole							
		Gypsum, tan white, moist, very stiff		SPT-1	0.0 - 1.5	1.1	2-5-9	10	
				SPT-2	1.5 - 3.0	1.5	10-11-20	6	
				SPT-3	3.0 - 4.5	1.4	8-24-25	7	
				SPT-4	4.5 - 6.0	1.3	10-24-33	9	
				SPT-5	6.0 - 7.5	1.5	25-45-47	19	
				SPT-6	7.5 - 9.0	1.5	10-24-32	7	
				SPT-7	9.0 - 10.5	1.5	10-28-38	9	
				SPT-8	10.5 - 11.8	1.3	22-48-50+/0.3	14	
				SPT-9	12.0 - 13.5	1.5	24-42-48	11	
				SPT-10	13.5 - 14.7	1.2	22-38-50+/0.2	13	
				SPT-11	15.0 - 16.2	1.5	22-44-50+/0.2	21	
				SPT-12	16.5 - 17.8	0.8	22-50+/0.3	20	
				SPT-13	18.0 - 19.5	1.5	25-38-42	21	
402.0	20.5			SPT-14	19.5 - 21.0	1.3	10-12-12	5	geotextile 20.5
		Gravel, gray, medium dense		SPT-15	21.0 - 22.5	0.7	6-9-9	9	
399.7	22.8								
		Bottom Ash, dark gray, moist to wet, loose to dense		SPT-16	22.5 - 24.0	0.8	8-18-19	14	
				SPT-17	24.0 - 25.5	1.0	10-25-15	15	
				SPT-18	25.5 - 27.0	1.5	8-9-11	16	
				SPT-19	27.0 - 28.5	1.3	6-6-4	12	
				SPT-20	28.5 - 30.0	1.5	4-3-4	14	
				SPT-21	30.0 - 31.5	0.9	4-2-2	19	
390.5	32.0			SPT-22	31.5 - 33.0	1.4	9-20-21	34	
		Fly Ash, dark gray, wet, very soft to very stiff, Flyash, dark gray, wet, very soft to very stiff, zones sand sized		SPT-23	33.0 - 34.5	1.2	7-7-30	64	
				SPT-24	34.5 - 36.0	1.5	12-13-12	42	Drilling mud used below 35

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

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SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-31** Total Depth 70.9 ft

Lithology: Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fly Ash, dark gray, wet, very soft to very stiff, Flyash, dark gray, wet, very soft to very stiff, zones sand sized *(Continued)*		SPT-25	36.0 - 37.5	1.5	8-12-14	25	
				SPT-26	37.5 - 39.0	1.5	2-4-5	30	
				SPT-27	39.0 - 40.5	1.5	0-1-0	35	
				SPT-28	40.5 - 42.0	1.5	0-0-0	37	
				SPT-29	42.0 - 43.5	1.5	1-0-0	39	
				SPT-30	43.5 - 45.0	1.5	0-1-1	36	
				SPT-31	45.0 - 46.5	1.5	0-1-0	39	
				SPT-32	46.5 - 48.0	1.5	1-3-2	52	
				SPT-33	48.0 - 49.5	1.5	1-0-0	47	
				SPT-34	49.5 - 51.0	1.5	1-2-4	47	
				SPT-35	51.0 - 52.5	1.5	1-1-1	55	
				SPT-36	52.5 - 54.0	1.5	0-1-4	49	
				SPT-37	54.0 - 55.5	1.5	2-4-4	42	
				SPT-38	55.5 - 57.0	1.5	10-12-13	35	
				SPT-39	57.0 - 58.5	1.5	1-0-0	40	
				SPT-40	58.5 - 60.0	1.5	0-0-0	38	
				SPT-41	60.0 - 61.5	1.5	0-0-0	51	
				SPT-42	61.5 - 63.0	1.5	0-0-1	43	
				SPT-43	63.0 - 64.5	1.5	1-4-4	31	
357.0	65.5			SPT-44	64.5 - 66.0	0.8	1-3-3	24	
		Lean Clay, brown with gray, wet, medium stiff to stiff, mottled (CL)		SPT-45	66.0 - 67.5	1.5	4-7-7	21	
				SPT-46	67.5 - 69.0	1.5	4-4-4	22	
352.6	69.9			SPT-47	69.0 - 69.8	0.8	17-50+/0.3	28	
351.6	70.9	Limestone (augered)							

Auger Refusal /
Bottom of Hole

Top of Rock = 69.9
Elevation (352.6)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-32** Total Depth 60.4 ft
County	Stewart, TN	Surface Elevation	410.7 ft
Project Type	HSA 3.25	Date Started	5/18/09 Completed 5/18/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	18.1 ft Date/Time 5/18/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden Rock Core	Sample # RQD	Depth Run	Rec. Ft. Rec. Ft.	Blows Rec. %	Mois.Cont. % Run Depth	Remarks
410.7	0.0	Top of Hole							
409.6	1.1	Bottom Ash, black to dark gray, medium		SPT-1	0.0 - 1.5	1.5	6-8-5	11	use revert
		Clayey Gravel, red brown to brown, damp to moist, very stiff, (GC)		SPT-2	1.5 - 3.0	1.5	10-9-11	20	
				SPT-3	3.0 - 4.5	1.5	4-9-10	13	
				SPT-4	4.5 - 4.8	0.3	50+	18	cobble 4.7-5.6
				SPT-5	6.0 - 7.5	1.5	13-14-16	22	
				SPT-6	7.5 - 9.0	0.7	25-28-25	7	gray rock fragments
				SPT-7	9.0 - 10.5	1.2	6-14-23	17	
				SPT-8	10.5 - 12.0	1.5	8-9-10	14	
				SPT-9	12.0 - 13.5	1.5	9-13-28	18	
				SPT-10	13.5 - 15.0	1.5	9-7-11	18	
				SPT-11	15.0 - 16.5	1.5	4-4-5	21	
393.0	17.7			SPT-12	16.5 - 18.0	1.5	5-7-5	27	
		Flyash, dark brownish gray, moist to wet, stiff, alternating zones clayey, lensed and cemented		SPT-13	18.0 - 19.5	1.5	1-2-6	48	
				SPT-14	20.0 - 21.5	1.5	6-8-16	19	
				SPT-15	22.5 - 24.0	1.5	7-13-20	21	
				SPT-16	25.0 - 26.5	1.5	3-8-21	47	
				SPT-17	27.5 - 29.0	1.5	5-6-7	41	
				SPT-18	30.0 - 31.5	1.5	0-1-2	44	
				SPT-19	32.5 - 34.0	1.5	0-1-2	22	
				SPT-20	35.0 - 36.5	1.5	2-3-4	49	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

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SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-32**
		Total Depth	60.4 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Flyash, dark brownish gray, moist to wet, stiff, alternating zones clayey, lensed and cemented *(Continued)*		SPT-21	37.5 - 39.0	1.5	3-9-12	40	
				SPT-22	40.0 - 41.5	1.5	3-3-4	42	
				SPT-23	42.5 - 44.0	1.5	1-2-2	45	
				SPT-24	45.0 - 46.5	1.5	7-9-8	34	
				SPT-25	47.5 - 49.0	1.5	2-2-2	44	
360.4	50.3								
359.5	51.2	Bottom Ash, black to dark gray, wet		SPT-26	50.0 - 51.5	1.5	0-5-11	32	
		Lean Clay, light brown and gray, wet, very stiff, mottled (CL)		SPT-27	52.5 - 54.0	0.8	5-8-10	24	
				SPT-28	55.0 - 56.5	1.5	6-10-10	27	
				SPT-29	57.5 - 59.0	1.1	5-7-9	40	60.2-60.4 dry, fissile
350.5	60.2			SPT-30	60.0 - 60.4	0.4	50+	25	
350.3	60.4	Rock (augered)							

Auger Refusal / Bottom of Hole

Top of Rock = 60.2 Elevation (350.5)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-33** Total Depth 54.3 ft
County	Stewart, TN	Surface Elevation	395.4 ft
Project Type	HSA 3.25	Date Started	5/13/09 Completed 5/14/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	18.0 ft Date/Time 5/14/09
Logged By	Ryan J Riker	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
395.4	0.0	Top of Hole							
		Fat Clay, reddish brown to brown, moist, stiff to very stiff, with many cherty gravels (CH)		SPT-1	0.0 - 1.5	0.7	9-6-6	21	spt 1 contained 0.3 DGA
				SPT-2	1.5 - 3.0	0.7	6-6-8	27	
				SPT-3	3.0 - 4.5	0.9	3-4-5	17	
				SPT-4	4.5 - 6.0	0.5	7-10-12	18	
387.9	7.5			SPT-5	6.0 - 7.5	0.2	9-14-21	16	
		Lean Clay, brown to light gray, moist to wet, medium to very stiff, with many gravels, zones gray mottled (CL)		SPT-6	7.5 - 9.0	1.5	6-9-14	19	
				SPT-7	9.0 - 10.5	1.5	6-11-12	21	
				SPT-8	10.5 - 12.0	0.9	5-6-9	22	
				SPT-9	12.0 - 13.5	1.5	10-9-10	20	end use of auto hammer @ 12.0'
				SPT-10	13.5 - 15.0	1.5	5-7-20	22	
				SPT-11	15.0 - 16.5	1.0	5-10-40	23	
				SPT-12	16.5 - 18.0	1.1	12-14-15	20	water table @ 18.0'
				SPT-13	18.0 - 19.5	1.0	3-4-4	33	
374.4	21.0			SPT-14	19.5 - 21.0	0.7	4-15-14	17	
		Flyash, gray to dark gray, wet, soft to very stiff		SPT-15	21.0 - 22.5	1.5	4-6-7	51	
				SPT-16	22.5 - 24.0	1.3	4-3-50	54	
				SPT-17	24.0 - 24.4	0.5	50+/0.4	36	
				SPT-18	25.5 - 27.0	0.8	1-1-2	36	
				SPT-19	27.0 - 28.5	1.2	6-6-5	42	
365.4	30.0			SPT-20	28.5 - 30.0	1.1	2-7-50	39	
		Lean Clay, brown to gray, moist to wet, stiff to very stiff, gravel-rich zone from 30.0 to 33.0, manganese concretions throughout (CL)		SPT-21	30.0 - 31.5	0.2	10-9-8	24	
				SPT-22	31.5 - 33.0	0.3	7-7-10	26	
				SPT-23	33.0 - 34.5	1.0	6-6-7	17	
				SPT-24	34.5 - 36.0	0.7	8-8-9	18	

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-33**	Total Depth	54.3 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
				SPT-25	36.0 - 37.5	0.9	7-11-13	29	
				SPT-26	37.5 - 39.0	0.9	7-8-12	24	
355.3	40.1			SPT-27	39.0 - 40.1	0.9	9-34-50+/0.1	24	auger refused @ 43.5' moved 2.5' auger refused @ 44.3'
		Shale (Augered)		SPT-28	40.5 - 41.2	0.5	50+/0.5	25	
				SPT-29	42.0 - 42.2	0.2	50+/0.2	10	
351.1	44.3			SPT-30	43.5 - 43.6	0.1	50+/0.1	7	Began Core
341.1	54.3	Calcareous Shale interbedded with Limestone, light gray, moderately hard to hard, thick bedded, highly weathered from 40.1 to 43.6.		56	10.0	10.0	100	54.3	

Bottom of Hole

Top of Rock = 40.1
Elevation (355.3)

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-34** Total Depth 24.7 ft
County	Stewart, TN	Surface Elevation	378.7 ft
Project Type	HSA 3.25	Date Started	6/16/09 Completed 6/16/09
Supervisor	D. Rogers Driller Greg Thompson	Depth to Water	7.1 ft Date/Time 6/16/09
Logged By	Russell Mehnert	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
378.7	0.0	Top of Hole							
		Lean Clay, brown with gray, moist, medium stiff to stiff, mottling, with roots, gravel and chert fragments (CL)		SPT-1	0.0 - 1.5	1.0	2-3-5	18	
				SPT-2	1.5 - 3.0	1.3	4-6-7	18	Boring backfilled with (1) bag Quik Grout and (1) Portland Cement
				SPT-3	3.0 - 4.5	1.2	2-4-5	23	
				SPT-4	4.5 - 6.0	1.2	4-4-5	22	
372.0	6.7			SPT-5	6.0 - 7.5	1.5	3-5-5	27	SPT-5 - 2 bags: 6.0'-6.7' - clay 6.7'-7.5' - organic clay
		Lean Clay, grayish brown to dark brown, moist, medium stiff to stiff, with gray mottling, gravel, and faint organic smell (CL)		SPT-6	7.5 - 9.0	1.1	4-5-8	20	
				SPT-7	9.0 - 10.5	1.2	3-5-8	16	
				SPT-8	10.5 - 12.0	1.2	4-4-8	22	
				SPT-9	12.0 - 13.5	1.1	3-5-6	22	
				SPT-10	13.5 - 15.0	0.8	2-3-3	20	
				SPT-11	15.0 - 16.5	1.1	3-4-5	20	
360.7	18.0			SPT-12	16.5 - 18.0	1.5	5-5-7	28	
		Lean Clay, brown with gray, moist, medium stiff to stiff, mottling, with gravel and chert fragments (CL)		SPT-13	18.0 - 19.5	1.5	2-3-3	24	
				SPT-14	19.5 - 21.0	1.2	3-3-5	20	SPT-17 - 2 bags: 24.0'-24.5 - clay 24.5'-24.7' - limestone
				SPT-15	21.0 - 22.5	1.4	4-5-5	24	
				SPT-16	22.5 - 24.0	1.5	2-1-1	36	
354.2	24.5			SPT-17	24.0 - 24.7	0.7	15-50+/0.2	24	
354.0	24.7	Limestone, very light gray, hard, highly weathered, close fracture spacing							

No Refusal /
Bottom of Hole

Top of Rock = 24.5
Elevation (354.2)

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-35** Total Depth 67.9 ft
County	Stewart, TN	Surface Elevation	425.7 ft
Project Type	HSA 3.25	Date Started	5/30/09 Completed 5/31/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	35.0 ft Date/Time 5/31/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
425.7	0.0	Top of Hole							
		Gypsum, white tan, damp to moist, very stiff		SPT-1	0.0 - 1.5	1.5	2-7-11	7	
				SPT-2	1.5 - 3.0	1.5	11-20-24	8	
				SPT-3	3.0 - 4.5	1.5	15-20-25	8	thin lensed
				SPT-4	4.5 - 6.0	1.5	14-26-30	13	
				SPT-5	6.0 - 7.5	1.5	20-25-26	13	
				SPT-6	7.5 - 9.0	1.5	16-19-20	11	
				SPT-7	9.0 - 10.5	1.5	15-20-34	12	PZ Installed Screen 48.5-58.5
				SPT-8	10.5 - 12.0	1.5	21-24-29	7	
				SPT-9	12.0 - 13.5	1.5	19-25-34	7	
				SPT-10	13.5 - 15.0	1.5	11-25-32	6	higher moisture
				SPT-11	15.0 - 15.9	0.9	42-50+	9	
				SPT-12	16.5 - 17.3	0.8	47-50+	8	
				SPT-13	18.0 - 18.8	0.8	39-50+	11	
				SPT-14	19.5 - 20.2	0.7	35-50+	15	
402.9	22.8			SPT-15	21.0 - 22.5	1.5	18-28-32	21	geotextile fabric 22.8
401.2	24.5	Gravel, dark gray, moist, medium dense		SPT-16	22.5 - 24.0	1.0	10-12-9	24	
		Flyash, dark gray, wet, medium stiff		SPT-17	24.0 - 25.5	0.8	1-1-0	28	
				SPT-18	25.5 - 27.0	1.0	1-3-2	25	little bottom ash
397.5	28.2			SPT-19	27.0 - 28.5	1.5	3-3-4	35	
		Bottom Ash, black, wet, loose		SPT-20	28.5 - 30.0	0.6	3-3-3	20	thin clayey lens
394.0	31.7			SPT-21	30.0 - 31.5	0.7	4-5-6	18	
		Fly Ash, dark gray, wet, very stiff, laminated		SPT-22	31.5 - 33.0	1.5	10-8-9	27	
				SPT-23	33.0 - 34.5	1.5	7-9-10	46	
				SPT-24	34.5 - 36.0	1.5	9-10-14	40	

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-35**	Total Depth	67.9 ft

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fly Ash, dark gray, wet, very stiff, laminated *(Continued)*		SPT-25	36.0 - 37.5	1.5	8-17-25	46	
				SPT-26	37.5 - 39.0	1.5	5-7-14	39	
385.2	40.5			SPT-27	39.0 - 40.5	1.5	5-10-12	39	softer, more plastic
		Fly Ash, dark gray, wet, soft to medium stiff		SPT-28	40.5 - 42.0	1.3	1-1-2	51	
				SPT-29	42.0 - 43.5	1.5	0-0-1	42	
				SPT-30	43.5 - 45.0	1.5	1-3-2	37	
				SPT-31	45.0 - 46.5	1.5	1-2-6	45	
				SPT-32	46.5 - 48.0	1.5	3-4-2	33	
				SPT-33	48.0 - 49.5	1.5	2-2-9	46	
				SPT-34	49.5 - 51.0	1.5	1-1-3	65	
				SPT-35	51.0 - 52.5	1.5	9-7-8	39	
				SPT-36	52.5 - 54.0	1.5	0-1-2	44	
				SPT-37	54.0 - 55.5	1.5	1-1-2	49	lens bottom ash
				SPT-38	55.5 - 57.0	1.1	2-35-8	42	
				SPT-39	57.0 - 58.5	1.5	0-0-12	51	
				SPT-40	58.5 - 60.0	1.5	2-0-0	58	
				SPT-41	60.0 - 61.5	1.3	0-1-0	64	
363.6	62.1			SPT-42	61.5 - 63.0	1.5	1-5-8	24	
		Lean Clay, brown and gray, moist, stiff, mottled, some rock fragments (CL)							
				SPT-43	65.0 - 66.5	1.5	12-14-17	43	
358.3	67.4								
357.8	67.9	No Core							

Auger Refusal /
Bottom of Hole

Top of Rock = 67.4
Elevation (358.3)

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-35 A** Total Depth 48.0 ft
County	Stewart, TN	Surface Elevation	425.7 ft
Project Type	Mud Rotary	Date Started	6/1/09 Completed 6/2/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	35.0 ft Date/Time 6/1/09
Logged By	James Felts	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
425.7	0.0	Top of Hole							
		Gypsum, white tan, damp to moist, very stiff							Boring backfilled with 1.5 bags of quikgrout and 1 bag of portland cement.
									Tube Crushed
				ST-1	10.0 - 12.0	0.0		--	
									Tube Crushed
				ST-2	15.0 - 17.0	0.0		--	
402.9	22.8								
401.2	24.5	Gravel, dark gray, moist, medium							
397.5	28.2	Fly Ash, dark gray, wet, medium stiff							
394.0	31.7	Bottom Ash, black, wet, loose							
		Fly Ash, dark gray, wet, very stiff, laminated							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-35 A** Total Depth 48.0 ft

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
385.2	40.5	Fly Ash, dark gray, wet, very stiff, laminated *(Continued)*		ST-3	37.0 - 38.0	0.8		--	
377.7	48.0	Fly Ash, dark gray, wet, medium stiff		ST-4	46.0 - 48.0	1.4		--	
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-36** Total Depth 51.7 ft
County	Stewart, TN	Surface Elevation	411.2 ft
Project Type	HSA 3.25	Date Started	5/17/09 Completed 5/17/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	17.4 ft Date/Time 5/17/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
411.2	0.0	Top of Hole						
409.4	1.8	Bottom Ash, dark blackish brown, damp, medium dense, little silt	SPT-1	0.0 - 1.5	1.5	4-10-11	13	
		Clayey Gravel, reddish brown to brown, damp, dense to very dense, some sand, and cobbles (GC)	SPT-2	1.5 - 3.0	1.2	3-4-48	25	
			SPT-3	3.0 - 4.5	1.1	14-9-28	12	layers bottom ash in clay
			SPT-4	4.5 - 6.0	0.8	14-48-36	56	
			SPT-5	6.0 - 7.5	1.0	14-16-20	15	PZ Installed, Screen 38-48
			SPT-6	7.5 - 9.0	1.2	5-20-49	9	
			SPT-7	9.0 - 10.5	1.5	30-29-40	10	
			SPT-8	10.5 - 11.4	0.6	22-50+	11	sample wet
			SPT-9	12.0 - 13.5	1.5	12-10-13	16	
396.5	14.7		SPT-10	13.5 - 15.0	1.5	10-19-49	13	
		Clayey Gravel, gray to black, moist, dense to medium dense, some bottom ash lenses (GC)	SPT-11	15.0 - 16.5	1.5	14-18-12	11	geotexile 14.8 + 19.0
			SPT-12	16.5 - 18.0	0.7	9-15-14	11	
			SPT-13	18.0 - 19.5	0.3	3-3-10	14	
391.2	20.0		SPT-14	19.5 - 21.0	1.5	9-3-3	43	
		Flyash, dark brown gray, wet, stiff, laminated with clay	SPT-15	21.0 - 22.5	1.1	6-19-23	34	
			SPT-16	22.5 - 24.0	1.5	12-13-13	40	
			SPT-17	24.0 - 25.5	1.5	3-11-25	45	clayey lens 26.5
			SPT-18	25.5 - 27.0	1.5	9-19-18	42	
			SPT-19	27.5 - 29.0	1.5	1-2-1	45	
			SPT-20	30.0 - 31.5	1.5	0-2-2	47	zones softer, mildly plastic 28-32
			SPT-21	32.5 - 34.0	1.5	5-3-7	47	
			SPT-22	35.0 - 36.5	1.5	4-4-5	48	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-36
		Total Depth	51.7 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		Flyash, dark brown gray, wet, stiff, laminated with clay *(Continued)*		SPT-23	37.5 - 39.0	1.5	4-5-8	47	less lenses 35-42
				SPT-24	40.0 - 41.5	1.5	2-2-5	53	
				SPT-25	42.5 - 44.0	1.5	3-2-3	42	
				SPT-26	45.0 - 46.5	1.5	2-1-2	48	alternating zones lensed and homogeneous ash and clay lensed 47.9-48.2
363.0	48.2	Lean Clay, red brown, wet, very stiff, (CL)		SPT-27	47.5 - 49.0	1.5	4-10-14	25	
360.4	50.8	Rock (Augered)		SPT-28	50.0 - 50.8	0.8	14-50+	26	
359.5	51.7	Auger Refusal / Bottom of Hole Top of Rock = 50.8 Elevation (360.4)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-36 A** Total Depth 46.0 ft
County	Stewart, TN	Surface Elevation	411.2 ft
Project Type	Mud Rotary	Date Started	5/28/09 Completed 5/29/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	Dry Date/Time 5/29/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
411.2	0.0	Top of Hole						
409.4	1.8	Bottom Ash, dark black-brown, damp, medium, little silt						
		Clayey Gravel, red-brown to brown, damp, very stiff, some sand, and cobbles (GC)						tube crushed, U-shaped
			ST-1	11.0 - 12.1	1.1		--	
			ST-2	13.0 - 14.6	1.6		--	
396.5	14.7	Clayey Gravel, gray to black, moist, very stiff, some bottom ash lenses (GC)						
391.2	20.0	Fly Ash, dark brown-gray, wet, stiff, laminated with clay						
			ST-3	24.0 - 26.0	2.0		--	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-36 A** Total Depth 46.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fly Ash, dark brown-gray, wet, stiff, laminated with clay *(Continued)*							end deformed
365.2	46.0		ST-4	44.0 - 46.0	2.0		--		
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-36 B** Total Depth 21.0 ft
County	Stewart, TN	Surface Elevation	411.2 ft
Project Type	HSA 3.25	Date Started	6/26/09 Completed 6/26/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	Dry Date/Time 6/26/09
Logged By	James Felts	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
411.2	0.0	Top of Hole							
409.4	1.8	Bottom Ash, dark black-brown, damp, medium, little silt							
396.5	14.7	Clayey Gravel, red-brown to brown, damp, very stiff, some sand, and cobbles (GC)							Boulder 6'-8'
				ST-1	10.8 - 12.8	1.7		--	
				ST-2	13.0 - 13.7	0.7		--	Brown by 13 feet
391.2	20.0	Clayey Gravel, gray to black, moist, very stiff, some bottom ash lenses (GC)							
				ST-3	15.5 - 15.6	0.0		--	
				ST-4	17.0 - 17.1	0.0		--	
390.2	21.0	Flyash, dark brown-gray, wet, stiff, laminated with clay		ST-5	19.0 - 21.0	1.7		--	Few pieces of wood and organics
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-37** Total Depth 38.3 ft
County	Stewart, TN	Surface Elevation	395.2 ft
Project Type	HSA 3.25	Date Started	5/16/09 Completed 5/17/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	18.2 ft Date/Time 5/17/09
Logged By	D. Rogers	Depth to Water	18.2 ft Date/Time 5/17/09

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.2	0.0	Top of Hole						
394.7	0.5	Crushed Stone	SPT-1	0.0 - 1.5	1.5	9-5-10	18	
		Fat Clay, reddish brown, moist, stiff, (CH)	SPT-2	1.5 - 3.0	1.2	6-6-7	23	
			SPT-3	3.0 - 4.5	1.4	5-8-15	26	
389.1	6.1		SPT-4	4.5 - 6.0	0.8	36-22-14	23	trace sand large gravel
		Lean Clay, brown with gray, damp to moist, very stiff, some cobbles, mottled, grading lighter in color (CL)	SPT-5	6.0 - 7.5	1.3	6-8-7	20	
			SPT-6	7.5 - 9.0	1.5	8-12-16	25	
			SPT-7	9.0 - 10.5	1.2	9-15-21	23	wood fragments 10-12
			SPT-8	10.5 - 12.0	1.5	5-8-16	22	
			SPT-9	12.0 - 13.5	1.5	10-12-15	20	
			SPT-10	13.5 - 15.0	1.5	5-11-13	26	
			SPT-11	15.0 - 16.5	1.5	6-6-7	25	
			SPT-12	16.5 - 18.0	1.0	5-9-17	21	
			SPT-13	18.0 - 19.5	0.3	4-4-4	23	
374.0	21.2		SPT-14	19.5 - 21.0	0.8	2-2-3	28	
		Flyash, dark gray, wet, stiff	SPT-15	21.0 - 22.5	1.5	5-6-6	48	
			SPT-16	22.5 - 24.0	0.1	6-5-5	--	
			SPT-17	24.0 - 25.5	1.5	2-2-3	66	
			SPT-18	25.5 - 27.0	1.5	1-2-1	39	
366.7	28.5		SPT-19	27.0 - 28.5	1.5	5-6-7	49	large gravel 28.5
366.2	29.0	Crushed stone	SPT-20	28.5 - 30.0	1.5	16-6-7	26	PZ Installed, Screen 18-28
		Lean Clay, dark gray-brown, stiff, little sand, mottled (CL)	SPT-21	30.0 - 31.5	1.5	3-5-7	23	
363.2	32.0		SPT-22	31.5 - 33.0	1.5	8-12-13	25	weathered stone in tip
361.9	33.3	Lean Clay, reddish brown, wet, very stiff, little sand (CL)	SPT-23	33.0 - 33.4	4.0	50+	27	Began Core
		Limestone, very light gray, hard, close fracture spacing						

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-37** Total Depth 38.3 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
356.9	38.3			88	4.9	4.6	94	38.3	

Bottom of Hole

Top of Rock = 33.3
Elevation (361.9)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-37 A** Total Depth 35.0 ft
County	Stewart, TN	Surface Elevation	395.2 ft
Project Type	Mud Rotary	Date Started	5/26/09 Completed 5/27/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	Dry Date/Time 5/27/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.2	0.0	Top of Hole							
394.7	0.5	Crushed Stone							
389.1	6.1	Fat Clay, red-brown, moist, stiff, (CH)							
374.0	21.2	Lean Clay, brown with gray, damp to moist, very stiff, some cobbles, mottled, grading lighter in color (CL)		ST-1	19.5 - 21.5	2.0		--	SI installed to 35.0
366.7	28.5	Fly Ash, dark gray, wet, stiff		ST-2	24.0 - 26.0	2.0		--	
366.2	29.0	Crushed stone							
363.2	32.0	Lean Clay, dark gray-brown, stiff, little sand, mottled (CL)							
361.9	33.3	Lean Clay, red-brown, wet, very stiff, little sand (CL)							
360.2	35.0	Rock (Augered)							
		No Refusal /							

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-37 A**	Total Depth	35.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Bottom of Hole Top of Rock = 33.3 Elevation (361.9)							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-37 B** Total Depth 17.5 ft
County	Stewart, TN	Surface Elevation	395.2 ft
Project Type	HSA 3.25	Date Started	6/28/09 Completed 6/28/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	Dry Date/Time 6/28/09
Logged By	James Felts	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.2	0.0	Top of Hole							
394.7	0.5	Crushed Stone							
		Fat Clay, red-brown, moist, stiff, (CH)							
389.1	6.1								
		Lean Clay, brown with gray, damp to moist, very stiff, some cobbles, mottled, grading lighter in color (CL)		ST-1	8.0 - 10.0	0.8		--	
				BAG-1	6.0 - 14.5			--	
				ST-2	11.0 - 12.4	1.7		--	
				ST-3	15.5 - 17.5	0.0		--	
377.7	17.5								
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Stantec

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-38**
		Total Depth	20.2 ft
County	Stewart, TN	Surface Elevation	380.0 ft
Project Type	HSA 3.25	Date Started	5/16/09
		Completed	5/16/09
Supervisor	D. Rogers	Driller	Greg Thompson
Depth to Water	1.1 ft	Date/Time	6/16/09
Logged By	Russell Mehnert		
Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
380.0	0.0	Top of Hole							
		Lean Clay, brown with gray, moist, medium stiff to stiff, mottled with gravels, roots and manganese concretions (CL)		SPT-1	0.0 - 1.5	1.3	2-3-4	19	
				SPT-2	1.5 - 3.0	1.1	3-5-7	22	Boring backfilled with (1) bag Quik Grout and (1) Portland Cement
				SPT-3	3.0 - 4.5	1.5	3-5-8	24	
374.9	5.1			SPT-4	4.5 - 6.0	1.3	2-3-4	23	SPT-4 - 2 bags: 4.5'-5.1' - clay 5.1'-6.0' - organic clay
		Lean Clay, grayish brown to dark brown, moist, medium stiff to stiff, grayish brown to dark brown, moist, medium stiff to stiff with areas of silty clay with gray modeling, gravel, and light organic smell (CL)		SPT-5	6.0 - 7.5	1.5	3-4-6	21	SPT-5 - 2 bags: 6.0'-7.0' - organic clay 7.0'-7.5' - clay
				SPT-6	7.5 - 9.0	1.5	3-3-3	22	
				SPT-7	9.0 - 10.5	1.4	2-3-5	21	Clay to 8.0' then organic clay to 9.0'
				SPT-8	10.5 - 12.0	0.9	2-3-6	18	
				SPT-9	12.0 - 13.5	1.2	7-8-9	18	
				SPT-10	13.5 - 15.0	1.5	2-2-3	26	
364.8	15.2			SPT-11	15.0 - 16.5	1.5	2-2-3	26	SPT-11 - 2 bags: 15.0'-15.2 - organic clay 15.2'-16.5' - Clay
		Lean Clay, brown with gray, moist, medium stiff to stiff, mottled with gravels and manganese concretions (CL)		SPT-12	16.5 - 18.0	1.5	4-6-7	23	
				SPT-13	18.0 - 19.5	1.5	3-3-3	38	
359.9	20.1			SPT-14	19.5 - 20.1	0.7	9-50+/0.2	37	
359.8	20.2	Limestone, very light gray, hard, highly weathered							

Auger Refusal /
Bottom of Hole

Top of Rock = 20.1
Elevation (359.9)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-39** Total Depth 19.2 ft
County	Stewart, TN	Surface Elevation	395.9 ft
Project Type	Mud Rotary	Date Started	6/9/09 Completed 6/9/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	Dry Date/Time 6/9/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
395.9	0.0	Top of Hole						
394.9	1.0	Bottom Ash, with crushed stone	SPT-1	0.0 - 1.5	1.2	12-13-9	5	
		Fat Clay, red brown, damp, stiff, (CH)	SPT-2	1.5 - 3.0	1.5	5-6-.3	16	
			SPT-3	3.0 - 4.5	1.5	7-13-13	16	
			SPT-4	4.5 - 6.0	1.5	6-8-12	23	wood fragments 5.5
			SPT-5	6.0 - 7.5	0.6	5-5-6	22	bent spoon, cobble
386.9	9.0		SPT-6	7.5 - 9.0	1.5	7-29-32	29	
		Limestone, (Augered)	SPT-7	9.0 - 9.1		50+	7	
385.3	10.6		~~SPT-8~~	~~10.5 - 10.6~~	~~0.0~~	~~50+~~	~~--~~	Began Core
		Limestone, light gray, hard, wide fracture spacing, all breaks mechanical	100	1.4	1.4	100	12.0	
376.7	19.2		100	7.2	7.2	100	19.2	

Bottom of Hole

Top of Rock = 9.0
Elevation (386.9)

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-40** Total Depth 31.9 ft
County	Stewart, TN	Surface Elevation	411.3 ft
Project Type	HSA	Date Started	6/15/09 Completed 6/15/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	22.0 ft Date/Time 6/15/09
Logged By	D. Rogers	Depth to Water	22.0 ft Date/Time 6/15/09

Lithology Elevation	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						
410.0	1.3	Bottom Ash, black gray, moist, medium	SPT-1	0.0 - 1.5	1.5	7-9-16	8	
		Clayey Gravel, gray-brown, damp, dense, angular, trace sand (GC)	SPT-2	1.5 - 3.0	1.5	25-27-18	6	
			SPT-3	3.0 - 4.5	1.2	13-9-10	7	
			SPT-4	4.5 - 6.0	1.3	7-20-17	8	many cobbles
403.8	7.5		SPT-5	6.0 - 7.5	1.0	7-9-10	5	
		Clayey Gravel, brown, moist, medium dense, with little coarse sand (GC)	SPT-6	7.5 - 9.0	1.3	5-5-7	24	
			SPT-7	9.0 - 10.5	0.3	5-5-6	11	gravel block spoon
			SPT-8	10.5 - 12.0	1.5	4-7-23	7	sample 8 split shale cobble
			SPT-9	12.0 - 13.5	0.8	4-8-12	12	
			SPT-10	13.5 - 15.0	1.5	7-17-22	13	
			SPT-11	15.0 - 16.5	1.0	3-3-3	17	
394.3	17.0	Flyash, dark gray, moist to wet, stiff	SPT-12	16.5 - 18.0	1.1	2-2-6	36	
			SPT-13	18.0 - 19.5	1.5	5-5-8	48	
			SPT-14	19.5 - 21.0	1.5	4-5-7	37	
			SPT-15	21.0 - 22.5	1.5	1-2-4	46	
			SPT-16	22.5 - 24.0	1.5	1-1-4	45	
			SPT-17	24.0 - 25.5	1.5	1-2-2	55	soft zones mildly plastic
383.8	27.5		SPT-18	25.5 - 27.0	1.5	0-0-0	48	
		Lean Clay, gray and red-brown, wet, stiff, little sand, mottled (CL)	SPT-19	27.0 - 28.5	1.5	0-8-6	22	
			SPT-20	28.5 - 30.0	1.5	3-5-6	23	
379.6	31.7		SPT-21	30.0 - 31.5	1.5	6-8-10	32	
379.4	31.9	Rock (augered)						
		Auger Refusal / Bottom of Hole Top of Rock = 31.7 Elevation (379.6)						

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-41** Total Depth 46.0 ft
County	Stewart, TN	Surface Elevation	422.6 ft
Project Type	Mud Rotary	Date Started	6/9/09 Completed 6/10/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	15.5 ft Date/Time 6/9/09
Logged By	D. Rogers	Depth to Water	20.5 ft Date/Time 6/9/09

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
422.6	0.0	Top of Hole							
		Gypsum, tan white, damp to moist, very stiff		SPT-1	0.0 - 1.5	1.4	3-5-10	9	ST offset
				ST-1	0.1 - 2.1	1.8		--	
				SPT-2	1.5 - 3.0	1.5	9-10-12	9	
				SPT-3	3.0 - 4.5	1.5	25-11-10	18	
				SPT-4	4.5 - 6.0	1.5	4-4-7	24	
				SPT-5	6.0 - 7.5	1.5	4-16-17	20	
				SPT-6	7.5 - 9.0	1.3	12-14-16	18	
				SPT-7	9.0 - 10.5	1.5	18-24-34	18	zones of rejects @ 9+9.5
				SPT-8	10.5 - 12.0	1.5	24-26-25	15	
				SPT-9	12.0 - 12.9	0.9	39-50+	10	
				SPT-10	13.5 - 14.3	0.8	49-50+	17	
				SPT-11	15.0 - 15.9	0.5	37-50+	23	15-15.1 clay
				SPT-12	16.5 - 17.3	0.6	49-50+	19	
				SPT-13	18.0 - 19.5	1.5	49-49-47	26	
402.1	20.5			SPT-14	19.5 - 21.0	1.5	36-29-10	24	gravel and geotextile 20.5
401.3	21.3	Crushed stone							
		Bottom Ash, dark black-gray, wet, loose		SPT-15	21.0 - 22.5	1.5	10-6-4	27	drill fluid loss 200gal
399.6	23.0			SPT-16	22.5 - 24.0	0.8	6-8-7	26	
		Fly Ash, dark gray, wet, very stiff, thin lenses occasional soft lens		SPT-17	24.0 - 25.5	1.5	10-13-12	25	
				SPT-18	25.5 - 27.0	1.5	9-11-12	29	
				SPT-19	27.0 - 28.5	1.5	6-7-9	36	
				SPT-20	28.5 - 30.0	1.5	1-4-9	41	lens soft with fibers 29.0-29.3
				SPT-21	30.0 - 31.5	1.5	6-6-8	45	
				SPT-22	31.5 - 33.0	1.5	4-11-12	41	
				SPT-23	33.0 - 34.5	1.5	4-11-14	47	
				SPT-24	34.5 - 36.0	1.5	7-6-8	48	35.5 roots and wood

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Stantec

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-41** Total Depth 46.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
385.6	37.0	Lean Clay With Sand, light red-brown, wet, very soft, some organics (CL)	SPT-25	36.0 - 37.5	0.6	0-0-0	29	lenses flyash 38.5-39, 41-41.5 cobble 39.8-40.8
			SPT-26	37.5 - 39.0	1.5	0-0-0	35	
381.6	41.0		SPT-27	39.0 - 40.4	0.0	0-0-50+	--	
		Lean Clay, dark gray and brown, wet, very stiff, trace sand, mottled (CL)	SPT-28	41.0 - 42.5	0.5	0-0-0	4	
			SPT-29	42.5 - 44.0	1.5	4-10-7	20	
377.6	45.0		SPT-30	44.0 - 44.9	0.9	5-50+	30	
376.6	46.0	Rock (augered)						

No Refusal /
Bottom of Hole

Top of Rock = 45.0
Elevation (377.6)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-42** Total Depth 42.6 ft
County	Stewart, TN	Surface Elevation	396.2 ft
Project Type	HSA	Date Started	6/13/09 Completed 6/14/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	Dry Date/Time 6/14/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
396.2	0.0	Top of Hole							
395.2	1.0	Bottom Ash, black gray, moist, medium		SPT-1	0.0 - 1.5	1.2	13-18-5	8	
		Fat Clay, red brown, moist, stiff, and rock fragments (CH)		SPT-2	1.5 - 3.0	1.3	2-3-6	18	
391.7	4.5			SPT-3	3.0 - 4.5	1.5	3-6-8	24	
		Lean Clay With Sand, red brown with gray, moist, stiff, and rock fragments, mottled (CL)		SPT-4	4.5 - 6.0	1.5	5-6-8	20	few cobbles
				SPT-5	6.0 - 7.5	1.5	8-6-8	22	
				SPT-6	7.5 - 9.0	1.2	4-10-13	20	
				SPT-7	9.0 - 10.5	1.5	2-3-4	29	pz installed screen 29.0-39.0
				SPT-8	10.5 - 12.0	1.5	1-4-5	21	
				SPT-9	12.0 - 13.5	1.5	3-4-5	24	13.5 water in layer
				SPT-10	13.5 - 15.0	1.5	1-4-5	25	
				SPT-11	15.0 - 16.5	1.5	1-5-9	21	
				SPT-12	16.5 - 18.0	1.5	7-8-9	22	17.0-17.1 19.9-20.3 sand lens
				SPT-13	18.0 - 19.5	1.5	5-6-7	22	19.4 wood fragments
375.3	20.9			SPT-14	19.5 - 21.0	1.5	3-4-6	26	
		Lean Clay, brown with dark gray, moist to wet, stiff to medium stiff, trace sand, mottled (CL)		SPT-15	21.0 - 22.5	1.5	3-4-5	23	20.9-22.3 organics
				SPT-16	22.5 - 24.0	0.9	2-2-2	23	
				SPT-17	25.0 - 26.5	1.5	2-2-2	23	
				SPT-18	27.5 - 29.0	1.1	2-4-6	23	
				SPT-19	30.0 - 31.5	1.5	0-2-9	32	
				SPT-20	32.5 - 34.0	1.5	2-28-5	32	cobble 33 0-33.5
				SPT-21	35.0 - 35.0			--	boulder cored 34.7-37 broke through at 38.0

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-42**	Total Depth	42.6 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
355.7	40.5	Lean Clay, brown with dark gray, moist to wet, stiff to medium stiff, trace sand, mottled (CL) *(Continued)*		SPT-21 SPT-22	38.0 - 39.5 39.5 - 39.9	1.5 0.4	0-2-3 50+	30 39	
353.6	42.6	Rock (augered)							

Auger Refusal /
Bottom of Hole

Top of Rock = 40.5
Elevation (355.7)

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-43** Total Depth 62.0 ft
County	Stewart, TN	Surface Elevation	411.3 ft
Project Type	HSA	Date Started	6/15/09 Completed 6/16/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	Dry Date/Time 6/16/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
411.3	0.0	Top of Hole						
		Bottom Ash, black gray, damp, medium	SPT-1	0.0 - 1.5	1.3	5-10-10	10	
408.9	2.4		SPT-2	1.5 - 3.0	1.2	5-3-2	22	
		Clayey Gravel, brown, moist, loose to dense, some sand (GC)	SPT-3	3.0 - 4.5	1.2	2-8-5	24	
			SPT-4	4.5 - 6.0	0.9	3-3-4	19	
			SPT-5	6.0 - 7.5	1.0	4-4-7	21	
			SPT-6	7.5 - 8.1	0.5	23-50+	14	
			SPT-7	9.5 - 10.5	1.0	7-12	16	boulders 8.1-9.4 + 13.5-14.9
			SPT-8	10.5 - 12.0	1.5	4-7-16	13	
			SPT-9	12.0 - 13.5	0.6	3-14-33	13	
			SPT-10	15.0 - 16.5	0.4	3-4-3	12	
			SPT-11	16.5 - 18.0	1.2	2-1-2	21	
			SPT-12	18.0 - 19.5	1.3	1-1-2	22	
			SPT-13	19.5 - 21.0	0.6	2-1-5	20	
388.7	22.6		SPT-14	21.0 - 22.5	0.3	17-12-10	4	gravel block spoon
		Fly Ash, dark gray, wet, medium stiff	SPT-15	22.5 - 24.0	1.3	6-1-2	20	
			SPT-16	24.0 - 25.5	1.5	14-13-8	26	
			SPT-17	25.5 - 27.0	1.5	3-5-6	24	
			SPT-18	27.0 - 28.5	1.5	1-4-7	32	
			SPT-19	28.5 - 30.0	1.5	2-2-3	32	
			SPT-20	30.0 - 31.5	1.5	6-1-4	35	
			SPT-21	31.5 - 33.0		1-2-2	43	
			SPT-22	33.0 - 34.5	1.5	1-0-1	42	
375.3	36.0		SPT-23	34.5 - 36.0	1.5	0-1-1	45	

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	STN-43
		Total Depth	62.0 ft

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Bottom Ash, black gray, wet, dense *(Continued)*		SPT-24	36.0 - 37.5	1.5	21-18-20	28	
371.8	39.5			SPT-25	37.5 - 39.0	1.5	10-12-11	25	
		Fly Ash, gray, wet, stiff		SPT-26	39.0 - 40.5	1.5	12-5-2	49	
368.6	42.7			SPT-27	40.5 - 42.0	1.5	2-2-3	35	
		Lean Clay, brown and gray, wet, very stiff, some sand, little gravel (CL)		SPT-28	42.0 - 43.5	1.5	0-17-26	11	
				SPT-29	43.5 - 45.0	1.5	12-14-18	16	several cobbles
				SPT-30	45.0 - 46.5	1.5	16-9-9	18	
				SPT-31	47.5 - 49.0	0.3	9-7-6	16	
				SPT-32	50.0 - 51.5	1.5	1-3-5	25	
				SPT-33	52.5 - 54.0	1.5	9-7-6	25	
				SPT-34	55.0 - 56.5	1.5	5-7-7	24	
				SPT-35	57.5 - 59.0	1.5	3-5-7	25	
349.9	61.4			SPT-36	60.0 - 61.5	1.5	5-7-20	31	
349.3	62.0	Shale, brown, soft, (augered)							

Auger Refusal /
Bottom of Hole

Top of Rock = 61.4
Elevation (349.9)

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-43 A** Total Depth 65.7 ft
County	Stewart, TN	Surface Elevation	411.3 ft
Project Type	Mud Rotary	Date Started	6/22/09 Completed 6/24/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	Dry Date/Time 6/24/09
Logged By	Norman Puckett	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
411.3	0.0	Top of Hole							
408.9	2.4	Bottom Ash, black gray, damp, medium							
		Clayey Gravel, brown, moist, medium stiff, some sand (GC)							SI Installed to 65.7'
				ST-1	18.0 - 20.0	0.0		--	
				ST-2	20.0 - 22.0	1.0		--	
388.7	22.6								
		Fly Ash, dark gray, wet, medium stiff							
				ST-3	26.0 - 28.0	0.2		--	
				ST-4	29.0 - 31.0	2.0		--	
375.3	36.0								

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-43 A**
		Total Depth	65.7 ft

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
371.8	39.5	Bottom Ash, black gray, wet, dense *(Continued)*							
368.6	42.7	Fly Ash, gray, wet, stiff							
		Lean Clay, brown and gray, wet, very stiff, some sand, little gravel (CL)							
				ST-5	47.0 - 49.0	2.0		--	
				ST-6	50.0 - 52.0	1.9		--	
347.6	63.7								
345.6	65.7	Bedrock (Rollered for SI Socket)							

No Refusal /
Bottom of Hole

Top of Rock = 63.7
Elevation (347.6)

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-44** Total Depth 73.9 ft
County	Stewart, TN	Surface Elevation	419.5 ft
Project Type	HSA 3.25	Date Started	6/11/09 Completed 6/12/09
Supervisor	D. Rogers Driller James Felts	Depth to Water	13.2 ft Date/Time 6/11/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
419.5	0.0	Top of Hole						
		Gypsum, tan white, moist, very stiff	SPT-1	0.0 - 1.5	1.3	4-7-9	12	PZ Installed Screen 27.0-37.0
			SPT-2	1.5 - 3.0	1.4	6-9-7	17	
			SPT-3	3.0 - 4.5	1.5	4-5-5	17	
			SPT-4	4.5 - 6.0	1.3	2-4-4	15	
			SPT-5	6.0 - 7.5	1.4	2-6-8	16	
			SPT-6	7.5 - 9.0	1.5	8-23-16	10	damp
			SPT-7	9.0 - 10.5	1.5	13-28-36	17	moist
			SPT-8	10.5 - 12.0	1.5	13-33-42	16	
			SPT-9	12.0 - 13.5	1.5	4-22-36	18	13.0 wet lens
			SPT-10	13.5 - 15.0	1.5	19-38-47	23	
			SPT-11	15.0 - 16.5	4.5	29-38-49	24	
			SPT-12	16.5 - 18.0	1.5	37-42-49	26	
400.2	19.3		SPT-13	18.0 - 19.5	1.0	7-8-8	22	19.3 gravel
398.6	20.9	Gravel, gray, medium	SPT-14	19.5 - 21.0	0.5	4-4-4	20	19.3+20.9 geotextile
		Fly Ash, dark gray, wet, stiff, lensed	SPT-15	21.0 - 22.5	1.5	11-12-16	32	
			SPT-16	22.5 - 24.0	1.5	10-8-10	47	
			SPT-17	24.0 - 25.5	1.5	9-9-7	26	revert 24 and down
392.5	27.0		SPT-18	25.5 - 27.0	1.5	4-5-8	39	
		Fly Ash, dark gray, wet, very soft	SPT-19	27.0 - 28.5	1.5	1-0-0	40	
			SPT-20	28.5 - 30.0	1.5	0-0-0	69	
			SPT-21	30.0 - 31.5	1.3	1-0-0	49	
387.5	32.0							
386.7	32.8	Lean Clay, light red-brown, wet, stiff, little sand, some gravel (CL)	SPT-22	31.5 - 33.0	1.5	7-7-6	37	
			SPT-23	33.0 - 34.5	1.3	3-2-3	45	
		Fly Ash, dark gray, wet, soft to stiff	SPT-24	34.5 - 36.0	1.5	3-1-5	37	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-44**
		Total Depth	73.9 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		Fly Ash, dark gray, wet, soft to stiff *(Continued)*		SPT-25	36.0 - 37.5	1.5	3-0-0	38	
				SPT-26	37.5 - 39.0	1.5	3-1-1	36	
				SPT-27	39.0 - 40.5	1.5	1-0-1	45	
				SPT-28	40.5 - 42.0	1.3	1-1-1	39	
				SPT-29	42.0 - 43.5	0.9	3-1-2	40	
374.9	44.6			SPT-30	43.5 - 45.0	1.5	3-2-8	44	
		Bottom Ash, dark black-gray, wet, medium to very dense		SPT-31	45.0 - 46.5	1.5	6-7-10	21	
371.5	48.0			SPT-32	46.5 - 48.0	1.5	40-49-38	22	
		Fly Ash, dark gray, wet, soft		SPT-33	48.0 - 49.5	1.5	3-1-2	52	
				SPT-34	49.5 - 51.0	1.5	3-2-1	52	
				SPT-35	51.0 - 52.5	1.5	0-1-12	45	
				SPT-36	52.5 - 54.0	1.3	10-6-7	43	
				SPT-37	54.0 - 55.5	1.5	0-1-2	38	
363.4	56.1			SPT-38	55.5 - 57.0	1.1	0-1-2	26	
		Lean Clay, dark brown and gray, wet, medium stiff, some organics, mottled (CL)		SPT-39	57.0 - 58.5	1.5	2-7-7	23	
				SPT-40	58.5 - 60.0	1.5	2-3-3	27	
				SPT-41	60.0 - 61.5	1.2	2-3-5	24	
357.5	62.0			SPT-42	61.5 - 63.0	1.5	5-7-9	24	
		Lean Clay, brown and gray, wet, very stiff, mottled (CL)		SPT-43	63.0 - 64.5	1.2	3-6-6	25	
				SPT-44	65.0 - 66.5	1.5	5-5-5	24	
				SPT-45	67.5 - 69.0	1.5	3-4-4	26	
349.0	70.5			SPT-46	70.0 - 70.7	0.6	19-50+	18	
		Rock (augered)							
345.6	73.9			SPT-47	72.5 - 73.1	0.6	42-50+	9	

Auger Refusal /
Bottom of Hole

Top of Rock = 70.5
Elevation (349.0)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-45** Total Depth 63.2 ft
County	Stewart, TN	Surface Elevation	411.6 ft
Project Type	HSA 3.25	Date Started	6/24/09 Completed 6/26/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	12.5 ft Date/Time 6/25/09
Logged By	Norman Puckett	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
411.6	0.0	Top of Hole							
		Bottom Ash, Bottom Ash, black, moist, dense		SPT-1	0.0 - 1.5		9-13-14	8	
409.1	2.5			SPT-2	1.5 - 3.0		13-15-16	8	
		Gypsum, Gypsum, tan-white, moist, very stiff to medium stiff.		SPT-3	3.0 - 4.5		10-15-12	12	
				SPT-4	4.5 - 6.0		14-26-23	18	
				SPT-5	6.0 - 7.5		10-2-4	19	
402.6	9.0			SPT-6	7.5 - 9.0		2-4-2	18	
		Fly Ash, gypsum and clay interlensed, brown, black and gray, moist to wet, soft to stiff		SPT-7	9.0 - 10.5		2-6-2	15	Cobbles, Boulders 9.7-11.7, 16.3-17.3, 18.5-19.1, 19.1-20.1
				SPT-8	10.5 - 12.0		1-4-4	11	
				SPT-9	12.0 - 13.5		1-0-3	20	
				SPT-10	13.5 - 15.0		1-2-2	24	
				SPT-11	15.0 - 16.5		2-3-9	24	
				SPT-12	16.5 - 18.0		2-5-8	14	
				SPT-13	18.0 - 19.5		3-6-8	17	
				SPT-14	20.1 - 21.6		1-3-22	12	
				SPT-15	22.0 - 23.5		3-6-3	1	
				SPT-16	23.5 - 25.0		2-1-1	26	
386.1	25.5			SPT-17	25.0 - 26.5		3-38-15	24	
		Fly Ash, Flyash, black to brownish gray, moist to wet, very stiff to soft to very stiff		SPT-18	26.5 - 27.0		22-34-17	35	
				SPT-19	28.0 - 29.5		9-15-16	28	
				SPT-20	30.0 - 31.5		0-3-8	49	
				SPT-21	31.5 - 33.0		0-0-0	30	
				SPT-22	33.0 - 34.5		0-0-4	21	
				SPT-23	34.5 - 36.0		3-3-4	12	

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-45**
		Total Depth	63.2 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
371.6	40.0	Fly Ash, Flyash, black to brownish gray, moist to wet, very stiff to soft to very stiff *(Continued)*		SPT-24	36.0 - 37.5		3-4-5	17	
				SPT-25	37.5 - 39.0		8-9-12	17	
				SPT-26	39.0 - 39.6		23-50+/0.1	17	
369.6	42.0	Concrete (cored)							
367.3	44.3	Bottom Ash, Clay and Gravel, dark gray and brown, wet		SPT-27	42.0 - 43.0		0-1	--	
				SPT-28	43.0 - 44.2		0-2-50+/0.2	12	
364.5	47.1	Concrete (cored)							Wire in Core Barrel. TVA CUF Advised to Proceed
348.9	62.7	Lean Clay, light brown to brown mottled, soft to stiff (CL)		SPT-29	47.5 - 49.0		3-4-4	32	
				SPT-30	49.0 - 50.5		3-4-5	36	
				SPT-31	50.5 - 52.0		1-2-2	40	
				SPT-32	62.0 - 62.7		8-50+/0.2	15	
348.4	63.2	Rock (Augered)							

Auger Refusal / Bottom of Hole

Top of Rock = 62.7 Elevation (348.9)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-45A** — Total Depth 20.0 ft
County	Stewart, TN	Surface Elevation	411.7 ft
Project Type	HSA 4.25	Date Started	8/6/09 — Completed 8/6/09
Supervisor	D. Rogers — Driller J. Felts	Depth to Water	Dry — Date/Time 8/6/09
Logged By	Z. Massey	Depth to Water	N/A — Date/Time N/A

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
411.7	0.0	Top of Hole							
		Augered for PZ Install							PZ Installed, screen 8.7'-18.7'
391.7	20.0								
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-45B**
		Total Depth	15.0 ft
County	Stewart, TN	Surface Elevation	411.6 ft
Project Type	HSA 4.25	Date Started	8/14/08
		Completed	8/14/09
Supervisor	D. Rogers	Driller	Mark Martin
Depth to Water	7.0 ft	Date/Time	8/14/09
Logged By	D. Rogers		
Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
411.6	0.0	Top of Hole							
		Gypsum (Augered)							Profile boring
									Wet below 7 ft
399.6	12.0								
397.6	14.0	Crushed Limestone (Drainage Layer)							
396.6	15.0	Flyash, wet							
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-45C** Total Depth 15.0 ft
County	Stewart, TN	Surface Elevation	411.6 ft
Project Type	HSA 4.25	Date Started	8/14/08 Completed 8/14/09
Supervisor	D. Rogers Driller Mark Martin	Depth to Water	7.0 ft Date/Time 8/14/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
411.6	0.0	Top of Hole							
411.1	0.5	Gypsum							
408.6	3.0	Bottom Ash							profile boring
402.1	9.5	Gypsum							Wet below 7 ft
401.1	10.5	Cobbles							
396.6	15.0	Clay, brown-gray mottled, little gravel (CL)							

No Refusal / Bottom of Hole

Stantec

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil		
Project Name	CUF	Boring No.	**STN-46**	Total Depth	73.6 ft
County	Stewart, TN	Surface Elevation	420.3 ft		
Project Type	HSA 3.25	Date Started	7/7/09	Completed	7/9/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	23.0 ft	Date/Time	7/7/09
Logged By	James Felts	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
420.3	0.0	Top of Hole							
		Gypsum, tan-white, stiff to very stiff, damp to moist		SPT-1	0.0 - 1.5	1.1	3-5-7	10	
				SPT-2	1.5 - 3.0	1.2	6-13-15	10	
				SPT-3	3.0 - 4.5	1.0	12-18-20	11	
				SPT-4	4.5 - 6.0	1.1	5-10-9	10	
				SPT-5	6.0 - 7.5	1.3	5-7-8	11	
				SPT-6	7.5 - 9.0	1.2	6-10-19	11	
				SPT-7	9.0 - 10.5	1.2	10-18-22	9	
				SPT-8	10.5 - 12.0	1.0	12-19-30	11	
				SPT-9	12.0 - 13.5	1.5	36-28-22	19	
				SPT-10	13.5 - 14.4	0.9	26-50+/0.4	9	
				SPT-11	15.0 - 16.5	1.4	22-26-37	22	
				SPT-12	16.5 - 18.0	1.0	8-10-13	7	
400.8	19.5			SPT-13	18.0 - 19.5	0.9	5-6-6	8	
399.3	21.0	Crushed stone		SPT-14	19.5 - 21.0	0.9	3-3-2	27	drainage layer
		Fly Ash, dark gray-brown, wet, medium stiff to Very stiff, silt to sand size, layers of bottom ash 44.0 to 50.0		SPT-15	21.0 - 22.5	1.4	3-6-8	34	
				SPT-16	22.5 - 24.0	1.3	2-4-8	33	
				SPT-17	24.0 - 25.5	1.2	2-4-6	45	
				SPT-18	25.5 - 27.0	1.3	4-6-7	30	
				SPT-19	27.0 - 28.5	1.1	3-7-11	28	
				SPT-20	28.5 - 30.0	1.2	5-9-12	27	
				SPT-21	30.0 - 31.5	1.4	4-9-16	28	
				SPT-22	31.5 - 33.0	1.1	6-9-14	30	
				SPT-23	33.0 - 34.5	1.2	5-8-15	35	
				SPT-24	34.5 - 36.0	1.4	7-15-21	30	

Stantec

SUBSURFACE LOG

Project Number 175539009 | Location Cumberland Fossil

Project Name CUF | Boring No. **STN-46** | Total Depth 73.6 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fly Ash, dark gray-brown, wet, medium stiff to Very stiff, silt to sand size, layers of bottom ash 44.0 to 50.0 *(Continued)*		SPT-25	36.0 - 37.5	1.3	7-21-33	48	
				SPT-26	37.5 - 39.0	1.1	10-18-29	34	
				SPT-27	39.0 - 40.5	1.4	28-34-9	24	
				SPT-28	40.5 - 42.0	1.5	2-10-8	35	
				SPT-29	42.0 - 43.5	1.3	3-4-6	38	
				SPT-30	43.5 - 45.0	1.4	14-20-6	30	
				SPT-31	45.0 - 46.5	1.0	6-8-4	23	
				SPT-32	46.5 - 48.0	1.1	3-6-5	37	
				SPT-33	48.0 - 49.5	0.8	4-4-8	20	
369.3	51.0			SPT-34	49.5 - 51.0	0.9	20-36-20	18	
		Boulders (Likely construction debris, rubble)		SPT-35	51.0 - 52.1	1.0	12-23-50+/0.1	17	
				SPT-36	52.5 - 52.6	0.0	50+/0.1	--	
				SPT-37	54.0 - 54.1	0.0	50+/0.1	--	
363.4	56.9			SPT-38	55.5 - 55.6	0.0	50+/0.1	--	
		Lean Clay, brown-gray mottled, medium stiff, wet (CL)		SPT-39	57.0 - 58.5	0.8	3-4-4	30	
				SPT-40	58.5 - 60.0	0.8	4-6-6	36	
				SPT-41	60.0 - 61.5	1.1	3-4-3	33	
				SPT-42	61.5 - 63.0	1.3	3-3-5	36	
				SPT-43	63.0 - 64.5	1.0	2-3-3	31	
				SPT-44	64.5 - 66.0	1.2	2-2-3	31	
353.5	66.8			SPT-45	66.0 - 66.1	0.0	50+/0.1	--	
346.7	73.6	Rock							(Roller Bit used for BR confirmation)

No Refusal /
Bottom of Hole

Top of Rock = 66.8
Elevation (353.5)

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-46A** Total Depth 21.0 ft
County	Stewart, TN	Surface Elevation	420.3 ft
Project Type	HSA 4.25	Date Started	8/6/09 Completed 8/6/09
Supervisor	D. Rogers Driller J. Felts	Depth to Water	Dry Date/Time 8/6/09
Logged By	Z. Massey	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
420.3	0.0	Top of Hole							
		Augered for PZ Install							PZ Installed, screen 10.0'-20.0'
399.3	21.0								
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

SUBSURFACE LOG

Project Number	175539009	Location	Cumberland Fossil
Project Name	CUF	Boring No.	**STN-63** Total Depth 20.0 ft
County	Stewart, TN	Surface Elevation	379.0 ft
Project Type	HSA 3.25	Date Started	6/24/09 Completed 6/24/09
Supervisor	D. Rogers Driller Greg Thompson	Depth to Water	Dry Date/Time 6/24/09
Logged By	D. Rogers	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
379.0	0.0	Top of Hole						
378.5	0.5	Topsoil						
		Lean Clay, reddish brown, moist to wet, medium stiff to stiff, some gravel, some cobbles (CL)						end of tube bent
			ST-1	5.0 - 7.0	2.0		--	
			ST-2	8.0 - 10.0	2.0		--	
359.0	20.0							
		No Refusal / Bottom of Hole						

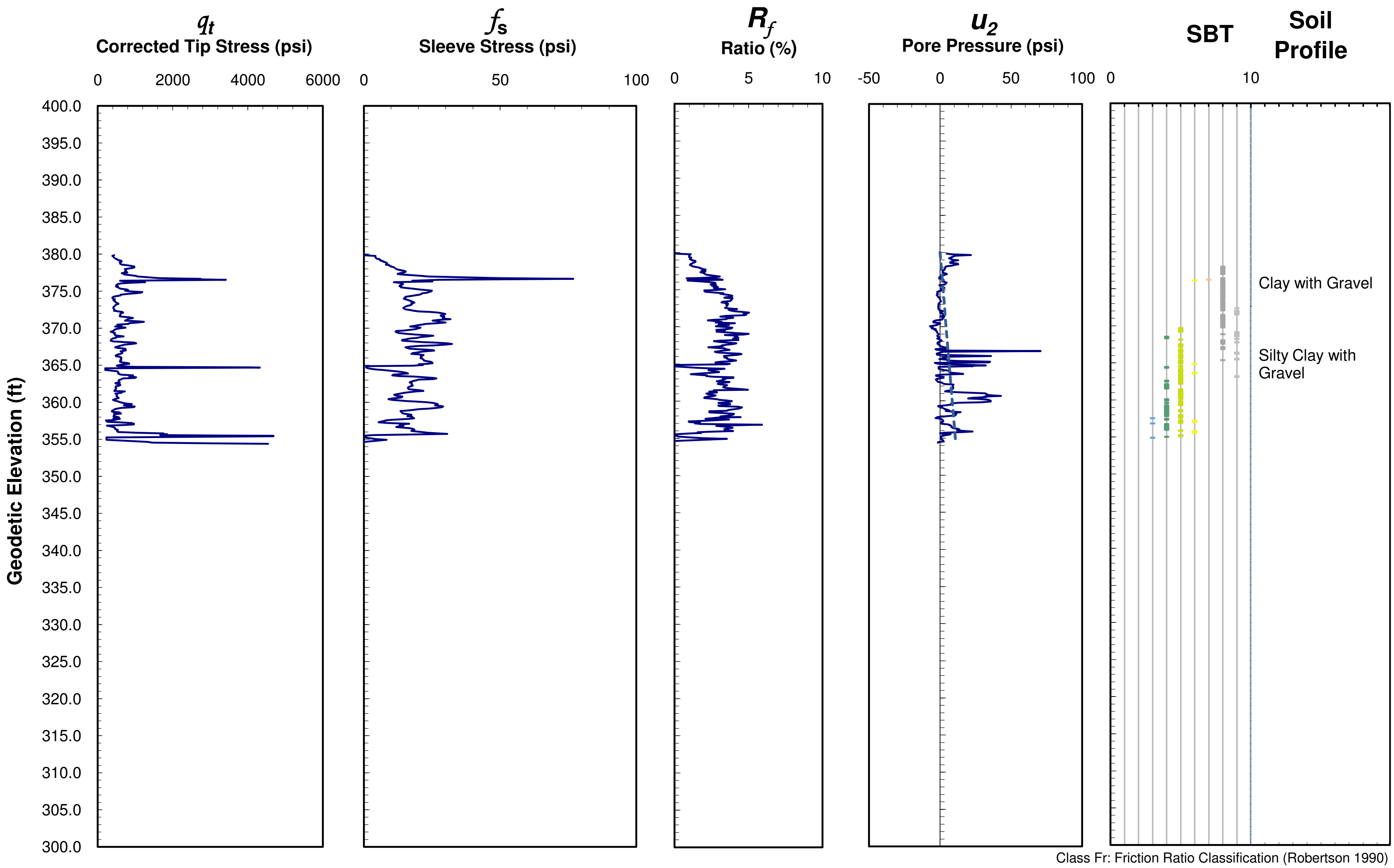
STANTEC/FMSM_LEGACY 175539009-CUF.GPJ FMSM-GRAPHIC LOG.GDT 11/12/09

Appendix D

Cone Penetrometer Test Logs

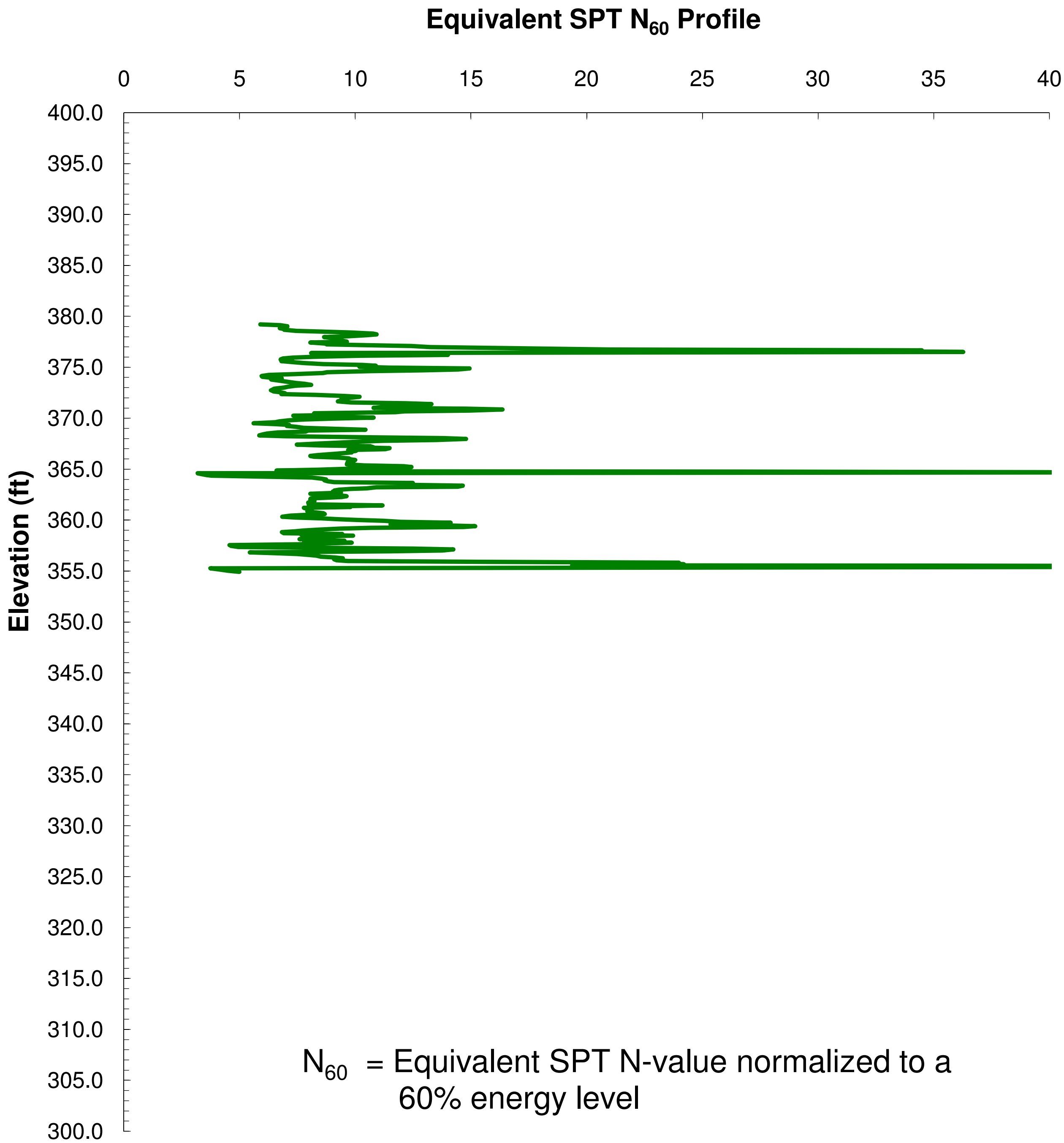
Stantec Consulting Inc.

Elevation: 380.00 ft SCPTu Start Elevation: 380.00 ft Groundwater Elevation: 380.00 ft	Test Date: June 25, 2009 Project No. 175539009	CPT3
Client: TVA Project: Cumberland Fossil Plant		



SCPTu Results

SCPTu N_{60} Values



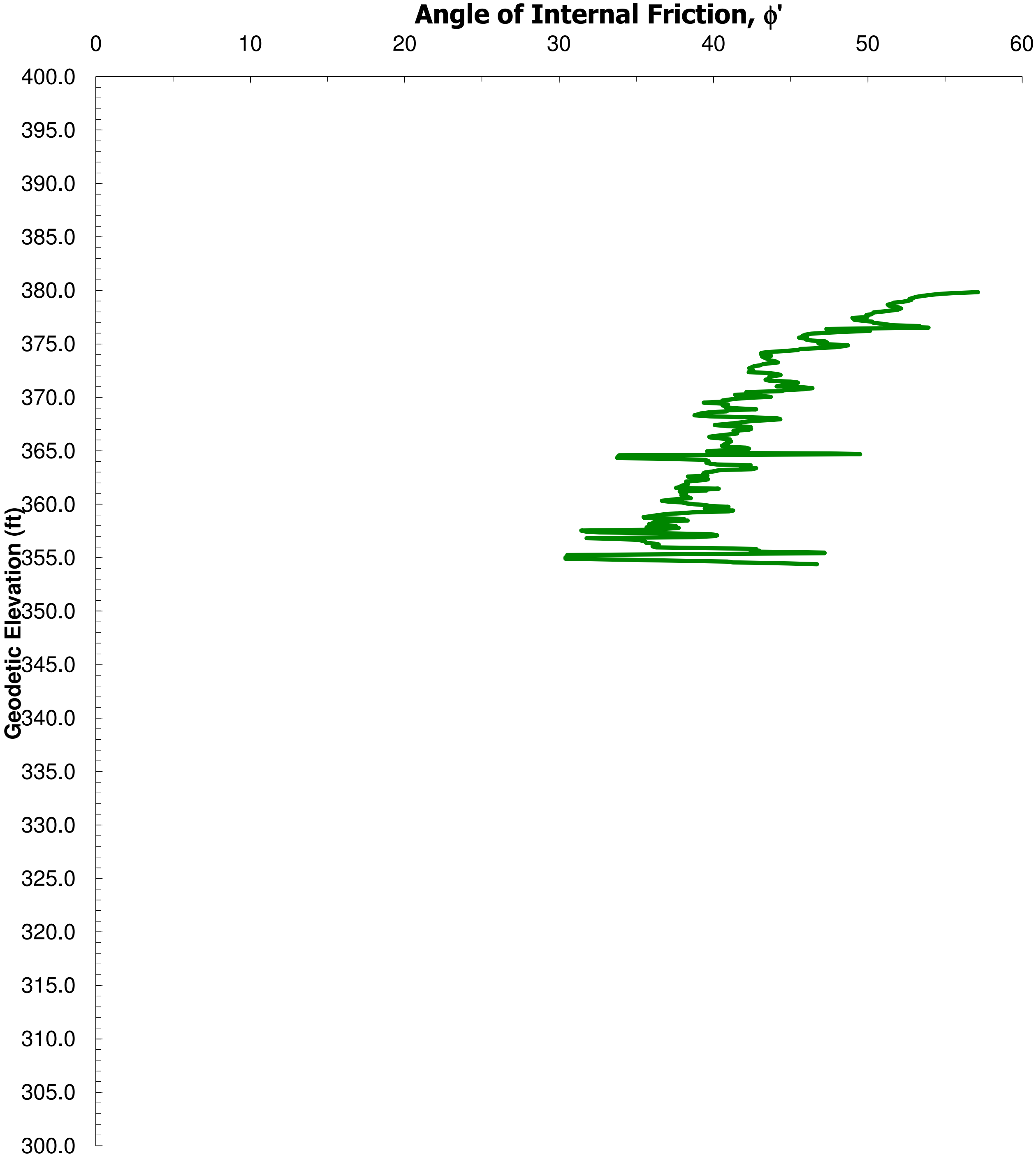
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT3

SCPTu RESULTS

Effective Angle of Internal Friction

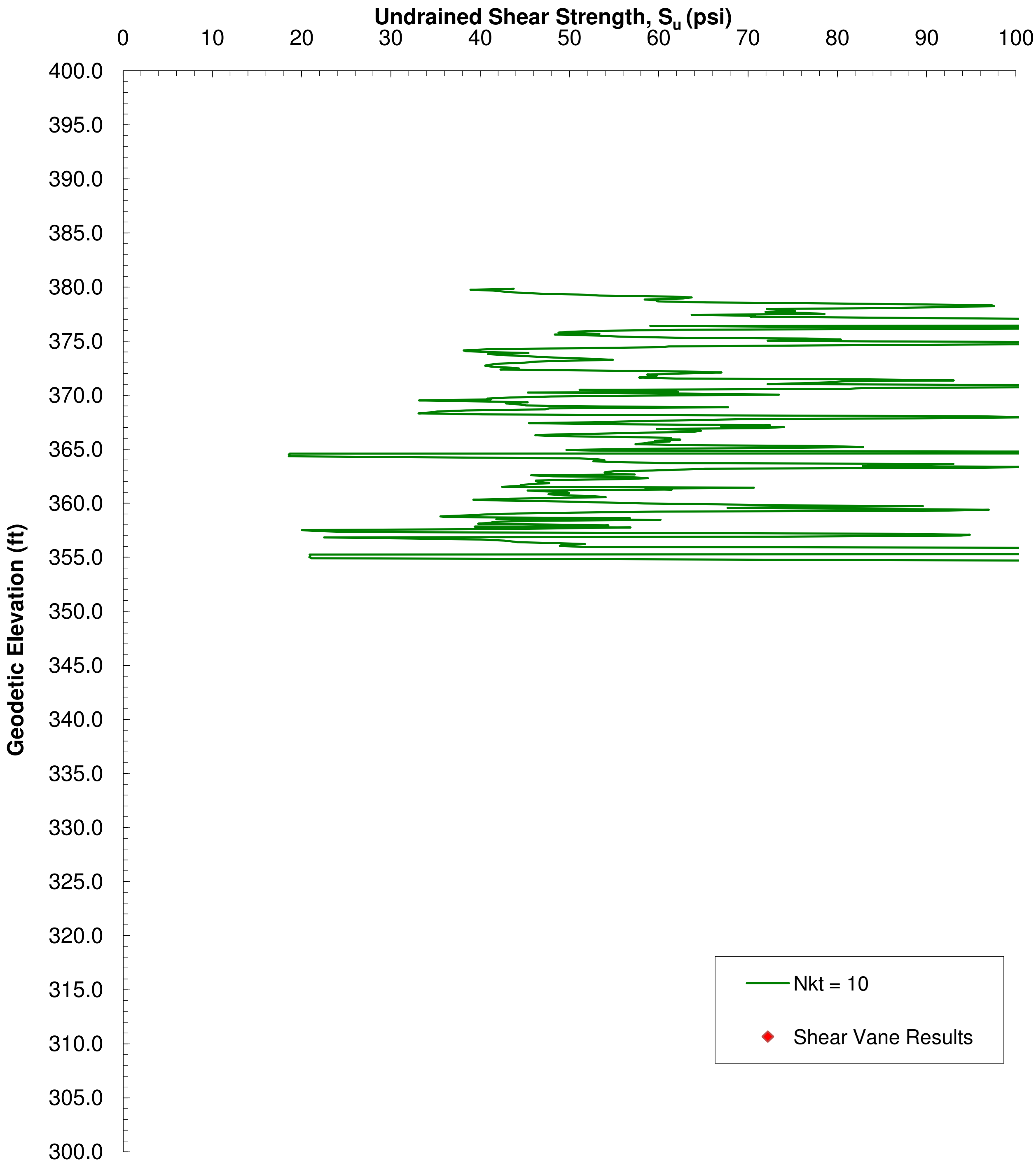


Project No. 175539009

CPT3

SCPTu RESULTS

Undrained Shear Strength, S_u



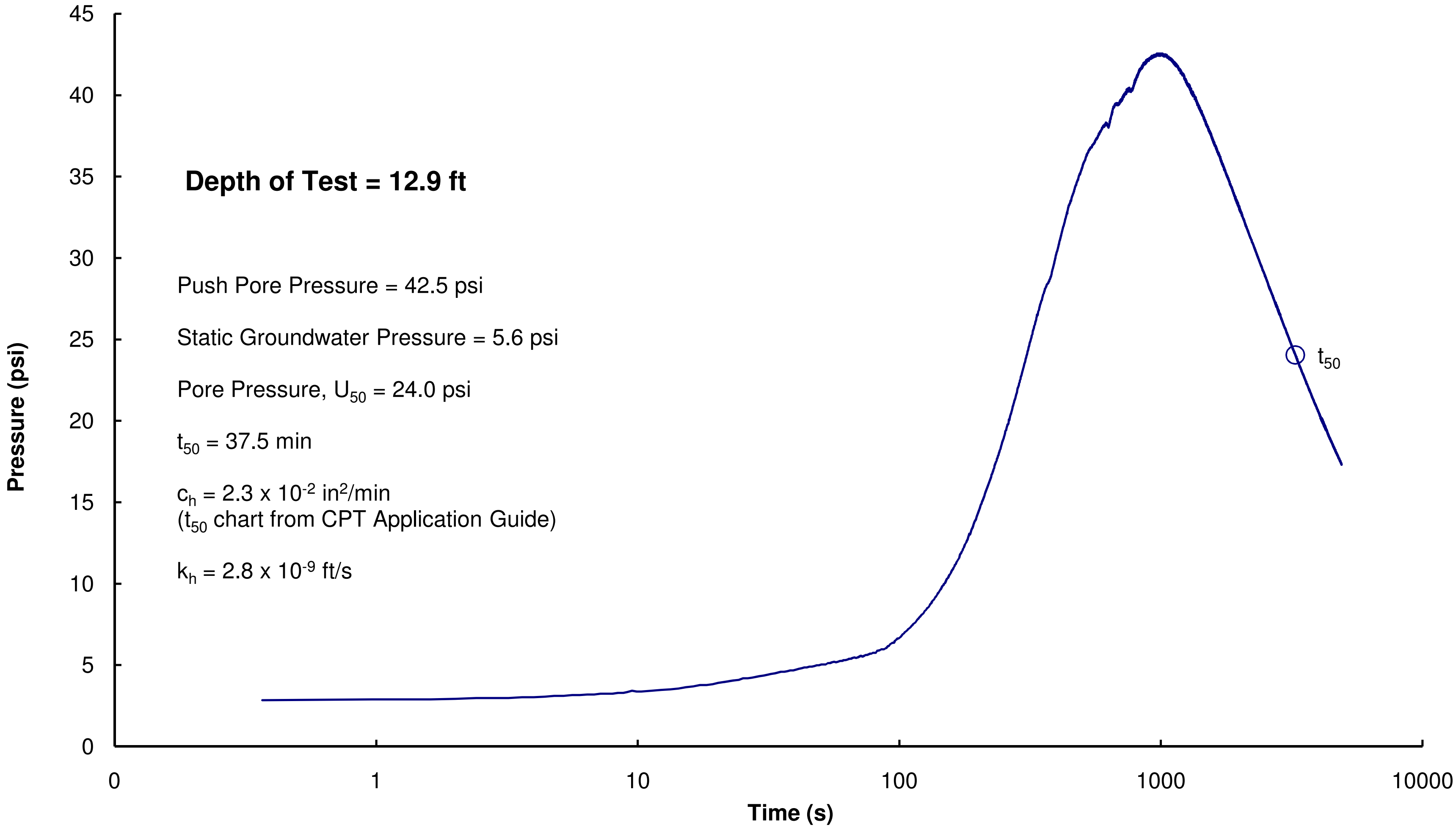
Project No. 175539009

CPT3

Stantec Consulting Inc.

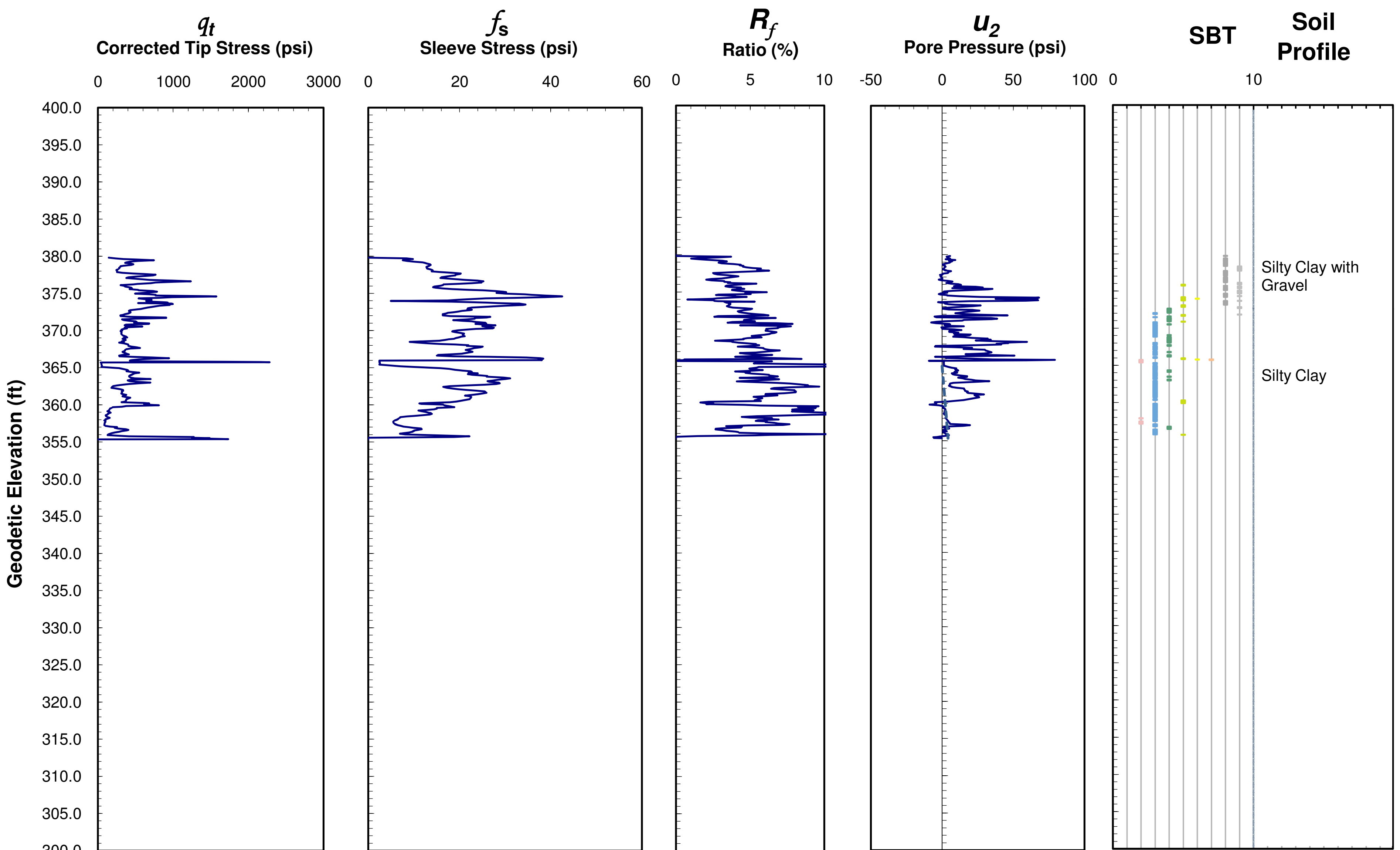
SCPTu DISSIPATION RESULTS

Coefficient of Consolidation



Project No. 175539009
CPT3

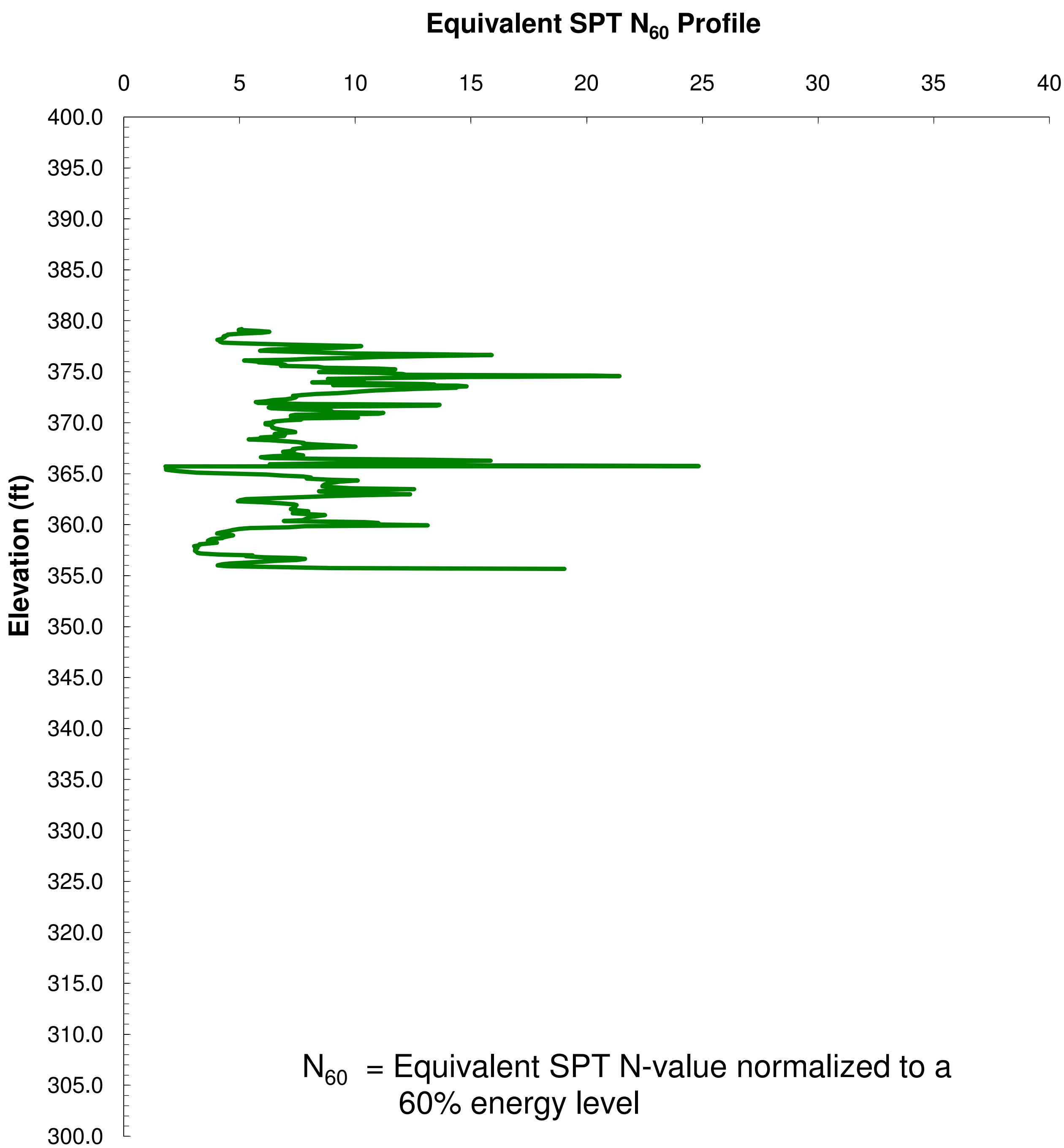
Stantec Consulting Inc.	Elevation: 380.00 ft SCPTu Start Elevation: 380.00 ft Groundwater Elevation: 365.00 ft	Test Date: June 24, 2009 Project No. 175539009	CPT4
	Client: TVA Project: Cumberland Fossil Plant		



Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values



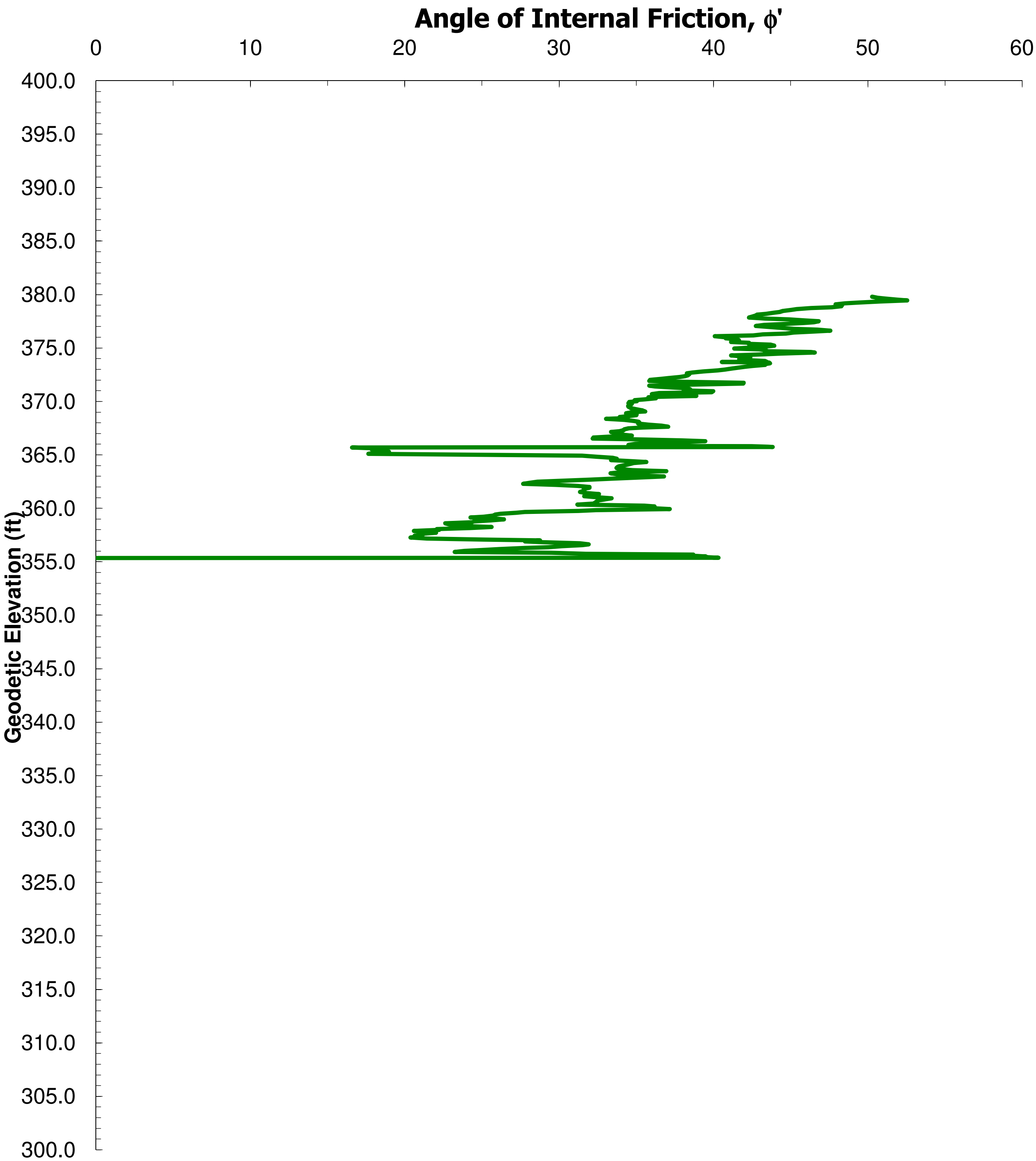
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT4

SCPTu RESULTS

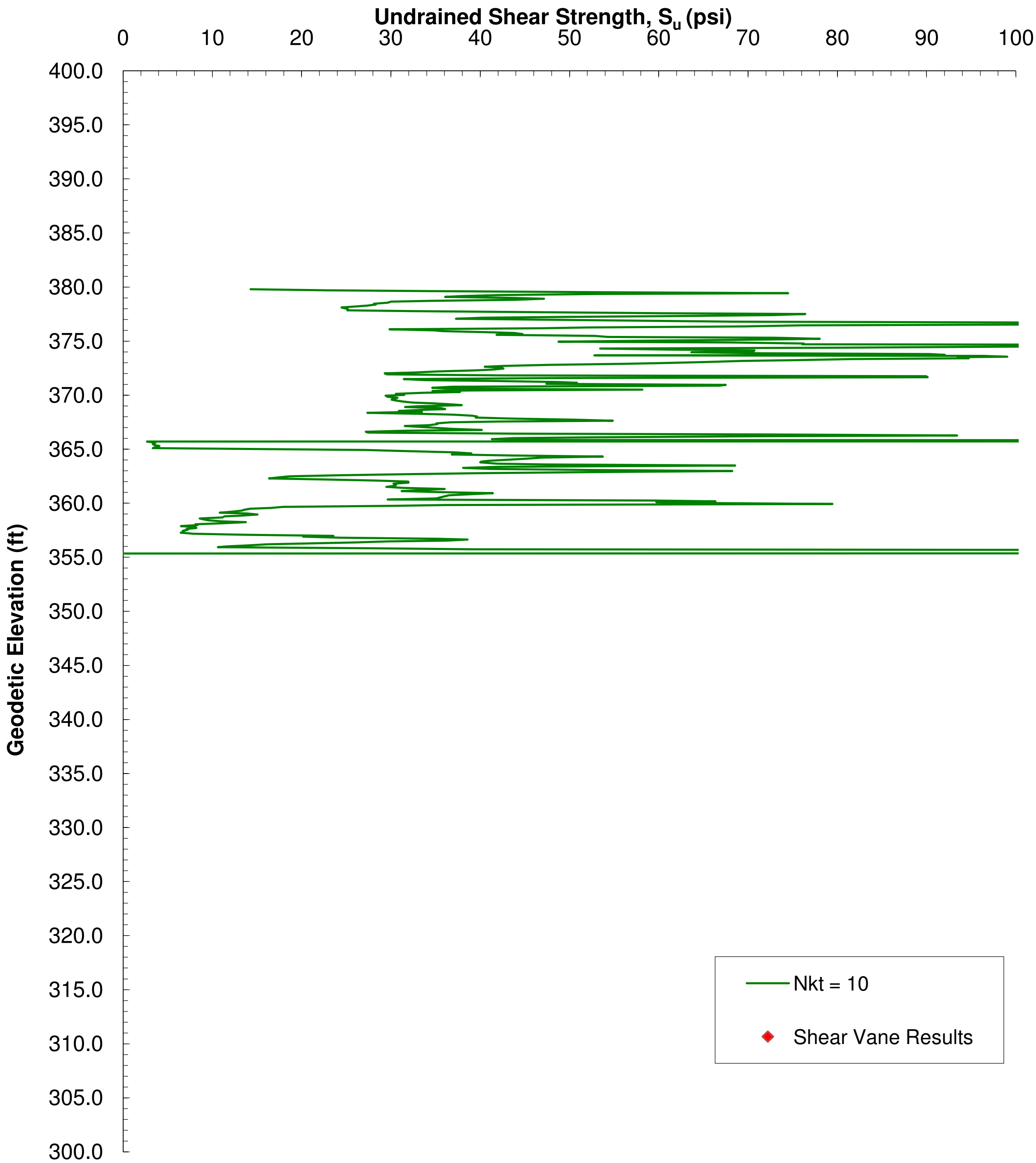
Effective Angle of Internal Friction



Project No. 175539009
CPT4

SCPTu RESULTS

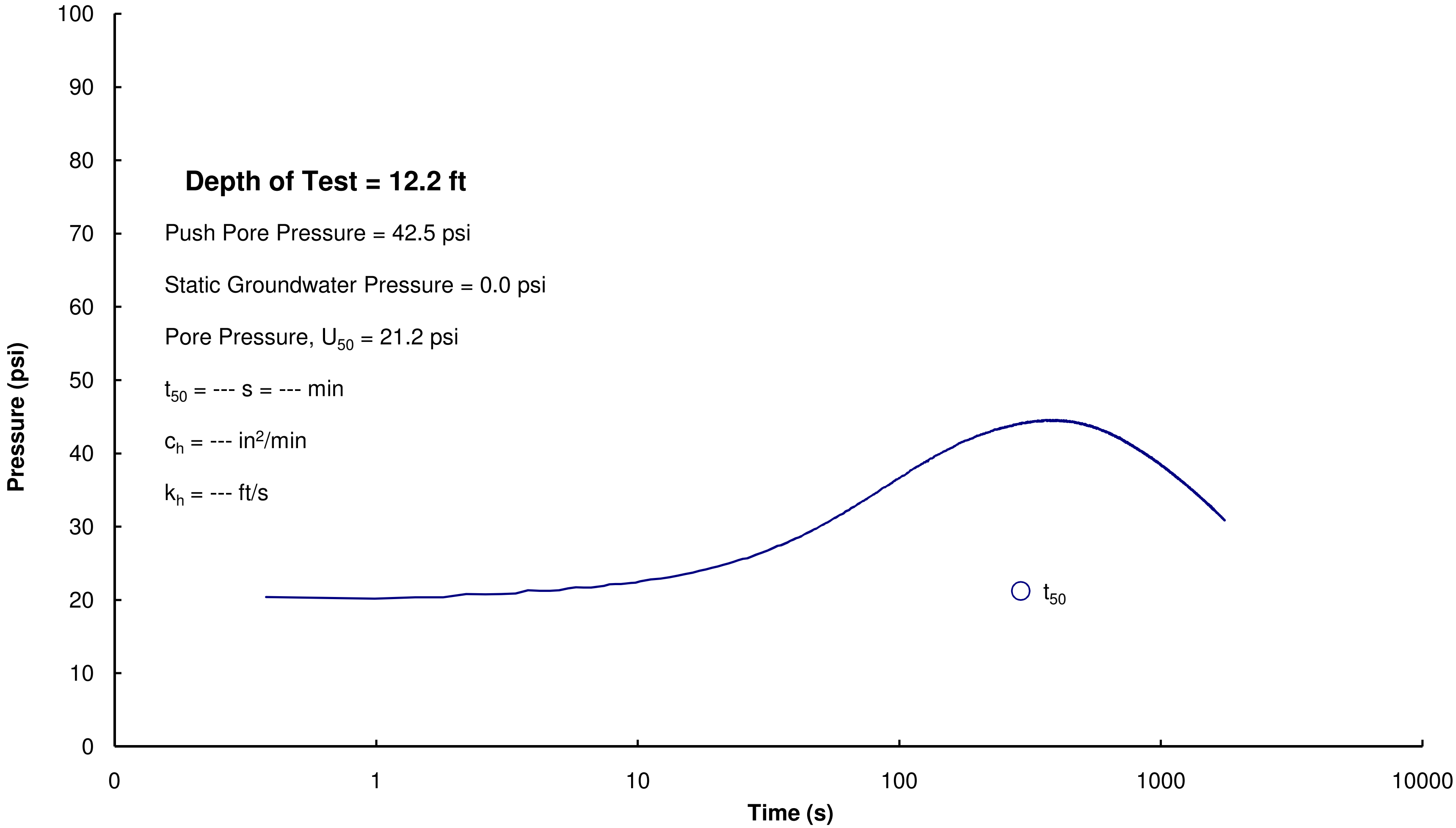
Undrained Shear Strength, S_u



Project No. 175539009
CPT4

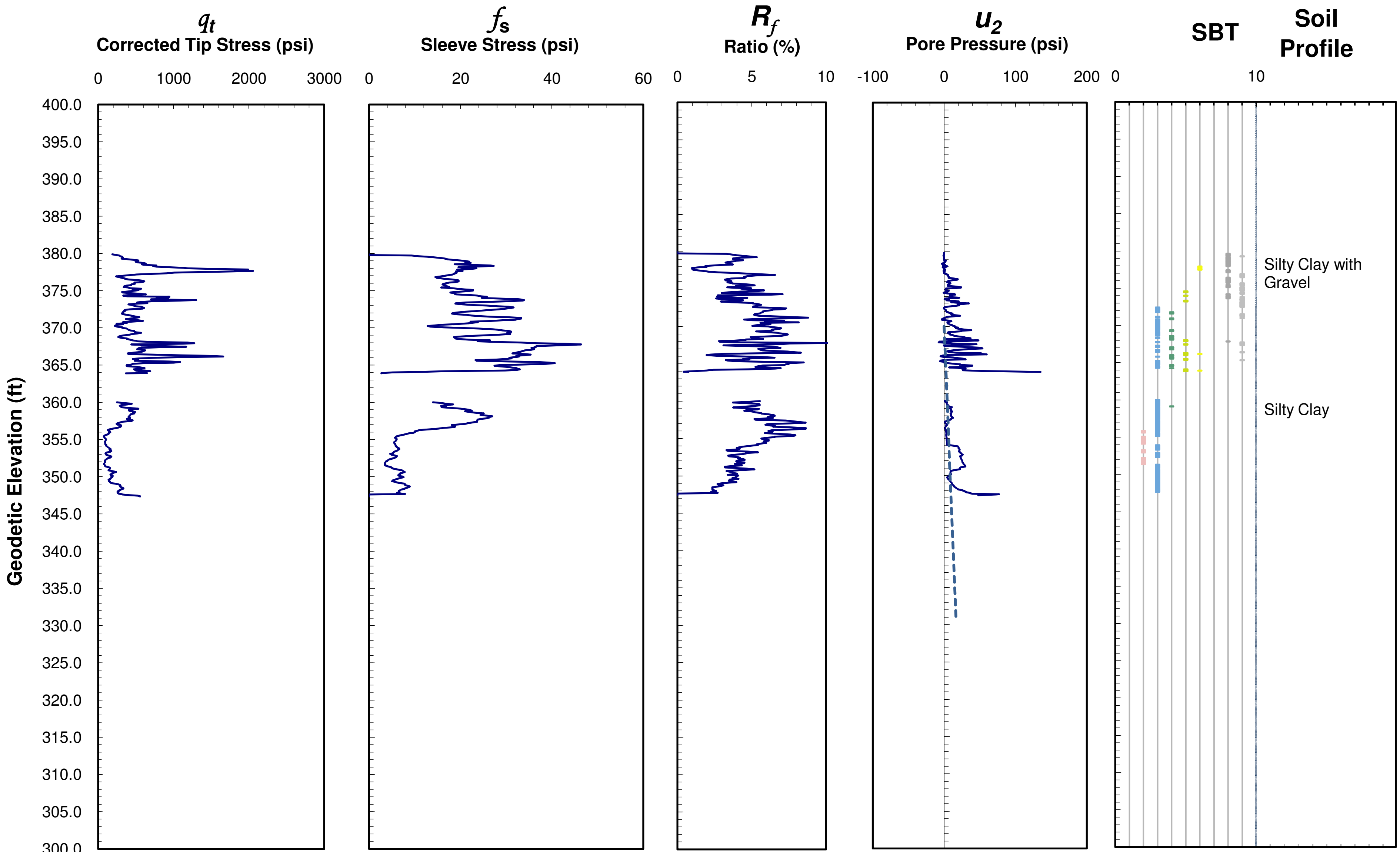
Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Project No. 175539009
CPT4

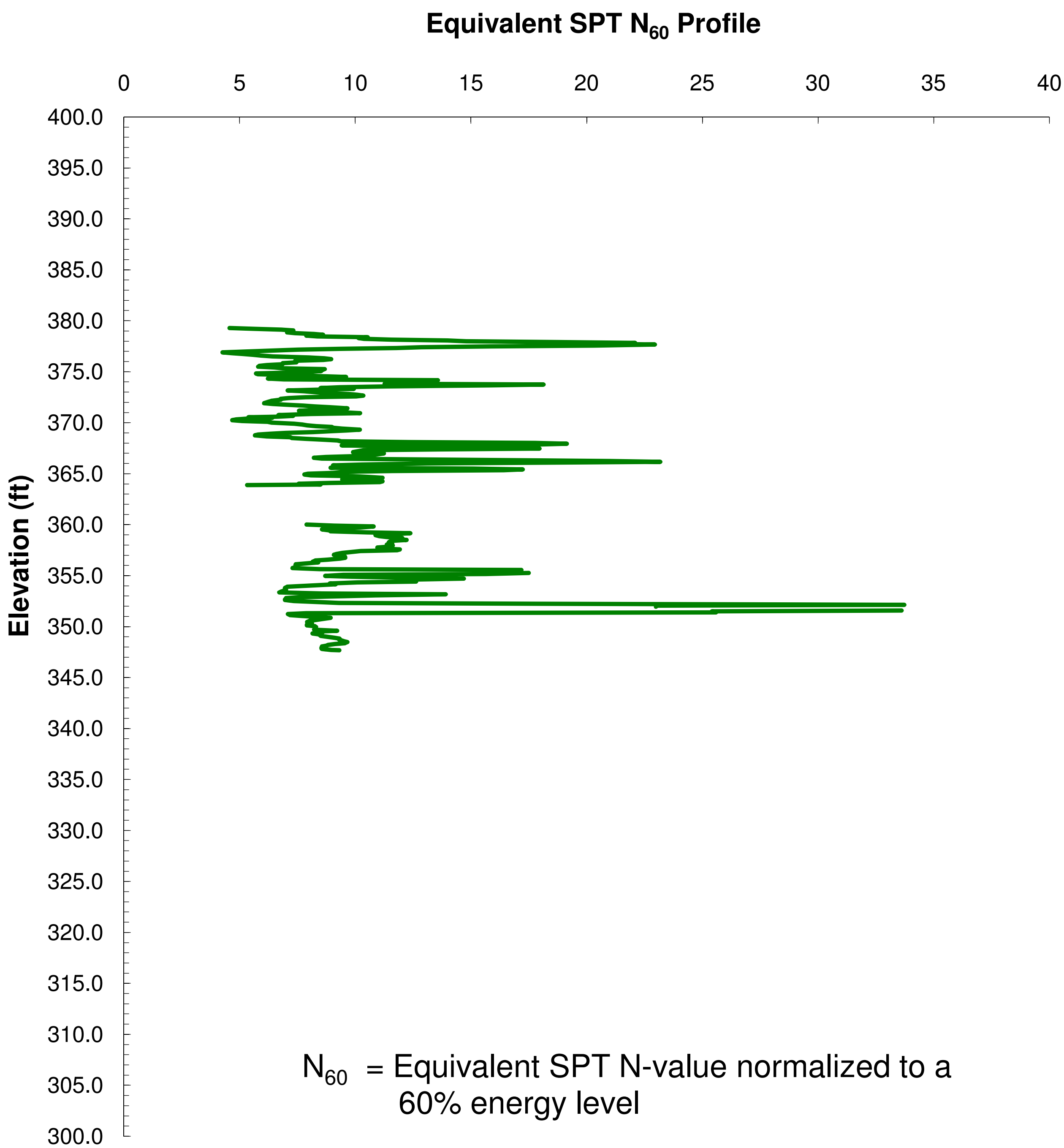
Stantec Consulting Inc.	Elevation: 380.00 ft SCPTu Start Elevation: 380.00 ft Groundwater Elevation: 370.00 ft	Test Date: June 24, 2009 Project No. 175539009	CPT5
	Client: TVA Project: Cumberland Fossil Plant		



Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values



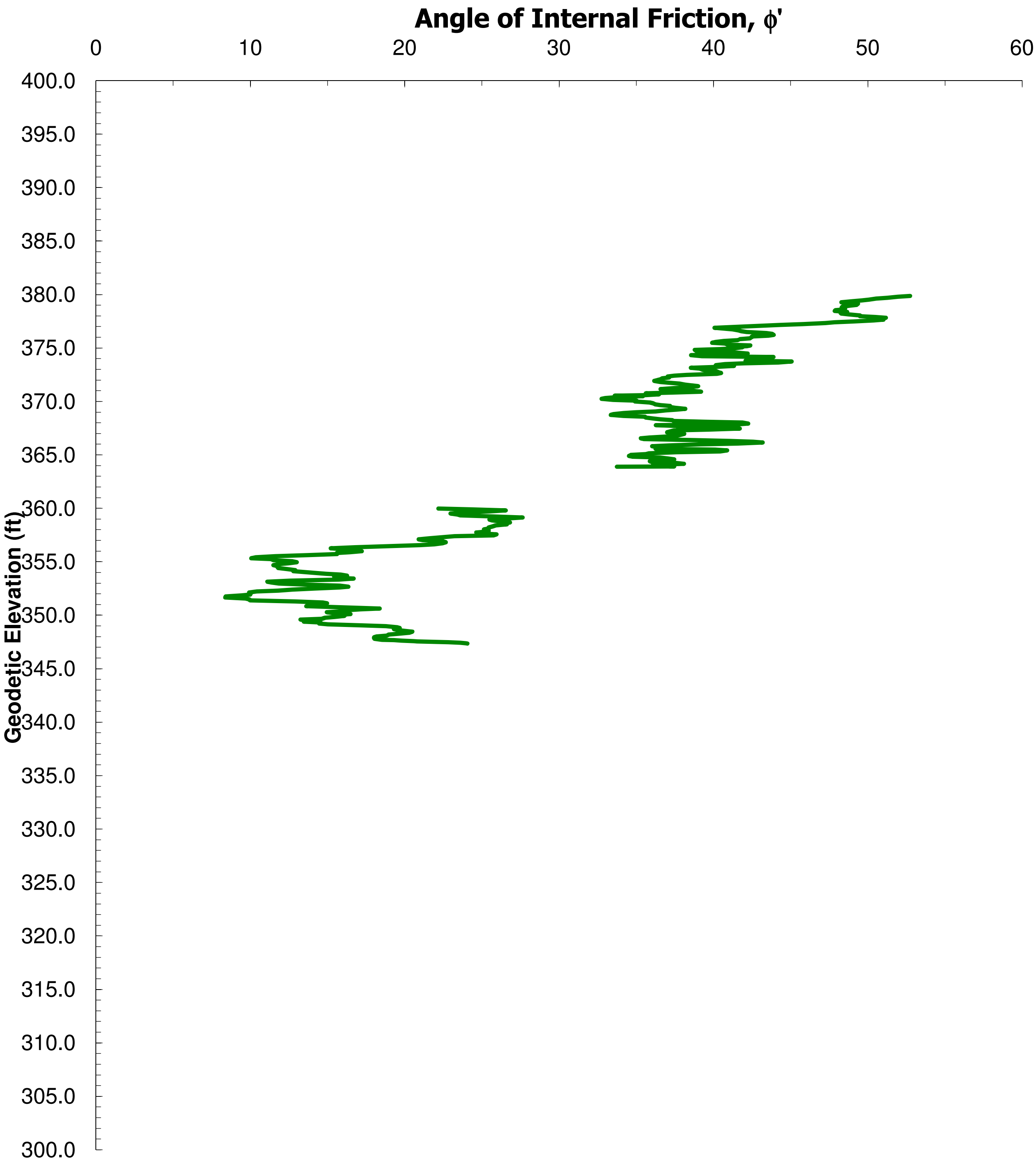
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT5

SCPTu RESULTS

Effective Angle of Internal Friction

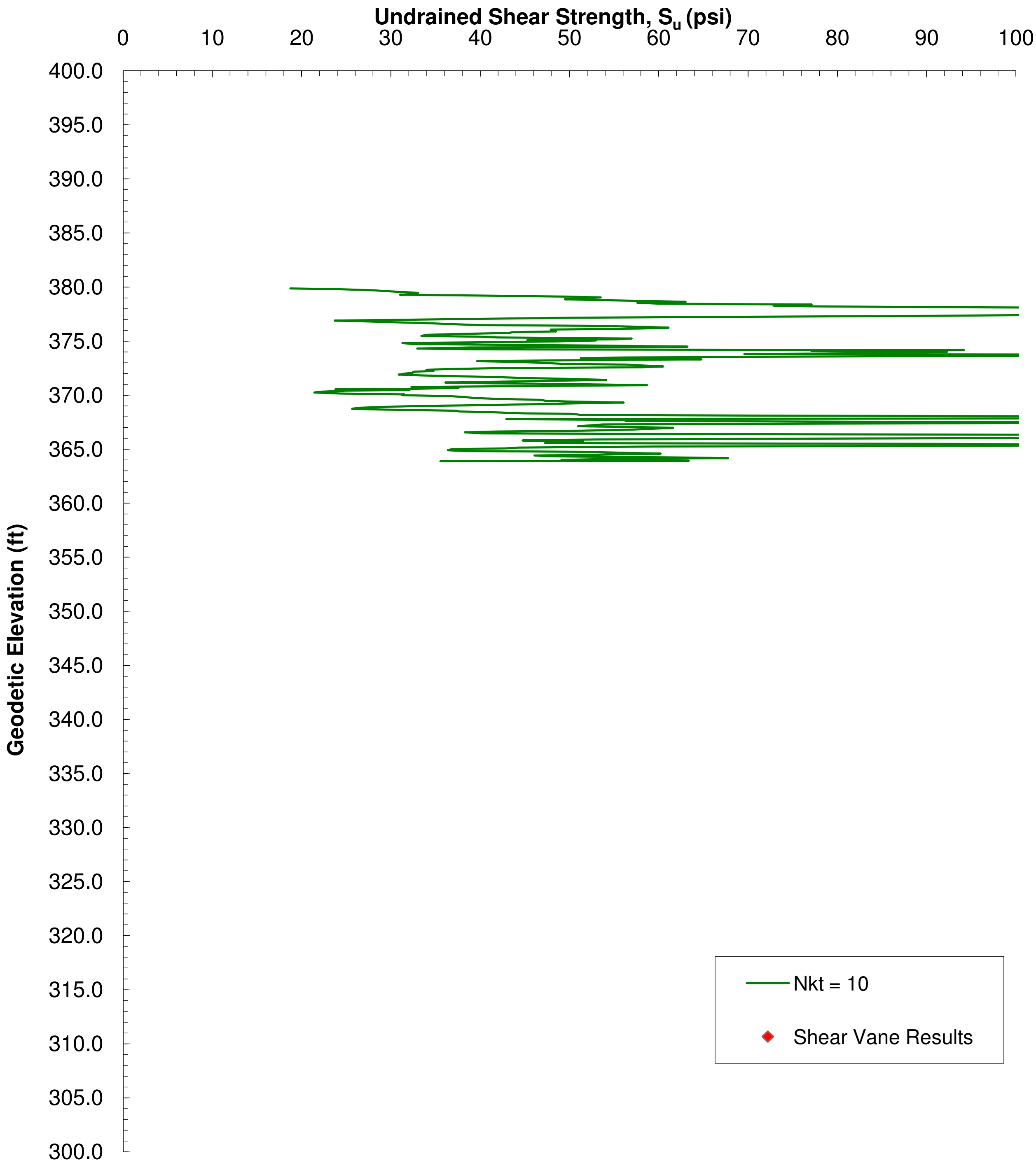


Project No. 175539009

CPT5

SCPTu RESULTS

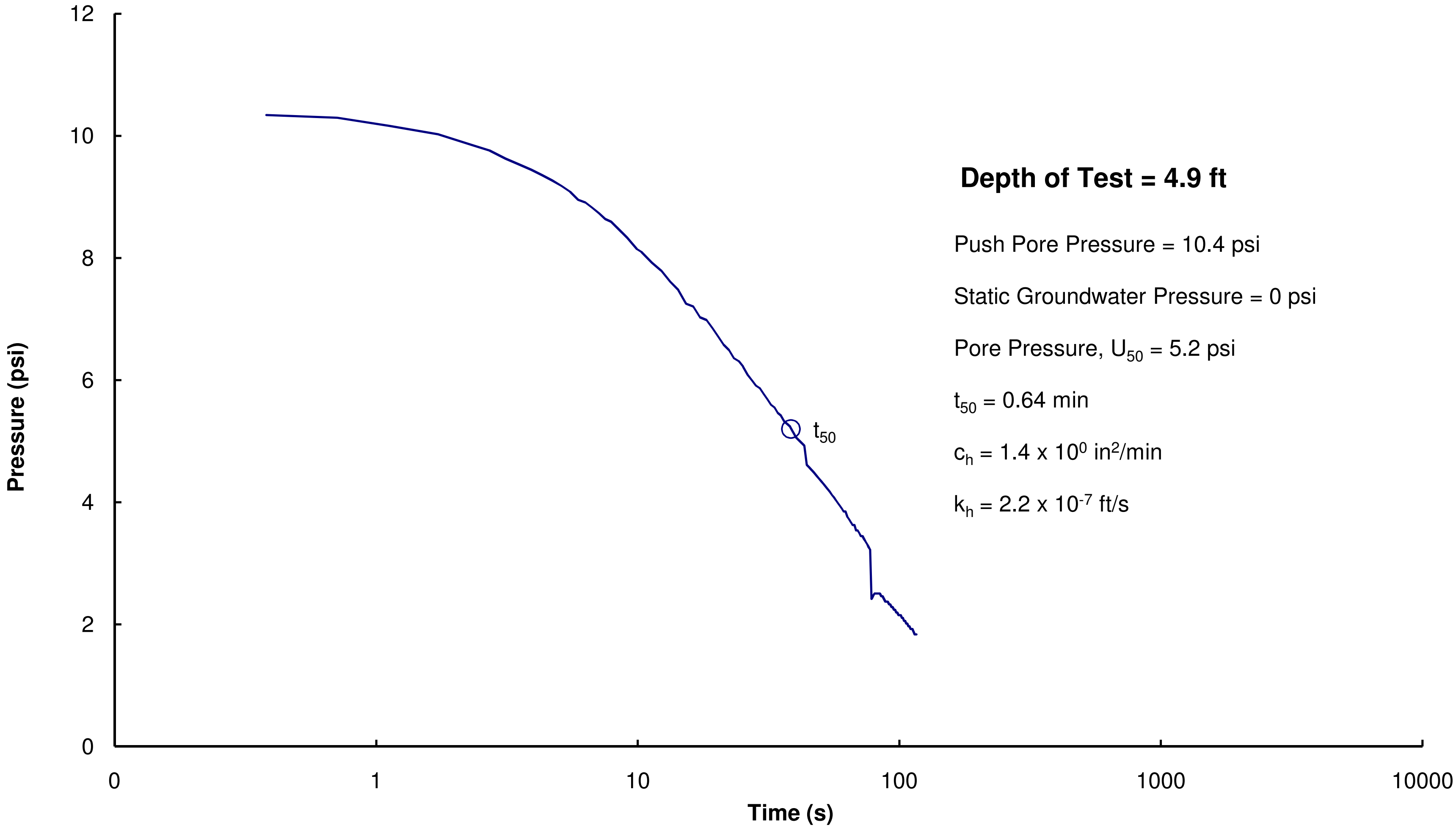
Undrained Shear Strength, S_u



Project No. 175539009
CPT5

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 4.9 ft

Push Pore Pressure = 10.4 psi

Static Groundwater Pressure = 0 psi

Pore Pressure, U_{50} = 5.2 psi

t_{50} = 0.64 min

$c_h = 1.4 \times 10^0$ in^2/min

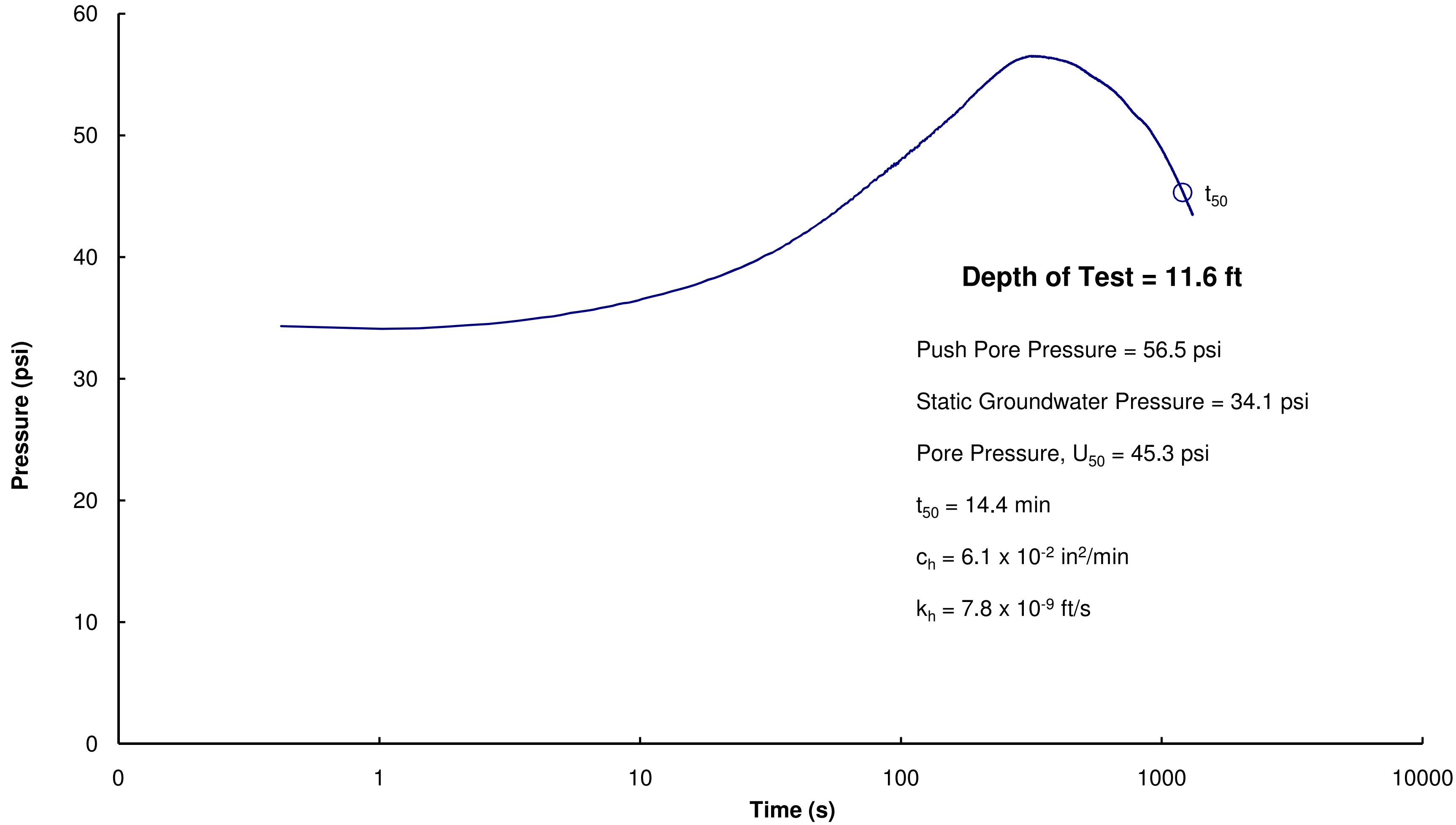
$k_h = 2.2 \times 10^{-7}$ ft/s

Project No. 175539009
CPT5

Stantec

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 11.6 ft

Push Pore Pressure = 56.5 psi

Static Groundwater Pressure = 34.1 psi

Pore Pressure, U_{50} = 45.3 psi

t_{50} = 14.4 min

$c_h = 6.1 \times 10^{-2}$ in^2/min

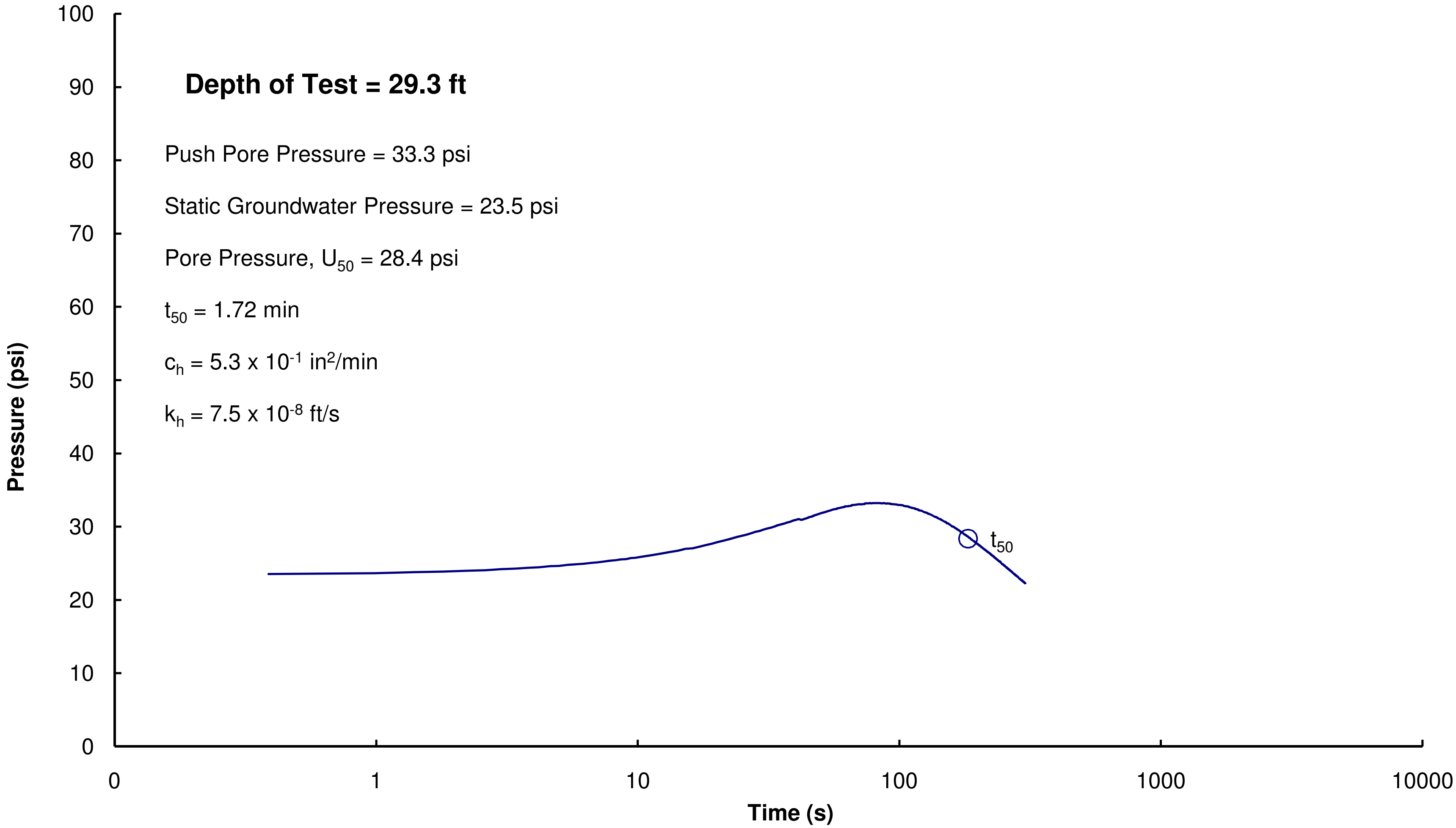
$k_h = 7.8 \times 10^{-9}$ ft/s

Project No. 175539009
CPT5

D:\My Documents\CUF-CPT\CPT5.xlsm

Stantec Consulting Inc.

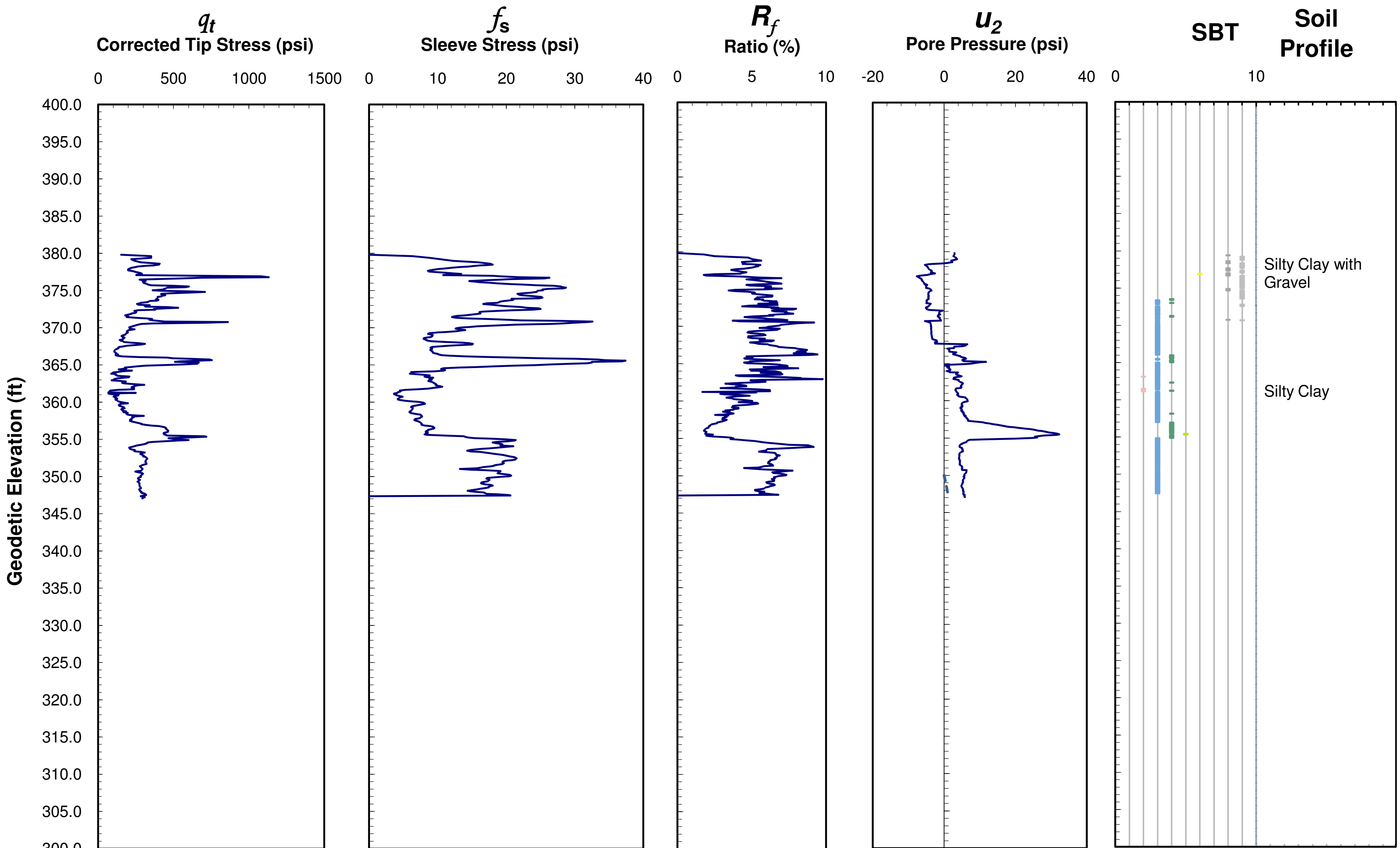
SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Project No. 175539009
CPT5

D:\My Documents\CUF-CPT\CPT5.xlsm

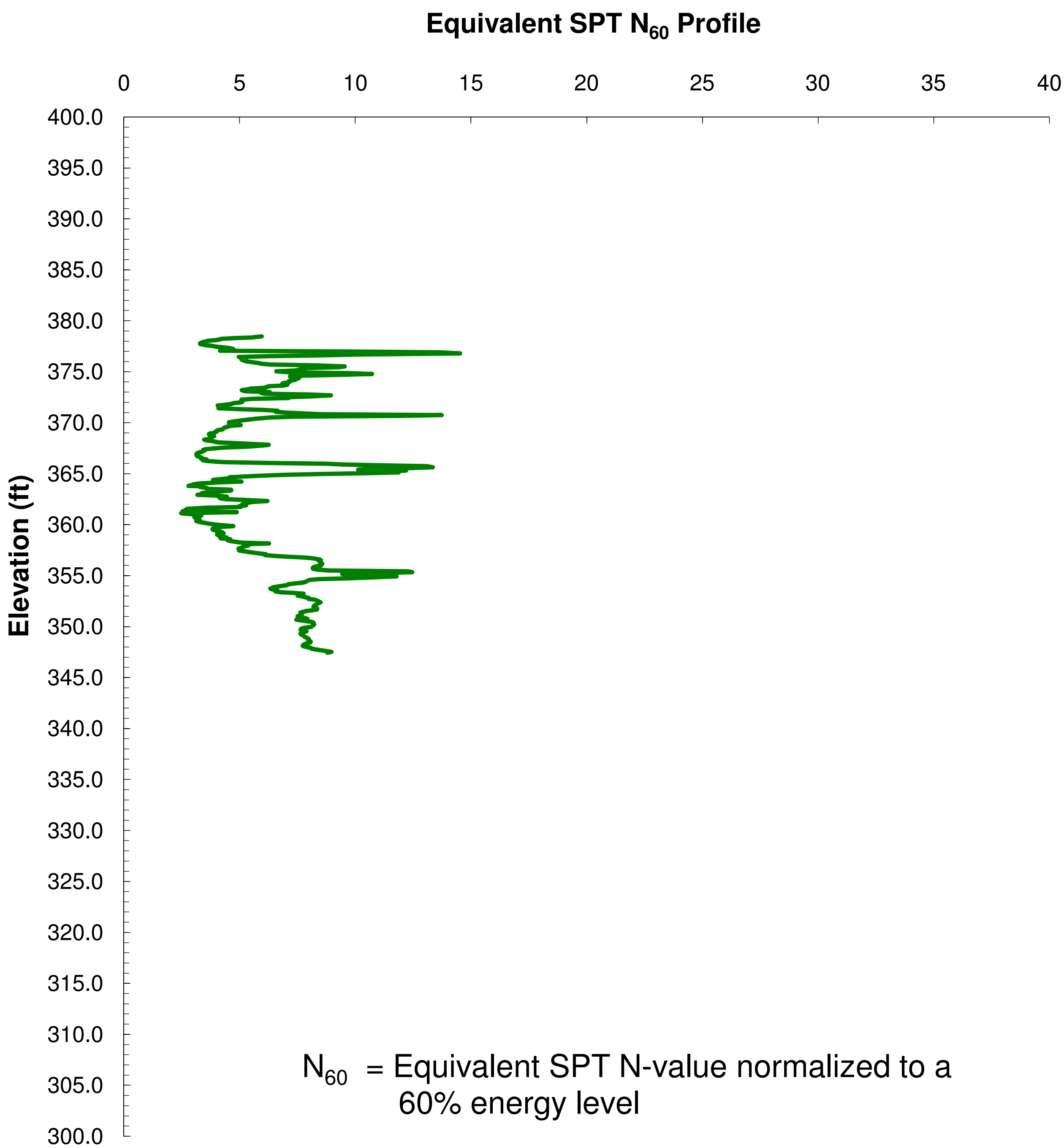
Stantec Consulting Inc.	Elevation: 380.00 ft SCPTu Start Elevation: 380.00 ft Groundwater Elevation: 350.00 ft	Test Date: June 23, 2009 Project No. 175539009	CPT6
	Client: TVA Project: Cumberland Fossil Plant		



Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values



N_{60} = Equivalent SPT N-value normalized to a 60% energy level

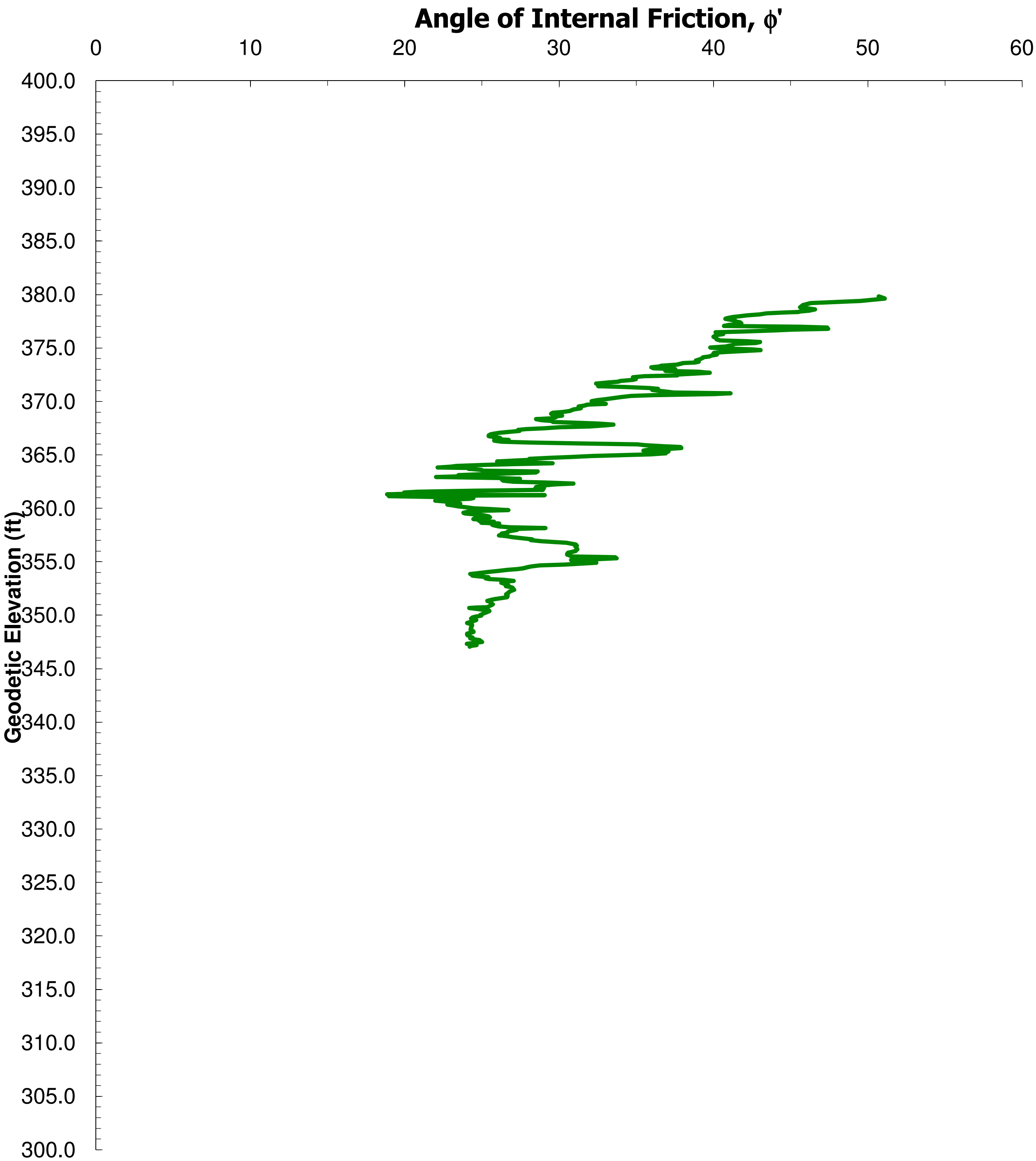
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT6

SCPTu RESULTS

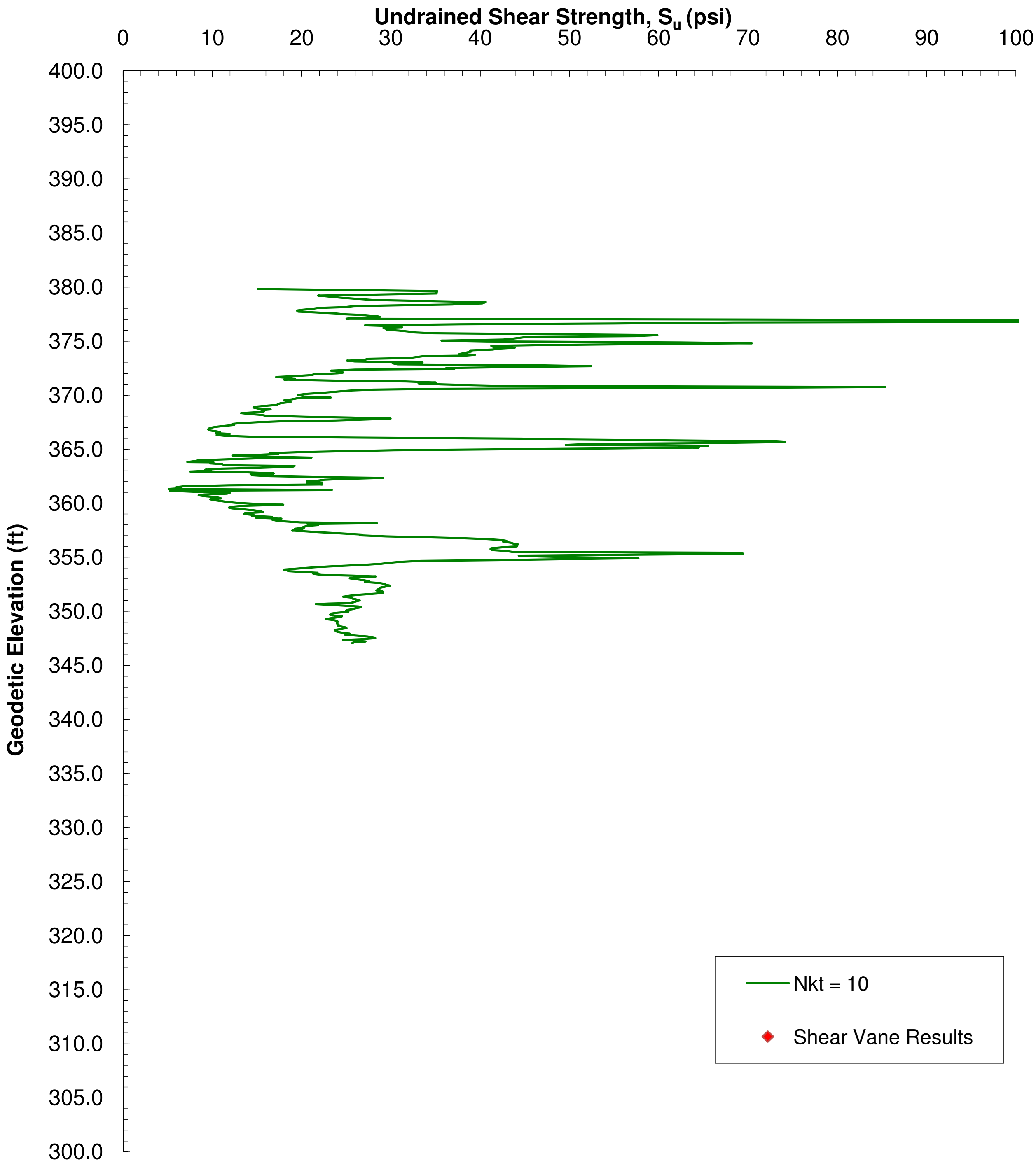
Effective Angle of Internal Friction



Project No. 175539009
CPT6

SCPTu RESULTS

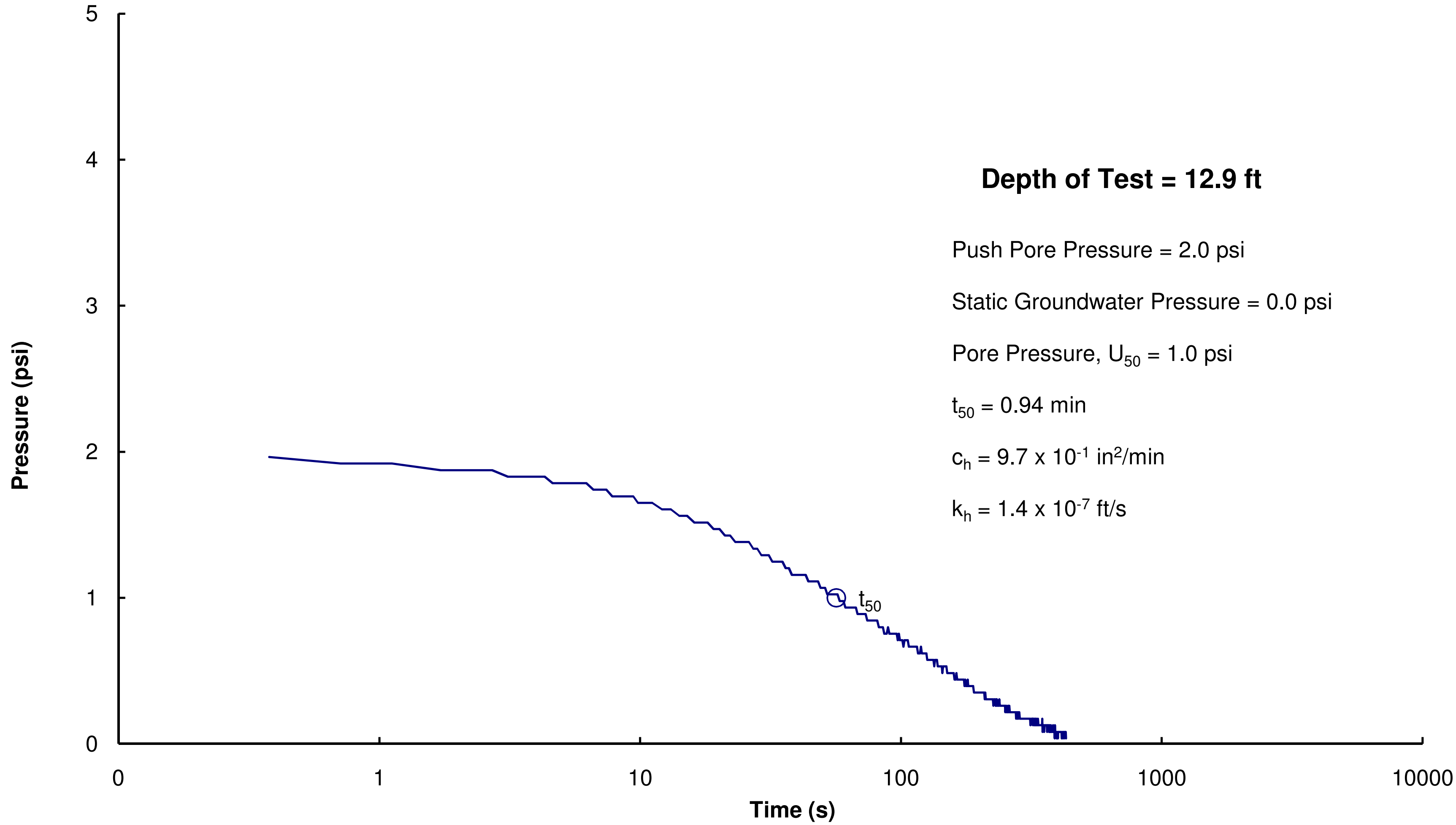
Undrained Shear Strength, S_u



Project No. 175539009
CPT6

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 12.9 ft

Push Pore Pressure = 2.0 psi

Static Groundwater Pressure = 0.0 psi

Pore Pressure, U_{50} = 1.0 psi

t_{50} = 0.94 min

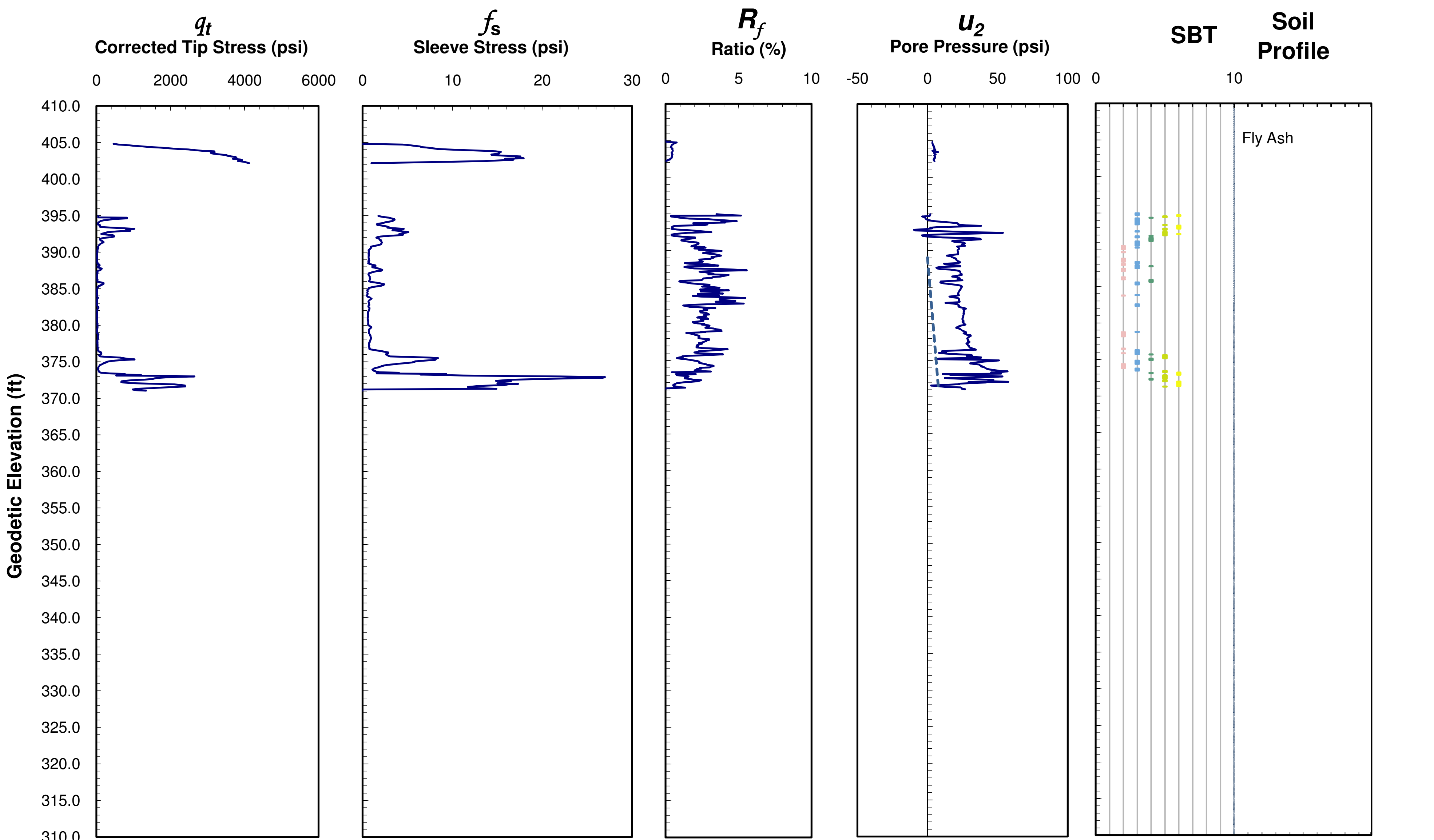
$c_h = 9.7 \times 10^{-1}$ in^2/min

$k_h = 1.4 \times 10^{-7}$ ft/s

Project No. 175539009
CPT6

D:\My Documents\CUF-CPT\CPT6.xlsm

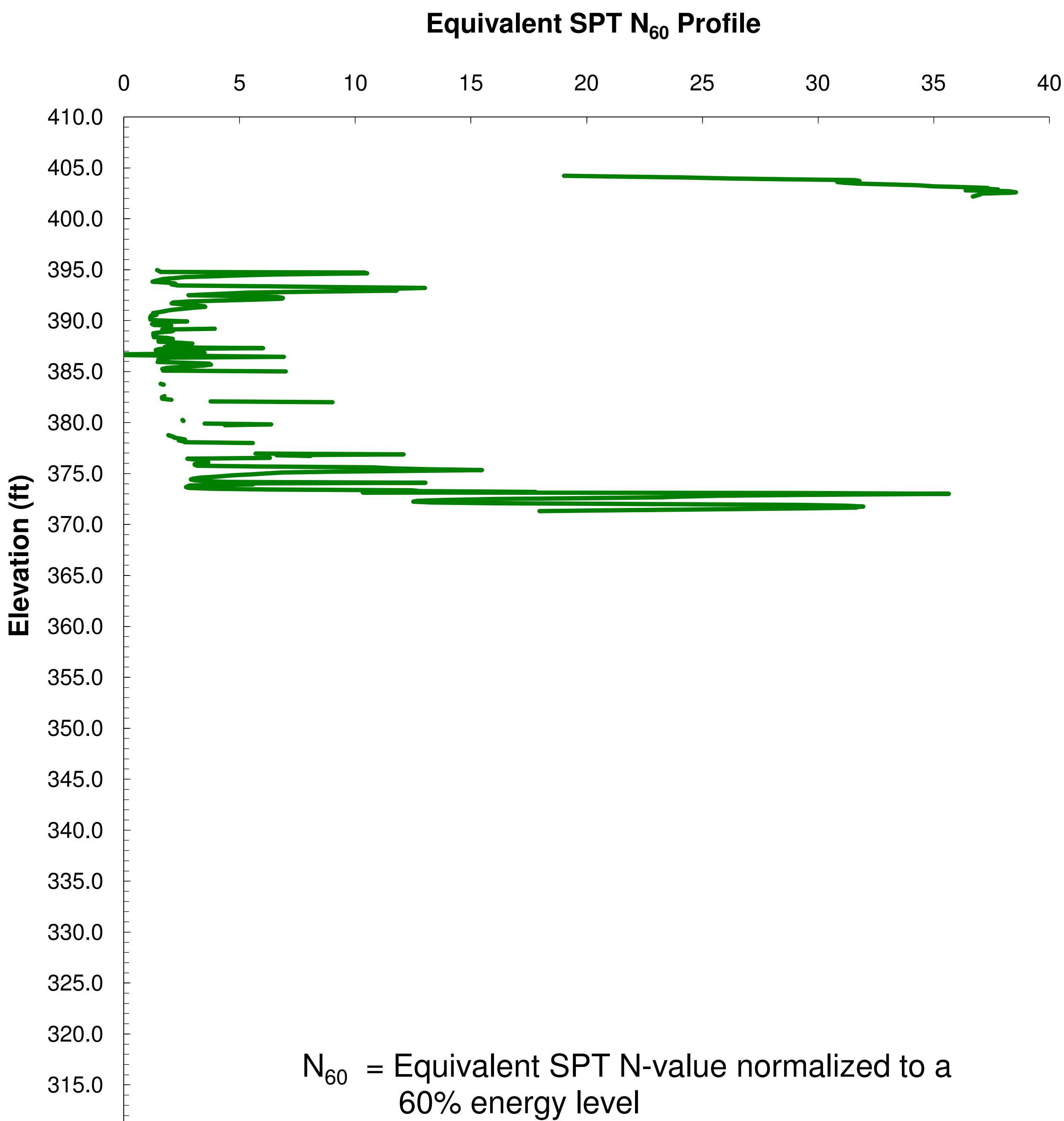
Stantec Consulting Inc.	Elevation: 405.00 ft SCPTu Start Elevation: 405.00 ft Groundwater Elevation: 389.00 ft	Test Date: June 23, 2009 Project No. 175539009	CPT14
	Client: TVA Project: Cumberland Fossil Plant		



Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values



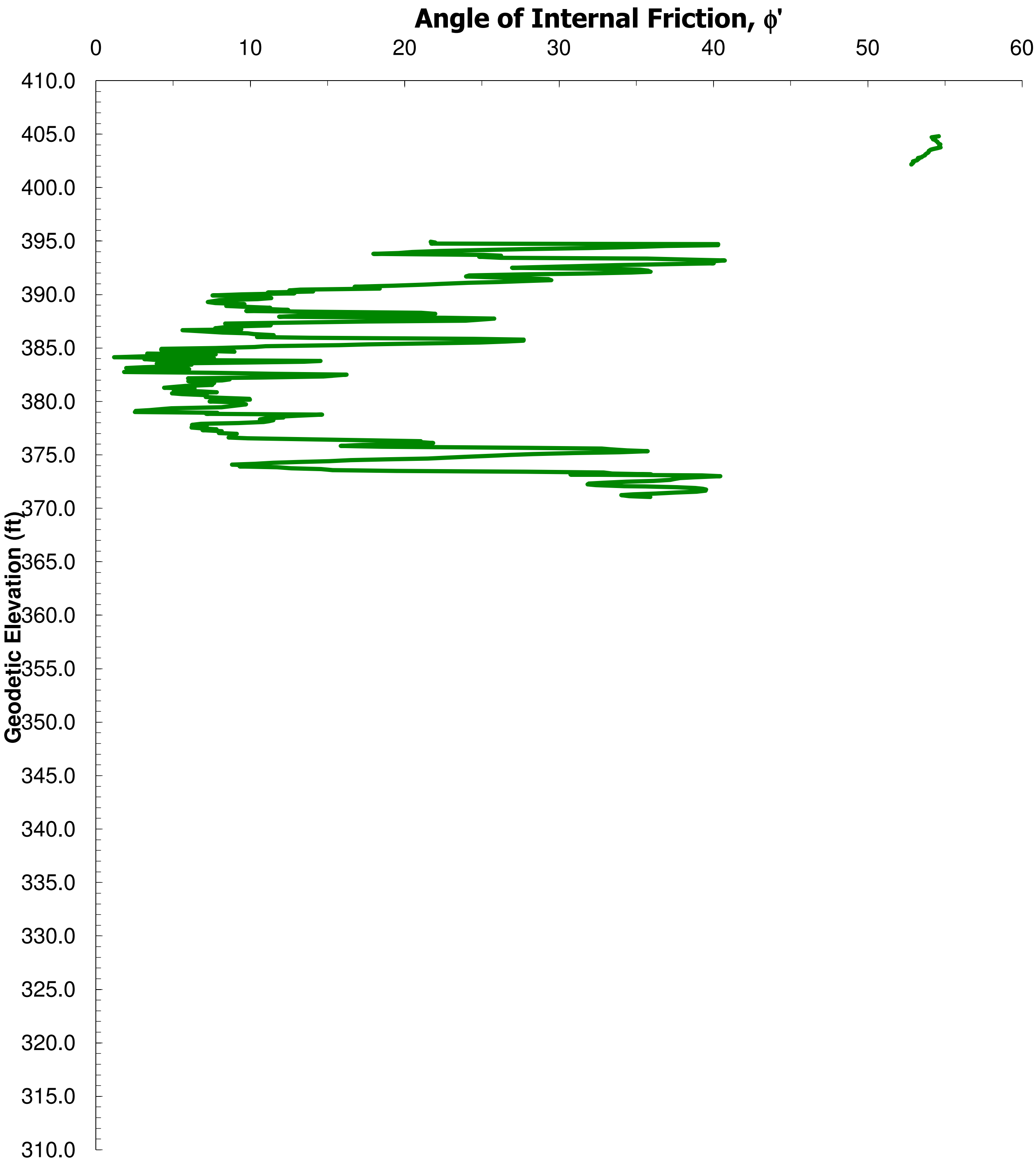
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT14

SCPTu RESULTS

Effective Angle of Internal Friction

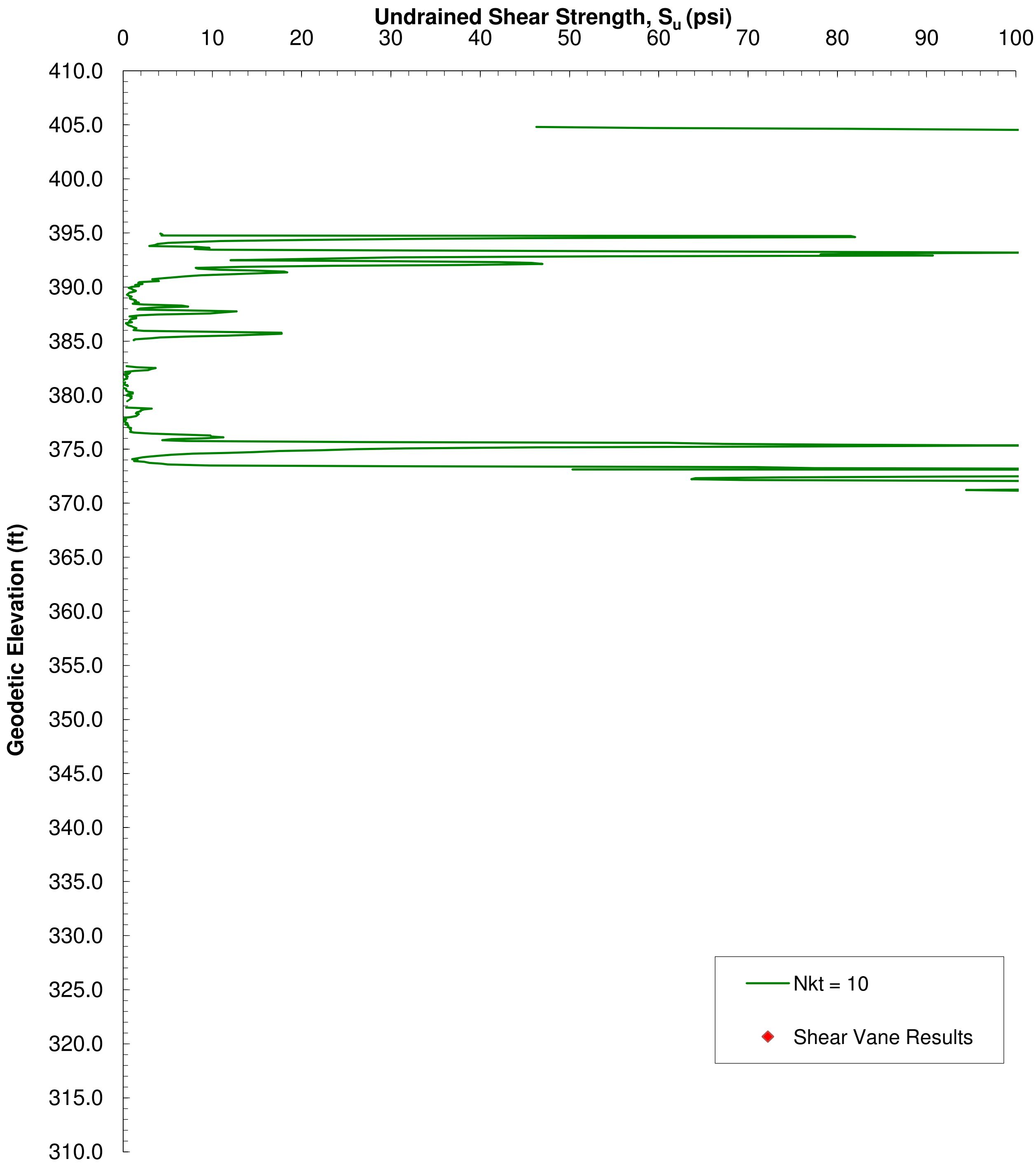


Project No. 175539009

CPT14

SCPTu RESULTS

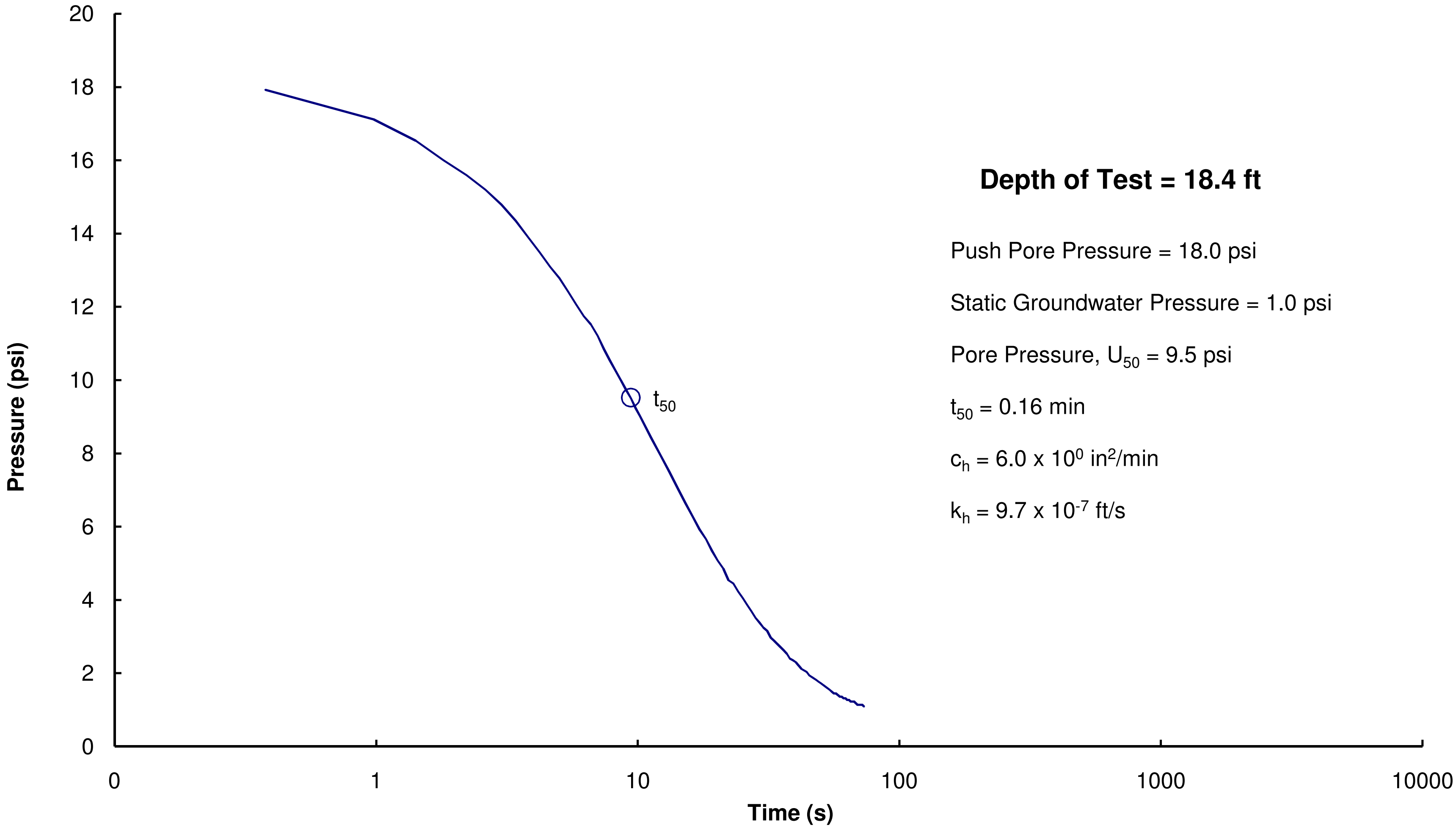
Undrained Shear Strength, S_u



Project No. 175539009
CPT14

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 18.4 ft

Push Pore Pressure = 18.0 psi

Static Groundwater Pressure = 1.0 psi

Pore Pressure, U_{50} = 9.5 psi

t_{50} = 0.16 min

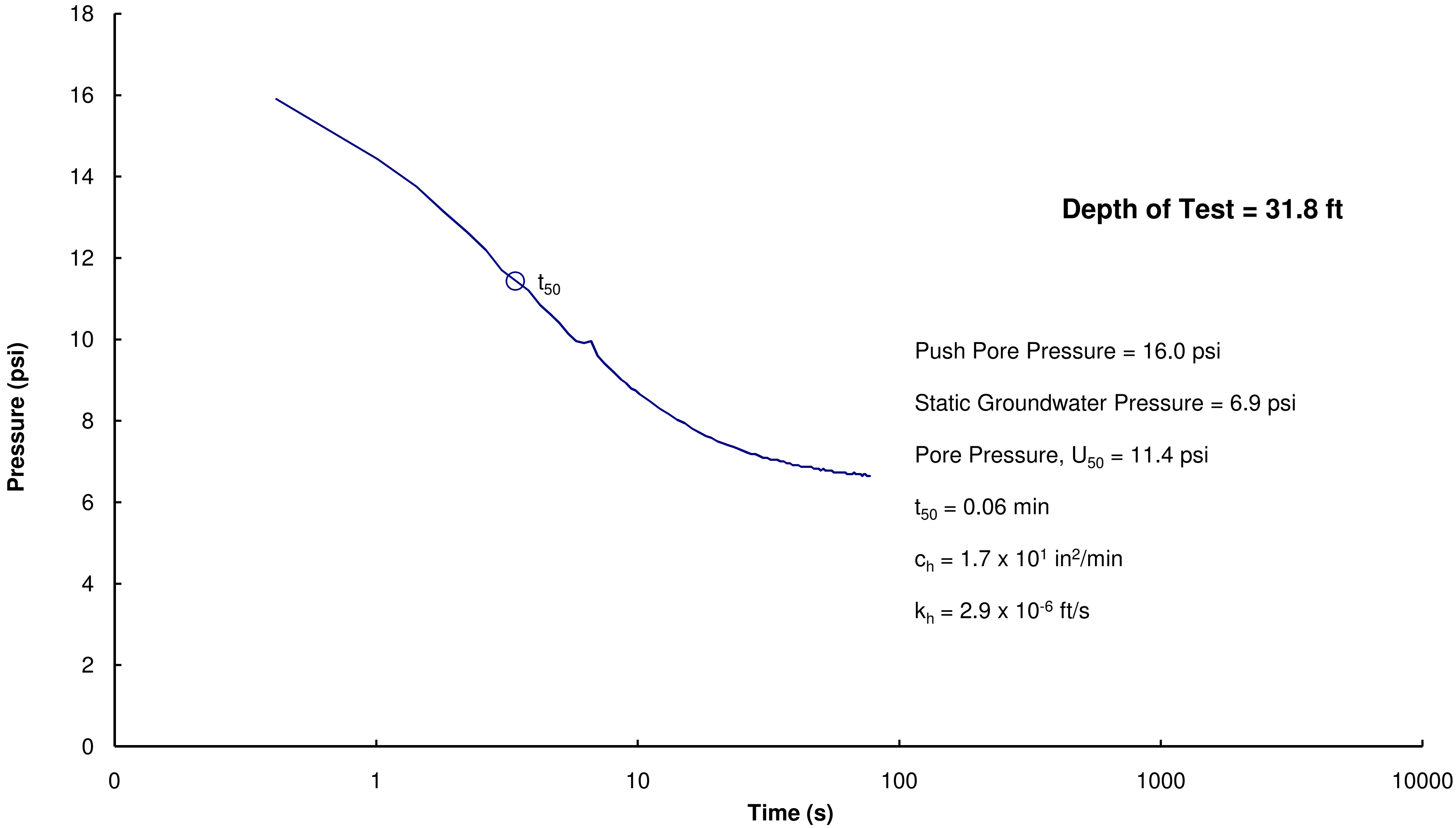
$c_h = 6.0 \times 10^0$ in^2/min

$k_h = 9.7 \times 10^{-7}$ ft/s

Project No. 175539009
CPT14

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 31.8 ft

Push Pore Pressure = 16.0 psi

Static Groundwater Pressure = 6.9 psi

Pore Pressure, U_{50} = 11.4 psi

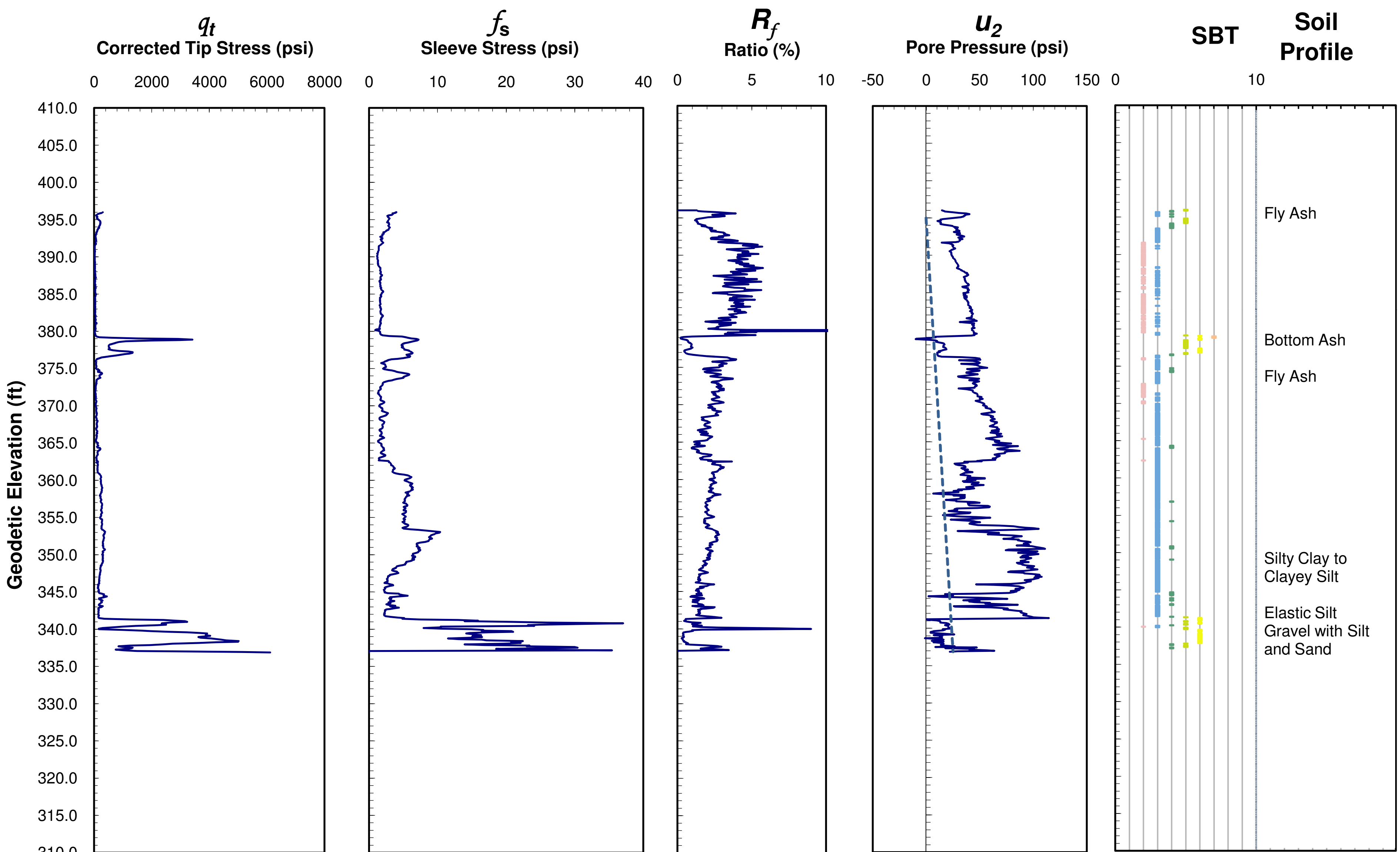
t_{50} = 0.06 min

$c_h = 1.7 \times 10^{1}\ in^2/min$

$k_h = 2.9 \times 10^{-6}\ ft/s$

Project No. 175539009
CPT14

Stantec Consulting Inc.	Elevation: 405.00 ft SCPTu Start Elevation: 396.00 ft Groundwater Elevation: 395.00 ft	Test Date: July 8, 2009 Project No. 175539009	CPT14C
	Client: TVA Project: Cumberland Fossil Plant		

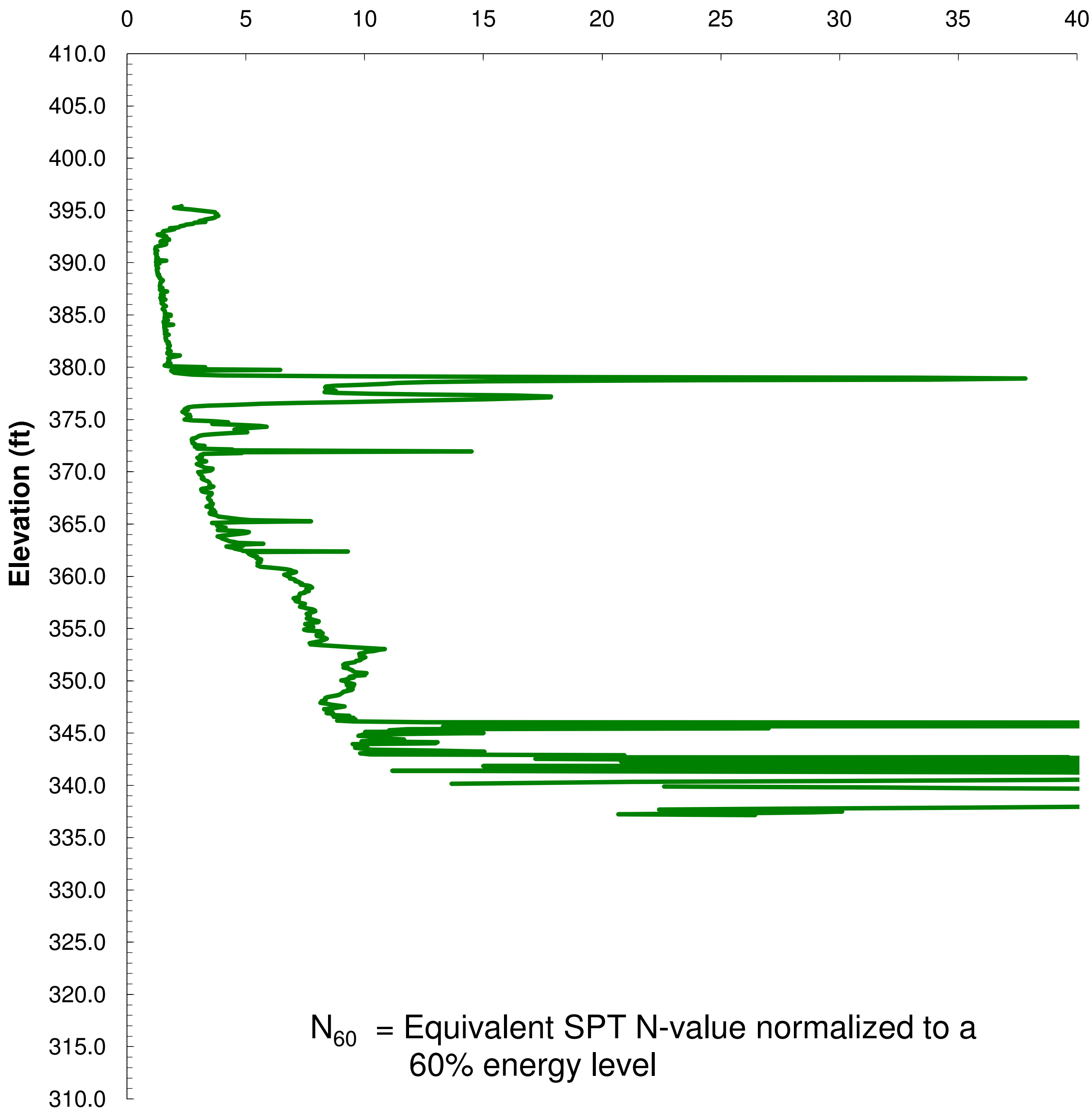


Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values

Equivalent SPT N_{60} Profile



N_{60} = Equivalent SPT N-value normalized to a 60% energy level

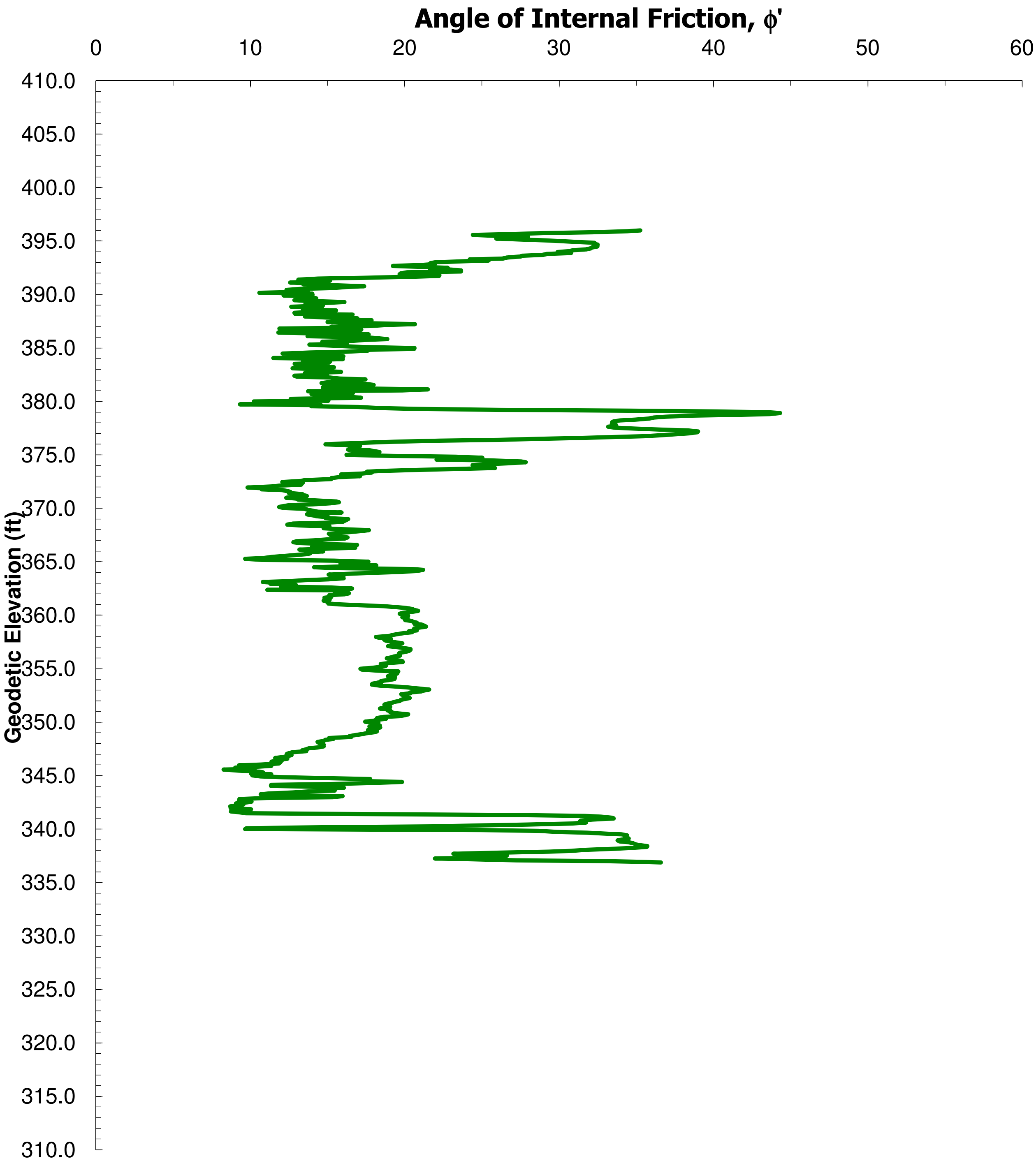
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT14C

SCPTu RESULTS

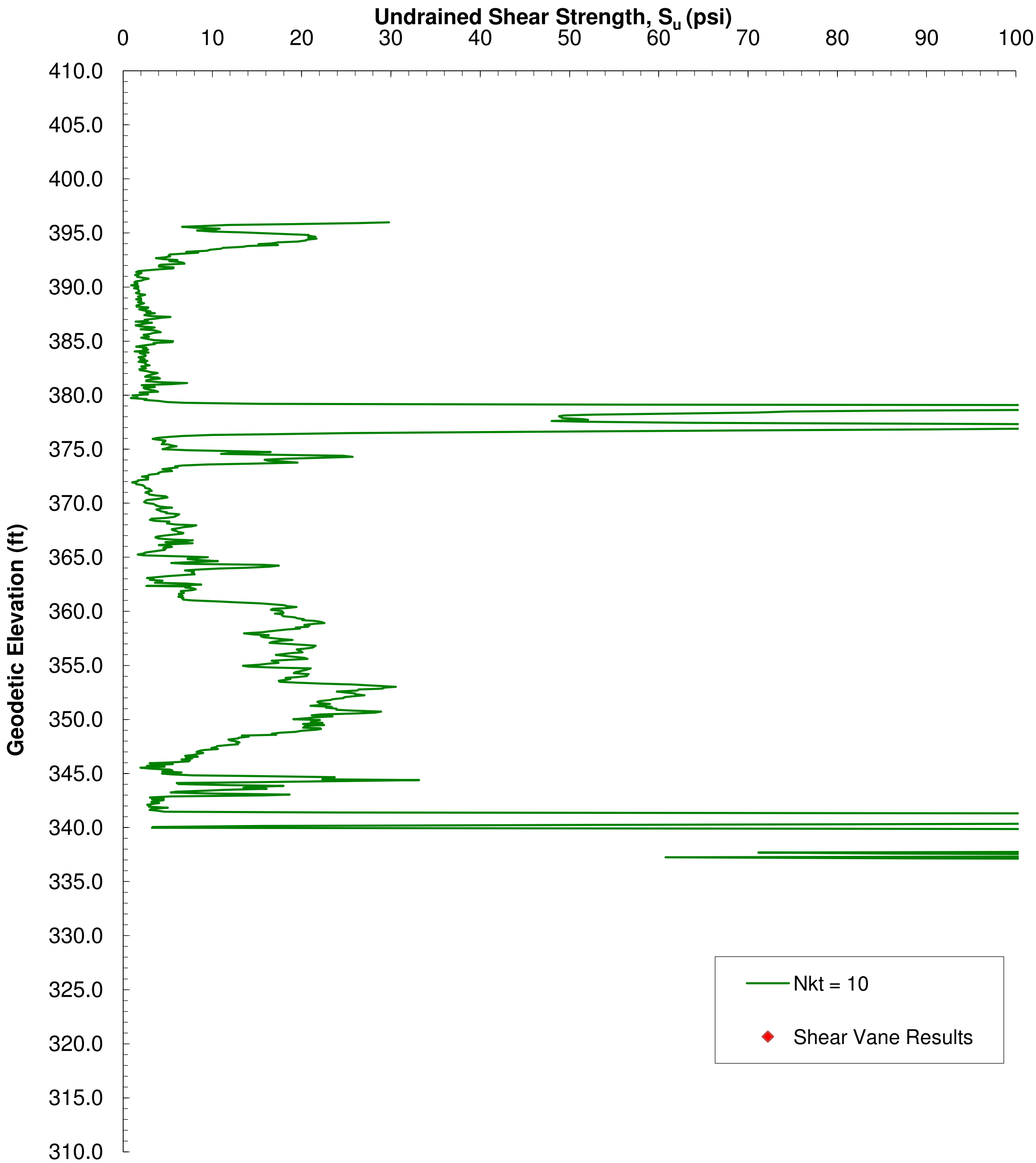
Effective Angle of Internal Friction



Project No. 175539009
CPT14C

SCPTu RESULTS

Undrained Shear Strength, S_u

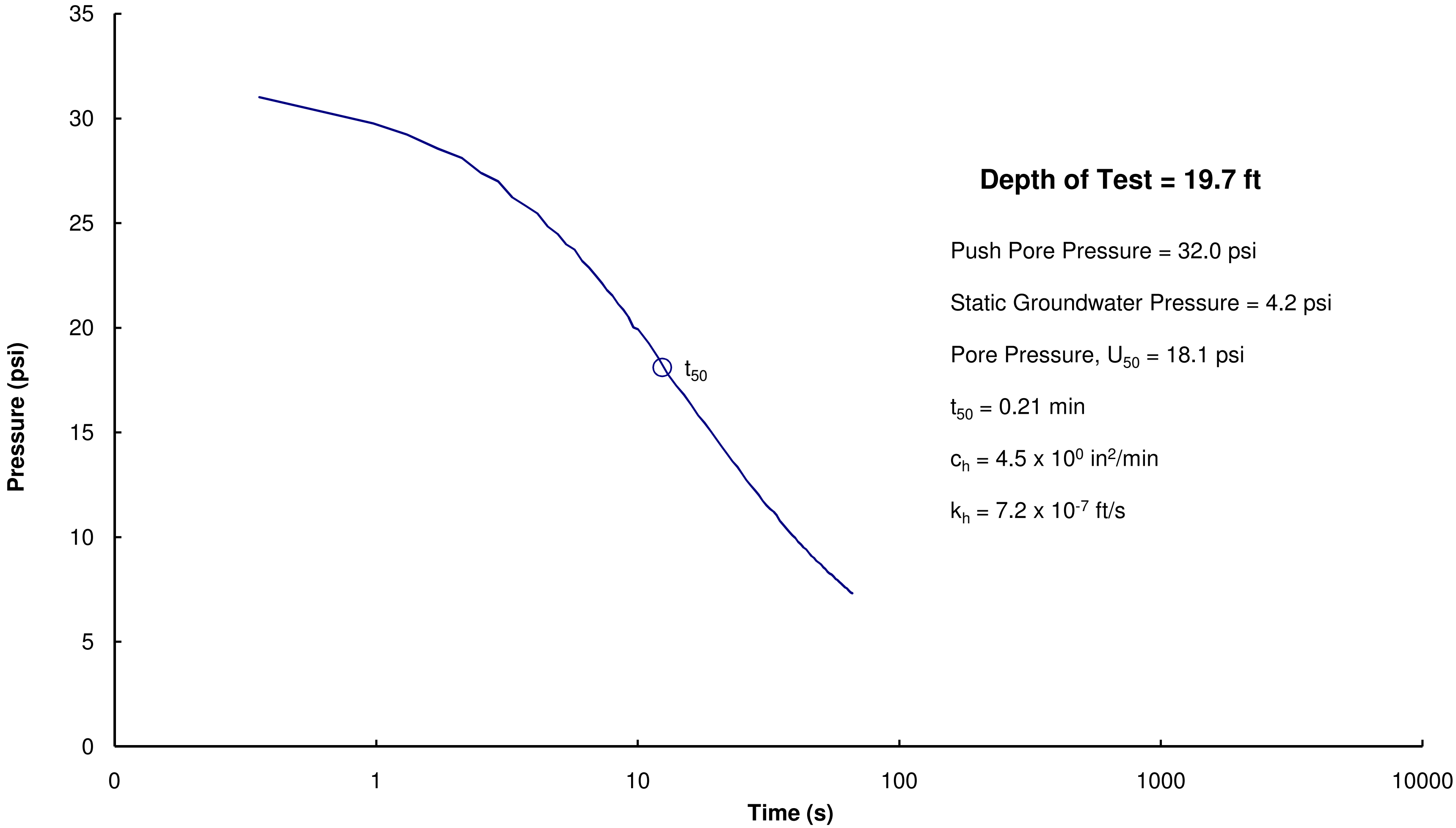


Project No. 175539009

CPT14C

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 19.7 ft

Push Pore Pressure = 32.0 psi

Static Groundwater Pressure = 4.2 psi

Pore Pressure, U_{50} = 18.1 psi

t_{50} = 0.21 min

$c_h = 4.5 \times 10^0$ in^2/min

$k_h = 7.2 \times 10^{-7}$ ft/s

Project No. 175539009
CPT14C

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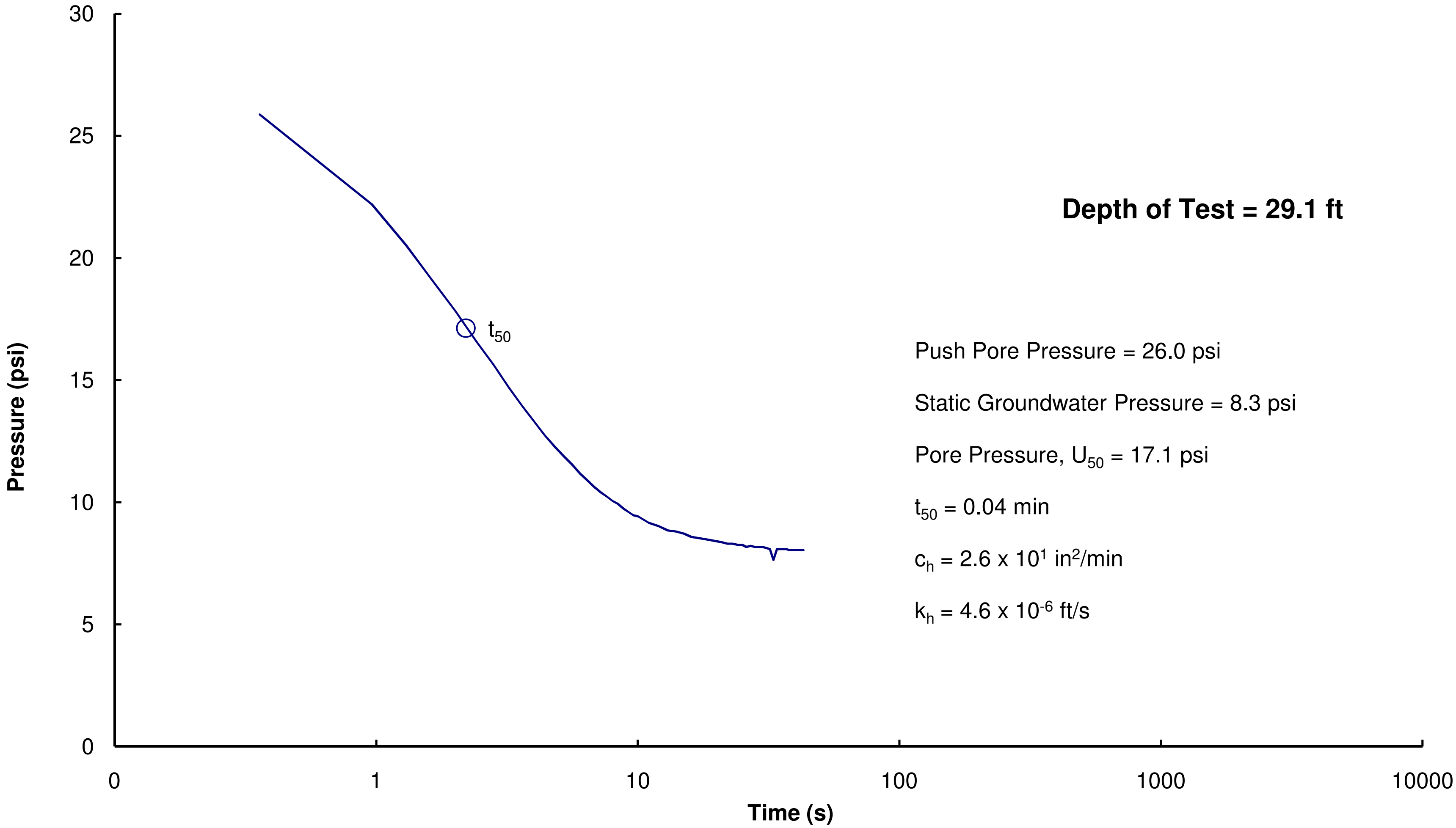
Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 29.1 ft

Push Pore Pressure = 26.0 psi

Static Groundwater Pressure = 8.3 psi

Pore Pressure, U_{50} = 17.1 psi

t_{50} = 0.04 min

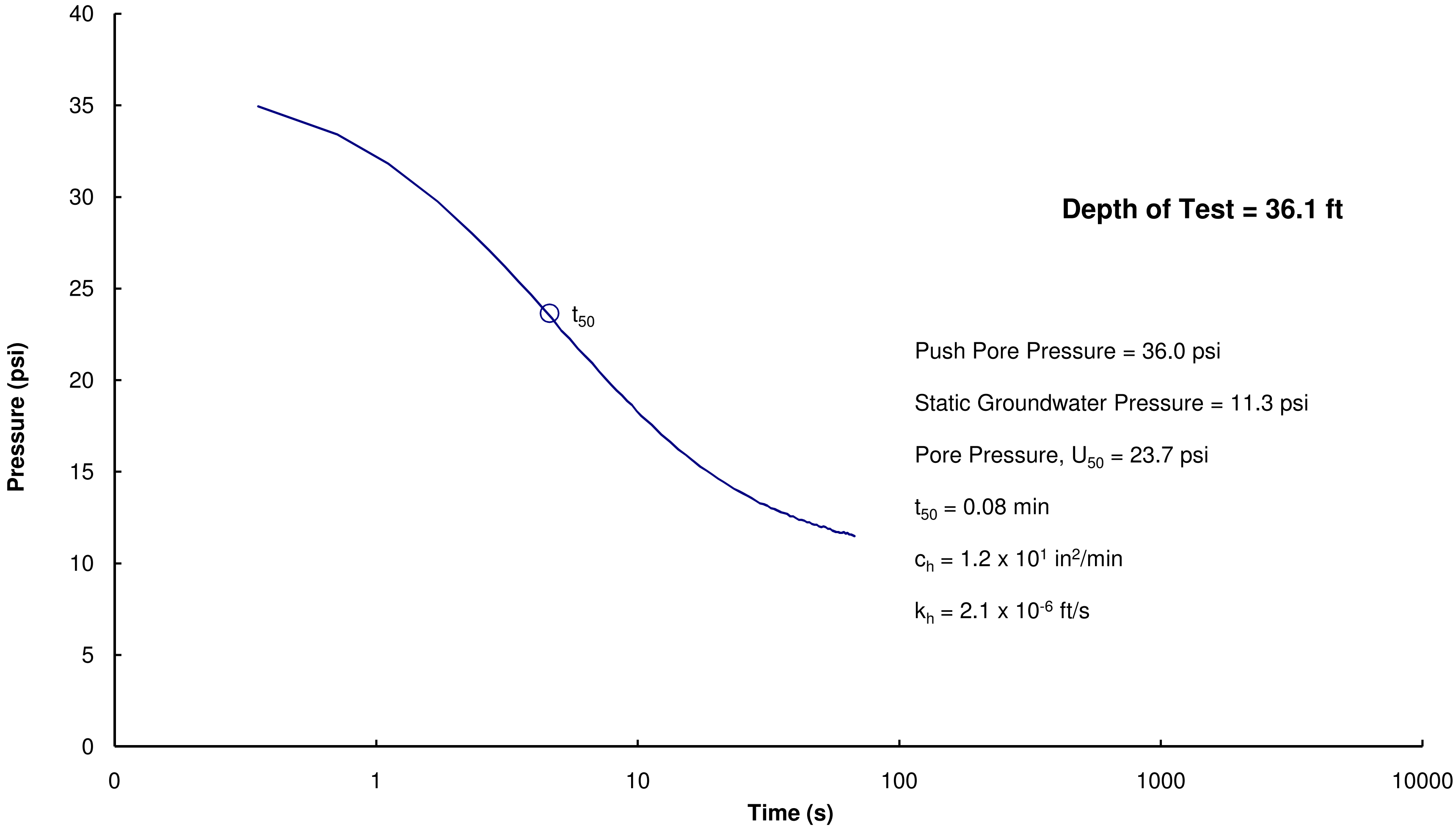
$c_h = 2.6 \times 10^1$ in^2/min

$k_h = 4.6 \times 10^{-6}$ ft/s

Project No. 175539009
CPT14C

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 36.1 ft

Push Pore Pressure = 36.0 psi

Static Groundwater Pressure = 11.3 psi

Pore Pressure, U_{50} = 23.7 psi

t_{50} = 0.08 min

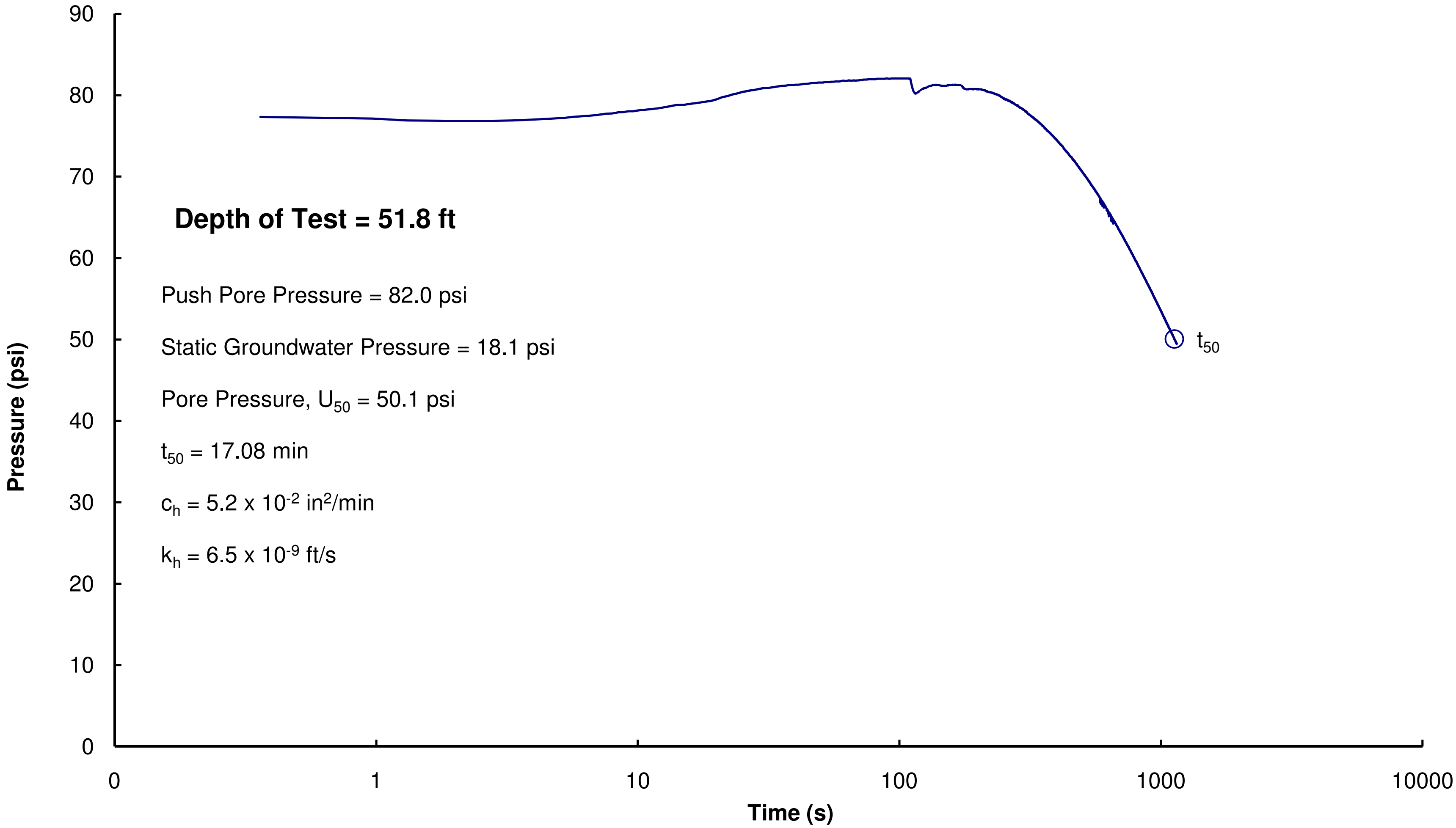
$c_h = 1.2 \times 10^{1}$ in^2/min

$k_h = 2.1 \times 10^{-6}$ ft/s

Project No. 175539009
CPT14C

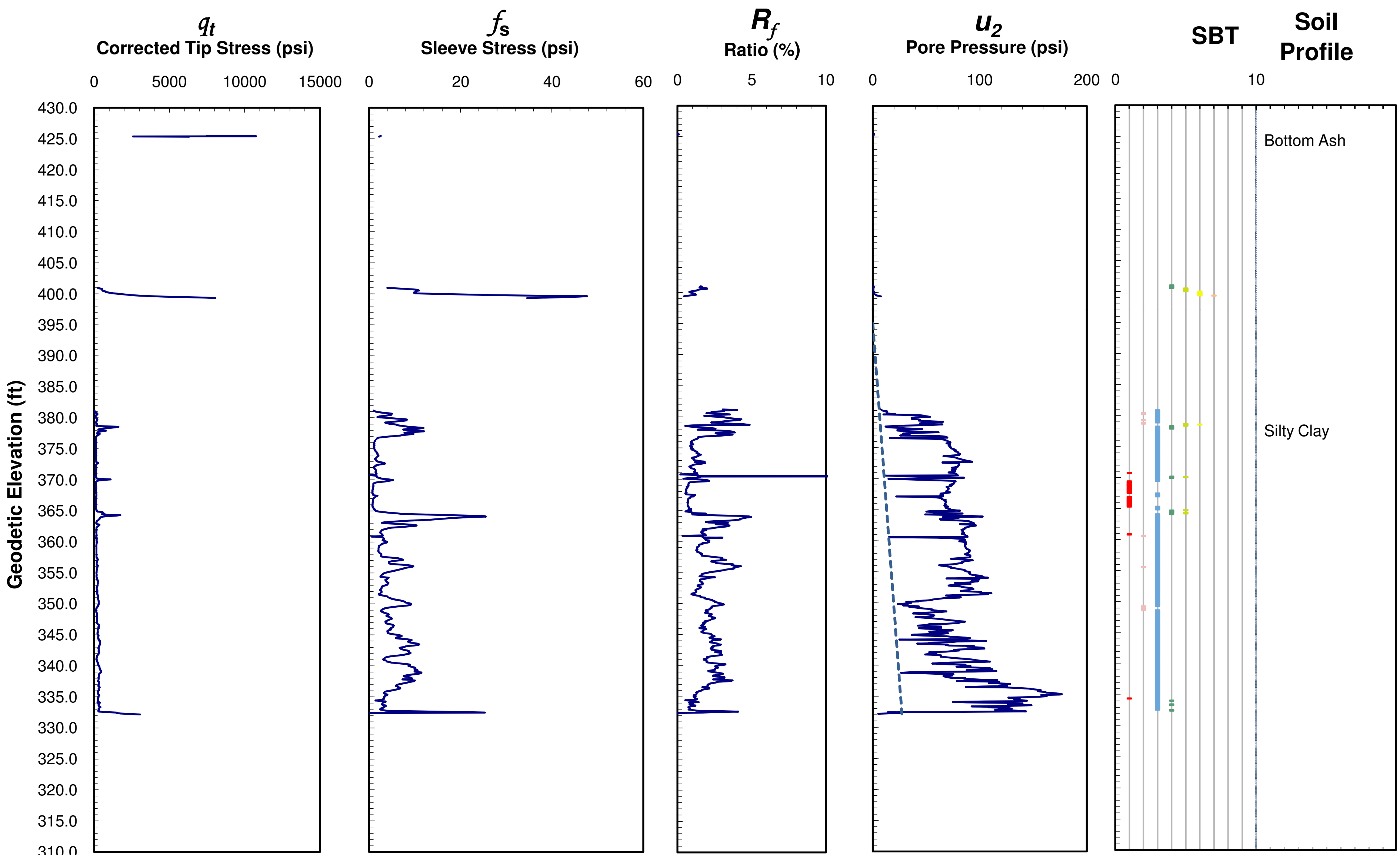
Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Project No. 175539009
CPT14C

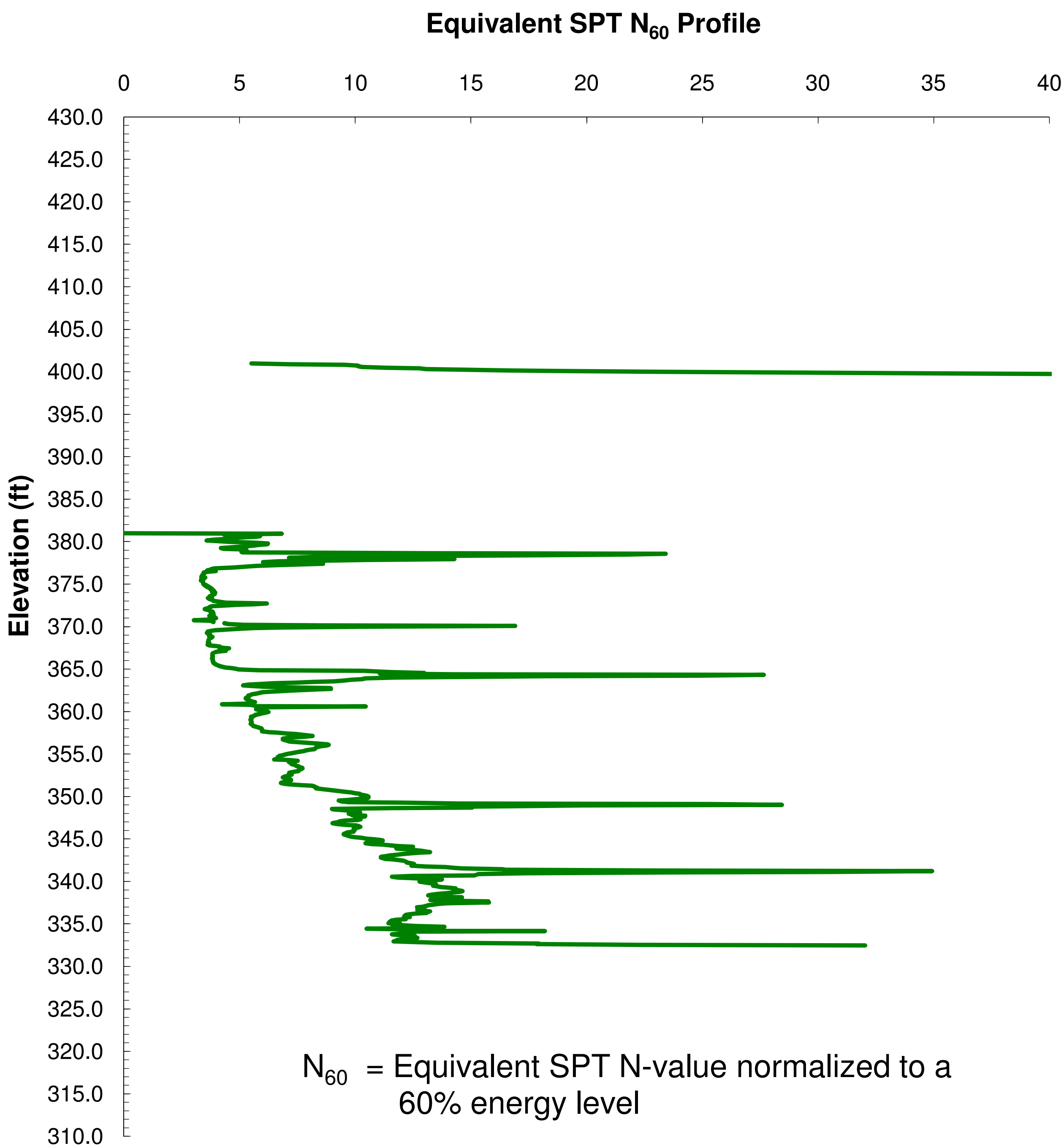
Stantec Consulting Inc.	Elevation: 430.00 ft SCPTu Start Elevation: 425.50 ft Groundwater Elevation: 395.00 ft	Test Date: July 7, 2009 Project No. 175539009	CPT15
	Client: TVA Project: Cumberland Fossil Plant		



Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values



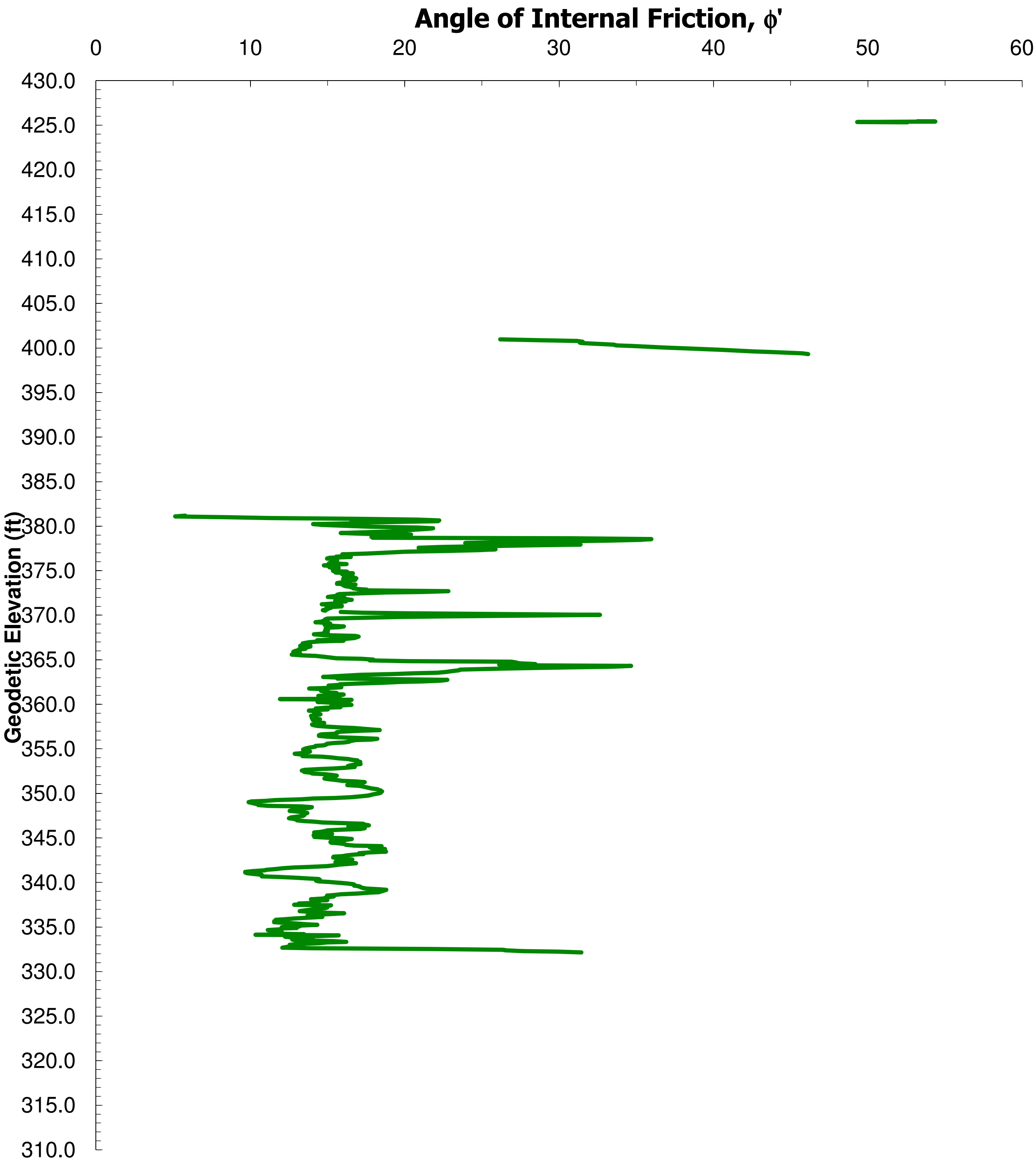
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT15

SCPTu RESULTS

Effective Angle of Internal Friction

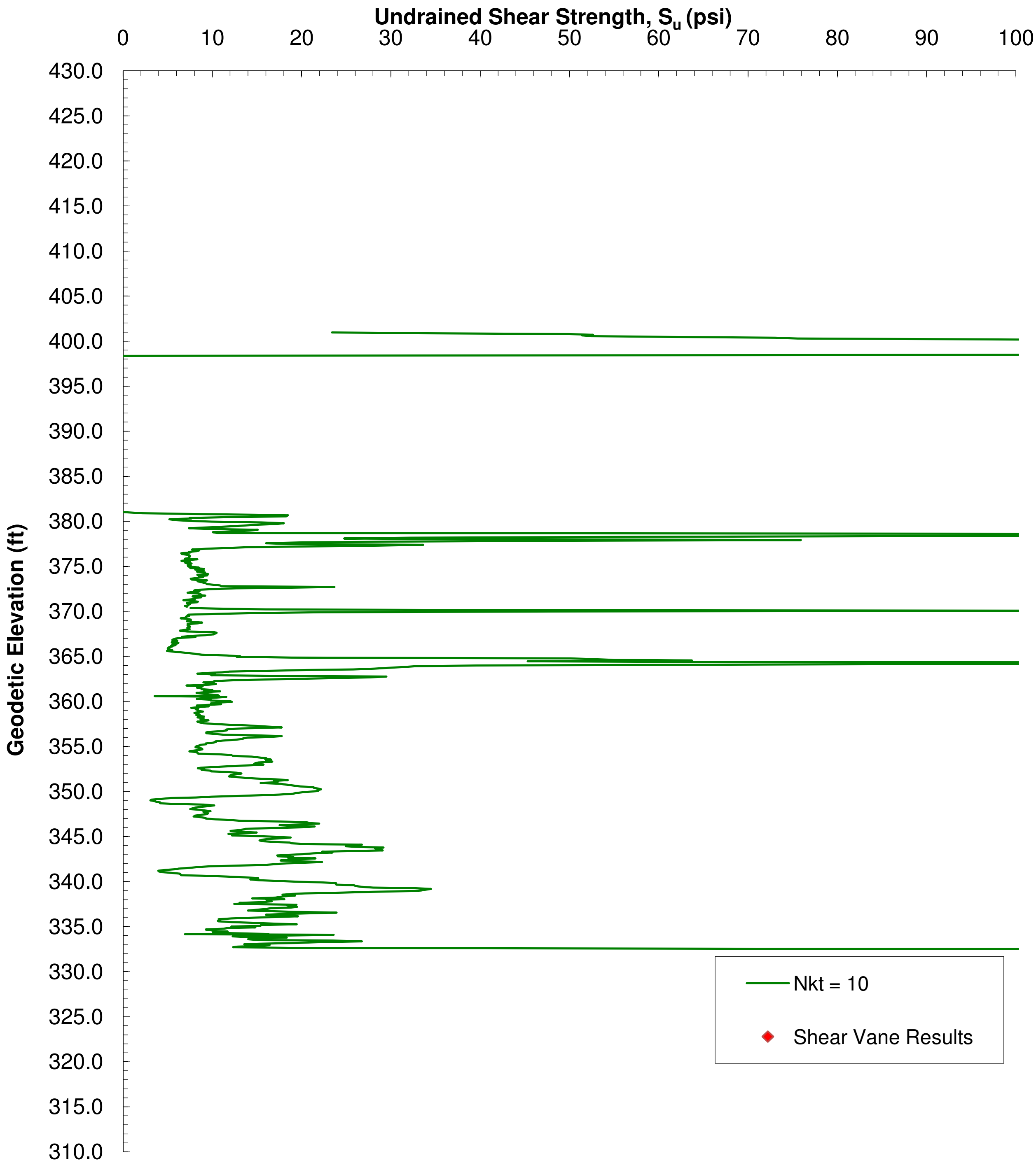


Project No. 175539009

CPT15

SCPTu RESULTS

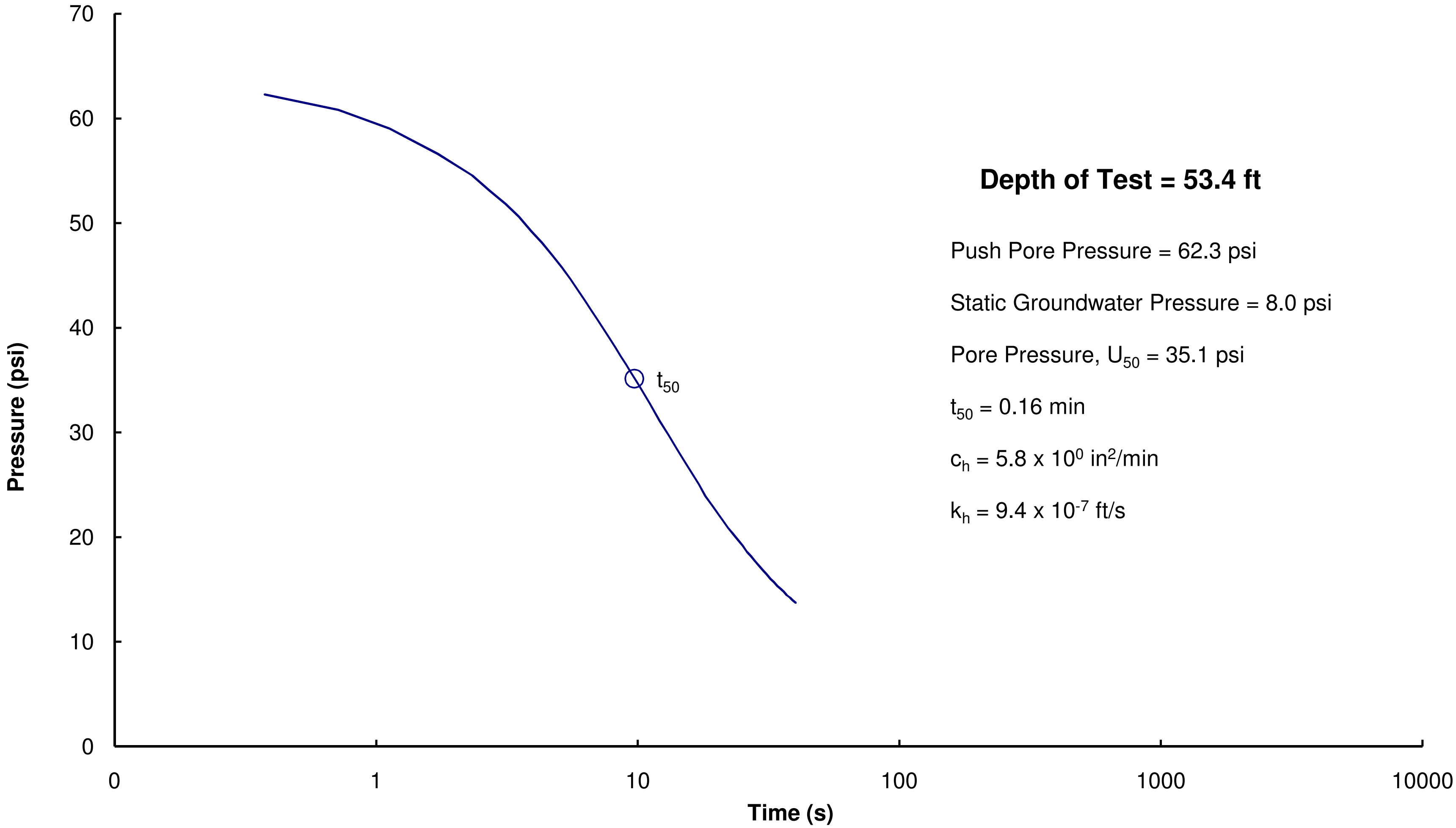
Undrained Shear Strength, S_u



Project No. 175539009
CPT15

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 53.4 ft

Push Pore Pressure = 62.3 psi

Static Groundwater Pressure = 8.0 psi

Pore Pressure, U_{50} = 35.1 psi

t_{50} = 0.16 min

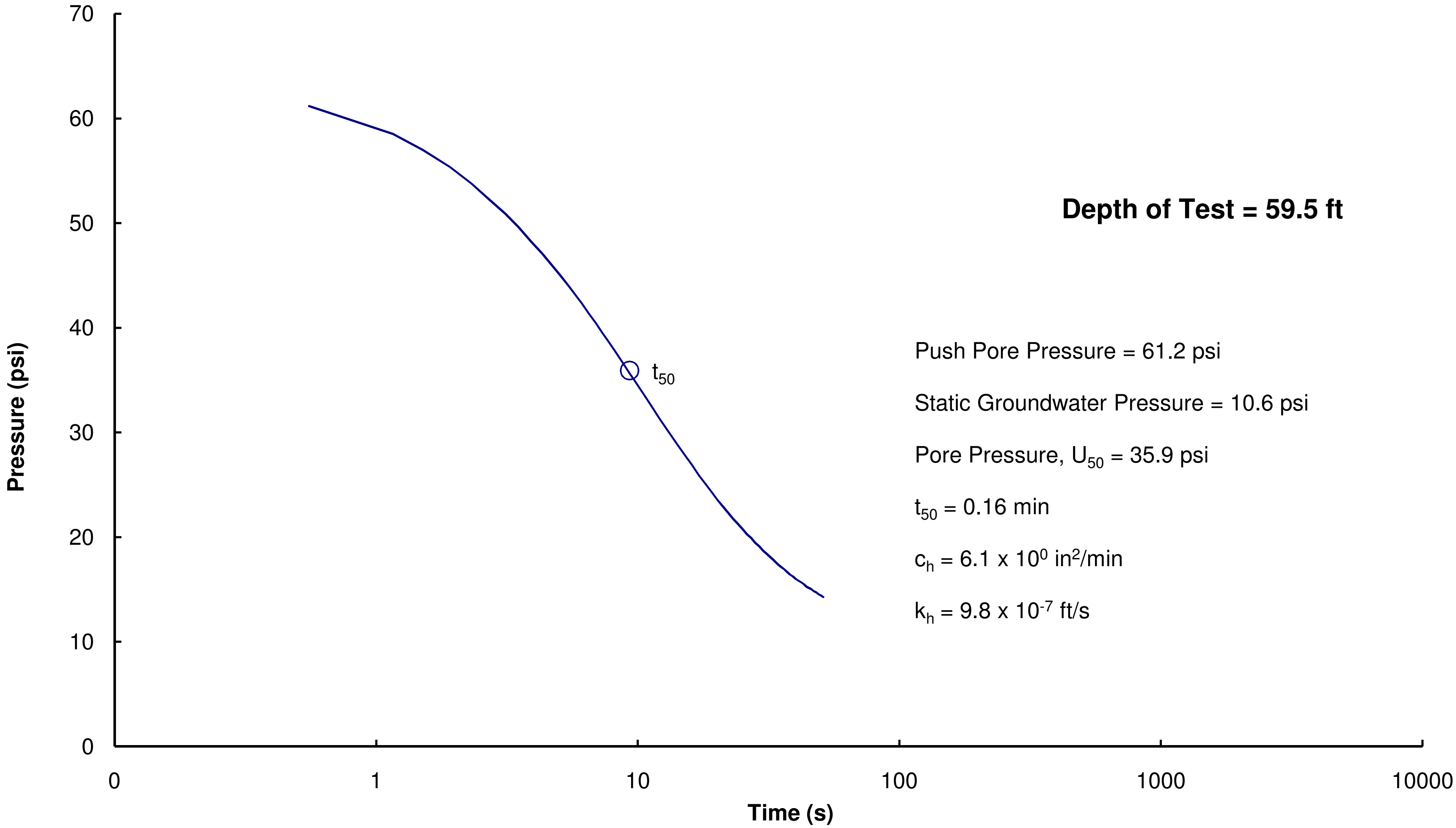
$c_h = 5.8 \times 10^0$ in^2/min

$k_h = 9.4 \times 10^{-7}$ ft/s

Project No. 175539009
CPT15

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 59.5 ft

Push Pore Pressure = 61.2 psi

Static Groundwater Pressure = 10.6 psi

Pore Pressure, U_{50} = 35.9 psi

t_{50} = 0.16 min

$c_h = 6.1 \times 10^0$ in^2/min

$k_h = 9.8 \times 10^{-7}$ ft/s

Project No. 175539009
CPT15

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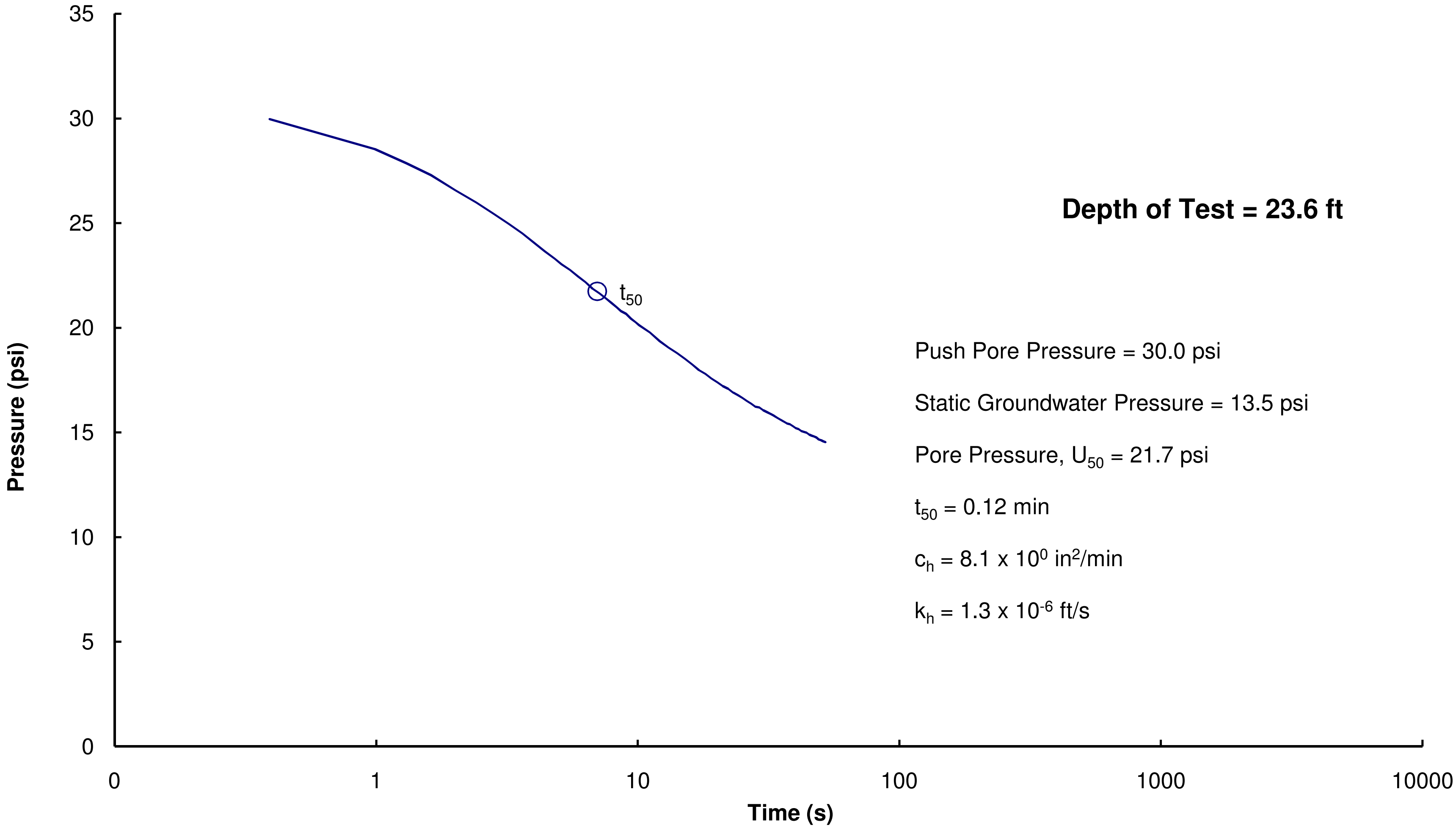
Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 23.6 ft

Push Pore Pressure = 30.0 psi

Static Groundwater Pressure = 13.5 psi

Pore Pressure, U_{50} = 21.7 psi

t_{50} = 0.12 min

$c_h = 8.1 \times 10^0$ in^2/min

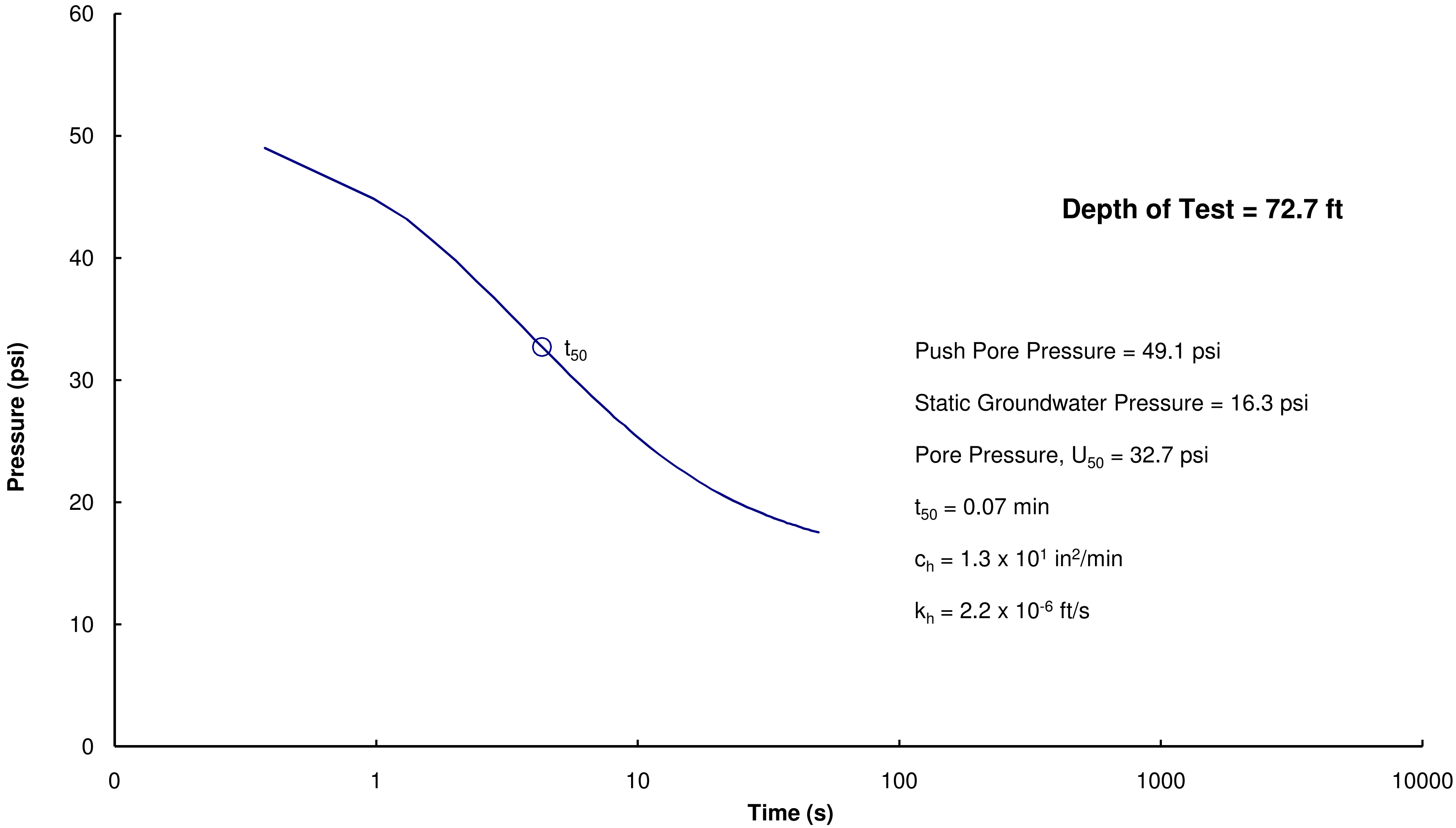
$k_h = 1.3 \times 10^{-6}$ ft/s

Project No. 175539009
CPT15

D:\My Documents\CUF-CPT\CPT15.xlsm

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 72.7 ft

Push Pore Pressure = 49.1 psi

Static Groundwater Pressure = 16.3 psi

Pore Pressure, U_{50} = 32.7 psi

t_{50} = 0.07 min

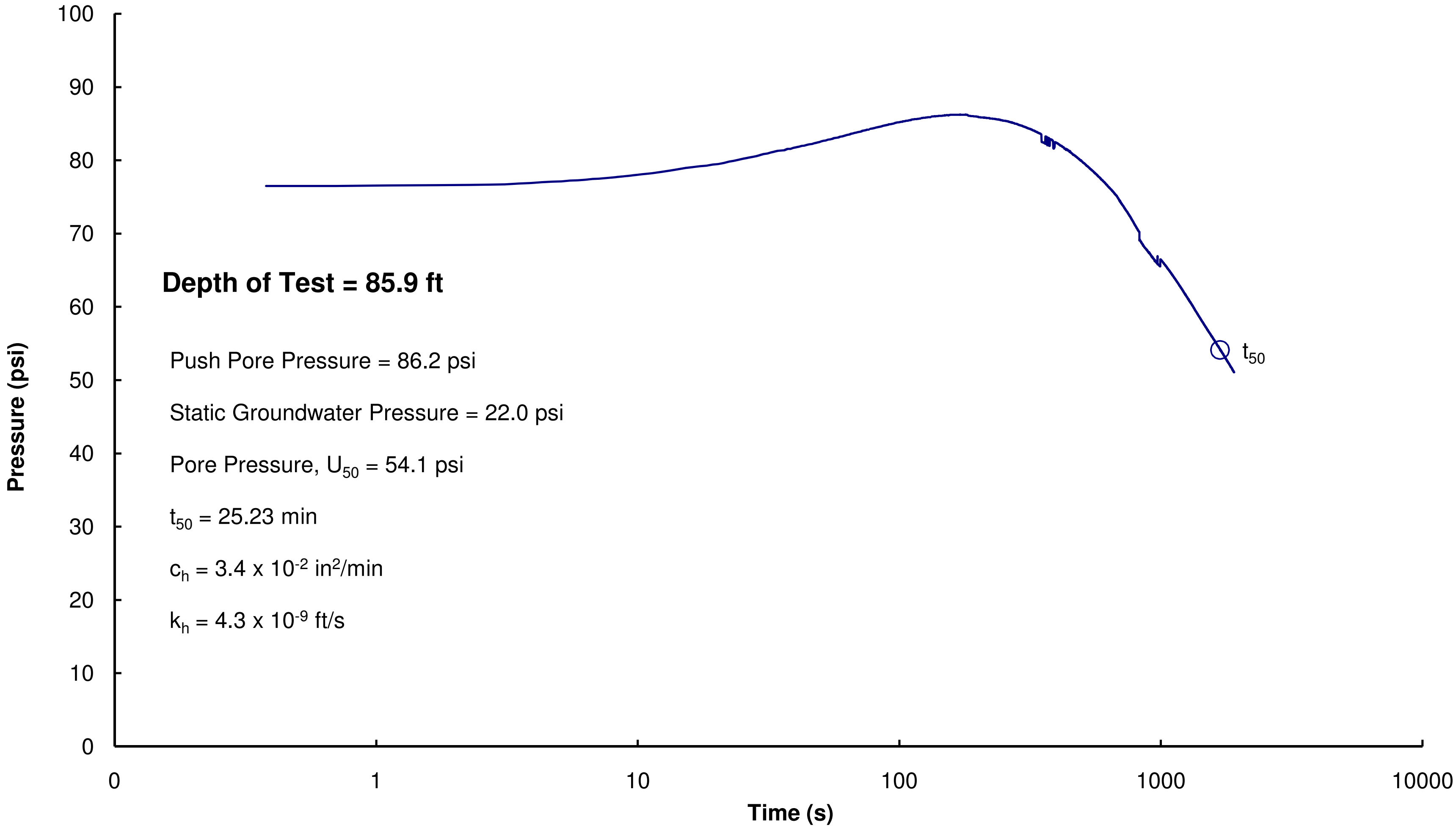
c_h = 1.3 x 10^{1} in^2/min

k_h = 2.2 x 10^{-6} ft/s

Project No. 175539009
CPT15

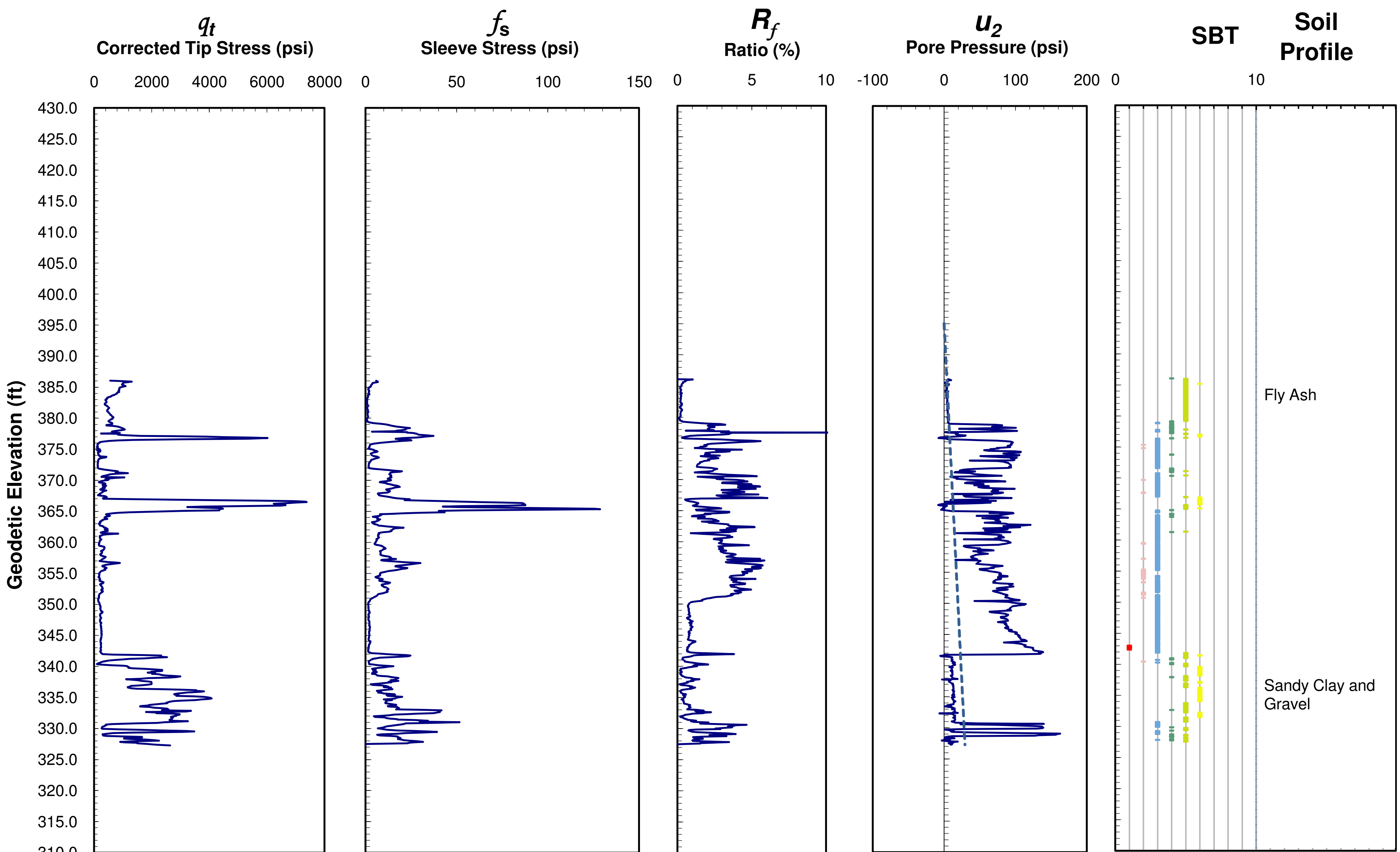
Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Project No. 175539009
CPT15

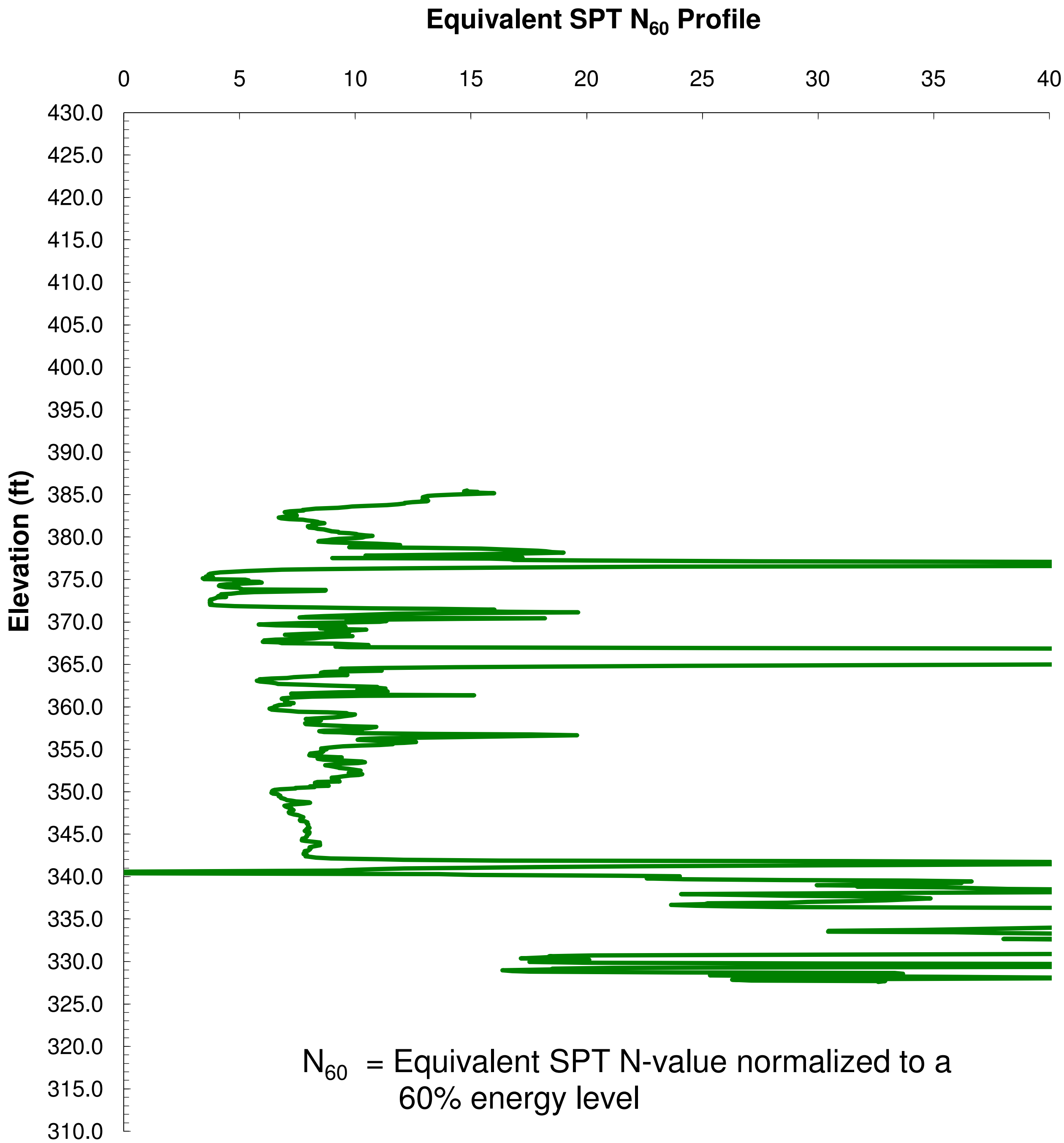
Stantec Consulting Inc.	Elevation: 430.00 ft SCPTu Start Elevation: 386.10 ft Groundwater Elevation: 395.00 ft	Test Date: July 8, 2009 Project No. 175539009	CPT16
	Client: TVA Project: Cumberland Fossil Plant		



Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values



N_{60} = Equivalent SPT N-value normalized to a 60% energy level

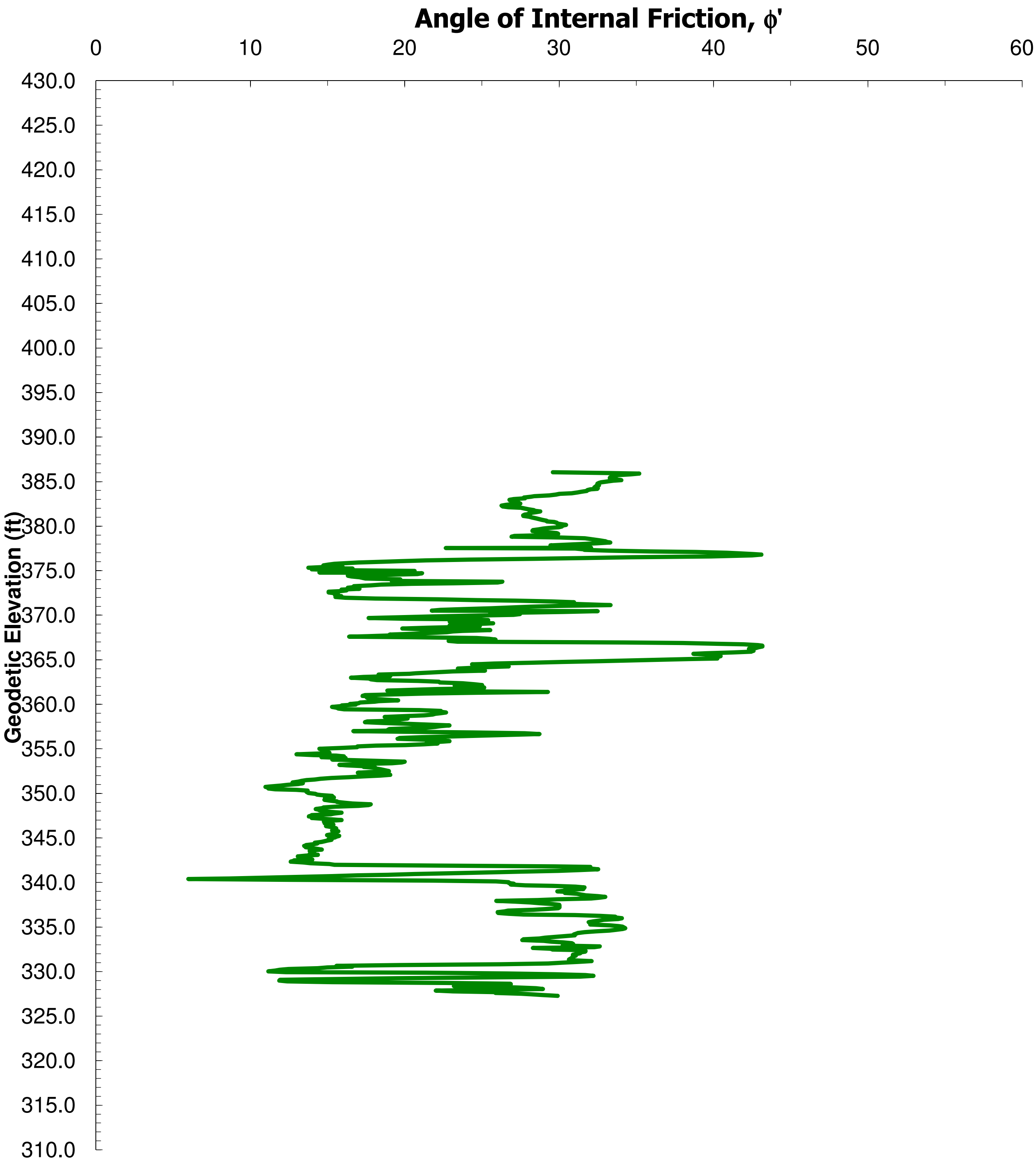
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT16

SCPTu RESULTS

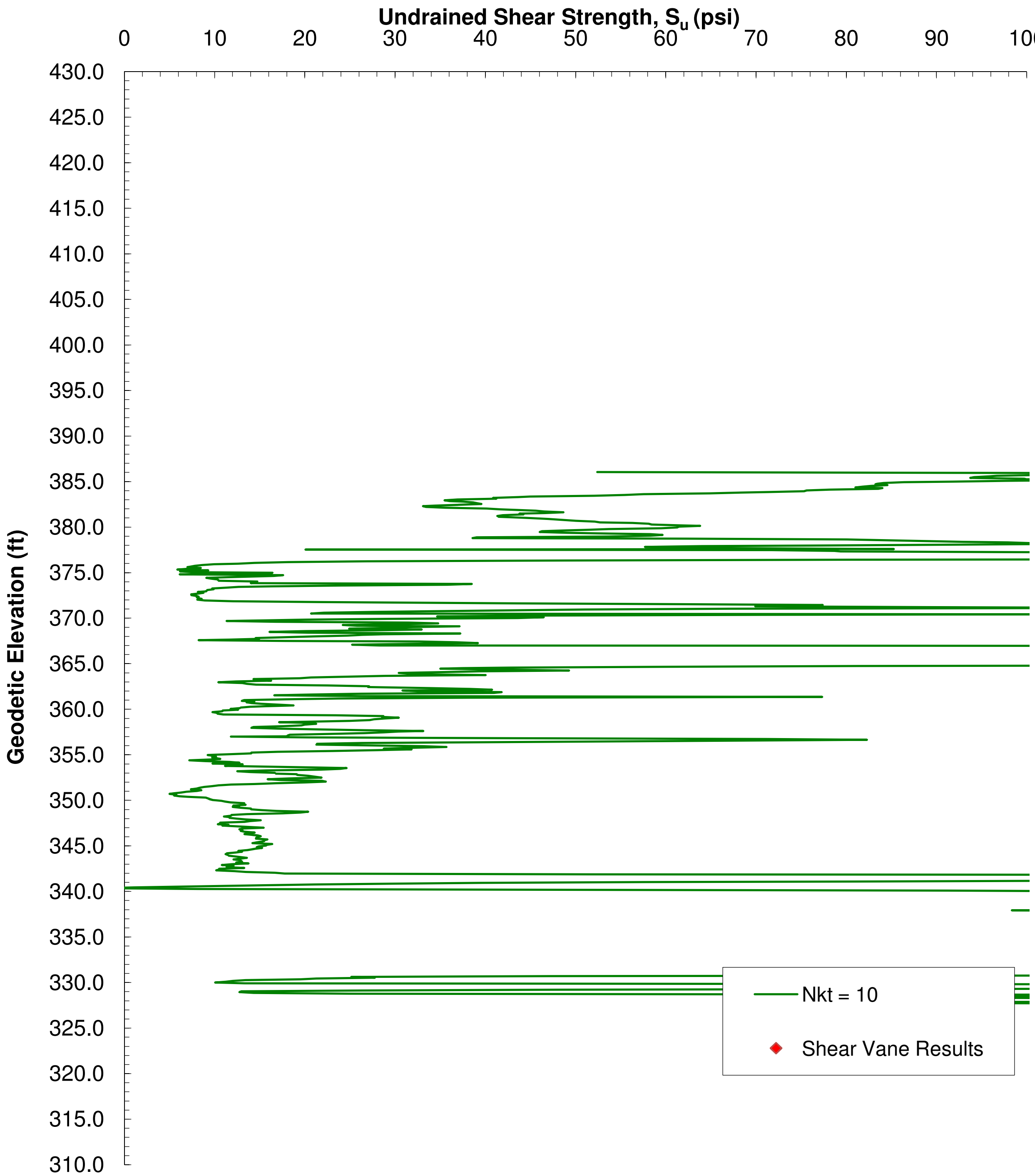
Effective Angle of Internal Friction



Project No. 175539009
CPT16

SCPTu RESULTS

Undrained Shear Strength, S_u

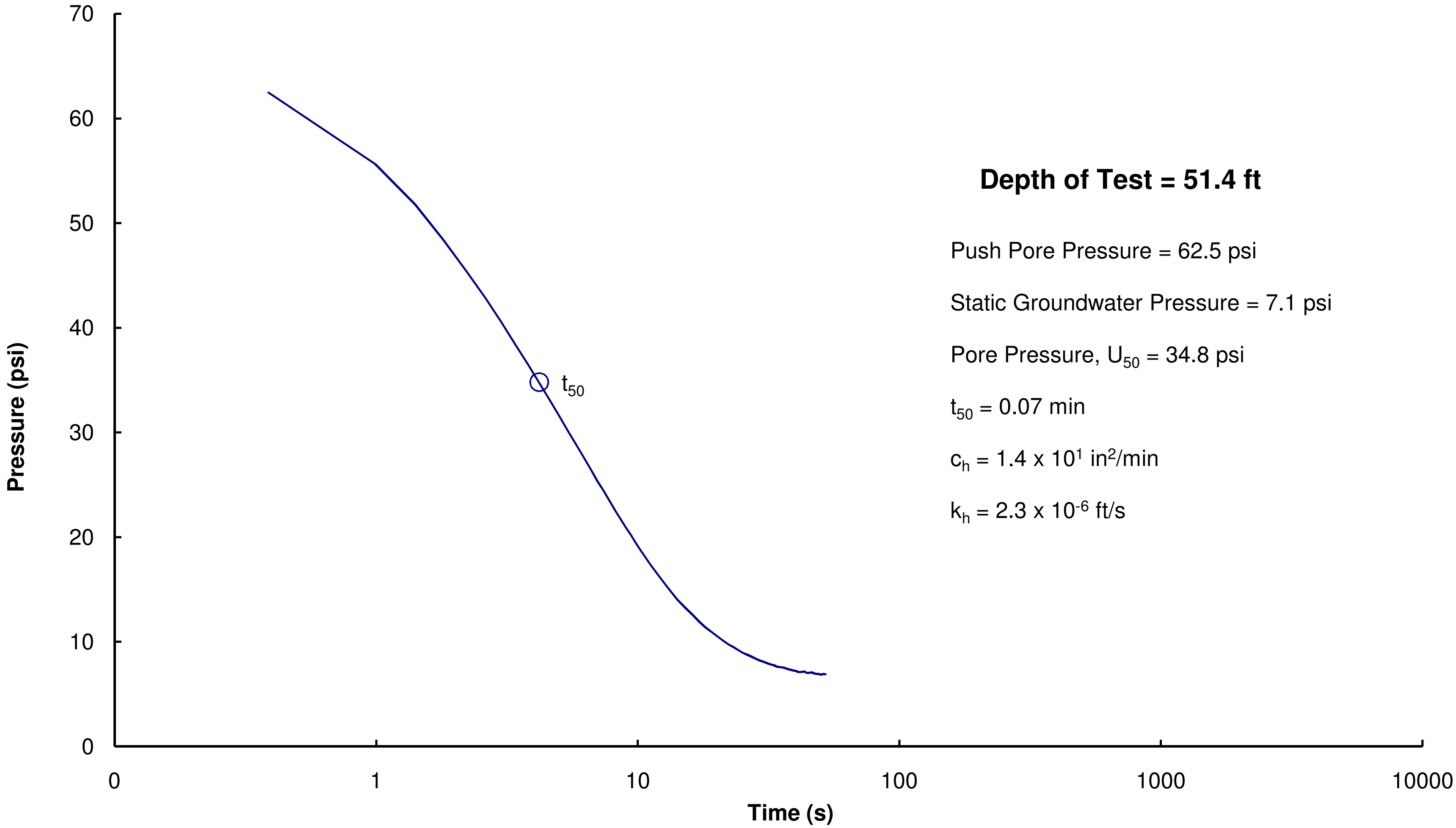


Project No. 175539009

CPT16

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 51.4 ft

Push Pore Pressure = 62.5 psi

Static Groundwater Pressure = 7.1 psi

Pore Pressure, U_{50} = 34.8 psi

t_{50} = 0.07 min

$c_h = 1.4 \times 10^1$ in^2/min

$k_h = 2.3 \times 10^{-6}$ ft/s

Project No. 175539009
CPT16

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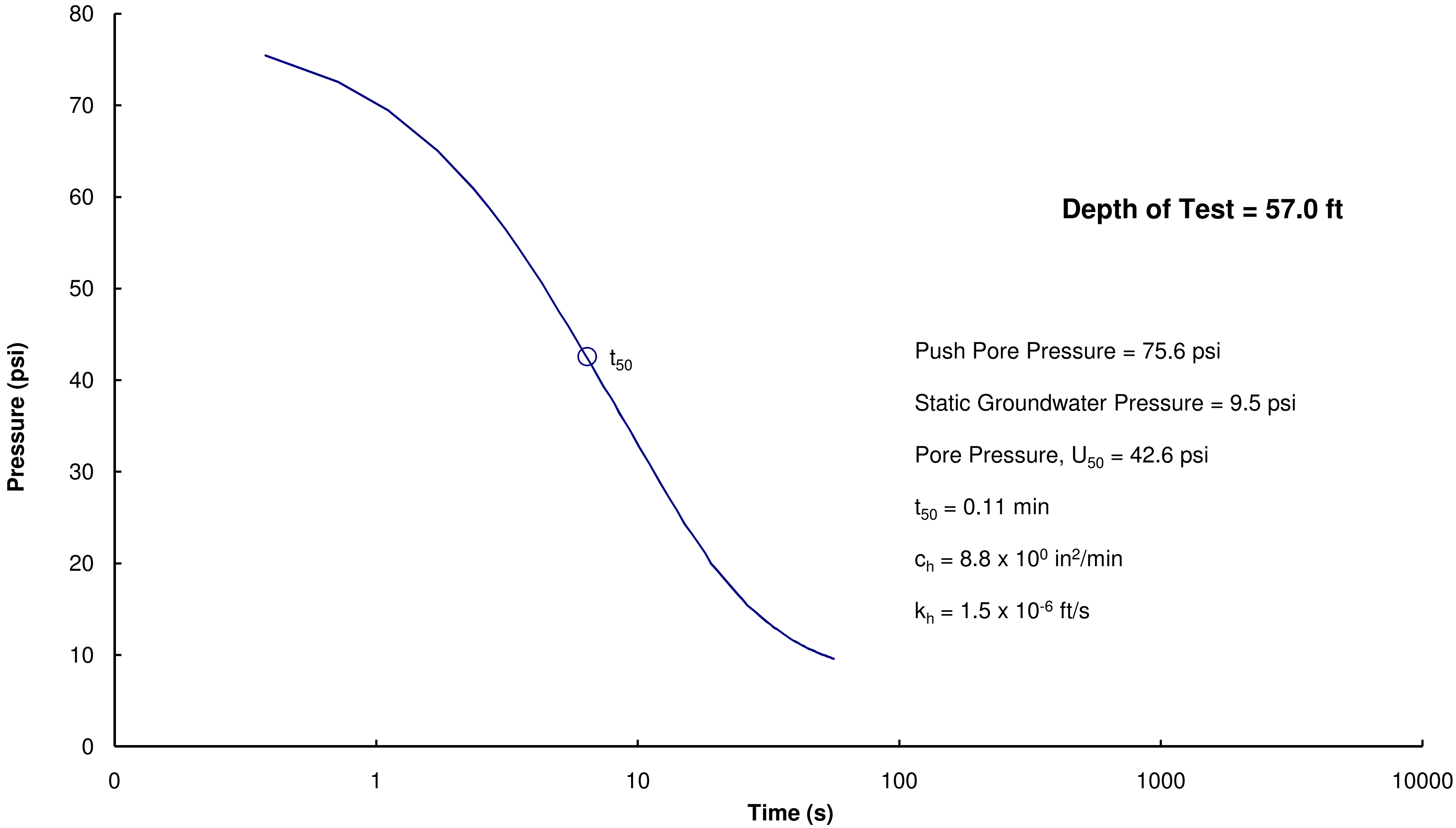
Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 57.0 ft

Push Pore Pressure = 75.6 psi

Static Groundwater Pressure = 9.5 psi

Pore Pressure, U_{50} = 42.6 psi

t_{50} = 0.11 min

$c_h = 8.8 \times 10^0$ in^2/min

$k_h = 1.5 \times 10^{-6}$ ft/s

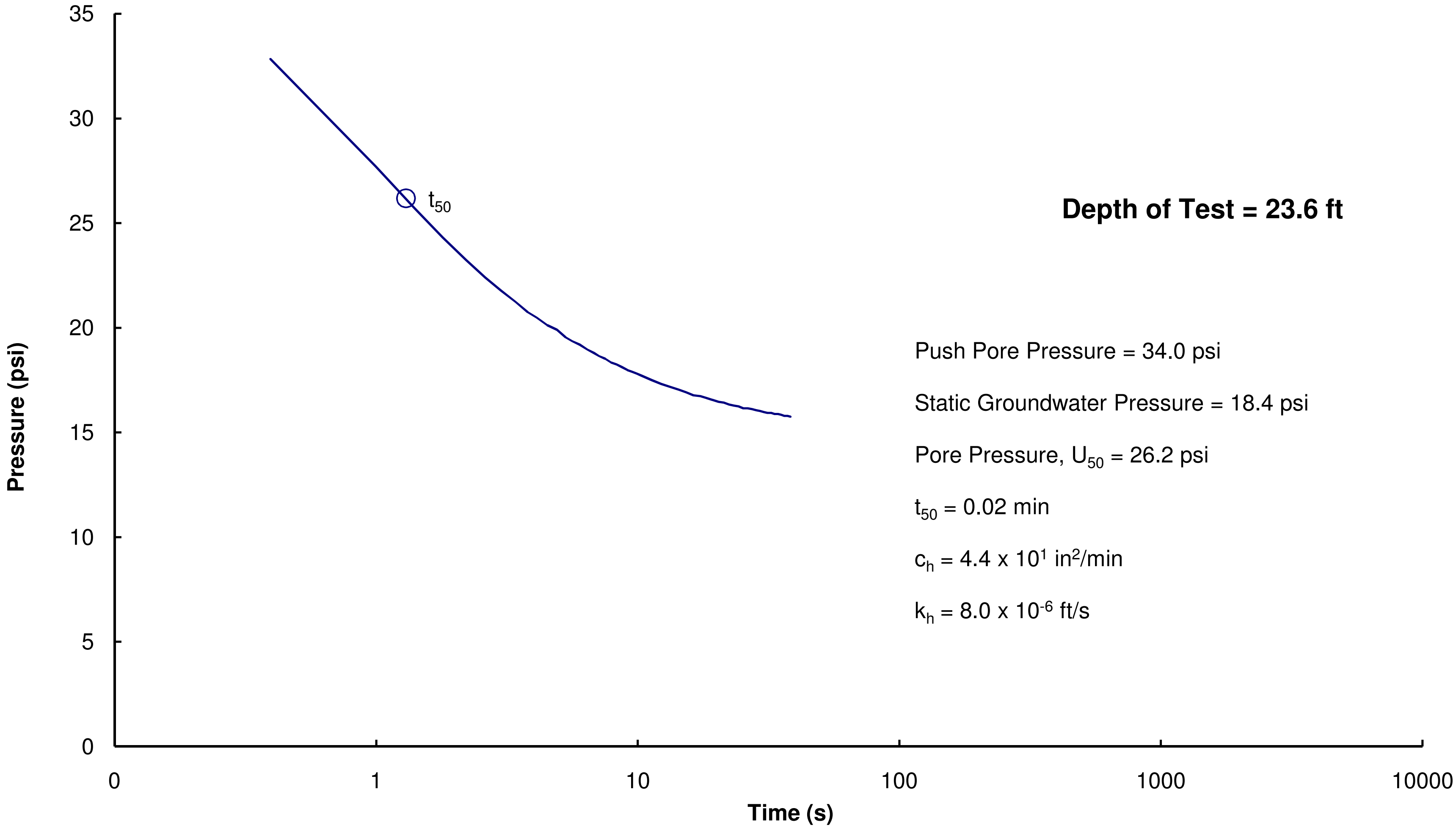
Project No. 175539009
CPT16

D:\My Documents\CUF-CPT\CPT16.xlsm

Stantec

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation

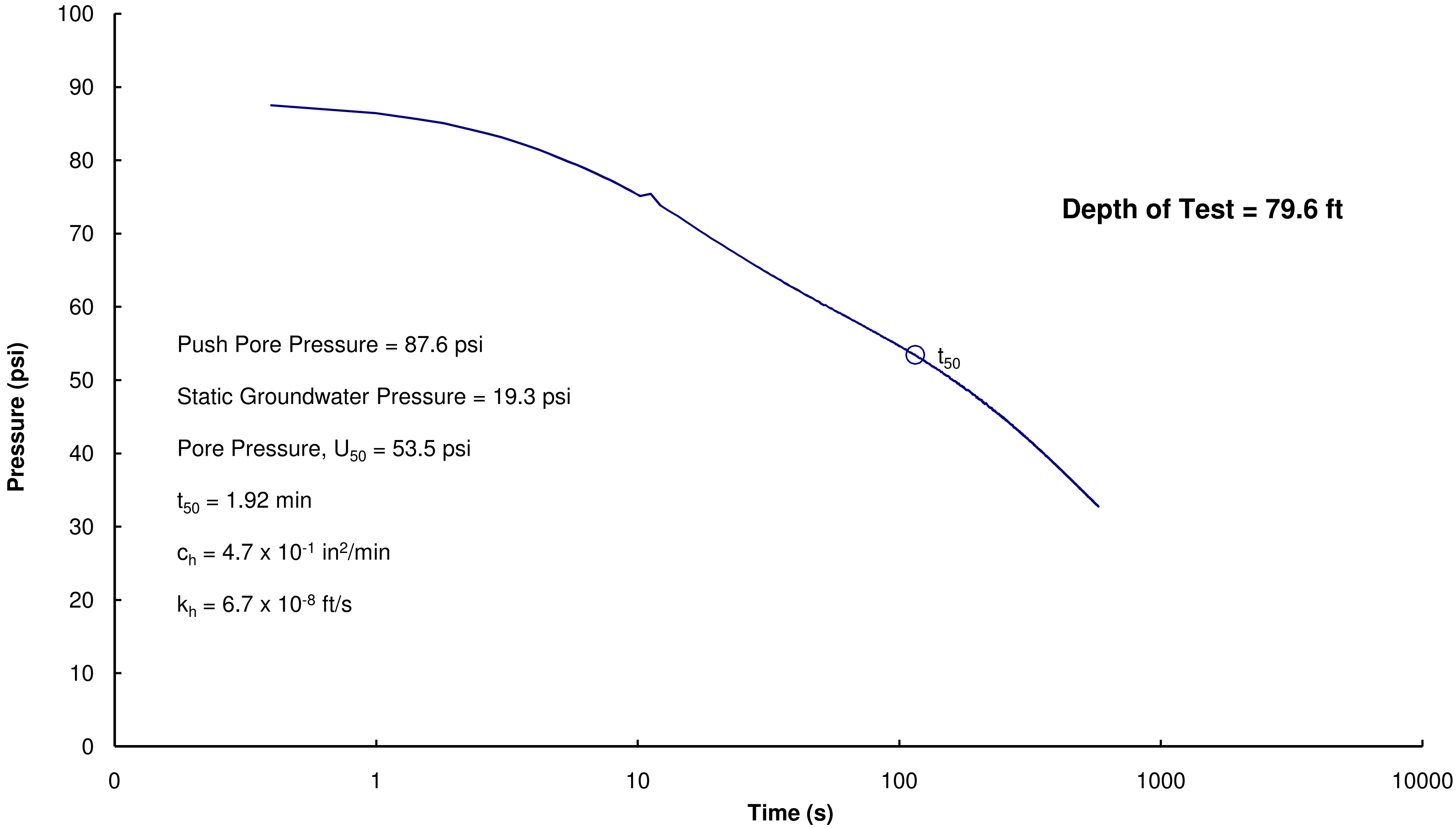


Project No. 175539009
CPT16

D:\My Documents\CUF-CPT\CPT16.xlsm

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation

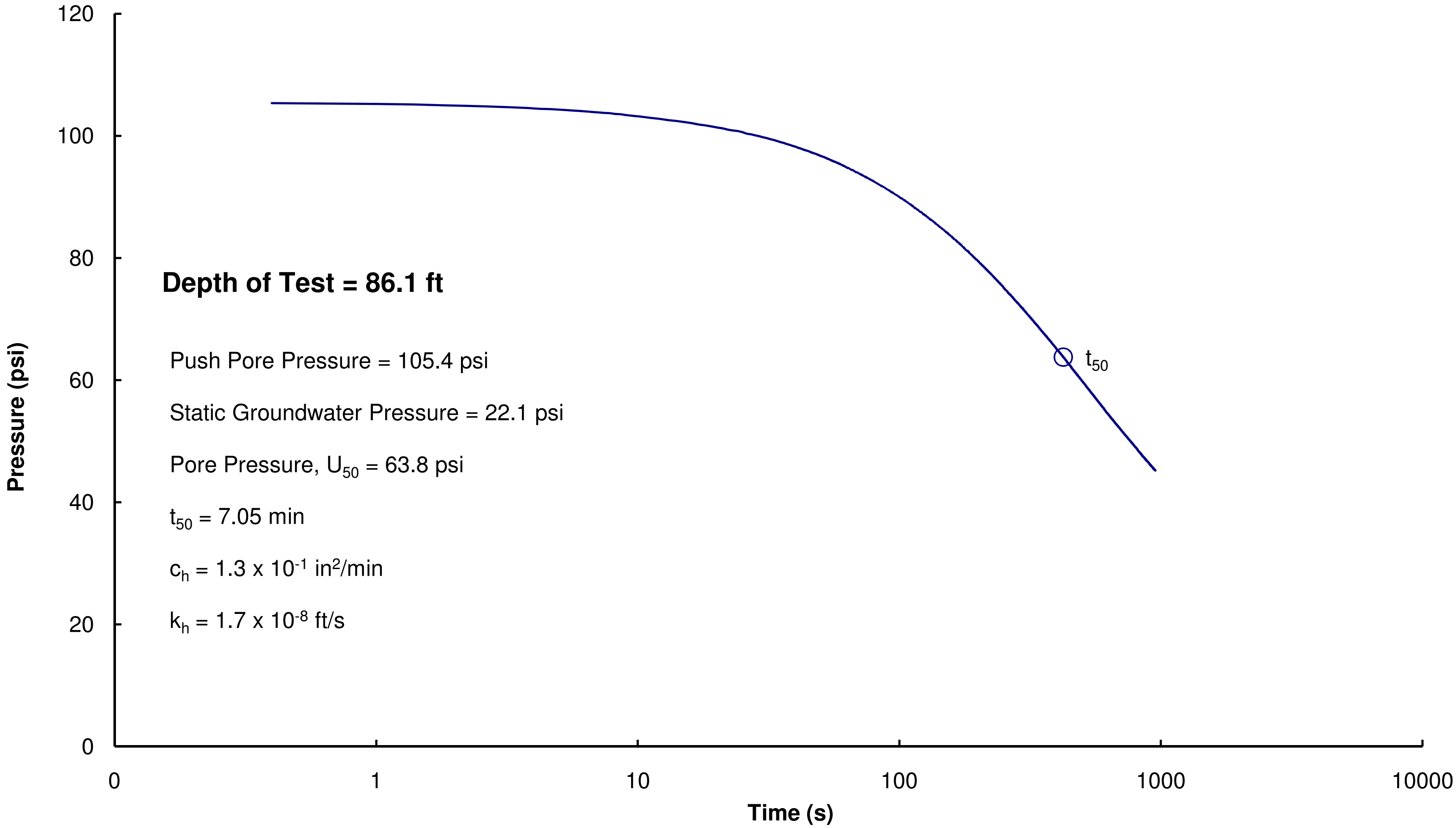


Project No. 175539009
CPT16

Stantec

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 86.1 ft

Push Pore Pressure = 105.4 psi

Static Groundwater Pressure = 22.1 psi

Pore Pressure, U_{50} = 63.8 psi

t_{50} = 7.05 min

$c_h = 1.3 \times 10^{-1}$ in^2/min

$k_h = 1.7 \times 10^{-8}$ ft/s

Project No. 175539009
CPT16

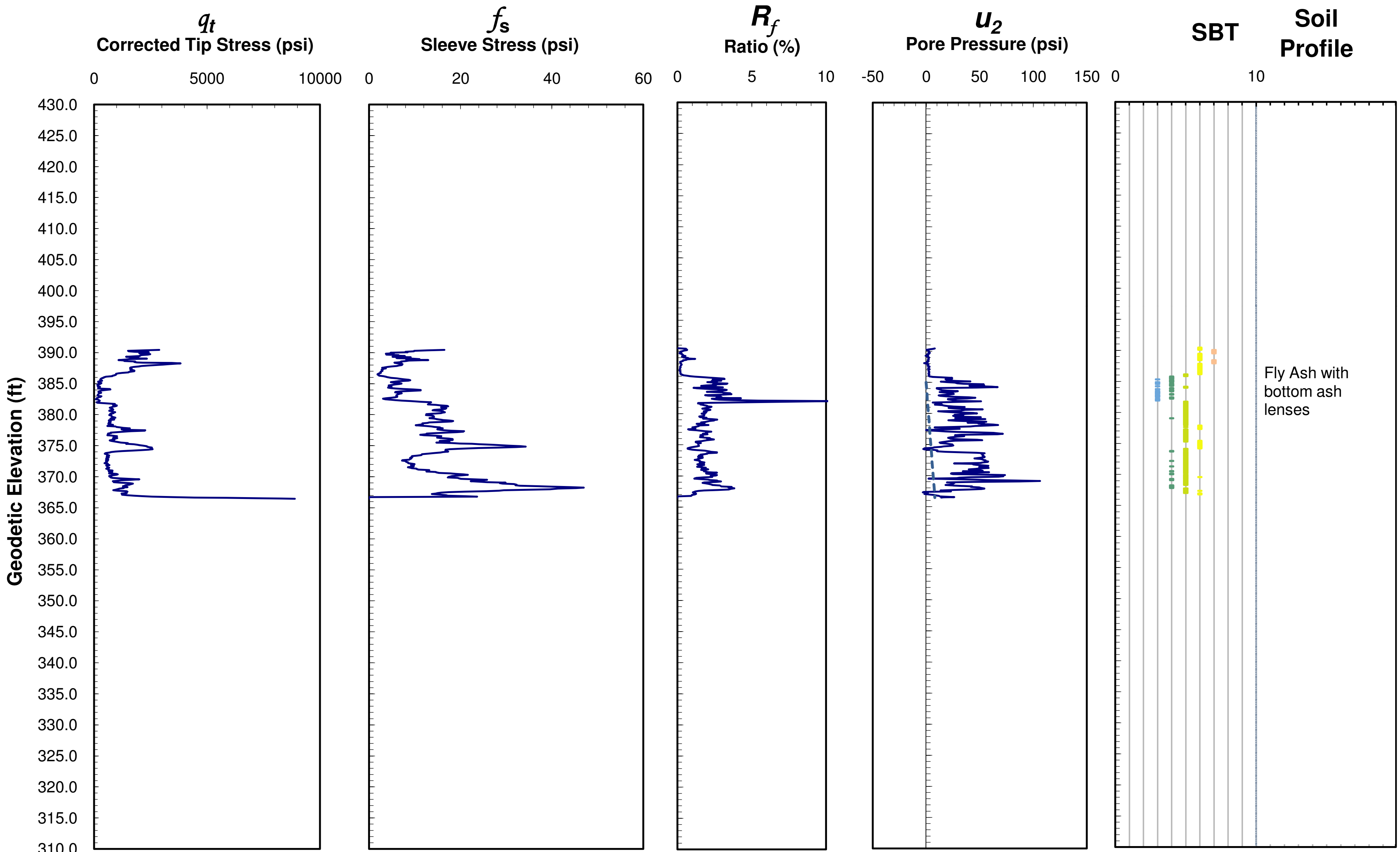
D:\My Documents\CUF-CPT\CPT16.xlsm

Stantec Consulting Inc.

Elevation:	400.00 ft	Test Date: July 7, 2009	CPT17
SCPTu Start Elevation:	390.50 ft	Project No. 175539009	
Groundwater Elevation:	385.00 ft		

Client: TVA

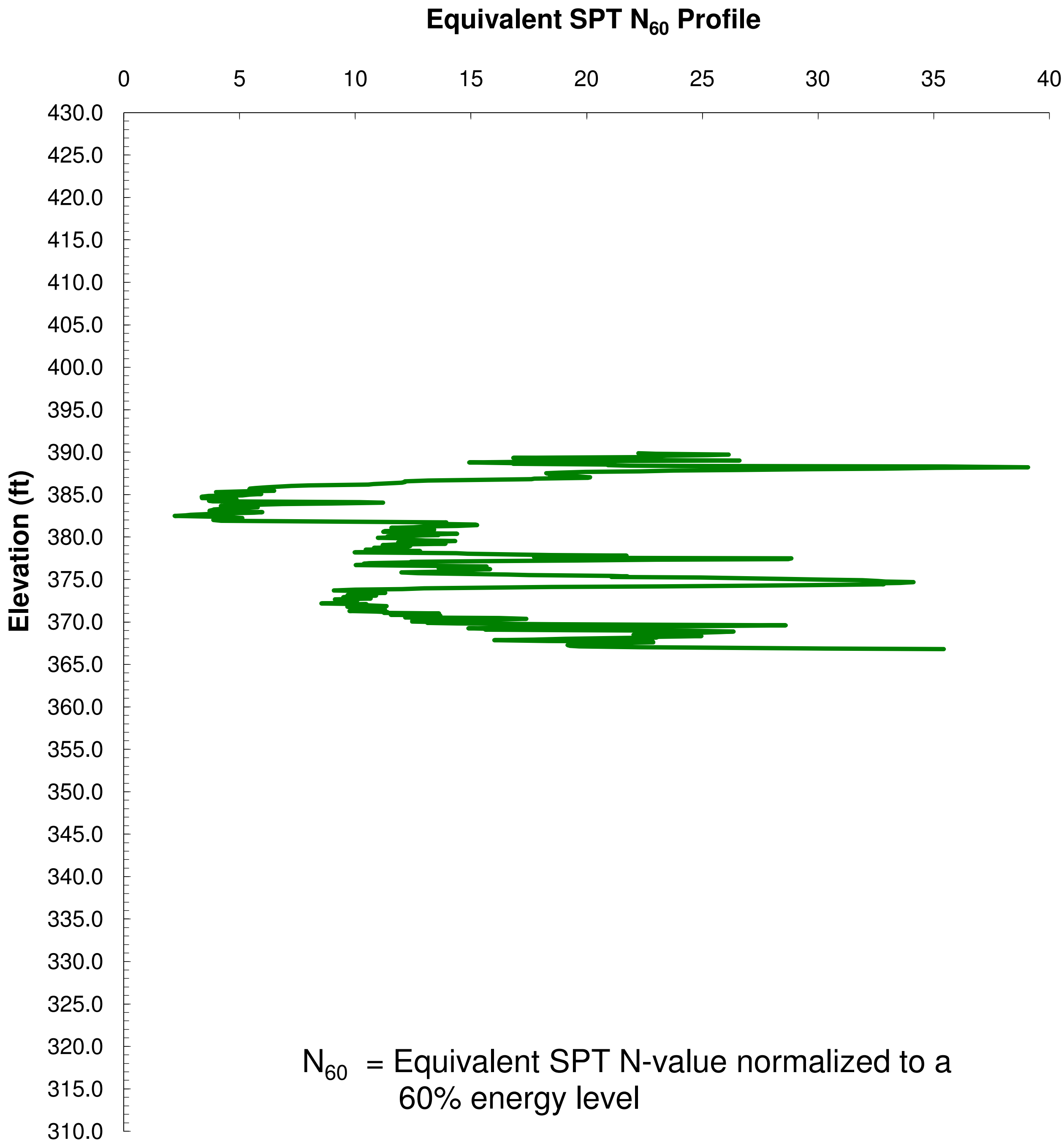
Project: Cumberland Fossil Plant



Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values



N_{60} = Equivalent SPT N-value normalized to a 60% energy level

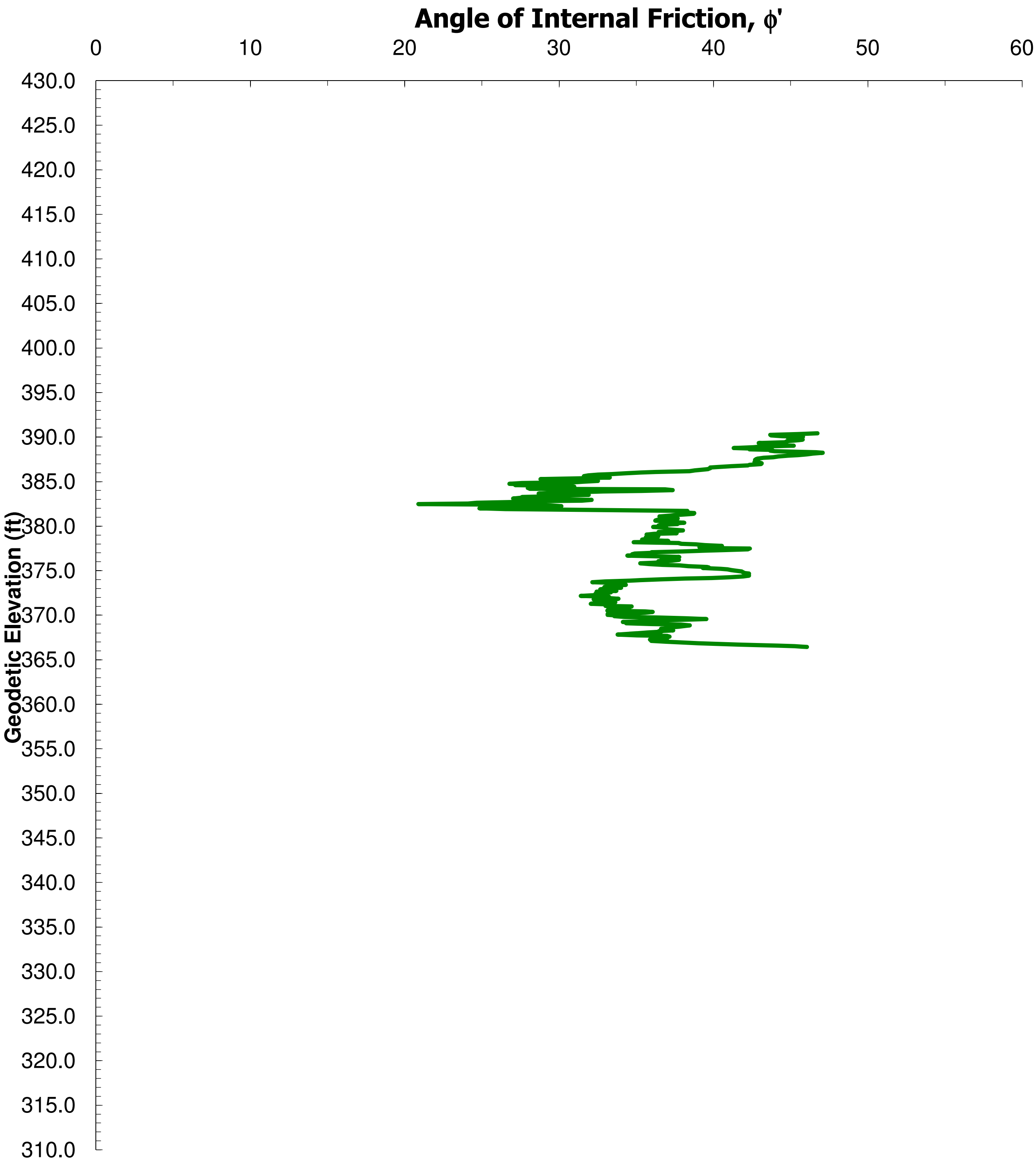
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT17

SCPTu RESULTS

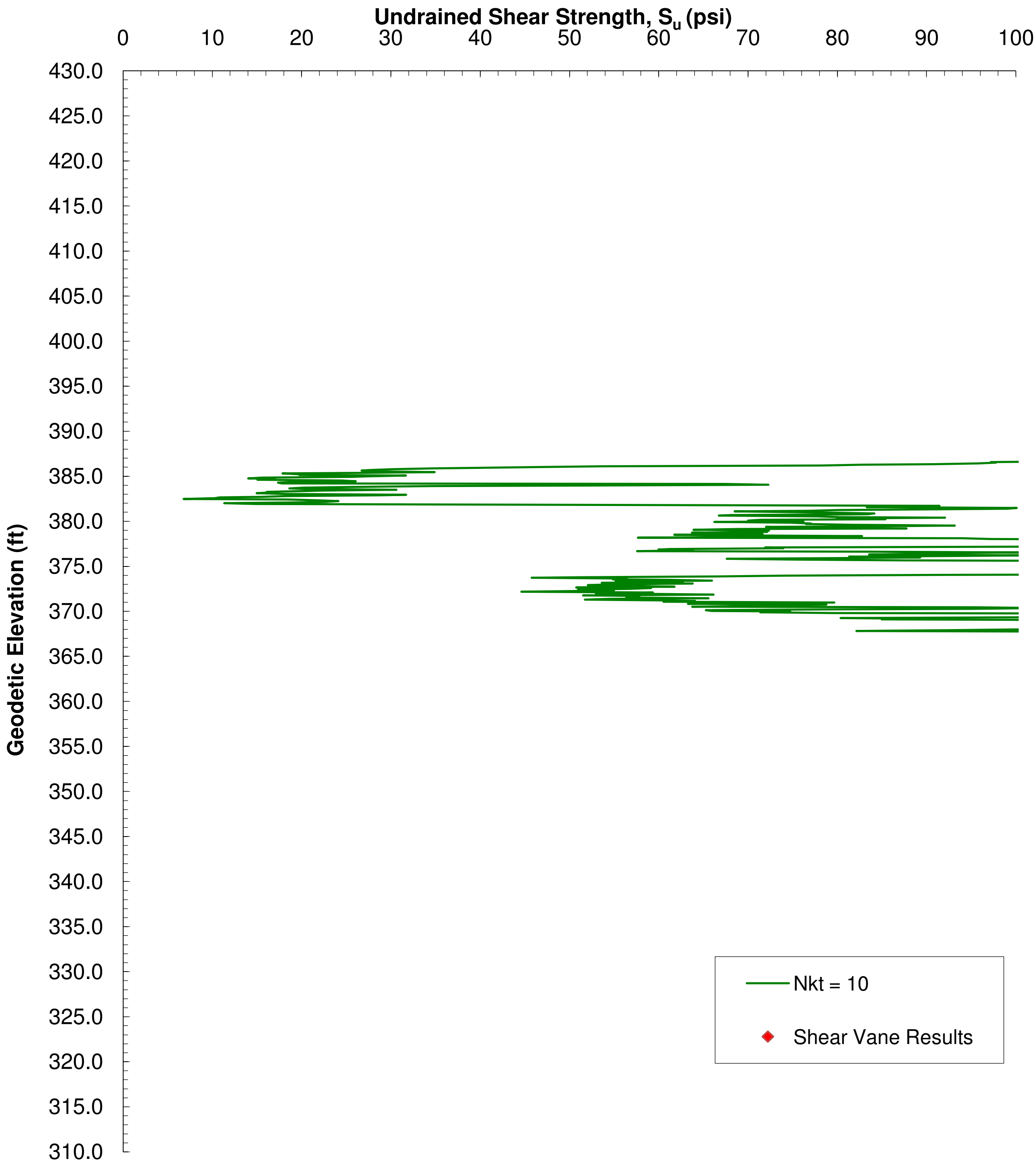
Effective Angle of Internal Friction



Project No. 175539009
CPT17

SCPTu RESULTS

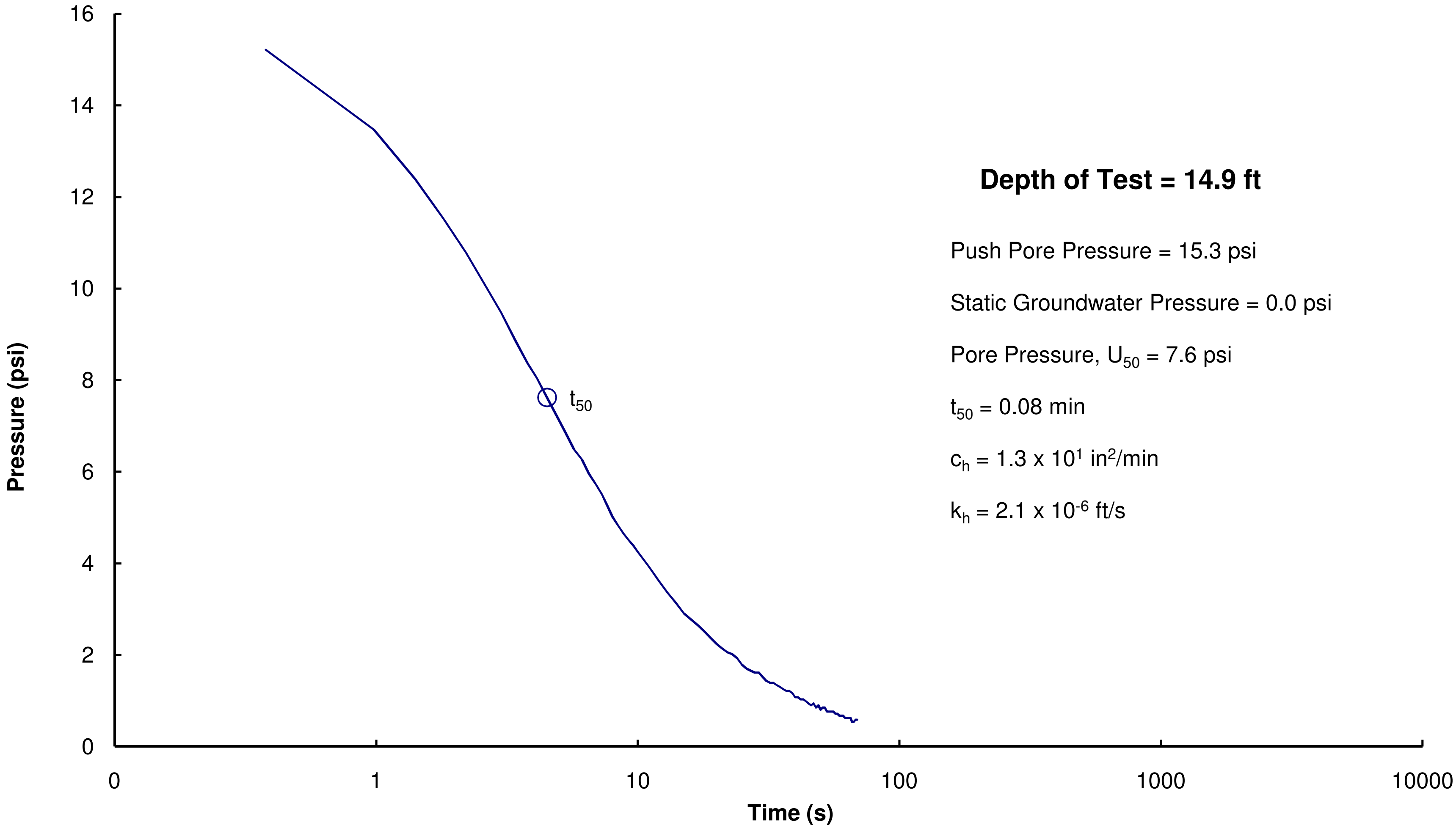
Undrained Shear Strength, S_u



Project No. 175539009
CPT17

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 14.9 ft

Push Pore Pressure = 15.3 psi

Static Groundwater Pressure = 0.0 psi

Pore Pressure, U_{50} = 7.6 psi

t_{50} = 0.08 min

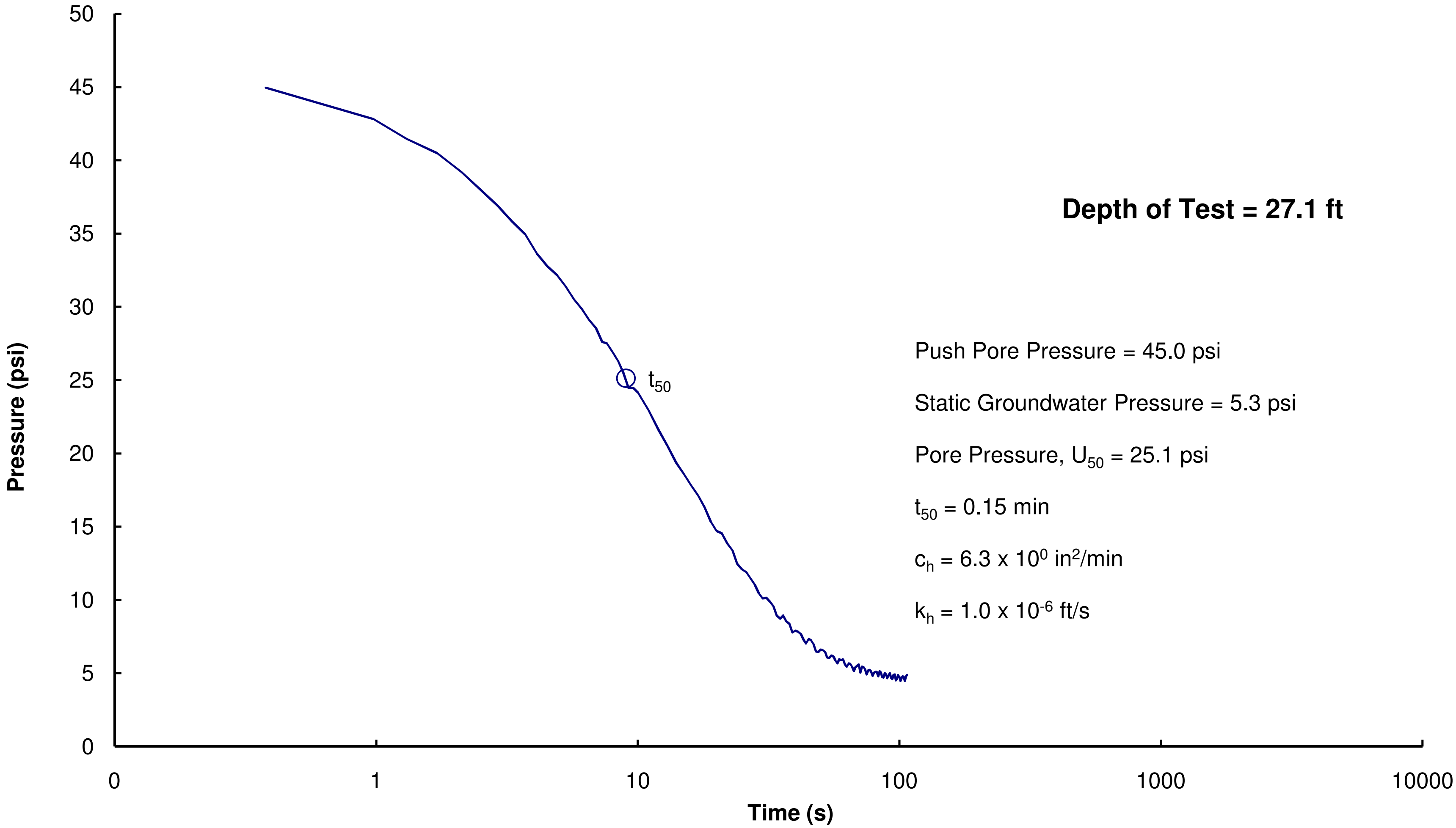
$c_h = 1.3 \times 10^1\ in^2/min$

$k_h = 2.1 \times 10^{-6}$ ft/s

Project No. 175539009
CPT17

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 27.1 ft

Push Pore Pressure = 45.0 psi

Static Groundwater Pressure = 5.3 psi

Pore Pressure, U_{50} = 25.1 psi

t_{50} = 0.15 min

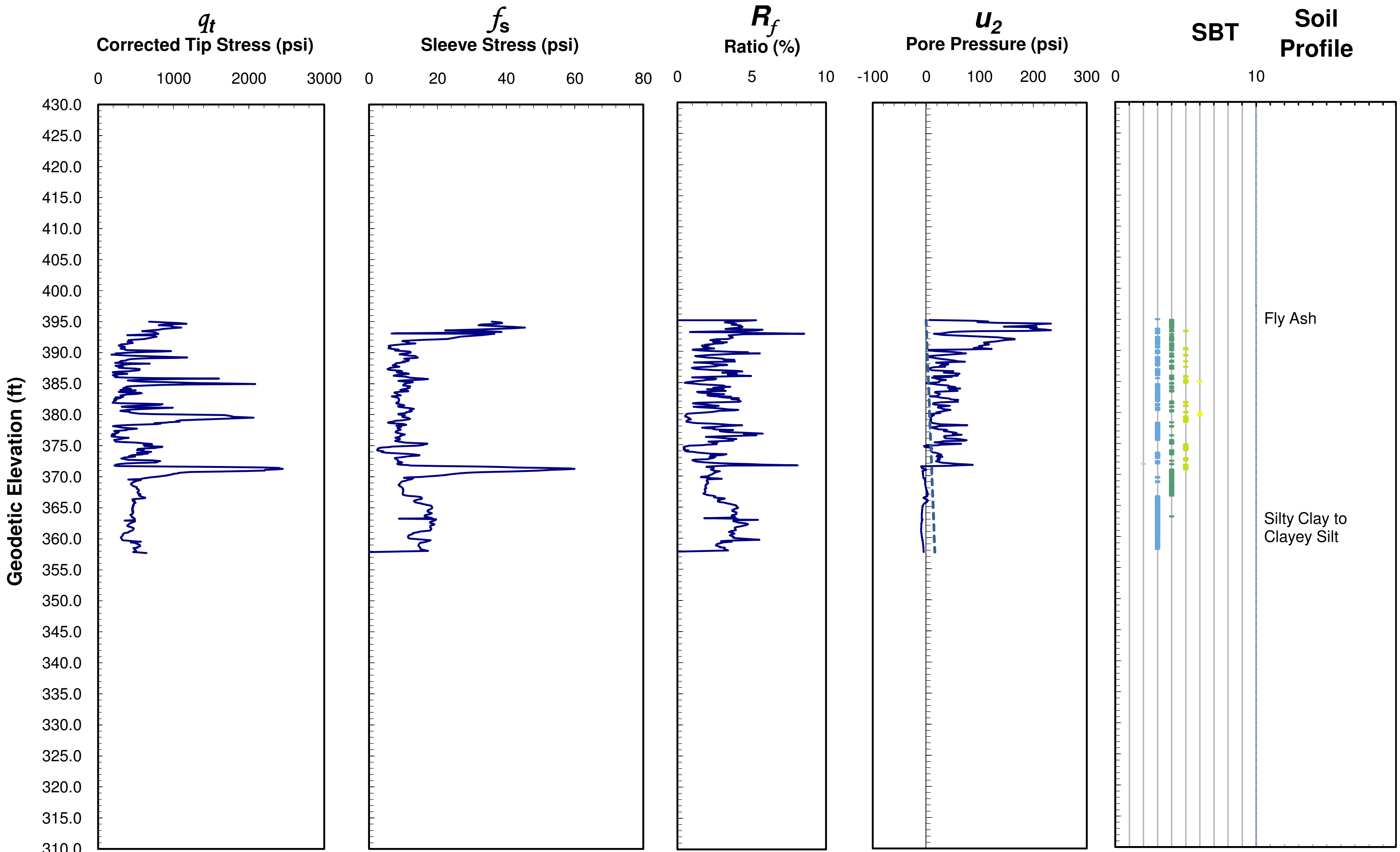
$c_h = 6.3 \times 10^0\ in^2/min$

$k_h = 1.0 \times 10^{-6}$ ft/s

Project No. 175539009
CPT17

D:\My Documents\CUF-CPT\CPT17.xlsm

Stantec Consulting Inc.	Elevation: 425.00 ft SCPTu Start Elevation: 395.00 ft Groundwater Elevation: 395.00 ft	Test Date: June 29, 2009 Project No. 175539009	CPT18
	Client: TVA Project: Cumberland Fossil Plant		

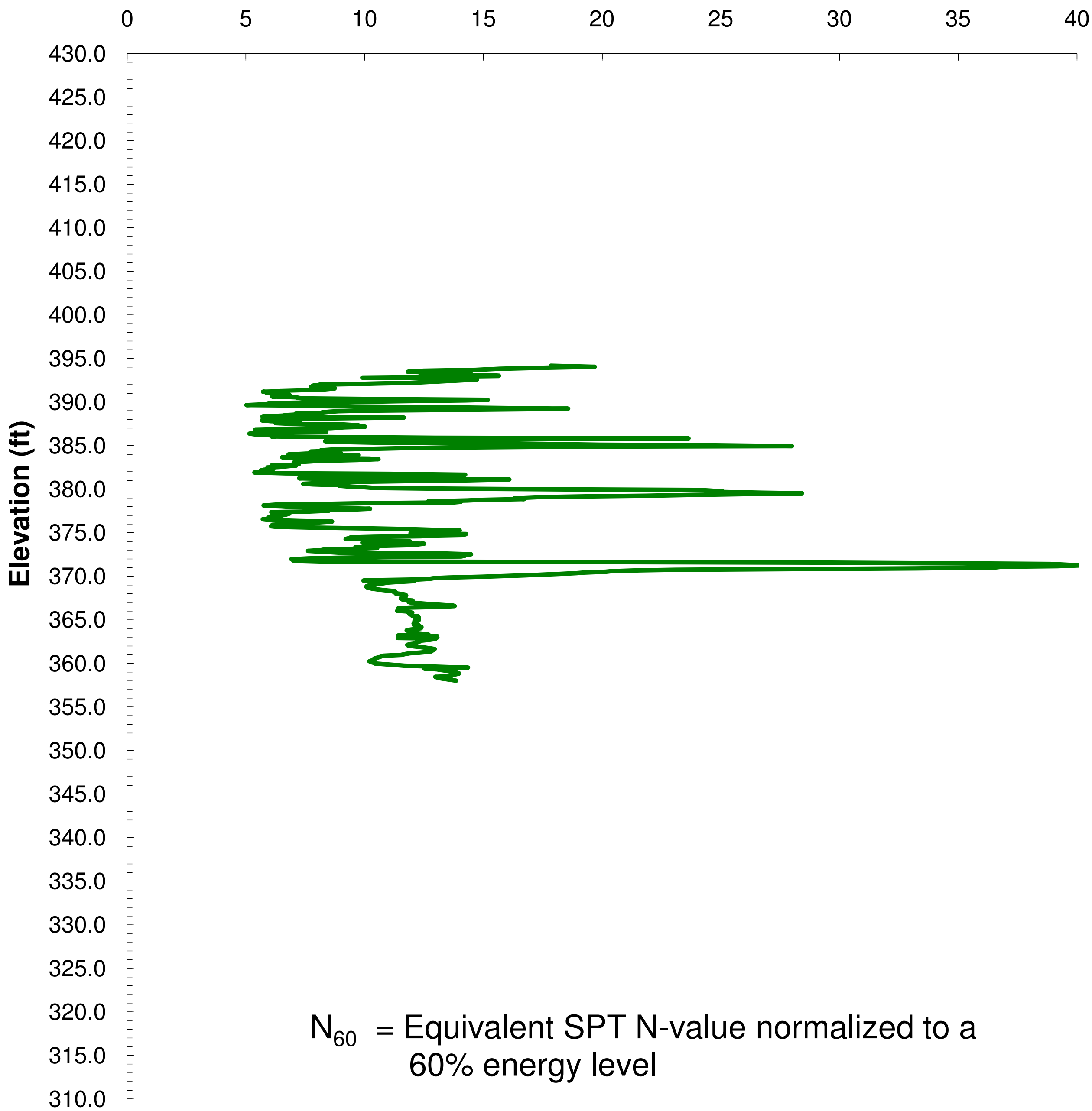


Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values

Equivalent SPT N_{60} Profile



N_{60} = Equivalent SPT N-value normalized to a 60% energy level

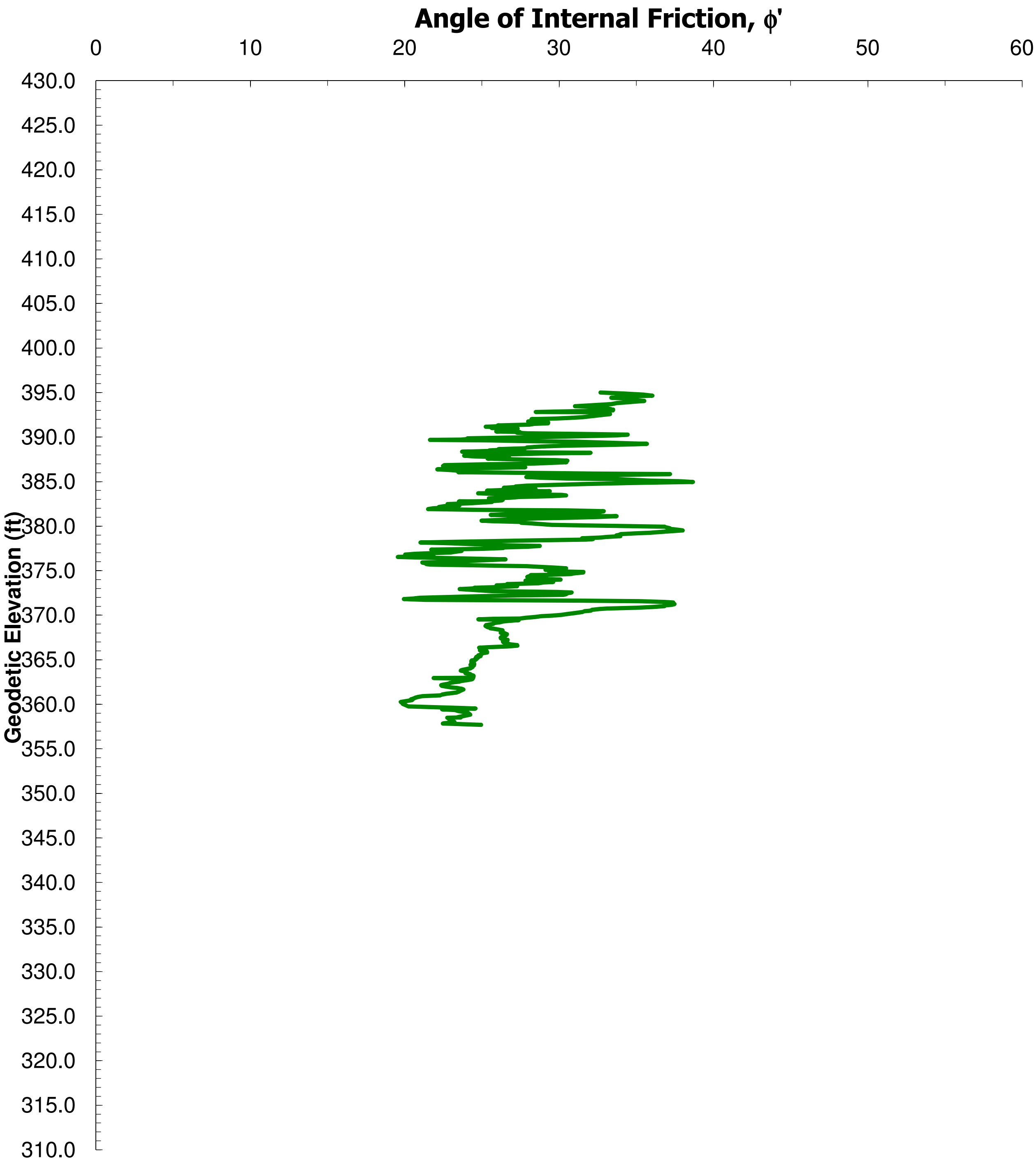
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT18

SCPTu RESULTS

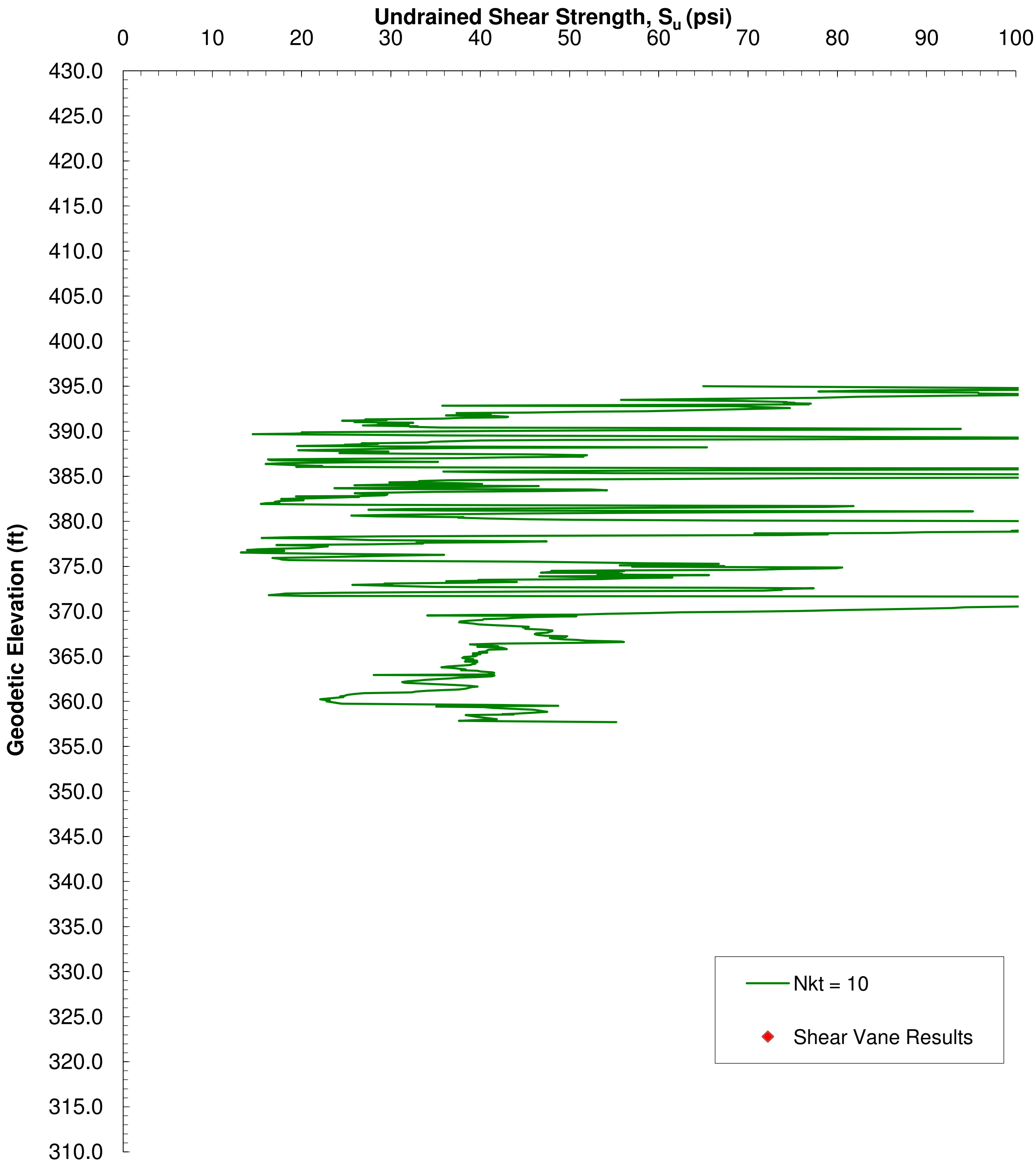
Effective Angle of Internal Friction



Project No. 175539009
CPT18

SCPTu RESULTS

Undrained Shear Strength, S_u

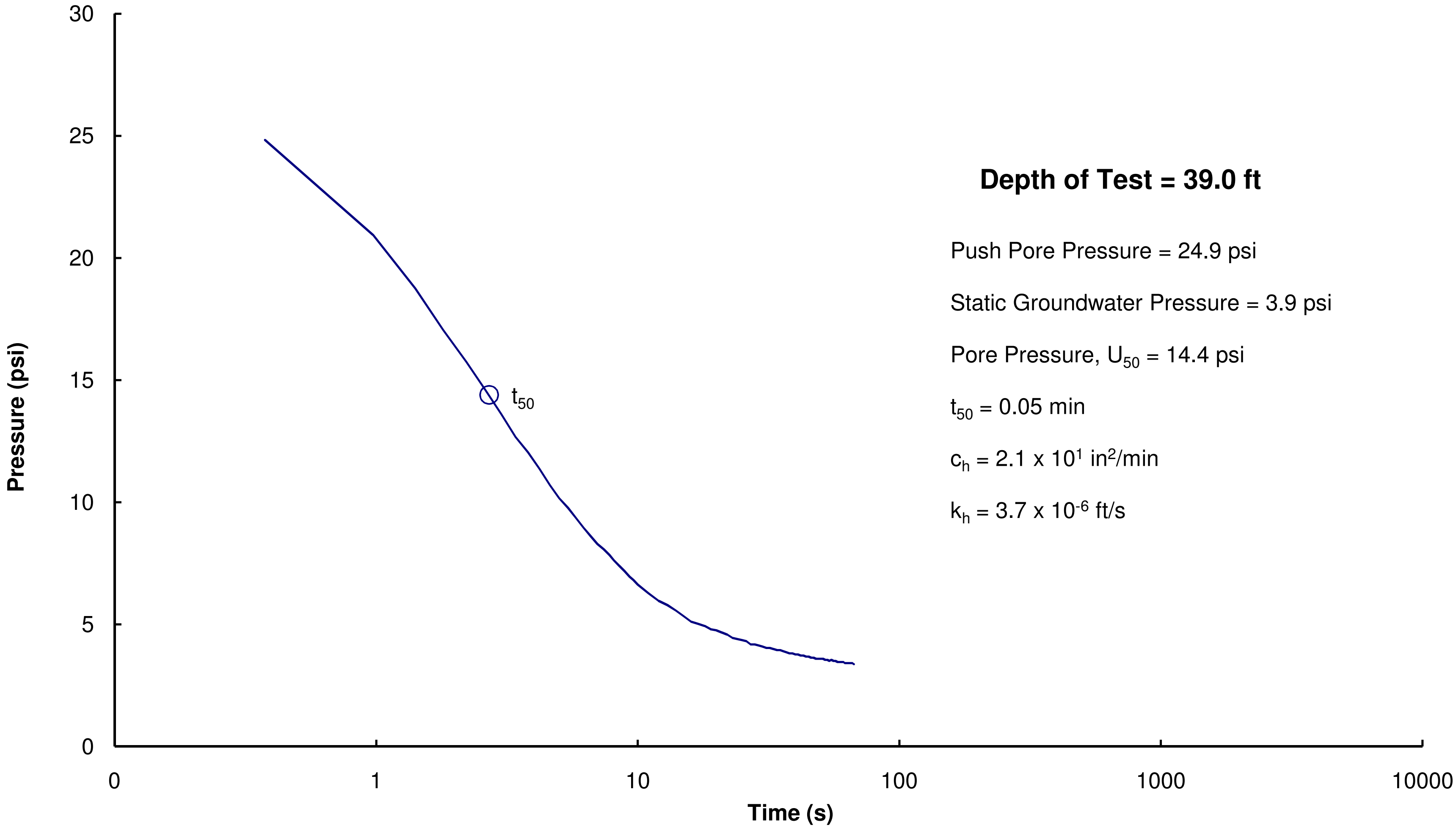


Project No. 175539009

CPT18

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 39.0 ft

Push Pore Pressure = 24.9 psi

Static Groundwater Pressure = 3.9 psi

Pore Pressure, U_{50} = 14.4 psi

t_{50} = 0.05 min

$c_h = 2.1 \times 10^{1}$ in^2/min

$k_h = 3.7 \times 10^{-6}$ ft/s

Project No. 175539009
CPT18

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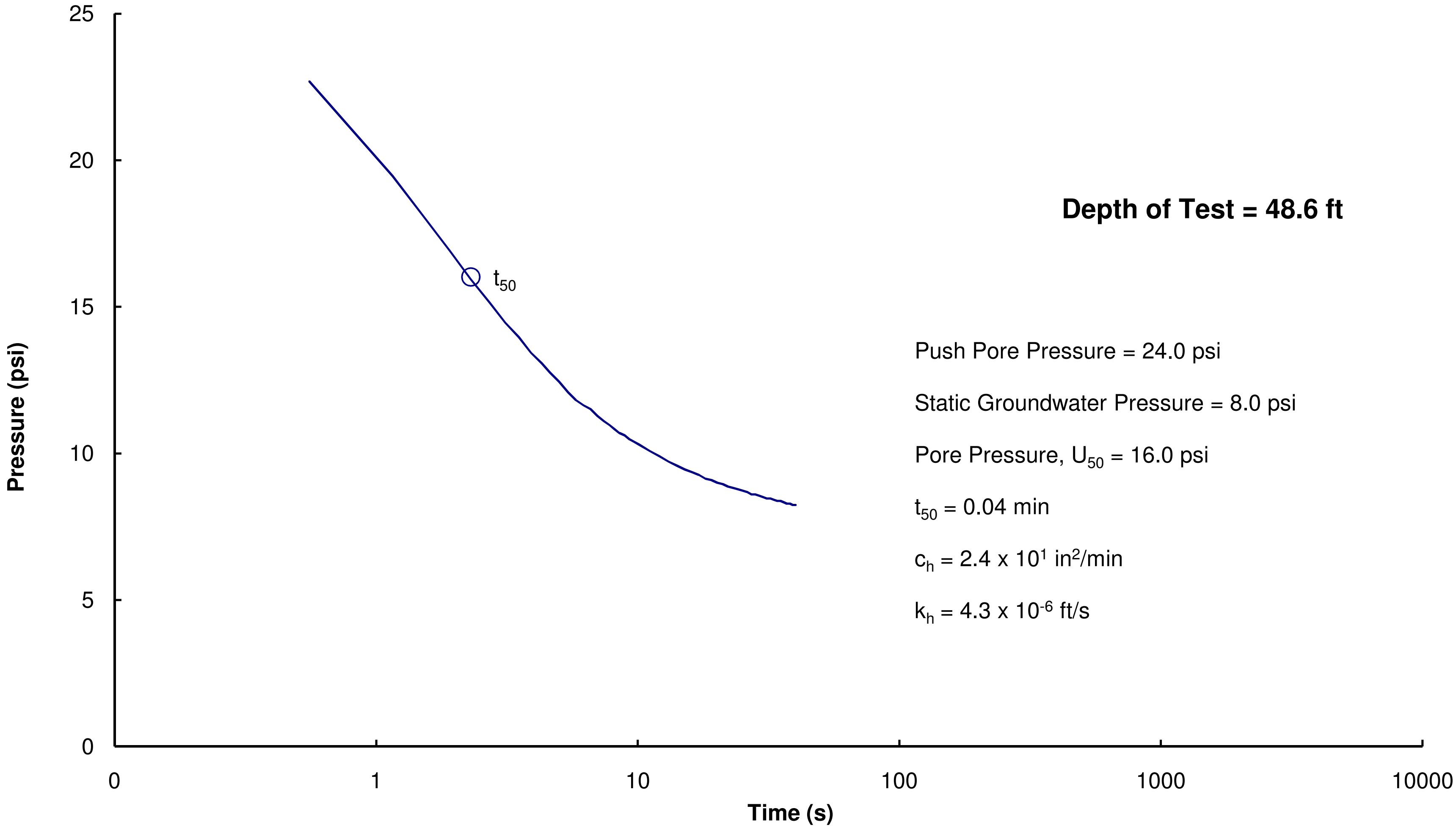
Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 48.6 ft

Push Pore Pressure = 24.0 psi

Static Groundwater Pressure = 8.0 psi

Pore Pressure, U_{50} = 16.0 psi

t_{50} = 0.04 min

$c_h = 2.4 \times 10^1$ in^2/min

$k_h = 4.3 \times 10^{-6}$ ft/s

Project No. 175539009
CPT18

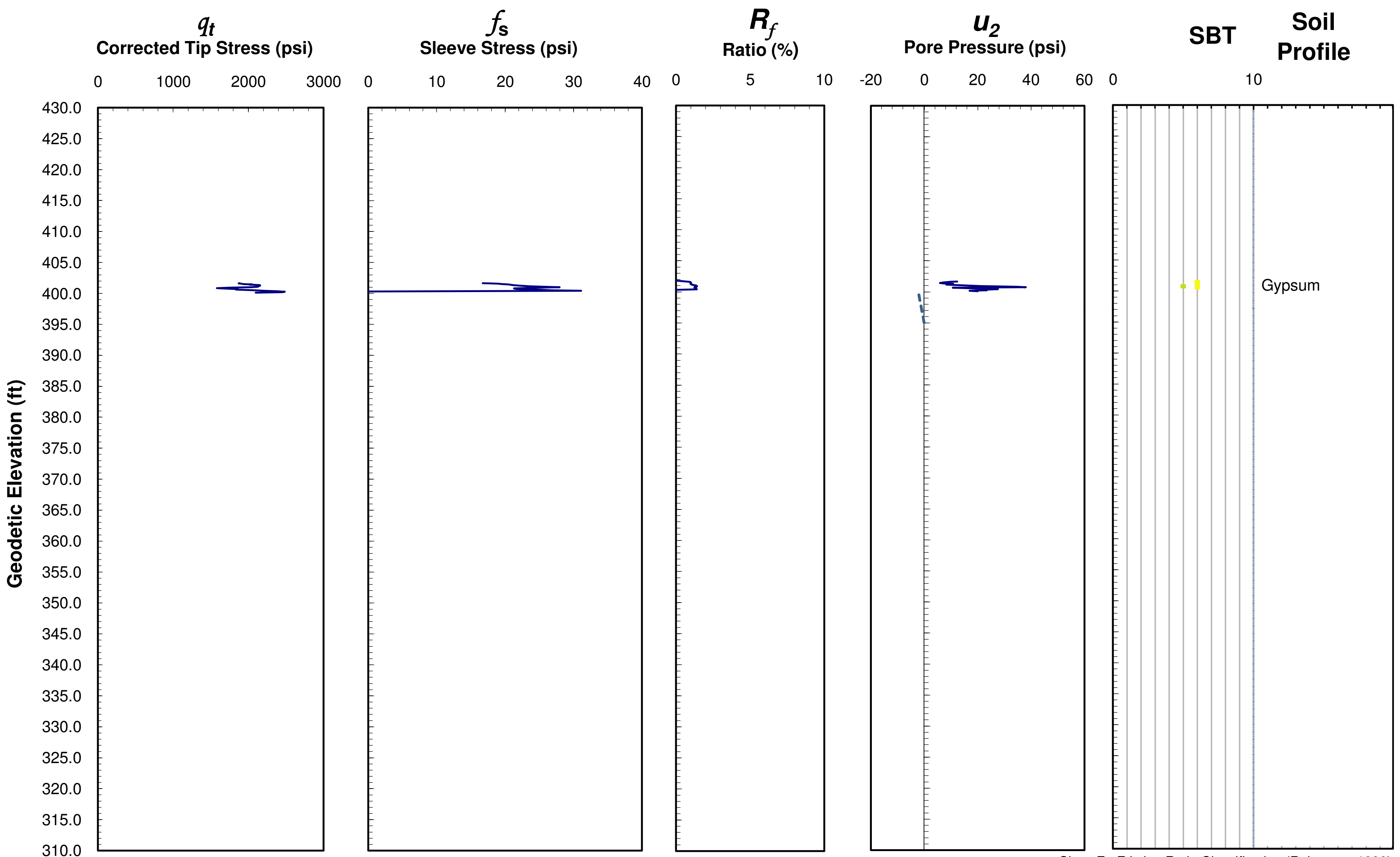
Stantec Consulting Inc.

Elevation:	425.00 ft
SCPTu Start Elevation:	401.80 ft
Groundwater Elevation:	395.00 ft

Test Date: June 26, 2009
Project No. 175539009

CPT19

Client: TVA
Project: Cumberland Fossil Plant



Class Fr: Friction Ratio Classification (Robertson 1990)

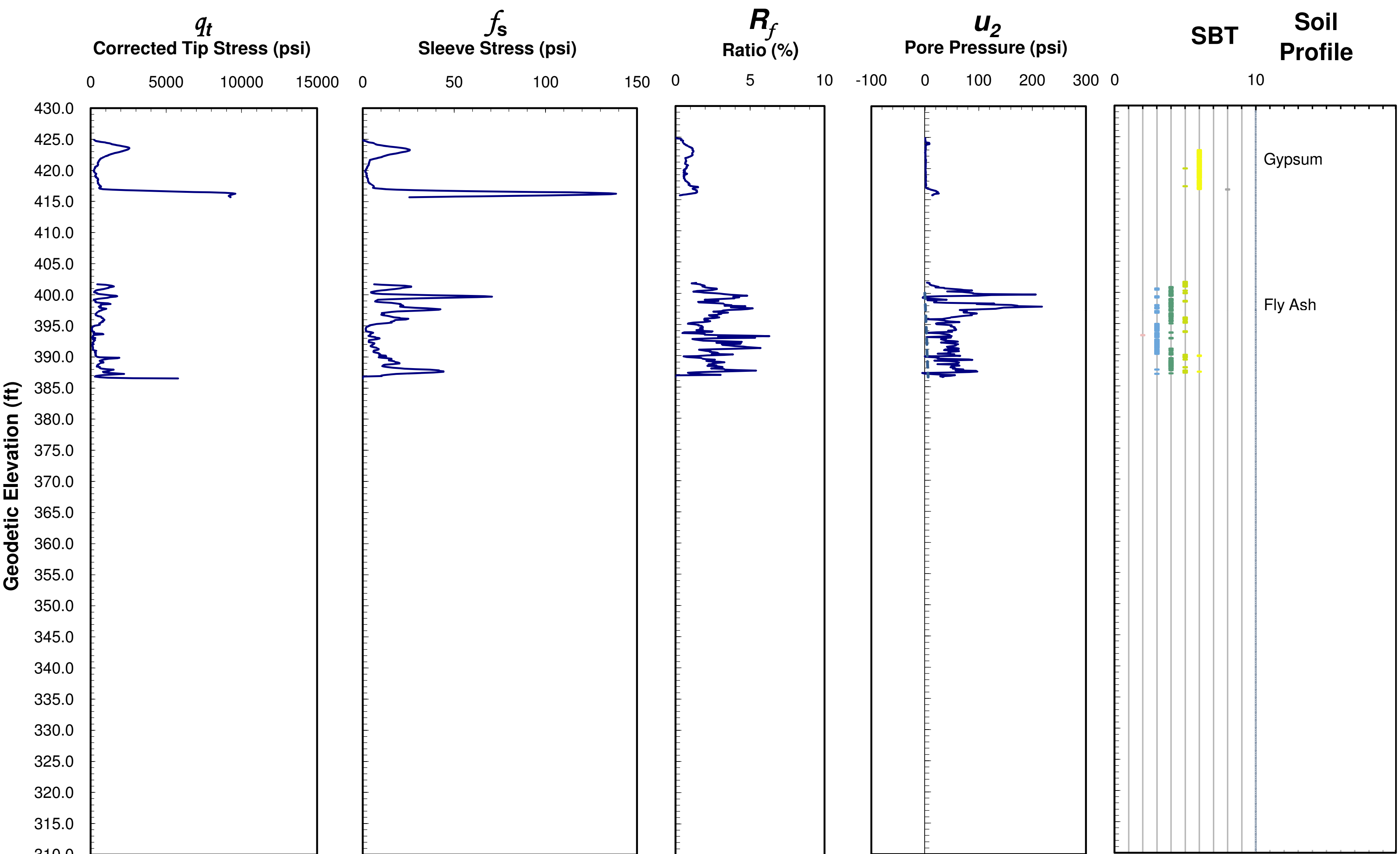
Stantec Consulting Inc.

Elevation: 425.00 ft
SCPTu Start Elevation: 425.00 ft
Groundwater Elevation: 400.00 ft

Test Date: July 9, 2009
Project No. 175539009

CPT20

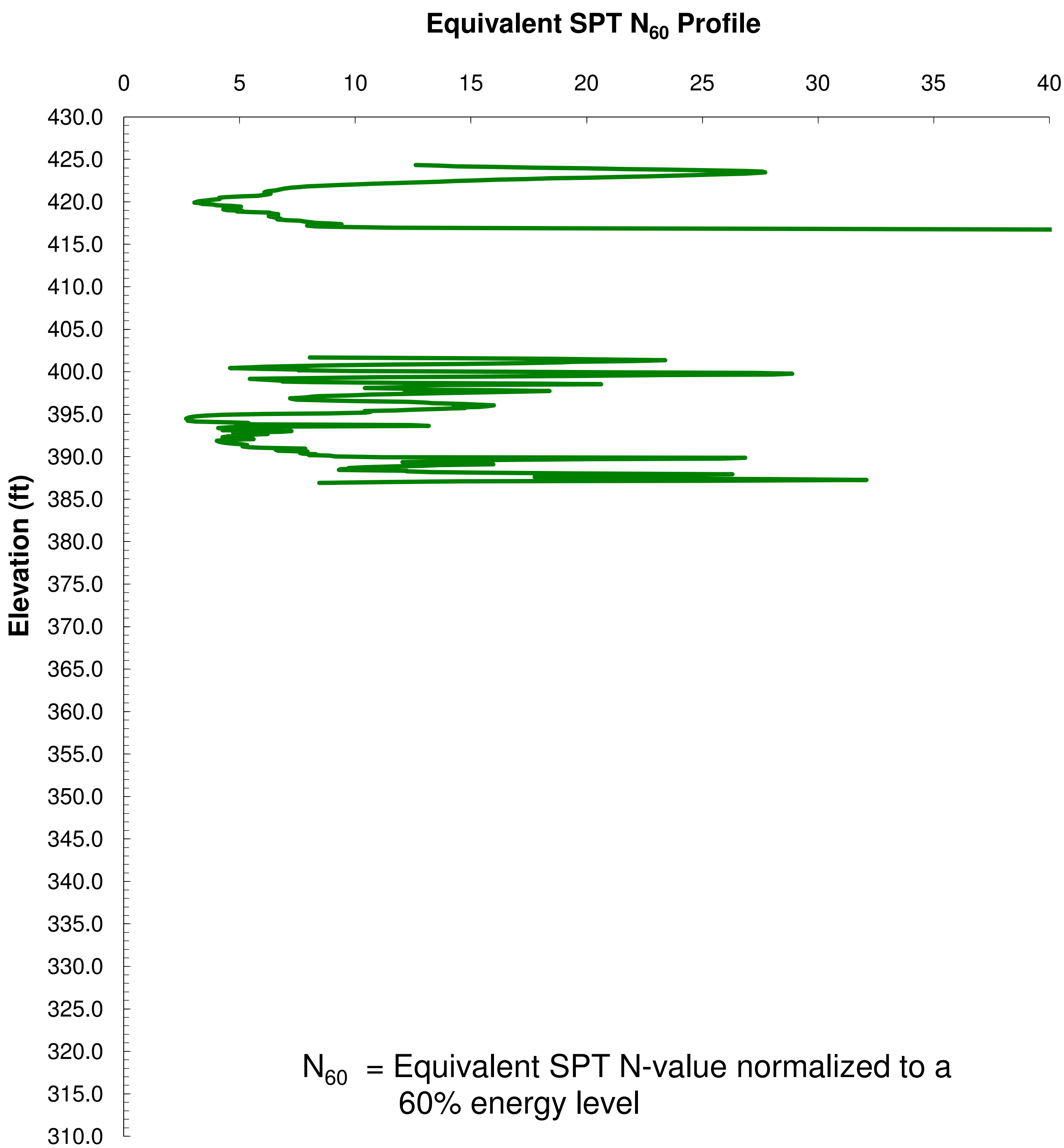
Client: TVA
Project: Cumberland Fossil Plant



Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values



N_{60} = Equivalent SPT N-value normalized to a 60% energy level

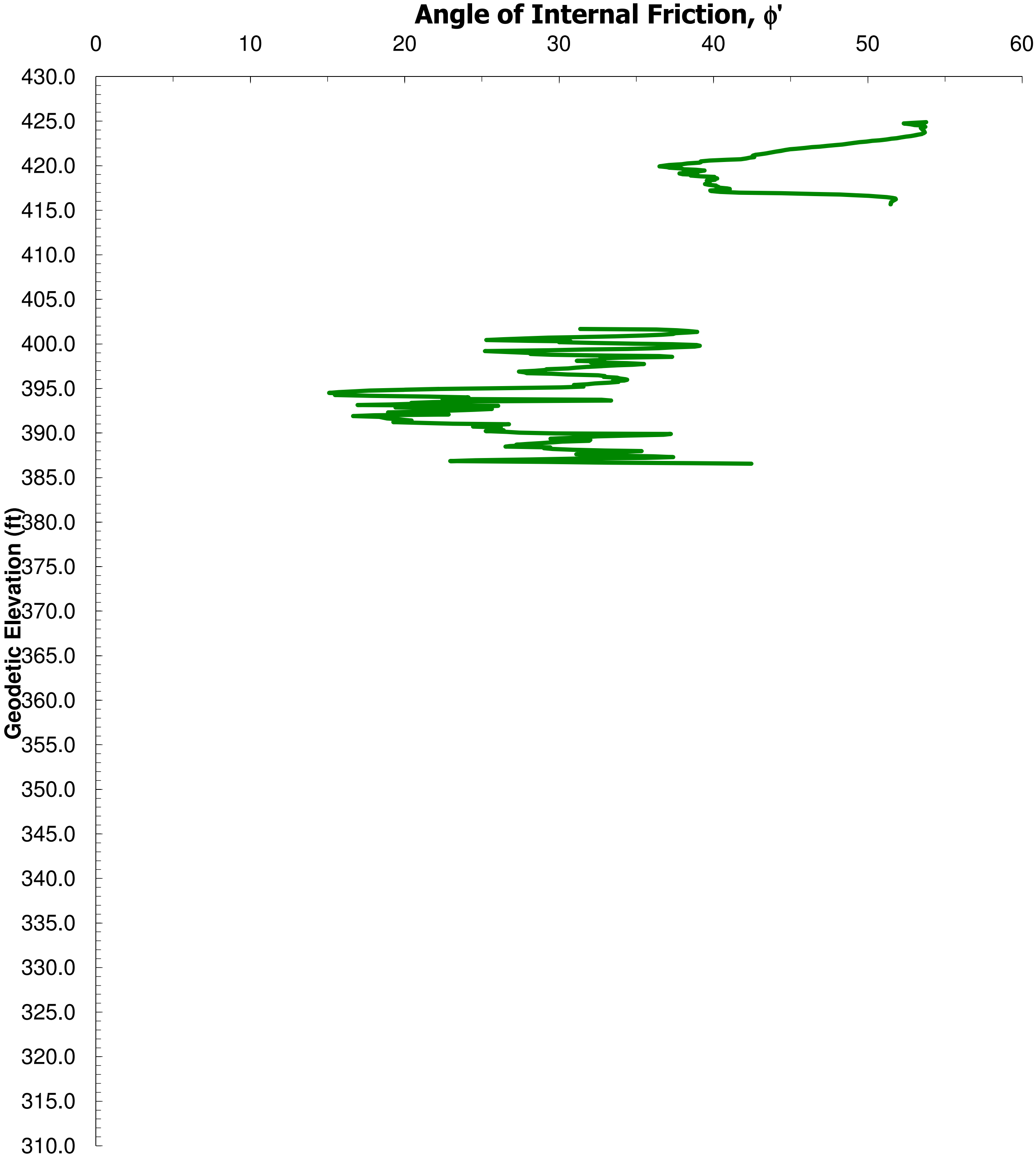
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT20

SCPTu RESULTS

Effective Angle of Internal Friction

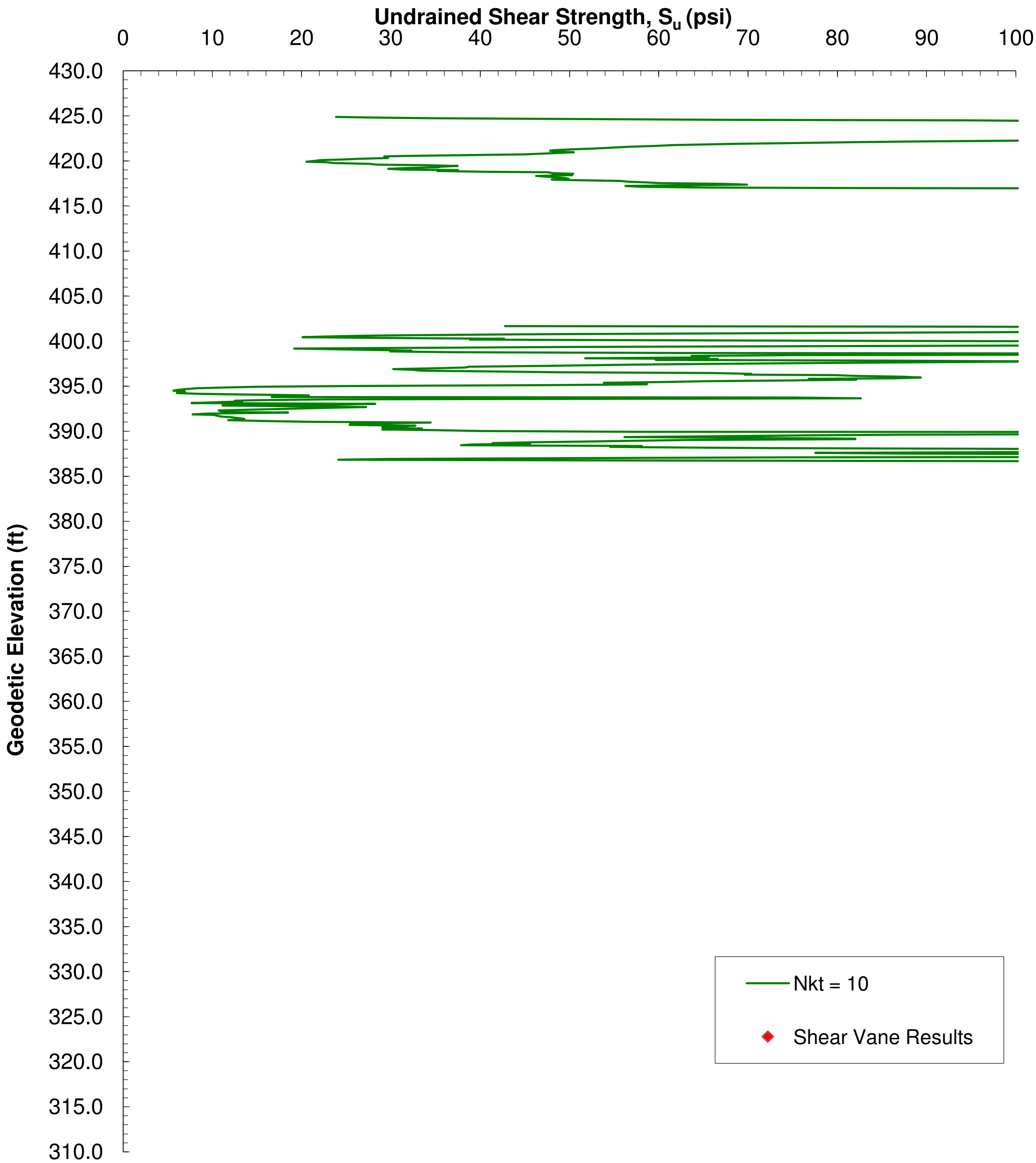


Project No. 175539009

CPT20

SCPTu RESULTS

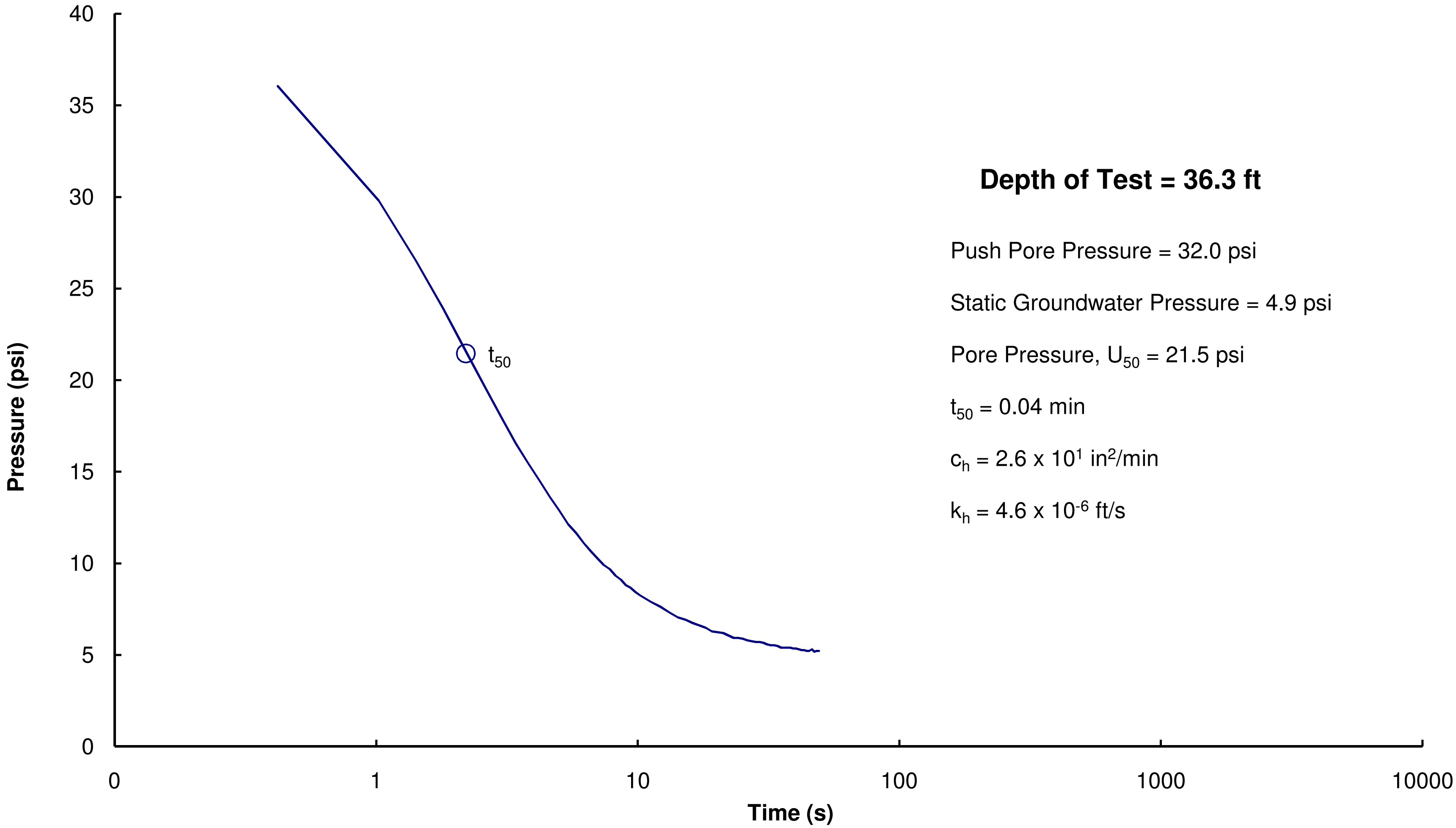
Undrained Shear Strength, S_u



Project No. 175539009
CPT20

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 36.3 ft

Push Pore Pressure = 32.0 psi

Static Groundwater Pressure = 4.9 psi

Pore Pressure, U_{50} = 21.5 psi

t_{50} = 0.04 min

$c_h = 2.6 \times 10^1$ in^2/min

$k_h = 4.6 \times 10^{-6}$ ft/s

Project No. 175539009
CPT20

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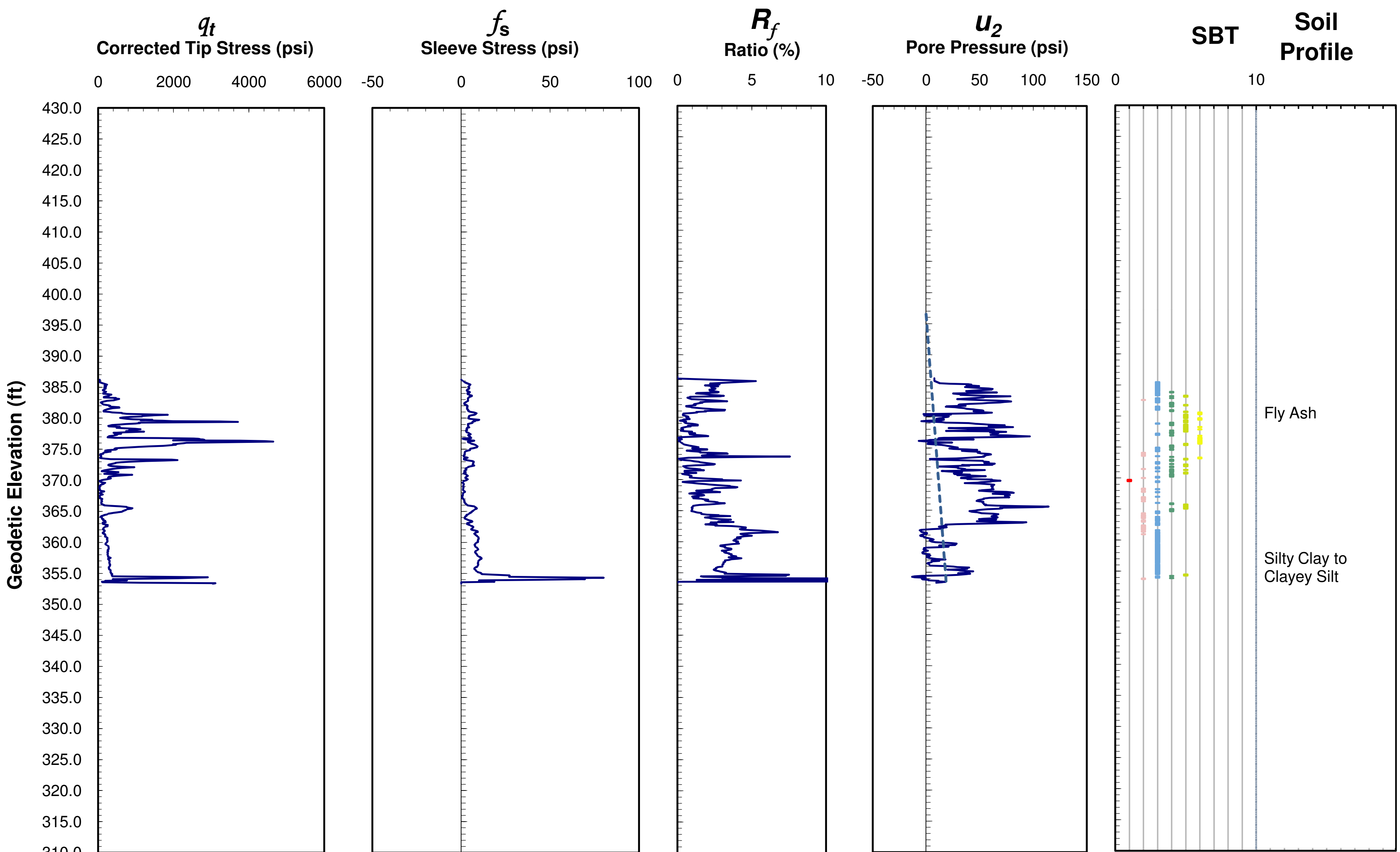
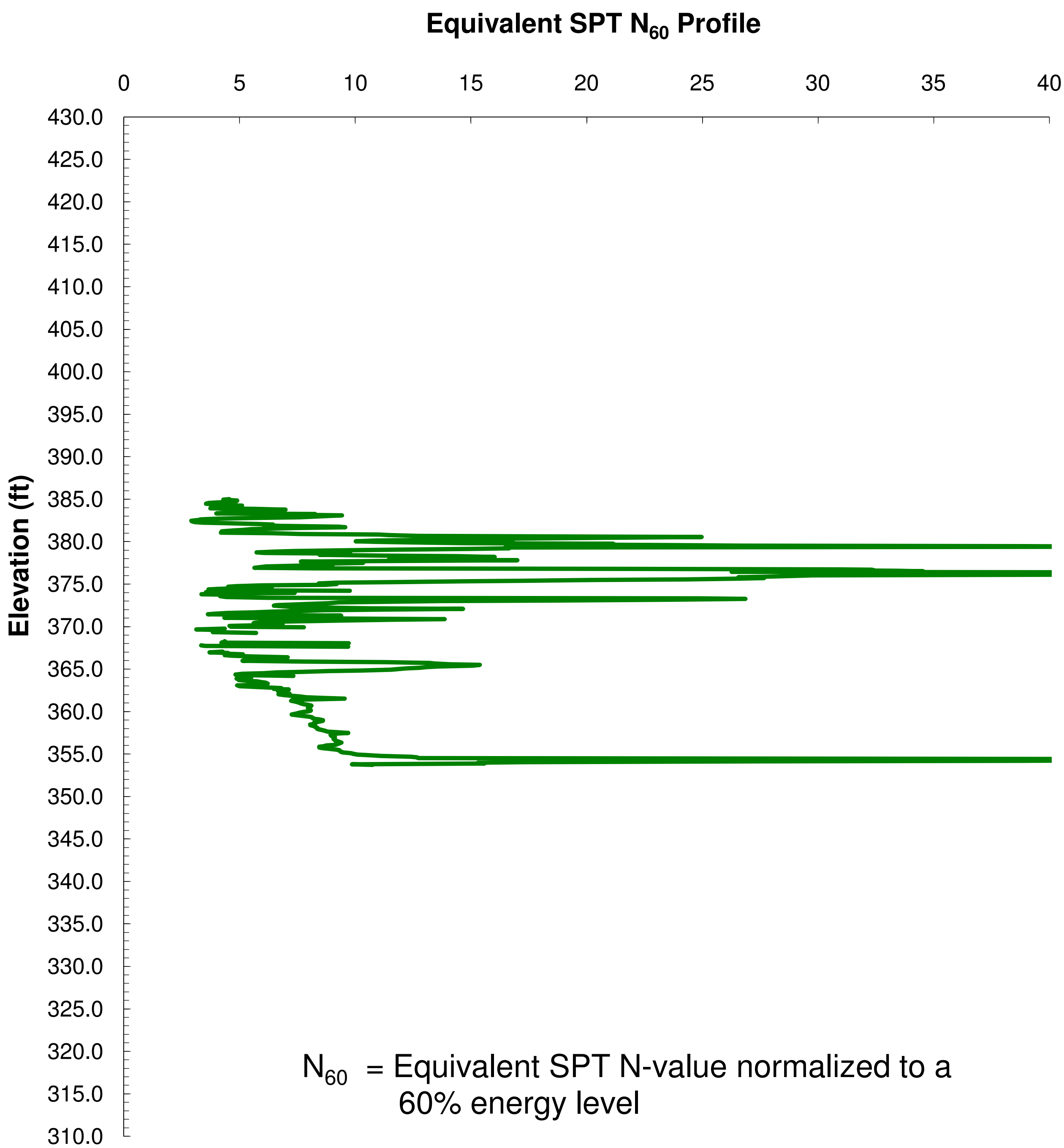
Stantec Consulting Inc.	Elevation: 425.00 ft SCPTu Start Elevation: 386.50 ft Groundwater Elevation: 396.50 ft	Test Date: June 27, 2009 Project No. 175539009	CPT22
	Client: TVA Project: Cumberland Fossil Plant		



Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values



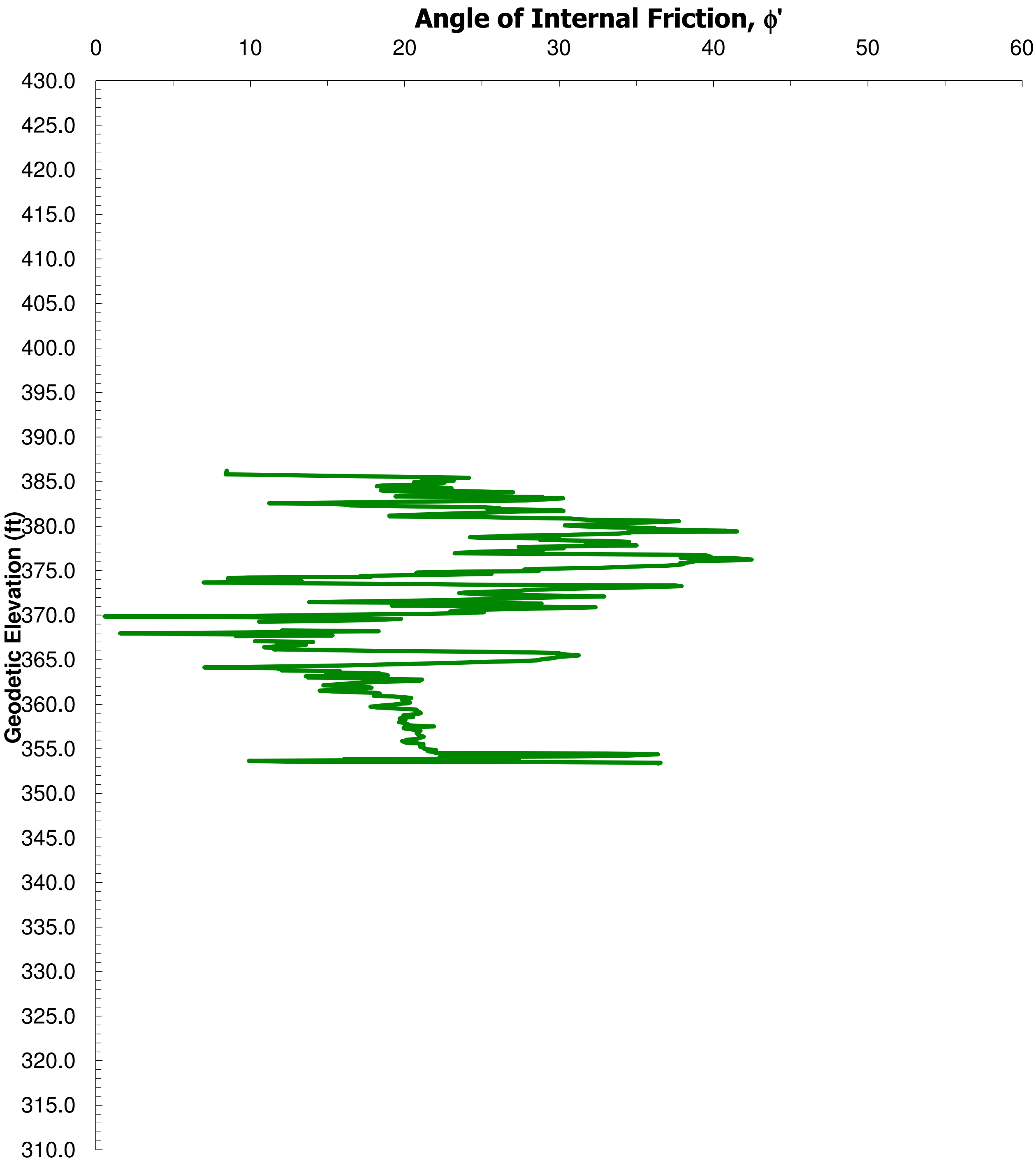
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT22

SCPTu RESULTS

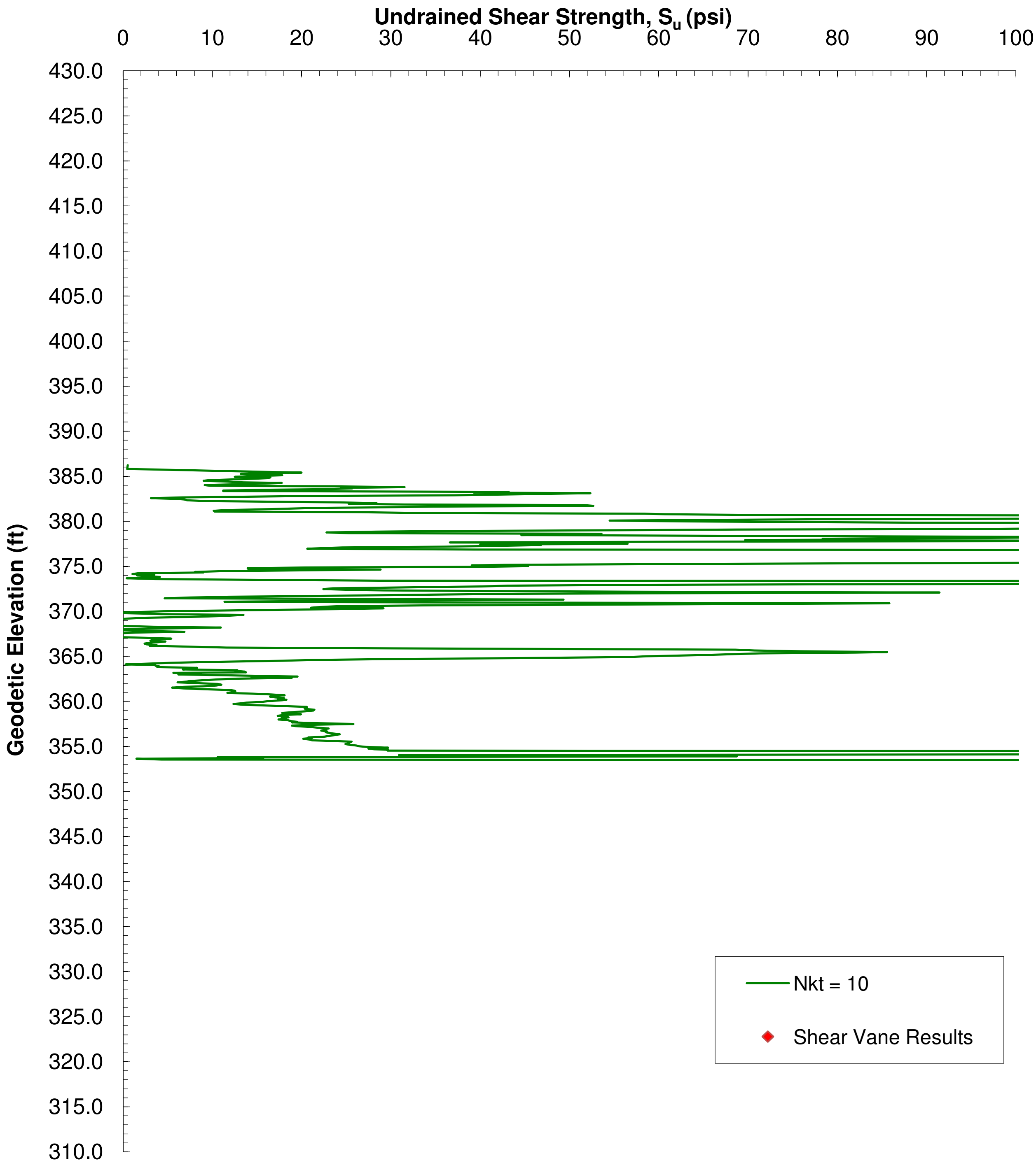
Effective Angle of Internal Friction



Project No. 175539009
CPT22

SCPTu RESULTS

Undrained Shear Strength, S_u

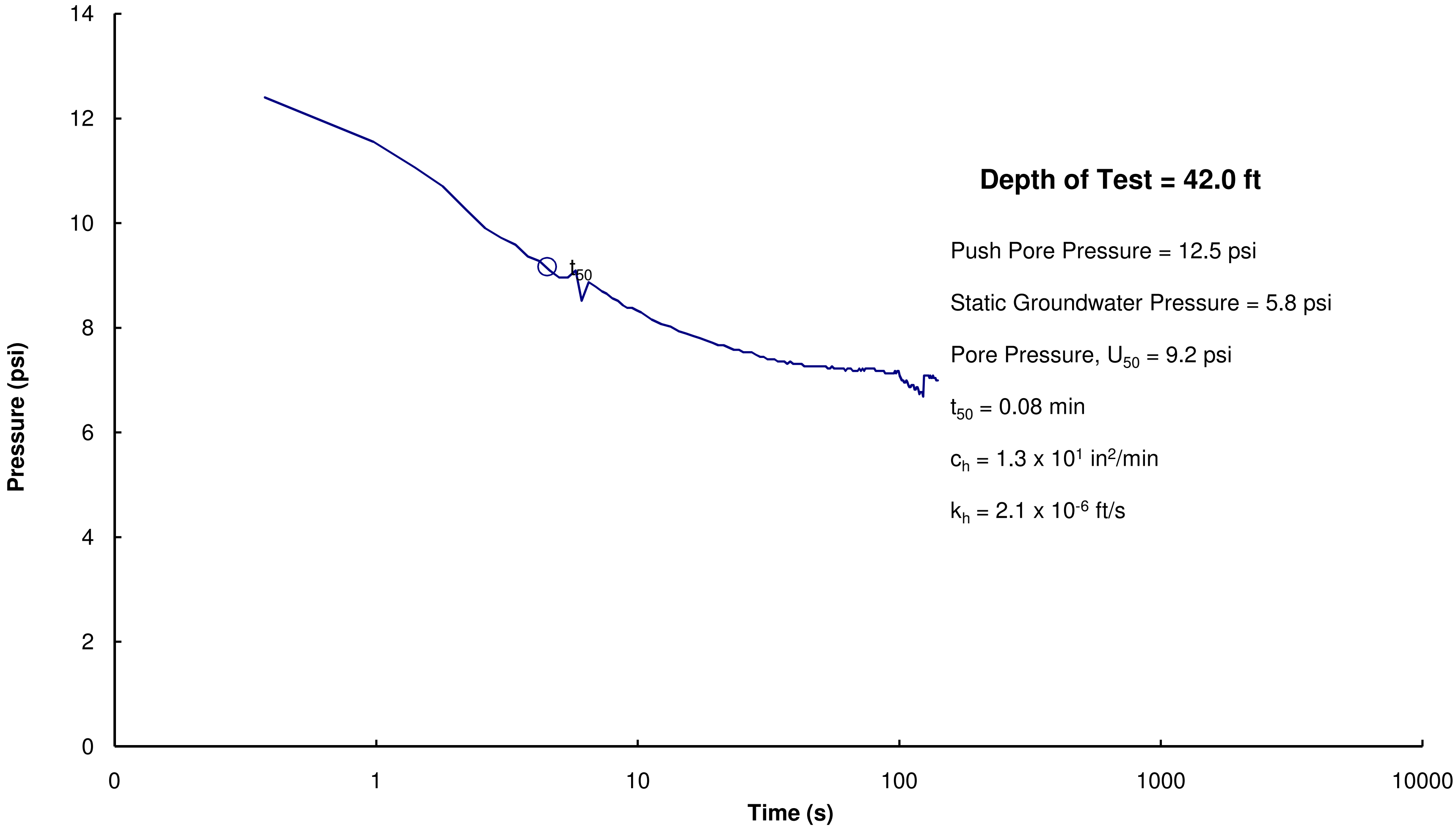


Project No. 175539009
CPT22

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS

Coefficient of Consolidation



Depth of Test = 42.0 ft

Push Pore Pressure = 12.5 psi

Static Groundwater Pressure = 5.8 psi

Pore Pressure, U_{50} = 9.2 psi

t_{50} = 0.08 min

$c_h = 1.3 \times 10^{1}\ in^2/min$

$k_h = 2.1 \times 10^{-6}$ ft/s

Project No. 175539009
CPT22

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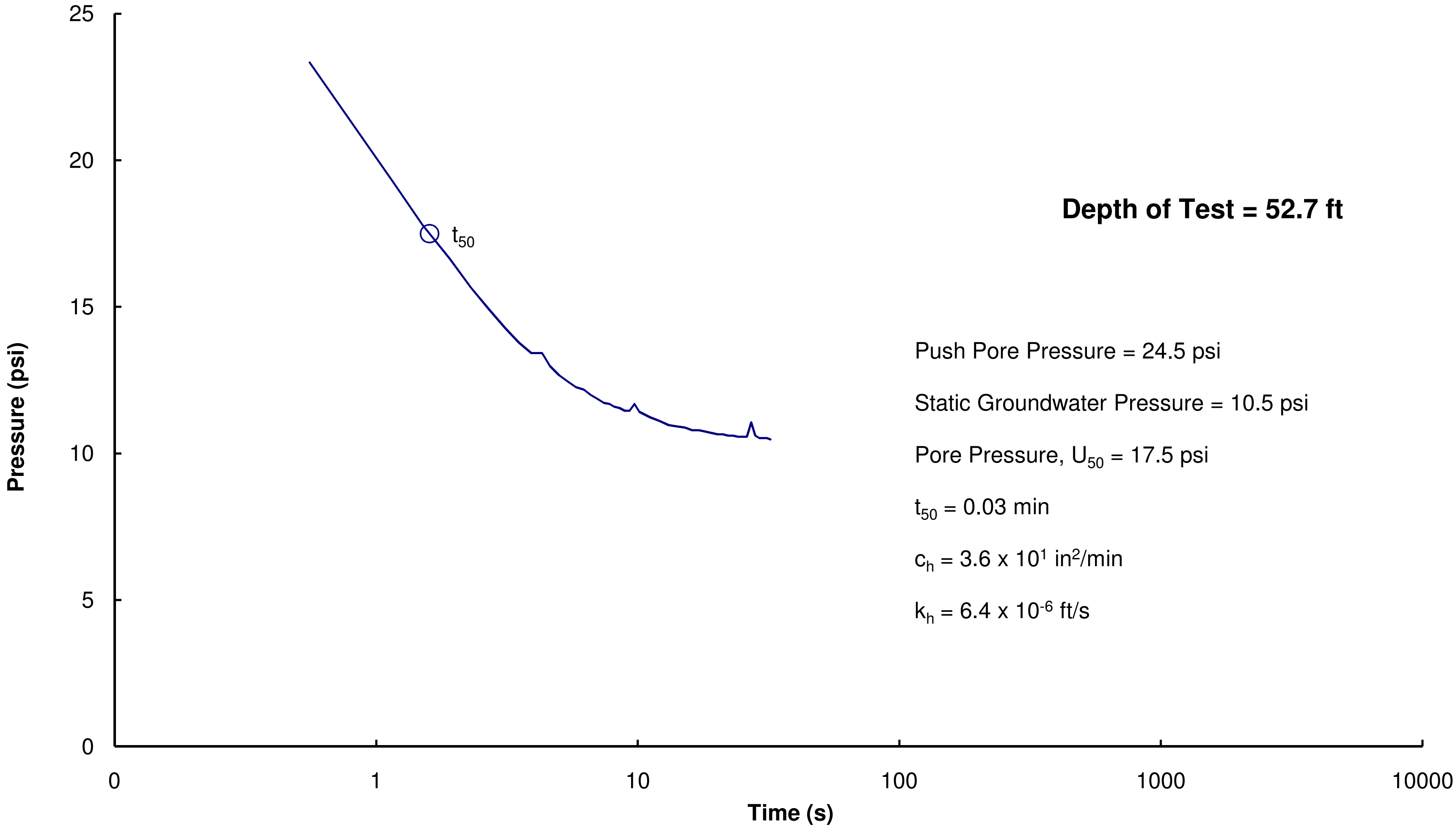
Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 52.7 ft

Push Pore Pressure = 24.5 psi

Static Groundwater Pressure = 10.5 psi

Pore Pressure, U_{50} = 17.5 psi

t_{50} = 0.03 min

$c_h = 3.6 \times 10^1\ in^2/min$

$k_h = 6.4 \times 10^{-6}$ ft/s

Project No. 175539009
CPT22

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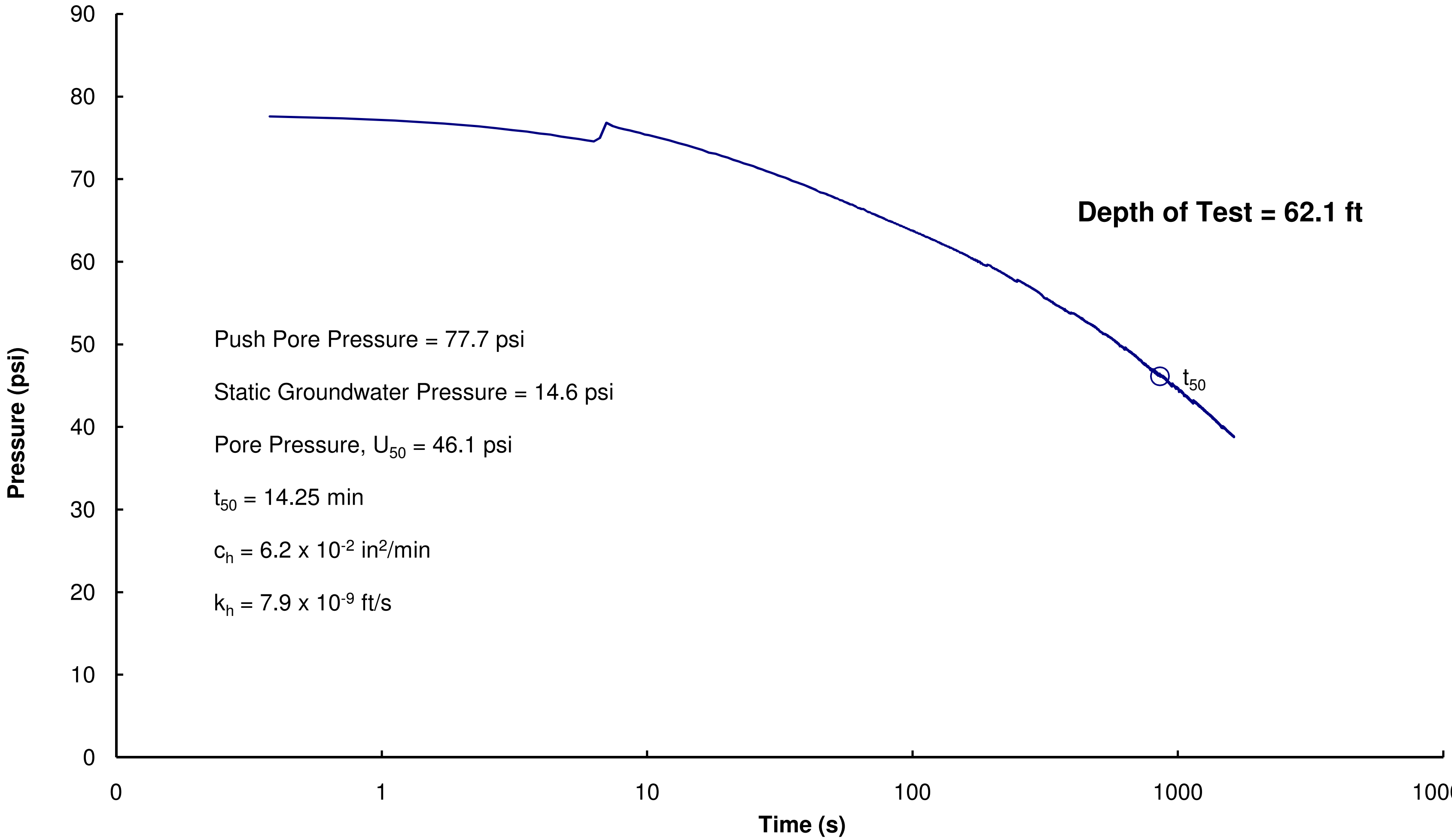
Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Project No. 175539009
CPT22

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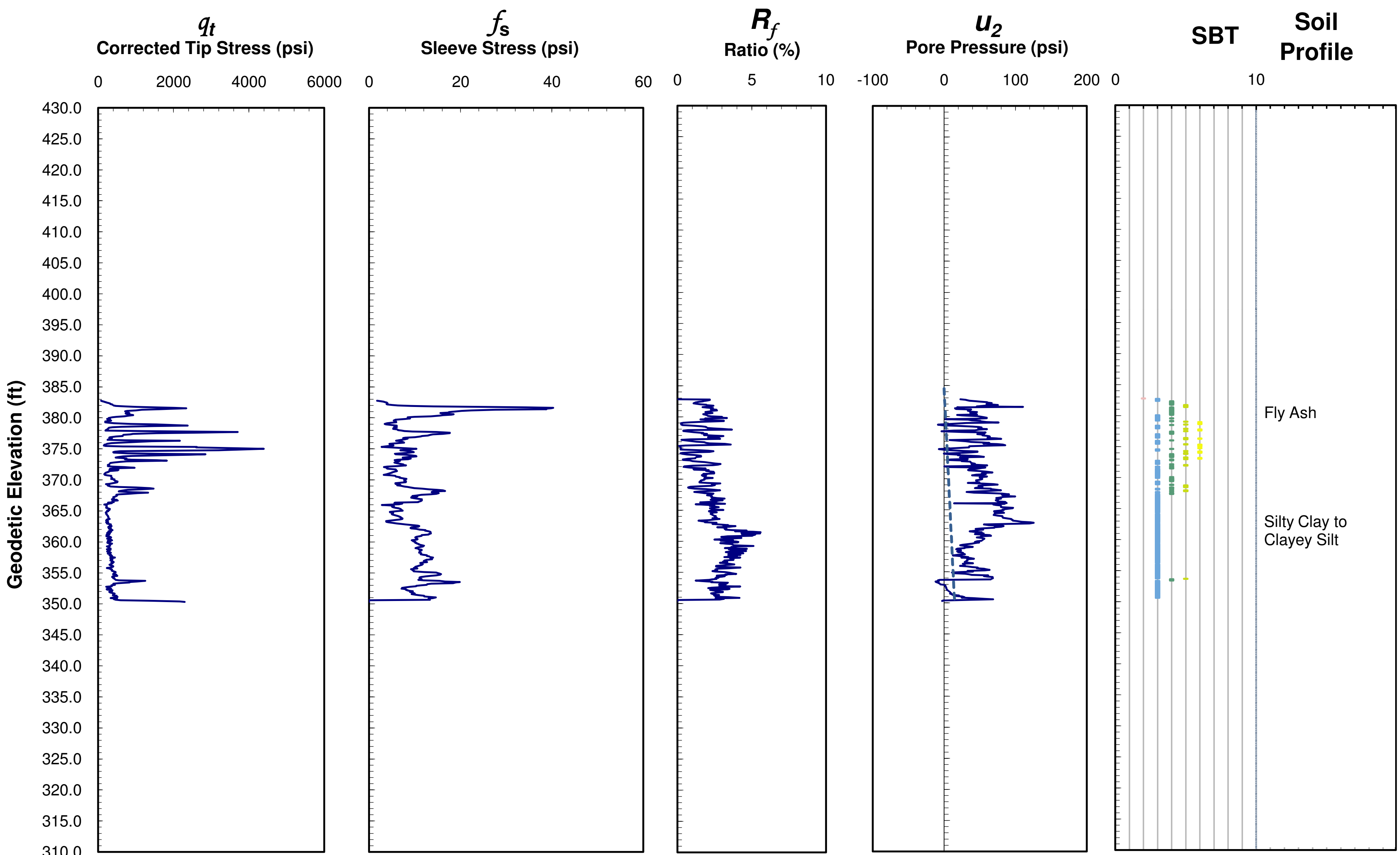
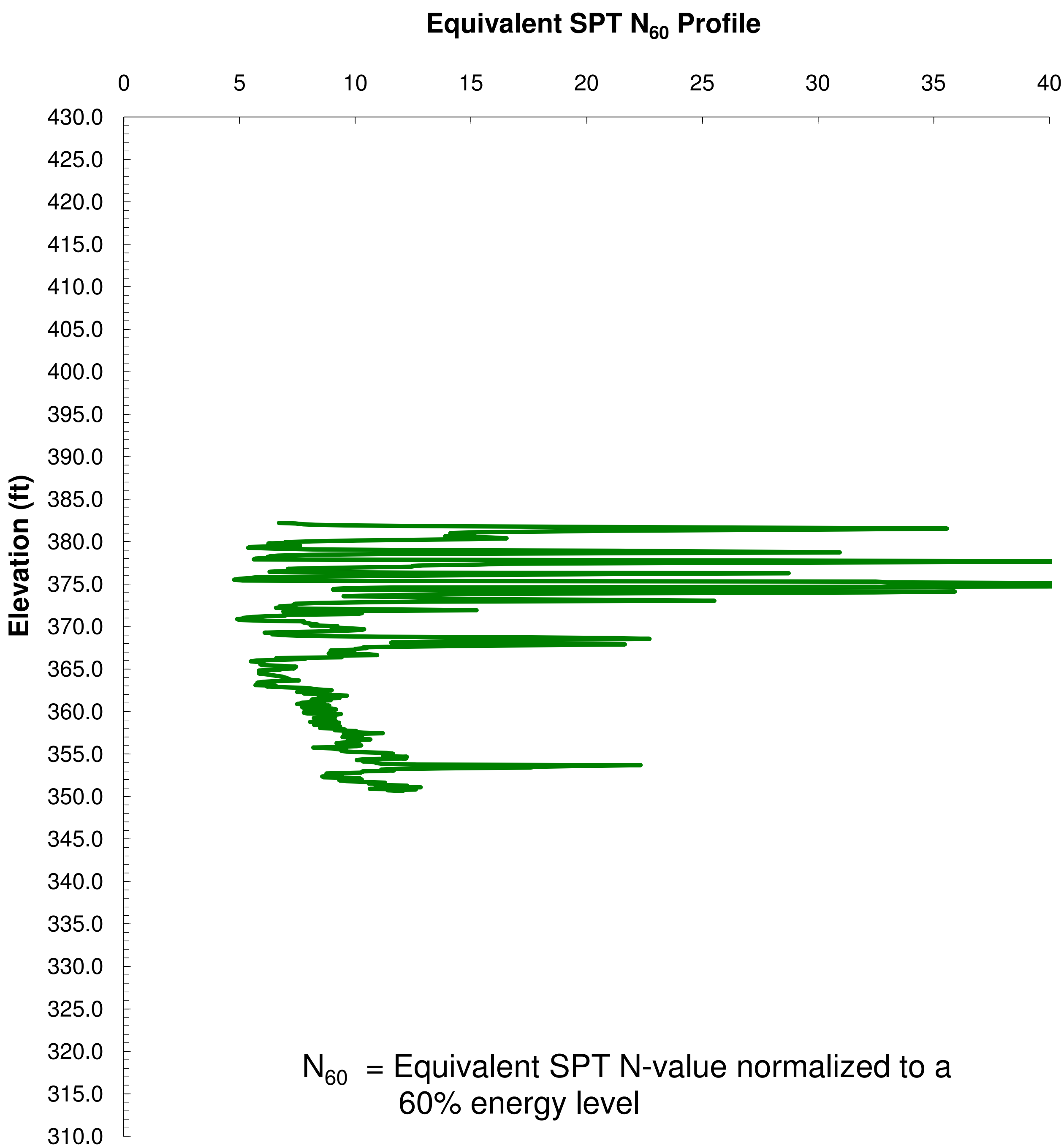
Stantec Consulting Inc.	Elevation: 425.00 ft SCPTu Start Elevation: 382.80 ft Groundwater Elevation: 384.50 ft	Test Date: June 28, 2009 Project No. 175539009	CPT23
	Client: TVA Project: Cumberland Fossil Plant		



Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values



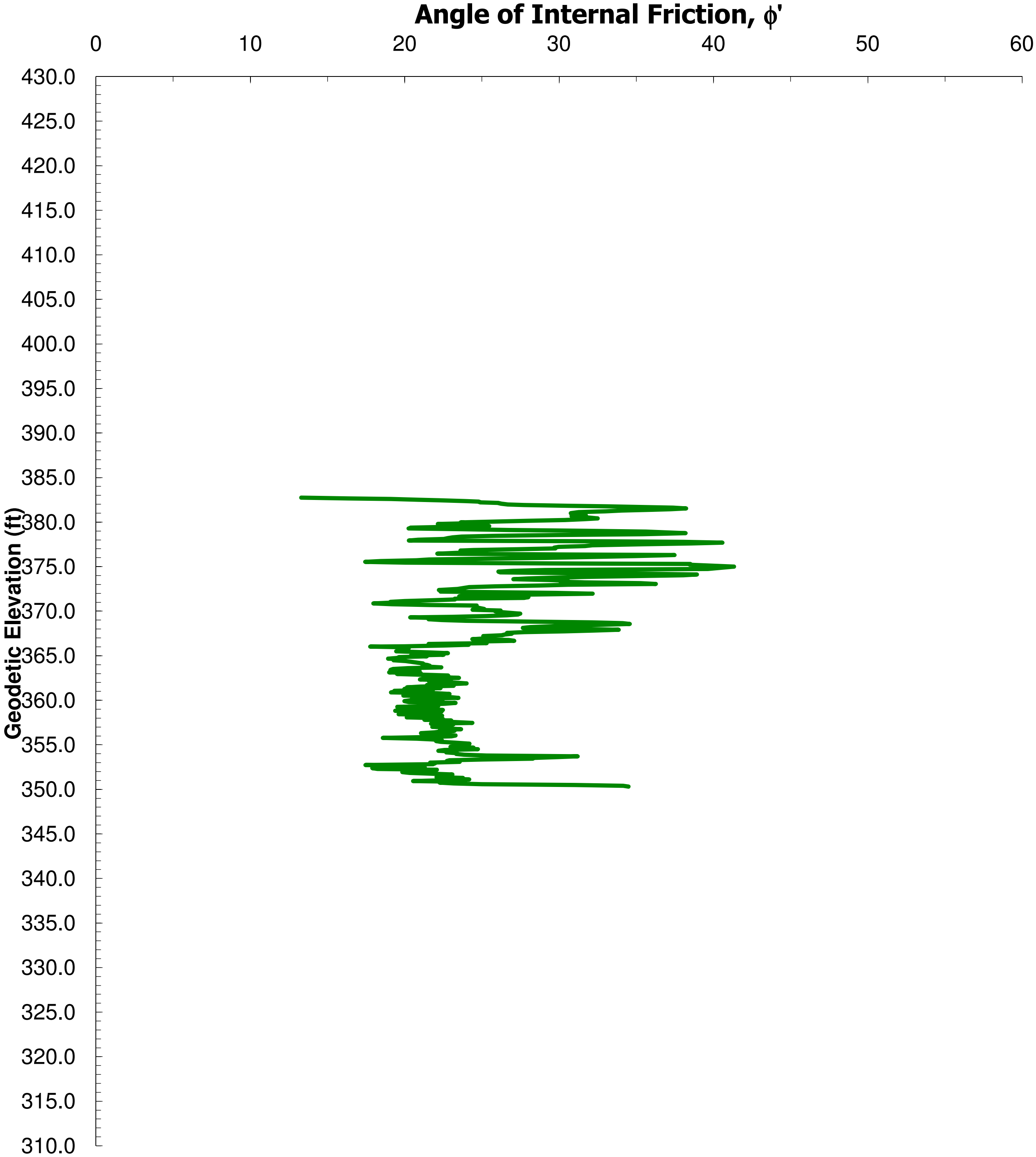
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT23

SCPTu RESULTS

Effective Angle of Internal Friction

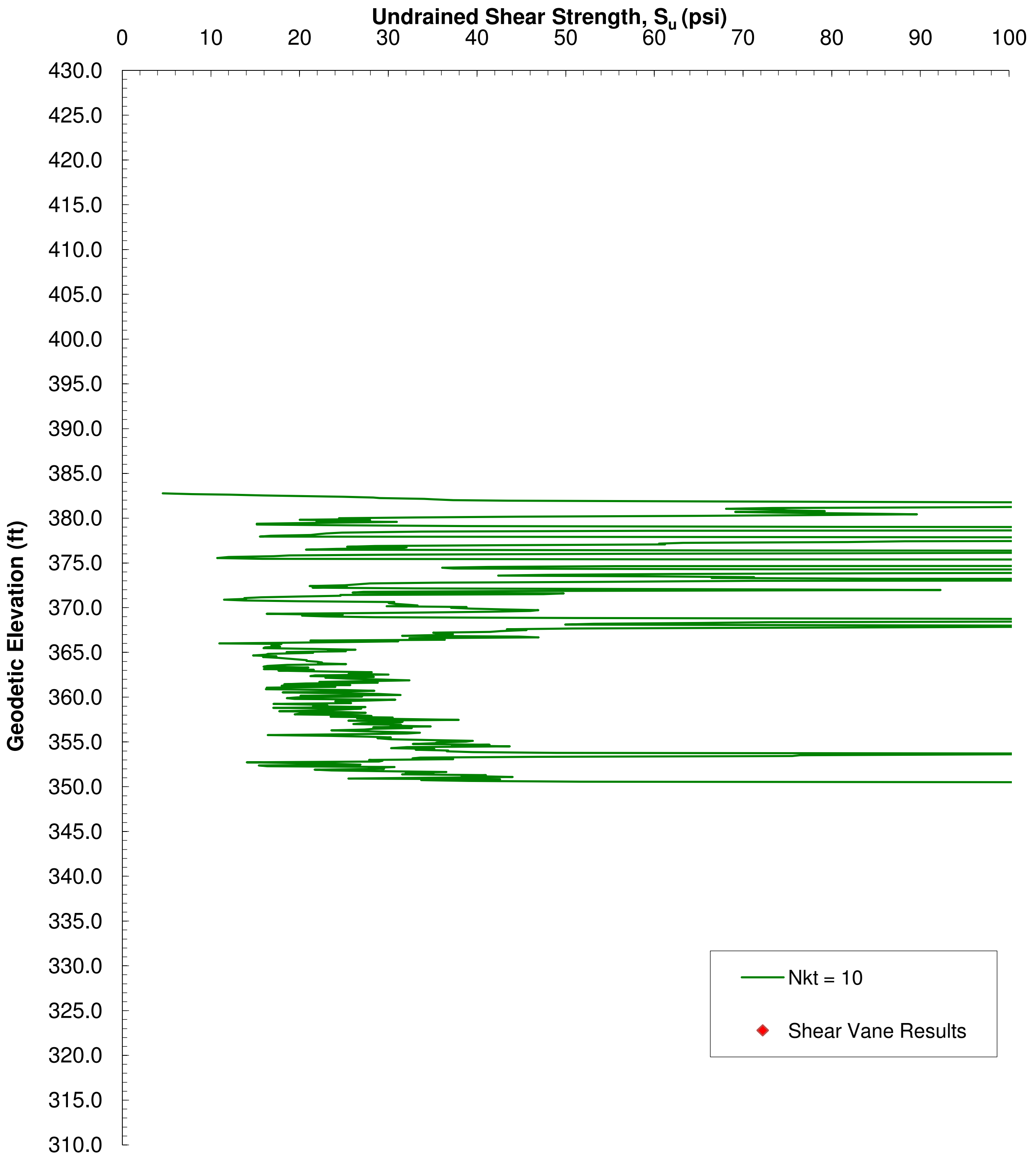


Project No. 175539009

CPT23

SCPTu RESULTS

Undrained Shear Strength, S_u

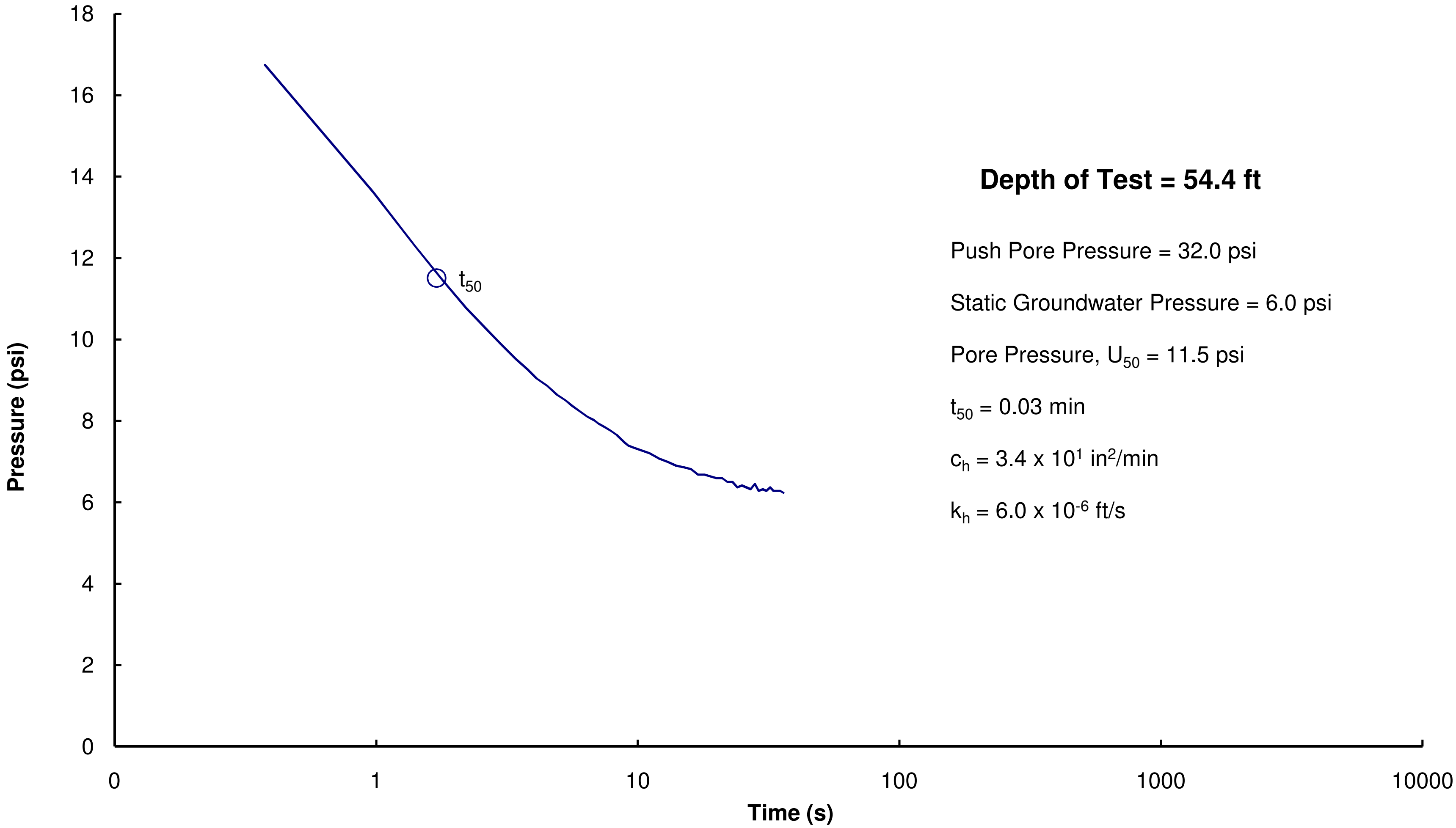


Project No. 175539009
CPT23

Stantec

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 54.4 ft

Push Pore Pressure = 32.0 psi

Static Groundwater Pressure = 6.0 psi

Pore Pressure, U_{50} = 11.5 psi

t_{50} = 0.03 min

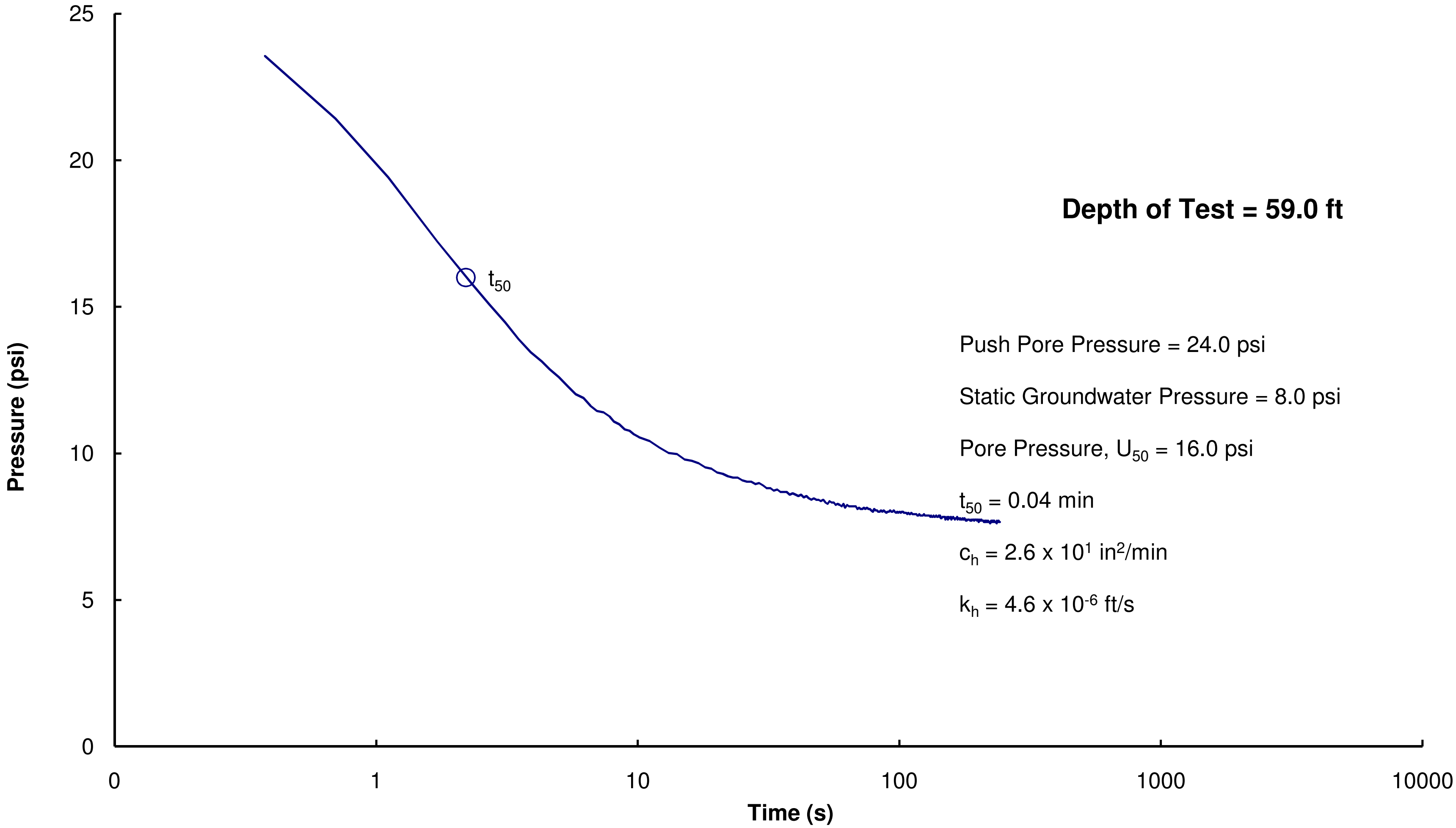
$c_h = 3.4 \times 10^1$ in^2/min

$k_h = 6.0 \times 10^{-6}$ ft/s

Project No. 175539009
CPT23

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Project No. 175539009
CPT23

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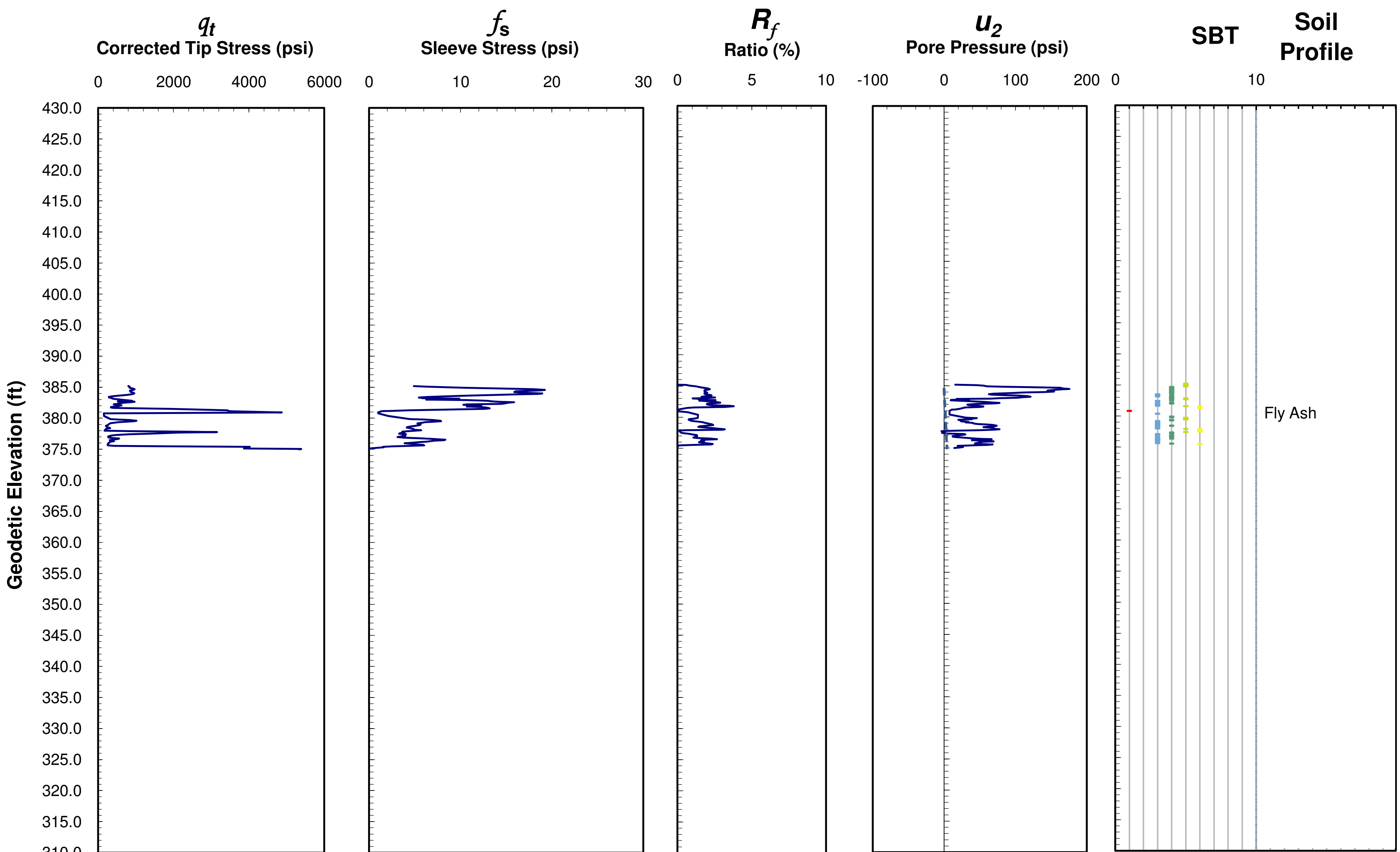
Stantec Consulting Inc.	Elevation: 425.00 ft SCPTu Start Elevation: 385.20 ft Groundwater Elevation: 384.50 ft	Test Date: June 28, 2009 Project No. 175539009	CPT24
	Client: TVA Project: Cumberland Fossil Plant		

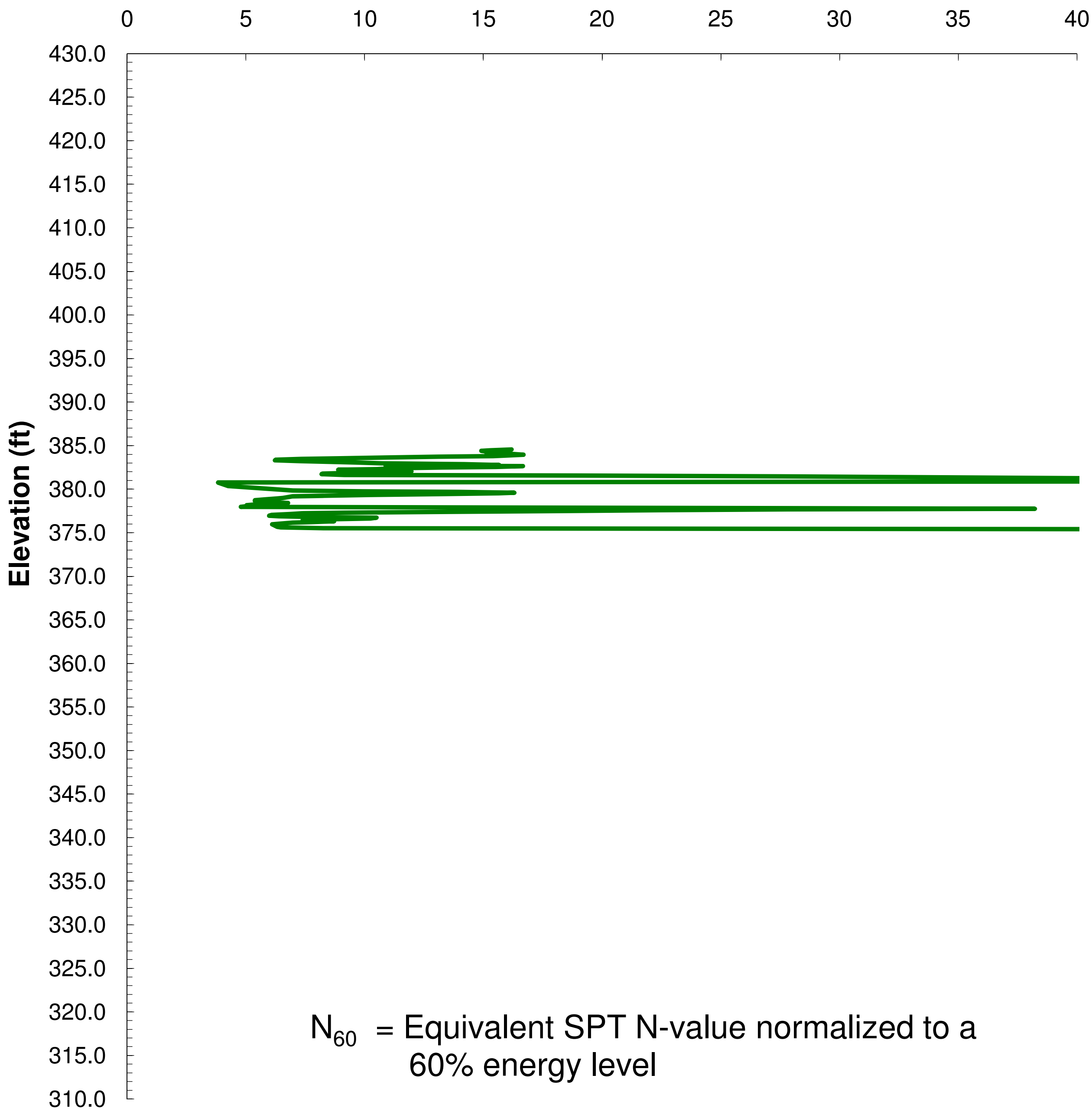


Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values

Equivalent SPT N_{60} Profile



N_{60} = Equivalent SPT N-value normalized to a 60% energy level

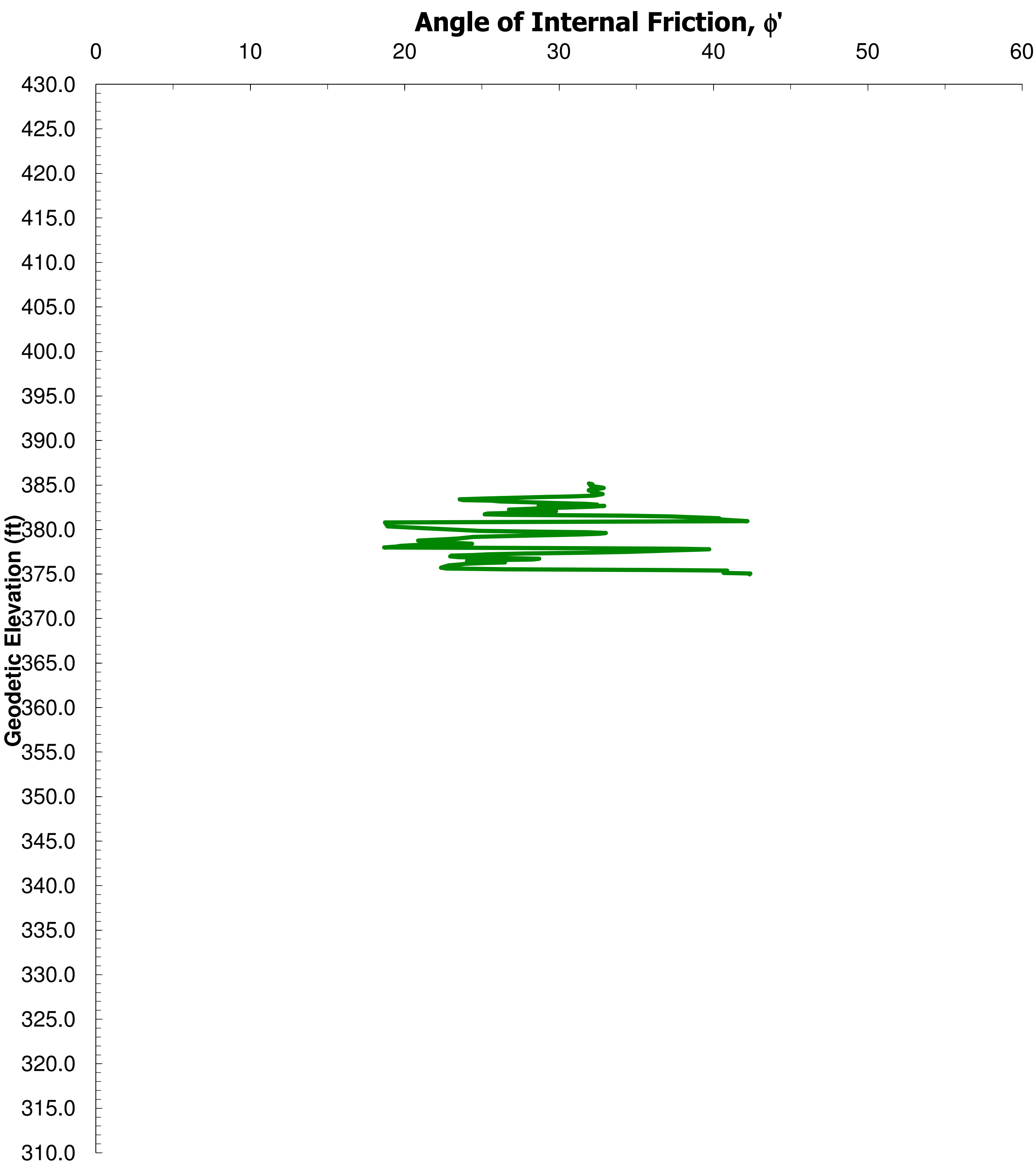
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT24

SCPTu RESULTS

Effective Angle of Internal Friction



Project No. 175539009

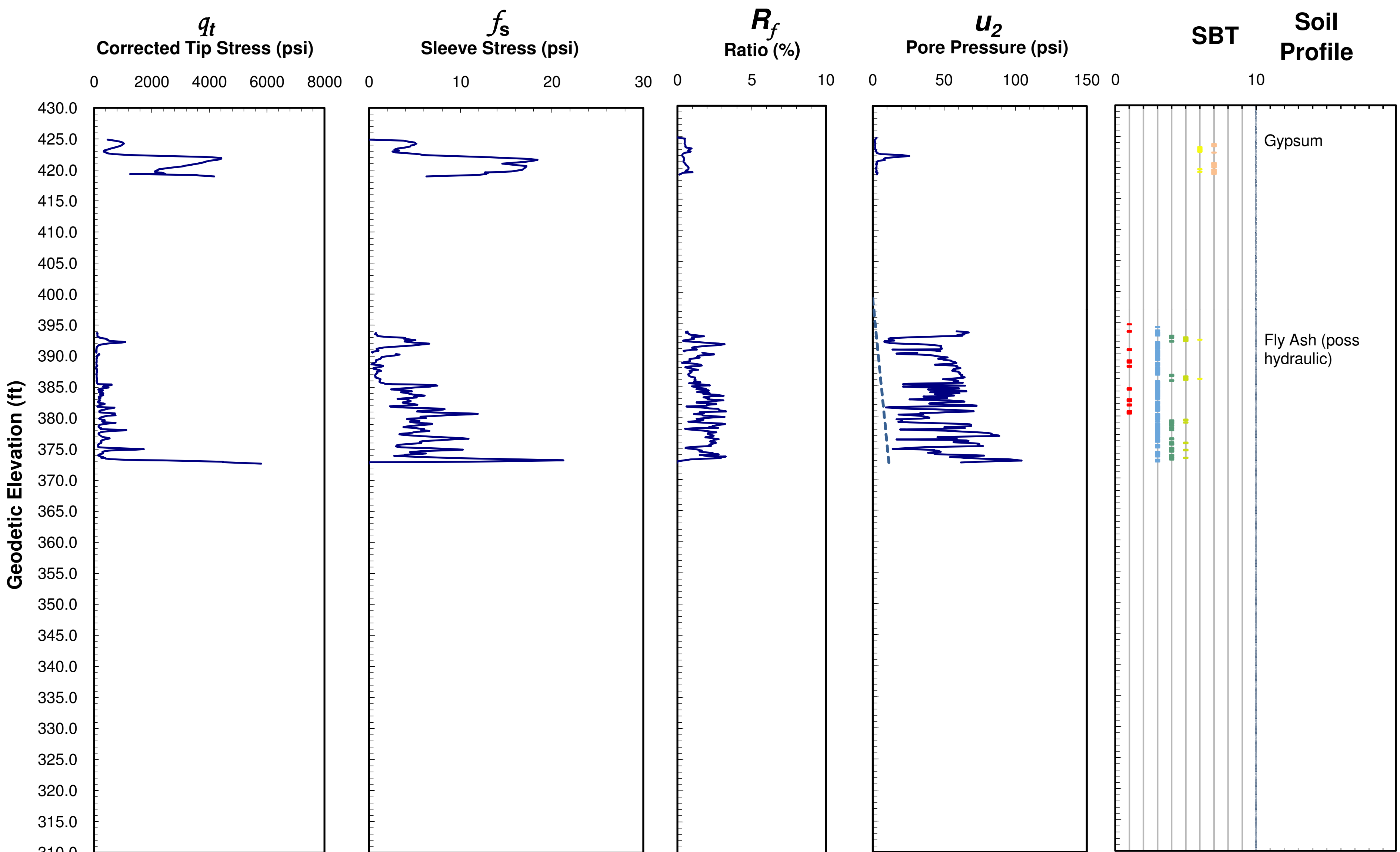
CPT24

SCPTu RESULTS

Undrained Shear Strength, S_u

Project No. 175539009
CPT24

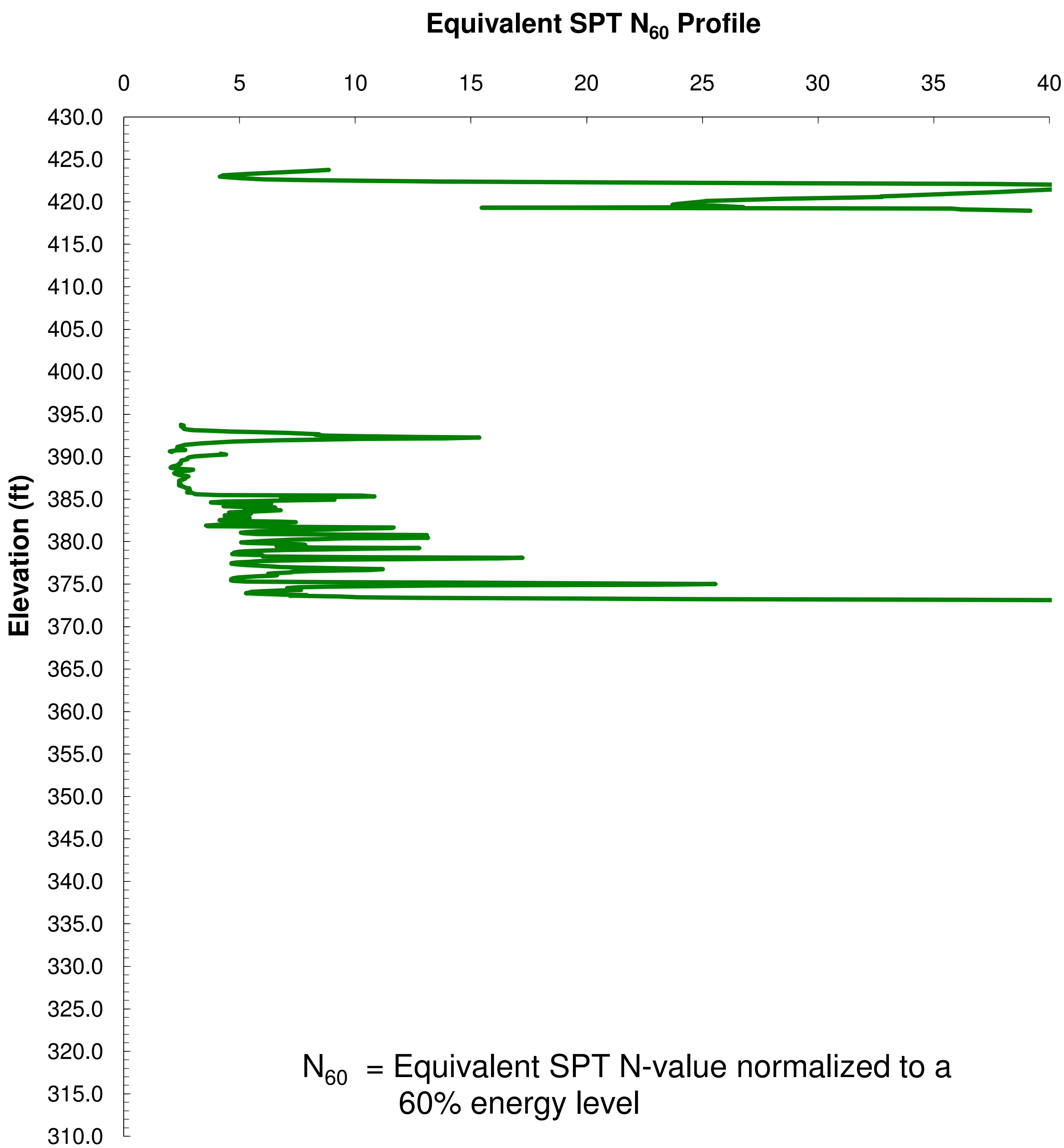
Stantec Consulting Inc.	Elevation: 425.00 ft SCPTu Start Elevation: 425.00 ft Groundwater Elevation: 399.00 ft	Test Date: June 29, 2009 Project No. 175539009	CPT25
	Client: TVA Project: Cumberland Fossil Plant		



Class Fr: Friction Ratio Classification (Robertson 1990)

SCPTu Results

SCPTu N_{60} Values



N_{60} = Equivalent SPT N-value normalized to a 60% energy level

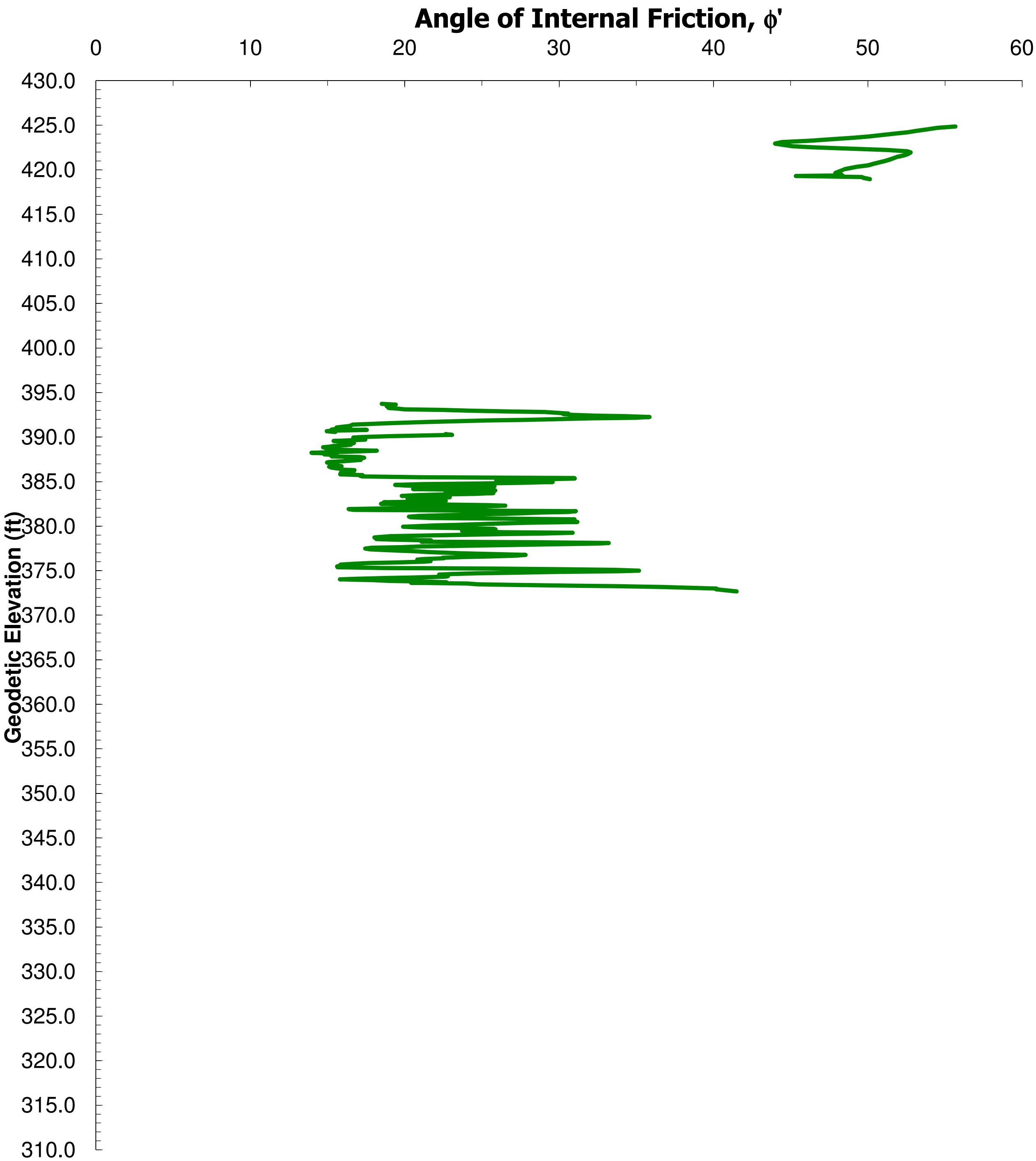
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT25

SCPTu RESULTS

Effective Angle of Internal Friction

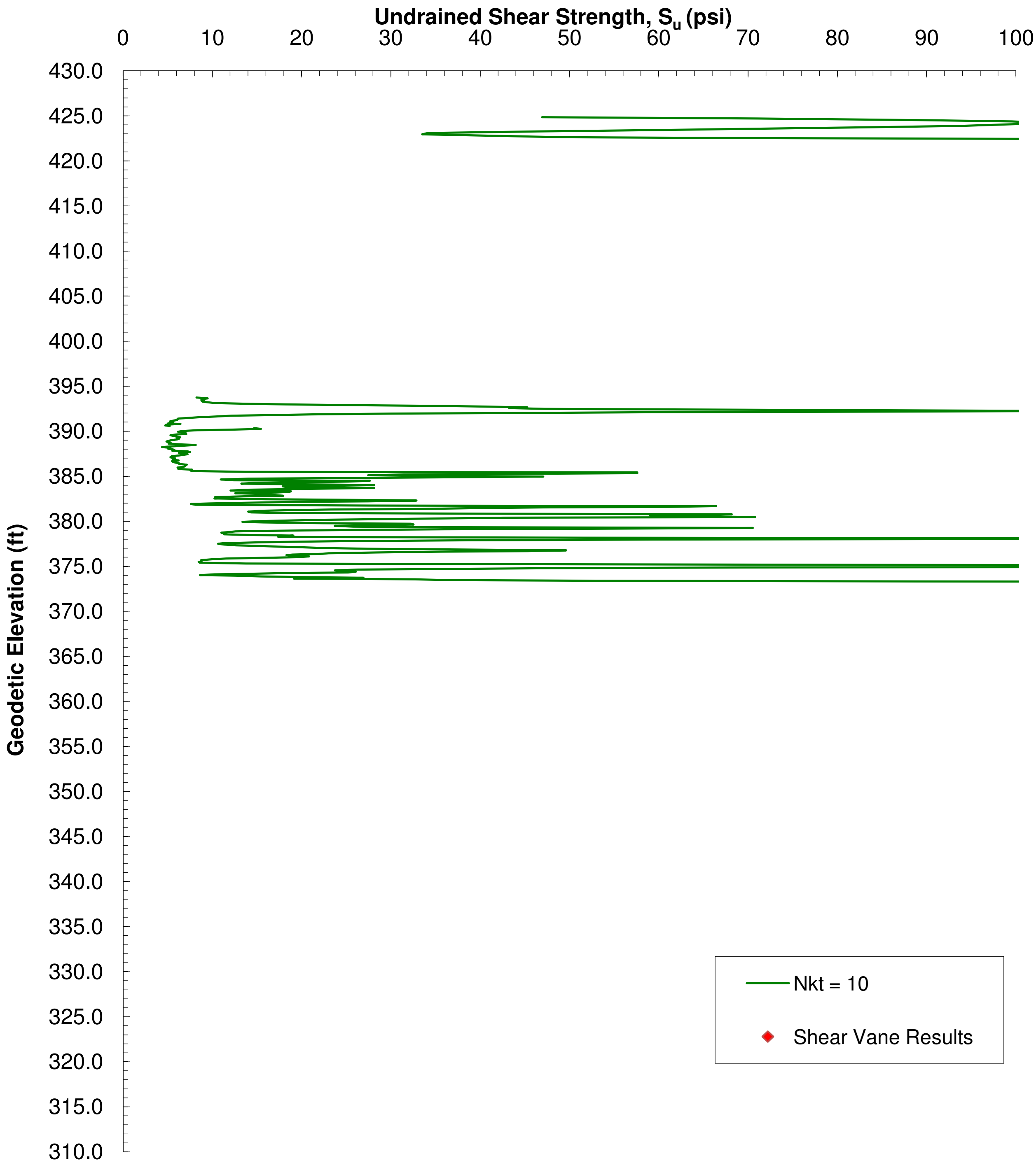


Project No. 175539009

CPT25

SCPTu RESULTS

Undrained Shear Strength, S_u

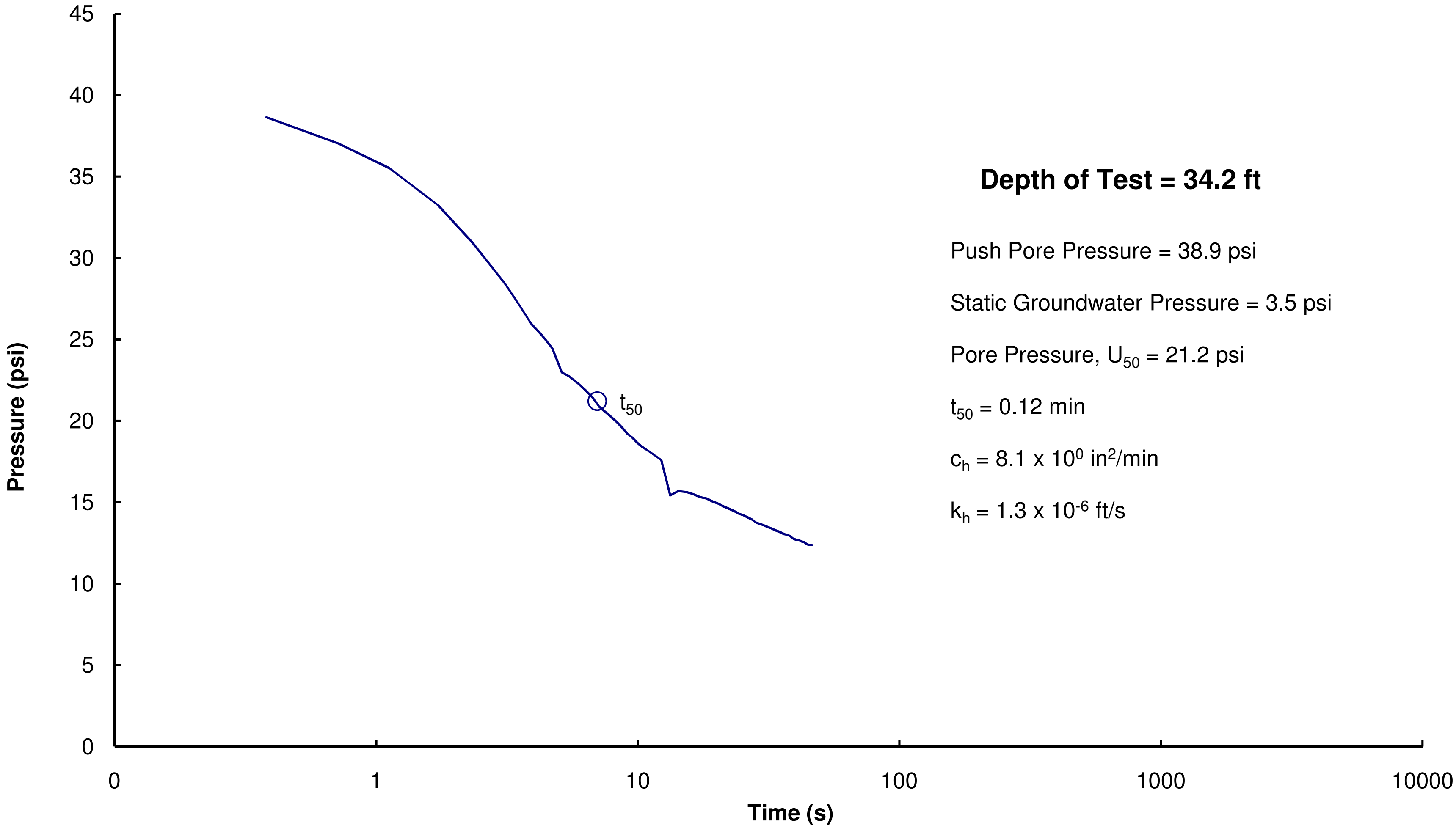


Project No. 175539009

CPT25

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 34.2 ft

Push Pore Pressure = 38.9 psi

Static Groundwater Pressure = 3.5 psi

Pore Pressure, U_{50} = 21.2 psi

t_{50} = 0.12 min

$c_h = 8.1 \times 10^0$ in^2/min

$k_h = 1.3 \times 10^{-6}$ ft/s

Project No. 175539009
CPT25

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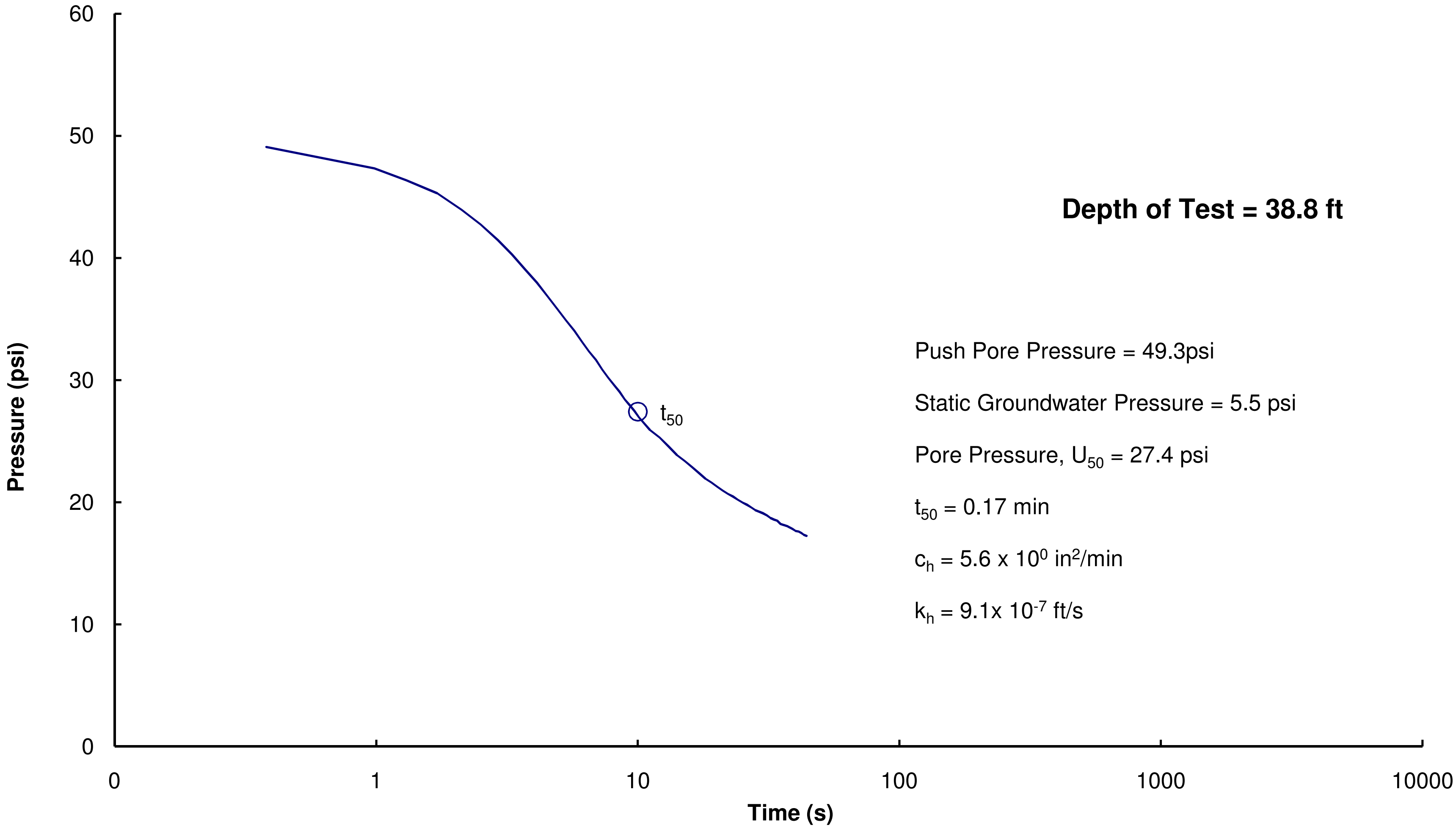
Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 38.8 ft

Push Pore Pressure = 49.3psi

Static Groundwater Pressure = 5.5 psi

Pore Pressure, U_{50} = 27.4 psi

t_{50} = 0.17 min

$c_h = 5.6 \times 10^0$ in^2/min

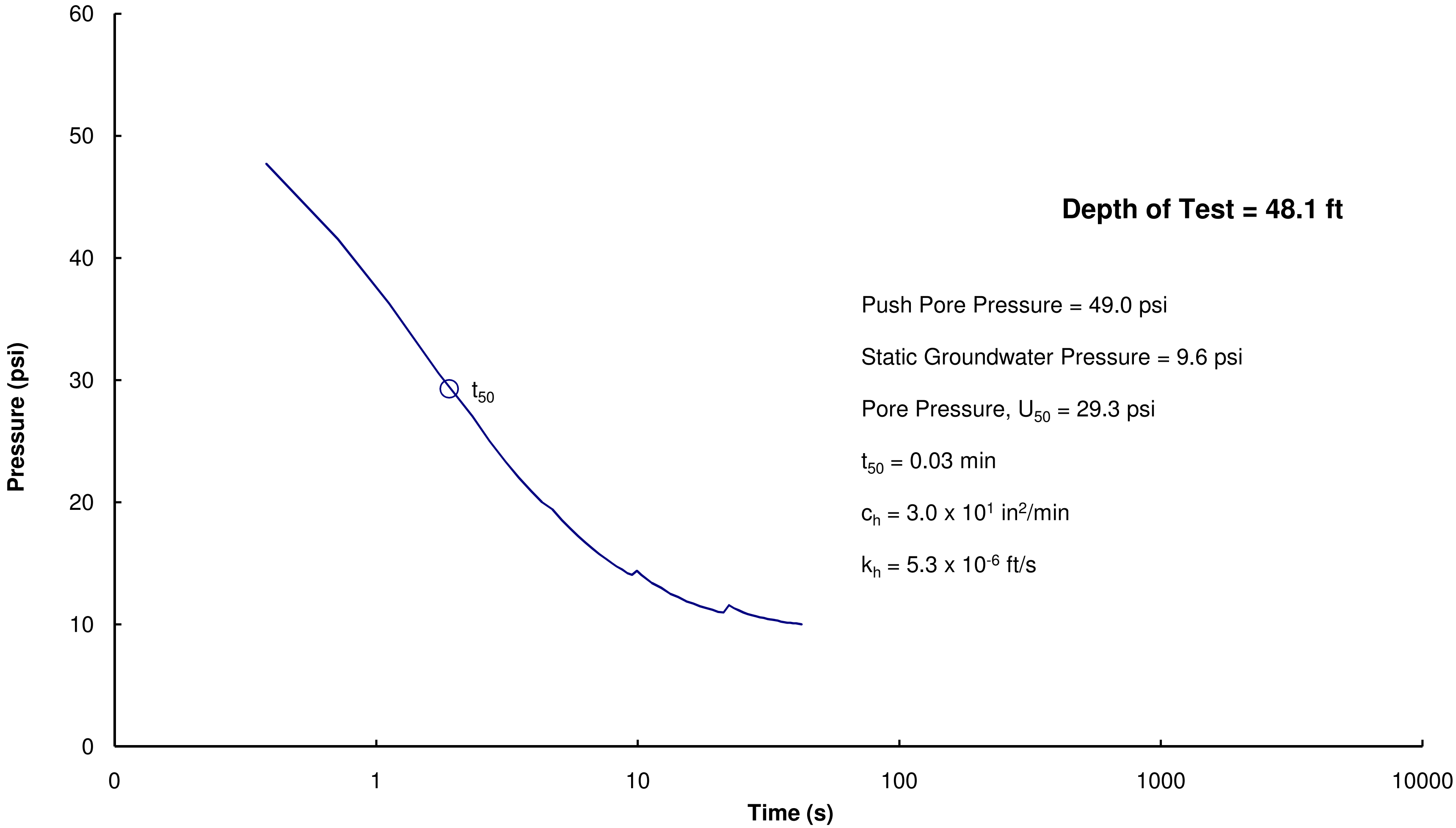
$k_h = 9.1 \times 10^{-7}$ ft/s

Project No. 175539009
CPT25

D:\My Documents\CUF-CPT\CPT25.xlsm

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 48.1 ft

Push Pore Pressure = 49.0 psi

Static Groundwater Pressure = 9.6 psi

Pore Pressure, U_{50} = 29.3 psi

t_{50} = 0.03 min

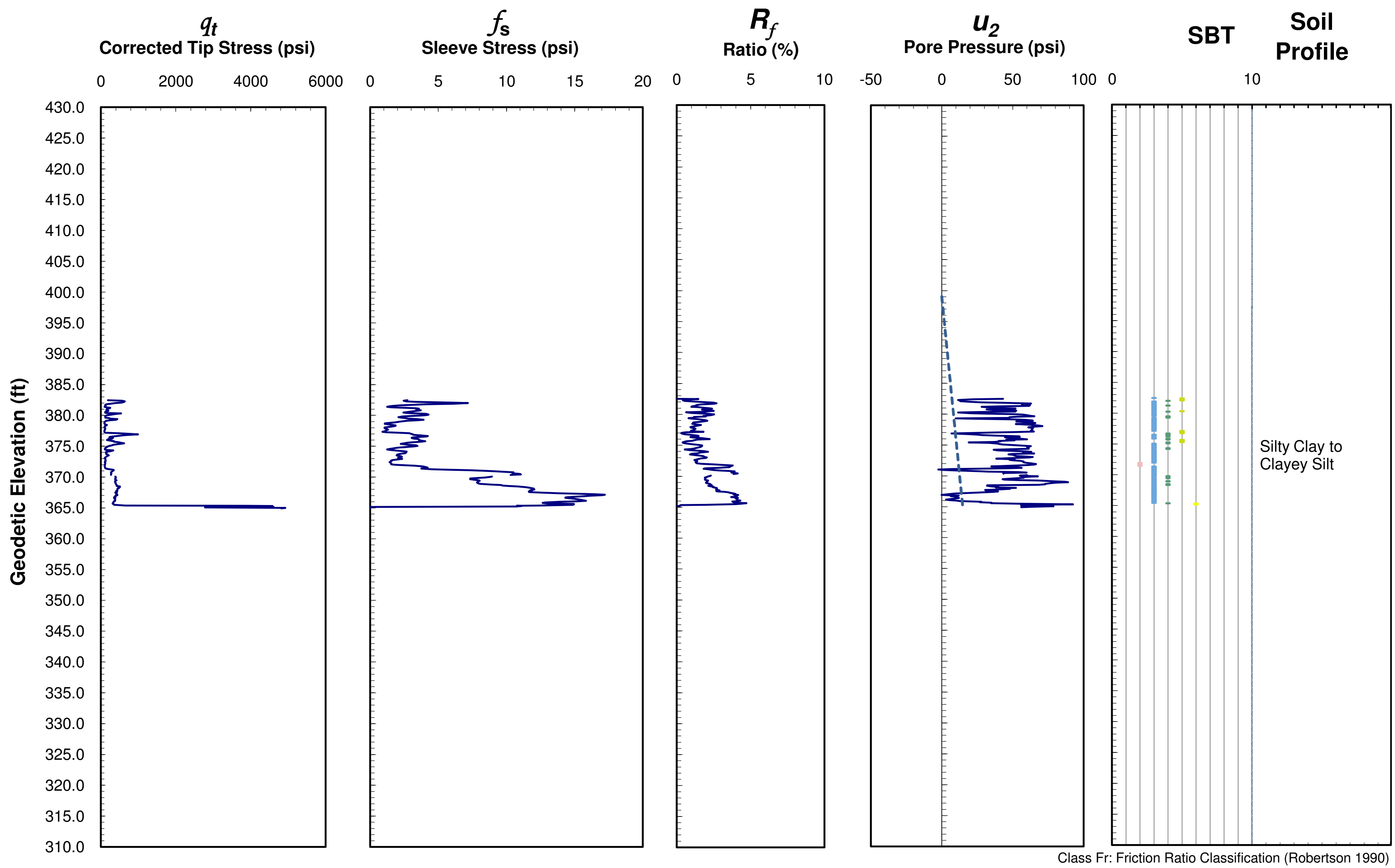
$c_h = 3.0 \times 10^1$ in^2/min

$k_h = 5.3 \times 10^{-6}$ ft/s

Project No. 175539009
CPT25

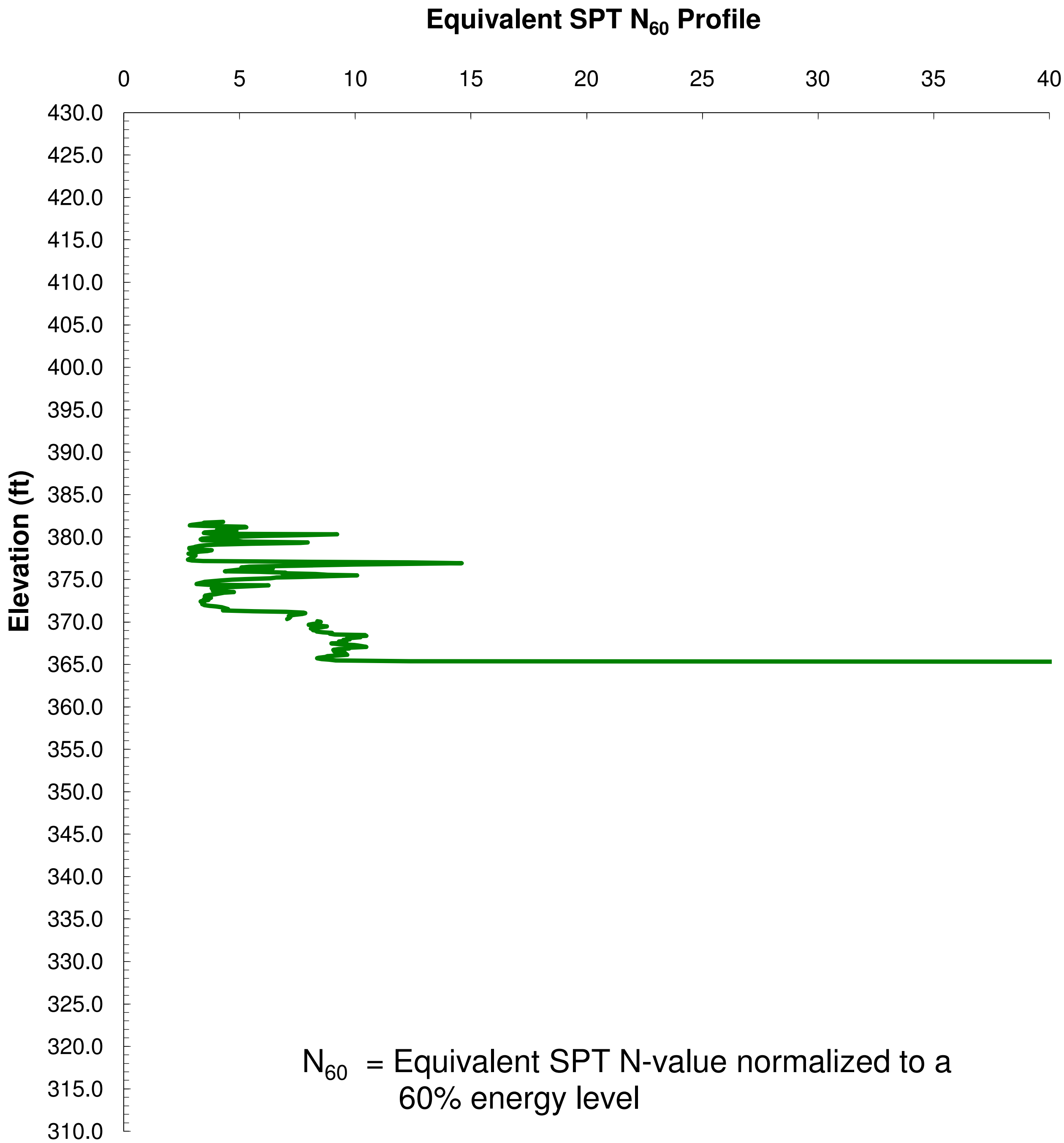
D:\My Documents\CUF-CPT\CPT25.xlsm

Stantec Consulting Inc.	Elevation: 425.00 ft SCPTu Start Elevation: 382.50 ft Groundwater Elevation: 399.00 ft	Test Date: June 29, 2009 Project No. 175539009	CPT26
	Client: TVA Project: Cumberland Fossil Plant		



SCPTu Results

SCPTu N_{60} Values



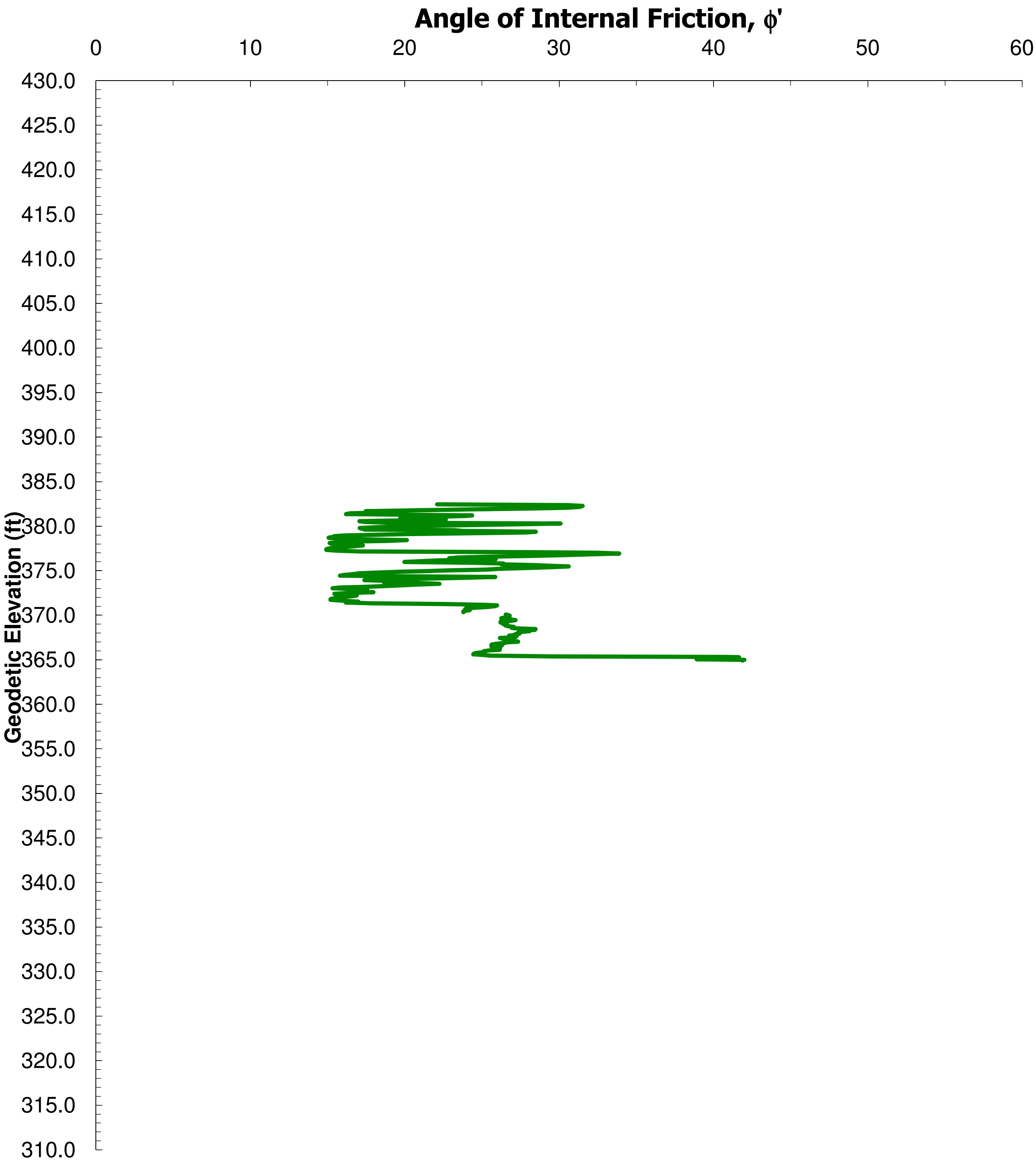
The correlation from SCPTu data to equivalent SPT N_{60} values is based on the Jefferies and Davies (1993) approach.

Project No. 175539009

CPT26

SCPTu RESULTS

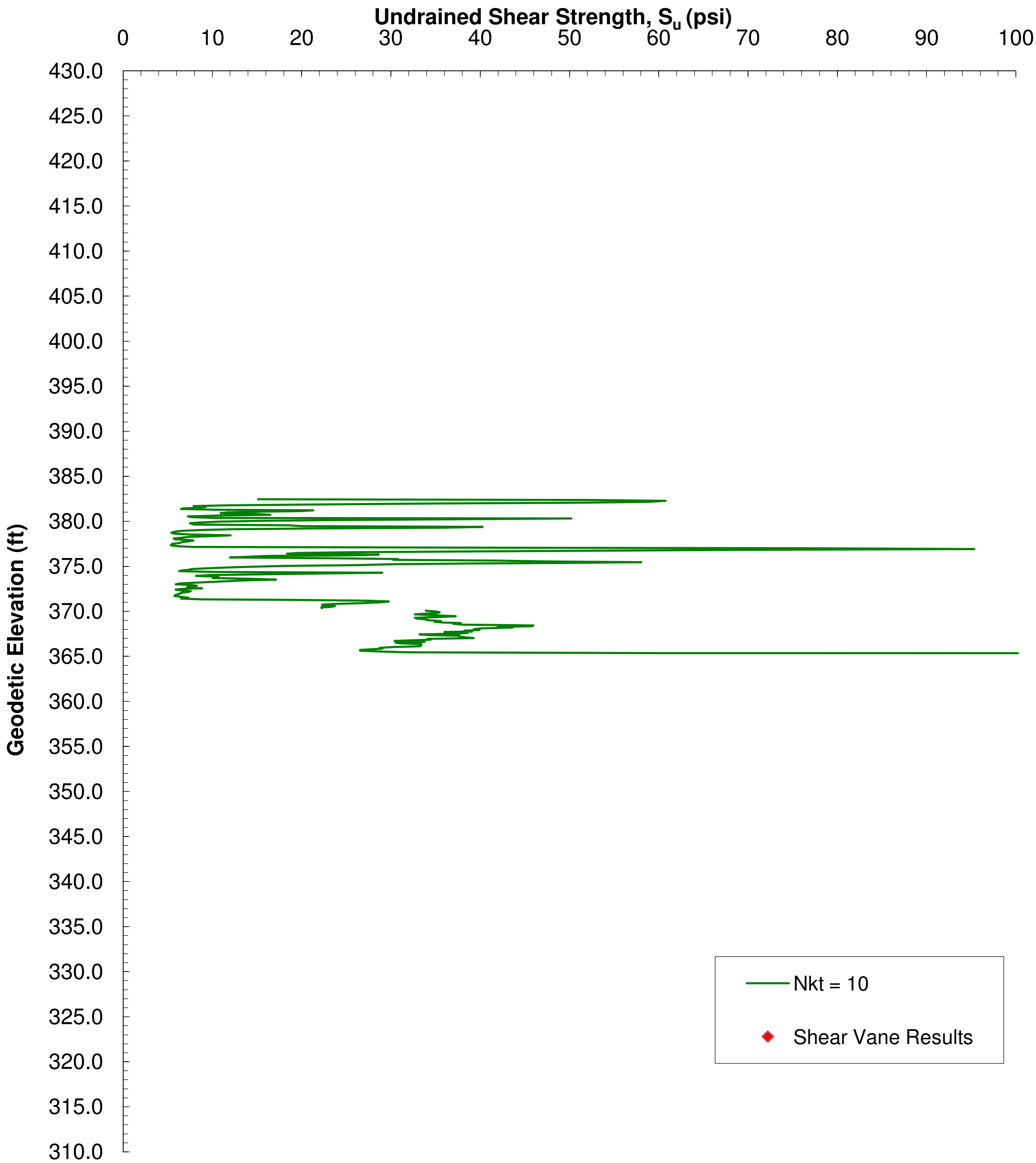
Effective Angle of Internal Friction



Project No. 175539009
CPT26

SCPTu RESULTS

Undrained Shear Strength, S_u

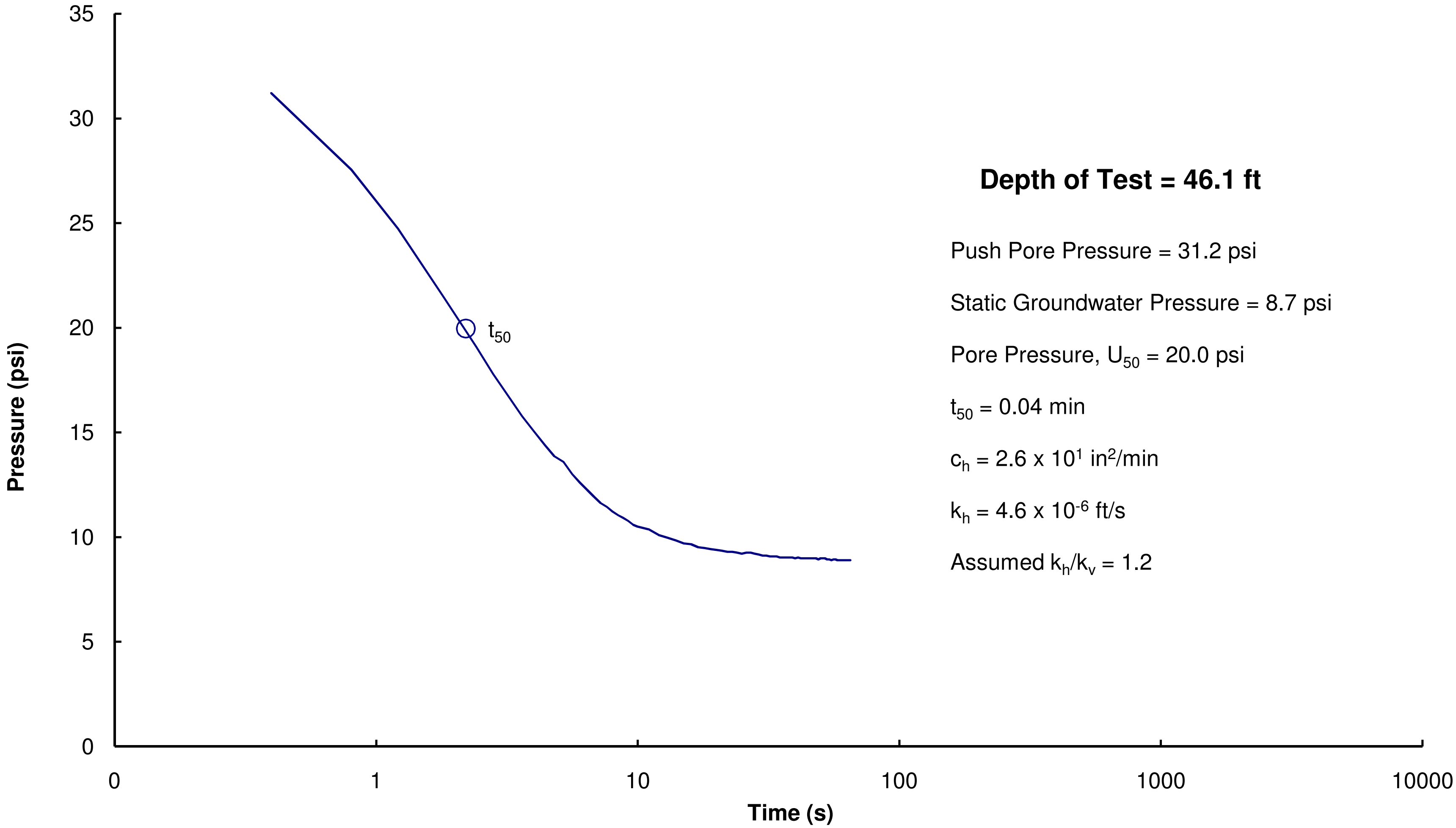


Project No. 175539009
CPT26

Stantec

Stantec Consulting Inc.

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



Depth of Test = 46.1 ft

Push Pore Pressure = 31.2 psi

Static Groundwater Pressure = 8.7 psi

Pore Pressure, U_{50} = 20.0 psi

t_{50} = 0.04 min

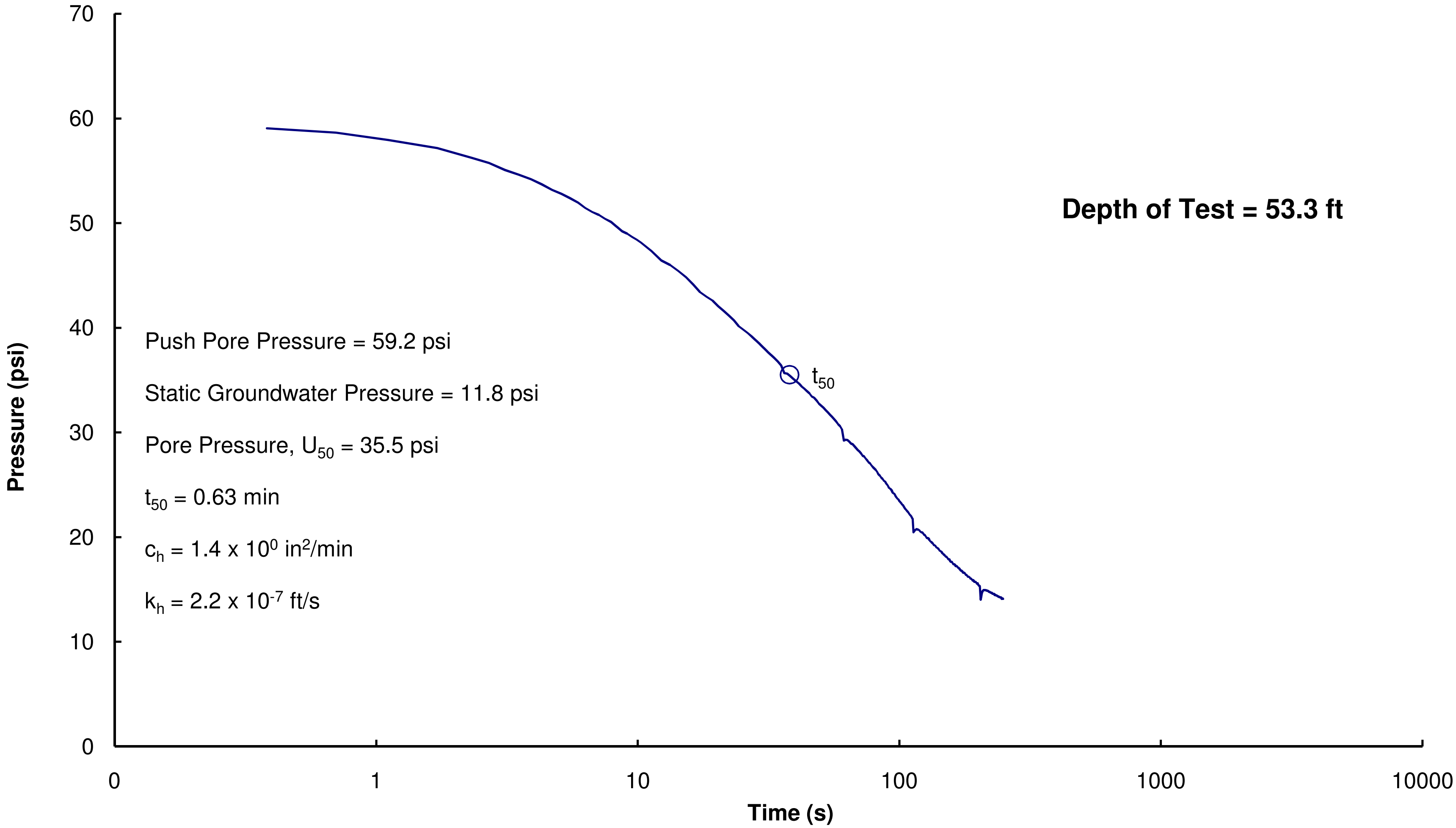
c_h = 2.6 x 10^1 in^2/min

k_h = 4.6 x 10^{-6} ft/s

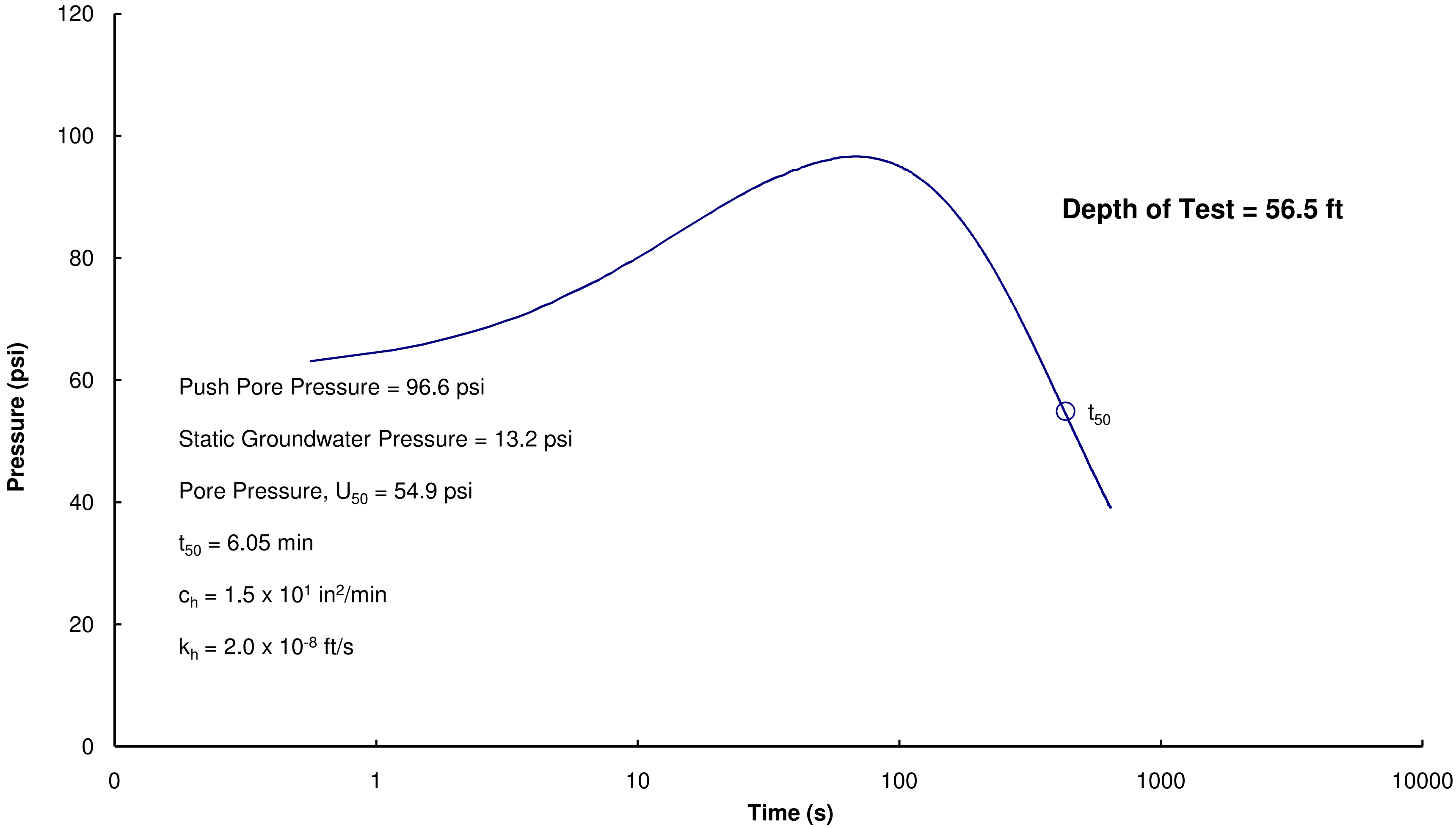
Assumed k_h/k_v = 1.2

Project No. 175539009
CPT26

SCPTu DISSIPATION RESULTS
Coefficient of Consolidation



SCPTu DISSIPATION RESULTS
Coefficient of Consolidation

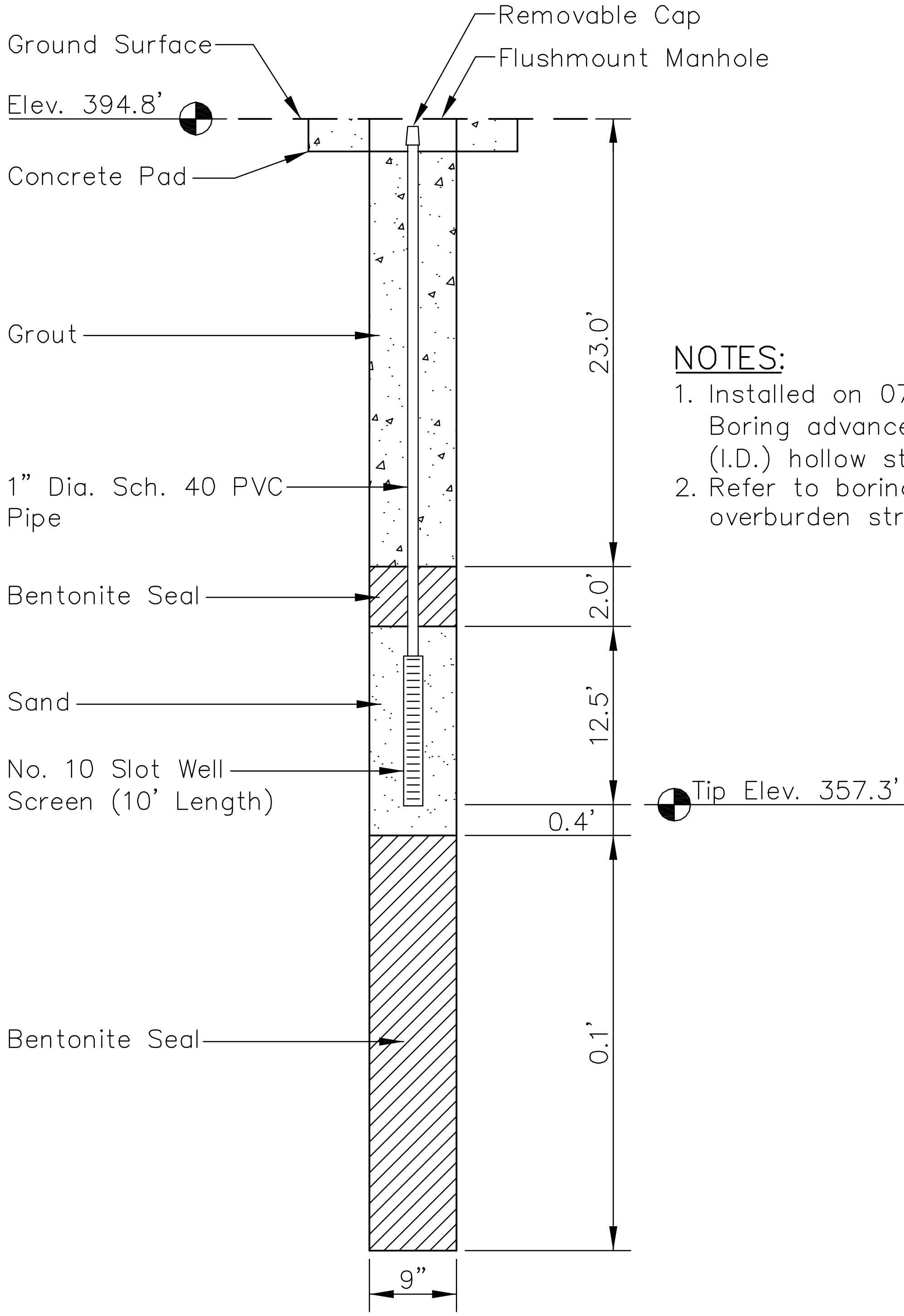


Project No. 175539009
CPT26

CPT Numbering	
Original	Redesignation
CPT-3	STN-64
CPT-4	STN-65
CPT-5	STN-66
CPT-6	STN-67
CPT-14	STN-68
CPT-14C	STN-69
CPT-15	STN-70
CPT-16	STN-71
CPT-17	STN-72
CPT-18	STN-73
CPT-19	STN-74
CPT-20	STN-75
CPT-22	STN-76
CPT-23	STN-77
CPT-24	STN-78
CPT-25	STN-79
CPT-26	STN-80

Appendix E

Instrumentation Logs



NOTES:

1. Installed on 07/15/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

LOCATION:

Northing: 732,139.24
Easting: 1,509,474.38
Ground Elevation: 394.8'

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

PIEZOMETER STN-3A
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

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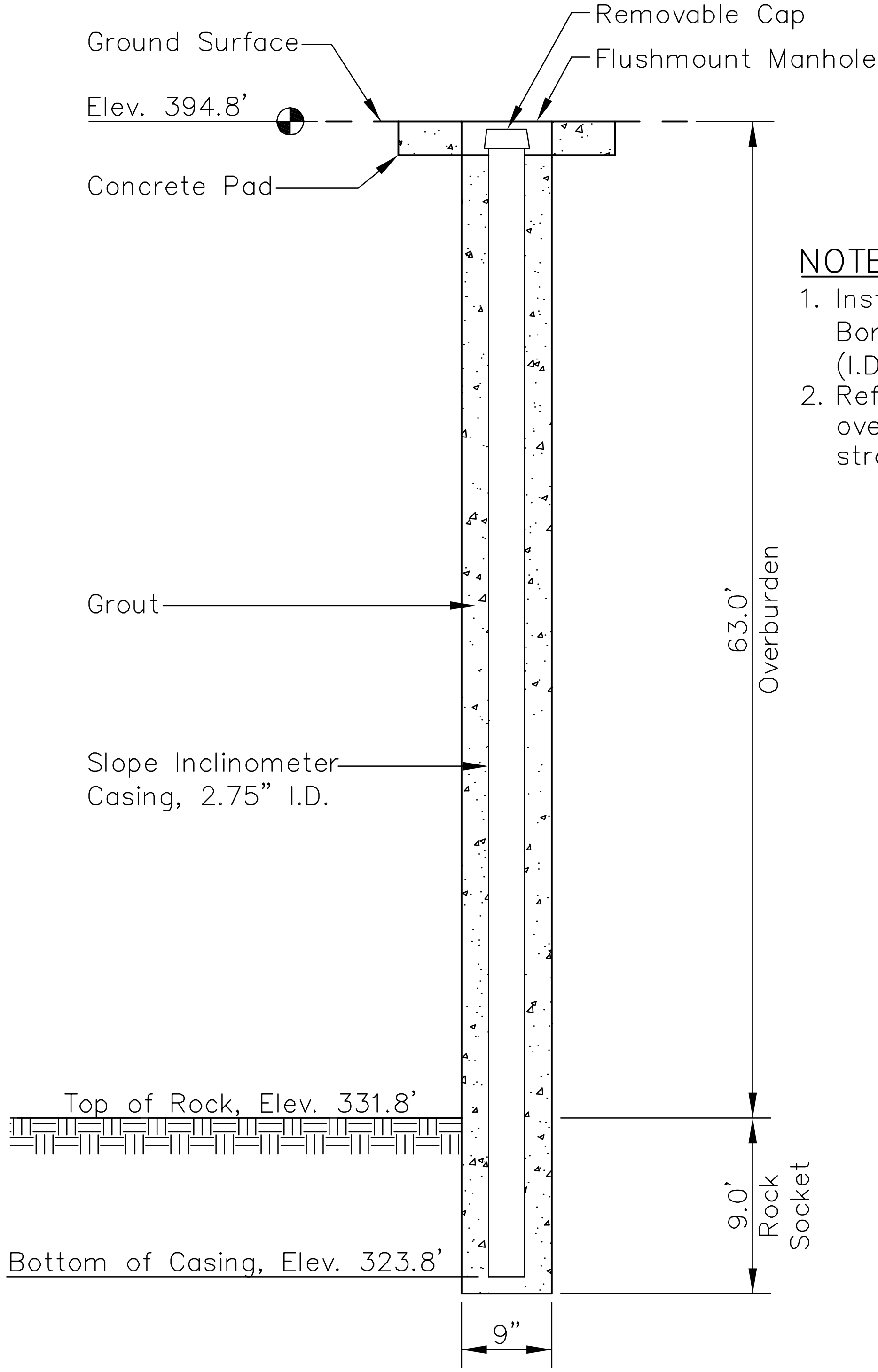
CHECKED BY	SAH	SCALE	NTS	2.	4.	

PLOT DATE: 10/07/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ3A.DWG



NOTES:
1. Installed on 07/14/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden and rock stratigraphy.

PLOT DATE: 10/07/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-SI3.DWG

LOCATION:
Northing: 732,139.24
Easting: 1,509,478.38
Ground Elevation: 394.8'

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

SLOPE INCLINOMETER STN-3
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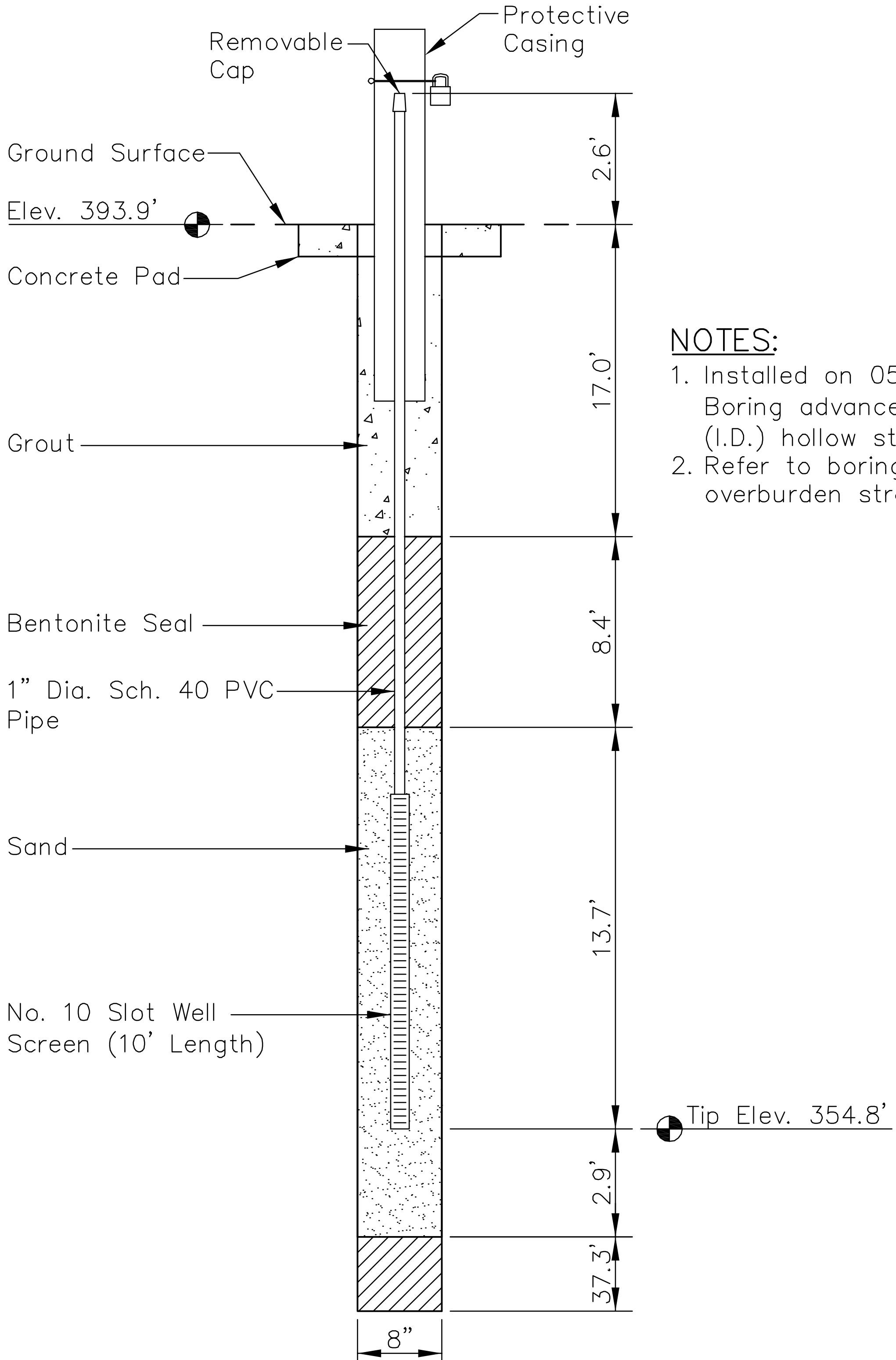

NOTES:
1. Installed on 05/31/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ4.DWG

LOCATION:
Northing: 731,897.61
Easting: 1,509,866.05
Ground Elevation: 393.9'

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

PIEZOMETER STN-4
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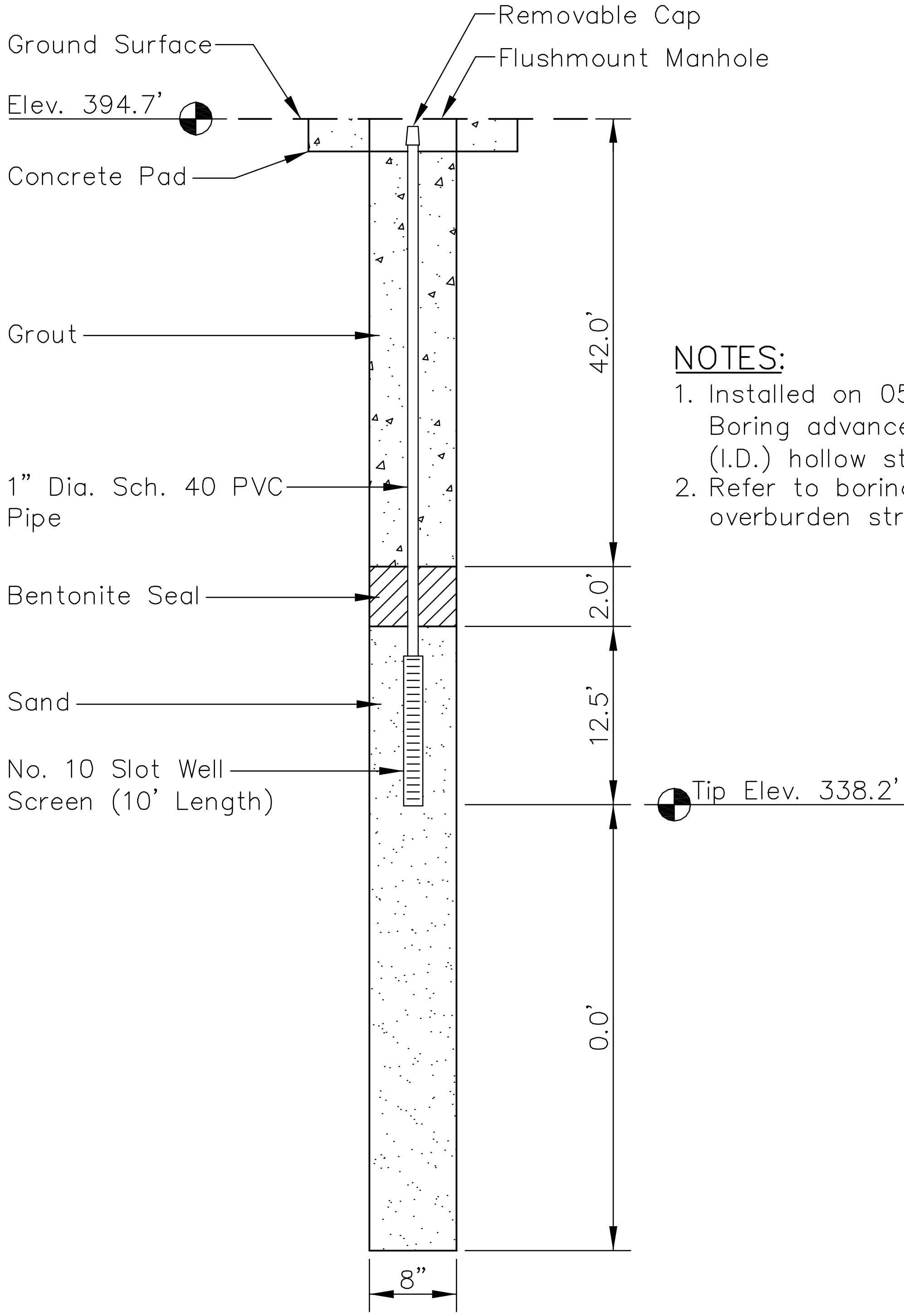
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 05/05/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ9.DWG

LOCATION:

Northing: 730,659.51
Easting: 1,509,396.49
Ground Elevation: 394.7'

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

PIEZOMETER STN-9
DRY FLY ASH STACK
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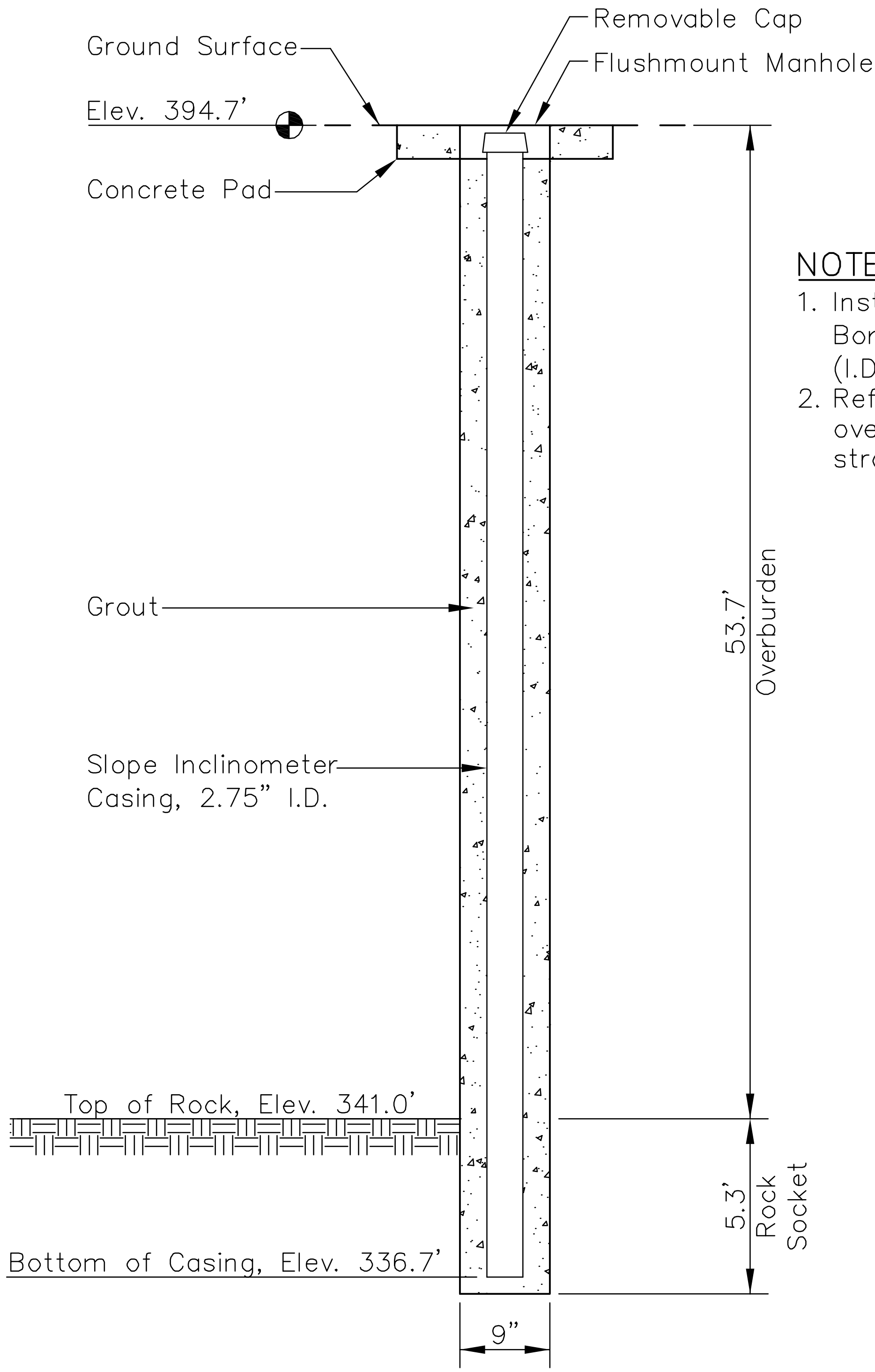
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:
1. Installed on 05/05/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden and rock stratigraphy.

PLOT DATE: 10/07/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-SI9A.DWG

LOCATION:
Northing: 730,655.56
Easting: 1,509,398.56
Ground Elevation: 394.7'

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

SLOPE INCLINOMETER STN-9A
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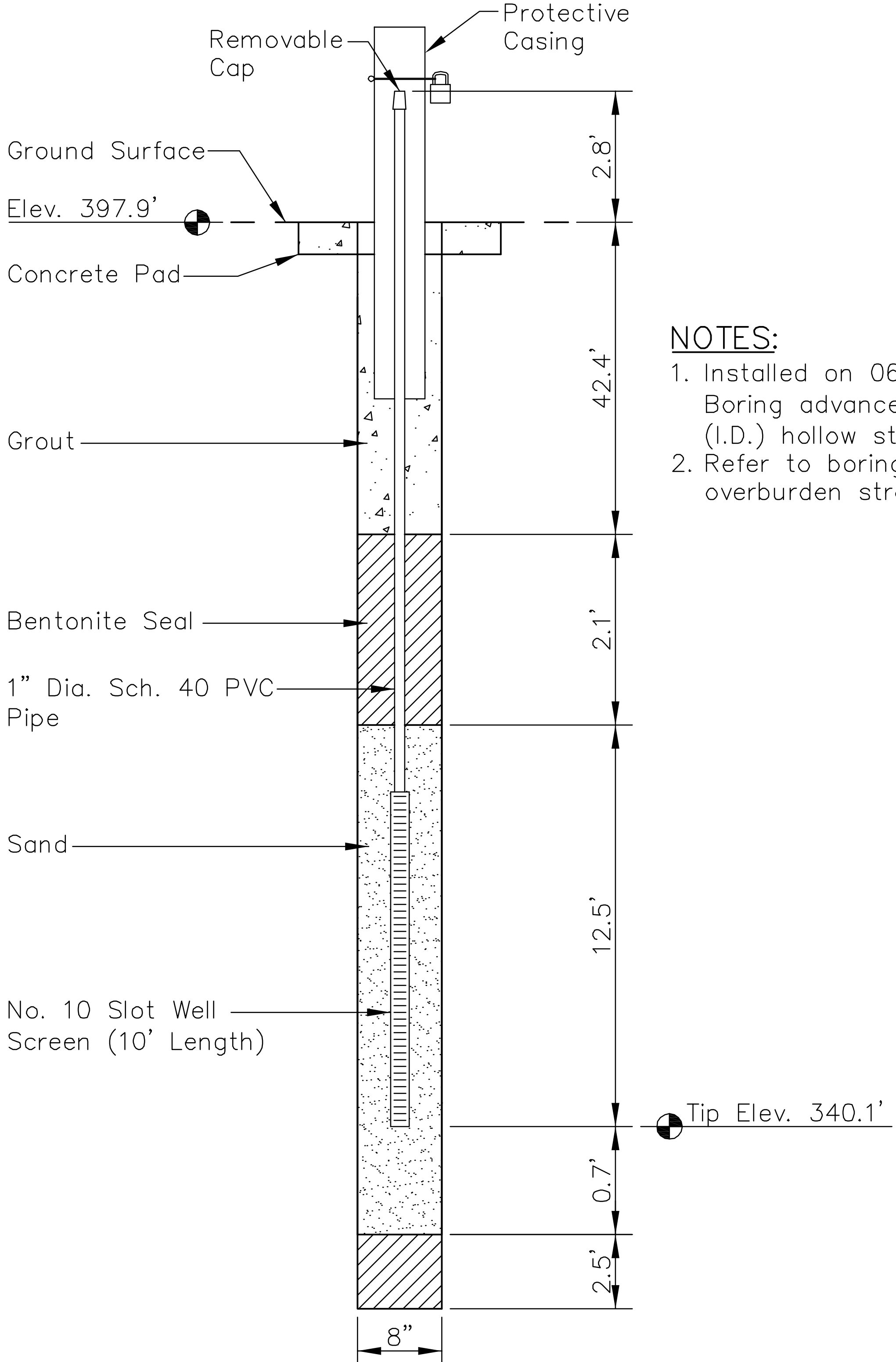
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:
1. Installed on 06/17/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ10.DWG

LOCATION:
Northing: 730,721.30
Easting: 1,509,488.66
Ground Elevation: 397.9'

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

PIEZOMETER STN-10
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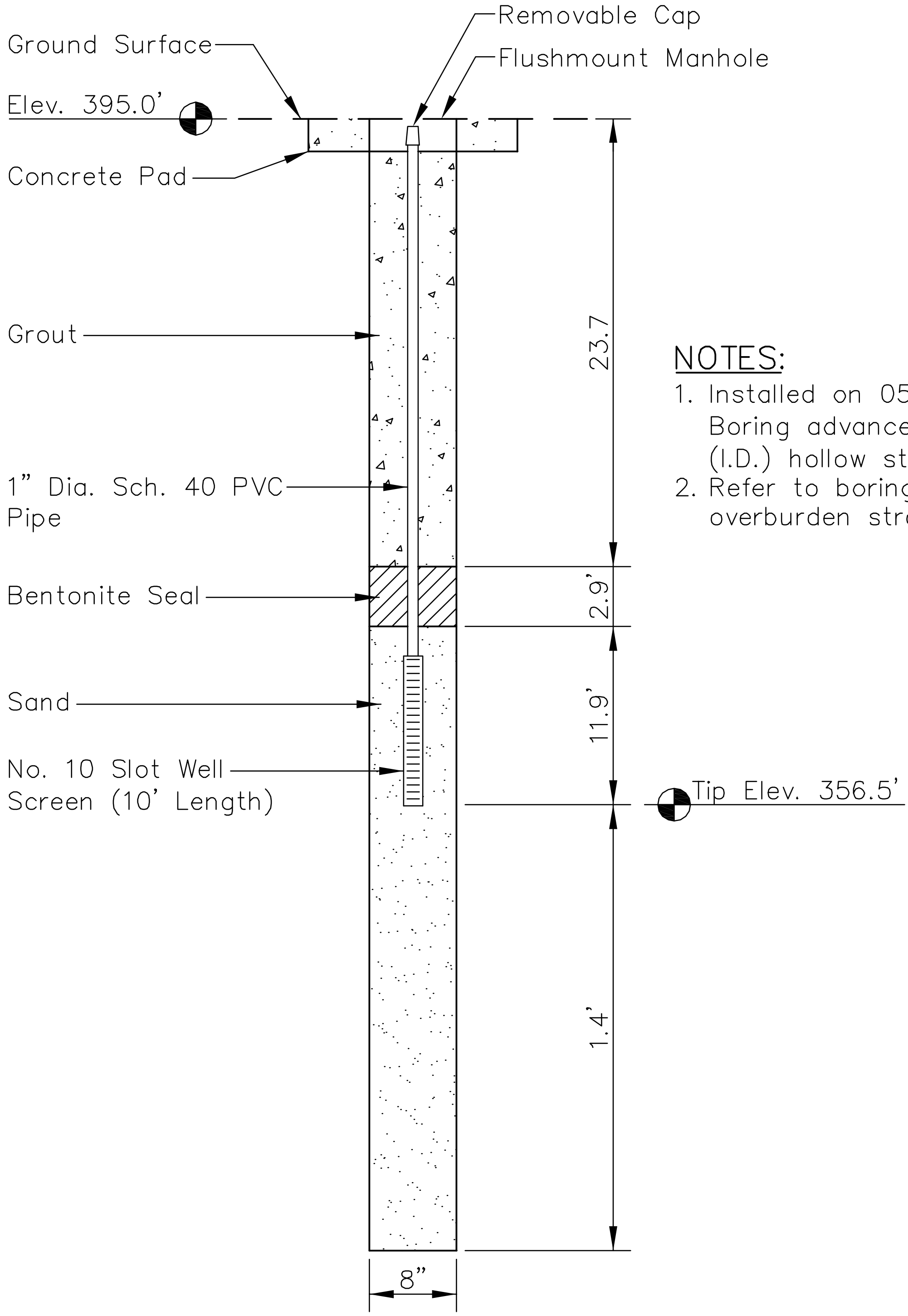
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 05/13/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ15A.DWG

LOCATION:

Northing: 729,713.11
Easting: 1,510,331.12
Ground Elevation: 395.0'

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

PIEZOMETER STN-15A
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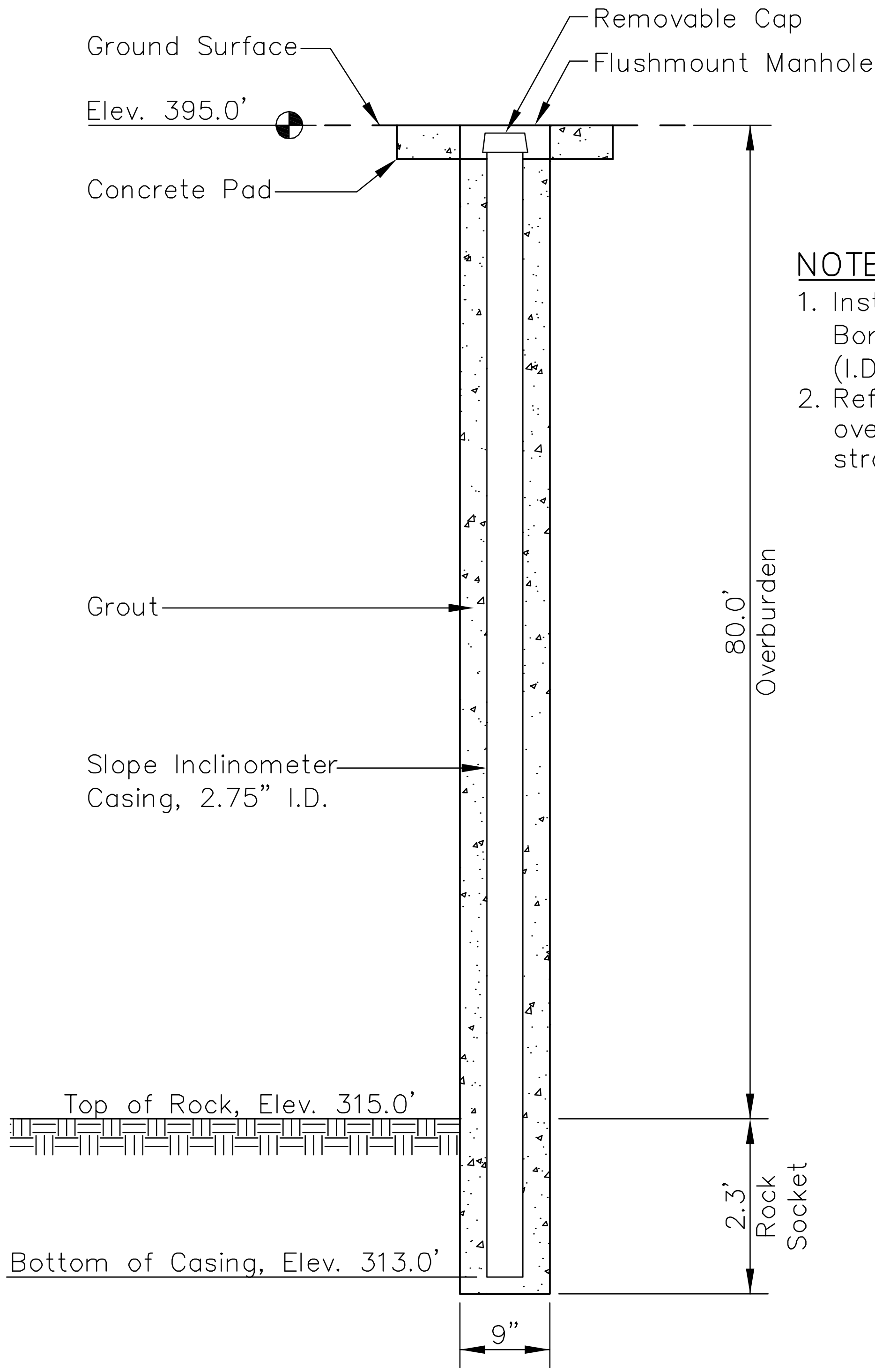

NOTES:

1. Installed on 05/19/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden and rock stratigraphy.

PLOT DATE: 10/07/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-SI15B.DWG

LOCATION:

Northing: 729,715.91
Easting: 1,510,328.25
Ground Elevation: 395.0'

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

SLOPE INCLINOMETER STN-15B
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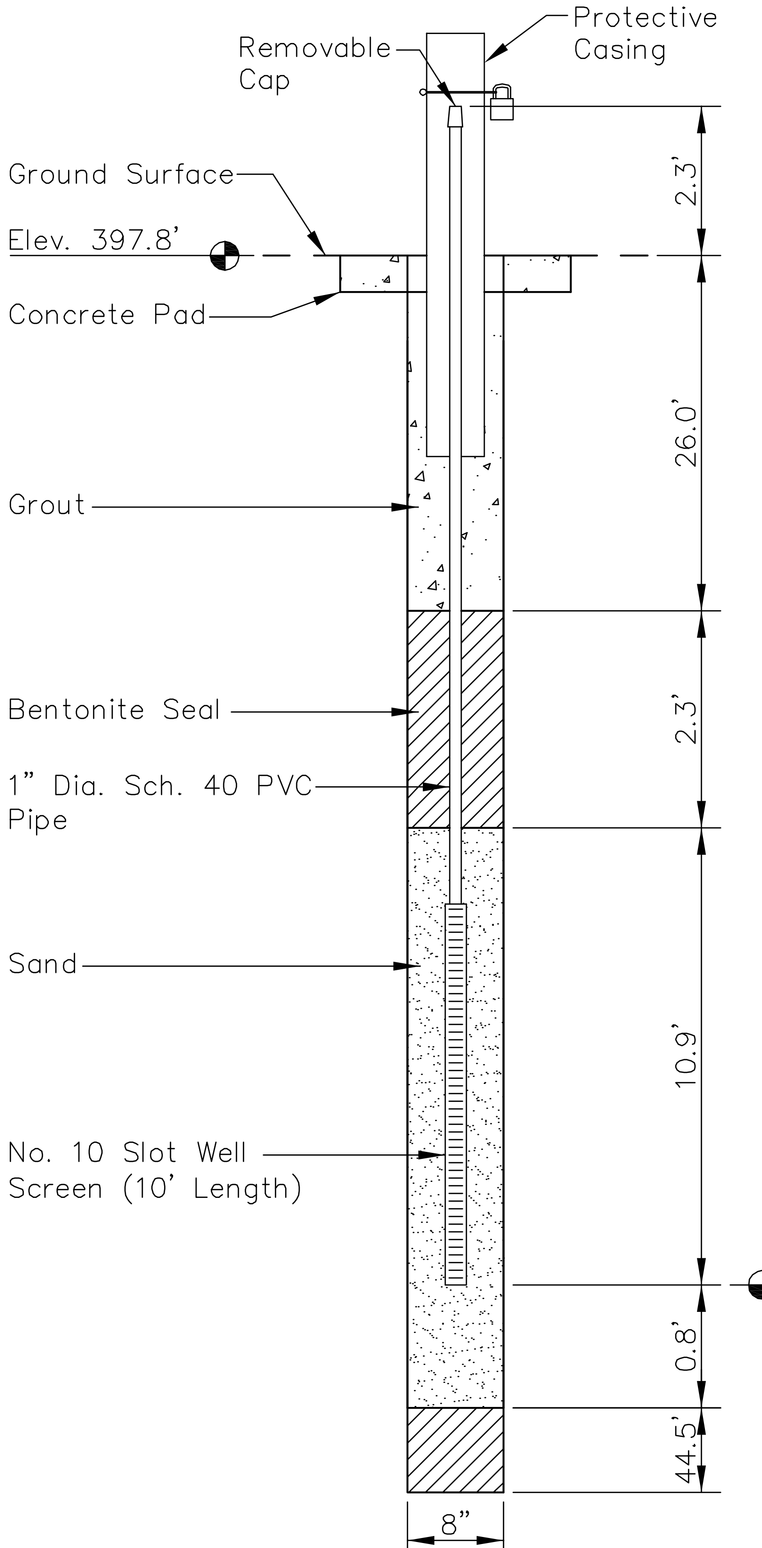

NOTES:
1. Installed on 06/11/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ16.DWG

LOCATION:
Northing: 729,763.04
Easting: 1,510,385.22
Ground Elevation: 397.8'

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

PIEZOMETER STN-16
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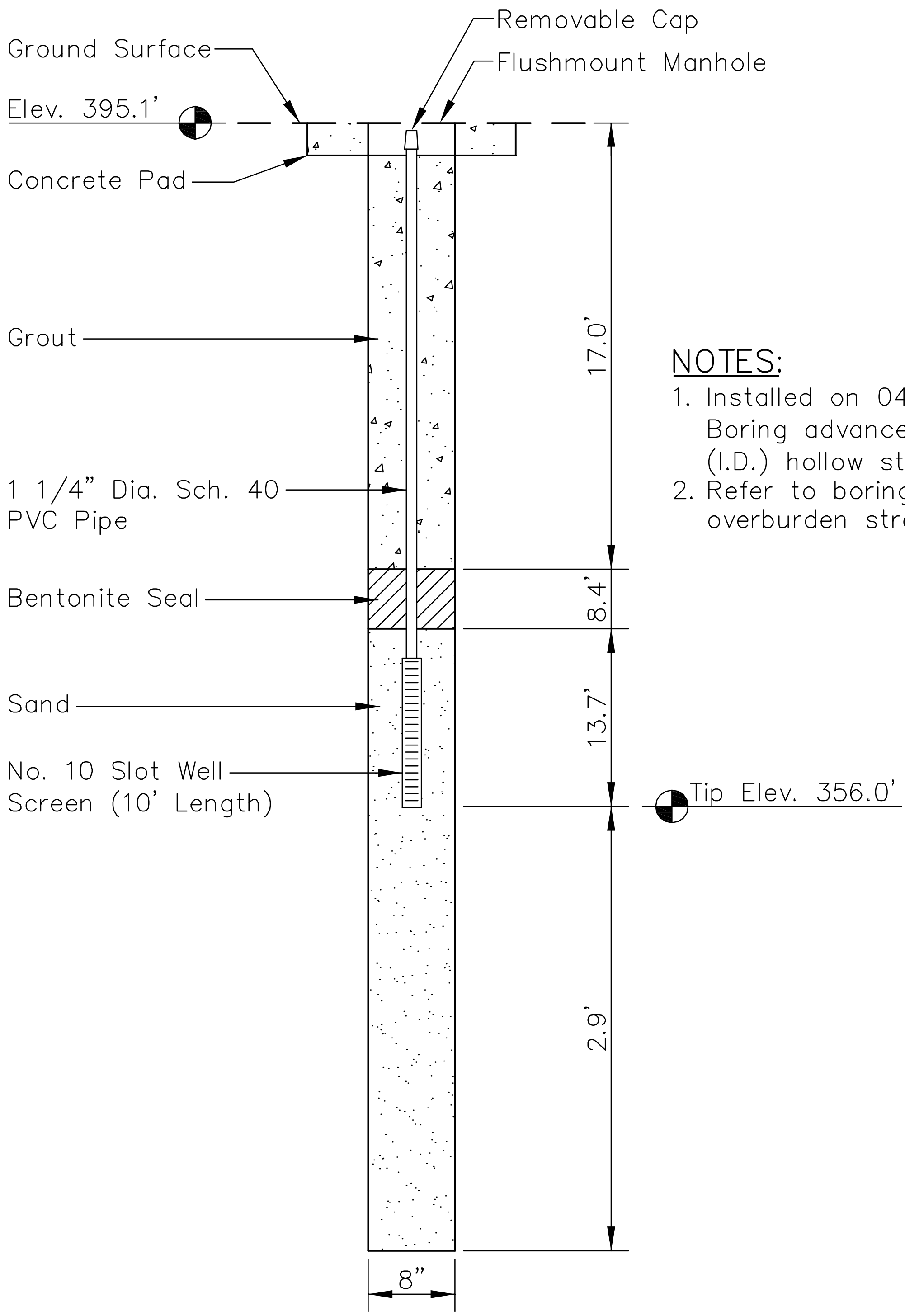

NOTES:
1. Installed on 04/30/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

LOCATION:
Northing: 728,813.36
Easting: 1,510,875.59
Ground Elevation: 395.1'

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

PIEZOMETER STN-21
DRY FLY ASH STACK
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CHECKED BY	SAH	SCALE	NTS	2.	4.	

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
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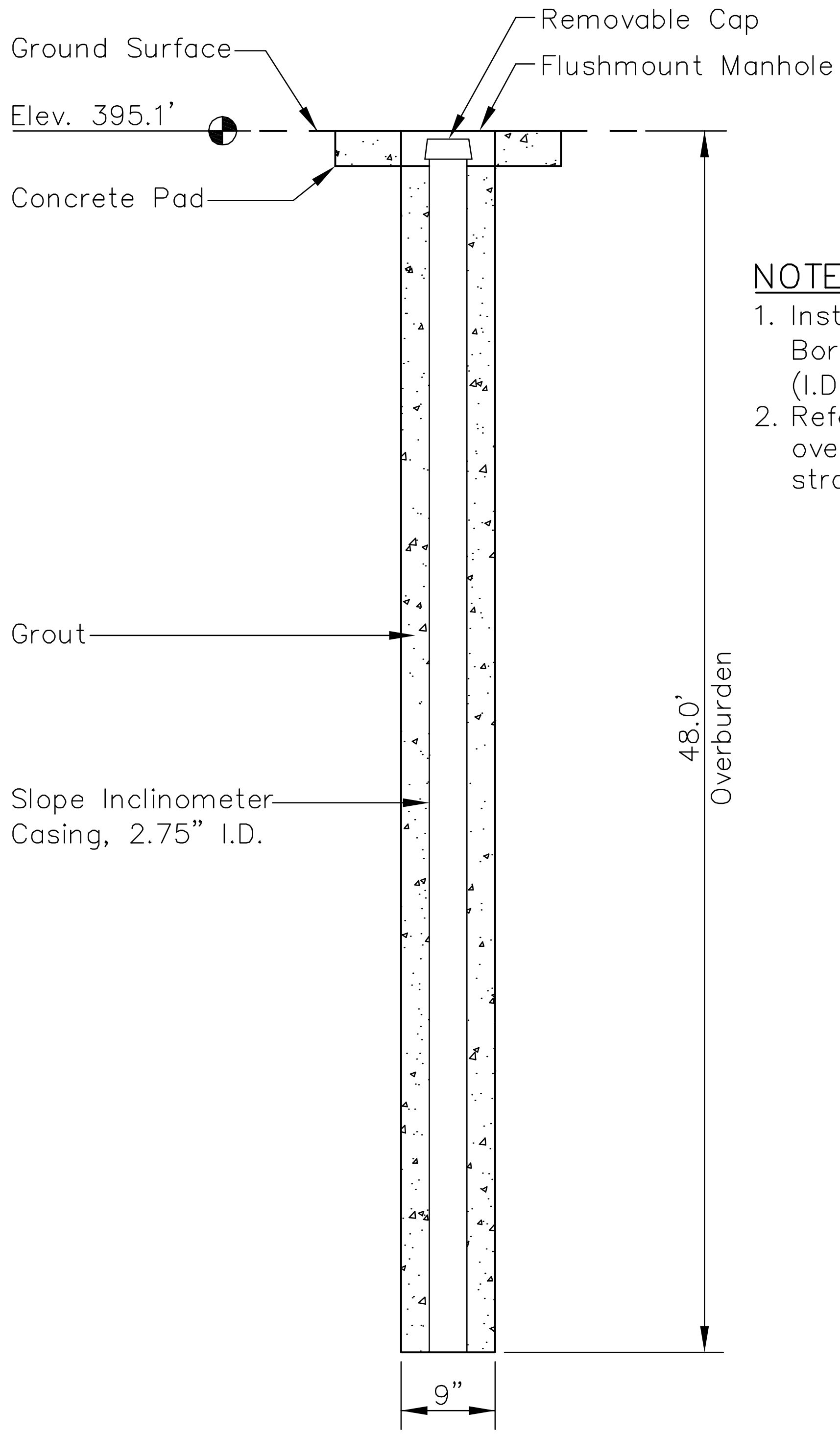

NOTES:

1. Installed on 05/01/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden and rock stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-SI21A.DWG

LOCATION:

Northing: 728,808.93
Easting: 1,510,877.54
Ground Elevation: 395.1'

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

SLOPE INCLINOMETER STN-21A
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

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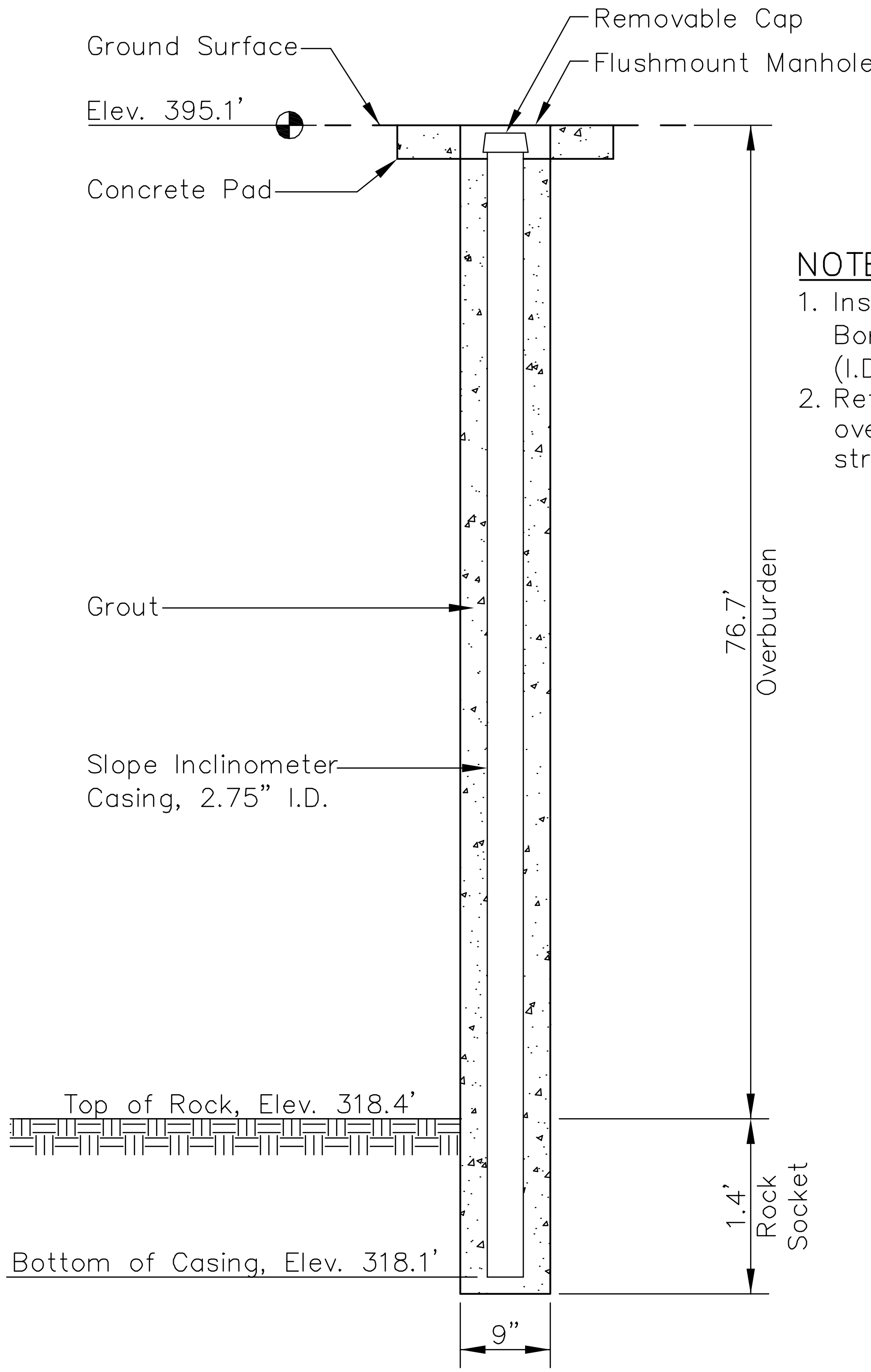

NOTES:

1. Installed on 07/15/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden and rock stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-SI21B.DWG

LOCATION:

Northing: 728,804.50
Easting: 1,510,879.50
Ground Elevation: 395.1'

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

SLOPE INCLINOMETER STN-21B
DRY FLY ASH STACK
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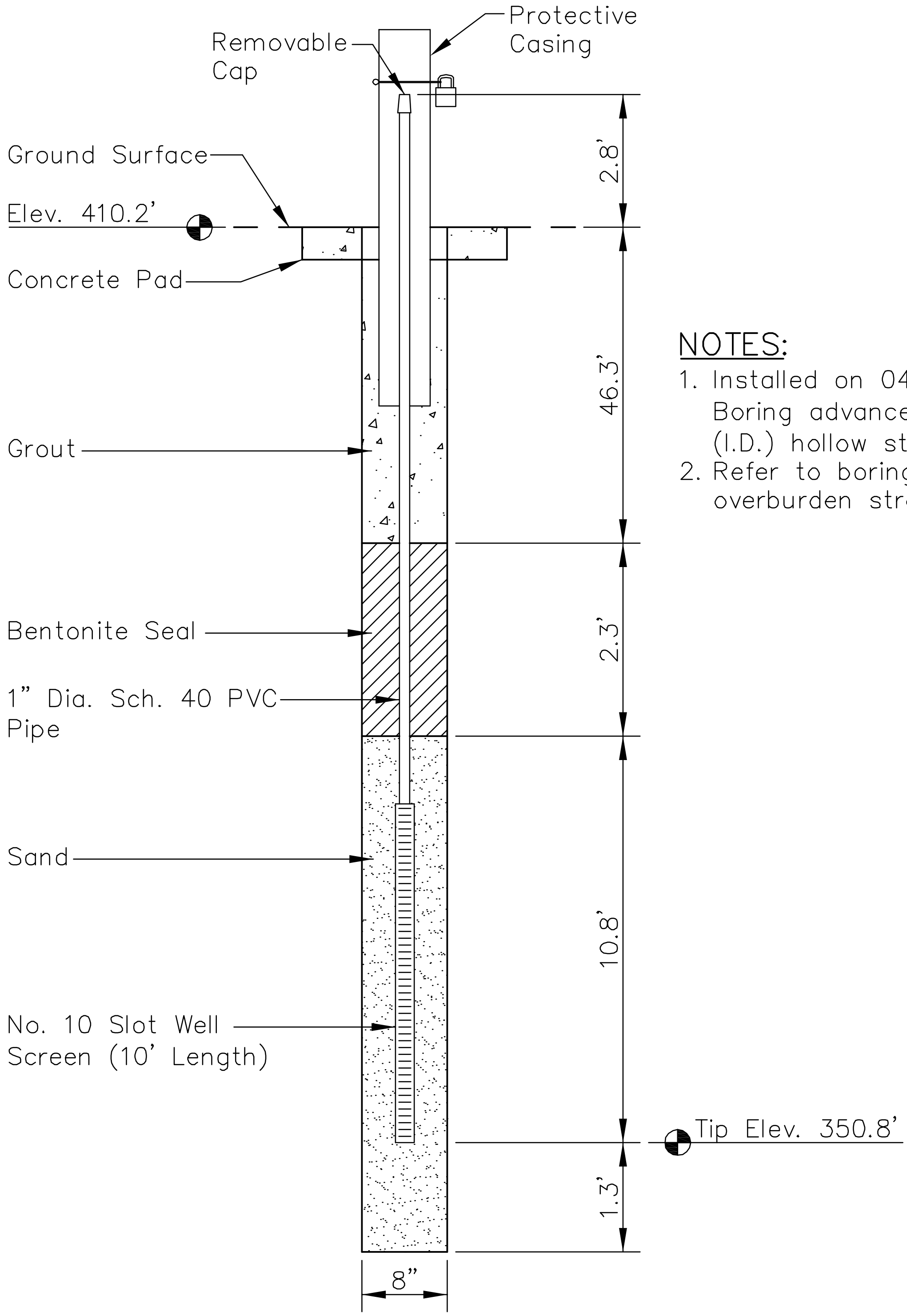

NOTES:

1. Installed on 04/29/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ22A.DWG

LOCATION:

Northing: 728,829.60
Easting: 1,510,964.76
Ground Elevation: 410.2'

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

PIEZOMETER STN-22A
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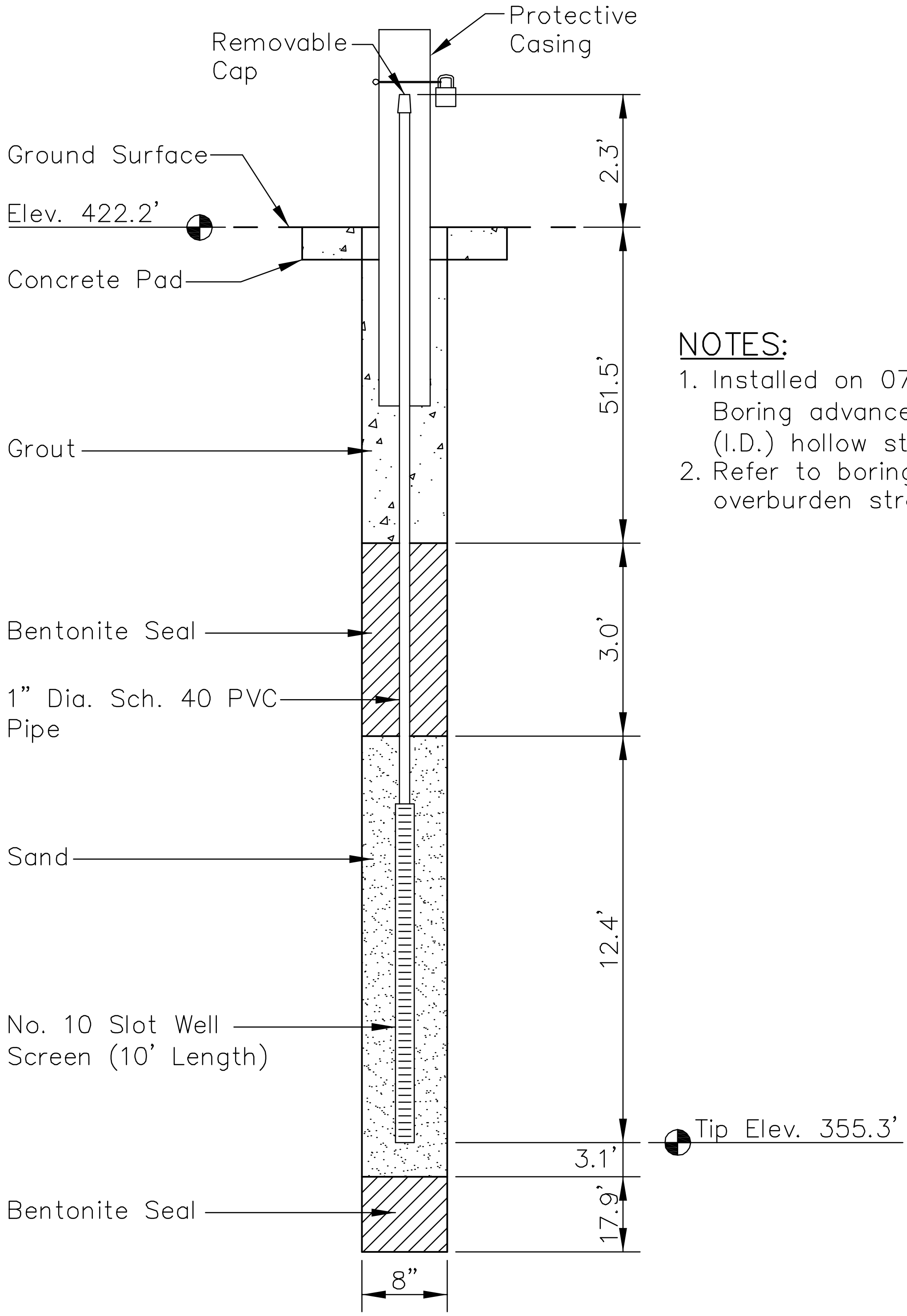

NOTES:

1. Installed on 07/17/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

LOCATION:

Northing: 728,342.65
Easting: 1,512,519.26
Ground Elevation: 422.2'

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

PIEZOMETER STN-27
DRY FLY ASH STACK
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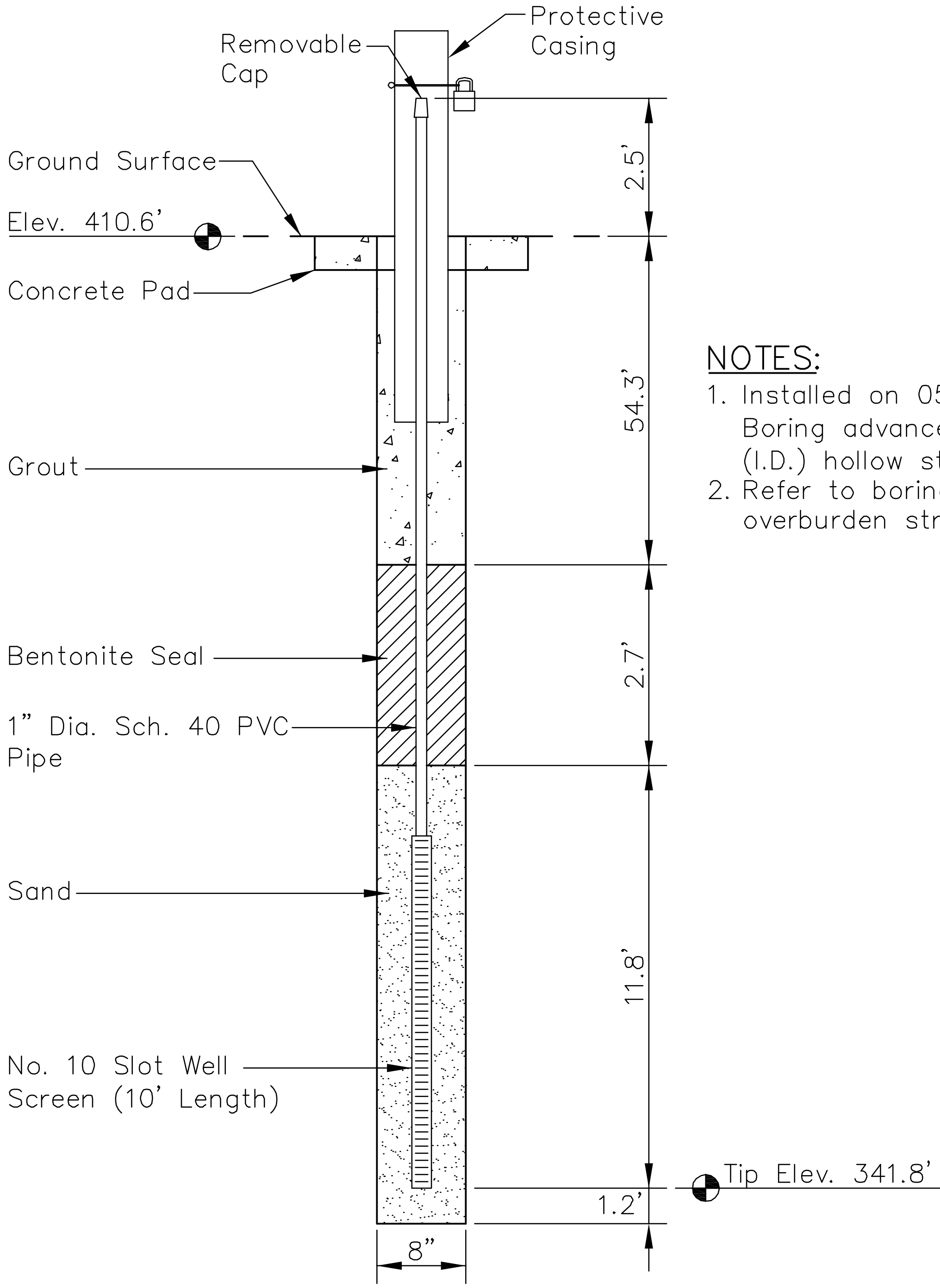
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 05/19/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ28.DWG

LOCATION:

Northing: 728,264.15
Easting: 1,512,555.40
Ground Elevation: 410.6'

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

PIEZOMETER STN-28
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

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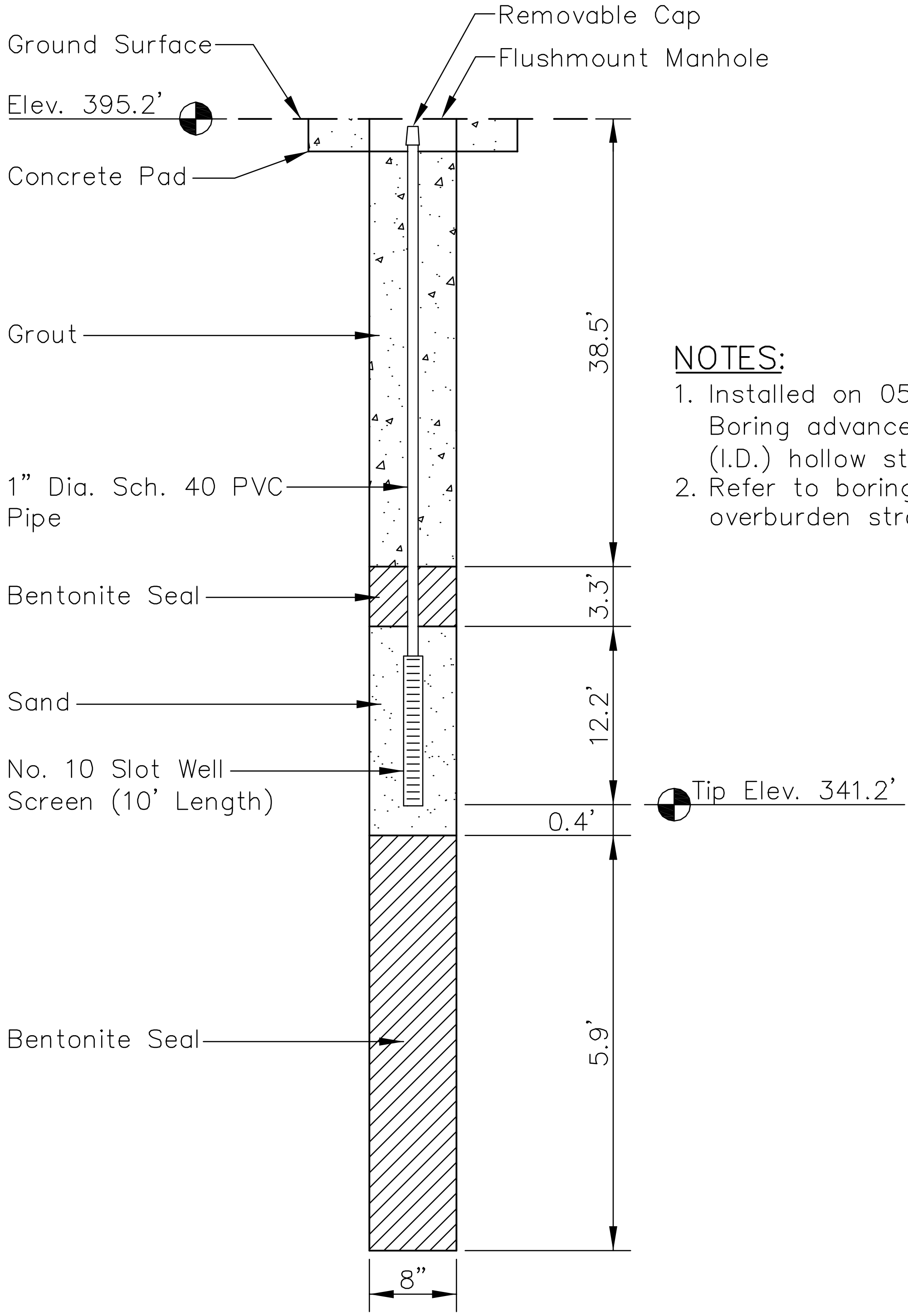
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 05/16/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

LOCATION:

Northing: 728,179.37
Easting: 1,512,587.54
Ground Elevation: 395.2'

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

PIEZOMETER STN-29
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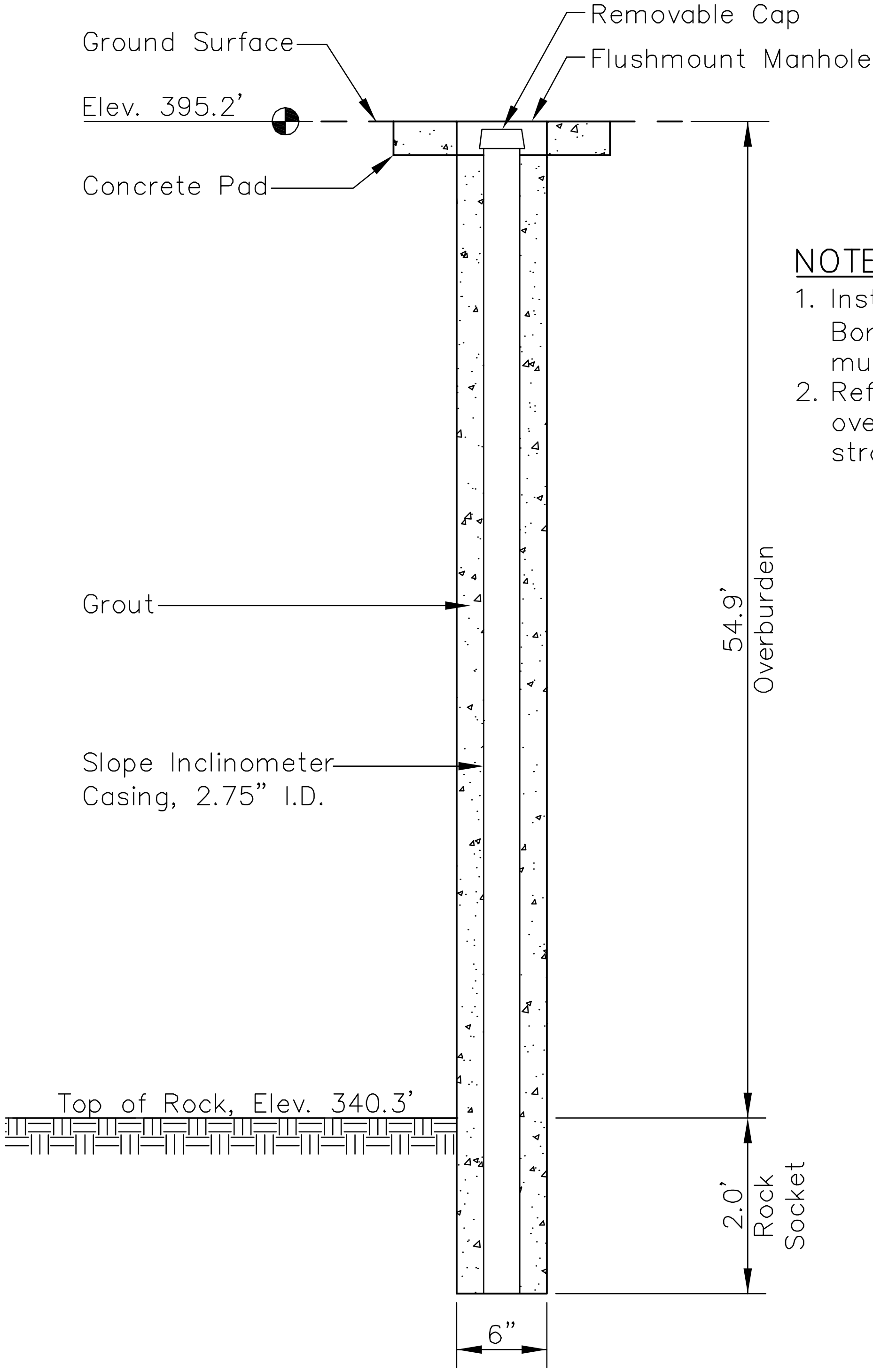

NOTES:

1. Installed on 05/28/2009. Boring advanced by 5.125" mud-rotary drilling.
2. Refer to boring log for overburden and rock stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-SI29A.DWG

LOCATION:

Northing: 728,181.10
Easting: 1,512,591.60
Ground Elevation: 395.2'

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

SLOPE INCLINOMETER STN-29A
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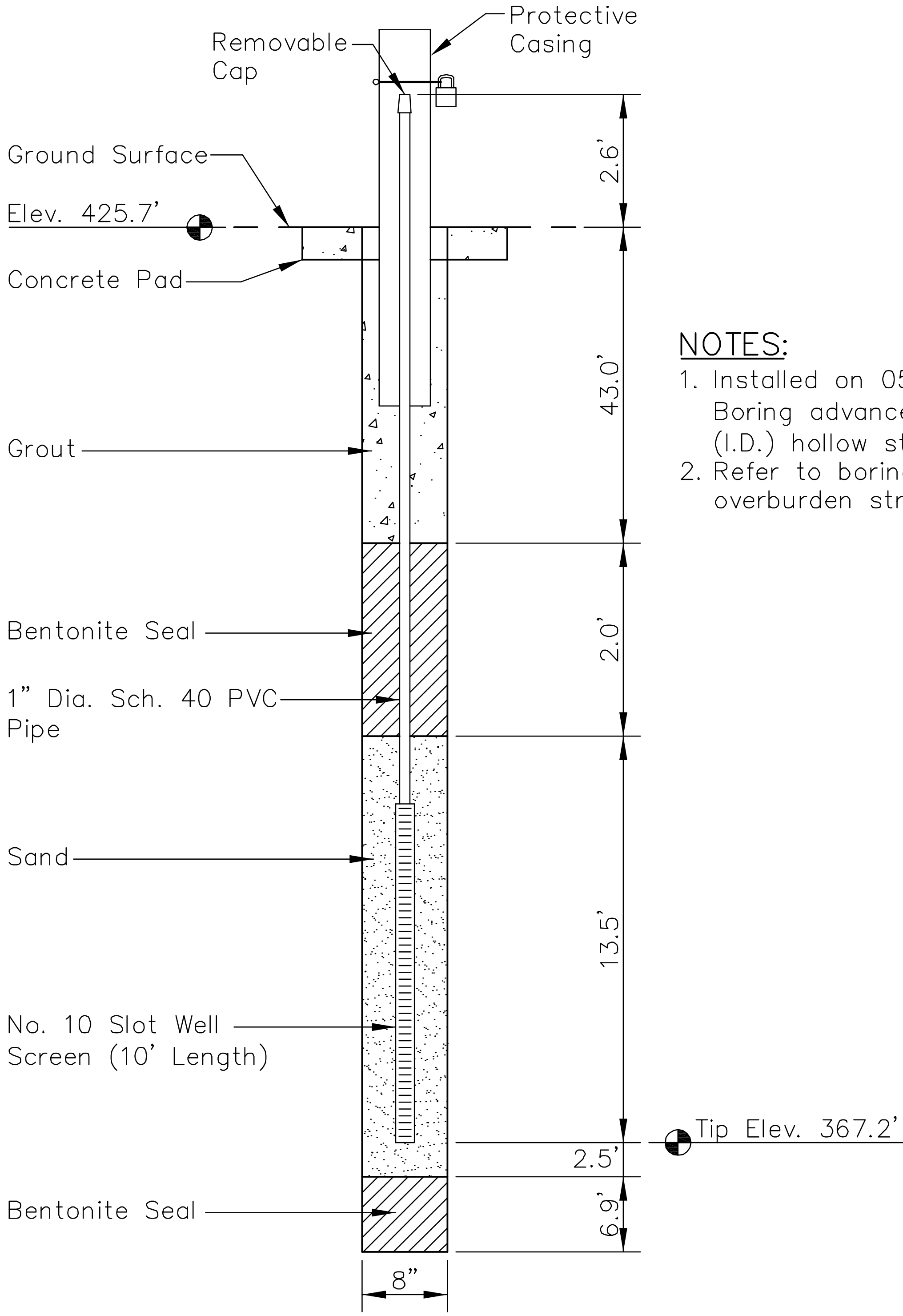
DRAWN BY	CW	**DATE**	OCT., 2009	**REVISED**			**SHEET**
CHECKED BY	DBR	**PROJ. NO.**	175539009	**1.**		**3.**	**1 OF 1**
CHECKED BY	SAH	**SCALE**	NTS	**2.**		**4.**	



NOTES:

1. Installed on 05/31/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

LOCATION:

Northing: 728,903.76
Easting: 1,513,833.70
Ground Elevation: 425.7'

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

PIEZOMETER STN-35
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

Stantec

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200

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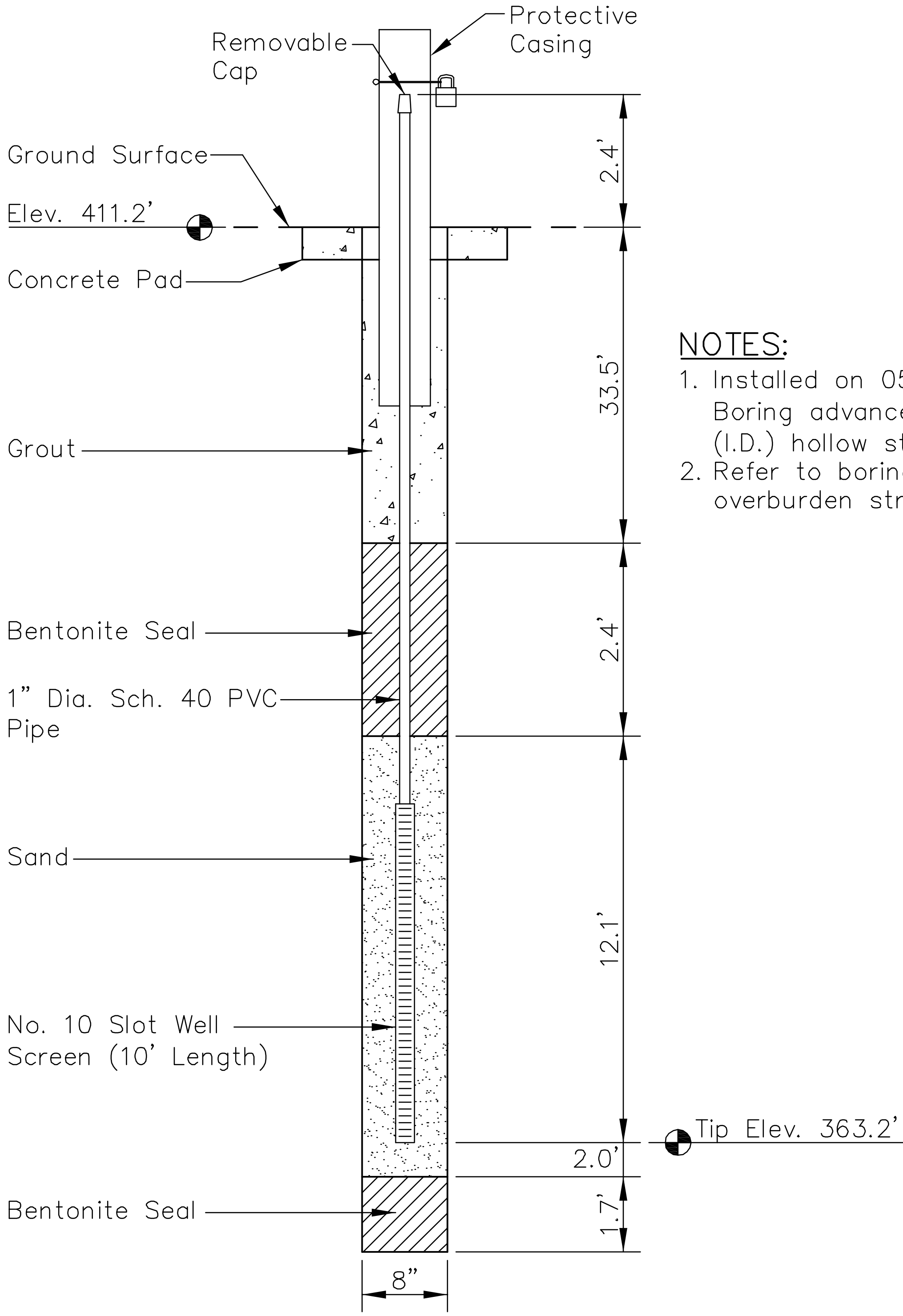
				REVISED		SHEET
DRAWN BY	CW	DATE	OCT., 2009			
CHECKED BY	DBR	PROJ. NO.	175539009	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ35.DWG



NOTES:
1. Installed on 05/17/2009.
   Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/07/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ36.DWG

LOCATION:
Northing: 728,879.61
Easting: 1,513,930.45
Ground Elevation: 411.2'

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

PIEZOMETER STN-36
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

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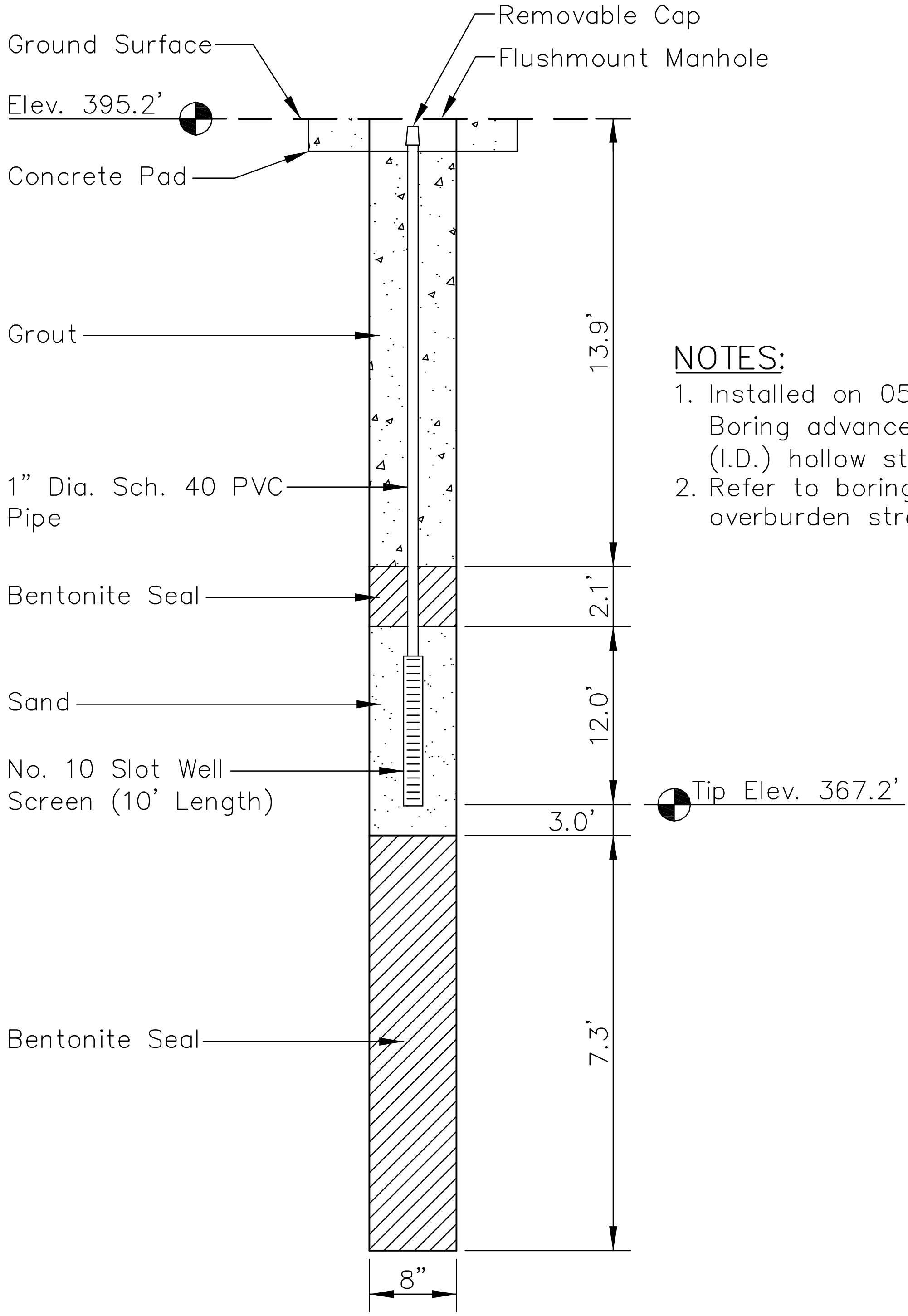
				REVISED		SHEET
DRAWN BY	CW	DATE	OCT., 2009			
CHECKED BY	DBR	PROJ. NO.	175539009	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 05/17/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ37.DWG

LOCATION:

Northing: 728,853.00
Easting: 1,514,022.47
Ground Elevation: 395.2'

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

PIEZOMETER STN-37
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

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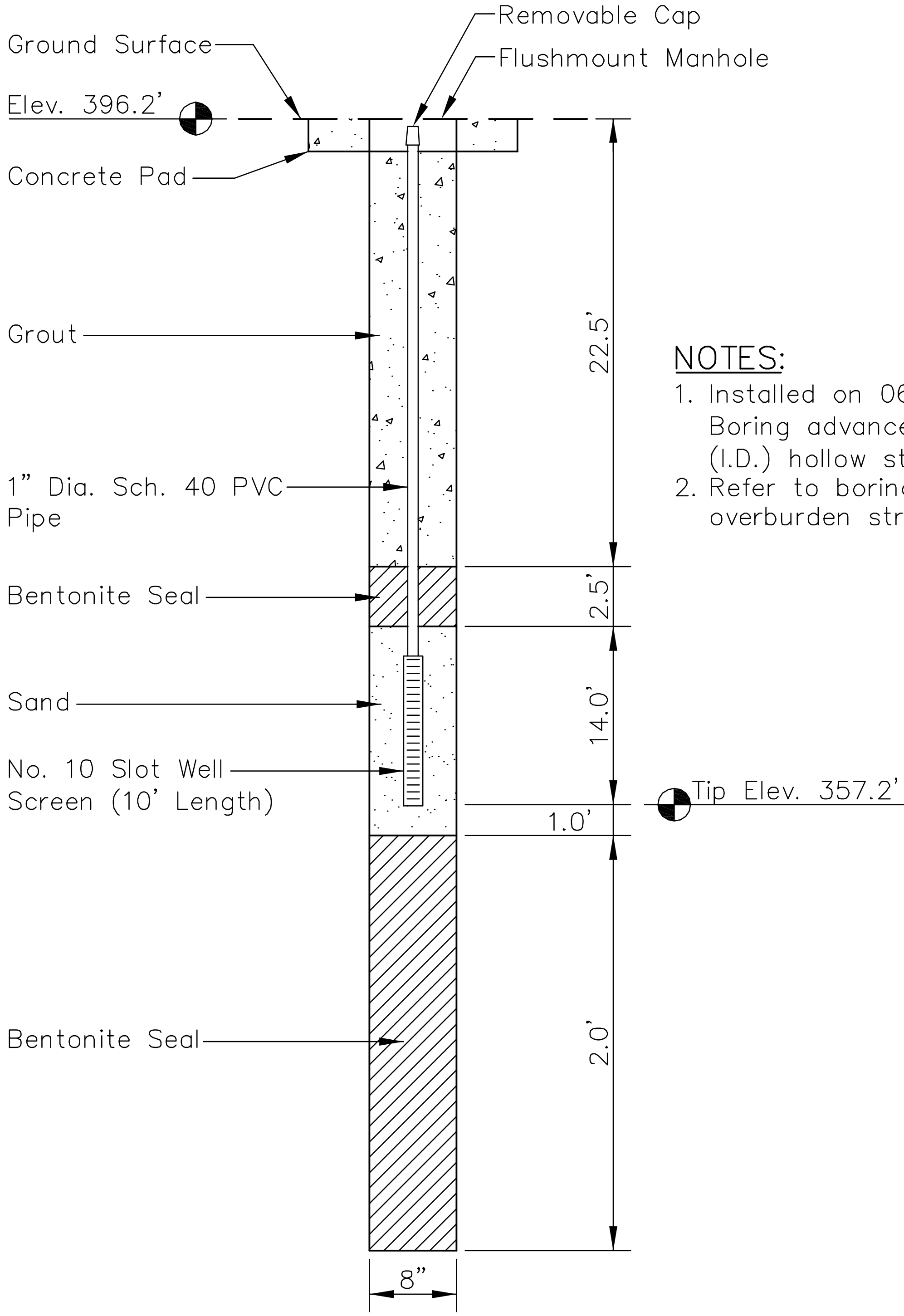
				REVISED		SHEET
DRAWN BY	CW	DATE	OCT., 2009			
CHECKED BY	DBR	PROJ. NO.	175539009	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:
1. Installed on 06/14/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ42.DWG

LOCATION:
Northing: 730,342.74
Easting: 1,512,760.25
Ground Elevation: 396.2'

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

PIEZOMETER STN-42
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

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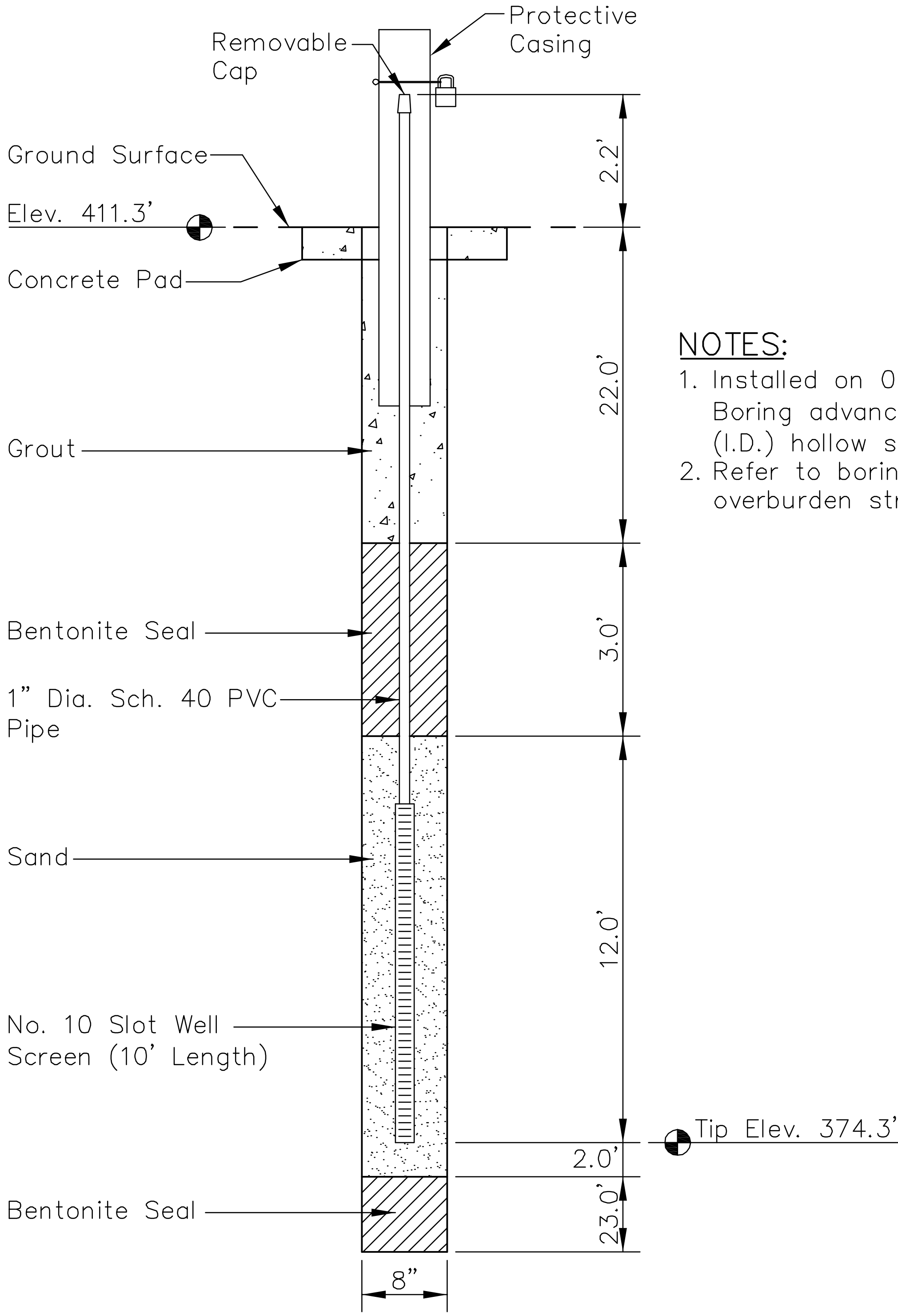
DRAWN BY	CW	DATE	OCT., 2009	REVISED		SHEET
CHECKED BY	DBR	PROJ. NO.	175539009	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:
1. Installed on 06/16/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ43.DWG

LOCATION:

Northing: 730,394.20
Easting: 1,512,495.22
Ground Elevation: 411.3'

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

PIEZOMETER STN-43
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

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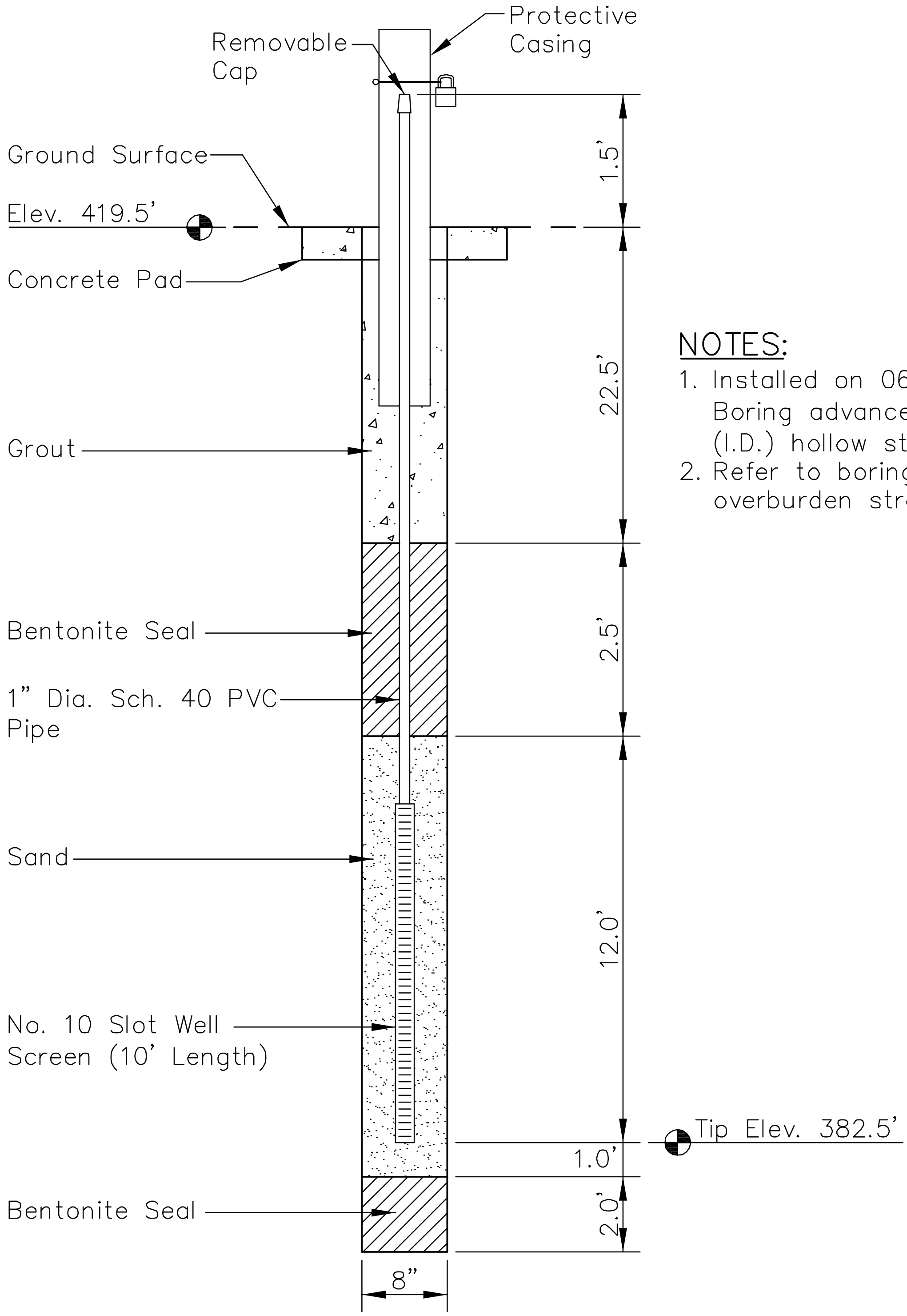
DRAWN BY	CW	DATE	OCT., 2009	REVISED		SHEET
CHECKED BY	DBR	PROJ. NO.	175539009	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 06/12/2009. Boring advanced with 3.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ44.DWG

LOCATION:

Northing: 730,328.91
Easting: 1,512,450.02
Ground Elevation: 419.5'

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

PIEZOMETER STN-44
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

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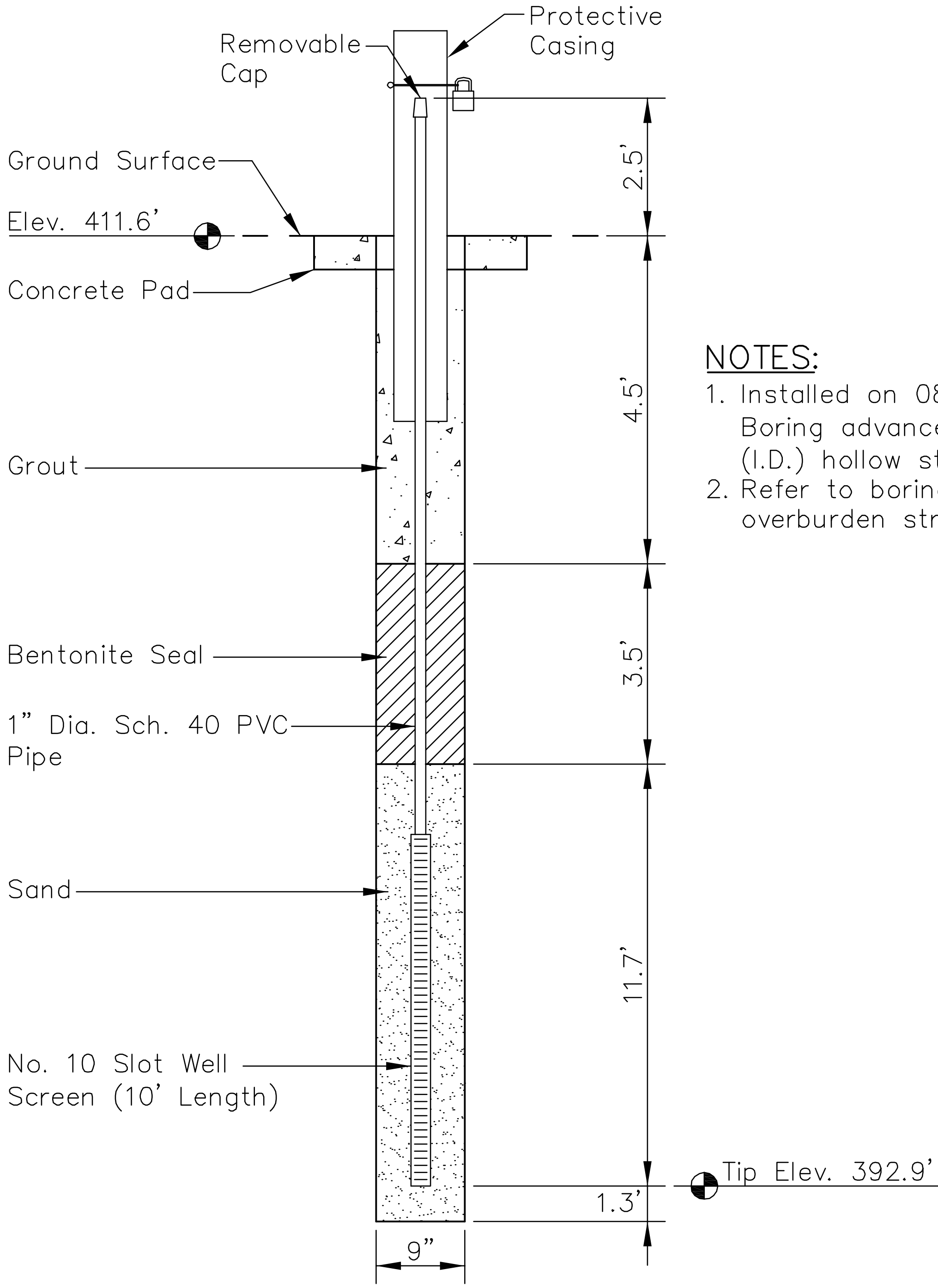
DRAWN BY	CW	DATE	OCT., 2009	REVISED		SHEET
CHECKED BY	DBR	PROJ. NO.	175539009	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 08/06/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ45A.DWG

LOCATION:

Northing: 730,351.38
Easting: 1,511,965.25
Ground Elevation: 411.6'

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

PIEZOMETER STN-45A
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

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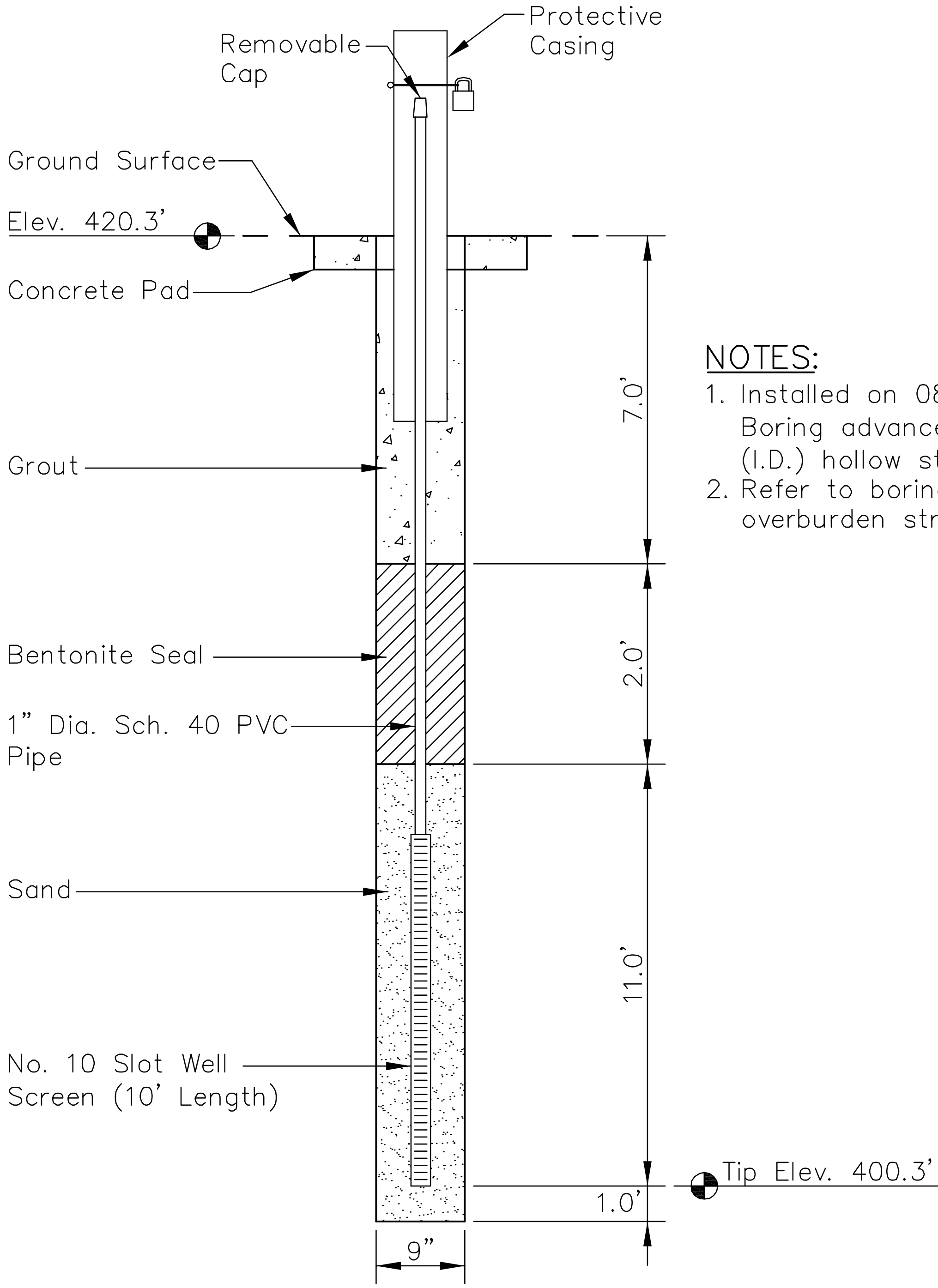
DRAWN BY	CW	DATE	OCT., 2009			
CHECKED BY	DBR	PROJ. NO.	175539009	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 08/06/2009. Boring advanced with 4.25" (I.D.) hollow stem augers.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-PZ46A.DWG

LOCATION:

Northing: 730,309.78
Easting: 1,511,946.44
Ground Elevation: 420.3'

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

PIEZOMETER STN-46A
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

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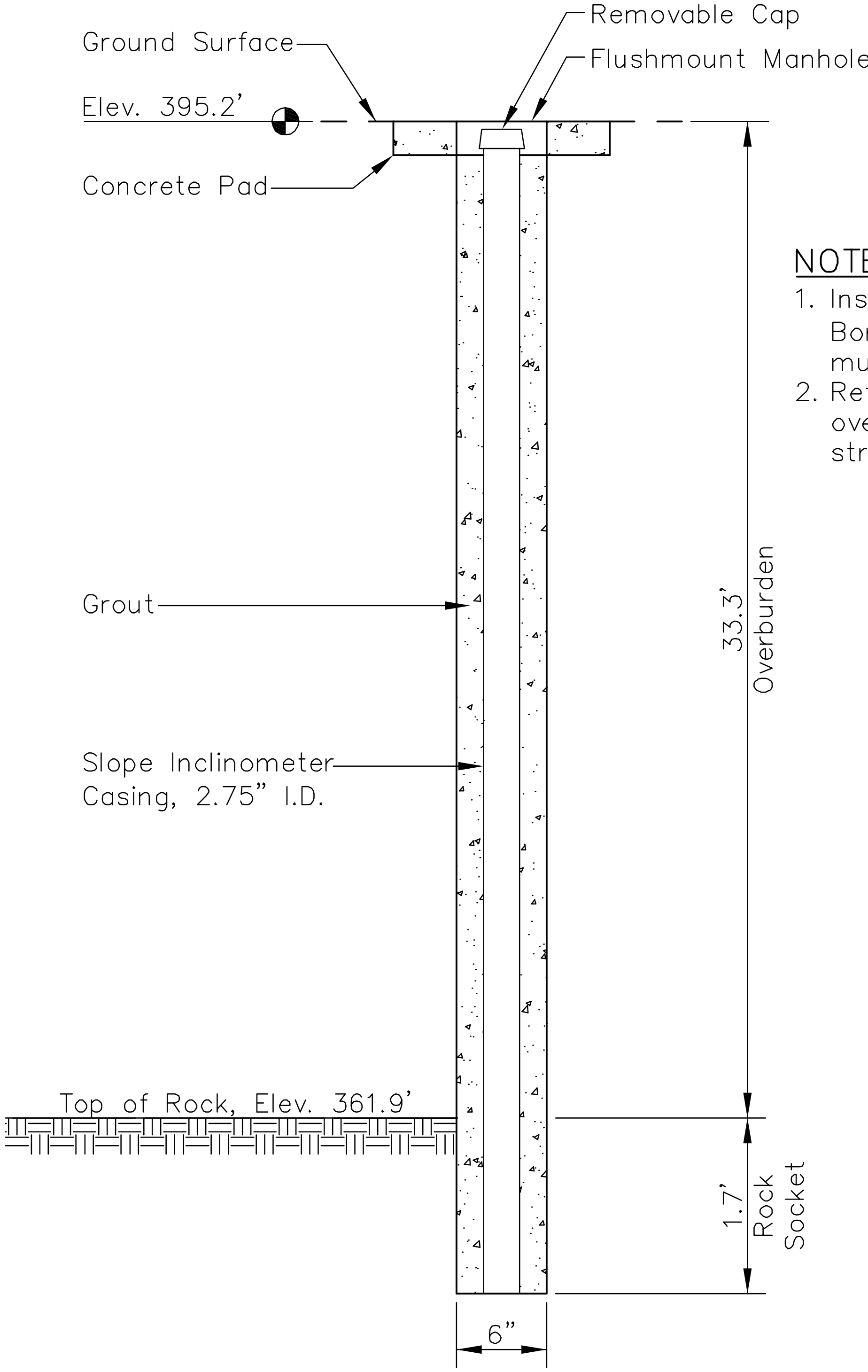
CHECKED BY	DBR	PROJ. NO.	175539009	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 05/27/2009. Boring advanced by 5.125" mud-rotary drilling.
2. Refer to boring log for overburden and rock stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-SI37A.DWG

LOCATION:

Northing: 728,848.41
Easting: 1,514,021.00
Ground Elevation: 395.2'

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

SLOPE INCLINOMETER STN-37A
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

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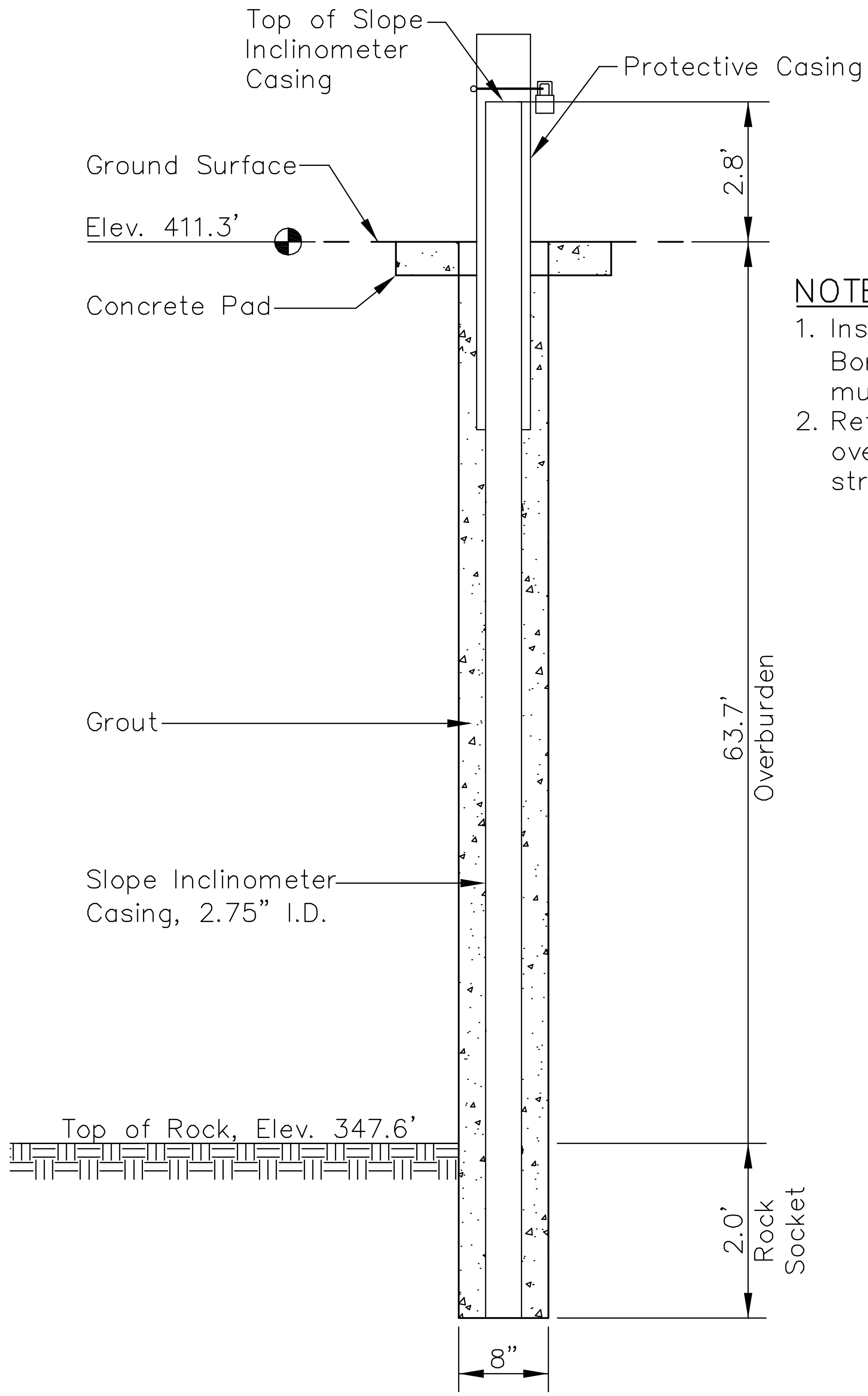
DRAWN BY	CW	DATE	OCT., 2009	REVISED			SHEET
CHECKED BY	DBR	PROJ. NO.	175539009	1.		3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.		4.	



NOTES:

1. Installed on 06/24/2009. Boring advanced by 5.125" mud–rotary drilling.
2. Refer to boring log for overburden and rock stratigraphy.

PLOT DATE: 10/12/2009 USER: WITHERS, CHEYENNE
V:\1755\ACTIVE\175539009\GEOTECHNICAL\DRAWING\GEOTECH\INSTRUMENTS\39009B-CUF-301-SI43A.DWG

LOCATION:

Northing: 730,397.50
Easting: 1,512,491.36
Ground Elevation: 411.3'

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

SLOPE INCLINOMETER STN-43A
DRY FLY ASH STACK
CUMBERLAND FOSSIL PLANT

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				REVISED		SHEET
DRAWN BY	CW	DATE	OCT., 2009			
CHECKED BY	DBR	PROJ. NO.	175539009	1.	3.	1 OF 1
CHECKED BY	SAH	SCALE	NTS	2.	4.	

Appendix F

Instrumentation Monitoring Results

Stantec

Cumberland Fossil Plant
815 Cumberland City Rd
Cumberland City,TN
175539009

Location	6/13/2009 Surface Elevation (ft)	6/13/2009 Stickup (ft)	6/13/2009 Depth Measurement (ft)	6/13/2009 Water Elevation (ft)	7/16/2009 Surface Elevation (ft)	7/16/2009 Stickup (ft)	7/16/2009 Depth Measurement (ft)	7/16/2009 Water Elevation (ft)	8/19/2009 Surface Elevation (ft)	8/19/2009 Stickup (ft)	8/19/2009 Depth Measurement (ft)	8/19/2009 Water Elevation (ft)
B-3	0.0	0.0	0.0	0.0	394.8	2.5	13.3	384.0	394.8	0.0	11.1	383.6
B-4	0.0	3.0	7.8	-4.8	393.9	3.0	11.2	385.7	393.9	2.6	11.2	385.4
B-9	394.7	0.0	17.2	377.5	394.7	0.0	17.5	377.2	394.7	0.0	17.5	377.2
B-10	0.0	0.0	0.0	0.0	397.1	3.0	21.0	379.1	397.1	2.8	20.8	379.1
B-15A	395.0	0.0	7.8	387.2	395.0	0.0	8.8	386.3	395.0	0.0	8.4	386.7
B-16	397.8	2.3	39.1	361.0	397.8	2.3	39.0	361.2	397.8	2.3	40.2	359.9
B-21	395.1	0.0	4.6	390.5	395.1	0.0	4.9	390.3	395.1	0.0	4.6	390.6
B-22	410.2	3.8	19.9	394.1	410.2	3.8	24.1	389.9	410.2	2.8	23.4	389.6
B-27	0.0	0.0	0.0	0.0	422.2	0.0	0.0	422.2	422.2	2.3	27.5	397.0
B-28	410.6	0.8	28.2	383.2	410.6	0.8	30.5	380.9	410.6	2.5	32.2	380.9
B-29	395.2	0.0	20.0	375.2	395.2	0.0	20.7	374.5	395.2	0.0	19.9	375.3
B-35	425.7	2.2	29.6	398.2	425.7	2.2	33.9	393.9	425.7	2.6	45.4	382.9
B-36	411.2	0.0	25.1	386.1	411.2	0.0	25.7	385.4	411.2	2.4	27.8	385.7
B-37	395.2	1.8	17.1	380.0	395.2	0.0	20.1	375.1	395.2	0.0	18.1	377.1
B-42	0.0	0.0	0.0	0.0	396.2	0.0	18.0	378.3	396.2	0.0	16.7	379.5
B-43	0.0	0.0	0.0	0.0	411.3	0.8	19.8	392.4	411.3	2.2	21.2	392.3
B-44	0.0	0.0	0.0	0.0	419.5	2.0	27.5	394.0	419.5	1.5	27.5	393.5
B-45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	411.6	2.5	21.1	393.0
B-46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	420.3	3.2	23.3	400.2

Change in elevation

Stantec

Cumberland Fossil Plant
815 Cumberland City Rd
Cumberland City,TN
175539009

	9/15/2009				10/20/2009				11/5/2009			
Location	Surface Elevation (ft)	Stickup (ft)	Depth Measurement (ft)	Water Elevation (ft)	Surface Elevation (ft)	Stickup (ft)	Depth Measurement (ft)	Water Elevation (ft)	Surface Elevation (ft)	Stickup (ft)	Depth Measurement (ft)	Water Elevation (ft)
B-3	394.8	0.0	11.0	383.8	394.8	0.0	10.9	383.9	394.8	0.0	0.0	394.8
B-4	393.9	2.6	11.3	385.2	393.9	2.6	10.9	385.6	393.9	2.6	0.0	396.5
B-9	394.7	0.0	17.8	376.9	394.7	0.0	17.3	377.4	394.7	0.0	0.0	394.7
B-10	397.1	2.8	21.3	378.6	397.1	2.8	21.1	378.8	397.1	2.8	0.0	399.9
B-15A	395.0	0.0	8.7	386.3	395.0	0.0	8.4	386.7	395.0	0.0	0.0	395.0
B-16	397.8	2.3	42.1	358.1	397.8	2.3	40.6	359.5	397.8	2.3	37.5	362.7
B-21	395.1	0.0	0.0	395.1	395.1	0.0	0.0	395.1	395.1	0.0	4.4	390.7
B-22	410.2	2.8	24.0	389.0	410.2	2.8	23.5	389.5	410.2	2.8	0.0	413.0
B-27	422.2	2.3	27.7	396.7	422.2	2.3	27.5	397.0	422.2	2.3	0.0	424.5
B-28	410.6	2.5	32.4	380.7	410.6	2.5	31.8	381.3	410.6	2.5	0.0	413.1
B-29	395.2	0.0	20.1	375.1	395.2	0.0	19.5	375.7	395.2	0.0	0.0	395.2
B-35	425.7	2.6	35.6	392.6	425.7	2.6	35.5	392.8	425.7	2.6	0.0	428.3
B-36	411.2	2.4	27.8	385.7	411.2	2.4	27.6	386.0	411.2	2.4	0.0	413.5
B-37	395.2	0.0	18.1	377.1	395.2	0.0	17.7	377.5	395.2	0.0	0.0	395.2
B-42	396.2	0.0	0.0	396.2	396.2	0.0	0.0	396.2	396.2	0.0	17.1	379.1
B-43	411.3	2.2	21.6	391.9	411.3	2.2	21.2	392.3	411.3	2.2	0.0	413.5
B-44	419.5	1.5	28.0	393.0	419.5	1.5	27.7	393.2	419.5	1.5	0.0	421.0
B-45	411.6	2.5	21.3	392.8	411.6	2.5	21.3	392.8	411.6	2.5	0.0	414.1
B-46	420.3	3.2	24.3	399.2	420.3	3.2	23.4	400.1	420.3	3.2	0.0	423.5

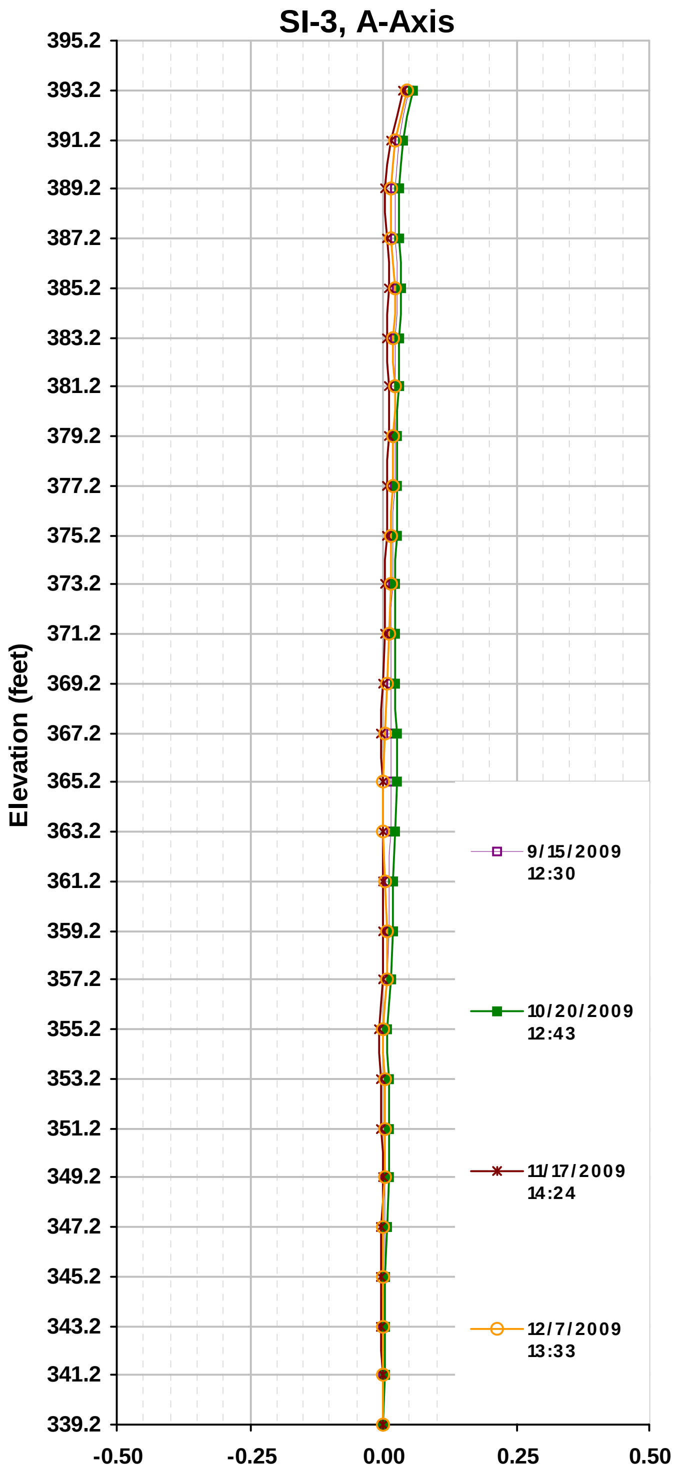
Change in elevation

Stantec

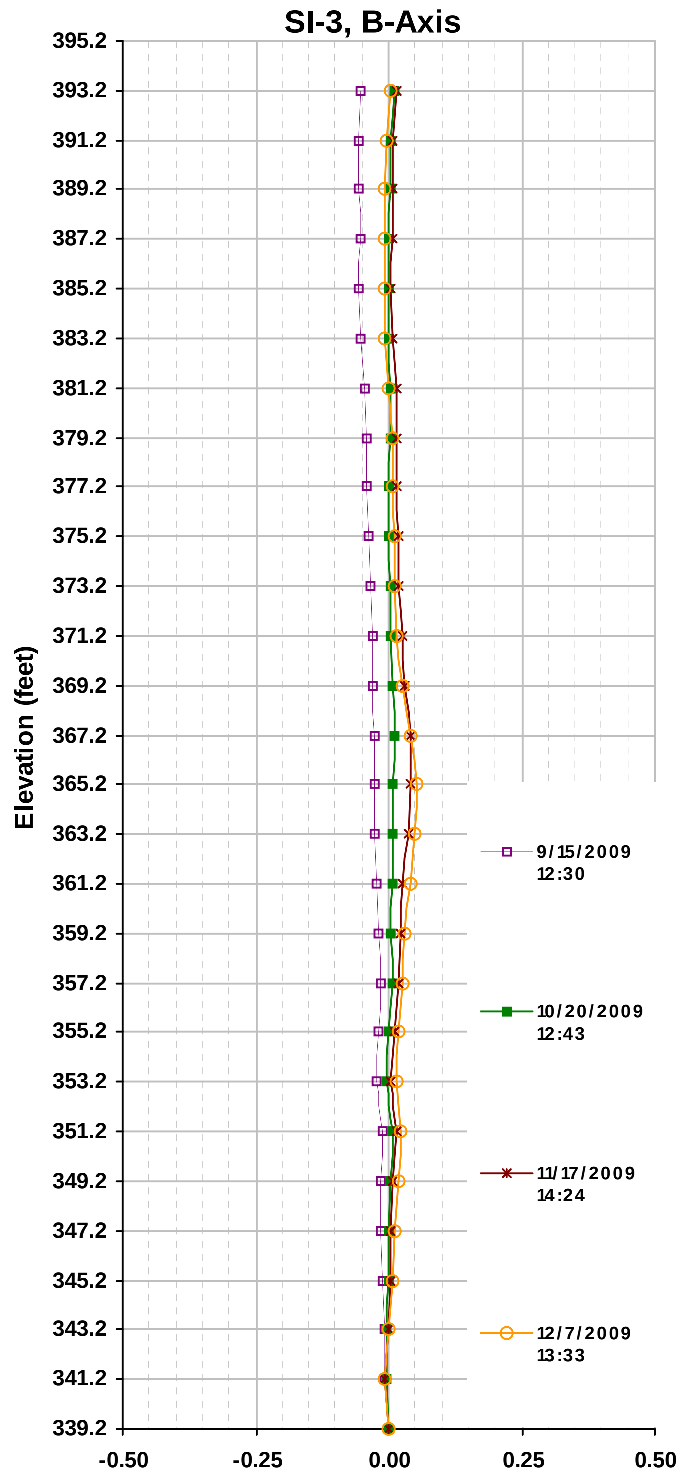
Cumberland Fossil Plant
815 Cumberland City Rd
Cumberland City,TN
175539009

	11/17/2009				12/7/2009			
Location	Surface Elevation (ft)	Stickup (ft)	Depth Measurement (ft)	Water Elevation (ft)	Surface Elevation (ft)	Stickup (ft)	Depth Measurement (ft)	Water Elevation (ft)
B-3	394.8	0.0	10.8	384.0	394.8	0.0	11.0	383.8
B-4	393.9	2.7	10.9	385.7	393.9	2.7	11.2	385.5
B-9	394.7	0.0	16.9	377.8	394.7	0.0	17.2	377.4
B-10	397.1	2.8	20.8	379.1	397.1	2.8	21.2	378.7
B-15A	395.0	0.0	8.4	386.6	395.0	0.0	8.9	386.1
B-16	397.8	2.3	41.4	358.6	397.8	2.3	41.8	358.2
B-21	395.1	0.0	4.6	390.5	395.1	0.0	5.2	389.9
B-22	410.2	2.9	23.6	389.5	410.2	2.9	24.1	389.0
B-27	422.2	3.0	27.5	397.7	422.2	3.0	27.9	397.3
B-28	410.6	2.7	31.8	381.5	410.6	2.7	32.3	381.0
B-29	395.2	0.0	19.2	376.0	395.2	0.0	19.6	375.6
B-35	425.7	2.5	35.2	392.9	425.7	2.5	35.5	392.6
B-36	411.2	2.4	27.5	386.0	411.2	2.4	27.8	385.8
B-37	395.2	0.0	17.6	377.6	395.2	0.0	18.0	377.3
B-42	396.2	0.0	17.4	378.8	396.2	0.0	17.4	378.8
B-43	411.3	2.3	21.3	392.2	411.3	2.3	21.9	391.6
B-44	419.5	1.6	27.8	393.3	419.5	1.6	28.5	392.5
B-45	411.6	2.6	21.3	392.9	411.6	2.6	21.3	392.9
B-46	420.3	3.3	23.4	400.1	420.3	3.3	23.4	400.1

Change in elevation

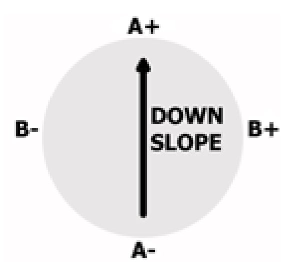


Cumulative Displacement (in) from 8/19/2009



Cumulative Displacement (in) from 8/19/2009

Stantec



Cumulative Fossil Plant
B-3
Cumberland City, TN
175539009
12/8/2009

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 9/15/2009 12:30:54 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:01:57 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	141	-131	0.1632	154	-152	0.1836	0.0204	0.0492
4	174	-161	0.2010	175	-169	0.2064	0.0054	0.0288
6	152	-137	0.1734	147	-141	0.1728	-0.0006	0.0234
8	80	-69	0.0894	76	-72	0.0888	-0.0006	0.0240
10	39	-23	0.0372	35	-28	0.0378	0.0006	0.0246
12	36	-27	0.0378	33	-30	0.0378	0.0000	0.0240
14	47	-35	0.0492	45	-40	0.0510	0.0018	0.0240
16	30	-18	0.0288	28	-22	0.0300	0.0012	0.0222
18	-14	25	-0.0234	-17	21	-0.0228	0.0006	0.0210
20	-91	103	-0.1164	-93	98	-0.1146	0.0018	0.0204
22	-201	209	-0.2460	-203	204	-0.2442	0.0018	0.0186
24	-294	308	-0.3612	-297	302	-0.3594	0.0018	0.0168
26	-347	357	-0.4224	-351	353	-0.4224	0.0000	0.0150
28	-315	325	-0.3840	-319	320	-0.3834	0.0006	0.0150
30	-251	262	-0.3078	-255	257	-0.3072	0.0006	0.0144
32	-198	205	-0.2418	-201	200	-0.2406	0.0012	0.0138
34	-153	162	-0.1890	-156	156	-0.1872	0.0018	0.0126
36	-129	139	-0.1608	-130	133	-0.1578	0.0030	0.0108
38	-128	139	-0.1602	-127	130	-0.1542	0.0060	0.0078
40	-168	181	-0.2094	-175	178	-0.2118	-0.0024	0.0018
42	-269	279	-0.3288	-274	276	-0.3300	-0.0012	0.0042
44	-236	248	-0.2904	-240	244	-0.2904	0.0000	0.0054
46	-189	202	-0.2346	-193	197	-0.2340	0.0006	0.0054
48	-186	197	-0.2298	-189	191	-0.2280	0.0018	0.0048
50	-169	181	-0.2100	-172	176	-0.2088	0.0012	0.0030
52	-97	107	-0.1224	-100	102	-0.1212	0.0012	0.0018
54	-1	15	-0.0096	-5	10	-0.0090	0.0006	0.0006
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 10/20/2009 12:43:03 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:01:57 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	141	-131	0.1632	157	-150	0.1842	0.0210	0.0576
4	174	-161	0.2010	179	-168	0.2082	0.0072	0.0366
6	152	-137	0.1734	149	-137	0.1716	-0.0018	0.0294
8	80	-69	0.0894	77	-68	0.0870	-0.0024	0.0312
10	39	-23	0.0372	39	-26	0.0390	0.0018	0.0336
12	36	-27	0.0378	36	-29	0.0390	0.0012	0.0318
14	47	-35	0.0492	49	-39	0.0528	0.0036	0.0306
16	30	-18	0.0288	31	-19	0.0300	0.0012	0.0270
18	-14	25	-0.0234	-14	24	-0.0228	0.0006	0.0258
20	-91	103	-0.1164	-90	102	-0.1152	0.0012	0.0252
22	-201	209	-0.2460	-200	209	-0.2454	0.0006	0.0240
24	-294	308	-0.3612	-294	308	-0.3612	0.0000	0.0234
26	-347	357	-0.4224	-349	357	-0.4236	-0.0012	0.0234
28	-315	325	-0.3840	-317	323	-0.3840	0.0000	0.0246
30	-251	262	-0.3078	-251	261	-0.3072	0.0006	0.0246
32	-198	205	-0.2418	-194	203	-0.2382	0.0036	0.0240
34	-153	162	-0.1890	-152	159	-0.1866	0.0024	0.0204
36	-129	139	-0.1608	-127	136	-0.1578	0.0030	0.0180
38	-128	139	-0.1602	-122	132	-0.1524	0.0078	0.0150
40	-168	181	-0.2094	-172	183	-0.2130	-0.0036	0.0072
42	-269	279	-0.3288	-270	279	-0.3294	-0.0006	0.0108
44	-236	248	-0.2904	-235	246	-0.2886	0.0018	0.0114
46	-189	202	-0.2346	-187	200	-0.2322	0.0024	0.0096
48	-186	197	-0.2298	-185	194	-0.2274	0.0024	0.0072
50	-169	181	-0.2100	-168	179	-0.2082	0.0018	0.0048
52	-97	107	-0.1224	-98	106	-0.1224	0.0000	0.0030
54	-1	15	-0.0096	2	13	-0.0066	0.0030	0.0030
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 11/17/2009 2:24:32 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:01:57 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	141	-131	0.1632	156	-154	0.1860	0.0228	0.0360
4	174	-161	0.2010	177	-172	0.2094	0.0084	0.0132
6	152	-137	0.1734	147	-139	0.1716	-0.0018	0.0048
8	80	-69	0.0894	73	-69	0.0852	-0.0042	0.0066
10	39	-23	0.0372	36	-29	0.0390	0.0018	0.0108
12	36	-27	0.0378	31	-29	0.0360	-0.0018	0.0090
14	47	-35	0.0492	45	-39	0.0504	0.0012	0.0108
16	30	-18	0.0288	28	-21	0.0294	0.0006	0.0096
18	-14	25	-0.0234	-17	21	-0.0228	0.0006	0.0090
20	-91	103	-0.1164	-91	98	-0.1134	0.0030	0.0084
22	-201	209	-0.2460	-202	205	-0.2442	0.0018	0.0054
24	-294	308	-0.3612	-296	302	-0.3588	0.0024	0.0036
26	-347	357	-0.4224	-347	351	-0.4188	0.0036	0.0012
28	-315	325	-0.3840	-319	322	-0.3846	-0.0006	-0.0024
30	-251	262	-0.3078	-256	261	-0.3102	-0.0024	-0.0018
32	-198	205	-0.2418	-202	202	-0.2424	-0.0006	0.0006
34	-153	162	-0.1890	-157	159	-0.1896	-0.0006	0.0012
36	-129	139	-0.1608	-130	134	-0.1584	0.0024	0.0018
38	-128	139	-0.1602	-126	130	-0.1536	0.0066	-0.0006
40	-168	181	-0.2094	-175	178	-0.2118	-0.0024	-0.0072
42	-269	279	-0.3288	-273	276	-0.3294	-0.0006	-0.0048
44	-236	248	-0.2904	-243	245	-0.2928	-0.0024	-0.0042
46	-189	202	-0.2346	-190	198	-0.2328	0.0018	-0.0018
48	-186	197	-0.2298	-189	193	-0.2292	0.0006	-0.0036
50	-169	181	-0.2100	-172	177	-0.2094	0.0006	-0.0042
52	-97	107	-0.1224	-102	107	-0.1254	-0.0030	-0.0048
54	-1	15	-0.0096	-5	14	-0.0114	-0.0018	-0.0018
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 12/7/2009 1:33:48 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:01:57 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	141	-131	0.1632	158	-154	0.1872	0.0240	0.0468
4	174	-161	0.2010	179	-171	0.2100	0.0090	0.0228
6	152	-137	0.1734	147	-138	0.1710	-0.0024	0.0138
8	80	-69	0.0894	74	-67	0.0846	-0.0048	0.0162
10	39	-23	0.0372	37	-27	0.0384	0.0012	0.0210
12	36	-27	0.0378	34	-27	0.0366	-0.0012	0.0198
14	47	-35	0.0492	46	-39	0.0510	0.0018	0.0210
16	30	-18	0.0288	29	-21	0.0300	0.0012	0.0192
18	-14	25	-0.0234	-15	22	-0.0222	0.0012	0.0180
20	-91	103	-0.1164	-90	99	-0.1134	0.0030	0.0168
22	-201	209	-0.2460	-201	207	-0.2448	0.0012	0.0138
24	-294	308	-0.3612	-293	303	-0.3576	0.0036	0.0126
26	-347	357	-0.4224	-344	349	-0.4158	0.0066	0.0090
28	-315	325	-0.3840	-317	320	-0.3822	0.0018	0.0024
30	-251	262	-0.3078	-254	261	-0.3090	-0.0012	0.0006
32	-198	205	-0.2418	-203	205	-0.2448	-0.0030	0.0018
34	-153	162	-0.1890	-157	162	-0.1914	-0.0024	0.0048
36	-129	139	-0.1608	-130	137	-0.1602	0.0006	0.0072
38	-128	139	-0.1602	-123	131	-0.1524	0.0078	0.0066
40	-168	181	-0.2094	-174	182	-0.2136	-0.0042	-0.0012
42	-269	279	-0.3288	-271	277	-0.3288	0.0000	0.0030
44	-236	248	-0.2904	-238	246	-0.2904	0.0000	0.0030
46	-189	202	-0.2346	-189	199	-0.2328	0.0018	0.0030
48	-186	197	-0.2298	-187	193	-0.2280	0.0018	0.0012
50	-169	181	-0.2100	-170	178	-0.2088	0.0012	-0.0006
52	-97	107	-0.1224	-102	106	-0.1248	-0.0024	-0.0018
54	-1	15	-0.0096	-3	12	-0.0090	0.0006	0.0006
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 9/15/2009 12:30:54 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:02:07 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-284	351	-0.3810	-283	346	-0.3774	0.0036	-0.0522
4	-273	339	-0.3672	-277	336	-0.3678	-0.0006	-0.0558
6	-280	339	-0.3714	-285	337	-0.3732	-0.0018	-0.0552
8	-297	357	-0.3924	-297	355	-0.3912	0.0012	-0.0534
10	-301	362	-0.3978	-305	359	-0.3984	-0.0006	-0.0546
12	-259	318	-0.3462	-268	323	-0.3546	-0.0084	-0.0540
14	-150	206	-0.2136	-154	208	-0.2172	-0.0036	-0.0456
16	-63	111	-0.1044	-67	110	-0.1062	-0.0018	-0.0420
18	27	34	-0.0042	22	34	-0.0072	-0.0030	-0.0402
20	120	-86	0.1236	115	-86	0.1206	-0.0030	-0.0372
22	310	-277	0.3522	304	-277	0.3486	-0.0036	-0.0342
24	513	-465	0.5868	510	-465	0.5850	-0.0018	-0.0306
26	583	-532	0.6690	581	-532	0.6678	-0.0012	-0.0288
28	503	-440	0.5658	499	-443	0.5652	-0.0006	-0.0276
30	421	-357	0.4668	417	-359	0.4656	-0.0012	-0.0270
32	357	-293	0.3900	353	-293	0.3876	-0.0024	-0.0258
34	333	-266	0.3594	327	-266	0.3558	-0.0036	-0.0234
36	310	-255	0.3390	305	-254	0.3354	-0.0036	-0.0198
38	279	-214	0.2958	280	-220	0.3000	0.0042	-0.0162
40	221	-173	0.2364	220	-179	0.2394	0.0030	-0.0204
42	91	-36	0.0762	79	-29	0.0648	-0.0114	-0.0234
44	-27	81	-0.0648	-29	77	-0.0636	0.0012	-0.0120
46	-150	194	-0.2064	-151	191	-0.2052	0.0012	-0.0132
48	-211	270	-0.2886	-215	272	-0.2922	-0.0036	-0.0144
50	-333	369	-0.4212	-337	368	-0.4230	-0.0018	-0.0108
52	-595	638	-0.7398	-598	636	-0.7404	-0.0006	-0.0090
54	-645	678	-0.7938	-653	684	-0.8022	-0.0084	-0.0084
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 10/20/2009 12:43:03 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:02:07 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-284	351	-0.3810	-279	343	-0.3732	0.0078	0.0120
4	-273	339	-0.3672	-272	338	-0.3660	0.0012	0.0042
6	-280	339	-0.3714	-280	337	-0.3702	0.0012	0.0030
8	-297	357	-0.3924	-294	357	-0.3906	0.0018	0.0018
10	-301	362	-0.3978	-303	363	-0.3996	-0.0018	0.0000
12	-259	318	-0.3462	-264	319	-0.3498	-0.0036	0.0018
14	-150	206	-0.2136	-151	203	-0.2124	0.0012	0.0054
16	-63	111	-0.1044	-61	109	-0.1020	0.0024	0.0042
18	27	34	-0.0042	27	33	-0.0036	0.0006	0.0018
20	120	-86	0.1236	118	-86	0.1224	-0.0012	0.0012
22	310	-277	0.3522	308	-276	0.3504	-0.0018	0.0024
24	513	-465	0.5868	514	-461	0.5850	-0.0018	0.0042
26	583	-532	0.6690	581	-528	0.6654	-0.0036	0.0060
28	503	-440	0.5658	502	-442	0.5664	0.0006	0.0096
30	421	-357	0.4668	420	-360	0.4680	0.0012	0.0090
32	357	-293	0.3900	357	-295	0.3912	0.0012	0.0078
34	333	-266	0.3594	334	-267	0.3606	0.0012	0.0066
36	310	-255	0.3390	310	-253	0.3378	-0.0012	0.0054
38	279	-214	0.2958	282	-221	0.3018	0.0060	0.0066
40	221	-173	0.2364	223	-177	0.2400	0.0036	0.0006
42	91	-36	0.0762	83	-28	0.0666	-0.0096	-0.0030
44	-27	81	-0.0648	-26	77	-0.0618	0.0030	0.0066
46	-150	194	-0.2064	-145	191	-0.2016	0.0048	0.0036
48	-211	270	-0.2886	-210	272	-0.2892	-0.0006	-0.0012
50	-333	369	-0.4212	-331	368	-0.4194	0.0018	-0.0006
52	-595	638	-0.7398	-593	636	-0.7374	0.0024	-0.0024
54	-645	678	-0.7938	-650	681	-0.7986	-0.0048	-0.0048
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 11/17/2009 2:24:32 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:02:07 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-284	351	-0.3810	-277	348	-0.3750	0.0060	0.0150
4	-273	339	-0.3672	-269	341	-0.3660	0.0012	0.0090
6	-280	339	-0.3714	-277	341	-0.3708	0.0006	0.0078
8	-297	357	-0.3924	-292	359	-0.3906	0.0018	0.0072
10	-301	362	-0.3978	-302	366	-0.4008	-0.0030	0.0054
12	-259	318	-0.3462	-265	326	-0.3546	-0.0084	0.0084
14	-150	206	-0.2136	-147	209	-0.2136	0.0000	0.0168
16	-63	111	-0.1044	-61	110	-0.1026	0.0018	0.0168
18	27	34	-0.0042	26	38	-0.0072	-0.0030	0.0150
20	120	-86	0.1236	119	-83	0.1212	-0.0024	0.0180
22	310	-277	0.3522	307	-272	0.3474	-0.0048	0.0204
24	513	-465	0.5868	513	-456	0.5814	-0.0054	0.0252
26	583	-532	0.6690	579	-519	0.6588	-0.0102	0.0306
28	503	-440	0.5658	503	-437	0.5640	-0.0018	0.0408
30	421	-357	0.4668	425	-361	0.4716	0.0048	0.0426
32	357	-293	0.3900	363	-305	0.4008	0.0108	0.0378
34	333	-266	0.3594	341	-267	0.3648	0.0054	0.0270
36	310	-255	0.3390	314	-257	0.3426	0.0036	0.0216
38	279	-214	0.2958	287	-217	0.3024	0.0066	0.0180
40	221	-173	0.2364	226	-178	0.2424	0.0060	0.0114
42	91	-36	0.0762	85	-29	0.0684	-0.0078	0.0054
44	-27	81	-0.0648	-21	79	-0.0600	0.0048	0.0132
46	-150	194	-0.2064	-143	193	-0.2016	0.0048	0.0084
48	-211	270	-0.2886	-207	275	-0.2892	-0.0006	0.0036
50	-333	369	-0.4212	-329	366	-0.4170	0.0042	0.0042
52	-595	638	-0.7398	-589	630	-0.7314	0.0084	0.0000
54	-645	678	-0.7938	-651	686	-0.8022	-0.0084	-0.0084
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

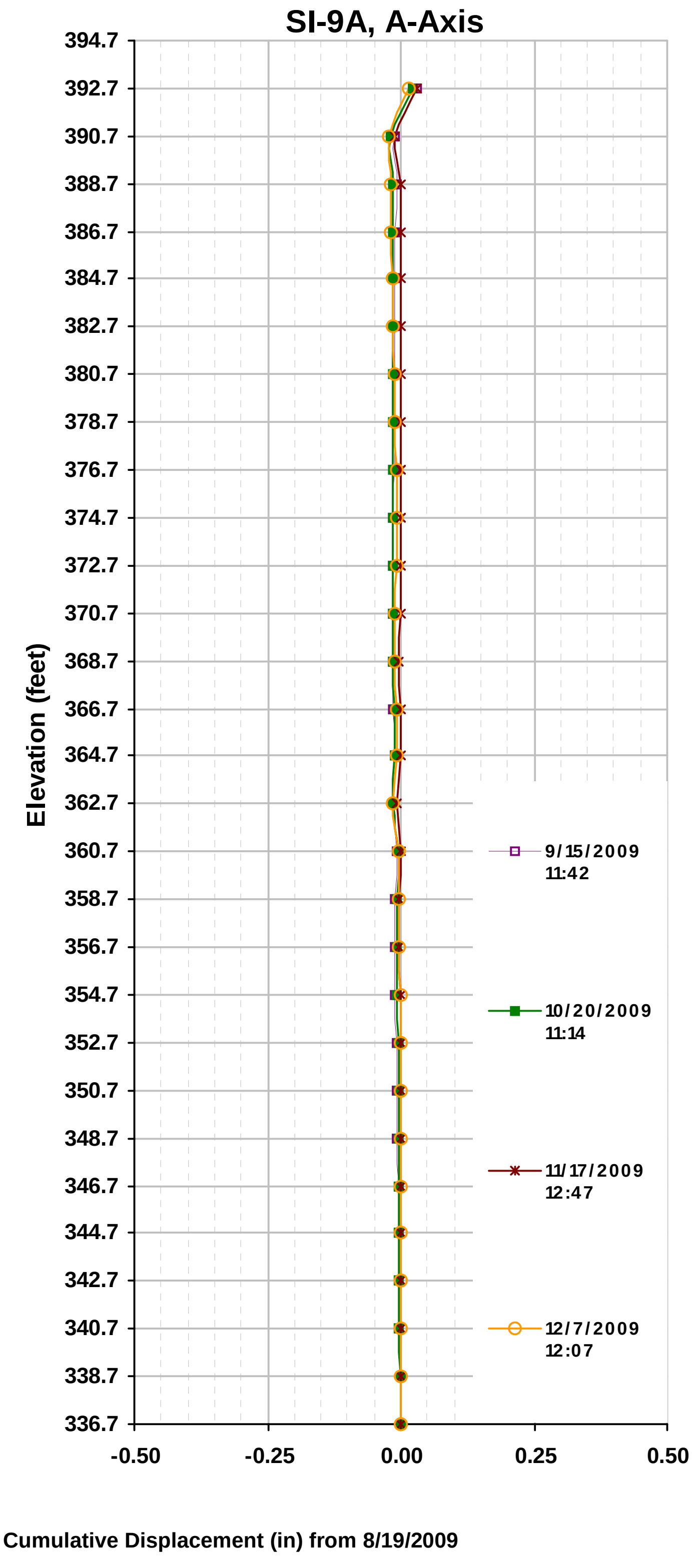
CURRENT SURVEY 12/7/2009 1:33:48 PM

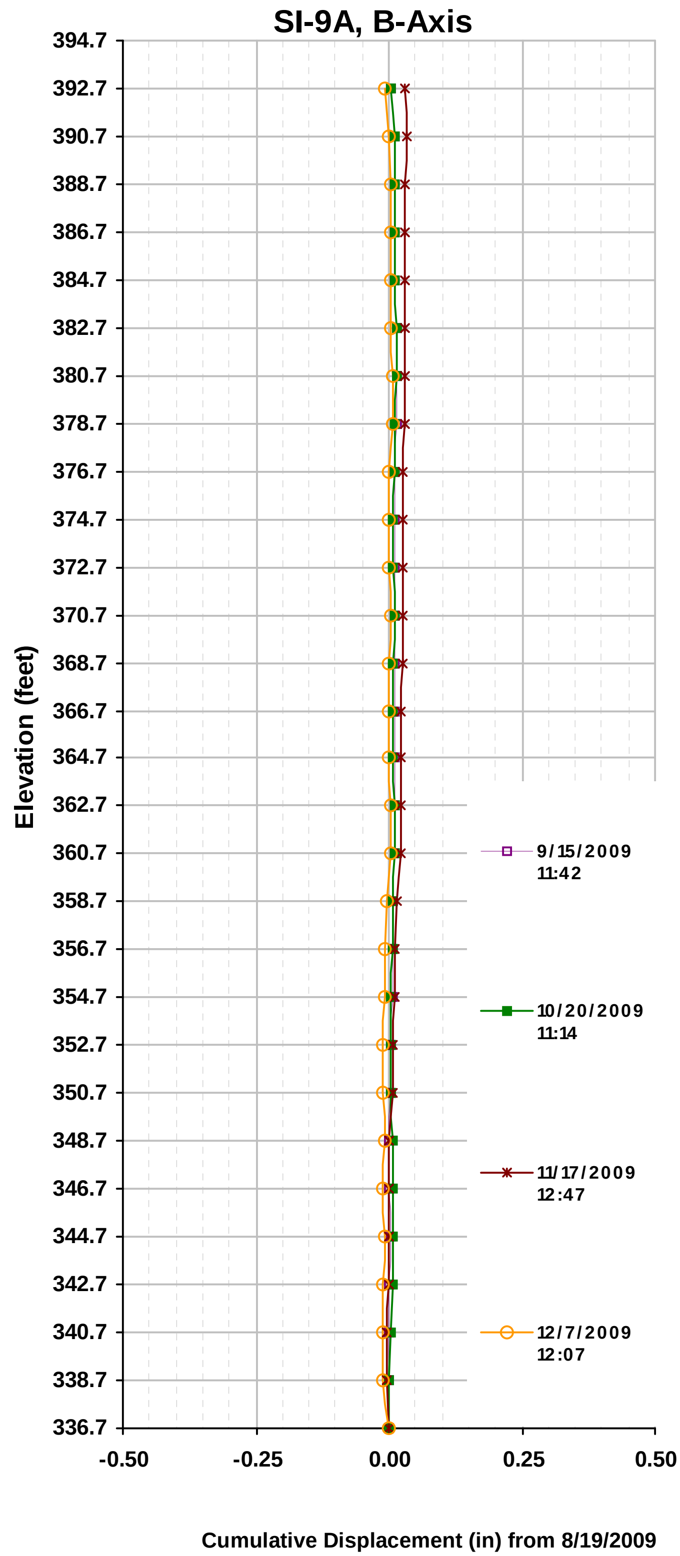
INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:02:07 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-284	351	-0.3810	-277	346	-0.3738	0.0072	0.0024
4	-273	339	-0.3672	-270	340	-0.3660	0.0012	-0.0048
6	-280	339	-0.3714	-278	341	-0.3714	0.0000	-0.0060
8	-297	357	-0.3924	-293	357	-0.3900	0.0024	-0.0060
10	-301	362	-0.3978	-302	362	-0.3984	-0.0006	-0.0084
12	-259	318	-0.3462	-263	327	-0.3540	-0.0078	-0.0078
14	-150	206	-0.2136	-155	213	-0.2208	-0.0072	0.0000
16	-63	111	-0.1044	-61	113	-0.1044	0.0000	0.0072
18	27	34	-0.0042	27	38	-0.0066	-0.0024	0.0072
20	120	-86	0.1236	120	-81	0.1206	-0.0030	0.0096
22	310	-277	0.3522	306	-274	0.3480	-0.0042	0.0126
24	513	-465	0.5868	511	-453	0.5784	-0.0084	0.0168
26	583	-532	0.6690	573	-515	0.6528	-0.0162	0.0252
28	503	-440	0.5658	496	-430	0.5556	-0.0102	0.0414
30	421	-357	0.4668	423	-358	0.4686	0.0018	0.0516
32	357	-293	0.3900	367	-299	0.3996	0.0096	0.0498
34	333	-266	0.3594	343	-273	0.3696	0.0102	0.0402
36	310	-255	0.3390	317	-255	0.3432	0.0042	0.0300
38	279	-214	0.2958	286	-218	0.3024	0.0066	0.0258
40	221	-173	0.2364	228	-175	0.2418	0.0054	0.0192
42	91	-36	0.0762	86	-27	0.0678	-0.0084	0.0138
44	-27	81	-0.0648	-23	79	-0.0612	0.0036	0.0222
46	-150	194	-0.2064	-143	189	-0.1992	0.0072	0.0186
48	-211	270	-0.2886	-206	270	-0.2856	0.0030	0.0114
50	-333	369	-0.4212	-327	363	-0.4140	0.0072	0.0084
52	-595	638	-0.7398	-587	629	-0.7296	0.0102	0.0012
54	-645	678	-0.7938	-654	684	-0.8028	-0.0090	-0.0090
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000





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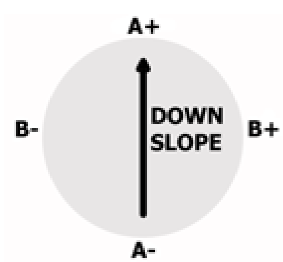


Cumberland Fossil Plant
B-9
Cumberland City, TN
175539009
12/8/2009

SITE CUFTVA

INSTALLATION SI-9A

DESCRIPTION

CURRENT SURVEY 9/15/2009 11:42:31 AM

INITIAL SURVEY 8/19/2009 12:28:54 PM

DATE PRINTED 12/8/2009 11:29:49 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-229	238	-0.2802	-201	200	-0.2406	0.0396	0.0282
4	-257	267	-0.3144	-263	265	-0.3168	-0.0024	-0.0114
6	-257	266	-0.3138	-260	262	-0.3132	0.0006	-0.0090
8	-235	245	-0.2880	-240	239	-0.2874	0.0006	-0.0096
10	-310	320	-0.3780	-314	315	-0.3774	0.0006	-0.0102
12	-342	352	-0.4164	-346	347	-0.4158	0.0006	-0.0108
14	-390	400	-0.4740	-394	395	-0.4734	0.0006	-0.0114
16	-458	467	-0.5550	-462	462	-0.5544	0.0006	-0.0120
18	-533	543	-0.6456	-537	537	-0.6444	0.0012	-0.0126
20	-601	610	-0.7266	-606	605	-0.7266	0.0000	-0.0138
22	-563	571	-0.6804	-567	566	-0.6798	0.0006	-0.0138
24	-553	563	-0.6696	-557	558	-0.6690	0.0006	-0.0144
26	-567	578	-0.6870	-573	574	-0.6882	-0.0012	-0.0150
28	-591	599	-0.7140	-597	595	-0.7152	-0.0012	-0.0138
30	-661	669	-0.7980	-665	663	-0.7968	0.0012	-0.0126
32	-684	693	-0.8262	-692	693	-0.8310	-0.0048	-0.0138
34	-757	767	-0.9144	-759	761	-0.9120	0.0024	-0.0090
36	-838	846	-1.0104	-843	841	-1.0104	0.0000	-0.0114
38	-899	909	-1.0848	-905	905	-1.0860	-0.0012	-0.0114
40	-1002	1015	-1.2102	-1009	1011	-1.2120	-0.0018	-0.0102
42	-1070	1079	-1.2894	-1075	1075	-1.2900	-0.0006	-0.0084
44	-1177	1191	-1.4208	-1185	1186	-1.4226	-0.0018	-0.0078
46	-1242	1253	-1.4970	-1247	1250	-1.4982	-0.0012	-0.0060
48	-1298	1307	-1.5630	-1304	1302	-1.5636	-0.0006	-0.0048
50	-1390	1399	-1.6734	-1395	1394	-1.6734	0.0000	-0.0042
52	-1407	1418	-1.6950	-1414	1413	-1.6962	-0.0012	-0.0042
54	-1446	1458	-1.7424	-1454	1453	-1.7442	-0.0018	-0.0030
56	-1579	1591	-1.9020	-1586	1586	-1.9032	-0.0012	-0.0012
58	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-9A

DESCRIPTION

CURRENT SURVEY 10/20/2009 11:14:37 AM

INITIAL SURVEY 8/19/2009 12:28:54 PM

DATE PRINTED 12/8/2009 11:29:49 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-229	238	-0.2802	-195	205	-0.2400	0.0402	0.0210
4	-257	267	-0.3144	-258	270	-0.3168	-0.0024	-0.0192
6	-257	266	-0.3138	-257	266	-0.3138	0.0000	-0.0168
8	-235	245	-0.2880	-235	245	-0.2880	0.0000	-0.0168
10	-310	320	-0.3780	-311	321	-0.3792	-0.0012	-0.0168
12	-342	352	-0.4164	-342	353	-0.4170	-0.0006	-0.0156
14	-390	400	-0.4740	-390	401	-0.4746	-0.0006	-0.0150
16	-458	467	-0.5550	-457	469	-0.5556	-0.0006	-0.0144
18	-533	543	-0.6456	-532	544	-0.6456	0.0000	-0.0138
20	-601	610	-0.7266	-601	611	-0.7272	-0.0006	-0.0138
22	-563	571	-0.6804	-561	571	-0.6792	0.0012	-0.0132
24	-553	563	-0.6696	-553	563	-0.6696	0.0000	-0.0144
26	-567	578	-0.6870	-569	580	-0.6894	-0.0024	-0.0144
28	-591	599	-0.7140	-593	601	-0.7164	-0.0024	-0.0120
30	-661	669	-0.7980	-657	667	-0.7944	0.0036	-0.0096
32	-684	693	-0.8262	-690	701	-0.8346	-0.0084	-0.0132
34	-757	767	-0.9144	-754	765	-0.9114	0.0030	-0.0048
36	-838	846	-1.0104	-838	846	-1.0104	0.0000	-0.0078
38	-899	909	-1.0848	-900	911	-1.0866	-0.0018	-0.0078
40	-1002	1015	-1.2102	-1002	1017	-1.2114	-0.0012	-0.0060
42	-1070	1079	-1.2894	-1069	1081	-1.2900	-0.0006	-0.0048
44	-1177	1191	-1.4208	-1174	1192	-1.4196	0.0012	-0.0042
46	-1242	1253	-1.4970	-1241	1255	-1.4976	-0.0006	-0.0054
48	-1298	1307	-1.5630	-1298	1309	-1.5642	-0.0012	-0.0048
50	-1390	1399	-1.6734	-1389	1401	-1.6740	-0.0006	-0.0036
52	-1407	1418	-1.6950	-1407	1419	-1.6956	-0.0006	-0.0030
54	-1446	1458	-1.7424	-1446	1459	-1.7430	-0.0006	-0.0024
56	-1579	1591	-1.9020	-1578	1595	-1.9038	-0.0018	-0.0018
58	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-9A

DESCRIPTION

CURRENT SURVEY 11/17/2009 12:47:18 PM

INITIAL SURVEY 8/19/2009 12:28:54 PM

DATE PRINTED 12/8/2009 11:29:49 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-229	238	-0.2802	-198	204	-0.2412	0.0390	0.0294
4	-257	267	-0.3144	-259	280	-0.3234	-0.0090	-0.0096
6	-257	266	-0.3138	-258	264	-0.3132	0.0006	-0.0006
8	-235	245	-0.2880	-237	243	-0.2880	0.0000	-0.0012
10	-310	320	-0.3780	-313	320	-0.3798	-0.0018	-0.0012
12	-342	352	-0.4164	-343	351	-0.4164	0.0000	0.0006
14	-390	400	-0.4740	-391	399	-0.4740	0.0000	0.0006
16	-458	467	-0.5550	-459	466	-0.5550	0.0000	0.0006
18	-533	543	-0.6456	-534	541	-0.6450	0.0006	0.0006
20	-601	610	-0.7266	-602	609	-0.7266	0.0000	0.0000
22	-563	571	-0.6804	-562	569	-0.6786	0.0018	0.0000
24	-553	563	-0.6696	-553	561	-0.6684	0.0012	-0.0018
26	-567	578	-0.6870	-570	578	-0.6888	-0.0018	-0.0030
28	-591	599	-0.7140	-591	598	-0.7134	0.0006	-0.0012
30	-661	669	-0.7980	-657	664	-0.7926	0.0054	-0.0018
32	-684	693	-0.8262	-692	699	-0.8346	-0.0084	-0.0072
34	-757	767	-0.9144	-755	763	-0.9108	0.0036	0.0012
36	-838	846	-1.0104	-838	845	-1.0098	0.0006	-0.0024
38	-899	909	-1.0848	-901	909	-1.0860	-0.0012	-0.0030
40	-1002	1015	-1.2102	-1003	1014	-1.2102	0.0000	-0.0018
42	-1070	1079	-1.2894	-1070	1079	-1.2894	0.0000	-0.0018
44	-1177	1191	-1.4208	-1179	1190	-1.4214	-0.0006	-0.0018
46	-1242	1253	-1.4970	-1243	1253	-1.4976	-0.0006	-0.0012
48	-1298	1307	-1.5630	-1298	1309	-1.5642	-0.0012	-0.0006
50	-1390	1399	-1.6734	-1388	1398	-1.6716	0.0018	0.0006
52	-1407	1418	-1.6950	-1409	1419	-1.6968	-0.0018	-0.0012
54	-1446	1458	-1.7424	-1446	1457	-1.7418	0.0006	0.0006
56	-1579	1591	-1.9020	-1579	1591	-1.9020	0.0000	0.0000
58	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-9A

DESCRIPTION

CURRENT SURVEY 12/7/2009 12:07:11 PM

INITIAL SURVEY 8/19/2009 12:28:54 PM

DATE PRINTED 12/8/2009 11:29:49 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-229	238	-0.2802	-199	205	-0.2424	0.0378	0.0156
4	-257	267	-0.3144	-261	270	-0.3186	-0.0042	-0.0222
6	-257	266	-0.3138	-259	265	-0.3144	-0.0006	-0.0180
8	-235	245	-0.2880	-237	245	-0.2892	-0.0012	-0.0174
10	-310	320	-0.3780	-312	321	-0.3798	-0.0018	-0.0162
12	-342	352	-0.4164	-345	352	-0.4182	-0.0018	-0.0144
14	-390	400	-0.4740	-392	401	-0.4758	-0.0018	-0.0126
16	-458	467	-0.5550	-459	469	-0.5568	-0.0018	-0.0108
18	-533	543	-0.6456	-534	542	-0.6456	0.0000	-0.0090
20	-601	610	-0.7266	-602	610	-0.7272	-0.0006	-0.0090
22	-563	571	-0.6804	-562	569	-0.6786	0.0018	-0.0084
24	-553	563	-0.6696	-553	562	-0.6690	0.0006	-0.0102
26	-567	578	-0.6870	-570	579	-0.6894	-0.0024	-0.0108
28	-591	599	-0.7140	-592	599	-0.7146	-0.0006	-0.0084
30	-661	669	-0.7980	-656	665	-0.7926	0.0054	-0.0078
32	-684	693	-0.8262	-694	701	-0.8370	-0.0108	-0.0132
34	-757	767	-0.9144	-756	765	-0.9126	0.0018	-0.0024
36	-838	846	-1.0104	-841	846	-1.0122	-0.0018	-0.0042
38	-899	909	-1.0848	-900	909	-1.0854	-0.0006	-0.0024
40	-1002	1015	-1.2102	-1003	1015	-1.2108	-0.0006	-0.0018
42	-1070	1079	-1.2894	-1070	1079	-1.2894	0.0000	-0.0012
44	-1177	1191	-1.4208	-1177	1190	-1.4202	0.0006	-0.0012
46	-1242	1253	-1.4970	-1243	1254	-1.4982	-0.0012	-0.0018
48	-1298	1307	-1.5630	-1298	1307	-1.5630	0.0000	-0.0006
50	-1390	1399	-1.6734	-1389	1399	-1.6728	0.0006	-0.0006
52	-1407	1418	-1.6950	-1409	1419	-1.6968	-0.0018	-0.0012
54	-1446	1458	-1.7424	-1446	1458	-1.7424	0.0000	0.0006
56	-1579	1591	-1.9020	-1578	1591	-1.9014	0.0006	0.0006
58	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-9A

DESCRIPTION

CURRENT SURVEY 9/15/2009 11:42:31 AM

INITIAL SURVEY 8/19/2009 12:28:54 PM

DATE PRINTED 12/8/2009 11:29:59 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-298	345	-0.3858	-301	354	-0.3930	-0.0072	0.0036
4	-270	314	-0.3504	-267	320	-0.3522	-0.0018	0.0108
6	-238	285	-0.3138	-233	287	-0.3120	0.0018	0.0126
8	-211	275	-0.2916	-215	273	-0.2928	-0.0012	0.0108
10	-191	249	-0.2640	-195	247	-0.2652	-0.0012	0.0120
12	-193	250	-0.2658	-195	249	-0.2664	-0.0006	0.0132
14	-176	234	-0.2460	-176	233	-0.2454	0.0006	0.0138
16	-214	273	-0.2922	-214	271	-0.2910	0.0012	0.0132
18	-248	299	-0.3282	-247	298	-0.3270	0.0012	0.0120
20	-253	311	-0.3384	-255	310	-0.3390	-0.0006	0.0108
22	-229	286	-0.3090	-233	284	-0.3102	-0.0012	0.0114
24	-200	257	-0.2742	-202	254	-0.2736	0.0006	0.0126
26	-238	292	-0.3180	-238	291	-0.3174	0.0006	0.0120
28	-298	351	-0.3894	-298	351	-0.3894	0.0000	0.0114
30	-296	350	-0.3876	-298	350	-0.3888	-0.0012	0.0114
32	-330	383	-0.4278	-330	382	-0.4272	0.0006	0.0126
34	-366	421	-0.4722	-364	417	-0.4686	0.0036	0.0120
36	-384	438	-0.4932	-384	437	-0.4926	0.0006	0.0084
38	-399	449	-0.5088	-399	446	-0.5070	0.0018	0.0078
40	-447	494	-0.5646	-444	492	-0.5616	0.0030	0.0060
42	-509	557	-0.6396	-507	558	-0.6390	0.0006	0.0030
44	-586	630	-0.7296	-582	629	-0.7266	0.0030	0.0024
46	-665	707	-0.8232	-666	707	-0.8238	-0.0006	-0.0006
48	-739	776	-0.9090	-743	777	-0.9120	-0.0030	0.0000
50	-747	799	-0.9276	-748	795	-0.9258	0.0018	0.0030
52	-755	806	-0.9366	-753	805	-0.9348	0.0018	0.0012
54	-774	825	-0.9594	-773	825	-0.9588	0.0006	-0.0006
56	-810	850	-0.9960	-810	852	-0.9972	-0.0012	-0.0012
58	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-9A

DESCRIPTION

CURRENT SURVEY 10/20/2009 11:14:37 AM

INITIAL SURVEY 8/19/2009 12:28:54 PM

DATE PRINTED 12/8/2009 11:29:59 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-298	345	-0.3858	-300	354	-0.3924	-0.0066	0.0048
4	-270	314	-0.3504	-265	321	-0.3516	-0.0012	0.0114
6	-238	285	-0.3138	-231	292	-0.3138	0.0000	0.0126
8	-211	275	-0.2916	-211	274	-0.2910	0.0006	0.0126
10	-191	249	-0.2640	-193	249	-0.2652	-0.0012	0.0120
12	-193	250	-0.2658	-194	250	-0.2664	-0.0006	0.0132
14	-176	234	-0.2460	-174	233	-0.2442	0.0018	0.0138
16	-214	273	-0.2922	-214	270	-0.2904	0.0018	0.0120
18	-248	299	-0.3282	-246	299	-0.3270	0.0012	0.0102
20	-253	311	-0.3384	-253	311	-0.3384	0.0000	0.0090
22	-229	286	-0.3090	-230	286	-0.3096	-0.0006	0.0090
24	-200	257	-0.2742	-198	255	-0.2718	0.0024	0.0096
26	-238	292	-0.3180	-236	293	-0.3174	0.0006	0.0072
28	-298	351	-0.3894	-297	352	-0.3894	0.0000	0.0066
30	-296	350	-0.3876	-298	353	-0.3906	-0.0030	0.0066
32	-330	383	-0.4278	-329	385	-0.4284	-0.0006	0.0096
34	-366	421	-0.4722	-362	419	-0.4686	0.0036	0.0102
36	-384	438	-0.4932	-382	439	-0.4926	0.0006	0.0066
38	-399	449	-0.5088	-396	448	-0.5064	0.0024	0.0060
40	-447	494	-0.5646	-447	494	-0.5646	0.0000	0.0036
42	-509	557	-0.6396	-506	559	-0.6390	0.0006	0.0036
44	-586	630	-0.7296	-594	631	-0.7350	-0.0054	0.0030
46	-665	707	-0.8232	-662	709	-0.8226	0.0006	0.0084
48	-739	776	-0.9090	-739	778	-0.9102	-0.0012	0.0078
50	-747	799	-0.9276	-746	797	-0.9258	0.0018	0.0090
52	-755	806	-0.9366	-750	804	-0.9324	0.0042	0.0072
54	-774	825	-0.9594	-772	824	-0.9576	0.0018	0.0030
56	-810	850	-0.9960	-807	851	-0.9948	0.0012	0.0012
58	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-9A

DESCRIPTION

CURRENT SURVEY 11/17/2009 12:47:18 PM

INITIAL SURVEY 8/19/2009 12:28:54 PM

DATE PRINTED 12/8/2009 11:29:59 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-298	345	-0.3858	-299	353	-0.3912	-0.0054	0.0294
4	-270	314	-0.3504	-266	310	-0.3456	0.0048	0.0348
6	-238	285	-0.3138	-230	290	-0.3120	0.0018	0.0300
8	-211	275	-0.2916	-211	275	-0.2916	0.0000	0.0282
10	-191	249	-0.2640	-192	253	-0.2670	-0.0030	0.0282
12	-193	250	-0.2658	-191	251	-0.2652	0.0006	0.0312
14	-176	234	-0.2460	-172	234	-0.2436	0.0024	0.0306
16	-214	273	-0.2922	-212	272	-0.2904	0.0018	0.0282
18	-248	299	-0.3282	-244	301	-0.3270	0.0012	0.0264
20	-253	311	-0.3384	-253	312	-0.3390	-0.0006	0.0252
22	-229	286	-0.3090	-230	288	-0.3108	-0.0018	0.0258
24	-200	257	-0.2742	-195	258	-0.2718	0.0024	0.0276
26	-238	292	-0.3180	-233	294	-0.3162	0.0018	0.0252
28	-298	351	-0.3894	-294	353	-0.3882	0.0012	0.0234
30	-296	350	-0.3876	-297	352	-0.3894	-0.0018	0.0222
32	-330	383	-0.4278	-325	385	-0.4260	0.0018	0.0240
34	-366	421	-0.4722	-358	417	-0.4650	0.0072	0.0222
36	-384	438	-0.4932	-378	438	-0.4896	0.0036	0.0150
38	-399	449	-0.5088	-397	449	-0.5076	0.0012	0.0114
40	-447	494	-0.5646	-446	493	-0.5634	0.0012	0.0102
42	-509	557	-0.6396	-506	558	-0.6384	0.0012	0.0090
44	-586	630	-0.7296	-576	630	-0.7236	0.0060	0.0078
46	-665	707	-0.8232	-659	711	-0.8220	0.0012	0.0018
48	-739	776	-0.9090	-737	777	-0.9084	0.0006	0.0006
50	-747	799	-0.9276	-747	801	-0.9288	-0.0012	0.0000
52	-755	806	-0.9366	-748	806	-0.9324	0.0042	0.0012
54	-774	825	-0.9594	-771	829	-0.9600	-0.0006	-0.0030
56	-810	850	-0.9960	-811	853	-0.9984	-0.0024	-0.0024
58	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-9A

DESCRIPTION

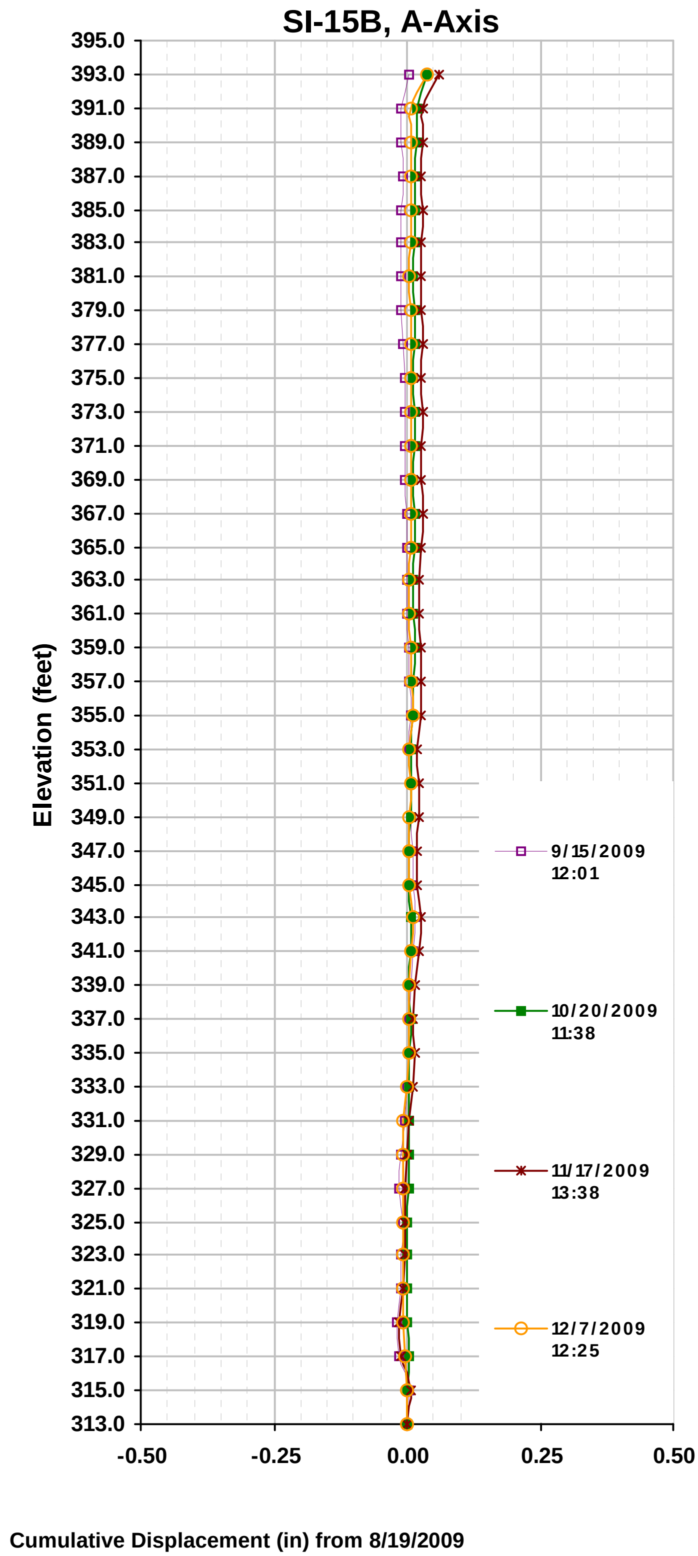
CURRENT SURVEY 12/7/2009 12:07:11 PM

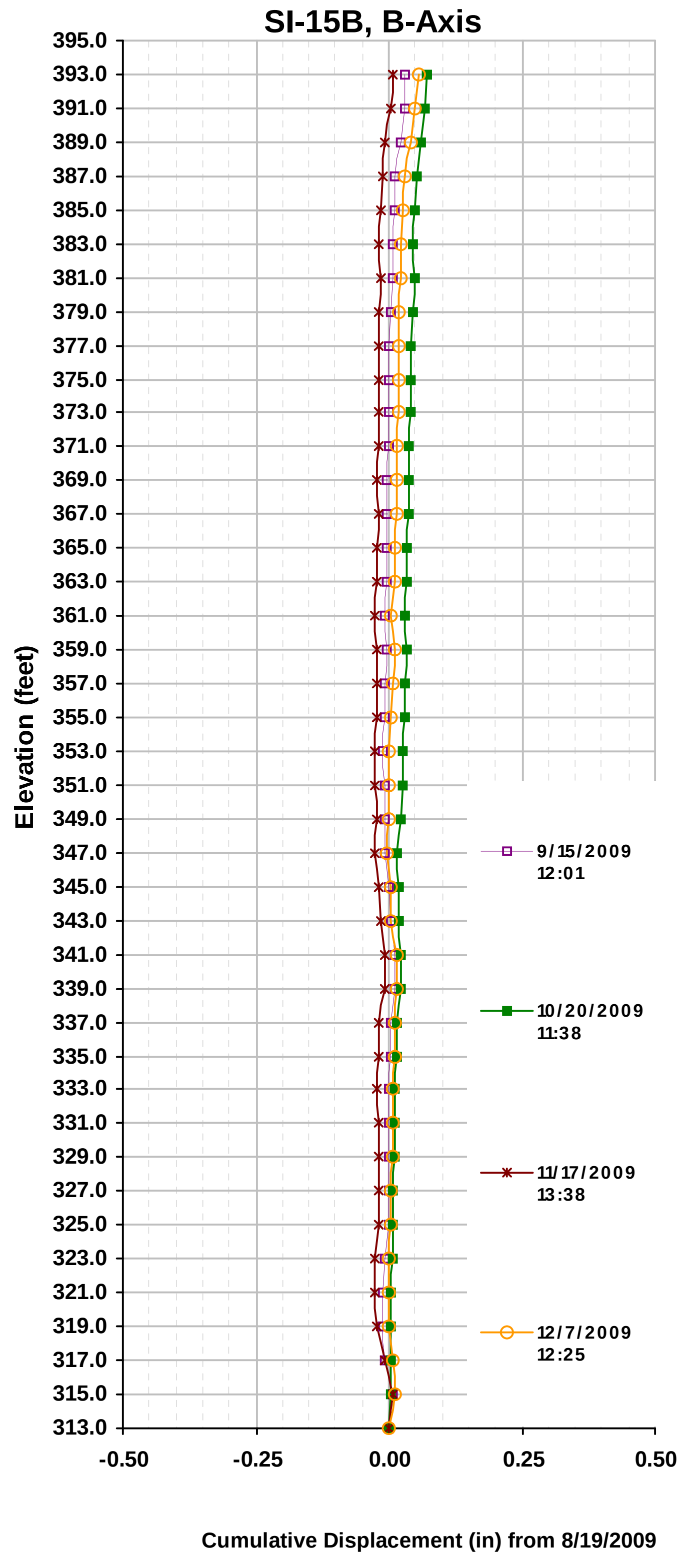
INITIAL SURVEY 8/19/2009 12:28:54 PM

DATE PRINTED 12/8/2009 11:29:59 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-298	345	-0.3858	-299	355	-0.3924	-0.0066	-0.0060
4	-270	314	-0.3504	-266	323	-0.3534	-0.0030	0.0006
6	-238	285	-0.3138	-230	291	-0.3126	0.0012	0.0036
8	-211	275	-0.2916	-211	276	-0.2922	-0.0006	0.0024
10	-191	249	-0.2640	-191	251	-0.2652	-0.0012	0.0030
12	-193	250	-0.2658	-194	253	-0.2682	-0.0024	0.0042
14	-176	234	-0.2460	-174	235	-0.2454	0.0006	0.0066
16	-214	273	-0.2922	-211	266	-0.2862	0.0060	0.0060
18	-248	299	-0.3282	-244	302	-0.3276	0.0006	0.0000
20	-253	311	-0.3384	-253	315	-0.3408	-0.0024	-0.0006
22	-229	286	-0.3090	-229	288	-0.3102	-0.0012	0.0018
24	-200	257	-0.2742	-196	258	-0.2724	0.0018	0.0030
26	-238	292	-0.3180	-233	295	-0.3168	0.0012	0.0012
28	-298	351	-0.3894	-294	354	-0.3888	0.0006	0.0000
30	-296	350	-0.3876	-297	355	-0.3912	-0.0036	-0.0006
32	-330	383	-0.4278	-327	386	-0.4278	0.0000	0.0030
34	-366	421	-0.4722	-359	419	-0.4668	0.0054	0.0030
36	-384	438	-0.4932	-378	438	-0.4896	0.0036	-0.0024
38	-399	449	-0.5088	-394	449	-0.5058	0.0030	-0.0060
40	-447	494	-0.5646	-441	494	-0.5610	0.0036	-0.0090
42	-509	557	-0.6396	-512	559	-0.6426	-0.0030	-0.0126
44	-586	630	-0.7296	-593	629	-0.7332	-0.0036	-0.0096
46	-665	707	-0.8232	-656	709	-0.8190	0.0042	-0.0060
48	-739	776	-0.9090	-738	779	-0.9102	-0.0012	-0.0102
50	-747	799	-0.9276	-745	798	-0.9258	0.0018	-0.0090
52	-755	806	-0.9366	-754	805	-0.9354	0.0012	-0.0108
54	-774	825	-0.9594	-775	826	-0.9606	-0.0012	-0.0120
56	-810	850	-0.9960	-821	857	-1.0068	-0.0108	-0.0108
58	0	0	0.0000	0	0	0.0000	0.0000	0.0000





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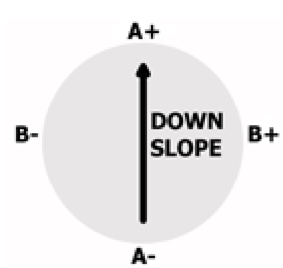


Cumberland Fossil Plant
B-15
Cumberland City, TN
175539009
12/8/2009

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 9/15/2009 12:01:05 PM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:44 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-262	272	-0.3204	-251	258	-0.3054	0.0150	0.0054
4	-236	245	-0.2886	-238	243	-0.2886	0.0000	-0.0096
6	-223	237	-0.2760	-227	235	-0.2772	-0.0012	-0.0096
8	-237	246	-0.2898	-238	243	-0.2886	0.0012	-0.0084
10	-265	274	-0.3234	-266	272	-0.3228	0.0006	-0.0096
12	-287	298	-0.3510	-289	295	-0.3504	0.0006	-0.0102
14	-315	325	-0.3840	-318	324	-0.3852	-0.0012	-0.0108
16	-281	293	-0.3444	-284	293	-0.3462	-0.0018	-0.0096
18	-151	160	-0.1866	-154	161	-0.1890	-0.0024	-0.0078
20	-41	51	-0.0552	-43	50	-0.0558	-0.0006	-0.0054
22	66	-57	0.0738	63	-57	0.0720	-0.0018	-0.0048
24	166	-158	0.1944	164	-159	0.1938	-0.0006	-0.0030
26	219	-209	0.2568	216	-209	0.2550	-0.0018	-0.0024
28	264	-255	0.3114	261	-255	0.3096	-0.0018	-0.0006
30	336	-326	0.3972	336	-329	0.3990	0.0018	0.0012
32	387	-377	0.4584	383	-378	0.4566	-0.0018	-0.0006
34	451	-443	0.5364	447	-442	0.5334	-0.0030	0.0012
36	565	-554	0.6714	562	-555	0.6702	-0.0012	0.0042
38	629	-619	0.7488	626	-621	0.7482	-0.0006	0.0054
40	681	-673	0.8124	681	-675	0.8136	0.0012	0.0060
42	763	-755	0.9108	758	-755	0.9078	-0.0030	0.0048
44	854	-847	1.0206	851	-848	1.0194	-0.0012	0.0078
46	960	-950	1.1460	957	-951	1.1448	-0.0012	0.0090
48	1074	-1064	1.2828	1071	-1064	1.2810	-0.0018	0.0102
50	1173	-1163	1.4016	1169	-1164	1.3998	-0.0018	0.0120
52	1159	-1147	1.3836	1161	-1151	1.3872	0.0036	0.0138
54	1025	-1015	1.2240	1025	-1020	1.2270	0.0030	0.0102
56	786	-773	0.9354	787	-780	0.9402	0.0048	0.0072
58	714	-705	0.8514	711	-703	0.8484	-0.0030	0.0024
60	820	-809	0.9774	822	-813	0.9810	0.0036	0.0054
62	470	-459	0.5574	472	-467	0.5634	0.0060	0.0018
64	183	-170	0.2118	186	-176	0.2172	0.0054	-0.0042
66	-110	123	-0.1398	-109	118	-0.1362	0.0036	-0.0096
68	-33	44	-0.0462	-38	47	-0.0510	-0.0048	-0.0132
70	-39	39	-0.0468	-40	35	-0.0450	0.0018	-0.0084
72	-134	141	-0.1650	-134	137	-0.1626	0.0024	-0.0102
74	-494	506	-0.6000	-490	499	-0.5934	0.0066	-0.0126
76	-818	822	-0.9840	-821	824	-0.9870	-0.0030	-0.0192
78	-92	97	-0.1134	-109	112	-0.1326	-0.0192	-0.0162

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 9/15/2009 12:01:05 PM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:44 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	366	-353	0.4314	365	-359	0.4344	0.0030	0.0030
82	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 10/20/2009 11:38:20 AM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:44 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-262	272	-0.3204	-247	259	-0.3036	0.0168	0.0360
4	-236	245	-0.2886	-234	246	-0.2880	0.0006	0.0192
6	-223	237	-0.2760	-223	231	-0.2724	0.0036	0.0186
8	-237	246	-0.2898	-235	248	-0.2898	0.0000	0.0150
10	-265	274	-0.3234	-263	275	-0.3228	0.0006	0.0150
12	-287	298	-0.3510	-285	297	-0.3492	0.0018	0.0144
14	-315	325	-0.3840	-314	327	-0.3846	-0.0006	0.0126
16	-281	293	-0.3444	-280	295	-0.3450	-0.0006	0.0132
18	-151	160	-0.1866	-148	161	-0.1854	0.0012	0.0138
20	-41	51	-0.0552	-40	53	-0.0558	-0.0006	0.0126
22	66	-57	0.0738	68	-55	0.0738	0.0000	0.0132
24	166	-158	0.1944	169	-156	0.1950	0.0006	0.0132
26	219	-209	0.2568	220	-206	0.2556	-0.0012	0.0126
28	264	-255	0.3114	266	-253	0.3114	0.0000	0.0138
30	336	-326	0.3972	340	-327	0.4002	0.0030	0.0138
32	387	-377	0.4584	389	-376	0.4590	0.0006	0.0108
34	451	-443	0.5364	449	-439	0.5328	-0.0036	0.0102
36	565	-554	0.6714	567	-554	0.6726	0.0012	0.0138
38	629	-619	0.7488	629	-619	0.7488	0.0000	0.0126
40	681	-673	0.8124	689	-676	0.8190	0.0066	0.0126
42	763	-755	0.9108	762	-751	0.9078	-0.0030	0.0060
44	854	-847	1.0206	857	-846	1.0218	0.0012	0.0090
46	960	-950	1.1460	963	-951	1.1484	0.0024	0.0078
48	1074	-1064	1.2828	1076	-1063	1.2834	0.0006	0.0054
50	1173	-1163	1.4016	1172	-1159	1.3986	-0.0030	0.0048
52	1159	-1147	1.3836	1161	-1147	1.3848	0.0012	0.0078
54	1025	-1015	1.2240	1027	-1015	1.2252	0.0012	0.0066
56	786	-773	0.9354	787	-771	0.9348	-0.0006	0.0054
58	714	-705	0.8514	717	-705	0.8532	0.0018	0.0060
60	820	-809	0.9774	821	-807	0.9768	-0.0006	0.0042
62	470	-459	0.5574	471	-459	0.5580	0.0006	0.0048
64	183	-170	0.2118	186	-168	0.2124	0.0006	0.0042
66	-110	123	-0.1398	-109	124	-0.1398	0.0000	0.0036
68	-33	44	-0.0462	-29	43	-0.0432	0.0030	0.0036
70	-39	39	-0.0468	-38	41	-0.0474	-0.0006	0.0006
72	-134	141	-0.1650	-131	142	-0.1638	0.0012	0.0012
74	-494	506	-0.6000	-495	506	-0.6006	-0.0006	0.0000
76	-818	822	-0.9840	-818	826	-0.9864	-0.0024	0.0006
78	-92	97	-0.1134	-85	99	-0.1104	0.0030	0.0030

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 10/20/2009 11:38:20 AM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:45 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	366	-353	0.4314	367	-352	0.4314	0.0000	0.0000
82	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 11/17/2009 1:38:06 PM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:45 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-262	272	-0.3204	-235	248	-0.2898	0.0306	0.0600
4	-236	245	-0.2886	-235	246	-0.2886	0.0000	0.0294
6	-223	237	-0.2760	-222	235	-0.2742	0.0018	0.0294
8	-237	246	-0.2898	-237	247	-0.2904	-0.0006	0.0276
10	-265	274	-0.3234	-263	275	-0.3228	0.0006	0.0282
12	-287	298	-0.3510	-285	297	-0.3492	0.0018	0.0276
14	-315	325	-0.3840	-315	327	-0.3852	-0.0012	0.0258
16	-281	293	-0.3444	-281	295	-0.3456	-0.0012	0.0270
18	-151	160	-0.1866	-149	161	-0.1860	0.0006	0.0282
20	-41	51	-0.0552	-40	53	-0.0558	-0.0006	0.0276
22	66	-57	0.0738	67	-57	0.0744	0.0006	0.0282
24	166	-158	0.1944	168	-157	0.1950	0.0006	0.0276
26	219	-209	0.2568	219	-207	0.2556	-0.0012	0.0270
28	264	-255	0.3114	266	-254	0.3120	0.0006	0.0282
30	336	-326	0.3972	340	-328	0.4008	0.0036	0.0276
32	387	-377	0.4584	389	-378	0.4602	0.0018	0.0240
34	451	-443	0.5364	448	-437	0.5310	-0.0054	0.0222
36	565	-554	0.6714	567	-554	0.6726	0.0012	0.0276
38	629	-619	0.7488	630	-619	0.7494	0.0006	0.0264
40	681	-673	0.8124	689	-678	0.8202	0.0078	0.0258
42	763	-755	0.9108	761	-749	0.9060	-0.0048	0.0180
44	854	-847	1.0206	856	-846	1.0212	0.0006	0.0228
46	960	-950	1.1460	963	-951	1.1484	0.0024	0.0222
48	1074	-1064	1.2828	1075	-1063	1.2828	0.0000	0.0198
50	1173	-1163	1.4016	1170	-1158	1.3968	-0.0048	0.0198
52	1159	-1147	1.3836	1162	-1149	1.3866	0.0030	0.0246
54	1025	-1015	1.2240	1030	-1020	1.2300	0.0060	0.0216
56	786	-773	0.9354	791	-775	0.9396	0.0042	0.0156
58	714	-705	0.8514	714	-699	0.8478	-0.0036	0.0114
60	820	-809	0.9774	825	-812	0.9822	0.0048	0.0150
62	470	-459	0.5574	474	-466	0.5640	0.0066	0.0102
64	183	-170	0.2118	186	-171	0.2142	0.0024	0.0036
66	-110	123	-0.1398	-106	119	-0.1350	0.0048	0.0012
68	-33	44	-0.0462	-31	47	-0.0468	-0.0006	-0.0036
70	-39	39	-0.0468	-37	38	-0.0450	0.0018	-0.0030
72	-134	141	-0.1650	-130	141	-0.1626	0.0024	-0.0048
74	-494	506	-0.6000	-492	498	-0.5940	0.0060	-0.0072
76	-818	822	-0.9840	-818	826	-0.9864	-0.0024	-0.0132
78	-92	97	-0.1134	-110	107	-0.1302	-0.0168	-0.0108

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 11/17/2009 1:38:06 PM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:45 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	366	-353	0.4314	371	-358	0.4374	0.0060	0.0060
82	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 12/7/2009 12:25:39 PM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:45 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-262	272	-0.3204	-238	250	-0.2928	0.0276	0.0366
4	-236	245	-0.2886	-234	245	-0.2874	0.0012	0.0090
6	-223	237	-0.2760	-223	237	-0.2760	0.0000	0.0078
8	-237	246	-0.2898	-237	247	-0.2904	-0.0006	0.0078
10	-265	274	-0.3234	-262	274	-0.3216	0.0018	0.0084
12	-287	298	-0.3510	-285	298	-0.3498	0.0012	0.0066
14	-315	325	-0.3840	-315	327	-0.3852	-0.0012	0.0054
16	-281	293	-0.3444	-281	296	-0.3462	-0.0018	0.0066
18	-151	160	-0.1866	-149	161	-0.1860	0.0006	0.0084
20	-41	51	-0.0552	-40	53	-0.0558	-0.0006	0.0078
22	66	-57	0.0738	67	-58	0.0750	0.0012	0.0084
24	166	-158	0.1944	168	-157	0.1950	0.0006	0.0072
26	219	-209	0.2568	219	-205	0.2544	-0.0024	0.0066
28	264	-255	0.3114	266	-254	0.3120	0.0006	0.0090
30	336	-326	0.3972	341	-328	0.4014	0.0042	0.0084
32	387	-377	0.4584	389	-377	0.4596	0.0012	0.0042
34	451	-443	0.5364	447	-437	0.5304	-0.0060	0.0030
36	565	-554	0.6714	566	-554	0.6720	0.0006	0.0090
38	629	-619	0.7488	629	-617	0.7476	-0.0012	0.0084
40	681	-673	0.8124	689	-677	0.8196	0.0072	0.0096
42	763	-755	0.9108	761	-750	0.9066	-0.0042	0.0024
44	854	-847	1.0206	857	-846	1.0218	0.0012	0.0066
46	960	-950	1.1460	965	-950	1.1490	0.0030	0.0054
48	1074	-1064	1.2828	1073	-1062	1.2810	-0.0018	0.0024
50	1173	-1163	1.4016	1168	-1157	1.3950	-0.0066	0.0042
52	1159	-1147	1.3836	1161	-1149	1.3860	0.0024	0.0108
54	1025	-1015	1.2240	1029	-1017	1.2276	0.0036	0.0084
56	786	-773	0.9354	789	-774	0.9378	0.0024	0.0048
58	714	-705	0.8514	714	-702	0.8496	-0.0018	0.0024
60	820	-809	0.9774	824	-811	0.9810	0.0036	0.0042
62	470	-459	0.5574	475	-465	0.5640	0.0066	0.0006
64	183	-170	0.2118	186	-170	0.2136	0.0018	-0.0060
66	-110	123	-0.1398	-113	122	-0.1410	-0.0012	-0.0078
68	-33	44	-0.0462	-30	46	-0.0456	0.0006	-0.0066
70	-39	39	-0.0468	-39	40	-0.0474	-0.0006	-0.0072
72	-134	141	-0.1650	-131	140	-0.1626	0.0024	-0.0066
74	-494	506	-0.6000	-495	506	-0.6006	-0.0006	-0.0090
76	-818	822	-0.9840	-818	828	-0.9876	-0.0036	-0.0084
78	-92	97	-0.1134	-90	106	-0.1176	-0.0042	-0.0048

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 12/7/2009 12:25:39 PM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:45 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	366	-353	0.4314	366	-352	0.4308	-0.0006	-0.0006
82	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 9/15/2009 12:01:05 PM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:53 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-105	158	-0.1578	-103	156	-0.1554	0.0024	0.0306
4	-86	136	-0.1332	-77	135	-0.1272	0.0060	0.0282
6	-61	107	-0.1008	-46	105	-0.0906	0.0102	0.0222
8	-34	88	-0.0732	-30	89	-0.0714	0.0018	0.0120
10	-47	106	-0.0918	-45	104	-0.0894	0.0024	0.0102
12	-66	117	-0.1098	-67	115	-0.1092	0.0006	0.0078
14	-101	162	-0.1578	-99	157	-0.1536	0.0042	0.0072
16	-171	231	-0.2412	-171	229	-0.2400	0.0012	0.0030
18	-185	248	-0.2598	-185	247	-0.2592	0.0006	0.0018
20	-213	274	-0.2922	-211	272	-0.2898	0.0024	0.0012
22	-236	293	-0.3174	-237	293	-0.3180	-0.0006	-0.0012
24	-268	331	-0.3594	-267	329	-0.3576	0.0018	-0.0006
26	-329	389	-0.4308	-328	387	-0.4290	0.0018	-0.0024
28	-359	422	-0.4686	-359	421	-0.4680	0.0006	-0.0042
30	-387	449	-0.5016	-387	448	-0.5010	0.0006	-0.0048
32	-399	454	-0.5118	-398	452	-0.5100	0.0018	-0.0054
34	-401	462	-0.5178	-403	463	-0.5196	-0.0018	-0.0072
36	-368	429	-0.4782	-367	427	-0.4764	0.0018	-0.0054
38	-350	410	-0.4560	-348	409	-0.4542	0.0018	-0.0072
40	-386	446	-0.4992	-385	443	-0.4968	0.0024	-0.0090
42	-372	417	-0.4734	-375	418	-0.4758	-0.0024	-0.0114
44	-293	353	-0.3876	-293	353	-0.3876	0.0000	-0.0090
46	-230	275	-0.3030	-230	275	-0.3030	0.0000	-0.0090
48	-95	134	-0.1374	-103	139	-0.1452	-0.0078	-0.0090
50	57	-10	0.0402	54	-6	0.0360	-0.0042	-0.0012
52	147	-120	0.1602	143	-111	0.1524	-0.0078	0.0030
54	86	-61	0.0882	85	-60	0.0870	-0.0012	0.0108
56	-117	153	-0.1620	-108	149	-0.1542	0.0078	0.0120
58	-243	299	-0.3252	-244	296	-0.3240	0.0012	0.0042
60	-324	367	-0.4146	-318	367	-0.4110	0.0036	0.0030
62	-439	483	-0.5532	-439	485	-0.5544	-0.0012	-0.0006
64	-417	481	-0.5388	-418	480	-0.5388	0.0000	0.0006
66	-471	533	-0.6024	-472	530	-0.6012	0.0012	0.0006
68	-453	487	-0.5640	-453	487	-0.5640	0.0000	-0.0006
70	-771	791	-0.9372	-766	784	-0.9300	0.0072	-0.0006
72	-973	1004	-1.1862	-971	1002	-1.1838	0.0024	-0.0078
74	-1161	1209	-1.4220	-1160	1209	-1.4214	0.0006	-0.0102
76	-1022	1052	-1.2444	-1023	1057	-1.2480	-0.0036	-0.0108
78	-306	318	-0.3744	-317	329	-0.3876	-0.0132	-0.0072

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 9/15/2009 12:01:05 PM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:54 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-157	189	-0.2076	-154	182	-0.2016	0.0060	0.0060
82	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 10/20/2009 11:38:20 AM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:54 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-105	158	-0.1578	-100	157	-0.1542	0.0036	0.0720
4	-86	136	-0.1332	-73	135	-0.1248	0.0084	0.0684
6	-61	107	-0.1008	-48	110	-0.0948	0.0060	0.0600
8	-34	88	-0.0732	-27	88	-0.0690	0.0042	0.0540
10	-47	106	-0.0918	-41	105	-0.0876	0.0042	0.0498
12	-66	117	-0.1098	-69	118	-0.1122	-0.0024	0.0456
14	-101	162	-0.1578	-99	159	-0.1548	0.0030	0.0480
16	-171	231	-0.2412	-169	230	-0.2394	0.0018	0.0450
18	-185	248	-0.2598	-182	247	-0.2574	0.0024	0.0432
20	-213	274	-0.2922	-210	275	-0.2910	0.0012	0.0408
22	-236	293	-0.3174	-233	295	-0.3168	0.0006	0.0396
24	-268	331	-0.3594	-267	332	-0.3594	0.0000	0.0390
26	-329	389	-0.4308	-327	389	-0.4296	0.0012	0.0390
28	-359	422	-0.4686	-355	421	-0.4656	0.0030	0.0378
30	-387	449	-0.5016	-386	450	-0.5016	0.0000	0.0348
32	-399	454	-0.5118	-394	454	-0.5088	0.0030	0.0348
34	-401	462	-0.5178	-402	465	-0.5202	-0.0024	0.0318
36	-368	429	-0.4782	-364	428	-0.4752	0.0030	0.0342
38	-350	410	-0.4560	-346	410	-0.4536	0.0024	0.0312
40	-386	446	-0.4992	-382	444	-0.4956	0.0036	0.0288
42	-372	417	-0.4734	-370	418	-0.4728	0.0006	0.0252
44	-293	353	-0.3876	-290	351	-0.3846	0.0030	0.0246
46	-230	275	-0.3030	-225	267	-0.2952	0.0078	0.0216
48	-95	134	-0.1374	-98	137	-0.1410	-0.0036	0.0138
50	57	-10	0.0402	57	-10	0.0402	0.0000	0.0174
52	147	-120	0.1602	150	-110	0.1560	-0.0042	0.0174
54	86	-61	0.0882	91	-57	0.0888	0.0006	0.0216
56	-117	153	-0.1620	-107	154	-0.1566	0.0054	0.0210
58	-243	299	-0.3252	-240	298	-0.3228	0.0024	0.0156
60	-324	367	-0.4146	-320	369	-0.4134	0.0012	0.0132
62	-439	483	-0.5532	-438	485	-0.5538	-0.0006	0.0120
64	-417	481	-0.5388	-415	481	-0.5376	0.0012	0.0126
66	-471	533	-0.6024	-470	530	-0.6000	0.0024	0.0114
68	-453	487	-0.5640	-451	487	-0.5628	0.0012	0.0090
70	-771	791	-0.9372	-769	791	-0.9360	0.0012	0.0078
72	-973	1004	-1.1862	-971	1003	-1.1844	0.0018	0.0066
74	-1161	1209	-1.4220	-1159	1210	-1.4214	0.0006	0.0048
76	-1022	1052	-1.2444	-1019	1053	-1.2432	0.0012	0.0042
78	-306	318	-0.3744	-308	318	-0.3756	-0.0012	0.0030

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 10/20/2009 11:38:20 AM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:54 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-157	189	-0.2076	-156	183	-0.2034	0.0042	0.0042
82	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 11/17/2009 1:38:06 PM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:54 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-105	158	-0.1578	-99	159	-0.1548	0.0030	0.0060
4	-86	136	-0.1332	-69	136	-0.1230	0.0102	0.0030
6	-61	107	-0.1008	-47	114	-0.0966	0.0042	-0.0072
8	-34	88	-0.0732	-23	91	-0.0684	0.0048	-0.0114
10	-47	106	-0.0918	-39	108	-0.0882	0.0036	-0.0162
12	-66	117	-0.1098	-66	122	-0.1128	-0.0030	-0.0198
14	-101	162	-0.1578	-98	161	-0.1554	0.0024	-0.0168
16	-171	231	-0.2412	-169	234	-0.2418	-0.0006	-0.0192
18	-185	248	-0.2598	-181	250	-0.2586	0.0012	-0.0186
20	-213	274	-0.2922	-209	278	-0.2922	0.0000	-0.0198
22	-236	293	-0.3174	-232	296	-0.3168	0.0006	-0.0198
24	-268	331	-0.3594	-266	332	-0.3588	0.0006	-0.0204
26	-329	389	-0.4308	-327	392	-0.4314	-0.0006	-0.0210
28	-359	422	-0.4686	-355	422	-0.4662	0.0024	-0.0204
30	-387	449	-0.5016	-383	452	-0.5010	0.0006	-0.0228
32	-399	454	-0.5118	-394	455	-0.5094	0.0024	-0.0234
34	-401	462	-0.5178	-401	469	-0.5220	-0.0042	-0.0258
36	-368	429	-0.4782	-365	430	-0.4770	0.0012	-0.0216
38	-350	410	-0.4560	-347	413	-0.4560	0.0000	-0.0228
40	-386	446	-0.4992	-383	445	-0.4968	0.0024	-0.0228
42	-372	417	-0.4734	-369	421	-0.4740	-0.0006	-0.0252
44	-293	353	-0.3876	-290	357	-0.3882	-0.0006	-0.0246
46	-230	275	-0.3030	-224	277	-0.3006	0.0024	-0.0240
48	-95	134	-0.1374	-99	143	-0.1452	-0.0078	-0.0264
50	57	-10	0.0402	58	-3	0.0366	-0.0036	-0.0186
52	147	-120	0.1602	148	-105	0.1518	-0.0084	-0.0150
54	86	-61	0.0882	93	-58	0.0906	0.0024	-0.0066
56	-117	153	-0.1620	-104	150	-0.1524	0.0096	-0.0090
58	-243	299	-0.3252	-239	301	-0.3240	0.0012	-0.0186
60	-324	367	-0.4146	-319	370	-0.4134	0.0012	-0.0198
62	-439	483	-0.5532	-437	488	-0.5550	-0.0018	-0.0210
64	-417	481	-0.5388	-416	482	-0.5388	0.0000	-0.0192
66	-471	533	-0.6024	-470	535	-0.6030	-0.0006	-0.0192
68	-453	487	-0.5640	-449	489	-0.5628	0.0012	-0.0186
70	-771	791	-0.9372	-765	788	-0.9318	0.0054	-0.0198
72	-973	1004	-1.1862	-970	1008	-1.1868	-0.0006	-0.0252
74	-1161	1209	-1.4220	-1159	1212	-1.4226	-0.0006	-0.0246
76	-1022	1052	-1.2444	-1039	1065	-1.2624	-0.0180	-0.0240
78	-306	318	-0.3744	-318	328	-0.3876	-0.0132	-0.0060

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 11/17/2009 1:38:06 PM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:54 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-157	189	-0.2076	-149	185	-0.2004	0.0072	0.0072
82	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

CURRENT SURVEY 12/7/2009 12:25:39 PM

INITIAL SURVEY 8/19/2009 12:56:14 PM

DATE PRINTED 12/8/2009 10:57:54 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-105	158	-0.1578	-96	156	-0.1512	0.0066	0.0546
4	-86	136	-0.1332	-71	138	-0.1254	0.0078	0.0480
6	-61	107	-0.1008	-44	109	-0.0918	0.0090	0.0402
8	-34	88	-0.0732	-23	91	-0.0684	0.0048	0.0312
10	-47	106	-0.0918	-38	109	-0.0882	0.0036	0.0264
12	-66	117	-0.1098	-63	121	-0.1104	-0.0006	0.0228
14	-101	162	-0.1578	-97	160	-0.1542	0.0036	0.0234
16	-171	231	-0.2412	-167	234	-0.2406	0.0006	0.0198
18	-185	248	-0.2598	-180	251	-0.2586	0.0012	0.0192
20	-213	274	-0.2922	-209	279	-0.2928	-0.0006	0.0180
22	-236	293	-0.3174	-231	295	-0.3156	0.0018	0.0186
24	-268	331	-0.3594	-265	329	-0.3564	0.0030	0.0168
26	-329	389	-0.4308	-327	393	-0.4320	-0.0012	0.0138
28	-359	422	-0.4686	-352	422	-0.4644	0.0042	0.0150
30	-387	449	-0.5016	-383	451	-0.5004	0.0012	0.0108
32	-399	454	-0.5118	-392	454	-0.5076	0.0042	0.0096
34	-401	462	-0.5178	-401	469	-0.5220	-0.0042	0.0054
36	-368	429	-0.4782	-363	429	-0.4752	0.0030	0.0096
38	-350	410	-0.4560	-345	411	-0.4536	0.0024	0.0066
40	-386	446	-0.4992	-381	446	-0.4962	0.0030	0.0042
42	-372	417	-0.4734	-366	418	-0.4704	0.0030	0.0012
44	-293	353	-0.3876	-291	357	-0.3888	-0.0012	-0.0018
46	-230	275	-0.3030	-226	274	-0.3000	0.0030	-0.0006
48	-95	134	-0.1374	-103	141	-0.1464	-0.0090	-0.0036
50	57	-10	0.0402	62	-6	0.0408	0.0006	0.0054
52	147	-120	0.1602	146	-106	0.1512	-0.0090	0.0048
54	86	-61	0.0882	89	-56	0.0870	-0.0012	0.0138
56	-117	153	-0.1620	-109	157	-0.1596	0.0024	0.0150
58	-243	299	-0.3252	-238	301	-0.3234	0.0018	0.0126
60	-324	367	-0.4146	-318	369	-0.4122	0.0024	0.0108
62	-439	483	-0.5532	-435	488	-0.5538	-0.0006	0.0084
64	-417	481	-0.5388	-414	482	-0.5376	0.0012	0.0090
66	-471	533	-0.6024	-466	534	-0.6000	0.0024	0.0078
68	-453	487	-0.5640	-450	489	-0.5634	0.0006	0.0054
70	-771	791	-0.9372	-767	790	-0.9342	0.0030	0.0048
72	-973	1004	-1.1862	-970	1006	-1.1856	0.0006	0.0018
74	-1161	1209	-1.4220	-1159	1211	-1.4220	0.0000	0.0012
76	-1022	1052	-1.2444	-1030	1057	-1.2522	-0.0078	0.0012
78	-306	318	-0.3744	-301	325	-0.3756	-0.0012	0.0090

SITE CUFTVA

INSTALLATION SI-15B

DESCRIPTION

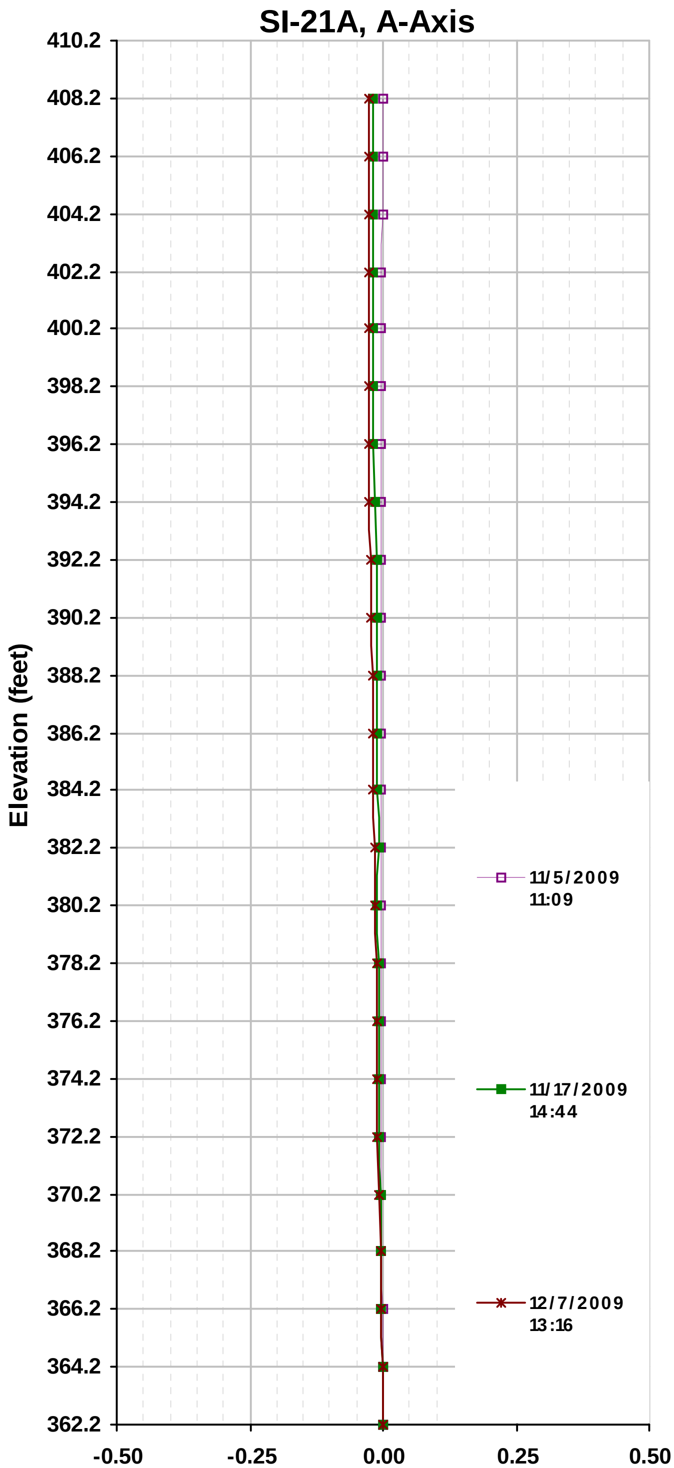
CURRENT SURVEY 12/7/2009 12:25:39 PM

INITIAL SURVEY 8/19/2009 12:56:14 PM

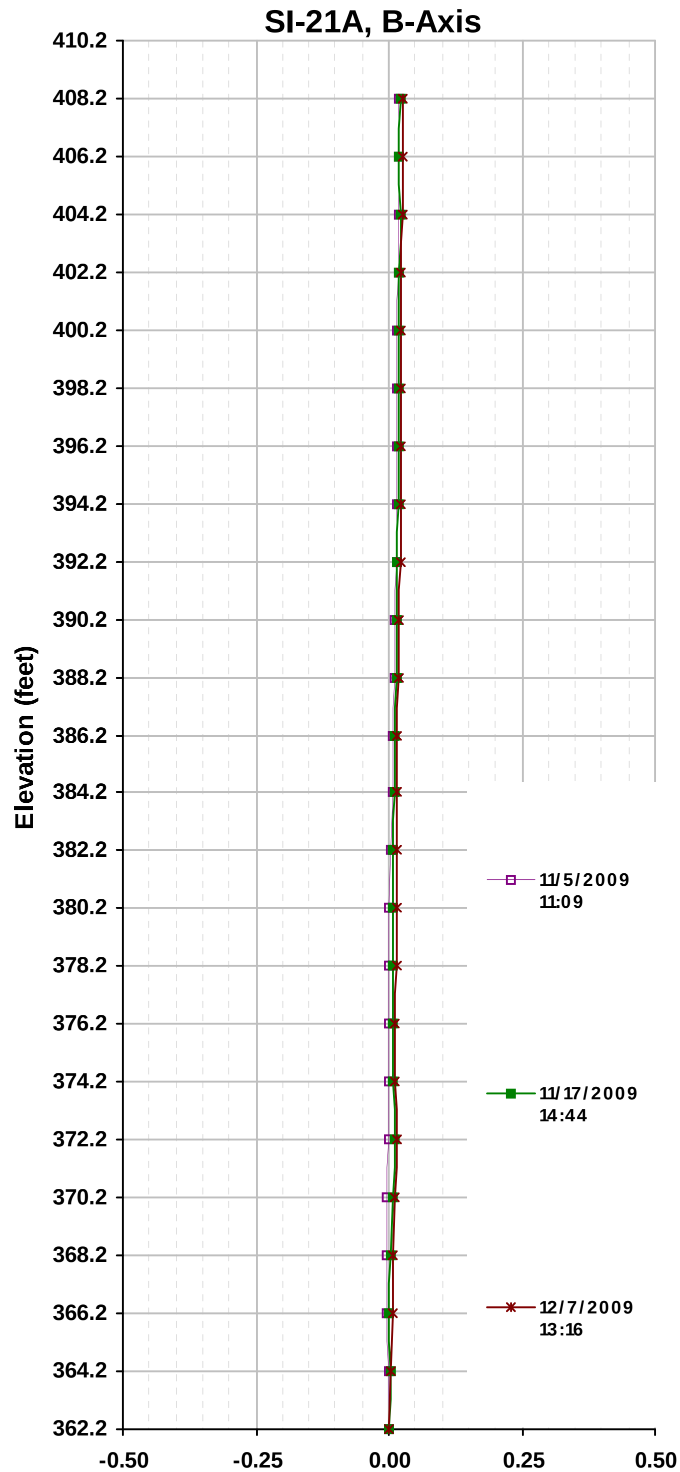
DATE PRINTED 12/8/2009 10:57:54 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
80	-157	189	-0.2076	-154	175	-0.1974	0.0102	0.0102
82	0	0	0.0000	0	0	0.0000	0.0000	0.0000

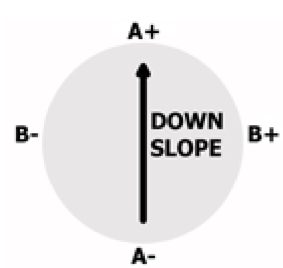


Cumulative Displacement (in) from 8/19/2009



Cumulative Displacement (in) from 8/19/2009

Stantec



Cumberland Fossil Plant
B-21A
Cumberland City, TN
175539009
12/8/2009

SITE CUFTVA

INSTALLATION SI-21A

DESCRIPTION

CURRENT SURVEY 11/5/2009 11:09:26 AM

INITIAL SURVEY 8/19/2009 1:49:26 PM

DATE PRINTED 12/8/2009 10:58:29 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	138	-126	0.1584	138	-125	0.1578	-0.0006	-0.0018
4	117	-105	0.1332	118	-105	0.1338	0.0006	-0.0012
6	120	-107	0.1362	121	-107	0.1368	0.0006	-0.0018
8	116	-103	0.1314	117	-104	0.1326	0.0012	-0.0024
10	176	-166	0.2052	178	-165	0.2058	0.0006	-0.0036
12	221	-209	0.2580	223	-209	0.2592	0.0012	-0.0042
14	297	-285	0.3492	298	-284	0.3492	0.0000	-0.0054
16	401	-391	0.4752	401	-389	0.4740	-0.0012	-0.0054
18	494	-482	0.5856	494	-481	0.5850	-0.0006	-0.0042
20	537	-528	0.6390	538	-526	0.6384	-0.0006	-0.0036
22	550	-538	0.6528	551	-538	0.6534	0.0006	-0.0030
24	557	-547	0.6624	559	-546	0.6630	0.0006	-0.0036
26	558	-547	0.6630	558	-545	0.6618	-0.0012	-0.0042
28	570	-558	0.6768	571	-557	0.6768	0.0000	-0.0030
30	595	-586	0.7086	597	-585	0.7092	0.0006	-0.0030
32	654	-642	0.7776	655	-641	0.7776	0.0000	-0.0036
34	686	-676	0.8172	687	-675	0.8172	0.0000	-0.0036
36	678	-667	0.8070	680	-667	0.8082	0.0012	-0.0036
38	587	-575	0.6972	586	-572	0.6948	-0.0024	-0.0048
40	589	-579	0.7008	590	-579	0.7014	0.0006	-0.0024
42	609	-597	0.7236	609	-595	0.7224	-0.0012	-0.0030
44	640	-627	0.7602	639	-625	0.7584	-0.0018	-0.0018
46	683	-673	0.8136	685	-671	0.8136	0.0000	0.0000
48	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-21A

DESCRIPTION

CURRENT SURVEY 11/17/2009 2:44:50 PM

INITIAL SURVEY 8/19/2009 1:49:26 PM

DATE PRINTED 12/8/2009 10:58:29 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	138	-126	0.1584	137	-126	0.1578	-0.0006	-0.0186
4	117	-105	0.1332	116	-105	0.1326	-0.0006	-0.0180
6	120	-107	0.1362	120	-109	0.1374	0.0012	-0.0174
8	116	-103	0.1314	115	-103	0.1308	-0.0006	-0.0186
10	176	-166	0.2052	175	-166	0.2046	-0.0006	-0.0180
12	221	-209	0.2580	221	-209	0.2580	0.0000	-0.0174
14	297	-285	0.3492	295	-285	0.3480	-0.0012	-0.0174
16	401	-391	0.4752	399	-387	0.4716	-0.0036	-0.0162
18	494	-482	0.5856	494	-481	0.5850	-0.0006	-0.0126
20	537	-528	0.6390	537	-526	0.6378	-0.0012	-0.0120
22	550	-538	0.6528	550	-538	0.6528	0.0000	-0.0108
24	557	-547	0.6624	558	-546	0.6624	0.0000	-0.0108
26	558	-547	0.6630	557	-545	0.6612	-0.0018	-0.0108
28	570	-558	0.6768	569	-563	0.6792	0.0024	-0.0090
30	595	-586	0.7086	594	-581	0.7050	-0.0036	-0.0114
32	654	-642	0.7776	653	-642	0.7770	-0.0006	-0.0078
34	686	-676	0.8172	686	-675	0.8166	-0.0006	-0.0072
36	678	-667	0.8070	679	-666	0.8070	0.0000	-0.0066
38	587	-575	0.6972	585	-573	0.6948	-0.0024	-0.0066
40	589	-579	0.7008	588	-580	0.7008	0.0000	-0.0042
42	609	-597	0.7236	607	-596	0.7218	-0.0018	-0.0042
44	640	-627	0.7602	639	-625	0.7584	-0.0018	-0.0024
46	683	-673	0.8136	684	-671	0.8130	-0.0006	-0.0006
48	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-21A

DESCRIPTION

CURRENT SURVEY 12/7/2009 1:16:21 PM

INITIAL SURVEY 8/19/2009 1:49:26 PM

DATE PRINTED 12/8/2009 10:58:29 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	138	-126	0.1584	137	-126	0.1578	-0.0006	-0.0276
4	117	-105	0.1332	115	-106	0.1326	-0.0006	-0.0270
6	120	-107	0.1362	119	-109	0.1368	0.0006	-0.0264
8	116	-103	0.1314	114	-104	0.1308	-0.0006	-0.0270
10	176	-166	0.2052	175	-165	0.2040	-0.0012	-0.0264
12	221	-209	0.2580	221	-210	0.2586	0.0006	-0.0252
14	297	-285	0.3492	295	-286	0.3486	-0.0006	-0.0258
16	401	-391	0.4752	399	-390	0.4734	-0.0018	-0.0252
18	494	-482	0.5856	493	-481	0.5844	-0.0012	-0.0234
20	537	-528	0.6390	535	-526	0.6366	-0.0024	-0.0222
22	550	-538	0.6528	549	-538	0.6522	-0.0006	-0.0198
24	557	-547	0.6624	557	-546	0.6618	-0.0006	-0.0192
26	558	-547	0.6630	555	-546	0.6606	-0.0024	-0.0186
28	570	-558	0.6768	569	-558	0.6762	-0.0006	-0.0162
30	595	-586	0.7086	594	-582	0.7056	-0.0030	-0.0156
32	654	-642	0.7776	653	-642	0.7770	-0.0006	-0.0126
34	686	-676	0.8172	685	-675	0.8160	-0.0012	-0.0120
36	678	-667	0.8070	678	-667	0.8070	0.0000	-0.0108
38	587	-575	0.6972	581	-574	0.6930	-0.0042	-0.0108
40	589	-579	0.7008	588	-578	0.6996	-0.0012	-0.0066
42	609	-597	0.7236	607	-596	0.7218	-0.0018	-0.0054
44	640	-627	0.7602	637	-625	0.7572	-0.0030	-0.0036
46	683	-673	0.8136	683	-672	0.8130	-0.0006	-0.0006
48	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-21A

DESCRIPTION

CURRENT SURVEY 11/5/2009 11:09:26 AM

INITIAL SURVEY 8/19/2009 1:49:26 PM

DATE PRINTED 12/8/2009 10:58:38 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-57	119	-0.1056	-57	119	-0.1056	0.0000	0.0192
4	3	59	-0.0336	4	61	-0.0342	-0.0006	0.0192
6	59	-3	0.0372	61	-5	0.0396	0.0024	0.0198
8	82	-34	0.0696	86	-32	0.0708	0.0012	0.0174
10	140	-81	0.1326	142	-81	0.1338	0.0012	0.0162
12	169	-104	0.1638	170	-104	0.1644	0.0006	0.0150
14	188	-127	0.1890	190	-126	0.1896	0.0006	0.0144
16	182	-121	0.1818	183	-121	0.1824	0.0006	0.0138
18	151	-101	0.1512	153	-101	0.1524	0.0012	0.0132
20	164	-102	0.1596	163	-103	0.1596	0.0000	0.0120
22	187	-122	0.1854	191	-123	0.1884	0.0030	0.0120
24	223	-160	0.2298	226	-161	0.2322	0.0024	0.0090
26	246	-185	0.2586	247	-190	0.2622	0.0036	0.0066
28	263	-214	0.2862	265	-215	0.2880	0.0018	0.0030
30	312	-254	0.3396	313	-255	0.3408	0.0012	0.0012
32	350	-286	0.3816	353	-285	0.3828	0.0012	0.0000
34	359	-296	0.3930	361	-295	0.3936	0.0006	-0.0012
36	367	-305	0.4032	369	-302	0.4026	-0.0006	-0.0018
38	355	-302	0.3942	355	-304	0.3954	0.0012	-0.0012
40	353	-298	0.3906	357	-298	0.3930	0.0024	-0.0024
42	384	-321	0.4230	385	-321	0.4236	0.0006	-0.0048
44	388	-339	0.4362	382	-338	0.4320	-0.0042	-0.0054
46	255	-220	0.2850	254	-219	0.2838	-0.0012	-0.0012
48	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-21A

DESCRIPTION

CURRENT SURVEY 11/17/2009 2:44:50 PM

INITIAL SURVEY 8/19/2009 1:49:26 PM

DATE PRINTED 12/8/2009 10:58:38 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-57	119	-0.1056	-53	120	-0.1038	0.0018	0.0222
4	3	59	-0.0336	3	62	-0.0354	-0.0018	0.0204
6	59	-3	0.0372	63	-2	0.0390	0.0018	0.0222
8	82	-34	0.0696	88	-30	0.0708	0.0012	0.0204
10	140	-81	0.1326	145	-78	0.1338	0.0012	0.0192
12	169	-104	0.1638	172	-101	0.1638	0.0000	0.0180
14	188	-127	0.1890	193	-122	0.1890	0.0000	0.0180
16	182	-121	0.1818	185	-121	0.1836	0.0018	0.0180
18	151	-101	0.1512	156	-99	0.1530	0.0018	0.0162
20	164	-102	0.1596	166	-99	0.1590	-0.0006	0.0144
22	187	-122	0.1854	193	-122	0.1890	0.0036	0.0150
24	223	-160	0.2298	227	-157	0.2304	0.0006	0.0114
26	246	-185	0.2586	248	-186	0.2604	0.0018	0.0108
28	263	-214	0.2862	267	-210	0.2862	0.0000	0.0090
30	312	-254	0.3396	313	-253	0.3396	0.0000	0.0090
32	350	-286	0.3816	354	-282	0.3816	0.0000	0.0090
34	359	-296	0.3930	362	-293	0.3930	0.0000	0.0090
36	367	-305	0.4032	370	-299	0.4014	-0.0018	0.0090
38	355	-302	0.3942	361	-302	0.3978	0.0036	0.0108
40	353	-298	0.3906	360	-296	0.3936	0.0030	0.0072
42	384	-321	0.4230	389	-321	0.4260	0.0030	0.0042
44	388	-339	0.4362	384	-337	0.4326	-0.0036	0.0012
46	255	-220	0.2850	254	-229	0.2898	0.0048	0.0048
48	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-21A

DESCRIPTION

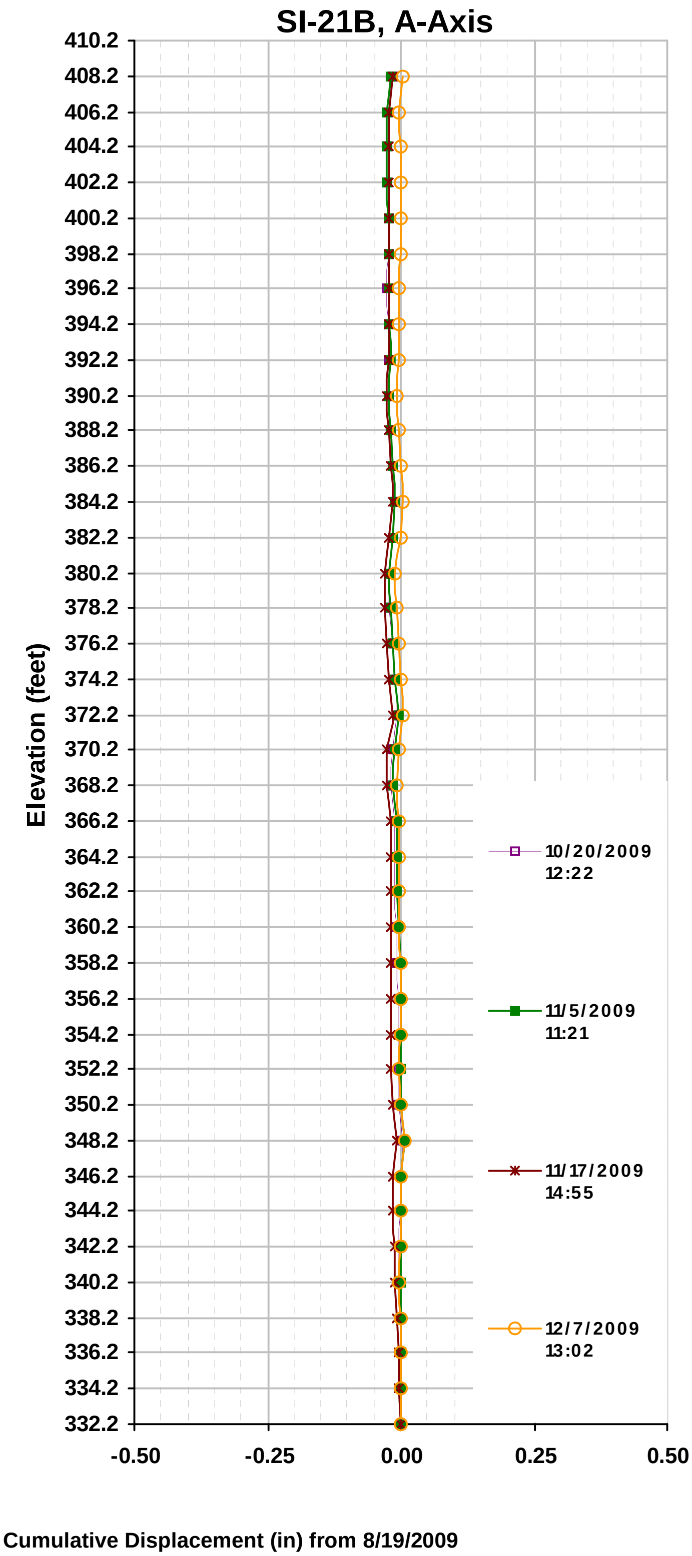
CURRENT SURVEY 12/7/2009 1:16:21 PM

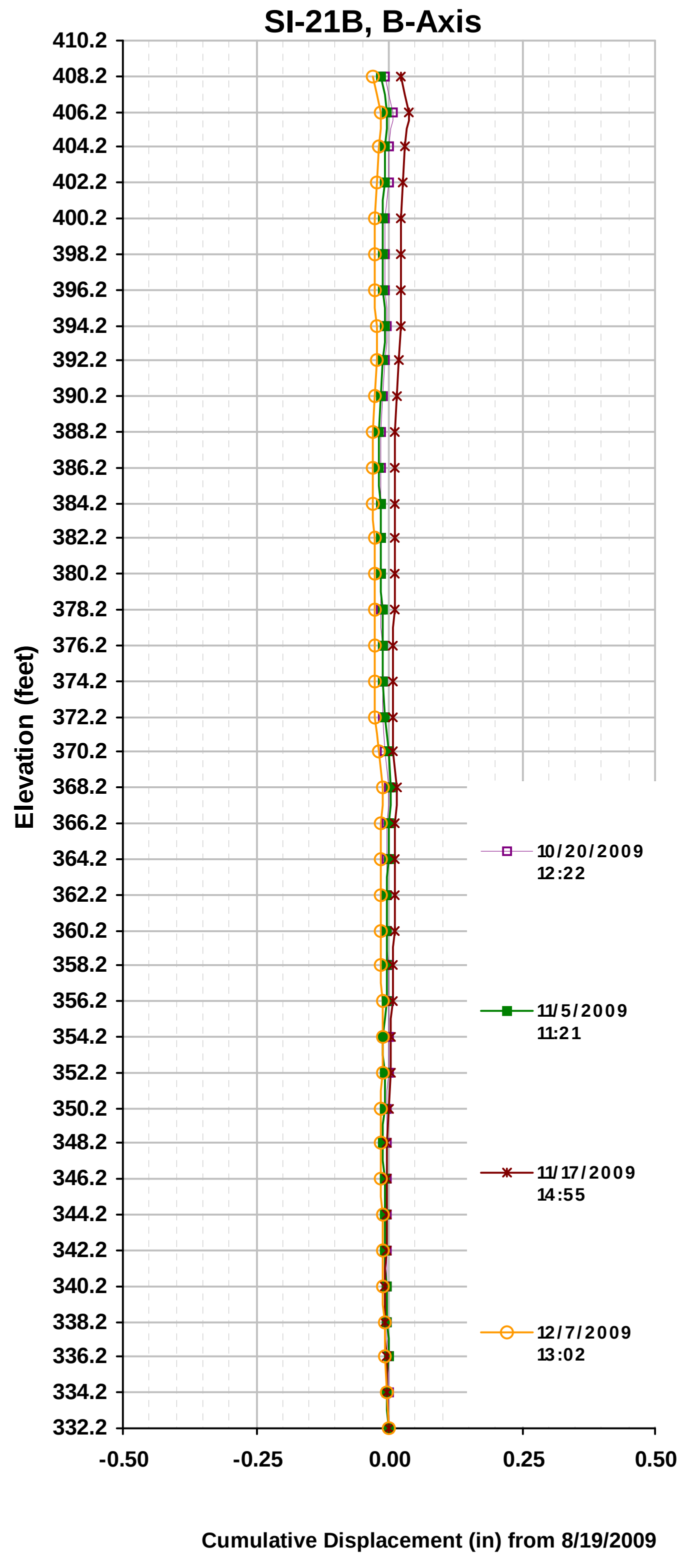
INITIAL SURVEY 8/19/2009 1:49:26 PM

DATE PRINTED 12/8/2009 10:58:39 AM

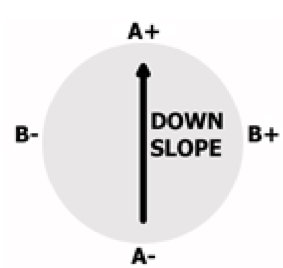
Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-57	119	-0.1056	-54	121	-0.1050	0.0006	0.0252
4	3	59	-0.0336	5	61	-0.0336	0.0000	0.0246
6	59	-3	0.0372	62	-1	0.0378	0.0006	0.0246
8	82	-34	0.0696	87	-30	0.0702	0.0006	0.0240
10	140	-81	0.1326	145	-78	0.1338	0.0012	0.0234
12	169	-104	0.1638	171	-101	0.1632	-0.0006	0.0222
14	188	-127	0.1890	192	-124	0.1896	0.0006	0.0228
16	182	-121	0.1818	186	-119	0.1830	0.0012	0.0222
18	151	-101	0.1512	155	-99	0.1524	0.0012	0.0210
20	164	-102	0.1596	166	-103	0.1614	0.0018	0.0198
22	187	-122	0.1854	192	-121	0.1878	0.0024	0.0180
24	223	-160	0.2298	227	-157	0.2304	0.0006	0.0156
26	246	-185	0.2586	249	-185	0.2604	0.0018	0.0150
28	263	-214	0.2862	267	-210	0.2862	0.0000	0.0132
30	312	-254	0.3396	315	-251	0.3396	0.0000	0.0132
32	350	-286	0.3816	354	-283	0.3822	0.0006	0.0132
34	359	-296	0.3930	362	-293	0.3930	0.0000	0.0126
36	367	-305	0.4032	367	-299	0.3996	-0.0036	0.0126
38	355	-302	0.3942	361	-302	0.3978	0.0036	0.0162
40	353	-298	0.3906	359	-298	0.3942	0.0036	0.0126
42	384	-321	0.4230	387	-318	0.4230	0.0000	0.0090
44	388	-339	0.4362	397	-339	0.4416	0.0054	0.0090
46	255	-220	0.2850	259	-222	0.2886	0.0036	0.0036
48	0	0	0.0000	0	0	0.0000	0.0000	0.0000





Stantec



Cumberland Fossil Plant
B-21B
Cumberland City, TN
175539009
12/8/2009

SITE CUFTVA

INSTALLATION SI-21B

DESCRIPTION

CURRENT SURVEY 10/20/2009 12:22:40 PM

INITIAL SURVEY 8/19/2009 1:32:46 PM

DATE PRINTED 12/8/2009 10:59:22 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	714	-702	0.8496	721	-711	0.8592	0.0096	-0.0162
4	491	-476	0.5802	488	-477	0.5790	-0.0012	-0.0258
6	375	-362	0.4422	373	-364	0.4422	0.0000	-0.0246
8	301	-284	0.3510	297	-286	0.3498	-0.0012	-0.0246
10	251	-239	0.2940	250	-240	0.2940	0.0000	-0.0234
12	220	-205	0.2550	218	-209	0.2562	0.0012	-0.0234
14	122	-109	0.1386	119	-110	0.1374	-0.0012	-0.0246
16	43	-30	0.0438	40	-30	0.0420	-0.0018	-0.0234
18	50	-36	0.0516	49	-38	0.0522	0.0006	-0.0216
20	75	-65	0.0840	72	-63	0.0810	-0.0030	-0.0222
22	17	-3	0.0120	13	-3	0.0096	-0.0024	-0.0192
24	-93	106	-0.1194	-99	109	-0.1248	-0.0054	-0.0168
26	-127	141	-0.1608	-125	135	-0.1560	0.0048	-0.0114
28	-206	222	-0.2568	-202	216	-0.2508	0.0060	-0.0162
30	-288	300	-0.3528	-291	299	-0.3540	-0.0012	-0.0222
32	-330	345	-0.4050	-337	347	-0.4104	-0.0054	-0.0210
34	-307	319	-0.3756	-311	320	-0.3786	-0.0030	-0.0156
36	-344	357	-0.4206	-349	359	-0.4248	-0.0042	-0.0126
38	-447	463	-0.5460	-442	455	-0.5382	0.0078	-0.0084
40	-358	369	-0.4362	-358	367	-0.4350	0.0012	-0.0162
42	-362	377	-0.4434	-369	380	-0.4494	-0.0060	-0.0174
44	-358	372	-0.4380	-361	370	-0.4386	-0.0006	-0.0114
46	-342	355	-0.4182	-345	354	-0.4194	-0.0012	-0.0108
48	-411	426	-0.5022	-414	426	-0.5040	-0.0018	-0.0096
50	-435	447	-0.5292	-438	446	-0.5304	-0.0012	-0.0078
52	-525	540	-0.6390	-528	539	-0.6402	-0.0012	-0.0066
54	-589	603	-0.7152	-593	602	-0.7170	-0.0018	-0.0054
56	-515	526	-0.6246	-515	524	-0.6234	0.0012	-0.0036
58	-489	505	-0.5964	-491	504	-0.5970	-0.0006	-0.0048
60	-490	503	-0.5958	-498	506	-0.6024	-0.0066	-0.0042
62	-498	511	-0.6054	-496	506	-0.6012	0.0042	0.0024
64	-440	455	-0.5370	-442	453	-0.5370	0.0000	-0.0018
66	-308	321	-0.3774	-309	318	-0.3762	0.0012	-0.0018
68	-190	205	-0.2370	-191	204	-0.2370	0.0000	-0.0030
70	-93	105	-0.1188	-97	105	-0.1212	-0.0024	-0.0030
72	-9	23	-0.0192	-11	21	-0.0192	0.0000	-0.0006
74	83	-70	0.0918	83	-71	0.0924	0.0006	-0.0006
76	146	-131	0.1662	143	-132	0.1650	-0.0012	-0.0012
78	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-21B

DESCRIPTION

CURRENT SURVEY 11/5/2009 11:21:07 AM

INITIAL SURVEY 8/19/2009 1:32:46 PM

DATE PRINTED 12/8/2009 10:59:22 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	714	-702	0.8496	721	-707	0.8568	0.0072	-0.0204
4	491	-476	0.5802	490	-474	0.5784	-0.0018	-0.0276
6	375	-362	0.4422	374	-361	0.4410	-0.0012	-0.0258
8	301	-284	0.3510	299	-282	0.3486	-0.0024	-0.0246
10	251	-239	0.2940	251	-238	0.2934	-0.0006	-0.0222
12	220	-205	0.2550	221	-206	0.2562	0.0012	-0.0216
14	122	-109	0.1386	122	-107	0.1374	-0.0012	-0.0228
16	43	-30	0.0438	42	-29	0.0426	-0.0012	-0.0216
18	50	-36	0.0516	53	-37	0.0540	0.0024	-0.0204
20	75	-65	0.0840	74	-62	0.0816	-0.0024	-0.0228
22	17	-3	0.0120	14	0	0.0084	-0.0036	-0.0204
24	-93	106	-0.1194	-97	112	-0.1254	-0.0060	-0.0168
26	-127	141	-0.1608	-122	137	-0.1554	0.0054	-0.0108
28	-206	222	-0.2568	-201	218	-0.2514	0.0054	-0.0162
30	-288	300	-0.3528	-289	302	-0.3546	-0.0018	-0.0216
32	-330	345	-0.4050	-335	350	-0.4110	-0.0060	-0.0198
34	-307	319	-0.3756	-309	323	-0.3792	-0.0036	-0.0138
36	-344	357	-0.4206	-348	363	-0.4266	-0.0060	-0.0102
38	-447	463	-0.5460	-439	457	-0.5376	0.0084	-0.0042
40	-358	369	-0.4362	-355	368	-0.4338	0.0024	-0.0126
42	-362	377	-0.4434	-368	382	-0.4500	-0.0066	-0.0150
44	-358	372	-0.4380	-358	373	-0.4386	-0.0006	-0.0084
46	-342	355	-0.4182	-343	357	-0.4200	-0.0018	-0.0078
48	-411	426	-0.5022	-413	428	-0.5046	-0.0024	-0.0060
50	-435	447	-0.5292	-436	449	-0.5310	-0.0018	-0.0036
52	-525	540	-0.6390	-526	542	-0.6408	-0.0018	-0.0018
54	-589	603	-0.7152	-590	605	-0.7170	-0.0018	0.0000
56	-515	526	-0.6246	-513	527	-0.6240	0.0006	0.0018
58	-489	505	-0.5964	-489	506	-0.5970	-0.0006	0.0012
60	-490	503	-0.5958	-495	509	-0.6024	-0.0066	0.0018
62	-498	511	-0.6054	-492	506	-0.5988	0.0066	0.0084
64	-440	455	-0.5370	-439	454	-0.5358	0.0012	0.0018
66	-308	321	-0.3774	-306	320	-0.3756	0.0018	0.0006
68	-190	205	-0.2370	-189	206	-0.2370	0.0000	-0.0012
70	-93	105	-0.1188	-94	107	-0.1206	-0.0018	-0.0012
72	-9	23	-0.0192	-8	23	-0.0186	0.0006	0.0006
74	83	-70	0.0918	85	-69	0.0924	0.0006	0.0000
76	146	-131	0.1662	146	-130	0.1656	-0.0006	-0.0006
78	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-21B

DESCRIPTION

CURRENT SURVEY 11/17/2009 2:55:49 PM

INITIAL SURVEY 8/19/2009 1:32:46 PM

DATE PRINTED 12/8/2009 10:59:22 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	714	-702	0.8496	719	-708	0.8562	0.0066	-0.0156
4	491	-476	0.5802	490	-476	0.5796	-0.0006	-0.0222
6	375	-362	0.4422	375	-362	0.4422	0.0000	-0.0216
8	301	-284	0.3510	301	-285	0.3516	0.0006	-0.0216
10	251	-239	0.2940	251	-238	0.2934	-0.0006	-0.0222
12	220	-205	0.2550	221	-207	0.2568	0.0018	-0.0216
14	122	-109	0.1386	122	-109	0.1386	0.0000	-0.0234
16	43	-30	0.0438	42	-30	0.0432	-0.0006	-0.0234
18	50	-36	0.0516	52	-38	0.0540	0.0024	-0.0228
20	75	-65	0.0840	73	-62	0.0810	-0.0030	-0.0252
22	17	-3	0.0120	14	-2	0.0096	-0.0024	-0.0222
24	-93	106	-0.1194	-97	109	-0.1236	-0.0042	-0.0198
26	-127	141	-0.1608	-122	135	-0.1542	0.0066	-0.0156
28	-206	222	-0.2568	-199	216	-0.2490	0.0078	-0.0222
30	-288	300	-0.3528	-288	299	-0.3522	0.0006	-0.0300
32	-330	345	-0.4050	-335	349	-0.4104	-0.0054	-0.0306
34	-307	319	-0.3756	-310	323	-0.3798	-0.0042	-0.0252
36	-344	357	-0.4206	-348	360	-0.4248	-0.0042	-0.0210
38	-447	463	-0.5460	-440	456	-0.5376	0.0084	-0.0168
40	-358	369	-0.4362	-357	368	-0.4350	0.0012	-0.0252
42	-362	377	-0.4434	-367	382	-0.4494	-0.0060	-0.0264
44	-358	372	-0.4380	-359	373	-0.4392	-0.0012	-0.0204
46	-342	355	-0.4182	-343	355	-0.4188	-0.0006	-0.0192
48	-411	426	-0.5022	-411	426	-0.5022	0.0000	-0.0186
50	-435	447	-0.5292	-435	446	-0.5286	0.0006	-0.0186
52	-525	540	-0.6390	-524	539	-0.6378	0.0012	-0.0192
54	-589	603	-0.7152	-590	605	-0.7170	-0.0018	-0.0204
56	-515	526	-0.6246	-515	528	-0.6258	-0.0012	-0.0186
58	-489	505	-0.5964	-490	505	-0.5970	-0.0006	-0.0174
60	-490	503	-0.5958	-499	510	-0.6054	-0.0096	-0.0168
62	-498	511	-0.6054	-493	505	-0.5988	0.0066	-0.0072
64	-440	455	-0.5370	-441	455	-0.5376	-0.0006	-0.0138
66	-308	321	-0.3774	-309	323	-0.3792	-0.0018	-0.0132
68	-190	205	-0.2370	-190	207	-0.2382	-0.0012	-0.0114
70	-93	105	-0.1188	-97	108	-0.1230	-0.0042	-0.0102
72	-9	23	-0.0192	-10	25	-0.0210	-0.0018	-0.0060
74	83	-70	0.0918	83	-68	0.0906	-0.0012	-0.0042
76	146	-131	0.1662	143	-129	0.1632	-0.0030	-0.0030
78	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-21B

DESCRIPTION

CURRENT SURVEY 12/7/2009 1:02:35 PM

INITIAL SURVEY 8/19/2009 1:32:46 PM

DATE PRINTED 12/8/2009 10:59:23 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	714	-702	0.8496	717	-711	0.8568	0.0072	0.0048
4	491	-476	0.5802	486	-479	0.5790	-0.0012	-0.0024
6	375	-362	0.4422	374	-364	0.4428	0.0006	-0.0012
8	301	-284	0.3510	298	-286	0.3504	-0.0006	-0.0018
10	251	-239	0.2940	250	-240	0.2940	0.0000	-0.0012
12	220	-205	0.2550	219	-210	0.2574	0.0024	-0.0012
14	122	-109	0.1386	121	-111	0.1392	0.0006	-0.0036
16	43	-30	0.0438	41	-31	0.0432	-0.0006	-0.0042
18	50	-36	0.0516	51	-40	0.0546	0.0030	-0.0036
20	75	-65	0.0840	71	-63	0.0804	-0.0036	-0.0066
22	17	-3	0.0120	13	-2	0.0090	-0.0030	-0.0030
24	-93	106	-0.1194	-98	110	-0.1248	-0.0054	0.0000
26	-127	141	-0.1608	-123	133	-0.1536	0.0072	0.0054
28	-206	222	-0.2568	-200	215	-0.2490	0.0078	-0.0018
30	-288	300	-0.3528	-289	300	-0.3534	-0.0006	-0.0096
32	-330	345	-0.4050	-336	347	-0.4098	-0.0048	-0.0090
34	-307	319	-0.3756	-311	320	-0.3786	-0.0030	-0.0042
36	-344	357	-0.4206	-350	359	-0.4254	-0.0048	-0.0012
38	-447	463	-0.5460	-441	454	-0.5370	0.0090	0.0036
40	-358	369	-0.4362	-357	365	-0.4332	0.0030	-0.0054
42	-362	377	-0.4434	-369	379	-0.4488	-0.0054	-0.0084
44	-358	372	-0.4380	-360	370	-0.4380	0.0000	-0.0030
46	-342	355	-0.4182	-343	354	-0.4182	0.0000	-0.0030
48	-411	426	-0.5022	-413	425	-0.5028	-0.0006	-0.0030
50	-435	447	-0.5292	-437	446	-0.5298	-0.0006	-0.0024
52	-525	540	-0.6390	-526	539	-0.6390	0.0000	-0.0018
54	-589	603	-0.7152	-592	602	-0.7164	-0.0012	-0.0018
56	-515	526	-0.6246	-515	523	-0.6228	0.0018	-0.0006
58	-489	505	-0.5964	-492	503	-0.5970	-0.0006	-0.0024
60	-490	503	-0.5958	-501	509	-0.6060	-0.0102	-0.0018
62	-498	511	-0.6054	-492	502	-0.5964	0.0090	0.0084
64	-440	455	-0.5370	-442	453	-0.5370	0.0000	-0.0006
66	-308	321	-0.3774	-309	318	-0.3762	0.0012	-0.0006
68	-190	205	-0.2370	-192	202	-0.2364	0.0006	-0.0018
70	-93	105	-0.1188	-97	105	-0.1212	-0.0024	-0.0024
72	-9	23	-0.0192	-11	21	-0.0192	0.0000	0.0000
74	83	-70	0.0918	83	-72	0.0930	0.0012	0.0000
76	146	-131	0.1662	142	-133	0.1650	-0.0012	-0.0012
78	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-21B

DESCRIPTION

CURRENT SURVEY 10/20/2009 12:22:40 PM

INITIAL SURVEY 8/19/2009 1:32:46 PM

DATE PRINTED 12/8/2009 10:59:31 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	148	-94	0.1452	139	-79	0.1308	-0.0144	-0.0072
4	205	-154	0.2154	216	-153	0.2214	0.0060	0.0072
6	181	-124	0.1830	185	-125	0.1860	0.0030	0.0012
8	50	-8	0.0348	56	-9	0.0390	0.0042	-0.0018
10	6	51	-0.0270	5	50	-0.0270	0.0000	-0.0060
12	33	34	-0.0006	34	33	0.0006	0.0012	-0.0060
14	47	15	0.0192	43	17	0.0156	-0.0036	-0.0072
16	88	-29	0.0702	91	-33	0.0744	0.0042	-0.0036
18	89	-37	0.0756	92	-39	0.0786	0.0030	-0.0078
20	64	-6	0.0420	67	-9	0.0456	0.0036	-0.0108
22	0	63	0.0000	1	61	-0.0360	0.0000	-0.0144
24	-69	132	-0.1206	-70	132	-0.1212	-0.0006	-0.0144
26	-101	162	-0.1578	-101	162	-0.1578	0.0000	-0.0138
28	-137	189	-0.1956	-136	189	-0.1950	0.0006	-0.0138
30	-159	217	-0.2256	-160	217	-0.2262	-0.0006	-0.0144
32	-168	235	-0.2418	-170	237	-0.2442	-0.0024	-0.0138
34	-168	231	-0.2394	-168	231	-0.2394	0.0000	-0.0114
36	-182	243	-0.2550	-182	241	-0.2538	0.0012	-0.0114
38	-245	294	-0.3234	-250	298	-0.3288	-0.0054	-0.0126
40	-186	233	-0.2514	-191	237	-0.2568	-0.0054	-0.0072
42	-54	104	-0.0948	-48	105	-0.0918	0.0030	-0.0018
44	54	5	0.0294	53	6	0.0282	-0.0012	-0.0048
46	126	-70	0.1176	125	-71	0.1176	0.0000	-0.0036
48	149	-94	0.1458	147	-94	0.1446	-0.0012	-0.0036
50	106	-47	0.0918	104	-48	0.0912	-0.0006	-0.0024
52	69	-2	0.0426	67	-2	0.0414	-0.0012	-0.0018
54	115	-58	0.1038	115	-59	0.1044	0.0006	-0.0006
56	210	-147	0.2142	210	-148	0.2148	0.0006	-0.0012
58	109	-57	0.0996	108	-59	0.1002	0.0006	-0.0018
60	72	-18	0.0540	75	-17	0.0552	0.0012	-0.0024
62	46	19	0.0162	46	19	0.0162	0.0000	-0.0036
64	21	39	-0.0108	21	41	-0.0120	-0.0012	-0.0036
66	30	30	0.0000	30	31	-0.0006	0.0000	-0.0024
68	-12	59	-0.0426	-11	59	-0.0420	0.0006	-0.0024
70	-33	91	-0.0744	-34	91	-0.0750	-0.0006	-0.0030
72	-10	77	-0.0522	-13	76	-0.0534	-0.0012	-0.0024
74	41	23	0.0108	39	21	0.0108	0.0000	-0.0012
76	89	-58	0.0882	87	-58	0.0870	-0.0012	-0.0012
78	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-21B

DESCRIPTION

CURRENT SURVEY 11/5/2009 11:21:07 AM

INITIAL SURVEY 8/19/2009 1:32:46 PM

DATE PRINTED 12/8/2009 10:59:31 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	148	-94	0.1452	141	-79	0.1320	-0.0132	-0.0162
4	205	-154	0.2154	217	-150	0.2202	0.0048	-0.0030
6	181	-124	0.1830	182	-123	0.1830	0.0000	-0.0078
8	50	-8	0.0348	56	-6	0.0372	0.0024	-0.0078
10	6	51	-0.0270	6	50	-0.0264	0.0006	-0.0102
12	33	34	-0.0006	34	35	-0.0006	0.0000	-0.0108
14	47	15	0.0192	46	19	0.0162	-0.0030	-0.0108
16	88	-29	0.0702	90	-34	0.0744	0.0042	-0.0078
18	89	-37	0.0756	90	-39	0.0774	0.0018	-0.0120
20	64	-6	0.0420	66	-10	0.0456	0.0036	-0.0138
22	0	63	0.0000	-1	63	-0.0384	0.0000	-0.0174
24	-69	132	-0.1206	-71	134	-0.1230	-0.0024	-0.0174
26	-101	162	-0.1578	-101	162	-0.1578	0.0000	-0.0150
28	-137	189	-0.1956	-138	190	-0.1968	-0.0012	-0.0150
30	-159	217	-0.2256	-161	218	-0.2274	-0.0018	-0.0138
32	-168	235	-0.2418	-170	237	-0.2442	-0.0024	-0.0120
34	-168	231	-0.2394	-167	232	-0.2394	0.0000	-0.0096
36	-182	243	-0.2550	-183	243	-0.2556	-0.0006	-0.0096
38	-245	294	-0.3234	-251	300	-0.3306	-0.0072	-0.0090
40	-186	233	-0.2514	-188	240	-0.2568	-0.0054	-0.0018
42	-54	104	-0.0948	-47	102	-0.0894	0.0054	0.0036
44	54	5	0.0294	55	7	0.0288	-0.0006	-0.0018
46	126	-70	0.1176	128	-72	0.1200	0.0024	-0.0012
48	149	-94	0.1458	147	-96	0.1458	0.0000	-0.0036
50	106	-47	0.0918	105	-47	0.0912	-0.0006	-0.0036
52	69	-2	0.0426	69	-2	0.0426	0.0000	-0.0030
54	115	-58	0.1038	118	-66	0.1104	0.0066	-0.0030
56	210	-147	0.2142	209	-147	0.2136	-0.0006	-0.0096
58	109	-57	0.0996	107	-59	0.0996	0.0000	-0.0090
60	72	-18	0.0540	74	-17	0.0546	0.0006	-0.0090
62	46	19	0.0162	46	21	0.0150	-0.0012	-0.0096
64	21	39	-0.0108	21	43	-0.0132	-0.0024	-0.0084
66	30	30	0.0000	30	31	-0.0006	0.0000	-0.0060
68	-12	59	-0.0426	-11	62	-0.0438	-0.0012	-0.0060
70	-33	91	-0.0744	-34	92	-0.0756	-0.0012	-0.0048
72	-10	77	-0.0522	-13	77	-0.0540	-0.0018	-0.0036
74	41	23	0.0108	42	22	0.0120	0.0012	-0.0018
76	89	-58	0.0882	83	-59	0.0852	-0.0030	-0.0030
78	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-21B

DESCRIPTION

CURRENT SURVEY 11/17/2009 2:55:49 PM

INITIAL SURVEY 8/19/2009 1:32:46 PM

DATE PRINTED 12/8/2009 10:59:32 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	148	-94	0.1452	138	-79	0.1302	-0.0150	0.0222
4	205	-154	0.2154	217	-153	0.2220	0.0066	0.0372
6	181	-124	0.1830	185	-125	0.1860	0.0030	0.0306
8	50	-8	0.0348	57	-9	0.0396	0.0048	0.0276
10	6	51	-0.0270	7	51	-0.0264	0.0006	0.0228
12	33	34	-0.0006	34	33	0.0006	0.0012	0.0222
14	47	15	0.0192	46	18	0.0168	-0.0024	0.0210
16	88	-29	0.0702	91	-32	0.0738	0.0036	0.0234
18	89	-37	0.0756	94	-39	0.0798	0.0042	0.0198
20	64	-6	0.0420	69	-8	0.0462	0.0042	0.0156
22	0	63	0.0000	2	61	-0.0354	0.0000	0.0114
24	-69	132	-0.1206	-70	133	-0.1218	-0.0012	0.0114
26	-101	162	-0.1578	-100	162	-0.1572	0.0006	0.0126
28	-137	189	-0.1956	-135	188	-0.1938	0.0018	0.0120
30	-159	217	-0.2256	-158	217	-0.2250	0.0006	0.0102
32	-168	235	-0.2418	-168	233	-0.2406	0.0012	0.0096
34	-168	231	-0.2394	-166	231	-0.2382	0.0012	0.0084
36	-182	243	-0.2550	-180	243	-0.2538	0.0012	0.0072
38	-245	294	-0.3234	-246	298	-0.3264	-0.0030	0.0060
40	-186	233	-0.2514	-190	238	-0.2568	-0.0054	0.0090
42	-54	104	-0.0948	-49	102	-0.0906	0.0042	0.0144
44	54	5	0.0294	54	7	0.0282	-0.0012	0.0102
46	126	-70	0.1176	126	-69	0.1170	-0.0006	0.0114
48	149	-94	0.1458	150	-94	0.1464	0.0006	0.0120
50	106	-47	0.0918	108	-50	0.0948	0.0030	0.0114
52	69	-2	0.0426	69	-1	0.0420	-0.0006	0.0084
54	115	-58	0.1038	114	-67	0.1086	0.0048	0.0090
56	210	-147	0.2142	211	-148	0.2154	0.0012	0.0042
58	109	-57	0.0996	112	-61	0.1038	0.0042	0.0030
60	72	-18	0.0540	78	-15	0.0558	0.0018	-0.0012
62	46	19	0.0162	49	19	0.0180	0.0018	-0.0030
64	21	39	-0.0108	22	42	-0.0120	-0.0012	-0.0048
66	30	30	0.0000	30	34	-0.0024	0.0000	-0.0036
68	-12	59	-0.0426	-8	59	-0.0402	0.0024	-0.0036
70	-33	91	-0.0744	-32	92	-0.0744	0.0000	-0.0060
72	-10	77	-0.0522	-12	78	-0.0540	-0.0018	-0.0060
74	41	23	0.0108	40	24	0.0096	-0.0012	-0.0042
76	89	-58	0.0882	87	-55	0.0852	-0.0030	-0.0030
78	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-21B

DESCRIPTION

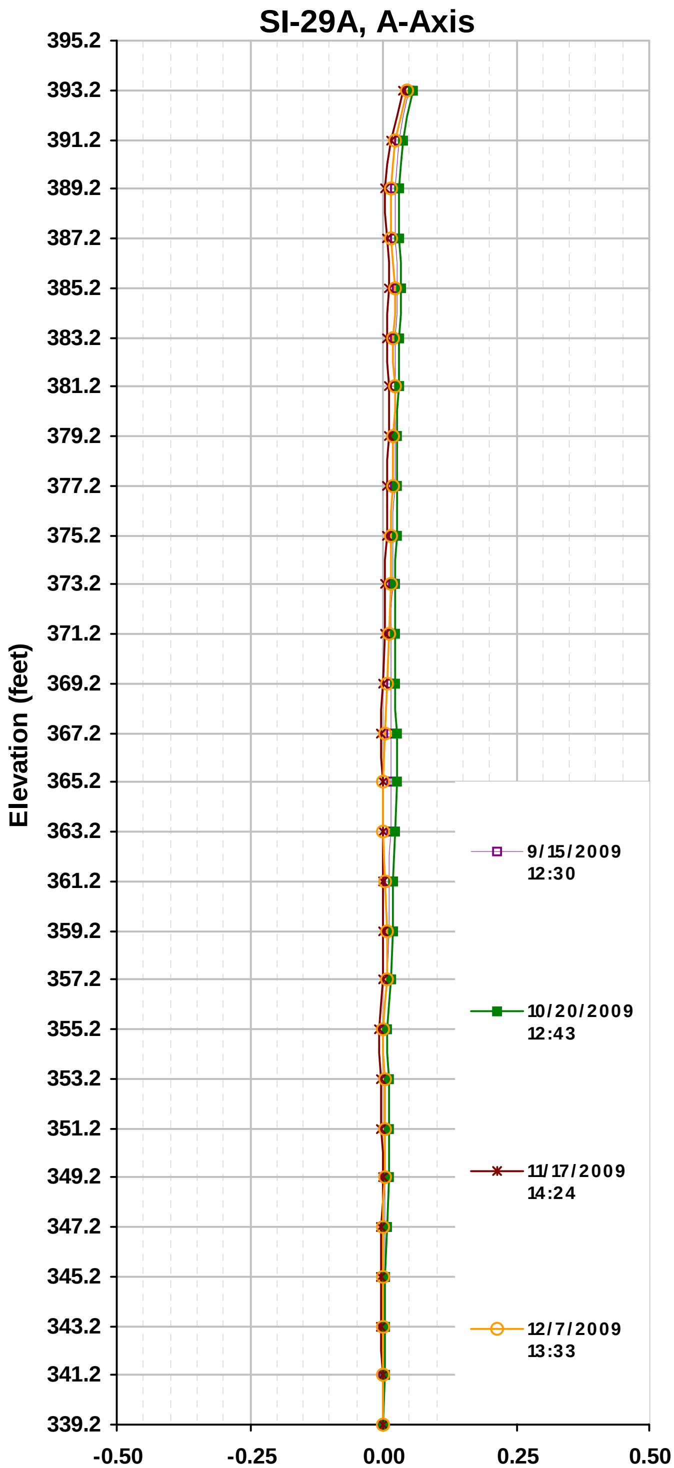
CURRENT SURVEY 12/7/2009 1:02:35 PM

INITIAL SURVEY 8/19/2009 1:32:46 PM

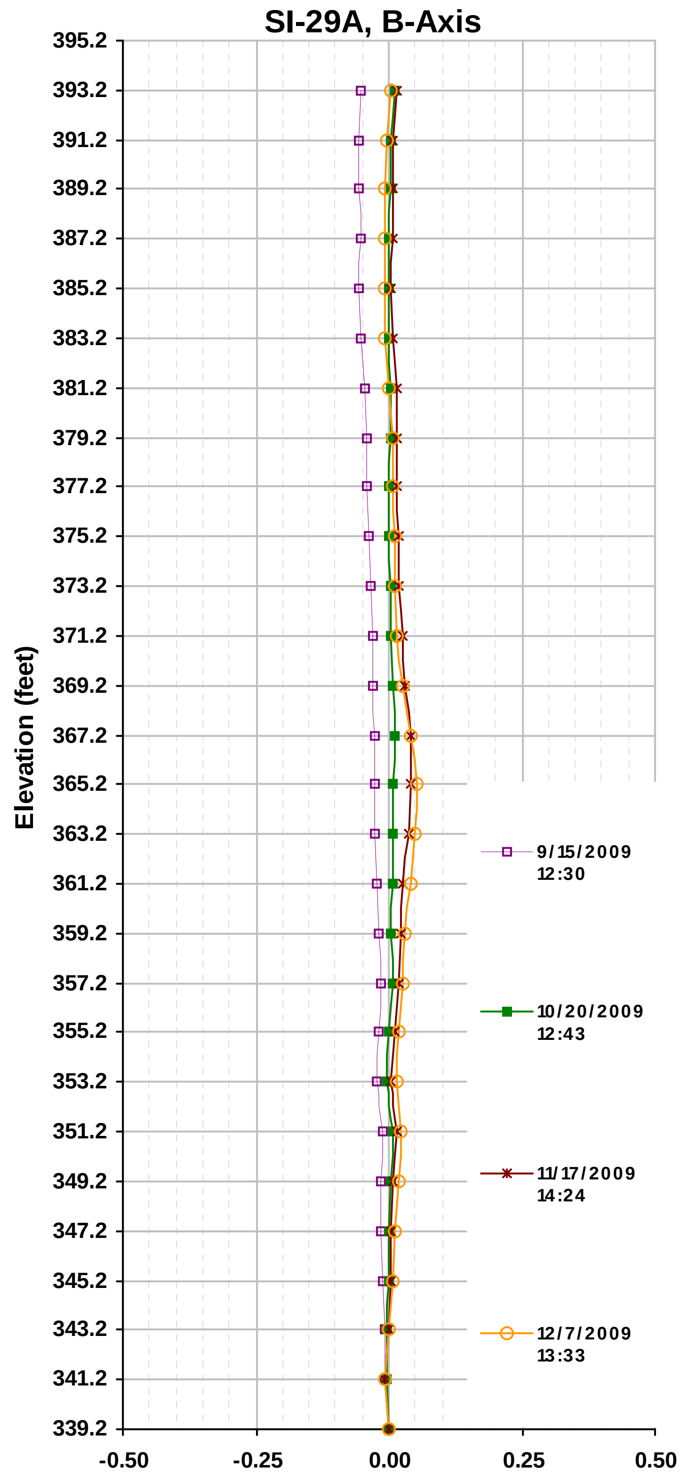
DATE PRINTED 12/8/2009 10:59:32 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	148	-94	0.1452	140	-77	0.1302	-0.0150	-0.0312
4	205	-154	0.2154	217	-149	0.2196	0.0042	-0.0162
6	181	-124	0.1830	189	-122	0.1866	0.0036	-0.0204
8	50	-8	0.0348	58	-3	0.0366	0.0018	-0.0240
10	6	51	-0.0270	9	53	-0.0264	0.0006	-0.0258
12	33	34	-0.0006	35	37	-0.0012	-0.0006	-0.0264
14	47	15	0.0192	46	22	0.0144	-0.0048	-0.0258
16	88	-29	0.0702	92	-29	0.0726	0.0024	-0.0210
18	89	-37	0.0756	97	-35	0.0792	0.0036	-0.0234
20	64	-6	0.0420	70	-6	0.0456	0.0036	-0.0270
22	0	63	0.0000	3	63	-0.0360	0.0000	-0.0306
24	-69	132	-0.1206	-68	137	-0.1230	-0.0024	-0.0306
26	-101	162	-0.1578	-97	167	-0.1584	-0.0006	-0.0282
28	-137	189	-0.1956	-133	194	-0.1962	-0.0006	-0.0276
30	-159	217	-0.2256	-157	219	-0.2256	0.0000	-0.0270
32	-168	235	-0.2418	-166	239	-0.2430	-0.0012	-0.0270
34	-168	231	-0.2394	-164	236	-0.2400	-0.0006	-0.0258
36	-182	243	-0.2550	-178	247	-0.2550	0.0000	-0.0252
38	-245	294	-0.3234	-246	301	-0.3282	-0.0048	-0.0252
40	-186	233	-0.2514	-187	246	-0.2598	-0.0084	-0.0204
42	-54	104	-0.0948	-45	105	-0.0900	0.0048	-0.0120
44	54	5	0.0294	55	10	0.0270	-0.0024	-0.0168
46	126	-70	0.1176	127	-68	0.1170	-0.0006	-0.0144
48	149	-94	0.1458	151	-91	0.1452	-0.0006	-0.0138
50	106	-47	0.0918	108	-46	0.0924	0.0006	-0.0132
52	69	-2	0.0426	70	1	0.0414	-0.0012	-0.0138
54	115	-58	0.1038	118	-55	0.1038	0.0000	-0.0126
56	210	-147	0.2142	213	-144	0.2142	0.0000	-0.0126
58	109	-57	0.0996	111	-56	0.1002	0.0006	-0.0126
60	72	-18	0.0540	77	-13	0.0540	0.0000	-0.0132
62	46	19	0.0162	50	22	0.0168	0.0006	-0.0132
64	21	39	-0.0108	25	45	-0.0120	-0.0012	-0.0138
66	30	30	0.0000	29	35	-0.0036	0.0000	-0.0126
68	-12	59	-0.0426	-8	64	-0.0432	-0.0006	-0.0126
70	-33	91	-0.0744	-33	96	-0.0774	-0.0030	-0.0120
72	-10	77	-0.0522	-10	81	-0.0546	-0.0024	-0.0090
74	41	23	0.0108	42	26	0.0096	-0.0012	-0.0066
76	89	-58	0.0882	87	-51	0.0828	-0.0054	-0.0054
78	0	0	0.0000	0	0	0.0000	0.0000	0.0000

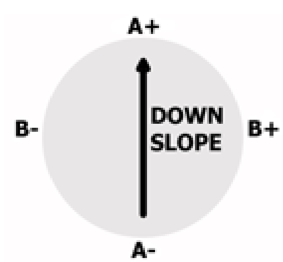


Cumulative Displacement (in) from 8/19/2009



Cumulative Displacement (in) from 8/19/2009

Stantec



Cumulative Fossil Plant
B-29
Cumberland City, TN
175539009
12/8/2009

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 9/15/2009 12:30:54 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:00:11 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	141	-131	0.1632	154	-152	0.1836	0.0204	0.0492
4	174	-161	0.2010	175	-169	0.2064	0.0054	0.0288
6	152	-137	0.1734	147	-141	0.1728	-0.0006	0.0234
8	80	-69	0.0894	76	-72	0.0888	-0.0006	0.0240
10	39	-23	0.0372	35	-28	0.0378	0.0006	0.0246
12	36	-27	0.0378	33	-30	0.0378	0.0000	0.0240
14	47	-35	0.0492	45	-40	0.0510	0.0018	0.0240
16	30	-18	0.0288	28	-22	0.0300	0.0012	0.0222
18	-14	25	-0.0234	-17	21	-0.0228	0.0006	0.0210
20	-91	103	-0.1164	-93	98	-0.1146	0.0018	0.0204
22	-201	209	-0.2460	-203	204	-0.2442	0.0018	0.0186
24	-294	308	-0.3612	-297	302	-0.3594	0.0018	0.0168
26	-347	357	-0.4224	-351	353	-0.4224	0.0000	0.0150
28	-315	325	-0.3840	-319	320	-0.3834	0.0006	0.0150
30	-251	262	-0.3078	-255	257	-0.3072	0.0006	0.0144
32	-198	205	-0.2418	-201	200	-0.2406	0.0012	0.0138
34	-153	162	-0.1890	-156	156	-0.1872	0.0018	0.0126
36	-129	139	-0.1608	-130	133	-0.1578	0.0030	0.0108
38	-128	139	-0.1602	-127	130	-0.1542	0.0060	0.0078
40	-168	181	-0.2094	-175	178	-0.2118	-0.0024	0.0018
42	-269	279	-0.3288	-274	276	-0.3300	-0.0012	0.0042
44	-236	248	-0.2904	-240	244	-0.2904	0.0000	0.0054
46	-189	202	-0.2346	-193	197	-0.2340	0.0006	0.0054
48	-186	197	-0.2298	-189	191	-0.2280	0.0018	0.0048
50	-169	181	-0.2100	-172	176	-0.2088	0.0012	0.0030
52	-97	107	-0.1224	-100	102	-0.1212	0.0012	0.0018
54	-1	15	-0.0096	-5	10	-0.0090	0.0006	0.0006
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 10/20/2009 12:43:03 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:00:11 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	141	-131	0.1632	157	-150	0.1842	0.0210	0.0576
4	174	-161	0.2010	179	-168	0.2082	0.0072	0.0366
6	152	-137	0.1734	149	-137	0.1716	-0.0018	0.0294
8	80	-69	0.0894	77	-68	0.0870	-0.0024	0.0312
10	39	-23	0.0372	39	-26	0.0390	0.0018	0.0336
12	36	-27	0.0378	36	-29	0.0390	0.0012	0.0318
14	47	-35	0.0492	49	-39	0.0528	0.0036	0.0306
16	30	-18	0.0288	31	-19	0.0300	0.0012	0.0270
18	-14	25	-0.0234	-14	24	-0.0228	0.0006	0.0258
20	-91	103	-0.1164	-90	102	-0.1152	0.0012	0.0252
22	-201	209	-0.2460	-200	209	-0.2454	0.0006	0.0240
24	-294	308	-0.3612	-294	308	-0.3612	0.0000	0.0234
26	-347	357	-0.4224	-349	357	-0.4236	-0.0012	0.0234
28	-315	325	-0.3840	-317	323	-0.3840	0.0000	0.0246
30	-251	262	-0.3078	-251	261	-0.3072	0.0006	0.0246
32	-198	205	-0.2418	-194	203	-0.2382	0.0036	0.0240
34	-153	162	-0.1890	-152	159	-0.1866	0.0024	0.0204
36	-129	139	-0.1608	-127	136	-0.1578	0.0030	0.0180
38	-128	139	-0.1602	-122	132	-0.1524	0.0078	0.0150
40	-168	181	-0.2094	-172	183	-0.2130	-0.0036	0.0072
42	-269	279	-0.3288	-270	279	-0.3294	-0.0006	0.0108
44	-236	248	-0.2904	-235	246	-0.2886	0.0018	0.0114
46	-189	202	-0.2346	-187	200	-0.2322	0.0024	0.0096
48	-186	197	-0.2298	-185	194	-0.2274	0.0024	0.0072
50	-169	181	-0.2100	-168	179	-0.2082	0.0018	0.0048
52	-97	107	-0.1224	-98	106	-0.1224	0.0000	0.0030
54	-1	15	-0.0096	2	13	-0.0066	0.0030	0.0030
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 11/17/2009 2:24:32 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:00:11 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	141	-131	0.1632	156	-154	0.1860	0.0228	0.0360
4	174	-161	0.2010	177	-172	0.2094	0.0084	0.0132
6	152	-137	0.1734	147	-139	0.1716	-0.0018	0.0048
8	80	-69	0.0894	73	-69	0.0852	-0.0042	0.0066
10	39	-23	0.0372	36	-29	0.0390	0.0018	0.0108
12	36	-27	0.0378	31	-29	0.0360	-0.0018	0.0090
14	47	-35	0.0492	45	-39	0.0504	0.0012	0.0108
16	30	-18	0.0288	28	-21	0.0294	0.0006	0.0096
18	-14	25	-0.0234	-17	21	-0.0228	0.0006	0.0090
20	-91	103	-0.1164	-91	98	-0.1134	0.0030	0.0084
22	-201	209	-0.2460	-202	205	-0.2442	0.0018	0.0054
24	-294	308	-0.3612	-296	302	-0.3588	0.0024	0.0036
26	-347	357	-0.4224	-347	351	-0.4188	0.0036	0.0012
28	-315	325	-0.3840	-319	322	-0.3846	-0.0006	-0.0024
30	-251	262	-0.3078	-256	261	-0.3102	-0.0024	-0.0018
32	-198	205	-0.2418	-202	202	-0.2424	-0.0006	0.0006
34	-153	162	-0.1890	-157	159	-0.1896	-0.0006	0.0012
36	-129	139	-0.1608	-130	134	-0.1584	0.0024	0.0018
38	-128	139	-0.1602	-126	130	-0.1536	0.0066	-0.0006
40	-168	181	-0.2094	-175	178	-0.2118	-0.0024	-0.0072
42	-269	279	-0.3288	-273	276	-0.3294	-0.0006	-0.0048
44	-236	248	-0.2904	-243	245	-0.2928	-0.0024	-0.0042
46	-189	202	-0.2346	-190	198	-0.2328	0.0018	-0.0018
48	-186	197	-0.2298	-189	193	-0.2292	0.0006	-0.0036
50	-169	181	-0.2100	-172	177	-0.2094	0.0006	-0.0042
52	-97	107	-0.1224	-102	107	-0.1254	-0.0030	-0.0048
54	-1	15	-0.0096	-5	14	-0.0114	-0.0018	-0.0018
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 12/7/2009 1:33:48 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:00:12 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	141	-131	0.1632	158	-154	0.1872	0.0240	0.0468
4	174	-161	0.2010	179	-171	0.2100	0.0090	0.0228
6	152	-137	0.1734	147	-138	0.1710	-0.0024	0.0138
8	80	-69	0.0894	74	-67	0.0846	-0.0048	0.0162
10	39	-23	0.0372	37	-27	0.0384	0.0012	0.0210
12	36	-27	0.0378	34	-27	0.0366	-0.0012	0.0198
14	47	-35	0.0492	46	-39	0.0510	0.0018	0.0210
16	30	-18	0.0288	29	-21	0.0300	0.0012	0.0192
18	-14	25	-0.0234	-15	22	-0.0222	0.0012	0.0180
20	-91	103	-0.1164	-90	99	-0.1134	0.0030	0.0168
22	-201	209	-0.2460	-201	207	-0.2448	0.0012	0.0138
24	-294	308	-0.3612	-293	303	-0.3576	0.0036	0.0126
26	-347	357	-0.4224	-344	349	-0.4158	0.0066	0.0090
28	-315	325	-0.3840	-317	320	-0.3822	0.0018	0.0024
30	-251	262	-0.3078	-254	261	-0.3090	-0.0012	0.0006
32	-198	205	-0.2418	-203	205	-0.2448	-0.0030	0.0018
34	-153	162	-0.1890	-157	162	-0.1914	-0.0024	0.0048
36	-129	139	-0.1608	-130	137	-0.1602	0.0006	0.0072
38	-128	139	-0.1602	-123	131	-0.1524	0.0078	0.0066
40	-168	181	-0.2094	-174	182	-0.2136	-0.0042	-0.0012
42	-269	279	-0.3288	-271	277	-0.3288	0.0000	0.0030
44	-236	248	-0.2904	-238	246	-0.2904	0.0000	0.0030
46	-189	202	-0.2346	-189	199	-0.2328	0.0018	0.0030
48	-186	197	-0.2298	-187	193	-0.2280	0.0018	0.0012
50	-169	181	-0.2100	-170	178	-0.2088	0.0012	-0.0006
52	-97	107	-0.1224	-102	106	-0.1248	-0.0024	-0.0018
54	-1	15	-0.0096	-3	12	-0.0090	0.0006	0.0006
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 9/15/2009 12:30:54 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:00:24 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-284	351	-0.3810	-283	346	-0.3774	0.0036	-0.0522
4	-273	339	-0.3672	-277	336	-0.3678	-0.0006	-0.0558
6	-280	339	-0.3714	-285	337	-0.3732	-0.0018	-0.0552
8	-297	357	-0.3924	-297	355	-0.3912	0.0012	-0.0534
10	-301	362	-0.3978	-305	359	-0.3984	-0.0006	-0.0546
12	-259	318	-0.3462	-268	323	-0.3546	-0.0084	-0.0540
14	-150	206	-0.2136	-154	208	-0.2172	-0.0036	-0.0456
16	-63	111	-0.1044	-67	110	-0.1062	-0.0018	-0.0420
18	27	34	-0.0042	22	34	-0.0072	-0.0030	-0.0402
20	120	-86	0.1236	115	-86	0.1206	-0.0030	-0.0372
22	310	-277	0.3522	304	-277	0.3486	-0.0036	-0.0342
24	513	-465	0.5868	510	-465	0.5850	-0.0018	-0.0306
26	583	-532	0.6690	581	-532	0.6678	-0.0012	-0.0288
28	503	-440	0.5658	499	-443	0.5652	-0.0006	-0.0276
30	421	-357	0.4668	417	-359	0.4656	-0.0012	-0.0270
32	357	-293	0.3900	353	-293	0.3876	-0.0024	-0.0258
34	333	-266	0.3594	327	-266	0.3558	-0.0036	-0.0234
36	310	-255	0.3390	305	-254	0.3354	-0.0036	-0.0198
38	279	-214	0.2958	280	-220	0.3000	0.0042	-0.0162
40	221	-173	0.2364	220	-179	0.2394	0.0030	-0.0204
42	91	-36	0.0762	79	-29	0.0648	-0.0114	-0.0234
44	-27	81	-0.0648	-29	77	-0.0636	0.0012	-0.0120
46	-150	194	-0.2064	-151	191	-0.2052	0.0012	-0.0132
48	-211	270	-0.2886	-215	272	-0.2922	-0.0036	-0.0144
50	-333	369	-0.4212	-337	368	-0.4230	-0.0018	-0.0108
52	-595	638	-0.7398	-598	636	-0.7404	-0.0006	-0.0090
54	-645	678	-0.7938	-653	684	-0.8022	-0.0084	-0.0084
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 10/20/2009 12:43:03 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:00:24 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-284	351	-0.3810	-279	343	-0.3732	0.0078	0.0120
4	-273	339	-0.3672	-272	338	-0.3660	0.0012	0.0042
6	-280	339	-0.3714	-280	337	-0.3702	0.0012	0.0030
8	-297	357	-0.3924	-294	357	-0.3906	0.0018	0.0018
10	-301	362	-0.3978	-303	363	-0.3996	-0.0018	0.0000
12	-259	318	-0.3462	-264	319	-0.3498	-0.0036	0.0018
14	-150	206	-0.2136	-151	203	-0.2124	0.0012	0.0054
16	-63	111	-0.1044	-61	109	-0.1020	0.0024	0.0042
18	27	34	-0.0042	27	33	-0.0036	0.0006	0.0018
20	120	-86	0.1236	118	-86	0.1224	-0.0012	0.0012
22	310	-277	0.3522	308	-276	0.3504	-0.0018	0.0024
24	513	-465	0.5868	514	-461	0.5850	-0.0018	0.0042
26	583	-532	0.6690	581	-528	0.6654	-0.0036	0.0060
28	503	-440	0.5658	502	-442	0.5664	0.0006	0.0096
30	421	-357	0.4668	420	-360	0.4680	0.0012	0.0090
32	357	-293	0.3900	357	-295	0.3912	0.0012	0.0078
34	333	-266	0.3594	334	-267	0.3606	0.0012	0.0066
36	310	-255	0.3390	310	-253	0.3378	-0.0012	0.0054
38	279	-214	0.2958	282	-221	0.3018	0.0060	0.0066
40	221	-173	0.2364	223	-177	0.2400	0.0036	0.0006
42	91	-36	0.0762	83	-28	0.0666	-0.0096	-0.0030
44	-27	81	-0.0648	-26	77	-0.0618	0.0030	0.0066
46	-150	194	-0.2064	-145	191	-0.2016	0.0048	0.0036
48	-211	270	-0.2886	-210	272	-0.2892	-0.0006	-0.0012
50	-333	369	-0.4212	-331	368	-0.4194	0.0018	-0.0006
52	-595	638	-0.7398	-593	636	-0.7374	0.0024	-0.0024
54	-645	678	-0.7938	-650	681	-0.7986	-0.0048	-0.0048
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

CURRENT SURVEY 11/17/2009 2:24:32 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

DATE PRINTED 12/8/2009 11:00:24 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-284	351	-0.3810	-277	348	-0.3750	0.0060	0.0150
4	-273	339	-0.3672	-269	341	-0.3660	0.0012	0.0090
6	-280	339	-0.3714	-277	341	-0.3708	0.0006	0.0078
8	-297	357	-0.3924	-292	359	-0.3906	0.0018	0.0072
10	-301	362	-0.3978	-302	366	-0.4008	-0.0030	0.0054
12	-259	318	-0.3462	-265	326	-0.3546	-0.0084	0.0084
14	-150	206	-0.2136	-147	209	-0.2136	0.0000	0.0168
16	-63	111	-0.1044	-61	110	-0.1026	0.0018	0.0168
18	27	34	-0.0042	26	38	-0.0072	-0.0030	0.0150
20	120	-86	0.1236	119	-83	0.1212	-0.0024	0.0180
22	310	-277	0.3522	307	-272	0.3474	-0.0048	0.0204
24	513	-465	0.5868	513	-456	0.5814	-0.0054	0.0252
26	583	-532	0.6690	579	-519	0.6588	-0.0102	0.0306
28	503	-440	0.5658	503	-437	0.5640	-0.0018	0.0408
30	421	-357	0.4668	425	-361	0.4716	0.0048	0.0426
32	357	-293	0.3900	363	-305	0.4008	0.0108	0.0378
34	333	-266	0.3594	341	-267	0.3648	0.0054	0.0270
36	310	-255	0.3390	314	-257	0.3426	0.0036	0.0216
38	279	-214	0.2958	287	-217	0.3024	0.0066	0.0180
40	221	-173	0.2364	226	-178	0.2424	0.0060	0.0114
42	91	-36	0.0762	85	-29	0.0684	-0.0078	0.0054
44	-27	81	-0.0648	-21	79	-0.0600	0.0048	0.0132
46	-150	194	-0.2064	-143	193	-0.2016	0.0048	0.0084
48	-211	270	-0.2886	-207	275	-0.2892	-0.0006	0.0036
50	-333	369	-0.4212	-329	366	-0.4170	0.0042	0.0042
52	-595	638	-0.7398	-589	630	-0.7314	0.0084	0.0000
54	-645	678	-0.7938	-651	686	-0.8022	-0.0084	-0.0084
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-29A

DESCRIPTION

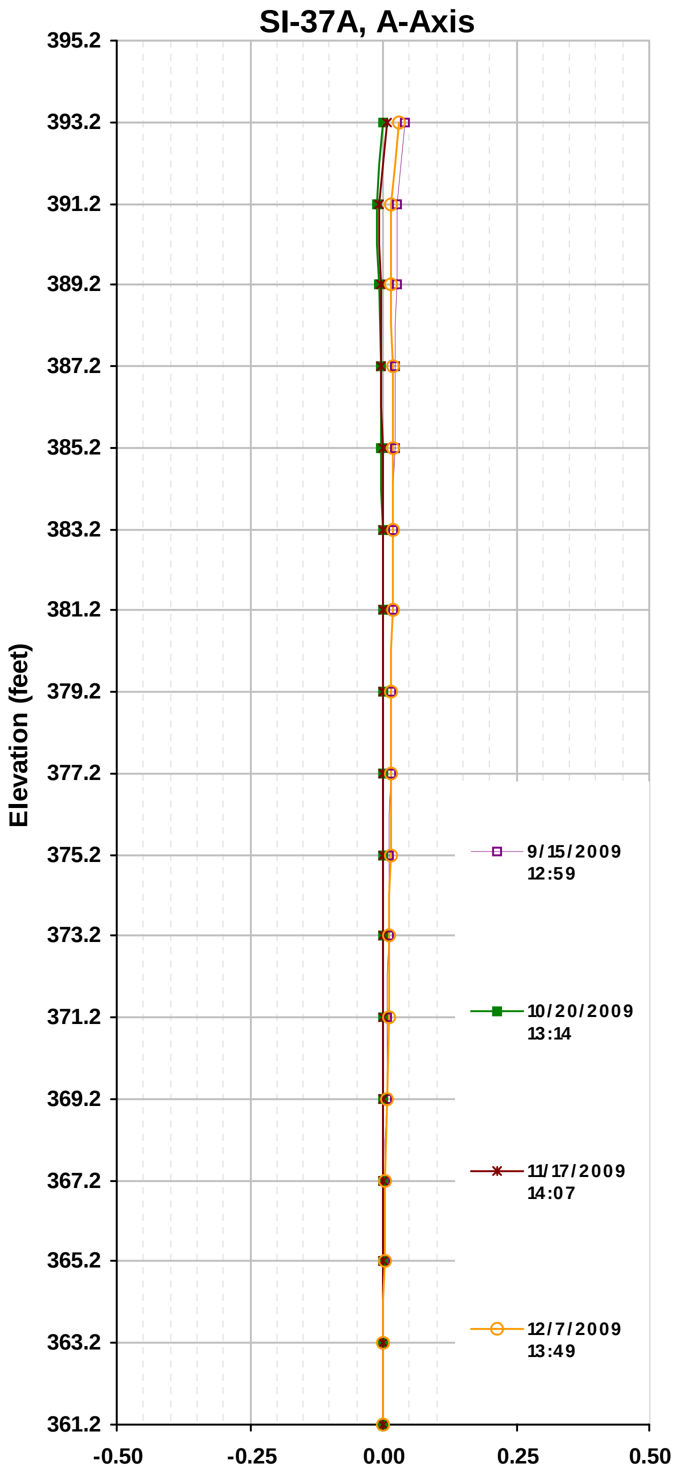
CURRENT SURVEY 12/7/2009 1:33:48 PM

INITIAL SURVEY 8/19/2009 2:10:15 PM

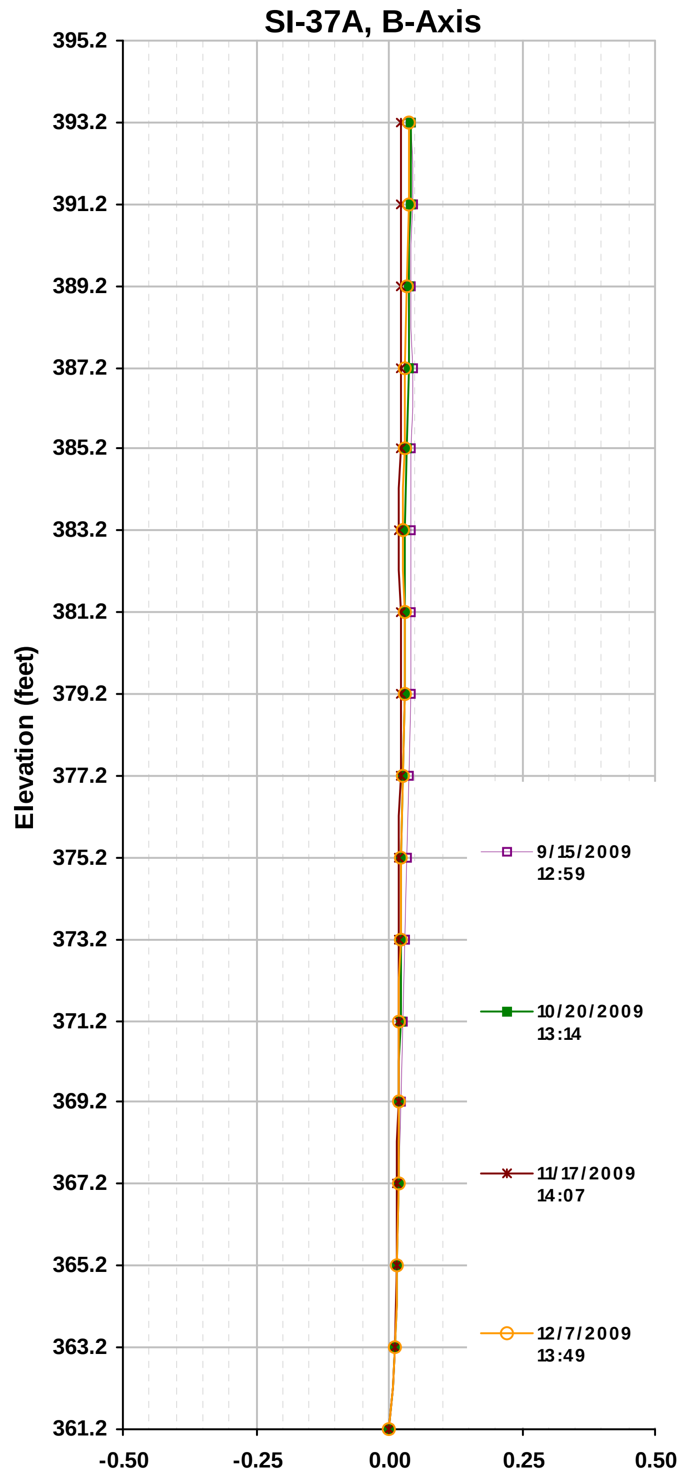
DATE PRINTED 12/8/2009 11:00:24 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-284	351	-0.3810	-277	346	-0.3738	0.0072	0.0024
4	-273	339	-0.3672	-270	340	-0.3660	0.0012	-0.0048
6	-280	339	-0.3714	-278	341	-0.3714	0.0000	-0.0060
8	-297	357	-0.3924	-293	357	-0.3900	0.0024	-0.0060
10	-301	362	-0.3978	-302	362	-0.3984	-0.0006	-0.0084
12	-259	318	-0.3462	-263	327	-0.3540	-0.0078	-0.0078
14	-150	206	-0.2136	-155	213	-0.2208	-0.0072	0.0000
16	-63	111	-0.1044	-61	113	-0.1044	0.0000	0.0072
18	27	34	-0.0042	27	38	-0.0066	-0.0024	0.0072
20	120	-86	0.1236	120	-81	0.1206	-0.0030	0.0096
22	310	-277	0.3522	306	-274	0.3480	-0.0042	0.0126
24	513	-465	0.5868	511	-453	0.5784	-0.0084	0.0168
26	583	-532	0.6690	573	-515	0.6528	-0.0162	0.0252
28	503	-440	0.5658	496	-430	0.5556	-0.0102	0.0414
30	421	-357	0.4668	423	-358	0.4686	0.0018	0.0516
32	357	-293	0.3900	367	-299	0.3996	0.0096	0.0498
34	333	-266	0.3594	343	-273	0.3696	0.0102	0.0402
36	310	-255	0.3390	317	-255	0.3432	0.0042	0.0300
38	279	-214	0.2958	286	-218	0.3024	0.0066	0.0258
40	221	-173	0.2364	228	-175	0.2418	0.0054	0.0192
42	91	-36	0.0762	86	-27	0.0678	-0.0084	0.0138
44	-27	81	-0.0648	-23	79	-0.0612	0.0036	0.0222
46	-150	194	-0.2064	-143	189	-0.1992	0.0072	0.0186
48	-211	270	-0.2886	-206	270	-0.2856	0.0030	0.0114
50	-333	369	-0.4212	-327	363	-0.4140	0.0072	0.0084
52	-595	638	-0.7398	-587	629	-0.7296	0.0102	0.0012
54	-645	678	-0.7938	-654	684	-0.8028	-0.0090	-0.0090
56	0	0	0.0000	0	0	0.0000	0.0000	0.0000

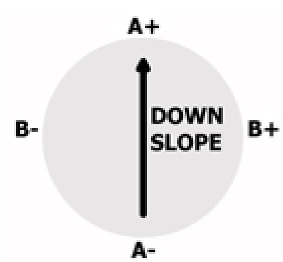


Cumulative Displacement (in) from 8/19/2009



Cumulative Displacement (in) from 8/19/2009

Stantec



Cumulative Fossil Plant
B-37
Cumberland City, TN
175539009
12/8/2009

SITE CUFTVA

INSTALLATION SI-37A

DESCRIPTION

CURRENT SURVEY 9/15/2009 12:59:47 PM

INITIAL SURVEY 8/19/2009 2:35:44 PM

DATE PRINTED 12/8/2009 11:02:53 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-28	37	-0.0390	-17	22	-0.0234	0.0156	0.0408
4	50	-42	0.0552	49	-44	0.0558	0.0006	0.0252
6	123	-114	0.1422	123	-117	0.1440	0.0018	0.0246
8	121	-114	0.1410	120	-117	0.1422	0.0012	0.0228
10	162	-155	0.1902	162	-158	0.1920	0.0018	0.0216
12	194	-186	0.2280	194	-189	0.2298	0.0018	0.0198
14	155	-147	0.1812	156	-150	0.1836	0.0024	0.0180
16	123	-114	0.1422	123	-117	0.1440	0.0018	0.0156
18	102	-96	0.1188	102	-99	0.1206	0.0018	0.0138
20	88	-82	0.1020	88	-85	0.1038	0.0018	0.0120
22	42	-35	0.0462	42	-38	0.0480	0.0018	0.0102
24	18	-10	0.0168	18	-14	0.0192	0.0024	0.0084
26	62	-55	0.0702	62	-58	0.0720	0.0018	0.0060
28	74	-67	0.0846	74	-70	0.0864	0.0018	0.0042
30	91	-86	0.1062	92	-89	0.1086	0.0024	0.0024
32	129	-121	0.1500	127	-123	0.1500	0.0000	0.0000
34	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-37A

DESCRIPTION

CURRENT SURVEY 10/20/2009 1:14:41 PM

INITIAL SURVEY 8/19/2009 2:35:44 PM

DATE PRINTED 12/8/2009 11:02:53 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-28	37	-0.0390	-15	29	-0.0264	0.0126	0.0012
4	50	-42	0.0552	50	-35	0.0510	-0.0042	-0.0114
6	123	-114	0.1422	124	-109	0.1398	-0.0024	-0.0072
8	121	-114	0.1410	122	-110	0.1392	-0.0018	-0.0048
10	162	-155	0.1902	164	-151	0.1890	-0.0012	-0.0030
12	194	-186	0.2280	197	-182	0.2274	-0.0006	-0.0018
14	155	-147	0.1812	159	-144	0.1818	0.0006	-0.0012
16	123	-114	0.1422	126	-110	0.1416	-0.0006	-0.0018
18	102	-96	0.1188	105	-91	0.1176	-0.0012	-0.0012
20	88	-82	0.1020	91	-78	0.1014	-0.0006	0.0000
22	42	-35	0.0462	46	-31	0.0462	0.0000	0.0006
24	18	-10	0.0168	22	-6	0.0168	0.0000	0.0006
26	62	-55	0.0702	66	-51	0.0702	0.0000	0.0006
28	74	-67	0.0846	77	-65	0.0852	0.0006	0.0006
30	91	-86	0.1062	95	-82	0.1062	0.0000	0.0000
32	129	-121	0.1500	132	-118	0.1500	0.0000	0.0000
34	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-37A

DESCRIPTION

CURRENT SURVEY 11/17/2009 2:07:57 PM

INITIAL SURVEY 8/19/2009 2:35:44 PM

DATE PRINTED 12/8/2009 11:02:53 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-28	37	-0.0390	-14	25	-0.0234	0.0156	0.0078
4	50	-42	0.0552	49	-38	0.0522	-0.0030	-0.0078
6	123	-114	0.1422	123	-111	0.1404	-0.0018	-0.0048
8	121	-114	0.1410	121	-111	0.1392	-0.0018	-0.0030
10	162	-155	0.1902	162	-153	0.1890	-0.0012	-0.0012
12	194	-186	0.2280	195	-184	0.2274	-0.0006	0.0000
14	155	-147	0.1812	158	-146	0.1824	0.0012	0.0006
16	123	-114	0.1422	124	-113	0.1422	0.0000	-0.0006
18	102	-96	0.1188	103	-93	0.1176	-0.0012	-0.0006
20	88	-82	0.1020	90	-80	0.1020	0.0000	0.0006
22	42	-35	0.0462	44	-33	0.0462	0.0000	0.0006
24	18	-10	0.0168	19	-8	0.0162	-0.0006	0.0006
26	62	-55	0.0702	64	-53	0.0702	0.0000	0.0012
28	74	-67	0.0846	76	-66	0.0852	0.0006	0.0012
30	91	-86	0.1062	94	-85	0.1074	0.0012	0.0006
32	129	-121	0.1500	130	-119	0.1494	-0.0006	-0.0006
34	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-37A

DESCRIPTION

CURRENT SURVEY 12/7/2009 1:49:45 PM

INITIAL SURVEY 8/19/2009 2:35:44 PM

DATE PRINTED 12/8/2009 11:02:53 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-28	37	-0.0390	-11	28	-0.0234	0.0156	0.0300
4	50	-42	0.0552	53	-35	0.0528	-0.0024	0.0144
6	123	-114	0.1422	126	-109	0.1410	-0.0012	0.0168
8	121	-114	0.1410	125	-109	0.1404	-0.0006	0.0180
10	162	-155	0.1902	167	-151	0.1908	0.0006	0.0186
12	194	-186	0.2280	199	-182	0.2286	0.0006	0.0180
14	155	-147	0.1812	162	-144	0.1836	0.0024	0.0174
16	123	-114	0.1422	129	-111	0.1440	0.0018	0.0150
18	102	-96	0.1188	107	-91	0.1188	0.0000	0.0132
20	88	-82	0.1020	95	-78	0.1038	0.0018	0.0132
22	42	-35	0.0462	49	-31	0.0480	0.0018	0.0114
24	18	-10	0.0168	25	-7	0.0192	0.0024	0.0096
26	62	-55	0.0702	69	-51	0.0720	0.0018	0.0072
28	74	-67	0.0846	81	-63	0.0864	0.0018	0.0054
30	91	-86	0.1062	98	-82	0.1080	0.0018	0.0036
32	129	-121	0.1500	135	-118	0.1518	0.0018	0.0018
34	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-37A

DESCRIPTION

CURRENT SURVEY 9/15/2009 12:59:47 PM

INITIAL SURVEY 8/19/2009 2:35:44 PM

DATE PRINTED 12/8/2009 11:03:01 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-19	81	-0.0600	-22	83	-0.0630	-0.0030	0.0408
4	-69	125	-0.1164	-68	125	-0.1158	0.0006	0.0438
6	-81	145	-0.1356	-81	146	-0.1362	-0.0006	0.0432
8	-81	140	-0.1326	-79	139	-0.1308	0.0018	0.0438
10	-54	117	-0.1026	-53	116	-0.1014	0.0012	0.0420
12	-10	73	-0.0498	-10	72	-0.0492	0.0006	0.0408
14	14	29	-0.0090	14	28	-0.0084	0.0006	0.0402
16	18	45	-0.0162	19	42	-0.0138	0.0024	0.0396
18	-9	65	-0.0444	-6	62	-0.0408	0.0036	0.0372
20	-21	76	-0.0582	-18	74	-0.0552	0.0030	0.0336
22	-45	106	-0.0906	-43	103	-0.0876	0.0030	0.0306
24	-54	102	-0.0936	-50	99	-0.0894	0.0042	0.0276
26	22	37	-0.0090	23	33	-0.0060	0.0030	0.0234
28	51	5	0.0276	56	3	0.0318	0.0042	0.0204
30	40	21	0.0114	43	17	0.0156	0.0042	0.0162
32	7	41	-0.0204	24	38	-0.0084	0.0120	0.0120
34	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-37A

DESCRIPTION

CURRENT SURVEY 10/20/2009 1:14:41 PM

INITIAL SURVEY 8/19/2009 2:35:44 PM

DATE PRINTED 12/8/2009 11:03:01 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-19	81	-0.0600	-18	82	-0.0600	0.0000	0.0408
4	-69	125	-0.1164	-67	123	-0.1140	0.0024	0.0408
6	-81	145	-0.1356	-81	143	-0.1344	0.0012	0.0384
8	-81	140	-0.1326	-79	137	-0.1296	0.0030	0.0372
10	-54	117	-0.1026	-52	112	-0.0984	0.0042	0.0342
12	-10	73	-0.0498	-11	73	-0.0504	-0.0006	0.0300
14	14	29	-0.0090	14	28	-0.0084	0.0006	0.0306
16	18	45	-0.0162	19	42	-0.0138	0.0024	0.0300
18	-9	65	-0.0444	-5	62	-0.0402	0.0042	0.0276
20	-21	76	-0.0582	-19	76	-0.0570	0.0012	0.0234
22	-45	106	-0.0906	-44	105	-0.0894	0.0012	0.0222
24	-54	102	-0.0936	-55	100	-0.0930	0.0006	0.0210
26	22	37	-0.0090	24	37	-0.0078	0.0012	0.0204
28	51	5	0.0276	55	3	0.0312	0.0036	0.0192
30	40	21	0.0114	43	18	0.0150	0.0036	0.0156
32	7	41	-0.0204	24	38	-0.0084	0.0120	0.0120
34	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-37A

DESCRIPTION

CURRENT SURVEY 11/17/2009 2:07:57 PM

INITIAL SURVEY 8/19/2009 2:35:44 PM

DATE PRINTED 12/8/2009 11:03:01 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-19	81	-0.0600	-18	82	-0.0600	0.0000	0.0228
4	-69	125	-0.1164	-67	127	-0.1164	0.0000	0.0228
6	-81	145	-0.1356	-82	146	-0.1368	-0.0012	0.0228
8	-81	140	-0.1326	-78	139	-0.1302	0.0024	0.0240
10	-54	117	-0.1026	-53	115	-0.1008	0.0018	0.0216
12	-10	73	-0.0498	-13	75	-0.0528	-0.0030	0.0198
14	14	29	-0.0090	14	31	-0.0102	-0.0012	0.0228
16	18	45	-0.0162	19	44	-0.0150	0.0012	0.0240
18	-9	65	-0.0444	-5	65	-0.0420	0.0024	0.0228
20	-21	76	-0.0582	-18	77	-0.0570	0.0012	0.0204
22	-45	106	-0.0906	-44	106	-0.0900	0.0006	0.0192
24	-54	102	-0.0936	-52	102	-0.0924	0.0012	0.0186
26	22	37	-0.0090	23	37	-0.0084	0.0006	0.0174
28	51	5	0.0276	56	5	0.0306	0.0030	0.0168
30	40	21	0.0114	43	20	0.0138	0.0024	0.0138
32	7	41	-0.0204	22	37	-0.0090	0.0114	0.0114
34	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-37A

DESCRIPTION

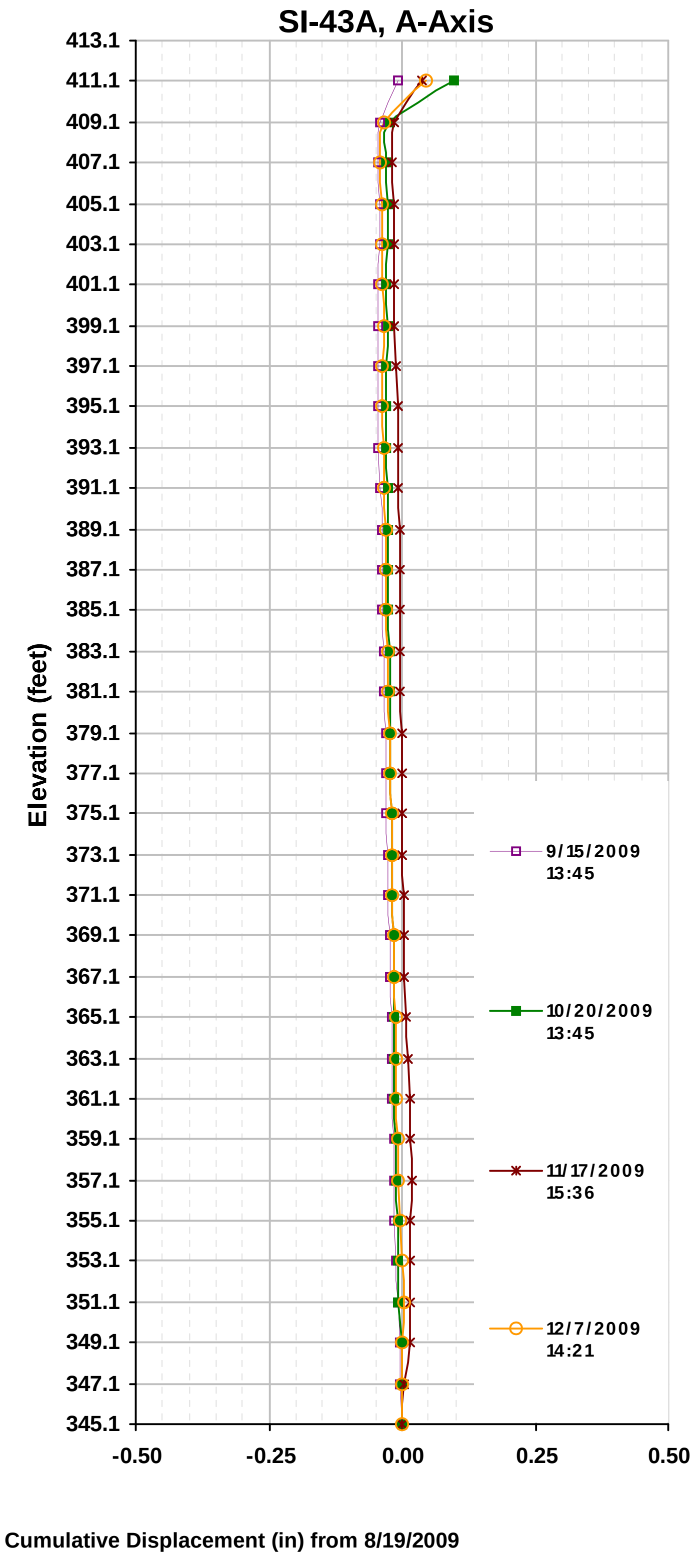
CURRENT SURVEY 12/7/2009 1:49:45 PM

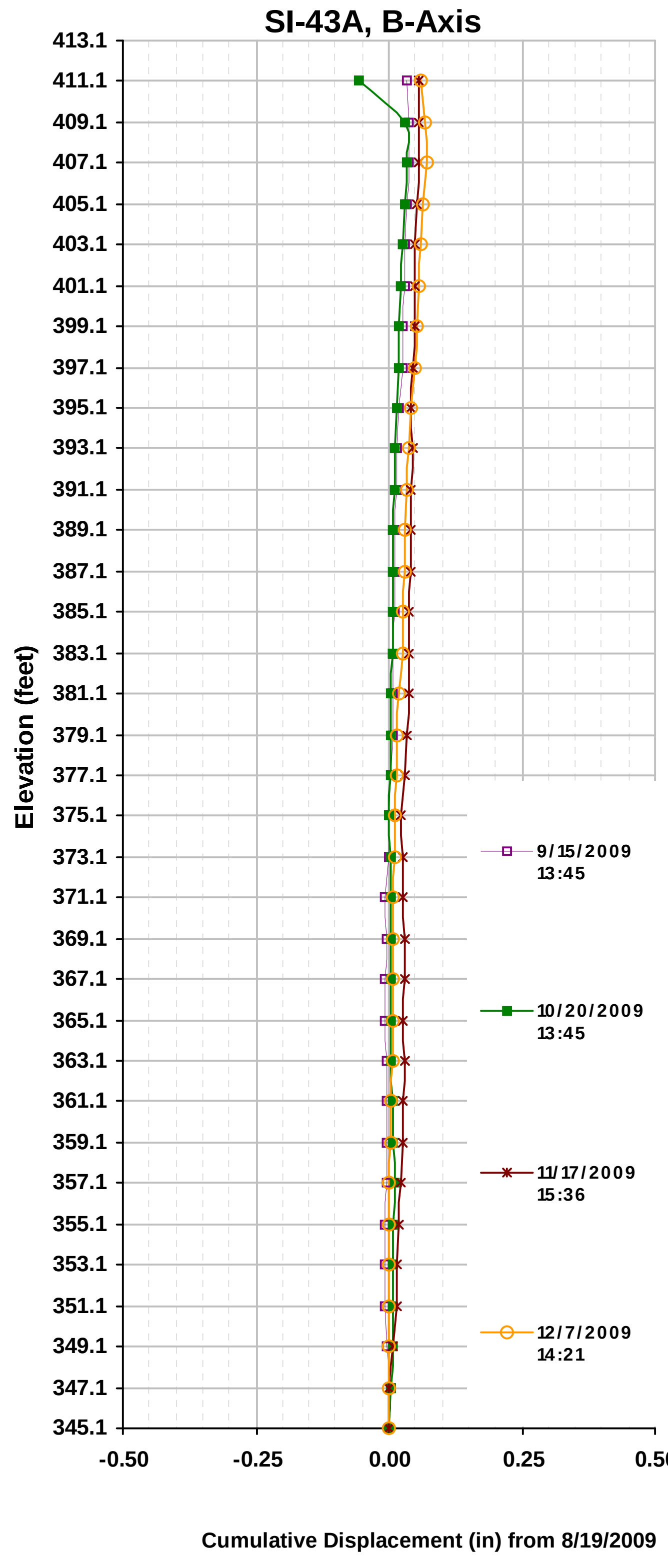
INITIAL SURVEY 8/19/2009 2:35:44 PM

DATE PRINTED 12/8/2009 11:03:01 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	-19	81	-0.0600	-14	83	-0.0582	0.0018	0.0378
4	-69	125	-0.1164	-63	127	-0.1140	0.0024	0.0360
6	-81	145	-0.1356	-78	145	-0.1338	0.0018	0.0336
8	-81	140	-0.1326	-76	140	-0.1296	0.0030	0.0318
10	-54	117	-0.1026	-49	117	-0.0996	0.0030	0.0288
12	-10	73	-0.0498	-9	78	-0.0522	-0.0024	0.0258
14	14	29	-0.0090	15	33	-0.0108	-0.0018	0.0282
16	18	45	-0.0162	23	45	-0.0132	0.0030	0.0300
18	-9	65	-0.0444	-2	66	-0.0408	0.0036	0.0270
20	-21	76	-0.0582	-16	78	-0.0564	0.0018	0.0234
22	-45	106	-0.0906	-40	109	-0.0894	0.0012	0.0216
24	-54	102	-0.0936	-50	105	-0.0930	0.0006	0.0204
26	22	37	-0.0090	26	40	-0.0084	0.0006	0.0198
28	51	5	0.0276	59	6	0.0318	0.0042	0.0192
30	40	21	0.0114	47	21	0.0156	0.0042	0.0150
32	7	41	-0.0204	25	41	-0.0096	0.0108	0.0108
34	0	0	0.0000	0	0	0.0000	0.0000	0.0000





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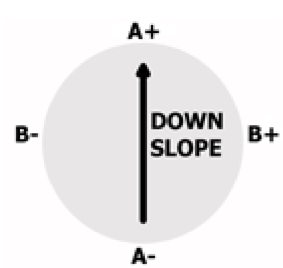


Cumberland Fossil Plant
B-43
Cumberland City, TN
175539009
12/8/2009

SITE CUFTVA

INSTALLATION SI-43A

DESCRIPTION

CURRENT SURVEY 9/15/2009 1:45:45 PM

INITIAL SURVEY 8/19/2009 3:12:33 PM

DATE PRINTED 12/8/2009 11:25:21 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	331	-313	0.3864	347	-351	0.4188	0.0324	-0.0072
4	391	-382	0.4638	392	-388	0.4680	0.0042	-0.0396
6	342	-341	0.4098	339	-342	0.4086	-0.0012	-0.0438
8	423	-418	0.5046	423	-419	0.5052	0.0006	-0.0426
10	485	-481	0.5796	485	-484	0.5814	0.0018	-0.0432
12	514	-508	0.6132	511	-509	0.6120	-0.0012	-0.0450
14	567	-560	0.6762	564	-565	0.6774	0.0012	-0.0438
16	670	-662	0.7992	666	-667	0.7998	0.0006	-0.0450
18	811	-806	0.9702	809	-806	0.9690	-0.0012	-0.0456
20	766	-762	0.9168	762	-762	0.9144	-0.0024	-0.0444
22	700	-694	0.8364	695	-694	0.8334	-0.0030	-0.0420
24	682	-677	0.8154	679	-678	0.8142	-0.0012	-0.0390
26	662	-657	0.7914	658	-658	0.7896	-0.0018	-0.0378
28	626	-619	0.7470	622	-620	0.7452	-0.0018	-0.0360
30	546	-542	0.6528	543	-542	0.6510	-0.0018	-0.0342
32	496	-491	0.5922	493	-492	0.5910	-0.0012	-0.0324
34	458	-455	0.5478	456	-455	0.5466	-0.0012	-0.0312
36	404	-401	0.4830	401	-401	0.4812	-0.0018	-0.0300
38	465	-458	0.5538	462	-460	0.5532	-0.0006	-0.0282
40	448	-443	0.5346	444	-444	0.5328	-0.0018	-0.0276
42	403	-396	0.4794	399	-397	0.4776	-0.0018	-0.0258
44	394	-388	0.4692	390	-389	0.4674	-0.0018	-0.0240
46	404	-397	0.4806	400	-397	0.4782	-0.0024	-0.0222
48	494	-489	0.5898	490	-490	0.5880	-0.0018	-0.0198
50	531	-527	0.6348	528	-529	0.6342	-0.0006	-0.0180
52	573	-567	0.6840	570	-569	0.6834	-0.0006	-0.0174
54	595	-589	0.7104	591	-590	0.7086	-0.0018	-0.0168
56	541	-531	0.6432	537	-532	0.6414	-0.0018	-0.0150
58	434	-426	0.5160	430	-426	0.5136	-0.0024	-0.0132
60	250	-244	0.2964	246	-243	0.2934	-0.0030	-0.0108
62	-1	8	-0.0054	-5	9	-0.0084	-0.0030	-0.0078
64	-323	335	-0.3948	-327	334	-0.3966	-0.0018	-0.0048
66	-560	567	-0.6762	-565	567	-0.6792	-0.0030	-0.0030
68	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-43A

DESCRIPTION

CURRENT SURVEY 10/20/2009 1:45:50 PM

INITIAL SURVEY 8/19/2009 3:12:33 PM

DATE PRINTED 12/8/2009 11:25:21 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	331	-313	0.3864	422	-424	0.5076	0.1212	0.0972
4	391	-382	0.4638	398	-385	0.4698	0.0060	-0.0240
6	342	-341	0.4098	343	-336	0.4074	-0.0024	-0.0300
8	423	-418	0.5046	427	-414	0.5046	0.0000	-0.0276
10	485	-481	0.5796	490	-478	0.5808	0.0012	-0.0276
12	514	-508	0.6132	516	-504	0.6120	-0.0012	-0.0288
14	567	-560	0.6762	570	-560	0.6780	0.0018	-0.0276
16	670	-662	0.7992	673	-659	0.7992	0.0000	-0.0294
18	811	-806	0.9702	814	-801	0.9690	-0.0012	-0.0294
20	766	-762	0.9168	769	-758	0.9162	-0.0006	-0.0282
22	700	-694	0.8364	701	-689	0.8340	-0.0024	-0.0276
24	682	-677	0.8154	685	-673	0.8148	-0.0006	-0.0252
26	662	-657	0.7914	665	-654	0.7914	0.0000	-0.0246
28	626	-619	0.7470	628	-616	0.7464	-0.0006	-0.0246
30	546	-542	0.6528	549	-538	0.6522	-0.0006	-0.0240
32	496	-491	0.5922	498	-487	0.5910	-0.0012	-0.0234
34	458	-455	0.5478	462	-450	0.5472	-0.0006	-0.0222
36	404	-401	0.4830	406	-395	0.4806	-0.0024	-0.0216
38	465	-458	0.5538	468	-455	0.5538	0.0000	-0.0192
40	448	-443	0.5346	450	-439	0.5334	-0.0012	-0.0192
42	403	-396	0.4794	404	-392	0.4776	-0.0018	-0.0180
44	394	-388	0.4692	396	-385	0.4686	-0.0006	-0.0162
46	404	-397	0.4806	405	-393	0.4788	-0.0018	-0.0156
48	494	-489	0.5898	497	-485	0.5892	-0.0006	-0.0138
50	531	-527	0.6348	535	-523	0.6348	0.0000	-0.0132
52	573	-567	0.6840	574	-563	0.6822	-0.0018	-0.0132
54	595	-589	0.7104	597	-586	0.7098	-0.0006	-0.0114
56	541	-531	0.6432	542	-527	0.6414	-0.0018	-0.0108
58	434	-426	0.5160	434	-422	0.5136	-0.0024	-0.0090
60	250	-244	0.2964	251	-242	0.2958	-0.0006	-0.0066
62	-1	8	-0.0054	-1	15	-0.0096	-0.0042	-0.0060
64	-323	335	-0.3948	-323	336	-0.3954	-0.0006	-0.0018
66	-560	567	-0.6762	-559	570	-0.6774	-0.0012	-0.0012
68	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-43A

DESCRIPTION

CURRENT SURVEY 11/17/2009 3:36:22 PM

INITIAL SURVEY 8/19/2009 3:12:33 PM

DATE PRINTED 12/8/2009 11:25:21 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	331	-313	0.3864	393	-335	0.4368	0.0504	0.0360
4	391	-382	0.4638	398	-383	0.4686	0.0048	-0.0144
6	342	-341	0.4098	344	-334	0.4068	-0.0030	-0.0192
8	423	-418	0.5046	427	-411	0.5028	-0.0018	-0.0162
10	485	-481	0.5796	490	-476	0.5796	0.0000	-0.0144
12	514	-508	0.6132	517	-503	0.6120	-0.0012	-0.0144
14	567	-560	0.6762	570	-554	0.6744	-0.0018	-0.0132
16	670	-662	0.7992	671	-657	0.7968	-0.0024	-0.0114
18	811	-806	0.9702	814	-799	0.9678	-0.0024	-0.0090
20	766	-762	0.9168	771	-757	0.9168	0.0000	-0.0066
22	700	-694	0.8364	703	-687	0.8340	-0.0024	-0.0066
24	682	-677	0.8154	687	-672	0.8154	0.0000	-0.0042
26	662	-657	0.7914	666	-651	0.7902	-0.0012	-0.0042
28	626	-619	0.7470	630	-615	0.7470	0.0000	-0.0030
30	546	-542	0.6528	551	-537	0.6528	0.0000	-0.0030
32	496	-491	0.5922	500	-485	0.5910	-0.0012	-0.0030
34	458	-455	0.5478	463	-450	0.5478	0.0000	-0.0018
36	404	-401	0.4830	408	-396	0.4824	-0.0006	-0.0018
38	465	-458	0.5538	468	-451	0.5514	-0.0024	-0.0012
40	448	-443	0.5346	452	-437	0.5334	-0.0012	0.0012
42	403	-396	0.4794	406	-391	0.4782	-0.0012	0.0024
44	394	-388	0.4692	397	-382	0.4674	-0.0018	0.0036
46	404	-397	0.4806	406	-392	0.4788	-0.0018	0.0054
48	494	-489	0.5898	494	-483	0.5862	-0.0036	0.0072
50	531	-527	0.6348	534	-520	0.6324	-0.0024	0.0108
52	573	-567	0.6840	575	-561	0.6816	-0.0024	0.0132
54	595	-589	0.7104	598	-583	0.7086	-0.0018	0.0156
56	541	-531	0.6432	545	-528	0.6438	0.0006	0.0174
58	434	-426	0.5160	439	-421	0.5160	0.0000	0.0168
60	250	-244	0.2964	255	-239	0.2964	0.0000	0.0168
62	-1	8	-0.0054	9	13	-0.0024	0.0030	0.0168
64	-323	335	-0.3948	-309	331	-0.3840	0.0108	0.0138
66	-560	567	-0.6762	-550	572	-0.6732	0.0030	0.0030
68	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-43A

DESCRIPTION

CURRENT SURVEY 12/7/2009 2:21:33 PM

INITIAL SURVEY 8/19/2009 3:12:33 PM

DATE PRINTED 12/8/2009 11:25:21 AM

Data Reduction for A Axis:

	Initial			Current				
Depth (ft)	A0	A180	Incr. Dev (in)	A0	A180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	331	-313	0.3864	376	-402	0.4668	0.0804	0.0450
4	391	-382	0.4638	395	-386	0.4686	0.0048	-0.0354
6	342	-341	0.4098	342	-335	0.4062	-0.0036	-0.0402
8	423	-418	0.5046	426	-414	0.5040	-0.0006	-0.0366
10	485	-481	0.5796	488	-478	0.5796	0.0000	-0.0360
12	514	-508	0.6132	515	-505	0.6120	-0.0012	-0.0360
14	567	-560	0.6762	570	-562	0.6792	0.0030	-0.0348
16	670	-662	0.7992	670	-660	0.7980	-0.0012	-0.0378
18	811	-806	0.9702	814	-801	0.9690	-0.0012	-0.0366
20	766	-762	0.9168	768	-757	0.9150	-0.0018	-0.0354
22	700	-694	0.8364	700	-690	0.8340	-0.0024	-0.0336
24	682	-677	0.8154	685	-673	0.8148	-0.0006	-0.0312
26	662	-657	0.7914	664	-652	0.7896	-0.0018	-0.0306
28	626	-619	0.7470	626	-615	0.7446	-0.0024	-0.0288
30	546	-542	0.6528	549	-537	0.6516	-0.0012	-0.0264
32	496	-491	0.5922	498	-486	0.5904	-0.0018	-0.0252
34	458	-455	0.5478	461	-450	0.5466	-0.0012	-0.0234
36	404	-401	0.4830	406	-395	0.4806	-0.0024	-0.0222
38	465	-458	0.5538	467	-455	0.5532	-0.0006	-0.0198
40	448	-443	0.5346	449	-439	0.5328	-0.0018	-0.0192
42	403	-396	0.4794	405	-392	0.4782	-0.0012	-0.0174
44	394	-388	0.4692	395	-384	0.4674	-0.0018	-0.0162
46	404	-397	0.4806	405	-393	0.4788	-0.0018	-0.0144
48	494	-489	0.5898	495	-485	0.5880	-0.0018	-0.0126
50	531	-527	0.6348	535	-522	0.6342	-0.0006	-0.0108
52	573	-567	0.6840	574	-562	0.6816	-0.0024	-0.0102
54	595	-589	0.7104	596	-585	0.7086	-0.0018	-0.0078
56	541	-531	0.6432	542	-527	0.6414	-0.0018	-0.0060
58	434	-426	0.5160	433	-421	0.5124	-0.0036	-0.0042
60	250	-244	0.2964	249	-238	0.2922	-0.0042	-0.0006
62	-1	8	-0.0054	0	14	0.0000	0.0054	0.0036
64	-323	335	-0.3948	-323	338	-0.3966	-0.0018	-0.0018
66	-560	567	-0.6762	-555	572	-0.6762	0.0000	0.0000
68	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-43A

DESCRIPTION

CURRENT SURVEY 9/15/2009 1:45:45 PM

INITIAL SURVEY 8/19/2009 3:12:33 PM

DATE PRINTED 12/8/2009 11:25:50 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	98	-70	0.1008	94	-68	0.0972	-0.0036	0.0330
4	-210	238	-0.2688	-212	240	-0.2712	-0.0024	0.0366
6	-353	413	-0.4596	-351	408	-0.4554	0.0042	0.0390
8	-455	501	-0.5736	-451	498	-0.5694	0.0042	0.0348
10	-523	582	-0.6630	-523	578	-0.6606	0.0024	0.0306
12	-537	601	-0.6828	-538	598	-0.6816	0.0012	0.0282
14	-477	518	-0.5970	-479	514	-0.5958	0.0012	0.0270
16	-331	370	-0.4206	-332	360	-0.4152	0.0054	0.0258
18	-116	167	-0.1698	-118	159	-0.1662	0.0036	0.0204
20	-49	110	-0.0954	-50	105	-0.0930	0.0024	0.0168
22	-64	126	-0.1140	-66	121	-0.1122	0.0018	0.0144
24	-135	191	-0.1956	-135	188	-0.1938	0.0018	0.0126
26	-214	269	-0.2898	-217	266	-0.2898	0.0000	0.0108
28	-205	261	-0.2796	-206	257	-0.2778	0.0018	0.0108
30	-256	314	-0.3420	-256	311	-0.3402	0.0018	0.0090
32	-320	381	-0.4206	-321	378	-0.4194	0.0012	0.0072
34	-377	440	-0.4902	-378	436	-0.4884	0.0018	0.0060
36	-429	489	-0.5508	-431	483	-0.5484	0.0024	0.0042
38	-352	398	-0.4500	-354	395	-0.4494	0.0006	0.0018
40	-261	319	-0.3480	-265	303	-0.3408	0.0072	0.0012
42	-181	246	-0.2562	-185	243	-0.2568	-0.0006	-0.0060
44	-138	203	-0.2046	-141	199	-0.2040	0.0006	-0.0054
46	-156	213	-0.2214	-159	209	-0.2208	0.0006	-0.0060
48	-160	204	-0.2184	-166	202	-0.2208	-0.0024	-0.0066
50	-177	235	-0.2472	-179	232	-0.2466	0.0006	-0.0042
52	-223	285	-0.3048	-226	282	-0.3048	0.0000	-0.0048
54	-296	357	-0.3918	-298	354	-0.3912	0.0006	-0.0048
56	-358	414	-0.4632	-361	410	-0.4626	0.0006	-0.0054
58	-427	469	-0.5376	-428	468	-0.5376	0.0000	-0.0060
60	-487	546	-0.6198	-491	542	-0.6198	0.0000	-0.0060
62	-569	629	-0.7188	-575	624	-0.7194	-0.0006	-0.0060
64	-680	735	-0.8490	-698	733	-0.8586	-0.0096	-0.0054
66	-753	767	-0.9120	-750	763	-0.9078	0.0042	0.0042
68	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-43A

DESCRIPTION

CURRENT SURVEY 10/20/2009 1:45:50 PM

INITIAL SURVEY 8/19/2009 3:12:33 PM

DATE PRINTED 12/8/2009 11:25:50 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	98	-70	0.1008	-29	-57	0.0168	-0.0840	-0.0558
4	-210	238	-0.2688	-213	244	-0.2742	-0.0054	0.0282
6	-353	413	-0.4596	-349	410	-0.4554	0.0042	0.0336
8	-455	501	-0.5736	-450	499	-0.5694	0.0042	0.0294
10	-523	582	-0.6630	-520	578	-0.6588	0.0042	0.0252
12	-537	601	-0.6828	-534	601	-0.6810	0.0018	0.0210
14	-477	518	-0.5970	-477	516	-0.5958	0.0012	0.0192
16	-331	370	-0.4206	-330	363	-0.4158	0.0048	0.0180
18	-116	167	-0.1698	-117	165	-0.1692	0.0006	0.0132
20	-49	110	-0.0954	-47	108	-0.0930	0.0024	0.0126
22	-64	126	-0.1140	-64	123	-0.1122	0.0018	0.0102
24	-135	191	-0.1956	-133	192	-0.1950	0.0006	0.0084
26	-214	269	-0.2898	-213	269	-0.2892	0.0006	0.0078
28	-205	261	-0.2796	-203	261	-0.2784	0.0012	0.0072
30	-256	314	-0.3420	-254	313	-0.3402	0.0018	0.0060
32	-320	381	-0.4206	-320	380	-0.4200	0.0006	0.0042
34	-377	440	-0.4902	-377	439	-0.4896	0.0006	0.0036
36	-429	489	-0.5508	-429	487	-0.5496	0.0012	0.0030
38	-352	398	-0.4500	-354	397	-0.4506	-0.0006	0.0018
40	-261	319	-0.3480	-262	318	-0.3480	0.0000	0.0024
42	-181	246	-0.2562	-182	245	-0.2562	0.0000	0.0024
44	-138	203	-0.2046	-139	202	-0.2046	0.0000	0.0024
46	-156	213	-0.2214	-156	213	-0.2214	0.0000	0.0024
48	-160	204	-0.2184	-162	207	-0.2214	-0.0030	0.0024
50	-177	235	-0.2472	-178	235	-0.2478	-0.0006	0.0054
52	-223	285	-0.3048	-225	285	-0.3060	-0.0012	0.0060
54	-296	357	-0.3918	-297	361	-0.3948	-0.0030	0.0072
56	-358	414	-0.4632	-358	412	-0.4620	0.0012	0.0102
58	-427	469	-0.5376	-426	469	-0.5370	0.0006	0.0090
60	-487	546	-0.6198	-489	545	-0.6204	-0.0006	0.0084
62	-569	629	-0.7188	-569	626	-0.7170	0.0018	0.0090
64	-680	735	-0.8490	-681	731	-0.8472	0.0018	0.0072
66	-753	767	-0.9120	-746	765	-0.9066	0.0054	0.0054
68	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-43A

DESCRIPTION

CURRENT SURVEY 11/17/2009 3:36:22 PM

INITIAL SURVEY 8/19/2009 3:12:33 PM

DATE PRINTED 12/8/2009 11:25:50 AM

Data Reduction for B Axis:

	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	98	-70	0.1008	93	-73	0.0996	-0.0012	0.0570
4	-210	238	-0.2688	-206	242	-0.2688	0.0000	0.0582
6	-353	413	-0.4596	-347	411	-0.4548	0.0048	0.0582
8	-455	501	-0.5736	-447	504	-0.5706	0.0030	0.0534
10	-523	582	-0.6630	-520	582	-0.6612	0.0018	0.0504
12	-537	601	-0.6828	-535	601	-0.6816	0.0012	0.0486
14	-477	518	-0.5970	-476	517	-0.5958	0.0012	0.0474
16	-331	370	-0.4206	-329	367	-0.4176	0.0030	0.0462
18	-116	167	-0.1698	-121	166	-0.1722	-0.0024	0.0432
20	-49	110	-0.0954	-46	109	-0.0930	0.0024	0.0456
22	-64	126	-0.1140	-62	125	-0.1122	0.0018	0.0432
24	-135	191	-0.1956	-131	192	-0.1938	0.0018	0.0414
26	-214	269	-0.2898	-211	270	-0.2886	0.0012	0.0396
28	-205	261	-0.2796	-202	263	-0.2790	0.0006	0.0384
30	-256	314	-0.3420	-252	315	-0.3402	0.0018	0.0378
32	-320	381	-0.4206	-317	381	-0.4188	0.0018	0.0360
34	-377	440	-0.4902	-375	438	-0.4878	0.0024	0.0342
36	-429	489	-0.5508	-425	480	-0.5430	0.0078	0.0318
38	-352	398	-0.4500	-353	399	-0.4512	-0.0012	0.0240
40	-261	319	-0.3480	-262	322	-0.3504	-0.0024	0.0252
42	-181	246	-0.2562	-181	249	-0.2580	-0.0018	0.0276
44	-138	203	-0.2046	-136	205	-0.2046	0.0000	0.0294
46	-156	213	-0.2214	-151	213	-0.2184	0.0030	0.0294
48	-160	204	-0.2184	-159	208	-0.2202	-0.0018	0.0264
50	-177	235	-0.2472	-173	237	-0.2460	0.0012	0.0282
52	-223	285	-0.3048	-219	285	-0.3024	0.0024	0.0270
54	-296	357	-0.3918	-291	357	-0.3888	0.0030	0.0246
56	-358	414	-0.4632	-353	413	-0.4596	0.0036	0.0216
58	-427	469	-0.5376	-422	471	-0.5358	0.0018	0.0180
60	-487	546	-0.6198	-484	545	-0.6174	0.0024	0.0162
62	-569	629	-0.7188	-562	625	-0.7122	0.0066	0.0138
64	-680	735	-0.8490	-673	733	-0.8436	0.0054	0.0072
66	-753	767	-0.9120	-749	768	-0.9102	0.0018	0.0018
68	0	0	0.0000	0	0	0.0000	0.0000	0.0000

SITE CUFTVA

INSTALLATION SI-43A

DESCRIPTION

CURRENT SURVEY 12/7/2009 2:21:33 PM

INITIAL SURVEY 8/19/2009 3:12:33 PM

DATE PRINTED 12/8/2009 11:25:51 AM

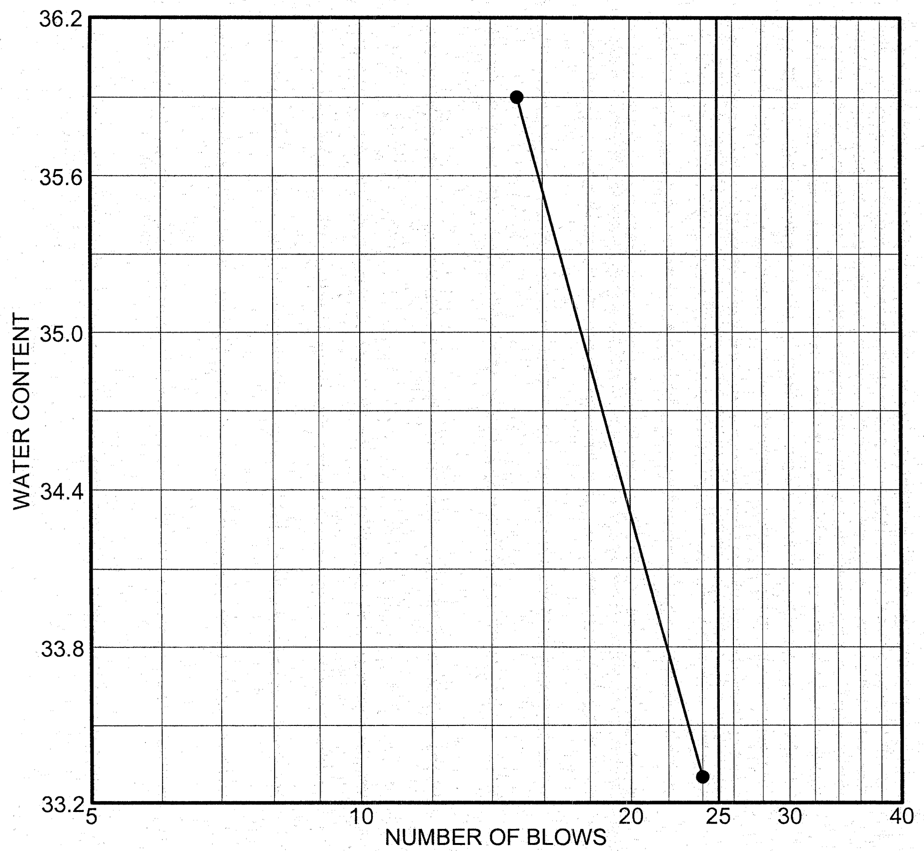
Data Reduction for B Axis:

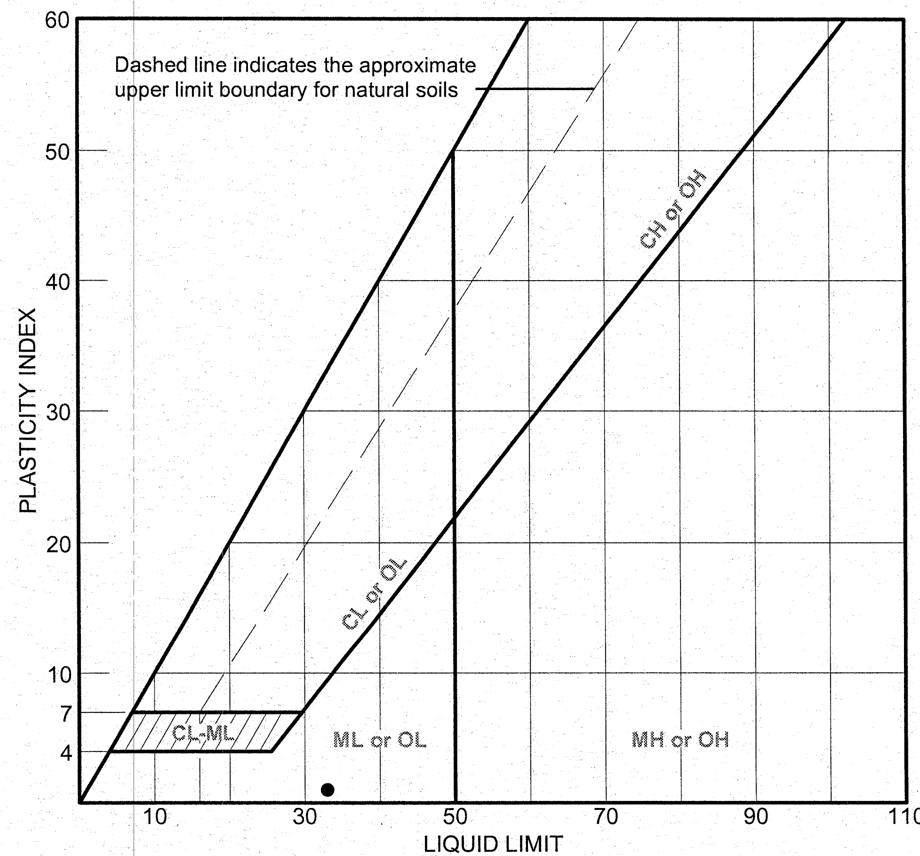
	Initial			Current				
Depth (ft)	B0	B180	Incr. Dev (in)	B0	B180	Incr. Dev (in)	Incr. Disp. (in)	Cum. Disp. (in)
2	98	-70	0.1008	96	-65	0.0966	-0.0042	0.0618
4	-210	238	-0.2688	-210	245	-0.2730	-0.0042	0.0660
6	-353	413	-0.4596	-346	411	-0.4542	0.0054	0.0702
8	-455	501	-0.5736	-445	502	-0.5682	0.0054	0.0648
10	-523	582	-0.6630	-518	582	-0.6600	0.0030	0.0594
12	-537	601	-0.6828	-531	601	-0.6792	0.0036	0.0564
14	-477	518	-0.5970	-474	517	-0.5946	0.0024	0.0528
16	-331	370	-0.4206	-326	362	-0.4128	0.0078	0.0504
18	-116	167	-0.1698	-112	163	-0.1650	0.0048	0.0426
20	-49	110	-0.0954	-46	109	-0.0930	0.0024	0.0378
22	-64	126	-0.1140	-59	124	-0.1098	0.0042	0.0354
24	-135	191	-0.1956	-129	193	-0.1932	0.0024	0.0312
26	-214	269	-0.2898	-211	268	-0.2874	0.0024	0.0288
28	-205	261	-0.2796	-201	262	-0.2778	0.0018	0.0264
30	-256	314	-0.3420	-250	310	-0.3360	0.0060	0.0246
32	-320	381	-0.4206	-315	381	-0.4176	0.0030	0.0186
34	-377	440	-0.4902	-375	441	-0.4896	0.0006	0.0156
36	-429	489	-0.5508	-425	489	-0.5484	0.0024	0.0150
38	-352	398	-0.4500	-347	400	-0.4482	0.0018	0.0126
40	-261	319	-0.3480	-258	318	-0.3456	0.0024	0.0108
42	-181	246	-0.2562	-179	248	-0.2562	0.0000	0.0084
44	-138	203	-0.2046	-137	205	-0.2052	-0.0006	0.0084
46	-156	213	-0.2214	-153	215	-0.2208	0.0006	0.0090
48	-160	204	-0.2184	-155	207	-0.2172	0.0012	0.0084
50	-177	235	-0.2472	-172	237	-0.2454	0.0018	0.0072
52	-223	285	-0.3048	-220	286	-0.3036	0.0012	0.0054
54	-296	357	-0.3918	-290	359	-0.3894	0.0024	0.0042
56	-358	414	-0.4632	-356	415	-0.4626	0.0006	0.0018
58	-427	469	-0.5376	-422	474	-0.5376	0.0000	0.0012
60	-487	546	-0.6198	-485	547	-0.6192	0.0006	0.0012
62	-569	629	-0.7188	-565	630	-0.7170	0.0018	0.0006
64	-680	735	-0.8490	-677	737	-0.8484	0.0006	-0.0012
66	-753	767	-0.9120	-753	770	-0.9138	-0.0018	-0.0018
68	0	0	0.0000	0	0	0.0000	0.0000	0.0000

Appendix G

Results of Laboratory Testing

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●		Gypsum Rejects		9/21/09	ML			33	1

Client STANTEC

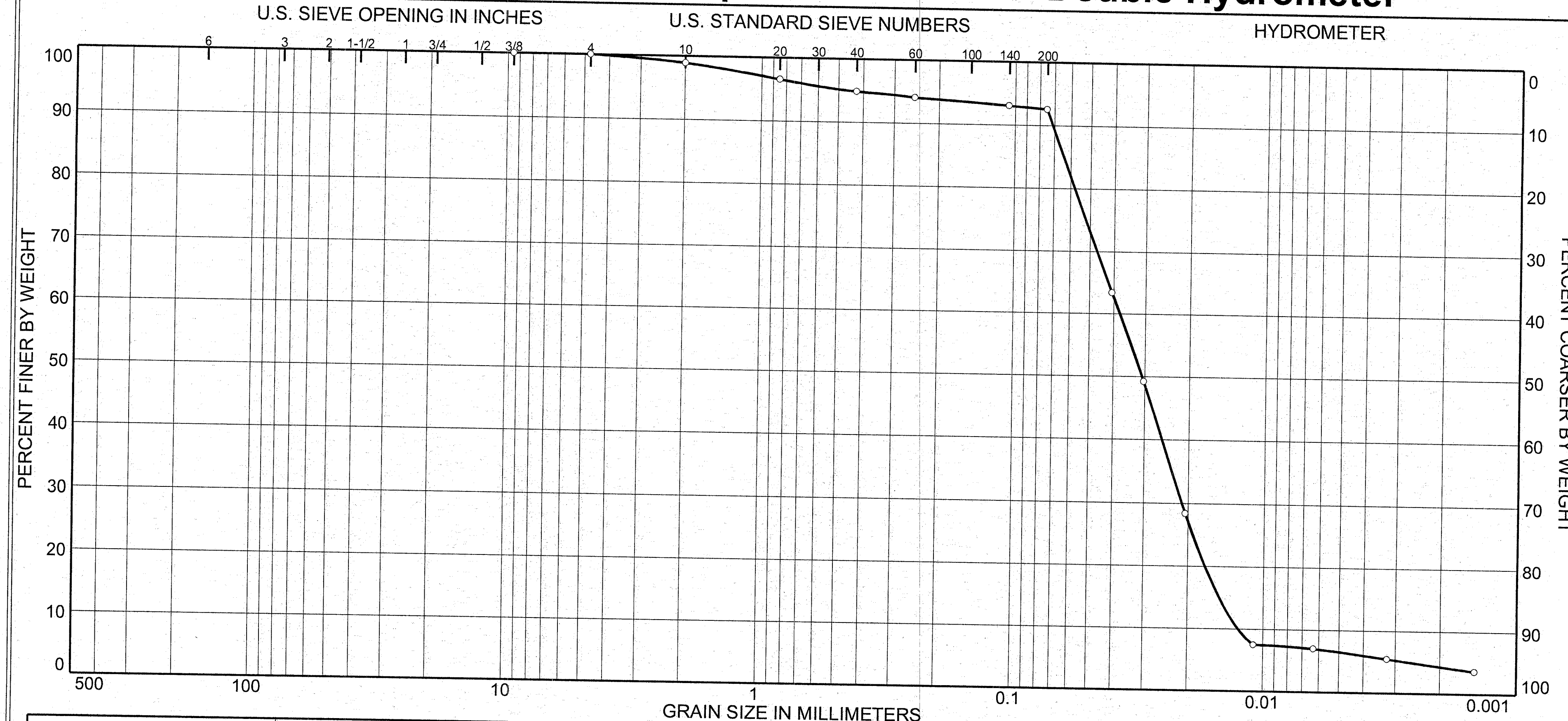
Project Cumberland Fossil Plant (Ash and Gypsum Stacks)

Project No. GTX-1484 Lab no.

GeoTesting Express Inc.

● Could not get >25 blows on LL, Could not roll <1/4" thread

Particle Size Distribution Report ASTM D4221-Double Hydrometer

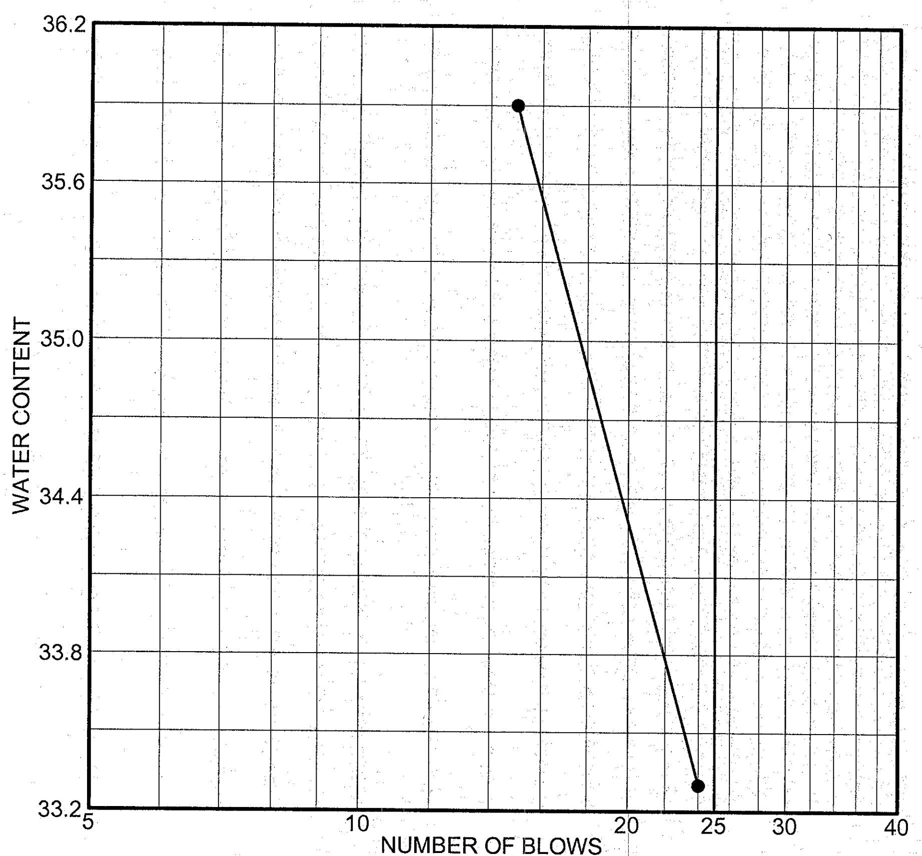


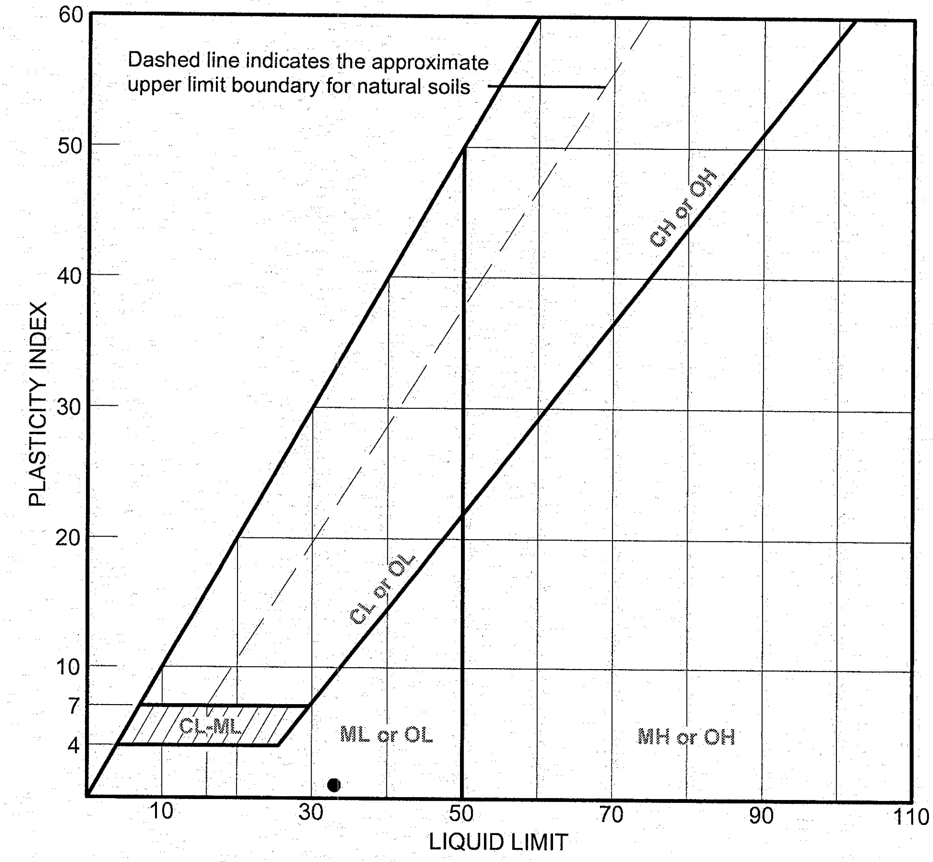
% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	7.4	86.1	6.5

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
	Gypsum Rejects		9/21/09	ML			33	32

Client STANTEC	**GeoTesting Express Inc.**
Project Cumberland Fossil Plant (Ash and Gypsum Stacks)	
Project No. GTX-1484	Lab no.

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●		Gypsum Rejects		9/21/09	ML			33	1

Client STANTEC

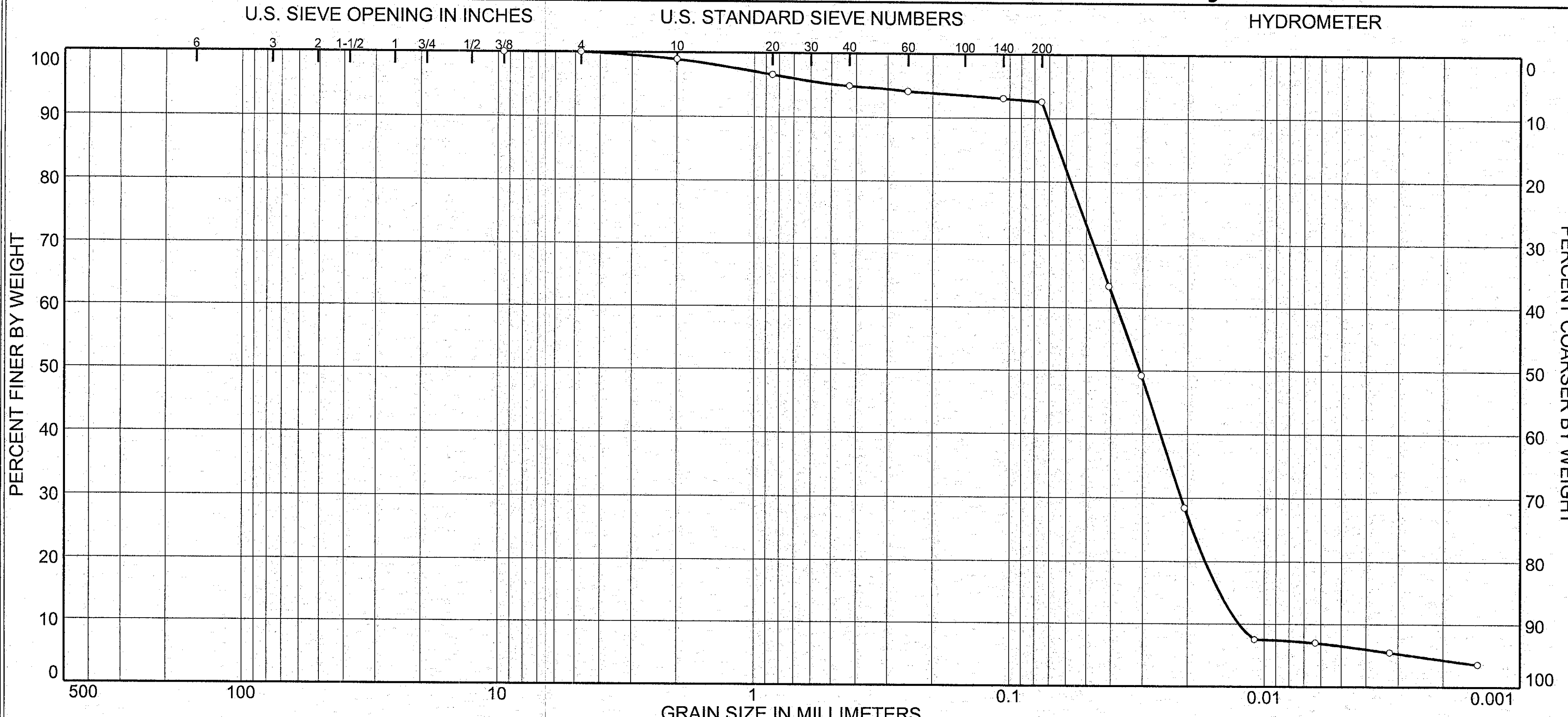
Project Cumberland Fossil Plant (Ash and Gypsum Stacks)

Project No. GTX-1484 Lab no.

GeoTesting Express Inc.

● Could not get >25 blows on LL, Could not roll <1/4" thread

Particle Size Distribution Report ASTM D4221-Double Hydrometer



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.0	7.4	86.1	6.5

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○		Gypsum Rejects		9/21/09	ML			33	32

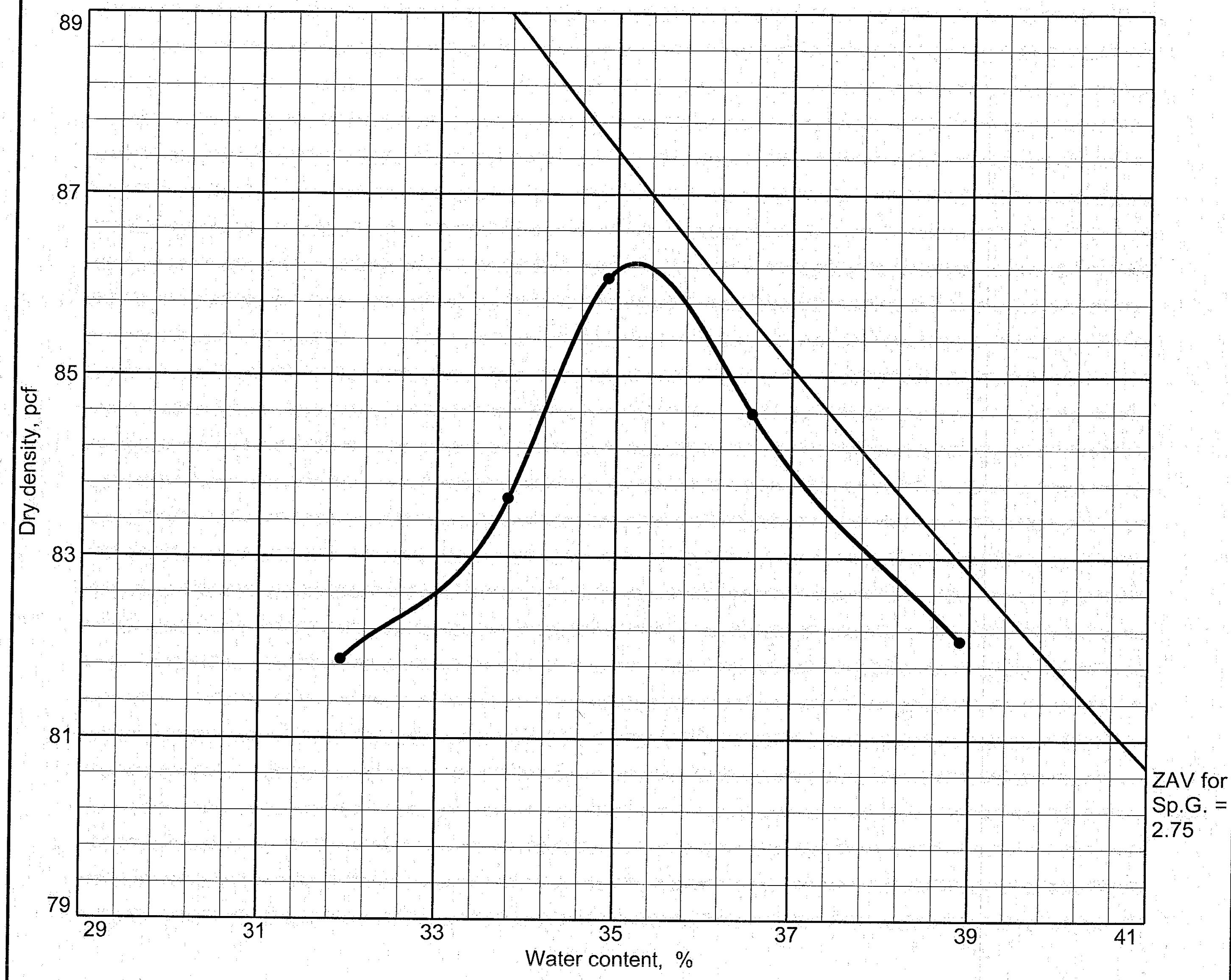
Client STANTEC

Project Cumberland Fossil Plant (Ash and Gypsum Stacks)

Project No. GTX-1484 Lab no.

GeoTesting Express Inc.

COMPACTION TEST REPORT



Test specification: ASTM D 698-78 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	ML	A-4(0)		2.75	33	1	0.0	92.6

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 86.2 pcf Optimum moisture = 35.2 %	

Project No. GTX-1484 **Client:** STANTEC

Project: Cumberland Fossil Plant (Ash and Gypsum Stacks)

● **Source:** **Sample No.:** Gypsum Rejects

COMPACTION TEST REPORT

GeoTesting Express Inc.

Remarks:

Lab no.

GeoTesting Express

SPECIFIC GRAVITY TEST

(ASTM D854)

roject No. GTX-1484 Tested By JM Reviewed By MM

Project Name Cumberland Ash Test Date 9/9/2009 Review Date 9/17/2009

(1) Boring No.	(2) Depth (ft)	(3) Sample No.	(4) Lab No.	(5) Flask No.	(6) Temperature (^{0}C)	(7) Weight, WF (grams)	(8) Weight, WFS (grams)	(9) Weight of Soil (grams) (8)-(7)	(10) Weight, CWF (grams)	(11) Weight, DS (grams)	(12) Specific Gravity (9)/[(10)-(11)+(9)]	(13) Specific Gravity at 20^0 C
--	--	Gypsum Rejects	---	41	20	304.60	358.10	53.50	433.68	467.56	2.727	2.728

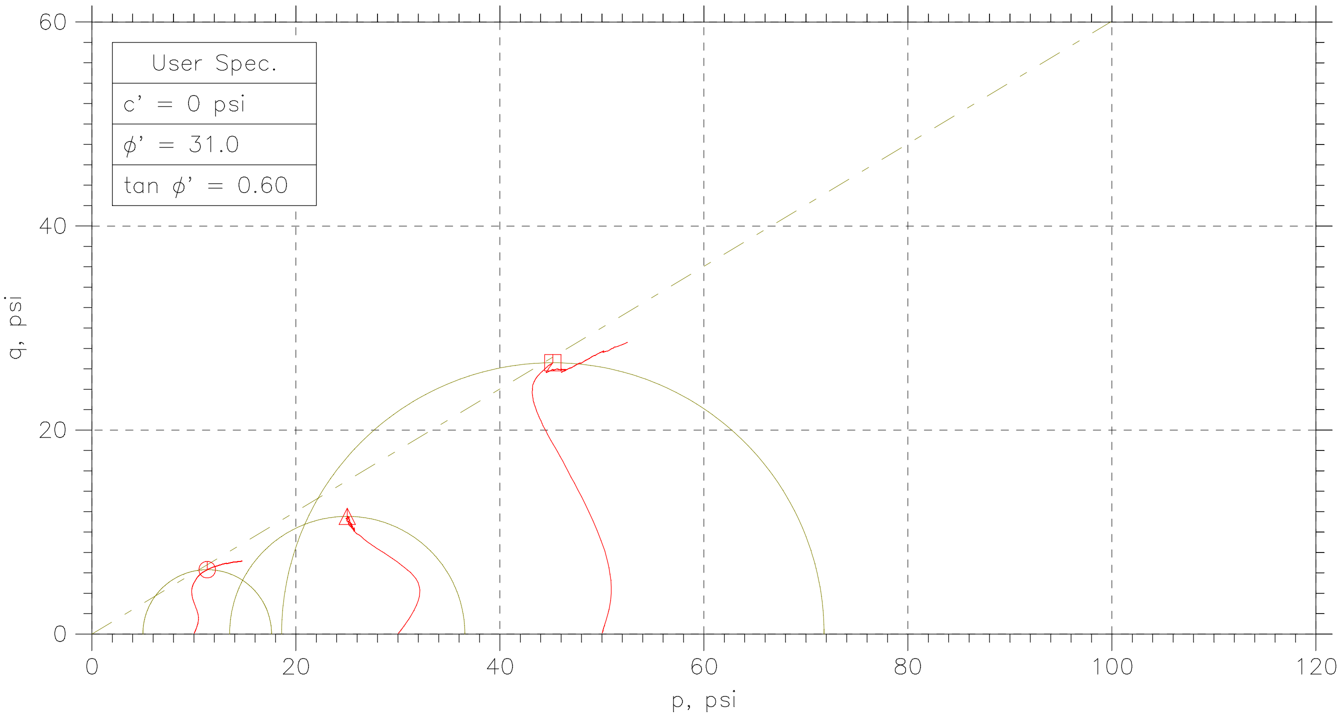
WF - Water and Flask

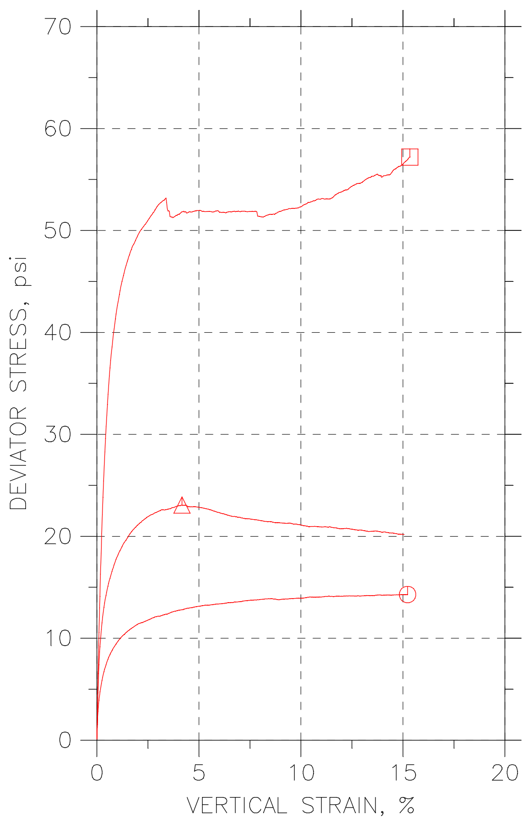
WFS - Water, Flask and Soil

CWF - Calibration Water and Flask

DS - Deaired Sample

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		1628	1633	1626	
Test No.		4.1	4.2	4.3	
Depth		17.5-18.0'	14.5-15.0'	10.8-11.3	
Initial	Diameter, in	2.888	2.859	2.882	
	Height, in	6.054	5.96	5.973	
	Water Content, %	18.0	23.6	20.9	
	Dry Density, pcf	109.	99.89	103.2	
	Saturation, %	88.8	92.6	89.3	
	Void Ratio	0.547	0.687	0.633	
Before Shear	Water Content, %	18.7	23.1	20.8	
	Dry Density, pcf	111.9	103.7	108.	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.506	0.625	0.56	
	Back Press., psi	62.52	59.45	68.46	
Ver. Eff. Cons. Stress, psi		9.959	29.98	49.94	
Shear Strength, psi		7.145	11.53	28.6	
Strain at Failure, %		15.2	4.17	15.3	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.95	0.95	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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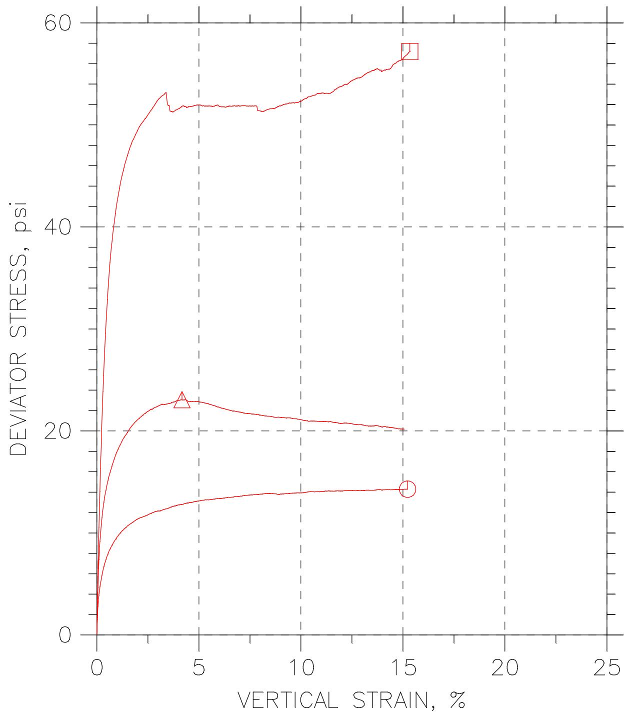
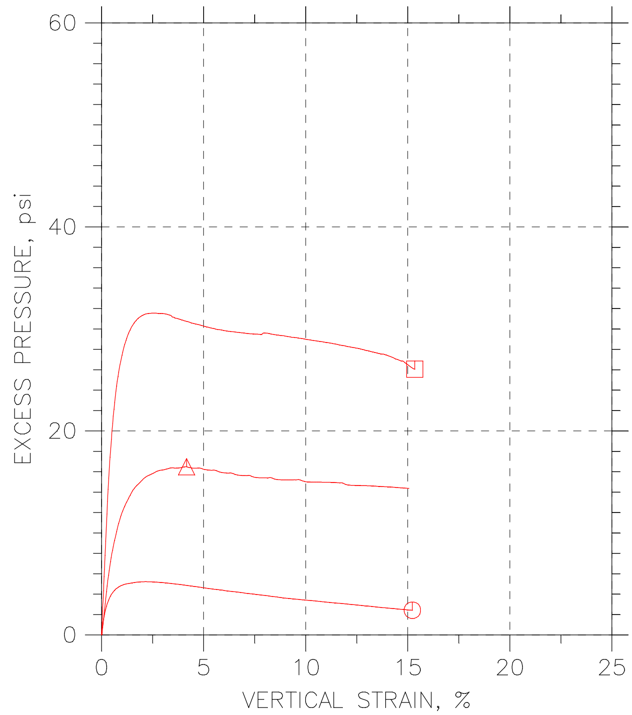
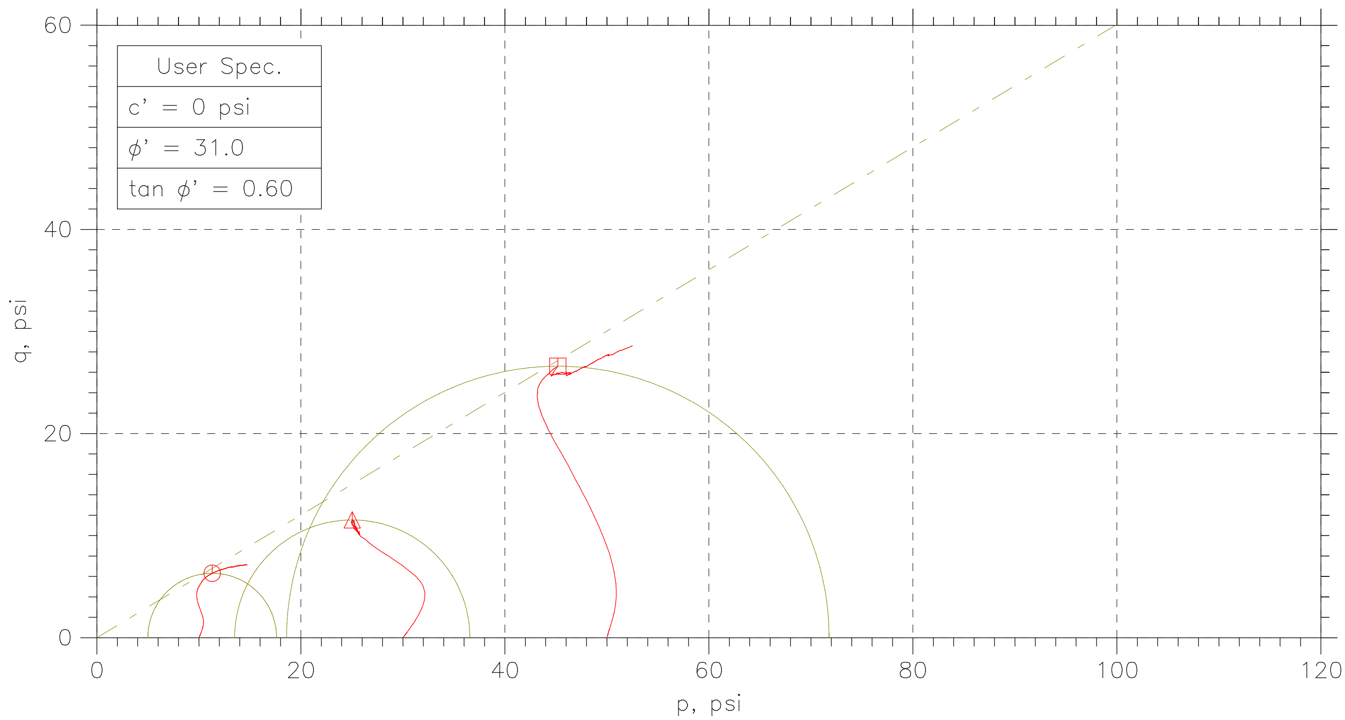
Project: Cumberland Ash
Location: ---
Project No.: GTX-1484
Boring No.: 19-C
Sample Type: UD
Description: Gray-Brown Lean clay with sand
Remarks: 2054

Mon, 21-SEP-2009 18:00:29

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	1628	4.1	17.5-18.0'	JM	9/3/09	MM		1484-4.1.dat
△	1633	4.2	14.5-15.0	JM	9/4/09	MM		1484-4.2.dat
□	1626	4.3	10.8-11.3	JM	9/2/09	MM		1484-4.3.dat

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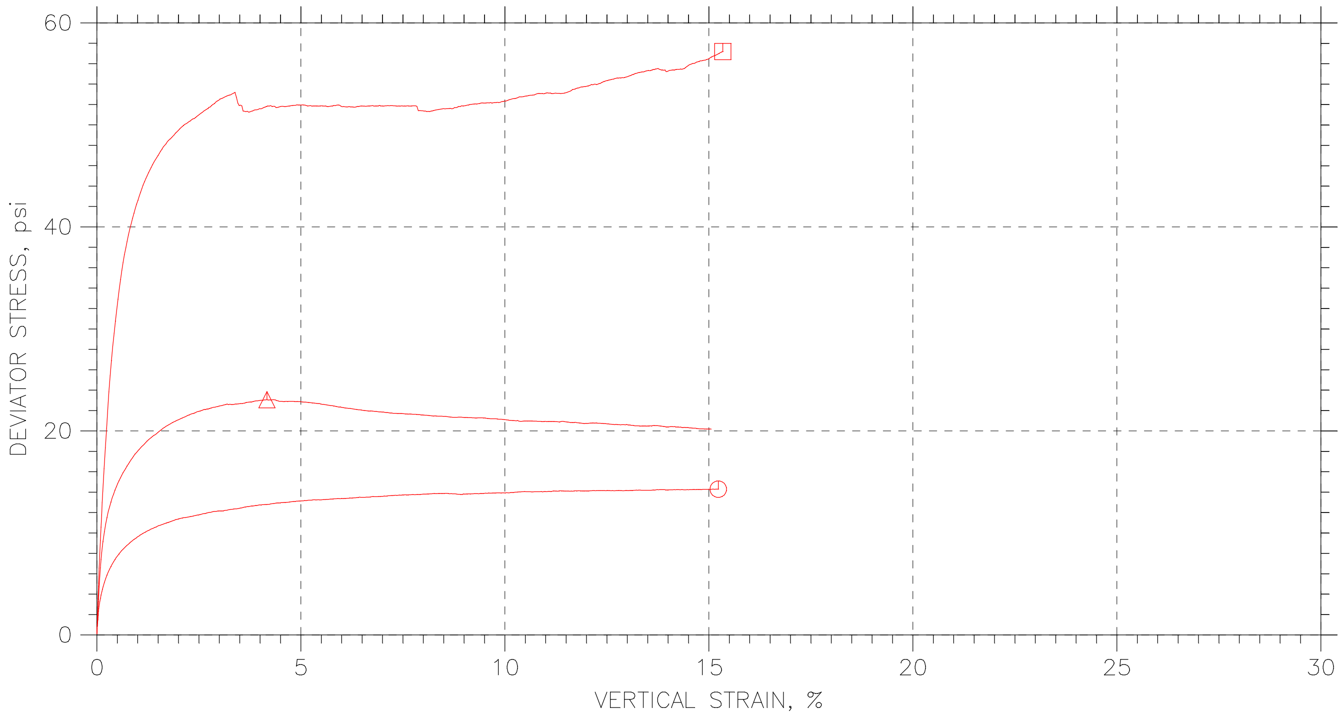
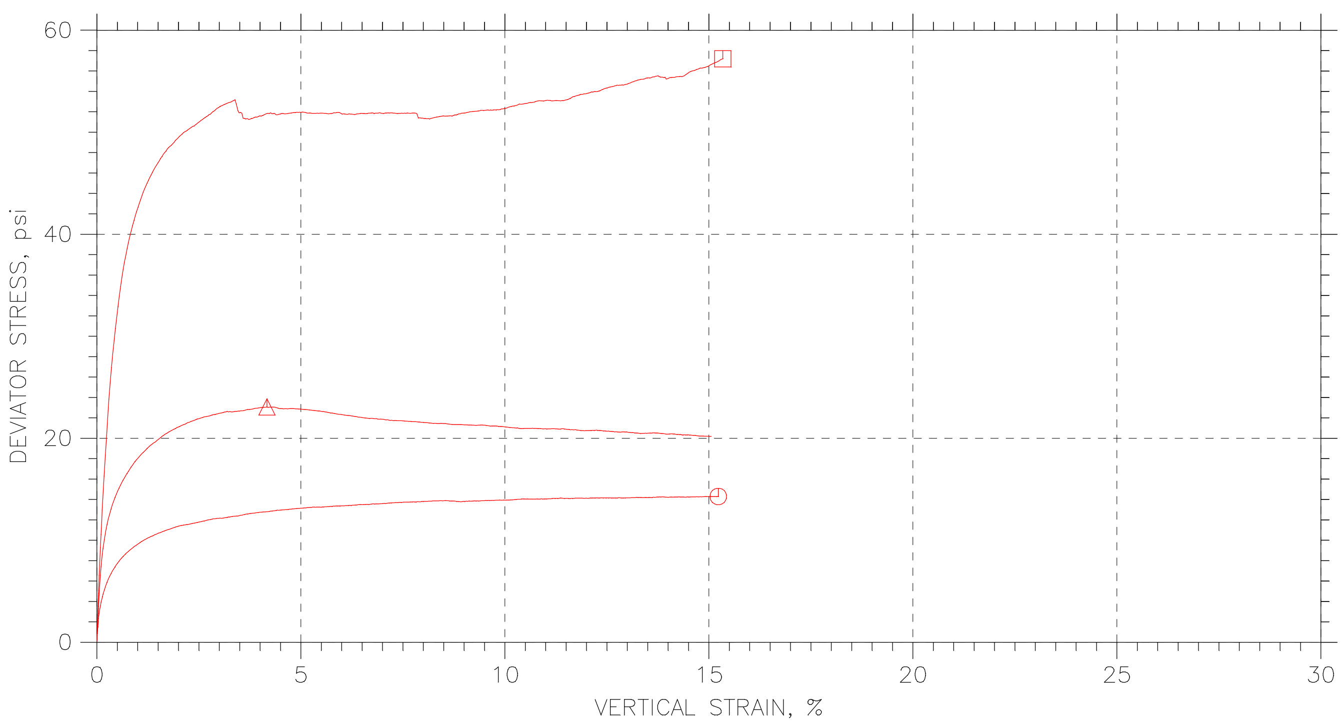
Project: Cumberland Ash	Location: ---	Project No.: GTX-1484
Boring No.: 19-C	Sample Type: UD	
Description: Gray-Brown Lean clay with sand		
Remarks: 2054		

Mon, 21-SEP-2009 18:00:31

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767




60
40
20
0
DEVIATOR STRESS, psi
0
5
10
15
20
25
30
VERTICAL STRAIN, %

	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	1628	4.1	17.5-18.0'	JM	9/3/09	MM		1484-4.1.dat
△	1633	4.2	14.5-15.0	JM	9/4/09	MM		1484-4.2.dat
□	1626	4.3	10.8-11.3	JM	9/2/09	MM		1484-4.3.dat

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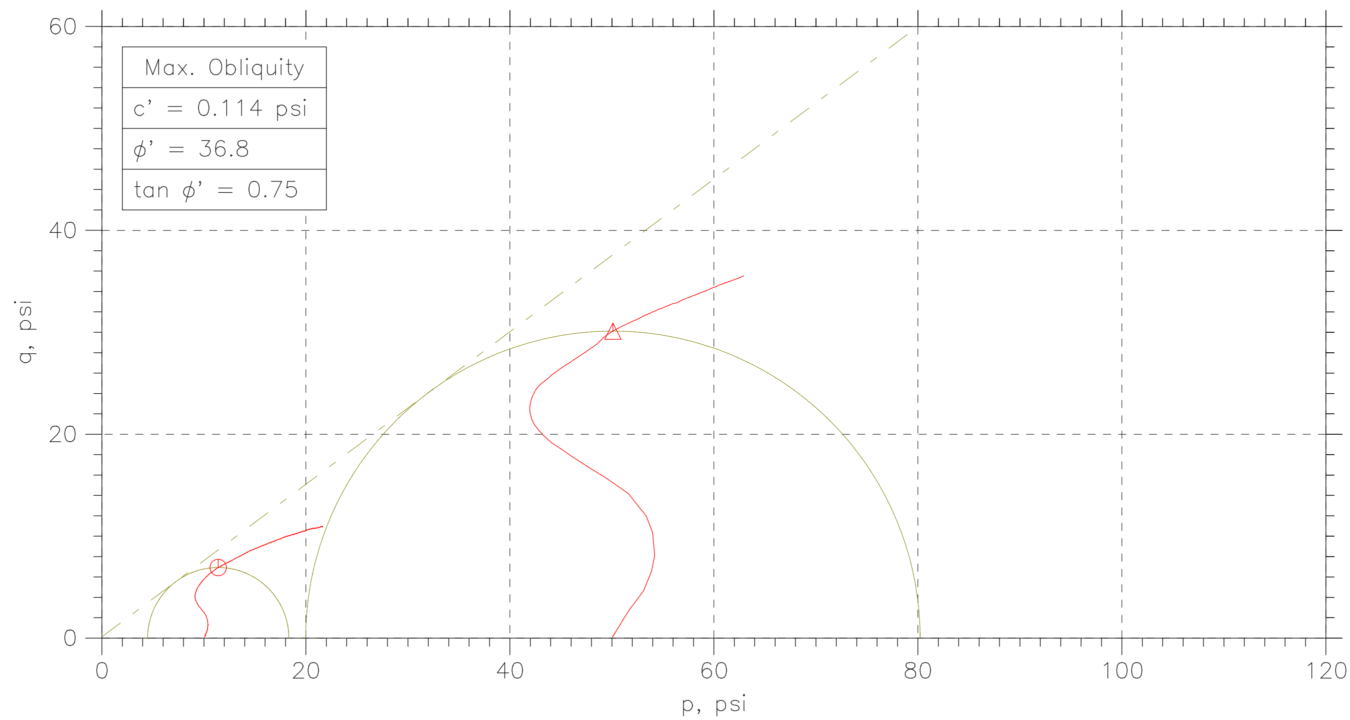
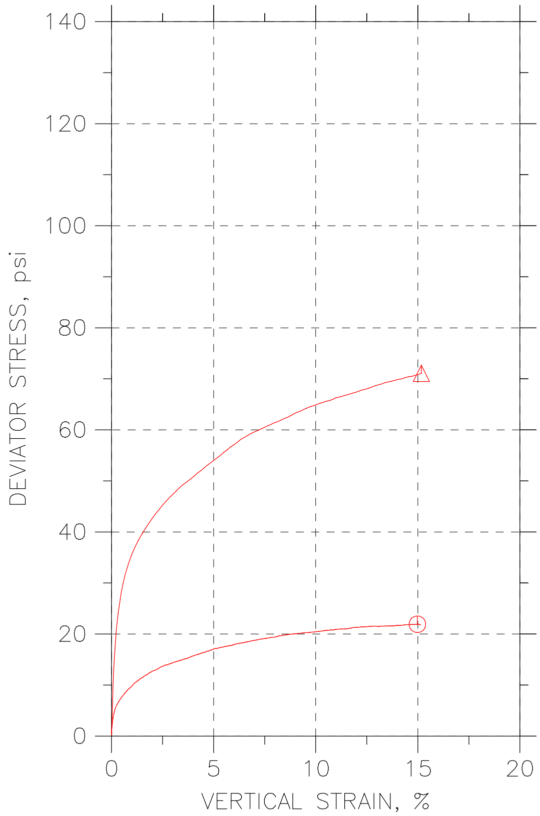
Project: Cumberland Ash	Location: ---	Project No.: GTX-1484
Boring No.: 19-C	Sample Type: UD	
Description: Gray-Brown Lean clay with sand		
Remarks: 2054		

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Symbol	○	△		
	Sample No.	1616A	1616B		
	Test No.	1.1	1.2		
	Depth	29.2-29.7'	29.7-30.2'		
Initial	Diameter, in	2.85	2.851		
	Height, in	5.939	5.973		
	Water Content, %	22.5	21.4		
	Dry Density, pcf	102.4	105.7		
	Saturation, %	94.1	97.0		
	Void Ratio	0.646	0.595		
Before Shear	Water Content, %	22.3	19.5		
	Dry Density, pcf	105.2	110.4		
	Saturation*, %	100.0	100.0		
	Void Ratio	0.603	0.527		
	Back Press., psi	103.9	100.5		
	Ver. Eff. Cons. Stress, psi	9.965	49.96		
	Shear Strength, psi	10.96	35.54		
	Strain at Failure, %	15	15.2		
	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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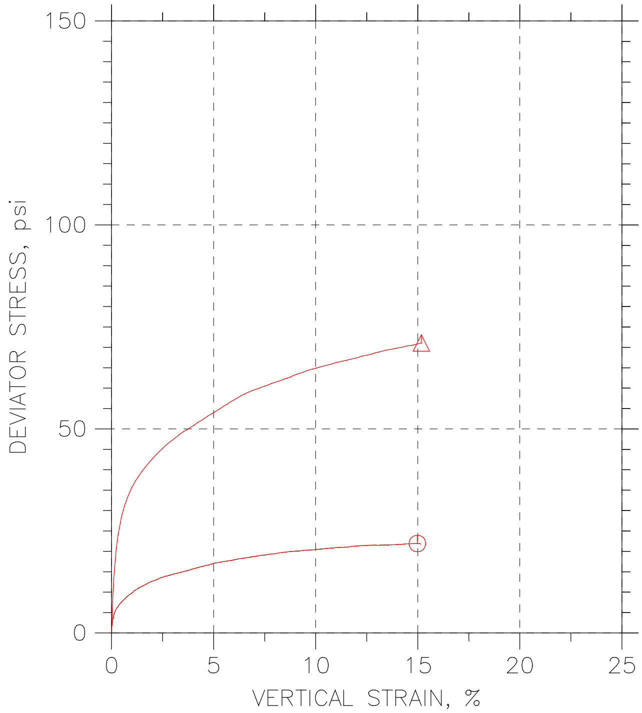
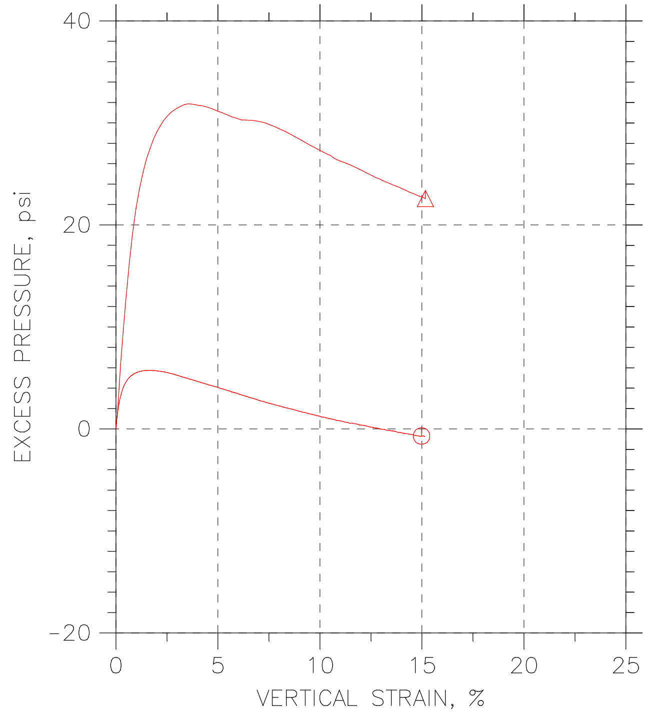
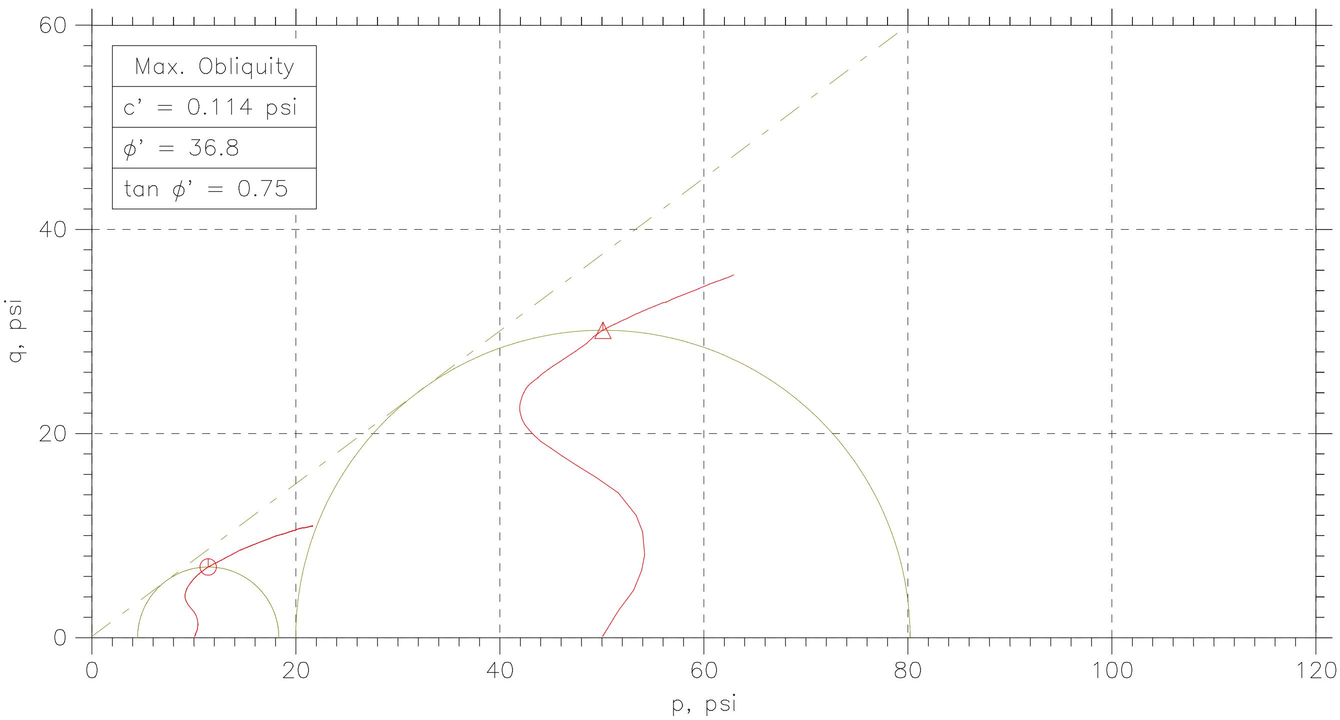
Project: Cumberland Ash	
Location: ---	
Project No.: GTX-1484	
Boring No.: B-29A	
Sample Type: UD	
Description: Brown Lean clay with sand	
Remarks: System 1057	

Mon, 21-SEP-2009 17:41:35

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	1616A	1.1	29.2-29.7'	MM	9/2/09	CA		1484-1.1.dat
△	1616B	1.2	29.7-30.2'	MM	9/2/09	CA		1484-1.2.dat

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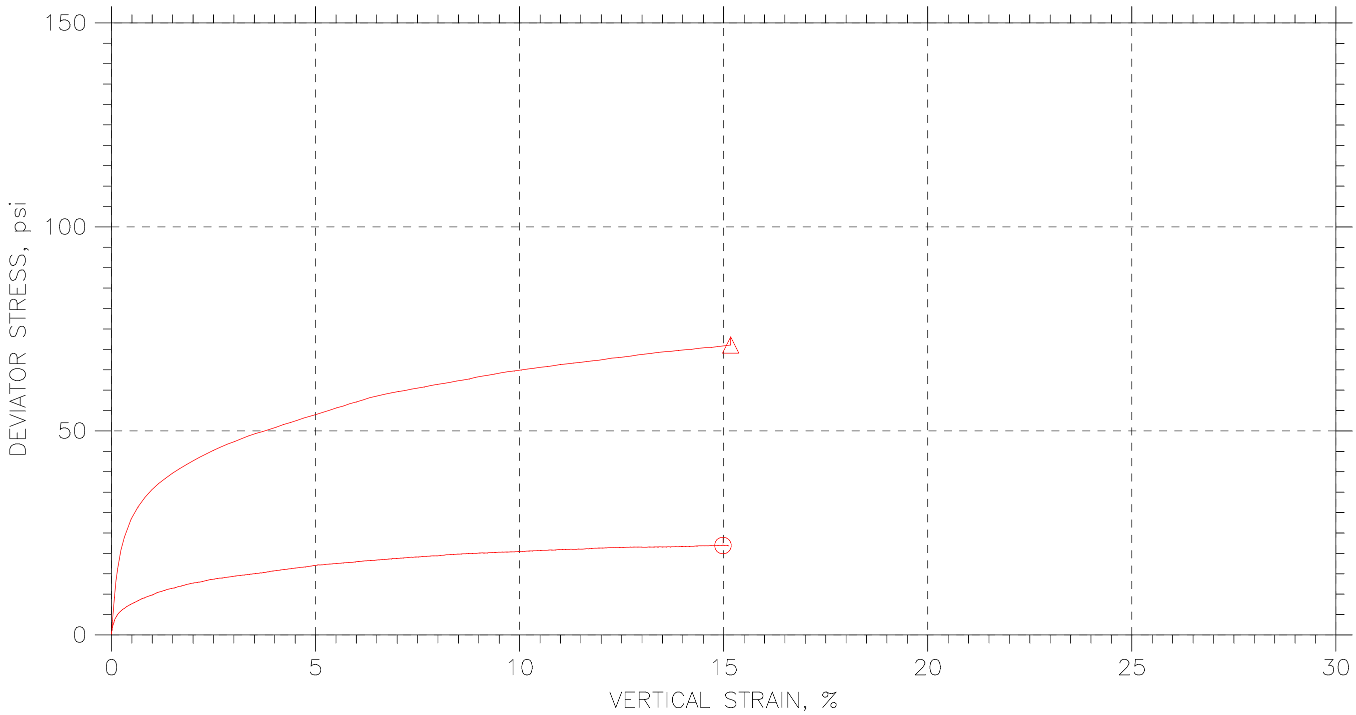
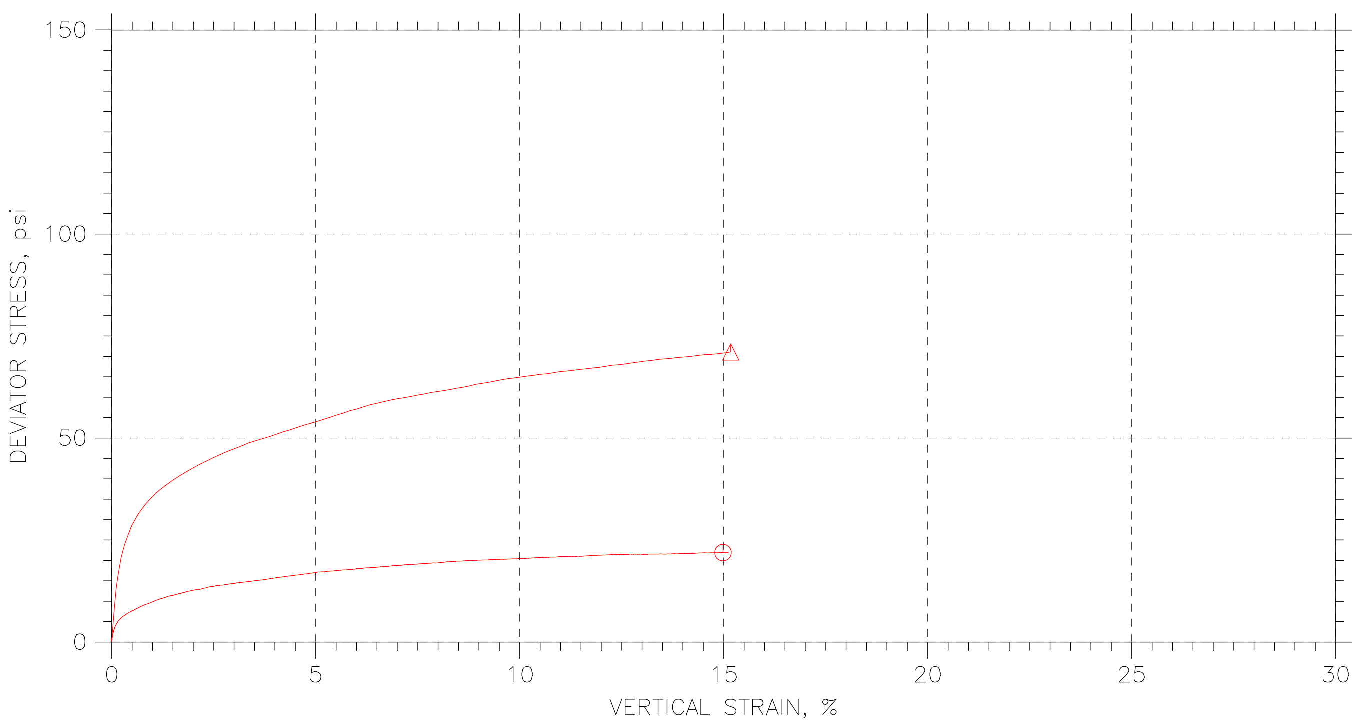
Project: Cumberland Ash	Location: ---	Project No.: GTX-1484
Boring No.: B-29A	Sample Type: UD	
Description: Brown Lean clay with sand		
Remarks: System 1057		

Mon, 21-SEP-2009 17:41:36

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	1616A	1.1	29.2-29.7'	MM	9/2/09	CA		1484-1.1.dat
△	1616B	1.2	29.7-30.2'	MM	9/2/09	CA		1484-1.2.dat

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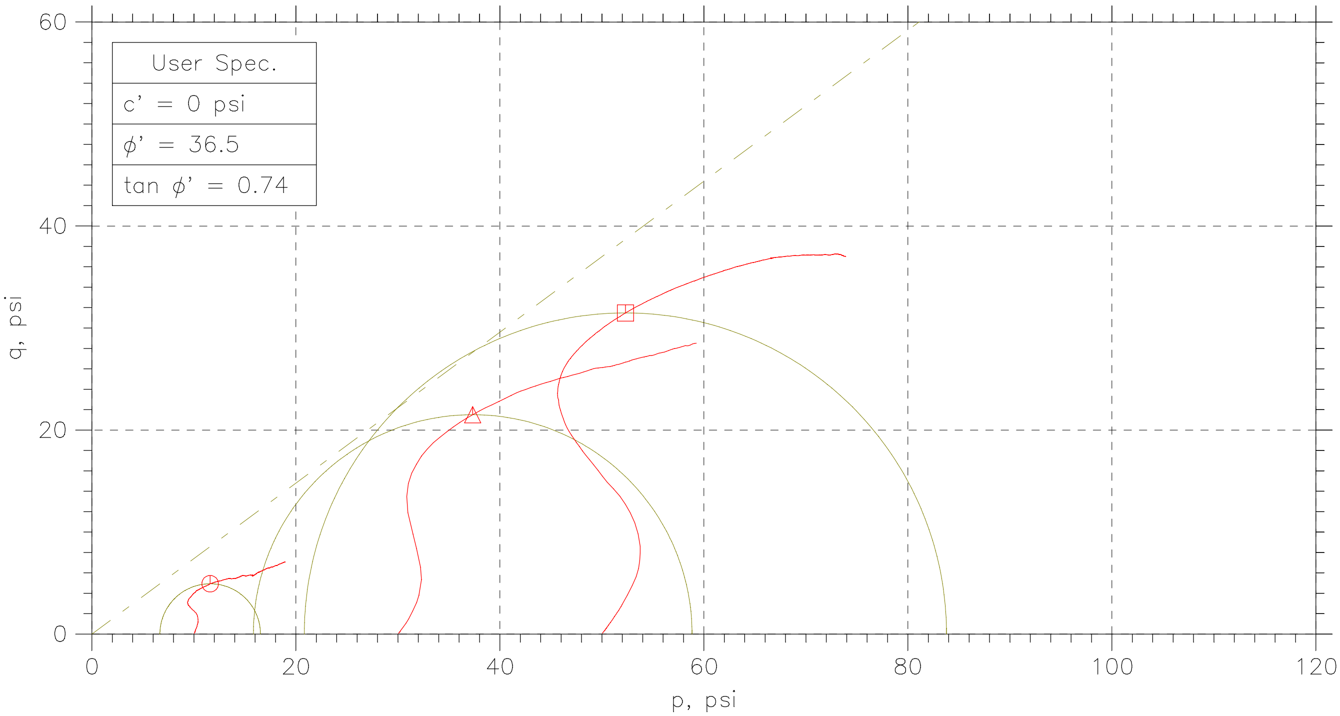
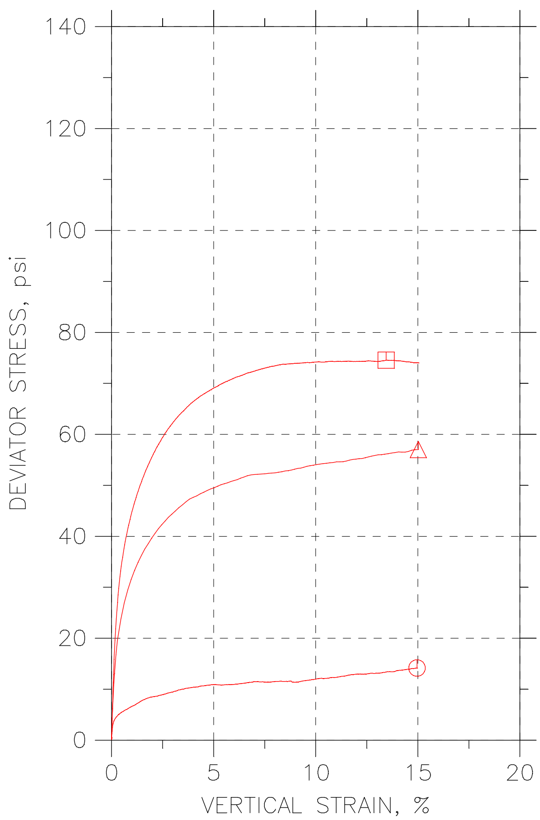
Project: Cumberland Ash	Location: ---	Project No.: GTX-1484
Boring No.: B-29A	Sample Type: UD	
Description: Brown Lean clay with sand		
Remarks: System 1057		

Mon, 21-SEP-2009 17:41:37

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





		○	△	□	
Sample No.		1618A	1618B	1619	
Test No.		3.1	3.2	3.3	
Depth		12-12.5 ft	12.5-13 ft	14.8-15.3 '	
Initial	Diameter, in	2.884	2.88	2.812	
	Height, in	5.985	5.956	5.936	
	Water Content, %	25.6	18.8	17.0	
	Dry Density, pcf	100.6	111.8	115.	
	Saturation, %	102.4	99.9	98.7	
	Void Ratio	0.675	0.507	0.466	
Before Shear	Water Content, %	25.5	18.8	17.4	
	Dry Density, pcf	99.78	111.8	114.6	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.689	0.508	0.471	
	Back Press., psi	140	119	80.58	
Ver. Eff. Cons. Stress, psi		9.972	30	49.98	
Shear Strength, psi		7.078	28.51	37.27	
Strain at Failure, %		15	15	13.4	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.95	0.95	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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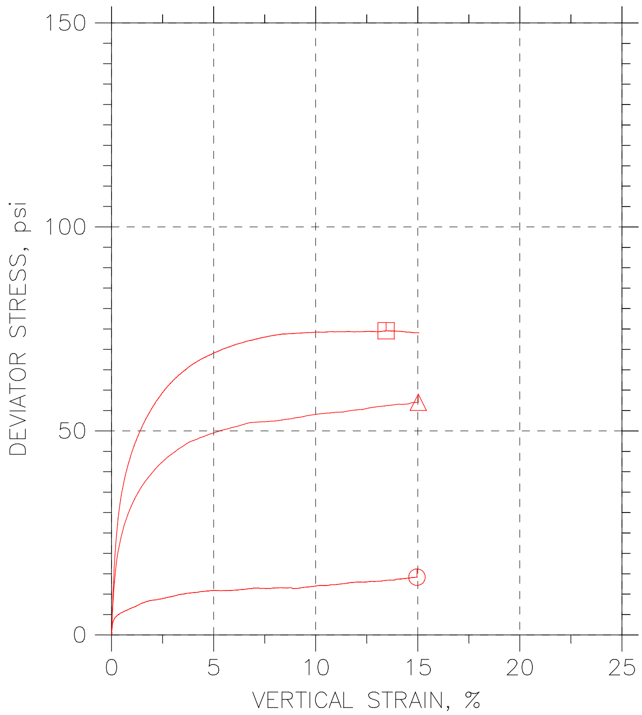
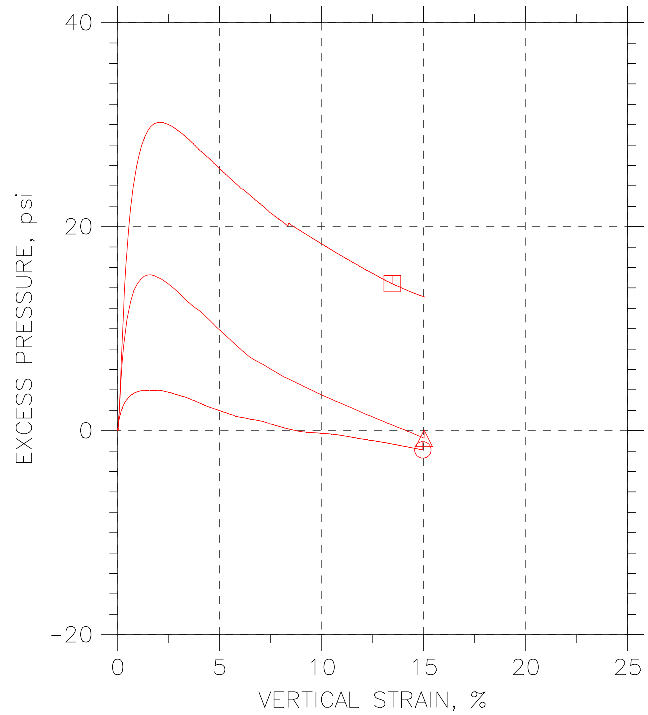
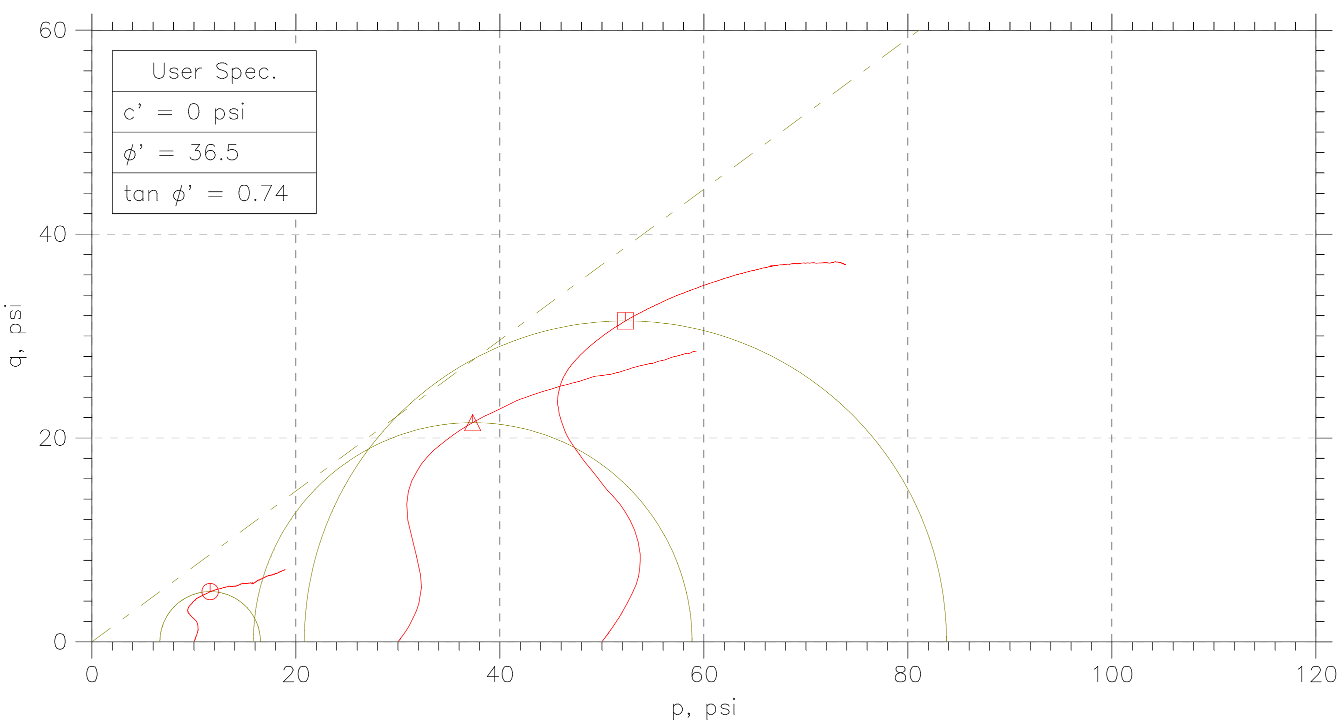
Project: Cumberland	
Location: ---	
Project No.: GTX-1484	
Boring No.: B-29B	
Sample Type: Remolded	
Description:	
Remarks: System 1057	

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	1618A	3.1	12-12.5 ft	MM	8/31/09	CA		1484-3.1.dat
△	1618B	3.2	12.5-13 ft	MM	8/31/09	CA		1484-3.2.dat
□	1619	3.3	14.8-15.3 '	JM	8/31/09	MM		1484-3.3.dat

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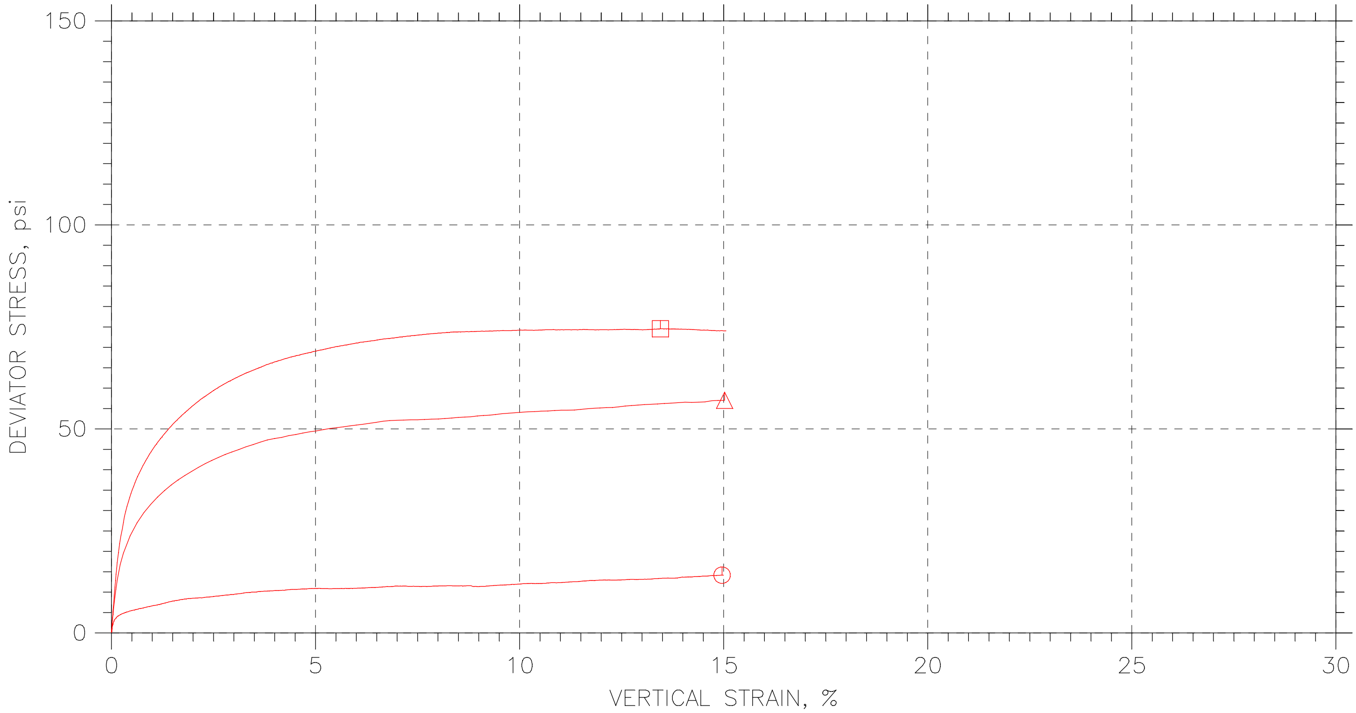
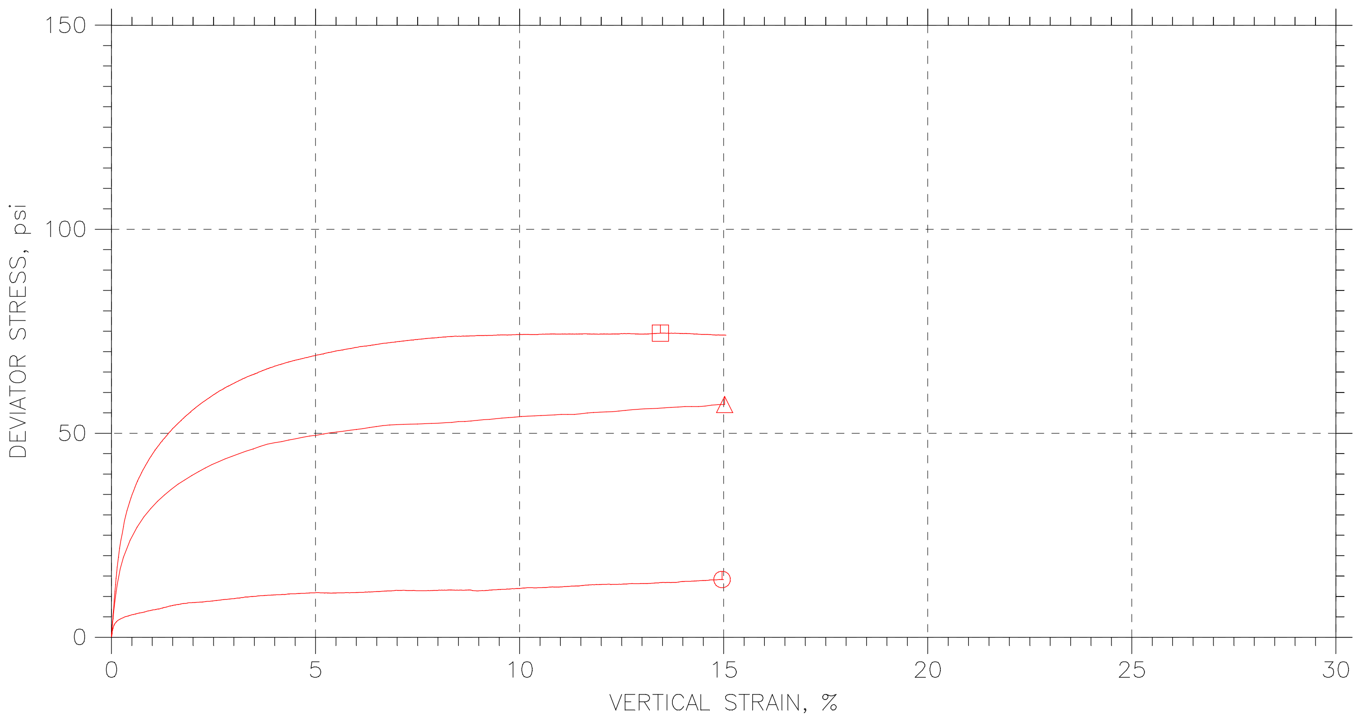
Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: B-29B	Sample Type: Remolded	
Description:		
Remarks: System 1057		

Mon, 21-SEP-2009 17:51:59

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	1618A	3.1	12-12.5 ft	MM	8/31/09	CA		1484-3.1.dat
△	1618B	3.2	12.5-13 ft	MM	8/31/09	CA		1484-3.2.dat
□	1619	3.3	14.8-15.3 '	JM	8/31/09	MM		1484-3.3.dat

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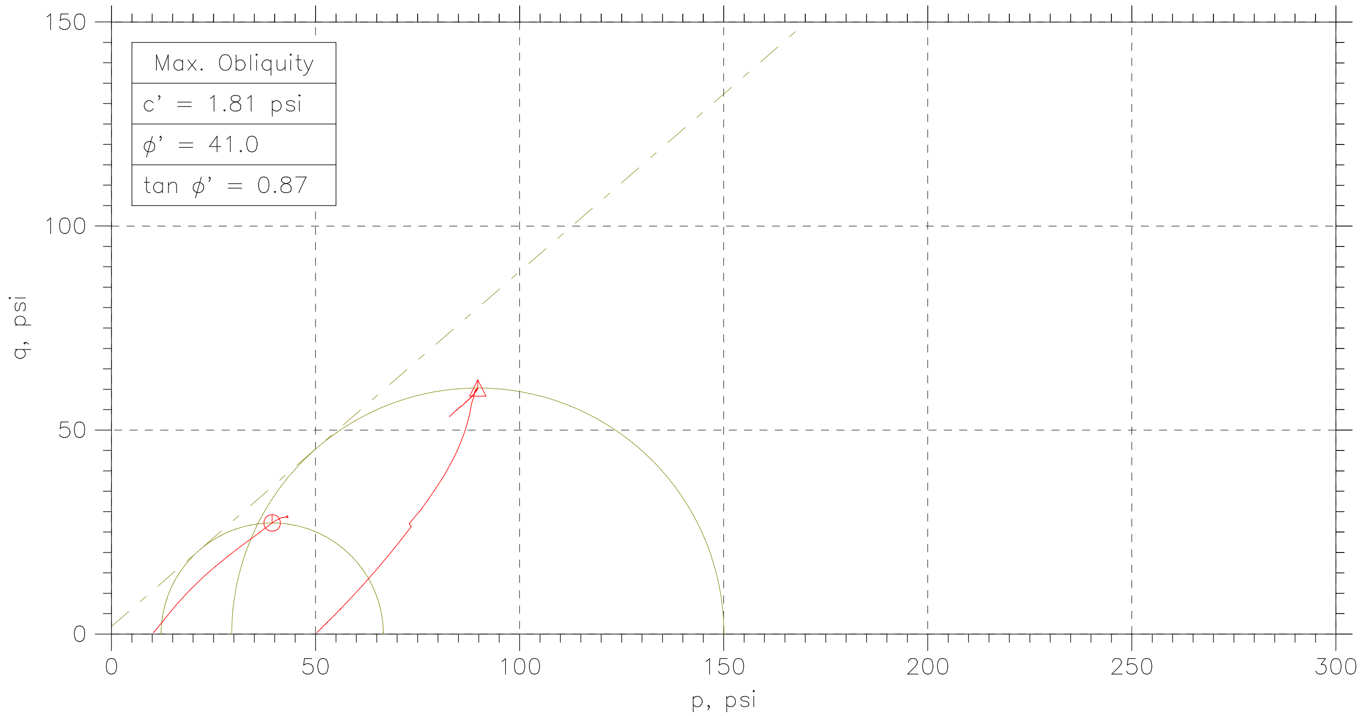
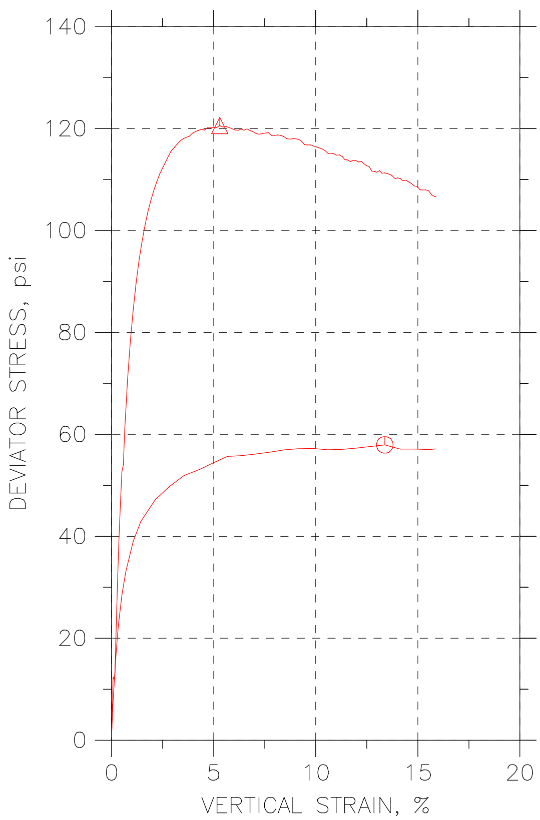
Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: B-29B	Sample Type: Remolded	
Description:		
Remarks: System 1057		

Mon, 21-SEP-2009 17:52:00

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△		
Sample No.		----	------		
Test No.		BA-1.1	BA-1.3		
Depth		----	-----		
Initial	Diameter, in	2.872	2.87		
	Height, in	5.76	5.758		
	Water Content, %	16.5	16.1		
	Dry Density, pcf	87.66	88.12		
	Saturation, %	48.3	47.5		
	Void Ratio	0.923	0.913		
Before Shear	Water Content, %	29.8	28.6		
	Dry Density, pcf	93.43	95.09		
	Saturation*, %	100.0	100.0		
	Void Ratio	0.804	0.773		
	Back Press., psi	140	68.08		
Ver. Eff. Cons. Stress, psi		9.973	50		
Shear Strength, psi		28.97	60.29		
Strain at Failure, %		13.4	5.3		
Strain Rate, %/min		0.07	0.07		
B-Value		0.95	0.95		
Estimated Specific Gravity		2.7	2.7		
Liquid Limit		---	---		
Plastic Limit		---	---		

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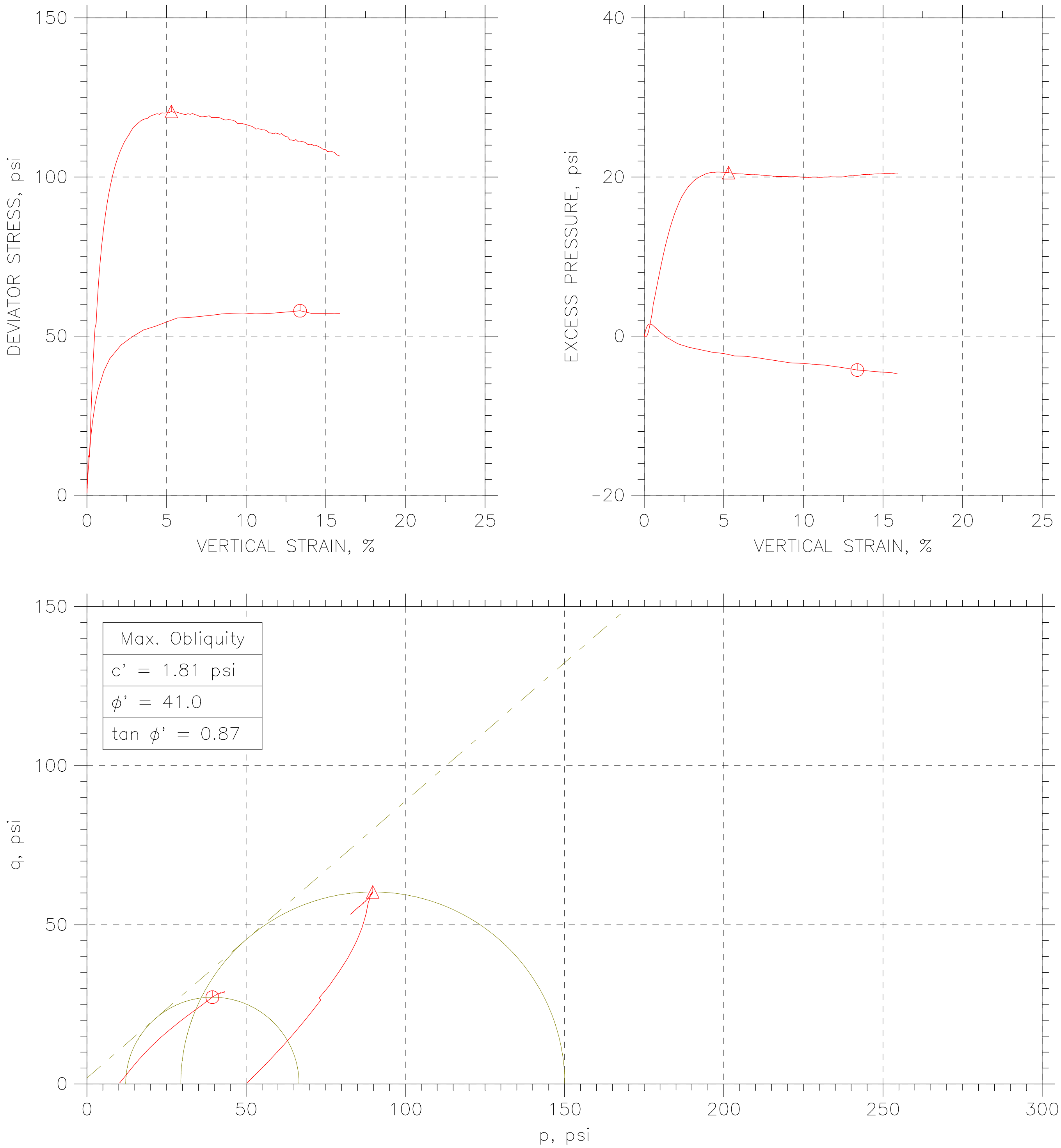
Project: Cumberland	
Location: ---	
Project No.: GTX-1484	
Boring No.: ---	
Sample Type: UD	
Description: Bottom ASH	
Remarks: System 1062	

Tue, 22-SEP-2009 15:36:06

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊕	----	BA-1.1	----	MM	9/17/09	CA		1484-BA-1.1.dat
△	------	BA-1.3	-----	JM	9/17/09	MM		1484-BA-1.3.dat

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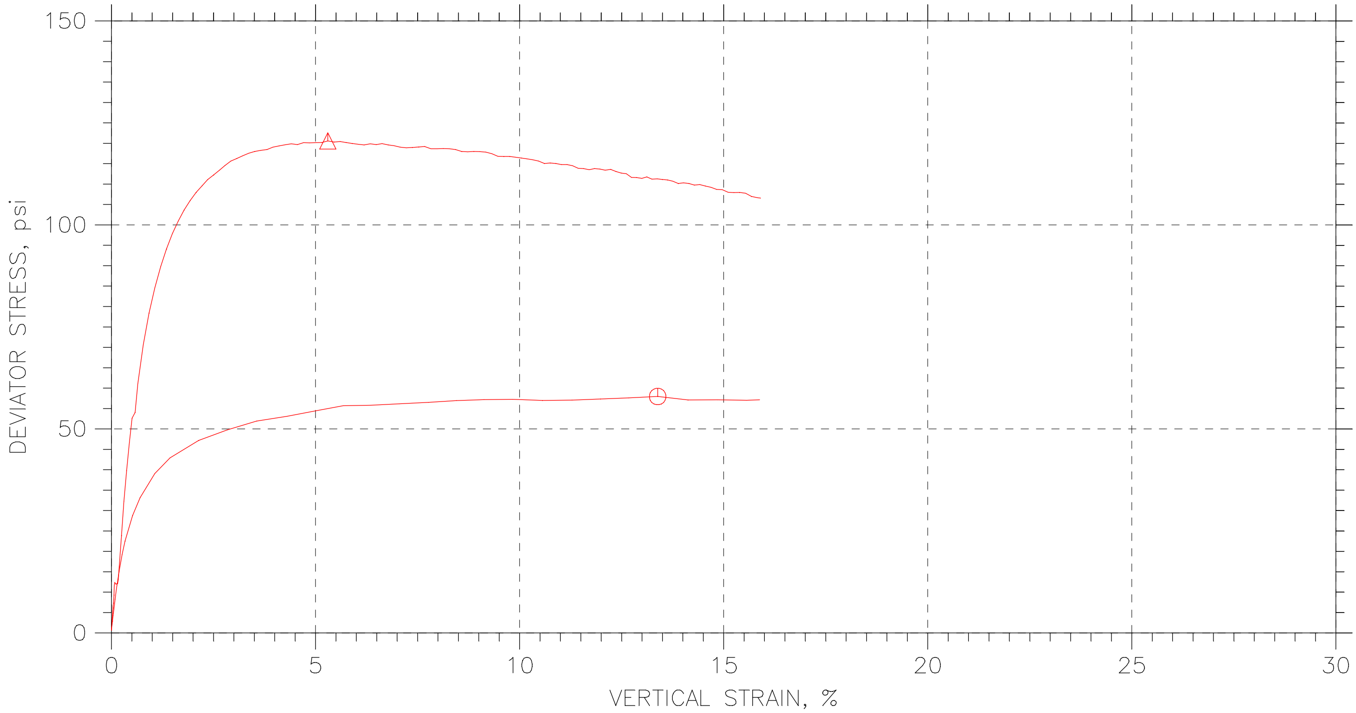
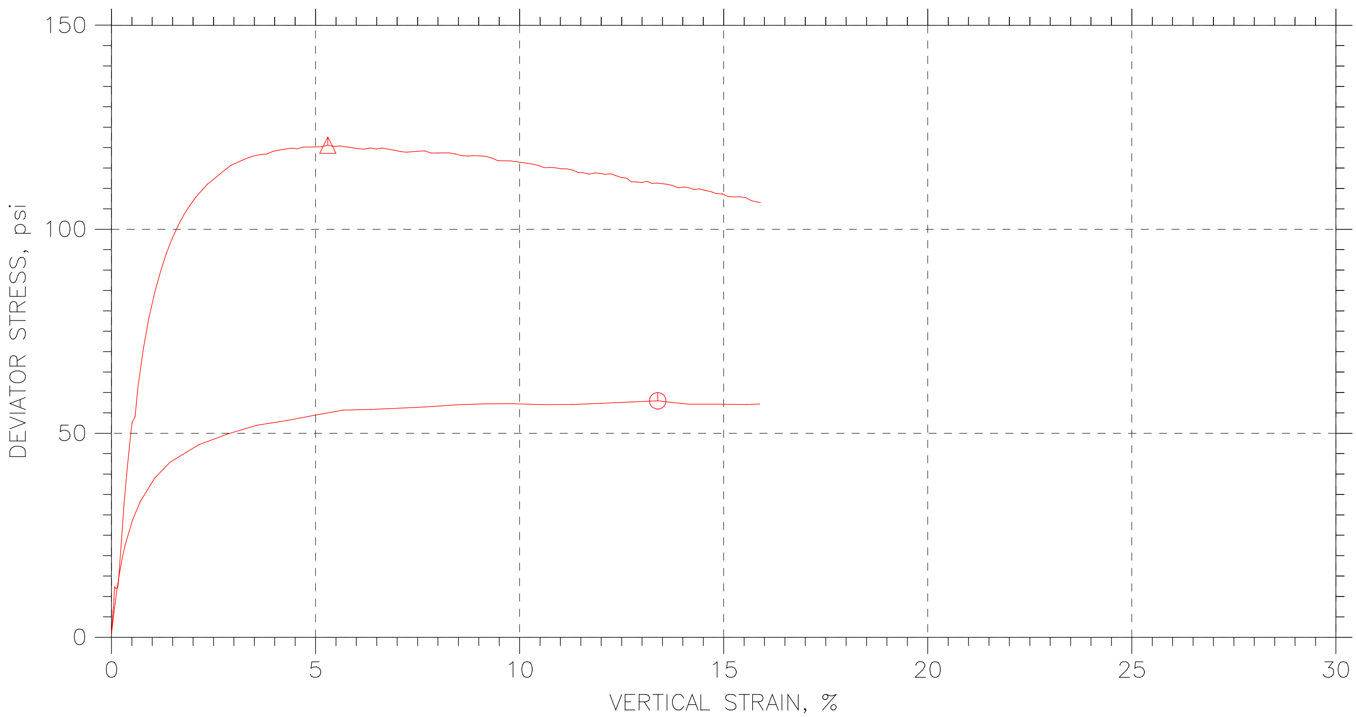
Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: UD	
Description: Bottom ASH		
Remarks: System 1062		

Tue, 22-SEP-2009 15:36:07

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⦶	----	BA-1.1	----	MM	9/17/09	CA		1484-BA-1.1.dat
△	------	BA-1.3	-----	JM	9/17/09	MM		1484-BA-1.3.dat

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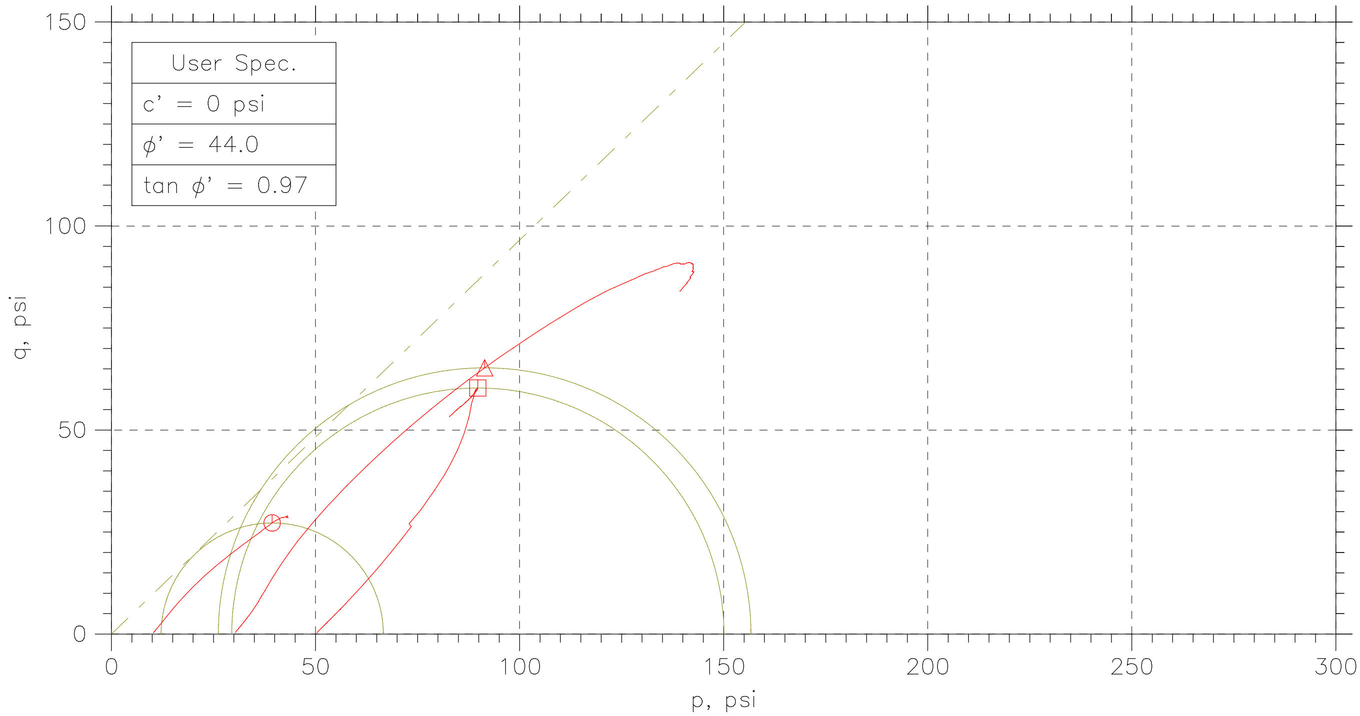
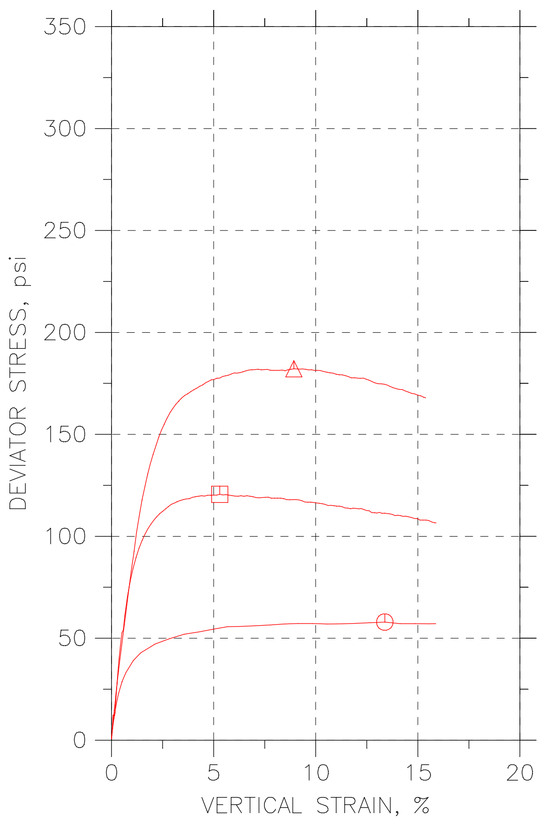
Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: UD	
Description: Bottom ASH		
Remarks: System 1062		

Tue, 22-SEP-2009 15:36:10

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		----	----	------	
Test No.		BA-1.1	BA-1.2	BA-1.3	
Depth		----	----	-----	
Initial	Diameter, in	2.872	2.871	2.87	
	Height, in	5.76	5.751	5.758	
	Water Content, %	16.5	16.8	16.1	
	Dry Density, pcf	87.66	87.57	88.12	
	Saturation, %	48.3	53.8	47.5	
	Void Ratio	0.923	0.782	0.913	
Before Shear	Water Content, %	29.8	25.9	28.6	
	Dry Density, pcf	93.43	94.74	95.09	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.804	0.647	0.773	
	Back Press., psi	140	119	68.08	
Ver. Eff. Cons. Stress, psi		9.973	29.95	50	
Shear Strength, psi		28.97	91.06	60.29	
Strain at Failure, %		13.4	8.93	5.3	
Strain Rate, %/min		0.07	0.07	0.07	
B-Value		0.95	0.95	0.95	
Estimated Specific Gravity		2.7	2.5	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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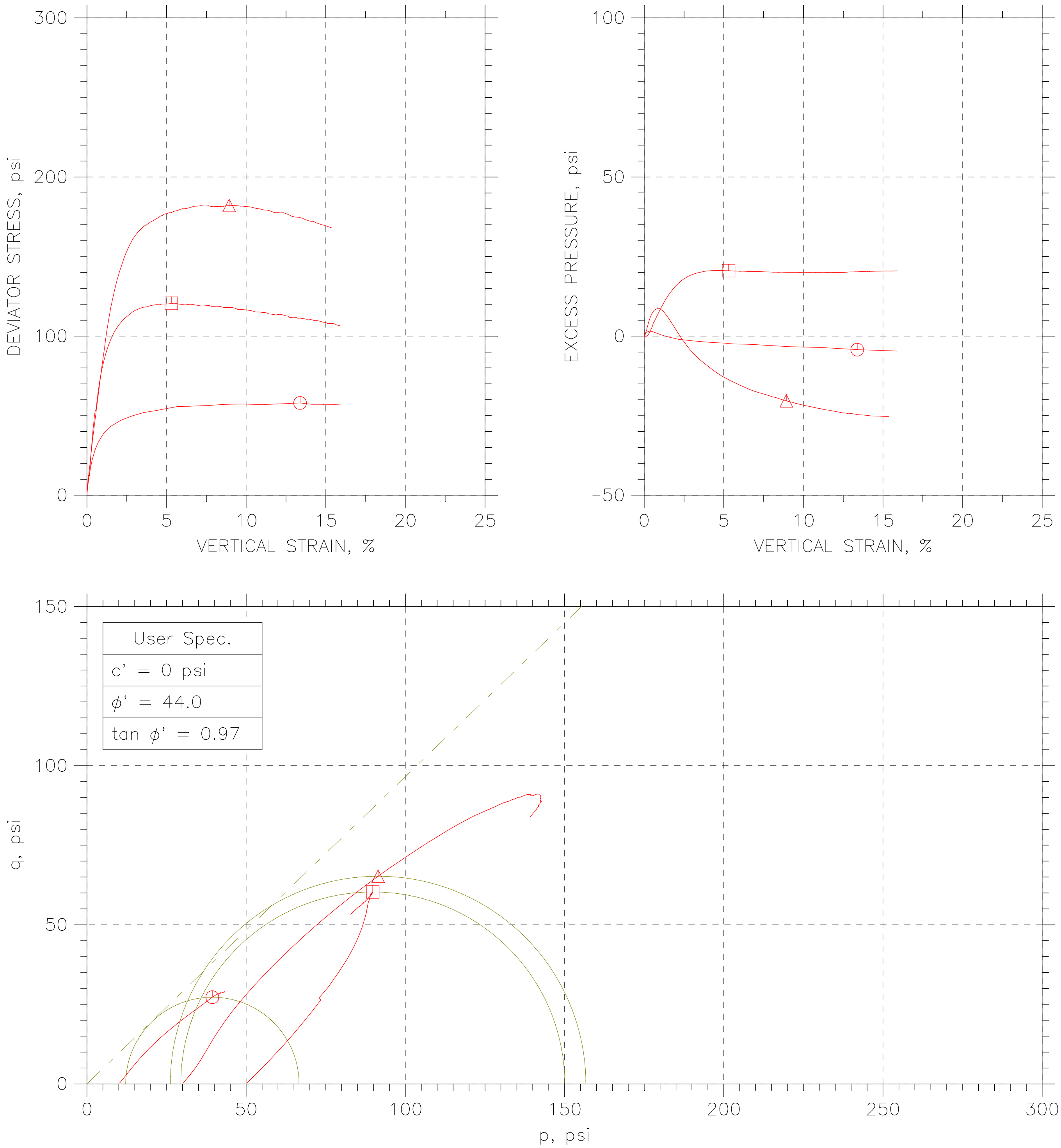
Project: Cumberland	
Location: ---	
Project No.: GTX-1484	
Boring No.: ---	
Sample Type: UD	
Description: Bottom ASH	
Remarks: System 1062	

Tue, 22-SEP-2009 15:40:43

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	----	BA-1.1	----	MM	9/17/09	CA		1484-BA-1.1.dat
△	----	BA-1.2	----	JM	9/18/09	MM		1484-BA-1.2.dat
□	------	BA-1.3	-----	JM	9/17/09	MM		1484-BA-1.3.dat

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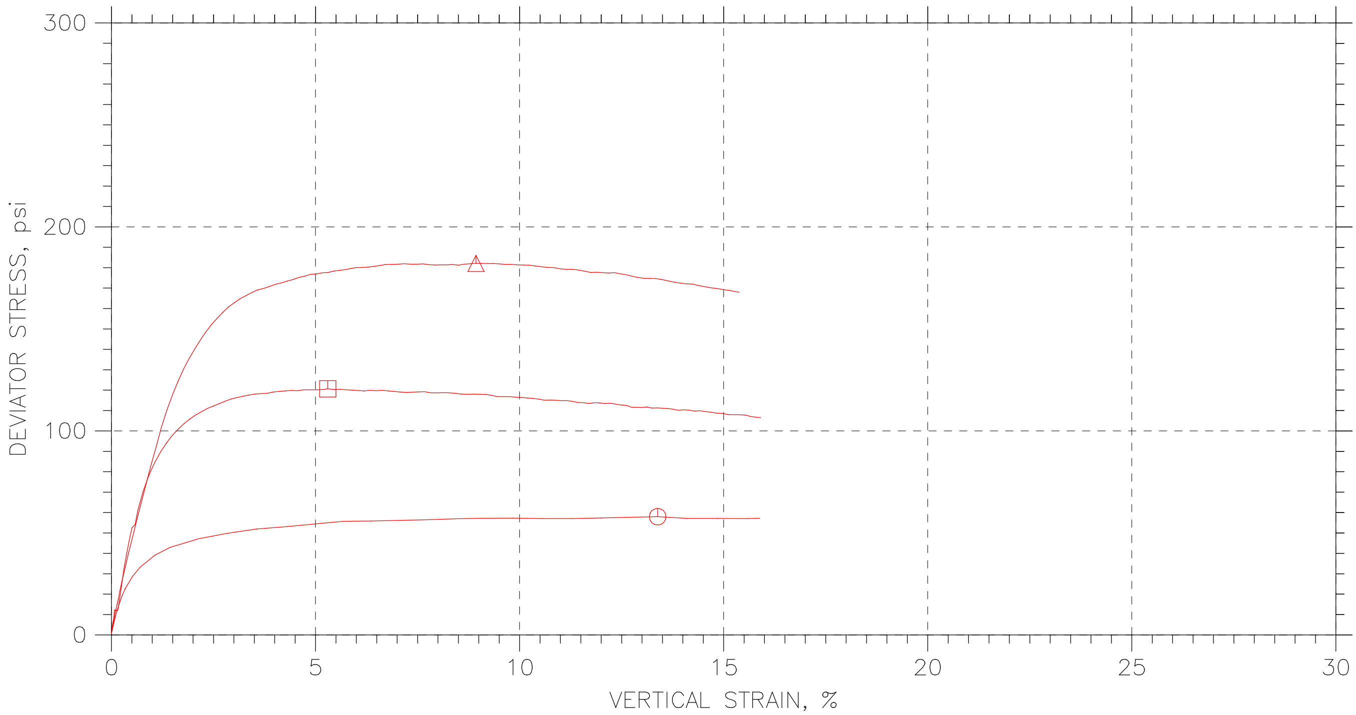
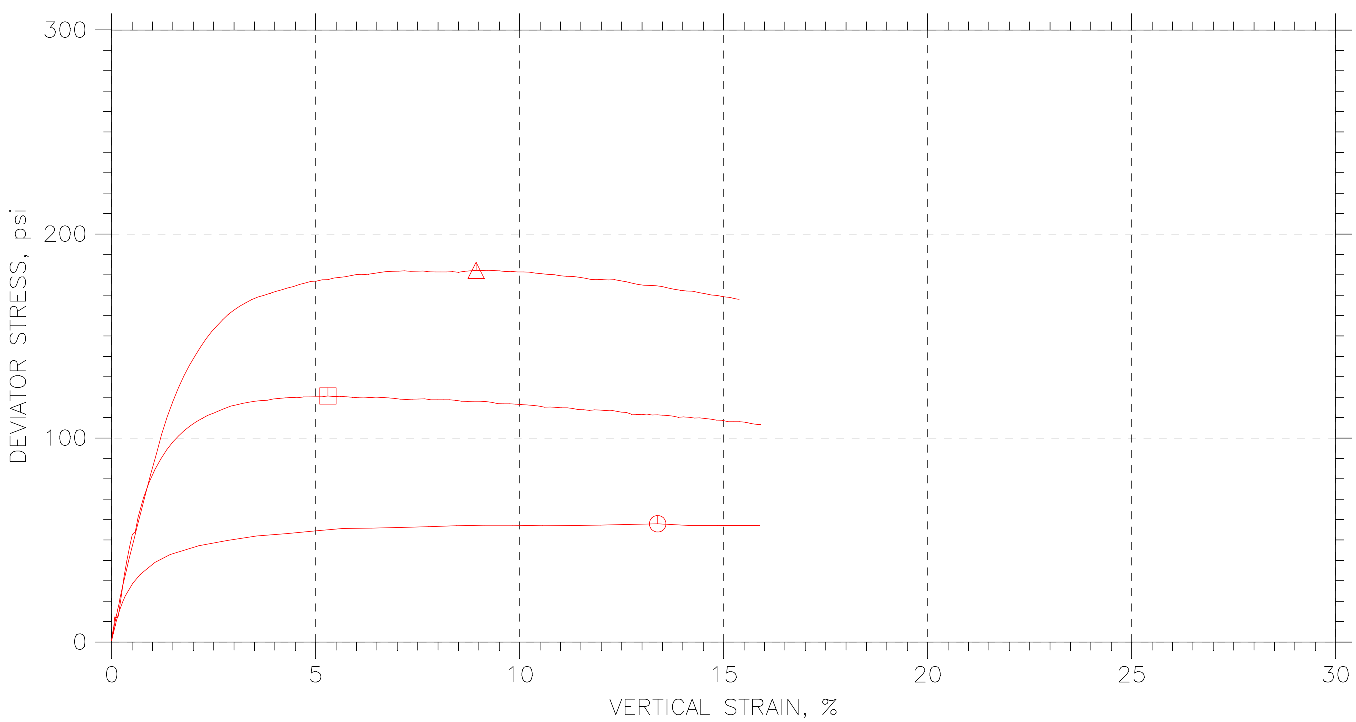
Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: UD	
Description: Bottom ASH		
Remarks: System 1062		

Tue, 22-SEP-2009 15:40:44

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	----	BA-1.1	----	MM	9/17/09	CA		1484-BA-1.1.dat
△	----	BA-1.2	----	JM	9/18/09	MM		1484-BA-1.2.dat
□	------	BA-1.3	-----	JM	9/17/09	MM		1484-BA-1.3.dat

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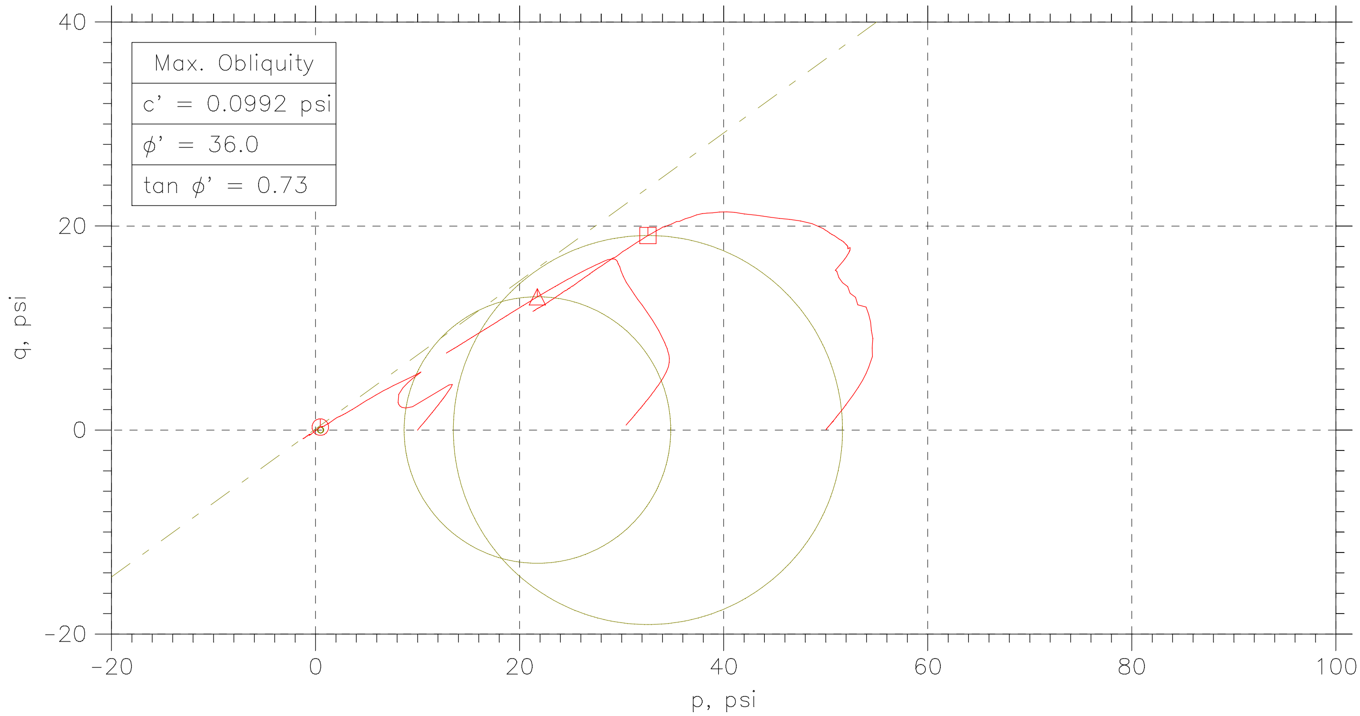
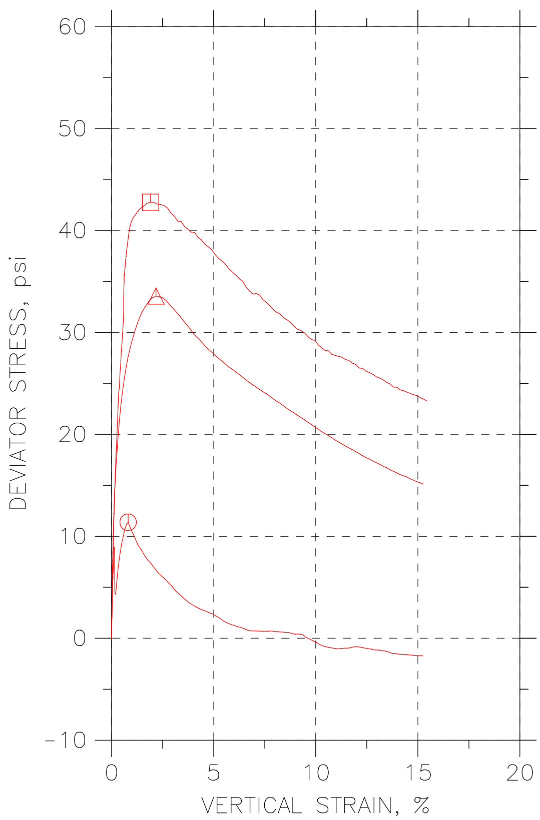
Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: UD	
Description: Bottom ASH		
Remarks: System 1062		

Tue, 22-SEP-2009 15:40:45

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





		○	△	□	
Symbol		○	△	□	
Sample No.		----	----	----	
Test No.		FA-1.1	FA-1.2	FA-1.3	
Depth		----	----	----	
Initial	Diameter, in	2.871	2.85	2.87	
	Height, in	5.831	5.721	5.836	
	Water Content, %	33.6	33.8	34.4	
	Dry Density, pcf	65.75	66.09	66.21	
	Saturation, %	61.2	62.0	63.3	
	Void Ratio	1.37	1.36	1.36	
Before Shear	Water Content, %	46.9	43.7	43.8	
	Dry Density, pcf	71.87	74.6	74.53	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	1.17	1.09	1.09	
	Back Press., psi	140	119	101	
Ver. Eff. Cons. Stress, psi		10	29.94	50	
Shear Strength, psi		5.693	16.78	21.39	
Strain at Failure, %		0.81	2.18	1.91	
Strain Rate, %/min		0.08	0.08	0.08	
B-Value		0.95	0.95	0.96	
Estimated Specific Gravity		2.5	2.5	2.5	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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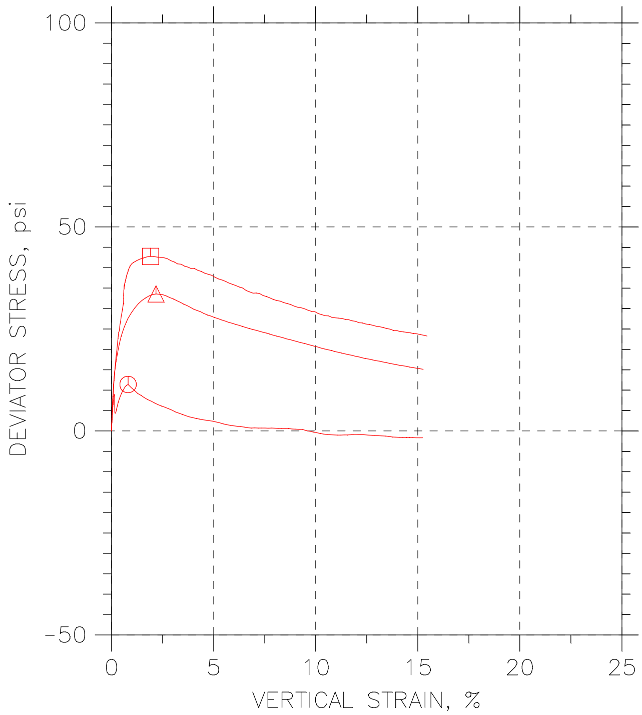
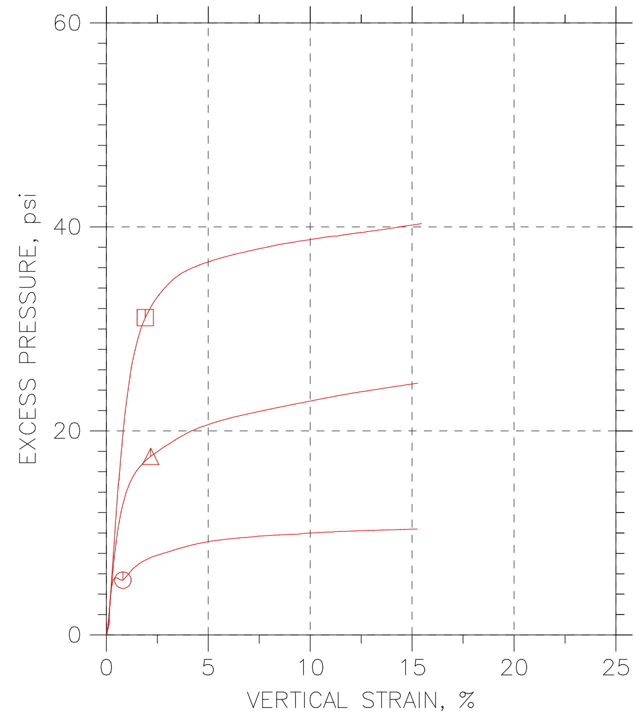
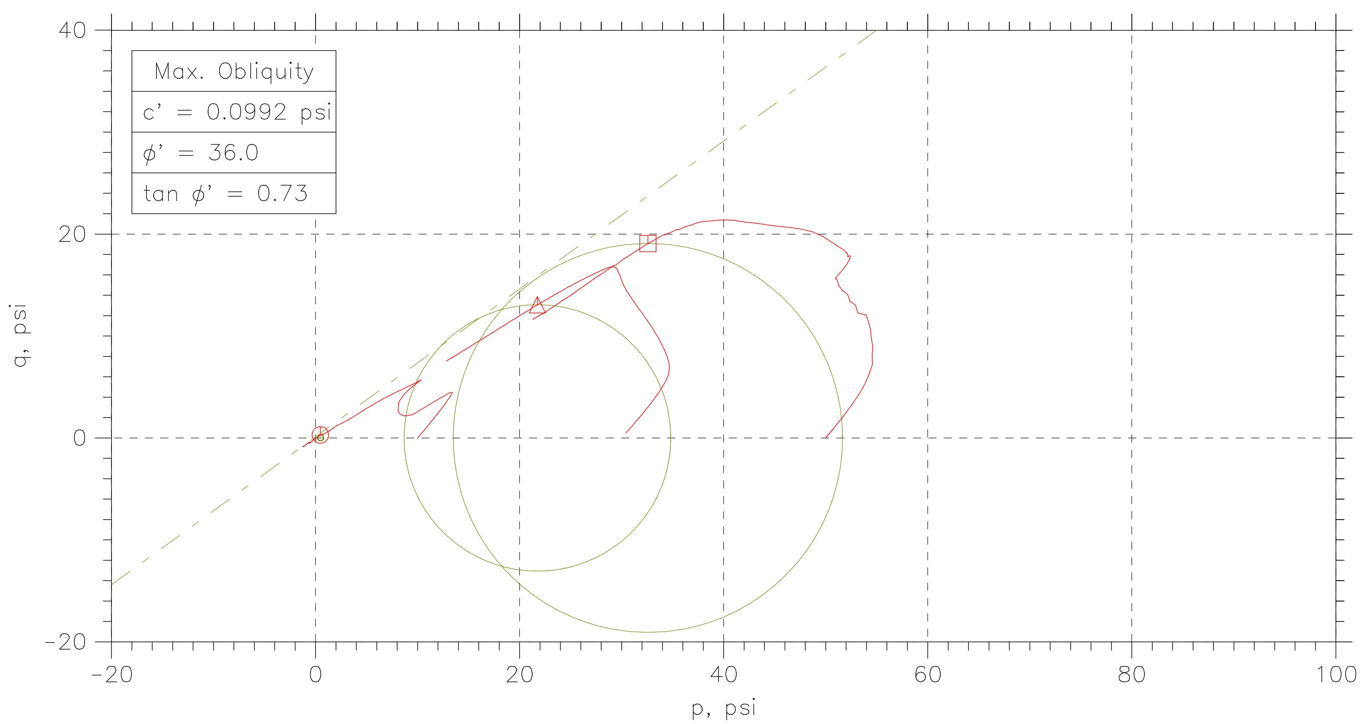
Project: Cumberland	
Location: ---	
Project No.: GTX-1484	
Boring No.: ---	
Sample Type: Remolded	
Description: Dark Gray-Black (FLY ASH-BULK)	
Remarks: System 1057	

Mon, 21-SEP-2009 18:26:32

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	----	FA-1.1	----	JM	9/4/09	MM		1484-FA-1.1.dat
△	----	FA-1.2	----	JM	9/10/09	MM		1484-FA-1.2.dat
□	----	FA-1.3	----	JM	9/3/09	MM		1484-FA-1.3.dat

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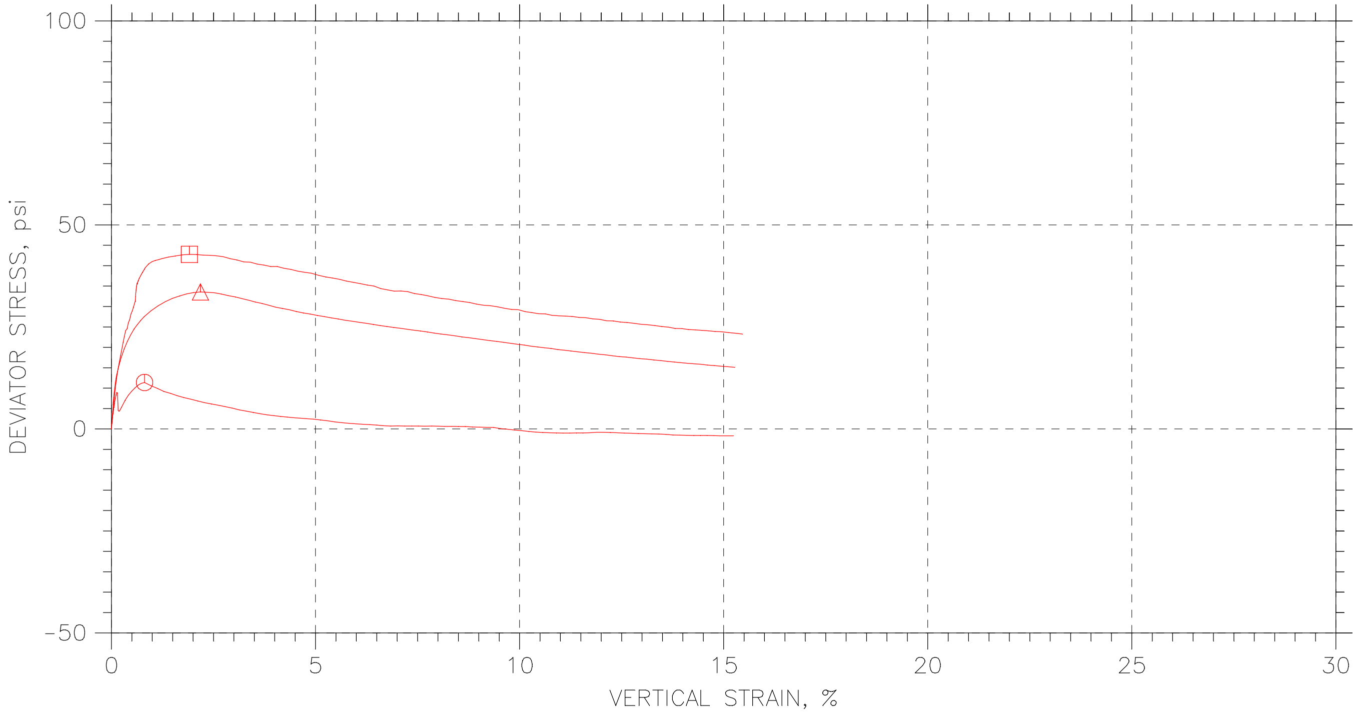
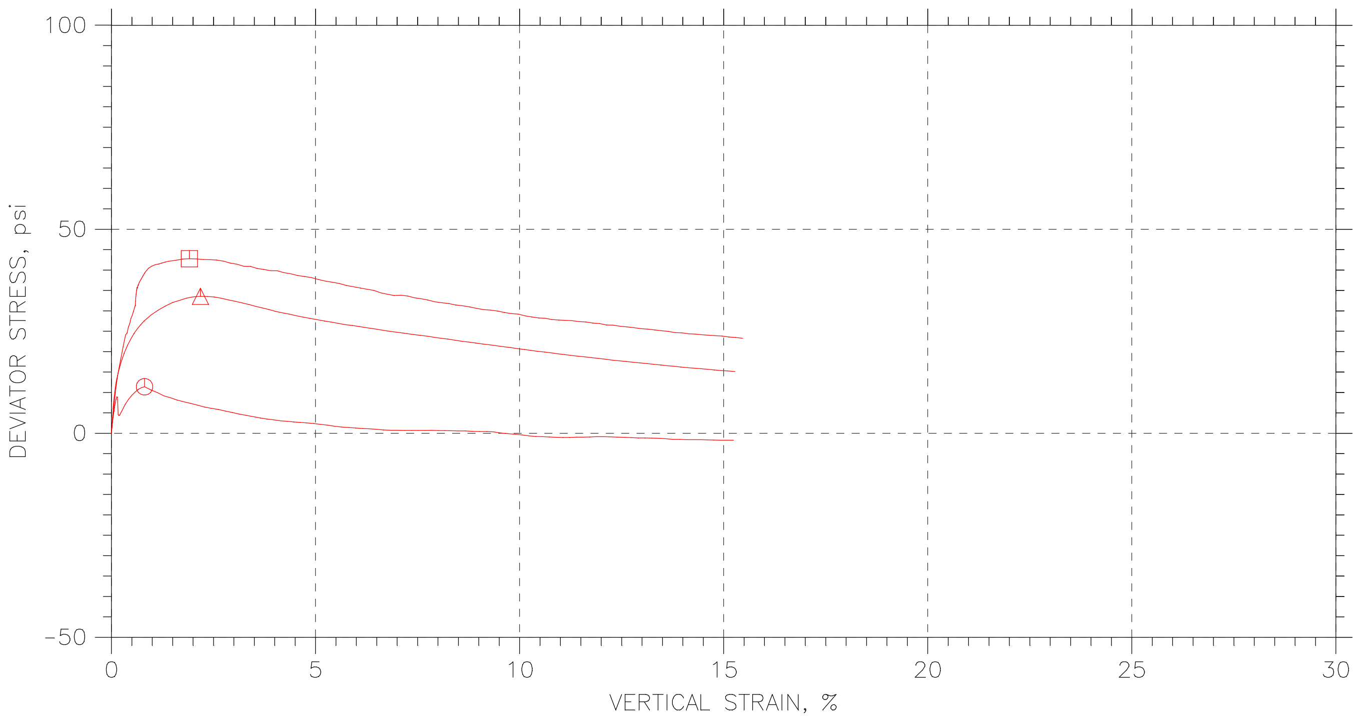
Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: Remolded	
Description: Dark Gray-Black (FLY ASH-BULK)		
Remarks: System 1057		

Mon, 21-SEP-2009 18:26:33

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	----	FA-1.1	----	JM	9/4/09	MM		1484-FA-1.1.dat
△	----	FA-1.2	----	JM	9/10/09	MM		1484-FA-1.2.dat
□	----	FA-1.3	----	JM	9/3/09	MM		1484-FA-1.3.dat

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Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: Remolded	
Description: Dark Gray-Black (FLY ASH-BULK)		
Remarks: System 1057		

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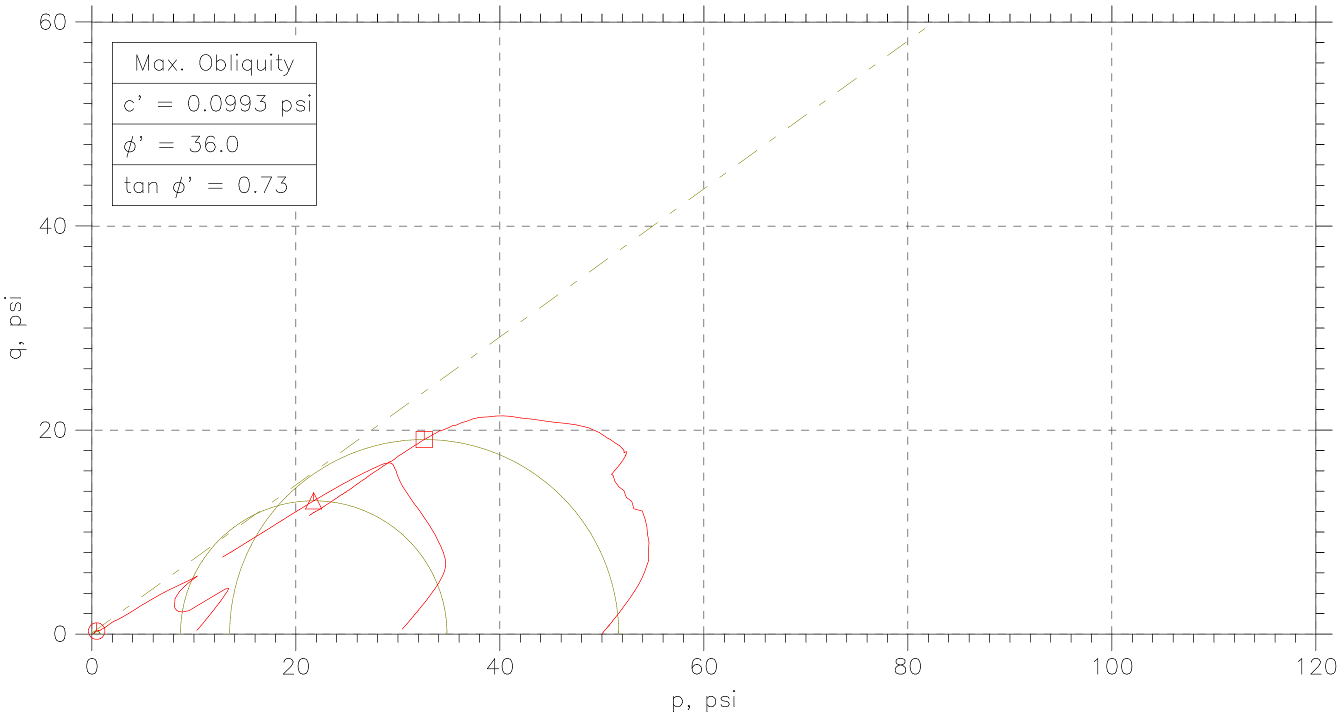
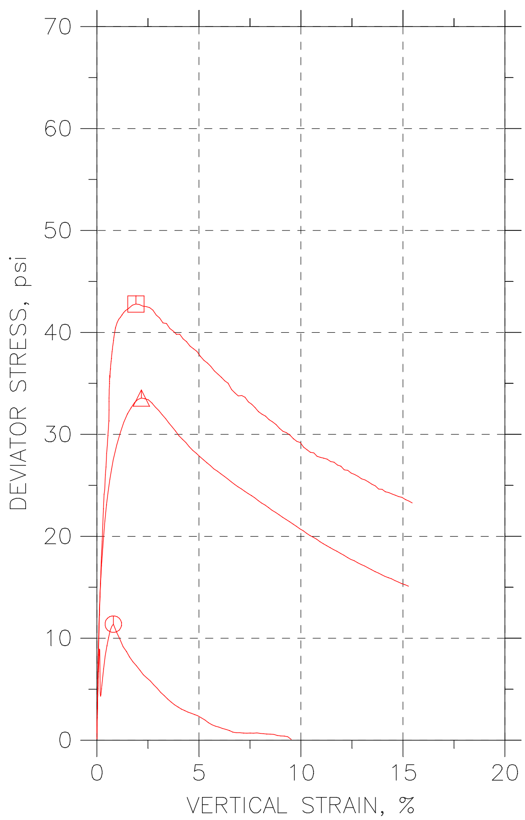
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		----	----	----	
Test No.		FA-1.1	FA-1.2	FA-1.3	
Depth		----	----	----	
Initial	Diameter, in	2.871	2.85	2.87	
	Height, in	5.831	5.721	5.836	
	Water Content, %	33.6	33.8	34.4	
	Dry Density, pcf	65.75	66.09	66.21	
	Saturation, %	61.2	62.0	63.3	
	Void Ratio	1.37	1.36	1.36	
Before Shear	Water Content, %	46.9	43.7	43.8	
	Dry Density, pcf	71.87	74.6	74.53	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	1.17	1.09	1.09	
	Back Press., psi	140	119	101	
Ver. Eff. Cons. Stress, psi		9.948	29.94	50	
Shear Strength, psi		5.693	16.78	21.39	
Strain at Failure, %		0.804	2.18	1.91	
Strain Rate, %/min		0.08	0.08	0.08	
B-Value		0.95	0.95	0.96	
Estimated Specific Gravity		2.5	2.5	2.5	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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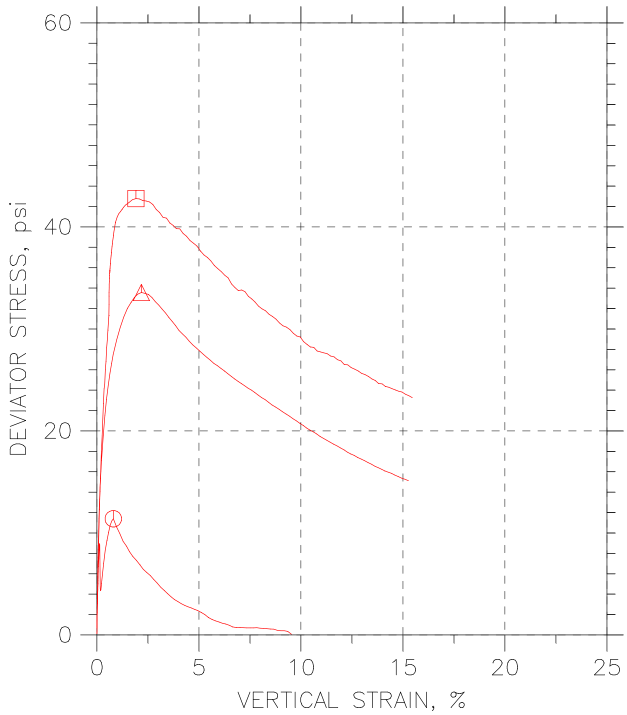
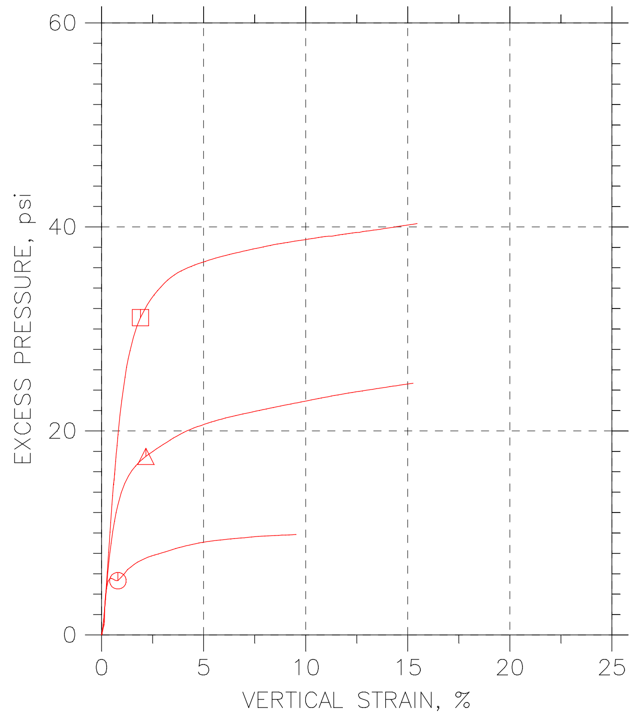
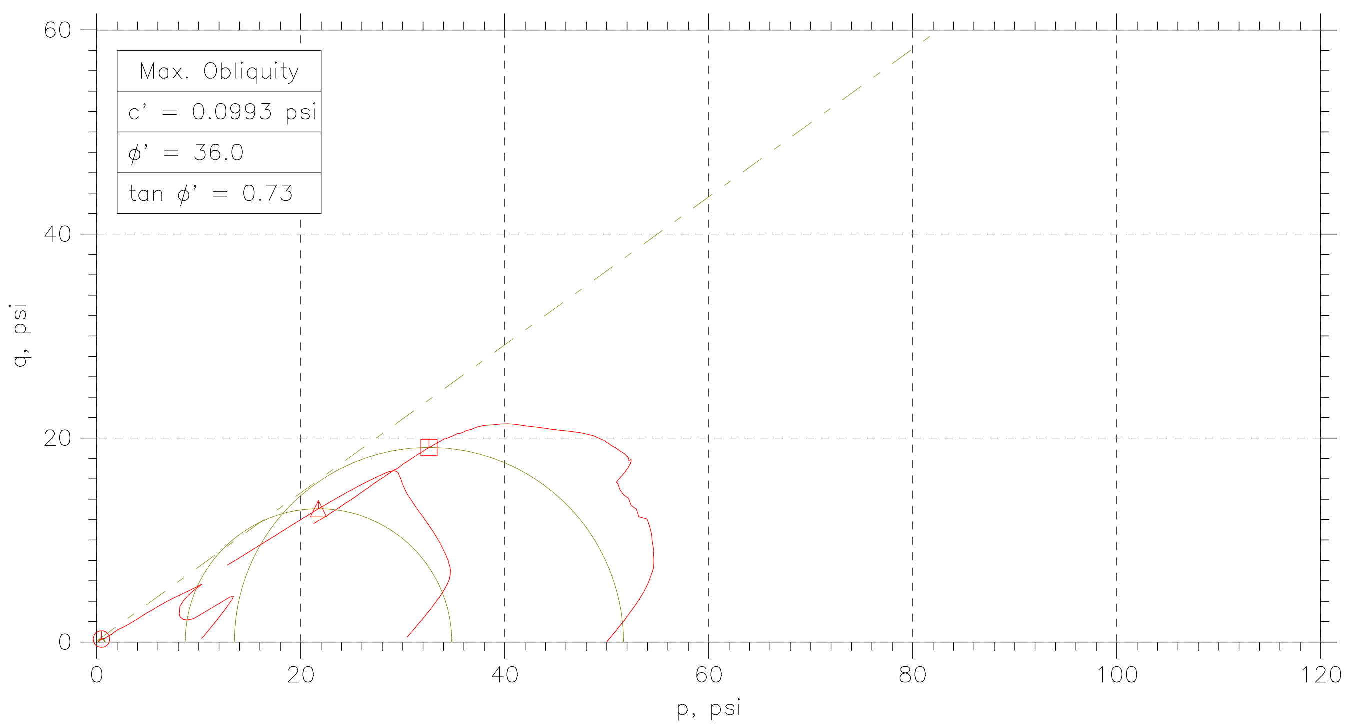
Project: Cumberland	
Location: ---	
Project No.: GTX-1484	
Boring No.: ---	
Sample Type: Remolded	
Description: Dark Gray-Black (FLY ASH-BULK)	
Remarks: System 1057	

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	----	FA-1.1	----	JM	9/4/09	MM		1484-FA-1.1ammended.dat
△	----	FA-1.2	----	JM	9/10/09	MM		1484-FA-1.2.dat
□	----	FA-1.3	----	JM	9/3/09	MM		1484-FA-1.3.dat

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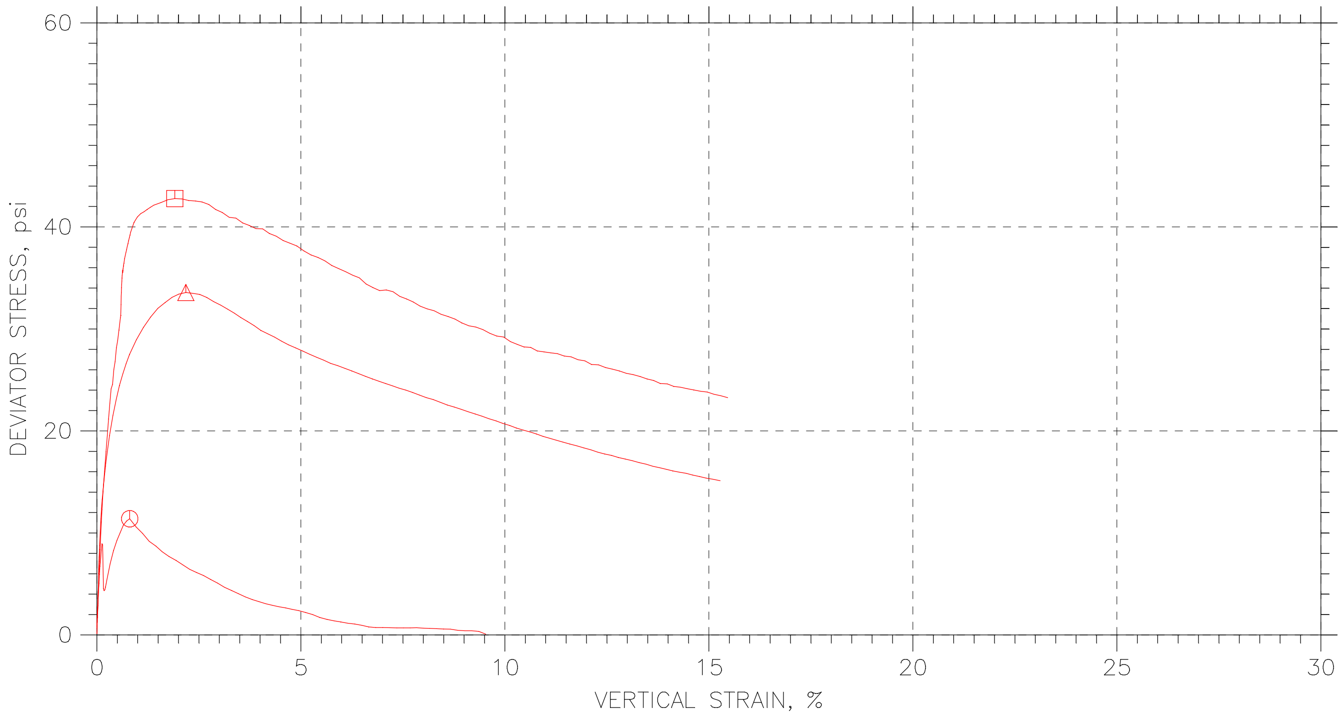
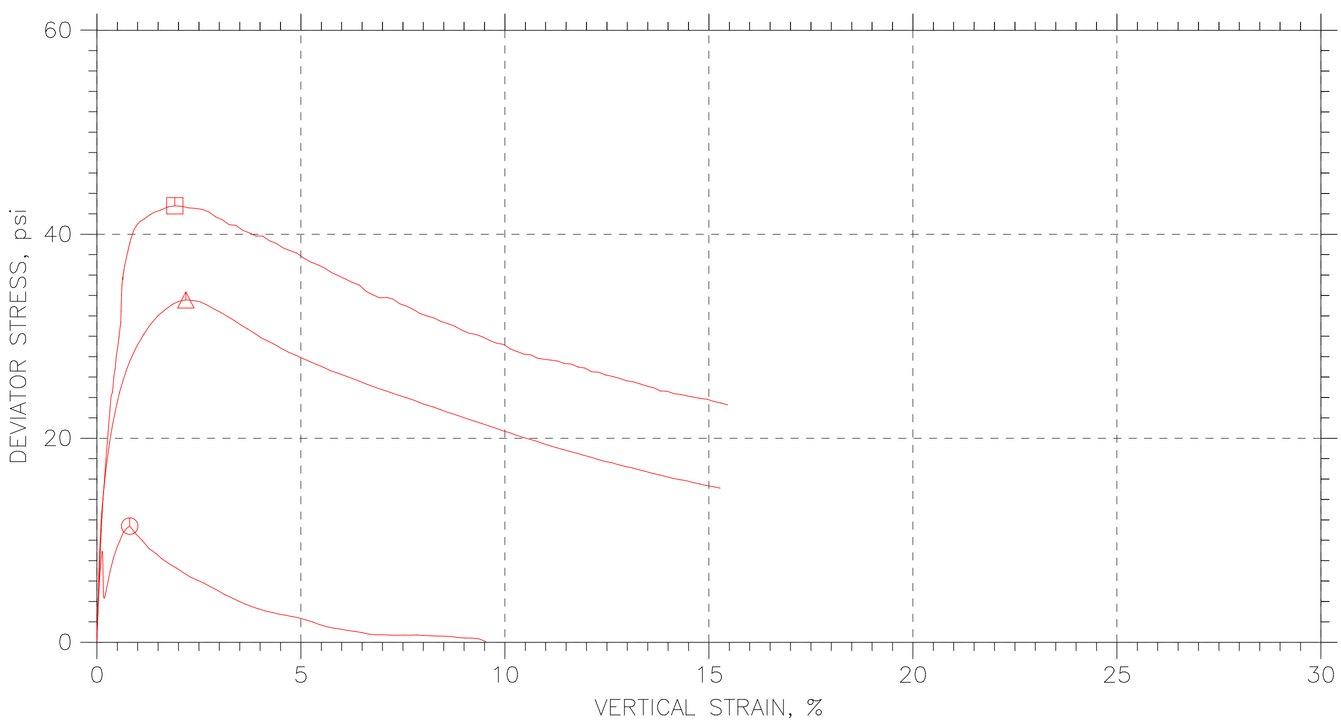
Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: Remolded	
Description: Dark Gray-Black (FLY ASH-BULK)		
Remarks: System 1057		

Mon, 21-SEP-2009 18:29:25

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	----	FA-1.1	----	JM	9/4/09	MM		1484-FA-1.1ammended.dat
△	----	FA-1.2	----	JM	9/10/09	MM		1484-FA-1.2.dat
□	----	FA-1.3	----	JM	9/3/09	MM		1484-FA-1.3.dat

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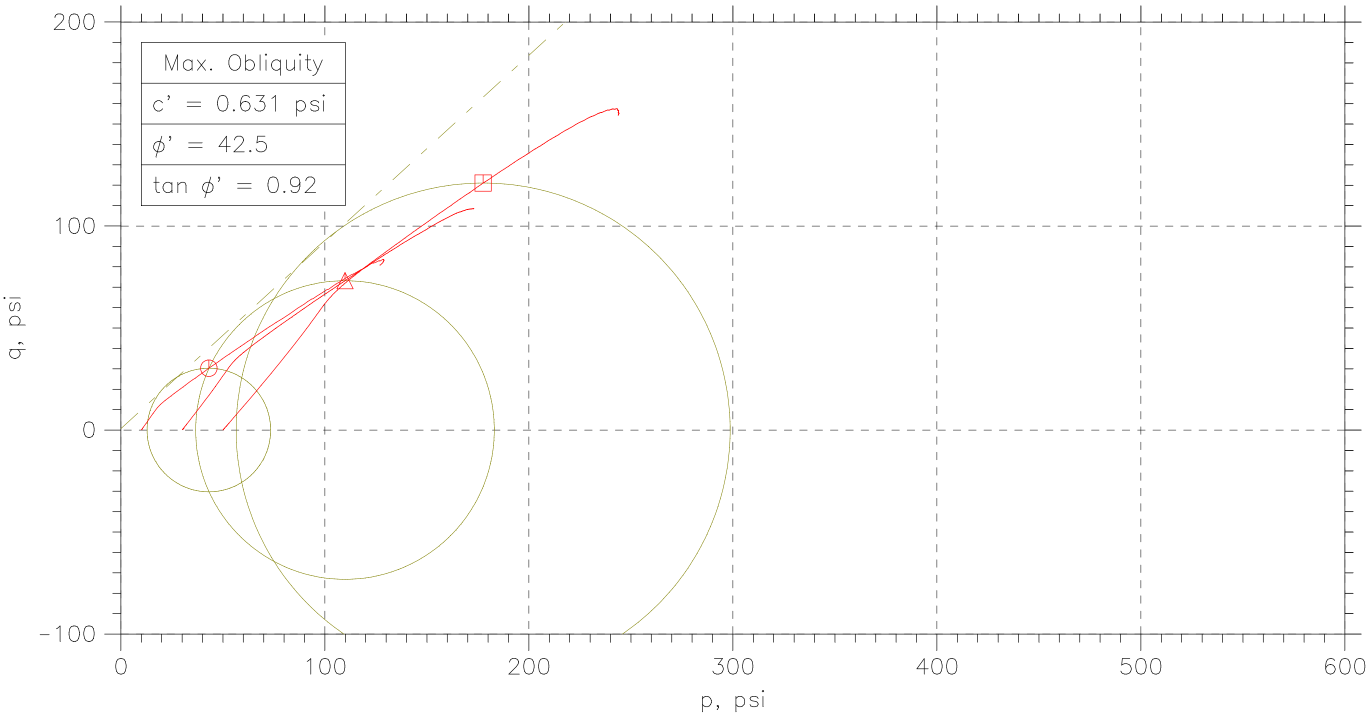
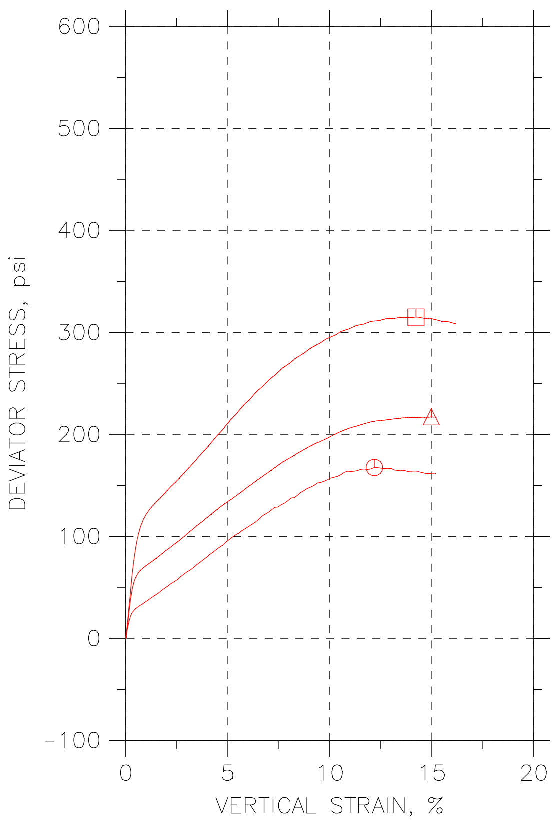
Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: Remolded	
Description: Dark Gray-Black (FLY ASH-BULK)		
Remarks: System 1057		

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		----	----	------	
Test No.		GB-1.1	GB-1.2	BA-1.3	
Depth		----	----	-----	
Initial	Diameter, in	2.851	2.873	2.87	
	Height, in	5.901	5.901	5.901	
	Water Content, %	29.1	28.9	29.2	
	Dry Density, pcf	80.97	80.17	80.41	
	Saturation, %	72.6	76.2	72.0	
	Void Ratio	1.08	0.947	1.1	
Before Shear	Water Content, %	40.0	37.1	36.9	
	Dry Density, pcf	81.09	80.96	84.44	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	1.08	0.928	0.996	
	Back Press., psi	140	119	101.4	
Ver. Eff. Cons. Stress, psi		9.976	29.98	50	
Shear Strength, psi		83.75	108.6	157.5	
Strain at Failure, %		12.2	15	14.2	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.95	0.95	0.95	
Estimated Specific Gravity		2.7	2.5	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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Project: Cumberland
Location: ---
Project No.: GTX-1484
Boring No.: ---
Sample Type: UD
Description: Gypsum BULK
Remarks: System 1062

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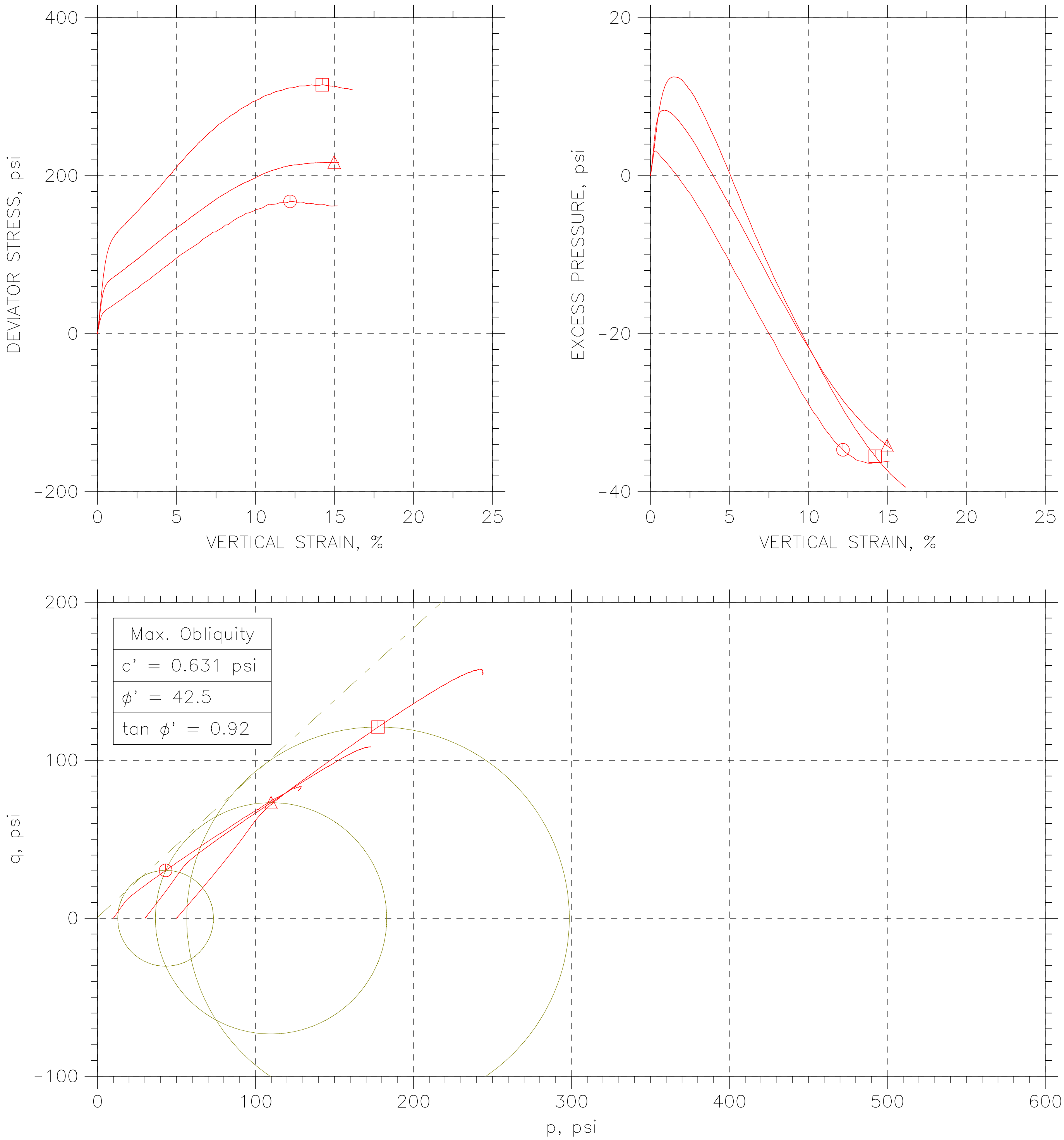
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	----	GB-1.1	----	MM	9/10/09	CA		1484-GB-1.1.dat
△	----	GB-1.2	----	JM	9/11/09	MM		1484-GB-1.2.dat
□	------	BA-1.3	-----	JM	9/10/09	MM		1484-GB-1.3.dat

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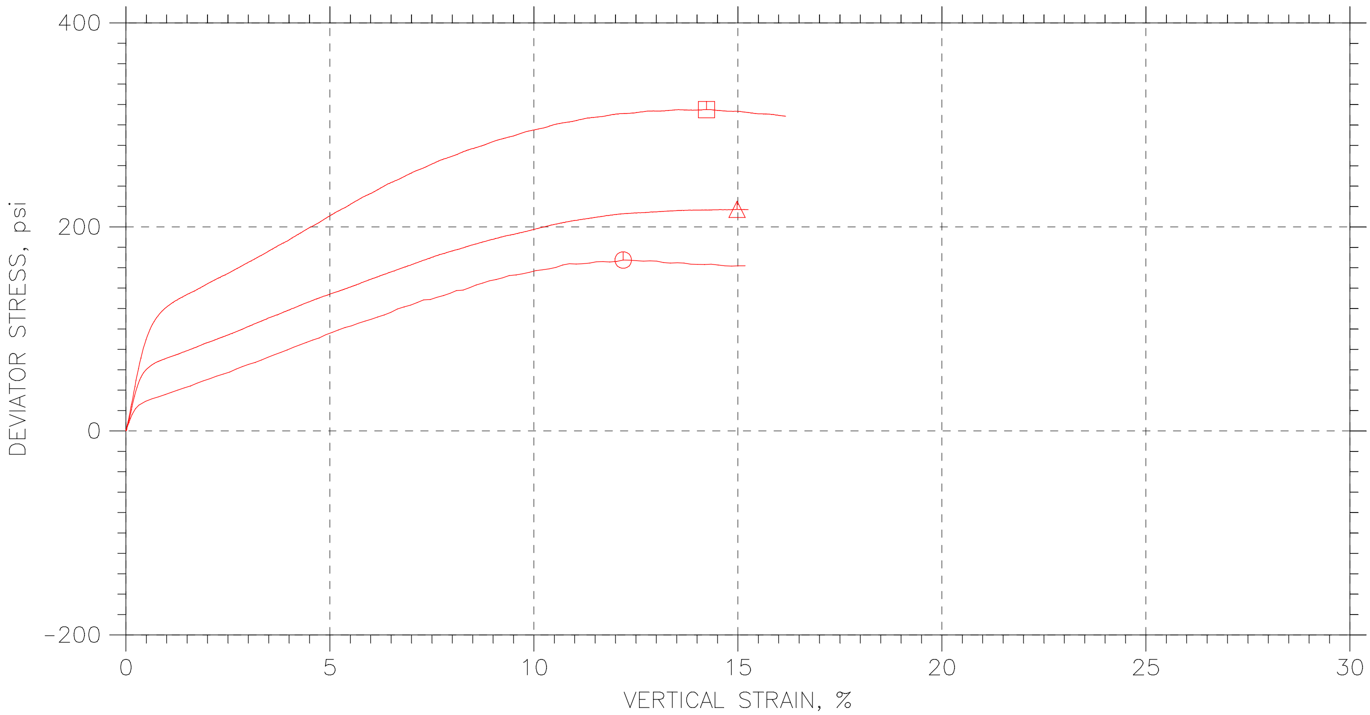
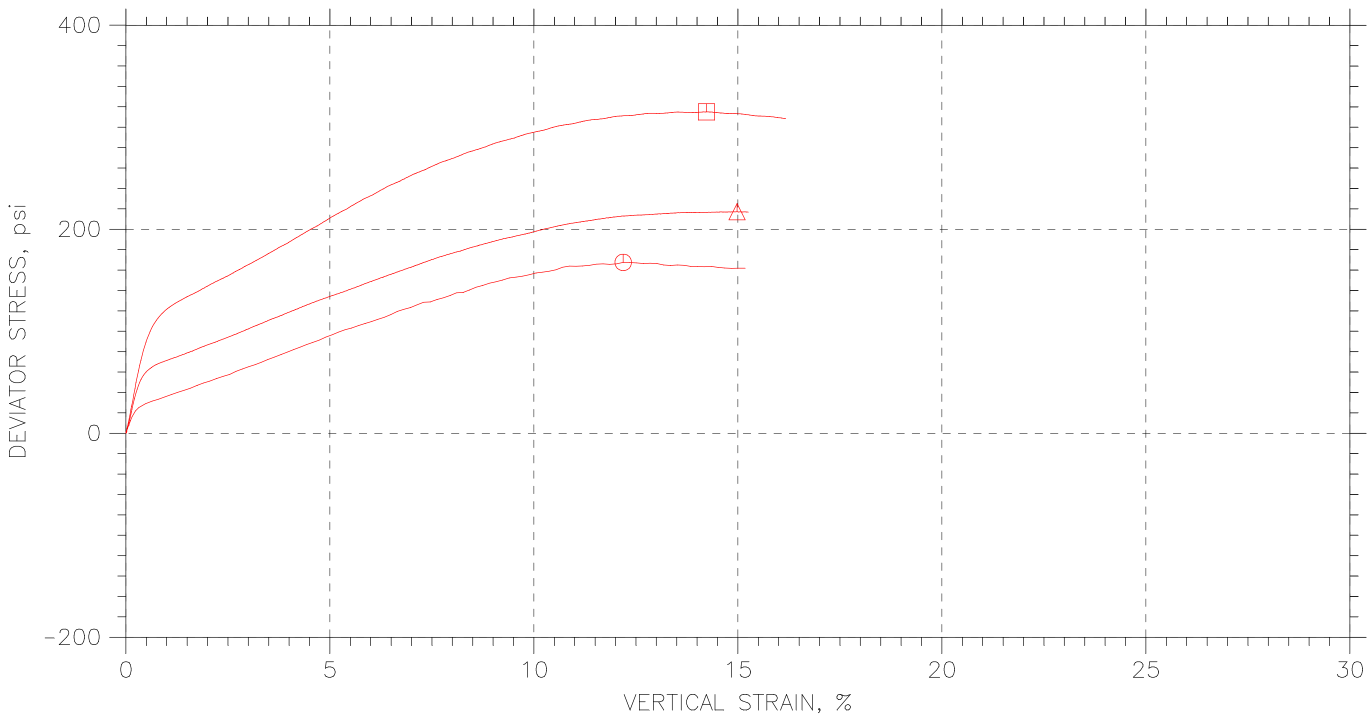
Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: UD	
Description: Gypsum BULK		
Remarks: System 1062		

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	----	GB-1.1	----	MM	9/10/09	CA		1484-GB-1.1.dat
△	----	GB-1.2	----	JM	9/11/09	MM		1484-GB-1.2.dat
□	------	BA-1.3	-----	JM	9/10/09	MM		1484-GB-1.3.dat

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Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: UD	
Description: Gypsum BULK		
Remarks: System 1062		

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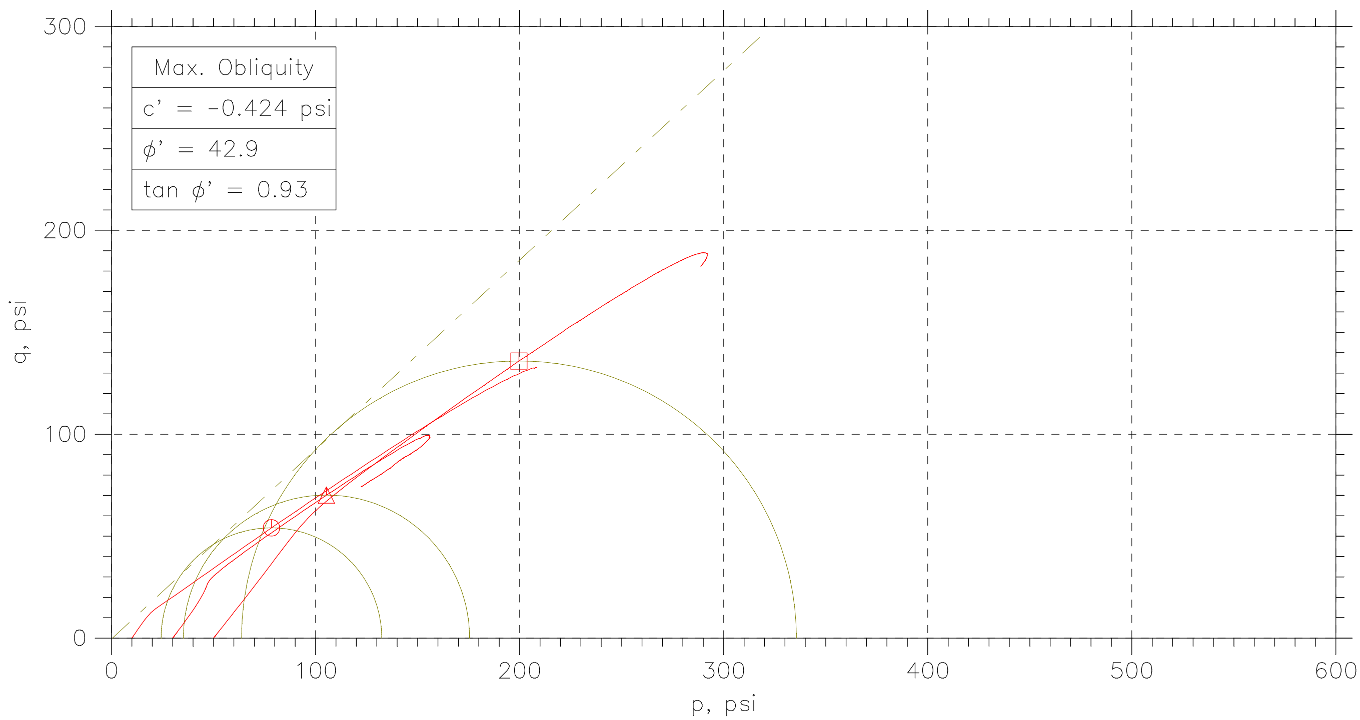
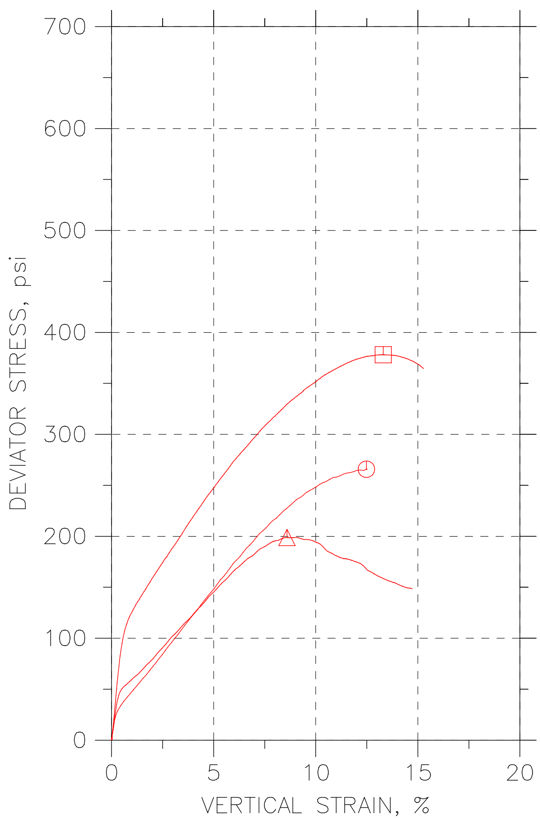
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		----	----	------	
Test No.		GR-1.1	GR-1.2	GR-1.3	
Depth		----	----	-----	
Initial	Diameter, in	2.875	2.874	2.875	
	Height, in	5.995	5.988	5.981	
	Water Content, %	27.2	26.9	26.9	
	Dry Density, pcf	80.71	80.79	80.75	
	Saturation, %	67.4	66.9	66.8	
	Void Ratio	1.09	1.09	1.09	
Before Shear	Water Content, %	33.6	31.0	25.8	
	Dry Density, pcf	88.41	91.8	99.36	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.907	0.836	0.696	
	Back Press., psi	140	119	101	
Ver. Eff. Cons. Stress, psi		9.981	29.97	49.98	
Shear Strength, psi		132.9	99.42	189.1	
Strain at Failure, %		12.5	8.59	13.3	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.95	0.95	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		33	33	33	
Plastic Limit		32	32	32	

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Project: Cumberland
Location: ---
Project No.: GTX-1484
Boring No.: ---
Sample Type: UD
Description: Gypsum REJECTS
Remarks: System 1062

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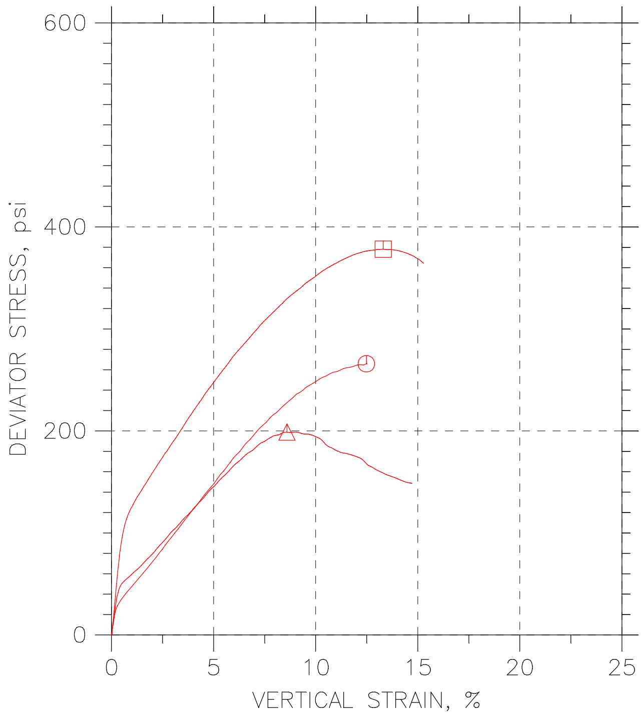
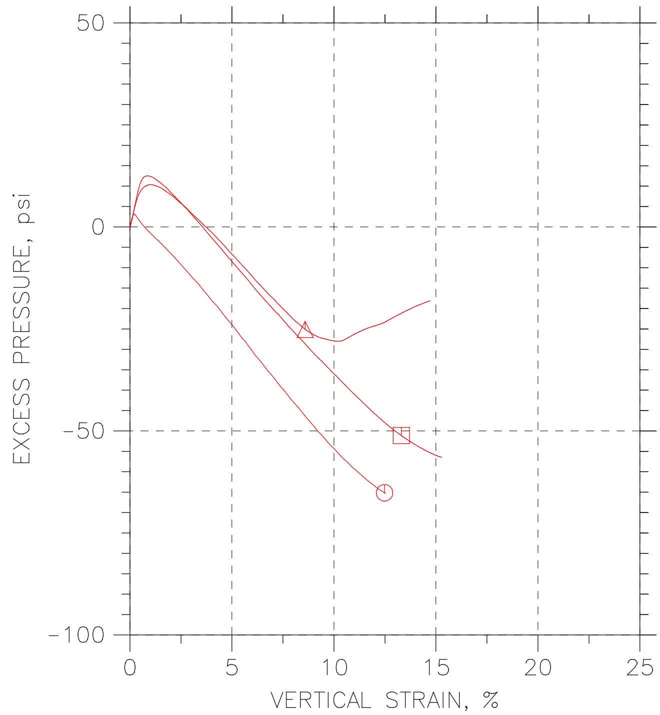
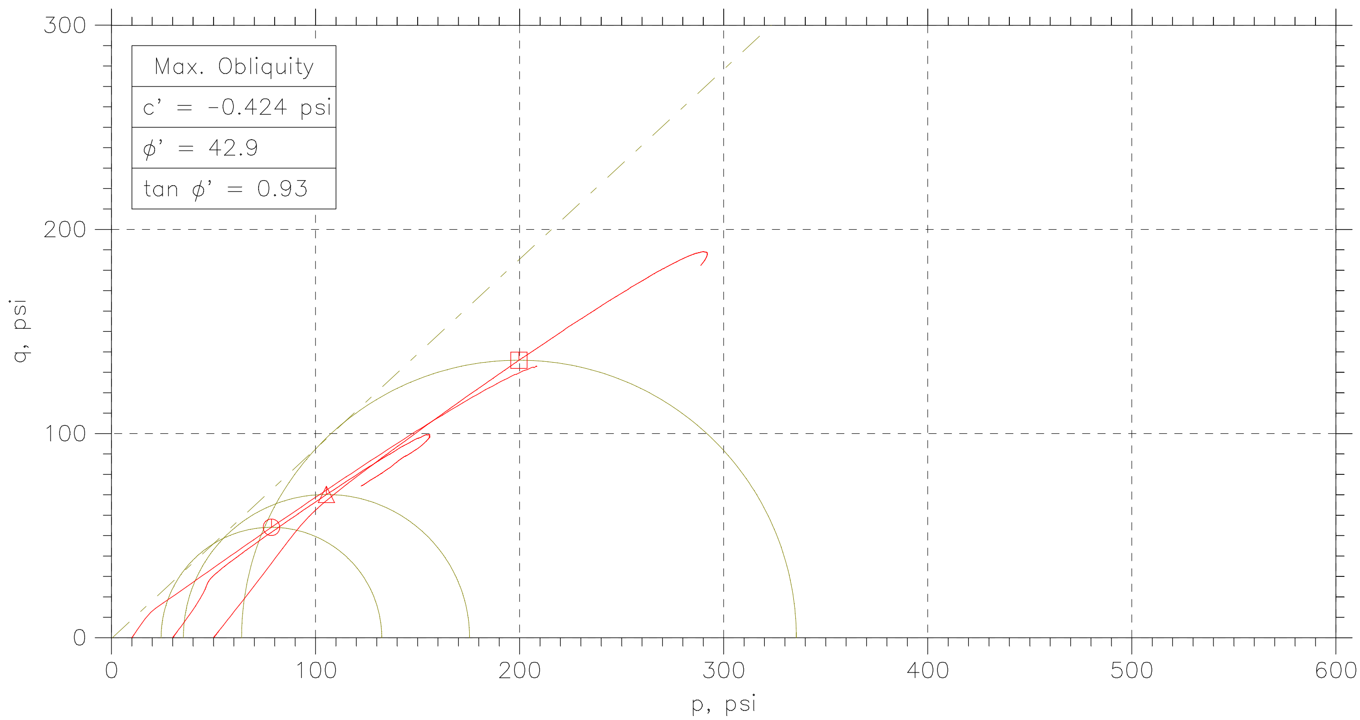
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	----	GR-1.1	----	MM	9/13/09	CA		1484-GR-1.1.dat
△	----	GR-1.2	----	JM	9/14/09	MM		1484-GR-1.2.dat
□	------	GR-1.3	-----	JM	9/13/09	MM		1484-GR-1.3.dat

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Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: UD	
Description: Gypsum REJECTS		
Remarks: System 1062		

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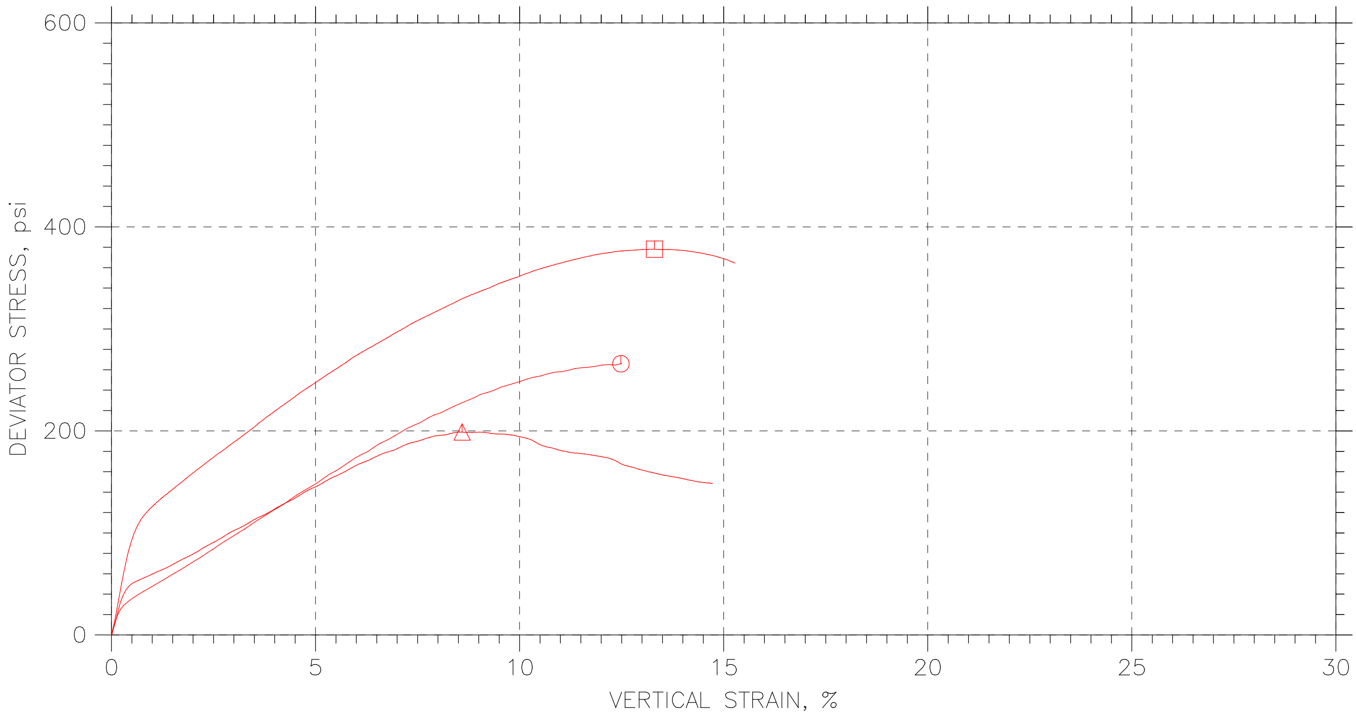
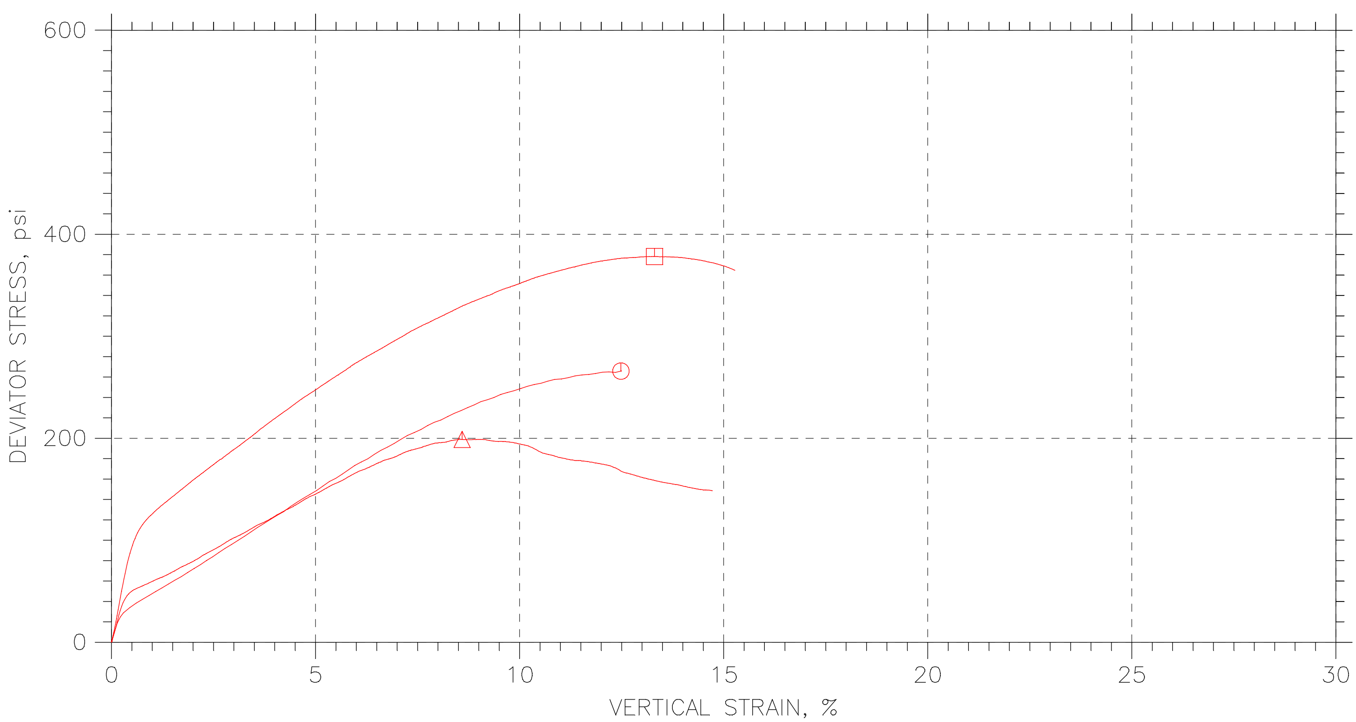
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⌽	----	GR-1.1	----	MM	9/13/09	CA		1484-GR-1.1.dat
△	----	GR-1.2	----	JM	9/14/09	MM		1484-GR-1.2.dat
⊡	------	GR-1.3	-----	JM	9/13/09	MM		1484-GR-1.3.dat

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Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: UD	
Description: Gypsum REJECTS		
Remarks: System 1062		

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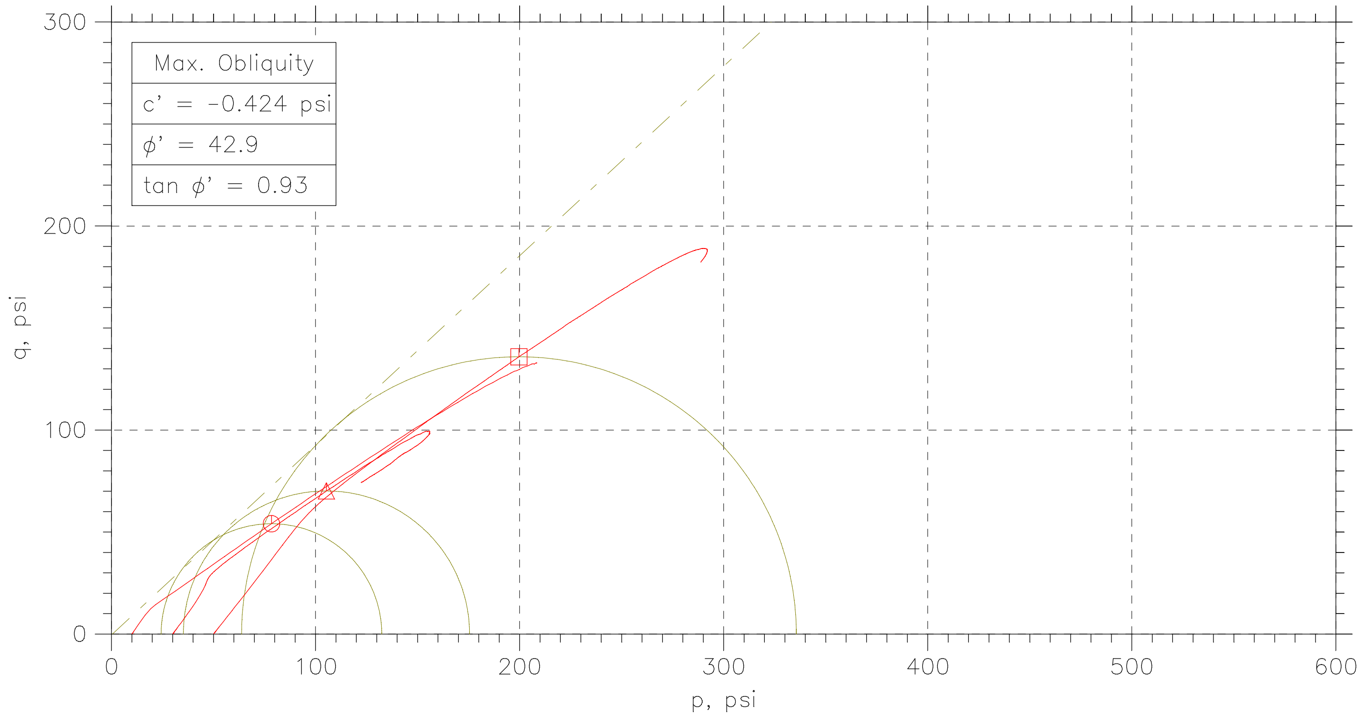
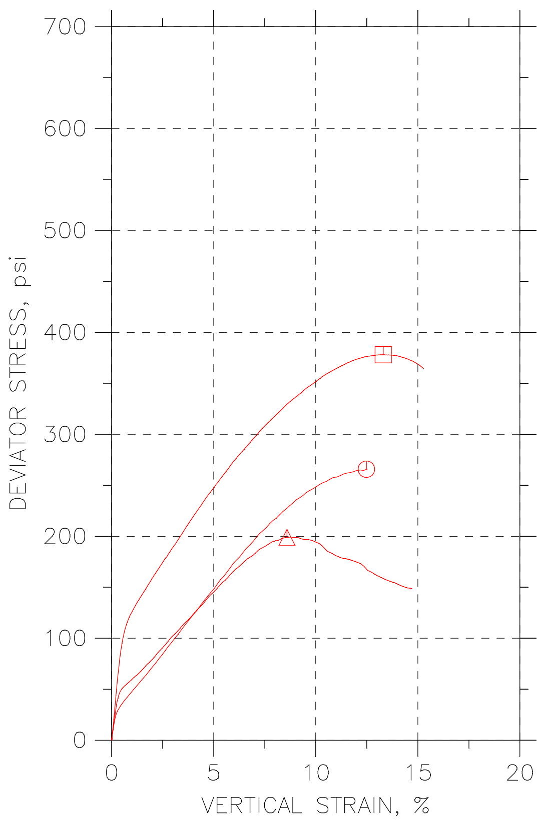
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Symbol	○	△	□	
	Sample No.	----	----	------	
	Test No.	GR-1.1	GR-1.2	GR-1.3	
	Depth	----	----	-----	
Initial	Diameter, in	2.875	2.874	2.875	
	Height, in	5.995	5.988	5.981	
	Water Content, %	27.2	26.9	26.9	
	Dry Density, pcf	80.71	80.79	80.75	
	Saturation, %	67.4	66.9	66.8	
	Void Ratio	1.09	1.09	1.09	
Before Shear	Water Content, %	33.6	31.0	25.8	
	Dry Density, pcf	88.41	91.8	99.36	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.907	0.836	0.696	
	Back Press., psi	140	119	101	
	Ver. Eff. Cons. Stress, psi	9.981	29.97	49.98	
	Shear Strength, psi	132.9	99.42	189.1	
	Strain at Failure, %	12.5	8.59	13.3	
	Strain Rate, %/min	0.016	0.016	0.016	
	B-Value	0.95	0.95	0.95	
	Estimated Specific Gravity	2.7	2.7	2.7	
	Liquid Limit	33	33	33	
	Plastic Limit	32	32	32	

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Project: Cumberland
Location: ---
Project No.: GTX-1484
Boring No.: ---
Sample Type: UD
Description: Gypsum REJECTS
Remarks: System 1062

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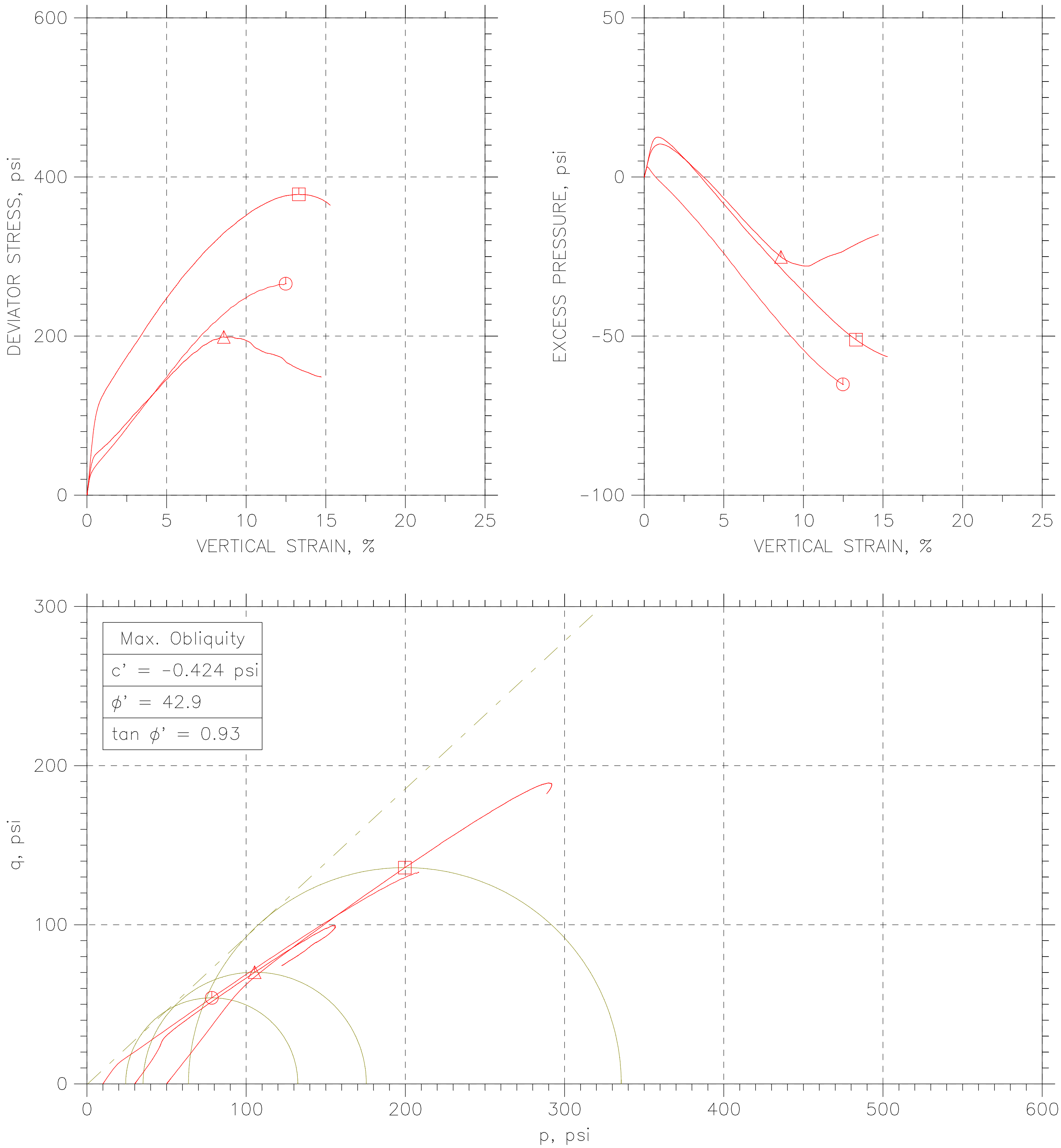
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	----	GR-1.1	----	MM	9/13/09	CA		1484-GR-1.1.dat
△	----	GR-1.2	----	JM	9/14/09	MM		1484-GR-1.2.dat
□	------	GR-1.3	-----	JM	9/13/09	MM		1484-GR-1.3.dat

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Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: UD	
Description: Gypsum REJECTS		
Remarks: System 1062		

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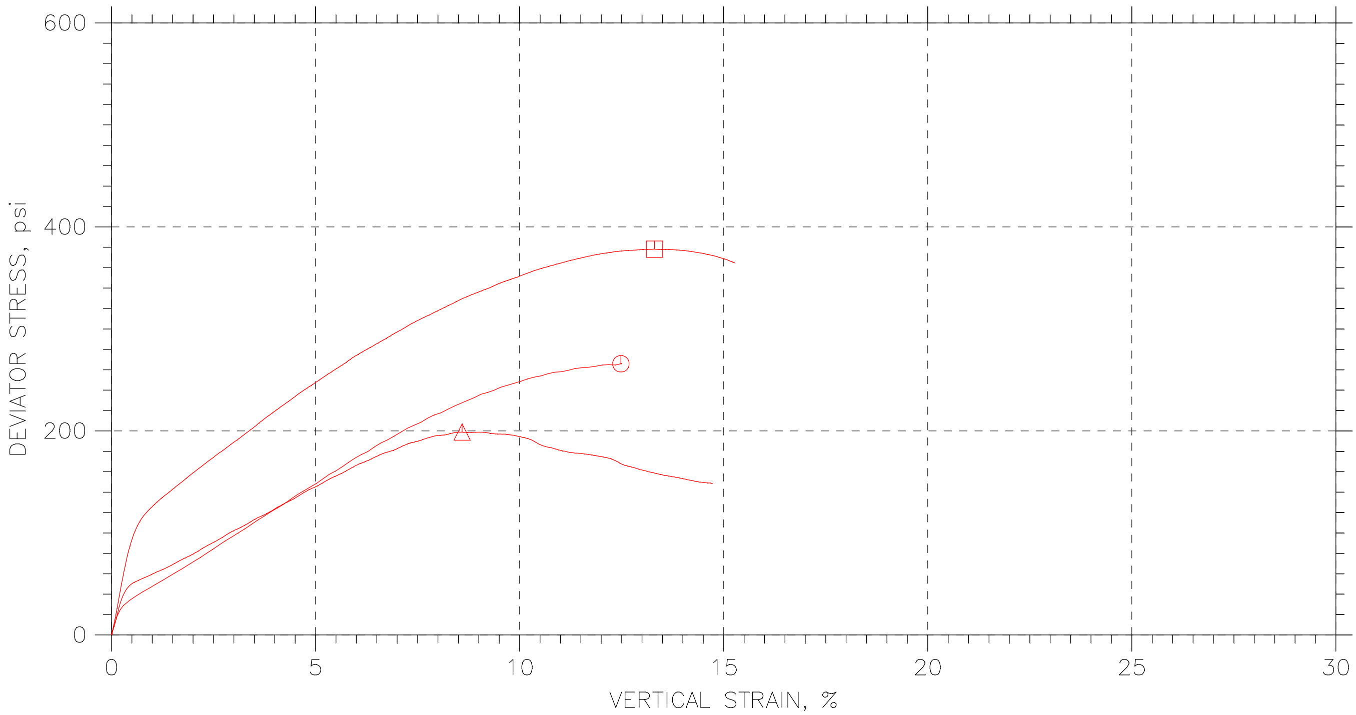
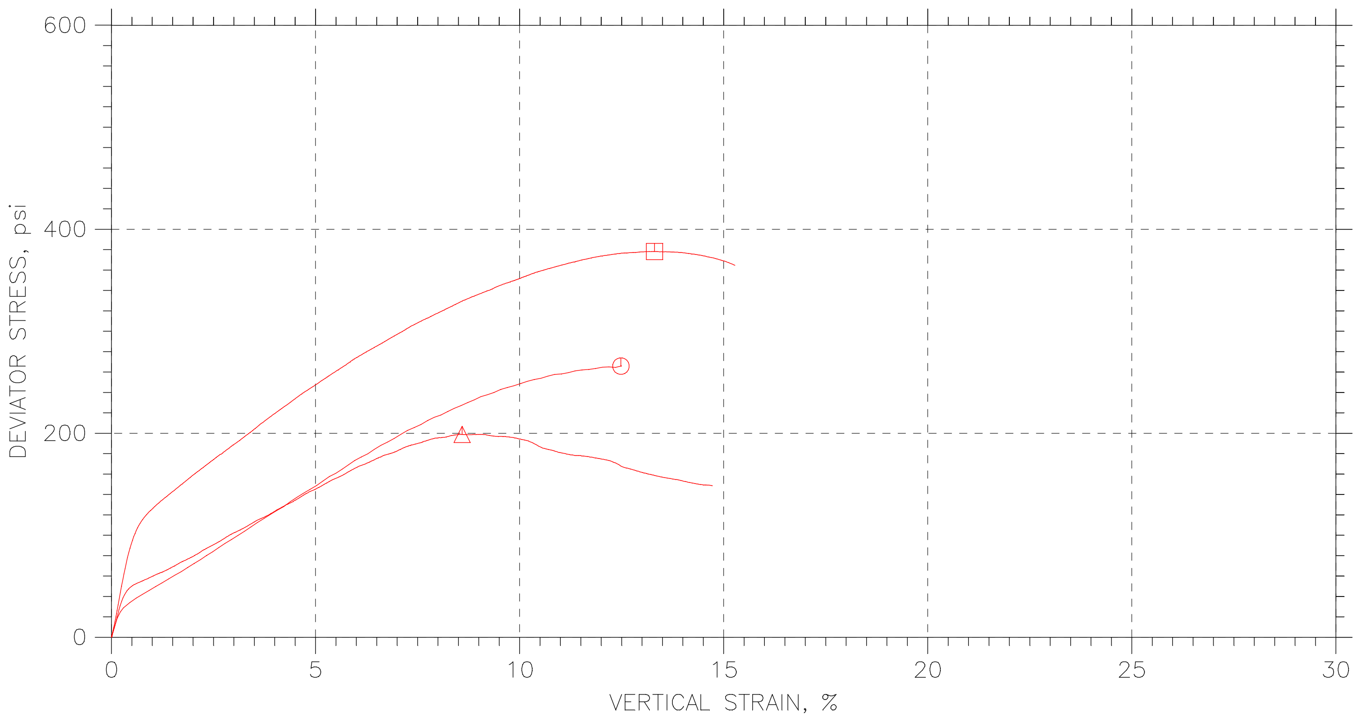
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	----	GR-1.1	----	MM	9/13/09	CA		1484-GR-1.1.dat
△	----	GR-1.2	----	JM	9/14/09	MM		1484-GR-1.2.dat
□	------	GR-1.3	-----	JM	9/13/09	MM		1484-GR-1.3.dat

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Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: UD	
Description: Gypsum REJECTS		
Remarks: System 1062		

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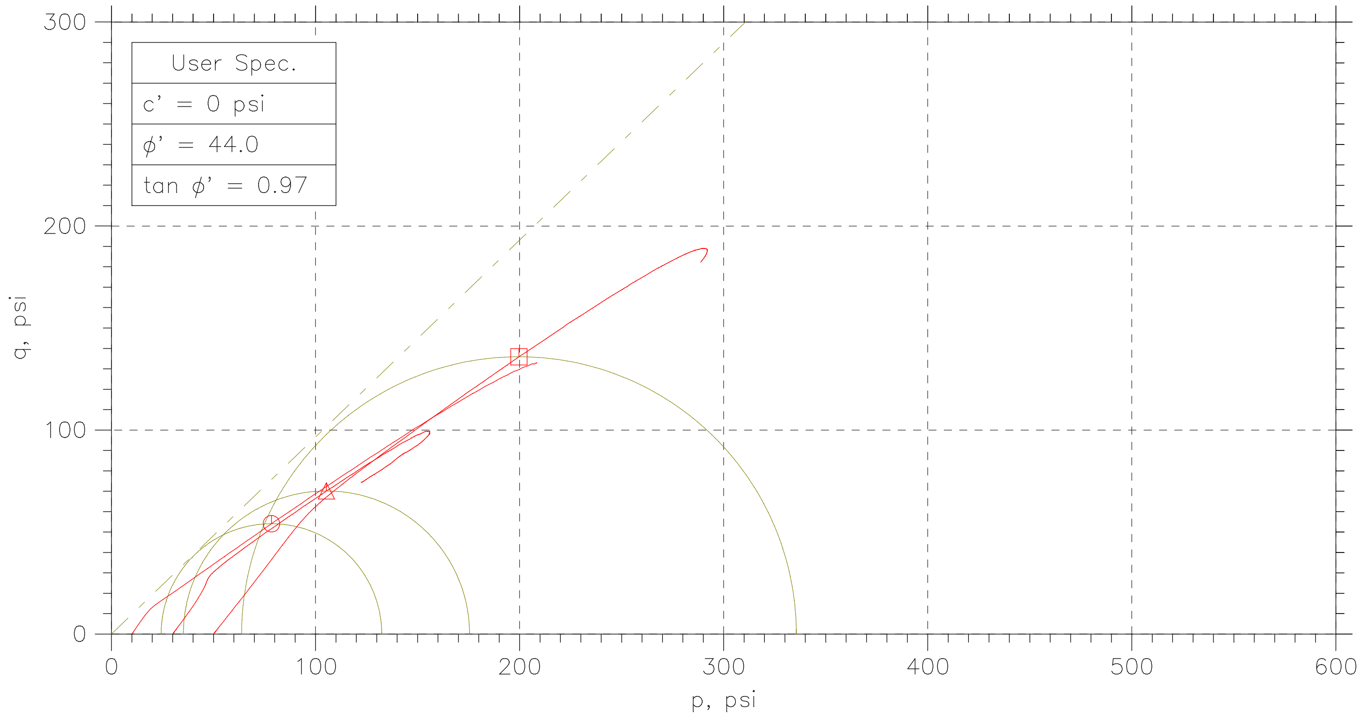
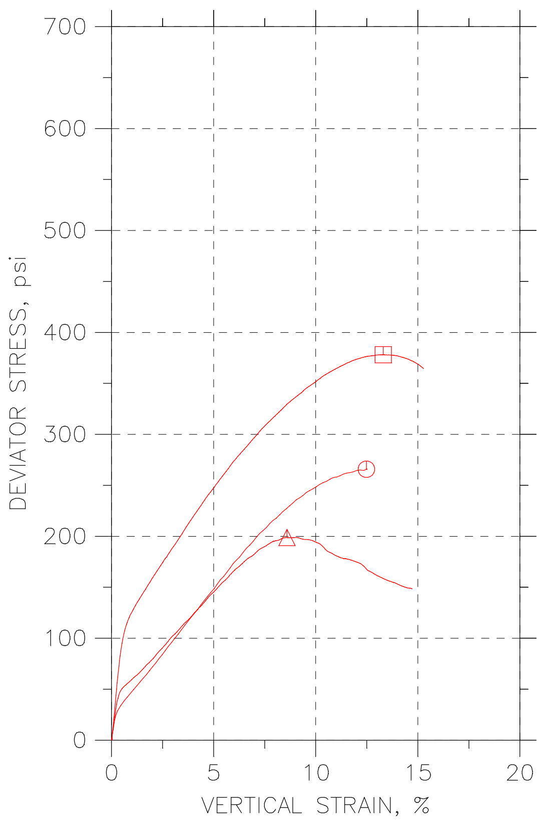
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





		○	△	□	
Symbol		○	△	□	
Sample No.		----	----	------	
Test No.		GR-1.1	GR-1.2	GR-1.3	
Depth		----	----	-----	
Initial	Diameter, in	2.875	2.874	2.875	
	Height, in	5.995	5.988	5.981	
	Water Content, %	27.2	26.9	26.9	
	Dry Density, pcf	80.71	80.79	80.75	
	Saturation, %	67.4	66.9	66.8	
	Void Ratio	1.09	1.09	1.09	
Before Shear	Water Content, %	33.6	31.0	25.8	
	Dry Density, pcf	88.41	91.8	99.36	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.907	0.836	0.696	
	Back Press., psi	140	119	101	
Ver. Eff. Cons. Stress, psi		9.981	29.97	49.98	
Shear Strength, psi		132.9	99.42	189.1	
Strain at Failure, %		12.5	8.59	13.3	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.95	0.95	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		33	33	33	
Plastic Limit		32	32	32	

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Project: Cumberland
Location: ---
Project No.: GTX-1484
Boring No.: ---
Sample Type: UD
Description: Gypsum REJECTS
Remarks: System 1062

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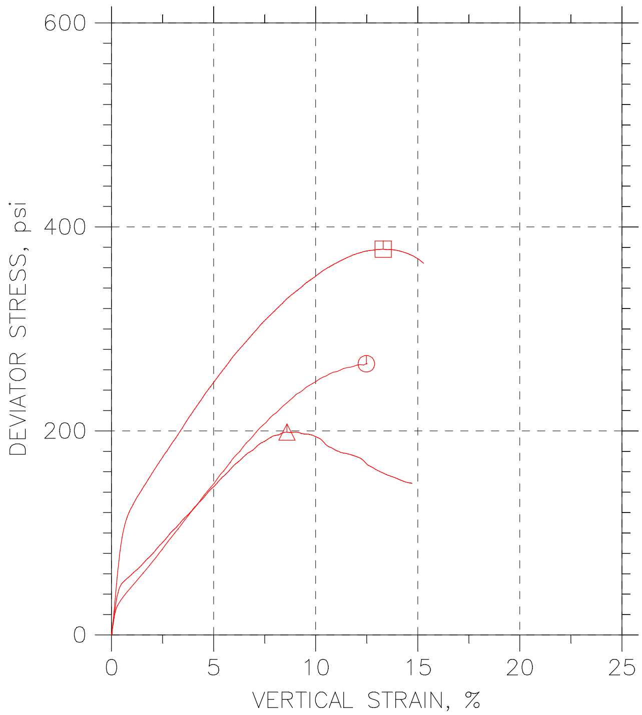
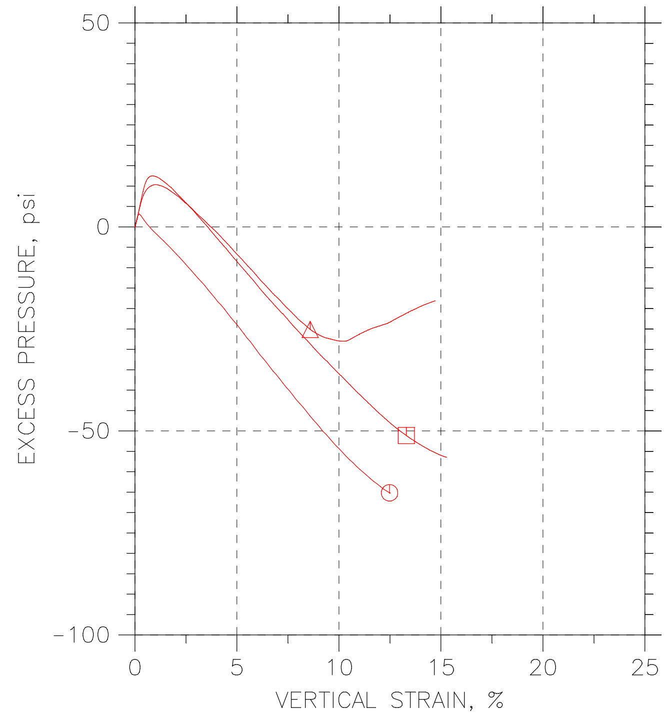
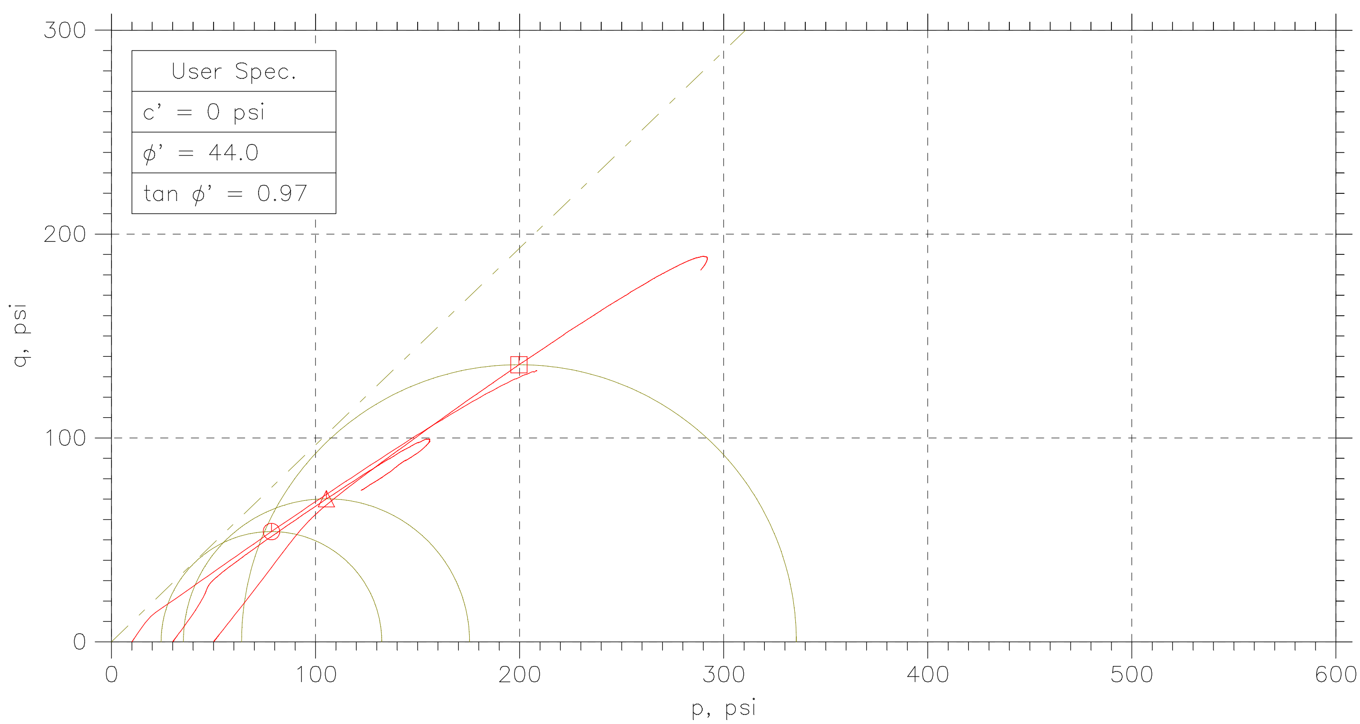
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	----	GR-1.1	----	MM	9/13/09	CA		1484-GR-1.1.dat
△	----	GR-1.2	----	JM	9/14/09	MM		1484-GR-1.2.dat
□	------	GR-1.3	-----	JM	9/13/09	MM		1484-GR-1.3.dat

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Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: UD	
Description: Gypsum REJECTS		
Remarks: System 1062		

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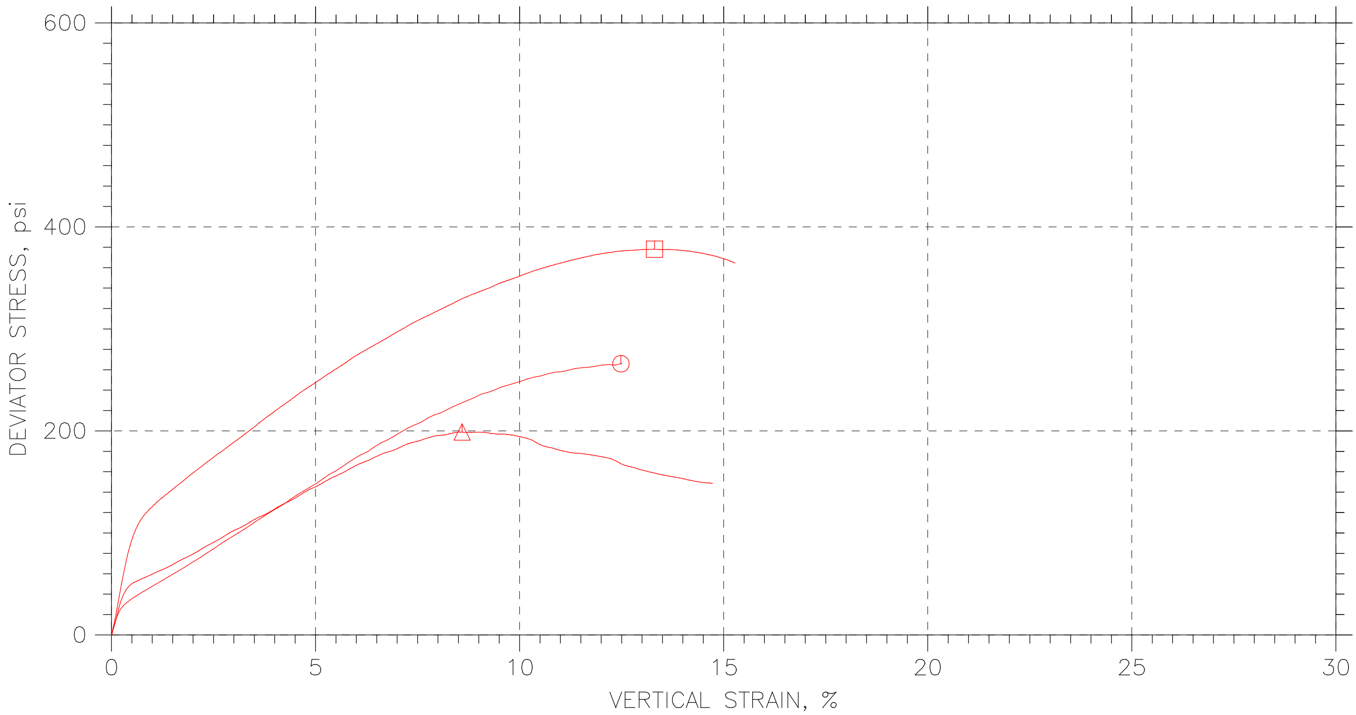
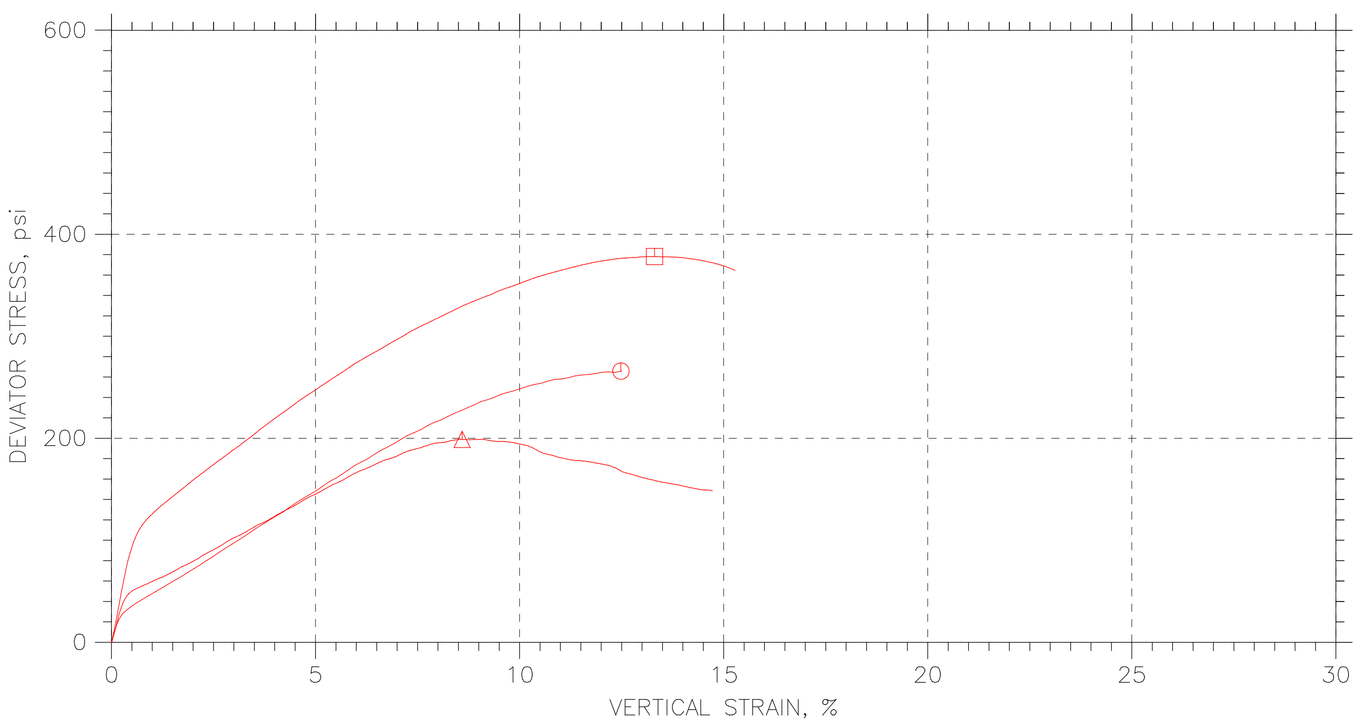
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	----	GR-1.1	----	MM	9/13/09	CA		1484-GR-1.1.dat
△	----	GR-1.2	----	JM	9/14/09	MM		1484-GR-1.2.dat
□	------	GR-1.3	-----	JM	9/13/09	MM		1484-GR-1.3.dat

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Project: Cumberland	Location: ---	Project No.: GTX-1484
Boring No.: ---	Sample Type: UD	
Description: Gypsum REJECTS		
Remarks: System 1062		

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PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1484	Tested By	MM
Project Name	Cumberland Ash	Test Date	09/12/09
Boring No.	B9B	Reviewed By	JM
Sample No.	1262	Review Date	09/16/09
Sample Depth	6-6.8	Lab No.	--
Sample Description	Brown Lean clay		

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Sample Data

Length, in		Diameter, in		Pan No.	A-33
Location 1	1.819	Location 1	2.882	Dry Soil+Pan, grams	344.13
Location 2	1.823	Location 2	2.884	Pan Weight, grams	17.01
Location3	1.825	Location 3	2.883		
Average	1.822	Average	2.883	Moisture Content, %	26.3
		Wet Soil + Tare, grams	413.12	Wet Unit Weight, pcf	132.3
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	104.8

Remarks:

Chamber Pressure, psi	75
Back Pressure, psi	65
Confining Pressure, psi	10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				3800	7.8	210.1	11.00	206.9	7.5E-08	22	7.1E-08
				4890	7.8	210.1	12.00	205.9	7.6E-08	24	6.9E-08
				5189	7.8	210.1	12.30	205.6	7.7E-08	24	7.0E-08
				5989	7.8	210.1	12.80	205.1	7.5E-08	24	6.8E-08
				9056	7.8	210.1	7.40	194.3	7.7E-08	24	7.0E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	na	N/A	Vertical

Avg. k at 20 °C 7.0E-08 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 42.12 cm²
L = 4.63 cm

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	***GTX-1484***	Tested By	***MM***
Project Name	***Cumberland Ash***	Test Date	***9/12/2009***
Boring No.	***B9B***	Reviewed By	***JM***
Sample No.	***1262***	Review Date	***9/16/2009***
Sample Depth	***6-6.8***	Lab No.	--
Sample Description	***Brown Lean clay***		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*26.3*
Wet Unit Weight, pcf:	*132.3*
Dry Unit Weight, pcf:	*104.8*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***7.0E-08***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1484	Tested By	MM
Project Name	Cumberland Ash	Test Date	09/11/09
Boring No.	B9B	Reviewed By	JM
Sample No.	1263	Review Date	09/13/09
Sample Depth	10.1-10.6	Lab No.	--
Sample Description	Brown Lean clay		

Sample Data

Length, in		Diameter, in		Pan No.	A-19
Location 1	2.491	Location 1	2.891	Dry Soil+Pan, grams	488.27
Location 2	2.497	Location 2	2.890	Pan Weight, grams	16.49
Location3	2.502	Location 3	2.889		
Average	2.497	Average	2.890	Moisture Content, %	18.4
		Wet Soil + Tare, grams	558.39	Wet Unit Weight, pcf	129.9
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	109.7

Remarks:

Chamber Pressure, psi	75
Back Pressure, psi	65
Confining Pressure, psi	10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				2010	6.0	193.5	6.40	193.1	2.6E-08	22	2.4E-08
				6500	6.0	193.5	7.20	192.3	2.4E-08	24	2.2E-08
				18987	6.0	193.5	10.40	189.1	3.0E-08	24	2.8E-08
				31234	6.0	193.5	11.80	187.7	2.5E-08	24	2.2E-08
				41098	6.0	193.5	12.70	186.8	2.2E-08	24	2.0E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	na	N/A	Vertical

Avg. k at 20 °C 2.3E-08 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 42.32 cm²
L = 6.34 cm

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HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1484*	Tested By	*MM*
Project Name	*Cumberland Ash*	Test Date	*9/11/2009*
Boring No.	*B9B*	Reviewed By	*JM*
Sample No.	*1263*	Review Date	*9/13/2009*
Sample Depth	*10.1-10.6*	Lab No.	--
Sample Description	*Brown Lean clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*18.4*
Wet Unit Weight, pcf:	*129.9*
Dry Unit Weight, pcf:	*109.7*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***2.3E-08***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

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Project Number	GTX-1484	Tested By	MM
Project Name	Cumberland Ash	Test Date	09/12/09
Boring No.	B-15B	Reviewed By	JM
Sample No.	1605A	Review Date	09/14/09
Sample Depth	---	Lab No.	--
Sample Description	Brown Lean clay		

Sample Data

Length, in		Diameter, in		Pan No.	A-19
Location 1	2.361	Location 1	2.826	Dry Soil+Pan, grams	395.31
Location 2	2.368	Location 2	2.831	Pan Weight, grams	15.97
Location3	2.364	Location 3	2.822		
Average	2.364	Average	2.826	Moisture Content, %	26.7
		Wet Soil + Tare, grams	480.55	Wet Unit Weight, pcf	123.4
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	97.4

Remarks:

Chamber Pressure, psi	75
Back Pressure, psi	65
Confining Pressure, psi	10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				900	3.8	207.6	4.00	207.4	2.6E-08	22	2.5E-08
				1800	3.8	207.6	4.20	207.2	2.6E-08	24	2.4E-08
				3720	3.8	207.6	4.60	206.8	2.5E-08	24	2.3E-08
				7080	3.8	207.6	5.20	206.2	2.3E-08	24	2.1E-08
				11760	3.8	207.6	6.20	205.1	2.5E-08	24	2.2E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	na	N/A	Vertical

Avg. k at 20 °C 2.3E-08 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 40.48 cm²
L = 6.01 cm

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HYDRAULIC CONDUCTIVITY

Project No.	***GTX-1484***	Tested By	***MM***
Project Name	***Cumberland Ash***	Test Date	***9/12/2009***
Boring No.	***B-15B***	Reviewed By	***JM***
Sample No.	***1605A***	Review Date	***9/14/2009***
Sample Depth	---	Lab No.	--
Sample Description	***Brown Lean clay***		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*26.7*
Wet Unit Weight, pcf:	*123.4*
Dry Unit Weight, pcf:	*97.4*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***2.3E-08***

Remarks: ______________________________

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number GTX-1484 | Tested By MM
Project Name Cumberland Ash | Test Date 09/12/09
Boring No. B-17A | Reviewed By JM
Sample No. 1606B | Review Date 09/15/09
Sample Depth 32.7-33.2 | Lab No. --
Sample Description Gray Silt-ASH

Sample Data

Length, in		Diameter, in		Pan No.	A-43
Location 1	2.454	Location 1	2.854	Dry Soil+Pan, grams	308.33
Location 2	2.456	Location 2	2.859	Pan Weight, grams	17.05
Location3	2.501	Location 3	2.861		
Average	2.470	Average	2.858	Moisture Content, %	40.8
		Wet Soil + Tare, grams	410.19	Wet Unit Weight, pcf	98.6
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	70.0

Remarks:

Chamber Pressure, psi 75
Back Pressure, psi 65
Confining Pressure, psi 10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				320	5.4	198.5	7.30	196.6	7.5E-07	22	7.2E-07
				1547	5.4	198.5	14.30	189.6	7.6E-07	24	6.9E-07
				2565	5.4	198.5	19.60	184.3	7.5E-07	24	6.8E-07
				3299	5.4	198.5	23.80	180.1	7.8E-07	24	7.0E-07
				4901	5.4	198.5	31.30	172.6	7.7E-07	24	7.0E-07

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	na	N/A	Vertical

Avg. k at 20 °C 7.0E-07 cm/sec

a = area of burette in cm² | Ha = initial inlet head in cm | H_b = final inlet head in cm
L = length of sample in cm | H_1 = initial outlet head in cm | H_2 = final outlet head in cm
A = area of sample in cm² | t = time in seconds

a = 0.16 cm²
A = 41.39 cm²
L = 6.27 cm

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HYDRAULIC CONDUCTIVITY

Project No.	***GTX-1484***	Tested By	***MM***
Project Name	***Cumberland Ash***	Test Date	***9/12/2009***
Boring No.	***B-17A***	Reviewed By	***JM***
Sample No.	***1606B***	Review Date	***9/15/2009***
Sample Depth	***32.7-33.2***	Lab No.	--
Sample Description	***Gray Silt-ASH***		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*40.8*
Wet Unit Weight, pcf:	*98.6*
Dry Unit Weight, pcf:	*70.0*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***7.0E-07***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number GTX-1484
Project Name Cumberland Ash
Boring No. B-17A
Sample No. 1608
Sample Depth 70-70.5 ft
Sample Description Gray Silt-ASH

Tested By MM
Test Date 09/12/09
Reviewed By JM
Review Date 09/15/09
Lab No. --

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Sample Data

Length, in		Diameter, in		Pan No.	A-27
Location 1	2.504	Location 1	2.856	Dry Soil+Pan, grams	309.59
Location 2	2.501	Location 2	2.857	Pan Weight, grams	16.98
Location3	2.507	Location 3	2.854		
Average	2.504	Average	2.856	Moisture Content, %	42.6
		Wet Soil + Tare, grams	417.15	Wet Unit Weight, pcf	99.1
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	69.5

Remarks:

Chamber Pressure, psi 75
Back Pressure, psi 65
Confining Pressure, psi 10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				1020	4.7	193.3	7.30	186.1	6.4E-07	22	6.2E-07
				1651	4.7	193.3	11.10	182.3	7.2E-07	24	6.5E-07
				2365	4.7	193.3	14.50	178.9	7.2E-07	24	6.5E-07
				2987	4.7	193.3	17.80	175.6	7.4E-07	24	6.7E-07
				4104	4.7	193.3	23.20	170.2	7.5E-07	24	6.8E-07

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	na	N/A	Vertical

Avg. k at 20 °C 6.5E-07 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 41.32 cm²
L = 6.36 cm

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HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1484*	Tested By	*MM*
Project Name	*Cumberland Ash*	Test Date	*9/12/2009*
Boring No.	*B-17A*	Reviewed By	*JM*
Sample No.	*1608*	Review Date	*9/15/2009*
Sample Depth	*70-70.5 ft*	Lab No.	--
Sample Description	*Gray Silt-ASH*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*42.6*
Wet Unit Weight, pcf:	*99.1*
Dry Unit Weight, pcf:	*69.5*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***6.5E-07***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1484	Tested By	MM
Project Name	Cumberland Ash	Test Date	09/12/09
Boring No.	B-19C	Reviewed By	JM
Sample No.	1629	Review Date	09/15/09
Sample Depth	20-20.5 ft	Lab No.	--
Sample Description	Brown Lean clay		

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Sample Data

Length, in		Diameter, in		Pan No.	A-44
Location 1	2.345	Location 1	2.873	Dry Soil+Pan, grams	429.22
Location 2	2.342	Location 2	2.870	Pan Weight, grams	17.01
Location3	2.346	Location 3	2.869		
Average	2.344	Average	2.871	Moisture Content, %	24.5
		Wet Soil + Tare, grams	513.22	Wet Unit Weight, pcf	128.9
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	103.5

Remarks:

Chamber Pressure, psi	75
Back Pressure, psi	65
Confining Pressure, psi	10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				1134	6.8	213.2	7.10	212.9	2.9E-08	22	2.8E-08
				1892	6.8	213.2	7.40	212.6	3.5E-08	24	3.2E-08
				3998	6.8	213.2	8.10	211.9	3.6E-08	24	3.3E-08
				6211	6.8	213.2	8.80	211.1	3.7E-08	24	3.3E-08
				12990	6.8	213.2	10.90	209	3.6E-08	24	3.3E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	na	N/A	Vertical

Avg. k at 20 °C 3.2E-08 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 41.76 cm²
L = 5.95 cm

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HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1484*	Tested By	*MM*
Project Name	*Cumberland Ash*	Test Date	*9/12/2009*
Boring No.	*B-19C*	Reviewed By	*JM*
Sample No.	*1629*	Review Date	*9/15/2009*
Sample Depth	*20-20.5 ft*	Lab No.	--
Sample Description	*Brown Lean clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*24.5*
Wet Unit Weight, pcf:	*128.9*
Dry Unit Weight, pcf:	*103.5*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***3.2E-08***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

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Project Number	GTX-1484	Tested By	MM
Project Name	Cumberland Ash	Test Date	09/12/09
Boring No.	B-21B	Reviewed By	JM
Sample No.	1610	Review Date	09/14/09
Sample Depth	---	Lab No.	--
Sample Description	Brown Lean clay		

Sample Data

Length, in		Diameter, in		Pan No.	A-21
Location 1	1.961	Location 1	2.882	Dry Soil+Pan, grams	366.03
Location 2	1.955	Location 2	2.879	Pan Weight, grams	16.74
Location3	1.963	Location 3	2.877		
Average	1.960	Average	2.879	Moisture Content, %	22.0
		Wet Soil + Tare, grams	426.01	Wet Unit Weight, pcf	127.2
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	104.3

Remarks:

Chamber Pressure, psi	75
Back Pressure, psi	65
Confining Pressure, psi	10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				900	2.1	213.6	2.40	213.3	3.1E-08	22	3.0E-08
				1800	2.1	213.6	2.60	213.1	2.5E-08	24	2.3E-08
				3720	2.1	213.6	2.90	212.8	2.0E-08	24	1.8E-08
				7080	2.1	213.6	3.00	212.7	1.2E-08	24	1.0E-08
				46675	2.1	213.6	7.90	207.8	1.1E-08	24	1.0E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	na	N/A	Vertical

Avg. k at 20 °C 1.8E-08 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 42.01 cm²
L = 4.98 cm

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1484*	Tested By	*MM*
Project Name	*Cumberland Ash*	Test Date	*9/12/2009*
Boring No.	*B-21B*	Reviewed By	*JM*
Sample No.	*1610*	Review Date	*9/14/2009*
Sample Depth	---	Lab No.	--
Sample Description	*Brown Lean clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*22.0*
Wet Unit Weight, pcf:	*127.2*
Dry Unit Weight, pcf:	*104.3*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***1.8E-08***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1484	Tested By	MM
Project Name	Cumberland Ash	Test Date	09/10/09
Boring No.	B-29A	Reviewed By	JM
Sample No.	1615	Review Date	09/13/09
Sample Depth	---	Lab No.	--
Sample Description	Brown Lean clay		

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Sample Data

Length, in		Diameter, in		Pan No.	A-21
Location 1	2.787	Location 1	2.874	Dry Soil+Pan, grams	495.86
Location 2	2.794	Location 2	2.876	Pan Weight, grams	16.73
Location3	2.785	Location 3	2.875		
Average	2.789	Average	2.875	Moisture Content, %	22.1
		Wet Soil + Tare, grams	584.85	Wet Unit Weight, pcf	123.1
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	100.8

Remarks:

Chamber Pressure, psi	75
Back Pressure, psi	65
Confining Pressure, psi	10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				800	3.3	195.1	3.50	194.9	3.4E-08	22	3.3E-08
				1659	3.3	195.1	3.60	194.8	2.5E-08	24	2.3E-08
				2567	3.3	195.1	3.70	194.7	2.2E-08	24	2.0E-08
				3989	3.3	195.1	3.90	194.5	2.1E-08	24	1.9E-08
				6565	3.3	195.1	4.20	194.2	1.9E-08	24	1.8E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	na	N/A	Vertical

Avg. k at 20 °C 2.2E-08 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 41.88 cm²
L = 7.08 cm

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1484	Tested By	MM
Project Name	Cumberland Ash	Test Date	09/11/09
Boring No.	B29A	Reviewed By	JM
Sample No.	1617A	Review Date	09/13/09
Sample Depth	50.2-50.7'	Lab No.	--
Sample Description	Brown Lean clay		

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Sample Data

Length, in		Diameter, in		Pan No.	A37
Location 1	2.534	Location 1	2.859	Dry Soil+Pan, grams	382.44
Location 2	2.536	Location 2	2.861	Pan Weight, grams	16.03
Location3	2.541	Location 3	2.853		
Average	2.537	Average	2.858	Moisture Content, %	35.5
		Wet Soil + Tare, grams	496.50	Wet Unit Weight, pcf	116.2
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	85.8

Remarks:

Chamber Pressure, psi	75
Back Pressure, psi	65
Confining Pressure, psi	10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				1890	5.3	178.9	5.40	178.8	7.6E-09	22	7.3E-09
				6960	5.3	178.9	5.60	178.6	6.2E-09	24	5.6E-09
				9300	5.3	178.9	5.80	178.4	7.7E-09	24	7.0E-09
				30800	5.3	178.9	6.90	177.3	7.5E-09	24	6.8E-09
				65090	5.3	178.9	8.80	176.2	7.0E-09	24	6.3E-09

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	na	N/A	Vertical

Avg. k at 20 °C 6.6E-09 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 41.38 cm²
L = 6.44 cm

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1484*	Tested By	*MM*
Project Name	*Cumberland Ash*	Test Date	*9/11/2009*
Boring No.	*B29A*	Reviewed By	*JM*
Sample No.	*1617A*	Review Date	*9/13/2009*
Sample Depth	*50.2-50.7'*	Lab No.	--
Sample Description	*Brown Lean clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*35.5*
Wet Unit Weight, pcf:	*116.2*
Dry Unit Weight, pcf:	*85.8*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***6.6E-09***

Remarks:

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1484*	Tested By	*MM*
Project Name	*Cumberland Ash*	Test Date	*9/10/2009*
Boring No.	*B-29A*	Reviewed By	*JM*
Sample No.	*1615*	Review Date	*9/13/2009*
Sample Depth	---	Lab No.	--
Sample Description	*Brown Lean clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*22.1*
Wet Unit Weight, pcf:	*123.1*
Dry Unit Weight, pcf:	*100.8*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***2.2E-08***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1484	Tested By	MM
Project Name	Cumberland Ash	Test Date	09/12/09
Boring No.	B-36A	Reviewed By	JM
Sample No.	1620	Review Date	09/15/09
Sample Depth	44.7-45.2	Lab No.	--
Sample Description	Gray Silt-ASH		

Sample Data

Length, in		Diameter, in		Pan No.	A-1
Location 1	2.286	Location 1	2.721	Dry Soil+Pan, grams	274.42
Location 2	2.287	Location 2	2.724	Pan Weight, grams	17.31
Location3	2.283	Location 3	2.720		
Average	2.285	Average	2.722	Moisture Content, %	41.3
		Wet Soil + Tare, grams	363.24	Wet Unit Weight, pcf	104.1
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	73.7

Remarks:

Chamber Pressure, psi	75
Back Pressure, psi	65
Confining Pressure, psi	10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				1841	3.3	205.5	6.70	188.7	7.1E-07	22	6.8E-07
				2055	3.3	205.5	8.10	187.3	7.3E-07	24	6.6E-07
				2699	3.3	205.5	11.30	184.1	7.2E-07	24	6.5E-07
				3099	3.3	205.5	12.90	182.5	7.0E-07	24	6.4E-07
				4224	3.3	205.5	19.10	176.3	7.4E-07	24	6.7E-07

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	na	N/A	Vertical

Avg. k at 20 °C 6.6E-07 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 37.53 cm²
L = 5.80 cm

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1484*	Tested By	*MM*
Project Name	*Cumberland Ash*	Test Date	*9/12/2009*
Boring No.	*B-36A*	Reviewed By	*JM*
Sample No.	*1620*	Review Date	*9/15/2009*
Sample Depth	*44.7-45.2*	Lab No.	--
Sample Description	*Gray Silt-ASH*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*41.3*
Wet Unit Weight, pcf:	*104.1*
Dry Unit Weight, pcf:	*73.7*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***6.6E-07***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1484	Tested By	MM
Project Name	Cumberland Ash	Test Date	09/08/09
Boring No.	B-37B	Reviewed By	JM
Sample No.	1624A	Review Date	9/11/.09
Sample Depth	---	Lab No.	--
Sample Description	Brown Lean clay		

GeoTesting express

Sample Data

Length, in		Diameter, in		Pan No.	A37
Location 1	2.457	Location 1	2.867	Dry Soil+Pan, grams	466.73
Location 2	2.461	Location 2	2.865	Pan Weight, grams	15.97
Location3	2.471	Location 3	2.859		
Average	2.463	Average	2.864	Moisture Content, %	18.0
		Wet Soil + Tare, grams	531.77	Wet Unit Weight, pcf	127.7
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	108.3

Remarks:

Chamber Pressure, psi	75
Back Pressure, psi	65
Confining Pressure, psi	10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				900	1.5	206.7	1.60	206.6	1.2E-08	22	1.2E-08
				1800	1.5	206.7	1.80	206.4	2.0E-08	24	1.8E-08
				3720	1.5	206.7	2.00	206.2	1.6E-08	24	1.4E-08
				7080	1.5	206.7	2.40	205.8	1.5E-08	24	1.4E-08
				11760	1.5	206.7	3.00	205.2	1.5E-08	24	1.4E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	na	N/A	Vertical

Avg. k at 20 °C 1.4E-08 cm/sec

a = area of burette in cm² | Ha = initial inlet head in cm | H_b = final inlet head in cm

L = length of sample in cm | H_1 = initial outlet head in cm | H_2 = final outlet head in cm

A = area of sample in cm² | t = time in seconds

a = 0.16 cm²

A = 41.55 cm²

L = 6.26 cm

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1484*	Tested By	*MM*
Project Name	*Cumberland Ash*	Test Date	*9/8/2009*
Boring No.	*B-37B*	Reviewed By	*JM*
Sample No.	*1624A*	Review Date	*9/11/.09*
Sample Depth	---	Lab No.	--
Sample Description	*Brown Lean clay*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*18.0*
Wet Unit Weight, pcf:	*127.7*
Dry Unit Weight, pcf:	*108.3*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***1.4E-08***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1490	Tested By	MM
Project Name	Cumberland Ash	Test Date	09/17/09
Boring No.	----	Reviewed By	JM
Sample No.	Bottom Ash	Review Date	09/21/09
Sample Depth	---	Lab No.	--
Sample Description	Bottom ASH		

GeoTesting express

Sample Data

Length, in		Diameter, in		Pan No.	B-28
Location 1	2.450	Location 1	2.872	Dry Soil+Pan, grams	407.71
Location 2	2.451	Location 2	2.871	Pan Weight, grams	58.73
Location3	2.449	Location 3	2.873		
Average	2.450	Average	2.872	Moisture Content, %	16.5
		Wet Soil + Tare, grams	406.57	Wet Unit Weight, pcf	97.6
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	83.8

Remarks:

Chamber Pressure, psi	75
Back Pressure, psi	65
Confining Pressure, psi	10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				120	10.1	99.6	11.10	98.5	2.4E-06	21.5	2.3E-06
				240	10.1	99.6	12.10	97.5	2.3E-06	21.5	2.3E-06
				480	10.1	99.6	14.20	95.4	2.4E-06	21.5	2.3E-06
				1020	10.1	99.6	18.20	91.4	2.3E-06	21.5	2.3E-06
				2210	10.1	99.6	27.20	82.4	2.6E-06	21.5	2.5E-06

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	103.7	N/A	Vertical

Avg. k at 20 °C 2.3E-06 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 41.80 cm²
L = 6.22 cm

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	***GTX-1490***	Tested By	***MM***
Project Name	***Cumberland Ash***	Test Date	***9/17/2009***
Boring No.	----	Reviewed By	***JM***
Sample No.	***Bottom Ash***	Review Date	***9/21/2009***
Sample Depth	---	Lab No.	--
Sample Description	***Bottom ASH***		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*16.5*
Wet Unit Weight, pcf:	*97.6*
Dry Unit Weight, pcf:	*83.8*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***2.3E-06***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1484	Tested By	MM
Project Name	Cumberland Ash	Test Date	09/08/09
Boring No.	---	Reviewed By	JM
Sample No.	Fly ASH	Review Date	09/11/09
Sample Depth	---	Lab No.	--
Sample Description	Black Fly ASH		

GeoTesting express

Sample Data

Length, in		Diameter, in		Pan No.	A2
Location 1	2.666	Location 1	2.867	Dry Soil+Pan, grams	293.67
Location 2	2.671	Location 2	2.865	Pan Weight, grams	19.01
Location3	2.673	Location 3	2.859		
Average	2.670	Average	2.864	Moisture Content, %	33.0
		Wet Soil + Tare, grams	365.33	Wet Unit Weight, pcf	80.9
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	60.9

Remarks:

Chamber Pressure, psi	75
Back Pressure, psi	65
Confining Pressure, psi	10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				120	1.5	206.7	1.90	206.3	4.2E-07	22	4.0E-07
				360	1.5	206.7	2.70	205.5	4.3E-07	24	3.9E-07
				2300	1.5	206.7	9.70	198.5	4.7E-07	24	4.3E-07
				3000	1.5	206.7	11.90	196.3	4.7E-07	24	4.2E-07
				20451	1.5	206.7	15.30	104.3	5.3E-07	24	4.8E-07

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	Remolded	83.6	72.8	Vertical

Avg. k at 20 °C 4.2E-07 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 41.55 cm²
L = 6.78 cm

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1484*	Tested By	*MM*
Project Name	*Cumberland Ash*	Test Date	*9/8/2009*
Boring No.	---	Reviewed By	*JM*
Sample No.	*Fly ASH*	Review Date	*9/11/2009*
Sample Depth	---	Lab No.	--
Sample Description	*Black Fly ASH*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*Remolded*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*33.0*
Wet Unit Weight, pcf:	*80.9*
Dry Unit Weight, pcf:	*60.9*
Compaction, %:	*72.8*
Hydraulic Conductivity, cm/sec. @20 °C	***4.2E-07***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

Project Number	GTX-1484	Tested By	MM
Project Name	Cumberland Ash	Test Date	09/18/09
Boring No.	----	Reviewed By	JM
Sample No.	----	Review Date	09/20/09
Sample Depth	---	Lab No.	--
Sample Description	Gypsum Bulk		

GeoTesting express

Sample Data

Length, in		Diameter, in		Pan No.	A41
Location 1	2.589	Location 1	2.872	Dry Soil+Pan, grams	375.20
Location 2	2.588	Location 2	2.874	Pan Weight, grams	19.56
Location3	2.585	Location 3	2.877		
Average	2.587	Average	2.874	Moisture Content, %	29.0
		Wet Soil + Tare, grams	458.77	Wet Unit Weight, pcf	104.1
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	80.7

Remarks:

Chamber Pressure, psi	75
Back Pressure, psi	65
Confining Pressure, psi	10

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				660	1.5	206.7	1.90	206.3	7.3E-08	22	7.0E-08
				1800	1.5	206.7	2.80	205.4	8.9E-08	24	8.1E-08
				6434	1.5	206.7	6.30	201.9	9.4E-08	24	8.5E-08
				14089	1.5	206.7	11.90	196.3	9.5E-08	24	8.6E-08
				20043	1.5	206.7	15.30	192.9	9.1E-08	24	8.2E-08

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	86.3	N/A	Vertical

Avg. k at 20 °C 8.1E-08 cm/sec

a = area of burette in cm²
L = length of sample in cm
A = area of sample in cm²

Ha = initial inlet head in cm
H_1 = initial outlet head in cm
t = time in seconds

H_b = final inlet head in cm
H_2 = final outlet head in cm

a = 0.16 cm²
A = 41.86 cm²
L = 6.57 cm

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	***GTX-1484***	Tested By	***MM***
Project Name	***Cumberland Ash***	Test Date	***9/18/2009***
Boring No.	----	Reviewed By	***JM***
Sample No.	----	Review Date	***9/20/2009***
Sample Depth	---	Lab No.	--
Sample Description	***Gypsum Bulk***		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*29.0*
Wet Unit Weight, pcf:	*104.1*
Dry Unit Weight, pcf:	*80.7*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***8.1E-08***

Remarks:

PERMEABILITY TEST
(ASTM D5084 - 90) (Method C, Increasing Tailwater Level)

GeoTesting express

Project Number	GTX-1484	Tested By	MM
Project Name	Cumberland Ash	Test Date	09/18/09
Boring No.	---	Reviewed By	JM
Sample No.	Gypsum REJECTS	Review Date	09/20/09
Sample Depth	---	Lab No.	---
Sample Description	Gypsum REJECTS		

Sample Data

Length, in		Diameter, in		Pan No.	B-12
Location 1	2.899	Location 1	2.875	Dry Soil+Pan, grams	422.72
Location 2	2.899	Location 2	2.875	Pan Weight, grams	56.76
Location3	2.899	Location 3	2.875		
Average	2.899	Average	2.875	Moisture Content, %	27.0
		Wet Soil + Tare, grams	464.77	Wet Unit Weight, pcf	94.1
		Tare Weight, grams	0.00	Dry Unit Weight, pcf	74.1

Remarks:

Chamber Pressure, psi	45
Back Pressure, psi	40
Confining Pressure, psi	5

Date Start	Date Finish	Time Start	Time Finish	Time (sec)	H_a (cm)	H_1 (cm)	H_b (cm)	H_2 (cm)	k cm/sec	Temp (°C)	k cm/sec at 20 °C
				240	10.1	99.6	10.40	99.2	4.6E-07	22	4.4E-07
				660	10.1	99.6	11.20	98.4	5.5E-07	22	5.3E-07
				1305	10.1	99.6	12.40	97.2	5.8E-07	22	5.6E-07
				2044	10.1	99.6	13.80	95.8	6.0E-07	22	5.8E-07
				3500	10.1	99.6	16.60	94.4	5.6E-07	22	5.4E-07

No. of Trials	Sample Type	Max. Density (pcf)	Compaction %	Sample Orientation
5	UD	86.2	N/A	Vertical

Avg. k at 20 °C 5.3E-07 cm/sec

a = area of burette in cm² | Ha = initial inlet head in cm | H_b = final inlet head in cm | a = 0.16 cm²

L = length of sample in cm | H_1 = initial outlet head in cm | H_2 = final outlet head in cm | A = 41.88 cm²

A = area of sample in cm² | t = time in seconds | L = 7.36 cm

GeoTesting express

HYDRAULIC CONDUCTIVITY

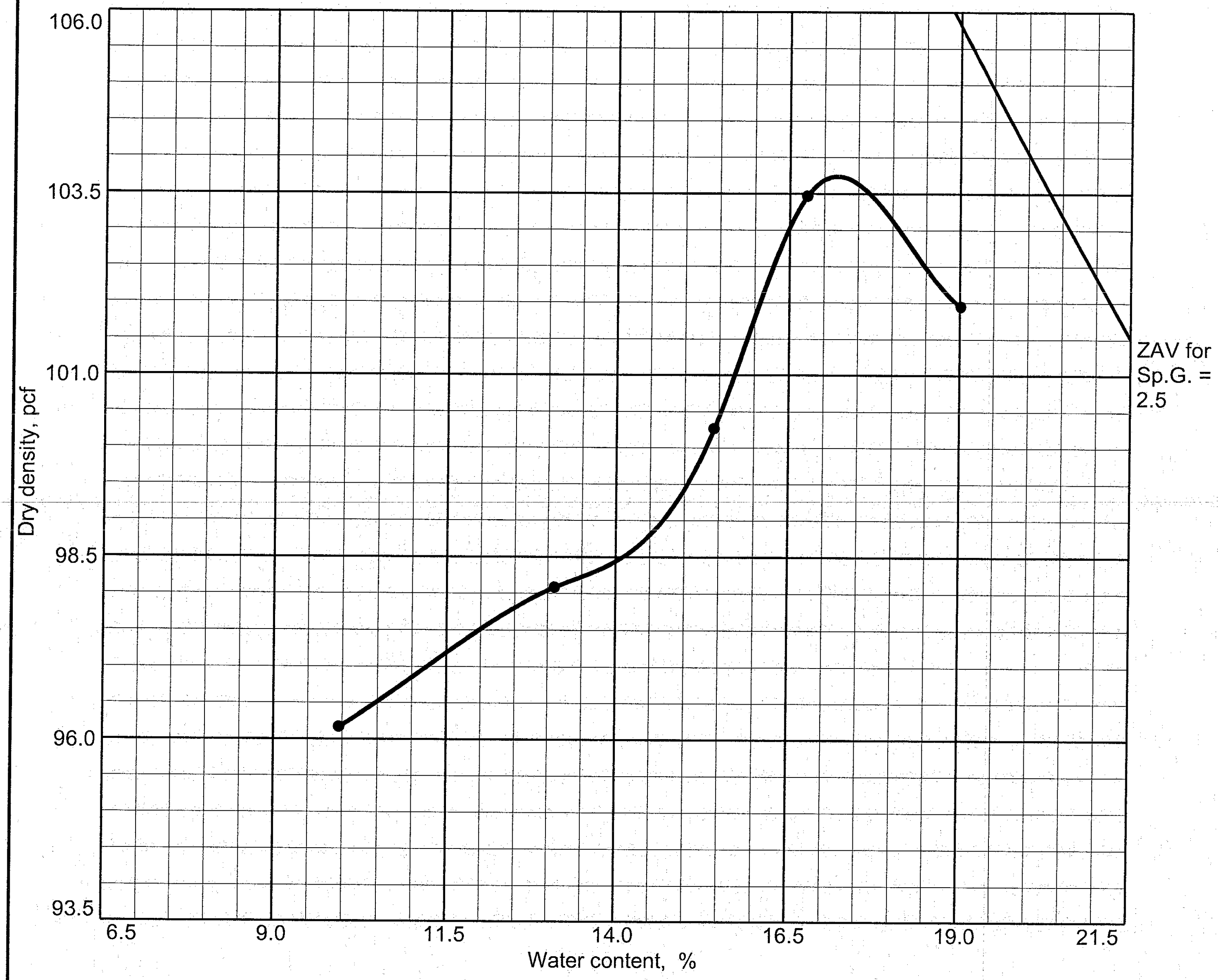
Project No.	*GTX-1484*	Tested By	*MM*
Project Name	*Cumberland Ash*	Test Date	*9/18/2009*
Boring No.	---	Reviewed By	*JM*
Sample No.	*Gypsum REJECTS*	Review Date	*9/20/2009*
Sample Depth	---	Lab No.	---
Sample Description	*Gypsum REJECTS*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*27.0*
Wet Unit Weight, pcf:	*94.1*
Dry Unit Weight, pcf:	*74.1*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***5.3E-07***

Remarks: ___________________

COMPACTION TEST REPORT



Test specification: ASTM D 698-78 Method C Standard
Oversize correction applied to each point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
				2.5				

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 103.7 pcf Optimum moisture = 17.2 %	

Project No. GTX-1484 **Client:** STANTEC
Project: Cumberland Fossil Plant (Ash and Gypsum Stacks)

● **Source:** **Sample No.:** Bottom Ash

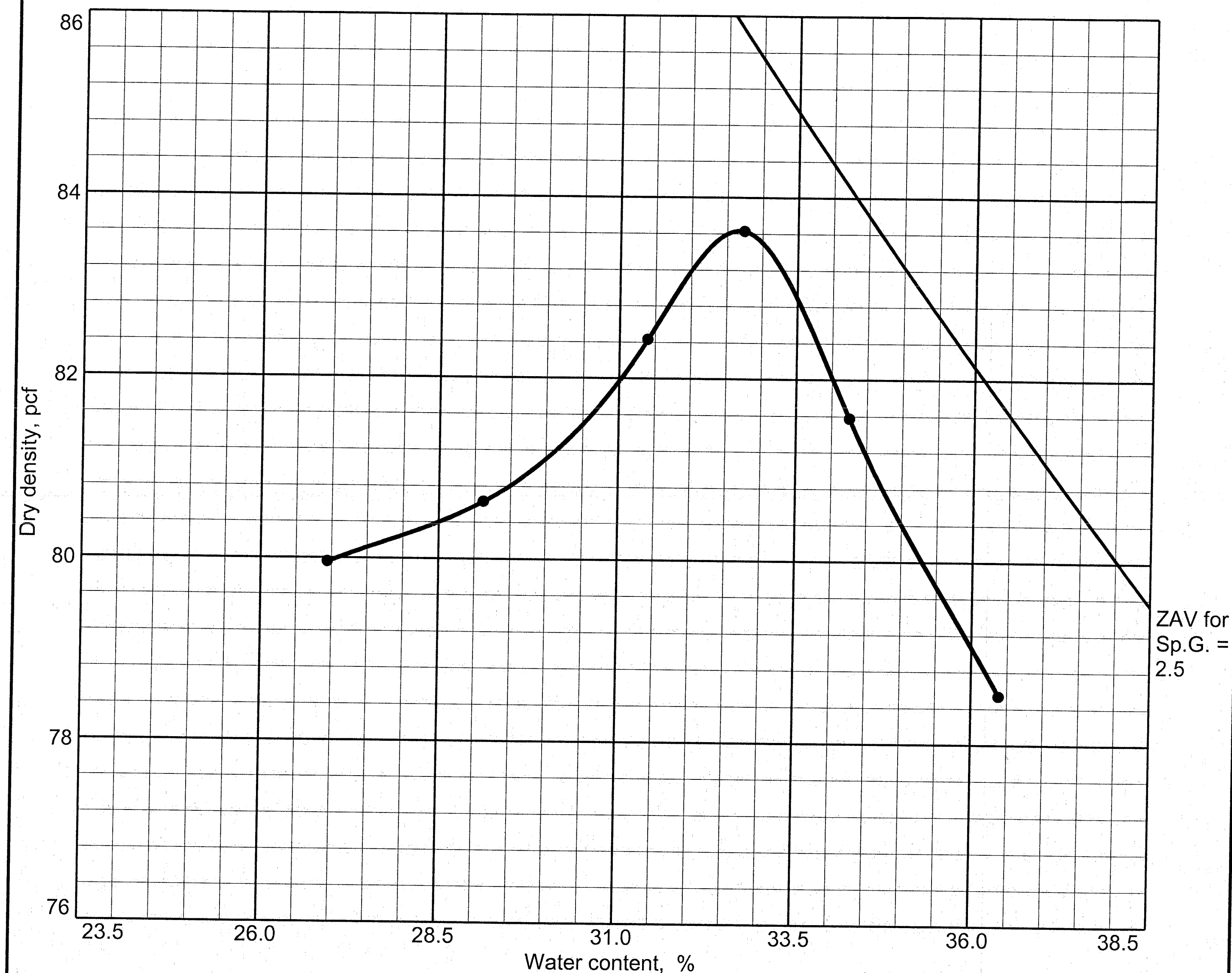
COMPACTION TEST REPORT

GeoTesting Express Inc.

Remarks:

Lab no.

COMPACTION TEST REPORT



Test specification: ASTM D 698-78 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
				2.5			0.0	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 83.6 pcf Optimum moisture = 32.7 %	

Project No. GTX-1484 **Client:** STANTEC

Project: Cumberland Fossil Plant (Ash and Gypsum Stacks)

Remarks:

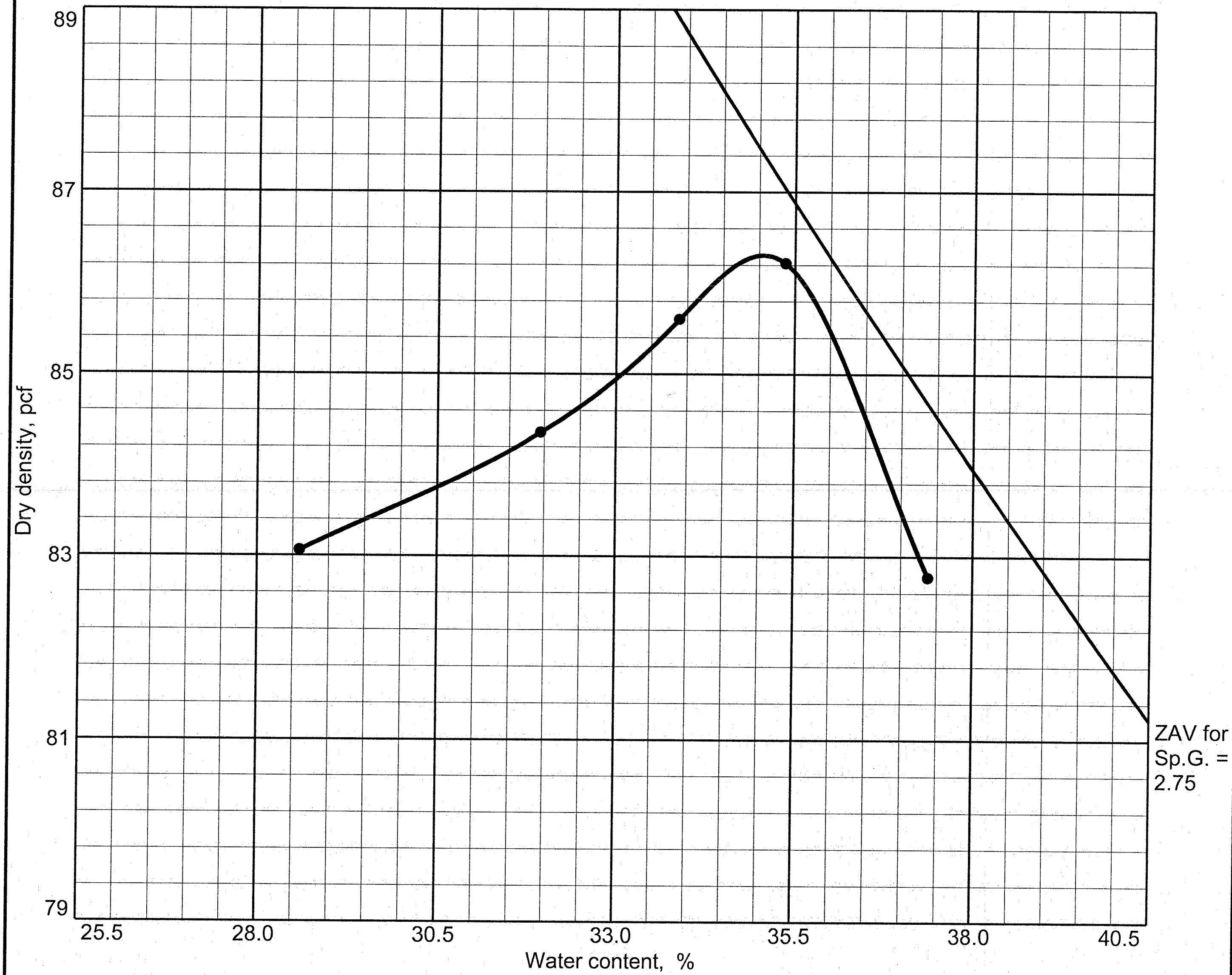
● **Source:** **Sample No.:** FlY ASH (BULK)

COMPACTION TEST REPORT

GeoTesting Express Inc.

Lab no.

COMPACTION TEST REPORT



Test specification: ASTM D 698-78 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
				2.75				

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 86.3 pcf Optimum moisture = 35.1 %	

Project No. GTX-1484 **Client:** STANTEC
Project: Cumberland Fossil Plant (Ash and Gypsum Stacks)

● **Source:** **Sample No.:** Gypsum Bulk

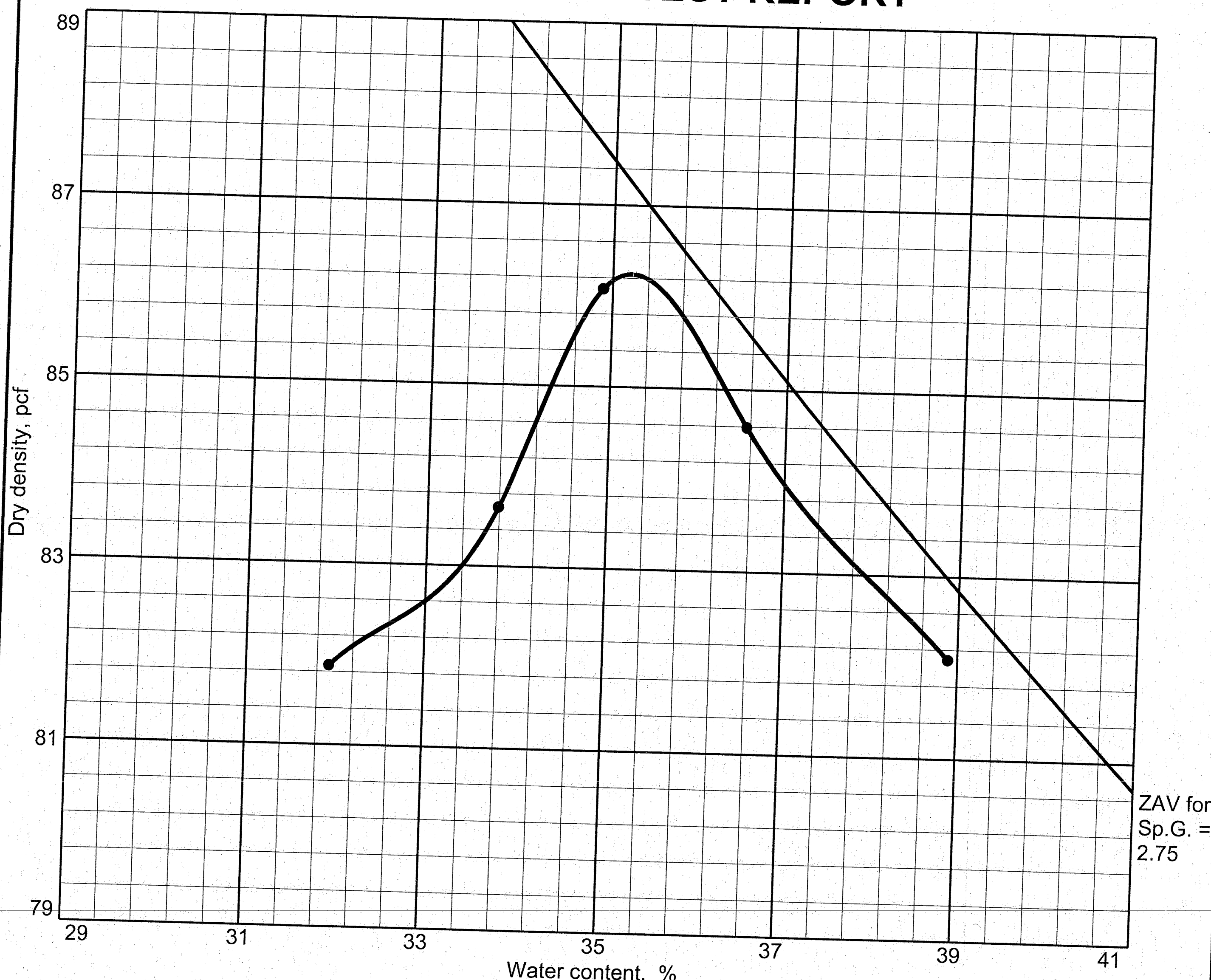
Remarks:

COMPACTION TEST REPORT

GeoTesting Express Inc.

Lab no.

COMPACTION TEST REPORT



Test specification: ASTM D 698-78 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	ML	A-4(0)		2.75	33	1	0.0	92.6

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 86.2 pcf Optimum moisture = 35.2 %	

Project No. GTX-1484 **Client:** STANTEC

Project: Cumberland Fossil Plant (Ash and Gypsum Stacks)

● **Source:** **Sample No.:** Gypsum Rejects

Remarks:

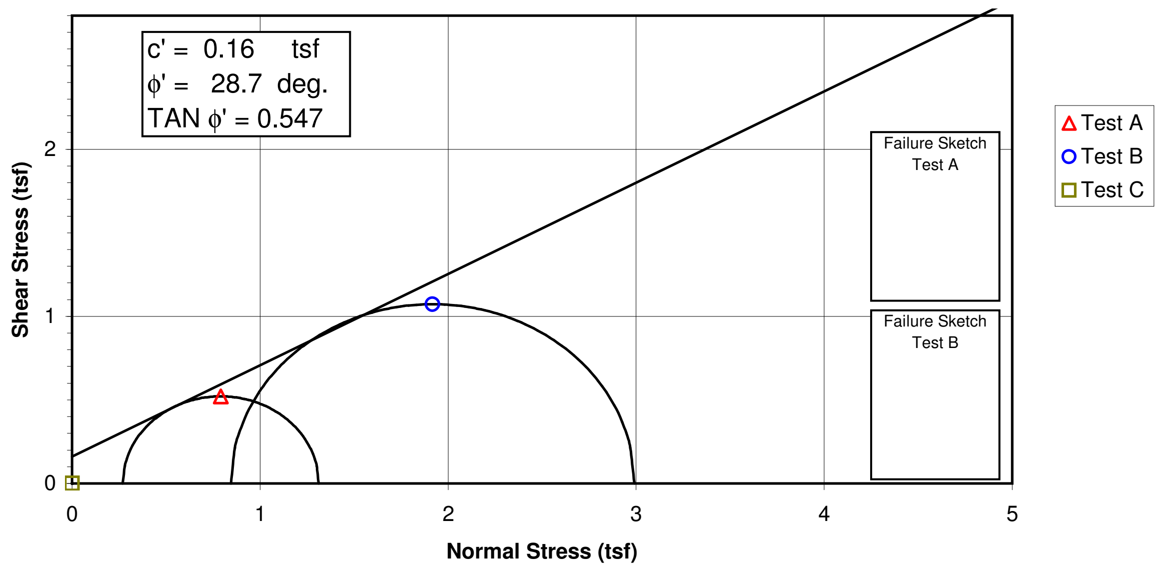
COMPACTION TEST REPORT

GeoTesting Express Inc.

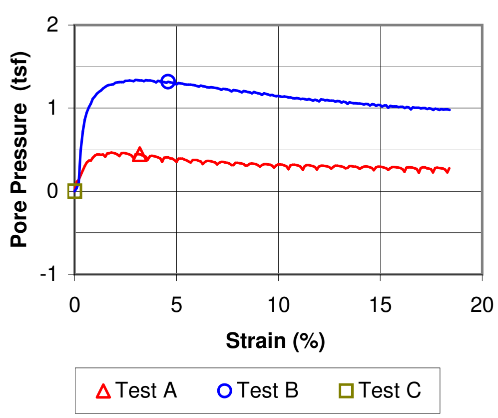
Lab no.

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



			A	B	C	
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	24.3	25.2	######	
	Dry Density PCF	γ_{d_o}	96.0	97.1	######	
	Saturation %	S_o	89.6	95.5	######	
	Void Ratio	e_o	0.716	0.698	######	
After Shear	Water content %	W_f	23.6	23.2	######	
	Dry Density PCF	γ_{d_f}	101.5	102.2	######	
	Saturation %	S_f	100.0	100.0	######	
	Void Ratio	e_f	0.623	0.612	######	
	Final Back Pressure TSF	u_c	5.76	4.32	0.00	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.27	0.85	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.04	2.15	0.00	
Time to $(\sigma 1'-\sigma 3')max$ min.		t_f	40.7	151.0	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	0.00	
Initial Diameter, in.		D_o	2.851	2.878	######	
Initial Height, in.		H_o	6.002	5.981	######	

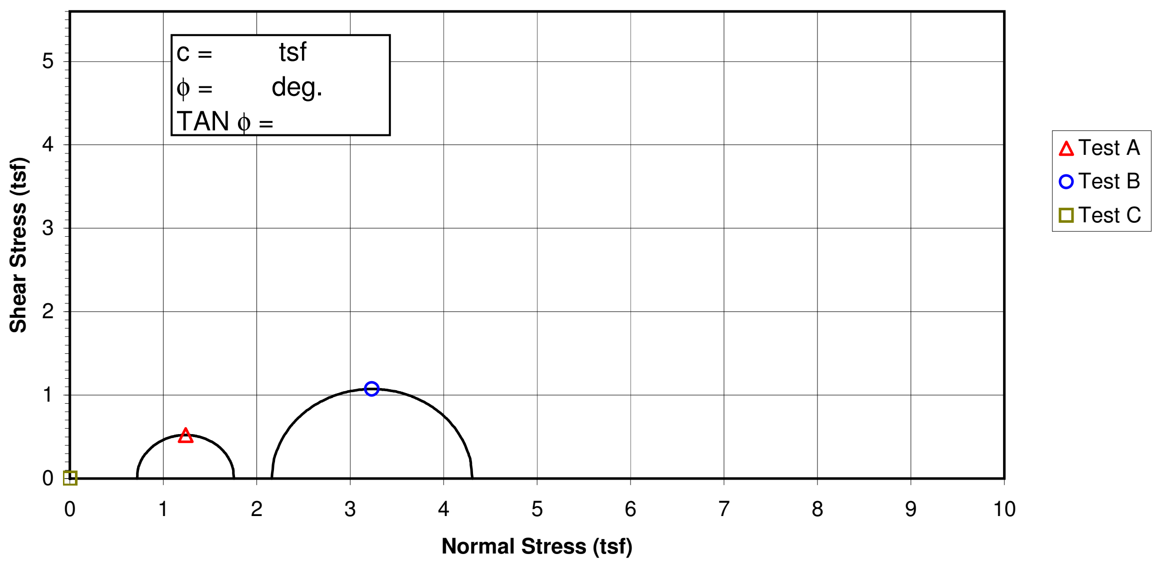
Controlled - Strain Test

Description of Specimens Lean Clay (CL), brown, moist, soft

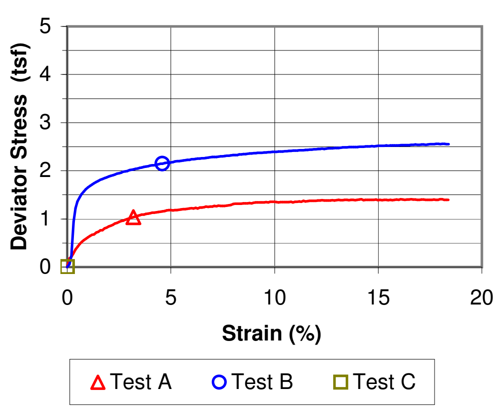
			Type of Specimen Undisturbed	Type of test $\bar{R}$
LL	PL	PI	Gs 2.64	Project Cumberland Dry Ash Stack and Gypsum Disposal Area
Remarks:				
			Boring No. B-5	Sample No. 1257
			Depth Elev. 18.0'-18.5', 18.6'-19.1'	
			Laboratory Stantec	Date 8-19-09
			TRIAXIAL COMPRESSION TEST REPORT	

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	24.3	25.2	######
	Dry Density PCF	γ_{d_o}	96.0	97.1	######
	Saturation %	S_o	89.6	95.5	######
	Void Ratio	e_o	0.716	0.698	######
After Shear	Water content %	W_f	23.6	23.2	######
	Dry Density PCF	γ_{d_f}	101.5	102.2	######
	Saturation %	S_f	100.0	100.0	######
	Void Ratio	e_f	0.623	0.612	######
	Final Back Pressure TSF	u_c	5.76	4.32	0.00
Minor Principal Stress TSF		σ_3	0.72	2.16	0.00
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	1.04	2.15	0.00
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	40.7	151.0	0.0
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	0.00
Initial Diameter, in.		D_o	2.851	2.878	######
Initial Height, in.		H_o	6.002	5.981	######

Controlled - Strain Test

Description of Specimens Lean Clay (CL), brown, moist, soft

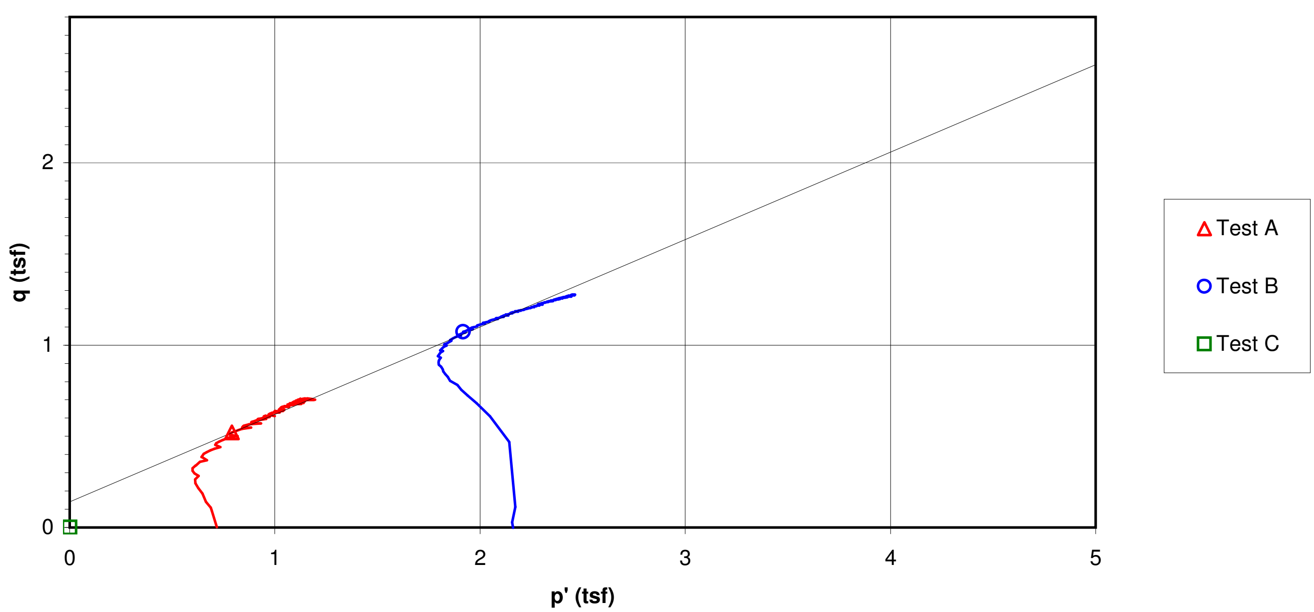
LL	PL	PI	Gs 2.64	Project	Cumberland Dry Ash Stack and Gypsum Disposal Area
				Type of Specimen	Undisturbed — Type of test $\overline{R}$
Remarks:				Boring No.	B-5 — Sample No. 1257
				Depth Elev.	18.0'-18.5', 18.6'-19.1'
				Laboratory	Stantec — Date 8-19-09

TRIAXIAL COMPRESSION TEST REPORT

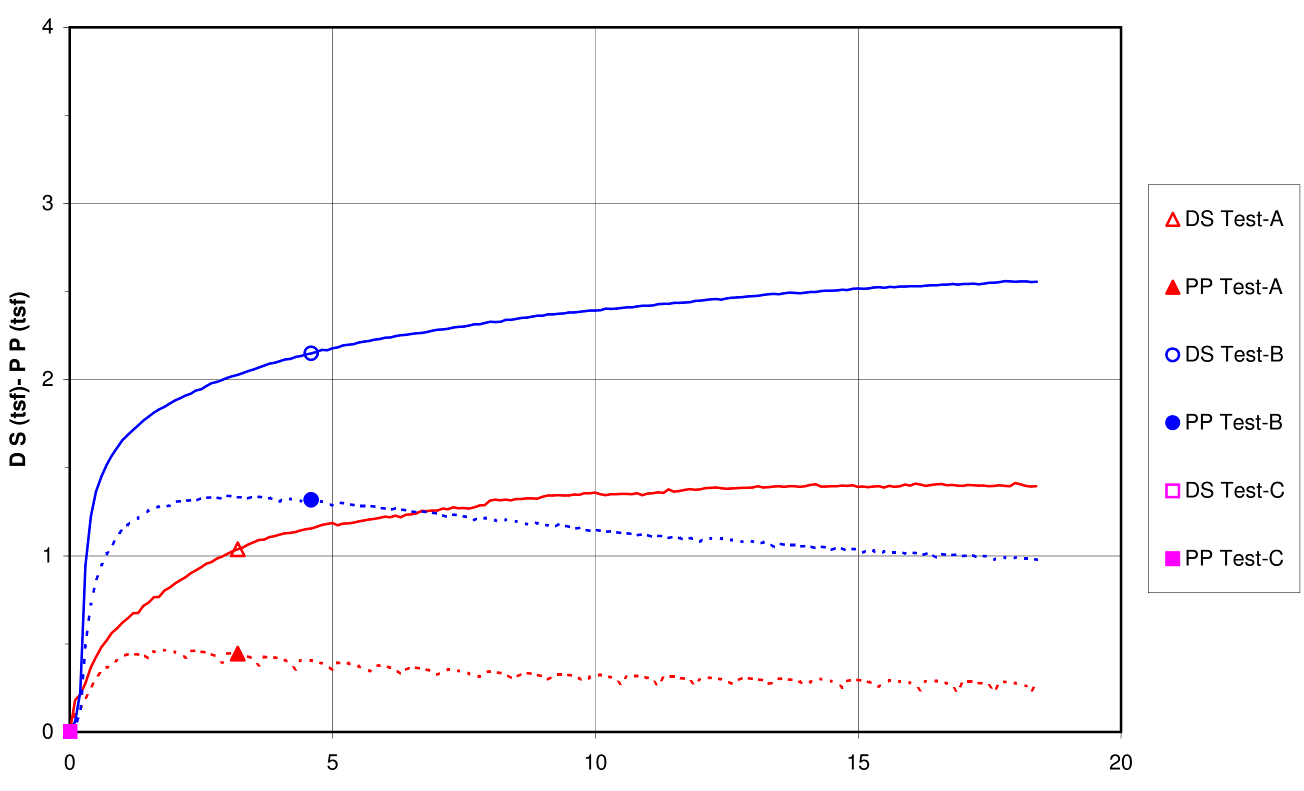
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project No.	175539009
Sample ID	B-5, 18.0'-18.5' & B-5, 18.6'-19.1'	Test Number	1257
Failure Criterion:	Maximum Effective Principal Stress Ratio φ' = 28.7 deg.	c' =	0.16 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



Stantec

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Sample Identification	B-5, 18.0'-18.5'	Test Number	CU-1257A
Visual Description	Lean Clay (CL), brown, moist, soft	Prepared By	CM
Undisturbed	Source B-5, 18.0'-20.0'	Date	7-24-2009

Specific Gravity 2.64 ASTM D854 Method A   Liquid Limit N/A   Plastic Limit N/A   Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in^3)		Specimen	
Top	2.869	1	5.991	Sample	38.3756 (V_o)	Wet Weight (g)	1200.80
Middle	2.845	2	6.019	Solids	22.3297 (VS_o)	Dry Weight (g)	966.08
Bottom	2.846	3	6.005	Water	14.3223 (Vw_o)	Wet Unit Weight (pcf)	119.2
Avg.	2.8533 (D_o)	4	5.991	Voids	16.0458 (Vv_o)	Dry Unit Weight (pcf)	95.9
Area (in^2)	6.3943 (A_o)	Avg. (H_o)	6.0015	Degree of Saturation (%)	89.3 (S_o)		
Moisture Content (%)	24.3	Final Trimmings		Void Ratio	0.719		

Saturation

Set Up & Saturated: Wet xx Dry ____   Set up By KDG

Back Pressure Saturated to: 80 (psi)   Final Pore Pressure Parameter B 0.96   Date 8-13-09

Panel Board Number A

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1213	Initial	16.13 (in.)	Initial	10.94 (in.)	Specimen Height (in.)	5.9983 (H_s)
Final	0.1245	Final	11.58 (in.)	Final	5.13 (in.)	Area (in^2) Method A	6.3875 (A_s)
Change	-0.0032 (ΔH_o)	Change	-4.55 (in.)	Change	-5.81 (in.)	Specimen Volume (in^3)	38.31 (Vs)

Consolidation

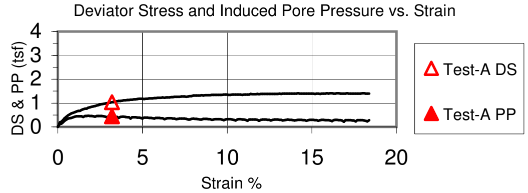
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1245	Initial	1.22 (in.)	Initial	17.53 (in.)	Chamber	90
Final	0.1281	Final	3.96 (in.)	Final	14.63 (in.)	Back	80
Change	-0.0036 (ΔH_c)	Change	-2.74 (in.)	Change	-2.90 (in.)	Lateral	10 (σ_3)
Height (in.)	5.9947 (H_c)			Volume (in^3)	36.2414 (V_c)		
Area (in^3) Method B	6.0456 (A_c)			Volume - Water (in^3)	13.9117 (VWc)	t_{50} (min.)	2.362
Diameter (in.)	2.7744 (D_c)			Water Content (%)	23.6		
Dry Density (pcf)	101.5			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.623

After Test

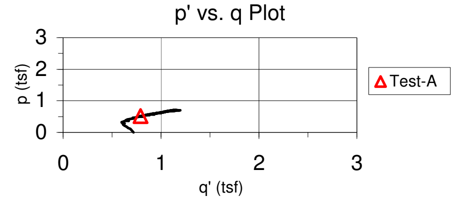
Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.185 (in.)	Wet Weight (g)	1194.07	Corrected Deviator	1.04 σ_d (tsf)
Wet weight (g)	1194.07 (WWf)	Dry Weight (g)	966.08	Major Principal	1.31 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.161 (in.)	Tare Weight (g)	0.00	Minor Principal	0.27 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.079
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	3.20
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch

Deviator Stress and Induced Pore Pressure vs. Strain



p' vs. q Plot



Comments:

Stantec

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Sample Identification	B-5, 18.6'-19.1'	Test Number	CU-1257B
Visual Description	Lean Clay (CL), brown, moist, firm	Prepared By	CM
Undisturbed	Source B-5, 18.0'-20.0'	Date	7-24-2009

Specific Gravity 2.64 ASTM D854 Method A | Liquid Limit N/A | Plastic Limit N/A | Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in3)		Specimen	
Top	2.885	1	5.984	Sample	38.9528 (V_o)	Wet Weight (g)	1242.10
Middle	2.874	2	5.979	Solids	22.9232 (VS_o)	Dry Weight (g)	991.76
Bottom	2.880	3	5.977	Water	15.2756 (Vw_o)	Wet Unit Weight (pcf)	121.5
Avg.	2.8797 (D_o)	4	5.984	Voids	16.0296 (Vv_o)	Dry Unit Weight (pcf)	97.0
Area (in^2)	6.5129 (A_o)	Avg. (H_o)	5.9809	Degree of Saturation (%)	95.3 (S_o)		
Moisture Content (%)	25.2	Final Trimmings		Void Ratio	0.699		

Saturation

Set Up & Saturated: Wet xx Dry ____ Set up By KDG

Back Pressure Saturated to: 60 (psi) Final Pore Pressure Parameter B 0.99 Date 8-13-09

Panel Board Number B

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1153	Initial	16.49 (in.)	Initial	10.86 (in.)	Specimen Height (in.)	5.9817 (H_s)
Final	0.1145	Final	13.45 (in.)	Final	4.36 (in.)	Area (in^2) Method A	6.5146 (A_s)
Change	0.0008 (ΔH_o)	Change	-3.04 (in.)	Change	-6.50 (in.)	Specimen Volume (in^3)	38.97 (V_s)

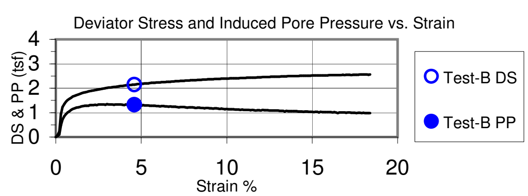
Consolidation

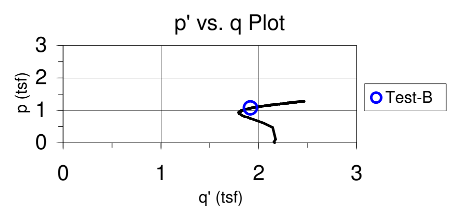
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1106	Initial	1.16 (in.)	Initial	17.61 (in.)	Chamber	90
Final	0.1806	Final	9.26 (in.)	Final	9.22 (in.)	Back	60
Change	-0.0700 (ΔH_c)	Change	-8.10 (in.)	Change	-8.39 (in.)	Lateral	30 (σ_3)
Height (in.)	5.9117 (H_c)			Volume (in^3)	36.9632 (V_c)		
Area (in^3) Method B	6.2526 (A_c)			Volume - Water (in^3)	14.0399 (VWc)	D_{50} (min.)	17
Diameter (in.)	2.8215 (D_c)			Water Content (%)	23.2		
Dry Density (pcf)	102.2			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.612

After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.423 (in.)	Wet Weight (g)	1221.85	Corrected Deviator	2.15 σ_d (tsf)
Wet weight (g)	1221.85 (WWf)	Dry Weight (g)	991.76	Major Principal	2.99 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.399 (in.)	Tare Weight (g)	0.00	Minor Principal	0.85 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.030
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	4.60
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch





Comments:

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				
Height	5.995	(in.)	15.227	(cm)
Diameter	2.775	(in)	7.047	(cm)
Area	6.046	(in^2)	39.006	(cm^2)

Final Values		
Height	4.892	(in.)
Dia. avg.	3.111	(in)
Area avg.	7.603	(in^2)

Tested By	KDG
Date	8-14-09
Press No.	1
Panel No.	A

Project Number	175539009
Test Number	CU-1257A
Data File ID	1257A
Lateral Pressure (psi)	10.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	9.7	-0.022	80.1	5.995	0.00	39.0060	0.0	0.000	0.000	0.720	0.720	0.715	0.718	0.002	1.007
0:01:03	25.0	-0.016	81.7	5.988	0.11	39.0471	15.3	0.182	0.182	0.902	0.786	0.600	0.693	0.093	1.311
0:01:58	27.6	-0.010	82.0	5.983	0.20	39.0846	17.9	0.213	0.212	0.932	0.796	0.579	0.688	0.108	1.374
0:03:14	33.0	-0.004	82.7	5.977	0.30	39.1234	23.3	0.277	0.276	0.996	0.805	0.524	0.665	0.140	1.536
0:04:27	40.7	0.002	83.6	5.971	0.40	39.1631	31.0	0.368	0.367	1.087	0.833	0.462	0.647	0.186	1.805
0:05:48	45.7	0.008	84.3	5.965	0.50	39.2029	36.0	0.427	0.426	1.146	0.841	0.411	0.626	0.215	2.049
0:07:08	50.4	0.014	84.9	5.959	0.60	39.2424	40.7	0.482	0.481	1.201	0.856	0.370	0.613	0.243	2.311
0:08:27	54.0	0.020	85.2	5.952	0.70	39.2828	44.3	0.524	0.522	1.242	0.875	0.348	0.612	0.263	2.514
0:09:46	57.3	0.026	85.2	5.947	0.80	39.3208	47.6	0.563	0.561	1.281	0.911	0.345	0.628	0.283	2.639
0:11:04	59.7	0.032	85.7	5.941	0.90	39.3605	50.0	0.590	0.588	1.308	0.905	0.312	0.608	0.297	2.902
0:12:22	62.3	0.038	86.0	5.935	1.00	39.3999	52.6	0.621	0.619	1.339	0.910	0.287	0.598	0.312	3.176
0:13:41	64.7	0.044	86.2	5.929	1.10	39.4405	55.0	0.648	0.646	1.366	0.924	0.274	0.599	0.325	3.377
0:15:00	67.2	0.050	86.2	5.923	1.20	39.4809	57.5	0.677	0.674	1.394	0.952	0.273	0.612	0.339	3.489
0:16:13	67.4	0.056	86.2	5.917	1.30	39.5199	57.8	0.680	0.676	1.396	0.957	0.276	0.616	0.341	3.471
0:17:33	70.9	0.062	86.2	5.911	1.40	39.5600	61.2	0.719	0.716	1.436	0.995	0.274	0.634	0.360	3.629
0:18:48	72.5	0.068	85.8	5.905	1.50	39.5996	62.8	0.737	0.733	1.453	1.037	0.299	0.668	0.369	3.465
0:20:08	75.2	0.074	86.4	5.899	1.60	39.6400	65.5	0.768	0.764	1.484	1.031	0.262	0.646	0.384	3.936
0:21:27	75.5	0.080	86.4	5.893	1.70	39.6801	65.8	0.771	0.767	1.487	1.028	0.256	0.642	0.386	4.012
0:22:48	78.7	0.086	86.5	5.887	1.80	39.7212	69.0	0.808	0.803	1.523	1.058	0.250	0.654	0.404	4.235
0:24:10	80.2	0.092	86.5	5.881	1.90	39.7610	70.5	0.824	0.820	1.540	1.080	0.255	0.668	0.412	4.228
0:25:30	82.3	0.098	86.4	5.875	2.00	39.8024	72.6	0.848	0.843	1.563	1.110	0.261	0.685	0.424	4.244
0:26:51	83.9	0.104	86.2	5.869	2.10	39.8431	74.2	0.866	0.860	1.580	1.139	0.273	0.706	0.433	4.165
0:28:08	85.5	0.110	85.9	5.863	2.20	39.8833	75.8	0.884	0.878	1.598	1.175	0.292	0.734	0.441	4.020
0:29:24	87.6	0.116	86.4	5.857	2.30	39.9242	77.9	0.907	0.901	1.621	1.162	0.256	0.709	0.453	4.534
0:30:42	89.1	0.122	86.5	5.851	2.40	39.9646	79.4	0.924	0.918	1.638	1.176	0.253	0.715	0.461	4.643
0:32:00	90.7	0.128	86.4	5.845	2.50	40.0061	81.0	0.942	0.935	1.655	1.199	0.258	0.729	0.470	4.638
0:33:18	92.5	0.134	86.3	5.839	2.60	40.0468	82.8	0.962	0.955	1.675	1.225	0.265	0.745	0.480	4.623
0:34:29	93.5	0.140	86.2	5.833	2.70	40.0877	83.8	0.972	0.965	1.685	1.243	0.272	0.757	0.485	4.562
0:35:44	95.3	0.146	86.0	5.827	2.80	40.1292	85.6	0.992	0.985	1.705	1.276	0.286	0.781	0.495	4.457
0:36:56	96.4	0.152	85.6	5.821	2.90	40.1706	86.7	1.003	0.996	1.716	1.319	0.318	0.819	0.501	4.144
0:38:09	97.9	0.158	86.2	5.815	3.00	40.2118	88.2	1.020	1.013	1.733	1.288	0.271	0.779	0.509	4.759
0:39:28	99.2	0.164	86.3	5.809	3.10	40.2540	89.5	1.034	1.026	1.746	1.299	0.268	0.783	0.516	4.850
0:40:42	100.3	0.170	86.3	5.803	3.20	40.2946	90.6	1.045	1.037	1.757	1.312	0.270	0.791	0.521	4.867
0:41:54	101.3	0.176	86.1	5.797	3.30	40.3361	91.6	1.056	1.048	1.768	1.332	0.279	0.806	0.526	4.767
0:43:09	102.9	0.182	86.0	5.791	3.40	40.3779	93.2	1.073	1.065	1.785	1.356	0.287	0.822	0.535	4.728
0:44:26	104.1	0.188	85.8	5.785	3.50	40.4204	94.4	1.086	1.078	1.798	1.382	0.299	0.840	0.541	4.618
0:45:42	105.3	0.193	85.3	5.779	3.60	40.4617	95.6	1.099	1.090	1.810	1.431	0.336	0.884	0.548	4.259
0:46:56	105.5	0.200	85.9	5.773	3.70	40.5040	95.8	1.100	1.091	1.811	1.388	0.292	0.840	0.548	4.747
0:48:09	107.0	0.206	86.0	5.767	3.80	40.5462	97.3	1.116	1.107	1.827	1.401	0.290	0.845	0.556	4.839
0:49:23	107.5	0.211	85.9	5.761	3.90	40.5880	97.8	1.121	1.111	1.831	1.408	0.292	0.850	0.558	4.824
0:50:38	108.5	0.218	85.8	5.755	4.00	40.6305	98.8	1.130	1.120	1.840	1.425	0.300	0.862	0.563	4.755
0:51:54	109.3	0.224	85.7	5.749	4.10	40.6730	99.6	1.138	1.128	1.848	1.440	0.307	0.873	0.566	4.690
0:53:10	109.6	0.229	85.6	5.743	4.20	40.7151	99.9	1.141	1.131	1.851	1.454	0.319	0.886	0.568	4.564
0:54:28	110.2	0.235	85.0	5.737	4.30	40.7577	100.5	1.146	1.136	1.856	1.502	0.362	0.932	0.570	4.152
0:55:44	111.0	0.241	85.7	5.731	4.40	40.8001	101.3	1.155	1.144	1.864	1.460	0.311	0.886	0.574	4.690
0:57:03	111.8	0.248	85.7	5.725	4.50	40.8440	102.1	1.162	1.151	1.871	1.463	0.307	0.885	0.578	4.764
0:58:20	112.4	0.253	85.7	5.719	4.60	40.8856	102.7	1.168	1.156	1.876	1.469	0.308	0.889	0.580	4.766
0:59:38	113.2	0.259	85.6	5.713	4.70	40.9284	103.5	1.176	1.164	1.884	1.489	0.320	0.905	0.585	4.649
1:00:50	114.3	0.265	85.5	5.707	4.80	40.9714	104.6	1.187	1.175	1.895	1.504	0.325	0.915	0.590	4.632
1:02:09	114.9	0.271	85.3	5.701	4.90	41.0149	105.2	1.193	1.180	1.900	1.523	0.338	0.930	0.593	4.507
1:03:28	115.5	0.277	85.0	5.695	5.00	41.0579	105.8	1.198	1.185	1.905	1.553	0.363	0.958	0.595	4.280
1:04:42	114.6	0.283	85.5	5.689	5.10	41.1010	104.9	1.186	1.174	1.894	1.502	0.324	0.913	0.589	4.638
1:05:57	115.5	0.289	85.5	5.683	5.20	41.1439	105.8	1.195	1.183	1.903	1.510	0.322	0.916	0.594	4.683
1:07:14	115.8	0.295	85.5	5.677	5.30	41.1873	106.1	1.198	1.185	1.905	1.514	0.324	0.919	0.595	4.675
1:08:31	116.3	0.301	85.4	5.671	5.40	41.2309	106.6	1.202	1.189	1.909	1.527	0.333	0.930	0.597	4.585
1:09:47	117.1	0.307	85.3	5.665	5.50	41.2750	107.4	1.210	1.196	1.916	1.543	0.342	0.942	0.600	4.515
1:11:06	117.6	0.313	85.1	5.659	5.60	41.3182	107.9	1.214	1.200	1.920	1.561	0.356	0.959	0.603	4.384
1:12:24	118.3	0.319	84.9	5.653	5.70	41.3625	108.6	1.221	1.206	1.926	1.580	0.369	0.974	0.606	4.284
1:13:42	118.7	0.325	85.3	5.647	5.80	41.4060	109.0	1.224	1.210	1.930	1.554	0.339	0.947	0.607	4.581
1:14:59	119.3	0.331	85.3	5.641	5.90	41.4498	109.6	1.230	1.215	1.935	1.557	0.337	0.947	0.610	4.622

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values		Tested By	KDG	Project Number	175539009
Height	5.995 (in.)	15.227 (cm)		Height	4.892 (in.)	Date	8-14-09	Test Number	CU-1257A
Diameter	2.775 (in)	7.047 (cm)		Dia. avg.	3.111 (in)	Press No.	1	Data File ID	1257A
Area	6.046 (in²)	39.006 (cm²)		Area avg.	7.603 (in²)	Panel No.	A	Lateral Pressure (psi)	10.0
								Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
1:16:22	120.1	0.337	85.3	5.635	6.00	41.4944	110.4	1.237	1.222	1.942	1.567	0.340	0.954	0.614	4.606
1:17:41	119.9	0.343	85.1	5.629	6.10	41.5384	110.2	1.234	1.219	1.939	1.573	0.350	0.961	0.612	4.499
1:18:59	120.9	0.349	85.0	5.623	6.20	41.5825	111.2	1.244	1.228	1.948	1.592	0.359	0.975	0.617	4.438
1:20:18	120.2	0.355	84.6	5.617	6.30	41.6268	110.5	1.234	1.219	1.939	1.610	0.387	0.999	0.612	4.161
1:21:35	121.7	0.361	85.0	5.611	6.40	41.6713	112.0	1.250	1.234	1.954	1.599	0.360	0.979	0.619	4.438
1:22:51	122.0	0.367	85.2	5.605	6.50	41.7161	112.3	1.252	1.236	1.956	1.590	0.349	0.969	0.620	4.553
1:24:03	122.7	0.373	85.1	5.599	6.60	41.7601	113.0	1.258	1.241	1.961	1.597	0.351	0.974	0.623	4.552
1:25:16	124.0	0.379	85.1	5.593	6.69	41.8047	114.3	1.271	1.255	1.975	1.615	0.355	0.985	0.630	4.543
1:26:33	124.0	0.385	85.0	5.587	6.80	41.8505	114.3	1.270	1.253	1.973	1.619	0.362	0.990	0.629	4.478
1:27:46	124.6	0.391	84.9	5.581	6.89	41.8946	114.9	1.275	1.258	1.978	1.633	0.371	1.002	0.631	4.406
1:29:00	124.7	0.397	84.6	5.575	7.00	41.9403	115.0	1.275	1.258	1.978	1.654	0.391	1.022	0.631	4.230
1:30:15	125.8	0.403	84.8	5.569	7.09	41.9847	116.1	1.286	1.268	1.988	1.647	0.374	1.010	0.636	4.406
1:31:30	125.6	0.409	85.0	5.563	7.20	42.0306	115.9	1.282	1.264	1.984	1.630	0.361	0.996	0.634	4.513
1:32:44	126.6	0.415	85.0	5.557	7.30	42.0758	117.0	1.292	1.274	1.994	1.641	0.362	1.001	0.640	4.536
1:33:56	126.4	0.421	84.9	5.551	7.40	42.1209	116.7	1.289	1.270	1.990	1.644	0.369	1.006	0.638	4.456
1:35:12	126.7	0.427	84.8	5.545	7.49	42.1663	117.0	1.290	1.272	1.992	1.649	0.372	1.011	0.638	4.428
1:36:28	126.4	0.433	84.7	5.539	7.59	42.2116	116.7	1.286	1.267	1.987	1.654	0.383	1.019	0.636	4.325
1:37:40	127.3	0.439	84.4	5.533	7.69	42.2576	117.6	1.294	1.275	1.995	1.681	0.401	1.041	0.640	4.196
1:38:56	128.5	0.445	84.4	5.527	7.80	42.3041	118.8	1.306	1.287	2.007	1.691	0.400	1.046	0.646	4.228
1:40:11	128.7	0.451	84.8	5.521	7.89	42.3491	119.0	1.307	1.287	2.007	1.666	0.374	1.020	0.646	4.454
1:41:27	131.2	0.457	84.8	5.515	8.00	42.3958	121.5	1.333	1.313	2.033	1.689	0.372	1.031	0.659	4.542
1:42:40	131.9	0.463	84.8	5.510	8.09	42.4410	122.2	1.339	1.319	2.039	1.699	0.376	1.038	0.662	4.524
1:43:59	131.7	0.469	84.7	5.503	8.20	42.4881	122.1	1.336	1.315	2.035	1.701	0.381	1.041	0.660	4.465
1:45:14	132.3	0.475	84.6	5.497	8.29	42.5339	122.6	1.340	1.319	2.039	1.713	0.389	1.051	0.662	4.402
1:46:30	132.0	0.481	84.3	5.491	8.39	42.5804	122.3	1.336	1.315	2.035	1.727	0.407	1.067	0.660	4.240
1:47:45	132.9	0.487	84.4	5.486	8.49	42.6266	123.2	1.344	1.323	2.043	1.733	0.405	1.069	0.664	4.276
1:49:02	133.0	0.493	84.7	5.479	8.59	42.6736	123.3	1.343	1.322	2.042	1.710	0.384	1.047	0.663	4.458
1:50:20	133.5	0.499	84.7	5.473	8.69	42.7205	123.8	1.348	1.326	2.046	1.712	0.380	1.046	0.666	4.499
1:51:36	133.7	0.505	84.7	5.467	8.79	42.7673	124.0	1.349	1.327	2.047	1.715	0.384	1.050	0.666	4.468
1:52:53	133.6	0.511	84.6	5.462	8.89	42.8139	123.9	1.346	1.324	2.044	1.718	0.390	1.054	0.664	4.410
1:54:10	134.8	0.517	84.5	5.455	9.00	42.8614	125.1	1.357	1.335	2.055	1.738	0.399	1.068	0.670	4.360
1:55:26	135.7	0.523	84.2	5.450	9.09	42.9081	126.0	1.365	1.342	2.062	1.765	0.418	1.092	0.674	4.222
1:56:44	135.8	0.529	84.4	5.444	9.19	42.9550	126.1	1.365	1.342	2.062	1.748	0.401	1.074	0.673	4.357
1:58:01	136.1	0.535	84.6	5.438	9.29	43.0028	126.4	1.367	1.344	2.064	1.737	0.388	1.062	0.674	4.472
1:59:14	136.1	0.541	84.6	5.432	9.39	43.0495	126.4	1.365	1.342	2.062	1.735	0.388	1.062	0.673	4.468
2:00:31	136.3	0.547	84.5	5.426	9.49	43.0970	126.6	1.366	1.343	2.063	1.740	0.392	1.066	0.674	4.434
2:01:50	137.0	0.553	84.5	5.420	9.59	43.1452	127.3	1.372	1.348	2.068	1.749	0.396	1.073	0.676	4.413
2:03:09	136.9	0.559	84.3	5.414	9.69	43.1928	127.2	1.369	1.345	2.065	1.759	0.408	1.083	0.675	4.306
2:04:25	138.0	0.565	84.0	5.408	9.79	43.2405	128.3	1.380	1.355	2.075	1.790	0.430	1.110	0.680	4.162
2:05:44	138.2	0.571	84.4	5.402	9.89	43.2885	128.5	1.380	1.355	2.075	1.764	0.403	1.084	0.680	4.371
2:07:05	138.7	0.577	84.5	5.396	9.99	43.3370	129.0	1.384	1.359	2.079	1.756	0.392	1.074	0.682	4.476
2:08:24	137.9	0.583	84.6	5.390	10.09	43.3853	128.2	1.374	1.349	2.069	1.746	0.392	1.069	0.677	4.455
2:09:43	137.7	0.589	84.5	5.384	10.19	43.4334	128.0	1.370	1.345	2.065	1.748	0.398	1.073	0.675	4.392
2:11:04	138.3	0.595	84.4	5.378	10.29	43.4814	128.6	1.375	1.349	2.069	1.758	0.404	1.081	0.677	4.352
2:12:24	138.4	0.601	84.3	5.372	10.39	43.5300	128.7	1.375	1.349	2.069	1.768	0.414	1.091	0.677	4.271
2:13:43	138.8	0.607	83.7	5.366	10.49	43.5792	129.1	1.378	1.351	2.071	1.807	0.451	1.129	0.678	4.008
2:14:57	138.9	0.613	84.4	5.360	10.59	43.6274	129.2	1.378	1.351	2.071	1.761	0.405	1.083	0.678	4.345
2:16:13	139.0	0.619	84.5	5.354	10.69	43.6761	129.3	1.377	1.350	2.070	1.752	0.397	1.075	0.677	4.409
2:17:29	139.6	0.625	84.5	5.348	10.79	43.7251	129.9	1.381	1.355	2.075	1.756	0.397	1.077	0.680	4.423
2:18:44	138.9	0.631	84.4	5.342	10.89	43.7740	129.2	1.372	1.345	2.065	1.751	0.401	1.076	0.675	4.364
2:20:00	139.9	0.637	84.3	5.336	10.99	43.8240	130.2	1.381	1.354	2.074	1.767	0.408	1.087	0.679	4.329
2:21:14	140.2	0.643	84.2	5.330	11.09	43.8724	130.5	1.383	1.355	2.075	1.778	0.418	1.098	0.680	4.256
2:22:29	140.9	0.649	83.7	5.324	11.19	43.9222	131.2	1.389	1.361	2.081	1.823	0.457	1.140	0.683	3.989
2:23:42	140.7	0.655	84.3	5.318	11.29	43.9710	131.0	1.386	1.358	2.078	1.773	0.410	1.091	0.681	4.321
2:24:57	142.7	0.661	84.4	5.312	11.39	44.0211	133.0	1.405	1.377	2.097	1.783	0.402	1.093	0.691	4.440
2:26:08	141.7	0.667	84.4	5.306	11.49	44.0706	132.0	1.393	1.365	2.085	1.770	0.401	1.086	0.685	4.415
2:27:19	142.3	0.673	84.3	5.300	11.59	44.1201	132.6	1.397	1.368	2.088	1.782	0.409	1.095	0.687	4.360
2:28:31	142.9	0.679	84.3	5.294	11.69	44.1701	133.2	1.402	1.373	2.093	1.791	0.413	1.102	0.689	4.339
2:29:46	143.6	0.685	84.1	5.288	11.79	44.2206	133.9	1.408	1.379	2.099	1.805	0.422	1.114	0.692	4.281
2:30:55	143.4	0.691	83.7	5.282	11.89	44.2704	133.7	1.405	1.375	2.095	1.834	0.454	1.144	0.690	4.041

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175539009
Height	5.995 (in.)	15.227 (cm)	Height	4.892 (in.)	Date	8-14-09	Test Number	CU-1257A
Diameter	2.775 (in)	7.047 (cm)	Dia. avg.	3.111 (in)	Press No.	1	Data File ID	1257A
Area	6.046 (in^2)	39.006 (cm^2)	Area avg.	7.603 (in^2)	Panel No.	A	Lateral Pressure (psi)	10.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
2:32:08	143.8	0.697	84.2	5.276	11.99	44.3204	134.1	1.407	1.377	2.097	1.802	0.420	1.111	0.691	4.288
2:33:26	144.6	0.703	84.3	5.270	12.09	44.3712	134.9	1.414	1.384	2.104	1.796	0.407	1.101	0.694	4.412
2:34:38	145.0	0.709	84.3	5.264	12.19	44.4218	135.3	1.416	1.386	2.106	1.798	0.407	1.103	0.695	4.413
2:35:52	145.4	0.715	84.3	5.258	12.29	44.4724	135.7	1.419	1.388	2.108	1.805	0.413	1.109	0.696	4.376
2:37:09	145.3	0.721	84.2	5.252	12.39	44.5226	135.6	1.416	1.385	2.105	1.805	0.415	1.110	0.695	4.345
2:38:25	145.0	0.727	84.1	5.246	12.49	44.5737	135.3	1.412	1.381	2.101	1.810	0.425	1.117	0.693	4.262
2:39:40	145.4	0.733	83.9	5.240	12.59	44.6243	135.7	1.414	1.383	2.103	1.829	0.442	1.135	0.694	4.143
2:40:56	145.8	0.739	84.1	5.234	12.69	44.6760	136.1	1.416	1.385	2.105	1.814	0.424	1.119	0.695	4.275
2:42:14	146.1	0.745	84.3	5.228	12.79	44.7269	136.4	1.418	1.386	2.106	1.799	0.408	1.104	0.696	4.409
2:43:30	146.2	0.751	84.3	5.222	12.89	44.7778	136.5	1.418	1.386	2.106	1.798	0.408	1.103	0.695	4.408
2:44:44	146.7	0.757	84.3	5.216	12.99	44.8293	137.0	1.421	1.389	2.109	1.807	0.413	1.110	0.697	4.374
2:46:01	147.5	0.763	84.2	5.210	13.09	44.8810	137.8	1.427	1.395	2.115	1.815	0.416	1.116	0.700	4.364
2:47:20	146.9	0.769	84.1	5.204	13.19	44.9332	137.2	1.420	1.387	2.107	1.815	0.423	1.119	0.696	4.290
2:48:34	147.4	0.775	83.9	5.198	13.29	44.9850	137.7	1.423	1.390	2.110	1.836	0.441	1.138	0.698	4.167
2:49:49	147.9	0.781	84.0	5.192	13.39	45.0371	138.2	1.426	1.393	2.113	1.833	0.435	1.134	0.699	4.213
2:51:05	148.2	0.786	84.3	5.186	13.49	45.0881	138.5	1.429	1.395	2.115	1.814	0.414	1.114	0.700	4.385
2:52:20	148.1	0.793	84.3	5.180	13.59	45.1407	138.4	1.426	1.392	2.112	1.809	0.412	1.110	0.698	4.389
2:53:35	148.5	0.798	84.2	5.174	13.69	45.1926	138.8	1.428	1.394	2.114	1.817	0.418	1.117	0.700	4.348
2:54:55	148.8	0.805	84.2	5.168	13.79	45.2456	139.1	1.430	1.395	2.115	1.821	0.420	1.121	0.700	4.330
2:56:12	148.7	0.810	84.1	5.162	13.89	45.2975	139.0	1.427	1.392	2.112	1.824	0.428	1.126	0.698	4.267
2:57:28	149.2	0.816	83.8	5.156	13.99	45.3503	139.5	1.430	1.395	2.115	1.847	0.447	1.147	0.700	4.135
2:58:48	150.0	0.823	84.0	5.150	14.09	45.4039	140.3	1.437	1.402	2.122	1.838	0.432	1.135	0.703	4.257
3:00:09	150.6	0.829	84.2	5.144	14.19	45.4568	140.9	1.442	1.406	2.126	1.829	0.418	1.123	0.706	4.377
3:01:27	149.5	0.834	84.2	5.138	14.29	45.5091	139.8	1.429	1.393	2.113	1.812	0.414	1.113	0.699	4.374
3:02:47	149.8	0.840	84.2	5.132	14.39	45.5620	140.1	1.430	1.394	2.114	1.820	0.421	1.120	0.699	4.323
3:04:08	150.0	0.846	84.1	5.126	14.49	45.6155	140.3	1.430	1.394	2.114	1.826	0.427	1.126	0.700	4.278
3:05:28	150.3	0.852	84.0	5.120	14.59	45.6684	140.6	1.431	1.395	2.115	1.834	0.434	1.134	0.700	4.225
3:06:48	150.8	0.858	83.6	5.114	14.69	45.7226	141.1	1.435	1.398	2.118	1.867	0.463	1.165	0.702	4.028
3:08:05	150.8	0.864	84.1	5.108	14.79	45.7763	141.1	1.434	1.397	2.117	1.829	0.427	1.128	0.701	4.281
3:09:20	151.4	0.870	84.2	5.102	14.89	45.8297	141.7	1.438	1.401	2.121	1.825	0.419	1.122	0.703	4.351
3:10:36	150.7	0.876	84.2	5.096	14.99	45.8836	141.0	1.429	1.392	2.112	1.816	0.419	1.117	0.698	4.330
3:11:53	151.1	0.882	84.1	5.090	15.09	45.9371	141.4	1.431	1.394	2.114	1.823	0.424	1.123	0.699	4.298
3:13:06	150.8	0.888	84.0	5.084	15.19	45.9916	141.1	1.427	1.389	2.109	1.824	0.430	1.127	0.697	4.240
3:14:20	151.5	0.894	83.9	5.078	15.29	46.0468	141.8	1.432	1.394	2.114	1.836	0.438	1.137	0.699	4.194
3:15:34	151.8	0.900	83.6	5.072	15.39	46.1000	142.1	1.433	1.395	2.115	1.859	0.460	1.160	0.700	4.043
3:16:47	151.3	0.906	83.9	5.066	15.49	46.1547	141.6	1.427	1.388	2.108	1.831	0.439	1.135	0.696	4.176
3:18:01	152.3	0.912	84.1	5.060	15.59	46.2098	142.6	1.435	1.396	2.116	1.825	0.424	1.124	0.701	4.308
3:19:12	152.0	0.918	84.1	5.054	15.69	46.2641	142.3	1.430	1.391	2.111	1.819	0.423	1.121	0.698	4.300
3:20:26	152.6	0.924	84.1	5.048	15.79	46.3200	142.9	1.434	1.395	2.115	1.828	0.428	1.128	0.700	4.272
3:21:39	153.6	0.930	84.0	5.042	15.89	46.3738	143.9	1.443	1.404	2.124	1.839	0.431	1.135	0.704	4.270
3:22:54	153.3	0.936	84.0	5.036	15.99	46.4298	143.7	1.439	1.399	2.119	1.839	0.435	1.137	0.702	4.224
3:24:09	154.6	0.942	83.7	5.030	16.09	46.4851	144.9	1.450	1.410	2.130	1.865	0.451	1.158	0.707	4.139
3:25:16	154.2	0.948	83.3	5.024	16.19	46.5399	144.5	1.444	1.404	2.124	1.888	0.479	1.184	0.704	3.938
3:26:32	153.7	0.954	84.0	5.018	16.29	46.5959	144.0	1.437	1.397	2.117	1.832	0.430	1.131	0.701	4.258
3:27:44	154.4	0.960	84.1	5.012	16.39	46.6515	144.7	1.442	1.402	2.122	1.832	0.426	1.129	0.703	4.302
3:28:57	155.0	0.966	84.1	5.006	16.49	46.7074	145.3	1.447	1.406	2.126	1.837	0.426	1.132	0.705	4.307
3:30:10	155.4	0.972	84.0	5.000	16.59	46.7625	145.7	1.449	1.408	2.128	1.845	0.433	1.139	0.706	4.265
3:31:26	154.9	0.978	83.9	4.994	16.69	46.8188	145.2	1.443	1.401	2.121	1.844	0.439	1.141	0.703	4.205
3:32:43	155.2	0.984	83.8	4.988	16.79	46.8752	145.5	1.443	1.402	2.122	1.854	0.448	1.151	0.703	4.140
3:34:00	155.1	0.990	83.1	4.982	16.89	46.9330	145.4	1.440	1.398	2.118	1.897	0.494	1.195	0.702	3.841
3:35:16	155.2	0.996	84.0	4.976	16.99	46.9877	145.5	1.440	1.397	2.117	1.835	0.433	1.134	0.701	4.237
3:36:35	155.9	1.002	84.1	4.970	17.09	47.0451	146.3	1.446	1.403	2.123	1.836	0.428	1.132	0.704	4.287
3:37:47	155.8	1.008	84.0	4.964	17.19	47.1017	146.1	1.443	1.400	2.120	1.833	0.429	1.131	0.702	4.276
3:39:03	155.9	1.014	83.9	4.958	17.29	47.1582	146.2	1.442	1.399	2.119	1.842	0.438	1.140	0.702	4.205
3:40:21	156.0	1.020	83.9	4.952	17.39	47.2152	146.3	1.441	1.398	2.118	1.844	0.442	1.143	0.701	4.176
3:41:38	156.0	1.026	83.7	4.946	17.49	47.2723	146.3	1.439	1.395	2.115	1.852	0.452	1.152	0.700	4.096
3:42:54	156.3	1.032	83.2	4.940	17.59	47.3309	146.6	1.441	1.397	2.117	1.891	0.490	1.190	0.701	3.863
3:44:09	157.0	1.038	84.0	4.934	17.69	47.3873	147.3	1.445	1.401	2.121	1.840	0.435	1.137	0.703	4.235
3:45:26	156.7	1.044	84.0	4.928	17.79	47.4447	147.0	1.441	1.397	2.117	1.833	0.431	1.132	0.701	4.254
3:46:41	156.8	1.050	84.0	4.922	17.89	47.5027	147.1	1.440	1.395	2.115	1.834	0.434	1.134	0.700	4.228

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values		
Height	5.995 (in.)	15.227 (cm)		Height	4.892 (in.)	
Diameter	2.775 (in)	7.047 (cm)		Dia. avg.	3.111 (in)	
Area	6.046 (in^2)	39.006 (cm^2)		Area avg.	7.603 (in^2)	

Tested By	KDG
Date	8-14-09
Press No.	1
Panel No.	A

Project Number	175539009
Test Number	CU-1257A
Data File ID	1257A
Lateral Pressure (psi)	10.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
3:47:59	158.8	1.056	83.9	4.916	17.99	47.5606	149.1	1.457	1.413	2.133	1.855	0.438	1.147	0.709	4.238
3:49:17	158.4	1.062	83.8	4.910	18.09	47.6194	148.7	1.452	1.407	2.127	1.856	0.444	1.150	0.706	4.177
3:50:35	157.6	1.068	83.7	4.904	18.19	47.6773	147.9	1.442	1.397	2.117	1.858	0.456	1.157	0.701	4.074
3:51:52	157.4	1.074	83.2	4.899	18.29	47.7348	147.7	1.439	1.393	2.113	1.887	0.489	1.188	0.699	3.856
3:53:12	157.7	1.080	83.9	4.892	18.39	47.7936	148.0	1.440	1.394	2.114	1.837	0.438	1.137	0.700	4.195

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values				
Height	5.912 (in.)	15.016 (cm)		Height	4.824 (in.)		Tested By	KDG
Diameter	2.822 (in)	7.167 (cm)		Dia. avg.	3.177 (in)		Date	8-17-09
Area	6.253 (in^2)	40.342 (cm^2)		Area avg.	7.929 (in^2)		Press No.	1
							Panel No.	B

Project Number	175539009
Test Number	CU-1257B
Data File ID	1257B
Lateral Pressure (psi)	30.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
0:00:00	12.0	-0.019	60.0	5.912	0.00	40.3416	0.0	0.000	0.000	2.160	2.160	2.163	2.162	-0.002	0.999
0:03:25	17.2	-0.013	60.4	5.906	0.10	40.3825	5.2	0.060	0.060	2.220	2.185	2.128	2.156	0.028	1.027
0:06:36	31.7	-0.007	61.4	5.900	0.20	40.4227	19.7	0.227	0.227	2.387	2.283	2.060	2.171	0.112	1.109
0:10:56	94.0	-0.001	66.8	5.894	0.30	40.4634	82.1	0.943	0.942	3.102	2.612	1.673	2.143	0.470	1.561
0:14:27	118.6	0.005	70.0	5.888	0.40	40.5040	106.6	1.223	1.223	3.383	2.658	1.438	2.048	0.610	1.848
0:18:01	131.1	0.011	71.9	5.882	0.50	40.5443	119.1	1.366	1.365	3.525	2.664	1.302	1.983	0.681	2.046
0:21:20	138.6	0.017	73.1	5.876	0.60	40.5851	126.6	1.450	1.449	3.609	2.662	1.216	1.939	0.723	2.189
0:24:39	144.5	0.023	74.0	5.870	0.70	40.6260	132.5	1.516	1.515	3.675	2.664	1.152	1.908	0.756	2.312
0:28:06	149.2	0.028	74.6	5.864	0.80	40.6668	137.2	1.569	1.567	3.727	2.671	1.107	1.889	0.782	2.413
0:31:21	153.4	0.034	75.4	5.858	0.90	40.7079	141.4	1.616	1.614	3.774	2.660	1.049	1.855	0.805	2.535
0:34:38	157.2	0.040	75.9	5.853	1.00	40.7491	145.2	1.657	1.654	3.814	2.668	1.017	1.843	0.826	2.623
0:37:53	160.1	0.046	76.3	5.846	1.10	40.7913	148.1	1.688	1.686	3.846	2.672	0.989	1.830	0.841	2.701
0:41:07	162.6	0.052	76.6	5.841	1.20	40.8317	150.6	1.716	1.713	3.873	2.676	0.966	1.821	0.855	2.770
0:44:14	165.2	0.058	76.8	5.835	1.30	40.8738	153.2	1.743	1.740	3.900	2.687	0.950	1.818	0.869	2.829
0:47:23	167.8	0.064	77.1	5.829	1.40	40.9143	155.8	1.770	1.767	3.927	2.692	0.928	1.810	0.882	2.900
0:50:34	169.8	0.070	77.4	5.823	1.50	40.9557	157.8	1.792	1.788	3.948	2.691	0.906	1.799	0.893	2.971
0:53:44	172.1	0.076	77.6	5.817	1.60	40.9974	160.1	1.816	1.812	3.972	2.703	0.894	1.798	0.904	3.024
0:56:46	174.0	0.082	77.7	5.811	1.70	41.0396	162.0	1.836	1.832	3.992	2.713	0.885	1.799	0.914	3.067
0:59:53	175.5	0.088	77.8	5.805	1.80	41.0812	163.5	1.851	1.846	4.006	2.723	0.880	1.802	0.922	3.094
1:02:57	177.3	0.093	77.8	5.799	1.90	41.1227	165.3	1.869	1.864	4.024	2.739	0.878	1.809	0.931	3.120
1:06:05	178.9	0.099	78.1	5.793	2.00	41.1654	167.0	1.886	1.881	4.041	2.733	0.855	1.794	0.939	3.195
1:09:11	180.4	0.105	78.1	5.787	2.10	41.2073	168.4	1.900	1.895	4.055	2.745	0.853	1.799	0.946	3.217
1:12:16	181.7	0.111	78.2	5.782	2.20	41.2493	169.8	1.914	1.908	4.068	2.756	0.850	1.803	0.953	3.240
1:15:26	183.1	0.117	78.2	5.776	2.30	41.2911	171.1	1.927	1.921	4.081	2.766	0.848	1.807	0.959	3.260
1:18:44	184.8	0.123	78.2	5.770	2.40	41.3333	172.8	1.945	1.939	4.099	2.787	0.851	1.819	0.968	3.274
1:21:54	185.7	0.129	78.4	5.764	2.50	41.3757	173.7	1.952	1.946	4.106	2.776	0.833	1.805	0.971	3.331
1:25:10	187.4	0.135	78.4	5.758	2.60	41.4182	175.4	1.969	1.963	4.123	2.793	0.833	1.813	0.980	3.352
1:28:23	189.1	0.141	78.4	5.752	2.70	41.4608	177.2	1.987	1.980	4.140	2.809	0.832	1.820	0.989	3.377
1:31:41	190.0	0.147	78.4	5.746	2.80	41.5033	178.0	1.994	1.987	4.147	2.818	0.833	1.826	0.992	3.381
1:35:01	191.1	0.153	78.3	5.740	2.90	41.5464	179.1	2.004	1.997	4.157	2.833	0.839	1.836	0.997	3.377
1:38:22	192.6	0.158	78.6	5.734	3.00	41.5893	180.6	2.019	2.012	4.172	2.831	0.822	1.826	1.004	3.444
1:41:38	193.6	0.164	78.5	5.728	3.10	41.6318	181.6	2.028	2.020	4.180	2.843	0.826	1.835	1.009	3.443
1:44:58	194.4	0.170	78.5	5.723	3.20	41.6748	182.5	2.036	2.028	4.188	2.854	0.829	1.842	1.013	3.442
1:48:15	195.6	0.176	78.4	5.717	3.30	41.7179	183.6	2.047	2.039	4.199	2.868	0.832	1.850	1.018	3.447
1:51:34	196.8	0.182	78.4	5.711	3.40	41.7615	184.8	2.058	2.050	4.210	2.883	0.837	1.860	1.023	3.447
1:54:54	197.8	0.188	78.5	5.705	3.50	41.8048	185.8	2.067	2.058	4.218	2.881	0.825	1.853	1.028	3.490
1:58:10	199.0	0.194	78.5	5.699	3.60	41.8477	187.0	2.078	2.069	4.229	2.895	0.829	1.862	1.033	3.493
2:01:24	200.2	0.200	78.5	5.693	3.70	41.8912	188.3	2.090	2.081	4.241	2.908	0.830	1.869	1.039	3.502
2:04:38	201.3	0.206	78.4	5.687	3.80	41.9348	189.3	2.099	2.090	4.250	2.922	0.835	1.878	1.043	3.500
2:07:53	202.1	0.212	78.3	5.681	3.90	41.9792	190.1	2.106	2.096	4.256	2.934	0.840	1.887	1.047	3.491
2:11:07	203.2	0.218	78.1	5.675	4.00	42.0221	191.2	2.116	2.106	4.266	2.958	0.855	1.906	1.051	3.459
2:14:21	204.2	0.223	78.4	5.669	4.10	42.0661	192.2	2.125	2.115	4.275	2.946	0.834	1.890	1.056	3.532
2:17:42	204.7	0.229	78.3	5.663	4.20	42.1099	192.7	2.128	2.118	4.278	2.956	0.841	1.898	1.057	3.514
2:21:00	205.9	0.235	78.3	5.658	4.30	42.1538	193.9	2.139	2.129	4.289	2.971	0.845	1.908	1.063	3.515
2:24:20	206.7	0.241	78.2	5.652	4.40	42.1978	194.7	2.146	2.135	4.295	2.983	0.851	1.917	1.066	3.506
2:27:40	207.8	0.247	78.1	5.646	4.50	42.2419	195.8	2.155	2.144	4.304	2.999	0.858	1.929	1.071	3.495
2:30:59	208.4	0.253	78.3	5.640	4.60	42.2863	196.4	2.160	2.149	4.309	2.991	0.845	1.918	1.073	3.538
2:34:20	209.5	0.259	78.2	5.634	4.70	42.3307	197.5	2.169	2.158	4.318	3.007	0.852	1.929	1.077	3.530
2:37:34	210.7	0.265	78.1	5.628	4.80	42.3751	198.7	2.180	2.168	4.328	3.021	0.855	1.938	1.083	3.532
2:41:01	210.8	0.271	78.0	5.622	4.90	42.4196	198.8	2.180	2.168	4.328	3.029	0.864	1.947	1.082	3.504
2:44:18	211.9	0.277	77.8	5.616	5.00	42.4642	200.0	2.190	2.177	4.337	3.051	0.877	1.964	1.087	3.480
2:47:35	212.8	0.283	78.0	5.610	5.10	42.5094	200.8	2.196	2.184	4.344	3.041	0.861	1.951	1.090	3.534
2:50:55	213.9	0.288	78.0	5.604	5.20	42.5538	201.9	2.206	2.194	4.354	3.056	0.865	1.960	1.095	3.533
2:54:12	214.6	0.294	77.9	5.598	5.30	42.5991	202.6	2.212	2.199	4.359	3.064	0.869	1.966	1.098	3.527
2:57:31	215.2	0.300	77.9	5.592	5.40	42.6441	203.2	2.216	2.203	4.363	3.074	0.875	1.974	1.100	3.515
3:00:45	216.1	0.306	77.8	5.587	5.50	42.6891	204.1	2.223	2.210	4.370	3.088	0.881	1.985	1.103	3.504
3:04:01	216.9	0.312	77.8	5.581	5.60	42.7346	205.0	2.230	2.216	4.376	3.094	0.881	1.987	1.107	3.514
3:07:13	217.5	0.318	77.8	5.575	5.70	42.7796	205.5	2.234	2.220	4.380	3.095	0.879	1.987	1.108	3.524
3:10:23	218.4	0.324	77.7	5.569	5.80	42.8250	206.4	2.241	2.227	4.387	3.109	0.885	1.997	1.112	3.514
3:13:38	219.0	0.330	77.6	5.563	5.90	42.8708	207.0	2.245	2.231	4.391	3.117	0.890	2.003	1.114	3.504

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values			
Height	5.912 (in.)	15.016 (cm)	Height	4.824 (in.)	Tested By	KDG
Diameter	2.822 (in)	7.167 (cm)	Dia. avg.	3.177 (in)	Date	8-17-09
Area	6.253 (in²)	40.342 (cm²)	Area avg.	7.929 (in²)	Press No.	1
					Panel No.	B

Project Number	175539009
Test Number	CU-1257B
Data File ID	1257B
Lateral Pressure (psi)	30.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
3:16:52	219.9	0.336	77.6	5.557	6.00	42.9163	207.9	2.253	2.238	4.398	3.131	0.896	2.013	1.117	3.495
3:19:57	220.3	0.342	77.4	5.551	6.10	42.9617	208.3	2.255	2.240	4.400	3.142	0.905	2.023	1.118	3.472
3:23:06	221.3	0.348	77.6	5.545	6.20	43.0075	209.3	2.263	2.248	4.408	3.137	0.892	2.015	1.122	3.515
3:26:19	221.9	0.353	77.5	5.539	6.30	43.0533	209.9	2.267	2.252	4.412	3.148	0.899	2.024	1.124	3.500
3:29:34	222.3	0.359	77.4	5.533	6.40	43.1001	210.4	2.270	2.254	4.414	3.155	0.904	2.029	1.125	3.490
3:32:44	223.1	0.365	77.4	5.527	6.50	43.1457	211.1	2.275	2.259	4.419	3.166	0.910	2.038	1.128	3.480
3:35:58	223.7	0.371	77.3	5.522	6.60	43.1914	211.7	2.280	2.263	4.423	3.176	0.916	2.046	1.130	3.468
3:39:19	224.2	0.377	77.3	5.516	6.70	43.2377	212.2	2.282	2.266	4.426	3.174	0.911	2.043	1.131	3.484
3:42:36	225.0	0.383	77.3	5.510	6.80	43.2843	213.0	2.288	2.271	4.431	3.183	0.915	2.049	1.134	3.480
3:45:51	225.9	0.389	77.2	5.504	6.90	43.3305	213.9	2.296	2.279	4.439	3.194	0.919	2.057	1.138	3.477
3:49:14	226.6	0.395	77.2	5.498	7.00	43.3773	214.7	2.301	2.284	4.444	3.204	0.923	2.064	1.141	3.471
3:52:35	227.0	0.401	77.1	5.492	7.10	43.4245	215.0	2.303	2.285	4.445	3.213	0.931	2.072	1.141	3.451
3:56:00	227.6	0.407	76.9	5.486	7.20	43.4709	215.6	2.306	2.288	4.448	3.229	0.943	2.086	1.143	3.422
3:59:26	228.6	0.413	77.1	5.480	7.30	43.5176	216.6	2.314	2.296	4.456	3.223	0.930	2.076	1.147	3.467
4:02:49	229.2	0.419	77.0	5.474	7.40	43.5646	217.2	2.318	2.300	4.460	3.230	0.933	2.081	1.148	3.462
4:06:15	229.6	0.424	77.0	5.468	7.50	43.6116	217.6	2.320	2.302	4.462	3.238	0.939	2.089	1.149	3.447
4:09:38	230.4	0.430	76.9	5.462	7.60	43.6588	218.4	2.326	2.308	4.468	3.250	0.945	2.098	1.152	3.438
4:12:56	231.2	0.436	76.7	5.457	7.70	43.7060	219.2	2.332	2.313	4.473	3.271	0.961	2.116	1.155	3.404
4:16:24	231.6	0.442	76.9	5.451	7.80	43.7535	219.6	2.334	2.315	4.475	3.257	0.946	2.102	1.156	3.444
4:19:43	232.4	0.448	76.8	5.445	7.90	43.8011	220.5	2.340	2.321	4.481	3.268	0.950	2.109	1.159	3.440
4:23:04	233.4	0.454	76.8	5.439	8.00	43.8488	221.4	2.348	2.328	4.488	3.277	0.952	2.115	1.162	3.441
4:26:21	233.6	0.460	76.7	5.433	8.10	43.8962	221.6	2.347	2.328	4.488	3.285	0.960	2.123	1.162	3.421
4:29:41	234.0	0.466	76.5	5.427	8.20	43.9441	222.1	2.350	2.330	4.490	3.301	0.974	2.137	1.163	3.389
4:33:01	235.2	0.472	76.7	5.421	8.30	43.9920	223.2	2.360	2.339	4.499	3.293	0.956	2.124	1.168	3.443
4:36:25	235.6	0.478	76.6	5.415	8.40	44.0399	223.6	2.361	2.340	4.500	3.300	0.963	2.132	1.169	3.427
4:39:54	236.2	0.484	76.6	5.409	8.50	44.0882	224.3	2.365	2.345	4.505	3.309	0.968	2.139	1.171	3.419
4:43:12	237.0	0.489	76.5	5.403	8.60	44.1363	225.0	2.371	2.350	4.510	3.321	0.974	2.148	1.173	3.409
4:46:33	237.6	0.495	76.3	5.397	8.70	44.1849	225.6	2.375	2.353	4.513	3.334	0.983	2.159	1.175	3.390
4:49:59	238.2	0.501	76.5	5.392	8.80	44.2333	226.3	2.379	2.357	4.517	3.325	0.971	2.148	1.177	3.425
4:53:23	239.1	0.507	76.4	5.386	8.90	44.2819	227.1	2.384	2.363	4.523	3.338	0.978	2.158	1.180	3.412
4:56:46	239.5	0.513	76.3	5.380	9.00	44.3312	227.5	2.386	2.364	4.524	3.346	0.985	2.166	1.180	3.397
5:00:12	240.3	0.519	76.3	5.374	9.10	44.3793	228.3	2.392	2.370	4.530	3.357	0.990	2.173	1.183	3.391
5:03:34	240.6	0.525	76.1	5.368	9.20	44.4281	228.6	2.393	2.370	4.530	3.369	1.002	2.186	1.184	3.363
5:06:51	241.3	0.531	76.3	5.362	9.30	44.4771	229.4	2.398	2.375	4.535	3.356	0.984	2.170	1.186	3.410
5:10:05	241.7	0.537	76.2	5.356	9.40	44.5258	229.7	2.399	2.376	4.536	3.364	0.991	2.178	1.186	3.394
5:13:19	242.5	0.543	76.1	5.350	9.50	44.5755	230.5	2.404	2.381	4.541	3.377	0.999	2.188	1.189	3.381
5:16:39	242.7	0.549	76.0	5.344	9.60	44.6246	230.7	2.404	2.381	4.541	3.387	1.009	2.198	1.189	3.357
5:19:53	243.5	0.554	76.1	5.338	9.70	44.6737	231.5	2.409	2.386	4.546	3.387	1.004	2.195	1.191	3.373
5:23:17	244.0	0.560	75.9	5.332	9.80	44.7233	232.1	2.413	2.389	4.549	3.401	1.015	2.208	1.193	3.349
5:26:40	244.6	0.566	75.8	5.327	9.90	44.7728	232.7	2.416	2.392	4.552	3.409	1.020	2.214	1.195	3.343
5:29:55	244.9	0.572	75.9	5.321	10.00	44.8227	233.0	2.417	2.392	4.552	3.406	1.017	2.212	1.195	3.349
5:32:59	245.5	0.578	75.8	5.315	10.10	44.8729	233.5	2.420	2.395	4.555	3.413	1.021	2.217	1.196	3.343
5:36:19	246.5	0.584	75.8	5.309	10.20	44.9228	234.5	2.427	2.402	4.562	3.425	1.026	2.226	1.200	3.339
5:39:23	246.7	0.590	75.8	5.303	10.30	44.9726	234.7	2.427	2.402	4.562	3.424	1.025	2.224	1.199	3.341
5:42:23	247.1	0.596	75.7	5.297	10.40	45.0227	235.1	2.428	2.403	4.563	3.428	1.029	2.228	1.200	3.333
5:45:39	247.8	0.602	75.7	5.291	10.50	45.0733	235.8	2.432	2.407	4.567	3.437	1.033	2.235	1.202	3.327
5:48:50	248.3	0.608	75.6	5.285	10.60	45.1235	236.4	2.436	2.410	4.570	3.441	1.034	2.238	1.203	3.327
5:52:03	248.8	0.614	75.5	5.279	10.70	45.1738	236.8	2.437	2.411	4.571	3.449	1.041	2.245	1.204	3.314
5:55:21	249.6	0.619	75.5	5.273	10.80	45.2248	237.6	2.443	2.416	4.576	3.459	1.045	2.252	1.207	3.308
5:58:36	250.1	0.625	75.5	5.267	10.90	45.2758	238.1	2.445	2.419	4.579	3.458	1.042	2.250	1.208	3.318
6:01:56	250.5	0.631	75.5	5.262	11.00	45.3264	238.5	2.447	2.420	4.580	3.463	1.046	2.254	1.209	3.311
6:05:09	251.0	0.637	75.3	5.256	11.10	45.3770	239.0	2.449	2.422	4.582	3.474	1.055	2.264	1.209	3.293
6:08:25	251.8	0.643	75.4	5.250	11.20	45.4281	239.9	2.455	2.428	4.588	3.474	1.049	2.261	1.212	3.311
6:11:48	252.4	0.649	75.4	5.244	11.30	45.4802	240.4	2.458	2.430	4.590	3.479	1.053	2.266	1.213	3.306
6:15:05	252.6	0.655	75.3	5.238	11.40	45.5310	240.6	2.458	2.430	4.590	3.488	1.062	2.275	1.213	3.285
6:18:25	253.5	0.661	75.3	5.232	11.50	45.5827	241.5	2.463	2.435	4.595	3.488	1.055	2.271	1.216	3.304
6:21:47	253.9	0.667	75.3	5.226	11.60	45.6342	241.9	2.465	2.437	4.597	3.494	1.060	2.277	1.217	3.295
6:25:10	254.3	0.673	75.1	5.220	11.70	45.6856	242.3	2.466	2.438	4.598	3.507	1.072	2.289	1.217	3.271
6:28:34	254.8	0.679	75.2	5.214	11.80	45.7371	242.9	2.469	2.440	4.600	3.500	1.063	2.281	1.219	3.293
6:31:50	255.8	0.684	75.2	5.208	11.90	45.7890	243.8	2.476	2.447	4.607	3.511	1.068	2.290	1.222	3.288

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values			Tested By	KDG	Project Number	175539009
Height	5.912 (in.)	15.016 (cm)		Height	4.824 (in.)		Date	8-17-09	Test Number	CU-1257B
Diameter	2.822 (in)	7.167 (cm)		Dia. avg.	3.177 (in)		Press No.	1	Data File ID	1257B
Area	6.253 (in^2)	40.342 (cm^2)		Area avg.	7.929 (in^2)		Panel No.	B	Lateral Pressure (psi)	30.0
									Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
6:35:10	256.3	0.690	75.0	5.202	12.00	45.8413	244.3	2.478	2.449	4.609	3.528	1.082	2.305	1.223	3.260
6:38:27	256.9	0.696	75.3	5.197	12.10	45.8934	244.9	2.481	2.452	4.612	3.506	1.058	2.282	1.224	3.315
6:41:47	257.7	0.702	75.2	5.191	12.20	45.9454	245.7	2.487	2.457	4.617	3.517	1.063	2.290	1.227	3.307
6:45:06	258.1	0.708	75.2	5.185	12.30	45.9978	246.2	2.488	2.458	4.618	3.523	1.068	2.296	1.228	3.299
6:48:24	258.0	0.714	75.2	5.179	12.40	46.0502	246.1	2.485	2.454	4.614	3.518	1.066	2.292	1.226	3.299
6:51:44	259.1	0.720	75.1	5.173	12.50	46.1030	247.1	2.492	2.461	4.621	3.531	1.072	2.302	1.229	3.292
6:55:09	259.7	0.726	75.1	5.167	12.60	46.1560	247.7	2.495	2.465	4.625	3.534	1.073	2.303	1.231	3.295
6:58:37	260.2	0.732	75.1	5.161	12.70	46.2091	248.2	2.497	2.466	4.626	3.537	1.074	2.305	1.232	3.294
7:01:56	260.7	0.738	74.9	5.155	12.80	46.2623	248.8	2.500	2.469	4.629	3.550	1.084	2.317	1.233	3.275
7:05:11	261.5	0.744	75.0	5.149	12.90	46.3145	249.5	2.505	2.473	4.633	3.548	1.078	2.313	1.235	3.291
7:08:36	261.8	0.749	75.0	5.143	13.00	46.3679	249.8	2.505	2.473	4.633	3.553	1.083	2.318	1.235	3.282
7:11:59	262.4	0.755	74.8	5.137	13.10	46.4216	250.4	2.508	2.476	4.636	3.568	1.095	2.332	1.237	3.258
7:15:19	263.2	0.761	74.9	5.132	13.20	46.4747	251.2	2.514	2.482	4.642	3.565	1.086	2.326	1.239	3.281
7:18:46	263.9	0.767	74.8	5.126	13.30	46.5281	251.9	2.517	2.485	4.645	3.573	1.091	2.332	1.241	3.274
7:22:11	264.4	0.773	74.5	5.120	13.40	46.5818	252.4	2.520	2.487	4.647	3.597	1.113	2.355	1.242	3.231
7:25:34	264.5	0.779	74.8	5.114	13.50	46.6358	252.5	2.517	2.484	4.644	3.575	1.093	2.334	1.241	3.269
7:28:50	265.4	0.785	74.7	5.108	13.60	46.6898	253.4	2.524	2.490	4.650	3.588	1.101	2.344	1.244	3.260
7:32:06	266.1	0.791	74.7	5.102	13.70	46.7437	254.1	2.528	2.494	4.654	3.593	1.102	2.348	1.246	3.260
7:35:21	266.2	0.797	74.7	5.096	13.80	46.7982	254.2	2.526	2.492	4.652	3.592	1.103	2.347	1.245	3.258
7:38:30	266.4	0.803	74.6	5.090	13.90	46.8528	254.4	2.525	2.491	4.651	3.597	1.109	2.353	1.244	3.243
7:41:45	267.0	0.809	74.6	5.084	14.00	46.9067	255.0	2.528	2.494	4.654	3.599	1.108	2.353	1.245	3.249
7:45:09	267.8	0.814	74.6	5.078	14.10	46.9616	255.8	2.533	2.498	4.658	3.605	1.110	2.358	1.248	3.248
7:48:26	268.0	0.820	74.4	5.072	14.20	47.0160	256.0	2.532	2.497	4.657	3.615	1.121	2.368	1.247	3.225
7:51:40	268.9	0.826	74.6	5.067	14.30	47.0712	257.0	2.538	2.503	4.663	3.612	1.112	2.362	1.250	3.248
7:54:53	269.5	0.832	74.5	5.061	14.40	47.1259	257.5	2.541	2.506	4.666	3.620	1.117	2.368	1.251	3.240
7:58:01	269.7	0.838	74.3	5.055	14.50	47.1816	257.7	2.540	2.504	4.664	3.631	1.130	2.381	1.251	3.213
8:01:07	270.3	0.844	74.5	5.049	14.60	47.2365	258.4	2.543	2.508	4.668	3.621	1.117	2.369	1.252	3.242
8:04:20	271.0	0.850	74.4	5.043	14.70	47.2919	259.1	2.547	2.511	4.671	3.628	1.120	2.374	1.254	3.239
8:07:31	271.0	0.856	74.2	5.037	14.80	47.3474	259.1	2.544	2.508	4.668	3.640	1.135	2.388	1.253	3.206
8:10:40	272.1	0.862	74.4	5.031	14.90	47.4029	260.2	2.552	2.516	4.676	3.637	1.124	2.380	1.256	3.235
8:13:57	272.7	0.868	74.3	5.025	15.00	47.4586	260.7	2.554	2.518	4.678	3.643	1.128	2.386	1.257	3.229
8:17:16	272.9	0.874	74.1	5.019	15.10	47.5143	260.9	2.554	2.517	4.677	3.657	1.144	2.400	1.257	3.198
8:20:26	273.3	0.879	74.3	5.013	15.20	47.5702	261.4	2.555	2.518	4.678	3.644	1.130	2.387	1.257	3.225
8:23:42	274.3	0.885	74.3	5.007	15.30	47.6268	262.3	2.561	2.523	4.683	3.653	1.132	2.393	1.260	3.225
8:26:58	274.8	0.891	73.9	5.002	15.40	47.6826	262.8	2.563	2.525	4.685	3.679	1.157	2.418	1.261	3.179
8:30:13	274.8	0.897	74.2	4.996	15.50	47.7393	262.8	2.560	2.522	4.682	3.655	1.136	2.396	1.259	3.217
8:33:29	275.6	0.903	74.1	4.990	15.60	47.7959	263.6	2.564	2.526	4.686	3.665	1.142	2.404	1.261	3.208
8:36:55	275.8	0.909	74.1	4.984	15.70	47.8525	263.8	2.564	2.525	4.685	3.666	1.144	2.405	1.261	3.204
8:40:21	276.4	0.915	74.1	4.978	15.80	47.9091	264.4	2.567	2.528	4.688	3.666	1.141	2.404	1.262	3.212
8:43:45	276.8	0.921	74.0	4.972	15.90	47.9666	264.9	2.568	2.529	4.689	3.674	1.149	2.412	1.263	3.199
8:47:08	277.3	0.927	74.1	4.966	16.00	48.0234	265.3	2.569	2.530	4.690	3.672	1.145	2.408	1.263	3.207
8:50:40	277.7	0.933	74.1	4.960	16.10	48.0804	265.7	2.570	2.530	4.690	3.674	1.147	2.411	1.264	3.203
8:54:06	278.0	0.939	73.9	4.954	16.20	48.1381	266.0	2.570	2.530	4.690	3.689	1.162	2.426	1.263	3.174
8:57:19	278.7	0.944	74.0	4.948	16.30	48.1953	266.7	2.574	2.534	4.694	3.679	1.149	2.414	1.265	3.203
9:00:36	279.2	0.950	74.0	4.942	16.40	48.2528	267.2	2.575	2.535	4.695	3.685	1.154	2.420	1.266	3.195
9:04:03	279.7	0.956	73.6	4.936	16.50	48.3112	267.7	2.577	2.536	4.696	3.711	1.177	2.444	1.267	3.152
9:07:19	280.4	0.962	74.0	4.931	16.60	48.3687	268.4	2.580	2.540	4.700	3.690	1.153	2.421	1.268	3.200
9:10:43	280.8	0.968	73.9	4.925	16.70	48.4272	268.8	2.581	2.540	4.700	3.696	1.159	2.427	1.269	3.190
9:14:09	281.5	0.974	73.9	4.919	16.80	48.4847	269.5	2.585	2.544	4.704	3.698	1.158	2.428	1.270	3.195
9:17:35	281.5	0.980	73.9	4.913	16.90	48.5436	269.5	2.582	2.540	4.700	3.695	1.157	2.426	1.269	3.192
9:20:53	282.1	0.986	73.8	4.907	17.00	48.6019	270.1	2.584	2.543	4.703	3.704	1.164	2.434	1.270	3.181
9:24:19	282.6	0.992	73.9	4.901	17.10	48.6603	270.6	2.586	2.544	4.704	3.701	1.160	2.430	1.270	3.190
9:27:46	283.0	0.998	73.9	4.895	17.20	48.7190	271.1	2.587	2.545	4.705	3.702	1.160	2.431	1.271	3.191
9:31:08	283.0	1.004	73.7	4.889	17.30	48.7783	271.0	2.583	2.541	4.701	3.712	1.174	2.443	1.269	3.161
9:34:34	283.7	1.010	73.8	4.883	17.40	48.8375	271.7	2.587	2.544	4.704	3.705	1.164	2.435	1.271	3.183
9:38:03	284.7	1.015	73.8	4.877	17.50	48.8960	272.8	2.594	2.551	4.711	3.716	1.168	2.442	1.274	3.182
9:41:31	285.0	1.021	73.5	4.871	17.60	48.9557	273.0	2.593	2.550	4.710	3.734	1.187	2.460	1.273	3.146
9:44:51	285.7	1.027	73.8	4.866	17.70	49.0150	273.7	2.597	2.554	4.714	3.719	1.168	2.443	1.275	3.183
9:48:14	286.6	1.033	73.7	4.860	17.80	49.0744	274.7	2.602	2.559	4.719	3.729	1.173	2.451	1.278	3.179
9:51:27	286.9	1.039	73.5	4.854	17.90	49.1344	275.0	2.602	2.558	4.718	3.740	1.184	2.462	1.278	3.157

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values		
Height	5.912 (in.)	15.016 (cm)		Height	4.824 (in.)	
Diameter	2.822 (in)	7.167 (cm)		Dia. avg.	3.177 (in)	
Area	6.253 (in^2)	40.342 (cm^2)		Area avg.	7.929 (in^2)	

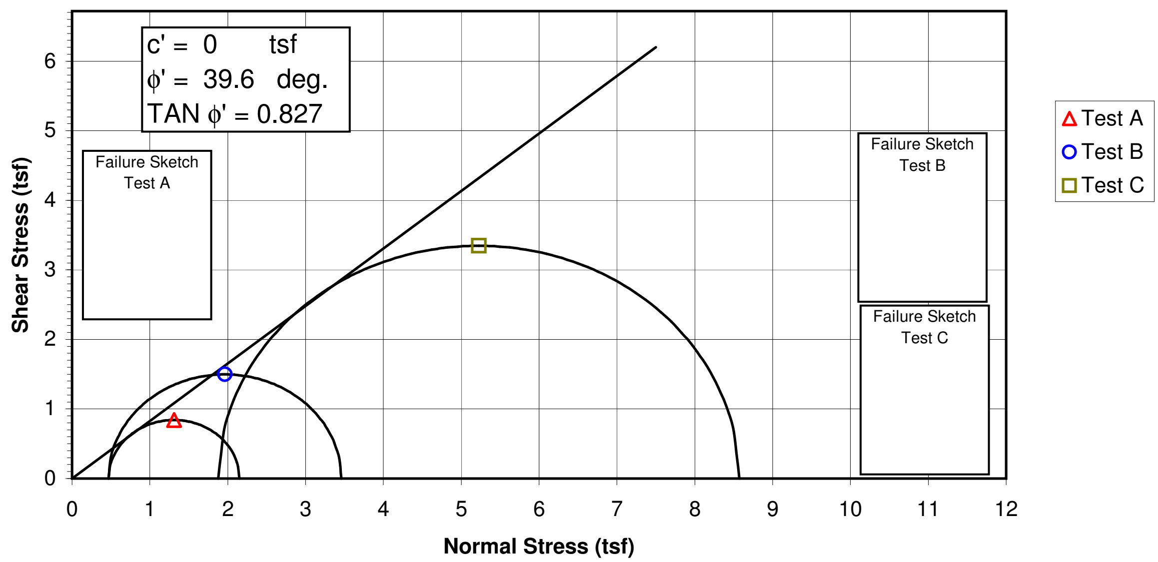
Tested By	KDG
Date	8-17-09
Press No.	1
Panel No.	B

Project Number	175539009
Test Number	CU-1257B
Data File ID	1257B
Lateral Pressure (psi)	30.0
Chamber Pressure - σ_3 (psi)	90

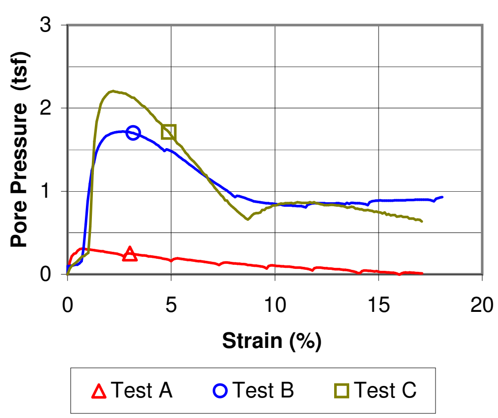
Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
9:54:47	287.0	1.045	73.7	4.848	18.00	49.1940	275.1	2.600	2.556	4.716	3.725	1.172	2.448	1.276	3.178
9:58:04	287.6	1.051	73.6	4.842	18.09	49.2541	275.7	2.603	2.558	4.718	3.735	1.179	2.457	1.278	3.167
10:01:25	288.0	1.057	73.6	4.836	18.20	49.3143	276.1	2.603	2.558	4.718	3.733	1.178	2.456	1.278	3.170
10:04:42	288.0	1.063	73.6	4.830	18.30	49.3749	276.0	2.599	2.555	4.715	3.730	1.178	2.454	1.276	3.166
10:08:01	288.5	1.069	73.5	4.824	18.40	49.4357	276.5	2.601	2.556	4.716	3.740	1.187	2.463	1.277	3.152

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



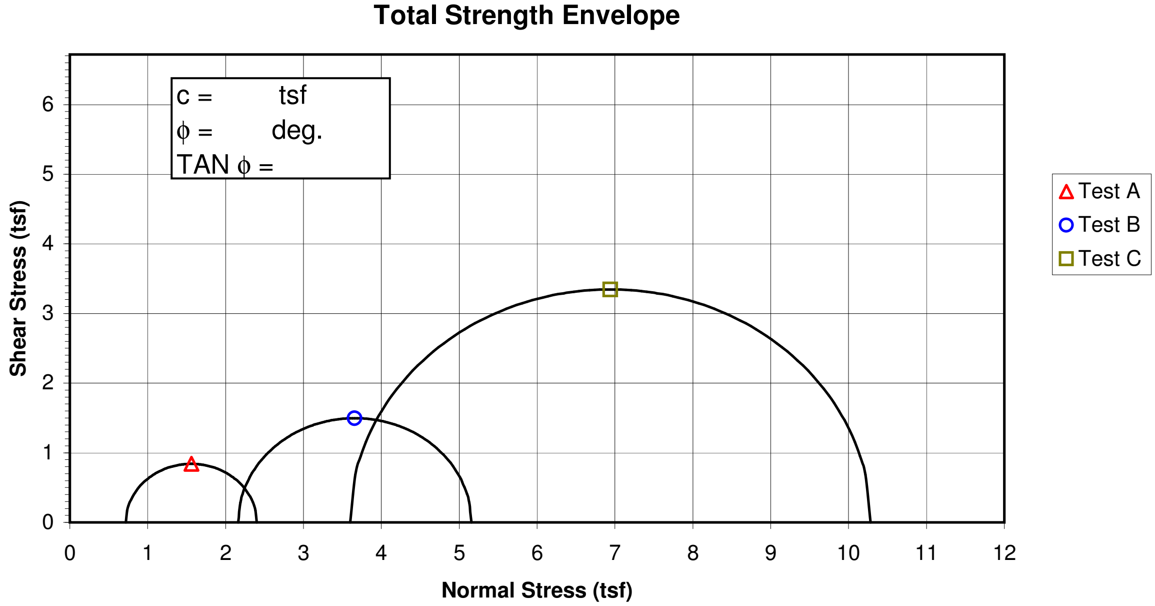
Induced Pore Pressure vs. Strain

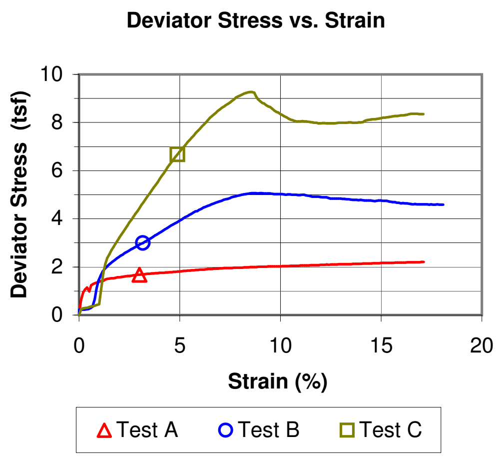


			A	B	C	
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	44.8	48.0	47.6	
	Dry Density PCF	γ_{d_o}	72.2	68.2	70.9	
	Saturation %	S_o	97.5	94.0	100.2	
	Void Ratio	e_o	1.134	1.262	1.174	
After Shear	Water content %	W_f	43.0	45.7	37.1	
	Dry Density PCF	γ_{d_f}	74.8	72.4	80.4	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	1.062	1.130	0.917	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		σ_3'f	0.47	0.47	1.88	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.68	3.00	6.68	
Time to (σ1'-σ3')max min.		t_f	22.3	15.5	26.8	
Ultimate Deviator Stress, t/sq ft		$(\sigma1'-\sigma3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.845	2.840	2.895	
Initial Height, in.		H_o	6.123	5.937	5.851	

Controlled - Strain Test					
Description of Specimens	Silt (ML), gray brown, moist, firm, fly ash				
		Type of Specimen	Undisturbed	Type of test	$\overline{R}$
LL	PL	PI	Gs 2.47	Project	Cumberland Dry Ash Stack and Gypsum Disposal Area
Remarks:					
		Boring No.	B-43A & B-35A	Sample No.	1278
		Depth Elev.	29.0'-29.5', 29.5'-30.0', 46.0'-46.5'		
		Laboratory	Stantec	Date	8-24-09
		TRIAXIAL COMPRESSION TEST REPORT			

Failure Criterion: Maximum Effective Principal Stress Ratio





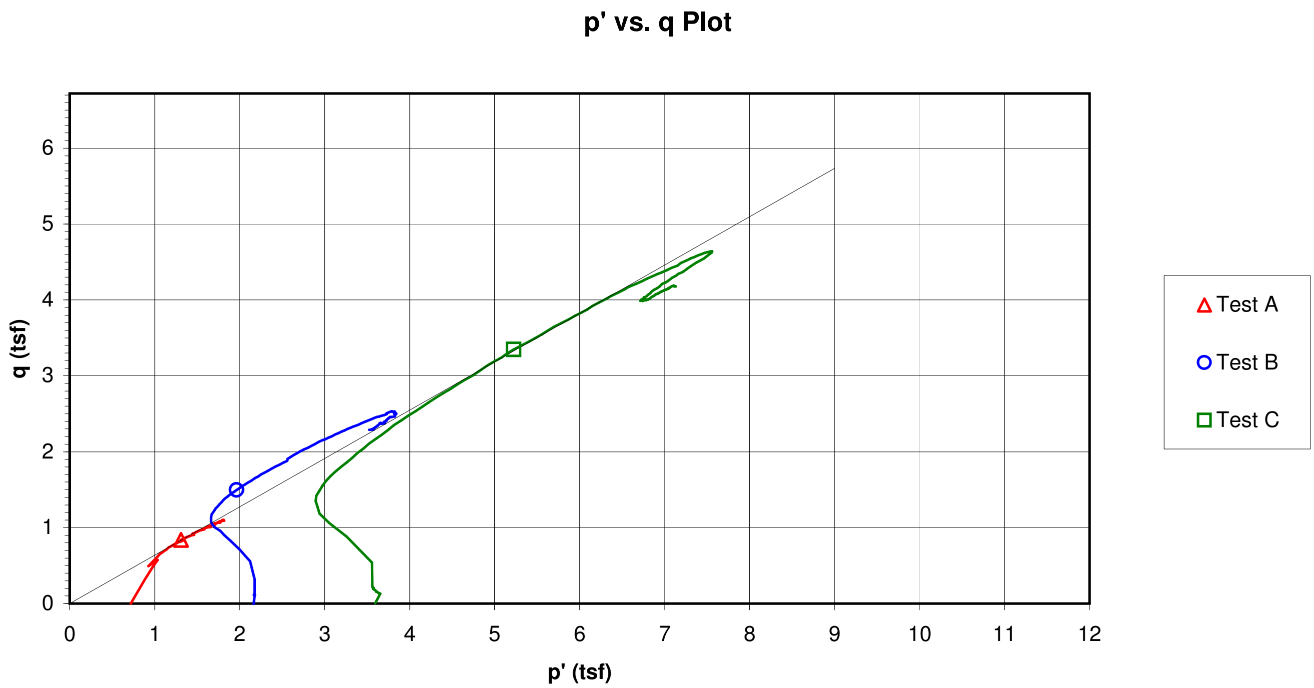
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	44.8	48.0	47.6	
	Dry Density PCF	γ_{d_o}	72.2	68.2	70.9	
	Saturation %	S_o	97.5	94.0	100.2	
	Void Ratio	e_o	1.134	1.262	1.174	
After Shear	Water content %	W_f	43.0	45.7	37.1	
	Dry Density PCF	γ_{d_f}	74.8	72.4	80.4	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	1.062	1.130	0.917	
	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		$(\sigma_1\text{-}\sigma_3)_{max}$	1.68	3.00	6.68	
Time to $(\sigma_1\text{-}\sigma_3)_{Max.}$ min.		t_f	22.3	15.5	26.8	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1\text{-}\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.845	2.840	2.895	
Initial Height, in.		H_o	6.123	5.937	5.851	

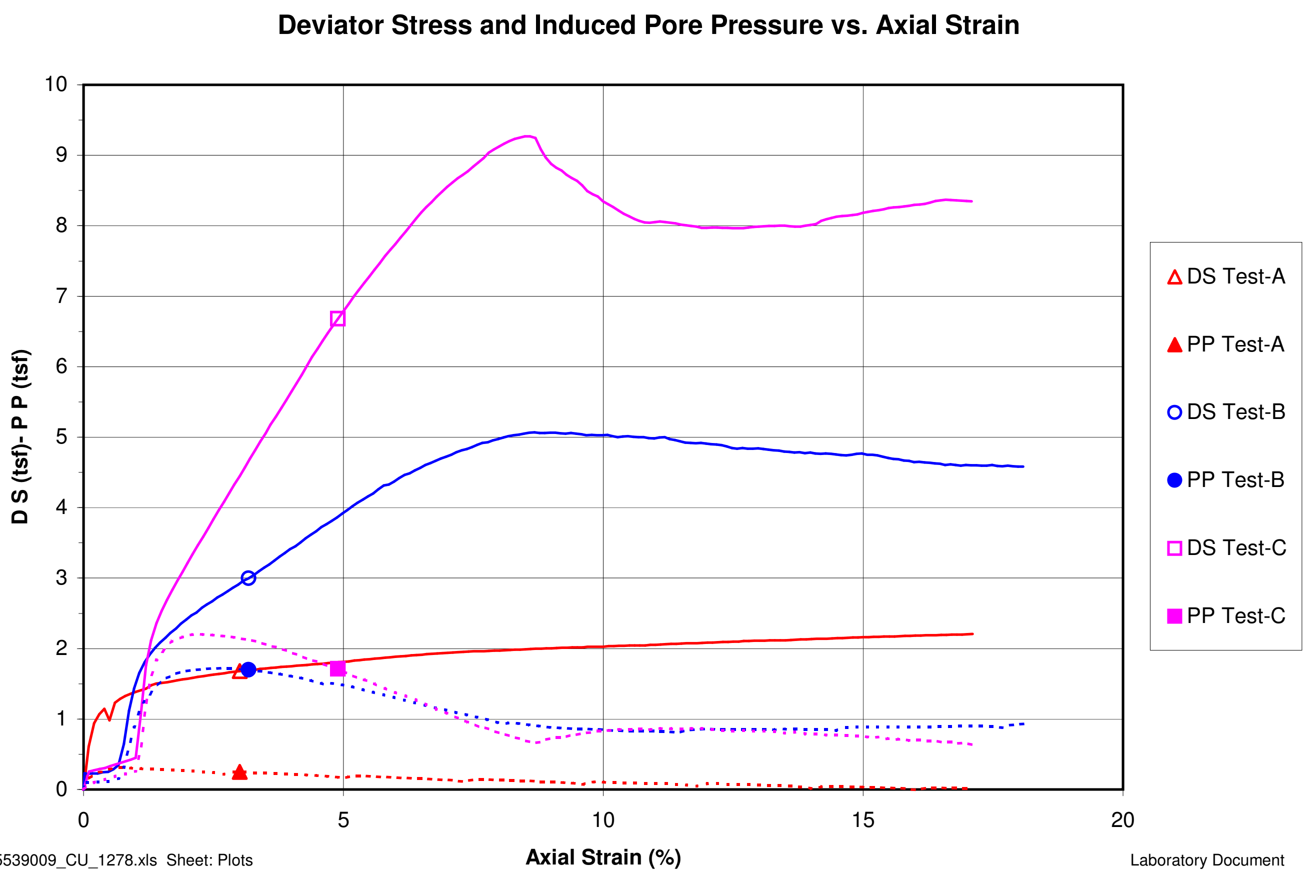
Controlled - Strain Test

Description of Specimens	Silt (ML), gray brown, moist, firm, fly ash				
	Type of Specimen	Undisturbed		Type of test	$\overline{R}$
LL	PL	PI	Gs 2.47	Project	Cumberland Dry Ash Stack and Gypsum Disposal Area
Remarks:					
	Boring No.	B-43A & B-35A		Sample No.	1278
	Depth Elev.	29.0'-29.5', 29.5'-30.0', 46.0'-46.5'			
	Laboratory	Stantec		Date	8-24-09
	TRIAXIAL COMPRESSION TEST REPORT				

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project No.	175539009
Sample ID	B-43A, 29.0'-29.5' & B-43A, 29.5'-30.0' & B-35A, 46.0'-46.5'	Test Number	1278
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 39.6 deg.	c' =	0.00 tsf





Stantec

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Sample Identification	B-43A, 29.0'-29.5'	Test Number	CU-1278A
Visual Description	Silt (ML), gray brown, moist, firm, fly ash	Prepared By	RC
Undisturbed	Source B-43A, 29.0'-31.0'	Date	7-18-2009

Specific Gravity 2.47 ASTM D854 Method A Liquid Limit N/A Plastic Limit N/A Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in^3)		Specimen	
Top	2.834	1	6.119	Sample	38.8860 (V_o)	Wet Weight (g)	1068.41
Middle	2.847	2	6.130	Solids	18.2276 (VS_o)	Dry Weight (g)	737.83
Bottom	2.850	3	6.123	Water	20.1722 (Vw_o)	Wet Unit Weight (pcf)	104.7
Avg.	2.8437 (D_o)	4	6.119	Voids	20.6584 (Vv_o)	Dry Unit Weight (pcf)	72.3
Area (in^2)	6.3511 (A_o)	Avg. (H_o)	6.1228	Degree of Saturation (%)	97.6 (S_o)		
Moisture Content (%)	44.8	Final Trimmings		Void Ratio	1.133		

Saturation

Set Up & Saturated: Wet xx Dry

Set up By KDG

Back Pressure Saturated to: 80 (psi) Final Pore Pressure Parameter B 0.96 Date 8-13-09

Panel Board Number F

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1274	Initial	16.67 (in.)	Initial	10.75 (in.)	Specimen Height (in.)	6.1289 (H_s)
Final	0.1213	Final	13.39 (in.)	Final	6.34 (in.)	Area (in^2) Method A	6.3637 (A_s)
Change	0.0061 (ΔH_o)	Change	-3.28 (in.)	Change	-4.41 (in.)	Specimen Volume (in^3)	39.00 (Vs)

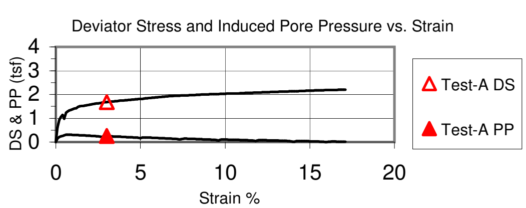
Consolidation

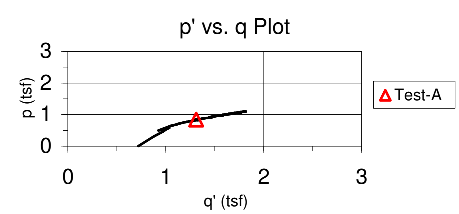
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1213	Initial	1.23 (in.)	Initial	17.72 (in.)	Chamber	90
Final	0.1304	Final	3.35 (in.)	Final	15.66 (in.)	Back	80
Change	-0.0091 (ΔH_c)	Change	-2.12 (in.)	Change	-2.06 (in.)	Lateral	10 (σ_3)
Height (in.)	6.1198 (H_c)			Volume (in^3)	37.5925 (V_c)		
Area (in^3) Method B	6.1428 (A_c)			Volume - Water (in^3)	19.3649 (VWc)	t_{50} (min.)	0.089
Diameter (in.)	2.7967 (D_c)			Water Content (%)	43.0		
Dry Density (pcf)	74.8			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	1.062

After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.382 (in.)	Wet Weight (g)	1055.18	Corrected Deviator	1.68 σ_d (tsf)
Wet weight (g)	1055.18 (WWf)	Dry Weight (g)	737.83	Major Principal	2.15 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.358 (in.)	Tare Weight (g)	0.00	Minor Principal	0.47 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.140
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	3.01
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch





Comments: One + 1 1/2" rock found in specimen after testing.

Stantec

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Sample Identification	B-43A, 29.5'-30.0'	Test Number	CU-1278B
Visual Description	Silt (ML), gray brown, moist, firm, fly ash	Prepared By	RC
Undisturbed	Source B-43A, 29.0'-31.0'	Date	7-28-2009

Specific Gravity 2.47 ASTM D854 Method A   Liquid Limit N/A   Plastic Limit N/A   Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in3)		Specimen	
Top	2.851	1	5.942	Sample	37.7256 (V_o)	Wet Weight (g)	996.10
Middle	2.827	2	5.921	Solids	16.6250 (VS_o)	Dry Weight (g)	672.96
Bottom	2.855	3	5.944	Water	19.7182 (Vw_o)	Wet Unit Weight (pcf)	100.6
Avg.	2.8443 (D_o)	4	5.942	Voids	21.1006 (Vv_o)	Dry Unit Weight (pcf)	68.0
Area (in^2)	6.3541 (A_o)	Avg. (H_o)	5.9373	Degree of Saturation (%)	93.4 (S_o)		
Moisture Content (%)	48.0	Final Trimmings		Void Ratio	1.269		

Saturation

Set Up & Saturated: Wet xx Dry ____   Set up By KDG

Back Pressure Saturated to: 60 (psi)   Final Pore Pressure Parameter B 0.98   Date 8-14-09

Panel Board Number A

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1217	Initial	16.56 (in.)	Initial	11.25 (in.)	Specimen Height (in.)	5.9382 (H_s)
Final	0.1208	Final	11.36 (in.)	Final	7.95 (in.)	Area (in^2) Method A	6.3560 (A_s)
Change	0.0009 (ΔH_o)	Change	-5.20 (in.)	Change	-3.30 (in.)	Specimen Volume (in^3)	37.74 (V_s)

Consolidation

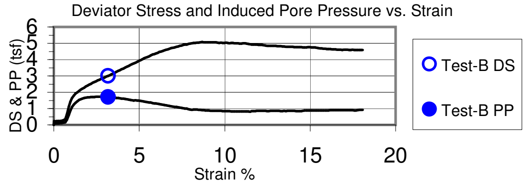
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1208	Initial	1.23 (in.)	Initial	16.13 (in.)	Chamber	90
Final	0.1212	Final	5.04 (in.)	Final	11.69 (in.)	Back	60
Change	-0.0004 (ΔH_c)	Change	-3.81 (in.)	Change	-4.44 (in.)	Lateral	30 (σ_3)
Height (in.)	5.9378 (H_c)			Volume (in^3)	35.4102 (V_c)		
Area (in^3) Method B	5.9636 (A_c)			Volume - Water (in^3)	18.7852 (VWc)	D_{50} (min.)	0.063
Diameter (in.)	2.7556 (D_c)			Water Content (%)	45.7		
Dry Density (pcf)	72.4			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	1.130

After Test

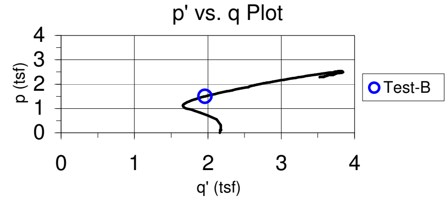
Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.204 (in.)	Wet Weight (g)	980.81	Corrected Deviator	3.00 σ_d (tsf)
Wet weight (g)	980.81 (WWf)	Dry Weight (g)	672.96	Major Principal	3.46 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.180 (in.)	Tare Weight (g)	0.00	Minor Principal	0.47 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.221
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	3.17
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch

Deviator Stress and Induced Pore Pressure vs. Strain



p' vs. q Plot



Comments: ____

File: 175539009_CU_1278.xls Sheet: Specimen-B
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Consolidated Undrained Triaxial Test

ASTM D4767-04

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Sample Identification	B-35A, 46.0'-46.5'	Test Number	CU-1278C
Visual Description	Silt (ML), gray brown, moist, firm, fly ash	Prepared By	RC
Undisturbed	Source B-35A, 46.0'-48.0'	Date	7-28-2009

Specific Gravity 2.47 ASTM D854 Method A   Liquid Limit N/A   Plastic Limit N/A   Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in^3)		Specimen	
Top	2.883	1	5.851	Sample	38.4607 (V_o)	Wet Weight (g)	1058.02
Middle	2.899	2	5.865	Solids	17.7080 (VS_o)	Dry Weight (g)	716.80
Bottom	2.897	3	5.837	Water	20.8215 (Vw_o)	Wet Unit Weight (pcf)	104.8
Avg.	2.8930 (D_o)	4	5.851	Voids	20.7526 (Vv_o)	Dry Unit Weight (pcf)	71.0
Area (in^2)	6.5733 (A_o)	Avg. (H_o)	5.8510	Degree of Saturation (%)	100.3 (S_o)		
Moisture Content (%)	47.6	Final Trimmings		Void Ratio	1.172		

Saturation

Set Up & Saturated: Wet xx Dry ____   Set up By KDG

Back Pressure Saturated to: 40 (psi)   Final Pore Pressure Parameter B 0.97   Date 8-13-09

Panel Board Number E

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1191	Initial	17.15 (in.)	Initial	9.54 (in.)	Specimen Height (in.)	5.8422 (H_s)
Final	0.1279	Final	14.75 (in.)	Final	7.08 (in.)	Area (in^2) Method A	6.5535 (A_s)
Change	-0.0088 (ΔH_o)	Change	-2.40 (in.)	Change	-2.46 (in.)	Specimen Volume (in^3)	38.29 (V_s)

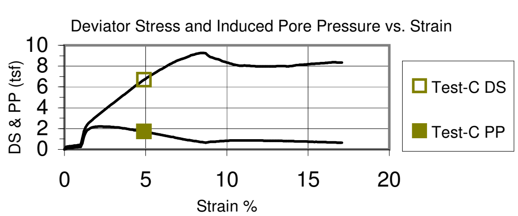
Consolidation

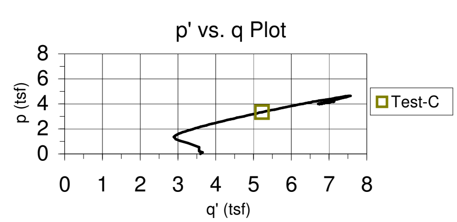
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1279	Initial	1.36 (in.)	Initial	16.86 (in.)	Chamber	90
Final	0.1242	Final	7.46 (in.)	Final	10.83 (in.)	Back	40
Change	0.0037 (ΔH_c)	Change	-6.10 (in.)	Change	-6.03 (in.)	Lateral	50 (σ_3)
Height (in.)	5.8459 (H_c)			Volume (in^3)	33.9506 (V_c)		
Area (in^3) Method B	5.8076 (A_c)			Volume - Water (in^3)	16.2426 (VWc)	D_{50} (min.)	0.206
Diameter (in.)	2.7193 (D_c)			Water Content (%)	37.1		
Dry Density (pcf)	80.4			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.917

After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.109 (in.)	Wet Weight (g)	982.98	Corrected Deviator	6.68 σ_d (tsf)
Wet weight (g)	982.98 (WWf)	Dry Weight (g)	716.80	Major Principal	8.57 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.085 (in.)	Tare Weight (g)	0.00	Minor Principal	1.88 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.186
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	4.90
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch





Comments:

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

	Consolidation Values			Final Values			
Height	6.120 (in.)	15.544 (cm)	Height	5.073 (in.)	Tested By	KDG	Project Number	175539009
Diameter	2.797 (in)	7.104 (cm)	Dia. avg.	3.239 (in)	Date	8-19-09	Test Number	CU-1278A
Area	6.143 (in²)	39.633 (cm²)	Area avg.	8.237 (in²)	Press No.	2	Data File ID	CU-1278A
					Panel No.	F	Lateral Pressure (psi)	10.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
0:00:00	8.9	-0.003	80.0	6.120	0.00	39.6334	0.0	0.000	0.000	0.720	0.720	0.719	0.719	0.001	1.002
0:00:59	60.9	0.003	82.1	6.114	0.10	39.6737	52.0	0.610	0.610	1.330	1.181	0.571	0.876	0.305	2.071
0:01:50	89.1	0.010	83.0	6.107	0.20	39.7144	80.3	0.940	0.939	1.659	1.443	0.503	0.973	0.470	2.871
0:02:39	100.0	0.016	83.4	6.101	0.30	39.7534	91.2	1.067	1.066	1.786	1.541	0.473	1.007	0.534	3.255
0:03:25	106.9	0.022	83.6	6.095	0.40	39.7932	98.0	1.145	1.144	1.864	1.609	0.463	1.036	0.573	3.474
0:04:09	93.1	0.028	84.0	6.089	0.50	39.8328	84.3	0.984	0.982	1.702	1.417	0.433	0.925	0.492	3.270
0:04:58	114.6	0.034	84.3	6.083	0.60	39.8729	105.7	1.233	1.231	1.951	1.646	0.413	1.030	0.616	3.982
0:05:47	119.5	0.040	84.3	6.077	0.70	39.9147	110.6	1.289	1.287	2.007	1.699	0.410	1.054	0.644	4.142
0:06:28	123.0	0.046	84.3	6.071	0.80	39.9538	114.1	1.328	1.326	2.046	1.737	0.410	1.074	0.664	4.237
0:07:14	125.9	0.052	84.2	6.065	0.90	39.9944	117.0	1.361	1.359	2.079	1.777	0.417	1.097	0.680	4.264
0:07:58	128.4	0.059	84.2	6.058	1.00	40.0354	119.6	1.389	1.386	2.106	1.807	0.419	1.113	0.694	4.309
0:08:40	130.4	0.064	84.1	6.052	1.10	40.0745	121.5	1.410	1.407	2.127	1.832	0.423	1.128	0.704	4.327
0:09:24	132.4	0.071	84.1	6.046	1.20	40.1160	123.5	1.432	1.429	2.149	1.858	0.427	1.142	0.715	4.347
0:10:08	136.9	0.077	84.1	6.040	1.31	40.1579	128.0	1.482	1.479	2.199	1.909	0.428	1.168	0.740	4.456
0:10:49	138.9	0.083	84.0	6.034	1.40	40.1963	130.1	1.505	1.501	2.221	1.935	0.433	1.184	0.751	4.474
0:11:33	140.2	0.089	83.9	6.028	1.50	40.2388	131.4	1.518	1.515	2.235	1.954	0.438	1.196	0.758	4.464
0:12:17	141.1	0.095	83.9	6.021	1.61	40.2805	132.3	1.527	1.523	2.243	1.967	0.442	1.205	0.762	4.447
0:12:58	142.3	0.101	83.9	6.015	1.70	40.3206	133.4	1.539	1.535	2.255	1.978	0.442	1.210	0.768	4.474
0:13:42	143.6	0.107	83.8	6.010	1.80	40.3601	134.7	1.552	1.548	2.268	1.996	0.447	1.222	0.775	4.464
0:14:27	145.1	0.114	83.7	6.003	1.90	40.4025	136.2	1.568	1.563	2.283	2.016	0.451	1.233	0.782	4.467
0:15:08	145.9	0.120	83.7	5.997	2.00	40.4438	137.1	1.576	1.571	2.291	2.028	0.456	1.242	0.786	4.450
0:15:52	147.4	0.126	83.6	5.991	2.10	40.4853	138.5	1.591	1.586	2.306	2.046	0.459	1.253	0.794	4.457
0:16:33	148.5	0.132	83.6	5.985	2.20	40.5263	139.6	1.602	1.596	2.316	2.060	0.463	1.261	0.799	4.454
0:17:17	149.6	0.138	83.5	5.979	2.31	40.5689	140.8	1.614	1.608	2.328	2.078	0.469	1.274	0.805	4.431
0:18:01	151.0	0.145	83.4	5.972	2.41	40.6125	142.1	1.627	1.621	2.341	2.095	0.473	1.284	0.811	4.432
0:18:43	151.8	0.150	83.4	5.967	2.50	40.6507	142.9	1.635	1.629	2.349	2.109	0.479	1.294	0.815	4.406
0:19:24	152.7	0.156	83.2	5.961	2.60	40.6923	143.9	1.644	1.638	2.358	2.126	0.487	1.306	0.819	4.368
0:20:08	153.9	0.163	83.0	5.954	2.71	40.7358	145.0	1.655	1.649	2.369	2.154	0.504	1.329	0.825	4.273
0:20:49	155.2	0.168	83.4	5.948	2.80	40.7753	146.4	1.669	1.662	2.382	2.138	0.474	1.306	0.832	4.510
0:21:36	156.2	0.175	83.5	5.942	2.91	40.8205	147.4	1.679	1.671	2.391	2.141	0.469	1.305	0.836	4.570
0:22:17	157.1	0.181	83.5	5.936	3.01	40.8623	148.3	1.687	1.680	2.400	2.151	0.469	1.310	0.841	4.582
0:22:59	157.8	0.187	83.4	5.930	3.10	40.9034	149.0	1.694	1.686	2.406	2.160	0.473	1.316	0.844	4.570
0:23:40	158.8	0.193	83.4	5.924	3.20	40.9443	149.9	1.703	1.695	2.415	2.173	0.476	1.324	0.848	4.563
0:24:24	159.5	0.199	83.3	5.917	3.31	40.9883	150.6	1.709	1.701	2.421	2.183	0.481	1.332	0.851	4.540
0:25:06	160.6	0.205	83.3	5.912	3.40	41.0291	151.7	1.719	1.711	2.431	2.196	0.484	1.340	0.856	4.539
0:25:49	161.2	0.212	83.2	5.905	3.51	41.0737	152.3	1.725	1.716	2.436	2.204	0.486	1.345	0.859	4.531
0:26:33	162.1	0.218	83.2	5.899	3.61	41.1177	153.2	1.733	1.724	2.444	2.215	0.490	1.353	0.862	4.517
0:27:12	162.7	0.224	83.2	5.893	3.70	41.1564	153.9	1.739	1.730	2.450	2.224	0.493	1.358	0.865	4.512
0:27:56	163.7	0.230	83.1	5.887	3.80	41.1998	154.9	1.748	1.738	2.458	2.237	0.497	1.367	0.870	4.501
0:28:38	164.4	0.236	83.0	5.881	3.90	41.2425	155.6	1.754	1.744	2.464	2.247	0.501	1.374	0.873	4.485
0:29:19	165.1	0.242	83.0	5.875	4.00	41.2852	156.2	1.759	1.750	2.470	2.254	0.503	1.379	0.875	4.478
0:30:01	165.9	0.248	83.0	5.869	4.10	41.3282	157.0	1.767	1.756	2.476	2.265	0.507	1.386	0.879	4.465
0:30:45	166.5	0.254	82.9	5.863	4.20	41.3723	157.7	1.772	1.762	2.482	2.275	0.511	1.393	0.882	4.447
0:31:26	167.1	0.260	82.8	5.857	4.30	41.4146	158.3	1.777	1.767	2.487	2.284	0.516	1.400	0.884	4.430
0:32:08	168.0	0.266	82.8	5.850	4.40	41.4586	159.2	1.785	1.774	2.494	2.295	0.519	1.407	0.888	4.419
0:32:50	168.7	0.272	82.7	5.844	4.50	41.5011	159.8	1.791	1.779	2.499	2.305	0.524	1.414	0.890	4.399
0:33:33	169.5	0.279	82.7	5.838	4.60	41.5458	160.6	1.798	1.786	2.506	2.316	0.528	1.422	0.894	4.385
0:34:15	170.2	0.285	82.6	5.832	4.70	41.5894	161.4	1.804	1.792	2.512	2.326	0.532	1.429	0.897	4.369
0:34:57	171.1	0.291	82.5	5.826	4.80	41.6321	162.3	1.812	1.800	2.520	2.339	0.537	1.438	0.901	4.353
0:35:41	171.8	0.297	82.4	5.820	4.91	41.6779	163.0	1.818	1.806	2.526	2.352	0.545	1.449	0.904	4.318
0:36:22	172.6	0.303	82.2	5.814	5.00	41.7197	163.7	1.825	1.812	2.532	2.373	0.559	1.466	0.907	4.245
0:37:04	173.2	0.309	82.5	5.807	5.10	41.7646	164.3	1.830	1.817	2.537	2.355	0.537	1.446	0.909	4.389
0:37:50	174.4	0.316	82.7	5.801	5.21	41.8108	165.6	1.841	1.829	2.549	2.358	0.528	1.443	0.915	4.467
0:38:32	175.1	0.322	82.7	5.795	5.31	41.8538	166.3	1.847	1.834	2.554	2.363	0.527	1.445	0.918	4.481
0:39:13	176.0	0.328	82.7	5.789	5.40	41.8959	167.2	1.856	1.842	2.562	2.372	0.528	1.450	0.922	4.492
0:39:57	176.7	0.334	82.6	5.783	5.50	41.9421	167.9	1.861	1.847	2.567	2.382	0.533	1.457	0.924	4.470
0:40:41	177.6	0.340	82.5	5.777	5.61	41.9872	168.8	1.869	1.855	2.575	2.393	0.537	1.465	0.928	4.460
0:41:22	178.3	0.346	82.5	5.771	5.70	42.0302	169.5	1.875	1.861	2.581	2.402	0.540	1.471	0.931	4.448
0:42:06	179.3	0.352	82.4	5.765	5.80	42.0756	170.4	1.883	1.869	2.589	2.414	0.544	1.479	0.935	4.441
0:42:48	180.1	0.358	82.4	5.759	5.90	42.1192	171.2	1.890	1.876	2.596	2.423	0.546	1.485	0.938	4.436

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

	Consolidation Values		Final Values					
Height	6.120 (in.)	15.544 (cm)	Height	5.073 (in.)	Tested By	KDG	Project Number	175539009
Diameter	2.797 (in)	7.104 (cm)	Dia. avg.	3.239 (in)	Date	8-19-09	Test Number	CU-1278A
Area	6.143 (in^2)	39.633 (cm^2)	Area avg.	8.237 (in^2)	Press No.	2	Data File ID	CU-1278A
					Panel No.	F	Lateral Pressure (psi)	10.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
0:43:32	181.0	0.365	82.4	5.752	6.01	42.1655	172.2	1.899	1.884	2.604	2.435	0.550	1.492	0.943	4.429
0:44:13	181.7	0.371	82.3	5.746	6.10	42.2098	172.8	1.904	1.889	2.609	2.443	0.553	1.498	0.945	4.419
0:44:55	182.3	0.377	82.3	5.740	6.20	42.2533	173.5	1.909	1.894	2.614	2.450	0.555	1.502	0.947	4.415
0:45:39	183.4	0.383	82.2	5.734	6.30	42.3001	174.6	1.919	1.903	2.623	2.463	0.559	1.511	0.952	4.409
0:46:20	184.2	0.389	82.2	5.728	6.40	42.3447	175.3	1.925	1.909	2.629	2.473	0.562	1.517	0.955	4.400
0:47:04	184.7	0.395	82.1	5.722	6.51	42.3914	175.9	1.929	1.913	2.633	2.480	0.565	1.522	0.957	4.387
0:47:45	185.6	0.401	82.1	5.716	6.60	42.4358	176.7	1.937	1.920	2.640	2.490	0.569	1.530	0.961	4.379
0:48:29	186.4	0.407	82.0	5.709	6.70	42.4818	177.5	1.943	1.927	2.647	2.501	0.572	1.537	0.964	4.368
0:49:11	187.0	0.413	82.0	5.703	6.80	42.5261	178.2	1.948	1.931	2.651	2.509	0.576	1.543	0.966	4.353
0:49:55	187.5	0.420	81.9	5.697	6.91	42.5731	178.6	1.951	1.934	2.654	2.516	0.581	1.549	0.968	4.332
0:50:36	188.2	0.426	81.9	5.691	7.01	42.6189	179.4	1.957	1.940	2.660	2.525	0.584	1.554	0.971	4.325
0:51:18	188.8	0.432	81.8	5.685	7.10	42.6639	179.9	1.961	1.944	2.664	2.534	0.589	1.562	0.972	4.301
0:51:59	189.4	0.438	81.7	5.679	7.20	42.7090	180.6	1.966	1.948	2.668	2.544	0.594	1.569	0.975	4.282
0:52:43	190.1	0.444	81.6	5.673	7.31	42.7573	181.2	1.971	1.953	2.673	2.562	0.608	1.585	0.977	4.217
0:53:24	190.6	0.450	81.8	5.667	7.40	42.8029	181.8	1.975	1.956	2.676	2.551	0.593	1.572	0.979	4.300
0:54:07	191.2	0.456	81.9	5.661	7.50	42.8489	182.3	1.979	1.960	2.680	2.542	0.581	1.562	0.981	4.378
0:54:48	191.4	0.462	82.0	5.654	7.60	42.8949	182.5	1.978	1.960	2.680	2.538	0.577	1.557	0.980	4.399
0:55:30	191.8	0.468	82.0	5.648	7.70	42.9408	182.9	1.981	1.962	2.682	2.540	0.577	1.558	0.982	4.404
0:56:11	192.3	0.474	81.9	5.642	7.80	42.9866	183.4	1.984	1.965	2.685	2.546	0.580	1.563	0.983	4.390
0:56:55	193.0	0.481	81.9	5.636	7.90	43.0353	184.2	1.990	1.971	2.691	2.556	0.584	1.570	0.986	4.377
0:57:36	193.4	0.487	81.9	5.630	8.00	43.0811	184.6	1.992	1.973	2.693	2.560	0.586	1.573	0.987	4.370
0:58:18	193.8	0.493	81.8	5.624	8.10	43.1279	184.9	1.994	1.974	2.694	2.564	0.588	1.576	0.988	4.357
0:59:02	194.4	0.499	81.8	5.618	8.21	43.1766	185.6	1.998	1.978	2.698	2.570	0.590	1.580	0.990	4.354
0:59:43	195.1	0.505	81.8	5.612	8.30	43.2224	186.2	2.003	1.983	2.703	2.576	0.592	1.584	0.992	4.352
1:00:25	195.4	0.511	81.7	5.606	8.40	43.2683	186.6	2.005	1.984	2.704	2.580	0.594	1.587	0.993	4.343
1:01:09	196.3	0.517	81.7	5.599	8.50	43.3171	187.4	2.012	1.991	2.711	2.589	0.596	1.592	0.996	4.341
1:01:50	196.9	0.523	81.7	5.593	8.60	43.3629	188.0	2.016	1.995	2.715	2.594	0.598	1.596	0.998	4.338
1:02:34	197.3	0.530	81.6	5.587	8.70	43.4119	188.4	2.018	1.997	2.717	2.603	0.605	1.604	0.999	4.300
1:03:18	197.6	0.536	81.5	5.581	8.81	43.4602	188.8	2.020	1.998	2.718	2.608	0.608	1.608	1.000	4.286
1:03:59	198.3	0.542	81.5	5.575	8.90	43.5067	189.5	2.025	2.003	2.723	2.615	0.611	1.613	1.002	4.283
1:04:43	198.7	0.548	81.5	5.569	9.00	43.5553	189.9	2.027	2.005	2.725	2.619	0.613	1.616	1.003	4.274
1:05:25	199.2	0.554	81.4	5.563	9.10	43.6017	190.4	2.030	2.008	2.728	2.625	0.616	1.620	1.005	4.263
1:06:08	199.8	0.560	81.4	5.557	9.20	43.6509	190.9	2.034	2.011	2.731	2.632	0.620	1.626	1.006	4.248
1:06:52	200.1	0.566	81.3	5.550	9.30	43.6996	191.3	2.035	2.012	2.732	2.638	0.624	1.631	1.007	4.227
1:07:34	200.7	0.572	81.3	5.544	9.40	43.7457	191.8	2.039	2.016	2.736	2.645	0.628	1.636	1.009	4.215
1:08:18	200.9	0.579	81.2	5.538	9.50	43.7949	192.1	2.040	2.016	2.736	2.651	0.634	1.642	1.009	4.183
1:09:02	201.2	0.585	81.0	5.532	9.60	43.8443	192.3	2.040	2.016	2.736	2.666	0.648	1.657	1.009	4.111
1:09:43	202.1	0.591	81.4	5.526	9.70	43.8913	193.3	2.048	2.024	2.744	2.643	0.618	1.631	1.013	4.276
1:10:27	202.5	0.597	81.5	5.520	9.80	43.9412	193.6	2.049	2.025	2.745	2.639	0.612	1.625	1.013	4.309
1:11:11	202.9	0.603	81.5	5.514	9.91	43.9913	194.1	2.051	2.027	2.747	2.639	0.611	1.625	1.014	4.319
1:11:52	203.2	0.609	81.5	5.508	10.00	44.0383	194.3	2.052	2.027	2.747	2.642	0.613	1.627	1.014	4.310
1:12:36	204.1	0.615	81.4	5.501	10.10	44.0878	195.2	2.059	2.034	2.754	2.652	0.616	1.634	1.018	4.302
1:13:20	204.3	0.622	81.4	5.495	10.20	44.1375	195.5	2.060	2.034	2.754	2.654	0.619	1.636	1.018	4.291
1:14:02	204.8	0.627	81.4	5.489	10.30	44.1847	196.0	2.062	2.037	2.757	2.659	0.621	1.640	1.019	4.285
1:14:45	205.2	0.634	81.4	5.483	10.40	44.2351	196.3	2.064	2.038	2.758	2.661	0.622	1.642	1.020	4.280
1:15:30	205.9	0.640	81.3	5.477	10.50	44.2855	197.0	2.069	2.043	2.763	2.668	0.624	1.646	1.022	4.275
1:16:14	206.2	0.646	81.3	5.471	10.61	44.3353	197.3	2.069	2.043	2.763	2.671	0.626	1.648	1.022	4.265
1:16:55	206.5	0.652	81.3	5.465	10.70	44.3831	197.6	2.071	2.044	2.764	2.673	0.628	1.651	1.023	4.257
1:17:39	206.8	0.658	81.2	5.459	10.80	44.4343	197.9	2.071	2.045	2.765	2.677	0.631	1.654	1.023	4.242
1:18:23	207.6	0.664	81.2	5.452	10.90	44.4844	198.7	2.078	2.051	2.771	2.686	0.634	1.660	1.026	4.237
1:19:04	208.3	0.670	81.2	5.447	11.00	44.5324	199.4	2.082	2.055	2.775	2.692	0.636	1.664	1.028	4.232
1:19:48	208.7	0.676	81.2	5.440	11.10	44.5827	199.9	2.085	2.057	2.777	2.694	0.636	1.665	1.029	4.237
1:20:32	209.4	0.683	81.1	5.434	11.20	44.6337	200.5	2.089	2.061	2.781	2.701	0.638	1.670	1.031	4.231
1:21:16	210.0	0.689	81.1	5.428	11.30	44.6843	201.1	2.093	2.065	2.785	2.709	0.643	1.676	1.033	4.216
1:22:00	210.5	0.695	81.0	5.422	11.41	44.7356	201.6	2.096	2.068	2.788	2.715	0.646	1.681	1.035	4.202
1:22:41	210.8	0.701	81.0	5.416	11.50	44.7839	202.0	2.097	2.069	2.789	2.720	0.650	1.685	1.035	4.185
1:23:25	211.5	0.707	80.9	5.410	11.60	44.8361	202.7	2.102	2.073	2.793	2.729	0.655	1.692	1.037	4.169
1:24:09	212.1	0.713	80.8	5.403	11.70	44.8874	203.2	2.105	2.076	2.796	2.740	0.663	1.701	1.039	4.135
1:24:53	212.4	0.720	80.7	5.397	11.81	44.9385	203.6	2.107	2.077	2.797	2.752	0.673	1.713	1.039	4.088
1:25:35	213.0	0.725	81.0	5.391	11.90	44.9880	204.2	2.110	2.081	2.801	2.729	0.647	1.688	1.041	4.221

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values			
Height	6.120 (in.)	15.544 (cm)	Height	5.073 (in.)	Tested By	KDG
Diameter	2.797 (in)	7.104 (cm)	Dia. avg.	3.239 (in)	Date	8-19-09
Area	6.143 (in^2)	39.633 (cm^2)	Area avg.	8.237 (in^2)	Press No.	2
					Panel No.	F

Project Number	175539009
Test Number	CU-1278A
Data File ID	CU-1278A
Lateral Pressure (psi)	10.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
1:26:19	213.5	0.732	81.1	5.385	12.01	45.0408	204.7	2.113	2.083	2.803	2.723	0.638	1.680	1.042	4.269
1:27:00	214.1	0.738	81.2	5.379	12.10	45.0899	205.2	2.116	2.086	2.806	2.724	0.637	1.680	1.044	4.279
1:27:44	214.8	0.744	81.1	5.373	12.20	45.1426	206.0	2.121	2.091	2.811	2.731	0.638	1.684	1.046	4.280
1:28:25	215.5	0.750	81.1	5.367	12.30	45.1924	206.6	2.126	2.095	2.815	2.738	0.641	1.690	1.048	4.269
1:29:09	215.6	0.756	81.1	5.361	12.40	45.2456	206.7	2.125	2.094	2.814	2.740	0.644	1.692	1.048	4.253
1:29:51	216.2	0.762	81.0	5.355	12.50	45.2957	207.4	2.129	2.098	2.818	2.746	0.646	1.696	1.050	4.248
1:30:35	216.7	0.768	81.0	5.348	12.60	45.3486	207.8	2.131	2.100	2.820	2.749	0.648	1.698	1.051	4.245
1:31:19	217.5	0.775	81.0	5.342	12.71	45.4020	208.6	2.137	2.105	2.825	2.756	0.650	1.703	1.053	4.241
1:32:00	217.9	0.781	80.9	5.336	12.80	45.4524	209.1	2.139	2.107	2.827	2.760	0.652	1.706	1.054	4.235
1:32:44	218.6	0.787	80.9	5.330	12.90	45.5059	209.8	2.144	2.112	2.832	2.769	0.656	1.712	1.057	4.223
1:33:25	218.8	0.793	80.9	5.324	13.00	45.5567	209.9	2.143	2.111	2.831	2.768	0.656	1.712	1.056	4.221
1:34:09	219.3	0.799	80.9	5.318	13.10	45.6101	210.4	2.145	2.113	2.833	2.772	0.658	1.715	1.057	4.214
1:34:51	219.8	0.805	80.8	5.312	13.20	45.6611	210.9	2.148	2.116	2.836	2.779	0.662	1.720	1.058	4.198
1:35:35	219.9	0.811	80.8	5.306	13.30	45.7151	211.1	2.147	2.114	2.834	2.779	0.663	1.721	1.058	4.189
1:36:19	220.3	0.817	80.8	5.299	13.41	45.7692	211.5	2.149	2.116	2.836	2.783	0.666	1.724	1.058	4.179
1:37:00	220.8	0.823	80.7	5.293	13.50	45.8203	211.9	2.151	2.117	2.837	2.787	0.668	1.727	1.059	4.172
1:37:44	221.6	0.830	80.7	5.287	13.61	45.8751	212.7	2.156	2.122	2.842	2.794	0.671	1.732	1.062	4.167
1:38:25	222.1	0.836	80.6	5.281	13.70	45.9267	213.3	2.159	2.125	2.845	2.806	0.679	1.742	1.063	4.132
1:39:07	222.7	0.842	80.5	5.275	13.80	45.9790	213.8	2.162	2.128	2.848	2.813	0.683	1.748	1.065	4.117
1:39:51	223.0	0.848	80.4	5.269	13.90	46.0343	214.2	2.163	2.129	2.849	2.821	0.691	1.756	1.065	4.085
1:40:32	223.6	0.854	80.2	5.263	14.00	46.0866	214.8	2.167	2.132	2.852	2.837	0.704	1.770	1.067	4.032
1:41:16	224.4	0.860	80.2	5.257	14.10	46.1416	215.6	2.173	2.138	2.858	2.844	0.705	1.774	1.070	4.035
1:41:58	224.7	0.866	80.6	5.251	14.20	46.1938	215.9	2.173	2.138	2.858	2.818	0.678	1.748	1.070	4.154
1:42:39	225.2	0.872	80.7	5.245	14.30	46.2471	216.3	2.175	2.140	2.860	2.813	0.672	1.743	1.070	4.185
1:43:23	225.9	0.878	80.7	5.238	14.40	46.3019	217.1	2.180	2.144	2.864	2.819	0.673	1.746	1.073	4.188
1:44:07	226.5	0.885	80.6	5.232	14.50	46.3575	217.6	2.183	2.147	2.867	2.825	0.676	1.750	1.074	4.177
1:44:48	227.0	0.891	80.6	5.226	14.60	46.4103	218.1	2.185	2.149	2.869	2.827	0.677	1.752	1.075	4.178
1:45:32	227.5	0.897	80.5	5.220	14.71	46.4664	218.7	2.188	2.152	2.872	2.834	0.681	1.757	1.077	4.164
1:46:14	228.2	0.903	80.5	5.214	14.80	46.5198	219.4	2.193	2.156	2.876	2.840	0.682	1.761	1.079	4.163
1:46:58	228.7	0.909	80.5	5.208	14.90	46.5752	219.8	2.195	2.158	2.878	2.840	0.681	1.760	1.080	4.171
1:47:39	229.4	0.915	80.5	5.202	15.00	46.6285	220.5	2.199	2.162	2.882	2.850	0.686	1.768	1.082	4.153
1:48:23	229.8	0.921	80.4	5.195	15.10	46.6843	221.0	2.201	2.164	2.884	2.855	0.690	1.773	1.083	4.138
1:49:07	230.4	0.928	80.4	5.189	15.21	46.7409	221.5	2.204	2.166	2.886	2.859	0.691	1.775	1.084	4.137
1:49:48	230.9	0.934	80.4	5.183	15.30	46.7947	222.0	2.206	2.168	2.888	2.862	0.693	1.777	1.085	4.133
1:50:30	231.5	0.940	80.3	5.177	15.40	46.8487	222.6	2.210	2.172	2.892	2.870	0.697	1.783	1.087	4.119
1:51:14	231.8	0.946	80.3	5.171	15.50	46.9059	222.9	2.210	2.172	2.892	2.870	0.697	1.784	1.087	4.118
1:51:55	232.2	0.952	80.3	5.165	15.60	46.9600	223.3	2.211	2.173	2.893	2.874	0.700	1.787	1.087	4.106
1:52:39	232.8	0.958	80.3	5.159	15.71	47.0183	224.0	2.215	2.176	2.896	2.878	0.700	1.789	1.089	4.110
1:53:21	233.5	0.964	80.2	5.153	15.80	47.0732	224.6	2.219	2.180	2.900	2.885	0.704	1.795	1.091	4.098
1:54:02	234.0	0.970	80.1	5.146	15.90	47.1286	225.1	2.221	2.182	2.902	2.895	0.712	1.804	1.092	4.066
1:54:43	234.6	0.976	80.0	5.140	16.00	47.1835	225.7	2.225	2.185	2.905	2.910	0.723	1.816	1.093	4.024
1:55:27	234.8	0.983	80.2	5.134	16.11	47.2427	226.0	2.224	2.184	2.904	2.893	0.708	1.800	1.093	4.089
1:56:09	235.4	0.989	80.3	5.128	16.21	47.2987	226.5	2.227	2.187	2.907	2.887	0.699	1.793	1.094	4.131
1:56:50	235.9	0.995	80.3	5.122	16.30	47.3543	227.0	2.229	2.189	2.909	2.886	0.696	1.791	1.095	4.147
1:57:32	236.4	1.001	80.3	5.116	16.40	47.4098	227.5	2.231	2.191	2.911	2.890	0.698	1.794	1.096	4.142
1:58:13	236.8	1.007	80.3	5.110	16.50	47.4665	227.9	2.233	2.192	2.912	2.889	0.696	1.793	1.097	4.151
1:58:55	237.2	1.013	80.3	5.104	16.60	47.5227	228.3	2.234	2.193	2.913	2.894	0.699	1.796	1.097	4.138
1:59:39	237.9	1.019	80.3	5.097	16.71	47.5824	229.0	2.238	2.197	2.917	2.898	0.700	1.799	1.099	4.141
2:00:20	238.1	1.025	80.3	5.091	16.80	47.6384	229.2	2.237	2.196	2.916	2.899	0.701	1.800	1.099	4.132
2:01:02	238.6	1.031	80.2	5.085	16.90	47.6954	229.7	2.239	2.198	2.918	2.902	0.703	1.803	1.100	4.127
2:01:43	239.4	1.038	80.2	5.079	17.00	47.7523	230.5	2.245	2.203	2.923	2.911	0.707	1.809	1.102	4.117
2:02:27	240.1	1.044	80.2	5.073	17.11	47.8119	231.2	2.249	2.206	2.926	2.914	0.706	1.810	1.104	4.127

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values		
Height	5.938 (in.)	15.082 (cm)		Height	4.864 (in.)	
Diameter	2.756 (in)	6.999 (cm)		Dia. avg.	3.155 (in)	
Area	5.964 (in^2)	38.477 (cm^2)		Area avg.	7.819 (in^2)	

Tested By	KDG
Date	8-17-09
Press No.	1
Panel No.	A

Project Number	175539009
Test Number	CU-1278B
Data File ID	1278B
Lateral Pressure (psi)	30.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	9.9	0.000	59.9	5.938	0.00	38.4770	0.0	0.000	0.000	2.160	2.160	2.165	2.163	-0.003	0.998
0:00:28	26.7	0.001	61.2	5.937	0.02	38.4835	16.8	0.203	0.203	2.363	2.273	2.075	2.174	0.099	1.095
0:00:57	29.1	0.001	61.3	5.937	0.02	38.4835	19.2	0.232	0.232	2.392	2.293	2.067	2.180	0.113	1.110
0:01:24	28.5	0.004	61.3	5.934	0.07	38.5042	18.6	0.225	0.225	2.385	2.287	2.067	2.177	0.110	1.106
0:01:49	28.9	0.010	61.4	5.928	0.17	38.5428	19.0	0.230	0.229	2.389	2.286	2.062	2.174	0.112	1.109
0:02:18	28.7	0.016	61.4	5.922	0.27	38.5822	18.8	0.227	0.226	2.386	2.279	2.058	2.169	0.110	1.107
0:02:45	30.2	0.022	61.5	5.916	0.37	38.6212	20.3	0.245	0.244	2.404	2.289	2.051	2.170	0.119	1.116
0:03:13	30.9	0.028	61.5	5.910	0.47	38.6602	21.0	0.253	0.252	2.412	2.296	2.050	2.173	0.123	1.120
0:03:40	33.9	0.034	61.7	5.904	0.57	38.6995	24.0	0.288	0.287	2.447	2.316	2.034	2.175	0.141	1.138
0:04:06	38.8	0.040	62.1	5.898	0.67	38.7369	28.9	0.347	0.346	2.506	2.348	2.007	2.177	0.170	1.170
0:04:38	63.9	0.046	64.2	5.892	0.77	38.7769	54.1	0.648	0.647	2.807	2.497	1.856	2.177	0.321	1.345
0:05:09	103.5	0.052	68.3	5.886	0.87	38.8165	93.6	1.121	1.119	3.279	2.678	1.565	2.122	0.557	1.712
0:05:37	129.8	0.058	72.1	5.880	0.97	38.8550	120.0	1.436	1.433	3.593	2.715	1.287	2.001	0.714	2.110
0:06:04	148.2	0.064	75.1	5.874	1.07	38.8944	138.3	1.654	1.651	3.811	2.718	1.073	1.896	0.823	2.534
0:06:32	161.3	0.070	77.3	5.868	1.18	38.9347	151.4	1.809	1.806	3.966	2.717	0.917	1.817	0.900	2.963
0:06:58	170.9	0.076	78.7	5.862	1.27	38.9734	161.0	1.921	1.918	4.078	2.727	0.815	1.771	0.956	3.346
0:07:23	178.7	0.082	80.2	5.856	1.38	39.0135	168.8	2.012	2.009	4.169	2.709	0.706	1.708	1.002	3.838
0:07:50	185.3	0.087	81.1	5.850	1.47	39.0525	175.5	2.089	2.086	4.246	2.720	0.640	1.680	1.040	4.249
0:08:16	191.1	0.093	81.8	5.844	1.57	39.0924	181.3	2.156	2.152	4.312	2.739	0.592	1.665	1.073	4.629
0:08:42	197.1	0.099	82.3	5.838	1.67	39.1311	187.2	2.225	2.221	4.381	2.771	0.556	1.663	1.108	4.987
0:09:10	202.7	0.106	82.7	5.832	1.78	39.1734	192.8	2.289	2.284	4.444	2.802	0.523	1.662	1.139	5.360
0:09:36	208.8	0.111	83.1	5.827	1.87	39.2112	198.9	2.359	2.355	4.515	2.848	0.498	1.673	1.175	5.713
0:10:04	214.0	0.117	83.2	5.820	1.98	39.2525	204.1	2.418	2.413	4.573	2.894	0.486	1.690	1.204	5.953
0:10:30	218.9	0.123	83.4	5.815	2.08	39.2924	209.0	2.474	2.469	4.629	2.937	0.474	1.706	1.232	6.198
0:10:56	222.8	0.129	83.5	5.809	2.17	39.3324	213.0	2.518	2.512	4.672	2.972	0.465	1.718	1.253	6.394
0:11:24	228.8	0.135	83.6	5.803	2.28	39.3729	218.9	2.586	2.580	4.740	3.033	0.459	1.746	1.287	6.615
0:11:50	232.7	0.141	83.7	5.797	2.37	39.4120	222.8	2.629	2.623	4.783	3.071	0.453	1.762	1.309	6.774
0:12:18	237.1	0.147	83.8	5.791	2.48	39.4537	227.2	2.678	2.671	4.831	3.115	0.449	1.782	1.333	6.932
0:12:44	242.0	0.153	83.8	5.785	2.57	39.4926	232.2	2.733	2.727	4.887	3.169	0.447	1.808	1.361	7.082
0:13:12	245.8	0.159	83.8	5.779	2.67	39.5331	235.9	2.775	2.768	4.928	3.209	0.446	1.827	1.381	7.194
0:13:41	250.3	0.165	83.8	5.773	2.78	39.5759	240.4	2.825	2.818	4.978	3.261	0.449	1.855	1.406	7.266
0:14:07	254.4	0.171	83.8	5.767	2.87	39.6146	244.5	2.870	2.863	5.023	3.307	0.449	1.878	1.429	7.366
0:14:34	258.4	0.177	83.7	5.761	2.98	39.6570	248.6	2.914	2.907	5.067	3.356	0.454	1.905	1.451	7.392
0:15:02	263.2	0.183	83.6	5.755	3.07	39.6973	253.4	2.968	2.960	5.120	3.416	0.461	1.938	1.477	7.412
0:15:30	266.8	0.188	83.5	5.749	3.17	39.7384	256.9	3.007	2.999	5.159	3.460	0.467	1.963	1.497	7.416
0:15:57	270.9	0.195	83.4	5.743	3.28	39.7806	261.1	3.052	3.043	5.203	3.513	0.475	1.994	1.519	7.400
0:16:24	275.9	0.200	83.3	5.737	3.37	39.8207	266.0	3.106	3.098	5.258	3.576	0.484	2.030	1.546	7.395
0:16:51	280.3	0.206	83.1	5.732	3.47	39.8616	270.4	3.154	3.146	5.306	3.634	0.493	2.064	1.570	7.366
0:17:19	284.6	0.212	83.0	5.726	3.57	39.9022	274.7	3.201	3.192	5.352	3.688	0.502	2.095	1.593	7.354
0:17:48	289.5	0.218	82.8	5.720	3.67	39.9437	279.7	3.256	3.246	5.406	3.757	0.516	2.136	1.621	7.283
0:18:16	295.0	0.224	82.7	5.714	3.77	39.9855	285.2	3.316	3.307	5.467	3.829	0.528	2.179	1.651	7.257
0:18:44	299.7	0.230	82.5	5.708	3.87	40.0270	289.8	3.366	3.357	5.517	3.892	0.540	2.216	1.676	7.204
0:19:12	304.5	0.236	82.3	5.702	3.97	40.0687	294.6	3.419	3.409	5.569	3.956	0.552	2.254	1.702	7.165
0:19:41	308.7	0.242	82.1	5.696	4.08	40.1123	298.8	3.464	3.454	5.614	4.015	0.567	2.291	1.724	7.087
0:20:08	313.5	0.248	81.9	5.690	4.18	40.1536	303.7	3.517	3.506	5.666	4.082	0.582	2.332	1.750	7.021
0:20:36	318.9	0.254	81.7	5.684	4.28	40.1954	309.0	3.575	3.564	5.724	4.157	0.598	2.378	1.779	6.948
0:21:03	323.5	0.260	81.4	5.678	4.37	40.2371	313.7	3.625	3.614	5.774	4.224	0.616	2.420	1.804	6.861
0:21:31	328.4	0.266	81.1	5.672	4.47	40.2795	318.6	3.678	3.666	5.826	4.298	0.637	2.468	1.831	6.745
0:21:58	333.7	0.272	80.8	5.666	4.58	40.3219	323.8	3.734	3.723	5.883	4.377	0.660	2.518	1.859	6.637
0:22:26	337.5	0.278	80.6	5.660	4.67	40.3636	327.7	3.775	3.763	5.923	4.437	0.679	2.558	1.879	6.535
0:22:54	342.2	0.284	80.8	5.654	4.77	40.4062	332.3	3.824	3.812	5.972	4.467	0.660	2.563	1.904	6.770
0:23:21	346.5	0.290	80.7	5.648	4.88	40.4493	336.7	3.870	3.858	6.018	4.521	0.668	2.595	1.926	6.765
0:23:48	351.9	0.295	80.5	5.642	4.97	40.4908	342.1	3.928	3.916	6.076	4.591	0.681	2.636	1.955	6.745
0:24:15	356.7	0.301	80.4	5.636	5.07	40.5336	346.9	3.979	3.966	6.126	4.655	0.694	2.675	1.981	6.706
0:24:43	361.7	0.307	80.2	5.630	5.18	40.5770	351.8	4.031	4.018	6.178	4.722	0.709	2.716	2.007	6.660
0:25:09	366.6	0.313	79.9	5.625	5.27	40.6191	356.7	4.084	4.071	6.231	4.791	0.726	2.759	2.033	6.599
0:25:37	370.9	0.319	79.6	5.619	5.37	40.6626	361.0	4.129	4.115	6.275	4.858	0.749	2.803	2.055	6.490
0:26:04	375.2	0.325	79.3	5.613	5.48	40.7066	365.3	4.173	4.159	6.319	4.921	0.767	2.844	2.077	6.413
0:26:29	379.1	0.331	79.1	5.607	5.57	40.7477	369.3	4.214	4.200	6.360	4.979	0.784	2.882	2.097	6.348
0:26:56	384.8	0.337	78.9	5.601	5.67	40.7913	374.9	4.274	4.260	6.420	5.056	0.802	2.929	2.127	6.305

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values					Final Values					
Height	5.938	(in.)	15.082	(cm)	Height	4.864	(in.)	Tested By	KDG	Project Number	175539009
Diameter	2.756	(in)	6.999	(cm)	Dia. avg.	3.155	(in)	Date	8-17-09	Test Number	CU-1278B
Area	5.964	(in^2)	38.477	(cm^2)	Area avg.	7.819	(in^2)	Press No.	1	Data File ID	1278B
								Panel No.	A	Lateral Pressure (psi)	30.0
										Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
0:27:23	389.8	0.343	78.6	5.595	5.77	40.8352	380.0	4.327	4.312	6.472	5.130	0.823	2.977	2.154	6.232
0:27:49	391.5	0.349	78.3	5.589	5.88	40.8790	381.7	4.342	4.327	6.487	5.163	0.842	3.003	2.161	6.133
0:28:14	395.8	0.355	78.1	5.583	5.97	40.9212	385.9	4.385	4.370	6.530	5.224	0.859	3.042	2.182	6.080
0:28:42	400.4	0.361	77.8	5.577	6.07	40.9652	390.5	4.433	4.418	6.578	5.292	0.879	3.085	2.206	6.019
0:29:10	405.1	0.367	77.5	5.571	6.18	41.0096	395.2	4.481	4.466	6.626	5.358	0.897	3.127	2.230	5.972
0:29:37	407.6	0.373	77.3	5.565	6.28	41.0531	397.7	4.505	4.489	6.649	5.399	0.915	3.157	2.242	5.898
0:30:03	411.6	0.378	77.0	5.559	6.37	41.0962	401.7	4.546	4.530	6.690	5.459	0.935	3.197	2.262	5.840
0:30:31	415.2	0.385	76.8	5.553	6.48	41.1414	405.3	4.581	4.565	6.725	5.513	0.953	3.233	2.280	5.784
0:30:58	419.3	0.390	76.5	5.547	6.58	41.1855	409.4	4.623	4.606	6.766	5.572	0.971	3.272	2.300	5.736
0:31:25	421.9	0.396	76.3	5.541	6.67	41.2284	412.0	4.647	4.631	6.791	5.614	0.989	3.302	2.313	5.677
0:31:52	425.4	0.402	76.0	5.535	6.78	41.2736	415.5	4.681	4.664	6.824	5.666	1.007	3.336	2.329	5.627
0:32:19	428.7	0.408	75.8	5.530	6.87	41.3169	418.8	4.713	4.696	6.856	5.714	1.023	3.369	2.345	5.585
0:32:46	431.4	0.414	75.6	5.524	6.98	41.3620	421.5	4.739	4.722	6.882	5.756	1.040	3.398	2.358	5.534
0:33:12	434.2	0.420	75.3	5.518	7.07	41.4057	424.4	4.766	4.748	6.908	5.801	1.059	3.430	2.371	5.480
0:33:40	438.0	0.426	75.1	5.512	7.18	41.4518	428.1	4.803	4.785	6.945	5.854	1.075	3.464	2.390	5.447
0:34:08	440.9	0.432	74.9	5.506	7.28	41.4972	431.1	4.830	4.812	6.972	5.897	1.091	3.494	2.403	5.408
0:34:34	443.3	0.438	74.6	5.500	7.38	41.5409	433.5	4.852	4.834	6.994	5.935	1.106	3.520	2.414	5.365
0:35:00	446.2	0.444	74.4	5.494	7.48	41.5862	436.3	4.879	4.860	7.020	5.978	1.123	3.551	2.427	5.322
0:35:26	449.5	0.450	74.2	5.488	7.57	41.6298	439.7	4.911	4.892	7.052	6.026	1.140	3.583	2.443	5.288
0:35:54	452.5	0.456	74.0	5.482	7.67	41.6756	442.6	4.939	4.919	7.079	6.070	1.156	3.613	2.457	5.252
0:36:20	453.9	0.462	73.7	5.476	7.78	41.7208	444.0	4.949	4.930	7.090	6.098	1.174	3.636	2.462	5.194
0:36:48	456.7	0.468	73.4	5.470	7.88	41.7663	446.8	4.974	4.955	7.115	6.144	1.195	3.670	2.475	5.142
0:37:14	458.9	0.473	73.1	5.464	7.97	41.8108	449.1	4.994	4.974	7.134	6.185	1.216	3.701	2.484	5.085
0:37:42	461.2	0.480	72.8	5.458	8.08	41.8573	451.4	5.014	4.994	7.154	6.226	1.237	3.732	2.494	5.031
0:38:08	463.6	0.485	73.1	5.452	8.17	41.9020	453.8	5.036	5.015	7.175	6.230	1.220	3.725	2.505	5.106
0:38:35	465.1	0.491	73.0	5.446	8.28	41.9485	455.2	5.046	5.025	7.185	6.245	1.225	3.735	2.510	5.098
0:39:02	466.8	0.497	72.9	5.440	8.38	41.9952	456.9	5.059	5.038	7.198	6.264	1.232	3.748	2.516	5.086
0:39:28	468.2	0.503	72.8	5.435	8.47	42.0398	458.3	5.069	5.048	7.208	6.281	1.238	3.760	2.521	5.072
0:39:54	470.1	0.509	72.6	5.429	8.58	42.0865	460.2	5.085	5.063	7.223	6.308	1.249	3.778	2.529	5.048
0:40:21	471.1	0.515	72.5	5.423	8.67	42.1316	461.2	5.091	5.069	7.229	6.321	1.258	3.790	2.532	5.025
0:40:48	470.9	0.521	72.4	5.417	8.77	42.1779	461.0	5.082	5.060	7.220	6.321	1.267	3.794	2.527	4.991
0:41:14	471.3	0.527	72.3	5.411	8.87	42.2238	461.4	5.082	5.060	7.220	6.330	1.276	3.803	2.527	4.962
0:41:42	472.1	0.533	72.2	5.405	8.98	42.2716	462.3	5.085	5.063	7.223	6.342	1.285	3.814	2.529	4.936
0:42:08	472.7	0.539	72.1	5.399	9.07	42.3168	462.8	5.085	5.063	7.223	6.348	1.290	3.819	2.529	4.920
0:42:35	472.6	0.545	72.0	5.393	9.18	42.3644	462.8	5.079	5.056	7.216	6.345	1.294	3.820	2.526	4.903
0:43:01	472.8	0.551	72.0	5.387	9.28	42.4107	462.9	5.075	5.052	7.212	6.346	1.299	3.822	2.523	4.885
0:43:29	474.0	0.557	71.9	5.381	9.38	42.4593	464.1	5.083	5.059	7.219	6.356	1.302	3.829	2.527	4.881
0:43:55	473.6	0.563	71.9	5.375	9.48	42.5056	463.7	5.073	5.049	7.209	6.349	1.305	3.827	2.522	4.864
0:44:21	473.2	0.569	71.8	5.369	9.58	42.5534	463.3	5.063	5.039	7.199	6.342	1.308	3.825	2.517	4.850
0:44:46	472.5	0.575	71.8	5.363	9.68	42.5990	462.6	5.050	5.026	7.186	6.329	1.308	3.819	2.510	4.837
0:45:13	473.6	0.581	71.8	5.357	9.78	42.6479	463.7	5.056	5.031	7.191	6.337	1.311	3.824	2.513	4.832
0:45:38	473.6	0.586	71.8	5.351	9.88	42.6936	463.8	5.051	5.026	7.186	6.335	1.314	3.824	2.510	4.822
0:46:05	474.3	0.592	71.7	5.345	9.98	42.7410	464.4	5.053	5.027	7.187	6.340	1.318	3.829	2.511	4.811
0:46:31	475.2	0.598	71.7	5.339	10.08	42.7893	465.3	5.057	5.031	7.191	6.346	1.320	3.833	2.513	4.807
0:46:57	474.0	0.604	71.5	5.333	10.18	42.8366	464.1	5.038	5.012	7.172	6.337	1.330	3.834	2.504	4.765
0:47:23	473.3	0.610	71.6	5.328	10.28	42.8837	463.4	5.025	4.999	7.159	6.319	1.326	3.822	2.497	4.767
0:47:49	474.9	0.616	71.5	5.322	10.38	42.9323	465.1	5.037	5.011	7.171	6.338	1.333	3.836	2.503	4.757
0:48:15	475.8	0.622	71.5	5.316	10.48	42.9800	465.9	5.041	5.015	7.175	6.344	1.335	3.839	2.505	4.753
0:48:41	475.3	0.628	71.5	5.310	10.58	43.0281	465.4	5.030	5.004	7.164	6.334	1.335	3.834	2.499	4.743
0:49:08	475.7	0.634	71.4	5.304	10.68	43.0762	465.9	5.029	5.002	7.162	6.334	1.338	3.836	2.498	4.735
0:49:34	476.0	0.640	71.4	5.298	10.77	43.1236	466.2	5.027	5.000	7.160	6.332	1.338	3.835	2.497	4.733
0:50:00	475.3	0.646	71.4	5.292	10.87	43.1719	465.4	5.013	4.985	7.145	6.319	1.339	3.829	2.490	4.719
0:50:27	475.3	0.652	71.4	5.286	10.98	43.2210	465.5	5.008	4.980	7.140	6.315	1.340	3.827	2.488	4.713
0:50:53	477.3	0.658	71.4	5.280	11.08	43.2693	467.5	5.024	4.996	7.156	6.333	1.342	3.837	2.495	4.718
0:51:21	478.5	0.664	71.3	5.274	11.18	43.3200	468.6	5.030	5.002	7.162	6.340	1.344	3.842	2.498	4.719
0:51:47	476.2	0.670	71.3	5.268	11.28	43.3670	466.4	5.001	4.972	7.132	6.313	1.346	3.829	2.484	4.691
0:52:13	475.4	0.676	71.2	5.262	11.38	43.4167	465.5	4.986	4.958	7.118	6.303	1.351	3.827	2.476	4.665
0:52:41	474.5	0.682	71.1	5.256	11.48	43.4674	464.6	4.971	4.942	7.102	6.295	1.358	3.827	2.468	4.634
0:53:05	473.1	0.687	71.6	5.250	11.58	43.5137	463.2	4.950	4.921	7.081	6.243	1.327	3.785	2.458	4.704
0:53:33	473.5	0.693	71.7	5.244	11.68	43.5652	463.6	4.948	4.919	7.079	6.233	1.319	3.776	2.457	4.724

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values			
Height	5.938 (in.)	15.082 (cm)	Height	4.864 (in.)	Tested By	KDG
Diameter	2.756 (in)	6.999 (cm)	Dia. avg.	3.155 (in)	Date	8-17-09
Area	5.964 (in²)	38.477 (cm²)	Area avg.	7.819 (in²)	Press No.	1
					Panel No.	A

Project Number	175539009
Test Number	CU-1278B
Data File ID	1278B
Lateral Pressure (psi)	30.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
0:53:59	473.6	0.699	71.7	5.238	11.78	43.6138	463.7	4.944	4.914	7.074	6.223	1.314	3.769	2.455	4.736
0:54:25	474.4	0.705	71.8	5.233	11.88	43.6624	464.5	4.947	4.917	7.077	6.222	1.310	3.766	2.456	4.748
0:54:52	474.1	0.711	71.8	5.227	11.98	43.7115	464.2	4.938	4.908	7.068	6.210	1.308	3.759	2.451	4.749
0:55:18	473.8	0.717	71.8	5.221	12.08	43.7617	463.9	4.929	4.899	7.059	6.202	1.308	3.755	2.447	4.742
0:55:46	473.8	0.723	71.8	5.215	12.18	43.8126	464.0	4.924	4.894	7.054	6.199	1.311	3.755	2.444	4.729
0:56:13	473.8	0.729	71.8	5.209	12.28	43.8633	463.9	4.918	4.888	7.048	6.192	1.310	3.751	2.441	4.727
0:56:39	472.5	0.735	71.8	5.203	12.38	43.9129	462.6	4.899	4.868	7.028	6.174	1.311	3.742	2.431	4.709
0:57:05	471.1	0.741	71.8	5.197	12.48	43.9628	461.2	4.878	4.847	7.007	6.154	1.313	3.734	2.421	4.688
0:57:31	470.7	0.747	71.8	5.191	12.58	44.0116	460.8	4.869	4.837	6.997	6.144	1.312	3.728	2.416	4.682
0:57:59	471.9	0.753	71.8	5.185	12.68	44.0629	462.0	4.876	4.844	7.004	6.150	1.312	3.731	2.419	4.689
0:58:25	471.7	0.759	71.8	5.179	12.78	44.1127	461.8	4.868	4.836	6.996	6.143	1.312	3.727	2.415	4.682
0:58:52	472.2	0.765	71.8	5.173	12.88	44.1642	462.3	4.868	4.835	6.995	6.142	1.312	3.727	2.415	4.682
0:59:20	473.3	0.771	71.8	5.167	12.98	44.2153	463.4	4.873	4.841	7.001	6.146	1.311	3.729	2.418	4.689
0:59:46	472.8	0.776	71.8	5.161	13.08	44.2651	462.9	4.863	4.830	6.990	6.135	1.310	3.723	2.412	4.682
1:00:12	472.5	0.782	71.8	5.155	13.18	44.3162	462.7	4.855	4.822	6.982	6.128	1.312	3.720	2.408	4.671
1:00:39	472.4	0.788	71.7	5.149	13.28	44.3686	462.5	4.848	4.814	6.974	6.125	1.316	3.720	2.405	4.655
1:01:06	472.7	0.795	71.7	5.143	13.38	44.4208	462.8	4.845	4.811	6.971	6.127	1.321	3.724	2.403	4.638
1:01:31	471.8	0.800	71.9	5.138	13.48	44.4702	461.9	4.830	4.796	6.956	6.097	1.306	3.702	2.395	4.668
1:01:58	472.0	0.806	71.7	5.131	13.58	44.5235	462.2	4.827	4.793	6.953	6.104	1.317	3.710	2.394	4.636
1:02:24	471.5	0.812	71.9	5.126	13.68	44.5742	461.6	4.815	4.781	6.941	6.082	1.306	3.694	2.388	4.657
1:02:49	472.5	0.818	71.8	5.120	13.78	44.6253	462.6	4.821	4.786	6.946	6.088	1.307	3.697	2.390	4.658
1:03:15	472.0	0.824	71.8	5.114	13.88	44.6770	462.1	4.810	4.775	6.935	6.079	1.310	3.695	2.385	4.641
1:03:42	473.1	0.830	71.8	5.108	13.98	44.7310	463.3	4.816	4.781	6.941	6.086	1.311	3.699	2.388	4.643
1:04:07	472.5	0.836	71.8	5.102	14.08	44.7802	462.6	4.804	4.769	6.929	6.074	1.311	3.693	2.382	4.633
1:04:33	472.4	0.842	71.7	5.096	14.18	44.8339	462.5	4.797	4.762	6.922	6.071	1.315	3.693	2.378	4.618
1:04:58	473.4	0.848	71.7	5.090	14.28	44.8850	463.6	4.802	4.767	6.927	6.078	1.317	3.698	2.381	4.616
1:05:24	473.9	0.854	71.6	5.084	14.38	44.9372	464.0	4.802	4.766	6.926	6.082	1.321	3.702	2.380	4.603
1:05:50	473.4	0.860	71.5	5.078	14.48	44.9905	463.6	4.791	4.755	6.915	6.081	1.332	3.706	2.375	4.567
1:06:16	473.1	0.866	72.0	5.072	14.58	45.0425	463.2	4.782	4.746	6.906	6.037	1.296	3.666	2.370	4.657
1:06:42	473.2	0.871	72.2	5.066	14.68	45.0951	463.3	4.777	4.740	6.900	6.020	1.285	3.653	2.368	4.685
1:07:09	474.7	0.878	72.2	5.060	14.78	45.1499	464.9	4.788	4.751	6.911	6.026	1.281	3.653	2.373	4.705
1:07:35	476.4	0.883	72.2	5.054	14.88	45.2017	466.5	4.799	4.762	6.922	6.036	1.279	3.658	2.378	4.718
1:08:00	477.4	0.889	72.3	5.048	14.98	45.2544	467.6	4.804	4.767	6.927	6.039	1.277	3.658	2.381	4.728
1:08:28	476.4	0.895	72.3	5.042	15.08	45.3085	466.5	4.788	4.750	6.910	6.020	1.275	3.648	2.372	4.721
1:08:55	476.8	0.901	72.3	5.036	15.18	45.3625	467.0	4.787	4.749	6.909	6.021	1.278	3.649	2.372	4.713
1:09:20	476.7	0.907	72.3	5.031	15.28	45.4146	466.8	4.779	4.741	6.901	6.013	1.278	3.645	2.368	4.707
1:09:47	475.3	0.913	72.2	5.025	15.38	45.4693	465.4	4.760	4.721	6.881	5.995	1.279	3.637	2.358	4.688
1:10:15	474.4	0.919	72.2	5.019	15.48	45.5244	464.5	4.744	4.706	6.866	5.979	1.279	3.629	2.350	4.676
1:10:40	473.7	0.925	72.2	5.013	15.58	45.5771	463.8	4.732	4.693	6.853	5.967	1.279	3.623	2.344	4.665
1:11:06	473.8	0.931	72.2	5.007	15.68	45.6302	464.0	4.728	4.689	6.849	5.962	1.278	3.620	2.342	4.664
1:11:33	472.4	0.937	72.3	5.001	15.78	45.6858	462.5	4.708	4.668	6.828	5.938	1.275	3.606	2.331	4.658
1:11:59	472.6	0.943	72.3	4.995	15.88	45.7393	462.8	4.705	4.665	6.825	5.936	1.276	3.606	2.330	4.652
1:12:26	471.4	0.949	72.3	4.989	15.98	45.7956	461.6	4.687	4.646	6.806	5.916	1.275	3.596	2.321	4.640
1:12:52	472.3	0.955	72.3	4.983	16.08	45.8477	462.5	4.690	4.650	6.810	5.920	1.275	3.597	2.322	4.644
1:13:20	472.1	0.961	72.3	4.977	16.18	45.9050	462.2	4.682	4.641	6.801	5.909	1.273	3.591	2.318	4.642
1:13:46	472.0	0.967	72.3	4.971	16.28	45.9579	462.1	4.676	4.635	6.795	5.903	1.273	3.588	2.315	4.637
1:14:13	471.9	0.972	72.3	4.965	16.38	46.0126	462.0	4.669	4.628	6.788	5.895	1.272	3.584	2.311	4.633
1:14:40	471.8	0.978	72.4	4.959	16.48	46.0685	461.9	4.662	4.621	6.781	5.886	1.270	3.578	2.308	4.635
1:15:06	470.8	0.984	72.4	4.953	16.58	46.1240	460.9	4.647	4.605	6.765	5.869	1.269	3.569	2.300	4.624
1:15:33	472.2	0.990	72.4	4.947	16.68	46.1792	462.3	4.655	4.613	6.773	5.879	1.271	3.575	2.304	4.626
1:16:00	471.9	0.996	72.4	4.941	16.78	46.2348	462.0	4.647	4.605	6.765	5.867	1.267	3.567	2.300	4.629
1:16:27	471.8	1.002	72.4	4.935	16.88	46.2910	461.9	4.640	4.598	6.758	5.859	1.266	3.563	2.296	4.627
1:16:53	473.2	1.008	72.4	4.930	16.98	46.3457	463.3	4.648	4.606	6.766	5.866	1.266	3.566	2.300	4.634
1:17:20	473.3	1.014	72.4	4.924	17.08	46.4011	463.4	4.644	4.601	6.761	5.861	1.266	3.563	2.298	4.631
1:17:47	473.8	1.020	72.4	4.918	17.18	46.4571	464.0	4.644	4.601	6.761	5.861	1.265	3.563	2.298	4.633
1:18:14	474.0	1.026	72.4	4.912	17.28	46.5150	464.1	4.640	4.597	6.757	5.857	1.265	3.561	2.296	4.628
1:18:40	474.3	1.032	72.4	4.906	17.38	46.5702	464.4	4.637	4.594	6.754	5.857	1.268	3.563	2.294	4.617
1:19:07	475.9	1.038	72.3	4.900	17.48	46.6269	466.1	4.648	4.604	6.764	5.871	1.272	3.572	2.299	4.614
1:19:33	475.4	1.044	72.2	4.894	17.58	46.6833	465.5	4.637	4.593	6.753	5.867	1.279	3.573	2.294	4.586
1:19:59	475.5	1.050	72.1	4.888	17.68	46.7392	465.7	4.633	4.588	6.748	5.871	1.288	3.579	2.292	4.560

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values				
Height	5.938 (in.)	15.082 (cm)		Height	4.864 (in.)		Tested By	KDG
Diameter	2.756 (in)	6.999 (cm)		Dia. avg.	3.155 (in)		Date	8-17-09
Area	5.964 (in^2)	38.477 (cm^2)		Area avg.	7.819 (in^2)		Press No.	1
							Panel No.	A

Project Number	175539009
Test Number	CU-1278B
Data File ID	1278B
Lateral Pressure (psi)	30.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
1:20:26	476.7	1.056	72.6	4.882	17.78	46.7978	466.9	4.639	4.594	6.754	5.844	1.255	3.549	2.295	4.657
1:20:53	476.6	1.062	72.7	4.876	17.88	46.8553	466.7	4.632	4.587	6.747	5.827	1.246	3.537	2.291	4.678
1:21:19	476.9	1.068	72.8	4.870	17.98	46.9131	467.0	4.629	4.584	6.744	5.817	1.239	3.528	2.289	4.695
1:21:43	477.2	1.073	72.8	4.864	18.08	46.9682	467.3	4.626	4.581	6.741	5.811	1.236	3.524	2.288	4.703

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175539009
Height	5.846 (in.)	14.849 (cm)	Height	4.847 (in.)	Date	8-14-09	Test Number	CU-1278C
Diameter	2.719 (in)	6.907 (cm)	Dia. avg.	3.058 (in)	Press No.	2	Data File ID	1278C
Area	5.808 (in²)	37.471 (cm²)	Area avg.	7.342 (in²)	Panel No.	E	Lateral Pressure (psi)	50.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
0:00:00	8.0	-0.003	40.1	5.846	0.00	37.4706	0.0	0.000	0.000	3.600	3.600	3.591	3.595	0.005	1.003
0:00:39	28.5	0.003	41.1	5.840	0.11	37.5103	20.5	0.254	0.254	3.854	3.785	3.522	3.653	0.132	1.075
0:01:11	30.1	0.009	41.5	5.834	0.21	37.5479	22.1	0.273	0.273	3.873	3.774	3.492	3.633	0.141	1.081
0:01:43	31.7	0.015	41.8	5.828	0.31	37.5860	23.7	0.293	0.292	3.892	3.770	3.469	3.619	0.151	1.087
0:02:15	32.8	0.021	42.1	5.822	0.41	37.6249	24.8	0.306	0.305	3.905	3.763	3.448	3.605	0.157	1.091
0:02:47	35.1	0.027	42.4	5.816	0.51	37.6623	27.1	0.334	0.333	3.933	3.769	3.427	3.598	0.171	1.100
0:03:17	37.0	0.032	42.7	5.810	0.61	37.6994	28.9	0.357	0.355	3.955	3.768	3.404	3.586	0.182	1.107
0:03:49	38.9	0.038	43.1	5.804	0.71	37.7380	30.8	0.380	0.378	3.978	3.762	3.375	3.568	0.194	1.115
0:04:22	40.8	0.044	43.2	5.799	0.81	37.7755	32.8	0.403	0.401	4.001	3.780	3.370	3.575	0.205	1.122
0:04:54	42.7	0.050	43.5	5.793	0.91	37.8129	34.7	0.426	0.424	4.024	3.780	3.347	3.564	0.217	1.129
0:05:24	44.9	0.056	43.7	5.787	1.00	37.8509	36.8	0.452	0.450	4.050	3.791	3.332	3.561	0.229	1.138
0:06:01	95.3	0.061	48.1	5.781	1.10	37.8880	87.3	1.071	1.068	4.668	4.094	3.017	3.556	0.539	1.357
0:06:38	151.5	0.067	57.0	5.776	1.20	37.9266	143.5	1.760	1.756	5.356	4.144	2.378	3.261	0.883	1.742
0:07:13	181.3	0.073	62.4	5.770	1.30	37.9641	173.2	2.122	2.119	5.719	4.117	1.990	3.053	1.064	2.069
0:07:48	201.3	0.079	65.6	5.764	1.40	38.0032	193.3	2.365	2.361	5.961	4.124	1.754	2.939	1.185	2.352
0:08:20	215.5	0.085	67.2	5.758	1.50	38.0425	207.5	2.536	2.532	6.132	4.186	1.645	2.916	1.271	2.545
0:08:55	228.8	0.091	68.6	5.752	1.61	38.0826	220.8	2.696	2.692	6.292	4.244	1.543	2.893	1.350	2.750
0:09:27	240.3	0.097	69.4	5.746	1.71	38.1214	232.2	2.833	2.828	6.428	4.323	1.485	2.904	1.419	2.911
0:09:59	251.6	0.102	69.8	5.740	1.80	38.1587	243.5	2.968	2.963	6.563	4.427	1.455	2.941	1.486	3.043
0:10:32	262.3	0.108	70.2	5.734	1.91	38.1989	254.3	3.096	3.091	6.691	4.523	1.423	2.973	1.550	3.178
0:11:04	273.0	0.114	70.5	5.729	2.00	38.2358	265.0	3.222	3.217	6.817	4.628	1.402	3.015	1.613	3.301
0:11:36	283.7	0.120	70.7	5.723	2.10	38.2748	275.7	3.349	3.344	6.944	4.744	1.392	3.068	1.676	3.410
0:12:08	294.1	0.125	70.7	5.717	2.20	38.3132	286.1	3.472	3.467	7.067	4.862	1.386	3.124	1.738	3.508
0:12:41	304.6	0.131	70.6	5.711	2.30	38.3530	296.5	3.595	3.590	7.190	4.992	1.393	3.193	1.799	3.583
0:13:13	315.0	0.137	70.6	5.706	2.40	38.3916	307.0	3.718	3.712	7.312	5.120	1.398	3.259	1.861	3.661
0:13:45	325.8	0.143	70.5	5.700	2.50	38.4308	317.8	3.845	3.839	7.439	5.251	1.403	3.327	1.924	3.742
0:14:18	336.1	0.149	70.5	5.694	2.60	38.4714	328.1	3.965	3.959	7.559	5.373	1.405	3.389	1.984	3.824
0:14:50	346.6	0.155	70.4	5.688	2.70	38.5110	338.6	4.088	4.081	7.681	5.505	1.414	3.459	2.045	3.893
0:15:22	357.1	0.161	70.3	5.682	2.80	38.5498	349.1	4.210	4.203	7.803	5.630	1.418	3.524	2.106	3.971
0:15:54	367.6	0.166	70.1	5.676	2.90	38.5897	359.6	4.333	4.326	7.926	5.767	1.432	3.600	2.168	4.027
0:16:27	378.1	0.172	69.9	5.670	3.00	38.6305	370.1	4.455	4.447	8.047	5.903	1.446	3.674	2.228	4.081
0:17:00	388.7	0.178	69.7	5.665	3.10	38.6698	380.7	4.578	4.570	8.170	6.040	1.461	3.750	2.290	4.135
0:17:32	399.6	0.184	69.6	5.659	3.20	38.7092	391.6	4.704	4.696	8.296	6.170	1.466	3.818	2.352	4.210
0:18:04	410.0	0.190	69.3	5.653	3.30	38.7490	402.0	4.824	4.815	8.415	6.313	1.489	3.901	2.412	4.240
0:18:37	420.5	0.196	69.0	5.647	3.40	38.7888	412.5	4.945	4.936	8.536	6.454	1.509	3.981	2.473	4.278
0:19:09	431.0	0.202	68.7	5.641	3.50	38.8299	422.9	5.065	5.056	8.656	6.600	1.535	4.067	2.532	4.300
0:19:41	441.4	0.207	68.4	5.636	3.60	38.8689	433.4	5.184	5.175	8.775	6.741	1.557	4.149	2.592	4.330
0:20:13	451.5	0.213	68.2	5.630	3.70	38.9102	443.4	5.299	5.290	8.890	6.869	1.570	4.220	2.649	4.375
0:20:48	462.3	0.219	67.8	5.623	3.80	38.9527	454.3	5.423	5.413	9.013	7.018	1.596	4.307	2.711	4.398
0:21:18	472.0	0.225	67.5	5.618	3.90	38.9905	463.9	5.533	5.523	9.123	7.153	1.621	4.387	2.766	4.413
0:21:53	483.1	0.231	67.0	5.612	4.00	39.0335	475.0	5.659	5.649	9.249	7.311	1.654	4.483	2.829	4.422
0:22:25	493.5	0.237	66.7	5.606	4.10	39.0732	485.4	5.777	5.767	9.367	7.451	1.675	4.563	2.888	4.449
0:22:57	504.1	0.242	66.4	5.600	4.20	39.1131	496.1	5.898	5.887	9.487	7.599	1.702	4.650	2.948	4.464
0:23:30	515.3	0.248	65.9	5.595	4.30	39.1535	507.3	6.024	6.013	9.613	7.761	1.738	4.750	3.011	4.464
0:24:04	526.6	0.254	65.6	5.589	4.40	39.1947	518.6	6.152	6.141	9.741	7.907	1.757	4.832	3.075	4.501
0:24:37	536.6	0.260	65.3	5.583	4.50	39.2358	528.5	6.264	6.253	9.853	8.039	1.778	4.908	3.131	4.523
0:25:09	546.6	0.266	64.9	5.577	4.60	39.2772	538.6	6.377	6.365	9.965	8.178	1.804	4.991	3.187	4.533
0:25:41	556.6	0.272	64.4	5.571	4.70	39.3180	548.6	6.488	6.476	10.076	8.325	1.840	5.083	3.242	4.524
0:26:13	566.1	0.277	64.2	5.566	4.80	39.3580	558.1	6.593	6.581	10.181	8.446	1.856	5.151	3.295	4.551
0:26:46	575.2	0.283	63.9	5.560	4.90	39.3995	567.2	6.694	6.682	10.282	8.571	1.880	5.225	3.345	4.559
0:27:20	585.4	0.289	63.4	5.553	5.00	39.4441	577.4	6.807	6.794	10.394	8.721	1.918	5.320	3.401	4.546
0:27:53	594.6	0.295	62.9	5.548	5.10	39.4851	586.6	6.908	6.895	10.495	8.856	1.952	5.404	3.452	4.537
0:28:25	603.5	0.301	62.5	5.542	5.20	39.5253	595.5	7.005	6.992	10.592	8.980	1.978	5.479	3.501	4.539
0:28:57	612.3	0.306	62.0	5.536	5.30	39.5657	604.3	7.102	7.088	10.688	9.110	2.013	5.561	3.549	4.526
0:29:30	621.6	0.312	61.8	5.530	5.40	39.6085	613.6	7.203	7.189	10.789	9.232	2.034	5.633	3.599	4.540
0:30:02	630.0	0.318	61.5	5.525	5.50	39.6503	622.0	7.294	7.280	10.880	9.344	2.054	5.699	3.645	4.548
0:30:34	638.7	0.324	61.0	5.519	5.60	39.6921	630.6	7.388	7.374	10.974	9.472	2.089	5.781	3.692	4.533
0:31:06	647.2	0.330	60.5	5.513	5.70	39.7338	639.2	7.480	7.466	11.066	9.602	2.127	5.865	3.738	4.514
0:31:41	656.8	0.336	60.1	5.507	5.80	39.7782	648.7	7.584	7.569	11.169	9.732	2.154	5.943	3.789	4.519
0:32:13	665.3	0.342	59.6	5.501	5.90	39.8210	657.3	7.675	7.660	11.260	9.861	2.192	6.026	3.835	4.499

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG		Project Number	175539009
Height	5.846 (in.)	14.849 (cm)	Height	4.847 (in.)	Date	8-14-09		Test Number	CU-1278C
Diameter	2.719 (in)	6.907 (cm)	Dia. avg.	3.058 (in)	Press No.	2		Data File ID	1278C
Area	5.808 (in^2)	37.471 (cm^2)	Area avg.	7.342 (in^2)	Panel No.	E		Lateral Pressure (psi)	50.0
								Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:32:43	672.7	0.347	59.2	5.495	5.99	39.8601	664.7	7.754	7.739	11.339	9.964	2.216	6.090	3.874	4.497
0:33:16	681.2	0.353	59.0	5.490	6.09	39.9025	673.2	7.845	7.829	11.429	10.071	2.233	6.152	3.919	4.511
0:33:50	689.9	0.359	58.5	5.484	6.20	39.9469	681.9	7.938	7.922	11.522	10.197	2.266	6.231	3.966	4.501
0:34:23	698.3	0.365	58.1	5.478	6.30	39.9897	690.3	8.027	8.011	11.611	10.314	2.294	6.304	4.010	4.496
0:34:55	707.0	0.371	57.8	5.472	6.40	40.0330	698.9	8.118	8.102	11.702	10.432	2.321	6.376	4.056	4.495
0:35:27	715.1	0.377	57.3	5.466	6.50	40.0748	707.1	8.205	8.188	11.788	10.554	2.357	6.455	4.099	4.478
0:35:59	722.5	0.383	56.9	5.460	6.60	40.1173	714.5	8.281	8.265	11.865	10.661	2.387	6.524	4.137	4.467
0:36:30	729.2	0.388	56.7	5.455	6.69	40.1589	721.2	8.351	8.334	11.934	10.742	2.399	6.571	4.171	4.477
0:37:02	736.6	0.394	55.9	5.449	6.79	40.2018	728.6	8.428	8.410	12.010	10.874	2.454	6.664	4.210	4.430
0:37:35	743.8	0.400	55.5	5.443	6.90	40.2461	735.7	8.501	8.483	12.083	10.975	2.482	6.728	4.246	4.421
0:38:08	750.6	0.406	55.1	5.437	7.00	40.2897	742.6	8.570	8.553	12.153	11.072	2.510	6.791	4.281	4.411
0:38:40	756.8	0.412	54.7	5.431	7.10	40.3340	748.8	8.632	8.614	12.214	11.168	2.545	6.857	4.312	4.389
0:39:13	762.8	0.418	54.2	5.425	7.20	40.3778	754.8	8.692	8.674	12.274	11.260	2.576	6.918	4.342	4.370
0:39:42	767.3	0.423	53.8	5.420	7.29	40.4182	759.3	8.736	8.717	12.317	11.331	2.605	6.968	4.363	4.350
0:40:15	773.2	0.429	53.4	5.414	7.40	40.4630	765.2	8.794	8.775	12.375	11.421	2.637	7.029	4.392	4.332
0:40:47	779.4	0.435	53.1	5.408	7.50	40.5070	771.4	8.855	8.836	12.436	11.504	2.659	7.081	4.423	4.327
0:41:20	785.4	0.441	52.5	5.402	7.60	40.5505	777.4	8.915	8.895	12.495	11.605	2.701	7.153	4.452	4.297
0:41:52	791.8	0.447	52.4	5.396	7.69	40.5939	783.7	8.978	8.958	12.558	11.673	2.706	7.189	4.484	4.314
0:42:25	799.7	0.452	52.0	5.390	7.79	40.6377	791.6	9.058	9.039	12.639	11.787	2.739	7.263	4.524	4.303
0:42:57	804.6	0.458	51.6	5.384	7.89	40.6817	796.6	9.105	9.085	12.685	11.859	2.765	7.312	4.547	4.289
0:43:29	808.9	0.464	51.3	5.379	7.99	40.7255	800.9	9.144	9.124	12.724	11.919	2.786	7.352	4.567	4.278
0:44:02	813.5	0.470	51.0	5.373	8.09	40.7701	805.4	9.186	9.166	12.766	11.982	2.807	7.394	4.587	4.269
0:44:34	817.5	0.476	50.7	5.367	8.19	40.8140	809.4	9.222	9.201	12.801	12.040	2.830	7.435	4.605	4.255
0:45:07	821.1	0.482	50.4	5.361	8.29	40.8590	813.1	9.253	9.232	12.832	12.094	2.853	7.473	4.621	4.240
0:45:39	823.8	0.487	50.1	5.355	8.39	40.9032	815.8	9.274	9.253	12.853	12.137	2.875	7.506	4.631	4.222
0:46:11	826.1	0.493	49.8	5.349	8.49	40.9482	818.0	9.289	9.268	12.868	12.171	2.894	7.533	4.638	4.205
0:46:44	827.2	0.499	49.5	5.344	8.59	40.9924	819.1	9.292	9.270	12.870	12.196	2.917	7.557	4.640	4.181
0:47:16	826.2	0.505	49.3	5.338	8.69	41.0376	818.1	9.270	9.248	12.848	12.189	2.931	7.560	4.629	4.158
0:47:48	812.6	0.511	49.5	5.332	8.80	41.0848	804.5	9.106	9.083	12.683	12.006	2.913	7.459	4.546	4.121
0:48:18	803.1	0.517	50.0	5.326	8.89	41.1281	795.1	8.989	8.967	12.567	11.858	2.882	7.370	4.488	4.115
0:48:50	796.1	0.523	50.2	5.320	9.00	41.1742	788.1	8.900	8.878	12.478	11.751	2.864	7.307	4.443	4.103
0:49:22	792.2	0.529	50.4	5.314	9.10	41.2201	784.1	8.846	8.823	12.423	11.686	2.854	7.270	4.416	4.094
0:49:54	789.6	0.535	50.4	5.308	9.20	41.2659	781.6	8.807	8.783	12.383	11.646	2.853	7.250	4.396	4.082
0:50:24	785.3	0.540	50.5	5.303	9.29	41.3086	777.3	8.749	8.726	12.326	11.580	2.845	7.212	4.368	4.070
0:50:56	781.8	0.546	50.9	5.297	9.39	41.3546	773.8	8.700	8.676	12.276	11.501	2.816	7.159	4.343	4.085
0:51:28	779.2	0.552	50.9	5.291	9.49	41.4005	771.1	8.661	8.637	12.237	11.461	2.814	7.138	4.323	4.072
0:52:01	774.5	0.558	51.2	5.285	9.59	41.4458	766.5	8.600	8.575	12.175	11.378	2.794	7.086	4.292	4.073
0:52:33	768.1	0.564	51.3	5.279	9.69	41.4925	760.1	8.519	8.494	12.094	11.290	2.787	7.038	4.252	4.051
0:53:05	764.9	0.569	51.4	5.273	9.79	41.5388	756.9	8.473	8.448	12.048	11.237	2.780	7.009	4.229	4.042
0:53:37	762.7	0.575	51.7	5.268	9.89	41.5846	754.7	8.439	8.414	12.014	11.183	2.760	6.972	4.211	4.051
0:54:09	757.8	0.581	51.6	5.262	9.99	41.6310	749.7	8.374	8.349	11.949	11.119	2.762	6.941	4.179	4.026
0:54:41	754.8	0.587	51.7	5.256	10.09	41.6772	746.7	8.331	8.306	11.906	11.071	2.756	6.914	4.157	4.017
0:55:14	751.8	0.593	51.9	5.250	10.19	41.7238	743.8	8.289	8.263	11.863	11.018	2.746	6.882	4.136	4.013
0:55:46	748.5	0.599	52.0	5.244	10.30	41.7710	740.5	8.243	8.217	11.817	10.963	2.737	6.850	4.113	4.006
0:56:18	745.1	0.605	51.9	5.238	10.40	41.8177	737.0	8.196	8.169	11.769	10.923	2.744	6.833	4.089	3.980
0:56:50	742.5	0.610	52.0	5.232	10.50	41.8650	734.5	8.158	8.131	11.731	10.876	2.735	6.805	4.070	3.977
0:57:22	740.2	0.616	52.0	5.226	10.60	41.9119	732.2	8.123	8.096	11.696	10.842	2.736	6.789	4.053	3.962
0:57:52	738.6	0.622	52.0	5.221	10.69	41.9558	730.5	8.097	8.069	11.669	10.812	2.734	6.773	4.039	3.955
0:58:24	737.2	0.628	52.0	5.215	10.79	42.0033	729.2	8.073	8.045	11.645	10.787	2.732	6.760	4.027	3.948
0:58:56	737.7	0.634	52.0	5.209	10.89	42.0503	729.7	8.069	8.042	11.642	10.790	2.740	6.765	4.025	3.939
0:59:29	739.3	0.639	52.1	5.203	10.99	42.0977	731.3	8.078	8.050	11.650	10.791	2.732	6.762	4.029	3.950
1:00:01	741.0	0.645	52.2	5.197	11.09	42.1453	732.9	8.087	8.059	11.659	10.791	2.723	6.757	4.034	3.963
1:00:33	741.0	0.651	52.1	5.192	11.19	42.1928	733.0	8.078	8.050	11.650	10.785	2.726	6.755	4.030	3.957
1:01:05	741.2	0.657	52.1	5.186	11.29	42.2408	733.1	8.071	8.042	11.642	10.781	2.730	6.755	4.026	3.949
1:01:37	741.2	0.663	52.1	5.180	11.39	42.2888	733.2	8.062	8.033	11.633	10.773	2.731	6.752	4.021	3.944
1:02:10	740.6	0.669	52.1	5.174	11.50	42.3378	732.6	8.046	8.017	11.617	10.758	2.731	6.744	4.013	3.939
1:02:42	740.3	0.675	52.1	5.168	11.60	42.3854	732.3	8.034	8.004	11.604	10.743	2.729	6.736	4.007	3.936
1:03:12	740.6	0.680	52.2	5.163	11.69	42.4308	732.5	8.028	7.998	11.598	10.732	2.724	6.728	4.004	3.939
1:03:44	740.5	0.686	52.1	5.157	11.79	42.4783	732.5	8.019	7.989	11.589	10.730	2.732	6.731	3.999	3.927
1:04:16	739.8	0.692	52.2	5.151	11.89	42.5273	731.7	8.001	7.971	11.571	10.704	2.724	6.714	3.990	3.929

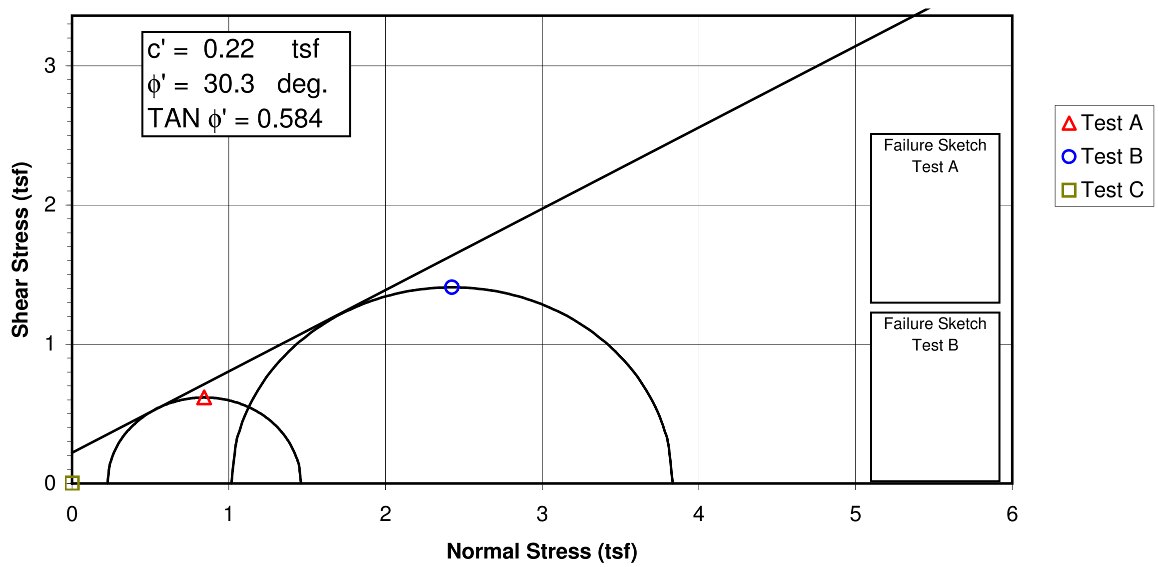
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values					
Height	5.846 (in.)	14.849 (cm)		Height	4.847 (in.)	Tested By	KDG	Project Number	175539009
Diameter	2.719 (in)	6.907 (cm)		Dia. avg.	3.058 (in)	Date	8-14-09	Test Number	CU-1278C
Area	5.808 (in^2)	37.471 (cm^2)		Area avg.	7.342 (in^2)	Press No.	2	Data File ID	1278C
						Panel No.	E	Lateral Pressure (psi)	50.0
								Chamber Pressure - σ_3 (psi)	90

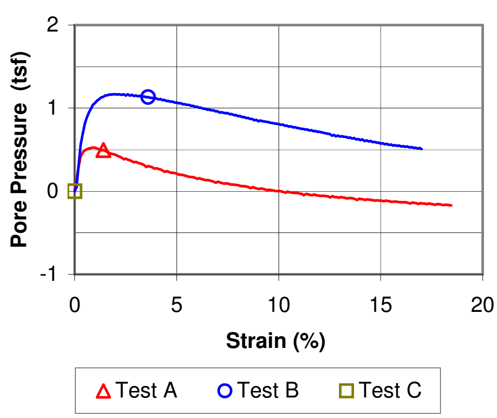
Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
1:04:48	740.7	0.698	52.0	5.145	11.99	42.5754	732.7	8.002	7.972	11.572	10.714	2.733	6.724	3.991	3.920
1:05:20	741.7	0.704	51.9	5.139	12.09	42.6244	733.7	8.004	7.974	11.574	10.722	2.740	6.731	3.991	3.914
1:05:52	742.7	0.710	51.9	5.133	12.19	42.6727	734.6	8.005	7.974	11.574	10.728	2.745	6.736	3.992	3.909
1:06:25	743.2	0.715	51.8	5.127	12.29	42.7205	735.2	8.002	7.971	11.571	10.731	2.751	6.741	3.990	3.901
1:06:57	744.1	0.721	51.7	5.122	12.39	42.7694	736.1	8.003	7.972	11.572	10.737	2.757	6.747	3.990	3.895
1:07:29	744.3	0.727	51.7	5.116	12.49	42.8179	736.2	7.995	7.964	11.564	10.732	2.759	6.745	3.986	3.890
1:08:04	745.5	0.733	51.7	5.110	12.59	42.8700	737.4	7.999	7.967	11.567	10.735	2.759	6.747	3.988	3.891
1:08:34	746.3	0.739	51.7	5.104	12.69	42.9159	738.3	7.999	7.967	11.567	10.730	2.754	6.742	3.988	3.896
1:09:06	748.0	0.744	51.7	5.098	12.79	42.9650	740.0	8.008	7.976	11.576	10.739	2.754	6.747	3.993	3.899
1:09:41	749.8	0.751	51.7	5.092	12.89	43.0174	741.8	8.018	7.986	11.586	10.754	2.759	6.757	3.997	3.897
1:10:13	751.0	0.756	51.7	5.086	12.99	43.0661	743.0	8.022	7.989	11.589	10.759	2.761	6.760	3.999	3.897
1:10:45	752.1	0.762	51.7	5.080	13.09	43.1158	744.0	8.024	7.991	11.591	10.760	2.760	6.760	4.000	3.899
1:11:17	753.6	0.768	51.6	5.075	13.19	43.1650	745.5	8.031	7.998	11.598	10.775	2.768	6.771	4.003	3.893
1:11:49	754.5	0.774	51.5	5.069	13.29	43.2145	746.4	8.032	7.998	11.598	10.778	2.771	6.775	4.004	3.890
1:12:22	755.7	0.780	51.4	5.063	13.39	43.2641	747.7	8.036	8.002	11.602	10.789	2.777	6.783	4.006	3.885
1:12:54	756.6	0.786	51.2	5.057	13.49	43.3145	748.5	8.036	8.001	11.601	10.801	2.790	6.796	4.005	3.871
1:13:27	756.7	0.791	51.3	5.051	13.59	43.3641	748.7	8.028	7.994	11.594	10.790	2.787	6.788	4.001	3.872
1:13:59	757.1	0.797	51.4	5.046	13.69	43.4144	749.1	8.023	7.989	11.589	10.776	2.779	6.777	3.999	3.878
1:14:31	757.8	0.803	51.4	5.040	13.79	43.4645	749.8	8.021	7.986	11.586	10.778	2.783	6.780	3.998	3.873
1:15:03	760.0	0.809	51.1	5.034	13.89	43.5143	752.0	8.036	8.001	11.601	10.812	2.802	6.807	4.005	3.859
1:15:35	761.7	0.815	51.1	5.028	13.99	43.5637	753.6	8.044	8.009	11.609	10.819	2.801	6.810	4.009	3.862
1:16:10	764.2	0.821	51.0	5.022	14.09	43.6179	756.1	8.061	8.025	11.625	10.841	2.807	6.824	4.017	3.863
1:16:42	769.3	0.826	51.0	5.016	14.19	43.6673	761.2	8.106	8.070	11.670	10.888	2.809	6.849	4.040	3.876
1:17:14	772.5	0.832	50.9	5.011	14.29	43.7175	764.4	8.131	8.094	11.694	10.922	2.819	6.870	4.052	3.875
1:17:46	775.1	0.838	50.9	5.005	14.39	43.7680	767.1	8.149	8.113	11.713	10.940	2.818	6.879	4.061	3.882
1:18:17	777.6	0.844	50.9	4.999	14.49	43.8182	769.6	8.167	8.130	11.730	10.956	2.817	6.887	4.069	3.889
1:18:52	779.2	0.850	50.8	4.993	14.59	43.8727	771.2	8.174	8.137	11.737	10.970	2.824	6.897	4.073	3.884
1:19:23	780.8	0.856	50.7	4.987	14.69	43.9241	772.8	8.181	8.144	11.744	10.981	2.828	6.905	4.077	3.883
1:19:55	782.3	0.862	50.6	4.981	14.79	43.9752	774.3	8.188	8.150	11.750	10.997	2.838	6.918	4.080	3.875
1:20:27	784.5	0.867	50.6	4.975	14.89	44.0270	776.5	8.201	8.163	11.763	11.006	2.833	6.920	4.086	3.884
1:20:58	787.2	0.873	50.5	4.969	14.99	44.0788	779.2	8.220	8.181	11.781	11.034	2.843	6.938	4.095	3.881
1:21:30	789.8	0.879	50.5	4.964	15.09	44.1305	781.8	8.237	8.199	11.799	11.054	2.846	6.950	4.104	3.884
1:22:02	791.8	0.885	50.3	4.958	15.19	44.1821	783.8	8.249	8.210	11.810	11.076	2.856	6.966	4.110	3.878
1:22:33	793.9	0.891	50.5	4.952	15.29	44.2344	785.8	8.261	8.222	11.822	11.078	2.847	6.963	4.116	3.891
1:23:05	796.1	0.897	50.1	4.946	15.39	44.2874	788.1	8.274	8.235	11.835	11.116	2.872	6.994	4.122	3.871
1:23:34	798.4	0.902	50.2	4.941	15.49	44.3360	790.3	8.289	8.250	11.850	11.125	2.867	6.996	4.129	3.881
1:24:06	800.5	0.908	50.0	4.935	15.58	44.3883	792.5	8.302	8.262	11.862	11.154	2.883	7.019	4.136	3.869
1:24:38	801.8	0.914	50.0	4.929	15.69	44.4428	793.8	8.306	8.266	11.866	11.152	2.877	7.015	4.137	3.876
1:25:10	803.6	0.920	50.0	4.923	15.79	44.4953	795.6	8.315	8.274	11.874	11.162	2.878	7.020	4.142	3.878
1:25:41	805.6	0.926	49.7	4.917	15.89	44.5488	797.6	8.325	8.285	11.885	11.192	2.898	7.045	4.147	3.862
1:26:13	807.5	0.932	49.8	4.911	15.99	44.6016	799.5	8.335	8.295	11.895	11.197	2.893	7.045	4.152	3.870
1:26:45	809.4	0.937	49.9	4.905	16.09	44.6556	801.3	8.344	8.303	11.903	11.202	2.890	7.046	4.156	3.877
1:27:16	811.2	0.943	49.7	4.899	16.19	44.7090	803.1	8.353	8.312	11.912	11.223	2.902	7.063	4.161	3.867
1:27:48	813.8	0.949	49.7	4.894	16.29	44.7621	805.8	8.371	8.329	11.929	11.239	2.901	7.070	4.169	3.874
1:28:20	816.7	0.955	49.7	4.888	16.39	44.8157	808.7	8.391	8.349	11.949	11.260	2.902	7.081	4.179	3.881
1:28:51	818.8	0.961	49.5	4.882	16.49	44.8694	810.8	8.402	8.361	11.961	11.288	2.918	7.103	4.185	3.868
1:29:23	820.5	0.967	49.4	4.876	16.59	44.9229	812.5	8.410	8.368	11.968	11.297	2.920	7.108	4.189	3.869
1:29:55	821.2	0.973	49.4	4.870	16.69	44.9771	813.2	8.407	8.365	11.965	11.295	2.921	7.108	4.187	3.867
1:30:27	821.6	0.978	49.2	4.864	16.79	45.0316	813.6	8.401	8.359	11.959	11.304	2.937	7.121	4.184	3.849
1:30:59	822.3	0.984	49.3	4.859	16.89	45.0857	814.3	8.398	8.355	11.955	11.297	2.933	7.115	4.182	3.852
1:31:30	822.7	0.990	49.2	4.853	16.99	45.1387	814.7	8.393	8.349	11.949	11.293	2.935	7.114	4.179	3.848
1:32:02	823.6	0.996	48.9	4.847	17.09	45.1930	815.5	8.391	8.348	11.948	11.313	2.956	7.135	4.178	3.827

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



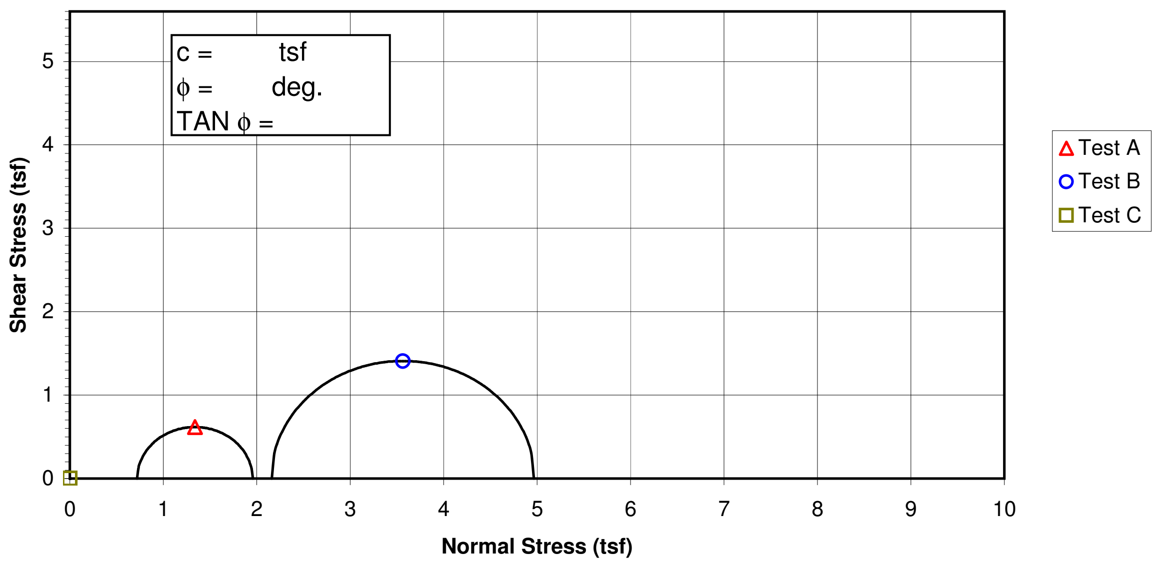
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	24.3	24.6	######	
	Dry Density PCF	γd_o	100.6	99.4	######	
	Saturation %	S_o	98.6	96.9	######	
	Void Ratio	e_o	0.657	0.677	######	
After Shear	Water content %	W_f	24.2	21.9	######	
	Dry Density PCF	γd_f	101.2	105.1	######	
	Saturation %	S_f	100.0	100.0	######	
	Void Ratio	e_f	0.647	0.586	######	
	Final Back Pressure TSF	u_c	5.76	4.32	0.00	
Minor Principal Stress TSF @ failure		σ_3'f	0.23	1.02	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.24	2.81	0.00	
Time to (σ1'-σ3')max min.		t_f	43.4	227.6	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma1'-\sigma3')_{ult}$	n/a	n/a	0.00	
Initial Diameter, in.		D_o	2.884	2.887	######	
Initial Height, in.		H_o	6.188	6.054	######	

Controlled - Strain Test

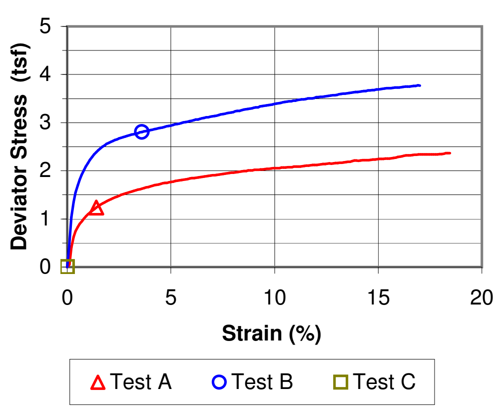
Description of Specimens	Lean Clay (CL), dark brown, moist, firm					
				Type of Specimen	Undisturbed	Type of test $\bar{R}$
LL	PL	PI	Gs 2.67	Project	Cumberland Dry Ash Stack and Gypsum Disposal Area	
Remarks:						
				Boring No.	B-43A	Sample No. 1260
				Depth Elev.	50.7'-51.2', 50.2'-50.7'	
				Laboratory	Stantec	Date 8-19-09
				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	24.3	24.6	######	
	Dry Density PCF	γ_{d_o}	100.6	99.4	######	
	Saturation %	S_o	98.6	96.9	######	
	Void Ratio	e_o	0.657	0.677	######	
After Shear	Water content %	W_f	24.2	21.9	######	
	Dry Density PCF	γ_{d_f}	101.2	105.1	######	
	Saturation %	S_f	100.0	100.0	######	
	Void Ratio	e_f	0.647	0.586	######	
	Final Back Pressure TSF	u_c	5.76	4.32	0.00	
Minor Principal Stress TSF		σ_3	0.72	2.16	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	1.24	2.81	0.00	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	43.4	227.6	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	0.00	
Initial Diameter, in.		D_o	2.884	2.887	######	
Initial Height, in.		H_o	6.188	6.054	######	

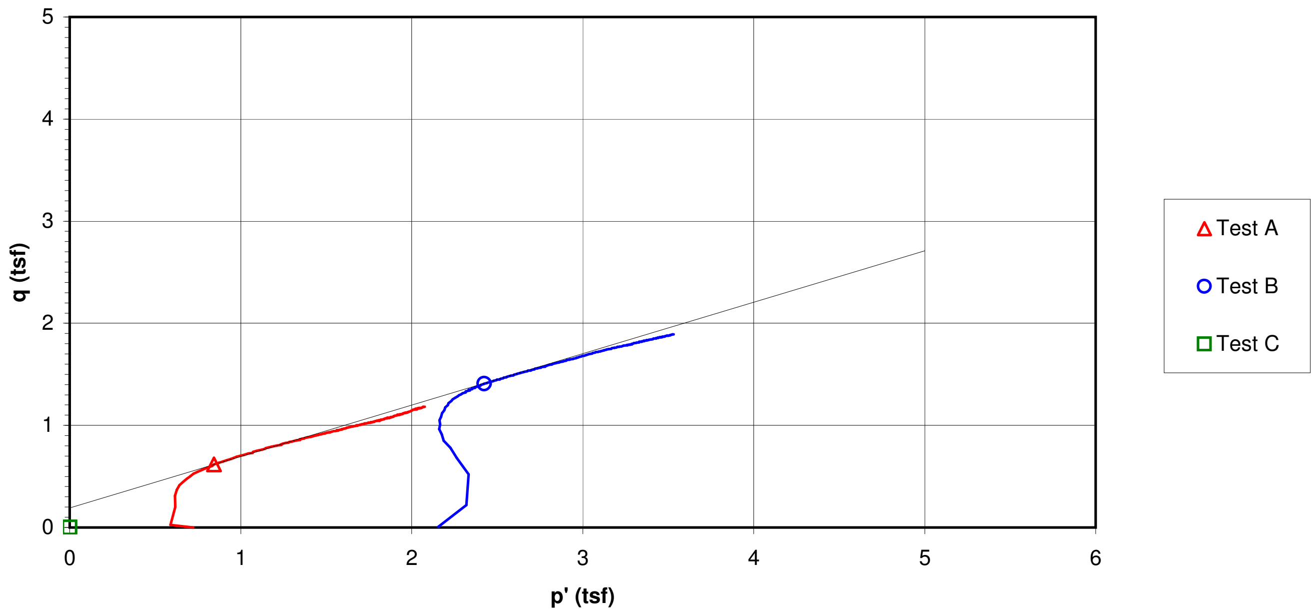
Controlled - Strain Test

Description of Specimens	Lean Clay (CL), dark brown, moist, firm				
		Type of Specimen	Undisturbed	Type of test	$\overline{R}$
LL	PL	PI	Gs 2.67	Project	Cumberland Dry Ash Stack and Gypsum Disposal Area
Remarks:					
		Boring No.	B-43A	Sample No.	1260
		Depth Elev.	50.7'-51.2', 50.2'-50.7'		
		Laboratory	Stantec	Date	8-19-09
		TRIAXIAL COMPRESSION TEST REPORT			

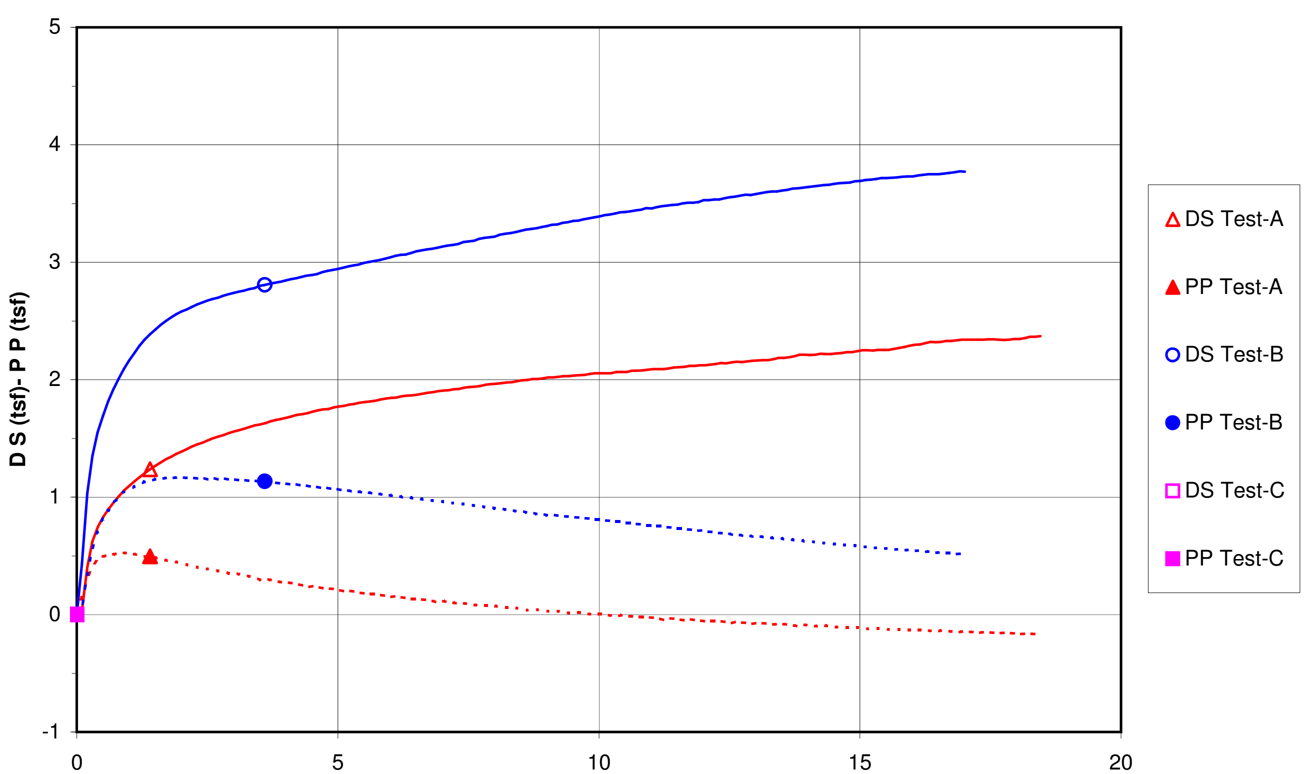
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project No.	175539009
Sample ID	B-43A, 50.7'-51.2' & B-43A, 50.2'-50.7'	Test Number	1260
Failure Criterion:	Maximum Effective Principal Stress Ratio φ' = 30.3 deg.	c' =	0.22 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



Axial Strain (%)

Stantec

Consolidated Undrained Triaxial Test

ASTM D4767-04

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Sample Identification	B-43A, 50.7'-51.2'	Test Number	CU-1260A
Visual Description	Lean Clay (CL), dark brown, moist, firm	Prepared By	RJ
Undisturbed	Source B-43A, 50.0'-52.0'	Date	7-27-2009

Specific Gravity 2.67 ASTM D854 Method A | Liquid Limit N/A | Plastic Limit N/A | Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in^3)		Specimen	
Top	2.888	1	6.187	Sample	40.4309 (V_o)	Wet Weight (g)	1326.47
Middle	2.884	2	6.184	Solids	24.3976 (VS_o)	Dry Weight (g)	1067.55
Bottom	2.881	3	6.193	Water	15.7995 (Vw_o)	Wet Unit Weight (pcf)	125.0
Avg.	2.8843 (D_o)	4	6.187	Voids	16.0333 (Vv_o)	Dry Unit Weight (pcf)	100.6
Area (in^2)	6.5340 (A_o)	Avg. (H_o)	6.1878	Degree of Saturation (%)	98.5 (S_o)		
Moisture Content (%)	24.3	Final Trimmings		Void Ratio	0.657		

Saturation

Set Up & Saturated: Wet xx Dry

Back Pressure Saturated to: 80 (psi) | Final Pore Pressure Parameter B 0.96

Set up By KDG | Date 8-13-09 | Panel Board Number C

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1364	Initial	10.96 (in.)	Initial	12.22 (in.)	Specimen Height (in.)	6.1942 (H_s)
Final	0.13	Final	8.36 (in.)	Final	8.93 (in.)	Area (in^2) Method A	6.5475 (A_s)
Change	0.0064 (ΔH_o)	Change	-2.60 (in.)	Change	-3.29 (in.)	Specimen Volume (in^3)	40.56 (Vs)

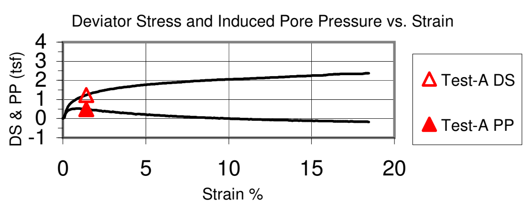
Consolidation

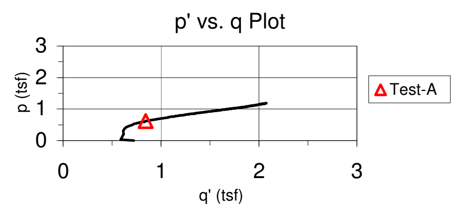
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.13	Initial	1.27 (in.)	Initial	17.63 (in.)	Chamber	90
Final	0.1435	Final	2.83 (in.)	Final	15.95 (in.)	Back	80
Change	-0.0135 (ΔH_c)	Change	-1.56 (in.)	Change	-1.68 (in.)	Lateral	10 (σ_3)
Height (in.)	6.1807 (H_c)			Volume (in^3)	40.1825 (V_c)		
Area (in^3) Method B	6.5013 (A_c)			Volume - Water (in^3)	15.7848 (VWc)	t_{50} (min.)	6.7
Diameter (in.)	2.8771 (D_c)			Water Content (%)	24.2		
Dry Density (pcf)	101.2			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.647

After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.375 (in.)	Wet Weight (g)	1326.23	Corrected Deviator	1.24 σ_d (tsf)
Wet weight (g)	1326.23 (WWf)	Dry Weight (g)	1067.55	Major Principal	1.46 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.351 (in.)	Tare Weight (g)	0.00	Minor Principal	0.23 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.033
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	1.40
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch





Comments:

Stantec

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Sample Identification	B-43A, 50.2'-50.7'	Test Number	CU-1260B
Visual Description	Lean Clay (CL), dark brown, moist, firm	Prepared By	RJ
Undisturbed	Source B-43A, 50.0'-52.0'	Date	7-27-2009

Specific Gravity 2.67 ASTM D854 Method A Liquid Limit N/A Plastic Limit N/A Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in3)		Specimen	
Top	2.885	1	6.043	Sample	39.6285 (V_o)	Wet Weight (g)	1287.66
Middle	2.886	2	6.094	Solids	23.6216 (VS_o)	Dry Weight (g)	1033.59
Bottom	2.890	3	6.036	Water	15.5034 (Vw_o)	Wet Unit Weight (pcf)	123.8
Avg.	2.8870 (D_o)	4	6.043	Voids	16.0069 (Vv_o)	Dry Unit Weight (pcf)	99.4
Area (in^2)	6.5461 (A_o)	Avg. (H_o)	6.0538	Degree of Saturation (%)	96.9 (S_o)		
Moisture Content (%)	24.6	Final Trimmings		Void Ratio	0.678		

Saturation

Set Up & Saturated: Wet xx Dry ____ Set up By KDG

Back Pressure Saturated to: 60 (psi) Final Pore Pressure Parameter B 0.97 Date 8-13-09

Panel Board Number D

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1518	Initial	16.64 (in.)	Initial	12.17 (in.)	Specimen Height (in.)	6.0574 (H_s)
Final	0.1482	Final	13.6 (in.)	Final	9.78 (in.)	Area (in^2) Method A	6.5539 (A_s)
Change	0.0036 (ΔH_o)	Change	-3.04 (in.)	Change	-2.39 (in.)	Specimen Volume (in^3)	39.70 (V_s)

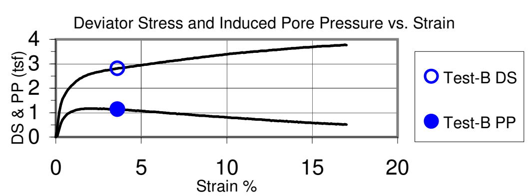
Consolidation

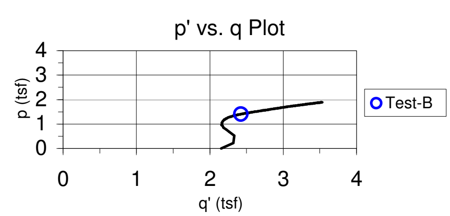
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1482	Initial	0.95 (in.)	Initial	17.56 (in.)	Chamber	90
Final	0.1986	Final	7.09 (in.)	Final	11.46 (in.)	Back	60
Change	-0.0504 (ΔH_c)	Change	-6.14 (in.)	Change	-6.10 (in.)	Lateral	30 (σ_3)
Height (in.)	6.0070 (H_c)			Volume (in^3)	37.4591 (V_c)		
Area (in^3) Method B	6.2360 (A_c)			Volume - Water (in^3)	13.8375 (VWc)	D_{50} (min.)	3.9
Diameter (in.)	2.8178 (D_c)			Water Content (%)	21.9		
Dry Density (pcf)	105.1			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.586

After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.312 (in.)	Wet Weight (g)	1260.36	Corrected Deviator	2.81 σ_d (tsf)
Wet weight (g)	1260.36 (WWf)	Dry Weight (g)	1033.59	Major Principal	3.83 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.288 (in.)	Tare Weight (g)	0.00	Minor Principal	1.02 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.015
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	3.60
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch





Comments:

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values			
Height	6.181 (in.)	15.699 (cm)	Height	5.040 (in.)	Tested By	KDG
Diameter	2.877 (in)	7.308 (cm)	Dia. avg.	3.277 (in)	Date	8-14-09
Area	6.502 (in^2)	41.947 (cm^2)	Area avg.	8.432 (in^2)	Press No.	1
					Panel No.	C

Project Number	175539009
Test Number	CU-1260A
Data File ID	1260A
Lateral Pressure (psi)	10.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	13.5	-0.022	80.0	6.181	0.00	41.9466	0.0	0.000	0.000	0.720	0.720	0.723	0.721	-0.001	0.996
0:03:28	18.5	-0.015	82.2	6.174	0.10	41.9899	5.0	0.056	0.055	0.775	0.616	0.563	0.589	0.026	1.093
0:06:43	50.1	-0.009	84.2	6.168	0.20	42.0317	36.6	0.405	0.404	1.124	0.817	0.416	0.617	0.201	1.964
0:09:56	70.0	-0.003	85.8	6.162	0.30	42.0732	56.5	0.624	0.623	1.343	0.925	0.305	0.615	0.310	3.034
0:13:04	81.1	0.003	86.5	6.156	0.40	42.1164	67.6	0.747	0.746	1.466	0.998	0.255	0.626	0.371	3.911
0:16:07	88.7	0.009	86.8	6.150	0.50	42.1585	75.2	0.829	0.828	1.548	1.055	0.229	0.642	0.413	4.597
0:19:09	94.9	0.016	87.0	6.143	0.60	42.2016	81.4	0.897	0.896	1.616	1.108	0.215	0.661	0.446	5.155
0:22:00	100.3	0.022	87.1	6.137	0.70	42.2433	86.8	0.955	0.954	1.674	1.160	0.209	0.685	0.475	5.542
0:25:01	105.1	0.028	87.2	6.131	0.81	42.2871	91.6	1.008	1.006	1.726	1.207	0.204	0.705	0.501	5.924
0:28:04	109.8	0.034	87.3	6.125	0.90	42.3294	96.3	1.058	1.056	1.776	1.250	0.197	0.724	0.527	6.339
0:31:03	113.6	0.040	87.2	6.119	1.00	42.3718	100.1	1.099	1.096	1.816	1.295	0.201	0.748	0.547	6.431
0:34:04	117.1	0.046	87.1	6.112	1.10	42.4149	103.6	1.136	1.134	1.854	1.340	0.209	0.774	0.565	6.412
0:37:11	120.5	0.053	87.0	6.106	1.20	42.4577	107.0	1.172	1.169	1.889	1.385	0.218	0.801	0.583	6.346
0:40:17	123.9	0.059	86.8	6.100	1.30	42.5009	110.4	1.208	1.205	1.925	1.433	0.231	0.832	0.601	6.205
0:43:23	127.0	0.065	86.9	6.094	1.40	42.5442	113.5	1.241	1.237	1.957	1.461	0.227	0.844	0.617	6.445
0:46:32	129.9	0.071	86.7	6.088	1.51	42.5876	116.4	1.271	1.267	1.987	1.503	0.239	0.871	0.632	6.287
0:49:34	132.6	0.077	86.5	6.081	1.61	42.6315	119.1	1.299	1.295	2.015	1.541	0.249	0.895	0.646	6.178
0:52:32	135.1	0.084	86.4	6.075	1.71	42.6749	121.6	1.325	1.321	2.041	1.578	0.260	0.919	0.659	6.061
0:55:34	137.2	0.090	86.2	6.069	1.81	42.7183	123.7	1.347	1.342	2.062	1.614	0.274	0.944	0.670	5.888
0:58:39	139.7	0.096	86.2	6.063	1.91	42.7622	126.2	1.372	1.367	2.087	1.641	0.276	0.958	0.682	5.940
1:01:35	141.6	0.102	86.0	6.057	2.01	42.8055	128.1	1.392	1.387	2.107	1.670	0.285	0.977	0.692	5.853
1:04:36	143.7	0.108	85.9	6.050	2.11	42.8494	130.2	1.413	1.408	2.128	1.702	0.297	0.999	0.702	5.730
1:07:35	145.8	0.115	85.7	6.044	2.21	42.8935	132.3	1.435	1.429	2.149	1.735	0.308	1.022	0.713	5.627
1:10:35	147.9	0.121	85.5	6.038	2.31	42.9376	134.4	1.455	1.450	2.170	1.767	0.321	1.044	0.723	5.512
1:13:33	149.4	0.127	85.3	6.032	2.41	42.9816	135.9	1.470	1.464	2.184	1.801	0.340	1.070	0.731	5.300
1:16:30	151.1	0.133	85.4	6.026	2.51	43.0257	137.6	1.487	1.481	2.201	1.810	0.332	1.071	0.739	5.449
1:19:21	153.1	0.139	85.3	6.019	2.61	43.0699	139.6	1.507	1.501	2.221	1.839	0.341	1.090	0.749	5.391
1:22:20	154.6	0.146	85.1	6.013	2.71	43.1146	141.1	1.522	1.516	2.236	1.864	0.351	1.108	0.756	5.304
1:25:14	156.1	0.152	85.0	6.007	2.81	43.1597	142.6	1.537	1.530	2.250	1.889	0.362	1.125	0.763	5.220
1:28:05	157.6	0.158	84.8	6.001	2.91	43.2036	144.1	1.551	1.544	2.264	1.913	0.373	1.143	0.770	5.136
1:31:04	159.0	0.164	84.9	5.995	3.01	43.2486	145.5	1.565	1.557	2.277	1.923	0.369	1.146	0.777	5.211
1:34:01	160.3	0.170	84.7	5.988	3.11	43.2931	146.8	1.577	1.569	2.289	1.947	0.380	1.163	0.783	5.120
1:36:58	161.8	0.177	84.6	5.982	3.21	43.3383	148.3	1.592	1.584	2.304	1.970	0.389	1.180	0.790	5.063
1:39:54	163.2	0.183	84.5	5.976	3.31	43.3835	149.7	1.605	1.597	2.317	1.992	0.398	1.195	0.797	5.003
1:42:50	164.6	0.189	84.3	5.970	3.41	43.4278	151.2	1.618	1.610	2.330	2.017	0.410	1.213	0.804	4.924
1:45:49	165.6	0.195	84.0	5.964	3.51	43.4732	152.1	1.627	1.618	2.338	2.046	0.430	1.238	0.808	4.757
1:48:53	166.7	0.201	84.2	5.957	3.61	43.5185	153.2	1.637	1.629	2.349	2.045	0.420	1.232	0.813	4.874
1:51:57	168.4	0.208	84.1	5.951	3.71	43.5637	154.9	1.654	1.645	2.365	2.070	0.428	1.249	0.821	4.839
1:55:02	169.7	0.214	83.9	5.945	3.81	43.6096	156.2	1.666	1.656	2.376	2.090	0.437	1.264	0.827	4.784
1:58:07	170.7	0.220	83.8	5.939	3.91	43.6548	157.2	1.674	1.665	2.385	2.110	0.449	1.279	0.831	4.705
2:01:10	171.9	0.226	83.8	5.933	4.01	43.7003	158.4	1.685	1.675	2.395	2.120	0.447	1.283	0.836	4.741
2:04:09	173.2	0.232	83.7	5.926	4.11	43.7459	159.7	1.697	1.687	2.407	2.139	0.455	1.297	0.842	4.704
2:07:12	174.5	0.239	83.6	5.920	4.21	43.7920	161.0	1.709	1.699	2.419	2.159	0.463	1.311	0.848	4.667
2:10:17	175.4	0.245	83.4	5.914	4.31	43.8377	161.9	1.717	1.707	2.427	2.179	0.475	1.327	0.852	4.590
2:13:21	176.3	0.251	83.2	5.908	4.42	43.8843	162.8	1.725	1.714	2.434	2.202	0.491	1.346	0.856	4.486
2:16:21	177.8	0.257	83.3	5.902	4.52	43.9301	164.3	1.739	1.728	2.448	2.206	0.481	1.343	0.863	4.586
2:19:21	179.0	0.263	83.2	5.895	4.61	43.9759	165.5	1.750	1.739	2.459	2.226	0.489	1.357	0.868	4.548
2:22:26	179.8	0.270	83.1	5.889	4.72	44.0223	166.3	1.757	1.746	2.466	2.242	0.499	1.371	0.871	4.491
2:25:26	180.5	0.276	83.1	5.883	4.82	44.0686	167.0	1.762	1.750	2.470	2.246	0.499	1.373	0.874	4.501
2:28:26	181.9	0.282	83.0	5.877	4.92	44.1159	168.4	1.775	1.764	2.484	2.266	0.505	1.386	0.880	4.483
2:31:29	182.9	0.288	82.9	5.871	5.02	44.1618	169.4	1.784	1.772	2.492	2.282	0.514	1.398	0.884	4.444
2:34:33	183.6	0.294	82.7	5.864	5.12	44.2086	170.1	1.789	1.777	2.497	2.298	0.524	1.411	0.887	4.385
2:37:38	184.8	0.301	82.7	5.858	5.22	44.2558	171.3	1.800	1.788	2.508	2.307	0.522	1.415	0.892	4.417
2:40:38	185.6	0.307	82.7	5.852	5.32	44.3021	172.1	1.807	1.794	2.514	2.319	0.528	1.423	0.895	4.391
2:43:41	186.7	0.313	82.5	5.846	5.42	44.3494	173.2	1.816	1.803	2.523	2.336	0.536	1.436	0.900	4.355
2:46:47	187.5	0.319	82.5	5.840	5.52	44.3964	174.0	1.822	1.809	2.529	2.349	0.543	1.446	0.903	4.325
2:49:49	188.3	0.325	82.4	5.833	5.62	44.4434	174.8	1.829	1.816	2.536	2.362	0.549	1.455	0.906	4.303
2:52:47	189.1	0.332	82.4	5.827	5.72	44.4905	175.6	1.835	1.821	2.541	2.367	0.549	1.458	0.909	4.313
2:55:48	190.3	0.338	82.3	5.821	5.82	44.5380	176.8	1.846	1.832	2.552	2.385	0.556	1.470	0.914	4.288
2:58:45	191.3	0.344	82.2	5.815	5.92	44.5854	177.8	1.854	1.840	2.560	2.400	0.563	1.482	0.918	4.261

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175539009
Height	6.181 (in.)	15.699 (cm)	Height	5.040 (in.)	Date	8-14-09	Test Number	CU-1260A
Diameter	2.877 (in)	7.308 (cm)	Dia. avg.	3.277 (in)	Press No.	1	Data File ID	1260A
Area	6.502 (in²)	41.947 (cm²)	Area avg.	8.432 (in²)	Panel No.	C	Lateral Pressure (psi)	10.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
3:01:40	192.0	0.350	82.0	5.809	6.02	44.6335	178.5	1.860	1.846	2.566	2.415	0.573	1.494	0.921	4.218
3:04:42	192.5	0.356	82.1	5.802	6.12	44.6811	179.1	1.863	1.849	2.569	2.414	0.568	1.491	0.923	4.250
3:07:37	193.6	0.363	82.0	5.796	6.22	44.7289	180.1	1.872	1.857	2.577	2.431	0.576	1.503	0.927	4.218
3:10:38	194.4	0.369	81.9	5.790	6.32	44.7765	180.9	1.878	1.863	2.583	2.443	0.583	1.513	0.930	4.190
3:13:36	194.9	0.375	81.8	5.784	6.42	44.8247	181.4	1.882	1.867	2.587	2.454	0.591	1.523	0.932	4.155
3:16:33	195.6	0.381	81.8	5.778	6.52	44.8726	182.1	1.887	1.872	2.592	2.458	0.589	1.523	0.934	4.173
3:19:24	196.8	0.387	81.8	5.771	6.62	44.9210	183.3	1.897	1.881	2.601	2.472	0.594	1.533	0.939	4.163
3:22:17	197.8	0.394	81.7	5.765	6.72	44.9692	184.3	1.905	1.889	2.609	2.486	0.600	1.543	0.943	4.146
3:25:18	198.4	0.400	81.6	5.759	6.82	45.0180	184.9	1.909	1.893	2.613	2.497	0.607	1.552	0.945	4.114
3:28:08	199.5	0.406	81.4	5.753	6.92	45.0659	186.0	1.919	1.903	2.623	2.521	0.621	1.571	0.950	4.060
3:31:03	200.2	0.412	81.5	5.747	7.02	45.1149	186.7	1.925	1.908	2.628	2.514	0.610	1.562	0.952	4.124
3:34:06	200.7	0.418	81.4	5.740	7.12	45.1634	187.2	1.927	1.910	2.630	2.524	0.617	1.571	0.954	4.091
3:37:03	201.7	0.425	81.3	5.734	7.22	45.2124	188.2	1.935	1.918	2.638	2.538	0.623	1.581	0.958	4.072
3:40:01	202.3	0.431	81.2	5.728	7.32	45.2616	188.8	1.940	1.922	2.642	2.552	0.633	1.593	0.960	4.032
3:43:02	203.4	0.437	81.3	5.722	7.42	45.3101	189.9	1.949	1.931	2.651	2.555	0.627	1.591	0.964	4.075
3:46:00	204.3	0.443	81.2	5.716	7.52	45.3593	190.8	1.956	1.938	2.658	2.567	0.632	1.600	0.967	4.059
3:49:05	204.6	0.449	81.1	5.709	7.62	45.4090	191.1	1.957	1.939	2.659	2.576	0.640	1.608	0.968	4.025
3:52:07	205.5	0.456	81.0	5.703	7.73	45.4582	192.1	1.965	1.946	2.666	2.588	0.645	1.617	0.972	4.012
3:55:11	206.7	0.462	81.1	5.697	7.83	45.5077	193.2	1.974	1.955	2.675	2.595	0.643	1.619	0.976	4.037
3:58:14	207.5	0.468	81.0	5.691	7.93	45.5570	194.0	1.981	1.961	2.681	2.605	0.646	1.626	0.979	4.031
4:01:17	208.1	0.474	80.9	5.685	8.03	45.6068	194.6	1.984	1.965	2.685	2.615	0.653	1.634	0.981	4.005
4:04:15	208.9	0.480	80.8	5.678	8.13	45.6565	195.4	1.990	1.970	2.690	2.627	0.660	1.643	0.984	3.983
4:07:18	209.7	0.487	80.8	5.672	8.23	45.7068	196.2	1.996	1.976	2.696	2.636	0.662	1.649	0.987	3.980
4:10:20	210.2	0.493	80.8	5.666	8.33	45.7569	196.7	1.999	1.979	2.699	2.638	0.662	1.650	0.988	3.987
4:13:18	211.1	0.499	80.7	5.660	8.43	45.8064	197.6	2.006	1.986	2.706	2.651	0.668	1.659	0.991	3.970
4:16:17	212.1	0.505	80.6	5.654	8.53	45.8567	198.6	2.014	1.994	2.714	2.665	0.674	1.669	0.995	3.954
4:19:15	212.6	0.511	80.5	5.647	8.63	45.9073	199.1	2.017	1.996	2.716	2.680	0.687	1.683	0.997	3.903
4:22:15	213.8	0.518	80.6	5.641	8.73	45.9576	200.3	2.026	2.005	2.725	2.678	0.676	1.677	1.001	3.964
4:25:21	214.1	0.524	80.5	5.635	8.83	46.0083	200.6	2.027	2.006	2.726	2.685	0.682	1.684	1.002	3.937
4:28:25	214.8	0.530	80.4	5.629	8.93	46.0590	201.3	2.032	2.011	2.731	2.696	0.689	1.692	1.004	3.916
4:31:25	215.8	0.536	80.3	5.623	9.03	46.1096	202.3	2.040	2.018	2.738	2.711	0.696	1.704	1.008	3.896
4:34:31	216.1	0.542	80.4	5.616	9.13	46.1605	202.6	2.041	2.019	2.739	2.706	0.690	1.698	1.008	3.924
4:37:32	216.8	0.549	80.3	5.610	9.23	46.2115	203.3	2.046	2.024	2.744	2.716	0.695	1.706	1.010	3.907
4:40:36	217.6	0.555	80.3	5.604	9.33	46.2625	204.1	2.051	2.029	2.749	2.727	0.701	1.714	1.013	3.892
4:43:40	217.9	0.561	80.2	5.598	9.43	46.3140	204.4	2.052	2.029	2.749	2.734	0.708	1.721	1.013	3.862
4:46:47	218.8	0.567	80.2	5.592	9.53	46.3652	205.3	2.059	2.036	2.756	2.737	0.704	1.721	1.017	3.889
4:49:50	219.3	0.573	80.2	5.585	9.63	46.4167	205.8	2.062	2.039	2.759	2.744	0.708	1.726	1.018	3.876
4:52:46	219.8	0.580	80.1	5.579	9.73	46.4683	206.3	2.064	2.041	2.761	2.752	0.714	1.733	1.019	3.854
4:55:46	220.7	0.586	80.0	5.573	9.83	46.5199	207.3	2.072	2.048	2.768	2.765	0.719	1.742	1.023	3.842
4:58:48	221.5	0.592	80.0	5.567	9.93	46.5720	208.0	2.077	2.053	2.773	2.770	0.720	1.745	1.025	3.847
5:01:45	221.9	0.598	80.0	5.561	10.03	46.6242	208.4	2.078	2.054	2.774	2.771	0.720	1.745	1.026	3.850
5:04:41	222.1	0.604	79.9	5.554	10.13	46.6757	208.6	2.078	2.054	2.774	2.776	0.725	1.750	1.026	3.830
5:07:40	222.5	0.611	79.9	5.548	10.23	46.7281	209.0	2.080	2.056	2.776	2.783	0.731	1.757	1.026	3.809
5:10:41	223.8	0.617	79.7	5.542	10.33	46.7802	210.3	2.091	2.066	2.786	2.803	0.740	1.772	1.031	3.786
5:13:34	224.0	0.623	79.9	5.536	10.43	46.8327	210.5	2.090	2.065	2.785	2.792	0.730	1.761	1.031	3.826
5:16:24	224.3	0.629	79.8	5.530	10.53	46.8854	210.8	2.091	2.066	2.786	2.799	0.736	1.768	1.031	3.801
5:19:16	225.6	0.635	79.7	5.523	10.63	46.9376	212.1	2.101	2.075	2.795	2.812	0.739	1.775	1.036	3.804
5:22:08	225.9	0.642	79.7	5.517	10.73	46.9904	212.4	2.102	2.076	2.796	2.818	0.745	1.781	1.037	3.784
5:25:01	226.3	0.648	79.7	5.511	10.83	47.0438	212.8	2.104	2.078	2.798	2.819	0.744	1.781	1.037	3.789
5:27:54	227.3	0.654	79.7	5.505	10.93	47.0964	213.8	2.111	2.085	2.805	2.827	0.745	1.786	1.041	3.795
5:30:52	228.2	0.660	79.6	5.499	11.04	47.1501	214.7	2.118	2.091	2.811	2.839	0.750	1.795	1.044	3.782
5:33:50	228.3	0.666	79.5	5.492	11.14	47.2027	214.8	2.116	2.089	2.809	2.842	0.756	1.799	1.043	3.761
5:36:51	228.6	0.673	79.3	5.486	11.24	47.2563	215.1	2.116	2.089	2.809	2.856	0.769	1.812	1.043	3.713
5:39:45	229.5	0.679	79.5	5.480	11.34	47.3098	216.0	2.123	2.096	2.816	2.848	0.755	1.802	1.047	3.771
5:42:47	230.5	0.685	79.5	5.474	11.44	47.3636	217.0	2.131	2.103	2.823	2.860	0.759	1.810	1.050	3.765
5:45:49	231.0	0.691	79.4	5.468	11.54	47.4168	217.5	2.133	2.105	2.825	2.869	0.766	1.817	1.051	3.743
5:48:50	231.7	0.697	79.3	5.461	11.64	47.4710	218.2	2.137	2.109	2.829	2.878	0.772	1.825	1.053	3.729
5:51:56	232.7	0.704	79.4	5.455	11.74	47.5254	219.2	2.144	2.116	2.836	2.878	0.765	1.821	1.057	3.764
5:55:03	233.1	0.710	79.3	5.449	11.84	47.5788	219.6	2.146	2.118	2.838	2.885	0.770	1.827	1.057	3.748
5:58:03	234.0	0.716	79.2	5.443	11.94	47.6328	220.5	2.152	2.124	2.844	2.895	0.774	1.835	1.060	3.739

Consolidation Values			Final Values		Tested By	KDG	Project Number	175539009
Height	6.181 (in.)	15.699 (cm)	Height	5.040 (in.)	Date	8-14-09	Test Number	CU-1260A
Diameter	2.877 (in)	7.308 (cm)	Dia. avg.	3.277 (in)	Press No.	1	Data File ID	1260A
Area	6.502 (in^2)	41.947 (cm^2)	Area avg.	8.432 (in^2)	Panel No.	C	Lateral Pressure (psi)	10.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
6:01:06	234.1	0.722	79.2	5.437	12.04	47.6872	220.6	2.151	2.122	2.842	2.899	0.779	1.839	1.060	3.719
6:04:12	235.0	0.728	79.2	5.430	12.14	47.7415	221.5	2.158	2.129	2.849	2.902	0.777	1.839	1.063	3.737
6:07:15	235.9	0.735	79.2	5.424	12.24	47.7967	222.4	2.164	2.134	2.854	2.909	0.778	1.844	1.066	3.741
6:10:15	236.8	0.741	79.1	5.418	12.34	47.8507	223.3	2.170	2.141	2.861	2.919	0.782	1.850	1.069	3.735
6:13:12	237.1	0.747	79.1	5.412	12.44	47.9055	223.6	2.170	2.140	2.860	2.924	0.787	1.855	1.069	3.716
6:16:13	238.1	0.753	78.9	5.406	12.54	47.9605	224.6	2.178	2.148	2.868	2.942	0.798	1.870	1.072	3.688
6:19:12	238.8	0.759	79.1	5.399	12.64	48.0157	225.3	2.182	2.152	2.872	2.933	0.784	1.858	1.074	3.742
6:22:14	238.9	0.766	79.0	5.393	12.74	48.0707	225.4	2.181	2.150	2.870	2.939	0.792	1.865	1.074	3.712
6:25:21	239.8	0.772	79.0	5.387	12.84	48.1263	226.3	2.187	2.156	2.876	2.948	0.795	1.872	1.076	3.707
6:28:21	240.7	0.778	78.9	5.381	12.94	48.1816	227.2	2.193	2.162	2.882	2.960	0.801	1.880	1.079	3.695
6:31:29	241.2	0.784	79.0	5.375	13.04	48.2377	227.8	2.195	2.164	2.884	2.955	0.793	1.874	1.081	3.724
6:34:34	241.7	0.790	78.9	5.368	13.14	48.2928	228.2	2.197	2.165	2.885	2.960	0.798	1.879	1.081	3.711
6:37:34	242.1	0.797	78.8	5.362	13.24	48.3486	228.6	2.198	2.166	2.886	2.967	0.803	1.885	1.082	3.694
6:40:41	243.2	0.803	78.8	5.356	13.34	48.4047	229.7	2.207	2.175	2.895	2.979	0.808	1.894	1.086	3.689
6:43:52	244.5	0.809	78.8	5.350	13.44	48.4611	231.0	2.216	2.184	2.904	2.985	0.804	1.894	1.091	3.713
6:46:56	245.0	0.815	78.8	5.344	13.54	48.5171	231.5	2.218	2.186	2.906	2.988	0.805	1.897	1.091	3.710
6:50:04	245.7	0.821	78.8	5.337	13.64	48.5734	232.2	2.223	2.190	2.910	2.997	0.810	1.903	1.093	3.701
6:53:06	246.8	0.828	78.7	5.331	13.74	48.6300	233.3	2.231	2.198	2.918	3.010	0.815	1.912	1.097	3.693
6:56:07	248.6	0.834	78.5	5.325	13.84	48.6869	235.1	2.245	2.212	2.932	3.036	0.827	1.932	1.104	3.670
6:59:07	248.9	0.840	78.7	5.319	13.94	48.7432	235.4	2.245	2.212	2.932	3.020	0.811	1.916	1.105	3.722
7:02:10	249.0	0.846	78.7	5.313	14.04	48.8000	235.5	2.244	2.210	2.930	3.023	0.816	1.919	1.103	3.706
7:05:11	249.6	0.852	78.6	5.306	14.15	48.8577	236.1	2.247	2.213	2.933	3.032	0.822	1.927	1.105	3.690
7:08:09	250.7	0.859	78.5	5.300	14.25	48.9147	237.2	2.255	2.220	2.940	3.045	0.828	1.936	1.109	3.679
7:11:16	250.8	0.865	78.6	5.294	14.35	48.9716	237.3	2.254	2.219	2.939	3.035	0.819	1.927	1.108	3.705
7:14:15	251.0	0.871	78.5	5.288	14.45	49.0291	237.5	2.252	2.218	2.938	3.040	0.825	1.933	1.107	3.683
7:17:06	251.9	0.877	78.5	5.282	14.55	49.0865	238.4	2.258	2.223	2.943	3.049	0.829	1.939	1.110	3.680
7:20:01	252.6	0.883	78.4	5.275	14.65	49.1441	239.1	2.262	2.227	2.947	3.058	0.834	1.946	1.112	3.668
7:23:00	253.6	0.890	78.4	5.269	14.75	49.2023	240.1	2.269	2.234	2.954	3.066	0.835	1.950	1.115	3.671
7:25:51	253.9	0.896	78.4	5.263	14.85	49.2601	240.4	2.269	2.234	2.954	3.062	0.832	1.947	1.115	3.682
7:28:41	255.2	0.902	78.4	5.257	14.95	49.3180	241.7	2.278	2.243	2.963	3.075	0.835	1.955	1.120	3.681
7:31:42	256.3	0.908	78.4	5.251	15.05	49.3764	242.8	2.286	2.250	2.970	3.085	0.838	1.961	1.124	3.683
7:34:43	256.6	0.914	78.3	5.244	15.15	49.4349	243.1	2.286	2.250	2.970	3.092	0.845	1.968	1.123	3.660
7:37:40	256.8	0.921	78.4	5.238	15.25	49.4934	243.3	2.286	2.249	2.969	3.084	0.838	1.961	1.123	3.682
7:40:43	257.6	0.927	78.3	5.232	15.35	49.5518	244.1	2.290	2.253	2.973	3.091	0.841	1.966	1.125	3.677
7:43:44	258.0	0.933	78.3	5.226	15.45	49.6108	244.5	2.291	2.254	2.974	3.096	0.845	1.970	1.126	3.666
7:46:45	258.3	0.939	78.2	5.220	15.55	49.6695	244.8	2.292	2.254	2.974	3.102	0.850	1.976	1.126	3.648
7:49:51	259.3	0.945	78.2	5.213	15.65	49.7287	245.8	2.299	2.261	2.981	3.104	0.846	1.975	1.129	3.669
7:52:50	260.6	0.952	78.2	5.207	15.75	49.7877	247.1	2.308	2.270	2.990	3.114	0.847	1.981	1.133	3.676
7:56:02	261.7	0.958	78.2	5.201	15.85	49.8478	248.2	2.315	2.277	2.997	3.126	0.851	1.988	1.137	3.671
7:59:12	263.2	0.964	78.1	5.195	15.95	49.9066	249.7	2.326	2.288	3.008	3.140	0.855	1.997	1.143	3.674
8:02:17	264.5	0.970	78.1	5.189	16.05	49.9671	251.0	2.336	2.297	3.017	3.150	0.855	2.003	1.147	3.682
8:05:22	265.1	0.976	78.1	5.182	16.15	50.0260	251.6	2.339	2.300	3.020	3.152	0.855	2.003	1.149	3.688
8:08:28	266.6	0.983	78.1	5.176	16.25	50.0863	253.1	2.350	2.311	3.031	3.163	0.855	2.009	1.154	3.698
8:11:32	268.0	0.989	78.0	5.170	16.35	50.1462	254.5	2.360	2.320	3.040	3.179	0.862	2.020	1.159	3.690
8:14:31	268.3	0.995	77.9	5.164	16.45	50.2063	254.8	2.360	2.320	3.040	3.190	0.873	2.031	1.159	3.656
8:17:34	268.6	1.001	78.1	5.158	16.55	50.2667	255.1	2.360	2.320	3.040	3.176	0.859	2.018	1.159	3.698
8:20:37	269.9	1.007	78.0	5.151	16.65	50.3272	256.4	2.369	2.329	3.049	3.187	0.861	2.024	1.163	3.701
8:23:41	270.4	1.014	77.9	5.145	16.75	50.3879	256.9	2.371	2.331	3.051	3.196	0.868	2.032	1.164	3.681
8:26:50	271.4	1.020	77.8	5.139	16.85	50.4486	257.9	2.377	2.336	3.056	3.208	0.875	2.042	1.167	3.667
8:29:54	272.0	1.026	78.0	5.133	16.95	50.5096	258.5	2.380	2.340	3.060	3.203	0.866	2.035	1.168	3.697
8:33:02	272.6	1.032	77.9	5.127	17.05	50.5707	259.1	2.383	2.342	3.062	3.208	0.869	2.039	1.169	3.690
8:36:12	272.9	1.038	77.9	5.120	17.15	50.6321	259.4	2.383	2.341	3.061	3.210	0.872	2.041	1.169	3.681
8:39:17	273.1	1.045	77.8	5.114	17.25	50.6934	259.7	2.382	2.340	3.060	3.217	0.880	2.049	1.169	3.656
8:42:22	273.5	1.051	77.9	5.108	17.35	50.7549	260.0	2.382	2.340	3.060	3.210	0.872	2.041	1.169	3.679
8:45:31	274.1	1.057	77.8	5.102	17.46	50.8169	260.6	2.385	2.343	3.063	3.216	0.875	2.045	1.170	3.673
8:48:40	274.5	1.063	77.8	5.096	17.56	50.8791	261.0	2.386	2.343	3.063	3.220	0.879	2.049	1.170	3.662
8:51:49	274.7	1.069	77.7	5.089	17.66	50.9407	261.2	2.384	2.342	3.062	3.224	0.885	2.054	1.169	3.644
8:54:53	274.6	1.076	77.8	5.083	17.76	51.0030	261.1	2.381	2.338	3.058	3.214	0.878	2.046	1.168	3.659
8:57:52	275.2	1.082	77.8	5.077	17.86	51.0648	261.7	2.383	2.340	3.060	3.218	0.880	2.049	1.169	3.655
9:00:59	276.1	1.088	77.7	5.071	17.96	51.1277	262.6	2.388	2.345	3.065	3.225	0.883	2.054	1.171	3.652

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values		Tested By	KDG	Project Number	175539009
Height	6.181 (in.)	15.699 (cm)		Height	5.040 (in.)	Date	8-14-09	Test Number	CU-1260A
Diameter	2.877 (in)	7.308 (cm)		Dia. avg.	3.277 (in)	Press No.	1	Data File ID	1260A
Area	6.502 (in^2)	41.947 (cm^2)		Area avg.	8.432 (in^2)	Panel No.	C	Lateral Pressure (psi)	10.0
								Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
9:04:03	276.6	1.094	77.7	5.065	18.06	51.1899	263.1	2.390	2.347	3.067	3.233	0.889	2.061	1.172	3.638
9:07:06	277.7	1.101	77.7	5.058	18.16	51.2535	264.2	2.397	2.354	3.074	3.238	0.887	2.062	1.175	3.651
9:10:13	279.3	1.107	77.7	5.052	18.26	51.3155	265.8	2.409	2.365	3.085	3.248	0.886	2.067	1.181	3.666
9:13:21	279.6	1.113	77.7	5.046	18.36	51.3783	266.1	2.409	2.365	3.085	3.251	0.889	2.070	1.181	3.656
9:16:24	280.5	1.119	77.6	5.040	18.46	51.4417	267.0	2.414	2.369	3.089	3.259	0.893	2.076	1.183	3.650

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values						
Height	6.007 (in.)	15.258 (cm)		Height	4.985 (in.)	Tested By	KDG	Project Number	175539009
Diameter	2.818 (in)	7.157 (cm)		Dia. avg.	3.206 (in)	Date	8-14-09	Test Number	CU-1260B
Area	6.236 (in^2)	40.234 (cm^2)		Area avg.	8.071 (in^2)	Press No.	2	Data File ID	1260B
						Panel No.	D	Lateral Pressure (psi)	30.0
								Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	-0.5	0.000	60.1	6.007	0.00	40.2344	0.0	0.000	0.000	2.160	2.160	2.150	2.155	0.005	1.005
0:08:00	36.6	0.006	60.8	6.001	0.10	40.2747	37.1	0.428	0.428	2.588	2.539	2.101	2.320	0.219	1.209
0:14:01	89.2	0.012	64.8	5.995	0.20	40.3152	89.7	1.035	1.034	3.194	2.856	1.811	2.334	0.522	1.577
0:20:05	116.8	0.018	68.0	5.989	0.30	40.3560	117.3	1.351	1.351	3.511	2.944	1.583	2.263	0.680	1.860
0:25:44	134.2	0.024	69.9	5.983	0.40	40.3963	134.7	1.551	1.550	3.710	3.006	1.446	2.226	0.780	2.079
0:31:40	146.8	0.030	71.5	5.977	0.50	40.4376	147.3	1.694	1.693	3.853	3.038	1.335	2.186	0.852	2.276
0:37:32	157.6	0.036	72.4	5.971	0.60	40.4784	158.1	1.816	1.815	3.975	3.089	1.264	2.176	0.912	2.444
0:43:20	166.5	0.042	73.4	5.965	0.70	40.5184	167.0	1.917	1.915	4.075	3.124	1.198	2.161	0.963	2.607
0:49:39	174.9	0.048	73.9	5.959	0.80	40.5594	175.4	2.011	2.009	4.169	3.176	1.157	2.166	1.010	2.746
0:55:57	182.2	0.054	74.6	5.953	0.90	40.6004	182.7	2.093	2.090	4.250	3.212	1.112	2.162	1.050	2.889
1:02:12	188.5	0.060	74.9	5.947	1.00	40.6414	189.0	2.163	2.160	4.320	3.258	1.088	2.173	1.085	2.995
1:08:18	194.5	0.066	75.3	5.941	1.10	40.6824	195.1	2.229	2.227	4.387	3.297	1.060	2.178	1.118	3.111
1:14:48	200.2	0.072	75.5	5.935	1.20	40.7234	200.7	2.291	2.288	4.448	3.339	1.041	2.190	1.149	3.208
1:20:58	205.1	0.078	75.8	5.929	1.30	40.7647	205.6	2.345	2.342	4.502	3.372	1.020	2.196	1.176	3.306
1:27:11	209.3	0.084	75.9	5.923	1.40	40.8065	209.8	2.390	2.387	4.547	3.410	1.012	2.211	1.199	3.368
1:33:19	212.8	0.090	76.2	5.917	1.50	40.8474	213.3	2.428	2.424	4.584	3.431	0.997	2.214	1.217	3.441
1:39:52	216.6	0.096	76.2	5.911	1.60	40.8906	217.1	2.469	2.465	4.625	3.469	0.994	2.231	1.238	3.491
1:46:05	219.7	0.102	76.3	5.905	1.70	40.9306	220.2	2.502	2.497	4.657	3.494	0.986	2.240	1.254	3.542
1:52:15	222.6	0.108	76.3	5.899	1.80	40.9729	223.1	2.532	2.528	4.688	3.524	0.986	2.255	1.269	3.574
1:58:33	225.4	0.114	76.3	5.893	1.90	41.0144	225.9	2.561	2.557	4.717	3.551	0.985	2.268	1.283	3.607
2:04:51	227.7	0.120	76.4	5.887	2.00	41.0566	228.2	2.584	2.579	4.739	3.571	0.982	2.276	1.295	3.638
2:11:16	229.5	0.126	76.3	5.881	2.10	41.0981	230.0	2.602	2.597	4.757	3.594	0.987	2.290	1.304	3.642
2:17:51	231.6	0.132	76.4	5.875	2.20	41.1400	232.1	2.624	2.618	4.778	3.611	0.982	2.297	1.314	3.676
2:24:22	233.7	0.138	76.2	5.869	2.30	41.1827	234.2	2.645	2.639	4.799	3.641	0.992	2.316	1.325	3.672
2:30:49	235.5	0.144	76.3	5.863	2.40	41.2245	236.0	2.662	2.656	4.816	3.650	0.984	2.317	1.333	3.711
2:37:12	237.2	0.150	76.1	5.857	2.50	41.2669	237.7	2.678	2.672	4.832	3.682	1.000	2.341	1.341	3.683
2:43:32	238.7	0.156	76.3	5.851	2.60	41.3092	239.2	2.692	2.686	4.846	3.681	0.984	2.333	1.348	3.739
2:49:55	240.0	0.162	76.1	5.845	2.70	41.3515	240.5	2.705	2.698	4.858	3.707	0.999	2.353	1.354	3.711
2:56:23	241.7	0.168	76.3	5.839	2.80	41.3944	242.2	2.721	2.714	4.874	3.714	0.990	2.352	1.362	3.753
3:02:51	243.2	0.174	76.1	5.833	2.90	41.4371	243.7	2.735	2.728	4.888	3.739	1.001	2.370	1.369	3.734
3:09:18	244.4	0.180	76.2	5.827	3.00	41.4795	244.9	2.745	2.738	4.898	3.745	0.997	2.371	1.374	3.756
3:15:34	245.7	0.186	76.0	5.821	3.10	41.5227	246.2	2.757	2.750	4.910	3.766	1.006	2.386	1.380	3.743
3:21:59	246.8	0.192	76.1	5.815	3.20	41.5654	247.3	2.767	2.759	4.919	3.771	1.002	2.387	1.384	3.762
3:28:24	248.3	0.198	75.9	5.809	3.30	41.6084	248.8	2.780	2.772	4.932	3.794	1.012	2.403	1.391	3.749
3:34:52	249.2	0.204	76.0	5.803	3.40	41.6513	249.8	2.788	2.780	4.940	3.800	1.010	2.405	1.395	3.763
3:41:15	251.1	0.210	75.9	5.797	3.50	41.6946	251.6	2.807	2.798	4.958	3.826	1.018	2.422	1.404	3.759
3:47:35	252.3	0.216	75.9	5.790	3.60	41.7384	252.8	2.816	2.807	4.967	3.834	1.017	2.425	1.409	3.771
3:53:53	253.5	0.222	75.8	5.785	3.70	41.7811	254.0	2.827	2.818	4.978	3.853	1.025	2.439	1.414	3.758
4:00:18	254.5	0.228	75.8	5.779	3.80	41.8250	255.0	2.835	2.825	4.985	3.860	1.025	2.442	1.418	3.767
4:06:34	255.6	0.234	75.6	5.773	3.90	41.8681	256.1	2.845	2.835	4.995	3.880	1.035	2.457	1.423	3.749
4:12:52	256.8	0.240	75.6	5.767	4.00	41.9119	257.3	2.855	2.845	5.005	3.889	1.034	2.462	1.428	3.761
4:19:12	258.0	0.246	75.5	5.760	4.10	41.9559	258.5	2.865	2.855	5.015	3.909	1.044	2.477	1.433	3.744
4:25:32	259.2	0.252	75.5	5.755	4.20	41.9993	259.7	2.875	2.865	5.025	3.917	1.042	2.480	1.437	3.758
4:31:58	260.4	0.258	75.4	5.749	4.30	42.0433	260.9	2.886	2.875	5.035	3.938	1.053	2.496	1.443	3.740
4:38:25	261.6	0.264	75.4	5.742	4.40	42.0875	262.1	2.896	2.886	5.046	3.948	1.052	2.500	1.448	3.752
4:44:50	262.4	0.270	75.2	5.736	4.50	42.1313	262.9	2.902	2.891	5.051	3.964	1.064	2.514	1.450	3.727
4:51:16	263.4	0.276	75.2	5.730	4.60	42.1755	263.9	2.910	2.898	5.058	3.972	1.064	2.518	1.454	3.734
4:57:39	265.2	0.283	75.1	5.724	4.70	42.2201	265.7	2.926	2.914	5.074	3.997	1.073	2.535	1.462	3.727
5:04:09	266.5	0.289	75.1	5.718	4.80	42.2643	267.0	2.938	2.926	5.086	4.006	1.070	2.538	1.468	3.744
5:10:36	267.6	0.295	75.0	5.712	4.90	42.3087	268.1	2.946	2.934	5.094	4.026	1.082	2.554	1.472	3.722
5:17:09	268.6	0.301	75.0	5.706	5.00	42.3532	269.1	2.954	2.942	5.102	4.035	1.083	2.559	1.476	3.726
5:23:39	270.1	0.307	74.8	5.700	5.10	42.3978	270.6	2.967	2.955	5.115	4.057	1.092	2.574	1.482	3.716
5:30:11	271.3	0.313	74.8	5.694	5.20	42.4426	271.8	2.978	2.965	5.125	4.067	1.092	2.580	1.488	3.724
5:36:34	272.3	0.319	74.7	5.688	5.30	42.4876	272.8	2.986	2.973	5.133	4.086	1.103	2.595	1.491	3.704
5:43:11	273.4	0.325	74.7	5.682	5.40	42.5328	273.9	2.995	2.981	5.141	4.094	1.103	2.598	1.496	3.713
5:49:39	274.8	0.331	74.6	5.676	5.50	42.5776	275.4	3.007	2.994	5.154	4.115	1.111	2.613	1.502	3.703
5:56:09	276.1	0.337	74.6	5.670	5.60	42.6225	276.6	3.017	3.004	5.164	4.125	1.111	2.618	1.507	3.712
6:02:51	277.1	0.343	74.4	5.664	5.70	42.6680	277.6	3.025	3.011	5.171	4.142	1.121	2.632	1.511	3.695
6:09:31	278.1	0.349	74.4	5.658	5.80	42.7132	278.6	3.033	3.019	5.179	4.152	1.123	2.637	1.515	3.698
6:16:16	279.5	0.355	74.3	5.652	5.90	42.7584	280.0	3.046	3.031	5.191	4.174	1.133	2.654	1.521	3.684

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

	Consolidation Values				Final Values						
Height	6.007 (in.)	15.258 (cm)		Height	4.985 (in.)	Tested By	KDG		Project Number	175539009
Diameter	2.818 (in)	7.157 (cm)		Dia. avg.	3.206 (in)	Date	8-14-09		Test Number	CU-1260B
Area	6.236 (in^2)	40.234 (cm^2)		Area avg.	8.071 (in^2)	Press No.	2		Data File ID	1260B
						Panel No.	D		Lateral Pressure (psi)	30.0
									Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
6:22:55	280.8	0.361	74.3	5.646	6.00	42.8041	281.3	3.056	3.041	5.201	4.185	1.134	2.659	1.526	3.691
6:29:35	282.3	0.367	74.1	5.640	6.10	42.8501	282.8	3.068	3.053	5.213	4.208	1.145	2.677	1.532	3.676
6:36:13	283.5	0.373	74.1	5.634	6.20	42.8953	284.0	3.079	3.064	5.224	4.218	1.145	2.682	1.537	3.685
6:42:55	284.0	0.379	73.9	5.628	6.30	42.9412	284.5	3.081	3.066	5.226	4.233	1.157	2.695	1.538	3.657
6:49:40	285.5	0.385	73.9	5.622	6.40	42.9871	286.0	3.094	3.078	5.238	4.245	1.157	2.701	1.544	3.670
6:56:23	287.1	0.391	73.8	5.616	6.50	43.0335	287.6	3.108	3.092	5.252	4.269	1.167	2.718	1.551	3.658
7:03:01	288.3	0.397	73.8	5.610	6.60	43.0792	288.8	3.118	3.101	5.261	4.278	1.167	2.723	1.556	3.667
7:09:41	289.4	0.403	73.7	5.604	6.70	43.1254	290.0	3.126	3.110	5.270	4.296	1.176	2.736	1.560	3.653
7:16:23	290.2	0.409	73.7	5.598	6.80	43.1716	290.7	3.131	3.114	5.274	4.301	1.177	2.739	1.562	3.654
7:23:05	291.3	0.415	73.5	5.592	6.90	43.2180	291.8	3.139	3.122	5.282	4.321	1.189	2.755	1.566	3.635
7:29:45	292.6	0.421	73.5	5.586	7.00	43.2646	293.1	3.151	3.134	5.294	4.330	1.186	2.758	1.572	3.650
7:36:37	293.7	0.427	73.3	5.580	7.10	43.3116	294.2	3.159	3.141	5.301	4.356	1.204	2.780	1.576	3.616
7:43:24	294.6	0.433	73.3	5.574	7.20	43.3580	295.1	3.165	3.147	5.307	4.357	1.199	2.778	1.579	3.633
7:50:18	295.8	0.439	73.2	5.568	7.30	43.4049	296.3	3.174	3.156	5.316	4.373	1.207	2.790	1.583	3.623
7:57:22	297.6	0.445	73.2	5.562	7.40	43.4520	298.1	3.190	3.172	5.332	4.390	1.208	2.799	1.591	3.633
8:04:24	298.3	0.451	73.2	5.556	7.50	43.4986	298.8	3.195	3.176	5.336	4.398	1.212	2.805	1.593	3.629
8:11:28	299.4	0.457	73.0	5.550	7.60	43.5458	299.9	3.202	3.184	5.344	4.416	1.222	2.819	1.597	3.613
8:18:18	301.1	0.463	73.0	5.544	7.70	43.5928	301.7	3.218	3.199	5.359	4.430	1.221	2.826	1.604	3.627
8:25:20	302.3	0.469	72.9	5.538	7.80	43.6402	302.8	3.227	3.207	5.367	4.451	1.233	2.842	1.609	3.609
8:32:19	303.2	0.475	72.8	5.532	7.90	43.6878	303.7	3.232	3.213	5.373	4.458	1.235	2.847	1.611	3.609
8:39:16	304.1	0.481	72.7	5.526	8.00	43.7352	304.6	3.239	3.219	5.379	4.475	1.246	2.861	1.615	3.592
8:46:01	306.0	0.487	72.7	5.520	8.10	43.7826	306.5	3.255	3.235	5.395	4.492	1.247	2.869	1.623	3.604
8:52:56	307.0	0.493	72.5	5.514	8.20	43.8306	307.5	3.263	3.243	5.403	4.510	1.257	2.884	1.626	3.587
8:59:41	307.9	0.499	72.5	5.508	8.30	43.8783	308.4	3.268	3.248	5.408	4.516	1.258	2.887	1.629	3.589
9:06:35	309.1	0.505	72.4	5.502	8.40	43.9261	309.6	3.278	3.257	5.417	4.536	1.269	2.903	1.634	3.574
9:13:17	310.5	0.511	72.4	5.496	8.50	43.9741	311.0	3.289	3.268	5.428	4.546	1.268	2.907	1.639	3.586
9:20:02	311.9	0.517	72.2	5.490	8.60	44.0224	312.4	3.300	3.279	5.439	4.569	1.280	2.925	1.644	3.569
9:26:42	312.8	0.523	72.3	5.484	8.70	44.0706	313.3	3.306	3.284	5.444	4.572	1.278	2.925	1.647	3.578
9:33:29	313.7	0.529	72.0	5.478	8.80	44.1189	314.2	3.311	3.290	5.450	4.593	1.294	2.943	1.650	3.551
9:40:11	314.9	0.535	72.1	5.472	8.91	44.1677	315.4	3.321	3.299	5.459	4.599	1.290	2.945	1.654	3.564
9:46:48	316.2	0.541	71.9	5.466	9.01	44.2162	316.8	3.331	3.309	5.469	4.624	1.305	2.964	1.660	3.544
9:53:26	317.4	0.547	71.9	5.460	9.10	44.2647	318.0	3.340	3.318	5.478	4.628	1.300	2.964	1.664	3.560
10:00:08	318.1	0.553	71.9	5.454	9.21	44.3135	318.6	3.343	3.321	5.481	4.638	1.307	2.972	1.665	3.549
10:06:40	319.9	0.559	71.8	5.448	9.31	44.3627	320.4	3.358	3.335	5.495	4.655	1.310	2.983	1.673	3.554
10:13:20	320.9	0.565	71.7	5.442	9.41	44.4114	321.4	3.365	3.342	5.502	4.667	1.315	2.991	1.676	3.548
10:20:00	322.1	0.571	71.7	5.436	9.51	44.4608	322.6	3.374	3.351	5.511	4.680	1.319	3.000	1.681	3.548
10:26:37	322.9	0.577	71.6	5.430	9.61	44.5098	323.4	3.378	3.355	5.515	4.689	1.325	3.007	1.682	3.540
10:33:12	324.3	0.583	71.5	5.424	9.71	44.5591	324.8	3.389	3.366	5.526	4.705	1.329	3.017	1.688	3.540
10:39:54	325.4	0.589	71.5	5.418	9.81	44.6083	325.9	3.397	3.373	5.533	4.715	1.332	3.024	1.691	3.539
10:46:32	326.5	0.595	71.4	5.412	9.91	44.6578	327.0	3.405	3.381	5.541	4.730	1.339	3.035	1.695	3.532
10:53:14	327.6	0.601	71.4	5.406	10.01	44.7079	328.2	3.413	3.389	5.549	4.741	1.342	3.041	1.699	3.533
10:59:56	329.1	0.607	71.2	5.400	10.11	44.7575	329.6	3.424	3.399	5.559	4.760	1.350	3.055	1.705	3.526
11:06:34	330.2	0.613	71.2	5.394	10.21	44.8072	330.7	3.432	3.407	5.567	4.767	1.350	3.059	1.708	3.530
11:13:11	331.3	0.619	71.1	5.388	10.31	44.8573	331.8	3.439	3.414	5.574	4.785	1.361	3.073	1.712	3.516
11:19:39	332.8	0.625	71.1	5.382	10.41	44.9072	333.3	3.451	3.426	5.586	4.796	1.360	3.078	1.718	3.527
11:26:16	333.4	0.631	71.0	5.376	10.51	44.9576	333.9	3.454	3.428	5.588	4.809	1.371	3.090	1.719	3.508
11:32:51	334.4	0.637	71.0	5.370	10.61	45.0076	334.9	3.460	3.434	5.594	4.814	1.370	3.092	1.722	3.515
11:39:28	335.5	0.643	70.9	5.364	10.71	45.0582	336.0	3.468	3.442	5.602	4.831	1.379	3.105	1.726	3.504
11:45:56	336.5	0.649	70.8	5.358	10.81	45.1089	337.0	3.474	3.447	5.607	4.838	1.380	3.109	1.729	3.505
11:52:28	338.1	0.655	70.7	5.352	10.91	45.1594	338.6	3.487	3.460	5.620	4.859	1.389	3.124	1.735	3.498
11:59:03	338.2	0.661	70.7	5.346	11.01	45.2101	338.7	3.484	3.457	5.617	4.857	1.390	3.123	1.733	3.494
12:05:35	339.8	0.667	70.6	5.340	11.11	45.2612	340.4	3.497	3.469	5.629	4.878	1.399	3.138	1.740	3.488
12:12:08	340.9	0.673	70.6	5.334	11.21	45.3121	341.4	3.503	3.476	5.636	4.883	1.398	3.140	1.743	3.494
12:18:50	341.9	0.679	70.5	5.328	11.31	45.3631	342.4	3.510	3.482	5.642	4.899	1.407	3.153	1.746	3.482
12:25:28	342.8	0.685	70.4	5.322	11.41	45.4144	343.3	3.515	3.487	5.647	4.905	1.408	3.157	1.748	3.483
12:32:00	343.6	0.691	70.3	5.316	11.51	45.4660	344.1	3.519	3.491	5.651	4.918	1.417	3.167	1.751	3.471
12:38:33	345.0	0.697	70.3	5.310	11.61	45.5172	345.5	3.529	3.501	5.661	4.927	1.416	3.172	1.756	3.479
12:45:00	345.9	0.703	70.2	5.304	11.71	45.5688	346.4	3.535	3.507	5.667	4.943	1.426	3.184	1.758	3.466
12:51:35	346.3	0.709	70.2	5.298	11.81	45.6205	346.8	3.535	3.506	5.666	4.944	1.428	3.186	1.758	3.462
12:58:03	347.4	0.715	70.1	5.292	11.91	45.6723	347.9	3.542	3.513	5.673	4.958	1.435	3.197	1.762	3.455

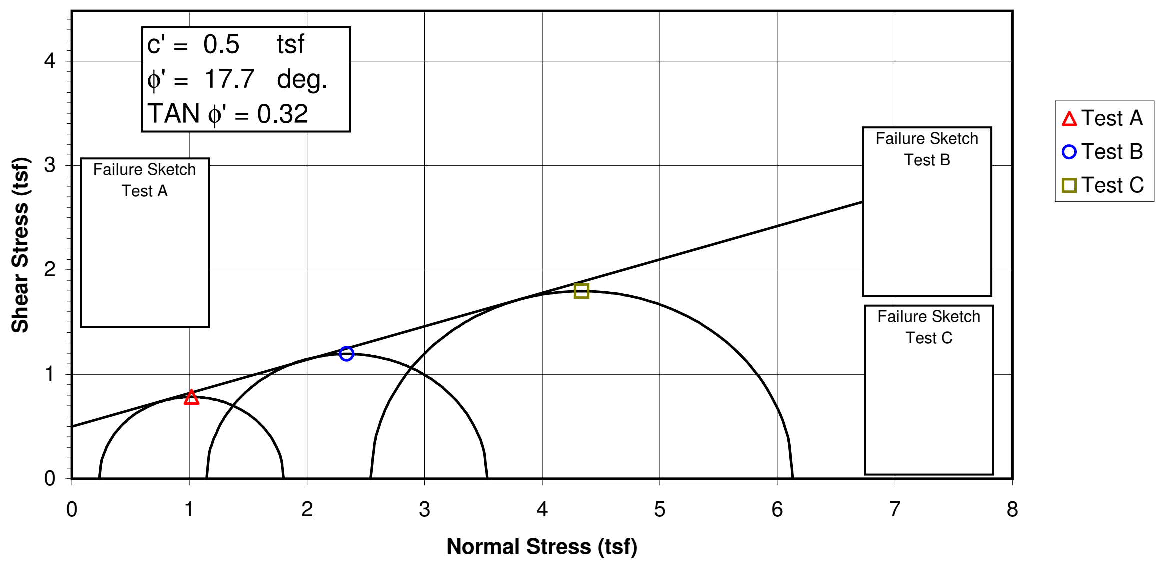
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values				
Height	6.007 (in.)	15.258 (cm)		Height	4.985 (in.)	Tested By	KDG	Project Number: 175539009
Diameter	2.818 (in)	7.157 (cm)		Dia. avg.	3.206 (in)	Date	8-14-09	Test Number: CU-1260B
Area	6.236 (in^2)	40.234 (cm^2)		Area avg.	8.071 (in^2)	Press No.	2	Data File ID: 1260B
						Panel No.	D	Lateral Pressure (psi): 30.0
								Chamber Pressure - σ_3 (psi): 90

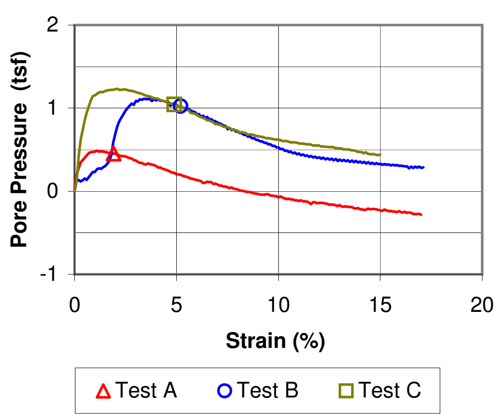
Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
13:04:35	349.3	0.721	70.1	5.286	12.01	45.7242	349.8	3.558	3.528	5.688	4.973	1.435	3.204	1.769	3.467
13:11:05	349.9	0.727	70.0	5.280	12.11	45.7764	350.4	3.560	3.530	5.690	4.983	1.443	3.213	1.770	3.453
13:17:42	350.8	0.733	69.9	5.274	12.21	45.8285	351.3	3.565	3.535	5.695	4.991	1.446	3.219	1.772	3.451
13:24:17	351.2	0.739	69.8	5.268	12.31	45.8806	351.7	3.564	3.534	5.694	4.998	1.454	3.226	1.772	3.437
13:30:57	352.7	0.745	69.8	5.262	12.41	45.9331	353.2	3.576	3.546	5.706	5.013	1.457	3.235	1.778	3.440
13:37:35	353.9	0.751	69.7	5.256	12.51	45.9856	354.4	3.584	3.553	5.713	5.023	1.460	3.241	1.782	3.441
13:44:09	354.9	0.757	69.5	5.250	12.61	46.0383	355.4	3.589	3.559	5.719	5.047	1.479	3.263	1.784	3.414
13:50:39	356.0	0.763	69.6	5.244	12.71	46.0909	356.5	3.597	3.566	5.726	5.047	1.471	3.259	1.788	3.431
13:57:12	357.2	0.769	69.3	5.238	12.81	46.1443	357.8	3.605	3.574	5.734	5.072	1.488	3.280	1.792	3.409
14:03:49	357.7	0.775	69.4	5.232	12.91	46.1969	358.2	3.605	3.573	5.733	5.063	1.480	3.272	1.792	3.422
14:10:24	358.7	0.781	69.3	5.226	13.01	46.2507	359.2	3.611	3.579	5.739	5.083	1.494	3.288	1.795	3.403
14:16:54	359.9	0.787	69.4	5.220	13.11	46.3037	360.4	3.620	3.587	5.747	5.084	1.486	3.285	1.799	3.421
14:23:34	361.2	0.793	69.2	5.214	13.21	46.3570	361.7	3.628	3.596	5.756	5.102	1.496	3.299	1.803	3.411
14:30:04	362.2	0.799	69.2	5.208	13.31	46.4101	362.7	3.634	3.601	5.761	5.106	1.495	3.301	1.806	3.415
14:36:44	362.8	0.805	69.1	5.202	13.41	46.4639	363.3	3.636	3.603	5.763	5.119	1.506	3.312	1.807	3.400
14:43:16	364.1	0.811	69.1	5.196	13.51	46.5176	364.6	3.645	3.612	5.772	5.124	1.502	3.313	1.811	3.411
14:49:52	365.1	0.817	68.9	5.190	13.61	46.5715	365.6	3.650	3.617	5.777	5.144	1.517	3.330	1.813	3.391
14:56:31	366.4	0.823	69.0	5.184	13.71	46.6259	366.9	3.659	3.626	5.786	5.148	1.512	3.330	1.818	3.405
15:03:02	367.2	0.829	68.8	5.178	13.81	46.6797	367.7	3.663	3.629	5.789	5.164	1.525	3.344	1.819	3.386
15:09:39	368.2	0.835	68.9	5.172	13.91	46.7338	368.7	3.669	3.635	5.795	5.167	1.522	3.344	1.822	3.395
15:16:14	369.2	0.841	68.7	5.166	14.01	46.7883	369.7	3.675	3.640	5.800	5.186	1.536	3.361	1.825	3.377
15:22:56	370.1	0.847	68.8	5.160	14.11	46.8428	370.7	3.679	3.645	5.805	5.183	1.528	3.356	1.827	3.391
15:29:33	371.2	0.853	68.6	5.154	14.21	46.8973	371.7	3.686	3.651	5.811	5.205	1.544	3.374	1.830	3.371
15:36:18	372.4	0.860	68.6	5.147	14.31	46.9527	372.9	3.693	3.658	5.818	5.207	1.539	3.373	1.834	3.384
15:42:58	373.0	0.865	68.5	5.141	14.41	47.0071	373.5	3.694	3.659	5.819	5.219	1.550	3.385	1.835	3.367
15:49:40	374.3	0.871	68.5	5.135	14.51	47.0620	374.8	3.704	3.668	5.828	5.225	1.547	3.386	1.839	3.378
15:56:31	375.3	0.878	68.4	5.129	14.61	47.1173	375.8	3.708	3.673	5.833	5.241	1.558	3.400	1.841	3.363
16:03:23	376.0	0.883	68.4	5.123	14.71	47.1723	376.5	3.711	3.675	5.835	5.240	1.555	3.398	1.843	3.369
16:10:12	376.9	0.889	68.2	5.117	14.81	47.2277	377.4	3.716	3.679	5.839	5.256	1.567	3.411	1.845	3.355
16:16:58	378.5	0.896	68.3	5.111	14.91	47.2832	379.0	3.727	3.691	5.851	5.265	1.564	3.415	1.850	3.366
16:23:47	379.2	0.902	68.1	5.105	15.01	47.3393	379.7	3.730	3.693	5.853	5.280	1.578	3.429	1.851	3.347
16:30:31	380.3	0.908	68.2	5.099	15.11	47.3948	380.8	3.736	3.699	5.859	5.281	1.572	3.427	1.855	3.359
16:37:11	381.3	0.914	68.0	5.093	15.21	47.4506	381.8	3.741	3.704	5.864	5.300	1.586	3.443	1.857	3.342
16:43:53	382.3	0.920	68.1	5.087	15.31	47.5066	382.8	3.747	3.710	5.870	5.299	1.579	3.439	1.860	3.355
16:50:47	383.5	0.926	67.9	5.081	15.41	47.5630	384.0	3.754	3.717	5.877	5.319	1.592	3.456	1.863	3.341
16:57:34	384.1	0.932	68.0	5.075	15.51	47.6200	384.6	3.755	3.717	5.877	5.314	1.586	3.450	1.864	3.350
17:04:15	384.8	0.938	67.8	5.069	15.61	47.6760	385.3	3.758	3.719	5.879	5.328	1.599	3.464	1.865	3.333
17:11:02	385.6	0.944	67.9	5.063	15.71	47.7322	386.1	3.761	3.723	5.883	5.327	1.594	3.461	1.867	3.342
17:17:51	386.5	0.950	67.7	5.057	15.81	47.7892	387.0	3.766	3.727	5.887	5.340	1.603	3.472	1.868	3.331
17:24:32	387.4	0.956	67.8	5.051	15.91	47.8462	387.9	3.770	3.731	5.891	5.340	1.599	3.469	1.870	3.339
17:31:18	387.9	0.962	67.6	5.045	16.01	47.9030	388.4	3.770	3.731	5.891	5.350	1.609	3.480	1.870	3.324
17:38:02	389.1	0.968	67.7	5.039	16.11	47.9600	389.6	3.778	3.738	5.898	5.354	1.606	3.480	1.874	3.334
17:45:11	390.3	0.974	67.6	5.033	16.21	48.0174	390.8	3.784	3.745	5.905	5.370	1.616	3.493	1.877	3.324
17:52:00	391.3	0.980	67.6	5.027	16.31	48.0751	391.8	3.789	3.749	5.909	5.373	1.613	3.493	1.880	3.331
17:58:37	391.7	0.986	67.5	5.021	16.41	48.1321	392.2	3.789	3.748	5.908	5.381	1.623	3.502	1.879	3.316
18:05:18	392.2	0.992	67.5	5.015	16.51	48.1898	392.7	3.790	3.749	5.909	5.379	1.620	3.500	1.880	3.320
18:12:10	393.4	0.998	67.4	5.009	16.61	48.2480	393.9	3.797	3.756	5.916	5.394	1.628	3.511	1.883	3.313
18:18:49	394.4	1.004	67.4	5.003	16.71	48.3060	394.9	3.801	3.760	5.920	5.396	1.626	3.511	1.885	3.319
18:25:26	395.3	1.010	67.3	4.997	16.81	48.3640	395.8	3.806	3.765	5.925	5.409	1.634	3.522	1.887	3.310
18:32:10	396.8	1.016	67.3	4.991	16.91	48.4221	397.3	3.816	3.774	5.934	5.416	1.632	3.524	1.892	3.319
18:38:47	396.9	1.022	67.2	4.985	17.01	48.4803	397.4	3.812	3.770	5.930	5.422	1.642	3.532	1.890	3.302

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



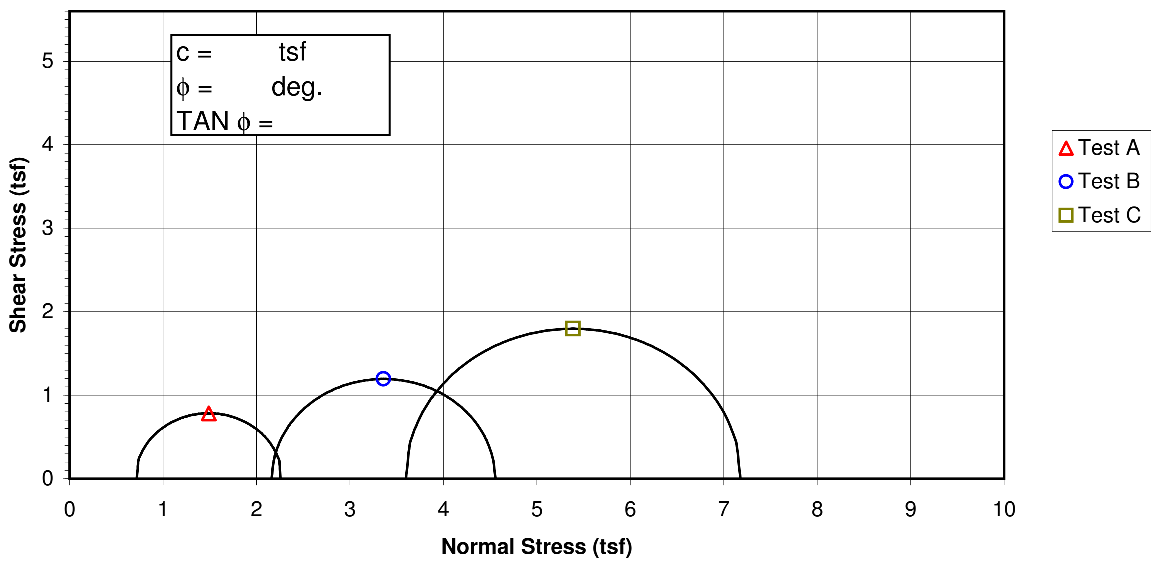
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	21.0	23.1	23.6	
	Dry Density PCF	γ_{d_o}	99.2	101.7	102.3	
	Saturation %	S_o	82.8	97.1	100.6	
	Void Ratio	e_o	0.674	0.633	0.623	
After Shear	Water content %	W_f	22.9	23.2	22.5	
	Dry Density PCF	γ_{d_f}	103.2	102.7	103.9	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.609	0.617	0.599	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		σ_3'f	0.24	1.14	2.54	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.54	2.40	3.58	
Time to (σ1'-σ3')max min.		t_f	10.5	369.7	345.1	
Ultimate Deviator Stress, t/sq ft		$(\sigma1'-\sigma3')_{ult}$	n/a	n/a	3.17	
Initial Diameter, in.		D_o	2.894	2.881	2.878	
Initial Height, in.		H_o	6.024	6.032	6.020	

Controlled - Strain Test

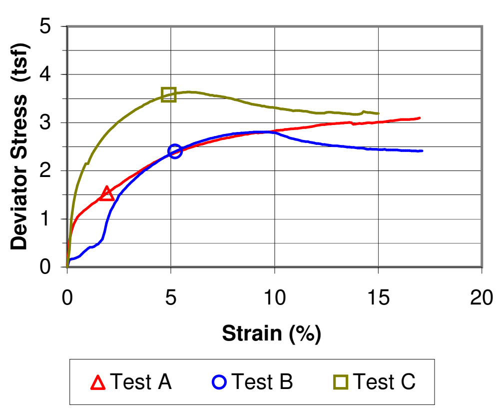
Description of Specimens	Fat Clay with Gravel (CH), red brown, moist, firm				
	Type of Specimen	Undisturbed		Type of test	$\overline{R}$
LL	PL	PI	Gs 2.66	Project	Cumberland Dry Ash Stack and Gypsum Disposal Area
Remarks:					
	Boring No.	B-63A		Sample No.	1270
	Depth Elev.	5.5'-6.0', 8.0'-8.5', 8.6'-9.1'			
	Laboratory	Stantec		Date	8-24-09
	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	21.0	23.1	23.6	
	Dry Density PCF	γd_o	99.2	101.7	102.3	
	Saturation %	S_o	82.8	97.1	100.6	
	Void Ratio	e_o	0.674	0.633	0.623	
After Shear	Water content %	W_f	22.9	23.2	22.5	
	Dry Density PCF	γd_f	103.2	102.7	103.9	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.609	0.617	0.599	
	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		$(\sigma_1-\sigma_3)_{max}$	1.54	2.40	3.58	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	10.5	369.7	345.1	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	3.17	
Initial Diameter, in.		D_o	2.894	2.881	2.878	
Initial Height, in.		H_o	6.024	6.032	6.020	

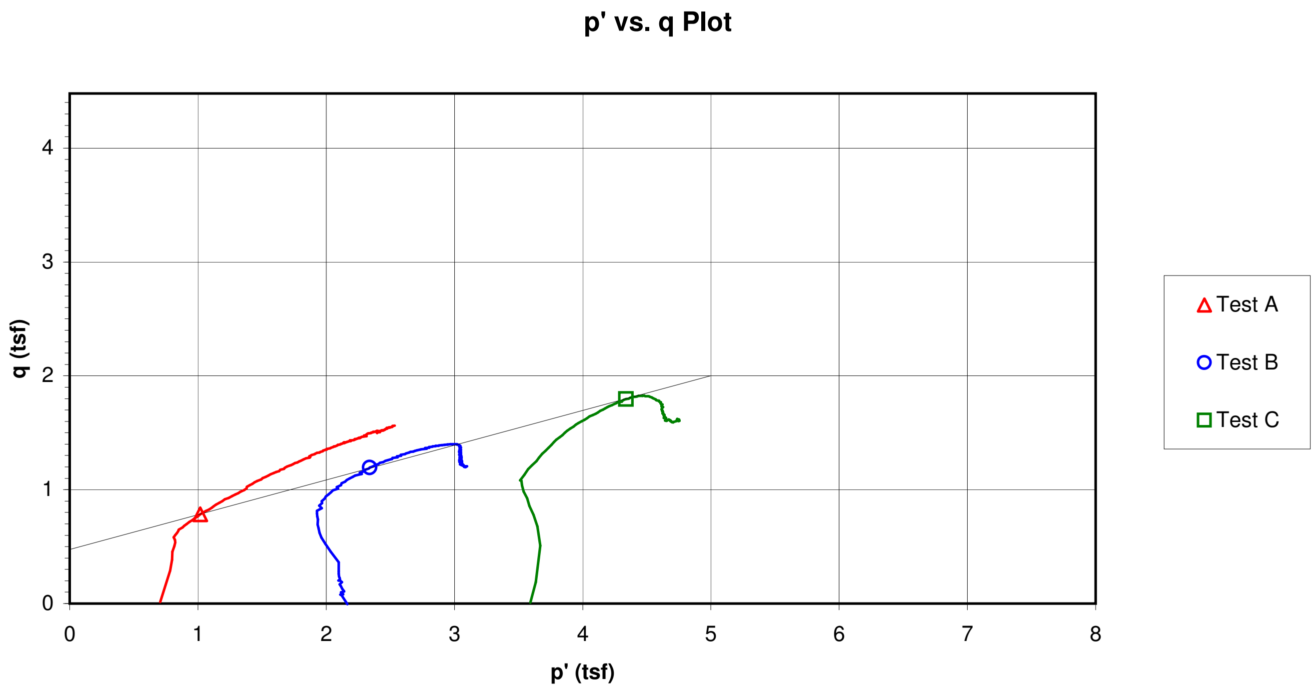
Controlled - Strain Test

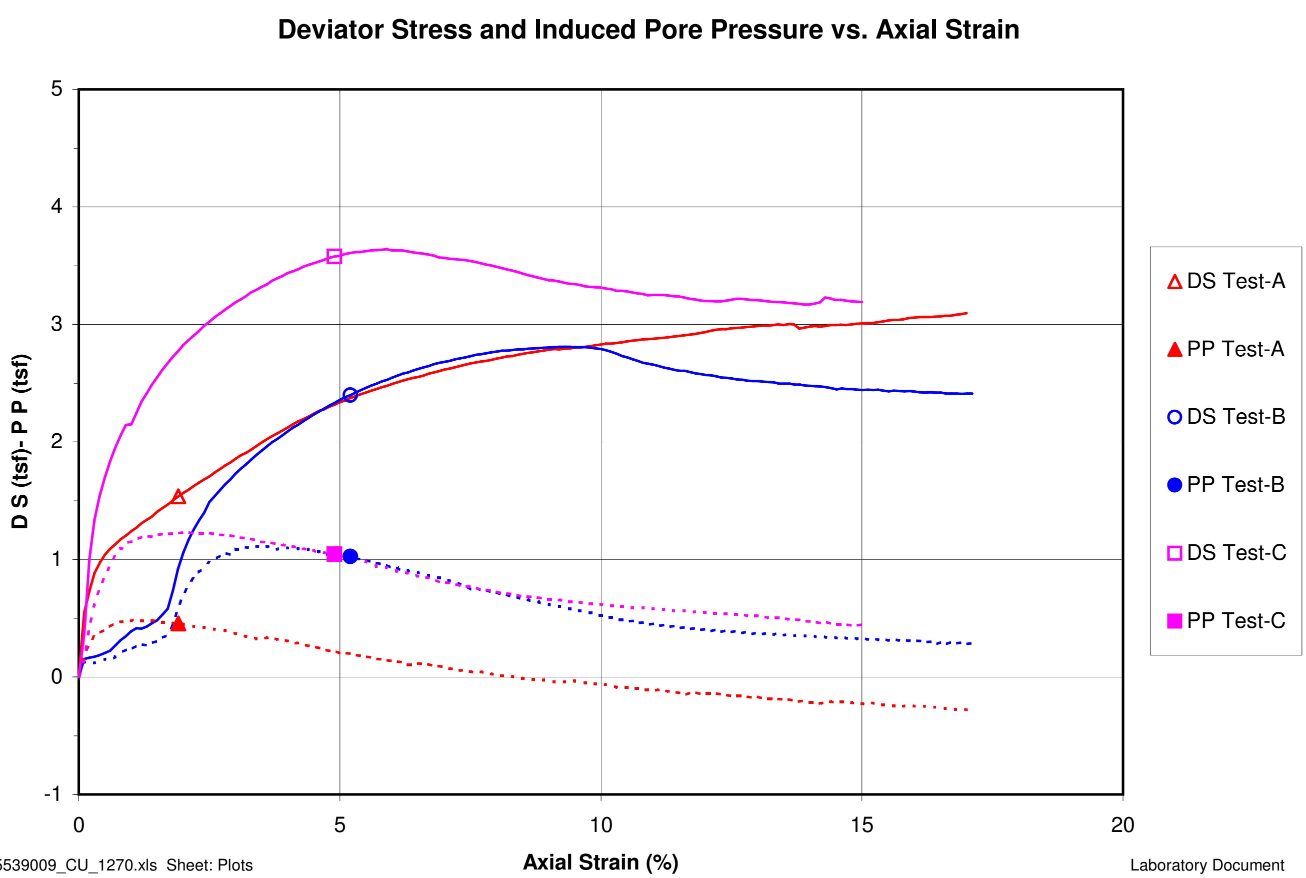
Description of Specimens Fat Clay with Gravel (CH), red brown, moist, firm

				Type of Specimen Undisturbed	Type of test $\bar{R}$
LL	PL	PI	Gs 2.66	Project	Cumberland Dry Ash Stack and Gypsum Disposal Area
Remarks:					
				Boring No. B-63A	Sample No. 1270
				Depth Elev. 5.5'-6.0', 8.0'-8.5', 8.6'-9.1'	
				Laboratory Stantec	Date 8-24-09
				TRIAXIAL COMPRESSION TEST REPORT	

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project No.	175539009
Sample ID	B-63A, 5.5'-6.0' & B-63A, 8.0'-8.5' & B-63A, 8.6'-9.1'	Test Number	1270
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 17.7 deg.	c' =	0.50 tsf





File: 175539009_CU_1270.xls Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Consolidated Undrained Triaxial Test
ASTM D4767-04

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Sample Identification	B-63A, 5.5'-6.0'	Test Number	CU-1270A
Visual Description	Fat Clay with Gravel (CH), red brown, moist, firm	Prepared By	RC
Undisturbed	Source B-63A, 5.0'-7.0'	Date	7-28-2009

Specific Gravity 2.66 ASTM D854 Method A | Liquid Limit N/A | Plastic Limit N/A | Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in^3)		Specimen	
Top	2.901	1	6.034	Sample	39.5887 (V_o)	Wet Weight (g)	1248.42
Middle	2.899	2	6.000	Solids	23.6715 (VS_o)	Dry Weight (g)	1031.89
Bottom	2.878	3	6.028	Water	13.2124 (Vw_o)	Wet Unit Weight (pcf)	120.1
Avg.	2.8927 (D_o)	4	6.034	Voids	15.9172 (Vv_o)	Dry Unit Weight (pcf)	99.3
Area (in^2)	6.5718 (A_o)	Avg. (H_o)	6.0240	Degree of Saturation (%)	83.0 (S_o)		
Moisture Content (%)	21.0	Final Trimmings		Void Ratio	0.672		

Saturation

Set Up & Saturated: Wet xx Dry ____ | Set up By KDG

Back Pressure Saturated to: 80 (psi) | Final Pore Pressure Parameter B 0.96 | Date 8-14-09

Panel Board Number E

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1375	Initial	16.66 (in.)	Initial	12.15 (in.)	Specimen Height (in.)	6.0280 (H_s)
Final	0.1335	Final	8.64 (in.)	Final	10.56 (in.)	Area (in^2) Method A	6.5806 (A_s)
Change	0.0040 (ΔH_o)	Change	-8.02 (in.)	Change	-1.59 (in.)	Specimen Volume (in^3)	39.67 (Vs)

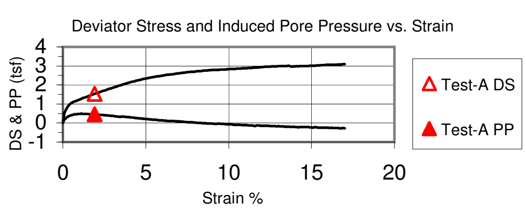
Consolidation

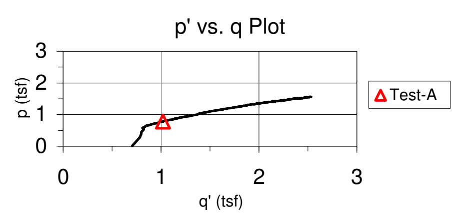
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1335	Initial	1.28 (in.)	Initial	17.79 (in.)	Chamber	90
Final	0.1392	Final	3.87 (in.)	Final	15.27 (in.)	Back	80
Change	-0.0057 (ΔH_c)	Change	-2.59 (in.)	Change	-2.52 (in.)	Lateral	10 (σ_3)
Height (in.)	6.0223 (H_c)			Volume (in^3)	38.0951 (V_c)		
Area (in^3) Method B	6.3257 (A_c)			Volume - Water (in^3)	14.4236 (VWc)	t_{50} (min.)	0.133
Diameter (in.)	2.8380 (D_c)			Water Content (%)	22.9		
Dry Density (pcf)	103.2			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.609

After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.351 (in.)	Wet Weight (g)	1268.27	Corrected Deviator	1.54 σ_d (tsf)
Wet weight (g)	1268.27 (WWf)	Dry Weight (g)	1031.89	Major Principal	1.80 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.327 (in.)	Tare Weight (g)	0.00	Minor Principal	0.24 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.186
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	1.91
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch





Comments:

Stantec

Consolidated Undrained Triaxial Test

ASTM D4767-04

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Sample Identification	B-63A, 8.0'-8.5'	Test Number	CU-1270B
Visual Description	Fat Clay with Gravel (CH), red brown, moist, firm	Prepared By	CM
Undisturbed	Source B-63A, 8.0'-10.0'	Date	7-28-2009

Specific Gravity 2.66 ASTM D854 Method A Liquid Limit N/A Plastic Limit N/A Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in3)		Specimen	
Top	2.881	1	6.039	Sample	39.3396 (V_o)	Wet Weight (g)	1292.30
Middle	2.880	2	6.031	Solids	24.0783 (VS_o)	Dry Weight (g)	1049.63
Bottom	2.884	3	6.019	Water	14.8080 (Vw_o)	Wet Unit Weight (pcf)	125.1
Avg.	2.8817 (D_o)	4	6.039	Voids	15.2613 (Vv_o)	Dry Unit Weight (pcf)	101.6
Area (in^2)	6.5219 (A_o)	Avg. (H_o)	6.0319	Degree of Saturation (%)	97.0 (S_o)		
Moisture Content (%)	23.1	Final Trimmings		Void Ratio	0.634		

Saturation

Set Up & Saturated: Wet xx Dry ____ Set up By KDG

Back Pressure Saturated to: 60 (psi) Final Pore Pressure Parameter B 0.97 Date 8-14-09

Panel Board Number F

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.1411	Initial	16.23 (in.)	Initial	9.47 (in.)	Specimen Height (in.)	6.0412 (H_s)
Final	0.1318	Final	10.55 (in.)	Final	8.97 (in.)	Area (in^2) Method A	6.5420 (A_s)
Change	0.0093 (ΔH_o)	Change	-5.68 (in.)	Change	-0.50 (in.)	Specimen Volume (in^3)	39.52 (V_s)

Consolidation

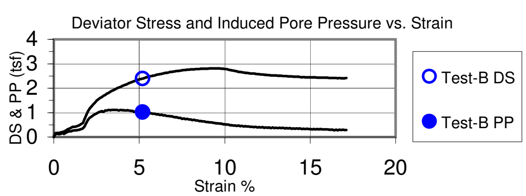
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1318	Initial	1.27 (in.)	Initial	17.23 (in.)	Chamber	90
Final	0.1375	Final	9.67 (in.)	Final	9.34 (in.)	Back	60
Change	-0.0057 (ΔH_c)	Change	-8.40 (in.)	Change	-7.89 (in.)	Lateral	30 (σ_3)
Height (in.)	6.0355 (H_c)			Volume (in^3)	38.9247 (V_c)		
Area (in^3) Method B	6.4493 (A_c)			Volume - Water (in^3)	14.8464 (VWc)	D_{50} (min.)	25
Diameter (in.)	2.8656 (D_c)			Water Content (%)	23.2		
Dry Density (pcf)	102.7			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.617

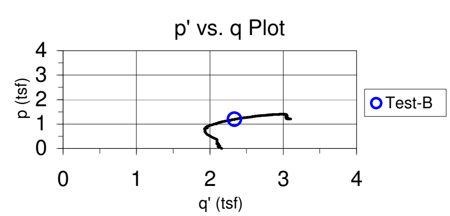
After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.322 (in.)	Wet Weight (g)	1292.93	Corrected Deviator	2.40 σ_d (tsf)
Wet weight (g)	1292.93 (WWf)	Dry Weight (g)	1049.63	Major Principal	3.53 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.298 (in.)	Tare Weight (g)	0.00	Minor Principal	1.14 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.018
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	5.20
Membrane Thickness (in.)	0.012				

Failure Criterion: Maximum Effective Principal Stress Ratio

Failure Sketch





Comments:

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Consolidated Undrained Triaxial Test

ASTM D4767-04

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Sample Identification	B-63A, 8.6'-9.1'	Test Number	1270C
Visual Description	Fat Clay with Gravel (CH), red brown, moist, firm	Prepared By	CM
Undisturbed	Source B-63A, 8.0'-10.0'	Date	7-28-2009

Specific Gravity 2.66 ASTM D854 Method A   Liquid Limit N/A   Plastic Limit N/A   Plasticity Index N/A

Initial Specimen Data

Specimen Diameter (in.)		Specimen Height (in.)		Volumes (in³)		Specimen	
Top	2.878	1	5.993	Sample	39.1500 (V_o)	Wet Weight (g)	1299.6
Middle	2.879	2	6.068	Solids	24.1261 (VS_o)	Dry Weight (g)	1051.71
Bottom	2.876	3	6.024	Water	15.1261 (Vw_o)	Wet Unit Weight (pcf)	126.5
Avg.	2.8777 (D_o)	4	5.993	Voids	15.0238 (Vv_o)	Dry Unit Weight (pcf)	102.3
Area (in^2)	6.5039 (A_o)	Avg. (H_o)	6.0195	Degree of Saturation (%)	100.7 (S_o)		
Moisture Content (%)	23.6	Final Trimmings		Void Ratio	0.623		

Saturation

Set Up & Saturated: Wet xx Dry ____   Set up By KDG

Back Pressure Saturated to: 40 (psi)   Final Pore Pressure Parameter B 0.96   Date 8-17-09

Panel Board Number D

Height Readings (in.)		Back Pressure Burette		Chamber Burette			
Initial	0.151	Initial	16.85 (in.)	Initial	12.73 (in.)	Specimen Height (in.)	6.0250 (H_s)
Final	0.1455	Final	13.54 (in.)	Final	12.82 (in.)	Area (in^2) Method A	6.5157 (A_s)
Change	0.0055 (ΔH_o)	Change	-3.31 (in.)	Change	0.09 (in.)	Specimen Volume (in^3)	39.26 (V_s)

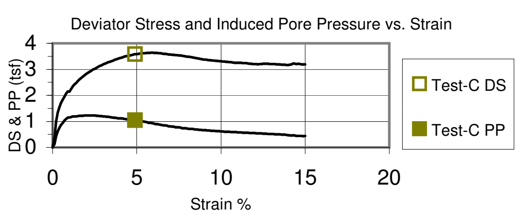
Consolidation

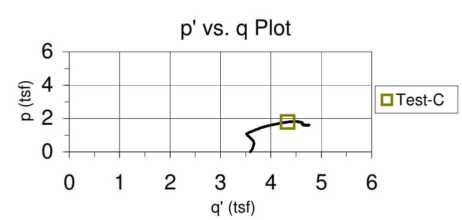
Height Readings (in.)		Back Pressure Burette Readings		Chamber Burette Readings		Pressures (psi)	
Initial	0.1455	Initial	0.95 (in.)	Initial	17.83 (in.)	Chamber	90
Final	0.1986	Final	7.66 (in.)	Final	11.14 (in.)	Back	40
Change	-0.0531 (ΔH_c)	Change	-6.71 (in.)	Change	-6.69 (in.)	Lateral	50 (σ_3)
Height (in.)	5.9719 (H_c)			Volume (in^3)	38.5700 (V_c)		
Area (in^3) Method B	6.4586 (A_c)			Volume - Water (in^3)	14.4439 (VWc)	D_{50} (min.)	39
Diameter (in.)	2.8676 (D_c)			Water Content (%)	22.5		
Dry Density (pcf)	103.9			Degree of Saturation (%)	100.0 (S_c)	Void Ratio	0.599

After Test

Final Measurements		Final Moisture Content		Stresses (membrane corrected) at Failure (psi)	
Maximum Diameter	3.229 (in.)	Wet Weight (g)	1288.42	Corrected Deviator	3.58 σ_d (tsf)
Wet weight (g)	1288.42 (WWf)	Dry Weight (g)	1051.71	Major Principal	6.13 $\sigma_1'_f$ (tsf)
Corrected Diameter	3.205 (in.)	Tare Weight (g)	0.00	Minor Principal	2.54 $\sigma_3'_f$ (tsf)
				Rate of Strain (% / min.)	0.014
Youngs Modulus for Membrane (psi)	200			Axial Strain at Failure (%)	4.90
Membrane Thickness (in.)	0.012			Failure Criterion:	Maximum Effective Principal Stress Ratio

Failure Sketch





Comments: ____

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values		Tested By	KDG		
Height	6.022 (in.)	15.297 (cm)		Height	4.999 (in.)	Date	8-17-09	Project Number	175539009
Diameter	2.838 (in)	7.209 (cm)		Dia. avg.	3.140 (in)	Press No.	2	Test Number	CU-1270A
Area	6.326 (in²)	40.813 (cm²)		Area avg.	7.745 (in²)	Panel No.	E	Data File ID	CU-1270A
								Lateral Pressure (psi)	10.0
								Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm²)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	-0.3	0.000	80.4	6.022	0.00	40.8132	0.0	0.000	0.000	0.720	0.720	0.690	0.705	0.015	1.044
0:00:51	47.7	0.006	83.1	6.016	0.10	40.8548	48.0	0.547	0.546	1.266	1.072	0.495	0.783	0.288	2.165
0:01:25	64.7	0.012	84.3	6.010	0.21	40.8974	65.0	0.739	0.739	1.459	1.182	0.413	0.798	0.385	2.861
0:01:57	77.4	0.018	85.2	6.004	0.30	40.9367	77.7	0.883	0.882	1.602	1.257	0.344	0.801	0.456	3.649
0:02:31	85.9	0.024	85.7	5.998	0.41	40.9810	86.2	0.978	0.977	1.697	1.321	0.313	0.817	0.504	4.220
0:03:01	91.6	0.030	86.0	5.992	0.50	41.0186	91.9	1.042	1.040	1.760	1.358	0.287	0.823	0.535	4.726
0:03:32	96.0	0.036	86.4	5.986	0.60	41.0599	96.4	1.091	1.090	1.810	1.381	0.261	0.821	0.560	5.294
0:04:04	99.9	0.042	86.8	5.980	0.71	41.1031	100.2	1.134	1.132	1.852	1.392	0.230	0.811	0.581	6.056
0:04:36	103.6	0.048	86.9	5.974	0.80	41.1436	103.9	1.174	1.172	1.892	1.424	0.222	0.823	0.601	6.420
0:05:08	106.6	0.054	87.0	5.968	0.90	41.1857	106.9	1.207	1.205	1.925	1.454	0.218	0.836	0.618	6.653
0:05:40	109.8	0.060	87.1	5.962	1.00	41.2265	110.1	1.242	1.239	1.959	1.481	0.212	0.847	0.635	6.999
0:06:09	112.6	0.066	87.2	5.956	1.10	41.2674	113.0	1.273	1.270	1.990	1.501	0.200	0.850	0.650	7.502
0:06:43	116.2	0.072	87.1	5.950	1.20	41.3108	116.5	1.312	1.309	2.029	1.551	0.212	0.881	0.669	7.319
0:07:15	118.8	0.078	87.1	5.944	1.30	41.3525	119.1	1.340	1.337	2.057	1.577	0.210	0.894	0.683	7.500
0:07:47	121.6	0.084	87.0	5.938	1.40	41.3944	121.9	1.370	1.366	2.086	1.609	0.213	0.911	0.698	7.570
0:08:19	125.2	0.090	87.0	5.932	1.50	41.4353	125.5	1.408	1.405	2.125	1.652	0.217	0.934	0.718	7.625
0:08:50	128.2	0.096	86.9	5.926	1.60	41.4767	128.5	1.441	1.437	2.157	1.691	0.224	0.958	0.734	7.550
0:09:25	131.1	0.103	86.8	5.919	1.71	41.5225	131.4	1.472	1.468	2.188	1.725	0.227	0.976	0.749	7.589
0:09:54	134.2	0.108	86.8	5.914	1.80	41.5625	134.5	1.505	1.500	2.220	1.763	0.232	0.997	0.765	7.600
0:10:28	137.6	0.115	86.7	5.907	1.91	41.6065	137.9	1.542	1.537	2.257	1.802	0.235	1.019	0.784	7.669
0:10:58	140.1	0.120	86.7	5.902	2.00	41.6464	140.4	1.568	1.563	2.283	1.833	0.239	1.036	0.797	7.656
0:11:29	142.8	0.126	86.5	5.896	2.10	41.6884	143.2	1.597	1.592	2.312	1.872	0.250	1.061	0.811	7.491
0:12:04	146.0	0.132	86.4	5.890	2.20	41.7323	146.3	1.630	1.625	2.345	1.914	0.259	1.086	0.828	7.396
0:12:35	148.9	0.138	86.3	5.884	2.30	41.7752	149.2	1.661	1.655	2.375	1.952	0.267	1.109	0.843	7.318
0:13:07	151.3	0.144	86.3	5.878	2.40	41.8180	151.6	1.686	1.680	2.400	1.979	0.268	1.123	0.855	7.379
0:13:39	153.7	0.150	86.2	5.872	2.50	41.8602	154.0	1.711	1.705	2.425	2.007	0.272	1.140	0.868	7.381
0:14:11	156.9	0.156	86.1	5.866	2.60	41.9030	157.2	1.745	1.739	2.459	2.052	0.283	1.168	0.884	7.241
0:14:42	159.9	0.163	86.0	5.859	2.70	41.9475	160.2	1.776	1.769	2.489	2.091	0.291	1.191	0.900	7.175
0:15:16	162.8	0.169	85.9	5.854	2.80	41.9897	163.1	1.806	1.800	2.520	2.126	0.296	1.211	0.915	7.188
0:15:49	165.4	0.175	85.7	5.847	2.90	42.0341	165.7	1.834	1.826	2.546	2.169	0.312	1.240	0.928	6.951
0:16:23	168.5	0.181	85.5	5.841	3.01	42.0790	168.8	1.866	1.858	2.578	2.211	0.322	1.266	0.944	6.869
0:16:55	171.0	0.187	85.4	5.835	3.10	42.1204	171.4	1.892	1.884	2.604	2.249	0.334	1.292	0.957	6.726
0:17:26	173.4	0.193	85.2	5.829	3.20	42.1637	173.7	1.916	1.908	2.628	2.285	0.346	1.316	0.969	6.600
0:17:58	175.9	0.199	85.2	5.824	3.30	42.2065	176.2	1.942	1.934	2.654	2.313	0.349	1.331	0.982	6.631
0:18:32	178.9	0.205	84.9	5.817	3.40	42.2516	179.2	1.972	1.964	2.684	2.359	0.364	1.362	0.997	6.472
0:19:04	181.8	0.211	84.9	5.812	3.50	42.2933	182.2	2.003	1.994	2.714	2.392	0.367	1.379	1.012	6.517
0:19:38	184.7	0.217	85.1	5.805	3.61	42.3414	185.1	2.032	2.024	2.744	2.409	0.356	1.382	1.027	6.777
0:20:08	187.3	0.223	84.9	5.799	3.70	42.3817	187.6	2.058	2.049	2.769	2.444	0.364	1.404	1.040	6.714
0:20:42	189.7	0.229	84.8	5.793	3.81	42.4277	190.0	2.082	2.073	2.793	2.475	0.372	1.423	1.052	6.659
0:21:14	192.3	0.235	84.8	5.787	3.90	42.4714	192.6	2.109	2.099	2.819	2.506	0.376	1.441	1.065	6.660
0:21:46	194.7	0.241	84.7	5.781	4.00	42.5151	195.1	2.133	2.124	2.844	2.538	0.384	1.461	1.077	6.603
0:22:18	197.3	0.247	84.4	5.775	4.10	42.5595	197.6	2.159	2.149	2.869	2.584	0.404	1.494	1.090	6.390
0:22:49	199.7	0.253	84.4	5.769	4.20	42.6030	200.1	2.184	2.173	2.893	2.606	0.402	1.504	1.102	6.485
0:23:21	201.8	0.259	84.2	5.763	4.30	42.6473	202.2	2.204	2.194	2.914	2.641	0.417	1.529	1.112	6.337
0:23:53	204.1	0.265	84.1	5.757	4.40	42.6916	204.4	2.227	2.216	2.936	2.672	0.425	1.548	1.123	6.283
0:24:25	206.6	0.271	84.0	5.751	4.50	42.7369	207.0	2.252	2.241	2.961	2.702	0.431	1.567	1.136	6.269
0:24:59	208.9	0.277	83.8	5.745	4.61	42.7838	209.3	2.274	2.263	2.983	2.737	0.444	1.590	1.147	6.171
0:25:28	210.6	0.283	83.7	5.739	4.70	42.8262	210.9	2.290	2.279	2.999	2.764	0.455	1.609	1.155	6.077
0:26:00	212.7	0.289	83.5	5.733	4.80	42.8711	213.0	2.310	2.299	3.019	2.797	0.469	1.633	1.164	5.971
0:26:32	214.6	0.295	83.5	5.727	4.90	42.9154	215.0	2.329	2.317	3.037	2.815	0.467	1.641	1.174	6.026
0:27:03	216.8	0.301	83.2	5.721	5.00	42.9606	217.1	2.350	2.338	3.058	2.857	0.488	1.672	1.184	5.850
0:27:35	218.3	0.307	83.3	5.715	5.10	43.0068	218.6	2.364	2.352	3.072	2.867	0.486	1.677	1.191	5.905
0:28:07	220.6	0.313	83.2	5.709	5.20	43.0516	220.9	2.386	2.373	3.093	2.896	0.492	1.694	1.202	5.886
0:28:38	222.3	0.319	83.0	5.703	5.30	43.0975	222.7	2.402	2.390	3.110	2.923	0.504	1.714	1.210	5.805
0:29:10	224.1	0.325	82.9	5.697	5.40	43.1427	224.5	2.419	2.406	3.126	2.947	0.511	1.729	1.218	5.771
0:29:42	225.7	0.331	82.8	5.691	5.50	43.1884	226.1	2.434	2.420	3.140	2.970	0.519	1.744	1.225	5.725
0:30:14	227.5	0.337	82.7	5.685	5.60	43.2348	227.8	2.450	2.436	3.156	2.990	0.523	1.757	1.233	5.714
0:30:45	228.9	0.343	82.6	5.679	5.70	43.2809	229.3	2.463	2.449	3.169	3.015	0.536	1.776	1.240	5.628
0:31:17	230.6	0.349	82.5	5.673	5.80	43.3272	231.0	2.479	2.465	3.185	3.036	0.541	1.788	1.248	5.616
0:31:49	232.1	0.355	82.4	5.667	5.90	43.3734	232.5	2.492	2.478	3.198	3.056	0.548	1.802	1.254	5.579

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

	Consolidation Values			Final Values					
Height	6.022 (in.)	15.297 (cm)	Height	4.999 (in.)	Tested By	KDG	Project Number	175539009
Diameter	2.838 (in)	7.209 (cm)	Dia. avg.	3.140 (in)	Date	8-17-09	Test Number	CU-1270A
Area	6.326 (in^2)	40.813 (cm^2)	Area avg.	7.745 (in^2)	Press No.	2	Data File ID	CU-1270A
					Panel No.	E	Lateral Pressure (psi)	10.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:32:21	233.8	0.361	82.3	5.661	6.00	43.4189	234.1	2.507	2.492	3.212	3.078	0.555	1.817	1.261	5.544
0:32:52	235.3	0.367	82.2	5.655	6.10	43.4643	235.6	2.520	2.506	3.226	3.095	0.559	1.827	1.268	5.538
0:33:24	236.9	0.373	82.1	5.649	6.20	43.5099	237.2	2.535	2.520	3.240	3.118	0.568	1.843	1.275	5.490
0:33:58	238.6	0.379	81.8	5.643	6.30	43.5593	238.9	2.550	2.535	3.255	3.154	0.589	1.872	1.283	5.355
0:34:30	239.7	0.385	81.8	5.637	6.40	43.6054	240.0	2.560	2.544	3.264	3.163	0.588	1.875	1.287	5.377
0:35:02	240.9	0.392	82.0	5.631	6.50	43.6526	241.3	2.570	2.554	3.274	3.160	0.576	1.868	1.292	5.490
0:35:31	242.2	0.397	81.9	5.625	6.60	43.6968	242.5	2.581	2.565	3.285	3.175	0.580	1.877	1.297	5.474
0:36:03	243.9	0.403	81.9	5.619	6.70	43.7432	244.2	2.596	2.580	3.300	3.191	0.581	1.886	1.305	5.496
0:36:38	245.3	0.410	81.7	5.612	6.81	43.7936	245.7	2.609	2.592	3.312	3.223	0.601	1.912	1.311	5.365
0:37:07	246.6	0.415	81.7	5.607	6.90	43.8372	246.9	2.619	2.602	3.322	3.229	0.597	1.913	1.316	5.410
0:37:41	248.1	0.422	81.6	5.601	7.00	43.8867	248.5	2.633	2.615	3.335	3.251	0.605	1.928	1.323	5.371
0:38:13	249.2	0.427	81.4	5.595	7.10	43.9333	249.6	2.641	2.624	3.344	3.274	0.620	1.947	1.327	5.282
0:38:45	250.4	0.433	81.3	5.589	7.20	43.9806	250.8	2.651	2.634	3.354	3.287	0.623	1.955	1.332	5.276
0:39:16	251.9	0.440	81.2	5.583	7.30	44.0281	252.2	2.664	2.646	3.366	3.311	0.634	1.973	1.338	5.218
0:39:48	253.2	0.445	81.2	5.577	7.40	44.0747	253.5	2.675	2.657	3.377	3.319	0.632	1.975	1.344	5.254
0:40:20	254.4	0.451	81.1	5.571	7.50	44.1217	254.8	2.685	2.667	3.387	3.339	0.642	1.991	1.349	5.201
0:40:51	255.6	0.457	81.0	5.565	7.60	44.1691	255.9	2.694	2.675	3.395	3.356	0.650	2.003	1.353	5.160
0:41:26	256.7	0.464	81.0	5.558	7.70	44.2199	257.1	2.703	2.684	3.404	3.361	0.646	2.003	1.357	5.202
0:41:57	257.5	0.470	80.9	5.552	7.80	44.2675	257.8	2.708	2.689	3.409	3.375	0.656	2.015	1.360	5.147
0:42:29	258.7	0.476	80.8	5.546	7.90	44.3146	259.0	2.718	2.699	3.419	3.394	0.665	2.030	1.364	5.102
0:43:01	259.8	0.482	80.7	5.541	8.00	44.3619	260.1	2.727	2.707	3.427	3.407	0.670	2.038	1.369	5.088
0:43:33	261.1	0.487	80.6	5.535	8.10	44.4095	261.4	2.737	2.718	3.438	3.427	0.679	2.053	1.374	5.048
0:44:07	262.4	0.494	80.5	5.528	8.20	44.4597	262.8	2.748	2.728	3.448	3.440	0.682	2.061	1.379	5.046
0:44:38	263.1	0.500	80.5	5.522	8.30	44.5090	263.4	2.752	2.732	3.452	3.449	0.688	2.069	1.381	5.017
0:45:10	264.4	0.506	80.4	5.516	8.40	44.5569	264.7	2.762	2.742	3.462	3.466	0.693	2.079	1.386	4.999
0:45:42	265.5	0.512	80.3	5.510	8.50	44.6052	265.8	2.771	2.751	3.471	3.481	0.700	2.090	1.390	4.973
0:46:14	266.5	0.518	80.3	5.504	8.60	44.6534	266.8	2.779	2.758	3.478	3.486	0.697	2.092	1.394	4.998
0:46:45	267.2	0.524	80.1	5.498	8.70	44.7015	267.6	2.783	2.762	3.482	3.503	0.711	2.107	1.396	4.930
0:47:17	268.5	0.530	80.1	5.492	8.80	44.7508	268.8	2.793	2.772	3.492	3.516	0.714	2.115	1.401	4.927
0:47:49	269.3	0.536	80.0	5.486	8.90	44.7992	269.6	2.798	2.777	3.497	3.525	0.718	2.121	1.404	4.910
0:48:21	270.4	0.542	80.0	5.480	9.00	44.8495	270.8	2.807	2.785	3.505	3.538	0.722	2.130	1.408	4.898
0:48:53	271.3	0.548	79.9	5.474	9.10	44.8989	271.7	2.813	2.791	3.511	3.551	0.730	2.140	1.411	4.867
0:49:25	271.4	0.554	79.9	5.468	9.20	44.9483	271.7	2.811	2.789	3.509	3.549	0.729	2.139	1.410	4.864
0:49:56	272.2	0.560	79.8	5.462	9.30	44.9978	272.5	2.816	2.793	3.513	3.557	0.734	2.145	1.412	4.848
0:50:28	272.6	0.566	79.9	5.456	9.40	45.0476	273.0	2.818	2.795	3.515	3.549	0.724	2.136	1.413	4.904
0:51:00	273.5	0.572	79.9	5.450	9.50	45.0980	273.9	2.824	2.801	3.521	3.556	0.725	2.141	1.415	4.903
0:51:31	274.3	0.578	79.7	5.444	9.60	45.1483	274.6	2.829	2.805	3.525	3.576	0.741	2.159	1.418	4.827
0:52:03	275.0	0.584	79.7	5.438	9.70	45.1977	275.3	2.832	2.809	3.529	3.579	0.740	2.160	1.420	4.835
0:52:35	275.8	0.590	79.6	5.432	9.80	45.2486	276.2	2.838	2.814	3.534	3.592	0.748	2.170	1.422	4.804
0:53:07	276.9	0.596	79.6	5.426	9.90	45.2980	277.2	2.846	2.822	3.542	3.602	0.750	2.176	1.426	4.803
0:53:39	277.8	0.602	79.4	5.420	10.00	45.3478	278.2	2.852	2.828	3.548	3.622	0.764	2.193	1.429	4.742
0:54:11	279.0	0.608	79.5	5.414	10.10	45.3974	279.3	2.861	2.837	3.557	3.619	0.752	2.186	1.433	4.810
0:54:42	279.3	0.614	79.4	5.408	10.20	45.4477	279.6	2.861	2.836	3.556	3.630	0.763	2.197	1.433	4.756
0:55:16	280.3	0.620	79.2	5.402	10.30	45.5009	280.7	2.868	2.843	3.563	3.651	0.778	2.214	1.437	4.696
0:55:48	281.2	0.626	79.1	5.396	10.40	45.5505	281.5	2.873	2.848	3.568	3.661	0.782	2.221	1.439	4.680
0:56:20	282.3	0.632	79.2	5.390	10.50	45.6014	282.7	2.882	2.857	3.577	3.666	0.779	2.223	1.444	4.706
0:56:52	283.1	0.638	79.1	5.384	10.60	45.6525	283.4	2.887	2.861	3.581	3.678	0.787	2.233	1.446	4.674
0:57:24	284.0	0.644	79.0	5.378	10.70	45.7043	284.3	2.893	2.867	3.587	3.685	0.789	2.237	1.448	4.674
0:57:57	284.8	0.650	78.9	5.372	10.80	45.7556	285.1	2.898	2.871	3.591	3.700	0.798	2.249	1.451	4.636
0:58:29	285.5	0.656	78.9	5.366	10.90	45.8066	285.8	2.901	2.875	3.595	3.703	0.798	2.250	1.453	4.641
0:59:01	286.2	0.662	78.8	5.360	11.00	45.8578	286.5	2.905	2.878	3.598	3.716	0.807	2.262	1.454	4.603
0:59:33	286.9	0.668	78.9	5.354	11.10	45.9085	287.2	2.909	2.882	3.602	3.711	0.799	2.255	1.456	4.644
1:00:05	287.5	0.674	78.7	5.348	11.20	45.9592	287.9	2.912	2.885	3.605	3.726	0.811	2.268	1.458	4.597
1:00:37	288.3	0.680	78.7	5.342	11.30	46.0105	288.6	2.917	2.890	3.610	3.731	0.811	2.271	1.460	4.600
1:01:10	289.4	0.686	78.7	5.336	11.40	46.0631	289.7	2.925	2.897	3.617	3.742	0.815	2.279	1.464	4.592
1:01:45	290.3	0.692	78.5	5.330	11.50	46.1174	290.6	2.930	2.902	3.622	3.760	0.827	2.293	1.466	4.546
1:02:17	291.2	0.698	78.3	5.324	11.60	46.1683	291.5	2.936	2.908	3.628	3.783	0.846	2.315	1.469	4.474
1:02:49	292.0	0.704	78.6	5.318	11.70	46.2204	292.3	2.941	2.912	3.632	3.766	0.823	2.294	1.471	4.575
1:03:22	292.9	0.710	78.6	5.312	11.80	46.2727	293.3	2.947	2.918	3.638	3.770	0.821	2.295	1.474	4.591
1:03:54	294.0	0.716	78.4	5.306	11.90	46.3238	294.4	2.955	2.926	3.646	3.789	0.833	2.311	1.478	4.548

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values			
Height	6.022 (in.)	15.297 (cm)	Height	4.999 (in.)	Tested By	KDG
Diameter	2.838 (in)	7.209 (cm)	Dia. avg.	3.140 (in)	Date	8-17-09
Area	6.326 (in^2)	40.813 (cm^2)	Area avg.	7.745 (in^2)	Press No.	2
					Panel No.	E

Project Number	175539009
Test Number	CU-1270A
Data File ID	CU-1270A
Lateral Pressure (psi)	10.0
Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
1:04:29	295.4	0.723	78.5	5.300	12.00	46.3794	295.7	2.965	2.936	3.656	3.794	0.828	2.311	1.483	4.582
1:05:01	296.6	0.729	78.5	5.294	12.10	46.4316	296.9	2.974	2.944	3.664	3.804	0.829	2.317	1.487	4.588
1:05:33	297.8	0.734	78.5	5.288	12.20	46.4836	298.1	2.982	2.952	3.672	3.813	0.830	2.322	1.491	4.592
1:06:06	298.7	0.740	78.4	5.282	12.30	46.5352	299.0	2.988	2.958	3.678	3.825	0.837	2.331	1.494	4.572
1:06:40	299.1	0.747	78.3	5.275	12.40	46.5917	299.5	2.989	2.958	3.678	3.831	0.842	2.336	1.494	4.551
1:07:13	300.3	0.753	78.2	5.269	12.50	46.6448	300.6	2.997	2.966	3.686	3.848	0.852	2.350	1.498	4.517
1:07:45	301.0	0.759	78.2	5.263	12.60	46.6980	301.3	3.000	2.970	3.690	3.850	0.850	2.350	1.500	4.528
1:08:17	301.7	0.765	78.2	5.257	12.70	46.7506	302.1	3.005	2.974	3.694	3.855	0.851	2.353	1.502	4.529
1:08:49	302.6	0.771	78.1	5.252	12.80	46.8036	303.0	3.010	2.979	3.699	3.866	0.856	2.361	1.505	4.514
1:09:21	303.2	0.777	78.0	5.245	12.90	46.8573	303.5	3.012	2.981	3.701	3.878	0.867	2.372	1.505	4.474
1:09:53	304.1	0.783	78.1	5.239	13.00	46.9111	304.5	3.018	2.986	3.706	3.875	0.858	2.367	1.508	4.515
1:10:26	304.7	0.789	77.9	5.233	13.10	46.9658	305.0	3.020	2.988	3.708	3.891	0.873	2.382	1.509	4.459
1:10:58	305.2	0.795	77.9	5.227	13.20	47.0201	305.5	3.021	2.989	3.709	3.894	0.875	2.384	1.510	4.452
1:11:30	306.1	0.801	77.9	5.221	13.30	47.0746	306.4	3.027	2.995	3.715	3.899	0.874	2.386	1.512	4.461
1:12:00	307.1	0.806	77.8	5.216	13.40	47.1259	307.4	3.033	3.000	3.720	3.908	0.877	2.392	1.515	4.456
1:12:32	306.9	0.813	77.8	5.209	13.50	47.1816	307.3	3.028	2.995	3.715	3.906	0.880	2.393	1.513	4.440
1:13:05	308.0	0.819	77.8	5.203	13.60	47.2372	308.4	3.035	3.002	3.722	3.913	0.880	2.397	1.516	4.445
1:13:37	308.2	0.825	77.6	5.197	13.70	47.2930	308.6	3.034	3.001	3.721	3.923	0.892	2.408	1.515	4.396
1:14:07	304.9	0.831	77.5	5.191	13.80	47.3467	305.2	2.998	2.964	3.684	3.894	0.899	2.396	1.497	4.330
1:14:39	306.2	0.837	77.6	5.185	13.90	47.4029	306.6	3.007	2.973	3.693	3.895	0.892	2.394	1.502	4.368
1:15:11	307.4	0.843	77.4	5.179	14.00	47.4586	307.7	3.015	2.981	3.701	3.919	0.907	2.413	1.506	4.318
1:15:41	308.2	0.849	77.4	5.173	14.10	47.5107	308.5	3.020	2.985	3.705	3.924	0.909	2.416	1.508	4.319
1:16:13	308.1	0.855	77.3	5.167	14.20	47.5667	308.5	3.016	2.981	3.701	3.926	0.915	2.421	1.506	4.291
1:16:45	309.2	0.861	77.4	5.161	14.30	47.6229	309.5	3.022	2.987	3.707	3.926	0.909	2.417	1.509	4.320
1:17:18	310.2	0.867	77.5	5.155	14.40	47.6793	310.6	3.029	2.994	3.714	3.924	0.900	2.412	1.512	4.359
1:17:50	310.8	0.873	77.4	5.149	14.50	47.7353	311.1	3.031	2.996	3.716	3.932	0.906	2.419	1.513	4.338
1:18:19	311.4	0.879	77.5	5.143	14.59	47.7877	311.7	3.033	2.998	3.718	3.930	0.902	2.416	1.514	4.358
1:18:51	311.3	0.885	77.5	5.137	14.69	47.8437	311.7	3.029	2.993	3.713	3.926	0.902	2.414	1.512	4.353
1:19:25	312.5	0.891	77.4	5.131	14.80	47.9039	312.8	3.037	3.001	3.721	3.937	0.906	2.422	1.516	4.345
1:19:55	313.4	0.897	77.3	5.125	14.90	47.9572	313.7	3.042	3.006	3.726	3.951	0.915	2.433	1.518	4.317
1:20:27	314.2	0.903	77.3	5.119	15.00	48.0134	314.5	3.046	3.009	3.729	3.957	0.917	2.437	1.520	4.315
1:20:59	314.8	0.909	77.1	5.113	15.09	48.0689	315.1	3.048	3.011	3.731	3.968	0.926	2.447	1.521	4.283
1:21:33	315.2	0.915	77.4	5.107	15.20	48.1292	315.5	3.048	3.011	3.731	3.951	0.909	2.430	1.521	4.346
1:22:05	316.4	0.921	77.2	5.101	15.30	48.1853	316.7	3.056	3.019	3.739	3.970	0.920	2.445	1.525	4.314
1:22:36	317.4	0.927	77.1	5.095	15.40	48.2419	317.7	3.062	3.025	3.745	3.985	0.930	2.457	1.528	4.286
1:23:08	318.7	0.933	77.1	5.089	15.50	48.2982	319.0	3.071	3.034	3.754	3.992	0.928	2.460	1.532	4.303
1:23:40	319.5	0.939	77.0	5.083	15.60	48.3548	319.8	3.076	3.038	3.758	4.003	0.935	2.469	1.534	4.282
1:24:11	319.8	0.945	77.0	5.077	15.70	48.4115	320.1	3.075	3.037	3.757	4.000	0.933	2.467	1.534	4.288
1:24:43	321.0	0.951	76.9	5.071	15.79	48.4687	321.4	3.083	3.045	3.765	4.015	0.940	2.478	1.537	4.271
1:25:17	322.4	0.957	77.1	5.065	15.90	48.5301	322.8	3.093	3.054	3.774	4.014	0.930	2.472	1.542	4.318
1:25:49	323.2	0.963	77.0	5.059	16.00	48.5871	323.5	3.096	3.057	3.777	4.026	0.939	2.483	1.544	4.289
1:26:21	324.2	0.969	76.9	5.053	16.10	48.6440	324.5	3.102	3.063	3.783	4.038	0.945	2.491	1.547	4.275
1:26:52	324.5	0.975	77.0	5.047	16.20	48.7017	324.9	3.102	3.062	3.782	4.030	0.937	2.484	1.546	4.299
1:27:24	325.1	0.981	76.8	5.041	16.30	48.7585	325.4	3.103	3.064	3.784	4.044	0.950	2.497	1.547	4.257
1:27:56	325.6	0.987	76.9	5.035	16.39	48.8161	325.9	3.104	3.064	3.784	4.041	0.947	2.494	1.547	4.269
1:28:30	326.3	0.993	76.8	5.029	16.50	48.8784	326.7	3.108	3.067	3.787	4.048	0.951	2.499	1.549	4.259
1:29:02	327.3	0.999	76.7	5.023	16.60	48.9354	327.7	3.114	3.073	3.793	4.063	0.960	2.511	1.552	4.234
1:29:33	327.8	1.005	76.6	5.017	16.70	48.9929	328.1	3.114	3.074	3.794	4.067	0.963	2.515	1.552	4.223
1:30:05	329.1	1.011	76.6	5.011	16.79	49.0512	329.4	3.123	3.082	3.802	4.077	0.965	2.521	1.556	4.226
1:30:37	330.1	1.017	76.7	5.005	16.89	49.1096	330.4	3.128	3.087	3.807	4.077	0.959	2.518	1.559	4.250
1:31:11	331.4	1.024	76.5	4.999	17.00	49.1725	331.7	3.137	3.095	3.815	4.097	0.971	2.534	1.563	4.219

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values		Tested By	KDG	Project Number	175539009
Height	6.035 (in.)	15.330 (cm)		Height	5.003 (in.)	Date	8-20-09	Test Number	CU-1270B
Diameter	2.866 (in)	7.279 (cm)		Dia. avg.	3.164 (in)	Press No.	2	Data File ID	CU-1270B
Area	6.450 (in^2)	41.611 (cm^2)		Area avg.	7.863 (in^2)	Panel No.	F	Lateral Pressure (psi)	30.0
								Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	10.2	-0.001	59.9	6.035	0.00	41.6109	0.0	0.000	0.000	2.160	2.160	2.169	2.164	-0.004	0.996
0:18:58	23.9	0.005	61.6	6.029	0.10	41.6533	13.7	0.153	0.153	2.313	2.192	2.048	2.120	0.072	1.070
0:27:41	24.9	0.011	61.8	6.023	0.20	41.6949	14.7	0.164	0.164	2.324	2.188	2.033	2.111	0.077	1.076
0:36:34	25.5	0.017	61.5	6.017	0.30	41.7366	15.4	0.171	0.171	2.331	2.213	2.051	2.132	0.081	1.079
0:45:19	27.0	0.023	61.7	6.011	0.40	41.7785	16.8	0.187	0.186	2.346	2.213	2.036	2.125	0.089	1.087
0:54:39	28.5	0.029	62.0	6.005	0.50	41.8212	18.4	0.205	0.203	2.363	2.212	2.017	2.115	0.097	1.096
1:04:30	30.4	0.035	61.8	5.999	0.60	41.8624	20.2	0.224	0.223	2.383	2.247	2.032	2.139	0.107	1.105
1:14:29	34.4	0.041	62.3	5.993	0.70	41.9046	24.3	0.269	0.267	2.427	2.254	1.996	2.125	0.129	1.130
1:24:21	38.5	0.047	62.7	5.987	0.80	41.9473	28.4	0.314	0.312	2.472	2.268	1.965	2.117	0.152	1.155
1:34:17	41.6	0.053	63.1	5.981	0.90	41.9897	31.5	0.348	0.346	2.506	2.275	1.937	2.106	0.169	1.174
1:44:18	45.2	0.059	63.1	5.975	1.00	42.0320	35.1	0.388	0.386	2.546	2.310	1.933	2.122	0.188	1.195
1:54:07	48.0	0.065	63.5	5.969	1.10	42.0742	37.8	0.418	0.415	2.575	2.311	1.904	2.108	0.203	1.214
2:03:46	47.8	0.071	63.7	5.963	1.20	42.1176	37.6	0.415	0.412	2.572	2.297	1.893	2.095	0.202	1.213
2:13:39	49.2	0.077	63.6	5.957	1.30	42.1598	39.0	0.430	0.427	2.587	2.317	1.899	2.108	0.209	1.220
2:23:45	51.9	0.083	63.9	5.951	1.40	42.2023	41.8	0.460	0.457	2.617	2.329	1.881	2.105	0.224	1.238
2:33:49	54.3	0.089	64.1	5.945	1.50	42.2451	44.1	0.486	0.482	2.642	2.337	1.864	2.101	0.237	1.254
2:43:50	58.9	0.095	64.5	5.939	1.60	42.2892	48.8	0.536	0.532	2.692	2.360	1.837	2.099	0.262	1.285
2:53:56	63.3	0.101	64.8	5.933	1.70	42.3314	53.1	0.583	0.579	2.739	2.383	1.813	2.098	0.285	1.315
3:04:12	77.4	0.107	65.9	5.927	1.80	42.3749	67.3	0.738	0.734	2.894	2.460	1.735	2.097	0.363	1.418
3:14:33	94.2	0.113	68.0	5.921	1.90	42.4178	84.1	0.922	0.917	3.077	2.489	1.581	2.035	0.454	1.575
3:24:41	107.3	0.119	69.6	5.915	2.00	42.4610	97.1	1.064	1.059	3.219	2.518	1.468	1.993	0.525	1.716
3:35:14	117.3	0.126	70.8	5.908	2.10	42.5052	107.2	1.172	1.167	3.327	2.543	1.384	1.964	0.579	1.837
3:45:42	125.3	0.132	71.6	5.903	2.20	42.5478	115.2	1.259	1.253	3.413	2.571	1.326	1.949	0.622	1.938
3:56:12	132.7	0.138	72.2	5.896	2.30	42.5926	122.5	1.338	1.332	3.492	2.602	1.279	1.940	0.662	2.035
4:06:08	138.9	0.144	72.8	5.890	2.40	42.6352	128.7	1.404	1.398	3.558	2.628	1.239	1.934	0.695	2.121
4:12:09	147.2	0.150	73.4	5.884	2.50	42.6793	137.1	1.493	1.487	3.647	2.674	1.195	1.935	0.739	2.237
4:16:35	152.1	0.156	73.8	5.878	2.60	42.7237	141.9	1.545	1.539	3.699	2.697	1.167	1.932	0.765	2.311
4:20:57	156.8	0.162	74.2	5.872	2.70	42.7669	146.7	1.595	1.588	3.748	2.718	1.139	1.929	0.790	2.387
4:25:20	161.4	0.168	74.5	5.866	2.80	42.8106	151.3	1.643	1.637	3.797	2.743	1.115	1.929	0.814	2.459
4:29:32	165.7	0.174	74.3	5.860	2.90	42.8555	155.6	1.688	1.681	3.841	2.803	1.131	1.967	0.836	2.479
4:33:52	170.5	0.180	74.9	5.854	3.01	42.9005	160.4	1.738	1.731	3.891	2.806	1.084	1.945	0.861	2.589
4:38:08	174.5	0.186	74.9	5.848	3.10	42.9435	164.3	1.779	1.772	3.932	2.849	1.086	1.967	0.881	2.624
4:42:20	178.2	0.192	75.2	5.842	3.20	42.9880	168.1	1.818	1.810	3.970	2.865	1.064	1.965	0.901	2.693
4:46:41	182.2	0.198	75.2	5.836	3.30	43.0326	172.0	1.859	1.851	4.011	2.909	1.067	1.988	0.921	2.727
4:51:03	186.0	0.204	75.3	5.830	3.41	43.0779	175.8	1.898	1.890	4.050	2.938	1.057	1.997	0.940	2.780
4:55:13	189.5	0.210	75.3	5.824	3.50	43.1215	179.4	1.934	1.926	4.086	2.976	1.059	2.017	0.958	2.810
4:59:33	193.1	0.216	75.3	5.818	3.60	43.1666	183.0	1.971	1.962	4.122	3.014	1.061	2.038	0.977	2.841
5:03:51	196.7	0.222	75.3	5.812	3.70	43.2119	186.5	2.007	1.998	4.158	3.047	1.058	2.053	0.995	2.881
5:08:08	199.4	0.228	74.9	5.806	3.80	43.2561	189.3	2.035	2.026	4.186	3.101	1.084	2.092	1.008	2.861
5:12:24	202.5	0.234	75.3	5.800	3.90	43.3016	192.4	2.066	2.056	4.216	3.107	1.059	2.083	1.024	2.933
5:16:41	205.9	0.240	75.1	5.794	4.00	43.3466	195.8	2.100	2.091	4.251	3.156	1.074	2.115	1.041	2.939
5:21:01	209.1	0.246	75.2	5.788	4.10	43.3917	199.0	2.132	2.122	4.282	3.178	1.064	2.121	1.057	2.986
5:25:21	211.7	0.252	75.0	5.782	4.20	43.4373	201.6	2.158	2.148	4.308	3.218	1.079	2.149	1.070	2.982
5:29:41	214.6	0.258	75.0	5.776	4.30	43.4827	204.5	2.187	2.176	4.336	3.244	1.077	2.161	1.084	3.013
5:33:59	217.6	0.264	74.9	5.770	4.40	43.5276	207.4	2.216	2.205	4.365	3.281	1.085	2.183	1.098	3.024
5:38:24	220.6	0.270	74.8	5.764	4.50	43.5733	210.4	2.245	2.235	4.395	3.320	1.094	2.207	1.113	3.034
5:42:48	223.2	0.277	74.7	5.758	4.61	43.6196	213.0	2.271	2.260	4.420	3.349	1.099	2.224	1.125	3.049
5:47:16	225.7	0.283	74.2	5.752	4.70	43.6648	215.5	2.295	2.284	4.444	3.415	1.139	2.277	1.138	2.997
5:51:40	228.4	0.289	74.6	5.745	4.80	43.7111	218.2	2.321	2.310	4.470	3.413	1.112	2.263	1.151	3.069
5:56:13	230.8	0.295	74.2	5.739	4.90	43.7572	220.7	2.345	2.333	4.493	3.463	1.139	2.301	1.162	3.042
6:00:42	233.6	0.301	74.3	5.733	5.00	43.8032	223.4	2.372	2.360	4.520	3.479	1.128	2.303	1.176	3.085
6:05:13	235.8	0.307	74.1	5.727	5.10	43.8493	225.6	2.392	2.380	4.540	3.519	1.148	2.333	1.186	3.066
6:09:42	237.7	0.313	74.1	5.721	5.20	43.8955	227.5	2.410	2.397	4.557	3.533	1.145	2.339	1.194	3.087
6:14:14	240.0	0.319	73.9	5.715	5.30	43.9420	229.8	2.432	2.419	4.579	3.573	1.162	2.367	1.205	3.074
6:18:46	242.2	0.325	73.8	5.709	5.40	43.9885	232.1	2.453	2.440	4.600	3.598	1.166	2.382	1.216	3.085
6:23:14	244.5	0.331	73.6	5.703	5.50	44.0348	234.4	2.475	2.462	4.622	3.634	1.181	2.407	1.226	3.078
6:27:43	246.5	0.337	73.6	5.697	5.60	44.0815	236.4	2.493	2.480	4.640	3.655	1.184	2.420	1.236	3.086
6:32:16	248.3	0.343	73.3	5.691	5.70	44.1284	238.2	2.510	2.496	4.656	3.687	1.200	2.444	1.244	3.073
6:36:43	250.4	0.349	73.2	5.685	5.80	44.1752	240.3	2.529	2.515	4.675	3.716	1.210	2.463	1.253	3.072
6:41:12	252.0	0.355	73.1	5.679	5.91	44.2228	241.9	2.543	2.529	4.689	3.739	1.219	2.479	1.260	3.068

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG	Project Number	175539009
Height	6.035 (in.)	15.330 (cm)	Height	5.003 (in.)	Date	8-20-09	Test Number	CU-1270B
Diameter	2.866 (in)	7.279 (cm)	Dia. avg.	3.164 (in)	Press No.	2	Data File ID	CU-1270B
Area	6.450 (in^2)	41.611 (cm^2)	Area avg.	7.863 (in^2)	Panel No.	F	Lateral Pressure (psi)	30.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
6:45:40	254.1	0.361	72.7	5.673	6.00	44.2691	243.9	2.562	2.547	4.707	3.784	1.245	2.515	1.269	3.039
6:50:12	256.0	0.367	72.8	5.667	6.11	44.3167	245.9	2.580	2.565	4.725	3.796	1.240	2.518	1.278	3.062
6:54:46	257.7	0.373	72.3	5.661	6.21	44.3639	247.6	2.595	2.580	4.740	3.842	1.271	2.557	1.286	3.023
6:59:16	259.2	0.379	72.5	5.655	6.31	44.4112	249.0	2.607	2.592	4.752	3.843	1.260	2.552	1.292	3.050
7:03:43	260.9	0.385	72.2	5.649	6.40	44.4585	250.8	2.623	2.607	4.767	3.883	1.285	2.584	1.299	3.022
7:08:10	262.5	0.391	72.3	5.643	6.50	44.5060	252.4	2.637	2.621	4.781	3.889	1.277	2.583	1.306	3.046
7:12:37	264.0	0.397	71.9	5.637	6.61	44.5537	253.9	2.649	2.634	4.794	3.926	1.302	2.614	1.312	3.016
7:17:12	265.5	0.403	71.9	5.631	6.71	44.6023	255.3	2.662	2.646	4.806	3.940	1.303	2.622	1.318	3.023
7:21:36	267.3	0.409	71.7	5.625	6.81	44.6494	257.1	2.678	2.661	4.821	3.973	1.320	2.646	1.326	3.009
7:26:08	268.6	0.415	71.6	5.619	6.91	44.6974	258.5	2.689	2.672	4.832	3.988	1.325	2.657	1.332	3.011
7:30:36	269.8	0.421	71.4	5.613	7.01	44.7457	259.6	2.698	2.681	4.841	4.014	1.342	2.678	1.336	2.992
7:35:08	270.9	0.427	71.2	5.607	7.11	44.7938	260.7	2.707	2.690	4.850	4.033	1.352	2.693	1.340	2.983
7:39:40	272.4	0.434	71.1	5.601	7.21	44.8421	262.3	2.720	2.702	4.862	4.055	1.362	2.709	1.347	2.977
7:44:15	273.6	0.440	70.8	5.595	7.31	44.8905	263.4	2.729	2.711	4.871	4.083	1.381	2.732	1.351	2.957
7:48:47	274.8	0.446	70.8	5.588	7.41	44.9393	264.7	2.739	2.721	4.881	4.097	1.385	2.741	1.356	2.958
7:53:26	276.2	0.452	70.2	5.582	7.51	44.9880	266.0	2.750	2.732	4.892	4.147	1.424	2.785	1.361	2.912
7:58:03	277.5	0.458	70.5	5.576	7.61	45.0367	267.4	2.760	2.742	4.902	4.139	1.405	2.772	1.367	2.945
8:02:38	278.2	0.464	70.1	5.570	7.71	45.0852	268.0	2.764	2.746	4.906	4.172	1.435	2.804	1.368	2.907
8:07:17	279.4	0.470	70.2	5.564	7.81	45.1341	269.2	2.774	2.755	4.915	4.174	1.428	2.801	1.373	2.924
8:11:56	280.4	0.476	69.9	5.558	7.91	45.1832	270.2	2.781	2.762	4.922	4.204	1.451	2.827	1.377	2.898
8:16:38	281.4	0.482	69.9	5.552	8.01	45.2324	271.3	2.789	2.769	4.929	4.209	1.449	2.829	1.380	2.906
8:21:13	282.3	0.488	69.6	5.546	8.11	45.2816	272.2	2.795	2.775	4.935	4.237	1.470	2.853	1.383	2.882
8:25:57	282.9	0.494	69.6	5.540	8.21	45.3309	272.7	2.797	2.777	4.937	4.238	1.469	2.853	1.384	2.885
8:30:39	283.5	0.500	69.3	5.534	8.31	45.3806	273.3	2.801	2.781	4.941	4.263	1.491	2.877	1.386	2.859
8:35:26	284.5	0.506	69.3	5.528	8.41	45.4304	274.3	2.808	2.787	4.947	4.268	1.489	2.878	1.389	2.866
8:40:12	284.9	0.512	69.0	5.522	8.51	45.4798	274.7	2.809	2.788	4.948	4.290	1.510	2.900	1.390	2.841
8:44:59	285.6	0.518	69.0	5.516	8.61	45.5296	275.5	2.813	2.793	4.953	4.295	1.511	2.903	1.392	2.842
8:49:41	286.3	0.524	68.7	5.510	8.71	45.5794	276.1	2.817	2.796	4.956	4.317	1.530	2.924	1.393	2.821
8:54:30	286.7	0.530	68.7	5.504	8.81	45.6295	276.6	2.818	2.797	4.957	4.319	1.530	2.925	1.394	2.822
8:59:14	287.4	0.536	68.5	5.498	8.91	45.6795	277.2	2.822	2.801	4.961	4.343	1.551	2.947	1.396	2.800
9:03:59	288.0	0.542	68.5	5.492	9.01	45.7300	277.8	2.825	2.803	4.963	4.346	1.551	2.949	1.397	2.802
9:08:50	288.7	0.548	68.2	5.486	9.11	45.7801	278.6	2.830	2.808	4.968	4.367	1.568	2.968	1.399	2.785
9:13:40	289.2	0.554	68.2	5.480	9.21	45.8307	279.1	2.831	2.809	4.969	4.368	1.568	2.968	1.400	2.786
9:18:29	289.5	0.560	68.0	5.474	9.31	45.8812	279.3	2.831	2.809	4.969	4.386	1.586	2.986	1.400	2.766
9:23:20	289.9	0.566	68.0	5.468	9.41	45.9319	279.7	2.832	2.809	4.969	4.388	1.588	2.988	1.400	2.764
9:28:17	289.9	0.572	67.7	5.462	9.51	45.9829	279.8	2.829	2.806	4.966	4.402	1.605	3.003	1.399	2.743
9:33:06	290.2	0.578	67.7	5.456	9.61	46.0335	280.1	2.829	2.806	4.966	4.402	1.605	3.003	1.399	2.743
9:37:56	290.6	0.585	67.5	5.450	9.71	46.0845	280.5	2.830	2.807	4.967	4.420	1.622	3.021	1.399	2.725
9:42:47	290.4	0.591	67.5	5.444	9.81	46.1360	280.2	2.824	2.801	4.961	4.415	1.623	3.019	1.396	2.720
9:47:39	290.2	0.597	67.2	5.437	9.91	46.1871	280.0	2.819	2.795	4.955	4.429	1.642	3.035	1.393	2.697
9:52:33	290.1	0.603	67.2	5.431	10.01	46.2385	279.9	2.815	2.791	4.951	4.425	1.643	3.034	1.391	2.693
9:57:27	289.3	0.609	66.9	5.425	10.11	46.2901	279.1	2.804	2.779	4.939	4.432	1.661	3.046	1.385	2.668
10:02:19	288.1	0.615	66.9	5.419	10.21	46.3414	278.0	2.789	2.764	4.924	4.417	1.662	3.040	1.378	2.658
10:07:13	286.9	0.621	66.7	5.413	10.31	46.3930	276.8	2.774	2.749	4.909	4.421	1.681	3.051	1.370	2.631
10:12:04	285.5	0.627	66.7	5.407	10.41	46.4452	275.3	2.756	2.731	4.891	4.403	1.680	3.041	1.361	2.620
10:17:03	284.6	0.633	66.4	5.401	10.51	46.4971	274.5	2.745	2.720	4.880	4.408	1.697	3.052	1.355	2.598
10:22:00	283.4	0.639	66.5	5.395	10.61	46.5497	273.3	2.730	2.704	4.864	4.387	1.692	3.040	1.348	2.593
10:26:59	282.2	0.645	66.2	5.389	10.71	46.6016	272.0	2.714	2.688	4.848	4.391	1.711	3.051	1.340	2.566
10:31:51	280.8	0.651	66.3	5.383	10.81	46.6534	270.7	2.698	2.672	4.832	4.367	1.704	3.036	1.331	2.562
10:36:52	280.4	0.657	66.1	5.377	10.91	46.7063	270.2	2.690	2.664	4.824	4.379	1.724	3.051	1.328	2.540
10:41:46	279.9	0.663	66.2	5.371	11.01	46.7585	269.7	2.682	2.656	4.816	4.363	1.716	3.040	1.324	2.542
10:46:40	279.2	0.669	65.9	5.365	11.11	46.8113	269.0	2.672	2.646	4.806	4.370	1.733	3.051	1.318	2.522
10:51:32	278.2	0.675	66.0	5.359	11.21	46.8639	268.0	2.660	2.633	4.793	4.350	1.726	3.038	1.312	2.520
10:56:23	277.6	0.681	65.8	5.353	11.31	46.9166	267.4	2.650	2.623	4.783	4.357	1.743	3.050	1.307	2.500
11:01:07	277.0	0.687	65.9	5.347	11.41	46.9695	266.8	2.642	2.614	4.774	4.342	1.736	3.039	1.303	2.501
11:06:00	276.5	0.693	65.6	5.341	11.51	47.0227	266.3	2.634	2.606	4.766	4.351	1.754	3.053	1.299	2.480
11:10:49	276.8	0.699	65.8	5.335	11.61	47.0768	266.6	2.633	2.605	4.765	4.342	1.746	3.044	1.298	2.488
11:15:43	276.1	0.705	65.5	5.329	11.71	47.1301	265.9	2.624	2.595	4.755	4.347	1.761	3.054	1.293	2.469
11:20:37	275.2	0.711	65.6	5.323	11.81	47.1829	265.0	2.612	2.583	4.743	4.328	1.754	3.041	1.287	2.468
11:25:31	275.0	0.717	65.4	5.317	11.91	47.2368	264.8	2.607	2.578	4.738	4.340	1.771	3.055	1.285	2.451

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values		Tested By	KDG	Project Number	175539009
Height	6.035 (in.)	15.330 (cm)		Height	5.003 (in.)	Date	8-20-09	Test Number	CU-1270B
Diameter	2.866 (in)	7.279 (cm)		Dia. avg.	3.164 (in)	Press No.	2	Data File ID	CU-1270B
Area	6.450 (in^2)	41.611 (cm^2)		Area avg.	7.863 (in^2)	Panel No.	F	Lateral Pressure (psi)	30.0
								Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
11:30:23	274.4	0.723	65.6	5.311	12.01	47.2906	264.2	2.598	2.569	4.729	4.320	1.760	3.040	1.280	2.455
11:35:17	274.4	0.729	65.3	5.305	12.11	47.3439	264.2	2.595	2.566	4.726	4.335	1.778	3.056	1.278	2.438
11:40:11	274.0	0.736	65.5	5.299	12.21	47.3981	263.9	2.589	2.559	4.719	4.316	1.766	3.041	1.275	2.444
11:45:07	273.0	0.742	65.2	5.293	12.31	47.4522	262.9	2.576	2.546	4.706	4.322	1.784	3.053	1.269	2.422
11:50:09	273.2	0.748	65.4	5.287	12.41	47.5062	263.1	2.575	2.545	4.705	4.308	1.772	3.040	1.268	2.431
11:55:08	272.9	0.754	65.2	5.280	12.51	47.5610	262.7	2.569	2.538	4.698	4.318	1.788	3.053	1.265	2.414
12:00:07	272.6	0.760	65.3	5.274	12.61	47.6152	262.4	2.563	2.532	4.692	4.301	1.778	3.039	1.262	2.420
12:05:03	272.6	0.766	65.1	5.268	12.71	47.6697	262.4	2.560	2.529	4.689	4.317	1.796	3.056	1.260	2.403
12:09:55	272.1	0.772	65.3	5.262	12.81	47.7245	261.9	2.552	2.521	4.681	4.294	1.781	3.038	1.256	2.411
12:14:54	272.0	0.778	65.0	5.256	12.91	47.7795	261.9	2.549	2.518	4.678	4.312	1.803	3.057	1.254	2.392
12:19:45	272.4	0.784	65.2	5.250	13.01	47.8343	262.3	2.549	2.518	4.678	4.297	1.788	3.042	1.255	2.404
12:24:35	272.2	0.790	64.9	5.244	13.11	47.8898	262.0	2.544	2.513	4.673	4.309	1.805	3.057	1.252	2.387
12:29:26	272.2	0.796	65.1	5.238	13.21	47.9444	262.0	2.541	2.510	4.670	4.294	1.793	3.043	1.250	2.395
12:34:23	272.1	0.802	64.9	5.232	13.31	47.9999	262.0	2.538	2.506	4.666	4.306	1.809	3.058	1.249	2.380
12:39:14	271.6	0.808	65.1	5.226	13.41	48.0552	261.4	2.529	2.497	4.657	4.283	1.795	3.039	1.244	2.386
12:44:11	271.8	0.814	64.8	5.220	13.51	48.1109	261.6	2.529	2.496	4.656	4.301	1.814	3.057	1.244	2.371
12:49:07	272.1	0.820	65.0	5.214	13.61	48.1665	261.9	2.528	2.496	4.656	4.288	1.801	3.044	1.243	2.381
12:54:01	271.7	0.826	64.7	5.208	13.71	48.2229	261.6	2.522	2.489	4.649	4.299	1.819	3.059	1.240	2.364
12:58:50	271.9	0.832	64.9	5.202	13.81	48.2787	261.8	2.521	2.488	4.648	4.284	1.805	3.044	1.240	2.374
13:03:42	271.5	0.838	64.7	5.196	13.91	48.3348	261.3	2.514	2.480	4.640	4.295	1.823	3.059	1.236	2.356
13:08:34	271.4	0.844	64.9	5.190	14.01	48.3910	261.2	2.510	2.476	4.636	4.277	1.810	3.043	1.234	2.363
13:13:25	271.4	0.850	64.6	5.184	14.11	48.4479	261.3	2.508	2.474	4.634	4.293	1.828	3.061	1.232	2.348
13:18:12	271.4	0.856	64.8	5.178	14.21	48.5037	261.3	2.505	2.471	4.631	4.277	1.815	3.046	1.231	2.356
13:23:08	271.2	0.862	64.5	5.172	14.31	48.5603	261.0	2.499	2.465	4.625	4.290	1.834	3.062	1.228	2.339
13:27:58	270.6	0.868	64.7	5.166	14.41	48.6174	260.5	2.491	2.457	4.617	4.268	1.821	3.044	1.224	2.345
13:32:47	270.0	0.875	64.5	5.160	14.51	48.6747	259.9	2.483	2.448	4.608	4.278	1.839	3.059	1.219	2.326
13:37:34	271.1	0.881	64.6	5.154	14.61	48.7314	261.0	2.490	2.455	4.615	4.273	1.827	3.050	1.223	2.339
13:42:20	270.8	0.887	64.4	5.148	14.71	48.7883	260.6	2.484	2.448	4.608	4.281	1.841	3.061	1.220	2.325
13:47:07	271.2	0.893	64.6	5.142	14.81	48.8459	261.0	2.485	2.449	4.609	4.272	1.832	3.052	1.220	2.333
13:51:49	271.0	0.899	64.4	5.135	14.91	48.9031	260.8	2.480	2.444	4.604	4.279	1.843	3.061	1.218	2.321
13:56:31	270.9	0.905	64.5	5.129	15.01	48.9610	260.7	2.476	2.440	4.600	4.270	1.839	3.054	1.216	2.322
14:01:17	271.6	0.911	64.3	5.123	15.11	49.0190	261.4	2.480	2.443	4.603	4.285	1.851	3.068	1.217	2.315
14:05:57	271.7	0.917	64.4	5.117	15.21	49.0764	261.6	2.479	2.442	4.602	4.274	1.841	3.058	1.217	2.321
14:10:38	272.3	0.923	64.3	5.111	15.31	49.1343	262.2	2.481	2.444	4.604	4.287	1.852	3.070	1.218	2.315
14:15:18	271.8	0.929	64.4	5.105	15.41	49.1925	261.7	2.474	2.436	4.596	4.274	1.846	3.060	1.214	2.315
14:19:56	271.7	0.935	64.2	5.099	15.51	49.2510	261.5	2.469	2.432	4.592	4.280	1.857	3.069	1.211	2.305
14:24:33	272.4	0.941	64.3	5.093	15.61	49.3092	262.2	2.473	2.435	4.595	4.275	1.848	3.062	1.213	2.313
14:29:06	272.6	0.947	64.2	5.087	15.71	49.3676	262.5	2.472	2.434	4.594	4.283	1.858	3.070	1.213	2.306
14:33:43	272.7	0.953	64.2	5.081	15.81	49.4264	262.5	2.470	2.432	4.592	4.277	1.855	3.066	1.211	2.306
14:38:19	273.0	0.959	64.2	5.075	15.91	49.4852	262.9	2.470	2.432	4.592	4.284	1.861	3.073	1.212	2.302
14:42:52	272.9	0.965	64.2	5.069	16.01	49.5440	262.7	2.466	2.427	4.587	4.279	1.861	3.070	1.209	2.299
14:47:29	272.8	0.971	64.1	5.063	16.11	49.6034	262.7	2.462	2.424	4.584	4.279	1.864	3.072	1.207	2.295
14:52:04	272.7	0.977	64.0	5.057	16.21	49.6627	262.5	2.458	2.419	4.579	4.281	1.871	3.076	1.205	2.288
14:56:41	273.4	0.983	64.0	5.051	16.31	49.7218	263.2	2.462	2.422	4.582	4.283	1.870	3.076	1.207	2.291
15:01:16	273.4	0.989	63.7	5.045	16.41	49.7814	263.3	2.459	2.419	4.579	4.305	1.894	3.099	1.205	2.273
15:05:56	273.7	0.995	64.0	5.039	16.51	49.8413	263.6	2.459	2.419	4.579	4.283	1.873	3.078	1.205	2.287
15:10:31	273.2	1.001	63.7	5.033	16.61	49.9007	263.0	2.451	2.411	4.571	4.292	1.890	3.091	1.201	2.271
15:15:08	273.7	1.007	64.0	5.027	16.71	49.9616	263.5	2.452	2.412	4.572	4.276	1.873	3.075	1.202	2.283
15:19:38	273.8	1.013	63.8	5.021	16.81	50.0209	263.7	2.451	2.410	4.570	4.288	1.886	3.087	1.201	2.273
15:24:16	274.0	1.019	64.0	5.015	16.91	50.0812	263.8	2.450	2.409	4.569	4.275	1.875	3.075	1.200	2.280
15:28:48	274.6	1.025	63.8	5.009	17.01	50.1415	264.4	2.452	2.411	4.571	4.290	1.887	3.089	1.201	2.273
15:33:18	275.0	1.032	63.9	5.003	17.11	50.2023	264.9	2.453	2.412	4.572	4.284	1.880	3.082	1.202	2.278

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values			Final Values		Tested By	KDG		
Height	5.972 (in.)	15.169 (cm)	Height	5.076 (in.)	Date	8-18-09	Project Number	175539009
Diameter	2.868 (in)	7.284 (cm)	Dia. avg.	3.141 (in)	Press No.	2	Test Number	1270C
Area	6.459 (in^2)	41.671 (cm^2)	Area avg.	7.746 (in^2)	Panel No.	D	Data File ID	1270C
							Lateral Pressure (psi)	50.0
							Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Height (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1'/σ_3'
0:00:00	14.1	0.000	40.2	5.972	0.00	41.6708	0.0	0.000	0.000	3.600	3.600	3.585	3.593	0.007	1.004
0:03:37	46.7	0.007	42.2	5.966	0.11	41.7151	32.6	0.364	0.363	3.963	3.823	3.445	3.634	0.189	1.110
0:06:25	103.9	0.012	46.1	5.960	0.20	41.7552	89.9	1.001	1.000	4.600	4.176	3.161	3.669	0.508	1.321
0:09:15	134.5	0.018	48.7	5.954	0.30	41.7968	120.4	1.339	1.339	4.939	4.325	2.971	3.648	0.677	1.456
0:11:52	152.7	0.024	50.6	5.948	0.40	41.8383	138.6	1.541	1.540	5.140	4.394	2.839	3.617	0.777	1.547
0:14:42	167.5	0.030	52.1	5.942	0.50	41.8802	153.4	1.703	1.702	5.302	4.443	2.726	3.585	0.858	1.630
0:17:25	179.7	0.036	53.3	5.936	0.60	41.9223	165.6	1.837	1.836	5.436	4.493	2.642	3.568	0.925	1.700
0:20:11	190.3	0.042	54.5	5.930	0.70	41.9645	176.2	1.952	1.951	5.551	4.521	2.556	3.539	0.983	1.769
0:22:57	200.2	0.048	55.4	5.924	0.80	42.0069	186.1	2.060	2.058	5.658	4.565	2.492	3.528	1.036	1.832
0:25:41	208.2	0.054	56.1	5.918	0.90	42.0499	194.1	2.147	2.144	5.744	4.602	2.442	3.522	1.080	1.884
0:29:50	208.9	0.060	56.2	5.912	1.00	42.0934	194.8	2.152	2.150	5.750	4.596	2.431	3.514	1.082	1.890
0:38:43	217.7	0.066	56.5	5.906	1.10	42.1346	203.6	2.247	2.245	5.845	4.674	2.415	3.545	1.130	1.936
0:49:00	227.0	0.072	56.7	5.900	1.20	42.1769	212.9	2.347	2.344	5.944	4.753	2.395	3.574	1.179	1.985
0:58:35	233.4	0.078	56.8	5.894	1.30	42.2198	219.3	2.415	2.412	6.012	4.817	2.390	3.604	1.214	2.015
1:08:09	240.2	0.084	56.8	5.888	1.40	42.2626	226.1	2.488	2.484	6.084	4.890	2.391	3.641	1.250	2.045
1:17:37	246.4	0.090	57.0	5.882	1.50	42.3054	232.3	2.553	2.550	6.150	4.942	2.378	3.660	1.282	2.079
1:27:10	252.5	0.096	57.1	5.876	1.60	42.3490	238.4	2.618	2.614	6.214	4.999	2.370	3.685	1.314	2.109
1:37:01	257.6	0.102	57.1	5.870	1.70	42.3914	243.5	2.671	2.667	6.267	5.050	2.368	3.709	1.341	2.132
1:46:20	263.2	0.108	57.2	5.864	1.80	42.4350	249.1	2.730	2.725	6.325	5.105	2.365	3.735	1.370	2.159
1:55:48	267.7	0.114	57.2	5.858	1.90	42.4776	253.6	2.776	2.771	6.371	5.149	2.363	3.756	1.393	2.179
2:04:14	272.8	0.120	57.3	5.852	2.00	42.5214	258.7	2.829	2.824	6.424	5.196	2.357	3.776	1.420	2.205
2:11:54	276.9	0.126	57.3	5.846	2.10	42.5654	262.8	2.871	2.865	6.465	5.234	2.354	3.794	1.440	2.224
2:19:10	280.8	0.132	57.2	5.841	2.20	42.6081	266.7	2.911	2.905	6.505	5.282	2.362	3.822	1.460	2.236
2:27:09	284.5	0.138	57.2	5.835	2.30	42.6518	270.5	2.949	2.943	6.543	5.320	2.362	3.841	1.479	2.252
2:34:53	289.1	0.144	57.2	5.829	2.40	42.6954	275.0	2.995	2.989	6.589	5.365	2.361	3.863	1.502	2.273
2:42:32	292.5	0.150	57.2	5.823	2.50	42.7394	278.4	3.029	3.023	6.623	5.398	2.361	3.879	1.519	2.287
2:50:09	296.2	0.156	57.1	5.817	2.60	42.7829	282.1	3.066	3.060	6.660	5.442	2.367	3.904	1.537	2.299
2:57:37	299.5	0.162	57.0	5.811	2.70	42.8276	285.4	3.099	3.093	6.693	5.482	2.375	3.929	1.554	2.308
3:05:16	302.8	0.168	57.0	5.805	2.80	42.8710	288.7	3.131	3.125	6.725	5.516	2.377	3.947	1.570	2.321
3:12:57	305.9	0.174	56.9	5.799	2.90	42.9150	291.8	3.162	3.155	6.755	5.551	2.382	3.966	1.585	2.331
3:20:35	309.2	0.180	56.8	5.793	3.00	42.9598	295.1	3.194	3.187	6.787	5.594	2.392	3.993	1.601	2.339
3:28:09	311.9	0.185	56.7	5.787	3.10	43.0035	297.8	3.220	3.213	6.813	5.626	2.399	4.013	1.614	2.346
3:35:55	314.8	0.191	56.6	5.781	3.20	43.0479	300.7	3.249	3.241	6.841	5.661	2.405	4.033	1.628	2.354
3:43:37	318.0	0.197	56.5	5.775	3.30	43.0926	303.9	3.279	3.271	6.871	5.696	2.410	4.053	1.643	2.364
3:51:21	320.5	0.203	56.3	5.769	3.40	43.1375	306.4	3.302	3.294	6.894	5.734	2.425	4.080	1.655	2.365
3:58:50	323.1	0.209	56.2	5.763	3.50	43.1822	309.0	3.327	3.319	6.919	5.768	2.434	4.101	1.667	2.370
4:06:28	325.3	0.215	56.1	5.757	3.60	43.2274	311.2	3.348	3.339	6.939	5.796	2.442	4.119	1.677	2.374
4:14:07	328.5	0.221	56.1	5.751	3.70	43.2713	314.4	3.378	3.370	6.970	5.828	2.443	4.135	1.692	2.385
4:21:48	330.9	0.228	55.9	5.745	3.80	43.3182	316.8	3.401	3.391	6.991	5.862	2.455	4.158	1.703	2.387
4:29:22	333.1	0.233	55.8	5.739	3.90	43.3617	319.0	3.421	3.412	7.012	5.890	2.463	4.177	1.713	2.391
4:36:56	335.7	0.239	55.7	5.733	4.00	43.4066	321.6	3.446	3.436	7.036	5.919	2.468	4.194	1.725	2.398
4:44:24	337.7	0.245	55.6	5.727	4.10	43.4517	323.6	3.463	3.453	7.053	5.942	2.473	4.207	1.734	2.402
4:52:05	339.4	0.251	55.5	5.721	4.20	43.4971	325.3	3.478	3.468	7.068	5.969	2.487	4.228	1.741	2.401
4:59:41	342.0	0.257	55.4	5.715	4.30	43.5426	327.9	3.502	3.491	7.091	6.000	2.494	4.247	1.753	2.406
5:07:20	343.7	0.263	55.3	5.709	4.40	43.5880	329.6	3.516	3.506	7.106	6.022	2.501	4.262	1.760	2.408
5:15:01	345.4	0.269	55.2	5.703	4.50	43.6337	331.3	3.530	3.519	7.119	6.041	2.507	4.274	1.767	2.410
5:22:39	347.1	0.275	54.9	5.697	4.60	43.6795	333.1	3.546	3.534	7.134	6.080	2.531	4.305	1.775	2.403
5:29:51	349.1	0.281	54.9	5.691	4.70	43.7252	335.0	3.562	3.551	7.151	6.093	2.527	4.310	1.783	2.411
5:37:22	350.8	0.287	54.8	5.685	4.80	43.7712	336.7	3.577	3.565	7.165	6.114	2.534	4.324	1.790	2.413
5:45:08	352.3	0.293	54.7	5.679	4.90	43.8172	338.2	3.589	3.577	7.177	6.133	2.541	4.337	1.796	2.414
5:52:34	353.3	0.299	54.5	5.673	5.00	43.8638	339.2	3.596	3.584	7.184	6.157	2.558	4.357	1.800	2.407
6:00:08	355.1	0.305	54.4	5.667	5.10	43.9101	341.0	3.611	3.598	7.198	6.176	2.563	4.369	1.807	2.410
6:07:36	356.2	0.311	54.4	5.661	5.20	43.9559	342.1	3.619	3.606	7.206	6.188	2.567	4.377	1.811	2.411
6:15:01	357.4	0.317	54.2	5.655	5.30	44.0025	343.3	3.628	3.615	7.215	6.210	2.580	4.395	1.815	2.407
6:22:14	357.8	0.323	54.0	5.650	5.40	44.0487	343.7	3.628	3.615	7.215	6.223	2.593	4.408	1.815	2.400
6:29:50	359.0	0.329	53.8	5.644	5.50	44.0956	344.9	3.637	3.624	7.224	6.243	2.604	4.423	1.820	2.398
6:37:16	360.0	0.335	53.7	5.638	5.60	44.1421	345.9	3.644	3.631	7.231	6.259	2.614	4.437	1.823	2.395
6:44:44	360.5	0.341	53.3	5.632	5.70	44.1892	346.4	3.645	3.632	7.232	6.288	2.641	4.464	1.823	2.381
6:52:02	361.3	0.347	53.3	5.626	5.80	44.2359	347.2	3.650	3.636	7.236	6.295	2.644	4.470	1.825	2.381
6:59:30	362.1	0.353	53.1	5.620	5.90	44.2828	348.0	3.654	3.640	7.240	6.308	2.653	4.481	1.827	2.377

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values				
Height	5.972 (in.)	15.169 (cm)		Height	5.076 (in.)	Tested By	KDG	Project Number	175539009
Diameter	2.868 (in)	7.284 (cm)		Dia. avg.	3.141 (in)	Date	8-18-09	Test Number	1270C
Area	6.459 (in^2)	41.671 (cm^2)		Area avg.	7.746 (in^2)	Press No.	2	Data File ID	1270C
						Panel No.	D	Lateral Pressure (psi)	50.0
								Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
7:07:21	361.5	0.359	53.0	5.614	6.00	44.3300	347.4	3.644	3.630	7.230	6.311	2.666	4.489	1.822	2.367
7:14:57	361.9	0.365	52.7	5.608	6.10	44.3776	347.8	3.645	3.630	7.230	6.329	2.685	4.507	1.822	2.358
7:22:46	362.3	0.371	52.6	5.602	6.20	44.4245	348.2	3.645	3.630	7.230	6.335	2.690	4.513	1.822	2.355
7:30:46	361.8	0.377	52.5	5.596	6.30	44.4718	347.7	3.636	3.621	7.221	6.338	2.702	4.520	1.818	2.345
7:38:06	361.6	0.383	52.4	5.590	6.40	44.5192	347.5	3.630	3.614	7.214	6.340	2.711	4.525	1.815	2.339
7:45:37	361.3	0.388	52.1	5.584	6.50	44.5669	347.2	3.623	3.607	7.207	6.351	2.729	4.540	1.811	2.327
7:53:23	361.1	0.394	52.0	5.578	6.60	44.6145	347.0	3.617	3.601	7.201	6.350	2.734	4.542	1.808	2.323
8:01:17	360.7	0.400	51.9	5.572	6.70	44.6625	346.6	3.609	3.593	7.193	6.350	2.743	4.547	1.804	2.315
8:09:19	360.5	0.406	51.8	5.566	6.80	44.7103	346.4	3.602	3.586	7.186	6.353	2.752	4.552	1.800	2.309
8:17:37	359.4	0.412	51.4	5.560	6.90	44.7584	345.3	3.587	3.571	7.171	6.363	2.777	4.570	1.793	2.291
8:25:42	359.5	0.418	51.4	5.554	7.00	44.8066	345.4	3.584	3.568	7.168	6.360	2.778	4.569	1.791	2.290
8:33:31	359.1	0.424	51.3	5.548	7.10	44.8547	345.0	3.576	3.559	7.159	6.360	2.786	4.573	1.787	2.283
8:41:30	359.2	0.430	51.2	5.542	7.20	44.9029	345.1	3.574	3.556	7.156	6.363	2.792	4.577	1.786	2.279
8:49:04	359.1	0.436	51.0	5.536	7.30	44.9512	345.0	3.569	3.551	7.151	6.375	2.809	4.592	1.783	2.270
8:56:40	359.1	0.442	51.0	5.530	7.40	44.9997	345.0	3.565	3.547	7.147	6.372	2.810	4.591	1.781	2.268
9:04:26	358.8	0.448	50.9	5.524	7.50	45.0485	344.7	3.558	3.540	7.140	6.371	2.817	4.594	1.777	2.262
9:12:05	358.3	0.454	50.8	5.518	7.60	45.0974	344.3	3.550	3.531	7.131	6.370	2.824	4.597	1.773	2.256
9:20:04	357.7	0.460	50.5	5.512	7.70	45.1461	343.6	3.539	3.520	7.120	6.379	2.844	4.611	1.767	2.243
9:27:56	357.1	0.466	50.5	5.506	7.80	45.1950	343.0	3.529	3.510	7.110	6.369	2.844	4.607	1.762	2.239
9:35:37	356.7	0.472	50.4	5.500	7.90	45.2440	342.6	3.521	3.502	7.102	6.366	2.849	4.608	1.759	2.234
9:43:07	355.9	0.478	50.3	5.494	8.00	45.2931	341.8	3.510	3.490	7.090	6.362	2.857	4.610	1.753	2.227
9:51:00	355.2	0.484	50.1	5.488	8.10	45.3429	341.1	3.498	3.479	7.079	6.369	2.875	4.622	1.747	2.215
9:58:49	354.7	0.490	50.1	5.482	8.20	45.3919	340.6	3.489	3.469	7.069	6.358	2.873	4.616	1.742	2.212
10:06:35	354.0	0.496	50.0	5.476	8.30	45.4413	339.9	3.478	3.458	7.058	6.352	2.879	4.616	1.736	2.206
10:14:29	353.2	0.502	49.9	5.470	8.40	45.4910	339.1	3.466	3.446	7.046	6.346	2.885	4.615	1.730	2.200
10:22:23	352.4	0.508	49.7	5.464	8.50	45.5406	338.3	3.455	3.434	7.034	6.352	2.903	4.628	1.724	2.188
10:30:23	351.5	0.514	49.7	5.458	8.60	45.5903	337.4	3.441	3.420	7.020	6.337	2.902	4.619	1.718	2.184
10:38:23	350.8	0.520	49.7	5.452	8.70	45.6403	336.7	3.430	3.409	7.009	6.329	2.905	4.617	1.712	2.179
10:46:22	350.2	0.526	49.6	5.447	8.80	45.6905	336.1	3.420	3.399	6.999	6.322	2.908	4.615	1.707	2.174
10:54:19	349.3	0.532	49.5	5.441	8.90	45.7409	335.2	3.408	3.386	6.986	6.319	2.918	4.619	1.701	2.166
11:02:16	348.8	0.538	49.4	5.435	9.00	45.7910	334.7	3.398	3.377	6.977	6.316	2.924	4.620	1.696	2.160
11:10:08	348.7	0.544	49.4	5.429	9.10	45.8410	334.6	3.394	3.372	6.972	6.313	2.926	4.620	1.693	2.158
11:18:12	348.3	0.550	49.3	5.423	9.20	45.8916	334.2	3.386	3.364	6.964	6.310	2.931	4.620	1.689	2.153
11:26:09	347.8	0.556	49.2	5.417	9.30	45.9424	333.7	3.378	3.355	6.955	6.308	2.937	4.623	1.685	2.147
11:34:06	347.2	0.562	49.1	5.411	9.40	45.9930	333.1	3.368	3.345	6.945	6.307	2.946	4.627	1.680	2.141
11:42:08	347.4	0.568	49.1	5.405	9.50	46.0438	333.3	3.366	3.343	6.943	6.304	2.946	4.625	1.679	2.140
11:49:57	346.9	0.574	49.0	5.399	9.60	46.0945	332.8	3.357	3.334	6.934	6.300	2.950	4.625	1.675	2.135
11:57:57	346.4	0.580	49.0	5.393	9.70	46.1457	332.3	3.349	3.325	6.925	6.294	2.953	4.623	1.670	2.131
12:05:46	346.3	0.585	48.9	5.387	9.80	46.1967	332.2	3.343	3.320	6.920	6.297	2.962	4.629	1.667	2.126
12:13:39	346.3	0.591	48.9	5.381	9.90	46.2480	332.2	3.340	3.316	6.916	6.293	2.962	4.628	1.665	2.124
12:21:37	346.3	0.597	48.8	5.375	10.00	46.2995	332.2	3.337	3.313	6.913	6.294	2.966	4.630	1.664	2.122
12:29:25	346.1	0.603	48.8	5.369	10.10	46.3509	332.0	3.331	3.306	6.906	6.291	2.969	4.630	1.661	2.118
12:37:20	345.9	0.609	48.6	5.363	10.20	46.4025	331.8	3.325	3.301	6.901	6.295	2.979	4.637	1.658	2.113
12:45:09	344.9	0.615	48.6	5.357	10.30	46.4542	330.8	3.311	3.286	6.886	6.282	2.981	4.632	1.650	2.107
12:53:05	345.3	0.621	48.6	5.351	10.40	46.5060	331.2	3.312	3.287	6.887	6.284	2.982	4.633	1.651	2.107
13:00:44	345.1	0.627	48.5	5.345	10.50	46.5580	331.0	3.306	3.281	6.881	6.282	2.987	4.635	1.648	2.103
13:08:42	344.6	0.633	48.4	5.339	10.60	46.6099	330.5	3.297	3.272	6.872	6.283	2.996	4.640	1.643	2.097
13:16:44	344.2	0.639	48.4	5.333	10.70	46.6625	330.1	3.290	3.264	6.864	6.275	2.996	4.636	1.639	2.094
13:24:35	344.0	0.645	48.4	5.327	10.80	46.7146	329.9	3.284	3.258	6.858	6.271	2.998	4.635	1.636	2.091
13:32:24	343.3	0.651	48.3	5.321	10.90	46.7668	329.2	3.273	3.247	6.847	6.264	3.002	4.633	1.631	2.087
13:40:10	344.0	0.657	48.2	5.315	11.00	46.8198	329.9	3.276	3.250	6.850	6.273	3.008	4.640	1.632	2.085
13:47:57	344.5	0.663	48.2	5.309	11.10	46.8722	330.4	3.278	3.251	6.851	6.277	3.011	4.644	1.633	2.085
13:55:28	344.9	0.669	48.2	5.303	11.20	46.9247	330.8	3.279	3.252	6.852	6.278	3.011	4.644	1.633	2.085
14:03:07	344.6	0.675	48.1	5.297	11.30	46.9779	330.5	3.272	3.244	6.844	6.274	3.015	4.644	1.630	2.081
14:10:45	344.6	0.681	48.1	5.291	11.40	47.0306	330.5	3.268	3.240	6.840	6.275	3.020	4.648	1.628	2.078
14:18:24	344.8	0.687	48.0	5.285	11.50	47.0842	330.7	3.266	3.238	6.838	6.274	3.021	4.647	1.627	2.077
14:26:05	344.4	0.693	48.0	5.279	11.60	47.1369	330.3	3.258	3.230	6.830	6.267	3.022	4.645	1.622	2.074
14:33:59	343.5	0.699	47.8	5.273	11.70	47.1903	329.4	3.246	3.218	6.818	6.269	3.036	4.653	1.616	2.065
14:41:43	343.4	0.705	47.9	5.267	11.80	47.2441	329.3	3.241	3.212	6.812	6.260	3.033	4.647	1.614	2.064
14:49:26	343.0	0.711	47.9	5.261	11.90	47.2977	328.9	3.234	3.205	6.805	6.255	3.035	4.645	1.610	2.061

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Consolidation Values				Final Values					
Height	5.972 (in.)	15.169 (cm)		Height	5.076 (in.)	Tested By	KDG	Project Number	175539009
Diameter	2.868 (in)	7.284 (cm)		Dia. avg.	3.141 (in)	Date	8-18-09	Test Number	1270C
Area	6.459 (in^2)	41.671 (cm^2)		Area avg.	7.746 (in^2)	Press No.	2	Data File ID	1270C
						Panel No.	D	Lateral Pressure (psi)	50.0
								Chamber Pressure - σ_3 (psi)	90

Clock Time (min.)	Load (lbf)	Deflection Dial Reading (in.)	Pore Pressure Reading (psi)	Corrected Hieght (in.)	Strain (%)	Corrected Area (cm^2)	Corrected Load (lbf)	Deviator Stress (tsf)	Corrected Deviator Stress* (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p' $(\sigma_1'+\sigma_3')/2$ (tsf)	q $(\sigma_1-\sigma_3)/2$ (tsf)	Effective Principal Stress Ratio σ_1' / σ_3'
14:57:10	342.8	0.717	47.8	5.255	12.00	47.3515	328.7	3.228	3.199	6.799	6.250	3.036	4.643	1.607	2.059
15:04:57	343.2	0.723	47.7	5.249	12.10	47.4052	329.1	3.228	3.199	6.799	6.262	3.048	4.655	1.607	2.054
15:12:41	343.2	0.729	47.7	5.244	12.20	47.4592	329.1	3.225	3.195	6.795	6.255	3.045	4.650	1.605	2.054
15:20:25	343.8	0.735	47.7	5.238	12.30	47.5131	329.7	3.226	3.197	6.797	6.260	3.049	4.654	1.606	2.054
15:28:06	344.5	0.741	47.7	5.232	12.40	47.5673	330.4	3.230	3.200	6.800	6.264	3.049	4.657	1.608	2.055
15:35:50	345.9	0.747	47.6	5.226	12.50	47.6219	331.8	3.240	3.209	6.809	6.280	3.055	4.668	1.612	2.055
15:43:20	347.1	0.753	47.6	5.220	12.60	47.6763	333.0	3.248	3.218	6.818	6.287	3.054	4.670	1.616	2.059
15:50:49	347.4	0.759	47.6	5.214	12.70	47.7309	333.3	3.247	3.217	6.817	6.286	3.055	4.671	1.616	2.058
15:58:22	347.3	0.765	47.4	5.208	12.80	47.7855	333.2	3.242	3.212	6.812	6.292	3.065	4.679	1.613	2.053
16:05:59	347.3	0.771	47.4	5.202	12.90	47.8402	333.2	3.239	3.208	6.808	6.290	3.067	4.679	1.611	2.051
16:13:27	347.6	0.777	47.4	5.196	13.00	47.8956	333.5	3.237	3.206	6.806	6.290	3.069	4.679	1.610	2.050
16:20:58	347.6	0.783	47.3	5.190	13.10	47.9506	333.5	3.234	3.203	6.803	6.289	3.071	4.680	1.609	2.048
16:28:36	347.4	0.788	47.2	5.184	13.20	48.0057	333.3	3.229	3.197	6.797	6.292	3.080	4.686	1.606	2.043
16:36:10	347.2	0.794	47.2	5.178	13.30	48.0610	333.1	3.223	3.191	6.791	6.288	3.082	4.685	1.603	2.040
16:43:46	347.6	0.800	47.2	5.172	13.40	48.1169	333.5	3.223	3.191	6.791	6.287	3.081	4.684	1.603	2.040
16:51:25	347.7	0.806	47.1	5.166	13.50	48.1723	333.6	3.220	3.188	6.788	6.289	3.086	4.687	1.601	2.038
16:58:58	347.6	0.812	47.0	5.160	13.60	48.2278	333.5	3.215	3.182	6.782	6.291	3.093	4.692	1.599	2.034
17:06:31	347.7	0.818	47.0	5.154	13.70	48.2840	333.6	3.213	3.180	6.780	6.289	3.094	4.692	1.597	2.033
17:13:52	347.5	0.824	46.9	5.148	13.80	48.3395	333.4	3.207	3.174	6.774	6.288	3.100	4.694	1.594	2.029
17:21:15	347.5	0.830	46.8	5.142	13.90	48.3957	333.4	3.203	3.170	6.770	6.296	3.112	4.704	1.592	2.023
17:28:41	347.8	0.836	46.8	5.136	14.00	48.4521	333.7	3.203	3.169	6.769	6.298	3.113	4.706	1.592	2.023
17:36:07	349.2	0.842	46.7	5.130	14.10	48.5086	335.1	3.212	3.178	6.778	6.309	3.116	4.713	1.597	2.025
17:43:19	350.7	0.848	46.6	5.124	14.20	48.5648	336.6	3.223	3.188	6.788	6.331	3.128	4.729	1.602	2.024
17:49:51	355.4	0.854	46.7	5.118	14.30	48.6219	341.3	3.264	3.229	6.829	6.359	3.114	4.737	1.622	2.042
17:52:11	354.8	0.860	46.5	5.112	14.40	48.6798	340.7	3.254	3.220	6.820	6.368	3.134	4.751	1.617	2.032
17:54:25	354.0	0.866	46.4	5.106	14.50	48.7352	339.9	3.243	3.208	6.808	6.361	3.138	4.750	1.612	2.027
17:56:48	354.5	0.872	46.4	5.100	14.60	48.7928	340.4	3.244	3.209	6.809	6.361	3.138	4.750	1.612	2.027
17:59:08	354.2	0.878	46.4	5.094	14.70	48.8496	340.1	3.238	3.202	6.802	6.358	3.141	4.750	1.609	2.024
18:01:28	353.9	0.884	46.3	5.088	14.80	48.9068	339.8	3.231	3.195	6.795	6.356	3.145	4.750	1.605	2.021
18:03:48	354.3	0.890	46.2	5.082	14.90	48.9647	340.2	3.230	3.195	6.795	6.360	3.150	4.755	1.605	2.019
18:06:08	354.3	0.896	46.4	5.076	15.00	49.0225	340.2	3.227	3.191	6.791	6.347	3.141	4.744	1.603	2.021

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Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Fossil Plant Dry Ash Stack and Gypsum Disposal Area

Project Number 175539009
Tested By

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Test Method ASTM

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-6, 0.0'-1.5'	1	5/13/09	Hom	3/4"			No	16.32	35.76	32.83	17.7
B-6, 1.5'-3.0'	2	5/13/09	Hom	3/4"			No	21.57	53.82	47.70	23.4
B-6, 3.0'-4.5'	3	5/13/09	Len	3/4"			No	17.14	44.10	40.00	17.9
B-6, 4.5'-6.0'	4	5/13/09	Hom	3/4"			No	16.82	34.76	31.81	19.7
B-6, 6.0'-7.5'	5	5/13/09	Len	3/4"			No	22.54	37.94	35.45	19.3
B-6, 7.5'-9.0'	6	5/13/09	Hom	3/4"			No	21.79	44.09	39.89	23.2
B-6, 9.0'-10.5'	7	5/13/09	Hom	3/4"			No	20.78	37.18	34.77	17.2
B-6, 10.5'-12.0'	8	5/13/09	Hom	3/4"			No	20.49	59.01	50.47	28.5
B-6, 12.0'-13.5'	9	5/13/09	Hom	3/8"			No	14.98	33.37	29.21	29.2
B-6, 13.5'-15.0'	10	5/13/09	Hom	3/4"			No	16.80	39.59	35.75	20.3
B-6, 15.0'-16.5'	11	5/13/09	Hom	3/8"			No	16.58	35.96	31.96	26.0
B-6, 16.5'-18.0'	12	5/13/09	Hom	3/8"			No	16.19	37.55	33.91	20.5
B-6, 18.0'-19.5'	13	5/13/09	Hom	3/8"			No	22.38	39.32	35.60	28.1
B-6, 19.5'-21.0'	14	5/13/09	Hom	3/8"			No	22.23	42.49	38.45	24.9
B-6, 21.0'-22.5'	15	5/13/09	Hom	3/8"			No	23.03	43.55	37.13	45.5
B-6, 22.5'-24.0'	16	5/13/09	Hom	3/8"			No	22.79	48.91	41.25	41.5
B-6, 24.0'-25.5'	18	5/13/09	Hom	3/8"			No	15.49	40.88	33.67	39.7
B-6, 25.5'-27.0'	19	5/13/09	Hom	3/8"			No	20.51	44.23	39.34	26.0
B-6, 27.0'-28.5'	20	5/13/09	Hom	3/8"			No	14.88	36.73	31.73	29.7
B-6, 28.5'-30.0'	21	5/13/09	Hom	3/8"			No	14.65	46.15	38.85	30.2
B-6, 30.0'-31.5'	22	5/13/09	Hom	3/8"			No	20.89	36.80	33.72	24.0
B-6, 31.5'-33.0'	23	5/13/09	Hom	3/8"			No	16.35	42.35	35.35	36.8
B-6, 33.0'-34.5'	24	5/13/09	Hom	3/8"			No	17.00	43.18	37.96	24.9
B-6, 34.5'-36.0'	25	5/13/09	Hom	3/8"			No	20.99	41.20	36.84	27.5
B-6, 36.0'-37.5'	27	5/13/09	Hom	3/8"			No	21.41	42.14	37.85	26.1
B-6, 37.5'-39.0'	28	5/13/09	Hom	3/8"			No	23.68	45.41	40.85	26.6
B-6, 40.0'-41.5'	29	5/13/09	Hom	3/8"			No	21.67	37.38	34.10	26.4
B-6, 42.5'-44.0'	30	5/13/09	Hom	3/8"			No	17.11	38.95	34.31	27.0

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Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Fossil Plant Dry Ash Stack and Gypsum Disposal Area

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-6, 45.0'-46.5'	31	5/13/09	Hom	3/8"			No	15.47	39.90	34.85	26.1
B-6, 47.5'-49.0'	32	5/13/09	Hom	3/8"			No	16.94	30.59	27.97	23.8
B-6, 50.0'-51.5'	33	5/13/09	Hom	3/8"			No	22.09	36.37	32.69	34.7
B-6, 52.5'-54.0'	34	5/13/09	Hom	3/8"			No	22.26	43.83	39.82	22.8
B-6, 55.0'-56.5'	35	5/13/09	Hom	3/8"			No	17.21	37.50	31.80	39.1
B-6, 57.5'-59.0'	36	5/13/09	Hom	3/8"			No	22.46	45.49	39.81	32.7
B-6, 60.0'-61.5'	37	5/13/09	Hom	3/8"			No	21.55	39.00	36.40	17.5
B-6, 62.5'-64.0' NO SAMPLE	38	5/13/09									
B-6, 23.5'-34.5' NO SAMPLE	40	5/13/09									
B-21, 0.0'-1.5'	41	5/13/09	Hom	3/4"			No	16.25	34.51	32.42	12.9
B-21, 1.5'-3.0'	42	5/13/09	Hom	3/4"			No	21.02	44.63	40.00	24.4
B-21, 3.0'-4.5'	43	5/13/09	Hom	3/4"			No	16.96	35.36	31.19	29.3
B-21, 4.5'-6.0'	44	5/13/09	Hom	3/4"			No	16.36	26.06	23.86	29.3
B-21, 6.0'-7.5'	45	5/13/09	Hom	3/8"			No	20.78	39.12	36.00	20.5
B-21, 7.5'-9.0'	46	5/13/09	Hom	3/8"			No	22.99	41.25	38.46	18.0
B-21, 9.0'-10.5'	47	5/13/09	Hom	3/8"			No	20.95	47.19	43.63	15.7
B-21, 10.5'-12.0'	48	5/13/09	Hom	3/8"			No	22.40	59.43	53.89	17.6
B-21, 12.0'-13.5'	49	5/13/09	Hom	3/8"			No	15.94	35.98	32.02	24.6
B-21, 13.5'-15.0'	50	5/13/09	Hom	3/8"			No	18.15	47.46	42.81	18.9
B-21, 15.0'-16.5'	51	5/13/09	Hom	3/8"			No	20.48	56.37	50.21	20.7
B-21, 16.5'-18.0'	52	5/13/09	Hom	3/8"			No	20.72	40.80	36.25	29.3
B-21, 18.0'-19.5'	54	5/13/09	Len	3/8"			No	15.04	34.22	32.22	11.6
B-21, 19.5'-21.0'	55	5/13/09	Len	3/8"			No	22.14	45.75	40.33	29.8
B-21, 21.0'-22.5'	56	5/13/09	Len	3/8"			No	21.83	44.04	39.97	22.4
B-21, 22.5'-24.0'	57	5/13/09	Len	3/8"			No	15.73	38.35	33.76	25.5
B-21, 24.0'-25.5'	58	5/13/09	Len	3/8"			No	22.95	39.92	36.83	22.3
B-21, 25.5'-27.0'	59	5/13/09	Len	3/8"			No	20.37	41.47	37.55	22.8
B-21, 27.0'-28.5'	60	5/13/09	Len	3/8"			No	22.44	40.25	36.58	26.0
B-21, 28.5'-30.0'	61	5/13/09	Hom	3/8"			No	20.19	35.86	30.19	56.7
B-21, 30.0'-31.5'	62	5/13/09	Len	3/4"			No	22.35	46.55	42.18	22.0
B-21, 31.5'-33.0'	63	5/13/09	Len	3/4"			No	22.62	69.82	64.09	13.8

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Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Fossil Plant Dry Ash Stack and Gypsum Disposal Area

Project Number 175539009

Tested By

Test Method ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-21, 33.0'-34.5'	64	5/13/09	Hom	3/8"			No	11.83	35.50	30.88	24.3
B-21, 34.5'-36.0'	65	5/13/09	Len	3/8"			No	16.25	31.45	28.80	21.1
B-21, 36.0'-37.5'	66	5/13/09	Hom	3/8"			No	20.12	47.04	41.81	24.1
B-21, 37.5'-39.0'	67	5/13/09	Hom	3/8"			No	22.54	43.44	39.70	21.8
B-21, 39.0'-40.5'	68	5/13/09	Hom	3/8"			No	17.18	52.36	46.25	21.0
B-21, 40.5'-42.0'	69	5/13/09	Hom	3/8"			No	21.18	46.16	42.59	16.7
B-21, 42.0'-43.5'	70	5/13/09	Hom	3/8"			No	11.80	46.11	43.22	9.2
B-22, 0.0'-1.5'	73	5/13/09	Hom	3/8"			No	14.88	34.01	32.44	8.9
B-22, 1.5'-3.0'	74	5/13/09	Hom	3/8"			No	22.77	44.72	41.50	17.2
B-22, 3.0'-4.5'	75	5/13/09	Hom	3/8"			No	22.35	39.12	37.76	8.8
B-22, 4.5'-6.0'	76	5/13/09	Hom	3/8"			No	16.39	30.21	28.47	14.4
B-22, 6.0'-7.5'	78	5/13/09	Hom	3/8"			No	11.23	53.33	49.14	11.1
B-22, 7.5'-9.0'	79	5/13/09	Hom	3/8"			No	20.90	59.49	54.73	14.1
B-22, 9.0'-10.5'	80	5/13/09	Hom	3/8"			No	16.17	49.65	48.01	5.2
B-22, 10.5'-12.0'	81	5/13/09	Hom	3/8"			No	16.35	38.89	36.27	13.2
B-22, 12.0'-13.5'	82	5/13/09	Hom	3/8"			No	20.46	41.84	39.00	15.3
B-22, 13.5'-15.0'	83	5/13/09	Hom	3/8"			No	16.22	44.19	40.21	16.6
B-22, 15.0'-16.5'	84	5/13/09	Hom	3/8"			No	22.30	45.07	41.84	16.5
B-22, 16.5'-18.0'	85	5/13/09	Hom	3/8"			No	22.07	48.62	43.79	22.2
B-22, 18.0'-19.5'	86	5/13/09	Hom	3/8"			No	20.58	41.70	38.93	15.1
B-22, 19.5'-21.0'	87	5/13/09	Hom	3/8"			No	20.70	44.87	41.93	13.8
B-22, 21.0'-22.5'	88	5/13/09	Hom	3/8"			No	22.90	54.52	47.50	28.5
B-22, 22.5'-24.0'	89	5/13/09	Hom	3/8"			No	15.84	42.84	37.03	27.4
B-22, 24.0'-25.5'	90	5/13/09	Hom	3/8"			No	22.52	46.99	42.27	23.9
B-22, 25.5'-27.0'	91	5/13/09	Hom	3/8"			No	14.96	45.36	40.13	20.8
B-22, 27.0'-28.5'	92	5/13/09	Hom	3/8"			No	17.39	50.90	45.22	20.4
B-22, 28.5'-30.0'	94	5/13/09	Hom	3/8"			No	16.47	42.62	36.82	28.5
B-22, 30.0'-31.5'	95	5/13/09	Hom	3/8"			No	20.90	55.24	46.95	31.8
B-22, 31.5'-33.0'	96	5/13/09	Hom	No. 4			No	16.09	37.62	31.50	39.7
B-22, 33.0'-34.5'	97	5/13/09	Hom	3/8"			No	16.39	30.03	26.19	39.2
B-22, 34.5'-36.0'	98	5/13/09	Hom	3/8"			No	16.60	49.04	39.84	39.6

Moisture Content of Soil

ASTM D 2216

Project Name: Cumberland Fossil Plant Dry Ash Stack and Gypsum Disposal Area

Project Number: 175539009

Tested By:

Test Method: ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-22, 36.0'-37.5'	99	5/13/09	Hom	3/8"			No	20.74	43.79	37.22	39.9
B-22, 37.5'-39.0'	100	5/13/09	Hom	3/8"			No	21.44	52.54	48.13	16.5
B-22, 39.0'-40.5'	101	5/13/09	Hom	3/8"			No	17.04	43.11	40.17	12.7
B-22, 40.5'-42.0'	102	5/13/09	Hom	3/8"			No	22.39	49.74	45.83	16.7
B-22, 42.0'-43.5'	103	5/13/09	Hom	3/8"			No	20.44	34.50	28.91	66.0
B-22, 43.5'-45.0'	104	5/13/09	Hom	3/8"			No	16.55	38.94	30.38	61.9
B-22, 45.0'-46.5'	105	5/13/09	Hom	3/8"			No	16.58	52.20	41.46	43.2
B-22, 46.5'-48.0'	106	5/13/09	Hom	3/8"			No	21.29	47.94	40.57	38.2
B-22, 48.0'-49.5'	107	5/13/09	Hom	3/8"			No	22.91	38.24	34.26	35.1
B-22, 49.5'-51.0'	108	5/13/09	Hom	3/8"			No	22.54	62.26	49.80	45.7
B-22, 51.0'-52.5'	109	5/13/09	Hom	3/8"			No	20.82	53.75	45.37	34.1
B-22, 52.5'-54.0'	110	5/13/09	Hom	3/8"			No	14.90	31.75	27.52	33.5
B-22, 54.0'-55.5'	111	5/13/09	Hom	3/8"			No	17.41	33.95	29.30	39.1
B-22, 55.5'-57.0'	112	5/13/09	Hom	3/8"			No	21.10	53.13	44.60	36.3
B-22, 57.0'-58.5'	113	5/13/09	Hom	3/8"			No	25.79	70.82	58.98	35.7
B-22, 58.5'-60.0'	114	5/13/09	Hom	3/8"			No	26.04	62.61	52.28	39.4
B-22, 60.0'-61.5'	115	5/13/09	Hom	3/8"			No	16.57	45.08	39.42	24.8
B-22, 62.5'-64.0'	116	5/13/09	Hom	3/8"			No	20.95	55.19	46.84	32.3
B-22, 65.0'-66.5'	117	5/13/09	Hom	3/8"			No	17.43	40.44	35.13	30.0
B-22, 67.5'-69.0'	118	5/13/09	Hom	3/8"			No	21.95	41.58	37.33	27.6
B-22, 70.0'-71.5'	119	5/13/09	Hom	3/8"			No	17.97	50.83	43.33	29.6
B-22, 72.5'-74.0'	120	5/13/09	Hom	3/8"			No	16.31	47.62	40.54	29.2
B-22, 75.0'-76.5'	122	5/13/09	Hom	3/8"			No	22.06	59.30	51.51	26.5
B-22, 77.5'-79.0'	123	5/13/09	Hom	3/8"			No	17.54	47.97	41.51	27.0
B-22, 80.0'-81.5'	124	5/13/09	Hom	3/8"			No	14.51	54.96	48.12	20.4
B-22, 82.5'-84.0'	125	5/13/09	Hom	3/8"			No	20.90	57.13	50.84	21.0
B-22, 85.0'-86.5'	126	5/13/09	Hom	3/8"			No	17.46	50.53	46.36	14.4
B-22, 87.5'-89.0'	127	5/13/09	Hom	3/8"			No	25.91	49.36	45.12	22.1
B-22, 90.0'-90.8'	128	5/13/09	Hom	3/8"			No	20.62	52.92	47.83	18.7

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Dry Ash Stack and Gypsum Disposal Area

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-9, 0.0'-1.5'	129	5/20/09	Hom	No. 4			No	21.41	81.30	70.65	21.6
B-9, 1.5'-3.0'	130	5/20/09	Hom	No. 4			No	22.19	76.03	67.17	19.7
B-9, 3.0'-4.5'	131	5/20/09	Hom	3/8"			No	17.58	79.46	68.13	22.4
B-9, 4.5'-6.0'	132	5/20/09	Hom	No. 4			No	20.96	93.83	82.86	17.7
B-9, 6.0'-7.5'	133	5/20/09	Hom	No. 4			No	17.42	93.77	80.71	20.6
B-9, 7.5'-9.0'	134	5/20/09	Hom	3/8"			No	22.41	81.45	71.45	20.4
B-9, 9.0'-10.5'	135	5/21/09	Hom	No. 10			Yes	16.24	51.01	43.68	26.7
B-9, 10.5'-12.0'	136	5/21/09	Hom	No. 4			No	14.98	66.37	56.24	24.6
B-9, 12.0'-13.5'	137	5/21/09	Hom	No. 4			No	16.56	65.39	57.40	19.6
B-9, 13.5'-15.0'	138	5/21/09	Hom	No. 10			Yes	17.42	73.60	63.54	21.8
B-9, 15.0'-16.5'	139	5/21/09	Hom	3/8"			No	22.29	84.57	71.36	26.9
B-9, 16.5'-18.0'	140	5/21/09	Hom	No. 10			Yes	16.57	77.54	66.91	21.1
B-9, 18.0'-19.5'	141	5/21/09	Hom	No. 4			No	14.89	70.37	62.13	17.4
B-9, 19.5'-21.0'	142	5/21/09	Hom	No. 4			No	20.67	76.13	66.94	19.9
B-9, 21.0'-22.5'	143	5/21/09	Hom	3/8"			No	22.56	78.72	67.01	26.3
B-9, 22.5'-24.0'	144	5/21/09	Hom	3/8"			No	20.46	95.94	82.70	21.3
B-9, 24.0'-25.5'	145	5/21/09	Hom	3/8"			No	14.89	110.95	97.12	16.8
B-9, 25.5'-27.0'	146	5/21/09	Hom	3/8"			No	20.92	92.00	82.99	14.5
B-9, 27.0'-28.5'	147	5/21/09	Hom	No. 4			No	11.20	65.64	52.47	31.9
B-9, 28.5'-30.0'	148	5/21/09	Hom	3/4"			No	16.07	69.76	67.60	4.2
B-9, 30.0'-31.5'	149	5/21/09	Hom	3/8"			No	20.59	98.58	85.04	21.0
B-9, 31.5'-33.0'	150	5/21/09	Hom	No. 10			Yes	20.88	72.86	61.90	26.7
B-9, 33.0'-34.5'	151	5/21/09	Hom	No. 4			No	22.91	84.23	70.89	27.8
B-9, 35.0'-36.5'	152	5/21/09	Len	No. 10			Yes	16.34	57.01	48.62	26.0
B-9, 37.5'-39.0'	153	5/21/09	Len	No. 4			No	16.70	63.41	54.89	22.3
B-9, 40.0'-41.5'	154	5/21/09	Len	No. 4			No	22.10	90.17	79.38	18.8
B-9, 42.5'-44.0'	155	5/21/09	Hom	No. 10			Yes	20.89	90.17	76.13	25.4
B-9, 45.0'-46.5'	156	5/21/09	Len	No. 4			No	16.16	86.02	74.32	20.1

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Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Dry Ash Stack and Gypsum Disposal Area

Project Number 175539009
Tested By
Test Method ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-9, 47.5'-49.0'	157	5/21/09	Hom	No. 10			Yes	22.57	95.33	80.64	25.3
B-9, 50.0'-51.5'	158	5/21/09	Hom	No. 10			Yes	16.40	64.77	54.99	25.3
B-9, 52.5'-54.0'	159	5/21/09	Hom	No. 10			Yes	16.50	69.14	58.16	26.4
B-9, 55.0'-56.5'	160	5/21/09	Hom	No. 4			No	20.46	90.85	80.75	16.8
B-12, 0.0'-1.5'	163	5/26/09	Hom	3/8"			No	22.49	85.07	74.16	21.1
B-12, 1.5'-3.0'	164	5/26/09	Hom	3/4"			No	22.00	79.10	69.15	21.1
B-12, 3.0'-4.5'	165	5/26/09	Hom	3/4"			No	22.65	66.14	59.34	18.5
B-12, 4.5'-6.0'	166	5/26/09	Hom	3/4"			No	20.11	83.83	73.34	19.7
B-12, 6.0'-7.5'	167	5/26/09	Hom	3/4"			No	20.66	81.91	70.75	22.3
B-12, 7.5'-9.0'	168	5/26/09	Hom	3/4"			No	16.97	49.97	44.74	18.8
B-12, 9.0'-10.5'	169	5/26/09	Hom	3/8"			No	17.13	55.45	48.37	22.7
B-12, 10.5'-12.0'	170	5/26/09	Hom	3/8"			No	17.05	52.67	46.12	22.5
B-12, 12.0'-13.5'	171	5/26/09	Hom	3/4"			No	22.21	76.67	67.74	19.6
B-12, 13.5'-15.0'	172	5/26/09	Hom	3/4"			No	17.19	77.32	67.12	20.4
B-12, 15.0'-16.5'	173	5/26/09	Hom	3/4"			No	15.87	47.86	41.01	27.2
B-12, 16.5'-18.0'	174	5/26/09	Hom	3/4"			No	21.96	76.93	68.78	17.4
B-12, 18.0'-19.5'	175	5/26/09	Hom	3/4"			No	20.96	73.03	66.30	14.8
B-12, 19.5'-21.0'	176	5/26/09	Hom	3/4"			No	14.98	51.47	44.37	24.2
B-12, 21.0'-22.5'	177	5/26/09	Hom	1 1/2"			No	22.27	74.01	65.52	19.6
B-12, 22.5'-24.0'	178	5/26/09	Hom	3/4"			No	22.42	62.71	53.40	30.1
B-12, 24.0'-25.5'	179	5/26/09	Hom	3/4"			No	17.43	59.85	51.51	24.5
B-12, 25.5'-27.0'	180	5/26/09	Hom	3/4"			No	20.44	67.36	57.25	27.5
B-12, 27.0'-28.5'	181	5/26/09	Hom	3/4"			No	22.20	95.26	77.05	33.2
B-12, 28.5'-30.0'	182	5/26/09	Hom	3/4"			No	14.57	76.56	67.23	17.7
B-12, 30.0'-31.5'	183	5/21/09	Hom	No. 4			No	20.46	79.68	67.42	26.1
B-12, 31.5'-33.0'	184	5/21/09	Hom	No. 4			No	20.24	80.42	70.35	20.1
B-12, 33.0'-34.5'	185	5/21/09	Hom	3/8"			No	11.80	80.48	68.29	21.6
B-12, 35.0'-36.5'	187	5/21/09	Hom	No. 10			Yes	20.47	69.62	59.73	25.2
B-12, 37.5'-39.0'	188	5/21/09	Hom	No. 10			Yes	20.73	58.76	51.09	25.3
B-12, 40.0'-41.5'	189	5/21/09	Hom	No. 4			No	22.76	86.59	73.13	26.7
B-12, 42.5'-44.0'	190	5/21/09	Hom	No. 10			Yes	15.06	63.63	53.91	25.0

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Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Dry Ash Stack and Gypsum Disposal Area

Project Number 175539009

Tested By

Test Method ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-12, 45.0'-46.5'	191	5/21/09	Hom	No. 10			Yes	17.14	51.55	44.55	25.5
B-12, 47.5'-49.0'	192	5/21/09	Hom	No. 10			Yes	17.22	67.70	57.50	25.3
B-12, 50.0'-51.5'	193	5/21/09	Hom	No. 10			Yes	21.00	64.05	55.29	25.5
B-12, 52.5'-54.0'	194	5/21/09	Hom	No. 10			Yes	22.65	72.28	62.17	25.6
B-12, 55.0'-56.6'	195	5/21/09	Hom	No. 10			Yes	20.66	58.95	50.93	26.5
B-12, 57.5'-59.0'	196	5/21/09	Hom	No. 10			Yes	22.43	69.67	59.75	26.6
B-12, 60.0'-61.5'	198	5/21/09	Hom	3/8"			No	16.80	69.12	61.06	18.2
B-12, 62.5'-64.0'	199	5/21/09	Hom	3/8"			No	16.92	47.66	42.47	20.3
B-12, 65.0'-66.5'	200	5/21/09	Hom	3/8"			No	21.43	68.25	60.31	20.4
B-12, 67.5'-69.0'	201	5/21/09	Hom	3/8"			No	20.11	78.22	68.51	20.1
B-12, 70.0'-71.5'	202	5/21/09	Hom	No. 4			No	22.21	79.93	67.74	26.8
B-12, 72.5'-74.0'	203	5/21/09	Hom	No. 4			No	22.06	87.89	75.15	24.0
B-12, 75.0'-76.5'	204	5/21/09	Hom	3/8"			No	22.50	70.10	57.48	36.1
B-12, 77.5'-79.0'	205	5/21/09	Hom	No. 10			Yes	23.04	87.69	64.56	55.7
B-12, 80.0'-81.5'	206	5/21/09	Hom	No. 10			Yes	17.04	57.68	45.89	40.9
B-12, 82.5'-83.3'	207	5/21/09	Hom	3/8"			No	15.85	80.55	73.37	12.5

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Moisture Content of Soil
ASTM D 2216

Project Name Geotechnical Exploration for Cumberland Dry Ash Stack/Gypsum Disposal Area

Project Number 175539009
Tested By
Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-15, 0.0'-1.5'	209	6/8/09	Hom	No. 10			Yes	21.12	98.89	85.64	20.5
B-15, 1.5'-3.0'	210	6/8/09	Hom	3/8"			No	20.62	118.19	102.90	18.6
B-15, 3.0'-4.5'	211	6/8/09	Hom	No. 4			No	20.79	121.92	102.98	23.0
B-15, 4.5'-6.0'	212	6/8/09	Hom	No. 4			No	20.61	129.98	110.77	21.3
B-15, 6.0'-7.5'	213	6/8/09	Hom	No. 4			No	20.78	138.47	115.28	24.5
B-15, 7.5'-9.0'	214	6/8/09	Hom	No. 4			No	20.72	123.08	103.41	23.8
B-15, 9.0'-10.5'	215	6/8/09	Hom	No. 4			No	20.84	126.97	107.63	22.3
B-15, 10.5'-12.0'	216	6/8/09	Hom	3/8"			No	20.85	128.72	107.74	24.1
B-15, 12.0'-13.5'	217	6/8/09	Hom	No. 4			No	20.61	139.21	116.30	23.9
B-15, 13.5'-15.0'	218	6/8/09	Hom	No. 4			No	20.63	123.39	104.53	22.5
B-15, 15.0'-16.5'	219	6/8/09	Hom	No. 4			No	25.82	136.34	117.55	20.5
B-15, 16.5'-18.0'	220	6/8/09	Len	No. 4			No	26.00	139.22	118.63	22.2
B-15, 18.0'-19.5'	221	6/8/09	Hom	3/8"			No	26.04	141.80	124.48	17.6
B-15, 19.5'-21.0'	222	6/8/09	Hom	3/8"			No	26.00	156.73	128.16	28.0
B-15, 21.0'-22.5'	223	6/8/09	Hom	No. 4			No	25.20	131.59	107.58	29.1
B-15, 22.5'-24.0'	224	6/8/09	Hom	No. 4			No	25.88	142.20	109.26	39.5
B-15, 24.0'-25.5'	225	6/8/09	Hom	3/4"			No	25.63	105.09	98.94	8.4
B-15, 25.5'-27.0'	226	6/8/09	Hom	No. 4			No	25.55	116.00	94.66	30.9
B-15, 27.0'-28.5'	227	6/8/09	Hom	3/8"			No	25.91	216.71	185.28	19.7
B-15, 28.5'-30.0'	228	6/8/09	Hom	3/8"			No	20.83	120.57	101.60	23.5
B-15, 30.0'-31.5'	229	6/8/09	Hom	3/8"			No	20.63	110.77	92.15	26.0
B-15, 31.5'-33.0'	230	6/8/09	Hom	3/8"			No	20.66	176.68	142.01	28.6
B-15, 33.0'-34.5'	231	6/8/09	Hom	No. 4			Yes	20.98	154.70	128.07	24.9
B-15, 34.5'-36.0'	232	6/8/09	Hom	No. 4			No	20.81	128.86	104.78	28.7
B-15, 36.0'-37.5'	233	6/8/09	Hom	No. 4			No	20.68	110.02	89.99	28.9
B-15, 37.5'-39.0'	234	6/8/09	Hom	No. 4			Yes	20.66	160.13	132.52	24.7
B-15, 39.0'-40.5'	235	6/8/09	Hom	No. 4			No	20.73	129.39	106.81	26.2
B-15, 40.5'-42.0'	236	6/8/09	Hom	No. 4			Yes	20.67	180.45	146.82	26.7

Moisture Content of Soil

ASTM D 2216

Project Name Geotechnical Exploration for Cumberland Dry Ash Stack/Gypsum Disposal Area

Project Number 175539009

Tested By

Test Method ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-15, 42.0'-43.5'	237	6/8/09	Hom	3/8"			No	20.61	126.77	108.33	21.0
B-15, 43.5'-45.0'	238	6/8/09	Hom	3/8"			No	20.74	134.17	116.67	18.2
B-15, 45.0'-46.5'	239	6/8/09	Hom	3/8"			No	20.76	97.70	91.16	9.3
B-15, 47.5'-49.0'	240	6/8/09	Hom	No. 4			Yes	20.80	160.51	131.93	25.7
B-15, 50.0'-51.5'	241	6/8/09	Hom	No. 4			Yes	20.96	166.88	137.42	25.3
B-15, 52.5'-54.0'	242	6/8/09	Hom	No. 4			Yes	20.80	162.72	131.93	27.7
B-15, 55.0'-56.5'	243	6/8/09	Hom	No. 4			Yes	20.86	178.99	145.94	26.4
B-15, 57.5'-59.0'	244	6/8/09	Hom	3/4"			No	20.70	195.65	166.56	19.9
B-15, 60.0'-61.5'	245	6/8/09	Hom	3/8"			No	20.98	174.45	151.87	17.3
B-15, 62.5'-64.0'	246	6/8/09	Hom	3/8"			No	20.62	146.71	124.48	21.4
B-15, 65.0'-66.5'	247	6/8/09	Hom	3/4"			No	20.64	193.27	169.08	16.3
B-15, 67.5'-69.0'	248	6/8/09	Hom	3/4"			No	20.64	199.32	176.01	15.0
B-15, 70.0'-71.5'	249	6/8/09	Hom	3/4"			No	20.73	196.16	169.10	18.2
B-15, 72.5'-74.0'	250	6/8/09	Hom	3/4"			No	20.65	129.61	109.71	22.3
B-15, 75.0'-76.5'	251	6/8/09	Hom	3/4"			No	20.58	178.64	151.29	20.9
B-15, 77.5'-79.0'	252	6/8/09	Hom	3/4"			No	20.82	155.21	131.92	21.0
B-15, 80.0'-81.5'	253	6/8/09	Hom	3/8"			No	20.61	35.13	33.40	13.5
B-25, 0.0'-1.5'	254	6/4/09	Hom	3/8"			No	21.39	110.51	95.71	19.9
B-25, 1.5'-3.0'	255	6/4/09	Hom	3/4"			No	22.68	96.84	85.26	18.5
B-25, 3.0'-4.5'	256	6/4/09	Hom	3/8"			No	22.33	113.48	97.55	21.2
B-25, 4.5'-6.0'	257	6/4/09	Hom	No. 4			No	22.22	104.84	91.31	19.6
B-25, 6.0'-7.5'	258	6/4/09	Hom	3/8"			No	20.96	102.93	89.61	19.4
B-25, 7.5'-9.0'	259	6/4/09	Hom	3/8"			No	15.00	107.82	91.22	21.8
B-25, 9.0'-10.5'	260	6/4/09	Hom	3/8"			No	17.46	95.10	78.06	28.1
B-25, 10.5'-12.0'	261	6/4/09	Hom	No. 4			No	20.95	93.74	80.21	22.8
B-25, 12.0'-13.5'	262	6/4/09	Hom	No. 4			No	21.94	88.73	77.77	19.6
B-25, 13.5'-15.0'	263	6/4/09	Hom	No. 4			No	14.60	87.10	74.29	21.5
B-25, 15.0'-16.5'	264	6/4/09	Hom	3/8"			No	22.92	99.84	84.29	25.3
B-25, 16.5'-18.0'	265	6/4/09	Hom	No. 4			No	21.16	71.73	60.27	29.3
B-25, 18.0'-19.5'	266	6/4/09	Hom	No. 4			No	20.89	135.57	110.60	27.8
B-25, 19.5'-21.0'	267	6/3/09	Hom	No. 4			No	16.59	98.14	87.55	14.9

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Moisture Content of Soil

ASTM D 2216

Project Name Geotechnical Exploration for Cumberland Dry Ash Stack/Gypsum Disposal Area

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-25, 21.0'-22.5'	268	6/3/09	Hom	No. 10			Yes	22.44	60.74	48.73	45.7
B-25, 22.5'-24.0'	269	6/3/09	Hom	No. 10			Yes	20.63	85.85	62.04	57.5
B-25, 24.0'-25.5'	270	6/3/09	Hom	No. 10			Yes	17.65	84.20	60.88	53.9
B-25, 25.5'-27.0'	271	6/3/09	Hom	No. 10			Yes	22.50	117.68	86.28	49.2
B-25, 27.0'-28.5'	272	6/3/09	Hom	No. 10			Yes	16.30	99.63	73.24	46.3
B-25, 28.5'-30.0'	273	6/3/09	Hom	No. 4			No	22.92	90.69	63.38	67.5
B-25, 30.0'-31.5'	274	6/3/09	Hom	No. 10			Yes	17.45	74.92	52.82	62.5
B-25, 31.5'-32.7'	275	6/3/09	Hom	No. 10			Yes	16.37	57.94	42.63	58.3
B-25, 37.5'-39.0'	276	6/3/09	Hom	No. 4			No	22.57	93.42	81.96	19.3
B-25, 39.0'-40.5'	277	6/3/09	Hom	No. 4			No	22.12	106.80	89.79	25.1
B-25, 40.5'-42.0'	278	6/3/09	Hom	No. 4			No	22.62	110.96	93.51	24.6
B-25, 42.0'-43.5'	279	6/3/09	Hom	No. 10			Yes	16.23	101.67	85.53	23.3
B-25, 43.5'-45.0'	280	6/3/09	Hom	No. 10			Yes	21.52	138.34	114.06	26.2
B-25, 45.0'-46.5'	281	6/3/09	Hom	No. 10			Yes	20.44	108.80	90.22	26.6
B-25, 47.5'-49.0'	282	6/3/09	Hom	No. 10			Yes	11.17	111.37	91.29	25.1
B-25, 50.0'-51.5'	283	6/3/09	Hom	No. 10			Yes	20.95	121.07	101.73	23.9
B-25, 52.5'-54.0'	284	6/3/09	Hom	No. 4			Yes	20.13	150.38	122.32	27.5
B-25, 55.0'-56.5'	285	6/3/09	Hom	3/8"			No	21.96	130.20	108.95	24.4
B-25, 57.5'-59.0'	286	6/3/09	Hom	No. 4			No	22.21	130.35	107.61	26.6
B-25, 60.0'-61.5'	287	6/3/09	Hom	No. 4			No	20.67	128.69	107.10	25.0
B-25, 62.5'-64.0'	288	6/3/09	Hom	3/4"			No	20.56	117.78	102.54	18.6
B-25, 65.0'-66.5'	289	6/3/09	Hom	3/8"			No	14.66	138.18	118.16	19.3
B-25, 67.5'-69.0'	290	6/3/09	Hom	3/4"			No	21.78	163.02	141.16	18.3
B-25, 70.0'-71.5'	291	6/3/09	Hom	3/4"			No	20.91	144.86	123.80	20.5
B-25, 72.5'-74.0'	292	6/3/09	Hom	3/8"			No	15.48	125.34	106.57	20.6
B-25, 75.0'-76.5'	293	6/3/09	Hom	3/4"			No	21.56	133.93	114.68	20.7
B-25, 10.5'-18.0'	294	6/3/09	Hom	No. 4			No	20.76	125.15	106.71	21.5
B-28, 0.0'-1.5'	295	6/9/09	Hom	No. 4			Yes	25.89	177.30	164.18	9.5
B-28, 1.5'-3.0'	296	6/9/09	Hom	No. 4			Yes	25.78	161.20	144.53	14.0
B-28, 3.0'-4.5'	297	6/9/09	Hom	No. 4			No	25.68	131.54	116.21	16.9
B-28, 4.5'-6.0'	298	6/9/09	Hom	No. 4			Yes	25.82	153.05	140.54	10.9

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Moisture Content of Soil
ASTM D 2216

Project Name Geotechnical Exploration for Cumberland Dry Ash Stack/Gypsum Disposal Area

Project Number 175539009
Tested By
Test Method ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-28, 6.0'-7.5'	299	6/9/09	Hom	No. 4			Yes	25.65	180.24	159.83	15.2
B-28, 7.5'-9.0'	300	6/9/09	Hom	No. 4			Yes	25.85	144.69	126.68	17.9
B-28, 9.0'-10.5'	301	6/9/09	Hom	No. 4			Yes	25.71	161.50	142.77	16.0
B-28, 10.5'-12.0'	302	6/9/09	Hom	No. 4			Yes	25.60	147.48	133.04	13.4
B-28, 12.0'-13.5'	303	6/9/09	Hom	No. 4			Yes	25.77	147.28	135.39	10.8
B-28, 13.5'-15.0'	304	6/9/09	Len	No. 4			No	26.03	141.21	125.37	15.9
B-28, 15.0'-16.5'	305	6/9/09	Hom	No. 4			Yes	26.07	157.24	135.63	19.7
B-28, 16.5'-18.0'	306	6/9/09	Hom	No. 4			No	26.03	134.75	115.42	21.6
B-28, 18.0'-19.5'	307	6/9/09	Hom	3/8"			No	25.34	141.13	121.98	19.8
B-28, 19.5'-21.0'	308	6/9/09	Hom	No. 10			Yes	25.89	178.04	130.18	45.9
B-28, 21.0'-22.5'	309	6/9/09	Hom	No. 10			Yes	25.98	181.10	138.13	38.3
B-28, 25.0'-26.5'	310	6/9/09	Hom	No. 10			Yes	25.55	155.20	124.30	31.3
B-28, 27.5'-29.0'	311	6/9/09	Hom	3/8"			No	26.17	165.08	129.37	34.6
B-28, 30.0'-31.5'	312	6/9/09	Hom	No. 4			Yes	25.72	164.44	129.76	33.3
B-28, 32.5'-34.0'	313	6/9/09	Hom	No. 4			No	26.04	159.36	125.38	34.2
B-28, 35.0'-36.5'	314	6/9/09	Hom	No. 4			No	25.77	154.41	117.05	40.9
B-28, 37.5'-39.0'	315	6/9/09	Hom	No. 4			No	25.50	149.69	109.49	47.9
B-28, 40.0'-41.5'	316	6/9/09	Hom	No. 10			Yes	25.96	157.48	115.85	46.3
B-28, 42.5'-44.0'	317	6/9/09	Hom	No. 10			Yes	26.13	146.62	110.15	43.4
B-28, 45.0'-46.5'	318	6/9/09	Hom	No. 10			Yes	25.97	160.06	126.01	34.0
B-28, 47.5'-49.0'	319	6/9/09	Hom	No. 10			Yes	25.90	155.00	119.30	38.2
B-28, 50.0'-51.5'	320	6/9/09	Hom	No. 10			Yes	25.56	133.70	105.89	34.6
B-28, 52.5'-54.0'	321	6/9/09	Hom	No. 10			Yes	25.78	150.62	116.54	37.5
B-28, 55.0'-56.5'	322	6/9/09	Hom	No. 10			Yes	26.12	168.75	145.28	19.7
B-28, 57.5'-59.0'	323	6/9/09	Hom	No. 4			No	25.89	141.09	121.32	20.7
B-28, 60.0'-61.5'	324	6/9/09	Len	No. 4			Yes	26.05	150.93	128.96	21.3
B-28, 62.5'-64.0'	325	6/9/09	Len	No. 4			No	26.06	133.89	113.90	22.8
B-28, 65.0'-66.5'	326	6/9/09	Hom	No. 4			Yes	25.51	158.95	133.02	24.1
B-28, 67.5'-69.0'	327	6/9/09	Hom	No. 10			Yes	25.12	140.07	116.85	25.3
B-28, 70.0'-71.2'	328	6/9/09	Hom	No. 10			Yes	25.97	175.65	144.73	26.0
B-32, 0.0'-1.5'	329	6/4/09	Len	3/8"			No	16.54	84.60	77.86	11.0

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Moisture Content of Soil

ASTM D 2216

Project Name Geotechnical Exploration for Cumberland Dry Ash Stack/Gypsum Disposal Area

Project Number 175539009

Tested By

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Test Method ASTM

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-32, 1.5'-3.0'	331	6/4/09	Hom	3/8"			No	16.82	79.21	68.81	20.0
B-32, 3.0'-4.5'	332	6/4/09	Hom	3/4"			No	15.87	89.92	81.37	13.1
B-32, 4.5'-6.0'	333	6/4/09	Hom	3/4"			No	16.56	45.58	41.25	17.5
B-32, 6.0'-7.5'	334	6/4/09	Hom	3/4"			No	22.26	72.92	63.77	22.0
B-32, 7.5'-9.0'	335	6/4/09	Hom	3/4"			No	20.70	68.96	65.86	6.9
B-32, 9.0'-10.5'	336	6/4/09	Hom	3/4"			No	16.97	59.80	53.64	16.8
B-32, 10.5'-12.0'	337	6/4/09	Hom	3/4"			No	23.63	94.93	86.00	14.3
B-32, 12.0'-13.5'	338	6/4/09	Hom	3/8"			No	20.91	87.17	77.29	17.5
B-32, 13.5'-15.0'	339	6/4/09	Hom	No. 10			Yes	22.38	74.48	66.42	18.3
B-32, 15.0'-16.5'	340	6/4/09	Hom	3/4"			No	16.94	71.39	61.81	21.4
B-32, 16.5'-18.0'	341	6/4/09	Hom	3/4"			No	16.24	65.20	54.90	26.6
B-32, 18.0'-19.5'	342	6/4/09	Hom	No. 4			No	15.66	103.27	75.06	47.5
B-32, 20.0'-21.5'	344	6/4/09	Hom	No. 4			No	22.91	83.35	73.89	18.6
B-32, 22.5'-24.0'	345	6/4/09	Hom	No. 4			No	16.32	103.85	88.44	21.4
B-32, 25.0'-26.5'	346	6/4/09	Hom	No. 4			No	16.16	76.40	57.13	47.0
B-32, 27.5'-29.0'	347	6/4/09	Hom	No. 4			No	22.55	94.99	73.95	40.9
B-32, 30.0'-31.5'	348	6/4/09	Hom	No. 4			No	21.16	62.53	49.92	43.8
B-32, 32.5'-34.0'	349	6/4/09	Hom	No. 4			No	10.81	61.14	52.20	21.6
B-32, 35.0'-36.5'	350	6/4/09	Hom	No. 4			No	16.20	69.32	51.92	48.7
B-32, 37.5'-39.0'	351	6/4/09	Hom	No. 4			No	22.25	96.16	74.92	40.3
B-32, 40.0'-41.5'	352	6/4/09	Hom	No. 4			No	17.30	81.77	62.76	41.8
B-32, 42.5'-44.0'	353	6/4/09	Hom	No. 4			No	20.95	112.27	83.93	45.0
B-32, 45.0'-46.5'	354	6/4/09	Hom	No. 4			No	22.50	82.82	67.50	34.0
B-32, 47.5'-49.0'	355	6/4/09	Hom	No. 4			No	20.90	100.32	76.20	43.6
B-32, 50.0'-51.5'	356	6/4/09	Hom	No. 4			No	11.88	86.34	68.40	31.7
B-32, 52.5'-54.0'	357	6/4/09	Hom	No. 4			No	16.34	83.81	70.68	24.2
B-32, 55.0'-56.5'	358	6/4/09	Hom	No. 4			No	20.46	76.93	65.08	26.6
B-32, 57.5'-59.0'	359	6/4/09	Hom	No. 4			No	17.08	79.75	61.83	40.0
B-32, 60.0'-60.4'	360	6/4/09	Hom	No. 4			No	17.61	108.97	90.45	25.4
B-33, 0.0'-1.5'	361	6/4/09	Hom	3/8"			No	20.89	137.43	116.90	21.4
B-33, 1.5'-3.0'	362	6/4/09	Hom	3/4"			No	20.94	117.92	97.10	27.3

Moisture Content of Soil

ASTM D 2216

Project Name Geotechnical Exploration for Cumberland Dry Ash Stack/Gypsum Disposal Area

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-33, 3.0'-4.5'	363	6/4/09	Hom	3/4"			No	21.00	174.06	151.68	17.1
B-33, 4.5'-6.0'	364	6/4/09	Hom	3/4"			No	20.95	126.37	110.57	17.6
B-33, 6.0'-7.5'	365	6/4/09	Hom	3/4"			No	20.90	41.37	38.57	15.8
B-33, 7.5'-9.0'	366	6/4/09	Hom	3/8"			No	20.74	122.21	105.86	19.2
B-33, 9.0'-10.5'	367	6/4/09	Hom	No. 4			No	20.86	110.87	95.27	21.0
B-33, 10.5'-12.0'	368	6/4/09	Hom	No. 4			No	21.04	139.05	117.47	22.4
B-33, 12.0'-13.5'	369	6/4/09	Hom	No. 4			Yes	20.84	157.47	134.46	20.3
B-33, 13.5'-15.0'	370	6/4/09	Hom	No. 4			No	20.97	128.46	109.16	21.9
B-33, 15.0'-16.5'	371	6/4/09	Hom	3/4"			No	20.98	108.23	91.92	23.0
B-33, 16.5'-18.0'	372	6/4/09	Hom	3/8"			No	20.95	166.11	141.75	20.2
B-33, 18.0'-19.5'	373	6/4/09	Hom	3/4"			No	20.94	155.25	122.26	32.6
B-33, 19.5'-21.0'	374	6/4/09	Hom	3/4"			No	21.10	116.78	103.03	16.8
B-33, 21.0'-22.5'	375	6/4/09	Hom	No. 10			Yes	20.73	184.01	128.57	51.4
B-33, 22.5'-24.0'	376	6/4/09	Hom	No. 10			Yes	20.94	109.34	78.25	54.2
B-33, 24.0'-25.5'	377	6/4/09	Hom	No. 4			No	21.01	120.13	93.79	36.2
B-33, 25.5'-27.0'	378	6/4/09	Hom	No. 10			Yes	20.85	127.25	99.25	35.7
B-33, 27.0'-28.5'	379	6/4/09	Hom	No. 4			No	21.08	134.35	100.82	42.0
B-33, 28.5'-30.0'	380	6/4/09	Hom	3/4"			No	20.98	102.93	80.11	38.6
B-33, 30.0'-31.5'	382	6/4/09	Hom	3/8"			No	20.82	136.14	113.88	23.9
B-33, 31.5'-33.0'	383	6/4/09	Hom	3/8"			No	20.75	84.40	71.44	25.6
B-33, 33.0'-34.5'	384	6/4/09	Hom	3/8"			No	20.58	125.47	110.46	16.7
B-33, 34.5'-36.0'	385	6/4/09	Hom	No. 4			No	20.65	130.25	113.60	17.9
B-33, 36.0'-37.5'	386	6/4/09	Hom	No. 4			No	20.89	133.54	108.31	28.9
B-33, 37.5'-39.0'	387	6/4/09	Hom	No. 4			No	21.15	127.57	107.35	23.5
B-33, 39.0'-40.5'	388	6/4/09	Hom	No. 4			Yes	20.83	169.95	141.51	23.6
B-33, 40.5'-41.2'	389	6/4/09	Hom	3/8"			No	21.00	124.70	104.16	24.7
B-33, 42.0'-42.2'	390	6/4/09	Hom	No. 4			No	20.62	124.37	115.35	9.5
B-33, 43.5'-43.6'	391	6/4/09	Hom	No. 4			No	20.79	88.64	84.21	7.0
B-36, 0.0'-1.5'	392	6/3/09	Hom	No. 4			No	21.57	124.26	112.24	13.3
B-36, 1.5'-3.0'	393	6/3/09	Hom	3/8"			No	17.17	102.95	85.85	24.9
B-36, 3.0'-4.5'	394	6/3/09	Hom	3/8"			No	16.79	96.46	87.78	12.2

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Moisture Content of Soil
ASTM D 2216

Project Name Geotechnical Exploration for Cumberland Dry Ash Stack/Gypsum Disposal Area

Project Number 175539009
Tested By
Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-36, 4.5'-6.0'	395	6/3/09	Hom	3/8"			No	14.93	166.26	112.02	55.9
B-36, 6.0'-7.5'	396	6/3/09	Hom	3/8"			No	22.96	129.41	115.23	15.4
B-36, 7.5'-9.0'	397	6/3/09	Hom	3/8"			No	16.30	97.28	90.35	9.4
B-36, 9.0'-10.5'	398	6/3/09	Hom	3/8"			No	20.64	126.41	116.68	10.1
B-36, 10.5'-12.0'	399	6/3/09	Hom	3/4"			No	20.48	124.00	113.67	11.1
B-36, 12.0'-13.5'	400	6/3/09	Hom	3/8"			No	20.46	108.03	96.30	15.5
B-36, 13.5'-15.0'	401	6/3/09	Hom	3/8"			No	14.89	101.37	91.64	12.7
B-36, 15.0'-16.5'	402	6/3/09	Hom	3/8"			No	17.21	76.98	71.16	10.8
B-36, 16.5'-18.0'	403	6/4/09	Hom	3/8"			No	22.47	151.98	138.94	11.2
B-36, 18.0'-19.5'	404	6/4/09	Hom	3/8"			No	15.41	106.69	95.20	14.4
B-36, 19.5'-21.0'	405	6/4/09	Hom	3/8"			No	11.80	84.53	62.65	43.0
B-36, 21.0'-22.5'	406	6/4/09	Hom	No. 4			No	15.91	95.41	75.17	34.2
B-36, 22.5'-24.0'	407	6/4/09	Hom	3/8"			No	16.96	76.14	59.10	40.4
B-36, 24.0'-25.5'	408	6/4/09	Hom	No. 4			No	16.17	94.43	70.34	44.5
B-36, 25.5'-27.0'	409	6/4/09	Hom	No. 4			No	21.98	106.01	81.23	41.8
B-36, 27.5'-29.0'	410	6/4/09	Hom	No. 10			Yes	17.00	100.47	74.49	45.2
B-36, 30.0'-31..5'	411	6/4/09	Hom	No. 10			Yes	17.11	96.94	71.37	47.1
B-36, 32.5'-34.0'	412	6/4/09	Hom	3/8"			No	17.44	88.87	66.02	47.0
B-36, 35.0'-36.5'	413	6/4/09	Hom	No. 10			Yes	22.19	80.46	61.54	48.1
B-36, 37.5'-39.0'	414	6/4/09	Hom	No. 10			Yes	20.48	82.40	62.51	47.3
B-36, 40.0'-41.5'	415	6/4/09	Hom	No. 10			Yes	22.64	71.09	54.31	53.0
B-36, 42.5'-44.0'	416	6/4/09	Hom	No. 10			Yes	16.10	77.34	59.39	41.5
B-36, 45.0'-46.5'	417	6/4/09	Hom	No. 10			Yes	20.72	93.63	69.91	48.2
B-36, 47.5'-49.0'	418	6/4/09	Hom	3/8"			No	15.07	80.88	67.80	24.8
B-36, 50.0'-50.8'	419	6/4/09	Hom	3/8"			No	21.00	80.65	68.33	26.0
B-37, 0.0'-1.5'	420	6/4/09	Hom	3/8"			No	21.34	97.04	85.50	18.0
B-37, 1.5'-3.0'	421	6/4/09	Hom	3/4"			No	14.89	86.80	73.55	22.6
B-37, 3.0'-4.5'	422	6/4/09	Hom	3/8"			No	16.46	72.96	61.25	26.1
B-37, 4.5'-6.0'	423	6/4/09	Hom	3/8"			No	22.42	78.80	68.30	22.9
B-37, 6.0'-7.5'	424	6/4/09	Hom	3/8"			No	20.83	91.88	80.06	20.0
B-37, 7.5'-9.0'	426	6/4/09	Hom	3/8"			No	22.06	92.49	78.56	24.7

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Tested By
Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

PRELIMINARY

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-37, 9.0'-10.5'	427	6/4/09	Hom	3/8"			No	14.94	66.83	57.22	22.7
B-37, 10.5'-12.0'	428	6/4/09	Hom	3/8"			No	16.65	86.37	73.74	22.1
B-37, 12.0'-13.5'	429	6/4/09	Hom	3/8"			No	22.76	86.48	75.67	20.4
B-37, 13.5'-15.0'	430	6/4/09	Hom	No. 4			No	20.21	80.90	68.35	26.1
B-37, 15.0'-16.5'	431	6/4/09	Hom	3/8"			No	16.35	56.08	48.21	24.7
B-37, 16.5'-18.0'	432	6/4/09	Hom	3/4"			No	20.70	75.99	66.30	21.3
B-37, 18.0'-19.5'	433	6/4/09	Hom	3/8"			No	16.58	99.12	83.71	23.0
B-37, 19.5'-21.0'	434	6/4/09	Hom	3/8"			No	22.97	106.65	88.54	27.6
B-37, 21.0'-22.5'	435	6/4/09	Hom	No. 10			Yes	17.42	67.69	51.37	48.1
B-37, 22.5'-24.0' Little Recovery	436	6/8/09									
B-37, 24.0'-25.5'	437	6/4/09	Hom	No. 4			No	16.49	100.37	67.04	65.9
B-37, 25.5'-27.0'	438	6/4/09	Hom	No. 4			No	22.55	132.40	101.60	39.0
B-37, 27.0'-28.5'	439	6/4/09	Hom	No. 10			Yes	20.99	154.22	110.47	48.9
B-37, 28.5'-30.0'	440	6/4/09	Hom	3/4"			No	20.96	142.61	117.87	25.5
B-37, 30.0'-31.5'	441	6/4/09	Hom	No. 4			No	20.99	140.46	118.07	23.1
B-37, 31.5'-33.0'	442	6/4/09	Hom	3/8"			No	20.67	152.62	126.10	25.2
B-37, 33.0'-33.4'	443	6/4/09	Hom	3/4"			No	20.86	100.76	83.62	27.3

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Moisture Content of Soil
ASTM D 2216

Project Name CUF - TVA

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

PRELIMINARY

Source		Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-35	1, 0.0'-1.5'	444	6/15/09	Hom	3/8"			No	21.39	41.12	39.83	7.0
B-35	2, 1.5'-3.0'	446	6/15/09	Hom	3/8"			No	22.33	42.52	41.03	8.0
B-35	3, 3.0'-4.5'	447	6/15/09	Hom	3/8"			No	15.93	35.02	33.58	8.2
B-35	4, 4.5'-6.0'	448	6/15/09	Hom	3/8"			No	21.29	40.90	38.64	13.0
B-35	5, 6.0'-7.5'	449	6/15/09	Hom	3/8"			No	17.57	40.42	37.79	13.0
B-35	6, 7.5'-9.0'	450	6/15/09	Hom	3/8"			No	21.02	44.73	42.39	10.9
B-35	7, 9.0'-10.5'	451	6/15/09	Hom	3/8"			No	20.86	41.83	39.61	11.8
B-35	8, 10.5'-12.0'	452	6/15/09	Hom	3/8"			No	15.87	31.70	30.70	6.7
B-35	9, 12.0'-13.5'	453	6/15/09	Hom	3/8"			No	16.07	43.91	42.00	7.4
B-35	10, 13.5'-15.0'	454	6/15/09	Hom	3/8"			No	10.92	32.94	31.68	6.1
B-35	11, 15.0'-16.5'	455	6/15/09	Hom	3/8"			No	20.97	42.53	40.81	8.7
B-35	12, 16.5'-18.0'	456	6/15/09	Hom	3/8"			No	16.50	30.69	29.59	8.4
B-35	13, 18.0'-19.5'	457	6/15/09	Hom	3/8"			No	22.35	43.15	41.13	10.8
B-35	14, 19.5'-21.0'	458	6/15/09	Hom	3/8"			No	23.57	46.13	43.16	15.2
B-35	15, 21.0'-22.5'	459	6/15/09	Hom	3/8"			No	21.19	43.97	40.10	20.5
B-35	16, 22.5'-24.0'	460	6/15/09	Hom	3/8"			No	16.56	40.05	35.44	24.4
B-35	17, 24.0'-25.5'	461	6/15/09	Hom	3/8"			No	20.80	50.79	44.26	27.8
B-35	18, 25.5'-27.0'	462	6/15/09	Hom	3/8"			No	16.28	46.16	40.10	25.4
B-35	19, 27.0'-28.5'	463	6/15/09	Hom	3/8"			No	16.44	39.96	33.87	34.9
B-35	20, 28.5'-30.0'	464	6/15/09	Hom	3/8"			No	15.18	36.54	32.99	19.9
B-35	21, 30.0'-31.5'	465	6/15/09	Hom	3/8"			No	17.05	38.27	34.99	18.3
B-35	22, 31.5'-33.0'	466	6/15/09	Hom	3/8"			No	22.98	64.11	55.46	26.6
B-35	23, 33.0'-34.5'	467	6/15/09	Hom	3/8"			No	22.26	50.60	41.70	45.8
B-35	24, 34.5'-36.0'	468	6/15/09	Hom	3/8"			No	16.61	41.75	34.56	40.1
B-35	25, 36.0'-37.5'	469	6/15/09	Hom	3/8"			No	16.80	38.41	31.64	45.6
B-35	26, 37.5'-39.0'	470	6/15/09	Hom	3/8"			No	22.14	46.12	39.44	38.6
B-35	27, 39.0'-40.5'	471	6/15/09	Hom	3/8"			No	20.43	47.20	39.68	39.1
B-35	28, 40.5'-42.0'	472	6/15/09	Hom	3/8"			No	15.40	41.35	32.55	51.3

Moisture Content of Soil

ASTM D 2216

Project Name CUF - TVA

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

PRELIMINARY

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-35 29, 42.0'-43.5'	473	6/15/09	Hom	3/8"			No	22.75	52.78	43.86	42.3
B-35 30, 43.5'-45.0'	474	6/15/09	Hom	3/8"			No	17.60	46.58	38.74	37.1
B-35 31, 45.0'-46.5'	475	6/15/09	Hom	3/8"			No	17.12	39.41	32.50	44.9
B-35 32, 46.5'-48.0'	476	6/15/09	Hom	3/8"			No	11.99	33.86	28.41	33.2
B-35 33, 48.0'-49.5'	477	6/15/09	Hom	3/8"			No	17.82	36.11	30.34	46.1
B-35 34, 49.5'-51.0'	478	6/15/09	Hom	3/8"			No	14.88	40.58	30.48	64.7
B-35 35, 51.0'-52.5'	479	6/15/09	Hom	3/8"			No	20.21	40.94	35.16	38.7
B-35 36, 52.5'-54.0'	480	6/15/09	Hom	3/8"			No	23.41	66.03	53.00	44.0
B-35 37, 54.0'-55.5'	481	6/15/09	Hom	3/8"			No	16.58	40.51	32.67	48.7
B-35 38, 55.5'-57.0'	482	6/15/09	Hom	3/8"			No	17.22	35.63	30.17	42.2
B-35 39, 57.0'-58.5'	483	6/15/09	Hom	3/8"			No	18.15	40.45	32.88	51.4
B-35 40, 58.5'-60.0'	484	6/15/09	Hom	3/8"			No	14.94	40.01	30.82	57.9
B-35 41, 60.0'-61.5'	485	6/15/09	Hom	3/8"			No	21.34	53.20	40.83	63.5
B-35 42, 61.5'-63.0'	486	6/15/09	Hom	3/8"			No	17.10	46.43	40.82	23.7
B-35 43, 65.0'-66.5'	487	6/15/09	Hom	3/8"			No	14.90	45.35	36.22	42.8
B-2 1, 0.0'-1.5'	488	6/15/09	Hom	3/8"			No	22.96	46.30	42.26	20.9
B-2 2, 1.5'-3.0'	489	6/15/09	Hom	3/8"			No	16.74	36.94	34.89	11.3
B-2 3, 3.0'-4.5'	490	6/15/09	Hom	3/8"			No	20.69	44.77	42.81	8.9
B-2 4, 4.5'-6.0'	492	6/15/09	Hom	3/8"			No	16.47	30.99	28.41	21.6
B-2 5, 7.5'-9.0'	493	6/15/09	Hom	3/8"			No	22.39	45.32	43.56	8.3
B-2 6, 10.0'-11.5'	494	6/15/09	Hom	3/8"			No	22.07	44.03	42.20	9.1
B-2 7, 12.5'-14.0'	495	6/15/09	Hom	3/8"			No	22.77	48.84	41.61	38.4
B-2 8, 15.0'-16.5'	496	6/15/09	Hom	3/8"			No	20.83	40.72	36.37	28.0
B-2 9, 17.5'-19.0'	497	6/15/09	Hom	3/8"			No	22.43	55.37	47.77	30.0
B-2 10, 20.0'-21.5'	498	6/15/09	Hom	3/8"			No	20.96	48.13	41.78	30.5
B-2 11, 22.5'-24.0'	499	6/15/09	Hom	3/8"			No	16.75	43.35	35.90	38.9
B-2 12, 25.0'-26.5'	500	6/15/09	Hom	3/8"			No	16.36	52.37	44.32	28.8
B-2 13, 27.5'-29.0'	501	6/15/09	Hom	3/8"			No	21.40	66.41	55.96	30.2
B-2 14, 30.0'-31.5'	502	6/15/09	Hom	3/8"			No	17.44	44.70	38.14	31.7
B-2 15, 32.5'-34.0'	503	6/15/09	Hom	3/8"			No	22.97	50.82	45.80	22.0
B-2 16, 35.0'-36.5'	504	6/16/09	Hom	3/8"			No	22.69	55.38	50.36	18.1

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Moisture Content of Soil
ASTM D 2216

Project Name CUF - TVA

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source		Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-2	17, 37.5'-39.0'	505	6/16/09	Hom	3/8"			No	15.01	50.66	42.94	27.6
B-2	18, 40.0'-41.5'	506	6/16/09	Hom	3/8"			No	22.21	46.82	39.78	40.1
B-2	19, 42.5'-44.0'	507	6/16/09	Hom	3/8"			No	20.96	68.85	57.52	31.0
B-2	20, 45.0'-46.5'	508	6/16/09	Hom	3/8"			No	14.63	42.59	34.16	43.2
B-2	21, 47.5'-49.0'	509	6/16/09	Hom	3/8"			No	21.96	54.60	41.87	63.9
B-2	22, 50.0'-51.5'	510	6/16/09	Hom	3/8"			No	20.96	63.37	49.22	50.1
B-2	23, 52.5'-54.0'	511	6/16/09	Hom	3/8"			No	22.70	54.60	47.94	26.4
B-2	24, 55.0'-56.5'	513	6/16/09	Hom	3/8"			No	21.89	55.59	48.74	25.5
B-2	25, 57.5'-59.0'	514	6/16/09	Hom	3/8"			No	22.81	57.69	50.36	26.6
B-2	26, 60.0'-61.5'	515	6/16/09	Hom	3/8"			No	17.36	39.45	34.82	26.5
B-2	27, 62.5'-64.0'	516	6/16/09	Hom	3/8"			No	18.52	39.40	35.05	26.3
B-2	28, 65.0'-66.5'	517	6/16/09	Hom	3/8"			No	21.15	43.85	38.74	29.1
B-2	29, 67.5'-69.0'	518	6/16/09	Hom	3/8"			No	22.14	46.48	41.24	27.4
B-2	30, 70.0'-71.5'	519	6/16/09	Hom	3/8"			No	23.92	50.50	44.00	32.4
B-2	31, 72.5'-74.0'	520	6/16/09	Hom	3/4"			No	16.72	41.66	36.31	27.3
B-2	32, 75.0'-76.5'	521	6/16/09	Hom	3/4"			No	21.50	50.32	43.90	28.7
B-2	33, 77.5'-79.0'	522	6/16/09	Hom	3/8"			No	16.62	56.50	48.09	26.7
B-2	34, 80.0'-81.5'	523	6/16/09	Hom	3/4"			No	22.08	51.87	46.82	20.4
B-2	35, 82.5'-84.0'	524	6/16/09	Hom	3/8"			No	16.22	47.58	42.27	20.4
B-2	36, 85.0'-86.5'	525	6/16/09	Hom	3/8"			No	20.44	47.99	41.39	31.5
B-2	37, 87.5'-89.0'	526	6/16/09	Hom	3/4"			No	22.70	73.61	66.79	15.5
B-2	38, 90.0'-91.5'	527	6/16/09	Hom	3/4"			No	20.97	59.64	53.76	17.9
B-2	39, 92.5'-94.0'	528	6/16/09	Hom	3/4"			No	22.70	68.92	59.20	26.6
B-2	40, 95.0'-96.5'	529	6/16/09	Hom	3/4"			No	20.62	49.66	44.26	22.8
B-2	41, 97.5'-99.0'	530	6/16/09	Hom	3/8"			No	20.69	53.15	45.65	30.0
B-2	42, 102.0'-103.0'	531	6/16/09	Hom	3/8"			No	22.17	87.63	73.68	27.1
B-2	43, 103.6'-103.9'	532	6/16/09	Hom	3/4"			No	20.30	55.72	51.18	14.7
B-24	1, 0.0'-1.5'	533	6/16/09	Hom	3/8"			No	22.29	48.89	46.35	10.6
B-24	2, 1.5'-3.0'	534	6/16/09	Hom	3/8"			No	22.40	55.46	50.80	16.4
B-24	3, 3.0'-4.5'	535	6/17/09	Hom	3/8"			No	20.32	49.21	45.12	16.5
B-24	4, 4.5'-6.0'	537	6/17/09	Hom	3/8"			No	20.69	57.75	55.37	6.9

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Moisture Content of Soil
ASTM D 2216

Project Name CUF - TVA

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-24 5, 6.0'-7.5'	538	6/17/09	Hom	3/8"			No	20.62	56.64	51.68	16.0
B-24 6, 7.5'-9.0'	539	6/17/09	Hom	3/4"			No	20.44	50.83	48.46	8.5
B-24 7, 9.0'-10.5'	540	6/17/09	Hom	3/4"			No	22.13	49.61	45.53	17.4
B-24 8, 10.5'-12.0'	541	6/17/09	Hom	3/8"			No	21.52	52.95	49.53	12.2
B-24 9, 12.0'-13.5'	542	6/17/09	Hom	3/4"			No	20.96	36.28	33.48	22.4
B-24 10, 13.5'-15.0'	543	6/17/09	Hom	3/4"			No	16.25	34.58	31.10	23.4
B-24 11, 15.0'-16.5'	544	6/17/09	Hom	1 1/2"			No	18.21	40.55	37.06	18.5
B-24 12, 16.5'-18.0'	545	6/17/09	Hom	3/8"			No	21.14	54.12	49.63	15.8
B-24 13, 18.0'-19.5'	546	6/17/09	Hom	3/4"			No	22.25	43.06	39.89	18.0
B-24 14, 19.5'-21.0'	547	6/17/09	Hom	3/8"			No	21.76	58.53	53.42	16.1
B-24 15, 21.0'-22.5'	548	6/17/09	Hom	3/4"			No	22.54	54.70	49.05	21.3
B-24 16, 22.5'-24.0'	549	6/17/09	Hom	3/4"			No	16.90	51.49	45.44	21.2
B-24 17, 24.0'-25.5'	550	6/17/09	Hom	3/8"			No	23.68	44.53	37.94	46.2
B-24 18, 25.5'-27.0'	551	6/17/09	Hom	3/8"			No	22.63	48.39	39.12	56.2
B-24 19, 27.0'-28.5'	553	6/17/09	Hom	3/8"			No	21.46	44.61	36.56	53.3
B-24 20, 28.5'-30.0'	554	6/17/09	Hom	3/8"			No	14.66	39.62	30.93	53.4
B-24 21, 30.0'-31.5'	555	6/17/09	Hom	3/8"			No	16.79	43.26	35.56	41.0
B-24 22, 31.5'-33.0'	556	6/17/09	Hom	3/8"			No	22.83	45.43	37.98	49.2
B-24 23, 33.0'-34.5'	557	6/17/09	Hom	3/8"			No	22.65	50.45	41.12	50.5
B-24 24, 35.0'-36.5'	558	6/17/09	Hom	3/8"			No	16.60	38.94	32.16	43.6
B-24 25, 37.5'-39.0'	559	6/17/09	Hom	3/8"			No	22.00	47.76	40.44	39.7
B-24 26, 40.0'-41.5'	560	6/17/09	Hom	3/8"			No	22.11	49.57	42.18	36.8
B-24 27, 42.5'-44.0'	561	6/17/09	Hom	3/8"			No	22.33	50.14	40.77	50.8
B-24 28, 45.0'-46.5'	562	6/17/09	Hom	3/8"			No	23.29	57.20	47.34	41.0
B-24 29, 47.5'-49.0'	563	6/17/09	Hom	3/8"			No	17.85	37.37	31.87	39.2
B-24 30, 50.0'-51.5'	564	6/17/09	Hom	3/8"			No	21.44	54.40	45.08	39.4
B-24 31, 52.5'-54.0'	565	6/17/09	Hom	3/8"			No	23.07	48.34	37.98	69.5
B-24 32, 55.0'-56.5'	566	6/17/09	Hom	3/8"			No	16.70	58.71	50.94	22.7
B-24 33, 57.5'-59.0'	567	6/17/09	Hom	3/8"			No	15.23	39.06	34.29	25.0
B-24 34, 60.0'-61.5'	568	6/17/09	Hom	3/8"			No	16.69	45.52	39.80	24.8
B-24 35, 62.5'-64.0'	569	6/17/09	Hom	3/8"			No	15.48	50.09	43.18	24.9

Moisture Content of Soil
ASTM D 2216

Project Name CUF - TVA

Project Number 175539009
Tested By
Test Method ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-24 36, 65.0'-66.5'	570	6/17/09	Hom	3/8"			No	20.71	56.82	49.69	24.6
B-24 37, 67.5'-69.0'	571	6/17/09	Hom	3/8"			No	22.34	65.48	57.74	21.9
B-24 38, 70.0'-71.5'	572	6/17/09	Hom	3/8"			No	16.74	51.11	45.50	19.5
B-24 39, 72.5'-74.0'	573	6/17/09	Hom	3/8"			No	22.77	68.50	58.99	26.3
B-24 40, 75.0'-76.5'	574	6/17/09	Hom	3/4"			No	22.59	67.84	59.02	24.2
B-24 41, 77.5'-79.0'	575	6/17/09	Hom	3/4"			No	22.97	47.91	43.04	24.3
B-24 42, 80.0'-81.5'	576	6/17/09	Hom	3/4"			No	21.83	61.43	55.50	17.6
B-24 43, 82.5'-84.0'	577	6/17/09	Hom	3/4"			No	16.50	60.03	52.71	20.2
B-24 44, 85.0'-86.5'	578	6/17/09	Hom	1 1/2"			No	15.60	59.65	50.47	26.3
B-24 45, 87.5'-89.0'	579	6/17/09	Hom	1 1/2"			No	22.06	65.24	58.61	18.1
B-24 46, 90.0'-90.4'	580	6/17/09	Hom	1 1/2"			No	23.51	58.77	53.75	16.6
B-4 1, 0.0'-1.5'	581	6/17/09	Hom	3/8"			No	17.10	48.85	45.74	10.9
B-4 2, 1.5'-3.0'	583	6/17/09	Hom	3/8"			No	20.82	43.64	41.83	8.6
B-4 3, 3.0'-4.5'	584	6/17/09	Hom	3/8"			No	17.20	39.58	37.89	8.2
B-4 4, 4.5'-6.0'	585	6/17/09	Hom	3/8"			No	11.99	27.30	25.98	9.4
B-4 5, 6.0'-7.5'	586	6/17/09	Hom	3/8"			No	14.94	31.60	27.82	29.3
B-4 6, 7.5'-9.0'	587	6/17/09	Hom	3/8"			No	18.14	36.86	28.73	76.8
B-4 7, 9.0'-10.5'	588	6/17/09	Hom	3/8"			No	16.48	39.55	31.86	50.0
B-4 8, 10.5'-12.0'	589	6/17/09	Hom	3/8"			No	17.23	36.29	29.95	49.8
B-4 9, 12.0'-13.5'	590	6/17/09	Hom	3/8"			No	16.75	33.85	28.51	45.4
B-4 10, 13.5'-15.0'	591	6/17/09	Hom	3/8"			No	22.89	64.86	48.22	65.7
B-4 11, 15.0'-16.5'	592	6/17/09	Hom	3/8"			No	16.64	51.69	41.66	40.1
B-4 12, 16.5'-18.0'	593	6/17/09	Hom	3/8"			No	22.18	56.45	46.29	42.1
B-4 13, 18.0'-19.5'	594	6/17/09	Hom	3/8"			No	20.22	59.23	48.23	39.3
B-4 14, 19.5'-21.0'	595	6/17/09	Hom	3/8"			No	17.94	56.07	45.03	40.8
B-4 15, 21.0'-22.5'	596	6/17/09	Hom	3/8"			No	17.90	48.99	40.45	37.9
B-4 16, 22.5'-24.0'	597	6/17/09	Hom	3/8"			No	16.59	47.05	38.25	40.6
B-4 17, 24.0'-25.5'	598	6/17/09	Hom	3/8"			No	20.49	51.99	42.44	43.5
B-4 18, 25.5'-27.0'	599	6/17/09	Hom	3/8"			No	23.01	54.16	44.46	45.2
B-4 19, 27.0'-28.5'	600	6/17/09	Hom	3/8"			No	16.30	44.22	35.99	41.8
B-4 20, 28.5'-30.0'	601	6/17/09	Hom	3/8"			No	20.84	61.06	47.88	48.7

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name CUF - TVA

Project Number 175539009

Tested By

Test Method ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-4 21, 30.0'-31.5'	602	6/17/09	Hom	3/8"			No	16.99	40.42	32.63	49.8
B-4 22, 31.5'-33.0'	603	6/17/09	Hom	3/8"			No	15.12	50.56	40.09	41.9
B-4 23, 33.0'-34.5'	604	6/17/09	Hom	3/8"			No	16.84	47.59	38.32	43.2
B-4 24, 34.5'-36.0'	605	6/17/09	Hom	3/8"			No	22.26	53.70	44.02	44.5
B-4 25, 36.0'-37.5'	606	6/17/09	Hom	3/8"			No	20.90	56.00	46.37	37.8
B-4 26, 37.5'-39.0'	607	6/17/09	Hom	3/8"			No	16.48	38.17	31.44	45.0
B-4 27, 39.0'-40.5'	608	6/17/09	Hom	3/8"			No	15.86	45.09	36.81	39.5
B-4 28, 40.5'-42.0'	609	6/17/09	Hom	3/8"			No	21.20	41.55	36.33	34.5
B-4 29, 42.0'-43.5'	610	6/17/09	Hom	3/8"			No	10.90	31.96	25.51	44.1
B-4 30, 43.5'-45.0'	612	6/17/09	Hom	3/8"			No	16.00	42.09	36.01	30.4
B-4 31, 45.0'-46.5'	613	6/17/09	Hom	3/8"			No	22.36	51.14	44.69	28.9
B-4 32, 47.5'-49.0'	614	6/17/09	Hom	3/8"			No	22.29	49.14	42.96	29.9
B-4 33, 50.0'-51.5'	615	6/17/09	Hom	3/8"			No	23.44	51.26	45.85	24.1
B-4 34, 52.5'-54.0'	616	6/17/09	Hom	3/8"			No	21.04	41.38	37.55	23.2
B-4 35, 55.0'-56.5'	617	6/17/09	Hom	3/8"			No	21.67	46.81	41.50	26.8
B-4 36, 57.5'-59.0'	618	6/17/09	Hom	3/8"			No	20.70	55.21	47.89	26.9
B-4 37, 60.0'-61.5'	619	6/17/09	Hom	3/8"			No	21.23	73.77	62.13	28.5
B-4 38, 62.5'-64.0'	620	6/17/09	Hom	3/8"			No	17.72	61.18	51.81	27.5
B-4 39, 65.0'-66.5'	621	6/17/09	Hom	3/8"			No	16.50	58.63	49.52	27.6
B-4 40, 67.5'-69.0'	622	6/17/09	Hom	3/8"			No	22.34	71.77	63.10	21.3
B-4 41, 70.0'-71.5'	623	6/17/09	Hom	3/8"			No	22.99	62.96	57.36	16.3
B-4 42, 72.5'-74.0'	624	6/17/09	Hom	3/8"			No	22.94	76.05	67.23	19.9
B-4 43, 75.0'-76.5'	625	6/17/09	Hom	3/8"			No	16.16	61.88	54.71	18.6
B-4 44, 77.5'-78.3'	626	6/17/09	Hom	3/8"			No	17.36	51.90	44.75	26.1
B-29, 0.0'-1.5'	627	6/18/09	Hom	3/4"			No	20.92	147.15	124.56	21.8
B-29, 1.5'-3.0'	628	6/18/09	Hom	3/4"			No	21.01	114.05	99.48	18.6
B-29, 3.0'-4.5'	629	6/18/09	Hom	3/4"			No	20.72	163.46	135.19	24.7
B-29, 4.5'-6.0'	630	6/18/09	Hom	3/4"			No	20.88	171.71	142.33	24.2
B-29, 6.0'-7.5'	631	6/18/09	Hom	3/4"			No	21.00	183.49	157.95	18.6
B-29, 7.5'-9.0'	632	6/18/09	Hom	3/4"			No	20.96	162.43	136.80	22.1
B-29, 9.0'-10.5'	633	6/18/09	Hom	3/4"			No	20.87	177.44	153.97	17.6

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name CUF - TVA

Project Number 175539009
Tested By
Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-29, 10.5'-12.0'	634	6/18/09	Hom	3/4"			No	20.73	180.19	153.99	19.7
B-29, 12.0'-13.5'	635	6/18/09	Hom	3/4"			No	21.05	140.53	107.34	38.5
B-29, 13.5'-15.0'	636	6/18/09	Hom	3/4"			No	20.70	147.03	129.99	15.6
B-29, 15.0'-16.5'	637	6/18/09	Hom	3/4"			No	20.62	140.58	121.65	18.7
B-29, 16.5'-18.0'	638	6/18/09	Hom	3/8"			No	20.96	188.72	157.71	22.7
B-29, 18.0'-19.5'	639	6/18/09	Hom	3/8"			No	20.69	123.25	102.09	26.0
B-29, 19.5'-21.0'	640	6/18/09	Hom	No. 4			Yes	20.67	165.11	122.55	41.8
B-29, 21.0'-22.5'	641	6/18/09	Hom	No. 4			Yes	20.62	183.21	131.09	47.2
B-29, 22.5'-24.0'	642	6/18/09	Hom	No. 4			No	20.79	168.45	117.98	51.9
B-29, 24.0'-25.5'	643	6/18/09	Hom	No. 4			Yes	20.64	172.52	125.44	44.9
B-29, 25.5'-27.0'	644	6/18/09	Hom	No. 4			No	20.72	164.22	116.86	49.3
B-29, 27.0'-28.5'	645	6/18/09	Hom	3/8"			No	21.12	114.99	95.24	26.6
B-29, 28.5'-30.0'	646	6/18/09	Hom	No. 4			No	20.85	136.19	114.75	22.8
B-29, 30.0'-31.5'	647	6/18/09	Hom	No. 4			No	20.63	122.48	97.82	31.9
B-29, 31.5'-33.0'	648	6/18/09	Hom	No. 4			No	20.79	86.24	70.51	31.6
B-29, 35.0'-36.5'	649	6/18/09	Hom	3/8"			No	20.88	207.56	166.65	28.1
B-29, 37.5'-39.0'	650	6/18/09	Hom	3/8"			No	20.64	164.69	141.26	19.4
B-29, 40.0'-41.5'	651	6/18/09	Hom	3/8"			No	26.05	211.66	176.29	23.5
B-29, 42.5'-44.0'	652	6/18/09	Hom	No. 4			Yes	25.77	182.62	150.17	26.1
B-29, 45.0'-46.5'	653	6/18/09	Hom	No. 4			Yes	25.74	187.75	156.78	23.6
B-29, 47.5'-49.0'	654	6/18/09	Hom	No. 4			Yes	26.03	218.14	181.57	23.5
B-29, 50.0'-51.5'	655	6/18/09	Hom	No. 4			Yes	25.98	277.11	224.16	26.7
B-29, 52.5'-54.0'	656	6/18/09	Hom	No. 4			Yes	26.16	250.92	181.23	44.9
B-29, 55.0'-55.8'	657	6/18/09	Hom	No. 4			No	25.82	118.78	102.21	21.7

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Dry Ash Stack and Gypsum Disposal Area

Project Number 175539009
Tested By
Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)

PRELIMINARY

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Gypsum Disposal Area and Dry Ash Stack

Project Number 175539009
Tested By
Test Method ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-19, 0.0'-1.5'	658	6/18/09	Hom	3/8"			No	25.59	168.76	156.27	9.6
B-19, 1.5'-3.0'	659	6/18/09	Hom	3/4"			No	26.14	197.18	180.00	11.2
B-19, 3.0'-4.5'	660	6/18/09	Hom	3/4"			No	25.79	241.00	219.80	10.9
B-19, 4.5'-6.0'	661	6/18/09	Hom	3/4"			No	25.15	180.55	154.21	20.4
B-19, 6.0'-7.5'	662	6/18/09	Hom	3/4"			No	25.93	208.85	182.01	17.2
B-19, 7.5'-9.0'	664	6/18/09	Hom	3/4"			No	25.99	208.52	186.20	13.9
B-19, 9.0'-10.5'	665	6/18/09	Hom	3/4"			No	26.09	186.84	154.89	24.8
B-19, 10.5'-12.0'	666	6/18/09	Hom	3/8"			No	26.18	196.37	165.51	22.1
B-19, 12.0'-13.5'	667	6/18/09	Hom	3/4"			No	25.82	186.22	159.55	19.9
B-19, 13.5'-15.0'	668	6/18/09	Hom	3/4"			No	25.92	198.01	164.56	24.1
B-19, 15.0'-16.5'	669	6/18/09	Hom	3/4"			No	26.08	136.33	119.11	18.5
B-19, 16.5'-18.0' NO RECOVERY	670	7/8/09									
B-19, 18.0'-19.5'	671	6/18/09	Hom	3/4"			No	26.15	139.51	121.84	18.5
B-19, 19.5'-21.0'	672	6/18/09	Hom	1 1/2"			No	20.85	44.87	40.22	24.0
B-19, 21.0'-22.5'	673	6/18/09	Hom	3/4"			No	20.65	166.87	149.38	13.6
B-19, 22.5'-24.0'	674	6/18/09	Hom	3/4"			No	20.98	141.41	122.51	18.6
B-19, 24.0'-25.5'	675	6/18/09	Hom	1 1/2"			No	20.76	38.90	35.96	19.3
B-19, 25.5'-27.0'	676	6/18/09	Hom	1 1/2"			No	20.86	40.65	37.57	18.4
B-19, 27.0'-28.5'	677	6/18/09	Hom	No. 4			No	20.72	152.18	120.10	32.3
B-19, 28.5'-30.0'	679	6/18/09	Hom	No. 4			Yes	20.86	163.95	120.97	42.9
B-19, 30.0'-31.5'	680	6/18/09	Hom	3/8"			No	21.29	74.91	61.13	34.6
B-19, 31.5'-33.0'	681	6/18/09	Hom	3/8"			No	21.14	165.49	137.64	23.9
B-19, 33.0'-34.5'	682	6/18/09	Hom	No. 4			Yes	21.60	179.29	133.03	41.5
B-19, 34.5'-36.0'	683	6/18/09	Hom	No. 4			No	21.04	150.72	106.07	52.5
B-19, 36.0'-37.5'	684	6/18/09	Hom	No. 10			Yes	26.18	213.03	163.44	36.1
B-19, 37.5'-39.0'	685	6/18/09	Hom	No. 10			Yes	25.90	265.74	223.44	21.4
B-19, 40.0'-41.5'	686	6/18/09	Hom	No. 10			Yes	25.51	238.32	198.27	23.2
B-19, 42.5'-44.0'	687	6/18/09	Hom	No. 10			Yes	26.07	202.00	175.38	17.8

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Gypsum Disposal Area and Dry Ash Stack

Project Number 175539009
Tested By
Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

PRELIMINARY

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-19, 45.0'-46.5'	688	6/18/09	Hom	3/8"			No	26.04	223.58	187.46	22.4
B-19, 47.5'-49.0'	689	6/18/09	Hom	3/4"			No	25.55	93.37	83.76	16.5
B-19, 50.0'-51.5'	690	6/18/09	Hom	3/4"			No	25.94	142.08	120.35	23.0
B-20, 0.0'-1.5'	692	6/18/09	Hom	No. 4			No	25.91	111.40	105.14	7.9
B-20, 1.5'-3.0'	693	6/18/09	Hom	No. 4			Yes	26.07	177.22	164.61	9.1
B-20, 3.0'-4.5'	694	6/18/09	Hom	No. 4			Yes	25.55	153.44	141.59	10.2
B-20, 4.5'-6.0'	695	6/18/09	Hom	No. 4			Yes	25.80	168.05	155.17	10.0
B-20, 6.0'-7.5'	696	6/18/09	Hom	No. 4			Yes	25.68	166.42	148.92	14.2
B-20, 7.5'-9.0'	697	6/18/09	Hom	No. 4			Yes	26.00	172.73	149.25	19.1
B-20, 9.0'-10.5'	698	6/18/09	Hom	No. 4			Yes	25.65	181.72	154.28	21.3
B-20, 10.5'-12.0'	699	6/18/09	Hom	No. 4			Yes	25.29	181.40	151.63	23.6
B-20, 12.0'-13.5'	700	6/18/09	Hom	No. 4			Yes	25.48	187.63	162.99	17.9
B-20, 13.5'-15.0'	701	6/18/09	Hom	No. 4			No	25.93	139.62	117.90	23.6
B-20, 15.0'-16.5'	702	6/18/09	Hom	No. 4			Yes	26.08	206.49	170.74	24.7
B-20, 16.5'-18.0'	703	6/18/09	Hom	No. 4			Yes	25.96	151.19	129.14	21.4
B-20, 18.0'-5.0'	704	6/18/09	Hom	3/8"			No	20.67	133.52	103.29	36.6
B-20, 19.5'-21.0' 1 Rock	705	6/18/09	Hom	3/4"			No	25.91	53.72	53.23	1.8
B-20, 21.0'-22.5'	706	6/18/09	Hom	No. 4			No	25.99	137.08	109.22	33.5
B-20, 22.5'-24.0'	707	6/18/09	Hom	No. 4			No	26.03	131.09	100.49	41.1
B-20, 24.0'-25.5'	708	6/18/09	Hom	No. 4			No	25.55	136.68	103.83	42.0
B-20, 25.5'-27.0'	709	6/18/09	Hom	No. 4			No	25.20	143.93	108.93	41.8
B-20, 27.0'-28.5'	710	6/18/09	Hom	No. 4			No	26.06	145.81	112.25	38.9
B-20, 28.5'-30.0'	711	6/18/09	Hom	No. 4			No	20.66	128.91	96.50	42.7
B-20, 30.0'-31.5'	712	6/18/09	Hom	No. 4			No	20.65	138.76	103.62	42.4
B-20, 31.5'-33.0'	713	6/18/09	Hom	No. 4			No	20.79	144.33	107.70	42.1
B-20, 33.0'-34.5'	714	6/18/09	Hom	No. 4			No	20.62	126.94	95.64	41.7
B-20, 34.5'-36.0'	715	6/18/09	Hom	No. 4			No	25.64	135.09	104.65	38.5
B-20, 36.0'-37.5'	716	6/18/09	Hom	No. 4			No	20.89	129.63	101.83	34.3
B-20, 37.5'-0.0'	717	6/18/09	Hom	No. 4			No	25.55	149.23	114.99	38.3
B-20, 39.0'-40.5'	718	6/18/09	Hom	No. 4			No	25.89	142.09	102.67	51.3
B-20, 40.5'-42.0'	719	6/18/09	Hom	No. 4			No	25.78	139.78	102.80	48.0

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Gypsum Disposal Area and Dry Ash Stack

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-20, 42.0'-43.5'	720	6/18/09	Hom	No. 4			No	25.99	142.46	108.15	41.8
B-20, 43.5'-45.0'	721	6/18/09	Len	3/8"			No	20.99	137.70	110.86	29.9
B-20, 45.0'-46.5'	722	6/18/09	Len	No. 4			Yes	20.88	157.10	130.61	24.1
B-20, 47.5'-49.0'	723	6/18/09	Hom	No. 4			No	25.83	150.38	123.06	28.1
B-20, 50.0'-51.5'	724	6/18/09	Hom	No. 4			Yes	20.74	147.85	121.35	26.3
B-20, 52.5'-54.0'	725	6/18/09	Hom	No. 4			Yes	20.76	147.68	123.28	23.8
B-20, 55.0'-55.5'	726	6/18/09	Hom	No. 4			No	20.86	146.43	119.25	27.6
B-18, 0.0'-1.5'	728	6/18/09	Hom	3/8"			No	20.60	137.24	127.86	8.7
B-18, 1.5'-3.0'	729	6/18/09	Hom	3/8"			No	20.68	141.40	122.83	18.2
B-18, 3.0'-4.5'	730	6/18/09	Hom	3/8"			No	21.01	124.02	105.94	21.3
B-18, 4.5'-6.0'	731	6/18/09	Hom	3/8"			No	21.00	126.16	112.47	15.0
B-18, 6.0'-7.5'	732	6/18/09	Hom	3/8"			No	26.01	144.11	134.71	8.6
B-18, 7.5'-9.0'	733	6/18/09	Hom	No. 4			No	25.86	143.70	121.74	22.9
B-18, 9.0'-10.5'	734	6/18/09	Hom	3/4"			No	25.97	159.37	156.13	2.5
B-18, 10.5'-12.0'	735	6/18/09	Hom	3/4"			No	21.05	147.91	144.13	3.1
B-18, 12.0'-13.5'	736	6/18/09	Hom	3/8"			No	20.85	142.31	111.32	34.3
B-18, 13.5'-15.0'	737	6/18/09	Hom	No. 4			No	21.15	129.41	97.04	42.7
B-18, 15.0'-16.5'	739	6/18/09	Hom	No. 4			No	20.95	157.37	120.14	37.5
B-18, 16.5'-18.0'	740	6/18/09	Hom	No. 4			No	20.67	155.28	113.87	44.4
B-18, 18.0'-19.5'	741	6/18/09	Hom	No. 4			No	20.90	151.61	114.56	39.6
B-18, 19.5'-21.0'	742	6/18/09	Hom	No. 4			No	21.22	142.32	103.87	46.5
B-18, 21.0'-22.5'	743	6/18/09	Hom	No. 4			No	21.03	143.74	114.90	30.7
B-18, 22.5'-24.0'	744	6/18/09	Hom	No. 4			Yes	20.89	190.59	164.13	18.5
B-18, 24.0'-25.5'	745	6/18/09	Hom	3/8"			No	20.94	144.14	108.25	41.1
B-18, 25.5'-27.0'	746	6/18/09	Hom	No. 4			No	20.95	144.52	107.28	43.1
B-18, 27.0'-28.5'	747	6/18/09	Hom	No. 4			No	20.74	148.12	114.00	36.6
B-18, 28.5'-30.0'	748	6/18/09	Hom	3/8"			No	20.66	178.52	136.89	35.8
B-18, 30.0'-31.5'	749	6/18/09	Hom	No. 4			No	21.01	133.45	102.71	37.6
B-18, 31.5'-33.0'	750	6/18/09	Hom	No. 4			No	20.67	142.39	107.76	39.8
B-18, 33.0'-34.5'	751	6/18/09	Hom	No. 4			No	20.96	144.95	114.66	32.3
B-18, 34.5'-36.0'	752	6/18/09	Hom	3/8"			No	21.00	150.46	120.67	29.9

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Gypsum Disposal Area and Dry Ash Stack

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-18, 36.0'-37.5'	753	6/18/09	Hom	No. 4			No	26.00	139.46	102.72	47.9
B-18, 37.5'-39.0'	754	6/18/09	Hom	No. 4			No	21.03	139.50	98.22	53.5
B-18, 39.0'-40.5'	755	6/18/09	Hom	No. 4			No	20.86	144.83	103.99	49.1
B-18, 40.5'-42.0'	756	6/18/09	Hom	No. 4			Yes	20.96	172.42	124.25	46.6
B-18, 42.0'-43.5'	757	6/18/09	Hom	No. 4			Yes	20.74	187.44	138.64	41.4
B-18, 43.5'-45.0'	758	6/18/09	Hom	No. 4			No	20.93	126.39	100.52	32.5
B-18, 45.0'-46.5' NO RECOVERY	759	7/8/09									
B-18, 47.5'-49.0'	760	6/18/09	Hom	No. 4			No	21.01	153.10	120.58	32.7
B-18, 50.0'-51.5'	761	6/18/09	Hom	No. 4			No	21.07	122.65	97.86	32.3
B-18, 52.5'-54.0'	762	6/18/09	Hom	No. 4			No	20.73	143.22	111.99	34.2
B-18, 55.0'-56.5'	763	6/18/09	Hom	No. 4			Yes	21.04	159.05	133.41	22.8
B-18, 57.5'-59.0'	764	6/18/09	Hom	No. 4			No	20.88	135.55	106.61	33.8
B-18, 60.0'-61.5'	765	6/18/09	Hom	No. 4			Yes	20.66	158.30	130.35	25.5
B-18, 62.5'-64.0'	766	6/18/09	Hom	No. 4			Yes	20.73	172.83	135.71	32.3
B-18, 65.0'-66.5'	767	6/18/09	Hom	3/4"			No	20.68	176.94	136.14	35.3

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Moisture Content of Soil
ASTM D 2216

Project Name TVA - Cumberland Fossil (CUF)

Project Number 175539009
Tested By KF/BB/CM

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

PRELIMINARY

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
5, 0.0'-1.5'	768	7/13/09	Hom	No. 4			Yes	21.25	161.22	139.22	18.6
5, 1.5'-3.0'	769	7/13/09	Hom	No. 4			Yes	20.89	157.69	133.54	21.4
5, 3.0'-4.5'	770	7/13/09	Hom	No. 4			Yes	21.35	159.53	136.84	19.6
5, 4.5'-6.0'	771	7/13/09	Hom	3/8"			No	20.73	152.60	129.96	20.7
5, 6.0'-7.5'	772	7/13/09	Hom	No. 4			Yes	20.99	157.23	132.59	22.1
5, 7.5'-9.0'	773	7/13/09	Hom	No. 4			Yes	21.34	152.06	126.63	24.2
5, 9.0'-10.5'	774	7/13/09	Hom	No. 4			Yes	20.89	151.20	126.74	23.1
5, 10.5'-12.0'	775	7/13/09	Hom	No. 4			Yes	21.12	158.60	128.62	27.9
5, 12.0'-13.5'	776	7/13/09	Hom	No. 4			Yes	21.21	155.30	128.67	24.8
5, 13.5'-15.0'	777	7/13/09	Hom	No. 4			Yes	20.78	157.90	130.72	24.7
5, 15.0'-16.5'	778	7/13/09	Hom	No. 4			Yes	21.06	163.82	137.03	23.1
5, 16.5'-18.0'	779	7/13/09	Hom	No. 4			Yes	20.99	163.73	137.38	22.6
5, 18.0'-20.0' No Sample	780	7/13/09									
5, 20.0'-22.0' No Sample	781	7/13/09									
5, 22.0'-23.5'	782	7/13/09	Hom	3/8"			No	20.99	167.41	141.17	21.8
5, 23.5'-25.0'	783	7/13/09	Hom	No. 4			Yes	20.98	157.10	128.57	26.5
5, 25.0'-26.5'	784	7/13/09	Hom	No. 4			Yes	20.90	159.18	129.83	26.9
5, 26.5'-28.0' No Sample	785	7/13/09									
5, 28.0'-29.5'	786	7/13/09	Hom	No. 4			Yes	20.69	152.45	121.17	31.1
5, 29.5'-31.0'	787	7/13/09	Hom	No. 4			Yes	20.80	168.11	131.37	33.2
5, 31.0'-32.5'	788	7/13/09	Hom	No. 4			Yes	21.80	162.45	126.55	34.3
5, 32.5'-34.0'	789	7/13/09	Hom	No. 4			Yes	20.97	160.71	124.39	35.1
5, 34.0'-35.5'	790	7/13/09	Hom	No. 4			Yes	21.07	159.41	123.40	35.2
5, 35.5'-37.0'	791	7/13/09	Hom	No. 4			Yes	20.77	186.05	140.89	37.6
5, 37.0'-38.5'	792	7/13/09	Hom	No. 4			Yes	21.17	167.11	131.57	32.2
5, 38.5'-40.0'	793	7/13/09	Hom	No. 4			Yes	21.08	158.52	126.25	30.7
5, 40.0'-41.5'	794	7/13/09	Hom	No. 4			Yes	20.79	197.91	158.58	28.5
5, 41.5'-43.0'	795	7/13/09	Hom	No. 4			Yes	21.16	177.63	140.37	31.3

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Moisture Content of Soil

ASTM D 2216

Project Name TVA - Cumberland Fossil (CUF)

Project Number 175539009

Tested By KF/BB/CM

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
5, 43.0'-44.5'	796	7/13/09	Hom	3/8"			No	20.75	169.81	128.79	38.0
5, 44.5'-46.0'	797	7/13/09	Hom	No. 4			No	20.78	186.09	118.19	69.7
5, 46.0'-47.5'	798	7/13/09	Hom	No. 4			Yes	25.82	208.18	135.69	66.0
5, 47.5'-49.0'	799	7/13/09	Hom	No. 4			No	21.09	160.81	111.94	53.8
5, 49.0'-49.7'	800	7/13/09	Hom	3/4"			No	21.17	166.37	131.85	31.2
8, 0.0'-1.5'	801	7/13/09	Hom	No. 4			Yes	20.94	159.79	137.94	18.7
8, 1.5'-3.0'	803	7/13/09	Hom	3/8"			No	26.36	168.97	150.81	14.6
8, 3.0'-4.5'	804	7/13/09	Hom	No. 4			Yes	21.10	148.54	129.55	17.5
8, 4.5'-6.0'	805	7/13/09	Hom	3/8"			No	20.86	160.47	138.61	18.6
8, 6.0'-7.5'	806	7/13/09	Hom	3/8"			No	21.18	177.25	143.05	28.1
8, 7.5'-9.0'	807	7/13/09	Hom	No. 4			Yes	20.94	150.17	129.93	18.6
8, 9.0'-10.5'	808	7/13/09	Hom	No. 4			Yes	20.95	153.13	128.47	22.9
8, 10.5'-12.0'	809	7/13/09	Hom	No. 4			Yes	21.02	162.21	135.71	23.1
8, 12.0'-13.5'	810	7/13/09	Hom	No. 4			Yes	21.00	158.63	130.92	25.2
8, 13.5'-15.0'	811	7/13/09	Hom	3/8"			No	21.16	180.94	147.79	26.2
8, 15.0'-16.5'	812	7/13/09	Hom	No. 4			Yes	20.77	159.42	127.18	30.3
8, 16.5'-18.0'	813	7/13/09	Hom	3/8"			No	20.73	178.57	143.38	28.7
8, 18.0'-19.5'	814	7/13/09	Hom	No. 4			Yes	20.64	169.91	138.45	26.7
8, 19.5'-21.0'	815	7/13/09	Hom	No. 4			Yes	25.34	168.31	139.72	25.0
8, 21.0'-22.5'	816	7/13/09	Hom	3/8"			No	21.01	183.94	153.18	23.3
8, 22.5'-24.0'	817	7/13/09	Hom	No. 4			Yes	25.55	172.42	143.85	24.2
8, 24.0'-25.5'	818	7/13/09	Hom	No. 4			Yes	21.27	160.88	137.88	19.7
8, 25.5'-27.0'	819	7/13/09	Hom	No. 4			Yes	20.63	166.24	142.13	19.8
8, 27.0'-28.5'	820	7/13/09	Hom	No. 4			Yes	21.41	165.63	141.10	20.5
8, 28.5'-30.0'	821	7/13/09	Hom	3/8"			No	21.11	162.97	140.74	18.6
8, 30.0'-31.5'	822	7/13/09	Hom	3/8"			No	20.74	173.42	145.62	22.3
8, 31.5'-33.0'	823	7/13/09	Hom	No. 4			Yes	20.90	150.44	127.08	22.0
8, 33.0'-34.5'	824	7/13/09	Hom	No. 4			Yes	20.72	163.03	135.86	23.6
8, 34.5'-36.0'	825	7/13/09	Hom	No. 4			Yes	26.10	168.79	136.58	29.2
8, 36.0'-37.5'	826	7/13/09	Hom	No. 4			Yes	20.75	176.95	138.27	32.9
8, 37.5'-39.0'	827	7/13/09	Hom	No. 4			Yes	20.86	165.96	140.59	21.2

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Moisture Content of Soil
ASTM D 2216

Project Name TVA - Cumberland Fossil (CUF)

Project Number 175539009
Tested By KF/BB/CM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Test Method ASTM

Material Type: Stratified, Laminated, Lensed, Homogeneous

PRELIMINARY

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
8, 39.0'-40.5'	828	7/13/09	Hom	No. 4			Yes	21.00	172.03	146.87	20.0
8, 40.5'-41.9'	829	7/13/09	Hom	3/8"			No	20.87	168.06	150.84	13.2
8, 42.0'-32.8'	830	7/13/09	Hom	No. 4			Yes	20.99	163.79	144.58	15.5
11, 0.0'-1.5'	831	7/13/09	Hom	No. 4			Yes	25.14	162.74	140.09	19.7
11, 1.5'-3.0'	832	7/13/09	Hom	3/8"			No	20.83	29.26	28.90	4.5
11, 3.0'-4.5'	833	7/13/09	Hom	No. 4			Yes	20.79	149.52	131.08	16.7
11, 4.5'-6.0'	834	7/13/09	Hom	No. 4			Yes	20.80	159.81	139.31	17.3
11, 6.0'-7.5'	835	7/13/09	Hom	No. 4			Yes	25.87	159.70	133.31	24.6
11, 7.5'-9.0'	836	7/13/09	Hom	3/8"			No	25.91	156.38	135.26	19.3
11, 9.0'-10.5'	837	7/13/09	Hom	No. 4			Yes	21.18	153.42	127.65	24.2
11, 10.5'-12.0'	838	7/13/09	Hom	No. 4			No	26.36	149.13	126.32	22.8
11, 12.0'-13.5'	839	7/13/09	Hom	3/8"			No	25.95	158.59	133.45	23.4
11, 13.5'-15.0'	840	7/13/09	Hom	No. 4			Yes	20.98	154.97	130.29	22.6
11, 15.0'-16.5'	842	7/13/09	Hom	No. 4			Yes	20.86	156.94	129.70	25.0
11, 16.5'-18.0'	843	7/13/09	Hom	3/8"			No	26.01	182.53	154.41	21.9
11, 18.0'-19.5'	844	7/13/09	Hom	No. 4			Yes	26.05	174.21	147.87	21.6
11, 19.5'-21.0'	845	7/13/09	Hom	No. 4			Yes	26.08	156.10	132.31	22.4
11, 21.0'-22.5'	846	7/13/09	Hom	3/8"			No	25.90	182.94	156.33	20.4
11, 22.5'-24.0'	847	7/13/09	Hom	No. 4			Yes	26.04	161.22	134.09	25.1
11, 24.0'-25.5'	848	7/13/09	Hom	No. 4			Yes	25.87	172.03	143.81	23.9
11, 25.5'-27.0'	849	7/13/09	Hom	No. 4			Yes	20.87	160.09	134.07	23.0
11, 27.0'-28.5'	850	7/13/09	Hom	No. 4			Yes	21.28	161.84	134.37	24.3
11, 28.5'-30.0'	851	7/13/09	Hom	No. 4			Yes	20.70	169.15	141.47	22.9
11, 30.0'-31.5'	852	7/13/09	Hom	No. 4			Yes	25.14	175.85	145.99	24.7
11, 31.5'-33.0'	853	7/13/09	Hom	No. 4			Yes	20.96	170.66	141.14	24.6
11, 33.0'-34.5'	854	7/13/09	Hom	No. 4			Yes	20.98	173.19	143.62	24.1
11, 34.5'-36.0'	855	7/13/09	Hom	No. 4			Yes	20.87	211.27	178.66	20.7
11, 36.0'-37.5'	856	7/13/09	Hom	3/8"			No	21.15	234.58	200.95	18.7
11, 37.5'-39.0'	857	7/13/09	Hom	No. 4			Yes	21.06	161.34	133.92	24.3
11, 39.0'-40.5'	858	7/13/09	Hom	3/8"			No	20.75	165.03	135.82	25.4
11, 40.5'-42.0'	859	7/13/09	Hom	3/8"			No	26.02	180.90	151.41	23.5

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name TVA - Cumberland Fossil (CUF)

Project Number 175539009
Tested By KF/BB/CM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Test Method ASTM

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
11, 42.0'-43.5'	860	7/13/09	Len	No. 4			Yes	20.91	177.93	140.67	31.1
11, 43.5'-45.0'	861	7/13/09	Hom	3/8"			No	20.73	167.07	140.60	22.1
11, 45.0'-46.5'	862	7/13/09	Hom	3/8"			No	20.75	183.20	157.55	18.8
11, 46.5'-48.0'	863	7/13/09	Hom	3/8"			No	26.04	201.78	168.42	23.4
11, 48.0'-49.5'	864	7/13/09	Hom	3/4"			No	26.08	203.03	169.67	23.2
11, 49.5'-51.0'	865	7/13/09	Hom	3/4"			No	25.92	192.81	168.19	17.3
11, 51.0'-52.5'	866	7/13/09	Hom	3/4"			No	26.23	208.85	179.45	19.2
11, 52.5'-54.0'	867	7/13/09	Hom	3/4"			No	25.86	229.08	190.25	23.6
11, 54.0'-54.6'	868	7/13/09	Hom	3/4"			No	21.17	99.61	88.27	16.9
11, 55.9' No Sample	869	7/13/09									
14, 0.0'-1.5'	870	7/13/09	Hom	3/8"			No	20.82	182.26	154.11	21.1
14, 1.5'-3.0'	872	7/13/09	Hom	3/8"			No	25.89	189.37	163.71	18.6
14, 3.0'-4.5'	873	7/13/09	Hom	3/8"			No	20.80	177.24	153.22	18.1
14, 4.5'-6.0'	874	7/13/09	Hom	3/8"			No	25.90	178.15	155.01	17.9
14, 6.0'-7.5'	875	7/13/09	Hom	3/8"			No	25.98	166.39	143.54	19.4
14, 7.5'-9.0'	876	7/13/09	Hom	3/8"			No	26.14	160.53	135.85	22.5
14, 9.0'-10.5'	877	7/13/09	Hom	3/8"			No	26.03	189.27	158.65	23.1
14, 10.5'-12.0'	878	7/13/09	Hom	3/8"			No	25.43	178.39	151.84	21.0
14, 12.0'-13.5'	879	7/13/09	Hom	3/8"			No	20.95	181.60	156.05	18.9
14, 13.5'-15.0'	880	7/13/09	Hom	3/8"			No	20.79	164.12	139.63	20.6
14, 15.0'-16.5'	881	7/13/09	Hom	3/8"			No	21.04	178.94	146.26	26.1
14, 16.5'-18.0'	882	7/13/09	Hom	3/8"			No	26.05	160.29	135.66	22.5
14, 18.0'-19.5'	883	7/13/09	Hom	3/8"			No	25.72	174.45	146.94	22.7
14, 19.5'-21.0'	884	7/13/09	Hom	3/8"			No	26.05	184.21	153.83	23.8
14, 21.0'-22.5'	885	7/13/09	Hom	3/8"			No	25.21	172.22	143.85	23.9
14, 22.5'-24.0'	886	7/13/09	Hom	3/8"			No	26.32	176.54	147.99	23.5
14, 24.0'-25.5'	887	7/13/09	Hom	3/8"			No	25.83	174.60	155.07	15.1
14, 25.5'-27.0'	888	7/13/09	Hom	3/8"			No	25.58	190.86	168.38	15.7
14, 27.0'-27.3'	889	7/13/09	Len	3/8"			No	26.12	170.59	144.44	22.1
14, 28.5'-30.0'	890	7/13/09	Hom	3/8"			No	25.95	182.91	151.09	25.4
14, 30.0'-31.5'	891	7/13/09	Hom	No. 4			Yes	26.05	168.50	138.12	27.1

Moisture Content of Soil

ASTM D 2216

Project Name TVA - Cumberland Fossil (CUF)

Project Number 175539009

Tested By KF/BB/CM

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
14, 31.5'-33.0'	892	7/13/09	Hom	No. 4			Yes	20.80	166.12	136.44	25.7
14, 33.0'-34.5'	893	7/13/09	Hom	No. 4			Yes	25.90	174.53	144.96	24.8
14, 35.0'-36.5'	894	7/13/09	Hom	No. 4			Yes	21.01	168.18	137.79	26.0
14, 37.5'-39.0'	895	7/13/09	Hom	3/4"			No	20.95	149.44	119.77	30.0
14, 40.0'-41.5' No Sample	897	7/13/09									
14, 42.5'-44.0'	898	7/13/09	Hom	3/8"			No	25.98	179.95	133.76	42.9
14, 45.0'-46.5'	899	7/13/09	Hom	No. 4			Yes	26.11	221.23	178.21	28.3
14, 47.5'-49.0'	900	7/13/09	Hom	3/8"			No	25.42	169.54	140.50	25.2
14, 50.0'-51.5'	901	7/13/09	Hom	3/4"			No	26.22	197.97	167.50	21.6
14, 52.5'-54.0'	903	7/13/09	Hom	3/4"			No	25.91	190.47	162.40	20.6
14, 55.0'-56.5'	904	7/13/09	Hom	3/4"			No	25.89	200.17	169.06	21.7
14, 57.5'-59.0'	905	7/13/09	Hom	3/4"			No	26.04	207.96	176.14	21.2
14, 60.0'-61.5'	906	7/13/09	Hom	3/4"			No	20.83	76.78	72.92	7.4
14, 62.5'-64.0'	907	7/13/09	Hom	3/4"			No	20.79	166.85	138.55	24.0
14, 65.0'-66.2'	908	7/13/09	Hom	3/4"			No	25.93	210.90	171.47	27.1
26, 0.0'-1.5'	909	7/13/09	Hom	3/8"			No	20.86	159.53	132.69	24.0
26, 1.5'-3.0'	911	7/13/09	Hom	3/8"			No	26.01	162.15	139.68	19.8
26, 3.0'-4.5'	912	7/13/09	Hom	3/8"			No	26.07	159.05	132.41	25.1
26, 4.5'-6.0'	913	7/13/09	Hom	3/8"			No	26.02	182.51	154.23	22.1
26, 6.0'-7.5'	914	7/13/09	Hom	3/8"			No	20.88	163.93	144.21	16.0
26, 7.5'-9.0'	915	7/13/09	Hom	3/8"			No	25.13	171.61	149.10	18.2
26, 9.0'-10.5'	916	7/13/09	Hom	No. 4			Yes	21.19	151.68	132.87	16.8
26, 10.5'-12.0'	917	7/13/09	Hom	3/8"			No	21.28	158.98	137.54	18.4
26, 12.0'-13.5'	918	7/13/09	Hom	3/8"			No	20.96	166.58	140.01	22.3
26, 13.5'-15.0'	919	7/13/09	Hom	No. 4			Yes	21.48	160.75	139.10	18.4
26, 15.0'-16.5'	921	7/13/09	Hom	No. 4			Yes	20.92	159.74	136.95	19.6
26, 16.5'-18.0'	922	7/13/09	Hom	No. 4			Yes	20.90	160.61	136.94	20.4
26, 18.0'-19.5'	923	7/13/09	Hom	No. 4			Yes	20.72	166.42	141.60	20.5
26, 19.5'-21.0'	924	7/13/09	Hom	3/8"			No	20.94	151.89	119.83	32.4
26, 21.0'-22.5'	925	7/13/09	Hom	3/8"			No	26.12	169.88	141.67	24.4
26, 22.5'-24.0'	926	7/13/09	Hom	No. 4			Yes	25.83	164.68	143.13	18.4

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Moisture Content of Soil
ASTM D 2216

Project Name TVA - Cumberland Fossil (CUF)

Project Number 175539009
Tested By KF/BB/CM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Test Method ASTM

PRELIMINARY

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
26, 24.0'-25.5'	927	7/13/09	Hom	No. 4			Yes	25.21	172.38	144.72	23.1
26, 25.5'-27.0'	928	7/13/09	Hom	No. 4			Yes	26.02	183.76	154.18	23.1
26, 27.0'-28.5'	929	7/13/09	Hom	No. 4			Yes	25.93	185.81	153.76	25.1
26, 28.5'-30.0'	930	7/13/09	Hom	No. 4			Yes	25.56	179.57	148.60	25.2
26, 30.0'-31.5'	931	7/13/09	Hom	No. 4			Yes	20.79	187.80	155.34	24.1
26, 31.5'-32.7'	932	7/13/09	Hom	No. 4			Yes	21.01	195.19	159.38	25.9
26, 37.5'-39.0'	933	7/13/09	Hom	No. 4			Yes	21.00	196.93	164.33	22.7
26, 39.0'-40.5'	934	7/13/09	Hom	3/4"			No	21.04	206.28	172.79	22.1
26, 40.5'-42.0'	935	7/13/09	Hom	3/4"			No	20.90	175.60	146.75	22.9
26, 42.0'-43.5'	936	7/13/09	Hom	3/4"			No	20.82	216.24	180.42	22.4
26, 43.5'-45.0'	937	7/13/09	Hom	3/8"			No	25.70	195.47	165.49	21.4
26, 45.0'-46.5'	938	7/13/09	Hom	3/4"			No	25.93	207.22	174.48	22.0
26, 47.5'-49.0'	939	7/13/09	Hom	3/4"			No	21.22	190.82	161.14	21.2
26, 50.0'-51.5'	940	7/13/09	Hom	3/4"			No	26.04	195.37	168.44	18.9
26, 52.5'-54.0'	941	7/13/09	Hom	3/4"			No	25.85	213.54	180.06	21.7
26, 55.0'-56.5'	942	7/13/09	Hom	3/4"			No	20.77	180.40	152.06	21.6
26, 57.5'-59.0'	943	7/13/09	Hom	3/8"			No	25.64	144.05	127.32	16.5
30, 0.0'-1.5'	945	7/13/09	Hom	3/8"			No	21.21	176.00	149.69	20.5
30, 1.5'-3.0'	946	7/13/09	Hom	3/8"			No	21.02	164.13	140.12	20.2
30, 3.0'-4.5'	947	7/13/09	Hom	3/8"			No	21.04	163.91	141.76	18.3
30, 4.5'-6.0'	948	7/13/09	Hom	3/8"			No	21.16	168.31	142.24	21.5
30, 6.0'-7.5'	949	7/13/09	Hom	3/4"			No	20.84	168.39	149.08	15.1
30, 7.5'-9.0'	950	7/13/09	Hom	3/4"			No	20.85	177.89	154.10	17.9
30, 9.0'-10.5'	952	7/13/09	Hom	3/8"			No	20.96	164.74	140.74	20.0
30, 10.5'-12.0'	953	7/13/09	Hom	No. 4			Yes	21.15	163.11	139.76	19.7
30, 12.0'-13.5'	954	7/13/09	Hom	No. 4			Yes	20.92	162.05	138.14	20.4
30, 13.5'-15.0'	955	7/13/09	Hom	No. 4			Yes	21.09	162.24	138.53	20.2
30, 15.0'-16.5'	956	7/13/09	Hom	No. 4			Yes	21.15	165.93	142.27	19.5
30, 16.5'-18.0'	957	7/13/09	Hom	No. 4			Yes	20.78	180.74	151.84	22.1
30, 18.0'-19.5'	958	7/13/09	Hom	3/8"			No	21.77	169.91	138.51	26.9
30, 19.5'-21.0'	959	7/13/09	Hom	3/8"			No	20.69	172.24	142.17	24.8

Moisture Content of Soil

ASTM D 2216

Project Name TVA - Cumberland Fossil (CUF)

Project Number 175539009

Tested By KF/BB/CM

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
30, 21.0'-22.5'	960	7/13/09	Hom	No. 4			Yes	25.84	167.66	142.14	21.9
30, 22.5'-24.0'	961	7/13/09	Hom	No. 4			Yes	26.49	168.66	144.00	21.0
30, 24.0'-25.5'	962	7/13/09	Len	No. 4			Yes	21.11	161.26	135.09	23.0
30, 25.5'-27.0'	963	7/13/09	Hom	No. 4			Yes	20.80	181.04	151.52	22.6
30, 27.0'-27.9'	964	7/13/09	Hom	No. 4			Yes	20.80	174.17	147.06	21.5
30, 28.5'-30.0'	965	7/13/09	Hom	3/4"			No	21.08	227.60	186.65	24.7
30, 30.0'-30.9'	966	7/13/09	Hom	3/4"			No	21.07	194.29	163.97	21.2
30, 31.5'-32.8'	967	7/13/09	Hom	3/4"			No	20.83	104.35	97.39	9.1
30, 33.0'-36.5' No Sample	968	7/13/09									
34, 0.0'-1.5'	970	7/13/09	Hom	No. 10			Yes	16.68	67.65	59.96	17.8
34, 1.5'-3.0'	971	7/13/09	Hom	No. 10			Yes	20.72	72.83	64.92	17.9
34, 3.0'-4.5'	972	7/13/09	Hom	3/8"			No	21.15	175.38	147.00	22.6
34, 4.5'-6.0'	973	7/13/09	Hom	3/8"			No	21.14	176.67	148.95	21.7
34, 6.0'-7.5'	974	7/13/09	Hom	3/8"			No	26.02	206.83	168.40	27.0
34, 7.5'-9.0'	976	7/13/09	Hom	No. 10			Yes	22.35	87.66	77.02	19.5
34, 9.0'-10.5'	977	7/13/09	Hom	No. 10			Yes	22.84	78.07	70.48	15.9
34, 10.5'-12.0'	978	7/13/09	Hom	No. 4			Yes	20.96	175.31	147.79	21.7
34, 12.0'-13.5'	979	7/13/09	Hom	No. 10			Yes	17.24	83.58	71.55	22.2
34, 13.5'-15.0'	980	7/13/09	Hom	No. 4			No	16.71	90.97	78.57	20.0
34, 15.0'-16.5'	981	7/13/09	Hom	No. 4			No	20.69	84.96	74.09	20.4
34, 16.5'-18.0'	982	7/13/09	Hom	No. 10			Yes	15.21	79.48	65.63	27.5
34, 18.0'-19.5'	983	7/13/09	Hom	No. 10			Yes	15.49	72.58	61.69	23.6
34, 19.5'-21.0'	984	7/13/09	Hom	No. 10			Yes	15.99	62.29	54.61	19.9
34, 21.0'-22.5'	985	7/13/09	Len	No. 10			Yes	16.47	69.39	59.15	24.0
34, 22.5'-24.0'	986	7/13/09	Len	No. 10			Yes	17.57	69.62	55.73	36.4
34, 24.0'-24.7'	987	7/13/09	Len	No. 4			Yes	25.87	171.25	143.03	24.1
38, 0.0'-1.5'	988	7/13/09	Hom	No. 10			Yes	22.30	73.42	65.45	18.5
38, 1.5'-3.0'	989	7/13/09	Hom	No. 10			Yes	22.33	88.81	76.94	21.7
38, 3.0'-4.5'	990	7/13/09	Hom	No. 4			Yes	20.83	169.55	140.37	24.4
38, 4.5'-6.0'	991	7/13/09	Hom	No. 10			Yes	21.68	179.54	150.36	22.7
38, 6.0'-7.5'	992	7/13/09	Len	No. 4			Yes	20.90	180.76	152.89	21.1

Moisture Content of Soil

ASTM D 2216

Project Name TVA - Cumberland Fossil (CUF)

Project Number 175539009

Tested By KF/BB/CM

Test Method ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
38, 7.5'-9.0'	993	7/13/09	Len	No. 4			Yes	20.75	178.37	149.69	22.2
38, 9.0'-10.5'	994	7/13/09	Hom	3/8"			No	21.14	160.69	136.59	20.9
38, 10.5'-12.0'	995	7/13/09	Hom	No. 4			Yes	21.00	169.91	146.83	18.3
38, 12.0'-13.5'	996	7/13/09	Hom	3/8"			No	20.70	179.38	154.79	18.3
38, 13.5'-15.0'	997	7/13/09	Len	No. 10			Yes	21.14	196.47	160.12	26.2
38, 15.0'-16.5'	998	7/13/09	Hom	No. 10			Yes	21.08	195.02	159.26	25.9
38, 16.5'-18.0'	999	7/13/09	Hom	No. 10			Yes	20.82	175.80	146.49	23.3
38, 18.0'-19.5'	1000	7/13/09	Hom	No. 10			Yes	21.14	175.31	132.65	38.3
38, 19.5'-20.1'	1001	7/13/09	Hom	No. 10			Yes	21.09	194.50	147.42	37.3
39, 0.0'-1.5'	1002	7/13/09	Hom	3/8"			No	21.01	197.90	189.54	5.0
39, 1.5'-3.0'	1003	7/13/09	Hom	No. 4			Yes	20.92	168.79	147.98	16.4
39, 3.0'-4.5'	1004	7/13/09	Hom	No. 4			Yes	26.00	173.87	153.34	16.1
39, 4.5'-6.0'	1005	7/13/09	Hom	No. 4			Yes	20.80	175.91	147.04	22.9
39, 6.0'-7.5'	1006	7/13/09	Hom	3/8"			No	25.84	162.89	137.79	22.4
39, 7.5'-9.0'	1007	7/13/09	Hom	No. 4			Yes	20.99	164.84	132.59	28.9
39, 9.0'-9.1'	1008	7/13/09	Hom	3/4"			No	21.02	73.61	70.09	7.2
39, 10.5'-10.6' No Sample	1009										
39, 10.6'-12.0' No Sample	1010										
39, 12.0'-19.2' No Sample	1011										
40, 0.0'-1.5'	1012	7/13/09	Hom	3/8"			No	20.81	174.76	163.54	7.9
40, 1.5'-3.0'	1013	7/13/09	Hom	3/4"			No	21.10	186.42	177.69	5.6
40, 3.0'-4.5'	1014	7/13/09	Hom	3/8"			No	25.68	178.53	169.05	6.6
40, 4.5'-6.0'	1015	7/13/09	Hom	3/4"			No	26.00	188.10	176.07	8.0
40, 6.0'-7.5'	1016	7/13/09	Hom	3/4"			No	25.82	190.73	183.05	4.9
40, 7.5'-9.0'	1017	7/17/09	Hom	3/8"			No	20.80	180.60	149.82	23.9
40, 9.0'-10.5'	1018	7/17/09	Hom	3/8"			No	25.74	158.38	145.53	10.7
40, 10.5'-12.0'	1019	7/17/09	Hom	3/4"			No	25.91	197.63	185.79	7.4
40, 12.0'-13.5'	1020	7/17/09	Hom	3/8"			No	20.79	183.86	166.15	12.2
40, 13.5'-15.0'	1021	7/17/09	Hom	3/8"			No	21.08	180.65	162.53	12.8
40, 15.0'-16.5'	1022	7/17/09	Hom	3/8"			No	25.86	205.84	180.40	16.5
40, 16.5'-18.0'	1023	7/17/09	Hom	No. 4			Yes	20.81	176.51	135.15	36.2

Moisture Content of Soil

ASTM D 2216

Project Name TVA - Cumberland Fossil (CUF)

Project Number 175539009

Tested By KF/BB/CM

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

PRELIMINARY

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
40, 18.0'-19.5'	1024	7/17/09	Hom	No. 10			Yes	25.90	183.88	132.48	48.2
40, 19.5'-21.0'	1025	7/17/09	Hom	No. 10			Yes	20.93	196.00	148.90	36.8
40, 21.0'-22.5'	1026	7/17/09	Hom	No. 10			Yes	20.79	177.44	128.31	45.7
40, 22.5'-24.0'	1027	7/17/09	Hom	No. 10			Yes	26.30	202.52	147.92	44.9
40, 24.0'-25.5'	1028	7/17/09	Hom	No. 10			Yes	20.96	208.09	142.04	54.6
40, 25.5'-27.0'	1029	7/17/09	Hom	No. 10			Yes	21.19	216.54	153.48	47.7
40, 27.0'-28.5'	1030	7/17/09	Len	No. 10			Yes	26.00	171.90	145.91	21.7
40, 28.5'-30.0'	1031	7/17/09	Hom	No. 4			Yes	21.42	180.63	150.87	23.0
40, 30.0'-31.5'	1032	7/17/09	Hom	No. 10			Yes	26.08	176.91	140.19	32.2
41, 0.0'-1.5'	1034	7/17/09	Hom	No. 10			Yes	21.13	121.28	113.17	8.8
41, 0.1'-2.1' No Sample	1035	7/17/09									
41, 1.5'-3.0'	1036	7/17/09	Hom	No. 10			Yes	20.64	99.90	93.49	8.8
41, 3.0'-4.5'	1037	7/17/09	Hom	No. 10			Yes	20.99	116.62	102.14	17.8
41, 4.5'-6.0'	1038	7/17/09	Hom	No. 10			Yes	25.55	140.31	118.38	23.6
41, 6.0'-7.5'	1039	7/17/09	Hom	No. 10			Yes	21.01	115.96	99.92	20.3
41, 7.5'-9.0'	1040	7/17/09	Hom	No. 10			Yes	20.71	119.68	104.55	18.0
41, 9.0'-10.5'	1041	7/17/09	Hom	No. 10			Yes	20.78	129.32	113.09	17.6
41, 10.5'-12.0'	1042	7/17/09	Hom	No. 10			Yes	21.04	100.79	90.19	15.3
41, 12.0'-12.9'	1043	7/17/09	Hom	No. 10			Yes	21.42	84.42	78.70	10.0
41, 13.5'-14.3'	1044	7/17/09	Hom	No. 10			Yes	20.69	119.12	104.85	17.0
41, 15.0'-15.9'	1045	7/17/09	Hom	No. 10			Yes	20.95	87.19	74.97	22.6
41, 16.5'-17.3'	1046	7/17/09	Hom	No. 10			Yes	21.22	107.85	94.15	18.8
41, 18.0'-19.5'	1047	7/17/09	Hom	No. 10			Yes	20.94	120.20	99.66	26.1
41, 19.5'-21.0'	1048	7/17/09	Hom	No. 10			Yes	21.35	119.27	100.52	23.7
41, 21.0'-22.5'	1049	7/17/09	Hom	No. 4			Yes	20.85	162.61	132.64	26.8
41, 22.5'-24.0'	1050	7/17/09	Hom	No. 4			Yes	20.99	180.31	147.28	26.2
41, 24.0'-25.5'	1052	7/17/09	Hom	No. 10			Yes	20.90	145.45	120.41	25.2
41, 25.5'-27.0'	1053	7/17/09	Hom	No. 10			Yes	21.13	127.63	103.93	28.6
41, 27.0'-28.5'	1054	7/17/09	Hom	No. 10			Yes	20.97	121.47	95.00	35.8
41, 28.5'-30.0'	1055	7/17/09	Hom	No. 10			Yes	21.16	92.81	72.17	40.5
41, 30.0'-31.5'	1056	7/17/09	Hom	No. 10			Yes	21.05	103.75	77.99	45.2

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name TVA - Cumberland Fossil (CUF)

Project Number 175539009
Tested By KF/BB/CM
Test Method ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
41, 31.5'-33.0'	1057	7/17/09	Hom	No. 10			Yes	21.08	103.89	79.76	41.1
41, 33.0'-34.5'	1058	7/17/09	Hom	No. 10			Yes	21.04	114.34	84.67	46.6
41, 34.5'-36.0'	1059	7/17/09	Hom	No. 10			Yes	20.79	129.41	94.27	47.8
41, 36.0'-37.5'	1060	7/17/09	Hom	3/8"			No	20.83	129.21	104.60	29.4
41, 37.5'-39.0'	1061	7/17/09	Hom	3/8"			No	21.19	145.87	113.34	35.3
41, 39.0'-40.4' No Sample	1062	7/17/09									
41, 41.0'-42.5'	1063	7/17/09	Hom	No. 10			Yes	21.08	75.54	73.40	4.1
41, 42.5'-44.0'	1064	7/17/09	Hom	No. 4			Yes	21.06	143.42	122.88	20.2
41, 44.0'-44.9'	1065	7/17/09	Hom	No. 4			No	21.02	137.05	110.10	30.3
42, 0.0'-1.5'	1066	7/17/09	Hom	No. 4			No	21.26	117.82	110.47	8.2
42, 1.5'-3.0'	1067	7/17/09	Len	3/8"			No	20.65	157.28	136.26	18.2
42, 3.0'-4.5'	1068	7/17/09	Hom	3/8"			No	25.33	128.73	108.68	24.1
42, 4.5'-6.0'	1070	7/17/09	Hom	3/8"			No	25.55	144.39	124.89	19.6
42, 6.0'-7.5'	1071	7/17/09	Hom	3/8"			No	25.95	148.33	125.91	22.4
42, 7.5'-9.0'	1072	7/17/09	Hom	3/8"			No	25.93	150.16	129.58	19.9
42, 9.0'-10.5'	1073	7/17/09	Hom	No. 4			Yes	26.14	174.54	140.79	29.4
42, 10.5'-12.0'	1074	7/17/09	Hom	No. 4			Yes	26.01	153.43	131.43	20.9
42, 12.0'-13.5'	1075	7/17/09	Hom	No. 4			No	25.82	138.27	116.82	23.6
42, 13.5'-15.0'	1076	7/17/09	Hom	No. 4			No	25.23	142.26	118.67	25.2
42, 15.0'-16.5'	1077	7/17/09	Hom	No. 4			No	20.91	116.05	99.25	21.4
42, 16.5'-18.0'	1078	7/17/09	Hom	No. 4			No	30.74	136.51	117.15	22.4
42, 18.0'-19.5'	1079	7/17/09	Hom	3/8"			No	21.00	153.55	129.93	21.7
42, 19.5'-21.0'	1080	7/17/09	Hom	No. 4			Yes	21.44	167.87	137.70	26.0
42, 21.0'-22.5'	1082	7/17/09	Hom	No. 4			Yes	20.94	154.14	129.16	23.1
42, 22.5'-24.0'	1083	7/17/09	Hom	No. 4			Yes	20.94	171.79	143.33	23.3
42, 25.0'-26.5'	1084	7/17/09	Hom	No. 4			Yes	21.65	163.56	137.44	22.6
42, 27.5'-29.0'	1085	7/17/09	Hom	No. 4			Yes	20.98	178.80	149.22	23.1
42, 30.0'-31.5'	1086	7/17/09	Hom	No. 4			Yes	22.43	160.92	127.40	31.9
42, 32.5'-34.0'	1087	7/17/09	Hom	No. 4			Yes	20.81	164.67	129.70	32.1
42, 35.0' No Sample	1088	7/17/09									
42, 38.0'-39.5'	1089	7/17/09	Hom	No. 4			Yes	21.01	175.39	139.56	30.2

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Moisture Content of Soil
ASTM D 2216

Project Name TVA - Cumberland Fossil (CUF)

Project Number 175539009
Tested By KF/BB/CM
Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
42, 39.5'-39.9'	1090	7/17/09	Hom	3/8"			No	26.09	176.84	134.23	39.4
43, 0.0'-1.5'	1091	7/17/09	Hom	3/8"			No	21.12	168.32	155.20	9.8
43, 1.5'-3.0'	1092	7/17/09	Hom	3/8"			No	21.39	166.71	140.84	21.7
43, 3.0'-4.5'	1093	7/17/09	Hom	3/8"			No	20.80	168.29	139.70	24.0
43, 4.5'-6.0'	1094	7/17/09	Hom	3/8"			No	21.01	163.94	141.01	19.1
43, 6.0'-7.5'	1095	7/17/09	Hom	3/8"			No	21.46	182.92	154.99	20.9
43, 7.5'-8.1'	1096	7/17/09	Hom	No. 4			Yes	21.64	166.03	148.74	13.6
43, 9.5'-10.5'	1097	7/17/09	Hom	No. 4			Yes	20.70	167.49	147.52	15.7
43, 10.5'-12.0'	1098	7/17/09	Hom	3/8"			No	21.06	189.36	170.01	13.0
43, 12.0'-13.5'	1099	7/17/09	Hom	3/4"			No	21.00	184.16	164.90	13.4
43, 15.0'-16.5'	1100	7/17/09	Hom	3/4"			No	21.09	170.86	154.61	12.2
43, 16.5'-18.0'	1101	7/17/09	Hom	3/8"			No	21.19	178.03	150.48	21.3
43, 18.0'-19.5'	1102	7/17/09	Hom	3/8"			No	21.22	196.20	164.48	22.1
43, 19.5'-21.0'	1103	7/17/09	Hom	3/8"			No	21.06	186.65	159.05	20.0
43, 21.0'-22.5'	1104	7/17/09	Hom	3/4"			No	21.01	155.84	150.19	4.4
43, 22.5'-24.0'	1105	7/17/09	Hom	3/8"			No	20.83	213.79	181.71	19.9
43, 24.0'-25.5'	1106	7/17/09	Hom	No. 4			Yes	21.18	164.43	135.03	25.8
43, 25.5'-27.0'	1107	7/17/09	Hom	No. 4			Yes	21.11	184.12	152.43	24.1
43, 27.0'-28.5'	1108	7/17/09	Hom	3/8"			No	21.26	165.37	130.21	32.3
43, 28.5'-30.0'	1109	7/17/09	Hom	No. 4			Yes	26.07	179.46	141.89	32.4
43, 30.0'-31.5'	1110	7/17/09	Hom	No. 4			Yes	21.19	172.44	133.41	34.8
43, 31.5'-33.0'	1111	7/17/09	Hom	No. 10			Yes	26.02	208.99	153.76	43.2
43, 33.0'-34.5'	1112	7/17/09	Hom	No. 10			Yes	25.89	204.10	151.57	41.8
43, 34.5'-36.0'	1113	7/17/09	Hom	No. 10			Yes	25.94	198.77	145.11	45.0
43, 36.0'-37.5'	1114	7/17/09	Hom	No. 4			Yes	21.01	169.40	136.63	28.3
43, 37.5'-39.0'	1115	7/17/09	Hom	No. 4			Yes	21.20	245.76	200.91	25.0
43, 39.0'-40.5'	1116	7/17/09	Hom	No. 4			Yes	21.27	193.23	136.36	49.4
43, 40.5'-42.0'	1117	7/17/09	Hom	No. 4			Yes	21.33	213.47	163.92	34.7
43, 42.0'-43.5'	1118	7/17/09	Hom	3/8"			No	21.33	224.26	204.39	10.9
43, 43.5'-45.0'	1119	7/17/09	Hom	3/4"			No	21.27	205.89	180.56	15.9
43, 45.0'-46.5'	1120	7/17/09	Hom	3/4"			No	21.17	183.18	158.43	18.0

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Moisture Content of Soil

ASTM D 2216

Project Name TVA - Cumberland Fossil (CUF)

Project Number 175539009

Tested By KF/BB/CM

Test Method ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
43, 47.5'-49.0'	1121	7/17/09	Hom	3/4"			No	21.72	195.26	171.90	15.6
43, 50.0'-51.5'	1122	7/17/09	Hom	No. 10			Yes	21.54	179.50	148.27	24.6
43, 52.5'-54.0'	1123	7/17/09	Hom	No. 4			Yes	20.90	166.65	137.39	25.1
43, 55.0'-56.5'	1124	7/17/09	Len	No. 4			Yes	20.86	186.69	154.53	24.1
43, 57.5'-59.0'	1125	7/17/09	Hom	No. 4			Yes	21.21	195.77	160.63	25.2
43, 60.0'-61.5'	1126	7/17/09	Len	No. 10			Yes	20.79	184.01	145.48	30.9
44, 0.0'-1.5'	1127	7/17/09	Hom	No. 10			Yes	20.88	141.10	127.82	12.4
44, 1.5'-3.0'	1128	7/17/09	Hom	No. 10			Yes	21.28	170.37	148.63	17.1
44, 3.0'-4.5'	1129	7/17/09	Hom	No. 10			Yes	21.72	182.68	159.47	16.8
44, 4.5'-6.0'	1130	7/17/09	Hom	No. 10			Yes	21.16	159.88	141.85	14.9
44, 6.0'-7.5'	1131	7/17/09	Hom	No. 10			Yes	20.78	154.54	136.12	16.0
44, 7.5'-9.0'	1132	7/17/09	Hom	No. 10			Yes	20.96	146.68	135.63	9.6
44, 9.0'-10.5'	1133	7/17/09	Hom	No. 10			Yes	20.84	163.46	142.57	17.2
44, 10.5'-12.0'	1134	7/17/09	Hom	No. 10			Yes	21.27	172.68	151.95	15.9
44, 12.0'-13.5'	1135	7/17/09	Hom	No. 10			Yes	21.33	151.33	131.09	18.4
44, 13.5'-15.0'	1136	7/17/09	Hom	No. 10			Yes	21.70	171.90	144.15	22.7
44, 15.0'-16.5'	1137	7/17/09	Hom	No. 10			Yes	21.45	183.48	152.10	24.0
44, 16.5'-18.0'	1138	7/17/09	Hom	No. 10			Yes	20.90	189.83	154.94	26.0
44, 18.0'-19.5'	1139	7/17/09	Hom	1 1/2"			No	25.86	192.32	162.53	21.8
44, 19.5'-21.0'	1140	7/17/09	Hom	3/8"			No	21.04	202.08	171.69	20.2
44, 21.0'-22.5'	1141	7/17/09	Hom	No. 4			Yes	21.10	157.00	124.23	31.8
44, 22.5'-24.0'	1142	7/17/09	Hom	No. 4			No	20.81	138.48	100.62	47.4
44, 24.0'-25.5'	1143	7/17/09	Hom	No. 4			No	21.14	147.08	120.77	26.4
44, 25.5'-27.0'	1144	7/17/09	Hom	No. 4			No	22.97	154.88	118.12	38.6
44, 27.0'-28.5'	1145	7/17/09	Hom	No. 4			Yes	21.22	170.13	127.77	39.8
44, 28.5'-30.0'	1146	7/17/09	Hom	No. 4			No	21.21	149.80	97.35	68.9
44, 30.0'-31.5'	1147	7/17/09	Hom	No. 4			No	21.04	162.44	115.75	49.3
44, 31.5'-33.0'	1148	7/17/09	Hom	No. 4			Yes	20.85	183.04	139.23	37.0
44, 33.0'-34.5'	1149	7/17/09	Hom	3/8"			No	25.73	278.69	200.30	44.9
44, 34.5'-36.0'	1150	7/17/09	Hom	3/8"			No	26.07	220.64	168.13	37.0
44, 36.0'-37.5'	1151	7/17/09	Hom	No. 4			Yes	25.67	192.22	146.10	38.3

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name TVA - Cumberland Fossil (CUF)

Project Number 175539009
Tested By KF/BB/CM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Test Method ASTM

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
44, 37.5'-39.0'	1152	7/17/09	Hom	No. 4			Yes	26.06	222.67	170.75	35.9
44, 39.0'-40.5'	1153	7/17/09	Hom	No. 4			No	25.87	163.02	120.52	44.9
44, 40.5'-42.0'	1154	7/17/09	Hom	No. 4			Yes	26.08	167.08	127.82	38.6
44, 42.0'-43.5'	1155	7/17/09	Hom	No. 4			No	26.08	158.71	121.04	39.7
44, 43.5'-45.0'	1156	7/17/09	Hom	No. 4			No	21.14	123.58	92.19	44.2
44, 45.0'-46.5'	1157	7/17/09	Hom	3/8"			No	21.81	199.65	168.89	20.9
44, 46.5'-48.0'	1158	7/17/09	Hom	3/8"			No	20.89	208.72	175.20	21.7
44, 48.0'-49.5'	1159	7/17/09	Hom	No. 4			No	26.07	159.19	113.49	52.3
44, 49.5'-51.0'	1160	7/17/09	Hom	No. 4			Yes	26.01	197.19	138.61	52.0
44, 51.0'-52.5'	1161	7/17/09	Hom	No. 4			No	21.05	148.99	109.18	45.2
44, 52.5'-54.0'	1162	7/17/09	Hom	No. 4			Yes	25.84	189.24	140.33	42.7
44, 54.0'-55.5'	1163	7/17/09	Hom	No. 10			Yes	21.00	198.04	149.60	37.7
44, 55.5'-57.0'	1164	7/17/09	Hom	No. 4			Yes	25.31	194.96	160.48	25.5
44, 57.0'-58.5'	1165	7/17/09	Hom	No. 10			Yes	20.64	176.60	147.89	22.6
44, 58.5'-60.0'	1166	7/17/09	Hom	No. 10			Yes	25.56	191.87	156.22	27.3
44, 60.0'-61.5'	1167	7/17/09	Hom	No. 4			Yes	21.06	179.09	148.61	23.9
44, 61.5'-63.0'	1168	7/17/09	Hom	No. 4			Yes	20.63	154.31	128.07	24.4
44, 63.0'-64.5'	1169	7/17/09	Hom	No. 4			Yes	21.00	154.77	128.06	24.9
44, 65.0'-66.5'	1170	7/17/09	Hom	No. 4			Yes	21.22	170.54	141.99	23.6
44, 67.5'-69.0'	1171	7/17/09	Hom	No. 4			Yes	21.38	161.40	132.62	25.9
44, 70.0'-70.7'	1172	7/17/09	Hom	3/4"			No	20.70	170.95	148.59	17.5
44, 72.5'-73.1'	1173	7/17/09	Hom	3/4"			No	20.85	173.13	161.00	8.7

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Fossil Plant (CFP)

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-10, 0.0'-1.5'	1174	6/29/09	Hom	3/8"			No	21.01	155.03	138.87	13.7
B-10, 1.5'-3.0'	1175	6/29/09	Hom	3/8"			No	20.92	152.81	143.85	7.3
B-10, 3.0'-4.5'	1176	6/29/09	Hom	3/8"			No	21.34	137.27	127.81	8.9
B-10, 4.5'-6.0'	1177	6/29/09	Len	3/8"			No	21.33	146.02	127.04	18.0
B-10, 6.0'-7.5'	1178	6/29/09	Hom	3/8"			No	20.81	149.28	129.26	18.5
B-10, 7.5'-9.0'	1179	6/29/09	Hom	3/8"			No	20.86	142.47	123.32	18.7
B-10, 9.0'-10.5'	1180	6/29/09	Hom	No. 4			No	21.05	127.89	93.87	46.7
B-10, 10.5'-12.0'	1181	6/29/09	Hom	No. 4			No	20.76	142.35	102.56	48.6
B-10, 12.0'-13.5'	1182	6/29/09	Hom	No. 4			Yes	21.08	160.86	124.57	35.1
B-10, 13.5'-15.0'	1183	6/29/09	Hom	No. 4			Yes	21.00	163.22	132.48	27.6
B-10, 15.0'-16.5'	1184	6/29/09	Hom	No. 4			Yes	21.03	173.63	131.16	38.6
B-10, 16.5'-18.0'	1185	6/29/09	Hom	No. 4			No	20.98	137.88	100.85	46.4
B-10, 18.0'-19.5'	1186	6/29/09	Hom	No. 4			Yes	21.10	166.25	125.30	39.3
B-10, 19.5'-21.0'	1187	6/29/09	Hom	No. 4			No	20.76	144.94	113.34	34.1
B-10, 21.0'-22.5'	1188	6/29/09	Hom	No. 4			Yes	26.16	237.22	178.66	38.4
B-10, 22.5'-24.0' NO RECOVERY	1189	6/29/09									
B-10, 24.0'-25.5'	1190	6/29/09	Hom	No. 4			No	20.93	145.67	108.04	43.2
B-10, 25.5'-27.0'	1191	6/29/09	Hom	No. 4			No	25.73	160.18	125.63	34.6
B-10, 27.0'-28.5'	1192	6/29/09	Len	3/8"			No	20.90	173.31	123.95	47.9
B-10, 28.5'-30.0'	1193	6/29/09	Hom	No. 4			No	23.25	148.02	112.62	39.6
B-10, 30.0'-31.5'	1194	6/29/09	Hom	No. 4			No	20.74	151.67	120.62	31.1
B-10, 31.5'-33.0'	1195	6/29/09	Hom	No. 4			Yes	20.62	153.50	121.14	32.2
B-10, 33.0'-34.5'	1196	6/29/09	Hom	No. 4			Yes	21.21	158.61	129.64	26.7
B-10, 34.5'-36.0'	1197	6/29/09	Hom	No. 4			Yes	20.86	188.95	144.24	36.2
B-10, 36.0'-37.5'	1198	6/29/09	Hom	No. 4			Yes	21.64	197.93	152.88	34.3
B-10, 37.5'-39.0'	1199	6/29/09	Hom	3/8"			No	21.33	165.70	138.60	23.1
B-10, 39.0'-40.5'	1200	6/29/09	Hom	3/8"			No	21.04	203.52	155.15	36.1
B-10, 40.5'-42.0'	1201	6/29/09	Len	No. 4			No	20.78	144.55	120.20	24.5

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Fossil Plant (CFP)

Project Number 175539009
Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-10, 42.0'-43.5'	1202	6/29/09	Hom	No. 4			Yes	20.95	157.48	132.10	22.8
B-10, 45.0'-46.5'	1203	6/29/09	Hom	3/8"			No	21.09	168.48	145.11	18.8
B-10, 46.5'-47.5' NO RECOVERY	1204	6/29/09									
B-10, 47.5'-49.0'	1205	6/29/09	Hom	No. 4			Yes	20.69	155.02	130.22	22.6
B-10, 50.0'-51.5'	1206	6/29/09	Hom	No. 4			Yes	20.83	156.69	135.84	18.1
B-10, 52.5'-54.0'	1207	6/29/09	Hom	No. 4			Yes	21.01	157.32	128.99	26.2
B-10, 55.0'-56.5'	1208	6/29/09	Hom	No. 4			Yes	20.80	186.67	156.36	22.4
B-10, 57.6'-59.0'	1209	6/29/09	Hom	3/8"			No	20.98	144.00	116.51	28.8
B-10, 60.0'-60.2'	1210	6/29/09	Hom	3/8"			No	21.44	95.62	89.35	9.2
B-7, 0.0'-1.5'	1211	6/29/09	Hom	3/8"			No	20.68	148.85	139.15	8.2
B-7, 1.5'-3.0'	1212	6/29/09	Hom	3/8"			No	21.14	158.39	147.79	8.4
B-7, 3.0'-4.5'	1213	6/29/09	Hom	3/8"			No	21.01	154.69	144.95	7.9
B-7, 4.5'-6.0'	1214	6/29/09	Hom	3/8"			No	20.94	131.89	122.69	9.0
B-7, 6.0'-7.5'	1215	6/29/09	Hom	3/8"			No	20.68	156.45	145.30	8.9
B-7, 7.5'-9.0'	1216	6/29/09	Hom	3/8"			No	20.87	142.01	131.67	9.3
B-7, 9.0'-10.5'	1217	6/29/09	Hom	3/8"			No	20.83	155.88	143.03	10.5
B-7, 10.5'-12.0'	1218	6/29/09	Hom	3/8"			No	20.64	149.02	125.49	22.4
B-7, 12.0'-13.5'	1219	6/29/09	Hom	3/8"			No	20.88	161.55	129.60	29.4
B-7, 13.5'-15.0'	1220	6/29/09	Hom	3/8"			No	20.81	179.25	140.10	32.8
B-7, 15.0'-16.5'	1221	6/29/09	Hom	No. 4			Yes	21.00	156.27	128.22	26.2
B-7, 16.5'-18.0'	1222	6/29/09	Hom	No. 4			No	20.87	141.33	103.32	46.1
B-7, 18.0'-19.5'	1223	6/29/09	Hom	No. 4			Yes	20.91	199.49	151.61	36.6
B-7, 19.5'-21.0'	1224	6/29/09	Hom	No. 4			Yes	21.02	202.95	152.48	38.4
B-7, 21.0'-22.5'	1225	6/29/09	Hom	No. 4			Yes	20.95	178.09	130.64	43.3
B-7, 22.5'-24.0'	1226	6/29/09	Hom	No. 4			No	20.77	159.57	118.13	42.6
B-7, 24.0'-25.5'	1227	6/29/09	Hom	No. 4			Yes	20.97	232.67	176.60	36.0
B-7, 25.5'-27.0'	1228	6/29/09	Hom	3/8"			No	20.60	97.00	80.66	27.2
B-7, 27.0'-28.5'	1229	6/29/09	Hom	3/8"			No	20.94	170.23	144.06	21.3
B-7, 28.5'-30.0'	1230	6/29/09	Hom	3/8"			No	20.69	173.01	144.93	22.6
B-7, 30.0'-31.5'	1231	6/29/09	Hom	3/8"			No	21.15	180.58	155.98	18.2
B-7, 31.5'-33.0'	1232	6/29/09	Hom	3/8"			No	20.69	173.82	144.37	23.8

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Fossil Plant (CFP)

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-7, 33.0'-34.5'	1233	6/29/09	Hom	3/8"			No	21.21	173.02	146.39	21.3
B-7, 34.5'-36.0'	1234	6/29/09	Hom	3/8"			No	20.83	202.87	175.92	17.4
B-7, 36.0'-37.5'	1235	6/29/09	Hom	3/8"			No	20.66	161.79	141.58	16.7
B-7, 37.5'-39.0'	1236	6/29/09	Hom	3/8"			No	20.88	157.65	119.01	39.4
B-7, 39.0'-40.5'	1237	6/29/09	Hom	No. 4			No	20.95	141.57	106.99	40.2
B-7, 40.5'-42.0'	1238	6/29/09	Hom	No. 4			Yes	20.63	205.05	147.78	45.0
B-7, 42.0'-43.5'	1239	6/29/09	Hom	No. 4			Yes	21.41	163.16	123.75	38.5
B-7, 43.5'-45.0'	1240	6/29/09	Hom	No. 4			No	20.68	160.91	115.99	47.1
B-7, 45.0'-46.5'	1241	6/29/09	Hom	No. 4			Yes	21.10	188.81	136.61	45.2
B-7, 46.5'-48.0'	1242	6/29/09	Hom	No. 4			Yes	20.91	173.36	125.50	45.8
B-7, 48.0'-49.5'	1243	6/29/09	Hom	No. 4			Yes	20.65	166.94	121.49	45.1
B-7, 49.5'-51.0'	1244	6/29/09	Hom	No. 4			Yes	20.99	163.71	132.85	27.6
B-7, 51.0'-52.5'	1245	6/29/09	Hom	No. 4			Yes	21.24	195.95	152.70	32.9
B-7, 52.5'-54.0'	1246	6/29/09	Hom	No. 4			Yes	21.04	212.51	162.89	35.0
B-7, 55.0'-56.5'	1247	6/29/09	Hom	No. 4			Yes	21.06	178.74	139.24	33.4
B-7, 57.5'-59.0'	1248	6/29/09	Hom	No. 4			Yes	21.01	160.76	133.24	24.5
B-7, 60.0'-61.5'	1249	6/29/09	Hom	No. 4			Yes	20.90	158.03	131.86	23.6
B-7, 62.5'-64.0'	1250	6/29/09	Hom	No. 4			Yes	21.25	171.02	141.97	24.1
B-7, 65.0'-66.5'	1251	6/29/09	Hom	No. 4			Yes	20.71	201.41	167.66	23.0
B-7, 67.5'-68.3'	1252	6/29/09	Hom	3/8"			No	20.78	181.96	149.14	25.6
B-7, 70.0'	1253	6/29/09	Hom	3/8"			No	20.84	157.36	143.41	11.4
B-7, 72.5' NO RECOVERY	1254	6/29/09									
B-7, 75.0'	1255	6/29/09	Hom	3/8"			No	20.91	176.08	149.64	20.5
B-7, 77.5'	1256	6/29/09	Hom	3/4"			No	21.22	104.93	98.08	8.9

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Dry Ash Stack and Gypsum Disposal Area

Project Number 175539009
Tested By KF/BB/CM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Test Method ASTM

PRELIMINARY

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-16, 0.0'-1.5'	1280	7/22/09	Hom	No. 4			Yes	21.26	163.96	152.31	8.9
B-16, 1.5'-3.0'	1281	7/22/09	Hom	No. 4			Yes	26.03	171.75	146.44	21.0
B-16, 3.0'-4.5'	1282	7/22/09	Hom	No. 10			Yes	26.08	174.84	144.93	25.2
B-16, 4.5'-6.0'	1283	7/22/09	Hom	No. 10			Yes	26.52	186.88	150.99	28.8
B-16, 6.0'-7.5'	1284	7/22/09	Hom	No. 4			Yes	21.74	177.77	138.92	33.2
B-16, 7.5'-9.0'	1285	7/22/09	Hom	No. 4			Yes	25.79	173.63	144.77	24.3
B-16, 9.0'-10.5'	1286	7/22/09	Hom	No. 10			Yes	25.12	163.07	127.42	34.8
B-16, 10.5'-12.0'	1287	7/22/09	Hom	No. 10			Yes	20.98	170.99	128.04	40.1
B-16, 12.0'-13.5'	1288	7/22/09	Hom	No. 10			Yes	25.86	182.67	136.52	41.7
B-16, 13.5'-15.0'	1289	7/22/09	Hom	No. 10			Yes	21.12	220.34	165.64	37.8
B-16, 15.0'-16.5'	1290	7/22/09	Hom	No. 10			Yes	20.80	210.32	152.84	43.5
B-16, 16.5'-18.0'	1291	7/22/09	Hom	No. 10			Yes	26.36	184.02	141.35	37.1
B-16, 18.0'-19.5'	1292	7/22/09	Hom	No. 10			Yes	21.00	220.86	164.66	39.1
B-16, 19.5'-21.0'	1293	7/22/09	Hom	No. 10			Yes	21.15	157.87	118.01	41.2
B-16, 21.0'-22.5'	1294	7/22/09	Hom	No. 10			Yes	20.43	165.67	125.71	38.0
B-16, 22.5'-24.0'	1295	7/22/09	Hom	3/8"			No	31.93	185.94	158.66	21.5
B-16, 24.0'-25.5'	1296	7/22/09	Hom	3/8"			No	30.95	178.32	148.16	25.7
B-16, 25.5'-27.0'	1297	7/22/09	Hom	No. 4			Yes	31.88	199.19	163.32	27.3
B-16, 27.5'-29.0'	1298	7/22/09	Hom	3/8"			No	32.20	184.62	152.12	27.1
B-16, 30.0'-31.5'	1299	7/22/09	Hom	3/8"			No	30.70	189.14	141.35	43.2
B-16, 31.5'-33.0'	1300	7/22/09	Hom	No. 4			Yes	32.00	197.66	148.69	42.0
B-16, 33.0'-34.5'	1301	7/22/09	Hom	No. 10			Yes	30.59	172.78	135.93	35.0
B-16, 34.5'-36.0'	1302	7/22/09	Hom	No. 10			Yes	20.75	183.50	142.63	33.5
B-16, 36.0'-37.5'	1303	7/22/09	Hom	No. 10			Yes	26.21	180.68	136.94	39.5
B-16, 37.5'-39.0'	1304	7/22/09	Hom	No. 4			Yes	25.92	200.19	157.66	32.3
B-16, 39.0'-40.5'	1305	7/22/09	Hom	No. 10			Yes	21.24	176.02	130.57	41.6
B-16, 40.5'-42.0'	1306	7/22/09	Hom	No. 10			Yes	25.99	197.90	143.63	46.1
B-16, 42.0'-43.5'	1307	7/22/09	Hom	No. 10			Yes	20.92	178.61	123.77	53.3

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Dry Ash Stack and Gypsum Disposal Area

Project Number 175539009
Tested By KF/BB/CM
Test Method ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-16, 43.5'-45.0'	1308	7/22/09	Hom	No. 10			Yes	20.83	170.17	123.18	45.9
B-16, 45.0'-46.5'	1309	7/22/09	Hom	No. 10			Yes	20.84	189.27	132.84	50.4
B-16, 46.5'-48.0'	1310	7/22/09	Hom	No. 10			Yes	20.80	186.32	150.34	27.8
B-16, 48.0'-49.5'	1311	7/22/09	Len	No. 10			Yes	25.86	197.36	161.75	26.2
B-16, 50.0'-51.5'	1312	7/22/09	Hom	No. 10			Yes	25.20	199.51	160.42	28.9
B-16, 52.5'-54.0'	1313	7/22/09	Hom	No. 10			Yes	20.90	163.25	130.53	29.8
B-16, 55.0'-56.5'	1314	7/22/09	Hom	No. 10			Yes	21.09	187.97	153.23	26.3
B-16, 57.5'-59.0'	1315	7/22/09	Hom	3/8"			No	21.59	180.22	153.47	20.3
B-16, 60.0'-61.5'	1316	7/22/09	Hom	3/8"			No	21.26	178.04	156.58	15.9
B-16, 62.5'-64.0'	1317	7/22/09	Hom	3/8"			No	25.83	190.78	166.70	17.1
B-16, 65.0'-66.5'	1318	7/22/09	Hom	3/8"			No	26.09	192.03	166.19	18.4
B-16, 67.5'-69.0'	1319	7/22/09	Hom	3/4"			No	21.17	189.17	162.15	19.2
B-16, 70.0'-71.2'	1320	7/22/09	Hom	3/4"			No	25.55	180.89	161.62	14.2
B-16, 72.5'-74.0'	1321	7/22/09	Hom	3/4"			No	21.38	196.04	169.28	18.1
B-16, 75.0'-76.5'	1322	7/22/09	Hom	3/4"			No	21.62	168.10	146.66	17.1
B-16, 77.5'-79.0'	1323	7/22/09	Hom	3/4"			No	21.22	181.84	156.74	18.5
B-16, 80.0'-81.5'	1324	7/22/09	Hom	3/8"			No	20.90	185.22	141.75	36.0
B-16, 82.5'-84.0'	1325	7/22/09	Hom	3/4"			No	26.20	215.47	183.59	20.3
B-17, 0.0'-1.5'	1326	7/22/09	Hom	No. 10			Yes	21.61	158.66	137.26	18.5
B-17, 1.5'-3.0'	1327	7/22/09	Hom	No. 10			Yes	21.31	172.11	147.11	19.9
B-17, 3.0'-4.5'	1328	7/22/09	Hom	No. 4			Yes	21.44	188.35	153.11	26.8
B-17, 4.5'-6.0'	1329	7/22/09	Hom	No. 10			Yes	31.87	179.46	157.96	17.1
B-17, 6.0'-7.5'	1330	7/22/09	Hom	No. 4			Yes	32.21	178.17	157.67	16.3
B-17, 7.5'-9.0'	1331	7/22/09	Hom	No. 10			Yes	25.95	175.27	151.91	18.5
B-17, 9.0'-10.5'	1332	7/22/09	Hom	No. 10			Yes	30.61	178.05	153.96	19.5
B-17, 10.5'-12.0'	1333	7/22/09	Hom	No. 4			Yes	20.83	171.51	148.54	18.0
B-17, 12.0'-13.5'	1334	7/22/09	Hom	No. 10			Yes	31.93	176.15	154.24	17.9
B-17, 13.5'-15.0'	1335	7/22/09	Hom	No. 10			Yes	21.88	175.70	152.77	17.5
B-17, 15.0'-16.5'	1336	7/22/09	Hom	No. 10			Yes	26.40	155.11	135.37	18.1
B-17, 16.5'-18.0'	1337	7/22/09	Hom	No. 10			Yes	21.59	181.72	154.68	20.3
B-17, 18.0'-19.5'	1338	7/22/09	Hom	No. 4			Yes	25.92	161.98	139.57	19.7

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name: Cumberland Dry Ash Stack and Gypsum Disposal Area

Project Number: 175539009

Tested By: KF/BB/CM

Test Method: ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-17, 19.5'-21.0'	1339	7/22/09	Hom	No. 4			Yes	21.04	147.43	129.00	17.1
B-17, 21.0'-22.5'	1340	7/22/09	Hom	No. 4			Yes	20.86	146.05	125.18	20.0
B-17, 22.5'-24.0'	1341	7/22/09	Hom	No. 10			Yes	25.91	176.81	153.44	18.3
B-17, 24.0'-25.5'	1342	7/22/09	Hom	No. 10			Yes	32.03	173.68	153.27	16.8
B-17, 25.5'-27.0'	1343	7/22/09	Hom	No. 10			Yes	26.65	167.15	145.66	18.1
B-17, 27.0'-28.5'	1344	7/22/09	Hom	No. 10			Yes	25.62	173.27	149.03	19.6
B-17, 28.5'-30.0'	1345	7/22/09	Hom	No. 10			Yes	25.80	198.58	166.68	22.6
B-17, 30.0'-31.5'	1346	7/22/09	Hom	No. 10			Yes	25.91	166.74	140.37	23.0
B-17, 31.5'-33.0'	1347	7/22/09	Hom	No. 10			Yes	25.71	154.55	132.73	20.4
B-17, 33.0'-34.5'	1348	7/24/09	Hom	No. 10			Yes	25.93	190.59	155.33	27.2
B-17, 34.5'-36.0'	1349	7/24/09	Hom	No. 10			Yes	25.57	189.99	157.58	24.6
B-17, 36.0'-37.5'	1350	7/24/09	Hom	No. 10			Yes	25.94	226.67	180.32	30.0
B-17, 37.5'-39.0'	1351	7/24/09	Len	No. 10			Yes	25.96	173.22	146.02	22.7
B-17, 39.0'-40.5'	1352	7/24/09	Len	No. 10			Yes	25.52	158.90	134.05	22.9
B-17, 40.5'-42.0'	1353	7/24/09	Hom	No. 4			Yes	25.55	251.06	178.28	47.7
B-17, 42.0'-43.5'	1354	7/24/09	Hom	No. 4			Yes	26.42	237.19	183.09	34.5
B-17, 43.5'-45.0'	1355	7/24/09	Hom	No. 4			Yes	25.79	208.84	162.74	33.7
B-17, 45.0'-46.5'	1356	7/24/09	Hom	No. 4			Yes	25.47	212.01	162.69	35.9
B-17, 46.5'-48.0'	1357	7/24/09	Hom	No. 10			Yes	26.31	196.19	154.46	32.6
B-17, 48.0'-49.5'	1358	7/24/09	Hom	No. 4			Yes	26.08	202.44	153.83	38.1
B-17, 49.5'-51.0'	1359	7/24/09	Hom	No. 4			Yes	25.80	187.97	144.20	37.0
B-17, 51.0'-52.5'	1360	7/24/09	Hom	No. 4			No	26.07	146.41	111.29	41.2
B-17, 52.5'-54.0'	1361	7/24/09	Hom	3/4"			No	25.87	212.09	163.56	35.2
B-17, 54.0'-55.5'	1362	7/24/09	Hom	No. 4			Yes	25.79	191.60	165.37	18.8
B-17, 55.5'-57.0'	1363	7/24/09	Hom	No. 4			Yes	26.02	224.49	174.15	34.0
B-17, 57.0'-58.5'	1364	7/24/09	Hom	No. 10			Yes	25.70	194.79	147.45	38.9
B-17, 58.5'-60.0'	1365	7/24/09	Hom	3/8"			No	25.61	206.20	164.93	29.6
B-17, 60.0'-61.5'	1366	7/24/09	Hom	No. 4			Yes	30.95	234.74	183.40	33.7
B-17, 61.5'-63.0'	1367	7/24/09	Hom	No. 4			Yes	26.09	198.14	153.72	34.8
B-17, 63.0'-64.5'	1368	7/24/09	Hom	No. 4			Yes	21.49	163.45	127.67	33.7
B-17, 64.5'-66.0'	1369	7/24/09	Hom	No. 10			Yes	22.16	165.87	120.07	46.8

Moisture Content of Soil

ASTM D 2216

Stantec

Project Name Cumberland Dry Ash Stack and Gypsum Disposal Area

Project Number 175539009

Tested By KF/BB/CM

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-17, 66.0'-67.5'	1370	7/24/09	Hom	No. 10			Yes	26.06	191.89	154.35	29.3
B-17, 67.5'-69.0'	1371	7/24/09	Hom	No. 10			Yes	26.06	166.42	127.24	38.7
B-17, 69.9'-70.5'	1372	7/24/09	Hom	No. 10			Yes	32.16	161.58	123.81	41.2
B-17, 70.5'-72.0'	1373	7/24/09	Hom	No. 10			Yes	30.79	177.65	135.89	39.7
B-17, 72.0'-73.5'	1374	7/24/09	Hom	No. 10			Yes	21.13	162.43	122.64	39.2
B-17, 73.5'-76.5'	1375	7/24/09	Hom	No. 10			Yes	20.84	158.89	117.75	42.5
B-17, 76.5'-78.0'	1376	7/24/09	Hom	No. 10			Yes	21.59	149.90	109.12	46.6
B-17, 78.0'-79.5'	1377	7/24/09	Hom	No. 10			Yes	21.21	164.09	118.06	47.5
B-17, 79.5'-81.0'	1378	7/24/09	Hom	No. 10			Yes	21.28	182.09	128.91	49.4
B-17, 81.0'-82.5'	1379	7/24/09	Hom	No. 10			Yes	21.02	181.49	136.86	38.5
B-17, 82.5'-84.0'	1380	7/24/09	Hom	No. 10			Yes	20.88	144.01	105.84	44.9
B-17, 84.0'-85.5'	1381	7/24/09	Hom	No. 4			No	20.92	149.37	113.96	38.1
B-17, 85.5'-87.0'	1382	7/24/09	Hom	No. 10			Yes	25.94	243.80	174.30	46.8
B-17, 87.0'-88.5'	1383	7/24/09	Hom	No. 10			Yes	26.01	202.74	155.38	36.6
B-17, 88.5'-90.0'	1384	7/24/09	Hom	No. 10			Yes	25.76	164.44	130.53	32.4
B-17, 90.0'-91.5'	1385	7/24/09	Hom	3/8"			No	26.17	167.50	135.67	29.1
B-17, 92.5'-4.0'	1386	7/24/09	Hom	3/8"			No	26.13	174.14	148.61	20.8
B-17, 95.0'-96.5'	1387	7/24/09	Hom	3/8"			No	20.93	177.54	150.70	20.7
B-17, 97.5'-99.0'	1388	7/24/09	Hom	3/8"			No	26.01	193.04	157.90	26.6
B-17, 100.0'-101.5'	1389	7/24/09	Hom	3/4"			No	25.45	205.17	169.21	25.0
B-17, 102.5'-104.0'	1390	7/24/09	Hom	3/4"			No	21.40	158.60	139.93	15.8
B-17, 105.0'-106.5'	1391	7/24/09	Hom	3/4"			No	25.17	207.49	174.36	22.2
B-17, 107.5'-109.0'	1392	7/24/09	Hom	3/4"			No	21.06	217.51	184.82	20.0
B-17, 110.0'-111.5'	1393	7/24/09	Hom	3/4"			No	21.74	184.19	153.74	23.1
B-17, 112.5'-114.0'	1394	7/24/09	Hom	3/8"			No	21.09	189.72	156.71	24.3
B-17, 115.0'-116.5'	1395	7/24/09	Hom	3/4"			No	21.20	196.80	169.85	18.1
B-46, 0.0'-1.5'	1396	7/24/09	Hom	No. 10			Yes	21.06	138.63	128.41	9.5
B-46, 1.5'-3.0'	1397	7/24/09	Hom	No. 10			Yes	21.26	149.44	137.43	10.3
B-46, 3.0'-4.5'	1398	7/26/09	Hom	No. 4			Yes	20.76	132.02	121.37	10.6
B-46, 4.5'-6.0'	1399	7/26/09	Hom	No. 4			Yes	21.17	131.64	121.31	10.3
B-46, 6.0'-7.5'	1400	7/26/09	Hom	No. 4			Yes	20.90	137.24	125.33	11.4

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name Cumberland Dry Ash Stack and Gypsum Disposal Area

Project Number 175539009

Tested By KF/BB/CM

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-46, 7.5'-9.0'	1401	7/26/09	Hom	No. 4			Yes	21.05	148.70	135.77	11.3
B-46, 9.0'-10.5'	1402	7/26/09	Hom	No. 4			Yes	20.65	134.17	124.57	9.2
B-46, 10.5'-12.0'	1403	7/26/09	Hom	No. 4			Yes	21.47	152.09	138.84	11.3
B-46, 12.0'-13.5'	1404	7/26/09	Hom	No. 4			Yes	20.87	147.58	127.03	19.4
B-46, 13.5'-15.0'	1405	7/26/09	Hom	No. 4			Yes	21.44	146.57	136.35	8.9
B-46, 15.0'-16.5'	1406	7/26/09	Hom	No. 4			Yes	21.40	163.43	138.00	21.8
B-46, 16.5'-18.0'	1407	7/26/09	Hom	3/4"			No	21.15	186.54	176.29	6.6
B-46, 18.0'-19.5'	1408	7/26/09	Hom	3/4"			No	21.03	186.65	173.95	8.3
B-46, 19.5'-21.0'	1409	7/26/09	Hom	3/4"			No	25.86	221.34	180.35	26.5
B-46, 21.0'-22.5'	1410	7/26/09	Hom	No. 10			Yes	25.34	194.47	151.70	33.8
B-46, 22.5'-24.0'	1411	7/26/09	Hom	No. 10			Yes	20.80	168.69	131.63	33.4
B-46, 24.0'-25.5'	1412	7/26/09	Hom	No. 10			Yes	21.29	157.97	115.50	45.1
B-46, 25.5'-27.0'	1413	7/26/09	Hom	No. 10			Yes	20.90	190.33	150.92	30.3
B-46, 27.0'-28.5'	1414	7/26/09	Hom	No. 10			Yes	21.44	191.03	153.94	28.0
B-46, 28.5'-30.0'	1415	7/26/09	Hom	No. 10			Yes	25.58	205.03	166.89	27.0
B-46, 30.0'-31.5'	1416	7/26/09	Hom	No. 10			Yes	31.94	196.85	160.96	27.8
B-46, 31.5'-33.0'	1417	7/26/09	Hom	No. 10			Yes	30.54	187.28	151.10	30.0
B-46, 33.0'-34.5'	1418	7/26/09	Hom	No. 4			No	31.72	164.86	130.65	34.6
B-46, 34.5'-36.0'	1419	7/26/09	Hom	No. 4			Yes	32.02	167.76	136.27	30.2
B-46, 36.0'-37.5'	1420	7/26/09	Hom	No. 4			No	32.31	147.04	109.77	48.1
B-46, 37.5'-39.0'	1421	7/26/09	Hom	No. 4			Yes	32.18	213.03	167.63	33.5
B-46, 39.0'-40.5'	1422	7/26/09	Hom	No. 4			Yes	30.93	223.43	186.83	23.5
B-46, 40.5'-42.0'	1423	7/26/09	Hom	No. 4			Yes	32.45	189.85	148.95	35.1
B-46, 42.0'-43.5'	1424	7/26/09	Hom	No. 4			No	32.26	168.99	131.58	37.7
B-46, 43.5'-45.0'	1425	7/26/09	Hom	No. 4			Yes	30.62	188.33	152.42	29.5
B-46, 45.0'-46.5'	1426	7/26/09	Hom	3/8"			No	32.33	217.95	183.57	22.7
B-46, 46.5'-48.0'	1427	7/26/09	Hom	3/8"			No	32.06	178.78	139.20	36.9
B-46, 48.0'-49.5'	1428	7/27/09	Hom	3/8"			No	31.79	213.28	183.43	19.7
B-46, 49.5'-51.0'	1429	7/27/09	Hom	3/8"			No	32.09	199.50	174.16	17.8
B-46, 51.0'-52..1'	1430	7/27/09	Hom	3/4"			No	30.97	192.70	169.70	16.6
B-46, 52.5'-54.0' NO RECOVERY	1431	8/3/09									

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Dry Ash Stack and Gypsum Disposal Area

Project Number 175539009
Tested By KF/BB/CM
Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-46, 54.0'-54.1' NO RECOVERY	1432	8/3/09									
B-46, 55.5'-55.6' NO RECOVERY	1433	8/3/09									
B-46, 57.0'-58.5'	1434	7/27/09	Hom	3/8"			No	31.67	177.27	143.95	29.7
B-46, 58.5'-60.0'	1435	7/27/09	Hom	3/8"			No	31.74	157.99	124.39	36.3
B-46, 60.0'-61.5'	1436	7/27/09	Hom	3/8"			No	32.02	177.05	141.44	32.5
B-46, 61.5'-63.0'	1437	7/27/09	Hom	3/8"			No	31.91	147.60	116.89	36.1
B-46, 63.0'-64.5'	1438	7/27/09	Hom	3/8"			No	26.05	200.87	159.05	31.4
B-46, 64.5'-66.0'	1439	7/27/09	Hom	No. 4			No	22.97	135.57	108.87	31.1
B-46, 66.0'-66.1' NO RECOVERY	1440	8/3/09									
B-1, 0.0'-1.5'	1441	7/27/09	Hom	3/8"			No	26.07	171.44	157.54	10.6
B-1, 1.5'-3.0'	1442	7/27/09	Hom	3/8"			No	21.62	132.76	123.29	9.3
B-1, 3.0'-4.5'	1443	7/27/09	Hom	3/8"			No	26.06	177.90	165.24	9.1
B-1, 4.5'-6.0'	1444	7/27/09	Hom	3/8"			No	25.78	161.82	148.19	11.1
B-1, 8.0'-9.0'	1445	7/27/09	Hom	3/4"			No	26.27	164.79	159.11	4.3
B-1, 9.0'-10.5'	1446	7/27/09	Hom	3/4"			No	22.14	62.65	60.58	5.4
B-1, 10.5'-12.0'	1447	7/27/09	Hom	3/4"			No	26.01	173.63	164.38	6.7
B-1, 12.0'-13.5'	1448	7/27/09	Hom	3/4"			No	26.13	117.30	106.86	12.9
B-1, 13.5'-15.0'	1449	7/27/09	Hom	3/4"			No	26.27	231.30	214.50	8.9
B-1, 15.0'-16.5'	1450	7/27/09	Hom	3/4"			No	26.00	223.86	200.13	13.6
B-1, 16.5'-18.0'	1451	7/27/09	Hom	3/4"			No	26.14	228.36	198.47	17.3
B-1, 19.5'-21.0'	1452	7/27/09	Hom	3/4"			No	25.54	217.51	192.06	15.3
B-1, 21.0'-22.5'	1453	7/27/09	Hom	3/4"			No	25.91	238.48	207.50	17.1
B-1, 25.5'-27.0' NO RECOVERY	1454	8/3/09									
B-1, 27.0'-28.5' NO RECOVERY	1455	8/3/09									
B-1, 28.5'-28.9' NO RECOVERY	1456	8/3/09									
B-29, 0.3'-10.0'	1457	7/27/09	Hom	3/8"			No	21.43	151.80	137.20	12.6
B-29, 10.4'-14.5'	1458	7/27/09	Hom	3/4"			No	25.59	209.65	173.02	24.8
B-28, 1.5'-15.0'	1459	7/27/09	Hom	3/8"			No	25.33	223.66	211.61	6.5
B-37, 6.0'-14.5'	1460	7/27/09	Hom	3/8"			No	26.05	208.82	183.16	16.3
B-45, 0.0'-1.5'	1461	7/27/09	Hom	3/8"			No	26.03	188.49	176.25	8.1
B-45, 1.5'-3.0'	1462	7/27/09	Hom	3/8"			No	25.61	166.62	156.01	8.1

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name Cumberland Dry Ash Stack and Gypsum Disposal Area

Project Number 175539009
Tested By KF/BB/CM
Test Method ASTM

PRELIMINARY

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-45, 3.0'-4.5'	1464	7/27/09	Hom	No. 4			Yes	21.60	191.60	173.26	12.1
B-45, 4.5'-6.0'	1465	7/27/09	Len	No. 4			Yes	21.42	201.61	173.99	18.1
B-45, 6.0'-7.5'	1466	7/27/09	Hom	No. 4			Yes	21.58	192.76	164.94	19.4
B-45, 7.5'-9.0'	1467	7/27/09	Hom	3/8"			No	21.62	145.11	126.21	18.1
B-45, 9.0'-10.5'	1468	7/27/09	Hom	3/4"			No	26.01	294.75	259.44	15.1
B-45, 10.5'-12.0'	1469	7/27/09	Hom	3/4"			No	25.87	262.16	239.58	10.6
B-45, 12.0'-13.5'	1470	7/27/09	Hom	3/8"			No	25.98	229.86	196.34	19.7
B-45, 13.5'-15.0'	1471	7/27/09	Hom	3/8"			No	25.66	222.65	184.94	23.7
B-45, 15.0'-16.5'	1472	7/27/09	Hom	3/8"			No	25.92	248.70	205.55	24.0
B-45, 16.5'-18.0'	1473	7/27/09	Hom	3/4"			No	25.84	245.34	218.98	13.6
B-45, 18.0'-19.5'	1474	7/27/09	Hom	3/4"			No	25.77	274.60	239.27	16.5
B-45, 20.1'-21.6'	1475	7/27/09	Hom	3/4"			No	26.08	241.04	218.15	11.9
B-45, 22.0'-23.5'	1476	7/27/09	Hom	3/4"			No	21.41	122.76	121.75	1.0
B-45, 23.5'-25.0'	1477	7/27/09	Hom	3/8"			No	26.03	261.56	212.37	26.4
B-45, 25.0'-26.5'	1479	7/27/09	Hom	No. 4			Yes	31.07	219.13	182.73	24.0
B-45, 26.5'-28.0'	1480	7/27/09	Hom	No. 4			Yes	26.05	235.87	182.02	34.5
B-45, 28.0'-29.5'	1481	7/27/09	Hom	No. 4			Yes	25.85	271.43	217.25	28.3
B-45, 30.0'-31.5'	1482	7/27/09	Hom	No. 4			Yes	25.75	213.34	152.10	48.5
B-45, 31.5'-33.0'	1483	7/27/09	Hom	No. 4			Yes	26.06	246.37	195.24	30.2
B-45, 33.0'-34.5'	1484	7/27/09	Hom	3/8"			No	26.08	220.45	186.78	21.0
B-45, 34.5'-36.0'	1485	7/27/09	Hom	3/8"			No	21.38	144.56	131.55	11.8
B-45, 36.0'-37.5'	1486	7/27/09	Hom	3/8"			No	25.68	276.41	239.84	17.1
B-45, 37.5'-39.0'	1487	7/27/09	Hom	3/8"			No	26.09	242.23	210.21	17.4
B-45, 39.0'-39.6'	1488	7/27/09	Hom	3/4"			No	25.87	277.84	241.99	16.6
B-45, 42.0'-43.0' NO RECOVERY	1489	8/3/09									
B-45, 43.0'-44.2'	1490	7/27/09	Hom	3/4"			No	25.69	200.23	181.01	12.4
B-45, 47.5'-49.0'	1491	7/27/09	Hom	No. 4			Yes	26.47	199.29	157.04	32.4
B-45, 49.0'-50.5'	1492	7/27/09	Hom	3/8"			No	26.34	193.96	149.52	36.1
B-45, 50.5'-52.0'	1493	7/27/09	Hom	3/8"			No	25.54	200.32	150.83	39.5
B-45, 62.0'-62.7'	1494	7/27/09	Hom	3/4"			No	26.29	224.15	198.76	14.7

Moisture Content of Soil
ASTM D 2216

Project Name CUF Dry Ash Stack and Gypsum Stack

Project Number 175539009
Tested By

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Test Method ASTM

PRELIMINARY

Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-3, 0.0'-1.5'	1495	7/21/09	Hom	No. 4			Yes	26.09	160.81	151.03	7.8
B-3, 1.5'-3.0'	1496	7/21/09	Hom	No. 4			Yes	25.58	176.07	163.38	9.2
B-3, 3.0'-4.5'	1497	7/21/09	Hom	3/8"			No	25.82	181.18	164.09	12.4
B-3, 4.5'-6.0'	1498	7/21/09	Hom	No. 4			Yes	25.93	162.63	138.02	22.0
B-3, 6.0'-7.5'	1499	7/21/09	Hom	No. 4			Yes	25.95	159.82	135.34	22.4
B-3, 7.5'-9.0'	1500	7/21/09	Hom	No. 4			Yes	25.87	163.70	144.55	16.1
B-3, 9.0'-10.5'	1501	7/21/09	Hom	3/8"			No	25.52	144.82	125.19	19.7
B-3, 10.5'-12.0'	1502	7/21/09	Hom	No. 4			Yes	25.79	160.57	132.58	26.2
B-3, 12.0'-13.5'	1503	7/21/09	Hom	No. 4			No	25.92	152.26	125.54	26.8
B-3, 13.5'-15.0'	1504	7/21/09	Hom	No. 4			No	25.79	156.20	125.14	31.3
B-3, 15.0'-16.5'	1505	7/21/09	Hom	No. 4			No	25.63	149.42	124.86	24.8
B-3, 16.5'-18.0'	1506	7/21/09	Hom	No. 4			Yes	25.97	162.76	130.00	31.5
B-3, 18.0'-19.5'	1507	7/21/09	Hom	3/8"			No	26.06	202.65	191.27	6.9
B-3, 19.5'-21.0'	1508	7/21/09	Len	3/8"			No	25.48	175.36	164.09	8.1
B-3, 21.0'-22.5'	1509	7/21/09	Hom	No. 4			Yes	25.55	148.25	125.82	22.4
B-3, 22.5'-24.0' NO RECOVERY	1510	7/21/09									
B-3, 24.0'-25.5'	1511	7/21/09	Hom	3/8"			No	25.61	176.98	153.42	18.4
B-3, 25.5'-27.0'	1512	7/21/09	Hom	3/8"			No	25.79	172.52	142.71	25.5
B-3, 27.0'-28.5'	1513	7/21/09	Hom	3/8"			No	25.39	237.01	200.80	20.6
B-3, 28.5'-30.0'	1514	7/21/09	Hom	3/8"			No	25.85	202.93	164.37	27.8
B-3, 30.0'-31.5'	1515	7/21/09	Hom	3/4"			No	25.94	127.73	108.76	22.9
B-3, 31.5'-33.0'	1516	7/21/09	Hom	3/8"			No	25.77	98.91	88.02	17.5
B-3, 33.0'-34.5'	1517	7/21/09	Hom	3/8"			No	26.32	148.99	117.25	34.9
B-3, 34.5'-36.0'	1518	7/21/09	Hom	3/8"			No	25.77	125.06	99.75	34.2
B-3, 36.0'-37.5'	1519	7/26/09	Lam	No. 4			Yes	26.05	176.39	148.43	22.8
B-3, 37.5'-39.0'	1520	7/26/09	Lam	No. 4			Yes	25.85	154.79	129.00	25.0
B-3, 39.0'-40.5'	1521	7/26/09	Hom	No. 4			Yes	26.28	160.49	134.54	24.0
B-3, 40.5'-42.0'	1522	7/26/09	Hom	No. 4			Yes	25.55	156.17	131.61	23.2

Stantec

Moisture Content of Soil
ASTM D 2216

Project Name CUF Dry Ash Stack and Gypsum Stack

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

PRELIMINARY

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-3, 42.0'-43.5'	1523	7/26/09	Hom	No. 4			Yes	26.12	158.81	132.29	25.0
B-3, 43.5'-45.0'	1524	7/26/09	Hom	No. 4			Yes	26.06	155.56	132.58	21.6
B-3, 45.0'-46.5'	1525	7/26/09	Hom	No. 4			Yes	26.07	160.24	134.99	23.2
B-3, 47.5'-49.0'	1526	7/26/09	Hom	No. 4			Yes	25.33	162.11	136.57	23.0
B-3, 50.0'-51.5'	1527	7/26/09	Hom	No. 4			Yes	25.99	173.75	132.93	38.2
B-3, 52.5'-54.0'	1528	7/26/09	Hom	No. 4			Yes	25.63	180.40	149.49	25.0
B-3, 55.0'-56.5'	1529	7/26/09	Hom	No. 10			Yes	25.74	75.13	63.88	29.5
B-3, 57.5'-59.0'	1530	7/26/09	Hom	No. 10			Yes	25.60	124.24	99.29	33.9
B-3, 60.0'-61.5'	1531	7/26/09	Hom	No. 10			Yes	25.70	181.10	135.34	41.7
B-3, 62.5'-64.0'	1532	7/26/09	Hom	3/8"			No	25.81	208.86	186.50	13.9
B-3, 65.0'-66.3'	1533	7/26/09	Hom	3/8"			No	25.68	204.17	189.93	8.7
B-21B, 45.0'-46.5'	1534	7/26/09	Hom	No. 4			Yes	25.84	191.17	159.10	24.1
B-21B, 46.5'-48.0'	1535	7/26/09	Hom	No. 10			Yes	21.49	153.44	124.25	28.4
B-21B, 52.0'-53.5'	1536	7/26/09	Hom	No. 10			Yes	21.48	133.88	109.60	27.6
B-21B, 53.5'-55.0'	1537	7/26/09	Hom	No. 10			Yes	21.07	167.06	129.53	34.6
B-21B, 56.8'-56.9'	1538	7/26/09	Hom	No. 10			Yes	21.31	141.49	111.77	32.9
B-21B, 57.5'-59.0'	1539	7/26/09	Hom	No. 4			Yes	21.01	162.70	138.59	20.5
B-21B, 61.0'-62.5'	1540	7/26/09	Hom	3/8"			No	26.01	223.30	194.70	17.0
B-21B, 65.0'-66.5'	1541	7/26/09	Hom	3/8"			No	21.26	203.89	171.47	21.6
B-21B, 67.5'-69.0'	1542	7/26/09	Hom	3/8"			No	21.38	180.36	149.67	23.9
B-21B, 70.0'-71.5'	1543	7/26/09	Hom	3/8"			No	21.11	193.81	165.44	19.7
B-21B, 72.5'-74.0'	1544	7/26/09	Hom	3/8"			No	26.13	225.74	194.82	18.3
B-21B, 75.0'-76.5'	1545	7/26/09	Hom	3/8"			No	21.30	166.63	144.18	18.3
B-27, 0.0'-1.5'	1546	7/26/09	Hom	No. 10			Yes	21.42	156.32	136.89	16.8
B-27, 1.5'-3.0'	1547	7/26/09	Hom	No. 10			Yes	21.89	119.11	110.17	10.1
B-27, 3.0'-4.5'	1548	7/26/09	Hom	No. 10			Yes	21.57	94.68	86.10	13.3
B-27, 4.5'-6.0'	1549	7/26/09	Hom	No. 10			Yes	22.42	120.64	108.04	14.7
B-27, 6.0'-7.5'	1550	7/26/09	Hom	No. 10			Yes	21.03	124.04	107.55	19.1
B-27, 7.5'-9.0'	1551	7/26/09	Hom	No. 10			Yes	20.84	116.88	102.84	17.1
B-27, 9.0'-10.5'	1552	7/26/09	Hom	No. 10			Yes	20.90	128.80	112.64	17.6
B-27, 10.5'-12.0'	1553	7/26/09	Hom	No. 10			Yes	26.02	143.98	132.63	10.6

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name CUF Dry Ash Stack and Gypsum Stack

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous

PRELIMINARY

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-27, 12.0'-13.5'	1554	7/26/09	Hom	No. 10			Yes	21.74	101.64	95.06	9.0
B-27, 13.5'-15.0'	1555	7/26/09	Hom	No. 10			Yes	21.03	121.51	104.89	19.8
B-27, 15.0'-16.5'	1556	7/26/09	Hom	No. 10			Yes	20.92	123.78	106.78	19.8
B-27, 16.5'-18.0'	1557	7/26/09	Hom	No. 10			Yes	21.01	101.17	88.34	19.1
B-27, 18.0'-19.5'	1558	7/26/09	Hom	No. 10			Yes	21.82	105.81	91.96	19.7
B-27, 19.5'-21.0'	1559	7/26/09	Hom	No. 10			Yes	22.78	118.03	101.40	21.2
B-27, 21.0'-22.5'	1560	7/26/09	Hom	No. 4			No	22.61	123.53	104.81	22.8
B-27, 22.5'-24.0'	1561	7/26/09	Hom	No. 4			No	22.07	121.15	102.30	23.5
B-27, 24.0'-25.5'	1562	7/26/09	Hom	3/8"			No	16.39	115.16	96.78	22.9
B-27, 25.5'-27.0' NO RECOVERY	1563	7/21/09									
B-27, 27.0'-28.5'	1564	7/26/09	Hom	3/8"			No	16.35	81.37	67.84	26.3
B-27, 28.5'-30.0'	1565	7/26/09	Hom	3/8"			No	15.32	113.67	98.26	18.6
B-27, 30.0'-31.5'	1566	7/26/09	Hom	3/8"			No	30.90	281.53	239.04	20.4
B-27, 31.5'-33.0'	1567	7/26/09	Hom	3/8"			No	16.96	125.59	103.72	25.2
B-27, 33.0'-34.5'	1568	7/26/09	Hom	3/8"			No	32.08	186.61	150.02	31.0
B-27, 34.5'-36.0'	1569	7/26/09	Hom	3/8"			No	31.62	188.54	149.90	32.7
B-27, 36.0'-37.5'	1570	7/26/09	Hom	No. 4			Yes	30.81	217.26	175.11	29.2
B-27, 37.5'-39.0'	1571	7/26/09	Hom	No. 4			No	16.07	90.00	69.47	38.4
B-27, 39.0'-40.5'	1572	7/26/09	Hom	No. 4			No	16.24	104.16	77.67	43.1
B-27, 40.5'-42.0'	1573	7/26/09	Hom	No. 10			Yes	16.23	101.44	75.26	44.4
B-27, 42.0'-43.5'	1574	7/26/09	Hom	No. 4			No	22.63	113.54	88.36	38.3
B-27, 43.5'-45.0'	1575	7/26/09	Hom	No. 4			No	20.45	121.15	96.28	32.8
B-27, 45.0'-46.5'	1576	7/26/09	Hom	No. 4			No	21.29	100.05	78.87	36.8
B-27, 46.5'-48.0'	1577	7/26/09	Hom	No. 4			No	21.13	111.36	90.56	30.0
B-27, 48.0'-49.5'	1578	7/26/09	Hom	3/8"			No	22.55	124.60	98.45	34.5
B-27, 49.5'-51.0'	1579	7/26/09	Hom	No. 4			No	14.88	102.38	74.89	45.8
B-27, 51.0'-52.5'	1580	7/26/09	Hom	No. 4			No	15.33	123.22	92.87	39.1
B-27, 52.5'-54.0'	1581	7/26/09	Hom	No. 4			No	21.50	114.89	86.54	43.6
B-27, 54.0'-55.5'	1582	7/27/09	Hom	No. 10			Yes	15.02	89.10	68.14	39.5
B-27, 55.5'-57.0'	1583	7/27/09	Hom	No. 10			Yes	16.63	89.26	68.91	38.9
B-27, 57.0'-58.5'	1584	7/27/09	Hom	No. 10			Yes	20.67	95.43	76.23	34.6

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name CUF Dry Ash Stack and Gypsum Stack

Project Number 175539009

Tested By

Test Method ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

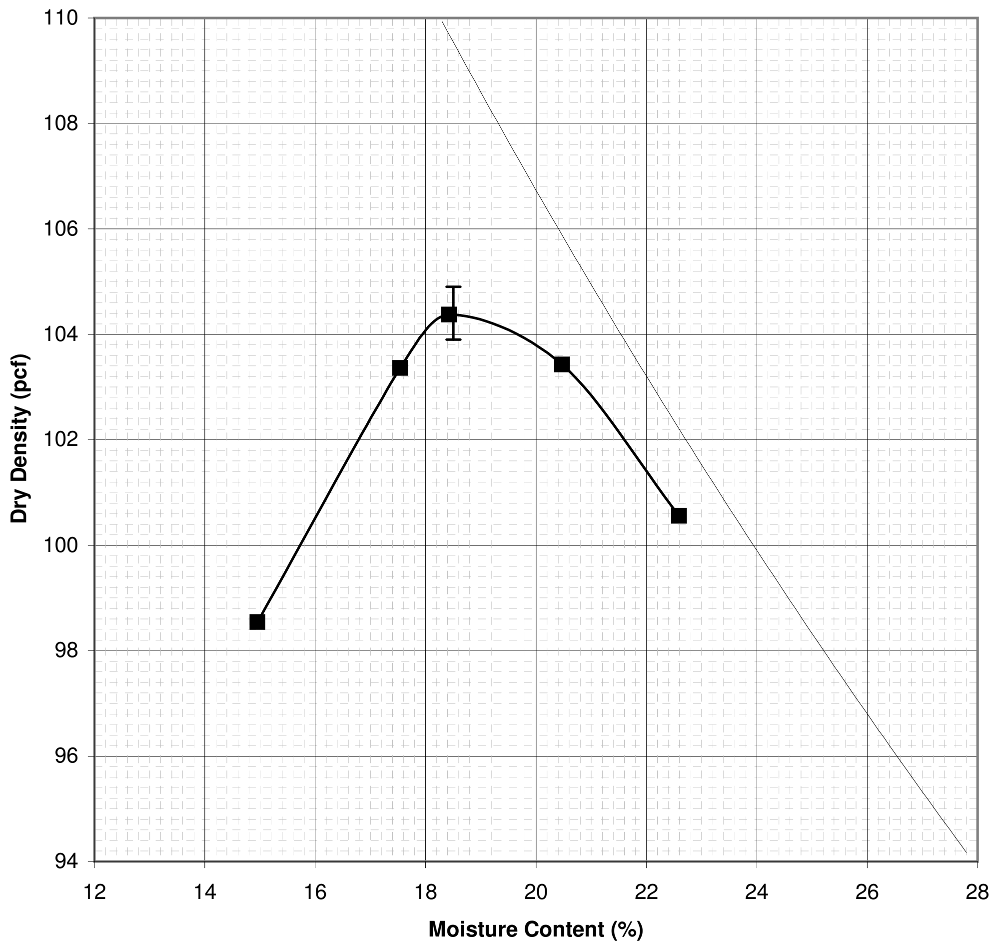
Material Type: Stratified, Laminated, Lensed, Homogeneous

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
B-27, 58.5'-60.0'	1585	7/27/09	Hom	No. 10			Yes	22.28	100.52	80.82	33.7
B-27, 60.0'-61.5'	1586	7/27/09	Hom	No. 10			Yes	17.22	65.76	50.02	48.0
B-27, 61.5'-63.0'	1587	7/27/09	Hom	No. 10			Yes	16.50	75.51	58.43	40.7
B-27, 63.0'-64.5'	1588	7/27/09	Hom	No. 10			Yes	16.62	80.70	61.52	42.7
B-27, 64.5'-66.0'	1589	7/27/09	Hom	No. 10			Yes	15.78	88.58	66.58	43.3
B-27, 66.0'-67.5'	1590	7/27/09	Hom	No. 10			Yes	16.41	99.22	84.79	21.1
B-27, 67.5'-69.0'	1591	7/27/09	Hom	No. 10			Yes	22.21	91.27	78.14	23.5
B-27, 70.0'-71.5'	1592	7/27/09	Hom	No. 10			Yes	16.05	81.63	69.46	22.8
B-27, 72.5'-74.0'	1593	7/27/09	Hom	No. 10			Yes	21.02	92.56	77.55	26.6
B-27, 75.0'-76.5'	1594	7/27/09	Hom	No. 10			Yes	15.46	92.86	77.29	25.2
B-27, 77.5'-79.0'	1595	7/27/09	Hom	No. 10			Yes	21.23	127.41	105.36	26.2
B-27, 80.0'-81.5'	1596	7/27/09	Hom	No. 10			Yes	22.84	121.78	101.81	25.3
B-27, 82.5'-84.0'	1597	7/27/09	Hom	No. 10			Yes	21.26	113.98	92.30	30.5
B-27, 85.0'-86.5'	1598	7/27/09	Hom	No. 10			Yes	16.63	79.42	64.67	30.7
B-27, 87.5'-87.9'	1599	7/27/09	Hom	No. 10			Yes	22.27	96.18	78.00	32.6

Moisture-Density Data Sheet

Project: Cumberland Dry Ash Stack and Gypsum Disposal Area
Project No.: 175539009
Source: B-25, 10.5'-18.0'
Sample No.: 294
Sample Description: fat clay, brown, moist
Nmc: 21.5 %
Visual Notes: N/A
Test Method: ASTM D 698 - Method A
Prepared: Moist Oversized Fraction: < 5 % Rammer: Mechanical
Gs - Fines: Assumed

Mold Weight 2043 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)
3754	1711	381.23	341.09	72.71	15.0	98.5
3878	1835	452.51	396.25	75.47	17.5	103.4
3910	1867	465.37	401.39	54.13	18.4	104.4
3925	1882	372.84	322.41	76.08	20.5	103.4
3905	1862	395.88	336.55	73.92	22.6	100.6



Maximum Dry Density 104.4 PCF
Optimum Moisture Content 18.5 %

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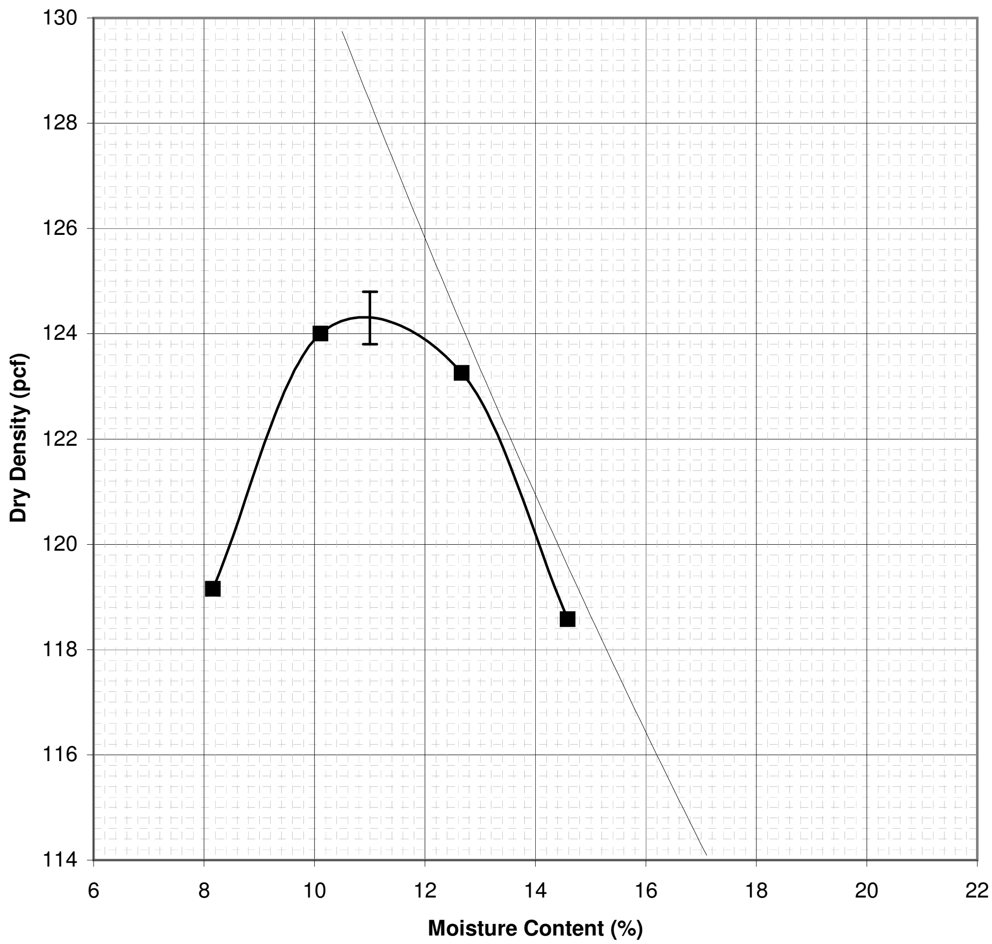
Moisture-Density Data Sheet

Project: CUF- Dry Stack/Gypsum Disposal
Project No.: 175539009
Source: B-28 1.5'-15.0'
Sample No.: 1459
Sample Description: Clay with trace of gravel, light brown, moist
Nmc: 6.5 %
Visual Notes:
Test Method: ASTM D 698 - Method A
Prepared: Dry Oversized Fraction: < 5 % Rammer: Manual
Gs - Fines: ASTM D 854

Mold Weight 2040 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)
4090	2050	213.53	200.90	75.98	10.1	124.0
4125	2085	236.20	217.95	73.89	12.7	123.3
4080	2040	108.53	98.80	32.10	14.6	118.6
3975	1935	215.53	205.00	76.00	8.2	119.2



Maximum Dry Density 124.3 PCF
Optimum Moisture Content 11.0 %

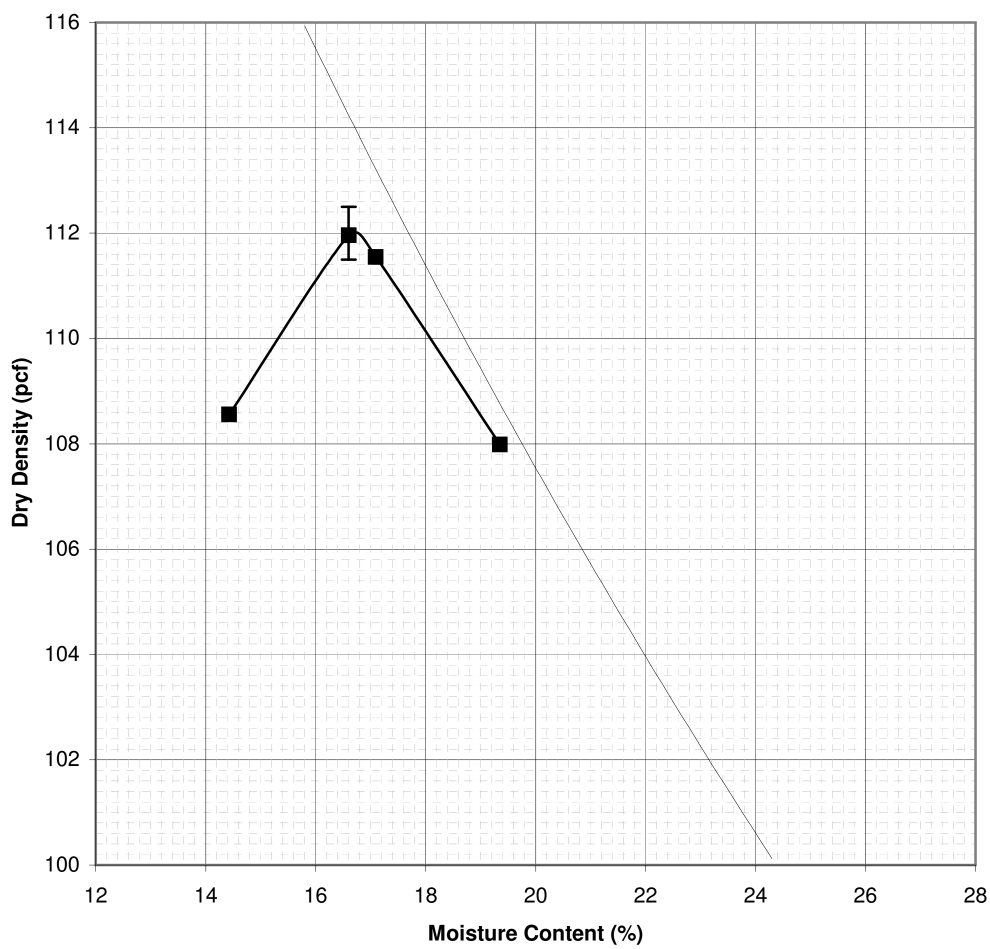
Stantec

Moisture-Density Data Sheet

Project: CUF- Dry Stack/Gypsum Disposal — Project No.: 175539009
Source: B-37, 6.0'-14.5' — Sample No.: 1460
Sample Description: brown clay, moist — Nmc: 16.3 %
Visual Notes: soft — Test Method: ASTM D 698 - Method A
Prepared: Dry — Oversized Fraction: < 5 % — Rammer: Manual — Gs - Fines: ASTM D 854

PRELIMINARY

Mold Weight 4125 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)
5990	1865	301.52	272.66	72.61	14.4	108.6
6085	1960	420.27	370.95	73.92	16.6	112.0
6086	1961	408.78	359.41	70.60	17.1	111.5
6060	1935	287.30	253.04	75.99	19.4	108.0



Maximum Dry Density 112.0 PCF
Optimum Moisture Content 16.6 %

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-2 4, 4.5'-6.0' & B-2 5, 7.5'-9.0' & B-2 6, 10.0'-11.5'	Lab ID	491
County	Stewart	Date Received	6-5-09
Sample Type	SPT Comp	Date Reported	7-9-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 25.9

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	99.1
3/4"	19	99.1
3/8"	9.5	93.2
No. 4	4.75	85.0
No. 10	2	73.2
No. 40	0.425	51.8
No. 200	0.075	33.9
	0.02	12.2
	0.005	3.9
	0.002	2.6
estimated	0.001	0.5

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	15.0	26.8
Coarse Sand	11.8	21.4
Medium Sand	21.4	---
Fine Sand	17.9	17.9
Silt	30.0	31.3
Clay	3.9	2.6

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: 2.62

Classification

Unified Group Symbol: SM

Group Name: Silty sand with gravel

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Summary of Soil Tests

Project Name: Cumberland Dry Ash Stack and Gypsum Disposal Area
Project Number: 175539009
Source: B-2 24, 55.0'-56.5' & B-2 25, 57.5'-59.0' & B-2 26, 6(
Lab ID: 512

County: Stewart
Date Received: 6-5-09
Sample Type: SPT Comp
Date Reported: 7-9-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 26.9

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	
No. 4	4.75	100.0
No. 10	2	100.0
No. 40	0.425	98.7
No. 200	0.075	95.1
	0.02	62.3
	0.005	35.8
	0.002	26.0
estimated	0.001	20.1

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	1.3
Medium Sand	1.3	---
Fine Sand	3.6	3.6
Silt	59.3	69.1
Clay	35.8	26.0

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 36
Plastic Limit: 20
Plasticity Index: 16
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: 2.56

Classification
Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-6 (16)

Comments:

Stantec

Summary of Soil Tests

Project Name: Cumberland Dry Ash Stack and Gypsum Disposal Area — Project Number: 175539009
Source: B-4 2, 1.5'-3.0' & B-4 3, 3.0'-4.5' & B-4 4, 4.5'-6.(— Lab ID: 582

County: Stewart — Date Received: 6-5-09
Sample Type: SPT Comp — Date Reported: 7-6-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 40.7

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	99.5
No. 4	4.75	97.6
No. 10	2	94.5
No. 40	0.425	79.9
No. 200	0.075	72.5
	0.02	42.0
	0.005	13.9
	0.002	4.7
estimated	0.001	0.2

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	2.4	5.5
Coarse Sand	3.1	14.6
Medium Sand	14.6	---
Fine Sand	7.4	7.4
Silt	58.6	67.8
Clay	13.9	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: 2.42

Classification

Unified Group Symbol: ML
Group Name: Silt with sand

AASHTO Classification: A-4 (0)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-4 30, 43.5'-45.0' & B-4 31, 45.0'-46.5' & B-4 3:	Lab ID	611
County	Stewart	Date Received	6-5-09
Sample Type	SPT Comp	Date Reported	7-6-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 27.2

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	95.6
No. 200	0.075	92.1
	0.02	69.6
	0.005	44.4
	0.002	32.2
estimated	0.001	24.2

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	4.4
Medium Sand	4.4	---
Fine Sand	3.5	3.5
Silt	47.7	59.9
Clay	44.4	32.2

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 40
Plastic Limit: 21
Plasticity Index: 19
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: 2.53

Classification
Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-6 (18)

Comments:

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-6, 0.0'-10.0'	Lab ID	39
County	Stewart	Date Received	5-12-09
Sample Type	Bag	Date Reported	6-1-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 24.3

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 55
Plastic Limit: 18
Plasticity Index: 37
Activity Index: 0.93

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	98.2
No. 4	4.75	94.0
No. 10	2	89.7
No. 40	0.425	81.8
No. 200	0.075	67.9
	0.02	56.3
	0.005	45.5
	0.002	40.4
estimated	0.001	37.1

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	6.0	10.3
Coarse Sand	4.3	7.9
Medium Sand	7.9	---
Fine Sand	13.9	13.9
Silt	22.4	27.5
Clay	45.5	40.4

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: 2.55

Classification
Unified Group Symbol: CH
Group Name: Sandy fat clay

AASHTO Classification: A-7-6 (23)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-6, 24.0'-25.5', 25.5'-27.0', 27.0'-28.5', 28.5'-30.0', 30.0'-31.5',	Lab ID	17
County	Stewart	Date Received	5-12-09
Sample Type	SPT Comp	Date Reported	6-1-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 31.1

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	100.0
1"	25	96.4
3/4"	19	85.1
3/8"	9.5	71.0
No. 4	4.75	57.5
No. 10	2	51.2
No. 40	0.425	42.7
No. 200	0.075	40.5
	0.02	30.4
	0.005	25.5
	0.002	23.1
estimated	0.001	21.3

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	42.5	48.8
Coarse Sand	6.3	8.5
Medium Sand	8.5	---
Fine Sand	2.2	2.2
Silt	15.0	17.4
Clay	25.5	23.1

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 56

Plastic Limit: 20

Plasticity Index: 36

Activity Index: 1.57

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: GC

Group Name: Clayey gravel with sand

AASHTO Classification: A-7-6 (8)

Comments:

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-6, 36.0'-37.5', 37.5'-39.0', 40.0'-41.5', 42.5'-44.0'	Lab ID	26
County	Stewart	Date Received	5-12-09
Sample Type	SPT Comp	Date Reported	6-1-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 26.5

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	98.7
No. 4	4.75	98.1
No. 10	2	97.8
No. 40	0.425	93.7
No. 200	0.075	90.1
	0.02	64.0
	0.005	36.3
	0.002	28.6
estimated	0.001	23.8

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	1.9	2.2
Coarse Sand	0.3	4.1
Medium Sand	4.1	---
Fine Sand	3.6	3.6
Silt	53.8	61.5
Clay	36.3	28.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 37

Plastic Limit: 18

Plasticity Index: 19

Activity Index: 0.66

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: 2.55

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-6 (17)

Comments:

Stantec

Summary of Soil Tests

Project Name: Cumberland Dry Ash Stack and Gypsum Disposal Area
Project Number: 175539009
Source: 8, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5
Lab ID: 802

County: Stewart
Date Received: 6-18-09
Sample Type: SPT Comp
Date Reported: 7-31-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 15.8

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	100.0
3/8"	9.5	99.7
No. 4	4.75	98.7
No. 10	2	97.9
No. 40	0.425	90.5
No. 200	0.075	85.6
	0.02	56.7
	0.005	36.6
	0.002	29.9
estimated	0.001	26.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	1.3	2.1
Coarse Sand	0.8	7.4
Medium Sand	7.4	---
Fine Sand	4.9	4.9
Silt	49.0	55.7
Clay	36.6	29.9

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 36
Plastic Limit: 19
Plasticity Index: 17
Activity Index: 0.57

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: 2.64

Classification
Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-6 (14)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-9, 0.0'-6.0'	Lab ID	161
County	Stewart	Date Received	5-18-09
Sample Type	Bag	Date Reported	6-3-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 20.3

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	99.0
No. 4	4.75	91.2
No. 10	2	88.1
No. 40	0.425	81.9
No. 200	0.075	68.7
	0.02	53.0
	0.005	41.0
	0.002	35.6
estimated	0.001	34.5

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	8.8	11.9
Coarse Sand	3.1	6.2
Medium Sand	6.2	---
Fine Sand	13.2	13.2
Silt	27.7	33.1
Clay	41.0	35.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 50

Plastic Limit: 17

Plasticity Index: 33

Activity Index: 0.92

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: CH/CL

Group Name: Sandy fat clay

AASHTO Classification: A-7-6 (21)

Comments:

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-9, 9.0'-12.0'	Lab ID	162
County	Stewart	Date Received	5-18-09
Sample Type	Bag	Date Reported	6-3-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 22.2

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	100.0
3/8"	9.5	98.7
No. 4	4.75	95.1
No. 10	2	92.7
No. 40	0.425	88.9
No. 200	0.075	83.0
	0.02	61.2
	0.005	48.7
	0.002	41.0
estimated	0.001	35.8

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	4.9	7.3
Coarse Sand	2.4	3.8
Medium Sand	3.8	---
Fine Sand	5.9	5.9
Silt	34.3	42.0
Clay	48.7	41.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 51
Plastic Limit: 19
Plasticity Index: 32
Activity Index: 0.78

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: CH/CL
Group Name: Fat clay with sand

AASHTO Classification: A-7-6 (27)

Comments:

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	11, 15.0'-16.5', 16.5'-18.0', 18.0'-19.5', 19.5'-21.0', 21.0'-22.5', 2	Lab ID	841
County	Stewart	Date Received	6-18-09
Sample Type	SPT Comp	Date Reported	7-31-09

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	100.0
3/4"	19	98.4
3/8"	9.5	96.2
No. 4	4.75	95.5
No. 10	2	95.0
No. 40	0.425	92.8
No. 200	0.075	89.7
	0.02	65.8
	0.005	41.9
	0.002	34.0
estimated	0.001	27.9

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	4.5	5.0
Coarse Sand	0.5	2.2
Medium Sand	2.2	---
Fine Sand	3.1	3.1
Silt	47.8	55.7
Clay	41.9	34.0

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 41

Plastic Limit: 24

Plasticity Index: 17

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: 2.66

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-7-6 (17)

Comments:

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-12, 15.0'	Lab ID	208
County	Stewart	Date Received	5-18-09
Sample Type	Bag	Date Reported	6-3-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 21.2

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	100.0
3/8"	9.5	97.0
No. 4	4.75	89.2
No. 10	2	86.6
No. 40	0.425	80.4
No. 200	0.075	73.0
	0.02	55.3
	0.005	41.0
	0.002	35.3
estimated	0.001	32.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	10.8	13.4
Coarse Sand	2.6	6.2
Medium Sand	6.2	---
Fine Sand	7.4	7.4
Silt	32.0	37.7
Clay	41.0	35.3

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 51

Plastic Limit: 18

Plasticity Index: 33

Activity Index: 0.94

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: 2.77

Classification

Unified Group Symbol: CH/CL

Group Name: Fat clay with sand

AASHTO Classification: A-7-6 (23)

Comments:

Stantec

Summary of Soil Tests

Project Name: Cumberland Dry Ash Stack and Gypsum Disposal Area
Project Number: 175539009
Source: B-12, 35.0'-36.5', 37.5'-39.0', 40.0'-41.5', 42.5'-44.0', 45.0'-46.5'
Lab ID: 186

County: Stewart
Date Received: 5-18-09
Sample Type: SPT Comp
Date Reported: 6-3-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 25.5

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	97.6
No. 4	4.75	96.3
No. 10	2	95.0
No. 40	0.425	92.2
No. 200	0.075	88.8
	0.02	67.4
	0.005	46.0
	0.002	34.2
estimated	0.001	28.5

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	3.7	5.0
Coarse Sand	1.3	2.8
Medium Sand	2.8	---
Fine Sand	3.4	3.4
Silt	42.8	54.6
Clay	46.0	34.2

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 40
Plastic Limit: 19
Plasticity Index: 21
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: 2.64

Classification
Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-6 (19)

Comments:

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area
Project Number	175539009
Source	B-12, 60.0'-61.5', 62.5'-64.0', 65.0'-66.5', 67.5'-69.0'
Lab ID	197
County	Stewart
Sample Type	SPT Comp
Date Received	5-18-09
Date Reported	6-3-09

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	100.0
1"	25	91.7
3/4"	19	88.1
3/8"	9.5	69.9
No. 4	4.75	54.4
No. 10	2	44.2
No. 40	0.425	31.5
No. 200	0.075	21.4
	0.02	13.0
	0.005	7.1
	0.002	5.6
estimated	0.001	5.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	45.6	55.8
Coarse Sand	10.2	12.7
Medium Sand	12.7	---
Fine Sand	10.1	10.1
Silt	14.3	15.8
Clay	7.1	5.6

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: 2.62

Classification

Unified Group Symbol: GM

Group Name: Silty gravel with sand

AASHTO Classification: A-1-b (0)

Comments:

Stantec

Summary of Soil Tests

Project Name: Cumberland Dry Ash Stack and Gypsum Disposal Area
Project Number: 175539009
Source: 14, 40.0'-41.5', 42.5'-44.0', 45.0'-46.5', 47.5'-49.0'
Lab ID: 896

County: Stewart
Date Received: 6-18-09
Sample Type: SPT Comp
Date Reported: 7-13-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 23.4

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	100.0
3/4"	19	94.5
3/8"	9.5	88.4
No. 4	4.75	81.2
No. 10	2	72.6
No. 40	0.425	35.7
No. 200	0.075	16.8
	0.02	8.7
	0.005	4.6
	0.002	2.8
estimated	0.001	2.2

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	18.8	27.4
Coarse Sand	8.6	36.9
Medium Sand	36.9	---
Fine Sand	18.9	18.9
Silt	12.2	14.0
Clay	4.6	2.8

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
Estimated
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification
Unified Group Symbol: SM
Group Name: Silty sand with gravel
AASHTO Classification: A-1-b (0)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	14, 52.5'-54.0', 55.0'-56.5', 57.5'-59.0', 60.0'-61.5', 62.5'-64.0'	Lab ID	902
County	Stewart	Date Received	6-18-09
Sample Type	SPT Comp	Date Reported	7-13-09

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	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	83.3
3/4"	19	76.2
3/8"	9.5	58.4
No. 4	4.75	47.0
No. 10	2	38.4
No. 40	0.425	22.7
No. 200	0.075	16.3
	0.02	10.3
	0.005	7.2
	0.002	6.1
estimated	0.001	5.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	53.0	61.6
Coarse Sand	8.6	15.7
Medium Sand	15.7	---
Fine Sand	6.4	6.4
Silt	9.1	10.2
Clay	7.2	6.1

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
Estimated
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification
Unified Group Symbol: GM
Group Name: Silty gravel with sand
AASHTO Classification: A-1-b (0)

Comments:

Stantec

Summary of Soil Tests

Project Name: Cumberland Dry Ash Stack and Gypsum Disposal Area
Project Number: 175539009
Source: B-18, 0.0'-1.5', 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5'
Lab ID: 727

County: Stewart
Date Received: 6-12-09
Sample Type: SPT Comp
Date Reported: 7-9-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 14.4

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	100.0
3/8"	9.5	95.6
No. 4	4.75	91.1
No. 10	2	82.7
No. 40	0.425	57.6
No. 200	0.075	39.5
	0.02	18.6
	0.005	7.1
	0.002	3.9
estimated	0.001	3.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	8.9	17.3
Coarse Sand	8.4	25.1
Medium Sand	25.1	---
Fine Sand	18.1	18.1
Silt	32.4	35.6
Clay	7.1	3.9

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: 2.61

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-4 (0)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-18, 15.0'-16.5', 16.5'-18.0', 18.0'-19.5', 19.5'-21.0', 21.0'-22.5'	Lab ID	738
County	Stewart	Date Received	6-12-09
Sample Type	SPT Comp	Date Reported	7-9-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 37.2

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	100.0
3/4"	19	95.5
3/8"	9.5	95.5
No. 4	4.75	95.2
No. 10	2	95.1
No. 40	0.425	90.6
No. 200	0.075	74.0
	0.02	38.5
	0.005	13.0
	0.002	4.4
estimated	0.001	1.2

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	4.8	4.9
Coarse Sand	0.1	4.5
Medium Sand	4.5	---
Fine Sand	16.6	16.6
Silt	61.0	69.6
Clay	13.0	4.4

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: 2.58

Classification
Unified Group Symbol: ML
Group Name: Silt with sand

AASHTO Classification: A-4 (0)

Comments:

Stantec

Summary of Soil Tests

Project Name: Cumberland Dry Ash Stack and Gypsum Disposal Area
Project Number: 175539009
Source: B-19, 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'-15.0', 15
Lab ID: 663

County: Stewart
Date Received: 6-12-09
Sample Type: SPT Comp
Date Reported: 7-9-09

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	100.0
3/4"	19	93.3
3/8"	9.5	84.4
No. 4	4.75	73.8
No. 10	2	67.2
No. 40	0.425	57.8
No. 200	0.075	49.0
	0.02	36.9
	0.005	26.5
	0.002	21.6
estimated	0.001	18.5

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	26.2	32.8
Coarse Sand	6.6	9.4
Medium Sand	9.4	---
Fine Sand	8.8	8.8
Silt	22.5	27.4
Clay	26.5	21.6

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 48
Plastic Limit: 19
Plasticity Index: 29
Activity Index: 1.32

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: 2.78

Classification
Unified Group Symbol: GC
Group Name: Clayey gravel with sand

AASHTO Classification: A-7-6 (10)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-19, 28.5'-30.0', 30.0'-31.5', 31.5'-33.0', 33.0'-34.5', 34.5'-36.0'	Lab ID	678
County	Stewart	Date Received	6-12-09
Sample Type	SPT Comp	Date Reported	7-9-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 30.3

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	99.5
No. 4	4.75	98.0
No. 10	2	97.2
No. 40	0.425	91.4
No. 200	0.075	80.0
	0.02	37.8
	0.005	11.7
	0.002	3.9
estimated	0.001	0.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	2.0	2.8
Coarse Sand	0.8	5.8
Medium Sand	5.8	---
Fine Sand	11.4	11.4
Silt	68.3	76.1
Clay	11.7	3.9

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: 2.46

Classification

Unified Group Symbol: ML

Group Name: Silt with sand

AASHTO Classification: A-4 (0)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-20, 0.0'-1.5', 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.	Lab ID	691
County	Stewart	Date Received	6-12-09
Sample Type	SPT Comp	Date Reported	7-9-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 15.7

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	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	93.6
No. 200	0.075	87.1
	0.02	7.1
	0.005	3.9
	0.002	3.8
estimated	0.001	3.7

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	6.4
Medium Sand	6.4	---
Fine Sand	6.5	6.5
Silt	83.2	83.3
Clay	3.9	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: 2.31

Classification

Unified Group Symbol: ML

Group Name: Silt

AASHTO Classification: A-4 (0)

Comments:

Stantec

Summary of Soil Tests

Project Name: Cumberland Dry Ash Stack and Gypsum Disposal Area
Project Number: 175539009
Source: B-21, 0.0'-9.0'
Lab ID: 71

County: Stewart
Date Received: 5-12-09
Sample Type: Bag
Date Reported: 6-1-09

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	100.0
3/4"	19	98.9
3/8"	9.5	95.4
No. 4	4.75	93.2
No. 10	2	89.9
No. 40	0.425	82.8
No. 200	0.075	70.6
	0.02	52.5
	0.005	37.5
	0.002	31.7
estimated	0.001	29.8

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	6.8	10.1
Coarse Sand	3.3	7.1
Medium Sand	7.1	---
Fine Sand	12.2	12.2
Silt	33.1	38.9
Clay	37.5	31.7

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 49
Plastic Limit: 18
Plasticity Index: 31
Activity Index: 0.97

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: 2.81

Classification
Unified Group Symbol: CL/CH
Group Name: Lean clay with sand

AASHTO Classification: A-7-6 (21)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-21, 12.0'-18.0'	Lab ID	72
County	Stewart	Date Received	5-12-09
Sample Type	Bag	Date Reported	5-27-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 91.1

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	100.0
No. 4	4.75	99.3
No. 10	2	97.2
No. 40	0.425	91.1
No. 200	0.075	85.6
	0.02	65.5
	0.005	53.8
	0.002	46.7
estimated	0.001	43.2

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.7	2.8
Coarse Sand	2.1	6.1
Medium Sand	6.1	---
Fine Sand	5.5	5.5
Silt	31.8	38.9
Clay	53.8	46.7

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 56

Plastic Limit: 20

Plasticity Index: 36

Activity Index: 0.77

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: 2.78

Classification

Unified Group Symbol: CH

Group Name: Fat clay

AASHTO Classification: A-7-6 (33)

Comments:

Stantec

Summary of Soil Tests

Project Name: Cumberland Dry Ash Stack and Gypsum Disposal Area
Project Number: 175539009
Source: B-21, 18.0'-19.5', 19.5'-21.0', 21.0'-22.5', 22.5'-24.0', 24.0'-25.5'
Lab ID: 53

County: Stewart
Date Received: 5-12-09
Sample Type: SPT Comp
Date Reported: 6-1-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 22.9

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	100.0
3/4"	19	98.5
3/8"	9.5	93.2
No. 4	4.75	79.4
No. 10	2	62.9
No. 40	0.425	34.5
No. 200	0.075	16.6
	0.02	7.9
	0.005	3.8
	0.002	2.8
estimated	0.001	2.3

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	20.6	37.1
Coarse Sand	16.5	28.4
Medium Sand	28.4	---
Fine Sand	17.9	17.9
Silt	12.8	13.8
Clay	3.8	2.8

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: 2.61

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-1-b (0)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-22, 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'	Lab ID	77
County	Stewart	Date Received	5-12-09
Sample Type	SPT Comp	Date Reported	5-27-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 14.3

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	100.0
1"	25	88.6
3/4"	19	84.1
3/8"	9.5	68.5
No. 4	4.75	55.4
No. 10	2	48.7
No. 40	0.425	38.6
No. 200	0.075	32.2
	0.02	22.4
	0.005	16.7
	0.002	13.0
estimated	0.001	11.4

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	44.6	51.3
Coarse Sand	6.7	10.1
Medium Sand	10.1	---
Fine Sand	6.4	6.4
Silt	15.5	19.2
Clay	16.7	13.0

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 36

Plastic Limit: 18

Plasticity Index: 18

Activity Index: 1.38

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: GC

Group Name: Clayey gravel with sand

AASHTO Classification: A-2-6 (1)

Comments:

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-22, 28.5'-30.0', 30.0'-31.5', 31.5'-33.0', 33.0'-34.5', 34.5'-36.0'	Lab ID	93
County	Stewart	Date Received	5-12-09
Sample Type	SPT Comp	Date Reported	5-27-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 33.6

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	100.0
3/8"	9.5	97.0
No. 4	4.75	92.4
No. 10	2	87.0
No. 40	0.425	72.7
No. 200	0.075	56.0
	0.02	31.8
	0.005	9.5
	0.002	2.3
estimated	0.001	0.8

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	7.6	13.0
Coarse Sand	5.4	14.3
Medium Sand	14.3	---
Fine Sand	16.7	16.7
Silt	46.5	53.7
Clay	9.5	2.3

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: 2.55

Classification

Unified Group Symbol: ML

Group Name: Sandy silt

AASHTO Classification: A-4 (0)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-22, 75.0'-76.5', 77.5'-79.0', 80.0'-81.5', 82.5'-84.0', 85.0'-86.5'	Lab ID	121
County	Stewart	Date Received	5-12-09
Sample Type	SPT Comp	Date Reported	5-27-09

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	100.0
1"	25	89.3
3/4"	19	79.6
3/8"	9.5	62.5
No. 4	4.75	45.8
No. 10	2	30.4
No. 40	0.425	14.9
No. 200	0.075	9.8
	0.02	6.8
	0.005	4.1
	0.002	3.2
estimated	0.001	2.8

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	54.2	69.6
Coarse Sand	15.4	15.5
Medium Sand	15.5	---
Fine Sand	5.1	5.1
Silt	5.7	6.6
Clay	4.1	3.2

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: 2.66

Classification

Unified Group Symbol: GP-GC

Group Name: Poorly graded clayey gravel

AASHTO Classification: A-1-a (0)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-24 4, 4.5'-6.0' & B-24 5, 6.0'-7.5' & B-24 6, 7.5'-9.0' &	Lab ID	536
County	Stewart	Date Received	6-5-09
Sample Type	SPT Comp	Date Reported	7-6-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 16.4

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	100.0
1"	25	96.9
3/4"	19	95.6
3/8"	9.5	79.4
No. 4	4.75	69.8
No. 10	2	62.3
No. 40	0.425	52.2
No. 200	0.075	44.9
	0.02	33.8
	0.005	23.4
	0.002	18.8
estimated	0.001	15.5

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	30.2	37.7
Coarse Sand	7.5	10.1
Medium Sand	10.1	---
Fine Sand	7.3	7.3
Silt	21.5	26.1
Clay	23.4	18.8

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 39

Plastic Limit: 19

Plasticity Index: 20

Activity Index: 1.05

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: 2.51

Classification

Unified Group Symbol: GC

Group Name: Clayey gravel with sand

AASHTO Classification: A-6 (5)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-24 19, 27.0'-28.5' & B-24 20, 28.5'-30.0' & B-24 21, 3(	Lab ID	552
County	Stewart	Date Received	6-5-09
Sample Type	SPT Comp	Date Reported	7-9-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 44.8

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	100.0
3/8"	9.5	99.8
No. 4	4.75	99.8
No. 10	2	99.7
No. 40	0.425	92.6
No. 200	0.075	78.0
	0.02	46.1
	0.005	13.7
	0.002	5.0
estimated	0.001	2.7

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.2	0.3
Coarse Sand	0.1	7.1
Medium Sand	7.1	---
Fine Sand	14.6	14.6
Silt	64.3	73.0
Clay	13.7	5.0

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: 2.44

Classification
Unified Group Symbol: ML
Group Name: Silt with sand

AASHTO Classification: A-4 (0)

Comments:

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-25, 10.5'-18.0'	Lab ID	294
County	Stewart	Date Received	5-29-09
Sample Type	Bag	Date Reported	6-25-09

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	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	99.7
No. 10	2	97.9
No. 40	0.425	94.0
No. 200	0.075	87.7
	0.02	70.4
	0.005	57.4
	0.002	50.4
estimated	0.001	45.2

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.3	2.1
Coarse Sand	1.8	3.9
Medium Sand	3.9	---
Fine Sand	6.3	6.3
Silt	30.3	37.3
Clay	57.4	50.4

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 58
Plastic Limit: 22
Plasticity Index: 36
Activity Index: 0.72

Moisture-Density Relationship
Test Method: ASTM D 698 Method A
Maximum Dry Density (lb/ft^3): 104.4
Maximum Dry Density (kg/m^3): 1672
Optimum Moisture Content (%): 18.4
Over Size Correction %: <5%

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: 2.54

Classification
Unified Group Symbol: CH
Group Name: Fat clay

AASHTO Classification: A-7-6 (34)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-28, 1.5'-15.0'	Lab ID	1459
County	Stewart	Date Received	7-15-09
Sample Type	BULK	Date Reported	8-4-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 6.5

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	100.0
3/4"	19	98.7
3/8"	9.5	88.5
No. 4	4.75	76.8
No. 10	2	68.9
No. 40	0.425	56.2
No. 200	0.075	47.5
	0.02	45.0
	0.005	35.8
	0.002	30.6
estimated	0.001	27.4

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	23.2	31.1
Coarse Sand	7.9	12.7
Medium Sand	12.7	---
Fine Sand	8.7	8.7
Silt	11.7	16.9
Clay	35.8	30.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 36

Plastic Limit: 17

Plasticity Index: 19

Activity Index: 0.61

Moisture-Density Relationship

ASTM D 698 - Method A

Maximum Dry Density (lb/ft^3): 124.3

Maximum Dry Density (kg/m^3): 1991

Optimum Moisture Content (%): 11.0

Over Size Correction %: <5

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: 2.66

Classification

Unified Group Symbol: SC

Group Name: Clayey sand with gravel

AASHTO Classification: A-6 (5)

Comments:

Summary of Soil Tests

Stantec

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-29, 0.3'-10.0'	Lab ID	1457
County	Stewart	Date Received	7-15-09
Sample Type	BULK	Date Reported	8-4-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 12.6

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	100.0
3/8"	9.5	99.3
No. 4	4.75	95.6
No. 10	2	92.6
No. 40	0.425	85.0
No. 200	0.075	77.3
	0.02	69.6
	0.005	56.1
	0.002	52.0
estimated	0.001	49.8

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	4.4	7.4
Coarse Sand	3.0	7.6
Medium Sand	7.6	---
Fine Sand	7.7	7.7
Silt	21.2	25.3
Clay	56.1	52.0

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 46

Plastic Limit: 21

Plasticity Index: 25

Activity Index: 0.48

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: 2.58

Classification

Unified Group Symbol: CL

Group Name: Lean clay with sand

AASHTO Classification: A-7-6 (19)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-29, 10.4'-14.5'	Lab ID	1458
County	Stewart	Date Received	7-15-09
Sample Type	BULK	Date Reported	8-4-09

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	100.0
3/8"	9.5	96.2
No. 4	4.75	91.6
No. 10	2	88.1
No. 40	0.425	80.8
No. 200	0.075	73.5
	0.02	66.8
	0.005	51.6
	0.002	45.9
estimated	0.001	42.6

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	8.4	11.9
Coarse Sand	3.5	7.3
Medium Sand	7.3	---
Fine Sand	7.3	7.3
Silt	21.9	27.6
Clay	51.6	45.9

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 46

Plastic Limit: 17

Plasticity Index: 29

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: 2.57

Classification

Unified Group Symbol: CL

Group Name: Lean clay with sand

AASHTO Classification: A-7-6 (20)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-32, 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0', 9.0'-10.5', 1	Lab ID	330
County	Stewart	Date Received	5-29-09
Sample Type	SPT Comp	Date Reported	7-6-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 16.0

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	100.0
1"	25	94.6
3/4"	19	88.9
3/8"	9.5	79.0
No. 4	4.75	67.2
No. 10	2	60.5
No. 40	0.425	51.4
No. 200	0.075	44.5
	0.02	32.1
	0.005	24.4
	0.002	19.6
estimated	0.001	17.1

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	32.8	39.5
Coarse Sand	6.7	9.1
Medium Sand	9.1	---
Fine Sand	6.9	6.9
Silt	20.1	24.9
Clay	24.4	19.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 40

Plastic Limit: 17

Plasticity Index: 23

Activity Index: 1.15

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: 2.63

Classification

Unified Group Symbol: GC

Group Name: Clayey gravel with sand

AASHTO Classification: A-6 (6)

Comments:

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-32, 20.0'-21.5', 22.5'-24.0', 25.0'-26.5', 27.5'-29.0', 30.0'-31.5'	Lab ID	343
County	Stewart	Date Received	5-29-09
Sample Type	SPT Comp	Date Reported	6-25-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 34.6

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	100.0
3/8"	9.5	98.9
No. 4	4.75	97.4
No. 10	2	96.1
No. 40	0.425	86.2
No. 200	0.075	79.3
	0.02	36.5
	0.005	9.6
	0.002	3.9
estimated	0.001	3.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	2.6	3.9
Coarse Sand	1.3	9.9
Medium Sand	9.9	---
Fine Sand	6.9	6.9
Silt	69.7	75.4
Clay	9.6	3.9

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: 2.52

Classification

Unified Group Symbol: ML

Group Name: Silt with sand

AASHTO Classification: A-4 (0)

Comments:

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-33, 30.0'-31.5', 31.5'-33.0', 33.0'-34.5', 34.5'-36.0', 36.0'-37.5'	Lab ID	381
County	Stewart	Date Received	5-29-09
Sample Type	SPT Comp	Date Reported	6-25-09

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	100.0
3/4"	19	97.0
3/8"	9.5	95.2
No. 4	4.75	92.0
No. 10	2	90.3
No. 40	0.425	85.4
No. 200	0.075	74.7
	0.02	49.6
	0.005	28.0
	0.002	21.0
estimated	0.001	15.6

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	8.0	9.7
Coarse Sand	1.7	4.9
Medium Sand	4.9	---
Fine Sand	10.7	10.7
Silt	46.7	53.7
Clay	28.0	21.0

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 35

Plastic Limit: 23

Plasticity Index: 12

Activity Index: 0.57

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: 2.62

Classification

Unified Group Symbol: CL

Group Name: Lean clay with sand

AASHTO Classification: A-6 (8)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-35 2, 1.5'-3.0' & B-35 3, 3.0'-4.5' & B-35 4, 4.5'-6.0'	Lab ID	445
County	Stewart	Date Received	6-5-09
Sample Type	SPT Comp	Date Reported	7-9-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 10.6

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	100.0
3/8"	9.5	99.7
No. 4	4.75	99.6
No. 10	2	99.5
No. 40	0.425	88.4
No. 200	0.075	81.2
	0.02	10.2
	0.005	5.1
	0.002	4.7
estimated	0.001	4.6

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.4	0.5
Coarse Sand	0.1	11.1
Medium Sand	11.1	---
Fine Sand	7.2	7.2
Silt	76.1	76.5
Clay	5.1	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: 2.94

Classification
Unified Group Symbol: ML
Group Name: Silt with sand
AASHTO Classification: A-4 (0)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-37, 6.0'-14.5'	Lab ID	1460
County	Stewart	Date Received	7-15-09
Sample Type	BULK	Date Reported	8-4-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 16.3

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	99.6
No. 4	4.75	99.4
No. 10	2	99.1
No. 40	0.425	97.0
No. 200	0.075	93.8
	0.02	84.2
	0.005	65.0
	0.002	56.1
estimated	0.001	53.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.6	0.9
Coarse Sand	0.3	2.1
Medium Sand	2.1	---
Fine Sand	3.2	3.2
Silt	28.8	37.7
Clay	65.0	56.1

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 53

Plastic Limit: 18

Plasticity Index: 35

Activity Index: 0.63

Moisture-Density Relationship

ASTM D 698 - Method A

Maximum Dry Density (lb/ft^3): 112.0

Maximum Dry Density (kg/m^3): 1794

Optimum Moisture Content (%): 16.6

Over Size Correction %: <5

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: 2.61

Classification

Unified Group Symbol: CH

Group Name: Fat clay

AASHTO Classification: A-7-6 (35)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-37, 7.5'-9.0', 9.0'-10.5', 10.5'-12.0', 12.0'-13.5', 13.5'-15.0', 15	Lab ID	425
County	Stewart	Date Received	5-29-09
Sample Type	SPT Comp	Date Reported	6-25-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 23.1

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	99.2
No. 4	4.75	97.4
No. 10	2	95.4
No. 40	0.425	91.1
No. 200	0.075	86.4
	0.02	63.3
	0.005	45.3
	0.002	37.9
estimated	0.001	32.9

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	2.6	4.6
Coarse Sand	2.0	4.3
Medium Sand	4.3	---
Fine Sand	4.7	4.7
Silt	41.1	48.5
Clay	45.3	37.9

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 45

Plastic Limit: 18

Plasticity Index: 27

Activity Index: 0.71

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: 2.62

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-7-6 (24)

Comments:

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	41, 0.0'-1.5', 0.1'-2.1', 1.5'-3.0', 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-	Lab ID	1033
County	Stewart	Date Received	6-18-09
Sample Type	SPT Comp	Date Reported	7-31-09

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	100.0
No. 4	4.75	100.0
No. 10	2	99.8
No. 40	0.425	97.8
No. 200	0.075	91.6
	0.02	28.5
	0.005	24.1
	0.002	22.7
estimated	0.001	21.4

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.2
Coarse Sand	0.2	2.0
Medium Sand	2.0	---
Fine Sand	6.2	6.2
Silt	67.5	68.9
Clay	24.1	22.7

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: 2.31

Classification

Unified Group Symbol: ML

Group Name: Silt

AASHTO Classification: A-4 (0)

Comments:

Stantec

Summary of Soil Tests

Project Name: Cumberland Dry Ash Stack and Gypsum Disposal Area — Project Number: 175539009
Source: 41, 24.0'-25.5', 25.5'-27.0', 27.0'-28.5', 28.5'-30.0', 30.0'-31.5', 3 — Lab ID: 1051

County: Stewart — Date Received: 6-18-09
Sample Type: SPT Comp — Date Reported: 7-31-09

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	100.0
No. 4	4.75	99.7
No. 10	2	98.9
No. 40	0.425	83.7
No. 200	0.075	67.3
	0.02	45.5
	0.005	24.4
	0.002	18.5
estimated	0.001	16.8

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.3	1.1
Coarse Sand	0.8	15.2
Medium Sand	15.2	---
Fine Sand	16.4	16.4
Silt	42.9	48.8
Clay	24.4	18.5

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: 2.52

Classification
Unified Group Symbol: ML
Group Name: Sandy silt

AASHTO Classification: A-4 (0)

Comments:

Stantec

Summary of Soil Tests

Project Name	Cumberland Dry Ash Stack and Gypsum Disposal Area	Project Number	175539009
Source	B-45, 3.0'-4.5', 4.5'-6.0', 6.0'-7.5', 7.5'-9.0'	Lab ID	1463
County	Stewart	Date Received	7-15-09
Sample Type	SPT Comp	Date Reported	8-4-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 16.1

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	99.8
No. 10	2	99.7
No. 40	0.425	97.7
No. 200	0.075	92.3
	0.02	25.2
	0.005	21.5
	0.002	21.6
estimated	0.001	21.4

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.2	0.3
Coarse Sand	0.1	2.0
Medium Sand	2.0	---
Fine Sand	5.4	5.4
Silt	70.8	70.7
Clay	21.5	21.6

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: 2.36

Classification

Unified Group Symbol: ML

Group Name: Silt

AASHTO Classification: A-4 (0)

Comments:

Stantec

Summary of Soil Tests

Project Name: Cumberland Dry Ash Stack and Gypsum Disposal Area
Project Number: 175539009
Source: B-45, 25.0'-26.5', 26.5'-28.0', 28.0'-29.5', 30.0'-31.5', 31.5'-33.0'
Lab ID: 1478

County: Stewart
Date Received: 7-15-09
Sample Type: SPT Comp
Date Reported: 8-4-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 35.7

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	97.7
No. 4	4.75	91.7
No. 10	2	82.3
No. 40	0.425	65.3
No. 200	0.075	41.9
	0.02	28.4
	0.005	16.6
	0.002	12.7
estimated	0.001	11.7

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	8.3	17.7
Coarse Sand	9.4	17.0
Medium Sand	17.0	---
Fine Sand	23.4	23.4
Silt	25.3	29.2
Clay	16.6	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

Estimated
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.71

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-4 (0)

Comments:

Appendix H

Phase 1 Coal Combustion Product Facility Summaries, 2009

TVA Disposal Facility Assessment
Phase 1 Coal Combustion Product Disposal Facility Summary
Cumberland Fossil Plant (CUF)
Dry Ash Stack (DS-1)

1. General Facility Information

Facility Status:	Active		
Surface Area:	110 acres (estimated)	Maximum Height (toe to top of stack):	35 feet Existing 200 feet Proposed

2. Site Visit Information

Stantec Assessment Team:	Stephen Bickel, PE, Nathan Bader, PE, Stan Harris, PE and Matthew Hoy, EIT
TVA Staff Present:	Stuart Harris and Carrie McCarty
Field Assessment Dates:	January 14, 2009 and February 3 - 4, 2009
Weather/Site Conditions:	Mid-30 degrees F, sunny, moist ground both days.

3. History/Description of Usage

History, Operation and Stacking Plan:

In 1972, Wells Creek was relocated in order to construct old Disposal Area 1. Old Area 1 was enclosed by the existing perimeter dike and contained sluiced ash. In the 1980s, sluicing operations ceased within Area 1 and began in the current Area 2 to the north. Divider dikes were constructed to separate the current pond from the gypsum and ash stacking operations. In 1995-96, the current divider dike between the Ash Pond and Dry Stack was constructed. In 1996, stacking within this area began. The Dry Stack is bordered by the Ash Pond to the north, by the bottom ash pond to the east, the Wet Gypsum Storage Area to the south, and by perimeter ditches and the old Area 1 perimeter dike to the west. There is a stacking plan available, and construction is currently proceeding to the north. The sequence consists of building the base and closing it, then moving up to the next level. The stack's maximum height is currently 35 feet. A small dredge cell was constructed within the northwest portion of the Dry Stack in 2007 to dispose of coal fines dredged to remove sediment build up in the Coal Yard Drainage Basin.

Stacking over Dredge Cells or CCB Ponds:	Previous Area 1 (the original ash pond) is located beneath the Dry Ash Stack and was used as the original ash pond for the plant. This pond operated until the 1980s when sluicing to Area 2 (current active ash pond) began. The stack is being constructed over sluiced bottom and fly ash. It is unknown how much sluiced ash is beneath the stack. A small dredge cell within the Dry Ash Stack area was also filled with dredged coal fines from the Coal Yard Drainage Basin in 2007.
Past Failures/Releases:	No failures or releases reported.

4. Owner's Operations, Maintenance and Inspection Information

TVA Maintenance:	Mowing is performed every two years.
TVA Inspections:	TVA Engineering performs annual dike inspections and prepares reports. Plant personnel recently started making daily observations, with documented inspections made weekly.
Problems Previously Identified During Past TVA Inspections:	Lack of vegetation and erosion along stack, erosion along access road, seepage areas along Wells Creek, animal burrow on exterior perimeter dike, tree growth on exterior dike, standing water, sedimentation and heavy growth in perimeter ditch.

5. Documents Reviewed

See attached Document Log for complete list of documents provided by TVA for review. In particular, the following provided pertinent information for the assessment of this facility:

TVA Design Drawings:	10W288-1 through 5
TVA As-Built Drawings:	None available.
TVA Construction Testing Records:	None available.
TVA Annual Inspection Reports:	TVA Annual Inspection Reports 1972-1984, 1986-1990, 1994-1995, 1997-2004, 2006-2008.

Geotechnical Data:	"Operations Manual: Dry Ash and Gypsum Stacking Facility", prepared by Tennessee Valley Authority, October 10, 2003. "TVA-Fly Ash, Bottom Ash, and Scrubber Gypsum Study", Law Engineering, Inc., October 1995. "Report of Subsurface Exploration and Stability Analyses, Proposed Fly Ash/Scrubber Sludge Disposal Facility, Cumberland Fossil Plant, Cumberland City, Tennessee", Law Engineering, January 27, 1992. "Report of Hydrogeologic Evaluation, Proposed Dry Fly Ash and Gypsum Disposal Facility, TVA Cumberland Fossil Plant, Cumberland City, Tennessee", Law Engineering, July 3, 1992. "Geotechnical Investigation Report, Dry Ash Conversion Project, CUF 1 & 2", Raytheon Engineers and Constructors, July 7, 1993. Results of Laboratory Testing, TVA Fly Ash & Gypsum Disposal Facilities, Cumberland Fossil Plant, United Engineers and Constructors Inc., June 1992.

6. Stantec Field Observations

See attached Concerns/Photo Log, Photos, and Site Plan Drawing.

6.1. Exterior Slopes and Benches

Vegetation:	Sparse to good vegetation coverage. Some areas of exposed soil present primarily along the southeast face and in areas to the north where the stack is just recently being constructed.
Trees:	None observed.
Erosion:	Several areas of erosion along the dry stack were noted where vegetation is sparse, primarily along the southeast face.
Instabilities:	No evidence of instabilities were observed.
Uniform Appearance	Good.

Benches:	None observed.
Slope:	Design: 3H:1V along Dry Ash Stack (from Drawing 10W288-4); 3H:1V along outer perimeter dike to west (from Drawing 10N213). Measured: 2.25H:1V along Dry Ash Stack at Section 4. 2.7H:1V along perimeter dike to west at Section 2.
Height:	35 feet along Dry Ash Stack at Section 4. 15 feet along perimeter dike to west at Section 2.
Other:	None.

6.2. Perimeter Drainage Ditches and Down-Drains

Vegetation:	Phragmites/tall grass along majority of west perimeter ditch.
Rip-Rap Channel Lining:	None observed.
Erosion:	Some scarping of the ditch side slopes was observed along west perimeter ditch. In addition, sedimentation had accumulated in ditch at several areas along the adjacent stack faces.
Siltation in Ditches:	Sedimentation observed throughout majority of west perimeter ditch.
Standing Water in Ditches or on Benches:	Standing water noted within the perimeter ditch to the west.
Silted/Impeded Drainage Pipes:	The drainage pipe for the perimeter ditch along the northwest corner of the stack area to the Ash Pond had signs of erosion around the inlet and outlet.
Other:	None.

7. Notable Observations and Concerns

- The area beneath the Dry Ash Stack was initially operated as a wet ash disposal pond. Constructing embankments over hydraulically placed ash is a potential slope stability concern and requires engineering analysis and geotechnical exploration.
- The southeast face of the stack consists of exposed soil cover which is eroded throughout. Other small areas of sparse vegetation or erosion were also observed. Further to the north, soil cover and vegetation have not yet been completed and the exposed ash slopes exhibit some erosion.
- Erosion was noted around the existing rock check within active portions of the stack.
- Areas of erosion and rutting were noted along the access road at the base of the stack.
- Eroded ash sedimentation, vegetation, poor drainage, and standing water were observed throughout the perimeter ditch. The side slopes of the ditch also exhibit shallow sloughs and scarps due to excavations made for cleaning of sedimentation.
- Vegetation has not yet been established where recent tree removal has occurred along the exterior west perimeter dike slope in the vicinity of the old bridge.
- Seepage was observed below the west perimeter dike along the banks of Wells Creek. The seepage does not appear to have changed from previous descriptions provided in inspection reports.
- The absence of an Emergency Action Plan, Operation and Maintenance Plan, as-built drawings and construction testing records is a concern.

8. Recommendations

8.1. Phase 2 Engineering and Programmatic Recommendations

- It is recommended that the Dry Ash Stack undergo further engineering study to evaluate the stacking plan and slope stability. This should include test borings, installation of piezometers, and installation of slope inclinometers; followed by laboratory testing and slope stability analysis of critical cross-sections.
- It is recommended that a program be established to develop as-built drawings and construction records for future maintenance and construction activities.
- Based on the findings of Phase 2 and designs from Phase 3, if performed, Stantec recommends that the existing O&M Manual be reviewed and updated. These updates may include sections on routine monitoring and facility maintenance.

8.2. Maintenance Recommendations

- CUF plant personnel should continue to monitor the seepage area below the west perimeter clay dike.
- Cut and maintain heavy/tall phragmite growth to allow better observation specifically in the perimeter ditches. Establish mowing program.
- Regrade and repair erosion areas where noted.
- Regrade, place new clay cover, and reseed the southeast face of the stack. Monitor other dry stack areas for erosion/sparse vegetation and repair as needed.
- Repair ruts and eroded areas along access road at base of stack if it is to remain in service.
- Clean sedimentation and phragmites from Dry Ash Stack perimeter ditches. Remove sedimentation, check grades and regrade the perimeter ditches as needed to promote positive drainage and alleviate standing water issues.
- Continue annual inspection program and execute recommendations.

Drawing Mark DS-1-1 Eroded ash from the adjacent dry stack deposited within the west perimeter ditch.

Drawing Mark DS-1-2 Seepage observed below the perimeter dike along the banks of Wells Creek.

Drawing Mark DS-1-3 Erosion around existing rock check in north portion of Dry Ash Stack

Drawing Mark DS-1-4 Exposed soil and erosion along southeast face of Dry Ash Stack.

Drawing Mark DS-1-5 Erosion and rutting along access road at the base of the Dry Ash Stack.

Drawing Mark DS-1-6 Uncompleted soil cover and vegetation along north end of Dry Ash Stack.

Concerns/Photo Log		
Drawing Mark	**Comments**	**Photo/GPS ID**
DS-1-1	Eroded ash from the adjacent dry stack deposited within the west perimeter ditch.	Photo 20A
DS-1-2	Seepage observed below the perimeter dike along the banks of Wells Creek.	Photo 3B
DS-1-3	Erosion around existing rock check in north portion of Dry Ash Stack	Photo 37B
DS-1-4	Exposed soil and erosion along southeast face of Dry Ash Stack.	Photo 20B
DS-1-5	Erosion and rutting along access road at the base of the Dry Ash Stack.	Photo 35B
DS-1-6	Uncompleted soil cover and vegetation along north end of Dry Ash Stack.	Photo 36B

TVA Disposal Facility Assessment
Phase 1 Coal Combustion Product Disposal Facility Summary
Cumberland Fossil Plant (CUF)
Gypsum Storage Area (GSA)

1. General Facility Information

Facility Status:	Temporarily Inactive	NID Identification:	TN16110
Surface Area (inside dikes)	170 acres (estimated)	Maximum Height (toe to top of dike):	50 feet (estimated, current phase) 140 feet (Proposed)
Free Water Volume:	Currently drained	Maximum Water Storage:	Currently drained
Estimated CCB Storage:	1,825,579 CY	Dike Length:	9,000 feet (estimated)
Plant Discharge to Facility:	6,000 gpm when active	Current Pool Elevation:	Drained

2. Site Visit Information

Stantec Assessment Team:	Steve Bickel, PE, Nathan Bader, PE, Stan Harris, PE and Matthew Hoy, EIT
TVA Staff Present:	Stuart Harris and Carrie McCarty
Field Assessment Dates:	January 14, 2009 and February 3 - 4, 2009
Weather/Site Conditions:	Mid-30 degrees F, sunny, moist ground both days.

3. History/Description of Usage

History and Operation: The gypsum storage area was constructed during 1995-1996. It was built over Area No. 1, which was the original ash pond. Approximately 1,100,000 tons of gypsum is produced each year. Roughly 75 percent of the gypsum is marketed to the adjacent wallboard company and the remaining 25 percent is wet-sluiced to the Gypsum Storage Area. The pond was constructed in several stages beginning with construction of a rock drainage blanket to collect and divert water away from the base. When gypsum is discharged to the pond intermittently, it is wet-sluiced to the northeast corner of the pond. Currently the pond is separated into a north and south area. The pond consists of an upper gypsum dike being

	constructed using rim-ditching operations, a lower perimeter ash dike, and an even lower clay dike which was the original perimeter dike for the disposal area. Discharge for the pond is through an RCP riser to outlet pipes in the northwest corner of the pond into the adjacent perimeter ditches. The perimeter ditches around the Gypsum Storage Area flow to the north along the neighboring Dry Stack and ultimately into the Ash Pond.
Past Failures/Releases:	A slope slough along the perimeter clay dike in the northwest corner of the Gypsum Storage Area reportedly occurred in 2005. The slope was temporarily repaired using rip rap and Stantec is currently evaluating slope stability. Seepage has also been reported in this area and along the Gypsum Storage Area to the east. As a result, the pond has also been drained until Stantec's evaluation is complete.

4. Owner's Operations, Maintenance and Inspection Information

Emergency Action Plan:	No EAP has been prepared for this facility.
Operations Manual:	"Operations Manual: Dry Ash and Gypsum Stacking Facility", prepared by Tennessee Valley Authority, October 10, 2003.
TVA Maintenance:	Exterior slopes mowed every two years.
TVA Inspections:	TVA Engineering performs annual inspections and prepares reports. Plant personnel recently started making daily observations, with documented inspections made weekly.
Problems Previously Identified During Past TVA Inspections:	Seepage areas around exterior dike, slope failure along northwest corner of perimeter dike.

5. Documents Reviewed

See attached Document Log for complete list of documents provided by TVA for review. In particular, the following provided pertinent information for the assessment of this facility:

TVA Design Drawings:	10W300-1 through 19, 6314-W-C110200 through 224, 6314-W-C110300 through 316.
TVA As-Built Drawings:	None available.
TVA Construction Testing Records:	None available.
TVA Annual Inspection Reports:	TVA Annual Inspection Reports 1972-1984, 1986-1990, 1994-1995, 1997-2004, 2006-2008.
Geotechnical Data:	"TVA-Fly Ash, Bottom Ash, and Scrubber Gypsum Study", Law Engineering, Inc., October 1995.
	"Report of Geotechnical Exploration, Gypsum Area Seepage Study, Cumberland Fossil Plant, Cumberland City, Tennessee", prepared by MACTEC Engineering and Consulting, Inc., May 1, 2007.
	"Report of Preliminary Geotechnical Exploration, Proposed Gypsum Wallboard Plant, TVA Cumberland Fossil Plant, Cumberland City, Tennessee", Law Engineering and Environmental Services, Inc., January 3, 1997.
	"Report of Subsurface Exploration and Stability Analyses, Proposed Fly Ash/Scrubber Sludge Disposal Facility, Cumberland Fossil Plant, Cumberland City, Tennessee", Law Engineering, January 27, 1992.
	"Report of Hydrogeologic Evaluation, Proposed Dry Fly Ash and Gypsum Disposal Facility, TVA Cumberland City, Tennessee", Law Engineering, March 13, 1992.
	"Laboratory Test Results, Samples from Gypsum Pond at Cumberland Fossil Plant", MACTEC Engineering and Consulting, May 13, 2004.

Project Update - Seepage Investigation and Repair, TVA Cumberland Fossil Plant, presented by Geosyntec Consultants to TVA, October 2007, May 2007, and July 2008.

Results of Laboratory Testing, TVA Fly Ash & Gypsum Disposal Facilities, Cumberland Fossil Plant, United Engineers and Constructors Inc., June 1992.

6. Stantec Field Observations

See attached Concerns/Photo Log, Photos, and Site Plan Drawing.

6.1. Interior Slopes

Vegetation:	None. Top dike consists of gypsum with no vegetation established.
Trees:	None observed.
Wave Wash Protection:	None observed.
Erosion:	None observed.
Instabilities:	Portions of the dike are currently being reconstructed using rim-ditching operations, but no evidence of instabilities were observed.
Animal Burrows:	None observed.
Freeboard:	**Measured:** Pond drained. **Design:** Not available on drawings.
Encroachments:	None observed.
Slope:	**Measured:** Currently being constructed, not measured. **Design:** Not available on drawings.

6.2. Crest

Crest Cover and Slope:	Gypsum cover from rim-ditching operations.
Erosion:	None observed.
Alignment:	Alignment appeared to agree with design drawings. No problem.

Settlement/Cracking:	None observed.	
Bare Spots/Rutting:	No rutting observed. Crest is bare with no vegetation established.	
Width:	**Measured:**	23 feet at Section 5; 20 feet at Section 6
	Design:	Not available on drawings.

6.3. Exterior Slopes

Vegetation:	Upper Gypsum slopes are bare and lack vegetation. Phragmites and brush are present on the intermediate ash dike slopes. A grass cover is present along the lower perimeter dike slopes.
Trees:	Small trees were located in a few areas around the perimeter of the pond.
Erosion:	Areas of erosion were observed along the upper gypsum dike and the lower ash dike in several areas.
Instabilities:	A slope failure has been repaired in the northwest corner of the pond along the perimeter clay dike. Slope instability in the form of shallow sloughing was also observed along the ash dike along the northwest side of the pond.
Uniform Appearance:	Good.
Seepage:	Seepage observed in the past when pond was filled at the northernmost portion of the pond. Seepage was also observed at the southeast side of the perimeter clay dike.
Benches:	One bench that consists of the surrounding access road was observed along the toe of the upper gypsum dike. The bench is 20 feet wide at Section 5 and Section 6.
Foundations, Drains, Relief Wells, Instrumentation:	Drainage pipes extending from the base of the Gypsum Storage Area were reportedly installed on 200-foot intervals. These pipes outlet along the toe of the slope in the perimeter drainage ditches. Flow was observed in selected outlets similar to the flow reported in previous annual inspection reports.

Animal Burrows:	None observed.	
Slope:	**Measured:**	3H:1V along upper gypsum dike at Section 5 and 6; 1.5H:1V to 2.3H:1V along the intermediate ash dike slope at Sections 5 and 6; 2.7H1V along the perimeter clay dike at Section 5.
	Design:	3H:1V for the upper gypsum dikes, intermediate ash dike, and lower perimeter clay dike (from Drawing 10W300-16)
Height:	**Measured:**	Approximately 50 feet at current phase.
	Design:	Approximately 140 feet at final stage (from Drawing 10W300-16).

6.4. Spillway Weirs/Riser Inlets

Number:	One located at northwest end of pond.
Size, Type and Material:	Unknown size, RCP
Height of Riser Inlets:	10 feet or less (estimated)
Access:	None
Joints:	Unknown, unable to observe.
Mis-Alignment:	Unknown, unable to observe.
Closed/Abandoned Conduits:	None reported or observed.

6.5. Outlet Pipes

Number:	Four
Size, Type and Material:	Outlets vary in size and range from steel pipe to corrugated metal pipe.
Headwall:	None was observed.
Joint Separations:	Unknown, could not observe.
Mis-Alignment:	Unknown, could not observe.
Closed/Abandoned Conduits:	None reported or observed.

7. Notable Observations and Concerns

- The gypsum pond is formed by a lower perimeter clay dike, an intermediate ash perimeter dike above the lower clay dike, and an upper gypsum dike. The pond contains two active cells (north and south). Rim-ditching operations are currently on-going to construct the upper gypsum dike. Seepage areas and past slope failures have been noted. Some slopes are also relatively steep (1.5H:1V). Seepage, slope instability, and on-going rim-ditching operations are a concern for the Gypsum Storage Area.
- The absence of an Emergency Action Plan, Operation and Maintenance Plan, as-built drawings and construction testing records is a concern.
- Reconstructed upper gypsum dikes are lacking vegetation.
- Some trees were observed along the perimeter ash dike to the northeast of the Gypsum Storage Area.
- Erosion was observed along the crest and outslopes of the ash divider dike at several areas.
- The southwest and southeast sides of the perimeter ditch contain sediment build-up and standing water.
- Vegetation has not yet been re-established where trees have been removed from the downstream slope of the perimeter clay dike.
- Discharge pipes from interior pond drainage are elevated above a rip-rap channel. Over time, toe erosion will likely occur.

8. Recommendations

8.1. Phase 2 Engineering and Programmatic Recommendations

- It is recommended that the Gypsum Storage Area undergo further engineering study to evaluate the seepage, slope stability, and the on-going rim-ditching stacking plan. Remediation efforts to address these items will be developed based on the results. It is also recommended that a hydraulic and hydrologic analysis be performed to check freeboard and pond outlet adequacy relative to process flow and stormwater. The pond is scheduled to remain drained and temporarily inactive until Phase 2 studies and remedial construction activities, if needed, are performed.

- Based on the findings of Phase 2 and designs from Phase 3, if performed, Stantec recommends that the existing O&M Manual be reviewed and updated. These updates may include sections on routine monitoring and facility maintenance.
- It is recommended that a program be established to develop as-built drawings and construction records for future maintenance and construction activities.

8.2. Maintenance Recommendations

- The loosely stacked gypsum material around the perimeter of the Gypsum Storage Area should be spread in appropriate thicknesses and compacted properly wherever it is to be used as structural dike material. The material used for dikes at outlet areas should consist of coarser gypsum, which has higher strength. Efforts to establish vegetation on completed slopes should also be made.
- CUF plant personnel should continue to monitor the existing slope failure along the perimeter dike outslope at the northwest corner of the Gypsum Storage Area until Phase 2 evaluations are complete and permanent repairs executed.
- CUF plant personnel should continue to monitor the seepage area below the perimeter clay dike.
- CUF personnel have reported a seepage area along the north corner of the Gypsum Storage Area that could not be seen because the pond is currently drained. If this seep re-appears upon re-filling, a crushed stone French drain should be installed by excavating back to intercept the gravel drainage layer that underlies the gypsum disposal area.
- The discharge pipes that drain the interior portion of the Gypsum Storage Area should be extended to ground level and away from the toe of slope.
- Remove trees from noted locations.
- Cut and maintain heavy/tall phragmite growth on slopes and the perimeter drainage ditch to allow better inspection. Establish annual mowing program.
- Regrade and repair erosion areas where noted.
- Clean sedimentation and phragmites from Gypsum Storage Area perimeter ditches. Remove sedimentation, check grades and regrade the perimeter ditches as needed to promote positive drainage and alleviate standing water issues. Use of rip-rap to re-establish ditch side slopes should be considered.

Drawing Mark GP-1-1 Riprap placed in area to temporarily repair slope slough along the perimeter dike at the NW corner of the Gypsum Stack.

Drawing Mark GP-1-2 Small slope slough along ash divider dike outslope at NW side of the Gypsum Storage Area.

Drawing Mark GP-1-3 Trees and erosion along the perimeter ash dike at the northeast side of the Gypsum Storage Area.

Drawing Mark GP-1-4 Reconstructed gypsum dikes surrounding the two ponds lacking vegetation.

Drawing Mark GP-1-5 Heavy vegetation and sedimentation in perimeter drainage ditch along the southwest and southeast sides of the Gypsum Stack.

Drawing Mark GP-1-6 Seepage observed below the perimeter dike along the southeast side of the Gypsum Stack.

Drawing Mark GP-1-7 Discharge pipes and riprap channel along northwest corner of Gypsum Storage Area.

Concerns/Photo Log

Drawing Mark	Comments	Photo/GPS ID
GP-1-1	Riprap placed in area to temporarily repair slope slough along the perimeter dike at the NW corner of the Gypsum Stack.	Photo 27B
GP-1-2	Small slope slough along ash divider dike outslope at NW side of the Gypsum Storage Area.	Photo 65B
GP-1-3	Trees and erosion along the perimeter ash dike at the northeast side of the Gypsum Storage Area.	Photo 79B
GP-1-4	Reconstructed gypsum dikes surrounding the two ponds lacking vegetation.	Photo 76B
GP-1-5	Heavy vegetation and sedimentation in perimeter drainage ditch along the southwest and southeast sides of the Gypsum Stack.	Photo 31B
GP-1-6	Seepage observed below the perimeter dike along the southeast side of the Gypsum Stack.	Photo 30B
GP-1-7	Discharge pipes and riprap channel along northwest corner of Gypsum Storage Area.	Photo 70B

Appendix I

Evaluation of Additional Piezometers in the Vicinity of Section ‘H’

Monitoring and Evaluating Piezometric Levels at Section H

Overview

Section H is located along the south dike of the Gypsum Disposal Area where previous instability and a temporary repair that included placement of rip-rap was performed. A total of 17 piezometers have been installed in this area. The Aerial Map (Figure 1) provided below shows the specific locations.

Figure 1 – Aerial Map of Section H and Vicinity

These piezometers were installed to monitor the piezometric (water) levels within the dikes at different elevations and in selected materials. The piezometric levels were evaluated and used in the slope stability models.

Evaluation of Data

Using the data gathered, several evaluations were performed. They included the following:

- Variation in Elevation
- Variation in Depth Below Ground Surface
- Change from Previous Readings
- Correlation with Precipitation Readings (and Influent Flow)

Each of these evaluations provided a different view of the data obtained and allowed for establishment of a typical range of values using minimum, maximum and average values. These evaluations are updated on a weekly basis (minimum) with the data provided by TVA and Stantec.

<u>Variation in Elevation</u>

Figure 2 is output from the Variation in Elevation evaluation:

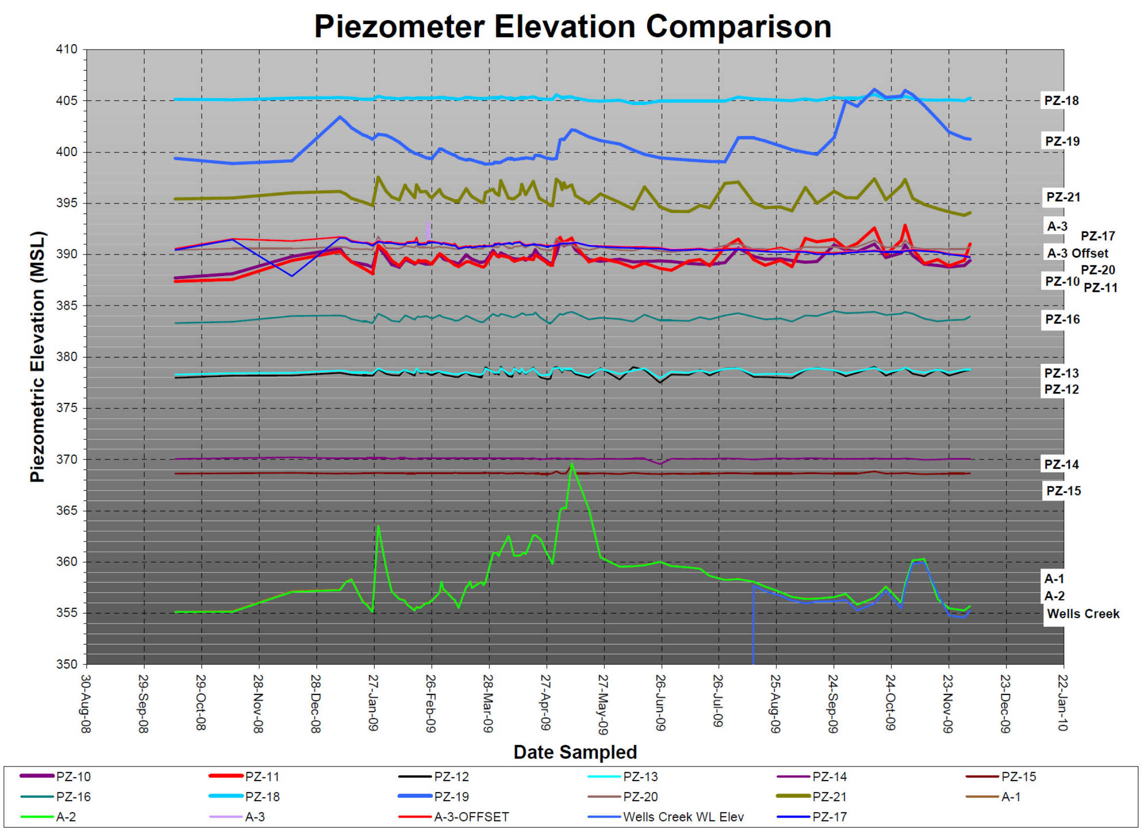


Figure 2

Note that a majority of the piezometric (PZ) levels are consistent, meaning they vary within a specific range. Other PZ levels such as PZ-19 and A-2 have more variance in there values. These differences could be attributed to differences in depths being monitored or the location on the dike. They are more directly connected to the piezometric variations that are encountered in the dikes.

Variation in Depth Below The Ground Surface

Figure 3 is from the Variation in Depth Below The Ground Surface evaluation:

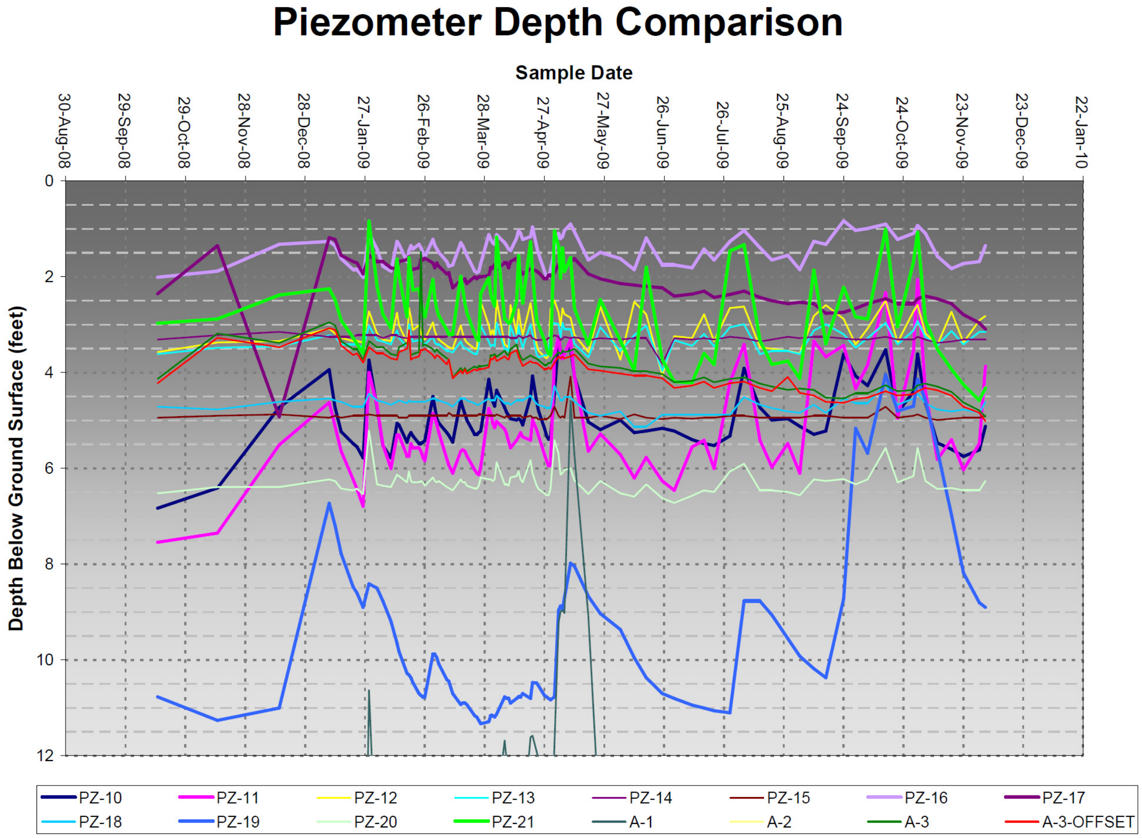


Figure 3

Note this evaluation has similar range consistencies and a couple that show more variances. In addition to determination of ranges, this evaluation also provides a graphical representation of what PZ levels are trending closer to the ground surface. For example, PZ-19 was near its highest level recorded on October 31, 2009, but it was approximately 4 feet below the ground surface. Currently the level have returned to a depth of 9 feet.

Change from Previous Readings

The data in Figure 4 shows how the change from previous readings are evaluated:

Well ID	Change from Previous Elevation (ft)	Change from Previous Elevation (ft)	Change from Previous Elevation (ft)	Change from Previous Elevation (ft)	Change from Previous Elevation (ft)	Change from Previous Elevation (ft)	Change from Previous Elevation (ft)	Change from Previous Elevation (ft)
COLLECTION DATE:	29-Oct-09	31-Oct-09	4-Nov-09	10-Nov-09	17-Nov-09	23-Nov-09	1-Dec-09	4-Dec-09
PZ-10	0.43	0.79	-1.02	-0.84	-0.13	-0.15	0.14	0.49
PZ-11	1.41	1.48	-2.33	-1.42	0.41	-0.63	0.55	1.61
PZ-12	0.65	0.13	-0.59	-0.24	0.69	-0.64	0.46	0.09
PZ-13	0.29	0.20	-0.33	-0.18	0.30	-0.28	0.26	0.00
PZ-14	0.00	0.06	-0.06	-0.07	0.03	0.04	0.00	0.00
PZ-15	0.04	0.03	-0.07	-0.05	0.03	0.02	0.00	0.04
PZ-16	0.13	0.16	-0.16	-0.48	-0.26	0.11	0.04	0.33
PZ-17	0.00	0.10	0.06	-0.06	-0.10	-0.23	-0.17	-0.13
PZ-18	0.13	0.10	-0.20	-0.13	-0.04	0.04	-0.07	0.23
PZ-19	0.10	0.56	-0.43	-1.05	-1.35	-1.21	-0.62	-0.10
PZ-20	0.13	0.59	-0.69	-0.17	0.02	-0.05	0.00	0.20
PZ-21	1.35	0.62	-1.84	-0.60	-0.42	-0.32	-0.33	0.26
A-1	-1.61	1.78	**2.32**	0.16	-3.89	-0.96	-0.16	0.43
A-2	-1.54	1.77	**2.36**	0.13	-3.92	-0.90	-0.20	0.43
A-3	0.03	0.10	0.03	-0.06	-0.11	-0.22	-0.17	-0.13
A-3-OFFSET	0.03	0.06	0.07	-0.05	-0.11	-0.23	-0.13	-0.17
Wells Creek WL Elev	-1.74	**2.00**	**2.37**	0.09	-2.99	-2.16	-0.23	0.69

Figure 4

A data point highlighted in yellow indicates an increase in elevation of more than 1 foot from the previous reading. A data point highlighted in red indicates an increase of more than 2 feet. This allows for evaluation of the ordinary fluctuations in PZ levels.

Correlation with Precipitation Readings

Figure 5 shows how the precipitation data is evaluated with the changes in PZ levels:

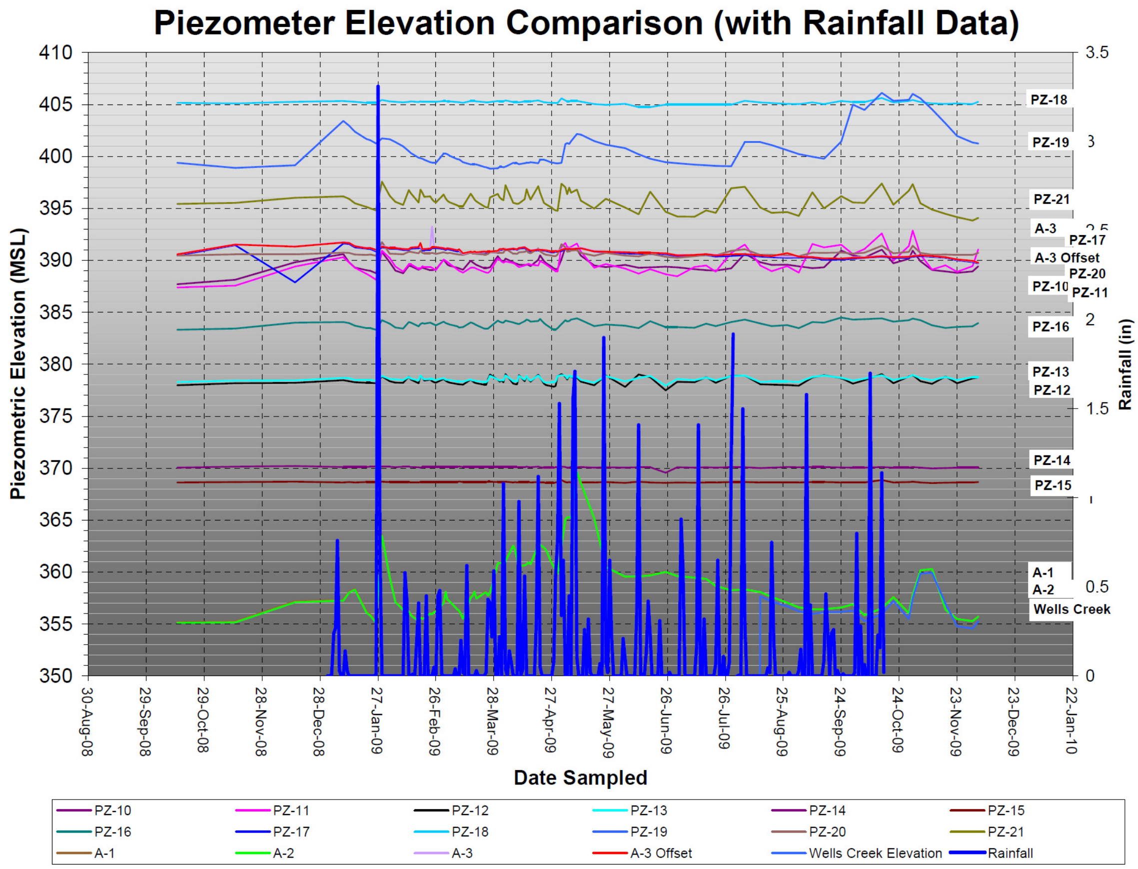


Figure 5
Some isolated locations show PZ level increases after a rainfall event such as around January 27, 2009 and May 10, 2009, however most locations do not show any clear connection with the increase in PZ levels versus the amount of precipitation. Continued data gathering may allow for comparisons in the future.

Establishment of Trigger Levels

Gathering all of the data can also be used to establish specific “Trigger Levels” using the slope stability models. Trigger levels are established by raising or lowering the piezometric levels along a selected section to predict Factors of Safety.

For Section H, trigger levels were selected at three Factors of Safety, 1.1, 1.3 and 1.5. A factor of safety greater than 1.5 is considered acceptable with 1.3 and 1.1 being established to raise awareness and determine what action might be appropriate to reduce the risk of slope instability. The following output shows the trigger level evaluation on October 15, 2009:

Piezometer Levels - Trigger Evaluation (Average of PZs)

Some interpolations of PZ levels were used to supplement the adjacent PZ readings and create a smooth curve and show standing water in ditchlines.

Original Model		Trigger Level 1.5		Trigger Level 1.3		Trigger Level 1.1		Piezometers in Area	Average Levels on 10/15/2009
X	Y	X	Y	X	Y	X	Y		
900	359	900	359	900	359	900	359		
1000	359	1000	359	1000	359	1000	359		
1019.69	359	1019.69	359	1019.69	359	1019.69	359		
1029.71	359.014	1029.71	360.014	1029.71	361	1029.71	361		
1044	362	1044	362	1044	363	1044	366		
1057	364	1057	365	1057	367	1057	372		
1066	366	1066	368	1066	370	1066	375	PZ-14, PZ-15 AND A-1	365.17
1078	367	1078	372	1078	375	1078	379		
1086	369	1086	374	1086	379	1086	382	PZ-12, PZ-13, A-2	371.51
1107	378	1107	**380**	1107	386	1107	388	PZ-16	384.43
1121	384	1121	**386**	1121	**390**	1121	392	PZ-11, A-3	391.53
1129	388.8101	1129	388.8101	1129	390	1129	392		
		1149	**391**	1149	**391**	1149	392	PZ-10	391.03
1153	389	1167	391	1167	391	1167	392		
1168	389	1168	391.4882	1168	391.4882	1168	392		
		1172	393	1172	393	1172	393		
						1174	394		
				1177.909	395.2996	1177.909	395.2996		
		a	**394**	a	396	1183	396.8239	PZ-20, PZ-21	394.41
				1187.367	398.1315	1187.367	398.1315		
						1202	403		
1216	395	1216	**402**	1216	**404.5**	1216	407	PZ-18, PZ-19	405.88
						1238	409.5		
1249	405	1249	405	1249	405	1249	409.5		
						1265	409.5		
1475	405	1475	405	1475	405	1475	408		

X = Horizontal Distance (or Station) from beginning extents of slope stability model.
Y = Elevation at Section Station

Figure 6

Figure 6 (shown above) illustrates that five of the seven areas being monitored (highlighted in green) have piezometric levels higher than the 1.5 F.S. trigger and three of those areas are higher than the 1.3 F.S. trigger level. No readings above the 1.1 F.S. trigger level were recorded during this evaluation.

Using two of the PZ locations, the following figure (7) illustrates how the trigger levels may be used:

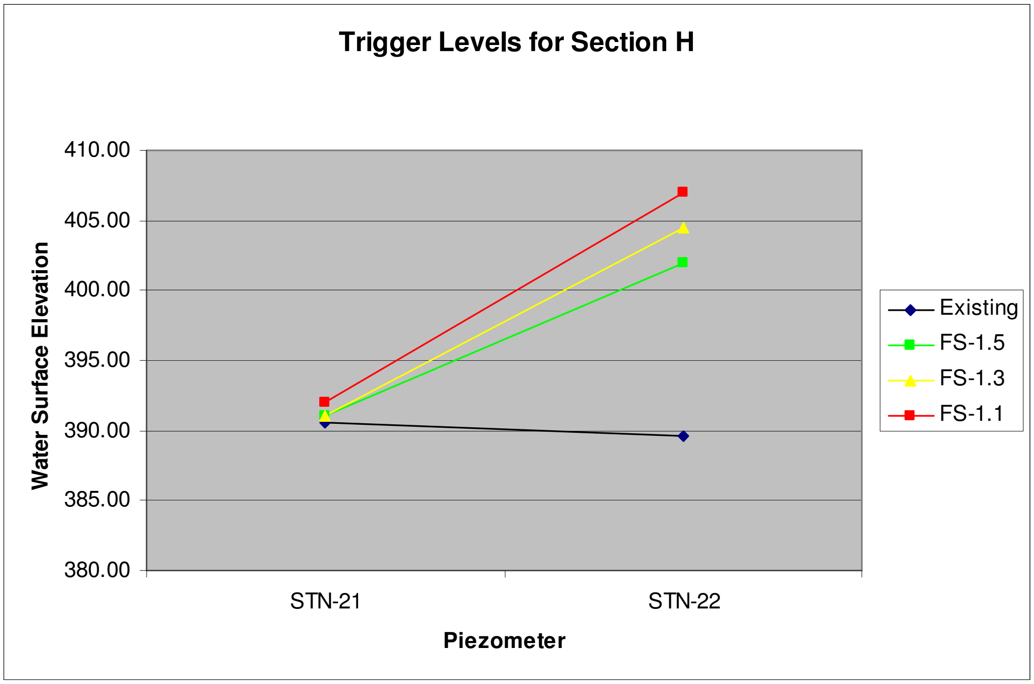


Figure 7

As the piezometric level increases in elevation, the factor of safety decreases. In this case, the existing readings are below the trigger levels, meaning the factor of safety is greater than 1.5. Note that at STN-21, the trigger levels are close together so a slight increase in piezometric level will reduce the factor of safety dramatically. On the other hand, trigger level elevations at piezometer STN-22 are further apart so it will take larger increases to reduce the factor of safety.

The following slope stability sections (Figures 8, 9 and 10) show the change in the piezometric level at each of the trigger levels (note the blue line near the face of the slope as it trends upward):

- Factor of Safety at 1.5:

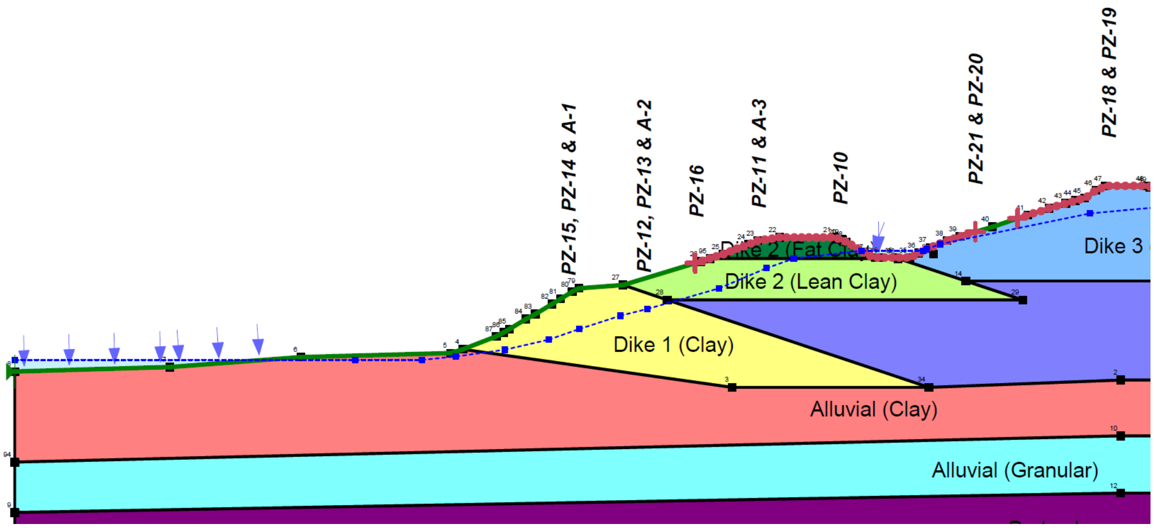


Figure 8

- Factor of Safety at 1.3:

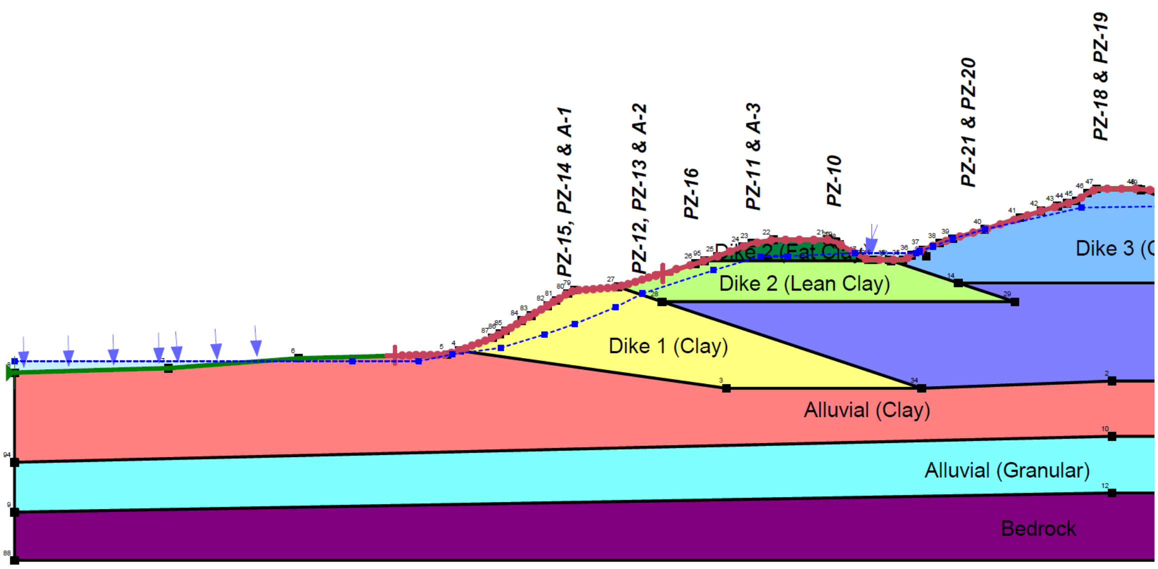


Figure 9

- Factor of Safety at 1.1:

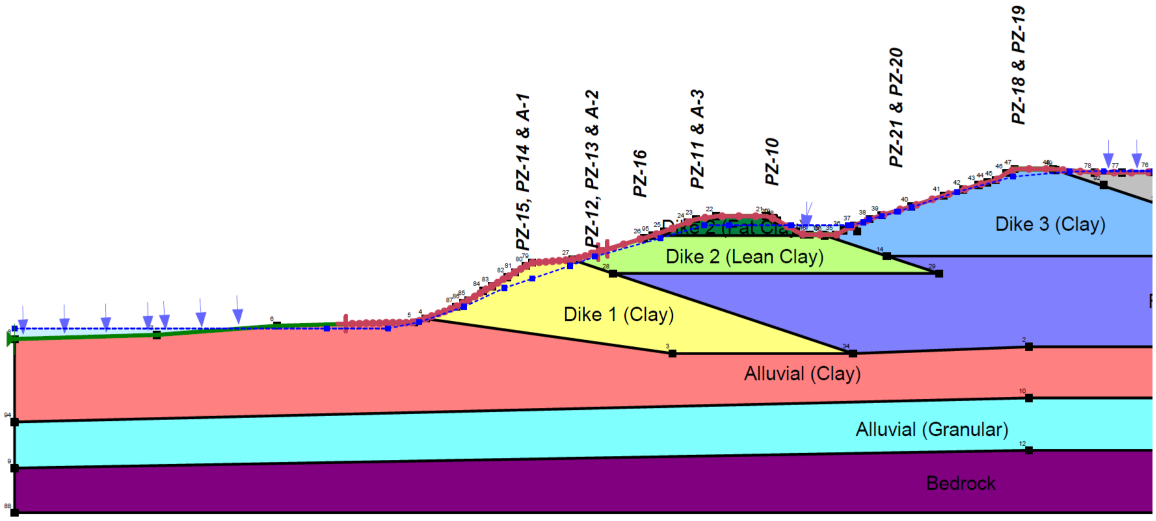


Figure 10

Monitoring the piezometric levels in the field on a weekly basis provides a relatively easy way to track changes and identify potential stability risks. It is also easy to increase the frequency (i.e., daily) during rain event or other conditions that could affect these levels.

Appendix J

Material Properties Calculation

OBJECTIVE:

As part of a TVA system-wide review, Stantec is analyzing the geotechnical stability of the existing Dry Fly Ash Stack and Gypsum Stack Complex at the Cumberland Fossil Plant. This calculation summarizes the basis of the material properties selected for the geotechnical analyses.

SITE OVERVIEW:

The Cumberland Fossil Plant was constructed between 1968 and 1973. It has two coal-fired generating units and produces roughly 750,000 tons of coal combustion byproducts (CCBs) in the forms of fly ash and bottom ash each year. Sulfur dioxide scrubbers were installed on the units in 1994. The synthetic gypsum byproduct generated by the scrubbers is marketed as a building material. However, any unsold gypsum (of the approximately one million tons produced each year) must be disposed by the plant.

The CCB storage facilities are located in the southern and southwestern areas of the plant and consist of aboveground cellular systems for dry fly ash, sluiced bottom ash, and sluiced/stacked gypsum. The stacks and retention ponds cover approximately 340 acres. The layout of these structures is shown on Figures 1 and 2 in Attachment 1. The structures include the Gypsum Stack Complex, the Dry Fly Ash Stack Area, the Bottom Ash Area, the Retention Pond (Ash Pond) and the Stilling Pond. The Gypsum Stack Complex consists of the North Cell and the South Cell separated by a Divider Dike. According to the introduction of the current operations manual of the facility (TVA, 2003):

> Fly ash is collected in a dry state, conditioned with moisture and then spread and compacted. Bottom ash is sluiced to a processing area, reclaimed, and then placed on the ash stack. The gypsum is sluiced into the gypsum stack area. Gypsum can also be diverted at a valve station into (the gypsum processing plant). (The processing plant) dewaters gypsum slurry using vacuum filter presses, and the filtrate is returned to the gypsum stack area where any remaining fines can settle. During unit outages, (the process plant) may also reclaim gypsum from the gypsum stack area either by direct excavation and truck hauling or by dredging using a small portable hydraulic dredge.

TVA operates the Gypsum Stack using the elevated rim ditching method. Dozers and excavators are used to construct rim ditches and to raise the perimeter gypsum dike. Currently minor sluicing is directed into the North Cell of the Gypsum Stack Complex as needed. Active dry stacking occurs in the South Cell.

GIVEN:

- Data from a geotechnical exploration performed by Stantec between April and July 2009 (Stantec 2009a). Field data include standard penetration tests (SPTs), cone penetration tests (CPTs), and visual assessment of existing site conditions. Disturbed and undisturbed soil samples were sent for laboratory testing to determine in-situ unit weight, density, and moisture conditions, strength and permeability, and soil classification testing.

- Plant-provided historical information for the facilities referencing previous engineering work and maintenance measures.
- Compiled data from related TVA facilities with similar material property assumptions and from similar Stantec project experience.

ASSUMPTIONS:

Thirteen soil horizons were identified based on historical construction data, geotechnical boring logs, and laboratory testing. Below is a brief description of each horizon based on the field exploration:

CCBs:

- Fly Ash – Classifies as silt (ML) or silt with sand/silty sand. Light gray to black or gray brown, silt to clay-sized grains, dry to wet. Soft to very stiff. Lenses of bottom ash or lean clay may be present.

    - Fly Ash (Sluiced) or Fly Ash/Bottom Ash (Sluiced) – Saturated fly ash, bottom ash, or a laminated zone of both that is wet to saturated, possibly hydraulically placed, soft to medium stiff. Fly ash alone classifies as silt (ML). The fly ash/bottom ash (sluiced) was visually classified as silty sand with gravel (SP), silty sand (SM), and sandy lean clay (CL). A distinction was not drawn between sluiced fly ash and a combination material of sluiced fly ash and bottom ash. Definite zones were unclear. Sluiced fly ash properties were conservatively assumed for both materials.

    - Fly Ash (Stacked) – Distinct from sluiced fly ash based on higher blow counts, lower moisture contents, and stronger cone penetrometer test (CPT) results. Some compaction effort is anticipated during controlled placement of this material.

- Bottom Ash – Segregated and stacked bottom ash. Classifies as a silty sand with gravel (SP) or silty sand (SM). Dark gray to black, coarse grained, damp to wet, very loose to very dense with occasional interbedded layers of fly ash and clay. Medium sand to gravel-sized grains with some fines. Some compaction effort is anticipated during controlled placement of this material. Sluiced bottom ash intermixed with fly ash is modeled as sluiced material (see above).

- Gypsum – Classifies as silt (ML), white to grey brown or tan, medium stiff to very stiff, damp to wet. Typically stacked material though some sluicing does occur as needed. Some compaction effort is anticipated during controlled placement of this material.

Stack Construction:

- Dike 1 – The original perimeter dike. A lean clay (CL), red brown to gray brown, moist to wet, very soft to very stiff. Occasional gray mottling, with areas of sand or gravel, chert fragments, wood or roots, and manganese concretions.

  Stantec (2009a) identified this zone in most borings surrounding the Dry Fly Ash Stack and Gypsum Stack Complex just above natural ground. It was not found in the borings on the northeast perimeter on the Gypsum Stack Complex near the Coal Yard Runoff Pond and Metal Cleaning Pond. Here the initial surface topography appeared to be at a higher elevation than the rest of the initial dike structure.

- Dike 2 – The raised dike upstream of the original perimeter dike. It has a crushed stone surface between 0.5 and 1.0 feet deep. Dike 2 was identified by Stantec (2009a) along the outside perimeter of the Dry Fly Ash Stack and Gypsum Stack Complex. It is not found in the divider dikes between the Gypsum Stack Complex, Dry Fly Ash Stack, and Retention Pond. The raised dike has two distinct soil horizons:

  - Dike 2 (Lean Clay) – Lean clay (CL) to lean clay with gravel, some cobbles, light brown to brown, some gray mottling, moist to wet, soft to very stiff.

  - Dike 2 (Fat Clay) – Fat clay (CH) to fat clay with gravel, dark brown to reddish brown, damp to wet, firm to very stiff. This layer is typically near the top of Dike 2 or may compose the complete Dike 2 zone.

- Dike 3 –The starter dike for stacking gypsum. Classifies as a clayey gravel with sand (GC) or clayey sand with gravel (SC) with just greater than 50% retained on the No. 200 sieve. Reddish brown to light gray, moist to wet, loose to dense, angular grains. The clay tends to be lean with some borderline fat clay present with manganese concretions. A bottom ash road (from 1.1 to 4 feet thick) is located along the dike's crest.

  Stantec (2009a) identified this zone in borings along the embankment crest surrounding the Gypsum Stack Complex. One exception was Boring 45 located next to the small pond at the complex's northwestern tip.

- Divider Dike – Located between the Retention Pond and the Dry Fly Ash Stack, this dike has a distinct composition of rip rap or boulder zones with a reddish brown silty clay matrix. The clay matrix is light brown to reddish or grayish brown, stiff to very stiff, and moist to wet. Typically, it was field-classified as lean with some fat clay present.

Foundation Materials:

- Alluvial (Clay) – Lean clay (CL), silty grading to sandy, manganese concretions, reddish brown to light gray, some gray mottling, soft to very stiff, moist to wet, with rock fragments. Few organics and wood fragments, but typically has a faint organic odor near the suspected natural ground interface.
  - Alluvial (Clay – Soft) – Historical reports denote a separate soft alluvial clay zone. This segregates the wettest and softest material as distinct layer in the stability analyses.
- Alluvial (Granular) – Varying between silty sand with gravel (SM), (yellowish brown to light gray, moist to wet, very loose to compact, medium to coarse grained, poorly sorted with increasing gravel size) and gravel with clay to silt and sand (GP-GC or GM) (gray, wet, very stiff to hard, angular, loose to very dense). Wood fragments with a slight organic odor near the suspected natural ground interface.
- Bedrock – Several borings indicate shale grading into limestone. The shale is light to dark gray, calcareous, moderately hard, and laminated. The limestone is light gray, hard, and turbulent bedded. A weathered zone is present before reaching competent rock.

Boring logs from Stantec (2009a) are included as Attachment 2. Geotechnical laboratory results from Stantec (2009a) are included as Attachment 3. A summary table of the geotechnical laboratory testing for Stantec (2009a) is also included in Attachment 3. It is organized by boring, depth, and assumed soil horizon. Historical data referenced for this calculation are included in Attachment 4. Table 1 outlines the design elevations for the various dikes.

Table 1. Details of Complex

Item	Value
Elevation of Initial Ash Dike (Dike 1)	380 feet
Elevation of Perimeter Ash Dike (Dike 2)	395 feet
Current Ash Stack Elevation	430 feet
Planned Maximum Ash Elevation	600 feet
Elevation of Initial Gypsum Dike (Dike 1)	380 feet
Elevation of Perimeter Gypsum Dike (Dike 2)	395 feet
Elevation of Gypsum Stacking Dike (Dike 3)	410 feet
Current Gypsum Stack Elevation	418-423 feet
Planned Maximum Height (Gypsum)	570 feet

ANALYSIS:

Key properties for slope stability analyses, including unit weight and drained shear strength parameters, were estimated for each soil horizon. Additional properties required for seepage analyses, such as saturated hydraulic conductivity and horizontal to vertical permeability ratio will be handled separately.

Initial estimates were developed from the available Stantec (2009a) geotechnical field and laboratory data. Field data included standard penetration tests (SPTs), cone penetrometer tests (CPTs), and visual assessments of the existing conditions. Laboratory testing was performed on disturbed (SPT and bulk) and undisturbed (Shelby tube) samples. Table 2 lists the geotechnical laboratory testing and associated ASTM methods performed for Stantec (2009a).

Table 2. Geotechnical Laboratory Testing

Test Description	ASTM Method
Consolidated-undrained (CU or R) triaxial with porewater measurements	D 4767
Falling-head permeability	D 5084, Method C
Specific gravity	D 854
Particle size analysis with hydrometer	D 421, 422
Atterberg limits	D 4318, Method A
Moisture-density relationships using standard Proctor	D 698, Method A
Natural moisture content	D 2216

The initial material property estimates were then compared to plant-provided historical geotechnical data from previous engineering and maintenance work on site and adjusted as needed. Finally, the estimates were compared to compiled data from related TVA facilities with similar materials, to data from similar Stantec projects, and published typical values based on soil types.

In fitting strength parameters to multiple test results, the design values of effective cohesion (c') and effective internal friction angle (ϕ') were selected so that data from about two-thirds of the tests were above the failure envelope (Stantec, 2009b from USACE, 2003). This straight-line assumption of the curved shearing resistance envelope over normal stresses is specific to the range of stresses tested.

The Stantec (2009a) consolidated-undrained triaxial test results were based on the maximum principal effective stress ratio (maximum value of σ'_1/σ'_3) or the point of maximum obliquity. This stress condition is where the slope of the failure envelope through the origin of stress has its maximum slope (maximum ϕ for c=0). In routine practice, this failure criterion is used in undrained laboratory tests.

Note that a small amount of effective cohesion was used for the clay dikes and the alluvial clay. Any cementation in the CCBs was neglected. Laboratory tests on a few discreet samples from the stack will not yield a complete understanding of the cementation in the stacks.

Additional field data from Stantec (2009a) was incorporated by creating histograms of the uncorrected SPT blow counts and from the analysis of the CPT data by material type. Stiffer materials such as gypsum and bottom ash are not represented in the CPT data. The histograms are included as Attachment 5. The CPT data (Stantec, 2009a) was reduced to determine equivalent SPT N60 using the Jefferies and Davies (1993) approach and to determine the effective angle of internal friction. This data is listed on the histogram charts included in Attachment 5 and included in the shear strength data discussed below. The CPT data from Stantec (2009a) is included as Attachment 6.

When possible, SPT blow counts (Stantec, 2009a) were converted to effective friction angles using N_{60} and the empirical chart originally from Peck et al. (1974) and modified by Carter and Bentley (1991). This chart is included as Attachment 7. Table 3 is an overview of the Stantec (2009a) uncorrected SPT blow count values.

Table 3. Uncorrected SPT N Value by Soil Type*

N (Blow Counts)	Min	Max	Average	Mode	Std Dev
Bottom Ash	0	87	23	13	15.1
Bottom Ash/Fly Ash	0	75	13	4	12.7
Fly Ash	0	72	11	0	13.4
Fly Ash Stacked	2	99	36	50	25.4
Matrix	0	50	19	50	16.8
Alluvial Clay	0	70	17	6	14.4
Alluvial Granular	0	116	27	50	18.8
Dike 1	3	83	16	13	13.4
Dike 2	3	61	18	9	9.8
Dike 3	3	84	25	30	16.4
Gypsum	3	98	47	50	24.9

* Stantec (2009a)

Soil Horizons:

1. **Fly Ash (Sluiced) or Fly Ash/Bottom Ash (Sluiced)**
2. **Fly Ash (Stacked)**
3. **Bottom Ash**

Historical reports were not always clear when differentiating between fly ash and bottom ash, compacted or sluiced material. When available, distinctions are provided. However, for clarity, these three materials will be discussed together.

Moist unit weights for the sluiced materials were estimated using the Stantec (2009a) undisturbed samples. The moist unit weight of sluiced fly ash ranged from 97.4 to 106.2 pounds per cubic feet (pcf) with an average over nine measurements of 102.6 pcf. Sluiced bottom ash-fly ash had a single reading of 125.0 pcf. For the stacked material, standard Proctor compaction testing resulted in a maximum moist unit weight for bottom ash of 121.5 pcf and fly ash of 110.9 pcf.

Typical blow counts for the sluiced fly ash were 0 to 3 (0 to 4 corrected for automatic hammer or N_{60}). Approximately 1/5 of the samples thought to be sluiced fly ash had blow counts of 0. Roughly ¾ of the samples had blow counts of 13 or less (N_{60} = 17). Sluiced bottom ash/fly ash zones tended to have N values of 3 to 8 (N_{60} = 3.9 to 10.4). Stacked bottom ash typical values were 10 to 23 (N_{60} = 13 to 29.9). Stacked fly ash had 27% of the blow counts at N = 50 (N_{60} = 65). An additional 40% of the stacked fly ash N values were less than 20 (N_{60} = 26).

Shear strength testing available for the fly ash and bottom ash is summarized below.

Table 4. Fly Ash (Sluiced) or Fly Ash/Bottom Ash (Sluiced) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2009a)	B-43A (29.0-31.0), B-35A (46.0-48.0)	103.3	0	39.6
Law (1992)	Sluiced ash	110	0	28
	Sluiced ash (dilatometer data and published sources)	71.6-139.5	0-900	11-28
TVA (1992)	Sluiced fly ash (stability analysis)	100	0	25
United (1992)	Sluiced fly ash (undrained parameters)	100	0	25
Stantec (2009a)	SPT N_{60} values – empirical (sluiced fly ash)			<28
	SPT N_{60} values – empirical (sluiced fly ash/bottom ash)			<28-30.1
	CPT N_{60} minimum, maximum, and average (2, 17, and 9) (fly ash)			13, 30, 22
Stantec (2009a)	CPT N_{60} minimum, maximum, and average (3, 11, and 7) (bottom ash/fly ash)			13, 28, 21
	Recommended unit weight (fly ash sluiced)	97.4-106.2 (average 102.6)		
	Recommended unit weight (bottom ash/fly ash sluiced)	125.0		
Stantec (2009a)	**Selected Parameters for Stability Analyses**	100	0	22

Table 5. Fly Ash (Stacked) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2009a)	Bulk sample (80% Standard Proctor)	87.8-89.0	14.3	36
Law (1992)	Compacted ash	105	0	36
	Compacted ash (Standard Proctor and published data)	102.6-123	0	37.5
United (1992)	Compacted fly ash (undrained parameters)	105	0	32
Law (April 1995)	Dry fly ash (Units 1-2) (Standard Proctor max at 13.2% moisture)	111.4	0	53.5
Stantec (2009a)	SPT N_{60} values – empirical (single value)			43.5
	CPT N_{60} (single value)			32
	Recommended unit weight	110.9 (maximum)		
Stantec (2009a)	**Selected Parameters for Stability Analyses**	100	0	32

Table 6. Bottom Ash Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2009a)	Bulk sample (84% Standard Proctor)	102.1-102.3	261	41
HBA (1986)	Recommended soil properties (compacted)	108	0	34
TVA (1987)	Recommended soil properties (compacted)	108	0	34
	Test 1 (maximum value of σ'_1/σ'_3)		500	39.8
	Test 2 (maximum value of σ'_1/σ'_3)		1500	36
United (1992)	Bottom ash (undrained parameters)	120	0	35
	Compact bottom ash (undrained parameters)	125	0	38
Law (April 1995)	Bottom ash – from pond (Standard Proctor max at 15.4% moisture)	90.1		30.8 (angle of repose)
Stantec (2009a)	SPT N_{60} values – empirical (N_{60} = 13-29.9)			31.3-36.2
	CPT N_{60} (single value)			50
	Recommended unit weight (maximum)	121.5		
Stantec (2009a)	**Selected Parameters for Stability Analyses**	105	0	35

4. Gypsum

Gypsum's moist unit weight was estimated using standard Proctor compaction on a bulk sample from the facility (Stantec, 2009a). SPT blow counts for the material ranged greatly from 3 to 98 with 16% of the 111 readings at an N of 50 (N_{60} = 65). Gypsum's shear strength is dependent on the compaction effort in the field. A more conservative effective internal friction angle was selected based on the United (1992) parameters. Though conservative, gypsum's shear strength does not appear to drive the stability of the current analyses.

Table 7. Gypsum Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2009a)	Bulk sample (89% Standard Proctor)	103.3-104.5	90.5	42.5
	Bulk sample - rejects (88% Standard Proctor)	102.5-102.7	0	44
United (1992)	Gypsum (undrained parameters)	100	0	35
Stantec (2009a)	SPT N_{60} values – empirical (single value)			43.5
Stantec (2009a)	**Selected Parameters for Stability Analyses**	105	0	38

5. Dike 1

Moist unit weights for Dike 1 was estimated using the Stantec (2009a) undisturbed samples. The moist unit weight of Dike 1 ranged from 119.1 to 126.9 pcf with an average over eight measurements of 123.6 pcf. Typical blow counts for Dike 1 were 9 to 13 (11.7 to 16.9 for N_{60}).

Shear strength values for this material would suggest that a higher effective internal friction angle could be used for stability analyses. However, several low values (17.7°, 18°, and 15°) were also found in the current study and historical data. Perhaps the differentiation between the bottom of Dike 1 and the historical substratum of soft alluvial clay is unclear.

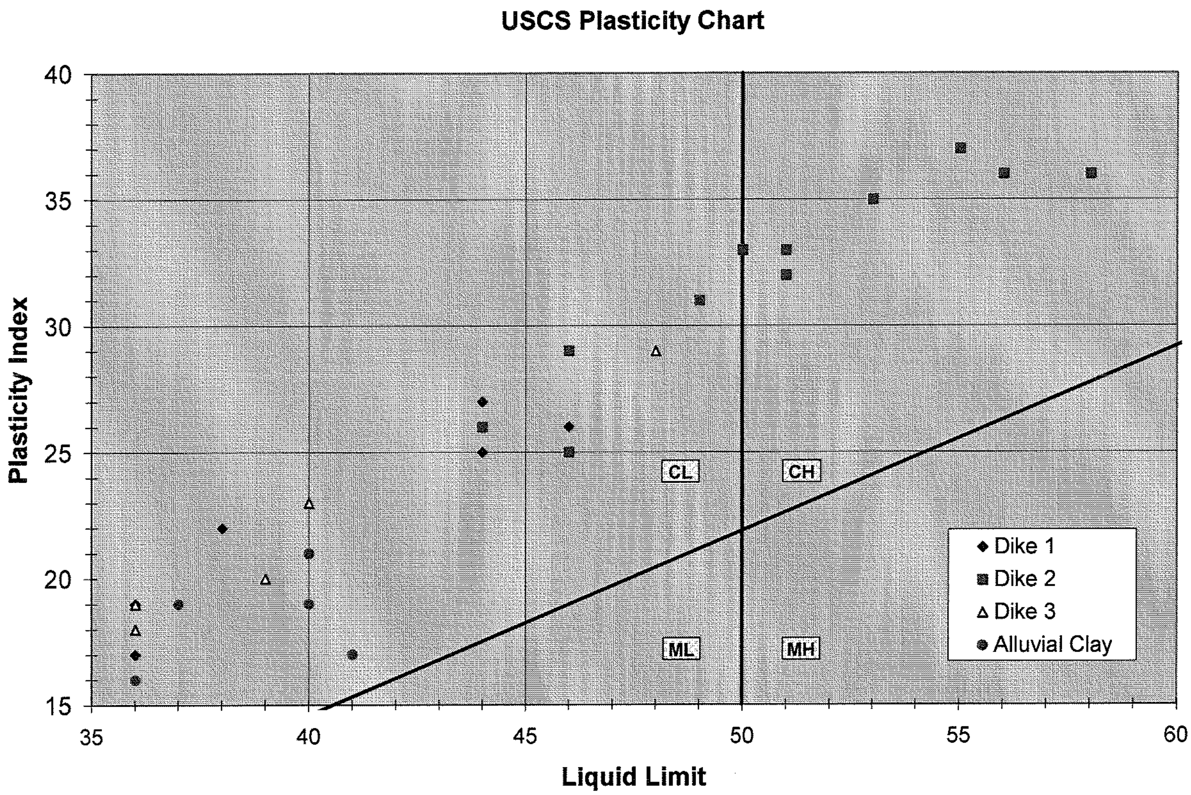
Table 8. Dike 1 Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2009a)	B-5 (18.0-20.0)	119.2-121.5	320	28.7
	B-29A (29.0-31.0)	125.4-128.3	16.4	36.8

Stantec (2009a)	B-63A (5.0-7.0, 8.0-10.0)	120.2-126.3	1000	17.7
HBA (1986)	Recommended soil properties	125	0	25
TVA (1987)	Boring No. 1 - original dike (10-12)			30 (max) 25.5 (min)
	Boring No. 5 – original dike (10-12)			42 (max) 35 (min)
	Boring No. 5 – original dike to alluvial (17-19)			29 (max) 18 (min)
	Boring No. 8 – original dike to alluvial (17-19)			34 (max) 15 (min)
	Recommended		0	27
	Recommended		0	25
Law (1992)	Dike fill	124	300	25
Mactec (2007)	MWA2 – brown sandy silty clay	126.5-130.2	0	36.6
	MWB2 – tan brown lean clay	123.2-123.6	105.7	31.4
Stantec (2009a)	CPT N_{60} minimum, maximum, and average (6, 8, and 7)			31, 43, 39
	Recommended unit weight	123.6		
Stantec (2009a)	**Selected Parameters for Stability Analyses**	124	100	25

6. Dike 2 (Lean Clay)
7. Dike 2 (Fat Clay)

Stantec (2009a) breaks Dike 2 into two zones: lean and fat clay. Historical reports do not separate Dike 2. However, the shear strength testing suggests a change in material properties with effective internal friction angles ranging from 11° to 36.5°. Atterberg limits from undisturbed samples show liquid limits between 44 and 58, and plasticity indices between 25 and 39.



Moist unit weights were estimated using the Stantec (2009a) undisturbed samples. The moist unit weight of Dike 2 (lean clay) ranged from 123.4 to 133.1 pcf with an average over eight measurements of 128.4 pcf. One outlying value of 117.1 pcf was neglected in the estimate. Dike 2 (fat clay) ranged from 125.2 to 129.6 pcf with an average over four measurements of 127.6 pcf. One outlying value of 115.9 pcf was neglected in the estimate.

Typical blow counts for Dike 2 was 8 to 18 (N_{60} = 10.4 to 23.4).

Table 9. Dike 2 (Lean Clay) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2009a)	B-29B (12.0-13.4, 14.5-16.5)	126.4-134.6	0	36.5
HBA (1986) Raised Dike Borrow Study	Recommended soil properties	121	0	25
	Boring 1 (26.0-28.0) - CL	125.3	0	33.6
	Boring 2 (26.0-28.0)	127.9	570	22.8
	Boring 2 (30.0-32.0)	124.5	590	14.4

HBA (1986) Raised Dike Borrow Study	Boring 5 (10.0-12.0)	124.2	940	30.9
	Boring 5 (17.0-19.0)	118.3	220	24.8
	Boring 8 (20.0-22.0)	123.6	980	11
TVA (1987)	W (95% compaction) average		520	23.78
	W (95% compaction) lower third		460	18.43
	W (95% compaction) recommended	121	0	25
	W (98% compaction) average		1240	23.9
	W (98% compaction) lower third		1040	17.2
	W (98% compaction) recommended	125	0	30
	E (95% compaction) average		1240	18.8
	E (95% compaction) lower third		1160	14.6
	E (95% compaction) recommended	119	400	28
	E (98% compaction) average		580	25.4
	E (98% compaction) lower third		620	18.6
	E (98% compaction) recommended	123	0	30
Law (1992)	Dike fill	124	300	25
	Triaxial shear strength test		260	27
Mactec (2007)	MWA3 – brown lean clay	126.1-129.9	568.8	28.9
Stantec (2009a)	**Selected Parameters for Stability Analyses**	128	100	28

Table 10. Dike 2 (Fat Clay) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
HBA (1986) Raised Dike Borrow Study	Boring 1 (10.0-12.0) - CH	125.5	170	27.5
	Boring 2 (24.0-26.0)	123.3	150	34.3
	Boring 8 (28.0-30.0)	126.8	0	19.5
Stantec (2009a)	**Selected Parameters for Stability Analyses**	127	200	19

8. Dike 3

Dike 3 contains more granular material than Dikes 1 and 2. Moist unit weights for Dike 3 were estimated using the Stantec (2009a) undisturbed samples. The moist unit weight ranged from 121.9 to 128.7 pcf with an average over six measurements of 126.0 pcf. Typical blow counts for Dike 3 were 12 to 30 (15.6 to 39 for N_{60}). Field data (Stantec, 2009a) suggested a mix of lean and fat clay was present. Data for Dike 3 is not available in the historical documentation for the facility. Though the triaxial test results do not show effective cohesion, a minimal value of 50 psf was assigned to the material. Field observations and similarities to Dikes1 and 2 suggest that some effective cohesion is anticipated for Dike 3.

Table 11. Dike 3 Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2009a)	B-19C (10.5-12.5, 17.5-19.5), B-28C (14.5-16.5)	123.5-128.6	0	31
Stantec (2009a)	**Selected Parameters for Stability Analyses**	126	50	30

9. Divider Dike

The divider dike separating the Retention Pond and the Dry Fly Ash Stack is markedly different from the other soil strata on site. It is a matrix of gravel, clay, and boulders combined onsite prior to placement. The intermixed boulders made field testing difficult. This material is conservatively modeled as slightly stronger than Dike 3.

Table 12. Divider Dike Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2009a)	**Selected Parameters for Stability Analyses**	130	0	35

10. Alluvial (Clay)
11. Alluvial (Clay – Soft)
12. Alluvial (Granular)

Historical reports break the alluvial layer into a soft foundation layer and a lower, stronger foundation layer. Field investigations for Stantec (2009a) suggested two primary layers: alluvial (clay) and alluvial (granular). The alluvial material showed increased sand and gravel percentages in zones classifying as silty gravel with sand or poorly graded clayey gravel. This would also be logical based on the nearby meandering creek channel.

Blow counts also indicated possible strength gain in the alluvial (clay) under the Dikes 1 and 2 for a depth of 5-10 feet. Softer zones were present in the alluvial (clay), but appeared to be discontinuous and not globally a concern for the site. The historical properties for the soft alluvial clay layer are summarized below in Table 13. Though not specifically called out as a separate layer in the stability analyses, the historical values were referenced in estimating the appropriate shear strength values for the alluvial (clay) zone. Please refer to the geotechnical exploration cross sections included in the report's drawings to see how the blow counts correspond to assigned material type.

Moist unit weights for alluvial (clay) were estimated using the Stantec (2009a) undisturbed samples. The moist unit weights ranged from 110.0 to 128.0 pcf with an average over seven measurements of 120.2 pcf. Typical blow counts for alluvial (clay) were 5 to 15 (6.5 to 19.5 for N_{60}). Typical blow counts for alluvial (granular) were 8 to 20 (10.4 to 26 for N_{60}). Undisturbed samples of the alluvial (granular) layer were not available.

Table 13. (Historical Layer) Alluvial (Clay – Soft) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
HBA (1986)	Recommended soil properties – soft layer	119	0	18
TVA (1987)	Boring No. 1 - soft foundation layer (26-28)			28 (max) 24.5 (min)
	Boring No. 2 – soft foundation layer (24-26)			34.5 (max) 14 (min)
	Boring No. 2 – soft foundation layer (26-28)			27 (max) 24.5 (min)
	Boring No. 2 – soft foundation layer (30-32)			21 (max) 17 (min)
	Boring No. 8 – soft foundation layer (30-31?)			18 (max) 10 (min)
	Recommended	119	0	18-20
	TVA US-6 Sample 4		300	19.5
	Recommended average		0	24.3
	Recommended lower third		0	22.7
	Recommended for analysis		0	24
	Recommended based on blow counts and engineering judgment		0	28
Law (1992)	Upper soil subgrade	124	300	27
United (1992)	In-situ soft clay (undrained parameters)	120	400	10

Table 14. Alluvial (Clay) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2009a)	B-43A (50.0-52.0)	123.9-125.0	440	30.3
HBA (1986)	Recommended soil properties - foundation	125	0	24

TVA (1987)	Recommended soil properties – foundation clay	125	0	28
Law (1992)	Lower soil subgrade	125	500	30
United (1992)	In-situ stiff clay (undrained parameters)	125	500	20
Mactec (2007)	MWA1 – brown lean clay	128.2-131.4	0	31.5
	MWA1 – brown silty clay with sand	123.2-126.1	0	35.2
Mactec (2007)	MWB1 – brown lean clay	126.0-131.0	72.144	32.0
	MWB1 – tan brown lean clay	125.3-126.5	89.712	32.1
Stantec (2009a)	CPT N_{60} minimum, maximum, and average (7, 25, and 12)			16, 28, and 20
Stantec (2009a)	**Selected Parameters for Stability Analyses**	121	200	30

Table 15. Alluvial (Granular) Shear Strength Summary

Report	Boring/Depth (ft)	γ_w (pcf)	c' (psf)	ϕ' (deg.)
Stantec (2009a)	SPT N_{60} values – empirical			30.1-34.5
Stantec (2009a)	**Selected Parameters for Stability Analyses**	130	0	32

13. Bedrock

This shale and limestone layer will be modeled as an impenetrable layer in the slope stability. The weaker, shallower materials will control the slope stability.

Stantec	Subject Cumberland Fossil Plant	Made by JSH	Job No 175539009
	Gypsum Stack Complex and Dry Ash Stack	Checked by DBK	Date 10/13/2009
	Soil Properties for Analyses	Approved by JAH	Sheet No 16 of 17

CONCLUSIONS:

Table 16 summarizes the recommended soil material properties for the slope stability analyses. Care should still be taken when applying these properties to specific slope stability cross sections. Field investigation data varying greatly from these recommended properties should be discussed with the project team prior to performing the analyses.

Table 16. Slope Stability Material Properties

Material Type	Unit Weight, γ (pcf)	Effective Stress	
		Cohesion, c' (psf)	Friction Angle, φ' (deg)
Clay Dike 1	124	100	25
Clay Dike 2 - Lean Clay	128	100	28
Clay Dike 2 - Fat Clay	127	200	19
Clay Dike 3	126	50	30
Fly Ash – Stacked	100	0	32
Bottom Ash or Fly Ash - Sluiced	100	0	22
Bottom Ash - Stacked	105	0	35
Gypsum	105	0	38
Alluvial – Clay	121	200	30
Alluvial – Granular	130	0	32
Matrix (gravel, clay & boulder)	130	0	35
Bedrock	Impenetrable		

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Attachment 1
Figures

STANTEC CONSULTING SERVICES INC.

1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

Aerial Plan View

Tennessee Valley Authority
Cumberland Fossil Plant
Cumberland, Stewart County, Tennessee

PROJECT NO.	175539009
DATE	AUGUST 2009
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CHECKED BY	SH
CHECKED BY	
SCALE	AS SHOWN
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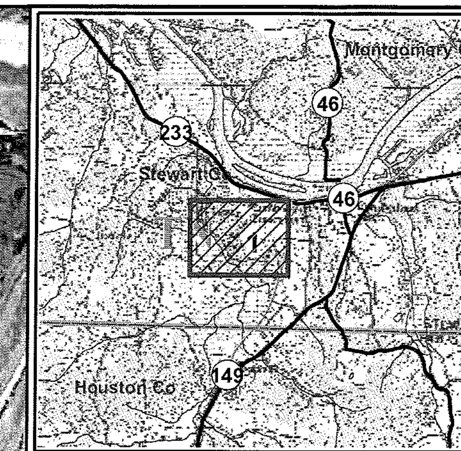
SHEET

1 OF 1



LEGEND

- Cross Section Data
- Geotechnical Boring

By-Products Disposal Features

(A) Cross Section identifier

This Is A Draft Plot
For Visual Representation Only

TVA

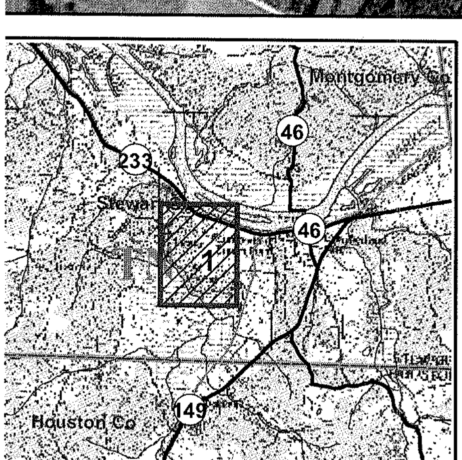
CUMBERLAND FOSSIL PLANT

BY-PRODUCTS DISPOSAL
EMBANKMENT STABILITY ANALYSIS
JUNE-AUGUST 2009 PROJECT: PCF535
FILE: PCF535.XYZ

500 250 0 500
Feet

Last Updated: Sep 22, 2009

Sheet 1 of 1



LEGEND

- ◑ Geotechnical Boring (September 2009)
- ● Drainage Feature (September 2009)

By-Products Disposal Features

This Is A Draft Plot
For Visual Representation Only

TVA

CUMBERLAND FOSSIL PLANT

BY-PRODUCTS DISPOSAL
EMBANKMENT STABILITY ANALYSIS
ADDENDUM
SEPTEMBER 2009 PROJECT: PCF555
FILES: PCF555.XYZ, PCF555.XLSX

500 250 0 500
Feet

Last Updated: Sep 22, 2009
Sheet 1 of 1

Attachment 2
Boring Logs (Stantec, 2009a)

Attachment 3
Geotechnical Laboratory Results
(Stantec, 2009a)

Geotechnical Laboratory Summary

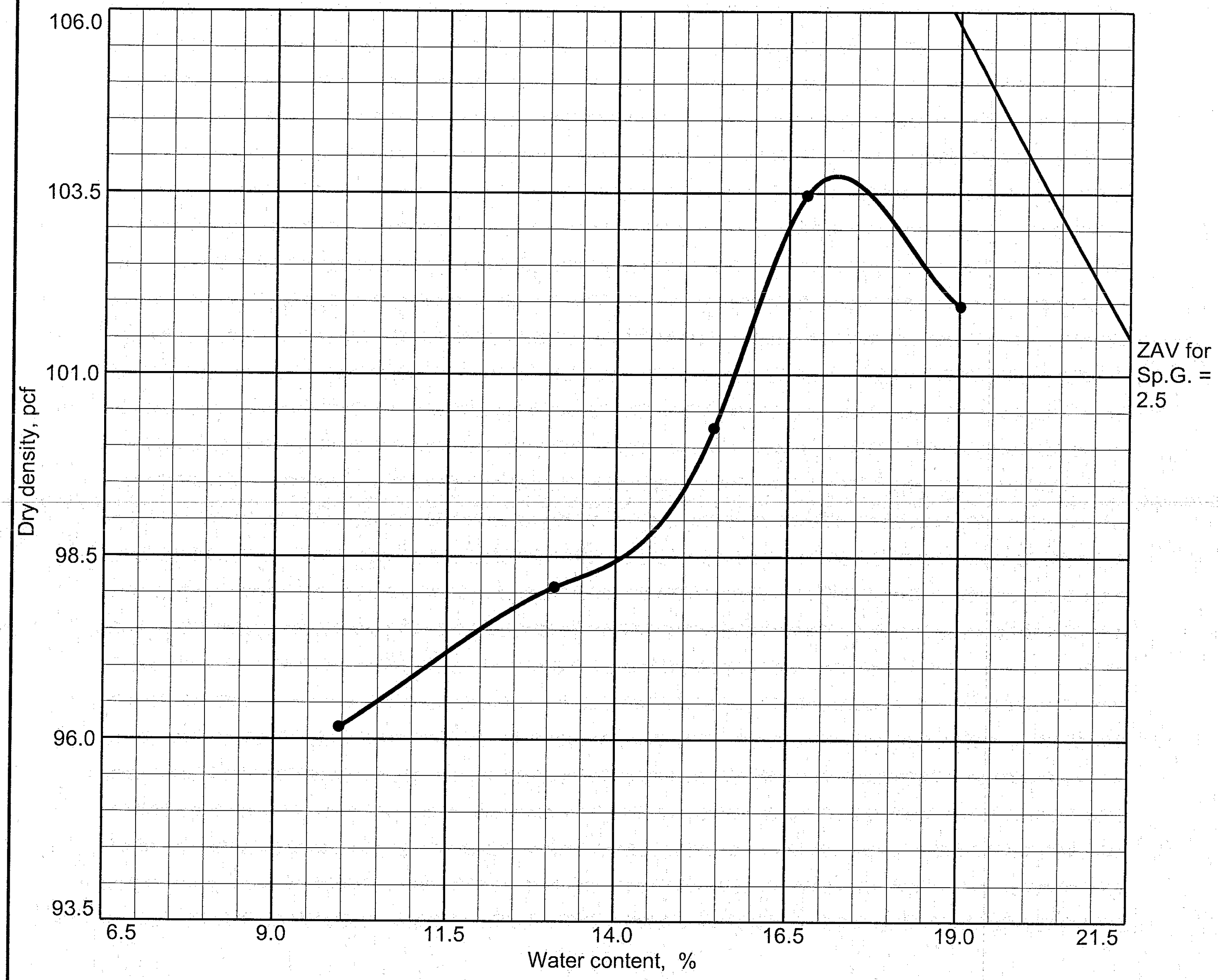
			Shelby Tube Extractions (UC Summary Sheet)			CU Triaxial								Moisture-Density Relationship		Atterberg Limits				Particle Size Analysis (ASTM) (%)									Permeability
Boring	Depth (ft)	Material Type	γ_{w0} (pcf)	w_0 (%)	γ_{d0} (pcf)	G_s	S_{r0} (%)	e_0	γ_{w0} (pcf)	w_0 (%)	γ_{d0} (pcf)	c' (psf)	ϕ' (deg)	γ_{dmax} (pcf)	ω_{opt} (%)	LL	PL	PI	Activity Index	Gravel *(3"- 4.75 mm) (> No. 4)*	Coarse Sand *(4.75-2 mm) (No. 4-No. 10)*	Medium Sand *(2-0.425 mm) (No. 10-No. 40)*	Fine Sand *(0.425 - 0.075 mm) (No. 40-No. 200)*	Silt *(0.075-0.005 mm) (<No. 200)*	Clay *(<0.005 mm)*	USCS	Group Name	AASHTO	Avg. k (20ºC) (cm/s)
B-5	18.0-20.0	Dike 1	119.1	24.3	95.8	2.64	89.3	0.719	119.2	24.3	95.9	320	28.7																
B-5	18.0-20.0	Dike 1	121.5	27.2	95.5	2.64	95.3	0.699	121.5	25.2	97																		
B-9A	25.5-27.5	Dike 1	126.9	24.9	101.6																								
B-21B	59.0-61.0	Dike 1		31.1																									
B-21B	59.0-61.0	Dike 1		22.5																									
B-29A	29.0-31.0	Dike 1	124.3	23.8	100.3	2.7*	94.1	0.646	125.4	22.5	102.4	16.4	36.8																
B-29A	29.0-31.0	Dike 1	125.6	20.1	104.6	2.7*	97	0.595	128.3	21.4	105.7																		
B-63A	5.0-7.0	Dike 1		19.9																									
B-63A	8.0-10.0	Dike 1	125.2	27.1	98.5							1000	17.7																
B-63A	8.0-10.0	Dike 1	126.3	20.4	104.8																								
B-63A	5.0-7.0	Dike 1	120.2	22.1	98.5																								
B-6	24.0-34.5	Dike 1		31.1		2.68										56	20	36	1.57	42.5	6.3	8.5	2.2	15.0	25.5	GC	Clayey gravel with sand	A-7-6 (8)	
B-8	1.5-19.5	Dike 1		15.8		2.64										36	19	17	0.57	1.3	0.8	7.4	4.9	49.0	36.6	CL	Lean clay	A-6 (14)	
B-14	1.5-18.0	Dike 1														44	19	25											
B-26	1.5-13.5	Dike 1														44	17	27											
B-26	15.0-21.0	Dike 1/Alluvial Clay														38	16	22											
B-30	0.0-7.5	Dike 1														46	20	26											
B-30	9.0--16.5	Dike 1														36	19	17											
B-34	0.0-6.0	Dike 1														44	18	26											
B-34	7.5-16.5	Dike 1														36	17	19											
B-3A	8.0-10.0	Dike 2	127.4	19.4	106.7																								
B-3A	14.0-16.0	Dike 2	125.2	25.1	100.1																								
B-3A	14.0-16.0	Dike 2	115.9	28.8	90.0																								
B-9A	3.0-5.0	Dike 2		17.3																									
B-9A	13.0-15.0	Dike 2		21.0																									
B-9B	6.0-8.0	Dike 2	129.6	22.2	106.0																								7.00E-08
B-9B	9.5-11.5	Dike 2	131.4	20.9	108.7																								2.30E-08
B-9B	14.0-16.0	Dike 2		21.7																									
B-21B	15.0-17.0	Dike 2		25.1																									
B-21B	20.0-22.0	Dike 2	128.1	24.6	102.8																								1.80E-08
B-29A	17.0-19.0	Dike 2	123.4	25.8	98.1																								2.20E-08
B-29B	12.0-13.4	Dike 2	124.6	20.0	103.8	2.7*	102.4	0.675	126.4	25.6	100.6																		
B-29B	12.0-13.4	Dike 2	131.3	21.4	108.2	2.7*	99.9	0.507	132.8	18.8	111.8	0	36.5																
B-29B	14.5-16.5	Dike 2	127.5	18.3	107.7	2.7*	98.7	0.466	134.6	17	115																		
B-37A	19.5-21.5	Dike 2	117.1	30.0	90.1																								
B-37A	19.5-21.5	Dike 2		34.9																									
B-37B	8.0-10.0	Dike 2	128.4	22.1	105.2																								
B-37B	11.0-12.4	Dike 2	133.1	18.5	112.3																								1.40E-08
B-37B	11.0-12.4	Dike 2	127.8	18.9	107.5																								
B-6	0.0-10.0	Dike 2		24.3		2.55										55	18	37	0.93	6.0	4.3	7.9	13.9	22.4	45.5	CH	Sandy fat clay	A-7-6 (23)	
B-9	0.0-6.0	Dike 2		20.3		2.70										50	17	33	0.92	8.8	3.1	6.2	13.2	27.7	41.0	CH/CL	Sandy fat clay	A-7-6 (21)	
B-9	9.0-12.0	Dike 2		22.2		2.68										51	19	32	0.78	4.9	2.4	3.8	5.9	34.3	48.7	CH/CL	Fat clay with sand	A-7-6 (27)	
B-12	15.0	Dike 2		21.2		2.77										51	18	33	0.94	10.8	2.6	6.2	7.4	32.0	41.0	CH/CL	Fat clay with sand	A-7-6 (23)	
B-21	0.0-9.0	Dike 2		23.6		2.81										49	18	31	0.97	6.8	3.3	7.1	12.2	33.1	37.5	CL/CH	Lean clay with sand	A-7-6 (21)	
B-21	12.0-18.0	Dike 2		91.1		2.78										56	20	36	0.77	0.7	2.1	6.1	5.5	31.8	53.8	CH	Fat clay	A-7-6 (33)	
B-25	10.5-18.0	Dike 2		21.5		2.54								104.4	18.4	58	22	36	0.72	0.3	1.8	3.9	6.3	30.3	57.4	CH	Fat clay	A-7-6 (34)	
B-29	0.3-10.0	Dike 2		12.6		2.58										46	21	25	0.48	4.4	3.0	7.6	7.7	21.2	56.1	CL	Lean clay with sand	A-7-6 (19)	
B-29	10.4-14.5	Dike 2		24.8		2.57										46	17	29	0.63	8.4	3.5	7.3	7.3	21.9	51.6	CL	Lean clay with sand	A-7-6 (20)	
B-37	6.0-14.5	Dike 2		16.3		2.61								112.0	16.6	53	18	35	0.63	0.6	0.3	2.1	3.2	28.8	65.0	CH	Fat clay	A-7-6 (35)	
B-42	4.5-15.0	Dike 2														44	18	26											
B-19C	17.5-19.5	Dike 3	128.7	12.4	114.5	2.7*	88.8	0.547	128.6	18	109																		
B-19C		Dike 3				2.7*	92.6	0.687	123.5	23.6	99.89	0	31																
B-19C	10.5-12.5	Dike 3	125.9	17.5	107.1	2.7*	89.3	0.633	124.8	20.9	103.2																		
B-19C	15.0-16.0	Dike 3		18.8																									
B-19C	20.0-22.0	Dike 3	127.3	13.8	111.8																								3.20E-08
B-22C	22.0-24.0	Dike 3		27.3																									
B-24C	10.0-11.6	Dike 3		14.7																									
B-28A	8.0-9.5	Dike 3		18.6																									
B-28C	14.5-16.5	Dike 3	121.9	20.0	101.6																								
B-36A	13.0-14.6	Dike 3	128.7	14.9	112.0																								
B-36B	10.8-12.8	Dike 3		20.8																									
B-36B	13.0-13.7	Dike 3		12.7																									
B-36B	19.0-21.0	Dike 3	123.3	29.7	95.1																								
B-43A	20.0-22.0	Dike 3		27.3																									
B-19	7.5-25.5	Dike 3		19.8		2.78										48	19	29	1.32	26.2	6.6	9.4	8.8	22.5	26.5	GC	Clayey gravel with sand	A-7-6 (10)	
B-22	6.0-13.5, …	Dike 3		14.3		2.72										36	18	18	1.38	44.6	6.7	10.1	6.4	15.5	16.7	GC	Clayey gravel with sand	A-2-6 (1)	
B-24	4.5-22.5	Dike 3		16.4		2.51										39	19	20	1.05	30.2	7.5	10.1	7.3	21.5	23.4	GC	Clayey gravel with sand	A-6 (5)	
B-28	1.5-15.0	Dike 3		6.5		2.66								124.3	11.0	36	17	19	0.63	23.2	7.9	12.7	8.7	11.7	35.8	SC	Clayey sand with gravel	A-6 (5)	
B-32	1.5-16.5	Dike 3		16.0		2.63										40	17	23	1.15	32.8	6.7	9.1	6.9	20.1	24.4	GC	Clayey gravel with sand	A-6 (6)	
B-5	20.0-22.0	Alluvial Clay		25.2																									
B-15B	46.0-48.0	Alluvial Clay	120.3	26.5	95.1																								2.30E-08
B-15B	46.0-48.0	Alluvial Clay	121.4	26.9	95.6																								
B-29A	50.0-52.0	Alluvial Clay	110.0	33.1	82.7																								6.60E-09
B-29A	50.0-52.0	Alluvial Clay	112.9	30.3	86.6																								
B-43A	47.0-49.0	Alluvial Clay	128.0	20.2	106.4																								
B-43A	50.0-52.0	Alluvial Clay	123.7	25.6	98.5	2.67	98.6	0.657	125.0	24.3	100.6	440	30.3																
B-43A	50.0-52.0	Alluvial Clay	125.0	24.2	100.6	2.67	96.9	0.677	123.9	24.6	99.4																		

Geotechnical Laboratory Summary

			Extractions (UC Summary Sheet)			CU Triaxial								Moisture-Density Relationship		Atterberg Limits				Particle Size Analysis (ASTM) (%)									Permeability
Boring	Depth (ft)	Material Type	γ_{w0} (pcf)	w_0 (%)	γ_{d0} (pcf)	G_s	S_{r0} (%)	e_0	γ_{w0} (pcf)	w_0 (%)	γ_{d0} (pcf)	c' (psf)	ϕ' (deg)	γ_{dmax} (pcf)	ω_{opt} (%)	LL	PL	PI	Activity Index	Gravel *(3"- 4.75 mm) (> No. 4)*	Coarse Sand *(4.75-2 mm) (No. 4-No. 10)*	Medium Sand *(2-0.425 mm) (No. 10-No. 40)*	Fine Sand *(0.425 - 0.075 mm) (No. 40-No. 200)*	Silt *(0.075-0.005 mm) (<No. 200)*	Clay *(<0.005 mm)*	USCS	Group Name	AASHTO	Avg. k (20ºC) (cm/s)
B-2	55.0-69.0	Alluvial Clay		26.9		2.56										36	20	16	0.62	0.0	0.0	1.3	3.6	59.3	35.8	CL	Lean clay	A-6 (16)	
B-4	43.5-56.5	Alluvial Clay		27.2		2.53										40	21	19	0.59	0.0	0.0	4.4	3.5	47.7	44.4	CL	Lean clay	A-6 (18)	
B-6	36.0-44.0	Alluvial Clay		26.5		2.55										37	18	19	0.66	1.9	0.3	4.1	3.6	53.8	36.3	CL	Lean clay	A-6 (17)	
B-11	15.0-36.0	Alluvial Clay		20.8		2.66										41	24	17	0.5	4.5	0.5	2.2	3.1	47.8	41.9	CL	Lean clay	A-7-6 (17)	
B-12	35.0-46.5	Alluvial Clay		25.5		2.64										40	19	21	0.62	3.7	1.3	2.8	3.4	42.8	46.0	CL	Lean clay	A-6 (19)	
B-33	30.0-39.0	Alluvial Clay		22.8		2.62										35	23	12	0.57	8.0	1.7	4.9	10.7	46.7	28.0	CL	Lean clay with sand	A-6 (8)	
B-42	21.0-34.0	Alluvial Clay														49	18	31											
B-12	60.0-69.0	Alluvial Granular		19.8		2.62											NP		N/A	45.6	10.2	12.7	10.1	14.3	7.1	GM	Silty gravel with sand	A-1-b (0)	
B-14	40.0-49.0	Alluvial Granular		23.4		2.70											NP		N/A	18.8	8.6	36.9	18.9	12.2	4.6	SM	Silty sand with gravel	A-1-b (0)	
B-14	52.5-64.0	Alluvial Granular		21.0		2.70											NP		N/A	53.0	8.6	15.7	6.4	9.1	7.2	GM	Silty gravel with sand	A-1-b (0)	
B-22	75.0-89.0	Alluvial Granular		21.9		2.66											NP		N/A	54.2	15.4	15.5	5.1	5.7	4.1	GP-GC	Poorly graded clayey gravel	A-1-a (0)	
B-17A	32.0-34.0	Fly Ash (Sluiced)		30.9																									
B-17A	32.0-34.0	Fly Ash (Sluiced)	106.2	27.4	83.4																								7.00E-07
B-17A	70.0-72.0	Fly Ash (Sluiced)	104.1	41.1	73.8																								6.50E-07
B-28	52.0-54.0	Fly Ash (Sluiced)	97.4	57.1	62.0																								
B-28A	50.0-52.0	Fly Ash (Sluiced)	100.7	41.4	71.2																								
B-28A	52.0-54.0	Fly Ash (Sluiced)	101.9	52.3	66.9																								
B-35A	37.0-38.0	Fly Ash (Sluiced)		47.5																									
B-36A	24.0-26.0	Fly Ash (Sluiced)		45.1																									
B-36A	44.0-46.0	Fly Ash (Sluiced)	102.8	40.5	73.2																								6.60E-07
B-37A	24.0-26.0	Fly Ash (Sluiced)		53.2																									
B-43A	29.0-31.0	Fly Ash (Sluiced)	104.6	32.0	79.3	2.47	97.5	1.134	104.5	44.8	72.2																		
B-43A	29.0-31.0	Fly Ash (Sluiced)	100.6	39.7	72.0	2.47	94	1.262	100.9	48	68.2	0	39.6																
B-35A	46.0-48.0	Fly Ash (Sluiced)	104.8	46.0	71.8	2.47	100.2	1.174	104.6	47.6	70.9																		
B-18	15.0-34.5	Fly Ash (Sluiced)		37.2		2.58											NP		N/A	4.8	0.1	4.5	16.6	61.0	13.0	ML	Silt with sand	A-4 (0)	
B-19	28.5-49.0	Fly Ash (Sluiced)		30.3		2.46											NP		N/A	2.0	0.8	5.8	11.4	68.3	11.7	ML	Silt with sand	A-4 (0)	
B-24	27.0-51.5	Fly Ash (Sluiced)		44.8		2.44											NP		N/A	0.2	0.1	7.1	14.6	64.3	13.7	ML	Silt with sand	A-4 (0)	
B-32	20.0-49.0	Fly Ash (Sluiced)		34.6		2.52											NP		N/A	2.6	1.3	9.9	6.9	69.7	9.6	ML	Silt with sand	A-4 (0)	
B-37	7.5-21.0	Fly Ash (Sluiced)		23.1		2.62										45	18	27	0.71	2.6	2.0	4.3	4.7	41.1	45.3	CL	Lean clay	A-7-6 (24)	
B-4	1.5-31.5	Fly Ash (Sluiced)		40.7		2.42											NP		N/A	2.4	3.1	14.6	7.4	58.6	13.9	ML	Silt with sand	A-4 (0)	
B-41	24.0-34.5	Fly Ash (Sluiced)		26.2		2.52											NP		N/A	0.3	0.8	15.2	16.4	42.9	24.4	ML	Sandy silt	A-4 (0)	
B-45	25.0-39.6	Fly Ash (Sluiced)		35.7		2.71											NP		N/A	8.3	9.4	17.0	23.4	25.3	16.6	SM	Silty sand	A-4 (0)	
B-17A	50.0-52.0	BA-FA (Sluiced)		20.0																									
B-21B	25.0-27.0	BA-FA (Sluiced)		16.3																									
B-21B	48.0-50.0	BA-FA (Sluiced)	125.0	25.2	99.8																								
B-24C	3.5-4.8	BA-FA (Sluiced)		15.6																									
B-2	4.5-39.0	BA-FA (Sluiced)		25.9		2.62											NP		N/A	15.0	11.8	21.4	17.9	30.0	3.9	SM	Silty sand with gravel	A-2-4 (0)	
B-18	0.0-7.5	BA-FA (Sluiced)		14.4		2.61											NP		N/A	8.9	8.4	25.1	18.1	32.4	7.1	SM	Silty sand	A-4 (0)	
B-21	18.0-30.0	BA-FA (Sluiced)		22.9		2.61											NP		N/A	20.6	16.5	28.4	17.9	12.8	3.8	SM	Silty sand with gravel	A-1-b (0)	
B-22	28.5-49.5	BA-FA (Sluiced)		33.6		2.55											NP		N/A	7.6	5.4	14.3	16.7	46.5	9.5	ML	Sandy silt	A-4 (0)	
B-41	0.1-2.1	Gypsum		7.2																									
B-20	0.0-15.0	Gypsum		15.7		2.31											NP		N/A	0.0	0.0	6.4	6.5	83.2	3.9	ML	Silt	A-4 (0)	
B-35	1.5-22.5	Gypsum		10.6		2.94											NP		N/A	0.4	0.1	11.1	7.2	76.1	5.1	ML	Silt with sand	A-4 (0)	
B-41	0.0-12.9	Gypsum		22.1		2.31											NP		N/A	0.0	0.2	2.0	6.2	67.5	24.1	ML	Silt	A-4 (0)	
B-45	3.0-9.0	Gypsum		16.1		2.36											NP		N/A	0.2	0.1	2.0	5.4	70.8	21.5	ML	Silt	A-4 (0)	
	Gypsum Bulk	Gypsum				2.75*								86.3	35.1														8.10E-08
	Gypsum Rejects Bulk	Gypsum Rejects				2.73								86.2	35.2	33	32	1		0.0	7.4			86.1	6.5	ML		A-4 (0)	5.30E-07
	Gypsum Rejects Bulk	Gypsum Rejects				2.7*	72.6	1.08	104.5	29.1	80.97																		
						2.5*	76.2	0.947	103.3	28.9	80.17	90.9	42.5																
						2.7*	72	1.1	103.9	29.2	80.41																		
	Gypsum Rejects Bulk	Gypsum Rejects				2.7*	67.4	1.09	102.7	27.2	80.71																		
						2.7*	66.9	1.09	102.5	26.9	80.79	0.0	44																
						2.7*	66.8	1.09	102.5	26.9	80.75																		
	Bottom Ash Bulk	Bottom Ash				2.5*								103.7	17.2														2.30E-06
	Bottom Ash Bulk	Bottom Ash				2.7*	48.3	0.923	102.1	16.5	87.66																		
						2.5*	53.8	0.782	102.3	16.8	87.57	0	44																
						2.7*	47.5	0.913	102.3	16.1	88.12																		
	Bottom Ash Bulk	Bottom Ash				2.7*	48.3	0.923	102.1	16.5	87.66	261	41																
						2.7*	47.5	0.913	102.3	16.1	88.12																		
	Fly Ash Bulk	Fly Ash				2.5*								83.6	32.7														4.20E-07
	Fly Ash Bulk					2.5*	61.2	1.37	87.8	33.6	65.75																		
						2.5*	62	1.36	88.4	33.8	66.09	14.3	36																
						2.5*	63.3	1.36	89.0	34.4	66.21																		

* G_s is assumed.

COMPACTION TEST REPORT



Test specification: ASTM D 698-78 Method C Standard
Oversize correction applied to each point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
				2.5				

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 103.7 pcf Optimum moisture = 17.2 %	

Project No. GTX-1484 **Client:** STANTEC
Project: Cumberland Fossil Plant (Ash and Gypsum Stacks)

● **Source:** **Sample No.:** Bottom Ash

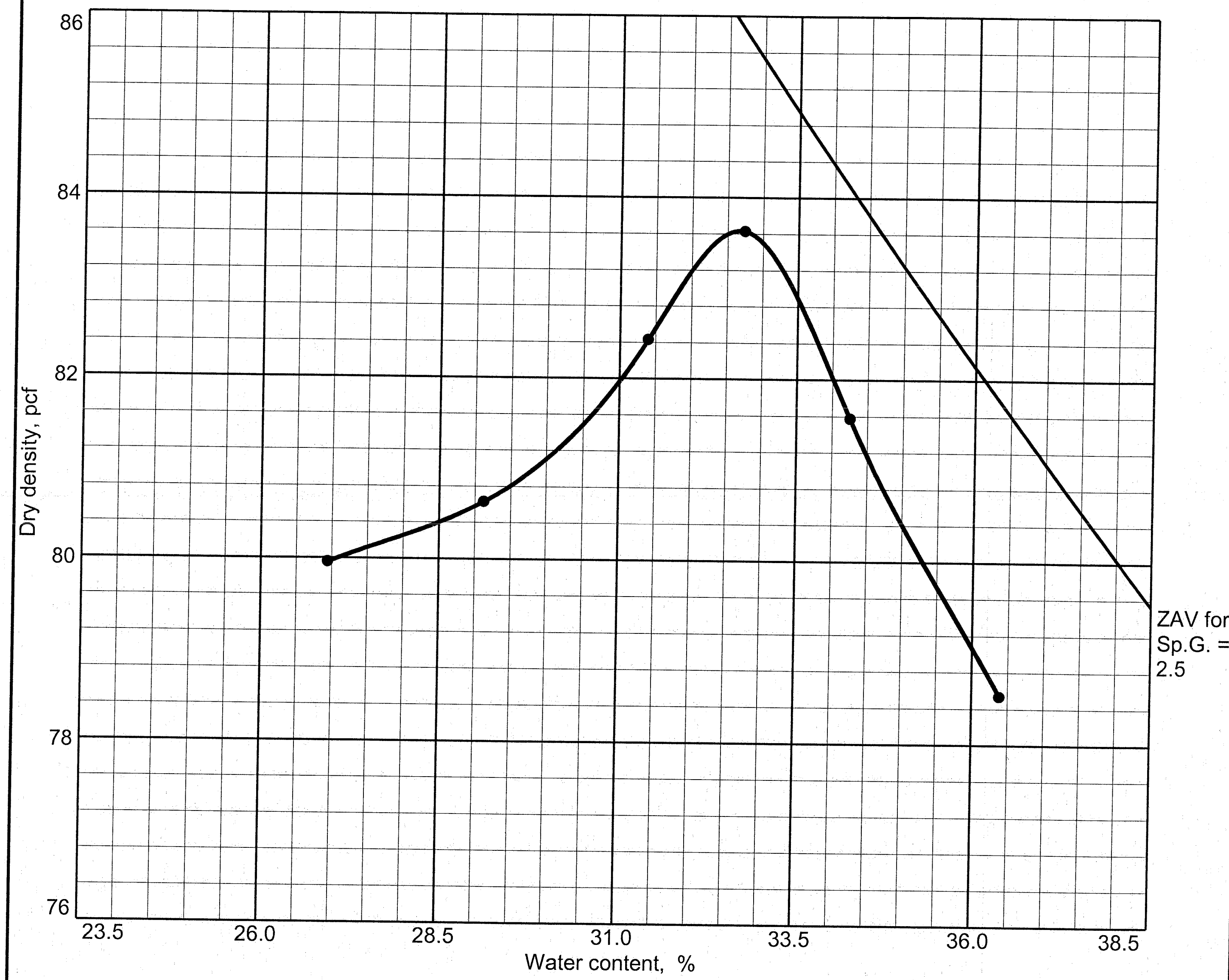
Remarks:

COMPACTION TEST REPORT

GeoTesting Express Inc.

Lab no.

COMPACTION TEST REPORT



Test specification: ASTM D 698-78 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
				2.5			0.0	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 83.6 pcf Optimum moisture = 32.7 %	

Project No. GTX-1484 **Client:** STANTEC

Project: Cumberland Fossil Plant (Ash and Gypsum Stacks)

● **Source:** **Sample No.:** FlY ASH (BULK)

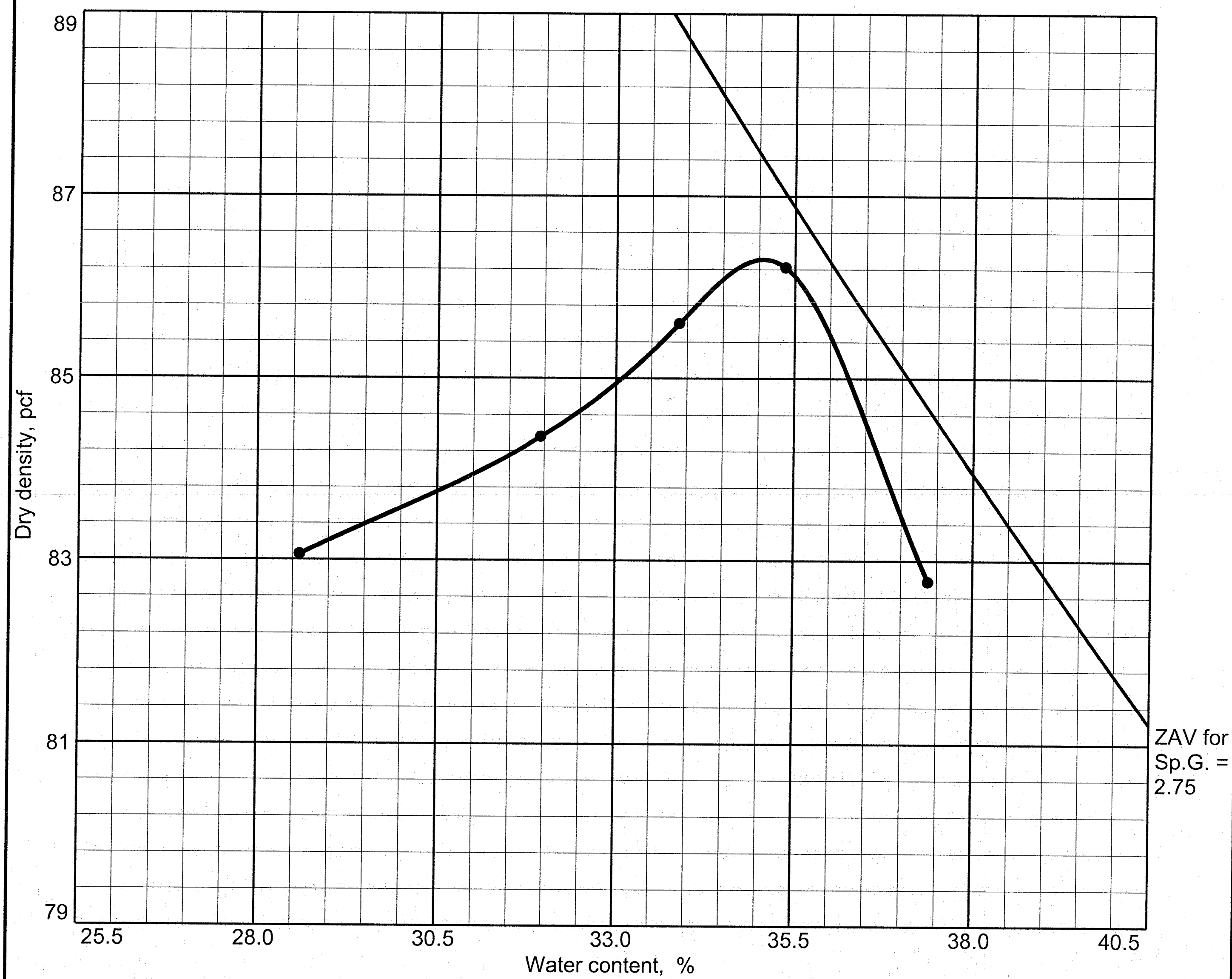
Remarks:

COMPACTION TEST REPORT

GeoTesting Express Inc.

Lab no.

COMPACTION TEST REPORT



Test specification: ASTM D 698-78 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
				2.75				

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 86.3 pcf Optimum moisture = 35.1 %	

Project No. GTX-1484 **Client:** STANTEC
Project: Cumberland Fossil Plant (Ash and Gypsum Stacks)

● **Source:** **Sample No.:** Gypsum Bulk

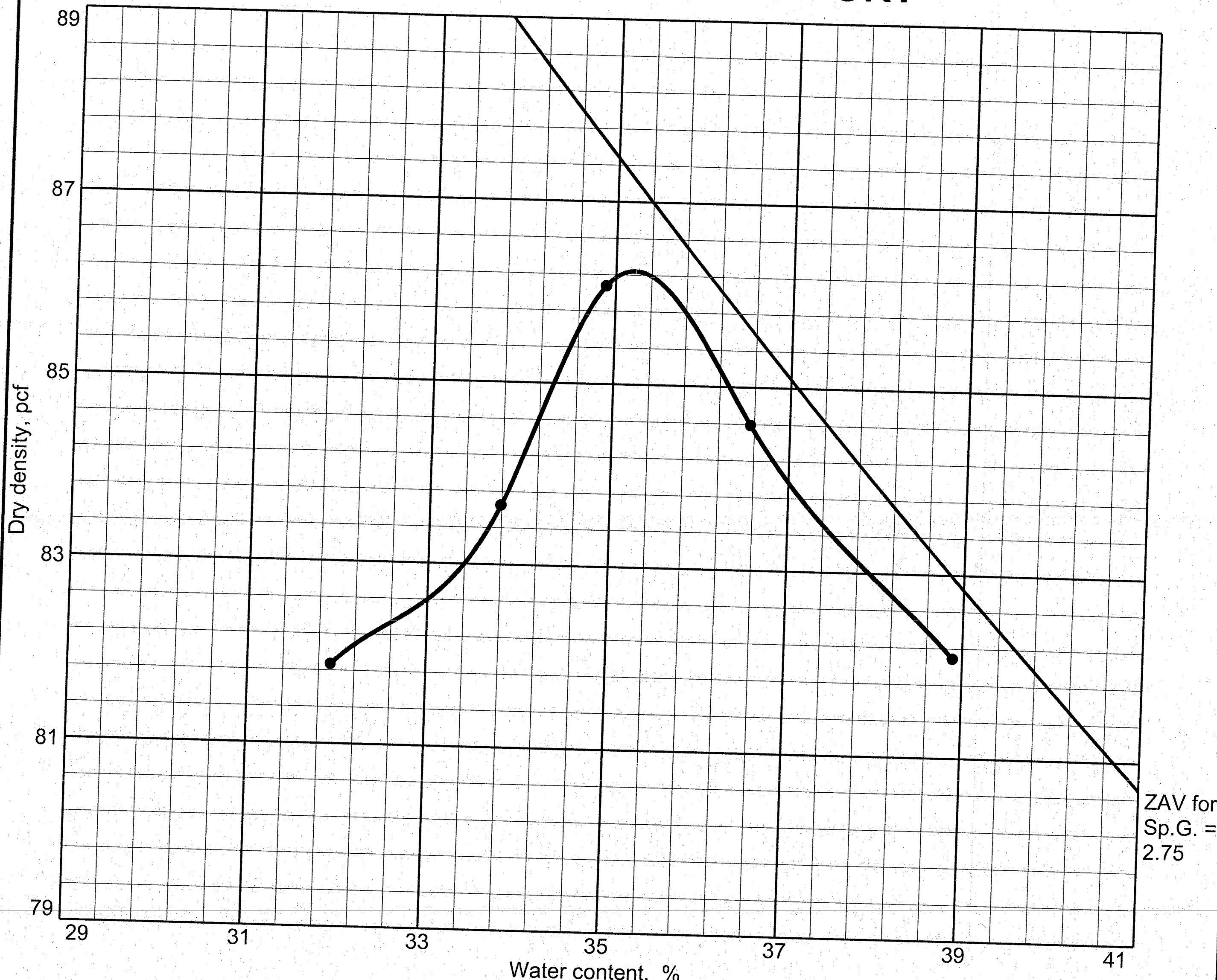
Remarks:

COMPACTION TEST REPORT

GeoTesting Express Inc.

Lab no.

COMPACTION TEST REPORT



Test specification: ASTM D 698-78 Method A Standard

Elev/ Depth	Classification USCS	Classification AASHTO	Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	ML	A-4(0)		2.75	33	1	0.0	92.6

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 86.2 pcf Optimum moisture = 35.2 %	

Project No. GTX-1484 **Client:** STANTEC

Project: Cumberland Fossil Plant (Ash and Gypsum Stacks)

● **Source:** **Sample No.:** Gypsum Rejects

Remarks:

COMPACTION TEST REPORT

GeoTesting Express Inc.

Lab no.

Attachment 4
Referenced Historical Data

Hall, Blake and Associates, Inc. (1986)

CUMBERLAND S.P.

B41 '87 0401 002
JMA 12-2-86

RECOMMENDED SOIL PROPERTIES

SOIL DESCRIPTION	[illegible] γ_{moist} (PCF)	WEIGHT γ_{sat} (PCF)	[illegible] c ([illegible])	[illegible] ϕ ([illegible])	[illegible] $\bar{c}$	[illegible] $\bar{\phi}$
RAISED DIKE FILL (EARTH FILL)	121	124	0.1	15	0	25
ORGINAL DIKE FILL (EARTH FILL)	125	126	0.25	20	0	25
SOFT LAYER	119	121	0.2	11	0	18
FOUNDATION SOIL	125	126	0.2	20	0	28
[illegible] (COMPACTED)	108	124	0.75	24	0	34
BORROW AREA W (95%)	121	126	0.25	21	0	25
BORROW AREA W (99%)	125	128	0.6	22	0	30
BORROW AREA E (95%)	119	125	0.6	20	0.2	28
BORROW AREA E (95%)	123	127	0.2	25	0.0	30

Tennessee Valley Authority (1986)

SHEET ii OF

preliminary
JMH 11-4-86

COMPUTED [redacted] DATE [redacted]

CHECKED [redacted] DATE [redacted]

Preliminary
send FEP 11-4-86

PRELIMINARY

RECOMMENDED SOIL PROPERTIES

SOIL IDENTIFICATION	UNIT WEIGHT γ_{MOIST} (PCF)	γ_{SAT} (PCF)	γ_{SUB} (PCF)	R-TRIAXIAL TEST APPARENT c (TSF)	ϕ (DEG)	EFFECTIVE $\bar{c}$ (TSF)	ϕ (DEG)
PRELIMINARY							
RAISED DIKE FILL	121	124	62	0.1	15	0	25
FILL-EXISTING DIKE	125	126	63	0.25	20	0	25
SOFT LAYER	119	121	58	0.3	11	0	18
FOUNDATION	125	126	63	0.2	20	0	24
ASH (BOTTOM ASH) COMPACTED	108	124	62	0.75	24	0	34

PRELIMINARY

pl. reevaluate considering negative pore pressure developed during testing & using the effective stress ratio criterion.
Cons. from re-evaluation. SBA 4/25/86

BORROW AREA W

95% $\gamma_m = 121^{PCF}$ $\gamma_{SAT} = 126^{PCF}$

$R - \phi = 21^\circ$

$c = 0.15^{TSF}$

TVA 11030 (WM-7-75)

CUMBERLAND STEAM PLANT

UNDISTURBED SAMPLES

SUMMARY OF LABORATORY TEST DATA

Elevation depth	Soil Symbol	Nat. Moist %	Atterb. Limits Liq. Limit %	Atterb. Limits Plastic Index %	Dry Dens. pcf	Vane Shear tsf	Saturated Triaxial R Apparent φ deg	Saturated Triaxial R Apparent c ksf	Saturated Triaxial R Effective φ deg	Saturated Triaxial R Effective c ksf
Boring 1										
10.0-12.0	CH	21.0	52	29	103.7	0.95	28.0	0.42	27.5	0.17
26-0.28.0	CL	25.3	38	20	100.0	100+	25.0	0.85	33.6	0.0
Boring 2										
24.0-26.0	CH	31.4	54	37	93.8	0.25	28.3	1.0	34.3	0.15
26.0-28.0	CL	23.3	45	24	103.7	0.30	11.1	2.64	22.8	0.57
30.0-32.0	CL	25.3	39	20	99.4	0.35	14.5	0.56	14.4	0.59
Boring 4										
5.0-7.0		29.7	47	28	91.4	1.00+				
Boring 5										
10.0-12.0	CL	24.0	39	18	100.2	0.67	32.1	0.97	30.9	0.94
17.0-19.0	CL	24.4	40	21	95.1	0.60	17.3	1.51	24.8	0.22
Boring 8										
20.0-22.0	CL	25.6	46	23	98.4	1.00+	11.9	1.12	11.0	0.98
28.0-30.0	CH	22.1	30	11	103.6	0.15	17.7	0.10	19.5	0.0
Boring 10										
4.0-6.0		19.4	52	32	99.3	1.00+				

CH = INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
CL = INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS.

A36283.1

TVA 489E (EN DES-12-76)

TENNESSEE VALLEY AUTHORITY

SHEET OF

SUBJECT Ash Pond Dike - Recommended Engg Properties for slope Stability Analysis

PROJECT Cumberland Steam Plant

COMPUTED BY GMR DATE 12-11-86 CHECKED BY SBA DATE 12-12-86

SOIL IDENTIFICATION	UNIT WEIGHT (pcf)			SHEAR STRENGTH						REMARKS
				Q		R		$\bar{R}$		
	γ moist	γ sat	γ sub	c (tsf)	ϕ (deg)	c (tsf)	ϕ (deg)	$\bar{c}$ (tsf)	$\bar{\phi}$ (deg)	
Raised Dike Embankment-Earthfill	121	124				0.10	15	0	25	
Original Dike Embankment-Earthfill	125	126				0.25	18	0	25	
Bottom Ash	108	124				0.75	24	0	34	
In situ Foundation Soft layer	119	121				0.20	11	0	19	
In situ Foundation Stiff-Hard soils	125	126				0.25	20	0	28	
Borrow Soil - Area W 95% Compaction	121	126				0.25	18	0	25	Compacted to 95% std. Max. Dry Density at opt. Moist ± 2%
Borrow Soil - Area W 98% Compaction	125	128				0.40	18	0	30	Compacted to 98% std. Max. Dry Density at opt. moist. ± 2%
Borrow Soil - Area E 95% Compaction	119	125				0.30	15	0	25	Compacted to 95% std. max. Dry Density at opt. moist ± 2%
Borrow Soil - Area E 98% Compaction	123	127				0.40	17	0	30	Compacted to 98% std. Max. Dry Density at opt. moist ± 2%.

TVA 488 (EN DES-3-77)

SHEET ______ OF ______

COMPUTED ______ DATE ______

CHECKED ______ DATE ______

Boring No. 1

Sample depth: 10'-12' — Original dike fill, N = 16-17

ϕ = 30° max; 25.5° min.

Sample depth: 26'-28' — Soft foundation area, N = 27

ϕ = 28° max; 24.5° Min

Boring No. 2

Sample depth: 24'-26' — Soft foundation area, N = 7

ϕ = 34.5° Max Seems high but 2 tests @ this value

20°? ϕ = 14° Min Mohrs Circle appears there may be an error in plotting

Sample depth: 26'-28' — Soft foundation area N = 9

ϕ = 27° Max, 24.5° Min. Good general agreement between circles

Sample depth: 30'-32' — Soft foundation area, N = 5

ϕ = 21° Max, 17° Min [illegible] general agreement between circles

Boring No. 5

Sample depth: 10'-12' — Original dike fill, N = 12-10

ϕ = 42° Max — Seems high, one circle

ϕ = 25° Min — Two circles, good agreement

Sample depth: 17'-19' — Bottom of dike fill & top of fdn. matl., N = 7-16

ϕ = 29° Max, other circle shows 27°

ϕ = 18° Min.

Boring No. 8

Sample depth: 20'-22 — Bottom of dike fill & top of fdn. N = 9

ϕ = 34° Max., 15° Min; Very poor circle agreement, one circle useless

Sample depth: 28'-30' — Soft foundation area, N = 4

ϕ = 18° Max (2 circles), 10° Min (third circle in poor agreement)

TVA 488 (EN DES-3-77)

SHEET ______ OF ______

COMPUTED ______ DATE ______

CHECKED ______ DATE ______

1. Strength parameters used by LAW are consistently higher than those recommended earlier by the old Geotech group. LAW states that a trend was noted (pg. 8) in the relationship between c & φ enabling them to determine likely combinations of c & φ from the Hall-Blake data. They do not expand on what this trend is for TVA to agree or disagree with its validity.

2. LAW conducted only one triaxial test ~~and one direct shear test~~ on remolded dike material (?) from an undisclosed location. There was a large disparity in the results of these tests.

3. Strength parameters for foundation materials were estimated based on SPT-N values, results of tests noted in (2) above and their experience.

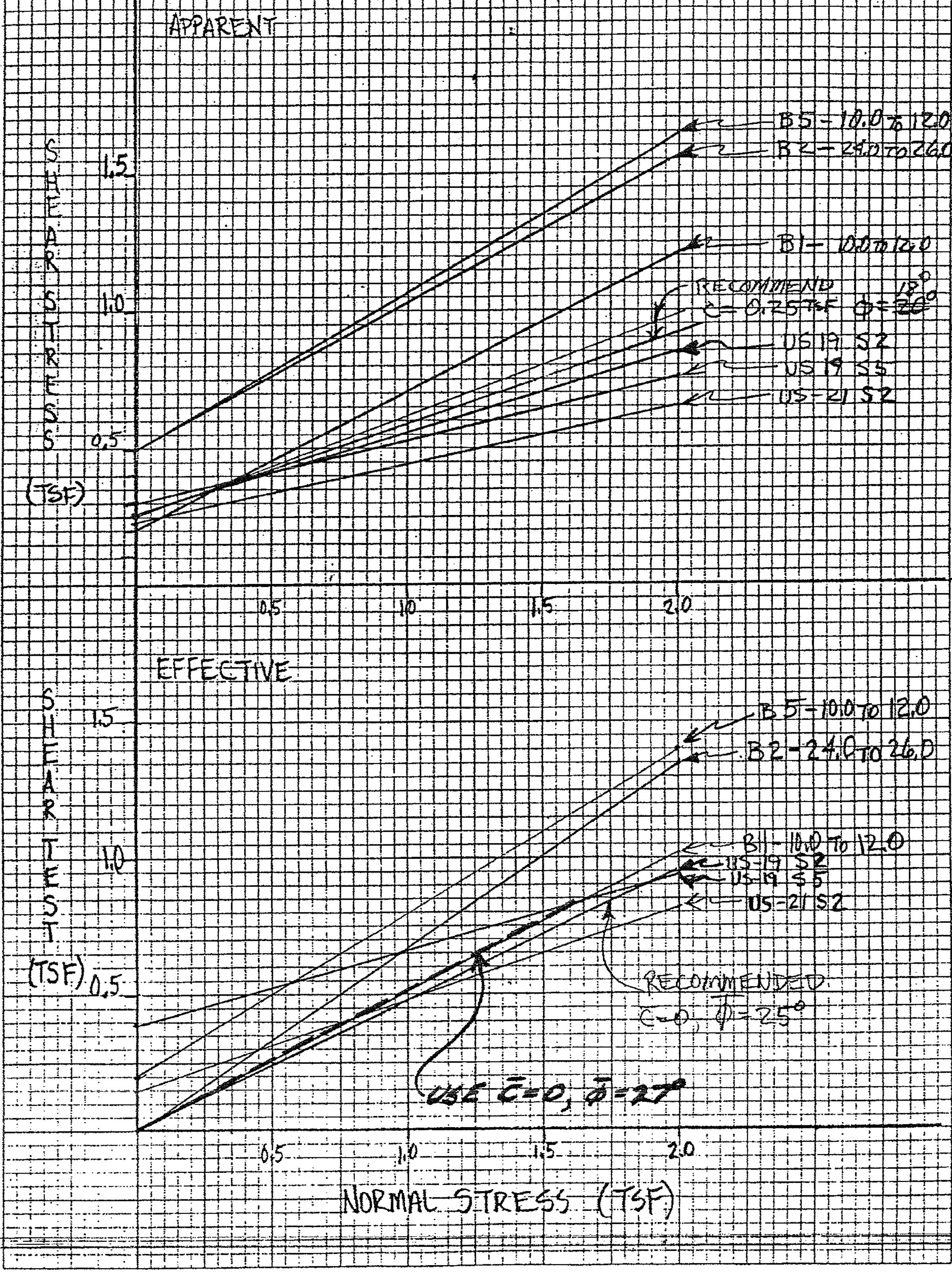
4. Some of LAWS analyses are based on a lowered phreatic surface. Is this economically feasible? We cannot extend drainage pipes thru dike as shown in Figure 10.

5. Soft foundation soils in some areas noted in Hall-Blake report is not addressed in LAW's report.

COMPUTED JMH date 11-18-86 CHECKED SLA DATE 12-8-86

CUMBERLAND S.P. TRIAXIAL R TEST

EARTH FILL - ORIGINAL DIKE



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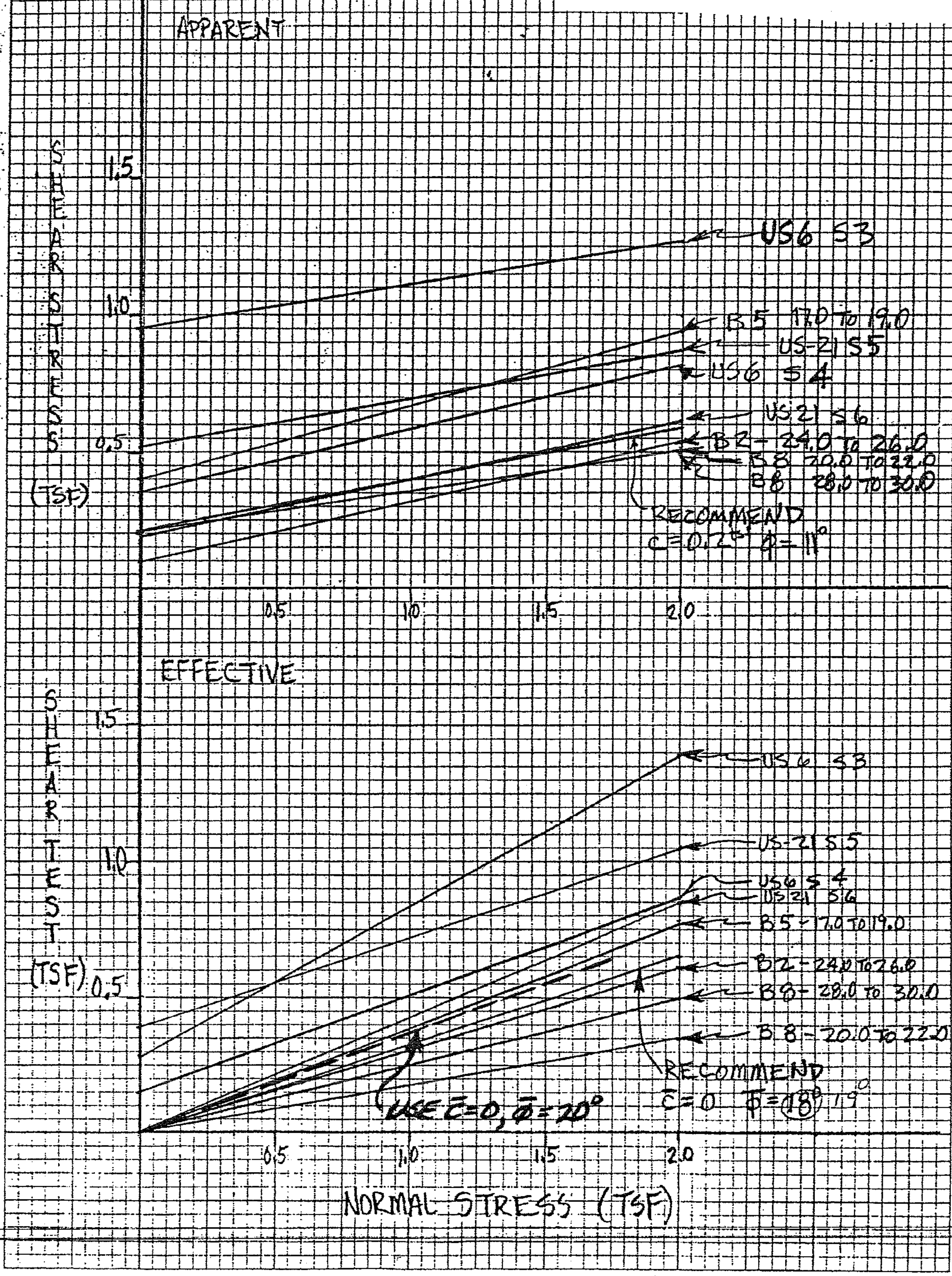
COMPUTED JMH date 11-18-86 checked SEA date 12-8-86

COMBERLAND S.P. TRIAXIAL R TEST

SOFT LAYER



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TVA 10697 (DNE-6-86) DNE CALCULATIONS Revised at Revision 0 **NEP-3.1** ATTACHMENT 2 PAGE 1 OF 1

TITLE CUMBERLAND S.P. - SOIL EVALUATION - ASH POND DIKE	PLANT/UNIT CUMBERLAND S.P.
PREPARING ORGANIZATION GES - CEB	KEY NOUNS (Consult RIMS DESCRIPTORS LIST) DIKES, SOIL, SLOPE, STABILITY **QA Record**

BRANCH/PROJECT IDENTIFIERS

Each time these calculations are issued, preparers must ensure that the original (RO) RIMS accession number is filled in.

Rev	(for RIMS' use)	RIMS accession number
R0	870413A0004 (73)	B41 '870401 002
R_		
R_		
R_		

APPLICABLE DESIGN DOCUMENT(S) DG-C1.4.2

SAR SECTION(S) NA UNID SYSTEM(S) NA

	Revision 0	R1	R2	R3
ECN No. (or indicate Not Applicable)	NA			
Prepared	James M Hoskins			
Checked	Syed B Ahmed			
Reviewed	Carl ? Tolstein			
Approved	Samuel D. Stone, Jr.			
Date	3-13-87			
List all pages added by this revision.				
List all pages deleted by this revision.				
List all pages changed by this revision.				

Use form TVA 01534 if more space required.

Safety-related? Yes ☐ No ☑

Statement of Problem

A SOIL EVALUATION IS REQUIRED FOR A SLOPE STABILITY ANALYSIS.

Abstract

These calculations contain an unverified assumption(s) that must be verified later. Yes ☐ No ☑

A SOIL EVALUATION HAS DETERMINED THE SOIL PROPERTIES AND THE CROSS SECTIONS FOR A SLOPE STABILITY ANALYSIS FROM SOIL INVESTIGATIONS BY TVA (CSB 78 1121 107) AND HALL, BLAKE AND ASSOCIATES, INC. (B46 861120 010).

☐ Microfilm and store calculations in RIMS Service Center. Microfilm and destroy ☐

☑ Microfilm and return calculations to: J. M. HOSKINS Address: 157 LB-K

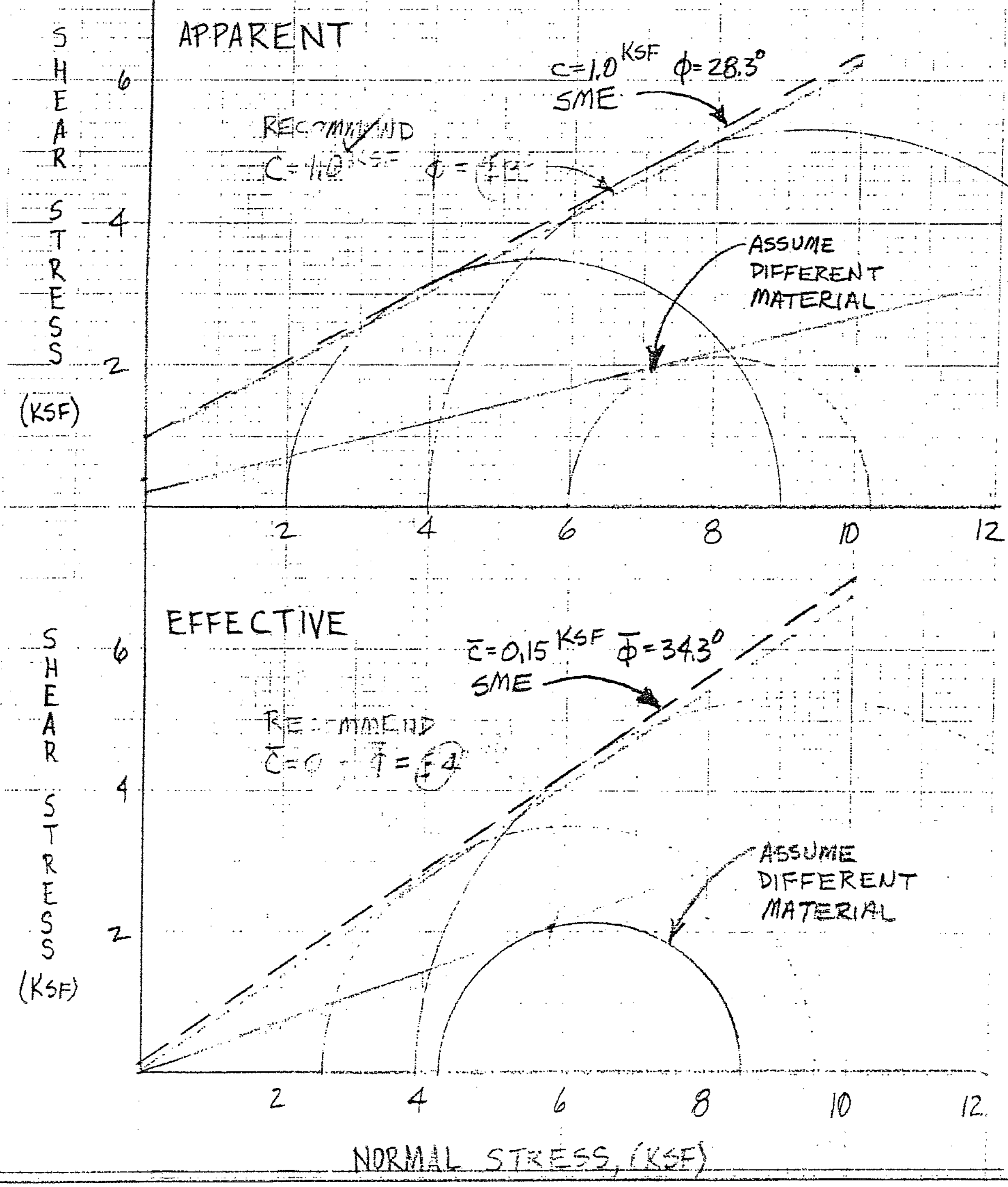
cc: RIMS, SL 26 C-K

Computed [illegible] date 11-19-86 checked date

CUMBERLAND STEAM PLANT (HBA)
BORING 2 24.0-26.0

B41 '87 0401 002

SOFT LAYER



B41 '87 0401 0(2

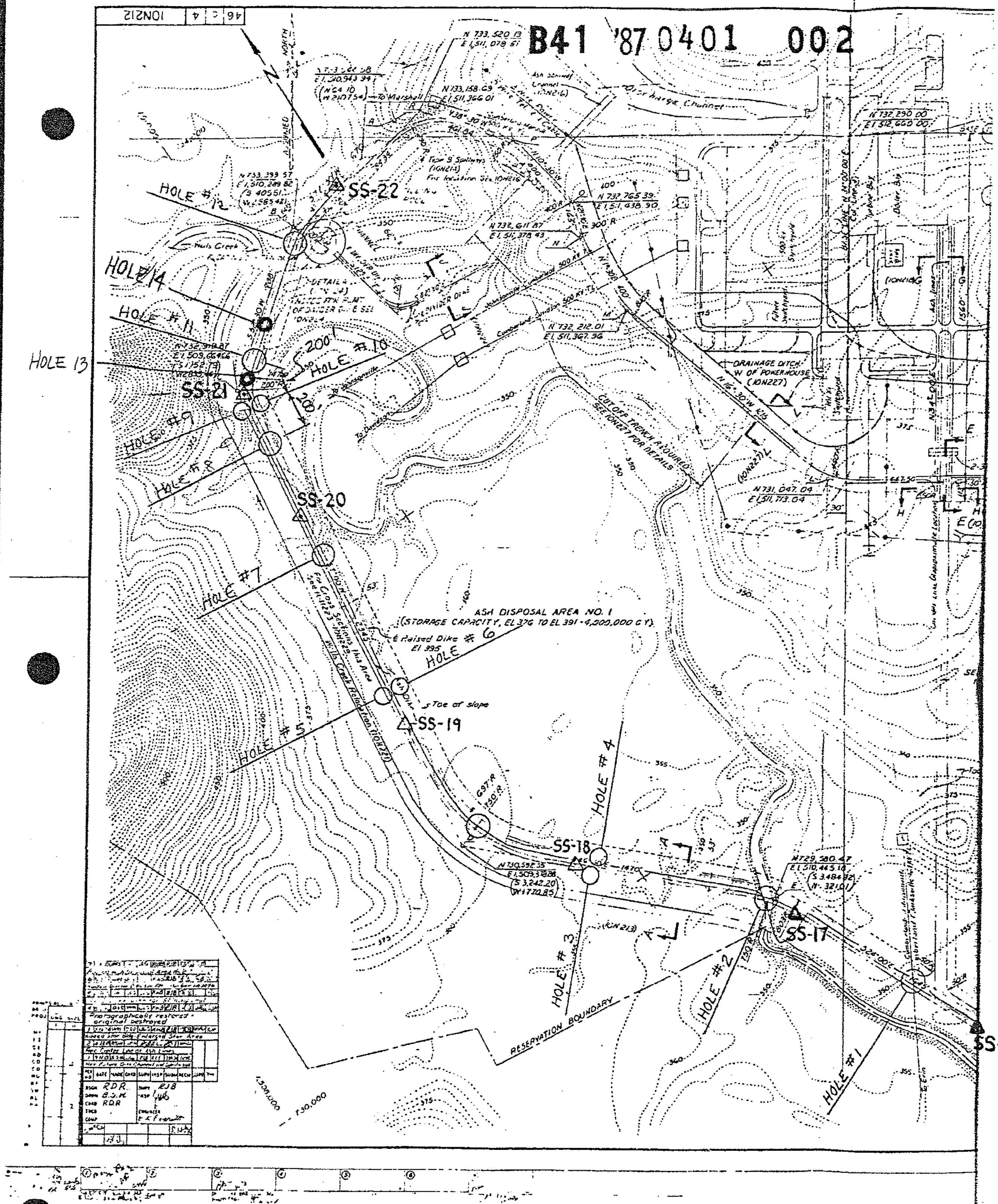
TABLE OF CONTENTS

CUMBERLAND S.P.

RECOMMENDED SOIL PROPERTIES

SOIL DESCRIPTION	UNIT γ_{moist} (PCF)	WEIGHT γ_{sat} (PCF)	Apparent c [illegible]	Apparent ϕ [illegible]	Effective $\bar{c}$ [illegible]	Effective $\bar{\phi}$ [illegible]
RAISED DIKE FILL (EARTH FILL)	121	124	0.1	15	0	25
ORIGINAL DIKE FILL (EARTH FILL)	125	126	0.25	20	0	25
SOFT LAYER	119	121	0.2	11	0	18
FOUNDATION SOIL	125	126	0.2	20	0	28
ASH (COMPACTED)	108	124	0.75	24	0	34
BORROW AREA W (95%)	121	126	0.25	21	0	25
BORROW AREA W (98%)	125	128	0.6	22	0	30
BORROW AREA E (95%)	119	125	0.6	20	0.2	28
BORROW AREA E (98%)	123	127	0.2	25	0.0	30

2/57



LEGEND:

△ TVA SPLIT SPOON BORING (CSB 781121 107 - MED 811201 224)

O HALL, BLAKE AND ASSOCIATES (B46 861120 010)

CUMBERLAND S.P.

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B41 '87 0401 002

JMH 11-19-86

REF: 1. HALL, BLAKE, AND ASSOCIATES, INC. - SITE INVESTIGATION - PROPOSED CUMBERLAND FOSSIL PLANT SOILS INVESTIGATION FOR ASH POND DIKE AND BORROW AREAS, DATED OCT. 3, 1986 (B46 861120 010)

REF 2. CUMBERLAND ASH DISPOSAL AREA DIKE RAISING - SOIL EXPLORATION AND TESTING - EN DES SOIL SCHEDULE NO. 70.1 (MED 811201 234)

RAISED DIKE FILL

FROM REF. 2 EVALUATION $C = 0.1^{TSF}$ $\phi = 15°$ R-APPARENT

$\bar{C} = 0^{TSF}$ $\bar{\phi} = 25°$ $\bar{R}$-EFFECTIVE

UNIT WEIGHT

$\gamma_{MOIST} = 123$; $\gamma_{SAT} = 126$; $\gamma_{\ell} = 63$

FROM REF 1 [illegible]

BORING 4, 5'-7', $\gamma_d = 91.4^{PCF}$, MC = 29.7% [illegible]

BORING 10, 1'-6', $\gamma_d = 99.3^{PCF}$, MC = 19.4 $G_s = 2.66$ $G = 2.69$

AVG $\gamma_d = 95.35$ MC = 24.55 G = 2.675

$\gamma_m = 118.8^{PCF}$; $\gamma_{SAT} = 122.1^{PCF}$; $\gamma_{SUB} = 59.7^{PCF}$

USE THE AVERAGE OF REF. 1 AND REF. 2

$\gamma_{MOIST} = \frac{122.6 + 118.8}{2} = 120.7$ USE $\underline{121^{PCF}}$

$\gamma_{SAT} = \frac{125.8 + 122.1}{2} = 123.95$ USE $\underline{124^{PCF}}$

$\gamma_{SUB} = 61.55$ USE $\gamma_{SUB} = 62^{PCF}$

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CUMBERLAND S.P.
SOIL EVALUATION

B41 '87 0401 002

JMcH 11-19-86

APPENDIX B

RAISED DIKE FILL

TRIAXIAL SHEAR TEST ON THE RAISED DIKE FILL WERE NOT PERFORMED BY HALL, BLAKE, AND ASSOCIATES

USE PREVIOUS VALUES FROM REMOLDED SAMPLES IN EN DES SOIL SCHEDULE No. 72.1 (MED 811201 224)

$\gamma_{MOIST} = 123^{PCF}$; $\gamma_{SAT} = 126^{PCF}$; $\gamma_{SUB} = 63^{PCF}$

R-APPARENT $c = 0.1^{TSF}$; $\phi = 15°$

$\bar{R}$-EFFECTIVE $c = 0^{TSF}$; $\phi = 26°$

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Cumberland S.P

B41 '87 0401 002

11-19-86

Fill Existing Dike (Original)

$e = \frac{G\gamma_w}{\gamma_d} - 1$

	γ_{DRY} (PCF)	M.C. (%)	G	e
TVA US-6 Sample 1	100.9	28.8	-	0.702
" US-6 Sample 2	102.9	22.2	-	0.657
" US-19 Sample 1	100.4	24.4	-	0.697
" US-19 " 2	100.7	25.0	-	0.705
" US-19 " 3	93.5	28.5	-	0.793
" US-19 " 4	94.4	27.4	-	0.791
" US-21 " 2	100.4	24.5	-	0.707
" US-21 " 3	92.3	32.2	-	0.830
TVA US-21 " 4	105.4	20.6	-	0.617
HBA Boring 1 10.0-12.0	103.7	21.0	2.71	0.631
HBA Boring 2 34.0-36.0	93.8	31.4	2.70	0.796
HBA Boring 5 10.0-12.0	100.2	24.0	2.68	0.669
Total	1188.6	310.0		8.595
Avg	99.05	25.83		0.7163

Moist Unit Weight $\gamma_m = 99.05\,(1.2583) = 124.6$ PCF

USE 125 PCF

Saturated Unit Weight

$\gamma_{SAT} = \gamma_{dry} + \left(\frac{e}{1+e}\right)\gamma_w$

$\gamma_{SAT} = 99.05 + \left(\frac{.7163}{1+.7163}\right) 62.4 = 125.09$ PCF

USE 126 PCF

Submerged Unit Weight

$\gamma_{SUB} = 125.09 - 62.4 = 62.6$ PCF

USE 63 PCF

CUMBERLAND

JMH 11-18-86

EARTH FILL - ORIGINAL DIKE

TRIAXIAL R

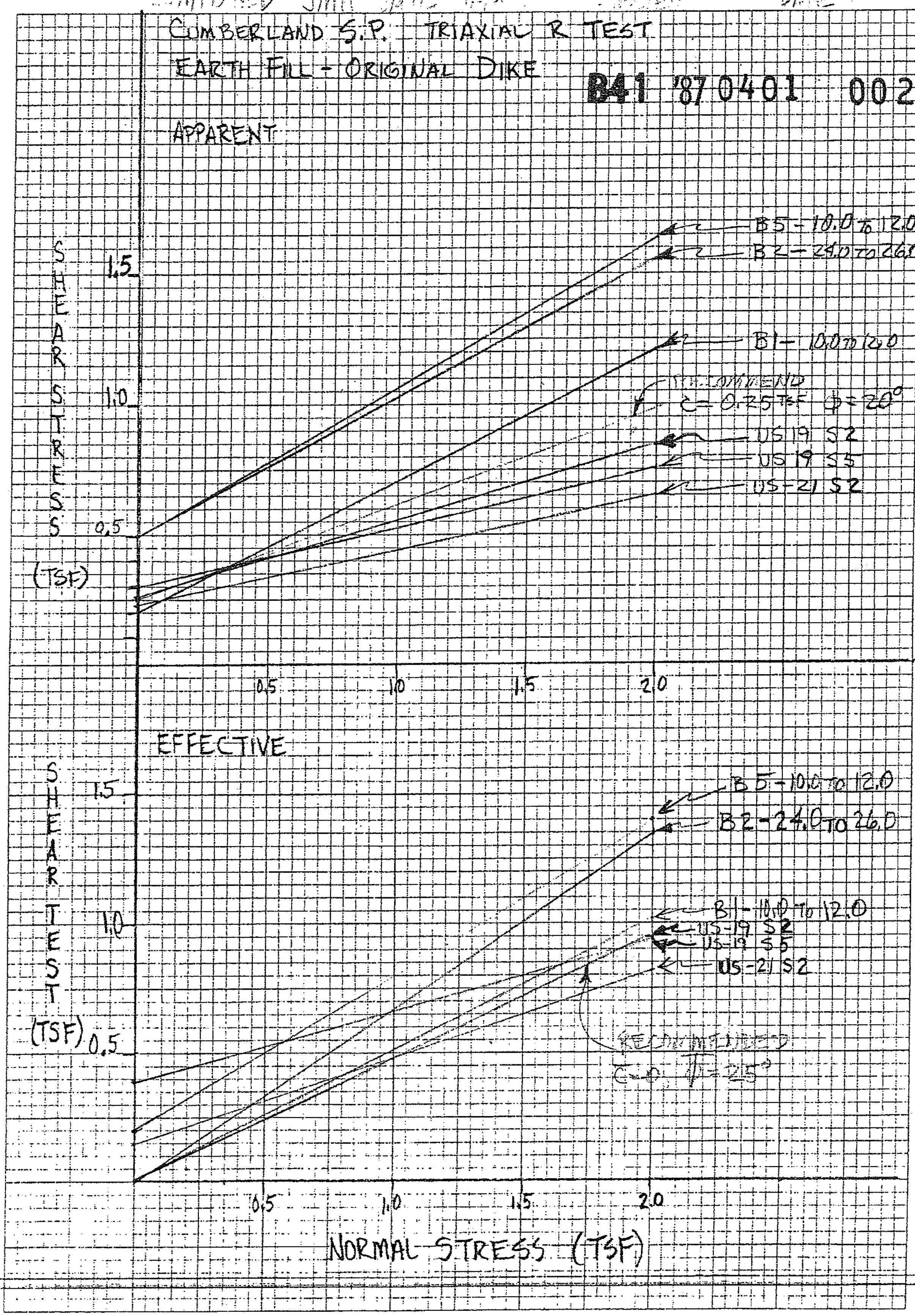
	C (tsf)	φ (deg)
TVA US-19 SAMPLE 2	0.27	16.0
TVA US-19 SAMPLE 5	0.30	13.0
TVA US-21 SAMPLE 2	0.22	12.0
HBA BORING 1 10.0-12.0	0.20	27.0
HBA BORING 2 24.0-26.0	0.50	28.0
HBA BORING 5 10.0-12.0	0.50	30.0
AVG	0.33	21.0
LOWER THIRD	0.3	18.0
USE	0.25 tsf	20°

$\overline{R}$ EFFECTIVE

	$\overline{C}$ (TSF)	$\overline{\phi}$ (deg)
TVA US-17 SAMPLE 2	0	25.5
TVA US-17 SAMPLE 5	0.37	15.5
TVA US-21 SAMPLE 2	0.15	18.5
HBA BORING 1 10.0-12.0	0	27
HBA BORING 2 24.0-26.0	0	34
HBA BORING 5 10.0-12.0	0.20	31
AVG	0.12	25.25
LOWER THIRD	0.13	21.7

USE $\overline{c} = 0$ $\overline{\phi} = 25°$

COMPUTED JMH DATE 11-2-?? CHECKED DATE



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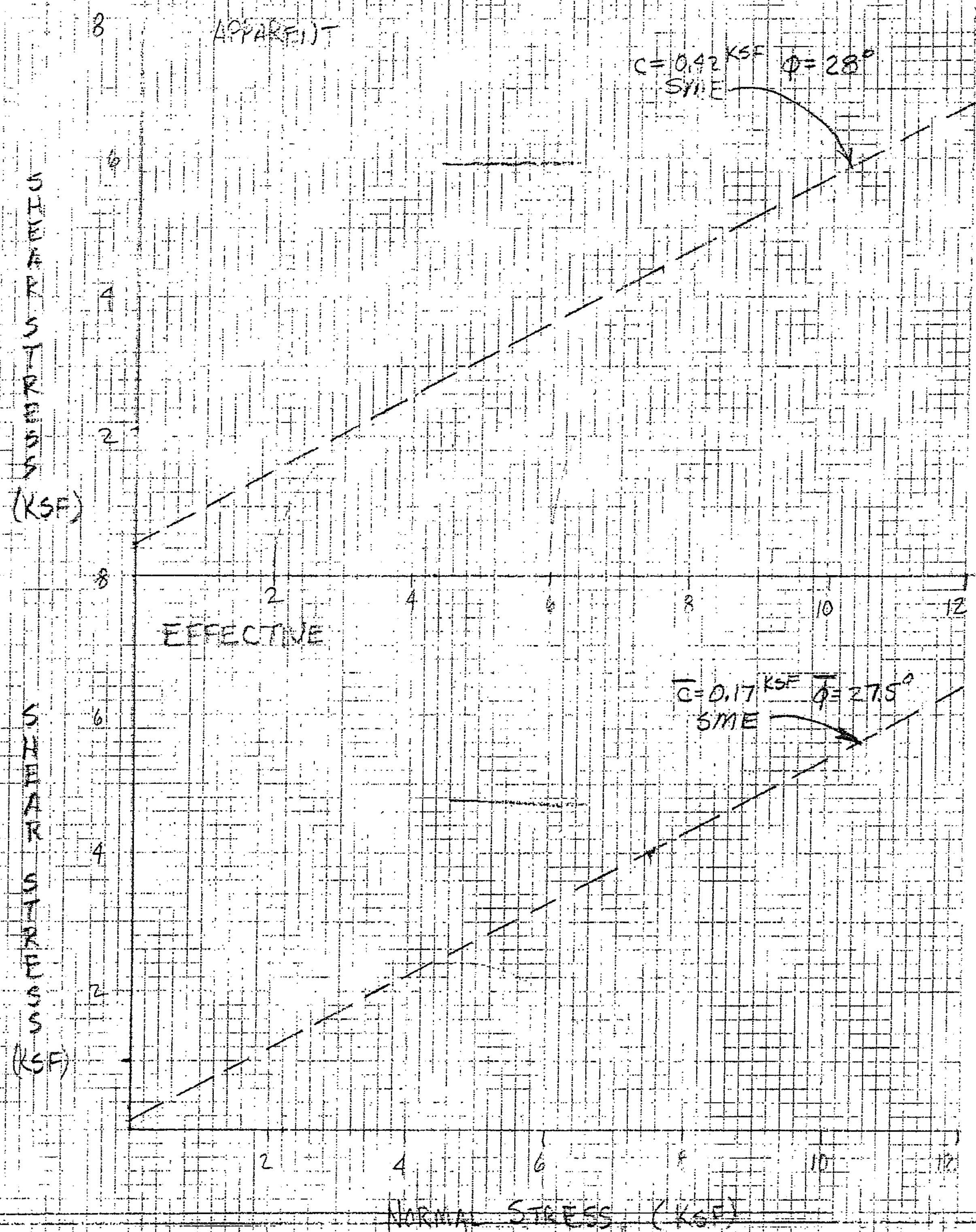
comp. by JMH date 11-19-86 checked date

CUMBERLAND STEAM PLANT (HBA)

BORING 1 DEPTH 10.0 - 12.0

EARTH FILL - ORIGINAL DIKE



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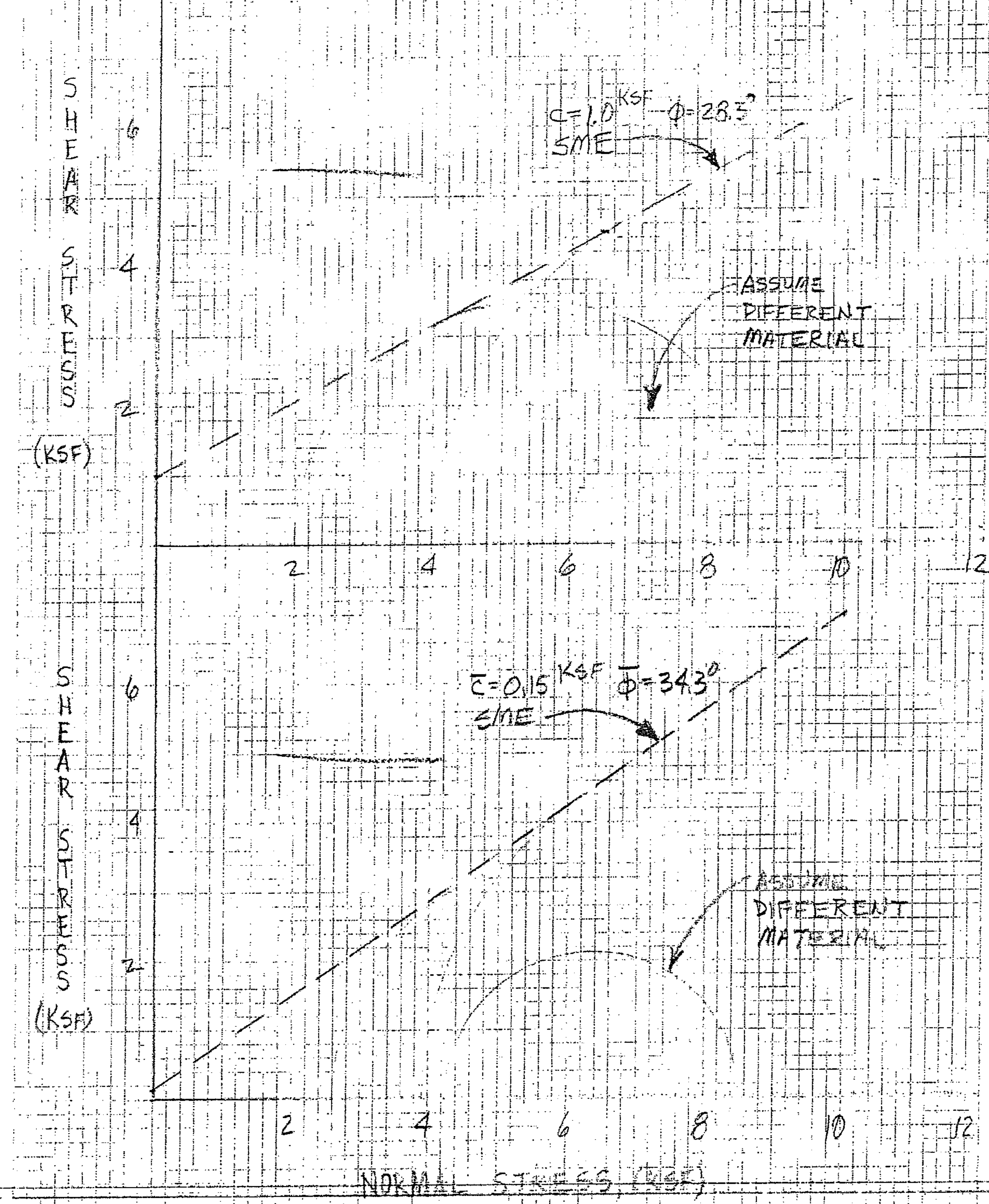
computed [illegible] date 11-19-86 checked [illegible] date 12-[illegible]-86

CUMBERLAND STEAM PLANT (HEA)
BORING 2 24.0-26.0

EARTH FILL - ORIGINAL DIKE



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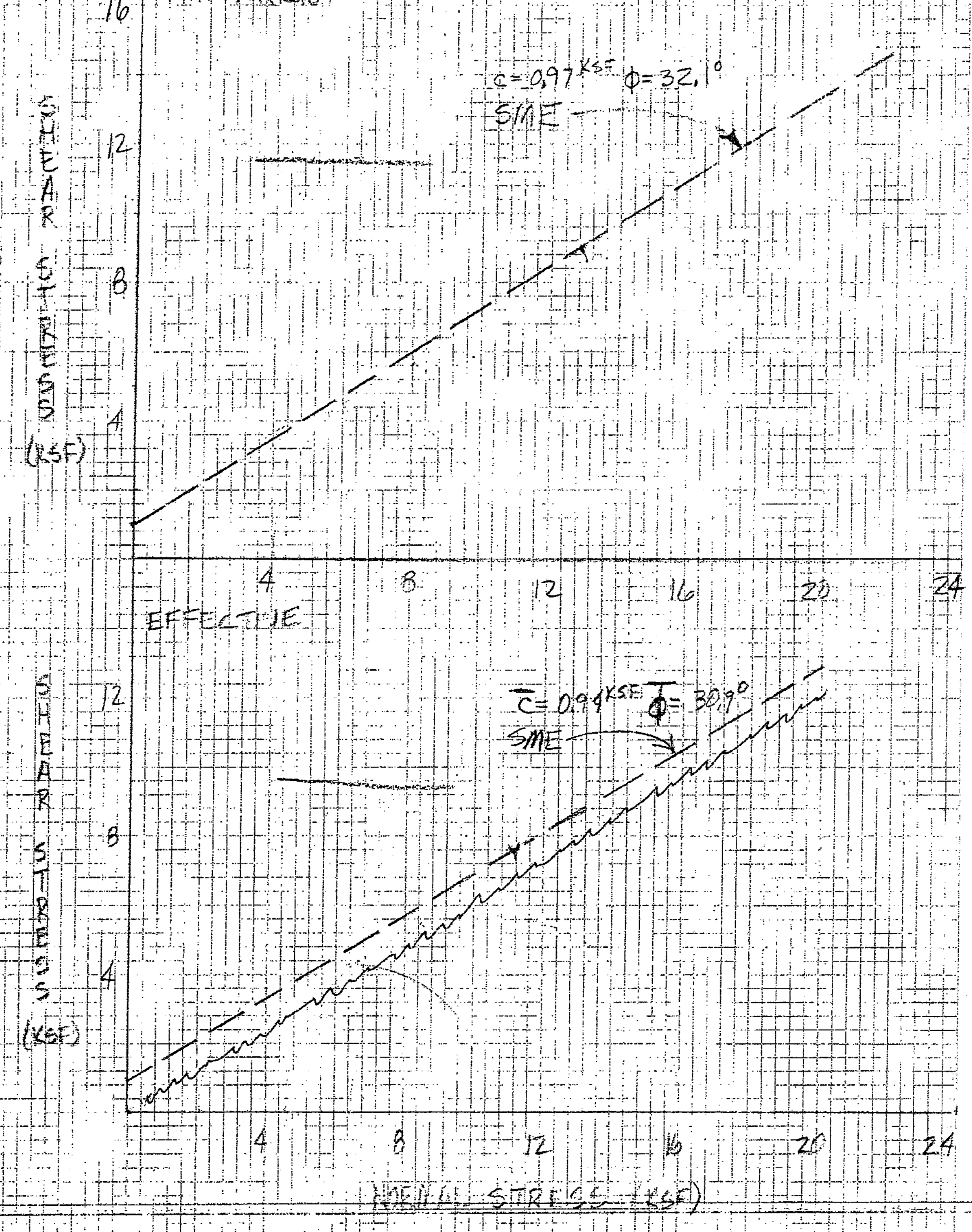
CUMBERLAND STEAM PLANT (B5/10)
BORING 5 DEPTH 10-12
EARTH FILL - ORIGINAL DIKE
APPARENT



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SUMBERLAND S.P.

B41 '87 0401 002

JMR 1-13-86
SBA 12-8-86

IN SITU SOFT LAYER

	γ_{dry} (PCF)	MC. (%)	G	e
TVA US-6 SAMPLE 3	96.7	26.4	—	.724
TVA US-19 SAMPLE 5	89.5	32.4	—	.920
TVA US-19 " 6	96.4	27.0	—	.741
TVA US-19 " 7	96.2	28.2	—	.745
TVA US-19 " 8	96.7	20.8	—	.723
TVA US-19 " 9	94.3	26.8	—	.795
TVA US-21 SAMPLE 5	97.8	26.3	—	.711
TVA US-21 " 6	84.3	35.6	—	1.008
TVA US-21 " 7	95.8	27.4	—	.746
TVA US-21 " 8	92.6	28.7	—	.833
TVA US-21 " 9	80.5	39.7	—	1.085
HBA BORING 5 17.0-19.0	95.1	24.4	2.68	0.758
HBA BORING 8 20.0-22.0	98.4	25.6	2.70	0.712
~~HBA BORING 8 28.0-30.0~~	~~103.6~~	~~22.1~~	~~2.68~~	~~0.614~~
TVA US-6 SAMPLE 4	90.0	30.9		0.928
TVA US-6 SAMPLE 5	86.7	36.0		1.015
TVA US-19 SAMPLE 14	84.0	36.9		1.079
TOTAL	1376.9	447.5		12.810
AVG	91.79	29.83		0.854

MOIST UNIT WEIGHT $\gamma_m = 91.79\,(1.2983) = 119.17^{PCF}$ USE $\underline{\underline{119^{PCF}}}$

SATURATED UNIT WEIGHT

$$\gamma_{SAT} = 91.79 + \left(\frac{0.854}{1.854}\right)62.4 = 120.53^{PCF} \text{ USE } \underline{\underline{121^{PCF}}}$$

SUBMERGED UNIT WEIGHT $\gamma_{SUB} = 120.53 - 62.4 = \underline{58.1}^{PCF}$

USE $\underline{\underline{58^{PCF}}}$

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Cumberland S.P.

B41 '87 0401 007

JWB 11-13-86

Soil Properties

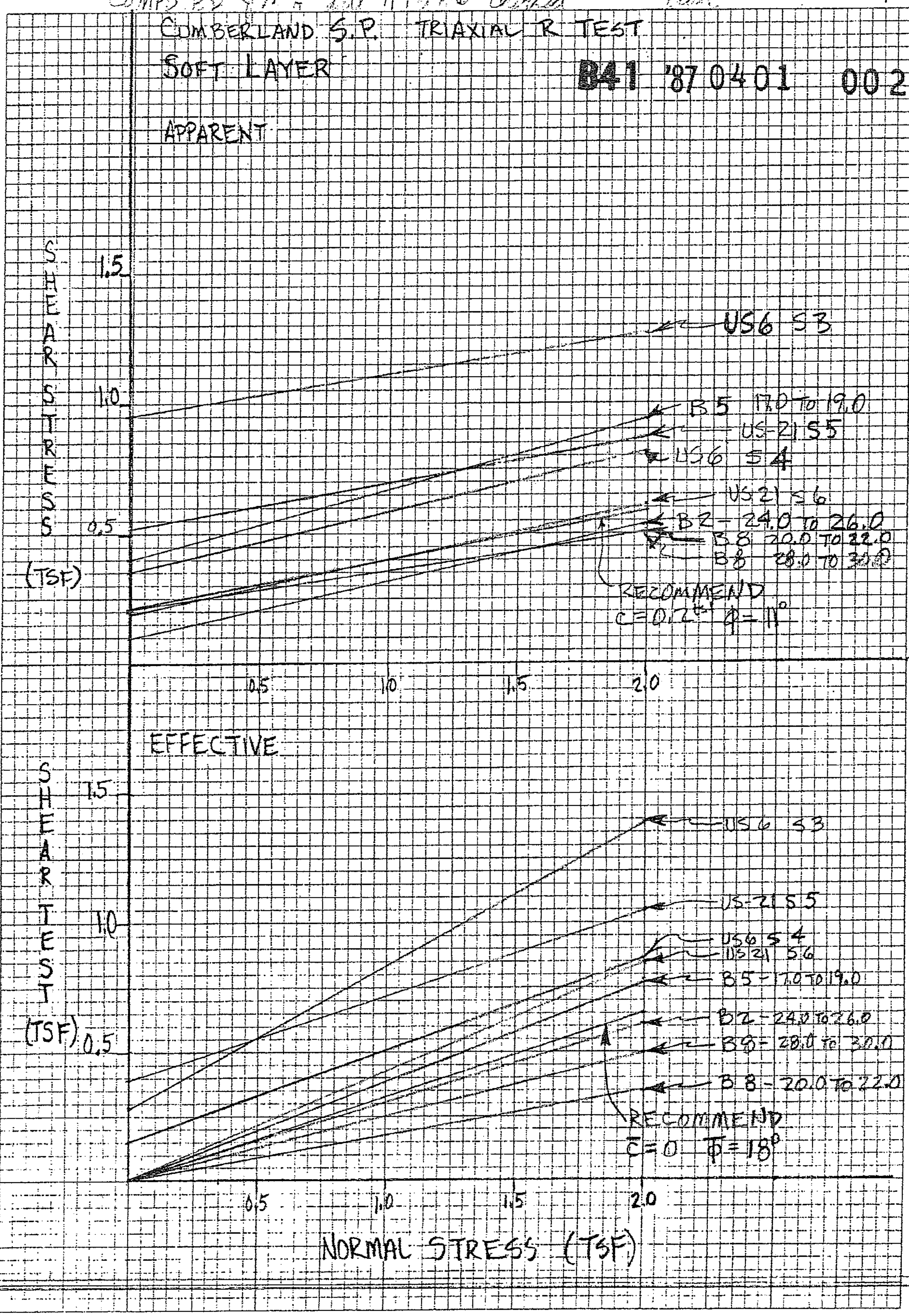
TRIAXIAL - R

SOFT LAYER

R-APPARENT	C (TSF)	φ (deg)
TVA US-21 SAMPLE 5	0.52	10
TVA US-21 SAMPLE 6	0.18	12
TVA US-6 SAMPLE 3	0.95	9
Soft Mat. → HBA BORING 2 24.0-26.0	0.10	12
HBA BORING 5 17.0-19.0	0.40	15
HBA BORING 8 20.0-22.0	0.20	9
HBA BORING 8 28.0-30.0	0.20	9
Appendix → TVA US6 SAMPLE 4	0.35	13
AVG	0.363	11.1
LOWER THIRD	0.38	11
USE	0.2	11

R-EFFECTIVE	C (TSF)	φ (deg)
TVA US-21 SAMPLE 5	0.39	18.3
TVA US-21 SAMPLE 6	0	23
TVA US-6 SAMPLE 3	0.23	29
Soft Material → HBA BORING 2 24.0-26.0	0	17
HBA BORING 5 17.0-19.0	0	21
HBA BORING 8 20.0-22.0	0	10
HBA BORING 8 28.0-30.0	0	14
Appendix E → TVA US6 SAMPLE 4	0.15	19.5
AVG	0.10	19.0
LOWER THIRD	0.13	16.3
USE	0	18

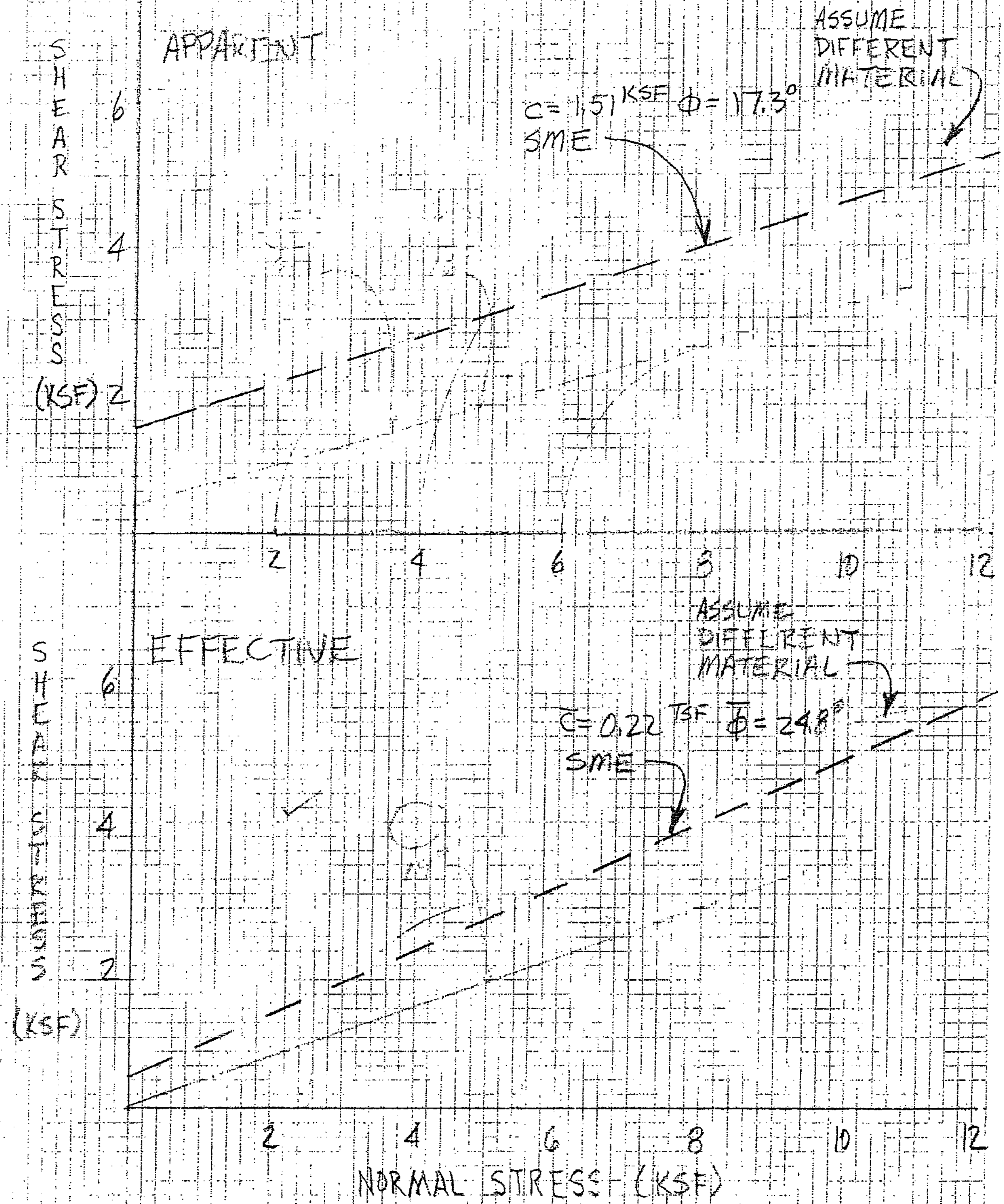
COMPUTED [illegible] date 11-13-86 checked date



computed JMA date 11-17-86 checked date

CUMBERLAND STEAM PLANT (HBA)
BORING 5 17.0 - 19.0
SOFT LAYER

B41 '87 0401 002

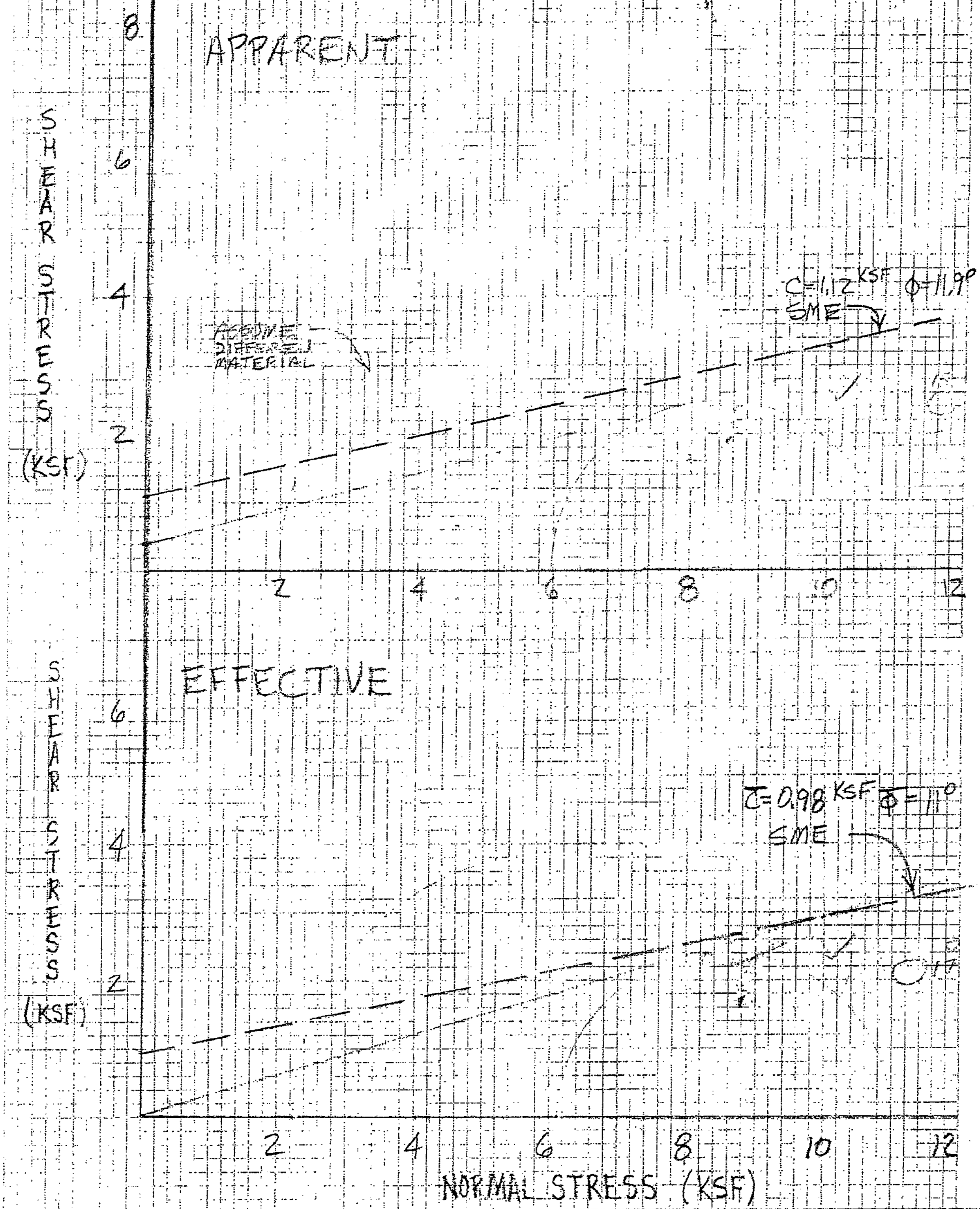


computed GMH date 11-19-86 checked date

CUMBERLAND STEAM PLANT (HBA)
BORING 8 DEPTH 20.0-22.0

SOFT LAYER

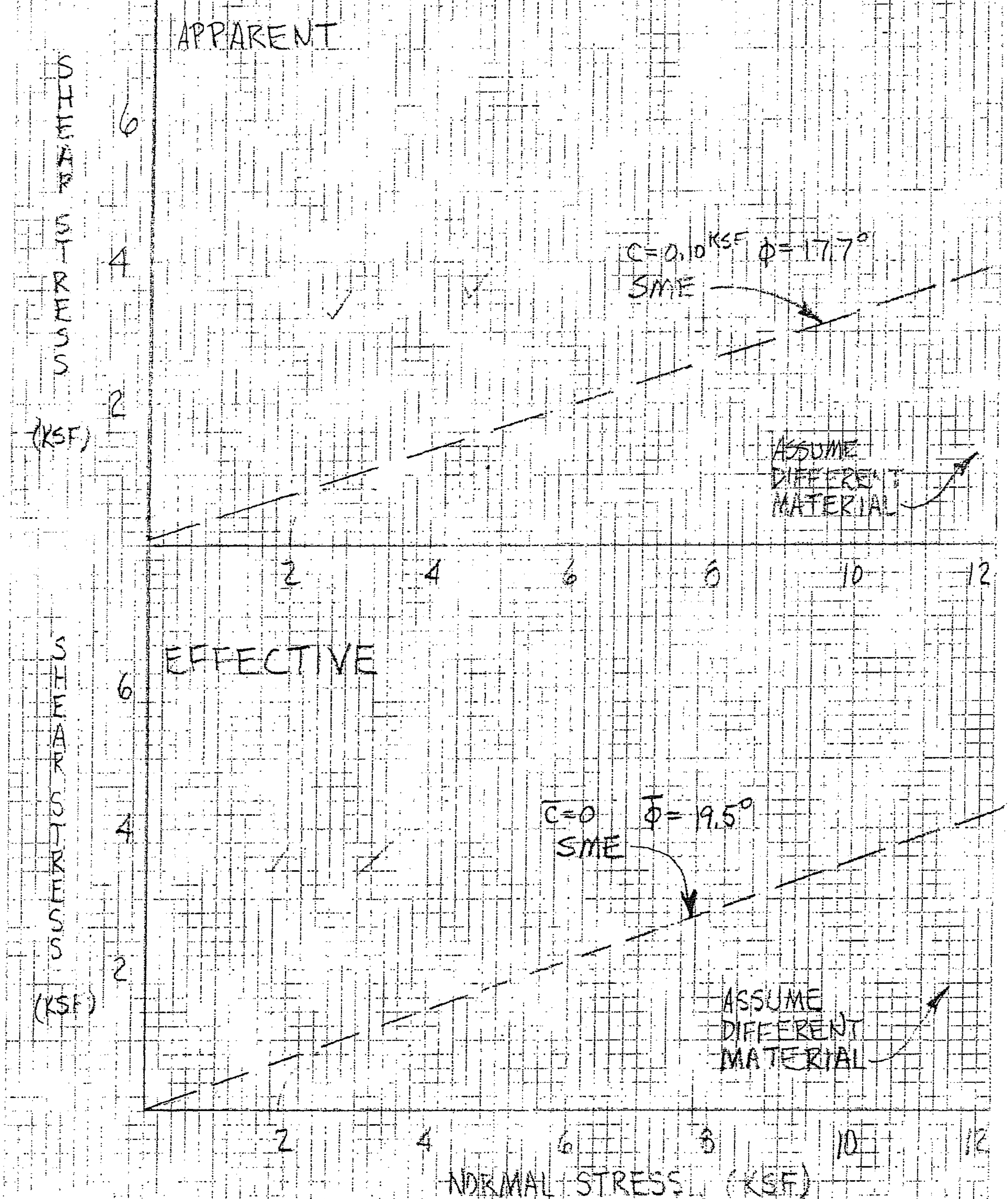
B41 '87 0401 002



computed gmH date 11-19-86 checked ... date ... 21/57

CUMBERLAND STEAM PLANT (HBA)
BORING 8 28.0-30.0
SOFT LAYER

B41 '87 0401 002



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CUMBERLAND S.P.

B41 '87 0401 002

JMF 10-27-86

FOUNDATION

$e = \frac{G\gamma_w}{\gamma_d} - 1$

	γ_{dry} (PCF)	MC %	G	e
HBA BORING 1 26.0-28.0	100.0	25.3	2.67	0.679
HBA BORING 2 26.0-28.0	103.7	23.3	2.68	0.613
HBA BORING 2 30.0-32.0	99.4	25.3	2.70	0.695
HBA BORING 8 28.0-30.0	103.6	22.1	2.68	0.614
TVA US-19 SAMPLE 10	102.6	24.3	—	0.660
TVA US-19 SAMPLE 11	106.2	21.2	—	0.582
TVA US-19 SAMPLE 12	104.1	21.2	—	0.632
TVA US-21 SAMPLE 10	99.7	25.6	—	0.679
TVA US-21 SAMPLE 11	93.9	26.4	—	0.756
TVA US-21 SAMPLE 12	96.0	27.7	—	0.750
TOTAL	1009.2	242.4		6.660
AVG.	100.9	24.2		0.666

MOIST UNIT WEIGHT, $\gamma_m = 100.9(1.242) = 125.3^{PCF}$ USE $\underline{125^{PCF}}$

SATURATED UNIT WEIGHT, $\gamma_{SAT} = 100.9 + \left(\frac{.666}{1.666}\right)62.4 = 125.8^{PCF}$ USE $\underline{126^{PCF}}$

SUBMERGED UNIT WEIGHT $\gamma_{sub} = 125.8 - 62.4 = 63.4^{PCF}$ SAY $\underline{63^{PCF}}$

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Cumberland S.P

B41 '87 0401 002

11-19-86

Foundation Soil

R-APPARENT	C (TSF)	φ (deg.)
~~TVA US-6 SAMPLE 4~~	~~0.35~~	~~13~~
HBA BORING 1 26.0-28.0	0.30	25
HBA BORING 2 26.0-28.0	0.20	23
HBA BORING 2 30.0-32.0	0.20	15
AVG	0.23	21
LOWER THIRD	0.23	18.3
USE	0.20	20

Not lower hydrusity

R-EFFECTIVE	C (TSF)	φ (deg.)
~~TVA US-6 SAMPLE 4~~	~~0.15~~	~~19.5~~
HBA BORING 1 26.0-28.0	0	28
HBA BORING 2 26.0-28.0	0	25
HBA BORING 2 30.0-32.0	0	20
AVG.	0	24.3
LOWER THIRD	0	22.7
USE	0	~~24~~

Not lower hydrusity

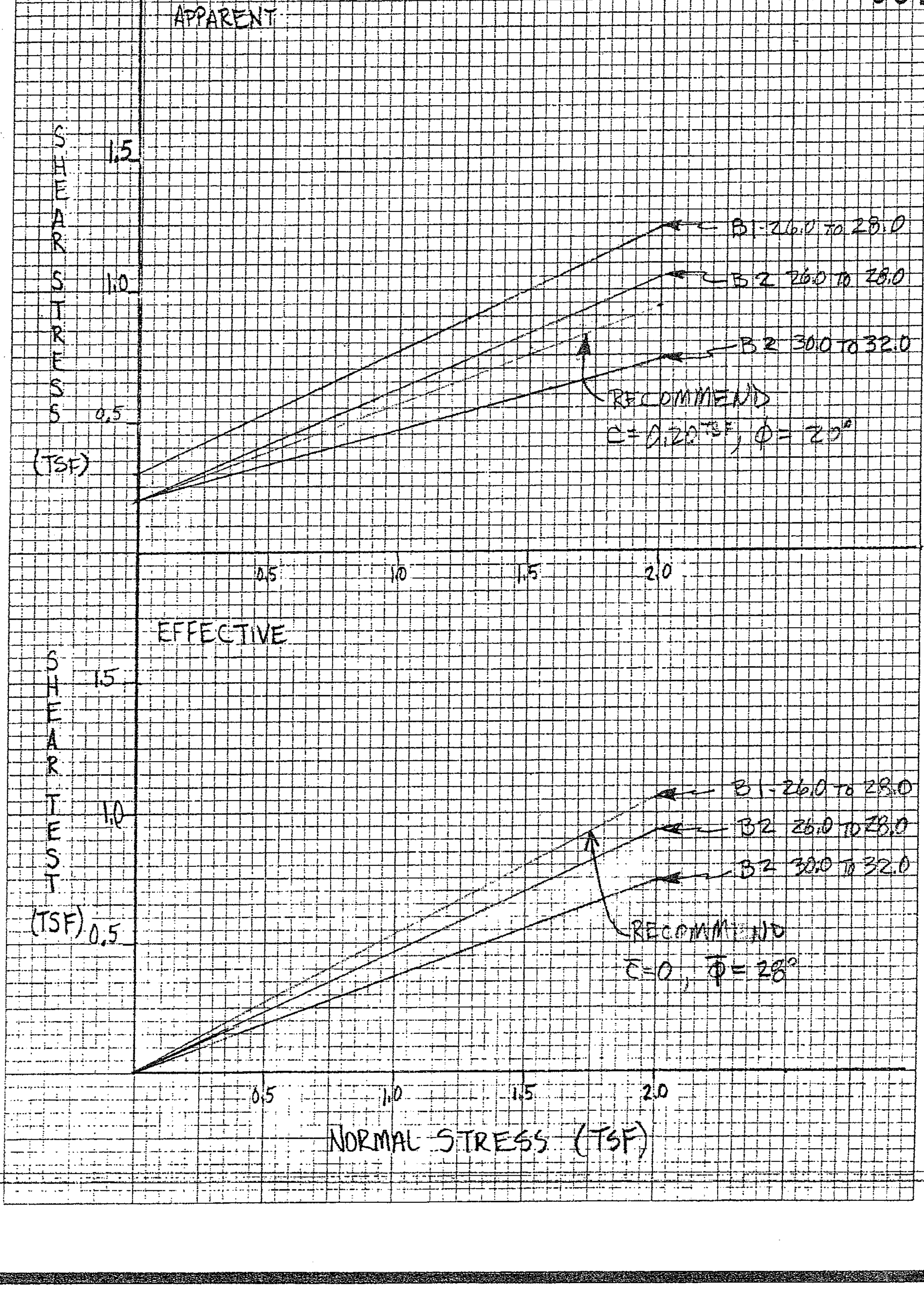
BASED ON BLOW COUNTS
AND ENGINEERING JUDGEMENT USE $\phi = 28°$

computed JMH date 11-12-86 checked date

CUMBERLAND S.P. TRIAXIAL R TEST

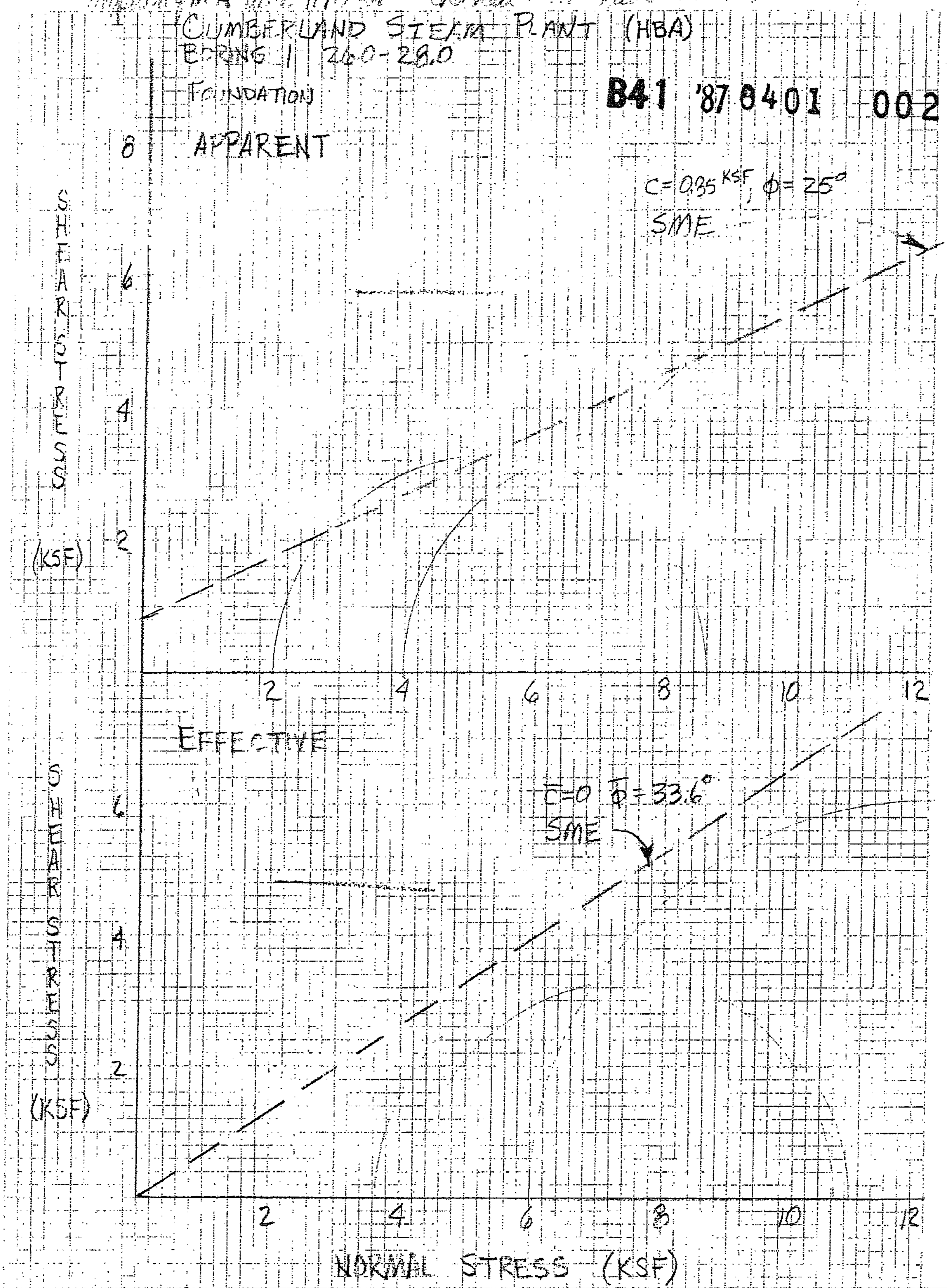
FOUNDATION SOIL

B41 '87 0401 002



computed by [illegible] date [illegible] checked [illegible] date [illegible]

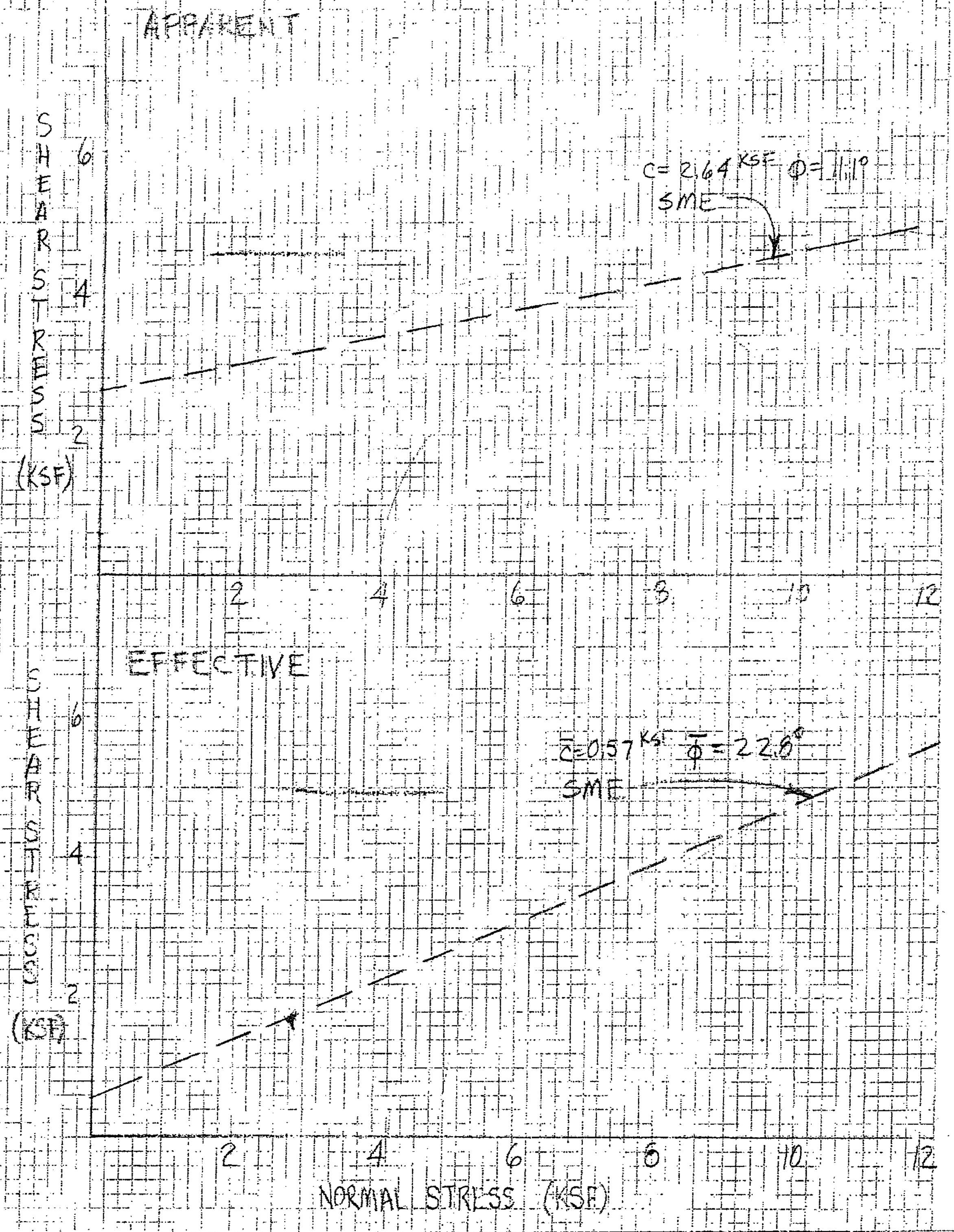
B41 '87 0401 002



Computed JMH date 11-19-86 Checked ... date ... 26/57

CUMBERLAND STEAM PLANT (HBA)
BORING 2 26.0 - 28.0
FOUNDATION

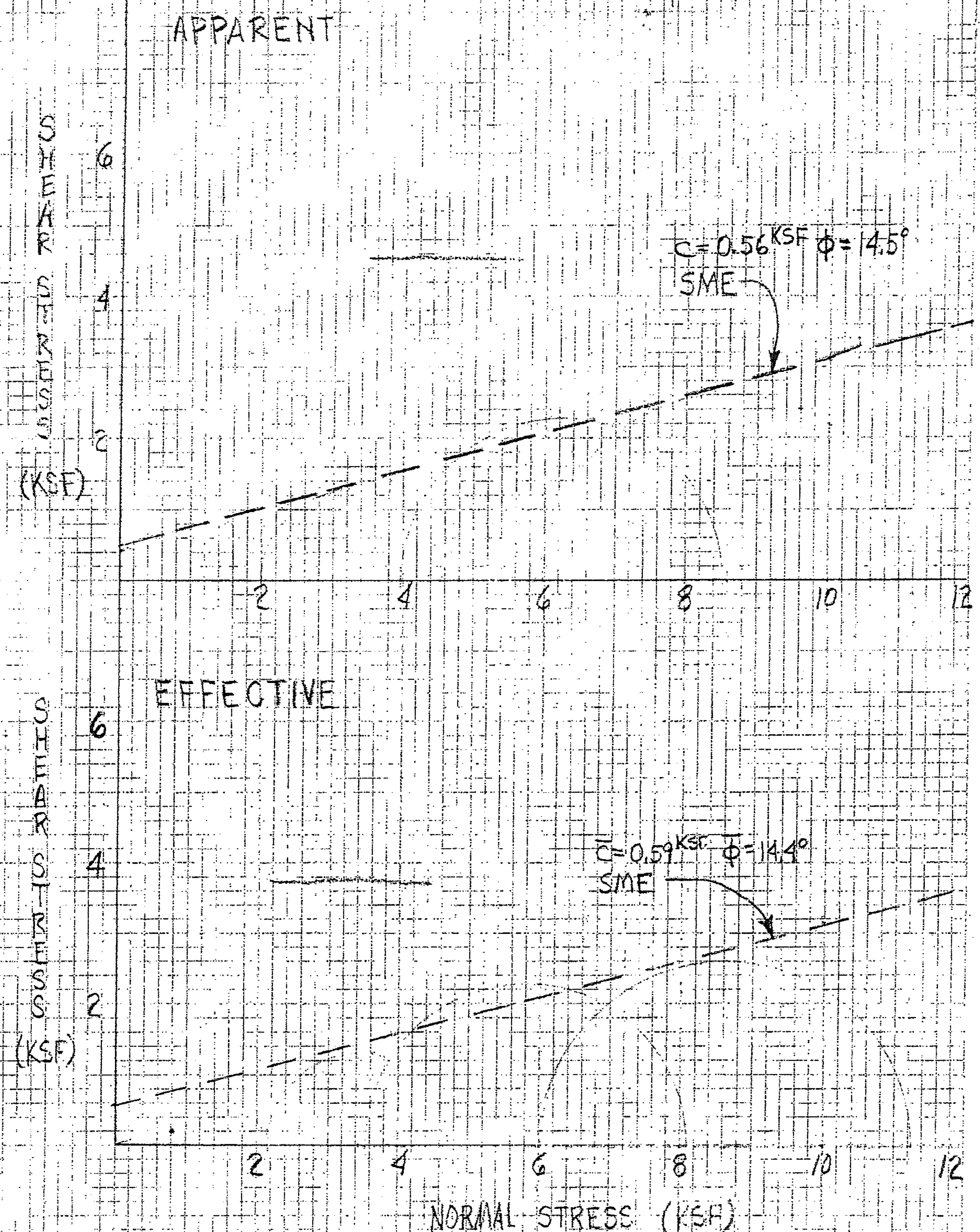
B41 '87 0401 002



computed JMA date 11-19-86 checked SBA date 12-5-86 27/57

CUMBERLAND STEAM PLANT (HBA)
BORING 2 30.0-32.0
FOUNDATION

B41 87U401 002



CUMBERLAND S. P.

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B41 '87 0401 002

APPENDIX B

ASH PROPERTIES

RE-EVALUATION CONSIDERING EFFECTIVE STRESS RATIO FAILURE CRITERIA

R- APPARENT ($\bar{\sigma}_1/\bar{\sigma}_3$ CRITERIA)

	C	ϕ
TEST 1	1.0 TSF	31°
TEST 2	1.25 TSF	30°

RECOMMEND c = 0.75 TSF ϕ = 29°

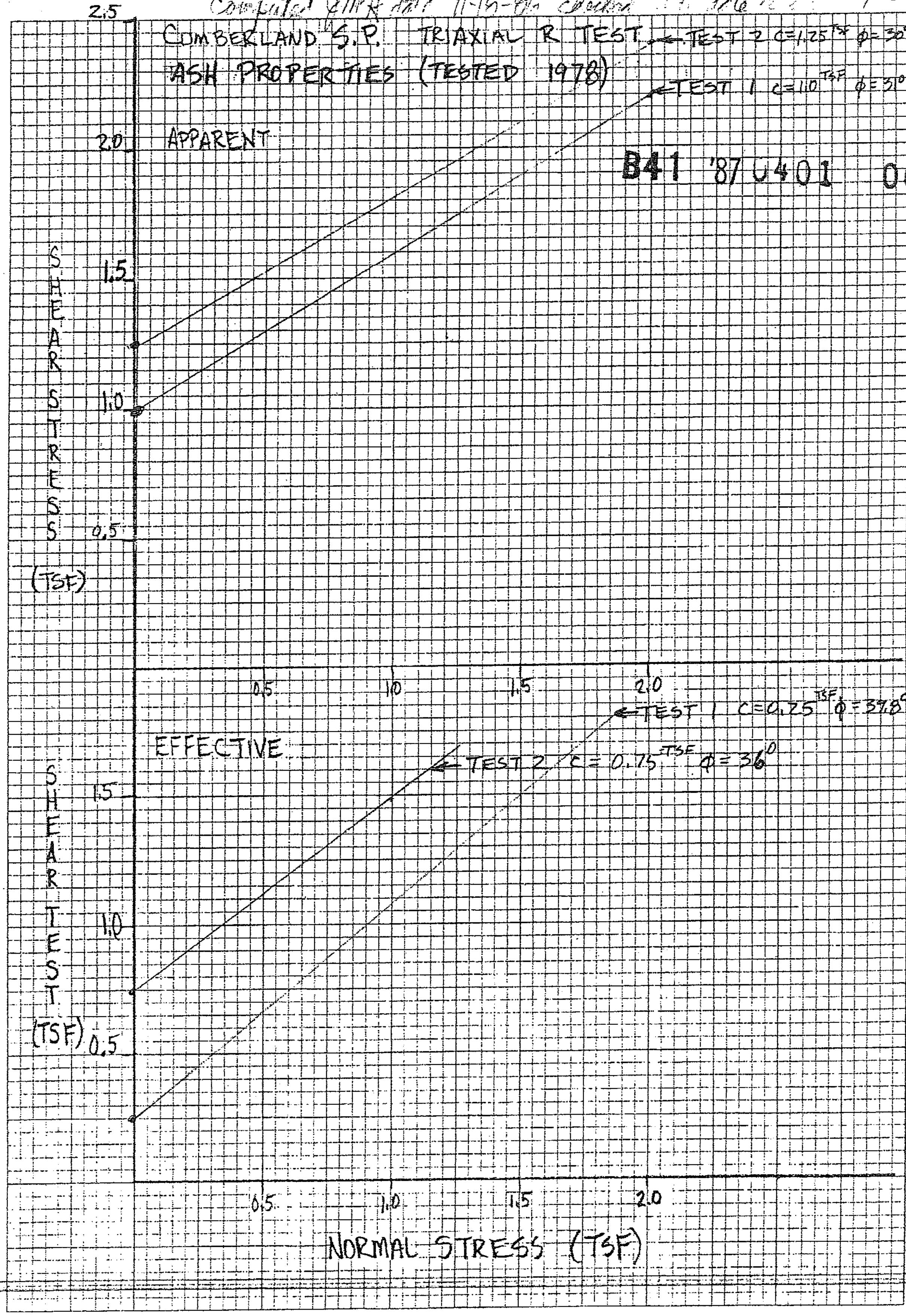
$\bar{R}$-EFFECTIVE ($\bar{\sigma}_1/\bar{\sigma}_3$ CRITERIA)

	C	ϕ
TEST 1	0.25 TSF	39.8°
TEST 2	0.75 TSF	36°

RECOMMEND c = 0 ϕ = 34°

computed JMR date 11-19-86 checked date

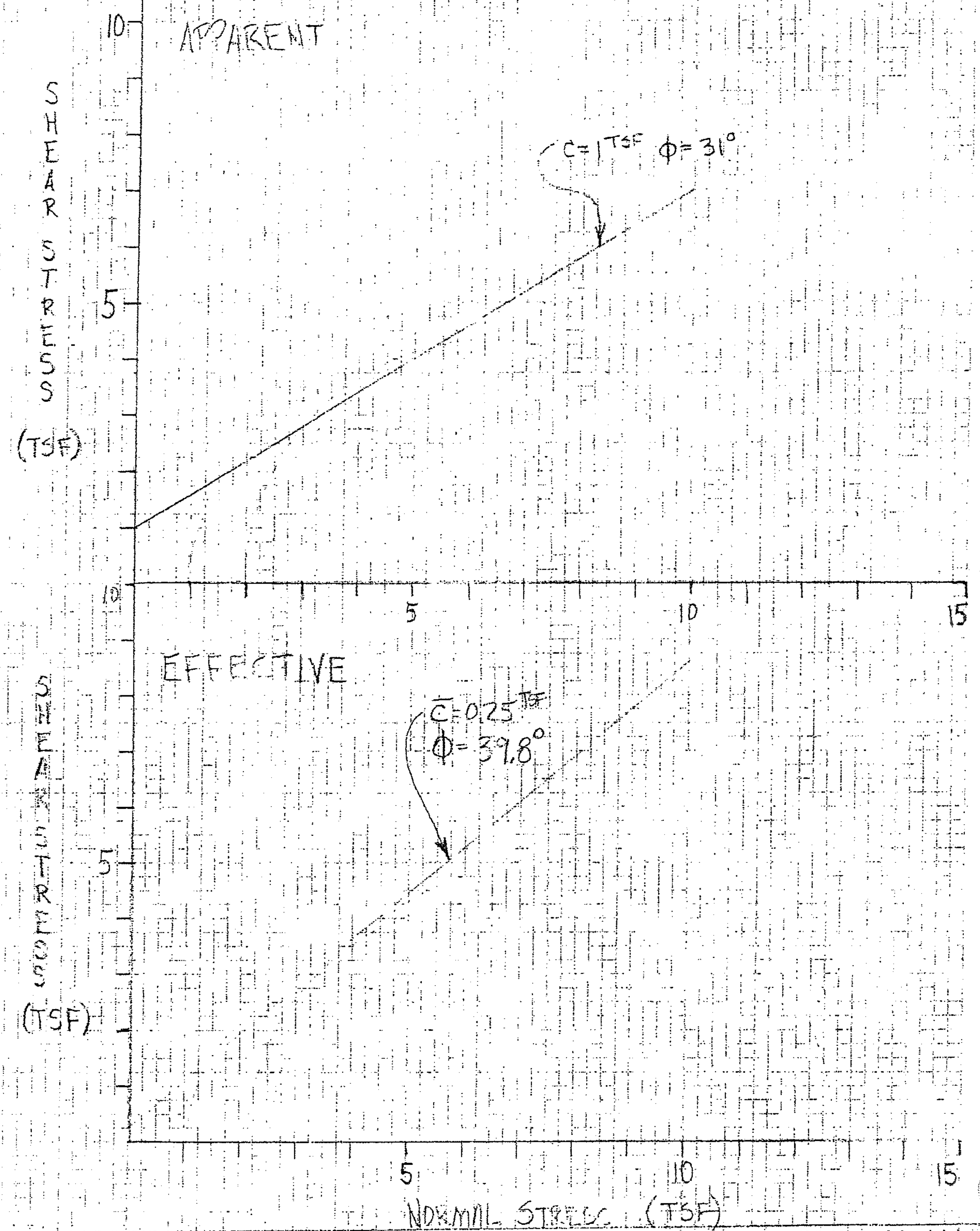
B41 '87 0401 002



CUMBERLAND S.P. TEST 1
ASH PROPERTIES

B41 '87 0401 002

$\bar{\sigma}_1/\bar{\sigma}_3$ CRITERIA



SHEET 42 OF 57

CUMBERLAND S.P.

B41 '87 0401 002

AGN PROPERTIES TEST 2

CHECKED JMH DATE 11-19-86

TRIAXIAL R

TEST 2 (Row 11726,0540)

	σ_3 (tsf)	$\sigma_1-\sigma_3$ (tsf)	σ_1 (tsf)	u (tsf)	$\bar{\sigma}_3$ (tsf)	$\bar{\sigma}_1$ (tsf)	$\bar{\sigma}_1/\bar{\sigma}_3$
	1.00	5.42	[illegible]	[illegible]	0.93	6.35	6.83
U=PORE PRESSURE	1.00	[illegible]	8.55*	[illegible]	1.66	9.21	5.55
	1.00	3.18	4.18	[illegible]	1.68	4.86	2.89
	1.00	2.82	3.82	−0.59	1.59	4.41	2.77
	1.00	2.68	3.68	−0.53	1.53	4.21	2.75

H_{CONSOL} = 7.9860

A_{CONSOL} = 12.730

CONSTANT = 7.6

t	Δ (in)	ε (%)	$A_{COR.}$ (in)	P.R.	P (#)	$\sigma_1-\sigma_3$ (tsf)	σ_3 (tsf)	σ_1 (tsf)	u (tsf)	$\bar{\sigma}_3$ (tsf)	$\bar{\sigma}_1$ (tsf)	$\bar{\sigma}_1/\bar{\sigma}_3$
8	.081	1.01	12.860	162	1231	6.89	1.0	7.89	−0.15	1.15	8.04	6.99 ←
10	.121	1.52	12.926	186	1414	7.87	1.0	8.87	−0.42	1.42	9.29	6.54
4	.032	0.41	12.78	87	661	3.72	1.0	4.72	0.22	0.78	4.50	5.77

* MAXIMUM σ_1 IN REPORT; $\sigma_1 = 8.55$
P.R. CONSTANT NOT STATED IN THE REPORT

$\bar{\sigma}_1/\bar{\sigma}_3$ FAILURE CRITERIA − $\sigma_3 = 1.00^{tsf}$, $\sigma_1 = 7.89^{tsf}$
$\bar{\sigma}_3 = 1.15^{tsf}$, $\bar{\sigma}_1 = 8.04^{tsf}$

CUMBERLAND S.P.

B41 '87 0401 007

ASH PROPERTIES

COMPUTED JMH DATE 11-19-86

CHECKED DATE

TRIAXIAL R
TEST 2 (Poll 11786, 0542)

σ_3 (tsf)	$\sigma_1-\sigma_3$ (tsf)	σ_1 (tsf)	u (tsf)	$\bar{\sigma}_3$ (tsf)	$\bar{\sigma}_1$ (tsf)	$\bar{\sigma}_1/\bar{\sigma}_3$
2.00	1.99	3.99	.29	1.71	3.70	2.16
2.00	3.79	5.79	.43	1.57	5.36	3.41
2.00	6.80	8.80	.35	1.65	8.45	5.12
2.00	8.32	10.32	.08	1.92	10.24	5.33 ← $\varepsilon = 1.4$
2.00	8.96	10.96	-.13	2.13	11.09	5.21
2.00	9.15	11.15	-.26	2.26	11.41	5.05
2.00	9.38★	11.38★	-.45	2.45	11.83	4.83
2.00	9.34	11.34	-.48	2.48	11.82	4.77
2.00	9.14	11.14	-.48	2.48	11.62	4.69

★ MAXIMUM $\sigma_1 = 11.38$

$\bar{\sigma}_1/\bar{\sigma}_3$ FAILURE CRITERIA – $\sigma_3 = 2.00^{tsf}$, $\sigma_1 = 10.32^{tsf}$
$\bar{\sigma}_3 = 1.92^{tsf}$, $\bar{\sigma}_1 = 10.24^{tsf}$

CUMBERLAND S. P.

B41 '87 0401 002

ASH PROPERTIES

COMPUTED JMH DATE 4-12-86

CHECKED DATE

TRIAXIAL R

TEST 2 (ROLL 11726, 0544)

σ_3 (tsf)	$\sigma_1 - \sigma_3$ (tsf)	σ_1 (tsf)	u (tsf)	$\bar{\sigma}_3$ (tsf)	$\bar{\sigma}_1$ (tsf)	$\bar{\sigma}_1 / \bar{\sigma}_3$
3.00	6.54	9.54	0.76	2.24	8.78	3.92
3.00	10.56	13.56	0.53	2.47	13.03	5.28 ←
3.00	10.84	13.84	0.37	2.63	13.47	5.12
3.00	10.91*	13.91*	0.34	2.66	13.57	4.95
3.00	10.8[illegible]	13.81	0.30	2.70	13.51	5.00
3.00	10.60	13.60	0.30	2.70	13.30	4.93
3.00	10.44	13.44	0.31	2.69	13.13	4.88
3.00	9.63	12.63	0.45	2.55	12.24	4.80
3.00	8.86	11.86	0.66	2.34	11.20	4.79

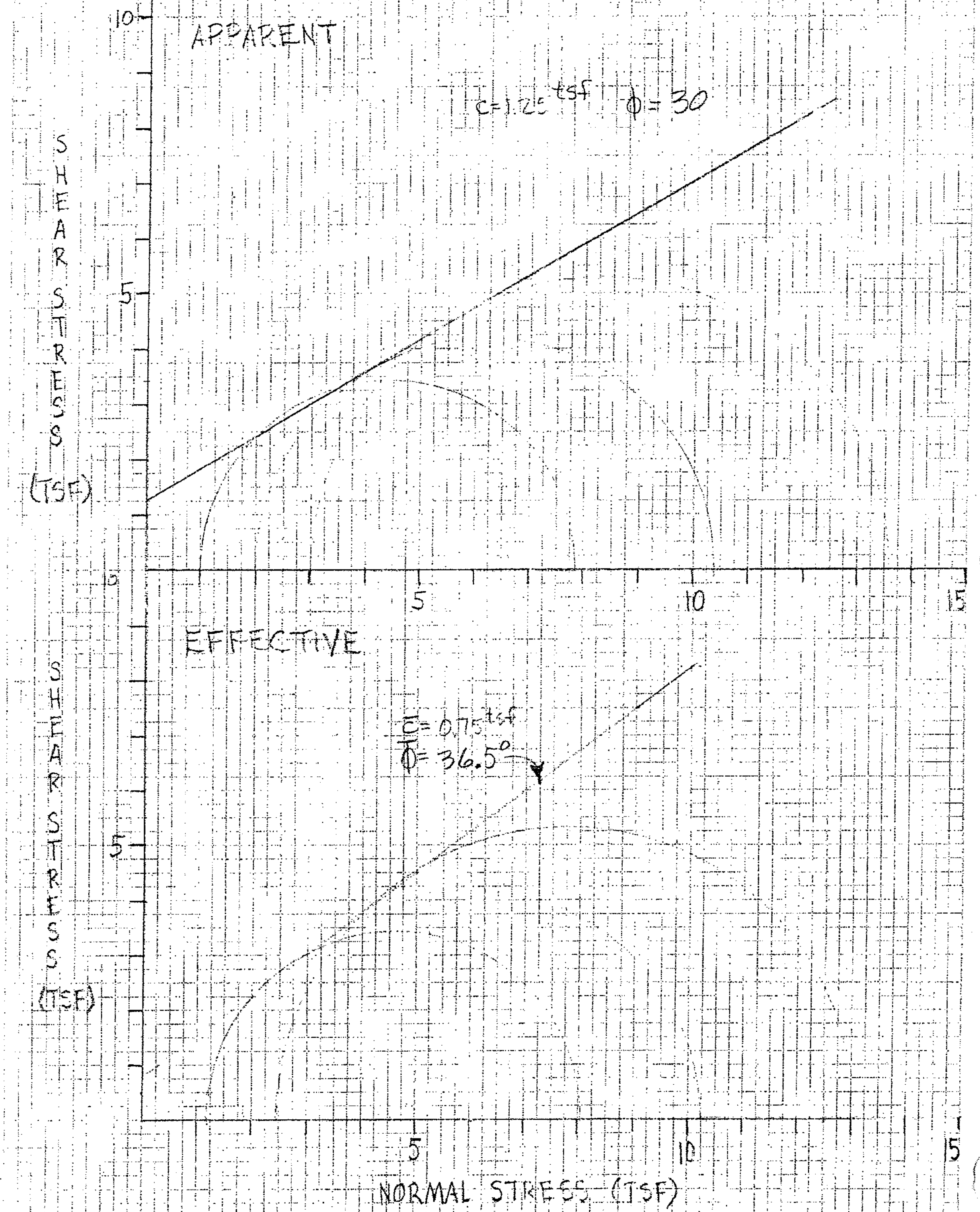
☆ MAXIMUM $\sigma_1 = 13.91^{tsf}$

$\bar{\sigma}_1 / \bar{\sigma}_3$ FAILURE CRITERIA - $\sigma_3 = 3.00^{tsf}$, $\sigma_1 = 13.56^{tsf}$
$\bar{\sigma}_3 = 2.47^{tsf}$, $\bar{\sigma}_1 = 13.03^{tsf}$

computed GMcA date 11-19-86 checked date

CUMBERLAND S.P. TEST 2 **B41** '87 0401 002

ASH PROPERTIES $\bar{\sigma}_1/\bar{\sigma}_3$ CRITERIA



CUMBERLAND S.P.

BORROW AREA W

EVALUATION OF SOIL PROPERTIES

UNIT WEIGHT

THREE SOIL CLASSES WERE FOUND FROM 20 GROUPS

CLASS I HAD	8 GROUPS	ASSUME	40% DISTRIBUTION
CLASS II HAD	9 GROUPS	ASSUME	45% "
CLASS III HAD	3 GROUPS	ASSUME	15% "
	TOTAL 20 GROUPS		TOTAL 100%

SOIL CLASS	SOIL DISTRIBUTION %	OPTIMUM MOISTURE CONTENT, %	MAXIMUM DRY DENSITY, PCF	SPECIFIC GRAVITY, G
I	40	17.0	110.0	2.68
II	45	16.0	105.9	2.69
III	15	19.4	102.3	2.68

WEIGHTED AVG. MAX. DRY DENSITY $= .4(110) + .45(105.9) + .15(102.3) = \underline{107.0}^{PCF}$

" " OPTIMUM MOISTURE CONTENT $= .4(17) + .45(16) + .15(19.4) = 16.91\%$

ANTICIPATED PLACEMENT REQUIREMENTS

DENSITY CONTROL = 95% COMPACTION
AND 98% COMPACTION

MOISTURE CONTROL = 2% DRY TO 2% WET OF OPTIMUM MOISTURE CONTENT (O.M.C.)

DRY DENSITY AT $95\% = .95\,(107.0) = 101.7^{PCF}$
$98\% = .98\,(107.0) = 104.9^{PCF}$

MOISTURE CONTENT AT 2% WET OF OMC = 18.91%

γ_{MOIST} AT $95\% = 101.7\,(1.1891) = 120.9^{PCF} \simeq \underline{121}^{PCF}$
AT $98\% = 104.9\,(1.1891) = 124.7^{PCF} \simeq \underline{125}^{PCF}$

γ_{SAT} AT $95\% = \left(1 - \frac{1}{2.68}\right)(101.7) + 62.5 = 126.3 \simeq \underline{126}^{PCF}$
$98\% = \left(1 - \frac{1}{2.68}\right)(104.9) + 62.5 = 128.3 \simeq \underline{128}^{PCF}$

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CUMBERLAND S.P.

B41 '87 0401 002

JMH 11/19

EVALUATION OF SOIL PROPERTIES
BORROW AREA E

UNIT WEIGHT

FOUR SOIL CLASSES MAKE TOTAL FROM 20 GROUPS

CLASS I	HAD	1 GROUP	ASSUME	5%	DISTRIBUTION
CLASS II	HAD	11 GROUPS		55%	"
CLASS III	HAD	3 GROUPS	"	15%	"
CLASS IV	HAD	5 GROUPS	"	25%	"
		20		100%	

SOIL CLASS	SOIL DISTRIBUTION %	(OMC) OPTIMUM MOISTURE CONTENT, %	MAX. DRY DENSITY, PCF	SPECIFIC GRAVITY, G
I	5	15.3	108.3	2.61
II	55	17.4	105.4	2.64
III	15	17.6	102.2	2.68
IV	25	18.6	105.1	2.71

WEIGHTED AVG. MAX. DRY DENSITY $= (.05)(108.3)+(.55)(105.4)+(.15)(102.2)+(.25)(105.1) = 104.99$

" " OPTIMUM MOISTURE CONTENT $= (.05)(15.3)+(.55)(17.4)+(.15)(17.6)+(.25)(18.6) = 17.63$

" " SPECIFIC GRAVITY $= (.05)(2.61)+(.55)(2.64)+(.15)(2.68)+(.25)(2.71) = 2.66$

ANTICIPATED PLACEMENT REQUIREMENTS

DENSITY CONTROL AT 95% AND 98% COMPACTION

MOISTURE CONTROL AT 2% DRY TO 2% WET OF OPTIMUM MOISTURE CONTENT

DRY DENSITY, γ_d @ 95% $= .95(104.99) = 99.74$

@ 98% $= .98(104.99) = 102.89$

MOISTURE CONTENT AT 2% WET OF O.M.C. $= 2 + 17.63 = 19.63\%$

γ_{moist} AT 95% $= 99.74(1.1963) = 119.32^{PCF} \approx \underline{119^{PCF}}$

AT 98% $= 102.89(1.1963) = 123.09^{PCF} \approx \underline{123^{PCF}}$

γ_{SAT} AT 95% $= \left(1-\frac{1}{2.66}\right)(99.74)+62.5 = 124.7^{PCF} \approx \underline{125^{PCF}}$

AT 98% $= \left(1-\frac{1}{2.66}\right)(102.89)+62.5 = 126.7^{PCF} \approx \underline{127^{PCF}}$

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B41 '87 0401 002

BORROW PROPERTIES

COMPUTED JMH DATE 11-21-86

REF. 3 B46 86 11 20 006

BORROW AREA W

TRIAXIAL R TEST 95% MAX. DRY DENSITY

R- APPARENT

	c (TSF)	ϕ (DEG)
CLASS I +2%	0.50	22.0
CLASS I -2%	0.70	21.3
CLASS II +2%	0.07	24.0
CLASS II -2%	0.00	27.0
CLASS III +2%	0.62	20.4
CLASS III -2%	0.57	14.2
AVG	0.41	21.48
LOWER THIRD	0.23	18.47
RECOMMEND	0.25^{TSF}	21°

$\bar{R}$- EFFECTIVE

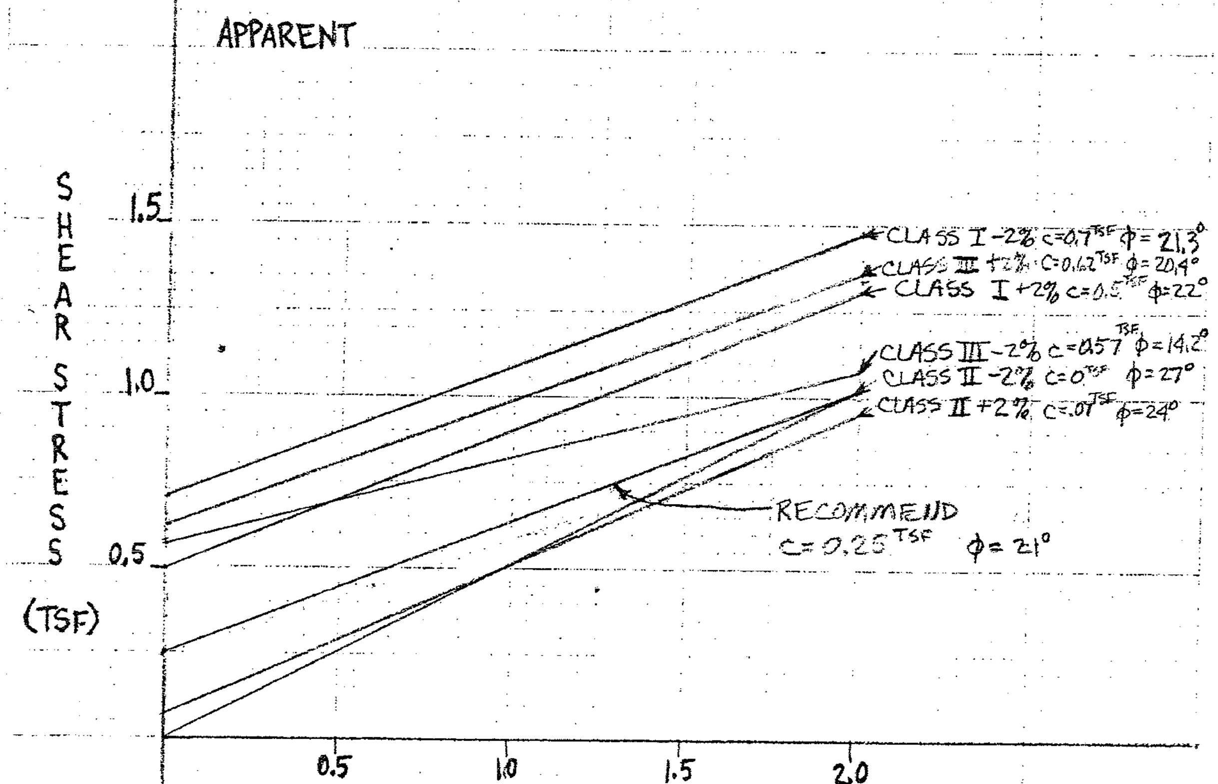
	$\bar{c}$ (TSF)	$\bar{\phi}$ (DEG)
CLASS I +2%	0.10	27.8
CLASS I -2%	0.27	29.1
CLASS II +2%	0.06	23.3
CLASS II -2%	0.03	28.7
CLASS III +2%	0.47	20.7
CLASS III -2%	0.63	13.1
AVG	0.26	23.78
LOWER THIRD	0.23	18.43

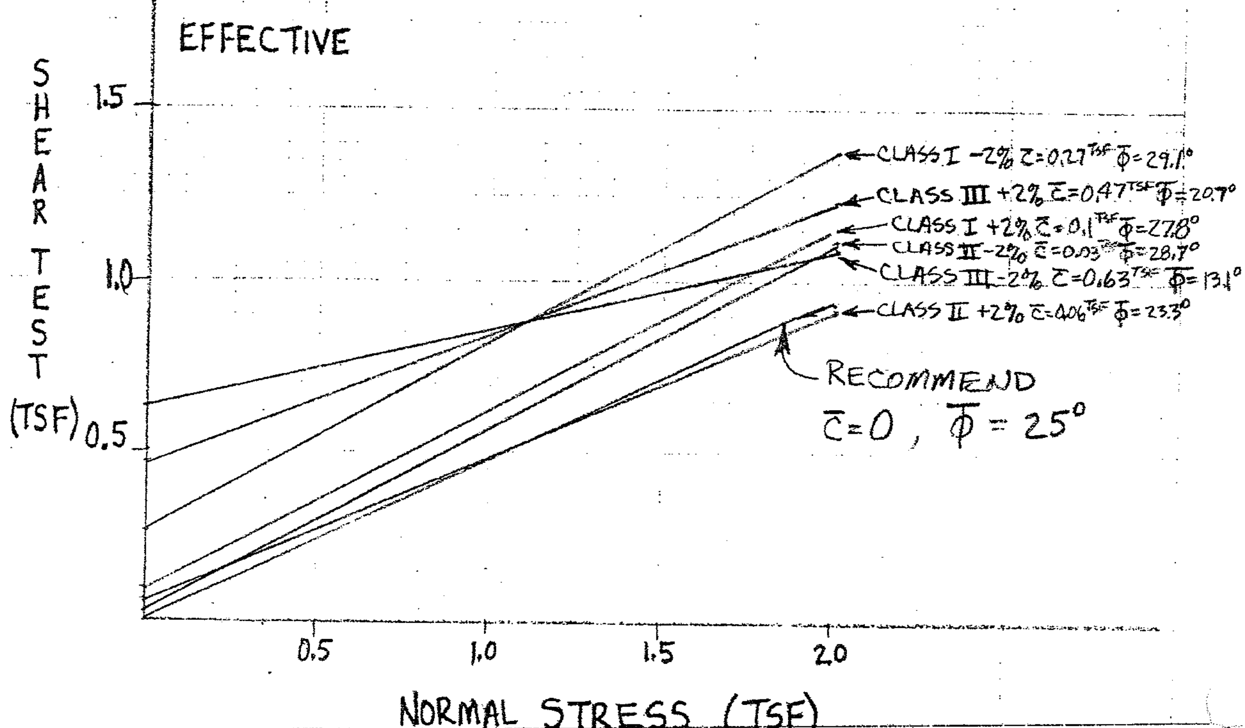
USE $\bar{c} = 0$ $\bar{\phi} = 25^{\circ}$

computed JMA date 11-21-86 checked date 51/57

CUMBERLAND S.P. TRIAXIAL R TEST B41 '87 0401 002

BORROW AREA W (95% MAX. DRY DENSITY)





CUMBERLAND S.P

B41 '87 C401 002

BORROW PROPERTIES

COMPUTED JMK DATE 11-21-86

BORROW AREA W

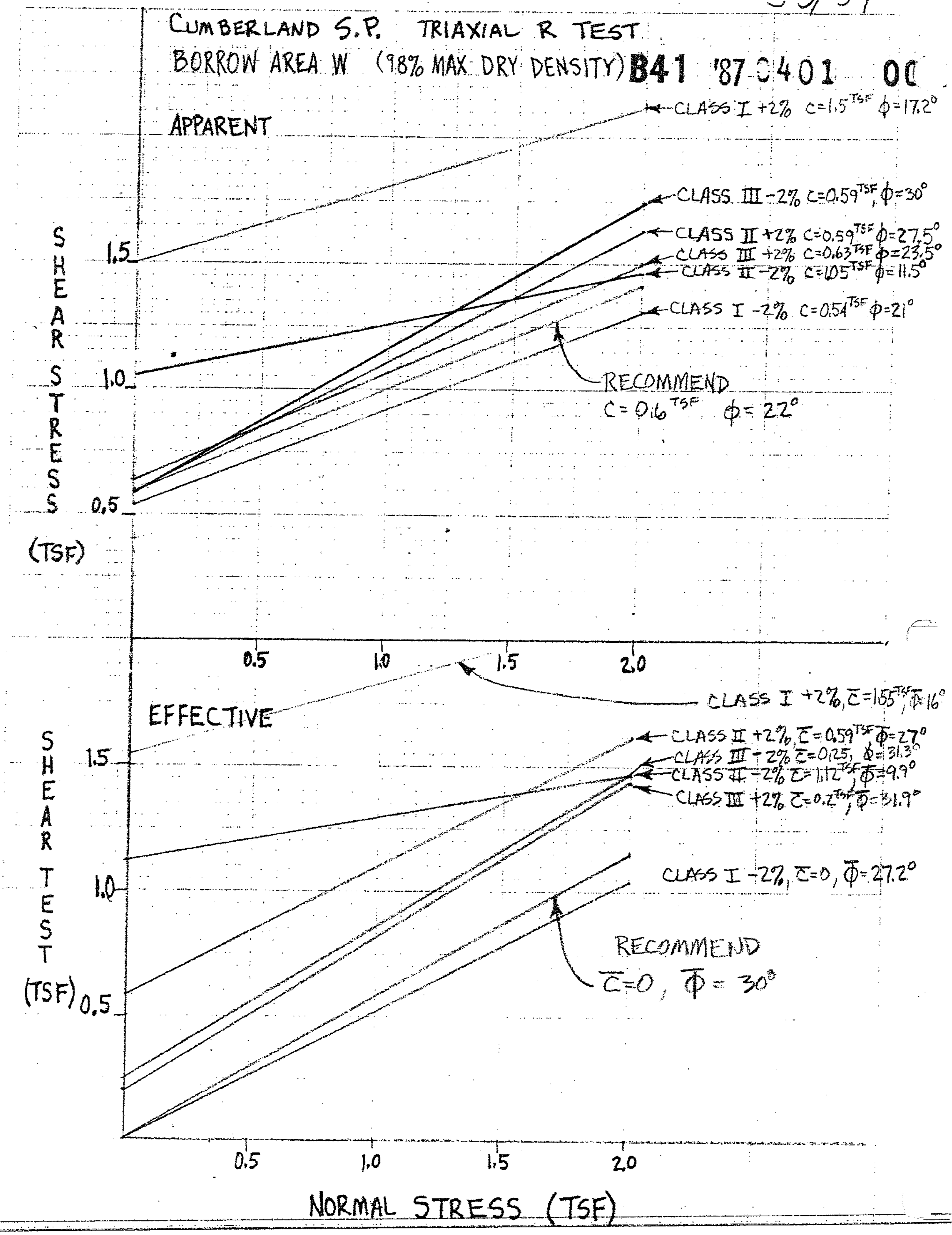
TRIAXIAL R TEST 98% MAX. DRY DENSITY

R-APPARENT	C (TSF)	φ (DEG)
CLASS I +2%	1.50	17.2
CLASS I -2%	0.54	21.0
CLASS II +2%	0.59	27.5
CLASS II -2%	1.05	11.5
CLASS III +2%	0.63	23.5
CLASS III -2%	0.59	30.0
AVG.	0.82	21.78
LOWER THIRD	0.86	17.67

RECOMMEND C = 0.6 TSF φ 22°

$\bar{R}$-EFFECTIVE	$\bar{C}$ (TSF)	$\bar{\phi}$ (DEG)
CLASS I +2%	1.55	16.0
CLASS I -2%	0.00	27.2
CLASS II +2%	0.59	27.0
CLASS II -2%	1.12	9.9
CLASS III +2%	0.20	31.9
CLASS III -2%	0.25	31.3
AVG.	0.62	23.9
LOWER THIRD	0.52	17.2

RECOMMEND $\bar{C}$ = 0.0 TSF $\bar{\phi}$ = 30°


CUMBERLAND S.P. TRIAXIAL R TEST
BORROW AREA W (98% MAX DRY DENSITY)
B41 '87 0401 00
APPARENT
CLASS I +2% C=1.5 TSF φ=17.2°
CLASS III -2% C=0.59 TSF, φ=30°
CLASS II +2% C=0.59 TSF φ=27.5°
CLASS III +2% C=0.63 TSF φ=23.5°
CLASS II -2% C=1.05 TSF φ=11.5°
CLASS I -2% C=0.54 TSF φ=21°
RECOMMEND
C=0.6 TSF φ=22°
SHEAR STRESS (TSF)
1.5
1.0
0.5
0.5
1.0
1.5
2.0
EFFECTIVE
CLASS I +2%, C̄=1.55 TSF, Φ̄=16°
CLASS II +2%, C̄=0.59 TSF Φ̄=27°
CLASS III -2% C̄=0.25, Φ̄=31.3°
CLASS II -2% C̄=1.12 TSF, Φ̄=9.9°
CLASS III +2% C̄=0.2 TSF, Φ̄=31.9°
CLASS I -2%, C̄=0, Φ̄=27.2°
RECOMMEND
C̄=0, Φ̄=30°
SHEAR TEST (TSF)
1.5
1.0
0.5
0.5
1.0
1.5
2.0
NORMAL STRESS (TSF)

CUMBERLAND S. P.

B41 '87 0401 002

BORROW PROPERTIES

JMH DATE 11-24-86

BORROW AREA E

TRIAXIAL R TEST 95% MAX. DRY DENSITY

R - APPARENT

	C (TSF)	φ (DEG)
CLASS I +2%	1.04	9.3
CLASS I -2%	1.25	10.2
CLASS II +2%	0.36	27.4
CLASS II -2%	1.21	8.2
CLASS III +2%	0.48	25.9
CLASS III -2%	0.80	18.6
CLASS IV +2%	0.79	18.1
CLASS IV -2%	0.44	5.8
AVG	0.80	15.4
LOWER THIRD	0.71	13.0

RECOMMEND $c = 0.6^{TSF}$ $\phi = 20^{\circ}$

$\bar{R}$ - EFFECTIVE

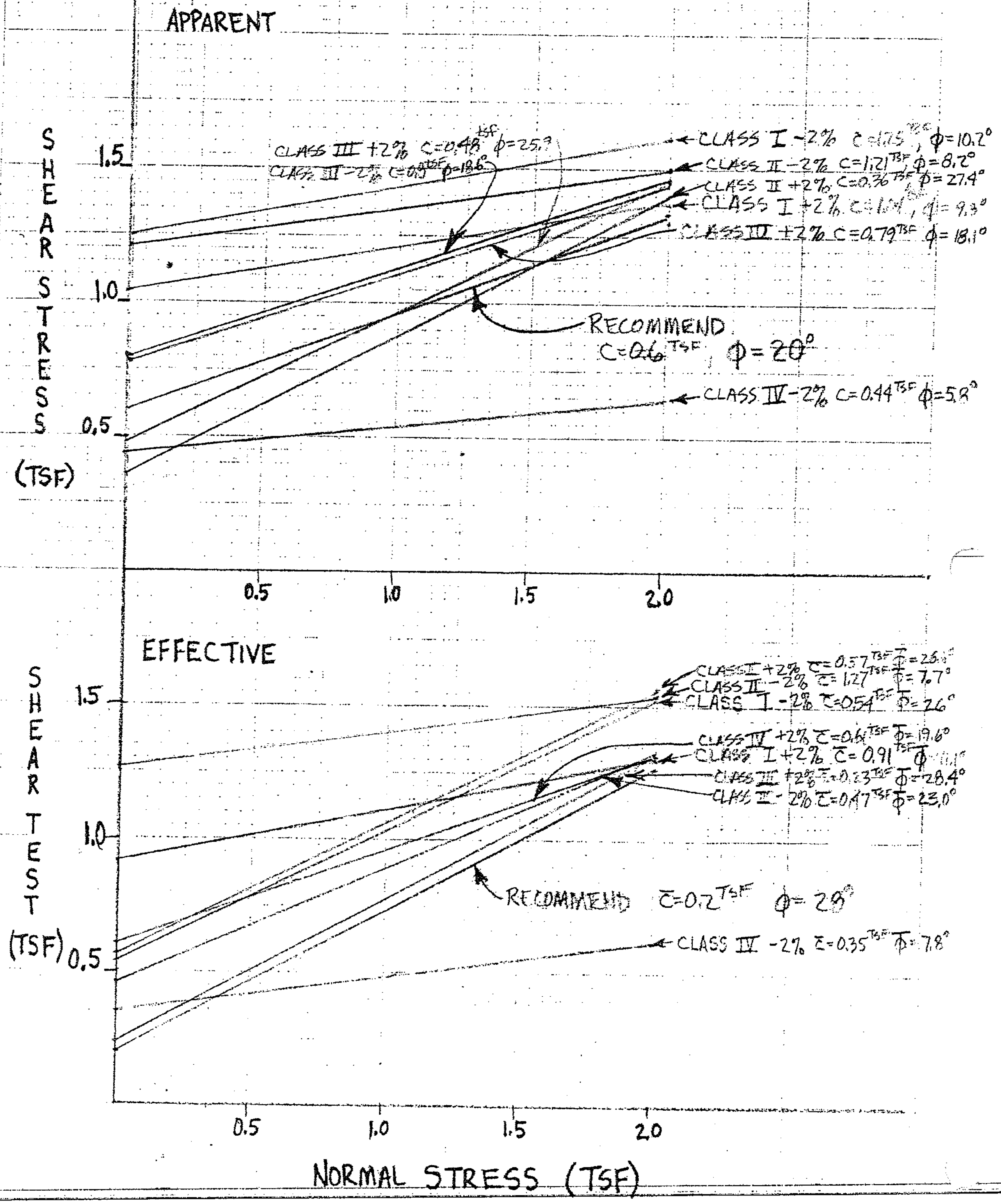
	$\bar{C}$ (TSF)	$\bar{\Phi}$ (DEG)
CLASS I +2%	0.91	11.1
CLASS I -2%	0.54	26.0
CLASS II +2%	0.57	26.6
CLASS II -2%	1.27	7.7
CLASS III +2%	0.23	28.4
CLASS III -2%	0.47	23.0
CLASS IV +2%	0.61	19.6
CLASS IV -2%	0.35	7.8
AVG.	0.62	18.8
LOWER THIRD	0.38	14.6

RECOMMEND $\bar{c} = 0.2^{SF}$ $\bar{\Phi} = 28^{\circ}$

55/57

CUMBERLAND S.P. TRIAXIAL R TEST B41 '87 0401 002

BORROW AREA E (95% MAX. DRY DENSITY)



CUMBERLAND S. P.

BORROW PROPERTIES

B41 '87 0401 002

BY JMH DATE 12-2-86

BORROW AREA E

TRIAXIAL R TEST 96% MAX. DRY DENSITY

R-APPARENT

	C (TSF)	Φ (DEG)
CLASS I +2%	1.25	17.0
CLASS I -2%	0.23	35.0
CLASS II +2%	0.17	31.3
CLASS II -2%	0.00	29.0
CLASS III +2%	0.36	18.1
CLASS III -2%	0.00	28.0
CLASS IV +2%	0.51	25.4
CLASS IV -2%	0.33	8.5
AVG.	0.42	24.0
LOWER THIRD	0.42	17.3

RECOMMEND C = 0.2 TSF Φ = 25°

$\bar{R}$-EFFECTIVE

	$\bar{C}$ (TSF)	$\bar{\Phi}$ (DEG)
CLASS I +2%	0.93	20.1
CLASS I -2%	0.43	35.0
CLASS II +2%	0.00	32.0
CLASS II -2%	0.00	28.0
CLASS III +2%	0.21	20.1
CLASS III -2%	0.00	26.7
CLASS IV +2%	0.00	31.0
CLASS IV -2%	0.71	10.4
AVG	0.29	25.4
LOWER THIRD	0.31	18.6

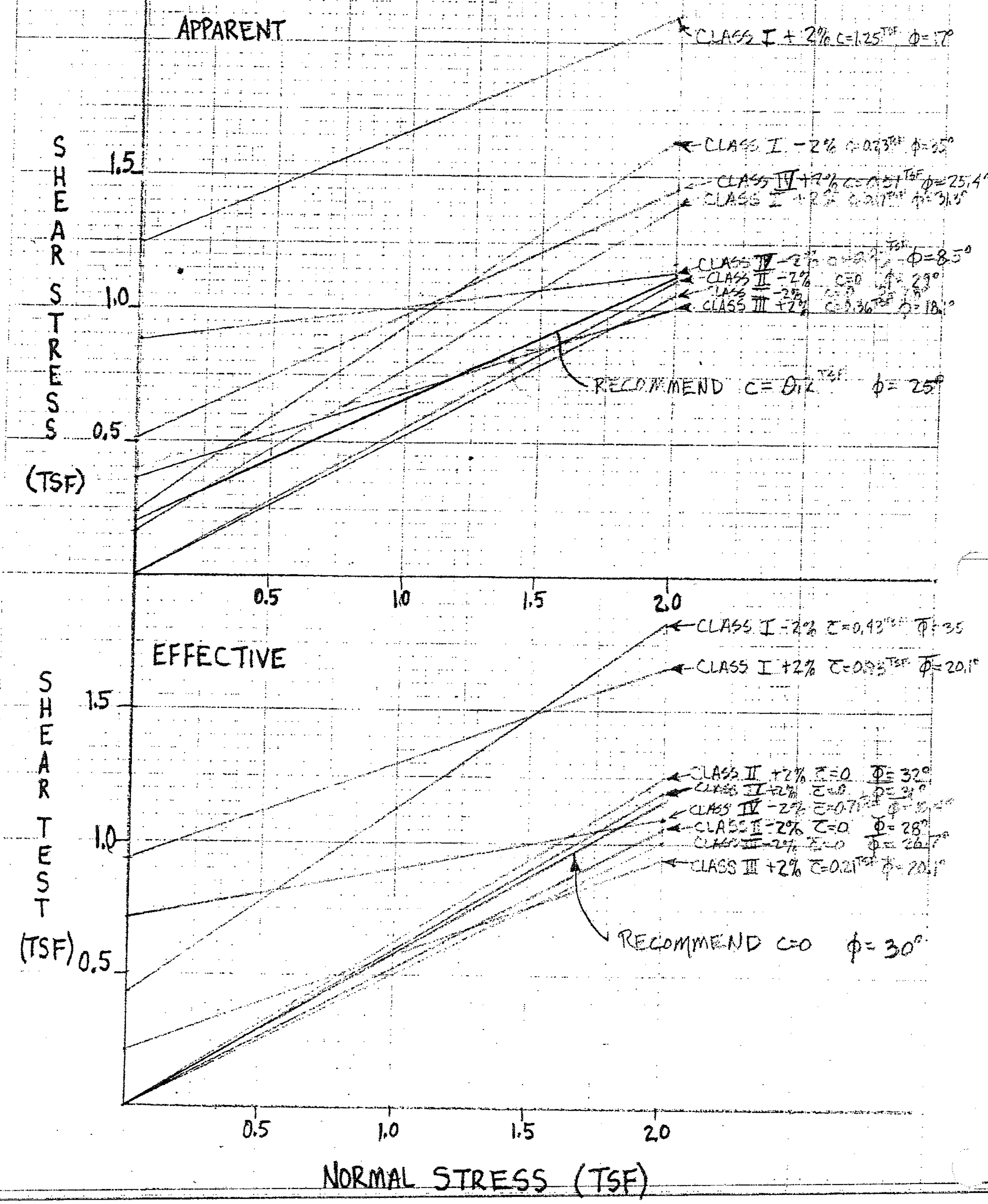
RECOMMEND $\bar{C}$ = 0.0 $\bar{\Phi}$ = 30 computed by JMH date 12-2-86 checked date

B41 '87 0401 002

57/57

CUMBERLAND S.P. TRIAXIAL R TEST

BORROW AREA E (98% MAX. DRY DENSITY)



Law Engineering and Environmental Services, Inc.
(1992)

January 27, 1992

LAW ENGINEERING

GEOTECHNICAL, ENVIRONMENTAL
& CONSTRUCTION MATERIALS
CONSULTANTS

Mr. Steve Baugh
Tennessee Valley Authority
1 D Blue Ridge Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

Subject: Report of Subsurface Exploration and Stability Analyses
Proposed Fly Ash/Scrubber Sludge Disposal Facility
Cumberland Fossil Fuel Plant
Cumberland City, Tennessee
Law Engineering Project No. 57401442.01

Dear Mr. Baugh:

As authorized, Law Engineering has conducted an exploration of the existing fly/bottom ash pond area for the purpose of evaluating its suitability for use as a new disposal facility for coal combustion by-products. This report presents a brief description of the proposed disposal facility, a discussion of the scope of our work, the results of field and laboratory tests, an overview of our analyses of stability, and our recommendations.

We appreciate the opportunity to have worked with you during this phase of the project. If there are any questions, or if we may be of further service, please feel free to contact us at your convenience.

Very truly yours,

LAW ENGINEERING, INC.

Karl E. Suter

Karl E. Suter, PE
Senior Engineer

James W. Niehoff

James W. Niehoff, PE
Principal Engineer

0144201.rja

396 PLASTERS AVENUE, N.E.
ATLANTA, GEORGIA 30324
404-873-4761
TELEFAX 404-881-0508

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APPENDICES

1.0 PROJECT DESCRIPTION

The Cumberland Fossil Fuel Plant is located on the south bank of the Cumberland River, just west of Cumberland City, Tennessee as shown on Figure 1. Currently, the plant generates approximately 500,000 tons of coal combustion by-products each year, consisting of bottom ash and fly ash. These materials are presently removed from the plant by means of a sluicing process, and discharged into a large pond located to the south. At current production rates, it is estimated that the pond may have about 5 years of remaining capacity.

As a result of new clean air regulations, the Tennessee Valley Authority (TVA) is considering the installation of SO_2 scrubbers at the plant. These would produce an estimated 1.2 million tons of scrubber sludge annually.

Considering the above factors, TVA is currently performing a study of by-product disposal needs through the year 2015. As part of this study, a detailed search has been conducted for suitable disposal sites for scrubber sludge, bottom ash, and fly ash. Although many potential sites have been considered, the most favorable location found thus far from an operations standpoint is the existing fly ash/bottom ash pond located to the south of the plant. Although project planning is preliminary at this point, the configuration of the facility will include a wet scrubber sludge stack within the eastern portion of the pond, a basin for reclaimed water in the central portion, a dry fly ash stack in the western portion, and runoff ponds at the western extreme (Figure 2). Both disposal stacks will incorporate 3:1 side slopes (horizontal to vertical) with 20 foot wide horizontal benches every 30 vertical feet.

The purpose of our study has been to evaluate the geotechnical characteristics of the site and to determine if it can be developed as a disposal area without incurring excessive costs related to site preparation or slope configuration.

2.0 SITE DESCRIPTION

The proposed disposal site occupies approximately 360 acres southwest of and adjacent to the generating facility. The existing ash ponds in this location are built above the original ground surface elevation by means of compacted soil dikes up to 40 feet in height with a crest elevation of approximately 395 feet (MSL). These dikes incorporate exterior side slopes of 3 horizontal to 1 vertical. Interior slopes vary from 2.5:1 to 3:1. The crest of the dikes are generally 12 to 15 feet in width.

An intermediate dike extends from northeast to southwest across the middle of the pond, forming two separate storage cells. The easternmost portion has been used both for sluiced ash and as a dredge cell. At the time of this study, the ash surface in this portion of the disposal area was within 4 to 5 feet of the dike crest in some locations. This area is not active at this time. The northwestern section is currently receiving both bottom and fly ash sluiced from the plant. Pond surface elevations vary, but typically are greater than 10 to 15 feet below the surrounding dike crest. Excess water currently drains towards the western extent of this cell.

Beyond the perimeter dike, the ash pond is bounded to the northeast by the remainder of the Cumberland Facility, to the south by an abandoned quarry, and to the north, west, and east by undeveloped land. Further to the north lies the Cumberland River. Wells Creek flows from the south towards the river along the western portions of the perimeter dike. The water surface of the stream is approximately 35 to 40 feet below the dike crest.

3.0 FIELD EXPLORATION

Previous subsurface work within the general site area was conducted by Hall, Blake & Associates in 1986. During their study, a total of 14 borings were drilled in the western portion of the dike to explore the conditions both within and beneath the dike. The study included the exploration of two potential borrow sources to the east and west of the site.

To supplement the available information, we conducted a series of soil test borings within dike areas and dilatometer probes in open pond areas. Descriptions of the testing procedures are presented in the Appendix. A total of 15 soil test borings and 6 dilatometer probes were made. Twelve soil test borings were originally planned at 1000 foot centers along the perimeter dike. The boring locations were modified during the field exploration to include 13 soil test borings and 2 offset borings adjacent to B-9 and B-12 where shallow refusal was encountered. The borings extended to depths of 14 to 45 feet. Five of the borings encountered refusal in the foundation materials. Three of the borings encountered refusal within the dike fill due to the presence of rock fragments and boulders. The dilatometer probes were extended to refusal at depths of 9 to 33 feet.

4.0 SUBSURFACE CONDITIONS

The site stratigraphy was interpreted by reviewing both new and previous data. A drawing indicating the test boring and dilatometer probe locations is included as Figure 3 in Appendix A. Soil test boring and dilatometer records are included in Appendix B. Summaries of prior laboratory test results and the results of the testing from this study are included in Appendix C.

4.1 AREA GEOLOGY

In general, this portion of Tennessee is underlain by nearly flat-lying sedimentary rock consisting of limestone, dolomite and shale of Mississippian and earlier age. However, the plant site itself lies within a large geologic feature known as the Wells Creek Structure. The Wells Creek Structure is roughly circular in shape with a diameter of nearly 2 miles. Within the central part of the structure Knox Dolomite and bedrock of the Stones River Group are exposed. Around the periphery, a series of more recent sedimentary strata are exposed in parallel bands. The rock within the central portion of the feature is highly fractured to a depth of several thousand feet. Beyond the central portion of the structure, a radial and longitudinal pattern has been mapped extending several miles in all directions. Although there is some disagreement among several experts, it appears that the structure was most likely the result of a meteor impact.

4.2 SUBSURFACE MATERIALS

Four general types of subsurface materials were encountered at the site. The subsurface materials existent prior to construction of the dikes included alluvium in and adjacent to the Wells Creek channel and residual soils beneath the alluvium and in areas adjacent to the creek. The dikes are composed of silty clay fill with limestone and chert fragments. The basin formed by the dikes is filled with sluiced bottom ash and fly ash. A second stage of dike construction was conducted on the southern portion of the dike. More detailed descriptions of the materials encountered are provided in the following subsections. Cross sections drawn to represent conditions along the longitudinal axis of the dike are presented on Figures 4 through 6 in Appendix A.

4.2.1 Alluvium

The alluvial soils were deposited in the former floodplain of Wells Creek. Based upon the materials encountered in the borings, it is apparent that the creek changed path numerous times. As a consequence, both the nature and thickness of the alluvial materials varies widely over the site limits. The thickness generally was found to range from 5 to 25 feet in the soil borings. Its composition includes soils with various percentages of clay, sand and gravel. In some locations, sections of tree limbs and other organics were also encountered. Standard Penetration Test "N-values" in the alluvium ranged from 4 to more than 50 blows per foot (bpf). Although some soft and loose zones were encountered in the borings, the alluvium is generally stiff to very stiff where composed of clay, and medium dense where it is sandy.

4.2.2 Residuum

The residual soils encountered were typically moderate to high plasticity silty clays with chert and limestone fragments. Residuum was encountered beneath the alluvium where it was present and at the former ground level where alluvium was absent. Standard penetration test N-values in the residuum ranged from 8 to 26 bpf indicating firm to very stiff soils.

4.2.3 Dike Fill

The dike fill is composed of remolded residual soils. Consequently, it includes moderate to high plasticity silty clay with chert and limestone fragments. Standard penetration test N-value in the fill ranged from 4 to more than 50 bpf with an average of about 17 bpf.

4.2.4 Sluiced Ash

The ash contained by the dike is variable in composition and includes coarse grained bottom ash as well as fine grained fly ash. Typically, the upper 15 to 17 feet of the ash is loose in nature. Below this depth, the ash is somewhat denser and exhibits some cementation. The thickness of ash inside the pond varies based on the pond bottom topography. At our dilatometer probe locations, the ash typically extended to a depth of 20 to 30 feet.

4.3 MATERIAL PROPERTIES

Material properties were obtained from a variety of sources including prior soil test borings and triaxial shear tests conducted by Hall, Blake & Associates, our field and laboratory test results, published data and our experience with similar soils. The following discussion outlines the sources of the soil parameters used in our analyses for each of the major strata.

4.3.1 Dike Materials

Triaxial shear strength tests were conducted by Hall, Blake & Associates on over 30 samples of undisturbed and re-molded soils obtained from the dike and borrow areas. Our review of these tests results revealed some inconsistencies, possibly relating to the initial degree of saturation of the samples. To derive a parameters for stability analysis, we conducted regression analysis of the strength intercept (c) and friction angle (ϕ) for effective and total stress conditions in an effort to establish a trend in the data. A significant trend was noted in the relationship between c and ϕ. As a result, we were able to determine likely combinations of c and ϕ from this data. From the HBA data we estimate undrained strength parameters of $c=1000$ psf, $\phi=20°$ and drained parameters of $c'=400$ psf, and $\phi'=25°$.

As part of our work on this project, a limited program of strength testing was conducted to confirm the order of magnitude of parameters derived during previous studies. The confirmation program included one direct shear test and one triaxial shear strength test conducted on remolded samples of the dike material. The results of the tests are included in Appendix C. Drained strength parameters of $c'=260$ psf, $\phi'=27°$ and undrained parameters of $c=360$ psf, $\phi=14°$ were obtained in the triaxial test. The direct shear test results indicate undrained strength parameters of $c=1080$ psf, and $\phi=34°$.

4.3.2 Foundation Soils

The foundation soils include both alluvium and residual soils. Laboratory test data was not obtained for these materials. The strength parameters were estimated based on the Standard Penetration Test N-values, the results of the tests on the remolded samples of residuum, and on our experience with similar soils. A summary of the soil properties estimated for our stability analyses is included below.

Moist Density	Undrained		Drained	
pcf	c	ϕ	c	ϕ
124	1000	20	300	27
125	1200	20	500	30

4.3.3 Sluiced Ash

Properties of sluiced ash were obtained from the dilatometer data and from published sources. A summary of the published data is presented below:

Dry Density	Moisture	Void	Undrained		Drained	
PCF	Content Percent	Ratio e_o	C psf	$\phi°$	C'psf	$\phi°$
53 - 90	35 - 55	0.85-1.3	0-660	11-22	0-900	11-28

4.3.4 Compacted Ash

Compacted ash was not present on site at the time of our exploration. The final design includes placement of compacted ash over the sluiced ash within the existing dike. Properties of compacted ash were estimated based on results of a standard Proctor compaction test and published values. The range of values is summarized below:

Maximum Dry PCF Density	Optimum Moisture Content Percent	Specific Gravity	Undrained psf	Undrained $\phi°$	Drained C'psf	Drained $\phi°$
90 - 100	14 - 23	2.3-2.5	0	34-35.5	0	37.5

4.3.5 Scrubber Sludge

Based upon our discussions with TVA, the process to be used to clean SO_2 emissions is new. As such, the properties of the resulting scrubber sludge are not known at this time. For the purposes of our study, we have assumed that the new scrubber sludge will have properties similar to that of compacted fly ash.

5.0 ANALYSES

The primary emphasis of this study concerned the stability of the new waste disposal facilities when constructed atop a relatively loose zone of granular material. Our analyses considered two major factors including: 1) the resistance of the sluiced ash to liquefaction under dynamic (earthquake) loading conditions, and 2) the resistance of the overall disposal facility configuration to instability under both static, steady state conditions, and under dynamic, earthquake loading conditions. Descriptions of both of these factors follow in the next subsections.

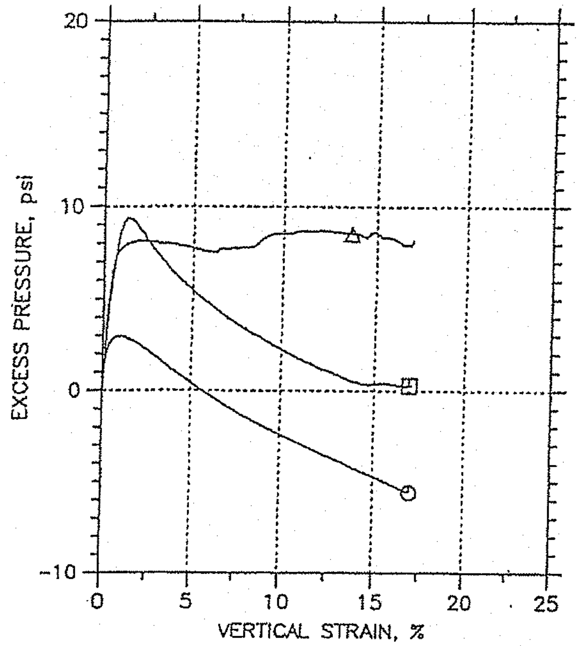
5.1 LIQUEFACTION ASSESSMENT

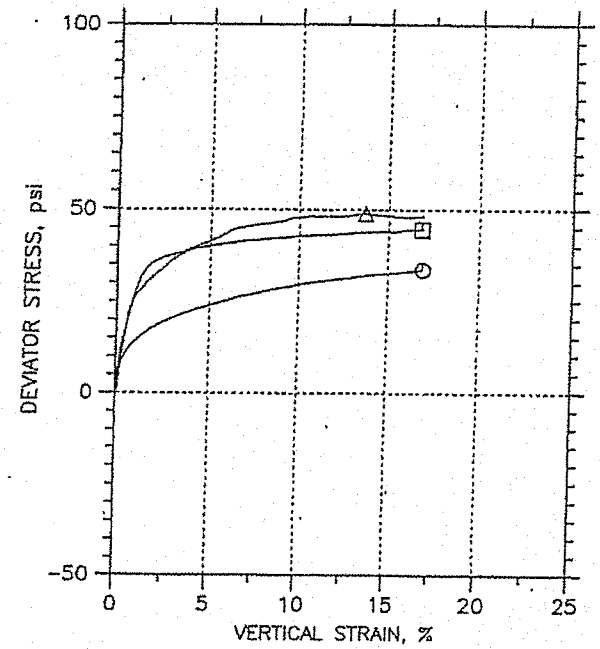
Liquefaction is a temporary loss of shear strength in cohesionless materials caused by an increase in pore water pressure. In the case of liquefaction, the pore water pressure equals the contact pressure between soil particles and the frictional resistance between the particles is lost. It is a documented phenomenon which can be caused by dynamic loading such as the rapid cyclic shear loading during an earthquake. During an earthquake, the cyclic waves propagating from the underlying rock create shear stresses and resulting shear strains in the soil mass. In the case of loose cohesionless soils, this tends to densify the soil. If the soil is below the water table, the voids between soil particles are filled with water which is relatively incompressible. As the soil tries to densify, it compresses the pore water between the soil particles creating an increase in pore water pressure. If the pore water pressure reaches a point where it exceeds the confining stress, the soil liquefies temporarily until the

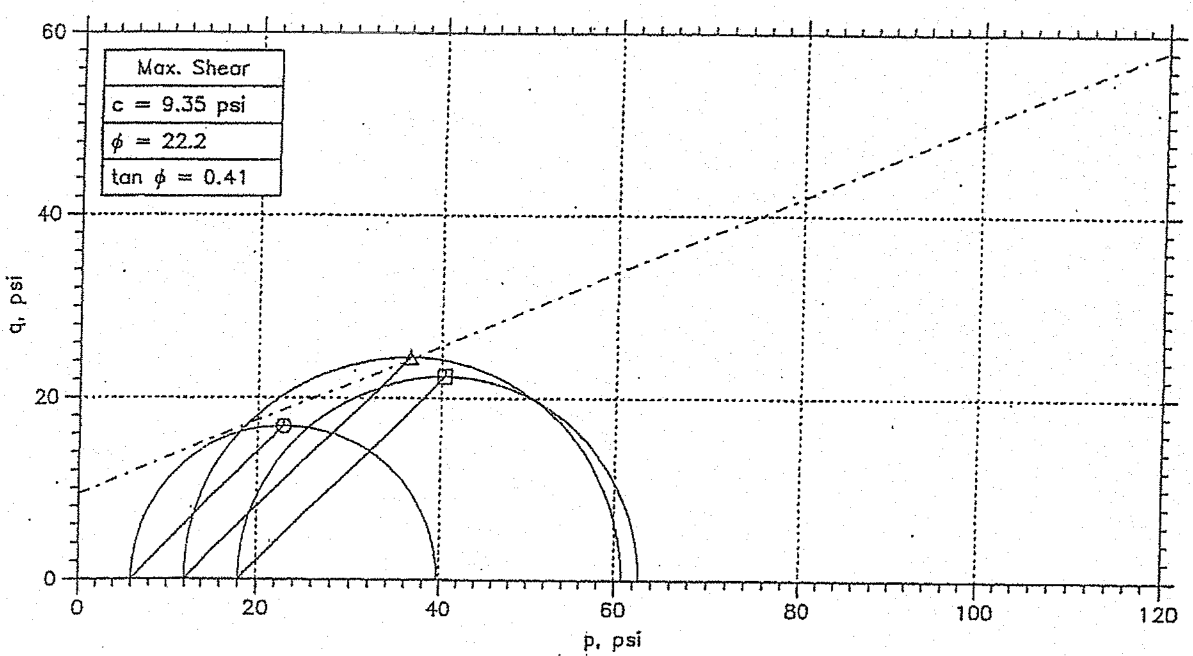
TVA – CUMBERLAND CITY
SLOPE STABILITY ANALYSIS – TABLE #1
SOIL STRENGTH PARAMETERS

SOIL DESCRIPTION	STRENGTH PARAMETERS				UNIT WEIGHT (MOIST) (PCF)	UNIT WEIGHT (SAT.) (PCF)
	C (PSF)	Ø (DEG.)	C' (PSF)	Ø' (DEG.)		
COMPACTED ASH	0	34	0	36	105	110
SLUICED ASH	0	25	0	28	100	105
DIKE FILL	1000	20	300	25	124	130
WATER	0	0	0	0	62.4	62.4
UPPER SOIL SUBGRADE	1000	20	300	27	124	130
LOWER SOIL SUBGRADE	1200	20	500	30	125	130

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



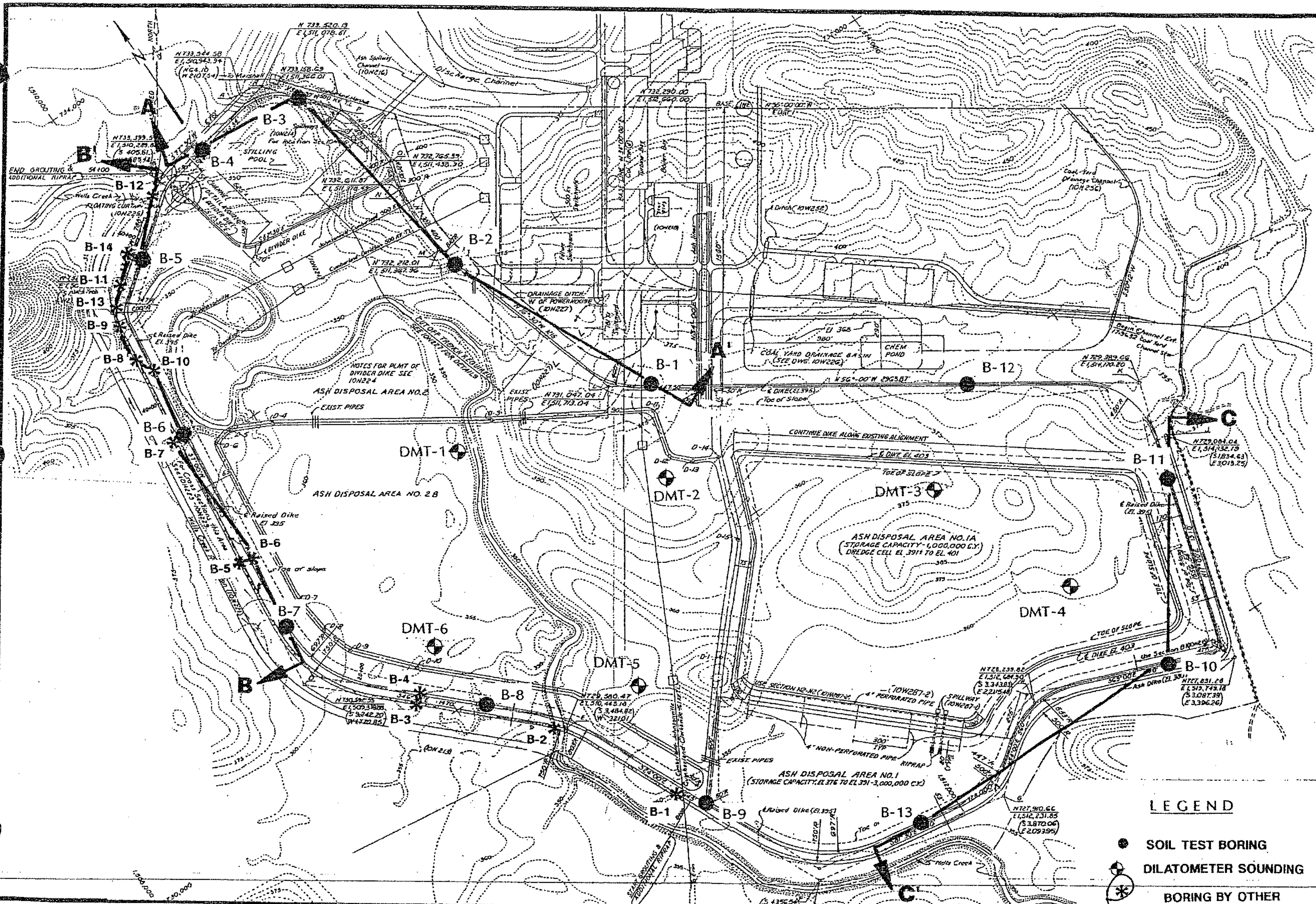




	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	UD-1	7066.1	5-7 ft	HJ	3/3/07	JL	4/13/07	7066.1a_90.dat
△	UD-2	7067.2	7-9 ft	HJ	3/3/07	JL	4/13/07	7067.2a_93.dat
□	UD-3	7067.3	9-11 ft	HJ	3/4/07	JL	4/13/07	7067.3a_96.dat

MACTEC	Project: TVA CUF Gypsum Seepage	Location: MWA1	Project No.: 3043061041
	Boring No.: MWA1	Sample Type: Shelby Tube	
	Description: Brown Lean Clay		
	Remarks:		

Mon, 16-APR-2007 08:23:58



LAW ENGINEERING
Atlanta, Georgia
Geotechnical, Materials & Environmental Consultants

SCALE	PROJECT NO.	DATE
1"=500'	57401442.01	JAN./1992

TVA - CUMBERLAND CITY
CUMBERLAND CITY, TENNESSEE

FIGURE 3
BORING LOCATION PLAN

318647

United Engineers and Constructors Inc. (1992)

GENERAL COMPUTATION SHEET

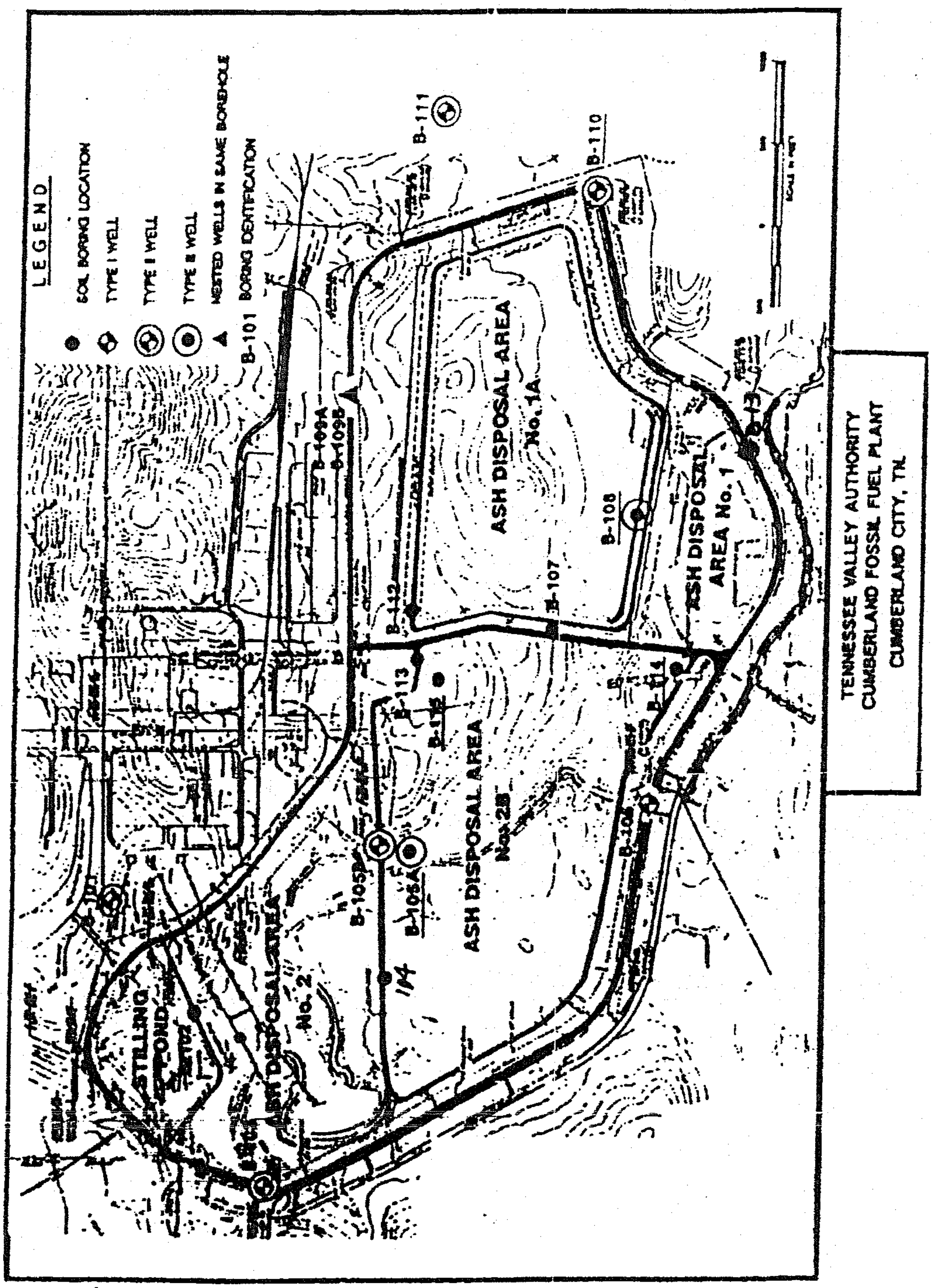
(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

NAME OF COMPANY TVA UNIT/S

SUBJECT FLY ASH/GYPSUM STACK STABILITY

CALC SET NO		REV	COMP BY	CHK'D BY
PRELIM		0	8. C	DJV
FINAL	6314-GT-DA-001		DATE 8-14-92	DATE 8-14-92
VOID				
SHEET	4 OF 45		DATE	DATE
JO	6314.006/009			



GENERAL COMPUTATION SHEET

(DISCIPLINE)

United Engineers & Constructors
A Raytheon Company

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PRELIM				
FINAL	6314-GT-DA-001	0	S. C. DATE 8-14-92	[illegible] DATE 8-14-92
VOID				
SHEET 6 OF 45			DATE	DATE
J.O.	6314.006/009			

NAME OF COMPANY TVA UNIT/S

SUBJECT FLY ASH/GYPSUM STACK STABILITY

SOIL PROPERTIES

The undrained strength parameters of the dike materials, flyash, bottom ash, gypsum, and in-situ clay are summarized as follows:

	Density (pcf)	Cohesion (psf)	Phi (deg)
Dike Fill:	125	1000	0
Sluiced Flyash:	100	0	25
Compacted Flyash:	105	0	32
Bottom Ash:	120	0	35
Compact Bottom Ash:	125	0	38
Gypsum:	100	0	35
In-situ Soft Clay:	120	400	10
In-situ Stiff Clay:	125	500	20

The impact of seismic loading upon the strength parameters of soils may be approximated as follows:

1. Dynamic friction angle of soil is equal to the static friction angle reduced by 2 degrees.(P. 228, Ref. 4)

2. Dynamic undrained cohesion of soil is equal to 1.5 times the static undrained cohesion.(P. 232, Ref. 4)

For seismic conditions, the undrained strength parameters of the dike materials, flyash, bottom ash, gypsum, and in-situ clay are summarized as follows:

	Density (pcf)	Cohesion (psf)	Phi (deg)
Dike Fill:	125	1500	0
Sluiced Flyash:	100	0	23
Compacted Flyash:	105	0	30
Bottom Ash:	120	0	33
Compact Bottom Ash:	125	0	36
Gypsum:	100	0	33
In-situ Soft Clay:	120	600	8
In-situ Stiff Clay:	125	750	18

MACTEC Engineering and Consulting, Inc. (2007)

KEY TO SYMBOLS AND DESCRIPTIONS

GROUP SYMBOLS	TYPICAL NAMES	GROUP SYMBOLS	TYPICAL NAMES
	TOPSOIL		CONCRETE
	ASPHALT		DOLOMITE
	GRAVEL		LIMESTONE
	FILL		SHALE
	SUBSOIL		LIMESTONE/SHALE - Limestone with shale interbeds
	ALLUVIUM		SANDSTONE
	ASH		SILTSTONE
	RESIDUUM - Soft to firm		AUGER BORING
	RESIDUUM - Stiff to very hard		UNDISTURBED SAMPLE ATTEMPT

	Undisturbed Sample 1.5-2.0 = Recovered (ft) / Pushed (ft)		
	Split Spoon Sample		Auger Cuttings
	Rock Core 60-100 = RQD / Recovery		Dilatometer
	No Sample		Crandall Sampler
	Rotary Drill		Pressure Meter
∇	Water Table at time of drilling	○	No Recovery
		▼	Water Table after 24 hours

Correlation of Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 20	Firm	5 - 8	Firm
21 - 30	Very Firm	9 - 15	Stiff
31 - 50	Dense	16 - 30	Very Stiff
Over 50	Very Dense	31 - 50	Hard
		Over 50	Very Hard

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

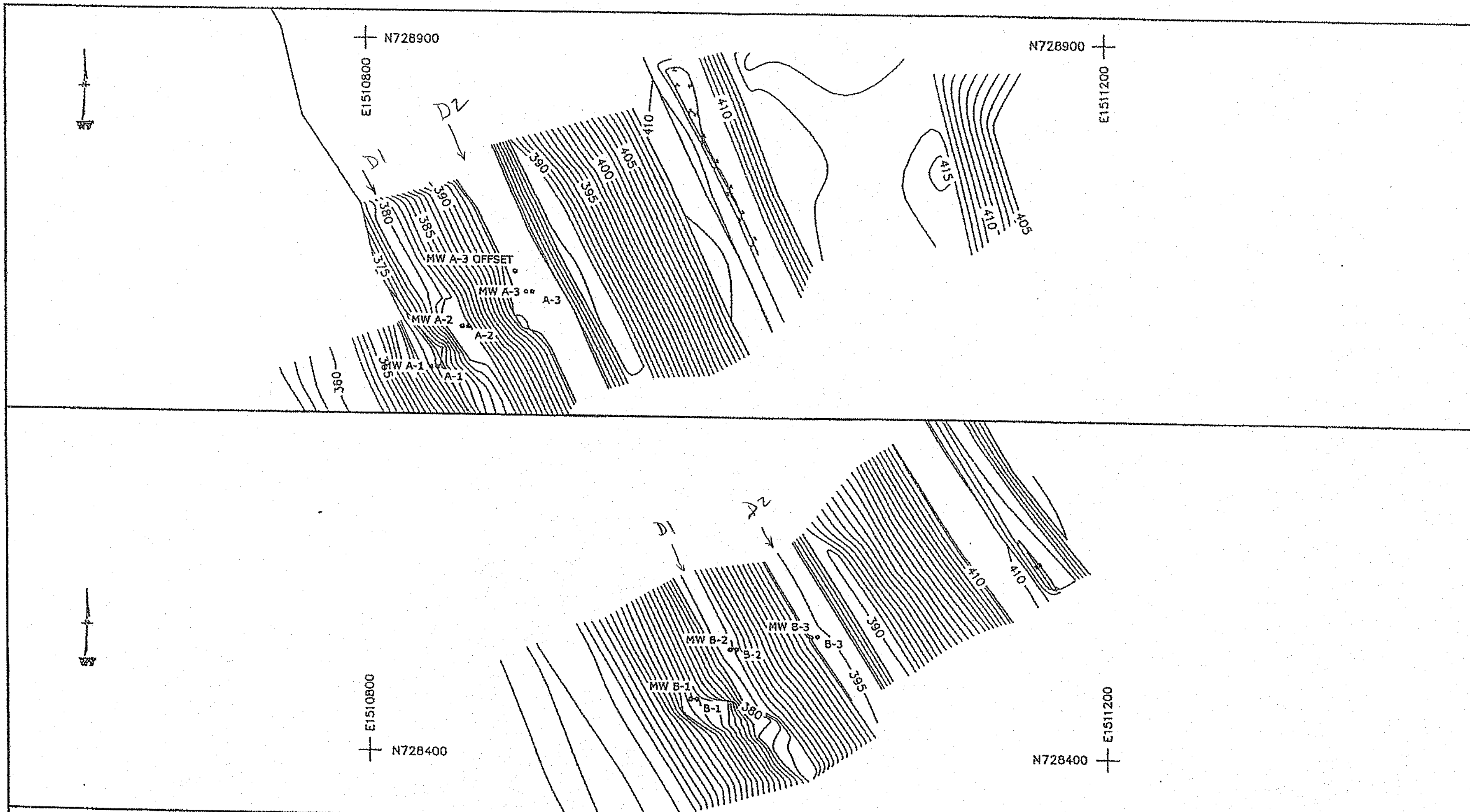
No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. 1, March, 1953 (Revised April, 1960)

MACTEC

MACTEC Engineering and Consulting of Georgia, Inc.
1725 Louisville Drive
Knoxville, Tennessee 37921-5904
865-588-8544 • Fax: 865-588-8026



LEGEND

A-1 BORING LOCATION AND IDENTIFICATION

MW A-1 MONITORING WELL LOCATION AND IDENTIFICATION

MACTEC

MACTEC Engineering and Consulting, Inc.
1725 Louisville Drive
Knoxville, Tennessee 37921-5904
865-588-8544 • Fax: 865-588-8026

FIGURE 2: BORING AND MONITORING WELL LOCATION PLAN
GYPSUM SEEPAGE AREA STUDY - TVA CUMBERLAND FOSSIL PLANT
CUMBERLAND CITY, TENNESSEE

DRAFTING BY:	PREPARED BY:	CHECKED BY:
JOB NUMBER: 3043061041/001	DATE: APRIL 27, 2007	SCALE: 0 50'

COORDINATES: N XX,XX,XX E XX,XX,XX

SOIL CLASSIFICATION AND REMARKS

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)
0	VERY LOOSE TO LOOSE, GRAY, MOIST, SANDY GRAVEL WITH A LITTLE SILT - FILL	374.0
5	FIRM TO STIFF, REDDISH BROWN, MOIST TO VERY MOIST, SILTY CLAY WITH CHERT AND ROCK FRAGMENTS - FILL	369.0
	FIRM TO STIFF, BROWN TO GRAY AND REDDISH BROWN, MOIST, SILTY CLAY WITH SOME SAND AND ROCK FRAGMENTS - FILL	
10		364.0
	VERY STIFF, ORANGISH BROWN TO GRAY, MOIST, SILTY CLAY WITH ROCK FRAGMENTS AND A TRACE OF SAND - FILL	
15	STIFF, REDDISH TO ORANGISH BROWN, MOIST, SILTY CLAY WITH CHERT AND ROCK FRAGMENTS - FILL	359.0
	STIFF TO FIRM, ORANGISH BROWN TO GRAY, MOIST, SILTY CLAY WITH ROCK FRAGMENTS - FILL	
20	FIRM, GRAY, MOIST, CLAYEY SILT WITH A TRACE OF SAND - ALLUVIUM	354.0
	SOFT TO VERY SOFT, GRAY TO BROWN, MOIST TO VERY MOIST, SILTY CLAY - ALLUVIUM	
	VERY LOOSE, ORANGISH BROWN, VERY MOIST TO WET, SILTY SAND - ALLUVIUM	
25	∇	349.0
	FIRM TO LOOSE, ORANGISH BROWN, WET, SILTY SAND - ALLUVIUM	
30		344.0
35	BORING TERMINATED AT 35.0'	339.0
40		334.0
45		329.0

SAMPLES

IDENT	N-COUNT (1st 6" / 2nd 6" / 3rd 6")
SPT-1	1-1-1
SPT-2	1-2-1
SPT-3	WOH-1-4
SPT-4	2-4-5
SPT-5	WOH-2-4
SPT-6	4-5-6
SPT-7	5-5-7
SPT-8	4-5-8
SPT-9	4-7-10
SPT-10	7-9-8
SPT-11	4-6-8
SPT-12	5-7-8
SPT-13	3-4-4
SPT-14	3-3-3
SPT-15	1-2-2
SPT-16	WOH-WOH-1
SPT-17	WOH-2-2
SPT-18	WOH-1-2
SPT-19	1-2-2
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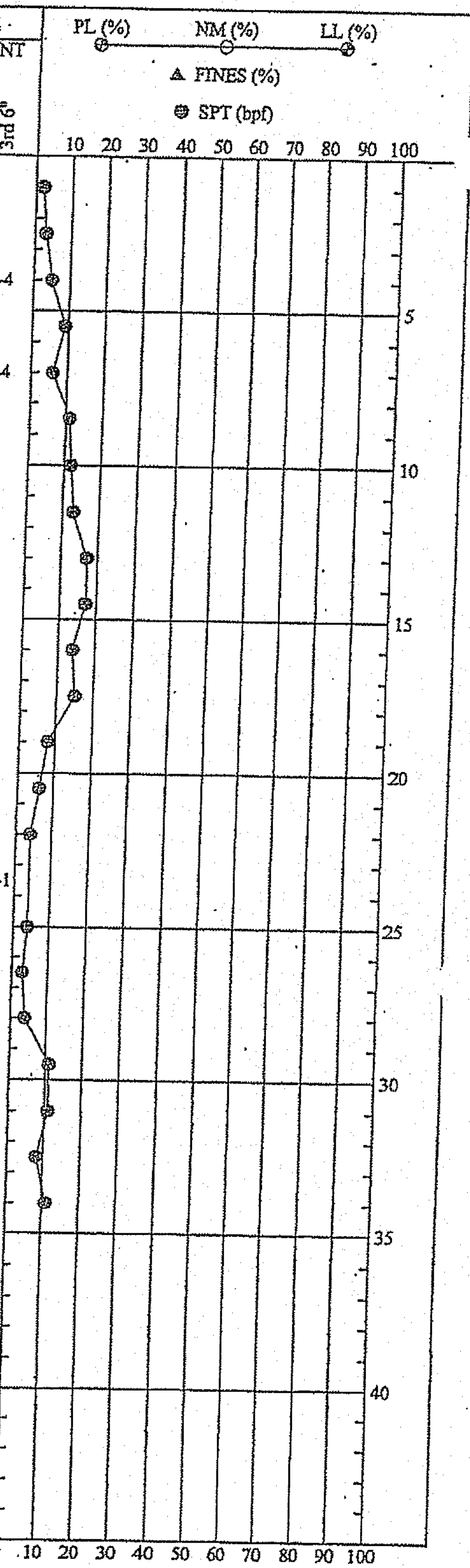
SPT-22	5-3-5
SPT-23	5-6-5-8



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. DRILLER REPORTED GROUNDWATER STABILIZING WITHIN THE BOREHOLE AT A DEPTH OF ABOUT 20' AFTER SAMPLING THE SUBMERGED ZONE AT A DEPTH OF ABOUT 25'.

SOIL TEST BORING RECORD

PROJECT: TVA CUF Gypsum Seepage Study

DRILLED: December 7, 2006 **BORING NO.:** A-1

PROJ. NO.: 3043061041/0001 **PAGE** 1 **OF** 1

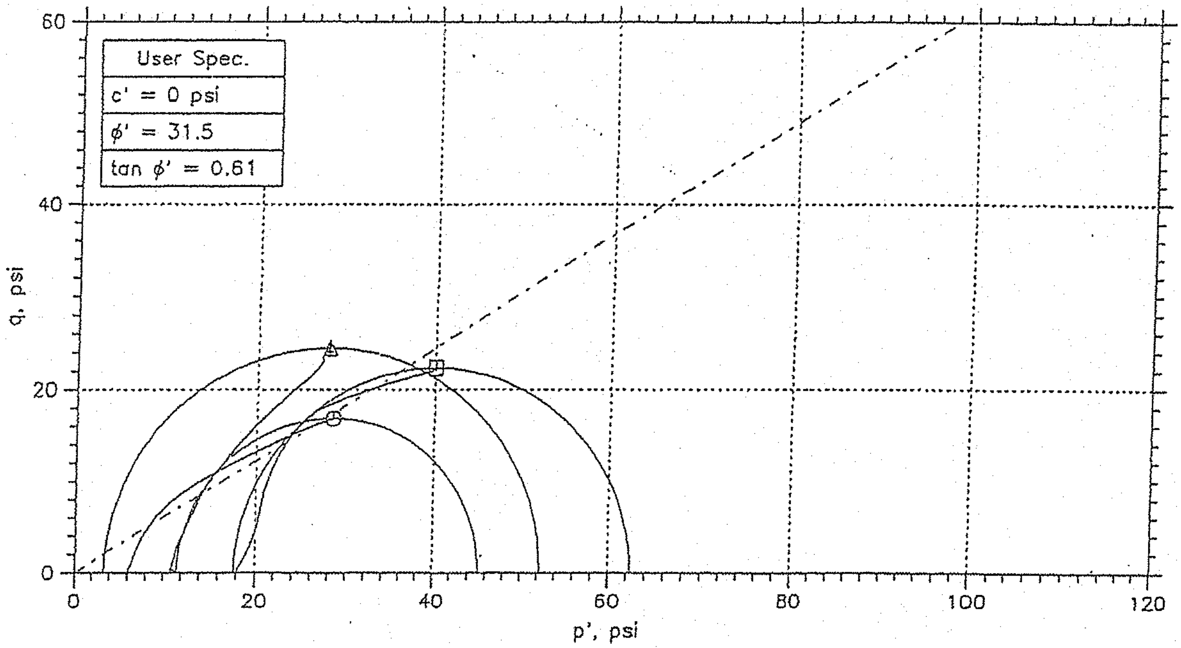
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

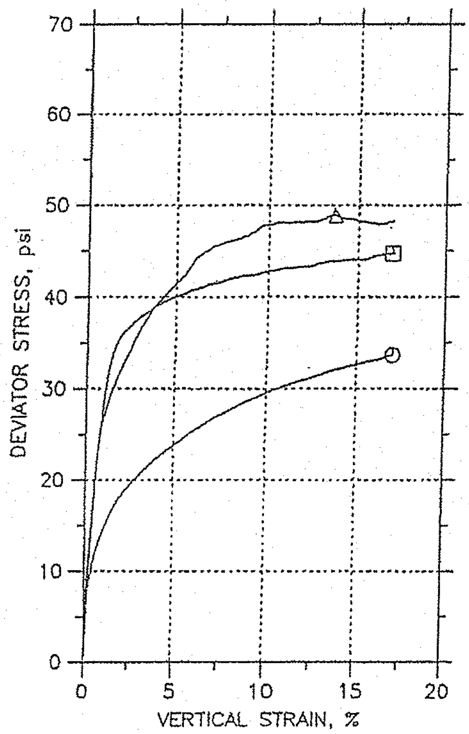
Driller: Akins
Prepared By: RDR
Checked By: Justice

MACTEC

SOIL 3043061041 01.GPJ LAW GIBB.GDT 4/25/07

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

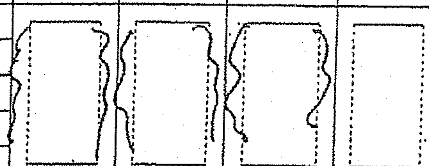




Symbol		○	△	□	
Sample No.		UD-1	UD-2	UD-3	
Test No.		7066.1	7067.2	7067.3	
Depth		5-7 ft	7-9 ft	9-11 ft	
Initial	Diameter, in	2.86	2.795	2.87	
	Height, in	5.6	5.6	6	
	Water Content, %	18.9	17.4	17.9	
	Dry Density, pcf	107.8	111.9	110.2	
	Saturation, %	90.3	92.7	91.2	
	Void Ratio	0.564	0.506	0.529	
Before Shear	Water Content, %	20.0	19.5	20.1	
	Dry Density, pcf	109.4	110.4	109.2	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.541	0.527	0.544	
	Back Press., psi	25.	20.95	35.89	
Ver. Eff. Cons. Stress, psi		6.001	11.97	17.99	
Shear Strength, psi		16.83	24.42	22.33	
Strain at Failure, %		17	13.7	16.9	
Strain Rate, %/min		0.1	0.1	0.1	
B-Value		0.96	0.97	0.97	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		45	45	45	
Plastic Limit		19	19	19	

MACTEC

Project: TVA CUF Gypsum Seepage
Location: MWA1
Project No.: 3043061041
Boring No.: MWA1
Sample Type: Shelby Tube
Description: Brown Lean Clay
Remarks:

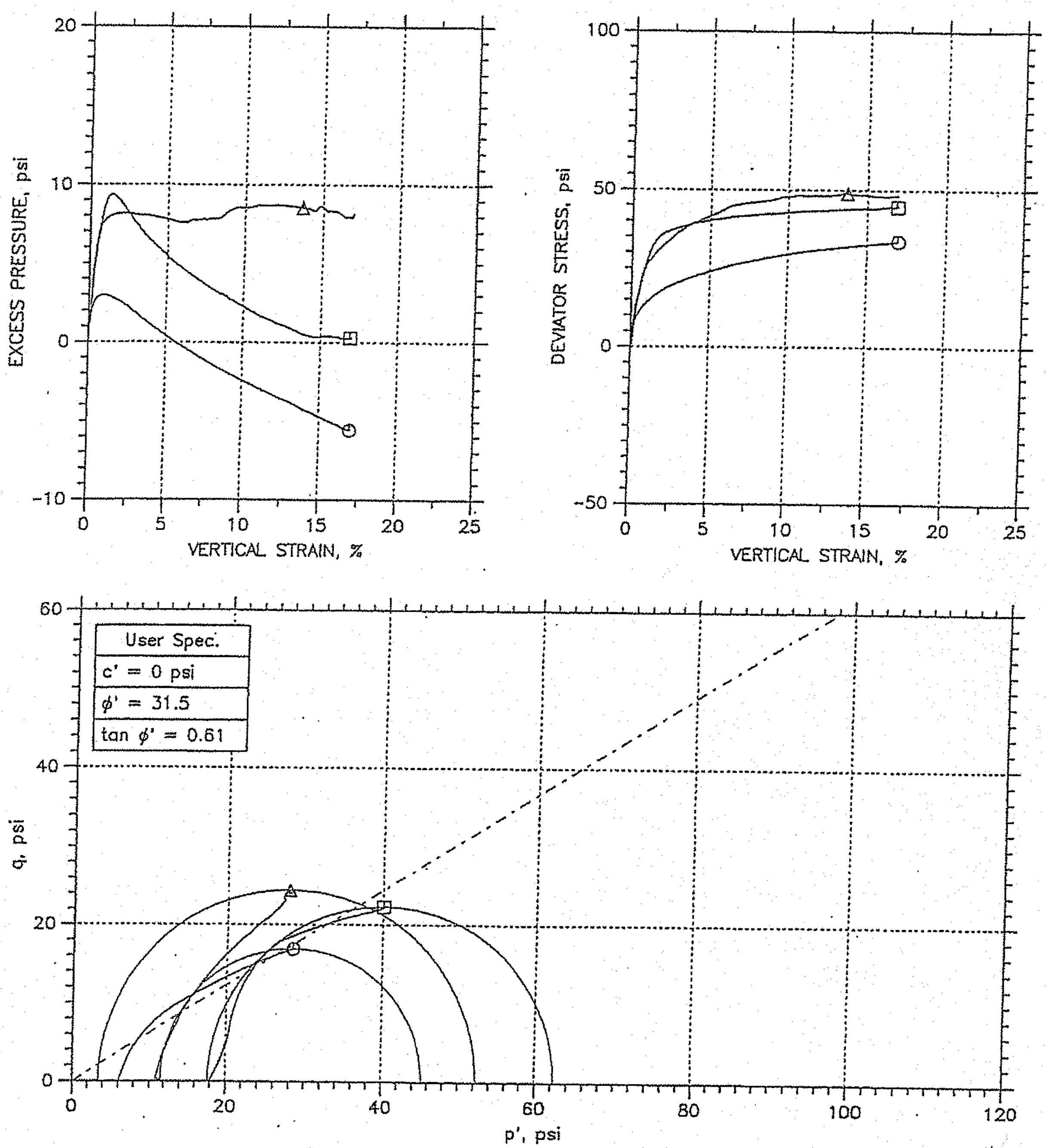


~~Phase calculations based on start and end of test.~~

* Saturation is set to 100% for phase calculations.

Mon, 16-APR-2007 08:23:40

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	UD-1	7066.1	5-7 ft	HJ	3/3/07	JL	4/13/07	7066.1a_90.dat
△	UD-2	7067.2	7-9 ft	HJ	3/3/07	JL	4/13/07	7067.2a_93.dat
□	UD-3	7067.3	9-11 ft	HJ	3/4/07	JL	4/13/07	7067.3a_96.dat

MACTEC			
	Project: TVA CUF Gypsum Seepage	Location: MWA1	Project No.: 3043061041
	Boring No.: MWA1	Sample Type: Shelby Tube	
	Description: Brown Lean Clay		
	Remarks:		

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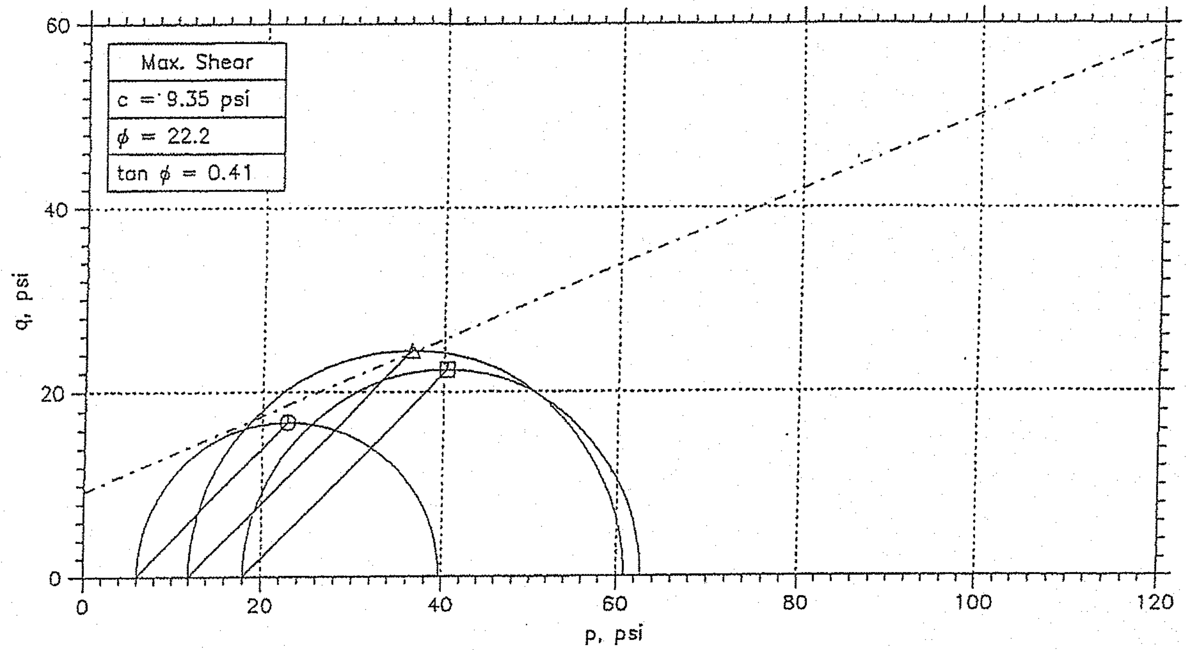
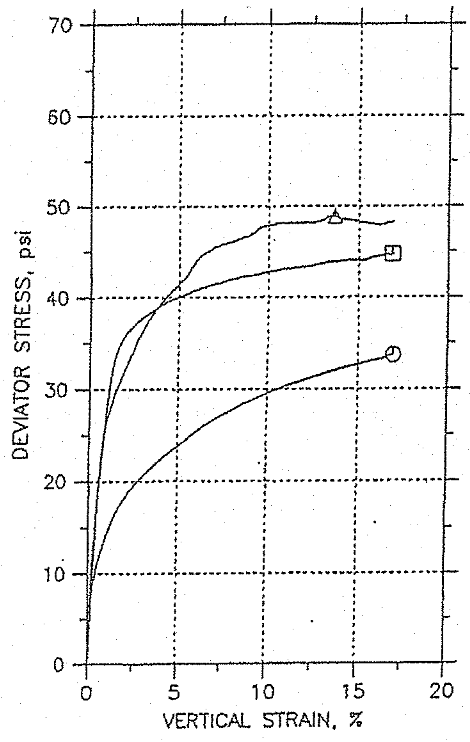
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

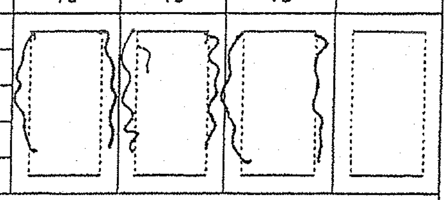




Symbol		○	△	□	
Sample No.		UD-1	UD-2	UD-3	
Test No.		7066.1	7067.2	7067.3	
Depth		5-7 ft	7-9 ft	9-11 ft	
Initial	Diameter, in	2.86	2.795	2.87	
	Height, in	5.6	5.6	6	
	Water Content, %	18.9	17.4	17.9	
	Dry Density, pcf	107.8	111.9	110.2	
	Saturation, %	90.3	92.7	91.2	
	Void Ratio	0.564	0.506	0.529	
Before Shear	Water Content, %	20.0	19.5	20.1	
	Dry Density, pcf	109.4	110.4	109.2	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.541	0.527	0.544	
	Back Press., psi	25.	20.95	35.89	
Ver. Eff. Cons. Stress, psi		6.001	11.97	17.99	
Shear Strength, psi		16.83	24.42	22.33	
Strain at Failure, %		17	13.7	16.9	
Strain Rate, %/min		0.1	0.1	0.1	
B-Value		0.96	0.97	0.97	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		45	45	45	
Plastic Limit		19	19	19	

MACTEC

Project: TVA CUF Gypsum Seepage
Location: MWA1
Project No.: 3043061041
Boring No.: MWA1
Sample Type: Shelby Tube
Description: Brown Lean Clay
Remarks:



~~Phase calculations based on start and end of test.~~

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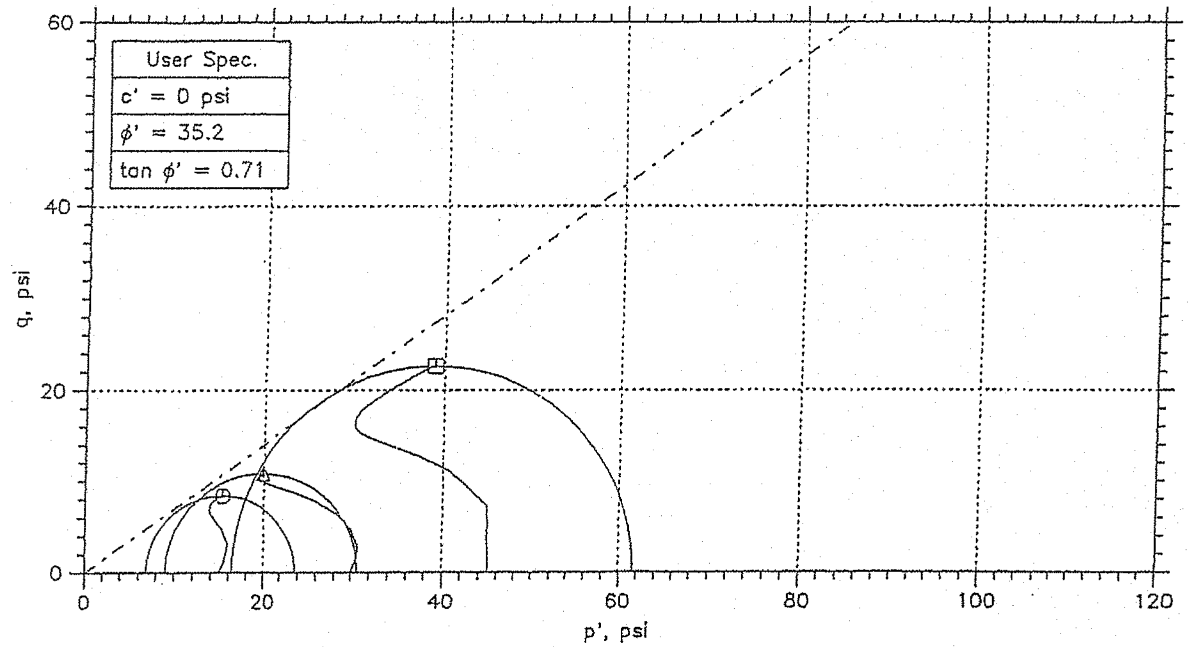
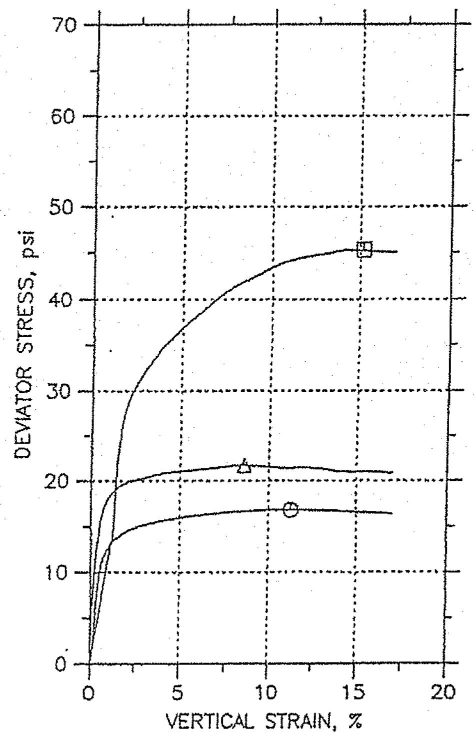
* Saturation is set to 100% for phase calculations.

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

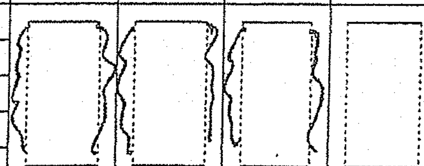




		○	△	□	
Symbol		○	△	□	
Sample No.		UD-6	UD-6	UD-6	
Test No.		7074.1	7074.2	7074.3	
Depth		22-24 ft.	22-24 ft.	22-24 ft.	
Initial	Diameter, in	2.824	2.86	2.866	
	Height, in	5.6	5.6	5.6	
	Water Content, %	25.1	24.8	23.5	
	Dry Density, pcf	100.4	98.68	102.1	
	Saturation, %	99.7	94.6	97.6	
	Void Ratio	0.679	0.708	0.651	
Before Shear	Water Content, %	23.1	22.0	19.8	
	Dry Density, pcf	103.8	105.7	109.8	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.624	0.595	0.535	
	Back Press., psi	28.93	73.99	61.01	
Ver. Eff. Cons. Stress, psi		15.	30.	44.99	
Shear Strength, psi		8.389	10.84	22.61	
Strain at Failure, %		11.3	8.55	15.2	
Strain Rate, %/min		0.1	0.1	0.1	
B-Value		0.96	0.98	0.99	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		25	25	25	
Plastic Limit		19	19	19	

MACTEC

Project: TVA CUF Gypsum Seepage
Location: MWA1
Project No.: 3043061041
Boring No.: MWA1
Sample Type: Shelby Tube
Description: Brown Silty Clay with Sand
Remarks:



Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

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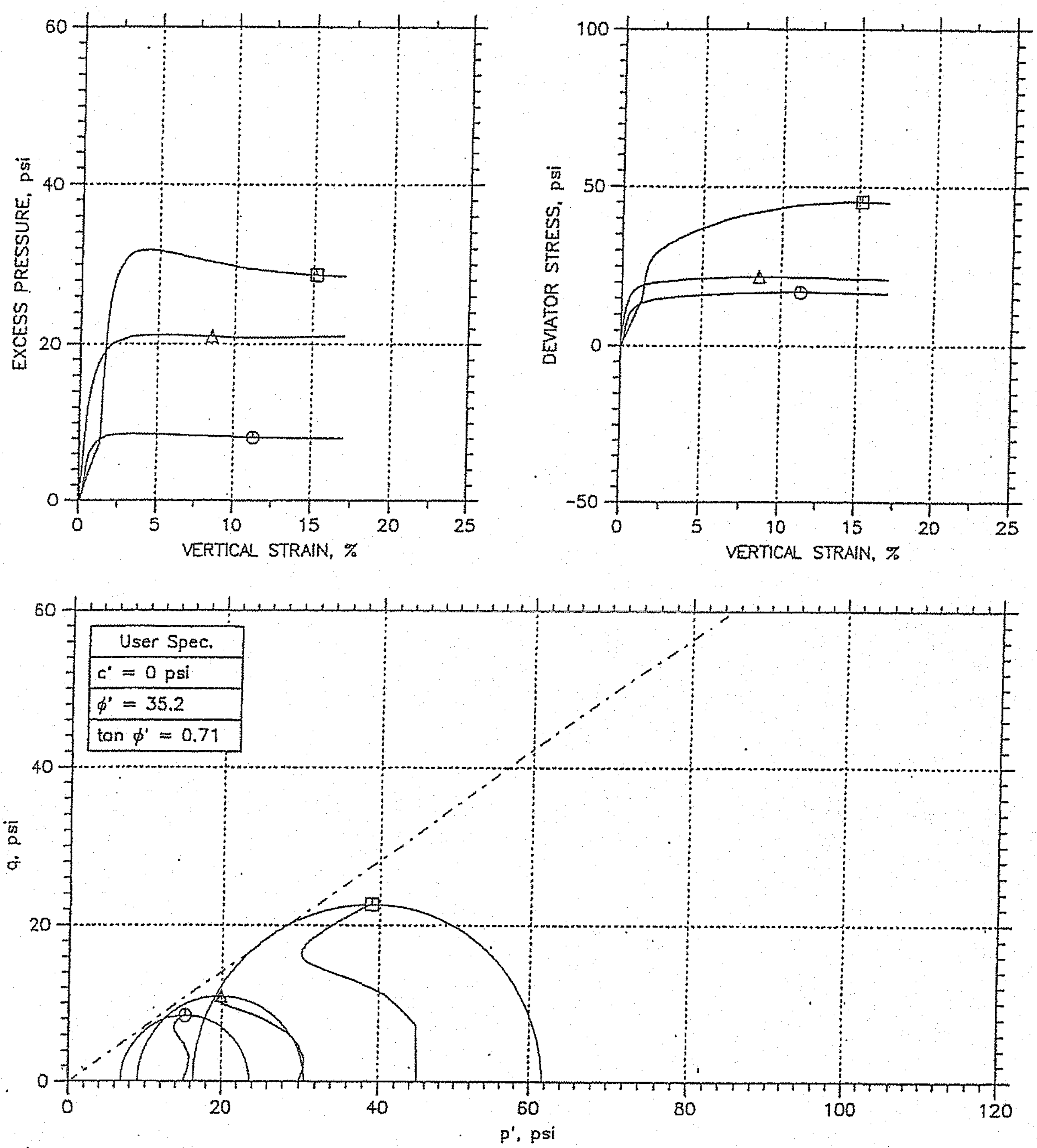
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



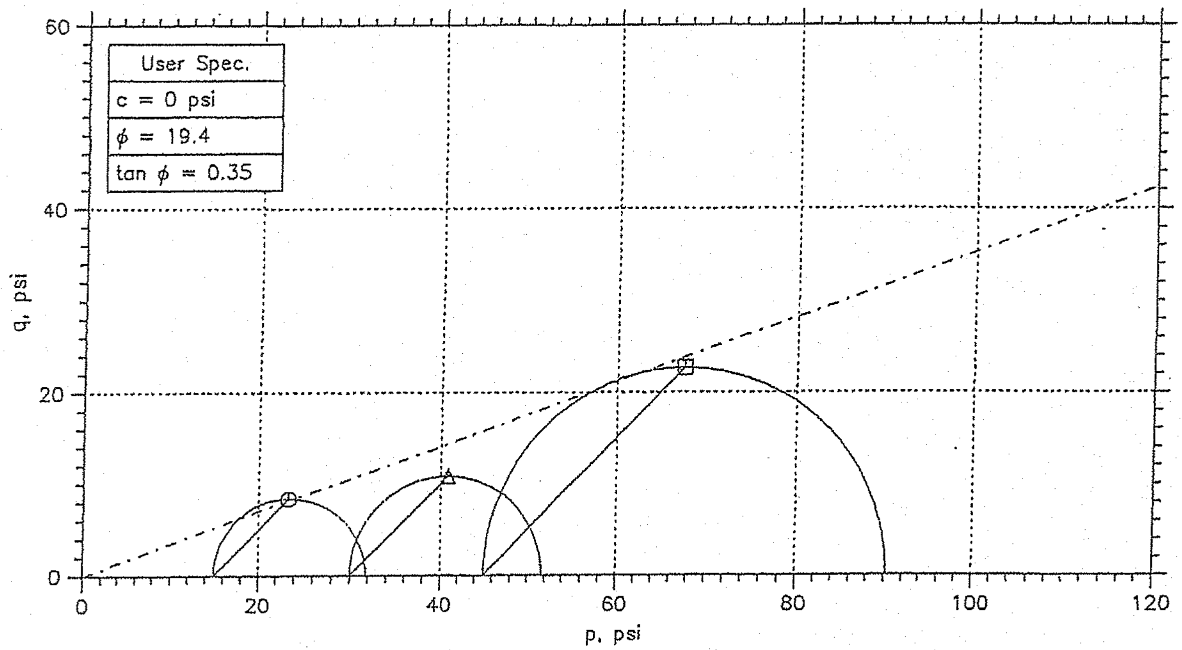
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	UD-6	7074.1	22-24 ft.	HJ	2/10/07/	JL	4/13/07	7074.1_90.dat
△	UD-6	7074.2	22-24 ft.	HJ	2/10/07	JL	4/13/07	7074.2_82.dat
□	UD-6	7074.3	22-24 ft.	HJ	2/10/07	JL	4/13/07	7074.3_65.dat

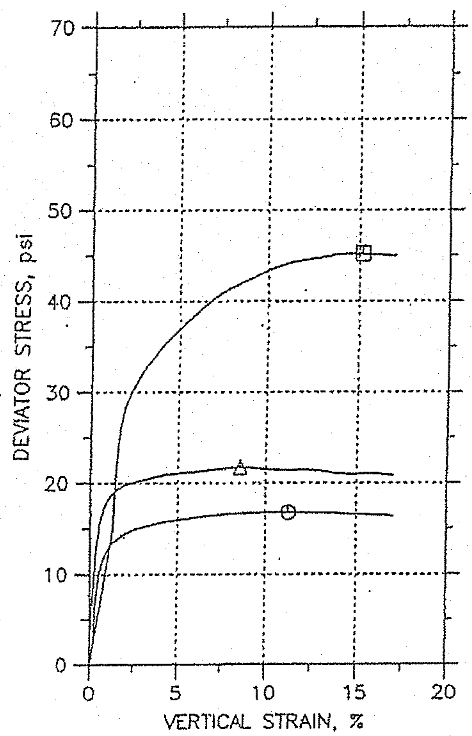
MACTEC

Project: TVA CUF Gypsum Seepage	Location: MWA1	Project No.: 3043061041
Boring No.: MWA1	Sample Type: Shelby Tube	
Description: Brown Silty Clay with Sand		
Remarks:		

Mon, 16-APR-2007 08:48:40

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

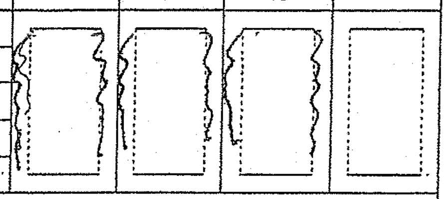




Symbol		○	△	□	
Sample No.		UD-6	UD-6	UD-6	
Test No.		7074.1	7074.2	7074.3	
Depth		22-24 ft.	22-24 ft.	22-24 ft.	
Initial	Diameter, in	2.824	2.86	2.866	
	Height, in	5.6	5.6	5.6	
	Water Content, %	25.1	24.8	23.5	
	Dry Density, pcf	100.4	98.68	102.1	
	Saturation, %	99.7	94.6	97.6	
	Void Ratio	0.679	0.708	0.651	
Before Shear	Water Content, %	23.1	22.0	19.8	
	Dry Density, pcf	103.8	105.7	109.8	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.624	0.595	0.535	
	Back Press., psi	28.93	73.99	61.01	
Ver. Eff. Cons. Stress, psi		15.	30.	44.99	
Shear Strength, psi		8.389	10.84	22.61	
Strain at Failure, %		11.3	8.55	15.2	
Strain Rate, %/min		0.1	0.1	0.1	
B-Value		0.96	0.98	0.99	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		25	25	25	
Plastic Limit		19	19	19	

MACTEC

Project: TVA CUF Gypsum Seepage
Location: MWA1
Project No.: 3043061041
Boring No.: MWA1
Sample Type: Shelby Tube
Description: Brown Silty Clay with Sand
Remarks:

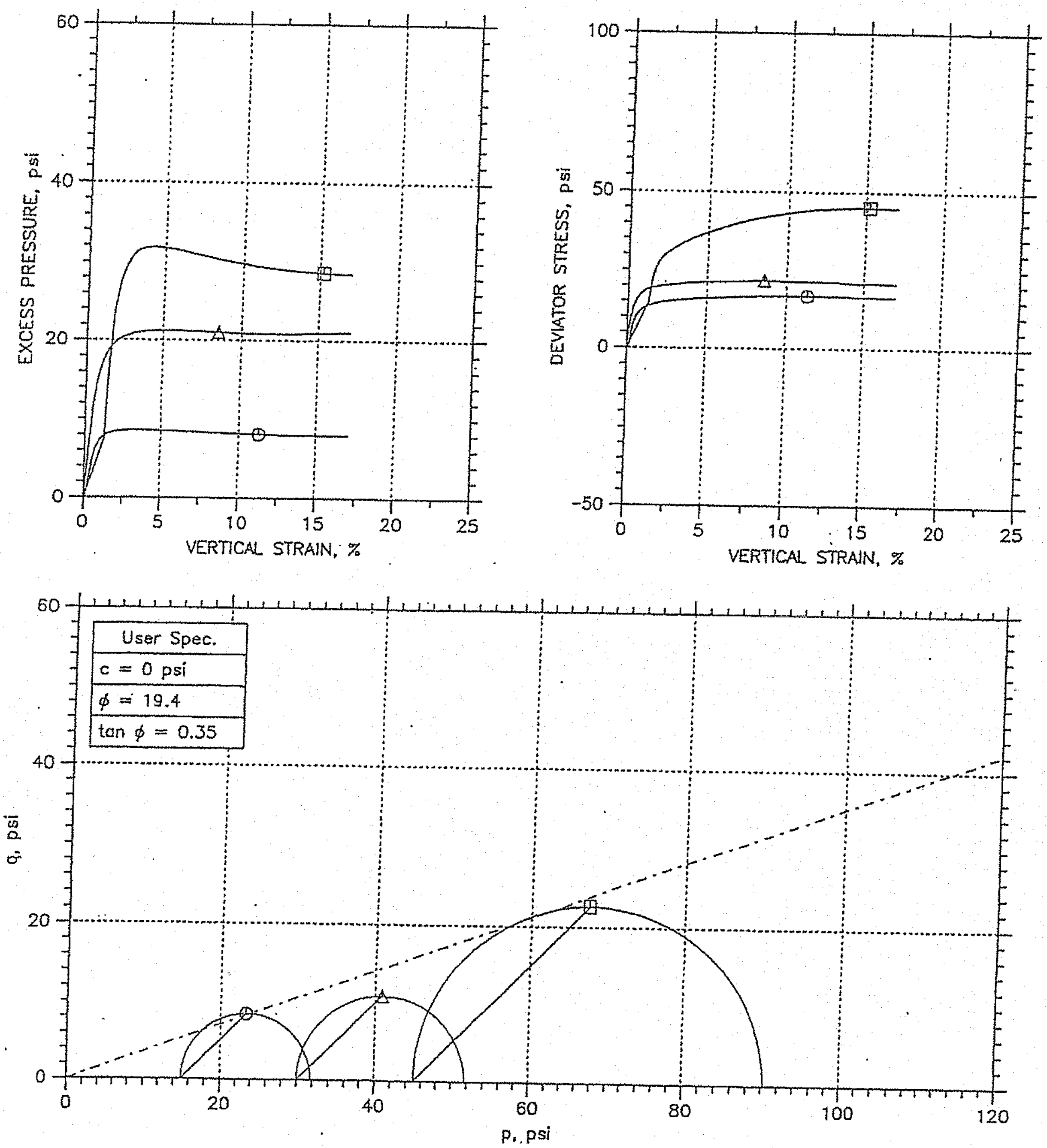


~~Phase calculations based on start and end of test.~~

Mon, 16-APR-2007 08:49:10

* Saturation is set to 100% for phase calculations.

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊖	UD-6	7074.1	22-24 ft.	HJ	2/10/07/	JL	4/13/07	7074.1_90.dat
△	UD-6	7074.2	22-24 ft.	HJ	2/10/07	JL	4/13/07	7074.2_82.dat
⊡	UD-6	7074.3	22-24 ft.	HJ	2/10/07	JL	4/13/07	7074.3_65.dat

MACTEC

Project: TVA CUF Gypsum Seepage	Location: MWA1	Project No.: 3043061041
Boring No.: MWA1	Sample Type: Shelby Tube	
Description: Brown Silty Clay with Sand		
Remarks:		

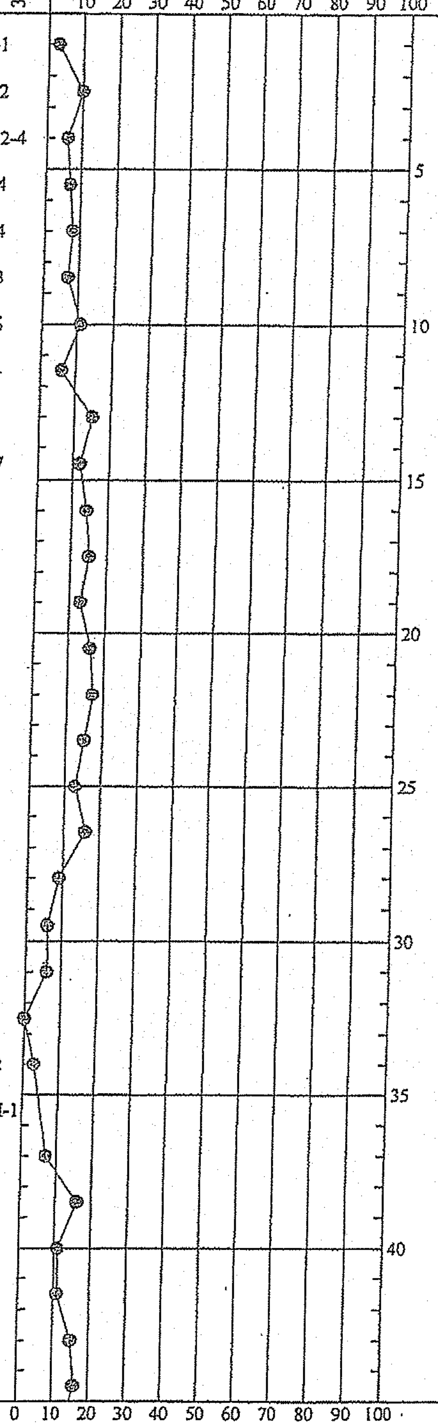
Mon, 16-APR-2007 08:49:10

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)
0	VERY LOOSE, GRAY TO BROWN, MOIST, SANDY GRAVEL - FILL	382.0
	STIFF TO FIRM, BLACK, VERY MOIST, CLAYEY SILT WITH ORGAINCS - FILL	
5	FIRM TO STIFF, ORANGISH BROWN, BROWN, AND GRAY, MOIST, SILTY CLAY WITH ROCK FRAGMENTS AND A TRACE OF SAND - FILL	377.0
10		372.0
	STIFF, REDDISH BROWN, MOIST, SILTY CLAY WITH ROCK FRAGMENTS - FILL	
15	STIFF TO VERY STIFF, GRAY TO BROWN, MOIST, SILTY CLAY WITH A LITTLE SAND AND ROCK FRAGMENTS - FILL	367.0
20		362.0
25	VERY STIFF, BROWN TO REDDISH BROWN, MOIST, SILTY CLAY WITH CHERT AND ROCK FRAGMENTS - FILL	357.0
	STIFF TO FIRM, GRAYISH BROWN TO BLACK, MOIST TO VERY MOIST, CLAYEY SILT WITH A FEW ROCK FRAGMENTS - ALLUVIUM	
30		352.0
	VERY SOFT, DARK GRAYISH BROWN, VERY MOIST, SILTY CLAY WITH A LITTLE SAND - ALLUVIUM ▽	
	VERY LOOSE TO LOOSE, BROWN, WET, SILTY SAND - ALLUVIUM	
35		347.0
	FIRM, ORANGISH BROWN, WET, SILTY SAND WITH GRAVEL - ALLUVIUM	
40		342.0
	FIRM, ORANGISH BROWN TO BROWN, WET, SANDY GRAVEL WITH A LITTLE SILT - ALLUVIUM	
45		337.0

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.

SAMPLES IDENT	N-COUNT (1st 6" 2nd 6" 3rd 6")
SPT-1	1-2-1
SPT-2	5-8-2
SPT-3	WOH-2-4
SPT-4	1-3-4
SPT-5	2-4-4
SPT-6	3-4-3
SPT-7	2-5-6
SPT-8	5-2-4
SPT-9	5-7-8
SPT-10	10-5-7
SPT-11	4-7-7
SPT-12	5-7-8
SPT-13	5-6-7
SPT-14	3-9-7
SPT-15	5-6-11
SPT-16	6-7-8
SPT-17	4-5-8
SPT-18	5-6-10
SPT-19	4-4-5
SPT-20	2-3-3
SPT-21	2-3-3
SPT-22	WOH
SPT-23	WOH-1-2
SPT-24	WOH-WOH-1
SPT-25	1-3-4
SPT-26	2-7-9
SPT-27	8-6-5
SPT-28	4-6-5
SPT-29	4-7-8
SPT-30	7-8-8

PL (%) NM (%) LL (%)
▲ FINES (%)
⊗ SPT (bpf)



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. GROUNDWATER WAS MEASURED WITHIN THE BOREHOLE AT A DEPTH OF ABOUT 20' AT THE TERMINATION OF THE BORING.

SOIL TEST BORING RECORD

PROJECT: TVA CUF Gypsum Seepage Study

DRILLED: December 6, 2006 **BORING NO.:** A-2

PROJ. NO.: 3043061041/0001 **PAGE** 1 **OF** 2

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

Driller : Akins
Prepared By: RDR
Checked By: Justice

MACTEC

SOIL 3043061041 01.GPJ LAW GIBB.GDT 4/25/07

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS (SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.)	ELEV (ft)	SAMPLES IDENT	N-COUNT (1st 6" / 2nd 6" / 3rd 6")
45	FIRM, ORANGISH BROWN TO BROWN, WET, SANDY GRAVEL WITH A LITTLE SILT - ALLUVIUM	337.0	SPT-31	7-7-6
	VERY FIRM TO FIRM, ORANGISH BROWN, WET, SILTY SAND WITH GRAVEL - ALLUVIUM		SPT-32	7-13-11
			SPT-33	7-12-7-11
50	BORING TERMINATED AT 50.0'	332.0		
55		327.0		
60		322.0		
65		317.0		
70		312.0		
75		307.0		
80		302.0		
85		297.0		
90		292.0		

PL (%) NM (%) LL (%)
▲ FINES (%)
⊗ SPT (bpf)
10 20 30 40 50 60 70 80 90 100

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. GROUNDWATER WAS MEASURED WITHIN THE BOREHOLE AT A DEPTH OF ABOUT 20' AT THE TERMINATION OF THE BORING.

SOIL TEST BORING RECORD

PROJECT: TVA CUF Gypsum Seepage Study

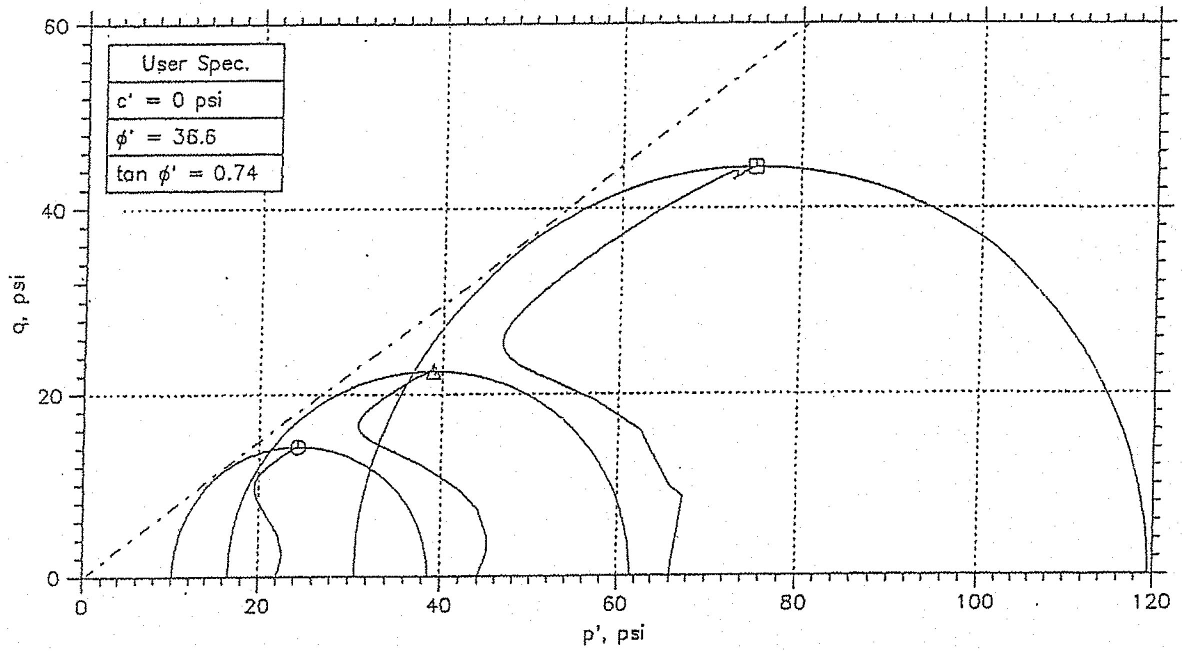
DRILLED: December 6, 2006 **BORING NO.:** A-2

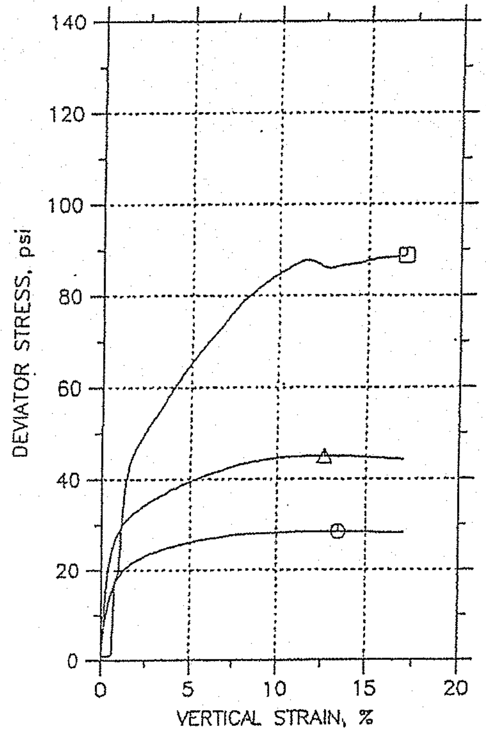
PROJ. NO.: 3043061041/0001

Driller : Akins
Prepared By: RDR
Checked By: Justice

MACTEC

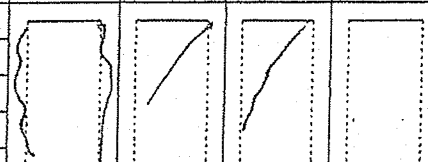
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		UD-6	UD-6	UD-6	
Test No.		7071.1	7074.2	7071.3	
Depth		32-34 ft	32-34 ft.	32-34 ft.	
Initial	Diameter, in	2.837	2.861	2.855	
	Height, in	5.6	5.6	5.6	
	Water Content, %	22.2	22.8	22.1	
	Dry Density, pcf	103.5	105.	106.6	
	Saturation, %	95.4	101.9	102.6	
	Void Ratio	0.629	0.605	0.582	
Before Shear	Water Content, %	22.8	23.4	21.8	
	Dry Density, pcf	104.4	103.3	106.	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.615	0.632	0.59	
	Back Press., psi	71.99	81.99	60.98	
Ver. Eff. Cons. Stress, psi		22.	44.01	66.01	
Shear Strength, psi		14.22	22.5	44.36	
Strain at Failure, %		13.5	12.7	17	
Strain Rate, %/min		0.1	0.1	0.1	
B-Value		0.98	0.98	0.99	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		24	24	24	
Plastic Limit		20	20	20	

MACTEC	Project: TVA CUF Gypsum Deepage
	Location: MWA2
	Project No.: 3043061041
	Boring No.: MWA2
	Sample Type: Shelby Tube
	Description: Brown Sandy Silty Clay
	Remarks:



Phase calculations based on start and end of test.

* Saturation is set to 100% for phase calculations.

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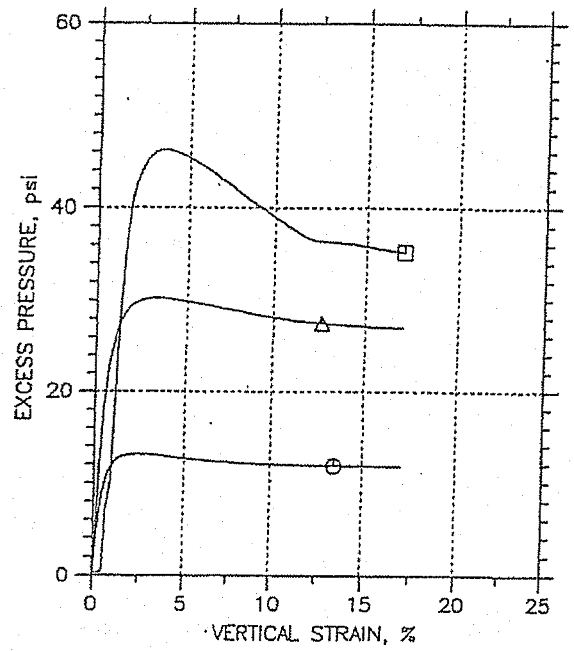
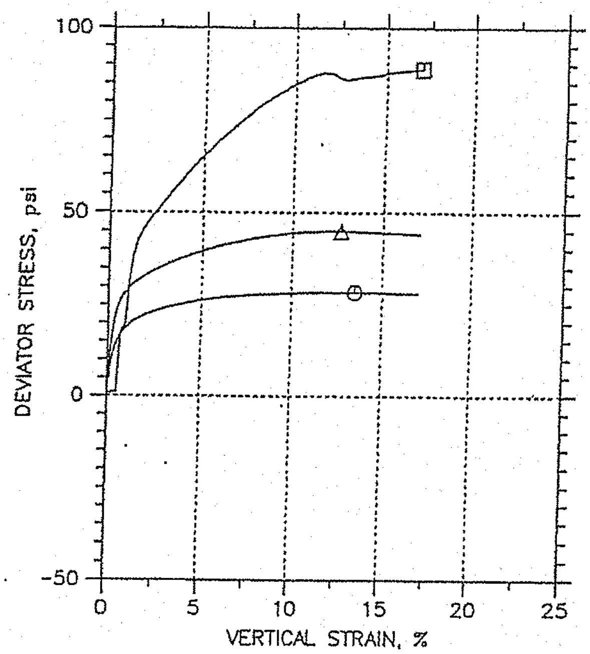
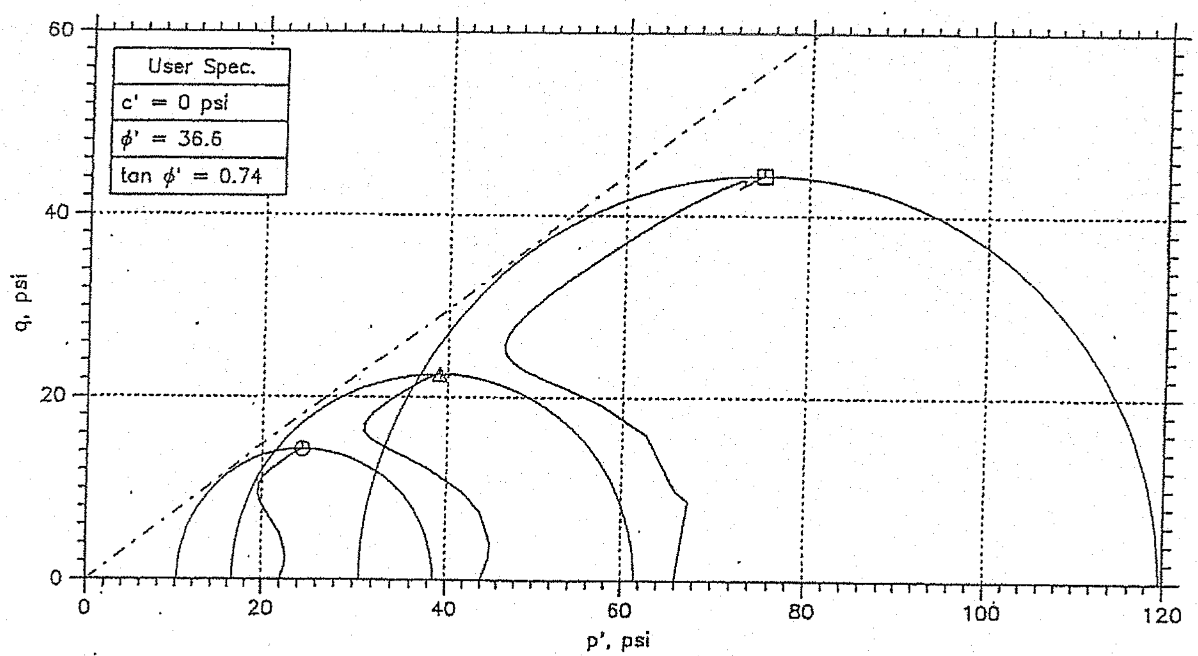
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	UD-6	7071.1	32-34 ft	HJ	2/15/07	JL	4/13/07	7071.1_71.dat
△	UD-6	7074.2	32-34 ft.	HJ	2/15/07	JL	4/13/07	7071.2_82.dat
□	UD-6	7071.3	32-34 ft.	HJ	2/16/07	JL	4/13/07	7071.3_65.dat

MACTEC		
Project: TVA CUF Gypsum Deepage	Location: MWA2	Project No.: 3043061041
Boring No.: MWA2	Sample Type: Shelby Tube	
Description: Brown Sandy Silty Clay		
Remarks:		

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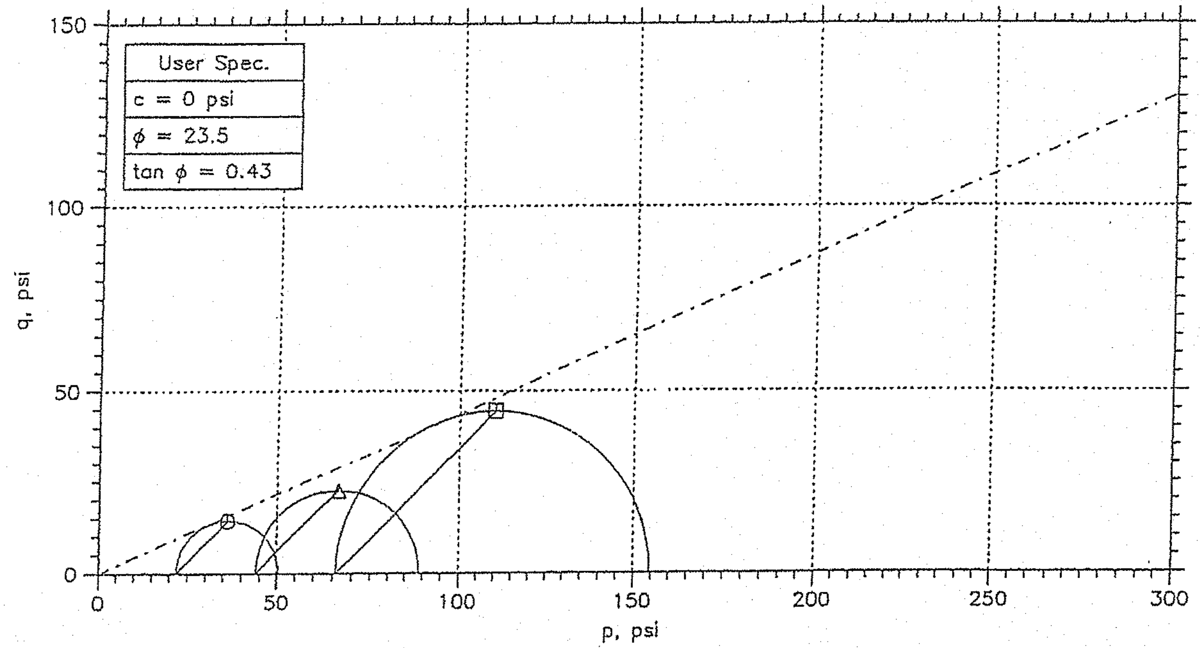
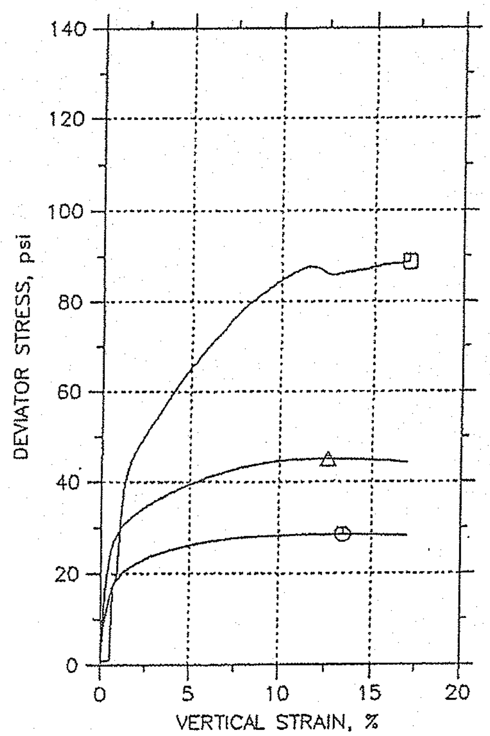
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

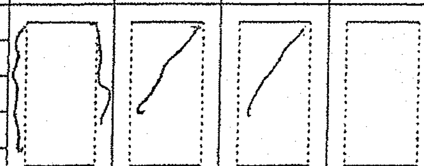




Symbol		⊙	△	⊡	
Sample No.		UD-6	UD-6	UD-6	
Test No.		7071.1	7074.2	7071.3	
Depth		32-34 ft	32-34 ft.	32-34 ft.	
Initial	Diameter, in	2.837	2.861	2.855	
	Height, in	5.6	5.6	5.6	
	Water Content, %	22.2	22.8	22.1	
	Dry Density, pcf	103.5	105.	106.6	
	Saturation, %	95.4	101.9	102.6	
	Void Ratio	0.629	0.605	0.582	
Before Shear	Water Content, %	22.8	23.4	21.8	
	Dry Density, pcf	104.4	103.3	106.	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.615	0.632	0.59	
	Back Press., psi	71.99	81.99	60.98	
Ver. Eff. Cons. Stress, psi		22.	44.01	66.01	
Shear Strength, psi		14.22	22.5	44.36	
Strain at Failure, %		13.5	12.7	17	
Strain Rate, %/min		0.1	0.1	0.1	
B-Value		0.98	0.98	0.99	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		24	24	24	
Plastic Limit		20	20	20	

MACTEC

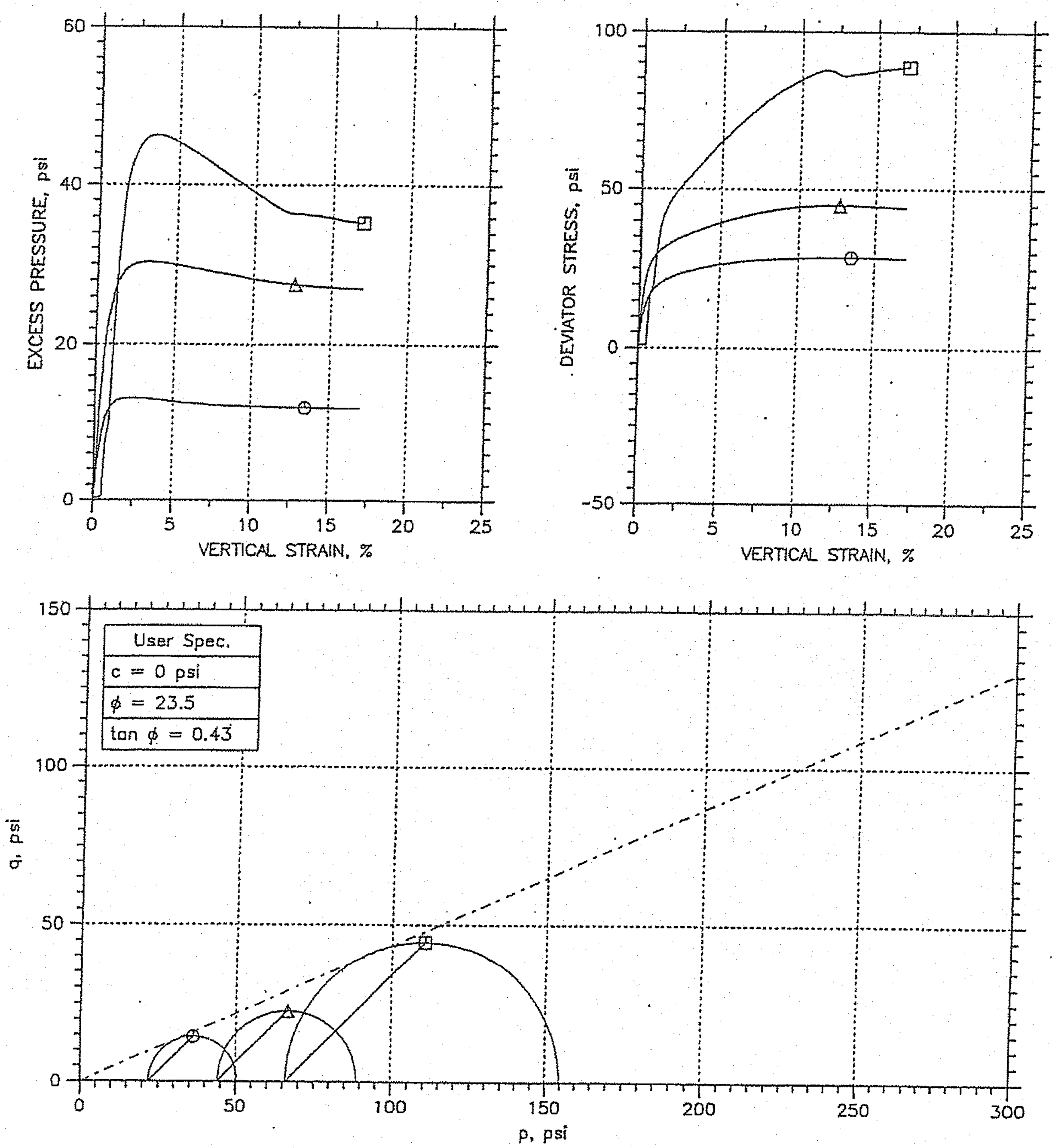
Project: TVA CUF Gypsum Deepage
Location: MWA2
Project No.: 3043061041
Boring No.: MWA2
Sample Type: Shelby Tube
Description: Brown Sandy Silty Clay
Remarks:



Mon, 16-APR-2007 08:41:19

~~Phase calculations based on start and end of test.~~
* Saturation is set to 100% for phase calculations.

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	UD-6	7071.1	32-34 ft	HJ	2/15/07	JL	4/13/07	7071.1_71.dat
△	UD-6	7074.2	32-34 ft.	HJ	2/15/07	JL	4/13/07	7071.2_82.dat
⊡	UD-6	7071.3	32-34 ft.	HJ	2/16/07	JL		7071.3_65.dat

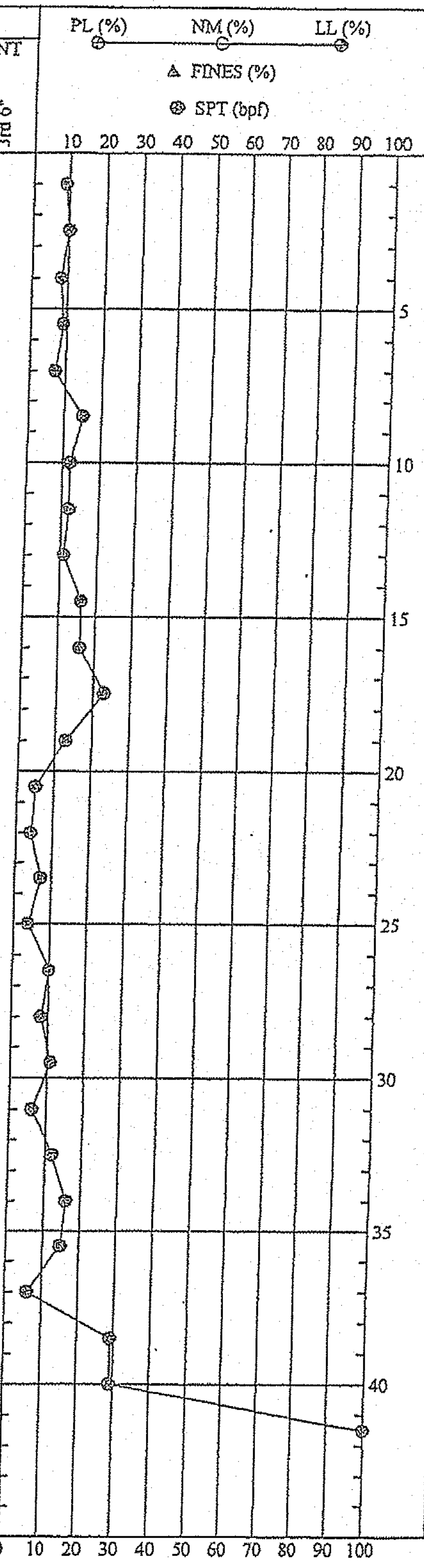
MACTEC	Project: TVA CUF Gypsum Deepage	Location: MWA2	Project No.: 3043061041
	Boring No.: MWA2	Sample Type: Shelby Tube	
	Description: Brown Sandy Silty Clay		
	Remarks:		

Mon, 16-APR-2007 08:41:19

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)
0	LOOSE, GRAY TO BROWN, MOIST, GRAVEL WITH SILTY SAND - FILL	395.0
	STIFF TO FIRM, REDDISH BROWN, MOIST, SILTY CLAY WITH LITTLE SAND AND ROCK FRAGMENTS - FILL	
5		390.0
	STIFF, TAN TO YELLOW BROWN, MOIST, SILTY CLAY WITH LITTLE SAND AND ROCK FRAGMENTS - FILL	
10		385.0
15	FIRM TO VERY FIRM, BLACK TO BROWN, MOIST TO WET, BOTTOM ASH	380.0
	LOOSE TO VERY LOOSE, BLACK TO BROWN, WET, BOTTOM ASH	
20		375.0
25	STIFF TO FIRM, REDDISH BROWN TO GRAY, MOIST, SILTY CLAY WITH A TRACE OF SAND AND CHERT FRAGMENTS - FILL	370.0
	FIRM TO STIFF, REDDISH BROWN TO GRAY, MOIST, SILTY CLAY WITH ROUNDED GRAVEL - POSSIBLE ALLUVIUM	
30		365.0
	VERY STIFF, BROWN TO GRAY, MOIST, SILTY CLAY - POSSIBLE ALLUVIUM	
35	STIFF TO FIRM, BROWN TO GRAY, VERY MOIST, SILTY CLAY WITH CALCAREOUS SHALE ROCK FRAGMENTS - POSSIBLE ALLUVIUM	360.0
	VERY STIFF, BROWN TO GRAY, VERY MOIST TO WET, SILTY CLAY WITH ROCK FRAGMENTS - POSSIBLE ALLUVIUM	
40		355.0
	VERY HARD, GRAY, WET, CLAYEY SILT WITH CALCAREOUS SHALE ROCK FRAGMENTS - POSSIBLE ALLUVIUM	
	AUGER REFUSAL AT 41.8'	
45		350.0

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.

SAMPLES IDENT	N-COUNT (1st 6" / 2nd 6" / 3rd 6")
SPT-1	9-4-5
SPT-2	4-5-5
SPT-3	3-3-5
SPT-4	4-3-6
SPT-5	3-3-4
SPT-6	7-6-9
SPT-7	4-4-8
SPT-8	7-6-6
SPT-9	3-5-6
SPT-10	6-8-8
SPT-11	5-6-10
SPT-12	15-12-11
SPT-13	3-6-7
SPT-14	4-2-3
SPT-15	2-2-2
SPT-16	2-3-4
SPT-17	3-2-2
SPT-18	3-5-5
SPT-19	3-4-4
SPT-20	2-5-6
SPT-21	1-2-4
SPT-22	3-5-7
SPT-23	5-8-8
SPT-24	2-6-9
SPT-25	2-3-3
SPT-26	7-18-11
SPT-27	15-19-10
SPT-28	6-13-50/0.2



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. DRILLER REPORTED GROUNDWATER STABILIZING WITHIN THE BOREHOLE AT A DEPTH OF ABOUT 8' AFTER SAMPLING THE SUBMERGED ZONE AT A DEPTH OF ABOUT 17.3'.

SOIL TEST BORING RECORD

PROJECT: TVA CUF Gypsum Seepage Study

DRILLED: November 28, 2006 **BORING NO.:** A-3

PROJ. NO.: 3043061041/0001 **PAGE** 1 **OF** 1

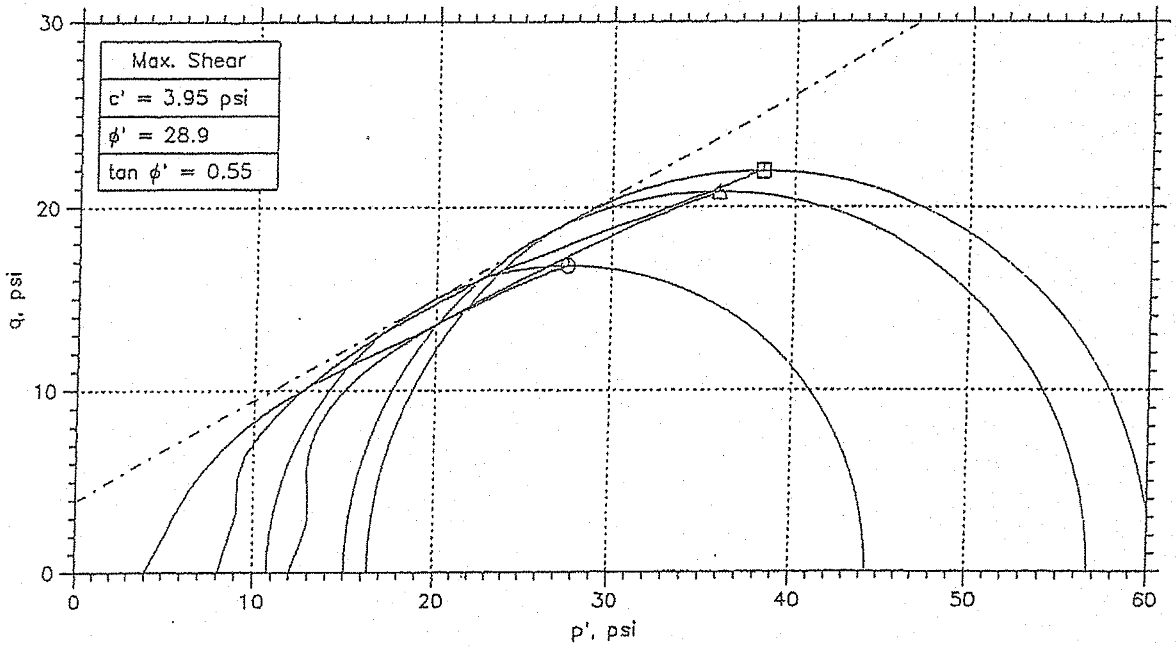
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

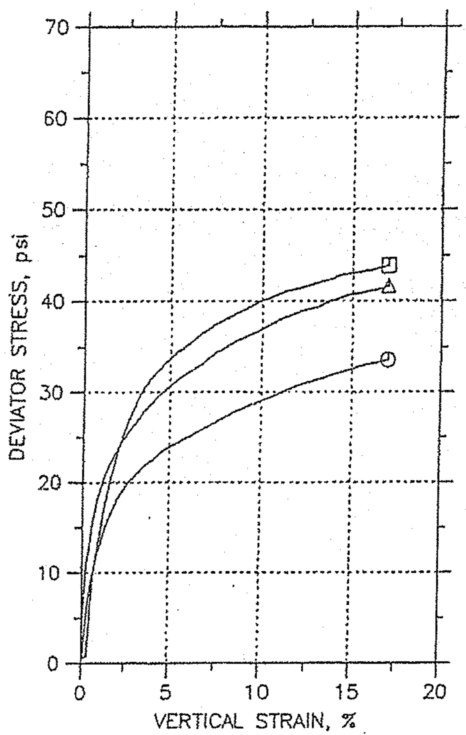
Driller: Akins
Prepared By: RDR
Checked By: Justice

MACTEC

SOIL 3043061041 01.GPJ LAW_GIBB.GDT 4/25/07

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

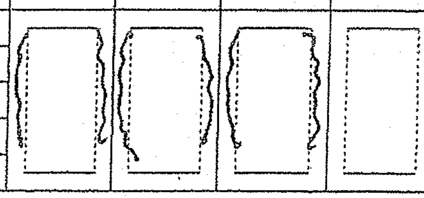




Symbol		○	△	□	
Sample No.		UD-2	UD-2	UD-2	
Test No.		7065.1	7064.3	7065.2	
Depth		7-9 ft.	5-7 ft.	7-9 ft.	
Initial	Diameter, in	2.867	2.861	2.862	
	Height, in	6	6	5.6	
	Water Content, %	21.0	19.1	20.2	
	Dry Density, pcf	104.2	109.1	108.1	
	Saturation, %	91.9	94.5	97.8	
	Void Ratio	0.618	0.546	0.559	
Before Shear	Water Content, %	23.0	19.9	21.7	
	Dry Density, pcf	103.9	109.6	106.3	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.622	0.538	0.586	
	Back Press., psi	53.94	80.99	110.9	
Ver. Eff. Cons. Stress, psi		4.	12.	7.996	
Shear Strength, psi		16.78	20.83	21.95	
Strain at Failure, %		17	17	17	
Strain Rate, %/min		0.1	0.1	0.1	
B-Value		0.97	0.98	0.96	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		45	45	45	
Plastic Limit		19	19	19	

MACTEC

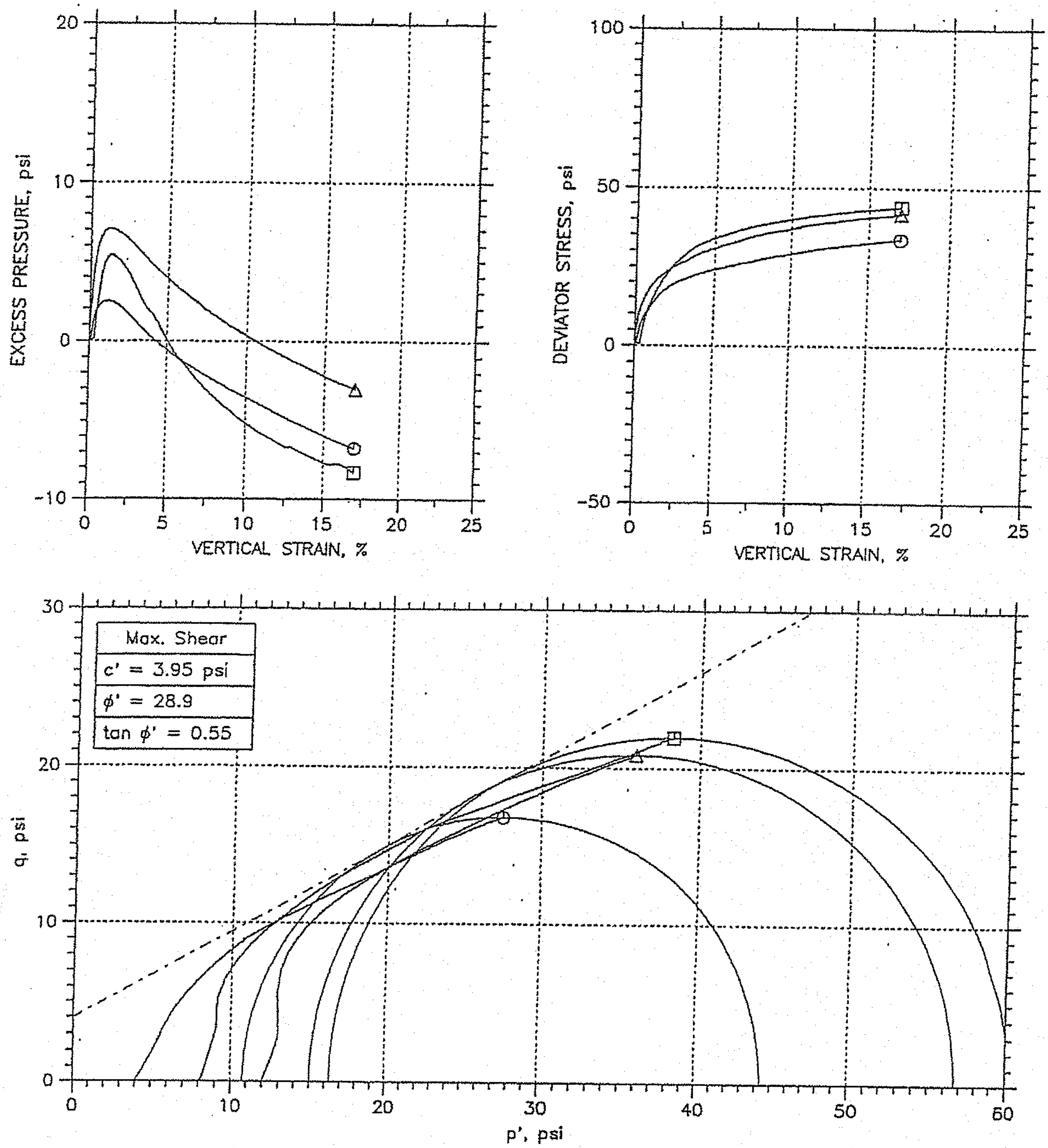
Project: TVA CUF Gypsum Seepage
Location: MWA3
Project No.: 3043061041
Boring No.: MWA3
Sample Type: Shelby Tube
Description: Brown Lean Clay
Remarks:



Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

Mon, 16-APR-2007 08:15:55

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



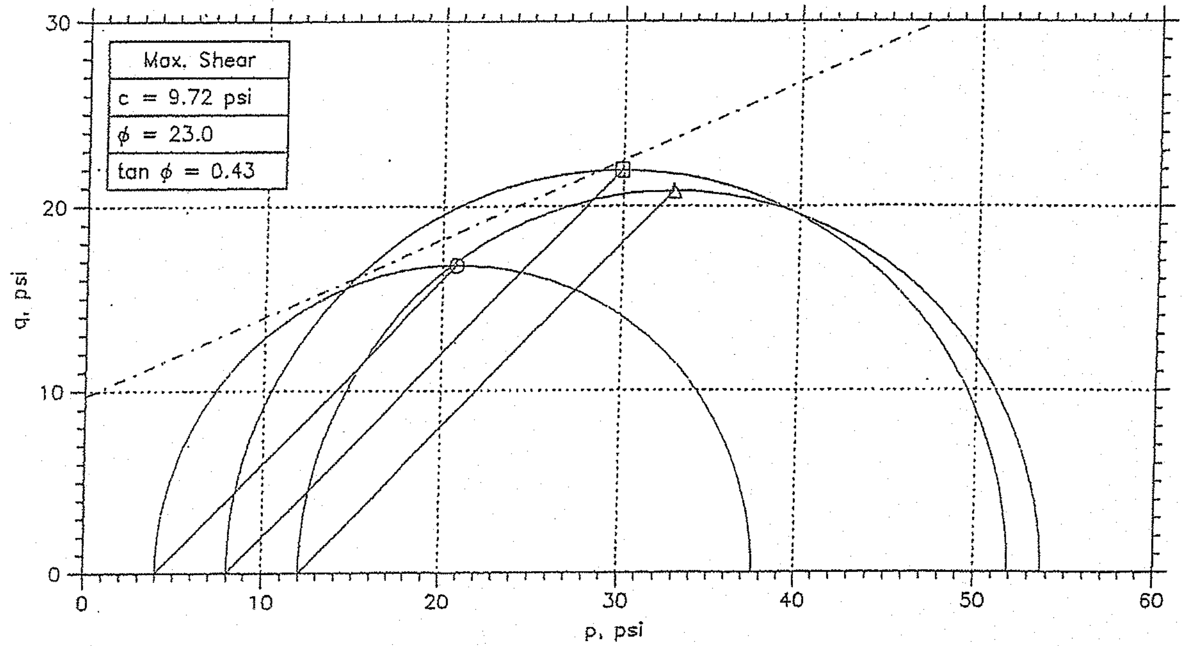
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	UD-2	7065.1	7-9 ft.	HJ	2/18/07	JL	4/13/07	7065.1_82.dat
△	UD-2	7064.3	5-7 ft.	HJ	2/18/07	JL	4/13/07	7064.3_71.dat
□	UD-2	7065.2	7-9 ft.	HJ	2/18/07	JL	4/13/07	7065.2_65.dat

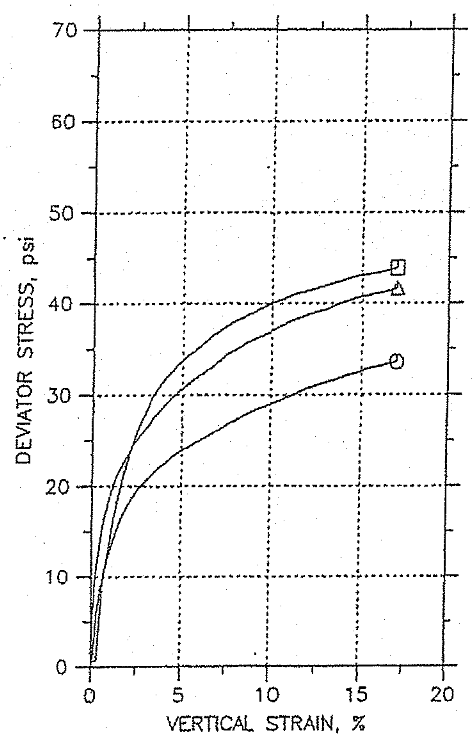
MACTEC

Project: TVA CUF Gypsum Seepage	Location: MWA3	Project No.: 3043061041
Boring No.: MWA3	Sample Type: Shelby Tube	
Description: Brown Lean Clay		
Remarks:		

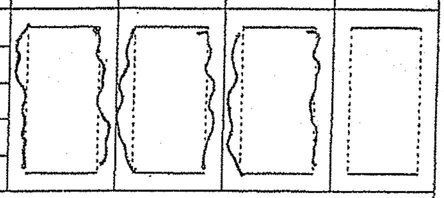
Mon, 16-APR-2007 08:15:55

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Symbol	○	△	□	
	Sample No.	UD-2	UD-2	UD-2	
	Test No.	7065.1	7064.3	7065.2	
	Depth	7-9 ft.	5-7 ft.	7-9 ft.	
Initial	Diameter, in	2.867	2.861	2.862	
	Height, in	6	6	5.6	
	Water Content, %	21.0	19.1	20.2	
	Dry Density, pcf	104.2	109.1	108.1	
	Saturation, %	91.9	94.5	97.8	
	Void Ratio	0.618	0.546	0.559	
Before Shear	Water Content, %	23.0	19.9	21.7	
	Dry Density, pcf	103.9	109.6	106.3	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.622	0.538	0.586	
	Back Press., psi	53.94	80.99	110.9	
	Ver. Eff. Cons. Stress, psi	4.	12.	7.996	
	Shear Strength, psi	16.78	20.83	21.95	
	Strain at Failure, %	17	17	17	
	Strain Rate, %/min	0.1	0.1	0.1	
	B-Value	0.97	0.98	0.96	
	Estimated Specific Gravity	2.7	2.7	2.7	
	Liquid Limit	45	45	45	
	Plastic Limit	19	19	19	



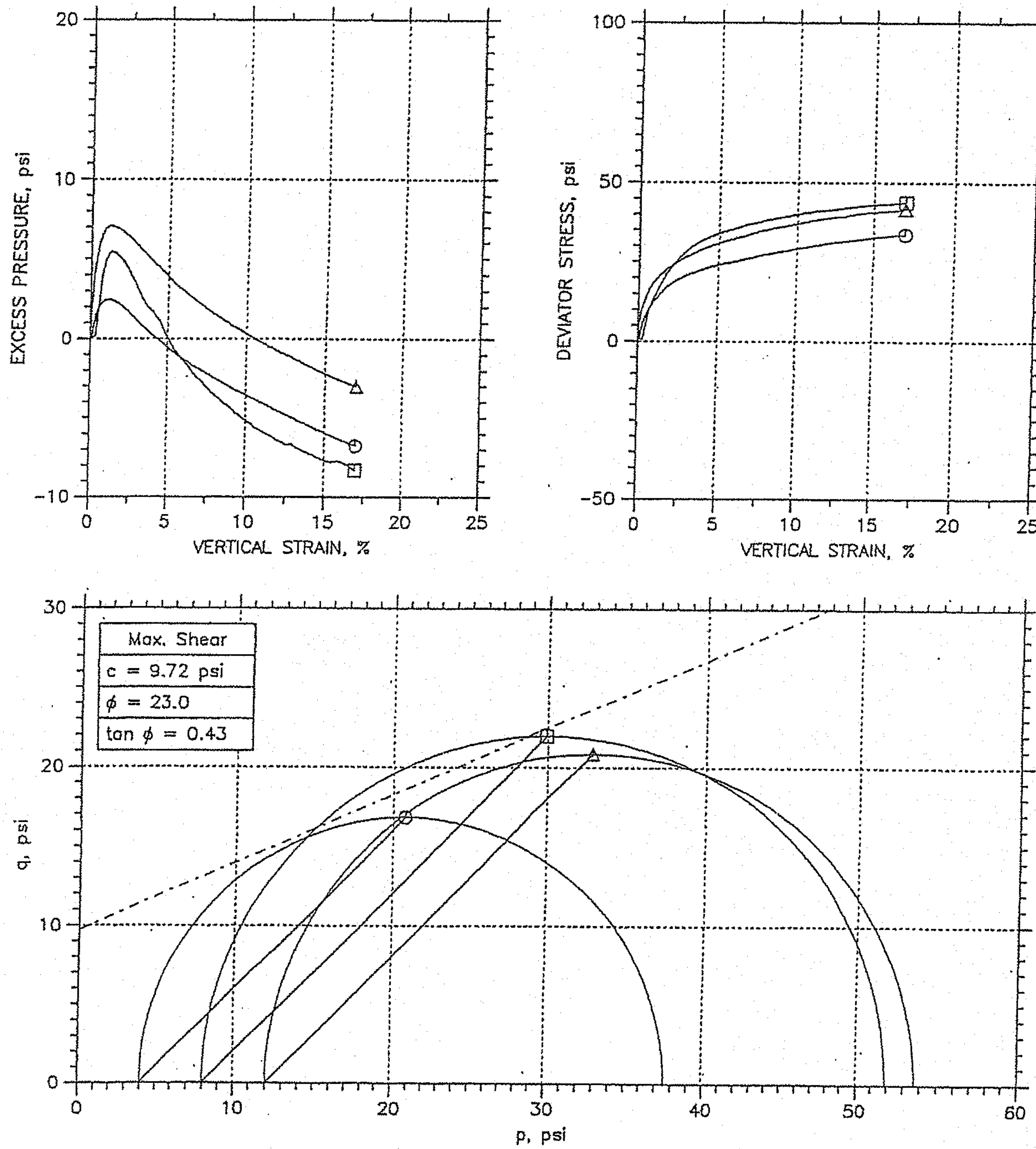
MACTEC

Project: TVA CUF Gypsum Seepage
Location: MWA3
Project No.: 3043061041
Boring No.: MWA3
Sample Type: Shelby Tube
Description: Brown Lean Clay
Remarks:

Mon, 16-APR-2007 08:16:06

Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
ʘ	UD-2	7065.1	7-9 ft.	HJ	2/18/07	JL	4/13/07	7065.1_82.dat
Δ	UD-2	7064.3	5-7 ft.	HJ	2/18/07	JL	4/13/07	7064.3_71.dat
⊡	UD-2	7065.2	7-9 ft.	HJ	2/18/07	JL	4/13/07	7065.2_65.dat

MACTEC

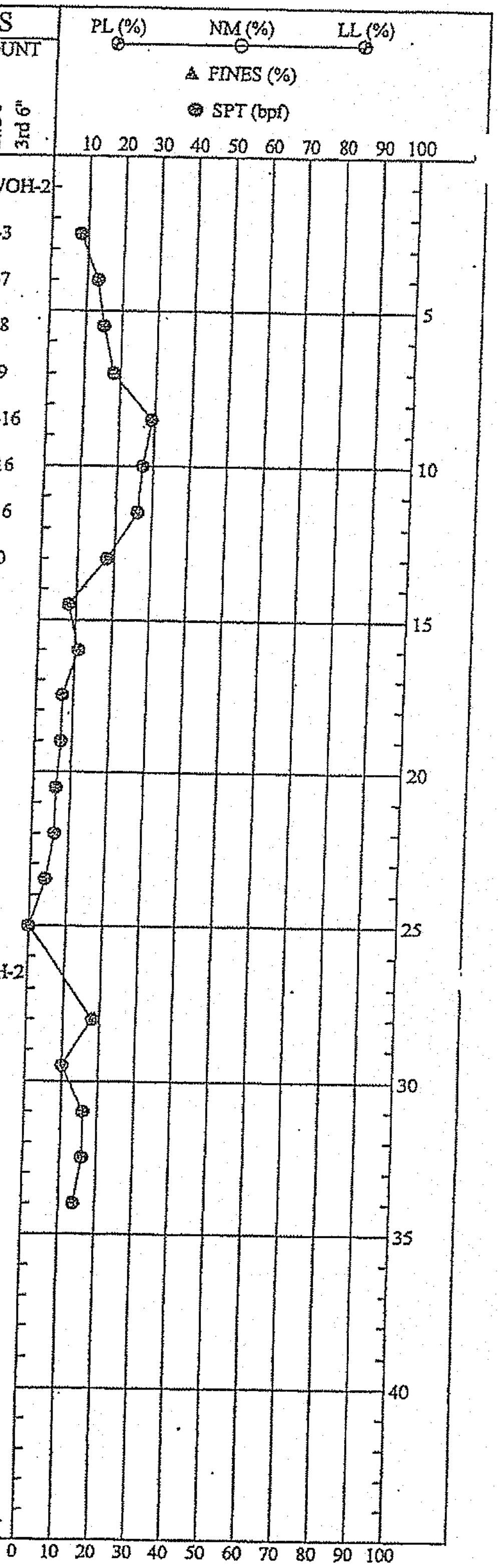
Project: TVA CUF Gypsum Seepage	Location: MWA3	Project No.: 3043061041
Boring No.: MWA3	Sample Type: Shelby Tube	
Description: Brown Lean Clay		
Remarks:		

Mon, 16-APR-2007 08:16:06

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)
0	VERY SOFT, MOIST, CLAYEY SILT WITH FINE ROOTS - FILL	371.5
	FIRM TO STIFF, BROWN, MOIST TO SLIGHTLY MOIST, SILTY CLAY WITH OCCASIONAL CHERT AND LIMESTONE GRAVEL - FILL	
5	STIFF, YELLOWISH BROWN, DRY TO SLIGHTLY MOIST, SILTY CLAY WITH OCCASIONAL GRAVEL - FILL	366.5
	VERY STIFF, DARK YELLOWISH BROWN, DRY, SILTY CLAY WITH OCCASIONAL LIMESTONE GRAVEL - FILL	
10	VERY STIFF, OLIVE YELLOW TO DARK YELLOWISH BROWN, DRY, SILTY CLAY WITH OCCASIONAL CHERT GRAVEL - FILL	361.5
	VERY STIFF, DARK GRAY, DRY, SILT - POSSIBLE ALLUVIUM	
	VERY STIFF TO FIRM, YELLOWISH RED, DRY TO SLIGHTLY MOIST, SILTY CLAY WITH SOME ROUNDED GRAVEL - POSSIBLE ALLUVIUM	
15	STIFF TO FIRM, BROWN, BLACK, TO DARK YELLOWISH BROWN, SLIGHTLY MOIST TO MOIST, CLAYEY SILT - ALLUVIUM	356.5
	FIRM, YELLOWISH BROWN, MOIST TO WET, SILTY CLAY - ALLUVIUM	
20		351.5
	SOFT TO VERY SOFT, YELLOWISH BROWN, WET, CLAYEY SILT WITH A LITTLE SAND - ALLUVIUM	
25		346.5
	VERY STIFF, YELLOWISH BROWN, WET, SANDY SILT - ALLUVIUM	
	LOOSE, YELLOWISH BROWN, WET, SAND - ALLUVIUM	
30	LOOSE, YELLOWISH BROWN, WET, GRAVELLY SAND - ALLUVIUM	341.5
	FIRM, YELLOWISH BROWN, WET, SANDY GRAVEL - ALLUVIUM	
	NOTE: INSPITE OF CHARGING THE AUGERS WITH WATER, THE DRILLER COULD ATTAIN, AT BEST, A MINIMUM OF ABOUT 1.5' OF SAND/GRAVEL HEAVING IN THE LEAD AUGER. SPT-24 WAS DRIVEN THROUGH THIS TO GET A REPRESENTATIVE SAMPLE FROM 34.5' TO 35.0'.	
35	BORING TERMINATED AT 35.0'	336.5
40		331.5
45		326.5

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.

SAMPLES IDENT	N-COUNT (1st 6" - 2nd 6" - 3rd 6")
SPT-1	WOH-WOH-2
SPT-2	6-5-3
SPT-3	4-6-7
SPT-4	5-7-8
SPT-5	5-9-9
SPT-6	11-13-16
SPT-7	8-11-16
SPT-8	7-10-16
SPT-9	7-8-10
SPT-10	4-3-5
SPT-11	3-5-6
SPT-12	3-3-4
SPT-13	3-3-4
SPT-14	3-3-3
SPT-15	3-3-3
SPT-16	1-2-2
SPT-17	WOH
SPT-18	WOH-WOH-2
SPT-19	6-8-10
SPT-20	4-5-5
SPT-21	8-9-7
SPT-22	8-9-7
SPT-23	6-8-6
SPT-24	X-X-5



SOIL 3043061041_01.GPJ LAW_GIBB.GDT 4/25/07

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. APPROXIMATE 12-HOUR GROUNDWATER LEVEL WAS MEASURED AT 14.7'.

SOIL TEST BORING RECORD

PROJECT: TVA CUF Gypsum Seepage Study

DRILLED: December 5, 2006 **BORING NO.:** B-1

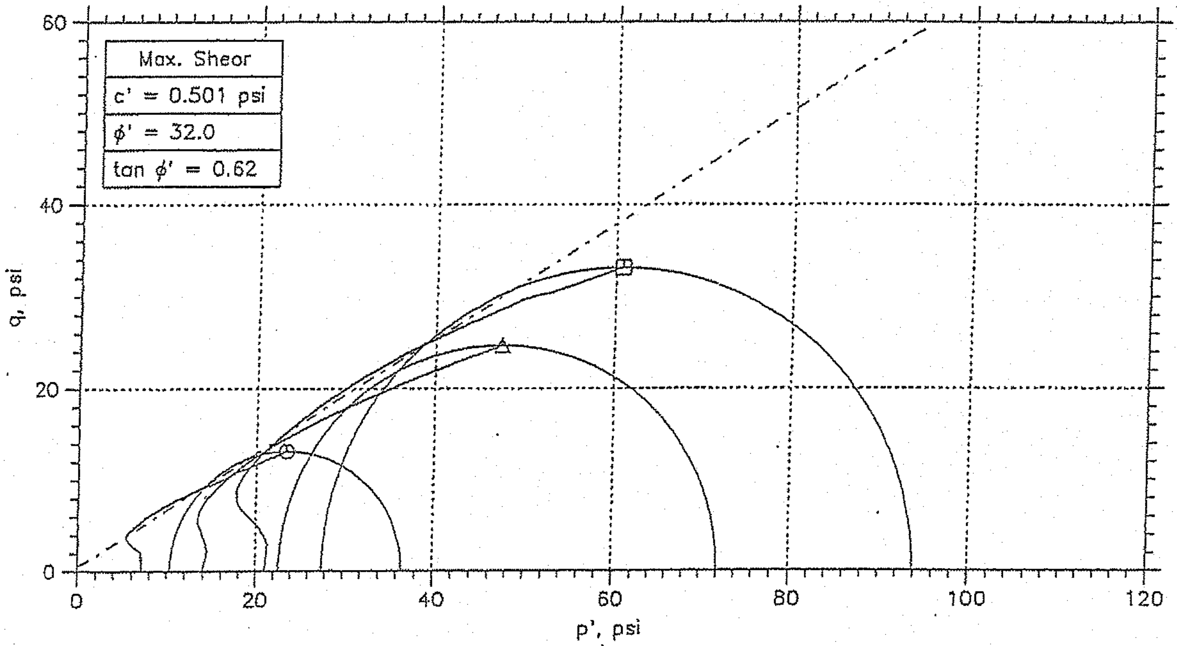
PROJ. NO.: 3043061041/0001 **PAGE** 1 **OF** 1

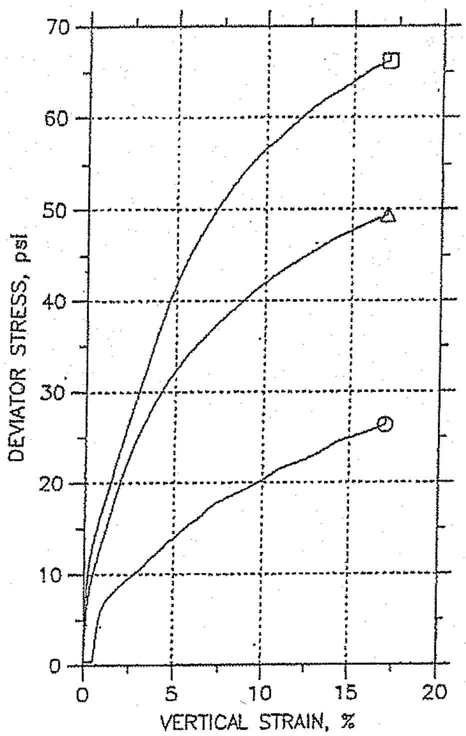
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

Driller: Akins
Prepared By: Mason
Checked By: Justice

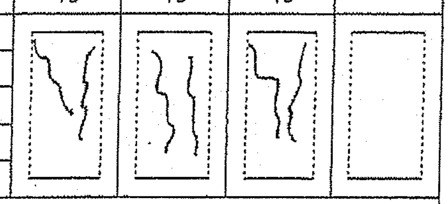
MACTEC

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Symbol	⊙	△	⊡	
	Sample No.	UD-2	UD-2	UD-2	
	Test No.	7080.1	7080.2	7080.3	
	Depth	8-10 ft.	8-10 ft	8-10 ft	
Initial	Diameter, in	2.84	2.84	2.837	
	Height, in	5.6	5.6	5.6	
	Water Content, %	19.4	18.3	17.9	
	Dry Density, pcf	105.5	109.5	111.1	
	Saturation, %	87.6	91.6	93.3	
	Void Ratio	0.597	0.54	0.517	
Before Shear	Water Content, %	22.1	19.5	18.5	
	Dry Density, pcf	105.6	110.4	112.4	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.596	0.526	0.5	
	Back Press., psi	94.93	80.	102.	
	Ver. Eff. Cons. Stress, psi	6.996	14.	20.99	
	Shear Strength, psi	13.15	24.69	33.11	
	Strain at Failure, %	17	17	17	
	Strain Rate, %/min	0.1	0.1	0.1	
	B-Value	0.97	0.99	0.98	
	Estimated Specific Gravity	2.7	2.7	2.7	
	Liquid Limit	30	30	30	
	Plastic Limit	19	19	19	



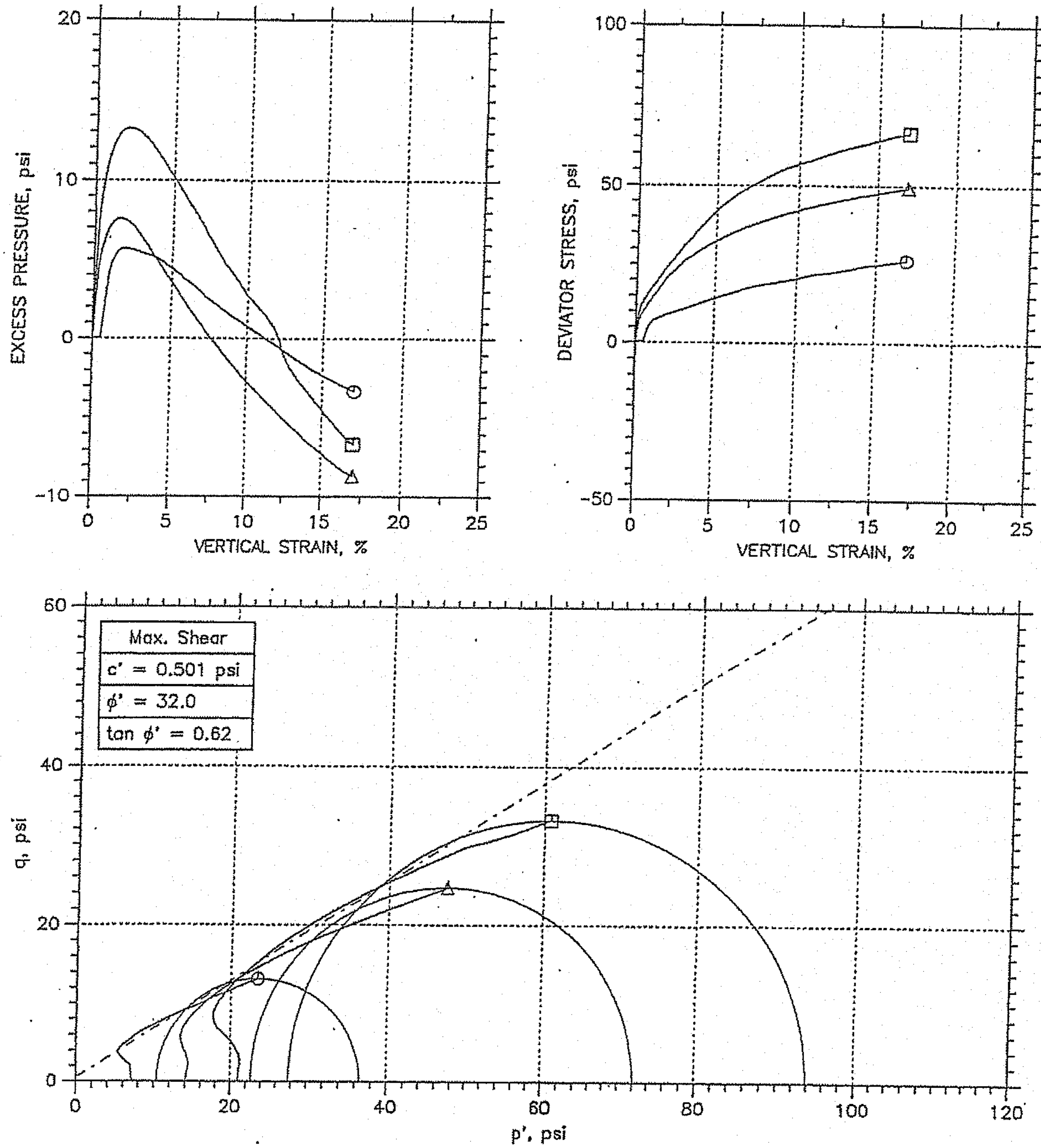
MACTEC

Project: TVA CUF Gypsum Seepage
Location: MWB1
Project No.: 3043061041
Boring No.: MWB1
Sample Type: Shelby Tube
Description: Brown Lean Clay
Remarks:

Mon, 16-APR-2007 08:54:19

Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



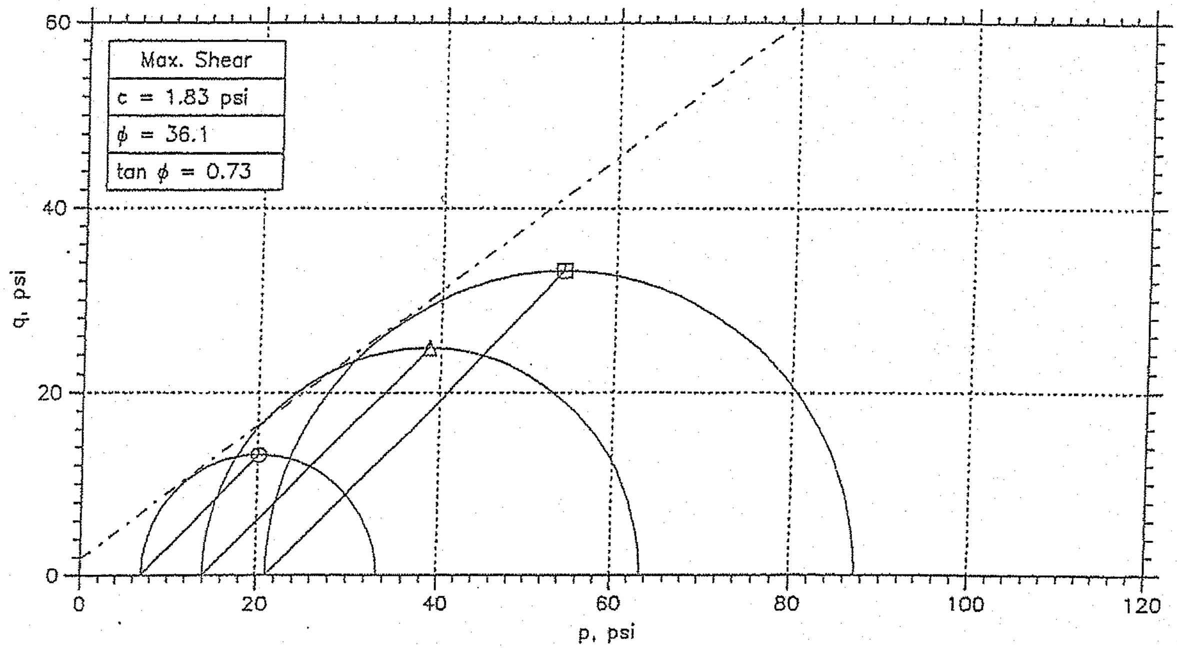
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	UD-2	7080.1	8-10 ft.	HJ	3/12/07	JL	4/13/07	7080.1_65.dat
△	UD-2	7080.2	8-10 ft	HJ	3/12/07	JL	4/13/07	7080.2_82.dat
□	UD-2	7080.3	8-10 ft	HJ	3/12/07	JL	4/13/07	7080.3_71.dat

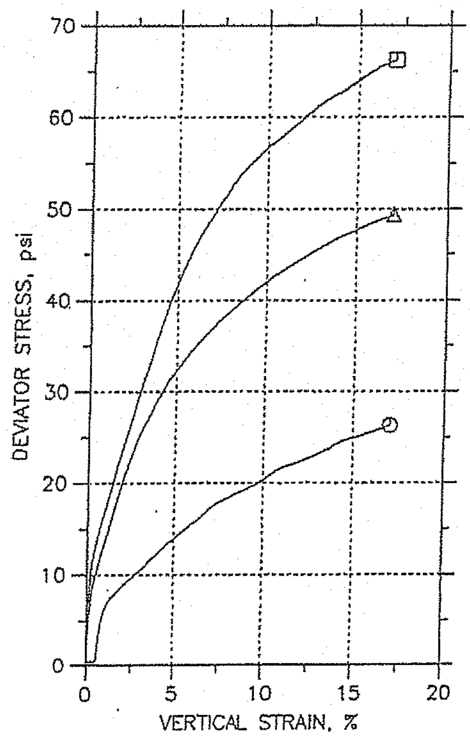
MACTEC

Project: TVA CUF Gypsum Seepage	Location: MWB1	Project No.: 3043061041
Boring No.: MWB1	Sample Type: Shelby Tube	
Description: Brown Lean Clay		
Remarks:		

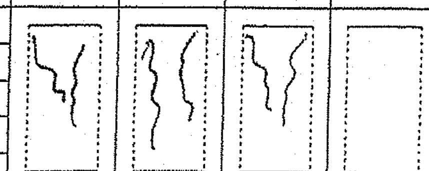
Mon, 16-APR-2007 08:54:19

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		UD-2	UD-2	UD-2	
Test No.		7080.1	7080.2	7080.3	
Depth		8-10 ft.	8-10 ft	8-10 ft	
Initial	Diameter, in	2.84	2.84	2.837	
	Height, in	5.6	5.6	5.6	
	Water Content, %	19.4	18.3	17.9	
	Dry Density, pcf	105.5	109.5	111.1	
	Saturation, %	87.6	91.6	93.3	
	Void Ratio	0.597	0.54	0.517	
Before Shear	Water Content, %	22.1	19.5	18.5	
	Dry Density, pcf	105.6	110.4	112.4	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.596	0.526	0.5	
	Back Press., psi	94.93	80.	102.	
Ver. Eff. Cons. Stress, psi		6.996	14.	20.99	
Shear Strength, psi		13.15	24.69	33.11	
Strain at Failure, %		17	17	17	
Strain Rate, %/min		0.1	0.1	0.1	
B-Value		0.97	0.99	0.98	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		30	30	30	
Plastic Limit		19	19	19	

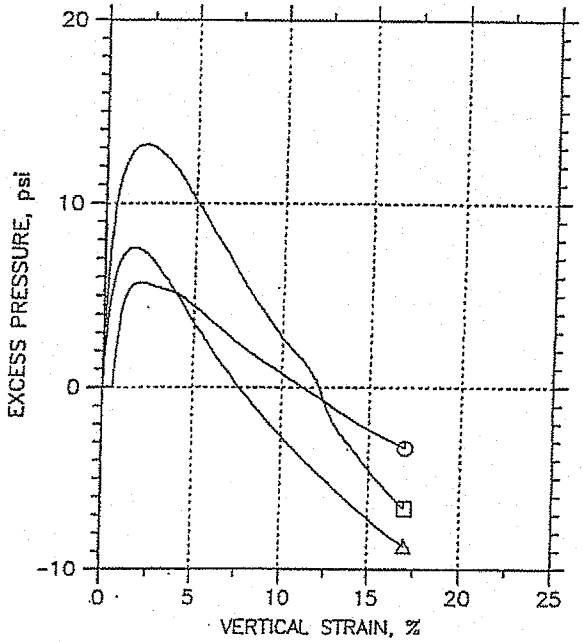


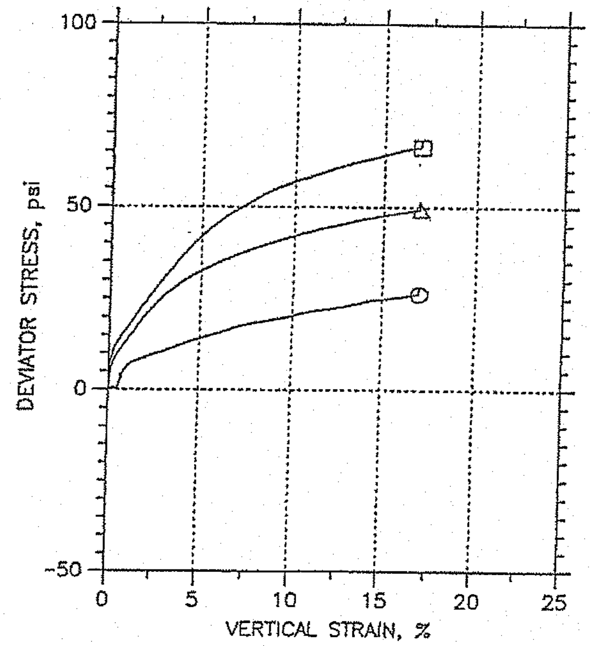
MACTEC

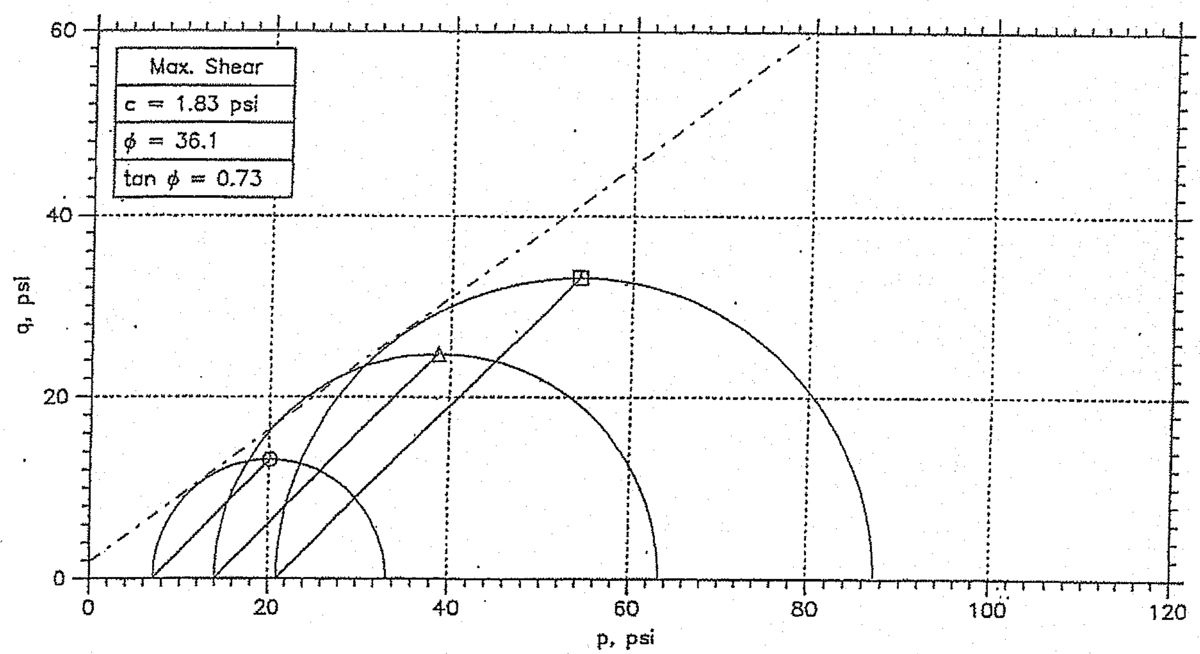
Project: TVA CUF Gypsum Seepage
Location: MWB1
Project No.: 3043061041
Boring No.: MWB1
Sample Type: Shelby Tube
Description: Brown Lean Clay
Remarks:
Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

Mon, 16-APR-2007 08:54:41

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





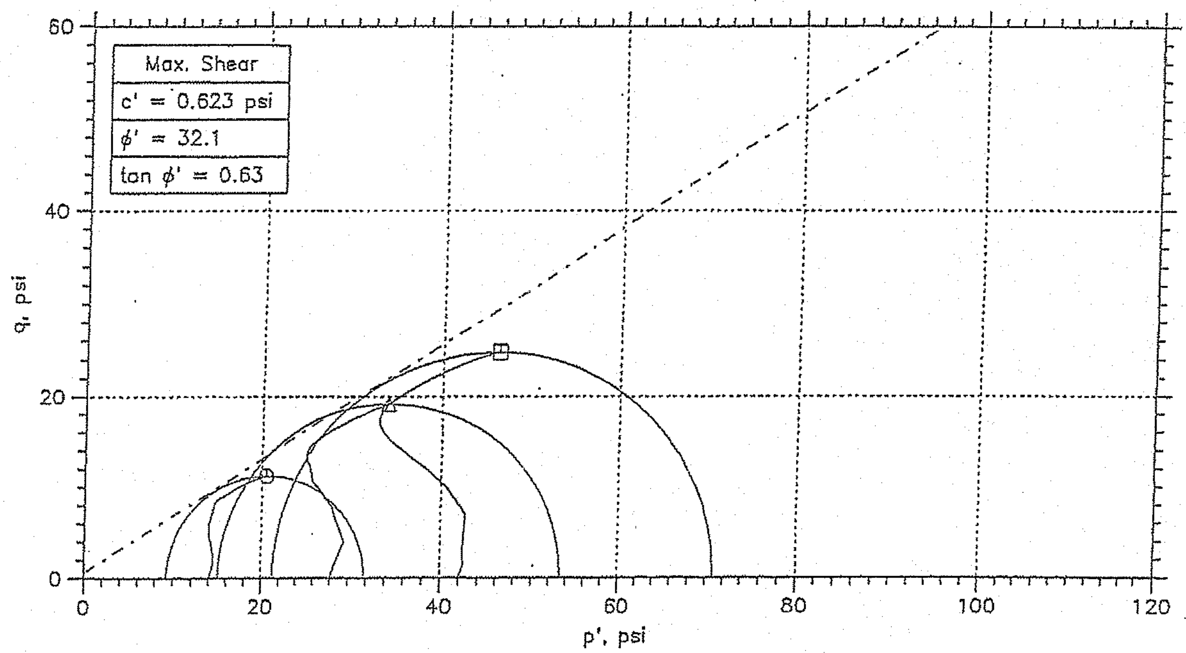


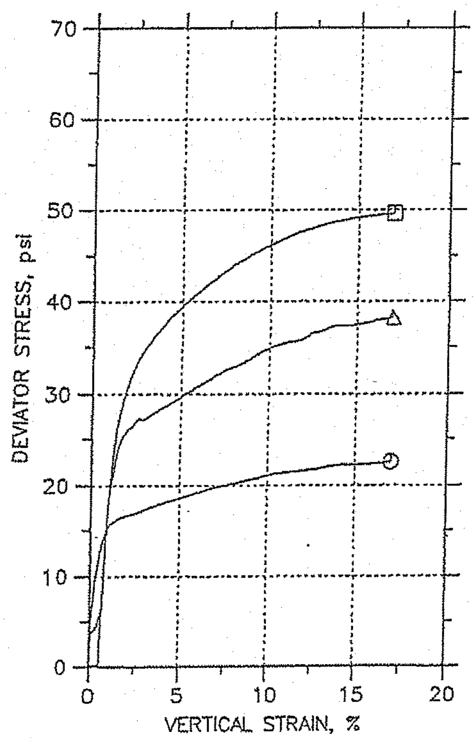
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	UD-2	7080.1	8-10 ft.	HJ	3/12/07	JL	4/13/07	7080.1_65.dat
△	UD-2	7080.2	8-10 ft	HJ	3/12/07	JL	4/13/07	7080.2_82.dat
□	UD-2	7080.3	8-10 ft	HJ	3/12/07	JL	4/13/07	7080.3_71.dat

MACTEC Project: TVA CUF Gypsum Seepage	Location: MWB1	Project No.: 3043061041
Boring No.: MWB1	Sample Type: Shelby Tube	
Description: Brown Lean Clay		
Remarks:		

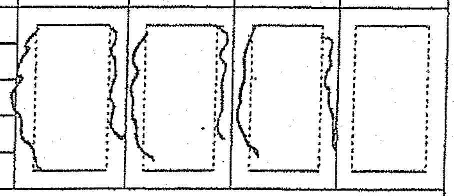
Mon, 16-APR-2007 08:54:41

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		UD-5	UD-5	UD-5	
Test No.		7086.1	7086.2	7086.3	
Depth		20-22 ft	20-22 ft	20-22 ft.	
Initial	Diameter, in	2.845	2.846	2.834	
	Height, in	5.6	5.6	5.6	
	Water Content, %	25.6	25.2	25.5	
	Dry Density, pcf	99.76	100.8	100.6	
	Saturation, %	100.2	101.2	101.7	
	Void Ratio	0.69	0.673	0.676	
Before Shear	Water Content, %	25.2	23.8	22.8	
	Dry Density, pcf	100.3	102.6	104.3	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.68	0.643	0.616	
	Back Press., psi	53.9	38.91	38.97	
Ver. Eff. Cons. Stress, psi		14.	28.02	42.	
Shear Strength, psi		11.24	19.1	24.79	
Strain at Failure, %		17	17	17	
Strain Rate, %/min		0.1	0.1	0.1	
B-Value		0.97	0.97	0.98	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		32	32	32	
Plastic Limit		20	20	20	

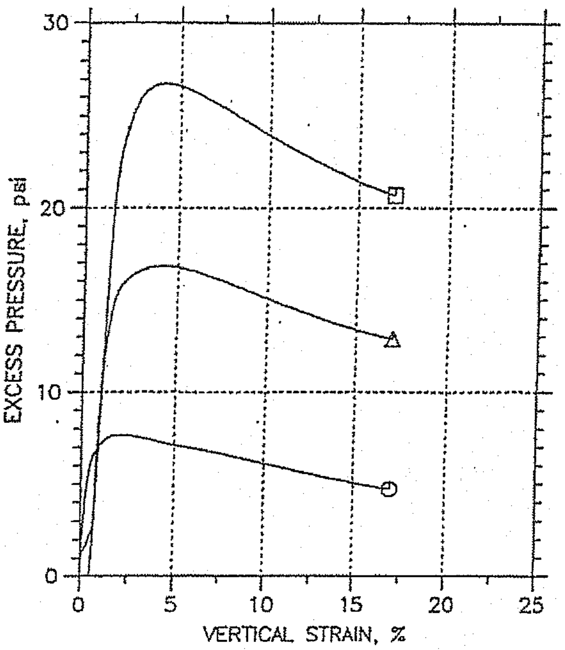


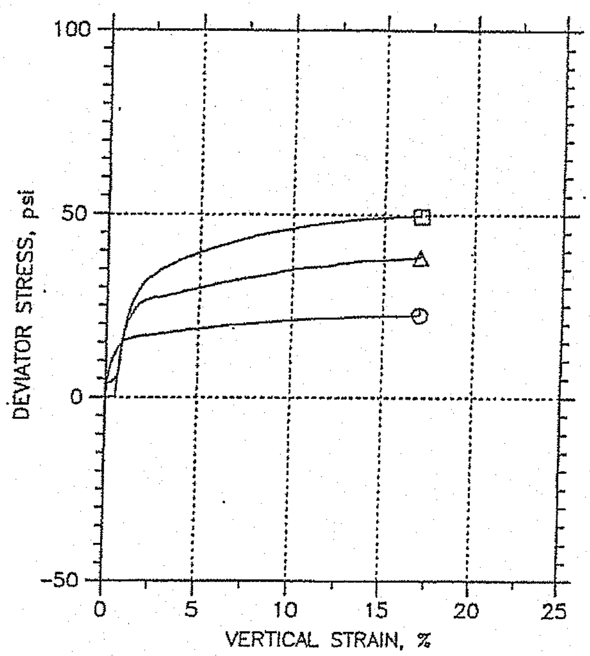
MACTEC

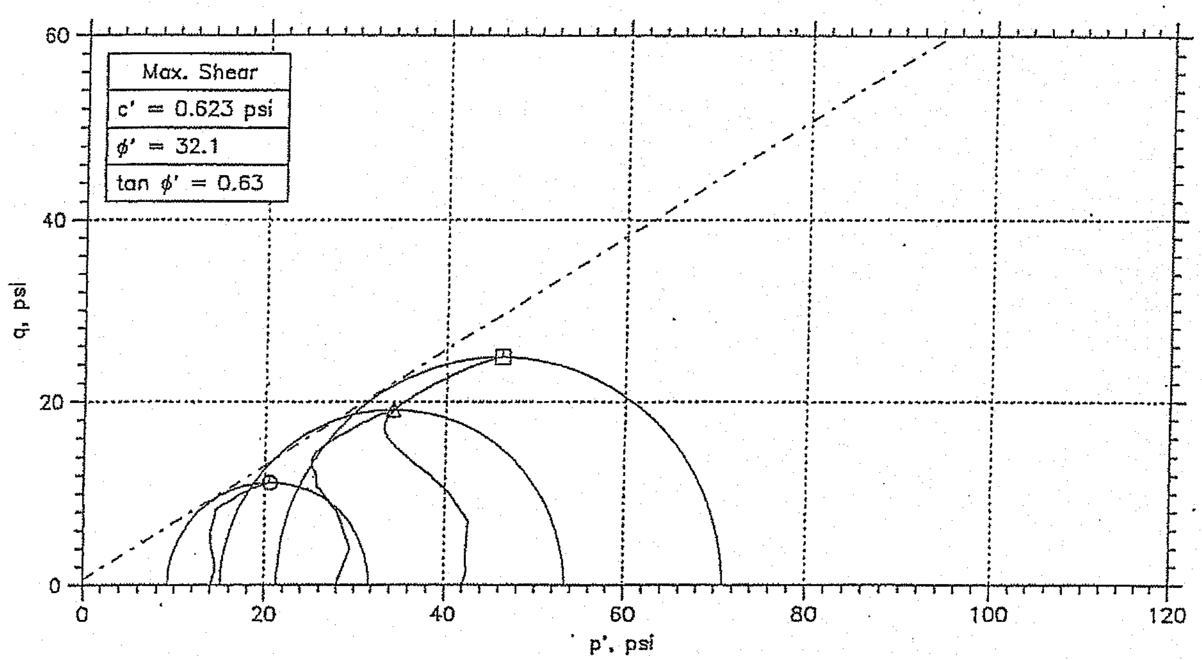
Project: TVA CUF Gypsum Seepage
Location: MWB1
Project No.: 3043061041
Boring No.: MWB1
Sample Type: Undisturbed
Description: Tan Brown Lean Clay
Remarks:
Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

Mon, 16-APR-2007 09:06:02

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





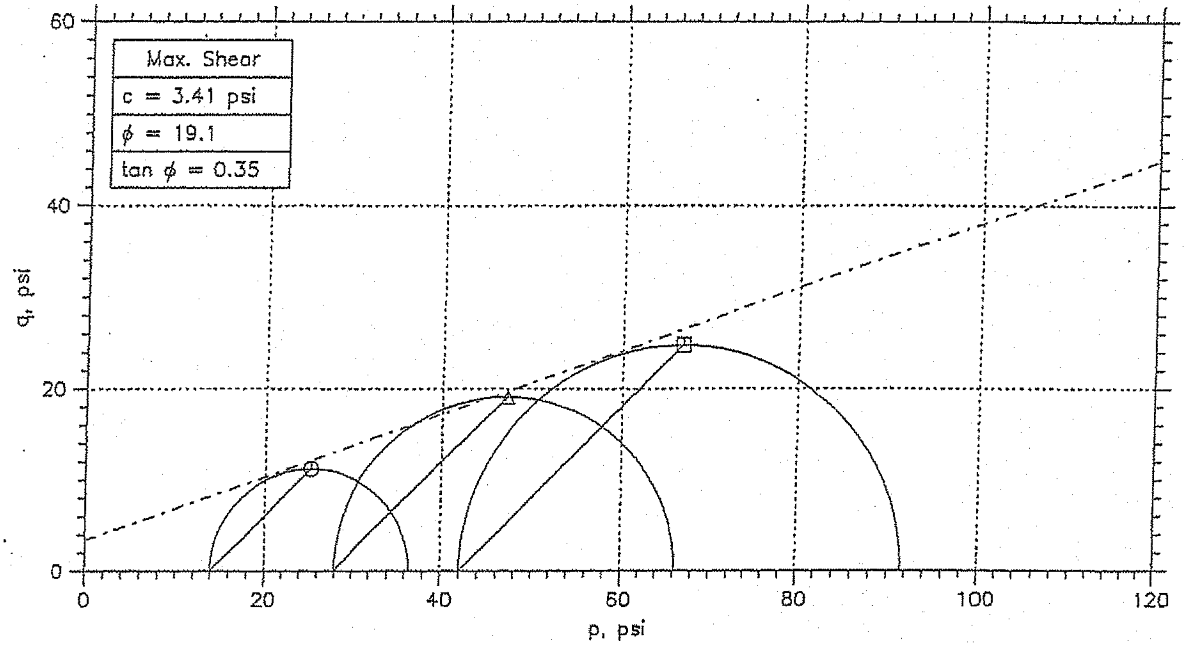


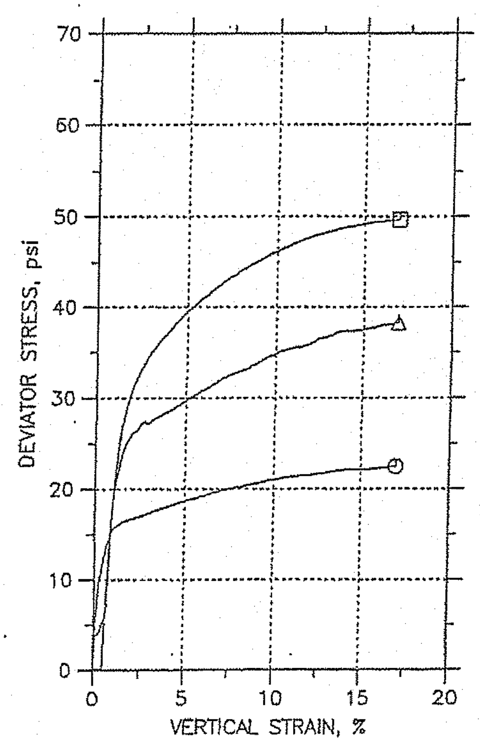
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	UD-5	7086.1	20-22 ft	HJ	3/16/07	JL	4/13/07	7086.1_96.dat
△	UD-5	7086.2	20-22 ft	HJ	3/16/07	JL	4/13/07	7086.2_93.dat
□	UD-5	7086.3	20-22 ft.	HJ	3/16/07	JL	4/13/07	7086.3_90.dat

MACTEC	Project: TVA CUF Gypsum Seepage	Location: MWB1	Project No.: 3043061041
	Boring No.: MWB1	Sample Type: Undisturbed	
	Description: Tan Brown Lean Clay		
	Remarks:		

Mon, 16-APR-2007 09:06:02

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

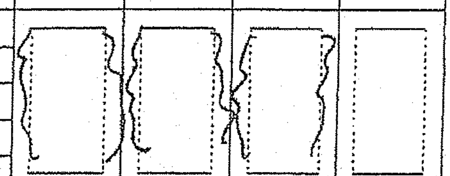




Symbol		○	△	□	
Sample No.		UD-5	UD-5	UD-5	
Test No.		7086.1	7086.2	7086.3	
Depth		20-22 ft	20-22 ft	20-22 ft.	
Initial	Diameter, in	2.845	2.846	2.834	
	Height, in	5.6	5.6	5.6	
	Water Content, %	25.6	25.2	25.5	
	Dry Density, pcf	99.76	100.8	100.6	
	Saturation, %	100.2	101.2	101.7	
	Void Ratio	0.69	0.673	0.676	
Before Shear	Water Content, %	25.2	23.8	22.8	
	Dry Density, pcf	100.3	102.6	104.3	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.68	0.643	0.616	
	Back Press., psi	53.9	38.91	38.97	
Ver. Eff. Cons. Stress, psi		14.	28.02	42.	
Shear Strength, psi		11.24	19.1	24.79	
Strain at Failure, %		17	17	17	
Strain Rate, %/min		0.1	0.1	0.1	
B-Value		0.97	0.97	0.98	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		32	32	32	
Plastic Limit		20	20	20	

MACTEC

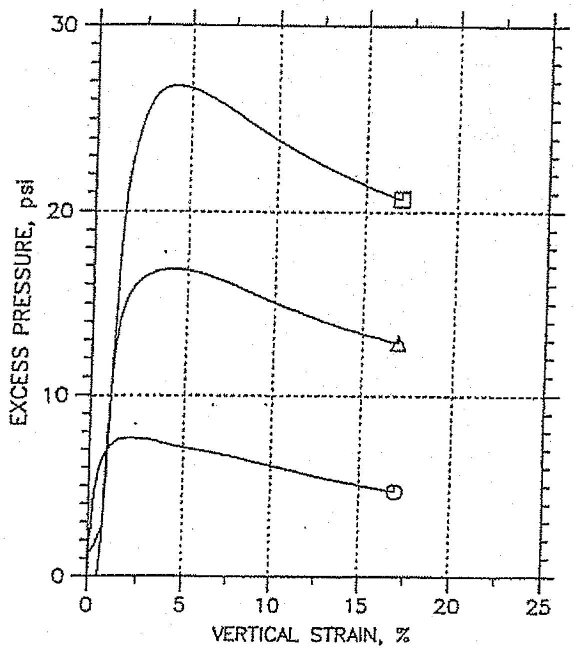
Project: TVA CUF Gypsum Seepage
Location: MWB1
Project No.: 3043061041
Boring No.: MWB1
Sample Type: Undisturbed

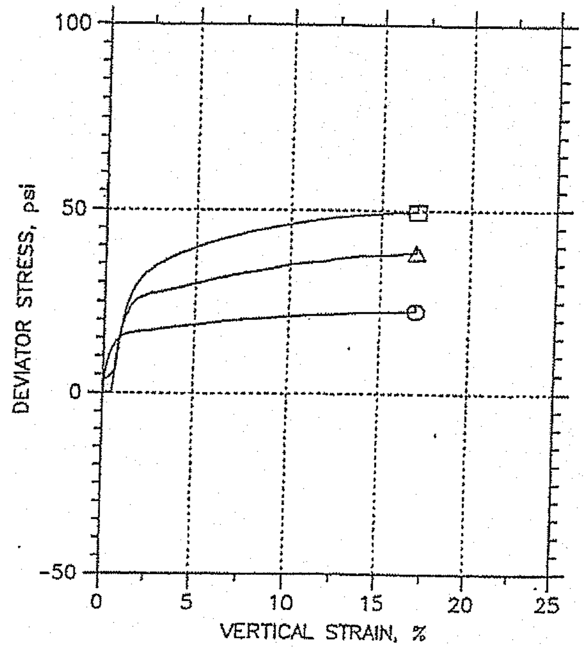


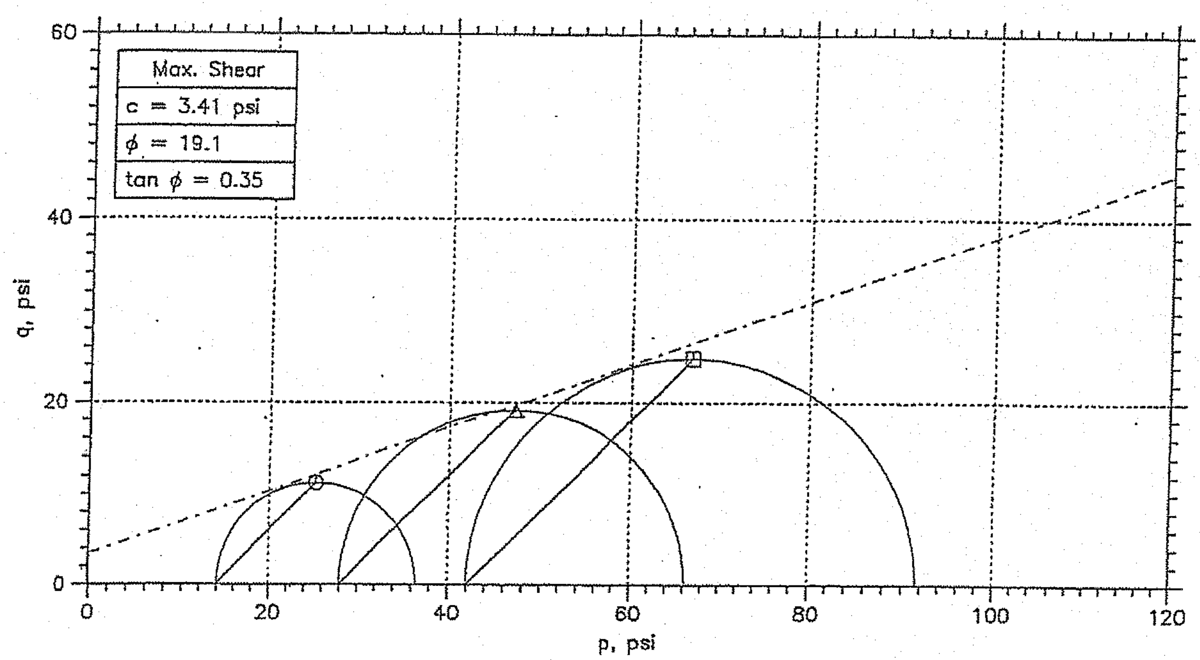
Description: Tan Brown Lean Clay
Remarks:
~~Phase calculations based on start and end of test.~~
* Saturation is set to 100% for phase calculations.

Mon, 16-APR-2007 09:06:12

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
O	UD-5	7086.1	20-22 ft	HJ	3/16/07	JL	4/13/07	7086.1_96.dat
Δ	UD-5	7086.2	20-22 ft	HJ	3/16/07	JL	4/13/07	7086.2_93.dat
⊡	UD-5	7086.3	20-22 ft	HJ	3/16/07	JL	4/13/07	7086.3_90.dat

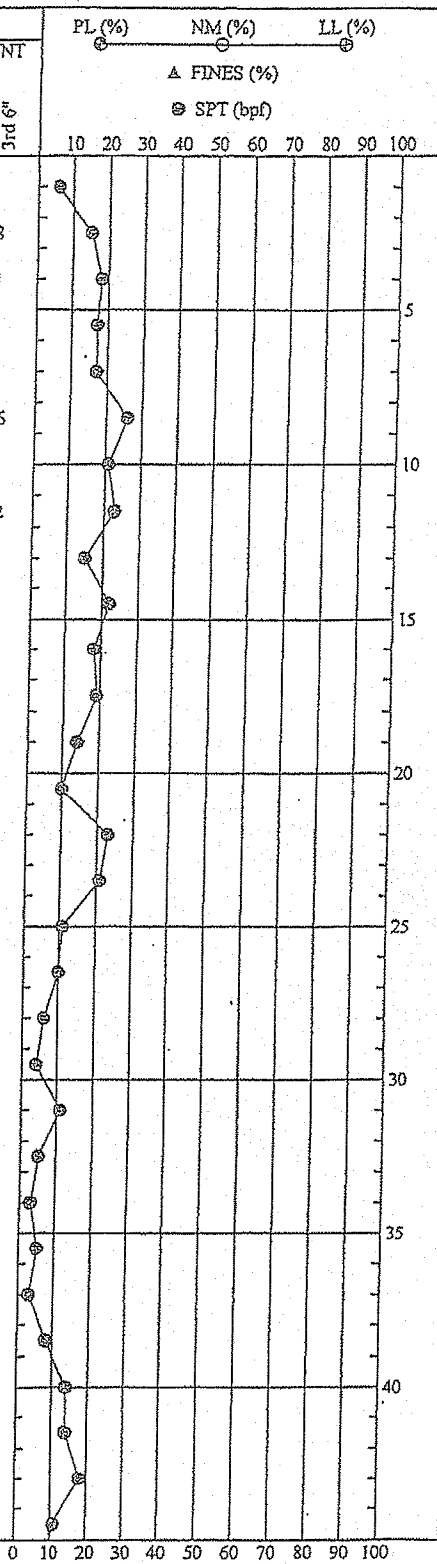
MACTEC			
	Project: TVA CUF Gypsum Seepage	Location: MWB1	Project No.: 3043061041
	Boring No.: MWB1	Sample Type: Undisturbed	
	Description: Tan Brown Lean Clay		
	Remarks:		

Mon, 16-APR-2007 09:06:12

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS (SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.)	ELEV (ft)
0	TOPSOIL (0.3')	381.0
	FIRM, REDDISH BROWN, MOIST, SILTY CLAY WITH A TRACE OF SAND AND ROCK FRAGMENTS - FILL	
	STIFF TO VERY STIFF, ORANGISH BROWN TO BROWN, MOIST, SILTY CLAY TO FAT CLAY WITH A LITTLE SAND, ORGANICS, AND ROCK FRAGMENTS - FILL	
5		376.0
10		371.0
15	VERY STIFF, GRAY TO BROWN, MOIST, FLYASH - FILL	366.0
	VERY STIFF TO STIFF, ORANGISH BROWN TO BROWN, MOIST, SILTY CLAY WITH A LITTLE SAND, ORGANICS, AND ROCK FRAGMENTS - FILL	
20		361.0
	VERY STIFF, SLIGHTLY MOIST, BLACK TO BROWN, CLAYEY SILT - ALLUVIUM	
25	STIFF, REDDISH BROWN, MOIST, SILTY CLAY WITH ROCK FRAGMENTS - ALLUVIUM	356.0
	STIFF TO SOFT, BROWN TO BLACK, MOIST TO WET, SILTY CLAY - ALLUVIUM	
30		351.0
35		346.0
	VERY LOOSE TO LOOSE, BROWN, WET, SILTY SAND - ALLUVIUM	
40	FIRM, ORANGISH BROWN, WET, SILTY SAND WITH GRAVEL - ALLUVIUM	341.0
	FIRM TO LOOSE, YELLOWISH BROWN, WET, SANDY GRAVEL - ALLUVIUM	
45		336.0

SAMPLES

IDENT	N-COUNT (1st 6" / 2nd 6" / 3rd 6")
SPT-1	1-3-3
SPT-2	10-7-8
SPT-3	6-7-11
SPT-4	8-8-9
SPT-5	6-8-9
SPT-6	5-10-16
SPT-7	8-9-12
SPT-8	9-11-12
SPT-9	5-6-9
SPT-10	7-9-13
SPT-11	6-7-11
SPT-12	5-8-11
SPT-13	5-6-8
SPT-14	4-4-6
SPT-15	4-10-13
SPT-16	4-10-11
SPT-17	3-5-6
SPT-18	3-4-6
SPT-19	2-3-3
SPT-20	2-2-2
SPT-21	1-3-8
SPT-22	WOH-2-3
SPT-23	WOH-1-2
SPT-24	WOH-1-4
SPT-25	2-1-2
SPT-26	4-4-4
SPT-27	WOH-6-8
SPT-28	5-8-6
SPT-29	8-9-9
SPT-30	4-4-7



SOIL 3043061041 01.GPJ LAW GIBB.GDT 4/25/07

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. APPROXIMATE 12-HOUR GROUNDWATER LEVEL WAS MEASURED AT 27.0'

SOIL TEST BORING RECORD

PROJECT: TVA CUF Gypsum Seepage Study

DRILLED: November 30, 2006 **BORING NO.:** B-2

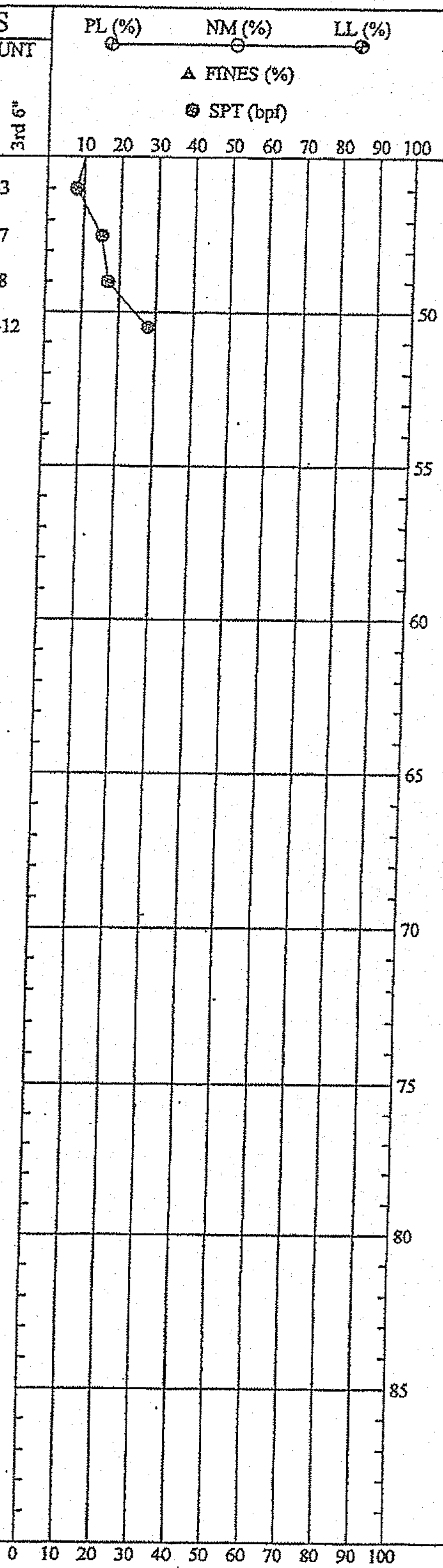
PROJ. NO.: 3043061041/0001 **PAGE 1 OF 2**

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

Driller: Akins
Prepared By: Mason
Checked By: Justice

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
45	FIRM TO LOOSE, YELLOWISH BROWN, WET, SANDY GRAVEL - ALLUVIUM		336.0	SPT-31		6-5-3
	STIFF, BROWN, VERY MOIST, SANDY SILT WITH GRAVEL - ALLUVIUM			SPT-32		6-8-7
	FIRM TO VERY FIRM, LIGHT YELLOWISH BROWN, WET, SILTY GRAVEL WITH SAND - ALLUVIUM			SPT-33		6-9-8
50			331.0	SPT-34		10-16-12
	BORING TERMINATED AT 51.0'					
55			326.0			
60			321.0			
65			316.0			
70			311.0			
75			306.0			
80			301.0			
85			296.0			
90			291.0			



SOIL 3043061041_01.GPJ LAW GIBB.GDT 4/25/07

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. APPROXIMATE 12-HOUR GROUNDWATER LEVEL WAS MEASURED AT 27.0'

SOIL TEST BORING RECORD

PROJECT: TVA CUF Gypsum Seepage Study

DRILLED: November 30, 2006 **BORING NO.:** B-2

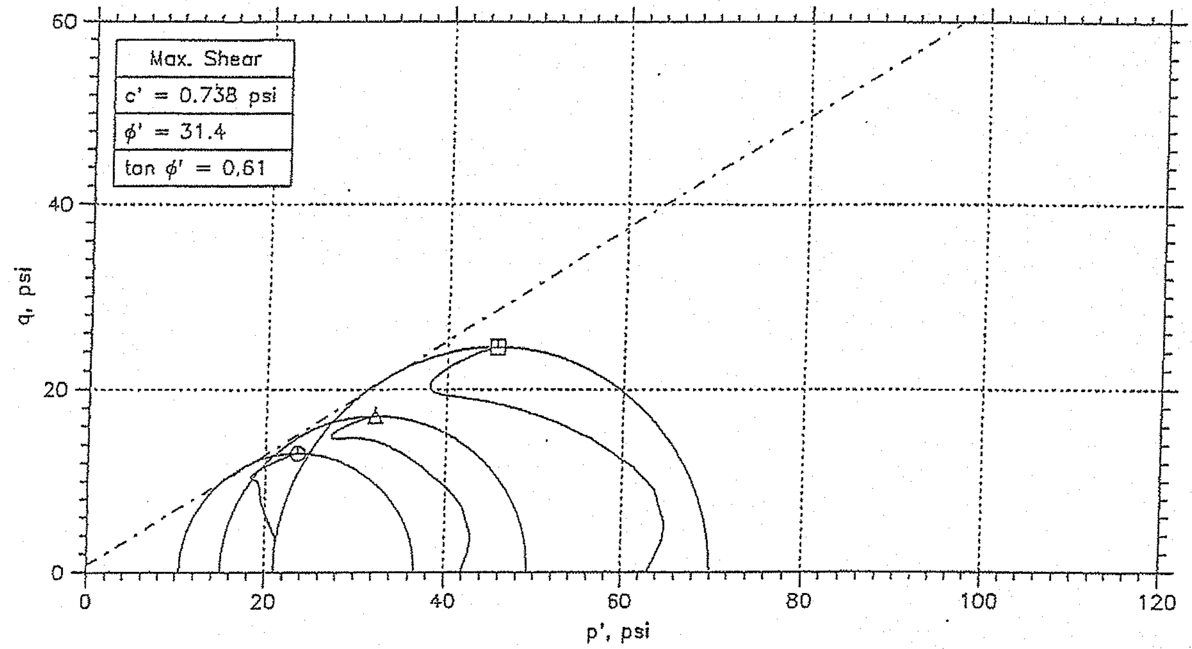
PROJ. NO.: 3043061041/0001 **PAGE 2 OF 2**

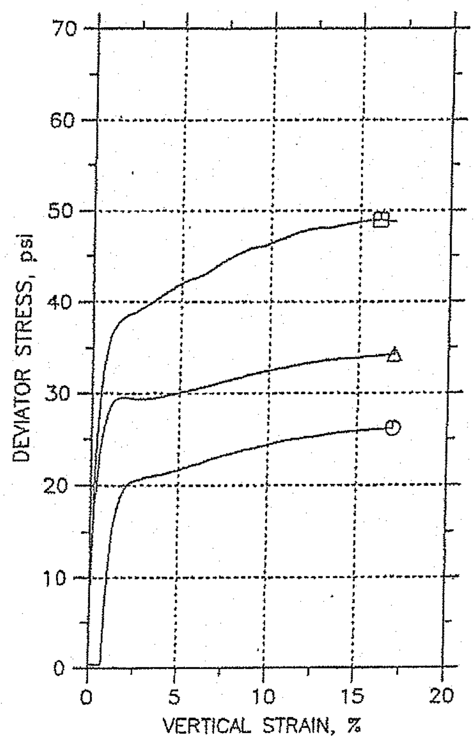
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

Driller: Akins
Prepared By: Mason
Checked By: Justice

MACTEC

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

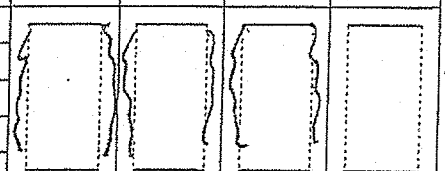




	Symbol	○	△	□	
	Sample No.	UD-5	UD-5	UD-5	
	Test No.	7083.1	7083.2	7083.3	
	Depth	30-32'	30-32'	30-32 ft	
Initial	Diameter, in	2.848	2.855	2.833	
	Height, in	5.6	5.6	5.6	
	Water Content, %	25.1	25.1	25.1	
	Dry Density, pcf	98.46	98.78	98.79	
	Saturation, %	95.3	95.9	96.0	
	Void Ratio	0.712	0.706	0.706	
Before Shear	Water Content, %	25.0	25.5	24.4	
	Dry Density, pcf	100.6	99.83	101.6	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.676	0.688	0.659	
	Back Press., psi	83.	80.01	96.01	
	Ver. Eff. Cons. Stress, psi	20.99	41.99	62.98	
	Shear Strength, psi	13.09	17.11	24.46	
	Strain at Failure, %	17	17	16.2	
	Strain Rate, %/min	0.1	0.1	0.1	
	B-Value	0.98	0.99	0.98	
	Estimated Specific Gravity	2.7	2.7	2.7	
	Liquid Limit	36	36	36	
	Plastic Limit	19	19	19	

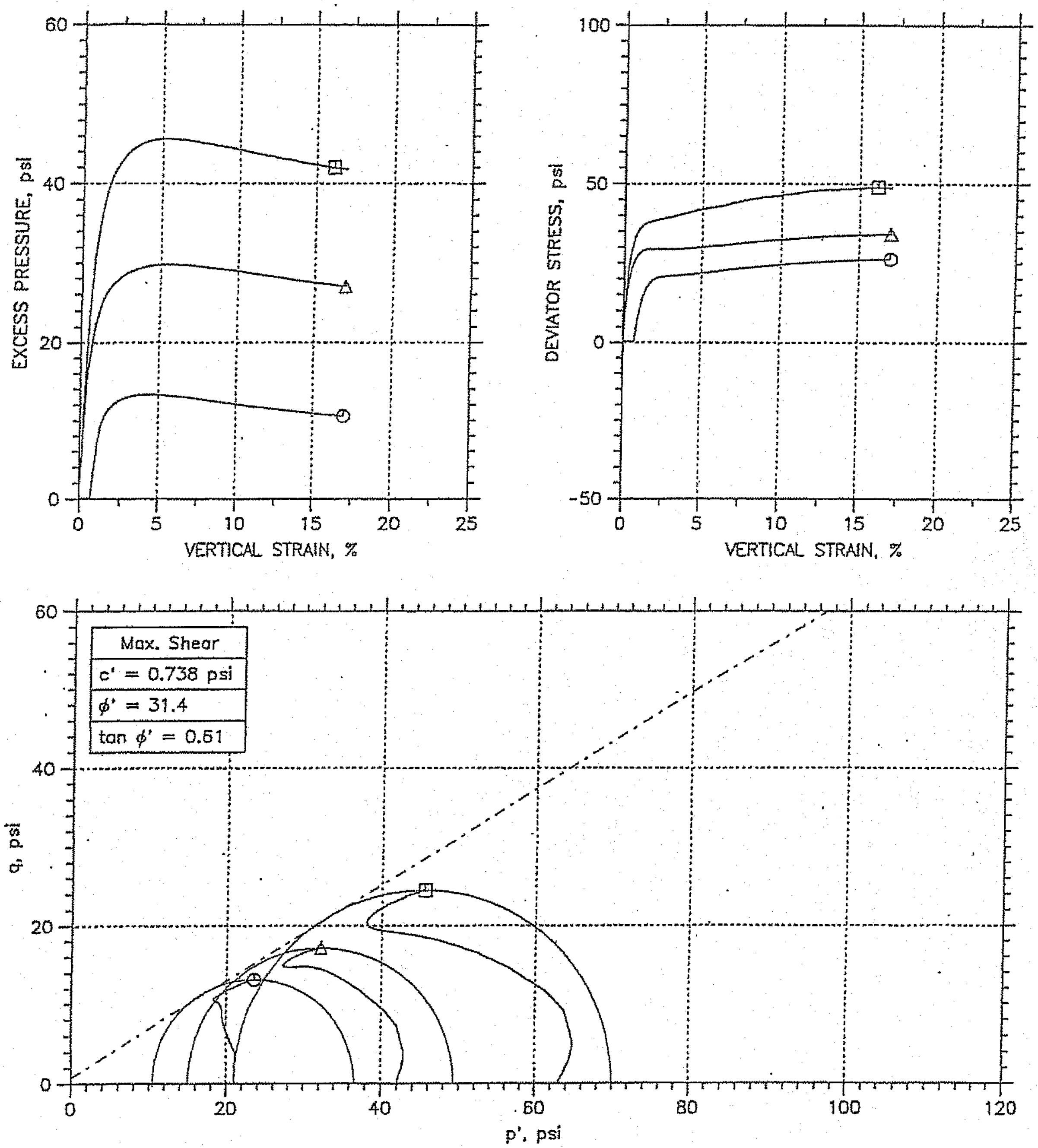
MACTEC

Project: TVA CUF Gypsum Seepage
Location: MWB2
Project No.: 3043061041
Boring No.: MWB2
Sample Type: Shelby Tube
Description: Tan Brown Lean Clay
Remarks:
Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.



Mon, 16-APR-2007 09:00:09

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



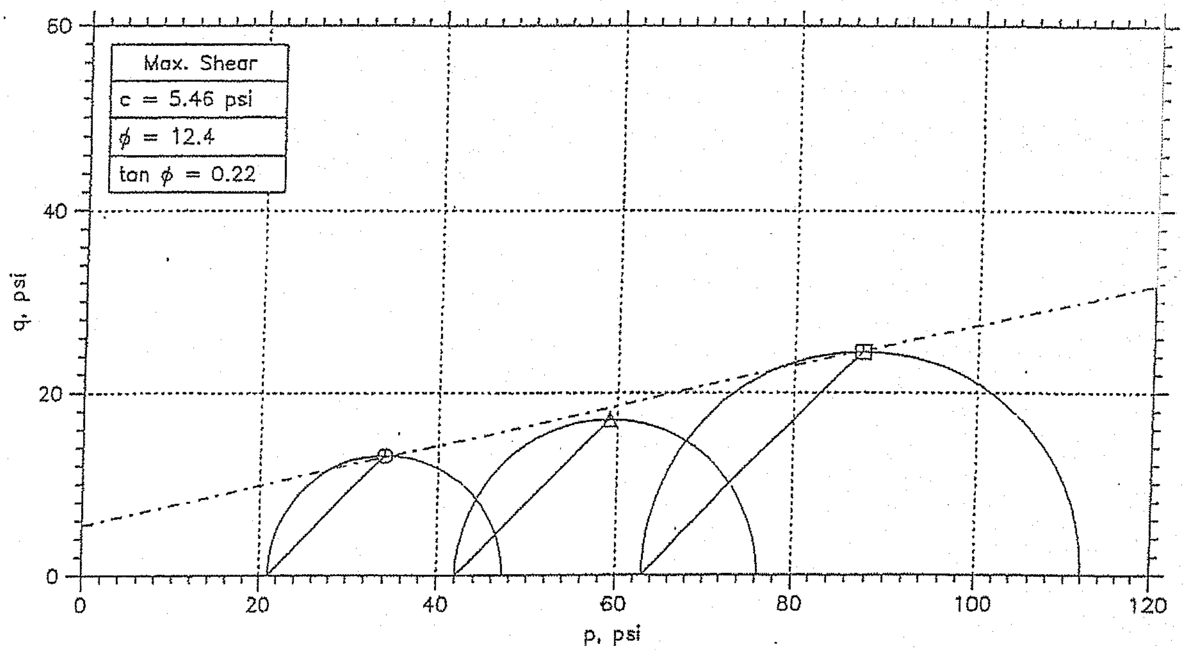
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	UD-5	7083.1	30-32'	HJ	3/14/07	JL	4/13/07	7083.1_65.dat
△	UD-5	7083.2	30-32'	HJ	3/14/07	JL	4/13/07	7083.2_82.dat
□	UD-5	7083.3	30-32 ft	HJ	3/14/07	JL	4/13/07	7083.3_71.dat

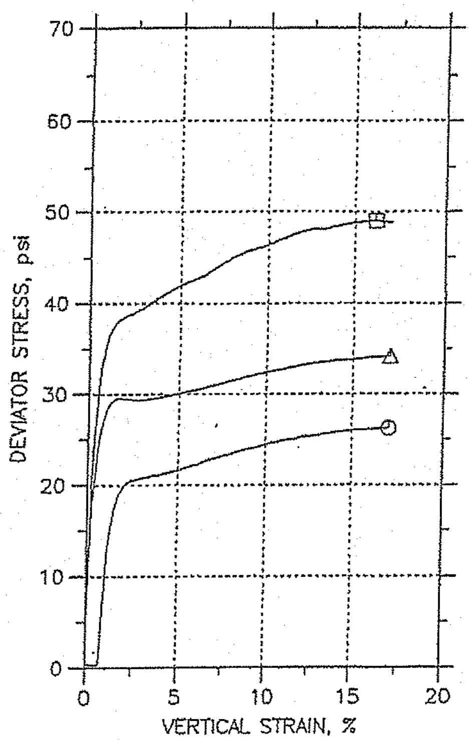
MACTEC

Project: TVA CUF Gypsum Seepage	Location: MWB2	Project No.: 3043061041
Boring No.: MWB2	Sample Type: Shelby Tube	
Description: Tan Brown Lean Clay		
Remarks:		

Mon, 16-APR-2007 09:00:10

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

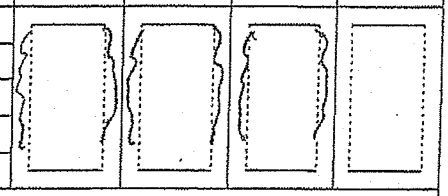




Symbol		○	△	□	
Sample No.		UD-5	UD-5	UD-5	
Test No.		7083.1	7083.2	7083.3	
Depth		30-32'	30-32'	30-32 ft	
Initial	Diameter, in	2.848	2.855	2.833	
	Height, in	5.6	5.6	5.6	
	Water Content, %	25.1	25.1	25.1	
	Dry Density, pcf	98.46	98.78	98.79	
	Saturation, %	95.3	95.9	96.0	
	Void Ratio	0.712	0.706	0.706	
Before Shear	Water Content, %	25.0	25.5	24.4	
	Dry Density, pcf	100.6	99.83	101.6	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.676	0.688	0.659	
	Back Press., psi	83.	80.01	96.01	
Ver. Eff. Cons. Stress, psi		20.99	41.99	62.98	
Shear Strength, psi		13.09	17.11	24.46	
Strain at Failure, %		17	17	16.2	
Strain Rate, %/min		0.1	0.1	0.1	
B-Value		0.98	0.99	0.98	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		36	36	36	
Plastic Limit		19	19	19	

MACTEC

Project: TVA CUF Gypsum Seepage
Location: MWB2
Project No.: 3043061041
Boring No.: MWB2
Sample Type: Shelby Tube
Description: Tan Brown Lean Clay
Remarks:
Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.



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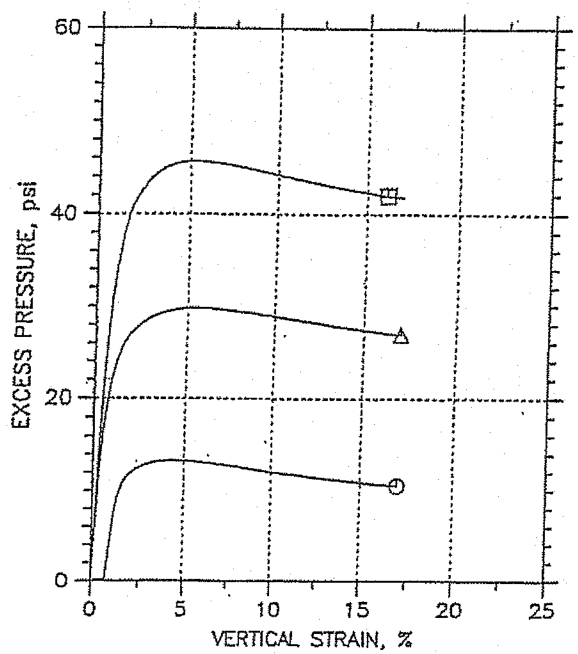
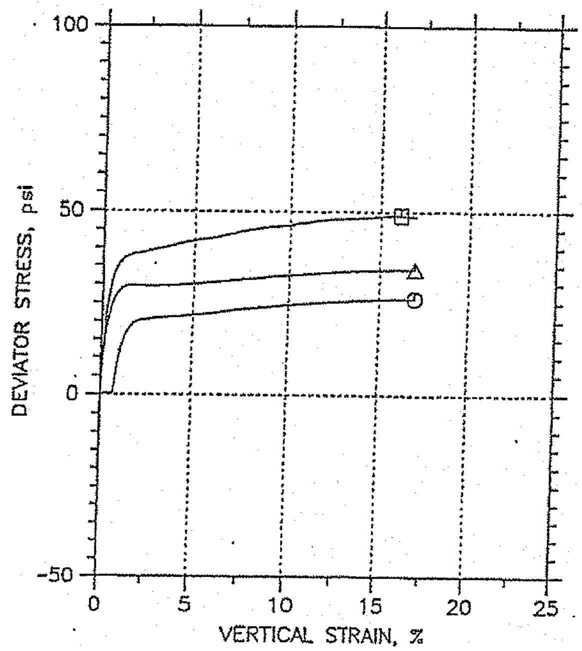
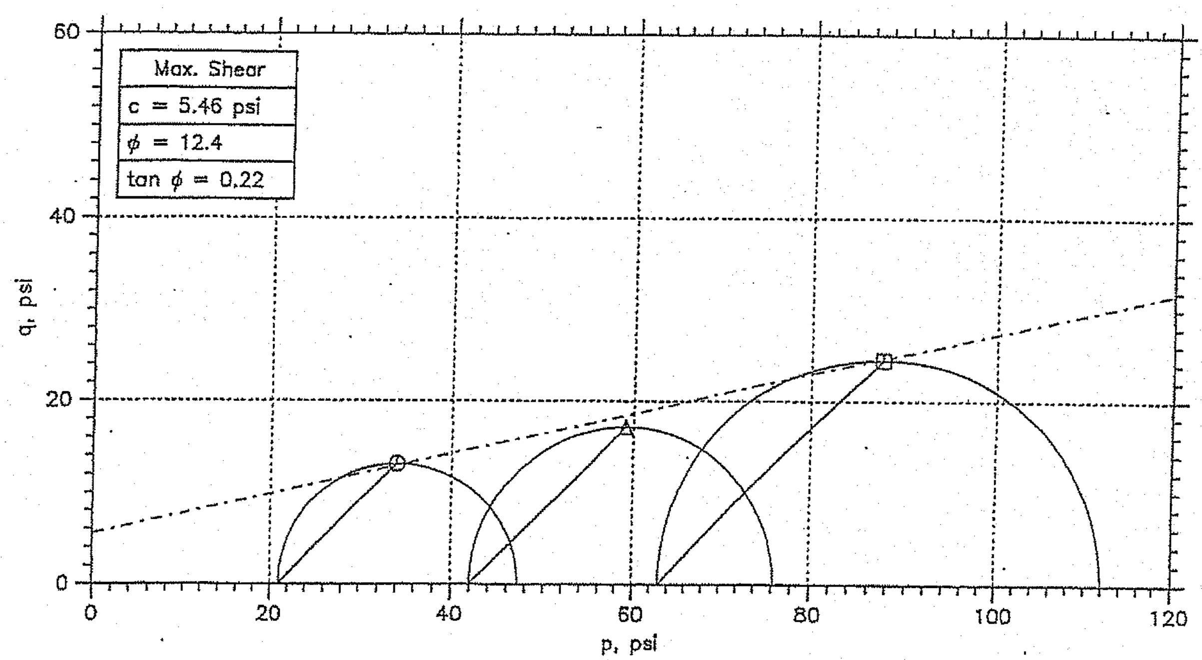
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





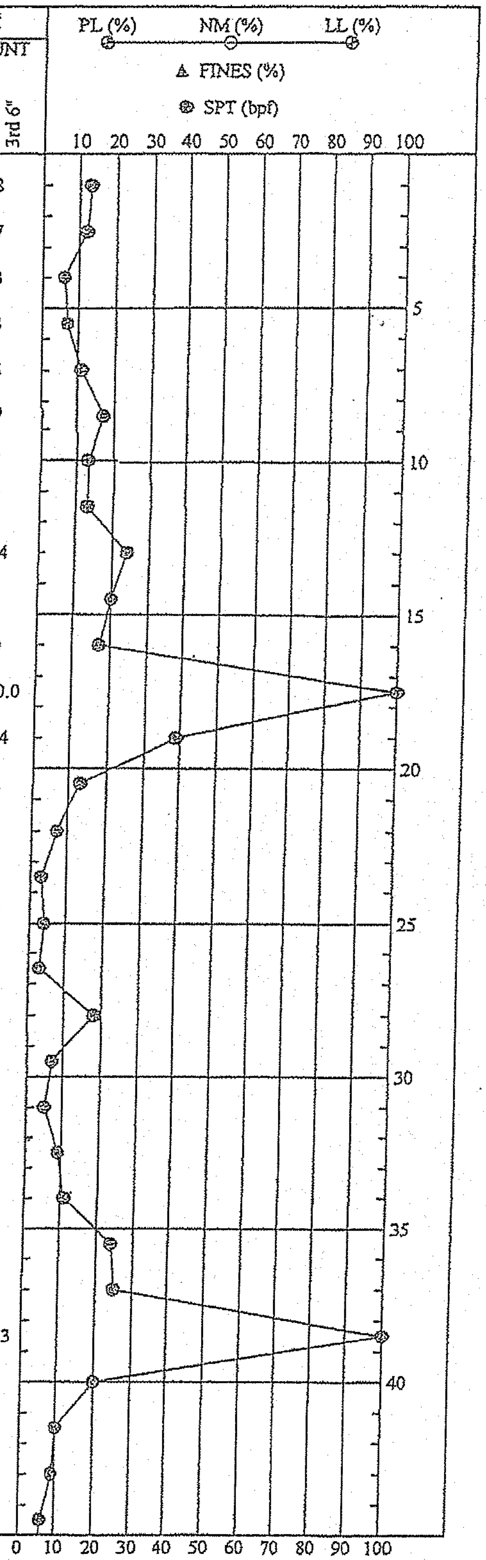


	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	UD-5	7083.1	30-32'	HJ	3/14/07	JL	4/13/07	7083.1_65.dat
△	UD-5	7083.2	30-32'	HJ	3/14/07	JL	4/13/07	7083.2_82.dat
□	UD-5	7083.3	30-32 ft	HJ	3/14/07	JL	4/13/07	7083.3_71.dat

Project: TVA CUF Gypsum Seepage	Location: MWB2	Project No.: 3043061041
Boring No.: MWB2	Sample Type: Shelby Tube	
Description: Tan Brown Lean Clay		
Remarks:		

Mon, 16-APR-2007 09:00:27

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	ELEV (ft)	SAMPLES IDENT	N-COUNT (1st 6" / 2nd 6" / 3rd 6")
0	FIRM, GRAY TO BROWN, MOIST, GRAVEL - FILL	395.0		
	STIFF TO FIRM, REDDISH BROWN, MOIST, SILTY CLAY WITH A LITTLE SAND AND ROCK FRAGMENTS AND A TRACE OF ORGANICS - FILL		SPT-1	7-5-8
			SPT-2	6-5-7
			SPT-3	3-3-3
5		390.0	SPT-4	3-4-3
			SPT-5	3-5-6
	VERY STIFF, BROWN TO TAN, MOIST, CLAYEY SILT WITH A TRACE OF SAND AND ROCK FRAGMENTS - FILL		SPT-6	5-8-9
10	STIFF TO VERY STIFF, REDDISH BROWN TO BROWN, MOIST, SILTY CLAY WITH VARYING AMOUNTS OF SILT AND A LITTLE SAND AND ROCK FRAGMENTS - FILL	385.0	SPT-7	6-6-7
			SPT-8	6-6-7
			SPT-9	6-10-14
			SPT-10	6-9-11
15		380.0	SPT-11	4-7-10
	VERY HARD TO HARD, VERY MOIST TO WET, LIMESTONE FRAGMENTS WITH REDDISH BROWN SILTY CLAY - FILL		SPT-12	8-50-50/0.0
			SPT-13	36-15-24
20	FIRM TO LOOSE, BLACK TO BROWN, WET, BOTTOM ASH	375.0	SPT-14	6-8-5
			SPT-15	4-4-3
	VERY LOOSE, BLACK TO BROWN, WET, BOTTOM ASH		SPT-16	2-1-2
25		370.0	SPT-17	2-2-2
			SPT-18	2-2-1
	VERY STIFF, GRAY TO BROWN, WET, FLY ASH		SPT-19	3-12-6
30	LOOSE, BLACK TO BROWN, WET, BOTTOM ASH WITH SOME CLAY	365.0	SPT-20	6-4-3
	FIRM TO VERY STIFF, BROWN TO DARK GRAY, MOIST CLAYEY SILT WITH A TRACE OF SAND, ROCK FRAGMENTS, AND ORGANICS - ALLUVIUM		SPT-21	1-2-3
			SPT-22	1-3-6
			SPT-23	1-4-7
35		360.0	SPT-24	3-9-15
			SPT-25	5-9-16
	VERY HARD, BROWN TO BLACK, VERY MOIST, CLAYEY SILT WITH ROCK FRAGMENTS - ALLUVIUM		SPT-26	11-17-50/0.3
40	VERY STIFF TO STIFF, BROWN, VERY MOIST, CLAYEY SILT - ALLUVIUM	355.0	SPT-27	10-10-10
			SPT-28	5-5-5
	STIFF TO FIRM, BROWN, VERY MOIST TO WET, SILTY CLAY WITH VARYING AMOUNTS OF SILT - ALLUVIUM		SPT-29	5-6-3
45		350.0	SPT-30	1-3-3



SOIL 3043061041 01.GPJ LAW_GIBB.GDT 4/25/07

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. DRILLER REPORTED GROUNDWATER STABILIZING WITHIN THE BOREHOLE AT A DEPTH OF ABOUT 7' AFTER SAMPLING THE SUBMERGED ZONE AT A DEPTH OF ABOUT 18.9'.

SOIL TEST BORING RECORD

PROJECT: TVA CUF Gypsum Seepage Study

DRILLED: November 29, 2006 **BORING NO.:** B-3

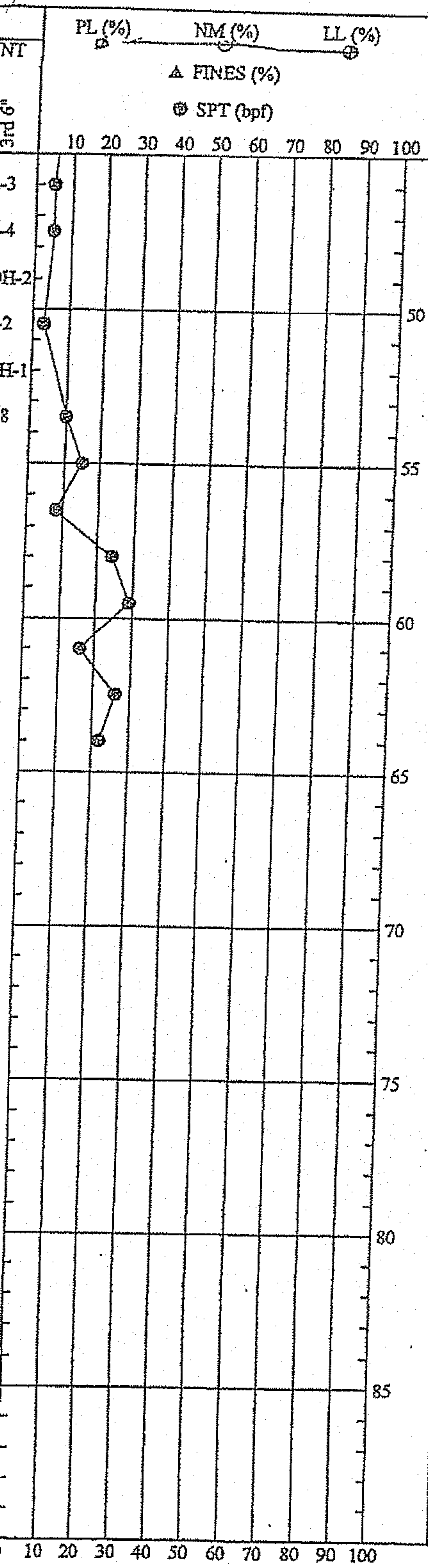
PROJ. NO.: 3043061041/0001 **PAGE 1 OF 2**

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

Driller: Akins
Prepared By: RDR
Checked By: Justice

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS (SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.)	ELEV (ft)	SAMPLES IDENT	N-COUNT (1st 6" 2nd 6" 3rd 6")
45	STIFF TO FIRM, BROWN, VERY MOIST TO WET, SILTY CLAY WITH VARYING AMOUNTS OF SILT - ALLUVIUM	350.0	SPT-31	WOH-2-3
	VERY SOFT TO SOFT, BROWN TO GRAY, VERY MOIST TO WET, SILTY CLAY - ALLUVIUM		SPT-32	WOH-1-4
			SPT-33	WOH-WOH-2
50		345.0	SPT-34	WOH-1-2
			SPT-35	WOH-WOH-1
	LOOSE TO VERY FIRM, BROWN, WET, SILTY SAND WITH GRAVEL - ALLUVIUM		SPT-36	WOH-2-8
55		340.0	SPT-37	4-8-7
			SPT-38	4-3-5
			SPT-39	9-10-14
60		335.0	SPT-40	15-11-18
			SPT-41	6-7-9
			SPT-42	10-10-16
			SPT-43	2-10-12-11
65	BORING TERMINATED AT 65.0'	330.0		
70		325.0		
75		320.0		
80		315.0		
85		310.0		
90		305.0		



SOIL 3043061041_01.GPJ LAW_GIBB.GDT 4/25/07

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. DRILLER REPORTED GROUNDWATER STABILIZING WITHIN THE BOREHOLE AT A DEPTH OF ABOUT 7' AFTER SAMPLING THE SUBMERGED ZONE AT A DEPTH OF ABOUT 18.9'.

SOIL TEST BORING RECORD

PROJECT: TVA CUF Gypsum Seepage Study

DRILLED: November 29, 2006 **BORING NO.:** B-3

PROJ. NO.: 3043061041/0001 **PAGE 2 OF 2**

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

Driller: Akins
Prepared By: RDR
Checked By: Justice

MACTEC

Law Engineering and Environmental Services, Inc.
(1995)

TVA - Fly Ash, Bottom Ash and Scrubber Sludge Study
Classification (Index Property) Summary
Law Engineering Project No. 5810860101

Source	Code	Material	Bucket Code	Date Collected	Moisture Content, %	Grain Size - ASTM D422 % Ret. on No. 4	Grain Size - ASTM D422 % Pass No. 200	Grain Size - ASTM D422 % Pass 0.005mm	Atterberg Limits/ASTM D4318 LL	Atterberg Limits/ASTM D4318 PL	Atterberg Limits/ASTM D4318 PI	Specific Gravity	USCS Classification	AASHTO Classification
Allen	ALF	Boiler Slag - Fine Reed Rejects	A-B	5/11/95	0.06	0.0	18.2	0.8	NL	NP	N/A	2.75	SM	A-2-4(0.0)
			C-D		0.12	0.0	14.6	0.8	NL	NP	N/A	2.79	SM	A-2-4(0.0)
			E-F		0.10	0.0	16.0	0.8	NL	NP	N/A	2.81	SM	A-2-4(0.0)
Bull Run	BRF	Dry Fly Ash	A-B	4/4/95	0.02	0.0	91.2	16.6	NL	NP	N/A	2.36	ML	A-4(0.0)
			C-D	4/5/95	0.05	0.0	91.2	19.5	NL	NP	N/A	2.28	ML	A-4(0.0)
			E-F	4/6/95	0.03	0.0	90.7	17.5	NL	NP	N/A	2.37	ML	A-4(0.0)
		Bottom Ash - From Pond	A-B	3/29/95	6.99	23.0	4.0	----	NL	NP	N/A	2.31	SW	A-1-b
			C-D		6.07	21.3	6.9	----	NL	NP	N/A	2.29	SW-SM	A-1-b
			E-F		6.74	17.9	5.9	----	NL	NP	N/A	2.35	SW-SM	A-1-b
Colbert	COF	Dry Fly Ash - Units 1&2	A	5/25/95	0.01	0.0	81.6	14.9	NL	NP	N/A	2.02	ML	A-4(0.0)
		- Units 3&4	B	5/25/95										
		- Units 1&2	C	5/26/95	0.01	0.0	69.9	11.5	NL	NP	N/A	2.00	ML	A-4(0.0)
		- Units 3&4	D	5/26/95										
		- Units 1&2	E	5/30/95	0.12	0.0	83.6	3.9	NL	NP	N/A	1.95	ML	A-4(0.0)
		- Units 3&4	F	5/30/95										
		Bottom Ash - From Pond	A-B	5/25/95	8.02	7.2	13.6	---	NL	NP	N/A	2.15	SM	A-1-b
			C-D		6.86	15.9	10.8	---	NL	NP	N/A	2.08	SP-SM	A-1-b
			E-F		7.92	12.8	10.5	----	NL	NP	N/A	2.10	SP-SM	A-1-b
Cumberland	CUF	Dry Fly Ash - Units 1&2	A-B	4/17/95	0.31	0.0	95.1	30.0	NL	NP	N/A	2.57	ML	A-4(0.0)
		- Units 1&2	C-D	4/18/95		0.0	92.0	20.7	NL	NP	N/A	2.64	ML	A-4(0.0)
		- Units 1&2	E-F	4/19/95	0.01	0.0	93.2	29.8	NL	NP	N/A	2.65	ML	A-4(0.0)
		Bottom Ash - From Pond	A-B	4/6/95	14.32	30.9	1.1	----	NL	NP	N/A	2.59	SW	A-1-a
			C-D		13.66	46.2	2.2	----	NL	NP	N/A	2.66	SW	A-1-a
			E-F		5.08	32.2	2.8	----	NL	NP	N/A	2.63	SW	A-1-a
		Scrubber Gypsum	A-B	4/6/95	30.44	----	---	---	NL	NP	N/A	---	---	---
			C-D		30.39	---	---	----	NL	NP	N/A	---	---	---
			E-F		29.41	----	----	----	NL	NP	N/A	---	---	----
Gallatin	GAF	Dry Fly Ash - Unit 2 Hoppers	A-B	6/9/95	0.03	0.0	94.2	12.0	NL	NP	N/A	2.37	ML	A-4(0.0)
			C-D		0.01	0.0	95.2	13.8	NL	NP	N/A	2.40	ML	A-4(0.0)
			E-F		0.01	0.0	95.5	14.8	NL	NP	N/A	2.39	ML	A-4(0.0)
		Bottom Ash - From Pond	A-B	6/9/95	19.11	18.2	5.9	---	NL	NP	N/A	2.56	SP-SM	A-1-b
			C-D		7.32	27.0	4.0	---	NL	NP	N/A	2.57	SW	A-1-b
			E-F		10.20	18.8	5.6	---	NL	NP	N/A	2.52	SW-SM	A-1-b
John Sevier	JSF	Dry Fly Ash - Unit 4, Hoppers 11&12	A	5/25/95	0.06	0.0	94.2	17.4	NL	NP	N/A	2.27	ML	A-4(0.0)
		- Unit 3, Hoppers 11&12	B											
		- Unit 4, Hoppers 9, 10&13	C	5/25/95	0.01	0.0	96.1	22.1	NL	NP	N/A	2.35	ML	A-4(0.0)
		- Unit 3, Hoppers 9&10	D											
		- Unit 4, Hopper 15,	E	5/25/95	0.20	0.0	94.1	28.0	NL	NP	N/A	2.43	ML	A-4(0.0)
		- Unit 3, Hopper 16												
		- Unit 4, Hopper 15	F											
		Bottom Ash - From Pond	A-B	4/12/95	26.68	22.8	4.3	---	NL	NP	N/A	2.25	SP	A-1-a
			C-D		27.22	22.2	3.3	---	NL	NP	N/A	2.24	SW	A-1-a
			E-F		30.70	27.8	3.7	---	NL	NP	N/A	2.22	SW	A-1-a

TVA - Fly Ash, Bottom Ash and Scrubber Sludge Study

Volumetric Testing Summary

Law Engineering Project No. 5810860101

Source	Code	Material	Standard Proctor		Modified Proctor		Relative Density, Dry Method (pcf)	
			Max. Dry Dens. (pcf)	Opt. Moisture (%)	Max. Dry Dens. (pcf)	Opt. Moisture (%)	Minimum	Maximum
Allen	ALF	Boiler Slag (Fine Reed Rejects)	95.3	21.5	102.6	23.2	----	----
Bull Run	BRF	Dry Fly Ash	91.6	17.4	95.7	15.1	----	----
		Bottom Ash - From Pond	91.9	22.6	98.7	18.5	73.9	92.1
Colbert	COF	Dry Fly Ash (Units 1-4)	56.7	45.4	62.9	40.3	----	----
		Bottom Ash - From Pond	64.2	27.4	73.2	17.2	55.7	71.2
Cumberland	CUF	Dry Fly Ash (Units 1-2)	111.4	13.2	116.3	11.5	----	----
		Bottom Ash - From Pond	90.1	15.4	103.3	15.7	67.0	87.1
		Scrubber Gypsum	----	----	----	----	----	----
Gallatin	GAF	Dry Fly Ash (Unit 2 Hoppers)	86.6	21.4	88.9	18.8	----	----
		Bottom Ash - From Pond	92.0	25.5	102.5	20.9	71.3	90.7
John Sevier	JSF	Dry Fly Ash (Units 3-4)	83.7	18.6	86.7	17.8	----	----
		Bottom Ash - From Pond	78.9	30.3	96.2	21.9	55.7	73.9
Johnsonville	JOF	Ponded Fly Ash (New Dredge Cell)	75.8	31.4	92.5	20.6	----	----
		Ponded Fly Ash (Old Dredge Cell)	89.5	20.5	96.0	16.1	----	----
		Ponded Fly Ash (Active Ash Pond)	86.6	22.8	91.7	18.0	----	----
		Bottom Ash - From Pond	99.2	18.0	104.1	12.0	80.2	99.2
Kingston	KIF	Ponded Fly Ash (Cell I)	81.0	25.2	84.7	24.1	----	----
		Ponded Fly Ash (Cell III)	81.0	23.5	84.4	23.7	----	----
		Bottom Ash - From Pond	89.0	24.1	97.6	21.0	71.0	88.4
Paradise	PAF	Ponded Fly Ash (East Cell)	110.0	16.5	114.4	13.7	----	----
		Boiler Slag (Reed Rejects)	112.5	18.2	116.0	18.7	----	----
		Scrubber Gypsum	----	----	----	----	----	----
Shawnee	SHF	Dry Fly Ash	72.4	28.3	77.2	24.4	----	----
		Bottom Ash - From Pond	71.7	30.5	81.4	26.1	57.4	74.0
		Spent Bed Material (SBM)	----	----	----	----	----	----
		Char	----	----	----	----	----	----
Widows Creek	WCF	Ponded Fly Ash (Ash Pond)	67.0	39.8	73.5	27.8	----	----
		Scrubber Gypsum	----	----	----	----	----	----
		Bottom Ash - From Pond	106.2	17.6	120.8	15.8	83.0	103.3

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TVA - Fly Ash, Bottom Ash and Scrubber Sludge Study
Consolidation/Hydraulic Conductivity/Chemical Testing Summary
Law Engineering Project No. 5810860101

Source	Code	Material	Consolidation Compression Index, C_c	Hydraulic Conductivity (cm/sec)	Resistivity (Ohm-cm)	pH	Water Soluble Sulfate (mg/kg)	Water Soluble Chloride (mg/kg)
Allen	ALF	Boiler Slag (Fine Reed Rejects)	0.04	9.0E-4	30000	7.5	43	<10
Bull Run	BRF	Dry Fly Ash	0.04	4.0E-5	690	8.4	4630	<10
		Bottom Ash - From Pond	----	1.8E-2	7300	7.2	370	<10
Colbert	COF	Dry Fly Ash (Units 1-4)	0.08	2.8E-4	850	9.4	1660	<10
		Bottom Ash - From Pond	----	1.6E-2	4500	5.4	215	<10
Cumberland	CUF	Dry Fly Ash (Units 1-2)	0.01	2.2E-5	2600	11.6	5020	<10
		Bottom Ash - From Pond	----	6.8E-2	1200	2.7	4790	<10
		Scrubber Gypsum	----	----	1100	7.8	4830	<10
Gallatin	GAF	Dry Fly Ash (Unit 2 Hoppers)	0.05	7.7E-5	420	10.6	5800	<10
		Bottom Ash - From Pond	----	2.9E-2	1600	2.8	1660	<10
John Sevier	JSF	Dry Fly Ash (Units 3-4)	0.05	5.5E-5	440	4.1	4910	<10
		Bottom Ash - From Pond	----	2.6E-2	5200	6.8	285	<10
Johnsonville	JOF	Ponded Fly Ash (New Dredge Cell)	0.06	5.0E-4	2800	8.1	83	<10
		Ponded Fly Ash (Old Dredge Cell)	0.10	5.8E-4	2600	6.8	1520	20
		Ponded Fly Ash (Active Ash Pond)	0.11	3.5E-5	690	8.4	2960	60
		Bottom Ash - From Pond	----	4.7E-3	740	6.0	2200	<10
Kingston	KIF	Ponded Fly Ash (Cell I)	0.05	8.3E-5	7700	7.6	200	<10
		Ponded Fly Ash (Cell III)	0.05	3.4E-5	6400	6.8	140	<10
		Bottom Ash - From Pond	----	9.1E-3	1900	4.0	490	<10
Paradise	PAF	Ponded Fly Ash (East Cell)	0.04	1.0E-5	2600	8.1	340	<10
		Boiler Slag (Reed Rejects)	----	1.3E-3	9700	4.3	220	<10
		Scrubber Gypsum	----	----	1100	7.7	4630	10
Shawnee	SHF	Dry Fly Ash	0.04	9.2E-5	1000	11.5	2270	<10
		Bottom Ash - From Pond	----	8.9E-3	3000	8.1	4200	10
		Spent Bed Material (SBM)	----	----	----	12.0	4190	150
		Char	----	----	190	12.0	4130	980
Widows Creek	WCF	Ponded Fly Ash (Ash Pond)	0.12	1.8E-4	1400	9.2	1060	<10
		Scrubber Gypsum	----	----	1200	6.7	3050	<10
		Bottom Ash - From Pond	----	3.4E-2	3100	8.0	4070	130

Note: Consolidation and Hydraulic Conductivity test specimen were remolded to approximately 95 percent of the Standard Proctor maximum dry density

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TVA - Fly Ash, Bottom Ash and Scrubber Sludge Study
Strength Testing Summary
Law Engineering Project No. 5810860101

Source	Code	Material	CBR %	Resilient Modulus (Standard Effort) K1	K2	K5	M_r at S_c=4psi, S_d=4psi	Resilient Modulus (Modified Effort) K1	K2	K5	M_r at S_c=4psi, S_d=4psi
Allen	ALF	Boiler Slag (Fine Reed Rejects)	37	2,662	0.09516	0.53980	6,419	2,468	0.14322	0.51069	6,110
Bull Run	BRF	Dry Fly Ash	2	3,225	-0.17750	0.54531	5,370	3,283	-0.01625	0.38843	5,500
		Bottom Ash - From Pond	35	1,857	0.10936	0.78070	6,378	1,977	0.13522	0.76648	6,901
Colbert	COF	Dry Fly Ash (Units 1-4)	9	1,353	-0.00868	0.56321	2,918	1,639	0.01011	0.53301	3,480
		Bottom Ash - From Pond	24	2,368	0.11934	0.58242	6,264	2,455	0.09488	0.59309	6,372
Cumberland	CUF	Dry Fly Ash (Units 1-2)	24	7,531	-0.03317	0.34550	11,612	10,959	0.14896	0.24877	19,021
		Bottom Ash - From Pond	15	2,194	0.09530	0.67882	6,417	1,994	0.13866	0.76150	6,945
		Scrubber Gypsum	----	----	----	----	----	----	----	----	----
Gallatin	GAF	Dry Fly Ash (Unit 2 Hoppers)	2	2,713	-0.09930	0.47991	4,598	3,602	-0.12389	0.45133	5,671
		Bottom Ash - From Pond	30	1,972	0.20995	0.65540	6,545	2,427	0.20416	0.61364	7,541
John Sevier	JSF	Dry Fly Ash (Units 3-4)	1	2,965	-0.08694	0.43636	4,813	4,033	-0.09489	0.39276	6,095
		Bottom Ash - From Pond	40	2,156	0.08085	0.76340	6,949	2,108	0.09702	0.69867	6,352
Johnsonville	JOF	Ponded Fly Ash (New Dredge Cell)	12	1,487	0.03358	0.63725	3,769	2,541	-0.01211	0.48836	4,917
		Ponded Fly Ash (Old Dredge Cell)	28	1,495	0.03707	0.78260	4,657	2,255	0.09559	0.65332	6,368
		Ponded Fly Ash (Active Ash Pond)	1	2,146	-0.18159	0.60215	3,844	3,980	-0.14235	0.42844	5,917
		Bottom Ash - From Pond	50	2,373	0.16927	0.51994	6,169	2,389	0.13323	0.56010	6,247
Kingston	KIF	Ponded Fly Ash (Cell I)	2	1,803	0.07728	0.41203	3,553	2,374	-0.04388	0.47386	4,309
		Ponded Fly Ash (Cell III)	1	2,592	-0.10787	0.48134	4,350	3,254	-0.09252	0.43051	5,199
		Bottom Ash - From Pond	60	1,427	0.13665	0.75876	4,938	1,822	0.19126	0.64487	5,807
Paradise	PAF	Ponded Fly Ash (East Cell)	4	5,929	-0.09595	0.40269	9,071	5,551	-0.06155	0.44309	9,421
		Boiler Slag (Reed Rejects)	55	1,661	0.06737	0.79102	5,460	1,715	0.08023	0.76411	5,529
		Scrubber Gypsum	----	----	----	----	----	----	----	----	----
Shawnee	SHF	Dry Fly Ash	9	2,390	-0.04340	0.45385	4,222	2,774	-0.03472	0.41978	4,731
		Bottom Ash - From Pond	25	1,928	0.11134	0.73640	6,244	1,558	0.08323	0.76224	5,030
		Spent Bed Material (SBM)	----	----	----	----	----	----	----	----	----
		Char	----	----	----	----	----	----	----	----	----
Widows Creek	WCF	Ponded Fly Ash (Ash Pond)	3	1,026	-0.02608	0.63430	2,384	3,283	-0.01625	0.38843	5,500
		Scrubber Gypsum	----	----	----	----	----	----	----	----	----
		Bottom Ash - From Pond	30	2,258	0.19103	0.66319	7,379	2,260	0.28011	0.26147	4,788

Note: CBR and Resilient Modulus test specimen were remolded to approximately 95 percent of the Standard Proctor (and Modified Proctor for Res. Mod.) maximum dry density at or near optimum moisture content

lab\soil\tva\prgrm.xls (Dynamic)

TVA - Fly Ash, Bottom Ash and Scrubber Sludge Study
Strength Testing Summary
Law Engineering Project No. 5810860101

Source	Code	Material	Triaxial CU with pore pressure: Effective Stress ($\bar{R}$): Cohesion, c (ksf)	Triaxial CU with pore pressure: Effective Stress ($\bar{R}$): Internal friction, φ	Triaxial CU with pore pressure: Total Stress (R): Cohesion, c (ksf)	Triaxial CU with pore pressure: Total Stress (R): Internal friction, φ	Direct Shear (S): Cohesion, c (ksf)	Direct Shear (S): Internal friction, φ	Angle of Repose
Allen	ALF	Boiler Slag (Fine Reed Rejects)	0.00	37.3	1.15	39.2	2.32	25.2	—
Bull Run	BRF	Dry Fly Ash	0.31	27.7	1.12	21.2	1.36	27.4	----
		Bottom Ash - From Pond	----	----	----	----	----	----	32.4
Colbert	COF	Dry Fly Ash (Units 1-4)	0.34	27.6	0.69	19.9	1.31	28.6	—
		Bottom Ash - From Pond	----	----	----	----	----	----	30.9
Cumberland	CUF	Dry Fly Ash (Units 1-2)	0.00	53.5	1.70	50.5	2.53	33.4	----
		Bottom Ash - From Pond	----	----	----	----	----	----	30.8
		Scrubber Gypsum	----	----	----	----	----	----	----
Gallatin	GAF	Dry Fly Ash (Unit 2 Hoppers)	0.00	31.7	0.57	26.2	1.37	34.5	----
		Bottom Ash - From Pond	----	----	----	----	----	----	31.8
John Sevier	JSF	Dry Fly Ash (Units 3-4)	0.22	22.4	0.26	17.7	1.11	33.6	----
		Bottom Ash - From Pond	----	----	----	----	----	----	27.4
Johnsonville	JOF	Av Pont Ponded Fly Ash (New Dredge Cell)	0.23	32.4	1.26	25.8	1.29	32.4	----
	South Loop	Ponded Fly Ash (Old Dredge Cell)	0.12	30.5	0.66	15.2	2.14	39.3	----
		Ponded Fly Ash (Active Ash Pond)	0.00	22.6	0.01	15.8	1.41	36.6	----
		Bottom Ash - From Pond	----	----	----	----	----	----	30.8
Kingston	KJF	Ponded Fly Ash (Cell I)	0.14	26.1	0.36	19.6	0.82	39.1	—
		Ponded Fly Ash (Cell III)	0.03	24.4	0.00	17.8	1.47	37.6	—
		Bottom Ash - From Pond	----	----	----	----	----	----	31.3
Paradise	PAF	Ponded Fly Ash (East Cell)	0.37	21.2	0.55	15.6	2.27	20.2	----
		Boiler Slag (Reed Rejects)	0.06	40.6	2.00	40.3	----	----	—
		Scrubber Gypsum	----	----	----	----	----	----	—
Shawnee	SHF	Dry Fly Ash	1.24	22.4	1.79	14.7	1.10	39.8	----
		Bottom Ash - From Pond	----	----	----	----	----	----	31.6
		Spent Bed Material (SBM)	----	----	----	----	----	----	----
		Char	----	----	----	----	----	----	----
Widows Creek	WCF	Ponded Fly Ash (Ash Pond)	1.85	25.5	1.94	21.5	1.70	31.2	—
		Scrubber Gypsum	----	----	----	----	----	----	----
		Bottom Ash - From Pond	----	----	----	----	----	----	29.0

Note: Triaxial CU and Direct Shear test specimen were remolded to approximately 95 percent of the Standard Proctor maximum dry density at or near optimum moisture content

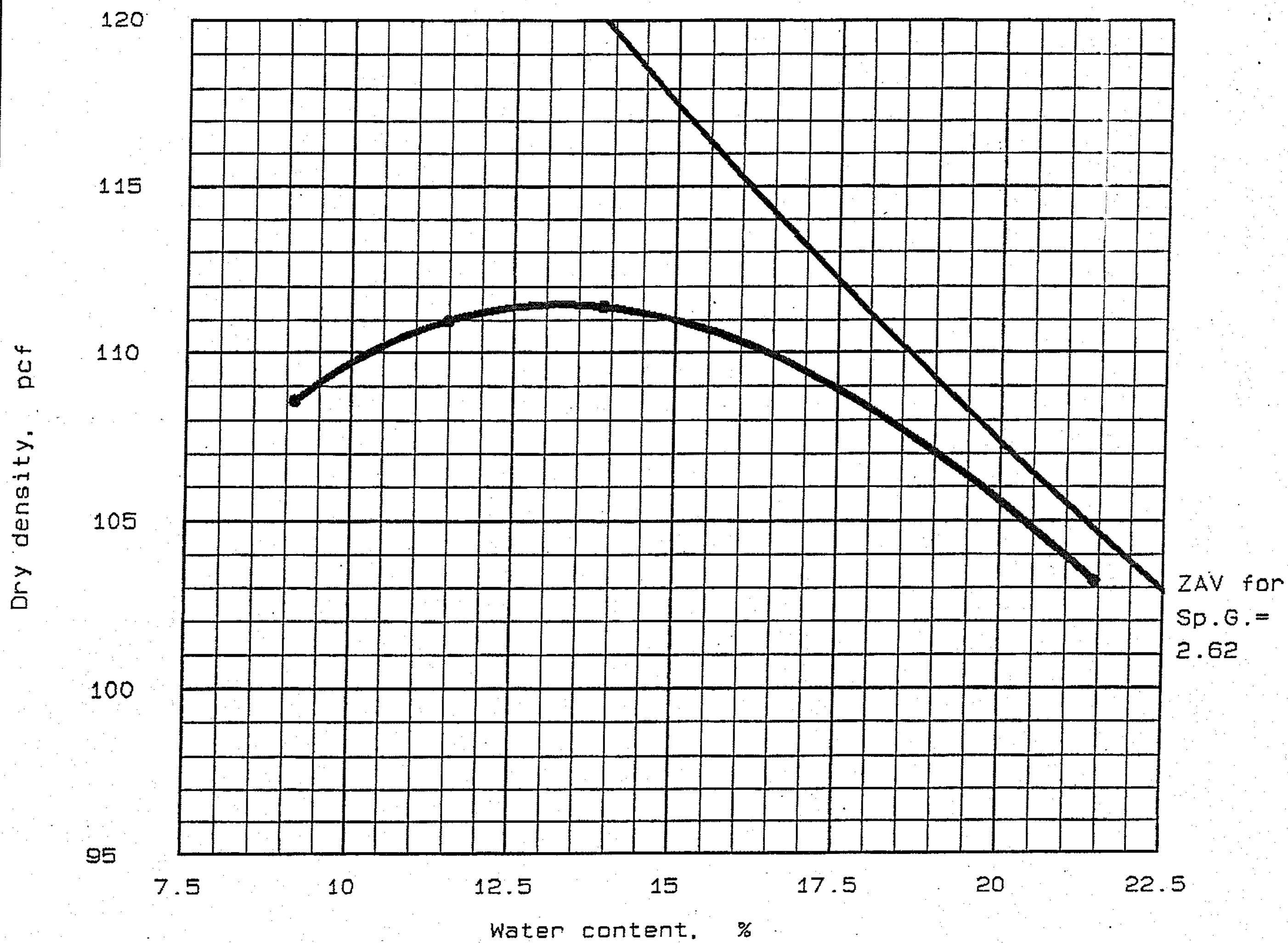
lab\soil\tva\prgrm.xls (Static)

TVA - CUMBERLAND
DRY FLY ASH (UNITS 1-2)

Description	Test Method	Property	Sample 1	Sample 2	Sample 3
Grain Size	ASTM D 422	Percent Retained on the #4 Sieve Percent Passing the #200 Sieve Percent Passing the 0.005 mm Sieve	0.0 95.1 30.0	0.0 92.0 20.7	0.0 93.2 29.8
Atterberg Limits	ASTM D 4318	Liquid Limit Plastic Limit Plasticity Index	NL NP N/A	NL NP N/A	NL NP N/A
Specific Gravity	ASTM D 854	Specific Gravity at 20°C	2.57	2.64	2.65
Classification	ASTM D 2487 AASHTO M 145	Unified Soil Classification System (USCS) AASHTO Classification	ML A-4(0.0)	ML A-4(0.0)	ML A-4(0.0)
				Composite Sample	
Moisture-Density Relations (Standard Effort)	ASTM D 698	Maximum Dry Density, pcf Optimum Moisture Content, %		111.4 13.2	
Moisture-Density Relations (Modified Effort)	ASTM D 1557	Maximum Dry Density, pcf Optimum Moisture Content, %		116.3 11.5	
			Result	Dry Density, pcf	Moisture Content, %
Consolidation	ASTM D2435	Compression Index C_c	0.01	104.8	11.6
Hydraulic Conductivity	ASTM D 5084	Hydraulic Conductivity, cm/sec	2.2E-5	106.3	12.4
Triaxial Shear Strength Consolidated-Undrained (CU)	ASTM D4767	Effective Stress, Cohesion, c', ksf Effective Stress, Internal Friction Angle, ϕ',degrees	0.00 53.5	106.3	12.2
		Total Stress, Cohesion, c, ksf Total Stress, Internal Friction Angle, ϕ, degrees	1.70 50.5	106.3	12.2
Direct Shear Strength	ASTM D 3080	Cohesion, c, ksf Internal Friction Angle, ϕ, degrees	2.53 33.4	93.7	12.9
California Bearing Ratio	ASTM D 1883	CBR, %	24	106.6	13.1
Resilient Modulus (Standard Compactive Effort)	SHRP P46	Resilient Modulus at 4psi axial stress and 4psi confining pressure	11,612	104.4	13.0
Resilient Modulus (Modified Compactive Effort)	SHRP P46	Resilient Modulus at 4psi axial stress and 4psi confining pressure	19,021	107.6	10.2
Soil Resistivity	AASHTO T 288	Minimum Resistivity, Ohm-cm		2,600	
pH of Soil	AASHTO T 289	pH		11.6	
Water Soluble Sulfate Ion	AASHTO T 290	Sulfate Ion Content, mg/kg		5020	
Water Soluble Chloride Ion	AASHTO T 290	Chloride Ion Content, mg/kg		<10	

cuf-fa.xls

MOISTURE-DENSITY RELATIONSHIP



"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	ML	A-4(0.0)	.160 %	2.62	NL	NP	0 %	93.4 %

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 13.2 % Maximum dry density = 111.4 pcf	

Project No.: 5810860101

Project: TVA - Cumberland

Location: Dry Fly Ash

Units 1-2

Date: July 25, 1995

MOISTURE-DENSITY RELATIONSHIP

LAW ENGINEERING, INC.

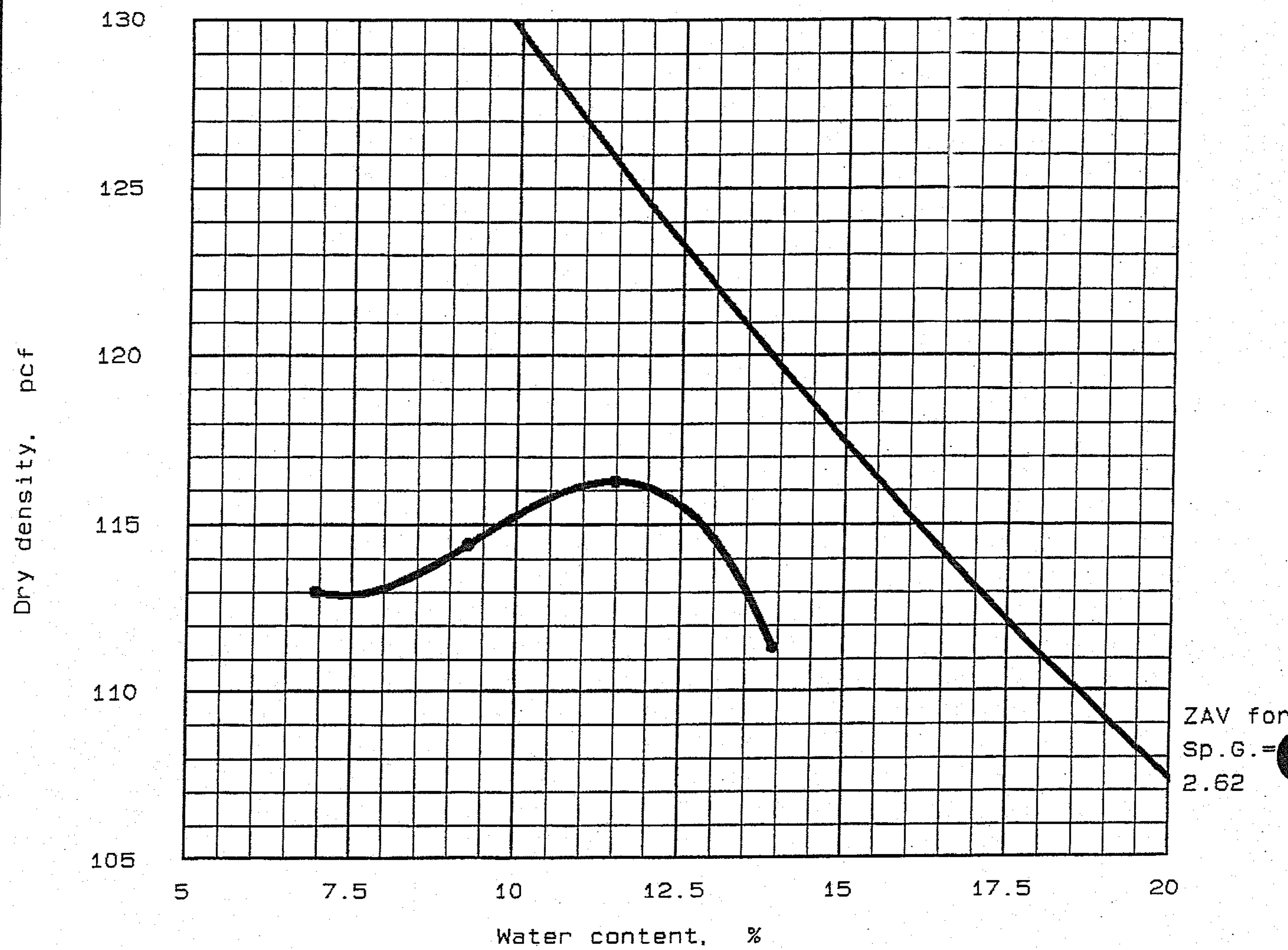
Remarks:

Tested by: JCR

Reviewed by: HS/RLB

Figure No. ______

MOISTURE-DENSITY RELATIONSHIP



"Modified" Proctor, ASTM D 1557, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	ML	A-4(0.0)	.160 %	2.62	NL	NP	0 %	93.4 %

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 11:5 % Maximum dry density = 116.3 pcf	

Project No.: 5810860101

Project: TVA - Cumberland

Location: Dry Fly Ash

Units 1-2

Date: July 25, 1995

Remarks:

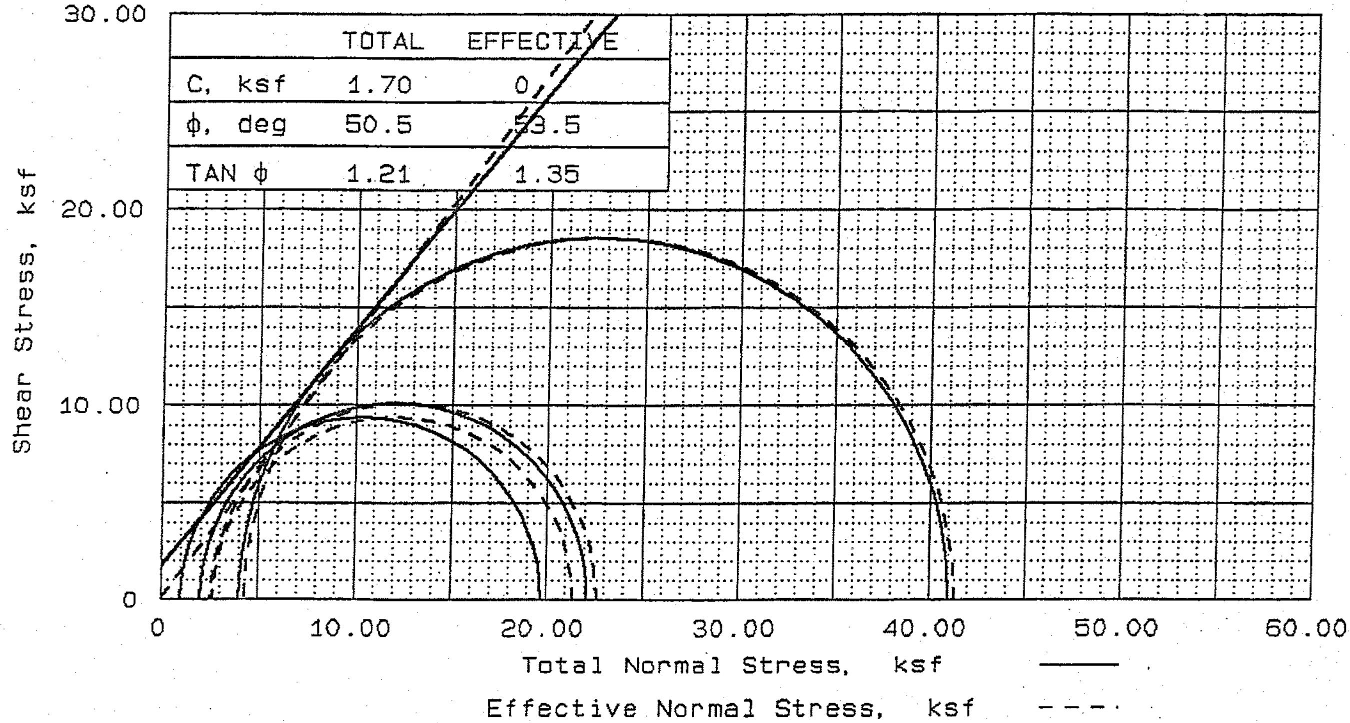
Tested by: JCR

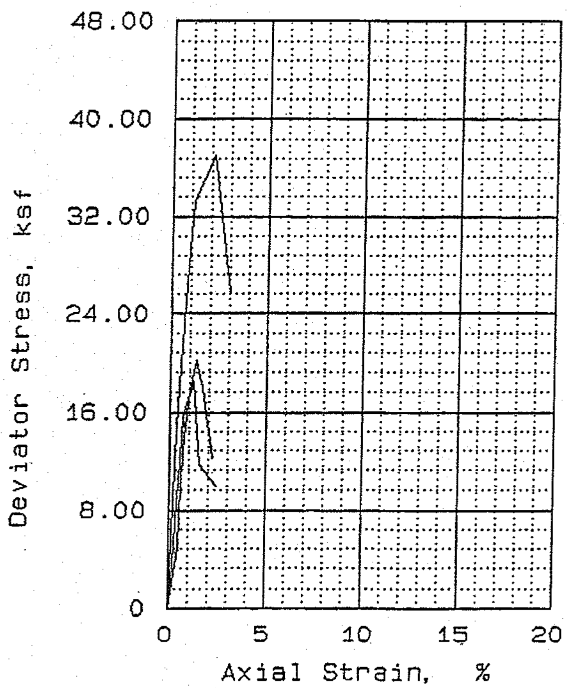
Reviewed by: RLB

MOISTURE-DENSITY RELATIONSHIP

LAW ENGINEERING, INC.

Figure No. ______





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	12.2	12.4	12.1
	DRY DENSITY, pcf	106.3	106.3	106.4
	SATURATION, %	59.6	60.1	59.3
	VOID RATIO	0.538	0.539	0.537
	DIAMETER, in	2.83	2.83	2.83
	HEIGHT, in	6.00	6.00	6.00
AT TEST	WATER CONTENT, %	20.5	20.3	20.1
	DRY DENSITY, pcf	106.5	106.8	107.1
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.536	0.531	0.527
	DIAMETER, in	2.84	2.82	2.82
	HEIGHT, in	5.97	6.00	6.00
BACK PRESSURE, ksf		4.08	2.94	4.09
CELL PRESSURE, ksf		5.07	4.94	8.09
FAILURE STRESS, ksf		18.74	20.16	37.05
PORE PRESSURE, ksf		2.40	2.43	3.80
STRAIN RATE, %/min.		0.100	0.100	0.100
ULTIMATE STRESS, ksf				
PORE PRESSURE, ksf				
$\bar{\sigma}_1$ FAILURE, ksf		21.41	22.67	41.35
$\bar{\sigma}_3$ FAILURE, ksf		2.67	2.51	4.29

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: Remolded
DESCRIPTION:

LL= NL PL= NP PI=
SPECIFIC GRAVITY= 2.62
REMARKS: Tested by: Hy

Reviewed by: RUB

FIG. NO.

CLIENT:

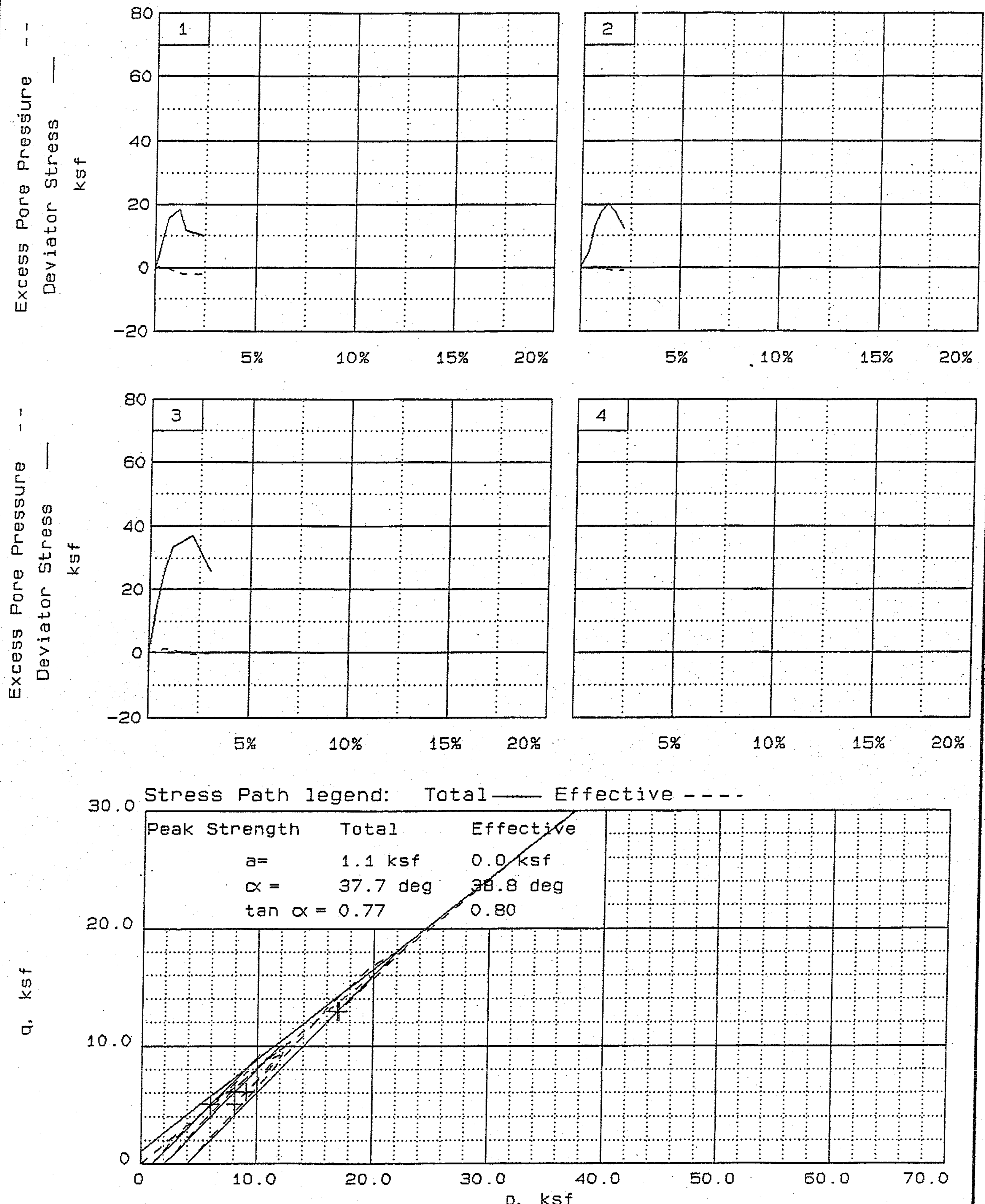
PROJECT: TVA – Cumberland

SAMPLE LOCATION: Dry Fly Ash
Units 1-2

PROJ. NO.: 5810860101 DATE: August 23, 1995

TRIAXIAL COMPRESSION TEST

LAW ENGINEERING, INC.

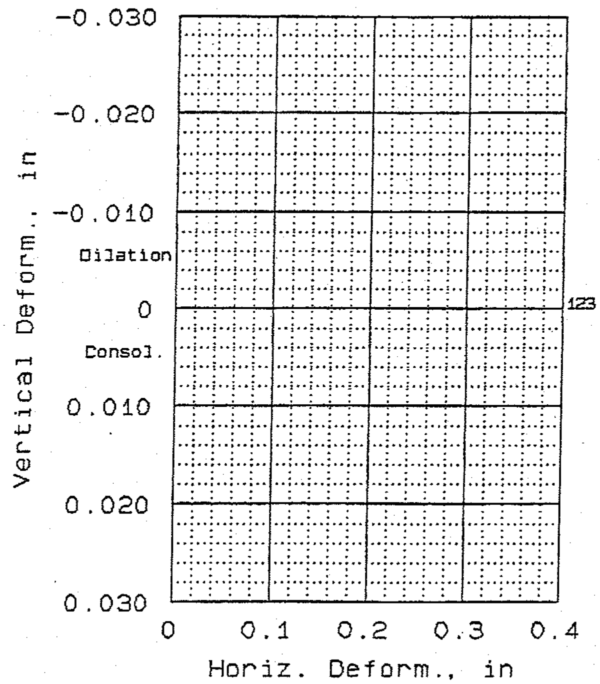


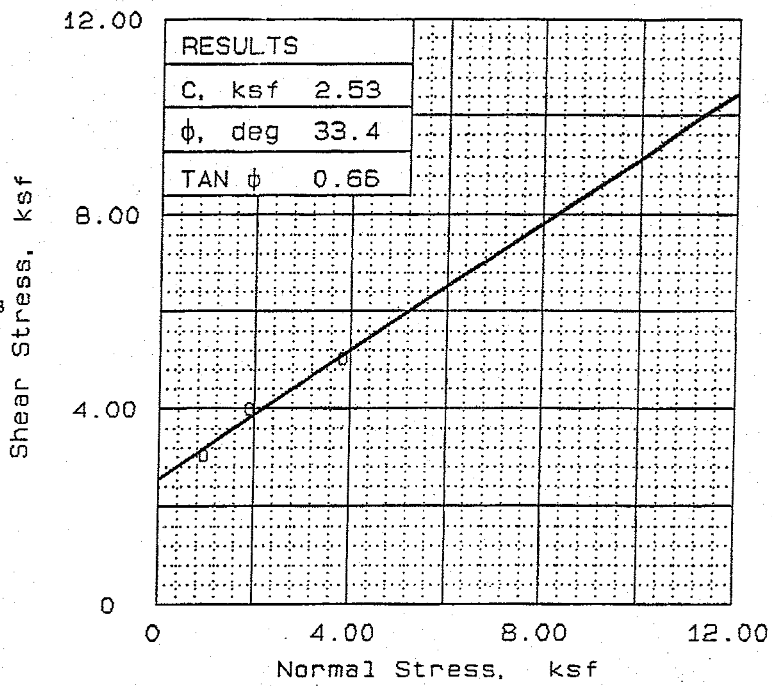
Client:

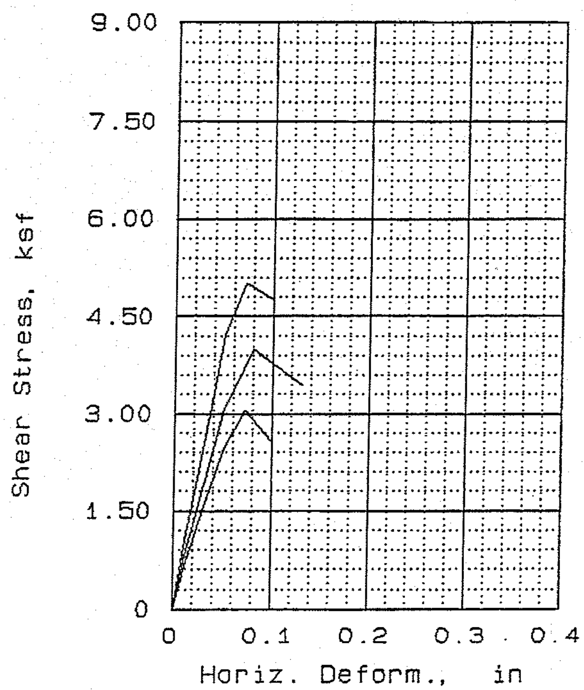
Project: TVA - Cumberland

Location: Dry Fly Ash Units 1-2

File: 8601D Project No.: 5810860101 Page 2/2 Fig. No. ____







SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	13.0	12.9	12.8
	DRY DENSITY, pcf	94.6	93.1	93.4
	SATURATION, %	46.8	44.6	44.8
	VOID RATIO	0.728	0.757	0.750
	DIAMETER, in	2.50	2.50	2.50
	HEIGHT, in	0.81	0.81	0.81
AT TEST	WATER CONTENT, %	13.0	12.9	12.8
	DRY DENSITY, pcf	94.6	93.1	93.4
	SATURATION, %	46.8	44.6	44.8
	VOID RATIO	0.728	0.757	0.750
	DIAMETER, in	2.50	2.50	2.50
	HEIGHT, in	0.81	0.81	0.81
NORMAL STRESS, ksf		0.97	1.94	3.88
MAX. SHEAR, ksf		3.04	4.00	5.02
STRAIN RATE, %/min.		0.500	0.500	0.500
ULT. SHEAR, ksf				

SAMPLE DATA

SAMPLE TYPE: Remolded

DESCRIPTION:

LL= NL PL= NP PI=

SPECIFIC GRAVITY= 2.62

REMARKS: Tested by: HD

Reviewed by: RLB

FIG. NO.

CLIENT:

PROJECT: TVA - Cumberland

SAMPLE LOCATION: Dry Fly Ash
Units 1-2

PROJ. NO.: 5810860101 DATE: August 23, 1995

DIRECT SHEAR TEST

LAW ENGINEERING, INC.

TVA - CUMBERLAND
BOTTOM ASH - FROM POND

Description	Test Method	Property	Sample 1	Sample 2	Sample 3
Grain Size	ASTM D 422	Percent Retained on the #4 Sieve Percent Passing the #200 Sieve	30.9 1.1	46.2 2.2	32.2 2.8
Atterberg Limits	ASTM D 4318	Liquid Limit Plastic Limit Plasticity Index	NL NP N/A	NL NP N/A	NL NP N/A
Specific Gravity	ASTM D 854	Specific Gravity at 20°C	2.59	2.66	2.63
Classification	ASTM D 2487 AASHTO M 145	Unified Soil Classification System (USCS) AASHTO Classification	SW A-1-a	SW A-1-a	SW A-1-a
				Composite Sample	
Moisture-Density Relations (Standard Effort)	ASTM D 698	Maximum Dry Density, pcf Optimum Moisture Content, %		90.1 15.4	
Moisture-Density Relations (Modified Effort)	ASTM D 1557	Maximum Dry Density, pcf Optimum Moisture Content, %		103.3 15.7	
Relative Density	ASTM D 4254 ASTM D 4253	Minimum Dry Density, pcf Maximum Dry Density (Dry Method), pcf		67.0 87.1	
			Result	Dry Density, pcf	Moisture Content, %
Hydraulic Conductivity	ASTM D 2434	Hydraulic Conductivity, cm/sec	6.8E-2	77.0	0.0
Angle of Repose	LAW TP6	Angle of Repose, degrees	30.8	67.0	0.0
California Bearing Ratio	ASTM D 1883	CBR, %	15	81.6	14.1
Resilient Modulus (Standard Compactive Effort)	SHRP P46	Resilient Modulus at 4psi axial stress and 4psi confining pressure	6,417	84.4	14.2
Resilient Modulus (Modified Compactive Effort)	SHRP P46	Resilient Modulus at 4psi axial stress and 4psi confining pressure	6,945	96.7	14.6
Soil Resistivity	AASHTO T 288	Minimum Resistivity, Ohm-cm		1,200	
pH of Soil	AASHTO T 289	pH		2.7	
Water Soluble Sulfate Ion	AASHTO T 290	Sulfate Ion Content, mg/kg		4790	
Water Soluble Chloride Ion	AASHTO T 290	Chloride Ion Content, mg/kg		<10	

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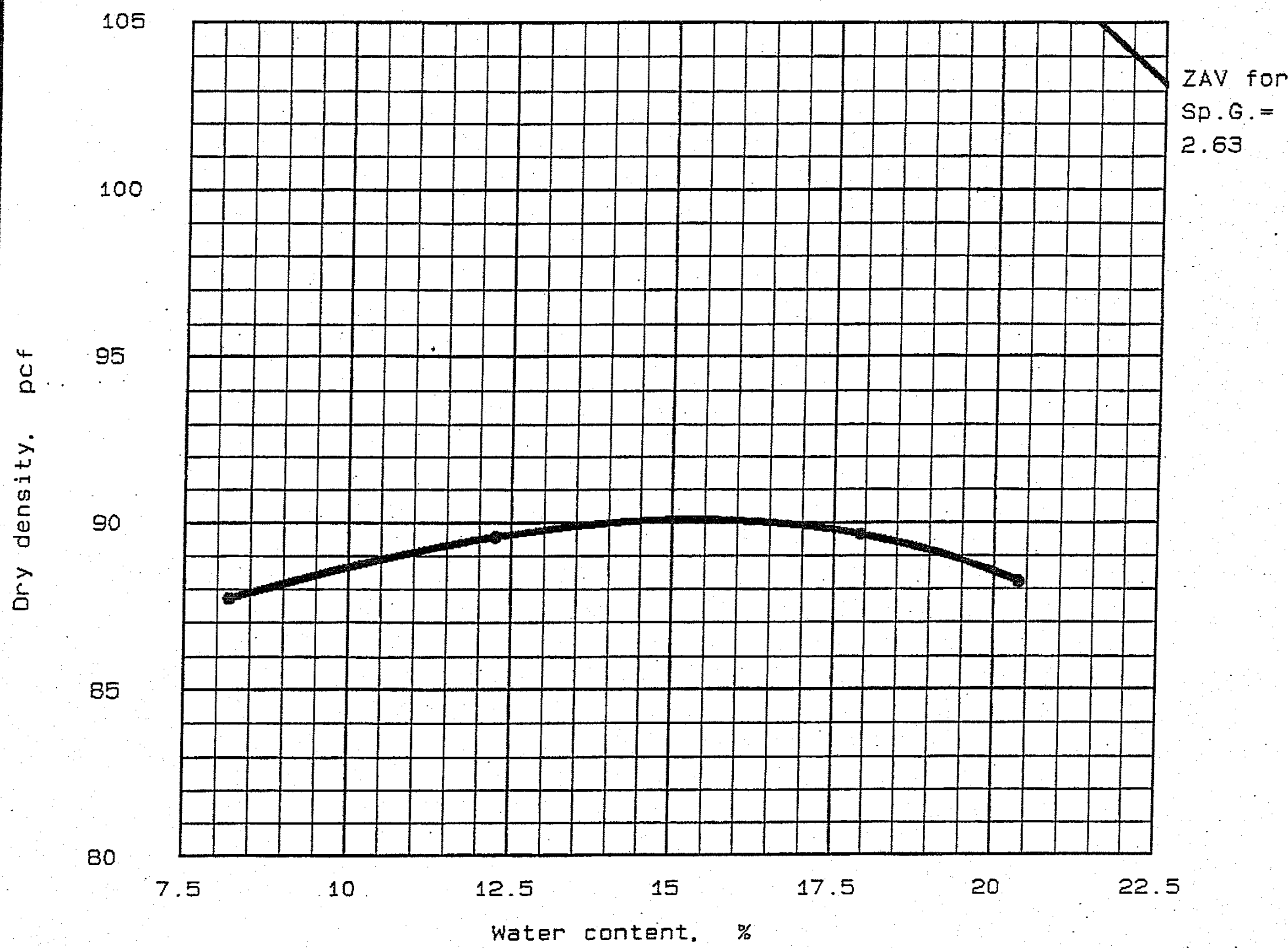
MOISTURE-DENSITY RELATIONSHIP



"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SW	A-1-a	11.0 %	2.63	NL	NP	36.4 %	3.03 %

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 15.4 % Maximum dry density = 90.1 pcf	

Project No.: 5810860101

Project: TVA - Cumberland

Location: Bottom Ash

Date: July 25, 1995

Remarks:

Tested by: EM

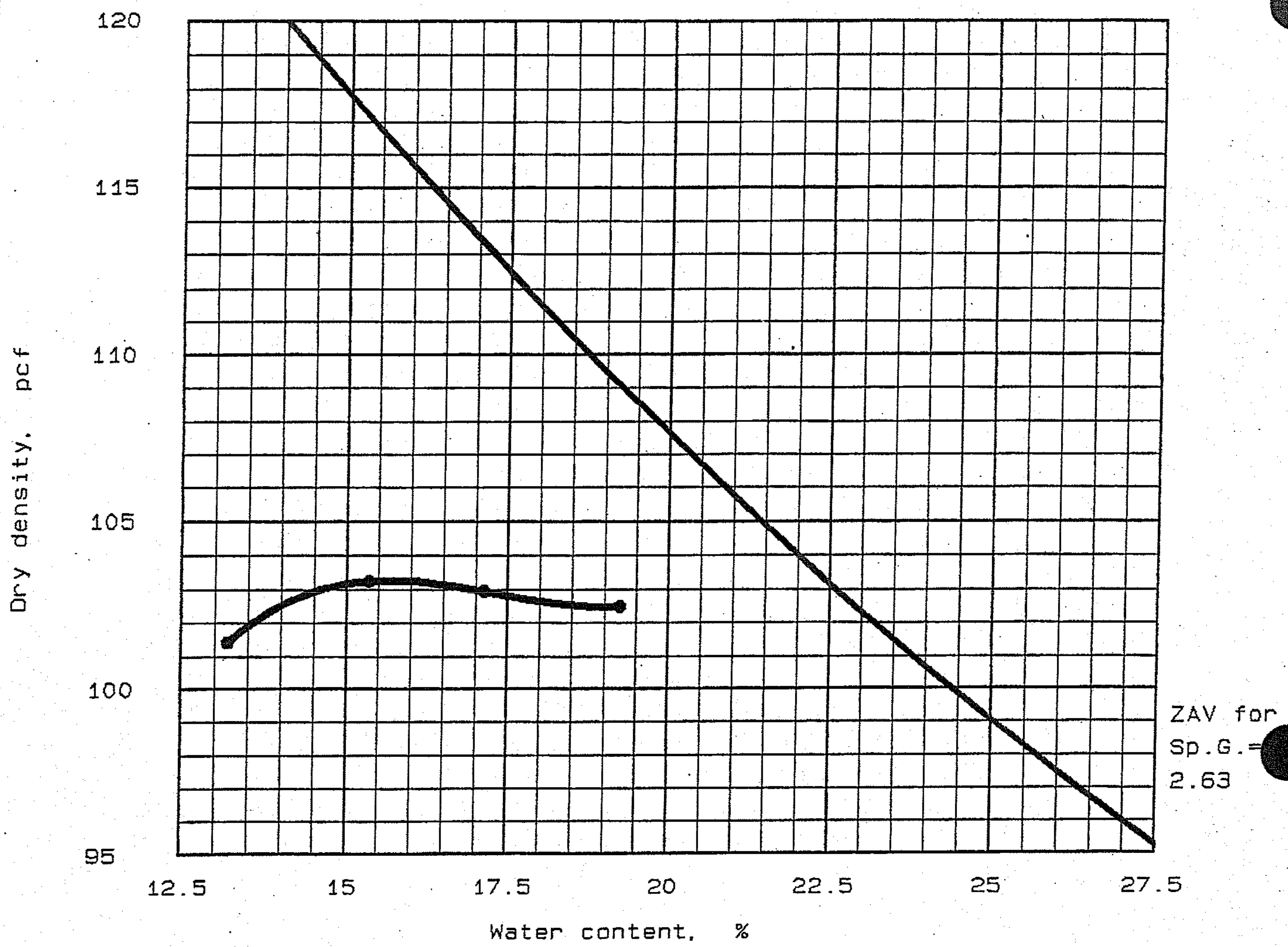
Reviewed by: RLB

MOISTURE-DENSITY RELATIONSHIP

LAW ENGINEERING, INC.

Figure No. ______

MOISTURE-DENSITY RELATIONSHIP



"Modified" Proctor, ASTM D 1557, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SW	A-1-a	11.0 %	2.63	NL	NP	36.4 %	3.03 %

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 15.7 % Maximum dry density = 103.3 pcf	

Project No.: 5810860101

Project: TVA - Cumberland

Location: Bottom Ash

Date: July 25, 1995

Remarks:

Tested by: JCR

Reviewed by: RLB

MOISTURE-DENSITY RELATIONSHIP

LAW ENGINEERING, INC.

Figure No. ______

TVA - CUMBERLAND
SCRUBBER GYPSUM

Description	Test Method	Property	Sample 1	Sample 2	Sample 3
Grain Size	ASTM D 422	Percent Retained on the #4 Sieve Percent Passing the #200 Sieve Percent Passing the 0.005 mm Sieve	see note 1 see note 1 see note 1	see note 1 see note 1 see note 1	see note 1 see note 1 see note 1
Atterberg Limits	ASTM D 4318	Liquid Limit Plastic Limit Plasticity Index	NL NP N/A	NL NP N/A	NL NP N/A
Specific Gravity	ASTM D 854	Specific Gravity at 20°C		3.41 (see note 2)	
Classification	ASTM D 2487 AASHTO M 145	Unified Soil Classification System (USCS) AASHTO Classification	see note 3 see note 3	see note 3 see note 3	see note 3 see note 3
				Composite Sample	
Moisture-Density Relations (Standard Effort)	ASTM D 698	Maximum Dry Density, pcf Optimum Moisture Content, %		77.6 40.6	
Moisture-Density Relations (Modified Effort)	ASTM D 1557	Maximum Dry Density, pcf Optimum Moisture Content, %		85.9 29.7	
			Result	**Dry Density, pcf**	**Moisture Content, %**
Consolidation	ASTM D2435	Compression Index C_c	0.12	73.5	56.9
Hydraulic Conductivity	ASTM D 5084	Hydraulic Conductivity, cm/sec	1.2E-3	67.6	52.3
Triaxial Shear Strength Consolidated-Undrained (CU)	ASTM D4767	Effective Stress, Cohesion, c', ksf Effective Stress, Internal Friction Angle, ϕ',degrees	0.00 38.1	68.1	51.4
		Total Stress, Cohesion, c, ksf Total Stress, Internal Friction Angle, ϕ, degrees	3.33 33.4	68.1	51.4
Direct Shear Strength	ASTM D 3080	Cohesion, c, ksf Internal Friction Angle, ϕ, degrees	1.32 41.4	67.8	52.7
California Bearing Ratio	ASTM D 1883	CBR, %	20	74.0	42.0
Resilient Modulus (Standard Compactive Effort)	SHRP P46	Resilient Modulus at 4psi axial stress and 4psi confining pressure	15,646	70.5	46.0
Resilient Modulus (Modified Compactive Effort)	SHRP P46	Resilient Modulus at 4psi axial stress and 4psi confining pressure	17,515	74.7	40.0
Soil Resistivity	AASHTO T 288	Minimum Resistivity, Ohm-cm		1,100	
pH of Soil	AASHTO T 289	pH		7.8	
Water Soluble Sulfate Ion	AASHTO T 290	Sulfate Ion Content, mg/kg		4830	
Water Soluble Chloride Ion	AASHTO T 290	Chloride Ion Content, mg/kg		<10	

Note 1: Material observed to chrystalize/set-up upon wetting. Test could not be performed.
Note 2: A test was performed on a composite sample from the 3 independant samples.
Note 3: A classification could not be performed without the ASTM D 422 results.

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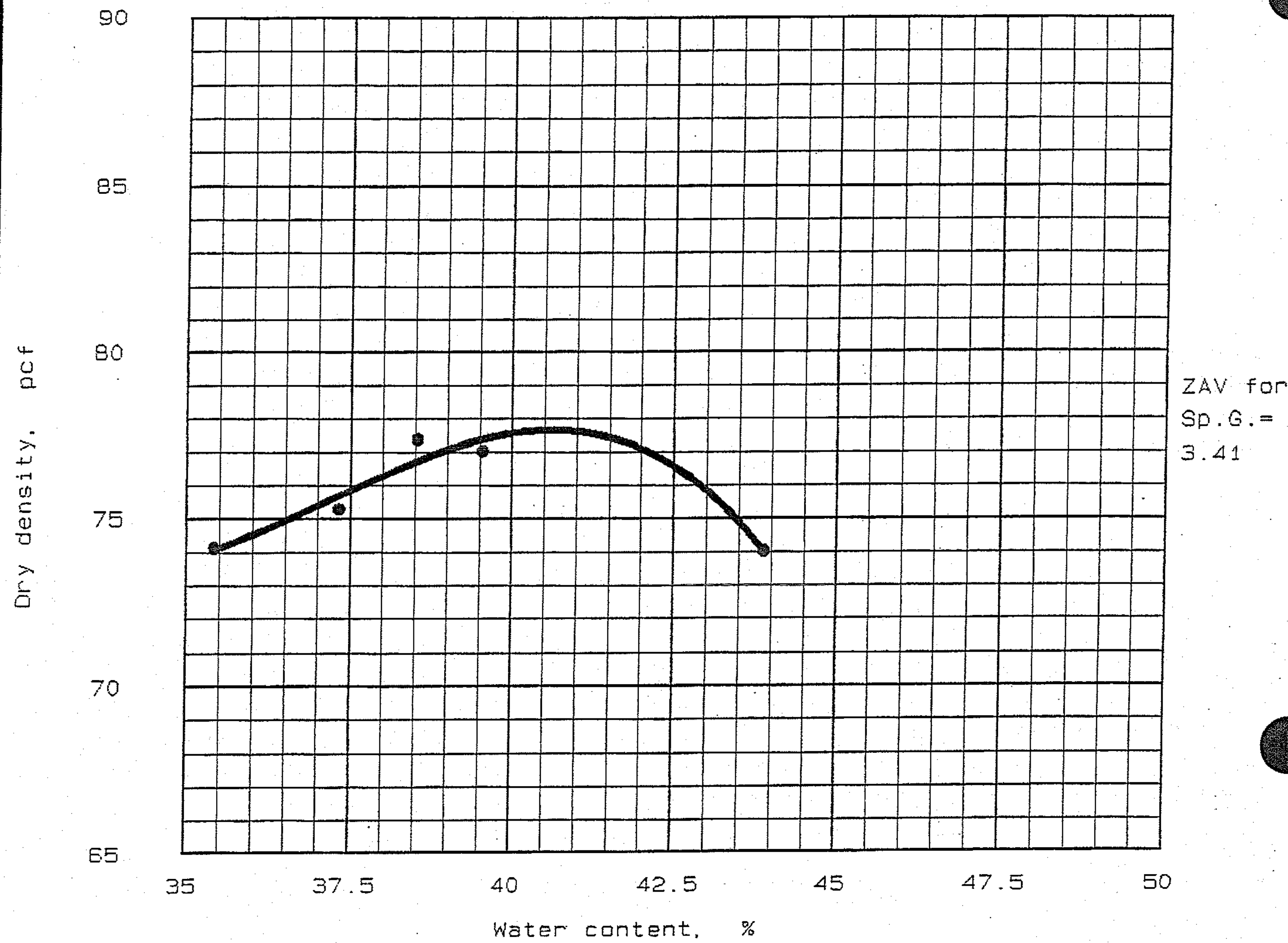
MOISTURE-DENSITY RELATIONSHIP



"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
				3.41	NL	NP		

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 40.6 % Maximum dry density = 77.6 pcf	Gypsum

Project No.: 5810850101

Project: TVA - Cumberland

Location: Scrubber Gypsum

Date: September 28, 1995

Remarks:

Tested by: CS

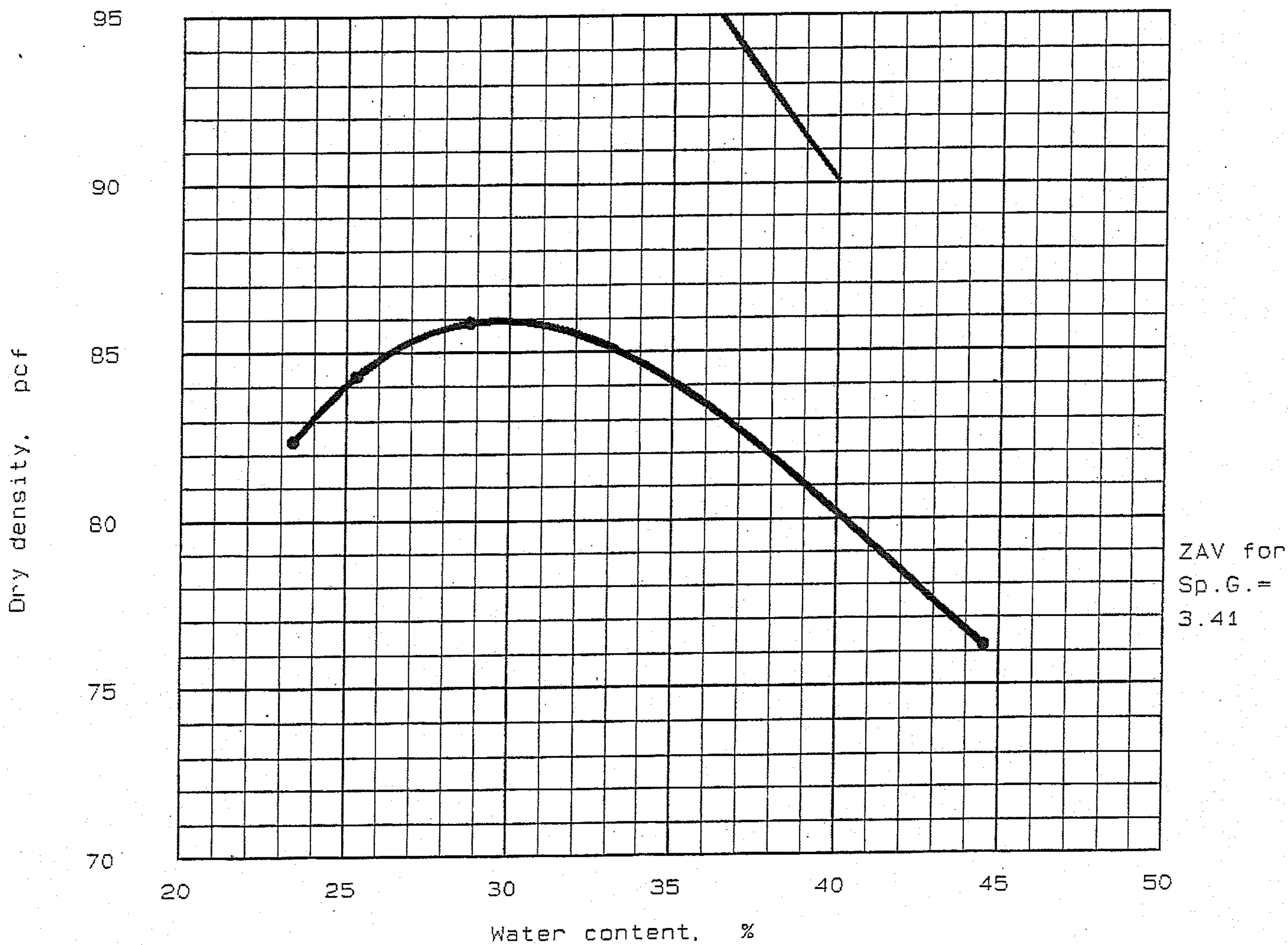
Reviewed by: HS

MOISTURE-DENSITY RELATIONSHIP

LAW ENGINEERING, INC.

Figure No. ______

MOISTURE-DENSITY RELATIONSHIP



"Modified" Proctor, ASTM D 1557, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
				3.41	NL	NP		

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 29.7 % Maximum dry density = 85.9 pcf	Gypsum

Project No.: 5810860101

Project: TVA - Cumberland

Location: Scrubber Gypsum

Date: September 27, 1995

MOISTURE-DENSITY RELATIONSHIP

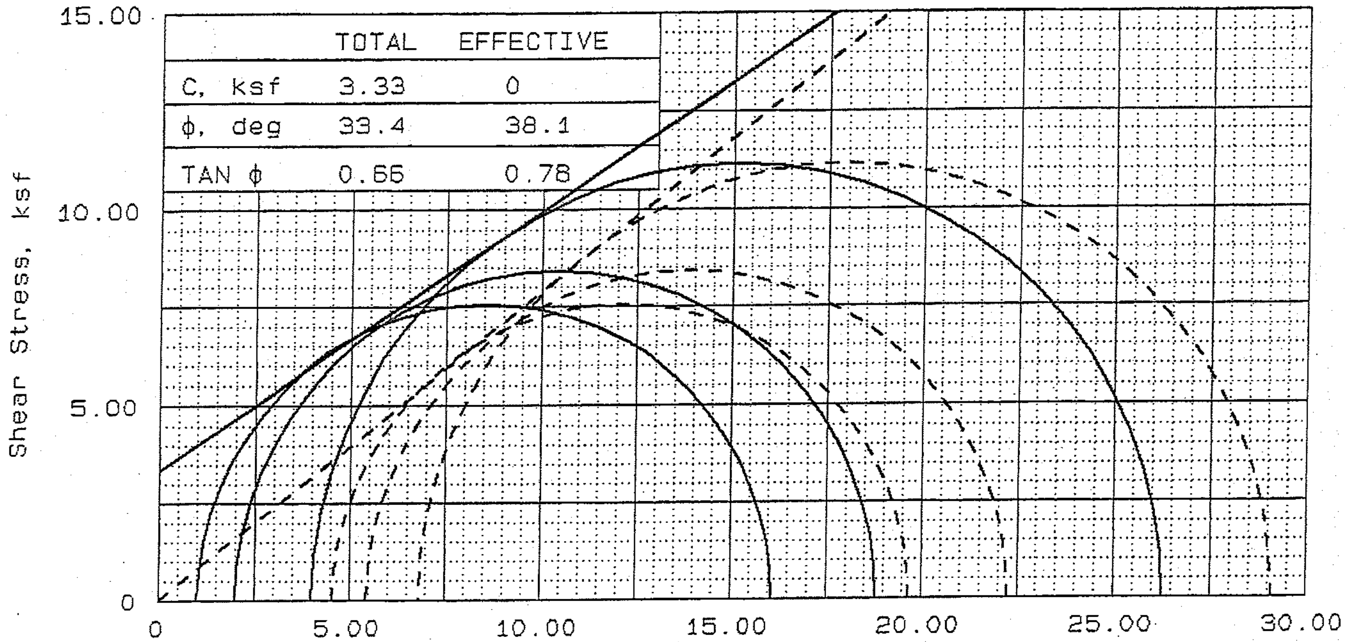
LAW ENGINEERING, INC.

Remarks:

Tested by: EM

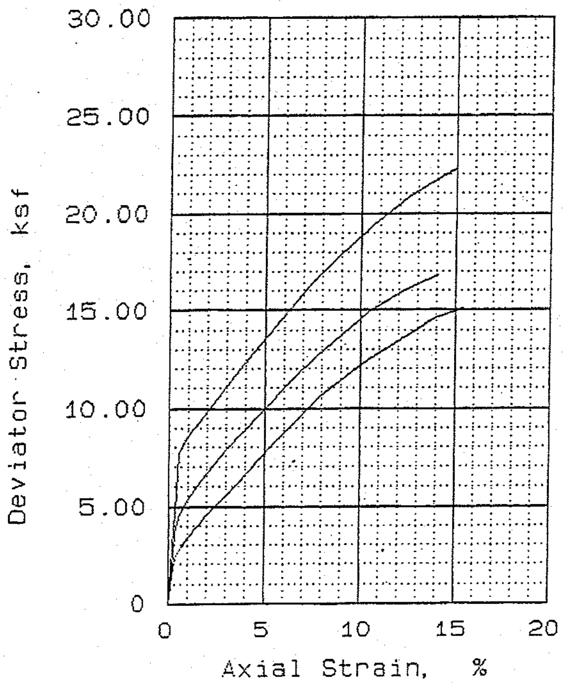
Reviewed by: Hb

Figure No. ______



Total Normal Stress, ksf ———

Effective Normal Stress, ksf - - - -



	SAMPLE NO.	1	2	3
INITIAL	WATER CONTENT, %	52.9	52.3	48.9
	DRY DENSITY, pcf	67.5	67.6	69.2
	SATURATION, %	83.6	83.1	80.3
	VOID RATIO	2.156	2.147	2.075
	DIAMETER, in	2.83	2.83	2.83
	HEIGHT, in	6.00	6.00	6.00
AT TEST	WATER CONTENT, %	61.7	60.9	58.5
	DRY DENSITY, pcf	68.6	69.2	71.1
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	2.105	2.076	1.994
	DIAMETER, in	2.81	2.80	2.80
	HEIGHT, in	5.98	5.97	5.96
	BACK PRESSURE, ksf	4.98	5.08	5.08
	CELL PRESSURE, ksf	5.98	7.08	9.08
	FAILURE STRESS, ksf	15.11	16.82	22.27
	PORE PRESSURE, ksf	1.43	1.64	2.26
	STRAIN RATE, %/min.	0.100	0.100	0.100
	ULTIMATE STRESS, ksf			
	PORE PRESSURE, ksf			
	$\bar{\sigma}_1$ FAILURE, ksf	19.67	22.26	29.09
	$\bar{\sigma}_3$ FAILURE, ksf	4.56	5.44	6.82

TYPE OF TEST:
CU with pore pressures

SAMPLE TYPE: Remolded

DESCRIPTION: Gypsum

LL= NL PL= NP PI=

SPECIFIC GRAVITY= 3.41

REMARKS: Tested by: Hb

Reviewed by: RLB

FIG. NO.

CLIENT:

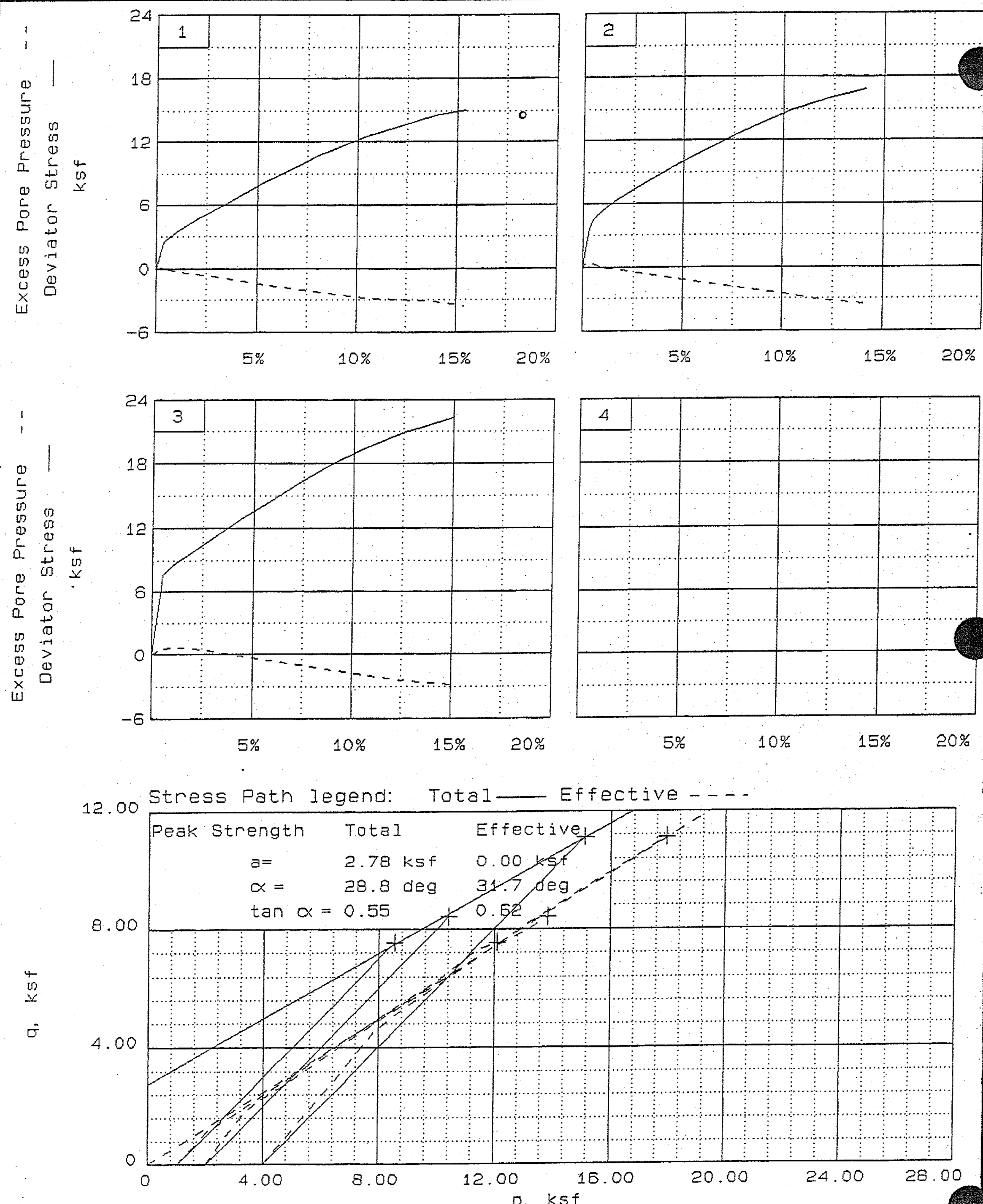
PROJECT: TVA - Cumberland

SAMPLE LOCATION: Scrubber Gypsum

PROJ. NO.: 5810860101 DATE: 10/23/95

TRIAXIAL COMPRESSION TEST

LAW ENGINEERING, INC.

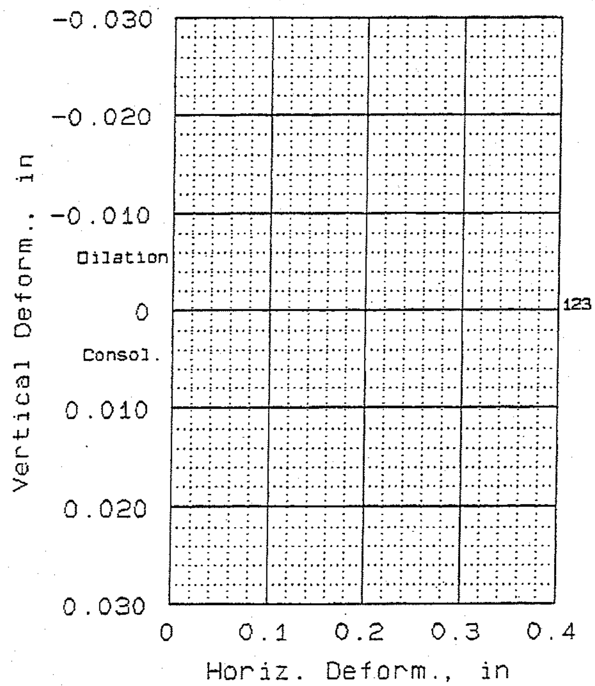


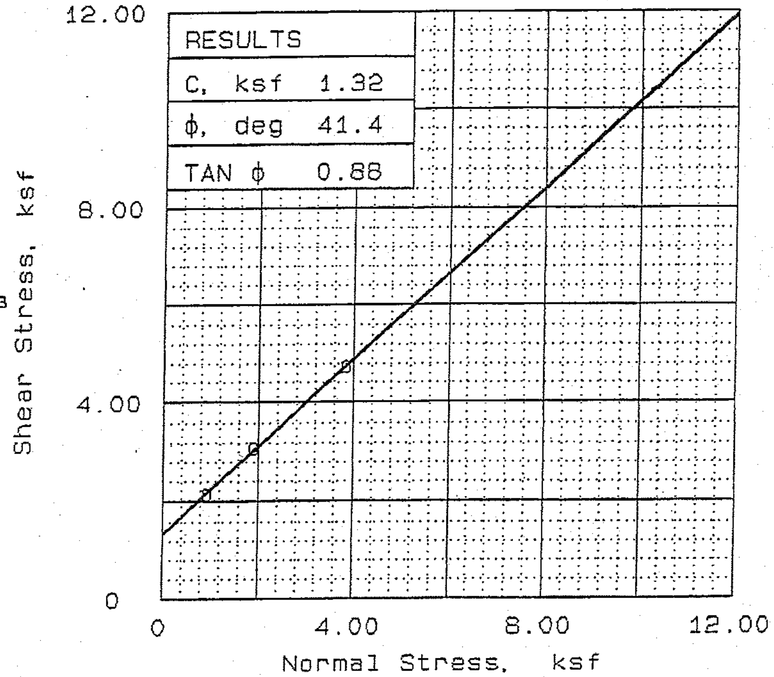
Client:

Project: TVA - Cumberland

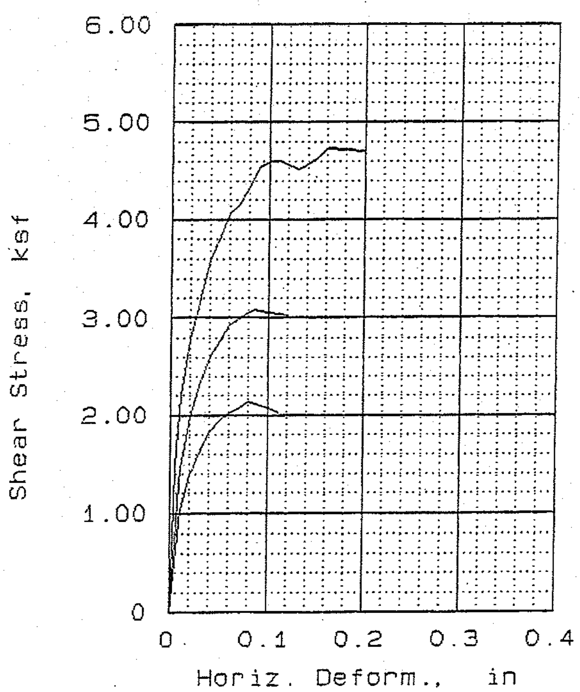
Location: Scrubber Gypsum

File: 8601P Project No.: 5810860101 Page 2/2 Fig. No. ____





RESULTS	
C, ksf	1.32
ϕ, deg	41.4
TAN ϕ	0.88



	SAMPLE NO.	1	2	3
INITIAL	WATER CONTENT, %	52.4	52.3	53.3
	DRY DENSITY, pcf	68.2	67.7	67.5
	SATURATION, %	97.4	96.0	97.4
	VOID RATIO	1.427	1.444	1.451
	DIAMETER, in	2.50	2.50	2.50
	HEIGHT, in	0.81	0.81	0.81
AT TEST	WATER CONTENT, %	52.4	52.3	53.3
	DRY DENSITY, pcf	68.2	67.7	67.5
	SATURATION, %	97.4	96.0	97.4
	VOID RATIO	1.427	1.444	1.451
	DIAMETER, in	2.50	2.50	2.50
	HEIGHT, in	0.81	0.81	0.81
	NORMAL STRESS, ksf	0.97	1.94	3.88
	MAX. SHEAR, ksf	2.14	3.08	4.73
	STRAIN RATE, %/min.	0.500	0.500	0.500
	ULT. SHEAR, ksf			

SAMPLE DATA

SAMPLE TYPE: Remolded

DESCRIPTION: Gypsum

LL= NL PL= NP PI=

SPECIFIC GRAVITY= 3.41

REMARKS: Tested by: HD

Reviewed by: RLB

FIG. NO.

CLIENT:

PROJECT: TVA - Cumberland

SAMPLE LOCATION: Scrubber Gypsum

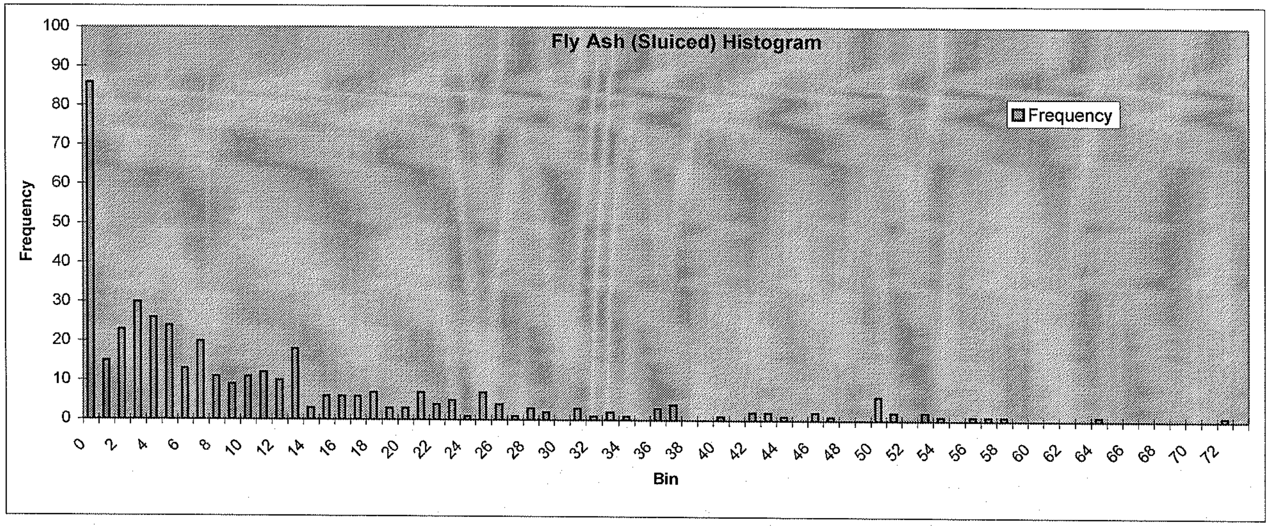
PROJ. NO.: 5810860101 DATE: 10/10/95

DIRECT SHEAR TEST

LAW ENGINEERING, INC.

Attachment 5
SPT N-Value Histograms
(Stantec, 2009a)

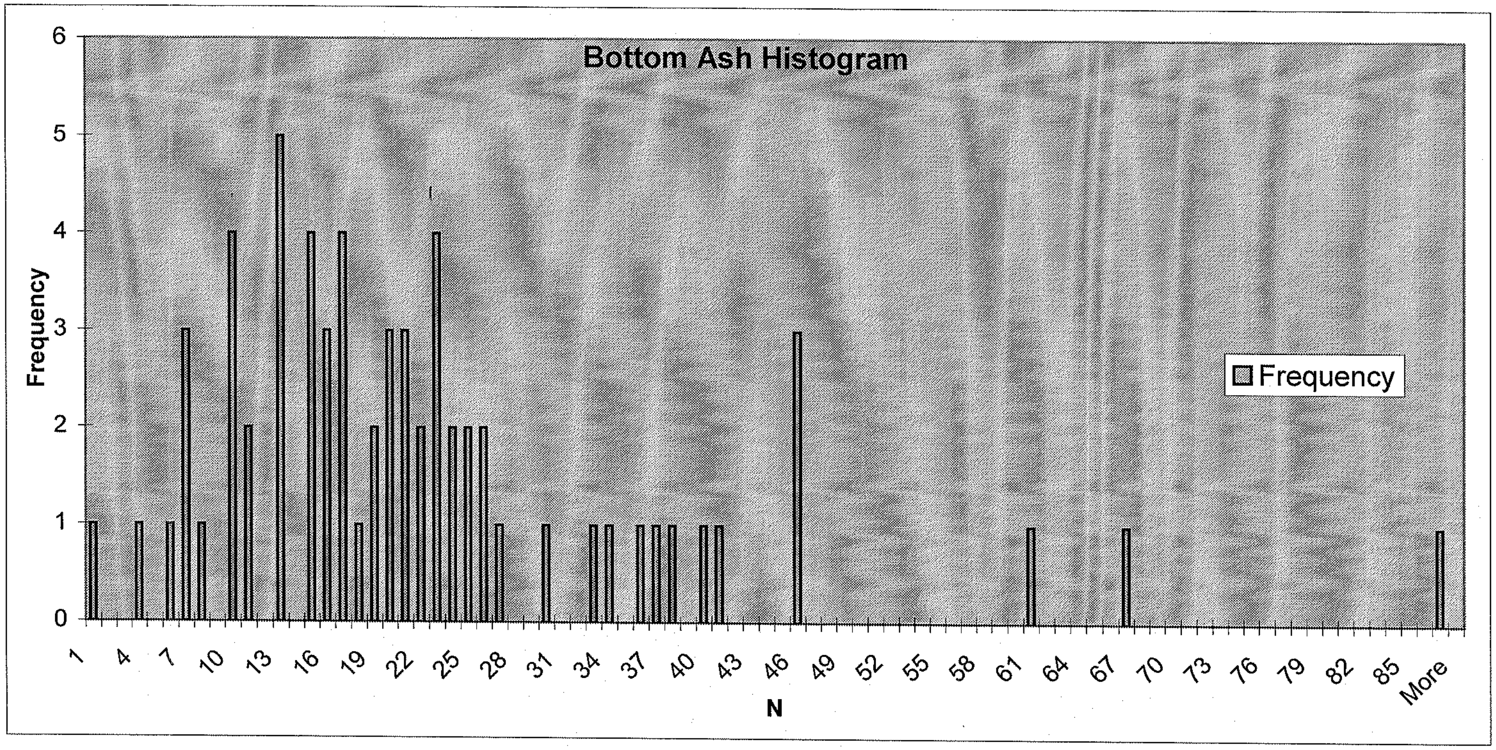
N (Blow Counts)	Min	Max	Average	Mode	Std Dev
Bottom Ash	0	87	23	13	15.1
Bottom Ash/Fly Ash	0	75	13	4	12.7
Fly Ash	0	72	11	0	13.4
Fly Ash Stacked	2	99	36	50	25.4
Matrix	0	50	19	50	16.8
Alluvial Clay	0	70	17	6	14.4
Alluvial Granular	0	116	27	50	18.8
Dike 1	3	83	16	13	13.4
Dike 2	3	61	18	9	9.8
Dike 3	3	84	25	30	16.4
Gypsum	3	98	47	50	24.9



Fly Ash (Sluiced)	N	0	3
	N60 (1.3*N)	0	3.9

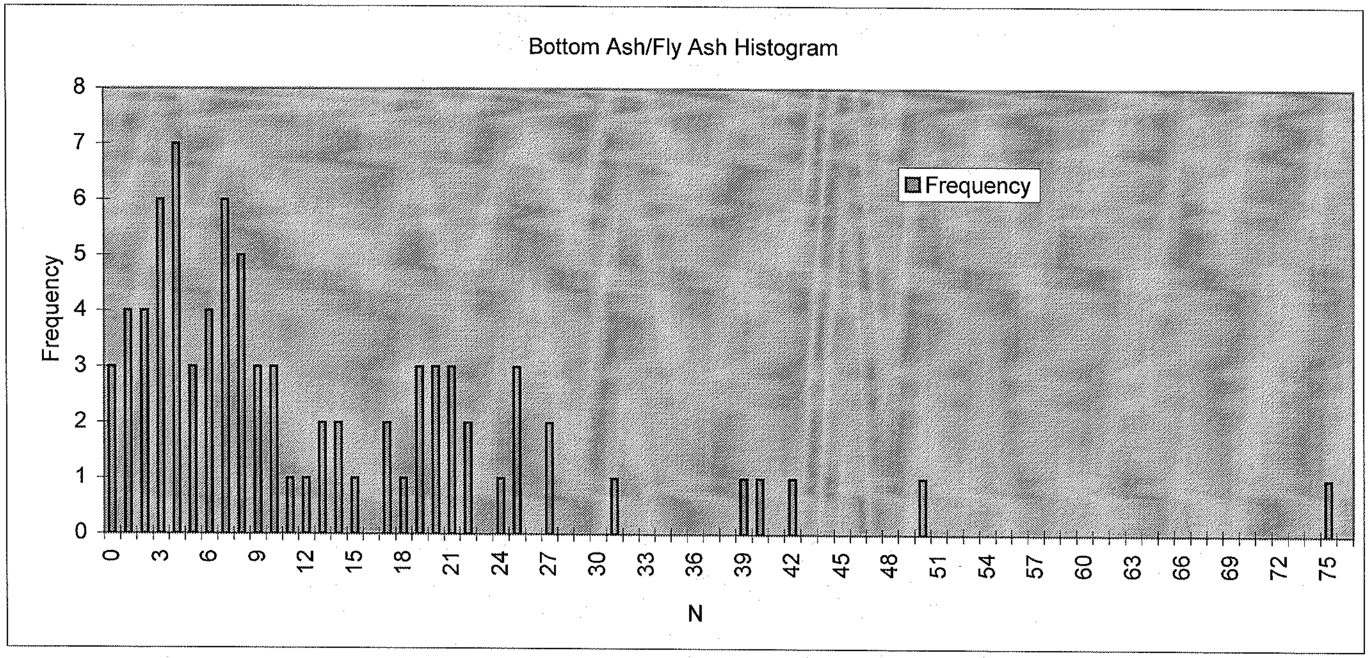
ϕ <28 (Originally from Peck et al., 1974, modified by Carter and Bentley, 1991)

CPTs	N60	ϕ'	su
	5	13	2
	6	14	5
	2	15	12
	7	22	34
	10	28	42
	10	30	30
	16	22	25
	6	26	56
	17	21	38
	6	25	54
	13	25	
min	2	13	2
max	17	30	56
average	9	22	30
mode	6	22	#N/A
st dev	5	6	19



Bottom Ash	N	10	23	
	N60 (1.3*N)	13	29.9	
		ϕ 31.3	ϕ 36.2	(Originally from Peck et al., 1974, modified by Carter and Bentley, 19

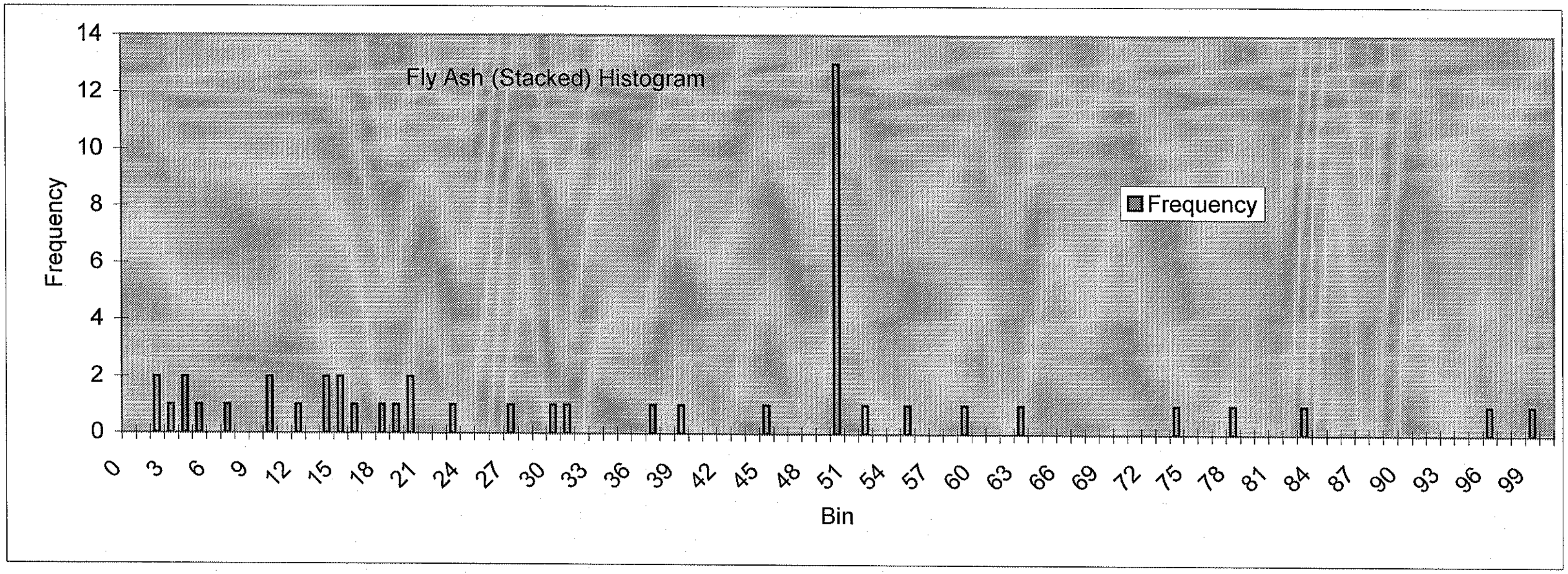
CPTs	N60		ϕ'	su		
		7	14		5	
BA Stacked			50			



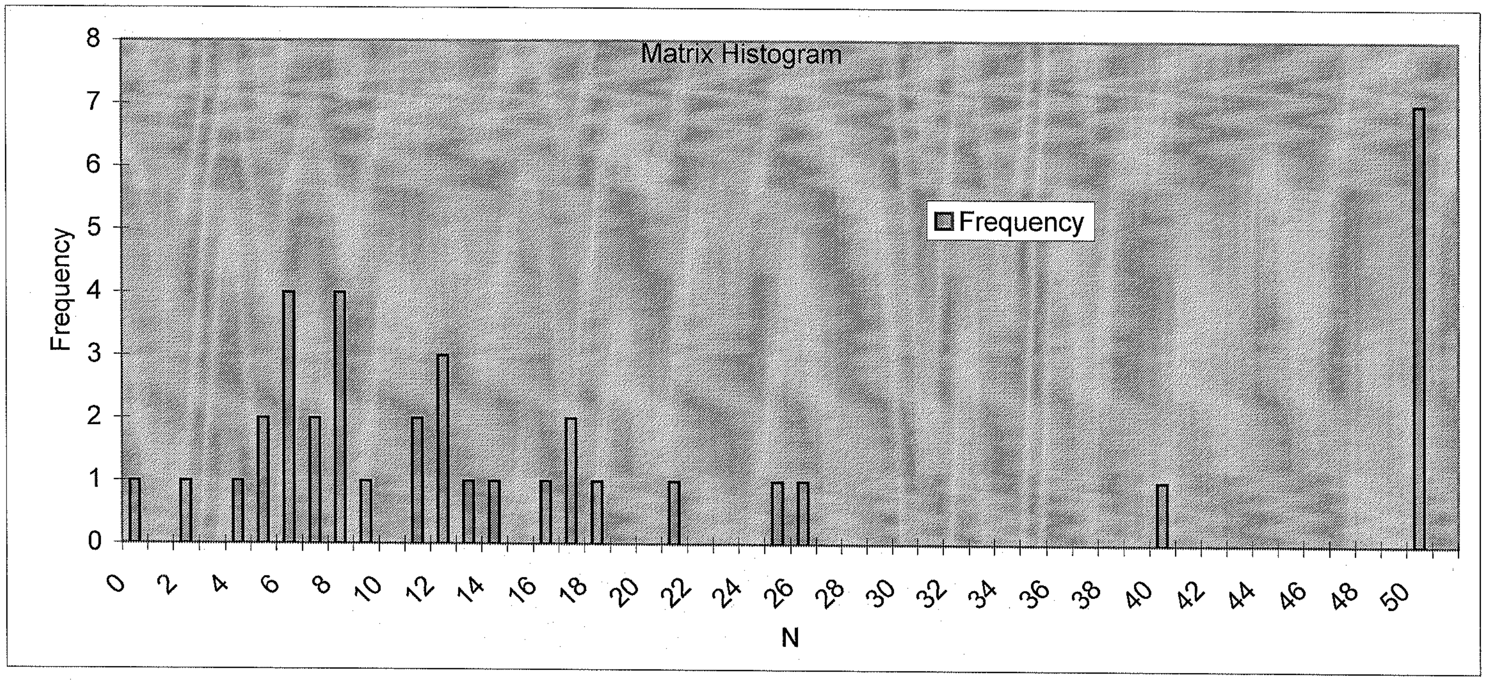
Bottom Ash/Fly Ash	N	3	8
	N60 (1.3*N)	3.9	10.4
		ϕ <28	ϕ 30.1

(Originally from Peck et al., 1974, modified by Carter and Bentley, 19

CPTs	N60	ϕ'	su
	3	13	5
	6	22	22
	11	28	52
min	3	13	5
max	11	28	52
average	7	21	26

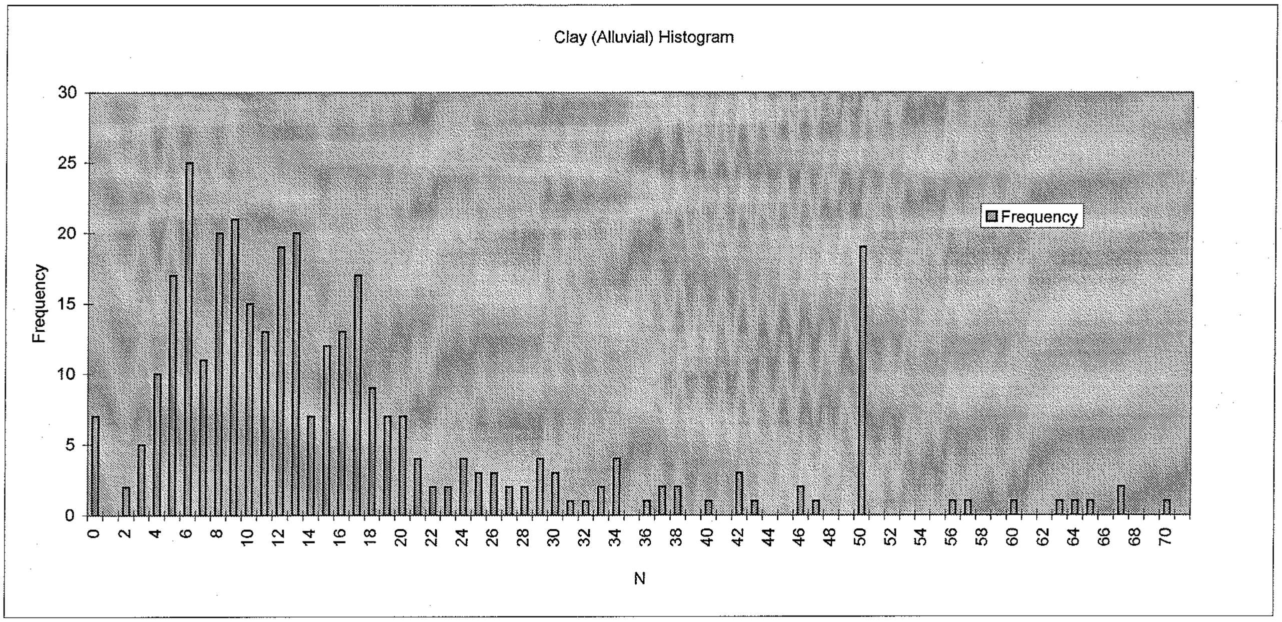


Fly Ash (Stacked)	N	50	
	N60 (1.3*N)	65	
		ϕ 43.5	(Originally from Peck et al., 1974, modified by Carter and Bentley, 1991)
CPT		32	



Matrix	N	6	8	
	N60 (1.3*N)	7.8	10.4	
	qu (kgf/cm2)	0.6	0.8	(after NAVFAC, 1982)
	qu(lb/in2)	9	11	
	cu (lb/in2)	4	6	

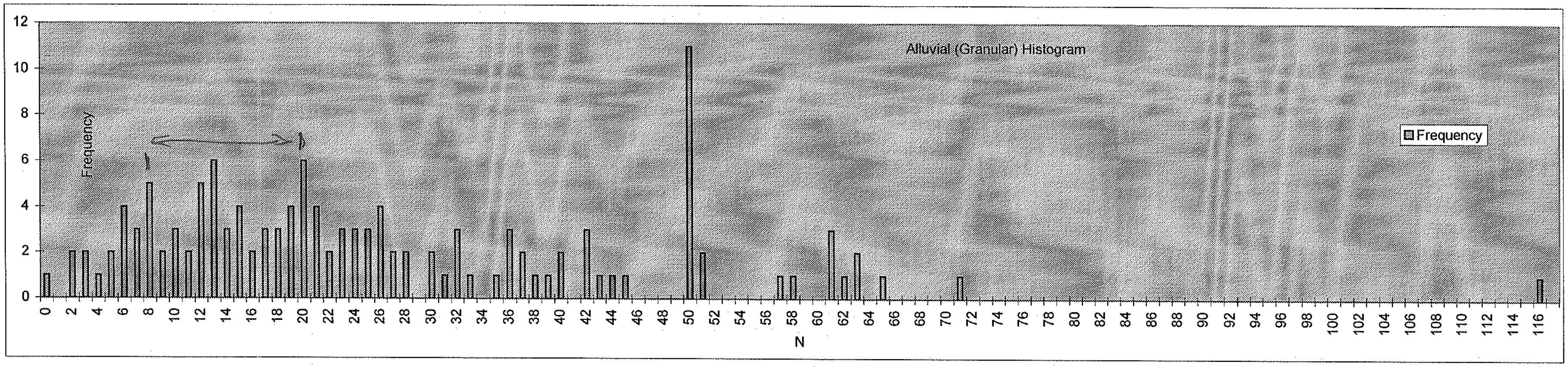
1	14.22334
kgf/cm2	lb/in2



Clay (Alluvial)	N	5	15
	N60 (1.3*N)	6.5	19.5
	qu (kgf/cm:	0.5	1.47 (after NAVFAC, 1982)
	qu(lb/in2)	7	21
	cu (lb/in2)	4	10

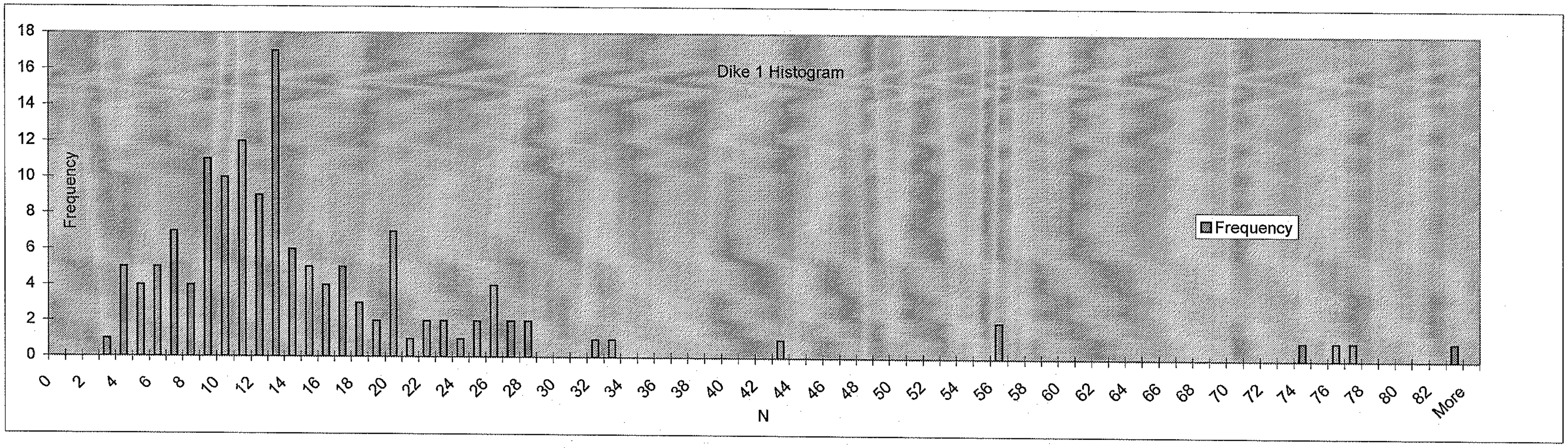
1	14.22334
kgf/cm2	lb/in2

CPTs	N60	ϕ'	su
	10	17	10
	20	18	30
	7	28	20
	8	16	50
	25	20	38
	13	23	22
	8	21	14
	8	19	
min	7	16	10
max	25	28	50
average	12	20	26
mode	8	#N/A	#N/A
st dev	7	4	14



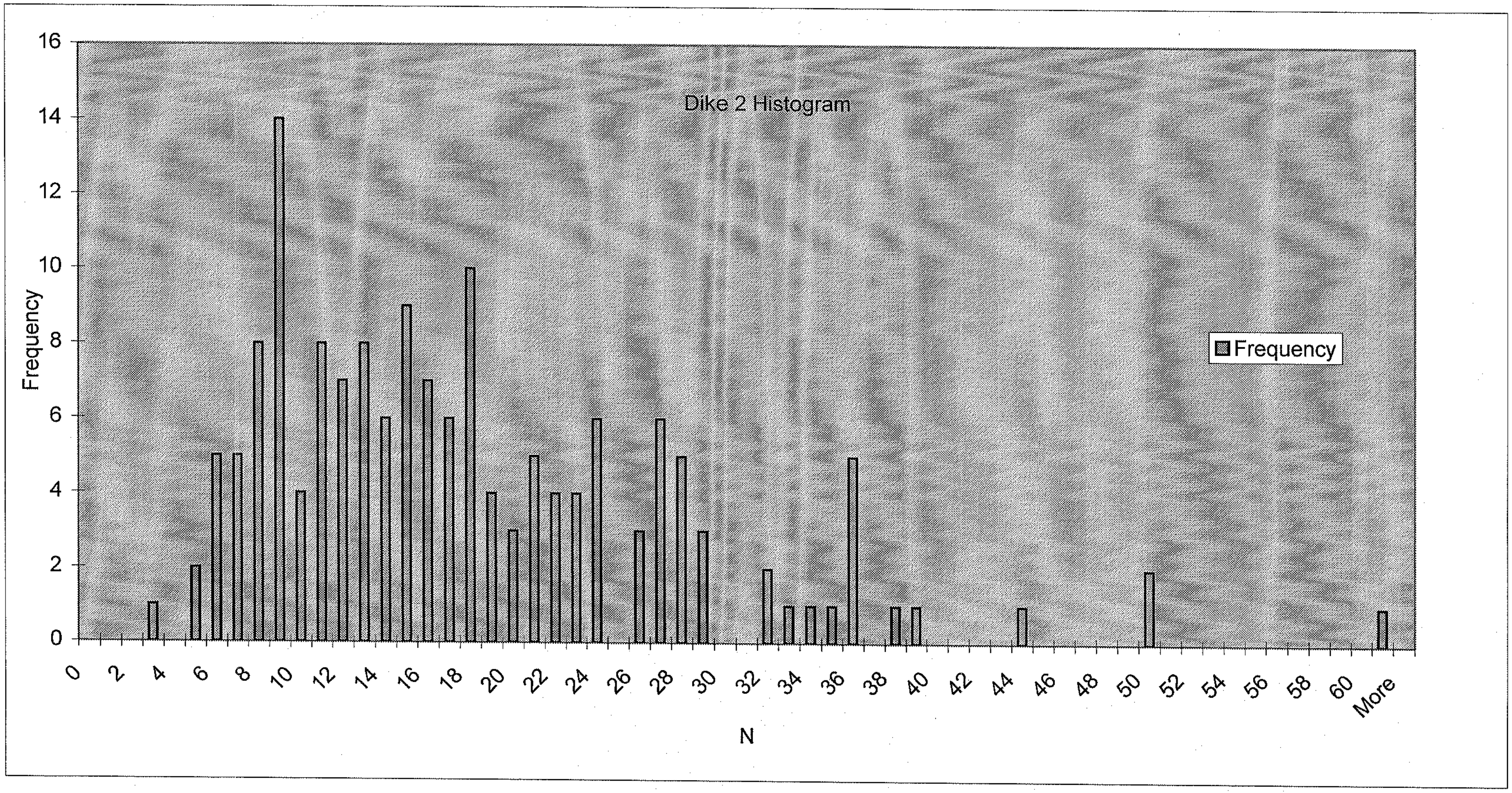
Alluvial (Granular)	N	8	20
	N60 (1.3*N)	10.4	26
		ϕ	ϕ
		30.1	34.5

(Originally from Peck et al., 1974, modified by Carter and Bentley, 1991)

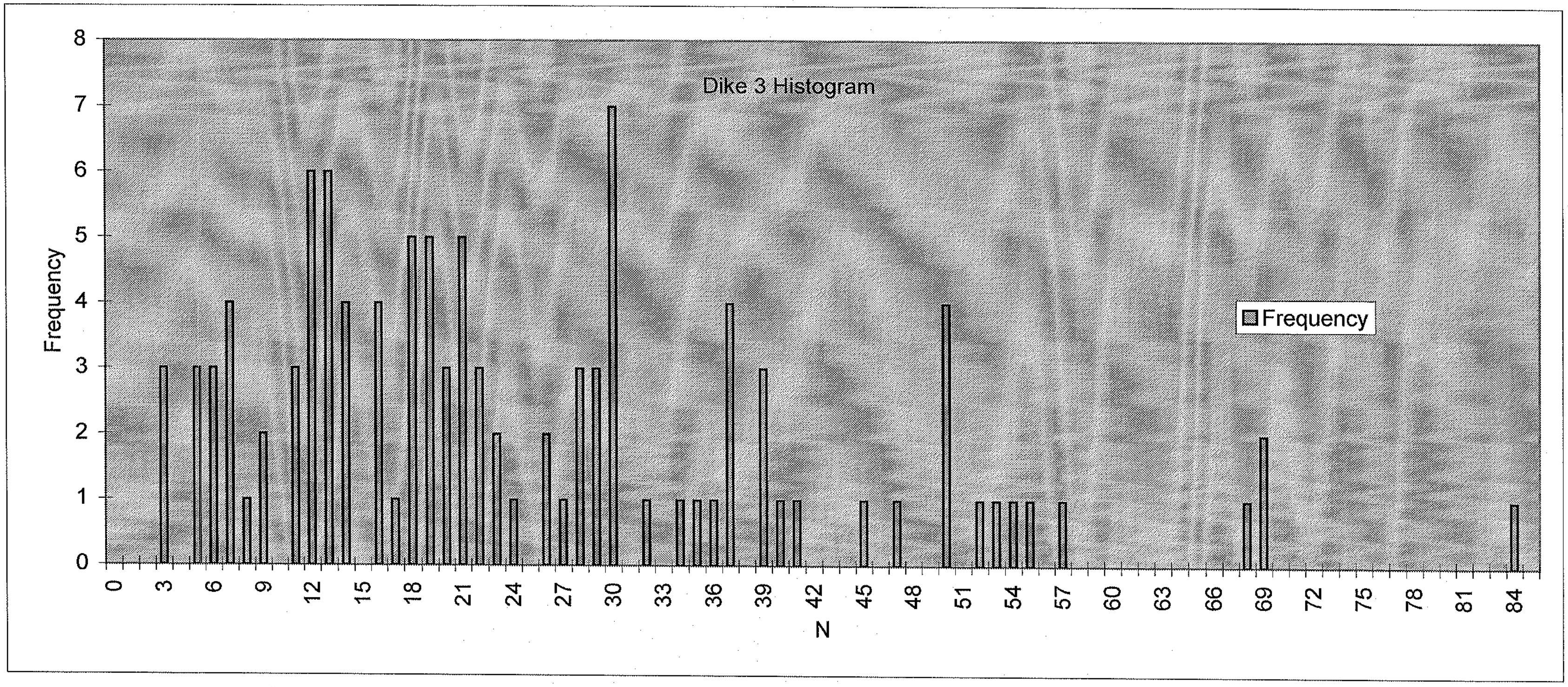


Dike 1	N	9	13	
	N60 (1.3*N)	11.7	16.9	
	qu (kgf/cm	0.9	1.3	(after NAVFAC, 1982)
	qu(lb/in2)	13	18	
	cu (lb/in2)	6	9	
	1 kgf/cm2	14.22334 lb/in2		

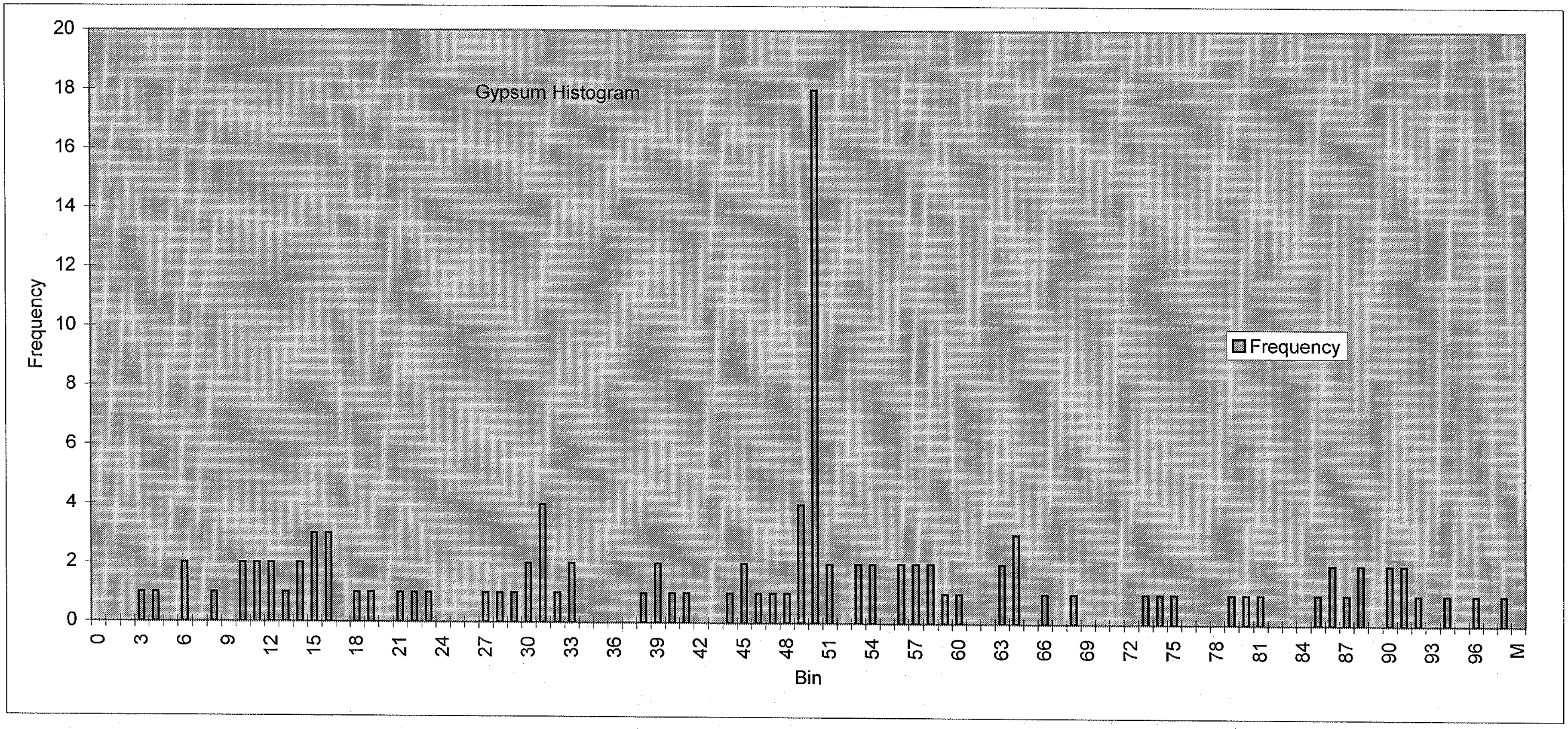
CPTs	N60	φ'	su
	6	42	40
	7	38	42
	8	43	60
	8	37	54
	8	43	50
	6	31	30
min	6	31	30
max	8	43	60
average	7	39	46
mode	8	43	#N/A
st dev	1	5	11



Dike 2	N	8	18	
	N60 (1.3*N)	10.4	23.4	
	qu (kgf/cm:	0.82	1.78	(after NAVFAC, 1982)
	qu(lb/in2)	12	25	
	cu (lb/in2)	6	13	
	1 kgf/cm2	14.22334 lb/in2		



Dike 3	N	12	30
	N60 (1.3*N)	15.6	39
	qu (kgf/cm:	1.21	3.9 (after NAVFAC, 1982)
	qu(lb/in2)	17	55
	cu (lb/in2)	9	28
	1 kgf/cm2	14.22334 lb/in2	



Gypsum	N	50
	N60 (1.3*N)	65

ϕ 43.5 (Originally from Peck et al., 1974, modified by Carter and Bentley, 1991)

Attachment 6
CPT Data Analysis

Stantec (2009a)

Attachment 7
SPT Blow Counts (N60) to Effective Friction Angle (ϕ') Empirical Chart

Originally from Peck et al. (1974) and modified by Carter and Bentley (1991)

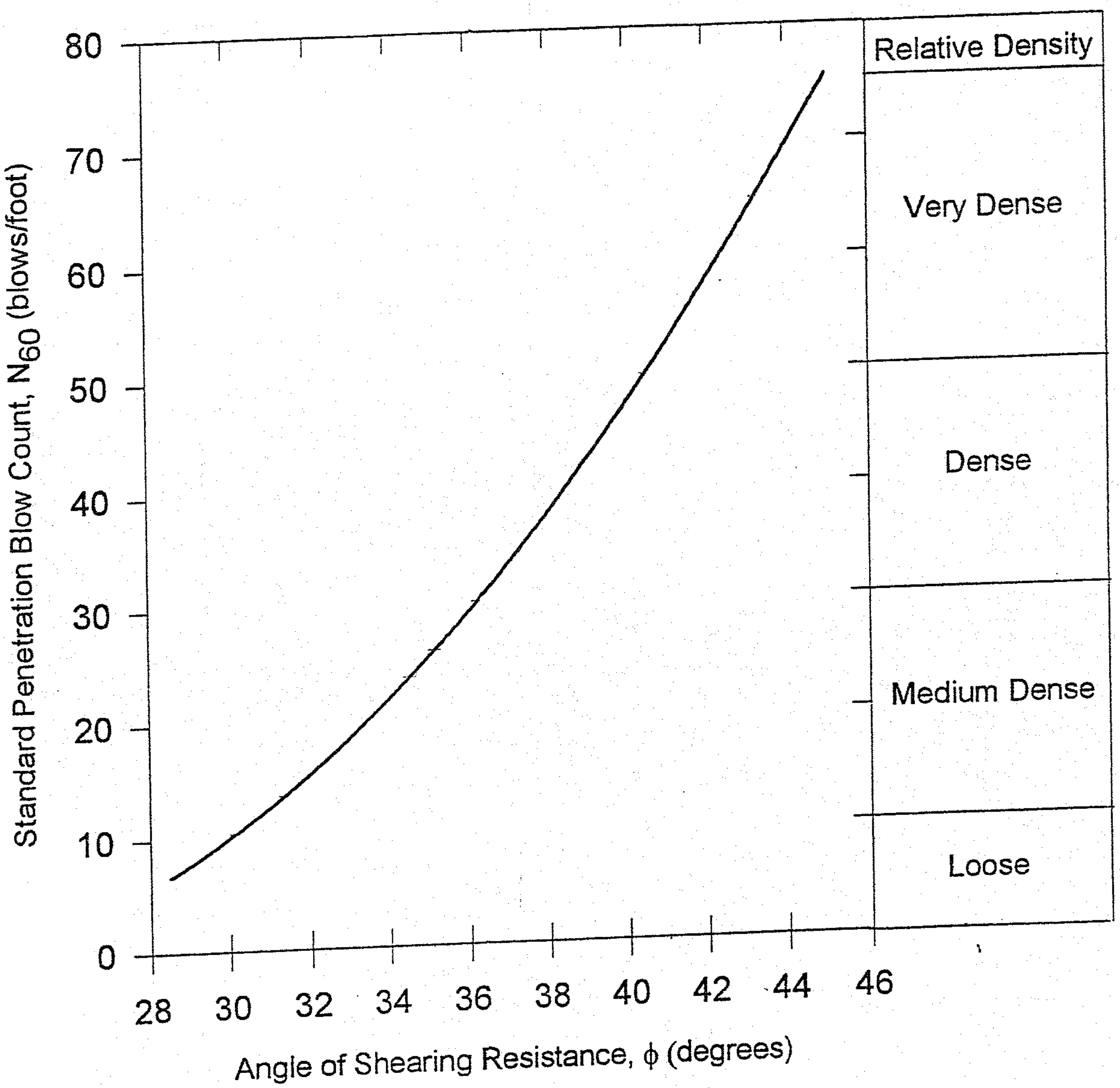
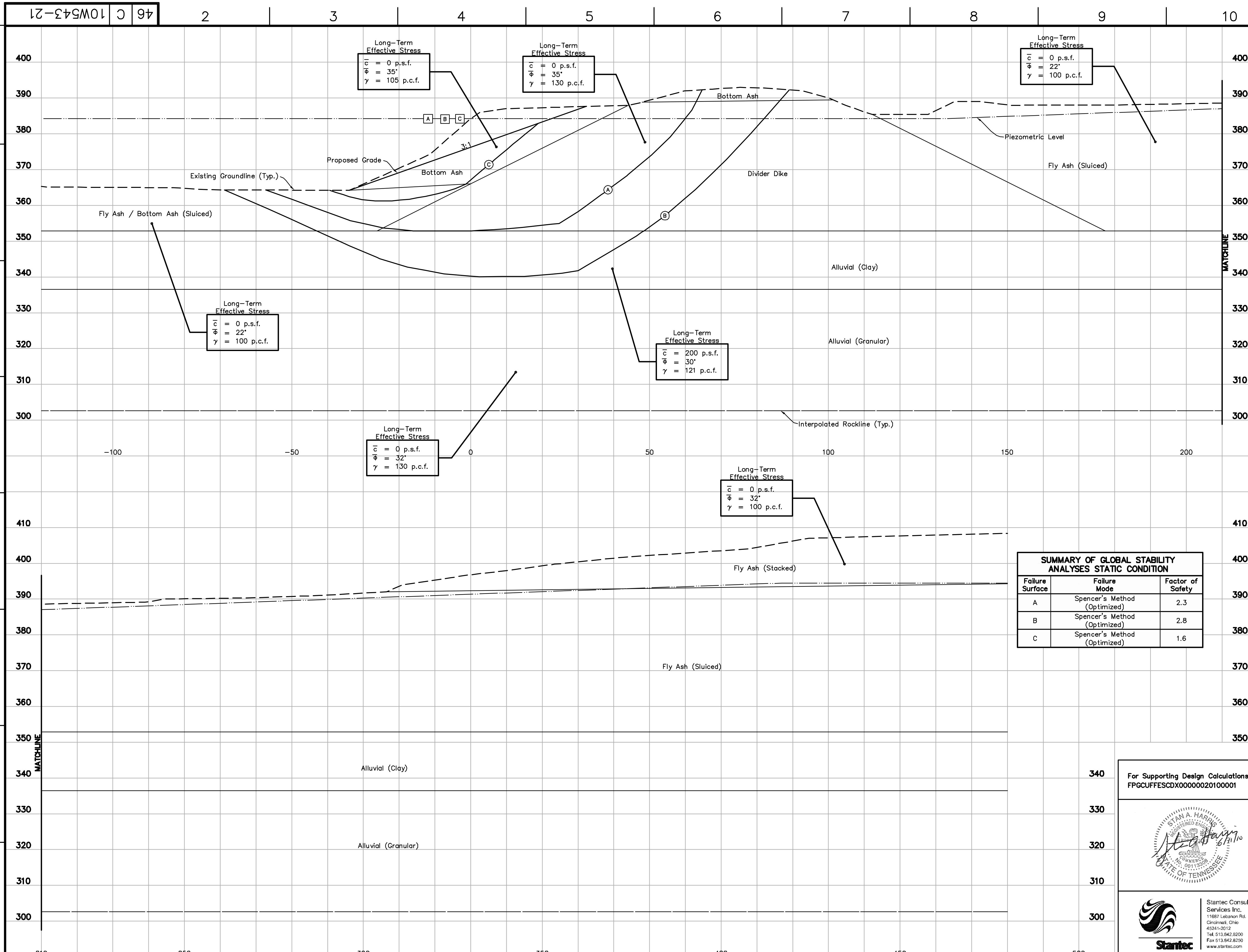


Figure 35. Estimation of the angle of shearing resistance of granular soils from standard penetration test results (Originally from Peck et al., 1974, modified by Carter and Bentley, 1991).

Appendix K

Proposed Repair and Buildout Cross Sections



SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	2.3
B	Spencer's Method (Optimized)	2.8
C	Spencer's Method (Optimized)	1.6

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION
DRY FLY ASH STACK STABILITY
SECTION A – REPAIR

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

Stantec Consulting Services Inc.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
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Fax 513.842.8250
www.stantec.com

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543–21 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

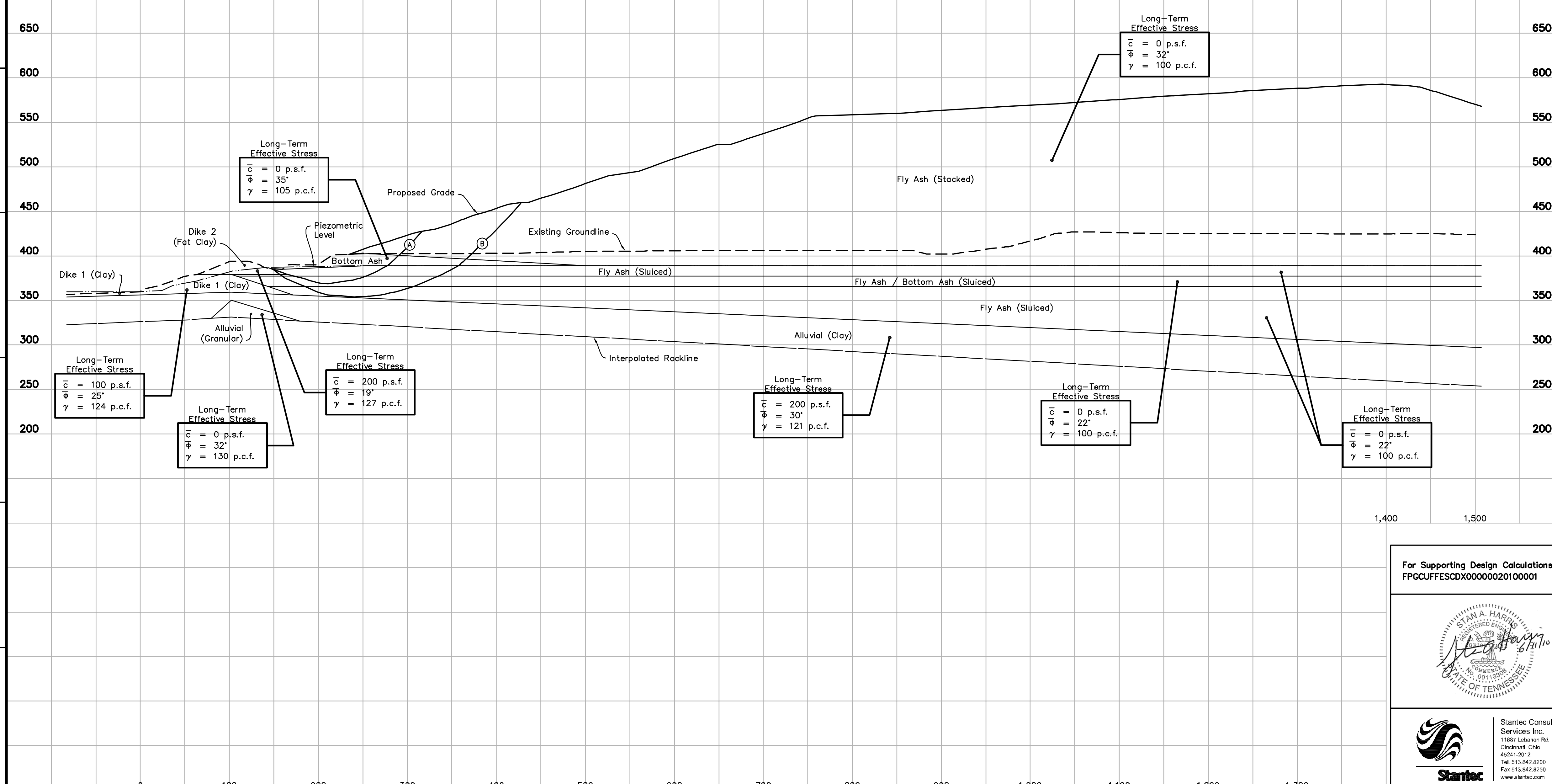
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.5
B	Spencer's Method (Optimized)	1.5

NOTE:

1. Buildout was developed from a CAD file transmitted from TVA on 10/16/2009.



RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX000000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ

RECORD DRAWING

SCALE: 1"=50' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION
DRY FLY ASH STACK STABILITY
SECTION C – BUILDOUT

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543–22 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

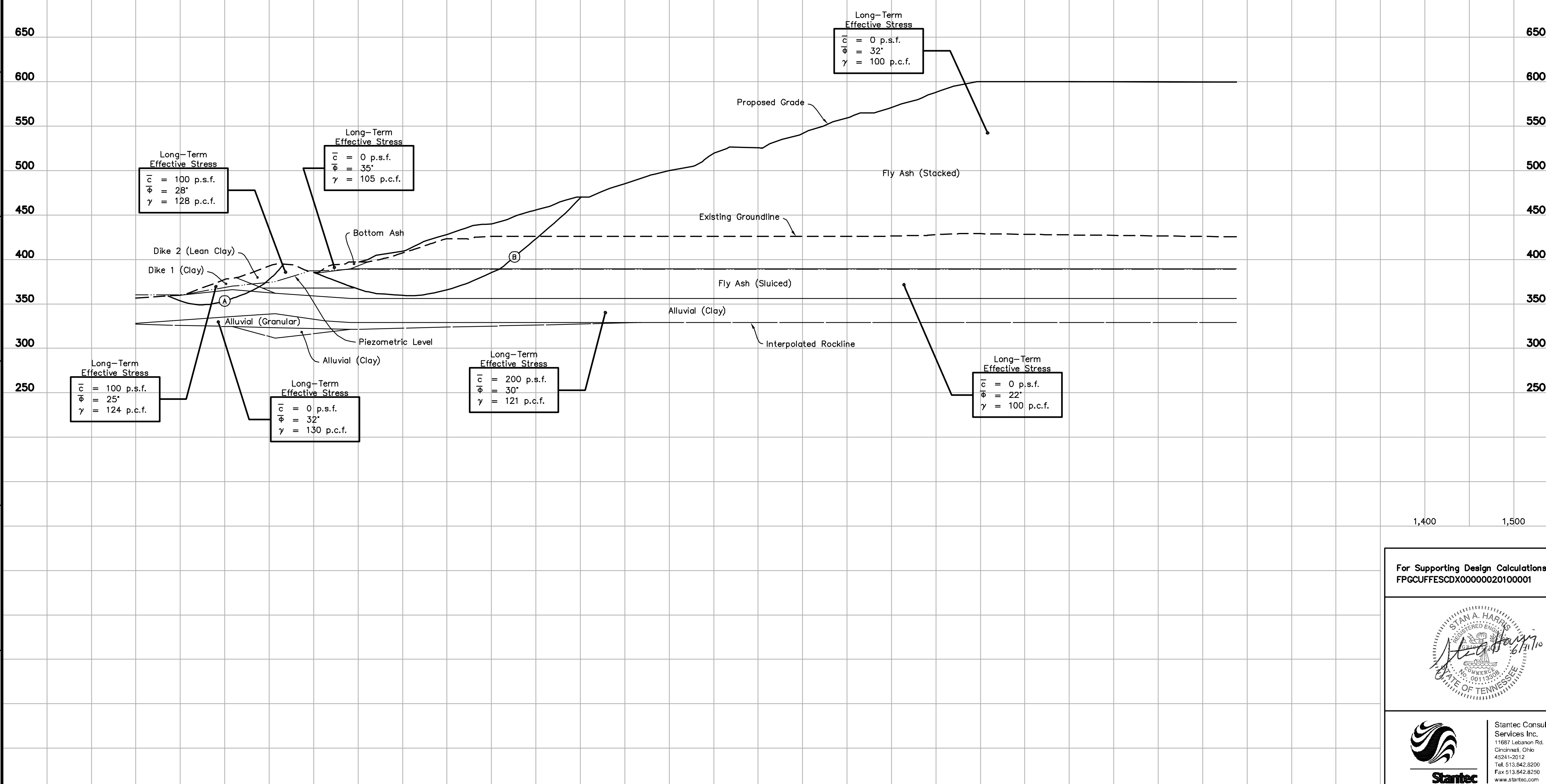
46 C 10W543-23

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.9
B	Spencer's Method (Optimized)	1.6

NOTE:

1. Buildout was developed from a CAD file transmitted from TVA on 10/16/2009.



RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX000000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ

RECORD DRAWING

SCALE: 1"=50' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION
DRY FLY ASH STACK STABILITY
SECTION E – BUILDOUT

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543-23 | R 0

STAN A. HARRIS
REGISTERED ENGINEER
NO. 00113305
STATE OF TENNESSEE
6/11/10

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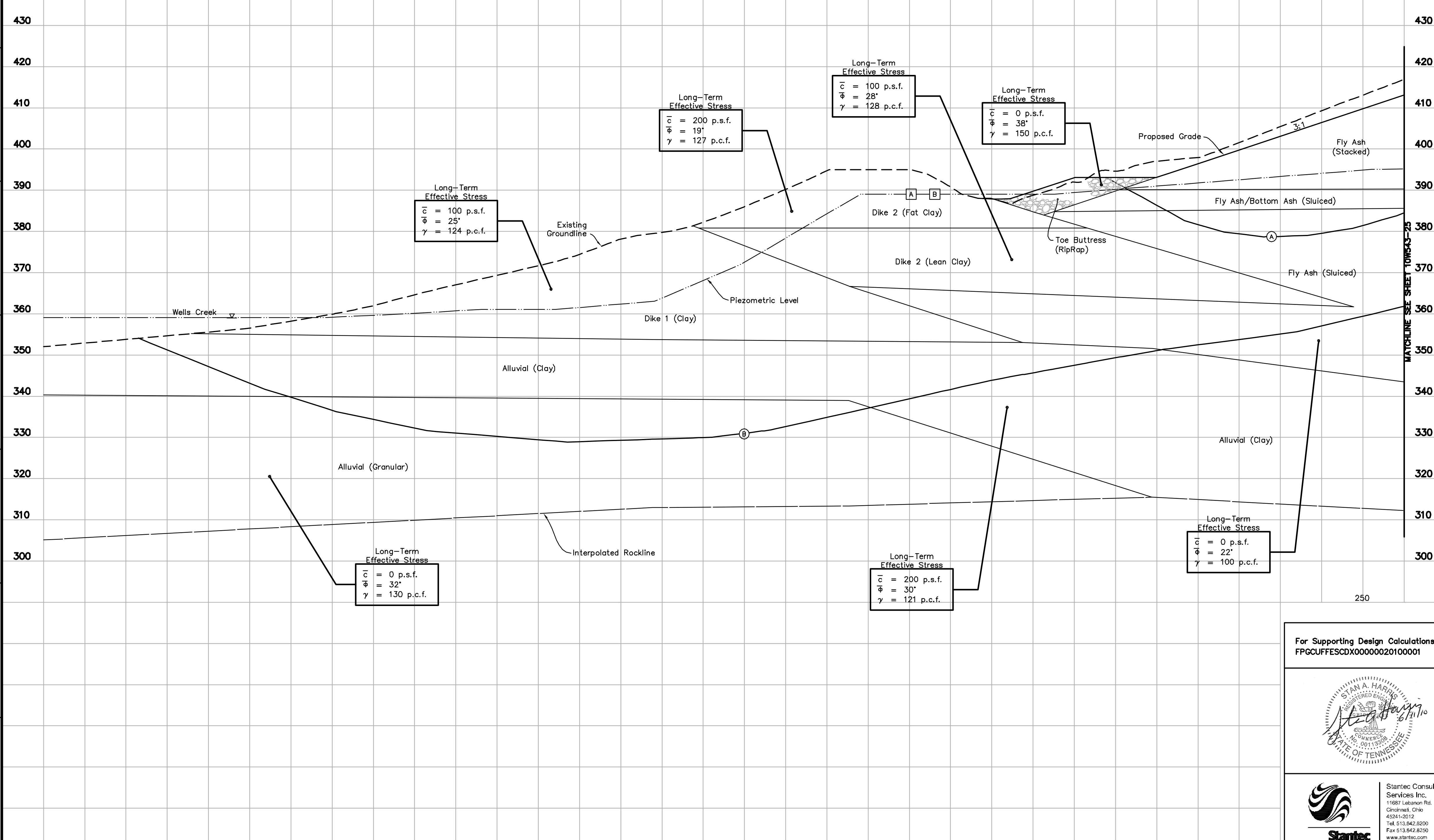
STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.5
B	Spencer's Method (Optimized)	2.1



RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION
DRY FLY ASH STACK STABILITY
SECTION F – REPAIR

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543–24 | R 0

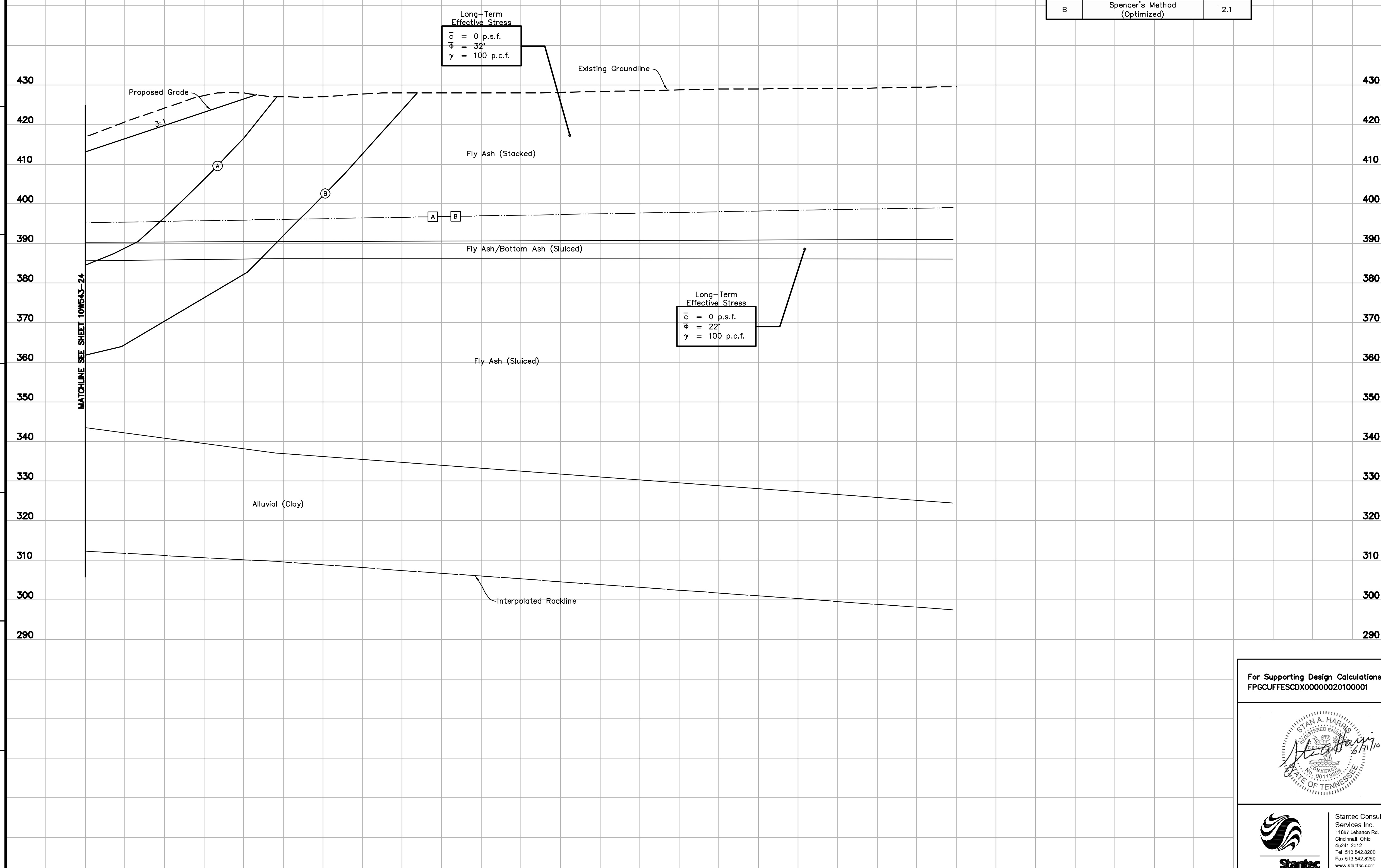
STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.5
B	Spencer's Method (Optimized)	2.1



RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–

RECORD DRAWING

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION
DRY FLY ASH STACK STABILITY
SECTION F – REPAIR

STAN A. HARRIS, REGISTERED ENGINEER, No. 00113309, STATE OF TENNESSEE – 6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543-25 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

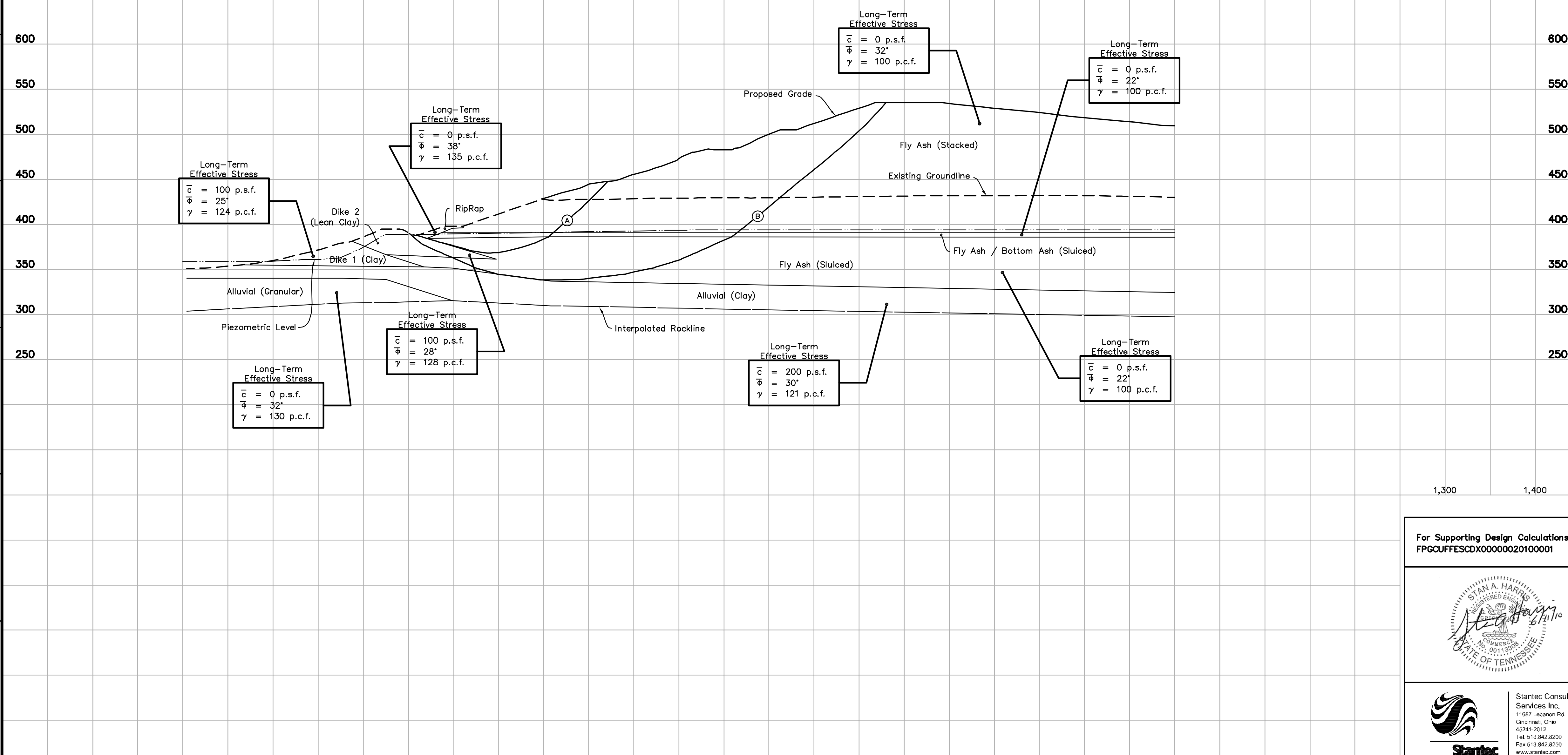
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.6
B	Spencer's Method (Optimized)	1.7

NOTE:

1. Buildout was developed from a CAD file transmitted from TVA on 10/16/2009.



RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE

SCALE: 1"=50' EXCEPT AS NOTED

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION DRY FLY ASH STACK STABILITY SECTION F – BUILDOUT

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543–26 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

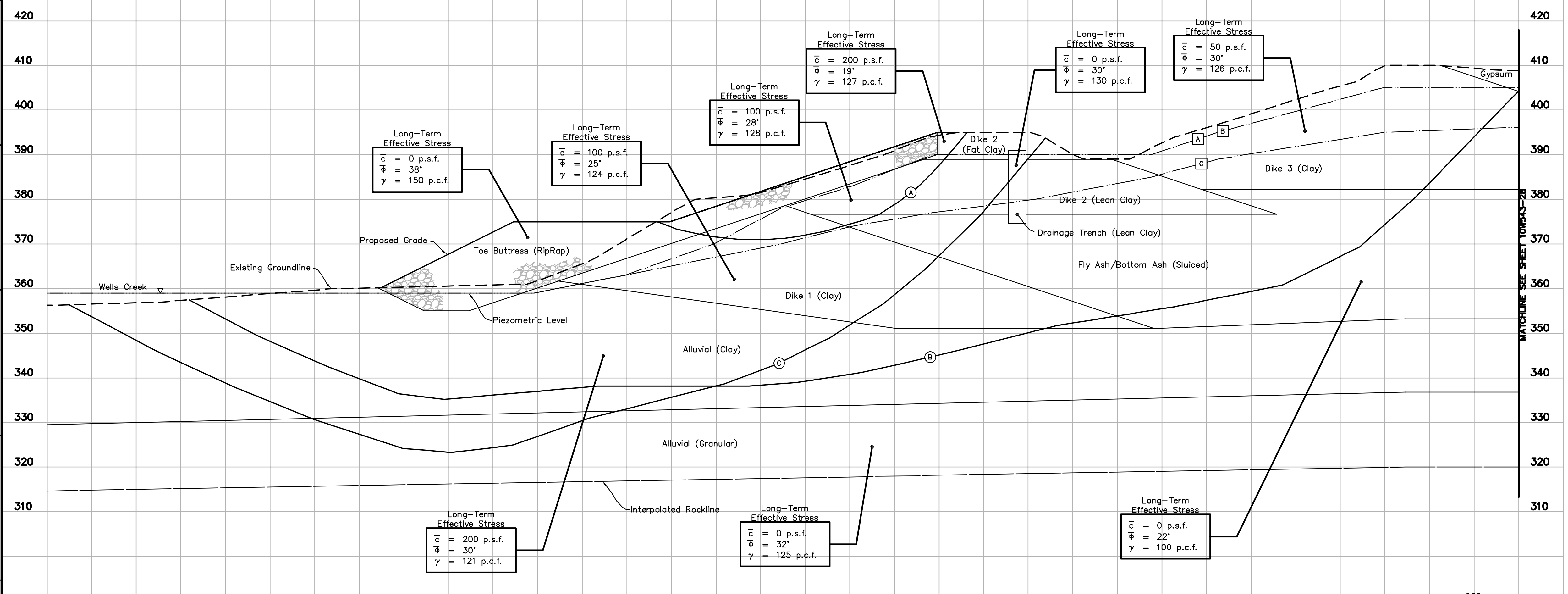
46 C 10W543–26

PLOT DATE: 06/10/2010

46 C 10W543-27

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.8
B	Spencer's Method (Optimized)	2.1
C	Spencer's Method (Optimized)	2.4



RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION
DRY FLY ASH STACK STABILITY
SECTION H – REPAIR

STAN A. HARRIS REGISTERED ENGINEER No. 00113308 STATE OF TENNESSEE 6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

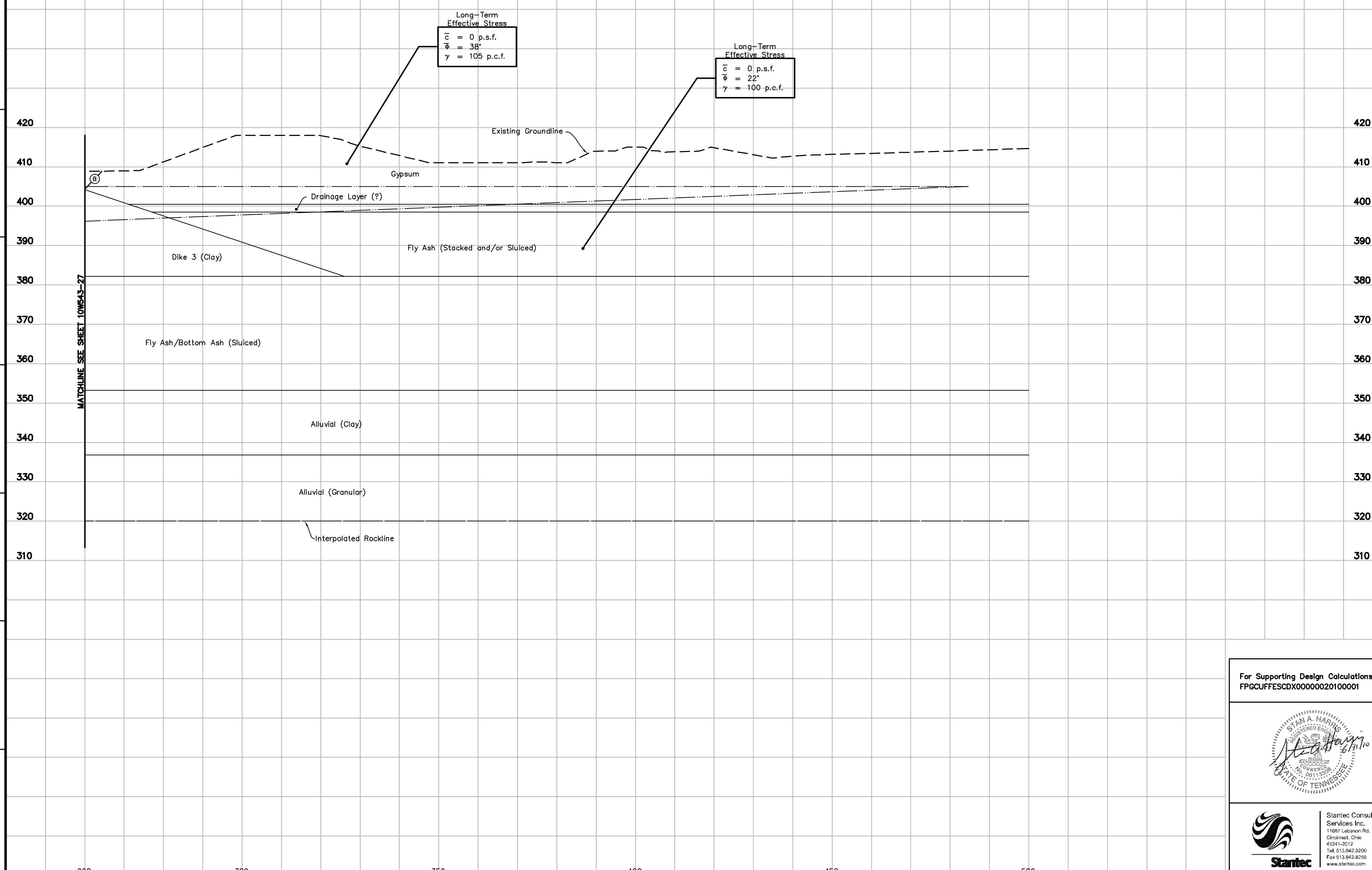
AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543-27 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 06/10/2010



NOTE:

1. Presence of drainage layer beneath gypsum was ignored for the slope stability analysis.

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE

SCALE: 1"=10' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION
DRY FLY ASH STACK STABILITY
SECTION H – REPAIR

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 06/11/10	46	C	10W543–28	R 0

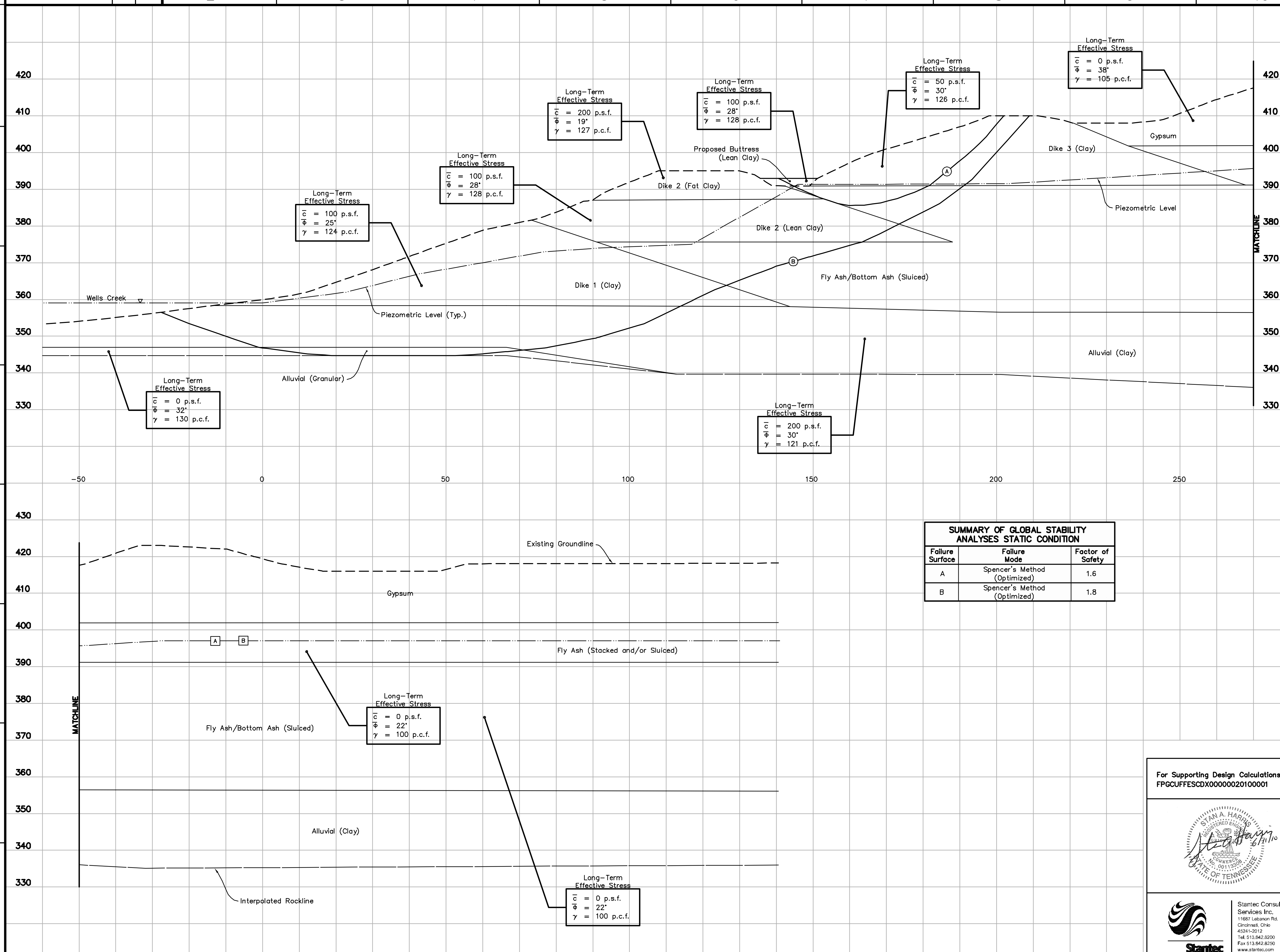
STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

46 C 10W543–28

PLOT DATE: 06/10/2010 USER: WITHERS, CHEYENNE



SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.6
B	Spencer's Method (Optimized)	1.8

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

R0 06/11/10 DBR CW DBR SAH SAH SAH TJ
RECORD DRAWING

SCALE: 1"=10' EXCEPT AS NOTED

YARD
GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION
GYPSUM DISPOSAL COMPLEX STABILITY
SECTION J – REPAIR

DESIGNED BY: D. ROGERS | DRAWN BY: C. WITHERS | CHECKED BY: D. ROGERS | SUPERVISED BY: S. HARRIS | REVIEWED BY: S. HARRIS | APPROVED BY: S. HARRIS | ISSUED BY: T. JOHNSON

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543-29 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

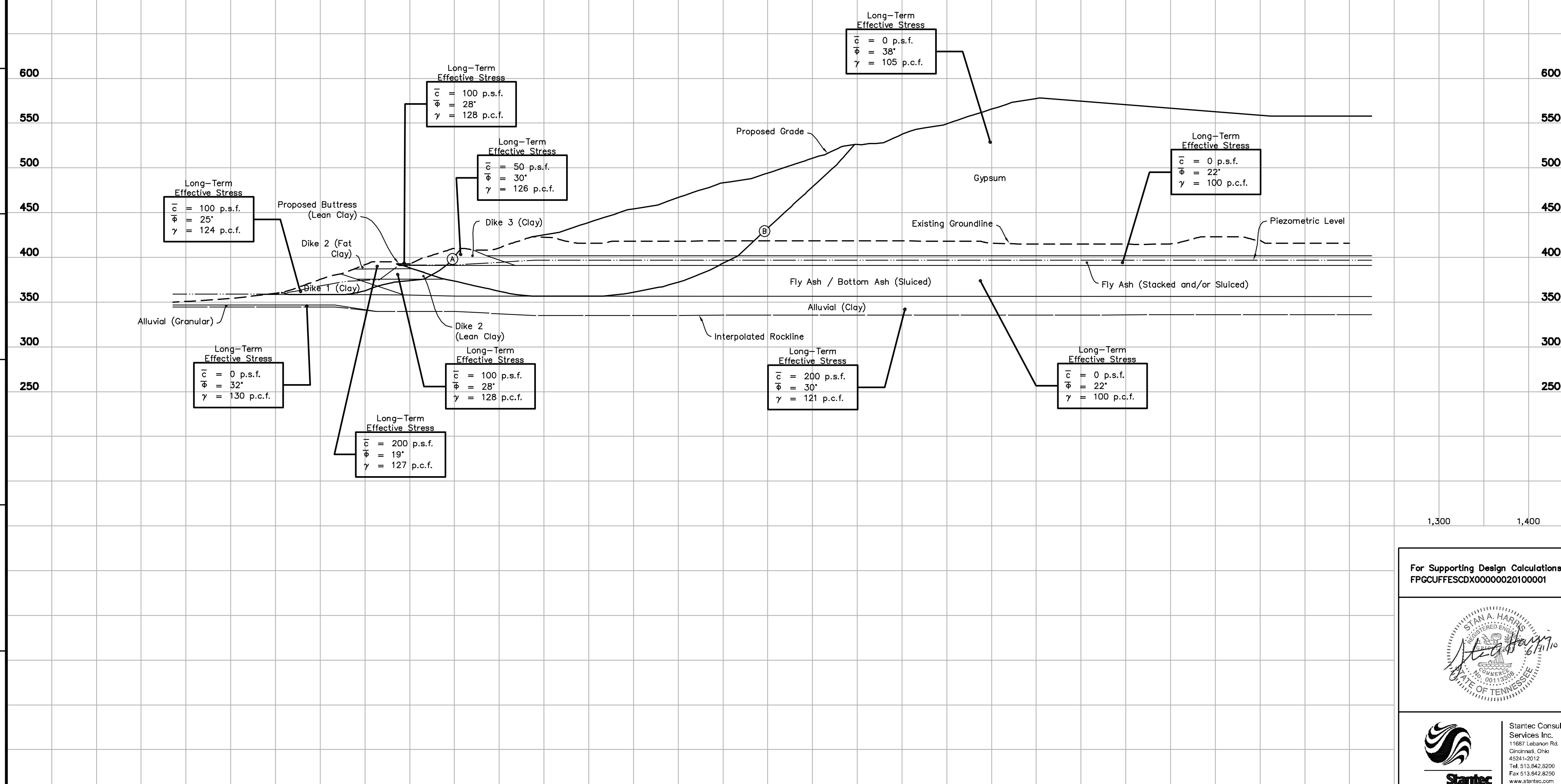
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

RECORD DRAWING

Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.7
B	Spencer's Method (Deep Failure)	1.8

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION



For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE

SCALE: 1"=50' EXCEPT AS NOTED

YARD
GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION GYPSUM DISPOSAL COMPLEX STABILITY SECTION J – BUILDOUT

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D. ROGERS	C. WITHERS	D. ROGERS	S. HARRIS	S. HARRIS	S. HARRIS	T. JOHNSON

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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

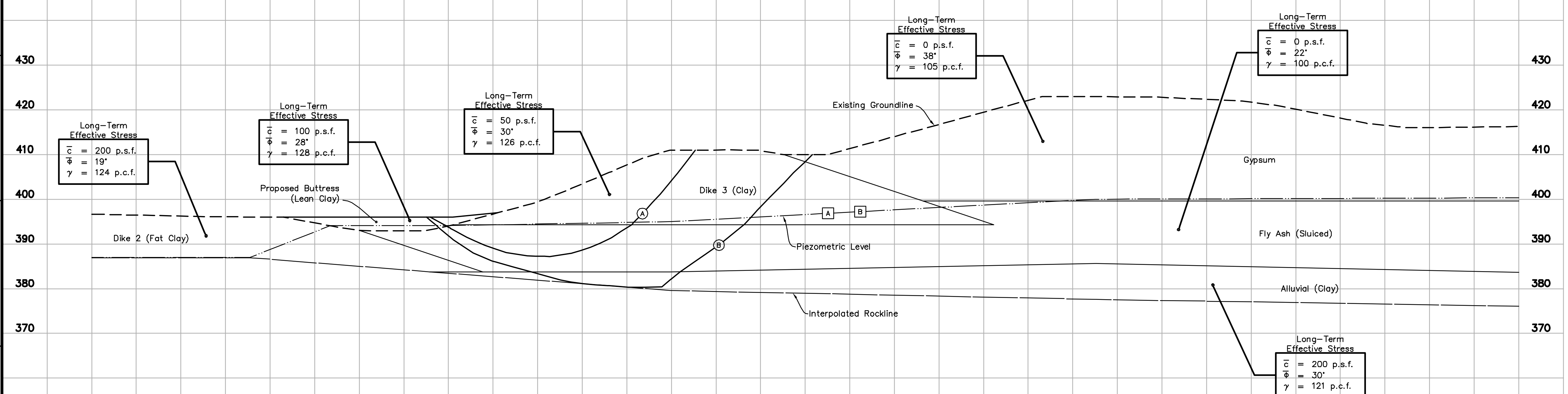
AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543-30 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.6
B	Spencer's Method (Optimized)	2.8



RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–	–

RECORD DRAWING

SCALE: 1"=10' EXCEPT AS NOTED

YARD
GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION
GYPSUM DISPOSAL COMPLEX STABILITY
SECTION M – REPAIR

STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE
6/11/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
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CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543–31 | R 0

DISCIPLINE INTERFACE 1 2 3 4

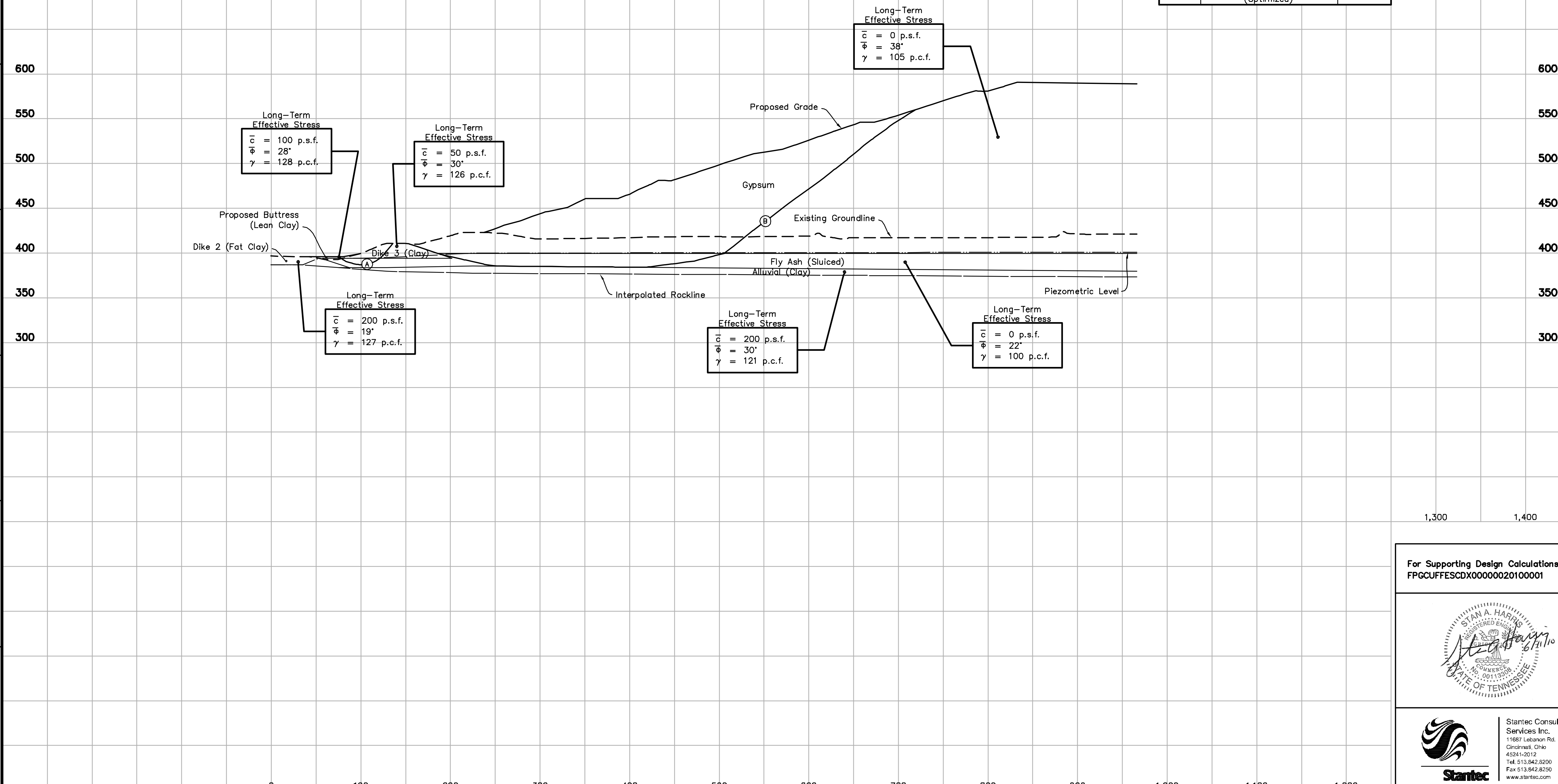
STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

46 C 10W543–31

SUMMARY OF GLOBAL STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Spencer's Method (Optimized)	1.6
B	Spencer's Method (Optimized)	2.1



NOTE:

1. Buildout was developed from a CAD file transmitted from TVA on 10/16/2009 and cross sections modified to maintain existing dike structure.

RECORD DRAWING

For Supporting Design Calculations see FPGCUFFESCDX00000020100001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R –	–	–	–	–	–	–	–	–	–	–
R 0	06/11/10	DBR	CW	DBR	SAH	SAH	SAH	TJ	–	–
RECORD DRAWING										

SCALE: 1"=50' EXCEPT AS NOTED

YARD
GYPSUM DISPOSAL COMPLEX

GEOTECHNICAL EXPLORATION
GYPSUM DISPOSAL COMPLEX STABILITY
SECTION M – BUILDOUT

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
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STAN A. HARRIS REGISTERED ENGINEER AGRICULTURE COMMERCE No. 00113308 STATE OF TENNESSEE 6/11/10

CUMBERLAND FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 06/11/10 | 46 | C | 10W543–32 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

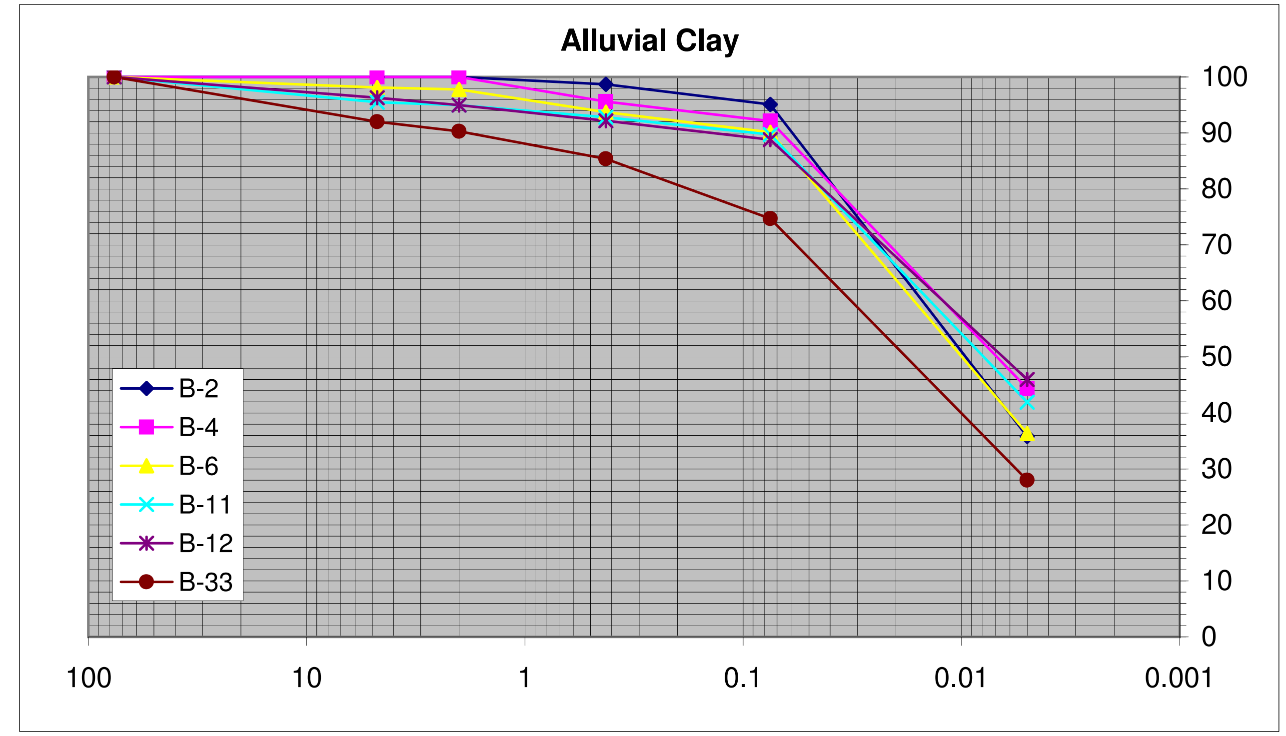
C.A.D. DRAWING DO NOT ALTER MANUALLY

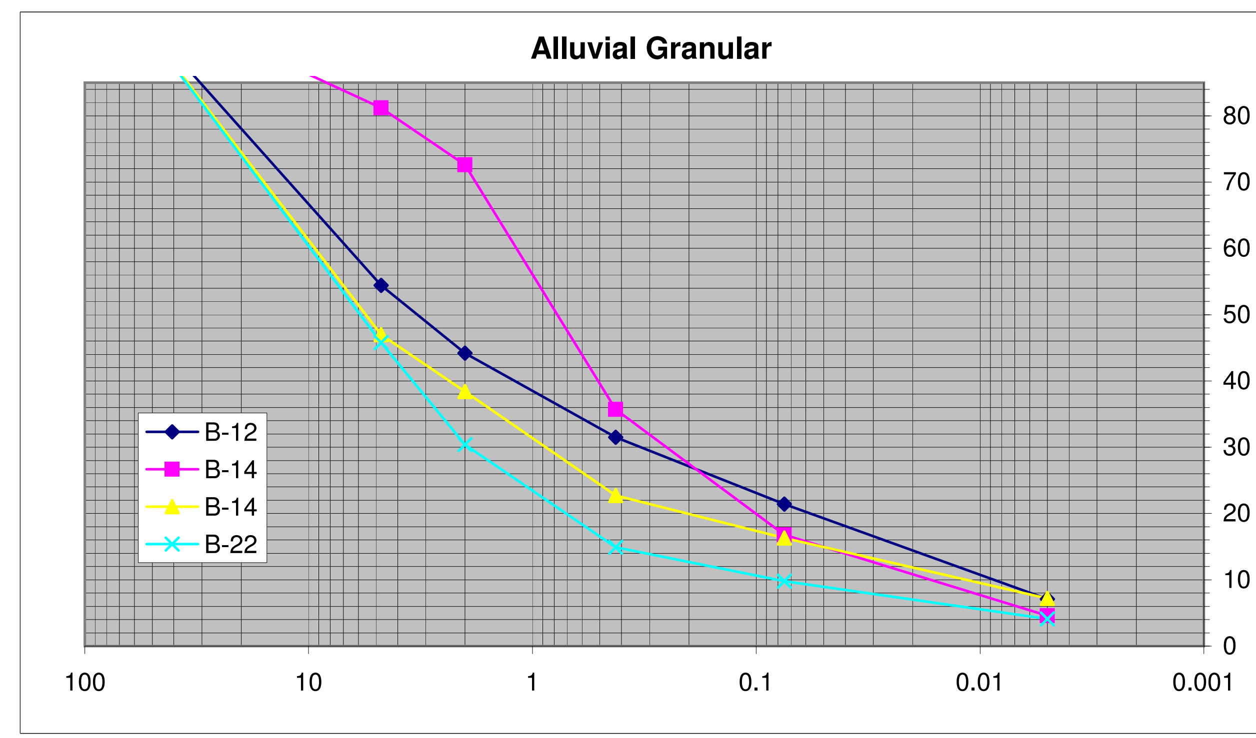
Appendix L

Seepage Analysis

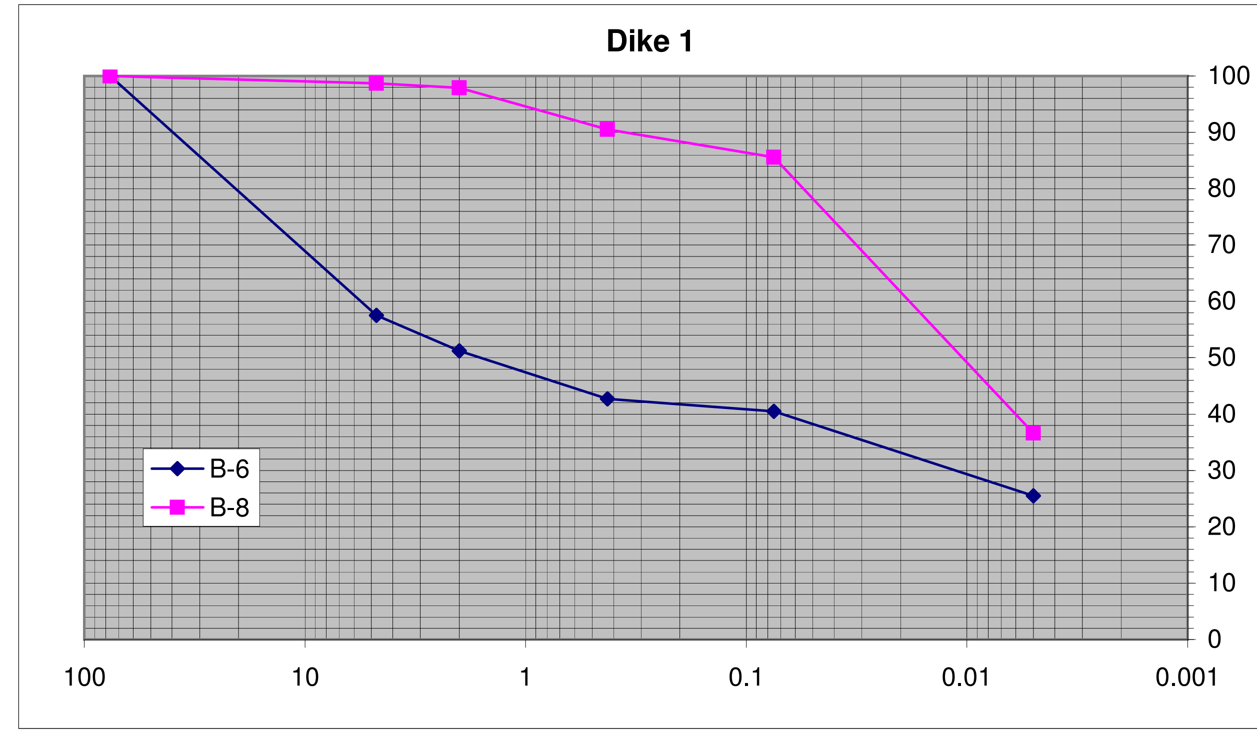
Particle Size Summary and Charts

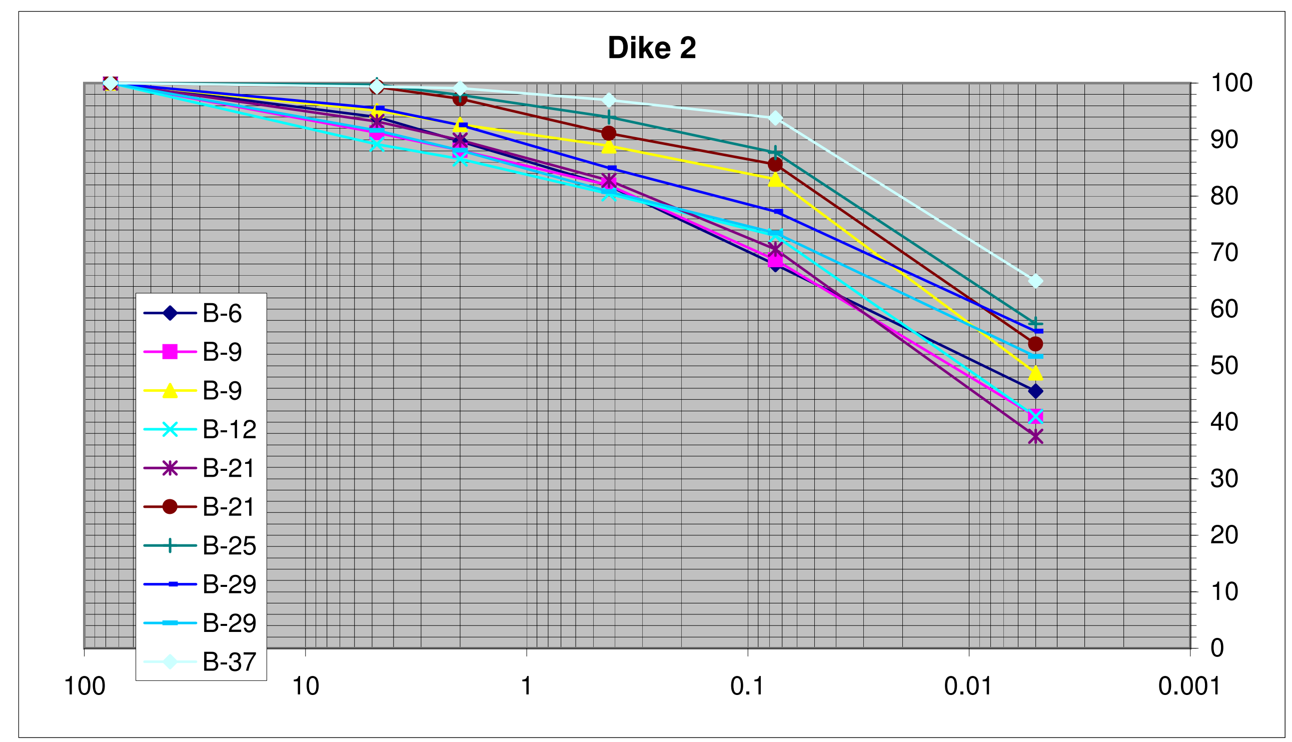
			Atterberg Limits	Grain Size (mm)					
Lab ID	**Boring**	**Material Type**	**LL**	**76.2**	**4.75**	**2**	**0.425**	**0.075**	**0.005**
512	B-2	Alluvial Clay	36	100.0	100.0	100.0	98.7	95.1	35.8
611	B-4	Alluvial Clay	40	100.0	100.0	100.0	95.6	92.1	44.4
26	B-6	Alluvial Clay	37	100.0	98.1	97.8	93.7	90.1	36.3
841	B-11	Alluvial Clay	41	100.0	95.5	95.0	92.8	89.7	41.9
186	B-12	Alluvial Clay	40	100.0	96.3	95.0	92.2	88.8	46.0
381	B-33	Alluvial Clay	35	100.0	92.0	90.3	85.4	74.7	28.0
1081	B-42	Alluvial Clay	49						
			39.7						
197	B-12	Alluvial Granular		100.0	54.4	44.2	31.5	21.4	7.1
896	B-14	Alluvial Granular		100.0	81.2	72.6	35.7	16.8	4.6
902	B-14	Alluvial Granular		100.0	47.0	38.4	22.7	16.3	7.2
121	B-22	Alluvial Granular		100.0	45.8	30.4	14.9	9.8	4.1
491	B-2	BA-FA (Sluiced)		100.0	85.0	73.2	51.8	33.9	3.9
727	B-18	BA-FA (Sluiced)		100.0	91.1	82.7	57.6	39.5	7.1
53	B-21	BA-FA (Sluiced)		100.0	79.4	62.9	34.5	16.6	3.8
93	B-22	BA-FA (Sluiced)		100.0	92.4	87.0	72.7	56.0	9.5
1637		Bottom Ash							
17	B-6	Dike 1	56	100.0	57.5	51.2	42.7	40.5	25.5
802	B-8	Dike 1	36	100.0	98.7	97.9	90.5	85.6	36.6
871	B-14	Dike 1	44						
910	B-26	Dike 1	44						
920	B-26	Dike 1/Alluvial Clay	38						
944	B-30	Dike 1	46						
951	B-30	Dike 1	36						
969	B-34	Dike 1	44						
975	B-34	Dike 1	36						
			40.5						
39	B-6	Dike 2	55	100.0	94.0	89.7	81.8	67.9	45.5
161	B-9	Dike 2	50	100.0	91.2	88.1	81.9	68.7	41.0
162	B-9	Dike 2	51	100.0	95.1	92.7	88.9	83.0	48.7
208	B-12	Dike 2	51	100.0	89.2	86.6	80.4	73.0	41.0
71	B-21	Dike 2	49	100.0	93.2	89.9	82.8	70.6	37.5

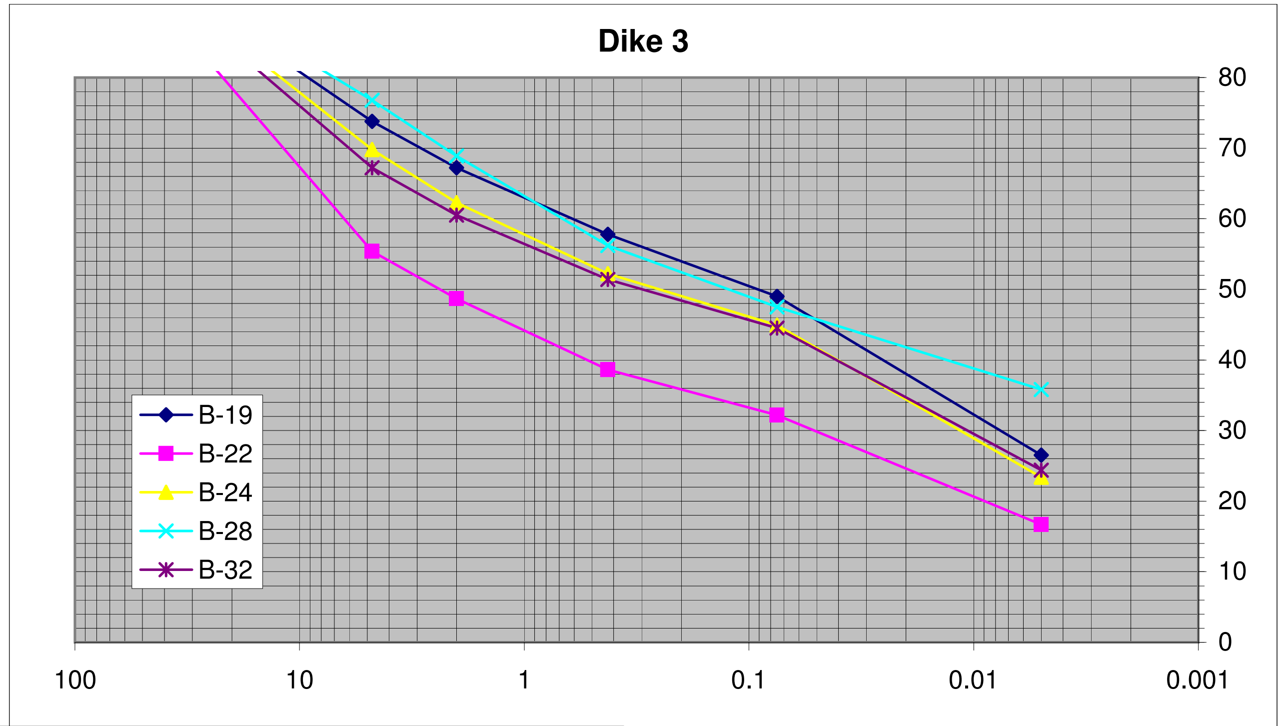


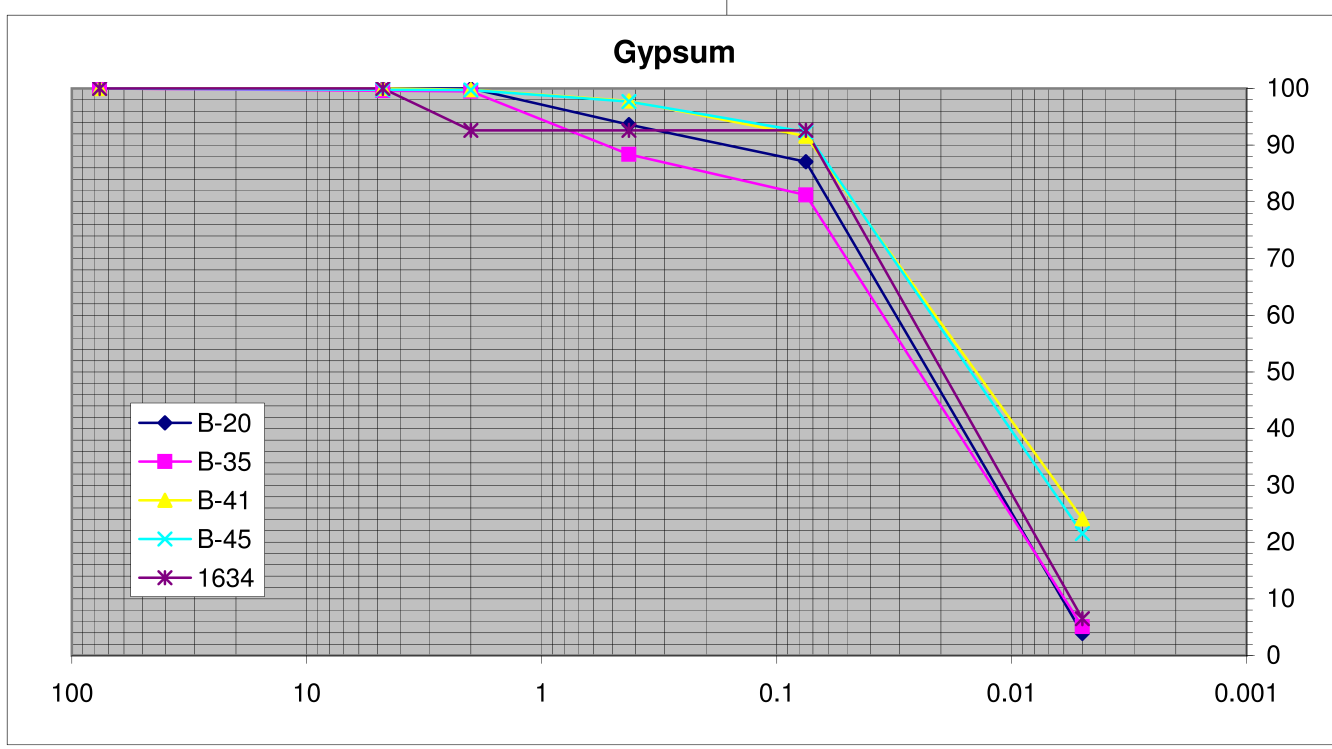


72	B-21	Dike 2	56	100.0	99.3	97.2	91.1	85.6	53.8
294	B-25	Dike 2	58	100.0	99.7	97.9	94.0	87.7	57.4
1457	B-29	Dike 2	46	100.0	95.6	92.6	85.0	77.3	56.1
1458	B-29	Dike 2	46	100.0	91.6	88.1	80.8	73.5	51.6
1460	B-37	Dike 2	53	100.0	99.4	99.1	97.0	93.8	65.0
1069	B-42	Dike 2	44						
			50.8						
663	B-19	Dike 3	48	100.0	73.8	67.2	57.8	49.0	26.5
77	B-22	Dike 3	36	100.0	55.4	48.7	38.6	32.2	16.7
536	B-24	Dike 3	39	100.0	69.8	62.3	52.2	44.9	23.4
1459	B-28	Dike 3	36	100.0	76.8	68.9	56.2	47.5	35.8
330	B-32	Dike 3	40	100.0	67.2	60.5	51.4	44.5	24.4
			39.8						
1636		Fly Ash							
738	B-18	Fly Ash (Sluiced)		100.0	95.2	95.1	90.6	74.0	13.0
678	B-19	Fly Ash (Sluiced)		100.0	98.0	97.2	91.4	80.0	11.7
552	B-24	Fly Ash (Sluiced)		100.0	99.8	99.7	92.6	78.0	13.7
343	B-32	Fly Ash (Sluiced)		100.0	97.4	96.1	86.2	79.3	9.6
425	B-37	Fly Ash (Sluiced)	45	100.0	97.4	95.4	91.1	86.4	45.3
582	B-4	Fly Ash (Sluiced)		100.0	97.6	94.5	79.9	72.5	13.9
1051	B-41	Fly Ash (Sluiced)		100.0	99.7	98.9	83.7	67.3	24.4
1478	B-45	Fly Ash (Sluiced)		100.0	91.7	82.3	65.3	41.9	16.6
691	B-20	Gypsum		100.0	100.0	100.0	93.6	87.1	3.9
445	B-35	Gypsum		100.0	99.6	99.5	88.4	81.2	5.1
1033	B-41	Gypsum		100.0	100.0	99.8	97.8	91.6	24.1
1463	B-45	Gypsum		100.0	99.8	99.7	97.7	92.3	21.5
1635		Gypsum							
1634		Gypsum	33	100.0	100.0	92.6	92.6	92.6	6.5






Dike 3
B-19
B-22
B-24
B-28
B-32
80
70
60
50
40
30
20
10
0
100
10
1
0.1
0.01
0.001


Gypsum
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B-35
B-41
B-45
1634
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100
10
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0.01
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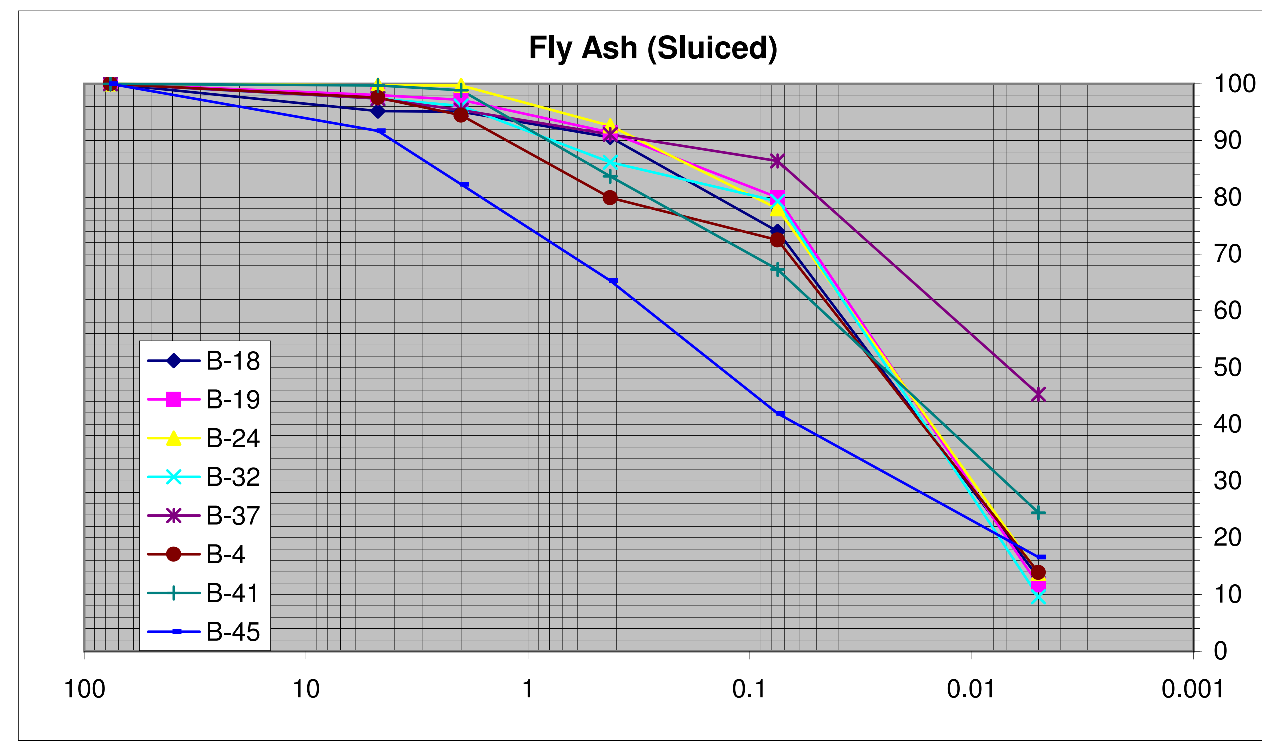
Fly Ash (Sluiced)
B-18
B-19
B-24
B-32
B-37
B-4
B-41
B-45
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70
60
50
40
30
20
10
0
100
10
1
0.1
0.01
0.001

Laboratory Permeability Summary

Lab ID	Boring	Depth (ft)	Material Type	UC Summary Sheet Visual Description	Permeability Avg. k (20ºC) (cm/s)		Avg. k (20ºC) ft/s
1262	B-9B	6.0-8.0	Dike 2	Fat Clay with Gravel (CH), red brown, moist, firm	7.00E-08	brown lean clay, 6-6.9	2.29659E-09
1263	B-9B	9.5-11.5	Dike 2	Lean Clay with Gravel (CL), light brown, moist, firm	2.30E-08	brown lean clay, 10.1-10.6	7.54593E-10
1610	B-21B	20.0-22.0	Dike 2	Fat Clay (CH), red brown, moist, firm	1.80E-08	brown lean clay	5.90551E-10
1615	B-29A	17.0-19.0	Dike 2	Gravelly Lean Clay (CL), brown, moist, soft to firm	2.20E-08	brown lean clay	7.21785E-10
1624A	B-37B	11.0-12.4	Dike 2	Lean Clay (CL), brown, moist, firm	1.40E-08	brown lean clay	4.59318E-10
1629	B-19C	20.0-22.0	Dike 3	Sandy Fat Clay (CH), brown, moist, firm	3.20E-08	brown lean clay	1.04987E-09
1605A	B-15B	46.0-48.0	Alluvial Clay	Lean Clay (CL), gray, moist, firm	2.30E-08	brown lean clay	7.54593E-10
1617A	B-29A	50.0-52.0	Alluvial Clay	Fat Clay (CH), brown, moist, firm	6.60E-09	brown lean clay, 50.2-50.7	2.16535E-10
1606B	B-17A	32.0-34.0	Fly Ash (Sluiced)	Silt (ML), black, moist, firm, fly ash	7.00E-07	gray silt - ASH, 32.7-33.2	2.29659E-08
1608	B-17A	70.0-72.0	Fly Ash (Sluiced)	Silt (ML), gray, moist, firm, flyash	6.50E-07	gray silt - ASH, 70-70.5	2.13255E-08
1620	B-36A	44.0-46.0	Fly Ash (Sluiced)	Silt (ML), black, wet, soft, fly ash	6.60E-07	gray silt - ASH, 44.7-45.2	2.16535E-08
1635		Gypsum Bulk	Gypsum		8.10E-08		2.65748E-09
1634		Gypsum Rejects Bulk	Gypsum Rejects		5.30E-07		1.73885E-08
1637		Bottom Ash Bulk	Bottom Ash		2.30E-06		7.54593E-08
1636		Fly Ash Bulk	Fly Ash		4.20E-07		1.37795E-08

Permeability Summary

t_{50} chart from CPT Application Guide

	CPT	El (ft)	El of Test (ft)	Material Type	k_h (ft/s)	Assumed kh/kv	Assumed kv/kh	**Avg. k_v (20ºC) (cm/s)**	ft/s	**Visual Description**	
	CPT15	430.0	344.1	Alluvial (Clay)	4.30E-09						
	CPT5	380.0	350.7	Alluvial (Clay)	7.50E-08						
	CPT14C	405.0	353.2	FA (Sluiced)/Alluvial (Clay)	6.50E-09						
	CPT16	430.0	343.9	FA (Sluiced)/Alluvial (Clay)	1.70E-08						
	CPT16	430.0	350.4	FA (Sluiced)/Alluvial (Clay)	6.70E-08						
	CPT22	425.0	362.9	FA (Sluiced)/Alluvial (Clay)	7.90E-09						
	CPT26	425.0	368.5	FA/BA (Sluiced)	2.00E-08						
1605A	B-15B		46.0-48.0	Alluvial Clay				2.30E-08	7.54593E-10	Lean Clay (CL), gray, moist, firm	brown lean clay
1617A	B-29A		50.0-52.0	Alluvial Clay				6.60E-09	2.16535E-10	Fat Clay (CH), brown, moist, firm	brown lean clay, 50.2-50.7
					2.82E-08	**58.1650**	**0.0172**	**1.48E-08**	**4.86E-10**		
	CPT3	380.0	367.1	Dike 1	2.80E-09						
	CPT4	380.0	367.8	Dike 1							
	CPT5	380.0	368.4	Dike 1	7.80E-09						
	CPT5	380.0	375.1	Dike 1	2.20E-07						
	CPT6	380.0	367.1	Dike 1	1.40E-07						
1262	B-9B		6.0-8.0	Dike 2				7.00E-08	2.29659E-09	Fat Clay with Gravel (CH), red brown, moist, firm	brown lean clay, 6-6.9
1263	B-9B		9.5-11.5	Dike 2				2.30E-08	7.54593E-10	Lean Clay with Gravel (CL), light brown, moist, firm	brown lean clay, 10.1-10.6
1610	B-21B		20.0-22.0	Dike 2				1.80E-08	5.90551E-10	Fat Clay (CH), red brown, moist, firm	brown lean clay
1615	B-29A		17.0-19.0	Dike 2				2.20E-08	7.21785E-10	Gravelly Lean Clay (CL), brown, moist, soft to firm	brown lean clay
1624A	B-37B		11.0-12.4	Dike 2				1.40E-08	4.59318E-10	Lean Clay (CL), brown, moist, firm	brown lean clay
1629	B-19C		20.0-22.0	Dike 3				3.20E-08	1.04987E-09	Sandy Fat Clay (CH), brown, moist, firm	brown lean clay
					9.27E-08	**94.6583**	**0.0106**	**2.98E-08**	**9.79E-10**		
	CPT14C	405.0	368.9	FA (Sluiced)	2.10E-06						
	CPT14C	405.0	375.9	FA (Sluiced)	4.60E-06						
	CPT14C	405.0	385.3	FA (Sluiced)	7.20E-07						
	CPT15	430.0	370.5	FA (Sluiced)	9.80E-07						
	CPT15	430.0	376.6	FA (Sluiced)	9.40E-07						
	CPT16	430.0	373.0	FA (Sluiced)	1.50E-06						
	CPT16	430.0	378.6	FA (Sluiced)	2.30E-06						
	CPT18	425.0	386.0	FA (Sluiced)	3.70E-06						
	CPT20	425.0	388.7	FA (Sluiced)	4.60E-06						
	CPT22	425.0	372.3	FA (Sluiced)	6.40E-06						
	CPT22	425.0	383.0	FA (Sluiced)	2.10E-06						
	CPT23	425.0	366.0	FA (Sluiced)	4.60E-06						
	CPT23	425.0	370.6	FA (Sluiced)	6.00E-06						
	CPT25	425.0	376.9	FA (Sluiced)	5.30E-06						
	CPT25	425.0	386.2	FA (Sluiced)	9.10E-07						
	CPT25	425.0	390.8	FA (Sluiced)	1.30E-06						
	CPT15	430.0	357.3	FA (Sluiced)/Alluvial (Clay)	2.20E-06						
	CPT18	425.0	376.4	FA (Sluiced)/Alluvial (Clay)	4.30E-06						

	Permeability Summary										
								t_{50} chart from CPT Application Guide			
	CPT	El (ft)	El of Test (ft)	Material Type	k_h (ft/s)	Assumed kh/kv	Assumed kv/kh	**Avg. k_v (20ºC) (cm/s)**	ft/s	**Visual Description**	
1606B	B-17A		32.0-34.0	Fly Ash (Sluiced)				7.00E-07	2.29659E-08	Silt (ML), black, moist, firm, fly ash	gray silt - ASH, 32.7-33.2
1608	B-17A		70.0-72.0	Fly Ash (Sluiced)				6.50E-07	2.13255E-08	Silt (ML), gray, moist, firm, flyash	gray silt - ASH, 70-70.5
1620	B-36A		44.0-46.0	Fly Ash (Sluiced)				6.60E-07	2.16535E-08	Silt (ML), black, wet, soft, fly ash	gray silt - ASH, 44.7-45.2
	CPT14	405.0	373.2	FA/BA (Sluiced)	2.90E-06						
	CPT14	405.0	386.6	FA/BA (Sluiced)	9.70E-07						
	CPT17	400.0	372.9	FA/BA (Sluiced)	1.00E-06						
	CPT17	400.0	385.1	FA/BA (Sluiced)	2.10E-06						
	CPT26	425.0	371.7	FA/BA (Sluiced)	2.20E-07						
	CPT26	425.0	378.9	FA/BA (Sluiced)	4.60E-06	1.2000	0.8333	3.83E-06	1.25766E-07		
					2.76E-06	**57.6738**	**0.0173**	**1.46E-06**	**4.79E-08**		
	CPT15	430.0	406.4	FA (Stacked)	1.30E-06						
	CPT16	430.0	406.4	FA (Stacked)	8.00E-06			2.20E-05	7.22E-07		
1636			Fly Ash Bulk	Fly Ash				4.20E-07	1.37795E-08		
					4.65E-06	**12.6434**	**0.0791**	**1.12E-05**	**3.68E-07**		
					1.97E-06						
1635			Gypsum Bulk	Gypsum				8.10E-08	2.65748E-09		
1634			Gypsum Rejects Bulk	Gypsum Rejects				5.30E-07	1.73885E-08		
1637			Bottom Ash Bulk	Bottom Ash				2.30E-06	7.54593E-08		
								6.80E-02	0.002230971		

CPT Hydraulic Conductivity
SCPTu Dissipation Results
Coefficient of Consolidation

CPT	El (ft)	SCPTu El (ft)	GW El (ft)	Depth of Test (ft)	El of Test (ft)	Material Type	Push Pore Pressure (psi)	Static GW Pressure (psi)	Pore Pressure, U_{50} (psi)	t_{50} (min)	c_h (in^2/min)	k_h (ft/s)	Assumed kh/kv	
CPT15	430.0	425.5	395.0	85.9	344.1	Alluvial (Clay)	86.2	22.0	54.1	25.23	3.40E-02	4.30E-09		t_{50} chart from CPT Application Gui
CPT5	380.0	380.0	370.0	29.3	350.7	Alluvial (Clay)	33.3	23.5	28.4	1.72	5.30E-01	7.50E-08		
CPT3	380.0	380.0	380.0	12.9	367.1	Dike 1	42.5	5.6	24.0	37.50	2.30E-02	2.80E-09		
CPT4	380.0	380.0	365.0	12.2	367.8	Dike 1	42.5	0.0	21.2					
CPT5	380.0	380.0	370.0	11.6	368.4	Dike 1	56.5	34.1	45.3	14.40	6.10E-02	7.80E-09		
CPT5	380.0	380.0	370.0	4.9	375.1	Dike 1	10.4	0.0	5.2	0.64	1.40E+00	2.20E-07		
CPT6	380.0	380.0	350.0	12.9	367.1	Dike 1	2.0	0.0	1.0	0.94	9.70E-01	1.40E-07		
CPT14C	405.0	396.0	395.0	36.1	368.9	FA (Sluiced)	36.0	11.3	23.7	0.08	1.20E+01	2.10E-06		
CPT14C	405.0	396.0	395.0	29.1	375.9	FA (Sluiced)	26.0	8.3	17.1	0.04	2.60E+01	4.60E-06		
CPT14C	405.0	396.0	395.0	19.7	385.3	FA (Sluiced)	32.0	4.2	18.1	0.21	4.50E+00	7.20E-07		
CPT15	430.0	425.5	395.0	59.5	370.5	FA (Sluiced)	61.2	10.6	35.9	0.16	6.10E+00	9.80E-07		
CPT15	430.0	425.5	395.0	53.4	376.6	FA (Sluiced)	62.3	8.0	35.1	0.16	5.80E+00	9.40E-07		
CPT16	430.0	386.1	395.0	57.0	373.0	FA (Sluiced)	75.6	9.5	42.6	0.11	8.80E+00	1.50E-06		
CPT16	430.0	386.1	395.0	51.4	378.6	FA (Sluiced)	62.5	7.1	34.8	0.07	1.40E+01	2.30E-06		
CPT18	425.0	395.0	395.0	39.0	386.0	FA (Sluiced)	24.9	3.9	14.4	0.05	2.10E+01	3.70E-06		
CPT20	425.0	425.0	400.0	36.3	388.7	FA (Sluiced)	32.0	4.9	21.5	0.04	2.60E+01	4.60E-06		
CPT22	425.0	386.5	396.5	52.7	372.3	FA (Sluiced)	24.5	10.5	17.5	0.03	3.60E+01	6.40E-06		
CPT22	425.0	386.5	396.5	42.0	383.0	FA (Sluiced)	12.5	5.8	9.2	0.08	1.30E+01	2.10E-06		
CPT23	425.0	382.8	384.5	59.0	366.0	FA (Sluiced)	24.0	8.0	16.0	0.04	2.60E+01	4.60E-06		
CPT23	425.0	382.8	384.5	54.4	370.6	FA (Sluiced)	32.0	6.0	11.5	0.03	3.40E+01	6.00E-06		
CPT25	425.0	425.0	399.0	48.1	376.9	FA (Sluiced)	49.0	9.6	29.3	0.03	3.00E+01	5.30E-06		
CPT25	425.0	425.0	399.0	38.8	386.2	FA (Sluiced)	49.3	5.5	27.4	0.17	5.60E+00	9.10E-07		
CPT25	425.0	425.0	399.0	34.2	390.8	FA (Sluiced)	38.9	3.5	21.2	0.12	8.10E+00	1.30E-06		
CPT14C	405.0	396.0	395.0	51.8	353.2	FA (Sluiced)/Alluvial (Clay)	82.0	18.1	50.1	17.08	5.20E-02	6.50E-09		
CPT15	430.0	425.5	395.0	72.7	357.3	FA (Sluiced)/Alluvial (Clay)	49.1	16.3	32.7	0.07	1.30E+01	2.20E-06		
CPT16	430.0	386.1	395.0	86.1	343.9	FA (Sluiced)/Alluvial (Clay)	105.4	22.1	63.8	7.05	1.30E-01	1.70E-08		
CPT16	430.0	386.1	395.0	79.6	350.4	FA (Sluiced)/Alluvial (Clay)	87.6	19.3	53.5	1.92	4.70E-01	6.70E-08		
CPT18	425.0	395.0	395.0	48.6	376.4	FA (Sluiced)/Alluvial (Clay)	24.0	8.0	16.0	0.04	2.40E+01	4.30E-06		
CPT22	425.0	386.5	396.5	62.1	362.9	FA (Sluiced)/Alluvial (Clay)	77.7	14.6	46.1	14.25	6.20E-02	7.90E-09		
CPT15	430.0	425.5	395.0	23.6	406.4	FA (Stacked)	30.0	13.5	21.7	0.12	8.10E+00	1.30E-06		
CPT16	430.0	386.1	395.0	23.6	406.4	FA (Stacked)	34.0	18.4	26.2	0.02	4.40E+01	8.00E-06		
CPT14	405.0	405.0	389.0	31.8	373.2	FA/BA (Sluiced)	16.0	6.9	11.4	0.06	1.70E+01	2.90E-06		
CPT14	405.0	405.0	389.0	18.4	386.6	FA/BA (Sluiced)	18.0	1.0	9.5	0.16	6.00E+00	9.70E-07		
CPT17	400.0	390.5	385.0	27.1	372.9	FA/BA (Sluiced)	45.0	5.3	25.1	0.15	6.30E+00	1.00E-06		
CPT17	400.0	390.5	385.0	14.9	385.1	FA/BA (Sluiced)	15.3	0.0	7.6	0.08	1.30E+01	2.10E-06		
CPT26	425.0	382.5	399.0	56.5	368.5	FA/BA (Sluiced)	96.6	13.2	54.9	6.05	1.50E+01	2.00E-08		
CPT26	425.0	382.5	399.0	53.3	371.7	FA/BA (Sluiced)	59.2	11.8	35.5	0.63	1.40E+00	2.20E-07		
CPT26	425.0	382.5	399.0	46.1	378.9	FA/BA (Sluiced)	31.2	8.7	20.0	0.04	2.60E+01	4.60E-06	1.2	

Critical Gradient

Boring	Depth (ft)	Material Type	CU Triaxial G_s	e_0	i_{crit}
B-29A	29.0-31.0	Dike 1	2.7	0.646	1.03
B-29A	29.0-31.0	Dike 1	2.7	0.595	1.07
B-6	24.0-34.5	Dike 1	2.68		
B-8	1.5-19.5	Dike 1	2.64		
			2.66	0.6205	1.02
B-29B	12.0-13.4	Dike 2	2.7	0.675	1.01
B-29B	12.0-13.4	Dike 2	2.7	0.507	1.13
B-29B	14.5-16.5	Dike 2	2.7	0.466	1.16
B-6	0.0-10.0	Dike 2	2.55		
B-9	0.0-6.0	Dike 2	2.70		
B-9	9.0-12.0	Dike 2	2.68		
B-12	15.0	Dike 2	2.77		
B-21	0.0-9.0	Dike 2	2.81		
B-21	12.0-18.0	Dike 2	2.78		
B-25	10.5-18.0	Dike 2	2.54		
B-29	0.3-10.0	Dike 2	2.58		
B-29	10.4-14.5	Dike 2	2.57		
B-37	6.0-14.5	Dike 2	2.61		
			2.66	0.549333	1.07
B-19C	17.5-19.5	Dike 3	2.7	0.547	1.10
B-19C		Dike 3	2.7	0.687	1.01
B-19C	10.5-12.5	Dike 3	2.7	0.633	1.04
B-19	7.5-25.5	Dike 3	2.78		
B-22	6.0-13.5, …	Dike 3	2.72		
B-24	4.5-22.5	Dike 3	2.51		
B-28	1.5-15.0	Dike 3	2.66		
B-32	1.5-16.5	Dike 3	2.63		
			2.66	0.622333	1.02
B-43A	50.0-52.0	Alluvial Clay	2.67	0.657	1.01
B-43A	50.0-52.0	Alluvial Clay	2.67	0.677	1.00
B-2	55.0-69.0	Alluvial Clay	2.56		
B-4	43.5-56.5	Alluvial Clay	2.53		
B-6	36.0-44.0	Alluvial Clay	2.55		
B-11	15.0-36.0	Alluvial Clay	2.66		
B-12	35.0-46.5	Alluvial Clay	2.64		
B-33	30.0-39.0	Alluvial Clay	2.62		
			2.61	0.667	0.97
B-12	60.0-69.0	Alluvial Granular	2.62		
B-14	40.0-49.0	Alluvial Granular	2.70		
B-14	52.5-64.0	Alluvial Granular	2.70		
B-22	75.0-89.0	Alluvial Granular	2.66		
B-43A	29.0-31.0	Fly Ash (Sluiced)	2.47	1.134	0.69
B-43A	29.0-31.0	Fly Ash (Sluiced)	2.47	1.262	0.65
B-35A	46.0-48.0	Fly Ash (Sluiced)	2.47	1.174	0.68
B-18	15.0-34.5	Fly Ash (Sluiced)	2.58		
B-19	28.5-49.0	Fly Ash (Sluiced)	2.46		

$$i_{crit} = \frac{\gamma_{sub}}{\gamma_w} = \frac{G_s - 1}{1 + e}$$

$$FS_{piping} = \frac{i_{crit}}{i}$$

Critical Gradient

			CU Triaxial		
Boring	**Depth (ft)**	**Material Type**	**G_s**	**e_0**	**i_{crit}**
B-24	27.0-51.5	Fly Ash (Sluiced)	2.44		
B-32	20.0-49.0	Fly Ash (Sluiced)	2.52		
B-37	7.5-21.0	Fly Ash (Sluiced)	2.62		
B-4	1.5-31.5	Fly Ash (Sluiced)	2.42		
B-41	24.0-34.5	Fly Ash (Sluiced)	2.52		
B-45	25.0-39.6	Fly Ash (Sluiced)	2.71		
			2.52	1.19	0.69
B-2	4.5-39.0	BA-FA (Sluiced)	2.62		
B-18	0.0-7.5	BA-FA (Sluiced)	2.61		
B-21	18.0-30.0	BA-FA (Sluiced)	2.61		
B-22	28.5-49.5	BA-FA (Sluiced)	2.55		
B-20	0.0-15.0	Gypsum	2.31		
B-35	1.5-22.5	Gypsum	2.94		
B-41	0.0-12.9	Gypsum	2.31		
B-45	3.0-9.0	Gypsum	2.36		
	Gypsum Rejects Bulk	Gypsum Rejects	2.73		
	Gypsum Rejects Bulk	Gypsum Rejects	2.7	1.08	0.82
			2.5	0.947	0.77
			2.7	1.1	0.81
	Bulk	Gypsum Rejects	2.7	1.09	0.81
	Bottom Ash Bulk	Bottom Ash	2.7	0.923	0.88
			2.7	0.913	0.89
	Bulk	Fly Ash	2.5	1.37	0.63
			2.5	1.36	0.64
	Fly Ash Bulk		2.5	1.37	0.63
			2.5	1.36	0.64

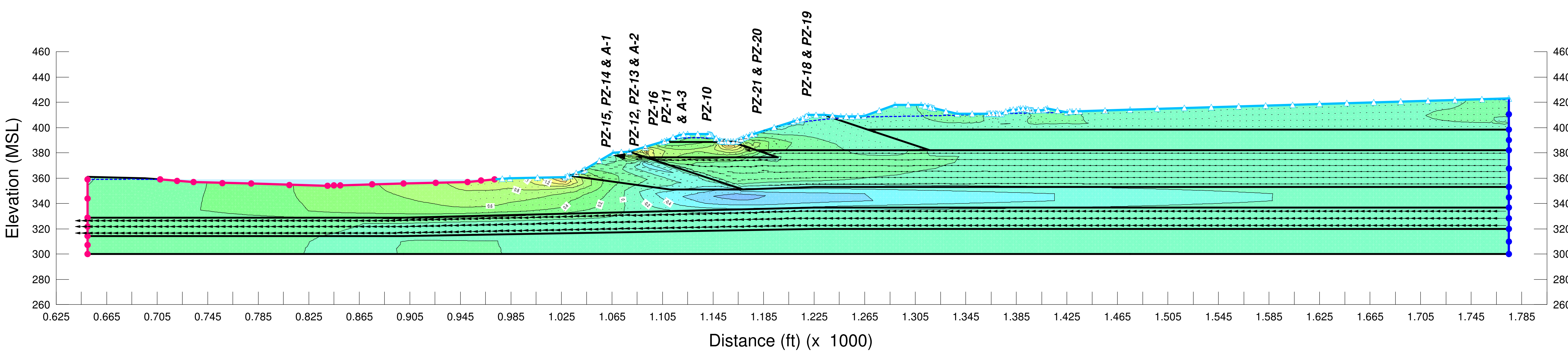
Indicates laboratory-assumed values.

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

File Name: Section H.gsz
Analysis Name: Steady-State Seepage
Date Saved: 10/30/2009
Last Solved on 10/30/2009 at 11:17:44 AM
Analysis Method: Steady-State

Material Type
Dike 1 (Clay) Saturated / Unsaturated Dike 1 (Clay) Dike 1 (Clay) 0.1 0 °
Dike 2 (Lean Clay) Saturated / Unsaturated Dike 2 (Lean Clay) Dike 2 (Lean Clay) 0.1 0 °
Dike 3 (Clay) Saturated / Unsaturated Dike 3 (Clay) Dike 3 (Clay) 0.1 0 °
Alluvial (Clay) Saturated / Unsaturated Alluvial (Clay) Alluival (Clay) 0.05 0 °
Alluvial (Granular) Saturated / Unsaturated Alluvial (Granular) Alluvial (Granular) 0.05 0 °
Gypsum Saturated / Unsaturated Gypsum Gypsum 0.02 0 °
Fly Ash (Stacked and/or Sluiced) Saturated / Unsaturated Fly Ash (Stacked and/or Sluiced) Fly Ash (Stacked and/or Sluiced) 0.02 0 °
Fly Ash / Bottom Ash (Sluiced) Saturated / Unsaturated Fly Ash/Bottom Ash (Sluiced) Fly Ash/Bottom Ash (Sluiced) 0.02 0 °
Dike 2 (Fat Clay) Saturated / Unsaturated Dike 2 (Fat Clay) Dike 2 (Fat Clay) 0.1 0 °
Bedrock Saturated Only 1e-012 ft/sec 0.05 ft³/ft³ 0 /psf 0.1 0 °

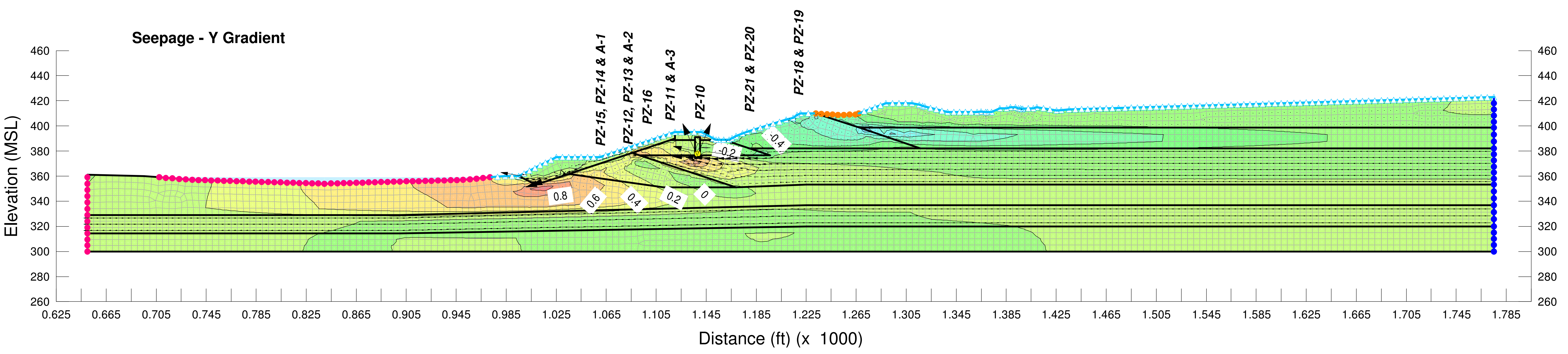
Seepage - Y Gradient



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

File Name: Section H (Stability - Repair Design).gsz
Analysis Name: Steady-State Seepage
Date Saved: 11/2/2009
Last Solved on 11/2/2009 at 1:58:04 PM
Analysis Method: Steady-State

Material Type
Dike 1 (Clay) Saturated / Unsaturated Dike 1 (Clay) Dike 1 (Clay) 0.1 0 °
Dike 2 (Lean Clay) Saturated / Unsaturated Dike 2 (Lean Clay) Dike 2 (Lean Clay) 0.1 0 °
Dike 3 (Clay) Saturated / Unsaturated Dike 3 (Clay) Dike 3 (Clay) 0.1 0 °
Alluvial (Clay) Saturated / Unsaturated Alluvial (Clay) Alluvial (Clay) 0.05 0 °
Alluvial (Granular) Saturated / Unsaturated Alluvial (Granular) Alluvial (Granular) 0.05 0 °
Gypsum Saturated / Unsaturated Gypsum Gypsum 0.02 0 °
Fly Ash (Stacked and/or Sluiced) Saturated / Unsaturated Fly Ash (Stacked and/or Sluiced) Fly Ash (Stacked and/or Sluiced) 0.02 0 °
Fly Ash / Bottom Ash (Sluiced) Saturated / Unsaturated Fly Ash/Bottom Ash (Sluiced) Fly Ash/Bottom Ash (Sluiced) 0.02 0 °
Dike 2 (Fat Clay) Saturated / Unsaturated Dike 2 (Fat Clay) Dike 2 (Fat Clay) 0.1 0 °
Toe Buttress (Rip Rap) Saturated / Unsaturated Rip Rap Rip Rap 0.5 0 °
Drainage Trench (Gravel) Saturated / Unsaturated Gravel Gravel 0.1 0 °
Bedrock Saturated Only 1e-012 ft/sec 0.05 ft³/ft³ 0 /psf 0.1 0 °

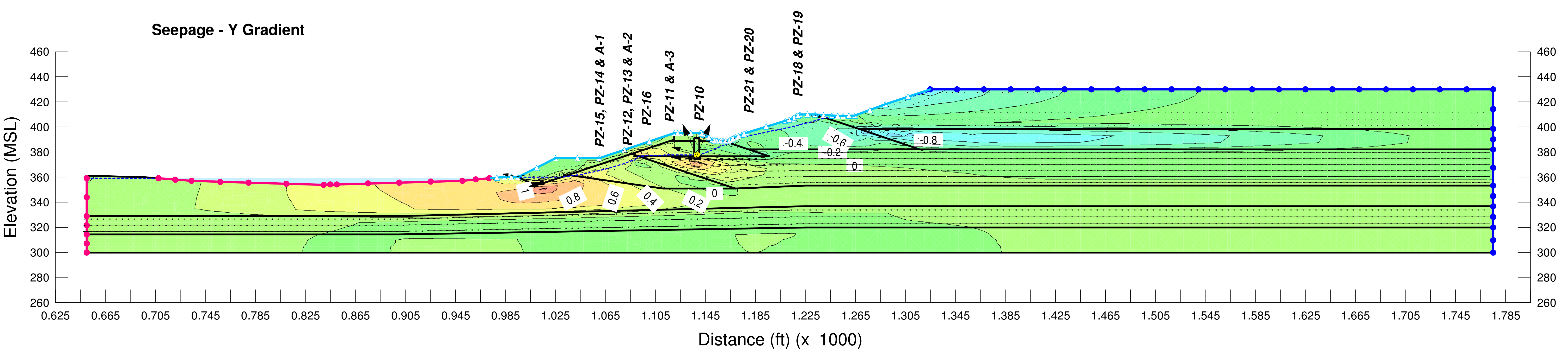


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

Stantec

File Name: Section H (StabRepDgn-Buildout 430)2.gsz
Analysis Name: Steady-State Seepage
Date Saved: 11/2/2009
Last Solved on 11/2/2009 at 1:02:44 PM
Analysis Method: Steady-State

Material Type
Dike 1 (Clay) Saturated / Unsaturated Dike 1 (Clay) Dike 1 (Clay) 0.1 0 °
Dike 2 (Lean Clay) Saturated / Unsaturated Dike 2 (Lean Clay) Dike 2 (Lean Clay) 0.1 0 °
Dike 3 (Clay) Saturated / Unsaturated Dike 3 (Clay) Dike 3 (Clay) 0.1 0 °
Alluvial (Clay) Saturated / Unsaturated Alluvial (Clay) Alluvial (Clay) 0.05 0 °
Alluvial (Granular) Saturated / Unsaturated Alluvial (Granular) Alluvial (Granular) 0.05 0 °
Gypsum Saturated / Unsaturated Gypsum Gypsum 0.02 0 °
Fly Ash (Stacked and/or Sluiced) Saturated / Unsaturated Fly Ash (Stacked and/or Sluiced) Fly Ash (Stacked and/or Sluiced) 0.02 0 °
Fly Ash / Bottom Ash (Sluiced) Saturated / Unsaturated Fly Ash/Bottom Ash (Sluiced) Fly Ash/Bottom Ash (Sluiced) 0.02 0 °
Dike 2 (Fat Clay) Saturated / Unsaturated Dike 2 (Fat Clay) Dike 2 (Fat Clay) 0.1 0 °
Toe Buttress (Rip Rap) Saturated / Unsaturated Rip Rap Rip Rap 0.5 0 °
Drainage Trench (Gravel) Saturated / Unsaturated Gravel Gravel 0.1 0 °
Bedrock Saturated Only 1e-012 ft/sec 0.05 ft³/ft³ 0 /psf 0.1 0 °

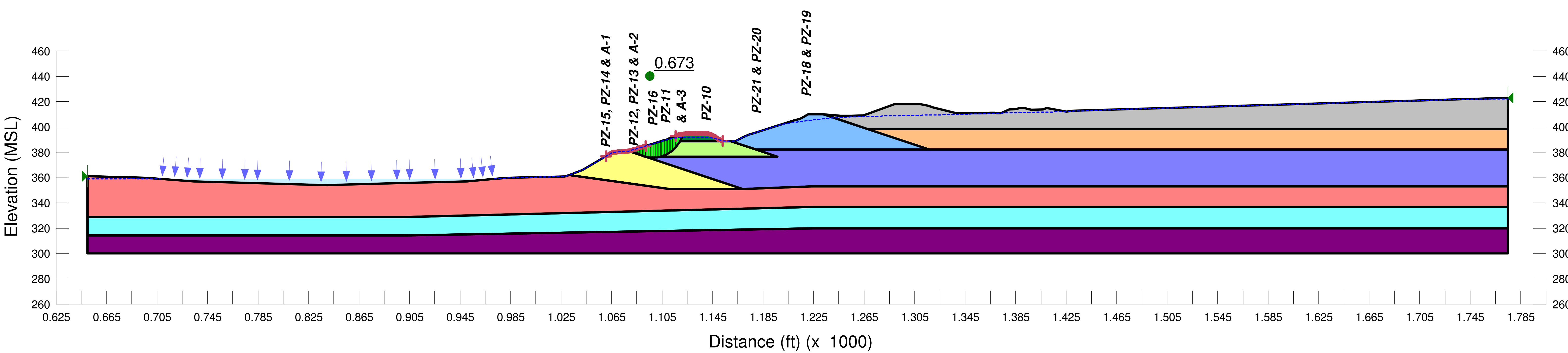


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

File Name: Section H.gsz
Analysis Name: Stability - Existing Condition with Existing PZ Levels
Date Saved: 10/30/2009
Last Solved on 10/30/2009 at 11:20:56 AM
Analysis Method: Spencer

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Stacked and/or Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Bedrock			

Calculated Factor of Safety: 0.673



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Kirkbride, Rob
Revision Number: 331
Last Edited By: Harmon, Jacqueline
Date: 11/2/2009
Time: 1:58:24 PM
File Name: Section H (Stability - Repair Design).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 11/2/2009
Last Solved Time: 2:01:28 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Parent: Steady-State Seepage
Method: Spencer
Settings
- PWP Conditions Source: Parent Analysis

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes
- Tension Crack
  - Tension Crack Option: (none)

FOS Distribution
    FOS Calculation Option: Constant
Advanced
    Number of Slices: 30
    Optimization Tolerance: 0.01
    Minimum Slip Surface Depth: 10 ft
    Optimization Maximum Iterations: 5000
    Optimization Convergence Tolerance: 1e-007
    Starting Optimization Points: 8
    Ending Optimization Points: 16
    Complete Passes per Insertion: 1
    Driving Side Maximum Convex Angle: 5 °
    Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)
Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °

Dike 2 (Lean Clay)
Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °

Dike 3 (Clay)
Model: Mohr-Coulomb
Unit Weight: 126 pcf
Cohesion: 50 psf
Phi: 30 °
Phi-B: 0 °

Alluvial (Clay)
Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °

Alluvial (Granular)
Model: Mohr-Coulomb

Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °

Fly Ash (Stacked and/or Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °

Toe Buttress (Rip Rap)

Model: Mohr-Coulomb
Unit Weight: 140 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °

Drainage Trench (Gravel)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 30 °
Phi-B: 0 °

Bedrock

Model: Bedrock (Impenetrable)

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (893, 355.4891) ft
Left-Zone Right Coordinate: (932, 356.4905) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (1105, 390) ft
Right-Zone Right Coordinate: (1146, 392.7181) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (650, 361.0346) ft
Right Coordinate: (1775, 423) ft

Regions

	Material	Points	Area (ft^2)
Region 1	Alluvial (Clay)	98,1,2,32,3,117,111,112,113,6,83,7,8,90,89,88,87,86,85,84,94,91,80,10,11,99	23170.811
Region 2	Alluvial (Granular)	100,99,11,10,80,91,92,9,12,13	18041.479
Region 3	Fly Ash (Stacked and/or Sluiced)	97,96,28,29,30,31	7878.8292
Region 4	Fly Ash / Botto	30,14,27,123,125,124,122,26,32,2,1,98,97,31	18513.972

	m Ash (Sluiced)		
Region 5	Dike 3 (Clay)	29,30,14,82,15,33,34,35,36,37,38,39,40,41,42,43	2464.0352
Region 6	Gypsum	96,95,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,129,69,70,71,42,43,29,28	9366.1015
Region 7	Dike 1 (Clay)	26,118,117,3,32	1707.8902
Region 8	Bedrock	9,92,93,75,76,101,100,13,12	20133.643
Region 9	Dike 2 (Lean Clay)	26,118,119,126,122	449.02152
Region 10	Dike 2 (Fat Clay)	82,15,16,77,17,18,19,20,21,22,116,110,119,126,120,121,127	164.07778
Region 11	Drainage Trench (Gravel)	127,121,120,126,122,124,125,123	65.48
Region 12	Dike 2 (Lean Clay)	127,123,27,14,82	461.38125
Region 13	Toe Buttress (Rip Rap)	111,112,113,114,115,116,110,119,118,117	1012.5

Points

	X (ft)	Y (ft)
Point 1	1475	353.19
Point 2	1225.0651	353.19
Point 3	1111.0025	351.03
Point 4	1031.6471	362.1655
Point 5	1028.0434	361.0017
Point 6	984.1443	359.9523
Point 7	950.6064	356.9591
Point 8	900	355.6847
Point 9	900	314.2811
Point 10	1225.0651	336.79
Point 11	1475	336.79
Point 12	1225.0651	319.99
Point 13	1475	319.99
Point 14	1179.475	382.19
Point 15	1159.0394	389.0012
Point 16	1154.7809	389.0017
Point 17	1150.4833	390.0017
Point 18	1144.3259	393.7324
Point 19	1143.197	394.2883
Point 20	1142.3686	394.55
Point 21	1140.9385	395.0017
Point 22	1124.8971	395.0017
Point 23	1118.2614	393.9807
Point 24	1108.1233	390.0017
Point 25	1078.7109	381.0017
Point 26	1091.7416	376.63
Point 27	1196.1567	376.63
Point 28	1475	398.5017
Point 29	1267.513	398.5017
Point 30	1316.4529	382.19
Point 31	1475	382.19
Point 32	1168.7329	351.03
Point 33	1163.2539	389.0017

Point 34	1165.7562	390.3163
Point 35	1168.9831	392.0017
Point 36	1174	394
Point 37	1177.9093	395.2996
Point 38	1208.8534	405.0017
Point 39	1214.4744	406.4996
Point 40	1217.7547	408.7126
Point 41	1220.5864	410.0017
Point 42	1232.7632	410.0017
Point 43	1233.6482	409.7888
Point 44	1475	414.1588
Point 45	1435.4684	413.0017
Point 46	1429.0876	412.5892
Point 47	1425.1901	412.2142
Point 48	1409.6758	415.0017
Point 49	1406.7021	414.0017
Point 50	1398.3521	413.7404
Point 51	1397.2875	413.4962
Point 52	1396.5743	414.0072
Point 53	1394.6161	414.0679
Point 54	1392.5046	415.0017
Point 55	1388.3079	415.0017
Point 56	1385.3407	414.0565
Point 57	1379.8252	413.9558
Point 58	1373.1553	411.0017
Point 59	1369.9178	411.0017
Point 60	1368.4737	411.2319
Point 61	1364.6893	411.2664
Point 62	1361.7463	411.0017
Point 63	1338.2008	411.0017
Point 64	1319.8195	415.397
Point 65	1317.9669	416.0017
Point 66	1315.4368	417.0017
Point 67	1309.737	418.0017
Point 68	1288.8897	418.0017
Point 69	1264.4456	409.0513

Point 70	1255.0277	408.8585
Point 71	1246.0502	408.9271
Point 72	1065.8502	380.0017
Point 73	1043.7085	367.0614
Point 74	1041.6113	366.0017
Point 75	900	300
Point 76	1475	300
Point 77	1153	389
Point 78	1170	390
Point 79	1249	405
Point 80	900	329
Point 81	1104.3302	388.8067
Point 82	1159.6	388.8143
Point 83	971.8829	359
Point 84	650	361.0346
Point 85	695.2744	359.9523
Point 86	707.5358	359
Point 87	733.8123	356.9591
Point 88	779.4187	355.6847
Point 89	839.7094	354
Point 90	850	354.2876
Point 91	650	329
Point 92	650	314.2811
Point 93	650	300
Point 94	650	359
Point 95	1775	423
Point 96	1775	398.5017
Point 97	1775	382.19
Point 98	1775	353.19
Point 99	1775	336.79
Point 100	1775	319.99
Point 101	1775	300
Point 102	945.6064	356.9591
Point 103	1173.3768	393.9777
Point 104	1187.3669	398.1315
Point 105	1197.7316	401.4796

Point 106	1204.1501	403.553
Point 107	1211.6339	405.7426
Point 108	1457.2701	413.6006
Point 109	1475	405
Point 110	1120	390
Point 111	1015	355
Point 112	1005	355
Point 113	995	360
Point 114	1025	375
Point 115	1060	375
Point 116	1120	395
Point 117	1035.1	361.7
Point 118	1085.8	378.6
Point 119	1116.4	388.8
Point 120	1136	391
Point 121	1140	391
Point 122	1136	376.63
Point 123	1140	376.63
Point 124	1136	374.63
Point 125	1140	374.63
Point 126	1136	388.8
Point 127	1140	388.8
Point 128	1138	378
Point 129	1267.0366	410

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.588	(1003.87, 494.422)	99.57434	(1134.2, 395.002)	(917.198, 356.118)
2	27636	1.623	(1003.87, 494.422)	165.306	(1135.94, 395.002)	(913.475, 356.024)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal	Frictional Strength	Cohesive

					Stress (psf)	(psf)	Strength (psf)
1	Optimized	921.67365	353.9729	402.98211	615.61562	122.76401	200
2	Optimized	930.6248	349.68315	856.9213	1225.0656	212.54821	200
3	Optimized	940.48255	345.24795	1334.0263	1811.3557	275.58627	200
4	Optimized	948.23555	342.03475	1685.7406	2226.8874	312.43126	200
5	Optimized	955.92585	339.04125	2019.8853	2669.034	374.78619	200
6	Optimized	966.5641	335.2235	2455.2573	3182.162	419.67866	200
7	Optimized	975.7414	332.20895	2806.0991	3656.3128	490.87109	200
8	Optimized	981.8721	330.56405	2987.6219	3716.1301	455.22248	0
9	Optimized	986.8582	329.73575	3056.3971	3860.0713	502.19134	0
10	Optimized	992.28605	328.8341	3131.2759	3991.2908	537.39698	0
11	Optimized	997.613	327.94925	3204.773	4361.7533	722.96151	0
12	Optimized	1002.613	327.5698	3246.1876	4614.2268	854.84576	0
13	Optimized	1006.5885	327.6607	3254.9416	4917.1867	1038.686	0
14	Optimized	1011.5885	328.33325	3232.1694	4956.022	1077.1826	0
15	Optimized	1016.87	329.31825	3191.1401	5176.5339	1240.6118	0
16	Optimized	1021.87	330.75235	3121.8528	5072.9919	1219.207	0
17	Optimized	1025.2445	331.9225	3062.6833	5109.8829	1279.2323	0
18	Optimiz	1030.294	333.6736	2910.0082	4870.493	1131.8869	200

	ed	5			7		
19	Optimized	1035.919	335.62385	2738.9547	4618.539	1085.1785	200
20	Optimized	1039.63	336.8633	2632.8689	4483.0019	1068.1748	200
21	Optimized	1045.414	338.77425	2471.6595	4240.3669	1021.1637	200
22	Optimized	1051.2295	340.55155	2328.02	4072.7179	1007.3018	200
23	Optimized	1057.0765	342.19525	2204.5394	3858.3556	954.83122	200
24	Optimized	1063.4225	343.9792	2076.6133	3772.3877	979.05576	200
25	Optimized	1070.866	346.47935	1899.5115	3651.9775	1011.7867	200
26	Optimized	1077.615	349.428	1689.4424	3423.3268	1001.0586	200
27	Optimized	1083.0715	352.2492	1495.6563	3307.7453	1046.2101	200
28	Optimized	1086.4945	354.01875	1382.9481	3237.8399	1070.9223	200
29	Optimized	1089.4655	355.5547	1302.6131	3241.7542	904.23631	100
30	Optimized	1094.488	358.1514	1177.7742	3123.2845	907.20633	100
31	Optimized	1100.1385	361.5325	1026.5245	2789.523	822.09972	100
32	Optimized	1105.948	365.45525	864.35985	2542.0251	782.30814	100
33	Optimized	1110.2955	368.6989	740.16422	2188.7802	675.50073	100
34	Optimized	1114.069	372.0538	495.96699	2056.7378	630.59235	0
35	Optimized	1117.862	375.42625	192.69328	1878.8573	681.25447	0
36	Optimized	1119.662	377.14145	37.636171	1477.7902	765.74348	100
37	Optimiz	1122.448	380.5656	-	1151.445	612.23441	100

	ed	5	5	223.87033	5		
38	Optimiz ed	1127.023 5	386.1872 5	-602.48287	684.2685 5	363.83204	100
39	Optimiz ed	1131.673	391.9008 5	-940.19062	182.1849 9	62.731323	200

Slices of Slip Surface: 27636

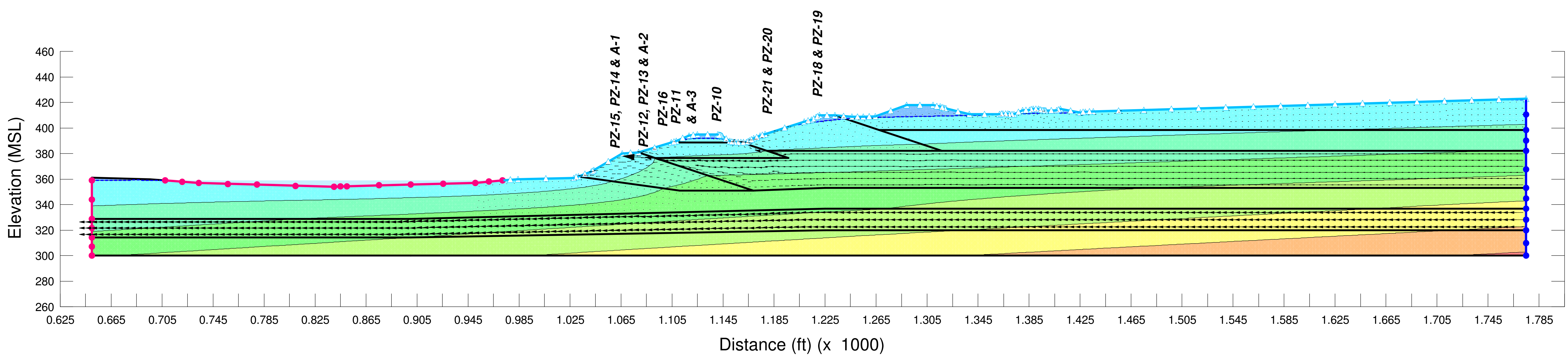
	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	27636	917.18795	353.7361	420.99734	702.2469	162.37951	200
2	27636	924.61425	349.4186	871.33788	1295.711	245.01194	200
3	27636	932.04055	345.5968	1276.3597	1796.1201	300.08378	200
4	27636	939.4669	342.2332	1637.7795	2218.6351	335.35711	200
5	27636	946.89325	339.2979	1960.9511	2572.9741	353.35166	200
6	27636	954.1525	336.8153	2241.0445	2881.5158	369.77628	200
7	27636	961.24465	334.7499	2481.4173	3147.3063	384.45118	200
8	27636	968.3368	333.02245	2688.9157	3365.5855	390.67551	200
9	27636	975.7444	331.5747	2871.6346	3562.6847	398.97795	200
10	27636	981.8751	330.603	2985.2708	3680.8149	434.62418	0
11	27636	989.57215	329.8267	3060.7712	3771.8187	444.31178	0
12	27636	1000	329.23785	3134.7379	4224.9381	681.23269	0
13	27636	1010	329.30615	3167.0211	4927.1101	1099.8257	0
14	27636	1020	329.98205	3162.1281	5426.5633	1414.9762	0
15	27636	1030.05	331.2827	3119.3086	5441.2911	1450.9357	0
16	27636	1035.5225	332.1754	3084.7115	5242.569	1348.379	0
17	27636	1039.954	333.1548	3009.0213	5060.1068	1184.1947	200
18	27636	1047.9725	335.16195	2846.9565	4715.561	1078.8393	200
19	27636	1055.991	337.60455	2648.9942	4329.7795	970.40181	200
20	27636	1064.3	340.6265	2406.0629	4059.8524	954.81581	200
21	27636	1072.9	344.29305	2121.7112	3887.0746	1019.2331	200
22	27636	1081.5	348.5585	1808.2466	3643.6949	1059.6966	200
23	27636	1088.3345	352.3536	1549.8088	3411.1768	1074.6613	200
24	27636	1091.3055	354.1323	1438.623	3373.3799	902.19195	100
25	27636	1095.189	356.68975	1298.972	3178.099	876.25134	100
26	27636	1102.083	361.5226	1058.8122	2800.9231	812.35967	100
27	27636	1108.9775	366.9114	826.33075	2377.286	723.22233	100

28	27636	1114.4125	371.54085	543.04996	2109.6999	632.96767	0
29	27636	1118.2	375.05285	227.11069	1888.8444	671.38398	0
30	27636	1122.4485	379.2988	-124.98329	1353.0029	719.40442	100
31	27636	1127.9655	385.3104	-533.83772	786.54228	418.21195	100
32	27636	1133.4865	391.90085	-919.31102	179.88609	61.939749	200

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

File Name: Section H.gsz
Analysis Name: Steady-State Seepage
Date Saved: 10/30/2009
Last Solved on 10/30/2009 at 11:17:44 AM
Analysis Method: Steady-State

Material Type
Dike 1 (Clay)   Saturated / Unsaturated   Dike 1 (Clay)   Dike 1 (Clay)   0.1   0 °
Dike 2 (Lean Clay)   Saturated / Unsaturated   Dike 2 (Lean Clay)   Dike 2 (Lean Clay)   0.1   0 °
Dike 3 (Clay)   Saturated / Unsaturated   Dike 3 (Clay)   Dike 3 (Clay)   0.1   0 °
Alluvial (Clay)   Saturated / Unsaturated   Alluvial (Clay)   Alluivial (Clay)   0.05   0 °
Alluvial (Granular)   Saturated / Unsaturated   Alluvial (Granular)   Alluvial (Granular)   0.05   0 °
Gypsum   Saturated / Unsaturated   Gypsum   Gypsum   0.02   0 °
Fly Ash (Stacked and/or Sluiced)   Saturated / Unsaturated   Fly Ash (Stacked and/or Sluiced)   Fly Ash (Stacked and/or Sluiced)   0.02   0 °
Fly Ash / Bottom Ash (Sluiced)   Saturated / Unsaturated   Fly Ash/Bottom Ash (Sluiced)   Fly Ash/Bottom Ash (Sluiced)   0.02   0 °
Dike 2 (Fat Clay)   Saturated / Unsaturated   Dike 2 (Fat Clay)   Dike 2 (Fat Clay)   0.1   0 °
Bedrock   Saturated Only   1e-012 ft/sec   0.05 ft³/ft³   0 /psf   0.1   0 °



Steady-State Seepage

File Information

Created By: Kirkbride, Rob
Revision Number: 330
Last Edited By: Harmon, Jacqueline
Date: 11/2/2009
Time: 1:54:16 PM
File Name: Section H (Stability - Repair Design).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\Seepage\
Last Solved Date: 11/2/2009
Last Solved Time: 1:58:05 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Steady-State Seepage

Kind: SEEP/W
Method: Steady-State
Settings
    Include Air Flow: No
Control
    Apply Runoff: Yes
Convergence
    Convergence Type: Gauss Point K
    Convergence Settings
        Maximum Number of Iterations: 500
        Tolerance: 0.01
        Maximum Change in K: 0.1
        Rate of Change in K: 1.02
        Minimum Change in K: 0.0001
    Equation Solver: Parallel Direct

Potential Seepage Max # of Reviews: 10

Time

Starting Time: 0 sec

Duration: 0 sec

Ending Time: 0 sec

Materials

Dike 1 (Clay)

Model: Saturated / Unsaturated

Hydraulic

K-Function: Dike 1 (Clay)

Vol. WC. Function: Dike 1 (Clay)

K-Ratio: 0.1

K-Direction: 0 °

Dike 2 (Lean Clay)

Model: Saturated / Unsaturated

Hydraulic

K-Function: Dike 2 (Lean Clay)

Vol. WC. Function: Dike 2 (Lean Clay)

K-Ratio: 0.1

K-Direction: 0 °

Dike 3 (Clay)

Model: Saturated / Unsaturated

Hydraulic

K-Function: Dike 3 (Clay)

Vol. WC. Function: Dike 3 (Clay)

K-Ratio: 0.1

K-Direction: 0 °

Alluvial (Clay)

Model: Saturated / Unsaturated

Hydraulic

K-Function: Alluvial (Clay)

Vol. WC. Function: Alluival (Clay)

K-Ratio: 0.05

K-Direction: 0 °

Alluvial (Granular)

Model: Saturated / Unsaturated

Hydraulic

K-Function: Alluvial (Granular)

Vol. WC. Function: Alluvial (Granular)

K-Ratio: 0.05

K-Direction: 0 °

Gypsum

Model: Saturated / Unsaturated
Hydraulic
K-Function: Gypsum
Vol. WC. Function: Gypsum
K-Ratio: 0.02
K-Direction: 0 °

Fly Ash (Stacked and/or Sluiced)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Fly Ash (Stacked and/or Sluiced)
Vol. WC. Function: Fly Ash (Stacked and/or Sluiced)
K-Ratio: 0.02
K-Direction: 0 °

Fly Ash / Bottom Ash (Sluiced)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Fly Ash/Bottom Ash (Sluiced)
Vol. WC. Function: Fly Ash/Bottom Ash (Sluiced)
K-Ratio: 0.02
K-Direction: 0 °

Dike 2 (Fat Clay)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Dike 2 (Fat Clay)
Vol. WC. Function: Dike 2 (Fat Clay)
K-Ratio: 0.1
K-Direction: 0 °

Toe Buttress (Rip Rap)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Rip Rap
Vol. WC. Function: Rip Rap
K-Ratio: 0.5
K-Direction: 0 °

Drainage Trench (Gravel)

Model: Saturated / Unsaturated
Hydraulic
K-Function: Gravel
Vol. WC. Function: Gravel
K-Ratio: 0.1

K-Direction: 0 °

Bedrock

Model: Saturated Only
Hydraulic
K-Sat: 1e-012 ft/sec
Volumetric Water Content: 0.05 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 0.1
K-Direction: 0 °

Boundary Conditions

Potential Seepage Face

Review: true
Type: Total Flux (Q) 0

Wells Creek Water Elevation 359

Type: Head (H) 359

Gypsum Stack Water Elevation 423

Type: Head (H) 423

Drainage Trench Pipe 378

Type: Head (H) 378

Gypsum Stack Water Elevation 410

Type: Head (H) 410

Initial Water Tables

Initial Water Table 1

Max. negative head: 5
Coordinates
Coordinate: (900, 359) ft
Coordinate: (1000, 359) ft
Coordinate: (1019.69, 359) ft
Coordinate: (1029.71, 359.014) ft
Coordinate: (1050, 363) ft
Coordinate: (1070, 370) ft
Coordinate: (1085, 378) ft
Coordinate: (1101, 383) ft
Coordinate: (1119, 390) ft
Coordinate: (1142, 390) ft
Coordinate: (1168, 390) ft

Coordinate: (1183, 395) ft
Coordinate: (1220, 405) ft
Coordinate: (1475, 405) ft

K Functions

Dike 1 (Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 9.27e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 9.27e-008)
Data Point: (0.018329807, 9.2169627e-008)
Data Point: (0.033598183, 9.1639459e-008)
Data Point: (0.061584821, 9.1108851e-008)
Data Point: (0.11288379, 9.0578011e-008)
Data Point: (0.20691381, 9.0046826e-008)
Data Point: (0.37926902, 8.9514842e-008)
Data Point: (0.6951928, 8.8981673e-008)
Data Point: (1.274275, 8.8446276e-008)
Data Point: (2.3357215, 8.7906582e-008)
Data Point: (4.2813324, 8.7359109e-008)
Data Point: (7.8475997, 8.6797329e-008)
Data Point: (14.384499, 8.6209441e-008)
Data Point: (26.366509, 8.557348e-008)
Data Point: (48.329302, 8.4848378e-008)
Data Point: (88.586679, 8.3970694e-008)
Data Point: (162.37767, 8.2807874e-008)
Data Point: (297.63514, 8.0745483e-008)
Data Point: (545.55948, 7.8919922e-008)
Data Point: (1000, 4.8579457e-008)
Estimation Properties
Volume Water Content Function: Dike 1 (Clay)
Hydraulic K Sat: 9.27e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.06 ft^3/ft^3

Rip Rap

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %

Segment Curvature: 100 %

K-Saturation: 3.28

Data Points: Matric Suction (psf), X-Conductivity (ft/sec)

Data Point: (0.01, 3.28)

Data Point: (0.018329807, 3.2799881)

Data Point: (0.033598183, 3.2799726)

Data Point: (0.061584821, 3.2799502)

Data Point: (0.11288379, 3.2799154)

Data Point: (0.20691381, 3.279858)

Data Point: (0.37926902, 3.2797606)

Data Point: (0.6951928, 3.2795703)

Data Point: (1.274275, 3.2792454)

Data Point: (2.3357215, 3.2792685)

Data Point: (4.2813324, 3.2759027)

Data Point: (7.8475997, 3.2586345)

Data Point: (14.384499, 2.5276764)

Data Point: (26.366509, 0.23163578)

Data Point: (48.329302, 0.0066290958)

Data Point: (88.586679, 0.00055090577)

Data Point: (162.37767, 5.3636887e-005)

Data Point: (297.63514, 7.0517584e-006)

Data Point: (545.55948, 8.5516803e-007)

Data Point: (1000, 8.0892457e-008)

Estimation Properties

Volume Water Content Function: Rip Rap

Hydraulic K Sat: 3.28 ft/sec

Hyd. K-Function Estimation Method: Fredlund-Xing Function

Maximum: 1000

Minimum: 0.01

Num. Points: 20

Residual Water Content: 0.02 ft^3/ft^3

Gravel

Model: Data Point Function

Function: X-Conductivity vs. Pore-Water Pressure

Curve Fit to Data: 100 %

Segment Curvature: 100 %

K-Saturation: 0.0328

Data Points: Matric Suction (psf), X-Conductivity (ft/sec)

Data Point: (0.01, 0.0328)

Data Point: (0.018329807, 0.032799881)

Data Point: (0.033598183, 0.032799726)

Data Point: (0.061584821, 0.032799502)

Data Point: (0.11288379, 0.032799154)

Data Point: (0.20691381, 0.03279858)

Data Point: (0.37926902, 0.032797606)

Data Point: (0.6951928, 0.032795703)

Data Point: (1.274275, 0.032792454)

Data Point: (2.3357215, 0.032792685)
Data Point: (4.2813324, 0.032759027)
Data Point: (7.8475997, 0.032586345)
Data Point: (14.384499, 0.025276764)
Data Point: (26.366509, 0.0023163578)
Data Point: (48.329302, 6.6290958e-005)
Data Point: (88.586679, 5.5090577e-006)
Data Point: (162.37767, 5.3636887e-007)
Data Point: (297.63514, 7.0517584e-008)
Data Point: (545.55948, 8.5516803e-009)
Data Point: (1000, 8.0892457e-010)

Estimation Properties

Volume Water Content Function: Gravel
Hydraulic K Sat: 0.0328 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.02 ft³/ft³

Dike 2 (Lean Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure

Curve Fit to Data: 100 %
Segment Curvature: 100 %

K-Saturation: 9.27e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)

Data Point: (0.01, 9.27e-008)
Data Point: (0.018329807, 9.1650515e-008)
Data Point: (0.033598183, 9.0600715e-008)
Data Point: (0.061584821, 8.9550498e-008)
Data Point: (0.11288379, 8.8501027e-008)
Data Point: (0.20691381, 8.7451297e-008)
Data Point: (0.37926902, 8.6400772e-008)
Data Point: (0.6951928, 8.5348899e-008)
Data Point: (1.274275, 8.4294959e-008)
Data Point: (2.3357215, 8.3236754e-008)
Data Point: (4.2813324, 8.2170877e-008)
Data Point: (7.8475997, 8.1090857e-008)
Data Point: (14.384499, 7.9984877e-008)
Data Point: (26.366509, 7.8831412e-008)
Data Point: (48.329302, 7.7591143e-008)
Data Point: (88.586679, 7.6190179e-008)
Data Point: (162.37767, 7.4495545e-008)
Data Point: (297.63514, 7.2312385e-008)
Data Point: (545.55948, 6.8986115e-008)
Data Point: (1000, 6.2537934e-008)

Estimation Properties

Volume Water Content Function: Dike 2 (Lean Clay)
Hydraulic K Sat: 9.28e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.109 ft^3/ft^3

Dike 2 (Fat Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 9.27e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 9.27e-008)
Data Point: (0.018329807, 8.8933713e-008)
Data Point: (0.033598183, 8.5164663e-008)
Data Point: (0.061584821, 8.139644e-008)
Data Point: (0.11288379, 7.7628413e-008)
Data Point: (0.20691381, 7.3860601e-008)
Data Point: (0.37926902, 7.0092235e-008)
Data Point: (0.6951928, 6.6323547e-008)
Data Point: (1.274275, 6.2553832e-008)
Data Point: (2.3357215, 5.8782165e-008)
Data Point: (4.2813324, 5.5006971e-008)
Data Point: (7.8475997, 5.1225309e-008)
Data Point: (14.384499, 4.7431845e-008)
Data Point: (26.366509, 4.3616747e-008)
Data Point: (48.329302, 3.9762167e-008)
Data Point: (88.586679, 3.5834286e-008)
Data Point: (162.37767, 3.1772781e-008)
Data Point: (297.63514, 2.7486773e-008)
Data Point: (545.55948, 2.2691519e-008)
Data Point: (1000, 1.6747254e-008)
Estimation Properties
Volume Water Content Function: Dike 2 (Fat Clay)
Hydraulic K Sat: 9.28e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.09 ft^3/ft^3

Dike 3 (Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %

Segment Curvature: 100 %
K-Saturation: 9.27e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 9.27e-008)
Data Point: (0.018329807, 9.1335539e-008)
Data Point: (0.033598183, 8.9970992e-008)
Data Point: (0.061584821, 8.8606153e-008)
Data Point: (0.11288379, 8.7241948e-008)
Data Point: (0.20691381, 8.587726e-008)
Data Point: (0.37926902, 8.4511613e-008)
Data Point: (0.6951928, 8.3144534e-008)
Data Point: (1.274275, 8.1774585e-008)
Data Point: (2.3357215, 8.0399265e-008)
Data Point: (4.2813324, 7.9014508e-008)
Data Point: (7.8475997, 7.7612585e-008)
Data Point: (14.384499, 7.6179098e-008)
Data Point: (26.366509, 7.4687722e-008)
Data Point: (48.329302, 7.3089827e-008)
Data Point: (88.586679, 7.1301301e-008)
Data Point: (162.37767, 6.9160863e-008)
Data Point: (297.63514, 6.6215873e-008)
Data Point: (545.55948, 6.2586118e-008)
Data Point: (1000, 4.3040637e-008)
Estimation Properties
Volume Water Content Function: Dike 3 (Clay)
Hydraulic K Sat: 1.367e-006 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.109 ft³/ft³

Alluvial (Clay)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 2.82e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 2.82e-008)
Data Point: (0.018329807, 2.6704895e-008)
Data Point: (0.033598183, 2.520874e-008)
Data Point: (0.061584821, 2.371319e-008)
Data Point: (0.11288379, 2.2217639e-008)
Data Point: (0.20691381, 2.0722088e-008)
Data Point: (0.37926902, 1.9226636e-008)
Data Point: (0.6951928, 1.7731325e-008)
Data Point: (1.274275, 1.6236271e-008)

Data Point: (2.3357215, 1.4741722e-008)
Data Point: (4.2813324, 1.324807e-008)
Data Point: (7.8475997, 1.1756079e-008)
Data Point: (14.384499, 1.0267137e-008)
Data Point: (26.366509, 8.7837534e-009)
Data Point: (48.329302, 7.3106411e-009)
Data Point: (88.586679, 5.8562064e-009)
Data Point: (162.37767, 4.4361326e-009)
Data Point: (297.63514, 3.0796113e-009)
Data Point: (545.55948, 1.836886e-009)
Data Point: (1000, 8.0419101e-010)

Estimation Properties

Volume Water Content Function: Alluival (Clay)
Hydraulic K Sat: 2.82e-008 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.056 ft^3/ft^3

Alluvial (Granular)

Model: Data Point Function

Function: X-Conductivity vs. Pore-Water Pressure

Curve Fit to Data: 100 %
Segment Curvature: 100 %

K-Saturation: 3.28e-006

Data Points: Matric Suction (psf), X-Conductivity (ft/sec)

Data Point: (0.01, 3.28e-006)
Data Point: (0.018329807, 3.2799977e-006)
Data Point: (0.033598183, 3.2799945e-006)
Data Point: (0.061584821, 3.2799893e-006)
Data Point: (0.11288379, 3.2799807e-006)
Data Point: (0.20691381, 3.2799659e-006)
Data Point: (0.37926902, 3.279941e-006)
Data Point: (0.6951928, 3.2798827e-006)
Data Point: (1.274275, 3.2797899e-006)
Data Point: (2.3357215, 3.2800754e-006)
Data Point: (4.2813324, 3.2780636e-006)
Data Point: (7.8475997, 3.2678735e-006)
Data Point: (14.384499, 3.3273578e-006)
Data Point: (26.366509, 1.4244433e-006)
Data Point: (48.329302, 1.651216e-007)
Data Point: (88.586679, 1.1791372e-008)
Data Point: (162.37767, 1.216472e-009)
Data Point: (297.63514, 1.8408862e-010)
Data Point: (545.55948, 3.2107908e-011)
Data Point: (1000, 4.0889304e-012)

Estimation Properties

Volume Water Content Function: Alluvial (Granular)
Hydraulic K Sat: 0.00236 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.041 ft^3/ft^3

Gypsum

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 5.0115e-007
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 5.0115e-007)
Data Point: (0.018329807, 5.0111464e-007)
Data Point: (0.033598183, 5.0107916e-007)
Data Point: (0.061584821, 5.0104346e-007)
Data Point: (0.11288379, 5.0100734e-007)
Data Point: (0.20691381, 5.0097044e-007)
Data Point: (0.37926902, 5.0093215e-007)
Data Point: (0.6951928, 5.008913e-007)
Data Point: (1.274275, 5.0084579e-007)
Data Point: (2.3357215, 5.007917e-007)
Data Point: (4.2813324, 5.0072188e-007)
Data Point: (7.8475997, 5.0062326e-007)
Data Point: (14.384499, 5.0047181e-007)
Data Point: (26.366509, 5.0022354e-007)
Data Point: (48.329302, 4.9979844e-007)
Data Point: (88.586679, 4.9904433e-007)
Data Point: (162.37767, 4.9768962e-007)
Data Point: (297.63514, 4.8249652e-007)
Data Point: (545.55948, 1.1771989e-007)
Data Point: (1000, 7.4126036e-010)
Estimation Properties
Volume Water Content Function: Gypsum
Hydraulic K Sat: 4.65e-006 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.041 ft^3/ft^3

Fly Ash (Stacked and/or Sluiced)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %

Segment Curvature: 100 %
K-Saturation: 4.79e-008
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 4.79e-008)
Data Point: (0.018329807, 4.7259093e-008)
Data Point: (0.033598183, 4.6617951e-008)
Data Point: (0.061584821, 4.5976651e-008)
Data Point: (0.11288379, 4.533499e-008)
Data Point: (0.20691381, 4.4692633e-008)
Data Point: (0.37926902, 4.4049026e-008)
Data Point: (0.6951928, 4.3403145e-008)
Data Point: (1.274275, 4.2753085e-008)
Data Point: (2.3357215, 4.2095366e-008)
Data Point: (4.2813324, 4.1423588e-008)
Data Point: (7.8475997, 4.0726056e-008)
Data Point: (14.384499, 3.9981312e-008)
Data Point: (26.366509, 3.9149997e-008)
Data Point: (48.329302, 3.8160256e-008)
Data Point: (88.586679, 3.6878927e-008)
Data Point: (162.37767, 3.506396e-008)
Data Point: (297.63514, 3.1556345e-008)
Data Point: (545.55948, 8.077977e-009)
Data Point: (1000, 9.4818218e-011)
Estimation Properties
Volume Water Content Function: Fly Ash (Stacked and/or Sluiced)
Hydraulic K Sat: 3.03e-006 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.015 ft³/ft³

Fly Ash/Bottom Ash (Sluiced)

Model: Data Point Function
Function: X-Conductivity vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
K-Saturation: 2.76e-006
Data Points: Matric Suction (psf), X-Conductivity (ft/sec)
Data Point: (0.01, 2.76e-006)
Data Point: (0.018329807, 2.6249802e-006)
Data Point: (0.033598183, 2.4898654e-006)
Data Point: (0.061584821, 2.3548067e-006)
Data Point: (0.11288379, 2.219744e-006)
Data Point: (0.20691381, 2.0846794e-006)
Data Point: (0.37926902, 1.9496102e-006)
Data Point: (0.6951928, 1.8145364e-006)
Data Point: (1.274275, 1.6794511e-006)

Data Point: (2.3357215, 1.5443461e-006)
Data Point: (4.2813324, 1.4092031e-006)
Data Point: (7.8475997, 1.2739923e-006)
Data Point: (14.384499, 1.1386606e-006)
Data Point: (26.366509, 1.0030923e-006)
Data Point: (48.329302, 8.6703015e-007)
Data Point: (88.586679, 7.3067463e-007)
Data Point: (162.37767, 5.9322097e-007)
Data Point: (297.63514, 4.4085998e-007)
Data Point: (545.55948, 3.1976211e-007)
Data Point: (1000, 3.0568348e-008)

Estimation Properties

Volume Water Content Function: Fly Ash/Bottom Ash (Sluiced)
Hydraulic K Sat: 3.03e-006 ft/sec
Hyd. K-Function Estimation Method: Fredlund-Xing Function
Maximum: 1000
Minimum: 0.01
Num. Points: 20
Residual Water Content: 0.027 ft³/ft³

Vol. Water Content Functions

Dike 1 (Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 3e-006 /psf
Porosity: 0.40137854
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)
Data Point: (0.01, 0.39927389)
Data Point: (0.018329807, 0.39927389)
Data Point: (0.033598183, 0.39927389)
Data Point: (0.061584821, 0.39927389)
Data Point: (0.11288379, 0.39927389)
Data Point: (0.20691381, 0.39927389)
Data Point: (0.37926902, 0.39927389)
Data Point: (0.6951928, 0.39927389)
Data Point: (1.274275, 0.39927389)
Data Point: (2.3357215, 0.39927389)
Data Point: (4.2813324, 0.39927389)
Data Point: (7.8475997, 0.39927389)
Data Point: (14.384499, 0.39927389)
Data Point: (26.366509, 0.39927389)
Data Point: (48.329302, 0.39927389)
Data Point: (88.586679, 0.39927389)

Data Point: (162.37767, 0.39927389)
Data Point: (297.63514, 0.39927389)
Data Point: (545.55948, 0.39922726)
Data Point: (1000, 0.38641719)

Estimation Properties

Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.3993 ft³/ft³
Liquid Limit: 40.5 %
Diameter at 10% passing: 0.0001
Diameter at 60% passing: 2
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Rip Rap

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure

Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 2e-005 /psf

Porosity: 0.39943641
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)

Data Point: (0.01, 0.39999999)
Data Point: (0.018329807, 0.39999998)
Data Point: (0.033598183, 0.39999996)
Data Point: (0.061584821, 0.39999993)
Data Point: (0.11288379, 0.39999988)
Data Point: (0.20691381, 0.39999977)
Data Point: (0.37926902, 0.39999958)
Data Point: (0.6951928, 0.39999922)
Data Point: (1.274275, 0.3999983)
Data Point: (2.3357215, 0.39999053)
Data Point: (4.2813324, 0.39983414)
Data Point: (7.8475997, 0.39627977)
Data Point: (14.384499, 0.33441755)
Data Point: (26.366509, 0.1497699)
Data Point: (48.329302, 0.077147868)
Data Point: (88.586679, 0.051761117)
Data Point: (162.37767, 0.039157663)
Data Point: (297.63514, 0.031594128)
Data Point: (545.55948, 0.026529945)
Data Point: (1000, 0.022885538)

Estimation Properties

Vol. WC Estimation Method: Sample functions
Sample Material: Gravel
Saturated Water Content: 0.4 ft³/ft³
Liquid Limit: 0 %

Diameter at 10% passing: 0
Diameter at 60% passing: 0
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Gravel

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 2e-005 /psf
Porosity: 0.39943641
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.39999999)
Data Point: (0.018329807, 0.39999998)
Data Point: (0.033598183, 0.39999996)
Data Point: (0.061584821, 0.39999993)
Data Point: (0.11288379, 0.39999988)
Data Point: (0.20691381, 0.39999977)
Data Point: (0.37926902, 0.39999958)
Data Point: (0.6951928, 0.39999922)
Data Point: (1.274275, 0.3999983)
Data Point: (2.3357215, 0.39999053)
Data Point: (4.2813324, 0.39983414)
Data Point: (7.8475997, 0.39627977)
Data Point: (14.384499, 0.33441755)
Data Point: (26.366509, 0.1497699)
Data Point: (48.329302, 0.077147868)
Data Point: (88.586679, 0.051761117)
Data Point: (162.37767, 0.039157663)
Data Point: (297.63514, 0.031594128)
Data Point: (545.55948, 0.026529945)
Data Point: (1000, 0.022885538)
Estimation Properties
Vol. WC Estimation Method: Sample functions
Sample Material: Gravel
Saturated Water Content: 0.4 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0
Diameter at 60% passing: 0
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Dike 2 (Lean Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure

Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 3e-006 /psf
Porosity: 0.35697485
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.35397485)
Data Point: (0.018329807, 0.35397485)
Data Point: (0.033598183, 0.35397485)
Data Point: (0.061584821, 0.35397485)
Data Point: (0.11288379, 0.35397485)
Data Point: (0.20691381, 0.35397485)
Data Point: (0.37926902, 0.35397485)
Data Point: (0.6951928, 0.35397485)
Data Point: (1.274275, 0.35397485)
Data Point: (2.3357215, 0.35397485)
Data Point: (4.2813324, 0.35397485)
Data Point: (7.8475997, 0.35397485)
Data Point: (14.384499, 0.35397485)
Data Point: (26.366509, 0.35397485)
Data Point: (48.329302, 0.35397485)
Data Point: (88.586679, 0.35397485)
Data Point: (162.37767, 0.35397485)
Data Point: (297.63514, 0.35397485)
Data Point: (545.55948, 0.35397485)
Data Point: (1000, 0.35397485)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.35456 ft^3/ft^3
Liquid Limit: 46 %
Diameter at 10% passing: 0.0001
Diameter at 60% passing: 0.004
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Dike 2 (Fat Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 1.4358e-005 /psf
Porosity: 0.4543618
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.44378537)
Data Point: (0.018329807, 0.44378537)
Data Point: (0.033598183, 0.44378537)
Data Point: (0.061584821, 0.44378537)

Data Point: (0.11288379, 0.44378537)
Data Point: (0.20691381, 0.44378537)
Data Point: (0.37926902, 0.44378537)
Data Point: (0.6951928, 0.44378537)
Data Point: (1.274275, 0.44378537)
Data Point: (2.3357215, 0.44378537)
Data Point: (4.2813324, 0.44378537)
Data Point: (7.8475997, 0.44378537)
Data Point: (14.384499, 0.44378537)
Data Point: (26.366509, 0.44378537)
Data Point: (48.329302, 0.44378537)
Data Point: (88.586679, 0.44378537)
Data Point: (162.37767, 0.44378537)
Data Point: (297.63514, 0.44378537)
Data Point: (545.55948, 0.44378537)
Data Point: (1000, 0.4400038)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.444 ft³/ft³
Liquid Limit: 53 %
Diameter at 10% passing: 0.0001
Diameter at 60% passing: 0.007
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Dike 3 (Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 4.786e-006 /psf
Porosity: 0.38639791
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)
Data Point: (0.01, 0.38361303)
Data Point: (0.018329807, 0.38361303)
Data Point: (0.033598183, 0.38361303)
Data Point: (0.061584821, 0.38361303)
Data Point: (0.11288379, 0.38361303)
Data Point: (0.20691381, 0.38361303)
Data Point: (0.37926902, 0.38361303)
Data Point: (0.6951928, 0.38361303)
Data Point: (1.274275, 0.38361303)
Data Point: (2.3357215, 0.38361303)
Data Point: (4.2813324, 0.38361303)
Data Point: (7.8475997, 0.38361303)
Data Point: (14.384499, 0.38361303)

Data Point: (26.366509, 0.38361303)
Data Point: (48.329302, 0.38361303)
Data Point: (88.586679, 0.38361303)
Data Point: (162.37767, 0.38361303)
Data Point: (297.63514, 0.38361303)
Data Point: (545.55948, 0.38354257)
Data Point: (1000, 0.37459607)

Estimation Properties

Vol. WC Estimation Method: Grain Size Function
Sample Material: Clay
Saturated Water Content: 0.3836 ft^3/ft^3
Liquid Limit: 39.8 %
Diameter at 10% passing: 0.0001
Diameter at 60% passing: 1.1
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Alluival (Clay)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure

Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 4.786e-005 /psf

Porosity: 0.44254793
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)

Data Point: (0.01, 0.40001102)
Data Point: (0.018329807, 0.40001102)
Data Point: (0.033598183, 0.40001102)
Data Point: (0.061584821, 0.40001102)
Data Point: (0.11288379, 0.40001102)
Data Point: (0.20691381, 0.40001102)
Data Point: (0.37926902, 0.40001102)
Data Point: (0.6951928, 0.40001102)
Data Point: (1.274275, 0.40001102)
Data Point: (2.3357215, 0.40001102)
Data Point: (4.2813324, 0.40001102)
Data Point: (7.8475997, 0.40001102)
Data Point: (14.384499, 0.40001102)
Data Point: (26.366509, 0.40001102)
Data Point: (48.329302, 0.40001102)
Data Point: (88.586679, 0.40001102)
Data Point: (162.37767, 0.40001102)
Data Point: (297.63514, 0.40001102)
Data Point: (545.55948, 0.3999073)
Data Point: (1000, 0.38449634)

Estimation Properties

Vol. WC Estimation Method: Grain Size Function

Sample Material: Clay
Saturated Water Content: 0.4 ft³/ft³
Liquid Limit: 39.7 %
Diameter at 10% passing: 0.0001
Diameter at 60% passing: 0.04
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Alluvial (Granular)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 2.3925e-006 /psf
Porosity: 0.26931422
Data Points: Matric Suction (psf), Vol. Water Content (ft³/ft³)
Data Point: (0.01, 0.27004271)
Data Point: (0.018329807, 0.27004271)
Data Point: (0.033598183, 0.27004271)
Data Point: (0.061584821, 0.27004271)
Data Point: (0.11288379, 0.27004271)
Data Point: (0.20691381, 0.27004271)
Data Point: (0.37926902, 0.27004271)
Data Point: (0.6951928, 0.27004271)
Data Point: (1.274275, 0.27004271)
Data Point: (2.3357215, 0.27004271)
Data Point: (4.2813324, 0.27004271)
Data Point: (7.8475997, 0.27004271)
Data Point: (14.384499, 0.26476794)
Data Point: (26.366509, 0.20945658)
Data Point: (48.329302, 0.13846113)
Data Point: (88.586679, 0.099029845)
Data Point: (162.37767, 0.079958221)
Data Point: (297.63514, 0.068945156)
Data Point: (545.55948, 0.060786901)
Data Point: (1000, 0.053624426)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Silty Sand
Saturated Water Content: 0.27 ft³/ft³
Liquid Limit: 0 %
Diameter at 10% passing: 0.018
Diameter at 60% passing: 8
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Gypsum

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 4.786e-006 /psf
Porosity: 0.51984061
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)
Data Point: (0.01, 0.51717808)
Data Point: (0.018329807, 0.51717808)
Data Point: (0.033598183, 0.51717808)
Data Point: (0.061584821, 0.51717808)
Data Point: (0.11288379, 0.51717808)
Data Point: (0.20691381, 0.51717808)
Data Point: (0.37926902, 0.51717808)
Data Point: (0.6951928, 0.51717808)
Data Point: (1.274275, 0.51717808)
Data Point: (2.3357215, 0.51717808)
Data Point: (4.2813324, 0.51717808)
Data Point: (7.8475997, 0.51717808)
Data Point: (14.384499, 0.51717808)
Data Point: (26.366509, 0.51717808)
Data Point: (48.329302, 0.51717808)
Data Point: (88.586679, 0.51717808)
Data Point: (162.37767, 0.51717808)
Data Point: (297.63514, 0.49885374)
Data Point: (545.55948, 0.31231747)
Data Point: (1000, 0.14422066)
Estimation Properties
Vol. WC Estimation Method: Grain Size Function
Sample Material: Silt
Saturated Water Content: 0.516 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0.0108
Diameter at 60% passing: 0.025
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Fly Ash (Stacked and/or Sluiced)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure
Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 7.179e-005 /psf
Porosity: 0.55841772
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)

Data Point: (0.01, 0.54398049)
Data Point: (0.018329807, 0.54398049)
Data Point: (0.033598183, 0.54398049)
Data Point: (0.061584821, 0.54398049)
Data Point: (0.11288379, 0.54398049)
Data Point: (0.20691381, 0.54398049)
Data Point: (0.37926902, 0.54398049)
Data Point: (0.6951928, 0.54398049)
Data Point: (1.274275, 0.54398049)
Data Point: (2.3357215, 0.54398049)
Data Point: (4.2813324, 0.54398049)
Data Point: (7.8475997, 0.54398049)
Data Point: (14.384499, 0.54398049)
Data Point: (26.366509, 0.54398049)
Data Point: (48.329302, 0.54398049)
Data Point: (88.586679, 0.54398049)
Data Point: (162.37767, 0.54398049)
Data Point: (297.63514, 0.52190637)
Data Point: (545.55948, 0.35987439)
Data Point: (1000, 0.20209818)

Estimation Properties

Vol. WC Estimation Method: Grain Size Function
Sample Material: Silt
Saturated Water Content: 0.543 ft^3/ft^3
Liquid Limit: 0 %
Diameter at 10% passing: 0.004
Diameter at 60% passing: 0.033
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Fly Ash/Bottom Ash (Sluiced)

Model: Data Point Function
Function: Vol. Water Content vs. Pore-Water Pressure

Curve Fit to Data: 100 %
Segment Curvature: 100 %
Mv: 6.2218e-005 /psf

Porosity: 0.37786527
Data Points: Matric Suction (psf), Vol. Water Content (ft^3/ft^3)

Data Point: (0.01, 0.35499418)
Data Point: (0.018329807, 0.35499418)
Data Point: (0.033598183, 0.35499418)
Data Point: (0.061584821, 0.35499418)
Data Point: (0.11288379, 0.35499418)
Data Point: (0.20691381, 0.35499418)
Data Point: (0.37926902, 0.35499418)
Data Point: (0.6951928, 0.35499418)
Data Point: (1.274275, 0.35499418)

Data Point: (2.3357215, 0.35499418)
Data Point: (4.2813324, 0.35499418)
Data Point: (7.8475997, 0.35499418)
Data Point: (14.384499, 0.35499418)
Data Point: (26.366509, 0.35499418)
Data Point: (48.329302, 0.35499418)
Data Point: (88.586679, 0.35499418)
Data Point: (162.37767, 0.35499418)
Data Point: (297.63514, 0.35499418)
Data Point: (545.55948, 0.34147401)
Data Point: (1000, 0.26813417)

Estimation Properties

Vol. WC Estimation Method: Grain Size Function
Sample Material: Silty Sand
Saturated Water Content: 0.3548 ft³/ft³
Liquid Limit: 0 %
Diameter at 10% passing: 0.004
Diameter at 60% passing: 0.049
Maximum: 1000
Minimum: 0.01
Num. Points: 20

Regions

	Material	Points
Region 1	Alluvial (Clay)	98,1,2,32,3,117,111,112,113,6,83,7,8,90,89,88,87,86,85,84,94,91,80,10,11,99
Region 2	Alluvial (Granular)	100,99,11,10,80,91,92,9,12,13
Region 3	Fly Ash (Stacked and/or Sluiced)	97,96,28,29,30,31
Region 4	Fly Ash / Bottom Ash (Sluiced)	30,14,27,123,125,124,122,26,32,2,1,98,97,31
Region 5	Dike 3 (Clay)	29,30,14,82,15,33,34,35,36,37,38,39,40,41,42,43
Region 6	Gypsum	96,95,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,129,6
Region 7	Dike 1 (Clay)	26,118,117,3,32

Region 8	Bedrock	9,92,93,75,76,101,100,13,12
Region 9	Dike 2 (Lean Clay)	26,118,119,126,122
Region 10	Dike 2 (Fat Clay)	82,15,16,77,17,18,19,20,21,22,116,110,119,126,120,121,127
Region 11	Drainage Trench (Gravel)	127,121,120,126,122,124,125,123
Region 12	Dike 2 (Lean Clay)	127,123,27,14,82
Region 13	Toe Buttress (Rip Rap)	111,112,113,114,115,116,110,119,118,117

Lines

	Start Point	End Point	Hydraulic Boundary
Line 1	1	2	
Line 2	7	8	Wells Creek Water Elevation 359
Line 3	10	11	
Line 4	12	13	
Line 5	27	14	
Line 6	28	29	
Line 7	29	30	
Line 8	30	31	
Line 9	30	14	
Line 10	26	32	
Line 11	32	3	
Line 12	15	33	Potential Seepage Face
Line 13	33	34	Potential Seepage Face
Line 14	34	35	Potential Seepage Face
Line 15	35	36	Potential Seepage Face
Line 16	36	37	Potential Seepage Face
Line 17	39	40	Potential Seepage Face

Line 18	40	41	Potential Seepage Face
Line 19	41	42	Potential Seepage Face
Line 20	42	43	
Line 21	43	29	
Line 22	45	46	Potential Seepage Face
Line 23	46	47	Potential Seepage Face
Line 24	47	48	Potential Seepage Face
Line 25	48	49	Potential Seepage Face
Line 26	49	50	Potential Seepage Face
Line 27	50	51	Potential Seepage Face
Line 28	51	52	Potential Seepage Face
Line 29	52	53	Potential Seepage Face
Line 30	53	54	Potential Seepage Face
Line 31	54	55	Potential Seepage Face
Line 32	55	56	Potential Seepage Face
Line 33	56	57	Potential Seepage Face
Line 34	57	58	Potential Seepage Face
Line 35	58	59	Potential Seepage Face
Line 36	59	60	Potential Seepage Face
Line 37	60	61	Potential Seepage Face
Line 38	61	62	Potential Seepage Face
Line 39	62	63	Potential Seepage Face
Line 40	63	64	Potential Seepage Face
Line 41	64	65	Potential Seepage Face
Line 42	65	66	Potential Seepage Face
Line 43	66	67	Potential Seepage Face
Line 44	67	68	Potential Seepage Face
Line 45	69	70	Gypsum Stack Water Elevation 410
Line 46	70	71	Gypsum Stack Water Elevation 410
Line 47	71	42	Gypsum Stack Water Elevation 410
Line 48	75	76	
Line 49	12	9	
Line 50	10	80	
Line 51	2	32	
Line 52	14	82	
Line 53	82	15	

Line 54	15	16	Potential Seepage Face
Line 55	16	77	Potential Seepage Face
Line 56	77	17	Potential Seepage Face
Line 57	17	18	Potential Seepage Face
Line 58	18	19	Potential Seepage Face
Line 59	19	20	Potential Seepage Face
Line 60	20	21	Potential Seepage Face
Line 61	21	22	Potential Seepage Face
Line 62	6	83	Potential Seepage Face
Line 63	83	7	Wells Creek Water Elevation 359
Line 64	8	90	Wells Creek Water Elevation 359
Line 65	90	89	Wells Creek Water Elevation 359
Line 66	89	88	Wells Creek Water Elevation 359
Line 67	88	87	Wells Creek Water Elevation 359
Line 68	87	86	Wells Creek Water Elevation 359
Line 69	86	85	
Line 70	85	84	
Line 71	91	92	Wells Creek Water Elevation 359
Line 72	92	93	Wells Creek Water Elevation 359
Line 73	84	94	
Line 74	94	91	Wells Creek Water Elevation 359
Line 75	96	95	Gypsum Stack Water Elevation 423
Line 76	95	44	Potential Seepage Face
Line 77	28	96	
Line 78	97	96	Gypsum Stack Water Elevation 423
Line 79	31	97	
Line 80	1	98	
Line 81	98	97	Gypsum Stack Water Elevation 423
Line 82	99	98	Gypsum Stack Water Elevation 423
Line 83	11	99	
Line 84	100	99	Gypsum Stack Water Elevation 423
Line 85	13	100	
Line 86	76	101	
Line 87	101	100	Gypsum Stack Water Elevation 423
Line 88	80	91	
Line 89	9	92	

Line 90	75	93	
Line 91	38	37	Potential Seepage Face
Line 92	39	38	Potential Seepage Face
Line 93	45	44	Potential Seepage Face
Line 94	22	116	Potential Seepage Face
Line 95	116	110	
Line 96	110	119	
Line 97	119	126	
Line 98	126	120	
Line 99	120	121	
Line 100	121	127	
Line 101	127	82	
Line 102	26	118	
Line 103	118	119	
Line 104	126	122	
Line 105	122	26	
Line 106	27	123	
Line 107	123	125	
Line 108	125	124	
Line 109	124	122	
Line 110	123	127	
Line 111	118	117	
Line 112	117	3	
Line 113	117	111	
Line 114	111	112	
Line 115	112	113	
Line 116	113	6	Potential Seepage Face
Line 117	113	114	Potential Seepage Face
Line 118	114	115	Potential Seepage Face
Line 119	115	116	Potential Seepage Face
Line 120	69	129	Gypsum Stack Water Elevation 410
Line 121	129	68	Potential Seepage Face

Points

	X (ft)	Y (ft)	Hydraulic Boundary

Point 1	1475	353.19	
Point 2	1225.0651	353.19	
Point 3	1111.0025	351.03	
Point 4	1031.6471	362.1655	
Point 5	1028.0434	361.0017	
Point 6	984.1443	359.9523	
Point 7	950.6064	356.9591	
Point 8	900	355.6847	
Point 9	900	314.2811	
Point 10	1225.0651	336.79	
Point 11	1475	336.79	
Point 12	1225.0651	319.99	
Point 13	1475	319.99	
Point 14	1179.475	382.19	
Point 15	1159.0394	389.0012	
Point 16	1154.7809	389.0017	
Point 17	1150.4833	390.0017	
Point 18	1144.3259	393.7324	
Point 19	1143.197	394.2883	
Point 20	1142.3686	394.55	
Point 21	1140.9385	395.0017	
Point 22	1124.8971	395.0017	
Point 23	1118.2614	393.9807	
Point 24	1108.1233	390.0017	
Point 25	1078.7109	381.0017	
Point 26	1091.7416	376.63	
Point 27	1196.1567	376.63	
Point 28	1475	398.5017	
Point 29	1267.513	398.5017	
Point 30	1316.4529	382.19	
Point 31	1475	382.19	
Point 32	1168.7329	351.03	
Point 33	1163.2539	389.0017	
Point 34	1165.7562	390.3163	
Point 35	1168.9831	392.0017	
Point 36	1174	394	

Point 37	1177.9093	395.2996	
Point 38	1208.8534	405.0017	
Point 39	1214.4744	406.4996	
Point 40	1217.7547	408.7126	
Point 41	1220.5864	410.0017	
Point 42	1232.7632	410.0017	
Point 43	1233.6482	409.7888	
Point 44	1475	414.1588	
Point 45	1435.4684	413.0017	
Point 46	1429.0876	412.5892	
Point 47	1425.1901	412.2142	
Point 48	1409.6758	415.0017	
Point 49	1406.7021	414.0017	
Point 50	1398.3521	413.7404	
Point 51	1397.2875	413.4962	
Point 52	1396.5743	414.0072	
Point 53	1394.6161	414.0679	
Point 54	1392.5046	415.0017	
Point 55	1388.3079	415.0017	
Point 56	1385.3407	414.0565	
Point 57	1379.8252	413.9558	
Point 58	1373.1553	411.0017	
Point 59	1369.9178	411.0017	
Point 60	1368.4737	411.2319	
Point 61	1364.6893	411.2664	
Point 62	1361.7463	411.0017	
Point 63	1338.2008	411.0017	
Point 64	1319.8195	415.397	
Point 65	1317.9669	416.0017	
Point 66	1315.4368	417.0017	
Point 67	1309.737	418.0017	
Point 68	1288.8897	418.0017	
Point 69	1264.4456	409.0513	
Point 70	1255.0277	408.8585	
Point 71	1246.0502	408.9271	
Point 72	1065.8502	380.0017	

Point 73	1043.7085	367.0614	
Point 74	1041.6113	366.0017	
Point 75	900	300	
Point 76	1475	300	
Point 77	1153	389	
Point 78	1170	390	
Point 79	1249	405	
Point 80	900	329	
Point 81	1104.3302	388.8067	
Point 82	1159.6	388.8143	
Point 83	971.8829	359	
Point 84	650	361.0346	
Point 85	695.2744	359.9523	
Point 86	707.5358	359	
Point 87	733.8123	356.9591	
Point 88	779.4187	355.6847	
Point 89	839.7094	354	
Point 90	850	354.2876	
Point 91	650	329	
Point 92	650	314.2811	
Point 93	650	300	
Point 94	650	359	
Point 95	1775	423	
Point 96	1775	398.5017	
Point 97	1775	382.19	
Point 98	1775	353.19	
Point 99	1775	336.79	
Point 100	1775	319.99	
Point 101	1775	300	
Point 102	945.6064	356.9591	
Point 103	1173.3768	393.9777	
Point 104	1187.3669	398.1315	
Point 105	1197.7316	401.4796	
Point 106	1204.1501	403.553	
Point 107	1211.6339	405.7426	
Point 108	1457.2701	413.6006	

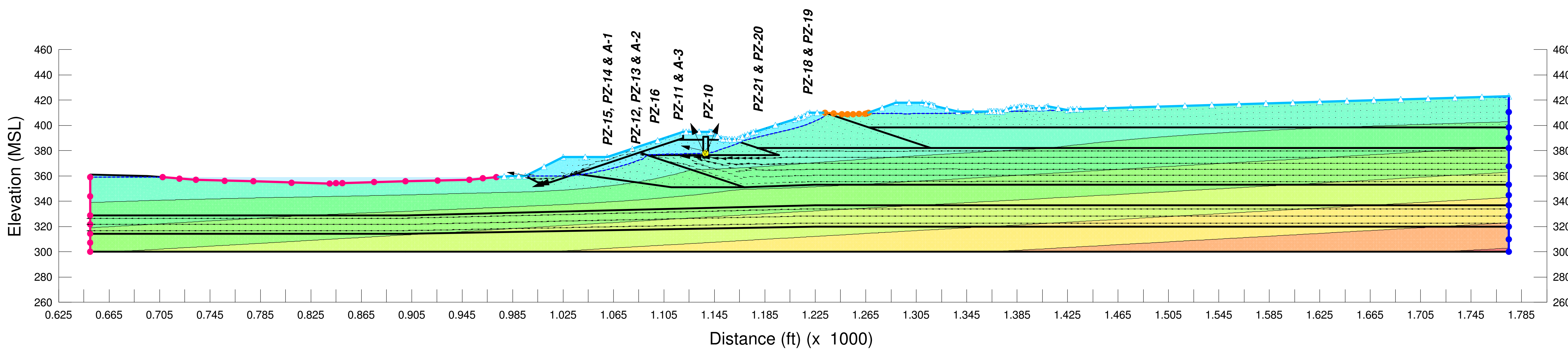
Point 109	1475	405	
Point 110	1120	390	
Point 111	1015	355	
Point 112	1005	355	
Point 113	995	360	
Point 114	1025	375	
Point 115	1060	375	
Point 116	1120	395	
Point 117	1035.1	361.7	
Point 118	1085.8	378.6	
Point 119	1116.4	388.8	
Point 120	1136	391	
Point 121	1140	391	
Point 122	1136	376.63	
Point 123	1140	376.63	
Point 124	1136	374.63	
Point 125	1140	374.63	
Point 126	1136	388.8	
Point 127	1140	388.8	
Point 128	1138	378	Drainage Trench Pipe 378
Point 129	1267.0366	410	

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

Stantec

File Name: Section H (Stability - Repair Design).gsz
Analysis Name: Steady-State Seepage
Date Saved: 11/2/2009
Last Solved on 11/2/2009 at 1:58:05 PM
Analysis Method: Steady-State

Material Type
Dike 1 (Clay) Saturated / Unsaturated Dike 1 (Clay) Dike 1 (Clay) 0.1 0 °
Dike 2 (Lean Clay) Saturated / Unsaturated Dike 2 (Lean Clay) Dike 2 (Lean Clay) 0.1 0 °
Dike 3 (Clay) Saturated / Unsaturated Dike 3 (Clay) Dike 3 (Clay) 0.1 0 °
Alluvial (Clay) Saturated / Unsaturated Alluvial (Clay) Alluvial (Clay) 0.05 0 °
Alluvial (Granular) Saturated / Unsaturated Alluvial (Granular) Alluvial (Granular) 0.05 0 °
Gypsum Saturated / Unsaturated Gypsum Gypsum 0.02 0 °
Fly Ash (Stacked and/or Sluiced) Saturated / Unsaturated Fly Ash (Stacked and/or Sluiced) Fly Ash (Stacked and/or Sluiced) 0.02 0 °
Fly Ash / Bottom Ash (Sluiced) Saturated / Unsaturated Fly Ash/Bottom Ash (Sluiced) Fly Ash/Bottom Ash (Sluiced) 0.02 0 °
Dike 2 (Fat Clay) Saturated / Unsaturated Dike 2 (Fat Clay) Dike 2 (Fat Clay) 0.1 0 °
Toe Buttress (Rip Rap) Saturated / Unsaturated Rip Rap Rip Rap 0.5 0 °
Drainage Trench (Gravel) Saturated / Unsaturated Gravel Gravel 0.1 0 °
Bedrock Saturated Only 1e-012 ft/sec 0.05 ft³/ft³ 0 /psf 0.1 0 °

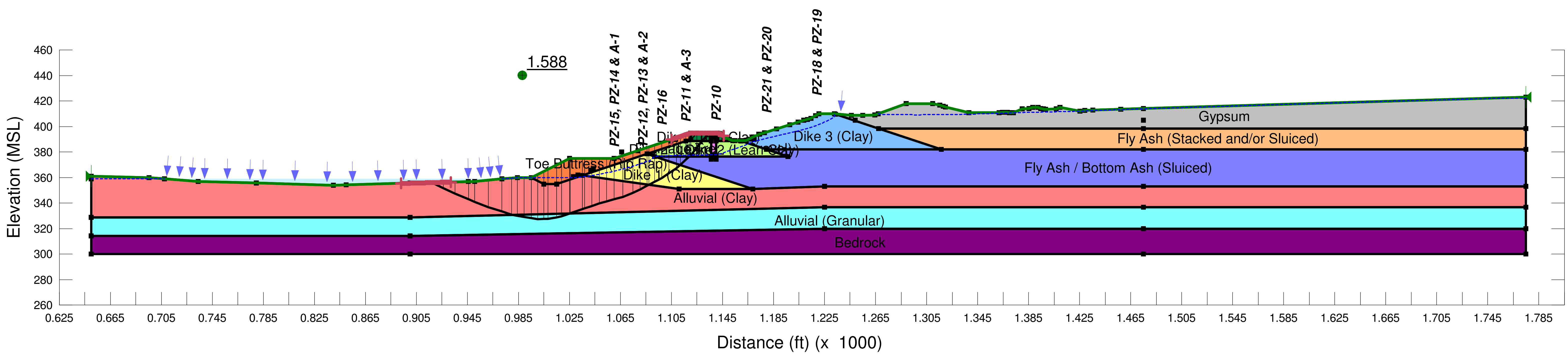


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

File Name: Section H (Stability - Repair Design).gsz
Analysis Name: Stability - Existing Condition with Existing PZ Levels
Date Saved: 11/2/2009
Last Solved on 11/2/2009 at 2:01:28 PM
Analysis Method: Spencer

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Stacked and/or Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Toe Buttress (Rip Rap)	140 pcf	0 psf	38 °
Drainage Trench (Gravel)	130 pcf	0 psf	30 °
Bedrock			

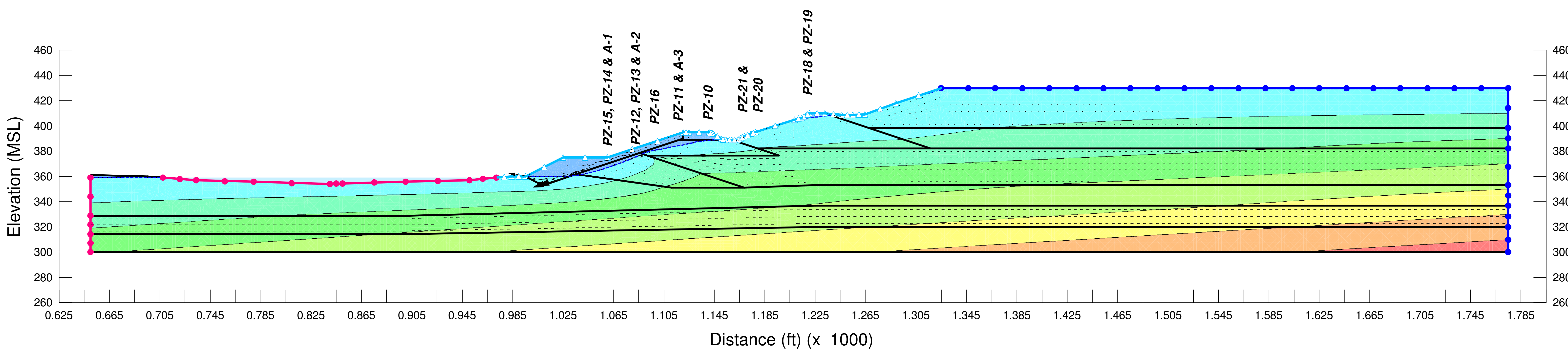
Calculated Factor of Safety: 1.588



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

File Name: Section H (StabRepDgn-Buildout 430) no drain.gsz
Analysis Name: Steady-State Seepage
Date Saved: 11/2/2009
Last Solved on 11/2/2009 at 10:24:56 AM
Analysis Method: Steady-State

Material Type
Dike 1 (Clay) Saturated / Unsaturated Dike 1 (Clay) Dike 1 (Clay) 0.1 0 °
Dike 2 (Lean Clay) Saturated / Unsaturated Dike 2 (Lean Clay) Dike 2 (Lean Clay) 0.1 0 °
Dike 3 (Clay) Saturated / Unsaturated Dike 3 (Clay) Dike 3 (Clay) 0.1 0 °
Alluvial (Clay) Saturated / Unsaturated Alluvial (Clay) Alluvial (Clay) 0.05 0 °
Alluvial (Granular) Saturated / Unsaturated Alluvial (Granular) Alluvial (Granular) 0.05 0 °
Gypsum Saturated / Unsaturated Gypsum Gypsum 0.02 0 °
Fly Ash (Stacked and/or Sluiced) Saturated / Unsaturated Fly Ash (Stacked and/or Sluiced) Fly Ash (Stacked and/or Sluiced) 0.02 0 °
Fly Ash / Bottom Ash (Sluiced) Saturated / Unsaturated Fly Ash/Bottom Ash (Sluiced) Fly Ash/Bottom Ash (Sluiced) 0.02 0 °
Dike 2 (Fat Clay) Saturated / Unsaturated Dike 2 (Fat Clay) Dike 2 (Fat Clay) 0.1 0 °
Toe Buttress (Rip Rap) Saturated / Unsaturated Rip Rap Rip Rap 0.5 0 °
Bedrock Saturated Only 1e-012 ft/sec 0.05 ft³/ft³ 0 /psf 0.1 0 °

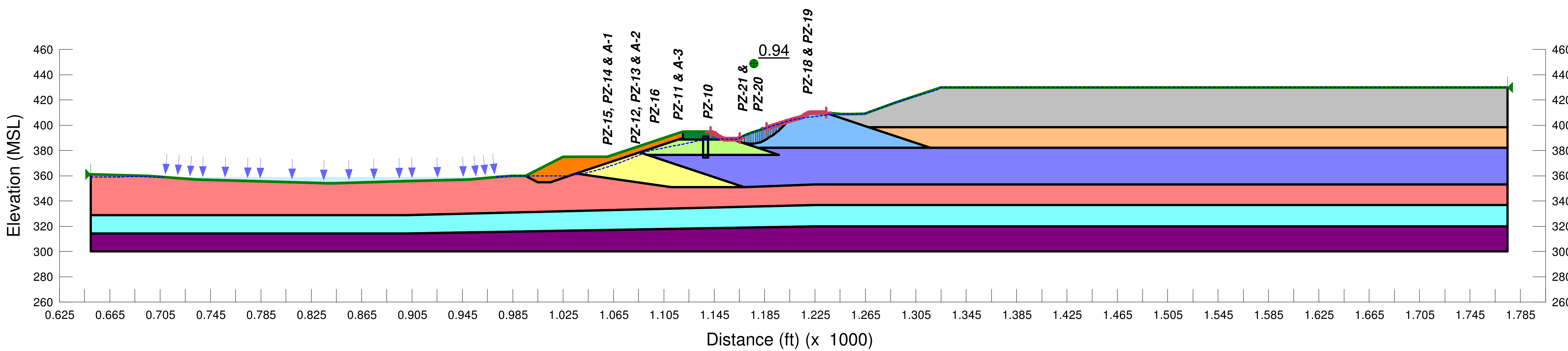


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

File Name: Section H (StabRepDgn-Buildout 430) no drain.gsz
Analysis Name: Stability - Existing Condition with Existing PZ Levels
Date Saved: 11/2/2009
Last Solved on 11/2/2009 at 10:30:38 AM
Analysis Method: Spencer

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Stacked and/or Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Toe Buttress (Rip Rap)	140 pcf	0 psf	38 °
Bedrock			

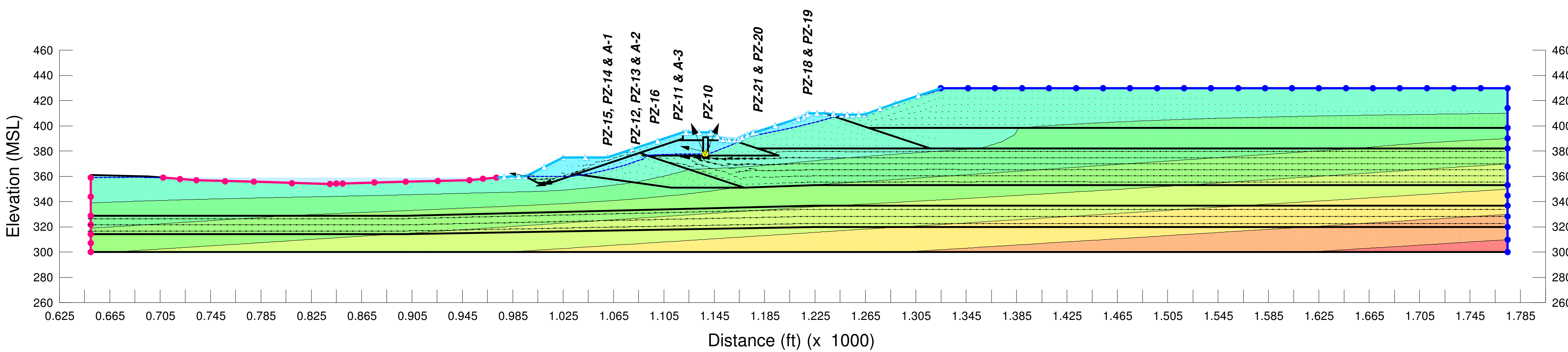
Calculated Factor of Safety: 0.94



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

File Name: Section H (StabRepDgn-Buildout 430)2.gsz
Analysis Name: Steady-State Seepage
Date Saved: 11/2/2009
Last Solved on 11/2/2009 at 1:02:44 PM
Analysis Method: Steady-State

Material Type
Dike 1 (Clay) Saturated / Unsaturated Dike 1 (Clay) Dike 1 (Clay) 0.1 0 °
Dike 2 (Lean Clay) Saturated / Unsaturated Dike 2 (Lean Clay) Dike 2 (Lean Clay) 0.1 0 °
Dike 3 (Clay) Saturated / Unsaturated Dike 3 (Clay) Dike 3 (Clay) 0.1 0 °
Alluvial (Clay) Saturated / Unsaturated Alluvial (Clay) Alluvial (Clay) 0.05 0 °
Alluvial (Granular) Saturated / Unsaturated Alluvial (Granular) Alluvial (Granular) 0.05 0 °
Gypsum Saturated / Unsaturated Gypsum Gypsum 0.02 0 °
Fly Ash (Stacked and/or Sluiced) Saturated / Unsaturated Fly Ash (Stacked and/or Sluiced) Fly Ash (Stacked and/or Sluiced) 0.02 0 °
Fly Ash / Bottom Ash (Sluiced) Saturated / Unsaturated Fly Ash/Bottom Ash (Sluiced) Fly Ash/Bottom Ash (Sluiced) 0.02 0 °
Dike 2 (Fat Clay) Saturated / Unsaturated Dike 2 (Fat Clay) Dike 2 (Fat Clay) 0.1 0 °
Toe Buttress (Rip Rap) Saturated / Unsaturated Rip Rap Rip Rap 0.5 0 °
Drainage Trench (Gravel) Saturated / Unsaturated Gravel Gravel 0.1 0 °
Bedrock Saturated Only 1e-012 ft/sec 0.05 ft³/ft³ 0 /psf 0.1 0 °



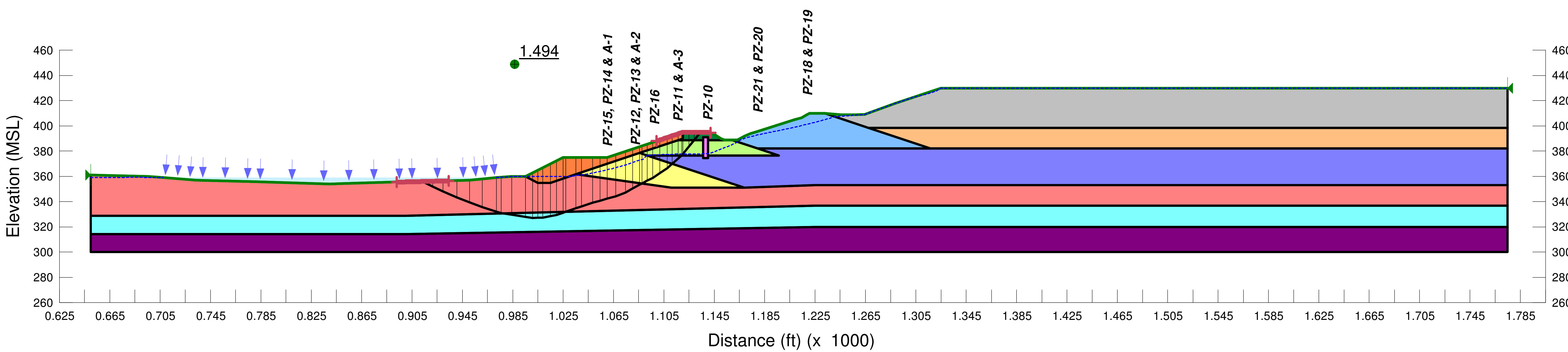
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

Stantec

File Name: Section H (StabRepDgn-Buildout 430)2.gsz
Analysis Name: Stability - Existing Condition with Existing PZ Levels
Date Saved: 11/2/2009
Last Solved on 11/2/2009 at 1:06:12 PM
Analysis Method: Spencer

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Stacked and/or Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Toe Buttress (Rip Rap)	140 pcf	0 psf	38 °
Drainage Trench (Gravel)	130 pcf	0 psf	30 °
Bedrock			

Calculated Factor of Safety: 1.494

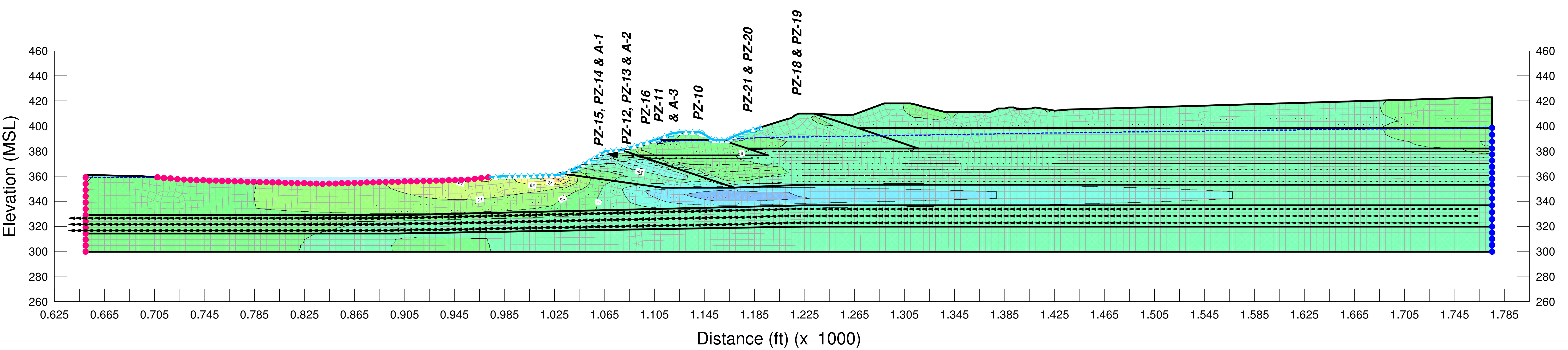


SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

File Name: Section H ns.gsz
Analysis Name: Steady-State Seepage
Date Saved: 12/9/2009
Last Solved on 12/9/2009 at 7:45:10 PM
Analysis Method: Steady-State

Material Type
Dike 1 (Clay) Saturated / Unsaturated Dike 1 (Clay) Dike 1 (Clay) 0.1 0 °
Dike 2 (Lean Clay) Saturated / Unsaturated Dike 2 (Lean Clay) Dike 2 (Lean Clay) 0.1 0 °
Dike 3 (Clay) Saturated / Unsaturated Dike 3 (Clay) Dike 3 (Clay) 0.1 0 °
Alluvial (Clay) Saturated / Unsaturated Alluvial (Clay) Alluival (Clay) 0.05 0 °
Alluvial (Granular) Saturated / Unsaturated Alluvial (Granular) Alluvial (Granular) 0.05 0 °
Gypsum Saturated / Unsaturated Gypsum Gypsum 0.02 0 °
Fly Ash (Stacked and/or Sluiced) Saturated / Unsaturated Fly Ash (Stacked and/or Sluiced) Fly Ash (Stacked and/or Sluiced) 0.02 0 °
Fly Ash / Bottom Ash (Sluiced) Saturated / Unsaturated Fly Ash/Bottom Ash (Sluiced) Fly Ash/Bottom Ash (Sluiced) 0.02 0 °
Dike 2 (Fat Clay) Saturated / Unsaturated Dike 2 (Fat Clay) Dike 2 (Fat Clay) 0.1 0 °
Bedrock Saturated Only 1e-012 ft/sec 0.05 ft³/ft³ 0 /psf 0.1 0 °

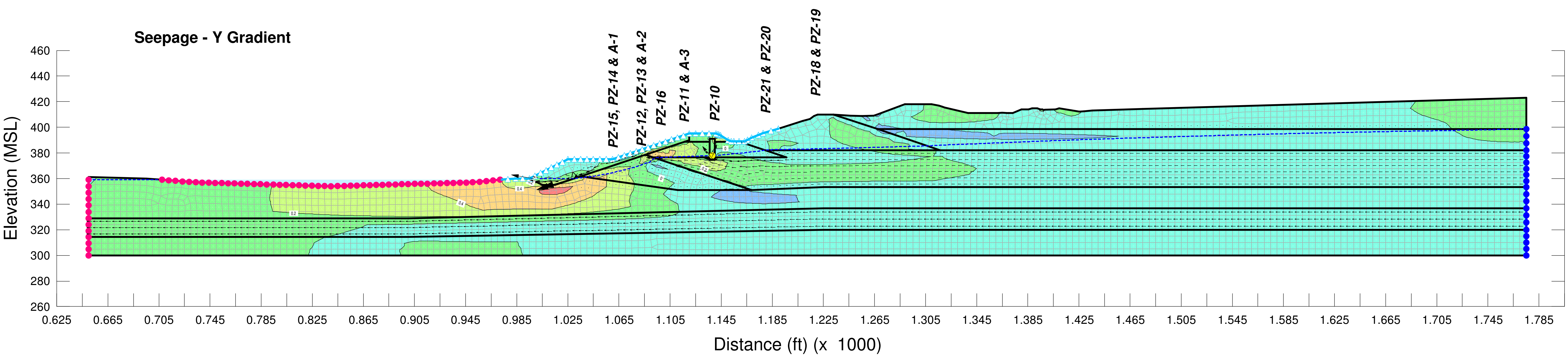
Seepage - Y Gradient



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

File Name: Section H (Stability - Repair Design) ns.gsz
Analysis Name: Steady-State Seepage
Date Saved: 12/9/2009
Last Solved on 12/9/2009 at 7:40:34 PM
Analysis Method: Steady-State

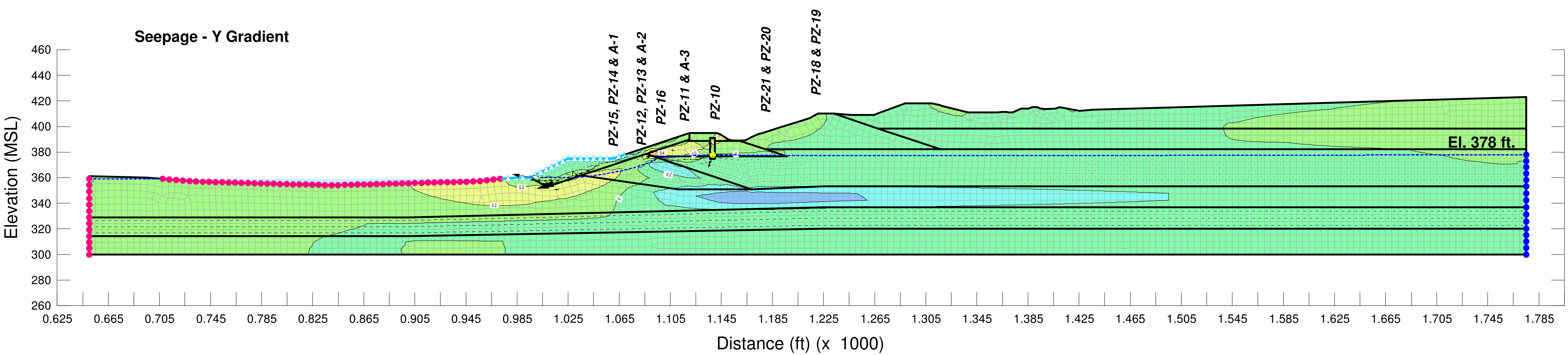
Material Type
Dike 1 (Clay) Saturated / Unsaturated Dike 1 (Clay) Dike 1 (Clay) 0.1 0 °
Dike 2 (Lean Clay) Saturated / Unsaturated Dike 2 (Lean Clay) Dike 2 (Lean Clay) 0.1 0 °
Dike 3 (Clay) Saturated / Unsaturated Dike 3 (Clay) Dike 3 (Clay) 0.1 0 °
Alluvial (Clay) Saturated / Unsaturated Alluvial (Clay) Alluvial (Clay) 0.05 0 °
Alluvial (Granular) Saturated / Unsaturated Alluvial (Granular) Alluvial (Granular) 0.05 0 °
Gypsum Saturated / Unsaturated Gypsum Gypsum 0.02 0 °
Fly Ash (Stacked and/or Sluiced) Saturated / Unsaturated Fly Ash (Stacked and/or Sluiced) Fly Ash (Stacked and/or Sluiced) 0.02 0 °
Fly Ash / Bottom Ash (Sluiced) Saturated / Unsaturated Fly Ash/Bottom Ash (Sluiced) Fly Ash/Bottom Ash (Sluiced) 0.02 0 °
Dike 2 (Fat Clay) Saturated / Unsaturated Dike 2 (Fat Clay) Dike 2 (Fat Clay) 0.1 0 °
Toe Buttress (Rip Rap) Saturated / Unsaturated Rip Rap Rip Rap 0.5 0 °
Drainage Trench (Gravel) Saturated / Unsaturated Gravel Gravel 0.1 0 °
Bedrock Saturated Only 1e-012 ft/sec 0.05 ft³/ft³ 0 /psf 0.1 0 °



SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

File Name: Section H (Stability - Repair Design) ns2.gsz
Analysis Name: Steady-State Seepage
Date Saved: 12/10/2009
Last Solved on 12/10/2009 at 10:11:39 AM
Analysis Method: Steady-State

Material Type
Dike 1 (Clay) Saturated / Unsaturated Dike 1 (Clay) Dike 1 (Clay) 0.1 0 °
Dike 2 (Lean Clay) Saturated / Unsaturated Dike 2 (Lean Clay) Dike 2 (Lean Clay) 0.1 0 °
Dike 3 (Clay) Saturated / Unsaturated Dike 3 (Clay) Dike 3 (Clay) 0.1 0 °
Alluvial (Clay) Saturated / Unsaturated Alluvial (Clay) Alluival (Clay) 0.05 0 °
Alluvial (Granular) Saturated / Unsaturated Alluvial (Granular) Alluvial (Granular) 0.05 0 °
Gypsum Saturated / Unsaturated Gypsum Gypsum 0.02 0 °
Fly Ash (Stacked and/or Sluiced) Saturated / Unsaturated Fly Ash (Stacked and/or Sluiced) Fly Ash (Stacked and/or Sluiced) 0.02 0 °
Fly Ash / Bottom Ash (Sluiced) Saturated / Unsaturated Fly Ash/Bottom Ash (Sluiced) Fly Ash/Bottom Ash (Sluiced) 0.02 0 °
Dike 2 (Fat Clay) Saturated / Unsaturated Dike 2 (Fat Clay) Dike 2 (Fat Clay) 0.1 0 °
Toe Buttress (Rip Rap) Saturated / Unsaturated Rip Rap Rip Rap 0.5 0 °
Drainage Trench (Gravel) Saturated / Unsaturated Gravel Gravel 0.1 0 °
Bedrock Saturated Only 1e-012 ft/sec 0.05 ft³/ft³ 0 /psf 0.1 0 °



Appendix M

Slope Stability Analyses Output

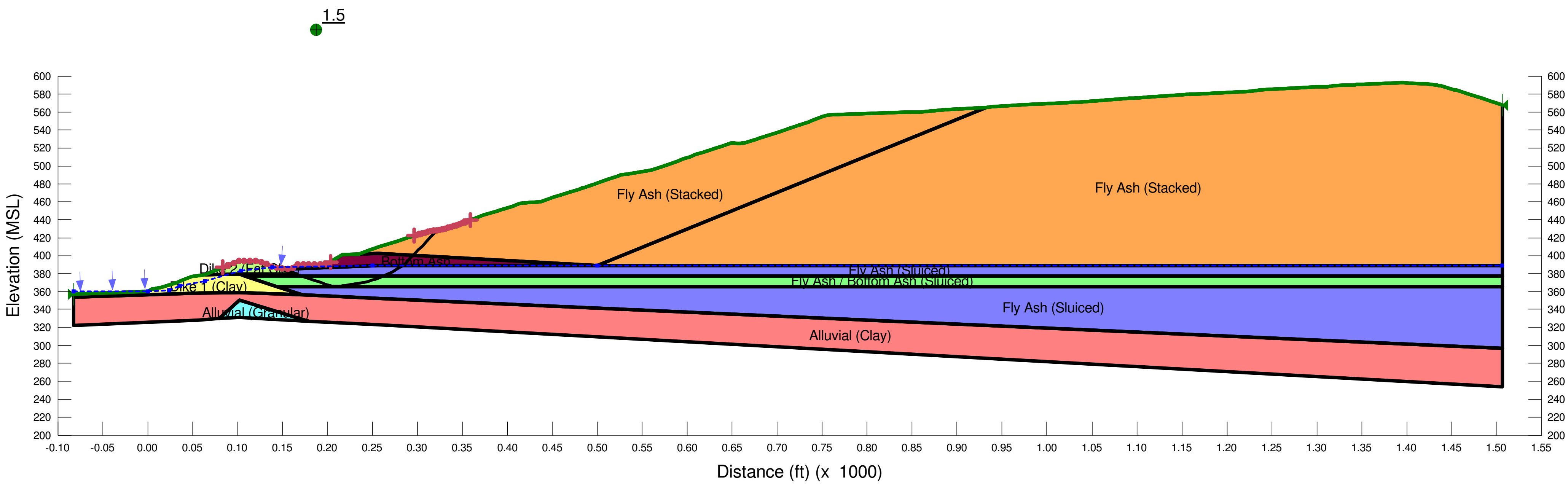
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section C (Stability - Repair Design-TVABuildout).gsz
Analysis Name: Stability - Buildout w Existing PZ Levels
Date Saved: 12/15/2009
Last Solved on 12/15/2009 at 9:00:53 PM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Fly Ash (Stacked)	100 pcf	0 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Bottom Ash	105 pcf	0 psf	35 °

Analysis Method: Spencer
Calculated Factor of Safety: 1.5



Stability - Buildout w Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 227
Last Edited By: Rogers, Daniel
Date: 12/15/2009
Time: 8:59:38 PM
File Name: Section C (Stability - Repair Design-TVABuildout).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\Buildout\
Last Solved Date: 12/15/2009
Last Solved Time: 9:00:53 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Buildout w Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30
- Optimization Tolerance: 0.01
- Minimum Slip Surface Depth: 10 ft
- Optimization Maximum Iterations: 5000

Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf

Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bottom Ash

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (83.6061, 387) ft
Left-Zone Right Coordinate: (203.3646, 393) ft
Left-Zone Increment: 20
Right Projection: Range
Right-Zone Left Coordinate: (295.8154, 422) ft
Right-Zone Right Coordinate: (359, 439.667) ft
Right-Zone Increment: 20
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-82.7906, 356.7674) ft
Right Coordinate: (1506.5837, 568.049) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-82.7906	359.891
	0	359.891
	24	361.2072
	36	366.578
	63.7	372
	104	383
	138.587	387.003
	249.7	389
	500	389
	1506	389

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.5	(218.394, 477.146)	86.91192	(321.799, 428.467)	(148.342, 385.695)
2	8048	1.5	(218.394, 477.146)	111.213	(318.054, 427.789)	(155.864, 385.177)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	149.85335	385.0984	131.48232	162.8533	12.674696	0
2	Optimized	155.47655	382.8778	276.35162	417.49045	57.023786	0
3	Optimized	160.12185	381.04335	396.0371	683.62477	116.19296	0
4	Optimized	161.5673	380.51745	430.46834	782.33537	142.16351	0
5	Optimized	164.0275	379.66705	486.3009	1084.2474	241.58606	0
6	Optimized	168.16315	378.23755	580.13625	1451.5642	352.07973	0
7	Optimized	173.43045	376.4169	699.65613	1659.7081	387.88617	0
8	Optimized	177.19795	375.11465	785.15588	1776.5911	400.56583	0
9	Optimized	181.63415	373.5835	885.64673	1951.0852	430.4651	0
10	Optimized	188.3306	371.27335	1037.3178	2215.0697	475.84265	0
11	Optimized	195.02705	368.9632	1188.9748	2479.0542	521.22591	0
12	Optimized	199.48495	367.4253	1289.9277	2744.0194	587.49121	0
13	Optimized	202.7549	366.61785	1343.9975	2909.875	632.65556	0
14	Optimized	207.22955	366.03095	1385.6283	3140.6915	709.09153	0
15	Optimized	211.73445	365.9999	1392.6335	3288.0294	765.78968	0
16	Optimized	215.30635	366.3492	1374.8288	3362.4367	803.04569	0

17	Optimized	219.672	367.03855	1336.711	3393.4529	830.97767	0
18	Optimized	225.64055	367.98105	1284.5969	3327.5863	825.42128	0
19	Optimized	231.6091	368.9235	1232.4829	3261.8852	819.93176	0
20	Optimized	238.5302	370.01635	1172.051	3310.8125	864.11577	0
21	Optimized	243.68875	371.00155	1116.3507	3235.6912	856.26914	0
22	Optimized	247.30525	372.07765	1053.2652	3254.9321	889.53117	0
23	Optimized	251.02965	373.18585	986.8159	3273.1911	923.75555	0
24	Optimized	253.80425	374.01145	935.27034	3286.7456	950.05767	0
25	Optimized	255.6746	374.62905	896.75176	3128.689	901.76118	0
26	Optimized	256.97845	375.2041	860.84917	3116.8156	911.46961	0
27	Optimized	259.8617	376.47575	781.51242	3078.9965	928.24381	0
28	Optimized	264.13835	378.36205	663.80404	3015.6619	950.21224	0
29	Optimized	268.6821	380.3661	538.75556	2948.4055	973.56178	0
30	Optimized	271.69305	381.7987	449.36306	2751.2907	930.03914	0
31	Optimized	273.69505	382.96515	376.58657	2697.5078	937.71306	0
32	Optimized	277.31785	385.07595	244.857	2605.6446	953.8201	0
33	Optimized	281.86525	387.72545	79.531787	2493.7247	975.39725	0
34	Optimized	284.187	389.0782	-4.8797524	2436.9149	984.57752	0
35	Optimized	287.38085	392.34755	-208.89123	1703.9282	1193.1034	0
36	Optimized	290.55865	395.66195	-415.71541	1550.3075	1085.537	0
37	Optimized	291.2718	396.40575	-462.11628	1516.1746	1061.6369	0
38	Optimized	293.56485	398.7593	-608.98795	1422.4076	995.9805	0
39	Optimized	297.96625	403.25135	-889.28567	1258.8063	786.58949	0
40	Optimized	303.0783	408.51205	-1217.546	1021.1319	638.07401	0
41	Optimized	307.66375	413.27445	-1514.73	796.58151	497.75937	0
42	Optimized	312.2691	418.1377	-1818.1507	540.37449	337.66346	0
43	Optimized	316.214	422.3651	-2081.9765	322.68014	201.63293	0
44	Optimized	319.76465	426.22875	-2323.1347	117.22781	73.252065	0

Slices of Slip Surface: 8048

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	8048	157.72635	383.96485	211.04529	315.2596	42.105316	0
2	8048	161.03415	381.882	344.73684	671.30781	131.94323	0
3	8048	164.0275	380.14415	456.53609	1129.5056	271.89731	0
4	8048	167.43385	378.3183	574.27302	1542.5935	391.22689	0
5	8048	170.0216	377.0077	658.96089	1710.619	424.89746	0

6	8048	173.43045	375.47045	758.7039	1835.7501	435.15492	0
7	8048	178.89315	373.2276	904.78642	2011.4575	447.12413	0
8	8048	184.4595	371.2776	1032.7138	2181.0764	463.96862	0
9	8048	190.02585	369.65105	1140.442	2310.9696	472.92386	0
10	8048	195.59215	368.3334	1228.9126	2405.0402	475.1864	0
11	8048	201.42735	367.27885	1301.2573	2686.64	559.73097	0
12	8048	207.5315	366.50785	1356.2119	3136.718	719.37114	0
13	8048	213.63565	366.07745	1389.9137	3529.6147	864.49534	0
14	8048	219.672	365.98105	1402.7064	3683.2206	921.38752	0
15	8048	225.64055	366.2103	1395.1009	3615.442	897.07606	0
16	8048	231.6091	366.7625	1367.3335	3518.106	868.9685	0
17	8048	237.1727	367.5618	1323.6984	3483.7387	872.71292	0
18	8048	242.33125	368.57245	1266.4235	3510.6916	906.74314	0
19	8048	247.30525	369.786	1196.2599	3506.7658	933.50495	0
20	8048	251.02965	370.8391	1133.2463	3485.5844	950.40628	0
21	8048	254.22965	371.88405	1068.0269	3452.5378	963.40495	0
22	8048	256.97845	372.84575	1008.0256	3417.2403	973.38593	0
23	8048	260.26645	374.15035	926.61207	3345.138	977.14791	0
24	8048	265.0856	376.245	795.91587	3214.435	977.14514	0
25	8048	269.96365	378.65245	645.68574	3054.9036	973.38719	0
26	8048	273.69505	380.6688	519.88091	2917.4607	968.6851	0
27	8048	277.31785	382.86765	382.66573	2768.0291	963.74934	0
28	8048	282.9418	386.6713	145.31193	2504.5827	953.20726	0
29	8048	286.30965	389.08	-4.9919695	2336.2142	943.89182	0
30	8048	288.42695	390.793	-111.88325	2033.9252	1424.1698	0
31	8048	290.55865	392.5268	-220.07264	1918.7851	1343.5478	0
32	8048	294.73015	396.4625	-465.66267	1662.0057	1163.7489	0
33	8048	302.13525	404.14215	-944.87016	1239.2672	774.38008	0
34	8048	307.7897	411.1038	-1379.2664	841.84279	526.04176	0
35	8048	312.39505	417.8725	-1801.6536	470.46138	293.9769	0
36	8048	316.37575	424.65675	-2224.9162	138.45611	86.516982	0

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

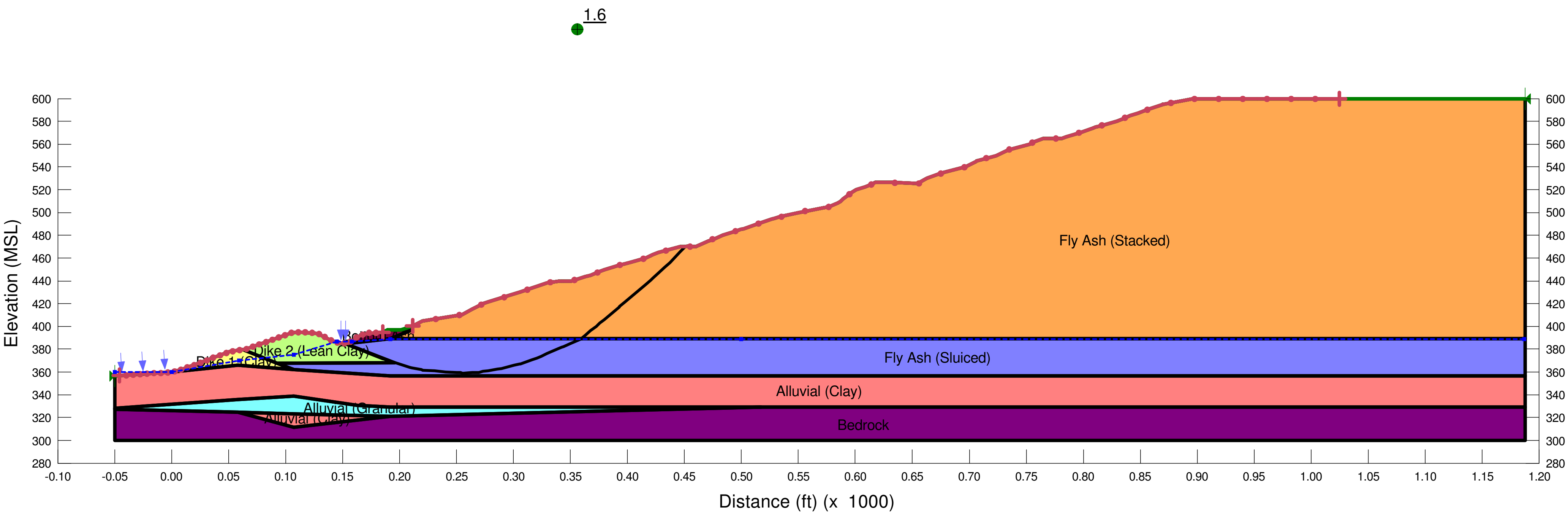
File Name: Section E (Stability -TVABuildout).gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels (Deep)

Date Saved: 10/23/2009
Last Solved on 10/23/2009 at 9:22:50 AM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Fly Ash (Stacked)	100 pcf	0 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Bottom Ash	105 pcf	0 psf	35 °
Bedrock			

Analysis Method: Spencer
Calculated Factor of Safety: 1.6



Stability - Existing Condition with Existing PZ Levels (Deep)

File Information

Created By: Cooper, Paul
Revision Number: 212
Last Edited By: Rogers, Daniel
Date: 10/23/2009
Time: 9:19:40 AM
File Name: Section E (Stability -TVABuildout).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\Buildout\
Last Solved Date: 10/23/2009
Last Solved Time: 9:22:50 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels (Deep)

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 60 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bottom Ash

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bedrock

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (-45.6134, 356.7306) ft
Left-Zone Right Coordinate: (185.478, 395) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (211.575, 400.3748) ft
Right-Zone Right Coordinate: (1025, 599.9336) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-50, 356.4268) ft
Right Coordinate: (1187.8959, 599.5322) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-50	360
	0	360
	59	370
	107	375
	145	387
	158	387
	192	389
	500	389
	1187	389

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.6	(251.188, 613.398)	155.9565	(450.875, 470.31)	(150.115, 385.416)
2	43601	1.6	(251.188, 613.398)	248.801	(454.702, 470.276)	(151.606, 385.396)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	151.26465	384.9722	126.53604	171.57209	31.534582	0
2	Optimized	153.6419	384.0551	183.76217	274.3117	36.584385	0
3	Optimized	156.2783	383.038	247.23189	448.30217	81.237667	0
4	Optimized	157.8434	382.43415	284.90934	569.15137	114.84123	0
5	Optimized	158.6998	382.10375	308.09042	676.86835	148.99596	0
6	Optimized	162.22035	380.74555	405.77015	1167.5484	307.77838	0
7	Optimized	167.7531	378.61105	559.27019	1810.5671	505.55678	0
8	Optimized	170.8946	377.3998	646.38232	2087.1234	582.09719	0
9	Optimized	178.41525	374.51045	854.27724	2507.9379	668.12227	0
10	Optimized	185.61	371.7463	1053.1945	2902.7496	747.26877	0
11	Optimized	186.60285	371.36485	1080.6033	3017.4803	782.5491	0
12	Optimized	188.4437	370.71105	1128.1623	3133.5622	810.23416	0
13	Optimized	190.55765	370.01755	1179.1908	3276.6382	847.42374	0
14	Optimized	191.86	369.5903	1210.6634	3324.1664	853.91061	0
15	Optimized	196.59455	368.03715	1308.0454	3492.533	882.59026	0
16	Optimized	205.17295	365.223	1483.6367	3955.5298	998.70963	0
17	Optimized	209.98865	363.7405	1576.2003	4074.0904	1009.2131	0

18	Optimized	214.99625	362.68355	1642.1996	4469.4495	1142.2831	0
19	Optimized	219.73415	361.7611	1699.7235	4565.8613	1157.9948	0
20	Optimized	220.5319	361.70275	1703.3479	4615.862	1176.7321	0
21	Optimized	225.7007	361.32485	1726.9293	4751.4815	1221.9984	0
22	Optimized	235.56705	360.6035	1771.9119	4993.1748	1301.4747	0
23	Optimized	245.4334	359.8821	1816.9956	5234.868	1380.9101	0
24	Optimized	251.97425	359.40385	1846.8102	5394.7367	1433.4554	0
25	Optimized	254.25115	359.23735	1857.2015	5476.0807	1462.1221	0
26	Optimized	255.45335	359.14945	1862.652	5551.371	1490.3392	0
27	Optimized	259.87945	359.26735	1855.3454	5505.2095	1474.6408	0
28	Optimized	266.27235	359.52495	1839.2516	5814.6634	1606.1707	0
29	Optimized	269.1528	359.68615	1829.1915	5678.1207	1555.0683	0
30	Optimized	271.498	360.0586	1805.9507	5757.3242	1596.4585	0
31	Optimized	275.63305	360.7153	1764.9634	5859.399	1654.2594	0
32	Optimized	281.8018	361.69495	1703.7997	5955.3327	1717.7308	0
33	Optimized	287.5953	362.773	1636.5646	5819.8816	1690.1698	0
34	Optimized	295.0474	364.61235	1521.8229	5859.5416	1752.5521	0
35	Optimized	303.16325	366.61555	1396.7873	5905.8025	1821.7604	0
36	Optimized	305.71765	367.24605	1357.4269	5922.9286	1844.5824	0
37	Optimized	310.96905	369.05585	1244.5274	5691.6372	1796.749	0
38	Optimized	318.31705	371.60145	1085.6729	5680.1147	1856.275	0
39	Optimized	322.2376	372.95965	1000.9063	5674.8362	1888.3903	0
40	Optimized	326.6162	374.73195	890.33386	5440.6512	1838.4475	0
41	Optimized	334.4932	378.21995	672.67206	5282.6627	1862.5571	0
42	Optimized	341.1459	381.1658	488.8656	5088.7558	1858.4763	0
43	Optimized	343.17395	382.06385	432.81911	5004.9904	1847.2771	0
44	Optimized	347.0934	383.7994	324.51168	4865.1254	1834.527	0
45	Optimized	354.62425	387.1341	116.42886	4686.8827	1846.5832	0
46	Optimized	359.1002	389.1161	-7.2445687	4622.9091	1867.7765	0
47	Optimized	359.45765	389.3106	-19.382291	3983.4643	1609.4241	0
48	Optimized	361.38405	390.89675	-118.35705	3678.0926	2298.3273	0
49	Optimized	365.46865	394.25995	-328.22648	3523.6129	2201.7977	0
50	Optimized	370.11045	398.0819	-566.70441	3368.7115	2105.0046	0
51	Optimized	374.19445	401.48175	-778.86468	3217.6078	2010.5845	0
52	Optimized	377.7073	404.45115	-964.15523	3116.0687	1947.1358	0
53	Optimized	386.11035	411.5542	-1407.3736	2806.3399	1753.5958	0
54	Optimized	392.83625	417.23985	-1762.1604	2539.3261	1586.7471	0

55	Optimized	395.0984	419.1566	-1881.752	2451.4188	1531.8165	0
56	Optimized	399.4157	422.81475	-2109.9913	2279.2494	1424.2331	0
57	Optimized	408.71355	430.693	-2601.6463	1904.9916	1190.3708	0
58	Optimized	418.22695	438.7539	-3104.6406	1550.1683	968.65264	0
59	Optimized	421.44645	441.54285	-3278.6654	1406.129	878.64689	0
60	Optimized	424.5885	444.44205	-3459.5619	1309.6789	818.3782	0
61	Optimized	429.80495	449.2553	-3759.8949	1109.3857	693.2211	0
62	Optimized	434.93095	453.9851	-4055.0471	879.1342	549.34402	0
63	Optimized	441.6494	460.71115	-4474.7637	520.17716	325.04276	0
64	Optimized	448.21195	467.539	-4900.8133	167.13468	104.43734	0
65	Optimized	450.58695	470.01	-5054.9685	18.505053	11.56324	0

Slices of Slip Surface: 43601

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	43601	152.476	385.01965	123.57279	169.70684	32.30341	0
2	43601	154.1079	384.3207	167.18851	247.62268	32.497514	0
3	43601	156.2783	383.41655	223.60792	411.81607	76.041027	0
4	43601	157.8434	382.7719	263.83367	537.59463	110.60661	0
5	43601	158.6998	382.4283	287.84041	647.42203	145.28041	0
6	43601	162.22035	381.0679	385.64865	1135.3104	302.88302	0
7	43601	168.1826	378.87585	544.32712	1778.8645	498.78546	0
8	43601	178.41525	375.59395	786.70344	2299.159	611.07172	0
9	43601	185.61	373.3956	950.2696	2574.6012	656.27256	0
10	43601	187.55445	372.88025	989.55773	2749.2091	710.94531	0
11	43601	190.55765	372.10115	1049.2027	2937.2585	762.82408	0
12	43601	191.86	371.7747	1074.3383	2963.9251	763.44263	0
13	43601	196.59455	370.7068	1141.4492	3042.449	768.05377	0
14	43601	206.0048	368.78375	1261.4445	3350.8173	844.16139	0
15	43601	215.5584	367.2085	1359.7546	3895.2336	1024.4	0
16	43601	220.5319	366.49355	1404.3901	4219.5097	1137.3821	0
17	43601	225.7007	365.9562	1437.9092	4333.6901	1169.9714	0
18	43601	235.56705	365.13765	1488.9925	4507.3382	1219.4908	0
19	43601	245.4334	364.71305	1515.5525	4634.711	1260.2218	0
20	43601	251.97425	364.604	1522.3076	4698.7606	1283.3703	0
21	43601	254.25115	364.61735	1521.5139	4740.0234	1300.3622	0

22	43601	259.3465	364.77085	1511.9175	4944.3574	1386.7957	0
23	43601	266.65305	365.0955	1491.6504	5229.8459	1510.329	0
24	43601	271.498	365.4358	1470.4133	5407.1921	1590.5619	0
25	43601	275.63305	365.811	1446.9966	5502.2594	1638.4325	0
26	43601	283.5971	366.78665	1386.1139	5579.7095	1694.3226	0
27	43601	295.0474	368.56135	1275.3955	5638.2241	1762.6972	0
28	43601	303.16325	370.1	1179.3629	5650.3477	1806.3951	0
29	43601	310.8737	371.9233	1065.5457	5641.0697	1848.6317	0
30	43601	318.31705	373.83555	946.26117	5617.9109	1887.469	0
31	43601	324.8876	375.808	823.17929	5571.6966	1918.5255	0
32	43601	334.4932	379.02405	622.4943	5389.0499	1925.8135	0
33	43601	341.1459	381.4348	472.05748	5171.1499	1898.5566	0
34	43601	343.17395	382.2274	422.60734	5074.6971	1879.5663	0
35	43601	347.0934	383.853	321.17008	4903.0871	1851.2146	0
36	43601	354.52825	387.11945	117.34507	4652.4934	1832.3188	0
37	43601	359.0503	389.1945	-12.137397	4535.6708	1832.5299	0
38	43601	361.3349	390.3174	-82.206368	4346.6039	2716.0595	0
39	43601	365.46865	392.41115	-212.85494	4220.6375	2637.347	0
40	43601	371.8061	395.84075	-426.8604	4053.814	2533.1041	0
41	43601	377.7073	399.17825	-635.11994	3916.4308	2447.2576	0
42	43601	386.2504	404.60225	-973.6087	3603.3759	2251.6391	0
43	43601	395.0984	410.45785	-1338.9737	3251.1919	2031.5701	0
44	43601	399.4157	413.5912	-1534.4959	3060.5771	1912.4609	0
45	43601	408.71355	421.03605	-1999.0654	2608.2509	1629.8161	0
46	43601	419.0357	429.79565	-2545.6843	2134.6426	1333.8727	0
47	43601	424.5885	435.0069	-2870.8159	1904.7601	1190.2262	0
48	43601	429.80495	440.2491	-3198.0053	1640.043	1024.8126	0
49	43601	439.40655	451.01045	-3869.4462	1053.8362	658.50995	0
50	43601	448.21195	461.50465	-4524.3137	502.40083	313.93488	0
51	43601	451.55685	465.9208	-4799.8775	251.27966	157.01696	0
52	43601	453.75825	468.95295	-4988.9799	77.253187	48.273149	0

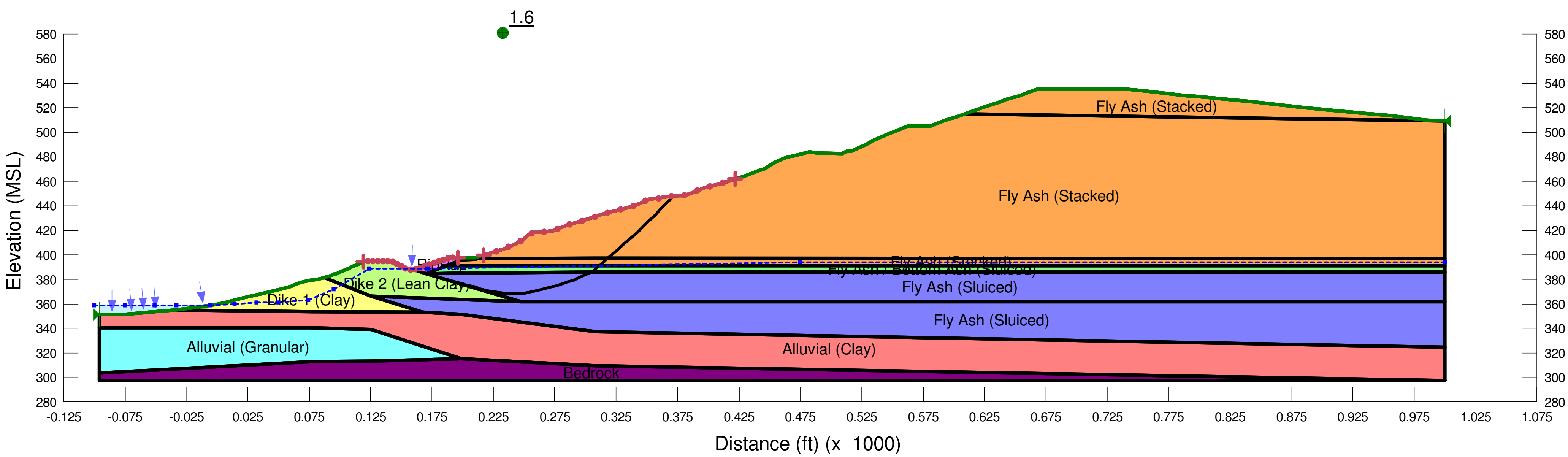
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

Stantec

File Name: Section F (Stability -TVABuildout).gsz
Analysis Name: Stability - Existing Condition with Existing PZ Levels
Date Saved: 10/26/2009
Last Solved On: 10/26/2009 at 3:13:38 PM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Fly Ash (Stacked)	100 pcf	0 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	32 °
RipRap	135 pcf	0 psf	38 °
Bedrock			

Analysis Method: Spencer
Calculated Factor of Safety: 1.6



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 227
Last Edited By: Rogers, Daniel
Date: 10/26/2009
Time: 3:07:56 PM
File Name: Section F (Stability -TVABuildout).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\Buildout\
Last Solved Date: 10/26/2009
Last Solved Time: 3:13:38 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

RipRap

Model: Mohr-Coulomb
Unit Weight: 135 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bedrock

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (119, 394.2769) ft
Left-Zone Right Coordinate: (196, 397.9986) ft
Left-Zone Increment: 20
Right Projection: Range
Right-Zone Left Coordinate: (217, 399.8946) ft
Right-Zone Right Coordinate: (422, 461.9095) ft
Right-Zone Increment: 20

Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-95.8093, 351.224) ft
Right Coordinate: (1000, 509.3361) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-100	359
	-75	359
	-51	359
	-33	359
	-6	359
	14	360
	32	361
	50	361
	74	363
	95	372
	124	389
	171	389
	475	394
	1000	394

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.6	(237.16, 526.106)	110.4817	(371.406, 447.881)	(159.097, 387.93)
2	8294	1.7	(237.16, 526.106)	154.333	(370.14, 447.781)	(165.221, 389.565)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	159.70655	387.7517	77.895571	138.52721	32.238415	100
2	Optimized	161.93885	387.09895	118.62556	297.84286	95.291528	100
3	Optimized	166.99135	385.62155	210.8179	792.75702	309.42252	100
4	Optimized	170.7105	384.53405	278.67661	1099.7217	331.72375	0
5	Optimized	172.4179	384.0348	311.28302	1224.2152	368.84853	0
6	Optimized	177.89585	382.40915	418.34279	1630.9338	489.91858	0

7	Optimized	183.0895	380.85995	520.3543	2013.9161	603.43815	0
8	Optimized	185.39045	380.21865	562.73892	2137.1974	636.1225	0
9	Optimized	188.2789	379.4686	612.48	2333.6776	695.40897	0
10	Optimized	194.37835	377.88475	717.58763	2504.1124	721.80284	0
11	Optimized	199.27775	376.6125	801.99728	2571.4663	714.91187	0
12	Optimized	200.77775	376.2082	828.76914	2632.0857	728.58718	0
13	Optimized	205.88675	374.80425	921.62214	2778.0926	750.06277	0
14	Optimized	210.29335	373.5933	1001.7017	2900.6079	767.2079	0
15	Optimized	211.1317	373.3629	1016.9465	2912.1573	765.71484	0
16	Optimized	211.82635	373.172	1029.5783	2927.8929	766.96886	0
17	Optimized	214.65545	372.39455	1080.9839	3118.8728	823.36056	0
18	Optimized	219.265	371.12785	1164.7606	3431.8141	915.94909	0
19	Optimized	221.56435	370.496	1206.548	3589.3838	962.72815	0
20	Optimized	224.7895	370.01785	1239.6971	3530.7664	925.65206	0
21	Optimized	230.46775	369.2737	1291.9602	3812.7737	1018.4748	0
22	Optimized	235.5214	368.6114	1338.4761	4081.8282	1108.3862	0
23	Optimized	239.50195	368.37265	1357.4545	4003.0009	1068.8701	0
24	Optimized	243.1678	368.47945	1354.5417	4162.8828	1134.6435	0
25	Optimized	247.31615	368.60035	1351.2534	4377.4094	1222.6464	0
26	Optimized	250.11465	368.6819	1349.0045	4559.0244	1296.9322	0
27	Optimized	251.28275	368.84395	1340.1147	4311.4476	1200.4964	0
28	Optimized	254.54255	369.61415	1295.4148	4454.4218	1276.3217	0
29	Optimized	260.06045	370.91785	1219.7336	4499.4985	1325.111	0
30	Optimized	266.66515	372.47835	1129.1393	4396.3829	1320.0521	0
31	Optimized	272.069	373.75515	1055.0221	4343.2346	1328.5241	0
32	Optimized	275.23115	374.50225	1011.6294	4363.1405	1354.0984	0
33	Optimized	281.1407	376.3671	901.33366	4213.9177	1338.3708	0
34	Optimized	286.6626	378.25685	789.0717	4217.2058	1385.0561	0
35	Optimized	289.2481	379.1417	736.52153	4208.3762	1402.7203	0
36	Optimized	290.8079	379.6755	704.82719	4202.023	1412.9588	0
37	Optimized	291.74065	380.0854	680.18722	4025.8438	1351.733	0
38	Optimized	295.51175	381.7741	578.68431	3973.7138	1371.6809	0
39	Optimized	301.3352	384.3819	421.92988	3893.1581	1402.4672	0
40	Optimized	304.68905	385.8838	331.65919	3848.32	1420.8232	0
41	Optimized	306.56585	387.30455	244.93174	3082.2036	1772.9242	0
42	Optimized	309.45115	389.76365	94.443883	2953.7487	1786.6919	0
43	Optimized	311.02305	391.10335	12.459953	2883.6143	1794.0964	0
44	Optimized	311.20315	391.2568	3.0683629	2875.4744	1794.8785	0
45	Optimized	313.15065	392.9166	-98.506565	2800.2541	1749.793	0
46	Optimized	316.4962	395.8123	-275.77072	2634.9766	1646.5161	0
47	Optimized	318.9049	397.93845	-405.97014	2538.613	1586.3015	0
48	Optimized	323.0848	401.628	-631.89407	2360.1968	1474.8146	0

49	Optimized	329.4763	407.2544	-976.42704	2087.7196	1304.552	0
50	Optimized	336.099	413.06815	-1332.3581	1801.9312	1125.9716	0
51	Optimized	340.65755	417.0699	-1577.4412	1618.1189	1011.1129	0
52	Optimized	343.4471	419.69315	-1738.2643	1454.8707	909.10412	0
53	Optimized	347.9691	424.12945	-2010.3999	1295.8571	809.7414	0
54	Optimized	353.7075	429.75915	-2355.8804	1038.9646	649.21714	0
55	Optimized	359.8539	435.94335	-2735.4117	675.7576	422.26021	0
56	Optimized	366.2089	442.50095	-3138.0677	308.90041	193.0224	0
57	Optimized	370.36515	446.8036	-3402.2822	64.618334	40.378016	0

Slices of Slip Surface: 8294

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	8294	165.7625	389.28245	-17.625006	115.37901	90.143961	0
2	8294	168.6519	387.8366	72.59632	651.26424	452.10493	0
3	8294	172.0605	386.1798	177.0667	1225.1164	818.82614	0
4	8294	174.2393	385.1871	241.24812	1388.8781	717.11881	0
5	8294	178.65675	383.3359	361.3033	1637.5325	515.63005	0
6	8294	184.25685	381.1443	503.8025	2085.0238	638.85488	0
7	8294	188.2789	379.72985	596.1881	2377.588	719.73228	0
8	8294	194.37835	377.89135	717.17893	2525.9532	730.79225	0
9	8294	200.2567	376.25815	825.11418	2581.0833	709.45756	0
10	8294	205.88675	375.0338	907.29099	2656.9547	706.91002	0
11	8294	210.29335	374.13	968.2096	2706.8991	702.47616	0
12	8294	211.1317	373.98495	978.13195	2702.3637	696.63483	0
13	8294	211.82635	373.8667	986.21328	2704.2901	694.14809	0
14	8294	214.65545	373.44715	1015.3048	2823.4507	730.53836	0
15	8294	219.265	372.82635	1058.7688	3008.6269	787.79382	0
16	8294	224.21045	372.34765	1093.7159	3187.7658	846.05109	0
17	8294	230.27475	371.95685	1124.3348	3383.3332	912.69462	0
18	8294	237.28745	371.8247	1139.7667	3598.9988	993.59426	0
19	8294	243.1678	371.90205	1140.9913	3795.4147	1072.4567	0
20	8294	247.31615	372.1244	1131.3612	3955.0713	1140.8529	0
21	8294	250.7328	372.3758	1119.1802	4148.2752	1223.8338	0
22	8294	254.54255	372.7784	1097.9576	4356.0971	1316.3738	0
23	8294	260.06045	373.50955	1057.9998	4397.6881	1349.3217	0

24	8294	266.66515	374.66765	992.52124	4256.2198	1318.6198	0
25	8294	272.069	375.7832	928.46767	4157.5956	1304.6524	0
26	8294	276.6992	376.9556	860.05511	4135.3176	1323.2919	0
27	8294	282.60875	378.6496	760.41182	4108.4199	1352.683	0
28	8294	286.6626	379.93255	684.49502	4072.5429	1368.8602	0
29	8294	289.2481	380.83775	630.68968	4031.183	1373.8885	0
30	8294	291.66725	381.72285	577.93061	3987.4404	1377.5314	0
31	8294	297.28395	384.05755	438.01382	3858.6347	1382.0205	0
32	8294	303.1074	386.5787	286.67478	3622.0842	2084.1951	0
33	8294	306.1237	388.05485	197.65943	3529.3944	2081.8991	0
34	8294	309.5724	389.82765	90.574418	3419.6091	2080.2118	0
35	8294	311.45125	390.83145	29.865085	3355.1815	2077.8883	0
36	8294	312.05075	391.16235	9.831144	3332.1403	2076.0092	0
37	8294	316.1	393.56215	-135.75702	3176.4306	1984.8541	0
38	8294	320.86235	396.4488	-310.99848	2989.7274	1868.189	0
39	8294	324.56095	398.949	-463.21444	2816.0402	1759.6572	0
40	8294	329.9468	402.8268	-699.6696	2552.0346	1594.6882	0
41	8294	336.099	407.7453	-1000.2623	2225.5775	1390.6951	0
42	8294	342.34785	413.2367	-1336.5608	1905.5137	1190.6971	0
43	8294	347.9691	418.75945	-1675.4181	1633.7691	1020.8922	0
44	8294	353.88805	425.2558	-2074.6574	1263.705	789.65053	0
45	8294	360.0625	432.89995	-2545.3602	794.99325	496.76692	0
46	8294	366.23695	441.69145	-3087.5699	306.78023	191.69756	0
47	8294	369.73225	447.0968	-3421.2547	34.263985	21.410514	0

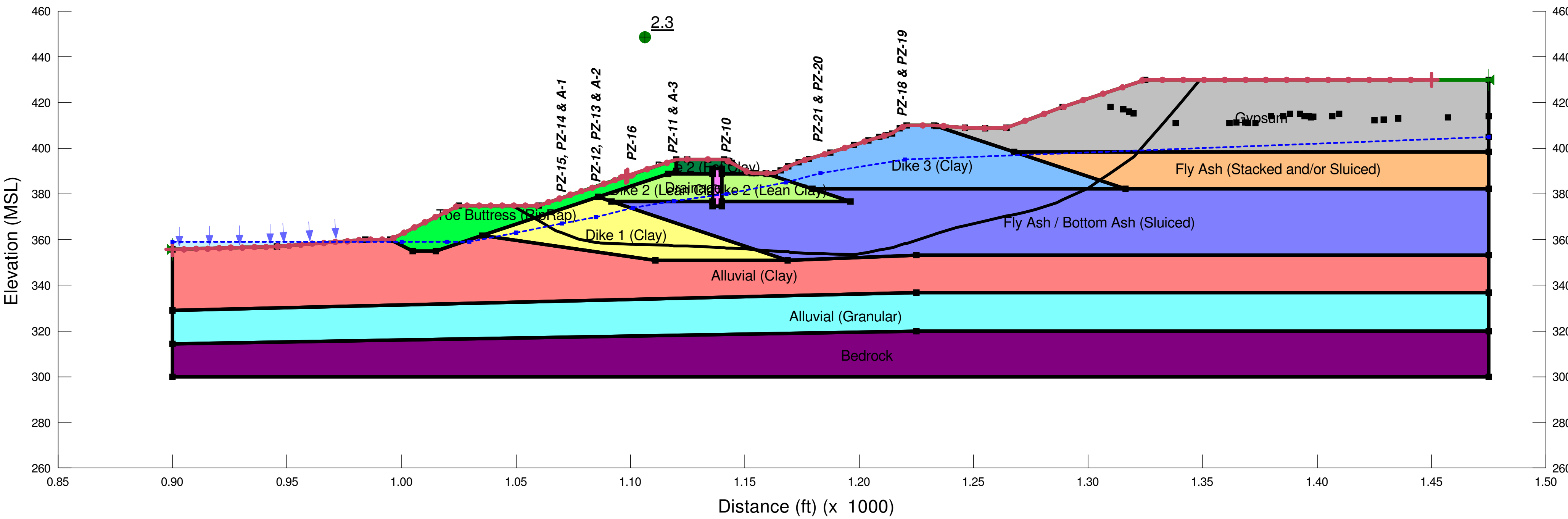
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

File Name: Section H (Stability - Repair Design-Buildout 430).gsz
Analysis Name: Stability - Existing Condition with Drainage Trench
Date Saved: 10/13/2009
Last Solved on 10/13/2009 at 2:33:18 AM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	125 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Dike 3 (Clay)	125 pcf	100 psf	25 °
Alluvial (Clay)	125 pcf	200 psf	28 °
Alluvial (Granular)	125 pcf	0 psf	30 °
Gypsum	100 pcf	0 psf	35 °
Fly Ash (Stacked and/or Sluiced)	100 pcf	0 psf	25 °
Fly Ash / Bottom Ash (Sluiced)	95 pcf	0 psf	25 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Toe Buttress (RipRap)	150 pcf	0 psf	38 °
Drainage Trench	130 pcf	0 psf	30 °
Bedrock			

Analysis Method: Spencer
Calculated Factor of Safety: 2.3



Stability - Existing Condition with Drainage Trench

File Information

Created By: Cooper, Paul
Revision Number: 206
Last Edited By: Rogers, Daniel
Date: 10/13/2009
Time: 2:31:16 AM
File Name: Section H (Stability - Repair Design-Buildout 430).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\Buildout\
Last Solved Date: 10/13/2009
Last Solved Time: 2:33:18 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Drainage Trench

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 50 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 200 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked and/or Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 95 pcf
Cohesion: 0 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Toe Buttress (RipRap)

Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °

Pore Water Pressure
Piezometric Line: 1

Drainage Trench

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bedrock

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (900, 355.68471) ft
Left-Zone Right Coordinate: (1097.9798, 387.65993) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (1098.8988, 387.96627) ft
Right-Zone Right Coordinate: (1450, 430) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (900, 355.68471) ft
Right Coordinate: (1475, 430) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	900	359
	1000	359
	1019.69	359
	1029.71	359.014
	1050	363
	1070	367
	1085	370

	1101	374
	1119	377
	1142	380
	1168	385
	1183	389
	1220	395
	1475	405

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	2.3	(1161.57, 644.289)	136.029	(1348.94, 430)	(1048.31, 375)
2	39071	2.4	(1161.57, 644.289)	291.831	(1359.68, 430)	(1049.11, 375)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	1049.157	374.5132	-728.78287	107.84857	84.260534	0
2	Optimized	1054.0405	371.6934	-492.04266	732.58256	572.35622	0
3	Optimized	1059.0405	368.80645	-249.49542	1209.5886	564.04043	100
4	Optimized	1062.092	367.04465	-101.47687	1595.4586	743.97458	100
5	Optimized	1065.8645	364.86645	81.523027	2133.538	956.8703	100
6	Optimized	1068.7725	363.44105	206.75616	2288.0058	970.50265	100
7	Optimized	1073.655	361.63125	380.61517	2774.4076	1116.2438	100
8	Optimized	1081.155	359.5849	601.91454	3192.004	1207.7785	100
9	Optimized	1085.4	358.82135	703.7945	3483.6025	1296.2458	100
10	Optimized	1086.421	358.6377	731.1755	3554.9372	1316.7417	100
11	Optimized	1089.392	358.44065	789.8141	3548.7514	1286.5136	100
12	Optimized	1095.986	358.20115	907.62936	3827.0066	1361.328	100
13	Optimized	1100.615	358.033	990.33188	4003.5135	1405.0697	100
14	Optimized	1104.85	357.8792	1045.9727	4165.6949	1454.7504	100
15	Optimized	1112.74	357.59265	1145.9153	4471.5569	1550.7722	100
16	Optimized	1117.89	357.4056	1211.1382	4664.9417	1610.535	100
17	Optimized	1119.5	357.34715	1230.3892	4726.0855	1630.07	100
18	Optimized	1122.4485	357.24005	1261.099	4610.7108	1561.9496	100
19	Optimized	1127.7695	357.04675	1316.4578	4578.545	1521.1362	100
20	Optimized	1133.321	356.79955	1377.0681	4574.1981	1490.8462	100
21	Optimized	1138	356.55005	1430.7173	4661.627	1506.5979	100
22	Optimized	1140.4695	356.4184	1458.982	4546.1249	1439.5584	100
23	Optimized	1141.4695	356.3651	1470.544	4519.8155	1421.8987	100
24	Optimized	1142.1845	356.32695	1479.4228	4486.8428	1402.383	100

25	Optimized	1142.783	356.295	1488.59	4459.3811	1385.3027	100
26	Optimized	1143.7615	356.2428	1503.5772	4400.869	1351.0294	100
27	Optimized	1147.4045	356.04855	1559.4176	4100.7773	1185.0555	100
28	Optimized	1151.7415	355.8173	1625.8934	3768.0397	998.89924	100
29	Optimized	1153.069	355.7465	1646.2491	3695.9801	955.80523	100
30	Optimized	1153.9595	355.68465	1660.8022	3711.9706	956.47553	100
31	Optimized	1156.91	355.4757	1709.2327	3713.1365	934.43569	0
32	Optimized	1159.3195	355.30505	1748.7948	3728.264	923.04164	0
33	Optimized	1161.427	355.1558	1783.4031	3739.5036	912.14467	0
34	Optimized	1164.505	354.9378	1833.9547	3842.5508	936.62376	0
35	Optimized	1166.878	354.7697	1872.9264	4019.0787	1000.7672	0
36	Optimized	1168.4915	354.6554	1901.655	4138.6514	1043.1286	0
37	Optimized	1169.337	354.59555	1919.4396	4197.7175	1062.3784	0
38	Optimized	1171.534	354.43995	1965.7556	4339.2067	1106.7584	0
39	Optimized	1175.462	354.16175	2048.4622	4548.7097	1165.8846	0
40	Optimized	1177.728	354.0093	2095.703	4593.6393	1164.8068	0
41	Optimized	1178.692	353.98375	2113.3294	4631.8944	1174.4262	0
42	Optimized	1181.2375	353.9163	2159.8945	4714.9412	1191.4378	0
43	Optimized	1185.1835	353.81175	2217.8433	4831.4808	1218.7591	0
44	Optimized	1191.762	353.63745	2295.2649	5039.984	1279.8836	0
45	Optimized	1196.9445	353.50015	2356.2747	5218.4991	1334.6772	0
46	Optimized	1198.0245	353.47155	2368.9823	5266.2067	1350.9979	0
47	Optimized	1201.2335	353.9995	2368.4795	5078.0834	1263.5091	0
48	Optimized	1206.5015	354.96715	2361.36	5190.5169	1319.2575	0
49	Optimized	1210.2435	355.6545	2356.4389	5259.602	1353.7672	0
50	Optimized	1213.054	356.17075	2352.6467	5302.5875	1375.58	0
51	Optimized	1214.4945	356.43535	2350.7195	5325.8093	1387.3072	0
52	Optimized	1216.135	356.9557	2334.8566	5241.2147	1355.257	0
53	Optimized	1218.8775	357.83035	2308.0285	5348.9369	1417.9989	0
54	Optimized	1220.293	358.2819	2291.9503	5383.2481	1441.4959	0
55	Optimized	1226.6745	360.3172	2180.5618	5215.8224	1415.3653	0
56	Optimized	1233.2055	362.40015	2066.5912	5023.0321	1378.611	0
57	Optimized	1238.1875	363.9891	1979.6048	4805.5129	1317.7426	0
58	Optimized	1244.3885	365.81105	1881.0636	4651.354	1291.8076	0
59	Optimized	1250.539	367.196	1809.6571	4459.7566	1235.7617	0
60	Optimized	1259.737	369.26715	1702.9698	4203.0412	1165.8025	0
61	Optimized	1265.9795	370.67285	1630.5219	4087.5158	1145.7151	0
62	Optimized	1269.712	371.5134	1587.2192	4111.3899	1177.0401	0
63	Optimized	1274.4395	372.578	1532.3412	4141.4055	1216.6266	0
64	Optimized	1281.63	374.7065	1417.1789	4028.1731	1217.5266	0
65	Optimized	1287.591	376.85165	1297.8432	3878.1601	1203.2215	0
66	Optimized	1294.399	379.9235	1122.8091	3762.6349	1230.971	0
67	Optimized	1302.4825	384.19875	875.82989	3289.6442	1125.5801	100
68	Optimized	1307.175	387.4602	683.81383	3096.5082	1125.0578	0
69	Optimized	1314.71	392.69675	375.47914	2841.6563	1149.9973	0

70	Optimized	1321.0315	397.4815	92.382996	2317.5152	1037.5962	0
71	Optimized	1322.1635	398.7585	15.468153	2083.5458	1448.0836	0
72	Optimized	1323.6405	400.42495	-84.901964	1999.7324	1400.2277	0
73	Optimized	1328.8305	406.28005	-437.55865	1626.7786	1139.0826	0
74	Optimized	1336.8125	415.5441	-996.10985	972.41756	680.89411	0
75	Optimized	1344.895	425.18135	-1577.6841	324.13919	226.9647	0

Slices of Slip Surface: 39071

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	39071	1049.5535	374.81435	-742.69091	36.383387	28.425817	0
2	39071	1055	372.6669	-540.82082	450.9695	352.33598	0
3	39071	1060.502	370.51985	-338.17184	886.18349	692.36242	0
4	39071	1065.502	368.76615	-166.33993	1342.5379	626.03569	100
5	39071	1070.1865	367.13615	-6.1676789	1792.9151	836.05005	100
6	39071	1077.6865	364.8789	228.2832	2429.18	1026.295	100
7	39071	1085.4	362.57505	469.55025	3069.519	1212.3853	100
8	39071	1088.771	361.70155	576.6498	3334.1412	1285.8394	100
9	39071	1095.986	359.95715	798.05589	3827.6194	1412.7087	100
10	39071	1100.615	358.8959	936.49203	4109.9661	1479.8153	100
11	39071	1108.89	357.36495	1120.0588	4566.9978	1607.3341	100
12	39071	1117.89	355.74815	1314.5694	5042.0924	1738.1725	100
13	39071	1119.5	355.50725	1345.1974	5120.2405	1760.3315	100
14	39071	1122.4485	355.10315	1394.4346	5022.9515	1692.0052	100
15	39071	1130.4485	354.1763	1517.3795	5012.7971	1629.94	100
16	39071	1138	353.4186	1626.1184	5096.2905	1618.1679	100
17	39071	1140.4695	353.2225	1658.406	4976.0682	1547.0513	100
18	39071	1141.4695	353.15185	1671.0087	4947.0503	1527.6433	100
19	39071	1142.1845	353.1029	1680.5972	4911.8028	1506.7359	100
20	39071	1142.783	353.0639	1690.2323	4882.2909	1488.4814	100
21	39071	1143.7615	353.00265	1705.7336	4820.386	1452.3863	100
22	39071	1147.4045	352.81845	1761.0023	4503.2411	1278.727	100
23	39071	1151.7415	352.6264	1825.0051	4150.6991	1084.489	100
24	39071	1153.8905	352.56055	1854.9349	4062.2099	1029.2692	100
25	39071	1156.91	352.50305	1894.721	4026.4905	994.06043	100
26	39071	1159.3195	352.46685	1925.9148	3996.8485	965.69223	100
27	39071	1161.427	352.46375	1951.3944	3965.6258	939.25151	100

28	39071	1163.8255	352.46725	1979.9789	3967.8298	926.9501	100
29	39071	1165.0765	352.47985	1994.2066	4033.589	950.9796	0
30	39071	1166.878	352.5084	2014.0176	4142.8661	992.69834	0
31	39071	1168.4915	352.54045	2033.7077	4239.5775	1028.6139	0
32	39071	1169.337	352.5615	2046.4017	4286.3742	1044.5164	0
33	39071	1171.534	352.63385	2078.4569	4394.1806	1079.8397	0
34	39071	1175.643	352.8062	2136.0679	4545.6178	1123.5916	0
35	39071	1178.692	352.9616	2177.1218	4628.4082	1143.0536	0
36	39071	1181.2375	353.1266	2209.1802	4677.8544	1151.1617	0
37	39071	1185.1835	353.42285	2242.1165	4738.589	1164.1242	0
38	39071	1191.762	354.0572	2269.0394	4838.5126	1198.165	0
39	39071	1196.9445	354.61045	2287.0332	4924.754	1229.9894	0
40	39071	1200.941	355.14355	2294.1728	5017.2005	1269.7687	0
41	39071	1206.5015	355.94695	2300.395	5134.3977	1321.5171	0
42	39071	1210.2435	356.54855	2300.6424	5195.7539	1350.0127	0
43	39071	1213.054	357.0382	2298.5303	5229.1305	1366.5613	0
44	39071	1216.1145	357.60475	2294.1563	5342.6994	1421.559	0
45	39071	1218.8775	358.14165	2288.5915	5475.3961	1486.0314	0
46	39071	1220.293	358.4267	2282.8278	5519.8127	1509.4309	0
47	39071	1226.6745	359.88055	2207.7807	5372.1142	1475.553	0
48	39071	1233.2055	361.38625	2129.8482	5198.4333	1430.9047	0
49	39071	1239.849	363.22525	2031.3081	4899.6541	1337.5317	0
50	39071	1250.539	366.3892	1860.0057	4436.198	1201.2982	0
51	39071	1259.737	369.50845	1687.9616	4055.9674	1104.2193	0
52	39071	1265.9795	371.7783	1561.5477	3843.1353	1063.9218	0
53	39071	1269.712	373.24325	1479.2684	3795.2051	1079.939	0
54	39071	1276.156	375.93295	1327.2094	3697.6827	1105.3699	0
55	39071	1284.6455	379.7198	1111.6412	3546.7208	1135.4963	0
56	39071	1289.3985	381.94215	984.66318	3451.5789	1150.3417	0
57	39071	1295.123	384.87535	815.60855	3215.134	1118.9171	100
58	39071	1304.816	390.08345	514.34359	2903.3564	1114.015	0
59	39071	1314.1005	395.55395	195.70272	2639.9606	1139.7762	0
60	39071	1319.2205	398.7025	11.763201	2384.738	1661.5748	0
61	39071	1322.2115	400.6694	-103.6522	2290.9147	1604.1157	0
62	39071	1330.688	406.56015	-450.49476	1855.1727	1299.0059	0
63	39071	1342.284	415.25965	-964.98396	1136.8721	796.04645	0
64	39071	1353.8805	424.91725	-1539.1918	381.0628	266.82305	0

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant
Tennessee Valley Authority (TVA)

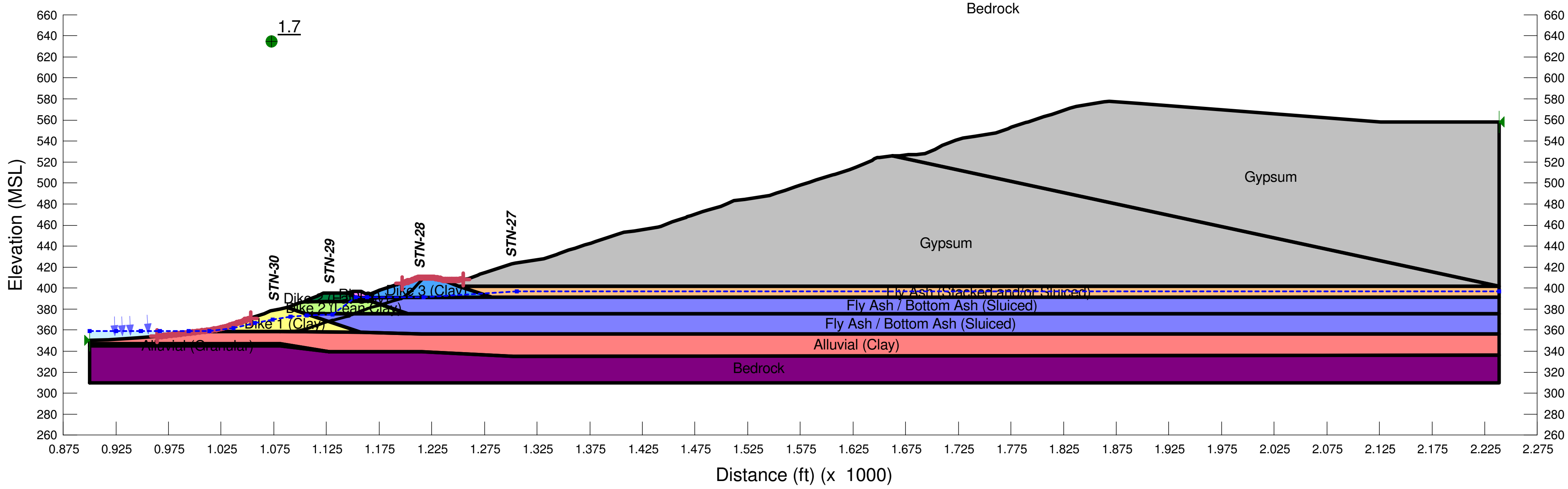
File Name: Section J (Stability - Repair Design-TVABuildout).gsz
Analysis Name: Stability - Existing Condition with Existing PZ Levels
Date Saved: 10/23/2009
Last Solved On: 10/23/2009 at 2:18:26 PM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Stacked and/or Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Riprap	135 pcf	0 psf	38 °
Bedrock			

Analysis Method: Spencer

Calculated Factor of Safety: 1.7



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Kirkbride, Rob
Revision Number: 97
Last Edited By: Rogers, Daniel
Date: 10/23/2009
Time: 2:04:15 PM
File Name: Section J (Stability - Repair Design-TVABuildout).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\Buildout\
Last Solved Date: 10/23/2009
Last Solved Time: 2:18:26 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 126 pcf
Cohesion: 50 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked and/or Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Riprap

Model: Mohr-Coulomb
Unit Weight: 135 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °

Pore Water Pressure
Piezometric Line: 1

Bedrock

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (963.8717, 354) ft
Left-Zone Right Coordinate: (1053, 371.1753) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (1197, 404.7296) ft
Right-Zone Right Coordinate: (1255, 408.4223) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (900, 350.1427) ft
Right Coordinate: (2238.9108, 558.0038) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	900	359
	925	359
	949	359
	967	359
	994	359
	1014	359
	1037	362
	1057	367
	1074	370
	1091	373
	1106	374
	1131	375
	1152.4982	391.2342
	1163.5128	391.2682
	1217	391.5

	1306	397
	2238.91	397

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.7	(1053.52, 656.989)	91.30133	(1217.5, 409.977)	(1020.29, 360.854)
2	31038	1.8	(1053.52, 656.989)	298.585	(1221.25, 409.968)	(1018.2, 360.5)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	1021.465	360.4905	-32.246833	127.80692	59.597347	100
2	Optimized	1024.1715	359.6524	42.076689	324.1632	131.5391	100
3	Optimized	1027.057	358.75885	121.32067	559.36331	204.26263	100
4	Optimized	1029.725	358.34275	168.99982	624.32811	212.32307	100
5	Optimized	1034.02	358.3524	203.35519	810.68588	283.20295	100
6	Optimized	1037.6875	358.36065	237.82848	972.66038	342.65774	100
7	Optimized	1042.421	358.37125	311.00461	1185.1296	407.61119	100
8	Optimized	1050.871	358.3902	441.63917	1569.652	526.00101	100
9	Optimized	1056.1375	358.40205	523.06233	1812.2059	601.13752	100
10	Optimized	1058.8665	358.40815	556.69113	1940.6644	645.35735	100
11	Optimized	1060.8365	358.41255	578.09338	2033.409	678.62482	100
12	Optimized	1062.052	358.3963	592.51566	2108.7605	707.03658	100
13	Optimized	1064.412	358.37695	619.67957	2208.2646	740.76936	100
14	Optimized	1068.642	358.36735	666.8662	2413.6425	814.53516	100
15	Optimized	1072.812	358.35795	713.3941	2612.6781	885.65065	100
16	Optimized	1074.3125	358.35455	730.12131	2678.1246	908.36887	100
17	Optimized	1077.438	358.34745	764.97374	2766.3552	933.25952	100
18	Optimized	1080.311	358.34385	796.83595	2780.4418	924.97058	100
19	Optimized	1083.866	358.5064	825.83408	2853.7311	945.62391	100
20	Optimized	1088.2095	358.705	861.30084	2946.0197	972.12035	100
21	Optimized	1090.029	358.78825	876.12454	3006.1261	993.23606	100
22	Optimized	1091.286	358.84575	884.41506	3057.8608	1013.4944	100
23	Optimized	1091.7845	358.8847	884.0616	2975.4628	975.2364	100
24	Optimized	1093.6695	359.11415	877.58712	3035.6899	1006.3399	100
25	Optimized	1096.44	359.4513	868.05972	3129.7265	1054.6325	100
26	Optimized	1098.3545	359.7499	857.42729	3084.074	1038.3024	100
27	Optimized	1100.3705	360.15715	840.35811	3139.0015	1071.875	100
28	Optimized	1102.785	360.64485	819.98622	3163.6165	1092.8527	100
29	Optimized	1104.559	361.00325	804.99805	3187.3802	1110.9231	100
30	Optimized	1105.141	361.1229	799.96599	3102.0936	1073.4997	100
31	Optimized	1105.582	361.2522	793.71991	3118.8615	1084.2313	100
32	Optimized	1106.234	361.44345	784.11846	3143.5638	1100.2274	100

33	Optimized	1108.0905	361.98775	754.77546	3162.5926	1122.7836	100
34	Optimized	1111.029	362.84925	708.36888	3181.2978	1153.1457	100
35	Optimized	1114.3985	363.9599	647.47339	3110.7288	1148.6349	100
36	Optimized	1119.2485	365.6718	552.74402	3106.7299	1190.9432	100
37	Optimized	1124.408	367.493	451.98444	2993.0101	1184.8997	100
38	Optimized	1128.8855	368.8813	376.52042	2948.8992	1039.3085	0
39	Optimized	1131.4435	369.5518	360.87465	2886.0159	1020.2233	0
40	Optimized	1134.892	370.45555	466.95808	2802.3279	943.55068	0
41	Optimized	1140.9015	372.0305	651.8483	2656.4891	809.92744	0
42	Optimized	1145.239	373.16735	785.32246	2609.2387	736.90998	0
43	Optimized	1146.8995	373.6515	833.33357	2504.2943	675.11198	0
44	Optimized	1147.7135	373.9867	850.78292	2508.6555	669.82402	0
45	Optimized	1149.1	374.55765	880.50166	2518.8235	661.92499	0
46	Optimized	1150.901	375.2991	919.06613	2498.5089	638.13632	0
47	Optimized	1152.15	375.8134	945.84512	2427.793	787.96568	100
48	Optimized	1152.6885	376.0353	948.43732	2405.6567	774.81729	100
49	Optimized	1154.653	376.84415	898.35834	2314.2234	752.82882	100
50	Optimized	1157.2135	377.89835	833.03794	2187.6137	720.24071	100
51	Optimized	1159.553	378.86165	773.41747	1949.4562	625.31089	100
52	Optimized	1162.053	379.8011	715.28267	1707.1957	527.40949	100
53	Optimized	1163.068	380.1227	695.3903	1591.059	476.23552	100
54	Optimized	1163.3245	380.20395	690.36276	1577.896	471.90981	100
55	Optimized	1164.413	380.5488	669.1575	1519.7007	452.24183	100
56	Optimized	1165.6565	380.94275	644.89175	1454.5366	430.49578	100
57	Optimized	1166.5	381.2099	628.44859	1437.873	430.37858	100
58	Optimized	1168.1775	381.7413	595.73111	1438.8469	448.29261	100
59	Optimized	1172.5415	383.0318	516.38792	1469.5478	506.8041	100
60	Optimized	1176.139	384.06765	452.72312	1483.4757	548.06088	100
61	Optimized	1178.477	384.74095	411.34565	1528.8276	451.49202	0
62	Optimized	1184.1605	386.3775	310.76347	1592.6388	517.91125	0
63	Optimized	1191.673	388.5407	177.81119	1648.6645	594.2633	0
64	Optimized	1195.6085	389.674	108.15701	1678.2459	634.35707	0
65	Optimized	1196.574	390.35455	65.949747	1361.9246	523.60785	0
66	Optimized	1197.631	391.2003	13.461531	1250.3708	714.12988	50
67	Optimized	1201.7195	394.47345	-189.68164	1062.6588	613.52637	50
68	Optimized	1206.739	398.49185	-439.0718	843.39458	486.93409	50
69	Optimized	1210.175	401.9142	-651.68351	574.04124	331.42286	50
70	Optimized	1214.7045	406.90275	-961.75231	235.57719	136.01056	50
71	Optimized	1217.248	409.70415	-1134.9874	5.677716	3.2780309	50

Slices of Slip Surface: 31038

							Cohesive

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Strength (psf)
1	31038	1020.1605	360.27965	-29.708188	98.507696	45.934893	100
2	31038	1023.9125	359.8808	25.716654	238.14021	99.05473	100
3	31038	1028.372	359.4768	87.221597	444.99634	166.8331	100
4	31038	1034.02	359.0563	159.43248	746.49056	273.74968	100
5	31038	1037.6875	358.8248	208.85956	938.62286	340.29422	100
6	31038	1042.421	358.63785	294.3649	1172.2108	409.34627	100
7	31038	1050.871	358.44835	438.01283	1568.2319	527.02982	100
8	31038	1056.1375	358.4169	522.13331	1802.3429	596.97154	100
9	31038	1058.8665	358.45795	553.57684	1917.7005	636.10131	100
10	31038	1063.1965	358.5713	594.19487	2090.4039	697.69372	100
11	31038	1068.642	358.80245	639.72076	2298.3528	773.43283	100
12	31038	1072.812	359.03065	671.41886	2447.0859	828.00715	100
13	31038	1074.3125	359.1294	681.76701	2492.0937	844.16921	100
14	31038	1077.498	359.3827	701.02914	2534.8142	855.10803	100
15	31038	1083.866	359.9713	734.42621	2600.8082	870.3082	100
16	31038	1088.2095	360.4277	753.78516	2642.3441	880.64949	100
17	31038	1090.029	360.64665	760.1751	2676.7362	893.70714	100
18	31038	1091.4985	360.83025	761.47245	2715.0059	910.94762	100
19	31038	1093.6695	361.1212	752.34857	2771.6265	941.60478	100
20	31038	1097.2565	361.6317	735.40449	2870.0539	995.40337	100
21	31038	1100.3705	362.10575	718.78285	2960.4861	1045.3234	100
22	31038	1102.785	362.4996	704.25679	2986.2323	1064.1026	100
23	31038	1104.582	362.8039	692.74288	3010.8323	1080.9428	100
24	31038	1105.582	362.97895	685.97885	3066.0114	1109.8274	100
25	31038	1106.234	363.095	681.05822	3098.1077	1127.0887	100
26	31038	1108.0905	363.4386	664.2506	3134.4581	1151.8767	100
27	31038	1113.0825	364.4262	615.07929	3202.0535	1206.3259	100
28	31038	1119.2485	365.74335	548.27724	3271.8393	1270.0178	100
29	31038	1125.182	367.15025	475.31075	3167.6037	1255.4368	100
30	31038	1129.6595	368.27945	416.01422	3003.7937	1045.5308	0
31	31038	1131.4435	368.75285	410.72592	2951.7865	1026.6551	0
32	31038	1134.892	369.72395	512.61352	2848.1375	943.61295	0
33	31038	1140.9015	371.4948	685.28124	2663.9837	799.44768	0
34	31038	1145.5665	372.95255	814.12471	2586.9903	716.28418	0
35	31038	1147.7135	373.65245	871.63171	2607.8769	701.48857	0
36	31038	1149.1	374.1184	907.89945	2622.692	692.82115	0
37	31038	1151.249	374.8552	963.18161	2596.2595	659.80631	0
38	31038	1152.6885	375.355	990.89861	2553.7246	631.42269	0
39	31038	1153.229	375.54605	979.08386	2535.3227	628.76129	0
40	31038	1155.003	376.18465	939.58606	2437.2701	796.33274	100
41	31038	1157.2135	376.99055	889.70496	2329.3649	765.48077	100
42	31038	1160.5	378.2413	812.28827	1968.0294	614.51847	100

43	31038	1163.068	379.2277	751.23205	1648.4139	477.04003	100
44	31038	1163.3245	379.32905	744.97364	1632.6717	471.99744	100
45	31038	1164.413	379.76365	718.13795	1563.176	449.31469	100
46	31038	1165.6565	380.2629	687.30619	1484.9474	424.11338	100
47	31038	1166.5	380.6064	666.10202	1457.9804	421.04922	100
48	31038	1171.364	382.68565	537.67759	1386.645	451.40397	100
49	31038	1178.066	385.6337	355.5361	1343.7648	399.2703	0
50	31038	1184.7545	388.8361	157.50663	1282.206	454.40804	0
51	31038	1189.513	391.17395	12.910777	1175.6119	671.2858	50
52	31038	1192.675	392.83355	-89.793488	1090.9621	629.86728	50
53	31038	1200.483	397.14305	-356.59605	872.82547	503.92602	50
54	31038	1208.973	402.09695	-663.42156	647.07054	373.58635	50
55	31038	1214.7045	405.6646	-884.49026	416.09159	240.23059	50
56	31038	1219.1235	408.5524	-1055.8807	128.63911	74.269825	50

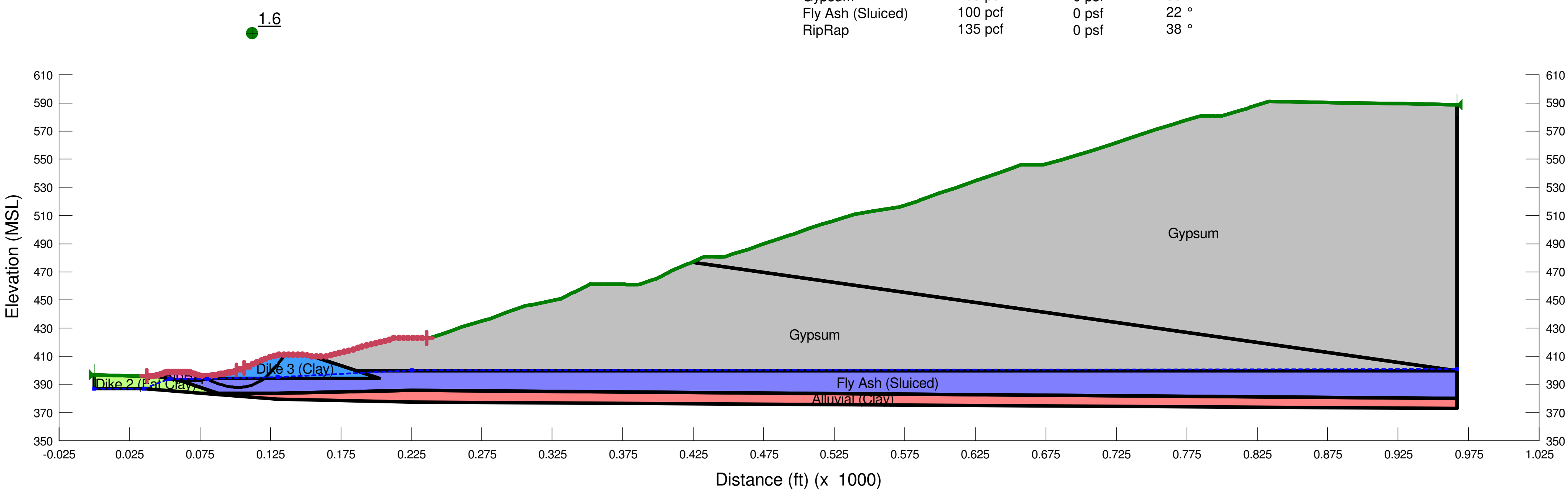
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

Stantec

File Name: Section M (Stability - Repair Design-TVABuildout).gsz
Analysis Name: Stability - Buildout w Existing PZ Levels
Date Saved: 10/23/2009
Last Solved On: 10/23/2009 at 4:44:38 PM

Analysis Method: Spencer
Calculated Factor of Safety: 1.6

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
RipRap	135 pcf	0 psf	38 °



Stability - Buildout w Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 224
Last Edited By: Rogers, Daniel
Date: 10/23/2009
Time: 4:42:37 PM
File Name: Section M (Stability - Repair Design-TVABuildout).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\Buildout\
Last Solved Date: 10/23/2009
Last Solved Time: 4:44:38 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Buildout w Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30
- Optimization Tolerance: 0.01
- Minimum Slip Surface Depth: 10 ft
- Optimization Maximum Iterations: 5000

Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 126 pcf
Cohesion: 50 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf

Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

RipRap

Model: Mohr-Coulomb
Unit Weight: 135 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (37.378, 396.03165) ft
Left-Zone Right Coordinate: (101, 399.8229) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (106.1173, 401.84614) ft
Right-Zone Right Coordinate: (236, 422.94773) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (0, 396.66) ft
Right Coordinate: (966.79, 588.92493) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	0	387
	35.5	387
	53.5	394.1
	80	394.1
	130	395
	225	400
	966.79	401

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.6	(100.123, 424.876)	30.85641	(135.599, 411.003)	(76.1043, 395.998)
2	32075	1.6	(100.123, 424.876)	36.981	(134.401, 410.997)	(77.0226, 395.998)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	77.0782	395.5261	-88.989943	112.0135	87.51454	0
2	Optimized	79.026065	394.5817	-30.056279	336.03589	262.54001	0
3	Optimized	80.009415	394.1049	-0.29541493	449.13161	350.90007	0
4	Optimized	80.080805	394.0703	1.9417208	455.78156	354.57854	0
5	Optimized	80.28001	393.9737	8.1951896	367.71311	145.25467	0
6	Optimized	80.44257	393.8949	13.295973	375.39586	146.29785	0
7	Optimized	80.7063	393.76185	21.894046	393.61387	150.18456	0
8	Optimized	81.0007	393.61275	31.530143	410.20409	152.9942	0
9	Optimized	81.1111	393.5568	35.14356	419.0137	155.0936	0
10	Optimized	82.2314	392.9893	71.812211	519.89681	181.03793	0
11	Optimized	84.3632	391.90945	141.5907	713.18426	230.93879	0
12	Optimized	86.84395	390.8227	212.18896	861.07097	262.16535	0
13	Optimized	89.40718	389.95905	268.96031	976.08393	285.69649	0
14	Optimized	91.91208	389.2679	314.90247	1115.3958	323.42029	0
15	Optimized	94.167885	388.7485	349.84757	1168.0065	330.55768	0
16	Optimized	95.96645	388.45835	369.97028	1241.0104	351.92304	0
17	Optimized	97.765015	388.1682	390.09848	1314.0142	373.28618	0
18	Optimized	99.1925	387.9379	406.07107	1386.4656	396.10511	0
19	Optimized	100.60875	387.8417	413.66688	1379.9405	390.39989	0
20	Optimized	102.69115	387.8159	417.61359	1488.0595	432.48821	0
21	Optimized	104.7898	387.9381	412.34555	1488.3362	434.72844	0
22	Optimized	106.59845	388.2121	397.2796	1551.1474	466.19286	0
23	Optimized	107.9655	388.41925	385.89215	1599.7461	490.42885	0
24	Optimized	109.2739	388.76425	365.83083	1531.4921	470.95771	0
25	Optimized	110.96535	389.31395	333.42761	1562.0792	496.40746	0
26	Optimized	112.6568	389.8637	301.02439	1592.6101	521.83449	0
27	Optimized	114.78635	390.79775	245.13566	1502.2029	507.88815	0
28	Optimized	117.27585	392.0759	168.17245	1500.8388	538.43214	0
29	Optimized	119.72935	393.5197	80.833621	1406.0143	535.40774	0
30	Optimized	121.22905	394.5956	15.385976	1137.3166	647.74695	50
31	Optimized	122.7156	396.07755	-75.420876	1062.1386	613.22602	50
32	Optimized	124.50325	397.85965	-184.61513	968.89483	559.39169	50
33	Optimized	126.12605	399.5689	-289.44995	834.89688	482.02794	50
34	Optimized	128.28735	401.97475	-437.13639	672.23216	388.11342	50

35	Optimized	129.5106	403.3824	-523.61215	571.88468	330.17777	50
36	Optimized	129.8212	403.759	-546.75745	545.44086	314.91043	50
37	Optimized	130.90365	405.0716	-625.49505	443.07073	255.807	50
38	Optimized	132.75515	407.3764	-763.24648	256.45616	148.06503	50
39	Optimized	134.6509	409.7944	-907.88284	71.911351	41.518038	50

Slices of Slip Surface: 32075

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	32075	78.321105	395.04915	-59.225677	308.3764	240.93005	0
2	32075	79.719575	394.0339	4.1261113	570.35458	442.38616	0
3	32075	79.895265	393.9183	11.339921	416.44559	163.67332	0
4	32075	79.9855	393.8594	15.015337	422.02708	164.44342	0
5	32075	80.20916	393.7163	24.177778	434.93009	165.95471	0
6	32075	80.68151	393.41995	43.201015	461.17928	168.87418	0
7	32075	81.0007	393.22345	55.820359	480.15352	171.44172	0
8	32075	81.1111	393.157	60.090503	489.2666	173.3984	0
9	32075	82.104505	392.6002	95.953075	575.12334	193.59735	0
10	32075	83.982515	391.62025	159.20836	722.91661	227.75292	0
11	32075	85.860525	390.7718	214.26354	848.24113	256.14357	0
12	32075	87.738535	390.04525	261.71073	954.49864	279.90448	0
13	32075	89.61655	389.433	302.0235	1044.2171	299.8657	0
14	32075	91.56915	388.91355	336.62981	1121.5875	317.14348	0
15	32075	93.596335	388.49065	365.29481	1186.9144	331.95585	0
16	32075	95.62352	388.1845	386.67276	1237.8738	343.90754	0
17	32075	97.650705	387.99225	400.94776	1275.461	353.32628	0
18	32075	100.08055	387.9227	408.01383	1338.2868	375.85467	0
19	32075	102.4978	387.9855	406.81547	1414.8044	407.25398	0
20	32075	104.4998	388.16925	397.59347	1468.4701	432.66223	0
21	32075	106.5018	388.46395	381.45423	1507.957	455.13667	0
22	32075	108.57375	388.8908	357.14967	1536.3749	476.43793	0
23	32075	110.7156	389.4626	323.87206	1552.3315	496.32982	0
24	32075	112.8574	390.1759	281.76854	1551.467	512.9915	0
25	32075	114.99925	391.03975	230.27262	1533.1847	526.41067	0
26	32075	116.8767	391.9206	177.41747	1503.2653	535.67731	0
27	32075	118.4897	392.79225	124.83657	1465.1967	541.54066	0
28	32075	120.1027	393.77195	65.51068	1415.3207	545.35865	0
29	32075	121.3103	394.5704	17.046899	1298.1594	739.65065	50
30	32075	122.83085	395.72275	-53.151361	1205.0672	695.74588	50
31	32075	124.899	397.45175	-158.71867	1057.929	610.79557	50
32	32075	126.79635	399.29805	-271.79775	892.20345	515.1139	50

33	32075	128.6937	401.44405	-403.58119	708.79887	409.22522	50
34	32075	129.8212	402.84175	-489.51854	591.74457	341.64389	50
35	32075	131.1002	404.77845	-606.57301	416.20575	240.2965	50
36	32075	133.3006	408.7356	-846.25342	110.13184	63.584647	50

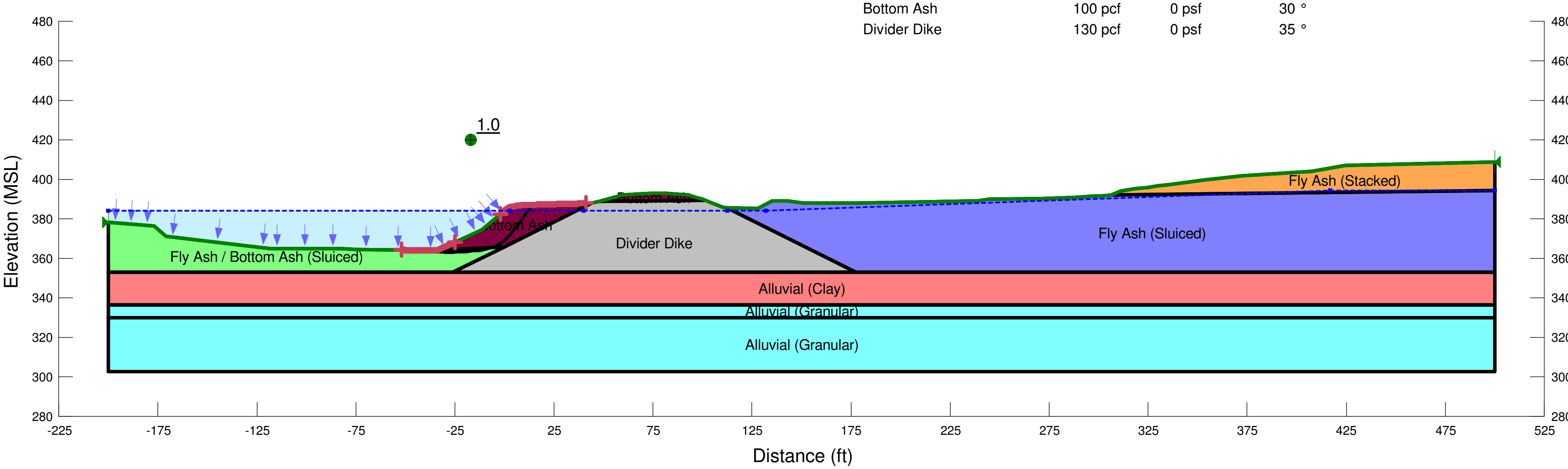
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section A_Extended.gsz
Analysis Name: Stability - Existing Condition (Shallow Failure)
Date Saved: 10/22/2009
Last Solved on 10/22/2009 at 11:01:40 AM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Fly Ash (Stacked)	100 pcf	0 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Bottom Ash	100 pcf	0 psf	30 °
Divider Dike	130 pcf	0 psf	35 °

Analysis Method: Spencer
Calculated Factor of Safety: 1.0



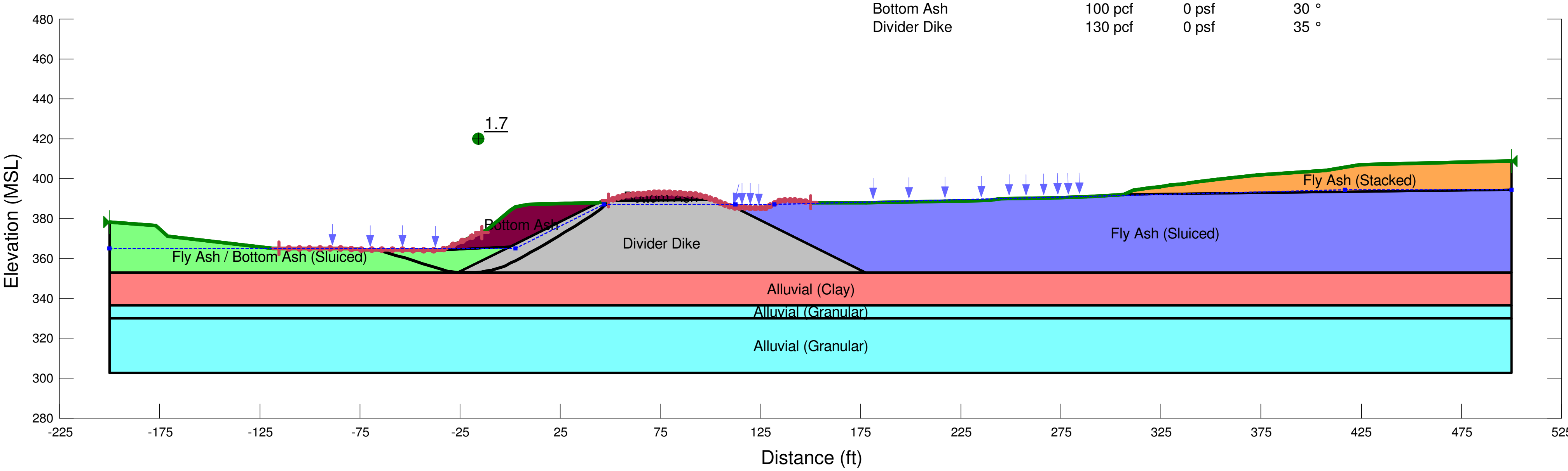
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section A_Extended.gsz
Analysis Name: Stability - Existing Condition with Rapid Drawdown
Date Saved: 5/18/2010
Last Solved on 5/18/2010 at 9:55:00 AM

Stantec

Analysis Method: Spencer
Calculated Factor of Safety: 1.7

Material Type	Unit Weight	Cohesion	Friction Angle
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Fly Ash (Stacked)	100 pcf	0 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Bottom Ash	100 pcf	0 psf	30 °
Divider Dike	130 pcf	0 psf	35 °



Stability - Existing Condition with Rapid Drawdown

File Information

Created By: Cooper, Paul
Revision Number: 255
Last Edited By: Rogers, Daniel
Date: 5/18/2010
Time: 9:54:07 AM
File Name: Section A_Extended.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 5/18/2010
Last Solved Time: 9:55:00 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Rapid Drawdown

Kind: SLOPE/W
Method: Spencer
Settings
  Apply Phreatic Correction: No
  PWP Conditions Source: Piezometric Line
  Use Staged Rapid Drawdown: No
SlipSurface
  Direction of movement: Right to Left
  Use Passive Mode: No
  Slip Surface Option: Entry and Exit
  Critical slip surfaces saved: 1
  Optimize Critical Slip Surface Location: Yes
  Tension Crack

Tension Crack Option: (none)
FOS Distribution
FOS Calculation Option: Constant
Advanced
Number of Slices: 30
Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 20 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb

Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bottom Ash

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Divider Dike

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (-115.57435, 365.12621) ft
Left-Zone Right Coordinate: (-14.24004, 373) ft
Left-Zone Increment: 20
Right Projection: Range
Right-Zone Left Coordinate: (49, 389.12344) ft
Right-Zone Right Coordinate: (150, 388.11207) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-200, 378.17346) ft
Right Coordinate: (500, 408.84049) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-200	365
	2.55408	365
	46.85	387
	112.5	387
	132	387
	417	394.47
	500	394.47

Regions

	Material	Points	Area (ft^2)
Region 1	Alluvial (Granular)	1,2,3,4	19180
Region 2	Alluvial (Granular)	4,3,5,6	4550
Region 3	Fly Ash (Sluiced)	7,8,60,20,21,22,23,24,25,26,27,28,29,30,31,32	13745.485
Region 4	Divider Dike	33,7,32,34,35,36,44,45,59	4743.6159
Region 5	Fly Ash / Bottom Ash (Sluiced)	51,52,53,54,55,56,57,58,33,59	2725.0786
Region 6	Alluvial (Clay)	58,6,5,8,7,33	11481.079
Region 7	Bottom Ash	45,46,47,48,49,50,51,59	703.64671
Region 8	Bottom Ash	36,37,38,39,40,41,42,43,44	140.63663

Region 9	Fly Ash (Stacked)	60,9,10,11,12,13,14,15,16,17,18,19,20	1950.1592

Points

	X (ft)	Y (ft)
Point 1	-200	302.596
Point 2	500	302.596
Point 3	500	329.996
Point 4	-200	329.996
Point 5	500	336.496
Point 6	-200	336.496
Point 7	177.35321	352.9001
Point 8	500	352.896
Point 9	500	408.84049
Point 10	424.54156	407
Point 11	407.45694	404
Point 12	372.75093	401.71589
Point 13	353.49765	399.74176
Point 14	342.15171	398.22744
Point 15	335.72485	397.46477
Point 16	329.59964	396.75803
Point 17	324.62229	396
Point 18	318.84971	395.16639
Point 19	311.11578	394
Point 20	306.41582	392
Point 21	303.37898	391.83615
Point 22	296.64966	391.47162
Point 23	287.88242	391
Point 24	270.02468	390.37161
Point 25	244.64276	390
Point 26	239.00788	389.13074
Point 27	177.72084	388.01295
Point 28	150.92636	388
Point 29	142.66019	389
Point 30	135.12957	389

Point 31	127.843	385.40673
Point 32	112.25926	385.445
Point 33	-26.19269	352.896
Point 34	110.25353	386
Point 35	104.82527	388
Point 36	101.26774	389.48724
Point 37	100.05725	390
Point 38	96.55264	390.996
Point 39	92.82196	391.996
Point 40	81.04847	392.8415
Point 41	75.34198	392.996
Point 42	67.45291	392.50526
Point 43	59.77612	391.996
Point 44	47.94316	388.84172
Point 45	44.00037	387.99019
Point 46	32.30678	387.65592
Point 47	9.17621	387
Point 48	2.55373	386
Point 49	0	384.23
Point 50	-11.39509	374.27184
Point 51	-33.91119	364.20596
Point 52	-73.45174	364.37631
Point 53	-83.12295	364.95495
Point 54	-118.37511	365.14099
Point 55	-171.03472	371.07123
Point 56	-176.83063	376.61401
Point 57	-200	378.17346
Point 58	-200	352.896
Point 59	0	366
Point 60	500	394.5

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.7	(-25.184,	55.13136	(50.2919,	(-66.5258,

			448.842)		389.468)	364.346)
2	11453	1.7	(-25.184, 448.842)	95.235	(49, 389.123)	(-69.1393, 364.358)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	-64.123795	363.65865	83.701827	123.57461	16.10965	0
2	Optimized	-59.31975	362.2829	169.54688	281.64093	45.288936	0
3	Optimized	-54.66011	360.9059	255.46041	443.68771	76.048765	0
4	Optimized	-50.144875	359.5277	341.46118	603.53052	105.88289	0
5	Optimized	-45.62964	358.1495	427.46195	763.35215	135.70845	0
6	Optimized	-41.00681	356.71255	517.14581	934.80097	168.74364	0
7	Optimized	-36.276395	355.2168	610.46869	1109.1918	201.49722	0
8	Optimized	-33.023105	354.18805	674.66589	1252.2761	233.36967	0
9	Optimized	-31.66741	353.75935	701.41222	1344.8348	259.95958	0
10	Optimized	-28.515885	353.26645	732.1679	1451.0505	290.44744	0
11	Optimized	-24.09951	352.9183	753.89864	1702.78	664.4139	0
12	Optimized	-20.634595	352.9121	754.27383	1936.0898	827.51642	0
13	Optimized	-18.184575	352.9077	754.56631	2101.0655	942.82887	0
14	Optimized	-15.94903	353.11775	741.44252	2050.5729	916.66293	0
15	Optimized	-12.91307	353.5404	715.08244	2180.0896	1025.8091	0

16	Optimized	-10.452355	353.88295	693.71814	2325.8416	1142.8252	0
17	Optimized	-7.9451475	354.5122	654.42738	2274.4618	1134.3603	0
18	Optimized	-4.8162025	355.5082	592.30109	2445.4613	1297.5968	0
19	Optimized	-2.625281	356.30355	542.65746	2359.2956	1272.0237	0
20	Optimized	-0.999416	357.07535	494.48411	2410.2315	1341.4208	0
21	Optimized	1.05552	358.05085	433.62384	2458.8564	1418.0831	0
22	Optimized	2.332385	358.67585	394.6369	2375.9416	1387.3245	0
23	Optimized	2.553905	358.7999	386.89397	2377.0795	1393.5429	0
24	Optimized	4.2096125	359.7271	380.32703	2320.8302	1358.755	0
25	Optimized	7.5206775	361.5813	367.25683	2208.3632	1289.1566	0
26	Optimized	9.359405	362.611	359.98986	2144.1269	1249.2662	0
27	Optimized	11.62442	363.91445	348.84582	2025.2322	1173.8184	0
28	Optimized	15.461105	366.15315	328.04117	1836.9913	1056.5783	0
29	Optimized	18.97083	368.2288	307.31787	1674.4912	957.3051	0
30	Optimized	22.412235	370.2756	286.23459	1509.0727	856.24047	0
31	Optimized	25.78533	372.29365	264.83886	1350.9072	760.47321	0
32	Optimized	29.88933	374.76455	237.85167	1153.4364	641.0993	0
33	Optimized	34.42488	377.50725	207.2717	938.36853	511.91952	0
34	Optimized	38.40733	380.0366	172.86511	715.95014	380.27223	0

35	Optimized	42.136025	382.53365	132.60531	519.119	270.6398	0
36	Optimized	44.830815	384.33835	103.51017	383.17923	195.82639	0
37	Optimized	46.25563	385.4815	76.330395	264.1787	131.5328	0
38	Optimized	47.32157	386.53425	29.062105	186.49265	110.23406	0
39	Optimized	47.86815	387.0741	-4.6226869	145.70925	102.02672	0
40	Optimized	48.811185	388.00545	-62.741572	84.581655	59.224713	0
41	Optimized	49.98554	389.16525	-135.1094	14.637432	8.4509253	0

Slices of Slip Surface: 11453

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	11453	-67.182135	363.39575	100.10361	168.88988	27.791456	0
2	11453	-63.267905	361.5797	213.42581	387.84684	70.47067	0
3	11453	-59.353675	359.9731	313.66949	570.84796	103.90684	0
4	11453	-55.439445	358.5647	401.55574	722.66468	129.73643	0
5	11453	-51.525215	357.34535	477.65826	846.94976	149.20345	0
6	11453	-47.61099	356.3076	542.41466	946.55654	163.28392	0
7	11453	-43.696765	355.44535	596.20903	1023.7373	172.73265	0
8	11453	-39.782535	354.75375	639.37415	1080.2661	178.13192	0
9	11453	-35.868305	354.2291	672.10682	1117.6394	180.00684	0
10	11453	-33.023105	353.93475	690.48908	1155.0795	187.70671	0
11	11453	-30.293475	353.76245	701.22375	1263.6072	227.21764	0
12	11453	-26.61038	353.6359	709.10665	1434.2035	292.95814	0
13	11453	-21.835485	353.7116	704.38982	1702.988	699.22599	0
14	11453	-17.025375	353.9763	687.87858	1924.6267	865.98033	0
15	11453	-13.27185	354.37435	663.028	2061.3235	979.09704	0
16	11453	-9.0460255	355.01505	623.05989	2279.5744	1159.9039	0
17	11453	-4.3478965	355.946	564.98008	2562.4836	1398.6671	0

18	11453	-0.999416	356.7353	515.72906	2734.6028	1553.6721	0
19	11453	1.276865	357.3671	476.29616	2812.5999	1635.8975	0
20	11453	2.553905	357.73655	453.23026	2843.6905	1673.8183	0
21	11453	4.2096125	358.2739	471.03171	2795.4814	1627.5972	0
22	11453	7.5206775	359.41665	502.33268	2694.1029	1534.6941	0
23	11453	11.10376	360.81675	525.99292	2549.2658	1416.7109	0
24	11453	14.958855	362.50765	539.97984	2360.6036	1274.8145	0
25	11453	18.81395	364.40835	540.84195	2156.3517	1131.1921	0
26	11453	22.669045	366.53345	527.70768	1936.3185	986.31993	0
27	11453	26.52414	368.9009	499.44754	1699.7682	840.4736	0
28	11453	30.379235	371.53305	454.6816	1446.0038	694.13125	0
29	11453	34.25571	374.47615	391.16413	1172.4703	547.0765	0
30	11453	38.153575	377.7708	306.38985	878.00984	400.25263	0
31	11453	42.05144	381.45215	197.4715	562.64757	255.69904	0
32	11453	45.425185	384.97175	82.405016	283.50339	140.8106	0
33	11453	47.04467	386.77345	14.136023	149.59617	94.850217	0
34	11453	47.59125	387.41695	-26.016455	104.53687	73.197501	0
35	11453	48.361855	388.3429	-83.791678	44.865152	31.414918	0
36	11453	48.890275	388.98765	-124.02878	6.4892719	3.7465829	0

Stability - Existing Condition (Shallow Failure)

File Information

Created By: Cooper, Paul
Revision Number: 242
Last Edited By: Rogers, Daniel
Date: 10/22/2009
Time: 10:57:01 AM
File Name: Section A_Extended.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 10/22/2009
Last Solved Time: 11:01:40 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition (Shallow Failure)

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 15 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bottom Ash

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Divider Dike

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (-52, 364.28389) ft
Left-Zone Right Coordinate: (-25, 368.18973) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (-2, 382.4822) ft
Right-Zone Right Coordinate: (41, 387.90442) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-200, 378.17346) ft
Right Coordinate: (500, 408.84049) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-200	384.23
	2.55408	384.23
	40	384.23
	112.5	384.23
	132	384.23
	417	394.47
	500	394.47

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.0	(-23.106, 402.391)	33.07378	(13.6553, 387.127)	(-39.0712, 364.228)
2	28478	1.1	(-23.106, 402.391)	40.515	(14.4323, 387.149)	(-36.6826, 364.218)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	-38.211195	364.0738	1257.7447	1285.6704	11.282723	0
2	Optimized	-36.49119	363.76505	1277.0294	1318.1741	16.62352	0
3	Optimized	-34.77119	363.45635	1296.257	1350.6206	21.964318	0
4	Optimized	-33.84751	363.29055	1306.6132	1424.237	47.523093	0
5	Optimized	-32.757935	363.2208	1310.9805	1427.617	47.124201	0
6	Optimized	-30.70614	363.10425	1318.2308	1473.9894	62.930566	0
7	Optimized	-28.84675	363.04285	1322.0819	1500.2472	71.983422	0
8	Optimized	-27.17977	363.0366	1322.4419	1528.0817	83.083896	0
9	Optimized	-25.253375	363.08035	1319.76	1544.4127	90.76556	0
10	Optimized	-23.06756	363.17405	1313.9094	1569.8718	103.41549	0
11	Optimized	-20.880905	363.3036	1305.8089	1583.6454	112.25324	0
12	Optimized	-18.693415	363.469	1295.5068	1601.5145	123.63512	0
13	Optimized	-16.575525	363.658	1283.6974	1608.5187	131.23633	0
14	Optimized	-14.52724	363.87055	1270.4403	1619.202	140.90886	0
15	Optimized	-12.478955	364.0831	1257.1833	1629.9339	150.601	0
16	Optimized	-11.42495	364.19495	1250.1922	1612.3919	146.33817	0
17	Optimized	-10.285555	364.4073	1236.9323	1644.0598	164.4902	0
18	Optimized	-8.126784	364.8947	1206.5453	1631.9597	171.87857	0
19	Optimized	-5.975869	365.46995	1170.6378	1633.5877	187.04393	0
20	Optimized	-4.17563	366.2311	1123.1033	1478.8201	205.37321	0

21	Optimized	-2.77851	367.1641	1064.8886	1426.7364	208.91294	0
22	Optimized	-1.039975	368.4299	985.93262	1330.3458	198.84701	0
23	Optimized	0.35442	369.5016	919.05822	1276.2678	206.23504	0
24	Optimized	1.631285	370.8223	836.65409	1154.0785	183.26506	0
25	Optimized	2.553905	371.8708	771.21065	1106.9414	193.83425	0
26	Optimized	3.20815	372.61435	724.80381	1052.5386	189.21774	0
27	Optimized	4.59075	374.27635	621.08676	912.3118	168.13885	0
28	Optimized	6.04781	376.11365	506.45608	778.06426	156.81306	0
29	Optimized	7.456115	377.94595	392.12277	634.79017	140.10409	0
30	Optimized	8.65605	379.6169	287.85933	502.54699	123.94998	0
31	Optimized	9.83831	381.33815	180.45047	373.19747	111.28254	0
32	Optimized	11.162515	383.26605	60.14873	224.54015	94.911432	0
33	Optimized	11.92235	384.3723	-8.8786697	142.84891	82.473856	0
34	Optimized	12.837705	385.8208	-99.265615	64.613174	37.304434	0

Slices of Slip Surface: 28478

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	28478	-35.989735	363.9855	1263.287	1316.5169	21.506284	0
2	28478	-34.60404	363.548	1290.544	1358.0121	27.258889	0
3	28478	-33.045185	363.1237	1317.0083	1467.7395	60.899328	0
4	28478	-31.313175	362.72535	1341.8971	1532.0944	76.844683	0
5	28478	-29.58117	362.40595	1361.8167	1586.3164	90.703769	0
6	28478	-27.849165	362.1636	1376.9464	1631.0169	102.65115	0
7	28478	-26.117155	361.99695	1387.3695	1666.6743	112.84648	0
8	28478	-24.385145	361.90505	1393.0639	1693.721	121.47336	0
9	28478	-22.65314	361.8874	1394.1907	1712.3564	128.54731	0
10	28478	-20.921135	361.9439	1390.6329	1722.9411	134.26126	0
11	28478	-19.189125	362.07485	1382.4551	1725.4686	138.58643	0
12	28478	-17.457115	362.28095	1369.6163	1720.1388	141.62029	0
13	28478	-15.72511	362.5634	1351.9704	1707.0082	143.44455	0
14	28478	-13.993105	362.9239	1329.5012	1686.0525	144.0561	0
15	28478	-12.261095	363.36455	1301.9812	1657.1125	143.48236	0
		-					

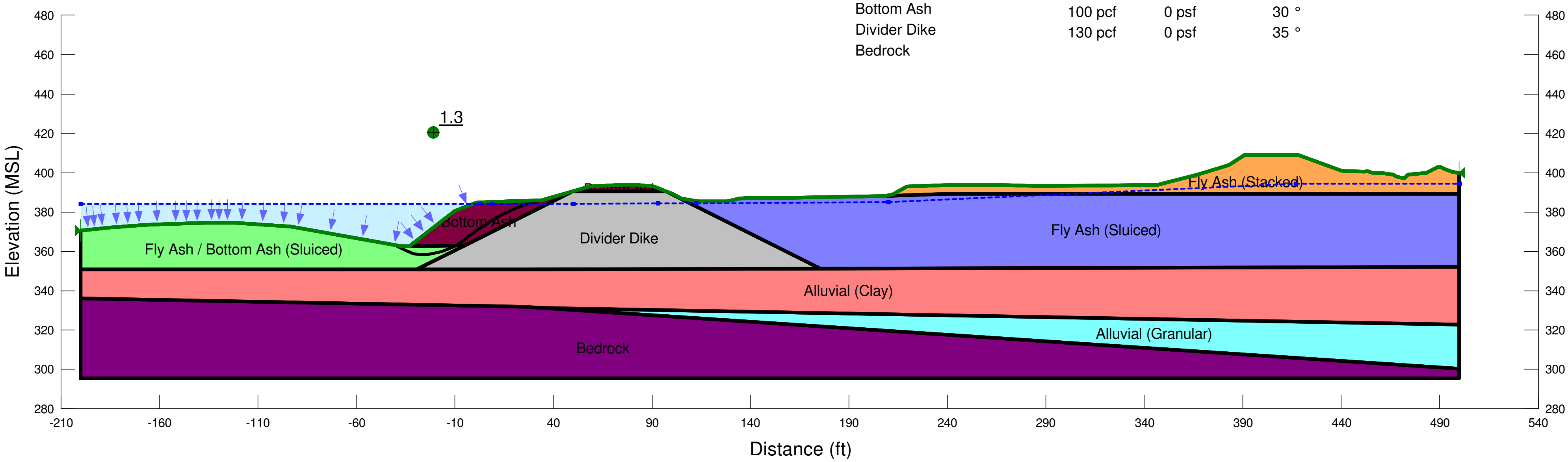
16	28478	10.488478	363.9024	1268.4338	1649.4251	153.93048	0
17	28478	-8.675254	364.54535	1228.3447	1621.9901	159.04307	0
18	28478	-6.8620305	365.288	1181.9749	1584.3193	162.55767	0
19	28478	-4.962849	366.1823	1126.1818	1511.4237	222.41952	0
20	28478	-2.9777095	367.2482	1059.659	1442.2676	220.89913	0
21	28478	-0.99257	368.4637	983.83278	1359.0422	216.62726	0
22	28478	1.276865	370.0741	883.34302	1279.9549	228.984	0
23	28478	2.553905	371.03765	823.21087	1244.3016	243.11686	0
24	28478	3.381846	371.75345	778.52375	1181.9049	232.8922	0
25	28478	5.0373785	373.2691	683.96405	1050.9861	211.90028	0
26	28478	6.692911	374.9686	577.90228	905.93515	189.38986	0
27	28478	8.3484435	376.88915	458.07677	744.3272	165.26676	0
28	28478	10.159735	379.3289	305.82829	536.26392	133.04208	0
29	28478	12.126785	382.4888	108.65013	271.25653	93.880851	0
30	28478	13.77129	385.6895	-91.073664	61.764321	35.659648	0

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section B_Extended.gsz
Analysis Name: Stability - Existing Condition with Triger at FS = 1.3
Date Saved: 10/26/2009
Last Solved on 10/26/2009 at 8:57:36 AM

Material Type	Unit Weight	Cohesion	Friction Angle
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Fly Ash (Stacked)	100 pcf	0 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Bottom Ash	100 pcf	0 psf	30 °
Divider Dike	130 pcf	0 psf	35 °
Bedrock			

Analysis Method: Spencer
Calculated Factor of Safety: 1.3



Stability - Existing Condition with Triger at FS = 1.3

File Information

Created By: Cooper, Paul
Revision Number: 223
Last Edited By: Rogers, Daniel
Date: 10/26/2009
Time: 8:56:53 AM
File Name: Section B_Extended.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 10/26/2009
Last Solved Time: 8:57:36 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Triger at FS = 1.3

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Auto-Search
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bottom Ash

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Divider Dike

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bedrock

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

Slip Surface Limits

Left Coordinate: (-200, 370.55929) ft
Right Coordinate: (499.99988, 399.9474) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-200	384
	2.55408	384
	9	384
	50	384
	93	384.5

	112.5	384.5
	210	385
	417	394.47
	500	394.46785

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.3	(-53.323, 559.433)	38.99783	(40.3309, 387.831)	(-40.8313, 363.185)
2	303	1.9	(-53.323, 559.433)	197.494	(48.0705, 389.953)	(-32.7931, 363.009)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	-39.020975	362.35005	1350.9511	1388.5465	15.189523	0
2	Optimized	-36.18502	361.0422	1432.564	1530.5799	39.600998	0
3	Optimized	-34.13382	360.09625	1491.5772	1638.8224	59.490929	0
4	Optimized	-32.10934	359.16265	1549.8407	1812.1627	105.98497	0
5	Optimized	-29.461285	358.59015	1585.5798	1889.3682	122.73846	0
6	Optimized	-26.16294	358.36645	1599.5245	2006.9754	164.62084	0
7	Optimized	-23.234245	358.51625	1590.1985	2019.6776	173.52084	0
8	Optimized	-20.675195	359.03955	1557.5415	2035.719	193.19623	0
9	Optimized	-18.116145	359.5628	1524.8846	2051.722	212.85615	0
10	Optimized	-16.818405	359.82815	1508.3181	2059.8486	222.83279	0
11	Optimized	-15.14407	360.51795	1465.2727	1991.0449	212.42575	0
12	Optimized	-11.831835	361.8901	1379.6708	1941.9821	227.18849	0
13	Optimized	-9.68392	362.7799	1324.1786	1901.7339	233.34748	0
14	Optimized	-8.177095	363.75125	1263.5137	1726.9343	267.55602	0
15	Optimized	-6.147045	365.2865	1167.7257	1611.0693	255.96457	0
16	Optimized	-3.980535	366.8948	1067.3468	1494.7415	246.75641	0
17	Optimized	-1.7685609	368.49465	967.53541	1377.1766	236.50648	0
18	Optimized	0.0787391	369.817	885.00605	1292.1905	235.08804	0
19	Optimized	1.709815	370.98455	812.16245	1214.8486	232.49097	0
20	Optimized	2.794945	371.76135	763.69972	1151.6262	223.96947	0
21	Optimized	3.59863	372.31135	729.37778	1114.1745	222.16248	0
22	Optimized	4.5628	372.97335	688.06759	1054.4922	211.55534	0
23	Optimized	5.518845	373.61805	647.83688	1011.0876	209.72288	0
24	Optimized	7.364685	374.81685	573.02198	909.74222	194.40552	0

25	Optimized	8.827915	375.7491	514.8596	843.88487	189.96283	0
26	Optimized	10.24764	376.5219	466.63163	777.2266	179.32209	0
27	Optimized	12.74292	377.88015	381.87271	660.08471	160.62577	0
28	Optimized	15.2382	379.2384	297.12436	542.94282	141.92335	0
29	Optimized	17.68854	380.46095	220.83705	446.74315	130.42695	0
30	Optimized	20.093945	381.5478	153.01862	353.1097	115.52264	0
31	Optimized	22.0626	382.366	101.96125	290.43657	108.81628	0
32	Optimized	24.72312	383.3204	42.408964	208.79559	96.063362	0
33	Optimized	27.17318	384.19925	-12.434201	135.16983	78.040336	0
34	Optimized	29.02095	384.7452	-46.503007	97.531499	56.309837	0
35	Optimized	31.605515	385.4386	-89.76605	43.722692	25.243308	0
36	Optimized	33.27453	385.889	-117.87218	8.7097324	5.0285664	0
37	Optimized	35.321175	386.45235	-153.02333	0.49133283	0.28367114	0
38	Optimized	38.66101	387.37165	-210.38976	0.16377665	0.094556491	0

Slices of Slip Surface: 303

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	303	-31.463365	363.15655	1300.6334	1363.9778	36.571882	0
2	303	-28.803955	363.471	1281.0133	1402.9097	70.37694	0
3	303	-26.144545	363.82215	1259.09	1437.6777	103.10767	0
4	303	-23.48514	364.21015	1234.885	1468.3542	134.79349	0
5	303	-20.825735	364.6352	1208.3477	1494.9033	165.44295	0
6	303	-18.166325	365.09755	1179.5043	1517.2931	195.02248	0
7	303	-15.171395	365.666	1144.0337	1537.2704	227.03533	0
8	303	-11.840945	366.35165	1101.2654	1553.5551	261.12958	0
9	303	-8.992264	366.982	1061.9232	1544.406	278.56156	0
10	303	-6.625352	367.5426	1026.9332	1518.1501	283.60422	0
11	303	-4.25844	368.13415	990.04593	1488.8339	287.9754	0
12	303	-1.8915279	368.7569	951.17159	1456.4127	291.70107	0
13	303	0.0787391	369.2971	917.4615	1444.6531	304.37423	0
14	303	1.709815	369.76305	888.36688	1431.3178	313.47285	0
15	303	4.31381	370.54495	839.58821	1371.5937	307.15354	0
16	303	7.53677	371.5559	776.51705	1288.257	295.45318	0

17	303	10.382855	372.50115	717.51061	1204.1105	280.93856	0
18	303	13.148565	373.4667	657.28591	1118.084	266.04191	0
19	303	15.914275	374.4787	594.14584	1027.9881	250.47895	0
20	303	18.679985	375.53785	528.05325	933.68865	234.19371	0
21	303	21.445695	376.64495	458.94725	835.20099	217.2302	0
22	303	23.850385	377.6444	396.59383	746.2821	201.89262	0
23	303	25.89406	378.52565	341.6016	667.90078	188.38892	0
24	303	28.59974	379.74075	265.77905	554.93458	202.46888	0
25	303	31.96742	381.3147	167.56386	418.78914	175.90983	0
26	303	35.305775	382.9519	65.403358	308.4636	170.19262	0
27	303	37.17097	383.8914	6.777086	262.73417	179.22308	0
28	303	38.79421	384.7449	-46.479881	225.69904	158.03617	0
29	303	41.619335	386.26425	-141.28729	160.04656	112.06581	0
30	303	44.291555	387.7549	-234.30669	97.985495	56.571952	0
31	303	46.810865	389.2121	-325.23632	33.166489	19.148682	0

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section C.gsz

Analysis Name: Stability - Existing Condition with Triger at FS = 1.5

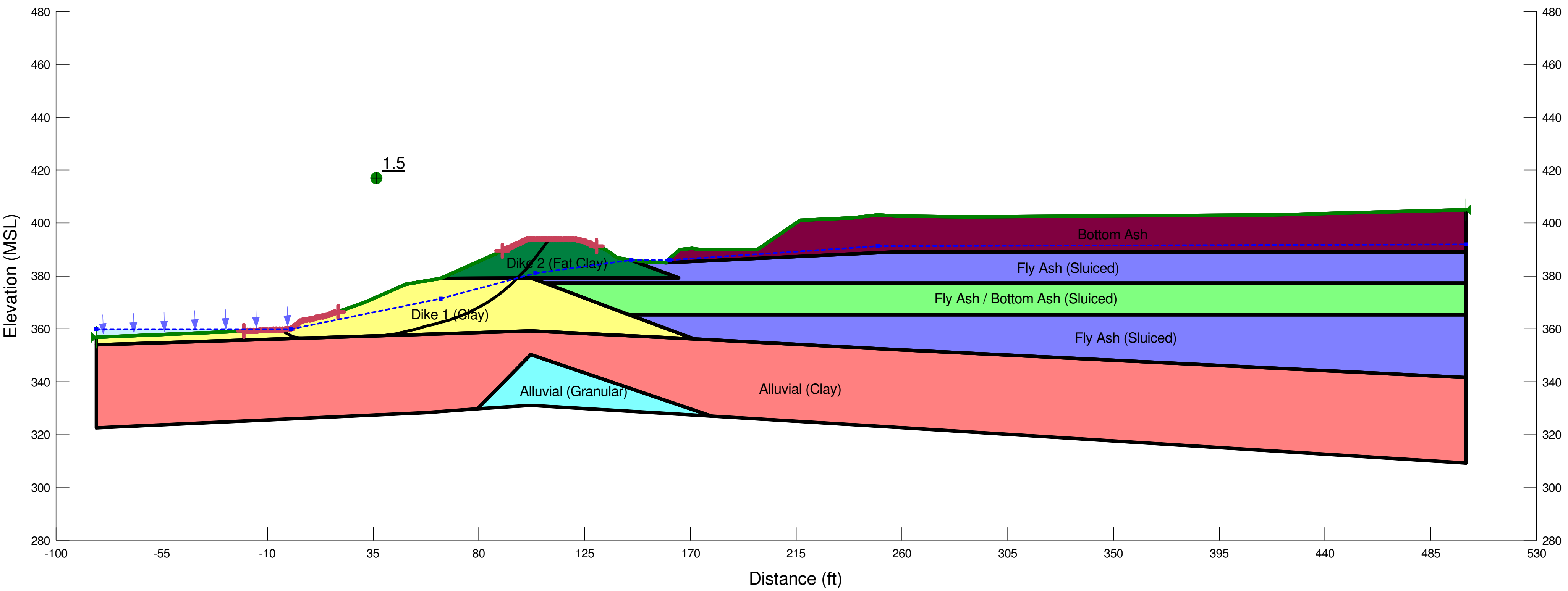
Date Saved: 11/12/2009

Last Solved on 11/12/2009 at 1:33:44 PM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Bottom Ash	105 pcf	0 psf	35 °

Analysis Method: Spencer

Calculated Factor of Safety: 1.5



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 349
Last Edited By: Rogers, Daniel
Date: 11/12/2009
Time: 1:22:35 PM
File Name: Section C.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 11/12/2009
Last Solved Time: 1:24:28 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 2000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bottom Ash

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (-20, 359.13643) ft
Left-Zone Right Coordinate: (20, 366.52849) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (90, 389.57657) ft
Right-Zone Right Coordinate: (130, 391.28201) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-82.79061, 356.76744) ft
Right Coordinate: (500, 404.96392) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-82.79062	359.891
	0	359.891
	63.7	372
	104	383
	138.58701	387.003
	249.7	389
	500	389

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.5	(25.081, 477.794)	58.45157	(110.606, 394.003)	(-4.71314, 359.713)
2	24842	1.5	(25.081, 477.794)	120.622	(111.85, 394.003)	(-0.328497, 359.879)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	-2.3565715	358.5788	81.881027	293.39905	98.632473	100
2	Optimized	0.28841	357.3056	164.7534	558.18082	183.45822	100
3	Optimized	1.94251	356.9037	209.45109	676.83969	217.94688	100
4	Optimized	3.792395	356.64855	247.31513	799.74485	257.60221	100
5	Optimized	6.03891	356.68555	271.65048	882.8357	285.00035	100
6	Optimized	9.56355	356.74365	309.8336	957.81191	302.15725	100
7	Optimized	13.08819	356.80175	348.01672	1032.7881	319.31415	100
8	Optimized	17.423405	356.8732	394.98781	1169.0497	360.95097	100
9	Optimized	21.51856	356.9539	438.51858	1318.1169	410.16344	100
10	Optimized	24.634415	357.03235	470.57827	1433.7221	449.12135	100
11	Optimized	28.712195	357.14765	511.76488	1578.9711	497.64643	100
12	Optimized	33.113195	357.28075	555.6681	1758.2338	560.76559	100
13	Optimized	36.946825	357.3967	593.89114	1936.1039	625.88409	100
14	Optimized	38.915255	357.461	613.23644	1929.765	613.90736	100
15	Optimized	41.76589	357.81035	625.25721	2029.8164	654.9567	100
16	Optimized	46.7159	358.59925	634.74324	2089.7568	678.48394	100
17	Optimized	50.296935	359.34155	630.90381	2127.948	698.08319	100
18	Optimized	53.722485	360.0792	625.50659	2080.61	678.52588	100
19	Optimized	57.71349	360.96165	617.77552	2039.5816	662.99905	100
20	Optimized	61.704495	361.84415	610.04446	1998.5531	647.47222	100
21	Optimized	63.730635	362.29215	606.2955	1977.6914	639.49243	100
22	Optimized	65.073305	362.589	610.65254	2007.1421	651.19377	100
23	Optimized	68.77822	363.55765	613.29443	2011.8823	652.17225	100
24	Optimized	74.003875	365.30785	593.09235	1969.6556	641.90201	100
25	Optimized	78.660515	367.25015	551.20723	1880.9081	620.04969	100
26	Optimized	82.308245	368.99145	504.67128	1853.6446	629.03658	100

27	Optimized	85.618825	370.81145	447.48671	1682.3482	575.82538	100
28	Optimized	88.59226	372.7101	379.65649	1611.1733	574.2657	100
29	Optimized	90.31644	373.81105	340.32831	1569.9079	573.36236	100
30	Optimized	92.17247	375.2851	279.96295	1387.9732	516.67366	100
31	Optimized	95.409615	377.9299	170.0614	1257.0463	506.86939	100
32	Optimized	97.85593	379.9286	87.011435	1165.1889	371.24627	200
33	Optimized	99.28884	381.2421	29.453852	982.1554	328.04145	200
34	Optimized	100.4392	382.4533	-26.534135	913.33458	314.48632	200
35	Optimized	102.4922	384.61495	-126.45492	744.14664	256.23024	200
36	Optimized	105.13865	387.4015	-266.43108	501.41237	172.65012	200
37	Optimized	108.44155	391.3017	-485.9471	134.62964	46.356701	200

Slices of Slip Surface: 24842

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	24842	-0.16424835	359.84345	2.9670164	46.291445	20.202513	100
2	24842	2.138295	359.39395	56.38019	343.28557	133.78618	100
3	24842	6.03891	358.6978	146.08581	705.13074	260.68693	100
4	24842	9.56355	358.1874	219.74689	848.71897	293.2945	100
5	24842	13.08819	357.78265	286.79949	974.00031	320.44701	100
6	24842	16.893745	357.4675	351.61845	1126.1703	361.17945	100
7	24842	20.980215	357.25895	413.10086	1300.7382	413.91209	100
8	24842	25.06668	357.18915	465.92803	1451.4246	459.54458	100
9	24842	29.153145	357.25795	510.10101	1579.3639	498.60548	100
10	24842	33.139005	357.45705	544.97431	1702.4637	539.74616	100
11	24842	37.02425	357.78045	570.86365	1821.4927	583.17792	100
12	24842	40.616875	358.1881	588.05888	1918.1556	620.23427	100
13	24842	43.91688	358.6633	597.54582	1995.7504	651.99349	100
14	24842	47.216885	359.23225	601.18653	2059.4407	679.99508	100
15	24842	50.72103	359.94365	598.36249	2052.319	677.99107	100
16	24842	54.42931	360.8122	588.14698	1975.8349	647.08949	100
17	24842	58.137585	361.8058	570.13394	1886.7792	613.96179	100
18	24842	61.84586	362.92765	544.12565	1785.1667	578.70694	100
19	24842	63.730635	363.53145	528.95697	1730.6709	560.3684	100
20	24842	65.641105	364.2131	518.96211	1726.1915	562.94031	100
21	24842	69.40078	365.62715	494.7665	1710.3717	566.84603	100
22	24842	73.160455	367.18705	461.47001	1677.5916	567.08679	100
23	24842	76.920125	368.89905	418.66598	1627.7132	563.78797	100
24	24842	80.679795	370.7705	365.919	1560.4959	557.04038	100
25	24842	84.43947	372.80995	302.70854	1475.6636	546.95793	100
26	24842	88.199145	375.02735	228.36851	1372.8401	533.67589	100

27	24842	92.34971	377.70805	131.78442	1236.6109	515.18904	100
28	24842	95.95048	380.20005	37.612774	1108.0939	368.59621	200
29	24842	99.13246	382.6066	-58.357517	970.62924	334.21445	200
30	24842	102.4922	385.30935	-169.78572	760.20876	261.76087	200
31	24842	105.9625	388.34595	-319.41208	457.30996	157.46445	200
32	24842	109.88745	392.06175	-522.929	105.49508	36.32487	200

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section D.gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels

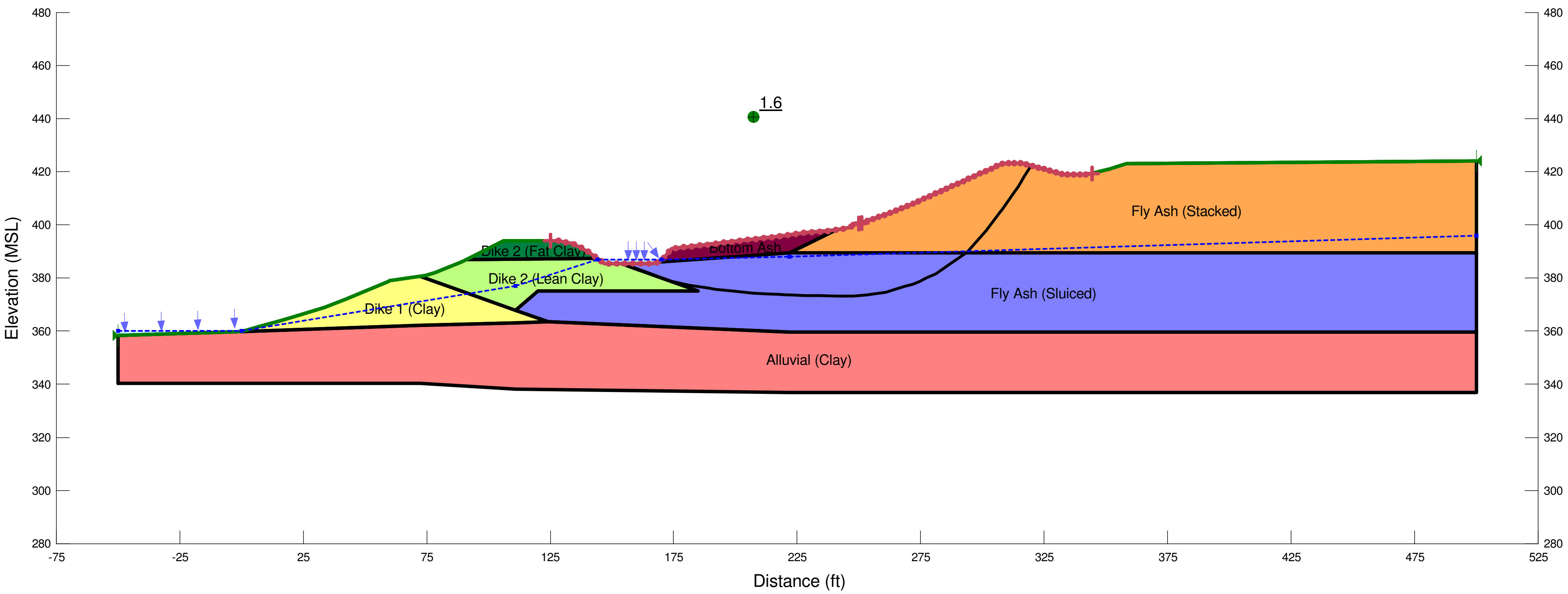
Date Saved: 10/11/2009

Last Solved on 10/11/2009 at 12:20:38 AM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Fly Ash (Stacked)	100 pcf	0 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Bottom Ash	105 pcf	0 psf	35 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °

Analysis Method: Spencer

Calculated Factor of Safety: 1.6



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 312
Last Edited By: Rogers, Daniel
Date: 10/11/2009
Time: 12:18:50 AM
File Name: Section D.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 10/11/2009
Last Solved Time: 12:20:38 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bottom Ash

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (125, 394.002) ft
Left-Zone Right Coordinate: (250, 400.40648) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (251, 400.73145) ft
Right-Zone Right Coordinate: (344.34149, 419.42785) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-50, 358.25326) ft
Right Coordinate: (500, 424.09795) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-50	360
	0	360
	111	377
	144	387
	170	387
	222	388
	500	396

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.610	(221.488, 487.817)	79.63433	(319.792, 422.323)	(154.802, 385.369)
2	16198	1.682	(221.488, 487.817)	118.578	(320.258, 422.203)	(161.797, 385.358)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	157.5613	384.39865	162.3218	221.60351	23.951369	0
2	Optimized	163.0805	382.45775	283.44397	444.14711	64.928284	0
3	Optimized	167.4687	380.91455	379.72059	640.55222	105.38282	0
4	Optimized	169.54865	380.1831	425.37057	760.39353	135.35806	0
5	Optimized	170.24385	379.93865	440.92912	809.90454	149.07575	0
6	Optimized	171.51305	379.4923	470.27813	1014.2514	219.77947	0
7	Optimized	173.3569	378.956	505.97483	1264.071	306.29075	0
8	Optimized	177.67195	378.0297	568.95301	1518.5036	383.64335	0
9	Optimized	185.1916	376.69505	661.26485	1712.8142	424.85352	0
10	Optimized	190.4879	375.92615	715.58791	1860.5363	462.58919	0
11	Optimized	195.36425	375.407	753.8396	1937.0708	478.05645	0
12	Optimized	203.0199	374.69675	807.34645	2102.8576	523.42047	0
13	Optimized	209.82375	374.17495	848.08233	2204.3644	547.97352	0
14	Optimized	215.32645	373.8832	872.87167	2298.1864	575.86454	0
15	Optimized	219.2696	373.67415	890.66173	2368.0315	596.89615	0
16	Optimized	221.1707	373.5985	897.62836	2370.6523	595.1403	0
17	Optimized	221.94	373.58495	899.44392	2382.2974	599.1117	0
18	Optimized	225.0922	373.5294	908.52079	2424.2849	612.40847	0
19	Optimized	231.3455	373.41925	926.62148	2491.1492	632.11024	0
20	Optimized	237.6677	373.3079	944.91922	2542.7055	645.54757	0
21	Optimized	243.27025	373.2092	961.13268	2625.4593	672.43159	0
22	Optimized	246.34015	373.1551	970.0142	2705.6825	701.25553	0
23	Optimized	247.4331	373.1751	970.74605	2658.3173	681.82306	0
24	Optimized	250.6724	373.3919	963.03644	2743.9814	719.54848	0
25	Optimized	257.28795	374.1544	927.3274	2801.1259	757.06372	0
26	Optimized	262.63505	375.13885	875.51512	2757.4913	760.36775	0

27	Optimized	266.34685	376.14335	819.48666	2782.1011	792.94769	0
28	Optimized	270.253	377.20045	760.55231	2822.4437	833.05819	0
29	Optimized	271.98235	377.66845	734.44634	2845.6215	852.97015	0
30	Optimized	273.38285	378.2667	699.61745	2692.2785	805.08731	0
31	Optimized	276.0186	379.40125	633.57489	2685.5349	829.04564	0
32	Optimized	279.26665	380.79935	552.16099	2677.1301	858.54327	0
33	Optimized	284.3286	383.63785	384.1246	2421.4295	823.12461	0
34	Optimized	290.6349	387.70385	141.73229	2282.3728	864.8749	0
35	Optimized	293.99975	389.93065	8.8161715	1768.2799	1099.4349	0
36	Optimized	297.80375	393.9821	-237.16009	1606.2312	1003.6847	0
37	Optimized	304.3477	401.32245	-683.45457	1246.3179	778.78585	0
38	Optimized	307.6222	405.28715	-924.94812	1034.0937	646.17343	0
39	Optimized	310.31575	408.87595	-1144.0754	840.51854	525.21427	0
40	Optimized	313.5445	413.17785	-1406.7039	591.85297	369.83078	0
41	Optimized	315.82005	416.41705	-1604.7469	373.12975	233.15735	0
42	Optimized	318.4773	420.3679	-1846.5212	128.43446	80.254756	0

Slices of Slip Surface: 16198

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	16198	163.8183	384.23265	172.68172	256.39297	33.821539	0
2	16198	167.4687	382.27345	294.93575	510.91771	87.262374	0
3	16198	169.54865	381.22	360.67402	670.86603	125.32571	0
4	16198	170.24385	380.88325	381.96916	731.96888	141.40907	0
5	16198	172.33155	379.9263	444.20579	1120.9898	273.43847	0
6	16198	176.68195	378.06295	565.67959	1618.5122	425.37198	0
7	16198	181.69505	376.14655	691.28243	1870.2526	476.33487	0
8	16198	186.70815	374.48415	801.03741	2085.882	519.1109	0
9	16198	191.65285	373.08095	894.52979	2266.5417	554.32881	0
10	16198	196.5292	371.9219	972.70609	2415.9277	583.09937	0
11	16198	201.3562	370.9852	1036.9579	2536.9083	606.0193	0
12	16198	206.1338	370.2616	1087.8341	2631.8968	623.84184	0
13	16198	210.9114	369.73565	1126.3888	2704.1254	637.44695	0
14	16198	215.689	369.4047	1152.7707	2754.7668	647.24844	0
15	16198	220.0389	369.26375	1166.7954	2787.7963	654.92689	0
16	16198	225.0922	369.33385	1170.3135	2801.0915	658.87707	0
17	16198	231.3455	369.6917	1159.2196	2769.9395	650.77307	0
18	16198	237.6677	370.3911	1126.9301	2690.8746	631.8746	0
19	16198	243.27025	371.28305	1081.3418	2629.8774	625.64898	0

20	16198	246.80465	371.97825	1044.2919	2619.4449	636.4031	0
21	16198	250.6049	372.9031	993.40961	2619.8988	657.14428	0
22	16198	256.0195	374.4135	908.87665	2599.2639	682.96078	0
23	16198	261.4341	376.2069	806.70052	2549.4887	704.13214	0
24	16198	266.34685	378.0774	698.79485	2486.3574	722.22213	0
25	16198	270.253	379.74635	601.66318	2433.2629	740.01431	0
26	16198	273.3542	381.19505	516.85551	2387.5071	755.79231	0
27	16198	276.0186	382.5309	438.26215	2338.9555	767.92997	0
28	16198	279.94035	384.69205	310.45908	2248.4962	783.01783	0
29	16198	285.2561	387.8948	120.15185	2099.2639	799.61316	0
30	16198	288.14885	389.75065	9.5402039	1908.569	1186.6449	0
31	16198	290.8383	391.681	-106.084	1813.084	1132.9406	0
32	16198	295.7475	395.42455	-330.86611	1629.1651	1018.0154	0
33	16198	300.65665	399.60025	-582.62147	1420.6316	887.70915	0
34	16198	305.5658	404.2734	-865.3986	1186.3803	741.33269	0
35	16198	310.31575	409.3419	-1173.1438	882.99829	551.75857	0
36	16198	314.88665	414.853	-1508.7853	503.65888	314.721	0
37	16198	318.71015	419.98445	-1822.1614	151.23499	94.502113	0

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section E.gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels

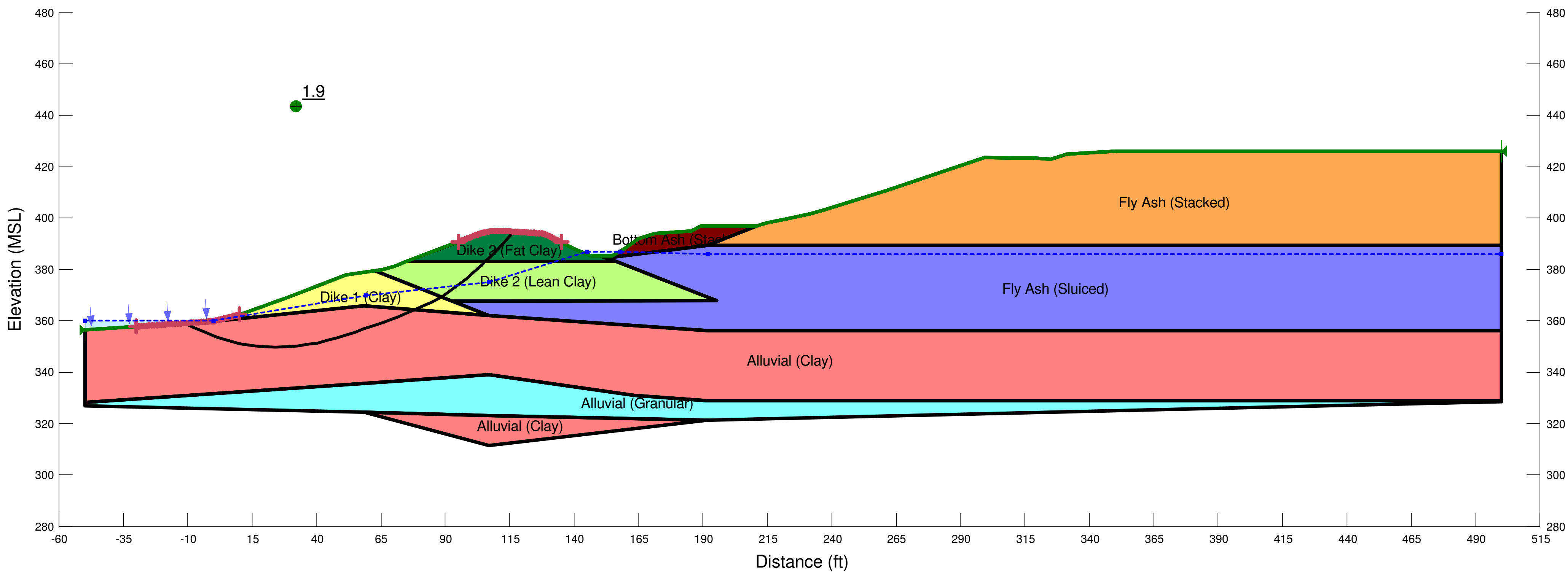
Date Saved: 10/11/2009

Last Solved on 10/11/2009 at 6:52:24 PM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Fly Ash (Stacked)	100 pcf	0 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Bottom Ash (Stacked)	105 pcf	0 psf	35 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °

Analysis Method: Spencer

Calculated Factor of Safety: 1.9



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 287
Last Edited By: Kirkbride, Rob
Date: 10/11/2009
Time: 6:49:23 PM
File Name: Section E.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 10/11/2009
Last Solved Time: 6:52:24 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 5 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bottom Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (-30, 357.8121) ft
Left-Zone Right Coordinate: (10, 362.45286) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (95, 390.7105) ft
Right-Zone Right Coordinate: (135, 390.68494) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-50, 356.42684) ft

Right Coordinate: (500, 426.00135) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-50	360
	0	360
	59	370
	107	375
	145	387
	158	387
	192	386
	500	386

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.9	(26.818, 463.424)	64.25932	(116.63, 394.765)	(-11.4984, 359.094)
2	19730	1.9	(26.818, 463.424)	112.575	(116.061, 394.803)	(-14.8854, 358.859)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	-9.582025	358.2887	106.78702	310.09203	117.3782	200
2	Optimized	-5.749215	356.6789	207.23798	585.76146	218.54063	200
3	Optimized	-1.916405	355.06905	307.68653	861.40683	319.69056	200
4	Optimized	0.7821	353.93565	386.68676	1077.1163	398.61969	200
5	Optimized	1.87365	353.4772	426.84571	1187.2666	439.0292	200
6	Optimized	5.371745	352.43695	528.75014	1352.1299	475.37854	200
7	Optimized	9.279645	351.32135	639.68898	1669.5444	594.5873	200
8	Optimized	12.99836	350.6357	721.80263	1824.0939	636.40818	200
9	Optimized	17.99377	350.0553	810.84956	2025.285	701.15462	200
10	Optimized	21.98567	349.8551	865.5667	2241.4765	794.38189	200
11	Optimized	26.235035	349.8772	909.12676	2309.9836	808.78506	200
12	Optimized	30.629715	350.1155	940.74761	2488.3284	893.49617	200
13	Optimized	34.66657	350.526	957.824	2508.228	895.12615	200
14	Optimized	38.457745	351.11475	961.18634	2617.1522	956.07231	200
15	Optimized	42.23072	351.87815	953.43984	2585.9149	942.5099	200
16	Optimized	45.9855	352.81625	934.62943	2647.9272	989.17295	200
17	Optimized	49.69941	353.90845	905.75806	2582.7975	968.23918	200

18	Optimized	53.244445	355.11135	868.1692	2555.6771	974.28312	200
19	Optimized	56.66148	356.27085	831.97585	2479.9925	951.48286	200
20	Optimized	58.685	356.9575	810.5138	2435.3593	938.10501	200
21	Optimized	60.79654	357.674	780.82873	2389.425	928.72348	200
22	Optimized	64.127795	358.8044	731.92268	2326.8872	920.8532	200
23	Optimized	65.690485	359.33465	708.99839	2303.3562	920.50291	200
24	Optimized	68.05611	360.23725	668.06183	2243.19	909.40068	200
25	Optimized	70.516125	361.17715	625.38075	2227.8044	925.15973	200
26	Optimized	72.64374	362.0919	582.13758	2171.7576	917.76754	200
27	Optimized	76.27034	363.66175	507.77468	2161.1696	954.58803	200
28	Optimized	79.388695	365.0116	443.80526	2174.1216	806.85977	100
29	Optimized	82.690265	366.4407	376.09901	2160.0456	831.86797	100
30	Optimized	86.62462	368.29745	285.79074	2062.3329	828.41521	100
31	Optimized	91.67787	371.5408	116.26025	1715.5201	850.34156	100
32	Optimized	96.41931	375.05645	-72.29777	1535.9161	816.6611	100
33	Optimized	100.92475	378.8257	-278.21648	1248.3942	663.78296	100
34	Optimized	103.7982	381.41455	-421.08396	1108.8631	589.59296	100
35	Optimized	104.71575	382.29105	-469.80864	1017.6676	541.10345	100
36	Optimized	106.22365	383.75235	-551.20015	936.96625	322.62335	200
37	Optimized	107.75975	385.241	-624.06721	829.31703	285.55675	200
38	Optimized	109.6522	387.075	-701.21261	674.87078	232.37664	200
39	Optimized	111.96265	389.501	-807.07466	417.52136	143.76413	200
40	Optimized	114.885	392.7969	-955.14503	117.70564	40.529303	200

Slices of Slip Surface: 19730

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	19730	-12.404475	357.93655	128.75922	332.15085	117.42821	200
2	19730	-7.442685	356.22125	235.80242	595.52446	207.68561	200
3	19730	-2.480895	354.75945	327.01004	808.03878	277.72208	200
4	19730	0.7821	353.9046	388.6259	946.45268	322.06144	200
5	19730	3.3132475	353.3452	450.29946	1092.578	370.81966	200
6	19730	6.8113425	352.6558	530.31258	1283.4853	434.84446	200
7	19730	10.553195	352.04885	607.76268	1497.1121	513.46615	200
8	19730	14.538805	351.5391	681.72341	1729.274	604.80359	200
9	19730	18.52442	351.17315	746.70785	1934.179	685.5868	200
10	19730	22.510035	350.9496	802.8261	2113.558	756.75141	200

11	19730	26.495645	350.8676	850.07934	2268.7014	819.04186	200
12	19730	30.7932	350.94335	890.82128	2419.7956	882.75375	200
13	19730	35.402695	351.2011	923.4772	2562.6427	946.37267	200
14	19730	40.01219	351.64945	944.26411	2676.5066	1000.1107	200
15	19730	44.621685	352.2907	952.98687	2761.8368	1044.34	200
16	19730	49.23118	353.12825	949.48577	2819.6927	1079.7645	200
17	19730	53.244445	354.00925	936.96502	2799.061	1075.0816	200
18	19730	56.66148	354.8917	918.03852	2709.3057	1034.1886	200
19	19730	58.685	355.45445	904.30787	2652.5918	1009.3722	200
20	19730	60.79654	356.11625	878.02714	2586.5875	986.43779	200
21	19730	64.127795	357.2243	830.5316	2486.6153	956.14036	200
22	19730	68.028135	358.6943	764.14896	2396.3737	942.36537	200
23	19730	72.521375	360.57055	676.29325	2315.7315	946.53012	200
24	19730	77.318075	362.85625	564.83868	2220.6832	956.00227	200
25	19730	80.43643	364.43985	486.29072	2182.701	791.04912	100
26	19730	82.798755	365.78	418.02154	2111.7162	789.7828	100
27	19730	86.62486	368.07675	299.56878	1983.597	785.27526	100
28	19730	91.69602	371.50575	118.56461	1743.7456	864.12405	100
29	19730	97.043655	375.48325	-94.872147	1479.2032	786.50629	100
30	19730	101.42269	379.17045	-296.49264	1240.5777	659.62689	100
31	19730	104.6012	382.0546	-455.80081	1040.7549	553.37921	100
32	19730	106.2951	383.70275	-547.63665	930.86175	320.52141	200
33	19730	107.75975	385.19155	-620.97029	810.45839	279.0632	200
34	19730	110.82995	388.57075	-771.351	499.85215	172.1129	200
35	19730	114.6006	392.98355	-972.40433	91.537678	31.51895	200

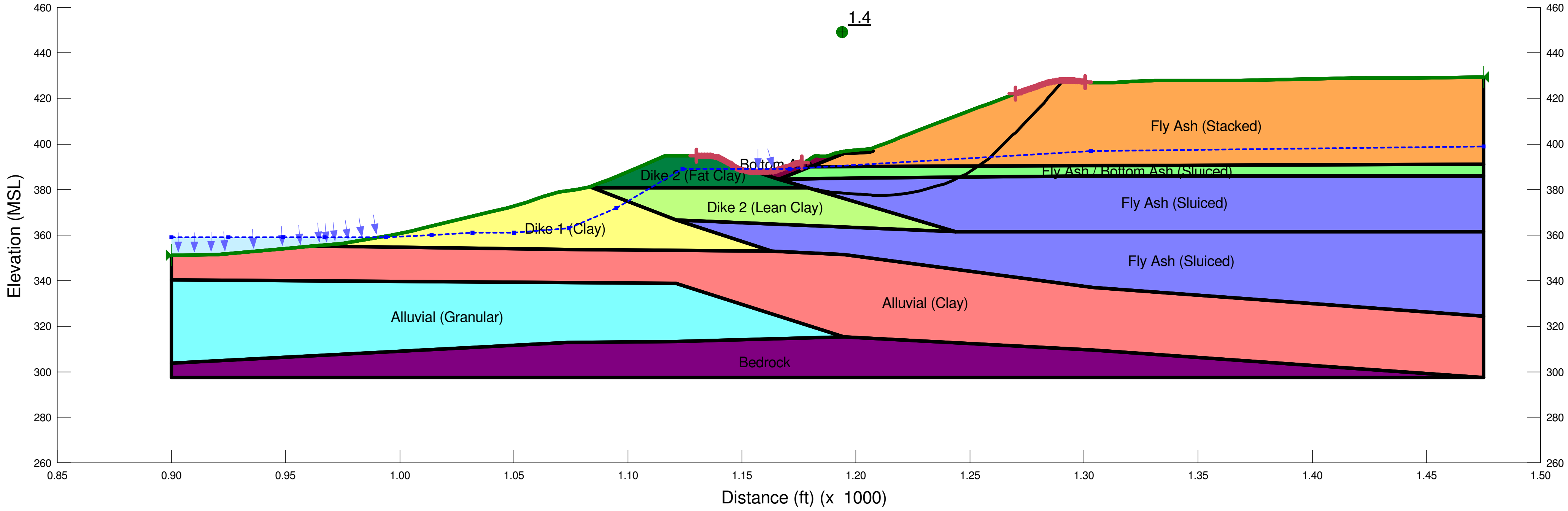
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section F.gsz
Analysis Name: Stability - Existing Condition with Existing PZ Levels
Date Saved: 10/26/2009
Last Solved on 10/26/2009 at 2:34:42 PM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Fly Ash (Stacked)	100 pcf	0 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Bottom Ash - Stacked	105 pcf	0 psf	35 °
Bedrock			

Analysis Method: Spencer
Calculated Factor of Safety: 1.4



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 229
Last Edited By: Rogers, Daniel
Date: 10/26/2009
Time: 2:20:53 PM
File Name: Section F.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 10/26/2009
Last Solved Time: 2:34:42 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bottom Ash - Stacked

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bedrock

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (1130, 394.95234) ft
Left-Zone Right Coordinate: (1176.3653, 391.86252) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (1270, 422.08921) ft
Right-Zone Right Coordinate: (1300.3591, 427.27394) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (900, 351.17633) ft
Right Coordinate: (1475, 429.48497) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	900	359
	925	359
	949	359
	967	359
	994	359
	1014	360
	1032	361
	1050	361
	1074	363
	1095	372
	1124	389
	1171	389
	1303	397
	1475	399

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.4	(1205.2, 472.484)	71.79959	(1290.8, 427.994)	(1156.31, 387.845)
2	35141	1.4	(1205.2, 472.484)	95.337	(1289.45, 427.87)	(1161.21, 387.9)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	1157.234	387.54585	90.741215	121.7405	21.705936	0
2	Optimized	1160.7	386.4199	160.99785	282.79594	85.283937	0
3	Optimized	1164.1975	385.2836	231.89924	469.44408	166.33069	0
4	Optimized	1165.7265	384.78685	262.89912	566.41115	212.52141	0
5	Optimized	1166.3445	384.586	275.42674	550.37583	111.08665	0
6	Optimized	1166.5575	384.5167	279.75276	561.36241	113.77768	0
7	Optimized	1167.157	384.32205	291.90057	603.79798	126.01473	0
8	Optimized	1167.8015	384.1128	304.9568	653.79891	140.94136	0
9	Optimized	1169.03	383.742	328.09981	732.15719	163.24978	0
10	Optimized	1170.521	383.29935	355.7236	846.31956	198.21363	0
11	Optimized	1172.018	382.85505	387.29571	977.1628	238.32178	0
12	Optimized	1173.8705	382.3052	428.60918	1133.9809	284.98869	0
13	Optimized	1175.086	381.9443	455.72319	1224.1567	310.46728	0
14	Optimized	1175.916	381.6978	474.24668	1256.6085	316.0947	0
15	Optimized	1177.008	381.37365	498.60738	1293.4672	321.14422	0
16	Optimized	1178.1225	381.0429	523.45731	1377.958	345.2407	0
17	Optimized	1178.8745	380.8197	540.23061	1470.3943	375.81051	0
18	Optimized	1179.557	380.6171	555.45544	1554.9842	403.83584	0
19	Optimized	1180.205	380.42475	569.91451	1635.8913	430.6826	0
20	Optimized	1180.5405	380.3372	576.65795	1556.596	395.92066	0
21	Optimized	1181.169	380.2353	585.37943	1613.5013	415.38818	0
22	Optimized	1182.055	380.09165	597.68809	1679.3918	437.03666	0
23	Optimized	1182.819	379.96775	608.30398	1706.1752	443.56877	0
24	Optimized	1183.6095	379.83955	619.30192	1713.8854	442.24045	0
25	Optimized	1184.0815	379.763	625.88389	1715.0987	440.07135	0
26	Optimized	1184.796	379.6471	635.79448	1716.3799	436.58484	0
27	Optimized	1186.136	379.42985	654.41924	1732.4647	435.55863	0
28	Optimized	1187.4035	379.2244	672.03466	1771.4006	444.17269	0
29	Optimized	1188.091	379.11295	681.59625	1799.0341	451.47418	0
30	Optimized	1189.035	378.9599	694.71304	1861.2042	471.29302	0
31	Optimized	1190.164	378.80325	708.7498	1860.455	465.3191	0
32	Optimized	1191.1095	378.7259	717.15933	1897.8803	477.04224	0
33	Optimized	1193.146	378.55935	735.24715	1958.8458	494.36595	0
34	Optimized	1195.051	378.40355	752.17198	2017.3002	511.14498	0
35	Optimized	1196.551	378.28085	765.49294	2052.2436	519.881	0
36	Optimized	1199.32	378.05435	790.09879	2104.9698	531.24236	0
37	Optimized	1201.488	377.87705	809.3673	2146.0305	540.04699	0
38	Optimized	1203.864	377.74725	826.46732	2148.4943	534.13358	0
39	Optimized	1206.129	377.6365	841.94268	2181.4598	541.20006	0
40	Optimized	1206.9675	377.5955	847.66908	2206.3489	548.94228	0
41	Optimized	1208.3135	377.52965	856.84993	2264.5804	568.76002	0

42	Optimized	1210.277	377.4336	870.29552	2356.5938	600.50347	0
43	Optimized	1211.5815	377.3865	878.13694	2294.7926	572.36603	0
44	Optimized	1214.13	377.5429	878.02855	2380.2192	606.92442	0
45	Optimized	1217.8185	377.7693	877.87292	2504.2505	657.09918	0
46	Optimized	1219.3275	377.8867	876.23466	2426.2522	626.24775	0
47	Optimized	1221.174	378.2103	863.01565	2464.839	647.17863	0
48	Optimized	1225.042	378.88825	835.35322	2545.9368	691.12064	0
49	Optimized	1227.707	379.35535	816.28495	2601.6907	721.35076	0
50	Optimized	1229.862	379.94915	787.39067	2487.8277	687.02116	0
51	Optimized	1233.32	380.98745	735.68267	2514.3603	718.63239	0
52	Optimized	1236.8975	382.0615	682.16804	2540.6594	750.87926	0
53	Optimized	1240.523	383.375	613.93047	2413.2079	726.95525	0
54	Optimized	1243.879	384.8076	537.22522	2396.1922	751.07143	0
55	Optimized	1246.6	385.9691	475.03834	2382.6406	770.72134	0
56	Optimized	1247.7915	386.47785	447.79331	2376.6454	779.30682	0
57	Optimized	1250.6865	388.4615	334.95902	2061.1082	697.40955	0
58	Optimized	1255.9185	392.07	129.57964	1821.9928	1057.5371	0
59	Optimized	1258.542	393.94625	22.422682	1522.6474	937.44444	0
60	Optimized	1258.858	394.25295	4.4774081	1506.9938	938.87646	0
61	Optimized	1261.1445	396.47445	-125.49691	1419.8812	887.24024	0
62	Optimized	1264.998	400.2436	-346.11675	1264.5326	790.16767	0
63	Optimized	1267.554	402.76545	-493.82339	1164.669	727.76594	0
64	Optimized	1269.123	404.33325	-585.71423	1085.5209	678.30872	0
65	Optimized	1272.28	407.5435	-774.09044	953.89476	596.0596	0
66	Optimized	1274.886	410.1982	-929.8757	829.18387	518.13159	0
67	Optimized	1277.5675	413.03985	-1097.0653	712.01427	444.9159	0
68	Optimized	1281.281	416.97485	-1328.5647	549.80801	343.55817	0
69	Optimized	1283.257	419.16205	-1457.5642	436.85771	272.979	0
70	Optimized	1286.175	422.57845	-1659.6937	278.19642	173.83642	0
71	Optimized	1289.529	426.50495	-1892.0532	79.885613	49.918071	0

Slices of Slip Surface: 35141

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	35141	1162.2285	387.3869	100.65882	173.55499	51.042448	0
2	35141	1164.1975	386.41995	160.9941	355.21334	135.99378	0

3	35141	1165.9395	385.6092	211.5842	510.18001	209.07903	0
4	35141	1167.02	385.1253	241.77806	610.41119	258.1197	0
5	35141	1167.448	384.93925	253.39303	573.78652	129.44737	0
6	35141	1167.916	384.7395	265.8556	615.76286	141.37171	0
7	35141	1169.1445	384.23215	297.51397	721.23505	171.19443	0
8	35141	1170.521	383.67845	332.06572	843.66531	206.69965	0
9	35141	1172.018	383.1135	371.16532	985.64815	248.26717	0
10	35141	1173.8705	382.4453	419.86645	1147.8738	294.13406	0
11	35141	1175.086	382.02805	450.49657	1236.5175	317.57306	0
12	35141	1175.916	381.7562	470.59871	1265.146	321.01795	0
13	35141	1177.008	381.4123	496.19378	1295.0129	322.74386	0
14	35141	1178.1225	381.07365	521.5377	1370.3749	342.95251	0
15	35141	1178.8745	380.85345	538.13014	1454.8836	370.39242	0
16	35141	1179.557	380.66065	552.74292	1530.6506	395.10034	0
17	35141	1180.2945	380.4576	568.19563	1611.6832	421.59633	0
18	35141	1181.169	380.2264	585.92705	1699.298	449.83104	0
19	35141	1182.055	379.99925	603.46043	1768.5221	470.71548	0
20	35141	1182.819	379.81175	618.04261	1795.0237	475.53122	0
21	35141	1183.6095	379.6242	632.73915	1800.7626	471.9121	0
22	35141	1184.0815	379.515	641.35876	1800.3546	468.26473	0
23	35141	1184.796	379.35765	653.86207	1798.426	462.43383	0
24	35141	1186.136	379.07495	676.56198	1807.5624	456.95382	0
25	35141	1187.4035	378.824	697.01828	1838.6944	461.2671	0
26	35141	1188.091	378.6946	707.69906	1861.389	466.121	0
27	35141	1189.364	378.47815	725.99489	1934.633	488.32148	0
28	35141	1191.1095	378.1958	750.22961	2018.7938	512.53322	0
29	35141	1193.146	377.92275	774.95741	2070.3023	523.35329	0
30	35141	1195.051	377.68995	796.70813	2116.7528	533.33267	0
31	35141	1196.551	377.5456	811.37693	2137.5152	535.79466	0
32	35141	1199.32	377.34475	834.38935	2156.8596	534.31267	0
33	35141	1203.45	377.1929	859.49076	2169.0837	529.10991	0
34	35141	1206.129	377.15235	872.15027	2169.944	524.34272	0
35	35141	1206.9675	377.16525	874.51253	2179.8363	527.38502	0
36	35141	1208.3135	377.2017	877.32981	2211.2657	538.94508	0
37	35141	1210.4285	377.2999	879.21541	2262.7475	558.98325	0
38	35141	1214.13	377.5973	874.64453	2338.685	591.51076	0
39	35141	1218.036	378.0281	862.5249	2403.7961	622.714	0
40	35141	1221.174	378.51015	844.316	2440.8903	645.0579	0
41	35141	1225.042	379.2638	811.91573	2468.6833	669.37757	0
42	35141	1229.223	380.24635	766.4081	2478.9855	691.92619	0
43	35141	1233.107	381.34695	712.43815	2467.9311	709.26517	0
44	35141	1236.862	382.5801	649.67857	2438.0313	722.5414	0
45	35141	1240.4875	383.941	578.47962	2390.6613	732.16893	0
46	35141	1243.2255	385.06615	518.62904	2345.2732	738.01215	0
47	35141	1245.9465	386.3178	450.80736	2287.5232	742.08137	0

48	35141	1250.637	388.73765	317.53516	2161.7832	745.12459	0
49	35141	1256.1555	391.969	136.77649	1893.1248	1097.4882	0
50	35141	1259.3275	394.008	21.541737	1762.9899	1088.1776	0
51	35141	1261.568	395.6274	-71.035458	1666.2079	1041.1623	0
52	35141	1264.952	398.2298	-220.63144	1517.6297	948.32029	0
53	35141	1268.213	400.97385	-379.52992	1359.9523	849.79252	0
54	35141	1272.388	404.94945	-611.81789	1132.1086	707.41995	0
55	35141	1277.5675	410.5494	-941.66006	828.14691	517.48363	0
56	35141	1282.117	416.26	-1280.7968	541.18132	338.16762	0
57	35141	1286.175	422.32425	-1643.8138	248.68439	155.39525	0
58	35141	1288.8535	426.77715	-1911.5958	47.675417	29.790907	0

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section G(2).gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels

Date Saved: 12/15/2009

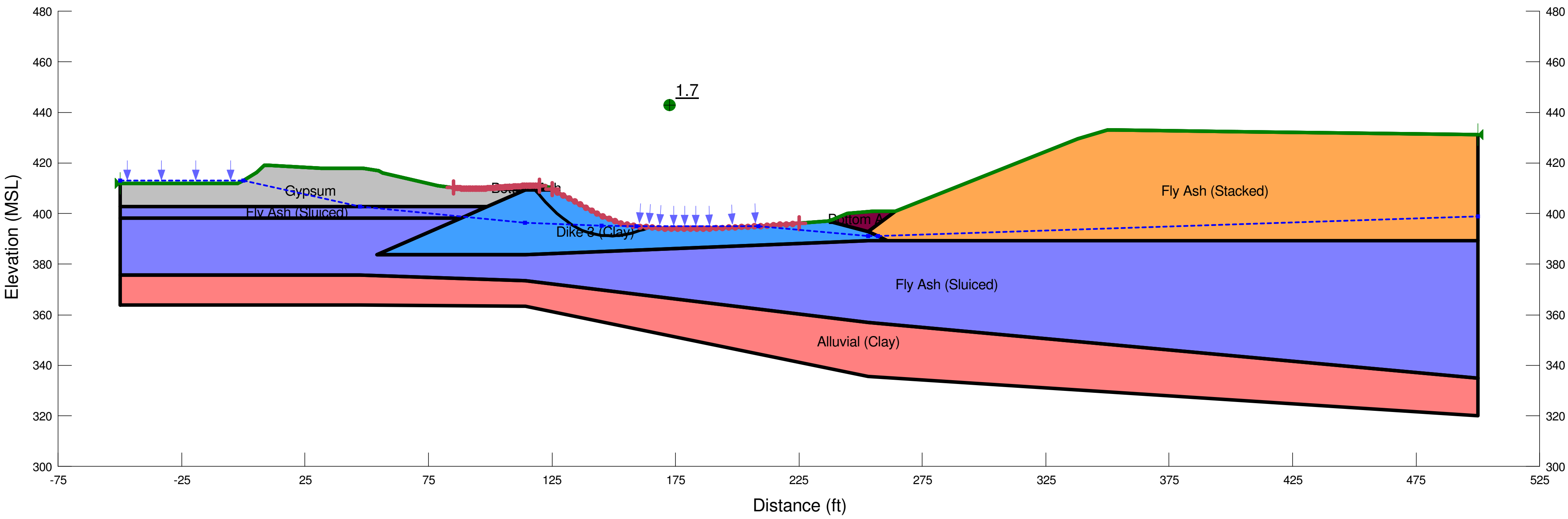
Last Solved on 12/15/2009 at 7:00:24 PM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Stacked)	100 pcf	0 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Bottom Ash	105 pcf	0 psf	35 °

Analysis Method: Spencer

Calculated Factor of Safety: 1.7



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 297
Last Edited By: Rogers, Daniel
Date: 12/15/2009
Time: 6:58:49 PM
File Name: Section G(2).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 12/15/2009
Last Solved Time: 7:00:24 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 126 pcf
Cohesion: 50 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bottom Ash

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (85, 410.31979) ft
Left-Zone Right Coordinate: (120, 410.995) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (125, 409.58495) ft
Right-Zone Right Coordinate: (225, 396.1561) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-50, 412.07731) ft
Right Coordinate: (500, 431.16225) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-50	413
	0	413
	47.24	402.8
	114	396.3
	145	395.3
	159.13426	394.995
	208.52666	394.995

	253	391
	257	391.05
	500	399

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.7	(150.192, 428.066)	26.63858	(116.773, 410.995)	(164.393, 394.565)
2	47572	1.7	(150.192, 428.066)	36.995	(117.371, 410.995)	(165.665, 394.462)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	117.44685	410.1975	-874.12386	47.903693	33.542527	0
2	Optimized	118.89075	408.4887	-770.43546	152.3102	87.936333	50
3	Optimized	120.3311	406.8295	-669.77466	285.30021	164.71815	50
4	Optimized	121.67165	405.3337	-579.16365	400.22683	231.07107	50
5	Optimized	122.6019	404.29575	-516.24661	471.15189	272.01967	50
6	Optimized	123.4786	403.3976	-461.97401	541.80327	312.81026	50
7	Optimized	124.71205	402.18145	-388.56435	596.29476	344.27094	50
8	Optimized	125.33875	401.5646	-351.33407	655.37339	378.38	50
9	Optimized	126.2139	400.7921	-304.89511	682.19491	393.86542	50
10	Optimized	128.1871	399.139	-205.71263	764.52492	441.39867	50
11	Optimized	129.99935	397.73915	-122.00716	836.81599	483.13594	50
12	Optimized	131.4078	396.7182	-61.135798	862.85691	498.17067	50
13	Optimized	132.51895	395.9486	-15.34822	921.97106	532.30024	50
14	Optimized	134.0416	394.9792	42.076516	941.93932	519.53603	50
15	Optimized	136.1442	393.8806	106.39873	1080.4412	562.36367	50
16	Optimized	138.118	393.10405	150.88083	1053.3323	521.03061	50
17	Optimized	139.9858	392.48265	185.89535	1093.6764	524.10761	50
18	Optimized	141.7476	392.01635	211.44848	1039.2998	477.96019	50
19	Optimized	143.81425	391.6112	232.57037	1031.3787	461.19221	50
20	Optimized	145.0308	391.4347	241.15727	971.95978	421.92902	50
21	Optimized	145.47735	391.3699	244.58738	957.78476	411.7647	50

22	Optimized	146.78065	391.26895	249.13884	967.21312	414.58038	50
23	Optimized	148.55575	391.18765	251.8232	885.61313	365.91879	50
24	Optimized	150.2041	391.20035	248.81075	864.85863	355.67541	50
25	Optimized	151.7257	391.30705	240.10448	763.70059	302.29836	50
26	Optimized	152.85435	391.4299	230.91924	746.56052	297.70563	50
27	Optimized	154.07605	391.66075	214.86624	666.41158	260.69982	50
28	Optimized	156.0375	392.03145	189.09545	556.59623	212.17667	50
29	Optimized	158.1397	392.53735	154.70074	461.4573	177.10599	50
30	Optimized	159.8805	393.0564	120.97049	339.61506	126.2345	50
31	Optimized	161.37285	393.5014	93.204873	255.6504	93.787971	50
32	Optimized	163.2562	394.1447	53.06162	147.84514	54.723294	50

Slices of Slip Surface: 47572

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	47572	117.8112	410.1975	-874.88651	38.02062	26.622325	0
2	47572	118.93305	408.32065	-760.00133	136.96082	79.074365	50
3	47572	120.2966	406.30465	-636.94762	292.06021	168.62104	50
4	47572	121.66015	404.5411	-529.66136	444.52738	256.64801	50
5	47572	123.0936	402.90465	-430.43447	574.5342	331.70748	50
6	47572	124.597	401.3743	-337.96701	677.86406	391.365	50
7	47572	126.2117	399.9182	-250.35776	771.35946	445.34459	50
8	47572	127.93775	398.5326	-167.36988	853.43695	492.73205	50
9	47572	129.66385	397.3063	-94.324984	922.52861	532.62214	50
10	47572	131.3899	396.22075	-30.059666	978.90725	565.17236	50
11	47572	133.0496	395.29445	24.40138	1023.124	576.61278	50
12	47572	134.643	394.50855	70.23406	1054.8206	568.45131	50
13	47572	136.2364	393.81475	110.31771	1074.582	556.71825	50
14	47572	137.8298	393.20755	144.99989	1082.6193	541.33482	50
15	47572	139.42315	392.68255	174.55506	1078.9235	522.13738	50
16	47572	141.0165	392.23605	199.20915	1063.5918	499.05154	50
17	47572	142.6099	391.86515	219.14543	1036.3891	471.83585	50
18	47572	144.2033	391.56755	234.50912	997.03225	440.24294	50
19	47572	145.0308	391.4325	241.2977	972.84745	422.36045	50
20	47572	145.87765	391.33235	246.40032	957.43917	410.51847	50
21	47572	147.50975	391.17715	253.88773	922.06703	385.7735	50

22	47572	149.14185	391.0946	256.83787	874.33648	356.51299	50
23	47572	150.77395	391.08425	255.28633	813.50271	322.28638	50
24	47572	152.4061	391.14605	249.23336	738.56888	282.51799	50
25	47572	154.07605	391.28515	238.30765	674.86435	252.04613	50
26	47572	155.63065	391.47945	224.08896	627.39263	232.84748	50
27	47572	157.0321	391.71545	207.47607	571.34983	210.08262	50
28	47572	158.43355	392.00745	187.36244	503.67004	182.62027	50
29	47572	159.9506	392.3909	162.4949	434.22366	156.88267	50
30	47572	161.5832	392.87845	132.07097	360.4505	131.85498	50
31	47572	163.2158	393.44985	96.419483	266.87771	98.414103	50
32	47572	164.84845	394.10935	55.266095	149.39701	54.346507	50

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

Stantec

File Name: Section H.gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels

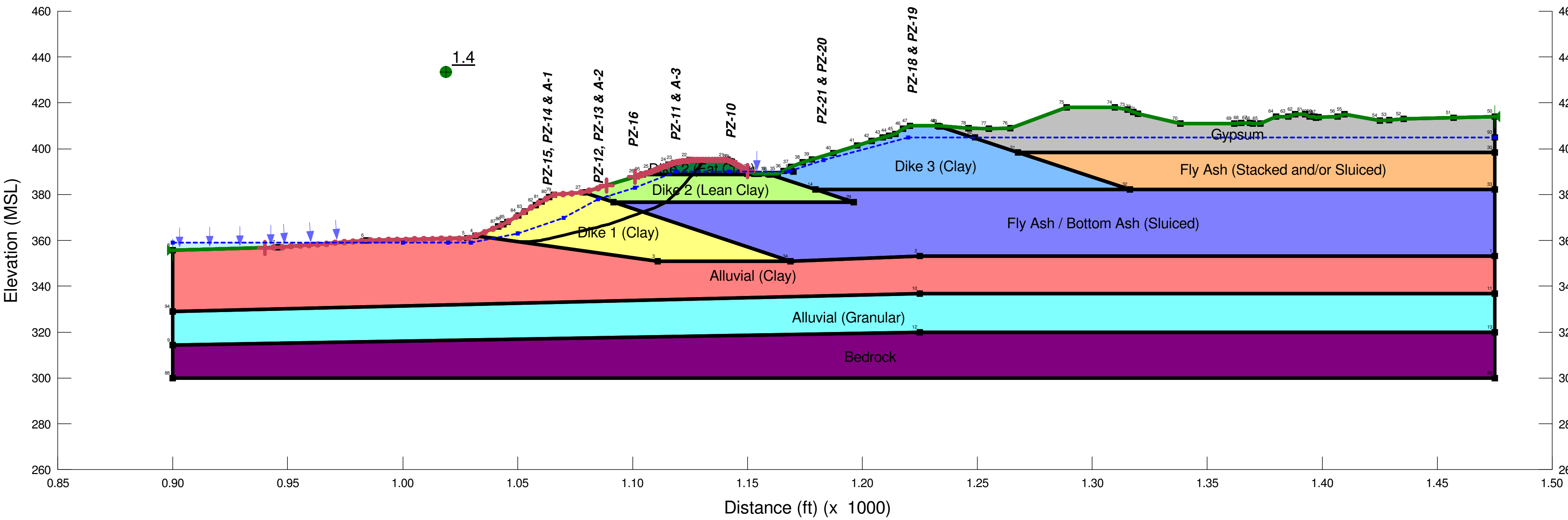
Date Saved: 12/15/2009

Last Solved on 12/15/2009 at 7:12:18 PM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Stacked and/or Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Bedrock			

Analysis Method: Spencer

Calculated Factor of Safety: 1.4



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 225
Last Edited By: Rogers, Daniel
Date: 12/15/2009
Time: 7:10:17 PM
File Name: Section H.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 12/15/2009
Last Solved Time: 7:12:18 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 0.1 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 126 pcf
Cohesion: 50 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked and/or Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bedrock

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (940, 356.80244) ft
Left-Zone Right Coordinate: (1088.5899, 384) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (1101, 387.76649) ft
Right-Zone Right Coordinate: (1150, 390.29453) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (900, 355.68471) ft
Right Coordinate: (1475, 414.15883) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	900	359
	1000	359
	1019.69	359
	1029.71	359.014
	1050	363
	1070	370
	1085	378
	1101	383
	1119	390
	1142	390
	1168	390
	1183	395
	1220	405
	1475	405

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.4	(1053.36, 472.323)	52.01278	(1131.05, 395.002)	(1031.65, 362.168)
2	31352	1.4	(1053.36, 472.323)	112.086	(1134.5, 395.002)	(1031.98, 362.294)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	1033.7105	361.8791	-129.74148	200.67873	93.578027	100
2	Optimized	1037.824	361.3011	-43.247962	527.69013	246.06595	100
3	Optimized	1040.5435	360.919	13.932262	741.44235	339.24353	100
4	Optimized	1041.4085	360.79745	32.1229	807.03165	361.34588	100
5	Optimized	1042.66	360.6217	58.428779	921.00641	402.22655	100
6	Optimized	1044.597	360.3496	99.150307	1114.9184	473.66043	100
7	Optimized	1047.647	359.92115	163.27485	1445.4583	597.89195	100
8	Optimized	1049.9045	359.6161	209.98362	1542.9744	621.58382	100
9	Optimized	1050.1365	359.61275	214.34639	1562.3078	628.56472	100
10	Optimized	1051.6385	359.59125	248.49532	1682.7141	668.78722	100
11	Optimized	1054.0535	359.55665	303.39517	1878.5781	734.51985	100
12	Optimized	1056.484	359.69805	347.64822	1896.7797	722.37189	100
13	Optimized	1059.1075	359.99525	386.40745	2057.5373	779.26066	100
14	Optimized	1060.5255	360.1559	407.35778	2143.8469	809.73818	100
15	Optimized	1062.25	360.54925	420.46016	2062.3167	765.6103	100
16	Optimized	1064.8245	361.17	437.96499	2152.8579	799.66769	100
17	Optimized	1067.925	361.9176	459.03593	2142.5113	785.01744	100
18	Optimized	1072.4835	363.01665	518.40519	2054.4387	716.26419	100
19	Optimized	1076.839	364.0276	600.26317	1996.2519	650.96025	100
20	Optimized	1080.041	364.7327	662.83071	1979.9025	614.16068	100
21	Optimized	1082.7015	365.3185	714.84551	2011.9116	604.83187	100
22	Optimized	1084.516	365.74675	748.49611	1971.5906	570.3383	100
23	Optimized	1085.688	366.0745	757.54342	1977.5907	568.9174	100
24	Optimized	1088.098	366.7484	762.51758	1989.9276	572.3507	100
25	Optimized	1090.781	367.545	765.10754	1952.78	553.82075	100
26	Optimized	1093.574	368.46125	762.41313	1936.1083	547.30304	100
27	Optimized	1096.8045	369.57515	755.92042	1867.7458	518.4527	100
28	Optimized	1099.6015	370.60065	746.45379	1831.4235	505.92969	100
29	Optimized	1101.3875	371.25545	742.26843	1808.3336	497.11435	100
30	Optimized	1101.8555	371.42695	742.91547	1802.3358	494.01583	100
31	Optimized	1103.133	371.88815	745.14729	1793.3348	488.77785	100
32	Optimized	1106.2265	373.00385	750.58504	1793.8648	421.51237	0
33	Optimized	1108.7725	373.92195	755.06983	1808.7634	425.71985	0
34	Optimized	1112.007	375.4517	738.11663	1719.8972	396.66509	0
35	Optimized	1115.159	377.26415	701.51274	1408.5636	375.9456	100
36	Optimized	1115.831	377.8765	679.61463	1374.9965	369.74111	100
37	Optimized	1117.0985	379.03155	638.28076	1310.8862	357.63068	100
38	Optimized	1118.501	380.3096	592.57067	1235.257	341.7224	100
39	Optimized	1118.8705	380.66205	579.53843	1157.3329	307.21876	100

40	Optimized	1120.884	382.7441	452.7696	989.57676	285.42543	100
41	Optimized	1123.8325	385.9546	252.43121	686.62378	230.86429	100
42	Optimized	1125.5685	388.01335	123.96444	514.82658	207.82509	100
43	Optimized	1126.742	389.40485	37.136541	376.04754	116.69641	200
44	Optimized	1128.0265	390.9282	-57.922984	246.08003	84.732148	200
45	Optimized	1129.9275	393.42905	-213.9734	19.423365	6.6880009	200

Slices of Slip Surface: 31352

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	31352	1033.986	361.94225	-130.30655	215.49574	100.48731	100
2	31352	1037.9955	361.313	-41.888697	534.3304	249.16236	100
3	31352	1040.8055	360.9448	15.53693	734.40462	335.21351	100
4	31352	1042.66	360.7535	50.203672	869.89004	382.22603	100
5	31352	1044.597	360.58335	84.564615	1030.3314	441.01828	100
6	31352	1047.7425	360.40045	134.53955	1295.4473	541.34016	100
7	31352	1050.1365	360.28325	172.50656	1488.9493	613.86732	100
8	31352	1051.6385	360.2584	206.86643	1595.9606	647.74527	100
9	31352	1055.4345	360.28255	288.26879	1853.7531	729.9973	100
10	31352	1059.1075	360.3914	361.68461	2086.6945	804.38533	100
11	31352	1062.0745	360.58975	414.10339	2249.109	855.67716	100
12	31352	1064.8245	360.8298	459.19028	2372.9632	892.40698	100
13	31352	1067.925	361.20735	503.35542	2367.0153	869.03888	100
14	31352	1071.452	361.7169	565.18317	2291.8315	805.14934	100
15	31352	1074.3555	362.2313	629.70699	2220.754	741.91741	100
16	31352	1077.259	362.8251	689.29874	2143.2662	677.99616	100
17	31352	1080.283	363.53115	745.87196	2100.956	631.88608	100
18	31352	1083.4275	364.3582	798.93023	2091.0227	602.51262	100
19	31352	1085.688	365.0034	824.40787	2078.4485	584.76875	100
20	31352	1087.7175	365.64275	824.07611	2060.2612	576.44259	100
21	31352	1090.4005	366.5445	820.13698	2030.0079	564.17207	100
22	31352	1093.285	367.60255	810.36222	1975.2674	543.20419	100
23	31352	1096.371	368.83225	793.78734	1895.3771	513.67974	100
24	31352	1099.457	370.16995	770.5044	1805.3454	482.5543	100
25	31352	1101.3875	371.0501	755.07474	1745.3948	461.79383	100
26	31352	1103.0525	371.8659	744.57285	1690.7409	441.20542	100
27	31352	1106.2265	373.5127	718.83915	1634.148	369.80877	0
28	31352	1109.921	375.57875	679.58606	1570.2809	359.86409	0
29	31352	1113.7225	377.9109	626.29817	1433.7465	429.32792	100
30	31352	1115.831	379.26215	593.11699	1360.9202	408.24821	100
31	31352	1117.0985	380.13655	569.32378	1310.2086	393.93545	100
32	31352	1118.6305	381.20515	539.83125	1240.4221	372.51075	100

33	31352	1120.4745	382.5722	463.49234	1114.8532	346.33472	100
34	31352	1123.423	384.8557	320.99657	906.29187	311.20703	100
35	31352	1126.5065	387.42335	160.7846	654.23332	262.37134	100
36	31352	1128.77	389.405	37.128255	443.48439	139.91964	200
37	31352	1131.9635	392.50085	-156.05268	148.70176	51.202123	200

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section I.gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels

Date Saved: 10/11/2009

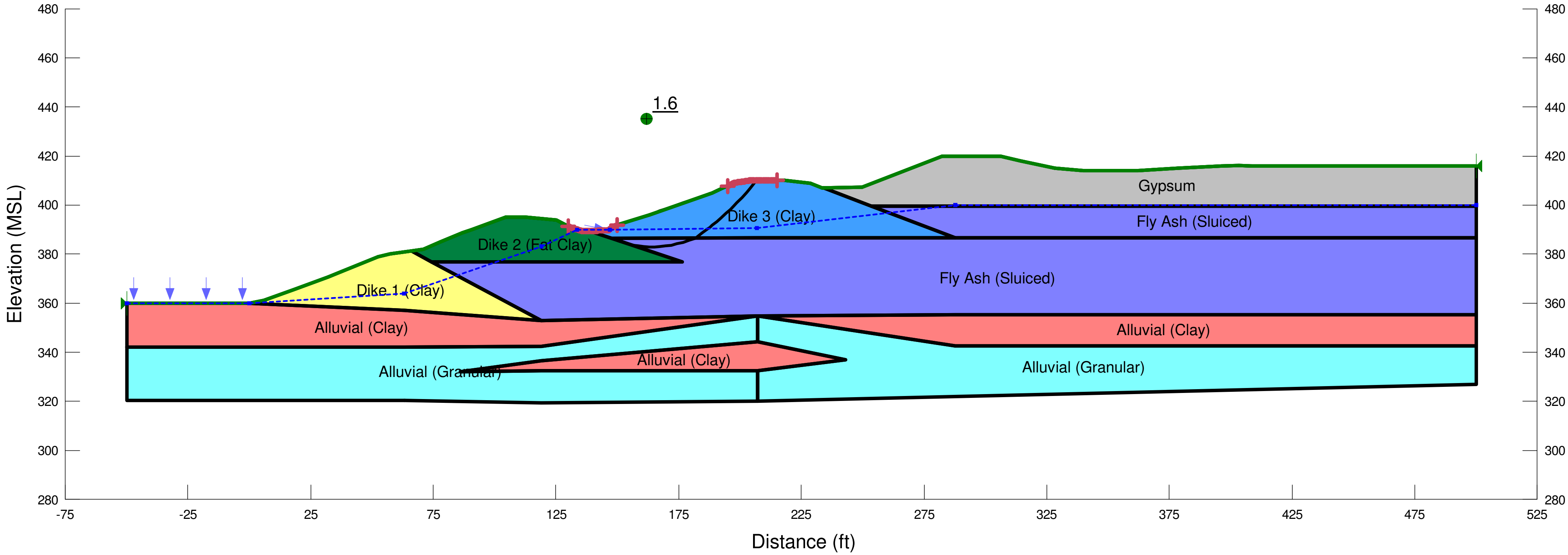
Last Solved on 10/11/2009 at 12:42:16 PM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °

Analysis Method: Spencer

Calculated Factor of Safety: 1.6



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 259
Last Edited By: Kirkbride, Rob
Date: 10/11/2009
Time: 12:39:36 PM
File Name: Section I.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 10/11/2009
Last Solved Time: 12:42:16 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 0.1 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 126 pcf
Cohesion: 50 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (130, 391.32236) ft
Left-Zone Right Coordinate: (150, 391.86103) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (195, 407.77872) ft
Right-Zone Right Coordinate: (215, 410.002) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-50, 359.89) ft
Right Coordinate: (500, 415.99507) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-50	360
	0	360
	63	364
	119	383
	133.62102	390
	146.86482	390
	207	390.5
	287.8	400
	500	400

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.6	(165.109, 428.014)	36.27632	(206.729, 410.002)	(139.732, 389.478)
2	29966	1.6	(165.109, 428.014)	45.004	(206.351, 410.002)	(141.743, 389.552)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	141.4063	388.6984	81.219972	222.50916	81.573353	50
2	Optimized	143.96185	387.62515	148.19132	377.52322	132.40484	50
3	Optimized	145.72335	387.0384	184.80557	478.15048	169.36276	50
4	Optimized	146.62535	386.7379	203.55414	557.47671	204.33729	50
5	Optimized	146.70345	386.7119	205.18049	555.68499	202.36387	50
6	Optimized	146.81255	386.67555	207.44414	569.90658	209.26779	50
7	Optimized	147.2673	386.52405	217.11049	645.07309	247.08432	50
8	Optimized	148.0268	386.2711	233.27989	696.01258	186.95614	0
9	Optimized	149.1897	385.88375	258.05909	849.34713	238.89588	0
10	Optimized	150.1304	385.5706	278.0887	968.26315	278.84858	0
11	Optimized	151.3602	385.16295	304.16328	1085.1922	315.55615	0
12	Optimized	153.5502	384.43705	350.59721	1284.7891	377.43804	0
13	Optimized	155.66135	383.8728	386.89828	1355.8044	391.46349	0
14	Optimized	157.6936	383.4702	413.07411	1497.1819	438.00796	0
15	Optimized	159.7823	383.18305	432.08058	1531.5478	444.21358	0
16	Optimized	161.92745	383.0113	443.9114	1644.698	485.14928	0
17	Optimized	163.1073	382.9168	450.42011	1707.4761	507.8836	0
18	Optimized	164.26065	382.93365	449.9627	1674.9421	494.92382	0
19	Optimized	166.35275	382.98455	447.87452	1767.5485	533.1829	0
20	Optimized	168.5384	383.15885	438.14865	1762.2094	534.95527	0
21	Optimized	170.8176	383.4565	420.74191	1833.8202	570.9207	0
22	Optimized	173.1797	383.89625	394.5268	1805.7644	570.17702	0
23	Optimized	175.62475	384.47815	359.48578	1853.2709	603.52838	0
24	Optimized	178.06625	385.19315	316.13513	1799.6403	599.37501	0

25	Optimized	180.5496	386.0571	263.51281	1819.3003	628.57893	0
26	Optimized	183.08805	387.456	177.54116	1440.1076	728.94308	50
27	Optimized	185.6362	389.374	59.181431	1331.0884	734.33581	50
28	Optimized	187.2715	390.60485	-16.778034	1263.3015	729.36749	50
29	Optimized	188.117	391.2776	-58.320655	1186.5346	685.04609	50
30	Optimized	189.5337	392.4503	-130.7631	1131.9032	653.50463	50
31	Optimized	191.3985	393.99395	-226.11627	1063.3306	613.91419	50
32	Optimized	192.48655	394.90785	-282.57113	983.5658	567.86198	50
33	Optimized	193.49195	395.8252	-339.29771	944.94959	545.5669	50
34	Optimized	195.1914	397.3758	-435.15757	880.96478	508.62525	50
35	Optimized	196.81925	398.94515	-532.26488	774.53872	447.18014	50
36	Optimized	198.20945	400.36385	-620.03812	696.3637	402.04577	50
37	Optimized	199.7937	402.04495	-724.14506	562.65511	324.84908	50
38	Optimized	201.7381	404.1578	-854.9878	418.57835	241.66632	50
39	Optimized	203.40975	406.04755	-972.05352	275.38376	158.99289	50
40	Optimized	205.41905	408.44145	-1120.3691	101.072	58.353946	50

Slices of Slip Surface: 29966

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	29966	142.95855	388.86415	70.87444	218.4964	85.229578	50
2	29966	145.3889	387.5839	150.76219	440.18994	167.10119	50
3	29966	146.62535	386.9816	188.3478	565.76338	217.90099	50
4	29966	146.70345	386.94655	190.53081	564.42001	215.86503	50
5	29966	146.81255	386.89785	193.57781	580.515	223.39829	50
6	29966	147.4311	386.63265	210.41897	691.73734	277.88929	50
7	29966	148.1906	386.31235	230.79678	734.33485	203.44259	0
8	29966	149.3245	385.88155	258.26495	877.87188	250.33745	0
9	29966	151.32645	385.18755	302.6098	1069.2614	309.74734	0
10	29966	153.44895	384.56125	342.79052	1214.6698	352.26208	0
11	29966	155.5714	384.0463	376.02903	1340.7606	389.77684	0
12	29966	157.69385	383.63875	402.56202	1449.5616	423.01528	0
13	29966	159.8163	383.33565	422.57442	1542.4572	452.46202	0
14	29966	161.93875	383.13495	436.19745	1620.6306	478.54205	0
15	29966	164.07805	383.0353	443.52803	1690.9576	503.99425	0

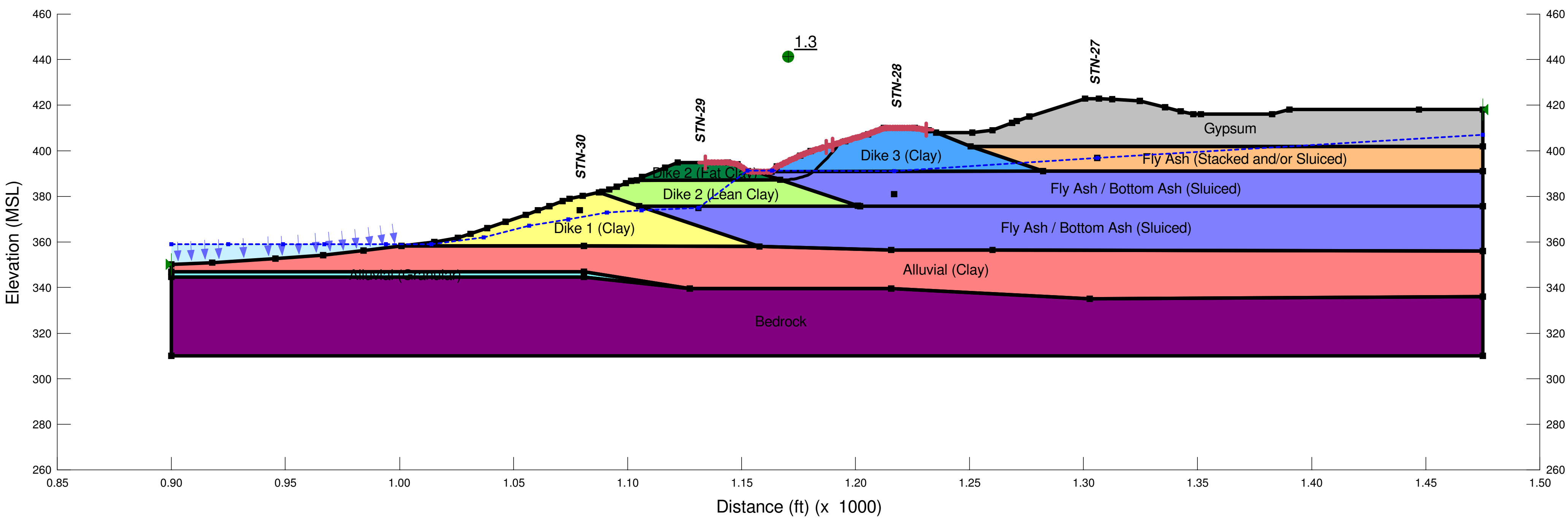
16	29966	166.2342	383.03755	444.50729	1753.4188	528.83458	0
17	29966	168.39035	383.1433	439.02647	1802.2598	550.78201	0
18	29966	170.5465	383.35335	427.03701	1837.9327	570.03884	0
19	29966	172.70265	383.6692	408.44408	1860.6907	586.74572	0
20	29966	174.85875	384.09315	383.11218	1870.5781	600.97525	0
21	29966	177.0149	384.6283	350.83796	1867.7038	612.85359	0
22	29966	179.17105	385.27885	311.36254	1851.8306	622.38951	0
23	29966	181.3272	386.05025	264.34552	1822.7966	629.6551	0
24	29966	183.43795	386.92755	210.69797	1739.3085	882.54368	50
25	29966	185.5033	387.9134	150.25299	1655.4802	869.04335	50
26	29966	187.56865	389.03355	81.426194	1556.5329	851.65324	50
27	29966	189.1764	389.99255	22.416409	1473.4414	837.74967	50
28	29966	191.19685	391.386	-63.48565	1363.4861	787.20908	50
29	29966	193.881	393.4465	-190.6703	1211.6136	699.52542	50
30	29966	196.3586	395.6746	-328.42414	1053.2503	608.09433	50
31	29966	198.6827	398.0892	-477.86989	855.83742	494.11797	50
32	29966	200.8533	400.72855	-641.44084	625.11549	360.91059	50
33	29966	203.0239	403.8534	-835.32143	379.91663	219.34497	50
34	29966	205.23025	407.77925	-1079.1385	106.14237	61.281324	50

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant
Tennessee Valley Authority (TVA)

File Name: Section J.gsz
Analysis Name: Stability - Existing Condition with Existing PZ Levels
Date Saved: 12/15/2009
Last Solved on 12/15/2009 at 7:42:52 PM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Stacked and/or Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Bedrock			

Analysis Method: Spencer
Calculated Factor of Safety: 1.3



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Kirkbride, Rob
Revision Number: 81
Last Edited By: Rogers, Daniel
Date: 12/15/2009
Time: 7:41:17 PM
File Name: Section J.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 12/15/2009
Last Solved Time: 7:42:52 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 126 pcf
Cohesion: 50 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked and/or Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bedrock

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (1134, 394.98991) ft
Left-Zone Right Coordinate: (1187, 401.76094) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (1190, 402.64639) ft
Right-Zone Right Coordinate: (1231, 409.14936) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (900, 350.14265) ft
Right Coordinate: (1475, 418.20122) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	900	359
	925	359
	949	359
	967	359
	994	359
	1014	359
	1037	362
	1057	367
	1074	370
	1091	373
	1106	374
	1131	375
	1152.4982	391.23424
	1163.5128	391.26817
	1217	391
	1306	397
	1475	407

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)

1	Optimized	1.3	(1170.61, 411.294)	20.93371	(1193.18, 403.585)	(1156.43, 390.894)
2	22993	1.3	(1170.61, 411.294)	23.734	(1193.04, 403.543)	(1158.47, 390.898)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	1156.912	390.7337	32.082137	45.514796	5.4271468	0
2	Optimized	1157.8685	390.41395	52.218734	85.988256	13.643773	0
3	Optimized	1158.888	390.07425	73.612932	128.85004	22.317241	0
4	Optimized	1159.97	389.71455	96.264752	174.32911	31.540047	0
5	Optimized	1161.009	389.36905	118.02587	218.01406	40.397851	0
6	Optimized	1162.005	389.03775	138.89206	259.89882	48.889904	0
7	Optimized	1162.8195	388.7663	155.98364	294.5725	55.993535	0
8	Optimized	1163.3245	388.59755	166.60951	337.02874	68.853837	0
9	Optimized	1164.413	388.2336	189.07378	550.20328	145.90579	0
10	Optimized	1165.348	387.921	208.29211	748.18165	218.12953	0
11	Optimized	1166.013	387.78405	216.62853	746.48327	214.07521	0
12	Optimized	1167.2725	387.53335	231.87178	873.10034	259.07315	0
13	Optimized	1168.6205	387.3881	240.51886	889.72281	262.29542	0
14	Optimized	1170.057	387.3483	242.55804	991.89061	302.75001	0
15	Optimized	1171.3	387.39335	239.35158	980.68578	299.51846	0
16	Optimized	1172.3505	387.5233	230.91465	1032.6489	323.92166	0
17	Optimized	1173.401	387.6533	222.47773	1084.612	348.32486	0
18	Optimized	1174.827	387.96515	202.57107	1051.4809	342.98182	0
19	Optimized	1176.2085	388.34375	178.51365	1089.1559	367.92336	0
20	Optimized	1177.17	388.6073	161.76358	1108.7144	382.59296	0
21	Optimized	1178.3165	389.07355	132.31141	995.20521	348.63173	0
22	Optimized	1179.6475	389.7425	90.15649	991.84893	364.30739	0
23	Optimized	1180.3585	390.10445	67.346718	943.07781	353.81833	0
24	Optimized	1181.116	390.56095	38.622882	927.286	359.04321	0
25	Optimized	1181.9195	391.0827	5.8135697	694.56597	397.65138	50
26	Optimized	1182.7305	391.90395	-45.684692	648.43166	374.3722	50
27	Optimized	1184.1185	393.3155	-134.19837	568.19906	328.04988	50
28	Optimized	1185.455	394.6815	-219.85468	493.32697	284.82246	50
29	Optimized	1186.82	396.1013	-308.88206	407.49931	235.26984	50
30	Optimized	1188.214	397.5749	-401.26763	326.97068	188.77661	50
31	Optimized	1189.5185	398.9982	-490.48991	238.64546	137.78202	50
32	Optimized	1190.7335	400.37125	-576.55608	164.2184	94.811537	50

33	Optimized	1191.8005	401.6896	-659.13112	76.78452	44.331563	50
34	Optimized	1192.72	402.9532	-738.28316	11.069128	6.3907643	50

Slices of Slip Surface: 22993

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	22993	1159.055	390.57295	42.52505	76.542095	13.743778	0
2	22993	1160.221	389.96395	80.748119	157.57987	31.042042	0
3	22993	1161.387	389.43405	114.03939	220.99971	43.214775	0
4	22993	1162.553	388.9777	142.73639	270.54341	51.637388	0
5	22993	1163.3245	388.7066	159.80633	318.39894	64.075574	0
6	22993	1163.963	388.5146	171.67627	420.92676	100.70373	0
7	22993	1164.863	388.271	186.59475	581.64021	159.60873	0
8	22993	1165.892	388.0414	200.60066	704.07147	203.41541	0
9	22993	1167.0495	387.83635	213.04028	789.85705	233.0491	0
10	22993	1168.2065	387.68975	221.82483	864.05159	259.47645	0
11	22993	1169.3635	387.60055	227.02952	927.72544	283.09953	0
12	22993	1170.5205	387.5681	228.69725	981.71131	304.23743	0
13	22993	1171.6775	387.5921	226.83401	1026.6451	323.14466	0
14	22993	1172.8345	387.6728	221.43336	1062.9008	339.9749	0
15	22993	1173.992	387.8108	212.45985	1090.8251	354.8826	0
16	22993	1175.1495	388.00705	199.85377	1110.638	367.98072	0
17	22993	1176.3125	388.2647	183.41273	1116.2846	376.90468	0
18	22993	1177.4815	388.58645	162.96384	1108.0657	381.84593	0
19	22993	1178.6505	388.97405	138.4168	1092.4635	385.45988	0
20	22993	1179.8195	389.43105	109.53367	1069.0883	387.68525	0
21	22993	1181.011	389.97355	75.311106	1031.0484	386.14294	0
22	22993	1182.225	390.6106	35.177377	978.07115	380.95381	0
23	22993	1183.01	391.0605	6.857508	901.37385	516.44925	50
24	22993	1183.735	391.5331	-22.859487	850.20154	490.86409	50
25	22993	1184.8295	392.30665	-71.471293	770.73587	444.98456	50
26	22993	1185.924	393.1794	-126.27269	685.1275	395.55855	50
27	22993	1187.0185	394.16665	-188.21577	593.18244	342.47404	50
28	22993	1188.1135	395.28975	-258.64056	494.52317	285.51309	50
29	22993	1189.208	396.5803	-339.51677	388.71791	224.42639	50
30	22993	1190.3025	398.08845	-433.96793	275.32612	158.95961	50
				-			

31	22993	1191.3975	399.90365	547.55748	154.04828	88.939815	50
32	22993	1192.492	402.223	-692.66307	25.448136	14.692488	50

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section K.gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels

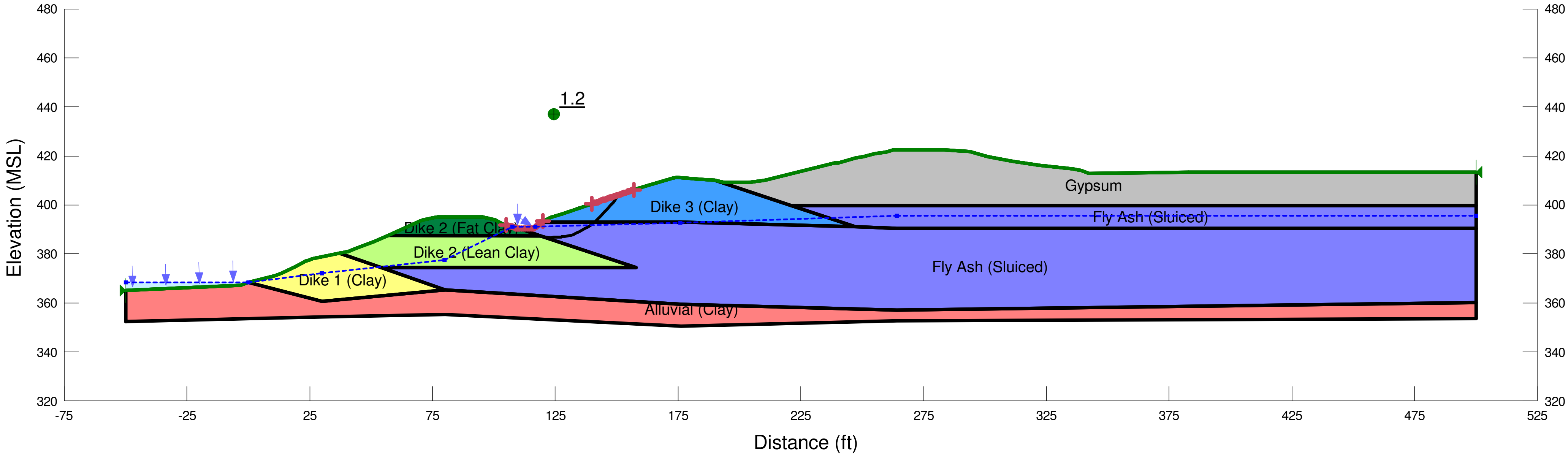
Date Saved: 10/13/2009

Last Solved on 10/13/2009 at 10:41:10 AM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °

Analysis Method: Spencer

Calculated Factor of Safety: 1.2



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 309
Last Edited By: Rogers, Daniel
Date: 10/13/2009
Time: 10:40:04 AM
File Name: Section K.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 10/13/2009
Last Solved Time: 10:41:10 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 126 pcf
Cohesion: 50 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (105, 391.72847) ft
Left-Zone Right Coordinate: (120, 393.34958) ft
Left-Zone Increment: 20
Right Projection: Range
Right-Zone Left Coordinate: (140, 400.46248) ft
Right-Zone Right Coordinate: (156.97953, 406.17376) ft
Right-Zone Increment: 30
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-50, 365.00654) ft
Right Coordinate: (500, 413.44393) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-50	368.4
	0	368.4
	30	372
	80	377.5
	107.5	391
	117	391
	176	392.6
	264	395.5
	500	395.5

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.2	(125.078, 413.17)	22.77603	(150.746, 404.066)	(110.376, 390.268)
2	9197	1.3	(125.078, 413.17)	26.314	(149.625, 403.69)	(112.12, 390.268)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	111.37725	389.9315	66.674778	93.995151	11.038147	0
2	Optimized	113.19485	389.32265	104.66916	169.67348	26.263451	0
3	Optimized	114.82795	388.77835	138.63522	237.46619	39.930303	0
4	Optimized	116.05765	388.36835	164.21449	288.58357	50.248372	0
5	Optimized	116.5841	388.1927	175.17374	340.93341	66.971253	0
6	Optimized	116.8487	388.10445	180.6822	355.54059	70.647377	0
7	Optimized	117.01685	388.04835	184.21166	367.23678	73.946948	0
8	Optimized	117.03505	388.04225	184.62123	368.72348	74.382139	0
9	Optimized	117.47765	387.89465	194.58279	441.11667	99.606153	0
10	Optimized	118.06025	387.70045	207.68703	535.94054	132.62303	0
11	Optimized	118.84665	387.4389	225.33811	659.20002	175.29159	0
12	Optimized	119.7455	387.14	245.51595	797.52028	223.02423	0
13	Optimized	120.53695	386.99875	255.66301	774.56374	209.6495	0
14	Optimized	122.05545	386.83825	268.24799	897.08331	254.06596	0
15	Optimized	123.04675	386.7351	276.36227	883.41135	245.26375	0
16	Optimized	123.77415	386.76855	275.50437	913.23915	257.66157	0
17	Optimized	125.2081	386.83445	273.81848	971.89712	282.04208	0
18	Optimized	126.64205	386.90035	272.13259	1030.5551	306.42258	0
19	Optimized	127.477	386.95595	270.07889	982.25255	287.73684	0
20	Optimized	128.18725	387.0924	262.76736	998.53917	297.27111	0
21	Optimized	129.37175	387.31995	250.57165	1025.567	313.11847	0
22	Optimized	130.55625	387.54745	238.37594	1052.512	328.93233	0
23	Optimized	131.74075	387.775	226.18023	1079.5399	344.77968	0
24	Optimized	132.93545	388.1694	203.59123	952.31432	302.50376	0

25	Optimized	134.14035	388.73065	170.61609	946.29558	313.39486	0
26	Optimized	135.32895	389.33515	134.90468	898.96634	308.70095	0
27	Optimized	136.50125	389.98285	96.474618	884.03334	318.19438	0
28	Optimized	137.5958	390.63	57.941848	833.45505	313.32767	0
29	Optimized	138.6126	391.2766	19.313949	813.3635	320.81684	0
30	Optimized	139.1286	391.60475	- 0.28970505	803.17175	324.50245	0
31	Optimized	140.169	392.35415	-45.29237	748.52386	302.42327	0
32	Optimized	141.8065	393.72595	-128.12236	542.37662	313.14129	50
33	Optimized	143.0159	394.98045	-204.35533	477.53497	275.70495	50
34	Optimized	144.2542	396.28625	-283.74215	402.47296	232.36787	50
35	Optimized	145.5214	397.64335	-366.28013	332.3655	191.89131	50
36	Optimized	146.7934	399.04755	-451.75411	249.82321	144.2355	50
37	Optimized	148.07025	400.4989	-540.17227	175.08265	101.08402	50
38	Optimized	149.21805	401.935	-627.82891	82.837265	47.826117	50
39	Optimized	150.2367	403.3558	-714.77314	12.029193	6.9450576	50

Slices of Slip Surface: 9197

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	9197	112.84505	389.8874	69.42431	111.22295	16.887745	0
2	9197	114.29535	389.18045	113.54031	200.64826	35.193896	0
3	9197	115.74565	388.5793	151.0515	268.71722	47.540035	0
4	9197	116.5841	388.2655	170.63312	331.83583	65.130124	0
5	9197	116.8487	388.17705	176.15153	344.07391	67.845046	0
6	9197	117.01685	388.1218	179.62879	353.95878	70.433888	0
7	9197	117.03505	388.11595	180.02343	355.23571	70.790359	0
8	9197	117.619	387.94325	191.79016	439.22283	99.96929	0
9	9197	118.84665	387.6137	214.43106	597.40068	154.72977	0
10	9197	120.28315	387.30965	235.83124	751.42247	208.31238	0
11	9197	121.57025	387.09625	251.32692	853.72571	243.38491	0
12	9197	122.56155	386.98195	260.14009	902.46228	259.51501	0
13	9197	123.62445	386.9029	266.86534	944.11943	273.62841	0
14	9197	124.7589	386.86465	271.17622	978.37095	285.72522	0
15	9197	125.89335	386.87535	272.43172	1005.815	296.30607	0
16	9197	127.0278	386.93505	270.61762	1026.7383	305.49257	0
17	9197	128.2248	387.0531	265.2762	1041.5878	313.65026	0
18	9197	129.48435	387.236	255.99942	1049.7965	320.71482	0
19	9197	130.74385	387.4819	242.78902	1050.548	326.35583	0
20	9197	132.0034	387.79265	225.53074	1043.9749	330.67289	0
21	9197	133.26295	388.1707	204.07193	1030.0177	333.70376	0
22	9197	134.52245	388.61915	178.22037	1008.589	335.49072	0
23	9197	135.782	389.14195	147.72445	979.43868	336.03436	0
24	9197	137.04155	389.7441	112.28431	942.3256	335.35845	0
25	9197	138.30105	390.4319	71.49544	896.76435	333.43028	0

26	9197	139.56055	391.2135	24.854193	842.3027	330.27063	0
27	9197	141.10745	392.33445	-42.474493	765.34977	309.22138	0
28	9197	142.65795	393.6092	-119.39482	618.34702	357.00282	50
29	9197	143.92465	394.8292	-193.38271	517.59594	298.83415	50
30	9197	145.19135	396.2321	-278.77901	408.49889	235.84695	50
31	9197	146.45805	397.86915	-378.78496	290.68528	167.82722	50
32	9197	147.72475	399.8292	-498.95597	163.91577	94.636814	50
33	9197	148.99145	402.29725	-650.80898	28.855243	16.659583	50

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section L.gsz

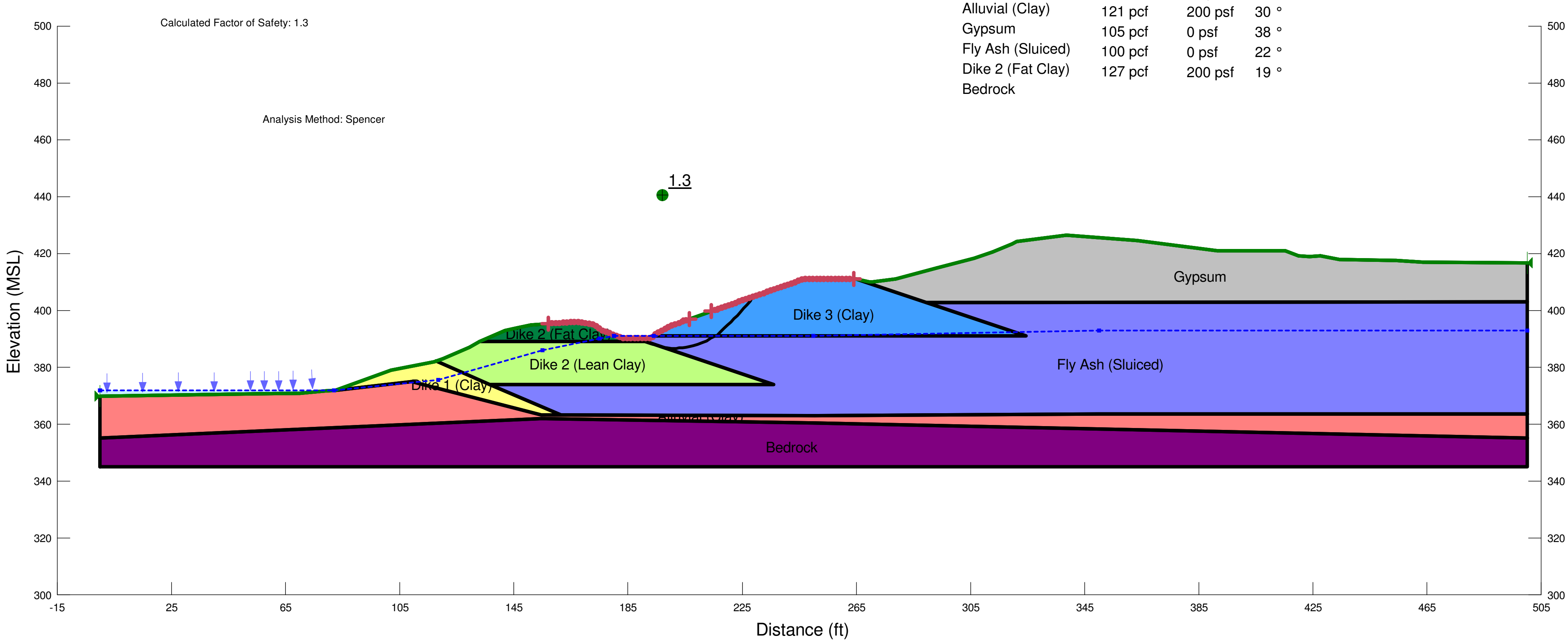
Analysis Name: Stability - Existing Condition with Existing PZ Levels

Date Saved: 12/15/2009

Last Solved on 12/15/2009 at 8:00:20 PM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Bedrock			



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Rogers, Daniel
Revision Number: 280
Last Edited By: Rogers, Daniel
Date: 12/15/2009
Time: 7:58:41 PM
File Name: Section L.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 12/15/2009
Last Solved Time: 8:00:20 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 126 pcf
Cohesion: 50 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bedrock

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (157, 395.37291) ft
Left-Zone Right Coordinate: (206.46194, 397) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (214.1328, 399.68778) ft
Right-Zone Right Coordinate: (264, 410.99682) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (0, 369.82) ft
Right Coordinate: (500, 416.67809) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	0	372
	82	372
	118.4	375.5
	155	386
	175	390
	180	391
	194	391
	250	391
	350	393
	500	393

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.3	(201.923, 416.284)	23.50305	(228.501, 404.722)	(187.222, 390.294)
2	32167	1.3	(201.923, 416.284)	29.214	(228.796, 404.826)	(188.595, 390.287)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	187.91555	390.063	58.46997	78.786607	8.208454	0
2	Optimized	189.3034	389.60035	87.337886	136.03438	19.674661	0
3	Optimized	190.69125	389.1377	116.20444	193.28899	31.144181	0
4	Optimized	192.2866	388.60565	149.40617	259.1745	44.349286	0
5	Optimized	193.5157	388.19555	174.99484	339.59882	66.504325	0
6	Optimized	193.86495	388.07905	182.26745	363.08994	73.057028	0
7	Optimized	193.94325	388.05305	183.88603	375.40716	77.379556	0
8	Optimized	194.01895	388.0279	185.45837	389.87355	82.589094	0
9	Optimized	194.3881	387.9054	193.09789	482.73794	117.02218	0
10	Optimized	195.6563	387.4845	219.3652	682.66019	187.18333	0
11	Optimized	196.78715	387.1385	240.94946	741.75724	202.33948	0
12	Optimized	197.7813	386.9456	252.99167	851.13761	241.66665	0
13	Optimized	198.6426	386.79155	262.60971	857.2933	240.26777	0
14	Optimized	199.49865	386.76505	264.26146	909.3567	260.63539	0
15	Optimized	201.0508	386.7169	267.26239	999.89954	296.00462	0
16	Optimized	202.40135	386.75215	265.06258	991.56052	293.52422	0

17	Optimized	203.55025	386.8708	257.66029	1037.7058	315.15884	0
18	Optimized	204.6992	386.9894	250.258	1083.8511	336.79346	0
19	Optimized	205.8633	387.1884	237.84611	1045.1101	326.15584	0
20	Optimized	207.185	387.50155	218.30056	1073.8261	345.65476	0
21	Optimized	208.64925	387.8485	196.65658	1102.6671	366.05199	0
22	Optimized	210.17645	388.35975	164.75495	1017.0202	344.3375	0
23	Optimized	211.7665	389.03525	122.6039	1017.8884	361.71844	0
24	Optimized	213.3208	389.77975	76.145123	957.99596	356.29087	0
25	Optimized	214.8394	390.59325	25.381901	943.3683	370.89058	0
26	Optimized	215.7547	391.0836	-5.215638	934.82628	377.69433	0
27	Optimized	216.6739	391.87285	-54.463878	689.91427	398.32219	50
28	Optimized	218.03675	393.14635	-133.93357	618.29931	356.97527	50
29	Optimized	219.2361	394.28205	-204.80219	560.90699	323.8398	50
30	Optimized	220.40305	395.4051	-274.87844	495.38594	286.0112	50
31	Optimized	221.5375	396.5155	-344.17287	439.08105	253.50357	50
32	Optimized	222.6617	397.64525	-414.66909	370.58234	213.95582	50
33	Optimized	223.77575	398.79435	-486.37253	312.08743	180.18376	50
34	Optimized	224.9139	400.0419	-564.19433	230.3845	133.01256	50
35	Optimized	226.0761	401.3879	-648.20771	161.96477	93.510401	50
36	Optimized	227.2383	402.73385	-732.16487	93.550651	54.011494	50
37	Optimized	228.16045	404.0646	-815.22014	2.2017219	1.2711648	50

Slices of Slip Surface: 32167

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	32167	189.3603	389.922	67.263834	104.64573	15.103268	0
2	32167	190.89135	389.2449	109.52061	188.38029	31.861379	0
3	32167	192.42245	388.66925	145.44284	252.76631	43.361495	0
4	32167	193.53725	388.3012	168.40608	320.15119	61.309004	0
5	32167	193.94325	388.1804	175.93958	348.64127	69.776012	0
6	32167	194.01895	388.15895	177.28091	361.44701	74.407933	0
7	32167	194.3881	388.06015	183.45186	443.42708	105.0368	0
8	32167	195.3037	387.83515	197.49025	570.1465	150.5629	0
9	32167	196.43455	387.5954	212.45088	662.43577	181.8057	0
10	32167	197.8613	387.36625	226.74424	781.81723	224.26404	0

11	32167	199.3668	387.1887	237.82738	886.39198	262.03711	0
12	32167	200.6552	387.1041	243.10109	943.40281	282.94026	0
13	32167	201.94355	387.0766	244.8206	991.32859	301.60881	0
14	32167	203.2319	387.106	242.98502	1030.8855	318.33245	0
15	32167	204.5203	387.1924	237.59604	1062.2359	333.17613	0
16	32167	205.8087	387.3364	228.60479	1085.8285	346.34087	0
17	32167	207.08445	387.5363	216.13868	1098.8095	356.62215	0
18	32167	208.3476	387.79215	200.16882	1101.6235	364.21134	0
19	32167	209.6108	388.1069	180.53012	1097.6305	370.53259	0
20	32167	210.874	388.48255	157.08515	1086.8459	375.64775	0
21	32167	212.1372	388.9217	129.68558	1069.094	379.54562	0
22	32167	213.4004	389.42745	98.128212	1044.3957	382.3169	0
23	32167	214.6636	390.0036	62.177841	1012.3863	383.90913	0
24	32167	215.9268	390.6549	21.535069	972.86077	384.36053	0
25	32167	216.69485	391.08	-4.9921196	946.24622	382.30829	0
26	32167	217.49605	391.579	-36.130786	868.97149	501.70093	50
27	32167	218.8255	392.4698	-91.715713	791.83931	457.16864	50
28	32167	220.1549	393.4729	-154.31125	707.27458	408.34517	50
29	32167	221.4843	394.604	-224.88627	615.0473	355.09772	50
30	32167	222.8137	395.8845	-304.79095	514.97784	297.32259	50
31	32167	224.1431	397.3451	-395.93806	406.72137	234.82069	50
32	32167	225.4725	399.0324	-501.23776	290.04757	167.45904	50
33	32167	226.80195	401.0235	-625.45425	164.95112	95.234574	50
34	32167	228.1314	403.4664	-777.91257	32.309148	18.653695	50

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section M.gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels

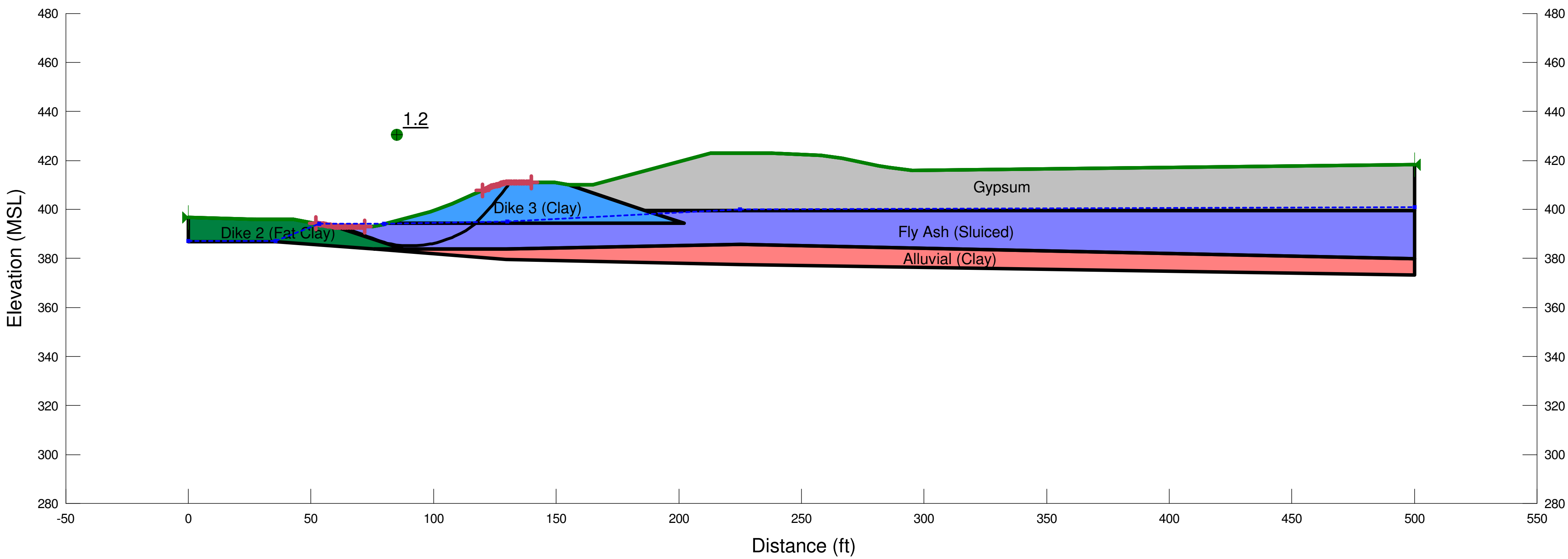
Date Saved: 10/8/2009

Last Solved on 10/8/2009 at 8:42:42 PM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °

Analysis Method: Spencer

Calculated Factor of Safety: 1.2



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 237
Last Edited By: Rogers, Daniel
Date: 10/8/2009
Time: 8:41:38 PM
File Name: Section M.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 10/8/2009
Last Solved Time: 8:42:42 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 126 pcf
Cohesion: 50 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (52, 394.33556) ft
Left-Zone Right Coordinate: (72, 392.97402) ft
Left-Zone Increment: 20
Right Projection: Range
Right-Zone Left Coordinate: (120, 407.66232) ft
Right-Zone Right Coordinate: (140, 411.02676) ft
Right-Zone Increment: 20
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (0, 396.66) ft
Right Coordinate: (500, 418.28266) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	0	387
	35.5	387
	53.5	394.1
	80	394.1
	130	395
	225	400
	500	401

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.2	(90.91, 428.717)	35.44875	(131.135, 410.98)	(62.5713, 392.978)
2	9475	1.2	(90.91, 428.717)	43.605	(130.744, 410.978)	(65.9669, 392.951)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	63.81192	392.5128	99.041507	134.11431	14.17033	0
2	Optimized	66.293205	391.5818	157.13519	246.5812	36.138535	0
3	Optimized	67.56286	391.1052	186.86928	305.26222	47.83385	0
4	Optimized	69.245345	390.4613	227.05604	385.13417	63.86771	0
5	Optimized	71.92684	389.4484	290.26088	506.91187	87.532685	0
6	Optimized	73.982885	388.68815	337.69947	600.20154	106.05772	0
7	Optimized	76.5466	387.74015	396.84006	734.86412	136.57058	0
8	Optimized	79.026645	386.89235	449.75766	830.57018	153.85824	0
9	Optimized	79.9855	386.6081	467.506	872.79248	163.74637	0
10	Optimized	80.209165	386.5418	471.86535	883.29509	166.2284	0
11	Optimized	80.791935	386.369	483.30948	917.95056	175.60639	0
12	Optimized	81.88258	386.0456	504.7059	999.41034	199.87357	0
13	Optimized	83.73427	385.66535	530.5278	1047.1494	208.72868	0
14	Optimized	86.00357	385.33005	553.98088	1174.5284	250.71747	0
15	Optimized	88.84689	385.1505	568.38233	1226.1304	265.74746	0
16	Optimized	91.78014	385.1301	572.95699	1335.7292	308.17998	0
17	Optimized	94.419615	385.30135	565.21735	1334.7094	310.89498	0
18	Optimized	97.249405	385.6608	545.97128	1395.4975	343.23089	0
19	Optimized	98.983585	385.8811	534.17592	1436.1153	364.40716	0
20	Optimized	100.39984	386.19525	516.16447	1394.5861	354.90537	0
21	Optimized	102.5492	386.73125	485.14419	1439.6207	385.63353	0
22	Optimized	104.5769	387.3751	447.2375	1391.8968	381.66713	0
23	Optimized	106.5275	388.1379	401.83244	1408.8939	406.87922	0
24	Optimized	108.0263	388.724	366.94318	1423.0624	426.69986	0
25	Optimized	109.6932	389.55305	317.08194	1338.9158	412.84768	0
26	Optimized	111.98005	390.8017	241.73483	1329.129	439.33575	0
27	Optimized	114.59685	392.4517	141.71273	1221.6673	436.32996	0
28	Optimized	116.67395	393.8977	53.815326	1184.5448	456.84438	0
29	Optimized	117.4924	394.54835	14.134088	905.80858	514.80851	50
30	Optimized	119.0992	396.27235	-91.637909	822.31928	474.76626	50
31	Optimized	121.91965	399.37255	-281.92181	660.3683	381.26381	50
32	Optimized	123.64915	401.34395	-402.99293	545.62116	315.01453	50
33	Optimized	124.9341	402.90075	-498.69689	462.65742	267.11539	50
34	Optimized	126.9017	405.28465	-645.24874	331.05191	191.13291	50
35	Optimized	128.76395	407.6941	-793.49247	178.73729	103.19402	50
36	Optimized	129.8212	409.15945	-883.75752	96.771375	55.870979	50

37	Optimized	130.56725	410.19345	-946.191	27.096876	15.644389	50

Slices of Slip Surface: 9475

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	9475	66.779375	392.41135	105.3723	167.78078	25.214665	0
2	9475	68.828375	391.1446	184.41778	335.60898	61.085211	0
3	9475	71.30139	389.79495	268.63379	497.26935	92.374764	0
4	9475	73.774405	388.64325	340.49804	622.13273	113.7878	0
5	9475	76.250935	387.67165	401.14374	733.51889	134.28828	0
6	9475	78.73098	386.8679	451.26923	826.65586	151.66604	0
7	9475	79.9855	386.50325	474.03807	867.32275	158.89733	0
8	9475	80.209165	386.44655	477.8114	874.16845	160.13865	0
9	9475	80.791935	386.3045	487.32303	898.25734	166.02824	0
10	9475	82.33929	385.98	509.30397	978.59537	189.60603	0
11	9475	84.686795	385.57525	537.2282	1091.7007	224.02142	0
12	9475	87.0343	385.30115	556.93216	1184.7643	253.66067	0
13	9475	89.381805	385.1552	568.67986	1259.542	279.12643	0
14	9475	91.56915	385.1293	572.74819	1314.2332	299.57938	0
15	9475	93.596335	385.2072	570.19908	1351.9149	315.83369	0
16	9475	95.62352	385.38	561.65835	1377.9338	329.7967	0
17	9475	97.650705	385.64885	547.16155	1392.6375	341.59446	0
18	9475	100.08055	386.11235	520.99368	1408.633	358.62956	0
19	9475	102.4978	386.6932	487.44949	1425.608	379.04063	0
20	9475	104.4998	387.2976	451.98992	1431.5506	395.7682	0
21	9475	106.5018	388.0094	409.82127	1424.8751	410.10838	0
22	9475	108.57375	388.8675	358.60111	1406.5492	423.39851	0
23	9475	110.7156	389.88845	297.30338	1374.7417	435.31333	0
24	9475	112.85745	391.0588	226.67609	1326.6404	444.41444	0
25	9475	114.9993	392.3931	145.81925	1261.191	450.63944	0
26	9475	116.87065	393.69665	66.582928	1189.9415	453.86632	0
27	9475	117.9863	394.5397	15.228637	1056.5302	601.19575	50
28	9475	119.24295	395.59475	-49.192515	976.70691	563.902	50
29	9475	121.12585	397.3057	-153.84321	854.14865	493.14295	50
30	9475	123.0088	399.23635	-272.19885	718.99957	415.11459	50
31	9475	124.899	401.44365	-407.82857	560.78077	323.76693	50
32	9475	126.79635	404.00345	-565.40056	380.83975	219.87793	50
33	9475	128.6937	407.0341	-752.3947	189.81564	109.59011	50
34	9475	129.8212	409.0408	-876.34636	75.539963	43.613018	50

35	9475	130.37175	410.186	-946.38378	8.852659	5.1110851	50

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section N.gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels

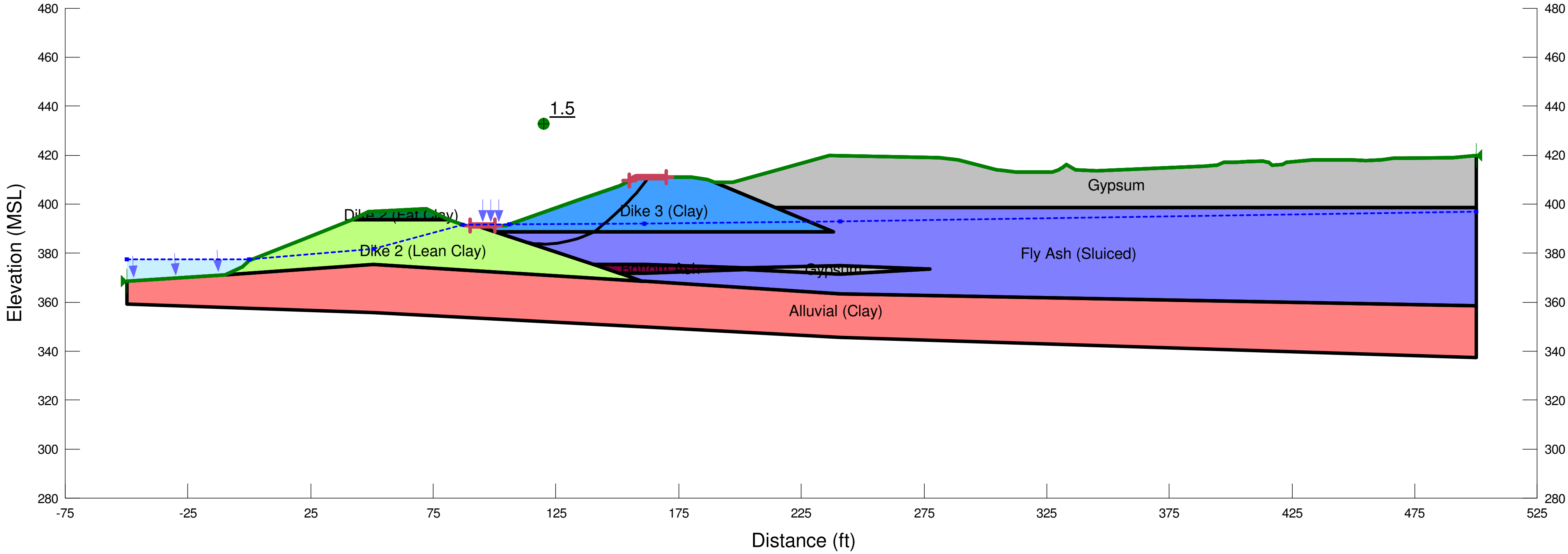
Date Saved: 10/8/2009

Last Solved on 10/8/2009 at 7:01:28 PM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Bottom Ash	105 pcf	0 psf	35 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °

Analysis Method: Spencer

Calculated Factor of Safety: 1.5



Stability - Existing Condition with Existing PZ Levels

File Information

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Revision Number: 236
Last Edited By: Rogers, Daniel
Date: 10/8/2009
Time: 6:59:57 PM
File Name: Section N.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 10/8/2009
Last Solved Time: 7:01:28 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 126 pcf
Cohesion: 50 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bottom Ash

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (90, 391.293) ft
Left-Zone Right Coordinate: (100, 391.293) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (155, 409.62138) ft
Right-Zone Right Coordinate: (170, 411.003) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-50, 368.59846) ft
Right Coordinate: (500, 420.00567) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-50	377.5
	0	377.5
	50.5	381.7
	87	391.65871
	106	391.79413
	161	392
	241	393
	500	397

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.5	(121.308, 426.791)	36.2508	(162.758, 411.003)	(94.5473, 391.293)
2	37407	1.5	(121.308, 426.791)	42.882	(161.178, 411.003)	(97.25, 391.293)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	95.96744	390.6443	67.288915	186.36711	68.749828	50
2	Optimized	98.80781	389.34685	149.51064	418.68231	155.40634	50
3	Optimized	101.3363	388.31485	215.03102	478.50521	106.45048	0
4	Optimized	103.51225	387.5624	262.95441	569.99275	124.05154	0
5	Optimized	105.28995	386.94765	302.10708	667.28957	147.5433	0
6	Optimized	106.27995	386.6053	323.85108	744.4895	169.94896	0
7	Optimized	107.9274	386.05445	358.5952	900.82556	219.07529	0
8	Optimized	110.6624	385.14635	415.92046	1168.6789	304.13415	0
9	Optimized	113.0186	384.49635	457.01836	1287.5468	335.55529	0
10	Optimized	114.99595	384.10445	481.94086	1437.2604	385.97416	0
11	Optimized	117.12875	383.84025	498.91771	1475.2906	394.48023	0
12	Optimized	119.41705	383.7038	507.9477	1602.4956	442.22605	0
13	Optimized	121.80235	383.7267	507.08252	1614.0178	447.2309	0
14	Optimized	124.28465	383.90885	496.3149	1709.5202	490.16675	0
15	Optimized	126.7127	384.2275	476.98167	1696.845	492.85679	0
16	Optimized	129.0865	384.6827	449.13809	1755.4283	527.77549	0
17	Optimized	131.13825	385.1798	418.60473	1705.9909	520.13777	0
18	Optimized	132.86795	385.71885	385.37135	1726.4685	541.83843	0
19	Optimized	134.65615	386.2762	351.01269	1746.5852	563.84787	0
20	Optimized	136.8102	387.0905	300.70265	1672.6662	554.30925	0
21	Optimized	139.32895	388.16805	234.05162	1670.3391	580.29782	0
22	Optimized	141.6078	389.52395	149.97679	1316.3755	673.42059	50
23	Optimized	143.58935	391.13365	49.992264	1218.4513	674.61012	50
24	Optimized	144.77445	392.0964	-9.8057267	1161.4184	670.5452	50
				-			

25	Optimized	146.0502	393.19255	77.906839	1075.113	620.71677	50
26	Optimized	148.21305	395.06905	-194.4947	977.22304	564.19999	50
27	Optimized	150.15665	396.7882	-301.31722	870.88462	502.80547	50
28	Optimized	151.78205	398.26055	-392.81218	805.23827	464.90453	50
29	Optimized	153.51085	399.9435	-497.41502	700.38404	404.36692	50
30	Optimized	155.4419	401.9265	-620.72105	622.67198	359.49984	50
31	Optimized	157.0116	403.6584	-728.42381	504.30347	291.15974	50
32	Optimized	158.57055	405.56885	-847.26543	385.5902	222.6206	50
33	Optimized	160.26265	407.71145	-980.56205	216.13333	124.78464	50
34	Optimized	161.87905	409.8435	-1112.7411	62.533697	36.103847	50

Slices of Slip Surface: 37407

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	37407	98.35477	390.59245	71.585554	241.04177	97.835594	50
2	37407	100.56432	389.28095	154.40532	471.62021	183.1441	50
3	37407	103.1245	387.988	236.22339	554.44913	128.57154	0
4	37407	105.28995	387.02	297.59214	678.05887	153.71854	0
5	37407	106.6803	386.4871	331.31671	788.27358	184.62256	0
6	37407	107.74815	386.111	355.03997	882.89372	213.26676	0
7	37407	109.20225	385.66785	383.02804	999.23682	248.96451	0
8	37407	111.33535	385.09875	419.03737	1152.7107	296.42326	0
9	37407	113.46845	384.6452	447.83583	1285.4897	338.43413	0
10	37407	115.60155	384.30355	469.64935	1399.7019	375.76562	0
11	37407	117.73465	384.0711	484.64429	1496.866	408.96411	0
12	37407	119.8677	383.94605	492.94966	1578.2261	438.48013	0
13	37407	122.00075	383.92745	494.61696	1644.6764	464.65417	0
14	37407	124.13385	384.01515	489.62946	1696.8863	487.76342	0
15	37407	126.26695	384.2098	477.99634	1735.2687	507.97102	0
16	37407	128.40005	384.5129	459.57891	1760.235	525.49918	0
17	37407	130.53315	384.92685	434.24656	1771.8996	540.4469	0
18	37407	132.66625	385.45495	401.79409	1770.2211	552.88042	0
19	37407	134.93515	386.1512	358.87765	1752.0632	562.88351	0
20	37407	137.33985	387.0393	304.02192	1715.1201	570.12066	0
21	37407	139.7446	388.0971	238.57657	1660.2115	574.3778	0
22	37407	141.83935	389.1568	172.94087	1540.1324	789.34841	50
23	37407	143.62405	390.18765	109.03106	1445.4869	771.60311	50
24	37407	145.40875	391.33835	37.644982	1338.0722	750.80202	50

25	37407	147.4805	392.8546	-56.484468	1202.8714	694.47814	50
26	37407	149.83935	394.81665	-178.36261	1038.519	599.58924	50
27	37407	152.1183	397.00645	-314.47473	878.22575	507.04387	50
28	37407	154.3173	399.47235	-467.84182	718.31811	414.72116	50
29	37407	156.5163	402.3872	-649.21355	533.8312	308.20759	50
30	37407	158.46185	405.44625	-839.64791	323.17701	186.58634	50
31	37407	160.15395	408.73975	-1044.7462	97.217605	56.12861	50
32	37407	161.08905	410.78175	-1171.9069	-19.105592	-11.030619	50

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section O.gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels

Date Saved: 11/20/2009

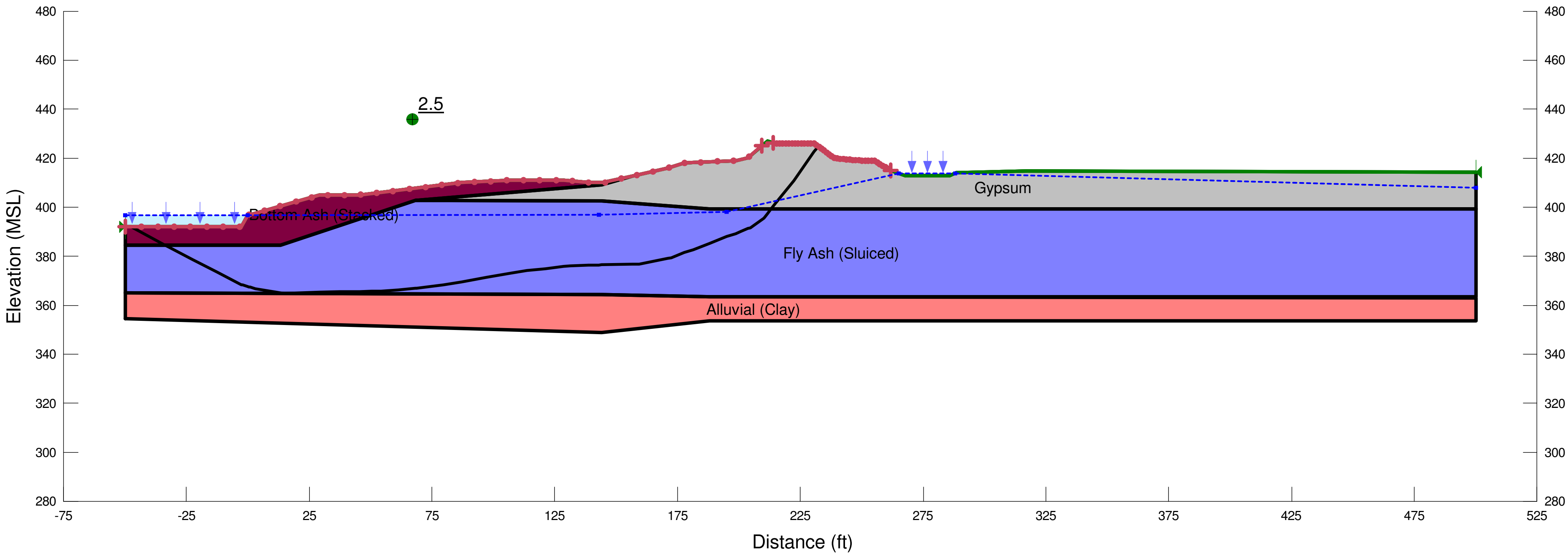
Last Solved on 11/20/2009 at 3:31:22 PM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Alluvial (Clay)	121 pcf	200 psf	30 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Bottom Ash (Stacked)	105 pcf	0 psf	35 °

Analysis Method: Spencer

Calculated Factor of Safety: 2.5



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 298
Last Edited By: Rogers, Daniel
Date: 11/20/2009
Time: 3:29:35 PM
File Name: Section O.gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\
Last Solved Date: 11/20/2009
Last Solved Time: 3:31:22 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bottom Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (-50, 391.95996) ft
Left-Zone Right Coordinate: (209.22258, 425) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (214, 426.26426) ft
Right-Zone Right Coordinate: (261.7205, 414.99699) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-50, 391.95996) ft
Right Coordinate: (500, 414.32918) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-50	396.78
	0	396.78
	143	397
	195	398
	265	413.81762
	288	413.81762
	500	408

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	2.5	(62.181, 609.412)	118.5151	(232.21, 424.902)	(-47.604, 391.96)
2	259	2.7	(62.181, 609.412)	244.684	(224.135, 425.997)	(-50, 391.96)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	-40.64426	388.2025	535.23541	778.71044	170.48305	0
2	Optimized	-33.050535	384.10285	791.05776	1232.7704	178.4635	0

3	Optimized	-27.428715	381.2071	971.72104	1545.206	231.70296	0
4	Optimized	-17.45307	376.1001	1290.4527	2107.2694	330.01539	0
5	Optimized	-7.477425	370.99305	1609.0951	2669.2436	428.32782	0
6	Optimized	-2.31067	368.3479	1774.1711	3037.833	510.55255	0
7	Optimized	-1.06587	367.9398	1799.6299	3046.7209	503.85749	0
8	Optimized	0.268525	367.5436	1824.441	3164.6134	541.46483	0
9	Optimized	0.70314	367.41455	1832.4732	3188.0266	547.67913	0
10	Optimized	2.00887	367.0268	1856.7968	3270.5919	571.21029	0
11	Optimized	8.187865	365.93385	1925.6074	3491.7825	632.77581	0
12	Optimized	14.06195	365.0543	1981.0174	3764.0575	720.39495	0
13	Optimized	21.94626	365.09035	1979.5304	3868.5825	763.2266	0
14	Optimized	33.121975	365.3457	1964.6434	4038.1982	837.7705	0
15	Optimized	41.374245	365.53425	1953.7402	4013.363	832.14163	0
16	Optimized	47.882225	365.68295	1945.0443	4021.675	839.01327	0
17	Optimized	52.24572	365.78265	1939.2398	4059.6952	856.71961	0
18	Optimized	57.736525	366.0836	1921.0131	4053.0562	861.40135	0
19	Optimized	64.754835	366.59495	1889.7494	4078.4935	884.31004	0
20	Optimized	68.464335	366.8652	1873.2447	4092.3246	896.56647	0
21	Optimized	74.1892	367.5594	1830.5242	4057.8208	899.88621	0
22	Optimized	83.466715	368.8954	1748.0469	4003.0536	911.08185	0
23	Optimized	92.204025	370.4236	1653.465	3924.9167	917.72604	0
24	Optimized	102.17267	372.16715	1545.6583	3805.4498	913.01505	0
25	Optimized	110.4539	373.61555	1456.0685	3689.3203	902.2923	0
26	Optimized	117.4716	374.60605	1394.9833	3636.3054	905.5529	0
27	Optimized	124.91325	375.43375	1343.9652	3554.7032	893.19612	0
28	Optimized	129.94425	375.99335	1309.5446	3485.9998	879.34495	0
29	Optimized	134.98945	376.2299	1295.288	3469.3756	878.38841	0
30	Optimized	140.86225	376.3727	1286.9423	3416.1023	860.23648	0
31	Optimized	143.605	376.4394	1283.6698	3409.4045	858.85257	0
32	Optimized	144.44315	376.45975	1283.4326	3407.5235	858.18842	0
33	Optimized	150.5905	376.60925	1281.4499	3531.8051	909.20251	0
34	Optimized	157.91935	376.78745	1279.1747	3689.2611	973.73811	0
35	Optimized	165.13825	377.9588	1214.7173	3627.667	974.89499	0
36	Optimized	171.6792	379.2401	1142.657	3666.3463	1019.6367	0
37	Optimized	175.0673	380.38875	1075.0306	3527.414	990.82719	0
38	Optimized	179.49195	382.0648	975.7434	3453.9286	1001.2518	0
39	Optimized	184.6076	384.00255	860.96248	3295.4785	983.60833	0
40	Optimized	191.475	386.60385	706.8865	3081.511	959.41058	0
41	Optimized	196.7974	388.61995	610.65533	2915.9221	931.38824	0
42	Optimized	199.6518	389.7012	583.43047	2848.1882	915.02152	0
43	Optimized	202.1588	390.65085	559.54176	2818.8948	912.83788	0
44	Optimized	204.0855	391.38065	541.15295	2824.4559	922.51426	0
45	Optimized	207.3528	393.60095	448.67867	2683.8558	903.0702	0
46	Optimized	210.85675	396.52465	315.64667	2439.7061	858.17574	0

47	Optimized	212.3273	398.34685	222.67719	2317.0936	846.19914	0
48	Optimized	213.9854	400.40385	117.70003	1868.3392	1367.7492	0
49	Optimized	215.36795	402.1145	30.448483	1704.8829	1308.2116	0
50	Optimized	219.12885	406.7747	-207.32151	1366.2479	1067.4298	0
51	Optimized	226.5165	416.73295	-724.54036	624.5716	487.96882	0
52	Optimized	231.13715	423.3628	-1073.0851	154.75128	120.90495	0
53	Optimized	231.9296	424.49985	-1132.8801	41.178759	32.172372	0

Slices of Slip Surface: 259

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	259	-46.01191	389.9935	423.4842	552.08908	90.050113	0
2	259	-38.03573	386.23615	657.93213	989.50586	232.17043	0
3	259	-28.787965	382.3382	901.15769	1388.1817	196.77048	0
4	259	-18.26862	378.3994	1146.9632	1795.4068	261.98821	0
5	259	-7.749275	374.99865	1359.1487	2139.566	315.30907	0
6	259	-1.2448	373.0955	1477.9004	2470.0209	400.84271	0
7	259	0.268525	372.69115	1503.1671	2596.4008	441.69509	0
8	259	0.70314	372.5778	1510.2744	2616.9814	447.13865	0
9	259	7.048225	371.10515	1602.7549	2958.4348	547.73024	0
10	259	17.169375	368.9377	1739.0079	3470.4111	699.53227	0
11	259	25.053685	367.59455	1823.5616	3818.9988	806.20896	0
12	259	33.121975	366.4957	1892.8884	4019.801	859.32845	0
13	259	41.374245	365.6499	1946.4449	4075.3276	860.12442	0
14	259	47.882225	365.15825	1977.7893	4129.6413	869.40465	0
15	259	53.51517	364.9036	1994.2262	4201.4772	891.78731	0
16	259	61.2907	364.7719	2003.2227	4277.638	918.92344	0
17	259	67.03956	364.77975	2003.2694	4322.7866	937.14575	0
18	259	73.00292	365.0139	1989.2178	4354.2073	955.51775	0
19	259	82.48078	365.6183	1952.4411	4383.6084	982.25532	0
20	259	92.204025	366.62925	1890.2769	4337.8704	988.89197	0
21	259	102.17267	368.07155	1801.266	4216.3142	975.74283	0
22	259	112.52625	370.0267	1680.2327	4018.9621	944.908	0
23	259	123.2648	372.5405	1524.3641	3743.0556	896.40954	0
24	259	133.6793	375.467	1342.8022	3381.6475	823.74699	0
25	259	140.86225	377.7349	1201.937	3095.8648	765.19651	0
26	259	143.605	378.6744	1144.2341	2999.1529	749.43581	0
27	259	144.44315	378.97115	1126.725	2968.7859	744.24095	0
28	259	150.5905	381.347	985.88607	2855.4199	755.34071	0
29	259	160.11415	385.2163	755.84539	2675.4555	775.57284	0

30	259	167.33305	388.5111	558.91175	2512.3199	789.22812	0
31	259	174.3306	391.97675	351.04346	2347.4597	806.60452	0
32	259	179.49195	394.6931	187.74047	2184.1565	806.60445	0
33	259	183.1521	396.73515	64.707484	2002.2628	782.82316	0
34	259	186.3195	398.5623	-45.506027	1842.9537	744.60164	0
35	259	191.3	401.6153	-230.03385	1479.076	1155.5808	0
36	259	196.7974	405.09865	-417.61335	1185.4756	926.19502	0
37	259	201.1018	408.01215	-538.71548	986.03615	770.37587	0
38	259	207.58945	412.68365	-738.74327	915.07801	714.9373	0
39	259	213.2282	416.927	-924.00942	790.5203	617.62215	0
40	259	219.5107	422.11255	-1158.9814	315.65457	246.61638	0

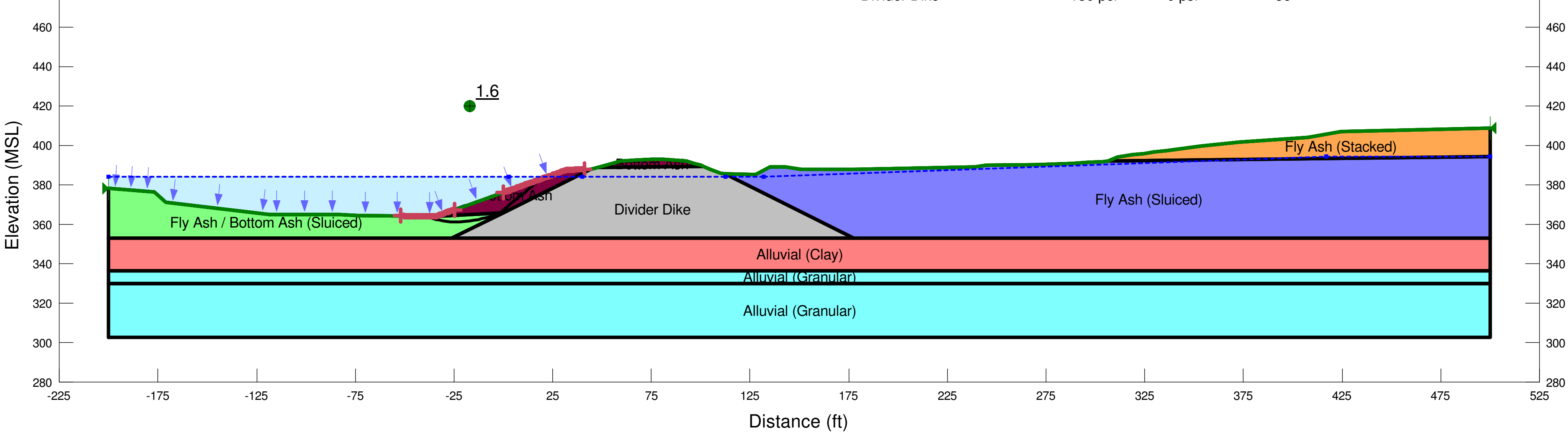
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section A_Ext (Stability - Repair Design).gsz
Analysis Name: Stability - Existing Condition (Shallow Failure)
Date Saved: 11/10/2009
Last Solved on 11/10/2009 at 8:53:06 PM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Fly Ash (Stacked)	100 pcf	0 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Bottom Ash	105 pcf	0 psf	35 °
Divider Dike	130 pcf	0 psf	35 °

Analysis Method: Spencer
Calculated Factor of Safety: 1.6



Stability - Existing Condition (Shallow Failure)

File Information

Created By: Cooper, Paul
Revision Number: 253
Last Edited By: Rogers, Daniel
Date: 11/10/2009
Time: 8:47:42 PM
File Name: Section A_Ext (Stability - Repair Design).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\Repair Sections\
Last Solved Date: 11/10/2009
Last Solved Time: 8:53:06 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition (Shallow Failure)

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bottom Ash

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Divider Dike

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (-52.00001, 364.28389) ft
Left-Zone Right Coordinate: (-24.73945, 367.45398) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (-0.01245, 376.21062) ft
Right-Zone Right Coordinate: (41, 387.90442) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (-200, 378.17346) ft
Right Coordinate: (500, 408.84049) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	-200	384.23
	2.55408	384.23
	40	384.23
	112.5	384.23
	132	384.23
	417	394.47
	500	394.47

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.6	(-22.427, 405.269)	30.9175	(18.8253, 382.882)	(-39.4244, 364.23)
2	23359	1.6	(-22.427, 405.269)	44.442	(15.1815, 381.591)	(-39.4816, 364.23)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	-38.50552	363.93635	1266.3261	1292.8148	10.702132	0
2	Optimized	-36.667785	363.3496	1302.923	1353.9824	20.629355	0
3	Optimized	-34.830055	362.76285	1339.5717	1415.2019	30.556577	0
4	Optimized	-33.53012	362.34785	1365.4285	1480.9224	46.662585	0
5	Optimized	-31.77687	361.93445	1391.2417	1542.1491	60.970527	0
6	Optimized	-29.48264	361.5484	1415.3185	1606.0165	77.046966	0
7	Optimized	-27.638545	361.3598	1427.0787	1653.111	91.322995	0
8	Optimized	-25.53397	361.2661	1432.9446	1681.9024	100.58546	0
9	Optimized	-23.16891	361.26735	1432.8601	1716.4892	114.59362	0
10	Optimized	-20.77977	361.37995	1425.8612	1727.9752	122.062	0
11	Optimized	-18.366545	361.60385	1411.8736	1740.3123	132.69783	0
12	Optimized	-16.023465	361.9149	1392.4701	1731.4871	136.97175	0
13	Optimized	-13.750535	362.3131	1367.5953	1724.1633	144.06284	0
14	Optimized	-11.796595	362.70505	1343.1748	1704.4622	145.96959	0
15	Optimized	-10.161642	363.09075	1319.0652	1689.4012	149.62545	0
16	Optimized	-8.5266865	363.4764	1295.0151	1674.2806	153.2332	0
17	Optimized	-6.8661	363.9217	1267.2409	1644.7544	152.52535	0
18	Optimized	-5.17988	364.42665	1235.7104	1618.7347	154.75183	0
19	Optimized	-2.834405	365.3306	1179.3102	1545.1062	147.79115	0

20	Optimized	-0.36051	366.8076	1087.156	1354.9839	187.53509	0
21	Optimized	1.58255	368.4586	984.12721	1224.0702	168.00991	0
22	Optimized	3.06823	369.72095	905.37742	1123.9219	153.0265	0
23	Optimized	4.331865	370.7864	838.89461	1040.5421	141.19512	0
24	Optimized	5.830835	372.0436	760.43353	940.91957	126.37769	0
25	Optimized	7.417115	373.3792	677.11096	834.66991	110.32396	0
26	Optimized	9.212835	374.88685	582.99866	715.84039	93.016777	0
27	Optimized	11.01831	376.38915	489.24827	597.24759	75.621935	0
28	Optimized	12.711415	377.7925	401.70289	486.20155	59.166602	0
29	Optimized	14.40452	379.19585	314.13022	375.14642	42.724005	0
30	Optimized	16.14462	380.64355	223.79652	260.40582	25.634107	0
31	Optimized	17.93172	382.13565	130.69043	142.25782	8.0995719	0

Slices of Slip Surface: 23359

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	23359	-38.55323	363.86835	1270.5889	1304.3622	13.645301	0
2	23359	-36.696415	363.19185	1312.7602	1372.2294	24.027126	0
3	23359	-34.8396	362.6069	1349.2556	1429.7187	32.50918	0
4	23359	-33.019195	362.11785	1379.7909	1507.2308	51.489043	0
5	23359	-31.235205	361.7185	1404.6969	1572.4342	67.770268	0
6	23359	-29.451215	361.3953	1424.8591	1628.7662	82.383821	0
7	23359	-27.66723	361.1466	1440.3919	1676.6814	95.467156	0
8	23359	-25.883245	360.9711	1451.3731	1716.4326	107.09102	0
9	23359	-24.099255	360.8679	1457.7766	1748.2676	117.366	0
10	23359	-22.315265	360.83655	1459.7583	1772.3154	126.28127	0
11	23359	-20.531275	360.8769	1457.257	1788.6835	133.90497	0
12	23359	-18.747285	360.98915	1450.2226	1797.4582	140.29229	0
13	23359	-16.963295	361.1738	1438.7253	1798.6986	145.43868	0
14	23359	-15.17931	361.4318	1422.6232	1792.4366	149.41433	0
15	23359	-13.395325	361.7645	1401.843	1778.5108	152.18366	0
16	23359	-11.611335	362.17355	1376.3261	1756.9022	153.76271	0
17	23359	-9.827345	362.6612	1345.8693	1727.516	154.1953	0
18	23359	-8.0433555	363.2302	1310.4029	1690.0845	153.40134	0

19	23359	-6.259367	363.88385	1269.6217	1644.3942	151.41794	0
20	23359	-4.4753785	364.6263	1223.2684	1590.1925	148.24697	0
21	23359	-2.69139	365.46255	1171.0929	1527.0058	143.79818	0
22	23359	-0.7110269	366.5147	1105.4469	1416.8861	218.07208	0
23	23359	1.4657111	367.81895	1024.0448	1307.6991	198.6169	0
24	23359	3.4560365	369.15985	940.40003	1194.6937	178.05835	0
25	23359	5.25995	370.52515	855.1833	1079.1454	156.81997	0
26	23359	7.0638635	372.0445	760.3918	950.5623	133.15882	0
27	23359	8.867777	373.74035	654.56654	807.45742	107.05535	0
28	23359	10.671692	375.6433	535.82579	647.84899	78.439485	0
29	23359	12.475605	377.79695	401.42453	469.00292	47.318896	0
30	23359	14.279515	380.2671	247.28756	267.00728	13.807895	0

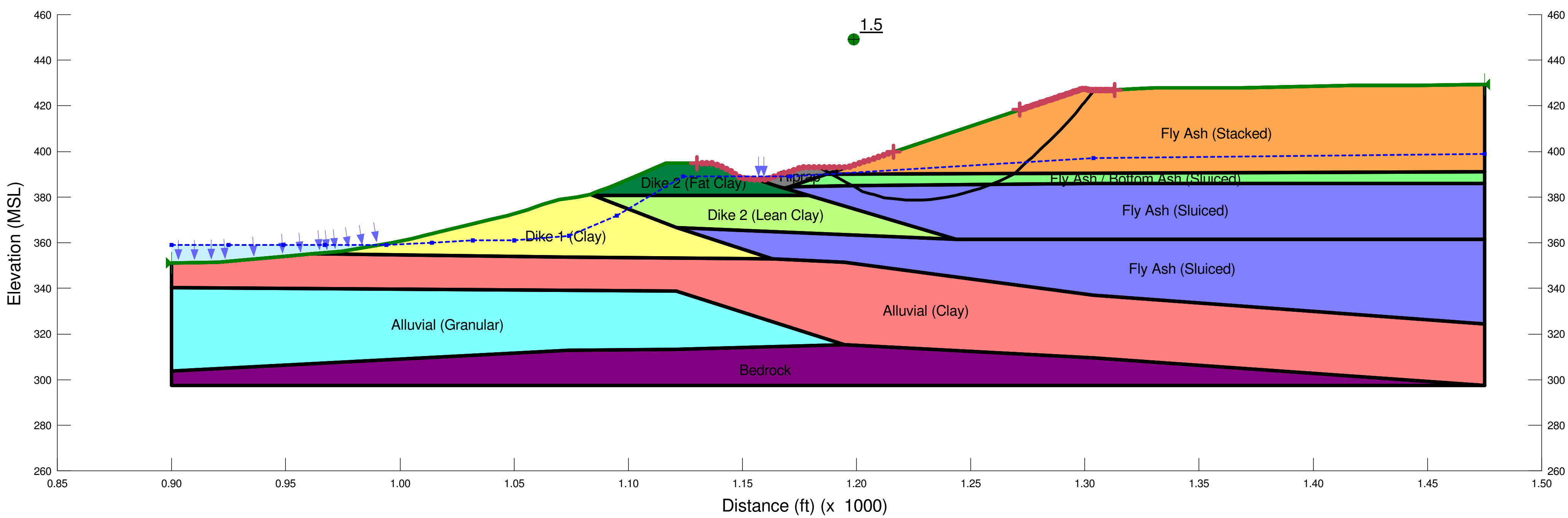
Stantec

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section F (Stability - Repair Design).gsz
Analysis Name: Stability - Existing Condition with Existing PZ Levels
Date Saved: 10/26/2009
Last Solved on 10/26/2009 at 2:46:10 PM

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Fly Ash (Stacked)	100 pcf	0 psf	32 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Riprap	150 pcf	0 psf	38 °
Bedrock			

Analysis Method: Spencer
Calculated Factor of Safety: 1.5



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 263
Last Edited By: Rogers, Daniel
Date: 10/26/2009
Time: 2:44:26 PM
File Name: Section F (Stability - Repair Design).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\Repair Sections\
Last Solved Date: 10/26/2009
Last Solved Time: 2:46:10 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Riprap

Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bedrock

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (1130, 394.95234) ft
Left-Zone Right Coordinate: (1216.0232, 399.79868) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (1271.2997, 418.21514) ft
Right-Zone Right Coordinate: (1313, 426.88948) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (900, 351.17633) ft
Right Coordinate: (1475, 429.48497) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	900	359
	925	359
	949	359
	967	359
	994	359
	1014	360
	1032	361
	1050	361
	1074	363
	1095	372
	1124	389
	1171	389
	1303.8099	397.05138
	1475	399

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.5	(1229, 455.973)	63.58513	(1304.16, 426.952)	(1183.5, 393)
2	32695	1.6	(1229, 455.973)	77.664	(1301.13, 427.166)	(1183.55, 393)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	1185.8335	391.74835	-115.38561	379.76443	296.70449	0
2	Optimized	1188.552	390.29195	-14.222509	681.81328	426.04422	0
3	Optimized	1190.613	389.18775	62.480297	664.75382	243.3343	0
4	Optimized	1193.987	387.343	190.35615	828.37029	257.77444	0
5	Optimized	1196.9175	385.70865	303.4221	1056.9902	304.46126	0
6	Optimized	1198.418	384.87175	361.31646	1238.8181	354.53368	0
7	Optimized	1200.5835	383.66405	444.8693	1501.2271	426.79624	0
8	Optimized	1204.155	382.11105	555.29777	1624.3988	431.94485	0
9	Optimized	1206.6645	381.3705	610.97653	1813.8813	486.00506	0
10	Optimized	1209.822	380.4387	681.07825	2052.0021	553.88917	0
11	Optimized	1214.558	379.4742	759.18811	2165.4977	568.18596	0
12	Optimized	1219.3915	378.914	812.4367	2405.3322	643.57155	0
13	Optimized	1223.5705	378.68505	842.53188	2428.1322	640.62413	0
14	Optimized	1227.095	378.7874	849.45206	2539.9612	683.01003	0
15	Optimized	1230.6195	378.8898	856.4006	2651.7902	725.38447	0
16	Optimized	1234.1985	379.23115	848.64822	2598.6726	707.05575	0
17	Optimized	1237.8315	379.8115	826.17089	2660.859	741.2621	0
18	Optimized	1241.4645	380.3919	803.69357	2723.0997	775.49042	0
19	Optimized	1245.076	381.19225	767.42926	2631.3315	753.06538	0
20	Optimized	1248.666	382.21255	717.35331	2646.8714	779.57589	0
21	Optimized	1252.2565	383.23285	667.25057	2662.4112	806.09723	0
22	Optimized	1256.373	384.6769	592.71259	2536.3998	785.30061	0
23	Optimized	1260.8465	386.47685	497.32599	2505.2713	811.26257	0
24	Optimized	1266.0715	388.8748	367.45929	2353.2715	802.32021	0
25	Optimized	1271.816	392.84025	141.74892	1748.1352	1003.7815	0
26	Optimized	1275.668	396.3484	-62.59068	1571.4716	981.96443	0
27	Optimized	1278.83	399.34015	-237.32054	1406.9873	879.18325	0
28	Optimized	1282.794	403.1744	-461.58555	1241.5991	775.83724	0
29	Optimized	1286.999	407.31	-703.73544	1048.3598	655.08791	0
30	Optimized	1290.862	411.27745	-936.6947	850.25335	531.29726	0
31	Optimized	1294.142	414.7754	-1142.5481	698.26673	436.32548	0
32	Optimized	1297.412	418.51825	-1363.7376	499.3058	312.00089	0
33	Optimized	1299.4205	420.97525	-1509.4551	382.3496	238.91855	0
				-			

34	Optimized	1301.23	423.24795	1644.4183	228.60997	142.85136	0
35	Optimized	1303.2355	425.78395	-1795.1015	68.413611	42.749569	0
36	Optimized	1303.9845	426.73135	-1851.9018	12.937045	8.0839627	0

Slices of Slip Surface: 32695

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	32695	1185.553	391.6463	-110.07764	499.0222	389.87887	0
2	32695	1187.767	390.1609	-9.0125778	790.21837	493.78324	0
3	32695	1189.904	388.9058	77.391174	734.72861	265.58156	0
4	32695	1193.7565	386.8013	223.28438	869.63805	261.14383	0
5	32695	1196.561	385.41615	320.32721	1008.9449	278.21961	0
6	32695	1197.503	384.984	350.85794	1094.9419	300.62943	0
7	32695	1198.1245	384.7139	370.06096	1149.2015	314.79322	0
8	32695	1200.469	383.7662	438.06816	1340.9213	364.77636	0
9	32695	1204.0405	382.45415	533.46236	1605.9282	433.30434	0
10	32695	1206.6645	381.596	596.90512	1782.3187	478.93818	0
11	32695	1209.4475	380.83805	654.7562	1946.5261	521.90891	0
12	32695	1213.3365	379.93125	726.04217	2149.1644	574.97871	0
13	32695	1217.2255	379.23215	784.3833	2321.4563	621.01782	0
14	32695	1221.1145	378.7351	830.10786	2465.792	660.8593	0
15	32695	1225.0035	378.43615	863.46627	2584.1074	695.18414	0
16	32695	1228.8925	378.333	884.61875	2677.5383	724.38652	0
17	32695	1232.7815	378.42495	893.58842	2747.5667	749.05586	0
18	32695	1236.6705	378.71265	890.35228	2794.4411	769.30182	0
19	32695	1240.5595	379.1983	874.76648	2818.8417	785.45739	0
20	32695	1244.4485	379.8857	846.57821	2821.3394	797.8553	0
21	32695	1248.3375	380.78035	805.47596	2801.3848	806.39953	0
22	32695	1252.2265	381.88985	750.9547	2759.0948	811.34128	0
23	32695	1256.1155	383.2241	682.40735	2694.2585	812.84064	0
24	32695	1260.0045	384.7957	599.0507	2605.6855	810.73308	0
25	32695	1264.08	386.72195	494.2709	2486.0064	804.71338	0
26	32695	1268.342	389.05405	364.85572	2331.1688	794.44204	0
27	32695	1272.2785	391.5192	225.93107	2065.5616	1149.5287	0
28	32695	1275.89	394.09995	78.554621	1868.4502	1118.4509	0
29	32695	1279.8305	397.318	-107.34716	1638.3979	1023.7847	0
30	32695	1284.0995	401.3196	-340.89072	1377.1391	860.53203	0
31	32695	1288.369	406.0077	-617.28349	1085.8609	678.52117	0
				-			

32	32695	1292.6385	411.60545	950.43077	762.0326	476.17082	0
33	32695	1296.9075	418.5391	-1366.9572	403.23429	251.96875	0
34	32695	1300.085	424.78885	-1744.9123	108.58281	67.850069	0

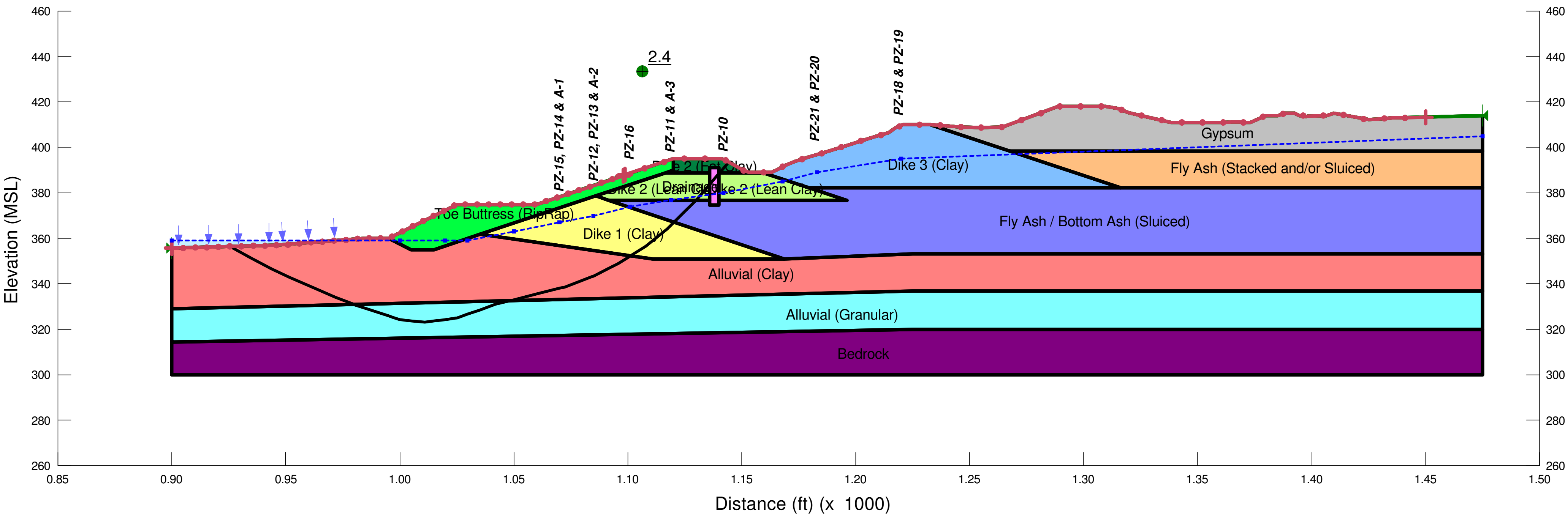
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Gypsum Stack Complex
Tennessee Valley Authority (TVA)

File Name: Section H (Stability - Repair Design).gsz
Analysis Name: Stability - Existing Condition with Drainage Trench
Date Saved: 10/12/2009
Last Solved on 10/12/2009 at 7:43:02 PM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	125 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Dike 3 (Clay)	125 pcf	100 psf	25 °
Alluvial (Clay)	125 pcf	200 psf	28 °
Alluvial (Granular)	125 pcf	0 psf	30 °
Gypsum	100 pcf	0 psf	35 °
Fly Ash (Stacked and/or Sluiced)	100 pcf	0 psf	25 °
Fly Ash / Bottom Ash (Sluiced)	95 pcf	0 psf	25 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Toe Buttress (RipRap)	150 pcf	0 psf	38 °
Drainage Trench	130 pcf	0 psf	30 °
Bedrock			

Analysis Method: Spencer
Calculated Factor of Safety: 2.4



Stability - Existing Condition with Drainage Trench

File Information

Created By: Cooper, Paul
Revision Number: 200
Last Edited By: Kirkbride, Rob
Date: 10/12/2009
Time: 7:39:50 PM
File Name: Section H (Stability - Repair Design).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\Repair Sections\
Last Solved Date: 10/12/2009
Last Solved Time: 7:43:02 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Drainage Trench

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 50 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 200 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 35 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked and/or Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 95 pcf
Cohesion: 0 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Toe Buttress (RipRap)

Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °

Pore Water Pressure
Piezometric Line: 1

Drainage Trench

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Bedrock

Model: Bedrock (Impenetrable)
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (900, 355.68471) ft
Left-Zone Right Coordinate: (1097.9798, 387.65993) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (1098.8988, 387.96627) ft
Right-Zone Right Coordinate: (1450, 413.40089) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (900, 355.68471) ft
Right Coordinate: (1475, 414.15883) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	900	359
	1000	359
	1019.69	359
	1029.71	359.014
	1050	363
	1070	367
	1085	370

	1101	374
	1119	377
	1142	380
	1168	385
	1183	389
	1220	395
	1475	405

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	2.4	(1017.09, 473.215)	101.0518	(1144.34, 393.725)	(925.366, 356.394)
2	6527	2.4	(1017.09, 473.215)	148.469	(1142.9, 394.383)	(925.454, 356.396)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	929.91945	353.97175	313.76244	633.90407	170.22232	200
2	Optimized	939.02635	349.12825	615.99777	1386.9378	409.91609	200
3	Optimized	944.5931	346.2234	797.26773	1796.3466	531.21968	200
4	Optimized	948.5396	344.34175	914.68204	2096.6015	628.43774	200
5	Optimized	956.92785	340.4692	1156.2904	2696.397	818.88922	200
6	Optimized	967.1329	336.0477	1432.1862	3350.8579	1020.1758	200
7	Optimized	975.77445	332.50465	1653.2744	3938.2809	1214.9595	200
8	Optimized	979.87985	330.82145	1758.3502	4204.76	1412.4353	0
9	Optimized	982.119	330.07445	1804.9654	4209.7628	1388.4104	0
10	Optimized	989.57215	327.64795	1956.3755	4580.2048	1514.8686	0
11	Optimized	996	325.55525	2086.9358	4984.969	1673.1803	0
12	Optimized	998.5	324.74135	2137.7287	5362.9432	1862.0784	0
13	Optimized	1000.1275	324.21155	2170.8006	5608.8636	1984.9666	0
14	Optimized	1002.6275	323.9682	2185.9674	5433.7385	1875.1015	0
15	Optimized	1007.987	323.51215	2214.4237	5958.4458	2161.6122	0
16	Optimized	1012.987	323.49515	2215.5069	5962.6346	2163.4052	0
17	Optimized	1017.345	324.00855	2183.4061	6203.7871	2321.1681	0
18	Optimized	1022.152	324.57485	2148.3514	6451.5088	2484.4291	0
19	Optimized	1024.807	324.93235	2126.2784	6140.1978	2317.4374	0
20	Optimized	1026.0155	325.3542	2100.0277	6095.055	2306.5301	0
21	Optimized	1028.3705	326.1762	2048.9458	5981.8476	2270.6619	0
22	Optimized	1032.405	327.5845	1994.2511	5789.1962	2191.0126	0
23	Optimized	1037.514	329.36775	1945.5989	5546.059	2078.7266	0
24	Optimized	1040.92	330.55655	1913.154	5384.0323	2003.9125	0
25	Optimized	1045.1555	331.72955	1891.8874	5361.3684	2003.1058	0
26	Optimized	1049.1995	332.76035	1877.1708	5206.3544	1770.1583	200
27	Optimized	1055	334.23885	1857.1222	4986.3708	1663.851	200

28	Optimized	1065	336.78775	1822.819	4842.5686	1605.6293	200
29	Optimized	1071.13	338.35025	1801.8393	4898.6741	1646.6163	200
30	Optimized	1075.251	339.7528	1765.7997	4729.9996	1576.0931	200
31	Optimized	1081.233	341.9818	1701.2584	4700.5488	1594.751	200
32	Optimized	1084.612	343.29115	1661.7575	4511.4879	1515.2285	200
33	Optimized	1085.4	343.68685	1648.1793	4496.1312	1514.2829	200
34	Optimized	1088.771	345.37925	1595.1146	4436.0882	1510.5725	200
35	Optimized	1093.7845	347.89645	1516.2926	4328.546	1495.3017	200
36	Optimized	1098.0285	350.3114	1431.8074	4037.0421	1385.2279	200
37	Optimized	1100.615	351.94365	1370.2925	3932.3824	1362.2874	200
38	Optimized	1104.4595	354.36975	1260.9594	3817.7148	1192.2346	100
39	Optimized	1112.5585	360.367	970.90531	3237.128	1056.757	100
40	Optimized	1118.099	365.06535	735.34479	2773.0887	950.21561	100
41	Optimized	1119.5	366.44035	662.98693	2667.8771	934.89562	100
42	Optimized	1122.4485	369.33435	506.40062	2372.8603	870.34443	0
43	Optimized	1127.5	374.2925	238.12631	1978.7884	811.68405	0
44	Optimized	1130.8615	377.74675	49.945027	1532.7751	788.43476	100
45	Optimized	1133.81	381.2426	-144.19689	1208.5618	642.60371	100
46	Optimized	1138.092	386.3196	-426.15495	777.68617	448.99732	0
47	Optimized	1140.5615	389.24735	-588.74756	482.22929	166.04486	200
48	Optimized	1141.4695	390.3239	-648.53742	363.7956	125.26487	200
49	Optimized	1142.1845	391.17175	-694.90965	261.59247	90.07351	200
50	Optimized	1142.783	391.8814	-732.00059	176.03472	60.613614	200
51	Optimized	1143.7615	393.04175	-792.6822	26.661078	9.1801452	200
52	Optimized	1144.332	393.7181	-828.00315	-64.512302	-22.213367	200

Slices of Slip Surface: 6527

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	6527	928.8125	353.91085	317.56468	710.46076	208.90655	200
2	6527	935.53005	349.21655	610.48778	1435.7688	438.80968	200
3	6527	942.2476	345.04625	870.71862	2043.2295	623.43507	200
4	6527	948.89095	341.386	1099.1182	2564.0818	778.93496	200
5	6527	955.4601	338.18785	1298.6797	3011.1001	910.51005	200
6	6527	962.02925	335.37685	1474.0363	3389.4213	1018.4282	200
7	6527	968.59835	332.92965	1626.8025	3706.6697	1105.885	200
8	6527	973.5016	331.2973	1728.6354	3921.0394	1165.7219	200
9	6527	979.6323	329.62335	1833.0694	4138.9088	1331.277	0
10	6527	989.57215	327.4222	1970.4344	4392.472	1398.364	0

11	6527	996	326.2544	2043.3263	4585.1976	1467.55	0
12	6527	998.5	325.92165	2064.1004	4843.5951	1604.742	0
13	6527	1002.5	325.4856	2091.2328	5237.7352	1816.634	0
14	6527	1010	324.99975	2121.5772	5845.3246	2149.9066	0
15	6527	1017.345	324.7648	2136.2441	6334.7453	2424.0058	0
16	6527	1022.345	324.86305	2130.2997	6595.6667	2578.0809	0
17	6527	1026.0155	325.0184	2121.0124	6694.6742	2640.6049	0
18	6527	1028.3705	325.1817	2111.0121	6620.7543	2603.7009	0
19	6527	1032.405	325.56345	2120.3428	6482.6391	2518.5729	0
20	6527	1037.514	326.1785	2144.5289	6295.1042	2396.3358	0
21	6527	1044.964	327.47725	2154.9059	5980.844	2208.9064	0
22	6527	1055	329.7621	2136.439	5509.611	1947.5018	0
23	6527	1062.912	332.02875	2093.6842	5230.3722	1810.9677	0
24	6527	1067.912	333.73485	2049.6783	5163.7342	1655.7729	200
25	6527	1073.75	336.0449	1978.373	5051.9123	1634.2298	200
26	6527	1081.25	339.39205	1863.167	4863.6872	1595.4048	200
27	6527	1085.4	341.3974	1791.0164	4742.0095	1569.0709	200
28	6527	1088.771	343.24325	1728.4123	4624.0335	1539.6291	200
29	6527	1095.986	347.54655	1572.499	4295.5632	1447.8789	200
30	6527	1100.615	350.47325	1462.1073	4051.5062	1376.8078	200
31	6527	1102.015	351.443	1418.1279	3968.1475	1355.8695	200
32	6527	1106.3725	354.66835	1262.1191	3738.9217	1154.952	100
33	6527	1113.0575	360.01995	997.75209	3272.824	1060.8835	100
34	6527	1116.59	363.02555	846.93592	3010.681	1008.9709	100
35	6527	1117.89	364.22375	785.69395	2904.5775	988.05162	100
36	6527	1119.5	365.7268	707.51439	2771.6319	962.51383	100
37	6527	1120.396	366.5869	661.14196	2594.296	901.44453	100
38	6527	1122.8445	369.05465	527.07627	2386.7572	867.18348	0
39	6527	1127.37	373.88435	262.53485	1961.2308	792.11495	0
40	6527	1130.686	377.63215	55.670831	1552.6901	795.97927	100
41	6527	1133.7645	381.4774	-159.20916	1166.1283	620.04143	100
42	6527	1138	387.1297	-477.45103	668.68373	386.06473	0
43	6527	1140.4695	390.64005	-676.37082	312.41185	107.57203	200
44	6527	1141.4695	392.1556	-762.82833	158.02289	54.411645	200
45	6527	1142.1845	393.25835	-825.1113	38.061718	13.1057	200
46	6527	1142.633	393.96495	-863.82368	-37.7727	-13.006184	200

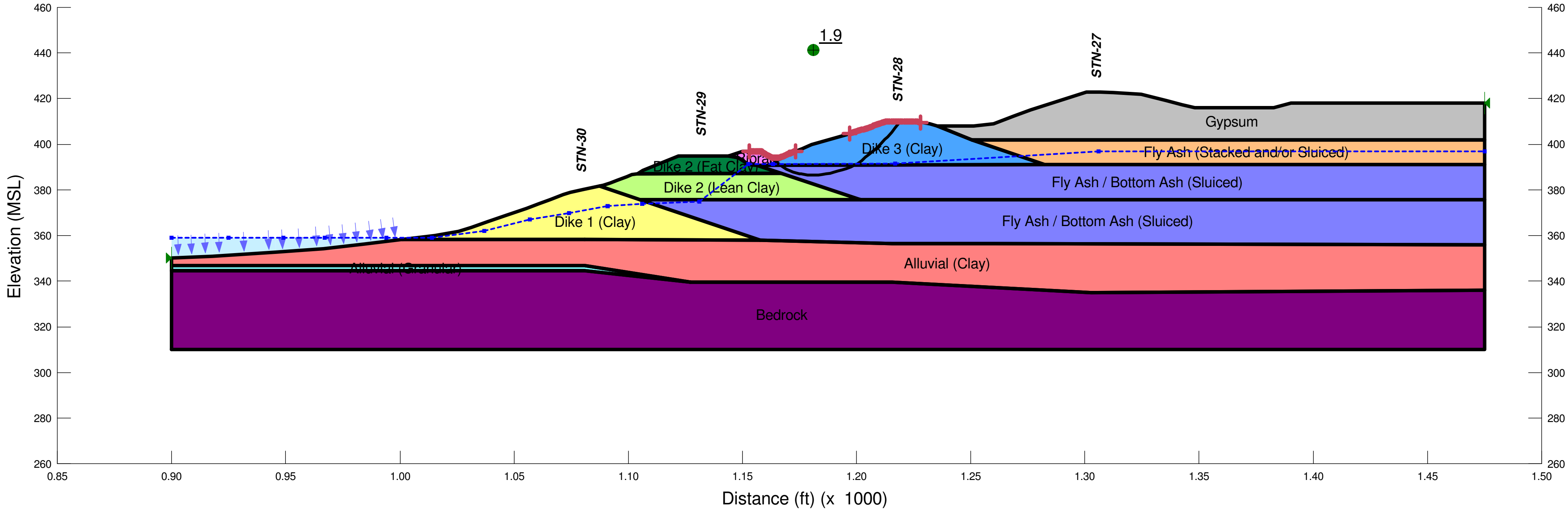
SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant
Tennessee Valley Authority (TVA)

File Name: Section J (Stability - Repair Design).gsz
Analysis Name: Stability - Existing Condition with Existing PZ Levels
Date Saved: 10/22/2009
Last Solved on 10/22/2009 at 1:27:14 PM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 1 (Clay)	124 pcf	100 psf	25 °
Dike 2 (Lean Clay)	128 pcf	100 psf	28 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Alluvial (Granular)	130 pcf	0 psf	32 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Stacked and/or Sluiced)	100 pcf	0 psf	22 °
Fly Ash / Bottom Ash (Sluiced)	100 pcf	0 psf	22 °
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Riprap	135 pcf	0 psf	38 °
Bedrock			

Analysis Method: Spencer
Calculated Factor of Safety: 1.9



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Kirkbride, Rob
Revision Number: 81
Last Edited By: Rogers, Daniel
Date: 10/22/2009
Time: 1:25:37 PM
File Name: Section J (Stability - Repair Design).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\Repair Sections\
Last Solved Date: 10/22/2009
Last Solved Time: 1:27:14 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 10 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 1 (Clay)

Model: Mohr-Coulomb
Unit Weight: 124 pcf
Cohesion: 100 psf
Phi: 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Lean Clay)

Model: Mohr-Coulomb
Unit Weight: 128 pcf
Cohesion: 100 psf
Phi: 28 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 126 pcf
Cohesion: 50 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Granular)

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Stacked and/or Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash / Bottom Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Riprap

Model: Mohr-Coulomb
Unit Weight: 135 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °

Pore Water Pressure

Piezometric Line: 1

Bedrock

Model: Bedrock (Impenetrable)

Pore Water Pressure

Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range

Left-Zone Left Coordinate: (1153, 397) ft

Left-Zone Right Coordinate: (1173.3143, 397) ft

Left-Zone Increment: 40

Right Projection: Range

Right-Zone Left Coordinate: (1197, 404.72957) ft

Right-Zone Right Coordinate: (1228, 409.63333) ft

Right-Zone Increment: 40

Radius Increments: 30

Slip Surface Limits

Left Coordinate: (900, 350.14265) ft

Right Coordinate: (1475, 418.20122) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	900	359
	925	359
	949	359
	967	359
	994	359
	1014	359
	1037	362
	1057	367
	1074	370
	1091	373
	1106	374
	1131	375
	1152.4982	391.23424
	1163.5128	391.26817
	1217	391.5

	1306	397
	1475	397

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.9	(1183.86, 420.295)	30.06568	(1219.29, 409.973)	(1161.69, 394.786)
2	22405	1.9	(1183.86, 420.295)	33.81	(1216.06, 409.981)	(1161.63, 394.82)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	1162.3445	394.2606	-186.95503	43.907242	34.304097	0
2	Optimized	1163.2565	393.52895	-141.12202	155.91501	121.81415	0
3	Optimized	1164.097	392.8544	-98.82275	379.17207	296.24169	0
4	Optimized	1164.997	392.132	-53.499943	529.56972	305.74722	50
5	Optimized	1165.6565	391.60295	-20.309962	650.28458	375.44198	50
6	Optimized	1166.03	391.30335	-1.5140986	723.33926	417.62012	50
7	Optimized	1166.1425	391.2129	4.159207	753.97959	432.909	50
8	Optimized	1166.3965	391.0312	15.565821	718.4486	405.80956	50
9	Optimized	1167.9415	389.98985	80.962678	858.10236	313.98481	0
10	Optimized	1170.7435	388.43285	178.87706	1124.0764	381.88534	0
11	Optimized	1173.553	387.42065	242.79728	1320.643	435.47793	0
12	Optimized	1175.331	386.986	270.4004	1387.0881	451.17112	0
13	Optimized	1177.157	386.73975	286.2647	1514.1055	496.0799	0
14	Optimized	1179.495	386.55795	298.2402	1562.2001	510.67295	0
15	Optimized	1181.8165	386.58595	297.11816	1660.5161	550.84852	0
16	Optimized	1184.08	386.7184	289.46757	1651.5806	550.32938	0
17	Optimized	1185.7825	386.9492	275.52539	1691.457	572.07349	0
18	Optimized	1187.485	387.18	261.58321	1731.3333	593.8176	0
19	Optimized	1189.24	387.5292	240.26797	1680.3929	581.84824	0
20	Optimized	1191.0485	387.99675	211.58421	1699.2906	601.07238	0
21	Optimized	1192.857	388.46425	182.90045	1718.1882	620.29652	0
22	Optimized	1194.595	389.03	148.06414	1637.6066	601.81421	0
23	Optimized	1196.4505	389.76855	102.48267	1632.8811	618.32109	0
24	Optimized	1198.5305	390.5965	51.383659	1628.356	637.13819	0
25	Optimized	1199.86	391.2224	12.687654	1356.7049	775.96872	50
26	Optimized	1201.136	392.18565	-47.074511	1300.7337	750.97893	50
27	Optimized	1202.99	393.63395	-	1189.4402	686.72362	50

				136.94742			
28	Optimized	1204.688	395.0131	-222.54927	1109.5927	640.62363	50
29	Optimized	1206.4555	396.4485	-311.63896	1033.2887	596.56951	50
30	Optimized	1208.167	397.92235	-403.14687	918.13267	530.08414	50
31	Optimized	1209.753	399.3785	-493.55728	842.69389	486.52954	50
32	Optimized	1211.4775	401.0929	-600.09228	709.73268	409.76435	50
33	Optimized	1212.99	402.6942	-699.60572	604.1539	348.80842	50
34	Optimized	1214.4615	404.31225	-800.1816	454.56816	262.44505	50
35	Optimized	1216.176	406.29075	-923.15644	283.5837	163.72712	50
36	Optimized	1218.1435	408.61945	-1063.8505	93.808397	54.160303	50

Slices of Slip Surface: 22405

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	22405	1162.317	394.25445	-186.5747	52.300821	40.86188	0
2	22405	1163.2565	393.4923	-138.83607	156.78057	122.49041	0
3	22405	1164.1175	392.85995	-99.161519	329.14484	257.15614	0
4	22405	1165.0175	392.2263	-59.381272	436.57701	252.05785	50
5	22405	1165.6565	391.8085	-33.137826	503.31403	290.58849	50
6	22405	1166.2525	391.4351	-9.6769365	584.00555	337.17576	50
7	22405	1166.8165	391.09905	11.444143	678.07397	384.87891	50
8	22405	1167.988	390.4595	51.669108	731.71383	274.7559	0
9	22405	1169.708	389.6054	105.43356	921.70546	329.79526	0
10	22405	1171.428	388.86855	151.88026	1088.4427	378.3958	0
11	22405	1173.148	388.24085	191.51075	1235.3985	421.75802	0
12	22405	1174.868	387.716	224.72452	1365.0154	460.70741	0
13	22405	1176.5075	387.30485	250.82824	1472.6352	493.64205	0
14	22405	1178.066	386.99545	270.55365	1561.0177	521.38133	0
15	22405	1179.6245	386.7613	285.58518	1638.6254	546.66373	0
16	22405	1181.343	386.5926	296.57723	1699.8622	566.96391	0
17	22405	1183.2215	386.5046	302.57313	1743.6896	582.24885	0
18	22405	1185.1	386.5212	302.04692	1775.1316	595.16483	0
19	22405	1186.978	386.64255	294.98214	1794.4186	605.81164	0
20	22405	1188.856	386.8698	281.31196	1801.7425	614.29381	0

21	22405	1190.734	387.20515	260.89772	1797.132	620.67895	0
22	22405	1192.612	387.6519	233.52571	1780.2941	624.935	0
23	22405	1194.49	388.2147	198.91435	1751.0892	627.11934	0
24	22405	1196.3115	388.8755	158.17361	1711.6206	627.63333	0
25	22405	1198.077	389.6344	111.29426	1662.141	626.58275	0
26	22405	1199.8425	390.5172	56.68958	1599.7983	623.4564	0
27	22405	1201.0975	391.21175	13.686534	1494.4084	854.89517	50
28	22405	1202.487	392.10445	-41.643862	1404.6495	810.97477	50
29	22405	1204.5205	393.56195	-132.04495	1262.8627	729.1141	50
30	22405	1206.396	395.11645	-228.53502	1121.4851	647.48973	50
31	22405	1208.114	396.77065	-331.29002	980.32858	565.99297	50
32	22405	1209.832	398.6885	-450.50076	820.17201	473.52653	50
33	22405	1211.55	400.9502	-591.16378	638.2075	368.46927	50
34	22405	1213.3215	403.8108	-769.19703	398.25345	229.93174	50
35	22405	1215.147	407.71145	-1012.1022	103.03561	59.487638	50

SLOPE STABILITY ANALYSIS
Cumberland Fossil Plant - Fly Ash Stack
Tennessee Valley Authority (TVA)

File Name: Section M (Stability - Repair Design).gsz

Analysis Name: Stability - Existing Condition with Existing PZ Levels

Date Saved: 10/22/2009

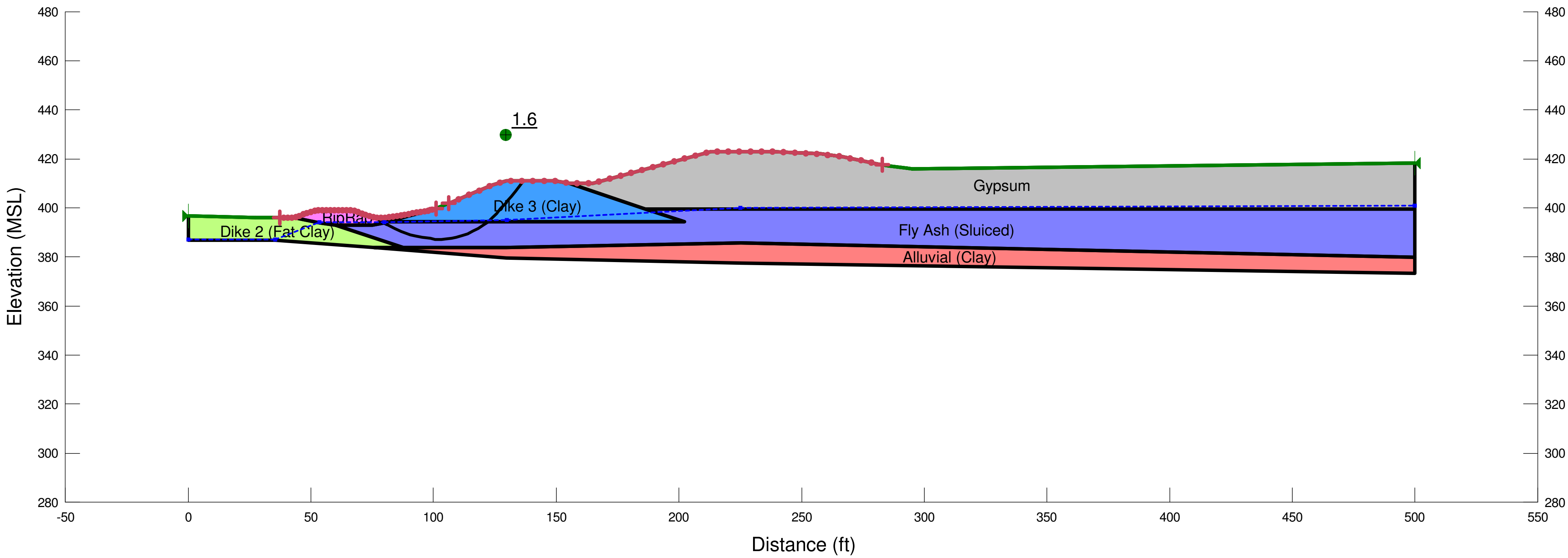
Last Solved on 10/22/2009 at 6:24:40 PM

Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Dike 2 (Fat Clay)	127 pcf	200 psf	19 °
Dike 3 (Clay)	126 pcf	50 psf	30 °
Alluvial (Clay)	121 pcf	200 psf	30 °
Gypsum	105 pcf	0 psf	38 °
Fly Ash (Sluiced)	100 pcf	0 psf	22 °
RipRap	135 pcf	0 psf	38 °

Analysis Method: Spencer

Calculated Factor of Safety: 1.6



Stability - Existing Condition with Existing PZ Levels

File Information

Created By: Cooper, Paul
Revision Number: 212
Last Edited By: Rogers, Daniel
Date: 10/22/2009
Time: 6:18:23 PM
File Name: Section M (Stability - Repair Design).gsz
Directory: V:\1755\active\175539009\geotechnical\analysis\Slope-W\Repair Sections\
Last Solved Date: 10/22/2009
Last Solved Time: 6:24:40 PM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Stability - Existing Condition with Existing PZ Levels

Kind: SLOPE/W
Method: Spencer
Settings
- Apply Phreatic Correction: No
- PWP Conditions Source: Piezometric Line
- Use Staged Rapid Drawdown: No

SlipSurface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: Yes

FOS Distribution
- FOS Calculation Option: Constant

Advanced
- Number of Slices: 30

Optimization Tolerance: 0.01
Minimum Slip Surface Depth: 0.1 ft
Optimization Maximum Iterations: 5000
Optimization Convergence Tolerance: 1e-007
Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

Dike 2 (Fat Clay)

Model: Mohr-Coulomb
Unit Weight: 127 pcf
Cohesion: 200 psf
Phi: 19 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dike 3 (Clay)

Model: Mohr-Coulomb
Unit Weight: 126 pcf
Cohesion: 50 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Alluvial (Clay)

Model: Mohr-Coulomb
Unit Weight: 121 pcf
Cohesion: 200 psf
Phi: 30 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gypsum

Model: Mohr-Coulomb
Unit Weight: 105 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Fly Ash (Sluiced)

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion: 0 psf
Phi: 22 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

RipRap

Model: Mohr-Coulomb
Unit Weight: 135 pcf
Cohesion: 0 psf
Phi: 38 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (37.37802, 396.03165) ft
Left-Zone Right Coordinate: (101, 399.8229) ft
Left-Zone Increment: 40
Right Projection: Range
Right-Zone Left Coordinate: (106.11727, 401.84613) ft
Right-Zone Right Coordinate: (283, 417.56925) ft
Right-Zone Increment: 40
Radius Increments: 30

Slip Surface Limits

Left Coordinate: (0, 396.66) ft
Right Coordinate: (500, 418.28266) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
	0	387
	35.5	387
	53.5	394.1
	80	394.1
	130	395
	225	400
	500	401

Critical Slip Surfaces

	Slip Surface	FOS	Center (ft)	Radius (ft)	Entry (ft)	Exit (ft)
1	Optimized	1.6	(100.997, 425.236)	31.54888	(136.733, 411.009)	(75.4195, 396.173)
2	32013	1.6	(100.997, 425.236)	37.81	(136.028, 411.006)	(77.0226, 395.998)

Slices of Slip Surface: Optimized

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	Optimized	75.682115	396.03625	-120.82139	12.159095	9.4997262	0
2	Optimized	77.414725	395.13155	-64.369983	212.52738	166.04459	0
3	Optimized	79.127465	394.232	-8.2380917	445.00786	347.67824	0
4	Optimized	79.519685	394.0187	5.0721501	495.34208	383.04085	0
5	Optimized	79.820075	393.85535	15.266031	398.56696	154.86363	0
6	Optimized	79.9855	393.7654	20.879921	408.10466	156.44895	0
7	Optimized	80.209165	393.64375	28.704633	420.50009	158.29564	0
8	Optimized	80.681535	393.38685	45.265746	446.64962	162.16961	0
9	Optimized	81.00073	393.21325	56.456301	466.13085	165.51926	0
10	Optimized	82.630875	392.3267	113.60665	621.16169	205.06555	0
11	Optimized	85.48173	390.9177	204.73379	828.9043	252.18126	0
12	Optimized	87.69363	390.0437	261.75678	949.70522	277.94921	0
13	Optimized	89.564025	389.4015	303.92489	1070.9657	309.90461	0
14	Optimized	91.72956	388.7873	344.68609	1140.9153	321.69748	0
15	Optimized	94.162075	388.2078	383.57994	1263.4547	355.49246	0
16	Optimized	96.18926	387.8052	410.97748	1301.7308	359.88768	0
17	Optimized	97.839285	387.57275	427.33689	1364.3238	378.56728	0
18	Optimized	99.64415	387.31845	445.23002	1459.3572	409.73398	0
19	Optimized	101.0604	387.1842	455.20235	1454.5578	403.76581	0
20	Optimized	102.31425	387.19505	455.93222	1516.8178	428.62559	0
21	Optimized	103.9491	387.20915	456.88639	1601.5917	462.49099	0
22	Optimized	106.13465	387.43995	444.95387	1596.02	465.0609	0
23	Optimized	108.37555	387.8064	424.59212	1672.7779	504.29977	0
24	Optimized	110.4075	388.3246	394.53756	1629.1621	498.82069	0
25	Optimized	112.72595	389.0756	350.2797	1671.2616	533.71135	0
26	Optimized	114.9777	389.97925	296.42269	1602.6991	527.76992	0
27	Optimized	117.12155	391.0156	234.16472	1607.6131	554.90916	0
28	Optimized	119.22095	392.21535	161.65673	1501.0897	541.16604	0
29	Optimized	121.36215	393.6282	75.896895	1470.636	563.51116	0
30	Optimized	122.7076	394.6114	16.058219	1173.6566	668.33974	50
31	Optimized	123.4551	395.3873	-31.519654	1131.9615	653.5383	50

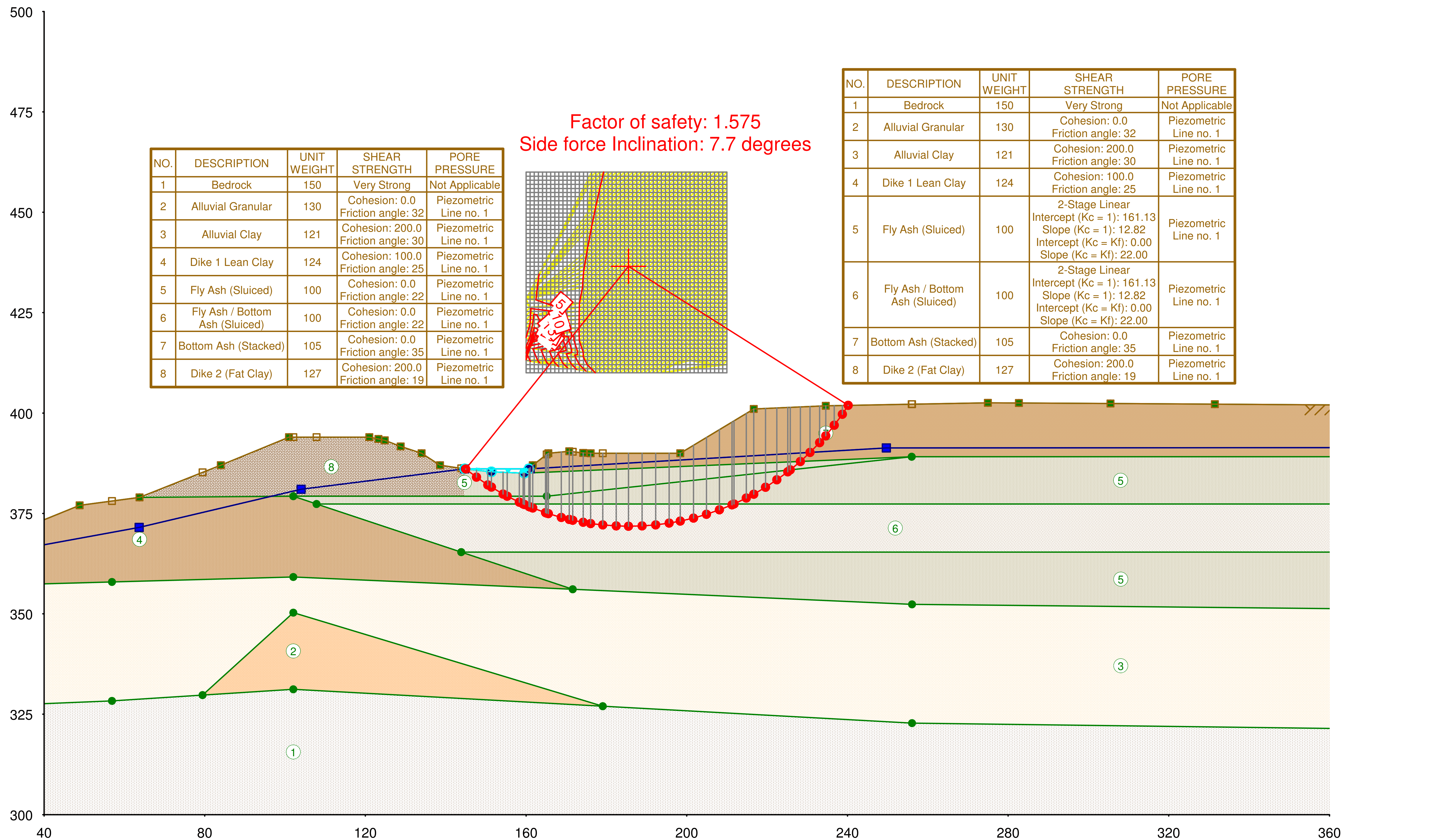
32	Optimized	124.83635	396.8211	-119.4353	1050.8678	606.71879	50
33	Optimized	126.57155	398.6875	-233.94839	909.13523	524.88947	50
34	Optimized	128.2698	400.5807	-350.17945	794.79542	458.87535	50
35	Optimized	129.38065	401.8465	-427.9228	689.83428	398.27601	50
36	Optimized	129.8212	402.3837	-460.9332	653.68031	377.4025	50
37	Optimized	130.87165	403.6645	-537.7893	553.64943	319.64965	50
38	Optimized	132.6149	405.7901	-664.7067	387.70011	223.83876	50
39	Optimized	134.2982	407.892	-790.33577	217.76515	125.72677	50
40	Optimized	135.92155	409.97025	-914.7145	58.799283	33.947782	50

Slices of Slip Surface: 32013

	Slip Surface	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
1	32013	78.28404	395.04915	-59.227953	313.52808	244.95498	0
2	32013	79.65135	394.0276	4.5180071	581.69975	450.9438	0
3	32013	79.864105	393.88315	13.532382	423.46389	165.62308	0
4	32013	79.9855	393.8014	18.633345	431.33883	166.74384	0
5	32013	80.209165	393.654	28.063701	444.78619	168.36682	0
6	32013	80.681535	393.34865	47.650701	472.18125	171.52147	0
7	32013	81.00073	393.1461	60.64933	491.93548	174.25091	0
8	32013	81.11113	393.07755	65.050303	501.32244	176.26538	0
9	32013	82.10454	392.50195	102.08204	589.66386	196.99584	0
10	32013	83.982545	391.4866	167.55184	742.0703	232.12053	0
11	32013	85.86055	390.6028	224.81153	871.90339	261.44208	0
12	32013	87.73855	389.84065	274.47856	982.57788	286.0907	0
13	32013	89.616555	389.1924	317.03613	1076.6747	306.91392	0
14	32013	91.56915	388.6348	354.02381	1158.5669	325.05652	0
15	32013	93.596335	388.1713	385.22062	1228.5671	340.73408	0
16	32013	95.62352	387.8233	409.21078	1284.283	353.55212	0
17	32013	97.650705	387.5876	426.19817	1326.7131	363.83165	0
18	32013	100.08055	387.46315	436.6971	1395.7154	387.46855	0
19	32013	102.4978	387.46855	439.07055	1478.9409	420.13488	0
20	32013	104.4998	387.60145	433.02524	1538.4439	446.61814	0
21	32013	106.5018	387.84195	420.26773	1584.0652	470.20468	0
22	32013	108.57375	388.20845	399.72519	1619.2738	492.7296	0
23	32013	110.7156	388.71255	370.67734	1642.6823	513.92336	0
24	32013	112.85745	389.35145	333.21645	1649.8796	531.96643	0
25	32013	114.9993	390.13255	286.87947	1640.3211	546.8259	0
26	32013	117.1789	391.08505	229.89148	1612.9367	558.78656	0
27	32013	119.3963	392.2284	161.03612	1565.8095	567.56528	0
28	32013	121.6137	393.5682	79.923716	1496.9587	572.51929	0

29	32013	123.1335	394.5869	18.06493	1359.4301	774.43753	50
30	32013	123.74745	395.0366	-9.3073877	1321.2537	762.82619	50
31	32013	124.899	395.96405	-65.885517	1234.838	712.93408	50
32	32013	126.79635	397.62515	-167.40548	1079.8887	623.47405	50
33	32013	128.6937	399.5339	-284.3791	908.56618	524.56093	50
34	32013	129.8212	400.7668	-360.04405	798.25389	460.8721	50
35	32013	131.00465	402.29125	-451.68011	645.15797	372.48213	50
36	32013	133.0139	405.21135	-627.29688	380.06236	219.42911	50
37	32013	135.02315	408.91165	-851.59288	99.182788	57.263209	50

TVA Cumberland Fossil Plant Section C FSu - Drained/Undrained Analysis

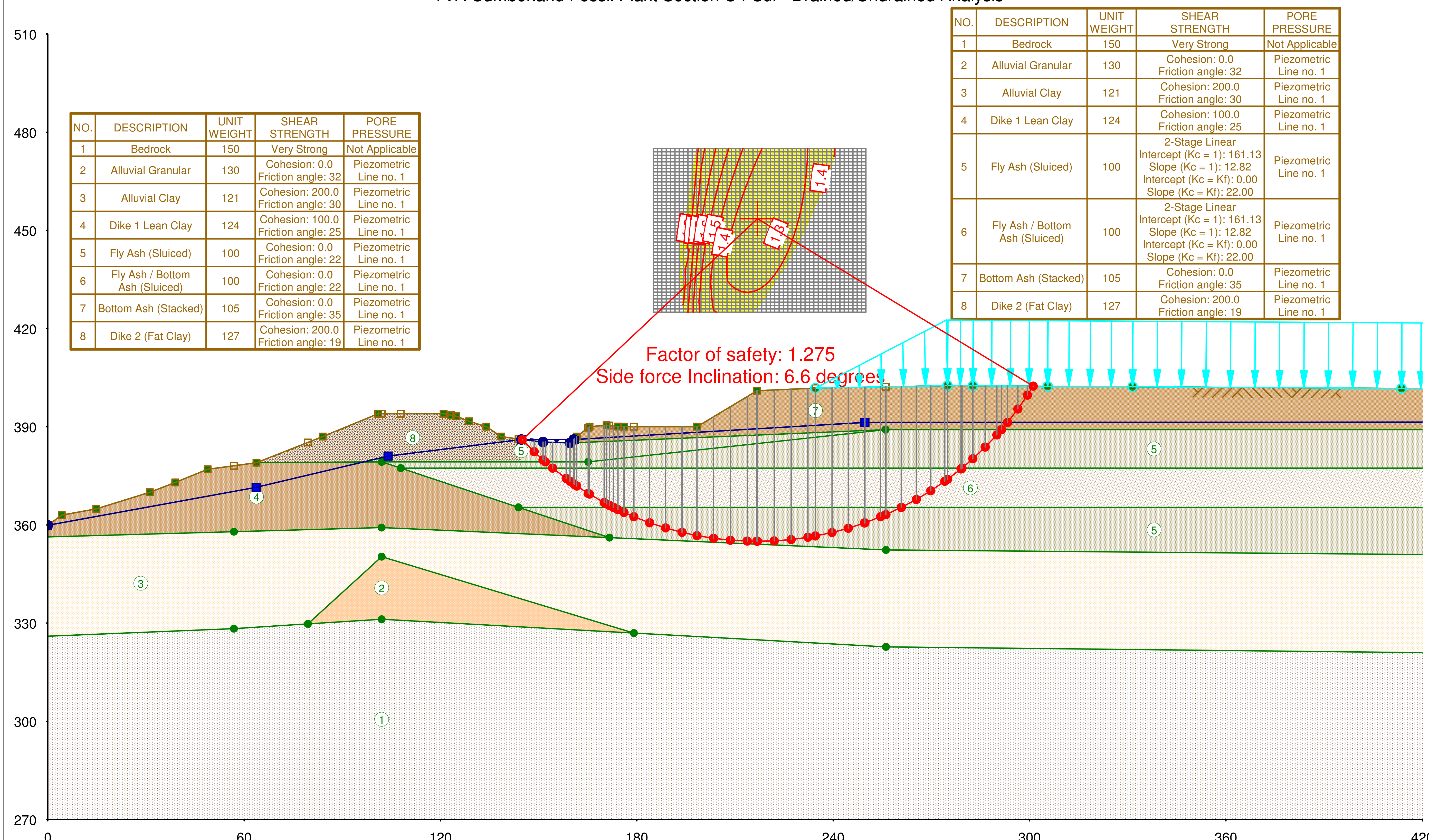


NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Bedrock	150	Very Strong	Not Applicable
2	Alluvial Granular	130	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
3	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
4	Dike 1 Lean Clay	124	Cohesion: 100.0 Friction angle: 25	Piezometric Line no. 1
5	Fly Ash (Sluiced)	100	Cohesion: 0.0 Friction angle: 22	Piezometric Line no. 1
6	Fly Ash / Bottom Ash (Sluiced)	100	Cohesion: 0.0 Friction angle: 22	Piezometric Line no. 1
7	Bottom Ash (Stacked)	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
8	Dike 2 (Fat Clay)	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Bedrock	150	Very Strong	Not Applicable
2	Alluvial Granular	130	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
3	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
4	Dike 1 Lean Clay	124	Cohesion: 100.0 Friction angle: 25	Piezometric Line no. 1
5	Fly Ash (Sluiced)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 22.00	Piezometric Line no. 1
6	Fly Ash / Bottom Ash (Sluiced)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 22.00	Piezometric Line no. 1
7	Bottom Ash (Stacked)	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
8	Dike 2 (Fat Clay)	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1

Date: Thu Mar 11 2010 Filename: SecC-FSu.UT4 Time: 15:40:06

TVA Cumberland Fossil Plant Section C FSul - Drained/Undrained Analysis

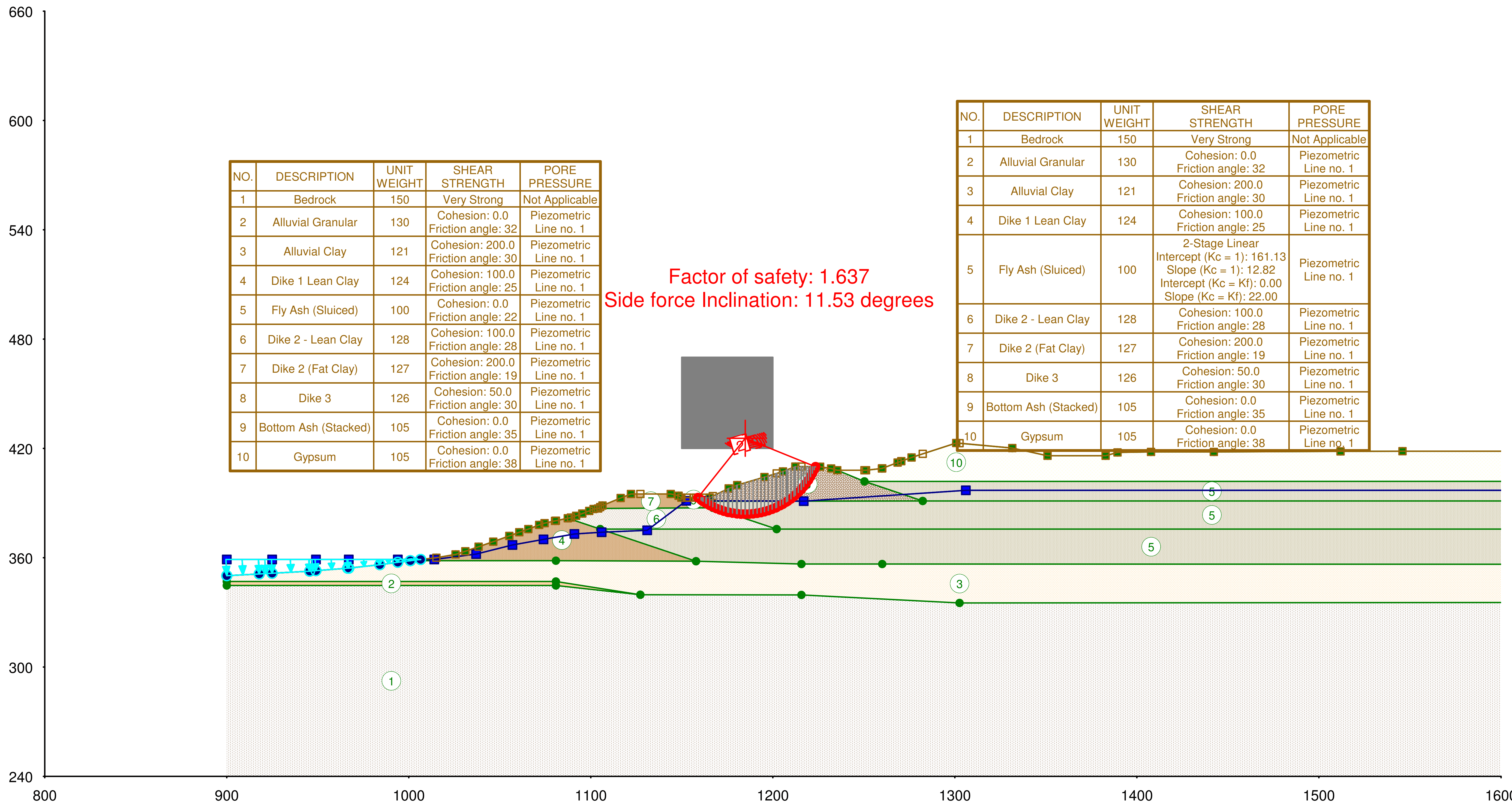


NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Bedrock	150	Very Strong	Not Applicable
2	Alluvial Granular	130	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
3	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
4	Dike 1 Lean Clay	124	Cohesion: 100.0 Friction angle: 25	Piezometric Line no. 1
5	Fly Ash (Sluiced)	100	Cohesion: 0.0 Friction angle: 22	Piezometric Line no. 1
6	Fly Ash / Bottom Ash (Sluiced)	100	Cohesion: 0.0 Friction angle: 22	Piezometric Line no. 1
7	Bottom Ash (Stacked)	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
8	Dike 2 (Fat Clay)	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Bedrock	150	Very Strong	Not Applicable
2	Alluvial Granular	130	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
3	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
4	Dike 1 Lean Clay	124	Cohesion: 100.0 Friction angle: 25	Piezometric Line no. 1
5	Fly Ash (Sluiced)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 22.00	Piezometric Line no. 1
6	Fly Ash / Bottom Ash (Sluiced)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 22.00	Piezometric Line no. 1
7	Bottom Ash (Stacked)	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
8	Dike 2 (Fat Clay)	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1

Date: Thu Mar 11 2010 Filename: SecC-FSul.UT4 Time: 15:43:35

TVA Cumberland Fossil Plant Section J FSu - Drained/Undrained Analysis



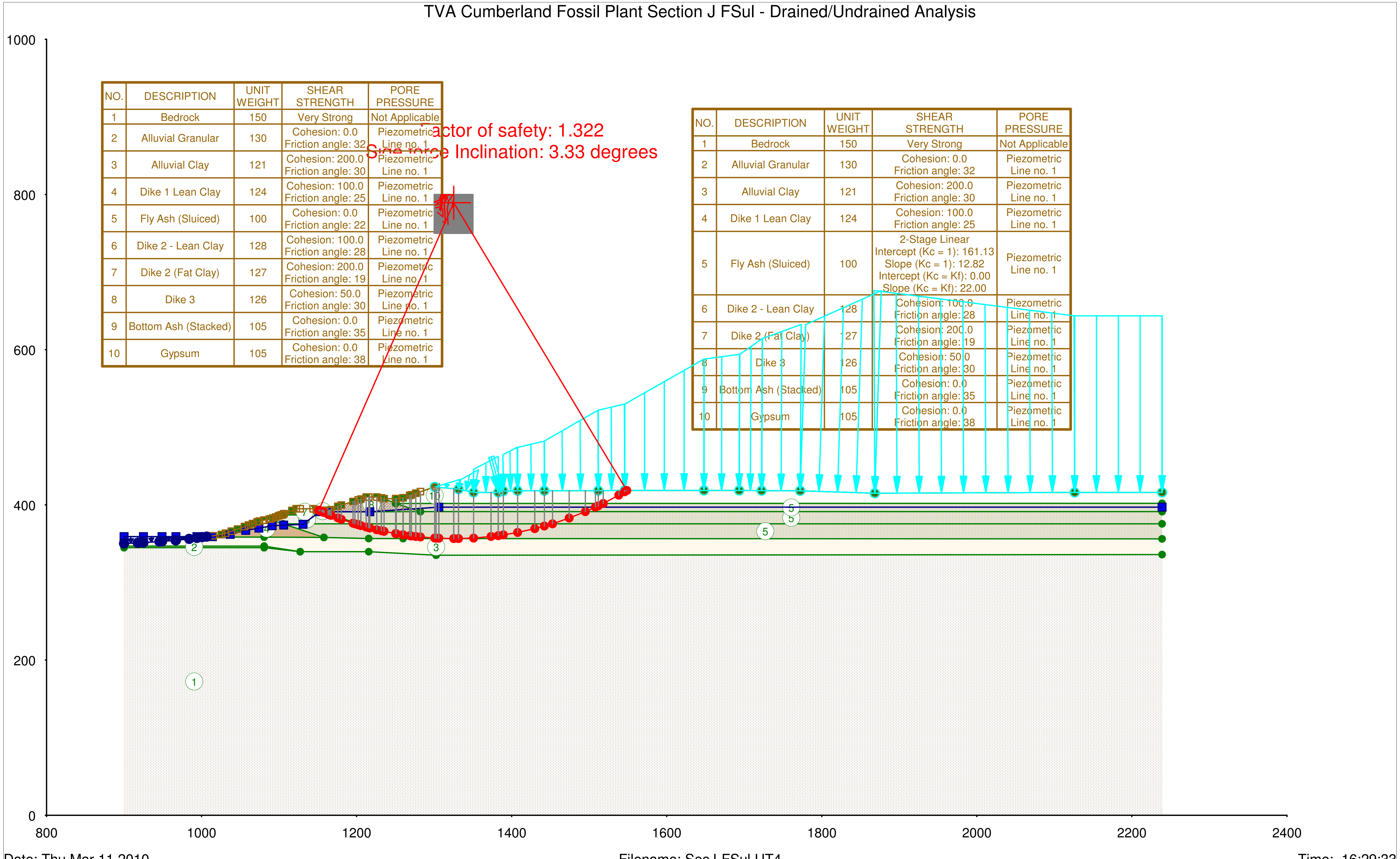
NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Bedrock	150	Very Strong	Not Applicable
2	Alluvial Granular	130	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
3	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
4	Dike 1 Lean Clay	124	Cohesion: 100.0 Friction angle: 25	Piezometric Line no. 1
5	Fly Ash (Sluiced)	100	Cohesion: 0.0 Friction angle: 22	Piezometric Line no. 1
6	Dike 2 - Lean Clay	128	Cohesion: 100.0 Friction angle: 28	Piezometric Line no. 1
7	Dike 2 (Fat Clay)	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1
8	Dike 3	126	Cohesion: 50.0 Friction angle: 30	Piezometric Line no. 1
9	Bottom Ash (Stacked)	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
10	Gypsum	105	Cohesion: 0.0 Friction angle: 38	Piezometric Line no. 1

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Bedrock	150	Very Strong	Not Applicable
2	Alluvial Granular	130	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
3	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
4	Dike 1 Lean Clay	124	Cohesion: 100.0 Friction angle: 25	Piezometric Line no. 1
5	Fly Ash (Sluiced)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 22.00	Piezometric Line no. 1
6	Dike 2 - Lean Clay	128	Cohesion: 100.0 Friction angle: 28	Piezometric Line no. 1
7	Dike 2 (Fat Clay)	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1
8	Dike 3	126	Cohesion: 50.0 Friction angle: 30	Piezometric Line no. 1
9	Bottom Ash (Stacked)	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
10	Gypsum	105	Cohesion: 0.0 Friction angle: 38	Piezometric Line no. 1

Date: Thu Mar 11 2010

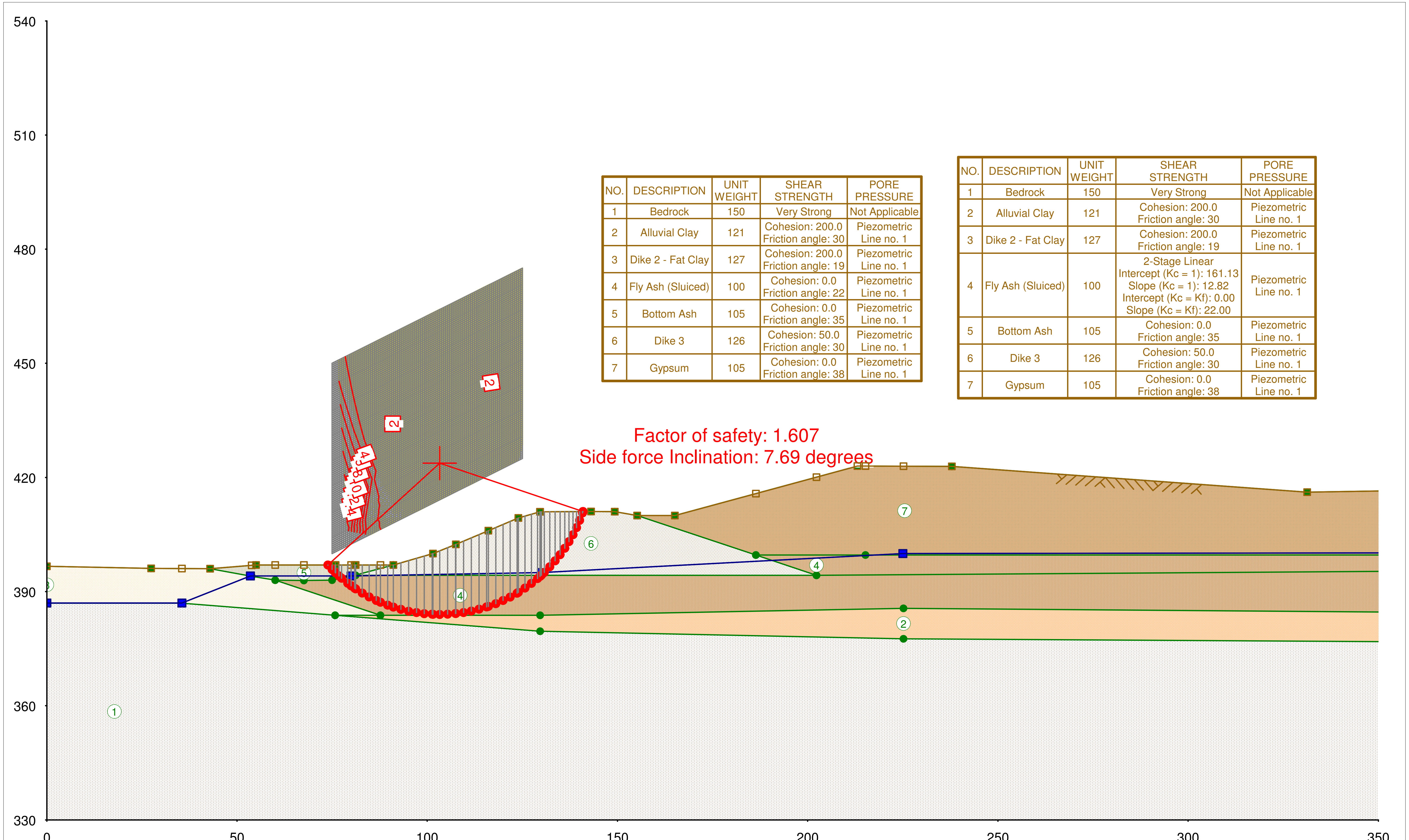
Filename: SecJ-FSu.UT4

Time: 16:28:19



NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Bedrock	150	Very Strong	Not Applicable
2	Alluvial Granular	130	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
3	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
4	Dike 1 Lean Clay	124	Cohesion: 100.0 Friction angle: 25	Piezometric Line no. 1
5	Fly Ash (Sluiced)	100	Cohesion: 0.0 Friction angle: 22	Piezometric Line no. 1
6	Dike 2 - Lean Clay	128	Cohesion: 100.0 Friction angle: 28	Piezometric Line no. 1
7	Dike 2 (Fat Clay)	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1
8	Dike 3	126	Cohesion: 50.0 Friction angle: 30	Piezometric Line no. 1
9	Bottom Ash (Stacked)	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
10	Gypsum	105	Cohesion: 0.0 Friction angle: 38	Piezometric Line no. 1

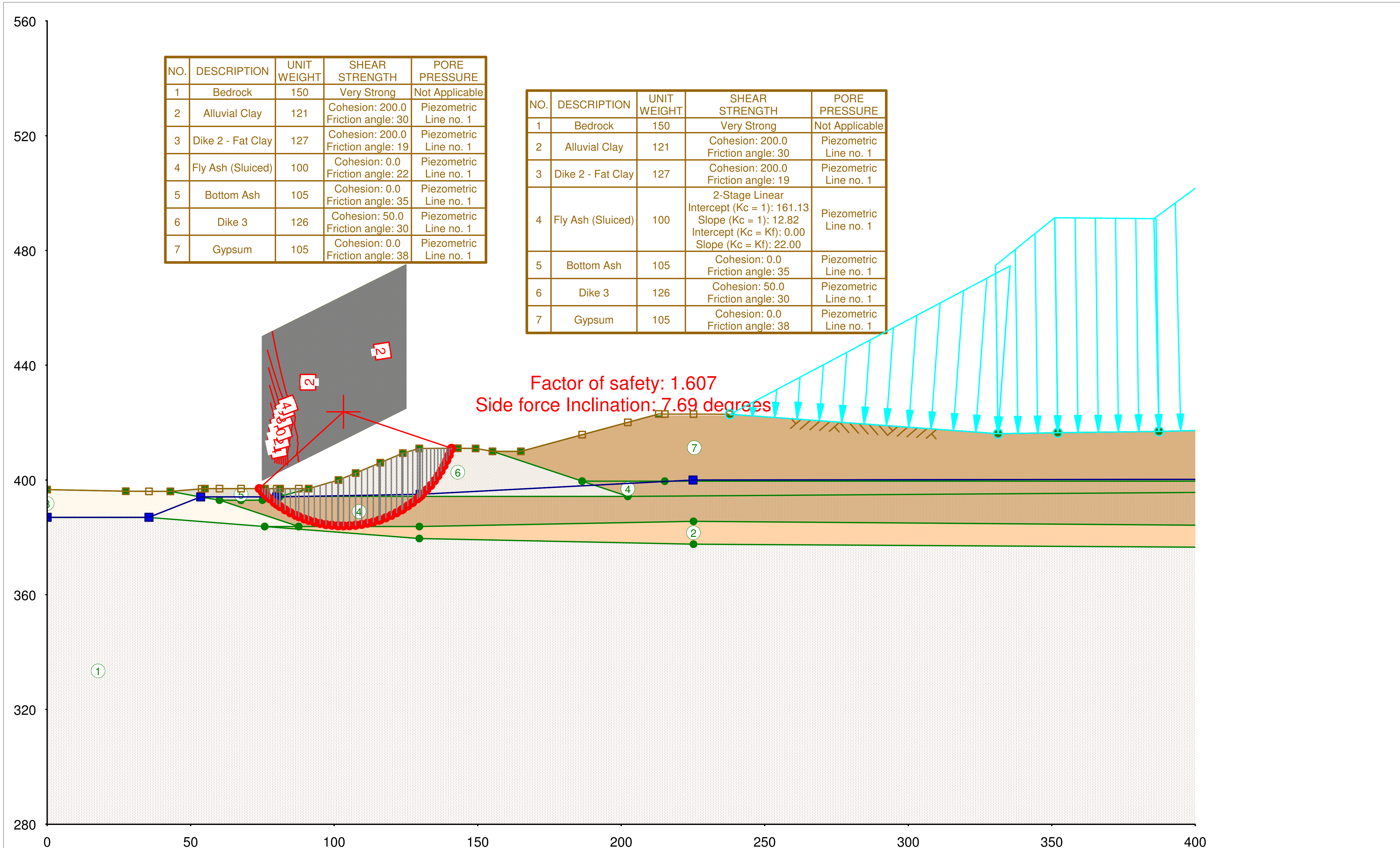
NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Bedrock	150	Very Strong	Not Applicable
2	Alluvial Granular	130	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
3	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
4	Dike 1 Lean Clay	124	Cohesion: 100.0 Friction angle: 25	Piezometric Line no. 1
5	Fly Ash (Sluiced)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 22.00	Piezometric Line no. 1
6	Dike 2 - Lean Clay	128	Cohesion: 100.0 Friction angle: 28	Piezometric Line no. 1
7	Dike 2 (Fat Clay)	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1
8	Dike 3	126	Cohesion: 50.0 Friction angle: 30	Piezometric Line no. 1
9	Bottom Ash (Stacked)	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
10	Gypsum	105	Cohesion: 0.0 Friction angle: 38	Piezometric Line no. 1



NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Bedrock	150	Very Strong	Not Applicable
2	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
3	Dike 2 - Fat Clay	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1
4	Fly Ash (Sluiced)	100	Cohesion: 0.0 Friction angle: 22	Piezometric Line no. 1
5	Bottom Ash	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
6	Dike 3	126	Cohesion: 50.0 Friction angle: 30	Piezometric Line no. 1
7	Gypsum	105	Cohesion: 0.0 Friction angle: 38	Piezometric Line no. 1

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Bedrock	150	Very Strong	Not Applicable
2	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
3	Dike 2 - Fat Clay	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1
4	Fly Ash (Sluiced)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 22.00	Piezometric Line no. 1
5	Bottom Ash	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
6	Dike 3	126	Cohesion: 50.0 Friction angle: 30	Piezometric Line no. 1
7	Gypsum	105	Cohesion: 0.0 Friction angle: 38	Piezometric Line no. 1

Date: Thu Mar 11 2010 Filename: SecM-FSu.UT4 Time: 16:30:51

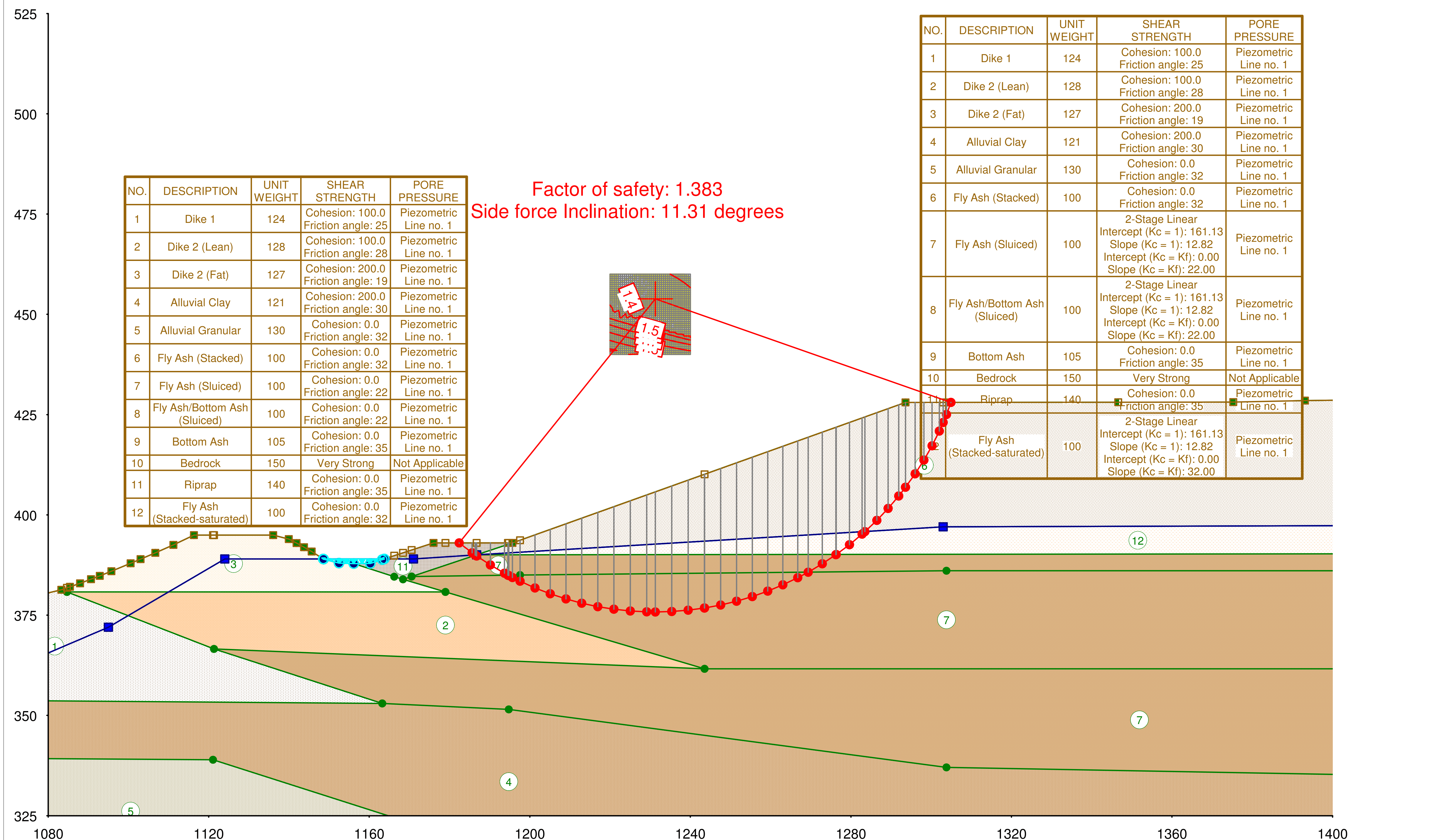


NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Bedrock	150	Very Strong	Not Applicable
2	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
3	Dike 2 - Fat Clay	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1
4	Fly Ash (Sluiced)	100	Cohesion: 0.0 Friction angle: 22	Piezometric Line no. 1
5	Bottom Ash	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
6	Dike 3	126	Cohesion: 50.0 Friction angle: 30	Piezometric Line no. 1
7	Gypsum	105	Cohesion: 0.0 Friction angle: 38	Piezometric Line no. 1

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Bedrock	150	Very Strong	Not Applicable
2	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
3	Dike 2 - Fat Clay	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1
4	Fly Ash (Sluiced)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 22.00	Piezometric Line no. 1
5	Bottom Ash	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
6	Dike 3	126	Cohesion: 50.0 Friction angle: 30	Piezometric Line no. 1
7	Gypsum	105	Cohesion: 0.0 Friction angle: 38	Piezometric Line no. 1

Date: Thu Mar 11 2010 Filename: SecM-FSul.UT4 Time: 16:32:12

TVA Cumberland Fossil Plant Section F FSu - Drained/Undrained Analysis

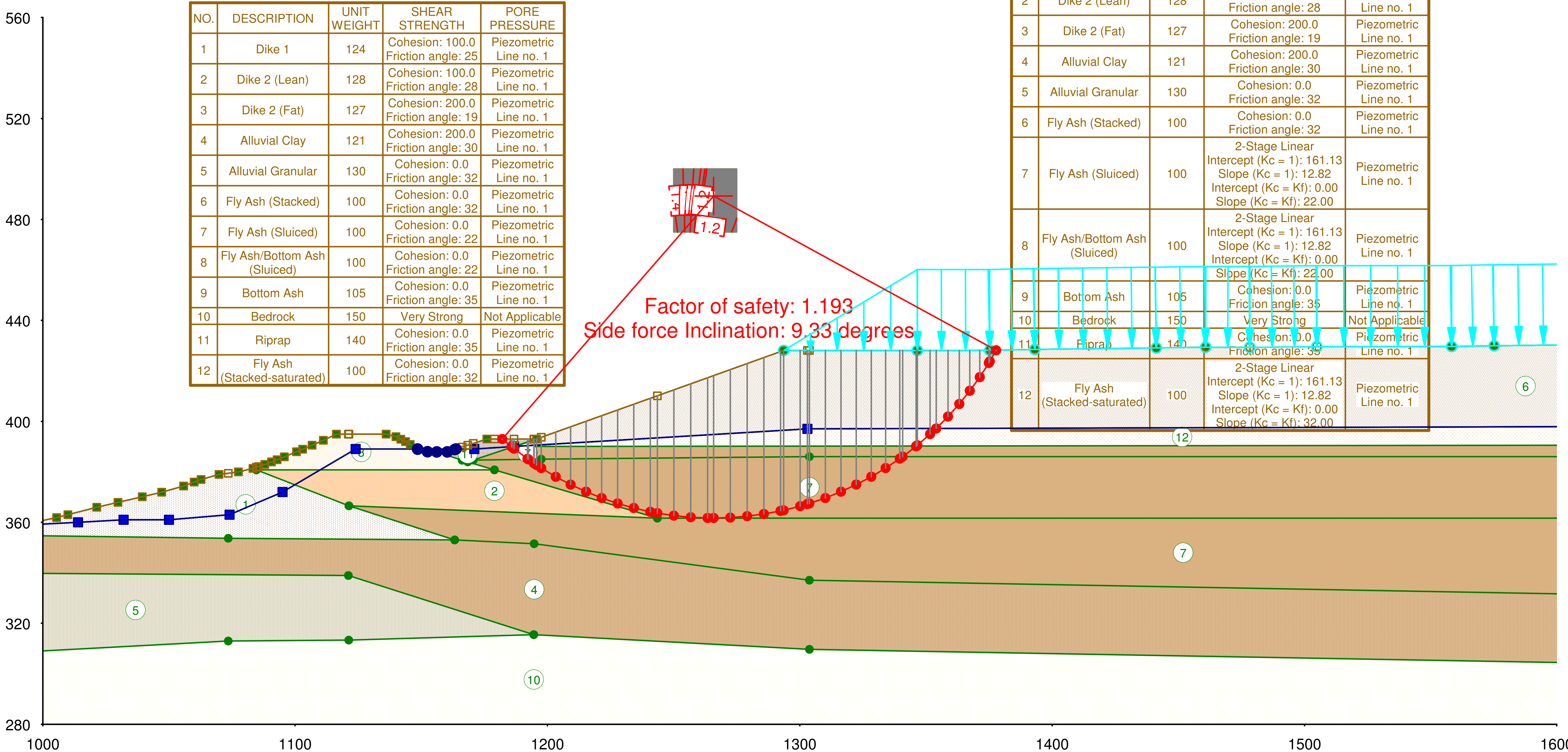


NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Dike 1	124	Cohesion: 100.0 Friction angle: 25	Piezometric Line no. 1
2	Dike 2 (Lean)	128	Cohesion: 100.0 Friction angle: 28	Piezometric Line no. 1
3	Dike 2 (Fat)	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1
4	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
5	Alluvial Granular	130	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
6	Fly Ash (Stacked)	100	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
7	Fly Ash (Sluiced)	100	Cohesion: 0.0 Friction angle: 22	Piezometric Line no. 1
8	Fly Ash/Bottom Ash (Sluiced)	100	Cohesion: 0.0 Friction angle: 22	Piezometric Line no. 1
9	Bottom Ash	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
10	Bedrock	150	Very Strong	Not Applicable
11	Riprap	140	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
12	Fly Ash (Stacked-saturated)	100	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Dike 1	124	Cohesion: 100.0 Friction angle: 25	Piezometric Line no. 1
2	Dike 2 (Lean)	128	Cohesion: 100.0 Friction angle: 28	Piezometric Line no. 1
3	Dike 2 (Fat)	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1
4	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
5	Alluvial Granular	130	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
6	Fly Ash (Stacked)	100	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
7	Fly Ash (Sluiced)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 22.00	Piezometric Line no. 1
8	Fly Ash/Bottom Ash (Sluiced)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 22.00	Piezometric Line no. 1
9	Bottom Ash	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
10	Bedrock	150	Very Strong	Not Applicable
11	Riprap	140	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
12	Fly Ash (Stacked-saturated)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 32.00	Piezometric Line no. 1

Date: Thu Mar 11 2010 Filename: SectF-FSu.UT4 Time: 16:24:26

TVA Cumberland Fossil Plant Section F FSul - Drained/Undrained Analysis



NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Dike 1	124	Cohesion: 100.0 Friction angle: 25	Piezometric Line no. 1
2	Dike 2 (Lean)	128	Cohesion: 100.0 Friction angle: 28	Piezometric Line no. 1
3	Dike 2 (Fat)	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1
4	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
5	Alluvial Granular	130	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
6	Fly Ash (Stacked)	100	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
7	Fly Ash (Sluiced)	100	Cohesion: 0.0 Friction angle: 22	Piezometric Line no. 1
8	Fly Ash/Bottom Ash (Sluiced)	100	Cohesion: 0.0 Friction angle: 22	Piezometric Line no. 1
9	Bottom Ash	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
10	Bedrock	150	Very Strong	Not Applicable
11	Riprap	140	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
12	Fly Ash (Stacked-saturated)	100	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Dike 1	124	Cohesion: 100.0 Friction angle: 25	Piezometric Line no. 1
2	Dike 2 (Lean)	128	Cohesion: 100.0 Friction angle: 28	Piezometric Line no. 1
3	Dike 2 (Fat)	127	Cohesion: 200.0 Friction angle: 19	Piezometric Line no. 1
4	Alluvial Clay	121	Cohesion: 200.0 Friction angle: 30	Piezometric Line no. 1
5	Alluvial Granular	130	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
6	Fly Ash (Stacked)	100	Cohesion: 0.0 Friction angle: 32	Piezometric Line no. 1
7	Fly Ash (Sluiced)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 22.00	Piezometric Line no. 1
8	Fly Ash/Bottom Ash (Sluiced)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 22.00	Piezometric Line no. 1
9	Bottom Ash	105	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
10	Bedrock	150	Very Strong	Not Applicable
11	Riprap	140	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1
12	Fly Ash (Stacked-saturated)	100	2-Stage Linear Intercept (Kc = 1): 161.13 Slope (Kc = 1): 12.82 Intercept (Kc = Kf): 0.00 Slope (Kc = Kf): 32.00	Piezometric Line no. 1

Date: Thu Mar 11 2010 Filename: SectF-FSul.UT4 Time: 16:26:38