# FINAL (REVISION 1)

# STATIC STABILITY OF THE PERIMETER EMBANKMENT OF ASH DISPOSAL AREA J

# FAST TRACK ISSUES AND PHASE 1 ENGINEERING

## COAL COMBUSTION PRODUCTS DISPOSAL PROGRAM

## TVA JOHN SEVIER FOSSIL PLANT – HAWKINS COUNTY, TENNESSEE

**Prepared for**
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**FINAL (Revision 1)**

**Static Stability of the Perimeter Embankment of Area J**
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# 1.0 EXECUTIVE SUMMARY

## 1.1 Overview of Area J

The coal combustion by-product (CCP) disposal area, including Ash Disposal Area J (hereinafter "Area J"), was developed on a low-lying area in the floodplain of the Holston River. Construction of the 22-acre Area J was completed in 1982. The embankments forming Area J were apparently constructed with clayey soil excavated from within the impoundment area and from a borrow site located southeast of the disposal area. The transfer of sluiced fly ash to Area J began shortly after the construction of the embankments.

The west embankment was modified in 1984 by flattening and placement of riprap along 700 feet of shoreline next to the west end of the north embankment. This last corrective measure was apparently implemented after an area between the toe of the embankment and steep river bank slumped into the river.

The Area J impoundment was closed in accordance with TDEC requirements in the 1990's.

## 1.2 Objective of This Work

The objective of the work reported herein was to complete a focused geotechnical assessment of areas of Area J where there was concern for less than acceptable slope stability. These areas are identified in February 2010 reporting by Stantec Consulting Services, Inc.

In February 2010 Stantec Consulting Services, Inc. finalized its report of a screening level assessment for areas of potential concern across the entire 190-acre area used for disposal of CCP (reference"*Report of Geotechnical Exploration, Dry Fly Ash Stack, Bottom Ash Disposal Area 2, Area J, John Sevier Fossil Plant, Rogersville, Tennessee*, hereinfater "Stantec 2010").

Stantec 2010 identified the north embankment of Area J as an area of concern, recommending that more geotechnical information be obtained in this area and noting that corrective measures to address slope stability and scour may be required. URS concurred with Stantec's judgment, recommending that the work reported herein be undertaken. TVA authorized URS Corporation (URS) to conduct a series of embankment stability analyses for Ash Disposal Area J in accordance with URS' proposal dated 2nd March 2010.

## 1.3 Approach to the Work

### 1.3.1 General

In order to accomplish the objective of this work, URS completed programs of field exploration, laboratory testing and engineering analyses. The work was directed at developing a more detailed understanding of site stratigraphy and soil strength by the use of soil borings, as well as *in-situ* and laboratory testing on the soils located in the area of embankment stability concerns. Data obtained from the field work was used to select conservative parameters for soil strength for use in numerical modeling to assess embankment stability.

The following subsections abstract the scope of each element of URS' work.

### 1.3.2 Field Exploration and In-Situ Testing

URS developed a focused testing program involing both in-situ and laboratory testing. The in-situ tesing consisted of Standard Penetration Test (SPT) borings, Cone Penetration Test (CPT) soundings and Marchetti flat plate dilatometer (DMT) soundings. A total of eight (8) soil test borings were completed and ranged in depth from 31 to 47 feet below existing grade (approximately 1,105 feet msl) for a cumulative drilled total of 298 lineal feet. Both disturbed and undisturbed samples were collected for subsequent visual classification and laboratory testing.

Twelve (12) CPT soundings were completed ranging in depth from 19 to 49 feet below existing grade (approximately 1,105 feet msl) for an aggregate probing of 473 lineal feet. A similar number of DMT soundings was accomplished with probed depths ranging from 14 to 35 feet below existing grade (approximately 1,105 feet msl) for a cumulative total of 293 lineal feet. Both the CMT and DMT soundings were performed primarily to gauge in-situ soil strength.

### 1.3.3 Laboratory Testing

The laboratory testing consisted of both strength and index property determinations. The soil strengths were developed from direct shear, vane shear and isotropically consolidated undrained triaxial testing. A total of twelve (12) strength tests were performed consisting of six (6) vane shear, and three (3) each for direct shear and triaxial shear. The index property testing consisted of ten (10) tests each for moisture content, Atterberg limits and grain size determinations.

### 1.3.4 Slope Stability Analyses

Static

Slope stability analyses were undertaken to calculate the factors of safety against slope failure. State-of-the practice procedures were utilized (i.e., using a limit equilibrium analytical procedure, assuming two-dimensional, plane strain conditions). URS utilized conservative soil strength parameters to evaluate stability.

URS evaluated the same sections (i.e., Sections J-J', K-K', M-M', and O-O') developed in Stantec 2010. The slopes of these sections are typically about 2.5:1 (horizontal: vertical) on the outboard (river side), with scour at the toe of these slopes. As is well understood, the inboard slopes of the embankment are now covered with hydraulically placed CCP waste.

Each stability section was analyzed at two river water levels, namely: (i) elevation +1,067 feet msl, representing normal river water levels, and (ii) elevation +1,073 feet msl, representing high river water levels. Rapid drawdown is not a consideration in this matter.

## 1.4 Findings and Recommendations

### 1.4.1 Slope Stability

The results of the static slope stability analyses indicate factors of safety in excess of the targeted value of 1.5 for all four (4) sections analysed. Based on these results, URS is of the opinion that there are no embankment stability concerns for these sections of Ash Disposal Area J.

### 1.4.2 Scour

URS concurs with Stantec 2010 that scouring of the toe of the embankment by the Holston River can compromise the stability of the embankment. Accordingly, adequate scour protection should be implemented as a near-term corrective measure. The design of scour protection is outside the scope of this work and is therefore not included herein.

# 2.0 BACKGROUND

## 2.1 Terms of Reference

This report provides the findings of a focused additional geotechnical investigation of a portion of the earth dike (hereinafter, "the embankment") bounding Ash Disposal Area J (hereinafter, "Area J"). The embankment was identified in previous work by Stantec Consulting Services, Inc. (Stantec) to be of concern for less than acceptable slope stability. The embankment is a 30-foot to 35-foot high earth embankment that borders the north side of Area J at the John Sevier Fossil (JSF) Plant in Rogersville, Tennessee. An aerial view of the general project vicinity is shown on Figure 1.

The work reported herein was completed by URS Corporation (URS) for the Tennessee Valley Authority (TVA). The work was undertaken in general accordance with the scope of services detailed in URS' proposal to TVA dated 04 May 2010. The proposal added this work to the scope of existing engineering services for Area J that are described in URS' proposal to TVA dated 02 March 2010.

This report was prepared by Mr. John F. O'Brien, P.E., G.E., Ms. Christina V. Vulova, P.E. and Mr. Robert E. Taunton of URS. The report was reviewed by Messrs Winston L. Stewart, P.E. and Jeffrey F. Rouleau, P.E., both of URS, in accordance with URS' requirements for internal review.

## 2.2 Previous Evaluations

### 2.2.1 Background Regarding Area J

Disposal of coal combustion by-products (CCP) has been conducted at JSF since the 1950's in a 200-acre area located to the west of the generating area. The CCP disposal area- including Area J- was developed on low-lying ground in the floodplain of the Holston River.

Construction of the 22-acre area known as Area J was completed in 1982. The embankments forming Area J were apparently constructed with clayey soil excavated from within the impoundment area and from a borrow site located southeast of the disposal area. The transfer of sluiced fly ash to Area J began shortly after the construction of the embankments.

The west embankment was modified in 1984 by flattening and placement of riprap along 700 feet of shoreline next to the west end of the north embankment. This last corrective measure was apparently implemented after an area between the toe of the embankment and steep river bank slumped into the river.

The Area J impoundment was closed in accordance with TDEC requirements in the 1990's. Figure 1 below shows the location of Area J relative to the plant and the Holston River.

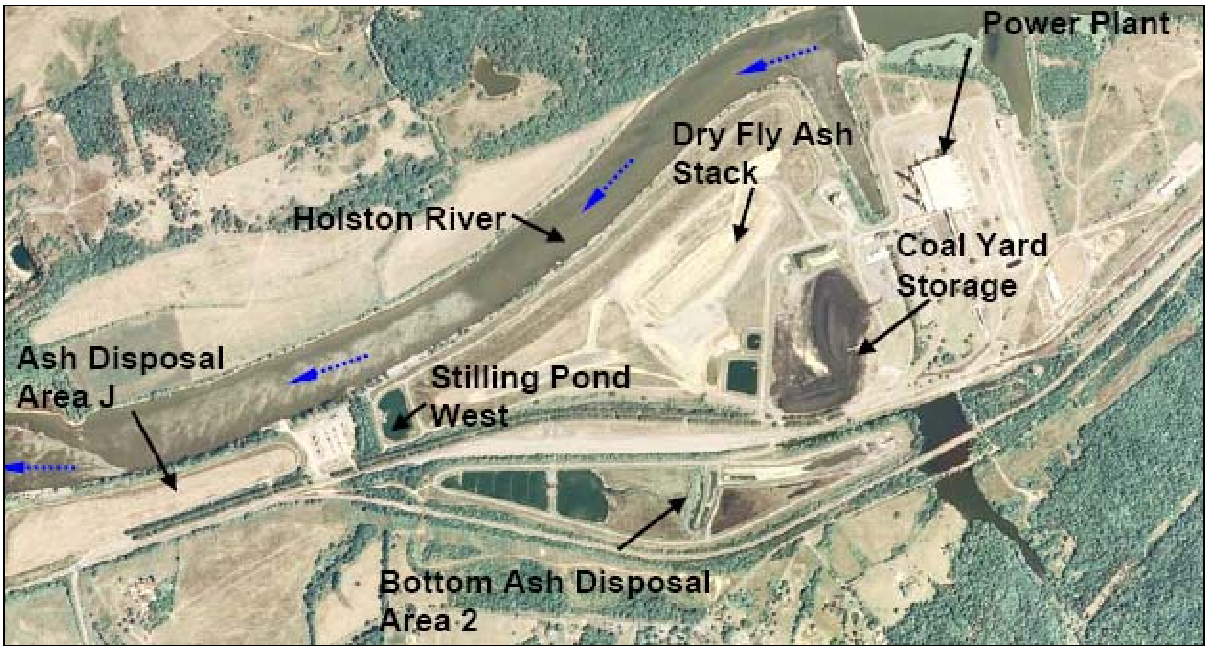


**Figure 1. Vicinity Map**

2.2.2 Work by Others

Stantec Consulting Services, Inc. completed a screening level geotechnical evaluation of Area J. The findings of that evaluation are provided in *Report of Geotechnical Exploration, Dry Fly Ash Stack, Bottom Ash Disposal Area 2, Area J, John Sevier Fossil Plant, Rogersville, Tennessee*, Stantec Consulting Services, Inc. report 001 175569038, February 08, 2010 ("Stantec 2010").

Stantec 2010 includes static slope stability analyses on cross-sections- referenced as Sections J-J', K-K', M-M' and O-O'- considered representative of the north embankment. The stability analyses show a long term factor of safety (FS) against deep seated failure at Section M-M' less than the required FS = 1.5. Analyses also showed the potential for shallow or maintenance failure at Sections

K-K' and O-O.' Figure 2 below- taken from Stantec 2010- depicts a typical section utilized for slope stability analyses.

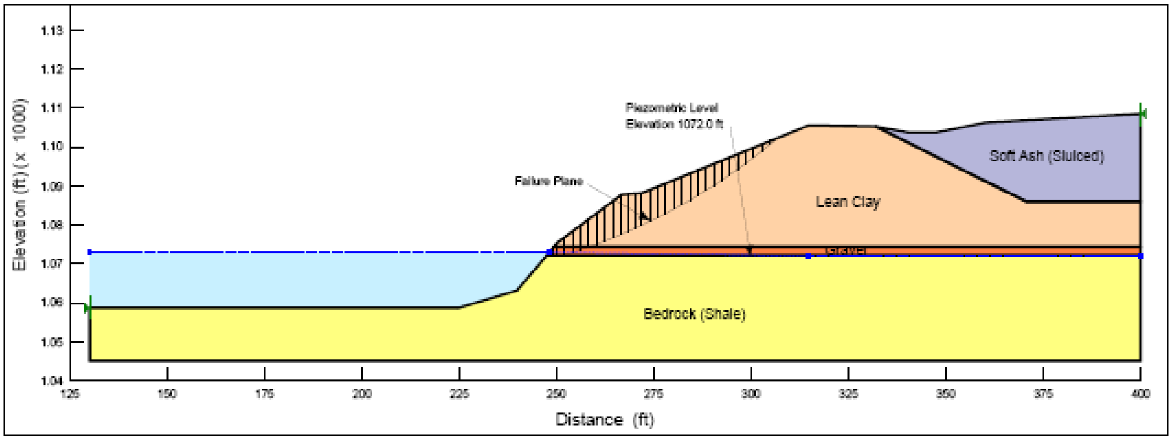


**Figure 2. Typical Slope Stability Section For the Area J**
(source: Stantec 2010)

### 2.2.3 Data Gaps

Stantec 2010 was a screening level assessment of areas of potential concern across the entire 190-acre area used for disposal of CCP. The stability analyses reported by Stantec 2010 identified the embankment as an area of concern and noted that corrective measures to address slope stability and scour may be required. The report further noted that the selection and design of corrective measures would require that more geotechnical information be obtained. URS concurred with this judgment, recommending the work reported herein be undertaken to address data gaps.

## 2.3 Organization of this Report

This document is organized as described below.

- Section 1 provides a brief introduction, overview of findings and report organization.
- Section 2 provides a summary of the project purpose and its scope, including an abstract of the key technical activities that were undertaken by URS.
- Section 3 provides a description of the field exploration.

- Section 4 provides a description of the site, including the subsurface stratigraphy, existing embankment geometry, and material properties of the embankment materials and the underlying alluvial soils.

- Section 5 summairzes the findings of the *in situ* and laboratory testing completed to develop an understanding of the strength and stiffness of the soils that comprise the embankment and its foundation.

- Section 6 describes the slope stability analyses and summarizes its findings.

- Section 7 summarizes the findingss of this work, providing recommendations based upon those findings.

- Section 8 provides references cited in the text.

This report is supported by three appendices, as described below.

- The results of the field exploration are included as Appendix A. Appendix A includes logs of engineering borings, DMT soundings and CPT soundings.

- The results of laboratory testing are included as Appendix B. The laboratory testing includes strength and index testing conducted by URS.

# 3.0 OBJECTIVE AND SCOPE OF THIS WORK

## 3.1 Objective

The objective of the work reported herein is to complete field exploration, laboratory testing, and engineering analyses to support threefold use, namely:

1. develop geotechnical data- stratigraphy and soil strength- to support more rigorous evaluation of slope stability in the area of concern along the embankment;

2. provide a basis for design of corrective measures, if any; and,

3. provide additional subsurface information for review by prospective specialty contractors should corrective measures need to be implemented.

## 3.2 Scope

URS performed geotechnical engineering studies with the broad scope of work identified below.

1. Field Exploration. Executed a geotechnical field exploration, obtaining subsurface information- including *in situ testing* and soils sampling- sufficient for characterization of the occurrence and strength of the subsurface materials.

2. Laboratory Testing. Completed strength and index property testing to support characterization of both the occurrence of subsurface materials and the mechanical characteristics of those materials.

3. Engineering Analyses. Completed evaluations of embankment stability, reproducing analyses reported in Stantec 2010 using the more extensive data base of soil strength developed by the field exploration and laboratory testing.

4. Reporting. Summarized all data, analyses and findings in this technical report to TVA.

# 4.0 FIELD EXPLORATION

## 4.1 Objectives of the Field Exploration

The geotechnical field exploration program was undertaken during May and June 2010 with two principal objectives, namely:

- to complete *in situ* testing to determine the mechanical characteristics (strength and stiffness) of the soil and the subsurface stratigraphy; and,
- recover samples for laboratory testing.

## 4.2 Organization of the Field Work

### 4.2.1 Ordering and Numbering the Exploration Points

The embankment of Area J that bounds the Holston River is approximately 2,700 feet in length. URS completed exploration at about 200 foot intervals along this alignment.

Figure 3 on the following page presents a view of Area J showing the location of the field exploration. Borings and soundings were completed at the locations shown on the figure, grouping borings and soundings on and around areas judged to be of greater concern (for example, around Section M-M', the area screened by Stantec 2010 to be of the lowest static stability along the embankment). Borings and soundings, the records of which are provided in Appendix A, were numbered by their location and type of exploration. For example, at Location 11, the boring is referenced as "B-11", the cone penetrometer sounding as "C-11," and the dilatometer sounding as "D-11".

Multiple modes of exploration were undertaken to (i) provide redundancy and improved reliability in the interpretation of stratigraphy and soil strength, and (ii) as is discussed in more detail in Section 5, to provide a basis for calibration of *in situ* testing with laboratory testing.

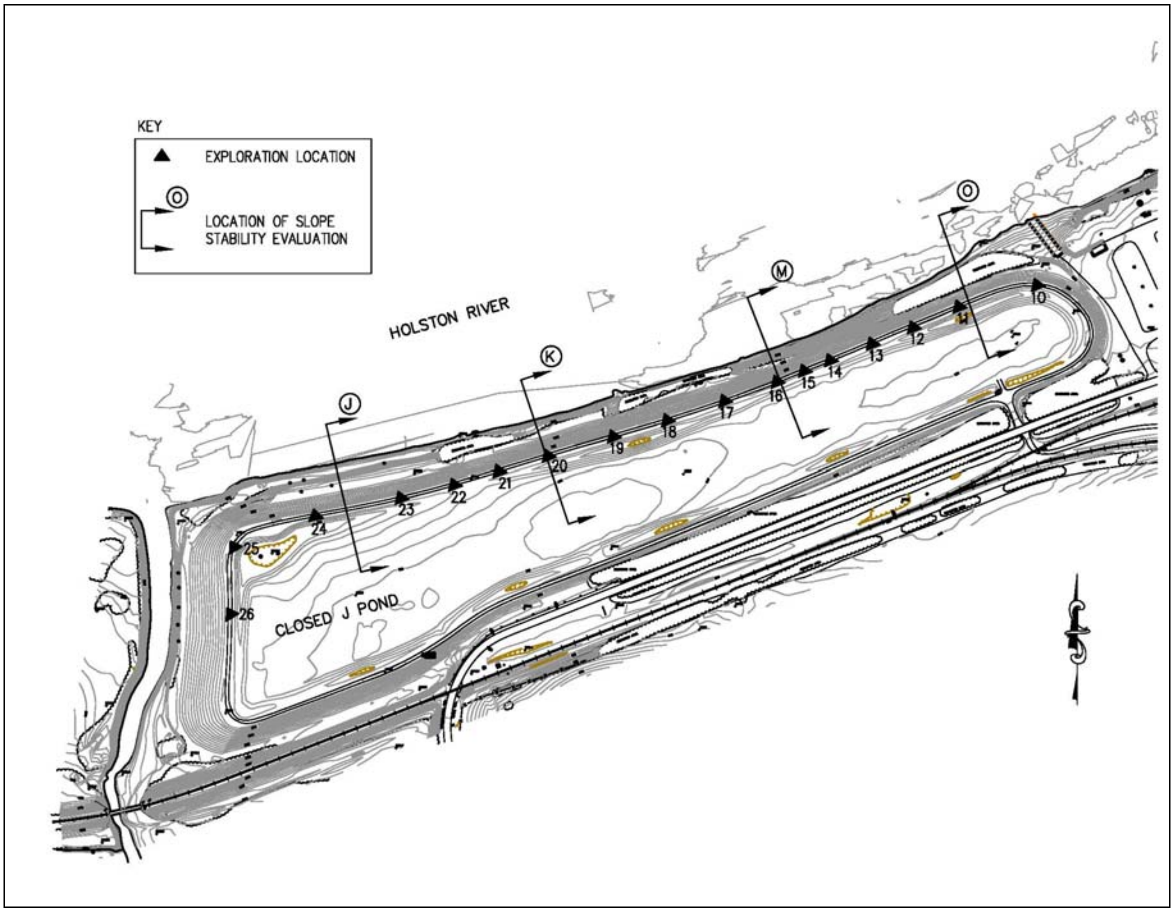


**Figure 3. Field Exploration Locations**

4.2.2 Subcontractors

ECS Southeast, Inc. was retained to provide specialty services in execution of all borings and soundings. All geotechnical laboratory testing was completed by Timely Engineering Soil Tests, LLC.

## 4.3 Description of the Field Exploration

4.3.1 General

The work reported in Stantec 2010 identified the general occurrence of soil and groundwater along the embankment, depicting a man-made clayey embankment of typically 30 feet set atop naturally occurring, finer grained alluvial soil of about five feet thickness. Groundwater was shown to occur under unconfined conditions within the alluvial soil.

Based upon the understood stratigraphy and the concerns regarding slope stability, URS undertook a field exploration program that was focused principally toward developing estimates of the strength of the soil that comprised the clay dike, including cone penetration test (CPT) soundings, hollow stem auger engineering borings, Marchetti flat plate dilatometer (DMT) soundings, disturbed soil sampling, and undisturbed (thin-walled tube) soil sampling. The table below summarizes the scope of the borings and soundings completed at each exploration location.

**Table 1. Summary of the SPT Borings and Dilatometer, and Cone Penetromter Soundings Completed by URS for This Work**

| Location[1] | SPT[2] Boring | Depth (feet) | DMT[3] Sounding | Depth (feet) | CPT[4] Sounding | Depth (feet) |
|---|---|---|---|---|---|---|
| 10 | | | X | 20 | X | 29 |
| 11 | X | 39 | X | 20 | X | 32.5 |
| 12 | | | X | 18 | | |
| 13 | X | 33 | | | X | 31 |
| 14 | X | 32 | X | 22 | | |
| 15 | | | | | X | 36.5 |
| 16 | X | 31.5 | X | 22 | X | 32 |
| 17 | X | 39 | X | 20 | | |
| 18 | X | 39 | | | X | 35 |
| 19 | | | X | 14 | | |
| 20 | X | 38 | X | 20 | X | 35 |
| 21 | | | | | X | 33 |
| 22 | X | 47 | X | 35 | | |
| 23 | | | X | 27 | X | 49 |
| 24 | | | X | 35 | X | 47 |
| 25 | | | X | 35 | X | 49 |
| 26 | | | | | X | 18 |
| 26 | | | | | X | 46.5 |
| **Total** | 8 | 298.5 | 12 | 293 | 13 | 473.5 |

1. "Location" refers to the exploration locations shown on Figure 3. A more detailed location plan, including the coordinates of each exploration point, is provided in Appendix A.

2. "SPT" refers to Standard Penetration Test boring, recovering disturbed soil samples after ASTM D1586. Undisturbed samples were recovered from SPT borings by pushing 3-inch diameter Shelby tubes after ASTM D1587.

3. "DMT" refers to "Marchetti flat plate dilatometer test" sounding after ASTM D6635

4. "CPT" refers to "static cone penetrometer test" sounding, after ASTM D3441

#### 4.3.2 Duration

The field exploration of Area J was undertaken during the period 25 May 2010 to 4 June 2010.

#### 4.3.3 Surveillance

All of the borings and soundings were completed under the direction of a URS geologist experienced in field exploration of this genre. Records of field work were kept in logs of the borings and soundings, as well as in Daily Reports.

The work on site was conducted in accordance with a project-specific Health and Safety Plan. All personnel utilized a modified OSHA Level D Personal Protective Equipment (hard hats, steel toed boots, long sleeve shirts, reflective vests, gloves) while on site. No environmental contamination was expected or encountered during the field work.

#### 4.3.4 Location and Survey

Exploration points were located by URS using a hand-held GPS device with a horizontal accuracy of less than 9 feet. These locations were marked after completion for subsequent, more accurate vertical and horizontal surveying by TVA.

#### 4.3.5 Soil Borings

A total of eight (8) soil borings were completed. The borings were performed using hollow stem auger drilling techniques (after ASTM D6151) to advance the borehole. Borings ranged in depth from 31 to 47 feet below existing grade (about elevation +1,105 feet msl), drilling an aggregate of 298 lineal feet. Both disturbed and undisturbed samples were obtained from the borings, which were then used for various material property testing in the laboratory.

Ground water level depths were measured in each of the borings at the time of completion. All borings were subsequently grouted to the surface before the drilling equipment and crew were demobilized from the site. Logs of the borings are presented in Appendix A.

#### 4.3.6 Soil Sampling

Disturbed samples of soil were recovered at regular depth intervals using the Standard Penetration Test (SPT) after ASTM D 1586. In this method, a 140-lb. hammer operating freely over a drop of 30-

inches is used to advance a 2-inch O.D. split-barrel sampler into the soils. The cumulative number of blows required to advance the split-barrel sampler 12-inches, after initial penetration of 6-inches, is termed the SPT N-value. The N-value provides an empirical measure of soil consistency. SPT samples are suitable for laboratory index testing.

Relatively undisturbed samples of the fine grained (clayey) soil were recovered from engineering borings using thin-walled tube samplers (the 'Shelby' tube, after ASTM D 1587). These samples were used in laboratory testing to evaluate soil strength. A total of 13 undisturbed samples were recovered at eight boring locations.

#### 4.3.7 Cone Penetrometer Soundings

Twelve (12) static cone penetrometer test (CPT) soundings were completed. CPT soundings ranged in depth from 18 to 49 feet below existing grade (about elevation +1,105 feet msl), probing an aggregate of 473 lineal feet.

The soundings were performed using a cone penetrometer equipped with a friction mantle and equipped to record tip pore pressure measurement. The CPT soundings utilized equipment and methods conforming to those described in ASTM D3441. CPT soundings have a well-documented record of effectiveness in evaluating subsurface stratigraphy (comparing CPT signatures of cone tip resistance, $q_c$, sleeve friction, $f_s$, and dynamic pore pressure, u, from sounding to sounding). The soundings also provided an indication of the shear strength of the soils, correlating tip resistance with laboratory measured strength.

Logs of the soundings are presented in Appendix A.

#### 4.3.8 Dilatometer Soundings

Twelve (12) flat plate dilatometer (DMT) soundings were completed using a Marchetti dilatometer in general accordance with ASTM D6635, Method for Performing the Flat Dilatometer Test. DMT soundings ranged in depth from 14 to 35 feet below existing grade (about elevation +1,105 feet msl), probing an aggregate of 293 lineal feet. The DMT soundings were limited in depth by the increasing occurrence of fine to medium gravel with depth. The DMT expands a membrane against the soil media surrounding it. Gravel damages the DMT probes and the DMT is not considered appropriate for use in gravelly soils.

The DMT soundings were principally performed both to provide *in-situ* measurements of soil strength (shear strength and stiffness) in the embankment clay, as well as provide indications of the state of stress of the *in situ* soils (as indicated by over-consolidation ratio, and coefficient of lateral earth pressure). A secondary objective of the DMT soundings was to support evaluation of stratigraphy, though the DMT does this with less accuracy and reliability than does the CPT.

Logs of the DMT soundings are presented in Appendix A.

# 5.0 SITE DESCRIPTION

## 5.1 Geology

The general area of the JSF plant is underlain by two distinct sedimentary rock formations, the Sevier Shale and the Newala Formation of the Knox Dolomite Group. Solution activity was not reported within the plant reservation south of Holston River in previous geotechnical studies nor was it encountered during Stantec's geotechnical exploration (Stantec 2010).

Area J is underlain by the Sevier Shale, a bluish gray calcareous shale that outcrops in the plant area and is evident in scoured areas along the river. The upper surface of this unit is weathered and broken, but of very dense/stiff consistency. The Sevier Shale extends to great depth below Area J. There is no potential for the Sevier Shale to affect the stability of the embankments at Area J.

The Sevier Shale is immediately overlain by alluvial deposits varying in thickness from less than 5 feet to perhaps 10 feet in the vicinity of Area J. Stantec 2010 reports that typical alluvium in this region of the state consists of sands, silts, and gravels with few interspersed cobbles, a finding consistent with that observed during this work. The clayey embankments of Area J are constructed immediately atop the alluvial deposits. Soil from this same unit was excavated from within and around Area J to provide the fill that creates the embankments.

## 5.2 Surface Conditions

The photographs on the following page are intended to represent the surface conditions of the embankment. The following may be seen from review of the photographs (taken June 2010):

1. Heavy Vegetation. The surface of the embankment is heavily vegetated by grasses, shrubs and small to large trees. The crest of the embankment is covered only by grassses.

2. Erosion. There is no evidence of surface erosion along the embankment.

3. Scour. The toe of the embankment is heavily scoured by river flow along most of its length, with evident undercutting of the embankment in several areas.

**Photo 1. Well Maintained Embankment Crest, Showing Heavy Vegetation**

**Photo 2. Toe of the Embankment, Showing Well Developed Root Mass and the Weathered Upper Surface of the Sevier Shale**

## 5.3 Subsurface Conditions

### 5.3.1 Anticipated Subsurface Conditions

Stantec 2010 reports the findings of six engineering borings completeted along the crest of the dike. These borings disclosed subsurface conditions similar to that encountered by URS, as follows:

- Dike Fill. The embankment soils are reported to be a brown low plasticity (Plasticity Index, PI = 25) clayey soil of medium stiff to hard, consistency, with some sand and trace gravel. SPT blow counts ('N') ranged from 6 to 43 with an average of 19. The soil in this unit largely classifies as CL by the Unified Soil Classification System (USCS).

- Alluvial Soils. The alluvial soils were principally clayey, described as a brown to dark brown sandy clay soil of low plasticity (PI = 19) and very stiff consistency. The SPT blow counts ('N') ranged from from 4 to 28 with an average of 11. This soil unit includes thin granular zones consisting of alluvial sand and gravel. The N-value of the sandy zones ranged from 5 to 16.

### 5.3.2 Subsurface Conditions Disclosed by the Field Exploration

The work by URS disclosed subsurface conditions consistent with those reported in Stantec 2010. With the benefit of a more expansive field exploration and *in situ* testing data, URS chose to consider the embankment fill as two separate units. The layers identified by URS are shown below: More detailed discussion of the mechanical characteristics of these materials is discussed in Section 5 and Section 6. Photos 3 and 4 (following page) depict the Upper Clay and Lower Clay, respectively.

**Table 2. Generalized Subsurface Conditions**

| Soil Layer | Depth (feet, bgs) | | Description |
|---|---|---|---|
| | From | To | |
| 1 | 0 | 25 | Upper Clay (CL to ML): Stiff to very stiff brown sandy clay and brown clay to sandy silt with lenses of medium dense fine sand (embankment fill) |
| 2 | 25 | 32 | Lower Clay (CL): Very stiff to hard silty and sandy brown clay, with zones of increased sand and trace gravel (embankment fill) |
| 3 | 32 | 40 | Alluvial Soil (CL/GC): Medium stiff to stiff brown to dark brown to grey sandy clay to clayey sand, trace to some gravel. This unit is principally comprised of clayey soil with sand and gravel, but reported by Stantec 2010 to include thin sandy (SP/SM) and gravelly (GW) zones |

Note: The thicknesses cited above are "typical." Thicknesses vary along the embankment.


**Photo 3. Upper Clay (sample from 16 feet depth)**

**Photo 4. Lower Clay and Alluvium (sample from 31 feet depth)**

## 5.4 Groundwater

URS did not encounter groundwater in its borings at the time of drilling.

Stantec 2010 reports groundwater to occur under unconfined conditions, encountered during the field work for this project at about 38 feet below ground surface (about elevation +1,067 feet msl), within the Layer 3 Alluvial Soil. Groundwater in the vicinity of the embankment flows toward the Holston River.

# 6.0 IN SITU AND LABORATORY TESTING

## 6.1 In Situ Testing

### 6.1.1 Strength

*DMT*

The Marchetti flat plate dilatometer can be used to estimate the undrained shear strength ($c_u$) of clayey soil by the following relationship (ISSMGE 2001):

$$c_u = 0.22\ \sigma'_{V0}\,(0.5\,K_D)^{1.25}$$

where,
$\sigma'_{V0}$ = effective overburden stress
$K_D$ = horizontal stress index, calculated as the corrected dilatometer reading / effective overburden stress

In general, shear strength of the Layer 1 Upper Clay (0' to 25' depth), estimated from the DMT soundings provided good agreement with those determined by vane shear testing of undisturbed samples conducted in the laboratory. Compared to the CPT, the knife-like DMT has the advantage of reduced soil disturbance during penetration. The reduced disturbance is the likely source of the better agreement, shown below.

**Table 3. Estimates of Undrained Shear Strength of the Upper Clay by the DMT and the Laboratory Vane Shear**

| Parameter | Laboratory Vane Shear* (psf) | DMT (psf) |
|---|---|---|
| Mean Shear Strength (x) | 3,400 | 3,350 |
| Standard Deviation (σ) | 770 | 1,700 |

*completed using the Torvane shear device after ASTM D4648

*CPT*

The undrained shear strength of the sandy clay that comprised the embankment fill (Layer 1 and Layer 2) can be estimated from cone penetrometer data correlations similar to that developed by Mayne and Chen (1993). These correlations relate tip resistance to estimated undrained shear strength ($c_u$) and are of the form cited below.

$$c_u = (q_c - \sigma'_{V0}) / N_k$$

where,
$q_c$ is the cone tip resistance,
$\sigma'_{V0}$ is the total overburden stress at the test depth, and
$N_k$ is the plasticity dependent cone factor, increasing with decreasing plasticity

$N_k$ was correlated at this site to be about 19, a relatively higher value than is common for low plasticity clayey soils such as the Layer 1, Layer 2 and Layer 3 soil at this site. Published data suggest $N_k$ is commonly in the range 10-20 for low plasticity clays. URS believes the sandy nature of the clay leads to the higher value. Shear strength estimated from the CPT soundings appear slightly higher than both the laboratory vane shear testing and the DMT for the Layer 1 Clay (0' to 25' depth), with a mean estimated undrained shear strength ($c_u$) of about 4,400 psf and a standard deviation of about 1,900 psf. Note that the higher mean and higher standard deviation exhibited by the CPT are due to the skew of the CPT data to high values of tip resistance, not low values (in statistical terms, "positive skew").

### 6.1.2 Other Parameters

*Stiffness*

The DMT measured a high dilatometer modulus (averaging about 1,000 bars) throughout the subsurface profile, suggestive of a very stiff soil matrix.

*Overconsolidation Ratio*

Both the CPT and the DMT measured a high apparent over-consolidation ratio (OCR), a characteristic of a well compacted/well densified soil. This finding supports the indication of other data that the embankment was well constructed, completed in a manner that resulted in a high quality earth fill embankment.

*Coefficient of Lateral Earth Pressure*

Both the CPT and the DMT measured a high coefficient of lateral earth pressure at rest ($K_o$). This parameter normally varies with factors such as relative density/compaction stress history, plasticity index and similar soil properties. In engineered fills, a high value of $K_o$ is suggestive of well-compacted soil, further supporting other findings by this work.

## 6.2 Laboratory Testing

### 6.2.1 General

The laboratory testing program was established upon completion of the field exploration. The CPT and DMT- which provide a continuous record of stratigraphy and provide an indication of the strength and stiffness of the soils- were the principal tools used to develop the first indications of the stratigraphic profiles. The stratigraphic profiles indicated by the CPT and DMT data were used to plan the laboratory testing program

The scope of testing undertaken to establish soil strength is summarized in Table 4 below.

**Table 4. Summary of Testing to Determine Strength**

| Boring | Depth (feet, bgs) | Direct Shear ASTM D3080 | Laboratory Vane Shear ASTM D4648 | TX/CU Test ASTM D4747 |
|---|---|---|---|---|
| B-11 | 21 | | X | |
| B-13 | 11 | | X | X |
| B-14 | 11 | | X | |
| B-14 | 21 | | X | |
| B-17 | 16 | | X | X |
| B-17 | 31 | X | X | |
| B-18 | 11 | | X | |
| B-18 | 26 | X | X | |
| B-20 | 26 | X | X | |
| B-22 | 16 | | X | X |
| | **Total** | **3** | **10** | **3** |

Testing to estimate soil index properties was undertaken to both (i) confirm field classifications and (ii) obtain data to estimate soil characteristics from published correlations. Table 5 on the following page summarizes this testing.

**Table 5. Summary of Index Testing After ASTM D 422**

| Boring | Depth (feet) | Moisture/ Density | Atterberg Limits | Grain Size with Hydrometer |
|---|---|---|---|---|
| B-11 | 23.5-25 | X | X | X |
| B-11 | 33.5-35 | X | X | X |
| B-13 | 8-10 | X | X | X |
| B-14 | 4-6 | X | X | X |
| B-14 | 28.5-30 | X | X | X |
| B-16 | 18.5-20 | X | X | X |
| B-17 | 28.5-30 | X | X | X |
| B-18 | 13.5-15 | X | X | X |
| B-18 | 33.5-35 | X | X | X |
| B-20 | 6-8 | X | X | X |
| | **Total:** | **10** | **10** | **10** |

### 6.2.2 Strength

*Laboratory Vane Shear*

As is discussed in Section 5.1.1, estimates of undrained shear strength were provided by vane shear testing of undisturbed samples in the laboratory, using the Torvane shear device after ASTM D4648. The soil shear strength determined by the laboratory testing correlates reasonably well with that determined by the DMT.

**Table 6. Summary of Laboratory Vane Shear Tests**

| Boring | Depth (feet) | Soil Unit | Laboratory Vane Shear Strength (psf) |
|---|---|---|---|
| B-13 | 11 | Upper Clay | 3,195 |
| B-17 | 16 | Upper Clay | 2,484 |
| B-17 | 31 | Alluvium | 2,250 |
| B-18 | 26 | Lower Clay | 4,000 |
| B-20 | 26 | Lower Clay | 3,400 |
| B-22 | 16 | Upper Clay | 3,150 |

*Direct Shear*

The direct shear testing was performed on the deeper soils, determining the strength of soils that will be stressed approximately in direct shear by the embankment. This data suggests cohesion (c’) of about 400 psf and an angle of friction (ø’) of about 27 degrees. The effective stress strength parameters determined from this testing are tabulated below in Table 7.

**Table 7. Sumary of Direct Shear Testing after ASTM D3080**

| Boring Ref | Depth (feet) | Soil Unit | Angle of Friction (ø') | Cohesion(c', psf) | Dry Density (lb/ft$^3$ ) | Natural Moisture (%) |
|---|---|---|---|---|---|---|
| 17 | 31 | Alluvial | 25 | 475 | 114 | 17 |
| 18 | 26 | Lower Clay | 29 | 504 | 110 | 19 |
| 20 | 26 | Lower Clay | 28 | 259 | 105 | 16 |

Records of the direct shear testing are presented in Appendix B.

*Triaxial*

Isotropically consolidated undrained triaxial (TX/CU, after ASTM D4747) shear testing was performed on the shallower soil units, determining the strength of soils that will be stressed approximately in axial shear by the embankment.  This data suggests cohesion (c') of about 400 psf and an angle of friction (ø') of about 31 degrees. The effective stress strength parameters determined from this testing are tabulated below in Table 8.

**Table 8. Sumary of TX/CU Testing after ASTM D4747**

| Boring Ref | Depth (feet) | Soil Unit | Angle of Friction (ø') | Cohesion(c', psf) | Dry Density (lb/ft$^3$ ) | Natural Moisture (%) |
|---|---|---|---|---|---|---|
| 13 | 11 | Upper Clay | 32 | 760 | 111 | 19 |
| 17 | 16 | Upper Clay | 31 | 400 | 104 | 24 |
| 20 | 16 | Upper Clay | 30 | 230 | 114 | 17 |

Records of the triaxial testing are presented in Appendix B.

### 6.2.3 Index Testing

*Index Testing by URS*

Table 9 on the following page presents the results of the laboratory index testing completed by URS.

**Table 9. Results of the Index Testing by URS**

| Boring | Depth (feet) | Soil Unit | Moisture Content (%) | Liquid Limit | Plasticity Index | USCS[A] | Percent by Wt. Finer Than 2μ[B] |
|---|---|---|---|---|---|---|---|
| B-11 | 24 | Lower Clay | 16 | 40 | 24 | CL | 29 |
| B-11 | 34 | Alluvium | 15 | 36 | 19 | CL | 11 |
| B-13 | 9 | Upper Clay | 10 | 33 | 14 | SC | 35 |
| B-14 | 5 | Upper Clay | 10 | 27 | 15 | SC | 24 |
| B-14 | 29 | Lower Clay | 18 | 42 | 24 | CL | 19 |
| B-16 | 19 | Lower Clay | 18 | 42 | 25 | CL | 36 |
| B-17 | 29 | Lower Clay | 13 | 40 | 22 | CL | 32 |
| B-18 | 14 | Upper Clay | 16 | 39 | 23 | CL | 26 |
| B-18 | 34 | Alluvium | 17 | 37 | 22 | CL | 13 |
| B-20 | 7 | Upper Clay | 20 | 35 | 9 | ML | 18 |

Notes:
A: USCS indicates the soil classification after the "Unified Soil Classification System," ASTM D2487
B: 2μ (0.002 mm) is considered by some to be the point of distinction between silt and clay-sized particles

Mechanical and hydrometer analyses after ASTM D 422 were undertaken on soils representative of Layers 1 and 2. The hydrometer analyses indicate that both the Layer 1 and Layer 2 soils typically include about clay-sized particles (i.e., about 24% particles by weight finer than 2μ), an indication of significant clay content.

Records of the index testing are presented in Appendix B.

*Index Testing Reported in Stantec 2010*

Stantec 2010 does not report strength testing of undisturbed samples for the borings (referenced as JP-1 through JP-6) completed in Area J, though extensive index testing is reported. Table 10 summarizes the index testing reported in Stantec 2010.

**Table 10. Results of the Index Testing Reported by Stantec 2010**
(source: Stantec 2010, Table 11)

| Soil Type | Boring | Depth (feet) | Unified Class | Plasticity Index | Specific Gravity | Gravel & Sand (%) | Silt & Clay ( %) |
|---|---|---|---|---|---|---|---|
| Dike (Soil 1) | JP-1 | 1.5-7.5 | CL | 28 | 2.73 | 30.3 | 69.7 |
| Dike (Soil 1) | JP-1 | 19.5-28.5 | CL | 26 | 2.69 | 17.9 | 82.1 |
| Dike (Soil 1) | JP-2 | 0.0-9.0 | CH/CL | 26 | 2.77 | 27.6 | 72.4 |
| Dike (Soil 1) | JP-2 | 22.5-24.0 | CL | 24 | 2.70 | 21.6 | 78.4 |
| Dike (Soil 1) | JP-3 | 6.5-11.5 | CL | 18 | 2.70 | 21.1 | 78.9 |
| Dike (Soil 1) | JP-3 | 26.5-30.0 | CL | 21 | 2.67 | 27.7 | 72.3 |
| Dike (Soil 1) | JP-4 | 0.0-11.5 | CL | 21 | 2.67 | 30 | 70.0 |
| Dike (Soil 1) | JP-4 | 20.0-25.0 | CL | 26 | 2.72 | 28 | 72.0 |
| Dike (Soil 1) | JP-5 | 6.5-16.5 | CL | 25 | 2.73 | 34.1 | 65.9 |
| Dike (Soil 1) | JP-5 | 26.5-32.0 | CH | 33 | 2.73 | 42.9 | 57.1 |
| Dike (Soil 1) | JP-5 | 36.5-40.0 | CL | 25 | 2.68 | 37 | 63.0 |
| Dike (Soil 1) | JP-6 | 6.5-15.0 | CH | 29 | 2.76 | 38.5 | 61.5 |
| Dike (Soil 1) | JP-6 | 26.5-34.5 | CL | 26 | 2.78 | 24.1 | 75.9 |
| Alluvial Clay (Soil 2) | JP-4 | 25.7-30.0 | CL | 22 | 2.69 | 16.8 | 83.2 |
| Alluvial Clay (Soil 2) | JP-4 | 37.5-45.0 | CL | 16 | 2.68 | 23.8 | 76.2 |

# 7.0 SLOPE STABILITY ANALYSES

## 7.1 Method of Analysis

### 7.1.1 General

Slope stability analyses were performed using the SLIDE v5.0 (Rocscience, Inc.) computer program to calculate the factors of safety against slope failure using limit equilibrium procedures and assuming two-dimensional, plane strain conditions. The program is capable of analyzing variables such as heterogeneous soil profiles, anisotropic soil strength parameters, excess pore water pressure due to shear, and static ground water and surface water.

SLIDE completes 2D stability calculations in rocks or soils offering the user the choice of procedures of varying rigor. The less rigorous alternatives available with SLIDE are the non-rigorous methods: Bishop simplified, Corps of Engineers, Janbu simplified/corrected, Lowe-Karafiath and Ordinary/Fellenius. The more rigorous choices include the Spencer and Morgenstern-Price procedures.

The program allows the user to complete alternative evaluations of embankment safety, as follows:

- Deterministic analyses calculate the lowest single factor of safety for a set of soil parameters and slope geometry.
- Probabilistic analyses allow the user to vary sensitive input parameters such as soil strength to determine the probability of failure, an alternative representation of the level of safety.

Only deterministic stability analyses were undertaken for this work.

### 7.1.2 Spencer's Procedure

URS selected Spencer's procedure for this study, reproducing the analyses reported in Stantec 2010. The differences between the many alternative procedures of limit equilibrium analyses are largely due to varying hypotheses regarding the location and direction of internal forces within the sliding soil mass. Studies by Espinoza et. al. (1992) have shown that variations in the factors of safety calculated for the same slip surface but by differing procedures is typically minimal.

The assumption inherent in all limit equilibrium procedures is that the soil is at limit equilibrium with a constant factor of safety along the entire slip surface. Limit equilibrium analysis procedures currently in use do not model progressive failure mechanisms, which can occur in materials of widely dissimilar stress-strain characteristics. URS believes this consideration is inconsequential in the relatively homogeneous, stiff clayey soil embankment analyzed in this instance.

Spencer's procedure was selected by both Stantec and URS for this analysis because the procedure is more rigorous than others in its solution of equations of equilibrium for both moments and forces. Duncan (1992) recommends the use of a rigorous analytical method such as Spencer's procedure, assessing it to generally be within 12 percent of that computed by other analyses of similar capability and within 6 percent of what may reasonably be considered to be the correct answer. Like all limit equilibrium methods of slope stability analysis, the factor of safety (FS) calculated by the Spencer procedure uses the following definition:

$$FS = \frac{\text{shear strength of the soil (resisting force)}}{\text{shear stress required for equilibrium (driving force)}}$$

## 7.2 Stratigraphy and Soil Strength

### 7.2.1 Stratigraphy

As is discussed Section 4, the indications of stratigraphy from the borings and soundings, and supported by the laboratory testing are tabulated below (Table 11):

**Table 11. Generalized Subsurface Conditions Used in Slope Stability Analyses**

| Soil Layer | Depth (feet, bgs) | | Description |
|---|---|---|---|
| | From | To | |
| 1 | 0 | 25 | Upper Clay (CL to ML): Stiff to very stiff brown sandy clay and brown clay to sandy silt with lenses of medium dense fine sand (embankment fill) |
| 2 | 25 | 32 | Lower Clay (CL): Very stiff to hard silty and sandy brown clay, with zones of increased sand and trace gravel (embankment fill) |
| 3 | 32 | 40 | Alluvial Soil (CL/GC): Medium stiff to stiff brown to dark brown to grey sandy clay to clayey sand, trace to some gravel. This unit is principally comprised of clayey soil with sand and gravel, but reported by Stantec 2010 to include thin sandy (SP/SM) and gravelly (GW) zones |
| 4 | 40 | >100 | Regionally continuous bedrock |

* Note: The thicknesses cited are "typical." These values vary somewhat along the embankment and as used in the stability analyses. No failure surface was allowed to penetrate the high strength rock that comprises Layer 4.

### 7.2.2 Selection of Soil Strength Parameters by URS

As is discussed in Section 5, the *in*-situ and laboratory testing was effective in its yield of a great deal of data regarding soil strength. Soil strength parameters were evaluated utilizing the results of laboratory testing, *in-situ* testing (CPT, DMT, SPT) and standard correlations between soil index parameters and previously published research data. All of the determinations of soil strength point to an embankment of well-engineered construction.

The slope stability analyses were undertaken employing the effective stress (virtually all soils are unsaturated) soil strength parameters listed in Table 12 on the following page and determined using the following logic:

1. Upper Clay. A relatively extensive data base of soil parameters was both sought and obtained for the clay fill that creates the embankment. Each data set (e.g., DMT data, CPT data, laboratory vane shear data, etc) was statistically evaluated, determining mean and standard deviation values for each set. The data sets were compared, from which it was judged that both of the units of the dike soils were fairly and conservatively represented by laboratory vane shear tests (with value of undrained shear strength).

   The Upper Clay is a very stiff sandy and silty clay, with trace amounts of fine gravel. A fill, the material was sourced from nearby alluvial soil. The shear strength of the Upper Clay that was determined by the laboratory testing was lower than the DMT and CPT, but showed reasonable correlation with those data. Because the values were high, a shear strength of 1,800 psf was used as the "expected value" of cohesion. A "low end" value of 40% of the "expected" strength was used, employing the maximum statistical variation in shear strength of clayey soil reported by Duncan (2005). Note that this sandy clay soil unit also has an angle of internal friction component that contributes to strength, but this potential contribution to strength was ignored.

2. Lower Clay. This unit is a very stiff to hard sandy and gravelly clay. A fill, the material was sourced from nearby alluvial soil. As is discussed in Section 3, use of the DMT was limited in this soil unit because of the increased occurrence of gravel. However, the CPT indicated that this

unit is consistently stronger than the Upper Clay, with mean values of cone penetrometer tip resistance ($q_c$) about 10% higher than the unit above it. URS thus assigned "expected" and "low end" strength values for this unit about 10% higher than the Upper Clay in the stability analysis.

3. Alluvial Soil. The alluvial soil unit is principally a medium stiff to stiff sandy clay (classified as "CL" by the USCS). Judgments as to "expected value" and "low end" strength of this clay were completed in the same manner as described above, but relying on the direct shear testing as conservative strength parameters. The alluvial soil includes some sandy and gravelly zones of limited thickness.

Table 12 below presents a summary of the soil strength parameters used in the slope stability analyses by URS.

**Table 12. Summary of Soil Strength Parameters Used in URS Analyses**

| Soil Unit | "Low End" Soil Parameters (x) | | "Expected Value" Soil Parameters | |
|---|---|---|---|---|
| | Cohesion (c', psf) | Friction Angle (ø', degrees) | Cohesion (c', psf) | Friction Angle (ø', degrees) |
| Upper Clay | 1,100 | 0 | 1,800 | 0 |
| Lower Clay | 1,200 | 0 | 2,000 | 0 |
| Alluvial Soil- Clayey | 400 | 26 | 600 | 30 |
| Alluvial Soil- Sand | 0 | 28 | 0 | 30 |
| Alluvial Soil- Gravel | 0 | 35 | 0 | 37 |

Note: The Layer 4 bedrock is of very high strength relative to the soil units above it. No failure surface was allowed to penetrate Layer 4.

### 7.2.3 Soil Strength Parameters Reported by Stantec 2010

Stantec 2010 reports the use of relatively lower parameters (c' and ø') for soil strength, particularly for the clay fill that comprises the embankment (referenced as "Lean Clay") and the clayey soil of the Alluvial Soil Unit.

Shear strength parameters for the clay dike and alluvial clay were noted to have been selected based on (1) results of five consolidated undrained (CU) triaxial tests performed on remolded samples, (2) results of the SPT data, and (3) the plasticity index of each soil. Shear strength parameters used for the granular elements of the Alluvial Soil were estimated using relationships to standard penetration tests. Stantec 2010 reports the parameters used for slope stability analysis on the Area J on Table 23 of that report (reproduced in Table 13 on the following page).

**Table 13. Material Properties Used in Stantec 2010 for Stability Analyses at Area J**

| Material | Unit Weight (pcf) | Cohesion (c') | Friction Angle (Φ') |
|---|---|---|---|
| Dike (Soil 1) | 124 | 0 | 30.0 |
| Alluvial Clay (Soil 2) | 127 | 0 | 31.0 |
| Sluiced Ash (Soil 5) | 105 | 0 | 24.0 |
| Alluvial Sand (Soil7) | 118 | 0 | 30.0 |
| Alluvial Gravel (Soil 6) | 132 | 0 | 37.5 |

(source: Stantec 2010, Table 23)

### 7.2.4 Slope Geometry, Drainage and Pseudostatic

*Geometry*

URS evaluated Sections J-J', K-K', M-M', and O-O' developed in Stantec 2010. The slopes of these sections are typically about 2.5:1 (horizontal: vertical) on the outboard board (river side), with scour at the toe of these slopes. The crest of the embankment is about 16 feet wide. As is well understood, the inboard slopes of the embankment are now covered with hydraulically placed CCP waste.

*Drainage and Water Level Conditions*

For each stability analysis, URS assumed two piezometric surfaces, reflecting normal and high river stages. Effective stress analyses were performed assuming drained soil parameters in the clayey embankment fill soil of Layers 1 and 2, as well as the alluvial soils of Layer 3.

Each stability section was analyzed at two water levels, namely: (i) elevation +1,067 feet msl, representing normal water levels, and (ii) elevation +1,073 feet msl, representing high river water levels. Rapid drawdown is not a consideration in this matter.

*Pseudostatic*

The slopes were each modeled to include a pseudostatic seismic coefficient ($k_h$) of 0.1, analyzing this scenario at the high water level only. This evaluation did not include a reduction in soil strengths, as extremely conservative soil parameters (discussed above) were already used.

## 7.3 Stability Analysis Results

### 7.3.1 Target Stability

The requirements for embankment stability analyses are detailed in the Master Programmatic Documents, *Facilities Design and Construction Requirements* (Volume 2 of 3), for the TVA Coal Combustion Products Management Program (URS 2009).

URS 2009 seeks analyses of the long term static stability of embankments in the CCP area that are in general conformance with the standards for such analyses provided by the US Army Corps of Engineers (*Slope Stability*, Engineering Manual (EM) 1110-2-1902, 31 Oct 2003). USACE 2003 recommends that long term static slope stability for circumstances such as the embankments with the scope of Stantec 2010 targets a design Factor of Safety (FS) of 1.5. The calculated stability of all slopes is compared to this standard.

### 7.3.2 Summary of Embankment Stability

Table 14 summarizes the stability of the embankment sections analysed by URS, comparing these results with those reported in Stantec 2010. As may be seen from review of Table 14, all of the sections analysed as a part of this work meet the minimum factor of safety (FS = 1.5) criteria

**Table 14. Summary of Stability Analyses**

| Section | Groundwater Condition | URS Factor of Safety | | Factor of Safety in Stantec 2010 |
|---|---|---|---|---|
| | | "Low End" Soil Parameters | Expected Value Soil Parameters | |
| Section J-J' | High | 1.8 | 2.7 | 1.6 |
| | Low | 2.0 | 2.0 | 1.6 |
| | High, $k_h$ = 0.10 | 1.7 | 2.0 | not analyzed |
| Section K-K' | High | 2.7 | 3.9 | 1.5 |
| | Low | 2.7 | 3.9 | 1.5 |
| | High, $k_h$ = 0.10 | 2.0 | 2.8 | not analyzed |
| Section M-M' | High | 2.2 | 3.2 | 1.3 |
| | Low | 2.2 | 3.2 | 1.3 |
| | High, $k_h$ = 0.10 | 1.7 | 2.4 | not analyzed |
| Section O-O' | High | 2.8 | 4.3 | 1.7 |
| | Low | 2.8 | 4.3 | 1.7 |
| | High, $k_h$ = 0.10 | 2.0 | 3.0 | not analyzed |

Note: $k_h$ is the horizontal pseudostatic seismic coefficient

### 7.3.3 Variance From the Results of Stantec 2010

As may be seen from review of the above table, the results of the stability analyses by URS indicate higher embankment stability than does the work reported by Stantec 2010. The dominant reason for this variance is the higher value of shear strength for the embankment clay used by URS than by Stantec 2010. As is discussed in Section 6.2.3, the embankment clay was modeled in Stantec 2010 to be cohesionless. URS believes that Stantec used zero cohesive strength in their analyses for the following reasons:

1. Preliminary Nature of the Work. Stantec's scope of work was more preliminary in nature; of relatively limited scope; and, did not include an extensive testing program to develop confidence in the soil strength parameters.

2. Concern for Fissured Clays. Stantec 2010 also notes a concern that overconsolidated clays such as those at the J Pond embankments are often fissured and the in-situ available cohesion ( c') may be significantly smaller than values determined from laboratory testing.. Stantec 2010 notes c' = 0 was selected with a concern for these soils as overconsolidated, stiff fissured clay, noting *"In routine geotechnical design practice, values of c' = 0 are usually assumed for both normally and overconsolidated saturated clays, and for uncemented granular soils. Detailed testing and characterization of a particular soil, coupled with careful application of the fitted strength envelopes, are necessary where values of c' are used in a stability evaluation. For these analyses, c' = 0 was used for all soils."*

URS believes the above two concerns accurately reflect geotechnical practice in screening level evaluations or in investigations with more limited data. Moreover, Stantec is properly concerned with the limited strength available from overconsolidated, stiff fissured clays (and the related and appropriate caution in using fully softened strengths).

URS performed a more expansive and focused *in-situ* and laboratory testing program which was very effective in yielding substantial data on soil shear strength. We were able to develop shear strength parameters for the various soil units from the data gathered in the field from the CPT, DMT and SPT testing; results of the laboratory testing on representative undisturbed samples; as well as from published data. URS believes the level of data now available from both its work and the previous work by Stantec adequately document the following:

1. These are not fissured clays. The clays are of stiff consistency, overconsolidated, and of relatively low plasticity and activity. Inspection of recovered soil samples showed no indication of fissures in the clay.

2. The data base is strong. Sufficient field and laboratory testing and characterization have been completed to confidently assert that the clays have at least moderate cohesion that is available to enhance embankment stability.

# 8.0 CONCLUSIONS AND RECOMMENDATIONS

## 8.1 Conclusions

A screening level assessment of areas of potential concern across the entire 190-acre area used for disposal of CCP was reported in Stantec 2010. That work identified the north embankment of Area J as an area of concern, recommending that more geotechnical information be obtained in this area and noting that corrective measures to address slope stability and scour may be required. URS concurred with Stantec's judgment, recommending that the work reported herein be undertaken.

URS has evaluated the stability of the existing embankment of Area J using limit equilibrium procedures, modeling the embankment using conservative soil strength parameters developed from laboratory and field test data. The stability analyses indicate that the embankment has a minimum static factor of safety (FS) against global deeper-seated slope failure of at least FS = 1.8. Concurrent "pseodostatic" analyses intended to emulate a seismic event show adequate stability in this instance, with a FS of 1.7

In consideration of the findings of the field exploration, laboratory testing and engineering analyses reported herein, it is the opinion of URS that no corrective measures are required to address global slope stability of this embankment. However, URS recommends that the scour protection discussed in Stantec 2010, and reviewed in Section 7.2, be employed to assure the long term integrity of the toe of the embankment.

## 8.2 Recommendations

### 8.2.1 Maintenance

Regular maintenance is essential to the continued stability of all embankments at JSF. While the stability of the Area J embankment against deeper seated slope failure is high, localized surficial sloughing related to erosion may occur. Such instabilities should be managed by implementation of routine inspection and maintenance of the embankment.

As is discussed in Section 5, the embankment is heavily vegetated. In general, this vegetation improves embankment stability by limiting the potential for erosion, a principal threat (along with scour, discussed below) to its stability. The smaller vegetation- including grasses, brush, and small trees- act to both limit eorsion and stabilize the slope against shallow, sloughing-type failures (roots grow across the plane of potential failure, effectively increasing soil shear strength by binding particles and by anchoring the surficial soil to the deeper, stronger soil). The larger, well established trees also contribute to the aggregate stability of the embankment.

URS recommends the following:

(1) Maintain the exsiting vegetation and replace dead or degraded vegetation, as necessary.

(2) Inspect the embankments on a regular basis, observing the embankment for signs of surface erosion, loss of vegetative/ground cover, sloughing, etc.

(3) Areas of the embankment that inspections show to have degraded should be restored. Of particular concern in this regard are the larger trees. Inattention to dead or blown down trees may lead to longer term damage to the embankment. In particular, larger trees include substantial root systems that must be removed and the ground restored in the event a large tree dies or is blown down.

#### 8.2.2 Scour Protection

Loss of embankment support due to scour by the Holston River is the most significant threat to embankment stability. As is discussed in Section 5, scour has undermined the toe of the embankment in numerous areas along the river. Accordingly, URS recommends that scour protection be implemented as a near term corrective measure.

Design of socur protection is outside the scope of this work (it is a part of the scope of URS' existing engineering services at Area J, as described in URS' proposal to TVA dated 02 March 2010). URS has completed a preliminary evaluation of the requirements for erosion/scour protection of the perimeter dike where it meets the Holston River. Historical peak velocities of the Holston River were reviewed, from which it can be determined that the mean plus one standard deviation peak river velocity is on the order of 12 feet per second. Utilizing this velocity, URS estimates a graded stone rip rap with a $D_{50}$ (i.e., mean stone diameter) of 18 inches and a largest stone of size of 30 inches would perform adequately in a thickness of about 45 inches at the interface of the river with the embankment.

## 9.0 REFERENCES

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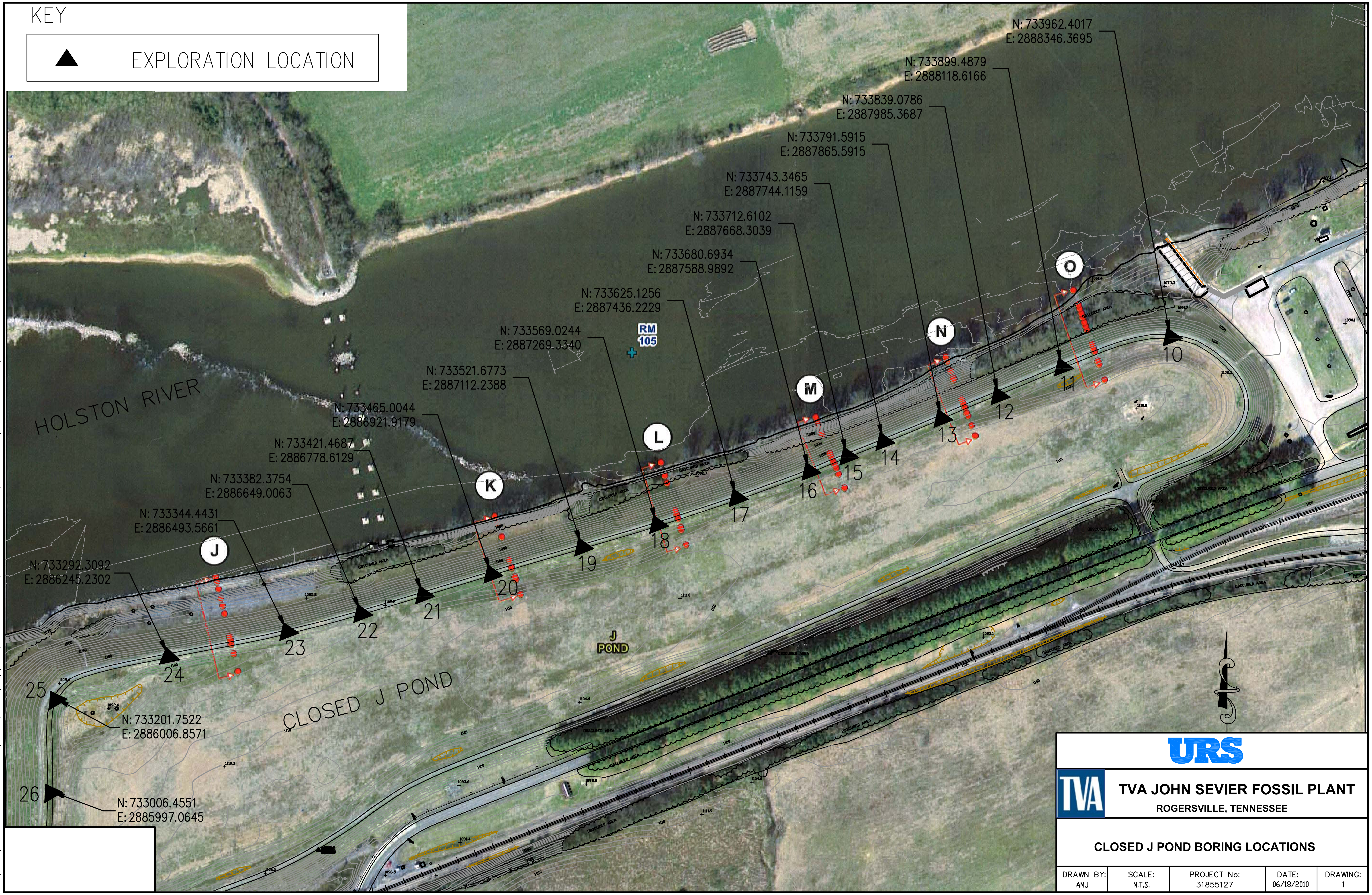
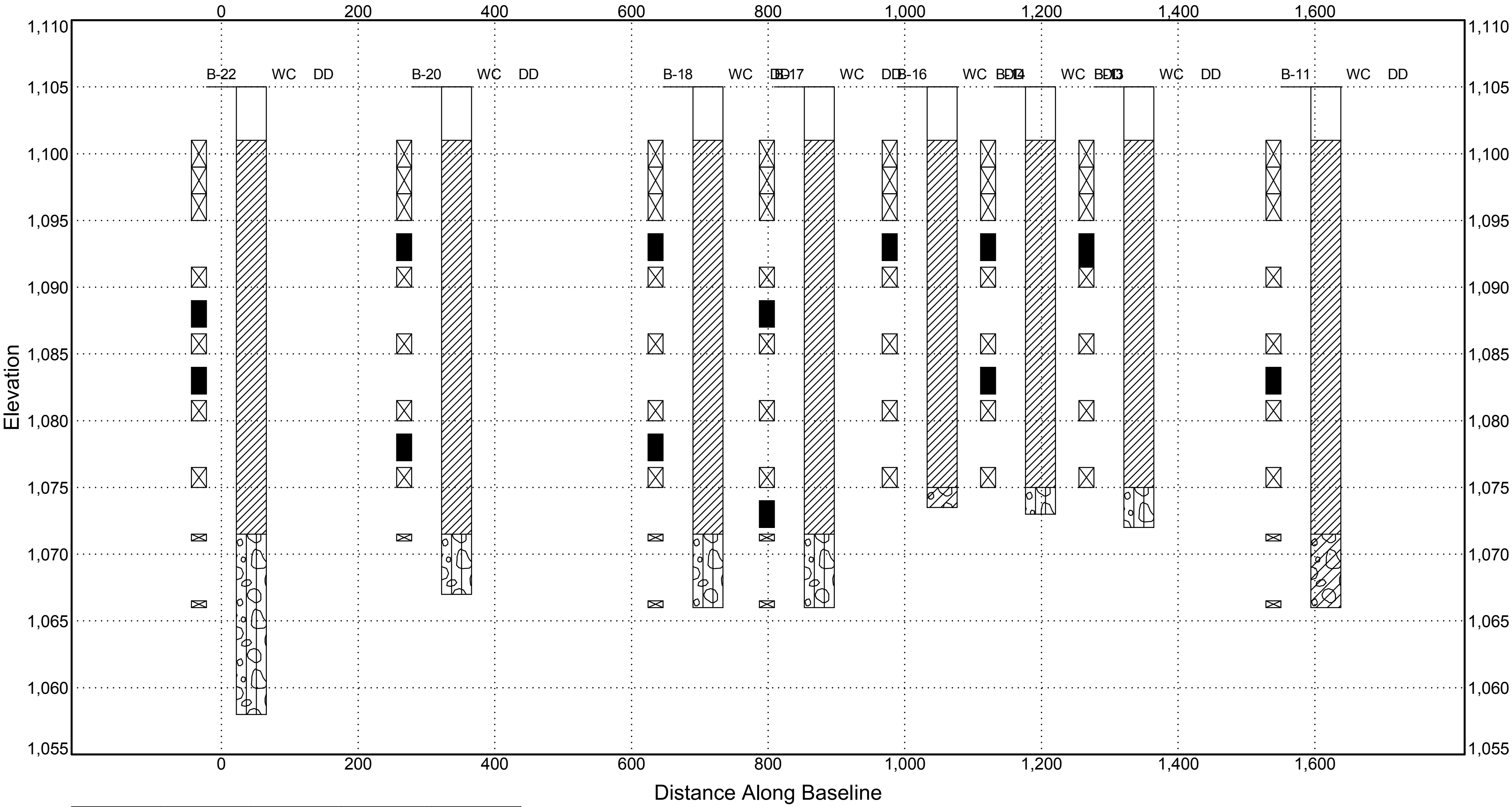
# APPENDIX A




P:\3185\5127 JSF_Closed J Pond\Working Files\dwg\Misc\3185-5127 Boring Plan - CURRENT.dwg User: Ashley_Jones Jun 24, 2010 - 2:18pm




| Borehole | North | East | Elev. | Depth |
|---|---|---|---|---|
| B-11 | 2888128 | 733896 | 1105.0 | 39.0 |
| B-13 | 2887874 | 733793 | 1105.0 | 33.0 |
| B-14 | 2887741 | 733738 | 1105.0 | 32.0 |
| B-16 | 2887608 | 733681 | 1105.0 | 31.5 |
| B-17 | 2887439 | 733619 | 1105.0 | 39.0 |
| B-18 | 2887284 | 733570 | 1105.0 | 39.0 |
| B-20 | 2886931 | 733465 | 1105.0 | 38.0 |
| B-22 | 2886645 | 733372 | 1105.0 | 47.0 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

DISTANCES:
Beginning 0
Ending 1600
VIEWING ANGLES (degrees):
Horizontal 0.0
Vertical 0.0

| Position | North | East |
|---|---|---|
| Left, Front | 2886650 | 733358 |
| Right, Front | 2888159 | 733889 |
| Left, Back | 2886650 | 733358 |
| Right, Back | 2888159 | 733889 |

SUBSURFACE FENCE DIAGRAM

TVA Geotechnical Investigation

Ash Disposal Area J - John Sevier Fossil Plant

| PROJECT # | DATE | PLATE |
|---|---|---|
| 31855127 | Jun 10 | 1 |

FAGWGN01 J POND BORINGS.GPJ FAGWGN01.GDT 6/18/10

# URS

## BORING/WELL CONSTRUCTION LOG

**PROJECT NUMBER** 31855127
**PROJECT NAME** TVA Geotechnical Investigation
**LOCATION** Ash Disposal Area J - John Sevier Fossil Plant
**DRILLING METHOD** Hollow Stem Auger
**SAMPLING METHOD** Split Spoon
**GROUND ELEVATION** 1105.00
**TOP OF CASING** N/A
**LOGGED BY** R. Hilliard
**REMARKS** No elevations recorded. All borings grouted after completion.

**BORING/WELL NUMBER** B-11
**DATE DRILLED** 6/1/10
**CASING TYPE/DIAMETER** N/A
**SCREEN TYPE/SLOT** N/A
**GRAVEL PACK TYPE** N/A
**GROUT TYPE/QUANTITY** N/A
**DEPTH TO WATER**
**GROUND WATER ELEVATION**

| PID (ppm) | N VALUE | RECOVERY (inches) | SAMPLE ID. | INTERVAL | DEPTH (ft. BGL) | U.S.C.S. | GRAPHIC LOG | LITHOLOGIC DESCRIPTION | ELEVATION (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | No Samples Collected to 4 feet bgs | 1101.0 |
| n/a | 18 | 18 | SPT 1 | | 5 | CL | | CLAY (fill) - dark brown/brownish yellow with gray mottling, very stiff, low plasticity, with fine rounded gravel, trace silt and fine to medium sand, moist | |
| n/a | 17 | 12 | SPT 2 | | | | | grades with increased sand at 6 feet bgs | |
| n/a | 20 | 15 | SPT 3 | | 10 | | | grades with less gravel at 8 feet bgs | |
| n/a | 17 | 18 | SPT 4 | | 15 | | | grades brownish yellow/light gray with increased silt at 13.5 feet bgs | |
| n/a | 25 | 20 | SPT 5 | | 20 | | | | |
| | | 24 | SH 1 | | | | | Shelby Tube collected at 21 feet bgs | |
| n/a | 27 | 20 | SPT 6 | | 25 | | | grades reddish brown/light gray at 23.5 feet bgs | |
| n/a | 15 | 16 | SPT 7 | | 30 | | | | 1071.5 |
| n/a | 50/3" | 3 | SPT 8 | | 35 | CL GC | | CLAYEY GRAVEL/GRAVELLY CLAY - dark gray, very dense, low plasticity clay, fine to medium grained shale fragments, with fine to coarse sand, moist | 1066.0 |
| n/a | 50/2" | 2 | SPT 9 | | | | | Auger refusal occurred at a depth of 39 feet bgs. Boring was terminated and grouted to surface. Groundwater was not encountered at the time of drilling. | |

BORING_WELL J POND BORINGS.GPJ DM_ATLNT.GDT 6/17/10

# URS

## BORING/WELL CONSTRUCTION LOG

**PROJECT NUMBER** 31855127
**PROJECT NAME** TVA Geotechnical Investigation
**LOCATION** Ash Disposal Area J - John Sevier Fossil Plant
**DRILLING METHOD** Hollow Stem Auger
**SAMPLING METHOD** Split Spoon
**GROUND ELEVATION** 1105.00
**TOP OF CASING** N/A
**LOGGED BY** R. Hilliard
**REMARKS** No elevations recorded. All borings grouted after completion.

**BORING/WELL NUMBER** B-13
**DATE DRILLED** 6/2/10
**CASING TYPE/DIAMETER** N/A
**SCREEN TYPE/SLOT** N/A
**GRAVEL PACK TYPE** N/A
**GROUT TYPE/QUANTITY** N/A
**DEPTH TO WATER**
**GROUND WATER ELEVATION**

| PID (ppm) | N VALUE | RECOVERY (inches) | SAMPLE ID. | INTERVAL | DEPTH (ft. BGL) | U.S.C.S. | GRAPHIC LOG | LITHOLOGIC DESCRIPTION | ELEVATION (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | No Samples Collected to 4 feet bgs | 1101.0 |
| n/a | 20 | 20 | SPT 1 | | 5 | CL | | CLAY (fill) - brownish yellow with gray mottling, very stiff, low plasticity, trace fine rounded gravel, silt and fine to medium sand, moist | |
| n/a | 28 | 12 | SPT 2 | | | | | grades with increased sand at 6 feet bgs | |
| n/a | 27 | 24 | SPT 3 | | 10 | | | grades with reddish brown/light gray mottled at 8 feet bgs | |
| | | 30 | SH 1 | | | | | Shelby Tube collected at 11 feet bgs | |
| n/a | 21 | 15 | SPT 4 | | 15 | | | grades brownish yellow/light gray with increased silt at 13.5 feet bgs | |
| n/a | 19 | 14 | SPT 5 | | 20 | | | | |
| n/a | 25 | 16 | SPT 6 | | 25 | | | grades reddish brown/light gray at 23.5 feet bgs | |
| n/a | 17 | 17 | SPT 7 | | 30 | | | | 1075.0 |
| | | | | | | GM | | SILTY CLAYEY GRAVEL - dark gray, very dense, fine to medium grained shale fragments, low plasticity clay with fine to coarse sand, moist | 1072.0 |
| | | | | | | | | Auger refusal occurred at a depth of 33 feet bgs. Boring was terminated and grouted to surface. Groundwater was not encountered at the time of drilling. | |

BORING_WELL J POND BORINGS.GPJ DM_ATLNT.GDT 6/17/10

URS

# BORING/WELL CONSTRUCTION LOG

**PROJECT NUMBER** 31855127
**PROJECT NAME** TVA Geotechnical Investigation
**LOCATION** Ash Disposal Area J - John Sevier Fossil Plant
**DRILLING METHOD** Hollow Stem Auger
**SAMPLING METHOD** Split Spoon
**GROUND ELEVATION** 1105.00
**TOP OF CASING** N/A
**LOGGED BY** R. Hilliard
**REMARKS** No elevations recorded. All borings grouted after completion.

**BORING/WELL NUMBER** B-14
**DATE DRILLED** 6/2/10
**CASING TYPE/DIAMETER** N/A
**SCREEN TYPE/SLOT** N/A
**GRAVEL PACK TYPE** N/A
**GROUT TYPE/QUANTITY** N/A
**DEPTH TO WATER**
**GROUND WATER ELEVATION**

| PID (ppm) | N VALUE | RECOVERY (inches) | SAMPLE ID. | INTERVAL | DEPTH (ft. BGL) | U.S.C.S. | GRAPHIC LOG | LITHOLOGIC DESCRIPTION | ELEVATION (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | No Samples Collected to 4 feet bgs | |
| | | | | | | | | | 1101.0 |
| n/a | 31 | 24 | SPT 1 | | 5 | CL | | CLAY (fill) - brown/brownish yellow with gray mottling, hard, low plasticity, trace fine rounded gravel, silt and fine to medium sand, moist | |
| n/a | 22 | 24 | SPT 2 | | | | | very stiff at 6 feet bgs | |
| n/a | 25 | 10 | SPT 3 | | 10 | | | | |
| | | 22 | SH 1 | | | | | Shelby Tube collected at 11 feet bgs | |
| n/a | 21 | 16 | SPT 4 | | 15 | | | grades reddish brown/brownish yellow at 13.5 feet bgs | |
| n/a | 20 | 16 | SPT 5 | | 20 | | | | |
| | | 22 | SH 2 | | | | | Shelby Tube collected at 21 feet bgs | |
| n/a | 19 | 15 | SPT 6 | | 25 | | | | |
| n/a | 15 | 18 | SPT 7 | | 30 | | | grades light gray/brownish yellow at 28.5 feet bgs | 1075.0 |
| | | | | | | GM | | SILTY CLAYEY GRAVEL - dark gray, very dense, fine to medium grained shale fragments, low plasticity clay with fine to coarse sand, moist | 1073.0 |
| | | | | | | | | Auger refusal occurred at a depth of 32 feet bgs. Boring was terminated and grouted to surface. Groundwater was not encountered at the time of drilling. | |

BORING_WELL J POND BORINGS.GPJ DM_ATLNT.GDT 6/17/10

URS

# BORING/WELL CONSTRUCTION LOG

**PROJECT NUMBER** 31855127
**PROJECT NAME** TVA Geotechnical Investigation
**LOCATION** Ash Disposal Area J - John Sevier Fossil Plant
**DRILLING METHOD** Hollow Stem Auger
**SAMPLING METHOD** Split Spoon
**GROUND ELEVATION** 1105.00
**TOP OF CASING** N/A
**LOGGED BY** R. Hilliard
**REMARKS** No elevations recorded. All borings grouted after completion.

**BORING/WELL NUMBER** B-16
**DATE DRILLED** 6/2/10
**CASING TYPE/DIAMETER** N/A
**SCREEN TYPE/SLOT** N/A
**GRAVEL PACK TYPE** N/A
**GROUT TYPE/QUANTITY** N/A
**DEPTH TO WATER**
**GROUND WATER ELEVATION**

| PID (ppm) | N VALUE | RECOVERY (inches) | SAMPLE ID. | INTERVAL | DEPTH (ft. BGL) | U.S.C.S. | GRAPHIC LOG | LITHOLOGIC DESCRIPTION | ELEVATION (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | No Samples Collected to 4 feet bgs | 1101.0 |
| n/a | 23 | 15 | SPT 1 | | 5 | CL | | CLAY (fill) - brownish yellow with gray mottling, very stiff, low plasticity, trace fine rounded gravel, silt and fine to medium sand, moist | |
| n/a | 19 | 12 | SPT 2 | | | | | | |
| n/a | 26 | 16 | SPT 3 | | 10 | | | | |
| | | 24 | SH 1 | | | | | Shelby Tube collected at 11 feet bgs | |
| n/a | 21 | 13 | SPT 4 | | 15 | | | grades reddish brown/light gray with increased silt at 13.5 feet bgs | |
| n/a | 20 | 15 | SPT 5 | | 20 | | | grades dark brown/reddish gray at 18.5 feet bgs | |
| n/a | 19 | 15 | SPT 6 | | 25 | | | grades brownish yellow/light gray at 23.5 feet bgs | |
| n/a | 11 | 18 | SPT 7 | | 30 | | | stiff at 28.5 feet bgs | 1075.0 |
| | | | | | | GC | | CLAYEY GRAVEL - dark gray, very dense, fine to medium grained shale fragments, low plasticity clay with fine to coarse sand, moist | 1073.5 |
| | | | | | | | | Auger refusal occurred at a depth of 31.5 feet bgs. Boring was terminated and grouted to surface. Groundwater was not encountered at the time of drilling. | |

BORING_WELL J POND BORINGS.GPJ DM_ATLNT.GDT 6/17/10

URS

# BORING/WELL CONSTRUCTION LOG

**PROJECT NUMBER** 31855127
**PROJECT NAME** TVA Geotechnical Investigation
**LOCATION** Ash Disposal Area J - John Sevier Fossil Plant
**DRILLING METHOD** Hollow Stem Auger
**SAMPLING METHOD** Split Spoon
**GROUND ELEVATION** 1105.00
**TOP OF CASING** N/A
**LOGGED BY** R. Hilliard
**REMARKS** No elevations recorded. All borings grouted after completion.

**BORING/WELL NUMBER** B-17
**DATE DRILLED** 6/2/10
**CASING TYPE/DIAMETER** N/A
**SCREEN TYPE/SLOT** N/A
**GRAVEL PACK TYPE** N/A
**GROUT TYPE/QUANTITY** N/A
**DEPTH TO WATER**
**GROUND WATER ELEVATION**

| PID (ppm) | N VALUE | RECOVERY (inches) | SAMPLE ID. | DEPTH (ft. BGL) | U.S.C.S. | LITHOLOGIC DESCRIPTION | ELEVATION (feet) |
|---|---|---|---|---|---|---|---|
| | | | | | | No Samples Collected to 4 feet bgs | 1101.0 |
| n/a | 15 | 12 | SPT 1 | 5 | CL | CLAY (fill) - reddish brown/brownish yellow with gray mottling, very stiff, low plasticity, trace fine rounded gravel, silt and fine to medium sand, moist | |
| n/a | 13 | 18 | SPT 2 | | | stiff at 6 feet bgs | |
| n/a | 19 | 12 | SPT 3 | 10 | | very stiff at 8 feet bgs | |
| n/a | 28 | 15 | SPT 4 | 15 | | | |
| | | 30 | SH 1 | | | Shelby Tube collected at 16 feet bgs | |
| n/a | 21 | 15 | SPT 5 | 20 | | grades brownish yellow/light gray with increased silt at 18.5 feet bgs | |
| n/a | 16 | 15 | SPT 6 | 25 | | grades reddish brown/light gray at 23.5 feet bgs | |
| n/a | 19 | 15 | SPT 7 | 30 | | | |
| | | 24 | SH 2 | | | Shelby Tube collected at 31 feet bgs | 1071.5 |
| n/a | 50/3" | 3 | SPT 8 | 35 | GM | SILTY CLAYEY GRAVEL - dark gray, very dense, fine to medium grained shale fragments, low plasticity clay with fine to coarse sand, moist | |
| n/a | 50/1" | 1 | SPT 9 | | | Auger refusal occurred at a depth of 39 feet bgs. Boring was terminated and grouted to surface. Groundwater was not encountered at the time of drilling. | 1066.0 |

BORING_WELL J POND BORINGS.GPJ DM_ATLNT.GDT 6/17/10

# URS

## BORING/WELL CONSTRUCTION LOG

**PROJECT NUMBER** 31855127
**PROJECT NAME** TVA Geotechnical Investigation
**LOCATION** Ash Disposal Area J - John Sevier Fossil Plant
**DRILLING METHOD** Hollow Stem Auger
**SAMPLING METHOD** Split Spoon
**GROUND ELEVATION** 1105.00
**TOP OF CASING** N/A
**LOGGED BY** R. Hilliard
**REMARKS** No elevations recorded. All borings grouted after completion.

**BORING/WELL NUMBER** B-18
**DATE DRILLED** 6/3/10
**CASING TYPE/DIAMETER** N/A
**SCREEN TYPE/SLOT** N/A
**GRAVEL PACK TYPE** N/A
**GROUT TYPE/QUANTITY** N/A
**DEPTH TO WATER**
**GROUND WATER ELEVATION**

| PID (ppm) | N VALUE | RECOVERY (inches) | SAMPLE ID. | INTERVAL | DEPTH (ft. BGL) | U.S.C.S. | GRAPHIC LOG | LITHOLOGIC DESCRIPTION | ELEVATION (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | No Samples Collected to 4 feet bgs | |
| | | | | | | | | | 1101.0 |
| n/a | 24 | 15 | SPT 1 | | 5 | CL | | CLAY (fill) - reddish brown/brownish yellow with gray mottling, very stiff, low plasticity, trace fine rounded gravel, silt and fine to medium sand, moist | |
| n/a | 14 | 15 | SPT 2 | | | | | stiff at 6 feet bgs | |
| n/a | 24 | 15 | SPT 3 | | | | | very stiff at 8 feet bgs | |
| | | | | | 10 | | | | |
| | | 24 | SH 1 | | | | | Shelby Tube collected at 11 feet bgs | |
| n/a | 21 | 14 | SPT 4 | | | | | | |
| | | | | | 15 | | | | |
| n/a | 20 | 15 | SPT 5 | | | CL | | | |
| | | | | | 20 | | | | |
| n/a | 27 | 15 | SPT 6 | | | | | grades reddish brown/light gray at 23.5 feet bgs | |
| | | | | | 25 | | | | |
| | | 24 | SH 2 | | | | | Shelby Tube collected at 26 feet bgs | |
| n/a | 18 | 16 | SPT 7 | | | | | | |
| | | | | | 30 | | | | |
| | | | | | | | | | 1071.5 |
| n/a | 50/1" | 9 | SPT 8 | | | GM | | SILTY CLAYEY GRAVEL - dark gray/reddish brown, very dense, fine to medium grained shale fragments, low plasticity clay with fine to coarse sand, moist | |
| | | | | | 35 | | | | |
| | | | | | | | | | 1066.0 |
| n/a | 50/0" | 1 | SPT 9 | | | | | Auger refusal occurred at a depth of 39 feet bgs. Boring was terminated and grouted to surface. Groundwater was not encountered at the time of drilling. | |

URS

# BORING/WELL CONSTRUCTION LOG

**PROJECT NUMBER** 31855127
**PROJECT NAME** TVA Geotechnical Investigation
**LOCATION** Ash Disposal Area J - John Sevier Fossil Plant
**DRILLING METHOD** Hollow Stem Auger
**SAMPLING METHOD** Split Spoon
**GROUND ELEVATION** 1105.00
**TOP OF CASING** N/A
**LOGGED BY** R. Hilliard
**REMARKS** No elevations recorded. All borings grouted after completion.

**BORING/WELL NUMBER** B-20
**DATE DRILLED** 6/3/10
**CASING TYPE/DIAMETER** N/A
**SCREEN TYPE/SLOT** N/A
**GRAVEL PACK TYPE** N/A
**GROUT TYPE/QUANTITY** N/A
**DEPTH TO WATER**
**GROUND WATER ELEVATION**

| PID (ppm) | N VALUE | RECOVERY (inches) | SAMPLE ID. | INTERVAL | DEPTH (ft. BGL) | U.S.C.S. | GRAPHIC LOG | LITHOLOGIC DESCRIPTION | ELEVATION (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | No Samples Collected to 4 feet bgs | 1101.0 |
| n/a | 17 | 15 | SPT 1 | | 5 | CL | | CLAY (fill) - reddish brown/brownish yellow with gray mottling, very stiff, low plasticity, trace fine rounded gravel, silt and fine to medium sand, moist | |
| n/a | 21 | 15 | SPT 2 | | | | | | |
| n/a | 17 | 6 | SPT 3 | | 10 | | | | |
| | | 24 | SH 1 | | | | | Shelby Tube collected at 11 feet bgs | |
| n/a | 23 | 15 | SPT 4 | | 15 | | | | |
| n/a | 15 | 9 | SPT 5 | | 20 | | | increased gravel at 18.5 feet bgs | |
| n/a | 21 | 17 | SPT 6 | | 25 | | | grades with less gravel at 23.5 feet bgs | |
| | | 24 | SH 2 | | | | | Shelby Tube collected at 26 feet bgs | |
| n/a | 12 | 18 | SPT 7 | | 30 | | | stiff and grades reddish brown with increased plasticity at 28.5 feet bgs | 1071.5 |
| n/a | 50/3" | 3 | SPT 8 | | 35 | GM | | SILTY CLAYEY GRAVEL - dark gray, very dense, fine to medium grained shale fragments, low plasticity clay with fine to coarse sand, moist | 1067.0 |
| | | | | | | | | Auger refusal occurred at a depth of 38 feet bgs. Boring was terminated and grouted to surface. Groundwater was not encountered at the time of drilling. | |

BORING_WELL J POND BORINGS.GPJ DM_ATLNT.GDT 6/17/10

URS

# BORING/WELL CONSTRUCTION LOG

**PROJECT NUMBER** 31855127
**PROJECT NAME** TVA Geotechnical Investigation
**LOCATION** Ash Disposal Area J - John Sevier Fossil Plant
**DRILLING METHOD** Hollow Stem Auger
**SAMPLING METHOD** Split Spoon
**GROUND ELEVATION** 1105.00
**TOP OF CASING** N/A
**LOGGED BY** R. Hilliard
**REMARKS** No elevations recorded. All borings grouted after completion.

**BORING/WELL NUMBER** B-22
**DATE DRILLED** 6/3/10
**CASING TYPE/DIAMETER** N/A
**SCREEN TYPE/SLOT** N/A
**GRAVEL PACK TYPE** N/A
**GROUT TYPE/QUANTITY** N/A
**DEPTH TO WATER**
**GROUND WATER ELEVATION**

| PID (ppm) | N VALUE | RECOVERY (inches) | SAMPLE ID. | INTERVAL | DEPTH (ft. BGL) | U.S.C.S. | GRAPHIC LOG | LITHOLOGIC DESCRIPTION | ELEVATION (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | No Samples Collected to 4 feet bgs | 1101.0 |
| n/a | 20 | 6 | SPT 1 | | 5 | | | CLAY (fill) - brownish yellow, very stiff, low plasticity, trace fine rounded gravel, silt and fine to medium sand, moist | |
| n/a | 13 | 9 | SPT 2 | | | | | stiff at 6 feet bgs | |
| n/a | 13 | 15 | SPT 3 | | 10 | | | | |
| n/a | 17 | 10 | SPT 4 | | 15 | | | very stiff at 13.5 feet bgs | |
| | | 24 | SH 1 | | | | | Shelby Tube collected at 16 feet bgs | |
| n/a | 23 | 15 | SPT 5 | | 20 | CL | | | |
| | | 24 | SH 2 | | | | | Shelby Tube collected at 21 feet bgs | |
| n/a | 28 | 15 | SPT 6 | | 25 | | | grades dark brown/reddish brown/gray at 23.5 feet bgs | |
| n/a | 23 | 15 | SPT 7 | | 30 | | | | 1071.5 |
| n/a | 12 | 18 | SPT 8 | | 35 | | | CLAYEY GRAVEL/SANDY GRAVEL - dark gray, very dense, fine to medium grained shale fragments, low plasticity clay, fine to coarse sand and clay, moist | |
| n/a | 50/3" | 15 | SPT 9 | | 40 | GC GM | | | |
| | | | | | 45 | | | | |

*Continued Next Page*

URS

# BORING/WELL CONSTRUCTION LOG

**PROJECT NUMBER** 31855127

**PROJECT NAME** TVA Geotechnical Investigation

**BORING/WELL NUMBER** B-22

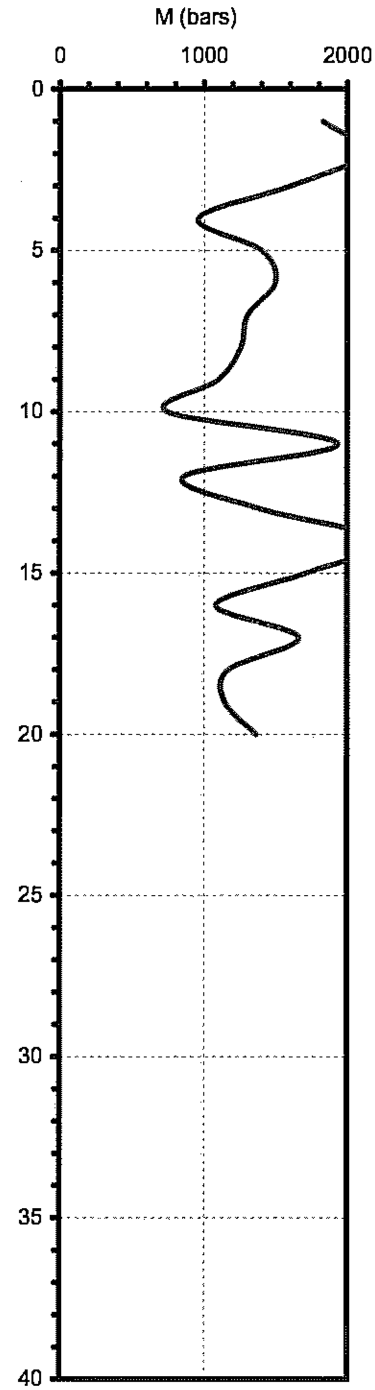
**DATE DRILLED** 6/3/10

*Continued from Previous Page*

| PID (ppm) | N VALUE | RECOVERY (inches) | SAMPLE ID. | INTERVAL | DEPTH (ft. BGL) | U.S.C.S. | GRAPHIC LOG | LITHOLOGIC DESCRIPTION | ELEVATION (feet) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 1058.0 |
| | | | | | | | | Auger refusal occurred at a depth of 47 feet bgs. Boring was terminated and grouted to surface. Groundwater was not encountered at the time of drilling. | |

BORING_WELL J POND BORINGS.GPJ DM_ATLNT.GDT 6/17/10

| Depth (feet) | Δz (inches) | A (bars) | B (bars) | M (bars) | Soil Behavior Type |
|---|---|---|---|---|---|
| 1 | 12 | 7.05 | 17.60 | 1829 | SANDY SILT |
| 2 | 12 | 7.45 | 21.80 | 2122 | SILTY SAND |
| 3 | 12 | 7.20 | 19.50 | 1601 | SANDY SILT |
| 4 | 12 | 5.50 | 14.40 | 959 | SANDY SILT |
| 5 | 12 | 8.00 | 20.10 | 1400 | SANDY SILT |
| 6 | 12 | 4.95 | 20.80 | 1497 | SAND |
| 7 | 12 | 10.80 | 22.20 | 1300 | SILT |
| 8 | 12 | 10.00 | 21.80 | 1257 | SILT |
| 9 | 12 | 8.95 | 20.10 | 1101 | SANDY SILT |
| 10 | 12 | 7.55 | 16.10 | 747 | SILT |
| 11 | 12 | 15.20 | 32.30 | 1933 | SILT |
| 12 | 12 | 6.95 | 17.60 | 861 | SANDY SILT |
| 13 | 12 | 17.10 | 29.80 | 1388 | CLAYEY SILT |
| 14 | 12 | 10.90 | 35.10 | 2269 | SILTY SAND |
| 15 | 12 | 17.10 | 33.20 | 1705 | SILT |
| 16 | 12 | 11.20 | 23.50 | 1083 | SILT |
| 17 | 12 | 14.60 | 31.80 | 1660 | SANDY SILT |
| 18 | 12 | 12.50 | 25.80 | 1172 | SILT |
| 19 | 12 | 13.00 | 26.10 | 1146 | SILT |
| 20 | 12 | 11.00 | 27.80 | 1362 | SANDY SILT |

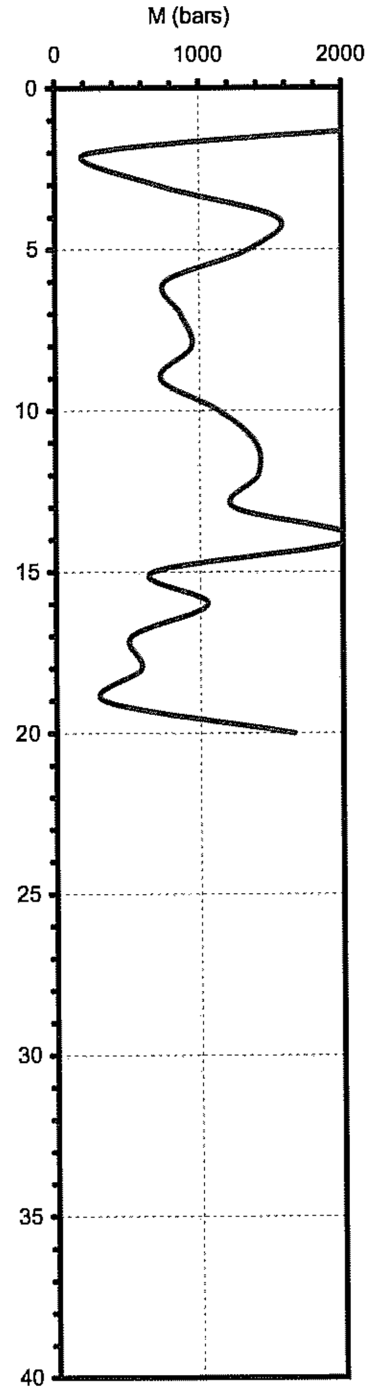



ΔA Initial: 0.20 ΔA Final: 0.20
ΔB Initial: 0.80 ΔB Final: 0.80

**Project Name: TVA**
**Sounding: D-10**
**Project Number: 10:5880**
**Date: 6/9/10**

**ECS Southeast, LLC**
**Measured DMT Values**

| Depth (feet) | Δz (inches) | A (bars) | B (bars) | M (bars) | Soil Behavior Type |
|---|---|---|---|---|---|
| 1 | 12 | 2.85 | 24.10 | 3078 | SAND |
| 2 | 12 | 2.40 | 5.35 | 248 | CLAYEY SILT |
| 3 | 12 | 2.65 | 10.00 | 708 | SILTY SAND |
| 4 | 12 | 5.55 | 19.20 | 1550 | SILTY SAND |
| 5 | 12 | 4.40 | 18.20 | 1346 | SAND |
| 6 | 12 | 4.50 | 13.10 | 765 | SANDY SILT |
| 7 | 12 | 4.55 | 14.70 | 871 | SILTY SAND |
| 8 | 12 | 5.70 | 16.40 | 950 | SILTY SAND |
| 9 | 12 | 5.00 | 14.20 | 733 | SANDY SILT |
| 10 | 12 | 4.80 | 19.50 | 1137 | SILTY SAND |
| 11 | 12 | 13.10 | 26.10 | 1392 | SILT |
| 12 | 12 | 13.20 | 26.70 | 1410 | SILT |
| 13 | 12 | 7.30 | 22.40 | 1240 | SILTY SAND |
| 14 | 12 | 15.10 | 34.80 | 2078 | SANDY SILT |
| 15 | 12 | 8.30 | 17.00 | 678 | SILT |
| 16 | 12 | 11.10 | 23.10 | 1058 | SILT |
| 17 | 12 | 7.20 | 14.90 | 524 | SILT |
| 18 | 12 | 7.60 | 16.20 | 593 | SILT |
| 19 | 12 | 4.15 | 11.20 | 336 | SANDY SILT |
| 20 | 12 | 10.20 | 30.90 | 1655 | SILTY SAND |

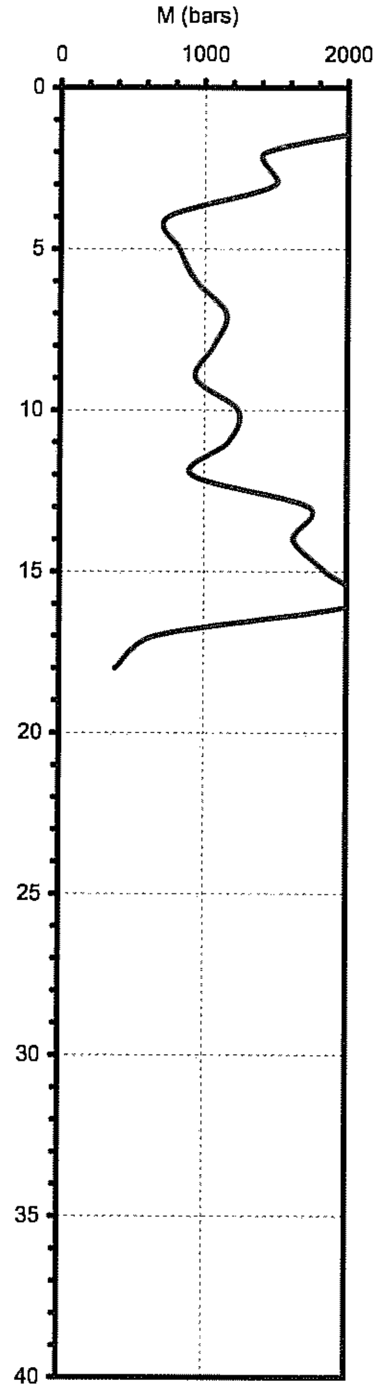



ΔA Initial: 0.20 ΔA Final: 0.20
ΔB Initial: 0.80 ΔB Final: 0.80

**Project Name: TVA**
**Sounding: D-11**
**Project Number: 10:5880**
**Date: 6/9/10**

**ECS Southeast, LLC**
**Measured DMT Values**

| Depth (feet) | Δz (inches) | A (bars) | B (bars) | M (bars) | Soil Behavior Type |
|---|---|---|---|---|---|
| 1 | 12 | 6.30 | 21.20 | 2598 | SILTY SAND |
| 2 | 12 | 3.10 | 15.30 | 1427 | SAND |
| 3 | 12 | 3.90 | 17.40 | 1495 | SAND |
| 4 | 12 | 4.25 | 11.80 | 744 | SANDY SILT |
| 5 | 12 | 3.50 | 12.90 | 826 | SILTY SAND |
| 6 | 12 | 5.30 | 15.20 | 943 | SILTY SAND |
| 7 | 12 | 2.20 | 21.80 | 1154 | SAND |
| 8 | 12 | 7.05 | 18.20 | 1069 | SANDY SILT |
| 9 | 12 | 8.15 | 18.00 | 941 | SILT |
| 10 | 12 | 10.00 | 22.30 | 1237 | SANDY SILT |
| 11 | 12 | 8.95 | 21.40 | 1170 | SANDY SILT |
| 12 | 12 | 7.15 | 18.20 | 917 | SANDY SILT |
| 13 | 12 | 16.80 | 32.40 | 1732 | SILT |
| 14 | 12 | 12.40 | 28.90 | 1623 | SANDY SILT |
| 15 | 12 | 15.60 | 33.40 | 1852 | SILT |
| 16 | 12 | 11.20 | 34.00 | 2068 | SILTY SAND |
| 17 | 12 | 8.10 | 17.20 | 668 | SILT |
| 18 | 12 | 5.65 | 12.40 | 389 | SILT |

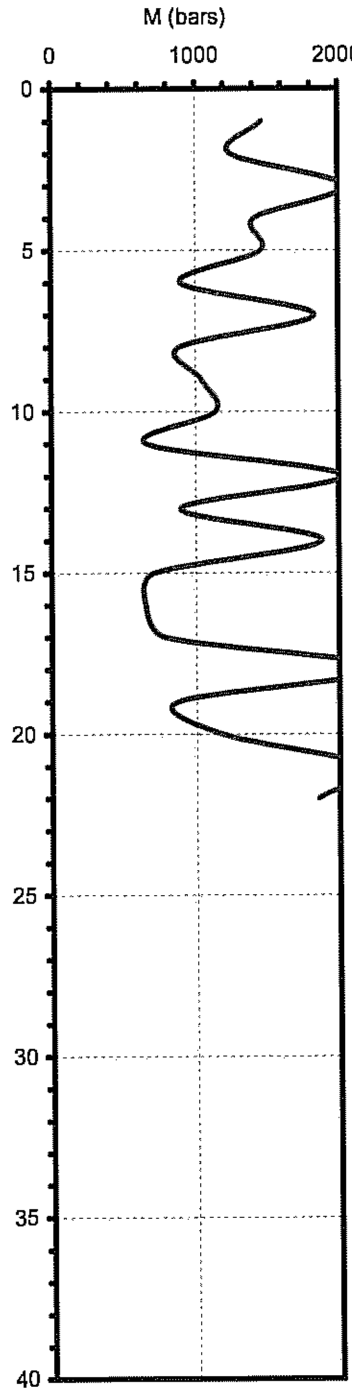



ΔA Initial: 0.20 ΔA Final: 0.20
ΔB Initial: 0.80 ΔB Final: 0.80

**Project Name: TVA**
**Sounding: D-12**
**Project Number: 10:5880**
**Date: 6/9/10**

**ECS Southeast, LLC**
**Measured DMT Values**

| Depth (feet) | Δz (inches) | A (bars) | B (bars) | M (bars) | Soil Behavior Type |
|---|---|---|---|---|---|
| 1 | 12 | 3.25 | 13.20 | 1468 | SILTY SAND |
| 2 | 12 | 3.95 | 14.00 | 1247 | SILTY SAND |
| 3 | 12 | 6.15 | 22.20 | 2045 | SILTY SAND |
| 4 | 12 | 6.05 | 18.40 | 1413 | SILTY SAND |
| 5 | 12 | 5.85 | 19.60 | 1460 | SILTY SAND |
| 6 | 12 | 5.55 | 15.00 | 901 | SANDY SILT |
| 7 | 12 | 2.70 | 35.00 | 1832 | SAND |
| 8 | 12 | 6.25 | 16.10 | 890 | SANDY SILT |
| 9 | 12 | 8.45 | 19.20 | 1043 | SANDY SILT |
| 10 | 12 | 8.20 | 20.40 | 1141 | SANDY SILT |
| 11 | 12 | 7.15 | 15.20 | 664 | SILT |
| 12 | 12 | 14.20 | 32.90 | 2028 | SANDY SILT |
| 13 | 12 | 12.00 | 21.40 | 898 | CLAYEY SILT |
| 14 | 12 | 17.00 | 34.30 | 1881 | SILT |
| 15 | 12 | 7.80 | 17.10 | 710 | SILT |
| 16 | 12 | 9.75 | 17.90 | 652 | CLAYEY SILT |
| 17 | 12 | 11.70 | 20.90 | 790 | CLAYEY SILT |
| 18 | 12 | 15.30 | 39.10 | 2324 | SANDY SILT |
| 19 | 12 | 10.00 | 21.20 | 874 | SILT |
| 20 | 12 | 13.20 | 26.80 | 1186 | SILT |
| 21 | 12 | 12.60 | 38.10 | 2179 | SILTY SAND |
| 22 | 12 | 12.00 | 34.60 | 1853 | SILTY SAND |




ΔA Initial: 0.20
ΔB Initial: 0.80

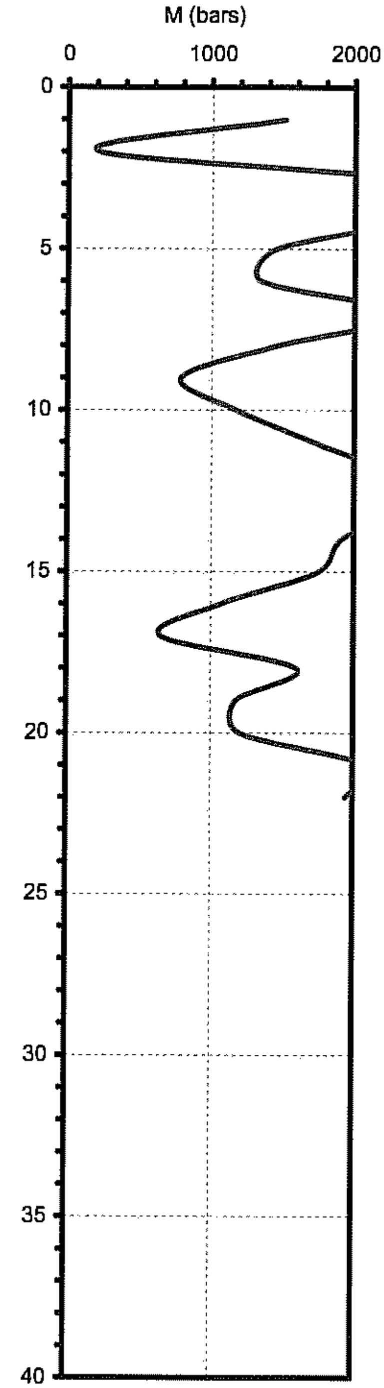
ΔA Final: 0.20
ΔB Final: 0.80

**Project Name: TVA**
**Sounding: D-14**
**Project Number: 10:5880**
**Date: 6/9/10**

ECS LLC SOUTHEAST

**ECS Southeast, LLC**
**Measured DMT Values**

| Depth (feet) | Δz (inches) | A (bars) | B (bars) | M (bars) | Soil Behavior Type |
|---|---|---|---|---|---|
| 1 | 12 | 4.00 | 13.80 | 1509 | SILTY SAND |
| 2 | 12 | 0.35 | 4.55 | 219 | SAND |
| 3 | 12 | 8.05 | 28.80 | 2891 | SILTY SAND |
| 4 | 12 | 4.55 | 27.90 | 2477 | SAND |
| 5 | 12 | 6.55 | 19.70 | 1452 | SILTY SAND |
| 6 | 12 | 4.50 | 19.20 | 1345 | SAND |
| 7 | 12 | 8.20 | 30.00 | 2356 | SILTY SAND |
| 8 | 12 | 6.25 | 21.90 | 1456 | SILTY SAND |
| 9 | 12 | 4.60 | 14.80 | 787 | SILTY SAND |
| 10 | 12 | 5.40 | 20.00 | 1175 | SILTY SAND |
| 11 | 12 | 10.80 | 27.70 | 1715 | SANDY SILT |
| 12 | 12 | 6.30 | 35.00 | 2266 | SAND |
| 13 | 12 | 15.40 | 36.90 | 2337 | SANDY SILT |
| 14 | 12 | 14.00 | 32.70 | 1913 | SANDY SILT |
| 15 | 12 | 14.90 | 32.10 | 1749 | SILT |
| 16 | 12 | 10.40 | 22.90 | 1072 | SANDY SILT |
| 17 | 12 | 8.50 | 17.30 | 652 | SILT |
| 18 | 12 | 14.60 | 31.50 | 1600 | SILT |
| 19 | 12 | 11.00 | 25.30 | 1180 | SANDY SILT |
| 20 | 12 | 11.40 | 26.10 | 1206 | SANDY SILT |
| 21 | 12 | 15.10 | 38.10 | 2101 | SANDY SILT |
| 22 | 12 | 14.80 | 36.70 | 1947 | SANDY SILT |



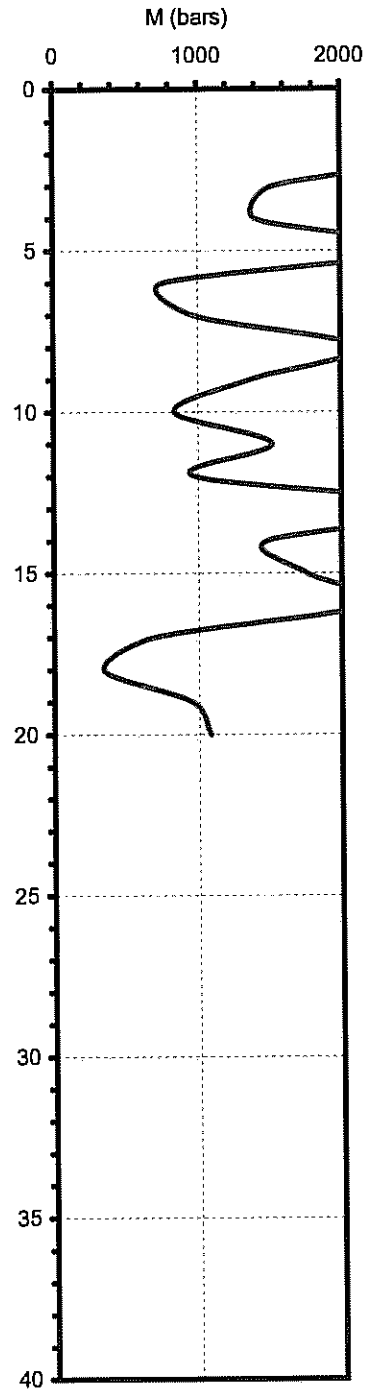

ΔA Initial: 0.20
ΔB Initial: 0.80

ΔA Final: 0.20
ΔB Final: 0.80

**Project Name: TVA**
**Sounding: D-16**
**Project Number: 10:5880**
**Date: 6/9/10**

**ECS Southeast, LLC**
**Measured DMT Values**

| Depth (feet) | Δz (inches) | A (bars) | B (bars) | M (bars) | Soil Behavior Type |
|---|---|---|---|---|---|
| 1 | 12 | 5.20 | 17.90 | 2110 | SILTY SAND |
| 2 | 12 | 4.75 | 26.40 | 2880 | SAND |
| 3 | 12 | 4.35 | 17.80 | 1528 | SILTY SAND |
| 4 | 12 | 5.50 | 18.20 | 1407 | SILTY SAND |
| 5 | 12 | 8.20 | 29.80 | 2571 | SILTY SAND |
| 6 | 12 | 4.60 | 13.20 | 760 | SANDY SILT |
| 7 | 12 | 5.75 | 16.20 | 967 | SANDY SILT |
| 8 | 12 | 5.30 | 30.10 | 2140 | SAND |
| 9 | 12 | 6.80 | 21.70 | 1365 | SILTY SAND |
| 10 | 12 | 5.90 | 16.20 | 839 | SANDY SILT |
| 11 | 12 | 8.40 | 24.80 | 1517 | SILTY SAND |
| 12 | 12 | 7.00 | 19.00 | 985 | SANDY SILT |
| 13 | 12 | 17.50 | 43.10 | 2912 | SANDY SILT |
| 14 | 12 | 13.00 | 28.00 | 1484 | SILT |
| 15 | 12 | 14.40 | 31.80 | 1752 | SANDY SILT |
| 16 | 12 | 10.80 | 35.70 | 2212 | SILTY SAND |
| 17 | 12 | 6.80 | 16.90 | 689 | SANDY SILT |
| 18 | 12 | 5.35 | 11.60 | 342 | SILT |
| 19 | 12 | 8.30 | 21.40 | 954 | SANDY SILT |
| 20 | 12 | 8.70 | 23.50 | 1084 | SANDY SILT |



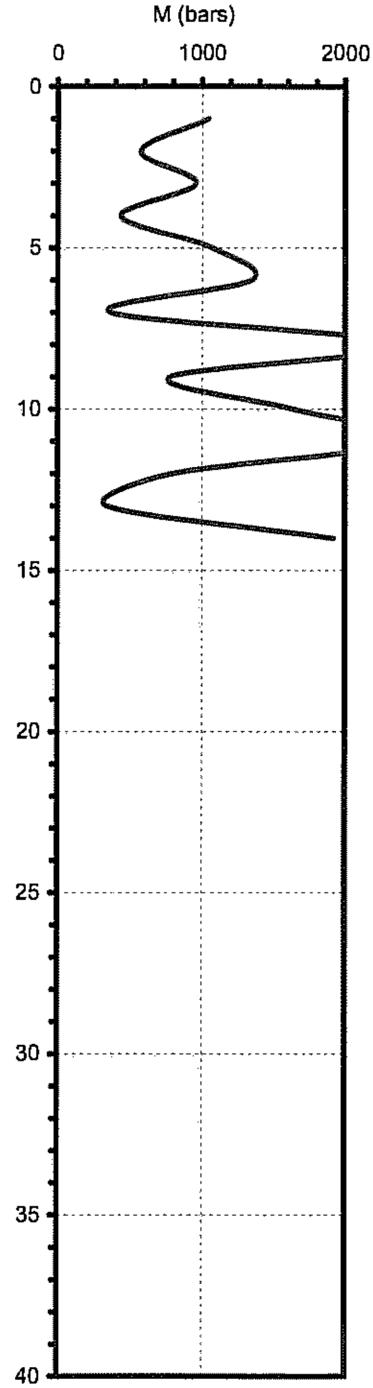

ΔA Initial: 0.20
ΔB Initial: 0.80

ΔA Final: 0.20
ΔB Final: 0.80

**Project Name: TVA**
**Sounding: D-17**
**Project Number: 10:5880**
**Date: 6/9/10**

**ECS Southeast, LLC**
**Measured DMT Values**

| Depth (feet) | Δz (inches) | A (bars) | B (bars) | M (bars) | Soil Behavior Type |
|---|---|---|---|---|---|
| 1 | 12 | 2.40 | 10.20 | 1047 | SILTY SAND |
| 2 | 12 | 3.90 | 8.95 | 573 | SILT |
| 3 | 12 | 3.85 | 12.70 | 956 | SILTY SAND |
| 4 | 12 | 2.75 | 8.05 | 439 | SANDY SILT |
| 5 | 12 | 4.80 | 15.60 | 1075 | SILTY SAND |
| 6 | 12 | 5.95 | 19.20 | 1342 | SILTY SAND |
| 7 | 12 | 3.55 | 8.70 | 372 | SANDY SILT |
| 8 | 12 | 4.70 | 35.00 | 2461 | SAND |
| 9 | 12 | 6.05 | 15.20 | 784 | SANDY SILT |
| 10 | 12 | 7.40 | 25.20 | 1644 | SILTY SAND |
| 11 | 12 | 8.35 | 35.00 | 2486 | SAND |
| 12 | 12 | 5.00 | 16.10 | 793 | SILTY SAND |
| 13 | 12 | 6.00 | 11.20 | 345 | CLAYEY SILT |
| 14 | 12 | 10.80 | 31.20 | 1923 | SILTY SAND |




ΔA Initial: 0.20 ΔA Final: 0.20
ΔB Initial: 0.80 ΔB Final: 0.80

**Project Name: TVA**
**Sounding: D-19**
**Project Number: 10:5880**
**Date: 6/9/10**

ECS LLC SOUTHEAST

**ECS Southeast, LLC**
**Measured DMT Values**

| Depth (feet) | Δz (inches) | A (bars) | B (bars) | M (bars) | Soil Behavior Type |
|---|---|---|---|---|---|
| 1 | 12 | 1.10 | 4.45 | 316 | SILTY SAND |
| 2 | 12 | 4.35 | 12.20 | 978 | SANDY SILT |
| 3 | 12 | 2.55 | 10.20 | 718 | SILTY SAND |
| 4 | 12 | 2.85 | 8.75 | 505 | SILTY SAND |
| 5 | 12 | 6.65 | 24.40 | 2005 | SILTY SAND |
| 6 | 12 | 11.60 | 24.80 | 1634 | SILT |
| 7 | 12 | 4.85 | 15.30 | 914 | SILTY SAND |
| 8 | 12 | 1.10 | 4.40 | 110 | SILTY SAND |
| 9 | 12 | 8.30 | 19.00 | 1036 | SANDY SILT |
| 10 | 12 | 5.45 | 28.60 | 1877 | SAND |
| 11 | 12 | 12.60 | 25.90 | 1408 | SILT |
| 12 | 12 | 5.80 | 15.10 | 694 | SANDY SILT |
| 13 | 12 | 8.75 | 26.40 | 1568 | SILTY SAND |
| 14 | 12 | 7.30 | 17.90 | 826 | SANDY SILT |
| 15 | 12 | 12.80 | 32.30 | 1903 | SANDY SILT |
| 16 | 12 | 12.60 | 60.00 | 4428 | SAND |
| 17 | 12 | 9.90 | 21.00 | 905 | SILT |
| 18 | 12 | 12.40 | 28.30 | 1422 | SANDY SILT |
| 19 | 12 | 5.50 | 20.10 | 893 | SILTY SAND |
| 20 | 12 | 6.35 | 12.90 | 375 | SILT |
| 21 | 12 | 11.10 | 25.20 | 1127 | SANDY SILT |
| 22 | 12 | 10.90 | 26.00 | 1176 | SANDY SILT |
| 23 | 12 | 7.40 | 17.30 | 605 | SANDY SILT |
| 24 | 12 | 13.10 | 60.00 | 3817 | SAND |
| 25 | 12 | 15.90 | 33.10 | 1496 | SILT |
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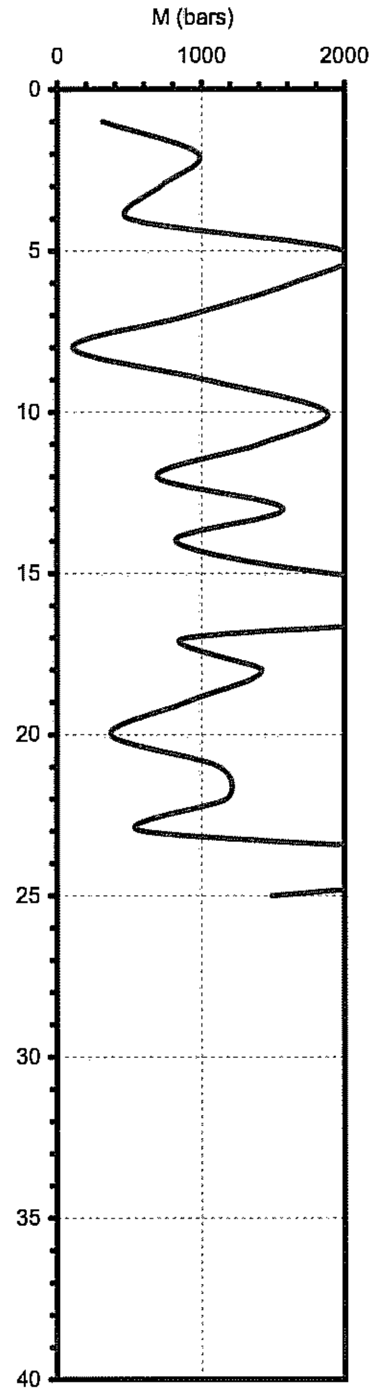


ΔA Initial: 0.20
ΔB Initial: 0.80

ΔA Final: 0.20
ΔB Final: 0.80

**Project Name: TVA**
**Sounding: D-20**
**Project Number: 10:5880**
**Date: 6/9/10**

ECS LLC SOUTHEAST

**ECS Southeast, LLC**
**Measured DMT Values**

| Depth (feet) | Δz (inches) | A (bars) | B (bars) | M (bars) | Soil Behavior Type |
|---|---|---|---|---|---|
| 1 | 12 | 3.25 | 10.20 | 980 | SILTY SAND |
| 2 | 12 | 4.50 | 12.60 | 1017 | SANDY SILT |
| 3 | 12 | 3.05 | 8.40 | 510 | SANDY SILT |
| 4 | 12 | 4.60 | 22.00 | 1874 | SAND |
| 5 | 12 | 3.85 | 18.60 | 1373 | SAND |
| 6 | 12 | 2.95 | 11.80 | 676 | SILTY SAND |
| 7 | 12 | 3.15 | 12.40 | 685 | SILTY SAND |
| 8 | 12 | 6.05 | 18.60 | 1154 | SILTY SAND |
| 9 | 12 | 5.85 | 17.40 | 997 | SILTY SAND |
| 10 | 12 | 9.15 | 20.00 | 1050 | SILT |
| 11 | 12 | 6.00 | 24.20 | 1491 | SAND |
| 12 | 12 | 5.75 | 22.40 | 1293 | SILTY SAND |
| 13 | 12 | 9.15 | 34.60 | 2312 | SILTY SAND |
| 14 | 12 | 7.15 | 17.00 | 756 | SANDY SILT |
| 15 | 12 | 6.15 | 15.30 | 633 | SANDY SILT |
| 16 | 12 | 10.25 | 20.50 | 870 | SILT |
| 17 | 12 | 12.60 | 27.80 | 1399 | SANDY SILT |
| 18 | 12 | 13.40 | 26.40 | 1186 | SILT |
| 19 | 12 | 11.20 | 38.40 | 2312 | SILTY SAND |
| 20 | 12 | 11.20 | 28.40 | 1421 | SANDY SILT |
| 21 | 12 | 6.40 | 13.80 | 424 | SILT |
| 22 | 12 | 4.85 | 15.40 | 537 | SILTY SAND |
| 23 | 12 | 10.20 | 32.00 | 1642 | SILTY SAND |
| 24 | 12 | 11.40 | 44.60 | 2578 | SAND |
| 25 | 12 | 8.20 | 38.40 | 1966 | SAND |
| 26 | 12 | 7.60 | 24.80 | 1053 | SILTY SAND |
| 27 | 12 | 4.65 | 18.20 | 616 | SILTY SAND |
| 28 | 12 | 11.50 | 23.60 | 851 | SILT |
| 29 | 12 | 8.20 | 20.60 | 720 | SANDY SILT |
| 30 | 12 | 6.85 | 22.40 | 826 | SILTY SAND |
| 31 | 12 | 6.15 | 38.50 | 1528 | SAND |
| 32 | 12 | 5.25 | 16.80 | 483 | SILTY SAND |
| 33 | 12 | 4.65 | 12.80 | 284 | SANDY SILT |
| 34 | 12 | 4.75 | 13.60 | 315 | SANDY SILT |
| 35 | 12 | 5.60 | 56.80 | 1697 | SAND |
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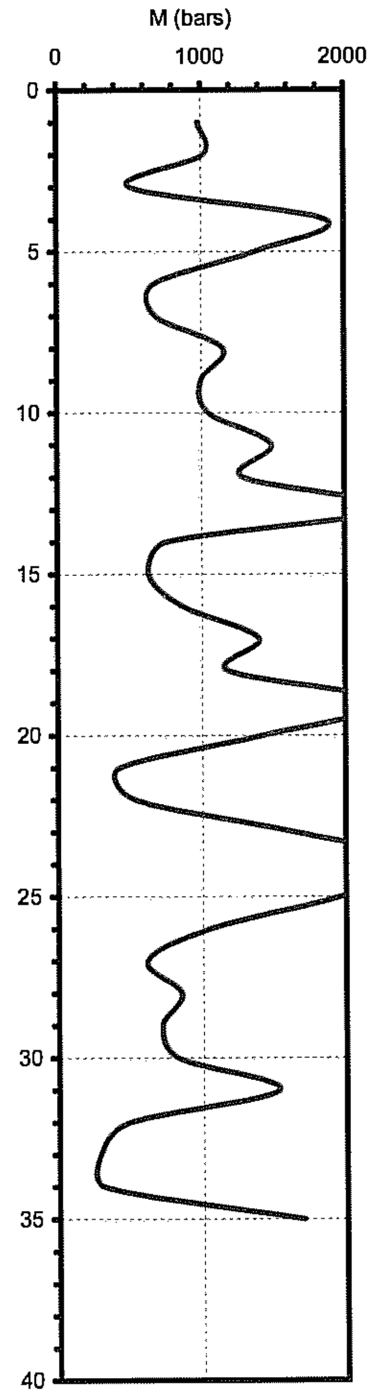
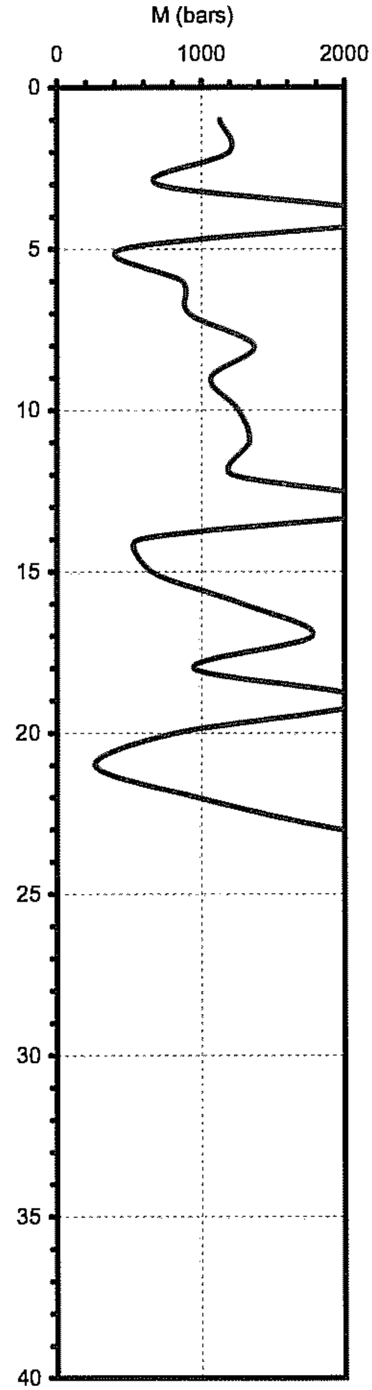



ΔA Initial: 0.20    ΔA Final: 0.20
ΔB Initial: 0.80    ΔB Final: 0.80

**Project Name: TVA**
**Sounding: D-22**
**Project Number: 10:5880**
**Date: 6/9/10**

**ECS Southeast, LLC**
**Measured DMT Values**

| Depth (feet) | Δz (inches) | A (bars) | B (bars) | M (bars) | Soil Behavior Type |
|---|---|---|---|---|---|
| 1 | 12 | 3.05 | 11.00 | 1128 | SILTY SAND |
| 2 | 12 | 3.35 | 13.40 | 1193 | SILTY SAND |
| 3 | 12 | 2.85 | 10.20 | 705 | SILTY SAND |
| 4 | 12 | 3.55 | 28.90 | 2391 | SAND |
| 5 | 12 | 3.05 | 8.75 | 452 | SANDY SILT |
| 6 | 12 | 2.85 | 14.20 | 864 | SAND |
| 7 | 12 | 3.15 | 15.40 | 917 | SAND |
| 8 | 12 | 6.00 | 20.80 | 1364 | SILTY SAND |
| 9 | 12 | 5.95 | 18.20 | 1066 | SILTY SAND |
| 10 | 12 | 7.95 | 21.40 | 1258 | SANDY SILT |
| 11 | 12 | 5.50 | 22.40 | 1334 | SAND |
| 12 | 12 | 6.05 | 21.50 | 1220 | SILTY SAND |
| 13 | 12 | 10.40 | 36.80 | 2518 | SILTY SAND |
| 14 | 12 | 7.15 | 14.80 | 568 | SILT |
| 15 | 12 | 6.05 | 15.60 | 658 | SANDY SILT |
| 16 | 12 | 12.00 | 26.00 | 1286 | SILT |
| 17 | 12 | 13.60 | 32.20 | 1770 | SANDY SILT |
| 18 | 12 | 11.40 | 22.60 | 950 | SILT |
| 19 | 12 | 10.60 | 36.80 | 2173 | SILTY SAND |
| 20 | 12 | 9.00 | 20.20 | 816 | SANDY SILT |
| 21 | 12 | 3.00 | 10.20 | 264 | SILTY SAND |
| 22 | 12 | 7.80 | 22.40 | 974 | SILTY SAND |
| 23 | 12 | 12.00 | 36.40 | 1973 | SILTY SAND |
| 24 | 12 | 13.20 | 56.00 | 3511 | SAND |
| 25 | 12 | 10.20 | 60.00 | 3485 | SAND |
| 26 | 12 | 8.40 | 58.50 | 3057 | SAND |
| 27 | 12 | 6.80 | 60.00 | 2635 | SAND |




ΔA Initial: 0.20 ΔA Final: 0.20
ΔB Initial: 0.80 ΔB Final: 0.80

**Project Name: TVA**
**Sounding: D-23**
**Project Number: 10:5880**
**Date: 6/9/10**

**ECS Southeast, LLC**
**Measured DMT Values**

| Depth (feet) | Δz (inches) | A (bars) | B (bars) | M (bars) | Soil Behavior Type |
|---|---|---|---|---|---|
| 1 | 12 | 2.55 | 9.45 | 938 | SILTY SAND |
| 2 | 12 | 3.25 | 11.20 | 913 | SILTY SAND |
| 3 | 12 | 2.90 | 7.30 | 392 | SILT |
| 4 | 12 | 3.15 | 40.00 | 2993 | SAND |
| 5 | 12 | 2.10 | 9.20 | 510 | SILTY SAND |
| 6 | 12 | 2.95 | 13.00 | 775 | SAND |
| 7 | 12 | 2.90 | 13.40 | 758 | SAND |
| 8 | 12 | 5.70 | 21.80 | 1462 | SILTY SAND |
| 9 | 12 | 6.15 | 16.20 | 875 | SANDY SILT |
| 10 | 12 | 8.20 | 21.20 | 1230 | SANDY SILT |
| 11 | 12 | 5.10 | 20.00 | 1141 | SILTY SAND |
| 12 | 12 | 5.85 | 20.50 | 1142 | SILTY SAND |
| 13 | 12 | 8.15 | 46.00 | 3223 | SAND |
| 14 | 12 | 6.70 | 16.90 | 765 | SANDY SILT |
| 15 | 12 | 5.85 | 15.40 | 650 | SANDY SILT |
| 16 | 12 | 11.90 | 23.80 | 1080 | SILT |
| 17 | 12 | 13.80 | 29.10 | 1454 | SILT |
| 18 | 12 | 11.30 | 23.40 | 1030 | SILT |
| 19 | 12 | 10.00 | 51.90 | 3339 | SAND |
| 20 | 12 | 8.20 | 21.40 | 936 | SANDY SILT |
| 21 | 12 | 3.05 | 9.80 | 250 | SILTY SAND |
| 22 | 12 | 6.55 | 16.60 | 595 | SANDY SILT |
| 23 | 12 | 9.80 | 45.00 | 2597 | SAND |
| 24 | 12 | 10.80 | 60.00 | 3633 | SAND |
| 25 | 12 | 6.40 | 60.00 | 2637 | SAND |
| 26 | 12 | 8.70 | 20.20 | 728 | SANDY SILT |
| 27 | 12 | 5.65 | 15.20 | 457 | SANDY SILT |
| 28 | 12 | 10.80 | 24.80 | 968 | SANDY SILT |
| 29 | 12 | 7.80 | 21.80 | 805 | SILTY SAND |
| 30 | 12 | 6.25 | 24.20 | 928 | SILTY SAND |
| 31 | 12 | 6.05 | 43.20 | 1686 | SAND |
| 32 | 12 | 4.95 | 15.70 | 429 | SILTY SAND |
| 33 | 12 | 4.70 | 14.40 | 357 | SILTY SAND |
| 34 | 12 | 3.95 | 10.00 | 170 | SANDY SILT |
| 35 | 12 | 4.20 | 60.00 | 1694 | SAND |
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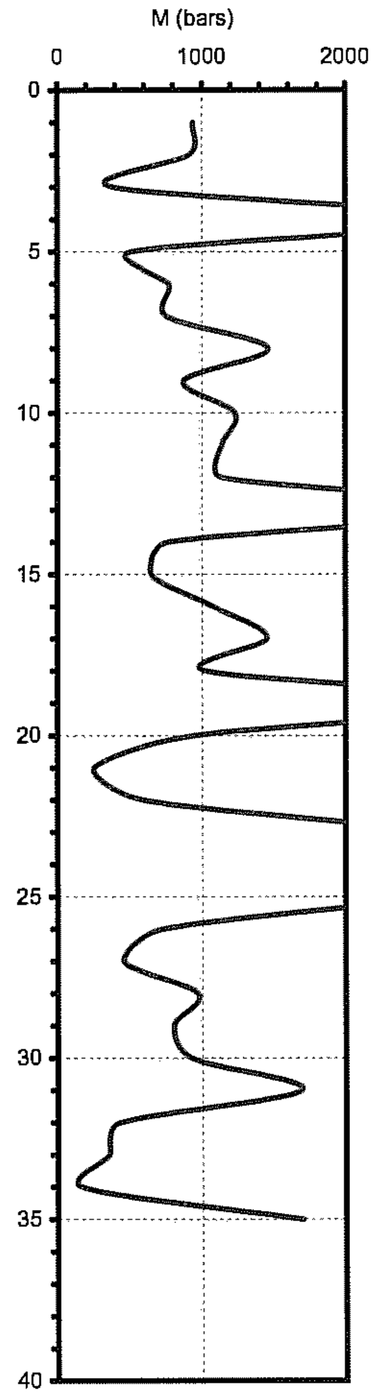
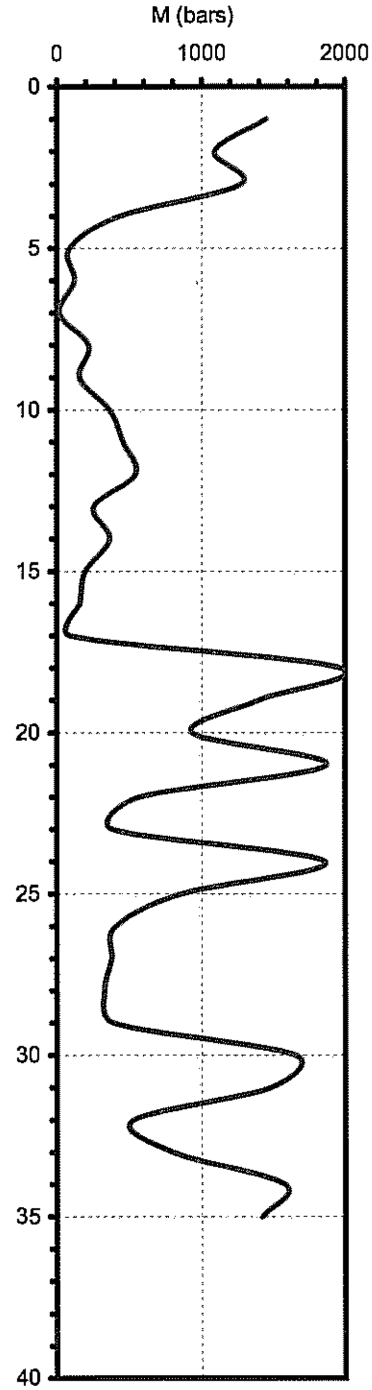



ΔA Initial: 0.20 ΔA Final: 0.20
ΔB Initial: 0.80 ΔB Final: 0.80

**Project Name: TVA**
**Sounding: D-24**
**Project Number: 10:5880**
**Date: 6/9/10**

**ECS Southeast, LLC**
**Measured DMT Values**

| Depth (feet) | Δz (inches) | A (bars) | B (bars) | M (bars) | Soil Behavior Type |
|---|---|---|---|---|---|
| 1 | 12 | 3.50 | 13.20 | 1451 | SILTY SAND |
| 2 | 12 | 4.60 | 13.20 | 1094 | SANDY SILT |
| 3 | 12 | 5.40 | 16.00 | 1277 | SILTY SAND |
| 4 | 12 | 2.80 | 8.00 | 430 | SANDY SILT |
| 5 | 12 | 1.70 | 3.80 | 88 | CLAYEY SILT |
| 6 | 12 | 1.60 | 4.30 | 121 | SILT |
| 7 | 12 | 1.85 | 3.10 | 18 | MUD |
| 8 | 12 | 2.15 | 6.25 | 219 | SANDY SILT |
| 9 | 12 | 2.85 | 5.90 | 156 | CLAYEY SILT |
| 10 | 12 | 3.00 | 9.00 | 366 | SANDY SILT |
| 11 | 12 | 5.10 | 11.40 | 457 | SILT |
| 12 | 12 | 4.50 | 12.40 | 542 | SANDY SILT |
| 13 | 12 | 3.85 | 8.40 | 255 | SILT |
| 14 | 12 | 5.35 | 11.00 | 366 | CLAYEY SILT |
| 15 | 12 | 2.80 | 7.30 | 195 | SANDY SILT |
| 16 | 12 | 3.55 | 7.15 | 159 | CLAYEY SILT |
| 17 | 12 | 2.40 | 5.60 | 100 | SILT |
| 18 | 12 | 8.10 | 33.00 | 1967 | SAND |
| 19 | 12 | 10.80 | 27.00 | 1397 | SANDY SILT |
| 20 | 12 | 8.50 | 21.00 | 935 | SANDY SILT |
| 21 | 12 | 6.55 | 35.00 | 1868 | SAND |
| 22 | 12 | 7.05 | 16.00 | 565 | SILT |
| 23 | 12 | 4.10 | 12.60 | 389 | SILTY SAND |
| 24 | 12 | 8.15 | 35.00 | 1858 | SAND |
| 25 | 12 | 10.20 | 22.00 | 858 | SILT |
| 26 | 12 | 5.80 | 13.80 | 405 | SANDY SILT |
| 27 | 12 | 6.50 | 13.80 | 379 | SILT |
| 28 | 12 | 5.10 | 12.60 | 330 | SANDY SILT |
| 29 | 12 | 6.65 | 14.40 | 394 | SILT |
| 30 | 12 | 7.95 | 35.00 | 1651 | SAND |
| 31 | 12 | 6.40 | 35.00 | 1484 | SAND |
| 32 | 12 | 6.60 | 17.20 | 526 | SANDY SILT |
| 33 | 12 | 8.45 | 22.40 | 807 | SANDY SILT |
| 34 | 12 | 8.40 | 35.00 | 1577 | SAND |
| 35 | 12 | 6.70 | 35.00 | 1423 | SAND |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

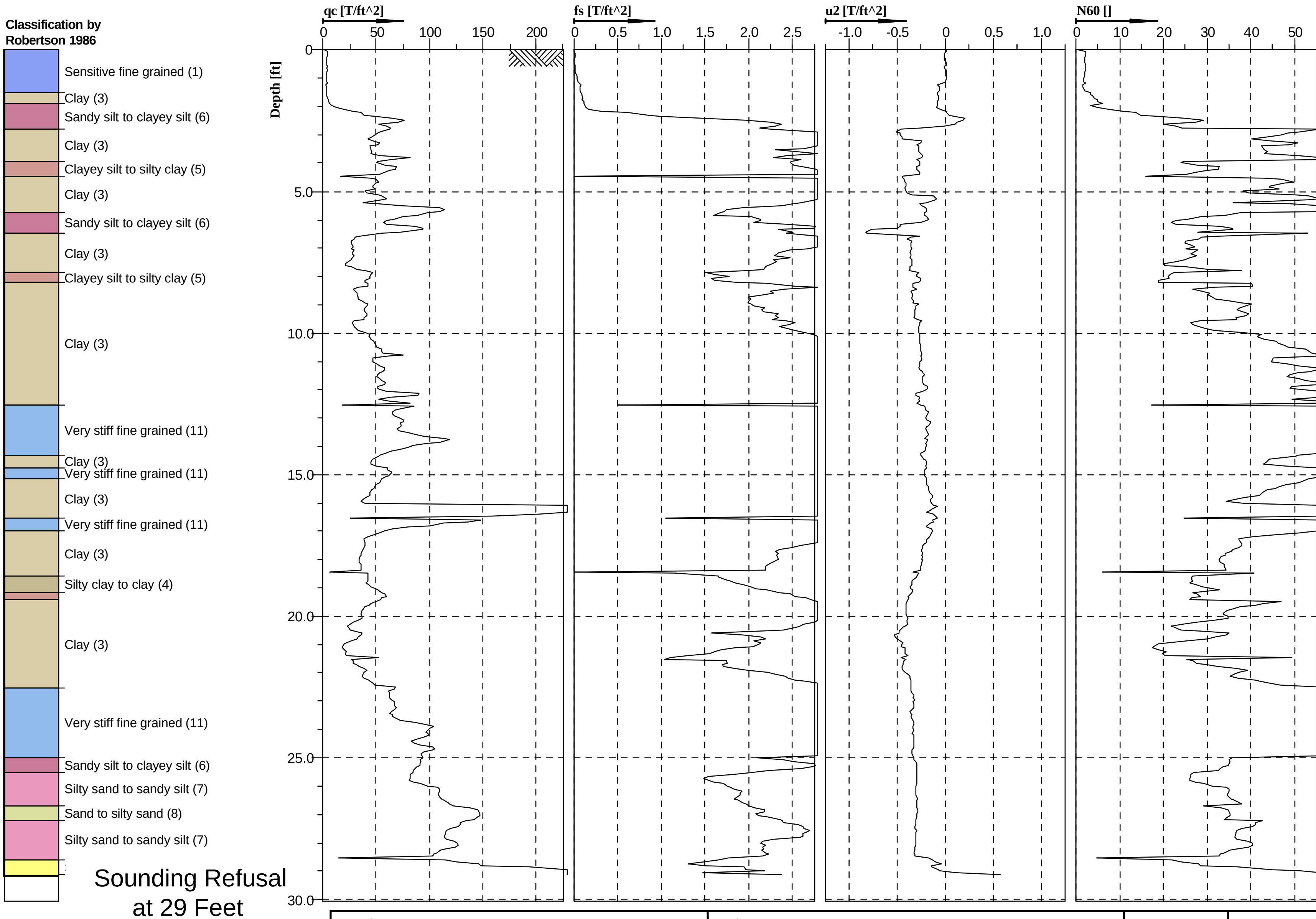



ΔA Initial: 0.20 ΔA Final: 0.20
ΔB Initial: 0.80 ΔB Final: 0.80

**Project Name: TVA**
**Sounding: D-25**
**Project Number: 10:5880**
**Date: 6/9/10**

ECS LLC SOUTHEAST

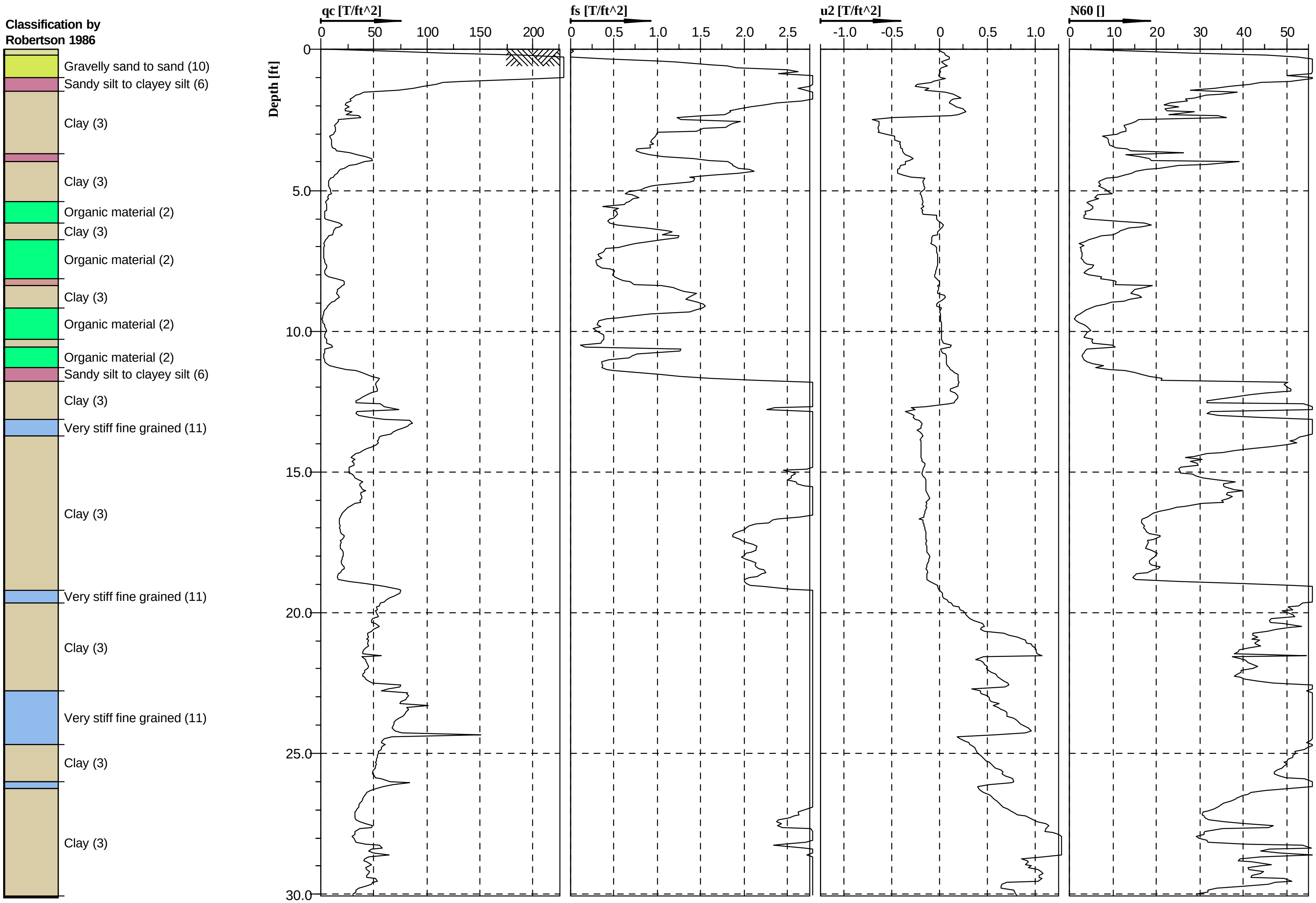
**ECS Southeast, LLC**
**Measured DMT Values**




U2

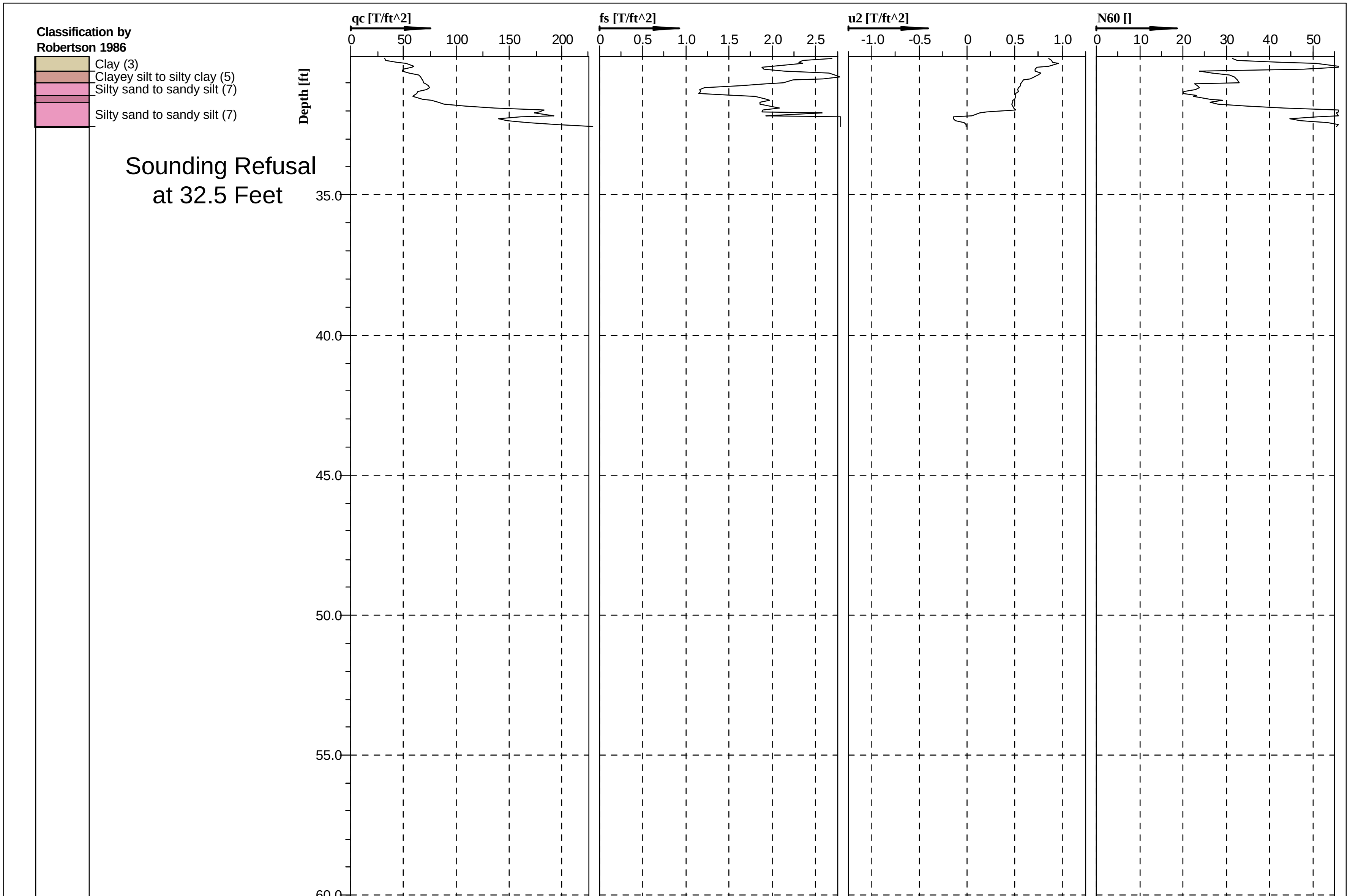
Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

| Location: | Project ID: | Ground Elev.: | Test No.: |
|---|---|---|---|
| Rogersville, Tennessee | 10:5880 | | C-10 |
| Project: | Client: | Date: | Page.: |
| TVA John Sevier Fossil Plant - Dike Investigation | URS Corporation | 5/27/10 | 1/1 |




Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

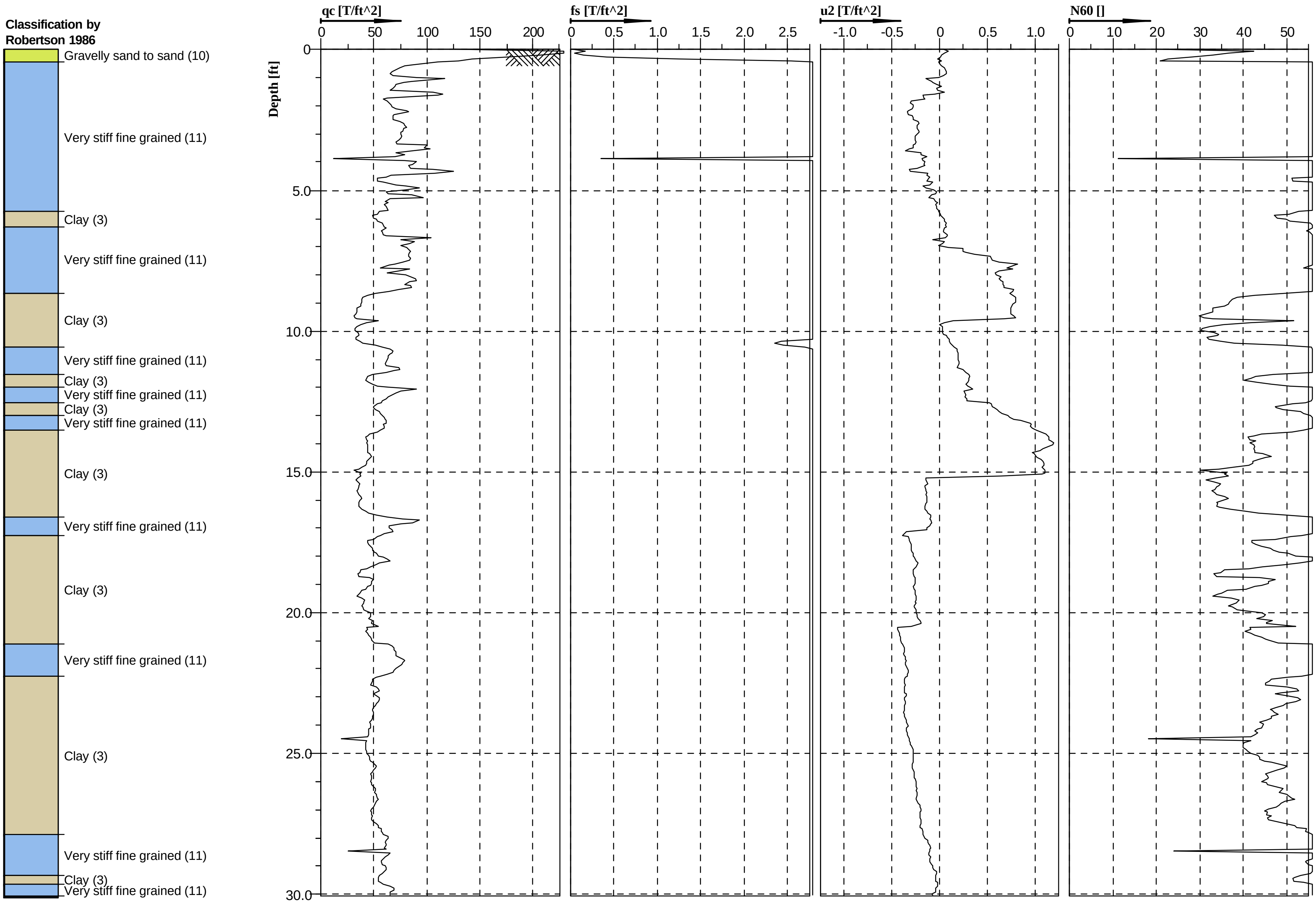
| Location: | Project ID: | Ground Elev.: | Test No.: |
|---|---|---|---|
| Rogersville, Tennessee | 10:5880 | | C-11 |
| Project: | Client: | Date: | Page.: |
| TVA John Sevier Fossil Plant - Dike Investigation | URS Corporation | 5/27/10 | 1/2 |




U2

Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

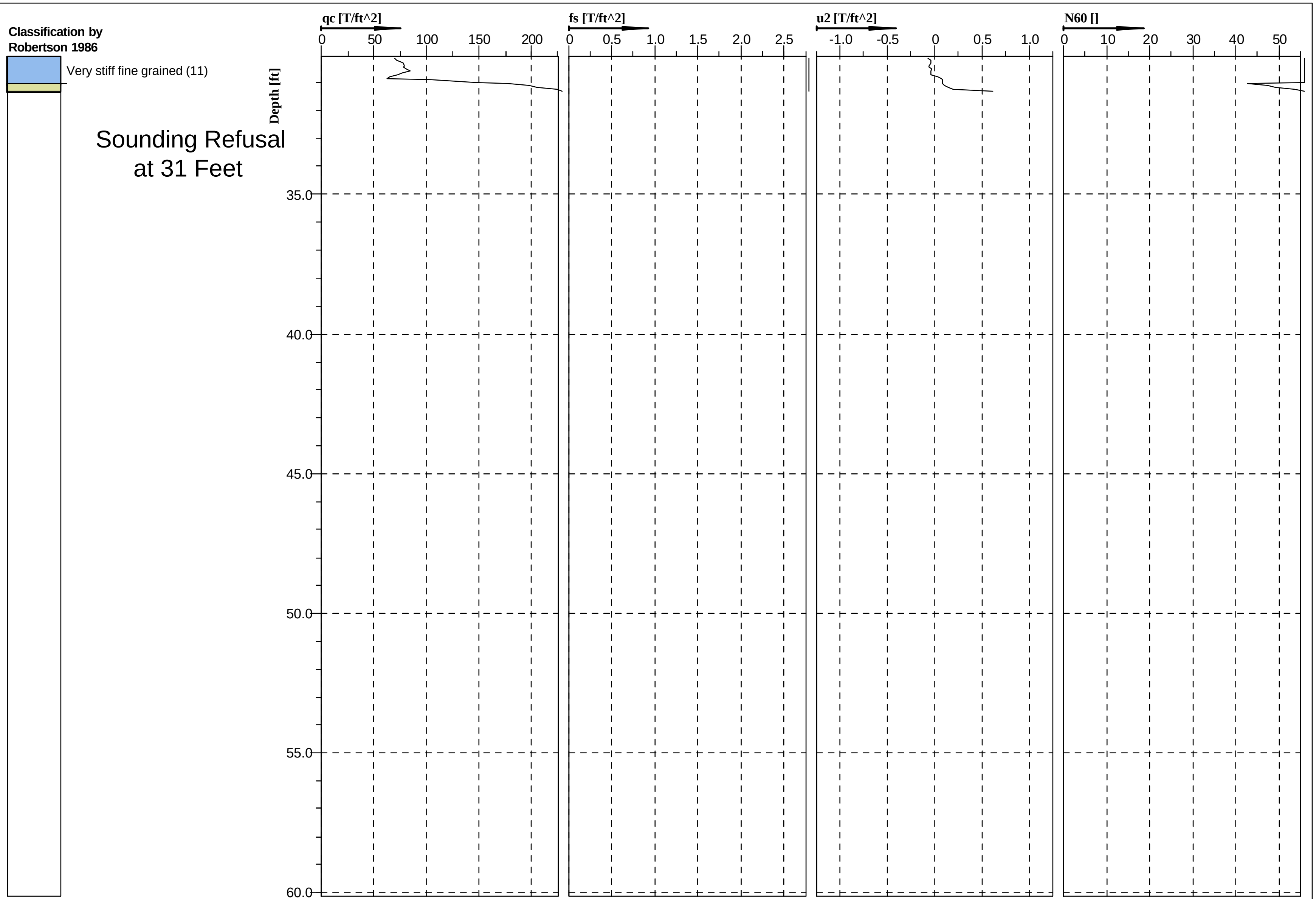
| | | | |
|---|---|---|---|
| Location: Rogersville, Tennessee | Project ID: 10:5880 | Ground Elev.: | Test No.: C-11 |
| Project: TVA John Sevier Fossil Plant - Dike Investigation | Client: URS Corporation | Date: 5/27/10 | Page.: 2/2 |




U2

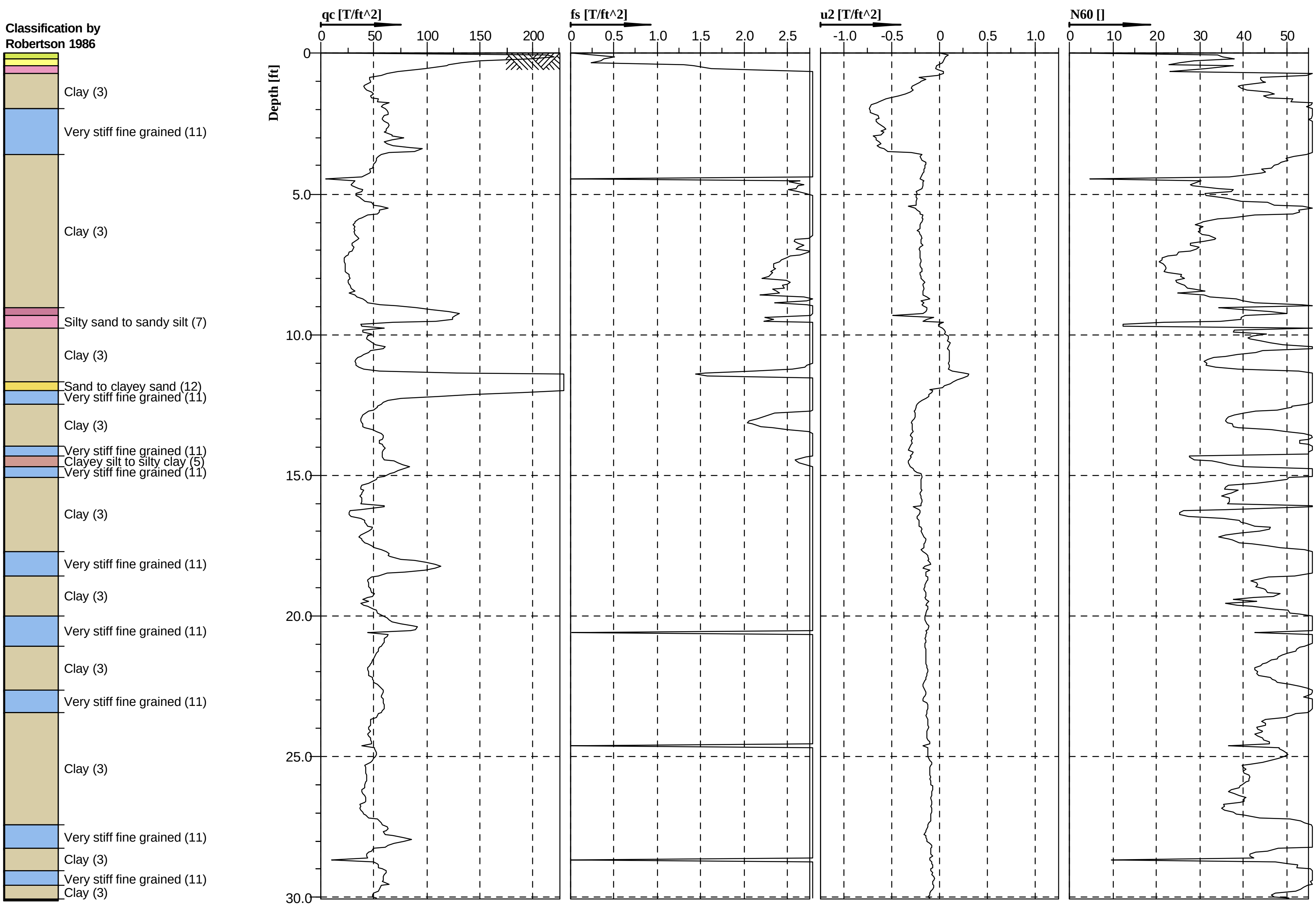
Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

| Location: Rogersville, Tennessee | Project ID: 10:5880 | Ground Elev.: | Test No.: C-13.2 |
|---|---|---|---|
| Project: TVA John Sevier Fossil Plant - Dike Investigation | Client: URS Corporation | Date: 5/27/10 | Page.: 1/2 |




Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

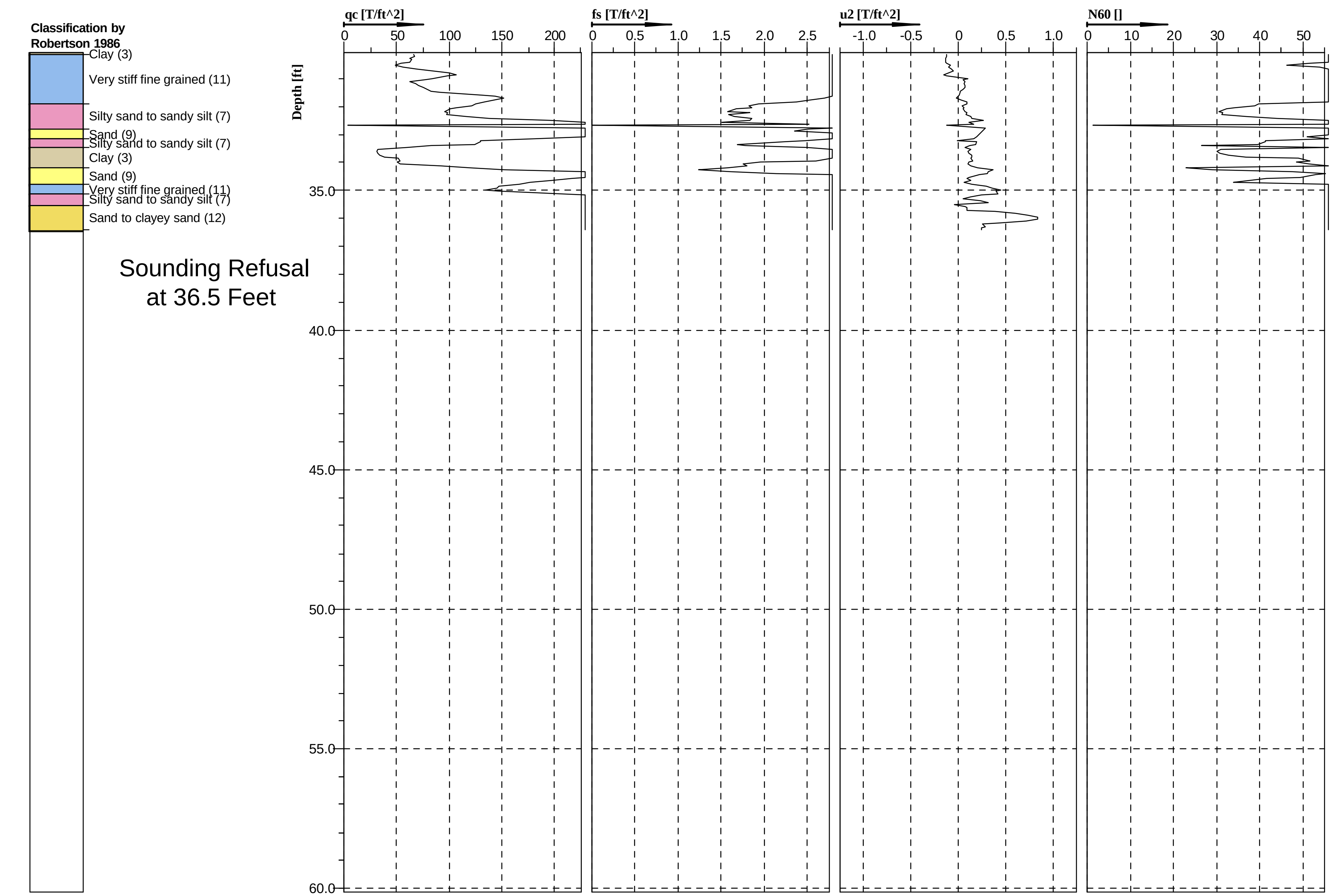
| Location: | Project ID: | Ground Elev.: | Test No.: |
|---|---|---|---|
| Rogersville, Tennessee | 10:5880 | | C-13.2 |
| Project: | Client: | Date: | Page.: |
| TVA John Sevier Fossil Plant - Dike Investigation | URS Corporation | 5/27/10 | 2/2 |




U2

Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

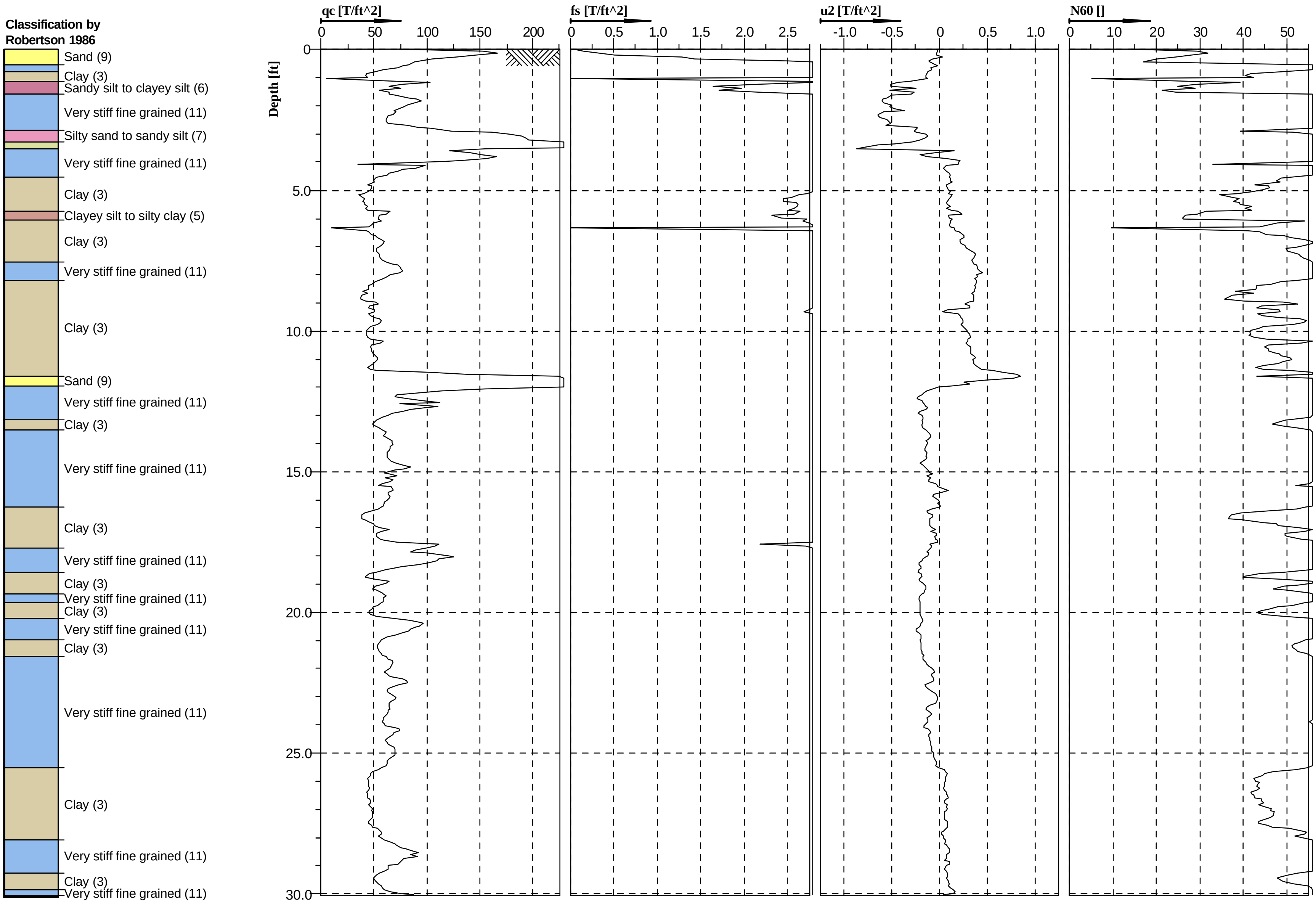
| Location: | Project ID: | Ground Elev.: | Test No.: |
|---|---|---|---|
| Rogersville, Tennessee | 10:5880 | | C-15 |
| **Project:** | **Client:** | **Date:** | **Page.:** |
| TVA John Sevier Fossil Plant - Dike Investigation | URS Corporation | 5/27/10 | 1/2 |




U2

Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

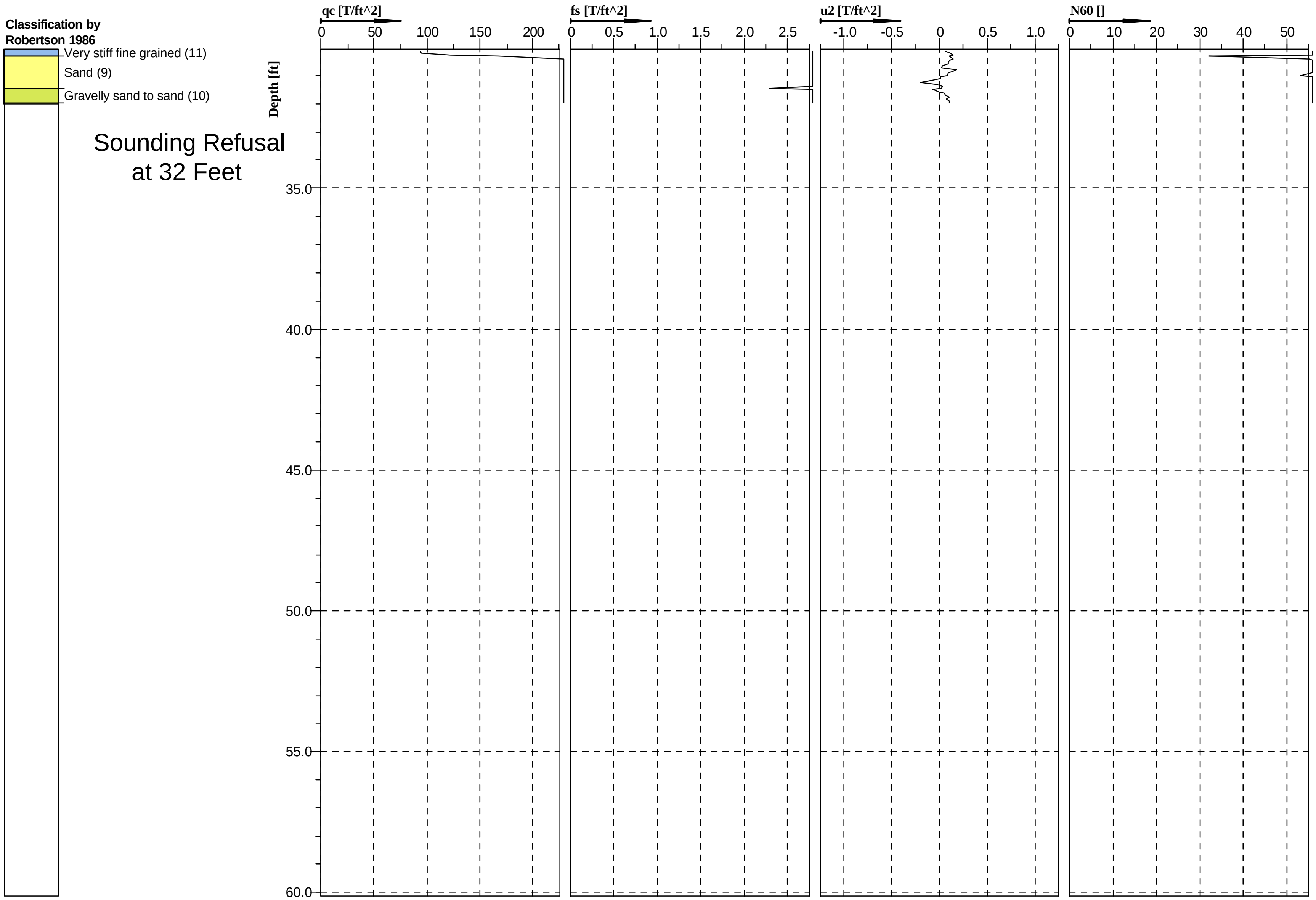
| Location: Rogersville, Tennessee | Project ID: 10:5880 | Ground Elev.: | Test No.: C-15 |
|---|---|---|---|
| Project: TVA John Sevier Fossil Plant - Dike Investigation | Client: URS Corporation | Date: 5/27/10 | Page.: 2/2 |




U2

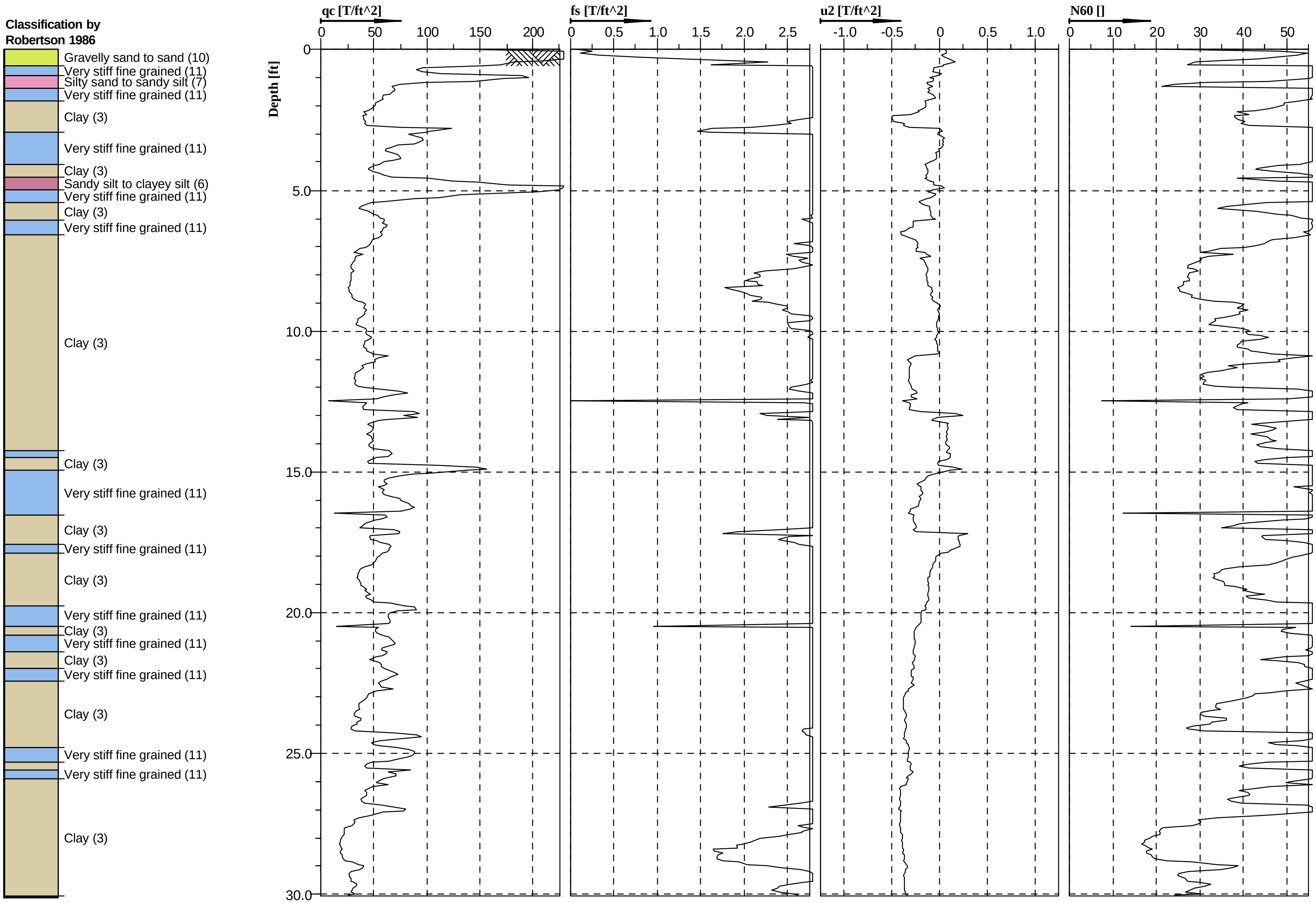
Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

| Location: | Project ID: | Ground Elev.: | Test No.: |
|---|---|---|---|
| Rogersville, Tennessee | 10:5880 | | C-16 |
| Project: | Client: | Date: | Page.: |
| TVA John Sevier Fossil Plant - Dike Investigation | URS Corporation | 5/27/10 | 1/2 |

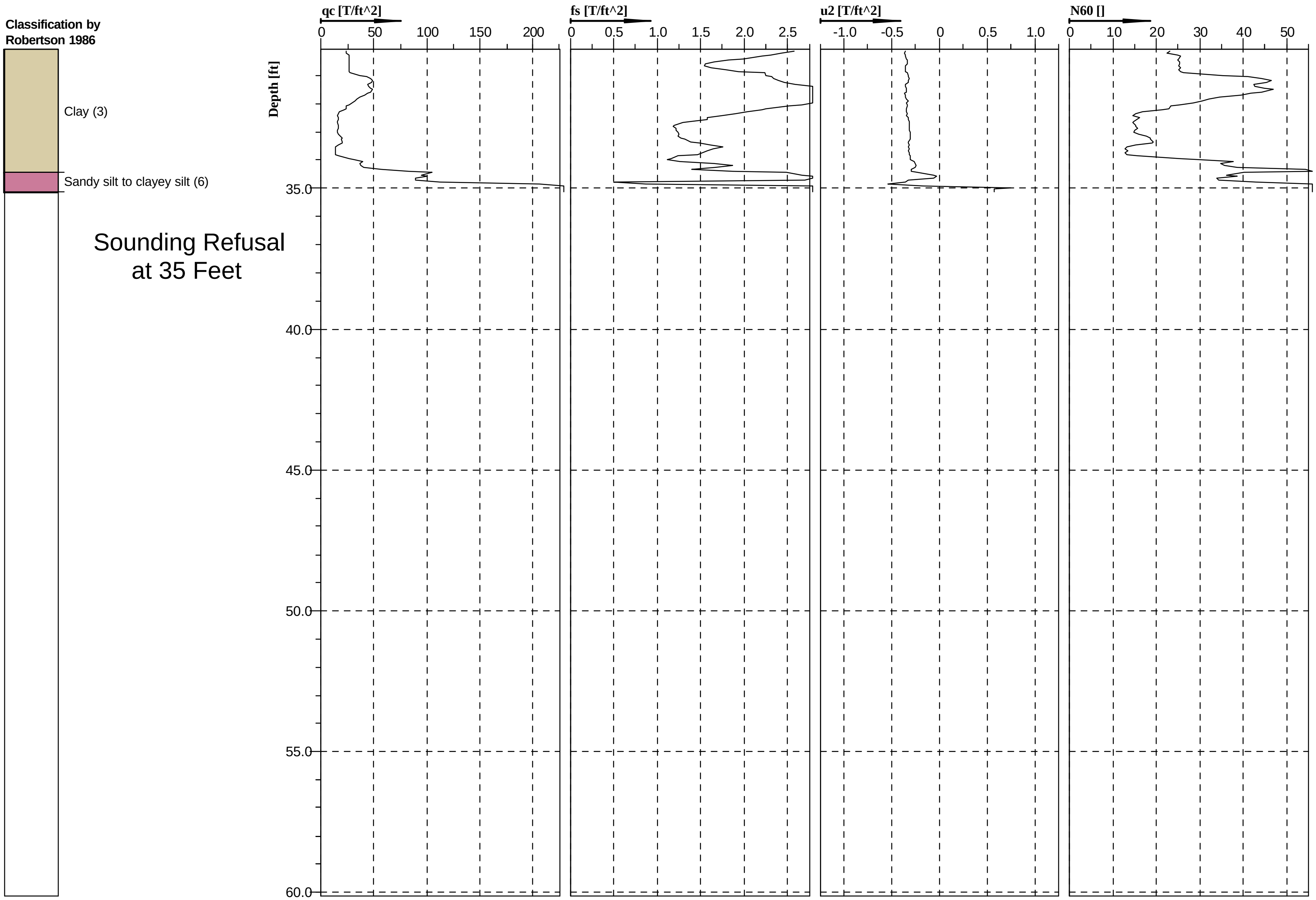



Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

| Location: Rogersville, Tennessee | Project ID: 10:5880 | Ground Elev.: | Test No.: C-16 |
|---|---|---|---|
| Project: TVA John Sevier Fossil Plant - Dike Investigation | Client: URS Corporation | Date: 5/27/10 | Page.: 2/2 |

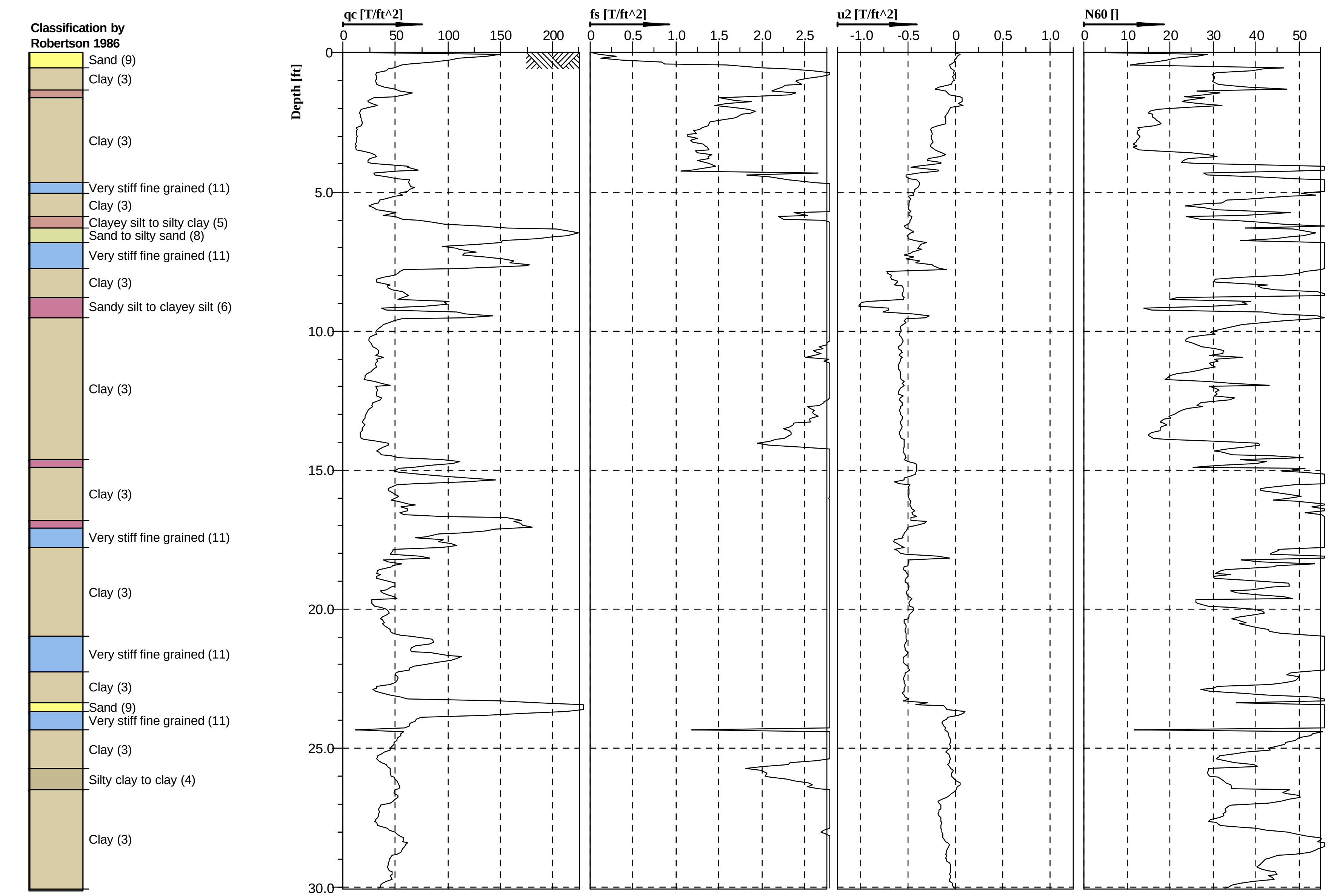


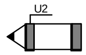

| Location: Rogersville, Tennessee | Project ID: 10:5880 | Ground Elev.: | Test No.: C-18 |
|---|---|---|---|
| Project: TVA John Sevier Fossil Plant - Dike Investigation | Client: URS Corporation | Date: 5/27/10 | Page.: 1/2 |




Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

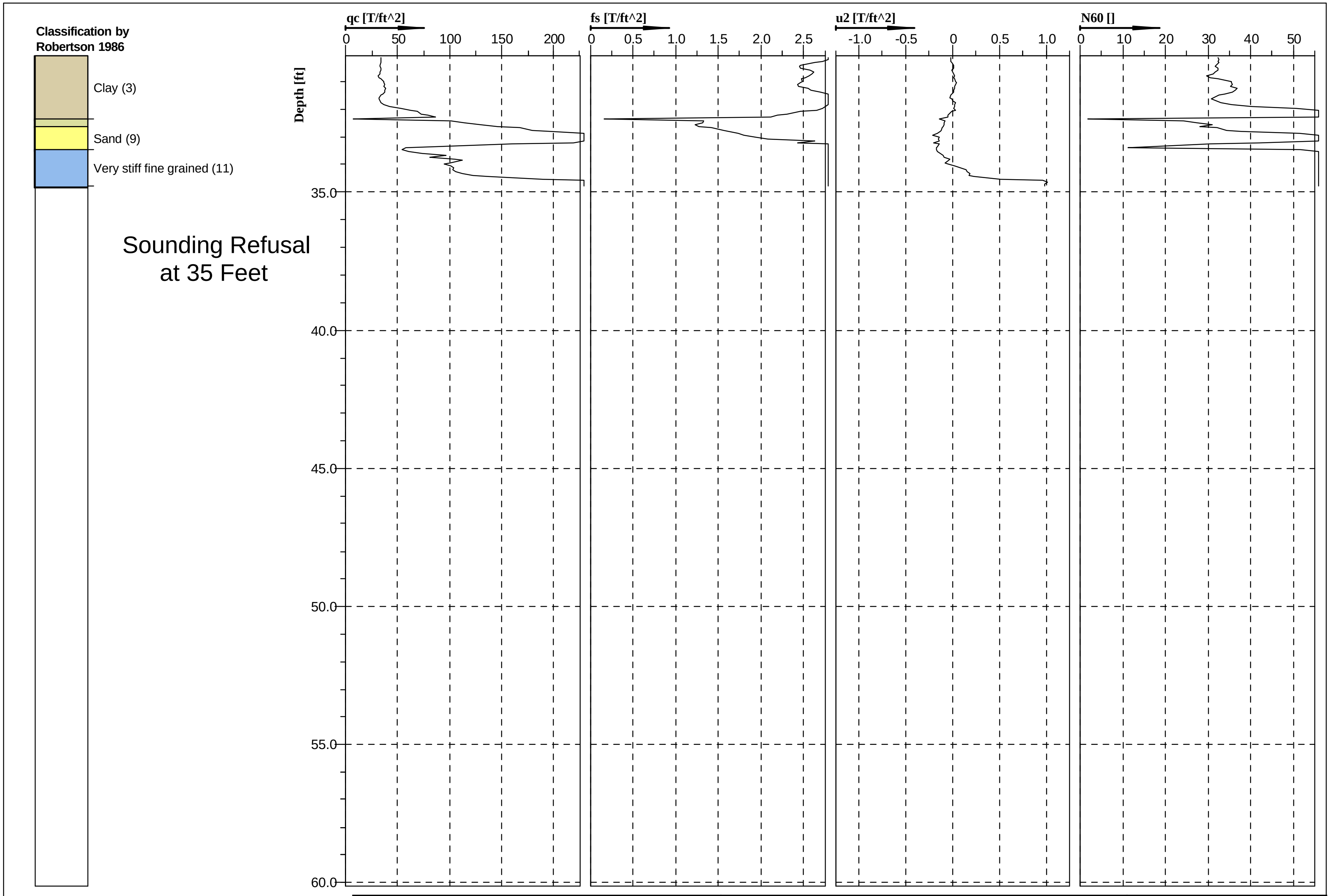
| | | | |
|---|---|---|---|
| Location: Rogersville, Tennessee | Project ID: 10:5880 | Ground Elev.: | Test No.: C-18 |
| Project: TVA John Sevier Fossil Plant - Dike Investigation | Client: URS Corporation | Date: 5/27/10 | Page.: 2/2 |



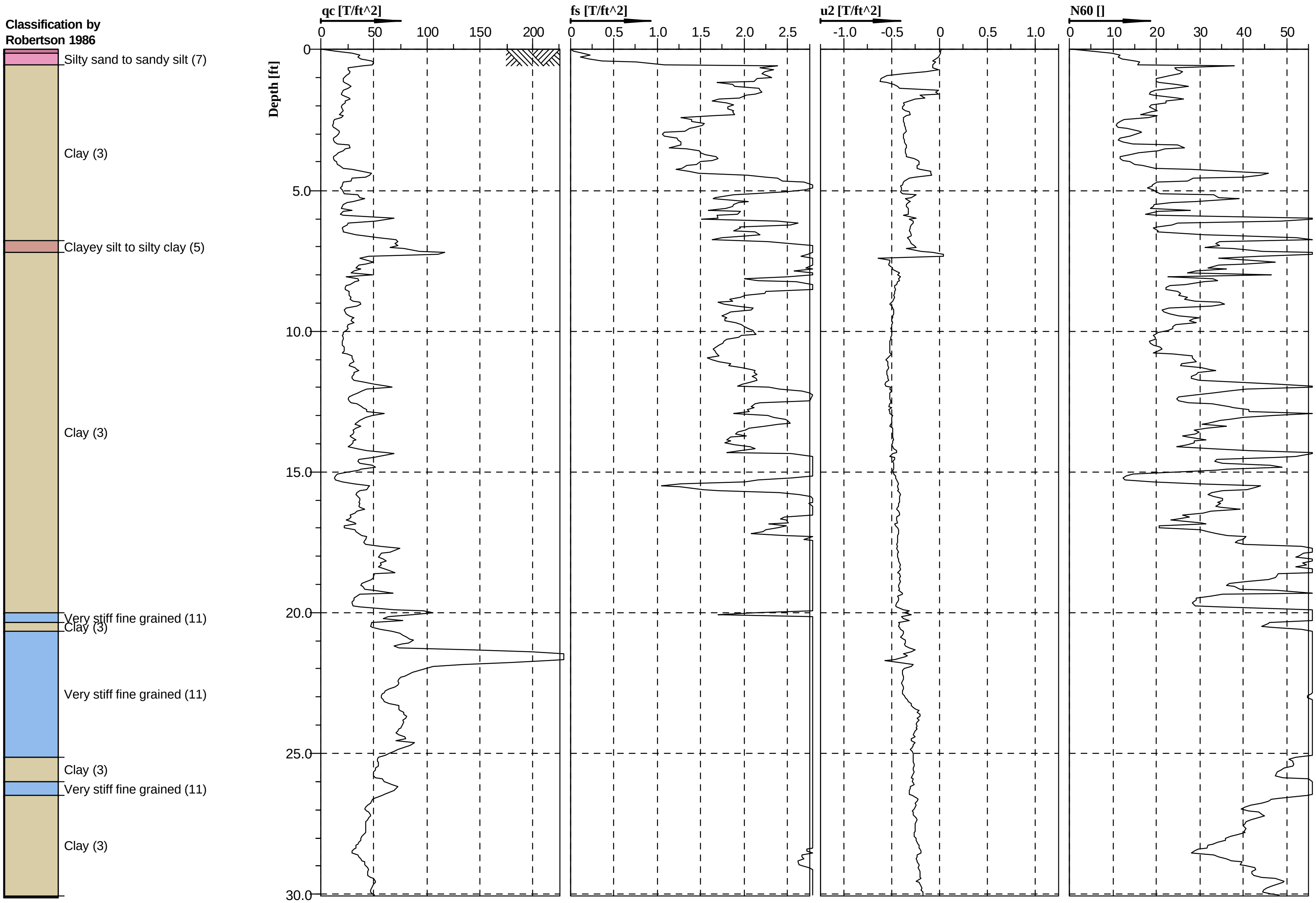

Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

| Location: | Project ID: | Ground Elev.: | Test No.: |
|---|---|---|---|
| Rogersville, Tennessee | 10:5880 | | C-20 |
| **Project:** | **Client:** | **Date:** | **Page.:** |
| TVA John Sevier Fossil Plant - Dike Investigation | URS Corporation | 5/27/10 | 1/2 |




Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

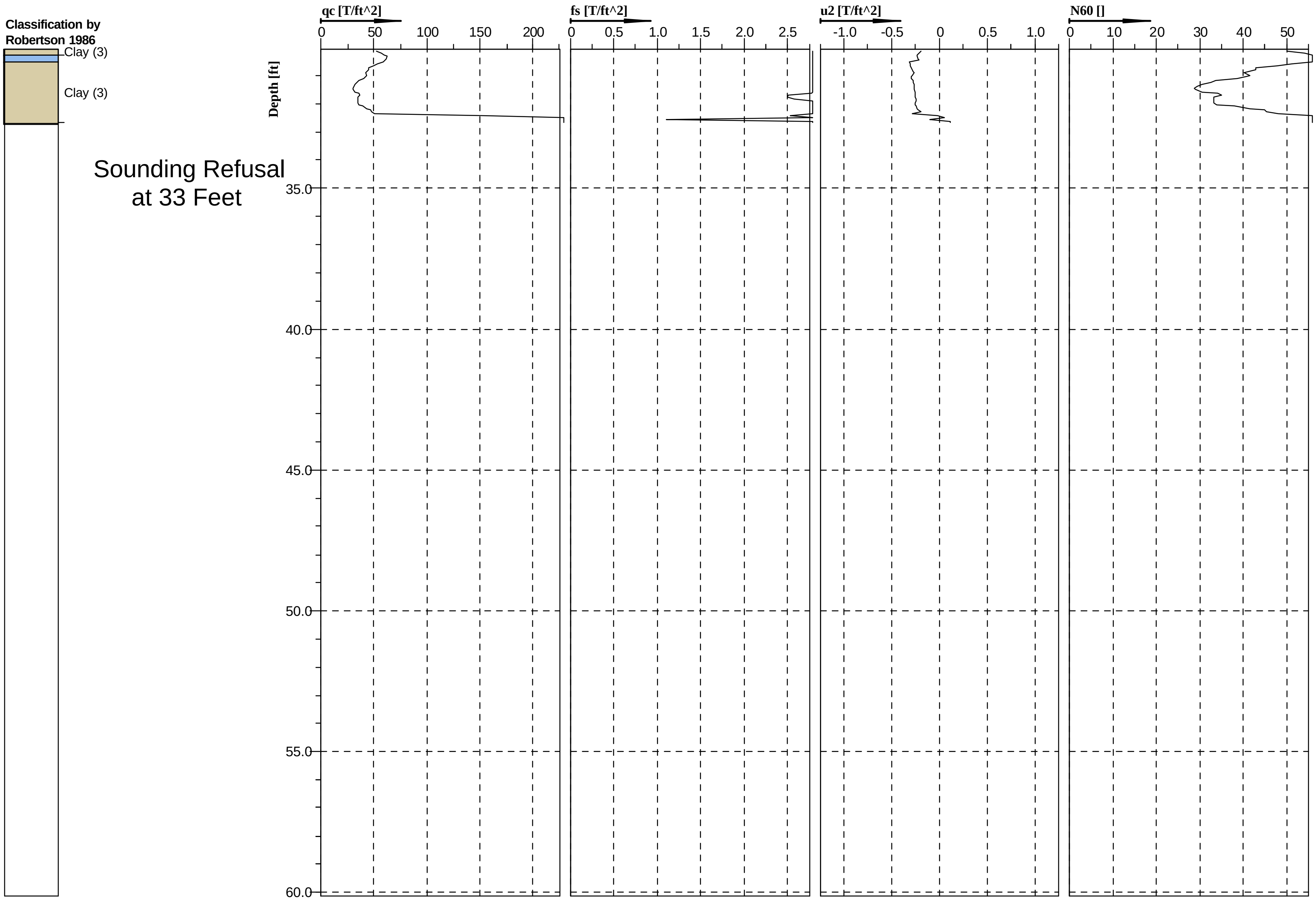
| Location: | Project ID: | Ground Elev.: | Test No.: |
|---|---|---|---|
| Rogersville, Tennessee | 10:5880 | | C-20 |
| Project: | Client: | Date: | Page.: |
| TVA John Sevier Fossil Plant - Dike Investigation | URS Corporation | 5/27/10 | 2/2 |




ECS LLP CAROLINAS

Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

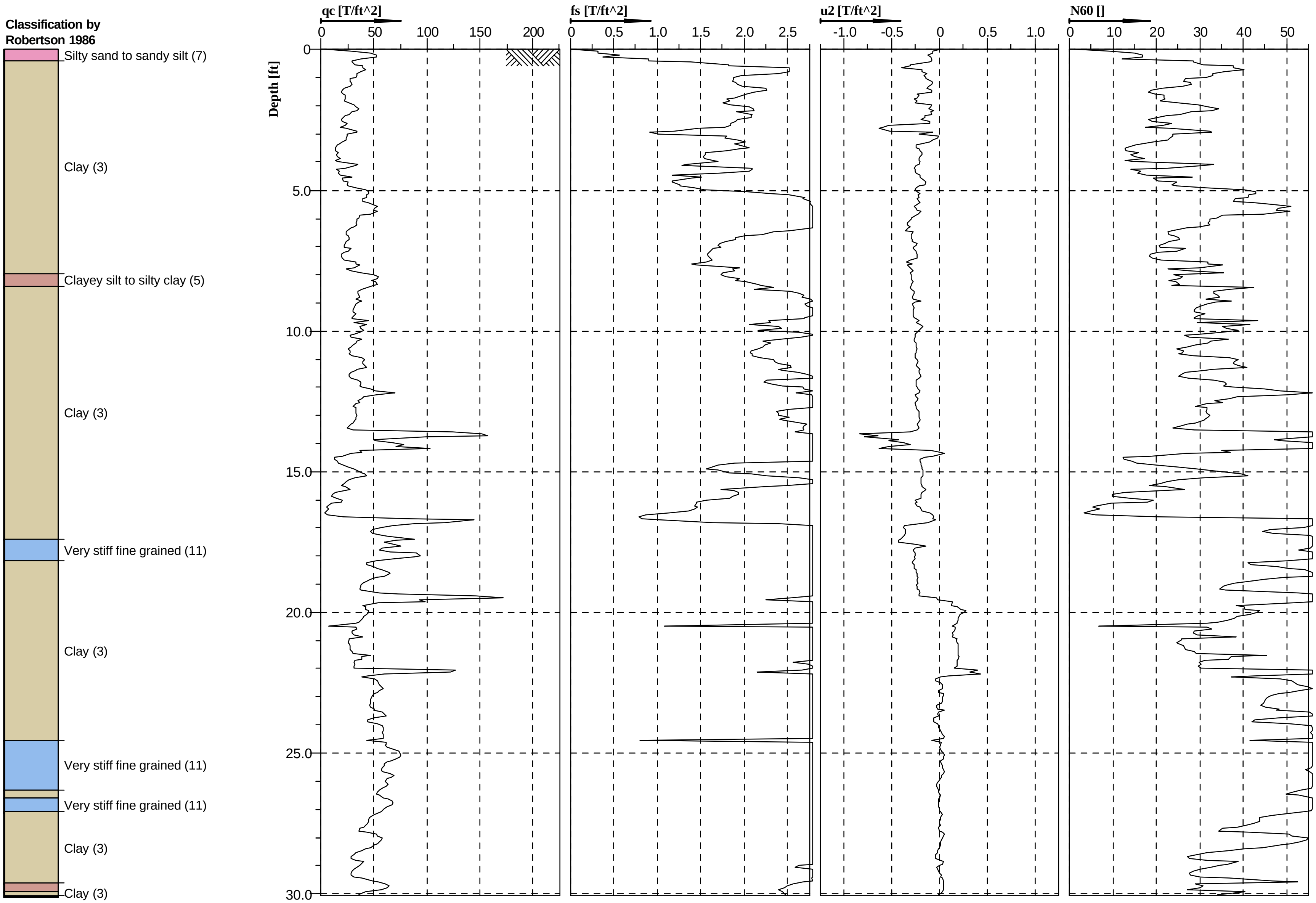
| Location: Rogersville, Tennessee | Project ID: 10:5880 | Ground Elev.: | Test No.: C-21 |
|---|---|---|---|
| Project: TVA John Sevier Fossil Plant - Dike Investigation | Client: URS Corporation | Date: 5/27/10 | Page.: 1/2 |




ECS LLP CAROLINAS

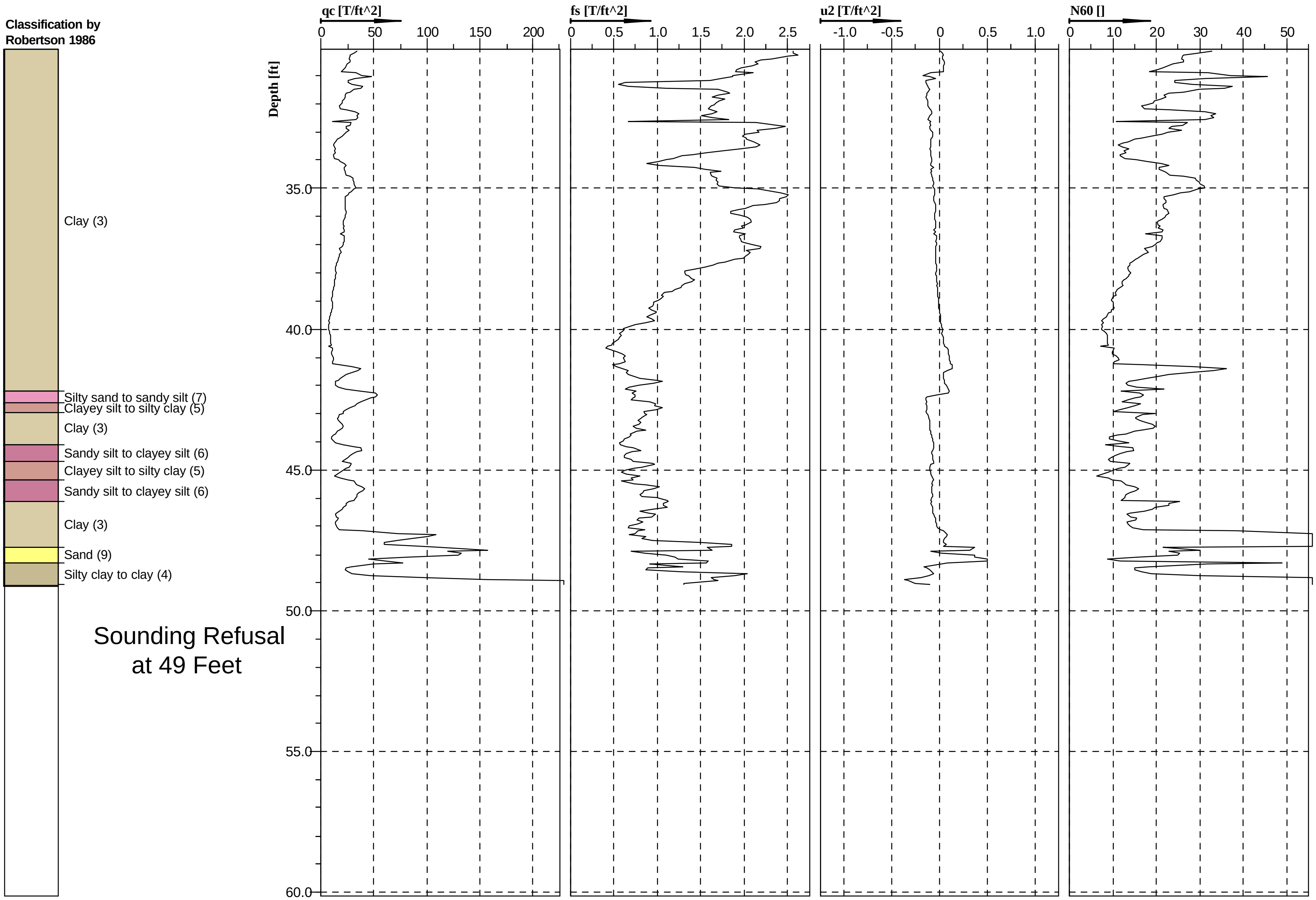
Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

| Location: | Project ID: | Ground Elev.: | Test No.: |
|---|---|---|---|
| Rogersville, Tennessee | 10:5880 | | C-21 |
| **Project:** | **Client:** | **Date:** | **Page.:** |
| TVA John Sevier Fossil Plant - Dike Investigation | URS Corporation | 5/27/10 | 2/2 |




Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

| Location: Rogersville, Tennessee | Project ID: 10:5880 | Ground Elev.: | Test No.: C-23 |
|---|---|---|---|
| Project: TVA John Sevier Fossil Plant - Dike Investigation | Client: URS Corporation | Date: 5/27/10 | Page.: 1/2 |

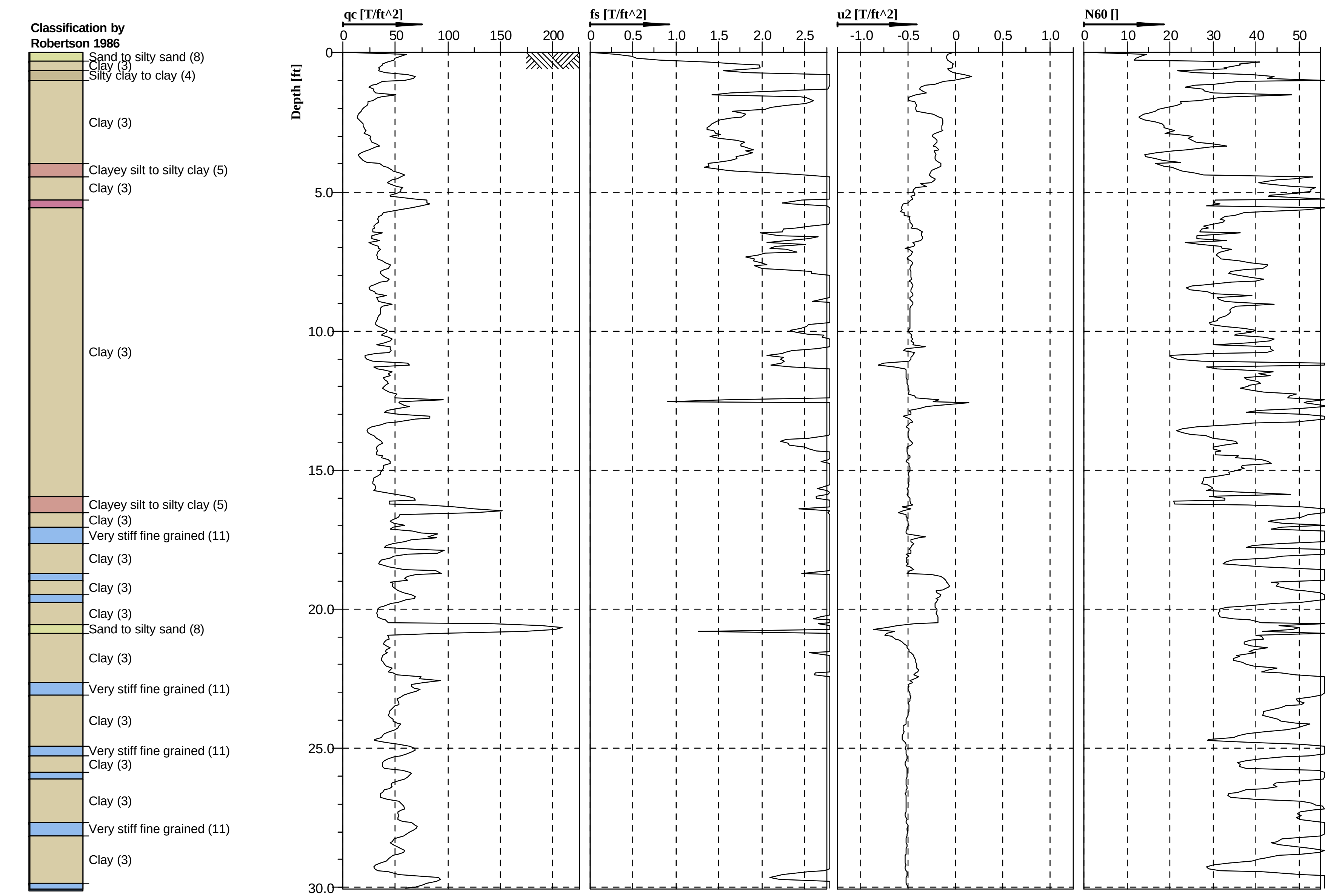



ECS LLP CAROLINAS

U2

Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

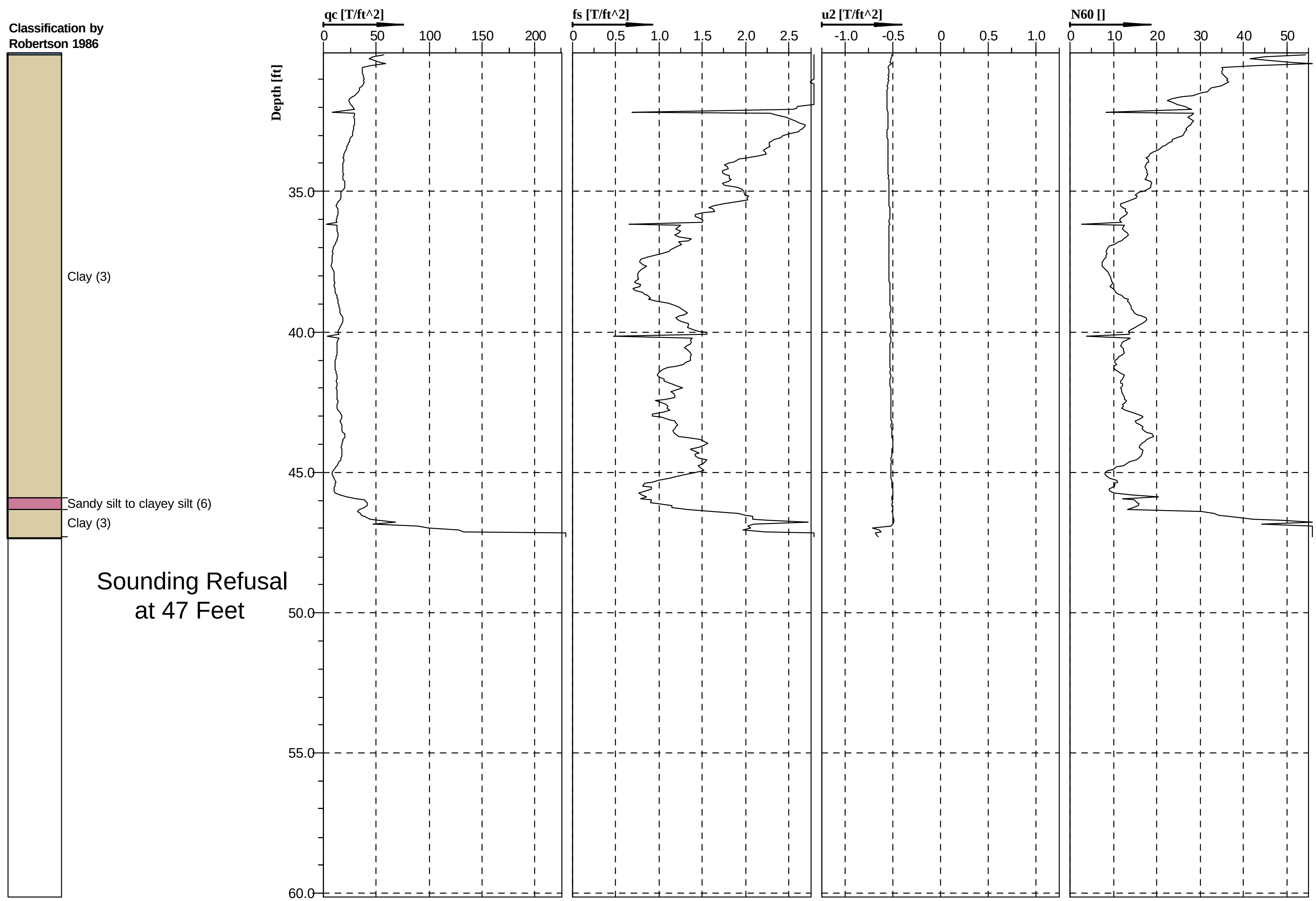
| Location: | Project ID: | Ground Elev.: | Test No.: |
|---|---|---|---|
| Rogersville, Tennessee | 10:5880 | | C-23 |
| Project: | Client: | Date: | Page.: |
| TVA John Sevier Fossil Plant - Dike Investigation | URS Corporation | 5/27/10 | 2/2 |




U2

Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

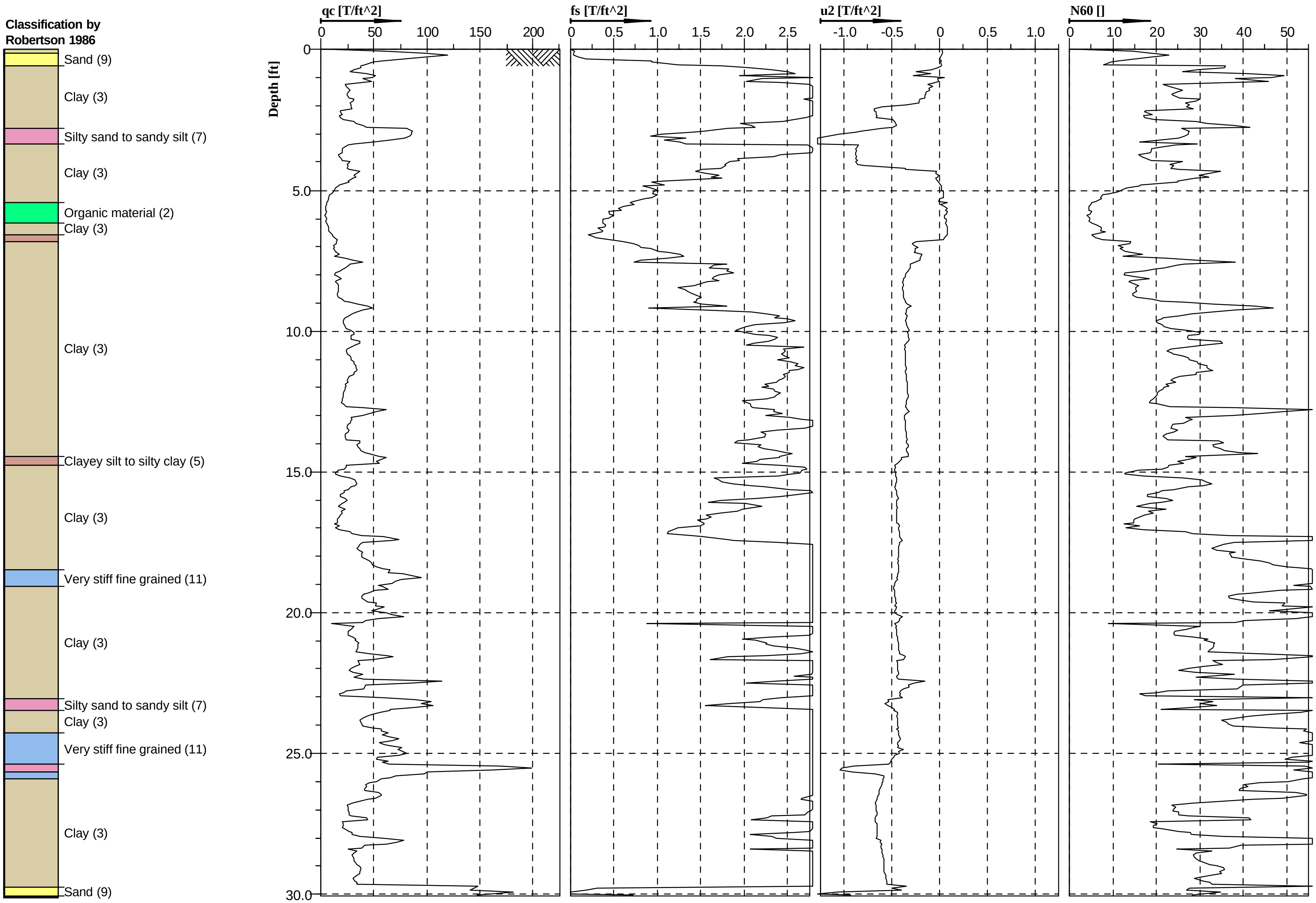
| Location: | Project ID: | Ground Elev.: | Test No.: |
|---|---|---|---|
| Rogersville, Tennessee | 10:5880 | | C-24 |
| Project: | Client: | Date: | Page.: |
| TVA John Sevier Fossil Plant - Dike Investigation | URS Corporation | 5/27/10 | 1/2 |




| | | | |
|---|---|---|---|
| Location: Rogersville, Tennessee | Project ID: 10:5880 | Ground Elev.: | Test No.: C-24 |
| Project: TVA John Sevier Fossil Plant - Dike Investigation | Client: URS Corporation | Date: 5/27/10 | Page.: 2/2 |

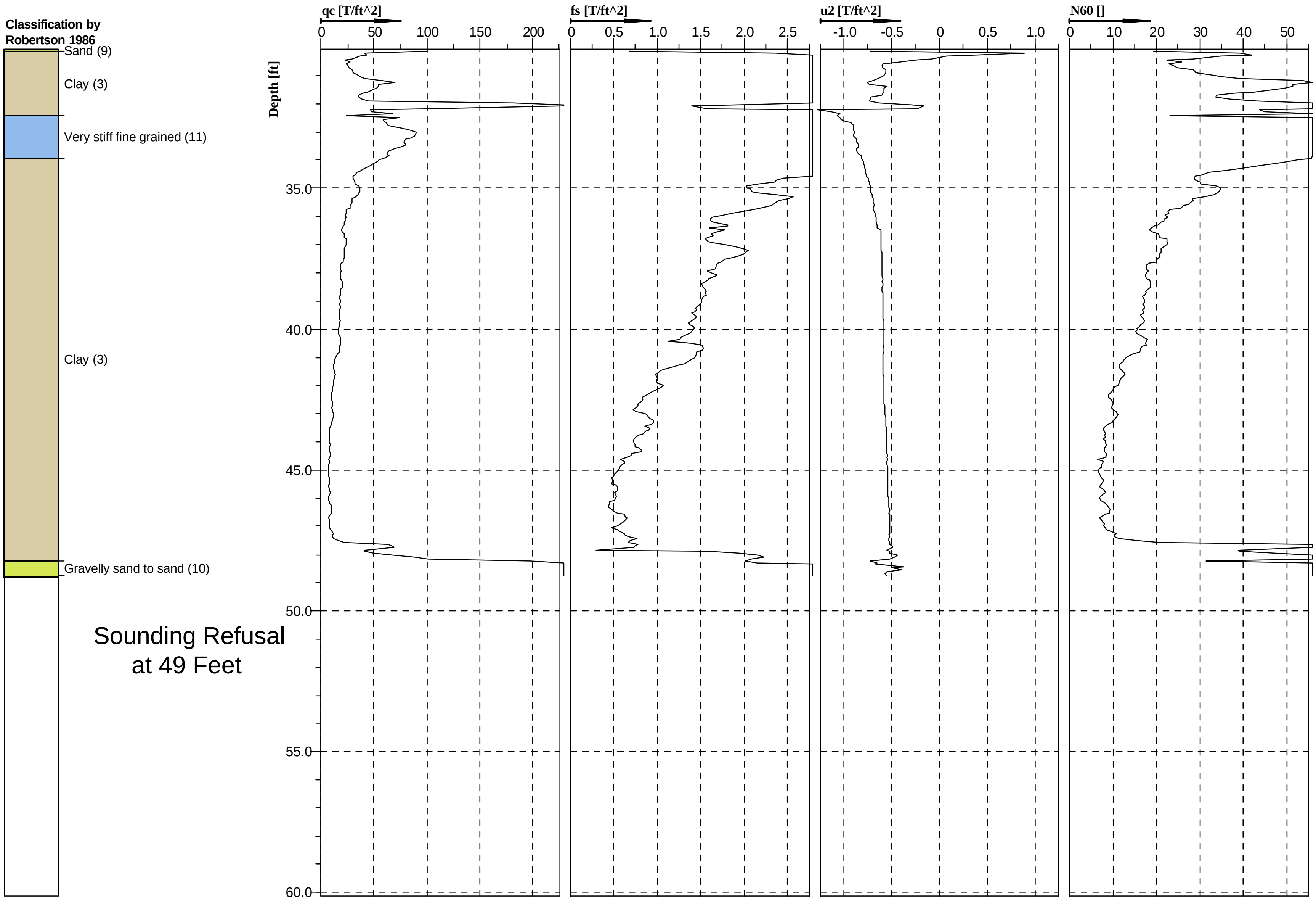
ECS LLP CAROLINAS

Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150




Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

| Location: Rogersville, Tennessee | Project ID: 10:5880 | Ground Elev.: | Test No.: C-25 |
|---|---|---|---|
| Project: TVA John Sevier Fossil Plant - Dike Investigation | Client: URS Corporation | Date: 5/27/10 | Page.: 1/2 |

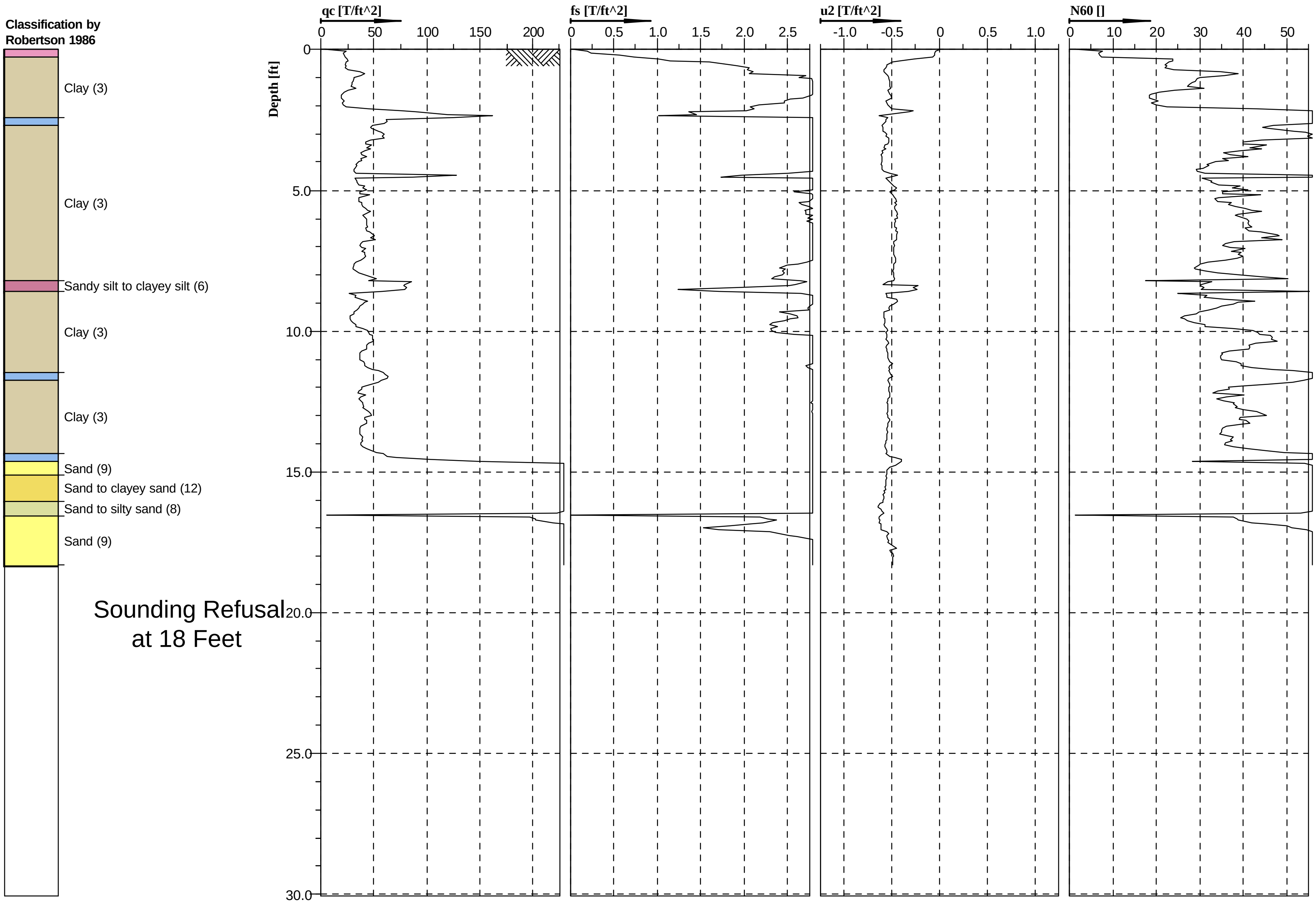



ECS LLP CAROLINAS

U2

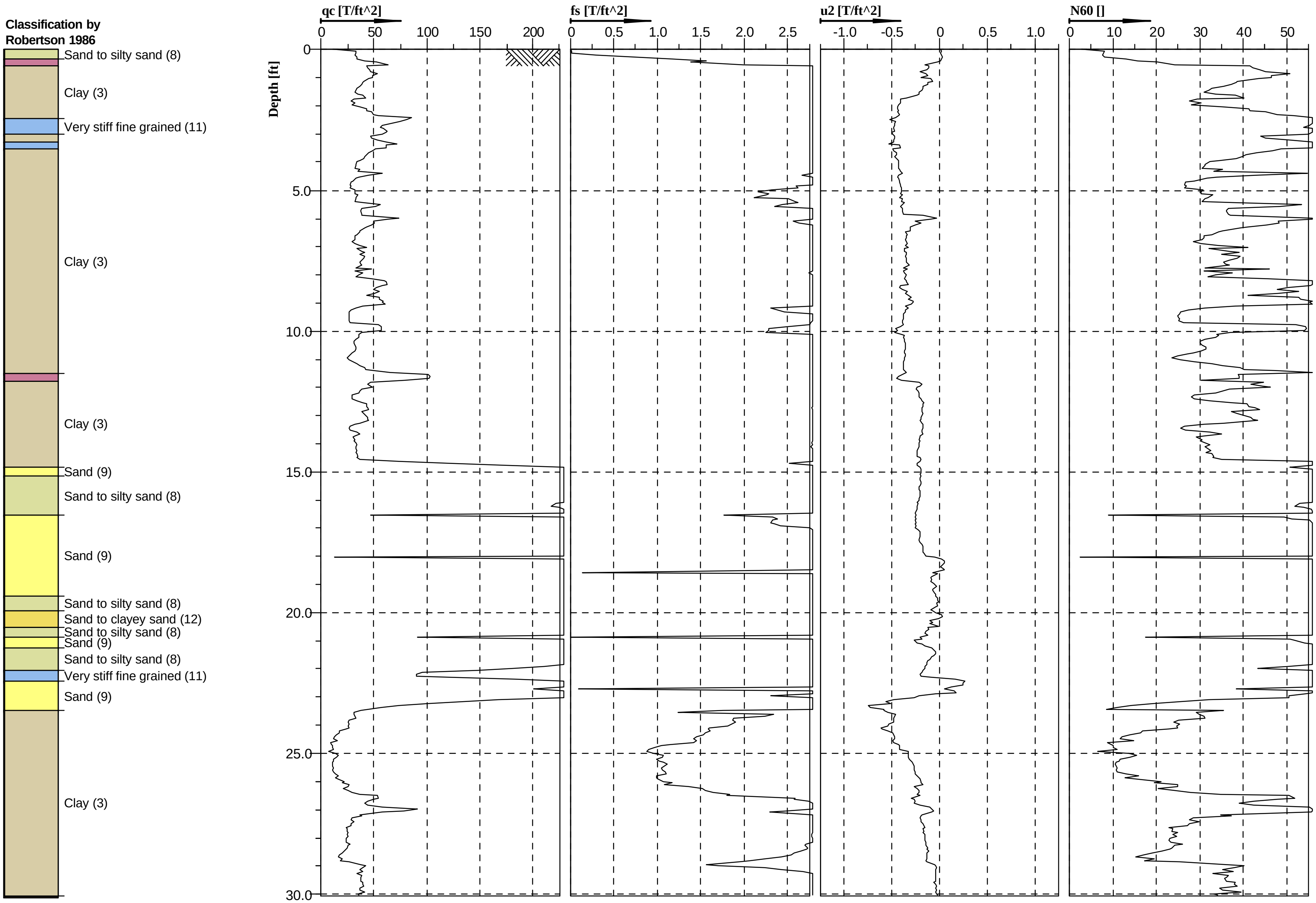
Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

| Location: | Project ID: | Ground Elev.: | Test No.: |
|---|---|---|---|
| Rogersville, Tennessee | 10:5880 | | C-25 |
| Project: | Client: | Date: | Page.: |
| TVA John Sevier Fossil Plant - Dike Investigation | URS Corporation | 5/27/10 | 2/2 |

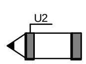



Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

| Location: Rogersville, Tennessee | Project ID: 10:5880 | Ground Elev.: | Test No.: C-26.1 |
|---|---|---|---|
| Project: TVA John Sevier Fossil Plant - Dike Investigation | Client: URS Corporation | Date: 5/27/10 | Page.: 1/1 |

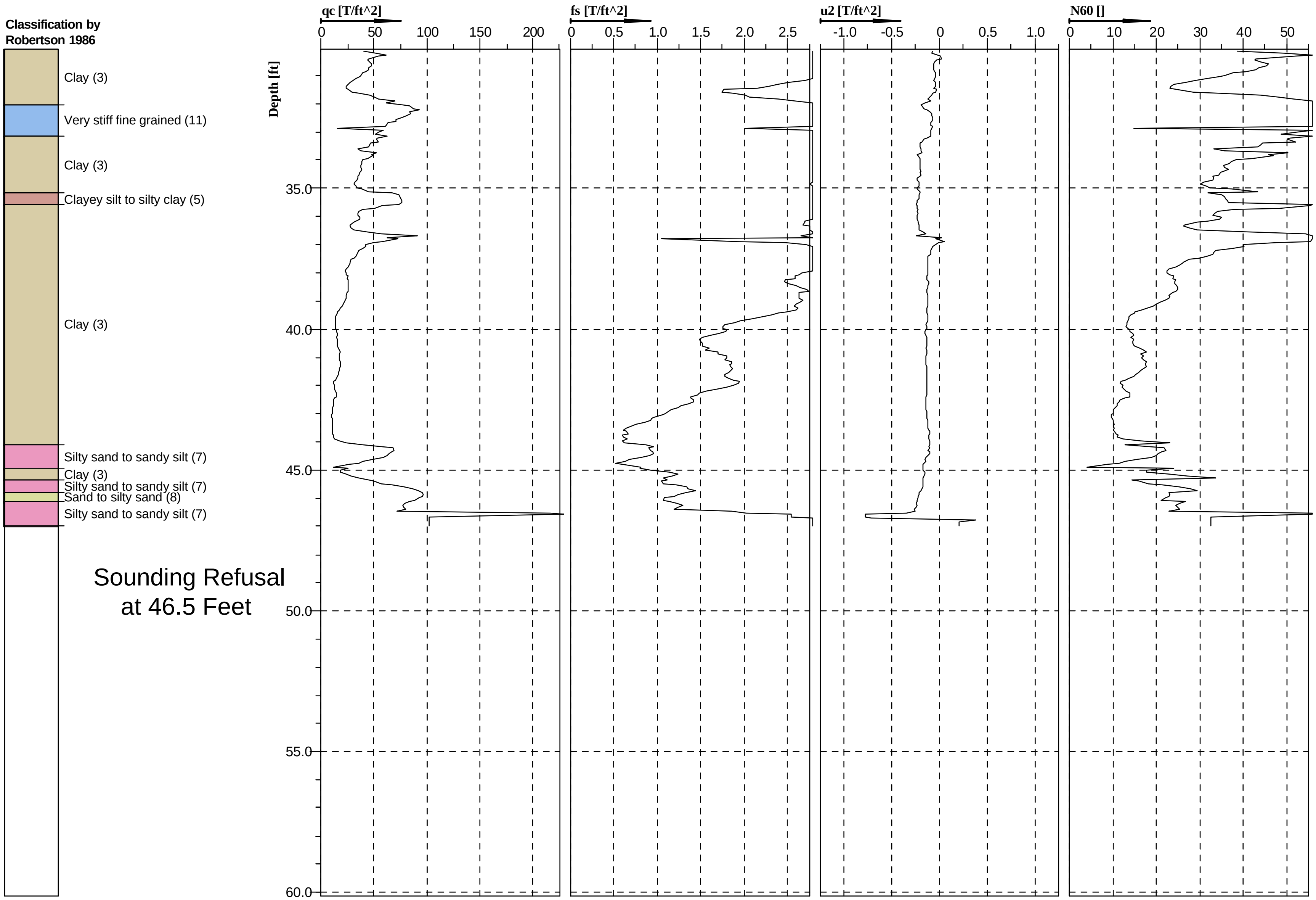



ECS LLP CAROLINAS




Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

| | | | |
|---|---|---|---|
| Location: Rogersville, Tennessee | Project ID: 10:5880 | Ground Elev.: | Test No.: C-26.2 |
| Project: TVA John Sevier Fossil Plant - Dike Investigation | Client: URS Corporation | Date: 5/28/10 | Page.: 1/2 |




ECS LLP CAROLINAS

U2

Cone No: 4048
Tip area [cm2]: 10
Sleeve area [cm2]: 150

| Location: Rogersville, Tennessee | Project ID: 10:5880 | Ground Elev.: | Test No.: C-26.2 |
|---|---|---|---|
| Project: TVA John Sevier Fossil Plant - Dike Investigation | Client: URS Corporation | Date: 5/28/10 | Page.: 2/2 |

# APPENDIX B

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233 Fax: 770-923-8973
Cell: 678-612-6534
Web: www.test-llc.com

# Summary of Soil Testing

**Project Number:** 1006-04

**Project Name:** TVA JSF-J Pond

| T.E.S.T. Sample Number | Client Sample Number | USCS | Moisture Content (%) | Grain Size Distribution %Finer #4 Sieve | % Finer #200 Sieve | % Finer 0.005mm | Atterberg Limits L.L. % | P.L. % | P.I. % | Proctor Opt. M.C. % | Max.Dry. Density pcf | Hydraulic Conductivity Initial M.C. % | Init.Dry Density pcf | Hydraulic Conduct. cm/sec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **1006-04-1** | | | | | | | | |
| 9200 | B-18 13.5-15' | CL | 16.4 | 92.4 | 72.0 | 34.8 | 40 | 16 | 24 | - | - | - | - | - |
| 9202 | B-20 6-8' | CL | 15.4 | 96.6 | 78.6 | 32.1 | 36 | 17 | 19 | - | - | - | - | - |
| 9206 | B-11 33.5-35' | SC | 10.4 | 71.4 | 33.8 | 16.5 | 33 | 19 | 14 | - | - | - | - | - |
| 9208 | B-14 28.5-30' | SC | 10.4 | 91.8 | 44.4 | 23.9 | 27 | 12 | 15 | - | - | - | - | - |
| 9210 | B-11 23.5-25' | CL | 18.4 | 99.1 | 80.1 | 38.6 | 42 | 18 | 24 | - | - | - | - | - |
| 9211 | B-13 8-10' | CL | 17.6 | 99.0 | 81.3 | 44.6 | 42 | 17 | 25 | - | - | - | - | - |
| 9213 | B-14 4-6' | CL | 12.6 | 95.0 | 61.7 | 33.0 | 40 | 18 | 22 | - | - | - | - | - |
| 9216 | B-16 18.5-20' | CL | 16.4 | 99.9 | 86.0 | 45.9 | 39 | 16 | 23 | - | - | - | - | - |
| 9218 | B-17 28.5-30' | CL | 17.1 | 99.5 | 75.4 | 40.9 | 37 | 15 | 22 | - | - | - | - | - |
| 9219 | B-18 33.5-35' | ML | 19.7 | 94.0 | 73.6 | 21.0 | 35 | 26 | 9 | - | - | - | - | - |

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | NK |
| Date | 06/15/10 |
| Checked By | [signature] |

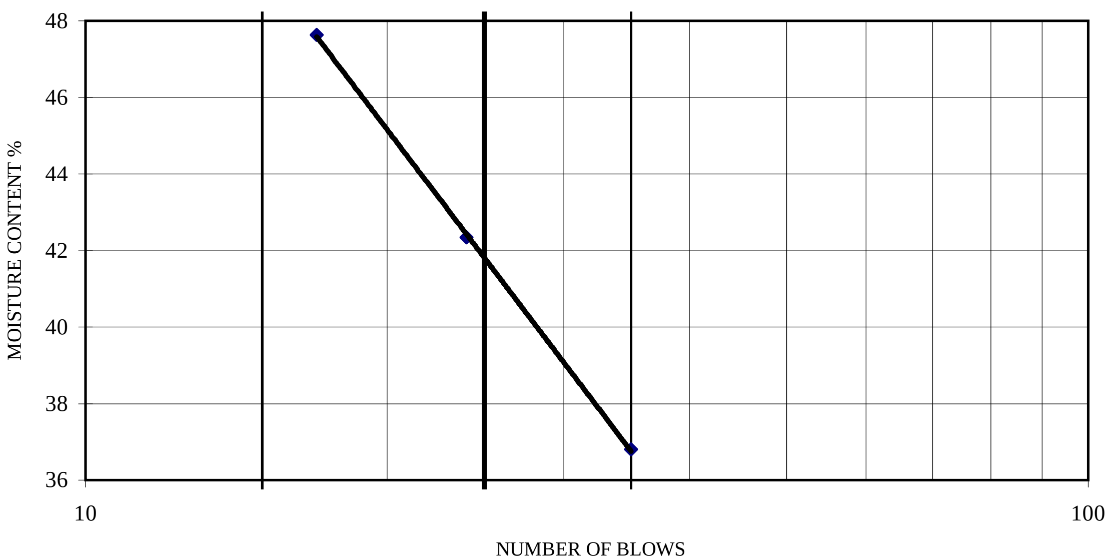
| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9210/B-11 | Depth/Elev. | 23.5'-25' |
| Location | - | Add. Info | - |

**ASTM D 4318/AASHTO T 88, T 89**

**Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)**

| LIQUID LIMIT | | | |
|---|---|---|---|
| Number of Blows | 35 | 24 | 17 |
| Mass of Wet Sample & Tare, g | 40.83 | 33.35 | 37.07 |
| Mass of Dry Sample & Tare, g | 36.72 | 30.78 | 33.56 |
| Mass of Tare, g | 25.55 | 24.71 | 26.19 |
| Moisture Content, % | 36.79 | 42.34 | 47.63 |

| | |
|---|---|
| Oven ID # | 12/13/14/15 |
| Balance ID # | 2 |
| Liquid Limit Device ID # | 56 |




| PLASTIC LIMIT | | |
|---|---|---|
| Mass of Wet Sample & Tare, g | 29.97 | 29.10 |
| Mass of Dry Sample & Tare, g | 28.42 | 27.81 |
| Mass of Tare, g | 19.73 | 20.44 |
| Moisture Content, % | 17.84 | 17.50 |

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

| NATURAL MOISTURE | |
|---|---|
| Mass of Wet Sample & Tare, g | 187.20 |
| Mass of Dry Sample & Tare, g | 167.82 |
| Mass of Tare, g | 62.59 |
| Moisture Content, % | 18.42 |

| | |
|---|---|
| LIQUID LIMIT (LL) | 42 |
| PLASTIC LIMIT (PL) | 18 |
| PLASTICITY INDEX (PI) | 24 |
| LIQUIDITY INDEX (LI) | 0.02 |

DESCRIPTION: Yellowish Brown Lean Clay with Sand

USCS (ASTM D2487; D2488): CL

AASHTO (M 145): NA

| | | |
|---|---|---|
| TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By: RI<br>Date: 06/09/10<br>Checked By: [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9210/B-11 | Depth/Elev. | 23.5'-25' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**
**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

*As-Received Moisture Content*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 187.20 |
| Mass of Dry Sample & Tare, g | 167.82 |
| Mass of Tare, g | 62.59 |
| Moisture Content, % | 18.4 |

*Moisture Content of Material Used for Hydrometer Analysis*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 250.80 |
| Mass of Dry Sample & Tare, g | 235.60 |
| Mass of Tare, g | 101.10 |
| Moisture Content, % | 11.3 |

| | |
|---|---|
| Mass of Total Sample before separation on #4 sieve & Tare, g | 820.50 |
| Mass of Tare, g | 0.00 |
| Total Mass of Dry Sample, g | 737.19 |

| | |
|---|---|
| Mass of Sample used for hydrometer analysis, g | 75.06 |
| Dry Mass, g | 67.44 |
| % of Total Sample passing #4 sieve | 99.1 |

SIEVE ANALYSIS

*PORTION OF SAMPLE RETAINED ON #4 SIEVE*

Mass of Tare, g: 0.00

| Sieve Size | | Sample & Tare, g | % RETAINED | %PASSING |
|---|---|---|---|---|
| 12" | COBBLES | | 0.0 | 100.0 |
| 3" | COARSE GRAVEL | | 0.0 | 100.0 |
| 2.5" | | | 0.0 | 100.0 |
| 2" | | | 0.0 | 100.0 |
| 1.5" | | | 0.0 | 100.0 |
| 1" | | | 0.0 | 100.0 |
| .75" | FINE GRAVEL | | 0.0 | 100.0 |
| .5" | | 0.00 | 0.0 | 100.0 |
| .375" | | 4.74 | 0.6 | 99.4 |
| #4 | COARSE SAND | 6.95 | 0.9 | 99.1 |

*PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)*

| Sieve Size | | Cumulative Mass retained, g | % PASSING |
|---|---|---|---|
| #10 | MEDIUM SAND | 0.05 | 99.0 |
| #20 | | 0.28 | 98.6 |
| #40 | FINE SAND | 0.78 | 97.9 |
| #60 | | 2.28 | 95.7 |
| #100 | | 5.77 | 90.6 |
| #200 | FINES | 12.88 | 80.1 |

Remarks

HYDROMETER ANALYSIS

| | |
|---|---|
| Length of Dispersion Period | 1 Minute |
| Mechanical Dispersion Device ID # | 61 |
| Amount of Dispersing Agent (ml) | 125.0 |
| Specific Gravity (assumed) | 2.700 |
| Specific Gravity (tested) | |
| Starting time | 14:38 |

**PARTICLE-SIZE ANALYSIS**

| | | | |
|---|---|---|---|
| % COBBLES | 0.0 | % MEDIUM SAND | 1.1 |
| % COARSE GRAVEL | 0.0 | % FINE SAND | 17.8 |
| % FINE GRAVEL | 0.9 | % FINES | 80.1 |
| % COARSE SAND | 0.1 | % TOTAL SAMPLE | 100.0 |
| % CLAY(<0.005mm) | 38.6 | % CLAY(<0.002mm) | 29.0 |

| Date | Time | Testing time (min) | Reading | Temp (°C) | K | Composite Correction | Actual Reading | Effective Depth (cm) | a | Particle Diam. (mm) | Percent Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 06/11/10 | 14:40 | 2 | 49.5 | 27.9 | 0.01255 | 6.0 | 43.5 | 9.2 | 0.99 | 0.0269 | 63.3 |
| 06/11/10 | 14:43 | 5 | 45.0 | 27.9 | 0.01255 | 6.0 | 39.0 | 9.9 | 0.99 | 0.0177 | 56.7 |
| 06/11/10 | 14:53 | 15 | 40.0 | 27.9 | 0.01255 | 6.0 | 34.0 | 10.7 | 0.99 | 0.0106 | 49.4 |
| 06/11/10 | 15:08 | 30 | 36.0 | 27.9 | 0.01255 | 6.0 | 30.0 | 11.4 | 0.99 | 0.0077 | 43.6 |
| 06/11/10 | 15:38 | 60 | 33.5 | 27.9 | 0.01255 | 6.0 | 27.5 | 11.8 | 0.99 | 0.0056 | 40.0 |
| 06/11/10 | 18:48 | 250 | 29.0 | 27.9 | 0.01255 | 6.0 | 23.0 | 12.6 | 0.99 | 0.0028 | 33.4 |
| 06/12/10 | 14:38 | 1440 | 23.0 | 27.9 | 0.01255 | 6.0 | 17.0 | 13.6 | 0.99 | 0.0012 | 24.7 |

| | | | |
|---|---|---|---|
| Hydrometer 152H ID # | 451190 | Oven ID # | 12/13/14/15 |
| Sieve Shaker ID # | 54/130 | Balance ID# | 1/6/7 |

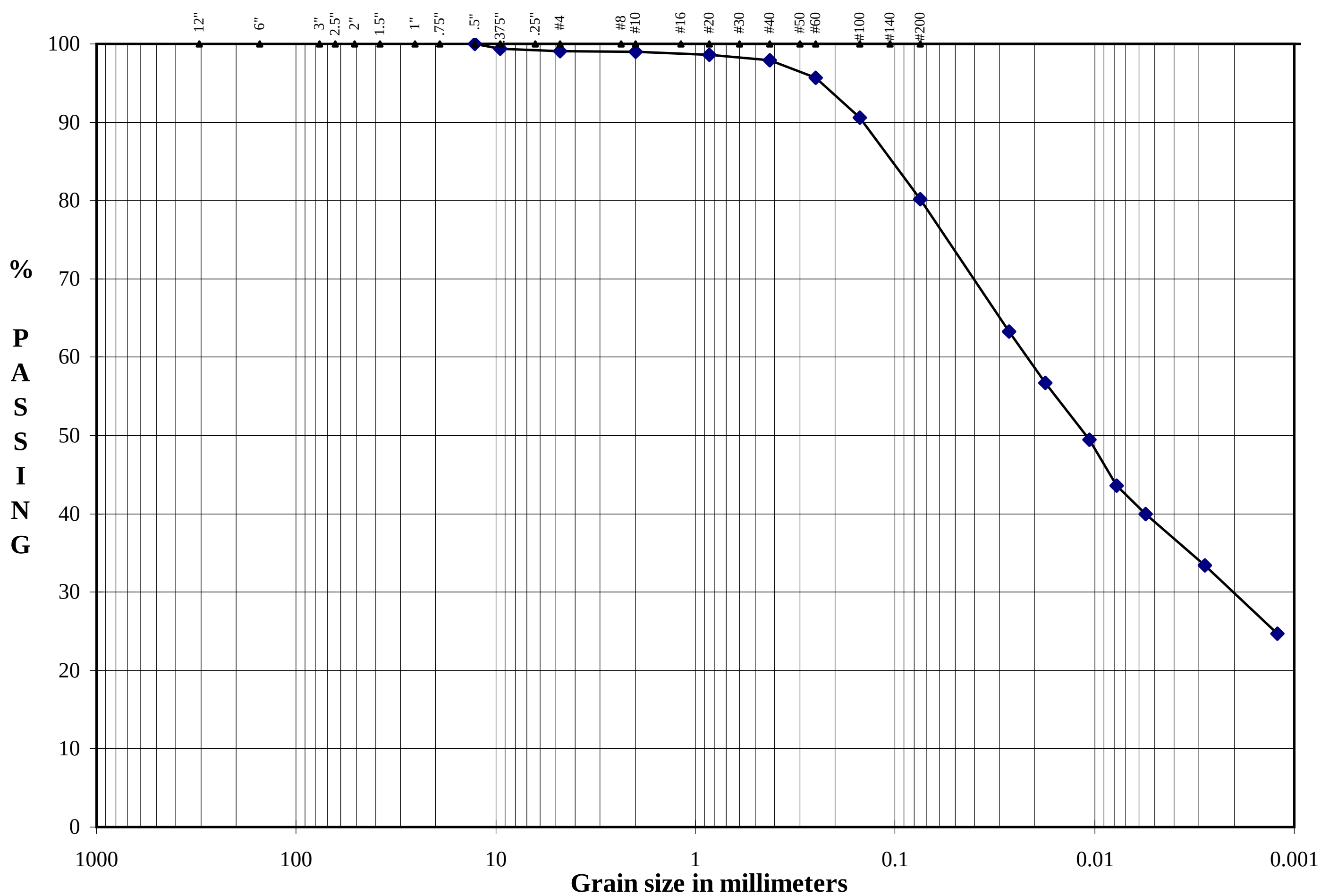
| | | | |
|---|---|---|---|
| TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By | RI |
| | | Date | 06/09/10 |
| | | Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9210/B-11 | Depth/Elev. | 23.5'-25' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**

**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

## Particle-Size Analysis




| Boulders | Cobbles | Gravel | | Sand | | | Fines |
|---|---|---|---|---|---|---|---|
| | | Coarse | Fine | Coarse | Medium | Fine | Silt or Clay |

DESCRIPTION: Yellowish Brown Lean Clay with Sand

| | | |
|---|---|---|
| $D_{10}$ | NA | mm |
| $D_{30}$ | NA | mm |
| $D_{60}$ | NA | mm |
| Cu | NA | |
| Cc | NA | |

USCS (ASTM D2487; D2488): CL

| | | | |
|---|---|---|---|
| T.E.S.T. | TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By: RI<br>Date: 06/18/10<br>Checked By: [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9206/B-11 | Depth/Elev. | 33.5'-35' |
| Location | - | Add. Info | - |

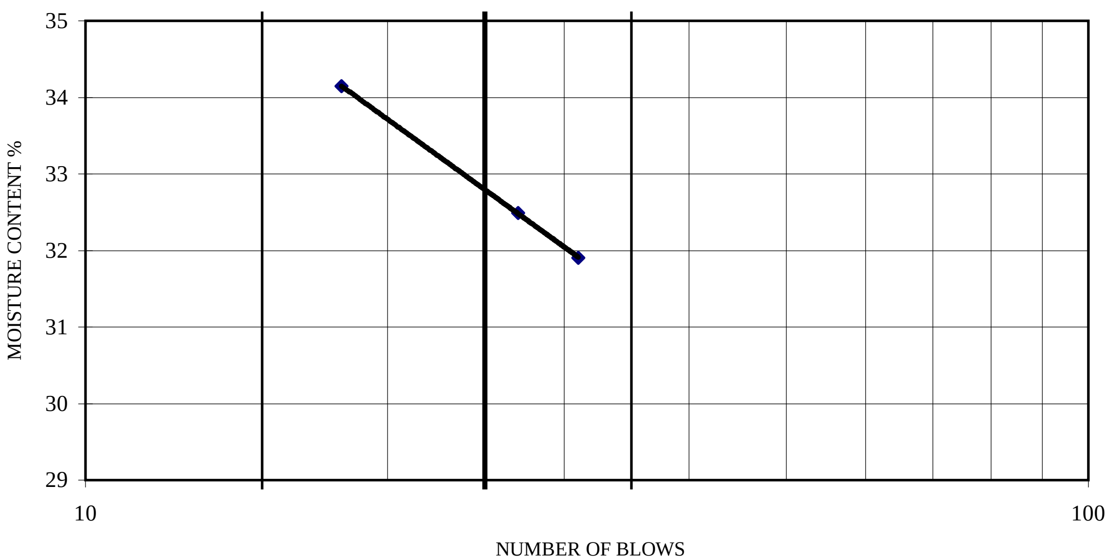
**ASTM D 4318/AASHTO T 88, T 89**

**Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)**

LIQUID LIMIT

| | | | |
|---|---|---|---|
| Number of Blows | 31 | 27 | 18 |
| Mass of Wet Sample & Tare, g | 37.60 | 33.12 | 34.52 |
| Mass of Dry Sample & Tare, g | 35.44 | 31.06 | 31.86 |
| Mass of Tare, g | 28.67 | 24.72 | 24.07 |
| Moisture Content, % | 31.91 | 32.49 | 34.15 |

| | |
|---|---|
| Oven ID # | 12/13/14/15 |
| Balance ID # | 2 |
| Liquid Limit Device ID # | 56 |




PLASTIC LIMIT

| | | |
|---|---|---|
| Mass of Wet Sample & Tare, g | 33.95 | 32.51 |
| Mass of Dry Sample & Tare, g | 32.33 | 30.91 |
| Mass of Tare, g | 23.70 | 22.25 |
| Moisture Content, % | 18.77 | 18.48 |

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 168.75 |
| Mass of Dry Sample & Tare, g | 158.38 |
| Mass of Tare, g | 58.84 |
| Moisture Content, % | 10.42 |

| | |
|---|---|
| LIQUID LIMIT (LL) | 33 |
| PLASTIC LIMIT (PL) | 19 |
| PLASTICITY INDEX (PI) | 14 |
| LIQUIDITY INDEX (LI) | -0.61 |

DESCRIPTION: Olive Brown Clayey Sand with Gravel

USCS (ASTM D2487; D2488): SC

AASHTO (M 145): NA

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/09/10 |
| Checked By | *(initials)* |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9206/B-11 | Depth/Elev. | 33.5'-35' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**
**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

*As-Received Moisture Content*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 168.75 |
| Mass of Dry Sample & Tare, g | 158.38 |
| Mass of Tare, g | 58.84 |
| Moisture Content, % | 10.4 |

*Moisture Content of Material Used for Hydrometer Analysis*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 156.20 |
| Mass of Dry Sample & Tare, g | 154.90 |
| Mass of Tare, g | 101.70 |
| Moisture Content, % | 2.4 |

| | |
|---|---|
| Mass of Total Sample before separation on #4 sieve & Tare, g | 310.60 |
| Mass of Tare, g | 0.00 |
| Total Mass of Dry Sample, g | 303.19 |

| | |
|---|---|
| Mass of Sample used for hydrometer analysis, g | 74.77 |
| Dry Mass, g | 72.99 |
| % of Total Sample passing #4 sieve | 71.4 |

SIEVE ANALYSIS

*PORTION OF SAMPLE RETAINED ON #4 SIEVE*

Mass of Tare, g: 0.00

| Sieve Size | | Sample & Tare, g | % RETAINED | %PASSING |
|---|---|---|---|---|
| 12" | COBBLES | | 0.0 | 100.0 |
| 3" | COARSE GRAVEL | | 0.0 | 100.0 |
| 2.5" | | | 0.0 | 100.0 |
| 2" | | | 0.0 | 100.0 |
| 1.5" | | | 0.0 | 100.0 |
| 1" | | 0.00 | 0.0 | 100.0 |
| .75" | FINE GRAVEL | 14.33 | 4.7 | 95.3 |
| .5" | | 30.97 | 10.2 | 89.8 |
| .375" | | 48.80 | 16.1 | 83.9 |
| #4 | COARSE SAND | 86.60 | 28.6 | 71.4 |

*PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)*

| Sieve Size | | Cumulative Mass retained, g | % PASSING |
|---|---|---|---|
| #10 | MEDIUM SAND | 15.02 | 56.7 |
| #20 | | 24.72 | 47.2 |
| #40 | FINE SAND | 29.82 | 42.3 |
| #60 | | 32.59 | 39.5 |
| #100 | | 35.03 | 37.2 |
| #200 | FINES | 38.41 | 33.8 |

Remarks

HYDROMETER ANALYSIS

| | |
|---|---|
| Length of Dispersion Period | 1 Minute |
| Mechanical Dispersion Device ID # | 61 |
| Amount of Dispersing Agent (ml) | 125.0 |
| Specific Gravity (assumed) | 2.700 |
| Specific Gravity (tested) | |
| Starting time | 14:34 |

**PARTICLE-SIZE ANALYSIS**

| | | | |
|---|---|---|---|
| % COBBLES | 0.0 | % MEDIUM SAND | 14.5 |
| % COARSE GRAVEL | 4.7 | % FINE SAND | 8.4 |
| % FINE GRAVEL | 23.8 | % FINES | 33.8 |
| % COARSE SAND | 14.7 | % TOTAL SAMPLE | 100.0 |
| % CLAY(<0.005mm) | 16.5 | % CLAY(<0.002mm) | 11.2 |

| Date | Time | Testing time (min) | Reading | Temp (°C) | K | Composite Correction | Actual Reading | Effective Depth (cm) | a | Particle Diam. (mm) | Percent Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 06/11/10 | 14:36 | 2 | 35.0 | 27.9 | 0.01255 | 6.0 | 29.0 | 11.6 | 0.99 | 0.0302 | 28.1 |
| 06/11/10 | 14:39 | 5 | 33.0 | 27.9 | 0.01255 | 6.0 | 27.0 | 11.9 | 0.99 | 0.0194 | 26.2 |
| 06/11/10 | 14:49 | 15 | 29.0 | 27.9 | 0.01255 | 6.0 | 23.0 | 12.6 | 0.99 | 0.0115 | 22.3 |
| 06/11/10 | 15:04 | 30 | 26.0 | 27.9 | 0.01255 | 6.0 | 20.0 | 13.1 | 0.99 | 0.0083 | 19.4 |
| 06/11/10 | 15:34 | 60 | 24.0 | 27.9 | 0.01255 | 6.0 | 18.0 | 13.4 | 0.99 | 0.0059 | 17.4 |
| 06/11/10 | 18:44 | 250 | 21.0 | 27.9 | 0.01255 | 6.0 | 15.0 | 13.9 | 0.99 | 0.0030 | 14.5 |
| 06/12/10 | 14:34 | 1440 | 15.0 | 27.9 | 0.01255 | 6.0 | 9.0 | 14.9 | 0.99 | 0.0013 | 8.7 |

| | | | |
|---|---|---|---|
| Hydrometer 152H ID # | 451190 | Oven ID # | 12/13/14/15 |
| Sieve Shaker ID # | 54/130 | Balance ID# | 1/6/7 |

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

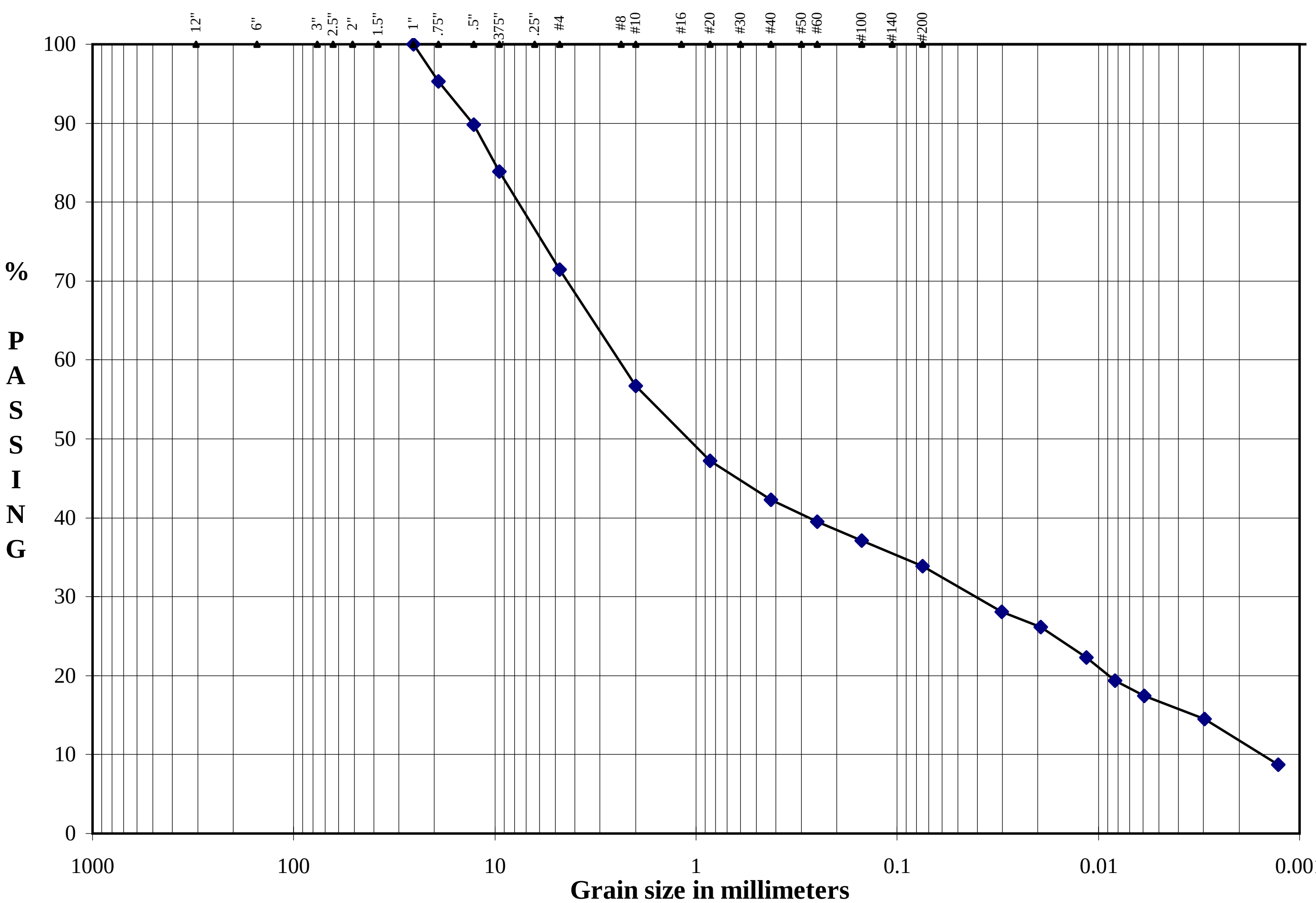
| | |
|---|---|
| Tested By | RI |
| Date | 06/09/10 |
| Checked By | |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9206/B-11 | Depth/Elev. | 33.5'-35' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**

**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

## Particle-Size Analysis




| Boulders | Cobbles | Coarse | Fine | Coarse | Medium | Fine | Silt or Clay |
|---|---|---|---|---|---|---|---|
| | | Gravel | | Sand | | | Fines |

DESCRIPTION: Olive Brown Clayey Sand with Gravel

| | | |
|---|---|---|
| $D_{10}$ | NA | mm |
| $D_{30}$ | NA | mm |
| $D_{60}$ | NA | mm |
| Cu | NA | |
| Cc | NA | |

USCS (ASTM D2487; D2488): SC

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1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | NK |
| Date | 06/15/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9211/B-13 | Depth/Elev. | 8'-10' |
| Location | - | Add. Info | - |

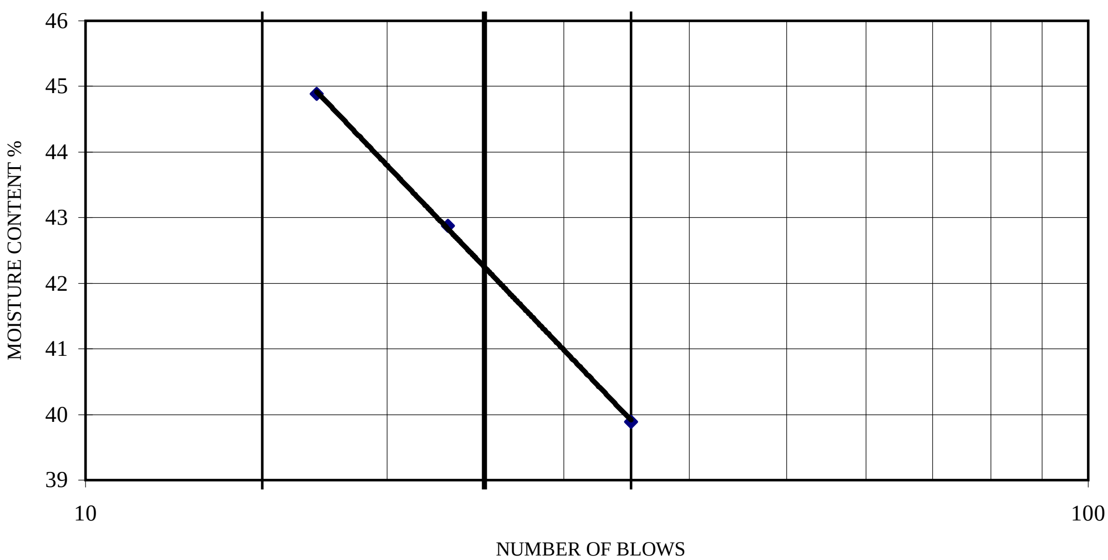
**ASTM D 4318/AASHTO T 88, T 89**

**Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)**

LIQUID LIMIT

| | | | |
|---|---|---|---|
| Number of Blows | 35 | 23 | 17 |
| Mass of Wet Sample & Tare, g | 41.30 | 36.62 | 37.73 |
| Mass of Dry Sample & Tare, g | 37.57 | 33.16 | 33.47 |
| Mass of Tare, g | 28.22 | 25.09 | 23.98 |
| Moisture Content, % | 39.89 | 42.87 | 44.89 |

| | |
|---|---|
| Oven ID # | 12/13/14/15 |
| Balance ID # | 2 |
| Liquid Limit Device ID # | 56 |




PLASTIC LIMIT

| | | |
|---|---|---|
| Mass of Wet Sample & Tare, g | 28.84 | 28.59 |
| Mass of Dry Sample & Tare, g | 27.44 | 27.18 |
| Mass of Tare, g | 19.30 | 18.90 |
| Moisture Content, % | 17.20 | 17.03 |

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 138.41 |
| Mass of Dry Sample & Tare, g | 126.96 |
| Mass of Tare, g | 61.92 |
| Moisture Content, % | 17.60 |

| | |
|---|---|
| LIQUID LIMIT (LL) | 42 |
| PLASTIC LIMIT (PL) | 17 |
| PLASTICITY INDEX (PI) | 25 |
| LIQUIDITY INDEX (LI) | 0.02 |

DESCRIPTION: Yellowish Brown Lean Clay with Sand

USCS (ASTM D2487; D2488): CL

AASHTO (M 145): NA

| | | |
|---|---|---|
| TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By: RI<br>Date: 06/09/10<br>Checked By: [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9211/B-13 | Depth/Elev. | 8'-10' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**
**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

*As-Received Moisture Content*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 138.41 |
| Mass of Dry Sample & Tare, g | 126.96 |
| Mass of Tare, g | 61.92 |
| Moisture Content, % | 17.6 |

*Moisture Content of Material Used for Hydrometer Analysis*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 246.30 |
| Mass of Dry Sample & Tare, g | 233.20 |
| Mass of Tare, g | 108.30 |
| Moisture Content, % | 10.5 |

| | |
|---|---|
| Mass of Total Sample before separation on #4 sieve & Tare, g | 673.00 |
| Mass of Tare, g | 0.00 |
| Total Mass of Dry Sample, g | 609.11 |

| | |
|---|---|
| Mass of Sample used for hydrometer analysis, g | 75.78 |
| Dry Mass, g | 68.59 |
| % of Total Sample passing #4 sieve | 99.0 |

SIEVE ANALYSIS

*PORTION OF SAMPLE RETAINED ON #4 SIEVE*

Mass of Tare, g: 0.00

| Sieve Size | | Sample & Tare, g | % RETAINED | %PASSING |
|---|---|---|---|---|
| 12" | COBBLES | | 0.0 | 100.0 |
| 3" | COARSE GRAVEL | | 0.0 | 100.0 |
| 2.5" | | | 0.0 | 100.0 |
| 2" | | | 0.0 | 100.0 |
| 1.5" | | | 0.0 | 100.0 |
| 1" | | | 0.0 | 100.0 |
| .75" | FINE GRAVEL | | 0.0 | 100.0 |
| .5" | | 0.00 | 0.0 | 100.0 |
| .375" | | 5.97 | 1.0 | 99.0 |
| #4 | COARSE SAND | 5.97 | 1.0 | 99.0 |

*PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)*

| Sieve Size | | Cumulative Mass retained, g | % PASSING |
|---|---|---|---|
| #10 | MEDIUM SAND | 0.26 | 98.6 |
| #20 | | 0.81 | 97.9 |
| #40 | FINE SAND | 1.57 | 96.8 |
| #60 | | 3.06 | 94.6 |
| #100 | | 6.67 | 89.4 |
| #200 | FINES | 12.27 | 81.3 |

Remarks

HYDROMETER ANALYSIS

| | |
|---|---|
| Length of Dispersion Period | 1 Minute |
| Mechanical Dispersion Device ID # | 61 |
| Amount of Dispersing Agent (ml) | 125.0 |
| Specific Gravity (assumed) | 2.700 |
| Specific Gravity (tested) | |
| Starting time | 11:27 |

**PARTICLE-SIZE ANALYSIS**

| | | | |
|---|---|---|---|
| % COBBLES | 0.0 | % MEDIUM SAND | 1.9 |
| % COARSE GRAVEL | 0.0 | % FINE SAND | 15.4 |
| % FINE GRAVEL | 1.0 | % FINES | 81.3 |
| % COARSE SAND | 0.4 | % TOTAL SAMPLE | 100.0 |
| % CLAY(<0.005mm) | 44.6 | % CLAY(<0.002mm) | 35.2 |

| Date | Time | Testing time (min) | Reading | Temp (°C) | K | Composite Correction | Actual Reading | Effective Depth (cm) | a | Particle Diam. (mm) | Percent Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 06/12/10 | 11:29 | 2 | 52.0 | 29.3 | 0.01212 | 5.5 | 46.5 | 8.7 | 0.99 | 0.0252 | 66.5 |
| 06/12/10 | 11:32 | 5 | 48.5 | 29.3 | 0.01212 | 5.5 | 43.0 | 9.2 | 0.99 | 0.0165 | 61.5 |
| 06/12/10 | 11:42 | 15 | 43.0 | 29.3 | 0.01212 | 5.5 | 37.5 | 10.2 | 0.99 | 0.0100 | 53.6 |
| 06/12/10 | 11:57 | 30 | 40.0 | 29.3 | 0.01212 | 5.5 | 34.5 | 10.7 | 0.99 | 0.0072 | 49.3 |
| 06/12/10 | 12:27 | 60 | 37.0 | 29.3 | 0.01212 | 5.5 | 31.5 | 11.2 | 0.99 | 0.0052 | 45.0 |
| 06/12/10 | 15:37 | 250 | 33.5 | 29.3 | 0.01212 | 5.5 | 28.0 | 11.7 | 0.99 | 0.0026 | 40.0 |
| 06/13/10 | 11:27 | 1440 | 25.5 | 29.3 | 0.01212 | 5.5 | 20.0 | 13.1 | 0.99 | 0.0012 | 28.6 |

| | | | |
|---|---|---|---|
| Hydrometer 152H ID # | 451190 | Oven ID # | 12/13/14/15 |
| Sieve Shaker ID # | 54/130 | Balance ID# | 1/6/7 |

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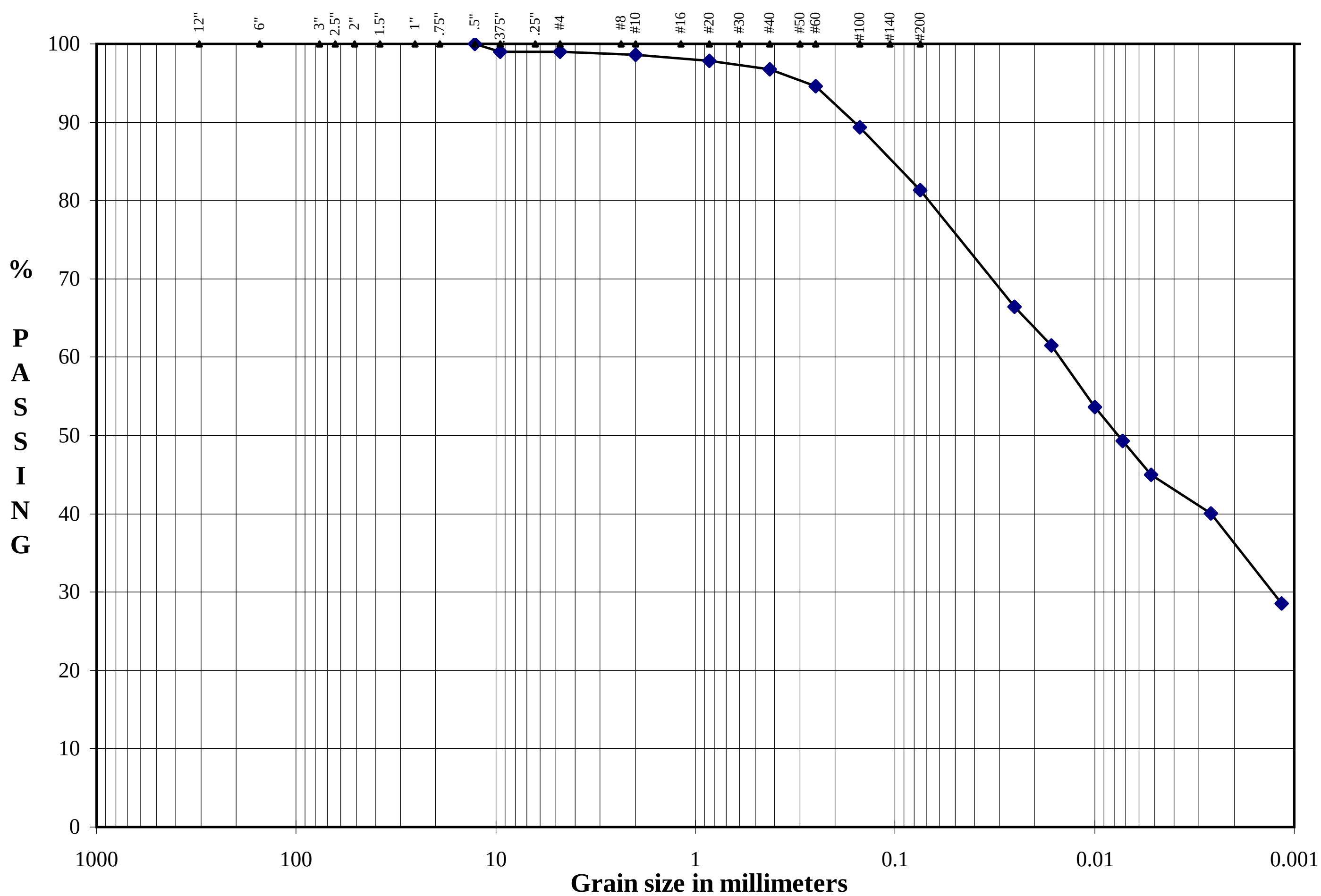
Fax: 770-923-8973
Web: www.test-llc.com

| | | | |
|---|---|---|---|
| Tested By | RI | | |
| Date | 06/09/10 | | |
| Checked By | [signature] | | |
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9211/B-13 | Depth/Elev. | 8'-10' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**

**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

## Particle-Size Analysis




| Boulders | Cobbles | Gravel (Coarse) | Gravel (Fine) | Sand (Coarse) | Sand (Medium) | Sand (Fine) | Fines (Silt or Clay) |
|---|---|---|---|---|---|---|---|

| | | |
|---|---|---|
| $D_{10}$ | NA | mm |
| $D_{30}$ | NA | mm |
| $D_{60}$ | NA | mm |
| Cu | NA | |
| Cc | NA | |

DESCRIPTION: Yellowish Brown Lean Clay with Sand

USCS (ASTM D2487; D2488): CL

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | NK |
| Date | 06/15/10 |
| Checked By | [signature] |

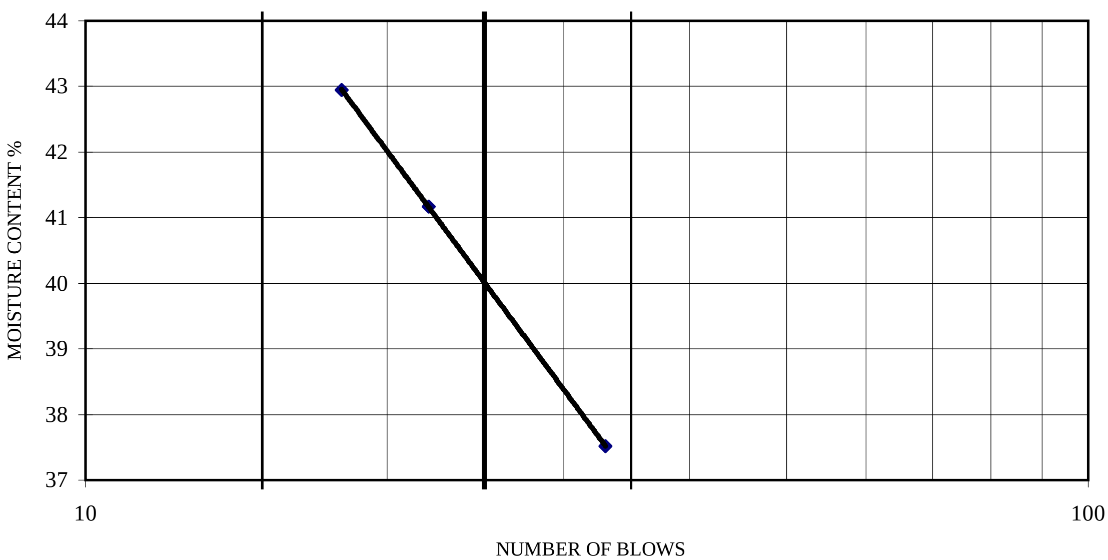
| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9213/B-14 | Depth/Elev. | 4'-6' |
| Location | - | Add. Info | - |

**ASTM D 4318/AASHTO T 88, T 89**
**Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)**

LIQUID LIMIT

| | | | |
|---|---|---|---|
| Number of Blows | 33 | 22 | 18 |
| Mass of Wet Sample & Tare, g | 34.60 | 37.54 | 36.19 |
| Mass of Dry Sample & Tare, g | 31.82 | 33.74 | 32.78 |
| Mass of Tare, g | 24.41 | 24.51 | 24.84 |
| Moisture Content, % | 37.52 | 41.17 | 42.95 |

| | |
|---|---|
| Oven ID # | 12/13/14/15 |
| Balance ID # | 2 |
| Liquid Limit Device ID # | 56 |




PLASTIC LIMIT

| | | |
|---|---|---|
| Mass of Wet Sample & Tare, g | 35.77 | 33.78 |
| Mass of Dry Sample & Tare, g | 34.37 | 32.29 |
| Mass of Tare, g | 26.78 | 24.20 |
| Moisture Content, % | 18.45 | 18.42 |

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 236.21 |
| Mass of Dry Sample & Tare, g | 216.73 |
| Mass of Tare, g | 61.66 |
| Moisture Content, % | 12.56 |

| | |
|---|---|
| LIQUID LIMIT (LL) | 40 |
| PLASTIC LIMIT (PL) | 18 |
| PLASTICITY INDEX (PI) | 22 |
| LIQUIDITY INDEX (LI) | -0.25 |

DESCRIPTION: Olive Brown Sandy Lean Clay

USCS (ASTM D2487; D2488): CL

AASHTO (M 145): NA

**TIMELY ENGINEERING SOIL TESTS, LLC**

T.E.ST.

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/09/10 |
| Checked By | LB |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9213/B-14 | Depth/Elev. | 4'-6' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**
**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

*As-Received Moisture Content*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 236.21 |
| Mass of Dry Sample & Tare, g | 216.73 |
| Mass of Tare, g | 61.66 |
| Moisture Content, % | 12.6 |

*Moisture Content of Material Used for Hydrometer Analysis*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 298.70 |
| Mass of Dry Sample & Tare, g | 278.60 |
| Mass of Tare, g | 95.70 |
| Moisture Content, % | 11.0 |

| | |
|---|---|
| Mass of Total Sample before separation on #4 sieve & Tare, g | 767.00 |
| Mass of Tare, g | 0.00 |
| Total Mass of Dry Sample, g | 691.06 |

| | |
|---|---|
| Mass of Sample used for hydrometer analysis, g | 75.26 |
| Dry Mass, g | 67.81 |
| % of Total Sample passing #4 sieve | 95.0 |

SIEVE ANALYSIS

*PORTION OF SAMPLE RETAINED ON #4 SIEVE*

Mass of Tare, g: 0.00

| Sieve Size | | Sample & Tare, g | % RETAINED | %PASSING |
|---|---|---|---|---|
| **12"** | COBBLES | | 0.0 | 100.0 |
| **3"** | COARSE GRAVEL | | 0.0 | 100.0 |
| **2.5"** | | | 0.0 | 100.0 |
| **2"** | | | 0.0 | 100.0 |
| **1.5"** | | | 0.0 | 100.0 |
| **1"** | | | 0.0 | 100.0 |
| **.75"** | FINE GRAVEL | 0.00 | 0.0 | 100.0 |
| **.5"** | | 3.33 | 0.5 | 99.5 |
| **.375"** | | 20.98 | 3.0 | 97.0 |
| **#4** | COARSE SAND | 34.73 | 5.0 | 95.0 |

*PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)*

| Sieve Size | | Cumulative Mass retained, g | % PASSING |
|---|---|---|---|
| **#10** | MEDIUM SAND | 7.63 | 84.3 |
| **#20** | | 12.49 | 77.5 |
| **#40** | FINE SAND | 15.10 | 73.8 |
| **#60** | | 17.67 | 70.2 |
| **#100** | | 20.51 | 66.2 |
| **#200** | FINES | 23.75 | 61.7 |

Remarks

HYDROMETER ANALYSIS

| | |
|---|---|
| Length of Dispersion Period | 1 Minute |
| Mechanical Dispersion Device ID # | 61 |
| Amount of Dispersing Agent (ml) | 125.0 |
| Specific Gravity (assumed) | 2.700 |
| Specific Gravity (tested) | |
| Starting time | 14:40 |

**PARTICLE-SIZE ANALYSIS**

| | | | |
|---|---|---|---|
| % COBBLES | 0.0 | % MEDIUM SAND | 10.5 |
| % COARSE GRAVEL | 0.0 | % FINE SAND | 12.1 |
| % FINE GRAVEL | 5.0 | % FINES | 61.7 |
| % COARSE SAND | 10.7 | % TOTAL SAMPLE | 100.0 |
| % CLAY(<0.005mm) | 33.0 | % CLAY(<0.002mm) | 24.0 |

| Date | Time | Testing time (min) | Reading | Temp (°C) | K | Composite Correction | Actual Reading | Effective Depth (cm) | a | Particle Diam. (mm) | Percent Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 06/11/10 | 14:42 | 2 | 46.0 | 27.9 | 0.01255 | 6.0 | 40.0 | 9.7 | 0.99 | 0.0277 | 55.5 |
| 06/11/10 | 14:45 | 5 | 40.5 | 27.9 | 0.01255 | 6.0 | 34.5 | 10.7 | 0.99 | 0.0183 | 47.8 |
| 06/11/10 | 14:55 | 15 | 37.0 | 27.9 | 0.01255 | 6.0 | 31.0 | 11.2 | 0.99 | 0.0109 | 43.0 |
| 06/11/10 | 15:10 | 30 | 33.0 | 27.9 | 0.01255 | 6.0 | 27.0 | 11.9 | 0.99 | 0.0079 | 37.4 |
| 06/11/10 | 15:40 | 60 | 30.5 | 27.9 | 0.01255 | 6.0 | 24.5 | 12.3 | 0.99 | 0.0057 | 34.0 |
| 06/11/10 | 18:50 | 250 | 27.5 | 27.9 | 0.01255 | 6.0 | 21.5 | 12.8 | 0.99 | 0.0028 | 29.8 |
| 06/12/10 | 14:40 | 1440 | 19.5 | 27.9 | 0.01255 | 6.0 | 13.5 | 14.1 | 0.99 | 0.0012 | 18.7 |

| | | | |
|---|---|---|---|
| Hydrometer 152H ID # | 451190 | Oven ID # | 12/13/14/15 |
| Sieve Shaker ID # | 54/130 | Balance ID# | 1/6/7 |

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

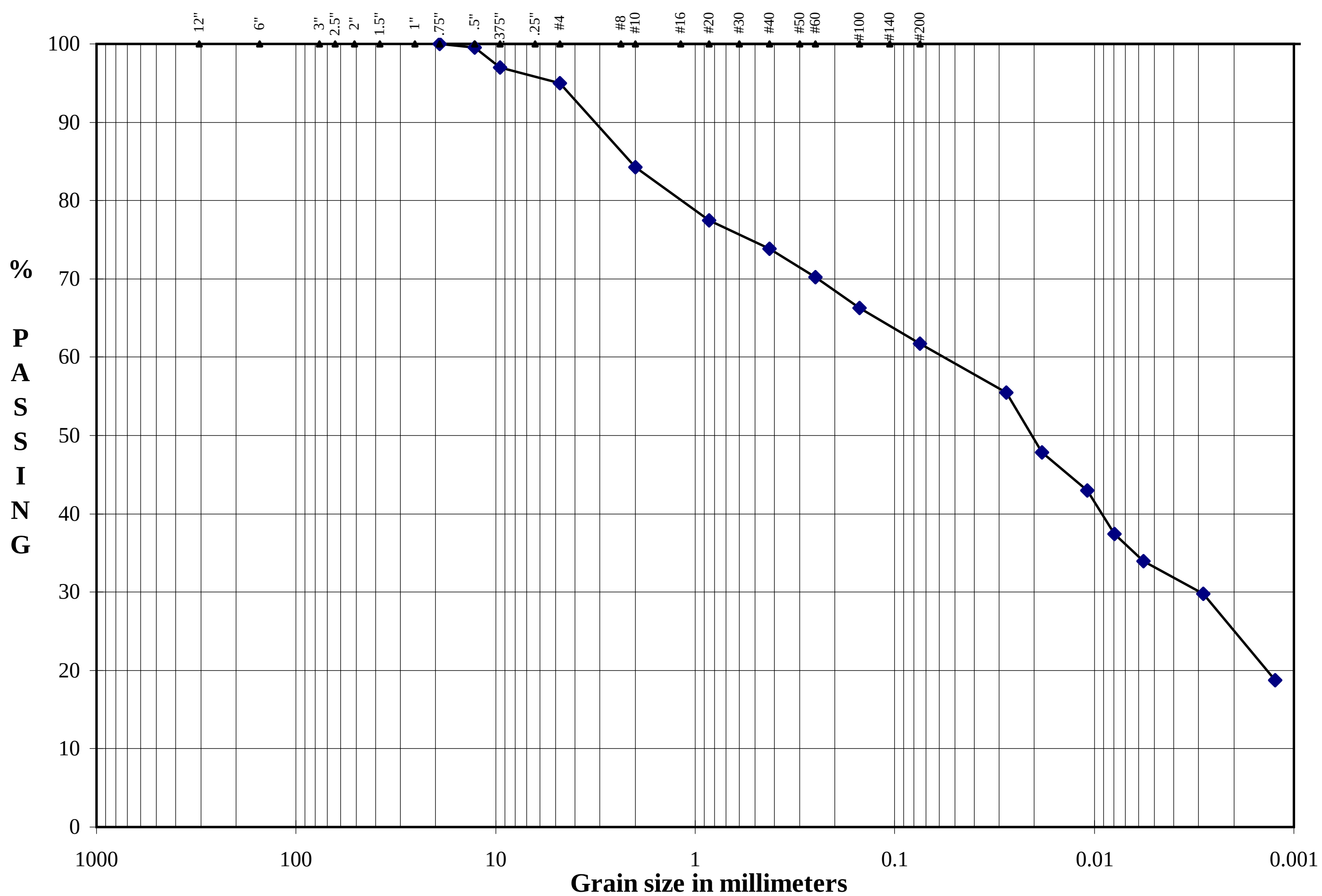
| | |
|---|---|
| Tested By | RI |
| Date | 06/09/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9213/B-14 | Depth/Elev. | 4'-6' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**

**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

## Particle-Size Analysis




| Boulders | Cobbles | Gravel (Coarse) | Gravel (Fine) | Sand (Coarse) | Sand (Medium) | Sand (Fine) | Fines (Silt or Clay) |
|---|---|---|---|---|---|---|---|

DESCRIPTION: Olive Brown Sandy Lean Clay

| | | |
|---|---|---|
| $D_{10}$ | NA | mm |
| $D_{30}$ | NA | mm |
| $D_{60}$ | NA | mm |
| Cu | NA | |
| Cc | NA | |

USCS (ASTM D2487; D2488): CL

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| | |
|---|---|
| Tested By | NK |
| Date | 06/15/10 |
| Checked By | [signature] |

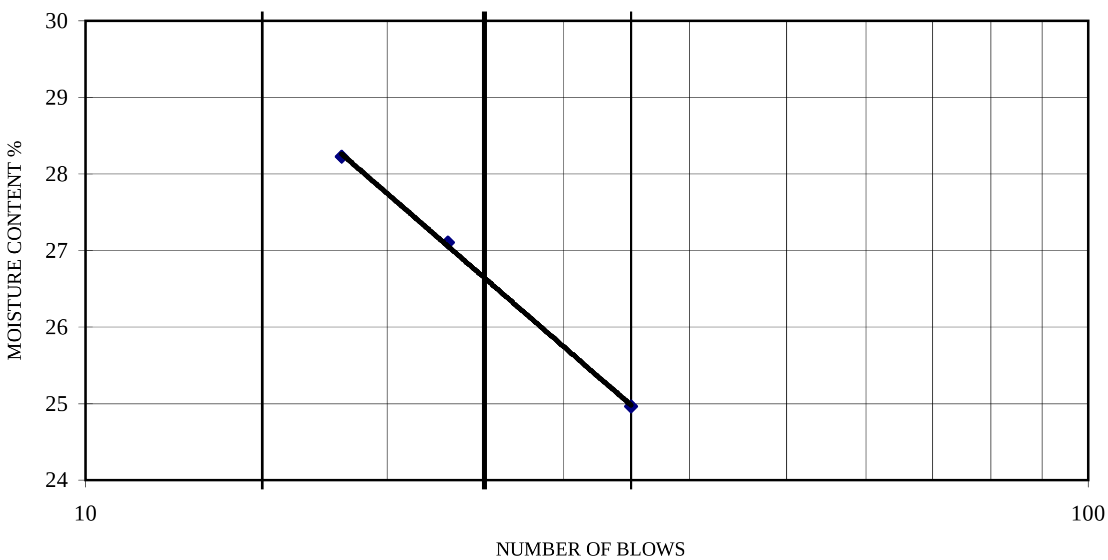
| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9208/B-14 | Depth/Elev. | 28.5'-30' |
| Location | - | Add. Info | - |

**ASTM D 4318/AASHTO T 88, T 89**
**Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)**

LIQUID LIMIT

| | | | |
|---|---|---|---|
| Number of Blows | 35 | 23 | 18 |
| Mass of Wet Sample & Tare, g | 40.83 | 40.53 | 37.62 |
| Mass of Dry Sample & Tare, g | 37.61 | 37.31 | 34.91 |
| Mass of Tare, g | 24.71 | 25.43 | 25.31 |
| Moisture Content, % | 24.96 | 27.10 | 28.23 |

| | |
|---|---|
| Oven ID # | 12/13/14/15 |
| Balance ID # | 2 |
| Liquid Limit Device ID # | 56 |




PLASTIC LIMIT

| | | |
|---|---|---|
| Mass of Wet Sample & Tare, g | 33.93 | 42.07 |
| Mass of Dry Sample & Tare, g | 33.11 | 40.69 |
| Mass of Tare, g | 26.31 | 29.33 |
| Moisture Content, % | 12.06 | 12.15 |

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 191.29 |
| Mass of Dry Sample & Tare, g | 178.94 |
| Mass of Tare, g | 59.92 |
| Moisture Content, % | 10.38 |

| | |
|---|---|
| LIQUID LIMIT (LL) | 27 |
| PLASTIC LIMIT (PL) | 12 |
| PLASTICITY INDEX (PI) | 15 |
| LIQUIDITY INDEX (LI) | -0.11 |

DESCRIPTION: Yellowish Brown Clayey Sand

USCS (ASTM D2487; D2488): SC

AASHTO (M 145): NA

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| | |
|---|---|
| Tested By | RI |
| Date | 06/09/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9208/B-14 | Depth/Elev. | 28.5'-30' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**
**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

*As-Received Moisture Content*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 191.29 |
| Mass of Dry Sample & Tare, g | 178.94 |
| Mass of Tare, g | 59.92 |
| Moisture Content, % | 10.4 |

*Moisture Content of Material Used for Hydrometer Analysis*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 275.80 |
| Mass of Dry Sample & Tare, g | 265.40 |
| Mass of Tare, g | 92.90 |
| Moisture Content, % | 6.0 |

| | |
|---|---|
| Mass of Total Sample before separation on #4 sieve & Tare, g | 589.10 |
| Mass of Tare, g | 0.00 |
| Total Mass of Dry Sample, g | 555.60 |

| | |
|---|---|
| Mass of Sample used for hydrometer analysis, g | 74.73 |
| Dry Mass, g | 70.48 |
| % of Total Sample passing #4 sieve | 91.8 |

SIEVE ANALYSIS

*PORTION OF SAMPLE RETAINED ON #4 SIEVE*

Mass of Tare, g: 0.00

| Sieve Size | | Sample & Tare, g | % RETAINED | %PASSING |
|---|---|---|---|---|
| 12" | COBBLES | | 0.0 | 100.0 |
| 3" | COARSE GRAVEL | | 0.0 | 100.0 |
| 2.5" | | | 0.0 | 100.0 |
| 2" | | | 0.0 | 100.0 |
| 1.5" | | | 0.0 | 100.0 |
| 1" | | 0.00 | 0.0 | 100.0 |
| .75" | FINE GRAVEL | 20.48 | 3.7 | 96.3 |
| .5" | | 20.48 | 3.7 | 96.3 |
| .375" | | 33.53 | 6.0 | 94.0 |
| #4 | COARSE SAND | 45.32 | 8.2 | 91.8 |

*PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)*

| Sieve Size | | Cumulative Mass retained, g | % PASSING |
|---|---|---|---|
| #10 | MEDIUM SAND | 0.72 | 90.9 |
| #20 | | 1.43 | 90.0 |
| #40 | FINE SAND | 4.06 | 86.6 |
| #60 | | 14.64 | 72.8 |
| #100 | | 27.34 | 56.2 |
| #200 | FINES | 36.42 | 44.4 |

Remarks

HYDROMETER ANALYSIS

| | |
|---|---|
| Length of Dispersion Period | 1 Minute |
| Mechanical Dispersion Device ID # | 61 |
| Amount of Dispersing Agent (ml) | 125.0 |
| Specific Gravity (assumed) | 2.700 |
| Specific Gravity (tested) | |
| Starting time | 14:36 |

**PARTICLE-SIZE ANALYSIS**

| | | | |
|---|---|---|---|
| % COBBLES | 0.0 | % MEDIUM SAND | 4.4 |
| % COARSE GRAVEL | 3.7 | % FINE SAND | 42.2 |
| % FINE GRAVEL | 4.5 | % FINES | 44.4 |
| % COARSE SAND | 0.9 | % TOTAL SAMPLE | 100.0 |
| % CLAY(<0.005mm) | 23.9 | % CLAY(<0.002mm) | 19.0 |

| Date | Time | Testing time (min) | Reading | Temp (°C) | K | Composite Correction | Actual Reading | Effective Depth (cm) | a | Particle Diam. (mm) | Percent Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 06/11/10 | 14:38 | 2 | 34.0 | 27.9 | 0.01255 | 6.0 | 28.0 | 11.7 | 0.99 | 0.0304 | 36.1 |
| 06/11/10 | 14:41 | 5 | 31.5 | 27.9 | 0.01255 | 6.0 | 25.5 | 12.1 | 0.99 | 0.0196 | 32.9 |
| 06/11/10 | 14:51 | 15 | 28.5 | 27.9 | 0.01255 | 6.0 | 22.5 | 12.6 | 0.99 | 0.0115 | 29.0 |
| 06/11/10 | 15:06 | 30 | 26.5 | 27.9 | 0.01255 | 6.0 | 20.5 | 13.0 | 0.99 | 0.0083 | 26.4 |
| 06/11/10 | 15:36 | 60 | 25.0 | 27.9 | 0.01255 | 6.0 | 19.0 | 13.2 | 0.99 | 0.0059 | 24.5 |
| 06/11/10 | 18:46 | 250 | 23.5 | 27.9 | 0.01255 | 6.0 | 17.5 | 13.5 | 0.99 | 0.0029 | 22.6 |
| 06/12/10 | 14:36 | 1440 | 18.5 | 27.9 | 0.01255 | 6.0 | 12.5 | 14.3 | 0.99 | 0.0013 | 16.1 |

| | | | |
|---|---|---|---|
| Hydrometer 152H ID # | 451190 | Oven ID # | 12/13/14/15 |
| Sieve Shaker ID # | 54/130 | Balance ID# | 1/6/7 |

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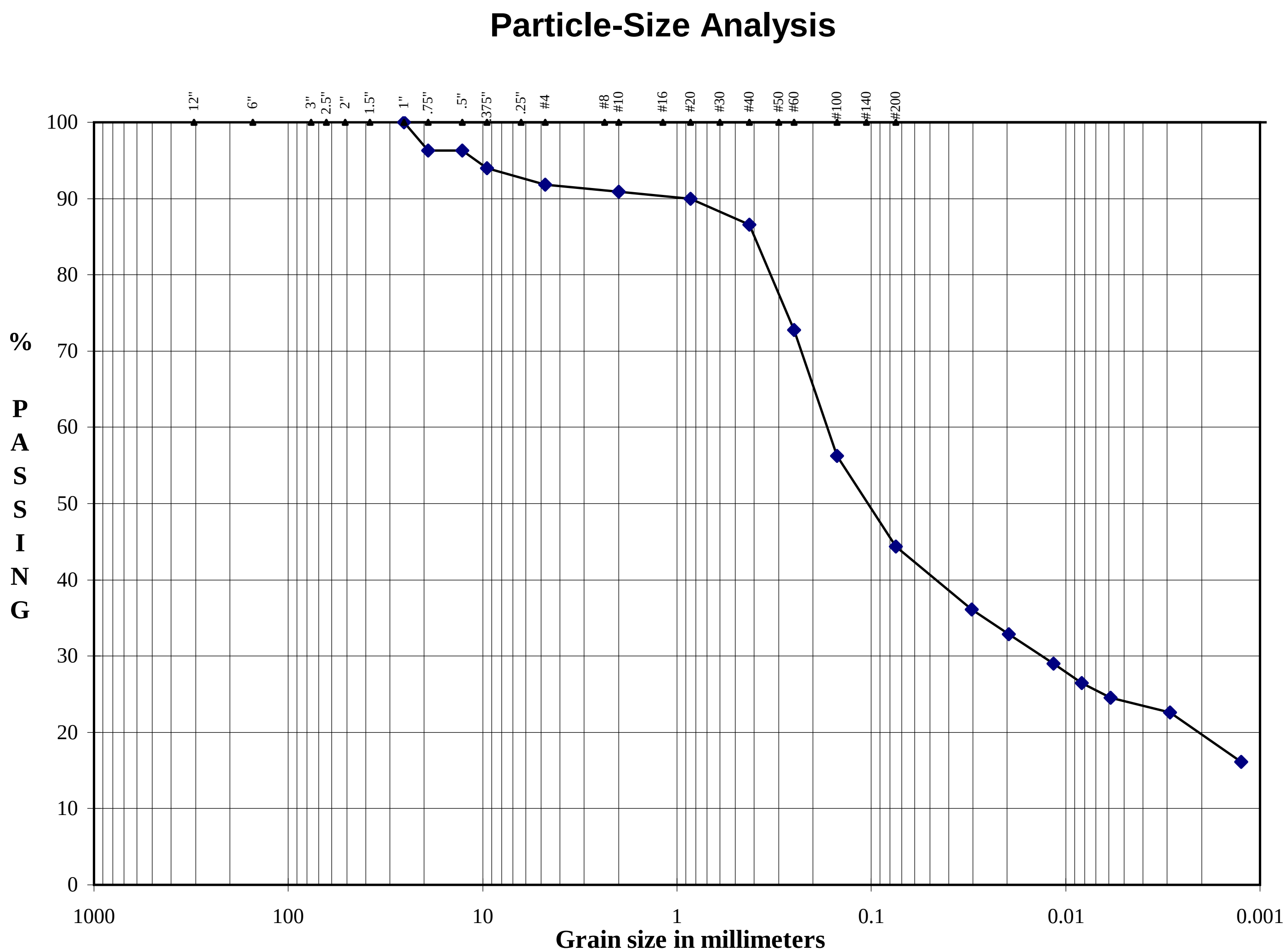
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/09/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9208/B-14 | Depth/Elev. | 28.5'-30' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**

**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**




| Boulders | Cobbles | Gravel: Coarse | Gravel: Fine | Sand: Coarse | Sand: Medium | Sand: Fine | Fines: Silt or Clay |
|---|---|---|---|---|---|---|---|

| | | |
|---|---|---|
| $D_{10}$ | NA | mm |
| $D_{30}$ | NA | mm |
| $D_{60}$ | NA | mm |
| Cu | NA | |
| Cc | NA | |

DESCRIPTION: Yellowish Brown Clayey Sand

USCS (ASTM D2487; D2488): SC

| | | | |
|---|---|---|---|
| T.E.S.T. — TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By | NK |
| | | Date | 06/15/10 |
| | | Checked By | LB |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9216/B-16 | Depth/Elev. | 18.5'-20' |
| Location | - | Add. Info | - |

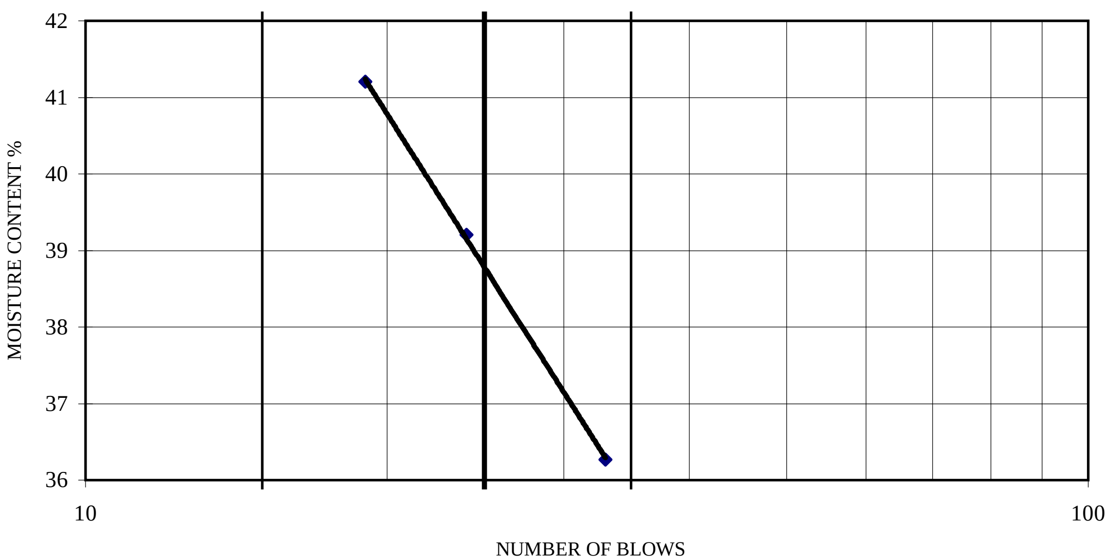
**ASTM D 4318/AASHTO T 88, T 89**

**Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)**

LIQUID LIMIT

| | | | |
|---|---|---|---|
| Number of Blows | 33 | 24 | 19 |
| Mass of Wet Sample & Tare, g | 39.86 | 40.80 | 34.72 |
| Mass of Dry Sample & Tare, g | 36.11 | 37.35 | 31.84 |
| Mass of Tare, g | 25.77 | 28.55 | 24.85 |
| Moisture Content, % | 36.27 | 39.20 | 41.20 |

| | |
|---|---|
| Oven ID # | 12/13/14/15 |
| Balance ID # | 2 |
| Liquid Limit Device ID # | 56 |




PLASTIC LIMIT

| | | |
|---|---|---|
| Mass of Wet Sample & Tare, g | 30.73 | 35.39 |
| Mass of Dry Sample & Tare, g | 29.61 | 33.88 |
| Mass of Tare, g | 22.78 | 24.71 |
| Moisture Content, % | 16.40 | 16.47 |

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 200.08 |
| Mass of Dry Sample & Tare, g | 180.32 |
| Mass of Tare, g | 59.69 |
| Moisture Content, % | 16.38 |

| | |
|---|---|
| LIQUID LIMIT (LL) | 39 |
| PLASTIC LIMIT (PL) | 16 |
| PLASTICITY INDEX (PI) | 23 |
| LIQUIDITY INDEX (LI) | 0.02 |

DESCRIPTION: Olive Brown Lean Clay

USCS (ASTM D2487; D2488): CL

AASHTO (M 145): NA

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Phone: 770-938-8233
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Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/09/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9216/B-16 | Depth/Elev. | 18.5'-20' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**
**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

*As-Received Moisture Content*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 200.08 |
| Mass of Dry Sample & Tare, g | 180.32 |
| Mass of Tare, g | 59.69 |
| Moisture Content, % | 16.4 |

*Moisture Content of Material Used for Hydrometer Analysis*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 288.70 |
| Mass of Dry Sample & Tare, g | 270.70 |
| Mass of Tare, g | 90.50 |
| Moisture Content, % | 10.0 |

| | |
|---|---|
| Mass of Total Sample before separation on #4 sieve & Tare, g | 658.30 |
| Mass of Tare, g | 0.00 |
| Total Mass of Dry Sample, g | 598.51 |

| | |
|---|---|
| Mass of Sample used for hydrometer analysis, g | 75.12 |
| Dry Mass, g | 68.30 |
| % of Total Sample passing #4 sieve | 99.9 |

SIEVE ANALYSIS

*PORTION OF SAMPLE RETAINED ON #4 SIEVE*

Mass of Tare, g: 0.00

| Sieve Size | | Sample & Tare, g | % RETAINED | %PASSING |
|---|---|---|---|---|
| 12" | COBBLES | | 0.0 | 100.0 |
| 3" | COARSE GRAVEL | | 0.0 | 100.0 |
| 2.5" | | | 0.0 | 100.0 |
| 2" | | | 0.0 | 100.0 |
| 1.5" | | | 0.0 | 100.0 |
| 1" | | | 0.0 | 100.0 |
| .75" | FINE GRAVEL | | 0.0 | 100.0 |
| .5" | | | 0.0 | 100.0 |
| .375" | | 0.00 | 0.0 | 100.0 |
| #4 | COARSE SAND | 0.84 | 0.1 | 99.9 |

*PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)*

| Sieve Size | | Cumulative Mass retained, g | % PASSING |
|---|---|---|---|
| #10 | MEDIUM SAND | 0.41 | 99.3 |
| #20 | | 0.66 | 98.9 |
| #40 | FINE SAND | 1.35 | 97.9 |
| #60 | | 2.61 | 96.0 |
| #100 | | 4.94 | 92.6 |
| #200 | FINES | 9.51 | 86.0 |

Remarks

HYDROMETER ANALYSIS

| | |
|---|---|
| Length of Dispersion Period | 1 Minute |
| Mechanical Dispersion Device ID # | 61 |
| Amount of Dispersing Agent (ml) | 125.0 |
| Specific Gravity (assumed) | 2.700 |
| Specific Gravity (tested) | |
| Starting time | 11:29 |

**PARTICLE-SIZE ANALYSIS**

| | | | |
|---|---|---|---|
| % COBBLES | 0.0 | % MEDIUM SAND | 1.4 |
| % COARSE GRAVEL | 0.0 | % FINE SAND | 11.9 |
| % FINE GRAVEL | 0.1 | % FINES | 86.0 |
| % COARSE SAND | 0.6 | % TOTAL SAMPLE | 100.0 |
| % CLAY(<0.005mm) | 45.9 | % CLAY(<0.002mm) | 35.9 |

| Date | Time | Testing time (min) | Reading | Temp (°C) | K | Composite Correction | Actual Reading | Effective Depth (cm) | a | Particle Diam. (mm) | Percent Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 06/12/10 | 11:31 | 2 | 54.5 | 29.3 | 0.01212 | 5.5 | 49.0 | 8.2 | 0.99 | 0.0246 | 70.9 |
| 06/12/10 | 11:34 | 5 | 50.0 | 29.3 | 0.01212 | 5.5 | 44.5 | 9.0 | 0.99 | 0.0163 | 64.4 |
| 06/12/10 | 11:44 | 15 | 44.0 | 29.3 | 0.01212 | 5.5 | 38.5 | 10.0 | 0.99 | 0.0099 | 55.7 |
| 06/12/10 | 11:59 | 30 | 40.5 | 29.3 | 0.01212 | 5.5 | 35.0 | 10.6 | 0.99 | 0.0072 | 50.7 |
| 06/12/10 | 12:29 | 60 | 37.5 | 29.3 | 0.01212 | 5.5 | 32.0 | 11.1 | 0.99 | 0.0052 | 46.3 |
| 06/12/10 | 15:39 | 250 | 33.5 | 29.3 | 0.01212 | 5.5 | 28.0 | 11.7 | 0.99 | 0.0026 | 40.5 |
| 06/13/10 | 11:29 | 1440 | 26.0 | 29.3 | 0.01212 | 5.5 | 20.5 | 13.0 | 0.99 | 0.0012 | 29.7 |

| | | | |
|---|---|---|---|
| Hydrometer 152H ID # | 451190 | Oven ID # | 12/13/14/15 |
| Sieve Shaker ID # | 54/130 | Balance ID# | 1/6/7 |

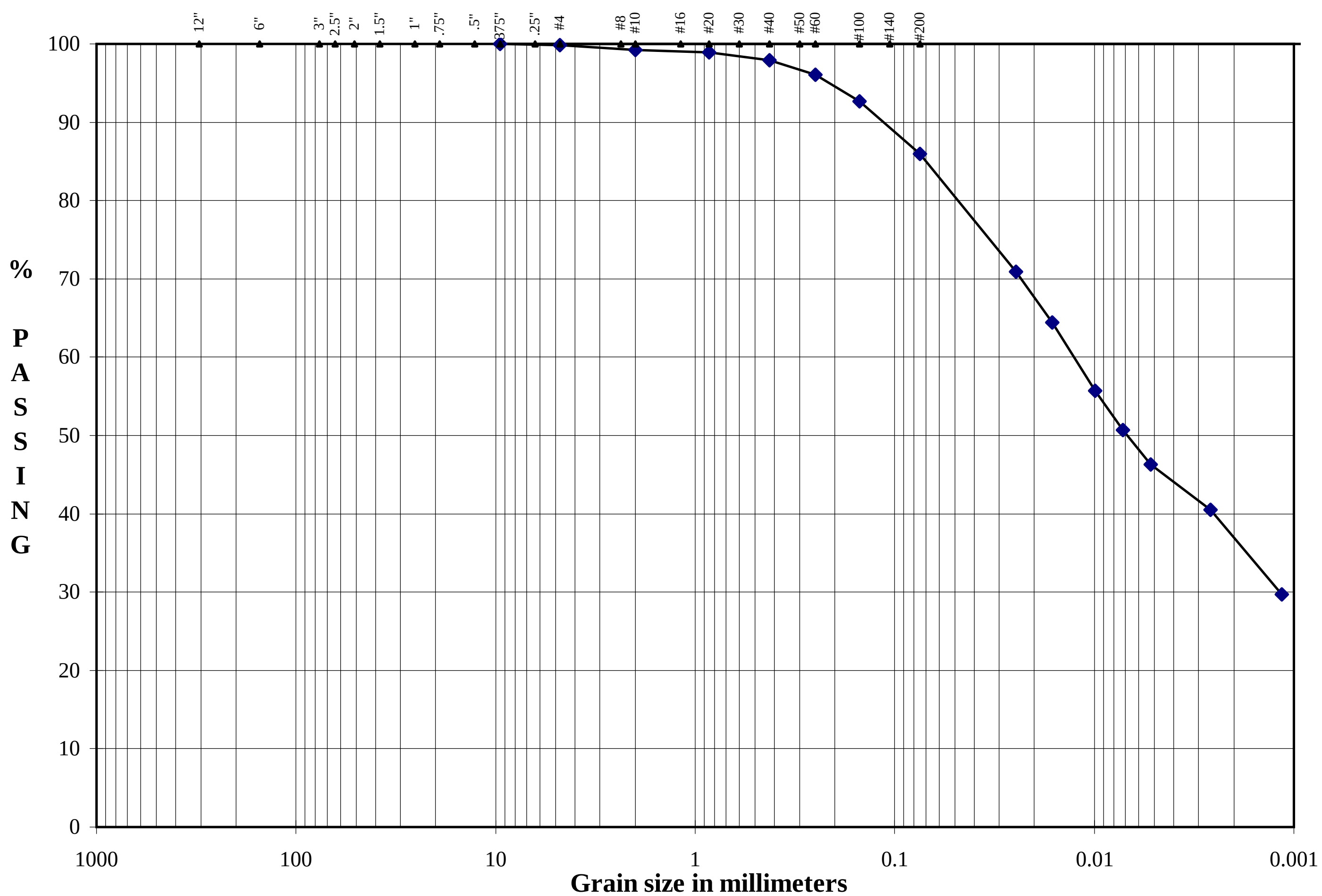
| | | | |
|---|---|---|---|
| TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By | RI |
| | | Date | 06/09/10 |
| | | Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9216/B-16 | Depth/Elev. | 18.5'-20' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**

**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

## Particle-Size Analysis




| Boulders | Cobbles | Gravel | | Sand | | | Fines |
|---|---|---|---|---|---|---|---|
| | | Coarse | Fine | Coarse | Medium | Fine | Silt or Clay |

| | | |
|---|---|---|
| $D_{10}$ | NA | mm |
| $D_{30}$ | NA | mm |
| $D_{60}$ | NA | mm |
| Cu | NA | |
| Cc | NA | |

DESCRIPTION: Olive Brown Lean Clay

USCS (ASTM D2487; D2488): CL

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1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | NK |
| Date | 06/15/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9218/B-17 | Depth/Elev. | 28.5'-30' |
| Location | - | Add. Info | - |

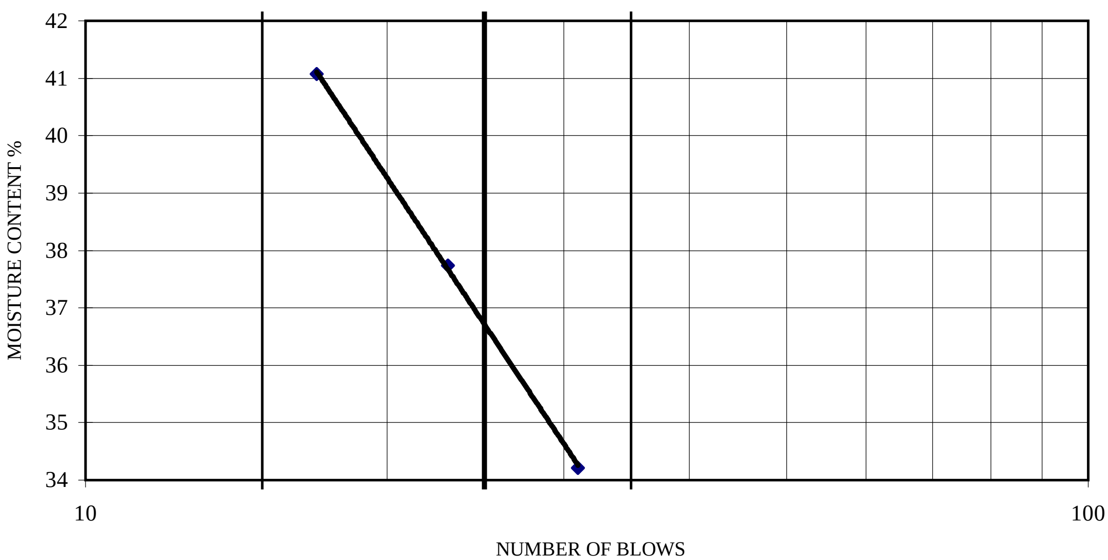
**ASTM D 4318/AASHTO T 88, T 89**

**Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)**

LIQUID LIMIT

| | | | |
|---|---|---|---|
| Number of Blows | 31 | 23 | 17 |
| Mass of Wet Sample & Tare, g | 39.52 | 35.52 | 32.20 |
| Mass of Dry Sample & Tare, g | 35.65 | 32.35 | 29.60 |
| Mass of Tare, g | 24.34 | 23.95 | 23.27 |
| Moisture Content, % | 34.22 | 37.74 | 41.07 |

| | |
|---|---|
| Oven ID # | 12/13/14/15 |
| Balance ID # | 2 |
| Liquid Limit Device ID # | 56 |




PLASTIC LIMIT

| | | |
|---|---|---|
| Mass of Wet Sample & Tare, g | 32.27 | 26.68 |
| Mass of Dry Sample & Tare, g | 30.77 | 25.60 |
| Mass of Tare, g | 20.76 | 18.32 |
| Moisture Content, % | 14.99 | 14.84 |

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 134.14 |
| Mass of Dry Sample & Tare, g | 123.36 |
| Mass of Tare, g | 60.47 |
| Moisture Content, % | 17.14 |

| | |
|---|---|
| LIQUID LIMIT (LL) | 37 |
| PLASTIC LIMIT (PL) | 15 |
| PLASTICITY INDEX (PI) | 22 |
| LIQUIDITY INDEX (LI) | 0.10 |

DESCRIPTION: Yellowish Brown Lean Clay with Sand

USCS (ASTM D2487; D2488): CL

AASHTO (M 145): NA

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/09/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9218/B-17 | Depth/Elev. | 28.5'-30' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**
**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

*As-Received Moisture Content*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 134.14 |
| Mass of Dry Sample & Tare, g | 123.36 |
| Mass of Tare, g | 60.47 |
| Moisture Content, % | 17.1 |

*Moisture Content of Material Used for Hydrometer Analysis*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 250.00 |
| Mass of Dry Sample & Tare, g | 235.10 |
| Mass of Tare, g | 102.50 |
| Moisture Content, % | 11.2 |

| | |
|---|---|
| Mass of Total Sample before separation on #4 sieve & Tare, g | 819.00 |
| Mass of Tare, g | 0.00 |
| Total Mass of Dry Sample, g | 736.27 |

| | |
|---|---|
| Mass of Sample used for hydrometer analysis, g | 75.16 |
| Dry Mass, g | 67.57 |
| % of Total Sample passing #4 sieve | 99.5 |

SIEVE ANALYSIS

*PORTION OF SAMPLE RETAINED ON #4 SIEVE*

Mass of Tare, g: 0.00

| Sieve Size | | Sample & Tare, g | % RETAINED | %PASSING |
|---|---|---|---|---|
| 12" | COBBLES | | 0.0 | 100.0 |
| 3" | COARSE GRAVEL | | 0.0 | 100.0 |
| 2.5" | | | 0.0 | 100.0 |
| 2" | | | 0.0 | 100.0 |
| 1.5" | | | 0.0 | 100.0 |
| 1" | | | 0.0 | 100.0 |
| .75" | FINE GRAVEL | | 0.0 | 100.0 |
| .5" | | 0.00 | 0.0 | 100.0 |
| .375" | | 2.56 | 0.3 | 99.7 |
| #4 | COARSE SAND | 3.79 | 0.5 | 99.5 |

*PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)*

| Sieve Size | | Cumulative Mass retained, g | % PASSING |
|---|---|---|---|
| #10 | MEDIUM SAND | 0.27 | 99.1 |
| #20 | | 0.47 | 98.8 |
| #40 | FINE SAND | 1.36 | 97.5 |
| #60 | | 4.99 | 92.1 |
| #100 | | 10.67 | 83.8 |
| #200 | FINES | 16.36 | 75.4 |

Remarks

HYDROMETER ANALYSIS

| | |
|---|---|
| Length of Dispersion Period | 1 Minute |
| Mechanical Dispersion Device ID # | 61 |
| Amount of Dispersing Agent (ml) | 125.0 |
| Specific Gravity (assumed) | 2.700 |
| Specific Gravity (tested) | |
| Starting time | 11:31 |

**PARTICLE-SIZE ANALYSIS**

| | | | |
|---|---|---|---|
| % COBBLES | 0.0 | % MEDIUM SAND | 1.6 |
| % COARSE GRAVEL | 0.0 | % FINE SAND | 22.1 |
| % FINE GRAVEL | 0.5 | % FINES | 75.4 |
| % COARSE SAND | 0.4 | % TOTAL SAMPLE | 100.0 |
| % CLAY(<0.005mm) | 40.9 | % CLAY(<0.002mm) | 32.2 |

| Date | Time | Testing time (min) | Reading | Temp (°C) | K | Composite Correction | Actual Reading | Effective Depth (cm) | a | Particle Diam. (mm) | Percent Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 06/12/10 | 11:33 | 2 | 48.0 | 29.3 | 0.01212 | 5.5 | 42.5 | 9.3 | 0.99 | 0.0262 | 62.0 |
| 06/12/10 | 11:36 | 5 | 44.0 | 29.3 | 0.01212 | 5.5 | 38.5 | 10.0 | 0.99 | 0.0171 | 56.1 |
| 06/12/10 | 11:46 | 15 | 39.5 | 29.3 | 0.01212 | 5.5 | 34.0 | 10.7 | 0.99 | 0.0103 | 49.6 |
| 06/12/10 | 12:01 | 30 | 37.0 | 29.3 | 0.01212 | 5.5 | 31.5 | 11.2 | 0.99 | 0.0074 | 45.9 |
| 06/12/10 | 12:31 | 60 | 34.0 | 29.3 | 0.01212 | 5.5 | 28.5 | 11.6 | 0.99 | 0.0053 | 41.5 |
| 06/12/10 | 15:41 | 250 | 30.5 | 29.3 | 0.01212 | 5.5 | 25.0 | 12.2 | 0.99 | 0.0027 | 36.4 |
| 06/13/10 | 11:31 | 1440 | 24.0 | 29.3 | 0.01212 | 5.5 | 18.5 | 13.3 | 0.99 | 0.0012 | 27.0 |

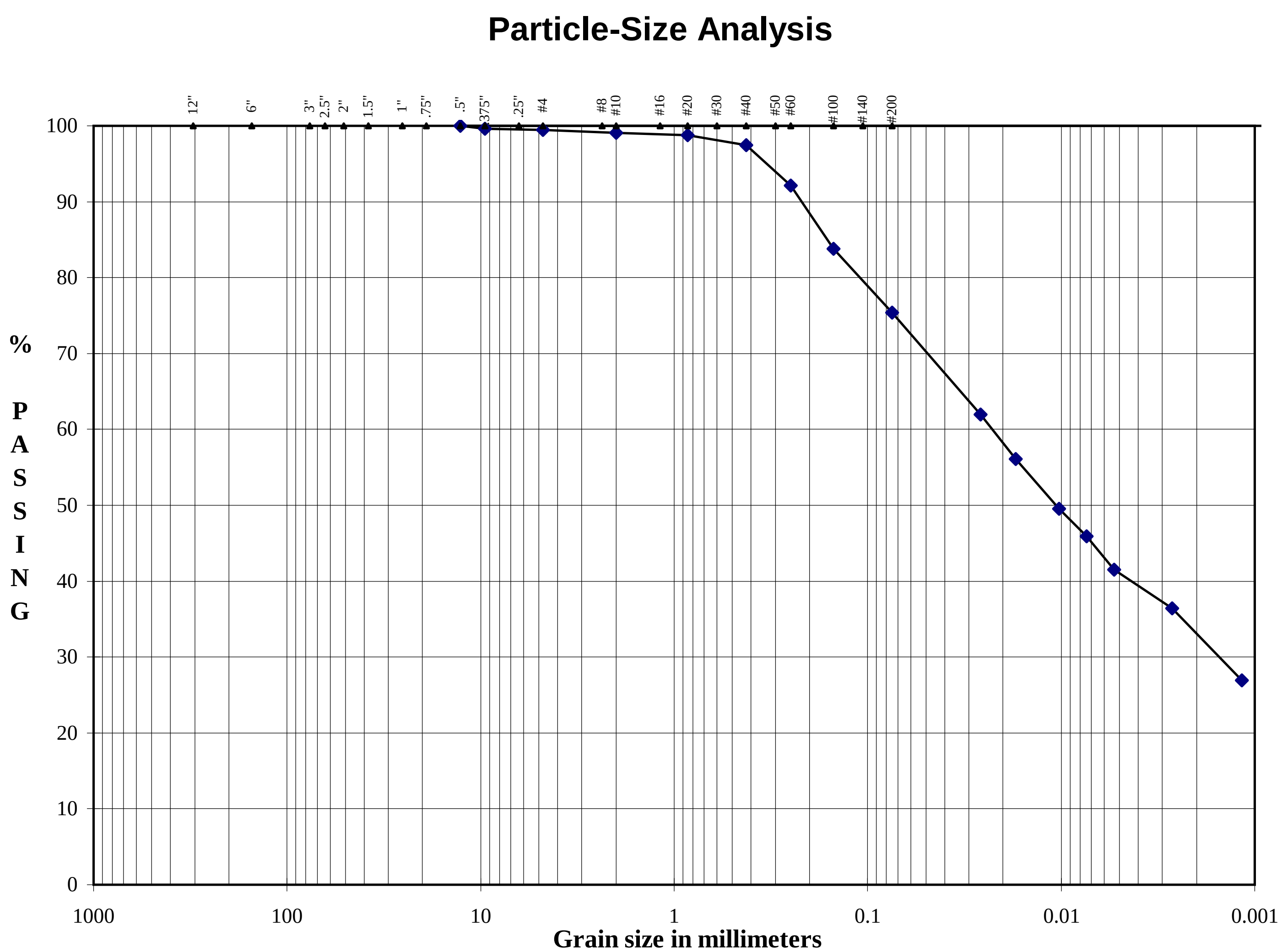
| | | | |
|---|---|---|---|
| Hydrometer 152H ID # | 451190 | Oven ID # | 12/13/14/15 |
| Sieve Shaker ID # | 54/130 | Balance ID# | 1/6/7 |

| | | | |
|---|---|---|---|
| **TIMELY ENGINEERING SOIL TESTS, LLC** | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By | RI |
| | | Date | 06/09/10 |
| | | Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9218/B-17 | Depth/Elev. | 28.5'-30' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**

**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**




| Boulders | Cobbles | Gravel | | Sand | | | Fines |
|---|---|---|---|---|---|---|---|
| | | Coarse | Fine | Coarse | Medium | Fine | Silt or Clay |

DESCRIPTION: Yellowish Brown Lean Clay with Sand

| | | |
|---|---|---|
| $D_{10}$ | NA | mm |
| $D_{30}$ | NA | mm |
| $D_{60}$ | NA | mm |
| Cu | NA | |
| Cc | NA | |

USCS (ASTM D2487; D2488): CL

T.E. S.T.

TIMELY ENGINEERING SOIL TESTS, LLC

1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

AASHTO R18

| | |
|---|---|
| Tested By | NK |
| Date | 06/14/10 |
| Checked By | (initials) |

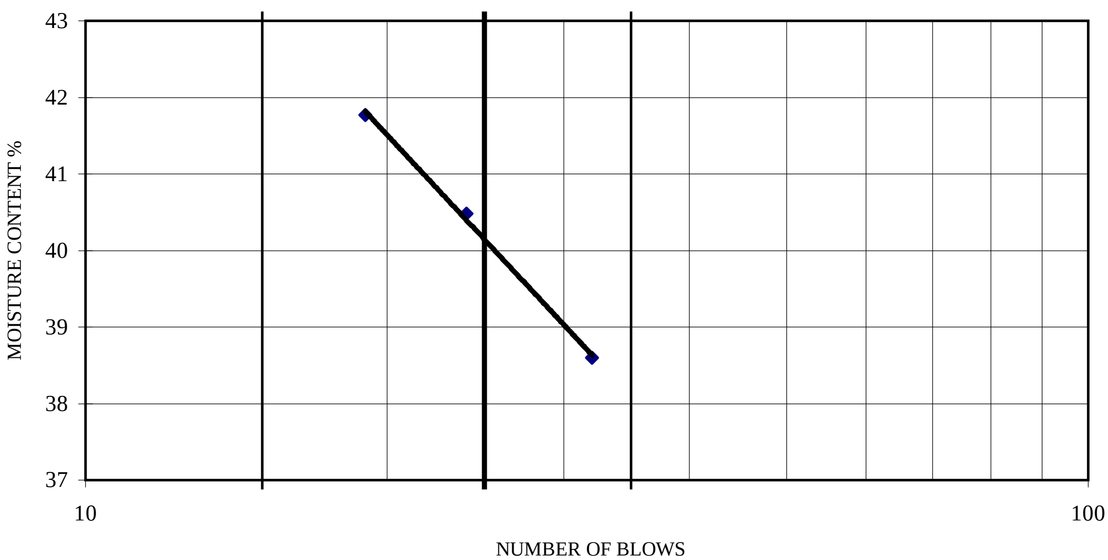
| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9200/B-18 | Depth/Elev. | 13.5'-15' |
| Location | - | Add. Info | - |

**ASTM D 4318/AASHTO T 88, T 89**
**Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)**

LIQUID LIMIT

| | | | |
|---|---|---|---|
| Number of Blows | 32 | 24 | 19 |
| Mass of Wet Sample & Tare, g | 43.04 | 40.82 | 40.84 |
| Mass of Dry Sample & Tare, g | 38.37 | 37.27 | 36.88 |
| Mass of Tare, g | 26.27 | 28.50 | 27.40 |
| Moisture Content, % | 38.60 | 40.48 | 41.77 |

| | |
|---|---|
| Oven ID # | 12/13/14/15 |
| Balance ID # | 2 |
| Liquid Limit Device ID # | 56 |




PLASTIC LIMIT

| | | |
|---|---|---|
| Mass of Wet Sample & Tare, g | 34.59 | 30.73 |
| Mass of Dry Sample & Tare, g | 33.03 | 29.57 |
| Mass of Tare, g | 23.24 | 22.30 |
| Moisture Content, % | 15.93 | 15.96 |

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 151.98 |
| Mass of Dry Sample & Tare, g | 139.16 |
| Mass of Tare, g | 60.91 |
| Moisture Content, % | 16.38 |

| | |
|---|---|
| LIQUID LIMIT (LL) | 40 |
| PLASTIC LIMIT (PL) | 16 |
| PLASTICITY INDEX (PI) | 24 |
| LIQUIDITY INDEX (LI) | 0.02 |

DESCRIPTION: Brownish Yellow Lean Clay with Sand

USCS (ASTM D2487; D2488): CL

AASHTO (M 145): NA

TIMELY ENGINEERING SOIL TESTS, LLC

1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/09/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9200/B-18 | Depth/Elev. | 13.5'-15' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**
**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

*As-Received Moisture Content*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 151.98 |
| Mass of Dry Sample & Tare, g | 139.16 |
| Mass of Tare, g | 60.91 |
| Moisture Content, % | 16.4 |

*Moisture Content of Material Used for Hydrometer Analysis*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 239.83 |
| Mass of Dry Sample & Tare, g | 226.90 |
| Mass of Tare, g | 95.00 |
| Moisture Content, % | 9.8 |

| | |
|---|---|
| Mass of Total Sample before separation on #4 sieve & Tare, g | 594.70 |
| Mass of Tare, g | 0.00 |
| Total Mass of Dry Sample, g | 541.61 |

| | |
|---|---|
| Mass of Sample used for hydrometer analysis, g | 75.10 |
| Dry Mass, g | 68.40 |
| % of Total Sample passing #4 sieve | 92.4 |

SIEVE ANALYSIS

*PORTION OF SAMPLE RETAINED ON #4 SIEVE*

Mass of Tare, g: 0.00

| Sieve Size | | Sample & Tare, g | % RETAINED | %PASSING |
|---|---|---|---|---|
| 12" | COBBLES | | 0.0 | 100.0 |
| 3" | COARSE GRAVEL | | 0.0 | 100.0 |
| 2.5" | | | 0.0 | 100.0 |
| 2" | | | 0.0 | 100.0 |
| 1.5" | | | 0.0 | 100.0 |
| 1" | | 0.00 | 0.0 | 100.0 |
| .75" | FINE GRAVEL | 29.00 | 5.4 | 94.6 |
| .5" | | 36.38 | 6.7 | 93.3 |
| .375" | | 38.83 | 7.2 | 92.8 |
| #4 | COARSE SAND | 41.27 | 7.6 | 92.4 |

*PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)*

| Sieve Size | | Cumulative Mass retained, g | % PASSING |
|---|---|---|---|
| #10 | MEDIUM SAND | 0.89 | 91.2 |
| #20 | | 1.75 | 90.0 |
| #40 | FINE SAND | 2.86 | 88.5 |
| #60 | | 4.76 | 86.0 |
| #100 | | 8.29 | 81.2 |
| #200 | FINES | 15.10 | 72.0 |

Remarks

HYDROMETER ANALYSIS

| | |
|---|---|
| Length of Dispersion Period | 1 Minute |
| Mechanical Dispersion Device ID # | 61 |
| Amount of Dispersing Agent (ml) | 125.0 |
| Specific Gravity (assumed) | 2.700 |
| Specific Gravity (tested) | |
| Starting time | 14:32 |

**PARTICLE-SIZE ANALYSIS**

| | | | |
|---|---|---|---|
| % COBBLES | 0.0 | % MEDIUM SAND | 2.7 |
| % COARSE GRAVEL | 5.4 | % FINE SAND | 16.5 |
| % FINE GRAVEL | 2.3 | % FINES | 72.0 |
| % COARSE SAND | 1.2 | % TOTAL SAMPLE | 100.0 |
| % CLAY(<0.005mm) | 34.8 | % CLAY(<0.002mm) | 25.6 |

| Date | Time | Testing time (min) | Reading | Temp ($^{o}C$) | K | Composite Correction | Actual Reading | Effective Depth (cm) | a | Particle Diam. (mm) | Percent Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 06/11/10 | 14:34 | 2 | 49.5 | 27.5 | 0.01255 | 6.0 | 43.5 | 9.2 | 0.99 | 0.0269 | 58.2 |
| 06/11/10 | 14:37 | 5 | 44.5 | 27.5 | 0.01255 | 6.0 | 38.5 | 10.0 | 0.99 | 0.0177 | 51.5 |
| 06/11/10 | 14:47 | 15 | 39.5 | 27.5 | 0.01255 | 6.0 | 33.5 | 10.8 | 0.99 | 0.0107 | 44.8 |
| 06/11/10 | 15:02 | 30 | 34.0 | 27.5 | 0.01255 | 6.0 | 28.0 | 11.7 | 0.99 | 0.0078 | 37.4 |
| 06/11/10 | 15:32 | 60 | 33.0 | 27.5 | 0.01255 | 6.0 | 27.0 | 11.9 | 0.99 | 0.0056 | 36.1 |
| 06/11/10 | 18:42 | 250 | 28.5 | 27.5 | 0.01255 | 6.0 | 22.5 | 12.6 | 0.99 | 0.0028 | 30.1 |
| 06/12/10 | 14:32 | 1440 | 22.0 | 27.5 | 0.01255 | 6.0 | 16.0 | 13.7 | 0.99 | 0.0012 | 21.4 |

| | | | |
|---|---|---|---|
| Hydrometer 152H ID # | 451190 | Oven ID # | 12/13/14/15 |
| Sieve Shaker ID # | 54/130 | Balance ID# | 1/6/7 |

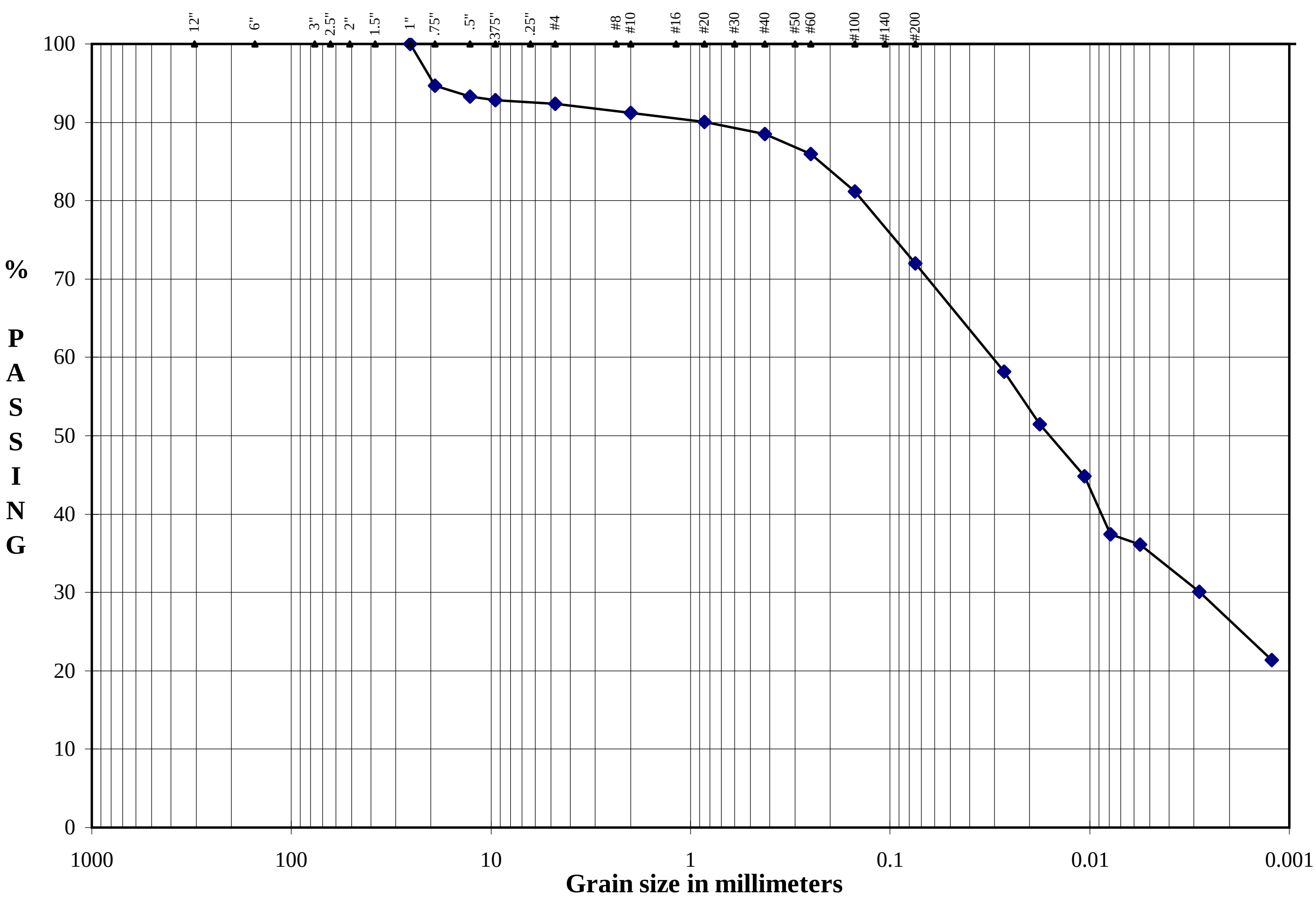
| TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By | RI |
|---|---|---|---|
| | | Date | 06/09/10 |
| | | Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9200/B-18 | Depth/Elev. | 13.5'-15' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**

**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

## Particle-Size Analysis




| Boulders | Cobbles | Gravel | | Sand | | | Fines |
|---|---|---|---|---|---|---|---|
| | | Coarse | Fine | Coarse | Medium | Fine | Silt or Clay |

| | | |
|---|---|---|
| $D_{10}$ | NA | mm |
| $D_{30}$ | NA | mm |
| $D_{60}$ | NA | mm |
| Cu | NA | |
| Cc | NA | |

DESCRIPTION: Brownish Yellow Lean Clay with Sand

USCS (ASTM D2487; D2488): CL

| | | | |
|---|---|---|---|
| T.E.S.T. | TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By: RI<br>Date: 06/18/10<br>Checked By: *[initials]* |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9219/B-18 | Depth/Elev. | 33.5'-35' |
| Location | - | Add. Info | - |

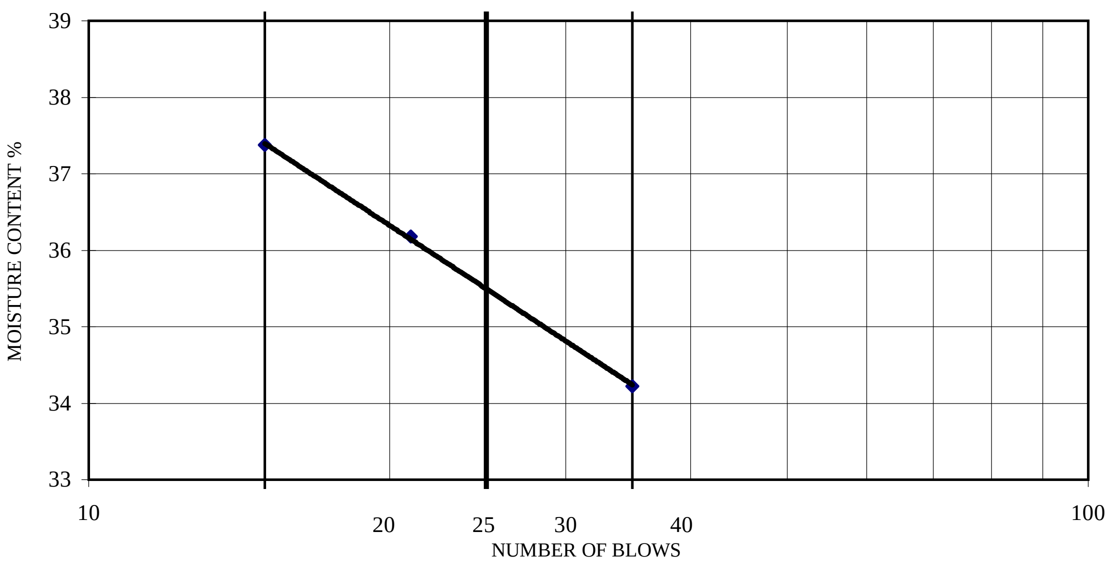
**ASTM D 4318/AASHTO T 88, T 89**

**Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)**

LIQUID LIMIT

| | | | |
|---|---|---|---|
| Number of Blows | 35 | 21 | 15 |
| Mass of Wet Sample & Tare, g | 35.20 | 34.58 | 34.97 |
| Mass of Dry Sample & Tare, g | 32.64 | 32.04 | 32.38 |
| Mass of Tare, g | 25.16 | 25.02 | 25.45 |
| Moisture Content, % | 34.22 | 36.18 | 37.37 |

| | |
|---|---|
| Oven ID # | 12/13/14/15 |
| Balance ID # | 2 |
| Liquid Limit Device ID # | 56 |




PLASTIC LIMIT

| | | |
|---|---|---|
| Mass of Wet Sample & Tare, g | 33.50 | 35.86 |
| Mass of Dry Sample & Tare, g | 31.51 | 33.80 |
| Mass of Tare, g | 23.78 | 25.83 |
| Moisture Content, % | 25.74 | 25.85 |

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 159.35 |
| Mass of Dry Sample & Tare, g | 143.20 |
| Mass of Tare, g | 61.38 |
| Moisture Content, % | 19.74 |

| | |
|---|---|
| LIQUID LIMIT (LL) | 35 |
| PLASTIC LIMIT (PL) | 26 |
| PLASTICITY INDEX (PI) | 9 |
| LIQUIDITY INDEX (LI) | -0.70 |

DESCRIPTION: Olive Brown Silt with Sand

USCS (ASTM D2487; D2488): ML

AASHTO (M 145): NA

| | | | |
|---|---|---|---|
| T.E. S.T. | TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By: RI<br>Date: 06/09/10<br>Checked By: LB |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9219/B-18 | Depth/Elev. | 33.5'-35' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**

**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

| *As-Received Moisture Content* | | *Moisture Content of Material Used for Hydrometer Analysis* | |
|---|---|---|---|
| Mass of Wet Sample & Tare, g | 159.35 | Mass of Wet Sample & Tare, g | 173.00 |
| Mass of Dry Sample & Tare, g | 143.20 | Mass of Dry Sample & Tare, g | 169.40 |
| Mass of Tare, g | 61.38 | Mass of Tare, g | 95.40 |
| Moisture Content, % | 19.7 | Moisture Content, % | 4.9 |

| | | | |
|---|---|---|---|
| Mass of Total Sample before separation on #4 sieve & Tare, g | 238.40 | Mass of Sample used for hydrometer analysis, g | 72.36 |
| Mass of Tare, g | 0.00 | Dry Mass, g | 69.00 |
| Total Mass of Dry Sample, g | 227.34 | % of Total Sample passing #4 sieve | 94.0 |

SIEVE ANALYSIS

*PORTION OF SAMPLE RETAINED ON #4 SIEVE*

Mass of Tare, g: 0.00

| Sieve Size | | Sample & Tare, g | % RETAINED | %PASSING |
|---|---|---|---|---|
| 12" | COBBLES | | 0.0 | 100.0 |
| 3" | COARSE GRAVEL | | 0.0 | 100.0 |
| 2.5" | | | 0.0 | 100.0 |
| 2" | | | 0.0 | 100.0 |
| 1.5" | | | 0.0 | 100.0 |
| 1" | | | 0.0 | 100.0 |
| .75" | FINE GRAVEL | | 0.0 | 100.0 |
| .5" | | 0.00 | 0.0 | 100.0 |
| .375" | | 4.47 | 2.0 | 98.0 |
| #4 | COARSE SAND | 13.66 | 6.0 | 94.0 |

*PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)*

| Sieve Size | | Cumulative Mass retained, g | % PASSING |
|---|---|---|---|
| #10 | MEDIUM SAND | 4.69 | 87.6 |
| #20 | | 8.27 | 82.7 |
| #40 | FINE SAND | 10.30 | 80.0 |
| #60 | | 11.58 | 78.2 |
| #100 | | 12.96 | 76.3 |
| #200 | FINES | 14.95 | 73.6 |

Remarks

HYDROMETER ANALYSIS

| | |
|---|---|
| Length of Dispersion Period | 1 Minute |
| Mechanical Dispersion Device ID # | 61 |
| Amount of Dispersing Agent (ml) | 125.0 |
| Specific Gravity (assumed) | 2.700 |
| Specific Gravity (tested) | |
| Starting time | 11:33 |

**PARTICLE-SIZE ANALYSIS**

| | | | |
|---|---|---|---|
| % COBBLES | 0.0 | % MEDIUM SAND | 7.6 |
| % COARSE GRAVEL | 0.0 | % FINE SAND | 6.3 |
| % FINE GRAVEL | 6.0 | % FINES | 73.6 |
| % COARSE SAND | 6.4 | % TOTAL SAMPLE | 100.0 |
| % CLAY(<0.005mm) | 21.0 | % CLAY(<0.002mm) | 13.5 |

| Date | Time | Testing time (min) | Reading | Temp (°C) | K | Composite Correction | Actual Reading | Effective Depth (cm) | a | Particle Diam. (mm) | Percent Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 06/12/10 | 11:35 | 2 | 35.0 | 29.3 | 0.01212 | 5.5 | 29.5 | 11.5 | 0.99 | 0.0290 | 39.8 |
| 06/12/10 | 11:38 | 5 | 32.5 | 29.3 | 0.01212 | 5.5 | 27.0 | 11.9 | 0.99 | 0.0187 | 36.4 |
| 06/12/10 | 11:48 | 15 | 27.5 | 29.3 | 0.01212 | 5.5 | 22.0 | 12.7 | 0.99 | 0.0112 | 29.7 |
| 06/12/10 | 12:03 | 30 | 25.0 | 29.3 | 0.01212 | 5.5 | 19.5 | 13.1 | 0.99 | 0.0080 | 26.3 |
| 06/12/10 | 12:33 | 60 | 22.0 | 29.3 | 0.01212 | 5.5 | 16.5 | 13.6 | 0.99 | 0.0058 | 22.3 |
| 06/12/10 | 15:43 | 250 | 18.5 | 29.3 | 0.01212 | 5.5 | 13.0 | 14.2 | 0.99 | 0.0029 | 17.5 |
| 06/13/10 | 11:33 | 1440 | 13.0 | 29.3 | 0.01212 | 5.5 | 7.5 | 15.1 | 0.99 | 0.0012 | 10.1 |

| | | | |
|---|---|---|---|
| Hydrometer 152H ID # | 451190 | Oven ID # | 12/13/14/15 |
| Sieve Shaker ID # | 54/130 | Balance ID# | 1/6/7 |

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1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

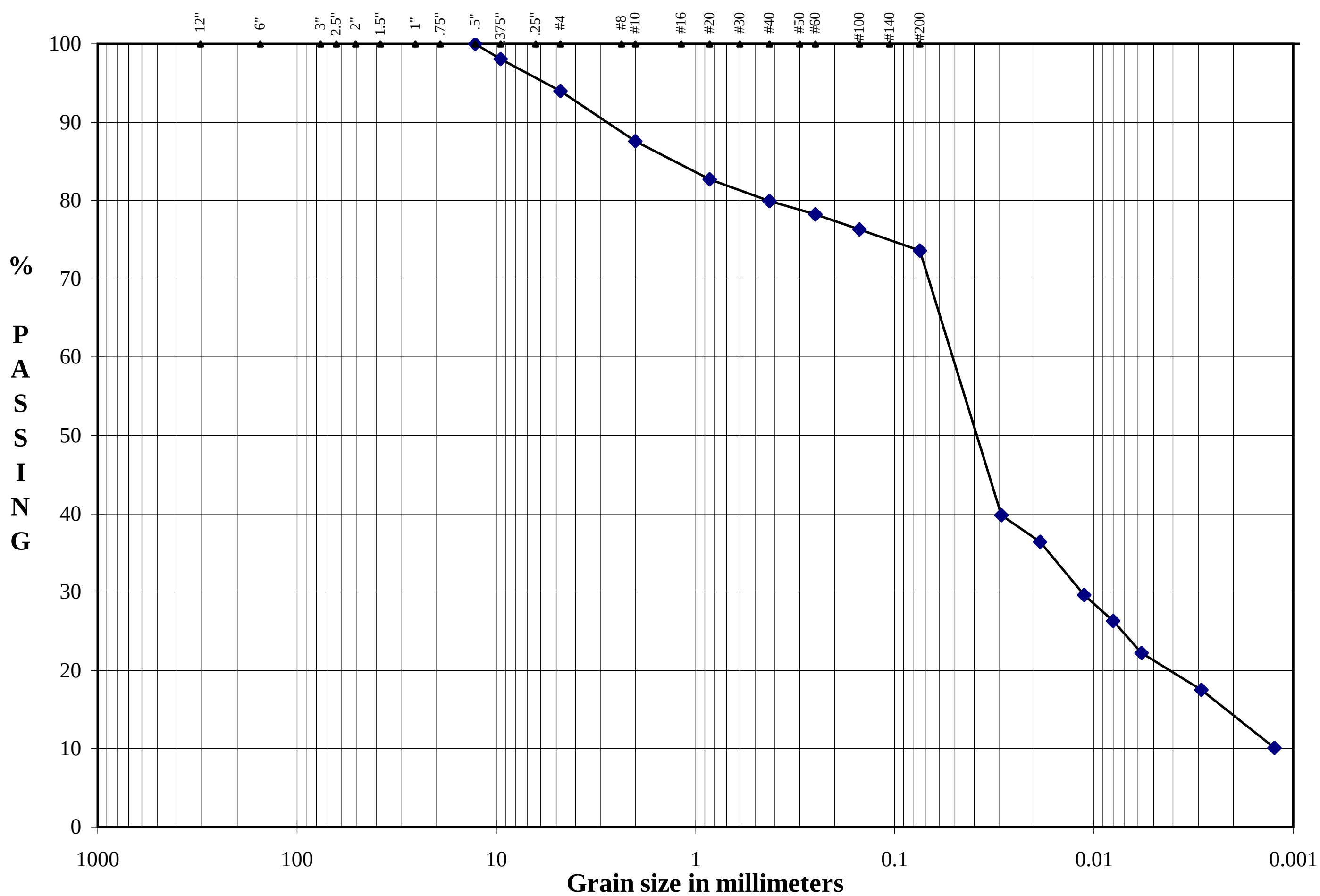
| | |
|---|---|
| Tested By | RI |
| Date | 06/09/10 |
| Checked By | (initials) |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9219/B-18 | Depth/Elev. | 33.5'-35' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**

**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

## Particle-Size Analysis




| Boulders | Cobbles | Gravel | | Sand | | | Fines |
|---|---|---|---|---|---|---|---|
| | | Coarse | Fine | Coarse | Medium | Fine | Silt or Clay |

| | | |
|---|---|---|
| $D_{10}$ | NA | mm |
| $D_{30}$ | NA | mm |
| $D_{60}$ | NA | mm |
| Cu | NA | |
| Cc | NA | |

DESCRIPTION: Olive Brown Silt with Sand

USCS (ASTM D2487; D2488): ML

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| | |
|---|---|
| Tested By | NK |
| Date | 06/15/10 |
| Checked By | [signature] |

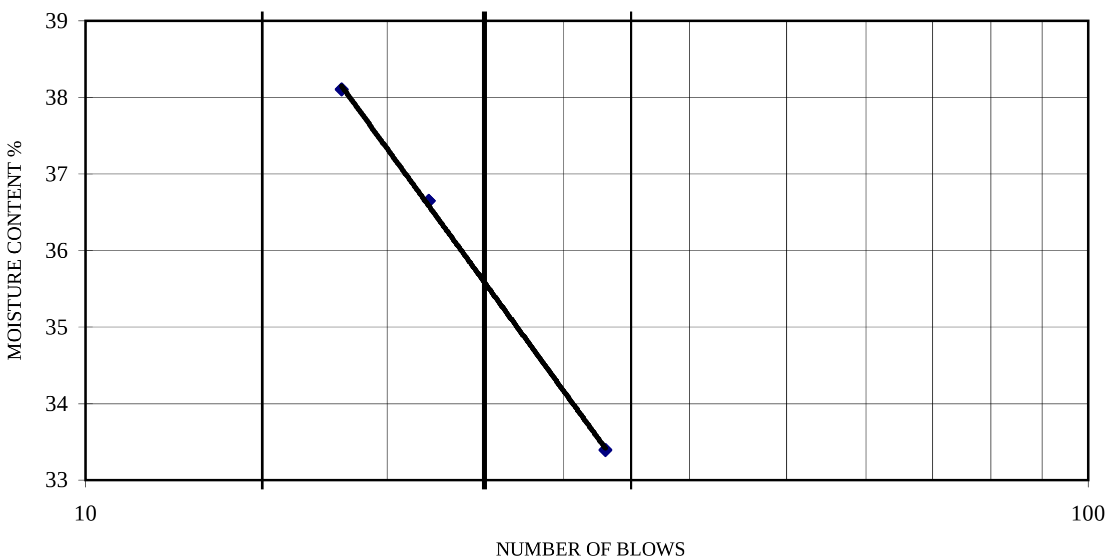
| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9202/B-20 | Depth/Elev. | 6'-8' |
| Location | - | Add. Info | - |

**ASTM D 4318/AASHTO T 88, T 89**
**Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)**

LIQUID LIMIT

| | | | |
|---|---|---|---|
| Number of Blows | 33 | 22 | 18 |
| Mass of Wet Sample & Tare, g | 41.85 | 41.86 | 38.00 |
| Mass of Dry Sample & Tare, g | 38.14 | 38.32 | 34.54 |
| Mass of Tare, g | 27.03 | 28.66 | 25.46 |
| Moisture Content, % | 33.39 | 36.65 | 38.11 |

| | |
|---|---|
| Oven ID # | 12/13/14/15 |
| Balance ID # | 2 |
| Liquid Limit Device ID # | 56 |




PLASTIC LIMIT

| | | |
|---|---|---|
| Mass of Wet Sample & Tare, g | 30.46 | 37.26 |
| Mass of Dry Sample & Tare, g | 29.14 | 35.81 |
| Mass of Tare, g | 21.26 | 27.19 |
| Moisture Content, % | 16.75 | 16.82 |

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 232.61 |
| Mass of Dry Sample & Tare, g | 209.82 |
| Mass of Tare, g | 61.92 |
| Moisture Content, % | 15.41 |

| | |
|---|---|
| LIQUID LIMIT (LL) | 36 |
| PLASTIC LIMIT (PL) | 17 |
| PLASTICITY INDEX (PI) | 19 |
| LIQUIDITY INDEX (LI) | -0.08 |

DESCRIPTION: Olive Brown Lean Clay with Sand.

USCS (ASTM D2487; D2488): CL

AASHTO (M 145): NA

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Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/09/10 |
| Checked By | LB |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9202/B-20 | Depth/Elev. | 6'-8' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**
**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

*As-Received Moisture Content*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 232.61 |
| Mass of Dry Sample & Tare, g | 209.82 |
| Mass of Tare, g | 61.92 |
| Moisture Content, % | 15.4 |

*Moisture Content of Material Used for Hydrometer Analysis*

| | |
|---|---|
| Mass of Wet Sample & Tare, g | 154.80 |
| Mass of Dry Sample & Tare, g | 149.80 |
| Mass of Tare, g | 91.20 |
| Moisture Content, % | 8.5 |

| | |
|---|---|
| Mass of Total Sample before separation on #4 sieve & Tare, g | 405.50 |
| Mass of Tare, g | 0.00 |
| Total Mass of Dry Sample, g | 373.62 |

| | |
|---|---|
| Mass of Sample used for hydrometer analysis, g | 75.10 |
| Dry Mass, g | 69.20 |
| % of Total Sample passing #4 sieve | 96.6 |

SIEVE ANALYSIS

*PORTION OF SAMPLE RETAINED ON #4 SIEVE*

Mass of Tare, g: 0.00

| Sieve Size | | Sample & Tare, g | % RETAINED | %PASSING |
|---|---|---|---|---|
| 12" | COBBLES | | 0.0 | 100.0 |
| 3" | COARSE GRAVEL | | 0.0 | 100.0 |
| 2.5" | | | 0.0 | 100.0 |
| 2" | | | 0.0 | 100.0 |
| 1.5" | | | 0.0 | 100.0 |
| 1" | | | 0.0 | 100.0 |
| .75" | FINE GRAVEL | | 0.0 | 100.0 |
| .5" | | 0.00 | 0.0 | 100.0 |
| .375" | | 3.93 | 1.1 | 98.9 |
| #4 | COARSE SAND | 12.87 | 3.4 | 96.6 |

*PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)*

| Sieve Size | | Cumulative Mass retained, g | % PASSING |
|---|---|---|---|
| #10 | MEDIUM SAND | 1.87 | 93.9 |
| #20 | | 3.09 | 92.2 |
| #40 | FINE SAND | 4.31 | 90.5 |
| #60 | | 5.65 | 88.7 |
| #100 | | 8.53 | 84.7 |
| #200 | FINES | 12.86 | 78.6 |

Remarks

HYDROMETER ANALYSIS

| | |
|---|---|
| Length of Dispersion Period | 1 Minute |
| Mechanical Dispersion Device ID # | 61 |
| Amount of Dispersing Agent (ml) | 125.0 |
| Specific Gravity (assumed) | 2.700 |
| Specific Gravity (tested) | |
| Starting time | 11:25 |

**PARTICLE-SIZE ANALYSIS**

| | | | |
|---|---|---|---|
| % COBBLES | 0.0 | % MEDIUM SAND | 3.4 |
| % COARSE GRAVEL | 0.0 | % FINE SAND | 11.9 |
| % FINE GRAVEL | 3.4 | % FINES | 78.6 |
| % COARSE SAND | 2.6 | % TOTAL SAMPLE | 100.0 |
| % CLAY(<0.005mm) | 32.1 | % CLAY(<0.002mm) | 18.2 |

| Date | Time | Testing time (min) | Reading | Temp (°C) | K | Composite Correction | Actual Reading | Effective Depth (cm) | a | Particle Diam. (mm) | Percent Passing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 06/12/10 | 11:27 | 2 | 46.0 | 29.3 | 0.01212 | 5.5 | 40.5 | 9.7 | 0.99 | 0.0266 | 55.9 |
| 06/12/10 | 11:30 | 5 | 42.0 | 29.3 | 0.01212 | 5.5 | 36.5 | 10.3 | 0.99 | 0.0174 | 50.4 |
| 06/12/10 | 11:40 | 15 | 36.5 | 29.3 | 0.01212 | 5.5 | 31.0 | 11.2 | 0.99 | 0.0105 | 42.8 |
| 06/12/10 | 11:55 | 30 | 32.0 | 29.3 | 0.01212 | 5.5 | 26.5 | 12.0 | 0.99 | 0.0077 | 36.6 |
| 06/12/10 | 12:25 | 60 | 29.5 | 29.3 | 0.01212 | 5.5 | 24.0 | 12.4 | 0.99 | 0.0055 | 33.2 |
| 06/12/10 | 15:35 | 250 | 25.5 | 29.3 | 0.01212 | 5.5 | 20.0 | 13.1 | 0.99 | 0.0028 | 27.6 |
| 06/13/10 | 11:25 | 1440 | 12.0 | 29.3 | 0.01212 | 5.5 | 6.5 | 15.3 | 0.99 | 0.0012 | 9.0 |

| | | | |
|---|---|---|---|
| Hydrometer 152H ID # | 451190 | Oven ID # | 12/13/14/15 |
| Sieve Shaker ID # | 54/130 | Balance ID# | 1/6/7 |

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Web: www.test-llc.com

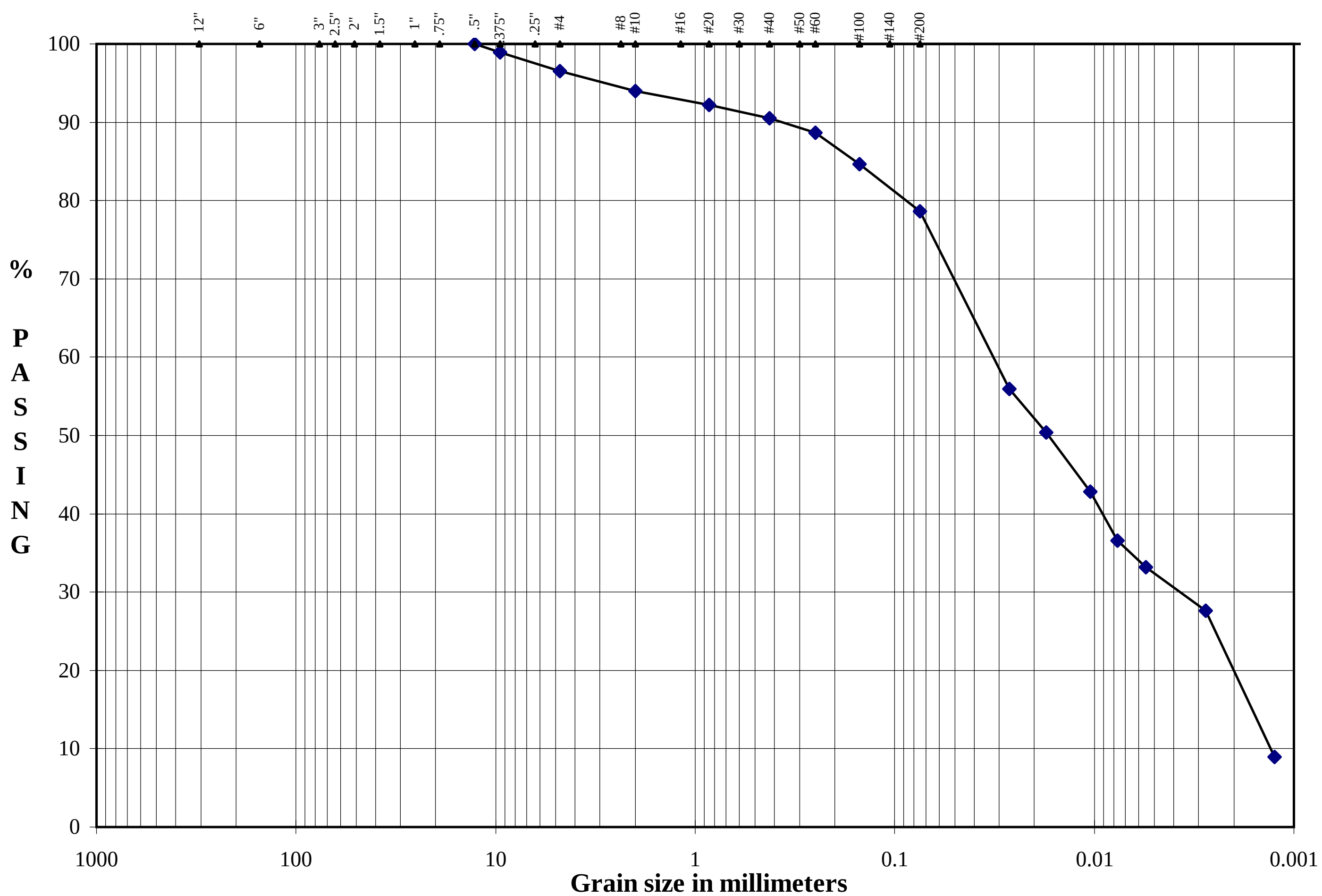
| | |
|---|---|
| Tested By | RI |
| Date | 06/09/10 |
| Checked By | LB |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | Bag |
| Sample ID | 9202/B-20 | Depth/Elev. | 6'-8' |
| Location | - | Add. Info | - |

**ASTM D 422/AASHTO T 88**

**Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)**

## Particle-Size Analysis




| Boulders | Cobbles | Gravel | | Sand | | | Fines |
|---|---|---|---|---|---|---|---|
| | | Coarse | Fine | Coarse | Medium | Fine | Silt or Clay |

| | | |
|---|---|---|
| $D_{10}$ | NA | mm |
| $D_{30}$ | NA | mm |
| $D_{60}$ | NA | mm |
| Cu | NA | |
| Cc | NA | |

DESCRIPTION: Olive Brown Lean Clay with Sand.

USCS (ASTM D2487; D2488): CL

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Web: www.test-llc.com

| | |
|---|---|
| Tested By | KI |
| Date | 06/16/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9192/B-17 D | Depth/Elev. | 31' |
| Location | - | Add. Info | - |

**ASTM D 3080; Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions**

## Sample Data

| | Initial | Final |
|---|---|---|
| Mass of Shear Box/Ring, g | 2101.40 | |
| Mass of Wet Sample and Box/Ring, g | 2273.30 | |
| Mass of Wet Sample, g | 171.90 | |
| Mass of Dry Sample, g | 146.84 | |
| Height of Sample, in | 1.000 | 0.982 |
| Diameter of Sample, in | 2.500 | 2.500 |
| Area of Sample, $in^2$ | 4.91 | 4.91 |
| Volume of Sample, $in^3$ | 4.91 | 4.82 |
| Specific Gravity (Assumed) | 2.800 | 2.800 |
| Wet Unit Weight, pcf | 133.4 | 138.0 |
| Dry Unit Weight, pcf | 114.0 | 116.0 |
| Height of Solids, in | 0.652 | 0.652 |
| Height of Voids, in | 0.348 | 0.330 |
| Height of Water, in | 0.311 | 0.346 |
| Void Ratio | 0.534 | 0.507 |
| Degree of Saturation, % | 89.5 | 104.7 |

## Moisture Content

| | Initial | Final |
|---|---|---|
| Mass of Wet Sample and Tare, g | 314.20 | 328.68 |
| Mass of Dry Sample and Tare, g | 298.40 | 301.21 |
| Mass of Tare, g | 205.80 | 156.22 |
| Moisture Content, % | 17.1 | 18.9 |

| | |
|---|---|
| Shear Apparatus ID | 385 |
| Shear Box ID | 385 B |
| Horizontal Displacement Indicator ID | 386 |
| Normal Deformation Indicator ID | 387 |
| Shear Force Load Cell ID | 388 |
| Normal Force Load Cell ID | 389 |
| Ring ID | 385B/102 |

REMARKS

Material passed #4 sieve used for testing. Sample for remold was collected 10" above bottom of shelby tube. Material was remolded to as-received density @ natural MC

*Notes: 1. Demineralized water used for inundation of sample*
*2. Gap approximately .025 inch used between the halves of the shear box*

## SHEAR DATA

| | |
|---|---|
| Normal force, lb | 68.7 |
| Normal Stress, psi | **14.0** |
| Time $t_{50}$, min | 0.34 |
| Displacement Rate, in/min | 0.01000 |

| | |
|---|---|
| Normal Seating Force, lb | 5.0 |
| Normal Seating Stress, psi | 1.0 |
| Initial Horizontal Displacement Indicator Reading, in | 0.0000 |
| Initial Normal Deformation Indicator Reading, in | 0.0000 |
| Apparatus Deformation, in | 0.0021 |
| Final Corrected Height Change, in | 0.0177 |

| Horizontal Deformation Reading,in | Horizontal Displacement, in | Shear Force, lb | Shear Stress, psi | Normal Deformation Reading,in | Height Change, in | Corrected Height Change,in |
|---|---|---|---|---|---|---|
| 0.000 | 0.000 | 1.9 | 0.0 | 0.0169 | 0.0169 | 0.0148 |
| 0.005 | 0.005 | 18.4 | 3.4 | 0.0174 | 0.0174 | 0.0153 |
| 0.010 | 0.010 | 29.3 | 5.6 | 0.0175 | 0.0175 | 0.0154 |
| 0.015 | 0.015 | 34.6 | 6.7 | 0.0175 | 0.0175 | 0.0154 |
| 0.020 | 0.020 | 38.2 | 7.4 | 0.0176 | 0.0176 | 0.0155 |
| 0.025 | 0.025 | 41.4 | 8.0 | 0.0176 | 0.0176 | 0.0155 |
| 0.050 | 0.050 | 44.5 | 8.7 | 0.0177 | 0.0177 | 0.0156 |
| 0.100 | 0.100 | 48.5 | 9.5 | 0.0176 | 0.0176 | 0.0155 |
| 0.150 | 0.150 | 49.9 | 9.8 | 0.0175 | 0.0175 | 0.0154 |
| 0.200 | 0.200 | 48.8 | 9.6 | 0.0174 | 0.0174 | 0.0153 |
| 0.250 | 0.250 | 48.3 | 9.5 | 0.0174 | 0.0174 | 0.0153 |
| 0.300 | 0.300 | 47.8 | 9.4 | 0.0173 | 0.0173 | 0.0152 |
| 0.375 | 0.375 | 46.7 | 9.1 | 0.0178 | 0.0178 | 0.0157 |
| 0.400 | 0.400 | 46.1 | 9.0 | 0.0181 | 0.0181 | 0.0160 |
| 0.450 | 0.450 | 45.6 | 8.9 | 0.0184 | 0.0184 | 0.0163 |
| 0.500 | 0.500 | 45.5 | 8.9 | 0.0198 | 0.0198 | 0.0177 |
| Maximum Shear Stress, psi | | | **9.8** | | | |

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

T.E. S.T.
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1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | KI |
| Date | 06/17/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9192/B-17 D | Depth/Elev. | 31' |
| Location | - | Add. Info | - |

**ASTM D 3080; Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions**

## Sample Data

| | Initial | Final |
|---|---|---|
| Mass of Shear Box/Ring, g | 2101.90 | |
| Mass of Wet Sample and Box/Ring, g | 2273.80 | |
| Mass of Wet Sample, g | 171.90 | |
| Mass of Dry Sample, g | 146.84 | |
| Height of Sample, in | 1.000 | 0.977 |
| Diameter of Sample, in | 2.500 | 2.500 |
| Area of Sample, $in^2$ | 4.91 | 4.91 |
| Volume of Sample, $in^3$ | 4.91 | 4.80 |
| Specific Gravity (Assumed) | 2.800 | 2.800 |
| Wet Unit Weight, pcf | 133.4 | 138.4 |
| Dry Unit Weight, pcf | 114.0 | 116.6 |
| Height of Solids, in | 0.652 | 0.652 |
| Height of Voids, in | 0.348 | 0.325 |
| Height of Water, in | 0.311 | 0.341 |
| Void Ratio | 0.534 | 0.499 |
| Degree of Saturation, % | 89.5 | 105.0 |

## Moisture Content

| | Initial | Final |
|---|---|---|
| Mass of Wet Sample and Tare, g | 314.20 | 332.88 |
| Mass of Dry Sample and Tare, g | 298.40 | 305.58 |
| Mass of Tare, g | 205.80 | 159.61 |
| Moisture Content, % | 17.1 | 18.7 |

| | |
|---|---|
| Shear Apparatus ID | 385 |
| Shear Box ID | 385 B |
| Horizontal Displacement Indicator ID | 386 |
| Normal Deformation Indicator ID | 387 |
| Shear Force Load Cell ID | 388 |
| Normal Force Load Cell ID | 389 |
| Ring ID | 385B/102 |

REMARKS

Material passed #4 sieve used for testing. Sample for remold was collected 10" above bottom of shelby tube. Material was remolded to as-received density @ natural MC

*Notes: 1. Demineralized water used for inundation of sample*
*2. Gap approximately .025 inch used between the halves of the shear box*

## SHEAR DATA

| | |
|---|---|
| Normal force, lb | 103.1 |
| Normal Stress, psi | **21.0** |
| Time $t_{50}$, min | 0.19 |
| Displacement Rate, in/min | 0.01000 |

| | |
|---|---|
| Normal Seating Force, lb | 5.0 |
| Normal Seating Stress, psi | 1.0 |
| Initial Horizontal Displacement Indicator Reading, in | 0.0000 |
| Initial Normal Deformation Indicator Reading, in | 0.0000 |
| Apparatus Deformation, in | 0.0029 |
| Final Corrected Height Change, in | 0.0229 |

| Horizontal Deformation Reading,in | Horizontal Displacement, in | Shear Force, lb | Shear Stress, psi | Normal Deformation Reading,in | Height Change, in | Corrected Height Change,in |
|---|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.0 | 0.0 | 0.0214 | 0.0214 | 0.0185 |
| 0.005 | 0.005 | 20.3 | 4.1 | 0.0218 | 0.0218 | 0.0189 |
| 0.010 | 0.010 | 31.6 | 6.4 | 0.0220 | 0.0220 | 0.0191 |
| 0.015 | 0.015 | 37.0 | 7.5 | 0.0225 | 0.0225 | 0.0196 |
| 0.020 | 0.020 | 40.5 | 8.3 | 0.0227 | 0.0227 | 0.0198 |
| 0.030 | 0.030 | 45.6 | 9.3 | 0.0233 | 0.0233 | 0.0204 |
| 0.050 | 0.050 | 51.5 | 10.5 | 0.0242 | 0.0242 | 0.0213 |
| 0.100 | 0.100 | 58.2 | 11.9 | 0.0252 | 0.0252 | 0.0223 |
| 0.150 | 0.150 | 61.2 | 12.5 | 0.0254 | 0.0254 | 0.0225 |
| 0.200 | 0.200 | 62.3 | 12.7 | 0.0255 | 0.0255 | 0.0226 |
| 0.250 | 0.250 | 63.0 | 12.8 | 0.0255 | 0.0255 | 0.0226 |
| 0.300 | 0.300 | 62.0 | 12.6 | 0.0255 | 0.0255 | 0.0226 |
| 0.375 | 0.375 | 61.2 | 12.5 | 0.0255 | 0.0255 | 0.0226 |
| 0.400 | 0.400 | 61.4 | 12.5 | 0.0255 | 0.0255 | 0.0226 |
| 0.450 | 0.450 | 61.6 | 12.5 | 0.0257 | 0.0257 | 0.0228 |
| 0.500 | 0.500 | 61.5 | 12.5 | 0.0258 | 0.0258 | 0.0229 |
| Maximum Shear Stress, psi | | | **12.8** | | | |

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | KI |
| Date | 06/17/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9192/B-17 D | Depth/Elev. | 31' |
| Location | - | Add. Info | - |

**ASTM D 3080; Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions**

## Sample Data

| | Initial | Final |
|---|---|---|
| Mass of Shear Box/Ring, g | 2101.30 | |
| Mass of Wet Sample and Box/Ring, g | 2273.30 | |
| Mass of Wet Sample, g | 172.00 | |
| Mass of Dry Sample, g | 146.93 | |
| Height of Sample, in | 1.000 | 0.967 |
| Diameter of Sample, in | 2.500 | 2.500 |
| Area of Sample, $in^2$ | 4.91 | 4.91 |
| Volume of Sample, $in^3$ | 4.91 | 4.75 |
| Specific Gravity (Assumed) | 2.800 | 2.800 |
| Wet Unit Weight, pcf | 133.5 | 139.2 |
| Dry Unit Weight, pcf | 114.0 | 117.9 |
| Height of Solids, in | 0.652 | 0.652 |
| Height of Voids, in | 0.348 | 0.315 |
| Height of Water, in | 0.312 | 0.330 |
| Void Ratio | 0.533 | 0.482 |
| Degree of Saturation, % | 89.6 | 104.9 |

## Moisture Content

| | Initial | Final |
|---|---|---|
| Mass of Wet Sample and Tare, g | 314.20 | 389.90 |
| Mass of Dry Sample and Tare, g | 298.40 | 363.53 |
| Mass of Tare, g | 205.80 | 217.56 |
| Moisture Content, % | 17.1 | 18.1 |

| | |
|---|---|
| Shear Apparatus ID | 385 |
| Shear Box ID | 385 B |
| Horizontal Displacement Indicator ID | 386 |
| Normal Deformation Indicator ID | 387 |
| Shear Force Load Cell ID | 388 |
| Normal Force Load Cell ID | 389 |
| Ring ID | 385B/102 |

**REMARKS**

Material passed #4 sieve used for testing. Sample for remold was collected 10" above bottom of shelby tube. Material was remolded to as-received density @ natural MC

*Notes: 1. Demineralized water used for inundation of sample*
*2. Gap approximately .025 inch used between the halves of the shear box*

## SHEAR DATA

| | |
|---|---|
| Normal force, lb | 137.4 |
| Normal Stress, psi | **28.0** |
| Time $t_{50}$, min | 0.34 |
| Displacement Rate, in/min | 0.01000 |

| | |
|---|---|
| Normal Seating Force, lb | 5.0 |
| Normal Seating Stress, psi | 1.0 |
| Initial Horizontal Displacement Indicator Reading, in | 0.0000 |
| Initial Normal Deformation Indicator Reading, in | 0.0000 |
| Apparatus Deformation, in | 0.0036 |
| Final Corrected Height Change, in | 0.0330 |

| Horizontal Deformation Reading,in | Horizontal Displacement, in | Shear Force, lb | Shear Stress, psi | Normal Deformation Reading,in | Height Change, in | Corrected Height Change,in |
|---|---|---|---|---|---|---|
| 0.000 | 0.000 | -1.1 | 0.0 | 0.0260 | 0.0260 | 0.0224 |
| 0.005 | 0.005 | 26.4 | 5.6 | 0.0267 | 0.0267 | 0.0231 |
| 0.010 | 0.010 | 37.8 | 7.9 | 0.0272 | 0.0272 | 0.0236 |
| 0.015 | 0.015 | 44.8 | 9.4 | 0.0280 | 0.0280 | 0.0244 |
| 0.020 | 0.020 | 50.1 | 10.4 | 0.0287 | 0.0287 | 0.0251 |
| 0.030 | 0.030 | 57.0 | 11.8 | 0.0298 | 0.0298 | 0.0262 |
| 0.050 | 0.050 | 64.1 | 13.3 | 0.0311 | 0.0311 | 0.0275 |
| 0.100 | 0.100 | 69.9 | 14.5 | 0.0330 | 0.0330 | 0.0294 |
| 0.150 | 0.150 | 73.6 | 15.2 | 0.0340 | 0.0340 | 0.0304 |
| 0.200 | 0.200 | 76.0 | 15.7 | 0.0348 | 0.0348 | 0.0312 |
| 0.250 | 0.250 | 77.5 | 16.0 | 0.0351 | 0.0351 | 0.0315 |
| 0.300 | 0.300 | 78.6 | 16.2 | 0.0352 | 0.0352 | 0.0316 |
| 0.375 | 0.375 | 77.8 | 16.1 | 0.0355 | 0.0355 | 0.0319 |
| 0.400 | 0.400 | 78.0 | 16.1 | 0.0357 | 0.0357 | 0.0321 |
| 0.450 | 0.450 | 77.7 | 16.1 | 0.0360 | 0.0360 | 0.0324 |
| 0.500 | 0.500 | 77.3 | 16.0 | 0.0366 | 0.0366 | 0.0330 |
| Maximum Shear Stress, psi | | | **16.2** | | | |

**DESCRIPTION**

NA

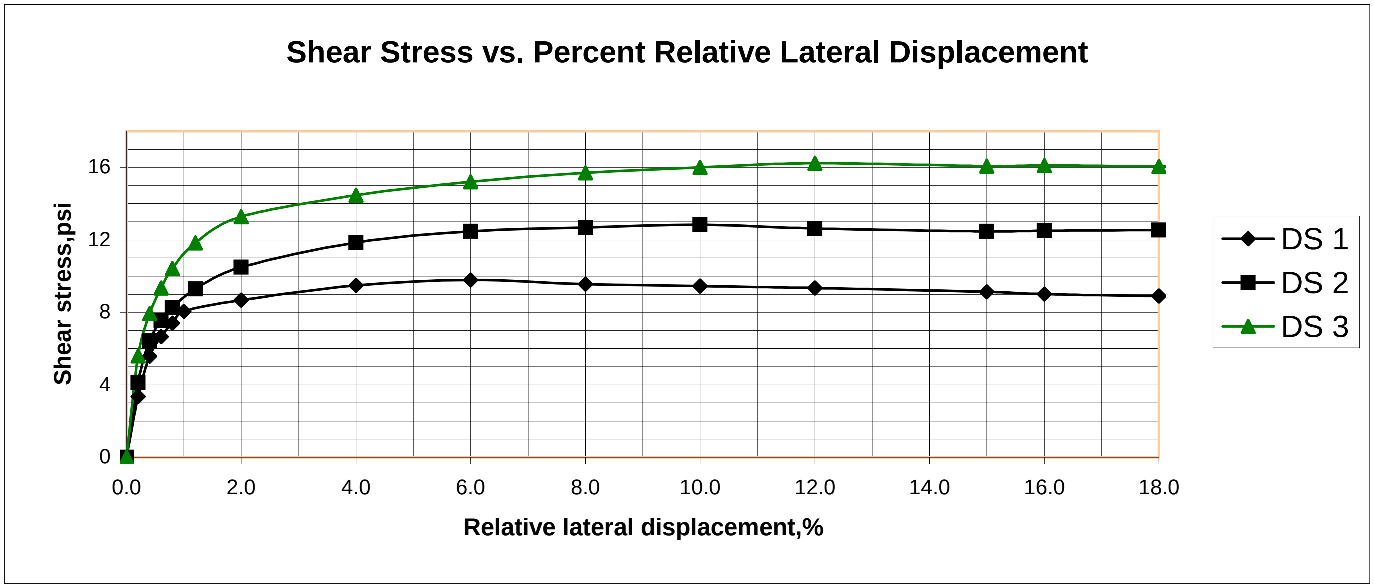
**USCS (ASTM D2487;2488)**

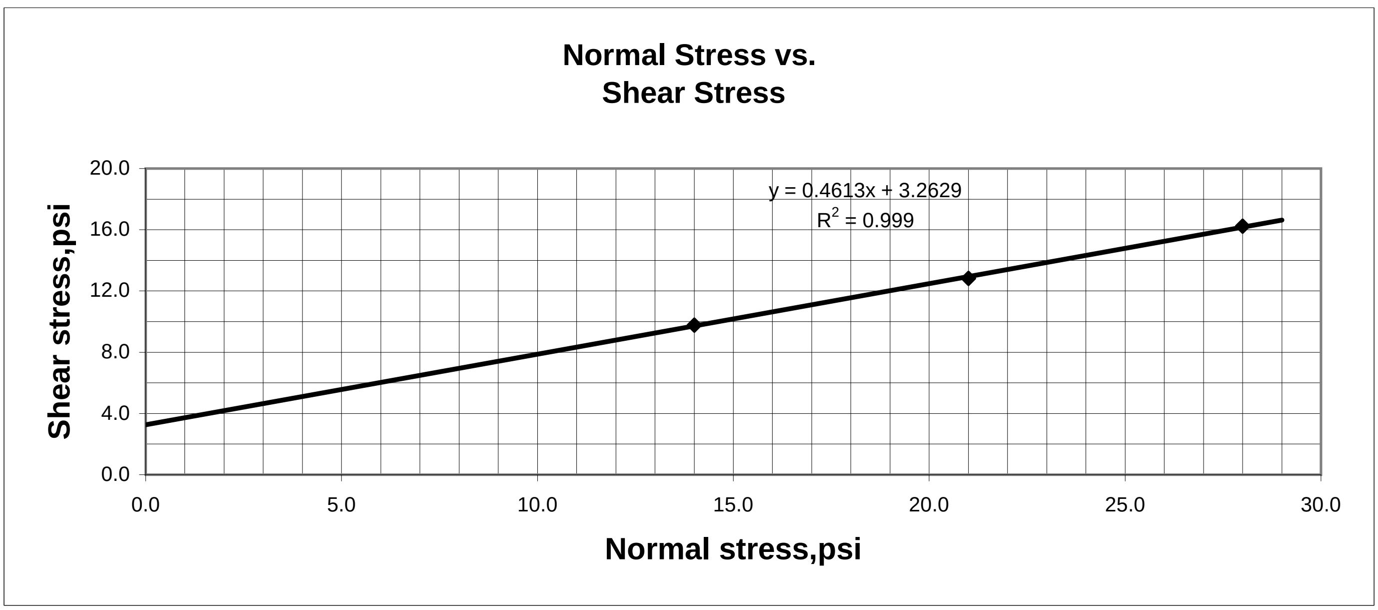
NA

| | | | |
|---|---|---|---|
| T.E. S.T. | TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By: KI<br>Date: 06/17/10<br>Checked By: [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9192/B-17 D | Depth/Elev. | 31' |
| Location | - | Add. Info | - |

**ASTM D 3080; Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions**




| | DS 1 | DS 2 | DS 3 |
|---|---|---|---|
| Normal Stress, psi | 14.0 | 21.0 | 28.0 |
| Max. Shear Stress, psi | 9.8 | 12.8 | 16.2 |
| Initial Moisture Content, % | 17.1 | 17.1 | 17.1 |
| Initial Dry Density, pcf | 114.0 | 114.0 | 114.0 |
| Initial Degree of Saturation, % | 89.5 | 89.5 | 89.6 |

| STRENGTH PARAMETERS | |
|---|---|
| $\phi$ ° | 24.8 |
| C, psi | 3.3 |

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | KI |
| Date | 06/11/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9197/B-18 | Depth/Elev. | 26' |
| Location | - | Add. Info | - |

**ASTM D 3080; Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions**

## Sample Data

| | Initial | Final |
|---|---|---|
| Mass of Shear Box/Ring, g | 157.28 | |
| Mass of Wet Sample and Box/Ring, g | 325.57 | |
| Mass of Wet Sample, g | 168.29 | |
| Mass of Dry Sample, g | 142.02 | |
| Height of Sample, in | 1.000 | 0.989 |
| Diameter of Sample, in | 2.500 | 2.500 |
| Area of Sample, $in^2$ | 4.91 | 4.91 |
| Volume of Sample, $in^3$ | 4.91 | 4.85 |
| Specific Gravity (Assumed) | 2.750 | 2.750 |
| Wet Unit Weight, pcf | 130.6 | 134.5 |
| Dry Unit Weight, pcf | 110.2 | 111.4 |
| Height of Solids, in | 0.642 | 0.642 |
| Height of Voids, in | 0.358 | 0.347 |
| Height of Water, in | 0.327 | 0.366 |
| Void Ratio | 0.558 | 0.540 |
| Degree of Saturation, % | 91.2 | 105.4 |

## Moisture Content

| | Initial | Final |
|---|---|---|
| Mass of Wet Sample and Tare, g | 326.10 | 388.36 |
| Mass of Dry Sample and Tare, g | 290.00 | 359.36 |
| Mass of Tare, g | 94.80 | 219.33 |
| Moisture Content, % | 18.5 | 20.7 |

| | |
|---|---|
| Shear Apparatus ID | 385 |
| Shear Box ID | 385 B |
| Horizontal Displacement Indicator ID | 386 |
| Normal Deformation Indicator ID | 387 |
| Shear Force Load Cell ID | 388 |
| Normal Force Load Cell ID | 389 |
| Ring ID | 385B/102 |

REMARKS

Portion of sample used for testing located 6" above bottom of shelby tube.

*Notes: 1. Demineralized water used for inundation of sample*
*2. Gap approximately .025 inch used between the halves of the shear box*

## SHEAR DATA

| | |
|---|---|
| Normal force, lb | 68.7 |
| Normal Stress, psi | **14.0** |
| Time $t_{50}$, min | 0.71 |
| Displacement Rate, in/min | 0.00500 |

| | |
|---|---|
| Normal Seating Force, lb | 5.0 |
| Normal Seating Stress, psi | 1.0 |
| Initial Horizontal Displacement Indicator Reading, in | 0.0000 |
| Initial Normal Deformation Indicator Reading, in | 0.0000 |
| Apparatus Deformation, in | 0.0021 |
| Final Corrected Height Change, in | 0.0110 |

| Horizontal Deformation Reading,in | Horizontal Displacement, in | Shear Force, lb | Shear Stress, psi | Normal Deformation Reading,in | Height Change, in | Corrected Height Change,in |
|---|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.0 | 0.0 | 0.0116 | 0.0116 | 0.0095 |
| 0.005 | 0.005 | 25.9 | 5.3 | 0.0117 | 0.0117 | 0.0096 |
| 0.010 | 0.010 | 35.1 | 7.2 | 0.0119 | 0.0119 | 0.0098 |
| 0.015 | 0.015 | 41.4 | 8.4 | 0.0120 | 0.0120 | 0.0099 |
| 0.020 | 0.020 | 45.2 | 9.2 | 0.0121 | 0.0121 | 0.0100 |
| 0.025 | 0.025 | 50.6 | 10.3 | 0.0121 | 0.0121 | 0.0100 |
| 0.050 | 0.050 | 54.1 | 11.0 | 0.0121 | 0.0121 | 0.0100 |
| 0.100 | 0.100 | 52.4 | 10.7 | 0.0112 | 0.0112 | 0.0091 |
| 0.150 | 0.150 | 49.7 | 10.1 | 0.0107 | 0.0107 | 0.0086 |
| 0.200 | 0.200 | 47.5 | 9.7 | 0.0106 | 0.0106 | 0.0085 |
| 0.250 | 0.250 | 45.5 | 9.3 | 0.0106 | 0.0106 | 0.0085 |
| 0.300 | 0.300 | 44.4 | 9.0 | 0.0107 | 0.0107 | 0.0086 |
| 0.375 | 0.375 | 42.4 | 8.6 | 0.0115 | 0.0115 | 0.0094 |
| 0.400 | 0.400 | 41.8 | 8.5 | 0.0119 | 0.0119 | 0.0098 |
| 0.450 | 0.450 | 41.0 | 8.4 | 0.0125 | 0.0125 | 0.0104 |
| 0.500 | 0.500 | 40.0 | 8.1 | 0.0131 | 0.0131 | 0.0110 |
| Maximum Shear Stress, psi | | | **11.0** | | | |

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | KI |
| Date | 06/13/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9197/B-18 | Depth/Elev. | 26' |
| Location | - | Add. Info | - |

**ASTM D 3080; Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions**

## Sample Data

| | Initial | Final |
|---|---|---|
| Mass of Shear Box/Ring, g | 157.28 | |
| Mass of Wet Sample and Box/Ring, g | 325.34 | |
| Mass of Wet Sample, g | 168.06 | |
| Mass of Dry Sample, g | 141.83 | |
| Height of Sample, in | 1.000 | 0.983 |
| Diameter of Sample, in | 2.500 | 2.500 |
| Area of Sample, $in^2$ | 4.91 | 4.91 |
| Volume of Sample, $in^3$ | 4.91 | 4.82 |
| Specific Gravity (Assumed) | 2.750 | 2.750 |
| Wet Unit Weight, pcf | 130.4 | 134.6 |
| Dry Unit Weight, pcf | 110.1 | 112.0 |
| Height of Solids, in | 0.641 | 0.641 |
| Height of Voids, in | 0.359 | 0.342 |
| Height of Water, in | 0.326 | 0.355 |
| Void Ratio | 0.560 | 0.533 |
| Degree of Saturation, % | 90.9 | 104.0 |

## Moisture Content

| | Initial | Final |
|---|---|---|
| Mass of Wet Sample and Tare, g | 326.10 | 371.35 |
| Mass of Dry Sample and Tare, g | 290.00 | 342.83 |
| Mass of Tare, g | 94.80 | 201.35 |
| Moisture Content, % | 18.5 | 20.2 |

| | |
|---|---|
| Shear Apparatus ID | 385 |
| Shear Box ID | 385 B |
| Horizontal Displacement Indicator ID | 386 |
| Normal Deformation Indicator ID | 387 |
| Shear Force Load Cell ID | 388 |
| Normal Force Load Cell ID | 389 |
| Ring ID | 385B/102 |

REMARKS

Portion of sample used for testing located 8" above bottom of shelby tube.

*Notes: 1. Demineralized water used for inundation of sample*
*2. Gap approximately .025 inch used between the halves of the shear box*

## SHEAR DATA

| | |
|---|---|
| Normal force, lb | 103.1 |
| Normal Stress, psi | **21.0** |
| Time $t_{50}$, min | 0.43 |
| Displacement Rate, in/min | 0.00500 |

| | |
|---|---|
| Normal Seating Force, lb | 5.0 |
| Normal Seating Stress, psi | 1.0 |
| Initial Horizontal Displacement Indicator Reading, in | 0.0000 |
| Initial Normal Deformation Indicator Reading, in | 0.0000 |
| Apparatus Deformation, in | 0.0029 |
| Final Corrected Height Change, in | 0.0171 |

| Horizontal Deformation Reading,in | Horizontal Displacement, in | Shear Force, lb | Shear Stress, psi | Normal Deformation Reading,in | Height Change, in | Corrected Height Change,in |
|---|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.0 | 0.0 | 0.0177 | 0.0177 | 0.0148 |
| 0.005 | 0.005 | 19.9 | 4.1 | 0.0182 | 0.0182 | 0.0153 |
| 0.010 | 0.010 | 32.8 | 6.7 | 0.0186 | 0.0186 | 0.0157 |
| 0.015 | 0.015 | 44.5 | 9.1 | 0.0188 | 0.0188 | 0.0159 |
| 0.020 | 0.020 | 52.7 | 10.7 | 0.0189 | 0.0189 | 0.0160 |
| 0.030 | 0.030 | 65.1 | 13.3 | 0.0189 | 0.0189 | 0.0160 |
| 0.050 | 0.050 | 75.7 | 15.4 | 0.0181 | 0.0181 | 0.0152 |
| 0.100 | 0.100 | 68.2 | 13.9 | 0.0169 | 0.0169 | 0.0140 |
| 0.150 | 0.150 | 64.1 | 13.1 | 0.0167 | 0.0167 | 0.0138 |
| 0.200 | 0.200 | 61.1 | 12.4 | 0.0167 | 0.0167 | 0.0138 |
| 0.250 | 0.250 | 58.4 | 11.9 | 0.0170 | 0.0170 | 0.0141 |
| 0.300 | 0.300 | 55.9 | 11.4 | 0.0177 | 0.0177 | 0.0148 |
| 0.375 | 0.375 | 54.3 | 11.1 | 0.0182 | 0.0182 | 0.0153 |
| 0.400 | 0.400 | 53.0 | 10.8 | 0.0189 | 0.0189 | 0.0160 |
| 0.450 | 0.450 | 51.7 | 10.5 | 0.0195 | 0.0195 | 0.0166 |
| 0.500 | 0.500 | 50.2 | 10.2 | 0.0200 | 0.0200 | 0.0171 |
| Maximum Shear Stress, psi | | | **15.4** | | | |

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

TIMELY ENGINEERING SOIL TESTS, LLC

1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | KI |
| Date | 06/14/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9197/B-18 | Depth/Elev. | 26' |
| Location | - | Add. Info | - |

**ASTM D 3080; Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions**

## Sample Data

| | Initial | Final |
|---|---|---|
| Mass of Shear Box/Ring, g | 157.28 | |
| Mass of Wet Sample and Box/Ring, g | 326.47 | |
| Mass of Wet Sample, g | 169.19 | |
| Mass of Dry Sample, g | 142.78 | |
| Height of Sample, in | 1.000 | 0.982 |
| Diameter of Sample, in | 2.500 | 2.500 |
| Area of Sample, $in^2$ | 4.91 | 4.91 |
| Volume of Sample, $in^3$ | 4.91 | 4.82 |
| Specific Gravity (Assumed) | 2.750 | 2.750 |
| Wet Unit Weight, pcf | 131.3 | 134.0 |
| Dry Unit Weight, pcf | 110.8 | 112.8 |
| Height of Solids, in | 0.645 | 0.645 |
| Height of Voids, in | 0.355 | 0.337 |
| Height of Water, in | 0.328 | 0.333 |
| Void Ratio | 0.549 | 0.522 |
| Degree of Saturation, % | 92.6 | 98.9 |

## Moisture Content

| | Initial | Final |
|---|---|---|
| Mass of Wet Sample and Tare, g | 326.10 | 374.16 |
| Mass of Dry Sample and Tare, g | 290.00 | 347.20 |
| Mass of Tare, g | 94.80 | 203.53 |
| Moisture Content, % | 18.5 | 18.8 |

| | |
|---|---|
| Shear Apparatus ID | 385 |
| Shear Box ID | 385 B |
| Horizontal Displacement Indicator ID | 386 |
| Normal Deformation Indicator ID | 387 |
| Shear Force Load Cell ID | 388 |
| Normal Force Load Cell ID | 389 |
| Ring ID | 385B/102 |

REMARKS

Portion of sample used for testing located 4" above bottom of shelby tube.

*Notes: 1. Demineralized water used for inundation of sample*
*2. Gap approximately .025 inch used between the halves of the shear box*

## SHEAR DATA

| | |
|---|---|
| Normal force, lb | 137.4 |
| Normal Stress, psi | **28.0** |
| Time $t_{50}$, min | 0.21 |
| Displacement Rate, in/min | 0.00500 |

| | |
|---|---|
| Normal Seating Force, lb | 5.0 |
| Normal Seating Stress, psi | 1.0 |
| Initial Horizontal Displacement Indicator Reading, in | 0.0000 |
| Initial Normal Deformation Indicator Reading, in | 0.0000 |
| Apparatus Deformation, in | 0.0036 |
| Final Corrected Height Change, in | 0.0179 |

| Horizontal Deformation Reading,in | Horizontal Displacement, in | Shear Force, lb | Shear Stress, psi | Normal Deformation Reading,in | Height Change, in | Corrected Height Change,in |
|---|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.0 | 0.0 | 0.0187 | 0.0187 | 0.0151 |
| 0.005 | 0.005 | 28.9 | 5.9 | 0.0193 | 0.0193 | 0.0157 |
| 0.010 | 0.010 | 44.8 | 9.1 | 0.0196 | 0.0196 | 0.0160 |
| 0.015 | 0.015 | 56.0 | 11.4 | 0.0200 | 0.0200 | 0.0164 |
| 0.020 | 0.020 | 63.8 | 13.0 | 0.0203 | 0.0203 | 0.0167 |
| 0.030 | 0.030 | 73.0 | 14.9 | 0.0206 | 0.0206 | 0.0170 |
| 0.050 | 0.050 | 81.9 | 16.7 | 0.0208 | 0.0208 | 0.0172 |
| 0.100 | 0.100 | 91.9 | 18.7 | 0.0208 | 0.0208 | 0.0172 |
| 0.150 | 0.150 | 88.9 | 18.1 | 0.0208 | 0.0208 | 0.0172 |
| 0.200 | 0.200 | 85.3 | 17.4 | 0.0206 | 0.0206 | 0.0170 |
| 0.250 | 0.250 | 83.5 | 17.0 | 0.0205 | 0.0205 | 0.0169 |
| 0.300 | 0.300 | 82.3 | 16.8 | 0.0205 | 0.0205 | 0.0169 |
| 0.375 | 0.375 | 80.3 | 16.4 | 0.0205 | 0.0205 | 0.0169 |
| 0.400 | 0.400 | 79.9 | 16.3 | 0.0205 | 0.0205 | 0.0169 |
| 0.450 | 0.450 | 79.1 | 16.1 | 0.0209 | 0.0209 | 0.0173 |
| 0.500 | 0.500 | 77.9 | 15.9 | 0.0215 | 0.0215 | 0.0179 |
| Maximum Shear Stress, psi | | | **18.7** | | | |

DESCRIPTION

NA

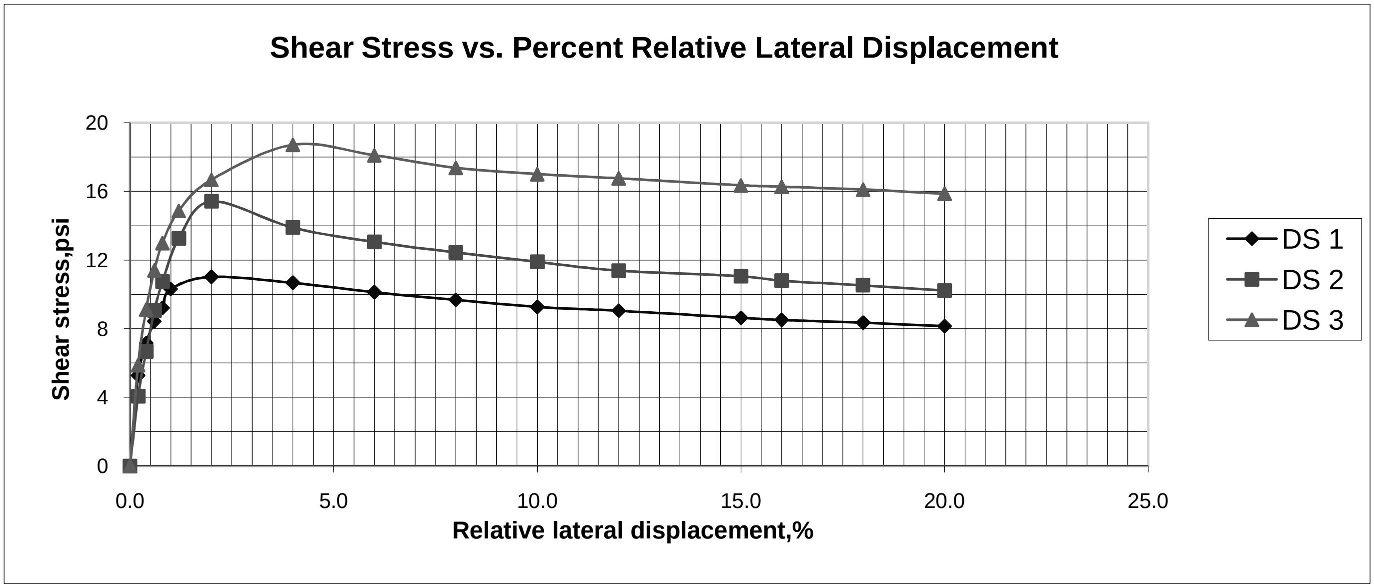
USCS (ASTM D2487;2488)

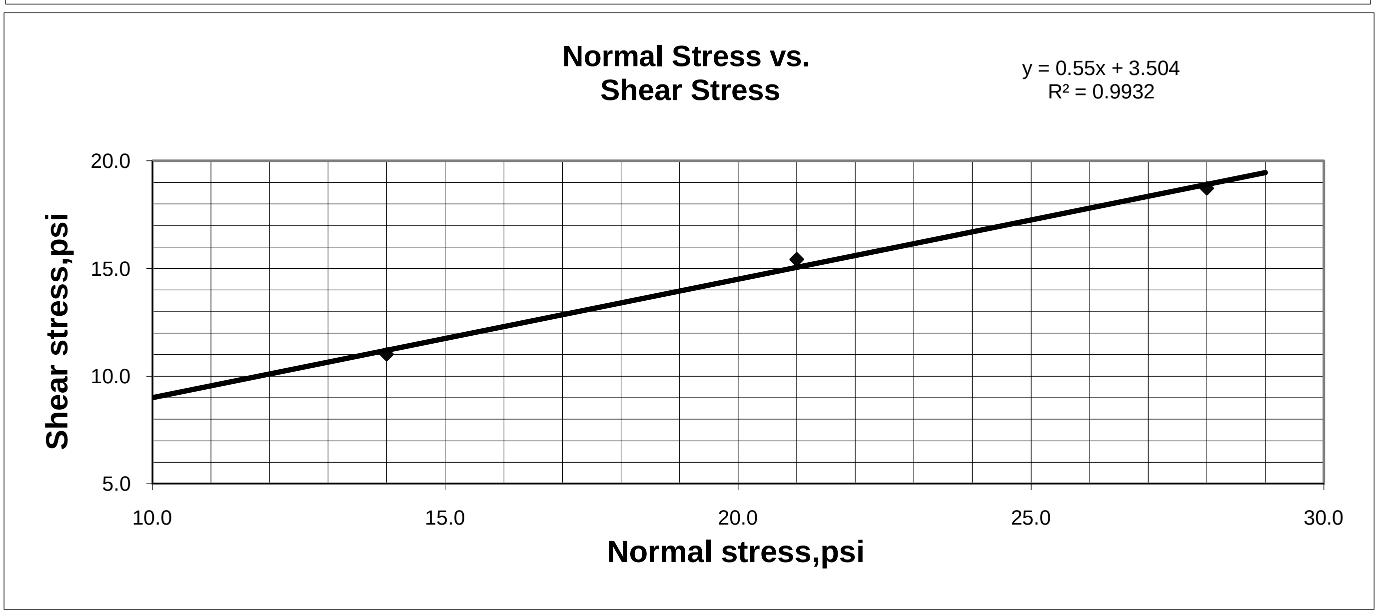
NA

| | | | |
|---|---|---|---|
| TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By | KI |
| | | Date | 06/14/10 |
| | | Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9197/B-18 | Depth/Elev. | 26' |
| Location | - | Add. Info | - |

**ASTM D 3080; Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions**




| | DS 1 | DS 2 | DS 3 |
|---|---|---|---|
| Normal Stress, psi | 14.0 | 21.0 | 28.0 |
| Max. Shear Stress, psi | 11.0 | 15.4 | 18.7 |
| Initial Moisture Content, % | 18.5 | 18.5 | 18.5 |
| Initial Dry Density, pcf | 110.2 | 110.1 | 110.8 |
| Initial Degree of Saturation, % | 91.2 | 90.9 | 92.6 |

| STRENGTH PARAMETERS | |
|---|---|
| $\phi^{o}$ | 28.8 |
| C, psi | 3.5 |

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | KI |
| Date | 06/14/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9199/B-20 | Depth/Elev. | 26' |
| Location | - | Add. Info | - |

**ASTM D 3080; Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions**

## Sample Data

| | Initial | Final |
|---|---|---|
| Mass of Shear Box/Ring, g | 2102.20 | |
| Mass of Wet Sample and Box/Ring, g | 2259.10 | |
| Mass of Wet Sample, g | 156.90 | |
| Mass of Dry Sample, g | 135.33 | |
| Height of Sample, in | 1.000 | 0.945 |
| Diameter of Sample, in | 2.500 | 2.500 |
| Area of Sample, $in^2$ | 4.91 | 4.91 |
| Volume of Sample, $in^3$ | 4.91 | 4.64 |
| Specific Gravity (Assumed) | 2.750 | 2.750 |
| Wet Unit Weight, pcf | 121.8 | 133.6 |
| Dry Unit Weight, pcf | 105.0 | 111.1 |
| Height of Solids, in | 0.612 | 0.612 |
| Height of Voids, in | 0.388 | 0.333 |
| Height of Water, in | 0.268 | 0.341 |
| Void Ratio | 0.635 | 0.545 |
| Degree of Saturation, % | 69.1 | 102.3 |

## Moisture Content

| | Initial | Final |
|---|---|---|
| Mass of Wet Sample and Tare, g | 406.20 | 365.80 |
| Mass of Dry Sample and Tare, g | 364.10 | 338.84 |
| Mass of Tare, g | 100.00 | 205.82 |
| Moisture Content, % | 15.9 | 20.3 |

| | |
|---|---|
| Shear Apparatus ID | 385 |
| Shear Box ID | 385 B |
| Horizontal Displacement Indicator ID | 386 |
| Normal Deformation Indicator ID | 387 |
| Shear Force Load Cell ID | 388 |
| Normal Force Load Cell ID | 389 |
| Ring ID | 385B/102 |

REMARKS

Portion of sample used for testing located 2" above bottom of shelby tube.

*Notes: 1. Demineralized water used for inundation of sample*
*2. Gap approximately .025 inch used between the halves of the shear box*

## SHEAR DATA

| | |
|---|---|
| Normal force, lb | 68.7 |
| Normal Stress, psi | **14.0** |
| Time $t_{50}$, min | 0.43 |
| Displacement Rate, in/min | 0.01000 |

| | |
|---|---|
| Normal Seating Force, lb | 5.0 |
| Normal Seating Stress, psi | 1.0 |
| Initial Horizontal Displacement Indicator Reading, in | 0.0000 |
| Initial Normal Deformation Indicator Reading, in | 0.0000 |
| Apparatus Deformation, in | 0.0021 |
| Final Corrected Height Change, in | 0.0548 |

| Horizontal Deformation Reading,in | Horizontal Displacement, in | Shear Force, lb | Shear Stress, psi | Normal Deformation Reading,in | Height Change, in | Corrected Height Change,in |
|---|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.0 | 0.0 | 0.0345 | 0.0345 | 0.0324 |
| 0.005 | 0.005 | 13.4 | 2.7 | 0.0350 | 0.0350 | 0.0329 |
| 0.010 | 0.010 | 17.5 | 3.6 | 0.0361 | 0.0361 | 0.0340 |
| 0.015 | 0.015 | 20.2 | 4.1 | 0.0367 | 0.0367 | 0.0346 |
| 0.020 | 0.020 | 22.2 | 4.5 | 0.0376 | 0.0376 | 0.0355 |
| 0.025 | 0.025 | 25.3 | 5.2 | 0.0389 | 0.0389 | 0.0368 |
| 0.050 | 0.050 | 29.7 | 6.1 | 0.0417 | 0.0417 | 0.0396 |
| 0.100 | 0.100 | 35.6 | 7.3 | 0.0464 | 0.0464 | 0.0443 |
| 0.150 | 0.150 | 39.0 | 7.9 | 0.0491 | 0.0491 | 0.0470 |
| 0.200 | 0.200 | 41.5 | 8.5 | 0.0509 | 0.0509 | 0.0488 |
| 0.250 | 0.250 | 42.5 | 8.7 | 0.0522 | 0.0522 | 0.0501 |
| 0.300 | 0.300 | 43.6 | 8.9 | 0.0533 | 0.0533 | 0.0512 |
| 0.375 | 0.375 | 44.0 | 9.0 | 0.0546 | 0.0546 | 0.0525 |
| 0.400 | 0.400 | 44.2 | 9.0 | 0.0552 | 0.0552 | 0.0531 |
| 0.450 | 0.450 | 44.7 | 9.1 | 0.0560 | 0.0560 | 0.0539 |
| 0.500 | 0.500 | 44.1 | 9.0 | 0.0569 | 0.0569 | 0.0548 |
| Maximum Shear Stress, psi | | | **9.1** | | | |

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

| TIMELY ENGINEERING SOIL TESTS, LLC (T.E.S.T.) | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | |
|---|---|---|

| | |
|---|---|
| Tested By | KI |
| Date | 06/15/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9199/B-20 | Depth/Elev. | 26' |
| Location | - | Add. Info | - |

**ASTM D 3080; Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions**

## Sample Data

| | Initial | Final |
|---|---|---|
| Mass of Shear Box/Ring, g | 2097.60 | |
| Mass of Wet Sample and Box/Ring, g | 2254.50 | |
| Mass of Wet Sample, g | 156.90 | |
| Mass of Dry Sample, g | 135.33 | |
| Height of Sample, in | 1.000 | 0.930 |
| Diameter of Sample, in | 2.500 | 2.500 |
| Area of Sample, $in^2$ | 4.91 | 4.91 |
| Volume of Sample, $in^3$ | 4.91 | 4.57 |
| Specific Gravity (Assumed) | 2.750 | 2.750 |
| Wet Unit Weight, pcf | 121.8 | 135.2 |
| Dry Unit Weight, pcf | 105.0 | 112.9 |
| Height of Solids, in | 0.612 | 0.612 |
| Height of Voids, in | 0.388 | 0.318 |
| Height of Water, in | 0.268 | 0.332 |
| Void Ratio | 0.635 | 0.520 |
| Degree of Saturation, % | 69.1 | 104.4 |

## Moisture Content

| | Initial | Final |
|---|---|---|
| Mass of Wet Sample and Tare, g | 406.20 | 362.80 |
| Mass of Dry Sample and Tare, g | 364.10 | 336.51 |
| Mass of Tare, g | 100.00 | 203.43 |
| Moisture Content, % | 15.9 | 19.8 |

| | |
|---|---|
| Shear Apparatus ID | 385 |
| Shear Box ID | 385 B |
| Horizontal Displacement Indicator ID | 386 |
| Normal Deformation Indicator ID | 387 |
| Shear Force Load Cell ID | 388 |
| Normal Force Load Cell ID | 389 |
| Ring ID | 385B/102 |

REMARKS

Portion of sample used for testing located 4.5" above bottom of shelby tube.

*Notes: 1. Demineralized water used for inundation of sample*
*2. Gap approximately .025 inch used between the halves of the shear box*

## SHEAR DATA

| | |
|---|---|
| Normal force, lb | 103.1 |
| Normal Stress, psi | **21.0** |
| Time $t_{50}$, min | 0.34 |
| Displacement Rate, in/min | 0.01000 |
| Normal Seating Force, lb | 5.0 |
| Normal Seating Stress, psi | 1.0 |
| Initial Horizontal Displacement Indicator Reading, in | 0.0000 |
| Initial Normal Deformation Indicator Reading, in | 0.0000 |
| Apparatus Deformation, in | 0.0029 |
| Final Corrected Height Change, in | 0.0700 |

| Horizontal Deformation Reading,in | Horizontal Displacement, in | Shear Force, lb | Shear Stress, psi | Normal Deformation Reading,in | Height Change, in | Corrected Height Change,in |
|---|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.0 | 0.0 | 0.0496 | 0.0496 | 0.0467 |
| 0.005 | 0.005 | 12.1 | 2.5 | 0.0499 | 0.0499 | 0.0470 |
| 0.010 | 0.010 | 19.8 | 4.0 | 0.0501 | 0.0501 | 0.0472 |
| 0.015 | 0.015 | 24.2 | 4.9 | 0.0511 | 0.0511 | 0.0482 |
| 0.020 | 0.020 | 27.8 | 5.7 | 0.0520 | 0.0520 | 0.0491 |
| 0.030 | 0.030 | 32.8 | 6.7 | 0.0539 | 0.0539 | 0.0510 |
| 0.050 | 0.050 | 39.5 | 8.0 | 0.0569 | 0.0569 | 0.0540 |
| 0.100 | 0.100 | 48.3 | 9.8 | 0.0614 | 0.0614 | 0.0585 |
| 0.150 | 0.150 | 53.6 | 10.9 | 0.0642 | 0.0642 | 0.0613 |
| 0.200 | 0.200 | 56.8 | 11.6 | 0.0660 | 0.0660 | 0.0631 |
| 0.250 | 0.250 | 58.7 | 12.0 | 0.0674 | 0.0674 | 0.0645 |
| 0.300 | 0.300 | 60.5 | 12.3 | 0.0687 | 0.0687 | 0.0658 |
| 0.375 | 0.375 | 61.8 | 12.6 | 0.0698 | 0.0698 | 0.0669 |
| 0.400 | 0.400 | 62.4 | 12.7 | 0.0708 | 0.0708 | 0.0679 |
| 0.450 | 0.450 | 61.8 | 12.6 | 0.0719 | 0.0719 | 0.0690 |
| 0.500 | 0.500 | 61.5 | 12.5 | 0.0729 | 0.0729 | 0.0700 |
| Maximum Shear Stress, psi | | | **12.7** | | | |

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

T.E. S.T.
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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/15/10 |
| Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9199/B-20 | Depth/Elev. | 26' |
| Location | - | Add. Info | - |

**ASTM D 3080; Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions**

## Sample Data

| | Initial | Final |
|---|---|---|
| Mass of Shear Box/Ring, g | 2101.00 | |
| Mass of Wet Sample and Box/Ring, g | 2258.00 | |
| Mass of Wet Sample, g | 157.00 | |
| Mass of Dry Sample, g | 135.41 | |
| Height of Sample, in | 1.000 | 0.928 |
| Diameter of Sample, in | 2.500 | 2.500 |
| Area of Sample, $in^2$ | 4.91 | 4.91 |
| Volume of Sample, $in^3$ | 4.91 | 4.55 |
| Specific Gravity (Assumed) | 2.750 | 2.750 |
| Wet Unit Weight, pcf | 121.8 | 135.4 |
| Dry Unit Weight, pcf | 105.1 | 113.3 |
| Height of Solids, in | 0.612 | 0.612 |
| Height of Voids, in | 0.388 | 0.316 |
| Height of Water, in | 0.268 | 0.328 |
| Void Ratio | 0.634 | 0.515 |
| Degree of Saturation, % | 69.2 | 104.1 |

## Moisture Content

| | Initial | Final |
|---|---|---|
| Mass of Wet Sample and Tare, g | 406.20 | 313.70 |
| Mass of Dry Sample and Tare, g | 364.10 | 287.75 |
| Mass of Tare, g | 100.00 | 154.75 |
| Moisture Content, % | 15.9 | 19.5 |

| | |
|---|---|
| Shear Apparatus ID | 385 |
| Shear Box ID | 385 B |
| Horizontal Displacement Indicator ID | 386 |
| Normal Deformation Indicator ID | 387 |
| Shear Force Load Cell ID | 388 |
| Normal Force Load Cell ID | 389 |
| Ring ID | 385B/102 |

REMARKS

Portion of sample used for testing located 7" above bottom of shelby tube.

*Notes: 1. Demineralized water used for inundation of sample*
*2. Gap approximately .025 inch used between the halves of the shear box*

## SHEAR DATA

| | |
|---|---|
| Normal force, lb | 137.4 |
| Normal Stress, psi | **28.0** |
| Time $t_{50}$, min | 0.19 |
| Displacement Rate, in/min | 0.01000 |

| | |
|---|---|
| Normal Seating Force, lb | 5.0 |
| Normal Seating Stress, psi | 1.0 |
| Initial Horizontal Displacement Indicator Reading, in | 0.0000 |
| Initial Normal Deformation Indicator Reading, in | 0.0000 |
| Apparatus Deformation, in | 0.0036 |
| Final Corrected Height Change, in | 0.0723 |

| Horizontal Deformation Reading,in | Horizontal Displacement, in | Shear Force, lb | Shear Stress, psi | Normal Deformation Reading,in | Height Change, in | Corrected Height Change,in |
|---|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.0 | 0.0 | 0.0486 | 0.0486 | 0.0450 |
| 0.005 | 0.005 | 14.0 | 2.9 | 0.0491 | 0.0491 | 0.0455 |
| 0.010 | 0.010 | 23.6 | 4.8 | 0.0502 | 0.0502 | 0.0466 |
| 0.015 | 0.015 | 28.5 | 5.8 | 0.0517 | 0.0517 | 0.0481 |
| 0.020 | 0.020 | 32.0 | 6.5 | 0.0528 | 0.0528 | 0.0492 |
| 0.030 | 0.030 | 39.0 | 7.9 | 0.0549 | 0.0549 | 0.0513 |
| 0.050 | 0.050 | 48.5 | 9.9 | 0.0583 | 0.0583 | 0.0547 |
| 0.100 | 0.100 | 61.5 | 12.5 | 0.0639 | 0.0639 | 0.0603 |
| 0.150 | 0.150 | 68.5 | 14.0 | 0.0671 | 0.0671 | 0.0635 |
| 0.200 | 0.200 | 73.0 | 14.9 | 0.0693 | 0.0693 | 0.0657 |
| 0.250 | 0.250 | 75.8 | 15.4 | 0.0710 | 0.0710 | 0.0674 |
| 0.300 | 0.300 | 78.2 | 15.9 | 0.0722 | 0.0722 | 0.0686 |
| 0.375 | 0.375 | 80.7 | 16.4 | 0.0738 | 0.0738 | 0.0702 |
| 0.400 | 0.400 | 80.0 | 16.3 | 0.0743 | 0.0743 | 0.0707 |
| 0.450 | 0.450 | 80.2 | 16.3 | 0.0751 | 0.0751 | 0.0715 |
| 0.500 | 0.500 | 79.8 | 16.3 | 0.0759 | 0.0759 | 0.0723 |
| Maximum Shear Stress, psi | | | **16.4** | | | |

DESCRIPTION

NA

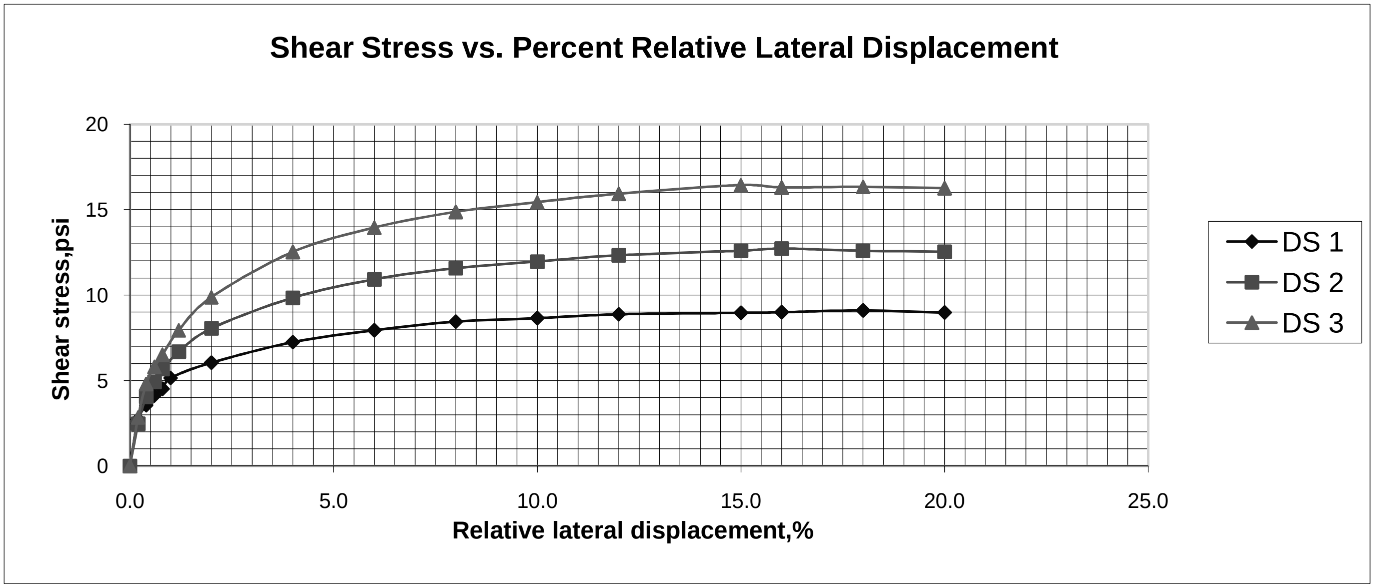
USCS (ASTM D2487;2488)

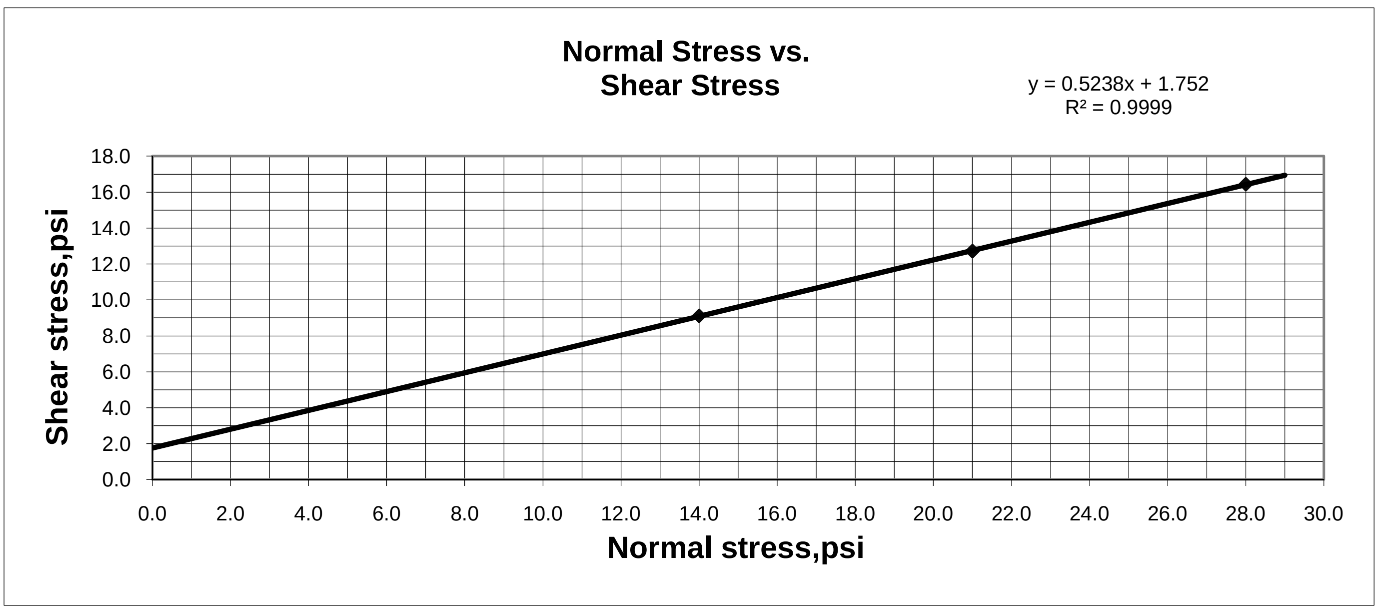
NA

| | | | |
|---|---|---|---|
| T.E.S.T. TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By | RI |
| | | Date | 06/15/10 |
| | | Checked By | [signature] |

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9199/B-20 | Depth/Elev. | 26' |
| Location | - | Add. Info | - |

**ASTM D 3080; Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions**




| | DS 1 | DS 2 | DS 3 |
|---|---|---|---|
| Normal Stress, psi | 14.0 | 21.0 | 28.0 |
| Max. Shear Stress, psi | 9.1 | 12.7 | 16.4 |
| Initial Moisture Content, % | 15.9 | 15.9 | 15.9 |
| Initial Dry Density, pcf | 105.0 | 105.0 | 105.1 |
| Initial Degree of Saturation, % | 69.1 | 69.1 | 69.2 |

| STRENGTH PARAMETERS | |
|---|---|
| $\phi^o$ | 27.6 |
| C, psi | 1.8 |

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| | |
|---|---|
| Tested By | RI |
| Date | 06/15/10 |
| Checked By | |

## ASTM D 4767M / AASHTO T 297M

### Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9191/B-13 D | Depth/Elev. | 11' |
| Location | - | Add. Info | - |

### SPECIMEN PROPERTIES

| | (initial) | (after consol.) |
|---|---|---|
| Height, in | 5.863 | 5.872 |
| Diameter, in | 2.830 | 2.903 |
| Height-to-Diameter Ratio | 2.1 | 2.0 |
| Area, $in^2$ | 6.29 | 6.62 |
| Volume, $cm^3$ | 604.34 | 637.06 |
| Mass of Wet Sample, g | 1272.40 | 1312.50 |
| Mass of Dry Sample, g | 1072.76 | 1072.76 |
| Wet Density, pcf | 131.4 | 128.6 |
| Dry Density, pcf | 110.8 | 105.1 |
| Specific Gravity (assumed) | 2.700 | 2.700 |
| Volume of Solids, $cm^3$ | 397.32 | 397.32 |
| Volume of Voids, $cm^3$ | 207.02 | 239.74 |
| Void Ratio | 0.52 | 0.60 |
| % Saturation | 96.4 | 100.0 |

### WATER CONTENT DETERMINATION

| | (initial) | (final) |
|---|---|---|
| Mass of Wet Sample and Tare, g | 1272.40 | 1312.50 |
| Mass of Dry Sample and Tare, g | 1072.76 | 1072.76 |
| Mass of Tare, g | 0.00 | 0.00 |
| Moisture, % | 18.61 | 22.35 |

### TEST DATA PRIOR TO LOADING

| | |
|---|---|
| Volume change (Consolidation), ml | 40.1 |
| Machine Speed, in / min | 0.0040 |
| Strain Rate, % / min | 0.07 |
| Chamber Pressure, psi | 92.5 |
| Back Pressure, psi | 80.0 |
| Eff. Consol. Stress,(Minor pr. stress, $\sigma_3$),psi | 12.5 |
| Change in Height, in | -0.009 |
| "B" Value | 0.95 |
| $t_{50}$, min | 5.38 |

### SHEAR DATA

| Elapsed Time (min) | Deformation Stage 1 (inch) | Axial Load (lb) | Pore-Water Pressure, psi | | Total Strain Stage 1 (%) | Corrected Area ($in^2$) | Dev.Stress ($\Delta\sigma=\sigma_1-\sigma_3$) | Major Principal Stress, psi | | Eff.Stress Ratio | P' $(\sigma'_1+\sigma'_3)/2$ (psi) | Q $(\sigma_1-\sigma_3)/2$ (psi) | Eff. Minor Pr. Stress |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total, U | Change,$\Delta$U | | | (psi) | Total $\sigma_1$ | Eff. $\sigma'_1$ | $\sigma'_1/\sigma'_3$ | | | $\sigma'_3$ (psi) |
| 0.0 | 0.000 | 19 | 80.3 | 0.3 | 0.00 | 6.62 | 0.0 | 12.5 | 12.2 | 1.00 | 12.2 | 0.0 | 12.2 |
| 1.3 | 0.005 | 67.4 | 85.9 | 5.9 | 0.09 | 6.63 | 7.3 | 19.8 | 13.9 | 2.11 | 10.3 | 3.7 | 6.6 |
| 2.5 | 0.010 | 82.1 | 87.2 | 7.2 | 0.17 | 6.63 | 9.5 | 22.0 | 14.8 | 2.80 | 10.1 | 4.8 | 5.3 |
| 3.8 | 0.015 | 91.1 | 87.8 | 7.8 | 0.26 | 6.64 | 10.9 | 23.4 | 15.6 | 3.31 | 10.1 | 5.4 | 4.7 |
| 5.0 | 0.020 | 98 | 88.3 | 8.3 | 0.34 | 6.64 | 11.9 | 24.4 | 16.1 | 3.83 | 10.1 | 5.9 | 4.2 |
| 6.3 | 0.025 | 103.6 | 88.6 | 8.6 | 0.43 | 6.65 | 12.7 | 25.2 | 16.6 | 4.26 | 10.3 | 6.4 | 3.9 |
| 7.5 | 0.030 | 110.3 | 89.0 | 9.0 | 0.51 | 6.65 | 13.7 | 26.2 | 17.2 | 4.92 | 10.4 | 6.9 | 3.5 |
| 8.8 | 0.035 | 116.1 | 89.2 | 9.2 | 0.60 | 6.66 | 14.6 | 27.1 | 17.9 | 5.42 | 10.6 | 7.3 | 3.3 |
| 10.0 | 0.040 | 121.7 | 89.4 | 9.4 | 0.68 | 6.67 | 15.4 | 27.9 | 18.5 | 5.97 | 10.8 | 7.7 | 3.1 |
| 12.5 | 0.050 | 133.2 | 89.8 | 9.8 | 0.85 | 6.68 | 17.1 | 29.6 | 19.8 | 7.33 | 11.3 | 8.6 | 2.7 |
| 18.8 | 0.075 | 162.6 | 90.1 | 10.1 | 1.28 | 6.71 | 21.4 | 33.9 | 23.8 | 9.92 | 13.1 | 10.7 | 2.4 |
| 25.0 | 0.100 | 187.3 | 89.9 | 9.9 | 1.70 | 6.74 | 25.0 | 37.5 | 27.6 | 10.61 | 15.1 | 12.5 | 2.6 |
| 27.5 | 0.110 | 198.8 | 89.6 | 9.6 | 1.87 | 6.75 | 26.6 | 39.1 | 29.5 | 10.19 | 16.2 | 13.3 | 2.9 |
| Values @ Failure | | | | **9.9** | **1.70** | **6.74** | **25.0** | **37.5** | **27.6** | **10.61** | **15.1** | **12.5** | **2.6** |

Failure criteria used* 3

*Note: "1" = Max Deviator Stress; "2" = Deviator Stress @ 15% Strain; "3" = Max Eff.Stress Ratio($\sigma'_1/\sigma'_3$)

*Multistage Triaxial CU.xls [Stage 1], REV. 1; 10-21-05*

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/16/10 |
| Checked By | [signature] |

# ASTM D 4767M / AASHTO T 297M

## Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9191/B-13 D | Depth/Elev. | 11' |
| Location | - | Add. Info | - |

### SPECIMEN PROPERTIES

| | | (initial) | (after consol.) |
|---|---|---|---|
| Height, in | | 5.762 | 5.791 |
| Diameter, in | | 2.931 | 2.917 |
| Height-to-Diameter Ratio | | 2.0 | 2.0 |
| Area, $in^2$ | | 6.75 | 6.68 |
| Volume, $cm^3$ | | 637.06 | 634.26 |
| Mass of Wet Sample, g | | 1312.50 | 1309.70 |
| Mass of Dry Sample, g | | 1072.76 | 1072.76 |
| Wet Density, pcf | | 128.6 | 128.9 |
| Dry Density, pcf | | 105.1 | 105.6 |
| Specific Gravity | (assumed) | 2.700 | 2.700 |
| Volume of Solids, $cm^3$ | | 397.32 | 397.32 |
| Volume of Voids, $cm^3$ | | 239.74 | 236.94 |
| Void Ratio | | 0.60 | 0.60 |
| % Saturation | | 100.0 | 100.0 |

### WATER CONTENT DETERMINATION

| | (initial) | (final) |
|---|---|---|
| Mass of Wet Sample and Tare, g | 1312.50 | 1309.70 |
| Mass of Dry Sample and Tare, g | 1072.76 | 1072.76 |
| Mass of Tare, g | 0.00 | 0.00 |
| Moisture, % | 22.35 | 22.09 |

### TEST DATA PRIOR TO LOADING

| | |
|---|---|
| Volume change (Consolidation), ml | -2.8 |
| Machine Speed, in / min | 0.0040 |
| Strain Rate, % / min | 0.07 |
| Chamber Pressure, psi | 99.5 |
| Back Pressure, psi | 80.0 |
| Eff. Consol. Stress,(Minor pr. stress, $\sigma_3$),psi | 19.5 |
| Change in Height, in | -0.029 |
| "B" Value | 0.95 |
| $t_{50}$, min | 5.38 |

### SHEAR DATA

| Deformation Stage 2 (inch) | Total Deformation ST.1 + ST.2 (inch) | Axial Load (lb) | Pore-Water Pressure, psi | | Strain Stage 2 % | Corrected Area ($in^2$) | Dev.Stress ($\Delta\sigma=\sigma_1-\sigma_3$) | Major Principal Stress, psi | | Effective Stress Ratio | P' $(\sigma'_1+\sigma'_3)/2$ (psi) | Q $(\sigma_1-\sigma_3)/2$ (psi) | Eff. Minor Pr. Stress | Total Strain ST.1 + ST.2 % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total, U | Change, $\Delta U$ | | | (psi) | Total $\sigma_1$ | Eff. $\sigma'_1$ | $\sigma'_1/\sigma'_3$ | | | $\sigma'_3$ (psi) | |
| 0.000 | 0.081 | 21.2 | 80.3 | 0.3 | 0.00 | 6.68 | 0.0 | 19.5 | 19.2 | 1.00 | 19.2 | 0.0 | 19.2 | 1.38 |
| 0.005 | 0.086 | 87.1 | 86.6 | 6.6 | 0.09 | 6.69 | 9.9 | 29.4 | 22.8 | 1.76 | 17.8 | 4.9 | 12.9 | 1.46 |
| 0.010 | 0.091 | 112.2 | 88.5 | 8.5 | 0.17 | 6.70 | 13.6 | 33.1 | 24.6 | 2.24 | 17.8 | 6.8 | 11.0 | 1.55 |
| 0.015 | 0.096 | 130.9 | 89.7 | 9.7 | 0.26 | 6.70 | 16.4 | 35.9 | 26.2 | 2.67 | 18.0 | 8.2 | 9.8 | 1.63 |
| 0.020 | 0.101 | 145.7 | 90.5 | 10.5 | 0.35 | 6.71 | 18.6 | 38.1 | 27.6 | 3.06 | 18.3 | 9.3 | 9.0 | 1.72 |
| 0.025 | 0.106 | 161.2 | 91.2 | 11.2 | 0.43 | 6.71 | 20.9 | 40.4 | 29.2 | 3.51 | 18.7 | 10.4 | 8.3 | 1.81 |
| 0.030 | 0.111 | 177 | 91.8 | 11.8 | 0.52 | 6.72 | 23.2 | 42.7 | 30.9 | 4.01 | 19.3 | 11.6 | 7.7 | 1.89 |
| 0.035 | 0.116 | 190.3 | 92.3 | 12.3 | 0.60 | 6.72 | 25.1 | 44.6 | 32.3 | 4.49 | 19.8 | 12.6 | 7.2 | 1.98 |
| 0.040 | 0.121 | 202.8 | 92.7 | 12.7 | 0.69 | 6.73 | 27.0 | 46.5 | 33.8 | 4.97 | 20.3 | 13.5 | 6.8 | 2.06 |
| 0.050 | 0.131 | 222.9 | 93.1 | 13.1 | 0.86 | 6.74 | 29.9 | 49.4 | 36.3 | 5.67 | 21.4 | 15.0 | 6.4 | 2.23 |
| 0.075 | 0.156 | 255.7 | 92.8 | 12.8 | 1.30 | 6.77 | 34.6 | 54.1 | 41.3 | 6.17 | 24.0 | 17.3 | 6.7 | 2.66 |
| 0.085 | 0.166 | 265.1 | 92.4 | 12.4 | 1.47 | 6.78 | 36.0 | 55.5 | 43.0 | 6.09 | 25.0 | 18.0 | 7.1 | 2.83 |
| Values @ Failure | | | | **12.8** | **1.30** | **6.77** | **34.6** | **54.1** | **41.3** | **6.17** | **24.0** | **17.3** | **6.7** | **2.66** |

Failure criteria used*: 3

*Note: "1" = Max Deviator Stress; "2" = Deviator Stress @ 15% Strain; "3" = Max Eff.Stress Ratio($\sigma'_1/\sigma'_3$)

*Multistage Triaxial CU.xls [Stage 2], REV. 1; 10-21-05*

TIMELY ENGINEERING SOIL TESTS, LLC

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Phone: 770-938-8233
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Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/17/10 |
| Checked By | [signature] |

## ASTM D 4767M / AASHTO T 297M

### Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9191/B-13 D | Depth/Elev. | 11' |
| Location | - | Add. Info | - |

### SPECIMEN PROPERTIES

| | (initial) | (after consol.) |
|---|---|---|
| Height, in | 5.706 | 5.752 |
| Diameter, in | 2.939 | 2.920 |
| Height-to-Diameter Ratio | 1.9 | 2.0 |
| Area, $in^2$ | 6.78 | 6.70 |
| Volume, $cm^3$ | 634.26 | 631.26 |
| Mass of Wet Sample, g | 1309.70 | 1306.70 |
| Mass of Dry Sample, g | 1072.76 | 1072.76 |
| Wet Density, pcf | 128.9 | 129.2 |
| Dry Density, pcf | 105.6 | 106.1 |
| Specific Gravity (assumed) | 2.700 | 2.700 |
| Volume of Solids, $cm^3$ | 397.32 | 397.32 |
| Volume of Voids, $cm^3$ | 236.94 | 233.94 |
| Void Ratio | 0.60 | 0.59 |
| % Saturation | 100.0 | 100.0 |

### WATER CONTENT DETERMINATION

| | (initial) | (final) |
|---|---|---|
| Mass of Wet Sample and Tare, g | 1309.70 | 1497.00 |
| Mass of Dry Sample and Tare, g | 1072.76 | 1263.10 |
| Mass of Tare, g | 0.00 | 190.50 |
| Moisture, % | 22.09 | 21.81 |

### TEST DATA PRIOR TO LOADING

| | |
|---|---|
| Volume change (Consolidation), ml | -3.0 |
| Machine Speed, in / min | 0.00400 |
| Strain Rate, % / min | 0.07 |
| Chamber Pressure, psi | 106.5 |
| Back Pressure, psi | 80.0 |
| Eff. Consol. Stress,(Minor pr. stress, $\sigma_3$),psi | 26.5 |
| Change in Height, in | -0.046 |
| "B" Value | 0.95 |
| $t_{50}$, min | 10.48 |

### SHEAR DATA

| Deformation Stage 3 (inch) | Total Deformation ST.1 + ST.2 + ST.3 (inch) | Axial Load (lb) | Pore-Water Pressure, psi | | Strain Stage 3 % | Corrected Area ($in^2$) | Deviator Stress ($\Delta\sigma=\sigma_1-\sigma_3$) | Major Principal Stress, psi | | Effective Stress Ratio | P' $(\sigma'_1+\sigma'_3)/2$ (psi) | Q $(\sigma_1-\sigma_3)/2$ (psi) | Eff. Minor Pr. Stress | Total Strain ST.1 + ST.2 + ST.3, % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total, U | Change, $\Delta U$ | | | (psi) | Total $\sigma_1$ | Eff. $\sigma'_1$ | $\sigma'_1/\sigma'_3$ | | | $\sigma'_3$ (psi) | |
| 0.000 | 0.120 | 23 | 80.6 | 0.6 | 0.00 | 6.70 | 0.0 | 26.5 | 25.9 | 1.00 | 25.9 | 0.0 | 25.9 | 2.04 |
| 0.004 | 0.124 | 99.7 | 87.3 | 7.3 | 0.08 | 6.70 | 11.4 | 37.9 | 30.6 | 1.60 | 24.9 | 5.7 | 19.2 | 2.12 |
| 0.009 | 0.129 | 132.2 | 89.9 | 9.9 | 0.15 | 6.71 | 16.3 | 42.8 | 32.9 | 1.98 | 24.7 | 8.1 | 16.6 | 2.19 |
| 0.013 | 0.133 | 155.3 | 91.5 | 11.5 | 0.23 | 6.71 | 19.7 | 46.2 | 34.7 | 2.31 | 24.9 | 9.9 | 15.0 | 2.27 |
| 0.018 | 0.138 | 174.4 | 92.6 | 12.6 | 0.31 | 6.72 | 22.5 | 49.0 | 36.4 | 2.62 | 25.2 | 11.3 | 13.9 | 2.35 |
| 0.022 | 0.142 | 192.8 | 93.5 | 13.5 | 0.39 | 6.72 | 25.3 | 51.8 | 38.3 | 2.94 | 25.6 | 12.6 | 13.0 | 2.43 |
| 0.032 | 0.152 | 227.8 | 94.8 | 14.8 | 0.55 | 6.73 | 30.4 | 56.9 | 42.1 | 3.60 | 26.9 | 15.2 | 11.7 | 2.59 |
| 0.046 | 0.166 | 273.4 | 96.1 | 16.1 | 0.80 | 6.75 | 37.1 | 63.6 | 47.5 | 4.57 | 28.9 | 18.5 | 10.4 | 2.83 |
| 0.071 | 0.191 | 316.2 | 95.8 | 15.8 | 1.23 | 6.78 | 43.2 | 69.7 | 53.9 | 5.04 | 32.3 | 21.6 | 10.7 | 3.24 |
| 0.096 | 0.216 | 339.2 | 94.5 | 14.5 | 1.66 | 6.81 | 46.4 | 72.9 | 58.4 | 4.87 | 35.2 | 23.2 | 12.0 | 3.67 |
| 0.121 | 0.241 | 354.8 | 93.0 | 13.0 | 2.10 | 6.84 | 48.5 | 75.0 | 62.0 | 4.59 | 37.8 | 24.3 | 13.5 | 4.10 |
| 0.146 | 0.266 | 366.1 | 91.5 | 11.5 | 2.54 | 6.87 | 49.9 | 76.4 | 64.9 | 4.33 | 40.0 | 25.0 | 15.0 | 4.53 |
| 0.171 | 0.291 | 375.4 | 90.0 | 10.0 | 2.97 | 6.90 | 51.1 | 77.6 | 67.6 | 4.09 | 42.0 | 25.5 | 16.5 | 4.96 |
| 0.245 | 0.365 | 393.6 | 87.4 | 7.4 | 4.26 | 7.00 | 53.0 | 79.5 | 72.1 | 3.77 | 45.6 | 26.5 | 19.1 | 6.22 |
| 0.296 | 0.416 | 406.4 | 84.5 | 4.5 | 5.14 | 7.06 | 54.3 | 80.8 | 76.3 | 3.47 | 49.2 | 27.2 | 22.0 | 7.08 |
| 0.346 | 0.466 | 418.6 | 82.5 | 2.5 | 6.01 | 7.13 | 55.5 | 82.0 | 79.5 | 3.31 | 51.8 | 27.8 | 24.0 | 7.93 |
| 0.396 | 0.516 | 429 | 80.6 | 0.6 | 6.88 | 7.19 | 56.5 | 83.0 | 82.4 | 3.18 | 54.1 | 28.2 | 25.9 | 8.78 |
| 0.445 | 0.565 | 438.7 | 79.2 | -0.8 | 7.74 | 7.26 | 57.3 | 83.8 | 84.6 | 3.10 | 55.9 | 28.6 | 27.3 | 9.63 |
| 0.496 | 0.616 | 449.1 | 77.6 | -2.4 | 8.61 | 7.33 | 58.1 | 84.6 | 87.0 | 3.01 | 58.0 | 29.1 | 28.9 | 10.48 |
| 0.545 | 0.665 | 459.7 | 76.1 | -3.9 | 9.48 | 7.40 | 59.0 | 85.5 | 89.4 | 2.94 | 59.9 | 29.5 | 30.4 | 11.33 |
| 0.620 | 0.740 | 474.3 | 74.2 | -5.8 | 10.78 | 7.51 | 60.1 | 86.6 | 92.4 | 2.86 | 62.4 | 30.1 | 32.3 | 12.60 |
| 0.695 | 0.815 | 489.1 | 72.4 | -7.6 | 12.08 | 7.62 | 61.2 | 87.7 | 95.3 | 2.79 | 64.7 | 30.6 | 34.1 | 13.88 |
| 0.765 | 0.885 | 502.6 | 70.9 | -9.1 | 13.29 | 7.72 | 62.1 | 88.6 | 97.7 | 2.74 | 66.6 | 31.0 | 35.6 | 15.06 |
| Values @ Failure | | | | **15.8** | **1.23** | **6.78** | **43.2** | **69.7** | **53.9** | **5.04** | **32.3** | **21.6** | **10.7** | **3.24** |

Failure criteria used* 3 — *Note: "1" = Max Deviator Stress; "2" = Deviator Stress @ 15% Strain; "3" = Max Eff.Stress Ratio($\sigma'_1/\sigma'_3$)

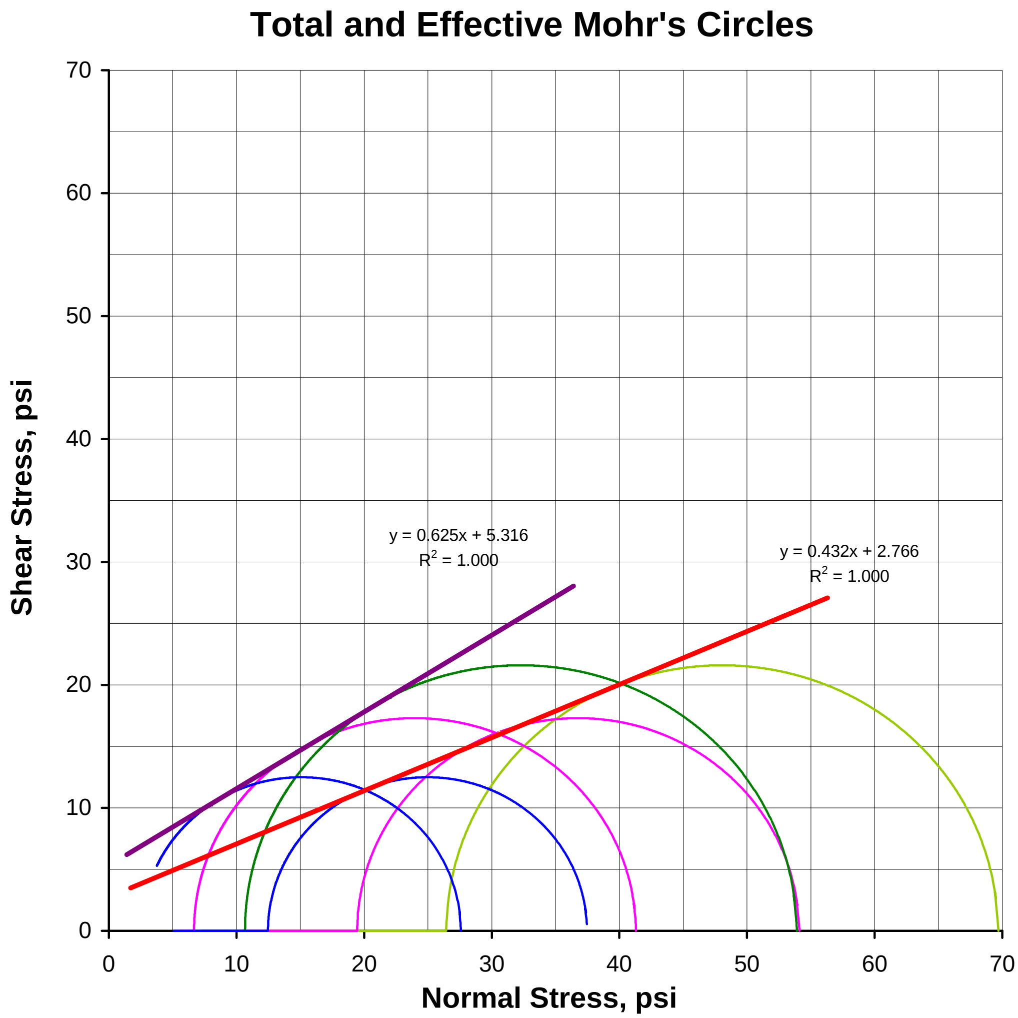
*Multistage Triaxial CU.xls [Stage 3], REV. 1; 10-21-05*

| | | | |
|---|---|---|---|
| T.E. S.T. | TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tested By: RI<br>Date: 06/17/10<br>Check: [signature] |

**ASTM D 4767M / AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9191/B-13 D | Depth/Elev. | 11' |
| Location | - | Add. Info | - |




| | ST. 1 | ST. 2 | ST. 3 |
|---|---|---|---|
| Effective Consolidation Stress, psi | 12.5 | 19.5 | 26.5 |
| Deviator Stress at Failure, psi | 25.0 | 34.6 | 43.2 |
| Effective Minor Principal Stress at Failure, psi | 2.6 | 6.7 | 10.7 |
| Effective Major Principal Stress at Failure, psi | 27.6 | 41.3 | 53.9 |
| Axial Strain at Failure, % | 1.70 | 1.30 | 1.23 |

| STRENGTH PARAMETERS | | | |
|---|---|---|---|
| Total | | Effective | |
| $\phi^{o}$ | 23.4 | $\phi'^{o}$ | 32.0 |
| C, psi | 2.8 | C', psi | 5.3 |

*Multistage Triaxial CU.xls [Mohr's Circles], REV. 1; 10-21-05*

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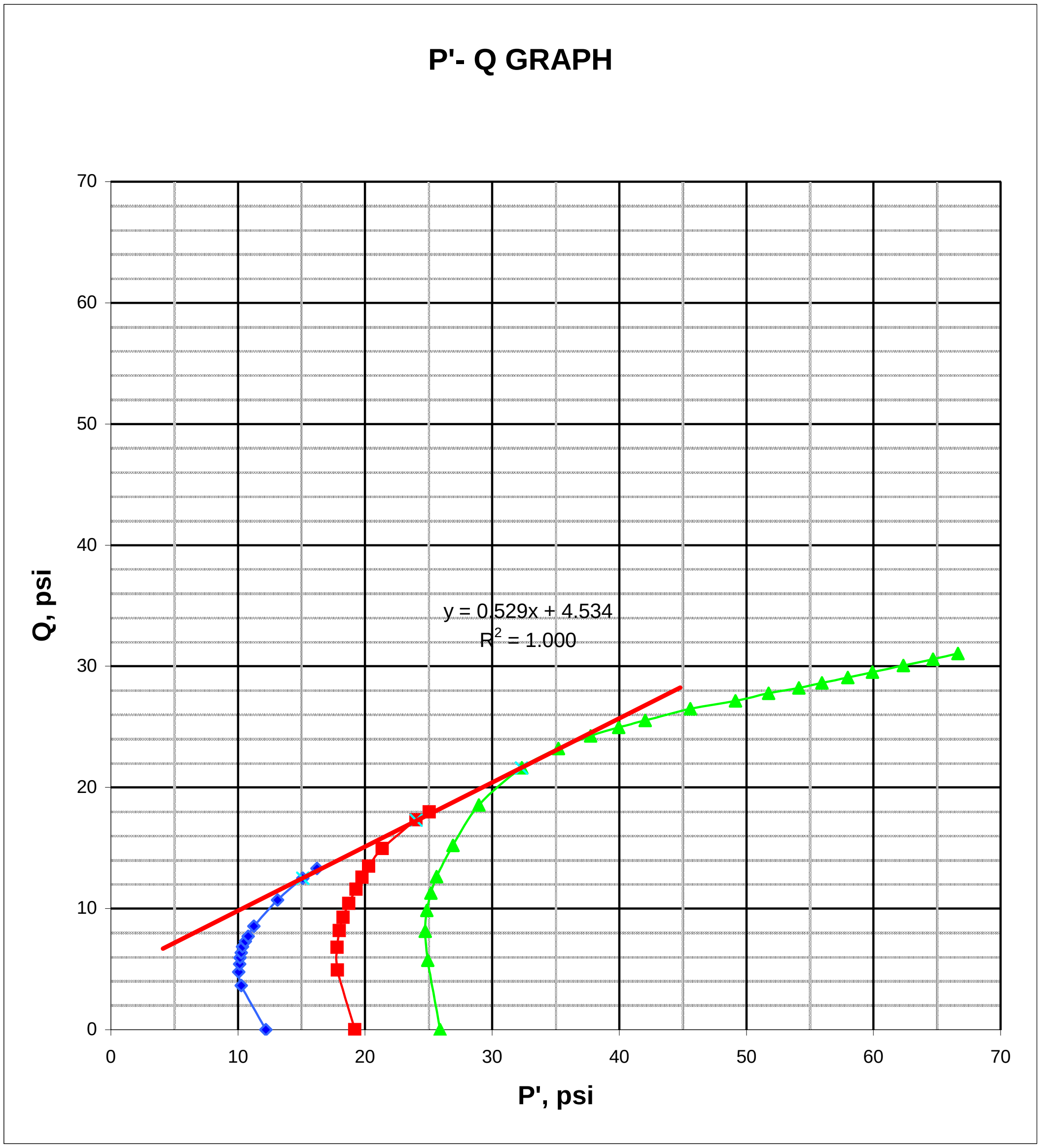
Web: www.test-llc.com

| | |
|---|---|
| Tech | RI |
| Date | 06/17/10 |
| Check | *(initials)* |

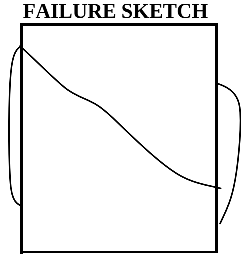
## ASTM D 4767M / AASHTO T 297M

### Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9191/B-13 D | Depth/Elev. | 11' |
| Location | - | Add. Info | - |




FAILURE SKETCH



| | |
|---|---|
| a, psi | 4.5 |
| α, degree | 27.9 |

*Multistage Triaxial CU.xls [P'-Q Graph], REV. 1; 10-21-05*

| | | | |
|---|---|---|---|
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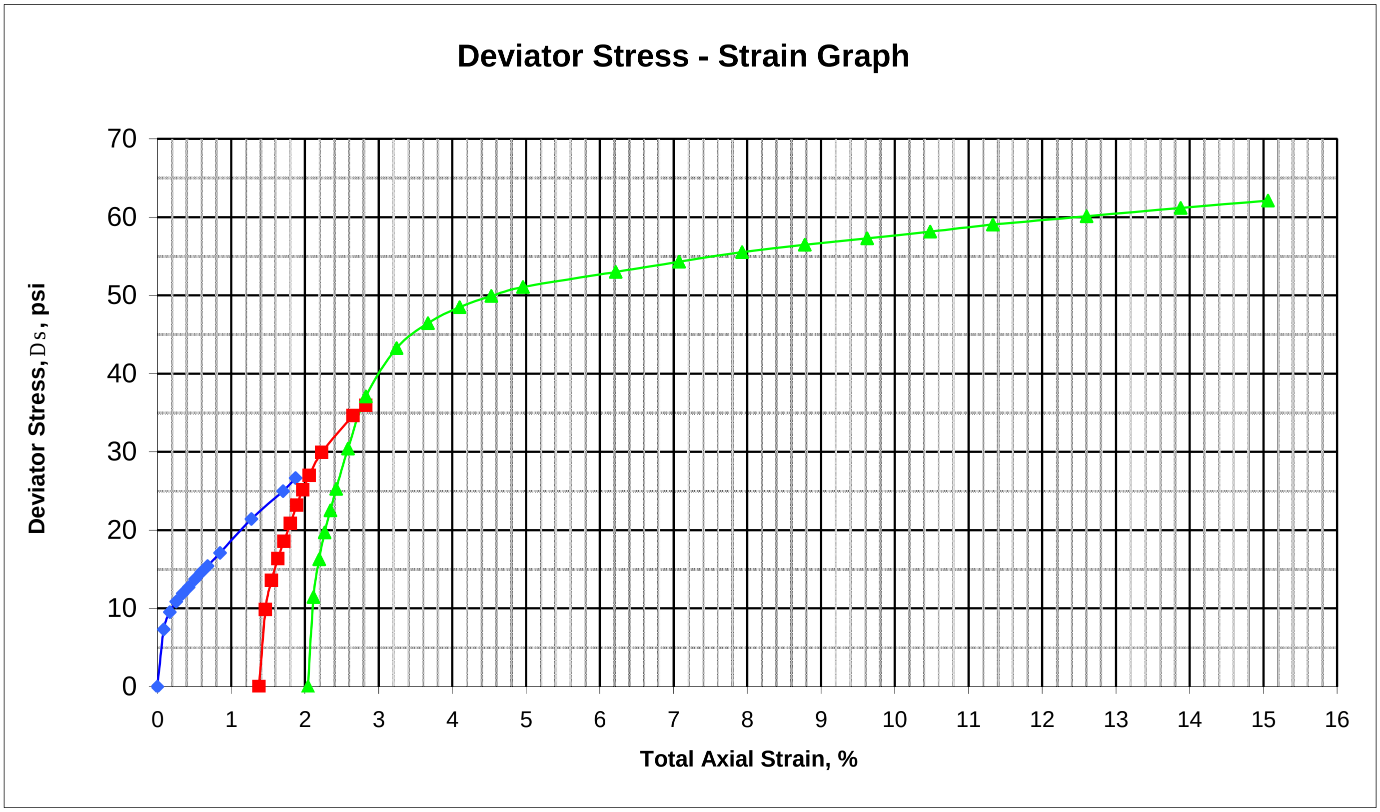
**ASTM D 4767M/ AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9191/B-13 D | Depth/Elev. | 11' |
| Location | - | Add. Info | - |




| | | REMARKS | DESCRIPTION |
|---|---|---|---|
| Balance ID Number | 1/6/7 | Portion of sample used for testing located 2" above bottom of shelby tube. | NA |
| Oven ID Number | 12/13/14 | | |
| Deformation Indicator ID # | 103-109 | | |
| Digital Caliper ID # | 16/17 | | |
| Load Cell ID # | 11 | | |
| Apparatus ID # | 10 | | |

NOTES:

1. Method for Saturation — WET
2. Method for determination of cross-sectional area after consol. — B
3. Final moisture content (Stage 3) obtained from entire sample

| | |
|---|---|
| LL | - |
| PL | - |
| PI | - |
| Gs | - |

**USCS (ASTM D2487: D2488)**: NA

*Multistage Triaxial CU.xls [Stress Strain Graph], REV. 1; 10-21-05*

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| | |
|---|---|
| Tested By | RI |
| Date | 06/15/10 |
| Checked By | |

## ASTM D 4767M / AASHTO T 297M

### Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9195/B-17 D | Depth/Elev. | 16' |
| Location | - | Add. Info | - |

### SPECIMEN PROPERTIES

| | (initial) | (after consol.) |
|---|---|---|
| Height, in | 6.009 | 6.005 |
| Diameter, in | 2.861 | 2.919 |
| Height-to-Diameter Ratio | 2.1 | 2.1 |
| Area, $in^2$ | 6.43 | 6.69 |
| Volume, $cm^3$ | 633.04 | 658.36 |
| Mass of Wet Sample, g | 1308.20 | 1320.50 |
| Mass of Dry Sample, g | 1051.64 | 1051.64 |
| Wet Density, pcf | 129.0 | 125.2 |
| Dry Density, pcf | 103.7 | 99.7 |
| Specific Gravity (assumed) | 2.700 | 2.700 |
| Volume of Solids, $cm^3$ | 389.50 | 389.50 |
| Volume of Voids, $cm^3$ | 243.54 | 268.86 |
| Void Ratio | 0.63 | 0.69 |
| % Saturation | 105.3 | 100.0 |

### WATER CONTENT DETERMINATION

| | (initial) | (final) |
|---|---|---|
| Mass of Wet Sample and Tare, g | 1308.20 | 1320.50 |
| Mass of Dry Sample and Tare, g | 1051.64 | 1051.64 |
| Mass of Tare, g | 0.00 | 0.00 |
| Moisture, % | 24.40 | 25.57 |

### TEST DATA PRIOR TO LOADING

| | |
|---|---|
| Volume change (Consolidation), ml | 12.3 |
| Machine Speed, in / min | 0.0030 |
| Strain Rate, % / min | 0.05 |
| Chamber Pressure, psi | 95.3 |
| Back Pressure, psi | 80.0 |
| Eff. Consol. Stress,(Minor pr. stress, $\sigma_3$),psi | 15.3 |
| Change in Height, in | 0.004 |
| "B" Value | 0.95 |
| $t_{50}$, min | 6.31 |

### SHEAR DATA

| Elapsed Time (min) | Deformation Stage 1 (inch) | Axial Load (lb) | Pore-Water Pressure, psi: Total, U | Pore-Water Pressure, psi: Change, $\Delta U$ | Total Strain Stage 1 (%) | Corrected Area ($in^2$) | Dev.Stress ($\Delta\sigma=\sigma_1-\sigma_3$) (psi) | Major Principal Stress, psi: Total $\sigma_1$ | Major Principal Stress, psi: Eff. $\sigma'_1$ | Eff.Stress Ratio $\sigma'_1/\sigma'_3$ | P' $(\sigma'_1+\sigma'_3)/2$ (psi) | Q $(\sigma_1-\sigma_3)/2$ (psi) | Eff. Minor Pr. Stress $\sigma'_3$ (psi) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.000 | 19.6 | 80.3 | 0.3 | 0.00 | 6.69 | 0.0 | 15.3 | 15.0 | 1.00 | 15.0 | 0.0 | 15.0 |
| 1.7 | 0.005 | 55.1 | 84.3 | 4.3 | 0.08 | 6.70 | 5.3 | 20.6 | 16.3 | 1.48 | 13.7 | 2.7 | 11.0 |
| 3.3 | 0.010 | 65.2 | 85.5 | 5.5 | 0.17 | 6.70 | 6.8 | 22.1 | 16.6 | 1.69 | 13.2 | 3.4 | 9.8 |
| 5.0 | 0.015 | 74.1 | 86.5 | 6.5 | 0.25 | 6.71 | 8.1 | 23.4 | 16.9 | 1.92 | 12.9 | 4.1 | 8.8 |
| 6.7 | 0.020 | 81.1 | 87.2 | 7.2 | 0.33 | 6.71 | 9.2 | 24.5 | 17.3 | 2.13 | 12.7 | 4.6 | 8.1 |
| 8.3 | 0.025 | 87 | 87.8 | 7.8 | 0.42 | 6.72 | 10.0 | 25.3 | 17.5 | 2.34 | 12.5 | 5.0 | 7.5 |
| 10.0 | 0.030 | 92.1 | 88.3 | 8.3 | 0.50 | 6.72 | 10.8 | 26.1 | 17.8 | 2.54 | 12.4 | 5.4 | 7.0 |
| 11.7 | 0.035 | 97 | 88.7 | 8.7 | 0.58 | 6.73 | 11.5 | 26.8 | 18.1 | 2.74 | 12.4 | 5.8 | 6.6 |
| 13.3 | 0.040 | 101.6 | 88.9 | 8.9 | 0.67 | 6.74 | 12.2 | 27.5 | 18.6 | 2.90 | 12.5 | 6.1 | 6.4 |
| 16.7 | 0.050 | 110.3 | 89.4 | 9.4 | 0.83 | 6.75 | 13.4 | 28.7 | 19.3 | 3.28 | 12.6 | 6.7 | 5.9 |
| 25.0 | 0.075 | 128.5 | 90.0 | 10.0 | 1.25 | 6.77 | 16.1 | 31.4 | 21.4 | 4.03 | 13.3 | 8.0 | 5.3 |
| 33.3 | 0.100 | 143.7 | 90.1 | 10.1 | 1.67 | 6.80 | 18.2 | 33.5 | 23.5 | 4.47 | 14.4 | 9.1 | 5.3 |
| 36.7 | 0.110 | 150 | 90.0 | 10.0 | 1.83 | 6.82 | 19.1 | 34.4 | 24.4 | 4.61 | 14.9 | 9.6 | 5.3 |
| 40.0 | 0.120 | 155.2 | 89.9 | 9.9 | 2.00 | 6.83 | 19.9 | 35.2 | 25.3 | 4.68 | 15.3 | 9.9 | 5.4 |
| 43.3 | 0.130 | 160.5 | 89.8 | 9.8 | 2.16 | 6.84 | 20.6 | 35.9 | 26.1 | 4.73 | 15.8 | 10.3 | 5.5 |
| 46.7 | 0.140 | 165.6 | 89.7 | 9.7 | 2.33 | 6.85 | 21.3 | 36.6 | 27.0 | 4.77 | 16.3 | 10.7 | 5.6 |
| 50.0 | 0.150 | 170.7 | 89.5 | 9.5 | 2.50 | 6.86 | 22.0 | 37.3 | 27.8 | 4.80 | 16.8 | 11.0 | 5.8 |
| 53.3 | 0.160 | 175.7 | 89.3 | 9.3 | 2.66 | 6.87 | 22.7 | 38.0 | 28.7 | 4.79 | 17.4 | 11.4 | 6.0 |
| Values @ Failure | | | | **9.5** | **2.50** | **6.86** | **22.0** | **37.3** | **27.8** | **4.80** | **16.8** | **11.0** | **5.8** |

Failure criteria used*: 3

*Note: "1" = Max Deviator Stress; "2" = Deviator Stress @ 15% Strain; "3" = Max Eff.Stress Ratio($\sigma'_1/\sigma'_3$)

*Multistage Triaxial CU.xls [Stage 1], REV. 1; 10-21-05*

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| | |
|---|---|
| Tested By | RI |
| Date | 06/16/10 |
| Checked By | [signature] |

**ASTM D 4767M / AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9195/B-17 D | Depth/Elev. | 16' |
| Location | - | Add. Info | - |

## SPECIMEN PROPERTIES

| | (initial) | (after consol.) |
|---|---|---|
| Height, in | 5.845 | 5.886 |
| Diameter, in | 2.958 | 2.936 |
| Height-to-Diameter Ratio | 2.0 | 2.0 |
| Area, in$^2$ | 6.87 | 6.77 |
| Volume, cm$^3$ | 658.36 | 652.86 |
| Mass of Wet Sample, g | 1320.50 | 1315.00 |
| Mass of Dry Sample, g | 1051.64 | 1051.64 |
| Wet Density, pcf | 125.2 | 125.7 |
| Dry Density, pcf | 99.7 | 100.6 |
| Specific Gravity (assumed) | 2.700 | 2.700 |
| Volume of Solids, cm$^3$ | 389.50 | 389.50 |
| Volume of Voids, cm$^3$ | 268.86 | 263.36 |
| Void Ratio | 0.69 | 0.68 |
| % Saturation | 100.0 | 100.0 |

## WATER CONTENT DETERMINATION

| | (initial) | (final) |
|---|---|---|
| Mass of Wet Sample and Tare, g | 1320.50 | 1315.00 |
| Mass of Dry Sample and Tare, g | 1051.64 | 1051.64 |
| Mass of Tare, g | 0.00 | 0.00 |
| Moisture, % | 25.57 | 25.04 |

## TEST DATA PRIOR TO LOADING

| | |
|---|---|
| Volume change (Consolidation), ml | -5.5 |
| Machine Speed, in / min | 0.0030 |
| Strain Rate, % / min | 0.05 |
| Chamber Pressure, psi | 102.2 |
| Back Pressure, psi | 80.0 |
| Eff. Consol. Stress,(Minor pr. stress, $\sigma_3$),psi | 22.2 |
| Change in Height, in | -0.041 |
| "B" Value | 0.95 |
| $t_{50}$, min | 8.40 |

## SHEAR DATA

| Deformation Stage 2 (inch) | Total Deformation ST.1 + ST.2 (inch) | Axial Load (lb) | Pore-Water Pressure, psi | | Strain Stage 2 % | Corrected Area (in$^2$) | Dev.Stress ($\Delta\sigma=\sigma_1-\sigma_3$) | Major Principal Stress, psi | | Effective Stress Ratio | P' $(\sigma'_1+\sigma'_3)/2$ (psi) | Q $(\sigma_1-\sigma_3)/2$ (psi) | Eff. Minor Pr. Stress | Total Strain ST.1 + ST.2 % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total, U | Change,$\Delta$U | | | (psi) | Total $\sigma_1$ | Eff. $\sigma'_1$ | $\sigma'_1/\sigma'_3$ | | | $\sigma'_3$ (psi) | |
| 0.000 | 0.119 | 21.3 | 80.2 | 0.2 | 0.00 | 6.77 | 0.0 | 22.2 | 22.0 | 1.00 | 22.0 | 0.0 | 22.0 | 1.98 |
| 0.005 | 0.124 | 86.3 | 85.7 | 5.7 | 0.08 | 6.77 | 9.6 | 31.8 | 26.1 | 1.58 | 21.3 | 4.8 | 16.5 | 2.06 |
| 0.010 | 0.129 | 108.2 | 87.5 | 7.5 | 0.17 | 6.78 | 12.8 | 35.0 | 27.5 | 1.87 | 21.1 | 6.4 | 14.7 | 2.15 |
| 0.015 | 0.134 | 124.6 | 88.6 | 8.6 | 0.25 | 6.79 | 15.2 | 37.4 | 28.8 | 2.12 | 21.2 | 7.6 | 13.6 | 2.23 |
| 0.020 | 0.139 | 138.3 | 89.4 | 9.4 | 0.34 | 6.79 | 17.2 | 39.4 | 30.0 | 2.35 | 21.4 | 8.6 | 12.8 | 2.31 |
| 0.025 | 0.144 | 150.8 | 90.1 | 10.1 | 0.42 | 6.80 | 19.1 | 41.3 | 31.2 | 2.57 | 21.6 | 9.5 | 12.1 | 2.40 |
| 0.030 | 0.149 | 162.1 | 90.6 | 10.6 | 0.51 | 6.80 | 20.7 | 42.9 | 32.3 | 2.78 | 21.9 | 10.3 | 11.6 | 2.48 |
| 0.035 | 0.154 | 171.7 | 91.0 | 11.0 | 0.59 | 6.81 | 22.1 | 44.3 | 33.3 | 2.97 | 22.2 | 11.0 | 11.2 | 2.56 |
| 0.040 | 0.159 | 181.8 | 91.4 | 11.4 | 0.68 | 6.81 | 23.6 | 45.8 | 34.4 | 3.18 | 22.6 | 11.8 | 10.8 | 2.65 |
| 0.050 | 0.169 | 198.4 | 91.9 | 11.9 | 0.85 | 6.83 | 25.9 | 48.1 | 36.2 | 3.52 | 23.3 | 13.0 | 10.3 | 2.81 |
| 0.075 | 0.194 | 223.1 | 92.1 | 12.1 | 1.27 | 6.86 | 29.4 | 51.6 | 39.5 | 3.91 | 24.8 | 14.7 | 10.1 | 3.23 |
| 0.100 | 0.219 | 239.4 | 91.6 | 11.6 | 1.70 | 6.89 | 31.7 | 53.9 | 42.3 | 3.99 | 26.4 | 15.8 | 10.6 | 3.65 |
| 0.110 | 0.229 | 244.5 | 91.3 | 11.3 | 1.87 | 6.90 | 32.4 | 54.6 | 43.3 | 3.97 | 27.1 | 16.2 | 10.9 | 3.81 |
| Values @ Failure | | | | **11.6** | **1.70** | **6.89** | **31.7** | **53.9** | **42.3** | **3.99** | **26.4** | **15.8** | **10.6** | **3.65** |

Failure criteria used*: 3

*Note: "1" = Max Deviator Stress; "2" = Deviator Stress @ 15% Strain; "3" = Max Eff.Stress Ratio($\sigma'_1/\sigma'_3$)

*Multistage Triaxial CU.xls [Stage 2], REV. 1; 10-21-05*

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/17/10 |
| Checked By | [signature] |

**ASTM D 4767M / AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9195/B-17 D | Depth/Elev. | 16' |
| Location | - | Add. Info | - |

**SPECIMEN PROPERTIES**

| | (initial) | (after consol.) |
|---|---|---|
| Height, in | 5.776 | 5.821 |
| Diameter, in | 2.963 | 2.943 |
| Height-to-Diameter Ratio | 1.9 | 2.0 |
| Area, $in^2$ | 6.90 | 6.80 |
| Volume, $cm^3$ | 652.86 | 648.86 |
| Mass of Wet Sample, g | 1315.00 | 1311.00 |
| Mass of Dry Sample, g | 1051.64 | 1051.64 |
| Wet Density, pcf | 125.7 | 126.1 |
| Dry Density, pcf | 100.6 | 101.2 |
| Specific Gravity (assumed) | 2.700 | 2.700 |
| Volume of Solids, $cm^3$ | 389.50 | 389.50 |
| Volume of Voids, $cm^3$ | 263.36 | 259.36 |
| Void Ratio | 0.68 | 0.67 |
| % Saturation | 100.0 | 100.0 |

**WATER CONTENT DETERMINATION**

| | (initial) | (final) |
|---|---|---|
| Mass of Wet Sample and Tare, g | 1315.00 | 1516.40 |
| Mass of Dry Sample and Tare, g | 1051.64 | 1257.10 |
| Mass of Tare, g | 0.00 | 205.70 |
| Moisture, % | 25.04 | 24.66 |

**TEST DATA PRIOR TO LOADING**

| | |
|---|---|
| Volume change (Consolidation), ml | -4.0 |
| Machine Speed, in / min | 0.00300 |
| Strain Rate, % / min | 0.05 |
| Chamber Pressure, psi | 109.2 |
| Back Pressure, psi | 80.0 |
| Eff. Consol. Stress,(Minor pr. stress, $\sigma_3$),psi | 29.2 |
| Change in Height, in | -0.045 |
| "B" Value | 0.95 |
| $t_{50}$, min | 2.10 |

**SHEAR DATA**

| Deformation Stage 3 (inch) | Total Deformation ST.1 + ST.2 + ST.3 (inch) | Axial Load (lb) | Pore-Water Pressure, psi | | Strain Stage 3 % | Corrected Area ($in^2$) | Deviator Stress ($\Delta\sigma=\sigma_1-\sigma_3$) | Major Principal Stress, psi | | Effective Stress Ratio | P' $(\sigma'_1+\sigma'_3)/2$ (psi) | Q $(\sigma_1-\sigma_3)/2$ (psi) | Eff. Minor Pr. Stress | Total Strain ST.1 + ST.2 + ST.3, % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total, U | Change, ΔU | | | (psi) | Total $\sigma_1$ | Eff. $\sigma'_1$ | $\sigma'_1/\sigma'_3$ | | | $\sigma'_3$ (psi) | |
| 0.000 | 0.184 | 21.3 | 80.2 | 0.2 | 0.00 | 6.80 | 0.0 | 29.2 | 29.0 | 1.00 | 29.0 | 0.0 | 29.0 | 3.06 |
| 0.004 | 0.188 | 97.7 | 86.7 | 6.7 | 0.07 | 6.81 | 11.2 | 40.4 | 33.7 | 1.50 | 28.1 | 5.6 | 22.5 | 3.13 |
| 0.009 | 0.193 | 129.7 | 89.2 | 9.2 | 0.15 | 6.81 | 15.9 | 45.1 | 35.9 | 1.80 | 28.0 | 8.0 | 20.0 | 3.21 |
| 0.014 | 0.198 | 151.1 | 90.8 | 10.8 | 0.23 | 6.82 | 19.0 | 48.2 | 37.4 | 2.03 | 27.9 | 9.5 | 18.4 | 3.29 |
| 0.018 | 0.202 | 169.2 | 91.8 | 11.8 | 0.31 | 6.82 | 21.7 | 50.9 | 39.1 | 2.25 | 28.2 | 10.8 | 17.4 | 3.37 |
| 0.023 | 0.207 | 186.3 | 92.5 | 12.5 | 0.40 | 6.83 | 24.2 | 53.4 | 40.9 | 2.45 | 28.8 | 12.1 | 16.7 | 3.45 |
| 0.033 | 0.217 | 214 | 93.7 | 13.7 | 0.56 | 6.84 | 28.2 | 57.4 | 43.7 | 2.82 | 29.6 | 14.1 | 15.5 | 3.61 |
| 0.047 | 0.231 | 249.8 | 94.9 | 14.9 | 0.81 | 6.86 | 33.3 | 62.5 | 47.6 | 3.33 | 31.0 | 16.7 | 14.3 | 3.85 |
| 0.072 | 0.256 | 283.6 | 95.2 | 15.2 | 1.24 | 6.89 | 38.1 | 67.3 | 52.1 | 3.72 | 33.0 | 19.0 | 14.0 | 4.26 |
| 0.097 | 0.281 | 300.3 | 94.5 | 14.5 | 1.66 | 6.92 | 40.3 | 69.5 | 55.0 | 3.74 | 34.9 | 20.2 | 14.7 | 4.68 |
| 0.121 | 0.305 | 312.5 | 93.7 | 13.7 | 2.08 | 6.95 | 41.9 | 71.1 | 57.4 | 3.70 | 36.5 | 21.0 | 15.5 | 5.08 |
| 0.146 | 0.330 | 323 | 92.8 | 12.8 | 2.51 | 6.98 | 43.2 | 72.4 | 59.6 | 3.64 | 38.0 | 21.6 | 16.4 | 5.49 |
| 0.171 | 0.355 | 332.5 | 92.0 | 12.0 | 2.93 | 7.01 | 44.4 | 73.6 | 61.6 | 3.58 | 39.4 | 22.2 | 17.2 | 5.91 |
| 0.246 | 0.430 | 353.5 | 89.6 | 9.6 | 4.23 | 7.10 | 46.8 | 76.0 | 66.4 | 3.39 | 43.0 | 23.4 | 19.6 | 7.16 |
| 0.296 | 0.480 | 364.8 | 88.1 | 8.1 | 5.09 | 7.17 | 47.9 | 77.1 | 69.0 | 3.27 | 45.1 | 24.0 | 21.1 | 7.99 |
| 0.346 | 0.530 | 375.2 | 86.7 | 6.7 | 5.94 | 7.23 | 48.9 | 78.1 | 71.4 | 3.18 | 47.0 | 24.5 | 22.5 | 8.82 |
| 0.396 | 0.580 | 383.3 | 85.4 | 5.4 | 6.79 | 7.30 | 49.6 | 78.8 | 73.4 | 3.08 | 48.6 | 24.8 | 23.8 | 9.65 |
| 0.446 | 0.630 | 391.7 | 84.3 | 4.3 | 7.66 | 7.37 | 50.3 | 79.5 | 75.2 | 3.02 | 50.0 | 25.1 | 24.9 | 10.49 |
| 0.496 | 0.680 | 399.3 | 83.1 | 3.1 | 8.52 | 7.44 | 50.8 | 80.0 | 76.9 | 2.95 | 51.5 | 25.4 | 26.1 | 11.32 |
| 0.546 | 0.730 | 407.1 | 82.1 | 2.1 | 9.37 | 7.51 | 51.4 | 80.6 | 78.5 | 2.90 | 52.8 | 25.7 | 27.1 | 12.15 |
| 0.596 | 0.780 | 413.4 | 81.2 | 1.2 | 10.23 | 7.58 | 51.7 | 80.9 | 79.7 | 2.85 | 53.9 | 25.9 | 28.0 | 12.98 |
| 0.671 | 0.855 | 423.8 | 80.0 | 0.0 | 11.53 | 7.69 | 52.4 | 81.6 | 81.6 | 2.79 | 55.4 | 26.2 | 29.2 | 14.24 |
| 0.727 | 0.911 | 431.4 | 79.1 | -0.9 | 12.49 | 7.77 | 52.8 | 82.0 | 82.9 | 2.75 | 56.5 | 26.4 | 30.1 | 15.17 |
| Values @ Failure | | | | **14.5** | **1.66** | **6.92** | **40.3** | **69.5** | **55.0** | **3.74** | **34.9** | **20.2** | **14.7** | **4.68** |

Failure criteria used*: 3

*Note: "1" = Max Deviator Stress; "2" = Deviator Stress @ 15% Strain; "3" = Max Eff.Stress Ratio($\sigma'_1/\sigma'_3$)

*Multistage Triaxial CU.xls [Stage 3], REV. 1; 10-21-05*

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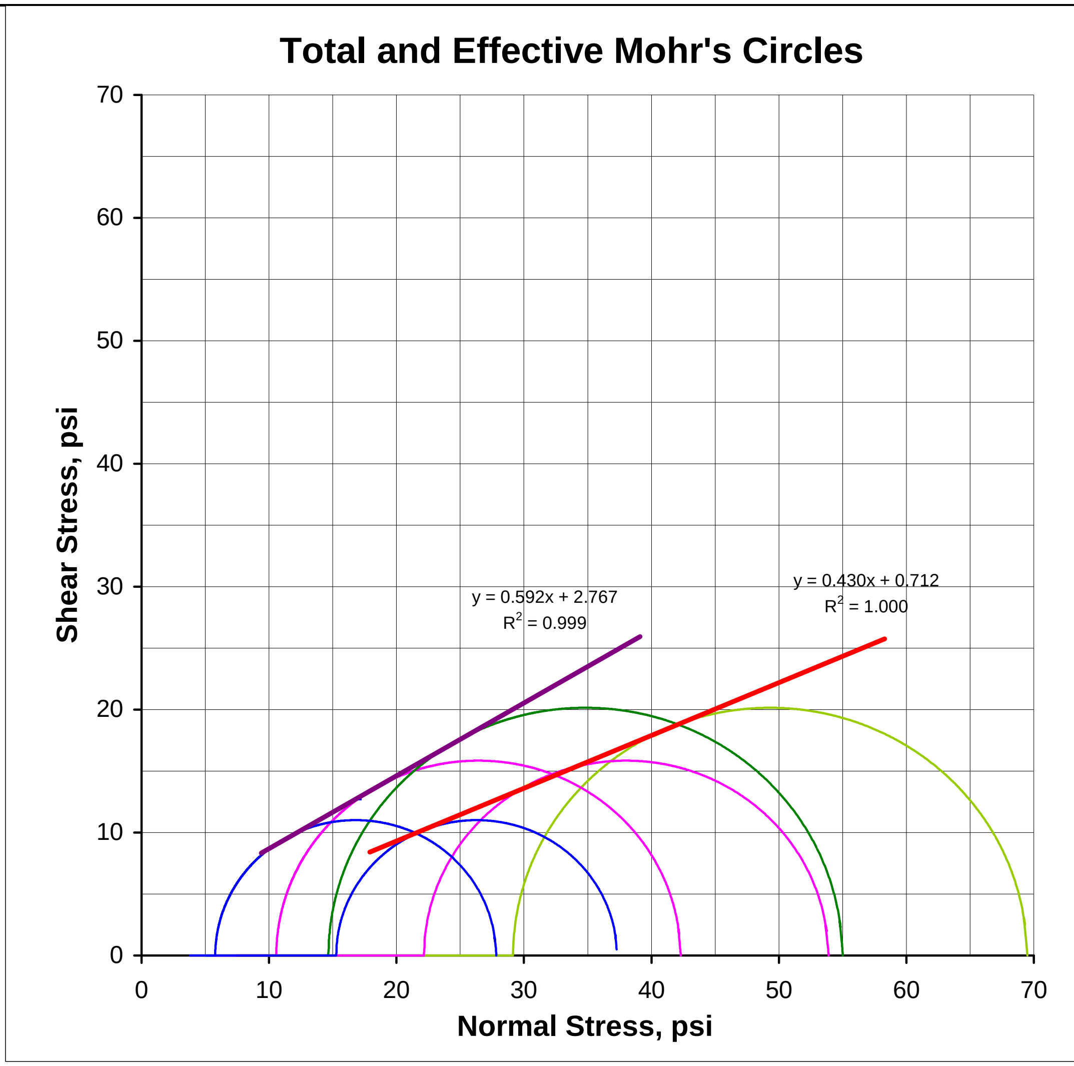
|---|---|---|---|
| | | Date | 06/17/10 |
| | | Check | [signature] |

**ASTM D 4767M / AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9195/B-17 D | Depth/Elev. | 16' |
| Location | - | Add. Info | - |




| | ST. 1 | ST. 2 | ST. 3 |
|---|---|---|---|
| Effective Consolidation Stress, psi | 15.3 | 22.2 | 29.2 |
| Deviator Stress at Failure, psi | 22.0 | 31.7 | 40.3 |
| Effective Minor Principal Stress at Failure, psi | 5.8 | 10.6 | 14.7 |
| Effective Major Principal Stress at Failure, psi | 27.8 | 42.3 | 55.0 |
| Axial Strain at Failure, % | 2.50 | 1.70 | 1.66 |

| STRENGTH PARAMETERS | | | |
|---|---|---|---|
| Total | | Effective | |
| $\phi$ ° | 23.3 | $\phi$ ' ° | 30.6 |
| C, psi | 0.7 | C', psi | 2.8 |

*Multistage Triaxial CU.xls [Mohr's Circles], REV. 1; 10-21-05*

| | | | |
|---|---|---|---|
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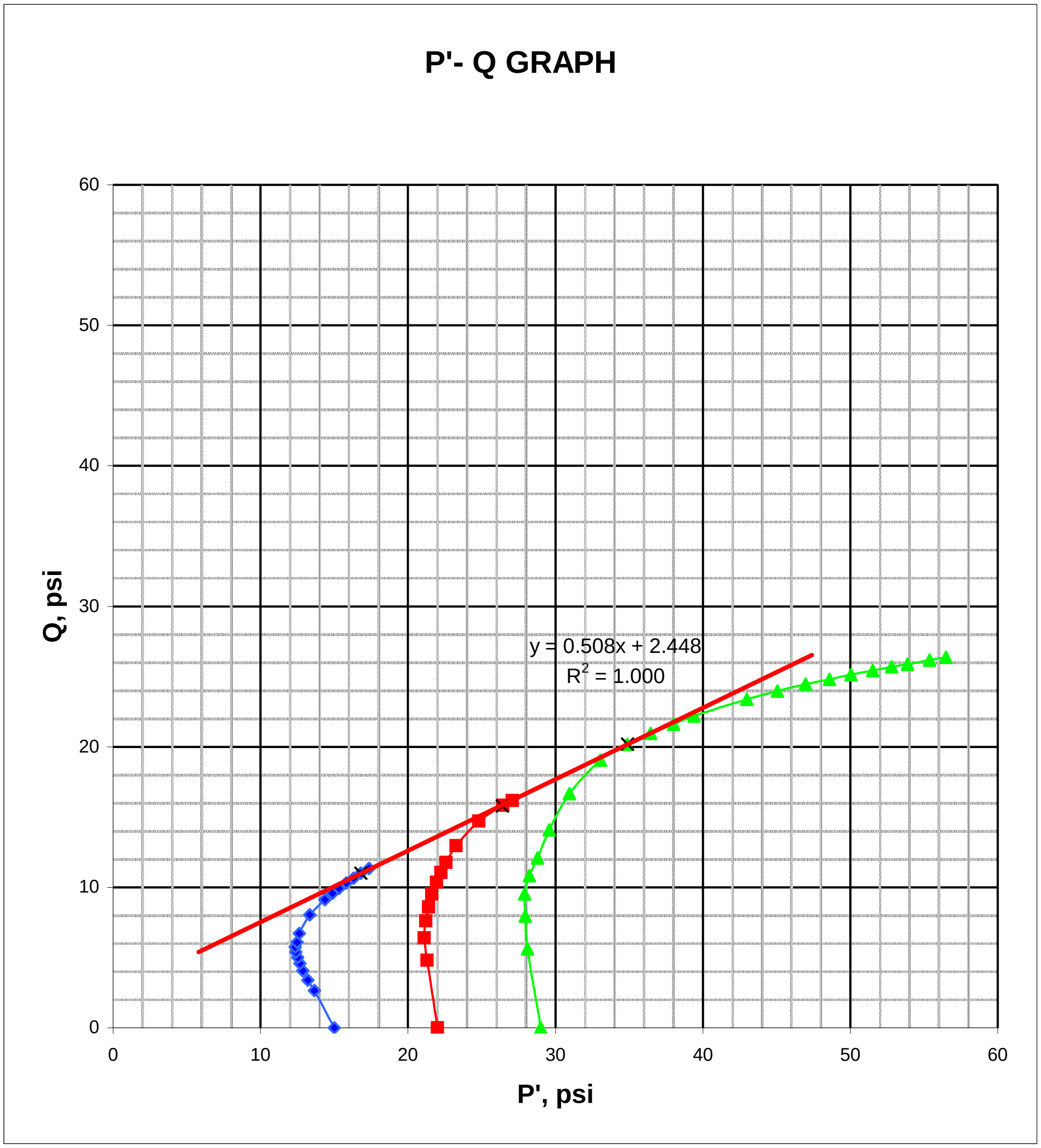
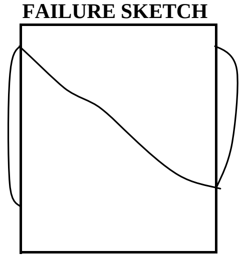
**ASTM D 4767M / AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9195/B-17 D | Depth/Elev. | 16' |
| Location | - | Add. Info | - |




**FAILURE SKETCH**



| | |
|---|---|
| a, psi | 2.4 |
| α, degree | 26.9 |

*Multistage Triaxial CU.xls [P'-Q Graph], REV. 1; 10-21-05*

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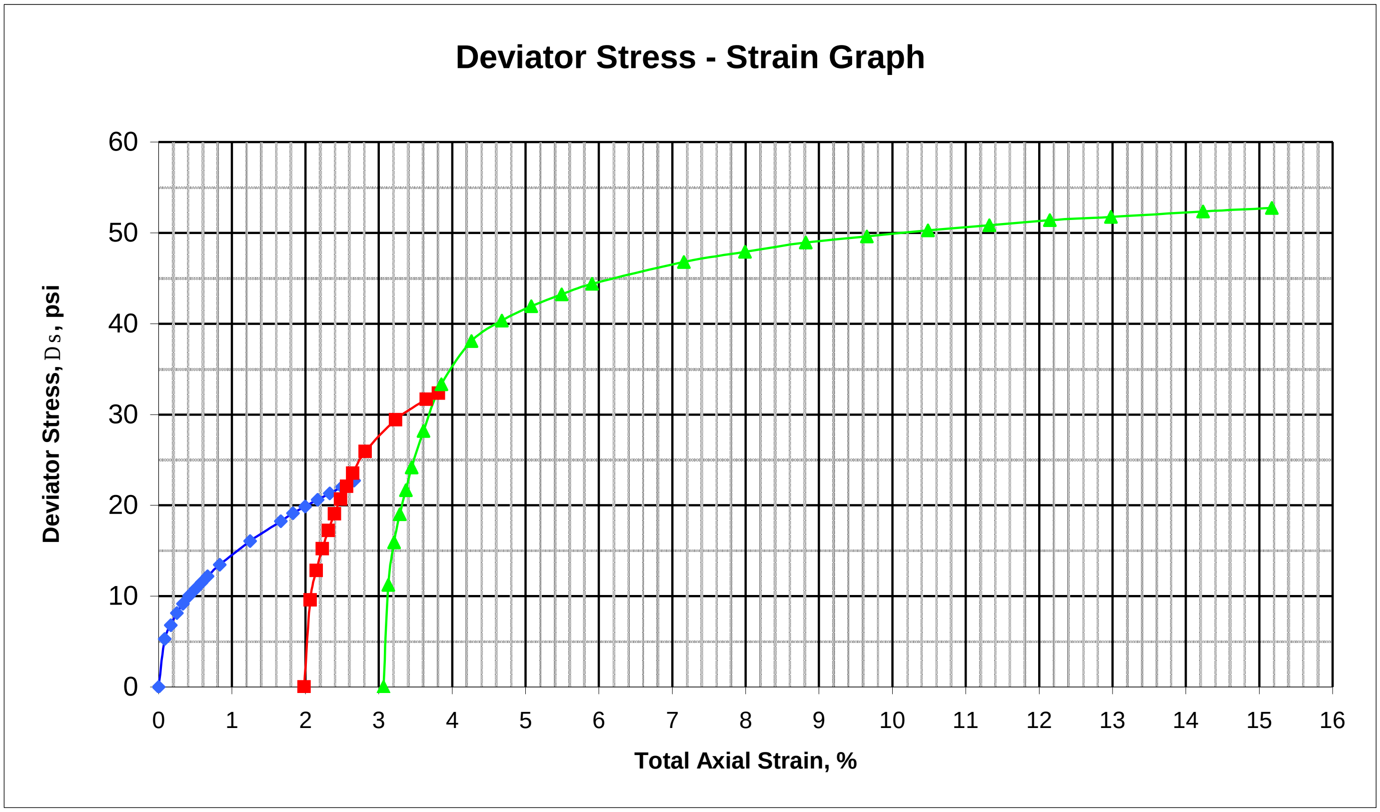
Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/17/10 |
| Check | |

**ASTM D 4767M/ AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9195/B-17 D | Depth/Elev. | 16' |
| Location | - | Add. Info | - |




| | |
|---|---|
| Balance ID Number | 1/6/7 |
| Oven ID Number | 12/13/14 |
| Deformation Indicator ID # | 103-109 |
| Digital Caliper ID # | 16/17 |
| Load Cell ID # | 11 |
| Apparatus ID # | 10 |

**REMARKS**

Portion of sample used for testing located 1" above the bottom of the shelby tube.

**DESCRIPTION**

NA

NOTES:

1. Method for Saturation — WET
2. Method for determination of cross-sectional area after consol. — B
3. Final moisture content (Stage 3) obtained from entire sample

| | |
|---|---|
| LL | - |
| PL | - |
| PI | - |
| Gs | - |

**USCS (ASTM D2487: D2488)**

NA

*Multistage Triaxial CU.xls [Stress Strain Graph], REV. 1; 10-21-05*

| | | | |
|---|---|---|---|
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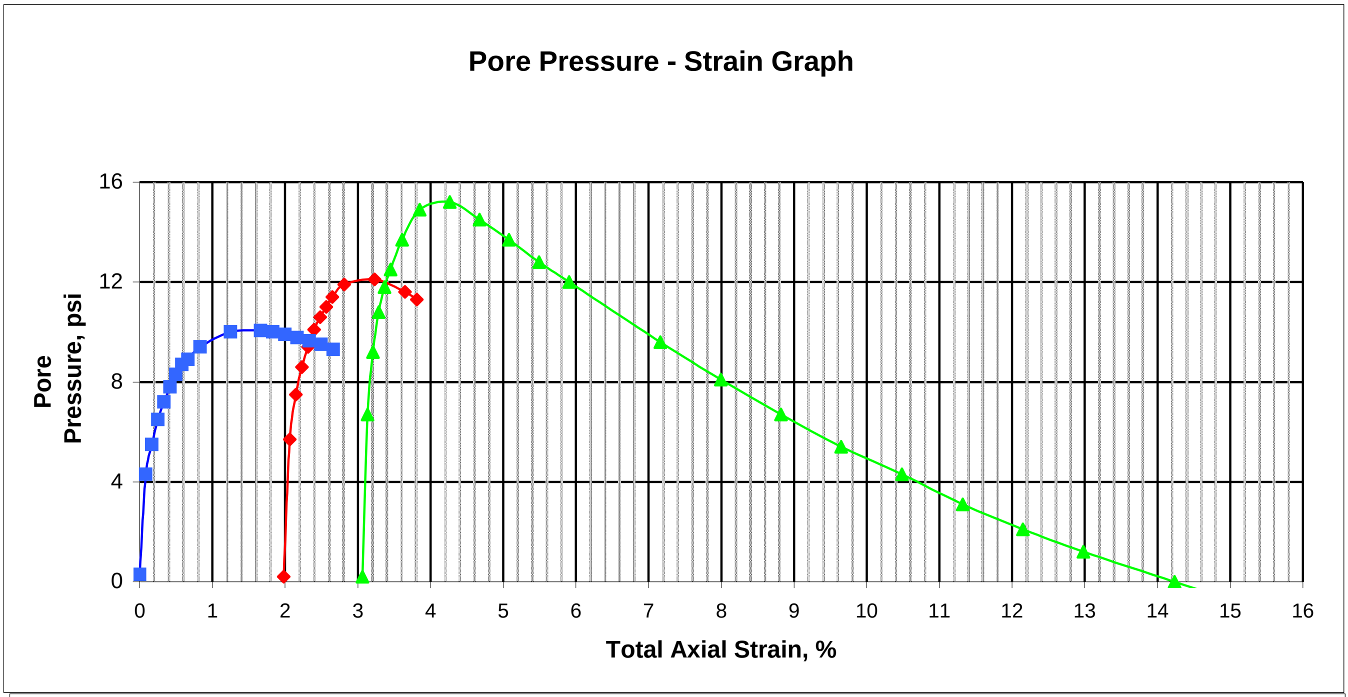
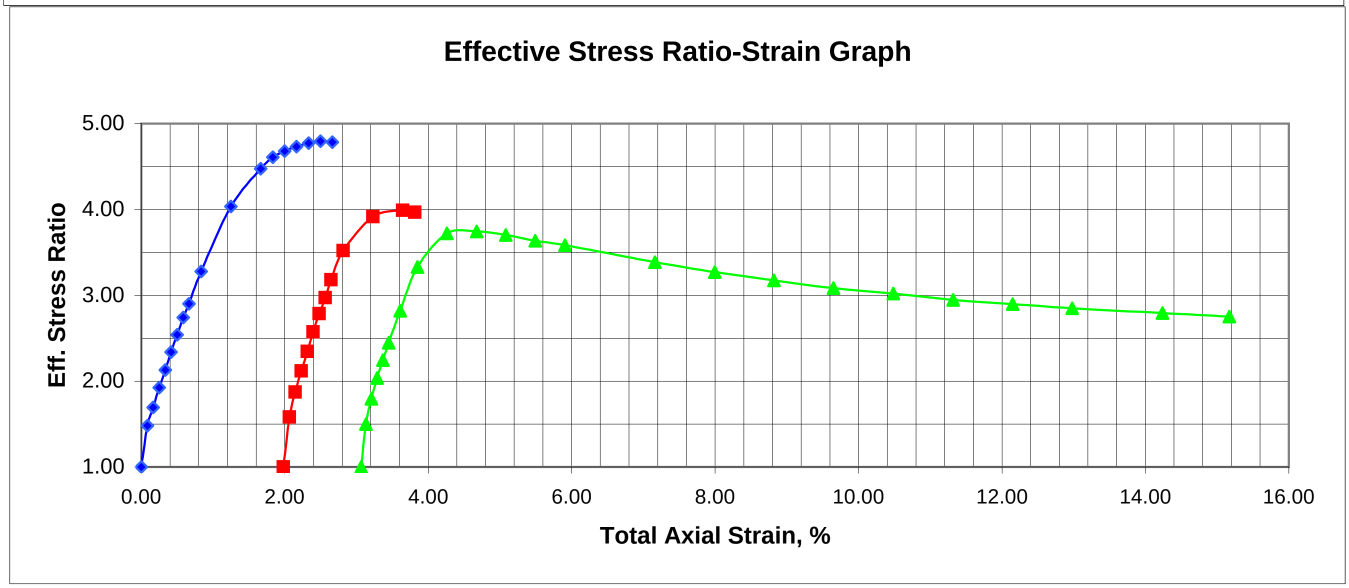
**ASTM D 4767M / AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9195/B-17 D | Depth/Elev. | 16' |
| Location | - | Add. Info | - |




*Multistage Triaxial CU.xls [Stress Ratio & Pore Water Pr.-Strain Graph], REV. 1; 10-21-05*

| | | | |
|---|---|---|---|
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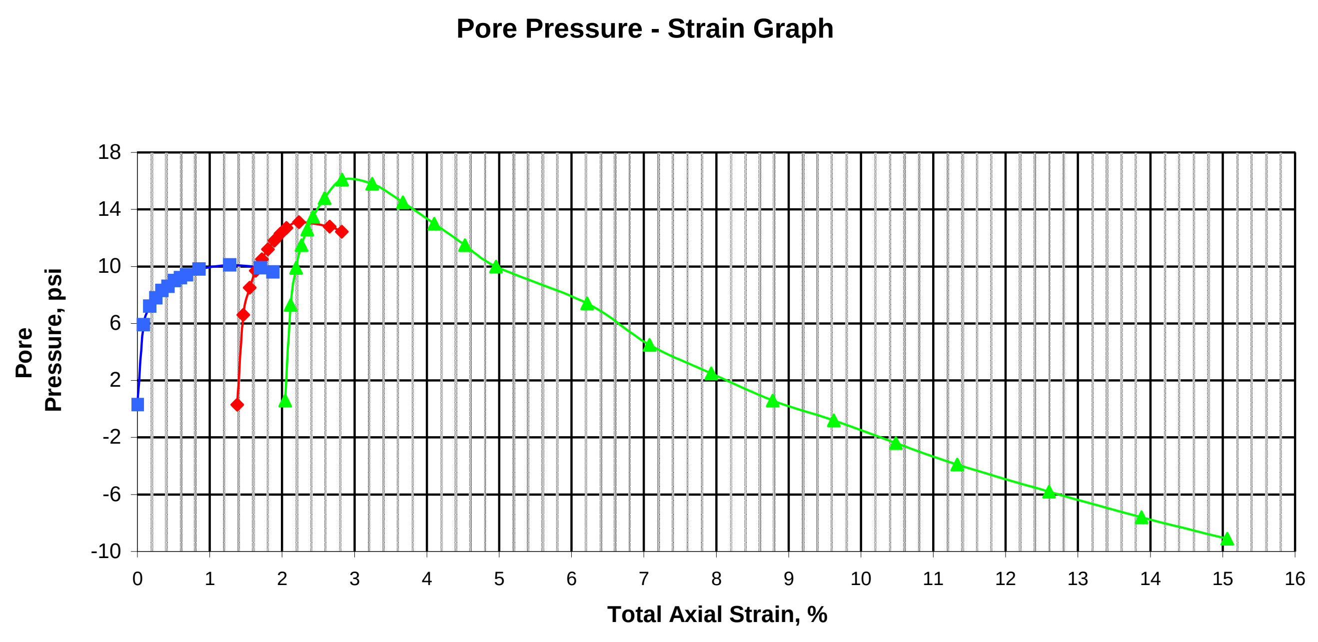
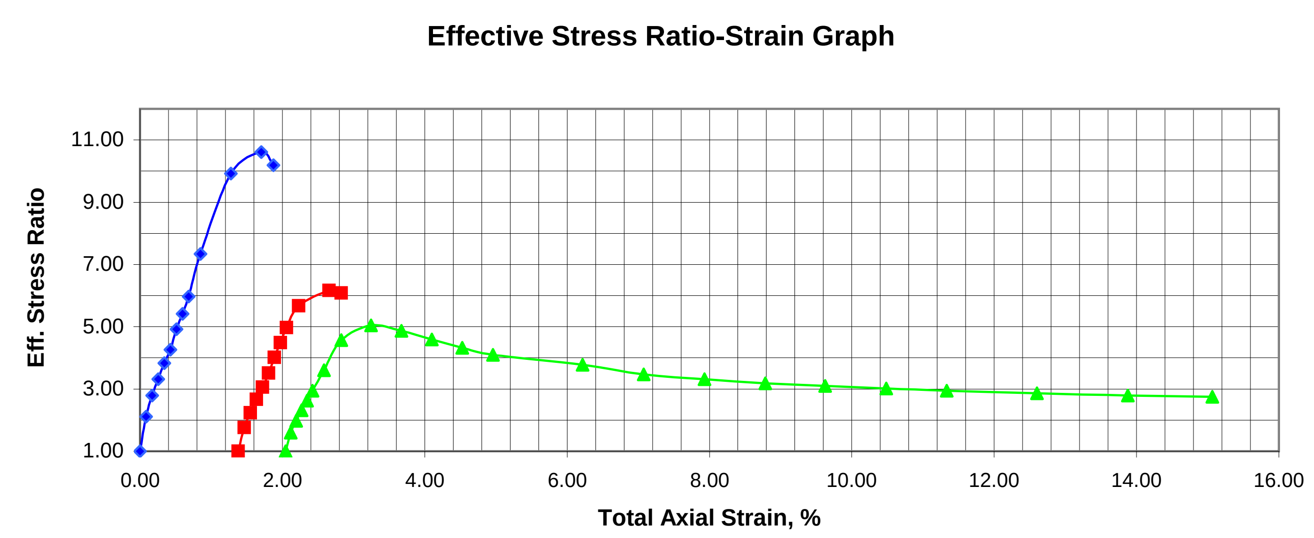
| | | Date | 06/17/10 |
| | | Check | |

**ASTM D 4767M / AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9191/B-13 D | Depth/Elev. | 11' |
| Location | - | Add. Info | - |




*Multistage Triaxial CU.xls [Stress Ratio & Pore Water Pr.-Strain Graph], REV. 1; 10-21-05*

| | | |
|---|---|---|
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## ASTM D 4767M / AASHTO T 297M

### Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9198/B-22 | Depth/Elev. | 16' |
| Location | - | Add. Info | - |

### SPECIMEN PROPERTIES

| | (initial) | (after consol.) |
|---|---|---|
| Height, in | 5.976 | 5.985 |
| Diameter, in | 2.877 | 2.906 |
| Height-to-Diameter Ratio | 2.1 | 2.1 |
| Area, $in^2$ | 6.50 | 6.63 |
| Volume, $cm^3$ | 636.62 | 650.30 |
| Mass of Wet Sample, g | 1363.00 | 1383.30 |
| Mass of Dry Sample, g | 1164.17 | 1164.17 |
| Wet Density, pcf | 133.7 | 132.8 |
| Dry Density, pcf | 114.2 | 111.8 |
| Specific Gravity (assumed) | 2.700 | 2.700 |
| Volume of Solids, $cm^3$ | 431.17 | 431.17 |
| Volume of Voids, $cm^3$ | 205.45 | 219.13 |
| Void Ratio | 0.48 | 0.51 |
| % Saturation | 96.8 | 100.0 |

### WATER CONTENT DETERMINATION

| | (initial) | (final) |
|---|---|---|
| Mass of Wet Sample and Tare, g | 1363.00 | 1383.30 |
| Mass of Dry Sample and Tare, g | 1164.17 | 1164.17 |
| Mass of Tare, g | 0.00 | 0.00 |
| Moisture, % | 17.08 | 18.82 |

### TEST DATA PRIOR TO LOADING

| | |
|---|---|
| Volume change (Consolidation), ml | 20.3 |
| Machine Speed, in / min | 0.0030 |
| Strain Rate, % / min | 0.05 |
| Chamber Pressure, psi | 95.3 |
| Back Pressure, psi | 80.0 |
| Eff. Consol. Stress,(Minor pr. stress, $\sigma_3$),psi | 15.3 |
| Change in Height, in | -0.009 |
| "B" Value | 0.95 |
| $t_{50,}$ min | 11.11 |

### SHEAR DATA

| Elapsed Time (min) | Deformation Stage 1 (inch) | Axial Load (lb) | Pore-Water Pressure, psi | | Total Strain Stage 1 (%) | Corrected Area ($in^2$) | Dev.Stress ($\Delta\sigma=\sigma_1-\sigma_3$) | Major Principal Stress, psi | | Eff.Stress Ratio | P' $(\sigma'_1+\sigma'_3)/2$ (psi) | Q $(\sigma_1-\sigma_3)/2$ (psi) | Eff. Minor Pr. Stress |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total, U | Change,$\Delta$U | | | (psi) | Total $\sigma_1$ | Eff. $\sigma'_1$ | $\sigma'_1/\sigma'_3$ | | | $\sigma'_3$ (psi) |
| 0.0 | 0.000 | 19.7 | 80.3 | 0.3 | 0.00 | 6.63 | 0.0 | 15.3 | 15.0 | 1.00 | 15.0 | 0.0 | 15.0 |
| 1.7 | 0.005 | 59.7 | 84.2 | 4.2 | 0.08 | 6.64 | 6.0 | 21.3 | 17.1 | 1.54 | 14.1 | 3.0 | 11.1 |
| 3.3 | 0.010 | 70.8 | 85.6 | 5.6 | 0.17 | 6.64 | 7.7 | 23.0 | 17.4 | 1.79 | 13.5 | 3.8 | 9.7 |
| 5.0 | 0.015 | 79.7 | 86.4 | 6.4 | 0.25 | 6.65 | 9.0 | 24.3 | 17.9 | 2.01 | 13.4 | 4.5 | 8.9 |
| 6.7 | 0.020 | 87 | 87.0 | 7.0 | 0.33 | 6.65 | 10.1 | 25.4 | 18.4 | 2.22 | 13.4 | 5.1 | 8.3 |
| 8.3 | 0.025 | 92.8 | 87.4 | 7.4 | 0.42 | 6.66 | 11.0 | 26.3 | 18.9 | 2.39 | 13.4 | 5.5 | 7.9 |
| 10.0 | 0.030 | 98.6 | 87.7 | 7.7 | 0.50 | 6.66 | 11.8 | 27.1 | 19.4 | 2.56 | 13.5 | 5.9 | 7.6 |
| 11.7 | 0.035 | 103.9 | 88.0 | 8.0 | 0.58 | 6.67 | 12.6 | 27.9 | 19.9 | 2.73 | 13.6 | 6.3 | 7.3 |
| 13.3 | 0.040 | 108.7 | 88.2 | 8.2 | 0.67 | 6.68 | 13.3 | 28.6 | 20.4 | 2.88 | 13.8 | 6.7 | 7.1 |
| 16.7 | 0.050 | 117.5 | 88.5 | 8.5 | 0.84 | 6.69 | 14.6 | 29.9 | 21.4 | 3.15 | 14.1 | 7.3 | 6.8 |
| 25.0 | 0.075 | 135.9 | 88.7 | 8.7 | 1.25 | 6.71 | 17.3 | 32.6 | 23.9 | 3.62 | 15.3 | 8.7 | 6.6 |
| 33.3 | 0.100 | 150.2 | 88.4 | 8.4 | 1.67 | 6.74 | 19.4 | 34.7 | 26.3 | 3.80 | 16.6 | 9.7 | 6.9 |
| 36.7 | 0.110 | 155 | 88.3 | 8.3 | 1.84 | 6.75 | 20.0 | 35.3 | 27.1 | 3.85 | 17.0 | 10.0 | 7.0 |
| 40.0 | 0.120 | 159.5 | 88.1 | 8.1 | 2.01 | 6.77 | 20.7 | 36.0 | 27.9 | 3.87 | 17.5 | 10.3 | 7.2 |
| 43.3 | 0.130 | 163.5 | 87.9 | 7.9 | 2.17 | 6.78 | 21.2 | 36.5 | 28.6 | 3.87 | 18.0 | 10.6 | 7.4 |
| 46.7 | 0.140 | 167.3 | 87.7 | 7.7 | 2.34 | 6.79 | 21.7 | 37.0 | 29.3 | 3.86 | 18.5 | 10.9 | 7.6 |
| **Values @ Failure** | | | | **8.1** | **2.01** | **6.77** | **20.7** | **36.0** | **27.9** | **3.87** | **17.5** | **10.3** | **7.2** |

Failure criteria used*: 3

*Note: "1" = Max Deviator Stress; "2" = Deviator Stress @ 15% Strain; "3" = Max Eff.Stress Ratio($\sigma'_1/\sigma'_3$)

*Multistage Triaxial CU.xls [Stage 1], REV. 1; 10-21-05*

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1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
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Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/16/10 |
| Checked By | [signature] |

## ASTM D 4767M / AASHTO T 297M

### Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9198/B-22 | Depth/Elev. | 16' |
| Location | - | Add. Info | - |

### SPECIMEN PROPERTIES

| | (initial) | (after consol.) |
|---|---|---|
| Height, in | 5.845 | 5.878 |
| Diameter, in | 2.940 | 2.920 |
| Height-to-Diameter Ratio | 2.0 | 2.0 |
| Area, $in^2$ | 6.79 | 6.70 |
| Volume, $cm^3$ | 650.30 | 644.90 |
| Mass of Wet Sample, g | 1383.30 | 1377.90 |
| Mass of Dry Sample, g | 1164.17 | 1164.17 |
| Wet Density, pcf | 132.8 | 133.4 |
| Dry Density, pcf | 111.8 | 112.7 |
| Specific Gravity (assumed) | 2.700 | 2.700 |
| Volume of Solids, $cm^3$ | 431.17 | 431.17 |
| Volume of Voids, $cm^3$ | 219.13 | 213.73 |
| Void Ratio | 0.51 | 0.50 |
| % Saturation | 100.0 | 100.0 |

### WATER CONTENT DETERMINATION

| | (initial) | (final) |
|---|---|---|
| Mass of Wet Sample and Tare, g | 1383.30 | 1377.90 |
| Mass of Dry Sample and Tare, g | 1164.17 | 1164.17 |
| Mass of Tare, g | 0.00 | 0.00 |
| Moisture, % | 18.82 | 18.36 |

### TEST DATA PRIOR TO LOADING

| | |
|---|---|
| Volume change (Consolidation), ml | -5.4 |
| Machine Speed, in / min | 0.0030 |
| Strain Rate, % / min | 0.05 |
| Chamber Pressure, psi | 102.2 |
| Back Pressure, psi | 80.0 |
| Eff. Consol. Stress,(Minor pr. stress, $\sigma_3$),psi | 22.2 |
| Change in Height, in | -0.033 |
| "B" Value | 0.95 |
| $t_{50}$, min | 5.16 |

### SHEAR DATA

| Deformation Stage 2 (inch) | Total Deformation ST.1 + ST.2 (inch) | Axial Load (lb) | Pore-Water Pressure, psi | | Strain Stage 2 % | Corrected Area ($in^2$) | Dev.Stress ($\Delta\sigma=\sigma_1-\sigma_3$) | Major Principal Stress, psi | | Effective Stress Ratio | P' $(\sigma'_1+\sigma'_3)/2$ (psi) | Q $(\sigma_1-\sigma_3)/2$ (psi) | Eff. Minor Pr. Stress | Total Strain ST.1 + ST.2 % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total, U | Change, $\Delta$U | | | (psi) | Total $\sigma_1$ | Eff. $\sigma'_1$ | $\sigma'_1/\sigma'_3$ | | | $\sigma'_3$ (psi) | |
| 0.000 | 0.107 | 21.2 | 80.2 | 0.2 | 0.00 | 6.70 | 0.0 | 22.2 | 22.0 | 1.00 | 22.0 | 0.0 | 22.0 | 1.79 |
| 0.005 | 0.112 | 82.2 | 85.6 | 5.6 | 0.09 | 6.70 | 9.1 | 31.3 | 25.7 | 1.55 | 21.2 | 4.6 | 16.6 | 1.87 |
| 0.010 | 0.117 | 107.2 | 87.5 | 7.5 | 0.17 | 6.71 | 12.8 | 35.0 | 27.5 | 1.87 | 21.1 | 6.4 | 14.7 | 1.95 |
| 0.015 | 0.122 | 126.6 | 88.7 | 8.7 | 0.26 | 6.71 | 15.7 | 37.9 | 29.2 | 2.16 | 21.4 | 7.9 | 13.5 | 2.04 |
| 0.020 | 0.127 | 142.3 | 89.4 | 9.4 | 0.34 | 6.72 | 18.0 | 40.2 | 30.8 | 2.41 | 21.8 | 9.0 | 12.8 | 2.12 |
| 0.025 | 0.132 | 153.7 | 89.9 | 9.9 | 0.43 | 6.72 | 19.7 | 41.9 | 32.0 | 2.60 | 22.2 | 9.9 | 12.3 | 2.21 |
| 0.030 | 0.137 | 166.3 | 90.3 | 10.3 | 0.51 | 6.73 | 21.6 | 43.8 | 33.5 | 2.81 | 22.7 | 10.8 | 11.9 | 2.29 |
| 0.035 | 0.142 | 176.4 | 90.6 | 10.6 | 0.60 | 6.74 | 23.0 | 45.2 | 34.6 | 2.99 | 23.1 | 11.5 | 11.6 | 2.37 |
| 0.040 | 0.147 | 185.3 | 90.8 | 10.8 | 0.68 | 6.74 | 24.3 | 46.5 | 35.7 | 3.14 | 23.6 | 12.2 | 11.4 | 2.46 |
| 0.050 | 0.157 | 199 | 91.0 | 11.0 | 0.85 | 6.75 | 26.3 | 48.5 | 37.5 | 3.35 | 24.4 | 13.2 | 11.2 | 2.62 |
| 0.075 | 0.182 | 218.7 | 90.6 | 10.6 | 1.28 | 6.78 | 29.1 | 51.3 | 40.7 | 3.51 | 26.2 | 14.6 | 11.6 | 3.04 |
| 0.100 | 0.207 | 229.5 | 90.1 | 10.1 | 1.70 | 6.81 | 30.6 | 52.8 | 42.7 | 3.53 | 27.4 | 15.3 | 12.1 | 3.46 |
| 0.110 | 0.217 | 233.5 | 89.7 | 9.7 | 1.87 | 6.82 | 31.1 | 53.3 | 43.6 | 3.50 | 28.0 | 15.6 | 12.5 | 3.63 |
| **Values @ Failure** | | | | **10.1** | **1.70** | **6.81** | **30.6** | **52.8** | **42.7** | **3.53** | **27.4** | **15.3** | **12.1** | **3.46** |

Failure criteria used*: 3

*Note: "1" = Max Deviator Stress; "2" = Deviator Stress @ 15% Strain; "3" = Max Eff.Stress Ratio($\sigma'_1/\sigma'_3$)

*Multistage Triaxial CU.xls [Stage 2], REV. 1; 10-21-05*

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Web: www.test-llc.com

| | |
|---|---|
| Tested By | RI |
| Date | 06/17/10 |
| Checked By | *(initials)* |

**ASTM D 4767M / AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9198/B-22 | Depth/Elev. | 16' |
| Location | - | Add. Info | - |

## SPECIMEN PROPERTIES

| | (initial) | (after consol.) |
|---|---|---|
| Height, in | 5.768 | 5.811 |
| Diameter, in | 2.947 | 2.927 |
| Height-to-Diameter Ratio | 2.0 | 2.0 |
| Area, $in^2$ | 6.82 | 6.73 |
| Volume, $cm^3$ | 644.90 | 640.70 |
| Mass of Wet Sample, g | 1377.90 | 1373.70 |
| Mass of Dry Sample, g | 1164.17 | 1164.17 |
| Wet Density, pcf | 133.4 | 133.8 |
| Dry Density, pcf | 112.7 | 113.4 |
| Specific Gravity (assumed) | 2.700 | 2.700 |
| Volume of Solids, $cm^3$ | 431.17 | 431.17 |
| Volume of Voids, $cm^3$ | 213.73 | 209.53 |
| Void Ratio | 0.50 | 0.49 |
| % Saturation | 100.0 | 100.0 |

## WATER CONTENT DETERMINATION

| | (initial) | (final) |
|---|---|---|
| Mass of Wet Sample and Tare, g | 1377.90 | 1567.90 |
| Mass of Dry Sample and Tare, g | 1164.17 | 1358.40 |
| Mass of Tare, g | 0.00 | 194.40 |
| Moisture, % | 18.36 | 18.00 |

## TEST DATA PRIOR TO LOADING

| | |
|---|---|
| Volume change (Consolidation), ml | -4.2 |
| Machine Speed, in / min | 0.00300 |
| Strain Rate, % / min | 0.05 |
| Chamber Pressure, psi | 109.2 |
| Back Pressure, psi | 80.0 |
| Eff. Consol. Stress,(Minor pr. stress, $\sigma_3$),psi | 29.2 |
| Change in Height, in | -0.043 |
| "B" Value | 0.95 |
| $t_{50}$, min | 9.86 |

## SHEAR DATA

| Deformation Stage 3 (inch) | Total Deformation ST.1 + ST.2 + ST.3 (inch) | Axial Load (lb) | Pore-Water Pressure, psi | | Strain Stage 3 % | Corrected Area ($in^2$) | Deviator Stress ($\Delta\sigma=\sigma_1-\sigma_3$) | Major Principal Stress, psi | | Effective Stress Ratio | P' ($\sigma'_1+\sigma'_3$)/2 (psi) | Q ($\sigma_1-\sigma_3$)/2 (psi) | Eff. Minor Pr. Stress | Total Strain ST.1 + ST.2 + ST.3, % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total, U | Change,$\Delta$U | | | (psi) | Total $\sigma_1$ | Eff. $\sigma'_1$ | $\sigma'_1/\sigma'_3$ | | | $\sigma'_3$ (psi) | |
| 0.000 | 0.174 | 22.5 | 80.4 | 0.4 | 0.00 | 6.73 | 0.0 | 29.2 | 28.8 | 1.00 | 28.8 | 0.0 | 28.8 | 2.91 |
| 0.005 | 0.179 | 96.1 | 87.1 | 7.1 | 0.08 | 6.73 | 10.9 | 40.1 | 33.0 | 1.49 | 27.6 | 5.5 | 22.1 | 2.98 |
| 0.009 | 0.183 | 130.7 | 89.5 | 9.5 | 0.16 | 6.74 | 16.1 | 45.3 | 35.8 | 1.82 | 27.7 | 8.0 | 19.7 | 3.06 |
| 0.014 | 0.188 | 153.3 | 90.9 | 10.9 | 0.24 | 6.74 | 19.4 | 48.6 | 37.7 | 2.06 | 28.0 | 9.7 | 18.3 | 3.14 |
| 0.019 | 0.193 | 173.8 | 91.8 | 11.8 | 0.32 | 6.75 | 22.4 | 51.6 | 39.8 | 2.29 | 28.6 | 11.2 | 17.4 | 3.22 |
| 0.023 | 0.197 | 191.6 | 92.5 | 12.5 | 0.40 | 6.76 | 25.0 | 54.2 | 41.7 | 2.50 | 29.2 | 12.5 | 16.7 | 3.30 |
| 0.033 | 0.207 | 222.3 | 93.4 | 13.4 | 0.57 | 6.77 | 29.5 | 58.7 | 45.3 | 2.87 | 30.6 | 14.8 | 15.8 | 3.46 |
| 0.048 | 0.222 | 254.9 | 94.0 | 14.0 | 0.82 | 6.78 | 34.3 | 63.5 | 49.5 | 3.25 | 32.3 | 17.1 | 15.2 | 3.70 |
| 0.072 | 0.246 | 279.7 | 93.5 | 13.5 | 1.24 | 6.81 | 37.8 | 67.0 | 53.5 | 3.40 | 34.6 | 18.9 | 15.7 | 4.12 |
| 0.097 | 0.271 | 291.6 | 92.8 | 12.8 | 1.66 | 6.84 | 39.3 | 68.5 | 55.7 | 3.40 | 36.1 | 19.7 | 16.4 | 4.52 |
| 0.122 | 0.296 | 300.6 | 92.1 | 12.1 | 2.09 | 6.87 | 40.5 | 69.7 | 57.6 | 3.37 | 37.3 | 20.2 | 17.1 | 4.94 |
| 0.146 | 0.320 | 307.6 | 91.5 | 11.5 | 2.52 | 6.90 | 41.3 | 70.5 | 59.0 | 3.33 | 38.4 | 20.7 | 17.7 | 5.35 |
| 0.197 | 0.371 | 318.8 | 90.4 | 10.4 | 3.39 | 6.96 | 42.5 | 71.7 | 61.3 | 3.26 | 40.1 | 21.3 | 18.8 | 6.20 |
| 0.247 | 0.421 | 328.5 | 89.4 | 9.4 | 4.25 | 7.03 | 43.5 | 72.7 | 63.3 | 3.20 | 41.6 | 21.8 | 19.8 | 7.04 |
| 0.297 | 0.471 | 336.9 | 88.6 | 8.6 | 5.10 | 7.09 | 44.3 | 73.5 | 64.9 | 3.15 | 42.8 | 22.2 | 20.6 | 7.86 |
| 0.346 | 0.520 | 344.4 | 87.7 | 7.7 | 5.96 | 7.15 | 45.0 | 74.2 | 66.5 | 3.09 | 44.0 | 22.5 | 21.5 | 8.69 |
| 0.397 | 0.571 | 351.3 | 87.0 | 7.0 | 6.83 | 7.22 | 45.5 | 74.7 | 67.7 | 3.05 | 45.0 | 22.8 | 22.2 | 9.54 |
| 0.447 | 0.621 | 357.8 | 86.4 | 6.4 | 7.69 | 7.29 | 46.0 | 75.2 | 68.8 | 3.02 | 45.8 | 23.0 | 22.8 | 10.37 |
| 0.496 | 0.670 | 363.6 | 85.9 | 5.9 | 8.54 | 7.36 | 46.4 | 75.6 | 69.7 | 2.99 | 46.5 | 23.2 | 23.3 | 11.20 |
| 0.546 | 0.720 | 369.2 | 85.3 | 5.3 | 9.40 | 7.43 | 46.7 | 75.9 | 70.6 | 2.95 | 47.2 | 23.3 | 23.9 | 12.03 |
| 0.596 | 0.770 | 374.9 | 84.8 | 4.8 | 10.26 | 7.50 | 47.0 | 76.2 | 71.4 | 2.93 | 47.9 | 23.5 | 24.4 | 12.87 |
| 0.672 | 0.846 | 382.6 | 84.1 | 4.1 | 11.56 | 7.61 | 47.3 | 76.5 | 72.4 | 2.89 | 48.8 | 23.7 | 25.1 | 14.13 |
| 0.731 | 0.905 | 388.6 | 83.6 | 3.6 | 12.58 | 7.70 | 47.6 | 76.8 | 73.2 | 2.86 | 49.4 | 23.8 | 25.6 | 15.12 |
| Values @ Failure | | | | **13.5** | **1.24** | **6.81** | **37.8** | **67.0** | **53.5** | **3.40** | **34.6** | **18.9** | **15.7** | **4.12** |

Failure criteria used* 3

*Note: "1" = Max Deviator Stress; "2" = Deviator Stress @ 15% Strain; "3" = Max Eff.Stress Ratio($\sigma'_1/\sigma'_3$)

*Multistage Triaxial CU.xls [Stage 3], REV. 1; 10-21-05*

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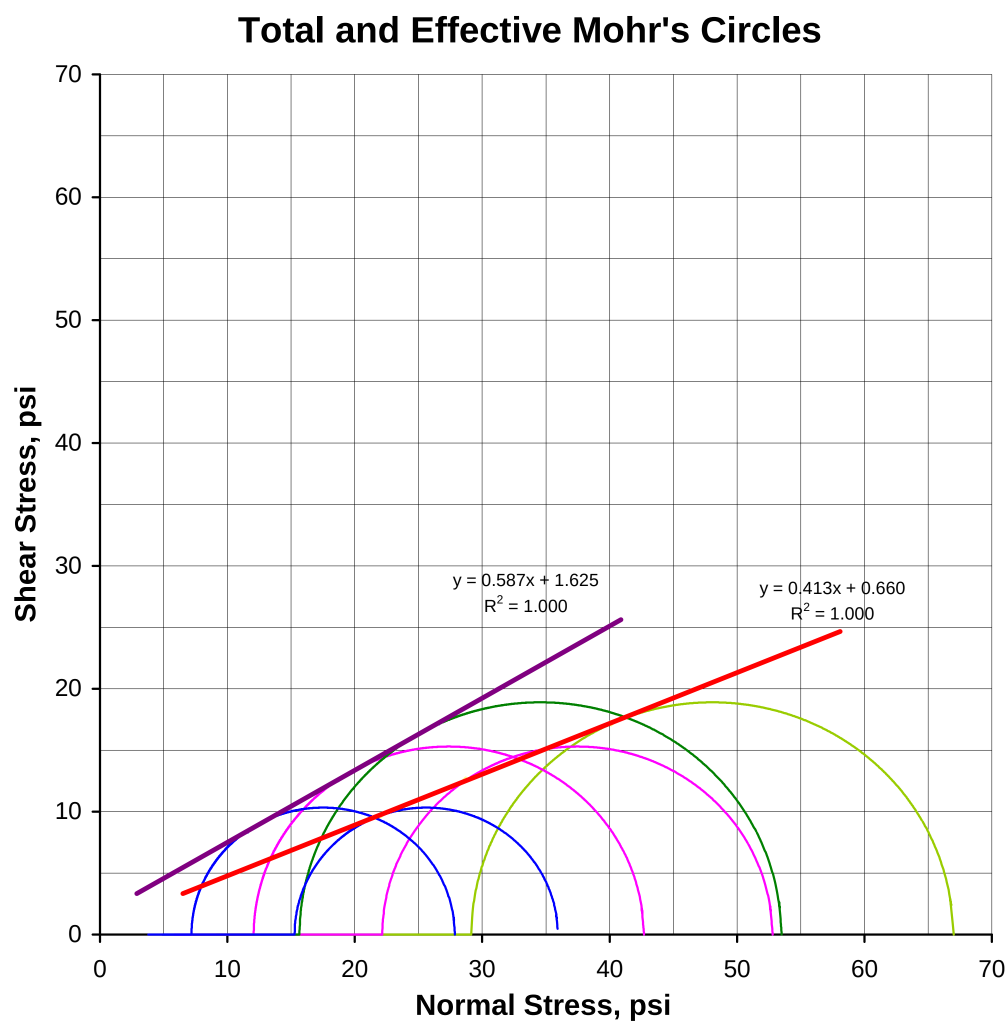
| | |
|---|---|
| Tested By | RI |
| Date | 06/17/10 |
| Check | [signature] |

**ASTM D 4767M / AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9198/B-22 | Depth/Elev. | 16' |
| Location | - | Add. Info | - |




| | ST. 1 | ST. 2 | ST. 3 |
|---|---|---|---|
| Effective Consolidation Stress, psi | 15.3 | 22.2 | 29.2 |
| Deviator Stress at Failure, psi | 20.7 | 30.6 | 37.8 |
| Effective Minor Principal Stress at Failure, psi | 7.2 | 12.1 | 15.7 |
| Effective Major Principal Stress at Failure, psi | 27.9 | 42.7 | 53.5 |
| Axial Strain at Failure, % | 2.01 | 1.70 | 1.24 |

| STRENGTH PARAMETERS | | | |
|---|---|---|---|
| Total | | Effective | |
| $\phi^o$ | 22.5 | $\phi'^o$ | 30.4 |
| C, psi | 0.7 | C', psi | 1.6 |

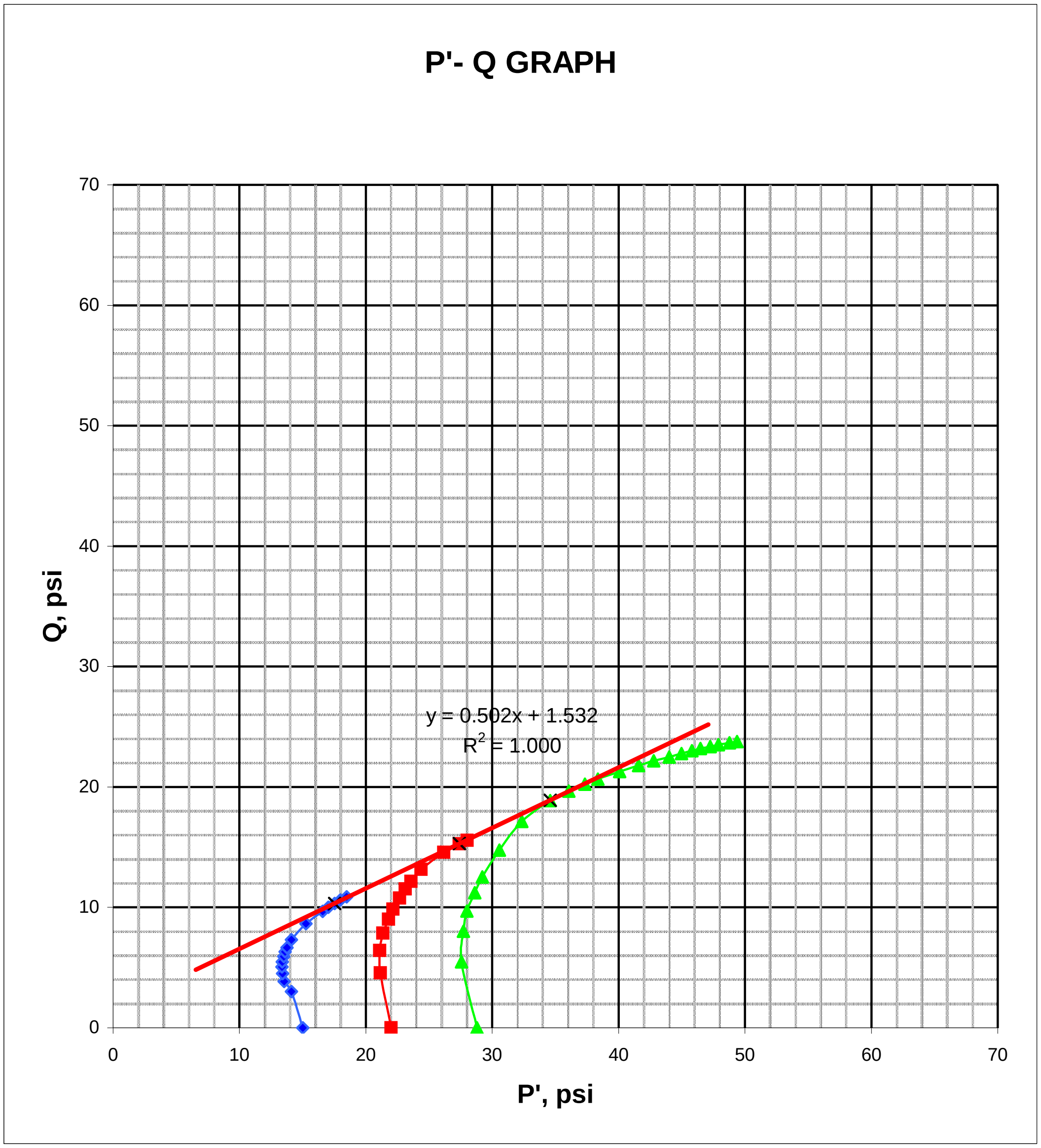
*Multistage Triaxial CU.xls [Mohr's Circles], REV. 1; 10-21-05*

| | | | |
|---|---|---|---|
| T.E. S.T. | TIMELY ENGINEERING SOIL TESTS, LLC | 1874 Forge Street Tucker, GA 30084<br>Phone: 770-938-8233<br>Fax: 770-923-8973<br>Web: www.test-llc.com | Tech: RI<br>Date: 06/17/10<br>Check: [handwritten initials] |

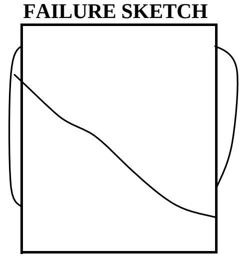
**ASTM D 4767M / AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9198/B-22 | Depth/Elev. | 16' |
| Location | - | Add. Info | - |




**FAILURE SKETCH**



| | |
|---|---|
| a, psi | 1.5 |
| α, degree | 26.7 |

*Multistage Triaxial CU.xls [P'-Q Graph], REV. 1; 10-21-05*

| | | | |
|---|---|---|---|
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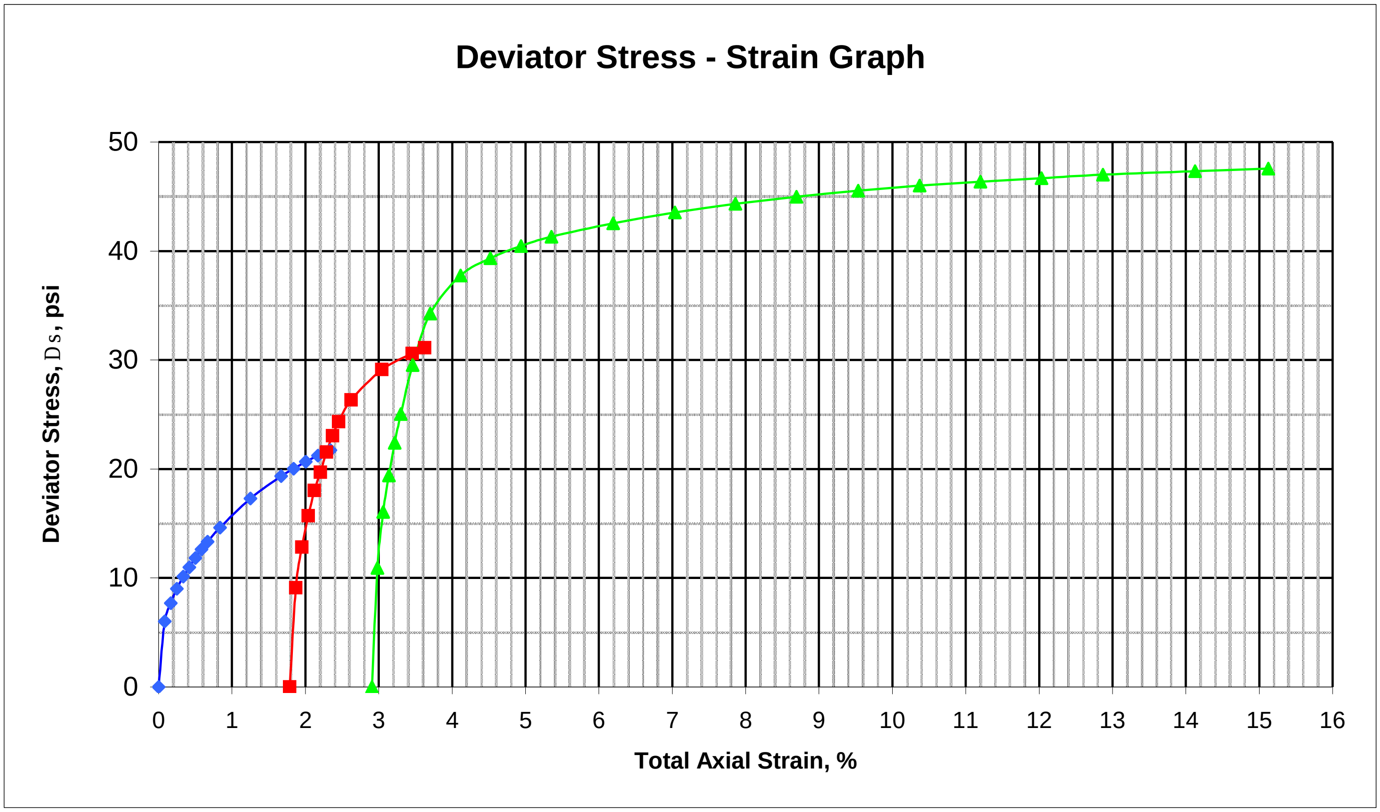
**ASTM D 4767M/ AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9198/B-22 | Depth/Elev. | 16' |
| Location | - | Add. Info | - |




| | | REMARKS |
|---|---|---|
| Balance ID Number | 1/6/7 | Portion of sample used for testing located 1.5" above bottom of shelby tube. |
| Oven ID Number | 12/13/14 | |
| Deformation Indicator ID # | 103-109 | |
| Digital Caliper ID # | 16/17 | |
| Load Cell ID # | 11 | |
| Apparatus ID # | 10 | |

**DESCRIPTION**

NA

NOTES:

1. Method for Saturation — WET
2. Method for determination of cross-sectional area after consol. — B
3. Final moisture content (Stage 3) obtained from entire sample

| | |
|---|---|
| LL | - |
| PL | - |
| PI | - |
| Gs | - |

**USCS (ASTM D2487: D2488)**

NA

*Multistage Triaxial CU.xls [Stress Strain Graph], REV. 1; 10-21-05*

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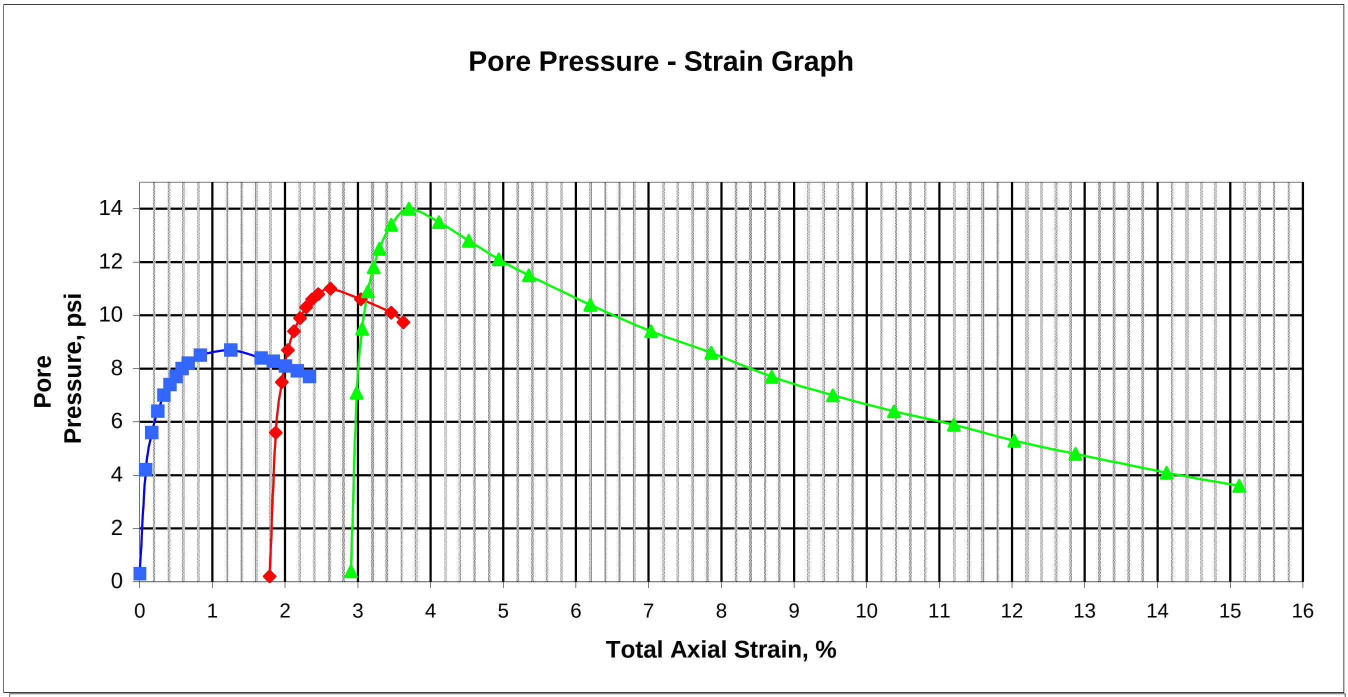
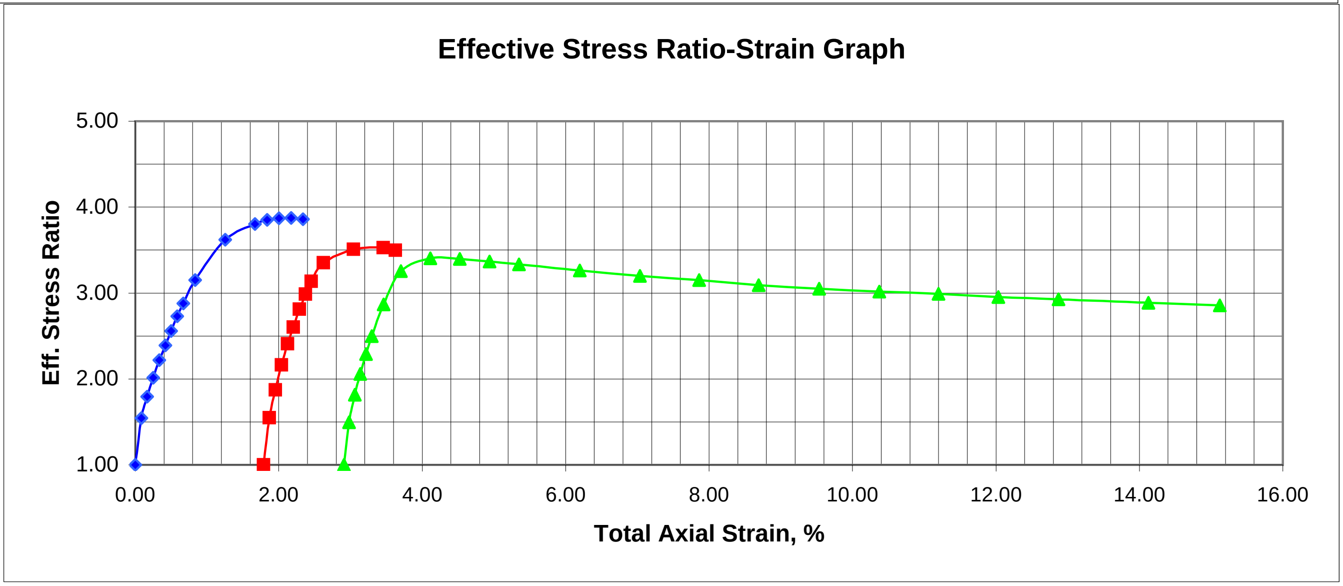
| Check | |

**ASTM D 4767M / AASHTO T 297M**

**Standard Test Method for Multistage Consolidated Undrained Triaxial Compression Test for Cohesive Soils**

| | | | |
|---|---|---|---|
| Client Pr. # | 31855127.30100 | Lab. PR. # | 1006-04-1 |
| Pr. Name | TVA JSF-J-Pond | S. Type | UD |
| Sample ID | 9198/B-22 | Depth/Elev. | 16' |
| Location | - | Add. Info | - |




*Multistage Triaxial CU.xls [Stress Ratio & Pore Water Pr.-Strain Graph], REV. 1; 10-21-05*

1874 Forge Street, Tucker GA 30084 ph: 770-938-8233 cell: 678-612-6534 fax: 770-923-8973 e-mail: lev@test-llc.com

# TIMELY ENGINEERING SOIL TESTS, LLC.

## CHAIN OF CUSTODY

Company Name: URS Corporation

Address: 1000 Abernathy Road, Suite 900, Atlanta, GA 30328

Billing address:

Report Sent to (Client Contact): John O'Brien

Contact Phone #: 678-808-8800

Fax #:

Project Name: TVA JSF - J Pond

Project Number: 31835127.30100

Client P.O. #:

E-mail: john_obrien@urscorp.com

*If AASHTO or other METHOD required please INDICATE

T.E.S.T. PROJECT #:

Sampler's Name (signature):

Sampler's Name (printed): Ron Hilliard

TESTS and ANALYSIS (ASTM TEST METHOD*)

| Client Sample ID # | Sample Location | Sample Type | T.E.S.T. Lab. Sample ID # | Std. Proctor(D698) | Mod. Proctor (D1557) | Moisture Content(D2216) | Atterberg Limits (D4318) | Specific Gravity(D854) | Sieve Analysis(D422,C136) | Sieve An. with Hydro(D422) | # 200 Sieve(D1140,C117) | Rigid Wall Perm(D2434) | Flex. Wall Perm(D5084) | CU Triaxial(D4767) | UU Triaxial(D2850) | UCS(D2166) | Direct Shear(D3080) | Consolidation(D2435) | USCS(D2487) | S. Vane (D4648) | | | Remarks, Conditions, and Parameters of Testing |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-11 D | 21' | S. Tube | | | | | | | | | | | | | | | | | | \| | | | |
| B-13 D | 11' | \| | | | | | | | | | | | | / | | / | | | | \| | | | |
| B-17 D | 31' | \| | | | | | | | | | | | | | | | / | | | \| | | | remold if necessary |
| B-14 D | 11' | \| | | | | | | | | | | | | | | | | | | \| | | | |
| B-14 D | 21' | \| | | | | | | | | | | | | | | | | | | \| | | | |
| B-17 D | 16' | | | | | | | | | | | | | / | | / | | | | | | | |
| B-18 | 11' | | | | | | | | | | | | | | | | | | | | | | |
| B-18 | 26' | | | | | | | | | | | | | | | | / | | | | | | |
| B-22 | 16' | | | | | | | | | | | | | / | | / | | | | | | | |
| B-20 | 26' | | | | | | | | | | | | | | | | / | | | | | | |

| Relinquished By | Date/Time | Received By | Date/Time |
|---|---|---|---|
| | | | |
| Relinquished By | Date/Time | Received By | Date/Time |
| | | | |

Special Requirements

D3080
Confining pressures
1,800 ; 2,200 ; 2,500

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Company Name: URS Corporation

Address: 1000 Abernathy Road, Suite 900, Atlanta, GA 30328

Billing address:

Report Sent to (Client Contact): John O'Brien

Contact Phone #: 678 808 8800

Fax #:

Project Name: TVA JSF - J-Pond

Project Number: 31855127.30100

Client P.O. #:

E-mail: john_obrien@urscorp.com

*If AASHTO or other METHOD required please INDICATE

T.E.S.T. PROJECT #

Sampler's Name (signature):

Sampler's Name (printed): Ron Hilliard

TESTS and ANALYSIS (ASTM TEST METHOD*)

| Client Sample ID # | Sample Location | Sample Type | T.E.S.T. Lab. Sample ID # | Std. Proctor(D698) | Mod. Proctor (D1557) | Moisture Content(D2216) | Atterberg Limits (D4318) | Specific Gravity(D854) | Sieve Analysis(D422,C136) | Sieve An. with Hydro(D422) | # 200 Sieve(D1140,C117) | Rigid Wall Perm(D2434) | Flex. Wall Perm(D5084) | CU Triaxial(D4767) | UU Triaxial(D2850) | UCS(D2166) | Direct Shear(D3080) | Consolidation(D2435) | USCS(D2487) | Remarks, Conditions, and Parameters of Testing |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-18 | 13.5-15 | SO | | | | \| | / | | | / | | | | | | | | | \| | |
| B-18 | 28.5-30 | \| | | | | \| | | | | | | | | | | | | | \| | |
| B-20 | 6-8 | \| | | | | \| | / | | | / | | | | | | | | | \| | |
| B-20 | 13.5-15 | \| | | | | \| | | | | | | | | | | | | | \| | |
| B-22 | 23.5-25 | \| | | | | \| | | | | | | | | | | | | | \| | |
| B-22 | 33.5-35 | \| | | | | \| | | | | | | | | | | | | | \| | |
| B-11 | 33.5-35 | \| | | | | \| | / | | | / | | | | | | | | | \| | |
| B-13 | 28.5-30 | \| | | | | \| | | | | | | | | | | | | | \| | |
| B-14 | 28.5-30 | \| | | | | \| | / | | | / | | | | | | | | | \| | |
| B-16 | 28.5-30 | | | | | \| | | | | | | | | | | | | | \| | |

| Relinquished By | Date/Time | Received By | Date/Time |
|---|---|---|---|
| | | | |

| Relinquished By | Date/Time | Received By | Date/Time |
|---|---|---|---|
| | | | |

Special Requirements

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Fax #:

Project Name: TVA JSF - J Pond

Project Number: 3185 5127. 30100

Client P O. #:

Sampler's Name (signature):

Sampler's Name (printed): Ron Hilliard

E-mail: john_obrion@urscorp.com

*If AASHTO or other METHOD required please INDICATE

T.E.S.T. PROJECT #

TESTS and ANALYSIS (ASTM TEST METHOD*)

| Client Sample ID # | Sample Location | Sample Type | T.E.S.T. Lab. Sample ID # | Std. Proctor(D698) | Mod. Proctor (D1557) | Moisture Content(D2216) | Atterberg Limits (D4318) | Specific Gravity(D854) | Sieve Analysis(D422,C136) | Sieve An. with Hydro(D422) | # 200 Sieve(D1140,C117) | Rigid Wall Perm(D2434) | Flex. Wall Perm(D5084) | CU Triaxial(D4767) | UU Triaxial(D2850) | UCS(D2166) | Direct Shear(D3080) | Consolidation(D2435) | USCS(D2487) | Remarks, Conditions, and Parameters of Testing |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-11 | 23.5-25 | SO | | | | \| | / | | | / | | | | | | | | | \| | |
| B-13 | 8-10 | \| | | | | \| | / | | | / | | | | | | | | | \| | |
| B-13 | 18.5-20 | \| | | | | \| | | | | | | | | | | | | | \| | |
| B-14 | 4-6 | \| | | | | \| | / | | | / | | | | | | | | | \| | |
| B-14 | 13.5-15 | \| | | | | \| | | | | | | | | | | | | | \| | |
| B-16 | 6-8 | \| | | | | \| | | | | | | | | | | | | | \| | |
| B-16 | 18.5-20 | \| | | | | \| | / | | | / | | | | | | | | | \| | |
| B-17 | 8-10 | \| | | | | \| | | | | | | | | | | | | | \| | |
| B-17 | 28.5-30 | \| | | | | \| | / | | | / | | | | | | | | | \| | |
| B-18 | 33.5-35 | \| | | | | \| | / | | | / | | | | | | | | | \| | |

| Relinquished By | Date/Time | Received By | Date/Time | Special Requirements |
|---|---|---|---|---|
| Relinquished By | Date/Time | Received By | Date/Time | |

Page ______ of ______