(Reporter's Note: Part 2 of 3)

I/A

SITE ANALYSIS AND REMOVAL PLAN

L.V. SUTTON ENERGY COMPLEX

April 2017
Revision 1

Prepared for

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EXECUTIVE SUMMARY

Geosyntec Consultants of North Carolina PC (Geosyntec) has prepared this Site Analysis and Removal Plan (Removal Plan) in support of the proposed closure of the Coal Combustion Residuals (CCR) Basins at the L.V. Sutton Energy Complex (Sutton) located near Wilmington, North Carolina (NC). The purpose of this Removal Plan is to seek the North Carolina Department of Environmental Quality's (NCDEQ – formerly the North Carolina Department of Environment and Natural Resources, NCDENR) concurrence with the Duke Energy Progress, LLC (DEP) plan for closure of the CCR basins located at Sutton The work to be performed in support of the closure of the basins is summarized in this document, which is consistent with the requirements of the Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities Rule (CCR Rule) [EPA, 2015] and the NC Coal Ash Management Act (CAMA). This Removal Plan is based on engineering and environmental factors minimizing the impacts to communities and managing cost. The Drawing Set presented herein is accurate at the time of preparing this Removal Plan and is subject to change pending further discussion with DEP. The closure option entails excavation of CCR within the basins and placement in an on-site engineered landfill. While permitting on the landfill is completed and the landfill is constructed, CCR will be transported off-site (via truck and/or rail) to a permitted landfill. Approximately 2 million tons of CCR are anticipated to be transported off-site prior to operation of the on-site landfill for beneficial reuse as lined, structural fill at the Brickhaven Clay Mine, located in Chatham County, NC.

Sutton is owned by DEP and includes the electricity generating plant and CCR basins associated with historical coal-fired electricity generation. Sutton was formerly operated as a coal-fired plant from 1954 to November 2013 and currently operates a gas-fired combined-cycle unit. The two CCR basins located at Sutton include: (i) the 1971 Basin; and (ii) the 1984 Basin. Other notable features at Sutton include: (i) the Lay of Land Area (LOLA), located to the south of the 1971 Basin; (ii) the Cooling Pond; and (iii) a Discharge Canal that conveys water from the plant to the Cooling Pond. The total estimated CCR volume in the basins is approximately 5.5 million cubic yards (cy) (approximately 6.7 million tons – assuming a density of approximately 1.2 tons/cy), while LOLA contains an additional CCR volume of approximately 0.6 million cy (approximately 0.7 million tons), resulting in a total CCR volume of approximately 6 million cy (approximately 7.3 million tons).

This Removal Plan discusses analytical results for CCR, background soil, soil collected during the installation of monitoring wells outside of the CCR basins, and soil from locations below the CCR. Analytical results obtained for groundwater and CCR interstitial water are also discussed. Results from background soil samples at Sutton indicate that soils are naturally acidic. Additionally, CCR exhibited concentrations for most analyzed constituents of interest (COIs) at levels greater than background soil levels. Background groundwater results indicated naturally acidic groundwater conditions and naturally elevated levels of iron, and to a lesser degree, manganese. Constituents in the groundwater in the immediate vicinity of the 1971 Basin appears to be influenced by CCR contained within this basin while monitoring points further away (e.g., the northern portion of the site) show a diminishing impact, suggesting that the clay liner within the 1984 Basin provides some protection of the surrounding groundwater.

Furthermore, elevated arsenic concentrations in groundwater attenuated to below the groundwater standard in all but one of the compliance wells.

A geochemical Conceptual Site Model (CSM) was developed to evaluate the distribution of the analyzed COIs in soil and groundwater. The CSM suggested that metals mobility was limited under the given geochemical conditions, especially in certain areas away from the basins where groundwater conditions became more aerobic and the mobility of redox-affected constituents such as iron, manganese, arsenic, and selenium decreased.

A preliminary geotechnical evaluation was performed and is presented in this Removal Plan. The results of the investigations indicate that the subsurface materials primarily consist of, from top to bottom, CCR (within the basins) or Dike Fill (at the perimeters of the basins), and Foundation Soils (consisting primarily of sand with varying amounts of silt at the top and Peedee Formation clayey soils at the bottom).

The closure of the CCR basins will entail the following activities. CCR will be excavated and placed in an off-site landfill while the on-site landfill is constructed. Once the on-site landfill is operational, CCR will be placed in the on-site landfill for final disposal. The excavated surfaces will either be left as open water (1971 Basin) and allowed to connect to the Cooling Pond or left as green areas (1984 Basin), graded to drain towards the Cooling Pond. This Removal Plan also presents a summary of the engineering evaluation and analyses performed, as well as technical specifications and Construction Quality Assurance (CQA) Plan.

The Wastewater and Stormwater Plans, including a plan for obtaining the required permits, are described in a preliminary manner in this Removal Plan. These plans will be developed and submitted under a separate cover. Applicable permits required for closure of the basins, including modifications to existing permits and applications for new permits, are identified.

A Post-Closure Care Plan is provided, including the groundwater monitoring program currently under evaluation by NCDEQ. This Removal Plan discusses the estimated schedule for milestones related to basin closure and post-closure activities.

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
3D	Three Dimensional
AST	Aboveground Storage Tank
BBL	Blasland, Bouck, and Lee, Inc.
bgs	Below Ground Surface
CAMA	Coal Ash Management Act
CAP	Corrective Action Plan
CCR	Coal Combustion Residuals
CFD	Computational Fluid Dynamics
CFR	Code of Federal Regulations
cm/s	Centimeters Per Second
COI	Constituent of Interest
CPT	Cone Penetration Test
CQA	Construction Quality Assurance
CSA	Comprehensive Site Assessment
CSM	Conceptual Site Model
cy	Cubic Yards
DEP	Duke Energy Progress, LLC
EPA	United States Environmental Protection Agency
E&SC	Erosion and Sediment Control
FGD	Flue Gas Desulfurization
FS	Factor of Safety
ft	Feet
gpm	Gallons Per Minute
H&H	Hydrology and Hydraulic
HSA	Hollow Stem Auger
ICA	Interior Containment Area
IMAC	Interim Maximum Allowable Concentrations
in	Inch
LOLA	Lay of Land Area
MDE	Maximum Design Earthquake
MGD	Million Gallons Per Day
µg/L	Micrograms Per Liter
mV	millivolts
mg/kg	Milligram Per Kilogram
NAVD88	North American Datum of 1988
NC	North Carolina
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
NCDEQ	North Carolina Department of Environmental Quality
NCDOT	North Carolina Department of Transportation

Acronym/Abbreviation	Definition
NCGS	North Carolina General Statute
NEHRP	National Earthquake Hazards Reduction Program
NPDES	National Pollutant Discharge Elimination System
ORP	Oxidation-Reduction Potential
PGA	Peak Ground Acceleration
PQL	Practical Quantification Limit
RCRA	Resource Conservation and Recovery Act
REC	Registered Environmental Consultant
SCPT	Seismic Cone Penetration Test
SOP	Standard Operating Procedure
SPLP	Synthetic Precipitation Leaching Procedure
SPT	Standard Penetration Test
s.u.	Standard Units
TDS	Total Dissolved Solids
tsf	Tons Per Square Foot
TSS	Total Suspended Solids
USACE	United States Army Corp. of Engineers
USGS	United States Geologic Survey
WQMP	Water Quality Management Plan

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1. INTRODUCTION

1.1 Site Analysis and Removal Plan Objectives

Geosyntec Consultants of North Carolina PC (Geosyntec) has prepared this Site Analysis and Removal Plan (Removal Plan) in support of the proposed closure of the Coal Combustion Residuals (CCR) Basins at the L.V. Sutton Energy Complex (Sutton) located near Wilmington, North Carolina (NC). The purpose of this Removal Plan is to seek the North Carolina Department of Environmental Quality's (NCDEQ – formerly the North Carolina Department of Environment and Natural Resources, NCDENR) concurrence with the Duke Energy Progress, LLC (DEP) plan for closure of the CCR basins located at Sutton. The work to be performed in support of the closure of the basins is summarized in this document, which is consistent with the requirements of the Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities Rule (CCR Rule) [EPA, 2015] and the NC Coal Ash Management Act (CAMA).

Sutton is owned by DEP and is located at 801 Sutton Steam Plan Road, Wilmington, North Carolina, 28401. Sutton includes the electricity generating plant and CCR basins associated with the historical coal-fired plant. Sutton formerly operated as a coal-fired plant from 1954 to November 2013 and currently operates a gas-fired combined-cycle unit. The two CCR basins located at Sutton include: (i) the 1971 Basin; and (ii) the 1984 Basin. Other notable features at Sutton include: (i) the Lay of Land Area (LOLA), located south of the 1971 Basin; (ii) the Cooling Pond, west of the CCR basins; and (iii) a Discharge Canal that conveys water from the plant to the Cooling Pond. Figure 1 presents a site map depicting the above-referenced features.

This Removal Plan was prepared under the responsible charge of Dr. Victor M. Damasceno, Ph.D., P.E. and reviewed by Dr. Majdi Othman, Ph.D., P.E., both of Geosyntec.

1.2 Selected Final Closure Option

The Drawing Set titled "Permit Application Drawings, 1971 and 1984 Basins, and LOLA Closure" is an integral part of this Removal Plan and is referred to hereafter as the Drawing Set. The final closure option, presented in the Drawing Set, was selected based on an evaluation of environmental, financial, and social impacts of the options considered. The Drawing Set presented herein is accurate at the time of preparing this Removal Plan and is subject to change pending further discussion with DEP. Approximately 2 million tons of CCR are anticipated to be transported off-site prior to operation of the on-site landfill. The landfill will be located east and adjacent to the 1984 Basin. A Site Application and Onsite CCR Landfill Construction Application Report were prepared by Geosyntec on behalf of DEP as part of the landfill construction application submitted to NCDEQ in May 2015 and August 2015, respectively. The Site Application and Construction Application were approved by NCDEQ in July 2015 and September 2016, respectively. Drawing 5, Drawing 6, and Drawing 7 show the anticipated grading of the basins and the LOLA after they have been excavated and decommissioned. The following activities are planned as part of the closure of the 1971 and 1984 Basins:

- excavate CCR to approximately elevation 10 feet (ft) North American Vertical Datum of 1988 (NAVD88), or until native soil is encountered, to expose the dams;
- excavate the Dam on the northern and eastern sides of the 1984 Basin down to elevation 20 ft-NAVD88;
- excavate the dam on the northern and eastern sides of the 1971 Basin down to approximately elevation 14 ft-NAVD88;
- excavate the southern 1971 Basin dike (adjacent to the Discharge Canal) and reconstruct a dike on a portion of the southern side of the 1971 Basin at elevation 12 ft-NAVD88;
- excavate the western 1971 Basin dike to allow the Cooling Pond to combine with the 1971 Basin;
- excavate the 1984 Basin dam to match surrounding existing elevations;
- grade soils within the 1984 Basin footprint to promote stormwater runoff towards the Cooling Pond.

The CCR impoundments will be excavated by utilizing technically sound and cost-effective measures with the goal of meeting the 31 August 2019 deadline set forth in CAMA and the closure time frame set forth in Title 40 Code of Federal Regulations (CFR) § 257.102(f). The schedule presented in the "Coal Ash Excavation Plan" (prepared by DEP and submitted to NCDEQ in 2015) called for completing excavation in March 2019. This date reasonably assumed that DEP would receive a landfill construction permit by June 2016. (DEP applied for the landfill construction permit in August 2015.) However, on 7 April 2016, NCDEQ initiated an environmental justice review for the landfill construction permit and, upon completion, transmitted it to the United States Environmental Protection Agency (EPA) for review and comment; EPA did not act on the environmental justice review. Although the permit was ultimately issued by NCDEQ on 21 September 2016, as a result of the delay, DEP will be forced to operate with little to no margin to achieve the 1 August 2019 CCR surface impoundment closure date. Additional CCR-related structures (e.g., dikes) and CCR potentially encountered outside of the basin footprint (e.g., LOLA) will also be mitigated; however, mitigation of these materials will be pursued to meet the 1 January 2026 date, following excavation of the CCR impoundments.

1.3 Report Organization

Although the Sutton CCR surface impoundments are specifically subject to the closure requirements set out in Part II, Sections 3.(b) and 3.(c) of Coal Ash Management Act (CAMA) (and not North Carolina General Statute (NCGS) §130A-309.214), for purposes of consistency with the closure plans for those non-high-priority DEP facilities to which NCGS § 130A-309.214 applies, this Removal Plan is structured to follow generally the Closure Plan elements set forth in NCGS § 130A-309.214(a)(4), as follows:

- *Section 2 – Governing Regulations:* This section identifies and lists applicable Federal and State regulations, requirements, and guidelines pertaining to CCR basin closure.
- *Section 3 – Facility Description and Existing Site Features:* This section presents an overview of the facility, including a summary of the operational history and a description of the basins.
- *Section 4 – Results of Hydrogeologic, Geologic, and Geotechnical Investigations:* This section summarizes the hydrogeological and geotechnical investigations performed at Sutton and reports the results of laboratory analyses.
- *Section 5 – Groundwater Modeling Analyses:* A site groundwater flow and contaminant transport model is being prepared by an independent consultant and will be submitted under a separate cover at a later date. Therefore, the requirements of this section are omitted from this Removal Plan.
- *Section 6 – Beneficial Reuse and Future Use:* This section presents plans for beneficial reuses and describes the anticipated future use of Sutton following the closure of the basins.
- *Section 7 – Closure Design Documents:* This section presents a summary of the engineering evaluation and preliminary analyses performed in support of the CCR basin closure at Sutton, as well as technical specifications and Construction Quality Assurance (CQA) Plan.
- *Section 8 – Management of Wastewater and Stormwater:* This section describes the provisions for disposal of anticipated wastewater and stormwater, including a plan for obtaining the required permits.
- *Section 9 – Description of Final Disposition of CCR:* This section describes the anticipated final disposition of the CCR.
- *Section 10 – Applicable Permits for Closure:* This section identifies the applicable permits required for closure of the basins, including modifications to existing permits and applications for new permits.
- *Section 11 – Post-Closure Monitoring and Care:* This section presents the post-closure care plan and groundwater monitoring program.
- *Section 12 – Project Milestones and Cost Estimates:* This section discusses the estimated schedule for milestones related to basin closure and post-closure activities. This section also presents projected costs of closure and post-closure care.
- *Section 13 – Referenced Documents:* This section summarizes the documents cited as part of this Removal Plan.

2. GOVERNING REQUIREMENTS

2.1 Federal CCR Rule

The Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities, referred to herein as the CCR Rule, was published in the Federal Register on 17 April 2015 and codified in 40 CFR Parts 257 and 261, with an effective date of 19 October 2015 [EPA, 2015]. This rule regulates CCR as a nonhazardous waste under Subtitle D of the Resource Conservation and Recovery Act (RCRA). Most of the regulatory deadlines are set from the date the rule was published.

Written closure requirements are defined in 40 CFR § 257.102(b)(1)(i-vi) and are summarized in Table 1. These requirements and related information are addressed in subsequent sections within this Removal Plan. Table 1 provides a cross-reference between each requirement and the corresponding Removal Plan section(s).

A History of Construction Report is required to be developed for each CCR unit as described in 40 CFR § 257.73(c)(1). Recordkeeping, as described in 40 CFR § 257.105, requires the History of Construction Report be maintained in a written operating record and be made available on a publicly accessible internet site.

2.2 North Carolina Rules

In August 2014, the NC General Assembly passed Senate Bill 729 known as the Coal Ash Management Act, CAMA, which lists specific requirements for CCR surface impoundment closure. For Sutton, “coal combustion residuals surface impoundment”, as defined in CAMA § 130A-309.201(6), is interpreted to include the 1971 and 1984 Basins. The CAMA requirements are summarized in Table 2. Part II, Section 3.(b) of CAMA classifies Sutton as a ‘high-priority’ site and specifically requires closure by removal, which is defined as:

- dewatering to the maximum extent possible;
- removing and transferring CCR from basins to a permitted landfill or structural fill; and
- providing corrective action to restore groundwater quality if needed, as provided in NCGS §130A-309.204.

CAMA requires the 1971 and 1984 Basins at Sutton to be closed by 31 August 2019. In July 2016, the NC General Assembly passed H.B. 630, Session Law 2016-95, which provides that impoundments shall be classified as “low-risk” if, by certain deadlines, the owner has established permanent alternative water supplies, as required, and has rectified any deficiencies identified by, and has otherwise complied with requirements of, any dam safety order. This Removal Plan is based on engineering and environmental factors minimizing the impacts to communities and managing costs. Closure Plan requirements for non-high-priority sites were codified at NCGS § 130A-309.214(a)(4) which requires plans for such sites to include the elements listed below. Although NCGS § 130A-309.214 is not specifically applicable to Sutton, which is a high-priority site required to close pursuant to Part II, Sections 3.(b) and 3.(c) of

CAMA, this Removal Plan relies on subsection (a)(4) of § 130A-309.214 solely to inform its organization.

Specifically, this Removal Plan addresses the following:

- facility description;
- site maps;
- hydrogeologic, geologic, geotechnical characterization results;
- groundwater potentiometric maps and extent of contaminants of concern;
- groundwater modeling;
- description of beneficial reuse plans;
- Removal Plan drawings, design documents, and specifications;
- description of the CQA Plan;
- description of waste water disposal and stormwater management provisions;
- description of how the final disposition of CCR will be provided;
- list of applicable permits to complete closure;
- description of post-closure monitoring and care plans;
- estimated closure and post-closure milestone dates;
- estimated costs of assessment, corrective action, closure and post-closure care; and
- future site use description.

In addition to the closure pathway, CAMA outlines groundwater assessment and corrective action requirements summarized as follows:

- submit proposed Groundwater Assessment Plans by 31 December 2014;
- complete groundwater assessment and submit a Groundwater Assessment Report within 180 days of Groundwater Assessment Plan approval; and
- provide a Corrective Action Plan (CAP) (if required) within 90 days (and no later than 180 days, subject to department approval) of Groundwater Assessment Report completion.

The groundwater assessment and corrective action activities for Sutton were performed by SynTerra Corp. (SynTerra). The Comprehensive Site Assessment (CSA) Report for Sutton was submitted on 5 August 2015 [SynTerra, 2015a]. The CSA Supplement 1 was submitted 31 August 2016 [SynTerra, 2016b]. Information from the CSA has been incorporated into this Removal Plan. DEP has been in correspondence with the NCDEQ and received permission to submit a CAP in two phases. The first phase of the CAP was submitted on 2 November 2015 [SynTerra, 2015b] and includes background information, a brief summary of the CSA findings, a brief description of site geology and hydrogeology, a summary of the previously completed receptor survey, a description of the North Carolina Administrative Code (NCAC) Title 15A Subchapter 2L groundwater standard (2L Standard) and Subchapter 2B surface water (2B Standard) exceedances, proposed site-specific groundwater background concentrations, a detailed description of the site conceptual model, and groundwater flow and transport modeling. The second phase of the CAP was submitted on 1 February 2016 [SynTerra, 2016a] and includes the risk assessment, alternative methods for achieving restoration, conceptual plans for recommended corrective actions, implementation schedule, and a plan for future monitoring and reporting. The CSA and CAP reports are presented herein in electronic format on the compact disc (CD) attached as Appendix A.

3. FACILITY DESCRIPTION AND EXISTING SITE FEATURES

3.1 Surface Impoundment Description

3.1.1 Site History and Operations

A comprehensive summary of the site history and operations is presented in the History of Construction Report that was prepared by Geosyntec and posted to the Sutton operating record. A summary of the History of Construction Report is presented herein. The Sutton plant began operations in 1954 as a three-unit, 575-megawatt coal-fired plant until retirement in November 2013, when a new 625-megawatt gas-fired combined-cycle unit began operations.

The CCR generated at Sutton was disposed within basins located on plant property. The CCR basins located at Sutton include the 1971 Basin and the 1984 Basin, as shown on Figure 1. The 1971 Basin covers an area of approximately 54 acres. In 1983, the dikes of the 1971 Basin were raised by approximately eight ft (to elevation 26 ft NAVD88). The 1971 Basin operated from 1971 to 2013 for CCR disposal and currently only receives stormwater. The 1984 Basin covers an area of approximately 82 acres. In 2006, an Interior Containment Area (ICA) was constructed within the footprint of the 1984 Basin. The 1984 Basin was operated from 1984 to 2013. The LOLA contains CCR generated from plant operations between approximately 1954 and 1972.

The CCR basins at Sutton contain sluiced fly ash and bottom ash. In addition to the CCR, the basins also contain boiler slag, stormwater, ash sluice water, coal pile runoff, and low volume wastewater [Dewberry & Davis, 2011]. Scrubbers were not installed at Sutton; as such, Flue Gas Desulfurization (FGD) residuals are not known to be impounded in the CCR basins.

3.1.2 Estimated Volume of CCR in Impoundments

Table 3 presents quantities and types of CCR at each basin and the LOLA. Details and assumptions for the calculations are discussed in Section 12.2. Based on these calculations, the total estimated CCR volume in the basins is approximately 5.5 million cubic yards (cy) (approximately 6.7 million tons – assuming an average density of approximately 1.2 tons/cy), while the LOLA contains an additional CCR volume of approximately 0.6 million cy (approximately 0.7 million tons). This results in a total CCR volume of approximately 6 million cy (approximately 7.3 million tons). The LOLA is comprised mainly of bottom ash and soil while the other areas contain fly ash and bottom ash.

3.1.3 Description of Surface Impoundment Structural Integrity

The structural integrity of the 1971 and 1984 Basin dikes has been evaluated by Geosyntec as part of a dewatering design prepared for Sutton in 2014. The evaluation performed by Geosyntec is supplemented by additional analyses performed by Amec Foster Wheeler Environment and Infrastructure, Inc. (Amec) as part of the Phase 2 Reconstitution of Ash Pond Designs Final Report (Phase 2 Report) [Amec, 2015]. Amec evaluated the structural stability of the 1971 and 1984 Basin dikes, performed Hydrology and Hydraulic (H&H) analysis, and evaluated the structural stability of the spillway as part of the Phase 2 Report. A summary of the findings of the evaluations is presented below.

3.1.3.1 Seepage Analysis

The 1971 and 1984 Basins are both inactive and have been since November 2013. The head difference between the water level observed along the dikes and the free field is generally small (approximately 5 ft or less). Seepage concerns were not identified during annual and five-year inspections. Therefore, seepage was not considered to be an issue at Sutton and was not performed at the time of preparing this Removal Plan.

3.1.3.2 Slope Stability Analysis

3.1.3.2.1 Normal Operating and Maximum Surcharge Pool Conditions

Geosyntec performed static slope stability analyses on several cross sections along the 1971 and 1984 Basin dikes under existing normal operating conditions [Geosyntec, 2014a]. The calculated factors of safety (FS) for global dike stability were found to meet and/or exceed the minimum required FS under operating (i.e. FS ≥ 1.50) and surcharge conditions (i.e. FS ≥ 1.40), respectively, as defined in 40 CFR § 257.73 (e)(1)(i-ii). This is consistent with the analyses presented in the Phase 2 Report. In both sets of analyses, the potential for surficial sloughing was identified. However, such sloughs are not considered critical and can typically be addressed through routine maintenance. Amec also performed slope stability analyses for maximum surcharge pool conditions. The calculated FS were also found to meet the minimum required FS.

3.1.3.2.2 Drawdown Conditions

Removal of bulk water from the northern area within the 1984 Basin was proposed as part of the Sutton Dewatering Plan. It is desirable to pump water at the maximum safe rate possible. Geosyntec performed rapid drawdown analyses for a cross section on the 1984 Basin dike to evaluate slope stability conditions that would require capping the maximum drawdown rate. This condition is equivalent to instantaneous removal of water within the basin. Such a condition could arise as a result of rapid pumping or loss of containment (e.g., a dike breach). NCDEQ requires a minimum FS of 1.25 for rapid drawdown conditions [NCDENR, 1980]. The United States Army Corp. of Engineers (USACE) recommends a minimum FS of 1.1 to 1.3 for rapid drawdown, dependent on site-specific conditions [USACE, 2003]. The minimum FS was conservatively selected to be 1.3. The slope stability analysis performed by Geosyntec found the calculated FS to meet the minimum required FS (i.e. FS ≥ 1.3).

3.1.3.2.3 Seismic (Pseudo-Static) Conditions

Pseudo-static slope stability analysis has not explicitly been performed for the dikes at Sutton. However, Geosyntec evaluated the estimated permanent seismic deformation under the anticipated seismic hazard as discussed below in Section 3.1.3.3. Geosyntec calculated the estimated permanent seismic deformation to be zero.

Post-liquefaction static slope stability analyses were performed as part of the Phase 2 Report. The calculated FS varied from 0.3 to 1.7. However, this may be a conservative analysis and as discussed in Section 3.1.3.3, liquefaction is not considered to pose a significant risk at Sutton.

3.1.3.3 Liquefaction Potential

Geosyntec performed a preliminary screening level liquefaction potential evaluation at selected locations as part of the Sutton Dewatering Plan. The appropriate seismic hazard is typically expressed in probabilistic terms as a specific hazard level that has a certain probability of exceedance within a given time period. The liquefaction potential was evaluated using seismic design parameters consistent with a 2 percent probability of exceedance in 50 years. These parameters include moment magnitude and Peak Ground Acceleration (PGA) with a return period of 2,475 years, typically referred to as a 2,500-year event. Parameters corresponding to a 2,500-year event were obtained using the United States Geological Survey (USGS) 2008 deaggregation tool (2008) [USGS, 2008]. The PGA and moment magnitude obtained from the USGS deaggregation tool were 0.114g and 7.30, respectively. Review of available subsurface information indicated that site effects would be insignificant. This assumption was considered acceptable for a screening level evaluation. Therefore, the design PGA (PGA_{design}) was selected to be equal 0.114g. The FS against liquefaction was calculated using the Standard Penetration Test (SPT)-based simplified procedure presented by Idriss and Boulanger [2008]. The minimum required FS against liquefaction is 1.20, as defined in 40 CFR § 257.73 (e)(1)(iv). The cross sections evaluated as part of the preliminary screening level liquefaction potential analysis were found to meet the minimum required FS, indicating that the soils have a low liquefaction potential under the evaluated seismic hazard.

Liquefaction triggering evaluation using a similar approach was also performed as part of the Phase 2 Report and found that the FS against liquefaction is less than 1.0 at various locations within the dike fill, foundation soils below the dike, and/or foundation soils at the toe area. The selected PGA_{rock} for Site Class B and moment magnitude were 0.105g and 7.36, respectively, based on data from the USGS 2008 seismic hazard maps. Because of the manner in which the PGA_{rock} was calculated, Geosyntec notes that it is less than the PGA with a 2% probability of exceedance in 50 years.

In addition, in the analyses presented in the Phase 2 Report, local site effects were accounted for via the National Earthquake Hazards Reduction Program (NEHRP) [2009] site coefficients. Based on a review of subsurface information, Amec assigned Site Class D, resulting in a site coefficient (F_{pga}) of 1.59 and a resulting PGA_{design} of 0.167g. The selected site coefficient is considered conservative given the deep Coastal Plain soil conditions at the site differ significantly from the soil conditions represented by the NEHRP site coefficients.

Furthermore, “embankment effects” were accounted for in the Phase 2 Report using results presented by Harder [1998] and the PGA_{crest} at the dike crest was selected to be 0.485g. However, the figure used (i.e., the figure developed by Harder [1998]) presents an upper bound estimation developed for dams approximately 50 to 300 ft high, which may not be applicable for the dikes at Sutton (e.g., the maximum height of perimeter dikes is equal to approximately 24 ft).

Therefore, the methods employed in the Phase 2 Report to account for the local site and embankment effects in the liquefaction triggering evaluation are considered conservative.

However, the analyses presented above were both performed using the USGS 2008 tools. The most recent USGS 2014 seismic hazard map indicates that the PGA for a 2,500-year event has been revised to be lower than that considered in 2008. According to the USGS 2014 seismic hazard map, the PGA at Sutton is estimated to be approximately 0.08g. Therefore, the previous analyses are also conservative based on this observation and liquefaction potential is not considered to pose a significant hazard at Sutton.

3.1.3.4 Hydrology and Hydraulics Capacity Analysis

H&H analyses were performed for the basins at Sutton as part of the Phase 2 Report. As compared to requirements as defined in 40 CFR § 257.82, findings presented in the Phase 2 Report indicate that the 1971 and 1984 Basins could effectively contain and pass the design storm event. However, analysis and assumptions presented in the Phase 2 Report indicate that the 2006 ICA does not have enough hydraulic capacity to contain and pass the design storm event.

3.1.3.5 Spillway Structural Stability

Structural stability analyses for the primary riser of the 1971 Basin and the internal riser of the 1984 Basin were performed as part of the Phase 2 Report. Analysis of the internal riser of the 1971 Basin was not performed due to lack of available information, and analysis of the primary riser of the 1984 Basin was not performed since the information from the available construction drawings was inconsistent with existing conditions of the riser documented in the field.

The risers were evaluated for: (i) moment equilibrium stability; (ii) sliding stability; (iii) floatation stability; (iv) bearing capacity; (v) separation at joint sections; and (vi) structural strength, under usual, unusual and extreme loads in general accordance with USACE EM 1110-2-2400. Findings presented in the Phase 2 Report indicate that 1971 and 1984 Basin risers did not meet the stability criteria for bearing capacity and joint separation under the extreme loading condition, which was defined as the Maximum Design Earthquake (MDE) or the 2,475 year return period earthquake (i.e. 2 percent probability of exceedance in 50 years).

3.1.4 Sources of Discharge into Surface Impoundments

The Sutton Plant was a three-unit, 575-megawatt coal-fired power plant and operated from 1954 until the retirement of the coal-fired units in November 2013. Dewberry and Davis [2011] indicates that the 1971 and 1984 Basins contain fly ash, bottom ash, boiler slag, stormwater, ash sluice water, coal pile runoff, and low-volume wastewater, and, as previously discussed, since scrubbers were not installed at the Sutton Plant, FGD residuals are not expected in the basins. The estimated CCR volume in the basins is presented in Section 3.1.2. Information related to the quantity of each CCR constituent were not available at the time of preparing this Removal Plan.

Dewberry and Davis [2011] presented the Sutton CCR handling system as follows:

- fly ash was collected by an electrostatic precipitator;
- collected ash was stored in hoppers and conveyed pneumatically to a silo;
- ash was hydraulically conveyed from the silo to the ash basins;
- bottom ash was collected from the bottom of the boiler and conveyed through the same transport system as the fly ash into the ash basins; and
- boiler slag was also collected from the boiler and conveyed to the basins.

3.1.5 Existing Liner System

The 1971 Basin is unlined; however, the 1984 Basin was constructed with an approximately 12-inch (in) thick compacted clay liner, as shown in historical as-built drawings included as part of the 1987 five-year inspection report. The liner extends into the upstream side of the dikes to elevation 32 ft and is protected on the side slopes by a 2-ft thick sand layer. Technical specifications included in the 1987 five-year inspection report indicate that liner was specified to be 1-ft thick, placed in two lifts and compacted to a minimum density of 95% of standard Proctor maximum density. The liner was specified to have permeability equal to or less than 10^{-7} centimeters per second (cm/s). Laboratory testing conducted on a sample collected from the borrow material indicated that the clay has a permeability of 1.06×10^{-8} cm/s and 2.02×10^{-8} when compacted to 92% and 95% of standard Proctor maximum density, respectively. A letter dated 24 September 1985 written by William Wells, a consulting engineer for the construction of the 1984 Basin, addressed to L.B. Wilson of the Carolina Power and Light, Fossil Engineering and Construction Department stated that the clay liner was compacted to the “specified density of 85 percent of standard Proctor” and that “Al [sic] permeability tests of the clay were satisfactory.” It is not clear from a review of the available information if the level of compaction required was relaxed. Daily and weekly reports detailing field density testing were provided and attached to the letter; however, tests conducted on the clay liner are not clearly identified.

In April 2006, Withers and Ravenel performed a subsurface investigation in support of the design of the 2006 ICA within the 1984 Basin. The investigation consisted of borings with SPTs and Cone Penetration Test (CPT) soundings advanced from the dike crest and within the 1984 Basin. In selected CPT soundings and borings within the basin, a casing was installed into or through the clay liner to prevent migration of CCR below the clay liner. Based on the boring logs from this investigation and one sample collected during the investigation, the clay liner was observed to be fine sandy clay to clay with a thickness of 4.5 to 7-in.

3.1.6 Inspection and Monitoring Summary

Several inspections have been conducted over the lifetime of the basins. The first five-year inspection was conducted in 1987 and was triggered by the raising of the 1971 Basin dikes in 1983. Inspections were not conducted prior to the 1983 modifications due to the low height (i.e. less than 15 ft) of the dikes, which made them exempt from the Dam Safety rules (15A NCAC 2K) at the time. A complete set of inspection reports, both five-year and annual, was not available for review; however, annual inspections from 2009 to 2013, and the 1987, 2007 and 2012 five-year inspection reports were reviewed and indicate that the dikes were typically found to be in generally good condition with only routine maintenance required. A breach of part of the 1984 Basin dike did occur in 2010; however, permanent repairs were made and later inspections have found no further issues. A summary of the inspection report findings is presented in Table 4.

3.2 Site Maps

3.2.1 Summary of Existing CCR Impoundment Related Structures

As discussed in Section 3.1, the 1971 and 1984 Basins were used for CCR disposal at Sutton. Drawing 2 of the drawing set presents information pertinent to the basins, including:

- property boundary;
- location of the power generating units;
- CCR basin outlines and compliance boundaries;
- CCR basin outlet structures; and
- topographic contours of the basins and surrounding areas.

3.2.2 Receptor Survey

SynTerra conducted a survey of potential water supply wells for an area within an approximately 0.5 miles of the compliance boundary, which is located 500 ft from the Basin boundaries. This receptor survey was submitted to NCDEQ in September 2014. An updated water supply well survey was later submitted to NCDEQ in November 2014. The receptor survey was included in the CSA Report prepared by SynTerra and submitted to NCDEQ on 5 August 2015 [SynTerra, 2015a, 2016b]. A copy of the receptor survey is included in Appendix B.

3.2.3 Existing On-Site Landfills

There are no existing active or closed on-site landfill facilities at Sutton. Therefore, the requirements of this section are not addressed as part of this Removal Plan.

3.3 Monitoring and Sampling Location Plan

Groundwater conditions at Sutton have been monitored according to specifications outlined in the National Pollutant Discharge Elimination System (NPDES) Permit NC0001422 since 1990. The monitoring network presently consists of 17 monitoring wells and six surface water/discharge sampling locations and is summarized on Figure 2. The CSA Report prepared by SynTerra addressed CAMA § 130A-309.209(a)(4) and § 130A-309.209(d) [SynTerra, 2015a, 2106b]. The CSA provided an update of site conditions, which included the delineation of the horizontal and vertical extent of constituents of interest in the soil, surface water, and groundwater. The CSA concluded with a proposed groundwater monitoring network consisting of 36 wells; however, several of the proposed groundwater monitoring wells are located within the proposed onsite landfill footprint. Consequently, the proposed monitoring network submitted by SynTerra will need to be re-evaluated to take into account the proposed onsite landfill and other relocated site features, and consider the comments (if any) provided by NCDEQ on the CSA prior to implementation.

4. RESULTS OF HYDROGEOLOGIC, GEOLOGIC, AND GEOTECHNICAL INVESTIGATIONS

4.1 Regional Geology and Hydrogeology

4.1.1 Geology

As shown on Figure 3, Sutton is located within the Coastal Plain Physiographic Province of NC. The Coastal Plain Physiographic Province is characterized by a southeastward thickening wedge of late Cretaceous to Holocene age sediments that overlie a Paleozoic age crystalline basement. These overlying sediments generally thicken and gently dip southeastwards from the Fall Line towards the Atlantic Ocean and exceed a total thickness of 1,515 ft in New Hanover County. The depositional history of these sediments begins with continental fragmentation and rifting of the Pangea Super Continent in the early Mesozoic Era followed by the opening of the modern Atlantic Ocean in the late Mesozoic and Cenozoic Eras. Extensive tectonic forces during rifting and post-rifting lead to the formation of major rift-basins which are areas of low elevation and arches (uplifted geologic structures). Examples of these in the vicinity of the study region include the Albemarle embayment in southern Virginia and northern North Carolina and the Cape Fear Arch, located roughly parallel to the Cape Fear River and southwest of the study area as presented on Figure 4. The long and complex depositional history of the Coastal Plain sediments resulted in successive geologic and hydrogeologic stratigraphic units. A correlation chart of the various geologic and hydrogeologic units is presented on Figure 5 and discussed in the following subsections.

4.1.2 Hydrogeology

Successive deposition of permeable and impermeable sediments in this region has resulted in aquifers that are separated by confining units, as shown on Figure 5. The various regional geologic and hydrogeologic stratigraphic units are discussed below sequentially from shallow to deep formations.

- ***Surficial Aquifer:*** The surficial aquifer is the uppermost unconfined hydrostratigraphic unit at Sutton and comprises the water table, which generally follows the surface topography. This aquifer is composed of undifferentiated sands of late Tertiary age and Quaternary surficial deposits, typical of what was encountered at the proposed landfill site during site investigations. These surficial sediments are well drained and consist of terraced and barrier-beach deposits, sandy coquinas, fossil sand dunes and stream channel deposits. The sediments are typically characterized as light gray to light yellow sand and silts [McSwain et al., 2014]. Regionally, the surficial aquifer varies in thickness between approximately 10 and 100 ft [Campbell and Coes, 2010] (Figure 6). The high hydraulic conductivity of the surficial sands (10^{-4} to 10^{-2} cm/s) makes the upper aquifer a prolific water producer for domestic, industrial and public water supply. The 1970 publication of “Geology and Ground-Water of New Hanover County” [Bain, 1970] reports that one of the industrial supply wells owned by DEP on Sutton Steam Plant Road was installed to a depth of 53 ft and yields 480 gallons per minute (gpm). Well yields over

100 gpm are typical in the upper 55 ft of undifferentiated Tertiary and Quaternary sand deposits in the local area.

- ***Castle Hayne Aquifer:*** Tertiary-age deposits that constitute the Castle Hayne confining unit generally separate the overlying Surficial Aquifer from the underlying Castle Hayne aquifer. However, isopach maps that show the elevation of the top of the Castle Hayne confining unit and aquifer (Figure 8 and Figure 9) indicate that the Castle Hayne formation is absent underneath the proposed landfill site, consistent with observations from previous and current site investigations.

- ***Peedee Aquifer*****:** The Cretaceous age Peedee Formation directly underlies the surficial deposits in the local area. The Peedee Formation consists of the Peedee confining unit and the Peedee Aquifer. The Peedee confining unit generally consists of black clay mixed with some silt, is discontinuous at Sutton, and generally dips and increases in thickness towards the southeast with thickness varying between 0 and 50 ft (Figure 9 and Figure 10). The Peedee aquifer typically consists of unconsolidated green to dark-gray silt, olive-green to gray sand, with trace quantities of glauconite, phosphorite, and pyrite [Campbell and Coes, 2010; McSwain et al., 2014]. In southeastern Brunswick and north central New Hanover Counties, the Peedee Formation may also consist of unconsolidated calcareous sandstone and impure limestone [McSwain et al., 2014]. The top of the Peedee aquifer in this region is at an elevation of approximately -10 to -20 ft (NAVD88) (Figure 11) and gently dips towards the southeast, varying in thickness from 200 to 300 ft in this part of New Hanover County (Figure 12).

- ***Black Creek Confining Unit*****:** The Black Creek confining unit underlies the entire site and is laterally continuous throughout the region [McSwain et al., 2014]. This unit typically consists of sandy clay, silty clay, and clay beds of the upper Black Creek Formation. The Black Creek confining unit dips to the southeast ranging in thickness from approximately 50 to 100 ft in the vicinity of the site (Figure 13).

4.2 Stratigraphy of the Geologic Units Underlying Surface Impoundments

A number of field investigations have been conducted at Sutton. Monitoring well and piezometer locations are shown on Figure 14. The boring logs associated with these monitoring wells and piezometers are included in Appendix C and construction details summarized in Table **5.** Field investigations conducted at Sutton are discussed in Appendix D. The findings from these investigations indicate that the subsurface soils primarily comprise, from top to bottom:

- **CCR**: The CCR consists predominantly of gray/black/dark tan silt-sized particles with varying amounts of sand-sized particles and exhibit no to low plasticity. CCR were generally reported to be very loose to loose and occasional pockets of medium dense CCR were encountered. In general, the thicknesses of CCR or CCR/soil mixtures were found to be approximately 18 to 84 ft within the 1971 Basin, 18 to 19 ft within the southern part of the 1984 Basin, up to 13 ft in the northern part of the 1984 Basin, 26 to 38 ft within the 2006 ICA, and up to 15 ft thick in the LOLA. SPT and CPT results are available only within the basin areas (i.e., no in-situ test results for within the LOLA). The reported SPT N-values typically range between 0 (i.e., weight of hammer) and 10. The tip resistance and sleeve friction measured from CPTs range typically between 10 and 50 tons per square foot (tsf) and between 0.1 and 0.7 tsf, respectively.

- **Dike fill**: The dike fill for the 1971 and 1984 Basins is predominantly sand with varying amounts of fines content generally reported to be loose to dense. The reported SPT N-values typically range between 10 and 46. The tip resistance and sleeve friction measured from CPTs range typically between 150 and 300 tsf and between 1 and 3 tsf, respectively. The LOLA dike is approximately 10 ft high, although the vertical extent of the dike is not clear based on the borings. Six LOLA dike borings indicate that the LOLA dike consists of sand and/or CCR/sand mixture. The reported SPT N-values for the LOLA dike typically range between 3 and 18. The MACTEC Engineering and Consulting, Inc. (MACTEC) [2011] and Geosyntec field investigations [Geosyntec, 2014a; Geosyntec 2015] found CCR and/or CCR/soil mixture below the southern portion of the 1971 perimeter dike. The thickness of this material is up to 15 ft along the dike centerline. Hand-augers advanced at the mid-slope and dike toe found this material to be 10-ft and 5.5-ft thick, respectively.

- **Clay liner**: As previously discussed in Section 3.1.5, the 1984 Basin was constructed with a 1-ft thick clay liner at the basin bottom and side slopes. The side slopes were protected by a 2-ft thick sand layer. Based on the boring logs from the Withers and Ravenel (2006) investigation and one sample collected during the investigation, the clay liner was observed to be fine sandy clay to clay with a thickness of 4.5 to 7 inches.

- **Foundation soils**: The foundation soils consist primarily of sand with varying amounts of fines content. The foundation soils at Sutton can be classified into two geologic units [USGS, 2014]: Surficial Aquifer and Peedee Aquifer. The discontinuous Peedee Confining Unit, which consists of silt or clay, has a thickness of 10 ft or less and separates the two aquifer units. The foundation soils are reported to be very loose to very dense with reported SPT N-values ranging between 2 and 80. The tip resistance and sleeve friction measured from CPTs typically range between 50 and 300 tsf and between 0.2 and 2.5 tsf, respectively.

The USGS regional geologic study referenced above indicates the Peedee Aquifer extends to a depth of approximately 400 ft below ground surface (bgs), underlain by the Black Creek Confining Unit. Characterization of geotechnical properties for the Black Creek Confining Unit was not considered relevant for the closure design of the basins and LOLA presented herein because of the thickness of the Peedee Aquifer.

Six cross sections of the basin areas and LOLA were developed based on the subsurface stratigraphy described above and the results of the topographic survey provided by DEP in 2014 (the topographic survey performed by WSP USA Corp. in 2015 shows similar results; as such the cross sections were not updated with the 2015 survey results). The locations of these cross sections are shown on Figure 16. The cross sections are presented on Figure 17 and Figure 18.

4.3 Hydraulic Conductivity Information

Slug testing was performed following installation of the monitoring wells and piezometers. Slug testing was performed in piezometer PZ-Int with the objective of evaluating the hydraulic conductivity of the CCR within the Basin. The calculations associated with the slug testing are included in Appendix E. The calculated hydraulic conductivities are summarized in Table 6.

A 46-hour aquifer pumping and recovery test was also performed by Geosyntec in the surficial aquifer, beneath the 1971 Basin in March 2015. The aquifer pumping test is described in Appendix F and shows that the hydraulic conductivity of the surficial aquifer ranges from 220 to 614 ft/day (0.08 to 0.22 cm/s) with a geometric mean of 339 ft/day (0.12 cm/s). Slug tests conducted in the same wells indicated a hydraulic conductivity of the surficial aquifer ranged from 23 to 190 ft/day (0.008 to 0.07 cm/s) with a geometric mean of 67.9 ft/day (0.02 cm/s). It is not uncommon for the hydraulic conductivity of a slug test to be an order of magnitude or more, less than that of an aquifer pumping test due to larger stresses being placed on the aquifer during an aquifer pumping test.

4.4 Geotechnical Properties

4.4.1 Summary of Boring and Sampling Frequency and Methods

A number of field investigations have been conducted by various consultants (including Geosyntec) in both the basins and LOLA areas between 2005 and 2015. The investigations consisted of borings advanced using both Hollow Stem Auger (HSA) and mud rotary methods. Borings typically included SPTs generally conducted at intervals of approximately 2.5 to 5 ft. Representative disturbed samples were collected using a split spoon sampler as part of the SPTs and samples were classified in the field by an engineer/geologist and shipped to a geotechnical laboratory for testing. CPTs were also conducted, and in some cases, CPTs included pore water dissipation tests and Seismic CPT (SCPT) shear wave velocity measurements. A detailed discussion of the field investigations can be found in the Geotechnical Subsurface Stratigraphy and Material Properties Package presented in Appendix D.

4.4.2 Summary of Laboratory Testing and Geotechnical Properties

Laboratory testing conducted on samples collected during the investigations described above included: (i) index testing (e.g. particle size, Atterberg limits, and unified soil classification system classification), (ii) unit weight and moisture content, (iii) specific gravity, (iv) shear strength, (v) compaction and (vi) hydraulic conductivity. A detailed discussion of the laboratory testing and interpretation of the results is presented in Appendix D.

4.5 Chemical Analysis of Impoundment Water, CCR and CCR-Affected Soil

4.5.1 Overview

A detailed description of the sampling approach and the results are provided in the Chemical Characterization Report prepared by Geosyntec, included as Appendix G. Soil and CCR samples were collected to evaluate background concentrations of constituents of interest (COI), COI concentrations within the CCR Basins and LOLA, and concentrations of COIs in vadose zone soils located outside of the CCR Basins.

The term COI has been used in this report to include all constituents analyzed during Geosyntec's preliminary site investigation, while SynTerra [2015a, 2015b, 2016a] subsequently defined the term to only include constituents detected in CCR interstitial water in excess of a North Carolina Groundwater Quality Standard found in the NCAC Title 15A Subchapter 2L.0202 (2L or 2L Standards) and the Interim Maximum Allowable Concentrations (IMAC) established by the NCDEQ pursuant to 15A NCAC 02L.0202(c). CCR interstitial water within a basin may not be representative of groundwater conditions outside of a basin and the results were compared to 2L Standards solely to provide a frame of reference.

Additional data were collected by SynTerra during 2015, which were summarized and interpreted in the CSA [2015a, 2016b] and the CAP, Part 1 [2015b], but were not included in this data summary. These additional data were consistent with historical data and the data collected during Geosyntec's preliminary site investigation and did not change the overall conclusions presented in this Removal Plan.

Soil and CCR samples were collected according to the EPA Region 4 Soil Sampling Standard Operating Procedure (SOP) [EPA, 2011a]. Samples were properly preserved, labeled, logged onto a chain-of-custody form, and placed into an iced cooler prior to shipment. The samples were submitted to Lancaster Laboratories located in Lancaster, PA, for analysis of:

- the NC Hazardous Substance List metals (antimony [Sb], arsenic [As], beryllium [Be], cadmium [Cd], chromium [Cr], copper [Cu], lead [Pb], manganese [Mn], mercury [Hg], nickel [Ni], selenium [Se], silver [Ag], thallium [Tl], and zinc [Zn]) using Method SW 846-7471B (Hg) and Method SW 846-6010C (all other metals);
- major cations (calcium [Ca], magnesium [Mg], sodium [Na], and potassium [K]) using Method SW 846-6010C;
- major anions (chloride [Cl], bromide [Br], and sulfate [SO_4] using EPA Method 300.0;
- strontium [Sr], boron [B], barium [Ba], molybdenum [Mo], and iron [Fe] using Method SW 846-6010C; and
- pH using Method SW 846-9045D modified.

Leachability of metals was also evaluated using the Synthetic Precipitation Leaching Procedure (SPLP; EPA Method 1312) for CCR and background soils.

Investigation of CCR within and the soils around and below the CCR basins and LOLA was conducted to supplement the historical investigation data, delineate the vertical boundaries of the CCR and collect groundwater quality information in the area.

Geosyntec also performed groundwater and CCR interstitial water investigation activities to supplement historical groundwater assessment data collected by other consultants and to fill certain data gaps. Groundwater results are discussed in Section 4.6. Two CCR piezometers (PZ-1971 and PZ-Int) were installed to monitor water elevations within the CCR Basins and collect interstitial water samples for laboratory analyses to evaluate CCR interstitial water conditions. Samples were sent under chain-of-custody protocol to Lancaster Laboratories for analysis of:

- the NC Hazardous Substance List metals (Sb, As, Be, Cd, Cr, Cu, Pb, Mn, Hg, Ni, Se, Ag, Tl, and Zn) using Method SW 846-7471B (Hg) and Method SW 846-6010C (all other metals);
- major cations (Ca, Mg, Na, and K) using Method SW 846-6010C;
- major anions (Cl, Br, SO_4, alkalinity [HCO_3], and nitrate/ nitrite [NO_3/NO_2]) using EPA Method 300.0 (Cl, Br, SO_4, NO_3/NO_2) and EPA Method 310.1 (HCO_3);
- Sr, B, Ba, Mo, Fe, and vanadium [V] using Method SW 846-6010C; and
- total dissolved solids (TDS) using Standard Method 2540 C-1997.

SynTerra installed additional wells and collected additional CCR interstitial water as well as groundwater samples during the 2015 investigation. A summary of these results in provided in the CSA [SynTerra, 2015a, 2016b] and CAP [SynTerra, 2015b, 2016a].

4.5.2 Coal Combustion Residuals

Two CCR samples were collected from representative locations within the 1984 Basin at varying depth increments [SS-SPT9(12.0-14.0 ft) from PZ-Int, and SS-SPT7(4.0-6.0) from the southern portion of the 1984 Basin]. Two CCR samples were also collected within the 1971 Basin from locations SS-SPT3(10.0-12.0), which is the same location as PZ-1971, and SS-GP3(24.0-28.0). Furthermore, samples were collected from materials where uncertainty existed in the field whether they should be classified as CCR or soil [SS-GP3(32.0-36.0), SS-G3(76.0-80.0), SS-GP3(80.0-84.0), SS-GP3(72.0-76.0), SS-GP2(72.0-76.0), and SS-GP2(52.0-56.0)]. The CCR and soil sampling locations are presented on Figure 1 of the Chemical Characterization Report (Appendix G).

An additional investigation was implemented within the boundaries of the 1971 Basin, but below the design bottom elevation of the 1971 Basin due to uncertainty related to the bottom of the CCR within portions of the 1971 Basin. This deeper area has been termed the 1971 Borrow Area. The additional investigation consisted of Geoprobe® borings and laboratory tests to delineate the horizontal and vertical extent of CCR within the 1971 Borrow Area. Samples were continuously collected during the Geoprobe® borings. Selected samples were transported for laboratory testing to characterize geotechnical and environmental properties. These laboratory testing results were used to verify the bottom of CCR estimated based on a visual assessment in the field. Figure 2 of the Chemical Characterization Report (Appendix G) presents the boring locations together with historical boring locations advanced within the CCR Basins.

Table 1 of the Chemical Characterization Report (Appendix G) summarizes the analytical results for CCR and soil samples. SPLP results are summarized in Table 2 (Appendix G).

As presented in Table 1 (Appendix G), with the exception of antimony, cadmium, mercury, molybdenum, silver, and thallium (which were all at or near non-detect concentrations non-detect), all metallic COIs were higher in CCR compared to soil samples. Furthermore, sulfate concentration and pH were also higher in CCR as compared to soil. COI concentrations appeared to be higher in CCR samples from the 1971 Basin as compared to CCR samples from the 1984 Basin.

This apparent trend generally holds true for leachable concentrations of COIs as measured by SPLP. Arsenic still appeared to be leaching at elevated concentrations from CCR, while boron, iron, manganese, and selenium concentrations were low to non-detect (Table 2 - Appendix G).

A follow-up investigation was conducted within the limits of the 1971 Basin. In order to supplement the visual and geotechnical characterization of the CCR within the 1971 Borrow Area, samples were collected for chemical analysis. Both total concentrations of COIs and SPLP concentrations were analyzed in nine CCR samples and the results are summarized in Table 3 (total concentrations) and Table 4 (SPLP) of the Chemical Characterization Report (Appendix G).

Total concentrations of many COIs indicate that the tested samples are CCR, consistent with the visual and geotechnical characterization of these samples. Consistent with the results of the earlier investigation, the samples exhibited elevated concentrations of arsenic and iron, which appear to be the most important “CCR indicator parameters” of the materials found within the 1971 Borrow Area. Arsenic concentrations ranged up to 155 milligrams per kilogram (mg/kg), a result obtained from the deepest sample submitted (MB2 at 76-80 ft bgs), and iron concentrations ranged up to 43,400 mg/kg. In comparison, site-specific soil samples exhibited non-detect results for arsenic (less than 1 mg/kg) and iron concentrations that were generally less than 1,000 mg/kg.

Leaching tests using the SPLP method indicate that the CCR located within the 1971 Borrow Area have the potential to leach arsenic at elevated concentrations. Arsenic concentrations of up to 316 micrograms per liter (µg/L) were measured in SPLP extracts, and total arsenic and SPLP arsenic concentrations appear to be correlated. Other CCR indicator parameters such as boron, iron, chromium, manganese, and selenium did not leach at elevated concentrations from the CCR submitted for analysis.

4.5.3 Soils

4.5.3.1 Background Soils

Background soil samples were collected from areas at Sutton that have not received CCR, to establish metals concentrations naturally occurring in Sutton soils. Two discrete background soil samples were collected using a hand auger from 2.5 ft to 3.0 ft bgs to avoid sampling soils that could potentially be affected by surface deposition of CCR-related dust.

Table 1 (Appendix G) summarizes the soil and CCR analytical data, including the results from the background soil samples, and Table 2 (Appendix G) summarizes the SPLP leaching data.

Background soils indicated low to non-detect levels of most constituents analyzed. However, iron was detected at a slightly elevated level at location SB-2, which is located close to monitoring well MW-7. Both background soil samples exhibited acidic pH at 4.6 to 4.7 standard units (s.u.), indicating naturally acidic soil conditions at Sutton.

SPLP results showed leachable iron and calcium, and, to a lesser extent, barium, silver and thallium at background soil location SB-2. All other COIs were not detected above the practical quantitation limit (PQL).

4.5.3.2 Site Soils

Soil samples were collected during the installation of monitoring wells MW-34C and MW-36C and from the soil below the CCR in the 1971 Basin based on visual observations from borings GP-5 and GP-6 (SS-GP5(20.0-24.0) and SS-GP6(24.0-28.0)). As presented in Table 1 (Appendix G), results were generally consistent with background soil conditions, except for location GP-5, which exhibited elevated concentrations of most COIs that may indicate leaching from the overlying CCR and/or a mix of soil and CCR at the sampled depth (20-24 ft bgs). Furthermore, pH was higher than background conditions (i.e., circumneutral to slightly alkaline), but lower than in CCR.

SPLP results summarized in Table 2 (Appendix G) indicate leachable barium, calcium, magnesium, and sodium above background in soil samples collected from below the CCR in the 1971 Basin. However, the concentrations were lower than leachable results from CCR.

4.5.4 Soil and CCR Mixtures at the LOLA

4.5.4.1 Previous Investigation of the LOLA

Environmental assessments were conducted periodically in the LOLA from 2001 through 2012 to assess potential CCR impacts. In June 2001, Law Environmental, subsequently Blasland, Bouck, and Lee, Inc. (BBL), conducted soil and groundwater assessments following the release of white liquor from one of the above ground storage tanks leased to International Paper. The release was remediated, but additional investigations were conducted by BBL when DEP entered the NC Registered Environmental Consultant (REC) voluntary remediation program under the Inactive Hazardous Sites Branch of the NCDEQ to assess potential impacts from CCR and petroleum in soil and groundwater. A Remedial Investigation report was submitted to

NCDEQ in May 2005 [BBL, 2005]. Soil borings using hand augers and larger test pits were used to delineate the extent of CCR in soil within the LOLA to determine the soil impacts. Groundwater monitoring wells were also installed as part of these investigations to assess groundwater quality in the LOLA. In many cases, the test pits and soil borings were terminated near the top of the water table, before reaching the native soil. A Remedial Action Plan was submitted by BBL in March 2006 [BBL, 2006]. The proposed remedy was monitored natural attenuation of arsenic in groundwater along with administrative controls and land use restrictions to address soil and CCR impacts above unrestricted use remedial goals. Limited groundwater sampling was performed within the LOLA during the Phase II Groundwater Quality Assessment conducted by Catlin [2012].

4.5.4.2 Supplemental Investigation of the LOLA

Geosyntec implemented a screening-level assessment of the soils and CCR in the LOLA using Geoprobe® investigation techniques to (i) visually assess materials to evaluate composition as either soil, CCR, or a mixture, (ii) verify native soil had been reached and (iii) collect soil and/or CCR samples from impacted locations [Geosyntec, 2014b]. The sample locations are shown on Figure 3 of the Chemical Characterization Report (Appendix G).

A subset of soil and/or CCR samples was collected from the borings. Following visual assessment, twelve soil samples from six locations deemed representative of CCR and CCR/soil mixtures were selected along with two additional samples for native soil verification.

The selected samples were submitted to Lancaster Laboratories for analysis of:

- the NC Hazardous Substance List metals (Sb, As, Be, Cd, Cr, Cu, Pb, Mn, Hg, Ni, Se, Ag, Tl, andZn using Method SW 846-7471B (Hg) and Method SW 846-6010C (all other metals);
- Sr, B, Ba, Mo, and Fe using Method SW 846-6010C;
- pH using Method SW 846-9045D modified; and
- leachability of metals using SPLP (EPA Method 1312).

The analytical results are presented in Table 5 (total metals, pH, and % moisture) and Table 6 (SPLP) of the Chemical Characterization Report (Appendix G). The analytical results were used to evaluate levels of COI, assess the current leachability potential, and supplement the visual identification of CCR to confirm that the vertical extent of CCR has been reached.

Figure 3 (Appendix G) includes descriptions of the depth increments that appeared to contain CCR. Based on the visual identification, the observed CCR appeared to include a range of grain sizes, which might indicate a minor presence of fly ash mixed in with mostly bottom ash within the LOLA.

The main purpose of this investigation was to evaluate the vertical extent of CCR. The elevations (NAVD88) for the bottom of CCR are presented on Figure 4, while Figure 5 of the Chemical Characterization Report (Appendix G) depicts isopach contours of the thickness of

CCR within the LOLA. The horizontal extent of the LOLA has changed from previously depicted delineations and may be subject to further adjustments pending additional investigations within this area. SynTerra's depiction of the waste boundary of the LOLA in the CSA [2015a, 2016b] accounts for the updated delineation based on Geosyntec's and SynTerra's 2014 and 2015 investigation results. As shown on Figure 5, the thickness of CCR varies considerably across the LOLA but appears to be thickest within the northwestern corner of the LOLA and thinnest within the southeastern corner.

The chemical characterization summarized in Table 5 (Appendix G) indicate relatively low concentrations of arsenic (up to a maximum of 42 mg/kg), boron (up to 25 mg/kg), chromium (up to 25 mg/kg), and iron (up to 16,200 mg/kg) compared to CCR characterized in the 1971 and 1984 Basins. The chemical signatures did indicate a contribution of CCR when arsenic, iron, and chromium were detected at elevated concentrations compared to native soils. The concentrations were more consistent with a CCR/soil mixture than pure CCR.

The SPLP data summarized in Table 6 (Appendix G) indicate that this CCR/soil mixture within the LOLA did not leach COIs at elevated concentrations. Again, this is in contrast to the CCR characterized within the 1971 and 1984 Basins, and it may be another indication that the CCR present within the LOLA is mostly bottom ash.

4.5.5 CCR Interstitial Water

Two CCR piezometers (PZ-1971 and PZ-Int) were installed to monitor water elevations within the CCR Basins and collect interstitial water samples for laboratory analyses. Figure 6 of the Chemical Characterization Report (Appendix G) shows the locations of the piezometers.

A CCR interstitial water sample was collected from piezometer PZ-Int, but no sample could be collected from PZ-1971 since the piezometer was dry. Field parameters were collected during the purging of the piezometer. Table 9 of the Chemical Characterization Report (Appendix G) presents the final measured field parameters, and Table 10 (Appendix G) presents the analytical results. Tables 7 and 8 (Appendix G) summarize historical groundwater results discussed in Section 4.6. The table numbering was kept unchanged to be consistent with the Chemical Characterization Report.

As presented in Table 9 and Table 10 (Appendix G), CCR interstitial water conditions were anaerobic, with oxidation-reduction potential (ORP) of -267 millivolts (mV), and pH conditions were circumneutral (pH 7.43 s.u.). Additionally, elevated concentrations of arsenic, boron, iron, and manganese were detected in CCR interstitial water at this location (i.e., PZ-Int) compared to groundwater outside the basins. The elevated concentrations of various constituents detected in groundwater well MW-2C are discussed in Section 4.6.3. In general, these interstitial water results were consistent with the interstitial water results from the 1971 Basin reported in the Phase II Groundwater Quality Assessment Report [Catlin, 2012], although PZ-Int exhibited higher boron concentrations and lower manganese concentrations compared to the two temporary piezometers sampled during the Phase II Groundwater Quality Assessment.

4.6 Historical Groundwater Sampling Results

4.6.1 Overview

Geosyntec performed groundwater investigation activities to supplement historical groundwater assessment data collected by other consultants and to fill data gaps as part of the evaluation of closure options for the CCR Basins. The field work was implemented in May 2014.

Geosyntec performed the following groundwater investigation activities as part of the supplemental investigation to fill data gaps identified during the review of historical information to evaluate potentially applicable CCR Basin closure options:

- piezometers were installed around the toe of the dike surrounding the CCR Basins;
- intermediate-depth (22-27 ft bgs), and deeper depth monitoring wells (40-45 ft bgs), intervals consistent with the depths of existing monitoring wells designated as “B-” and “C-” wells, were installed to supplement existing information on potential impacts to ground water in the surficial aquifer at Sutton;
- groundwater samples were collected from some existing and newly installed monitoring wells and piezometers located throughout Sutton, but not included in the NPDES compliance sampling plan; and
- a supplemental groundwater sampling event was implemented using existing groundwater monitoring wells located within the LOLA.

SynTerra installed additional wells and collected additional groundwater samples during the 2015 investigation as summarized in the CSA [SynTerra, 2015a, 2016b] and CAP [SynTerra, 2015b, 2016a].

4.6.2 Historical Investigations and NPDES Sampling Results

Historical and current groundwater analytical data and field parameters are provided in Table 7 (metals) and Table 8 (non-metals and field parameters) of the Chemical Characterization Report (Appendix G) for sampling events through June 2015. These sampling events are conducted under the requirements of the Sutton NPDES permit. Hard copies of laboratory analytical reports will be submitted under separate cover consistent with the requirements of the NPDES permit. New permit parameters may be included for upcoming compliance sampling. However, Tables 7 and 8 (Appendix G) do not include any new parameters and the discussion in this report is limited to the parameters routinely monitored until recently.

Figure 6 and Figure 7 of the Chemical Characterization Report (Appendix G) depict the monitoring well network at Sutton. Only existing NPDES monitoring wells that were relevant to the supplemental investigation are labeled on these two figures.

Background well MW-4B on the southeastern side of the Plant has exhibited consistent exceedances of the iron groundwater standard [NCDENR, 2013] of 300 µg/L (1,280 µg/L in June 2015) and occasional exceedances of the 50 µg/L manganese standard (59 µg/L in June 2015), while background well MW-5C on the northeastern side of the property has shown exceedances of the manganese standard (441 µg/L in June 2015) and naturally acidic pH conditions (pH 5.5 s.u. versus the pH groundwater standard of 6.5 s.u to 8.5 s.u.). This indicates that background geochemical conditions are likely contributing to the increased solubility of iron and manganese. The negative ORP measured in MW-4B likely contributes to the higher solubility of iron, while manganese is expected to be soluble under the acidic groundwater conditions in MW-5C.

Monitoring wells within the vicinity of the eastern and southeastern side of the 1971 Basin, including MW-2C, MW-17, and MW-18, have historically exhibited elevated concentrations of arsenic, boron, iron, and manganese. Occasionally, other metals and TDS were detected at slightly elevated concentrations and the groundwater pH was slightly acidic. While elevated manganese and iron concentrations and acidic groundwater conditions can be partially explained by background conditions, arsenic and boron concentrations are likely attributable to the presence of the CCR basins. Monitoring well MW-6C, located to the east of the ICA within the 1984 Basin, has historically shown elevated concentrations of boron, iron, and manganese as well as acidic groundwater conditions, but only the boron concentrations appear to have been elevated when compared to background conditions. This suggests that the clay liner within the 1984 Basin may provide increased groundwater protection and that arsenic has either been contained within the 1984 Basin or attenuates within a relatively short distance from the basin boundary.

Attenuation of arsenic has also been observed within the area outside of the 1971 Basin. A compliance monitoring well within this area (MW-21C) is the only well at or beyond the compliance boundary that has shown occasional exceedances of the 10 µg/L arsenic groundwater standard. However, arsenic concentrations appear to be increasing in this well with a current concentration of 53.8 µg/L measured during the June 2015 sampling event. Nevertheless, given that MW-21C is the only well in this area exceeding the arsenic standard, this suggests that arsenic is not very mobile in groundwater and is expected to be present as the less mobile arsenate (i.e., As^{5+}) form as opposed to the more mobile arsenite (i.e., As^{3+}) form in groundwater away from the Basins. This has been confirmed using Eh-pH stability diagrams for arsenic under site-specific conditions presented in the Data Interpretation and Analysis Report [Geosyntec, 2014c]. Similarly, selenium has not been consistently detected above its groundwater standard of 20 µg/L with the exception of monitoring well MW-27B along the northern side of the 1984 Basin, which had a detection of 28.4 µg/L during the June 2015 sampling event. Monitoring well MW-24B located along the eastern compliance boundary outside of the ICA within the 1984 Basin had historically shown detections above the selenium groundwater standard but has been non-detect during the past nine sampling events.

However, boron, which acts as a conservative ion that does not get attenuated via sorption, has historically shown concentrations above its groundwater standard of 700 µg/L in multiple monitoring wells at or beyond the compliance boundary. This includes compliance boundary wells MW-21C (2,120 µg/L in June 2015), MW-22C (2,560 µg/L in June 2015), MW-23B (currently at 137 µg/L and therefore, below the standard), MW-23C (2,050 µg/L in June 2015), MW-24B (currently at 409 µg/L and therefore, below the standard), and MW-24C (1,040 µg/L in

June 2015). Furthermore, several wells beyond the compliance boundary have historically shown exceedances of the boron groundwater standard. These wells include MW-12 (along the property boundary next to S.T. Wooten Corporation; 1,470 µg/L in June 2015), MW-19 (downgradient of MW-21C; 2,080 µg/L in June 2015), and MW-31C (along the property boundary next to S.T. Wooten Corporation; currently at 381 µg/L and therefore, below the standard).

Given that MW-12 and MW-31C are approximately 1,300 ft and 1,200 ft, respectively, east of the waste boundary suggests that groundwater extraction at the S.T. Wooten Site may influence groundwater flow pattern at Sutton. Furthermore, it is noted that the deeper C-wells (screened at about 40 ft to 45 ft bgs) generally exhibit higher concentrations of most COIs as compared to the B-wells, which are screened around 22 ft to 27 ft bgs.

Two temporary piezometers were installed during the Phase II Groundwater Quality Assessment [Catlin, 2012] within the CCR along the western end of the 1971 Basin. Results indicated elevated levels of arsenic, iron, and manganese, and slightly elevated levels of boron. These concentrations were generally consistent with the results reported in groundwater immediately outside the eastern and southeastern side of the 1971 Basin discussed above.

4.6.3 Supplemental Groundwater Monitoring

4.6.3.1 Overview

Three intermediate-depth monitoring wells (MW-34B, MW-35B, and MW-36B) and four deep monitoring wells (MW-27C, MW-34C, MW-35C, and MW-36C) were installed at Sutton as part of this supplementary investigation. Additionally, eight groundwater piezometers (GWPZ-1A/B through GWPZ-4A/B) were installed to monitor groundwater elevation at the toe of the dike around the CCR Basins. These piezometers were not sampled for chemical characterization and, therefore, are not further discussed in this section. However, some of the borings for these piezometers were used to construct cross-sections discussed below. These wells and piezometers are depicted on Figure 6 of the Chemical Characterization Report (Appendix G).

Depth-to-water measurements and groundwater samples were collected from the newly installed monitoring wells and piezometers after they had been allowed to stabilize for approximately one week after installation. Unfiltered groundwater samples were collected using low-flow sampling methods as described in EPA Region 4 Groundwater Sampling SOP [EPA, 2011b].

As indicated above, SynTerra installed additional wells and collected additional groundwater and CCR interstitial water samples during the 2015 investigation as summarized in the CSA [SynTerra, 2015a, 2016b] and CAP [SynTerra, 2015b, 2016a].

4.6.3.2 Groundwater Sampling and Testing

Groundwater samples were collected from monitoring wells installed by Geosyntec and from select existing monitoring wells and piezometers. Samples were sent under chain-of-custody protocol to Lancaster Laboratories for analysis of:

- the NC Hazardous Substance List metals (Sb, As, Be, Cd Cr, Cu, Pb, Mn, Hg, Ni, Se, Ag, Tl, and Zn) using Method SW 846-7471B (Hg) and Method SW 846-6010C (all other metals);
- major cations (Ca, Mg, Na, and K) using Method SW 846-6010C;
- major anions (Cl, Br, SO4, alkalinity (as HCO_3), and nitrate/nitrite [NO_3/NO_2]) using EPA Method 300.0 (Cl, Br, SO_4, NO_3/NO_2) and EPA Method 310.1 (HCO_3);
- Sr, B, Ba, Mo Fe, and V using Method SW 846-6010C; and
- TDS using Standard Method 2540 C-1997.

The newly installed wells discussed above were used to supplement the existing monitoring network, especially with respect to the areas northeast and north of the 1984 Basin. Select monitoring wells that do not serve as routine compliance monitoring wells were sampled to evaluate groundwater quality conditions along several transects away from the CCR Basins. These transects included MW-2B/2C and MW-3B (near the 1971 Basin), MW-6B/6C and PZ-25 (near the ICA within the 1984 Basin), MW-34B/34C and MW-35B/35C (northeast of the 1984 Basin), and MW-36B/36C and MW-27C to the north of the 1984 Basin. Well MW-5B was included as a background well.

These wells and transects are shown on Figure 7 and the results are summarized in Table 9 (Field Parameters) and Table 10 (Analytical Results) of the Chemical Characterization Report (Appendix G).

4.6.3.2.1 Background Conditions

Background well MW-5B indicated low to non-detect results for most COIs, consistent with results from historical sampling events of other background wells (i.e., MW-4B and MW-5C). However, iron was detected at 700 µg/L, which is above its groundwater standard (300 µg/L), indicating that geochemical background conditions contribute to elevated levels of iron in groundwater. Manganese was not detected above its groundwater standard of 50 µg/L despite fairly acidic conditions within this well (pH 3.94), while the deeper compliance background well (MW-5C) has historically exhibited elevated concentrations of manganese (but not iron).

Both the historical investigations including background wells MW-4B and MW-5C as well as the supplemental investigation including background well MW-5B have indicated that the groundwater at the Site has exhibited naturally acidic conditions. Furthermore, the historical data for MW-4B and MW-5C have also established naturally elevated concentrations of iron and manganese above their respective groundwater standards. It is noted, however, that the shallower background well MW-5B sampled during the supplemental investigation did not exhibit elevated concentrations of these constituents above groundwater standards.

4.6.3.2.2 Site Groundwater Conditions

Well MW-2B exhibited low concentrations of COIs; however, the deeper well MW-2C indicated elevated concentrations of several COIs, including arsenic (278 µg/L), boron (3,020 µg/L), iron (9,510 µg/L), manganese (375 µg/L), and TDS (542 mg/L). The levels were consistent with historical results from this well. Well MW-3B downgradient of the MW-2B/2C well pair exhibited low COI concentrations. However, it is likely that this well is screened too shallow to evaluate whether the elevated concentrations found in MW-2C were attenuated along the groundwater flow path.

With the exception of boron and manganese, the well pair MW-6B/6C exhibited low concentrations of COIs. The boron concentrations were approximately consistent with each other, while manganese concentrations were higher in MW-6C as compared to MW-6B. Overall, these concentrations were lower than the levels detected in MW-2C, indicating that the clay liner within the 1984 Basin provides a level of groundwater protection that is not found within the unlined 1971 Basin. The downgradient piezometer PZ-25, which is screened at the same depth as MW-6B but is located beyond the compliance boundary, did exhibit low concentrations of COIs and indicated attenuation of these constituents away from the basins.

Similarly, the newly installed well pair MW-34B/34C indicated low levels of COIs. However, the deeper well MW-34C exhibited somewhat elevated concentrations of manganese (303 µg/L) and iron (613 µg/L), even though these concentrations were consistent with background conditions. The downgradient newly installed well pair MW-35B/35C (located approximately coinciding with the compliance boundary) exhibited similar concentrations of COIs as wells MW-34B/34C, even though iron (2,810 µg/L) and manganese (345 µg/L) concentrations were somewhat higher in MW-35C and were above their respective groundwater standards. This can also likely be attributed to background conditions, and other CCR indicator parameters such as arsenic and boron were non-detect or low at these locations. This finding is further evidence that the clay liner is fairly effective in protecting groundwater from CCR leaching. However, well MW-35C did exhibit a selenium detection of 55 µg/L, which is above its groundwater standard of 20 µg/L. The wells closer to the basin boundary (i.e., MW-34B/34C) exhibited concentrations below the PQL of 40 µg/L, suggesting that the 1984 Basin is unlikely to be a continuing source of selenium and that this elevated detection in MW-35C may be the result of historical leaching.

The northern transect formed by the newly installed well pair MW-36B/36C and the newly installed well MW-27C indicated a very similar pattern of generally low concentrations of COIs, but elevated levels of iron and manganese in the deeper wells MW-36C and MW-27C. Again, well MW-27C indicated an elevated selenium concentration of 55 µg/L, while the well pair closer to the basin boundary (i.e. MW-36B/36C) exhibited levels below the PQL.

One well (MW-31B) was sampled along the property boundary with the S.T. Wooten Site. Elevated concentrations of iron (1,390 µg/L) were detected in this well, but this is likely attributable to background conditions. The deeper compliance well MW-31C (not sampled for this investigation) has historically shown elevated concentrations of iron (about twice the levels found in MW-31B), manganese, and boron.

4.6.4 Groundwater Monitoring at the LOLA

Unfiltered water samples were collected from the nine existing wells within the LOLA and analyzed for the same parameters as outlined in previous subsections for the wells and piezometers around the CCR Basins.

Figure 3 of the Chemical Characterization Report (Appendix G) depicts the monitoring well locations (as well as the boring locations for the soil and CCR samples described in Section 4.5.4.2 above).

Water quality samples were collected from all existing monitoring wells within the LOLA, including MW-13, MW-13D, MW-14, MW-15, MW-15D, MW-16, MW-16D, MW-20 and MW-20D. During purging of the wells, field parameters were collected and the readings are summarized in Table 11 of the Chemical Characterization Report (Appendix G). As shown in Table 11 (Appendix G), pH conditions were relatively uniform and circumneutral to slightly acidic and redox conditions were generally mildly reducing. This is consistent with other monitoring locations throughout the Site (including background conditions), even though many locations across Sutton appear to have more oxidizing conditions. The difference might be related to the input from natural organic matter (e.g., decaying leaf litter within the densely vegetated areas in the northern part of the LOLA) and/or potential historical impacts of petroleum hydrocarbons around the former aboveground storage tank (AST) area within the southern part of the LOLA.

The analytical results are presented in Table 12 of the Chemical Characterization Report (Appendix G). Consistent with historical sampling results, the arsenic concentration in MW-13 (shallow well) was elevated (218 µg/L); however, boron concentration was only slightly elevated (935 µg/L). On the other hand, the deep well at this location (MW-13D) indicated a low arsenic concentration (9.6 µg/L), but an elevated boron concentration (2,350 µg/L), which likely did not originate within the LOLA, but from the upgradient deeper zones within the 1971 Borrow Area. Note that the MW-13 well cluster is located within the compliance boundary. Shallow monitoring well MW-15, which appears to be located at the previously established compliance boundary around the LOLA, indicated an arsenic concentration of 31.2 µg/L, exceeding the groundwater standard of 10 µg/L. Manganese and iron concentrations were elevated throughout the LOLA, which is generally consistent with conditions across Sutton (including background conditions).

4.7 Groundwater Potentiometric Contour Maps

As described in Section 4.1, the general vicinity around Sutton is within the Tidewater sub-region of the Coastal Plain where many rivers and streams are affected by oceanic tides. Sutton itself is underlain by three hydrogeological units which dip and thicken toward the east. The uppermost unit is the Surficial Aquifer which is made up of Quaternary age near shore to shore deposits (e.g. stream, terrace, and barrier shore deposits), composed typically of sand, with some clay [Bain, 1970]. The second unit is a confining layer that is part of the Peedee formation, which ranges from a clay, silty clay, sandy clay, to clayey sand [Winner & Coble, 1996]. This confining unit is discontinuous near Sutton and can range in thickness from 0 to 89 ft [McSwain et al., 2014]. Data from the USGS [McSwain et al., 2014] and Geosyntec's investigations confirm that the confining layer is laterally discontinuous and, when present, varies in thickness between 0.5 to 5-ft thick [Geosyntec, 2015a]. Below the confining layer, where present, is the Cretaceous age Peedee Aquifer. The Peedee Aquifer consists of marine environment deposits, which typically consist of silt, sand, clay, and some consolidated sandstone and limestone [Winner & Coble, 1996]. Zones of the middle Peedee Aquifer often contain increased clay and silt content, which can create local confined to semiconfined conditions [Harden et al., 2003]. Water level measurements collected by Geosyntec on 19 May 2014 and shown on Figure 15 indicate the presence of a groundwater divide in the general vicinity of Sutton. To the west of Sutton, groundwater flows in a westward direction, towards the Cape Fear River. To the east of Sutton, groundwater flows in an eastward direction, towards the Northeast Cape Fear River. Additional updated information is provided in the CSA and CAP [SynTerra, 2015a, 2015b, 2016a, 2016b].

As such, Sutton is conceptualized as located in a sedimentary basin with two distinct hydrogeological units: (i) an overlying sand unit representing the Surficial Aquifer (which includes the dike fills and CCR); and (ii) the Peedee aquifer comprised of a discontinuous upper confining unit, an upper sandy portion, a middle portion which contains semi-confining zones of increased silt, clay and silty sand content, and a lower sandy zone. Hydraulic conductivity for the sand portions of the Surficial and Peedee Aquifers are assumed to be similar, given their similarity in geological composition. Hydraulic conductivity for the discontinuous confining layer and for the zones of semi-confining clays to silty sands is conceptualized to have a hydraulic conductivity lower than the Surficial and Peedee Aquifers. Both the discontinuous Peedee confining unit and the semi-confining zones are also assumed to be leaky, allowing for vertical flow between the Surficial and Peedee Aquifers at Sutton. This is supported and confirmed by borings at the Site which showed that the Peedee confining unit was sparsely present. A groundwater divide is estimated to exist within the center of the Site, causing groundwater to flow both to the east and to the west, discharging into either the Northeast Cape Fear River or Cape Fear River. Rivers and the Surficial Aquifer are assumed to be tidally influenced. The Peedee aquifer is assumed to not be influenced by the tides, given its depth.

4.8 Figures: Cross Section Vertical and Horizontal Extent of CCR within the Basins

Cross-sections were developed to summarize and graphically depict groundwater impacts at the Site. These cross-sections are depicted on Figures 8 through 10 of the Chemical Characterization Report (Appendix G). Figure 8 shows the locations of the cross-sections. Figure 9 depicts cross-section A-A', which was cut from west to east along the northern boundary of the 1984 Basin, and cross-section B-B', which was cut from west to east along the southern end of the 1971 Basin, including a small part of the northwestern corner of the LOLA and across the Discharge Canal. Figure 10 depicts cross-section C-C', which was cut from north to south across both the 1971 and 1984 Basins and towards the southern extent of the LOLA. Note that the cross-sections were limited to the areas within the compliance boundaries of the 1971 and 1984 Basins as well as the LOLA. Therefore, they do not delineate the horizontal or vertical extent of groundwater exceedances across Sutton, which would be impractical to delineate given the widespread occurrences of elevated levels of iron, manganese, and acidic pH conditions, much of which can be attributed to natural background conditions. Furthermore, boron concentrations are elevated at multiple monitoring locations outside the compliance boundary. Additional cross-sections, including monitoring wells showing exceedances of groundwater standards, can be found in the CSA [SynTerra, 2015a, 2016b].

These cross-sections include the monitoring wells, piezometers, and other borings used to construct them. Where applicable, wells and piezometers indicate groundwater detections found to be in excess of groundwater standards. Note that CCR interstitial water concentrations are not depicted given that these results do not represent groundwater conditions. These CCR interstitial water results are discussed in Section 4.5.5.

As can be seen on cross-section A-A’, the shallower B-wells do not indicate exceedances of groundwater standards, while the deeper C-wells do indicate exceedances of groundwater standards for iron, manganese, and in the case of MW-35C, for selenium. Given the relative protectiveness of the clay liner within the 1984 Basin as well as the naturally elevated concentrations of iron and manganese, the iron and manganese exceedances are partially attributable to background conditions. The selenium exceedance is likely attributable to historical leaching from CCR.

Cross-section B-B’ illustrates exceedances of the groundwater standards within the northwestern corner of the LOLA (the MW-13 well cluster) and outside the southeastern corner of the 1971 Basin. These exceedances include iron, manganese, boron, and arsenic. As previously discussed, the exceedances of iron and manganese are partially attributable to background conditions, while the boron and arsenic exceedances are linked to the CCR within the 1971 Basin.

Cross-section C-C’ depicts conditions from the compliance boundary north of the 1984 Basin to the southern extent of the LOLA. Review of Cross-section C-C’ indicates groundwater standards for iron, manganese and arsenic are exceeded at the southern extent of the compliance boundary for the LOLA (i.e, MW-15 well cluster), while groundwater standards for manganese and selenium are exceeded within the shallow and deep wells of the MW-27 cluster and standards for iron are exceeded within the deeper well of the MW-27 well cluster at the northern compliance boundary.

5. GROUNDWATER MODELING ANALYSIS

Initial groundwater modeling was performed as part of the first phase of the CAP [SynTerra, 2015b]. The groundwater flow model was developed using the three-dimensional finite difference model MODFLOW. The modelling included groundwater fate and transport, geochemistry and other supporting studies. The model matched observed conditions and was used to predict the distribution of selected constituents over 5, 15, and 30 year periods for scenarios assuming existing conditions, CCR cap in place, and CCR removal. The groundwater modeling was further refined as part of the second phase of the CAP [SynTerra, 2016a]. Background information is provided in the CSA [SynTerra, 2015a, 2016b]. Further discussion of the modeling analysis and results are provided in the CAP [SynTerra, 2015b, 2016a]. Post-closure groundwater modeling was also prepared by SynTerra and provided in Appendix A.

6. BENEFICIAL REUSE AND FUTURE USE

6.1 CCR Material Reuse

DEP considers CCR beneficial use in an environmentally responsible manner for CCR that is produced at its plants or is removed from existing basins. CCR basin closure by removal presents the opportunity for CCR beneficial reuse. DEP has a team dedicated to identifying beneficial use opportunities and evaluating their feasibility. Consistent with CAMA requirements, Part III, Section 4.(e), DEP issued a request for proposals to conduct a beneficial use market analysis, study the feasibility and advisability of installing existing beneficiation technologies, and examine innovative technologies.

Approximately 2 million tons of CCR are anticipated to be transported off-site prior to operation of the on-site landfill for beneficial reuse as lined, structural fill at the Brickhaven Clay Mine, located in Chatham County, NC. Section 9 discusses the final disposition of the remaining CCR at Sutton.

At this time, no additional CCR beneficial use opportunities have been identified. Findings indicate that large-scale beneficiation technologies are not feasible to install at this time in light of the 1 August 2019 CAMA closure deadline and the large investment that would be required, beneficiation is unsupportable on the basis of economic and business criteria. However, the final closure design does consider long-term reclamation of CCR should feasible beneficial uses be identified in the future. This does not necessarily change the general design but considers reclamation as part of the overall site planning and permitting.

6.2 Site Future Use

The primary land use after closure will be open green space in the 1984 Basin and open water for the 1971 Basin. Both land uses will promote the creation of wetland areas and wildlife habitats. The 1971 Basin will effectively become an extension of the Cooling Pond and may be used accordingly.

Given that all the CCR will be removed, there is no containment system that the post-closure use of the property could affect. Post-closure conditions will not affect future land use at Sutton The post-closure use shall not affect the integrity of the function of the monitoring systems.

7. CLOSURE DESIGN DOCUMENTS

7.1 Engineering Evaluations and Analyses

Additional engineering evaluations and analyses are planned in support of the selected final closure option presented in Section 1.2. The proposed analyses and evaluations include, but are not limited to, the following:

- slope stability (local, global, and pseudo-static as appropriate);
- erosion and sediment control (E&SC); and
- stormwater management.

In addition, a Confirmatory Sampling and Testing Plan to identify the bottom of CCR will be implemented. The details of this plan will be included in the 2016 Update Coal Ash Excavation Plan to be submitted to NCDEQ December 2016.

Engineering analyses and evaluations associated with the on-site CCR landfill are presented in the On-site CCR Landfill Construction Application Report [Geosyntec, 2015b].

7.2 Removal Plan Drawings

WSP Sells, Inc. (WSP) of Cary, NC provided a survey map and performed a limited bathymetry survey within the 1984 Basin (secondary basin with water) and near shore areas of the Cooling Pond and Discharge Canal. Geosyntec supplemented the contours for the areas outside the basins, not covered by these survey maps, using the NC Department of Transportation (NCDOT) LIDAR survey map dated May 2007 for the purposes of developing the Removal Plan.

The Removal Plan Drawing Set developed by Geosyntec includes the following drawings:

Drawing 1 Title Page

Drawing 2 Existing Conditions

Drawing 3 Interpreted Bottom of CCR

Drawing 4 Volume Isopach of CCR

Drawing 5 Final Grading – Plan View

Drawing 6 Final Grading – Sections I

Drawing 7 Final Grading – Sections II

Drawing 8 Erosion and Sediment Control Plan

Drawing 9 Erosion and Sediment Control Details

The Drawing Set presented herein is accurate at the time of preparing the Removal Plan and is subject to change pending further discussion with DEP.

7.3 Specifications

The proposed closure at Sutton is assumed to be implemented and constructed with quality materials. The technical specifications for all construction materials are presented in Appendix H.

7.4 Construction Quality Assurance Plan

The proposed closure at Sutton is assumed to be implemented and constructed using good construction practices, and that a good CQA program will be implemented. The CQA Plan for construction activities is presented in Appendix I.

8. MANAGEMENT OF WASTEWATER AND STORMWATER

8.1 Stormwater Management

This section describes the existing surface water runoff patterns and stormwater management features at Sutton, including general site topography, soils, and stormwater control structures. As described in Section 3.3, Sutton has a single NPDES permit and the sections related to stormwater are described below. This section also describes conceptual basin closure stormwater management plans and provisions for E&SC.

8.1.1 Existing Surface Water Runoff and Stormwater Management Features

The primary stormwater management features at Sutton include the 1971 Basin, the 1984 Basin, and a Discharge Canal that conveys water from the plant to the Cooling Pond. Figure 1 presents a site map depicting these features, including the relative proximity of the LOLA and existing plant operations.

The 1971 Basin covers an area of approximately 54 acres. Stormwater runoff is directed toward a surface water impoundment located along the west side of the basin, adjacent to the Cooling Pond. In 1983, the dikes of the 1971 Basin were raised by approximately eight ft. The 1971 Basin operated from 1971 to 2013 for CCR disposal and currently only receives stormwater. Stormwater discharge from the 1971 Basin is regulated by an existing riser structure and discharge pipe. Stormwater discharge from the 1971 Basin to the Cooling Pond is limited to infrequent and high-intensity storm events due to the relatively low normal water surface elevation within the impoundment area, the height of the riser structure control elevation, and resulting storage capacity.

The 1984 Basin covers an area of approximately 82 acres and was operated from 1984 to 2013. In 2006, an ICA was constructed within the footprint of the 1984 Basin. Stormwater runoff is directed toward a surface water impoundment located at the north side of the basin and adjacent to the Cooling Pond. Similar to the 1971 Basin, the 1984 Basin currently only receives stormwater, with discharge regulated by an existing riser structure and discharge pipe. Stormwater discharge from the 1984 Basin to the Cooling Pond is limited to infrequent and high-intensity storm events due to the relatively low normal water surface elevation within the impoundment area, the height of the riser structure control elevation, and resulting storage capacity.

8.1.2 Soils

Native soil types in the basin areas are generally characterized as well-drained (Type A) soils. As a result of the soil types present and the hydraulic conductivity previously documented in this report infiltration of stormwater into the underlying soils is relatively efficient (with the exception of the lined 1984 Basin). For areas exhibiting well-draining soils, peak stormwater discharge rates generated from the site are more readily managed, and erosion and sedimentation potential is reduced.

8.1.3 Current NPDES Permit

Sutton's NPDES Permit NC0001422 includes eight wastewater outfalls, four of which are internal outfalls that discharge to the effluent channel and four external outfalls that discharge to water bodies. The permit also includes seven internal stormwater outfalls that discharge to the effluent channel. The two receiving waterbodies are Sutton Lake (Cooling Pond) and the Cape Fear River. Outfall 001 is located at the southwest corner of the Intake Canal discharges into the Cape Fear River. Outfall 002 is located at the west side of the 1971 Basin and discharges into the Cooling Pond. Outfall 004 is located at the northwest side of the 1984 Basin and also discharges into the Cooling Pond or is routed to Outfall 001. Outfall 008 is located at the end of the effluent channel and conveys primarily recirculating cooling water, as well as stormwater and wastewater from internal outfalls, to the Cooling Pond. These outfalls are monitored in accordance with the following permit conditions:

- *Outfall 001*: Released Cooling Pond discharge, recirculation cooling water, non-contact water, and treated wastewater from the 1971 and 1984 Basins. Weekly and monthly monitoring screen the waters from the basin treatment system for various common pollutants attributed to the CCR generated in the processes at the plant. Additionally, since this is a direct discharge to the river, Outfall 001 has a toxicity testing requirement.
- *Outfall 002*: Discharges waters from the 1971 Basin, which is released to the Cooling Pond; parameters of concern for testing are arsenic, selenium, mercury, iron, aluminum, copper and zinc. This outfall also has a toxicity testing requirement. The plant has not discharged from this outfall since power generation ceased in November 2013.
- *Outfall 004*: Releases waters from the 1984 Basin; it consists of CCR sluice water, coal pile runoff, low volume wastes, and stormwater runoff. This wastewater can directly discharge into the Cape Fear River via Outfall 001, or to the Cooling Pond. The monitoring requirements at this outfall are identical to those at Outfall 002. Similar to Outfall 002, the plant has not discharged from this outfall to the Cooling Pond since November 2013. Discharges from the 1984 Basin are currently directed to the Cape Fear River via Outfall 001.
- *Outfall 008*: This outfall was newly created in 2015 after NCDEQ reclassified the Cooling Pond as waters of the state (Sutton Lake). Cooling water and wastewater from the combined cycle facility are currently conveyed to the Cooling Pond through this outfall. Stormwater from Internal Outfalls SW001 through SW007 are also directed to this outfall. Parameters limited in the NPDES permit are similar to those described for the other outfalls, in addition to temperature as described below.

NCDEQ historically has permitted a temperature mixing zone in the Cape Fear River to account for the discharge of heated water from the plant through the Cooling Pond into the Cape Fear River via Outfall 001. The mixing zone extends from 2,700 feet upstream of the Outfall 001 discharge gate to 6,600 feet downstream. The NCDEQ Fact Sheet associated with NPDES Permit NC0001422 states that Sutton has to develop a strategy to meet the state temperature standard in the Cooling Pond. NPDES Permit NC0001422 states that the instream temperature

1000 feet from Outfall 008 shall be monitored weekly but that the temperature limit of the receiving water (the Cooling Pond), which shall not be increased by more than 2.8°C above ambient water temperature and in no case exceed 32°C, is not being implemented until further notice.

8.1.4 Conceptual Basin Closure Stormwater Management

This section presents a conceptual level discussion of the anticipated work associated with one possible stormwater management solution. A final stormwater management plan for the basins will be prepared at a later date and submitted under a separate cover.

The final grading plan for the basin closure design is shown on Drawing 5. During excavation and removal of CCR deposits from the 1971 Basin, 1984 Basin, and the LOLA stormwater runoff will be managed and contained within the limits of each individual basin or work area. Thus, no off-site stormwater discharge will take place from the active excavation areas during construction.

Once the CCR deposits are removed, the excavation side slopes will be graded to 3:1 (horizontal to vertical) slopes and stabilized using erosion control matting and permanent seeding. The dikes separating the 1971 Basin from the Discharge Canal and Cooling Pond will then be breached in the areas designated on the drawings, establishing a hydraulic connection between the 1971 Basin, the Discharge Canal, and the Cooling Pond.

For the 1984 Basin, the Removal Plan includes establishing a gentle surface slope from east to west, directing surface runoff toward the Cooling Pond. During grading operations, the surface flow will be directed toward a temporary sediment basin through a combination of surface channels and diversion berms. The sediment basin will be sized for capturing sediment generated from the effective disturbed drainage area, and to treat total suspended solids (TSS) loading to NCDEQ standards.

8.1.5 Erosion and Sediment Control

Stormwater management and E&SC will be provided throughout each phase of basin closure construction through the design, installation, and maintenance of numerous E&SC measures (i.e. sediment fence, check dams, sediment basins, temporary and permanent vegetation) and open channels, stormwater pipes, and overflow structures. A site-wide E&SC permit for clearing and grading activities ancillary to the basin closure work was received from the Division of Energy, Mineral, and Land Resources on 18 March 2016. A phased approach will be used to identify and design appropriate stormwater management and E&SC features necessary for each specific phase of construction, modifying the permitted features and controls as construction progresses.

Although design and discussion of the phased construction features are beyond the scope of this document, a preliminary, final conditions E&SC plan and details are provided in Drawings 8 and 9, respectively.

8.2 Wastewater: Overview

This section presents a conceptual level discussion of the anticipated work associated with one possible wastewater management solution. A final wastewater management plan for the basins will be prepared at a later time and submitted under a separate cover.

CAMA calls for a description of wastewater disposal provisions in the Removal Plan. In October 2014, DEP provided a Work Plan document to NCDEQ which outlined a plan that included wastewater handling and treatment based on the current NPDES permit limits. Since then, Sutton has received a new NPDES permit that prescribes limits for CCR basin wastewater discharges through both bulk and interstitial dewatering activities. Treated CCR basin water will be discharged through the North 1984 Basin tower at existing permitted Outfall 001 to the Cape Fear River, with numerical limits for arsenic, selenium, mercury, copper, and iron. During interstitial dewatering, flow rates will be limited to be consistent with historic rates (2.1 million gallons per day [MGD]). As previously stated, a toxicity test is also required for this outfall.

The current CCR removal plan calls for the removal of CCR from the 1971 Basin through different methods than from the 1984 Basin and LOLA. Complete dewatering of the 1971 Basin to then allow for heavy excavation equipment to operate directly on top of the CCR in the basin has been deemed impractical due to the high groundwater recharge rates (e.g., the dewatering rate could likely not keep up with the recharge rate under practical scenarios). Therefore, the planned removal of CCR from the 1971 Basin incorporates hydraulic dredging and dewatering of the resulting dredged material.

The wastewater generated during CCR removal will be directed back to the 1971 Basin. As shown in Drawing 5, DEP plans to remove portions of the dike separating the 1971 Basin from the Cooling Pond to combine them into one water body. As such, the 1971 Basin will require water treatment for COI prior to dike removal to create the larger Basin. The wastewater management plan has not yet been finalized. However, the discharge procedure could include monitoring the discharge from the 1971 Basin to the Cooling Pond for a specific time period and/or a sampling program for the 1971 Basin prior to/and or during dike removal to ensure that the water in the 1971 Basin as a whole meets NPDES discharge limits.

Regardless of current and future NPDES permit requirements, wastewater is anticipated to require onsite treatment for TSS, metals, and other COI before discharge to the Cape Fear River or the Cooling Pond.

8.2.1 NPDES Permit Limits

Both the Cape Fear River and Sutton Lake (Cooling Pond) are classified as Class C-Swamp waters in the Cape Fear River Basin. As described above, NPDES Permit NC0001422 as it pertains to CCR basin water authorizes the facility to discharge from Outfalls 004 (to Cooling Pond) and 001 (to Cape Fear) as described below. Additional NPDES Permit limits are described in Section 8.1.3.

- *Outfall 001:* Cooling Pond blowdown, recirculation cooling water, non-contact cooling water, and treated wastewater from the 1971 and 1984 Basins. This outfall discharges to the Cape Fear River.

- *Outfall 004:* CCR sluice water, coal pile runoff, low volume wastes, and stormwater runoff. This internal outfall discharges to either the Cooling Pond or via Outfall 001 to the Cape Fear River.

The NPDES permit for Sutton contains discharge limits and monitoring requirements for CCR basin wastewater, which makes a distinction for treatment limits for (1) bulk water above the settled CCR layer that does not involve mechanical disturbance from the CCR and (2) interstitial water. Currently, treated wastewater from the 1984 Basin is discharged through Outfall 001 to the Cape Fear River. Numerical limits for bulk and interstitial water discharge through Outfall 001 are provided in Table 7 and Table 8, respectively. Limits for Outfall 004 to the Cooling Pond for bulk water are provided in Table 9.

8.2.2 Treatment Methods Evaluation

Water quality sampling and analysis of bulk water from the 1971 and 1984 Basins and entrapped water from the 1971 Basin have been conducted as part of CCR basin dewatering design at Sutton to help evaluate water quality with respect to NPDES Permit discharge limits and monitored parameters, and serve as a basis of design for water treatment. Based on these results, bulk water characteristics are consistent with historical water discharged at the plant and therefore does not require additional treatment. Interstitial water will require treatment before discharge.

Bulk dewatering from the 1984 Basin is currently underway. The treatment system to meet NPDES permit limits for interstitial water has been designed, evaluated, and installed.

However, the treatment methodology for water from the 1971 Basin generated during hydraulic dredging has yet to be finalized. For that water, a treatment method evaluation using the Basis of Design Report will be performed. The treatment system will also account for requirements for the breach of the dike between the Cooling Pond (Sutton Lake) and the 1971 Basin dike and has yet to be finalized.

8.2.2.1 Equipment Evaluation

Relevant treatment technologies (unit processes) that can achieve the treatment goals set forth in the Basis of Design Report for the 1971 Basin dredge water will be identified. The technologies will be screened as to their potential ability to treat the targeted constituents based upon published literature and vendor information. The evaluation will include a qualitative analysis of the cost of the technologies from both a capital and operations standpoint. In addition, this evaluation will include a constructability analysis to determine if land area is available and the infrastructure (electric, water, etc.) improvements that would be required for implementation of the technology.

8.2.2.2 Bench and Pilot Testing Plan Development

Depending on the water quality requirements for the combined Cooling Pond/1971 Basin water body, bench and/or pilot testing of the selected technologies may be required to ensure that the treatment system can meet the discharge goals for COI. The limits for these COI, if similar to those for the Outfall 004 discharge, for example, would be at low concentrations that will require assurances if the removal is achievable by the technologies. As part of this task, a bench, and/or pilot testing plan may be developed to evaluate the technologies and develop data required for the detailed design of the treatment system.

8.2.2.3 Calculations Packages

Technology evaluation and (if required) bench and/or pilot testing, and engineering calculations will be prepared for the treatment system using data collected and developed from the Basis of Design Report. These calculations will be utilized for the equipment sizing in the detailed design of the treatment system.

8.2.2.4 Wastewater Treatment System Evaluation Report

A wastewater treatment system evaluation report that will incorporate the feasibility of alternative treatment options, schedule, cost, and dewatering approach must be provided. Geosyntec will evaluate equipment and treatment methods based upon the work conducted in the previous subtasks to prepare a design document package moving forward. A constructability analysis will also be performed to identify potential obstacles during construction for the recommended option. Technical memos, calculation packages, and similar items will also be prepared as part of the Wastewater Treatment System Evaluation Report.

8.2.3 Meeting Water Quality Limits

Demonstration of water quality limits for the 1971 Basin required to breach the dike and mixing 1971 Basin water with Cooling Pond water will need to be verified through sampling strategies, to be established. A sampling method and standard must be developed and approved in order to define the water quality. Water quality sampling protocols will need to be developed to include a number of sampling points, location and depth of water in the 1971 Basin.

8.2.4 Treatment Implementation Timing

The CCR excavation process in the 1971 Basin could increase the concentration of TSS and other COI in the water in the immediate vicinity of the dredging location. Computational fluid dynamics (CFD) has been used by DEP and others to model TSS in basins as a function of distance from disturbances and could guide placement of floating weirs and other wastewater handling equipment to remove water from the basin to limit the concentration of TSS and other COI at the wastewater treatment system intake. CFD (or similar alternative) will be used to determine how and when to begin wastewater treatment in the 1971 Basin to reduce overall wastewater treatment time by showing, for example, where the impacts of dredging are insignificant to the wastewater treatment process.

9. DESCRIPTION OF FINAL DISPOSITION OF CCR

As part of the closure activities, CCR will be excavated and transported from the basins to on-site landfill or off-site structural fill using trucks and rail cars. CCR from Sutton is being transported by truck and/or rail to the Brickhaven Clay Mine, located in Chatham County, NC. CCR is being placed in a fully lined structural fill to reclaim the former clay mine back to the natural topography. To date, approximately 1.2 M tons have been excavated and transported off-site.

CCR will also be excavated and placed in an on-site CCR landfill designed to comply with all state and federal requirements. CCR will be placed at a ±5 percent of optimum moisture content and compacted (e.g., 95% standard Proctor) to provide structural stability during operations and post-closure. An engineered cover will be placed to provide separation and stormwater management following completion of filling activities. A Site Application and Onsite CCR Landfill Construction Application Report were prepared by Geosyntec on behalf of DEP as part of the landfill construction application submitted to NCDEQ in May 2015 and August 2015, respectively. The Site Application and Construction Application were approved by NCDEQ in July 2015 and September 2016, respectively.

10. APPLICABLE PERMITS FOR CLOSURE

New permits and modifications to existing permits will be required to support Removal Plan implementation. A list of applicable permits and permit modifications includes but is not limited to:

- E&SC plans;
- Possible NPDES permit modification;
- Section 401/404 permits;
- Dam decommissioning/modification of existing dams; and
- Solid waste permits for the landfill.

A Site Application and Onsite CCR Landfill Construction Application Report were prepared by Geosyntec on behalf of DEP as part of the landfill construction application submitted to NCDEQ in May 2015 and August 2015, respectively. The Site Application and Construction Application were approved by NCDEQ in July 2015 and September 2016, respectively.

11. POST-CLOSURE MONITORING AND CARE

Post-closure activities will be conducted at Sutton in accordance with all applicable statutory and regulatory requirements. Monitoring will include sampling of groundwater three times per year, and monthly inspection of the final cover systems. Maintenance will include mowing as necessary to promote a healthy vegetative cover. Maintenance activities will be initiated no later than 60 days after the discovery or within 24 hours if a danger or imminent threat to human health or the environment is indicated. A Post-Closure Care Plan is presented in Appendix J.

11.1 Groundwater Monitoring Program

As indicated in Section 3.3, the CSA Report and CSA Supplement 1 [SynTerra, 2015a, 2016b] were submitted to NCDEQ on 5 August 2015 and 31 August 2016, respectively, and addressed CAMA regulations § 130A-309.209(a)(4) and § 130A-309.209(d). The CSA provided an update of site conditions which included the delineation of the horizontal and vertical extent of constituents of interest in the soil, surface water, and groundwater. The CSA concluded with a proposed groundwater monitoring network consisting of 36 wells, however, several of the proposed groundwater monitoring wells are located within the proposed onsite landfill footprint. Consequently, the proposed monitoring network submitted by SynTerra will likely need to be re-evaluated to take into account the landfill and other recently constructed site features (e.g., scale house) and consider the comments (if any) provided by NCDEQ on the CSA. Once NCDEQ has provided comment on the CSA, Geosyntec will submit a revised Water Quality Monitoring Plan (WQMP).

12. PROJECT MILESTONES AND COST ESTIMATES

12.1 Project Schedule

Critical milestones are summarized in the table below.

MILESTONE	DATE
Submit Excavation Plan	13 November 2014 (actual/completed)
Complete Comprehensive Engineering Review	30 November 2014 (actual/completed)
Excavation Plan Acknowledgement	2 February 2015 (actual/completed)
Submit Updated Excavation Plan	13 November 2015 (actual/completed)
Commence Work – Ash Removal	30 October 2015 (actual/completed)
Receive NPDES Wastewater Permit	11 December 2015 (actual/completed)
Receive Permit-to-Construct Onsite Landfill	September 2016 (actual/completed)
Receive Permit-to-Operate On-Site Landfill	August 2017
Submit Updated Excavation Plan	December 2016
Submit Updated Excavation Plan	December – Annually
Eliminate Stormwater Discharge into Impoundments	July 2016 (actual/completed)
1971 and 1984 Basins closed pursuant to Part II, Sections 3.(b) and 3.(c) of the Coal Ash Act	February 2020

12.2 Closure and Post-Closure Cost Estimate

Volume calculations were performed between pertinent surfaces (existing topography, the bottom of CCR contours, top of grade to drain surface, etc.) using Autodesk Civil 3D 2014 (Civil 3D). Civil 3D creates three-dimensional (3D) surfaces (triangular irregular network surfaces) using topographical survey information and elevation data and uses these surfaces to calculate the volume and thickness of the fill. The thicknesses are then graphed as isopachs (contours connecting points of equal thickness).

As-built drawings for the bottom of CCR grades were not available for the 1971 CCR Basin; however, as-built drawings for the 1984 CCR Basin area are available. The data sources used to develop the bottom of CCR grades for the 1971 and 1984 Basins are provided in Appendix K. The lateral extents of the 1971 Borrow Area were interpreted based on historical aerial photographs provided in Appendix K. This information was supplemented by the field investigation performed by Geosyntec on April 2015. The volume of CCR to be removed from each basin is presented in Table 3 and isopachs for existing CCR in place and various construction quantities are presented in Appendix K.

The estimated cost associated with the assessment, corrective action, closure, and post-closure care of the site, and water line connection was prepared internally by Duke Energy to support the Duke Energy Carolinas (DEC) and DEP 31 December 2016 CCR asset retirement obligations within the balance sheets of the audited financial statements on Form 10-K submitted to the Securities and Exchange Commission. This cost estimate it presented in Appendix L.

13. REFERENCED DOCUMENTS

Amec Foster Wheeler Environment and Infrastructure, Inc. (2015), "Phase 2 Reconstitution of Ash Pond Designs, Final Report Submittal, Revision 0, L.V. Sutton Energy Complex".

Bain, G.L. (1970). Geology and Groundwater Resources of New Hanover County, North Carolina. Groundwater Bulletin No. 17, United States Geological Survey, p. 90.

Blasland, Bouck, and Lee, Inc. (BBL) (2005). Phase II Remedial Investigation Report for the Former Ash Disposal Area, L.V. Sutton Steam Electric Plant, Wilmington, NC. May 2005.

Blasland, Bouck, and Lee, Inc. (BBL) (2006). Remedial Action Plan, L.V. Sutton Steam Electric Plant, Wilmington, NC. March 2006.

Campbell, B.G., and Coes, A.L., eds., (2010), "Groundwater availability in the Atlantic Coastal Plain of North and South Carolina", U.S. Geological Survey Professional Paper 1773, 241 p., 7 pls.

Catlin (2012). Phase II Groundwater Quality Assessment for Ash Pond Impacts at the L.V. Sutton Electric Plant, Wilmington, North Carolina; July 2012.

Dewberry & Davis, LLC (2011). Coal Combustion Residue Impoundment Round 9 – Dam Assessment Report – L.V. Sutton Stream Electric Plant Ash Basins, Progress Energy Carolinas, Inc., Wilmington, North Carolina.

Environmental Protection Agency (EPA) Region 4 (2011a). Soil Sampling Operating Procedure. Science and Ecosystem Support Division. Athens, Georgia.

Environmental Protection Agency (EPA) Region 4 (2011b). Groundwater Sampling Operating Procedure. Science and Ecosystem Support Division. Athens, Georgia.

Environmental Protection Agency (EPA) (2015), "40 CFR Parts 257 and 261, Hazardous and Solid CCR Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule"

Geosyntec Consultants, Inc. (2014a). Data Interpretation and Analysis Report – Conceptual Closure Plan – L.V. Sutton Plant, September 2014.

Geosyntec Consultants, Inc. (2014b), "Preliminary Site Investigation Data Report Addendum No. 1, Conceptual Closure Plan, L.V. Sutton Plant."

Geosyntec Consultants, Inc. (2014c), "Data Interpretation and Analysis Report, Conceptual Closure Plan, L.V. Sutton Plant."

Geosyntec Consultants, Inc. (2015a), Site Suitability Report – Volume II – Hydrogeologic Report. May 2015.

Geosyntec Consultants, Inc. (2015b), Onsite CCR Landfill Construction Application Report, August 2015.

Harden, S.L., Fine, J.M, & Spruill, T.B. (2003). Hydrogeology and Groundwater Quality of Brunswick County, North Carolina. Water Resources Investigation Report 03-4051, United States Geological Survey, p. 98.

Harder Jr., L.F., Bray, J.D., Volpe, R.L., and Rodda, H.V. (1998), “The Loma Prieta, California, Earthquake of October 17, 1989 - Performance of Earth Dams During the Loma Prieta Earthquake”, U.S. Geological Survey Professional Paper 1552-D.

Idriss, I. M., and Boulanger, R. W., (2008) “Soil Liquefaction During Earthquakes”, Earthquake Engineering Research Institute, EERI Publication MNO-12.

MACTEC Engineering and Consulting, Inc. (2011), “Ash Pond Dike Stability Analysis, Progress Energy – Sutton Plant, New Hanover County, North Carolina”

McSwain, K.B., Gurley, L.N., and Antolonio, D.J. (2014), “Hydrogeology, hydraulic characteristics, and water-quality conditions in the surficial, Castle Hayne and Peedee aquifers of the greater New Hanover County area, North Carolina”, 2012-13: U.S. Geological Survey Scientific Investigations Report 2014-5169, 52 p., *http://dx.doi.org/10.3133/sir21045169*

National Earthquake Hazards Reduction Program (NEHRP) (2009), “NEHRP Recommended Seismic Provisions for New Buildings and Other Structures (FEMA P-750), 2009 Edition”.

North Carolina Department of Environment and Natural Resources (NCDENR) (1980), “North Carolina Administrative Code – Title 15A, Subchapter 2K – Dam Safety”

North Carolina Department of Environment and Natural Resources (NCDENR) (2013), “North Carolina Administrative Code – Title 15A, Subchapter 2L – Classifications and Water Quality Standards Applicable to the Groundwaters of North Carolina”

SynTerra Corporation (2015a), “Comprehensive Site Assessment Report, Duke Energy L.V. Sutton Energy Complex”, August 5, 2015.

SynTerra Corporation (2015b), “Corrective Action Plan, Part 1, Duke Energy L.V. Sutton Energy Complex, New Hannover County North Carolina”, November 2, 2015.

SynTerra Corporation (2016a), “Corrective Action Plan, Part 2, Duke Energy L.V. Sutton Energy Complex, New Hannover County North Carolina”, February 1, 2016.

SynTerra Corporation (2016b), “Comprehensive Site Assessment Report, Supplement 1, Duke Energy L.V. Sutton Energy Complex”, August 31, 2016.

United States Army Corps of Engineers (USACE) (2003), “Engineering and Design – Slope Stability”, Engineering Manual EM 1110-2-1902, October 2003.

United States Geological Survey (USGS) (2008), "2008 Interactive Deaggregations". http://geohazards.usgs.gov/deaggint/2008/

United States Geological Survey (USGS) (2014), "2014 National Seismic Hazard Maps". http://earthquake.usgs.gov/hazards/products/conterminous/

Winner & Coble. (1996). Hydrogeologic Framework of the North Carolina Coastal Plain. Professional Paper 1404-I, United States Geological Survey, p. 119.

TABLES

Table 1. Federal CCR Rule [EPA, 2015] Removal Plan Requirements Cross Reference Summary

Federal Register Vol. 80 No. 74 Part 2 (April 17, 2015)/40 CFR Part 257: Environmental Protection, Beneficial Use, Coal Combustion Products, CCR, Coal Combustion Waste, Disposal, Hazardous Waste, Landfill, Surface Impoundments, 40 CFR §257.102 (b)(1) (i. - vi) Removal Plans for all impoundments shall include all of following:		
No.	**Description**	**Corresponding Removal Plan Section**
i.	Narrative description of how CCR unit will be closed (in accordance with this section)	All Sections
ii.	If closure is through the removal of CCR from the unit, description of procedures to remove CCR and decontaminate CCR unit (in accordance with (c))	7
iii.	If closure by leaving CCR in place, description of final cover system (in accordance with (d)), methods & procedures used to install final cover, and also discussion of how final cover will achieve performance standards (in accordance with (d))	N/A
iv.	Estimate of maximum inventory of CCR ever on site over active life of CCR unit	3.1.2 &12.2
v.	Estimate of largest area of CCR unit ever requiring a final cover (in accordance with (d)) at any time during active life of CCR unit	7.1
vi.	Schedule for completion of all activities necessary to satisfy closure, including estimate of year in which all closure activities will be completed. Sufficient information to describe sequential steps of closure, including:	12.1
a.	Obtaining approvals and permits	10
b.	Dewatering and stabilization phases	8
c.	Installation of final cover system	11
d.	Estimated timeframes to complete each step/phase	12.1

Table 2. North Carolina CAMA Removal Plan Requirements

Part II. Provisions for Comprehensive Management of Coal Combustion Residuals § 130A-309.214(a)(4) Removal Plans for all impoundments shall include all of the following:		
No.	**Description**	**Corresponding Removal Plan Section**
a. Facility and coal combustion residuals surface impoundment description. – A description of the operation of the site that shall include, at a minimum, all of the following:		
1	Site history and history of site operations, including details on the manner in which coal combustion residuals have been stored and disposed of historically.	3.1.1
2	Estimated volume of material contained in the impoundment.	3.1.2 & 12.2
3	Analysis of the structural integrity of dikes or dams associated with impoundment.	3.1.3
4	All sources of discharge into the impoundment, including volume and characteristics of each discharge.	3.1.4
5	Whether the impoundment is lined, and, if so, the composition thereof.	3.1.5
6	A summary of all information available concerning the impoundment as a result of inspections and monitoring conducted pursuant to this Part and otherwise available.	3.1.6
b. Site maps, which, at a minimum, illustrate all of the following:		
1	All structures associated with the operation of any coal combustion residuals surface impoundment located on the site. For purposes of this sub-subdivision, the term "site" means the land or waters within the property boundary of the applicable electric generating station.	3.2.1
2	All current and former coal combustion residuals disposal and storage areas on the site, including details concerning coal combustion residuals produced historically by the electric generating station and disposed of through transfer to structural fills.	3.3
3	The property boundary for the applicable site, including established compliance boundaries within the site.	3.3
4	All potential receptors within 2,640 feet from established compliance boundaries.	3.2.2
5	Topographic contour intervals of the site shall be selected to enable an accurate representation of site features and terrain and in most cases should be less than 20-foot intervals.	3.3
6	Locations of all sanitary landfills permitted pursuant to this Article on the site that are actively receiving waste or are closed, as well as the established compliance boundaries and components of associated groundwater and surface water monitoring systems.	3.2.3
7	All existing and proposed groundwater monitoring wells associated with any coal combustion residuals surface impoundment on the site.	3.3
8	All existing and proposed surface water sample collection locations associated with any coal combustion residuals surface impoundment on the site.	3.3
c. The results of a hydrogeologic, geologic, and geotechnical investigation of the site, including, at a minimum, all of the following:		
1	A description of the hydrogeology and geology of the site.	4.1
2	A description of the stratigraphy of the geologic units underlying each coal combustion residuals surface impoundment located on the site.	4.2
3	The saturated hydraulic conductivity for (i) the coal combustion residuals within any coal combustion residuals surface impoundment located on the site and (ii) the saturated hydraulic conductivity of any existing liner installed at an impoundment, if any.	4.3
4	The geotechnical properties for (i) the coal combustion residuals within any coal combustion residuals surface impoundment located on the site, (ii) the geotechnical properties of any existing liner installed at an impoundment, if any, and (iii) the uppermost identified stratigraphic unit underlying the impoundment, including the soil classification based upon the Unified Soil Classification System, in-place moisture content, particle size distribution, Atterberg limits, specific gravity, effective friction angle, maximum dry density, optimum moisture content, and permeability.	4.4
5	A chemical analysis of the coal combustion residuals surface impoundment, including water, coal combustion residuals, and coal combustion residuals-affected soil.	4.5
6	Identification of all substances with concentrations determined to be in excess of the groundwater quality standards for the substance established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code, including all laboratory results for these analyses.	4.6
7	Summary tables of historical records of groundwater sampling results.	4.6
8	A map that illustrates the potentiometric contours and flow directions for all identified aquifers underlying impoundments (shallow, intermediate, and deep) and the horizontal extent of areas where groundwater quality standards established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code for a substance are exceeded.	4.7
9	Cross-sections that illustrate the following: the vertical and horizontal extent of the coal combustion residuals within an impoundment; stratigraphy of the geologic units underlying an impoundment; and the vertical extent of areas where groundwater quality standards established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code for a substance are exceeded.	4.8
d. The results of groundwater modeling of the site that shall include, at a minimum, all of the following:		
1	An account of the design of the proposed Removal Plan that is based on the site hydrogeologic conceptual model developed and includes (i) predictions on post-closure groundwater elevations and groundwater flow directions and velocities, including the effects on and from the potential receptors and (ii) predictions at the compliance boundary for substances with concentrations determined to be in excess of the groundwater quality standards for the substance established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code.	5

Table 2. North Carolina CAMA Removal Plan Requirements (Continued)

Part II. Provisions for Comprehensive Management of Coal Combustion Residuals § 130A-309.214(a)(4) Removal Plans for all impoundments shall include all of the following:		
No.	**Description**	**Corresponding Removal Plan Section**
2	Predictions that include the effects on the groundwater chemistry and should describe migration, concentration, mobilization, and fate for substances with concentrations determined to be in excess of the groundwater quality standards for the substance established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code pre- and post-closure, including the effects on and from potential receptors.	5
3	A description of the groundwater trend analysis methods used to demonstrate compliance with groundwater quality standards for the substance established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code and requirements for corrective action of groundwater contamination established by Subchapter L of Chapter 2 of Title 15A of the North Carolina Administrative Code.	5
e.	**A description of any plans for beneficial use of the coal combustion residuals in compliance with the requirements of Section .1700 of Subchapter B of Chapter 13 of Title 15A of the North Carolina Administrative Code (Requirements for Beneficial Use of Coal Combustion By-Products) and Section .1205 of Subchapter T of Chapter 2 of Title 15A of the North Carolina Administrative Code (Coal Combustion Products Management).**	6.1
f.	**All engineering drawings, schematics, and specifications for the proposed Removal Plan. If required by Chapter 89C of the General Statutes, engineering design documents should be prepared, signed, and sealed by a professional engineer.**	7.1, 7.2, 7.3
g.	**A description of the construction quality assurance and quality control program to be implemented in conjunction with the Removal Plan, including the responsibilities and authorities for monitoring and testing activities, sampling strategies, and reporting requirements.**	7.4
h.	**A description of the provisions for disposal of wastewater and management of stormwater and the plan for obtaining all required permits.**	8
i.	**A description of the provisions for the final disposition of the coal combustion residuals. If the coal combustion residuals are to be removed, the owner must identify (i) the location and permit number for the coal combustion residuals landfills, industrial landfills, or municipal solid waste landfills in which the coal combustion residuals will be disposed and (ii) in the case where the coal combustion residuals are planned for beneficial use, the location and manner in which the residuals will be temporarily stored. If the coal combustion residuals are to be left in the impoundment, the owner must (i) in the case of closure pursuant to sub-subdivision (a)(1)a. of this section, provide a description of how the ash will be stabilized prior to completion of closure in accordance with closure and post-closure requirements established by Section .1627 of Subchapter B of Chapter 13 of Title 15A of the North Carolina Administrative Code and (ii) in the case of closure pursuant to sub-subdivision (a)(1)b. of this section, provide a description of how the ash will be stabilized pre- and post-closure. If the coal combustion residuals are to be left in the impoundment, the owner must provide an estimate of the volume of coal combustion residuals remaining.**	9
j.	**A list of all permits that will need to be acquired or modified to complete closure activities.**	10
k.	**A description of the plan for post-closure monitoring and care for an impoundment for a minimum of 30 years. The length of the post-closure care period may be (i) proposed to be decreased or the frequency and parameter list modified if the owner demonstrates that the reduced period or modifications are sufficient to protect public health, safety, and welfare; the environment; and natural resources and (ii) increased by the Department at the end of the post-closure monitoring and care period if there are statistically significant increasing groundwater quality trends or if contaminant concentrations have not decreased to a level protective of public health, safety, and welfare; the environment; and natural resources. If the owner determines that the post-closure care monitoring and care period is no longer needed and the Department agrees, the owner shall provide a certification, signed and sealed by a professional engineer, verifying that post-closure monitoring and care has been completed in accordance with the post-closure plan. If required by Chapter 89C of the General Statutes, the proposed plan for post-closure monitoring and care should be signed and sealed by a professional engineer. The plan shall include, at a minimum, all of the following:**	11
1	A demonstration of the long-term control of all leachate, affected groundwater, and stormwater.	11
2	A description of a groundwater monitoring program that includes (i) post-closure groundwater monitoring, including parameters to be sampled and sampling schedules; (ii) any additional monitoring well installations, including a map with the proposed locations and well construction details; and (iii) the actions proposed to mitigate statistically significant increasing groundwater quality trends.	11
l.	**An estimate of the milestone dates for all activities related to closure and post-closure.**	12.1
m.	**Projected costs of assessment, corrective action, closure, and post-closure care for each coal combustion residuals surface impoundment.**	12.2
n.	**A description of the anticipated future use of the site and the necessity for the implementation of institutional controls following closure, including property use restrictions, and requirements for recordation of notices documenting the presence of contamination, if applicable, or historical site use.**	6.2
§ 130A-309.214(b)(3) No later than 60 days after receipt of a proposed Removal Plan, the Department shall conduct a public meeting in the county or counties proposed Removal Plan and alternatives to the public.		
§ 130A-309.214(d) Within 30 days of its approval of a Coal Combustion Residuals Surface Impoundment Removal Plan, the Department shall submit the Removal Plan to the Coal Ash Management Commission.		

Table 3. Estimated Quantities and Types of CCR for CCR Basins and Other Areas at Sutton

Basin	Volume (cy)	Type CCR[1]
1971 Basin	3,184,000 (3,820,800 tons)	Bottom ash and fly ash
1984 Basin	2,362,000 (2,834,400 tons)	Bottom ash and fly ash
Lay of Land Area (LOLA)	572,000 (686,400 tons)	Mostly bottom ash and soil
Total	6,118,000 (7,341,600 tons)	

Note(s):

[1] Tons calculated assuming a density of approximately 1.2 tons/cy.

[2] Sutton did not have FGD removal systems, and therefore FGD residuals are not expected within the CCR Basins.

Table 4. Summary of Available Inspection Reports

Year	Type	Consultant	General Conditions	Slope Stability	Hydrology and Hydraulics	Field Observations	Monitoring Information	Conclusions and Recommendations (from inspection or monitoring report)	Impoundment Modifications Performed as a Result of Inspection or Monitoring Activities
1987	Five Year Inspection	Law Engineering	Dikes found to be in generally good condition. No external, visible signs of serious conditons. Discharge structures found to be in generally good condition (1971 Basin discharge structure was not visible)	N/A	N/A	Items Inspected 1971 Basin - Dikes 1971 Basin - Discharge Structures 1984 Basin - Dikes 1984 Basin - Discharge Structures	N/A	Maintenance crews should monitor and repair any areas of erosion, including the sand cover of the 1984 Basin liner. Monitor the 1971 Basin discharge pipe and remove any accumulated soil.	N/A
2007	Five Year Inspection	MACTEC	Dikes found to be in generally good condition. Discharge structures found to be in generally good condition (1971 Basin discharge structure not inspected)	N/A	N/A	Items Inspected 1971 Basin - Dikes 1971 Basin - Discharge Structures 1984 Basin - Dikes 1984 Basin - Discharge Structures 2006 Interior Containment Area - Dikes	Plant staff were conducting monthly inspections following a checklist and the recommended inspection practices.	Clear dense vegetation. Continue to cut large trees. Continue monitoring vegetation growth.	N/A
2009	Annual Inspection	MACTEC	Dikes found to generally appear to be in stable and satisfactory condition. Discharge structures found to be in generally good condition (1971 Basin discharge structure not inspected)	N/A	N/A	Items Inspected 1971 Basin - Dikes 1971 Basin - Discharge Structures 1984 Basin - Dikes 1984 Basin - Discharge Structures 2006 Interior Containment Area - Dikes	N/A	Clear dense vegetation. Continue to cut large trees. Continue monitoring vegetation growth. Monitor for signs of seepage.	N/A

Table 4. Summary of Available Inspection Reports (Continued)

Year	Type	Consultant	General Conditions	Slope Stability	Hydrology and Hydraulics	Field Observations	Monitoring Information	Conclusions and Recommendations (from inspection or monitoring report)	Impoundment Modifications Performed as a Result of Inspection or Monitoring Activities
2010	Annual Inspection	MACTEC	Dikes found to generally appear to be in stable and satisfactory condition. Discharge structures found to be in generally good condition (1971 Basin discharge structure not inspected)	N/A	N/A	Items Inspected 1971 Basin - Dikes 1971 Basin - Discharge Structures 1984 Basin - Dikes 1984 Basin - Discharge Structures 2006 Interior Containment Area - Dikes	Plant staff were conducting monthly inspections following a checklist and the recommended inspection practices.	Clear dense vegetation. Continue to cut large trees. Continue monitoring vegetation growth. Monitor for signs of seepage. Repair local riprap slip around discharge structure in 2006 Interior Containment Area. Recommended that updated stability analysis be performed for 1971 Basin. Recommended that updated hydraulic analysis be performed for discharge structure in the 1971 Basin.	18 piezometers were installed on the 1984 Basin to investigate possible seepage. No evidence of seepage found. A breach on the east side of the 1984 Basin dike occurred on 27 September 2010. MACTEC providing support at time of inspection report.
2011	Annual Inspection - 1984 Basin	Amec	Dikes found to generally appear to be in stable and satisfactory condition. Discharge structures found to be in generally good condition.	Analysis was performed in 2011 for 1984 Basin. Calculated Factors of Safety found to be satisfactory.	N/A	Items Inspected 1984 Basin - Dikes 1984 Basin - Discharge Structures 2006 Interior Containment Area - Dikes	Plant staff were conducting monthly inspections following a checklist and the recommended inspection practices. Undocumented daily inspections also conducted during active CCR sluicing.	Clear dense vegetation. Continue to cut large trees. Continue monitoring vegetation growth. Survey and verify dike crest elevation. Repair animal burrows.	Permanent repair to breach of 1984 dike initiated on 11 February 2011 and completed 13 February 2011. Completion Report/Certification submitted 16 February 2011.
2012	Five Year Inspection - 1971 Basin	Amec	Dikes found to be in a generally stable and satisfactory condition. Discharge structures appeared to be operated and maintained in a satisfactory manner.	N/A	N/A	Items Inspected 1971 Basin - Dikes 1971 Basin - Discharge Structures	Plant staff were conducting monthly inspections following a checklist and the recommended inspection practices. Recommended that any changes or repairs be fully described in the inspection reports.	Continue to cut large trees. Continue monitoring vegetation growth.	N/A

Table 4. Summary of Available Inspection Reports (Continued)

Year	Type	Consultant	General Conditions	Slope Stability	Hydrology and Hydraulics	Field Observations	Monitoring Information	Conclusions and Recommendations (from inspection or monitoring report)	Impoundment Modifications Performed as a Result of Inspection or Monitoring Activities
2013	Annual Inspection - 1971 Basin	Amec	Dikes found to be generally stable and in fair condition. Soil-cement liner of intake canal in need of repair. Discharge riser found to be in generally good condition. Discharge pipe was not inspected.	N/A	N/A	Items Inspected 1971 Basin - Dikes 1971 Basin - Discharge Structures	Plant staff were conducting monthly inspections following a checklist and the recommended inspection practices. Undocumented daily inspections also conducted during active CCR sluicing.	Determine if piezometers should be abandoned. Inspect discharge pipe and determine if blocked. If pipe is blocked it should be cleared. Survey and verify dike crest elevation.	N/A
2013	Annual Inspection - 1984 Basin	Amec	Dikes found to generally appear to be in stable and satisfactory condition. Discharge structures found to be in satisfactory condition.	N/A	N/A	Items Inspected 1984 Basin - Dikes 1984 Basin - Discharge Structures 2006 Interior Containment Area - Dikes	Plant staff were conducting monthly inspections following a checklist and the recommended inspection practices. Undocumented daily inspections also conducted during active CCR sluicing.	Continue monitoring vegetation growth. Determine if piezometers should be abandoned. Inspect and repair animal burrows. Repair areas of erosion around splash pad of discharge structure. Clear vegetation and inspect discharge pipe. Survey and verify dike crest elevation.	N/A

Table 5. Historical Monitoring Well and Piezometer Construction Details

Location ID	Date Installed	Northing (ft)	Easting (ft)	Well Diameter (inches)	Screened Interval (ft bgs)	TOC (inner) Elevation Corrected to NAVD88 (ft)	Total Depth (ft bgs)	Constructed By
MW-1A**	12/4/1984	198312.98	2306558.21	2	12-17	20.46	17	Unknown
MW-1B	12/12/1984	-	-	2	22-27	20.61	27	Unknown
MW-2A	12/5/1984	-	-	2	12-17	23.86	17	Unknown
MW-2B[G]	12/12/1984	-	-	2	22-27	23.68	27	Unknown
MW-2C[G]	12/15/1986	-	-	2	40-45	24.59	45	Unknown
MW-3A	12/10/1984	-	-	2	12-17	16.92	17	Unknown
MW-3B	12/11/1984	-	-	2	22-27	16.86	27	Unknown
MW-4	12/13/1984	-	-	2	22-27	-	27	Unknown
MW-4A[G]	12/16/1986	-	-	2	12-17	-	17	Unknown
MW-4B[N]	12/12/1986	-	-	2	40-45	-	45	Unknown
MW-5A[T]	12/16/1986	-	-	2	12-17	-	17	Unknown
MW-5B[G]	12/15/1986	-	-	2	22-27	-	27	Unknown
MW-5C[N]	12/15/1986	-	-	2	40-45	-	45	Unknown
MW-6A**	12/16/1986	200371.81	2306083.31	2	12-17	15.69	17	Unknown
MW-6B[G]	12/16/1986	-	-	2	22-27	15.48	27	Unknown
MW-6C[G]	12/16/1986	-	-	2	40-45	15.65	45	Unknown
MW-7A	12/14/1986	-	-	2	12-17	-	17	Unknown
MW-7B	12/14/1986	-	-	2	22-27	-	27	Unknown
MW-7C[N,T]	12/14/1986	-	-	2	40-45	15.68	45	Unknown
MW-8[T]	2/8/1990	-	-	2	40-50	16.19	50	Unknown
MW-9	2/7/1990	-	-	2	40-50	26.49	50	Unknown
MW-10	2/8/1990	203192.17	2304857.67	2	40-50	26.58	50	Unknown
MW-11[N]	2/6/1990	-	-	2	40-50	24.40	50	Unknown
MW-12[N]	2/6/1990	-	-	2	40-50	19.86	50	Unknown
MW-13	5/25/2004	197946.82	2305021.78	2	3-13	16.91	13	Blasland, Bolick & Lee
MW-13D	1/28/2005	197963.95	2305018.78	2	33.5-38.5	16.86	39	Blasland, Bolick & Lee
MW-14**	5/25/2004	197250.99	2306180.30	2	1-11	12.97	11	Blasland, Bolick & Lee
MW-15	5/25/2004	196475.65	2306044.01	2	1-11	10.17	11	Blasland, Bolick & Lee
MW-15D	1/31/2005	196476.98	2306061.06	2	40-45	9.91	45	Blasland, Bolick & Lee
MW-16	6/7/2004	196974.53	2306754.58	2	2-12	15.61	12	Blasland, Bolick & Lee
MW-16D	6/7/2004	196961.33	2306759.71	2	42-47	15.13	47	Blasland, Bolick & Lee
MW-17	6/14/2004	-	-	2	45-50	29.79	50	Blasland, Bolick & Lee
MW-18	6/10/2004	-	-	2	45-50	21.03	50	Blasland, Bolick & Lee
MW-19[N]	6/15/2004	-	-	2	45-50	30.52	50	Blasland, Bolick & Lee
MW-20	2/2/2005	196257.98	2305318.10	2	4-14	12.4	14	Blasland, Bolick & Lee

Table 5. Historical Monitoring Well and Piezometer Construction Details (Continued)

Location ID	Date Installed	Northing (ft)	Easting (ft)	Well Diameter (inches)	Screened Interval (ft bgs)	TOC (inner) Elevation Corrected to NAVD88 (ft)	Total Depth (ft bgs)	Constructed By
MW-20D	2/1/2005	196256.89	2305326.09	2	43-48	12.14	48	Blasland, Bolick & Lee
MW-21C^{N}	9/16/2011	197773.53	2306913.73	2	40-45	30.17	45	Catlin Engineers and Scientists
MW-22B^{N}	9/15/2011	198349.05	2307016.96	2	23-27	19.04	27	Catlin Engineers and Scientists
MW-22C^{N}	9/15/2011	198349.48	2307023.29	2	39.5-44.5	19.10	45	Catlin Engineers and Scientists
MW-23B^{N}	9/6/2011	198967.44	2306901.76	2	21.5-26.5	16.20	27	Catlin Engineers and Scientists
MW-23C^{N}	9/7/2011	198972.10	2306903.52	2	40-45	16.64	45	Catlin Engineers and Scientists
MW-24B^{N}	9/9/2011	200712.12	2306251.09	2	23-27	15.37	27	Catlin Engineers and Scientists
MW-24C^{N}	9/12/2011	200716.55	2306263.90	2	40-45	15.02	45	Catlin Engineers and Scientists
MW-27B^{N}	9/8/2011	202585.56	2304679.81	2	22-27	31.77	27	Catlin Engineers and Scientists
MW-28B^{N}	9/28/2011	197368.43	2307359.97	2	25-30	31.77	30	Catlin Engineers and Scientists
MW-28C^{N}	9/21/2011	197356.57	2307354.09	2	40-45	30.93	45	Catlin Engineers and Scientists
MW-28T	9/22/2011	197370.11	2307352.85	2	55-60	32.14	60	Catlin Engineers and Scientists
MW-31B^{G}	9/13/2011	201045.10	2306851.42	2	22-27	17.50	27	Catlin Engineers and Scientists
MW-31C^{G,T}	9/14/2011	201046.82	2306858.17	2	40-45	17.51	45	Catlin Engineers and Scientists
MW-32C	11/14/2013			2	45-50	34.60	50	SynTerra
MW-34B	5/12/2014			2	22-27	20.37	27	Geosyntec
MW-34C	5/13/2014			2	40-45	20.19	45	Geosyntec
MW-35B	5/13/2014			2	22-27	27.37	27	Geosyntec
MW-35C	5/13/2014			2	40-45	27.37	45	Geosyntec
OAP-1	9/26/2011	-	-	2	5-15	-	15	Catlin Engineers and Scientists
OAP-2	9/26/2011	-	-	2	4-14	-	14	Catlin Engineers and Scientists
MW-32C^{G}	11/14/2013	197686.22	2307879.04	2	45-50	34.60	50	SynTerra
MW-33C**^{G,T}	11/13/2013	197598.47	2308274.92	2	40-45	24.66	45	SynTerra
PZ-1**	11/24/2008	201341.19	2305414.88	2	10-20	32.72	20	Golder Associates
PZ-1A**	-	201335.81	2305416.92	-	-	32.97	-	Unknown
PZ-1B	-	-	-	-	-	-	-	Unknown
PZ-2**	11/24/2008	201705.61	2305277.86	2	10-20	32.55	20	Golder Associates
PZ-2A**	-	201700.70	2305280.10	-	-	32.54	-	Unknown
PZ-2B	-	-	-	-	-	-	-	Unknown
PZ-3**	11/25/2008	202048.09	2304944.55	2	6-16	32.44	16	Golder Associates
PZ-3A**	-	202050.72	2304950.36	-	-	32.24	-	Unknown
PZ-3B	-	-	-	-	-	-	-	Unknown
PZ-4**	11/24/2008	201880.06	2304528.29	2	11-21	32.94	21	Golder Associates
PZ-4A**	-	201882.28	2304533.10	-	-	32.78	-	Unknown
PZ-4B	-	-	-	-	-	-	-	Unknown
PZ-5**	11/24/2008	201592.95	2304324.08	2	15-25	32.50	25	Golder Associates

Table 5. Historical Monitoring Well and Piezometer Construction Details (Continued)

Location ID	Date Installed	Northing (ft)	Easting (ft)	Well Diameter (inches)	Screened Interval (ft bgs)	TOC (inner) Elevation Corrected to NAVD88 (ft)	Total Depth (ft bgs)	Constructed By
PZ-5A**	-	201598.93	2304324.89	-	-	32.82	-	Unknown
PZ-5B	-	-	-	-	-	-	-	Unknown
PZ-6**	-	200985.53	2304343.62	-	-	33.03	-	Unknown
PZ-6A**	-	200991.36	2304343.40	-	-	33.25	-	Unknown
PZ-6B	-	-	-	-	-	-	-	Unknown
PZ-6D	12/6/2008	204200.00	2305620.40	2	80-100	29.61	100	Golder Associates
PZ-6S	11/25/2008	204191.30	2305618.60	2	16-26	29.85	26	Golder Associates
PZ-7	11/21/2008	203633.60	2305138.60	2	9-19	21.98	19	Golder Associates
PZ-8	11/25/2008	203942.50	2305532.20	2	20-30	35.08	30	Golder Associates
PZ-9	11/21/2008	203533.80	2305359.50	2	15-25	34.13	25	Golder Associates
PZ-10	5/25/2004	-	-	2	1-11	11.52	-	Unknown
PZ-10D	12/2/2008	203124.80	2305120.60	2	80-100	25.33	102	Golder Associates
PZ-10S	11/21/2008	203140.10	2305116.40	2	13-23	25.50	23	Golder Associates
PZ-11	11/20/2008	203258.90	2305266.00	2	9-19	22.77	19	Golder Associates
PZ-12	11/25/2008	203476.90	2305691.60	2	15-25	30.42	25	Golder Associates
PZ-13	11/20/2008	202946.00	2305558.80	2	15-25	28.53	25	Golder Associates
PZ-14	11/25/2008	203358.70	2305963.30	2	8-18	19.55	18	Golder Associates
PZ-15	11/20/2008	202702.70	2305482.10	2	9-19	21.02	19	Golder Associates
PZ-16	11/25/2008	202898.00	2305907.60	2	7-17	17.06	17	Golder Associates
PZ-17	11/20/2008	202570.20	2305697.40	2	4-14	17.30	14	Golder Associates
PZ-18	11/25/2008	202605.90	2306030.80	2	8-18	18.56	18	Golder Associates
PZ-19	11/20/2008	202207.80	2305730.00	2	7-17	16.64	17	Golder Associates
PZ-20	11/20/2008	201925.00	2305525.40	2	10-20	22.52	20	Golder Associates
PZ-21	12/1/2008	202152.60	2306342.40	2	14-24	27.67	24	Golder Associates
PZ-22	11/19/2008	201073.40	2305978.00	2	4-14	18.24	14	Golder Associates
PZ-23	11/26/2008	201410.80	2306536.90	2	3-13	14.17	13	Golder Associates
PZ-24	11/19/2008	200735.40	2305940.70	2	13-23	25.47	23	Golder Associates
PZ-25	11/26/2008	200416.50	2306852.90	2	17-27	30.21	27	Golder Associates
PZ-26	11/19/2008	199799.60	2306415.20	2	4-14	17.00	14	Golder Associates
PZ-27	11/19/2008	199451.70	2306844.80	2	20-30	35.30	30	Golder Associates
PZ-28	11/18/2008	199049.40	2306560.40	2	7-17	19.04	17	Golder Associates
PZ-29	11/18/2008	198828.80	2307625.60	2	12-22	24.92	22	Golder Associates
PZ-INT	5/7/2014	200420.50	2304536.30	2	13-18	42.58	18	Geosyntec
PZ-1971	5/9/2014	198492.38	2305987.63	2	17-22	47.98	22	Geosyntec
GWPZ-1A	5/8/2014	202183.51	2304953.21	1	10-15	15.00	15	Geosyntec
GWPZ-1B	5/8/2014	202181.71	2304948.23	1	22-27	27.00	27	Geosyntec
GWPZ-2A	5/8/2014	201760.44	2305335.14	1	10-15	15.00	15	Geosyntec

Table 5. Historical Monitoring Well and Piezometer Construction Details (Continued)

Location ID	Date Installed	Northing (ft)	Easting (ft)	Well Diameter (inches)	Screened Interval (ft bgs)	TOC (inner) Elevation Corrected to NAVD88 (ft)	Total Depth (ft bgs)	Constructed By
GWPZ-2B	5/8/2014	201755.59	2305337.34	1	22-27	27.00	27	Geosyntec
GWPZ-3A	5/7/2014	200404.04	2305825.52	2	10-15	22.00	15	Geosyntec
GWPZ-3B	5/7/2014	200405.32	2305829.62	2	22-27	21.99	27	Geosyntec
GWPZ-4A	5/7/2014	199057.58	2306398.82	2	10-15	21.24	15	Geosyntec
GWPZ-4B	5/7/2014	199058.85	2306403.64	2	22-27	21.20	27	Geosyntec
LA-PZ-1	2/10/2015	202897.98	2305358.04	2	40-50	22.95	50	Geosyntec
LA-PZ-2	2/11/2015	201637.48	2306475.92	2	35-45	29.28	50	Geosyntec
LA-PZ-3	2/13/2015	200553.67	2306698.53	2	36.5-46.5	25.75	50	Geosyntec
LA-PZ-4	2/16/2015	199963.74	2306964.30	2	40-50	21.48	50	Geosyntec
LA-PZ-5	2/12/2015	198148.10	2307616.62	2	39.5-49.5	25.04	50	Geosyntec
PZ-101	10/29/2014	200675.44	2304779.79	2	17-22	41.81	22	Geosyntec
PZ-102	10/29/2014	200868.15	2305186.86	2	17-22	41.32	22	Geosyntec
PZ-103	10/30/2014	200329.16	2305784.76	2	25-30	34.03	30	Geosyntec
PZ-104	11/4/2014	200008.41	2304134.25	2	25-30	32.79	30	Geosyntec
PZ-105	11/3/2014	198085.02	2305518.66	2	20.5-25.5	27.42	25	Geosyntec
PZ-106	11/3/2014	198414.87	2304821.39	2	20-25	27.04	25	Geosyntec
PZ-107	10/31/2014	198966.56	2304088.68	2	19.5-24.5	26.94	25	Geosyntec
PZ-108S	10/28/2014	198487.71	2304871.17	2	13-18	37.42	18	Geosyntec
PZ-108D	10/28/2014	198492.19	2304861.07	2	25-30	37.50	30	Geosyntec
ABMW-01D	3/28/2015	198964.17	2305386.78	2	103-108	45.71	108	SynTerra
ABMW-01S	3/29/2015	198968.22	2305388.87	2	71-76	45.75	76	SynTerra
ABMW-02D	3/27/2015	197177.19	2305583.43	2	41-45	10.10	45	SynTerra
ABMW-02S	3/27/2015	197177.71	2305589.13	2	3-8	9.98	8	SynTerra
AW-01B	1/31/2015	203061.57	2306091.71	2	20-25	16.61	25	SynTerra
AW-01C	1/31/2015	203064.20	2306090.72	2	40-45	16.55	45	SynTerra
AW-02B	1/31/2015	202156.49	2306450.12	2	20-25	27.08	25	SynTerra
AW-02C	1/31/2015	202160.58	2306445.96	2	42.4-47.4	27.20	48	SynTerra
AW-02D	5/10/2015	202147.28	2306457.78	2	92-97	26.62	97	SynTerra
AW-03B	2/2/2015	201583.66	2306678.86	2	20-25	18.23	25	SynTerra
AW-03C	2/2/2015	201584.81	2306673.94	2	40-45	18.20	48	SynTerra
AW-04B	1/30/2015	198812.83	2307820.78	2	20.4-25.4	18.62	25	SynTerra
AW-04C	1/29/2015	198803.25	2307818.27	2	40-45	18.43	48	SynTerra
AW-05B	2/2/2015	198021.26	2308134.95	2	20-25	23.70	25	SynTerra
AW-05C	2/2/2015	198024.46	2308133.35	2	40-45	23.69	47	SynTerra
AW-05D	6/10/2015	198024.76	2308125.18	2	90-100	23.78	100	SynTerra
AW-05E	5/8/2015	198018.09	2308127.63	2	140-150	23.50	150	SynTerra
AW-06B	1/31/2015	199639.95	2307503.39	2	20-25	17.34	27	SynTerra

Table 5. Historical Monitoring Well and Piezometer Construction Details (Continued)

Location ID	Date Installed	Northing (ft)	Easting (ft)	Well Diameter (inches)	Screened Interval (ft bgs)	TOC (inner) Elevation Corrected to NAVD88 (ft)	Total Depth (ft bgs)	Constructed By
AW-06D	1/31/2015	199642.47	2307502.47	2	104-109	17.48	127	SynTerra
AW-06E	5/12/2015	199648.93	2307507.34	2	140-150	17.43	150	SynTerra
AW-07D	1/31/2015	201037.19	2306853.91	2	93-98	14.80	98	SynTerra
AW-08B	2/5/2015	203420.00	2304212.85	2	20-25	13.47	25	SynTerra
AW-08C	2/4/2015	203419.38	2304205.34	2	40-45	13.40	48	SynTerra
AW-09B	5/7/2015	196083.31	2307795.83	2	18-23	14.26	27	SynTerra
AW-09C	4/14/2015	196081.45	2307793.85	2	40-45	17.36	45	SynTerra
AW-09D	5/7/2015	196076.31	2307788.10	2	20-25	14.59	97	SynTerra
SMW-01B	4/14/2015	199292.01	2308712.96	2	18.9-23.9	13.91	23.9	SynTerra
SMW-01C	4/14/2015	199295.12	2308717.75	2	41-46	13.99	48	SynTerra
SMW-02B	3/24/2015	198396.18	2308908.42	2	18.4-25.4	17.38	25	SynTerra
SMW-02C	3/24/2015	198403.45	2308904.84	2	40-45	17.50	48	SynTerra
SMW-03B	3/25/2015	197748.56	2309459.02	2	19.9-24.9	15.43	24.9	SynTerra
SMW-03C	3/25/2015	197745.03	2309453.18	2	41.5-46.5	15.33	53	SynTerra
SMW-04B	1/30/2015	202569.12	2307663.93	2	20-25	16.34	25	SynTerra
SMW-04C	4/13/2015	202565.07	2307665.57	2	40-45	13.03	45	SynTerra
SMW-05B	4/13/2015	201027.58	2308551.36	2	19.8-24.8	12.69	24.8	SynTerra
SMW-05C	4/13/2015	201027.18	2308554.63	2	38.8-43.8	13.49	43.8	SynTerra
SMW-06B	4/10/2015	200222.83	2309008.69	2	19.4-24.4	13.87	24.4	SynTerra
SMW-06C	4/10/2015	200222.29	2309012.80	2	39-44	13.03	44	SynTerra
SMW-06D	4/8/2015	200221.20	2309017.66	2	103-108	12.80	108	SynTerra
MW-23E	5/12/2015	198979.66	2306894.64	2	140-150	13.79	150	SynTerra
MW-37B	2/4/2015	193820.03	2308956.68	2	20-25	20.88	27	SynTerra
MW-37C	2/4/2015	193819.39	2308959.44	2	38-43	20.94	47	SynTerra

Note(s):

[1] ft indicates feet; bgs indicates below ground surface; ** indicates no datum specified for elevation except as otherwise indicated; * indicates elevation referenced to Mean Sea Level (MSL); NM indicates not measured; TOC indicates top of casing; ~ indicates elevations referenced to a North American Vertical Datum of 1988 (NAVD88) unless indicated otherwise; '+ RAP 2006 indicates these PZs have been abandoned; N indicates NPDES well; G indicates Geosyntec sampled location in May 2014; and T indicates Geosyntec installed a transducer in the well for short period prior to SynTerra groundwater sampling event.

[2] Table does not include wells installed around White Liquor Storage Tank (2001 SAR): MW1-MW10.

[3] Elevations were converted from MSL to NAVD88 by subtracting 1.3. A comparison of locations at the site that were referenced to both datums were compared to determine that MSL at the site was 1.3 ft higher than NAVD88.

Table 6. Slug Test Results Summary

Well Name	**Date**	**Hydraulic Conductivity (ft/d)**				**Geometric Mean (ft/d)**
		(Rising Head)		**(Falling Head)**		
		Bouwer and Rice	**Hvorslev**	**Bouwer and Rice**	**Hvorslev**	
PZ-INT (Test 1)	5/29/2014	1.70	2.03	1.71	2.09	2.42
PZ-INT (Test 2)	5/29/2014	4.53	5.07	1.76	2.37	

Note(s):

[1] ft/d indicates feet per day.

Table 7. Effluent Limits and Monitoring Requirements, Bulk Water Removal, Outfall 001

		Discharge Limitations		Monitoring Requirements		
Parameter	Units	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type	Sample Location
Flow	MGD			Daily	Pump logs	Effluent
Temperature	°C			Quarterly	Grab	Up/downstream
Temperature	°C			Daily	Grab	Effluent
pH	standard	6.0	9.0	Weekly	Grab	Effluent
Oil and Grease	mg/L	15.0	20.0	Weekly	Grab	Effluent
TSS	mg/L	30.0	100.0	Weekly	Grab	Effluent
Total Nitrogen (NO_2+NO_3+TKN)	mg/L			Weekly	Grab	Effluent
Total Phosphorus	mg/L			Weekly	Grab	Effluent
Dissolved Oxygen	mg/L			Weekly	Grab	Effluent
Acute Toxicity				Monthly	Grab	Effluent
Total Mercury	ng/L[1]	47.0	47.0	Weekly	Grab	Effluent
Total Arsenic	µg/L	10.0	50.0	Weekly	Grab	Effluent
Total Selenium	µg/L	5.0	56.0	Weekly	Grab	Effluent
Total Iron	mg/L	1.0	1.0	Weekly	Grab	Effluent
Total Lead	µg/L	25.0	33.8	Weekly	Grab	Effluent
Total Cadmium	µg/L	2.0	15.0	Weekly	Grab	Effluent
Total Aluminum				Weekly	Grab	Effluent
Total Copper	µg/L			Weekly	Grab	Effluent
Total Zinc	µg/L			Weekly	Grab	Effluent
Turbidity				Weekly	Grab	Effluent

Table 8. Effluent Limits and Monitoring Requirements, Interstitial Water Removal, Outfall 001

Parameter	Units	Discharge Limitations		Monitoring Requirements		
		Monthly Average	Daily Maximum	Measurement Frequency	Sample Type	Sample Location
Flow	MGD		2.1	Daily	Pump logs	Effluent
Temperature	°C			Quarterly	Grab	Up/downstream
Temperature	°C			Daily	Grab	Effluent
pH	standard	6.0	9.0	Weekly	Grab	Effluent
Oil and Grease	mg/L	15.0	20.0	Weekly	Grab	Effluent
TSS	mg/L	30.0	100.0	Weekly	Grab	Effluent
Total Nitrogen (NO_2+NO_3+TKN)	mg/L			Weekly	Grab	Effluent
Total Phosphorus	mg/L			Weekly	Grab	Effluent
Dissolved Oxygen	mg/L			Weekly	Grab	Effluent
Acute Toxicity				Monthly	Grab	Effluent
Total Iron	mg/L	1.0	1.0	Weekly	Grab	Effluent
Total Cadmium	μg/L	2.0	15.0	Weekly	Grab	Effluent
Total Aluminum				Weekly	Grab	Effluent
Total Lead	μg/L	25.0	33.8	Weekly	Grab	Effluent
Total Arsenic	μg/L	10.0	50.0	Weekly	Grab	Effluent
Total Selenium	μg/L	5.0	56.0	Weekly	Grab	Effluent
Total Mercury	ng/L	47.0	47.0	Weekly	Grab	Effluent
Total Copper	μg/L			Weekly	Grab	Effluent
Total Zinc	μg/L			Weekly	Grab	Effluent
Turbidity				Weekly	Grab	Effluent

Table 9. Effluent Limits and Monitoring Requirements, Bulk Water Removal, Outfall 004

Parameter	Units	Discharge Limitations		Monitoring Requirements		
		Monthly Average	Daily Maximum	Measurement Frequency	Sample Type	Sample Location
Flow	MGD			Weekly	Pump logs	Effluent
Oil and Grease	mg/L	15.0	20.0	Weekly	Grab	Effluent
TSS	mg/L	30.0	100.0	Weekly	Grab	Effluent
pH	standard	6.0	9.0	Weekly	Grab	Effluent
Total Copper	μg/L			Weekly	Grab	Effluent
Total Zinc	μg/L			Weekly	Grab	Effluent
Total Arsenic	μg/L	10.0	50.0	Weekly	Grab	Effluent
Total Selenium	μg/L	5.0	56.0	Weekly	Grab	Effluent
Total Mercury	ng/L	47.0	47.0	Weekly	Grab	Effluent
Total Iron	mg/L	1.0	1.0	Weekly	Grab	Effluent
Total Aluminum				Weekly	Grab	Effluent
Chronic Toxicity				Quarterly	Grab	Effluent

FIGURES

3

Legend

-·-·- Property Boundary

▭ Basin Boundary

Notes:
1. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. Property boundary compiled from publically available date from New Hanover County.

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L.V. SUTTON SITE MAP

L.V. Sutton Energy Complex
Wilmington, North Carolina

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Figure
1

Legend

D	Monitoring Well/Piezometer
—·—·—	Property Boundary
▭	Basin Boundary

Notes:
1. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. Property boundary compiled from publically available date from New Hanover County.
3. New wells will be added to the monitoring netwok once the Comprehensive Site Assessment and Corrective Action Plan is approved by NCDEQ.

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1,000 500 0 1,000 2,000 Feet

EXISTING MONITORING WELL NETWORK

L.V. Sutton Energy Complex
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Figure
2

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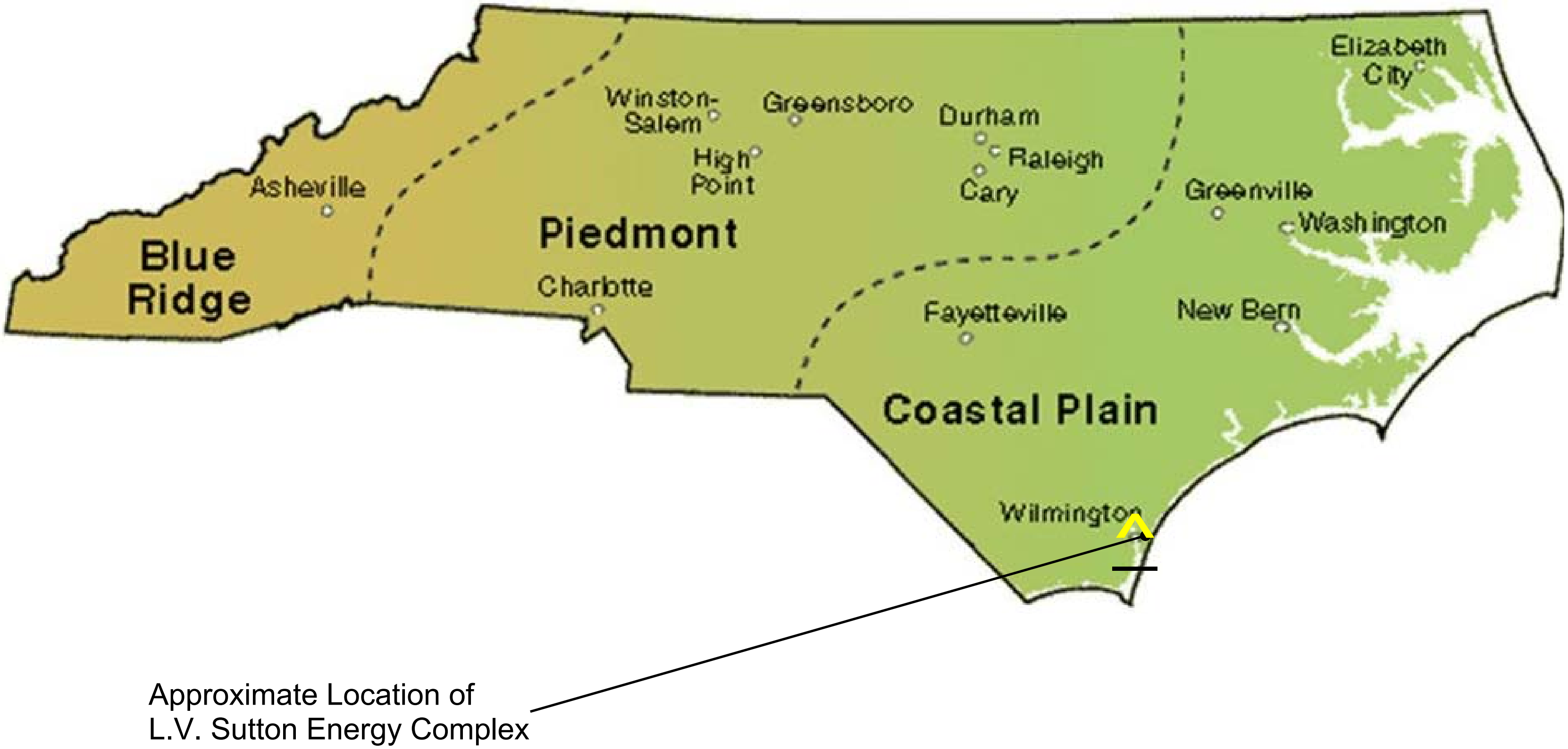

PHYSIOGRAPHIC PROVINCES OF NORTH CAROLINA

L.V. Sutton Energy Complex
New Hanover County, North Carolina

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Figure

3

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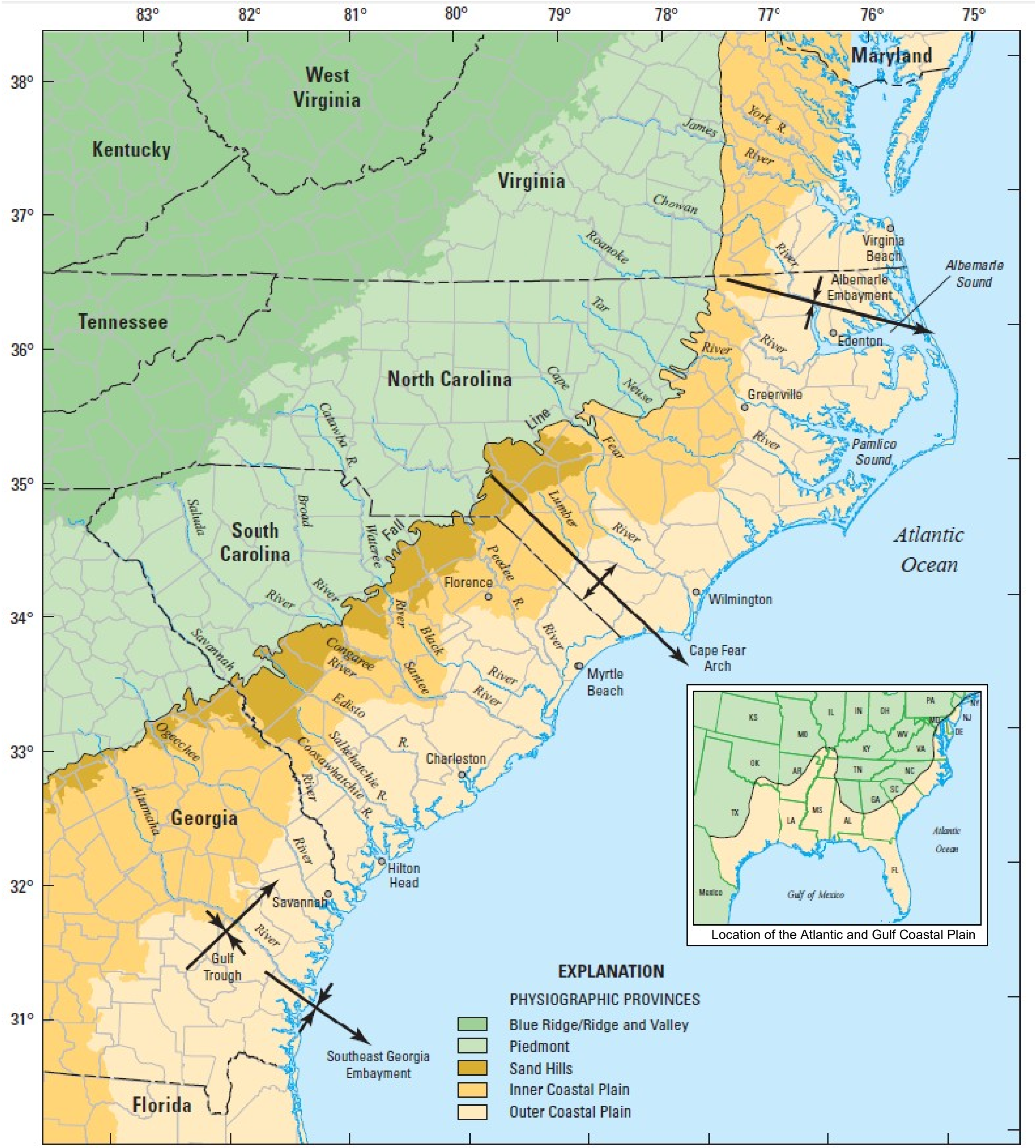

Base from digital files of:
U.S. Department of Commerce, Bureau of Census,
1990 Precensus TIGER/Line Files-Political boundaries, 1991
U.S. Environmental Protection Agency, River File 3
U.S. Geological Survey, 1:100,000 scale

PHYSIOGRAPHIC PROVINCES IN THE ATLANTIC COASTAL PLAIN [AFTER CAMPBELL AND COES, 2011]

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Figure

4

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SYSTEM	SERIES	GEOLOGIC UNITS	HYDROGEOLOGIC UNITS	DESCRIPTION
Quaternary	Holocene	Surficial sand deposits	Surficial aquifer	light gray to light yellow sand, silt, and clay
	Pleistocene	Undifferentiated Pleistocene and Pliocene deposits		
Tertiary	Pliocene			
	Oligocene	~~River Bend Formation~~ ^{1}	~~Castle Hayne confining unit~~	silt, clay, and sandy clay overlies moldic limestone and sand aquifer
	Eocene	~~Castle Hayne Formation~~ ^{2}	~~Castle Hayne aquifer~~	
	Paleocene	~~Beaufort Formation~~ ^{3}	Peedee confining unit	
Cretaceous	Upper Cretaceous	Peedee Formation	Peedee aquifer	gray, fine to medium-grained sand interbedded with black clay
		Black Creek Formation	Black Creek confining unit	sandy clay, silty clay, and clay

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GENERALIZED SUMMARY OF REGIONAL GEOLOGIC AND HYDROGEOLOGIC UNITS IN THE REGION [AFTER MCSWAIN ET AL., 2015]

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1990 Precensus TIGER/Line Files-Political boundaries, 1991
U.S. Environmental Protection Agency, River File 3
U.S. Geological Survey, 1:100,000 scale

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THICKNESS OF THE SURFICIAL AQUIFER IN THE ATLANTIC COASTAL PLAIN [AFTER CAMPBELL AND COES, 2010]

L.V. Sutton Steam Electric Plant
Wilmington, North Carolina

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Figure

6

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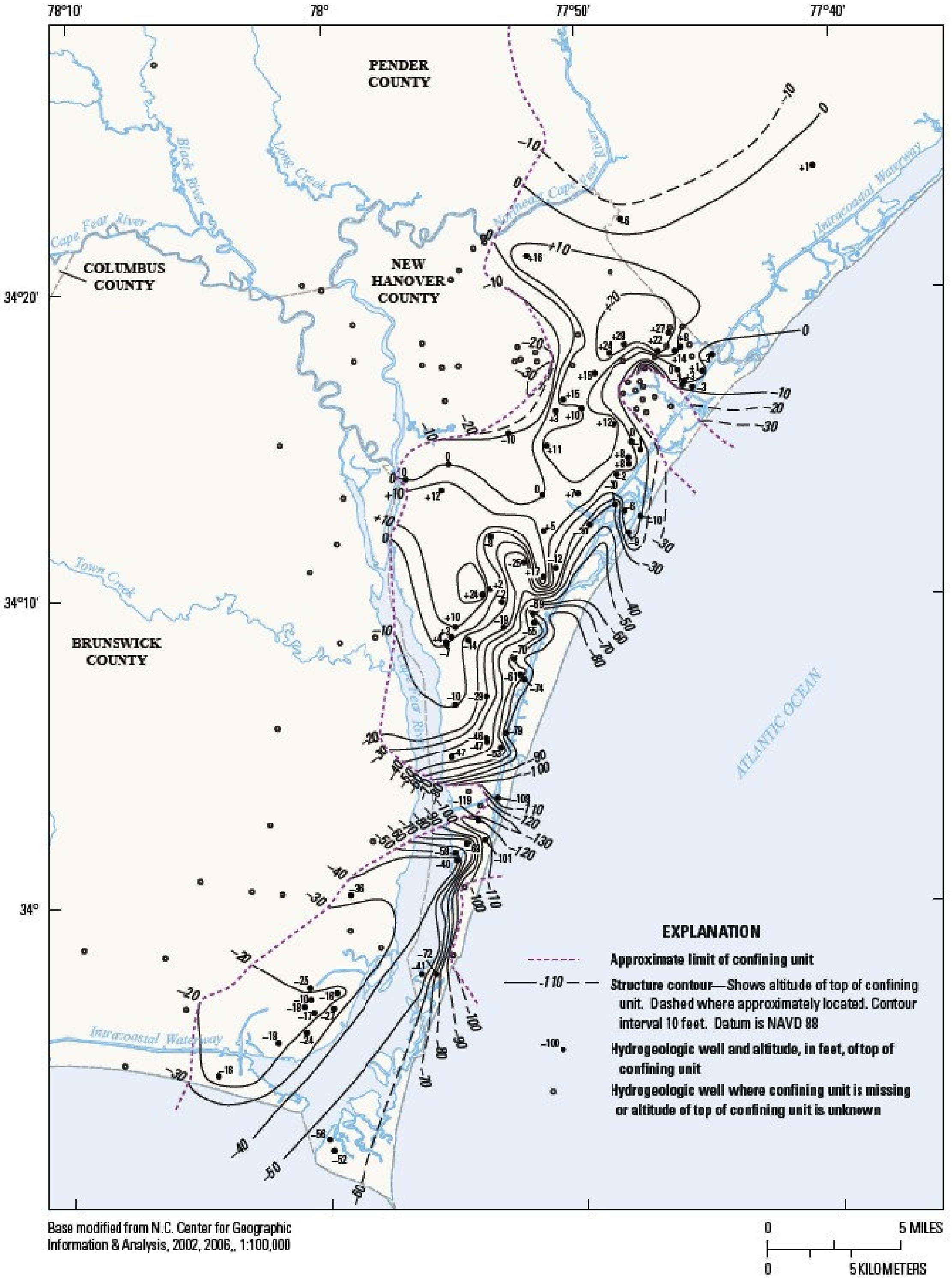

Base modified from N.C. Center for Geographic Information & Analysis, 2002, 2006,. 1:100,000

ELEVATION OF TOP OF CASTLE HAYNE CONFINING UNIT IN NEW HANOVER COUNTY, NORTH CAROLINA [AFTER MCSWAIN ET AL., 2014]

L.V. Sutton Steam Electric Plant
Wilmington, North Carolina

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Figure
7

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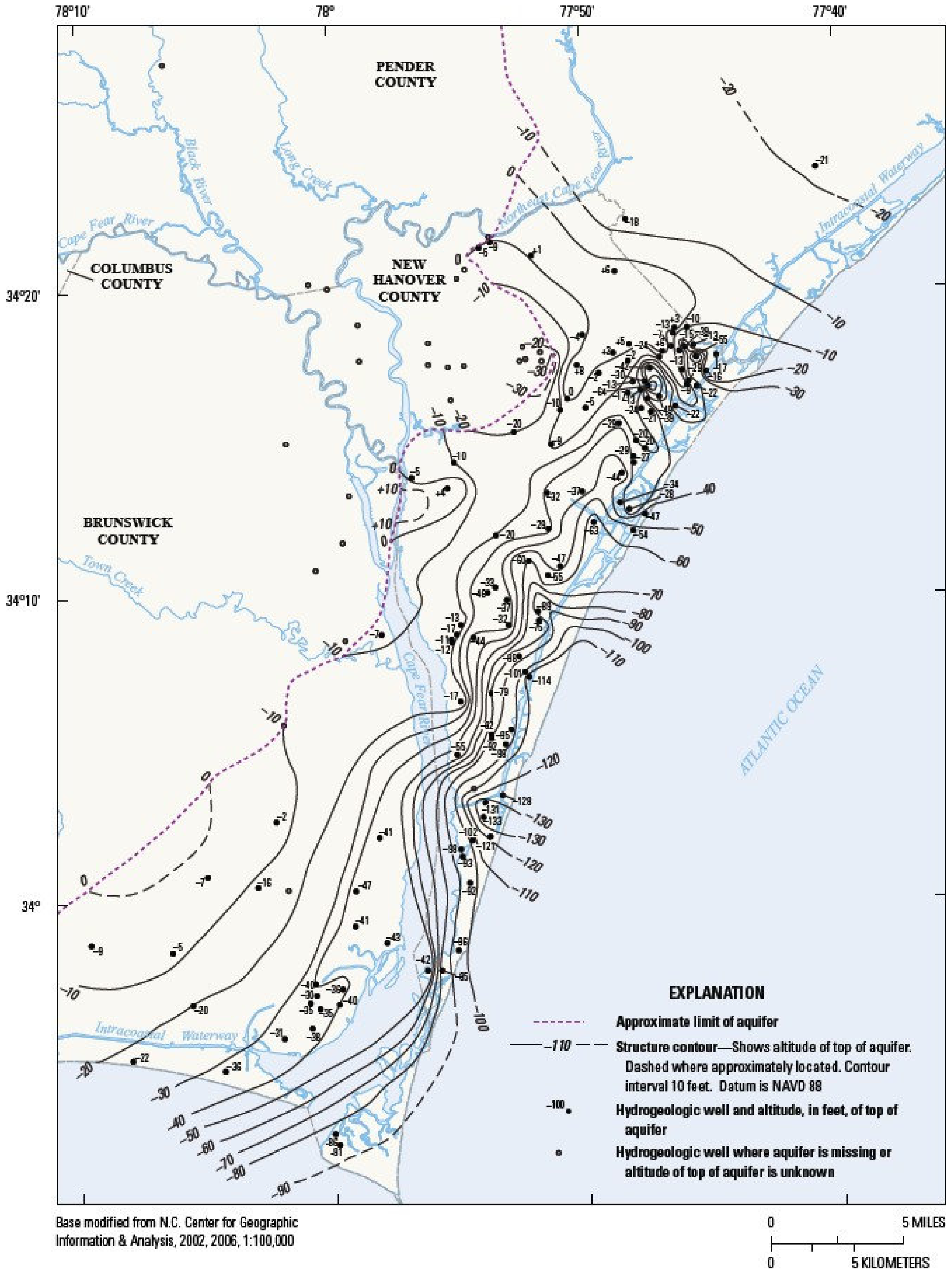

Base modified from N.C. Center for Geographic Information & Analysis, 2002, 2006, 1:100,000

ELEVATION OF TOP OF CASTLE HAYNE AQUIFER IN NEW HANOVER COUNTY, NORTH CAROLINA [AFTER MCSWAIN ET AL., 2014]

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Figure 8

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Base from digital files of:
U.S. Department of Commerce, Bureau of Census,
1990 Precensus TIGER/Line Files-Political boundaries, 1991
U.S. Environmental Protection Agency, River File 3
U.S. Geological Survey, 1:100,000 scale

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THICKNESS OF PEEDEE CONFINING UNIT IN THE ATLANTIC COASTAL PLAIN [AFTER CAMPBELL AND COES, 2010]

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CHARLOTTE, NC

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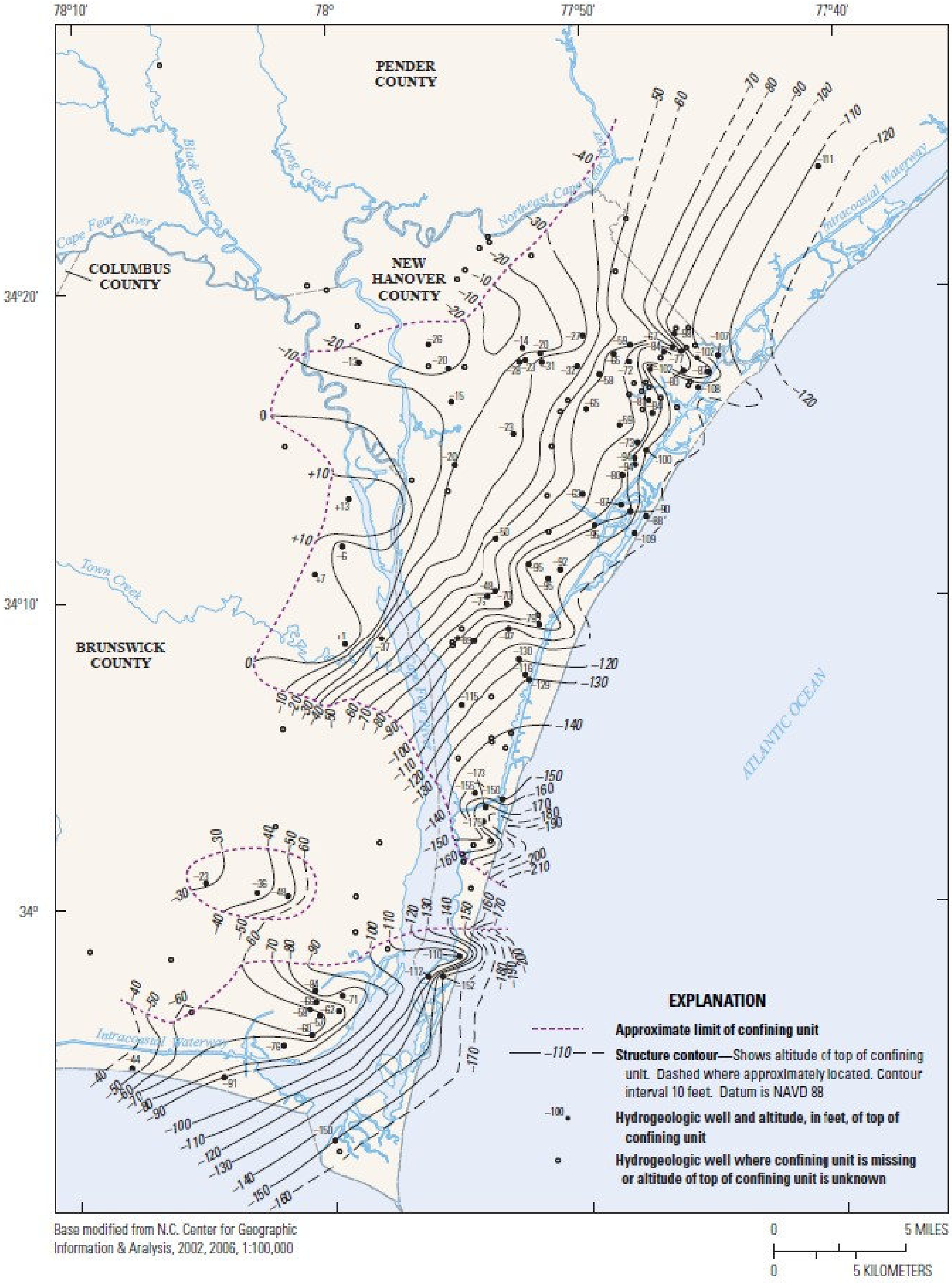
Figure
9



Base modified from N.C. Center for Geographic Information & Analysis, 2002, 2006, 1:100,000

ELEVATION OF TOP OF PEEDEE CONFINING UNIT IN NEW HANOVER, NORTH CAROLINA [AFTER MCSWAIN ET AL., 2014]

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Figure 10

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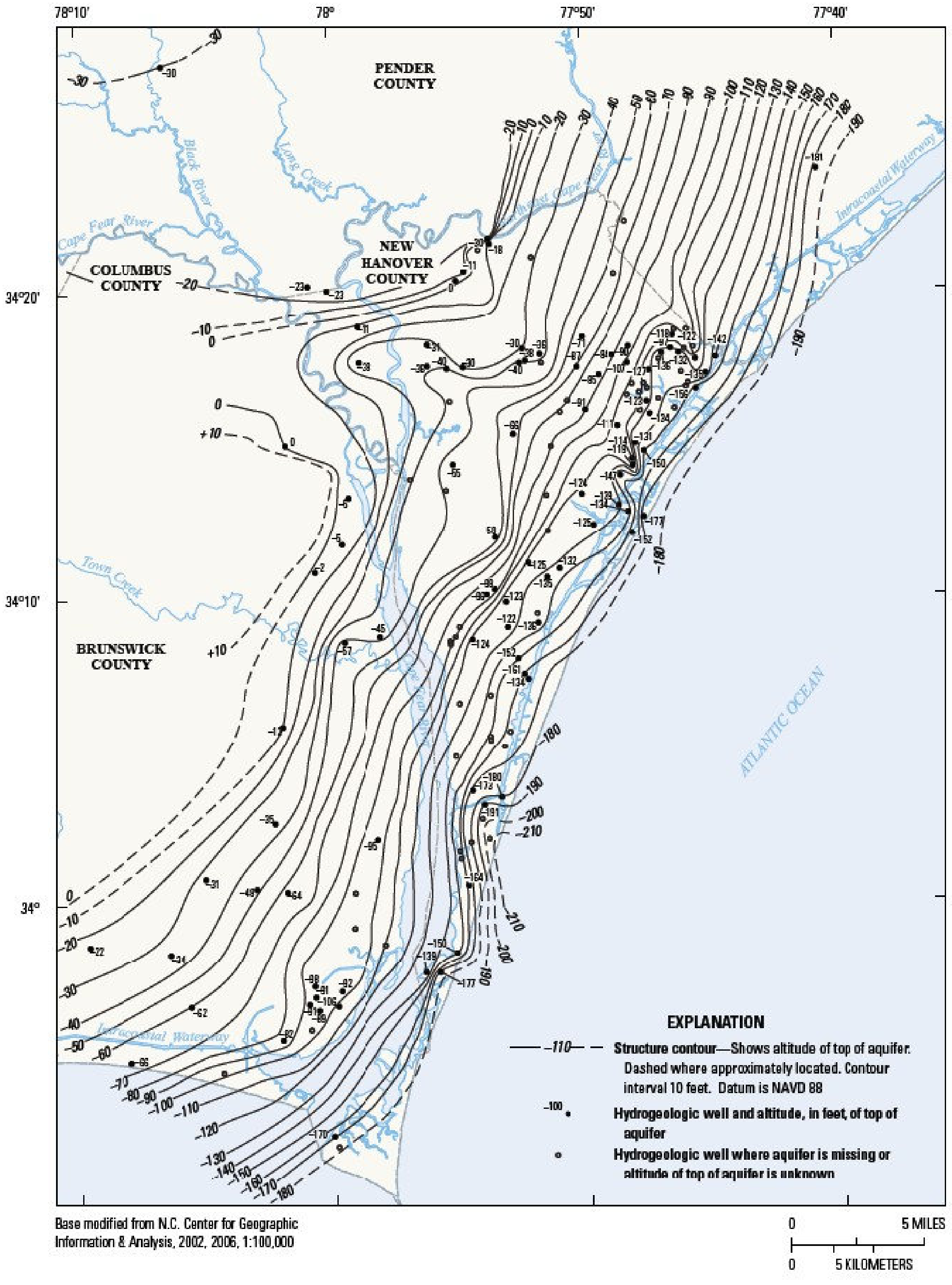

Base modified from N.C. Center for Geographic Information & Analysis, 2002, 2006, 1:100,000

ELEVATION OF TOP OF PEEDEE AQUIFER IN NEW HANOVER COUNTY, NORTH CAROLINA [AFTER MCSWAIN ET AL., 2014]

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Figure

11

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EXPLANATION

—— - - -	Extent of aquifer. Dashed where approximately located
—— 200 - - - -	Line of equal thickness, in feet. Contour interval is variable. Dashed where approximately located
•	Hydrostratigraphic borehole

Base from digital files of:
U.S. Department of Commerce, Bureau of Census,
1990 Precensus TIGER/Line Files-Political boundaries, 1991
U.S. Environmental Protection Agency, River File 3
U.S. Geological Survey, 1:100,000 scale

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THICKNESS OF PEEDEE AQUIFER IN THE ATLANTIC COASTAL PLAIN [AFTER CAMPBELL AND COES, 2010]

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Figure 12

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U.S. Department of Commerce, Bureau of Census,
1990 Precensus TIGER/Line Files-Political boundaries, 1991
U.S. Environmental Protection Agency, River File 3
U.S. Geological Survey, 1:100,000 scale

AREAL EXTENT OF BLACK CREEK CONFINING UNIT IN THE ATLANTIC COASTAL PLAIN [AFTER CAMPBELL AND COES, 2010]

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Figure 13

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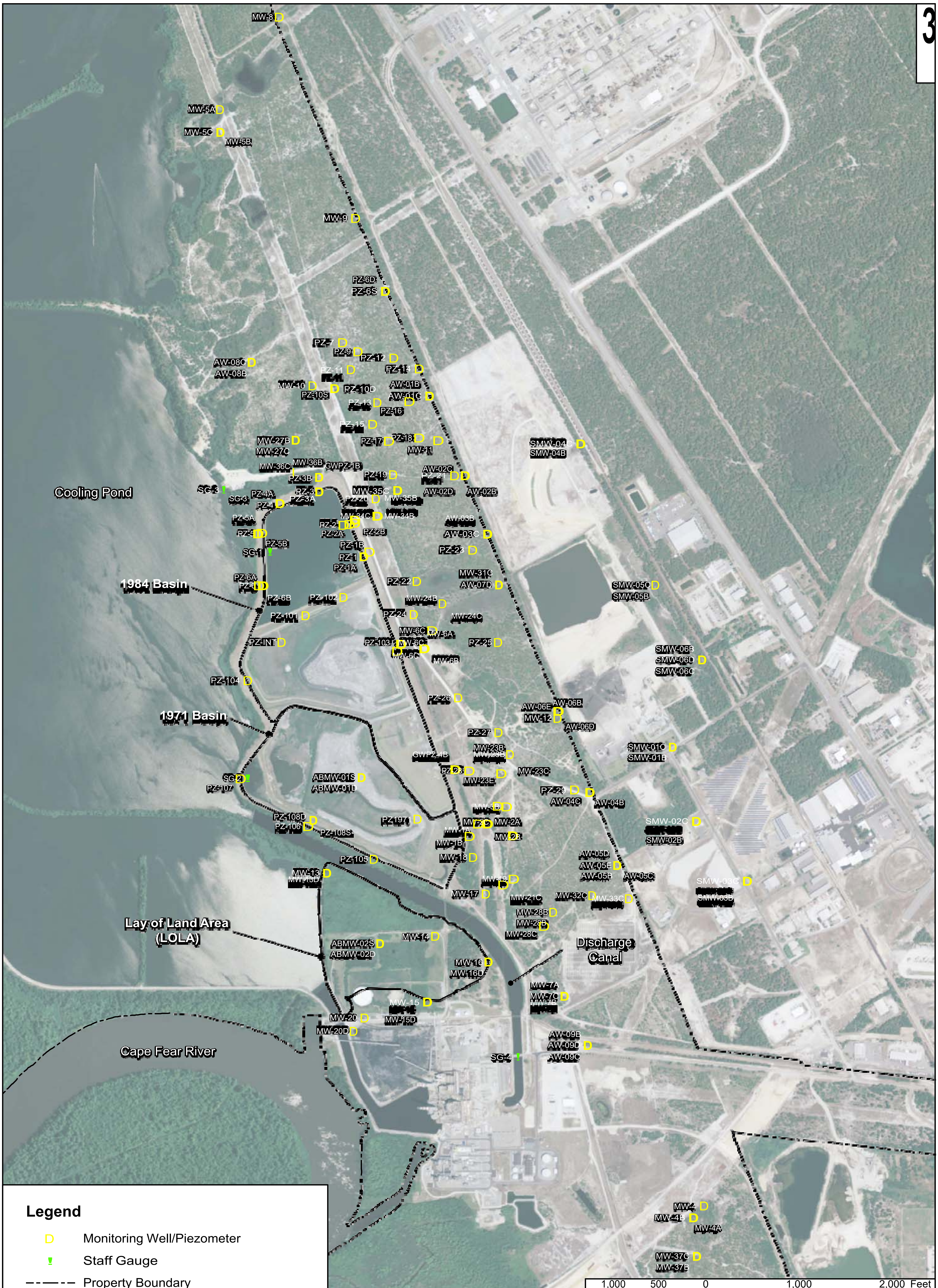
3



Legend

D	Monitoring Well/Piezometer
!	Staff Gauge
-·-·-	Property Boundary
▭	Basin Boundary

P:\GIS\Projects\D\Duke\LV Sutton - Closure Plan.mxd, AMARTORANA

Notes:
1. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. Property boundary compiled from publically available date from New Hanover County.
3. PZ-INT, PZ-1971, and PT-series were abandonded in March/April 2015.
4. HA-series, THB-series, and PZ-B series are shown at approximate locations.

EXISTING SITE FEATURES

L.V. Sutton Energy Complex
Wilmington, North Carolina

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Figure
14

CHARLOTTE, NC

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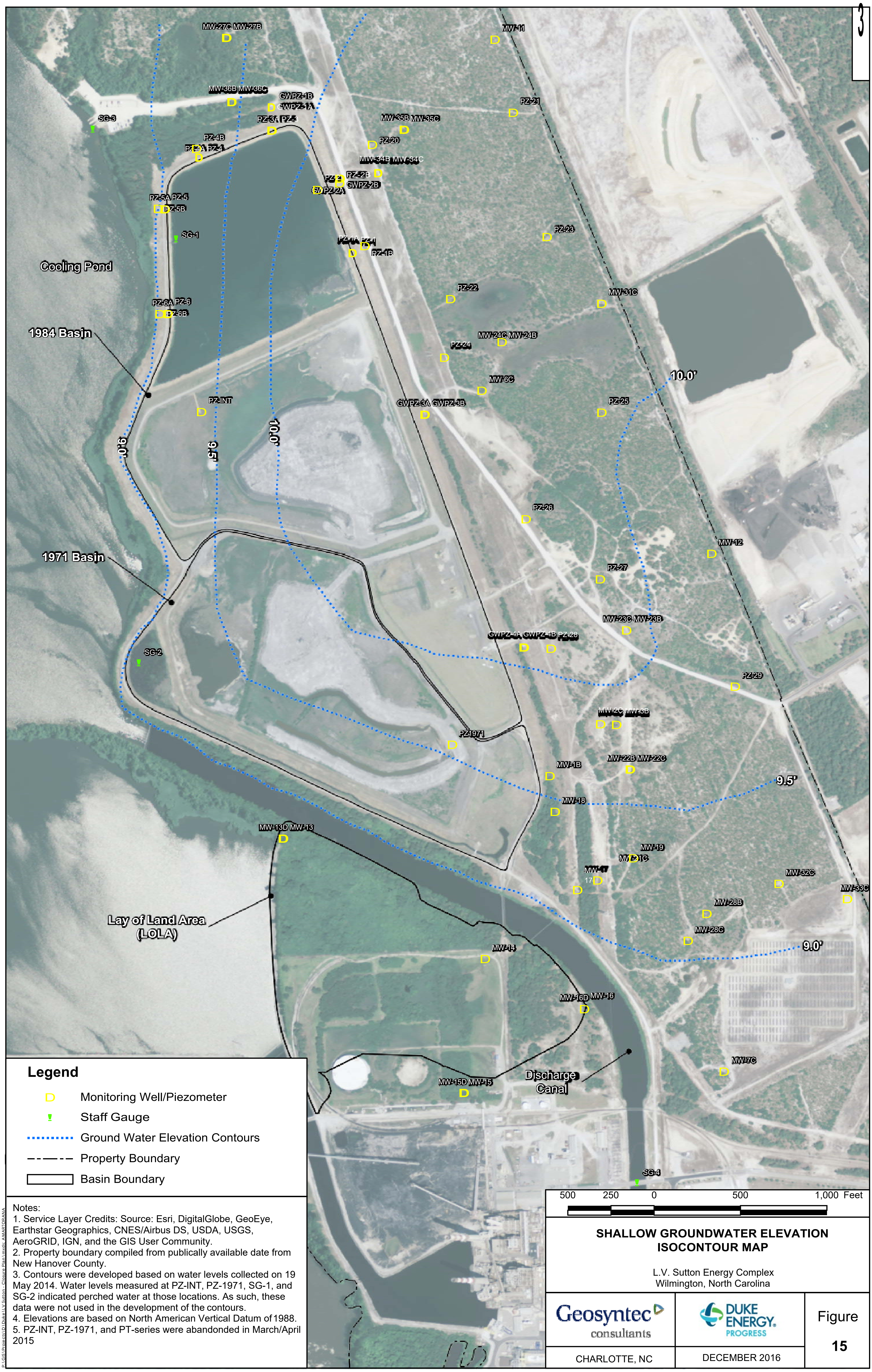

Legend

D	Monitoring Well/Piezometer
▼	Staff Gauge
········	Ground Water Elevation Contours
– – —— – –	Property Boundary
▭	Basin Boundary

Notes:
1. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. Property boundary compiled from publically available date from New Hanover County.
3. Contours were developed based on water levels collected on 19 May 2014. Water levels measured at PZ-INT, PZ-1971, SG-1, and SG-2 indicated perched water at those locations. As such, these data were not used in the development of the contours.
4. Elevations are based on North American Vertical Datum of 1988.
5. PZ-INT, PZ-1971, and PT-series were abandonded in March/April 2015

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SHALLOW GROUNDWATER ELEVATION
ISOCONTOUR MAP

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Wilmington, North Carolina

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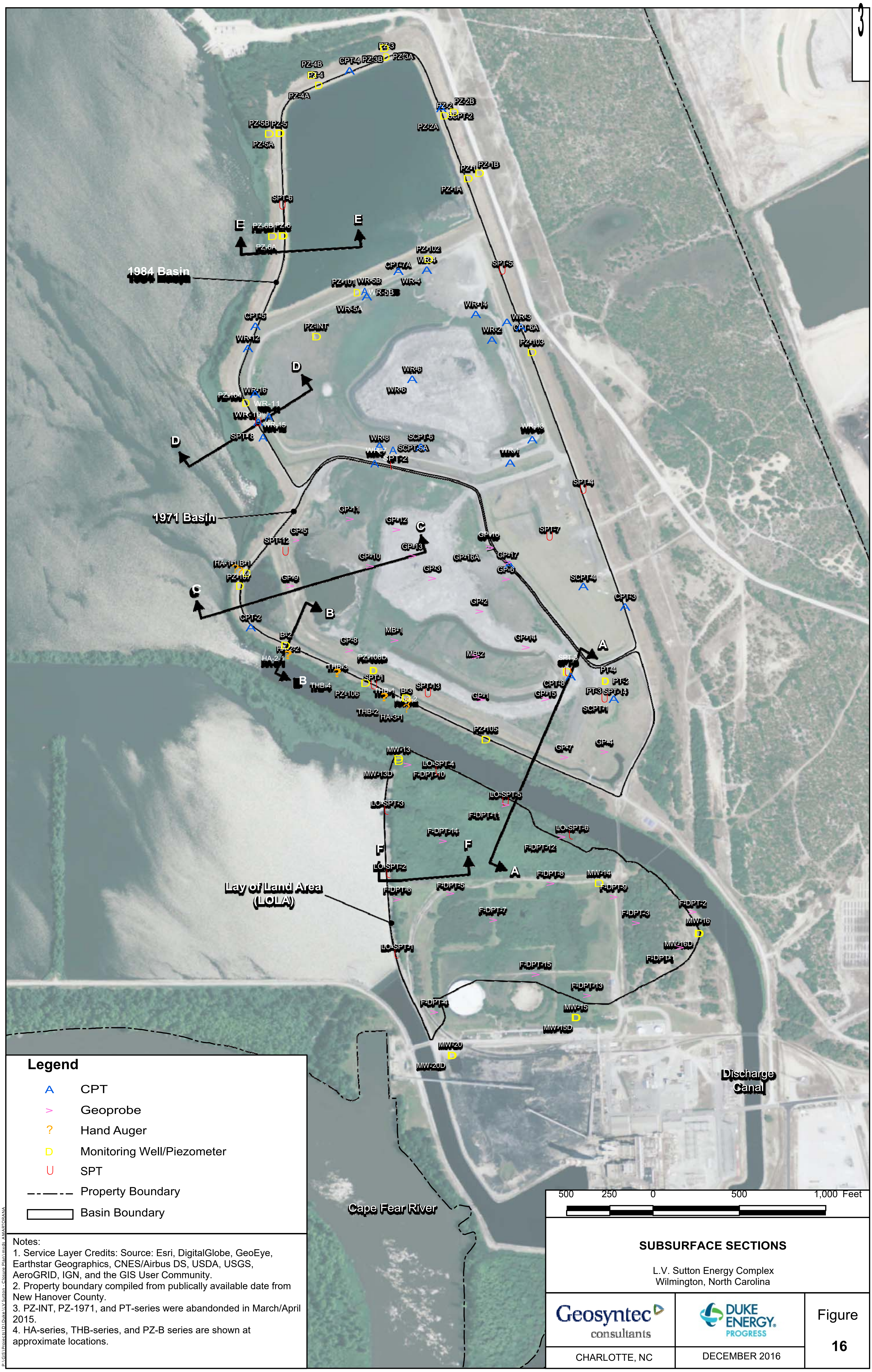
Figure
15



Legend

A CPT
> Geoprobe
? Hand Auger
D Monitoring Well/Piezometer
U SPT
-·-·- Property Boundary
▭ Basin Boundary

Notes:
1. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. Property boundary compiled from publically available date from New Hanover County.
3. PZ-INT, PZ-1971, and PT-series were abandonded in March/April 2015.
4. HA-series, THB-series, and PZ-B series are shown at approximate locations.

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SUBSURFACE SECTIONS

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Figure

16

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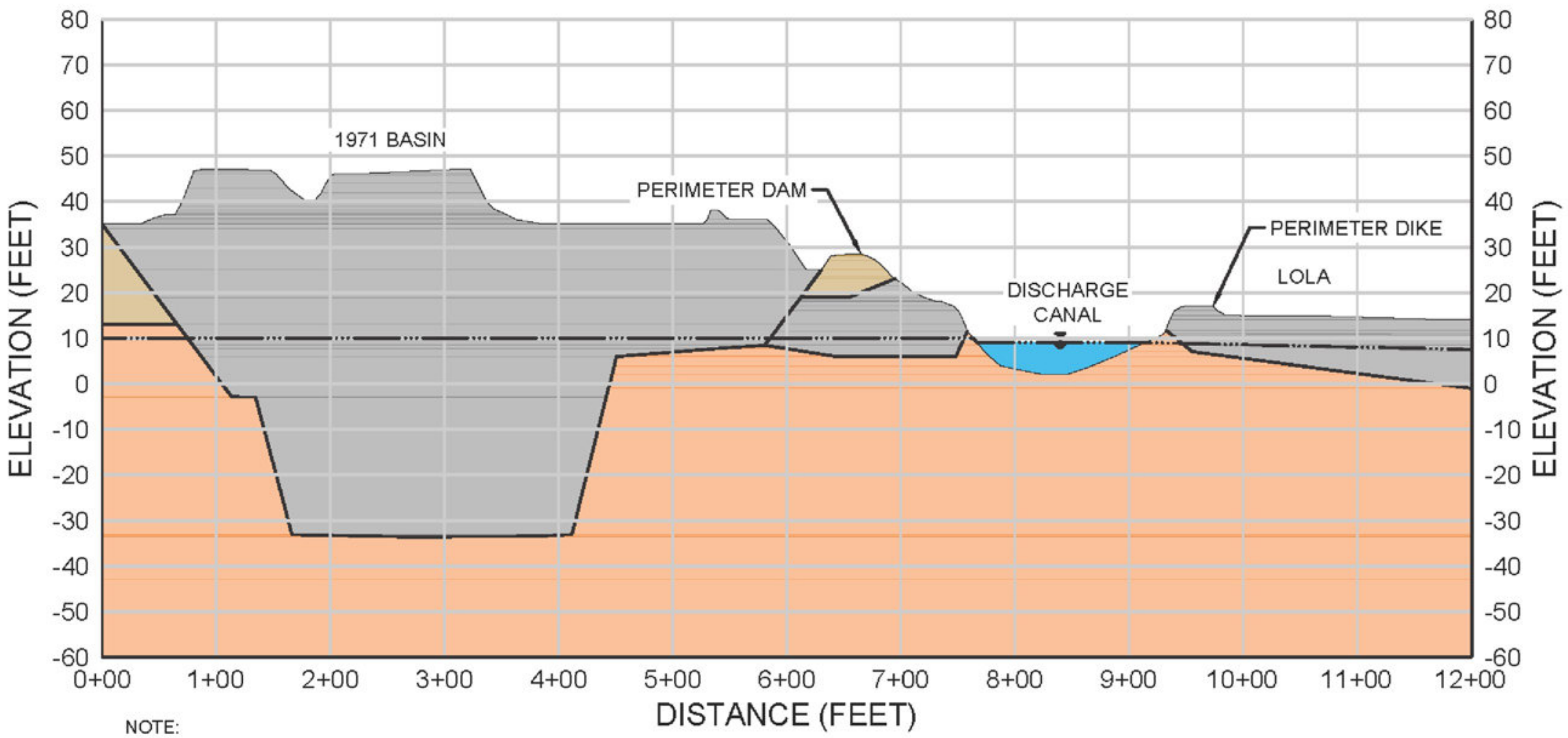
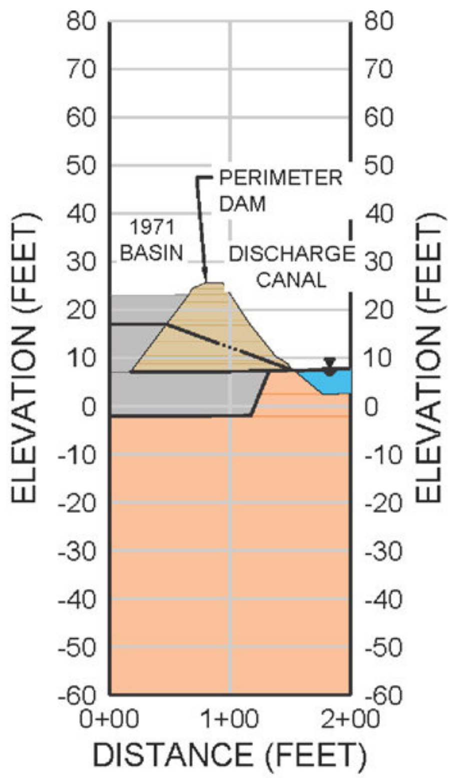


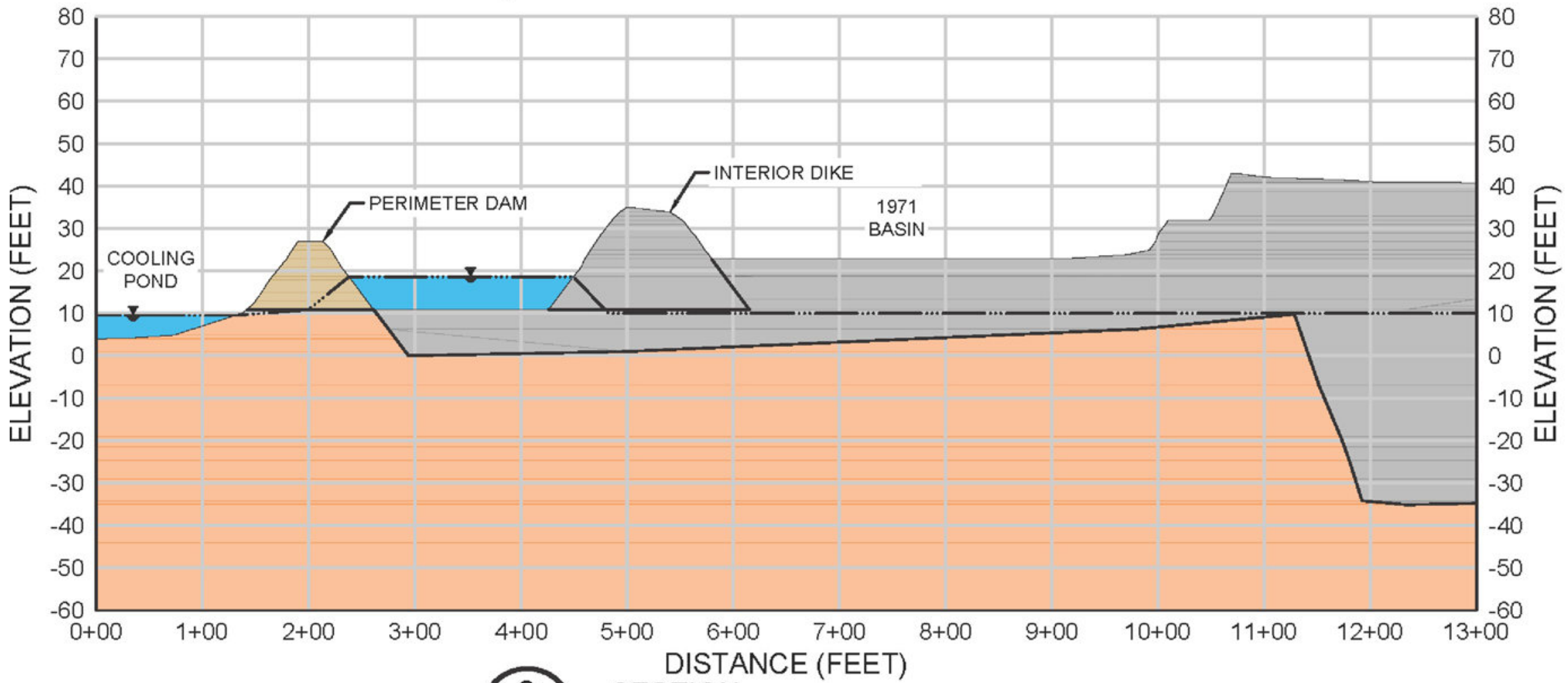
NOTE:

1. IT WAS REPORTED THAT THE DOWNSTREAM SLOPES OF 1971 DAM AND LOLA DIKE WERE COVERED BY TOPSOILS WITH ORGANIC MATTER AND/OR VEGETATION DURING GEOSYNTEC'S INVESTIGATIONS IN 2014 AND MARCH 2015.

A
16
SECTION
SUBSURFACE CROSS SECTION



B
16
SECTION
SUBSURFACE CROSS SECTION



C
16
SECTION
SUBSURFACE CROSS SECTION

LEGEND

▨	CCR
🟩	CONCRETE SHORELINE ARMORING
🟫	SANDY FILL
🟧	SANDY FOUNDATION SOIL
🟦	WATER
---▼---	ESTIMATED WATER TABLE LINE AND SYMBOL

SUBSURFACE SECTIONS - A THROUGH C

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Wilmington, North Carolina

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Figure
17

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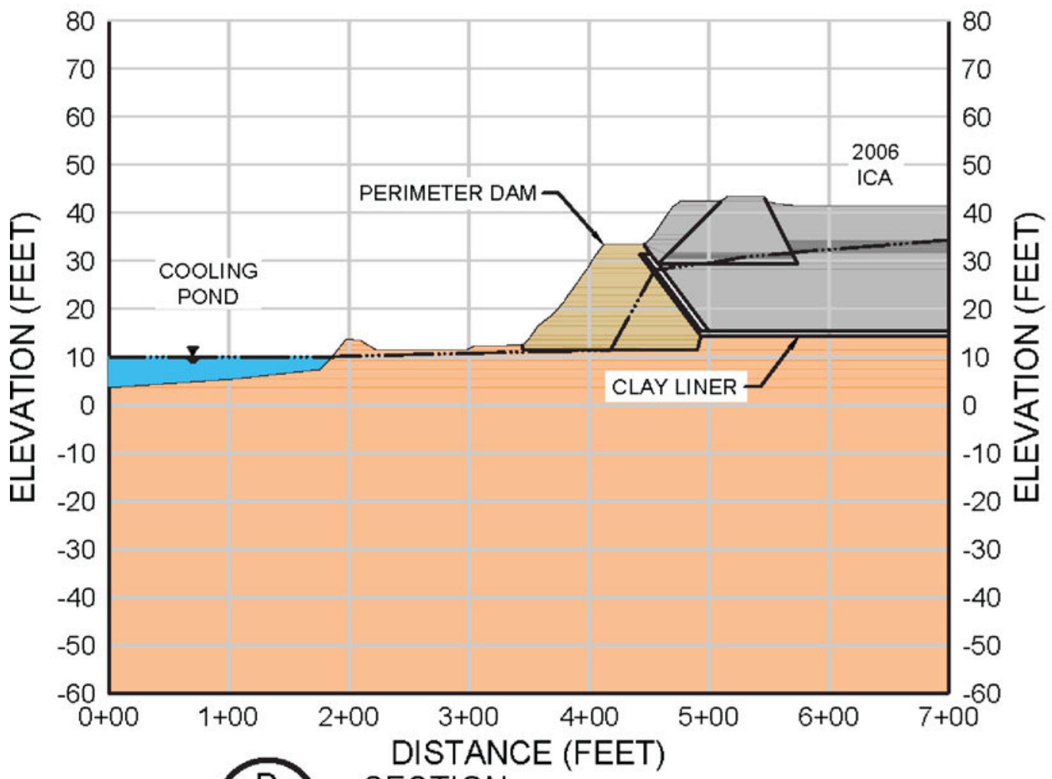
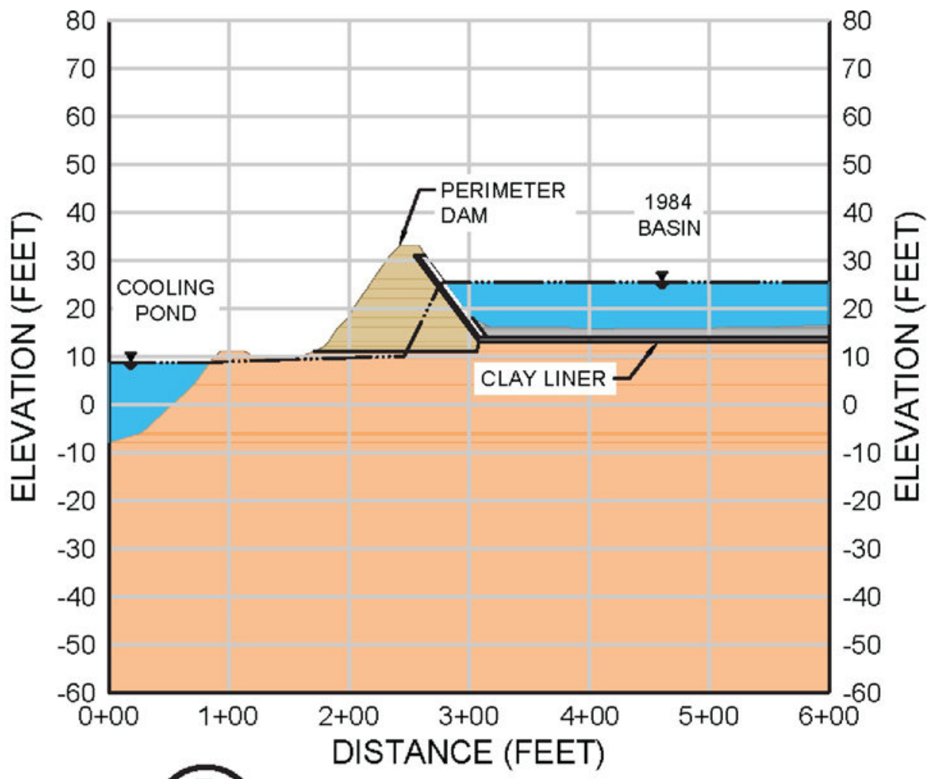
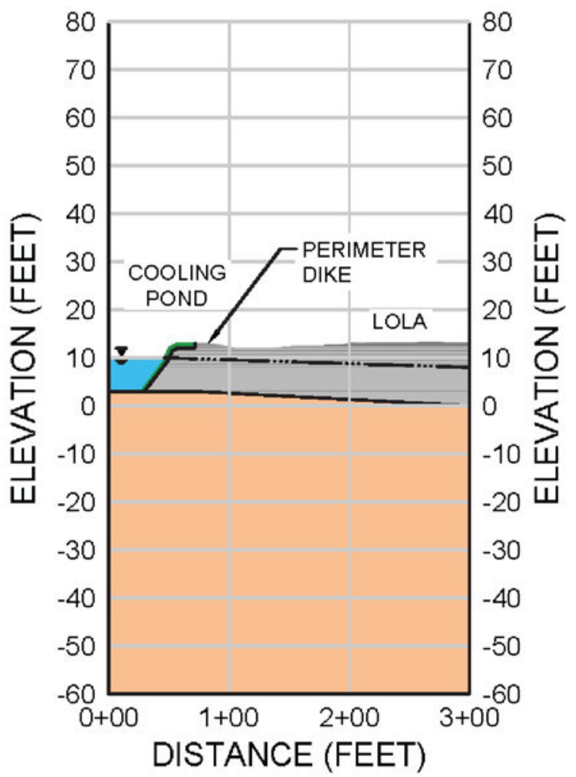


D
16
SECTION
SUBSURFACE CROSS SECTION



E
16
SECTION
SUBSURFACE CROSS SECTION



F
16
SECTION
SUBSURFACE CROSS SECTION

LEGEND

▨	CCR
🟩	CONCRETE SHORELINE ARMORING
🟫	SANDY FILL
🟧	SANDY FOUNDATION SOIL
🟦	WATER
—▼—	ESTIMATED WATER TABLE LINE AND SYMBOL

SUBSURFACE SECTIONS - D THROUGH F

L.V. Sutton Energy Complex
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Figure
18
CHARLOTTE, NC
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DRAWINGS

Appendix D
Geotechnical Subsurface Stratigraphy and Material Properties Package

GEOTECHNICAL SUBSURFACE STRATIGRAPHY AND MATERIAL PROPERTIES

L.V. SUTTON ENERGY COMPLEX
SITE ANALYSIS AND REMOVAL PLAN

December 2016
Revision 0

Prepared for

DUKE ENERGY PROGRESS

Duke Energy Progress, LLC
526 South Church Street
Charlotte, North Carolina 28202

Prepared by

Geosyntec consultants

Geosyntec Consultants of NC, PC
1300 South Mint Street, Suite 300
Charlotte, North Carolina 28203
License No. C-3500

TABLE OF CONTENTS

Tables

Figures

Attachments

1 INTRODUCTION

This calculation package was prepared to present a subsurface stratigraphy and geotechnical material properties selected for the engineering analyses of the CCR Basins and Lay of Land Area (LOLA), located at the L.V. Sutton Energy Complex (Sutton). This calculation package is an appendix to the *Site Analysis and Removal Plan* (Removal Plan) prepared by Geosyntec Consultants (Geosyntec). The remainder of this calculation package is organized to present the: (i) site investigations; (ii) subsurface stratigraphy; (iii) phreatic surface interpretation; and (iv) material parameter interpretation.

2 SITE INVESTIGATIONS

This section includes the historical and Geosyntec site investigations with a focus on the CCR Basins (1971 Basin, 1984 Basin, and 2006 Interior Containment Area (ICA)) and LOLA areas. Details on the field investigations performed in these areas are summarized in Table 1, and the field investigation locations along with site features are shown on Figure 1. The site investigations performed outside the referenced areas are described in the Removal Plan.

2.1 Historical Investigations in the Basin Areas

Three previous investigations were performed in the Basin areas prior to Geosyntec's recent investigations. In April 2006, Withers & Ravenel performed a subsurface investigation in support of the design of the 2006 ICA within the 1984 Basin. The investigation consisted of six borings with Standard Penetration Tests (SPTs) and 14 Cone Penetration Tests (CPTs) at 16 locations (both SPTs and CPTs were performed at four of these locations). The borings were advanced from the 1984 dike crest and within the 1984 Basin to a depth of 15.5 to 70 ft bgs using the Hollow Stem Auger (HSA) and mud rotary drilling methods. The CPT soundings were located at the dike crest and within the 1984 Basin and terminated at a depth of 13 to 70 ft bgs. In addition, pore pressure dissipation tests were conducted and shear wave velocities were measured at selected CPT locations. At the selected five investigation locations within the basin, a CPT sounding or boring was advanced through the clay liner with a casing installed into or through the clay liner. The purpose of the casing installation was to prevent migration of CCR below the clay liner. The boring logs, CPT sounding logs, dissipation test results, and shear wave velocity measurement results are presented in Attachment 1.1, Attachment 2.1, Attachment 2.2, and Attachment 2.3, respectively. During the borings, representative, bulk, and undisturbed CCR samples were collected for laboratory testing. The laboratory program for this investigation consisted of grain size distribution, dry unit weight, Atterberg Limit, Standard Proctor, consolidation, permeability, and consolidated undrained (CU) triaxial compression tests. No laboratory testing was conducted on the clay liner. The laboratory test results are presented in Attachment 3.1.

In February 2009, MACTEC installed piezometers in support of a seepage investigation in the 1984 Basin [MACTEC, 2010]. The investigation consisted of the advancement of six exploratory geoprobe borings and six hand-auger borings, followed by 18 piezometer installations. The geoprobe borings were located along the dike crest and advanced 30 ft below ground surface (bgs) with continuous sampling in 5-ft-long increments. The collected samples were visually classified in the field, but no additional laboratory testing was conducted. Near the geoprobe boring locations, six pairs of piezometers (i.e., twelve in total) were installed in boreholes advanced using the hollow-stem auger (HSA) drilling method. Of these twelve, six were screened from 10 to 15 ft below the dike crest surface and the other six were screened from 20 to 25 ft below the crest surface. At the toe of the downstream slope, six hand auger borings were advanced to a depth of 4.5 ft and a piezometer was installed in each of the hand-augered boreholes. The logs for the six geoprobe borings and the six hand augers along with twelve piezometer as-built construction details are included in Attachment 1.2.

In December 2010, MACTEC performed a subsurface investigation in support of slope stability analyses of the 1971 Basin [MACTEC, 2011]. The investigation included three soil test borings with SPTs generally at 2.5 to 5 ft intervals. In addition, it included six hand augers on the downstream slope, three at approximately mid-slope and the other three at the toe of the slope. The borings with SPTs were located at the dike crest and advanced to a depth of 30 ft bgs. The hand augers were advanced to a depth of 9 to 10 ft at the mid-slope and 3 ft to 7 ft at the toe. The logs of the soil test borings and hand augers are included in Attachment 1.3. During the SPTs, samples were collected by means of a split-spoon sampler for laboratory testing. The laboratory program for this investigation consisted of grain size distribution, moisture content, and Atterberg Limit tests. The laboratory test results are presented in Attachment 3.2.

2.2 Historic Investigations in the LOLA

Blasland, Bouck, and Lee, Inc. (BBL) performed Phase I and II investigations in the LOLA in support of a voluntary Administrative Agreement signed by Duke Energy Progress, LLC (DEP) and Inactive Hazardous Sites Branch of the North Carolina Department of Environment and Natural Resources (NCDENR), Division of Waste Management [BBL, 2005]. The BBL investigations included the installation of monitoring wells as well as the installation of temporary piezometers, hand auger borings, and test pits. The explanatory borings for the monitoring well installations were advanced to a depth of 11 to 52 ft bgs using the HSA and mud rotary drilling methods. No geotechnical laboratory testing was conducted. The boring logs for those monitoring wells are presented in Attachment 1.4.

2.3 Geosyntec Investigations in the Basin Areas

Geosyntec conducted three investigations in the Basin areas in support of the conceptual closure plan project, the dewatering plan, and the final closure plan. As part of the Conceptual Closure Plan project, Geosyntec conducted geotechnical investigations in May and June/July 2014 [Geosyntec, 2014a; Geosyntec, 2014b; Geosyntec, 2014c; Geosyntec, 2014d] to: (i) characterize geotechnical properties of the dike materials and foundation soils for the basins; (ii) characterize CCR geotechnical properties; and (iii) estimate the horizontal and vertical delineations of the CCR within the 1971 Basin. The field investigations consisted of nine mud rotary borings [ASTM D 1586] (two additional borings were performed in the proposed Landfill Area but are not included in this package), 14 CPT soundings [ASTM D 5778] (including six seismic CPT (SCPT) soundings) and 20 geoprobe borings (GPs) [ASTM D 6282]. Pore pressure dissipation tests were also performed at nine selected CPT and SCPT locations. Additionally, two piezometers were installed, one within the 1971 Basin and one within the 2006 ICA. Six of the nine borings were advanced to a depth of 35 to 50 ft bgs through the perimeter dikes and the three borings were advanced to a depth of 12 to 49 ft bgs within the CCR basins. Seven CPTs and three SCPTs were performed through the perimeter dikes, and those soundings were terminated at 6.7 to 71 ft bgs. One CPT and three SCPT soundings were advanced within the CCR basins, and those soundings were terminated at 12 to 70 ft bgs. Nineteen geoprobe borings were located within the 1971 Basin and terminated at 8 to 88 ft bgs. One geoprobe boring was advanced to a depth of 60 ft bgs through the divider dike between the 1971 and 1984 Basins. The boring logs along with the well construction logs, CPT sounding logs, pore pressure dissipation test results, and SCPT shear wave velocity measurement results are presented in Attachment 1.5, Attachment 2.4, Attachment 2.5, and Attachment 2.6, respectively. During the mud rotary and geoprobe borings, representative and undisturbed samples were collected for laboratory testing. The laboratory program for this investigation consisted of index property testing (grain size distribution, fines content tests, Atterberg limit tests, moisture content tests, and specific gravity tests), total unit weight, consolidation, and CU triaxial compression tests. The laboratory test results are presented in Attachment 3.3.

As part of the Dewatering Plan project, Geosyntec performed field investigations in October/November 2014 to: (i) confirm water levels through the dike centerlines interpreted during the Conceptual Closure Plan project; (ii) evaluate the potential for existence of perched entrapped water within the 1971 Basin; and (iii) evaluate surface erosion potential for washout of CCR. The field investigations consisted of nine piezometer installation and four hand-auger borings. Prior to the installation of each piezometer, an exploratory boring was performed with SPTs using the mud rotary drilling method. The borings were advanced through the dike centerline and within the CCR basins, and terminated at 18 to 30 ft bgs. Four hand-auger borings were conducted at the toe of the 1971 southern dike and advanced to a depth of 5 to 9.5 ft bgs. The boring logs along with as-built piezometer construction details are presented in Attachment 1.6. Representative samples were collected during the exploratory and hand-auger borings. The samples were visually classified in the field, but no additional laboratory testing was conducted on those samples.

As part of the Final Basin Closure Plan project, Geosyntec performed field investigations in March 2015 to characterize the foundation soils below the CCR for deep excavation design within the 1971 Basin. The field investigations consisted of three borings with SPTs within the 1971 Basin, and the installation of one 4-inch diameter extraction well and four 2-inch diameter monitoring piezometers for a pumping test within the basin. The three within-basin borings were advanced to a depth of 85 to 100 ft bgs using the mud rotary drilling method. The pumping test well and piezometers were installed in boreholes advanced to a depth of approximately 40 to 70 ft bgs using the mud rotary drilling method. Only during two of the five exploratory borings for the pumping test, samples were collected and logged due to the proximity between the borings. The boring logs along with the well construction logs are presented in Attachment 1.7. It is noted that this package presents only the geotechnical data collected during the installations of the extraction well and monitoring piezometers and that hydrological data obtained from the pumping test data are presented as an Appendix of the Removal Plan. During the Final Basin Closure borings, representative and undisturbed samples were collected for laboratory testing. The laboratory program for this investigation consisted of index property testing (grain size distribution, fines content tests, Atterberg limit tests, moisture content tests, and specific gravity tests), total unit weight, and CU triaxial compression tests. The laboratory test results are presented in Attachment 3.4.

2.4 Geosyntec Investigations in the LOLA

Geosyntec conducted two investigations in the LOLA. In July 2014, Geosyntec performed a field investigation to delineate the vertical boundaries of CCR in the areas, as part of the Conceptual Closure Plan project. The field investigation included 15 geoprobe borings within the LOLA and the borings were terminated at 12 to 24 ft bgs. The boring logs are included in Attachment 1.8. Representative samples were collected during the geoprobe borings. The samples were visually classified in the field, but no geotechnical laboratory testing was conducted.

In March 2015, Geosyntec performed six borings with SPTs along the LOLA dike to obtain geotechnical data for the LOLA dike and foundation soils, as part of the Final Basin Closure Plan project. The six borings were advanced to a depth of 50 ft bgs using the mud rotary method. The boring logs are included in Attachment 1.9. During the borings, representative samples were collected for laboratory testing. The laboratory program for this investigation consisted of grain size distribution, fines content tests, moisture content tests, and specific gravity tests. The laboratory test results are presented in Attachment 3.4.

3 SUBSURFACE STRATIGRAPHY

The subsurface stratigraphy at Sutton was developed based on the information obtained from the investigations described above. The findings from these investigations indicate that the subsurface soils primarily comprise, from top to bottom, the CCR (within the basins) or Dike Fill (on the perimeters of the basins), Clay Liner (only within the 1984 Basin), and the Foundation Soils, which are described as follows:

- CCR: The CCR consist predominantly of gray/black/dark tan silt-sized particles with varying amounts of sand-sized particles and exhibit no to low plasticity. The CCR were generally reported to be very loose to loose, and occasional pockets of medium dense CCR were encountered. In general, the thicknesses of CCR or CCR and soil mixtures were found to be approximately 18 to 84 ft within the 1971 Basin, 18 to 19 ft within the southern part of the 1984 Basin, up to 13 ft in the northern part of the 1984 Basin, 26 to 38 ft within the 2006 ICA, and up to 15 ft thick in the LOLA. The SPT and CPT results are available only within the basin areas (i.e., no in-situ test results for within-LOLA). The reported SPT N-values for the CCR typically ranges between 0 (i.e., weight of hammer) and 10. The tip resistance and sleeve friction measured from CPTs range typically between 10 and 50 tsf and between 0.1 and 0.7 tsf, respectively.

- Dike Fill: The 1971 and 1984 dikes are approximately 24 ft and 32 ft high, respectively. The Dike Fill for the 1971 and 1984 Basins is predominantly sand with varying amounts of fines content and is generally reported to be loose to dense. The reported SPT N-values for the Dike Fill for the basins typically range between 10 and 46. The tip resistance and sleeve friction measured from CPTs range typically between 150 and 300 tsf and between 1 and 3 tsf, respectively. The 2006 ICA dikes were constructed of compacted CCR and are approximately 14 ft high on top of impounded CCR in the 1984 Basin. The reported SPT N-values for the 2006 ICA dike typically range between 7 and 14. The tip resistance and sleeve friction measured from CPTs range typically between 50 and 150 tsf and between 1 and 4 tsf, respectively. The LOLA dike is approximately 10 ft high, although the vertical extent of the dike is not clear based on the borings. It was found from the six LOLA dike borings that the LOLA dike consists of sand, or/and CCR and sand mixture. The reported SPT N-values for the LOLA dike typically range between 3 and 18. The MACTEC [2011] and Geosyntec field investigations [Geosyntec, 2014a] found CCR or/and CCR and soil mixture below the southern portion of the 1971 perimeter dike. Along the dike centerline, the thickness of this material is up to 15 ft. The hand-augers at the mid-slope and dike toe found this material to be 5.5-ft and 10-ft thick, respectively.
- Clay Liner: The historical design drawings provided by DEP indicate that the 1984 Basin was constructed with a 1-ft thick clay liner at the basin bottom which extended along the side slopes. The drawings also show the side slopes were protected by a 2-ft thick sand layer. Based on the boring logs from the Withers & Ravenel investigation and one sample collected during the investigation, the Clay Liner was observed to be fine sandy clay to clay with a thickness of 4.5 to 7 inches.
- Foundation Soils: The Foundation Soils consist primarily of sand with varying amounts of fines content. According to a regional geologic study [USGS, 2014], the Foundation Soils at Sutton can be classified into two geologic units: Surficial Aquifer and Peedee Aquifer. The discontinuous Peedee confining unit with a thickness of 10 ft or less separates those two aquifer units, which consists of silt or clay. The Foundation Soils are reported to be very loose to very dense and the reported SPT N-values range between 2 and 80. The tip resistance and sleeve friction measured from CPTs range typically between 50 and 300 tsf and between 0.2 and 2.5 tsf, respectively.

The USGS regional geologic study referenced above indicates the Peedee aquifer extends to a depth of approximately 400 ft bgs, underlain by the Black Creek confining unit. Considering the thickness of the Peedee aquifer, the characterization of geotechnical properties for the Black

Creek confining unit was not considered necessary for the final closure and decommissioning design of the basins and LOLA.

Six cross sections of the basin areas and LOLA were developed based on the subsurface stratigraphy described above and the results of the topographic survey provided by DEP in 2014 (the topographic survey performed by WSP USA Corp. in 2015 shows similar results, and as such, the cross sections were not updated with the 2015 survey results). The locations of these cross sections are shown on Figure 1 and the cross sections are presented on Figures 2A and 2B.

4 PHREATIC SURFACE INTERPRETATION

The phreatic surfaces in the CCR basins area and the LOLA were estimated based on: (i) the water levels measured in piezometers and monitoring wells; and (ii) the results of the CPT pore pressure dissipation tests. These estimated phreatic surfaces are presented in the Removal Plan. It is noted that an elevated phreatic surface was observed within the 2006 ICA and ranged from Elevations 22 ft to 35 ft (NAVD88).

5 MATERIAL PARAMETER INTERPRETATION

The geotechnical properties of the CCR, Dike Fill, and Foundation Soils were interpreted from the available laboratory and in-situ test results as follows.

5.1 Index Parameters

5.1.1 Dike Fill and Foundation Soils

As part of Geosyntec’s laboratory testing programs, 40 grain size distribution tests [ASTM D 422] were conducted on the Dike Fill and Foundation Soils. Nineteen of these tests included the hydrometer tests [ASTM D 422]. Forty-two additional tests to determine fines content were also conducted [ASTM D 422]. In addition, the results of eight grain size distribution tests are available in the historical investigation report prepared by MACTEC [2011]. The grain size distribution data are plotted on Figure 3a. The results of the measured fines contents are plotted on Figure 4a. The results indicate that the Dike Fill and Foundation Soils typically consist of 44% to 98% sand and 1% to 52% fines (i.e., silt and clay). The fines content ranges were obtained specifically from the fines content tests, and as such, the fines content ranges do not directly correspond to the range of sand-sized particles (which came from grain-size distribution tests).

Because the Dike Fill and Foundation soils are predominantly sandy, the natural moisture content and Atterberg limits tests were conducted by Geosyntec for selected samples only. As part of Geosyntec’s laboratory testing program, seven natural moisture content tests [ASTM D 2216] and nineteen Atterberg limits tests [ASTM D 4318] were conducted on the Foundation Soils. In addition, the results of eight natural moisture content tests and five Atterberg limits tests are available in the historical investigation reports [MACTEC, 2011]. The measured natural moisture contents and Atterberg limits are presented on Figure 5a and Figure 6a, respectively. The data indicate that the four cohesive Foundation Soils have moisture contents of 34% and 107%. Historical moisture content tests by MACTEC [2011] indicate that the Dike Fill moisture content typically ranges from 13% to 29%. The cohesive Foundation Soil samples have liquid limits ranging from 26 to 152, plastic limits ranging from 14 to 66, and plasticity indices ranging from 4 to 95. Historical Atterberg limits tests performed by MACTEC [2011] on Dike Fill show it is generally non-plastic. Historical Atterberg limits tests performed by MACTEC [2011] on CCR samples collected below the 1971 dike show the materials have liquid limits ranging from 46 to 52, plastic limits ranging from 40 to 42 and plasticity indices ranging from 6 to 10.

As part of Geosyntec's laboratory testing program, fifteen specific gravity tests [ASTM D 854] were conducted on Dike Fill and Foundation Soil samples. The specific gravity test results are plotted on Figure 7a. The results indicate that the Dike Fill and Foundation Soils generally have a specific gravity of 2.51 to 2.73. Two specific gravity test results for the LOLA dike that consists of soils and CCR range between 2.42 and 2.49. All the index test results are summarized in Table 2.

5.1.2 CCR within the Basins

As part of Geosyntec's laboratory testing programs, six grain size distribution tests were conducted on the CCR samples. Four of those tests included a hydrometer test. Eleven additional tests to determine the fines content were also conducted. In addition, the results of four grain size distribution tests are available in the historical investigation report prepared by Withers & Ravenel (2006). The results of the grain size distribution and fines content tests are plotted on Figures 3b and 4b, respectively. The results indicate that the CCR typically consist of 6% to 82% sand-sized particles and 16% to 97% fines (i.e., silt and clay-sized particles). The stated fines content range was obtained specifically from the fines content tests, and as such, the fines content range does not directly correspond to the range of sand-sized particles (which came from grain-size distribution tests). It is noted that the test results indicate the CCR in the 1971 Basin contains a higher percentage of sand size particles when compared to those in the 1984 Basin/2006 ICA.

As part of Geosyntec's laboratory testing programs, 15 natural moisture content tests, and 19 Atterberg limits tests were conducted on the CCR samples. In addition, one historical Atterberg limits test is available (Withers & Ravenel, 2006). The results of the natural moisture content and Atterberg limits tests are plotted on Figures 5b and 6b, respectively. The data indicate that the CCR samples tested have natural moisture contents between 24% and 75% and that the CCR samples tested are mostly non-plastic. One sample tested as part of Geosyntec's laboratory testing program has a liquid limit of 32, plastic limit of 26, and plasticity index of 6.

As part of Geosyntec's laboratory testing programs, five specific gravity tests were conducted on the CCR samples. The specific gravity test results are plotted on Figure 7b. The results indicate that the CCR generally have a specific gravity of 2.27 to 2.35. All the index test results are summarized in Table 2.

No laboratory tests were conducted on the CCR samples collected from the LOLA. Based on the LOLA investigation report [Geosyntec, 2014b], the CCR samples observed consisted of silt and clay-sized particles as well as sand-size particles.

5.2 Shear Strength

5.2.1 Dike Fill and Foundation Soils

The Dike Fill and Foundation Soils are predominantly sandy, and will, therefore, exhibit drained behavior in general. The drained shear strength parameters, i.e., an effective stress friction angle (ϕ') and a cohesion intercept (c'), for those geotechnical units were estimated using in-situ test results as follows.

During the historical and Geosyntec investigations, SPTs were conducted at less than a 5-ft interval at selected boring locations in the field. The SPT N-blow counts for the Dike Fill and Foundation Soils in the basin areas and the LOLA are plotted on Figures 8a and 8b. The drained friction angle for the non-cohesive materials (i.e., the Dike Fill and Foundation Soils) was calculated using an empirical correlation with the corrected N-blow count ($(N_1)_{60}$) from an SPT [Hatanaka and Uchida, 1996] as follows:

$$\phi' = \sqrt{15.4 \times (N_1)_{60}} + 20 \qquad \text{Equation 1}$$

where:

ϕ' = drained friction angle (degrees); and

$(N_1)_{60}$ = corrected N-blow count.

The friction angles of the Dike Fill and Foundation Soils in the basin areas and the LOLA estimated from the empirical correlation are plotted on Figures 9a and 9b. As shown on Figure 9a, the estimated friction angles for the Dike Fill and Foundation Soils in the basin areas typically vary from 30 to 55 degrees and 25 to 50 degrees, respectively. The empirical correlation presented in Equation 1 was also used to estimate the strength of the Soil-CCR mix found under the 1971 dike. In this case, the calculated friction angles were adjusted depending on the material type. The estimated friction angles for the Dike Fill and Foundation Soils in the LOLA typically vary from 25 to 45 degrees, as shown on Figure 9b. For the Soil-CCR mix found in a portion of the LOLA dike, the estimated friction angles range from 25 to 40 degrees in general.

As part of the historical (Withers & Ravenel, 2006) and Geosyntec conceptual closure investigations [Geosyntec, 2014a], CPTs were conducted on the 1971 and 1984 dikes. These measurements were used to estimate the drained friction angle (ϕ') of the subsurface materials. The estimation was based on an empirical correlation with a normalized corrected cone tip resistance (q_{t1}) [Kulhawy and Mayne, 1990] as follows:

$$\phi' = 17.6° + 11.0 \log(q_{t1})$$ Equation 2

where:

ϕ' = drained friction angle (degrees); and

q_{t1} = normalized corrected CPT cone tip resistance; is given by:

$$q_{t1} = \frac{q_t / \sigma_{atm}}{\sqrt{\sigma_{vo}' / \sigma_{atm}}}$$

where:

σ_{atm} = atmospheric pressure; and

σ_{vo}' = effective vertical stress; and

q_t = corrected CPT cone tip resistance; is given by:

$$q_t = q_c + (1 - a_n)u_2$$

where:

q_c = measured CPT cone tip resistance; and

a_n = area correction; and

u_2 = measured pore water pressure.

The Dike Fill and Foundation Soils friction angles estimated from this empirical correlation are plotted on Figure 10. As shown in this figure, the estimated Dike Fill and Foundation Soils friction angles typically vary from 36 to 56 degrees and 30 to 44 degrees, respectively.

As part of Geosyntec's laboratory testing program, in addition, one set of three CU triaxial compression tests [ASTM D 4767] was conducted on one sample of clayey Foundation Soils. The sample was collected from within the 1971 Basin. During the CU triaxial tests, the sample was trimmed into three specimens and each specimen was tested under a different initial effective confining stress (σ_c'). The undrained shear strength (S_u) measured in each CU test corresponded to the σ_c' applied to the specimen. The loading conditions for the CU tests are summarized in Table 3. From the CU test results, the undrained shear strength ratios (S_u/σ_c') were calculated. A plot of the S_u/σ_c' calculated from these CU tests is shown on Figure 11a. Also, the effective normal (σ_{nf}') and shear stresses (τ_f') at failure obtained from the CU test results are plotted to estimate the drained strength parameters and are presented on Figure 12a.

5.2.2 CCR

The undrained and drained shear strengths of the CCR were interpreted from CU test results. As part of Geosyntec's laboratory testing program, one set of two CU tests was conducted on one sample of the CCR. In addition, the results from two sets of three CU tests are available from the historical report (Withers & Ravenel, 2006). The loading conditions for those CU tests are summarized in Table 3. From the CU test results, $S_u/\sigma_c{}'$ were calculated and is presented on Figure 11b. Also, the σ_f' and τ_f' obtained from the CU test results are plotted to estimate the drained strength parameters, and are presented on Figure 12b.

5.2.3 Selected Strength Parameters

Based on SPT-based and CPT-based estimations, representative drained shear strength parameters were selected to be $\phi' = 38$ degrees and c' = 0 psf for the Dike Fill in the basin areas, and $\phi' = 34$ degrees and c' = 0 psf for the Foundation Soils in the basin areas. For the CCR and soil mix found below the 1971 dike, representative drained shear strength parameters were conservatively selected to be $\phi' = 25$ degrees and c' = 0 psf.

For the LOLA Dike Fill and Foundation Soils, the drained shear strength parameters were selected to be $\phi' = 34$ degrees and c' = 0 psf from the SPT-based estimations. For the CCR and soil mix found in a portion of the LOLA dike, $\phi' = 31$ degrees and c' = 0 psf were selected as drained shear strength parameters.

The strength parameters for the clayey Foundation Soils were selected based on the CU test results. A representative $S_u/\sigma_c{}'$ of 0.35 and $\phi' = 20$ degrees and c' = 288 psf were selected as undrained and drained shear strength parameters for the clayey Foundation Soils, respectively.

The CCR strength parameters were selected based on the CU test results. A representative $S_u/\sigma_c{}'$ of 1.0 and $\phi' = 34$ degrees and c' = 0 psf were selected as undrained and drained shear strength parameters for CCR, respectively. In general, compacted CCR have a higher friction angle than impounded CCR, as indicated in SPT results and CPT soundings. Geosyntec conducted CU tests on compacted CCR samples (collected from another site) and selected representative strength parameters of $\phi' = 36$ degrees and c' = 0 psf. Those values can be used for slope stability analyses for the 2006 dike. The selected shear strength parameters are summarized in Table 4.

5.3 Compressibility

The preconsolidation pressure (P_c), the modified compression ratio ($C_{c\varepsilon}$), and the modified recompression ratio ($C_{r\varepsilon}$) were estimated from the 1-D consolidation test [ASTM D 2435]. The overconsolidation ratio (OCR) was calculated as the ratio between P_c and in-situ effective overburden stress.

As part of Geosyntec's laboratory testing program, one 1-D consolidation test was conducted on one CCR sample collected from the 2006 ICA. In addition, the results of two 1-D consolidation tests on the CCR samples collected from within the 1984 Basin are available in the historical investigation report prepared by Withers & Ravenel (2006). These consolidation test results are plotted on Figures 13a through 13d. The test results for the CCR samples indicate that the estimated P_c generally ranges from 1,500 psf to 5,500 psf, the estimated $C_{c\varepsilon}$ ranges from 0.03 to 0.09, and the estimated $C_{r\varepsilon}$ ranges from 0.004 to 0.008. With the estimated P_c, the calculated OCR is 2.0 or greater. The 1-D consolidation test results are summarized in Table 5.

A representative $C_{c\varepsilon}$ of 0.06 and a representative $C_{r\varepsilon}$ of 0.006 was selected for the CCR in the 1984 Basin and the 2006 ICA. The OCR can be conservatively assumed to be 1 (i.e., normally consolidated) for those CCR. The selected compressibility parameters are summarized in Table 4.

5.4 Hydraulic Conductivity

The result of one hydraulic conductivity test [ASTM D 5084] for the CCR bulk sample (remolded) collected from the 2006 ICA is available in the historical investigation report (Withers & Ravenel, 2006). The measured hydraulic conductivity is 2.0×10^{-4} cm/s. The information on the sample tested is summarized in Table 6. The hydraulic conductivities of Foundation Soils and CCR estimated from in-situ tests and using a correlation with grain size distributions are presented in the Removal Plan.

5.5 Compaction

The Standard Proctor test [ASTM D 698] or a variation is used to evaluate the moisture-density relationship for cohesive soils in general. The results of two Standard Proctor tests for the CCR bulk samples collected from within the 1984 Basin is available in the historical investigation report (Withers & Ravenel, 2006). Those test results are summarized in Table 7. The test results for the CCR samples indicate that the estimated maximum dry densities are 51.8 pcf and 61.2 pcf, and the corresponding estimated optimum moisture contents are 56.1% and 45.7%, respectively.

No compaction testing was conducted on the Foundation Soil samples due to sandy nature. Typical ranges of maximum dry unit weights and optimum moisture contents for different soil types are presented in Naval Facilities Engineering Command (NAVFAC) Design Manual 7.02 [1986]. From the presented range, a representative maximum dry density of 110 pcf and a representative optimum water content of 15% were selected for Foundation Soils.

5.6 CCR Flow Potential

As part of the Geosyntec conceptual closure investigation, pH [ASTM D 4972] and calcium content tests [ASTM D 4373] were conducted on 13 CCR samples collected from the 1971 Basin, 1984 Basin, and 2006 ICA to evaluate the flow potential. The results are summarized in Table 8.

Each set of pH tests was conducted with two types of test solutions (i.e., distilled water and calcium chloride). The results show that the type of test solution used did not have a significant impact on the measured pH values. The average pH value for each set of tests is plotted on

Figure 14. The calcium content test results indicate that no calcium was found in the tested samples. This is consistent with the information that flue gas desulfurization (FGD) materials were not removed from the flue gasses and disposed in the CCR Basins at Sutton.

5.7 Shear Wave Velocity

As part of the Geosyntec conceptual closure investigation, shear wave velocity measurements were taken at 1.3-ft to 5-ft intervals at selected locations using a seismic CPT (SCPT) in the field. These measurements were used to calculate the shear wave velocities (V_s) of the subsurface materials. The V_s values were calculated by the Mid-Atlantic Drilling (the CPT contractor) based on the direct SCPT measurements and provided to Geosyntec. The V_s for the Dike Fill and the Foundation Soils was also estimated using an empirical correlation with sleeve friction from CPT soundings [Mayne, 2006] as follows:

$$\mathrm{V_s} = 118.8\log(\mathrm{f_s}) + 18.5 \qquad \text{Equation 3}$$

where:

V_s = shear wave velocity (m/s); and

f_s = sleeve friction (kPa).

The results of V_s calculated using the direct SCPT measurements and the V_s profiles estimated from the empirical correlation are plotted on Figure 15a for the Dike Fill and the Foundation Soils. The results of V_s calculated based on the direct SCPT measurements are plotted on Figure 15b for the CCR in both the 1971 and 1984 Basins, and the 2006 ICA.

5.8 Total Unit Weight

5.8.1 Dike Fill and Foundation Soils

As part of Geosyntec's laboratory testing program, the dry unit weight and initial moisture content were measured during the shear strength testing for one sample of the clayey Foundation Soils. The total unit weight was calculated using the measured dry unit weight and initial moisture content. The measured dry unit weight and moisture content along with the calculated total unit weight are presented in Table 9. No total unit weight tests on Dike Fill or the sandy Foundation Soils were conducted as those are predominantly sandy. However, as part of the Geosyntec conceptual closure investigation, shear wave velocity measurements were taken at 1.3-ft to 5-ft intervals at selected locations using SCPT in the field. These measurements were used to estimate the saturated unit weight (γ_t) of the Dike Fill and sandy Foundation Soils. The estimation was based on an empirical correlation with a shear wave velocity (V_s) [Mayne, 2005] as follows:

$$\gamma_t = 8.32\times\log \mathrm{V_s} - 1.61\times\log \mathrm{z} \qquad \text{Equation 4}$$

where:

γ_t = saturated total unit weight (kN/m^3); and

V_s = shear wave velocity (m/s); and

z = depth (m).

The results of unit weight calculated using the direct SCPT are plotted on Figure 16a for the Dike Fill and the Foundation Soils, along with the total unit weight measurement for the clayey Foundation Soil sample.

5.8.2 CCR

As part of Geosyntec's laboratory testing program, the Bulk Density test [Modified ASTM D 2937] was conducted on one CCR sample collected from the 2006 ICA to measured dry unit weight and moisture content. The total unit weight was calculated using the measured dry unit weight and moisture content. In addition, three total unit weights of the CCR samples collected from within the 1984 Basin were: (i) reported in bulk density tests; or (ii) calculated from the dry unit weights and initial moisture contents measured in the shear strength and 1-D consolidation tests (Withers & Ravenel, 2006). The total unit weights of those CCR samples are summarized in Table 9 and presented on Figure 16b. The results indicate that the total unit weight of the CCR ranges from 87 pcf to 97 pcf.

5.8.3 Selected Total Unit Weight

Representative total unit weights of 120 pcf and 115 pcf were selected for the Dike Fill and Foundation Soils, respectively. A representative total unit weight of 95 pcf was selected for the CCR. The selected total unit weights are summarized in Table 4.

6 REFERENCES

ASTM Standard D 1586 (2011), "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils," ASTM International, West Conshohocken, PA, DOI: 10.1520/ D1586-11, www.astm.org.

ASTM Standard D 2216 (2010), "Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass," ASTM International, West Conshohocken, PA, DOI: 10.1520/ D2216-10, www.astm.org.

ASTM Standard D 2435 (2011), "Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading," ASTM International, West Conshohocken, PA, DOI: 10.1520/D2435_D2435M-11, www.astm.org.

ASTM Standard D 2937 (2010), "Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method," ASTM International, West Conshohocken, PA, DOI: 10.1520/D2937-10, www.astm.org.

ASTM Standard D 422 (2007), "Standard Test Method for Particle-Size Analysis of Soils," ASTM International, West Conshohocken, PA, DOI: 10.1520/D0422-63R07, www.astm.org.

ASTM Standard D 4318 (2010), "Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils," ASTM International, West Conshohocken, PA, DOI: 10.1520/D4318-10, www.astm.org.

ASTM Standard D 4373 (2007), "Standard Test Method for Rapid Determination of Carbonate Content of Soils," ASTM International, West Conshohocken, PA, DOI: 10.1520/D4373-02R07, www.astm.org.

ASTM Standard D 4767 (2011), "Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils," ASTM International, West Conshohocken, PA, DOI: 10.1520/D4767-11, www.astm.org.

ASTM Standard D 4972 (2007), "Standard Test Method for pH of Soils," ASTM International, West Conshohocken, PA, DOI: 10.1520/D4972-01R07, www.astm.org.

ASTM Standard D 5084 (2010), "Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter," ASTM International, West Conshohocken, PA, DOI: 10.1520/D5084-10, www.astm.org.

ASTM Standard D 5778 (2012), "Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils," ASTM International, West Conshohocken, PA, DOI: 10.1520/ D5778-12, www.astm.org.

ASTM Standard D 698, (2012), “Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort,” ASTM International, West Conshohocken, PA, DOI: 10.1520/D698-12e01, www.astm.org.

ASTM Standard D 6282 (1998), "Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations," ASTM International, West Conshohocken, PA, DOI: 10.1520/ D6282-98R05, www.astm.org.

ASTM Standard D 854 (2010), "Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer," ASTM International, West Conshohocken, PA, DOI: 10.1520/D0854-10, www.astm.org.

Blasland, Blocking & Lee, Inc (2005), “Phase II Remedial Investigation Report for the Former Ash Disposal Area, L.V. Sutton Steam Electric Plant, Wilmington, NC”

Geosyntec Consultants, Inc. (2014a), “Preliminary Site Investigation Data Report, Conceptual Closure Plan, L.V. Sutton Plant.”

Geosyntec Consultants, Inc. (2014b), “Preliminary Site Investigation Data Report Addendum No. 1, Conceptual Closure Plan, L.V. Sutton Plant.”

Geosyntec Consultants, Inc. (2014c), “Data Interpretation and Analysis Report, Conceptual Closure Plan, L.V. Sutton Plant.”

Geosyntec Consultants, Inc. (2014d), “Data Interpretation and Analysis Report Addendum No. 1, Conceptual Closure Plan, L.V. Sutton Plant.”

Hatanaka, M. and A. Uchida (1996), "Empirical Correlation between Penetration Resistance and Internal Friction Angle of Sandy Soils," Soils and Foundations, Vol. 36, No. 4, pp. 1-9.

Kulhawy, F.H. and P.W. Mayne (1990), "Manual on Estimating Soil Properties for Foundation Design," Report EPRI EL-6800, Electric Power Research Institute, Palo Alto, California, 306 pp.

MACTEC Engineering and Consulting, Inc. (2010), “Report of Piezometer Installation and Observations, 1984 Ash Pond – Sutton Plant, Wilmington, North Carolina”

MACTEC Engineering and Consulting, Inc. (2011), “Ash Pond Dike Stability Analysis, Progress Energy – Sutton Plant, New Hanover County, North Carolina”

Mayne, P.W. (2005), “Integrated ground behavior: In-situ and laboratory tests”, Deformation of Geomaterials, Vol. 2, pp.155–177.

Mayne, P.W. (2006), “The 2nd James K. Mitchell Lecture: Undisturbed Sand Strength from Seismic Cone Tests”, Geomechanics and Geoengineering, Vol. 1, No. 4, pp.239–247.

Naval Facilities Engineering Command (1986), “Foundations & Earth Structures,” Design Manual 7.02.

U.S. Gelogical Survey (USGS) (2014), “Hydrogeology, Hydraulic Characteristics, and Water-Quality Conditions in the Surficial, Castle Hayne, and Peedee Aquifers of the Greater New Hanover County Area, North Carolina, 2012-13.”

TABLES

Table 1. Summary of Field Investigation in Basins and LOLA

ID	Depth (ft, bgs)	Investigation Method	Location	Northing (NAD 83)	Easting (NAD 83)	Consultant (Year)	Remarks
B-1	30	Mud Rotary	1971 Dike	199047.7	2304123.9	MACTEC (2010)	Piezometer
B-2	30	Mud Rotary	1971 Dike	198633.0	2304359.2	MACTEC (2010)	Piezometer
B-3	30	Mud Rotary	1971 Dike	198308.0	2305057.9	MACTEC (2010)	Piezometer
HA-1-1	10	Hand Auger	1971 Dike Mid-Slope	Not Available	Not Available	MACTEC (2010)	
HA-1-2	5	Hand Auger	1971 Dike Toe	Not Available	Not Available	MACTEC (2010)	
HA-2-1	9	Hand Auger	1971 Dike Mid-Slope	Not Available	Not Available	MACTEC (2010)	
HA-2-2	3	Hand Auger	1971 Dike Toe	Not Available	Not Available	MACTEC (2010)	
HA-3-1	10	Hand Auger	1971 Dike Mid-Slope	Not Available	Not Available	MACTEC (2010)	
HA-3-2	7	Hand Auger	1971 Dike Toe	Not Available	Not Available	MACTEC (2010)	
PZ-1	15	HSA	1984 Dike	201335.8	2305416.9	MACTEC (2009)	
PZ-1A	30	HSA	1984 Dike	201341.2	2305414.9	MACTEC (2009)	
PZ-2	15	HSA	1984 Dike	201700.7	2305280.1	MACTEC (2009)	
PZ-2A	30	HSA	1984 Dike	201705.6	2305277.9	MACTEC (2009)	
PZ-3	15	HSA	1984 Dike	202050.7	2304950.4	MACTEC (2009)	

ID	Depth (ft, bgs)	Investigation Method	Location	Northing (NAD 83)	Easting (NAD 83)	Consultant (Year)	Remarks
PZ-3A	30	HSA	1984 Dike	202048.1	2304944.6	MACTEC (2009)	
PZ-4	15	HSA	1984 Dike	201882.3	2304533.1	MACTEC (2009)	
PZ-4A	30	HSA	1984 Dike	201880.1	2304528.3	MACTEC (2009)	
PZ-5	15	HSA	1984 Dike	201598.9	2304324.9	MACTEC (2009)	
PZ-5A	30	HSA	1984 Dike	201593.0	2304324.1	MACTEC (2009)	
PZ-6	15	HSA	1984 Dike	200991.4	2304343.4	MACTEC (2009)	
PZ-6A	30	HSA	1984 Dike	200985.5	2304343.6	MACTEC (2009)	
PZ-1B	4.5	Hand Auger	1984 Dike Toe	Not Available	Not Available	MACTEC (2009)	
PZ-2B	4.5	Hand Auger	1984 Dike Toe	Not Available	Not Available	MACTEC (2009)	
PZ-3B	4.5	Hand Auger	1984 Dike Toe	Not Available	Not Available	MACTEC (2009)	
PZ-4B	4.5	Hand Auger	1984 Dike Toe	Not Available	Not Available	MACTEC (2009)	
PZ-5B	4.5	Hand Auger	1984 Dike Toe	Not Available	Not Available	MACTEC (2009)	
PZ-6B	4.5	Hand Auger	1984 Dike Toe	Not Available	Not Available	MACTEC (2009)	

ID	Depth (ft, bgs)	Investigation Method	Location	Northing (NAD 83)	Easting (NAD 83)	Consultant (Year)	Remarks
WR-4	70	HSA & Mud Rotary, CPT	Within the 1984 Basin (2006 ICA)	200805.1	2305178.0	Withers & Ravenel (2006)	CPT only for top 13'; GPS Coordinates
WR-5A	65	HSA & Mud Rotary	Within the 1984 Basin (2006 ICA)	200643.3	2304829.1	Withers & Ravenel (2006)	Two offset borings to collect Shelby Tube samples; GPS Coordinates
WR-5B	64	HSA, CPT	Within the 1984 Basin (2006 ICA)	200683.4	2304845.4	Withers & Ravenel (2006)	Boring only for top 15.5'; Shear Wave Velocity Measurements during CPT; GPS Coordinates
WR-6	70	HSA & Mud Rotary, CPT	Within the 1984 Basin (2006 ICA)	200174.0	2305092.8	Withers & Ravenel (2006)	CPT only for top 13'; GPS Coordinates
WR-7	70	HSA & Mud Rotary	1971/1984 Divider Dike	199682.3	2304881.3	Withers & Ravenel (2006)	GPS Coordinates
WR-11	66	HSA, CPT	Within the 1984 Basin (2006 ICA)	199943.1	2304265.7	Withers & Ravenel (2006)	CPT only for top 18.5'; GPS Coordinates
MW-13	13	HSA	LOLA Dike	197948.1	2305008.2	BBL (2004)	
MW-13D	42	Mud Rotary	LOLA Dike	197965.4	2305017.5	BBL (2005)	
MW-14	11	HSA	LOLA	197252.2	2306178.4	BBL (2004)	
MW-15	11	HSA	LOLA	196475.7	2306044.0	BBL (2004)	
MW-15D	48	Mud Rotary	LOLA	196477.0	2306061.1	BBL (2005)	

ID	Depth (ft, bgs)	Investigation Method	Location	Northing (NAD 83)	Easting (NAD 83)	Consultant (Year)	Remarks
MW-16	12	HSA	LOLA	196975.9	2306753.2	BBL (2004)	
MW-16D	47	Mud Rotary	LOLA	196962.7	2306758.1	BBL (2005)	
MW-20	14	HSA	LOLA	196258.0	2305318.1	BBL (2005)	
MW-20D	52	Mud Rotary	LOLA	196256.9	2305326.1	BBL (2005)	
GP-01	40	Geoprobe	Within the 1971 Basin	198282.9	2305487.8	Geosyntec (2014)	
GP-02	84	Geoprobe	Within the 1971 Basin	198829.2	2305479.9	Geosyntec (2014)	
GP-03	88	Geoprobe	Within the 1971 Basin	199020.4	2305207.6	Geosyntec (2014)	
GP-04	28	Geoprobe	Within the 1971 Basin	198013.2	2306204.1	Geosyntec (2014)	
GP-05	24	Geoprobe	Within the 1971 Basin	199238.5	2304436.7	Geosyntec (2014)	
GP-06	28	Geoprobe	Within the 1971 Basin	199016.4	2305634.6	Geosyntec (2014)	
GP-07	36	Geoprobe	Within the 1971 Basin	197980.6	2305972.0	Geosyntec (2014)	
GP-08	32	Geoprobe	Within the 1971 Basin	198603.9	2304725.8	Geosyntec (2014)	
GP-09	40	Geoprobe	Within the 1971 Basin	198963.0	2304385.6	Geosyntec (2014)	

ID	Depth (ft, bgs)	Investigation Method	Location	Northing (NAD 83)	Easting (NAD 83)	Consultant (Year)	Remarks
GP-10	24	Geoprobe	Within the 1971 Basin	199091.6	2304846.3	Geosyntec (2014)	
GP-11	24	Geoprobe	Within the 1971 Basin	199364.0	2304729.4	Geosyntec (2014)	
GP-12	40	Geoprobe	Within the 1971 Basin	199302.5	2305001.6	Geosyntec (2014)	
GP-13	80	Geoprobe	Within the 1971 Basin	199150.5	2305092.7	Geosyntec (2014)	
GP-14	84	Geoprobe	Within the 1971 Basin	198621.2	2305747.4	Geosyntec (2014)	
GP-15	84	Geoprobe	Within the 1971 Basin	198295.2	2305863.3	Geosyntec (2014)	
GP-16	8	Geoprobe	Within the 1971 Basin	199205.8	2305531.9	Geosyntec (2014)	
GP-16A	16	Geoprobe	Within the 1971 Basin	199203.7	2305516.8	Geosyntec (2014)	
GP-17	60	Geoprobe	1971/1984 Divider Dike	199099.6	2305644.4	Geosyntec (2014)	
MB-1	36	Geoprobe	Within the 1971 Basin	198663.1	2304987.5	Geosyntec (2014)	
MB-2	84	Geoprobe	Within the 1971 Basin	198526.3	2305458.9	Geosyntec (2014)	
SPT-01	40	Mud Rotary	1971 Dike	198394.4	2304871.1	Geosyntec (2014)	

ID	Depth (ft, bgs)	Investigation Method	Location	Northing (NAD 83)	Easting (NAD 83)	Consultant (Year)	Remarks
SPT-02	45	Mud Rotary	1971/1984 Divider Dike	199661.1	2304984.0	Geosyntec (2014)	
SPT-03	49	Mud Rotary	Within the 1971 Basin	198480.3	2305994.5	Geosyntec (2014)	
PZ-1971	22	Mud Rotary	Within the 1971 Basin	198492.4	2305987.6	Geosyntec (2014)	Abandoned in 2015
SPT-04	35	Mud Rotary	1984 Dike	199524.4	2306083.5	Geosyntec (2014)	
SPT-05	40	Mud Rotary	1984 Dike	200793.1	2305614.9	Geosyntec (2014)	
SPT-06	50	Mud Rotary	1984 Dike	201169.8	2304341.6	Geosyntec (2014)	
SPT-07	12	Mud Rotary	Within the 1984 Basin	199252.5	2305887.9	Geosyntec (2014)	
SPT-08	45	Mud Rotary	1984 Dike	199898.8	2304200.6	Geosyntec (2014)	
SPT-09/ PZ-INT	18	Mud Rotary	Within the 2006 ICA	200420.5	2304536.3	Geosyntec (2014)	Boring and Piezometer Co-located
PZ-101	22	Mud Rotary	2006 Dike	200675.4	2304779.8	Geosyntec (2014)	
PZ-102	22	Mud Rotary	2006 Dike	200868.2	2305186.9	Geosyntec (2014)	
PZ-103	30	Mud Rotary	1984 Dike	200329.2	2305784.8	Geosyntec (2014)	
PZ-104	30	Mud Rotary	1984 Dike	200008.4	2304134.3	Geosyntec (2014)	
PZ-105	25	Mud Rotary	1971 Dike	198085.0	2305518.7	Geosyntec (2014)	
PZ-106	25	Mud Rotary	1971 Dike	198414.9	2304821.4	Geosyntec (2014)	

ID	Depth (ft, bgs)	Investigation Method	Location	Northing (NAD 83)	Easting (NAD 83)	Consultant (Year)	Remarks
PZ-107	25	Mud Rotary	1971 Dike	198966.6	2304088.7	Geosyntec (2014)	
PZ-108S	18	Mud Rotary	Within the 1971 Basin	198487.7	2304871.2	Geosyntec (2014)	
PZ-108D	30	Mud Rotary	Within the 1971 Basin	198492.2	2304861.1	Geosyntec (2014)	
THB-1	9	Hand Auger	1971 Dike Toe	198299	2304924	Geosyntec (2014)	Coordinates from Hand-held GPS
THB-2	9.5	Hand Auger	1971 Dike Toe	198299	2304924	Geosyntec (2014)	Approximate Coordinates
THB-3	5	Hand Auger	1971 Dike Toe	198442	2304651	Geosyntec (2014)	Coordinates from Hand-held GPS
THB-4	7	Hand Auger	1971 Dike Toe	198442	2304651	Geosyntec (2014)	Approximate Coordinates
SPT-12	100	Mud Rotary	Within the 1971 Basin	199189.8	2304359.6	Geosyntec (2015)	
SPT-13	85	Mud Rotary	Within the 1971 Basin	198345.9	2305184.2	Geosyntec (2015)	
SPT-14	100	Mud Rotary	Within the 1971 Basin	198316.1	2306206.3	Geosyntec (2015)	
EW-1	49	Mud Rotary	Within the 1971 Basin	198440	2306217	Geosyntec (2015)	Abandoned in 2015; Approximate Coordinates
PT-1	41	Mud Rotary	Within the 1971 Basin	198434	2306217	Geosyntec (2015)	Abandoned in 2015; Approximate Coordinates

ID	Depth (ft, bgs)	Investigation Method	Location	Northing (NAD 83)	Easting (NAD 83)	Consultant (Year)	Remarks
PT-2	40.3	Mud Rotary	Within the 1971 Basin	198428	2306217	Geosyntec (2015)	Abandoned in 2015; Coordinates from Hand-held GPS
PT-3	70	Mud Rotary	Within the 1971 Basin	198435	2306226	Geosyntec (2015)	Abandoned in 2015; Coordinates from Hand-held GPS
PT-4	70	Mud Rotary	Within the 1971 Basin	198431	2306227	Geosyntec (2015)	Abandoned in 2015; Approximate Coordinates
F-DPT-1	16	Geoprobe	LOLA	196875.5	2306640.9	Geosyntec (2014)	
F-DPT-2	12	Geoprobe	LOLA	197079.5	2306716.4	Geosyntec (2014)	
F-DPT-3	12	Geoprobe	LOLA	197022.7	2306385.9	Geosyntec (2014)	
F-DPT-4	20	Geoprobe	LOLA	196505.8	2305220.2	Geosyntec (2014)	
F-DPT-5	20	Geoprobe	LOLA	197182.6	2305313.3	Geosyntec (2014)	
F-DPT-6	20	Geoprobe	LOLA	197155.9	2305004.4	Geosyntec (2014)	
F-DPT-7	20	Geoprobe	LOLA	197035.6	2305560.4	Geosyntec (2014)	
F-DPT-8	20	Geoprobe	LOLA	197251.1	2305892.6	Geosyntec (2014)	
F-DPT-9	20	Geoprobe	LOLA	197173.0	2306258.2	Geosyntec (2014)	
F-DPT-10	24	Geoprobe	LOLA	197915.9	2305065.0	Geosyntec (2014)	
F-DPT-11	20	Geoprobe	LOLA	197706.3	2305633.3	Geosyntec (2014)	
F-DPT-12	20	Geoprobe	LOLA	197519.4	2305959.0	Geosyntec (2014)	

ID	Depth (ft, bgs)	Investigation Method	Location	Northing (NAD 83)	Easting (NAD 83)	Consultant (Year)	Remarks
F-DPT-13	12	Geoprobe	LOLA	196602.1	2306104.6	Geosyntec (2014)	
F-DPT-14	20	Geoprobe	LOLA	197495.7	2305270.0	Geosyntec (2014)	
F-DPT-15	16	Geoprobe	LOLA	196723.8	2305805.9	Geosyntec (2014)	
LO-SPT-1	50	Mud Rotary	LOLA Dike	196830.7	2305008.2	Geosyntec (2015)	
LO-SPT-2	50	Mud Rotary	LOLA Dike	197296.3	2304961.1	Geosyntec (2015)	
LO-SPT-3	50	Mud Rotary	LOLA Dike	197662.0	2304949.4	Geosyntec (2015)	
LO-SPT-4	50	Mud Rotary	LOLA Dike	197890.4	2305246.0	Geosyntec (2015)	
LO-SPT-5	50	Mud Rotary	LOLA Dike	197711.7	2305633.1	Geosyntec (2015)	
LO-SPT-6	50	Mud Rotary	LOLA Dike	197519.1	2306018.7	Geosyntec (2015)	
WR-1	20.8	CPT	Within the 1984 Basin (2006 ICA)	199689.7	2305659.7	Withers & Ravenel (2006)	Dissipation Tests @ 13.0' bgs; GPS Coordinates
WR-2	17.7	CPT	Within the 1984 Basin (2006 ICA)	200400.7	2305553.9	Withers & Ravenel (2006)	Dissipation Tests @ 7.1 and 16.7' bgs; Shear Wave Velocity Measurements; GPS Coordinates

ID	Depth (ft, bgs)	Investigation Method	Location	Northing (NAD 83)	Easting (NAD 83)	Consultant (Year)	Remarks
WR-3	70	CPT	1984 Dike	200475.8	2305723.6	Withers & Ravenel (2006)	GPS Coordinates
WR-8	16.4	CPT	Within the 1984 Basin (2006 ICA)	199775.1	2304903.0	Withers & Ravenel (2006)	Dissipation Tests @ 16.4' bgs; GPS Coordinates
WR-10	70	CPT	1984 Dike	199905.4	2304199.2	Withers & Ravenel (2006)	GPS Coordinates
WR-12	70	CPT	1984 Dike	200353.3	2304140.0	Withers & Ravenel (2006)	GPS Coordinates
WR-13	18.4	CPT	Within the 1984 Basin (2006 ICA)	199824.9	2305788.3	Withers & Ravenel (2006)	GPS Coordinates
WR-14	17.6	CPT	Within the 1984 Basin (2006 ICA)	200549.5	2305461.9	Withers & Ravenel (2006)	GPS Coordinates
WR-15	17.2	CPT	Within the 1984 Basin (2006 ICA)	199830.1	2304294.5	Withers & Ravenel (2006)	GPS Coordinates
WR-16	18	CPT	Within the 1984 Basin (2006 ICA)	200051.4	2304183.2	Withers & Ravenel (2006)	GPS Coordinates
CPT-1	59.4	CPT	1971/1984 Divider Dike	199089.0	2305654.6	Geosyntec (2014)	
CPT-2	40.0	CPT	1971 Dike	198736.6	2304157.1	Geosyntec (2014)	Dissipation Tests @14.9', 24.9', and 34.9' bgs

ID	Depth (ft, bgs)	Investigation Method	Location	Northing (NAD 83)	Easting (NAD 83)	Consultant (Year)	Remarks
CPT-3	70.9	CPT	1984 Dike	198855.7	2306324.2	Geosyntec (2014)	Dissipation Tests @35.1', 40.7', and 60.5' bgs
CPT-4	39.9	CPT	1984 Dike	201961.8	2304729.9	Geosyntec (2014)	Dissipation Tests @15.1', 18.5', and 34.9' bgs
CPT-5	6.7	CPT	1984 Dike	200480.1	2304183.8	Geosyntec (2014)	
CPT-6A	19.9	CPT	2006 Dike	200492.7	2305640.8	Geosyntec (2014)	Dissipation Tests @ 20.0' bgs
CPT-7A	19.9	CPT	2006 Dike	200775.7	2305010.9	Geosyntec (2014)	Dissipation Tests @ 20.0' bgs
CPT-8	70.2	CPT	Within the 1971 Basin	198459.5	2306009.7	Geosyntec (2014)	Dissipation Tests @ 34.9', 49.9', and 65.0' bgs
SCPT-1	49.9	CPT	Within the 1984 Basin	198324.2	2306263.9	Geosyntec (2014)	Shear Wave Velocity Measurements
SCPT-2	70.1	CPT	1984 Dike	201744.4	2305260.9	Geosyntec (2014)	Dissipation Tests @ 14.9', 30.0', 40.0, and 65.1' bgs; Shear Wave Velocity Measurements
SCPT-3A	19.7	CPT	2006 Dike	199955.1	2304248.6	Geosyntec (2014)	Dissipation Tests @ 19.8' bgs; Shear Wave Velocity Measurements
SCPT-4	11.8	CPT	Within the 1984 Basin	198965.3	2306083.4	Geosyntec (2014)	Shear Wave Velocity Measurements
SCPT-5A	20.8	CPT	2006 Dike	199742.4	2304973.5	Geosyntec (2014)	Dissipation Tests @ 21.0' bgs; Shear Wave Velocity Measurements

ID	Depth (ft, bgs)	Investigation Method	Location	Northing (NAD 83)	Easting (NAD 83)	Consultant (Year)	Remarks
SCPT-6	19.9	CPT	Within the 2006 ICA	199780.1	2305143.7	Geosyntec (2014)	Shear Wave Velocity Measurements

Note(s):

[1] bgs: Below Ground Surface; HSA: Hollow Stem Auger; ICA: Interior Containment Area.

[2] The official nomenclature for the piezometers installed on the 1971 and 1984 dikes includes a State Dam ID “NEWHA-004” and “NEWHA-005,” respectively.

[3] The postfix ‘a’ indicates the investigation was performed along the 2006 dike.

[4] WR-9 was not performed.

Table 2. Summary of Index Test Results

Sample ID	Sample Type [1]	Depth [2] (ft bgs)	Material	Natural Moisture Content [3] (%)	LL (%)	PL (%)	PI (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Fines Content (%)	Specific Gravity	USCS [4]
SPT-1-SS-2	SS	4.3	Soil	-	-	-	-	-	-	-	-	25.3	-	SM
SPT-1-SS-4A	SS	9.1	Soil	-	-	-	-	-	-	-	-	5.7	-	SP-SM
SPT-1-SS-6	SS	14.3	Ash & Soil	-	-	-	-	-	-	-	-	19	-	SM
SPT-1-SS-7	SS	16.0	Ash & Soil	-	-	-	-	0	57	38.6	4.4	43	-	SM
SPT-1-SS-8A	SS	17.8	Ash & Soil	-	-	-	-	0.4	23.1	72.1	4.4	76.5	-	ML
SPT-1-SS-8B	SS	18.8	Ash	-	-	-	-	-	-	-	-	36.7	-	SM
SPT-1-SS-9	SS	20.0	Ash	-	NP	NP	NP	-	-	-	-	65.7	-	ML
SPT-1-SS-10	SS	22.0	Ash & Soil	-	-	-	-	-	-	-	-	51.5	-	ML
SPT-1-SS-11A	SS	23.8	Ash	-	-	-	-	-	-	-	-	79.5	-	ML
SPT-1-SS-12	SS	26.0	Soil	-	-	-	-	0	96.7	-	-	3.3	-	SP
SPT-1-SS-14	SS	34.3	Soil	-	-	-	-	-	-	-	-	37.6	-	SM
SPT-1-SS-15	SS	39.3	Soil	-	-	-	-	-	-	-	-	-	2.683	SM
SPT-2-SS-3	SS	6.8	Soil	-	-	-	-	-	-	-	-	7.6	-	SP-SM
SPT-2-SS-6	SS	19.3	Soil	-	-	-	-	-	-	-	-	3.5	-	SP
SPT-2-SS-8	SS	29.3	Soil	-	-	-	-	0	97.1	-	-	2.9	-	SP
SPT-2-SS-10A	SS	39.3	Soil	77.8	95	45	50	-	-	-	-	-	-	CH
SPT-2-SS-10B	SS	40.3	Soil	-	-	-	-	-	-	-	-	6.1	-	SP-SM
SPT-3-SS-3	SS	5.0	Ash	26.8	-	-	-	-	-	-	-	52	-	ML
SPT-3-SS-6	SS	11.0	Ash	28.5	-	-	-	-	-	-	-	50.2	-	ML
SPT-3-SS-8	SS	15.0	Ash	-	-	-	-	9.9	62.4	24.3	3.4	27.7	-	SM
SPT-3-SS-12	SS	23.0	Ash	-	NP	NP	NP	-	-	-	-	88.2	-	ML
SPT-3-SS-13	SS	25.0	Ash	-	-	-	-	-	-	-	-	84.7	-	ML
SPT-3-SS-14A	SS	26.9	Ash	46.1	-	-	-	-	-	-	-	-	-	ML
SPT-3-SS-16B	SS	31.5	Ash	-	-	-	-	-	-	-	-	92.4	-	ML

Sample ID	Sample Type [1]	Depth [2] (ft bgs)	Material	Natural Moisture Content [3] (%)	LL (%)	PL (%)	PI (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Fines Content (%)	Specific Gravity	USCS [4]
SPT-3-SS-17A	SS	32.5	Ash	43.4	-	-	-	-	-	-	-	-	2.343	ML
SPT-3-SS-17B	SS	33.5	Soil	-	-	-	-	1.2	82.5	-	-	16.3	-	SM
SPT-3-SS-18	SS	35.0	Ash	-	NP	NP	NP	0.2	8.8	80.5	10.5	91	-	ML
SPT-3-SS-19	SS	37.0	Ash & Soil	-	-	-	-	-	-	-	-	24.5	-	SM
SPT-3-SS-20B	SS	40.0	Ash	-	-	-	-	-	-	-	-	77.3	-	ML
SPT-3-SS-21	SS	42.0	Ash & Soil	-	-	-	-	1.3	64.9	32.2	1.6	33.8	-	SM
SPT-3-SS-23	SS	46.0	Ash	-	-	-	-	-	-	-	-	44.9	-	SM
SPT-3-SS-24	SS	48.0	Ash	-	NP	NP	NP	-	-	-	-	-	-	ML
SPT-4-SS-3	SS	6.8	Soil	-	-	-	-	-	-	-	-	3.2	-	SP
SPT-4-SS-6	SS	19.3	Soil	-	-	-	-	0.4	96.6	1.6	1.4	3	-	SP
SPT-4-SS-7	SS	24.3	Soil	-	-	-	-	-	-	-	-	2.3	-	SP
SPT-4-SS-9	SS	34.3	Soil	-	-	-	-	-	-	-	-	2.7	2.694	SP
SPT-5-SS-3	SS	6.8	Soil	-	-	-	-	-	-	-	-	8	-	SP-SM
SPT-5-SS-4	SS	9.3	Soil	-	-	-	-	0	97.4	-	-	2.6	-	SP
SPT-5-SS-6	SS	19.3	Soil	-	-	-	-	0.9	97.4	1.1	0.6	1.7	-	SP
SPT-5-SS-8	SS	29.3	Soil	-	-	-	-	-	-	-	-	4.1	-	SP
SPT-6-SS-6	SS	19.3	Soil	-	-	-	-	-	-	-	-	3.9	-	SP
SPT-6-SS-8	SS	29.3	Soil	-	-	-	-	0.1	97.1	2.2	0.6	2.8	-	SP
SPT-6-SS-9	SS	34.3	Soil	-	-	-	-	-	-	-	-	-	2.693	SP
SPT-6-SS-11	SS	44.3	Soil	-	-	-	-	-	-	-	-	4.7	-	SP
SPT-7-SS-2	SS	3.0	Ash	31.1	-	-	-	-	-	-	-	-	-	ML
SPT-7-SS-4	SS	7.0	Ash	52.9	NP	NP	NP	-	-	-	-	-	-	ML
SPT-7-SS-5	SS	9.0	Ash	-	-	-	-	0	9.5	-	-	90.5	-	ML
SPT-7-SS-6	SS	11.0	Ash	-	-	-	-	-	-	-	-	81.2	2.354	ML
SPT-8-SS-2	SS	4.3	Soil	-	-	-	-	-	-	-	-	4.4	-	SP

Sample ID	Sample Type [1]	Depth [2] (ft bgs)	Material	Natural Moisture Content [3] (%)	LL (%)	PL (%)	PI (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Fines Content (%)	Specific Gravity	USCS [4]
SPT-8-SS-6	SS	19.3	Soil	-	-	-	-	0	94.6	3.1	2.3	5.4	-	SP-SM
SPT-8-SS-7	SS	24.3	Soil	-	-	-	-	0.3	96.3	2.5	0.9	3.4	-	SP
SPT-8-SS-10	SS	39.3	Soil	-	-	-	-	-	-	-	-	3.3	-	SP
SPT-9-SS-2	SS	3.0	Ash	73.7	-	-	-	-	-	-	-	-	-	ML
SPT-9-SS-4	SS	7.0	Ash	-	NP	NP	NP	-	-	-	-	-	-	ML
SPT-9-SS-5	SS	9.0	Ash	-	-	-	-	-	-	-	-	97	-	ML
SPT-9-ST-6	ST	11.0	Ash	54.7	NP	NP	NP	0	6	88	6	94	2.268	ML
SPT-9-SS-7	SS	13.0	Ash	-	-	-	-	-	-	-	-	92.8	-	ML
SPT-9-SS-8	SS	15.0	Ash	45.8	NP	NP	NP	-	-	-	-	-	-	ML
GP-1-S-5	GP	18.0	Ash	60.1	-	-	-	-	-	-	-	-	-	ML
GP-1-S-10	GP	38.0	Soil	20.6	-	-	-	-	-	-	-	1	-	SP
GP-2-S-7	GP	26.0	Ash	51.3	-	-	-	-	-	-	-	-	-	ML
GP-2-S-19A	GP	73.9	Ash	-	32	26	6	-	-	-	-	-	-	ML
GP-3-S-15	GP	58.0	Ash	-	NP	NP	NP	-	-	-	-	-	2.316	ML
GP-3-S-20	GP	78.0	Ash	41.1	NP	NP	NP	-	-	-	-	-	2.31	ML
GP-3-S-21	GP	82.0	Ash	-	NP	NP	NP	-	-	-	-	-	-	ML
GP-4-S-6	GP	22.0	Soil	19.9	-	-	-	-	-	-	-	-	-	SP
GP-5-S-4B	GP	15.0	Soil	106.9	152	57	95	-	-	-	-	-	-	CH
GP-13-S-17	GP	66.0	Ash	-	NP	NP	NP	-	-	-	-	-	-	ML
GP-13-S-18	GP	70.0	Ash	-	NP	NP	NP	-	-	-	-	-	-	ML
GP-14-S-18	GP	70.0	Ash	-	NP	NP	NP	-	-	-	-	-	-	ML
GP-14-S-19	GP	75.0	Ash	-	NP	NP	NP	-	-	-	-	-	-	ML
GP-15-S-16	GP	62.0	Ash	-	NP	NP	NP	-	-	-	-	-	-	ML
GP-17-S-11	GP	43.7	Soil	-	85	40	45	-	-	-	-	-	-	OH
GP-17-S-12A	GP	44.9	Soil	-	126	60	66	-	-	-	-	-	-	OH

Sample ID	Sample Type [1]	Depth [2] (ft bgs)	Material	Natural Moisture Content [3] (%)	LL (%)	PL (%)	PI (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Fines Content (%)	Specific Gravity	USCS [4]
GP-17-S-12B	GP	46.2	Soil	-	67	31	36	-	-	-	-	-	-	CH
GP-17-S-13	GP	50.0	Soil	-	50	24	26	-	-	-	-	-	-	CH
GP-17-S-14	GP	54.0	Soil	-	NP	NP	NP	0.1	58.8	24.7	16.8	41.1	-	SM
GP-17-S-15	GP	58.0	Soil	-	26	22	4	-	44.4	33.8	21.8	55.6	-	CL-ML
MB-2-S-14	GP	66.0	Ash	-	NP	NP	NP	-	-	-	-	-	-	ML
MB-2-S-17	GP	78.0	Ash	-	NP	NP	NP	-	-	-	-	-	-	ML
B-1-SS-5	SS	11.8	Soil	17.1	-	-	-	0	95.5	-	-	4.5	-	SP
B-1-SS-10	SS	24.3	Soil	19	-	-	-	0	98.2	-	-	1.8	-	SP
B-2-SS-2	SS	4.3	Soil	13.2	-	-	-	0	95.9	-	-	4.1	-	SP
B-2-SS-8	SS	19.3	Soil & Ash	71.1	52	42	10	0.4	19.8	-	-	79.8	-	MH
B-3-SS-4	SS	9.3	Soil	25	NP	NP	NP	0	69.4	-	-	30.6	-	SM
B-3-SS-5	SS	11.8	Soil	25.3	NP	NP	NP	0	74.7	-	-	25.3	-	SM
B-3-SS-6	SS	14.3	Soil	28.7	NP	NP	NP	0	70.5	-	-	29.5	-	SM
B-3-SS-8	SS	19.3	Soil & Ash	62.1	46	40	6	0	18.2	-	-	81.8	-	ML
WR-5A	ST	3.1	Ash	-	-	-	-	0	6.4	-	-	93.6	-	ML
WR-5A	ST	13.0	Ash	-	-	-	-	0	7.3	-	-	92.7	-	ML
Bulk Sample 1	BU	1.5	Ash	-	NP	NP	NP	0	27.4	-	-	72.6	-	ML
Bulk Sample 2	BU	7.5	Ash	-	-	-	-	0	34.5	-	-	65.5	-	ML
SPT-12-S-3	SS	4.5	Ash	24	-	-	-	-	-	-	-	-	-	ML
SPT-12-S-8	SS	24.25	Soil	-	147	66	81	0	0.6	27.5	71.9	99.4	2.513	MH
SPT-12-S-9	ST	26	Soil	102.6	90	48	42	1.1	1.8	30.5	66.6	97.1	-	MH
SPT-12-S-14	SS	46.75	Soil	-	-	-	-	0	94.7	-	-	5.3	2.713	SP-SC
SPT-12-S-15	SS	51.75	Soil	-	30	14	16	-	-	-	-	39	-	SC
SPT-12-S-18	SS	59.25	Soil	-	-	-	-	0.2	93.5	-	-	6.3	-	SP-SC
SPT-12-S-19	SS	64.25	Soil	-	-	-	-	-	-	-	-	7	-	SP-SC

Sample ID	Sample Type [1]	Depth [2] (ft bgs)	Material	Natural Moisture Content [3] (%)	LL (%)	PL (%)	PI (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Fines Content (%)	Specific Gravity	USCS [4]
SPT-12-S-23	SS	74.25	Soil	-	NP	NP	NP	0.2	82.2	11.7	5.7	17.6	-	SC
SPT-12-S-27	SS	94.25	Soil	-	NP	NP	NP	0	69.7	22.2	8.1	30.3	2.725	SC
SPT-13-S-2	SS	3	Ash	38.1	-	-	-	-	-	-	-	-	-	ML
SPT-13-S-12	SS	44.25	Soil	-	-	-	-	0	95.2	-	-	4.8	2.668	SP
SPT-13-S-17	ST	53	Soil	33.8	50	24	26	0	7	36	57	93	2.701	CH
SPT-13-S-20	SS	59.25	Soil	-	NP	NP	NP	0	95.7	3.3	1	4.3	-	SP
SPT-13-S-24	SS	79.25	Soil	-	NP	NP	NP	0.1	85.6	-	-	14.3	-	SC
SPT-14-S-3	SS	5	Ash	35.8	-	-	-	-	-	-	-	-	-	ML
SPT-14-S-9	SS	29.25	Soil	-	-	-	-	0	95	-	-	5	-	SP
SPT-14-S-12	SS	44.25	Soil	-	-	-	-	0.4	96.6	-	-	3	-	SP
SPT-14-S-15	SS	51.75	Soil	-	54	24	30	0	4.6	57.3	38.1	95.4	-	CH
SPT-14-S-19	SS	64.25	Soil	-	-	-	-	0.2	95.1	-	-	4.7	-	SP
SPT-14-S-23	SS	84.25	Soil	-	NP	NP	NP	0	79.8	-	-	20.2	2.695	SC
PT-2-S-7	SS	34.25	Soil	-	-	-	-	0	94.2	5.6	0.2	5.8	-	SP-SC
PT-3-S-11	SS	49.25	Soil	-	-	-	-	-	-	-	-	2.2	-	SP
PT-3-S-12	SS	51.75	Soil	-	-	-	-	0	93.3	6.3	0.4	6.7	-	SP-SC
PT-3-S-13	SS	54.25	Soil	-	-	-	-	-	-	-	-	2.6	-	SP
PT-3-S-17	SS	69.25	Soil	-	-	-	-	0.3	87.9	7.1	4.7	11.8	-	SP-SC
LO-SPT-1-S-3	SS	5	Soil & Ash	24.1	-	-	-	1.4	55.9	-	-	42.7	2.418	SM
LO-SPT-1-S-9	SS	29.25	Soil	-	-	-	-	0.2	96.7	-	-	3.1	2.693	SP
LO-SPT-1-S-12	SS	36.75	Soil	-	-	-	-	-	-	-	-	2.4	-	SP
LO-SPT-2-S-3	SS	6.75	Soil & Ash	-	-	-	-	0.8	72.2	-	-	27	-	SM
LO-SPT-2-S-6	SS	19.25	Soil	-	-	-	-	0	98	-	-	2	-	SP
LO-SPT-2-S-10	SS	39.25	Soil	-	-	-	-	-	-	-	-	1.9	-	SP
LO-SPT-2-S-11	SS	44.25	Soil	-	-	-	-	-	-	-	-	2.2	-	SP

Sample ID	Sample Type [1]	Depth [2] (ft bgs)	Material	Natural Moisture Content [3] (%)	LL (%)	PL (%)	PI (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Fines Content (%)	Specific Gravity	USCS [4]
LO-SPT-3-S-2	SS	4.25	Soil & Ash	-	-	-	-	0.3	49.6	-	-	50.1	2.485	ML
LO-SPT-3-S-5	SS	14.25	Soil	-	-	-	-	0	96.8	-	-	3.2	-	SP
LO-SPT-3-S-9	SS	34.25	Soil	-	-	-	-	-	-	-	-	2.1	2.678	SP
LO-SPT-4-S-2	SS	4.25	Soil & Ash	-	-	-	-	1.4	70.8	-	-	27.8	-	SM
LO-SPT-4-S-7	SS	24.25	Soil	-	-	-	-	0	97.2	-	-	2.8	-	SP
LO-SPT-4-S-9	SS	34.25	Soil	-	-	-	-	-	-	-	-	3.4	-	SP
LO-SPT-5-S-4	SS	9.25	Soil	-	-	-	-	-	-	-	-	1.2	2.673	SP
LO-SPT-5-S-7	SS	24.25	Soil	-	-	-	-	0	91.3	-	-	8.7	2.697	SP-SC
LO-SPT-6-S-3	SS	6.75	Soil	-	-	-	-	-	-	-	-	-	2.681	SP
LO-SPT-6-S-4	SS	9.25	Soil	-	-	-	-	-	-	-	-	2.7	-	SP
LO-SPT-6-S-5	SS	14.25	Soil	-	-	-	-	0	96.7	-	-	3.3	-	SP
LO-SPT-6-S-9	SS	34.25	Soil	-	-	-	-	-	-	-	-	2.5	-	SP
LO-SPT-6-S-10	SS	39.25	Soil	-	-	-	-	-	-	-	-	2	-	SP

Note(s):

[1] SS: Split-Spoon; ST: Shelby tube; GP: Geoprobe; BU: Bulk Sample

[2] Mid-depth of the sample; bgs: Below Ground Surface

[3] Additional moisture content tests were conducted as part of grain size distribution tests. However, these samples were excluded from the above table since they are affected by drilling mud used in the field. See Appendix 3 for these additional results.

[4] USCS classification is determined based on a combination of visual-manual classification and laboratory data.

[5] For SPT-9-ST-6 and SPT-13-S-17, the natural moisture content was also measured as part of additional laboratory tests. See Appendices 3.3 and 3.4 for these additional results.

Table 3. Summary of CU Test Results

Boring ID	Sample ID	Source	Sample Location	Depth[1] (ft, bgs)	Elevation[2] (ft, NAVD88)	Material	Moisture Content (%)	Dry Unit Weight (pcf)	$\sigma'_{consol.}$(psi)	Deviator Stress[3] ($\sigma'_1 - \sigma'_3$) (psi)
WR-5A	Not Available	Withers & Ravenel	1984 Basin (2006 ICA)	12.6	16.2	Ash	101.2	49.1	8	50
				13.6	15.2	Ash	55.8	63.7	15	100
				13.1	15.7	Ash	62.5	62.1	25	72
N/A	Bulk 2 [4]	Withers & Ravenel	1984 Basin (2006 ICA)	7.5	21.2	Ash	49.5	57.0	5	33
						Ash	49.5	57.0	12	43
						Ash	49.5	56.9	24	51
SPT-9	ST-6	Geosyntec	2006 ICA	11.0	28.9	Ash	55.3	62.1	3	104
							54.5	62.4	8	105
SPT-13	S-17	Geosyntec	1971 Basin	53	-19.5	Silty Clay	53.5	67.9	19	14
						Silty Clay	48.2	64.6	27	19
						Silty Clay	33.8	88	32	19

Note(s):

[1] Mid-depth of the sample; bgs: Below Ground Surface; N/A: Not Applicable.
[2] NAVD88: North American Vertical Datum of 1988.
[3] Deviator stress at an axial strain of 15%.
[4] The CU tests were conducted on the remolded samples.

Table 4. Selected Material Parameters

Area	Material	Total Unit Weight (pcf)	Drained Shear Strength		Undrained Shear Strength Ratio S_u/σ_c'[5]	Undrained Shear Strength Ratio S_u/σ_v'[5]	Compressibility		
			Cohesion, c' (psf)	Friction Angle, ϕ' (degrees)			Overconsolidation Ratio, OCR	Modified Compression Ratio, $C_{c\varepsilon}$	Modified Recompression Ratio, $C_{r\varepsilon}$
Basin	Dike Fill	120[1]	0	38	-	-	-	-	-
Basin	Sandy Foundation Soils[7]	115[1]	0	34	-	-	-	-	-
Basin	Clayey Foundation Soils	115[1]	288	20	0.35	0.24	-	-	-
Basin	Impounded CCR	95[2]	0 [2]	34 [2]	1.0	0.6	1 [2], [6]	0.06 [2]	0.006 [2]
Basin	CCR and Soil Mix[8]	95[2]	0 [3]	25	-	-	-	-	-
Basin	Compacted CCR	95[2]	0	36[4]	-	-	-	-	-
LOLA	Fill and Foundation Soils	115[1]	0	34	-	-	-	-	-
LOLA	CCR and Soil Mix	95[2]	0 [3]	31	-	-	-	-	-

Note(s):

[1] These parameters were selected as representative values for the given material.

[2] These parameters were selected based on the test results for the impounded CCR samples collected from within the 1984 Basin and the 2006 Interior Containment Area.

[3] A cohesion can be used for shallow depths to consider vegetation effects if any.

[4] These parameters were selected based on the CU tests conducted on CCR at another confidential site located in the southeastern US.

[5] S_u/σ'_v is the ratio between the undrained shear strength and vertical effective stress. It was obtained based on S_u/σ'_c (i.e., the ratio between the undrained shear strength and laboratory confining stress) after correcting for anisotropic effects. The S_u/σ'_v should be used for the slope stability analyses.

[6] The OCR was conservatively selected to be 1 (i.e., normally consolidated).

[7] The selected parameters are applicable for the material above Elevation -20 ft (NAVD88).

[8] This material was encountered below the 1971 dike.

[9] Due to sandy nature, no compaction testing was conducted on the Foundation Soil samples. Typical ranges of maximum dry unit weights and optimum moisture contents for different soil types are presented in Naval Facilities Engineering Command (NAVFAC) Design Manual 7.02 [1986]. From the presented range, a representative maximum dry density of 110 pcf and a representative optimum water content of 15% were selected for Foundation Soils.

Table 5. Summary of Consolidation Test Results

Boring ID	Sample ID	Source	Sample Location	Depth[1] (ft, bgs)	Elevation[2] (ft, NAVD88)	Material	Moisture Content (%)	Dry Unit Weight (pcf)	P_c (psf)	OCR[3]	$C_{c\varepsilon}$	$C_{r\varepsilon}$
WR-5A	Not Available	Withers & Ravenel	1984 Basin (2006 ICA)	3.4	25.3	Ash	78.16	51.5	3800	1.0	0.088	0.008
				12.2	16.5	Ash	101.17	41.11	5500	1.0	0.2526	Note 4
SPT-9	ST-6	Geosyntec	2006 ICA	11	28.9	Ash	54.6	60.3	1500	1.0	0.0309	0.004

Note(s):

[1] Mid-depth of the sample; bgs: Below Ground Surface
[2] NAVD88: North American Vertical Datum of 1988.
[3] The OCR was calculated to be 2.0 or greater but is conservatively assumed to be 1.0.
[4] No deformation was measured during the reloading, which indicates a malfunctioning gauge or inaccurate data.
[5] Pc: preconsolidation pressure; Ccε: modified compression ratio; and Crε: modified recompression ratio.

Table 6. Summary of Hydraulic Conductivity Test Results

Boring ID	Sample ID	Source	Sample Location	Depth[1] (ft, bgs)	Elevation[2] (ft, NAVD88)	Material	Average Permeability (cm/s)
N/A	Bulk Sample 2	Withers & Ravenel	1984 Basin (2006 ICA)	7.5	21.2	Ash	2.0E-04

Note(s):

[1] Mid-depth of the sample; bgs: Below Ground Surface; N/A: Not Applicable.
[2] NAVD88: North American Vertical Datum of 1988.
[3] The hydraulic conductivity tests were conducted on the remolded samples.

Table 7. Summary of Compaction Test Results

Boring ID	Sample ID	Source	Sample Location	Depth[1] (ft, bgs)	Elevation[2] (ft, NAVD88)	Material	Optimum Water Content (%)	Maxiumum Dry Density (pcf)
N/A	Bulk Sample 1	Withers & Ravenel	1984 Basin (2006 ICA)	1.5	27.2	Ash	56.1	51.8
N/A	Bulk Sample 2	Withers & Ravenel	1984 Basin (2006 ICA)	7.5	21.2	Ash	45.7	61.2

Note(s):

[1] Mid-depth of the sample; bgs: Below Ground Surface; N/A: Not Applicable.

[2] NAVD88: North American Vertical Datum of 1988.

Table 8. Summary Test Results for Flow Potential Evaluation

Boring ID	Sample ID	Source	Sample Location	Sample Type[1]	Depth[2] (ft, bgs)	Elevation[3] (ft, NAVD88)	Carbonate Content (%)	pH	
								Method 1[4]	Method 2[4]
SPT-1	SS-8B	Geosyntec	1971 Basin	SS	18.8	8.8	0%	6.1	6.0
	SS-9			SS	20.0	7.5	0%	5.6	5.2
SPT-3	SS-13		1971 Basin	SS	25.0	20.2	0%	5.0	5.1
	SS-18			SS	35.0	10.2	0%	5.4	5.3
	SS-23			SS	46.0	-0.8	0%	5.3	5.2
SPT-7	SS-5		1984 Basin	SS	9.0	23.8	0%	6.5	6.2
SPT-9	SS-5		2006 ICA	SS	9.0	30.9	0%	6.4	6.3
	SS-8			SS	15.0	24.9	0%	6.0	6.0
	SS-9			SS	17.0	22.9	0%	6.1	6.0
GP-2	S-7		1971 Basin	GP	26.0	19.1	0%	6.1	6.0
	S-19A			GP	73.9	-28.8	0%	6.0	6.0
GP-3	S-20		1971 Basin	GP	78.0	-30.7	0%	6.3	6.1
	S-21			GP	82.0	-34.7	0%	6.2	6.1

Note(s):

[1] SS: Split-spoon; GP: Geoprobe.
[2] Mid-depth of the sample; bgs: Below Ground Surface.
[3] NAVD88: North American Vertical Datum of 1988.
[4] The solution used to conduct the test for methods 1 and 2 are distilled water and calcium chloride, respectively.

Table 9. Summary of Total Unit Weight Test Results

Boring ID	Sample ID	Source	Sample Location	Material	Depth[1] (ft, bgs)	Elevation[2] (ft, NAVD88)	Moisture Content (%)	Dry Unit Weight (pcf)	Total Unit Weight (pcf)
WR-5A	Not Available	Withers & Ravenel	1984 Basin (2006 ICA)	Ash	3.4	25.3	78.16	51.5	91.8
WR-5A	Not Available	Withers & Ravenel	1984 Basin (2006 ICA)	Ash	9.2	19.6	74.69	49.8	87.0
WR-5A [3]	Not Available	Withers & Ravenel	1984 Basin (2006 ICA)	Ash	12.8	15.9	80.16	54	97.3
SPT-9	ST-6	Geosyntec	2006 Basin	Ash	11.0	28.9	54.9	61.5	95.3
SPT-13	S-17	Geosyntec	1971 Basin	Soil	53	-19.5	33.8	86.8	116.1

Note(s):

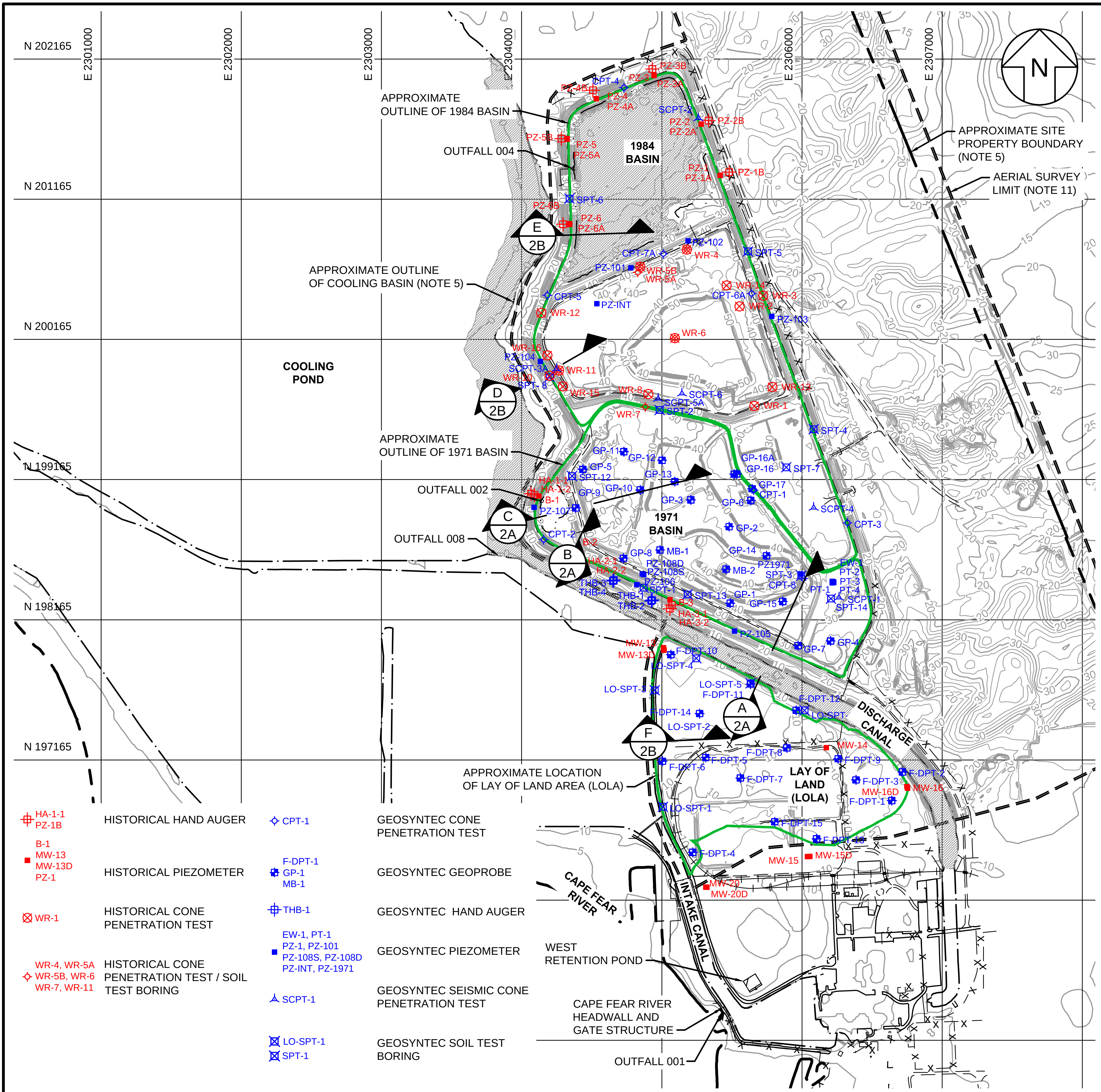
[1] Mid-depth of the sample; bgs: Below Ground Surface.

[2] NAVD88: North American Vertical Datum of 1988.

[3] The moisture content and dry unit weight presented are an average of the values measured during one 1-D consolidation and three CU tests.

FIGURES

M:\D\DUKE ENERGY\DUKE-SUTTON\DUKE-SUTTON CLOSURE-GC5592\FIGURES-CLOSURE GRADING OPTIONS II\5770F018 PLAN



HA-1-1 PZ-1B	HISTORICAL HAND AUGER	CPT-1	GEOSYNTEC CONE PENETRATION TEST
B-1 MW-13 MW-13D PZ-1	HISTORICAL PIEZOMETER	F-DPT-1 GP-1 MB-1	GEOSYNTEC GEOPROBE
⊗ WR-1	HISTORICAL CONE PENETRATION TEST	THB-1	GEOSYNTEC HAND AUGER
WR-4, WR-5A WR-5B, WR-6 WR-7, WR-11	HISTORICAL CONE PENETRATION TEST / SOIL TEST BORING	■ EW-1, PT-1 PZ-1, PZ-101 PZ-108S, PZ-108D PZ-INT, PZ-1971	GEOSYNTEC PIEZOMETER
		SCPT-1	GEOSYNTEC SEISMIC CONE PENETRATION TEST
		☒ LO-SPT-1 ☒ SPT-1	GEOSYNTEC SOIL TEST BORING

LEGEND

AERIAL SURVEY LIMIT (NOTE 11)

APPROXIMATE COOLING POND/CANAL OUTLINE

APPROXIMATE LOLA AND ASH BASIN OUTLINE

APPROXIMATE PROPERTY BOUNDARY

DIRT/UNPAVED ACCESS ROAD

EDGE OF WATER

10 EXISTING MAJOR CONTOUR ELEVATION

FENCE

MISCELLANEOUS STRUCTURE / CONCRETE

PAVED ACCESS ROAD

RAIL ROAD

AREA REPRESENTING BATHYMETRY SURVEY (NOTE 2)

A 2A APPROXIMATE SUBSURFACE SECTION LOCATION

NOTES:

1. THE PLANIMETRIC LOCATION ON THIS MAP IS BASED ON PHOTOGRAMMETRIC MAPPING OF IMAGERY COLLECTED ON 17 APRIL 2014. DATA PROVIDED WHERE CLEAR AND VISIBLE ON THE IMAGERY IS WITHIN 2' OF ITS TRUE POSITION.
2. BATHYMETRIC SURVEY WAS PROVIDED BY WSP, TITLED "GEOTECHNICAL / ENVIRONMENTAL INVESTIGATION LOCATIONS & BATHYMETRIC SURVEY", FILE NAME SUTTON WELL BASE.DWG, DATED JUNE 12, 2014. THE BATHYMETRY SURVEY AREA PRESENTED ON THIS DRAWING IS REPRESENTED BY SHADED AREA IN PLAN.
3. COORDINATES AND DIRECTIONS SHOWN ON THIS DRAWING ARE BASED ON NORTH CAROLINA STATE PLANE COORDINATE SYSTEM NCGRID/NAD83 (2011).
4. ELEVATIONS ON THIS SURVEY ARE REFERENCED TO NAVD88 VERTICAL DATUM.
5. APPROXIMATE PROPERTY LINE BOUNDARY AND COOLING POND OUTLINE WERE OBTAINED FROM THE NORTH CAROLINA NEW HANOVER COUNTY GIS WEBSITE: HTTP://WWW.NHCGOV.COM/GIS-DATA-AVAILABLE-FOR-DOWNLOAD/, PARCEL SHAPE FILE DATA AND MISC PROPERTY LINES RESPECTIVELY, LAST UPDATE ON AUGUST 10, 2005.
6. DISCHARGE TOWER AND PIPE LOCATIONS ARE APPROXIMATE BASED ON AERIAL IMAGES AND HISTORICAL DRAWINGS.
7. PZ-1971, EW-1, AND PT-SERIES WERE ABANDONED IN MARCH / APRIL 2015.
8. HA-SERIES, THB-SERIES, AND PZ-B SERIES POINTS ARE SHOWN AT APPROXIMATE LOCATIONS.
9. POST-FIX 'A' IN THE GEOSYNTEC INVESTIGATION IDS INDICATES A POINT ON THE DIKE OF 2006 INTERIOR CONTAINMENT AREA.
10. THE OFFICIAL NOMENCLATURE FOR THE PIEZOMETERS INSTALLED ON THE 1971 AND 1984 DIKES INCLUDES A STATE DAM ID "NEWHA-004" AND "NEWHA-005," RESPECTIVELY.
11. CONTOURS SHOWN OUTSIDE THE AERIAL MAPPING LIMIT ARE FROM A LIDAR SURVEY DATED APRIL 2007 OBTAINED FROM THE NORTH CAROLINA DOT GIS WEBSITE. CONTOURS AND TOPOGRAPHY WITHIN THE AERIAL MAPPING LIMIT WERE OBTAINED FROM AN AERIAL SURVEY DATED MARCH 2015 (FLOWN 17 APRIL 2014) AND WERE OBTAINED FROM WSP.

0 800'

SCALE IN FEET

DRAFT WORK IN PROGRESS - FOR REVIEW ONLY, NOT FOR CONSTRUCTION

FIELD INVESTIGATION LOCATION
L.V. SUTTON ENERGY COMPLEX
WILMINGTON, NORTH CAROLINA 28401

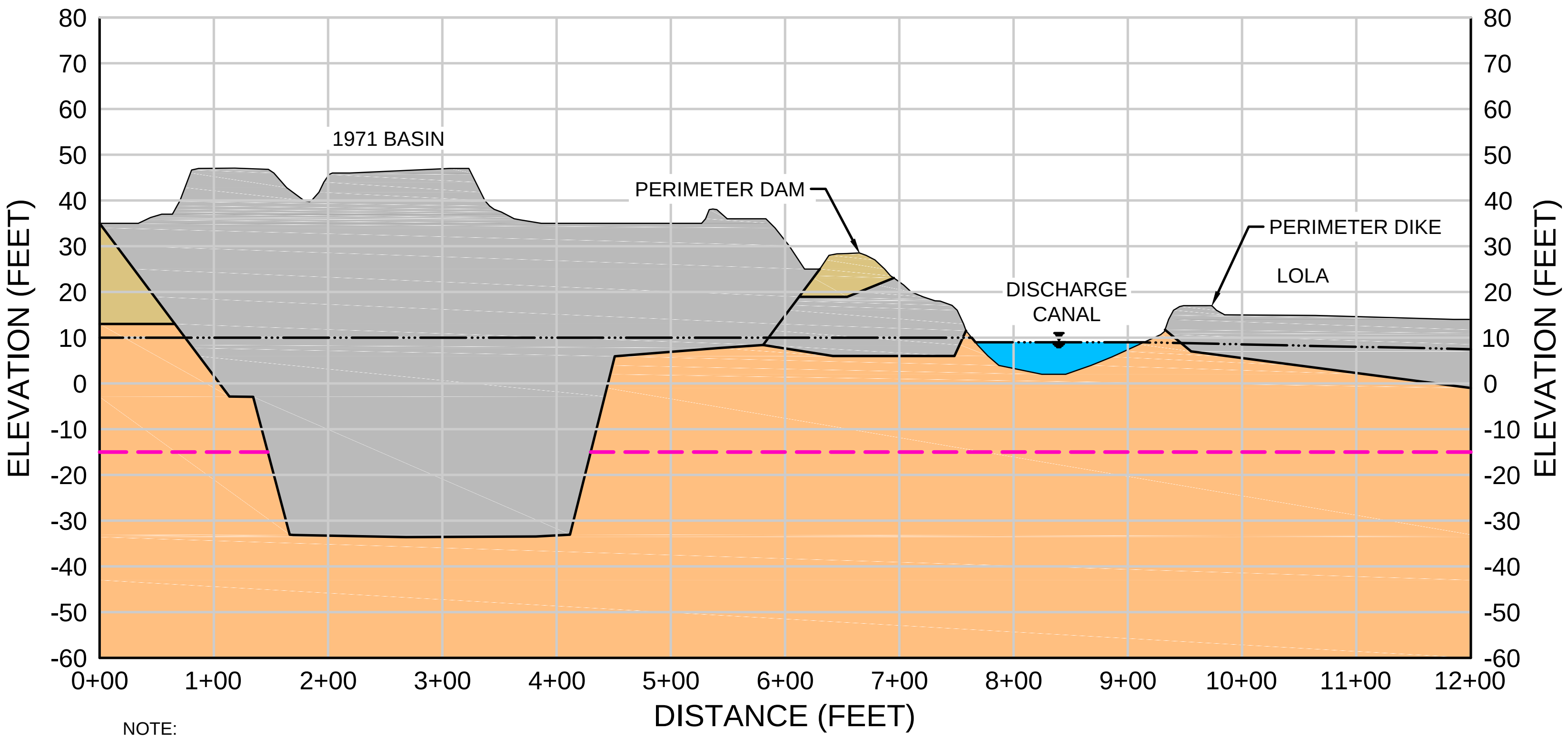
Geosyntec
consultants

FIGURE

1

PROJECT NO: GC5770

NOVEMBER 2015



NOTE:

1. IT WAS REPORTED THAT THE DOWNSTREAM SLOPES OF 1971 DAM AND LOLA DIKE WERE COVERED BY TOPSOILS WITH ORGANIC MATTER AND/OR VEGETATION DURING GEOSYNTEC'S INVESTIGATIONS IN 2014 AND MARCH 2015.

A
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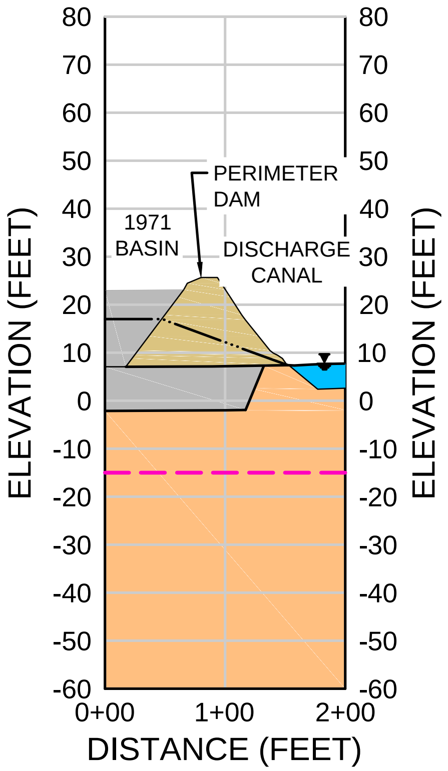

B
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SECTION
SUBSURFACE CROSS SECTION
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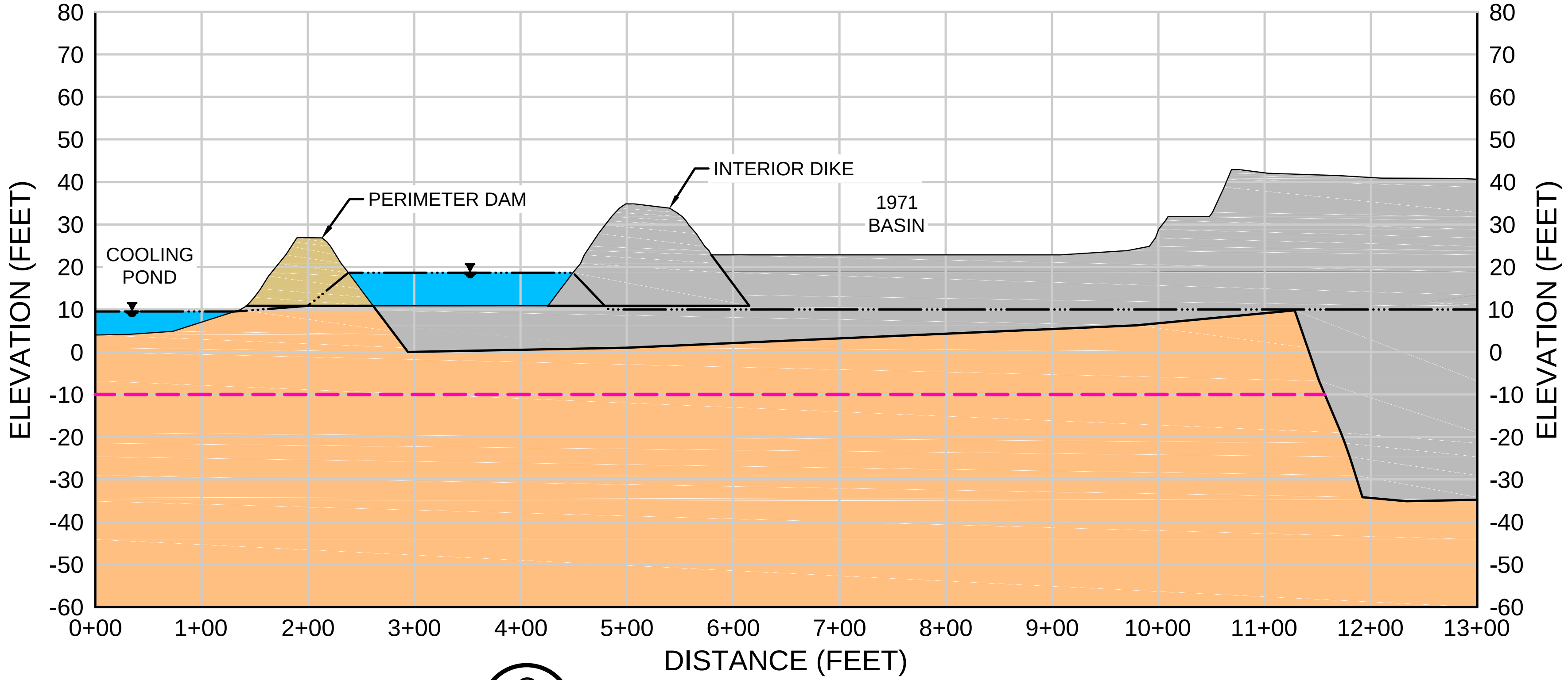

C
1
SECTION
SUBSURFACE CROSS SECTION
SCALE: 1"=160' (HORIZONTAL); 1"=40' (VERTICAL)

LEGEND

▨	CCR
🟩	CONCRETE SHORELINE ARMORING
🟨	SANDY FILL
🟧	SANDY FOUNDATION SOIL
🟦	WATER
– – – –	APPROXIMATE BOTTOM OF SURFICIAL AQUIFER (UPPERMOST STRATIGRAPHIC UNIT)
—···—▼—···—	ESTIMATED WATER TABLE LINE AND SYMBOL

0 160'
HORIZONTAL
SCALE IN FEET

0 40'
VERTICAL
SCALE IN FEET

DRAFT WORK IN PROGRESS - FOR REVIEW ONLY,
NOT FOR CONSTRUCTION

SUBSURFACE SECTIONS
L.V. SUTTON ENERGY COMPLEX
WILMINGTON, NORTH CAROLINA 28401

Geosyntec
consultants

FIGURE
2A

PROJECT NO: GC5770
NOVEMBER 2015

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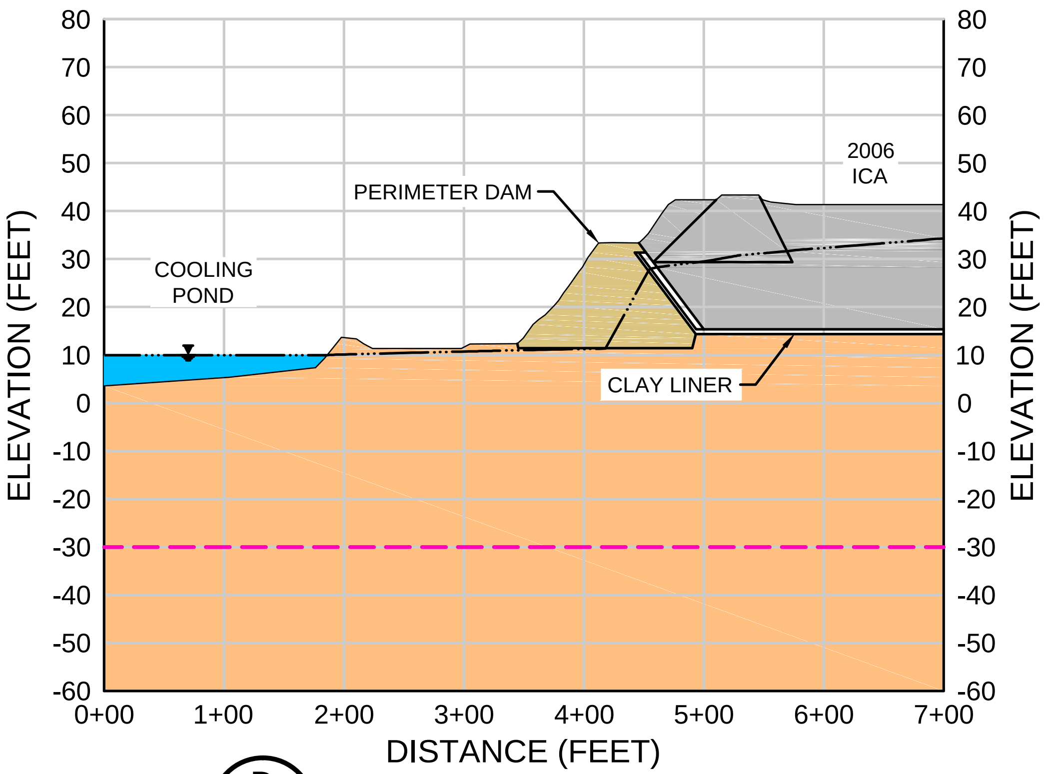

D
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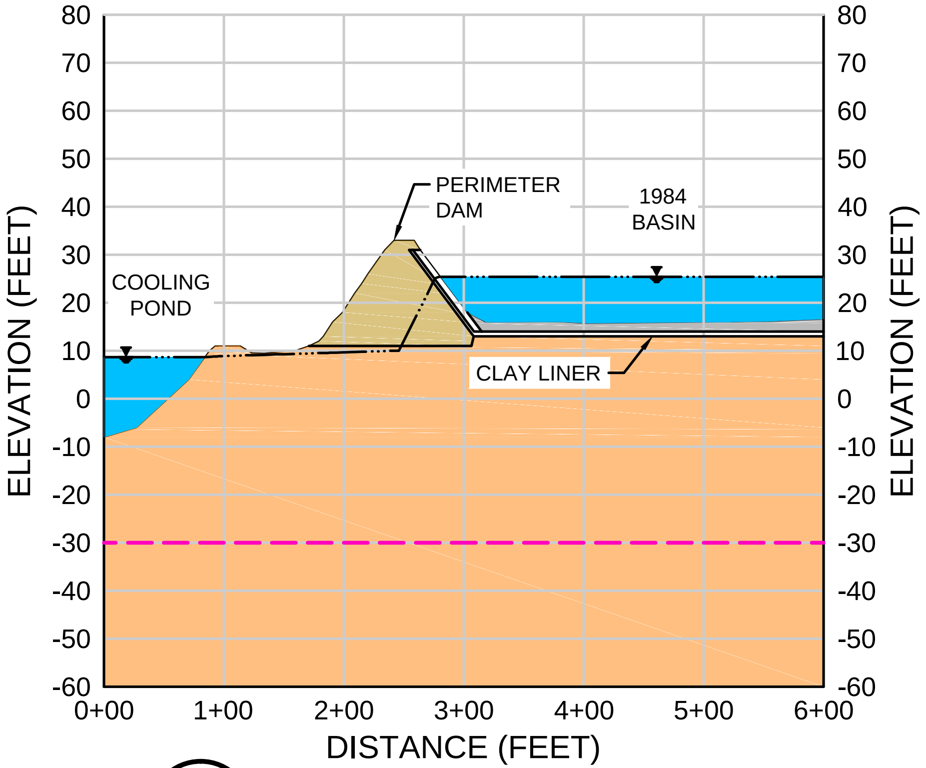

E
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SUBSURFACE CROSS SECTION
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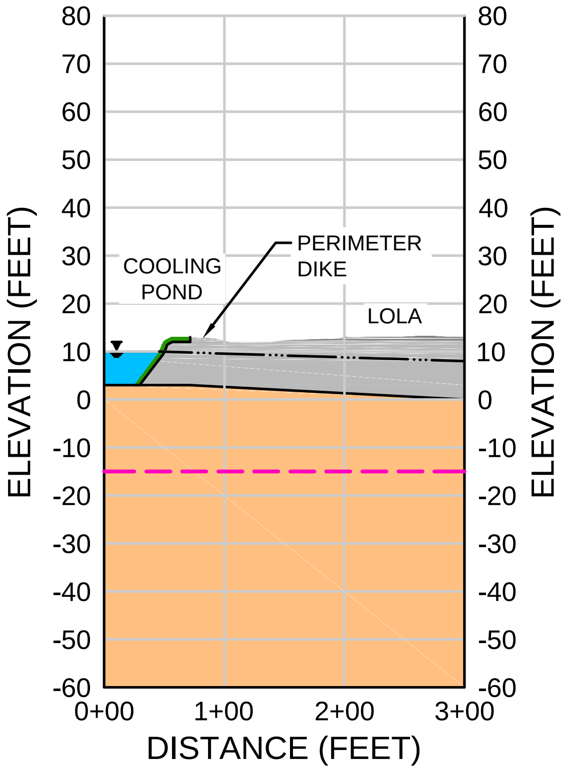

F
1
SECTION
SUBSURFACE CROSS SECTION
SCALE: 1"=160' (HORIZONTAL); 1"=40' (VERTICAL)

LEGEND

⬜	CCR
🟩	CONCRETE SHORELINE ARMORING
🟨	SANDY FILL
🟧	SANDY FOUNDATION SOIL
🟦	WATER
- - - -	APPROXIMATE BOTTOM OF SURFICIAL AQUIFER (UPPERMOST STRATIGRAPHIC UNIT)
—···—▼—···—	ESTIMATED WATER TABLE LINE AND SYMBOL

0 160'
HORIZONTAL
SCALE IN FEET

0 40'
VERTICAL
SCALE IN FEET

DRAFT WORK IN PROGRESS - FOR REVIEW ONLY,
NOT FOR CONSTRUCTION

SUBSURFACE SECTIONS
L.V. SUTTON ENERGY COMPLEX
WILMINGTON, NORTH CAROLINA 28401

Geosyntec
consultants

FIGURE
2B

PROJECT NO: GC5770
NOVEMBER 2015

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Oct 30 2019

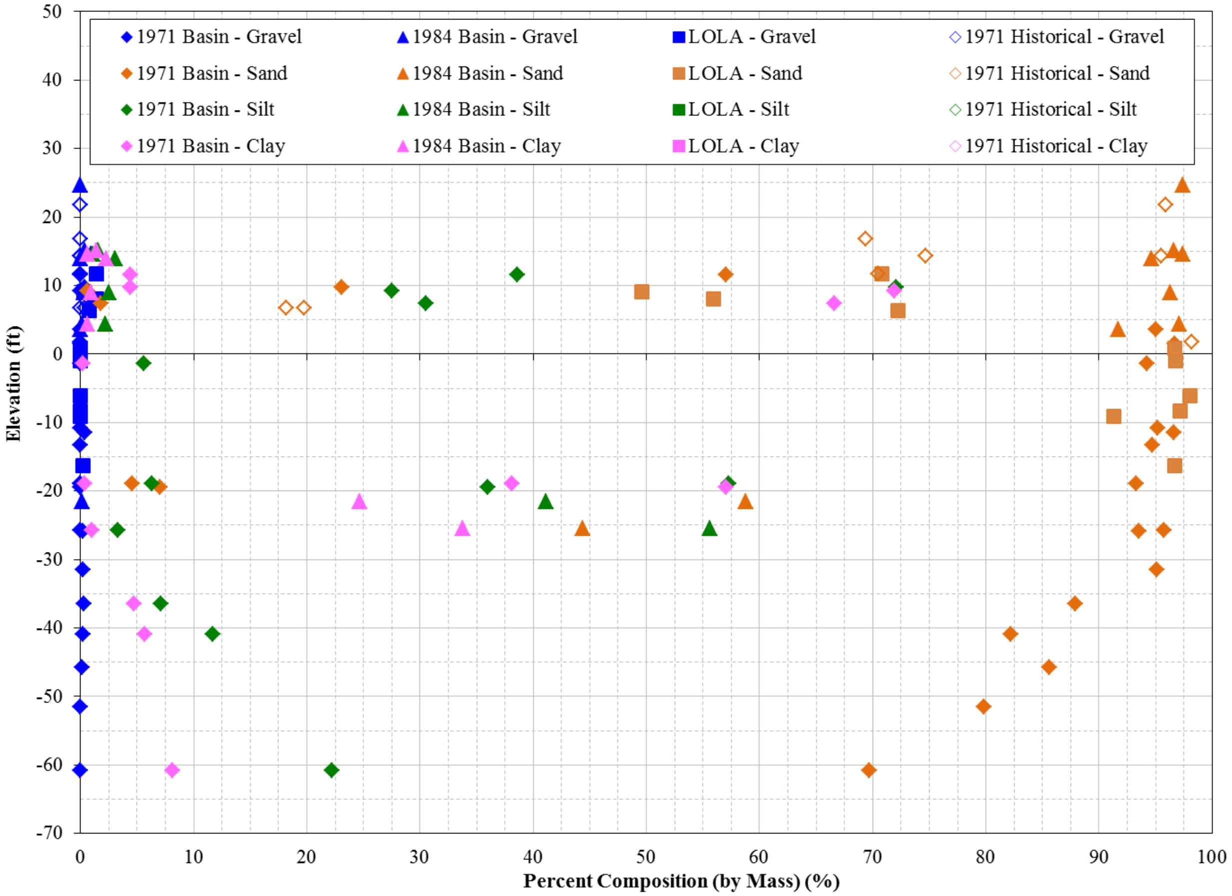

Figure 3a. Grain Size Distribution Test Results for Dike Fill and Foundation Soils

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.

[2] When a hydrometer test was not performed for the sample, percent compositions of silt and clay are not plotted. See Figure 4a for fines content data.

[3] The data for the CCR encountered below the 1971 Dike are included in the plot above as the material was considered as a foundation material.

[4] The data collected from the divider dike between the 1971 and 1984 Basins were considered to belong to the 1984 Basin for plotting purpose.

[5] The elevation of the Geosyntec data points is referenced to the NAVD88.

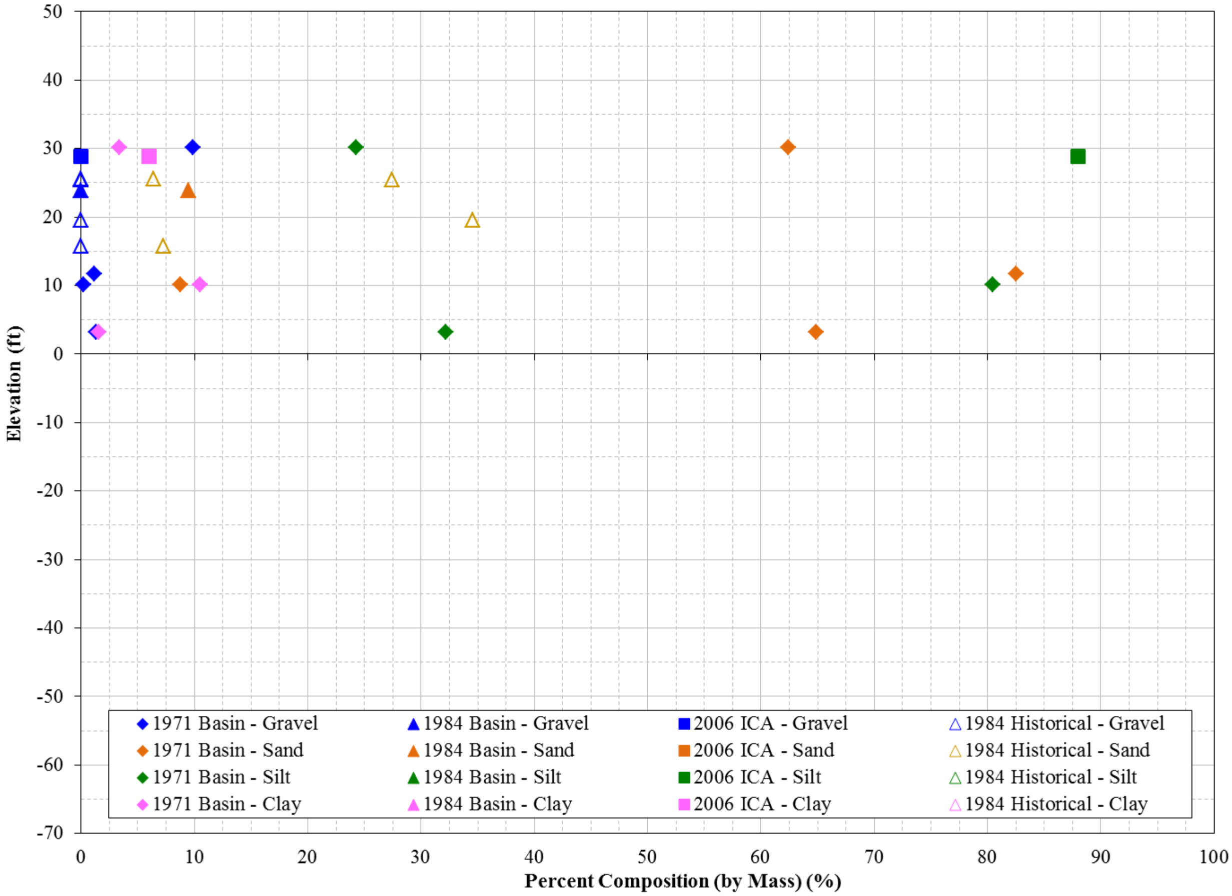

Figure 3b. Grain Size Distribution Test Results for the CCR within the Basins

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.

[2] When a hydrometer test was not performed for the sample, percent compositions of silt and clay are not plotted. See Figure 4b for fines content data.

[3] The Withers & Ravenel (2006) data were represented by 1984 Historical.

[4] The elevation of the Geosyntec data points is referenced to the NAVD88.

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Oct 30 2019

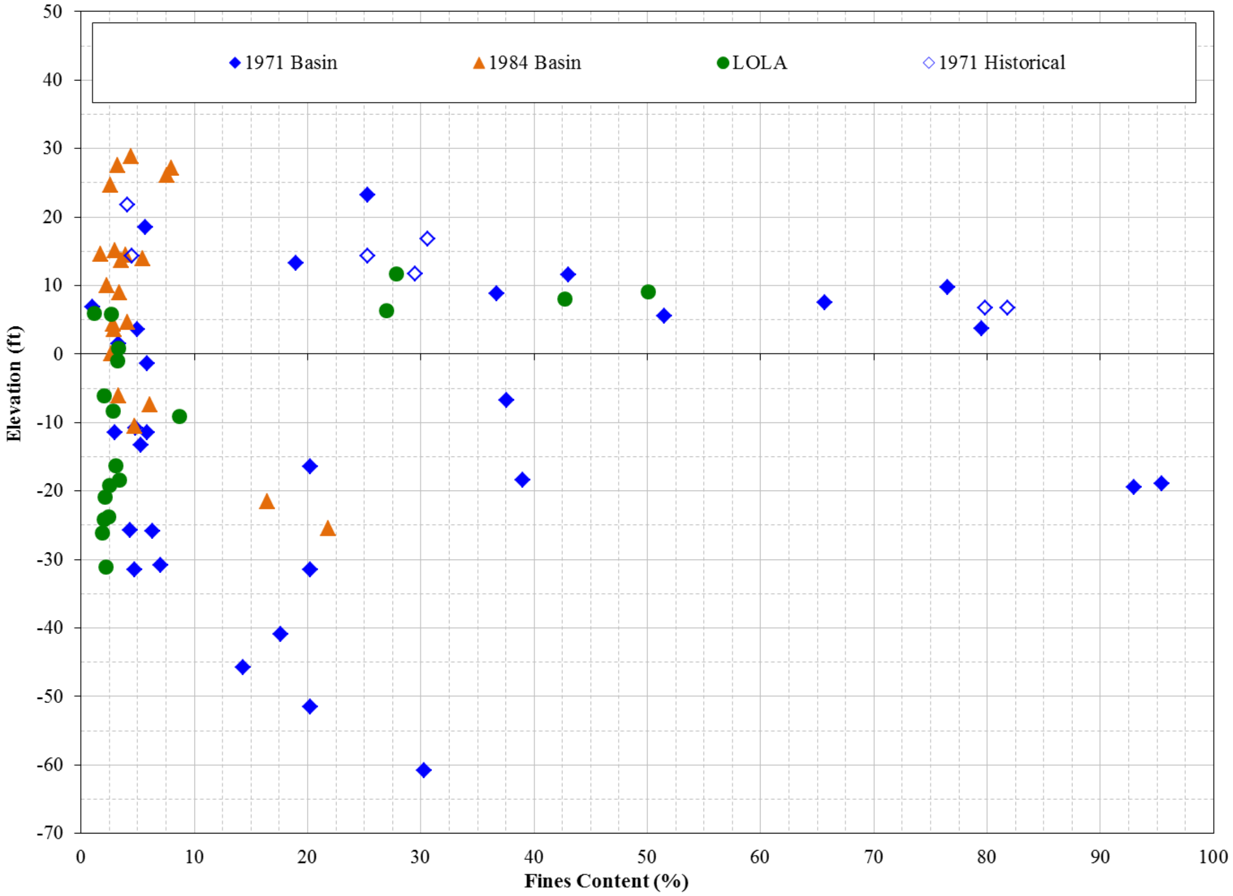

Figure 4a. Fines Content Data for Dike Fill and Foundation Soils

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.
[2] The data shown above include the results from grain size distribution testing and fine content testing.
[3] The data for the CCR encountered below the 1971 Dike are included in the plot above as the material was considered as a foundation material.
[4] The data collected from the divider dike between the 1971 and 1984 Basins were plotted as 1984 Basin for plotting purpose.
[5] The elevation of the Geosyntec data points is referenced to the NAVD88.

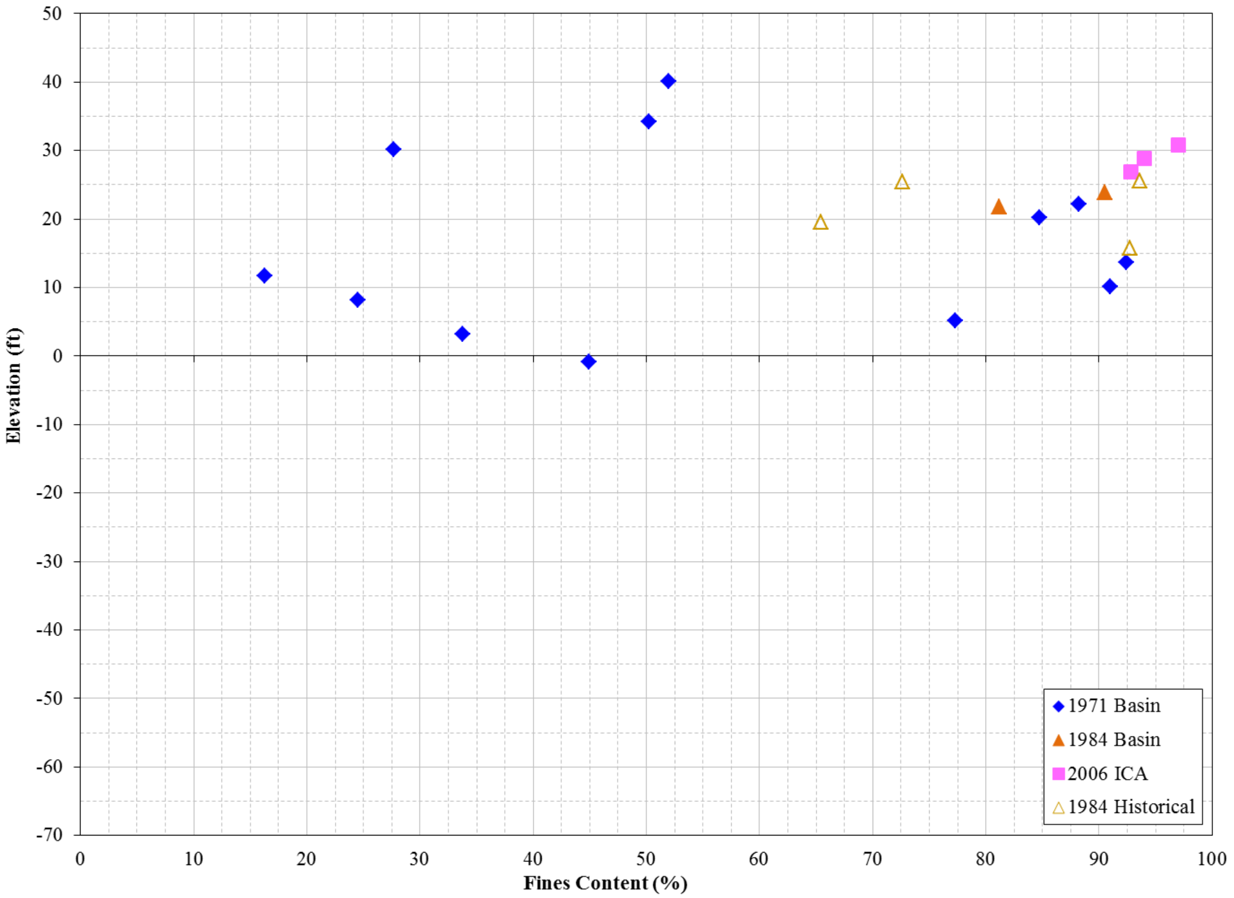

Figure 4b. Fines Content Data for the CCR within the Basins

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.
[2] The data shown above include the results from grain size distribution testing and fine content testing.
[3] The Withers & Ravenel (2006) data were represented by 1984 Historical.
[4] The elevation of the Geosyntec data points is referenced to the NAVD88.

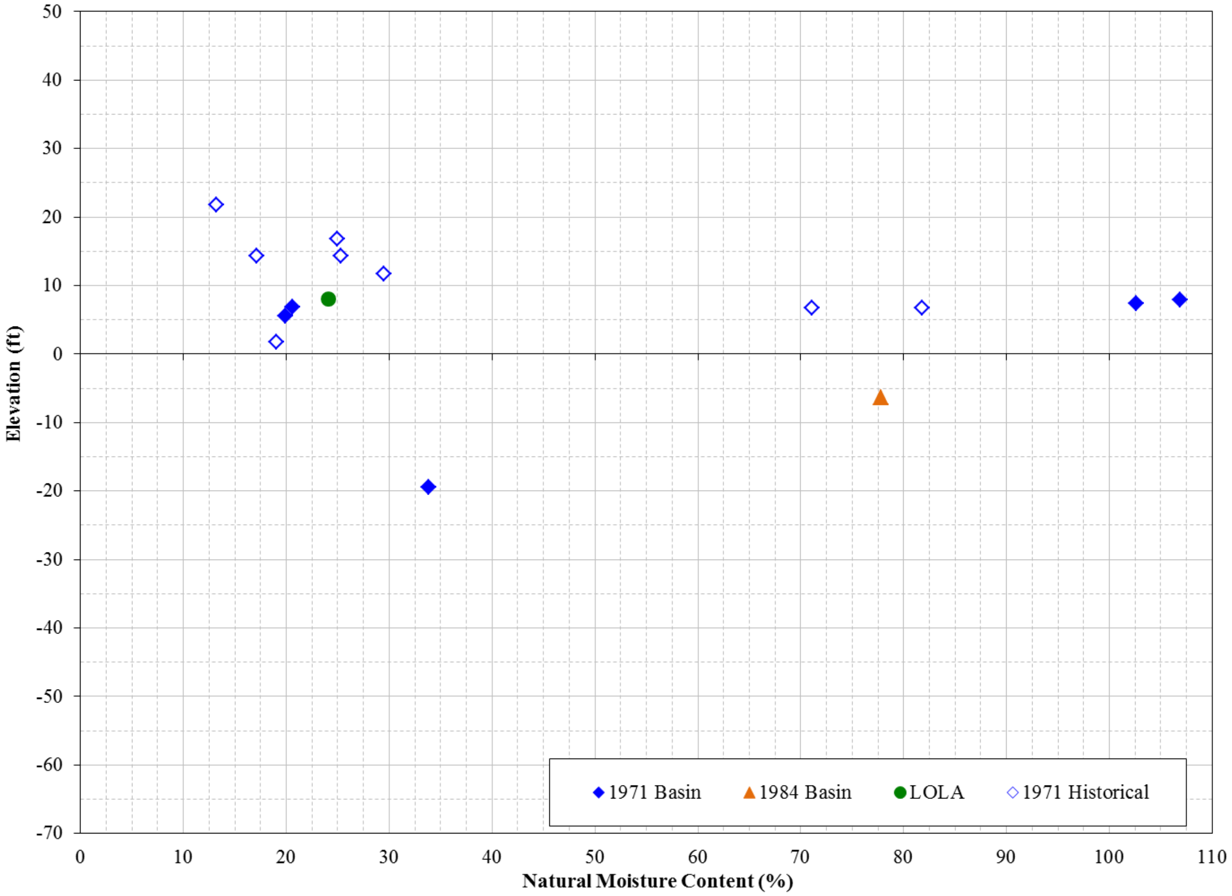

Figure 5a. Natural Moisture Content Data for Dike Fill and Foundation Soils

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.

[2] The data for the CCR encountered below the 1971 dike and along the LOLA dike are included in the plot above as the material was considered as a foundation material.

[3] The data collected from the divider dike between the 1971 and 1984 Basins were plotted as 1984 Basin for plotting purpose.

[4] The elevation of the Geosyntec data points is referenced to the NAVD88.

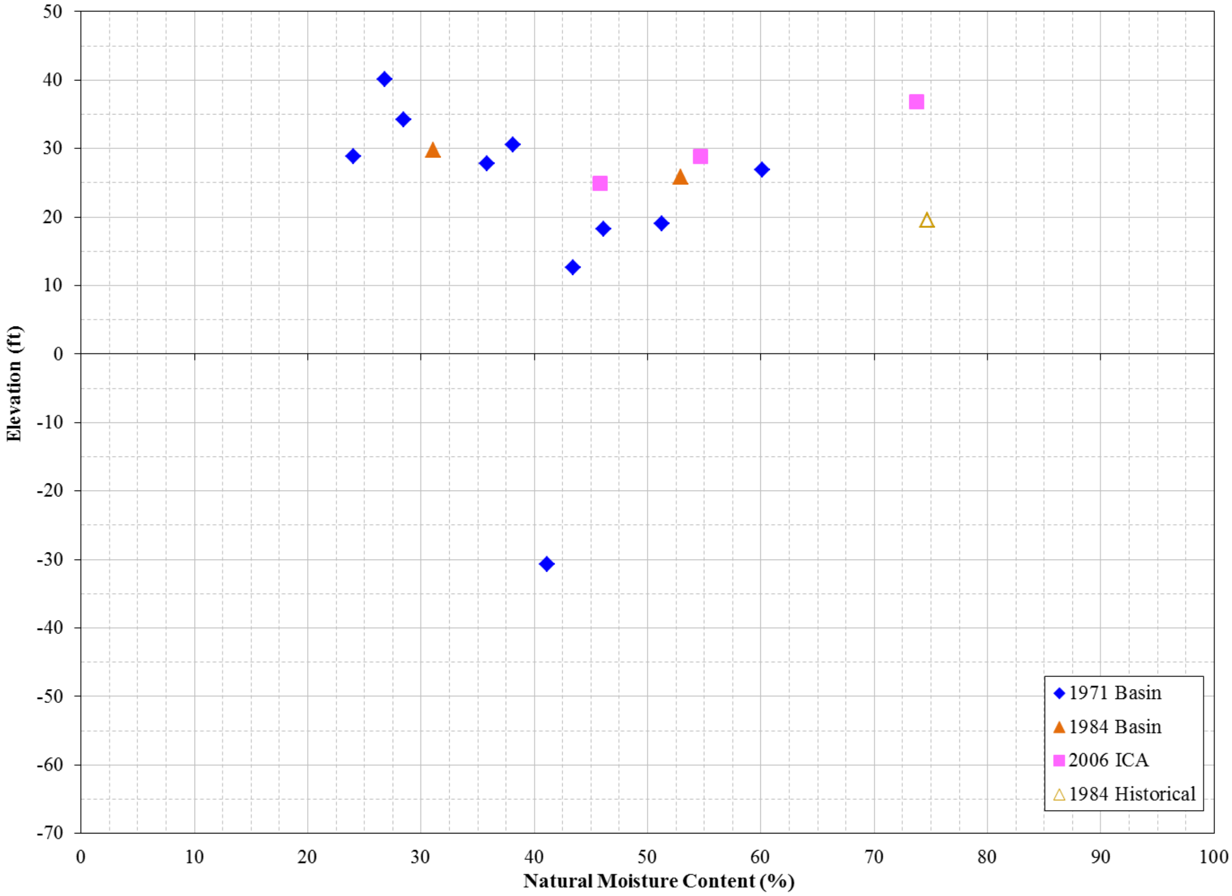

Figure 5b. Natural Moisture Content Data for the CCR within the Basins

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.

[2] The elevation is referenced to the NAVD88.

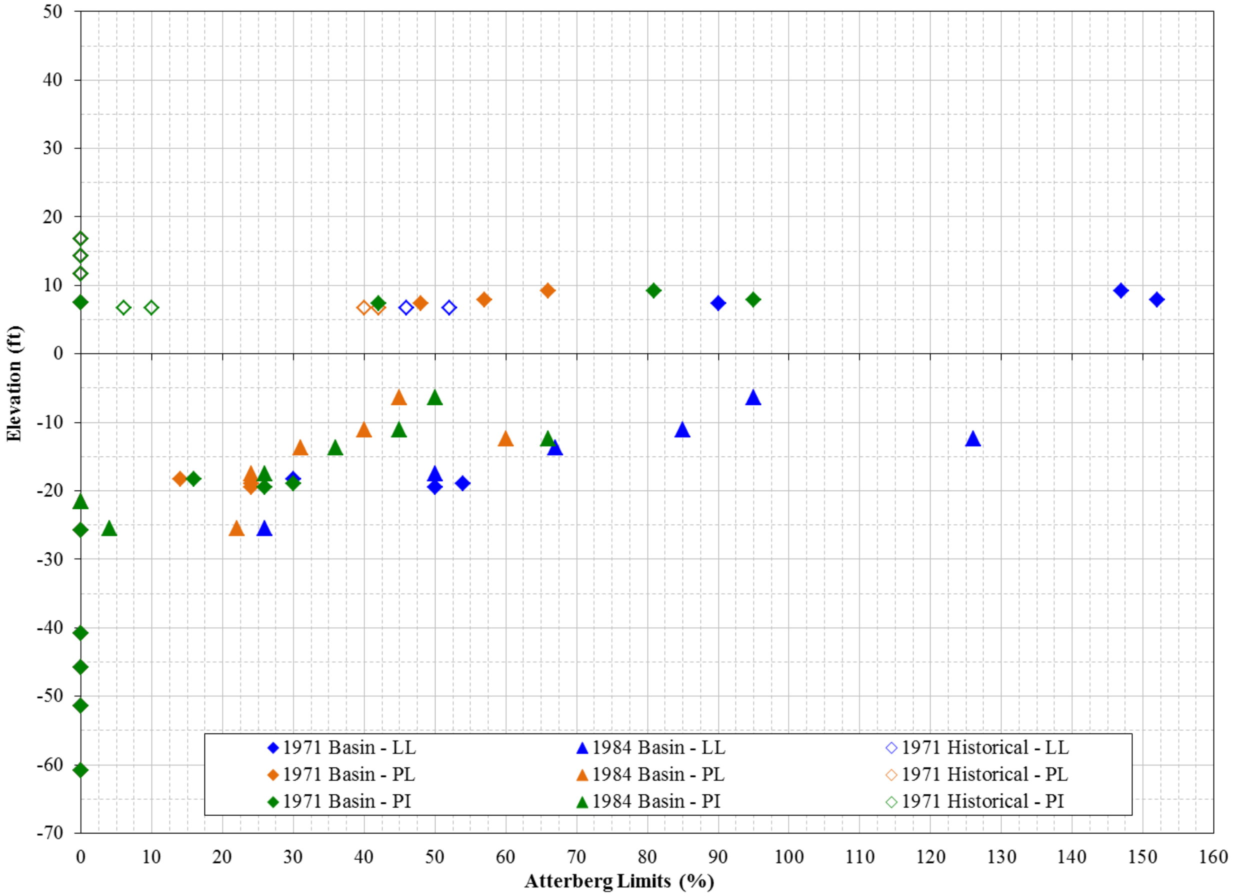

Figure 6a. Atterberg Limit Data for Dike Fill and Foundation Soils

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.

[2] The Dike Fill and Foundation Soils are predominantly sandy. As such Atterberg limits tests were conducted for selected cohesive samples only.

[3] Historical Atterberg limits tests performed by MACTEC [2011] on Dike Fill show it is non-plastic. Also, the data for the CCR encountered below the 1971 Dike are included in the plot above as the material was considered as a foundation material.

[4] The elevation of the Geosyntec data points is referenced to the NAVD88.

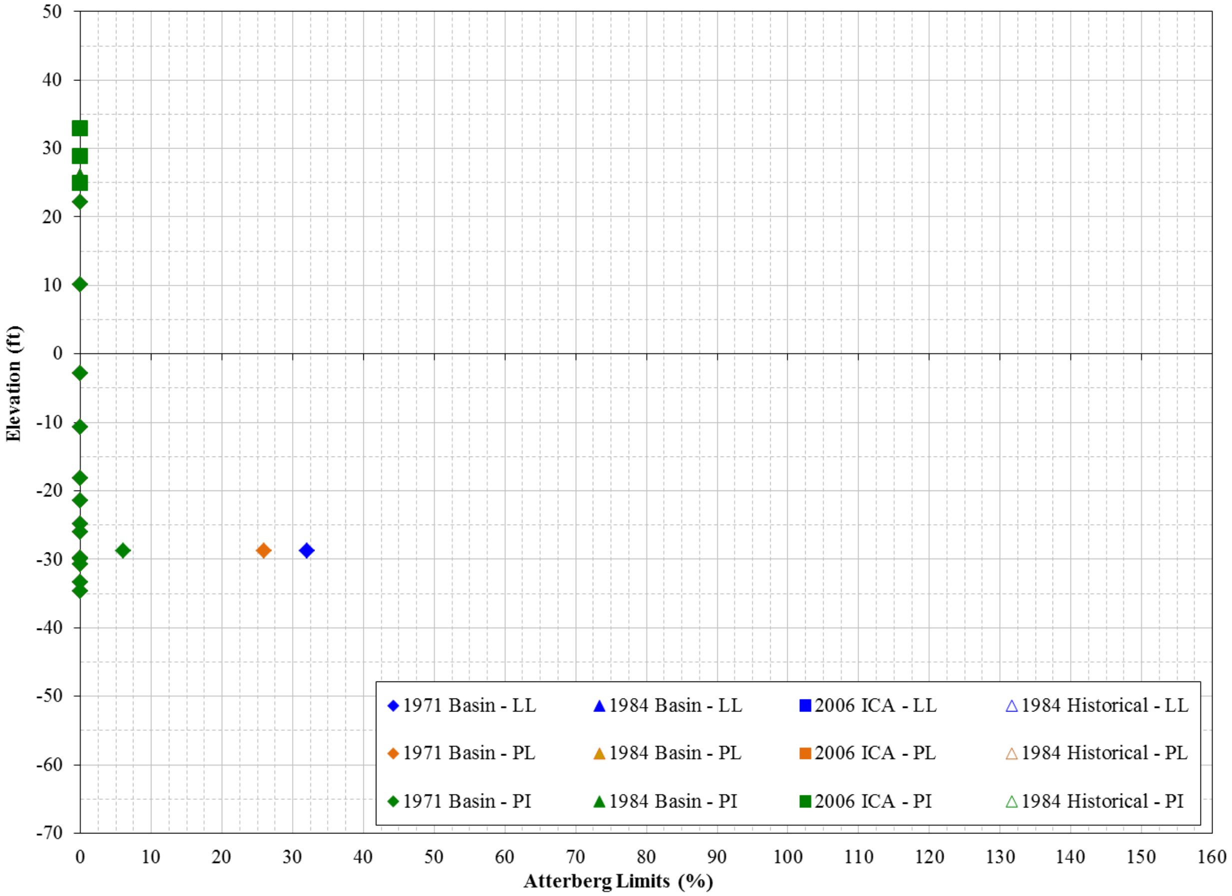

Figure 6b. Atterberg Limit Data for the CCR within the Basins

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.
[2] The elevation of the Geosyntec data points is referenced to the NAVD88.
[3] The Withers & Ravenel (2006) data were represented by 1984 Historical.

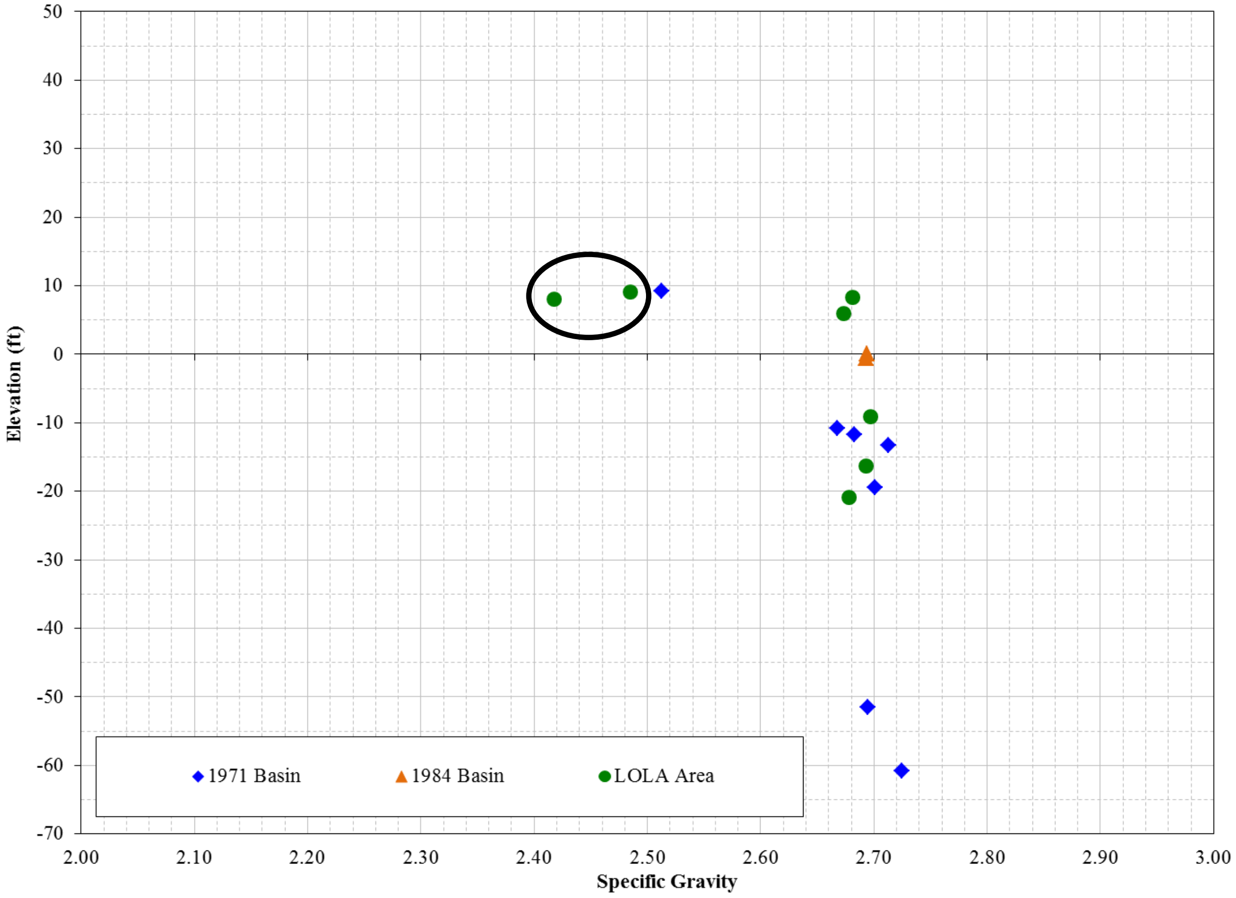

Figure 7a. Specific Gravity for Dike Fill and Foundation Soils

Note(s):

[1] The elevation is referenced to the NAVD88.
[2] The specific gravity data circled above are the results for the soil and CCR mix collected from the LOLA dike.

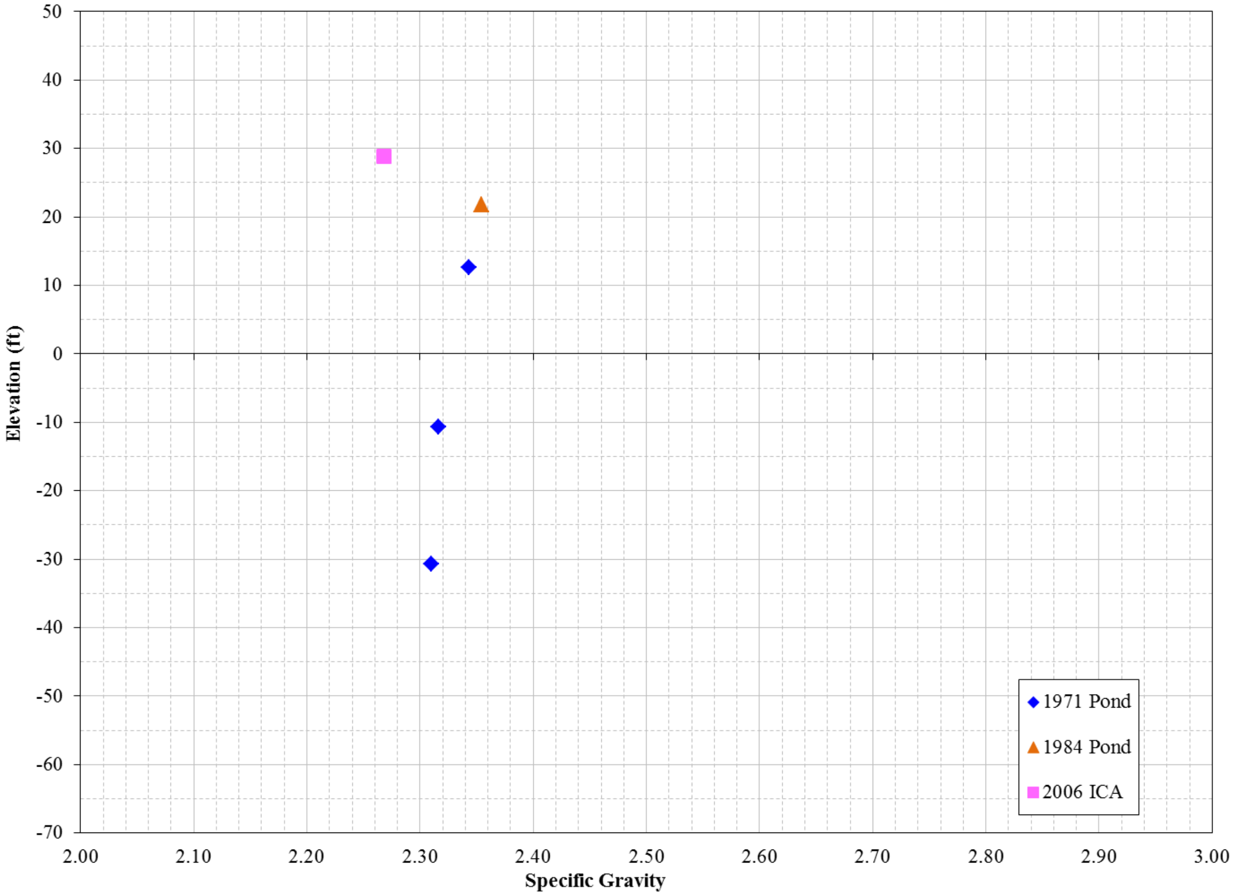

Figure 7b. Specific Gravity for the CCR within the Basins

Note(s):

[1] The elevation is referenced to the NAVD88.

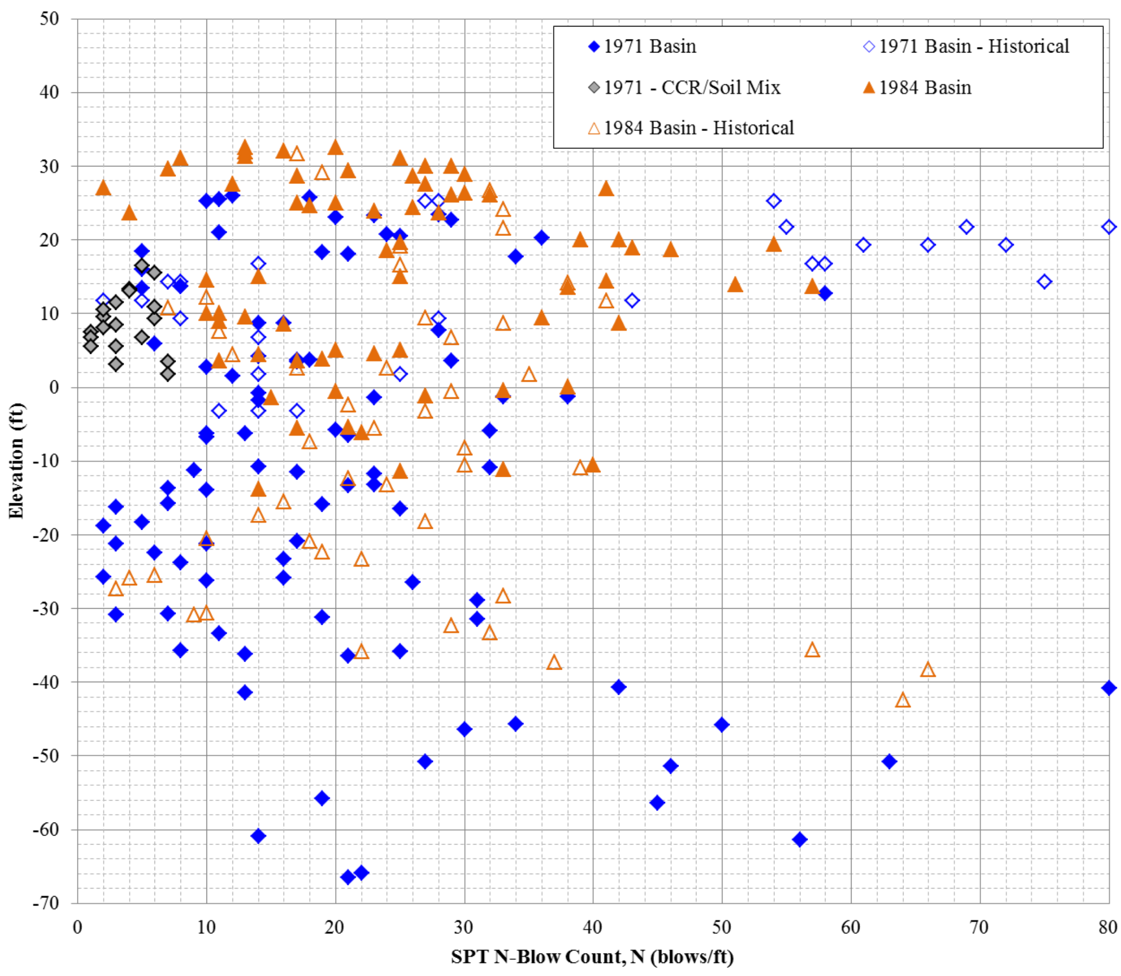

Figure 8a. SPT N-Blow Count for Dike Fill and Foundation Soils in the Basin Areas

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.
[2] The elevation of the Geosyntec data points is referenced to the NAVD88.
[3] The Withers & Ravenel (2006) data were represented by 1984 Historical.

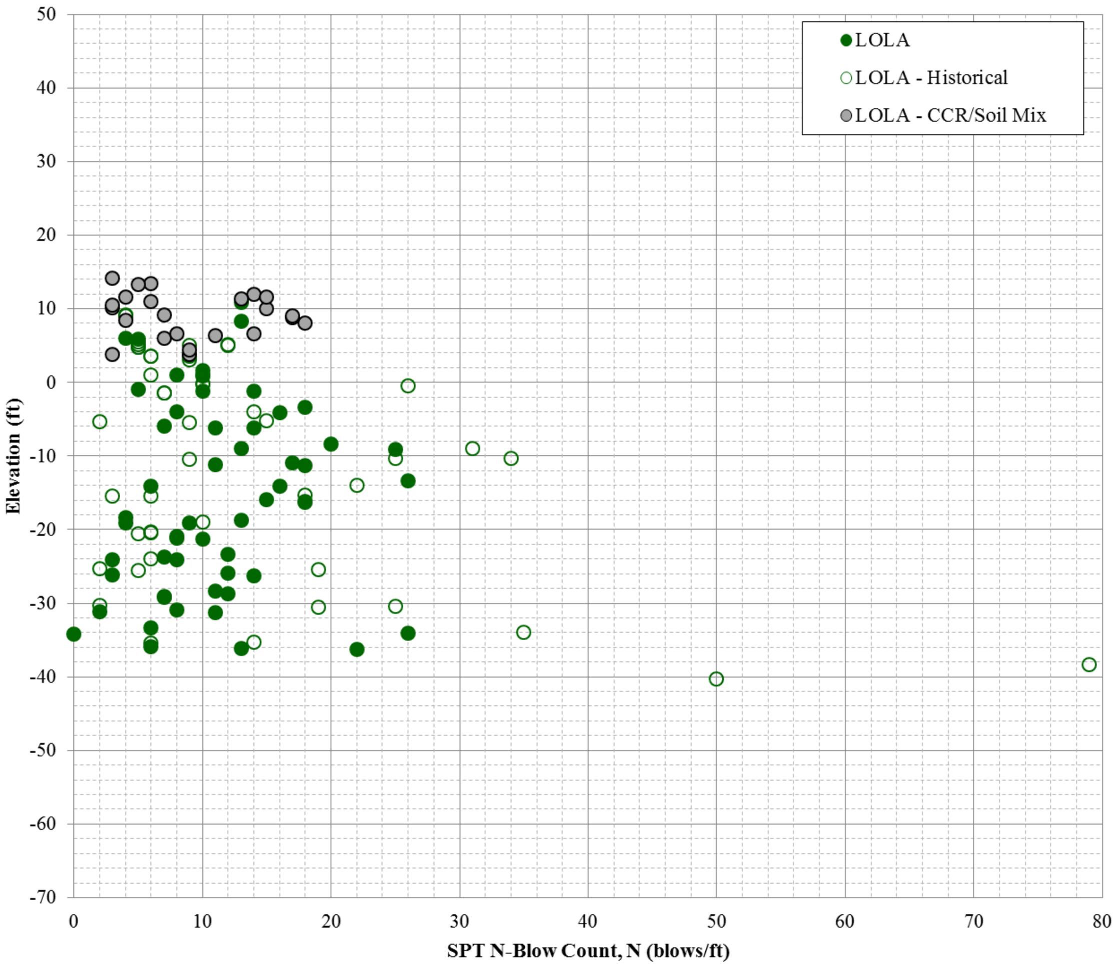

Figure 8b. SPT N-Blow Count for Dike Fill and Foundation Soils in the LOLA

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.

[2] The elevation of the Geosyntec data points is referenced to the NAVD88.

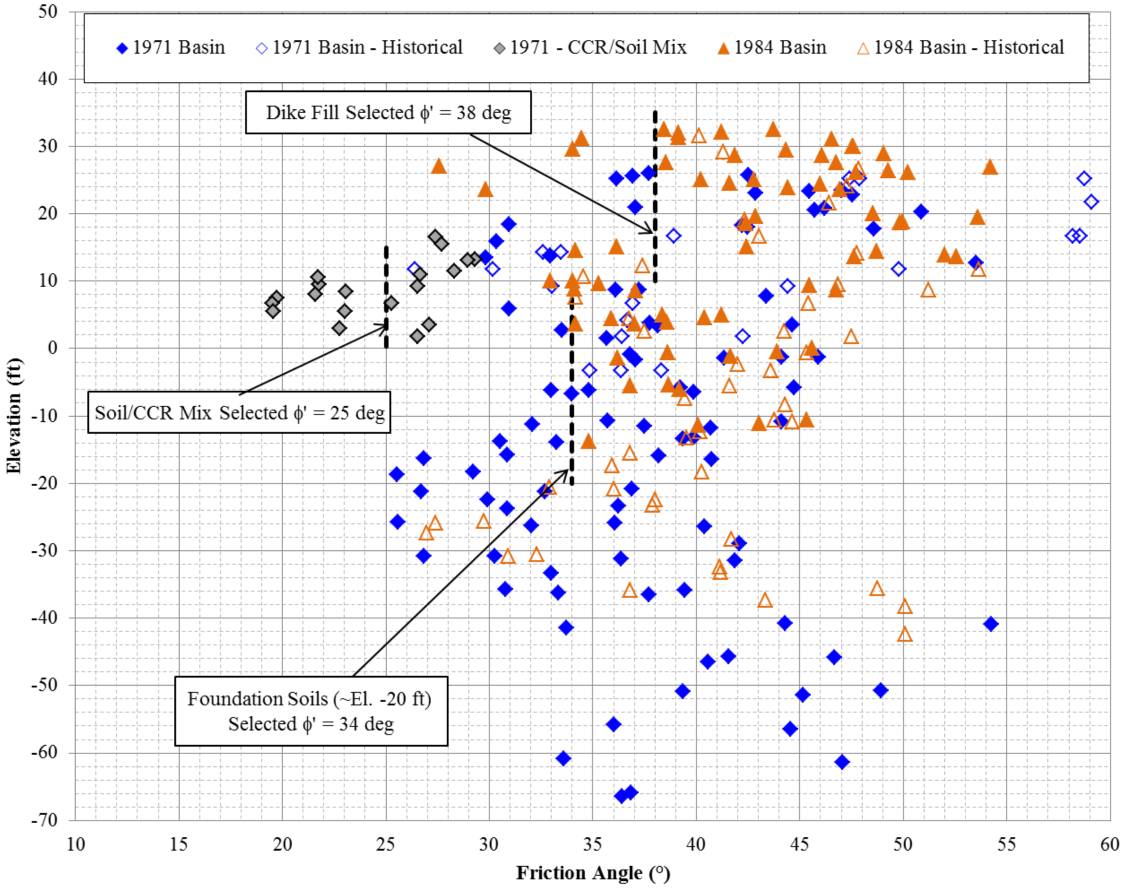

Figure 9a. Effective Friction Angle of Dike Fill and Foundation Soils in the Basin Areas Estimated from SPTs

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.

[2] The effective friction angles for the Dike Fill and Foundation Soils were estimated using a correlation proposed by Hatanaka and Uchida [1996].

[3] The effective friction angle for the CCR & Soil Mix was estimated using the correlation proposed by Hatanaka and Uchida [1996] and adjusted with soil type.

[4] The elevation of the Geosyntec data points is referenced to the NAVD88.

[5] The Withers & Ravenel (2006) data were represented by 1984 Historical.

[6] The following energy ratios were used to correct N values for the friction angle estimations shown above.

Boring ID	SPT Hammer Energy Reported (%)	Boring ID	SPT Hammer Energy Reported (%)
SPT-1 through -9	86.1	PT-series	82.5
SPT-12 and -14	87	PZ-series	79.8
SPT-13	82.5	B-series	85
WR-series	73 (assumed)		

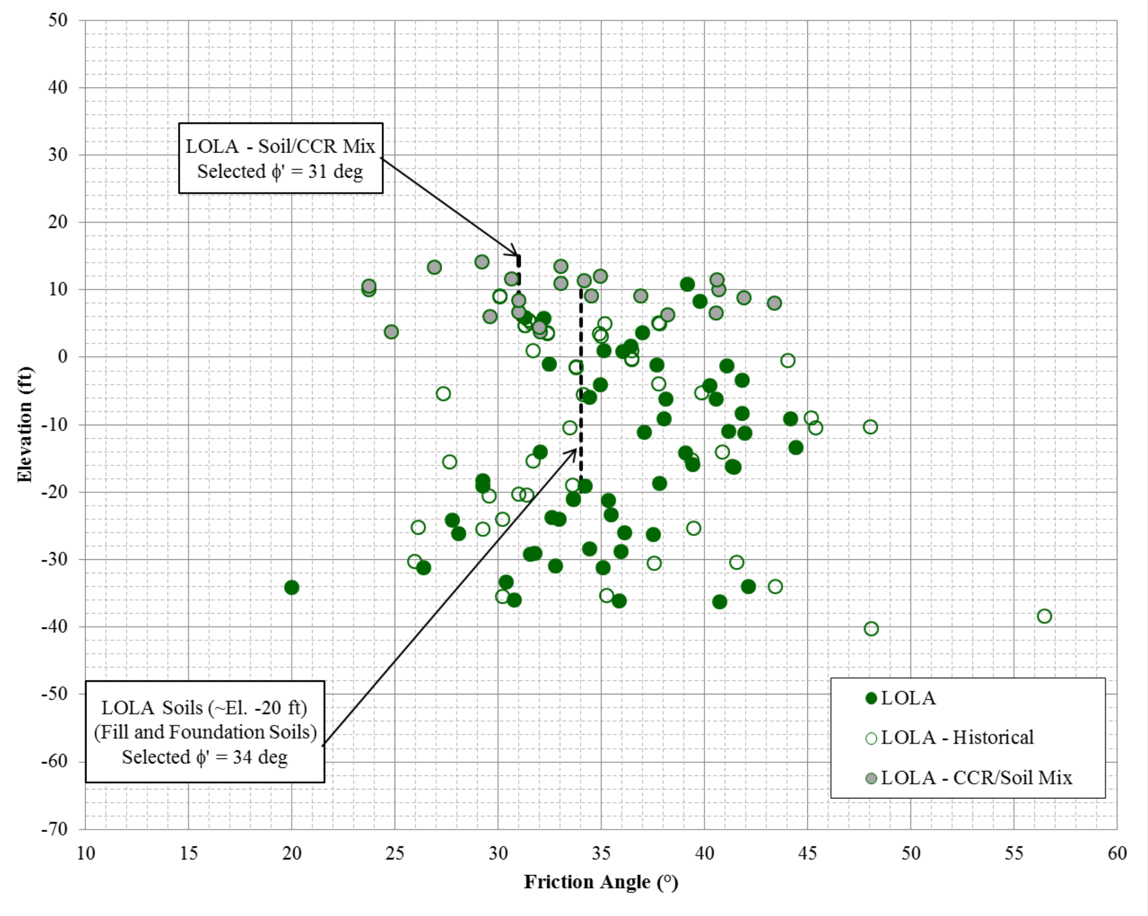

Figure 9b. Effective Friction Angle of Dike Fill and Foundation Soils in the LOLA Estimated from SPTs

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.

[2] The effective friction angles for the Dike Fill and Foundation Soils were estimated using the correlation proposed by Hatanaka and Uchida [1996].

[3] The effective friction angle for the CCR & Soil Mix was estimated using the correlation proposed by Hatanaka and Uchida [1996] and adjusted with soil type.

[4] The elevation of the Geosyntec data points is referenced to the NAVD88.

[5] The following energy ratios were used to correct N values for the friction angle estimations shown above.

Boring ID	SPT Hammer Energy Reported (%)	Boring ID	SPT Hammer Energy Reported (%)
LO-SPT-1	87	LO-SPT-4	82.5
The other LO-SPT-series	86.3	MW-series	73 (assumed)

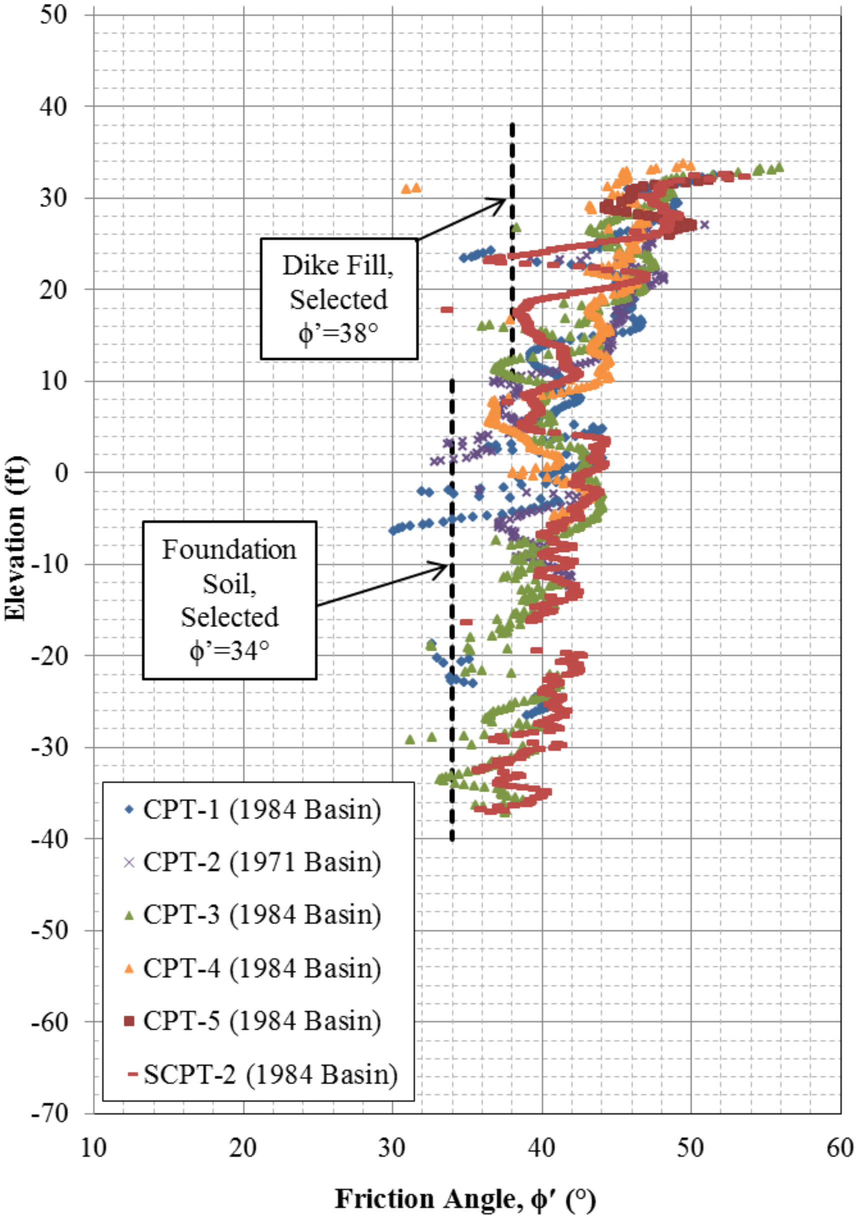

Figure 10. Effective Friction Angle of Dike Fill and Foundation Soils in the Basin Areas Estimated from CPTs

Note(s):

[1] The effective friction angles were estimated using a correlation proposed by Kulhawy and Mayne [1990].
[2] The elevation is referenced to the NAVD88.
[3] The plot presented above includes the Geosyntec CPT data only. The CPTs performed by Withers & Ravenel (2006) show similar results to the Geosyntec data and the Withers & Ravenel CPT data are presented in Appendix 2.1 of this package.

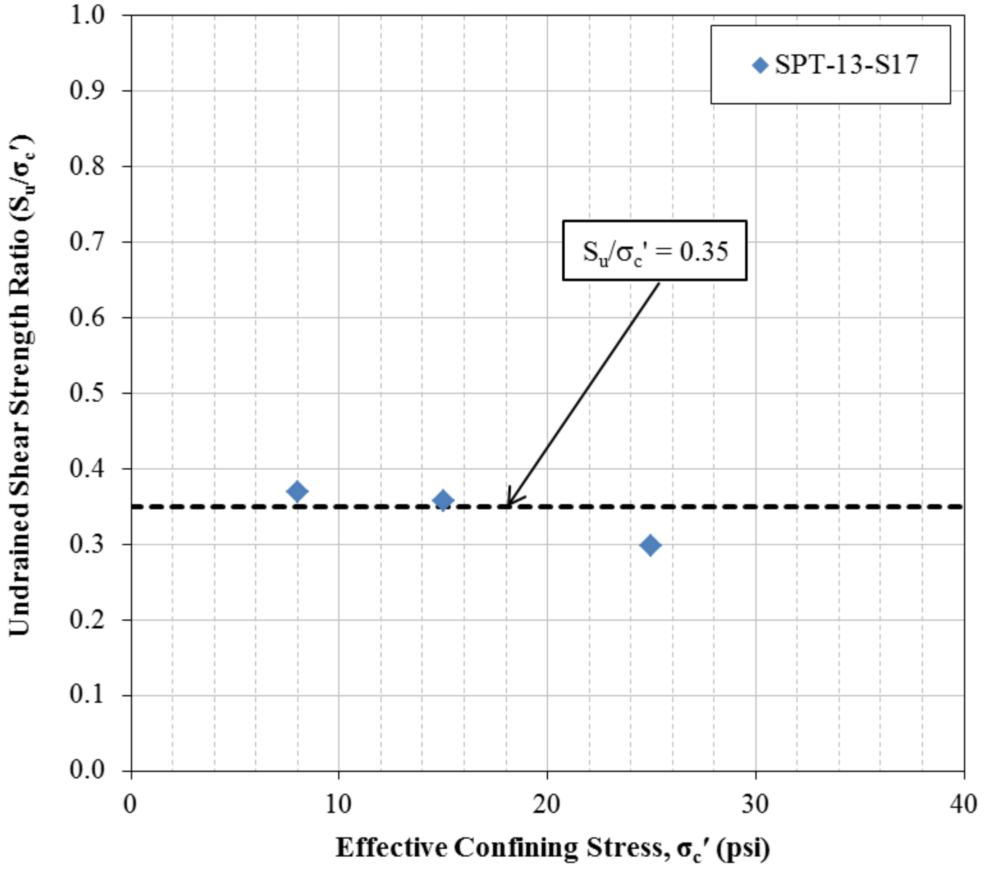

Figure 11a. Undrained Shear Strength Ratio Estimated from CU Tests (Clayey Foundation Soils)

Note(s):

[1] The undrained shear strength ratio shown above is taken with respect to an effective confining stress (σ_c'). For slope stability analyses, however, a undrained shear strength ratio with respect to an effective vertical stress (S_u/σ_v') should be used. After applying a correction factor, a S_u/σ_v' ratio of 0.24 can be used for the slope stability analyses.

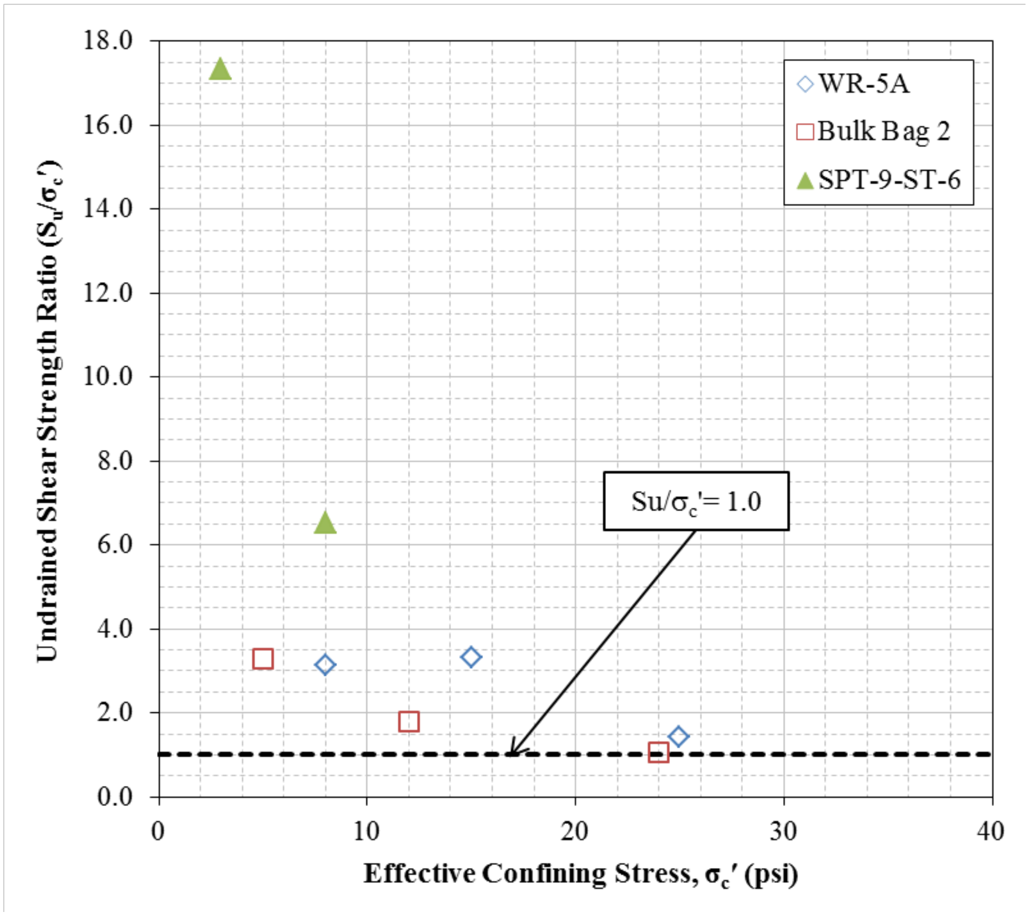

Figure 11b. Undrained Shear Strength Ratio Estimated from CU Tests (CCR)

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.

[2] The undrained shear strength ratio shown above is taken with respect to an effective confining stress. For slope stability analyses, however, a undrained shear strength ratio with respect to an effective vertical stress (S_u/σ_v') should be used. After applying a correction factor, a S_u/σ_v' ratio of 0.6 can be used for the slope stability analyses.

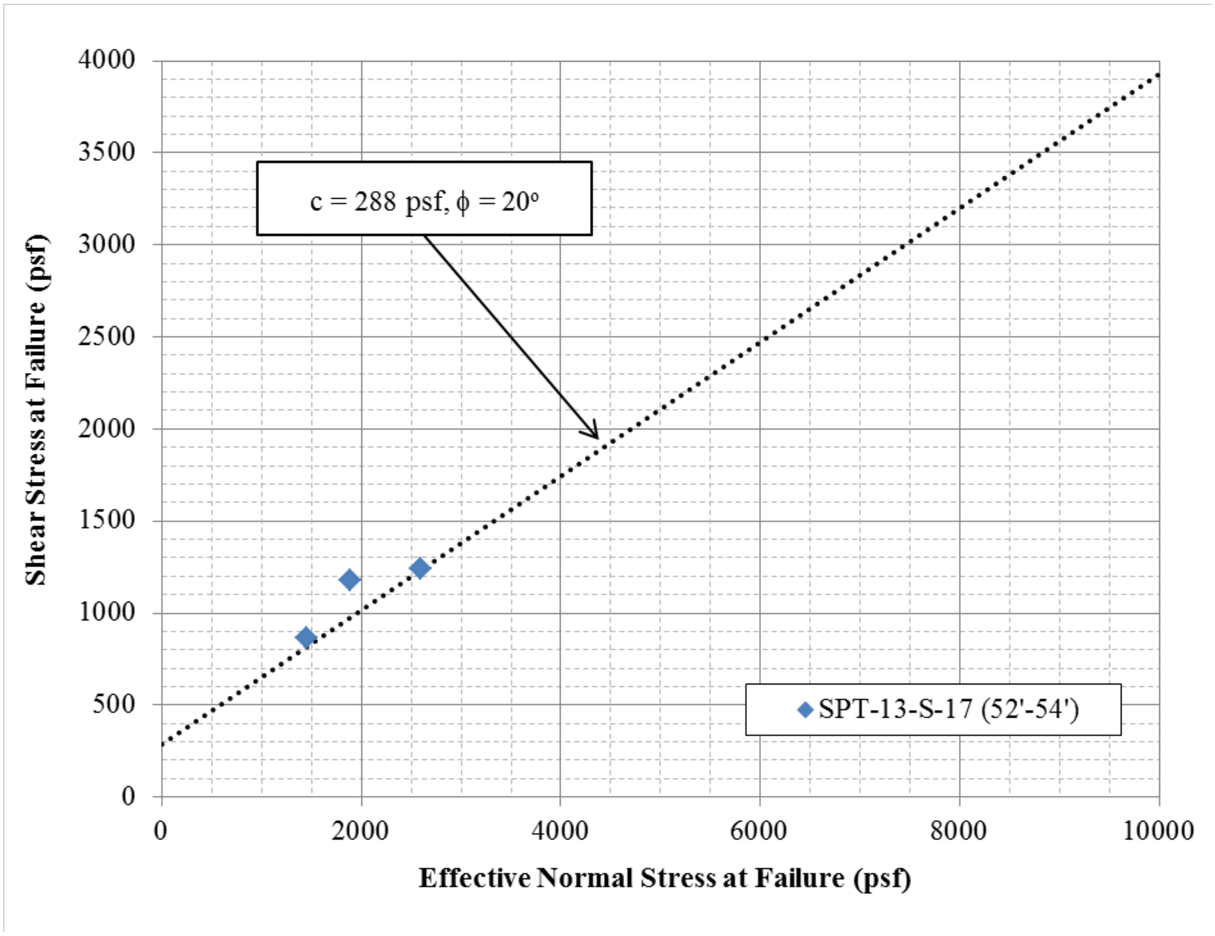

Figure 12a. Effective Strength Parameters Estimated from CU Tests (Clayey Foundation Soils)

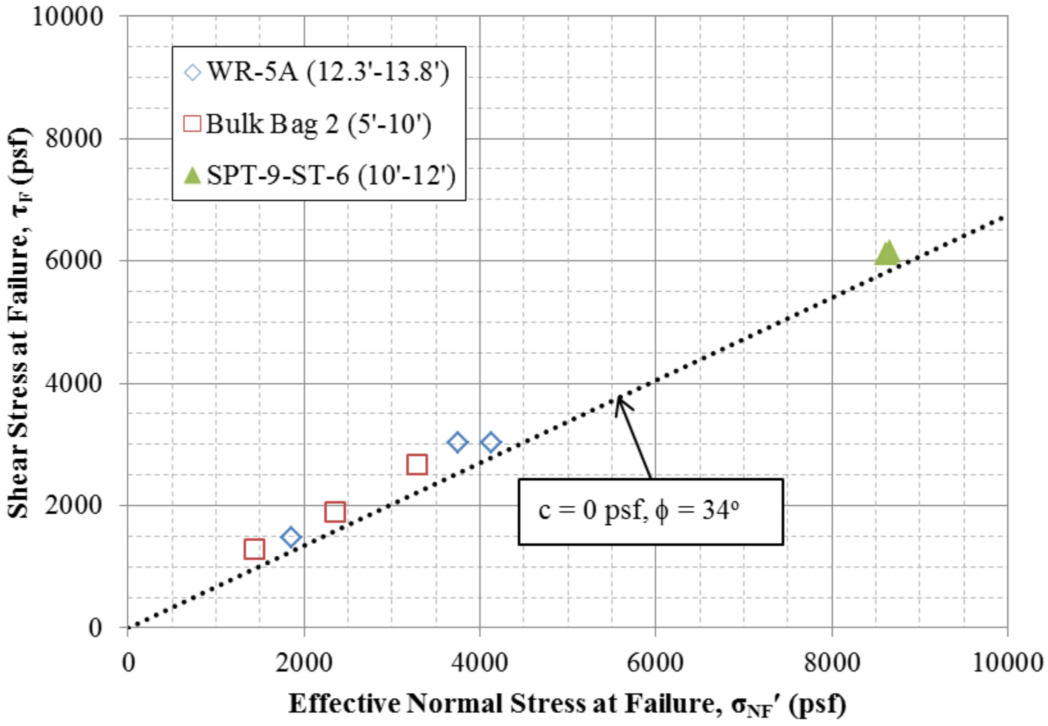

Figure 12b. Effective Strength Parameters Estimated from CU Tests (CCR)

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.

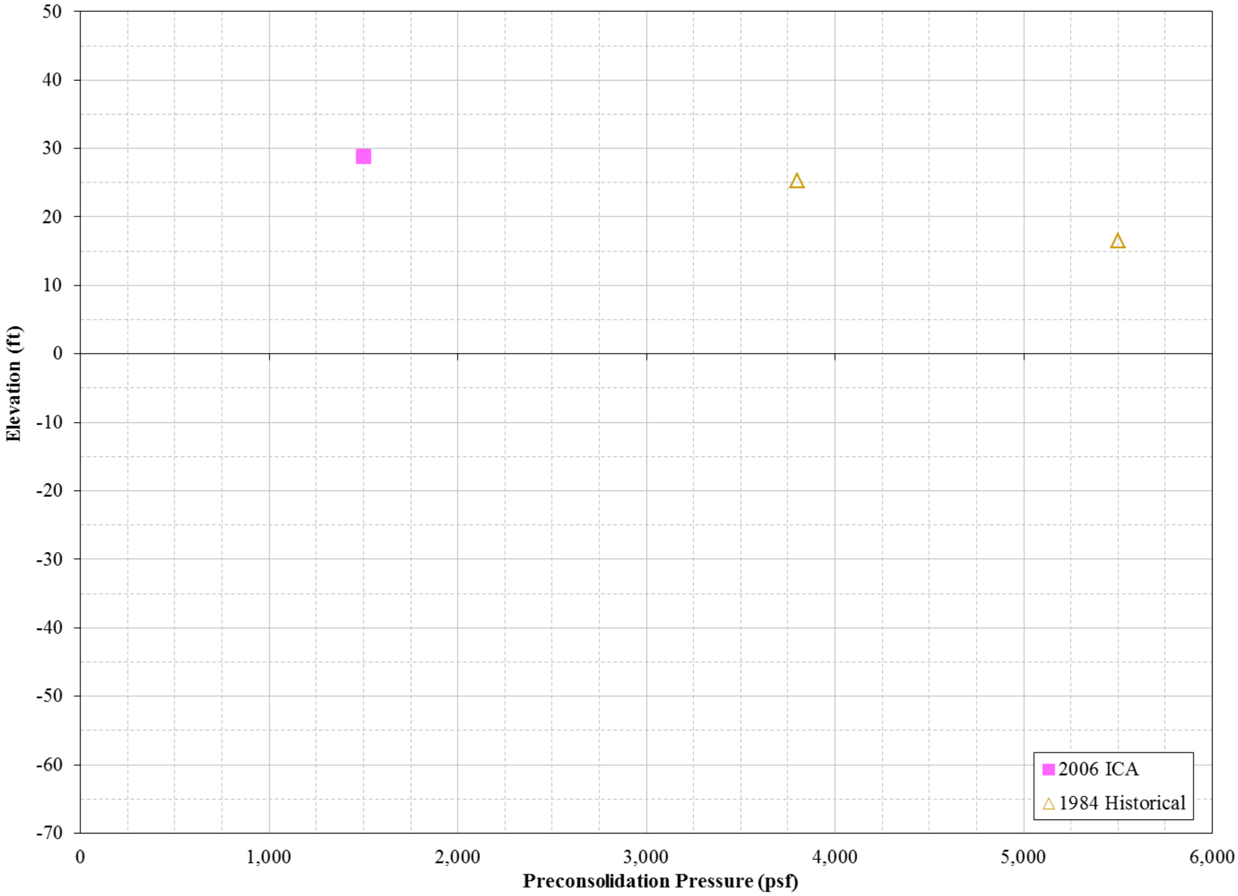

Figure 13a. Preconsolidation Pressure for CCR

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.
[2] The elevation of the Geosyntec data points is referenced to the NAVD88.

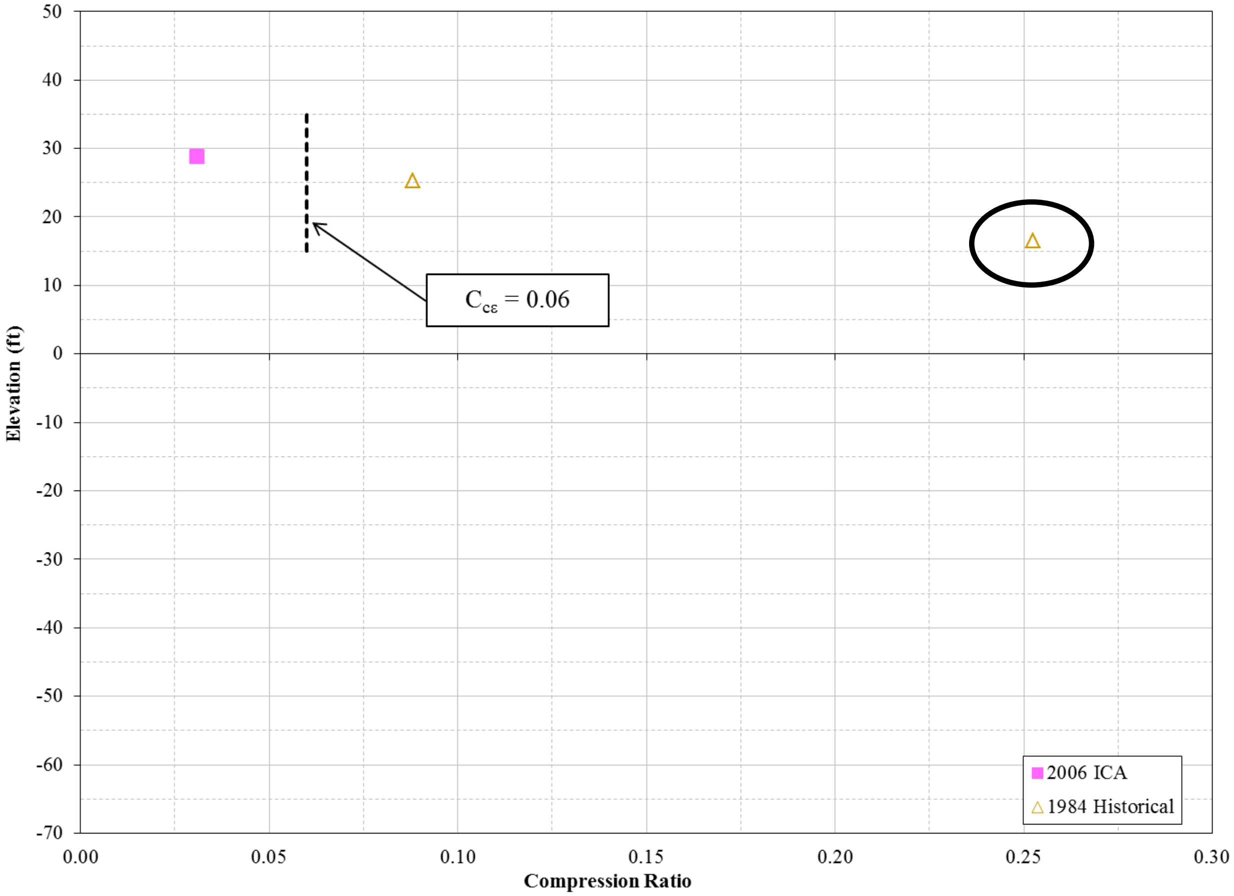

Figure 13b. Modified Compression Ratio ($C_{c\varepsilon}$) for CCR

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.
[2] The elevation of the Geosyntec data points is referenced to the NAVD88.
[3] In the test corresponding to the result circled above, no deformation was measured during the reloading, which indicates a malfunctioning gauge or inaccurate data.

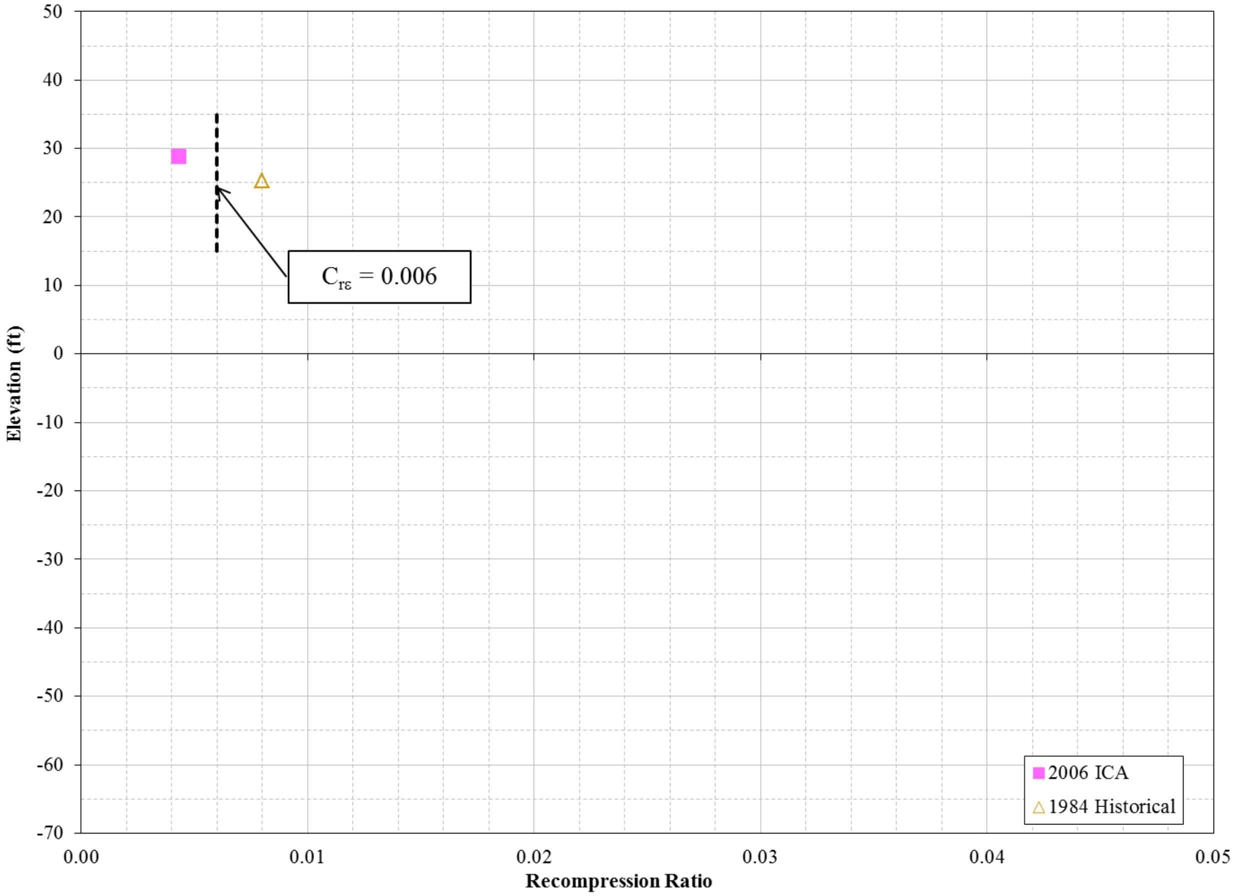

Figure 13c. Modified Recompression Ratio ($C_{r\varepsilon}$) for CCR

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.
[2] The elevation of the Geosyntec data points is referenced to the NAVD88.

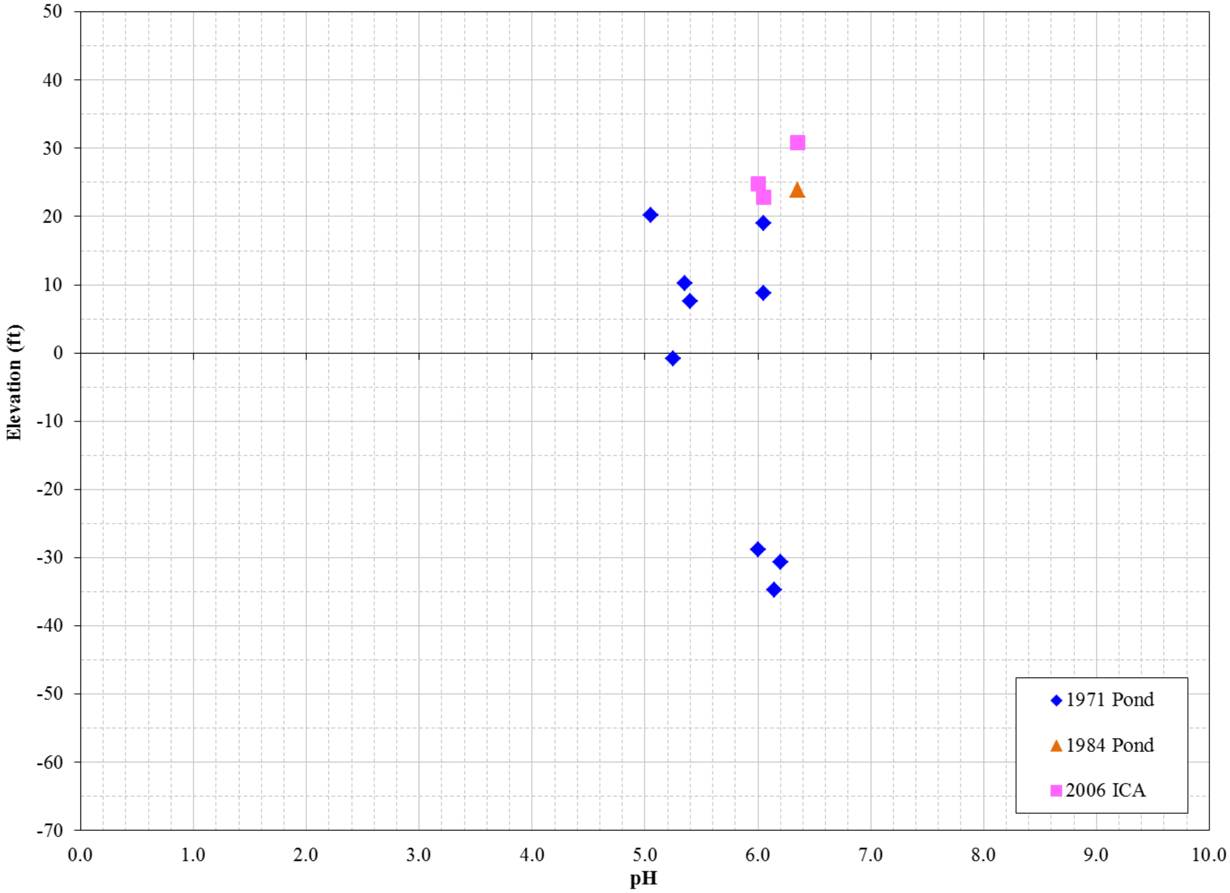

Figure 14. pH Test Results for CCR

Note(s):

[1] The elevation is referenced to the NAVD88.

Figure 15a. Shear Wave Velocities for Dike Fill and Foundation Soils

Note(s):

[1] The individual data points represent the measurements from seismic cone penetration tests (SCPTs) and the dotted profiles represent the data estimated using an empirical correlation proposed by Mayne for using CPT data [2006].

[2] The measured Vs values shown above were calculated by the Mid-Atlantic Drilling (the CPT contractor) and provided to Geosyntec.

[3] The elevation is referenced to the NAVD88.

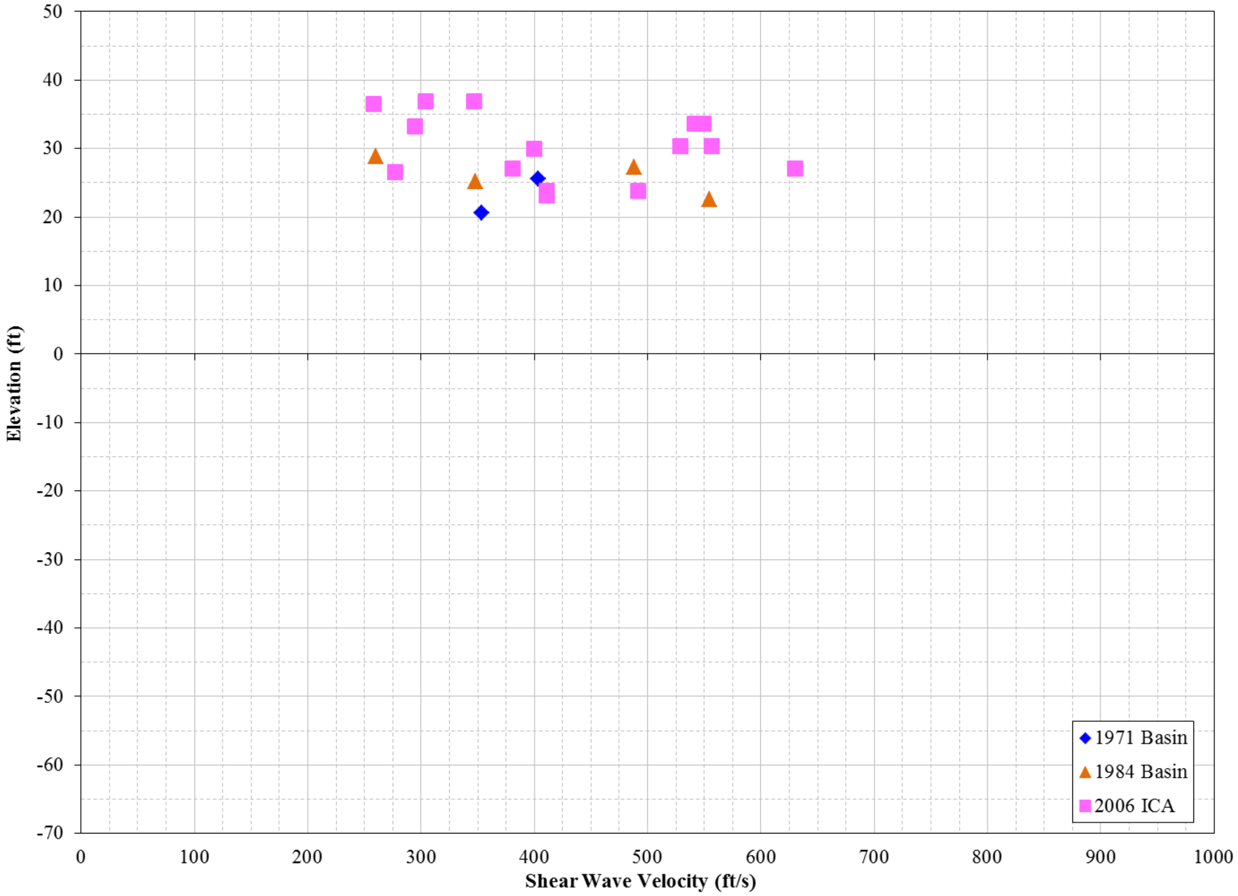

Figure 15b. Shear Wave Velocities for CCR

Note(s):

[1] The data points shown above are the measurements from seismic cone penetration tests (SCPTs).
[2] The measured Vs values shown above were calculated by the Mid-Atlantic Drilling (the CPT contractor) and provided to Geosyntec.
[3] The elevation is referenced to the NAVD88.

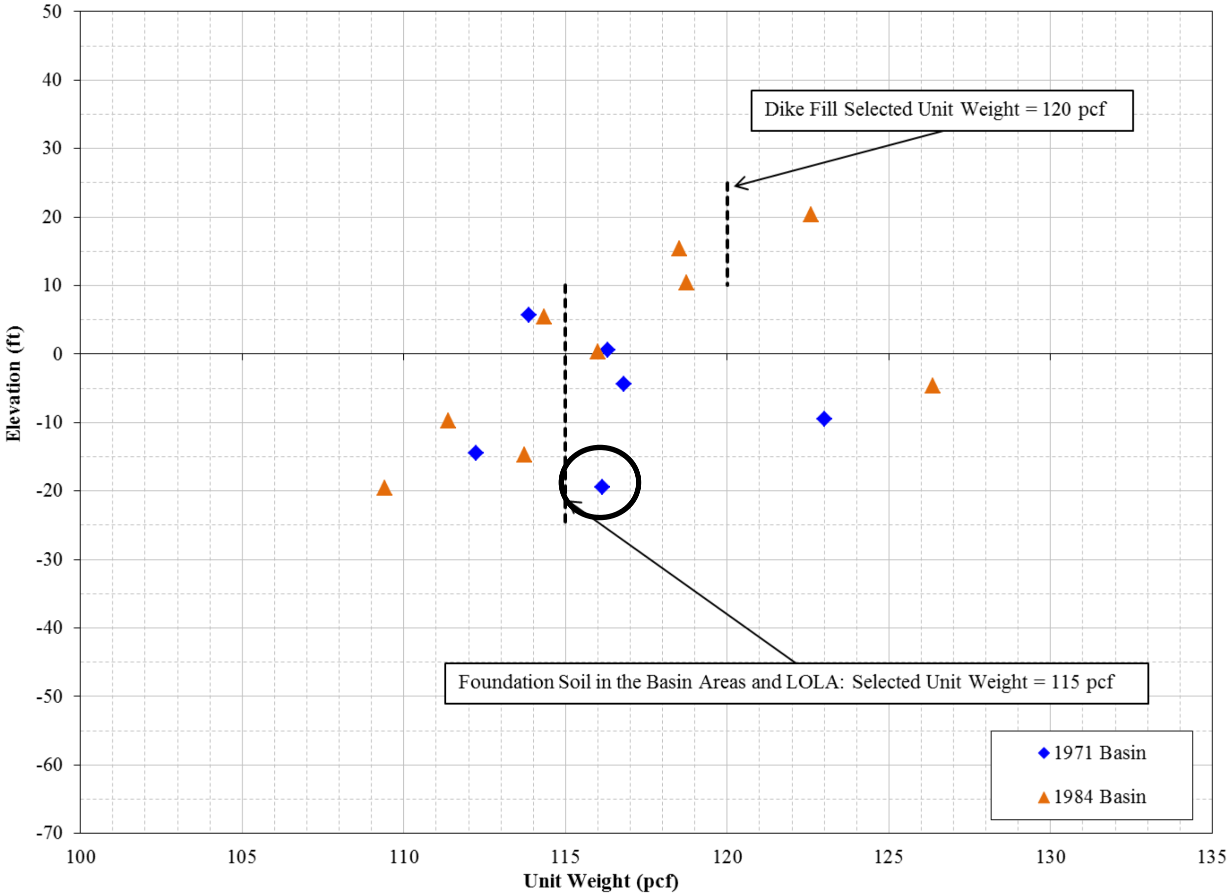

Figure 16a. Unit Weight of Dike Fill and Foundation Soils

Note(s):

[1] The data point circled above was measured during the shear strength testing for one sample and the other data points were estimated using a correlation proposed by Mayne [2005].

[2] The elevation is referenced to the NAVD88.

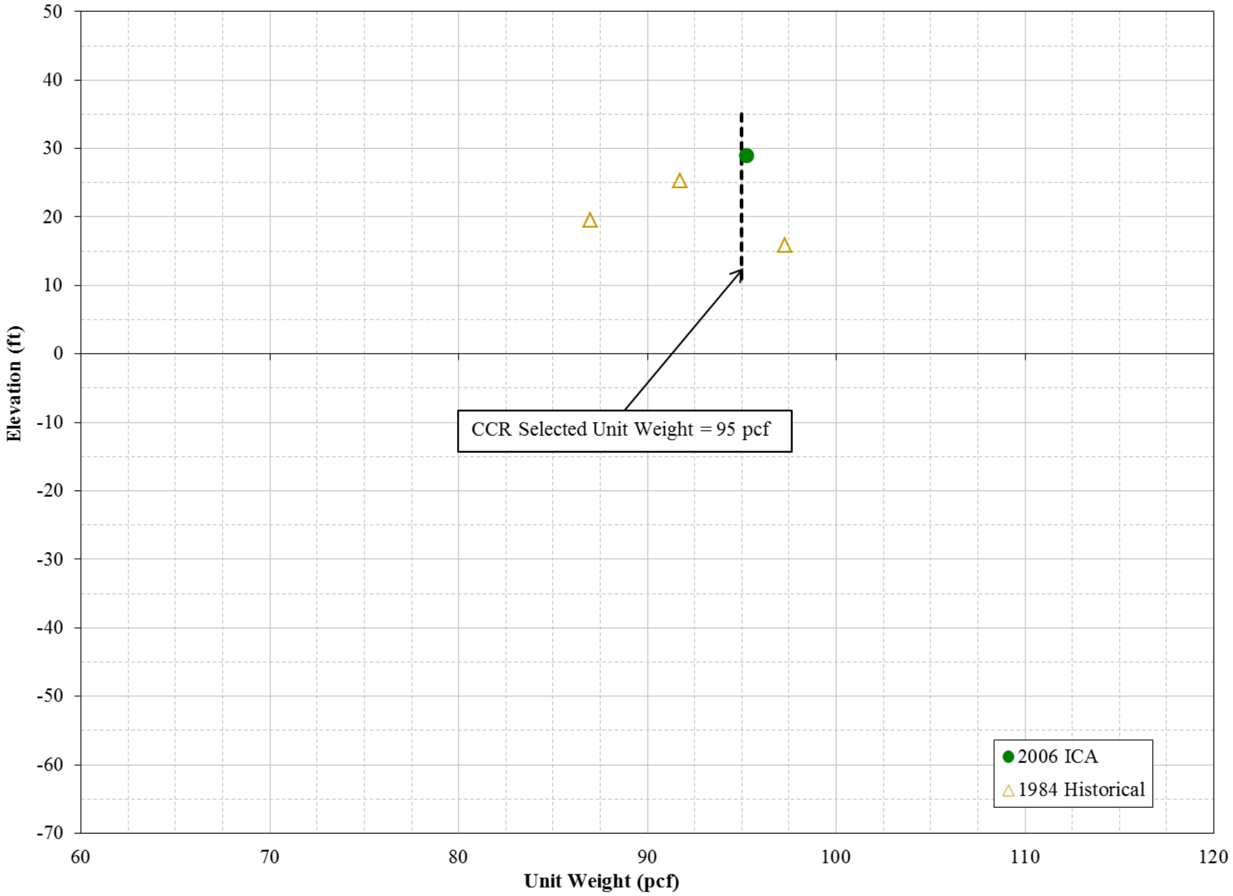

Figure 16b. Unit Weight of CCR

Note(s):

[1] The solid points represent the Geosyntec investigation data, while the hollow points represent the historical data.
[2] The elevation of the Geosyntec data points is referenced to the NAVD88.

ATTACHMENTS

Attachment 1

Historical and Geosyntec Boring Logs

Attachment 1.1

Withers & Ravenel Boring Logs

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LOG OF BORING WR-4

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Progress Energy / L.V. Sutton Plant
84-Pond Geotechnical Evaluation
New Hanover County, North Carolina
W&R Project No. 02050412.03

Date Started	: 4/24/06	Drilling Company	: Graham & Currie
Date Completed	: 4/24/06	Driller	: Earl Mosley
Hole Diameter	: 9" & 4"	Northing Coord.	: 200805.06
Drilling Method	: HSA & Mud Rotary	Easting Coord.	: 2305177.95
Sampling Method	: SPT	Surface Elevation	: ~26.9' NAVD 88

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	REMARKS
0			SILTY SAND / SANDY SILT; Very Fine Well Rounded Sand, ~50 to 60% Fines, Low to Medium Plasticity, Very Loose, Moist to Wet, Black (Ash)	1	1 1 WOH	Grouted Boring to Surface Upon Completion Samples are Saturated Below ~1.0' BLS
				2	WOH	Collected Bulk Soil Sample ~1.0 to 2.0' BLS
5				3	WOH	Retrieved Shelby Tube Sample ~1.75 to 3.75' BLS (Hand Pushed)
	SM/ML			4	WOH	
10				5	1 1 WOH	
				6	WOH WOH 1	
15						Visually Observed ~7.0" of Clay Liner in SPT Sample at this Location
	CH		CLAY WITH SAND; ~90% Fines, High Plasticty, Dense, Wet, Light Brown (Clay Liner)	7	3 18 27	Set 4-inch Temporary Steel Casing to ~18.5' BLS
			SAND; Very Fine to Fine Subangular, ~5% Fines, Non-Plastic, Dense to Very Dense, Wet, Light Brown and White, Minor Shell Fragments Noted ~33.5 to 40.0' BLS	8	8 14 19	Converted from HSA to Mud Rotary at ~18.5' BLS
20						
				9	10 10 14	
25	SP					
				10	11 11 10	
30						
				11	10 9 9	
35						

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84-Pond Geotechnical Evaluation
New Hanover County, North Carolina
W&R Project No. 02050412.03

Date Started : 4/24/06
Date Completed : 4/24/06
Hole Diameter : 9" & 4"
Drilling Method : HSA & Mud Rotary
Sampling Method : SPT

Drilling Company : Graham & Currie
Driller : Earl Mosley
Northing Coord. : 200805.06
Easting Coord. : 2305177.95
Surface Elevation : ~26.9' NAVD 88

Depth In Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	REMARKS
35 40	SP	░		12	9 10 11	
45 50	SP	░	SAND; Fine to Medium Subangular, Non-Plastic, Medium Dense, Wet, White and Light Gray	13 14 15	8 7 7 8 9 10 3 2 1	
55	MH	▥	CLAYEY SILT; ~95% Fines, Very Elastic, Soft, Wet, Tan, (Qp = 0.1 Kg/cm2, Qt = 0.75 to 1.0 Kg/cm2)			
60	SC	▨	SAND WITH CLAY; Very Fine to Fine Subangular, ~5 to 10% Fines, Non-Plastic, Very Stiff, Wet, Light Brown	16	15 14 15	
65 70	SM	▥	SILTY SAND; Very Fine Subangular, ~20% Fines, Somewhat Plastic to Low Plasticity, Very Dense, Wet, Dark Gray, Somewhat Micaceous (Pee Dee Formation)	17 18	8 12 25 20 31 33	

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84-Pond Geotechnical Evaluation
New Hanover County, North Carolina
W&R Project No. 02050412.03

Date Started	: 4/25/06	Drilling Company	: Graham & Currie
Date Completed	: 4/25/06	Driller	: Earl Mosley
Hole Diameter	: 9" & 4"	Northing Coord.	: 200643.27
Drilling Method	: HSA & Mud Rotary	Easting Coord.	: 2304829.10
Sampling Method	: SPT	Surface Elevation	: ~28.7' NAVD 88

Depth In Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	REMARKS
0	SM/ML		SILTY SAND / SANDY SILT; Very Fine Well Rounded Sand, ~40 to 60% Fines, Low to Medium Plasticity, Very Loose, Moist to Wet, Black (Ash)	1	1 1 WOH	Grouted Boring to Surface Upon Completion
				2	1 1 WOH	Retrieved Shelby Tube Sample ~2.5 to 3.75' BLS (Hand Pushed)
5				3	WOH	
				4	1 1 WOH	
10				5	1 1 1	
				6	WOR	
15	CH		SANDY CLAY; ~90% Fines, High Plasticty, Very Fine to Fine Subangular Sand, Stiff, Wet, Light Brown (Clay Liner)	7	1 5 17	Visually Observed ~4.5" of Clay Liner in SPT Sample at this Location Set 4-Inch Temporary Steel Casing to ~18.5' BLS
20	SP		SAND; Very Fine to Fine Subangular, ~5% Fines, Non-Plastic, Medium Dense, Wet, Tan	8	10 12 15	Converted from HSA to Mud Rotary at ~18.5' BLS
25	SM		SILTY SAND; Very Fine Subangular, ~10% Fines, Non-Plastic, Medium Dense, Wet, Tan and White	9	7 6 6	
30				10	11 12 17	
35	SP		SAND; Very Fine to Fine Subangular, ~5% Fines, Non-Plastic, Medium Dense, Wet, Tan	11	11 8 15	

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New Hanover County, North Carolina

W&R Project No. 02050412.03

Date Started	: 4/25/06	Drilling Company	: Graham & Currie
Date Completed	: 4/25/06	Driller	: Earl Mosley
Hole Diameter	: 9" & 4"	Northing Coord.	: 200643.27
Drilling Method	: HSA & Mud Rotary	Easting Coord.	: 2304829.10
Sampling Method	: SPT	Surface Elevation	: ~28.7' NAVD 88

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	REMARKS
35	SP					
40				12	10 14 16	
	SM		SILTY SAND; Very Fine Subangular, ~20% Fines, Non-Plastic, Medium Dense, Wet, White, Somewhat Micaceouse	13	14 10 6	
45						
	SW		SAND; Very Fine to Medium Subangular, Non-Plastic, Loose, Wet, Tan and White, Minor Shell Fragments Noted	14	4 5 5	
50						
55				15	4 3 3	
				16	5 5 5	
60	SM		SILTY SAND; Very Fine Subangular, ~15 to 25% Fines, Somewhat Plastic to Low Plasticity, Very Dense, Wet, Dark Gray, Somewhat Micaceous (Pee Dee Formation)	17	29 25 32	
65						
70						

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84-Pond Geotechnical Evaluation
New Hanover County, North Carolina

W&R Project No. 02050412.03

Date Started	: 4/25/06	Drilling Company	: Graham & Currie
Date Completed	: 4/25/06	Driller	: Earl Mosley
Hole Diameter	: 9"	Northing Coord.	: 200643.27
Drilling Method	: HSA	Easting Coord.	: 2304829.10
Sampling Method	: SPT	Surface Elevation	: ~28.7' NAVD 88

Depth In Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	REMARKS
0			SILTY SAND / SANDY SILT; Very Fine Well Rounded Sand, ~40 to 60% Fines, Low to Medium Plasticity, Very Loose, Moist to Wet, Black (Ash)			
						Grouted Boring to Surface Upon Completion
5						Collected Bulk Sample 5.0 to 10.0' BLS (Auger Cuttings)
	SM/ML					
						Attempted Shelby Tube Sample ~13.5 to 15.75' BLS (No Recovery)
10						
						(This Offset Boring Conducted to Collect Shelby Tube Samples)
15						

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84-Pond Geotechnical Evaluation
New Hanover County, North Carolina

W&R Project No. 02050412.03

Date Started	: 4/25/06	Drilling Company	: Graham & Currie
Date Completed	: 4/25/06	Driller	: Earl Mosley
Hole Diameter	: 9"	Northing Coord.	: 200643.27
Drilling Method	: HSA	Easting Coord.	: 2304829.10
Sampling Method	: SPT	Surface Elevation	: ~28.7' NAVD 88

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	REMARKS
0			SILTY SAND / SANDY SILT; Very Fine Well Rounded Sand, ~40 to 60% Fines, Low to Medium Plasticity, Very Loose, Moist to Wet, Black (Ash)			
						Grouted Boring to Surface Upon Completion
						Samples are Saturated Below ~1.0' BLS
5						
	SM/ML					
						Retrieved Shelby Tube Sample ~8.5 to 9.75' BLS
10						
						Retrieved Shelby Tube Sample ~11.75 to 14.0' BLS
						Retrieved Shelby Tube Sample ~14.0 to 16.0' BLS
15						(This Offset Boring Conducted to Collect Shelby Tube Samples)
	CH		SANDY CLAY; ~90% Fines, High Plasticty, Very Fine to Fine Subangular Sand, Stiff, Wet, Light Brown (Clay Liner)			
	SP		SAND; Very Fine to Fine Subangular, ~5% Fines, Non-Plastic, Medium Dense, Wet, Tan			

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W&R Project No. 02050412.03

Date Started	: 4/20/06	Drilling Company	: Graham & Currie
Date Completed	: 4/20/06	Driller	: Earl Mosley
Hole Diameter	: 9"	Northing Coord.	: 200683.38
Drilling Method	: HSA & CPT	Easting Coord.	: 2304845.41
Sampling Method	: SPT	Surface Elevation	: ~27.5' NAVD 88

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	REMARKS
0			SILTY SAND / SANDY SILT; Very Fine Well Rounded Sand, ~50 to 60% Fines, Low to Medium Plasticity, Very Loose, Moist to Wet, Black (Ash)			
						Grouted Boring to Surface Upon Completion
						Samples are Saturated Below ~1.0' BLS
				1	WOH	
5						
	SM/ML					
				2	WOR	
10						
				3	WOR WOR 1	Set 4-Inch Temporary Steel Casing to ~15.75' BLS
15						
						CPT Activities to be Completed Below Casing

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New Hanover County, North Carolina

W&R Project No. 02050412.03

Date Started	: 4/19/06	Drilling Company	: Graham & Currie
Date Completed	: 4/19/06	Driller	: Earl Mosley
Hole Diameter	: 9" & 4"	Northing Coord.	: 200174.04
Drilling Method	: HSA & Mud Rotary	Easting Coord.	: 23050.92.76
Sampling Method	: SPT	Surface Elevation	: ~31.0' NAVD 88

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	REMARKS
0 5 10 15	SM/ML		SILTY SAND/SANDY SILT; Very Fine Well Rounded Sand, ~40% Fines, Medium Plasticity, Very Loose, Moist to Wet, Black (Ash)			Grouted Boring to Surface Upon Completion Samples are Saturated Below ~2.5' BLS Attempted Shelby Tube Sample ~3.0 to 5.0' BLS (No Recovery) Attempted Shelby Tube Sample ~5.0 to 7.0' BLS (No Recovery)
	CH		CLAY WITH SAND/SANDY CLAY; Clay Liner Material			Set 4-inch Temporary Steel Casing to ~17.4' BLS
20	SC		SAND WITH CLAY; Very Fine to Fine Subangular, ~5% Fines, Non-Plastic, Dense, Wet, Light Brown	1	10 21 20	Converted from HSA to Mud Rotary at ~17.4' BLS
25	SP		SAND; Very Fine to Fine Subangular, ~5% Fines, Non-Plastic, Medium Dense, Wet, White and Light Gray	2	12 14 15	
30				3	13 15 20	
35				4	- 14 13	

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84-Pond Geotechnical Evaluation
New Hanover County, North Carolina

W&R Project No. 02050412.03

Date Started	: 4/19/06	Drilling Company	: Graham & Currie
Date Completed	: 4/19/06	Driller	: Earl Mosley
Hole Diameter	: 9" & 4"	Northing Coord.	: 200174.04
Drilling Method	: HSA & Mud Rotary	Easting Coord.	: 23050.92.76
Sampling Method	: SPT	Surface Elevation	: ~31.0' NAVD 88

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	REMARKS
35	SP					
				5	14 14 16	
40						
				6	10 11 13	
45						
	SW		SAND; Very Fine to Very Coarse Subangular, Non-Plastic, Medium Dense, Wet, White			
				7	11 12 15	
50						
				8	5 9 13	
55						
				9	11 15 18	
60						Driller Reported Semi-Lithofied Lens at ~66.0 to 68.5' BLS
	SP		SAND; Very Fine to Fine Subangular, Non-Plastic, Medium Dense, Wet, White			
	SM		SILTY SAND; Very Fine Subangular, ~25% Fines, Somewhat Plastic to Low Plasticity, Dense to Very Dense, Wet, Dark Gray, Micaceous (Pee Dee Formation)	10	6 9 23	
65						
				11	47 31 35	
70						

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84-Pond Geotechnical Evaluation
New Hanover County, North Carolina

W&R Project No. 02050412.03

Date Started	: 4/18/06	Drilling Company	: Graham & Currie
Date Completed	: 4/18/06	Driller	: Earl Mosley
Hole Diameter	: 9" & 4"	Northing Coord.	: 199682.26
Drilling Method	: HSA & Mud Rotary	Easting Coord.	: 2304881.33
Sampling Method	: SPT	Surface Elevation	: ~33.4' NAVD 88

Depth In Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	REMARKS
0	SP/GP		~~GRAVELLY SAND; (Apparent Crusher-Run Road Base)~~			
	SP		SAND ; Very Fine to Fine Subangular, ~5% Fines, Non-Plastic, Medium Dense to Dense, Somewhat Moist to Very Moist, Light Brown	1	6 5 12	Grouted Boring to Surface Upon Completion
				2	4 6 13	
5						Apparent Ash-Impacted Sand Begins at ~5.0' BLS as Dark Variegations in SPT Samples.
				3	9 15 17	
				4	9 15 18	
10						
				5	9 14 19	
	SP		SAND; Fine Subangular, Non-Plastic, Medium Dense, Wet, Dark Brown	6	6 9 16	
15						Although Pond Is Located approximately 15' Distant from this Boring Location, and Pond Surface is ~2.0' Below Top of Boring Surface - Soils Samples were Not Observed to be Saturated until ~15.5' BLS.
	SP		SAND; Very Fine to Fine Subangular, ~5% Fines, Non-Plastic, Medium Dense to Dense, Wet, Light Brown, Shell Fragments and Wood Fragments Noted	7	6 11 14	
				8	8 17 21	
20						
	SC		SAND WITH CLAY; Very Fine to Fine Subangular, ~10% Organic Fines, Somewhat Plastic, Firm, Wet, Light Brown			
25						Converted from HSA to Mud Rotary at ~25.0' BLS Using Hollow Stem Augers as Casing.
	SP		SAND; Very Fine to Fine Subangular, ~5% Fines, Non-Plastic, Medium Dense, Wet, White and Light Brown	9	6 5 6	
30				10	8 8 9	
35						

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LOG OF BORING WR-7

(Page 2 of 2)

Progress Energy / L.V. Sutton Plant
84-Pond Geotechnical Evaluation
New Hanover County, North Carolina
W&R Project No. 02050412.03

Date Started	: 4/18/06	Drilling Company	: Graham & Currie
Date Completed	: 4/18/06	Driller	: Earl Mosley
Hole Diameter	: 9" & 4"	Northing Coord.	: 199682.26
Drilling Method	: HSA & Mud Rotary	Easting Coord.	: 2304881.33
Sampling Method	: SPT	Surface Elevation	: ~33.4' NAVD 88

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	REMARKS
36	SP					
41						
	SM		SILTY SAND; Very Fine Subangular, ~15% Fines, Non-Plastic, Dense, Wet, White	11	15 18 21	
46						
51						
	SW		SAND; Fine to Coarse Subangular, ~5% Fines, Non-Plastic, Medium Dense to Loose, Wet, Gray and Light Brown	12	9 6 12	
56						
				13	WOH 1 3	
61						
				14	5 4 5	
66	SC		SAND WITH CLAY; Very Fine to Fine Subangular, ~10% Fines, Non-Plastic, Loose, Wet, Orange			
	SM		SILTY SAND; Very Fine Subangular, ~20% Fines, Somewhat Plastic, Medium Dense, Wet, Dark Gray, Micaceous (Pee Dee Formation)	15	10 10 12	
71						

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LOG OF BORING WR-11

(Page 1 of 1)

Progress Energy / L.V. Sutton Plant
84-Pond Geotechnical Evaluation
New Hanover County, North Carolina

W&R Project No. 02050412.03

Date Started	: 4/20/06	Drilling Company	: Graham & Currie
Date Completed	: 4/20/06	Driller	: Earl Mosley
Hole Diameter	: 9"	Northing Coord.	: 199943.11
Drilling Method	: HSA & CPT	Easting Coord.	: 2304265.73
Sampling Method	: SPT	Surface Elevation	: ~31.0' NAVD 88

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	REMARKS
0	SM/ML	▨	SILTY SAND/SANDY SILT; ~40 to 60% Fines, Medium Elasticity, Very Fine Well Rounded Sand, Very Loose, Very Moist to Wet, Black (Ash)			Grouted Boring to Surface Upon Completion
						Samples are Saturated Below ~1.5' BLS
				1	1 1 1	
5						
				2	WOH	
10						
				3	WOR WOH WOH	
15				4	WOR WOH 10	Driller Reported Hard Surface at ~15.5' BLS (Wood?)
	SP	▨	SAND; Very Fine to Fine Subangular, Non-Plastic, Loose, Wet, Dark Gray (Ash Impacted)			Set 4-inch Temporary Steel Casing to ~19.0' BLS
				5	4 3 4	
						CPT Activities to be Completed Below Casing

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Attachment 1.2

MACTEC 2010 Boring Logs & As-Built Piezometer Construction Details

SOIL CLASSIFICATION

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel - sand mixtures, little or no fines.
			GP	Pooly graded gravels or gravel - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel - sand - silt mixtures.
			GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 Sieve Size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand - silt mixtures
			SC	Clayey sands, sand - clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts and with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. 1, March, 1953 (Revised April, 1960)

NON-SOIL CLASSIFICATION

■	Undisturbed Sample	▮	Auger Cuttings
☒	Split Spoon Sample	≋	Bulk Sample
▯	Rock Core	▩	Crandall Sampler
▩	Dilatometer	^	Pressure Meter
□	Packer	○	No Recovery
▽	Water Table at time of drilling	▼	Water Table after 24 hours
✋	Grab Bag Sample	▤	Caved-in Depth

Correlation of Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
< 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very Stiff
		> 30	Hard

Sample Moisture Description

Saturated:	Usually liquid; very wet, usually from below the groundwater table
Wet:	Semisolid; required drying to attain optimum moisture
Moist:	Solid; at or near optimum moisture
Dry:	Requires additional water to attain optimum moisture

KEY TO SYMBOLS AND DESCRIPTIONS

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES: IDENT	TYPE	N-COUNT or Rec%/RQD%: 1st 6"	2nd 6"	3rd 6"	4th 6"
0	Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt	▨	34.0						
5		▨	29.0						
10		▨	24.0						
15		▨	19.0						
20		▨	14.0						
	Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt ▼	▨							
25		▨	9.0						
30	Boring terminated at 30 feet.		4.0						
35			-1.0						
40			-6.0						
45			-11.0						

PL (%) ● NM (%) ○ LL (%) ●
▲ FINES (%)
● SPT (bpf)
10 20 30 40 50 60 70 80 90 100
5 10 15 20 25 30 35 40
0 10 20 30 40 50 60 70 80 90 100

STD-NO STATION 6468-09-2340.GPJ MACTEC GEO.GDT 4/16/10

DRILLER: Carolina Drilling Co.
EQUIPMENT: Geoprobe Rig
METHOD: CPT-Direct Push
HOLE DIA.: 2 inch
REMARKS: Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

REVIEWED BY:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Progress Energy-Sutton Dike
Boring No.: PZ-1A
Location: Wilmington, NC
Drilled: February 11, 2009
Project #: 6468-09-2340
Page 1 **of** 1

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES: IDENT	TYPE	N-COUNT or Rec%/RQD%: 1st 6"	2nd 6"	3rd 6"	4th 6"	PL (%) ● — MC (%) ○ — LL (%) ◆; ▲ FINES (%); ● SPT (bpf): 10 20 30 40 50 60 70 80 90 100
0	Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt	▨	34.0							
5		▨	29.0							5
10		▨	24.0							10
15		▨	19.0							15
20		▨	14.0							20
	Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt ▼	▨								
25		▨	9.0							25
30	Boring terminated at 30 feet.		4.0							30
35			-1.0							35
40			-6.0							40
45			-11.0							

0 10 20 30 40 50 60 70 80 90 100

DRILLER: Carolina Drilling Co.
EQUIPMENT: Geoprobe Rig
METHOD: CPT-Direct Push
HOLE DIA.: 2 inch
REMARKS: Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

REVIEWED BY: _______

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Progress Energy-Sutton Dike

Boring No.: PZ-2A

Location: Wilmington, NC
Drilled: February 11, 2009
Project #: 6468-09-2340

Page 1 of 1

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	SAMPLES TYPE	N-COUNT or Rec%/RQD% 1st 6"	2nd 6"	3rd 6"	4th 6"
0	Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt		34.0						
5			29.0						
10			24.0						
15			19.0						
	Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt								
20			14.0						
		▼							
25			9.0						
30	Boring terminated at 30 feet.		4.0						
35			-1.0						
40			-6.0						
45			-11.0						

PL (%) ● ○ LL (%)

▲ FINES (%)

● SPT (bpf)

10 20 30 40 50 60 70 80 90 100

0 10 20 30 40 50 60 70 80 90 100

STD-NO STATION 6468-09-2340.GPJ MACTEC GEO.GDT 4/16/10

DRILLER:	Carolina Drilling Co.
EQUIPMENT:	Geoprobe Rig
METHOD:	CPT-Direct Push
HOLE DIA.:	2 inch
REMARKS:	Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

REVIEWED BY:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Progress Energy-Sutton Dike

Boring No.: PZ-3A

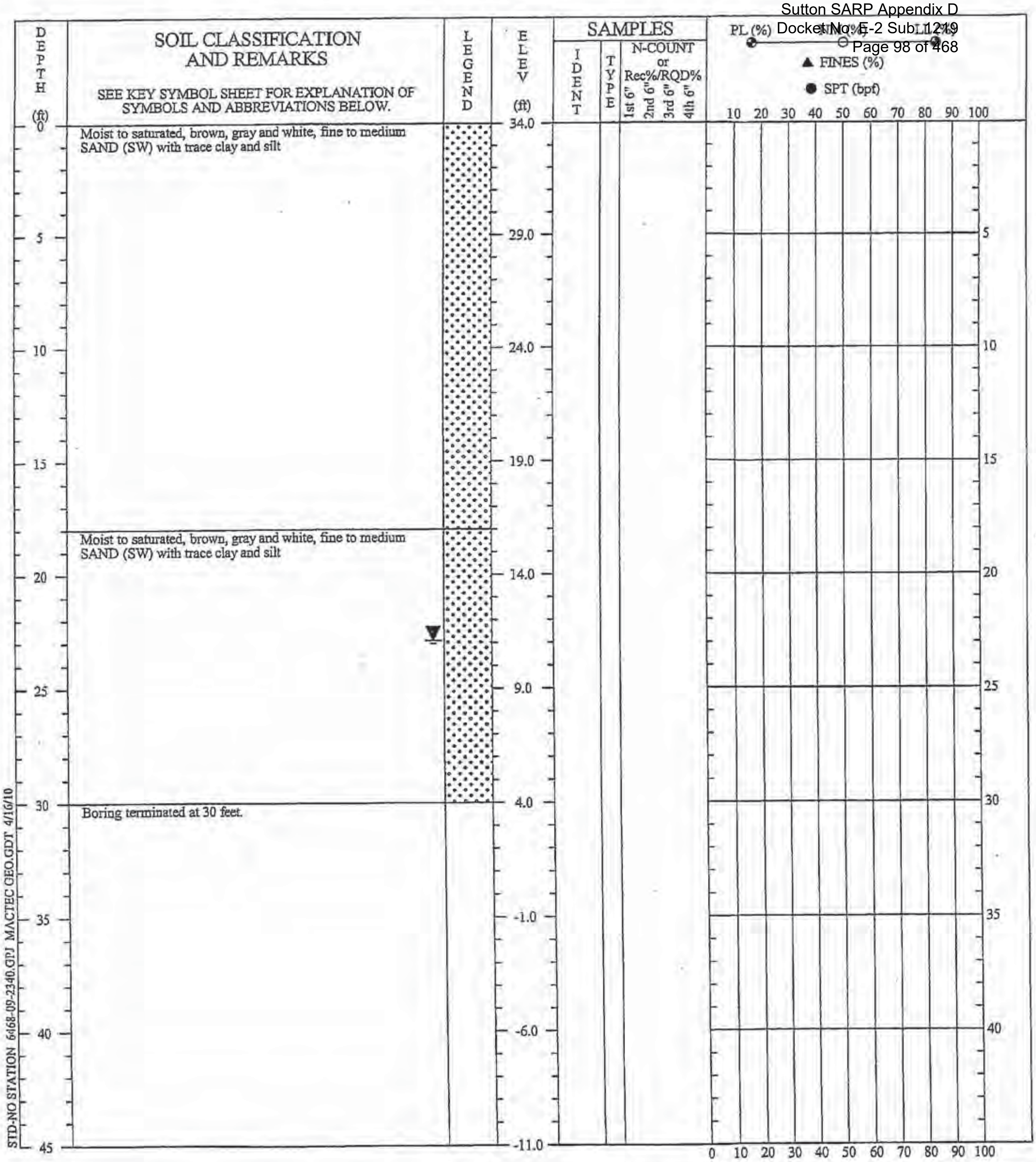
Location: Wilmington, NC
Drilled: February 11, 2009
Project #: 6468-09-2340

Page 1 of 1

MACTEC

SOIL CLASSIFICATION AND REMARKS

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.



Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Boring terminated at 30 feet.

DRILLER: Carolina Drilling Co.
EQUIPMENT: Geoprobe Rig
METHOD: CPT-Direct Push
HOLE DIA.: 2 inch
REMARKS: Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

REVIEWED BY: JAD

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Progress Energy-Sutton Dike
Boring No.: PZ-4A
Location: Wilmington, NC
Drilled: February 11, 2009
Project #: 6468-09-2340
Page 1 **of** 1

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	SAMPLES TYPE	N-COUNT or Rec%/RQD% 1st 6"	2nd 6"	3rd 6"	4th 6"	PL (%) NM (%) LL (%) ▲ FINES (%) ● SPT (bpf) 10 20 30 40 50 60 70 80 90 100
0	Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt		34.0							
5			29.0							5
10			24.0							10
15			19.0							15
	Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt									
20			14.0							20
	▼									
25			9.0							25
30	Boring terminated at 30 feet.		4.0							30
35			-1.0							35
40			-6.0							40
45			-11.0							0 10 20 30 40 50 60 70 80 90 100

STD-NO STATION 6468-09-2340.GPJ MACTEC GEO.GDT 4/16/10

DRILLER:	Carolina Drilling Co.
EQUIPMENT:	Geoprobe Rig
METHOD:	CPT - Direct Push
HOLE DIA.:	2 inch
REMARKS:	Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

REVIEWED BY: JQD

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Progress Energy-Sutton Dike

Boring No.: PZ-5A

Location: Wilmington, NC
Drilled: February 12, 2009
Project #: 6468-09-2340

Page 1 **of** 1

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	ELEV (ft)
0	Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt	34.0
5		29.0
10		24.0
15		19.0
	Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt	
20		14.0
25		9.0
30	Boring terminated at 30 feet.	4.0
35		-1.0
40		-6.0
45		-11.0

LEGEND

SAMPLES: IDENT | TYPE | N-COUNT or Rec%/RQD% (1st 6", 2nd 6", 3rd 6", 4th 6")

PL (%) LL (%)
▲ FINES (%)
● SPT (bpf)
10 20 30 40 50 60 70 80 90 100

STD-NO STATION 6468-09-2340.GPJ MACTEC GEO.GDT 4/16/10

DRILLER:	Carolina Drilling Co.
EQUIPMENT:	Geoprobe Rig
METHOD:	CPT -Direct Push
HOLE DIA.:	2 inch
REMARKS:	Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

REVIEWED BY:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

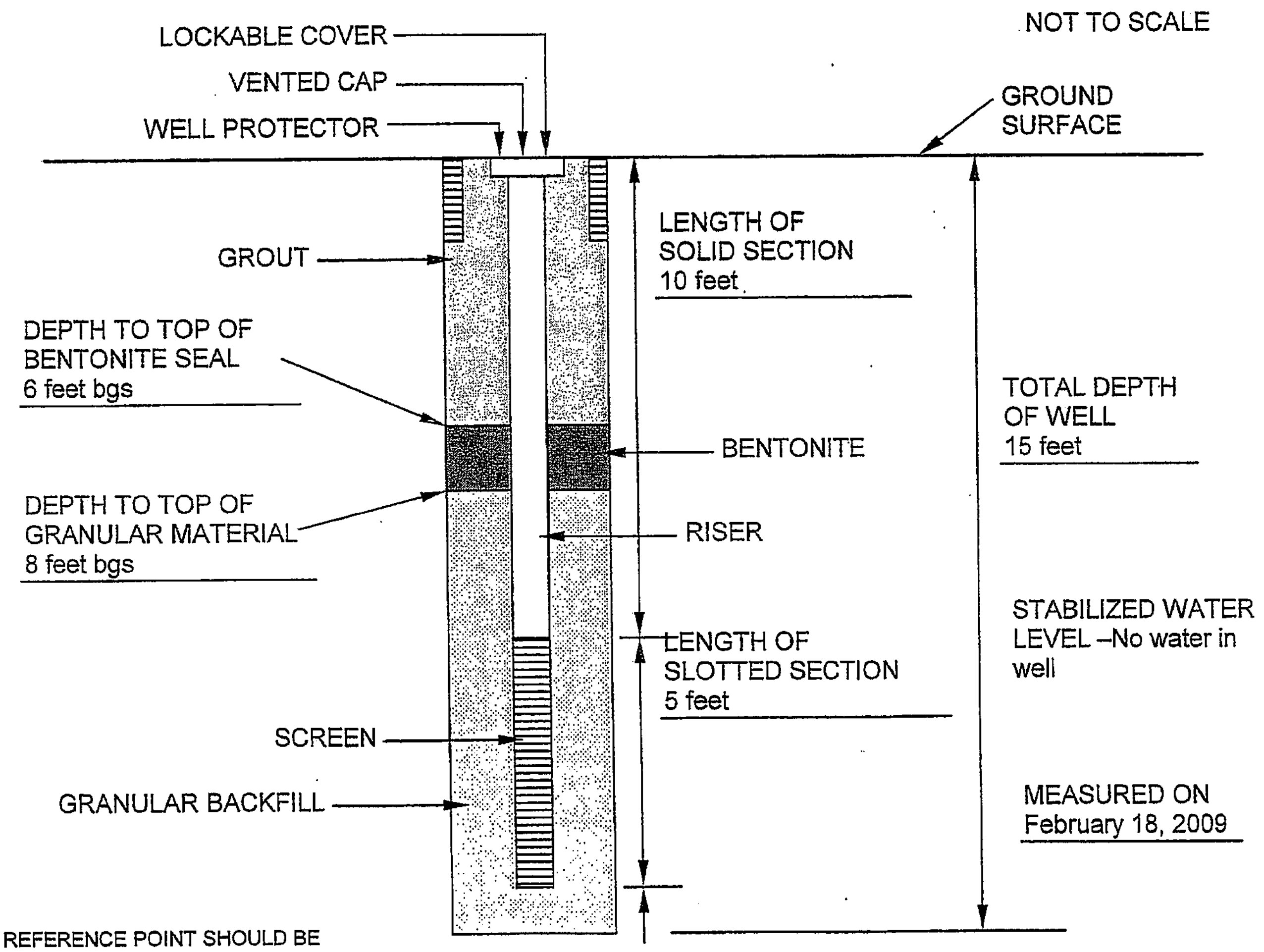
SOIL TEST BORING RECORD

Project: Progress Energy-Sutton Dike
Boring No.: PZ-6A
Location: Wilmington, NC
Drilled: February 12, 2009
Project #: 6468-09-2340
Page 1 **of** 1

MACTEC

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**
JOB NUMBER **6468-09-2340**
WELL NUMBER **PZ-1**
INSTALLATION DATE **February 11, 2009**
LOCATION **Wilmington, North Carolina**
GROUND SURFACE ELEVATION **Approx. 34 feet**
REFERENCE POINT ELEVATION * **Top of PVC**
GRANULAR BACKFILL MATERIAL **Sand**
SLOT SIZE **0.01**
SCREEN MATERIAL **Schedule 40 PVC**
SCREEN DIAMETER **2 inch**
RISER MATERIAL **Schedule 40 PVC**
RISER DIAMETER **2 inch**
DRILLING TECHNIQUE **Hollow Stem Auger**
DRILLING CONTRACTOR **Carolina Drilling**
BOREHOLE DIAMETER **7 inch**
MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**
LOCK BRAND **Master Lock**
KEY CODE/COMBINATION **No. 0536**



LENGTH OF SOLID SECTION 10 feet

DEPTH TO TOP OF BENTONITE SEAL 6 feet bgs

TOTAL DEPTH OF WELL 15 feet

DEPTH TO TOP OF GRANULAR MATERIAL 8 feet bgs

LENGTH OF SLOTTED SECTION 5 feet

STABILIZED WATER LEVEL –No water in well

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No.6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ-1A**

INSTALLATION DATE **February 11, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

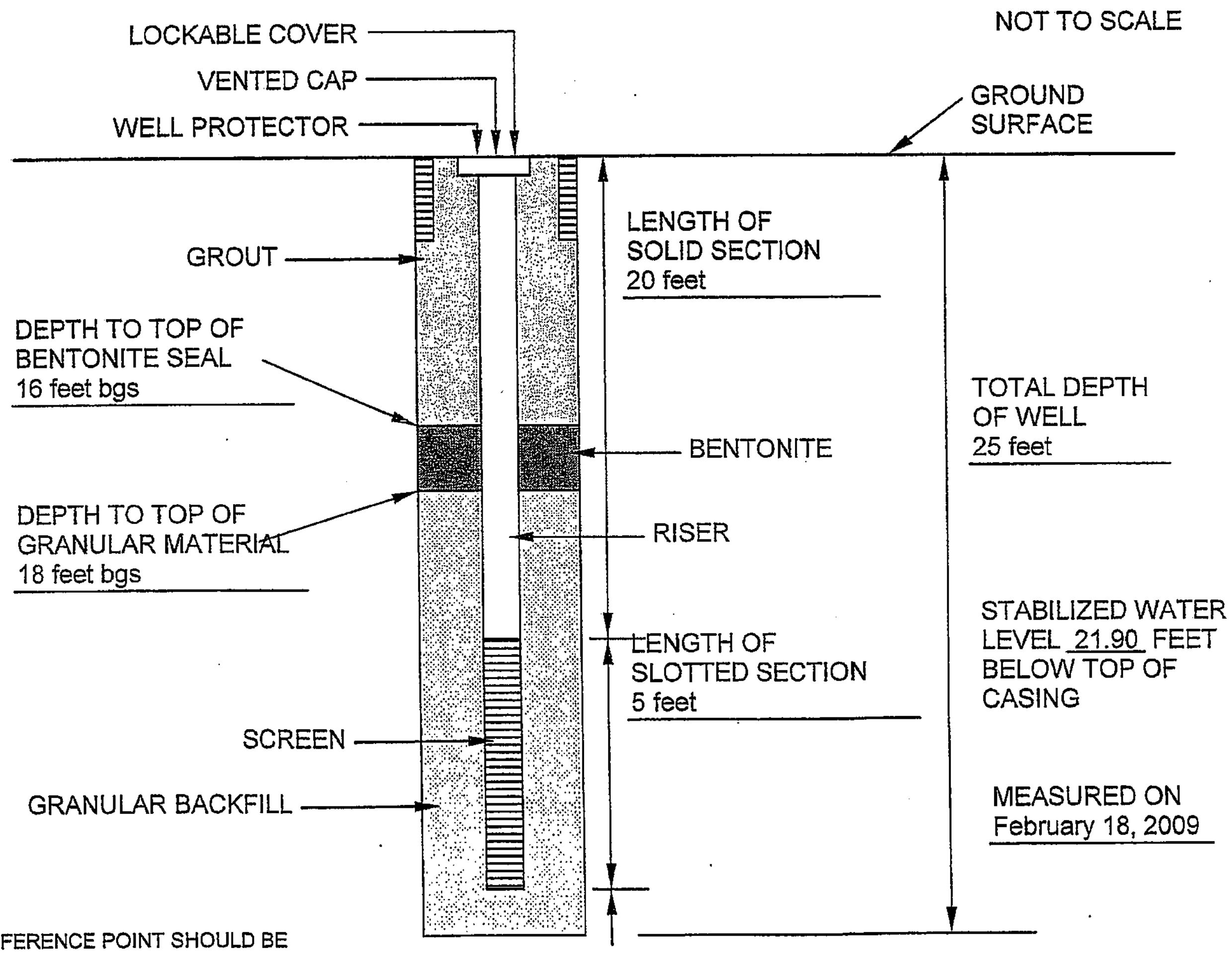
DRILLING CONTRACTOR **Carolina Drilling**

BOREHOLE DIAMETER **7 inch**

MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

KEY CODE/COMBINATION **No. 0536**



LENGTH OF SOLID SECTION 20 feet

DEPTH TO TOP OF BENTONITE SEAL 16 feet bgs

TOTAL DEPTH OF WELL 25 feet

DEPTH TO TOP OF GRANULAR MATERIAL 18 feet bgs

LENGTH OF SLOTTED SECTION 5 feet

STABILIZED WATER LEVEL 21.90 FEET BELOW TOP OF CASING

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

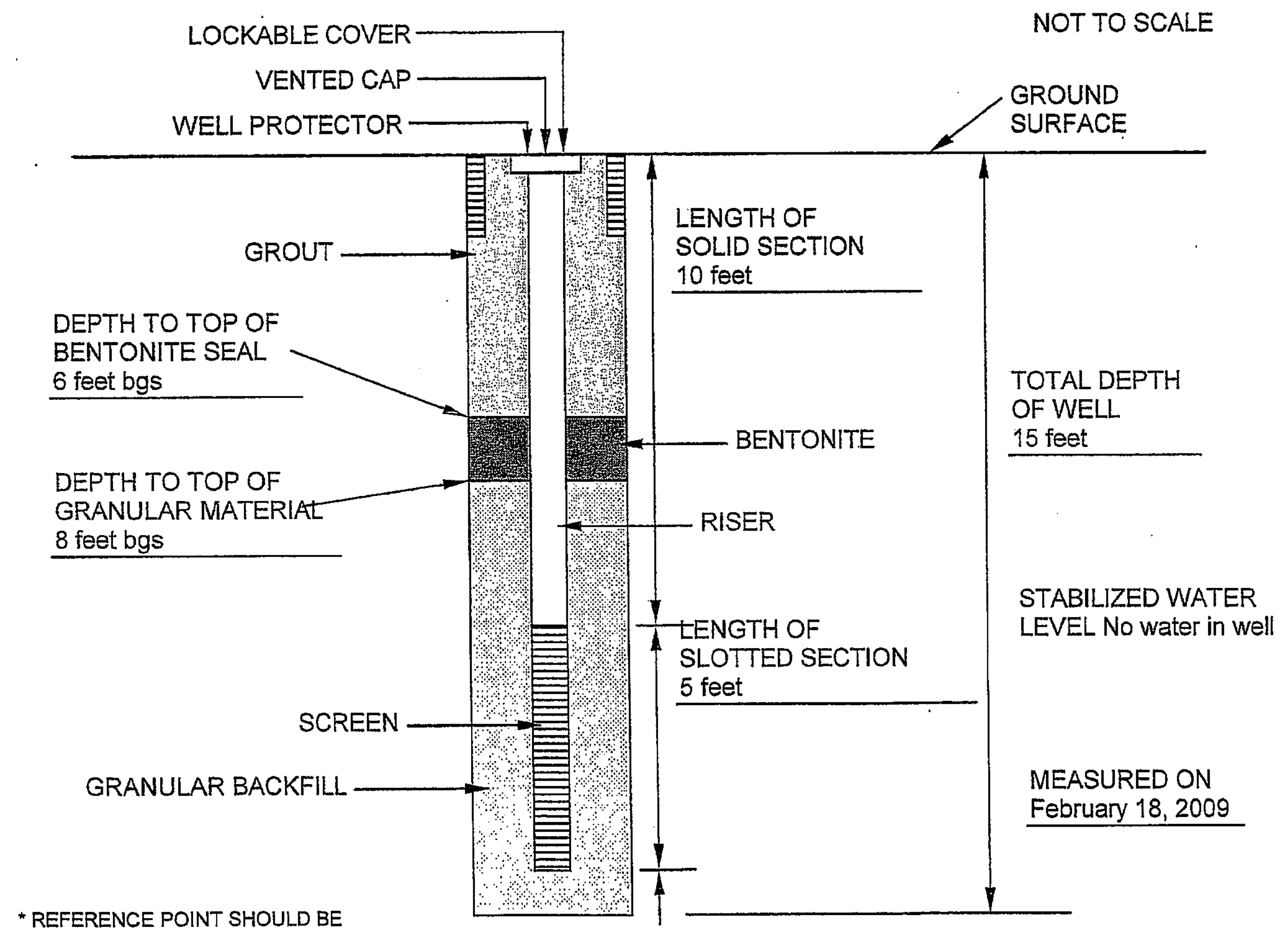
Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**
JOB NUMBER **6468-09-2340**
WELL NUMBER **PZ-2**
INSTALLATION DATE **February 12, 2009**
LOCATION **Wilmington, North Carolina**
GROUND SURFACE ELEVATION **Approx. 34 feet**
REFERENCE POINT ELEVATION * **Top of PVC**
GRANULAR BACKFILL MATERIAL **Sand**
SLOT SIZE **0.01**
SCREEN MATERIAL **Schedule 40 PVC**
SCREEN DIAMETER **2 inch**
RISER MATERIAL **Schedule 40 PVC**
RISER DIAMETER **2 inch**
DRILLING TECHNIQUE **Hollow Stem Auger**
DRILLING CONTRACTOR **Carolina Drilling**
BOREHOLE DIAMETER **7 inch**
MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**
LOCK BRAND **Master Lock**
KEY CODE/COMBINATION **No. 0536**



LENGTH OF SOLID SECTION 10 feet

DEPTH TO TOP OF BENTONITE SEAL 6 feet bgs

TOTAL DEPTH OF WELL 15 feet

DEPTH TO TOP OF GRANULAR MATERIAL 8 feet bgs

STABILIZED WATER LEVEL No water in well

LENGTH OF SLOTTED SECTION 5 feet

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ- 2A**

INSTALLATION DATE **February 12, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

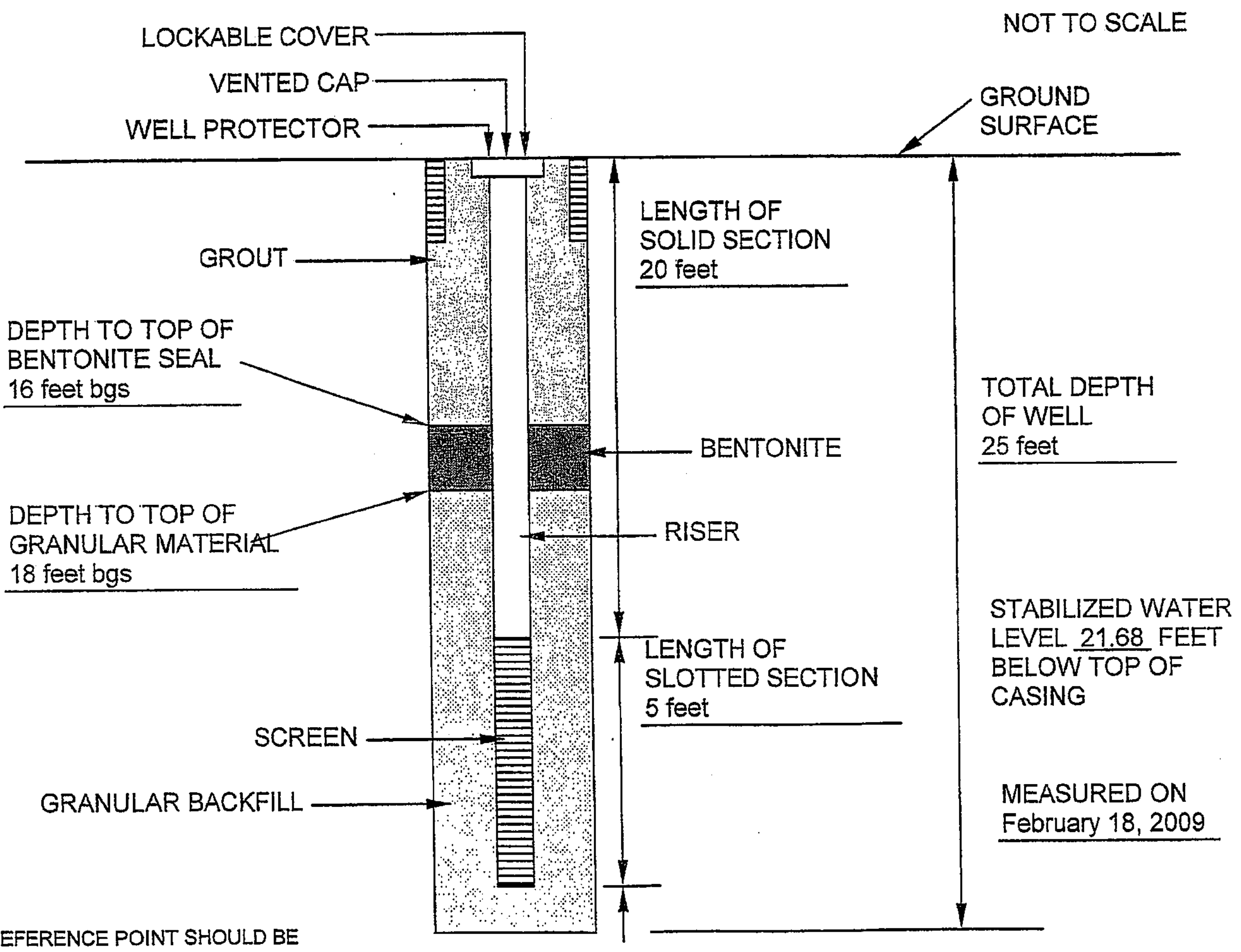
DRILLING CONTRACTOR **Carolina Drilling**

BOREHOLE DIAMETER **7 inch**

MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

KEY CODE/COMBINATION **0536**



* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

OFFICIAL COPY

Oct 30 2019

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ- 3**

INSTALLATION DATE **February 12, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

DRILLING CONTRACTOR **Carolina Drilling**

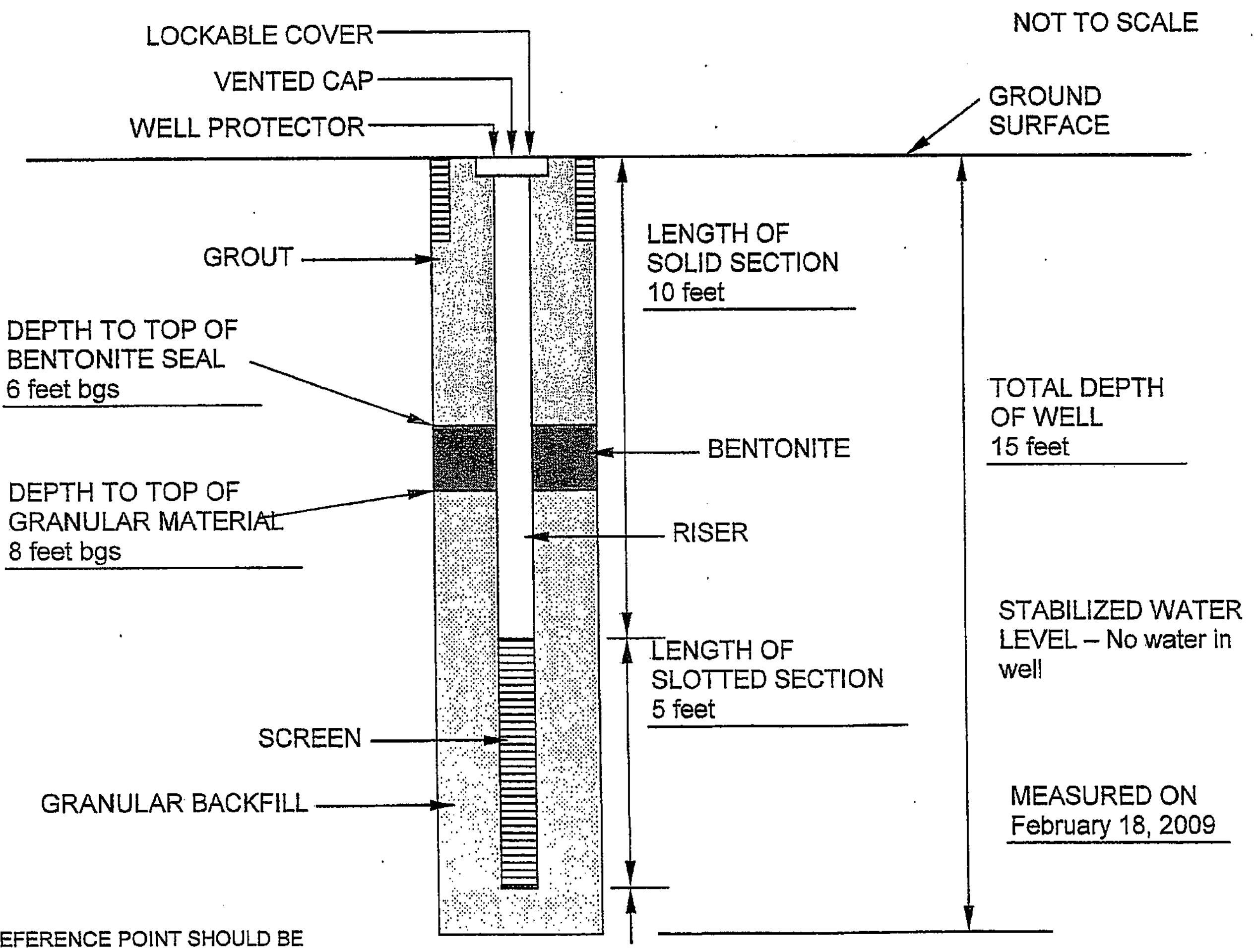
BOREHOLE DIAMETER **7 inch**

MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

SIZE/MODEL

KEY CODE/COMBINATION **0536**



LENGTH OF SOLID SECTION 10 feet

DEPTH TO TOP OF BENTONITE SEAL 6 feet bgs

TOTAL DEPTH OF WELL 15 feet

DEPTH TO TOP OF GRANULAR MATERIAL 8 feet bgs

LENGTH OF SLOTTED SECTION 5 feet

STABILIZED WATER LEVEL – No water in well

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ-3A**

INSTALLATION DATE **February 12, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

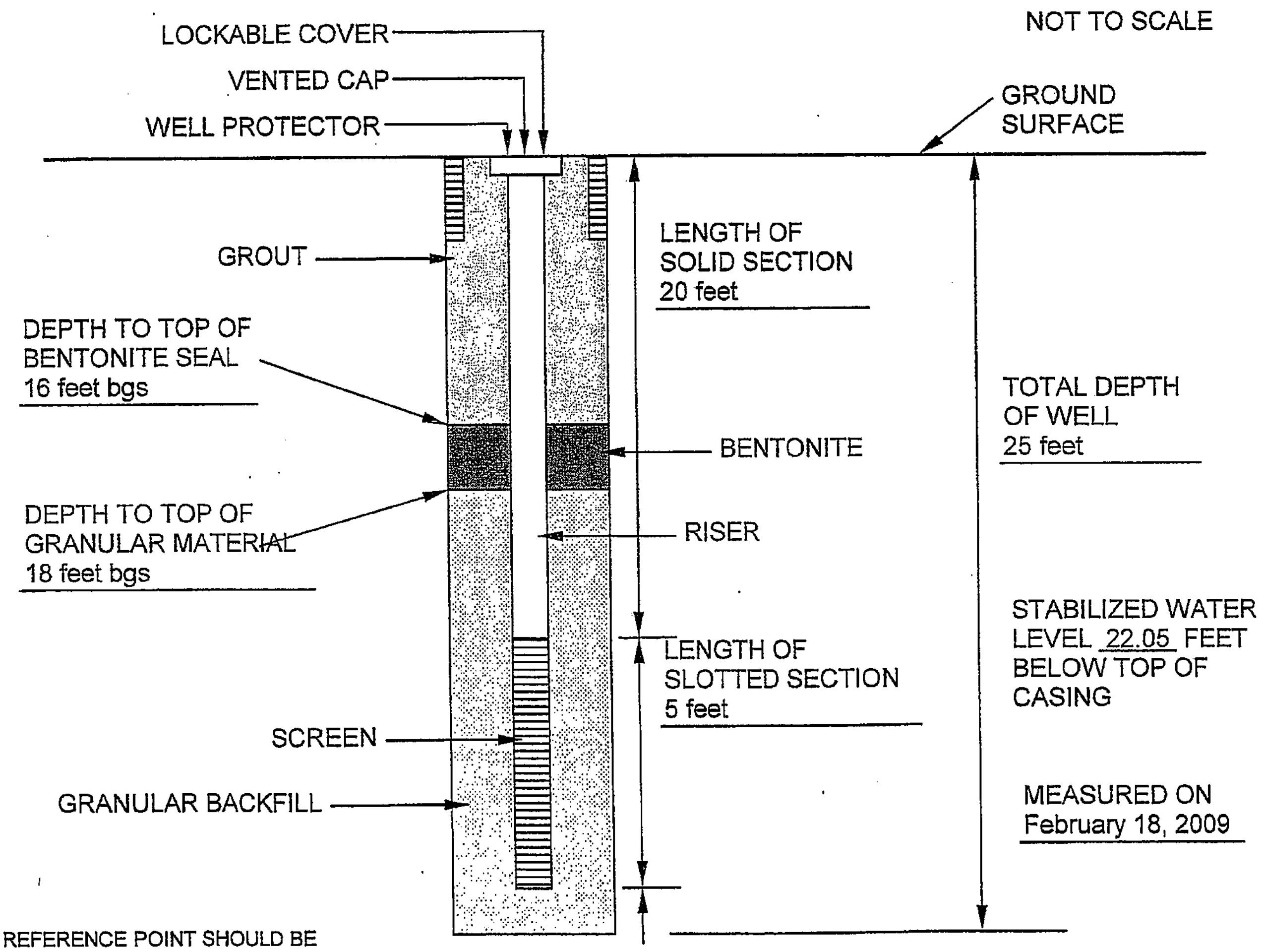
DRILLING CONTRACTOR **Carolina Drilling**

BOREHOLE DIAMETER **7 inch**

MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

KEY CODE/COMBINATION **0536**



LENGTH OF SOLID SECTION 20 feet

DEPTH TO TOP OF BENTONITE SEAL 16 feet bgs

TOTAL DEPTH OF WELL 25 feet

DEPTH TO TOP OF GRANULAR MATERIAL 18 feet bgs

STABILIZED WATER LEVEL 22.05 FEET BELOW TOP OF CASING

LENGTH OF SLOTTED SECTION 5 feet

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ-4**

INSTALLATION DATE **February 12, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

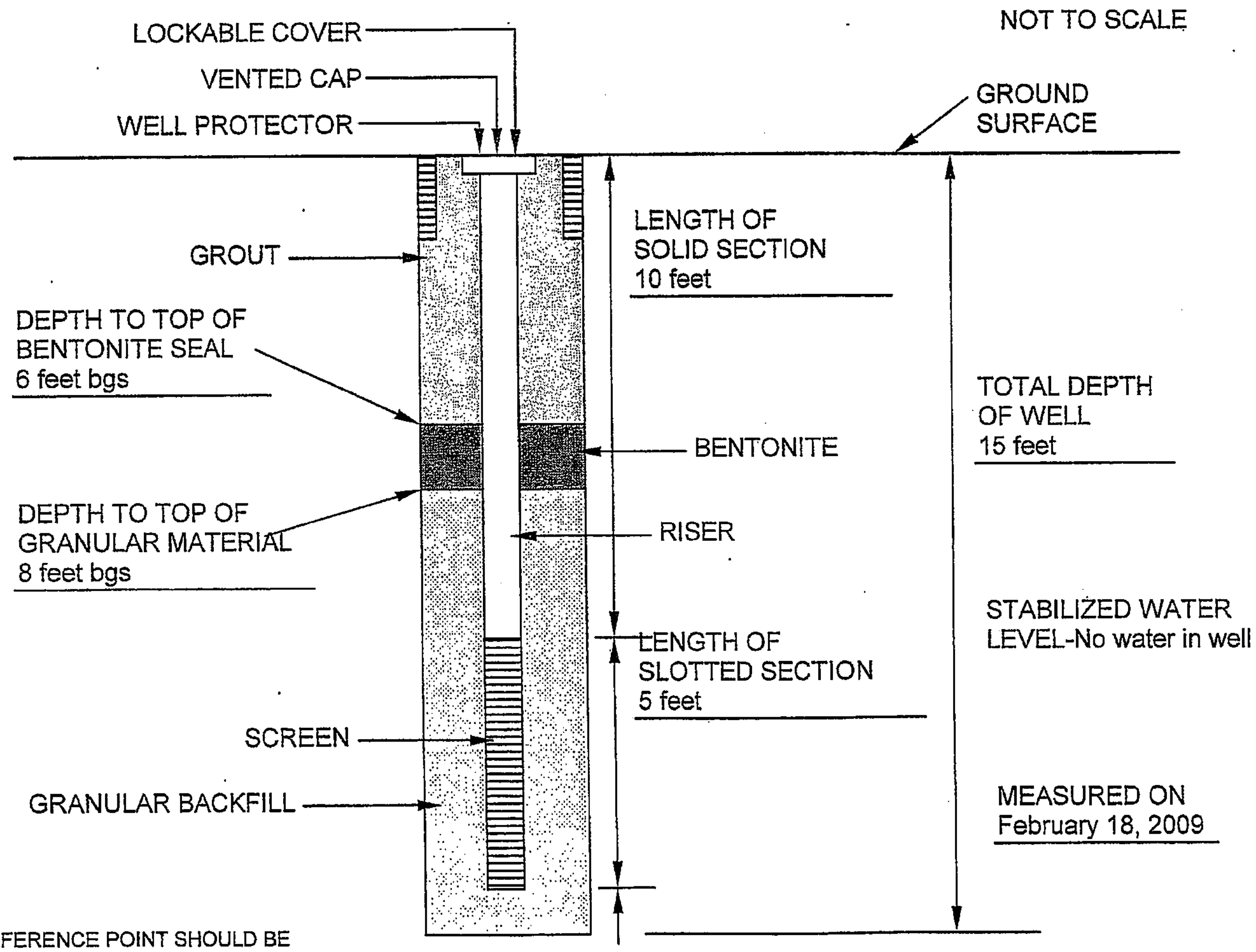
DRILLING CONTRACTOR **Carolina Drilling**

BOREHOLE DIAMETER **7 inch**

MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

KEY CODE/COMBINATION **No. 0536**



* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ-4A**

INSTALLATION DATE **February 12, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

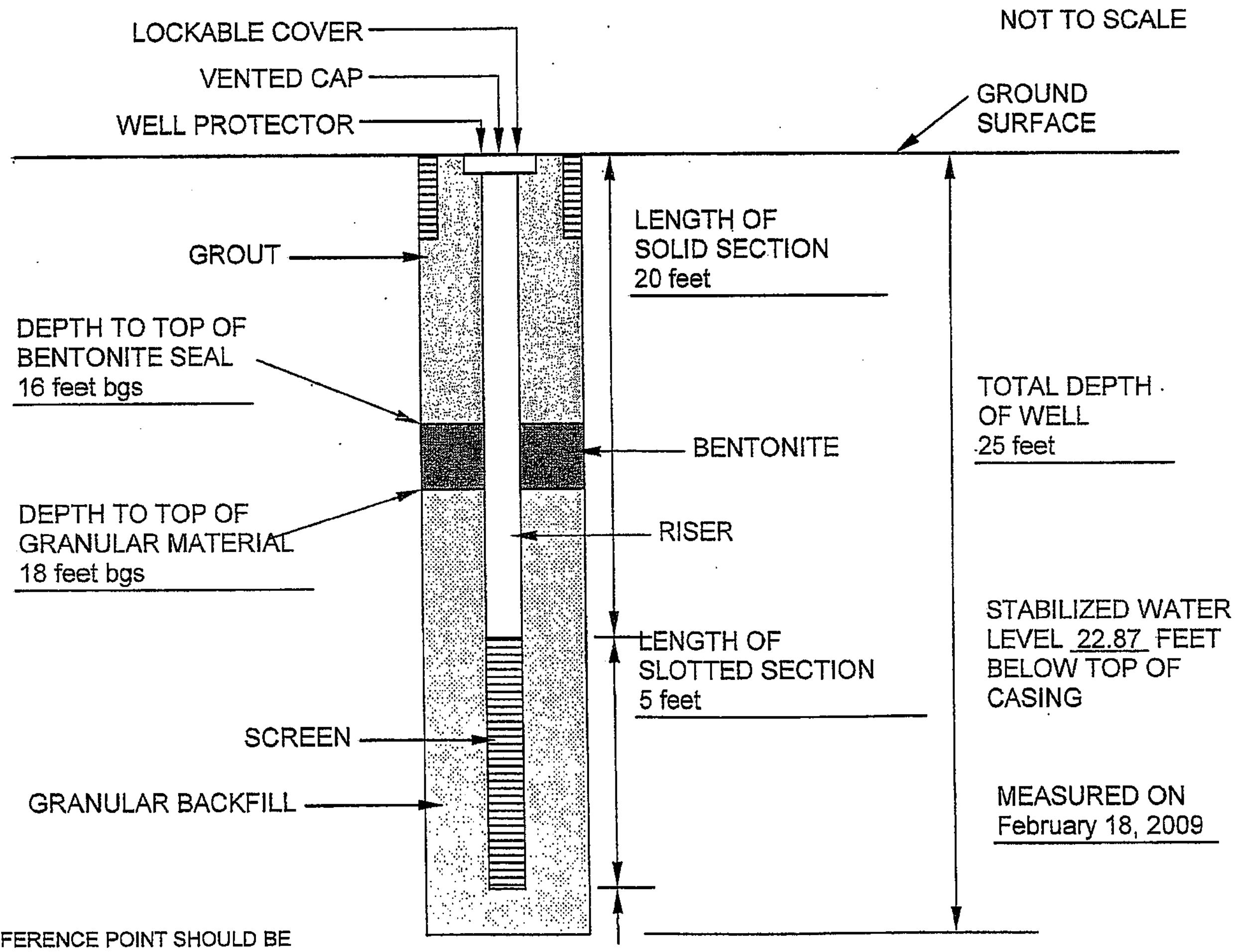
DRILLING CONTRACTOR **Carolina Drilling**

BOREHOLE DIAMETER **7 inch**

MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

KEY CODE/COMBINATION **No. 0536**



LENGTH OF SOLID SECTION 20 feet

DEPTH TO TOP OF BENTONITE SEAL 16 feet bgs

TOTAL DEPTH OF WELL 25 feet

DEPTH TO TOP OF GRANULAR MATERIAL 18 feet bgs

LENGTH OF SLOTTED SECTION 5 feet

STABILIZED WATER LEVEL 22.87 FEET BELOW TOP OF CASING

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant Wilmington, North Carolina Project No. 6468-09-2340	MACTEC	TYPE II MONITORING WELL INSTALLATION RECORD

OFFICIAL COPY

Oct 30 2019

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ-5**

INSTALLATION DATE **February 12, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

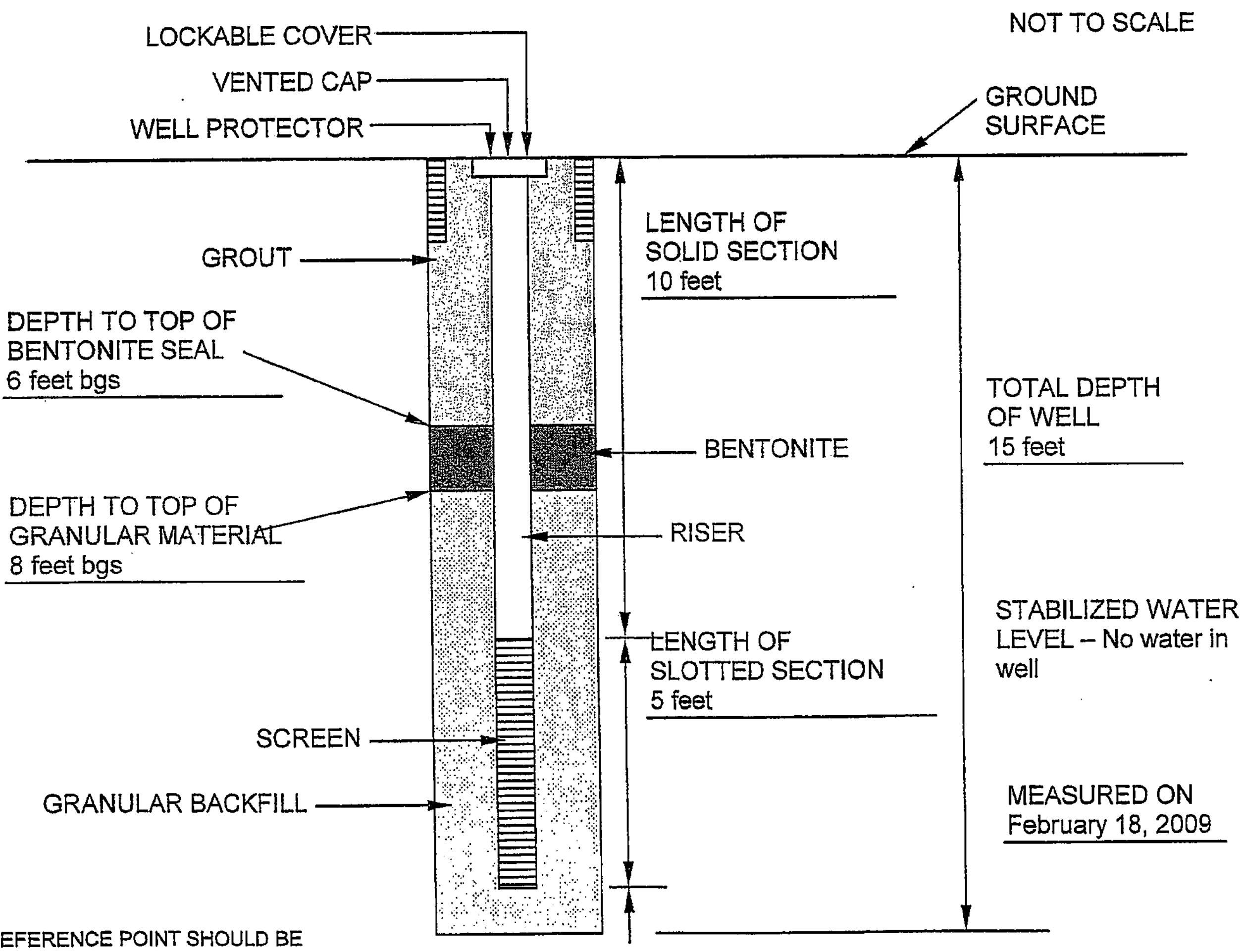
DRILLING CONTRACTOR **Carolina Drilling**

BOREHOLE DIAMETER **7 inch**

MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

KEY CODE/COMBINATION **No. 0536**



LENGTH OF SOLID SECTION 10 feet

DEPTH TO TOP OF BENTONITE SEAL 6 feet bgs

TOTAL DEPTH OF WELL 15 feet

DEPTH TO TOP OF GRANULAR MATERIAL 8 feet bgs

STABILIZED WATER LEVEL – No water in well

LENGTH OF SLOTTED SECTION 5 feet

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

OFFICIAL COPY

Oct 30 2019

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ-5A**

INSTALLATION DATE **February 12, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

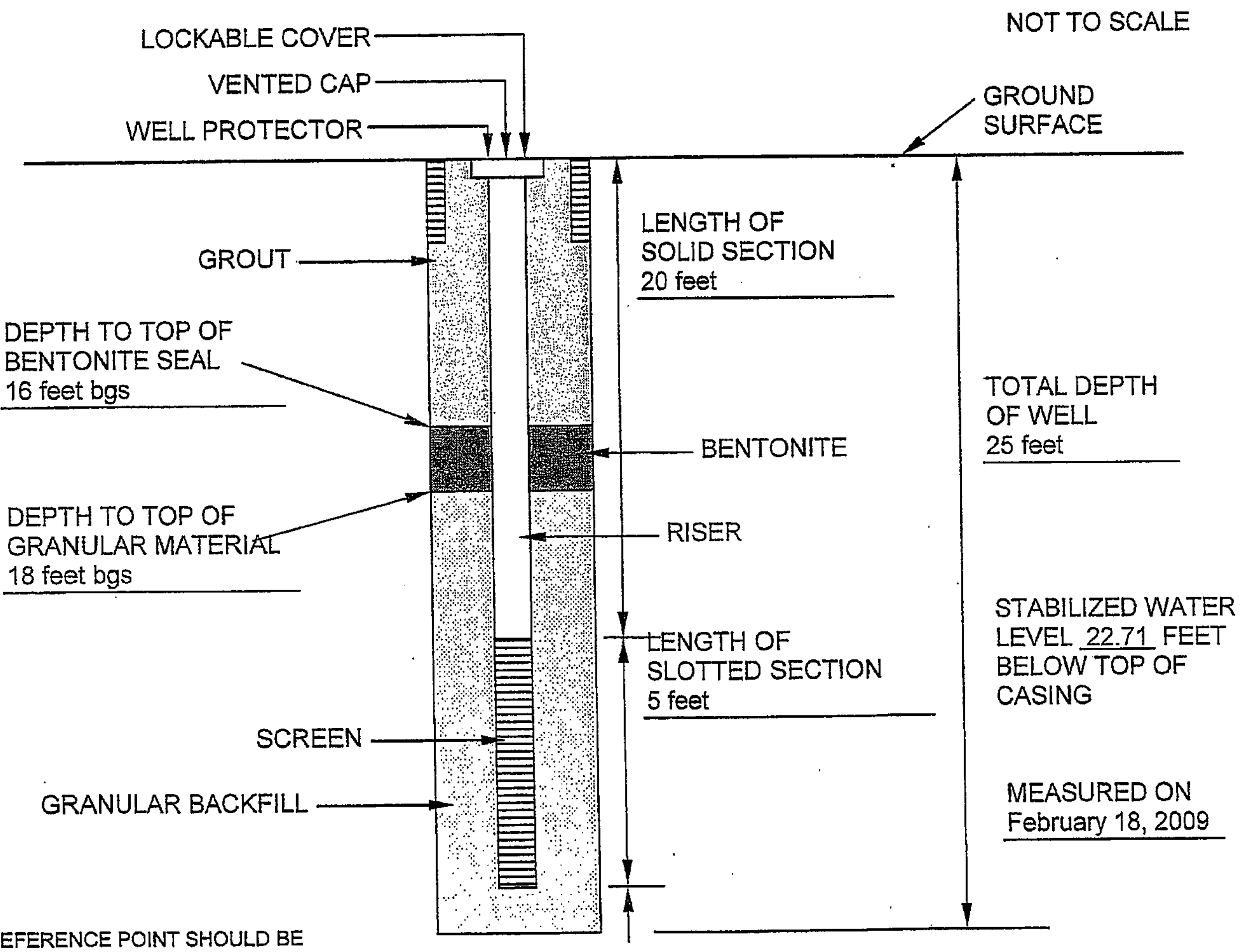
DRILLING CONTRACTOR **Carolina Drilling**

BOREHOLE DIAMETER **7 inch**

MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

KEY CODE/COMBINATION **No. 0536**



* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ-6**

INSTALLATION DATE **February 12, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

DRILLING CONTRACTOR **Carolina Drilling**

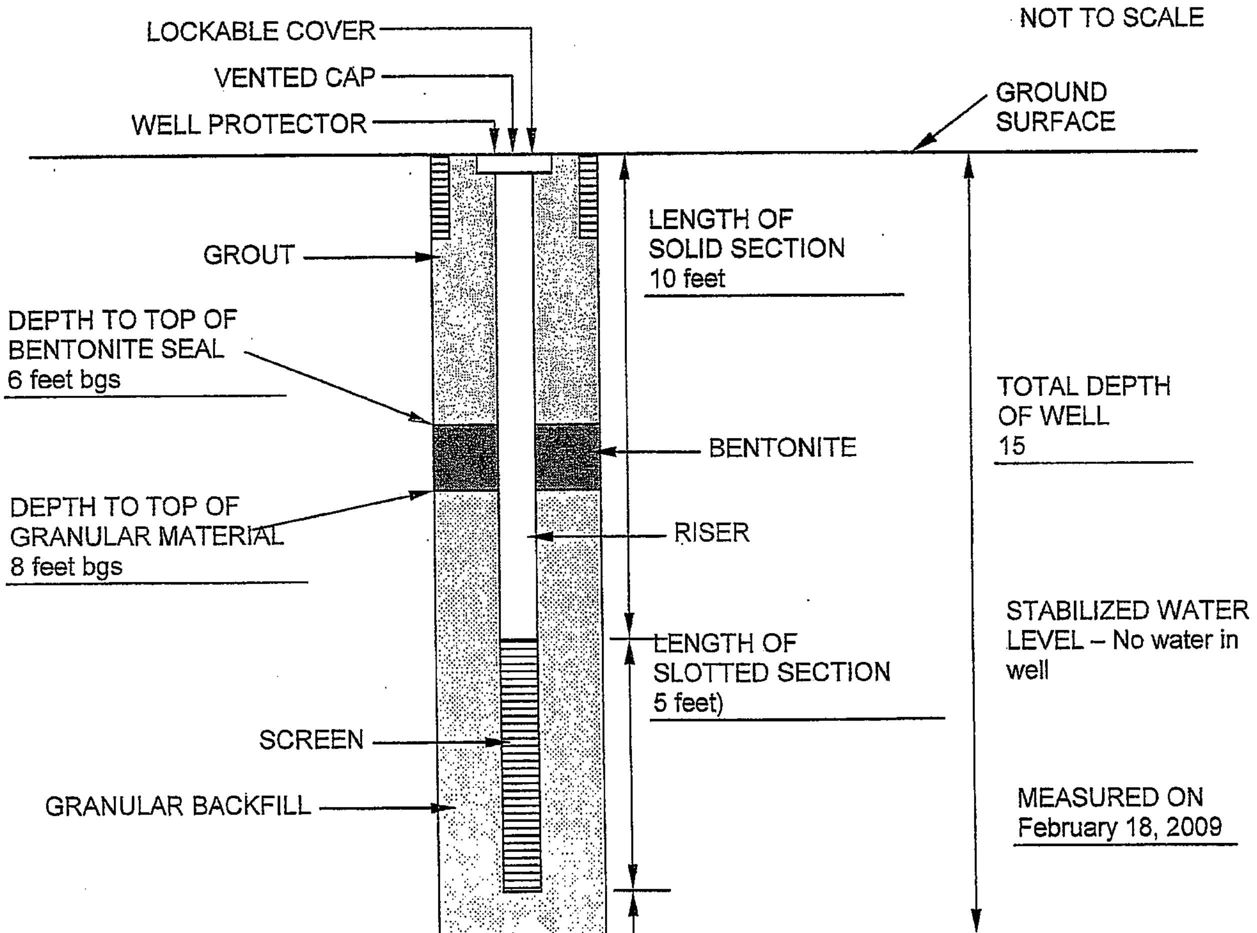
BOREHOLE DIAMETER **7 inch**

MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

KEY CODE/COMBINATION **No. 0536**

NOT TO SCALE



LENGTH OF SOLID SECTION 10 feet

DEPTH TO TOP OF BENTONITE SEAL 6 feet bgs

TOTAL DEPTH OF WELL 15

DEPTH TO TOP OF GRANULAR MATERIAL 8 feet bgs

LENGTH OF SLOTTED SECTION 5 feet)

STABILIZED WATER LEVEL – No water in well

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ-6A**

INSTALLATION DATE **February 12, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

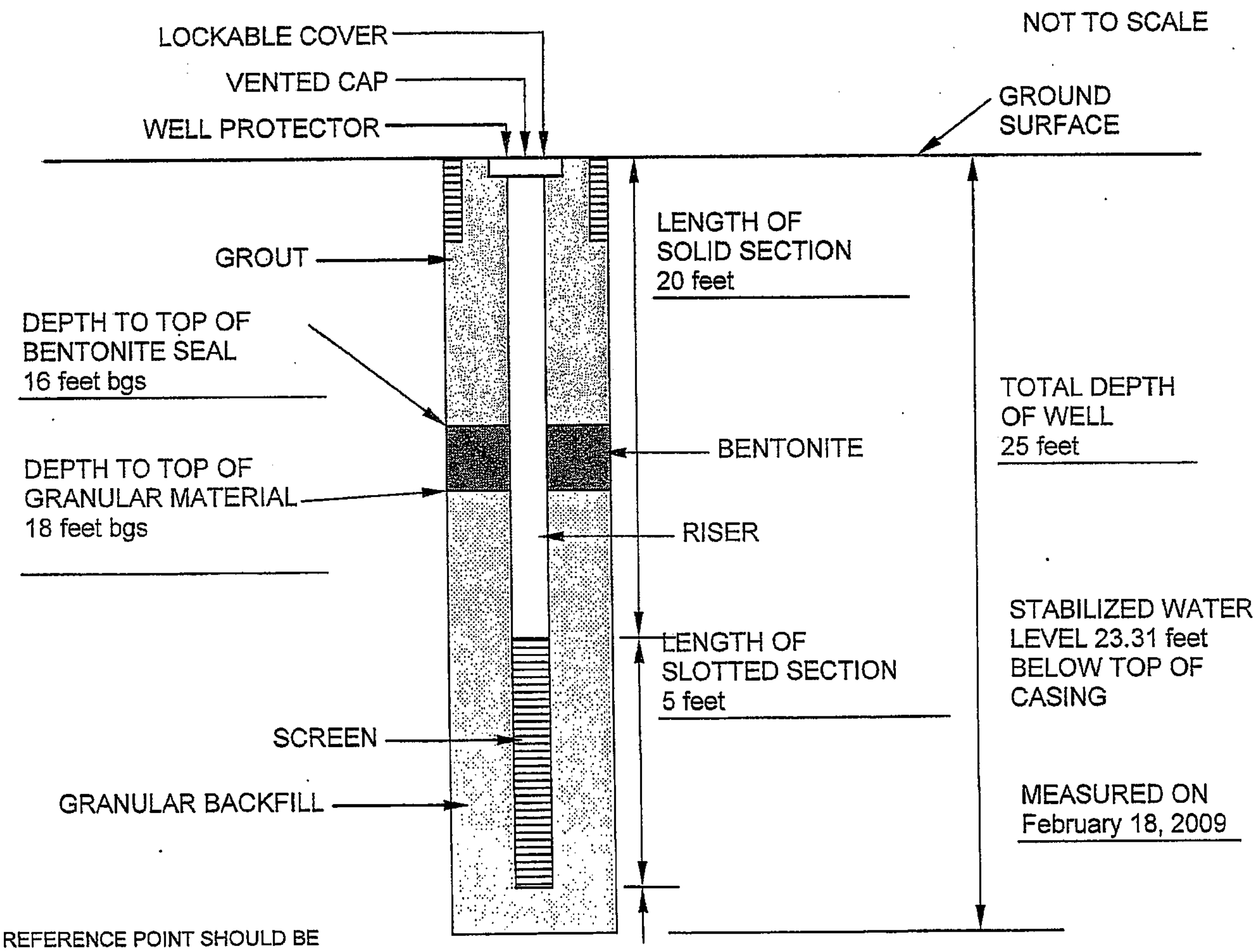
DRILLING CONTRACTOR **Carolina Drilling**

BOREHOLE DIAMETER **7 inch**

MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

KEY CODE/COMBINATION **No. 0536**



LENGTH OF SOLID SECTION 20 feet

DEPTH TO TOP OF BENTONITE SEAL 16 feet bgs

TOTAL DEPTH OF WELL 25 feet

DEPTH TO TOP OF GRANULAR MATERIAL 18 feet bgs

LENGTH OF SLOTTED SECTION 5 feet

STABILIZED WATER LEVEL 23.31 feet BELOW TOP OF CASING

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

Hand Auger Boring/ Well Log		
Job Name: Progress Energy-Sutton Plant		**Date:** February 11, 2009
Client: Progress Energy		**MACTEC Job No.** 6468-09-2340
Piezometer No. PZ- 1B	**Boring Location:** See boring location plan-toe of the dike slope	
Depth (feet)	**Blow Counts (None Taken)**	**Visual Soil Description**
0 to 0.2		Dry Light brown/gray silty fine SAND with root fibers
0.2 to 4.5		Moist to wet, light brown and gray fine to medium sand, trace (-) silt (SW)
		Bottom of auger boring at 4.5 feet
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009.

Hand Auger Boring/ Well Log		
Job Name: Progress Energy-Sutton Plant		**Date:** February 11, 2009
Client: Progress Energy		**MACTEC Job No.** 6468-09-2340
Piezometer No. PZ- 2B	**Boring Location:** See boring location plan-toe of the dike slope	
Depth (feet)	**Blow Counts (None Taken)**	**Visual Soil Description**
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan slightly silty fine SAND (SW), trace (-) clay
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009.

Prepared by: James A. Schff Reviewed by:

MACTEC

Hand Auger Boring/ Well Log

Job Name: Progress Energy-Sutton Plant
Date: February 11, 2009
Client: Progress Energy
MACTEC Job No. 6468-09-2340
Piezometer No. PZ- 3B
Boring Location: See boring location plan-toe of the dike slope

Depth (feet)	Blow Counts (None Taken)	Visual Soil Description
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan fine to medium SAND (SW), trace clay and silt
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009.

Hand Auger Boring/ Well Log

Job Name: Progress Energy-Sutton Plant
Date: February 11, 2009
Client: Progress Energy
MACTEC Job No. 6468-09-2340
Piezometer No. PZ- 4B
Boring Location: See boring location plan-toe of the dike slope

Depth (feet)	Blow Counts (None Taken)	Visual Soil Description
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan slightly fine to medium SAND (SW), trace clay and silt
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Groundwater noted at 3.6 feet below top of casing on February 18, 2009.

Hand Auger Boring /Well Log

Prepared by: James A Schiff Reviewed by:

MACTEC

Job Name: Progress Energy-Sutton Plant | **Date:** February 11, 2009

Client: Progress Energy | **MACTEC Job No.** 6468-09-2340

Piezometer No. PZ- 5B | **Boring Location:** See boring location plan-toe of the dike slope

Depth (feet)	Blow Counts (None Taken)	Visual Soil Description
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan fine to medium SAND (SW) with trace clay and silt
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009

Hand Auger Boring/ Well Log

Job Name: Progress Energy-Sutton Plant | **Date:** February 11, 2009

Client: Progress Energy | **MACTEC Job No.** 6468-09-2340

Piezometer No. PZ-6B | **Boring Location:** See boring location plan-toe of the dike slope

Depth (feet)	Blow Counts (None Taken)	Visual Soil Description
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan fine to medium SAND (SW), with trace clay and silt
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009

Prepared by: James A. Schiff Reviewed by:

MACTEC

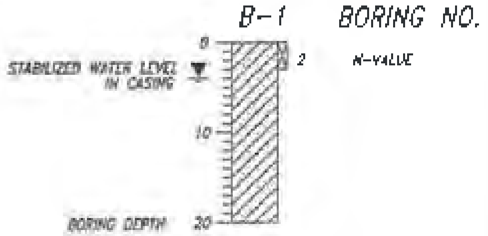
Attachment 1.3

MACTEC 2011 Boring Logs

P:\6468\Progress Energy\Progress Energy Projects 2010\Sutton\646810274 Sutton EAP Inundation and Stability\Drawings\Boring Location Plan.dwg Thu, 03 Mar 2011 - 4:01pm mahle

MATERIAL LAYERING CODES

- ▩ Fill
- ▨ Low Plasticity Inorganic Clays (CL)
- ▨ High Plasticity Inorganic Clays (CH)
- ▥ Low Plasticity Inorganic Silts (ML)
- ▥ High Plasticity Inorganic Silts (MH)
- ☐ Peat/Organic Muck
- ☐ Topsoil
- ☐ Poorly Graded Sand (SP)
- ▒ Well Graded Sand (SW)
- ▥ Silty Sand (SM)
- ▨ Clayey Sand (SC)
- ▨ Moderate to high Plasticity Clay (CL-CH)
- ▨ Poorly Graded Sand with Clay (SP-SC)
- ▥ Poorly Graded Sand with Silt (SP-SM)
- ▨ Silty Clayey Sand (SC-SM)
- ☐ Low Plasticity Organic Soils (OL)
- ▒ High Plasticity Organic Soils (OH)
- ■ Pavement section



MACTEC
MACTEC ENGINEERING AND CONSULTING, INC
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA

LEGEND FOR SECTIONS
PROGRESS ENERGY
L.V. SUTTON STEAM ELECTRIC PLANT - ASH POND
WILMINGTON, NORTH CAROLINA

DRAWN:	R.R.	DATE:	MARCH 2011
ENG CHECK:	JJT	SCALE:	
APPROVAL:		JOB No:	6468-10-0274

FIGURE
3

REFERENCE:

Oct 30 2019

OFFICIAL COPY

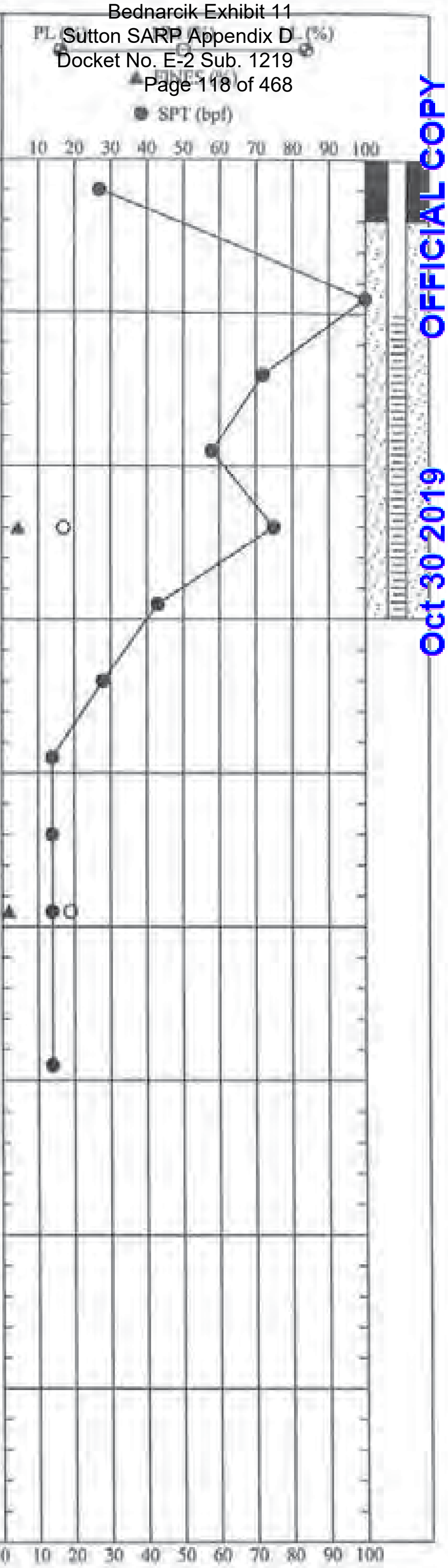
SOIL CLASSIFICATION AND REMARKS

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)
0	Dike Fill: Gray sandy GRAVEL, moist	26.0
	Dike Fill: Medium dense, gray, silty fine to medium SAND (SM), moist	
	Dike Fill: Very dense, brown, tan, slightly silty fine to medium SAND (SP-SM) with trace of rock fragments, moist	
5		21.0
	Dike Fill: Very Dense to medium dense, tan, slightly silty fine to medium SAND (SP), wet	
10		16.0
15		11.0
	Coastal Plain Deposits: Medium Dense, tan to light gray, fine to medium SAND (SP) with trace of silt, saturated	
20		6.0
25		1.0
30	Boring terminated at 30 feet.	-4.0
35		-9.0
40		-14.0
45		-19.0

SAMPLES

IDENT	TYPE	N-COUNT or Rec%/RQD% (1st 6" 2nd 6" 3rd 6" 4th 6")
SS-1	☒	10-13-14
SS-2	☒	7-19-50/0.4
SS-3	☒	22-32-40
SS-4	☒	16-26-32
SS-5	☒	18-27-48
SS-6	☒	18-18-25
SS-7	☒	12-14-14
SS-8	☒	4-6-8
SS-9	☒	3-6-8
SS-10	☒	5-6-8
SS-11	☒	7-7-7



DRILLER: D. White
EQUIPMENT: CME-45 LC
METHOD: Mud Rotary
HOLE DIA.: 3"
REMARKS: Groundwater level upon completion of boring not measured since drilling slurry was used. A casing was installed in the borehole. A Groundwater level of 13.2 feet was measured in the casing on 2/11/2011.

REVIEWED BY: JSJ / RSA

SOIL TEST BORING RECORD

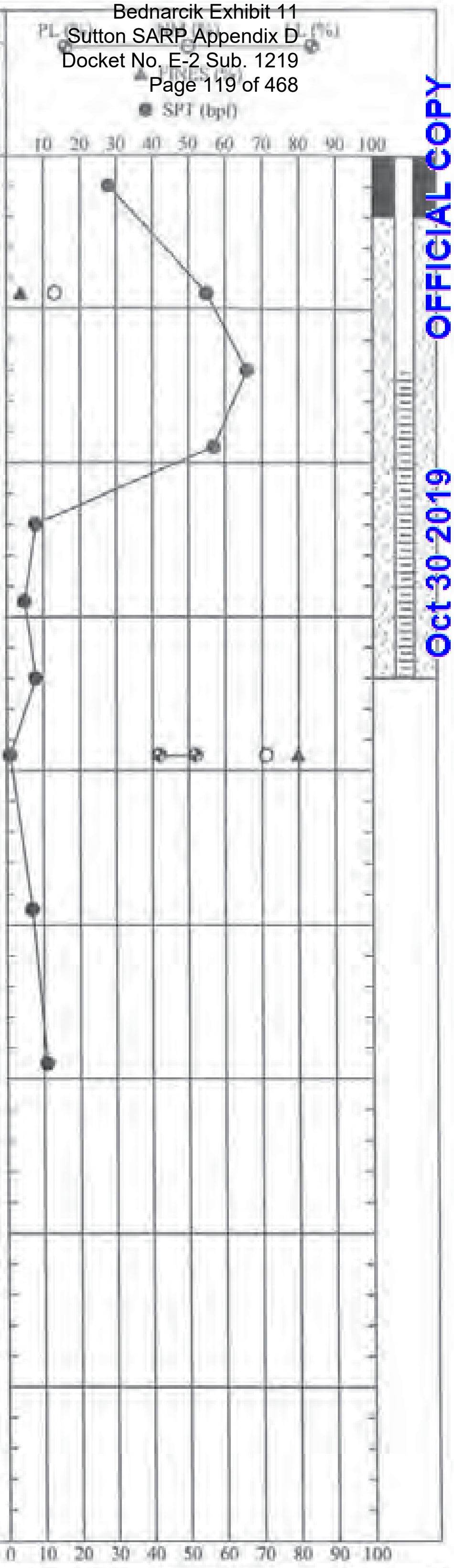
Project: Sutton Plant Ash Pond Dike Stability
Boring No.: B-1
Location: Wilmington, North Carolina
Drilled: December 16, 2010
Project #: 6468-10-0274
Page 1 **of** 1

MACTEC

SOIL CLASSIFICATION AND REMARKS

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT or Rec%/RQD% (1st 6" 2nd 6" 3rd 6" 4th 6")
0	Dike Fill: Gray, sandy GRAVEL, moist	26.0			
	Dike Fill: Medium Dense, gray, silty fine to medium SAND (SM), wet		SS-1	☒	24-16-12
	Dike Fill: Very dense, Light brown, fine to medium SAND (SP), with trace of silt, wet		SS-2	☒	14-29-26
5		21.0	SS-3	☒	21-26-40
			SS-4	☒	15-25-32
10	Dike Fill: Loose, gray, silty fine SAND (SM), saturated	16.0	SS-5	☒	4-4-4
	Dike Fill: Loose, brown, slightly silty fine to medium SAND (SP-SM), saturated		SS-6	☒	2-2-3
15		11.0	SS-7	☒	3-4-4
	Possible Ash: Very soft to medium stiff, gray, fine sandy SILT (MH), wet		SS-8	☒	1-0-1
20		6.0			
25		1.0	SS-9	☒	2-4-3
	Coastal Plain Deposits: Medium dense, brown-gray, silty fine to coarse SAND (SM), saturated		SS-10	☒	9-6-5
30	Boring terminated at 30 feet.	-4.0			
35		-9.0			
40		-14.0			
45		-19.0			



STD-NO STATION SUTTON.GPJ MACTEC GEO.GDT 3/4/11

DRILLER: D. White
EQUIPMENT: CME-45 LC
METHOD: Mud Rotary
HOLE DIA.: 4"
REMARKS: Groundwater level upon completion of boring not measured since drilling slurry was used. A casing was installed in the borehole. A Groundwater level of 14.1 feet was measured in the casing on 2/11/2011.

REVIEWED BY: JSJ / RSA

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Sutton Plant Ash Pond Dike Stability
Boring No.: B-2
Location: Wilmington, North Carolina
Drilled: December 16, 2010
Project #: 6468-10-0274
Page 1 **of** 1

MACTEC

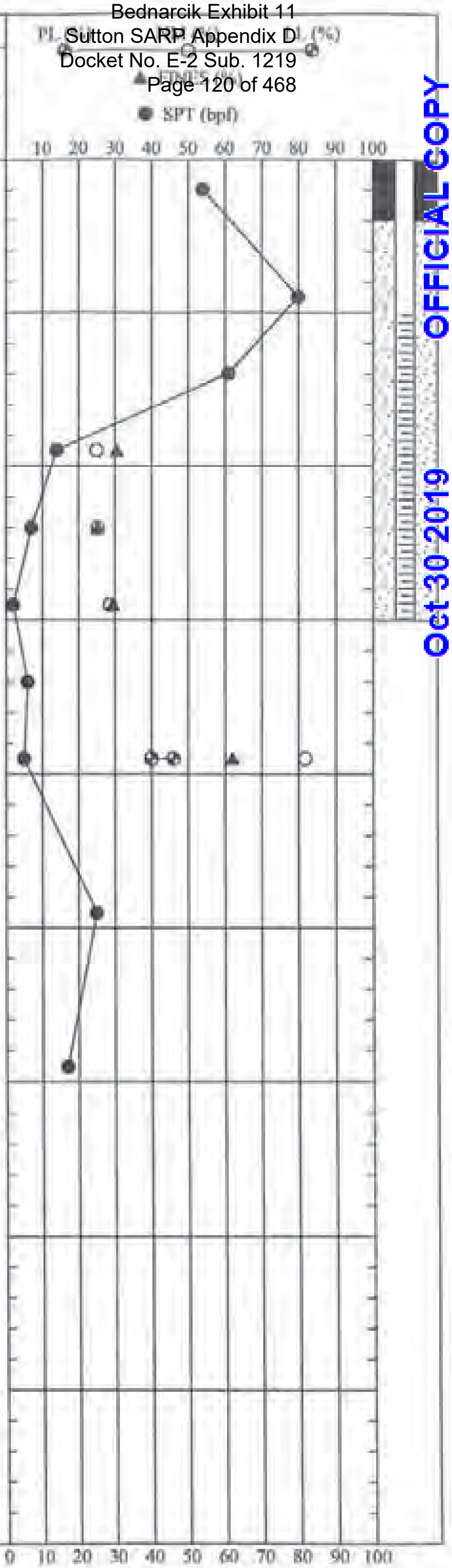
SOIL CLASSIFICATION AND REMARKS

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)
0	Dike Fill: Gray fine sandy GRAVEL.	26.0
	Dike Fill: Very dense, gray-brown, silty fine to medium SAND (SM), moist to wet	
5		21.0
	Dike Fill: Medium dense to loose, gray, slightly clayey, silty fine to medium SAND (SM), with possible ash, saturated	
10		16.0
	Dike Fill: Very loose, gray, silty fine to medium SAND (SM), with possible ash, saturated	
15		11.0
	Possible Ash: Medium stiff, dark gray, fine sandy SILT (ML), wet	
20		6.0
	Coastal Plain Deposits: Medium dense, brown to gray, slightly silty fine to coarse SAND (SP-SM), saturated	
25		1.0
30	Boring terminated at 30 feet.	-4.0
35		-9.0
40		-14.0
45		-19.0

SAMPLES

IDENT	N-COUNT or Rec%/RQD% (1st 6" 2nd 6" 3rd 6" 4th 6")
SS-1	64-19-35
SS-2	25-40-40
SS-3	27-38-23
SS-4	5-6-8
SS-5	4-4-3
SS-6	2-1-1
SS-7	2-3-3
SS-8	4-2-3
SS-9	7-10-15
SS-10	5-7-10



STD-NO STATION SUTTON.GPJ MACTEC GEO.GDT 3/4/11

DRILLER: D. White
EQUIPMENT: CME-45 LC
METHOD: Mud Rotary
HOLE DIA.: 3"
REMARKS: Groundwater level upon completion of boring not measured since drilling slurry was used. A casing was installed in the borehole. A Groundwater level of 14.5 feet was measured in the casing on 2/11/2011.

REVIEWED BY: JJT / RSA

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Sutton Plant Ash Pond Dike Stability
Boring No.: B-3
Location: Wilmington, North Carolina
Drilled: December 16, 2010
Project #: 6468-10-0274
Page 1 **of** 1

MACTEC

Hand Auger Log

Job Name: Sutton Ash Pond Stability
Date: 12/15/2010
Client: Progress Energy
MACTEC Job No. 6468-10-0274
Boring No. HA-1-1
Boring Location: On slope at B-1

Depth (feet)	Blow Counts	Visual Soil Description
0 - 4	NA	Tan Slightly Silty Fine to Coarse SAND (SP-SM), Moist
4-10	NA	Gray Slightly Silty Fine to Coarse SAND (SP-SM), Moist
		Boring dry at completion of hand auger.
		Dry on 12/16/10, 1/7/11 and 2/11/11

Hand Auger Log

Job Name: Sutton Ash Pond Stability
Date: 12/15/10
Client: Progress Energy
MACTEC Job No. 6468-10-0274
Boring No. HA-1-2
Boring Location: Near Toe of slope at B-1

Depth (feet)	Blow Counts	Visual Soil Description
0-5	NA	Tan Slightly Silty Fine to Medium SAND (SP-SM), Moist to wet
		Groundwater at 4.0 feet at hand auger completion.
		Groundwater at 3.3 feet on 12/15/10 (evening)
		Groundwater at 3.4 feet on 12/16/10
		Groundwater at 3.9 feet on 1/7/11
		Groundwater at 3.2 feet on 2/11/11

Prepared by: JJJ

Reviewed by: RSA

MACTEC

Hand Auger Log

Job Name: Sutton Ash Pond Stability
Date: 12/15/2010
Client: Progress Energy
MACTEC Job No. 6468-10-0274
Boring No. HA-2-1
Boring Location: On slope at B-2

Depth (feet)	Blow Counts	Visual Soil Description
0-4	NA	Tan Slightly Silty Fine to Coarse SAND (SP), dry to moist
4-5	NA	Tan to Brown Slightly Silty Fine to Coarse SAND (SP), moist
5-9	NA	Gray Silty Fine to Medium SAND (SM), moist to wet
		Boring dry at completion of hand auger.
		Groundwater at 7.3 feet on 12/15/10 (evening)
		Groundwater at 7.2 feet on 12/16/10
		Groundwater at 7.7 feet on 1/7/11
		Groundwater at 7.3 feet on 2/11/11

Hand Auger Log

Job Name: Sutton Ash Pond Stability
Date: 12/15/2010
Client: Progress Energy
MACTEC Job No. 6468-10-0274
Boring No. HA-2-2
Boring Location: Near Toe of Slope at B-2

Depth (feet)	Blow Counts	Visual Soil Description
0-1.5	NA	Brown-tan to Gray Silty Fine to Coarse SAND (SP-SM), moist to wet
1.5-3	NA	Gray Silty Fine SAND (SM), with trace organic matter, wet
		Groundwater at 1.5 feet at hand auger completion.
		Groundwater at 1.5 feet on 12/15/10 (evening)
		Groundwater at 1.4 feet on 12/16/10
		Groundwater at 1.8 feet on 1/7/11
		Groundwater at 1.4 feet on 2/11/11

Prepared by: TJT Reviewed by: RSA

MACTEC

Hand Auger Log

Job Name: Sutton Ash Pond Stability	**Date: 12/15/2010**
Client: Progress Energy	**MACTEC Job No. 6468-10-0274**
Boring No. HA-3-1	**Boring Location: On Slope Near B-3**

Depth (feet)	**Blow Counts**	**Visual Soil Description**
0-2	NA	Possible Ash: Gray Silty Fine SAND, (SM), moist
2-5.5	NA	Possible Ash: Gray fine Sandy SILT (ML), moist
5.5-8	NA	Gray and Tan Slightly Silty Fine to Coarse SAND (SP-SM), moist
8-10	NA	Gray Silty Fine Sand (SM), with Silt Seams, wet
		Boring dry at completion of hand auger.
		Dry on 12/16/10, 1/7/11 and 2/11/11

Hand Auger Log

Job Name: Sutton Ash Pond Stability	**Date: 12/15/2010**
Client: Progress Energy	**MACTEC Job No. 6468-10-0274**
Boring No. HA-3-2	**Boring Location: Near Toe of slope at AB-3**

Depth (feet)	**Blow Counts**	**Visual Soil Description**
0-1.5	NA	Possible Ash: Gray Fine Sandy SILT (ML), moist
1.5-5.5	NA	Gray Silty Fine to Medium Sand (SM), moist
5.5-7	NA	Gray Fine Sandy SILT (ML), wet
		Groundwater at 5.5 feet at hand auger completion
		Groundwater at 4.9 feet on 12/15/10 (evening)
		Groundwater at 4.8 feet on 12/16/10
		Groundwater at 5.4 feet on 1/7/11
		Groundwater at 4.8 feet on 2/11/11

Prepared by: JJT Reviewed by:

MACTEC

Attachment 1.4

Blasland, Bouck, & Lee Logs

Drilling Company: Geologic Exploration
Driller's Name: Mike McConahey
Drilling Method: HSA
Bit Size: NA
Auger Size: 4.25-inch I.D.
Rig Type: B-61 Mobile Rig
Sampling Method: 24-inch splitspoon

Northing: 197948.14
Easting: 2305008.16
Casing Elevation: 18.21 ft

Borehole Depth: 13 ft bls
Surface Elevation: 15.09 ft

Logged by: Daniel C.H. Peterman

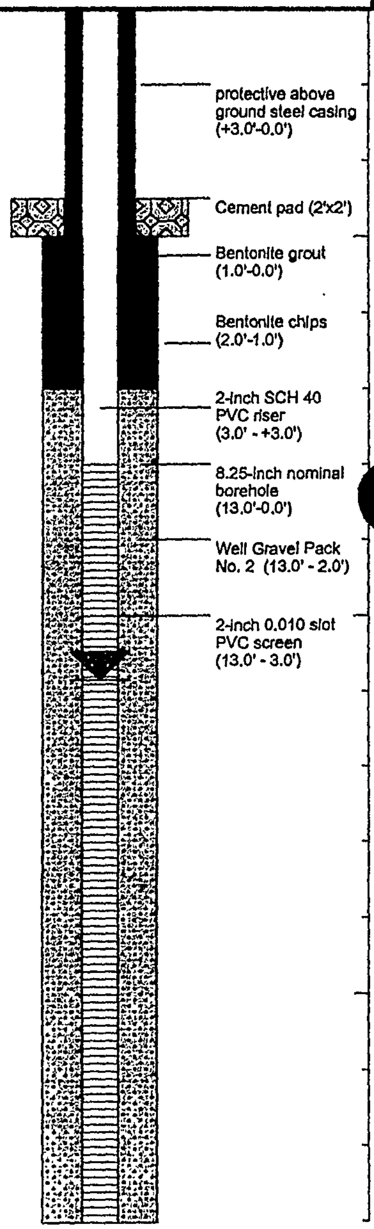
Well/Boring ID: MW-13 (FADA)

Client: Progress Energy Carolinas Inc.

Location: Progress Energy L.V. Sutton Steam
Electric Plant
Wilmington, NC

DEPTH	ELEVATION	Samp. Interval (ft bgs)	Recovery (inches)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Iron Staining	Geologic Column	Stratigraphic Description
0	15								Topsoil, trace coarse gravel, low organic content, dry to slightly damp, no odors.
						0.0			SAND and ASH, dark grey, silt to fine grained, very loose, slightly damp to damp, no odor.
						0.0			
			19	2 2 1 3	3	0.0			SAND and ASH, dark grey, silt to fine grained, very loose, slightly damp to damp, no odor.
5	10								
									clayey SAND (SC), dark grey, fine grained, low plasticity, very soft, wet, no odor.
			24	3 1 4 5	5	0.0			clayey SAND (SC), dark grey, fine grained, low plasticity, medium soft, wet, no odor.
10	5								
									SAND (SM), grey, mottled tan, fine grained, loose, wet, no odor.
			19	5 4 5 4	9	0.0			SAND (SM), dark brown, fine grained, loose, saturated, organic sulphur odor. Boring terminated at 13.0 ft bls

Well/Boring Construction



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Remarks:
HSA: Hollow Stem Auger
NA: Not Applicable
ft bls: feet below land surface
Air Monitoring Equipment: PID, V-RAE, and PDR-1000
PID: Photoionization Detector
V-RAE: Multi-Gas meter
PDR-1000: Particulate meter

Water Level Data

Date	Depth	Elev.
6/22/04	8.96	9.25

Depth measured from top of casing

OFFICIAL COPY

Oct 30 2019

Drilling Company: Parratt Wolffe
Driller's Name: Arnold Chapel
Drilling Method: Mud Rotary
Bit Size: 5.87-inch roller-bit
Auger Size:
Rig Type: B-61 Mobile Rig
Sampling Method: 24-inch splitspoon

Northing: 197965.38
Easting: 2305017.45
Casing Elevation: 18.16

Borehole Depth: 42 ft bgs
Surface Elevation: 15.53

Logged by: Brian Lovgren

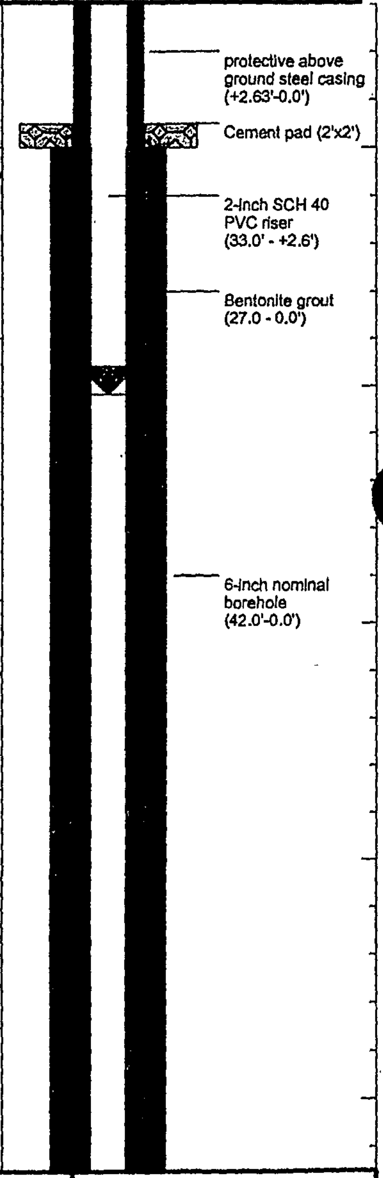
Well/Boring ID: MW-13D (FADA)

Client: Progress Energy Carolinas Inc.

Location: Progress Energy L.V. Sutton Steam
Electric Plant
Wilmington, NC

DEPTH	ELEVATION	Samp. Interval (ft bgs)	Recovery (inches)	Blows / 6 Inches	N - Value	PID (ppm)	Geologic Column	Stratigraphic Description
0	15							Topsoil, trace coarse gravel, low organic content, dry to slightly damp, no odors.
								SAND and ASH, dark grey, silt to fine grained, very loose, slightly damp to damp, no odor.
5	10		0.8'	2 2 1 3	3	0.0		SAND and ASH, dark grey, silt to fine grained, very loose, slightly damp to damp, no odor.
								clayey SAND (SC), dark grey, fine grained, low plasticity, very soft, wet, no odor.
10	5		2.0'	3 1 4 5	5	0.0		clayey SAND (SC), dark grey, fine grained, low plasticity, medium soft, wet, no odor.
			0.8'	5 4 5 4	9	0.0		SAND (SM), grey, mottled tan, fine grained, loose, wet, no odor.
								SAND (SM), dark brown, fine grained, loose, saturated, organic sulphur odor.
15	0		1.0'	2 3 3 7	6	0.0		SAND (SM), brown to dark brown, fine to medium grained, loose, wet, no odor.
20	-5		1.0'	6 7 7 9	14	0.0		SAND (SM), tan, fine to medium grained, medium dense, wet, no odor.

Well/Boring Construction



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Remarks:
NA: Not Applicable
ft bgs: feet below ground surface
PID: Photoionization Detector

Water Level Data

Date	Depth	Elev.
2/4/05	7.81	10.35

Depth measured from top of casing*

Page: 1 of 2

Project: 04015
Data File:MW-13D

Template:boring_wellWL2005.ldf
Date: 3/16/05

Client:
Progress Energy Carolinas Inc.

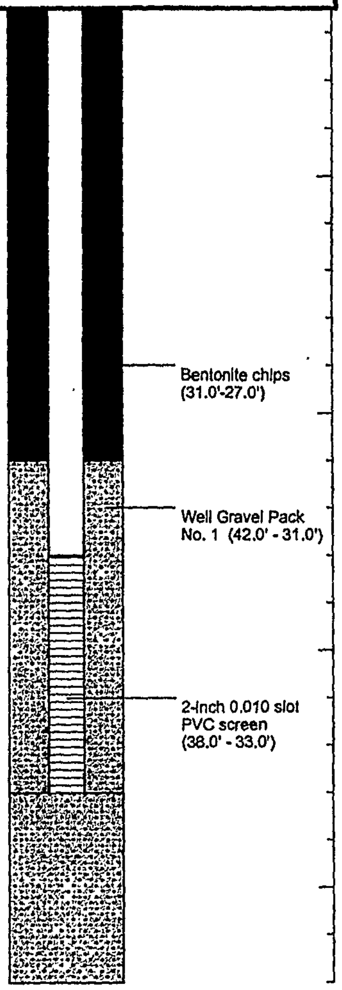
Site Location:
Progress Energy
L.V. Sutton Steam
Electric Plant

Well/Boring ID: MW-13D (FADA)

Borehole Depth: 42 ft bgs

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Iron Staining	Geologic Column	Stratigraphic Description
				1.0'	4 11 20 20	31	0.0			SAND (SM), tan, fine to medium grained, dense, wet, no odor.
25	-10									
				1.0'	8 10 12 13	22	0.0			SAND (SM), tan, fine to medium grained, medium dense, wet, no odor.
30	-15									
				1.0'	9 6 4 6	10	0.0			SAND (SM), tan to light gray, fine to medium grained, medium dense, wet, no odor.
35	-20									
				2.0'	3 2 4 4	6	0.0			clayey SAND (SC), brown, mottled orange, low plasticity, medium dense, wet, no odor.
										clayey SAND (SC), gray, low plasticity, medium dense, wet, no odor.
40	-25									
										CLAY (CL) observed on roller bit upon completion of drilling activities.

Well/Boring Construction



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Remarks:
NA: Not Applicable
ft bgs: feet below ground surface
PID: Photoionization Detector

Water Level Data

Date	Depth	Elev.
2/4/05	7.81	10.35

Depth measured from top of casing*

Project: 04015
Data File:MW-13D

Template:boring_wellWL2005.ldf
Date: 3/16/05

Drilling Company: Geologic Exploration
Driller's Name: Mike McConahey
Drilling Method: HSA
Bit Size: NA
Auger Size: 4.25-inch I.D.
Rig Type: B-61 Mobile Rig
Sampling Method: 24-inch splitspoon

Northing: 19725217
Easting: 230617843
Casing Elevation: 14.15 ft

Borehole Depth: 11.0 ft bls
Surface Elevation: 10.96 ft

Logged by: Daniel C.H. Peterman

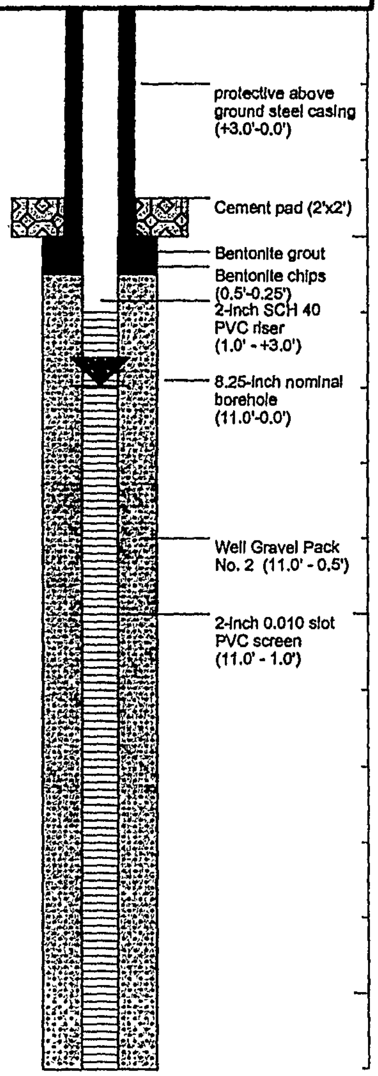
Well/Boring ID: MW-14 (PADA)

Client: Progress Energy Carolinas Inc.

Location: Progress Energy L.V. Sutton Steam
Electric Plant
Wilmington, NC

DEPTH	ELEVATION	Samp. Interval (ft bgs)	Recovery (inches)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Iron Staining	Geologic Column	Stratigraphic Description
0									Topsoil, high organic content, damp, no odor.
	10					0.0			SAND (SM), gray, mottled white, fine grained, loose, damp, no odor.
						0.0			SAND (SM), gray, mottled white, fine grained, loose, wet, no odor.
5	5		21	4 5 4 4	9	0.0			SAND (SM), light gray, mottled white, fine to medium grained, loose, wet, no odor.
									SAND (SM), light gray, mottled white, fine to medium grained, loose, wet, no odor.
10	0		24	5 4 6 4	10	0.0			SAND (SM), dark brown, fine to medium grained, medium dense, saturated, no odor. Boring terminated at 11.0 ft bls

Well/Boring Construction



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Remarks:
HSA: Hollow Stem Auger
NA: Not Applicable
ft bls: feet below land surface
Air Monitoring Equipment: PID, V-RAE, and PDR-1000
PID: Photoionization Detector
V-RAE: Multi-Gas meter
PDR-1000: Particulate meter

Water Level Data

Date	Depth	Elev.
6/22/04	5.16 ft	8.99

Depth measured from top of casing

Project: 04010
Data File:MW-14

Template:boring_wellWL2003.ldf
Date: 06/01/04

Page: 1 of 1

Date Start/Finish: 5/25/04
Drilling Company: Geologic Exploration
Driller's Name: Mike McConahey
Drilling Method: HSA
Bit Size: NA
Auger Size: 4.25 I.D.
Rig Type: B-61 Mobile Rig
Sampling Method: 24-inch splitspoon

Northing: 19647565
Easting: 230604401
Casing Elevation: 11.47 ft

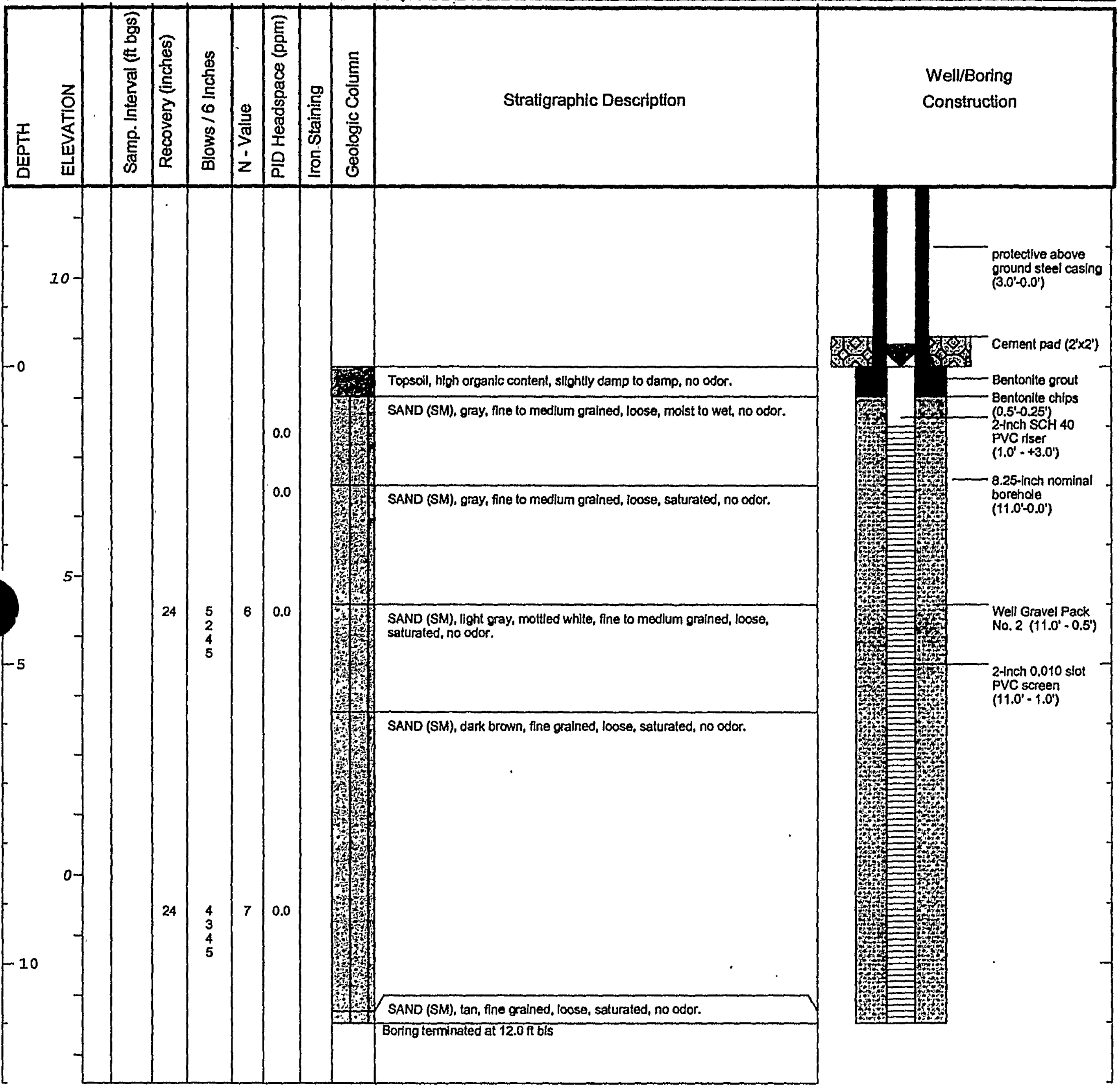
Borehole Depth: 11.0 ft bls
Surface Elevation: 8.53 ft

Logged by: Daniel C.H. Peterman

Well/Boring ID: MW-15 (FADA)

Client: Progress Energy Carolinas Inc.

Location: Progress Energy L.V. Sutton Steam
Electric Plant
Wilmington, NC



Recovery (inches)	Blows / 6 Inches	N - Value	PID Headspace (ppm)
			0.0
			0.0
24	5 2 4 5	6	0.0
24	4 3 4 5	7	0.0

Topsoil, high organic content, slightly damp to damp, no odor.

SAND (SM), gray, fine to medium grained, loose, moist to wet, no odor.

SAND (SM), gray, fine to medium grained, loose, saturated, no odor.

SAND (SM), light gray, mottled white, fine to medium grained, loose, saturated, no odor.

SAND (SM), dark brown, fine grained, loose, saturated, no odor.

SAND (SM), tan, fine grained, loose, saturated, no odor.

Boring terminated at 12.0 ft bls

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Remarks:
HSA: Hollow Stem Auger
NA: Not Applicable
ft bls: feet below land surface
Air Monitoring Equipment: PID, V-RAE, and PDR-1000
PID: Photoionization Detector
V-RAE: Multi-Gas meter
PDR-1000: Particulate meter

Water Level Data

Date	Depth	Elev.
6/22/04	2.94	8.53

Depth measured from top of casing

Project: 04010
Data File:MW-15

Template:boring_wellWL2003.ldf
Date: 06/01/04

Page: 1 of 1

Drilling Company: Parratt Wolffe
Driller's Name: Arnold Chapel
Drilling Method: Mud Rotary
Bit Size: 5.87-inch roller-bit
Auger Size:
Rig Type: B-61 Mobile Rig
Sampling Method: 24-inch splitspoon

Northing: 196476.98
Easting: 2306061.06
Casing Elevation: 11.21

Borehole Depth: 48 ft bgs
Surface Elevation: 8.61

Logged by: Brian Lovgren

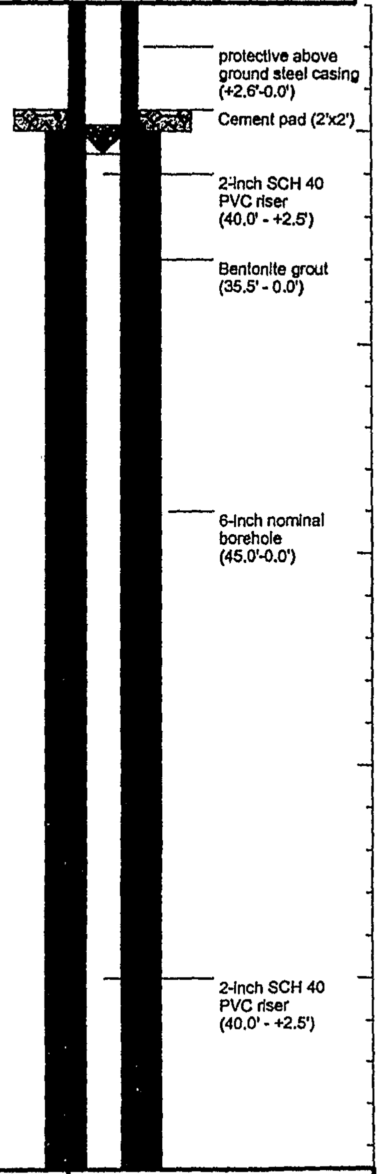
Well/Boring ID: MW-15D (FADA)

Client: Progress Energy Carolinas Inc.

Location: Progress Energy L.V. Sutton Steam
Electric Plant
Wilmington, NC

DEPTH	ELEVATION	Samp. Interval (ft bgs)	Recovery (inches)	Blows / 6 Inches	N - Value	PID (ppm)	Geologic Column	Stratigraphic Description
	10							
0								Topsoil, high organic content, slightly damp to damp, no odor.
								SAND (SM), gray, fine to medium grained, loose, moist to wet, no odor.
	5							SAND (SM), gray, fine to medium grained, loose, wet, no odor.
5			2.0'	5 2 4 5	6	0.0		SAND (SM), light gray, mottled white, fine to medium grained, loose, wet, no odor.
10	0		2.0'	4 3 4 5	7	0.0		SAND (SM), dark brown, fine grained, loose, wet, no odor.
								SAND (SM), tan, fine grained, loose, wet, no odor.
15	-5		1.0'	2 1 1 2	2	0.0		SAND (SM), tan, fine to medium grained, very loose, wet, no odor.
20	-10		1.2'	9 12 13 13	25	0.0		SAND (SM), tan, fine to medium grained, medium dense, wet, no odor.
	-15		0.8'	4 3 3 3	6	0.0		SAND (SM), tan, fine to coarse grained, loose, wet, no odor.

Well/Boring Construction



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Remarks:
NA: Not Applicable
ft bgs: feet below ground surface
PID: Photoionization Detector
NR: No Recovery

Water Level Data

Date	Depth	Elev.
2/4/05	3.13	8.08

Depth measured from top of casing*

Project: 04015
Data File:MW-15D

Template:boring_wellWL2005.ldf
Date: 3/16/05

Client:
Progress Energy Carolinas Inc.

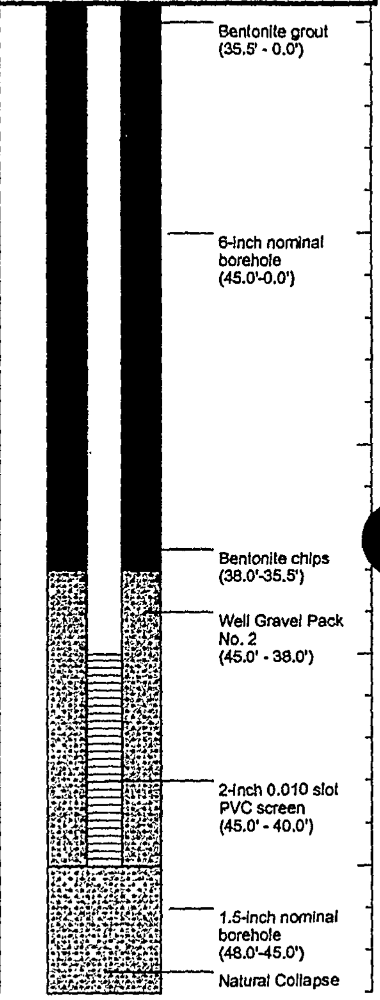
Site Location:
Progress Energy
L.V. Sutton Steam
Electric Plant

Well/Boring ID: MW-15D (FADA)

Borehole Depth: 48 ft bgs

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Iron Staining	Geologic Column	Stratigraphic Description
25										
	-20			0.8'	3 3 3 4	6	0.0			
30										
	-25			1.0'	5 8 11 13	19	0.0			SAND (SM), tan, fine to coarse grained, medium dense, wet, no odor.
35										
	-30			1.0'	10 11 14 15	15	0.0			SAND (SM). brown, mottled orange, fine to coarse grained, medium dense, wet, no odor.
40										SAND (SM). brown, fine to coarse grained, medium dense, wet, no odor.
	-35			1.2'	3 2 4 3	6	0.0			SAND (SM). brown, mottled orange, fine to coarse grained, loose, wet, no odor.
45										SAND (SM). dark gray, silt to fine fine grained, very dense, wet, no odor.
				1.2'	24 45 34 NR	79	0.0			

Well/Boring Construction



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Remarks:
NA: Not Applicable
ft bgs: feet below ground surface
PID: Photoionization Detector
NR: No Recovery

Water Level Data

Date	Depth	Elev.
2/4/05	3.13	8.08

Depth measured from top of casing*

Project: 04015
Data File:MW-15D

Template:boring_wellWL2005.ldf
Date: 3/16/05

Drilling Company: SAEDACCO
Driller's Name: Rich Lemire
Drilling Method: HSA
Bit Size: NA
Auger Size: 4.25-inch I.D.
Rig Type: B-61 Mobile Rig
Sampling Method: 24-inch splitspoon

Northing: 19697593
Easting: 230675316
Casing Elevation: 16.91 ft

Borehole Depth: 12.0 ft bls
Surface Elevation: 14.11 ft

Logged by: Daniel C.H. Peterman

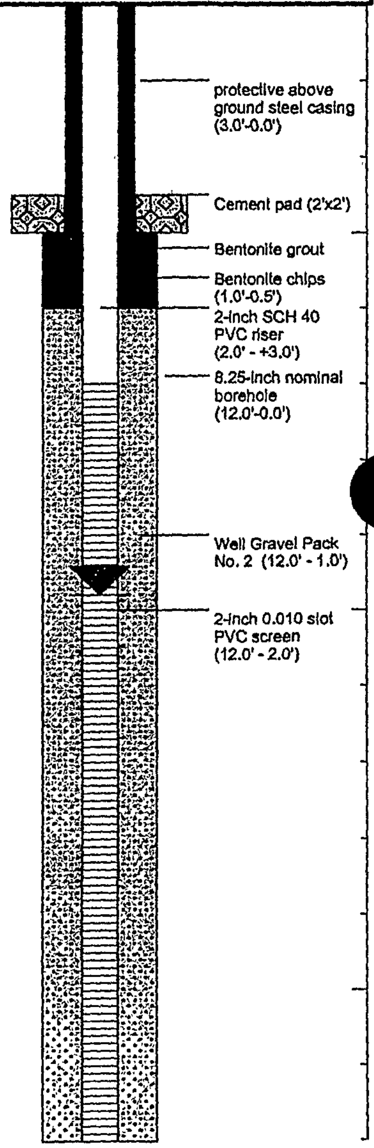
Well/Boring ID: MW-16 (FADA)

Client: Progress Energy Carolinas Inc.

Location: Progress Energy L.V. Sutton Steam
Electric Plant
Wilmington, NC

DEPTH	ELEVATION	Samp. Interval (ft bgs)	Recovery (inches)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Iron Staining	Geologic Column	Stratigraphic Description
	15								
0									SAND (SM), brown, fine grained, very loose, trace organics, dry, no odor.
						2.9			
						0.0			SAND (SM), white, mottled tan, fine, very loose, dry, no odor.
	10		24	1 2 2 1	4	0.0			SAND (SM), white, mottled tan, fine, very loose, wet to saturated, no odor.
5									
			24	1 6 6 7	12	0.0			SAND (SM), light gray, mottled white, fine to medium grained, medium dense, saturated, no odor.
	5								
10									
									Boring terminated at 12.0 ft bls

Well/Boring Construction



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Remarks:
HSA: Hollow Stem Auger
NA: Not Applicable
ft bls: feet below land surface
Air Monitoring Equipment: PID, V-RAE, and PDR-1000
PID: Photoionization Detector
V-RAE: Multi-Gas meter
PDR-1000: Particulate meter

Water Level Data

Date	Depth	Elev.
06/22/04	7.60	9.31 ft

Depth measured from top of casing

Page: 1 of 1

Project: 04010
Data File:MW-16

Template:boring_wellWL2003.ldf
Date: 06/30/04

Date Start/Finish: 1/26/05
Drilling Company: Parratt Wolffe
Driller's Name: Arnold Chapel
Drilling Method: Mud Rotary
Bit Size: 5.87-inch roller-bit
Auger Size:
Rig Type: B-61 Mobile Rig
Sampling Method: 24-inch splitspoon

Northing: 196962.70
Easting: 2306758.11
Casing Elevation: 16.43

Borehole Depth: 47 ft bgs
Surface Elevation: 14.00

Logged by: Brian Lovgren

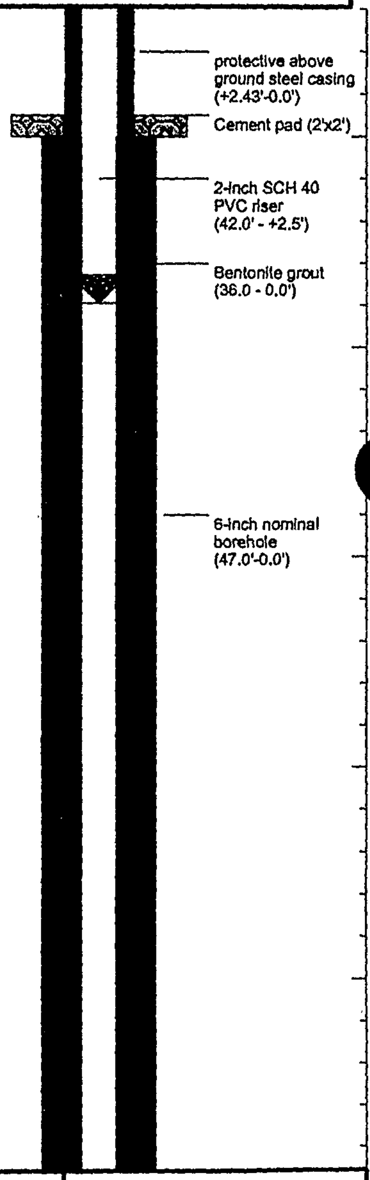
Well/Boring ID: MW-16D (FADA)

Client: Progress Energy Carolinas Inc.

Location: Progress Energy L.V. Sutton Stea
Electric Plant
Wilmington, NC

DEPTH	ELEVATION	Samp. Interval (ft bgs)	Recovery (inches)	Blows / 6 Inches	N - Value	PID (ppm)	Geologic Column	Stratigraphic Description
	15							
0								SAND (SM), brown, fine grained, very loose, trace organics, dry, no odor.
						2.9		
						0.0		SAND (SM), white, mottled tan, fine, very loose, dry, no odor.
	10		2.0'	1 2 2 1	4	0.0		SAND (SM), white, mottled tan, fine, very loose, wet , no odor.
5								
			2.0'	1 6 6 7	12	0.0		SAND (SM), light gray, mottled white, fine to medium grained, medium dense, wet, no odor.
	5							
10								
			1.0'	4 10 16 13	26	0.0		
	0							
15								
			1.0'	5 5 4 4	9	0.0		SAND (SM), tan, fine, loose, wet, no odor.
	-5							
20								
			1.2'	5 5 4	9	0.0		SAND (SM), tan, fine to coarse grained, loose, wet, no odor.
	-10							

Well/Boring Construction



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Remarks:
NA: Not Applicable
ft bgs: feet below ground surface
PID: Photoionization Detector

Water Level Data

Date	Depth	Elev.
2/4/05	6.38	10.05

Depth measured from top of casing*

Project: 04015
Data File:MW-16D

Template:boring_wellWL2005.ldf
Date: 3/15/05

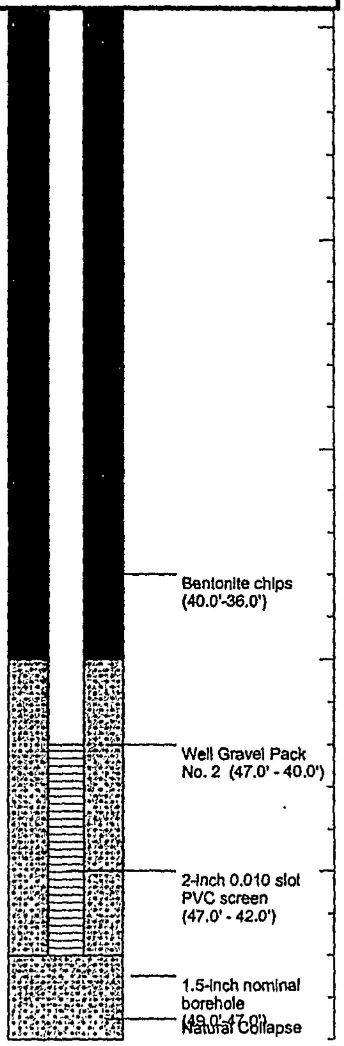
Client:
Progress Energy Carolinas Inc.

Site Location:
Progress Energy
L.V. Sutton Steam
Electric Plant

Well/Boring ID: MW-16D (FADA)

Borehole Depth: 47 ft bgs

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Iron Staining	Geologic Column	Stratigraphic Description	Well/Boring Construction
25					8						
	-15			1.0'	2 1 2 2	3	0.0				
30											
	-20			1.0'	2 2 3 2	5	0.0				
35											
	-25			1.0'	1 2 3 3	5	0.0			SAND (SM), tan, mottled orange, fine to coarse grained, loose, wet, no odor.	
40											
	-30			1.0'	9 11 8 6	19	0.0				
45											
				1.5'	10 19 16 24	35	0.0			SAND (SM), gray, fine, dense, wet, no odor. Boring terminated at 49.0 ft bls	
	-35										



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Remarks:
NA: Not Applicable
ft bgs: feet below ground surface
PID: Photoionization Detector

Water Level Data

Date	Depth	Elev.
2/4/05	6.38	10.05

Depth measured from top of casing*

Project: 04015
Data File:MW-16D

Template:boring_wellWL2005.ldf
Date: 3/15/05

ate Start/Finish: 2/2/05
Drilling Company: Parratt Wolffe
Driller's Name: Arnold Chapel
Drilling Method: HSA
Bit Size: NA
Auger Size: 3.25-inch (ID)
Rig Type: B-61 Mobile Rig
ampling Method:

Northing: 196257.98
Easting: 2305318.10
Casing Elevation: 13.70

Borehole Depth: 14 ft bgs
Surface Elevation: 10.78

Logged by: Brian Lovgren

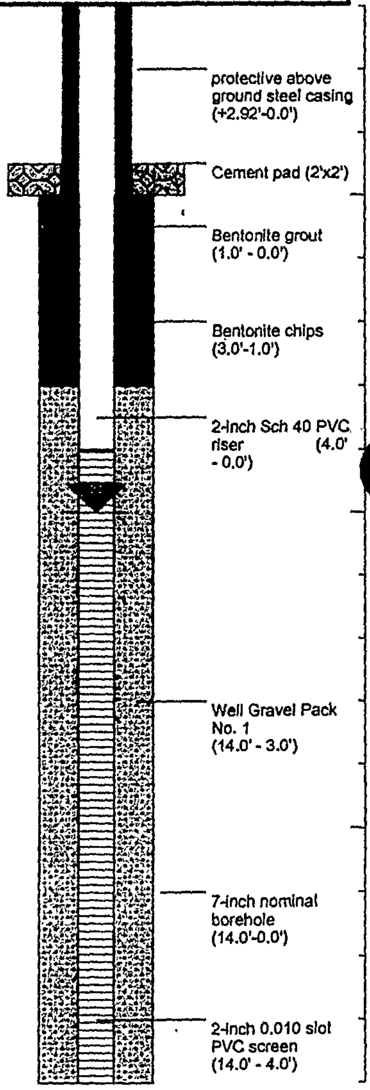
Well/Boring ID: MW-20 (FADA)

Client: Progress Energy Carolinas Inc.

Location: Progress Energy L.V. Sutton Steam
Electric Plant
Wilmington, NC

DEPTH	ELEVATION		Samp. Interval (ft bgs)	Recovery (inches)	Blows / 6 Inches	N - Value	PID (ppm)		Geologic Column	Stratigraphic Description
0										SAND (SM), black, fine to medium grained, loose, damp, no odor.
	10									
5				1.0'	3 2 3 2	5	0.0			
	5									
										SAND (SM), brown, mottled orange, fine to medium grained, loose, wet, no odor.
10				1.0'	5 5 5 7	10	0.0			SAND (SM), brown to light gray, fine to medium grained, loose to medium dense, wet, no odor.
	0									

Well/Boring Construction



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Remarks:
HSA: Hollow-Stem Auger
NA: Not Applicable
ft bgs: feet below ground surface
PID: Photoionization Detector

Water Level Data

Date	Depth	Elev.
2/4/05	7.92	5.78

Depth measured from top of casing*

Page: 1 of 1

Project: 04015
Data File:MW-20

Template:boring_wellWL2005.ldf
Date: 3/16/05

Drilling Company: Parratt Wolffe
Driller's Name: Arnold Chapel
Drilling Method: Mud Rotary
Bit Size: 5.87-inch roller-bit
Auger Size:
Rig Type: B-61 Mobile Rig
Sampling Method: 24-inch splitspoon

Northing: 196256.89
Easting: 2305326.09
Casing Elevation: 13.66

Borehole Depth: 52 ft bgs
Surface Elevation: 10.73

Logged by: Brian Lovgren

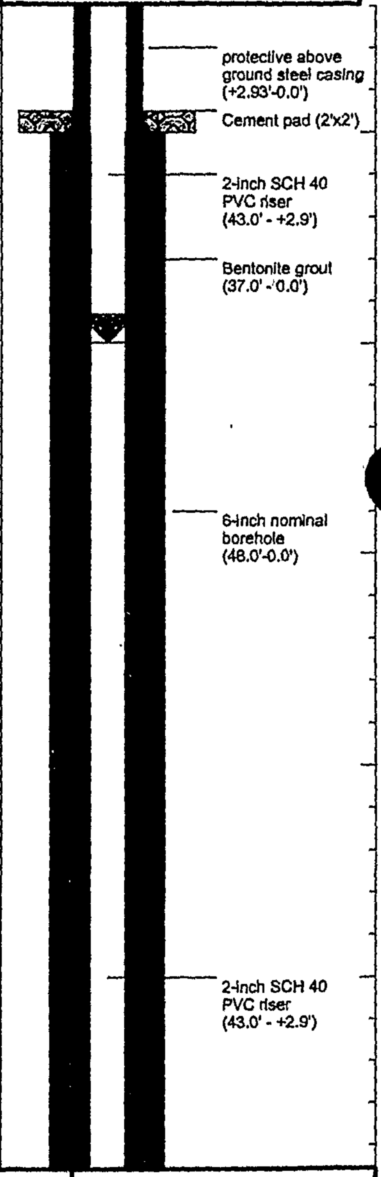
Well/Boring ID: MW-20D (FADA)

Client: Progress Energy Carolinas Inc.

Location: Progress Energy L.V. Sutton Steam Electric Plant
Wilmington, NC

DEPTH	ELEVATION		Samp. Interval (ft bgs)	Recovery (inches)	Blows / 6 inches	N - Value	PID (ppm)		Geologic Column	Stratigraphic Description
0	10									SAND (SM), black, fine to medium grained, loose, damp, no odor.
5	5			1.0'	3 2 3 2	5	0.0			
										SAND (SM), brown, mottled orange, fine to medium grained, loose, wet, no odor.
10	0			1.0'	5 5 5 7	10	0.0			SAND (SM), brown to light gray, fine to medium grained, loose to medium dense, wet, no odor.
15	-5			1.0'	6 7 8 6	15	0.0			SAND (SM), brown to tan, fine to medium grained, medium dense, wet, no odor.
20	-10			1.5'	13 17 17 18	34	0.0			SAND (SM), tan, fine to medium grained, dense, wet, no odor.

Well/Boring Construction



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Remarks:
NA: Not Applicable
ft bgs: feet below ground surface
PID: Photoionization Detector
NR: No Recovery

Water Level Data

Date	Depth	Elev.
2/4/05	7.90	5.76

Depth measured from top of casing*

Project: 04015
Data File:MW-20D

Template:boring_wellWL2005.ldf
Date: 3/16/05

Client:
Progress Energy Carolinas Inc.

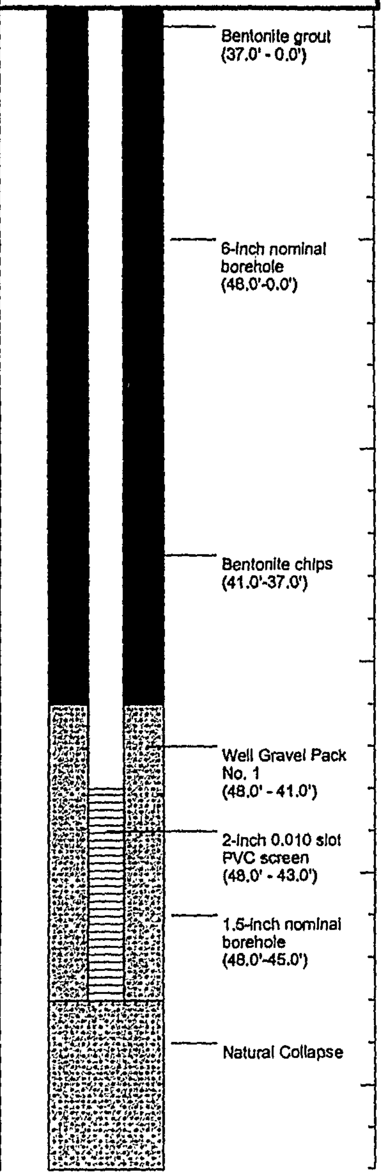
Site Location:
Progress Energy
L.V. Sutton Steam
Electric Plant

Well/Boring ID: MW-20D (FADA)

Borehole Depth: 52 ft bgs

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Iron Staining	Geologic Column	Stratigraphic Description
25	-15			1.5'	4 10 8 13	18	0.0			SAND (SM), tan, fine to medium grained, medium dense, wet, no odor.
30	-20			1.0'	3 3 3 4	6	0.0			SAND (SM), tan, fine to medium grained, loose, wet, no odor.
35	-25			1.0'	1 1 1 1	2	0.0			SAND (SM), dark brown, fine to medium grained, very loose, wet, no odor.
40	-30			1.0'	1 1 1 1	2	0.0			
45	-35			0.8'	4 7 7 8	14	0.0			SAND (SM), dark brown, fine to medium grained, medium dense, wet, no odor.
50	-40			1.5'	14 26 24 19	50	0.0			SAND (SM), green to dark gray, silt to fine grained, very dense, wet, no odor. Boring terminated at 52.0 ft bls

Well/Boring Construction



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Remarks:
NA: Not Applicable
ft bgs: feet below ground surface
PID: Photoionization Detector
NR: No Recovery

Water Level Data

Date	Depth	Elev.
2/4/05	7.90	5.76

Depth measured from top of casing*

Attachment 1.5

Geosyntec 2014 May through July Boring Logs & As-Built Piezometer Construction Details

Legend for Soil Classification Symbols

Pattern	Description
▒	SP – poorly graded sands
▩	SW – well graded sands
░	GP – poorly graded gravels
▚	GW – well graded gravels
▦	SM – silty sands
▒	SP-SM – poorly graded sand with silty sand
▩	SP-SC – poorly graded sand with clayey sand
▥	MH – elastic silts
▥	ML – inorganic silts with slight plasticity
▩	SC – clayey sands
▨	CL – lean clays
▨	CH – fat clays
≈	OH – organic clays
░	Ash
☰	Well Screen
▤	Bentonite
▩	Granular Backfill
□	PVC Riser

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BORING LOG

BOREHOLE ID: *GP-01 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant

PROJECT NO: *GC5592*

SITE LOCATION: *Wilmington, North Carolina*

BORING DATE: *05/16/2014*

GEOSYNTEC REPRESENTATIVE: *Weston Shin*

DRILLING CONTRACTOR: *Mid-Atlantic Drilling*

DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*

RIG TYPE: *5400 Track Rig (Serial # CFA00199)*

BOREHOLE DIA: *2.25"*

SAMPLING METHOD: *Dual-Tube*

NORTHING: *198282.90*

EASTING: *2305487.83*

GROUND ELEVATION: *44.89 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
	0	SILT (ML) (ash); gray; moist	▨	3.5'	
40	-5	SILT (ML) (ash); gray; moist	▨	3.0'	
35	-10	SILT (ML) (ash); gray; moist	▨	2.7'	
30	-15	SILT (ML) (ash); gray; moist	▨	2.8'	
		SILT with fine sand (ML) (ash); trace silt; gray/black; moist	▨	2.5'	60.1% MC Sample collected
25	-20	SILT (ML) (ash); gray; wet (bottom 0.7' moist)	▨	4.0'	Sample collected
20	-25	SILT with fine sand (ML) (ash); gray (scattered dark tan at 27' bgs); moist to wet	▨	3.0'	
15	-30	fine sandy SILT (ML) (ash); gray; wet; sand (soil) at tip	▨	4.0'	

All depths referenced to ground surface.

Total Depth: 40 ft bgs

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BORING LOG

BOREHOLE ID: *GP-01 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant

PROJECT NO: *GC5592*

SITE LOCATION: *Wilmington, North Carolina*

BORING DATE: *05/16/2014*

GEOSYNTEC REPRESENTATIVE: *Weston Shin*

DRILLING CONTRACTOR: *Mid-Atlantic Drilling*

DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*

RIG TYPE: *5400 Track Rig (Serial # CFA00199)*

BOREHOLE DIA: *2.25"*

SAMPLING METHOD: *Dual-Tube*

NORTHING: *198282.90*

EASTING: *2305487.83*

GROUND ELEVATION: *44.89 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
		fine to medium SAND (SP) (soil); trace silt; white/brown (occasionally black); wet		2.8'	Sample collected
10	-35				
		fine to medium SAND (SP) (soil); trace silt; white/brown; wet		3.0'	20.6% MC, 1.0% FC Sample collected Boring terminated at 40' bgs
5	-40				

All depths referenced to ground surface.

Total Depth: 40 ft bgs

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BORING LOG

BOREHOLE ID: *GP-02 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/16/2014, 05/19/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *5400 Track Rig (Serial # CFA00199)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual-Tube / Macro-Core*
NORTHING: *198829.21*
EASTING: *2305479.90*
GROUND ELEVATION: *45.08 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
45	0	SILT (ML) (ash); gray; moist	▨	2.8'	
40	-5	SILT (ML) (ash); gray; moist	▨	2.5'	
35	-10	SILT (ML) (ash); gray; moist to wet (wetter at bottom)	▨	2.5'	
30	-15	silty fine SAND (SM) (ash); gray/black; moist	▨	2.5'	
		silty fine SAND (SM) (ash); black; moist	▨	2.5'	Sample collected
25	-20	fine sandy SILT (ML) (ash); black; moist to wet	▨	2.6'	Rod falls by 1'
20	-25	fine sandy SILT (ML) (ash); gray/black; moist to wet	▨	3.7'	51.3% MC Sample collected
15	-30	fine sandy SILT (ML) (ash); gray/black/dark tan; wet	▨	4.0'	

All depths referenced to ground surface.

Total Depth: 84 ft bgs

BORING LOG

BOREHOLE ID: *GP-02 (within the 1971 Pond)*

GENERAL INFORMATION	TECHNICAL INFORMATION
PROJECT NAME: L.V. Sutton Steam Electric Plant	**DRILLING METHOD:** *Direct Push*
PROJECT NO: *GC5592*	**RIG TYPE:** *5400 Track Rig (Serial # CFA00199)*
SITE LOCATION: *Wilmington, North Carolina*	**BOREHOLE DIA:** *2.25"*
BORING DATE: *05/16/2014, 05/19/2014*	**SAMPLING METHOD:** *Dual-Tube / Macro-Core*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*	**NORTHING:** *198829.21*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*	**EASTING:** *2305479.90*
DRILLER NAME: *Jeffrey Stewart*	**GROUND ELEVATION:** *45.08 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
		fine sandy SILT (ML) (ash); gray; wet		4.0'	
10	-35				
		silty fine SAND (SM) (ash); gray (scattered black); wet		3.0'	
5	-40	silty fine SAND (SM) (ash); gray/black; wet		3.5'	
0	-45	silty fine SAND (SM) (ash); gray/black; wet		3.5'	
		silty fine SAND (SM) (ash); gray/black; wet		4.0'	
-5	-50				
		SILT (ML) (ash); dark tan (occasionally black); wet		4.0'	Environmental Sample: SS-GP2 (52.0-56.0)-20140516
-10	-55				
		SILT (ML) (ash); dark tan/gray/black; wet		4.0'	
-15	-60	silty fine SAND (SM) (ash); gray/black (occasionally dark tan); wet		3.5'	

All depths referenced to ground surface.

Total Depth: 84 ft bgs

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BORING LOG

BOREHOLE ID: *GP-02 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/16/2014, 05/19/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *5400 Track Rig (Serial # CFA00199)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual-Tube / Macro-Core*
NORTHING: *198829.21*
EASTING: *2305479.90*
GROUND ELEVATION: *45.08 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
			▒		
-20	-65	fine sandy SILT (ML) (ash); gray/dark tan; wet	▒	2.5'	
-25	-70	SILT with fine sand (ML) (ash); dark tan (occasionally gray/black); wet	▒	4.0'	Sample collected Resume boring on 5/19/14
-30	-75	Top 3.8': SILT (ML) (ash); dark tan (occasionally gray/black); wet Bottom 0.2': silty fine to medium SAND (SM) (soil & ash); white/gray; wet	▒	4.0'	Sample collected Top: LL=32, PL=26, PI=6 Environmental Sample: SS-GP2 (72.0-76.0)-20140519 Heaving sand in the borehole
		fine to medium SAND (SP) (soil); trace silt; white/gray; wet	░	2.5'	Sample collected Switch from Dual-Tube to Macro-Core
-35	-80	fine to medium SAND (SP) (soil); trace silt; white; wet	░	3.7'	Sample collected Boring terminated at 84' bgs

All depths referenced to ground surface.

Total Depth: 84 ft bgs

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BORING LOG

BOREHOLE ID: *GP-03 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/20/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *5400 Track Rig (Serial # CFA00199)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual-Tube / Macro-Core*
NORTHING: *199020.37*
EASTING: *2305207.57*
GROUND ELEVATION: *47.32 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
45	0	SILT (ML) (ash); gray; moist	▨	3.1'	
40	-5	SILT (ML) (ash); gray; wet	▨	2.8'	
	-10	SILT with fine sand (ML) (ash); gray; moist; sandier at top	▨	3.2'	
35	-15	SILT (ML) (ash); gray; moist to wet	▨	2.5'	
30		SILT (ML) (ash); gray; moist to wet; scattered roots	▨	2.8'	
25	-20	SILT with fine sand (ML) (ash): gray/black; wet (occasionally moist); scattered roots	▨	3.5'	
20	-25	SILT (ML) (ash); trace fine sand; gray (scattered black); moist (occasionally wet); scattered roots	▨	2.9'	Sample collected Environmental Sample: SS-GP3 (24.0-28.0)-20140520
	-30	SILT (ML) (ash); trace fine sand; gray (scattered black); wet (occasionally moist); scattered roots and wood debris	▨	3.1'	

All depths referenced to ground surface.

Total Depth: 88 ft bgs

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BORING LOG

BOREHOLE ID: *GP-03 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/20/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *5400 Track Rig (Serial # CFA00199)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual-Tube / Macro-Core*
NORTHING: *199020.37*
EASTING: *2305207.57*
GROUND ELEVATION: *47.32 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
			▨		
15	-35	SILT (ML) (ash); trace fine sand; dark tan (scattered black); wet	▨	4.0'	Sample collected Environmental Sample: SS-GP3 (32.0-36.0)-20140520
10		SILT (ML) (ash); trace fine sand; black (scattered dark tan); wet	▨	3.5'	
5	-40	Top 2.1': silty fine to medium SAND (SM) (ash & soil); gray; wet Bottom 1.5': SILT with fine sand (ML) (ash); gray; wet	▨	3.6'	Sample collected
0	-45	No Sample Recovery	▨	NR	
	-50	fine sandy SILT (ML) (ash); black/gray (occasionally dark tan); wet	▨	3.0'	
-5	-55	SILT with fine sand (ML) (ash); black/gray (occasionally dark tan); wet	▨	3.5'	
-10		SILT with fine sand (ML) (ash); black/gray (occasionally dark tan); wet	▨	4..0'	NP, SG=2.316 Sample collected
	-60	SILT with fine sand (ML) (ash); black/gray (occasionally dark tan); wet	▨	3.5'	

All depths referenced to ground surface.
Total Depth: 88 ft bgs

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BORING LOG

BOREHOLE ID: *GP-03 (within the 1971 Pond)*

GENERAL INFORMATION	**TECHNICAL INFORMATION**
PROJECT NAME: L.V. Sutton Steam Electric Plant	**DRILLING METHOD:** *Direct Push*
PROJECT NO: *GC5592*	**RIG TYPE:** *5400 Track Rig (Serial # CFA00199)*
SITE LOCATION: *Wilmington, North Carolina*	**BOREHOLE DIA:** *2.25"*
BORING DATE: *05/20/2014*	**SAMPLING METHOD:** *Dual-Tube / Macro-Core*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*	**NORTHING:** *199020.37*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*	**EASTING:** *2305207.57*
DRILLER NAME: *Jeffrey Stewart*	**GROUND ELEVATION:** *47.32 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
-15			▒		
-20	-65	SILT with fine sand (ML) (ash); black/gray/dark tan; wet	▒	2.0'	
	-70	SILT (ML) (ash); gray (occasionally dark tan); wet	▒	3.5'	
-25	-75	SILT (ML) (ash); dark tan (occasionally gray); wet	▒	2.3'	Clean out the borehole Sample collected Environmental Sample: SS-GP3 (72.0-76.0)-20140520
-30	-80	SILT (ML) (ash); dark tan (occasionally gray); wet	▒	4.0'	Sample collected 41.1% MC, NP, SG=2.310 Environmental Sample: SS-GP3 (76.0-80.0)-20140520
-35		SILT (ML) (ash); dark tan (occasionally gray); wet	▒	3.8'	Clean out the borehole Sample collected NP Environmental Sample: SS-GP3 (80.0-84.0)-20140520
-40	-85	No Sample Recovery	░		Clean out the borehole (sand is collected during cleanout) Switch from Dual-Tube to Macro-Core Boring terminated at 88' bgs

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BORING LOG

BOREHOLE ID: *GP-04 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/21/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *5400 Track Rig (Serial # CFA00199)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual-Tube*
NORTHING: *198013.19*
EASTING: *2306204.12*
GROUND ELEVATION: *27.49 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
25	0	sandy SILT (ML) (ash); gray/black; moist		3.0'	
20	-5	silty fine to medium SAND (SM) (ash & soil); gray/black/brown; moist (top 0.5' wet)		3.0'	Sample collected
	-10	fine sandy SILT (ML) (ash & soil); gray/brown; moist		2.2'	Sample collected Easier push @ 12'
15	-15	SILT with fine sand (ML) (ash); gray; moist (bottom 1' wet)		2.5'	
10		Top 2': SILT (ML) (ash); gray; wet Bottom 0.3': silty fine to medium SAND (SM) (soil); white; wet		2.3'	
5	-20	fine to medium SAND (SP) (soil); trace silt; brown/white; wet		3.4'	19.9% MC Sample collected
0	-25	fine to medium SAND (SP) (soil); trace silt; brown; wet		3.7'	

All depths referenced to ground surface.

Total Depth: 28 ft bgs

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BORING LOG

BOREHOLE ID: *GP-05 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/21/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *5400 Track Rig (Serial # CFA00199)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual-Tube / Macro-Core*
NORTHING: *199238.51*
EASTING: *2304436.73*
GROUND ELEVATION: *22.85 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
20	0	SILT (ML) (ash); gray; moist (bottom 1.3' wet)	▒	2.5'	
15	-5	fine sandy SILT (ML) (ash); gray/black; wet	▒	1.5'	
	-10	SILT with fine sand (ML) (ash); gray (occasionally black); wet	▒	2.5'	
10	-15	Top 1.5': SILT (ML) (ash); gray; wet Bottom 2': organic CLAY (OH) (soil); gray; moist; roots at tip	▒ ≈	3.5'	Sample collected Bottom: 106.9% MC; LL=152, PL=57; PI=95
5		Top 3.2': SILT with fine sand (ML) (ash & soil); gray; wet Bottom 0.8': fine to medium SAND (SP) (soil); trace silt; brown; wet	▒ ░	4.0'	Sample collected
0	-20	fine to medium SAND (SP) (soil); trace silt; white (bottom 1.3' brown); organic matter at 22.8'	░	3.5'	Switch from Dual-Tube to Macro-Core Environmental Sample: SS-GP5 (20.0-24.0)-20140521 Boring terminated at 24' bgs

All depths referenced to ground surface.
Total Depth: 24 ft bgs

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BORING LOG

BOREHOLE ID: *GP-06 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/21/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *5400 Track Rig (Serial # CFA00199)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Macro-Core*
NORTHING: *199016.35*
EASTING: *2305634.55*
GROUND ELEVATION: *35.76 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
35	0	fine sandy SILT (ML) (ash); gray; moist	▒	3.2'	
30	-5	sandy SILT (ML) (ash): gray; moist	▒	3.0'	
25	-10	sandy SILT (ML) (ash): gray/black; moist (wet at tip)	▒	3.8'	
20	-15	fine sandy SILT (ML) (ash & soil); gray (scattered dark tan); moist (occasionally wet)	▒	3.8'	
		SILT (ML) (ash&soil); gray/black/dark tan; wet; scattered organic matter	▒	3.8'	
15	-20	Top 0.3': SILT (ML) (ash); gray (occasionally tan); moist to wet Bottom 2.7': fine to medium SAND with silt (SP-SM) (soil); white/dark brown/brown; moist	▒ ░	3.0'	Sample collected
10	-25	fine to medium SAND with silt (SP-SM) (soil); brown/white; wet	░	2.5'	Sample collected Environmental Sample: SS-GP6 (24.0-28.0)-20140521 Boring terminated at 28' bgs

All depths referenced to ground surface.

Total Depth: 28 ft bgs

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BORING LOG

BOREHOLE ID: *GP-07 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *7/2/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *197980.6*
EASTING: *2305972.0*
GROUND ELEVATION: *33.3 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
30	0	sandy SILT (ML) (Ash); gray; moist	▒	3.5'	
	-5	sandy SILT (ML) (Ash); gray; moist	▒	3.1'	
25	-10	SILT with sand (top 1.4' sandier) (ML) (Ash); gray (occasional black); moist to wet	▒	3.2'	
20	-15	Top 0.3': SILT (ML) (Ash); gray; moist to wet Middle 2.2': Sand with silt (SP-SM) (Possible Ash); brown; moist Bottom 0.4': SILT with sand (ML) (Ash & Possible Soil); gray; moist	▒	2.9'	Sample Collected (12.3' - 14.5')
15		sandy SILT (ML) (Ash & Possible Soil); gray/brown; moist	▒	3'	
10	-20	SILT with sand (ML) (Ash); gray/brown/black; wet	▒	4'	
	-25	SILT with sand (ML) (Ash); gray/black; wet	▒	0.8'	
5	-30	Top 1.5': SILT with sand (ML) (Ash); gray/black; wet Bottom 2.5': fine to medium SAND with silt (SP-SM) (Soil); brown; wet	▒ ⠿	4'	Sample Collected (28' - 28.9')

All depths referenced to ground surface.

Total Depth: 36 ft

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BORING LOG

BOREHOLE ID: *GP-07 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *7/2/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *197980.6*
EASTING: *2305972.0*
GROUND ELEVATION: *33.3 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
0	-35	fine to medium SAND (SP) (Soil); brown; wet	▨	4'	Boring Terminated at 36 ft

All depths referenced to ground surface.

Total Depth: 36 ft

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BORING LOG

BOREHOLE ID: *GP-08 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/26/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Patinkin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *198603.9*
EASTING: *2304725.8*
GROUND ELEVATION: *32.6 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
30	0	SILT (ML) (Ash); gray; moist; occasional organic matter	▒	2.5'	
25	-5	SILT with fine sand (ML) (Ash); gray; moist; occasional roots at top 0.3'	▒	2.6'	
	-10	SILT with fine sand (ML) (Ash); gray (occasional black); moist	▒	4'	
20	-15	SILT with fine sand (ML) (Ash); gray/black (occasional dark tan); moist (wet at middle 0.3 ft)	▒	3'	
15		SILT (ML) (Ash); gray; wet	▒	4'	
10	-20	SILT (ML) (Ash); gray/dark tan (occasional black); wet	▒	4'	
5	-25	Top 2': SILT (ML) (Ash); gray (occasional black); wet Bottom 2': fine to medium SAND (SP) (Soil); gray/brown/white; wet	▒ ░	4'	Start using water
	-30	fine to medium SAND (SP) (Soil); brown/white; wet	░	2.5'	Boring Terminated at 32 ft

All depths referenced to ground surface.

Total Depth: 32 ft

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BORING LOG

BOREHOLE ID: *GP-09 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/26/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Patinkin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *198963.0*
EASTING: *2304385.6*
GROUND ELEVATION: *34.1 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
	0	Top 1.0': Top Soil (SP) (Soil); brown; dry; occasional gravels Bottom 3.0': SILT (ML) (Ash); gray; moist		4'	
30	-5	SILT (ML) (Ash); gray; moist		3.5'	
25	-10	SILT (ML) (Ash); gray; moist		3.0'	
20	-15	SILT (ML) (Ash); gray; moist		3.3'	
15		SILT (ML) (Ash); gray; moist to wet; occasional wood chips and roots		2.5'	
	-20	sandy SILT (ML) (Ash); gray/black/dark tan; wet		4'	
10	-25	Top 2.5': SILT (ML) (Ash); dark tan (occasional black); wet Bottom 1.5': sandy SILT (ML) (Ash); gray/black; wet; occasional wood chips		4'	
5	-30	SILT with sand (ML) (Ash); gray/dark tan/black; wet		3.3'	

All depths referenced to ground surface.

Total Depth: 40 ft

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BORING LOG

BOREHOLE ID: *GP-09 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/26/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Patinkin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *198963.0*
EASTING: *2304385.6*
GROUND ELEVATION: *34.1 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
0	-35	Top 2.0': SILT (ML) (Ash); gray/black/dark tan; wet Middle 0.5': organic CLAY (OL) (Soil); gray to black; moist Bottom 1.5': fine to medium SAND (SP) (Soil); brown; wet	▨	4'	Sample Collected Start using water
-5	-40	fine to medium SAND with silt (SP-SM) (Soil); white/brown; wet	▨	2.3'	Boring Terminated at 40 ft

All depths referenced to ground surface.

Total Depth: 40 ft

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BORING LOG

BOREHOLE ID: *GP-10 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/26/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Patinkin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *199091.6*
EASTING: *2304846.3*
GROUND ELEVATION: *23.4 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
20	0	SILT with fine sand (ML) (Ash); gray; moist to wet; occasional organic matter at top 0.3'	▒	2.5'	
	-5	SILT (ML) (Ash); trace fine sand; gray/tan; moist to wet	▒	3'	
15	-10	SILT (ML) (Ash); trace fine sand; gray/dark tan; wet (moist at top 1')	▒	4'	
10	-15	SILT with fine sand (ML) (Ash); gray/black/dark tan; wet; occasional roots at bottom 0.3'	▒	4'	
5		Top 2': silty SAND (SM) (Ash); gray; wet Bottom 1.5': fine to medium SAND (SP) (Soil); gray/white; wet	▒ ░	3.5'	Start using water
0	-20	fine to medium SAND (SP) (Soil); white/brown; wet	░	3'	Boring Terminated at 24 ft

All depths referenced to ground surface.

Total Depth: 24 ft

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BORING LOG

BOREHOLE ID: *GP-11 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/26/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Patinkin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *199364.0*
EASTING: *2304729.4*
GROUND ELEVATION: *24.6 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
	0	Top 1.5': silty SAND (SM) (Ash); gray; moist; occasional organic matter Bottom 1.0': sandy SILT (ML) (Ash); gray; moist to wet	▒	2.5'	
20	-5	Top 1.5': silty SAND (SM) (Ash); gray; moist to wet Bottom 1.0': SILT with fine sand (ML) (Ash); gray/black; wet	▒	2.5'	
15	-10	SILT with fine sand (ML) (Ash); gray/dark tan/black; wet	▒	2.5'	
10	-15	SILT with fine sand (sandier at bottom 1 ft) (ML) (Ash); gray/dark tan/black; wet	▒	3'	Sample Collected
5	-20	Top 2.7': SILT (ML) (Ash); gray/dark tan; wet; occasional organic matter Bottom 0.6': fine to medium SAND (SP) (Soil); white/gray; wet	▒ ░	3.3'	Start using water
		fine to medium SAND (SP) (Soil); white/gray/brown; wet	░	2.5'	Boring Terminated at 24 ft

All depths referenced to ground surface.

Total Depth: 24 ft

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BORING LOG

BOREHOLE ID: *GP-12 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *7/2/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *199302.5*
EASTING: *2305001.6*
GROUND ELEVATION: *41.5 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
40	0	SILT with fine sand (ML) (Ash); gray; moist		3.2'	
35	-5	SILT (ML) (Ash); trace fine sand; gray; moist		2.7'	
30	-10	SILT (ML) (Ash); trace fine sand; gray; moist (top 1' wet)		2.3'	
	-15	SILT with sand (ML) (Ash); gray; moist; occasional organic matter		3.1'	
25		SILT with sand (ML) (Ash); gray/tan; moist (occasionally wet)		2.8'	
20	-20	Top 1.0': SILT (ML) (Ash); gray; wet Bottom 1.8': sandy SILT (ML) (Ash); gray; moist (occasionally wet)		2.8'	
15	-25	SILT (with fine sand at top 1.5') (ML) (Ash); gray/dark tan; wet (top 1' moist); occasional organic matter		4'	
	-30	SILT with fine sand (ML) (Ash); dark tan/gray/black; wet		4'	Sample Collected Environmental Sample: SS-GP12 (28-32)-20140702

All depths referenced to ground surface.

Total Depth: 40 ft

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BORING LOG

BOREHOLE ID: *GP-12 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *7/2/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *199302.5*
EASTING: *2305001.6*
GROUND ELEVATION: *41.5 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
10		Top 2.5': SILT (ML) (Ash); dark tan/gray/black; wet Bottom 1.0': fine to medium SAND (SP) (Soil); gray/white; wet		3.5'	
	-35				
5		fine to medium SAND (SP) (Soil); gray; wet		1.8'	
	-40				Boring Terminated at 40 ft

All depths referenced to ground surface.

Total Depth: 40 ft

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BORING LOG

BOREHOLE ID: *GP-13 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/30/2014 to 7/1/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *199150.5*
EASTING: *2305092.7*
GROUND ELEVATION: *40.0 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
40	0	SILT (ML) (Ash); gray; moist		3.5'	
35	-5	SILT (ML) (Ash); gray; moist		3.2'	
		SILT with fine sand (top 1' sandier) (ML) (Ash); gray/brown; moist		2.5'	
30	-10				
		SILT (ML) (Ash); gray; moist to wet; occasional organic matter		3.4'	
25	-15				
		SILT with fine sand (ML) (Ash); black/gray; moist (bottom 0.7' wet); occasional wood chips		3.1'	
20	-20				
		sandy SILT (ML) (Ash); gray; moist (occasionally wet); occasional organic matter		2.7'	
15	-25	SILT with sand (ML) (Ash); dark tan; wet; 0.4' of sand at 25' bgs		4'	
		SILT with fine sand (ML) (Ash); dark tan/black/gray; wet		4'	
10	-30				

All depths referenced to ground surface.

Total Depth: 80 ft

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BORING LOG

BOREHOLE ID: *GP-13 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/30/2014 to 7/1/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *199150.5*
EASTING: *2305092.7*
GROUND ELEVATION: *40.0 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
		SILT with fine sand (ML) (Ash); dark tan/black; wet		4'	
5	-35				
		SILT with fine sand (ML) (Ash); dark tan/black; wet		4'	
					Clean out the borehole with water
0	-40	No Recovery		NR	
		SILT (with fine sand at top 1') (ML) (Ash); dark tan/black; wet		3.5'	Resume boring on 7/1/2014 Sample Collected
-5	-45				
		SILT with fine sand (ML) (Ash); dark tan/black/gray; wet		2'	
-10	-50				
		No Recovery		NR	
-15	-55				
		SILT (ML) (Ash); dark tan; wet		3.7'	
-20	-60	No Recovery		NR	

All depths referenced to ground surface.

Total Depth: 80 ft

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BORING LOG

BOREHOLE ID: *GP-13 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/30/2014 to 7/1/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *199150.5*
EASTING: *2305092.7*
GROUND ELEVATION: *40.0 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
-25	-65	SILT with fine sand (ML) (Ash); dark tan; wet	▨	3.3'	Sample Collected; NP Environmental Sample: SS-GP13 (64-68)-20140701
		SILT with fine sand (ML) (Ash); dark tan; wet	▨	4'	Sample Collected; NP Environmental Sample: SS-GP13 (68-72)-20140701
-30	-70		▨		
		No Recovery		NR	
-35	-75				
		No Recovery		NR	Trace sand (soil) is observed in the annulus between the sampler and outer casing
-40	-80				Boring Terminated at 80 ft

All depths referenced to ground surface.

Total Depth: 80 ft

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BORING LOG

BOREHOLE ID: *GP-14 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *7/2/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *198621.2*
EASTING: *2305747.4*
GROUND ELEVATION: *45.2 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
45	0				
		SILT with fine to medium sand (ML) (Ash); gray; moist		3.4'	
		SILT with fine sand (ML) (Ash); gray ; moist		3'	
40	-5				
		sandy SILT (ML) (Ash); gray/brown; moist		3.5'	
35	-10				
		SILT with fine to medium sand (ML) (Ash); gray (occasionally brown); moist		3.3'	
30	-15				
		SILT with fine sand (ML) (Ash); gray/brown/black; moist		3'	
25	-20				
		SILT with fine to medium sand (ML) (Ash); gray/black; wet		4'	
		SILT with fine sand (ML) (Ash); gray/black/dark tan; wet		4'	
20	-25				
		SILT with fine sand (ML) (Ash & Soil); dark tan/gray/black; wet; soil mix at bottom 0.7'		3.5'	
15	-30				

All depths referenced to ground surface.

Total Depth: 84 ft

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BORING LOG

BOREHOLE ID: *GP-14 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *7/2/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *198621.2*
EASTING: *2305747.4*
GROUND ELEVATION: *45.2 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
		sandy SILT (ML) (Ash & Possible Soil); gray/brown/black; wet; soil mix at middle 0.7'		3.5'	
10	-35				
		sandy SILT (ML) (Ash & Possible Soil); gray/black; wet		3.6'	
5	-40	SILT with fine sand (ML) (Ash); dark tan/gray/black; wet		3.8'	
0	-45	sandy SILT (ML) (Ash); black/gray; wet		3.7'	
-5	-50	Top 1.0': medium SAND (SP) (Possible Soil); brown/black; wet Bottom 3.0': SILT with fine sand (ML) (Ash); gray/black/dark tan; wet		4'	Sample Collected (48'-49')
		sandy SILT (ML) (Ash); gray; wet		0.6'	
-10	-55				
		No Recovery		NR	
-15	-60	SILT (ML) (Ash); dark tan/black; wet		4'	Sample Collected (60'-62') Environmental Sample: SS-GP14 (60-62)-20140702

All depths referenced to ground surface.

Total Depth: 84 ft

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BORING LOG

BOREHOLE ID: *GP-14 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *7/2/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *198621.2*
EASTING: *2305747.4*
GROUND ELEVATION: *45.2 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
-20	-65	No Recovery		NR	
-25	-70	SILT (ML) (Ash); dark tan/black; wet		4'	Sample Collected; NP Environmental Sample: SS-GP14 (68-72)-20140702
-30	-75	SILT (ML) (Ash); dark tan; wet		3.5'	Sample Collected (74.5'-75.5'); NP
		Top 2.8': SILT (ML) (Ash); dark tan/black; wet Bottom 1': sandy SILT (ML) (Soil); gray; wet		3.8'	Clean out the borehole with water
-35	-80	No Recovery		NR	Trace sand (soil) is observed in the annulus between the sampler and outer casing Boring Terminated at 84 ft

All depths referenced to ground surface.

Total Depth: 84 ft

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BORING LOG

BOREHOLE ID: *GP-15 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *7/1/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *198295.2*
EASTING: *2305863.3*
GROUND ELEVATION: *43.9 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
	0	SILT with fine to medium sand (ML) (Ash); gray; moist	▨	3'	
40	-5	SILT with fine to medium sand (ML) (Ash); gray; moist	▨	0.5'	
35	-10	SILT with fine to medium sand (ML) (Ash); gray; moist	▨	2.8'	
30	-15	SILT with fine to medium sand (ML) (Ash); gray/black; moist	▨	2.8'	
25		SILT with fine sand (ML) (Ash); gray/black; moist	▨	3.1'	
20	-20	SILT with fine sand (ML) (Ash); gray/black; moist (bottom 0.9' wet)	▨	3.9'	
	-25	SILT with fine sand (ML) (Ash); black/gray/dark tan; wet	▨	3.3'	
15	-30	sandy SILT (ML) (Ash); black/gray/dark tan; wet	▨	4'	

All depths referenced to ground surface.

Total Depth: 84 ft

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BORING LOG

BOREHOLE ID: *GP-15 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *7/1/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *198295.2*
EASTING: *2305863.3*
GROUND ELEVATION: *43.9 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
		Top 2.0': SILT (ML) (Ash); dark tan/black; wet Bottom 1.5': fine to medium SAND (SP) (Possible Soil); gray; wet		3.5'	
10					
	-35				
		SILT with fine sand (ML) (Ash (possible soil mix at bottom)); black/dark tan/gray; wet		3.8'	
5					
	-40				
		sandy SILT (ML) (Ash); dark tan/black; wet		3.5'	
0					
	-45	sandy SILT (ML) (Ash & Possible Soil); dark tan/black/brown; wet		2.5'	Sample Collected
		sandy SILT (ML) (Ash); dark tan/black; wet		3.6'	
-5					
	-50				
		SILT with fine sand (ML) (Ash); dark tan/black; wet		3.8'	
-10					
	-55				
		SILT with fine sand (ML) (Ash); dark tan/black; wet		1.5'	Sample Collected
-15					
	-60	SILT (ML) (Ash); dark tan; wet		3.5'	Sample Collected; NP Environmental Sample: SS-GP15 (60-64)-20140701

All depths referenced to ground surface.

Total Depth: 84 ft

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BORING LOG

BOREHOLE ID: *GP-15 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *7/1/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *198295.2*
EASTING: *2305863.3*
GROUND ELEVATION: *43.9 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
-20	-65	SILT (ML) (Ash); dark tan (occasionally black); wet	▨	3'	
-25	-70	SILT with sand (ML) (Ash); gray/dark tan/black; wet	▨	2.7'	Sample Collected (68.7'-70.7') Environmental Sample: SS-GP15 (68.7-70.7)-20140701
-30	-75	SILT with sand (ML) (Ash); gray/black; wet	▨	1.7'	
-35		Top 3.6': SILT with sand (ML) (Ash); dark tan/black; wet Bottom 0.2': fine to medium SAND (SP) (Soil); brown; wet	▨ ░	3.8'	
-40	-80	fine to medium SAND (SP) (Soil); brown; wet	░	1.1'	Boring Terminated at 84 ft

All depths referenced to ground surface.

Total Depth: 84 ft

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BORING LOG

BOREHOLE ID: *GP-16 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/30/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *199205.8*
EASTING: *2305534.9*
GROUND ELEVATION: *31.6 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
30	0	Top 2.2': SILT (ML) (Ash); gray; moist Bottom 1.3': fine to medium SAND (SP) (Soil); brown; moist	▨ ░	3.5'	
25	-5	fine to medium SAND (SP) (Soil); brown; moist	░	2.5'	Boring Terminated at 8 ft

All depths referenced to ground surface.

Total Depth: 8 ft

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BORING LOG

BOREHOLE ID: *GP-16A (within the 1971 Pond)*

GENERAL INFORMATION	TECHNICAL INFORMATION
PROJECT NAME: L.V. Sutton Steam Electric Plant	**DRILLING METHOD:** *Direct Push*
PROJECT NO: *GC5592*	**RIG TYPE:** *6600 Track Rig (Serial # 99103P66)*
SITE LOCATION: *Wilmington, North Carolina*	**BOREHOLE DIA:** *2.25"*
BORING DATE: *6/30/2014*	**SAMPLING METHOD:** *Dual Tube*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*	**NORTHING:** *199203.7*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*	**EASTING:** *2305516.8*
DRILLER NAME: *Mike Small*	**GROUND ELEVATION:** *31.6 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
30	0	SILT (ML) (Ash); trace fine sand; gray; moist		2.5'	
25	-5	SILT with fine sand (ML) (Ash); gray; moist		2.7'	
20	-10	Top 0.4': SILT (ML) (Ash); trace fine sand; gray; moist Bottom 2.4': fine to medium SAND (SP) (Soil); brown; moist		2.8'	
	-15	fine to medium SAND (SP) (Soil); brown/white; moist		3.2'	Boring Terminated at 16 ft

All depths referenced to ground surface.

Total Depth: 16 ft

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BORING LOG

BOREHOLE ID: *GP-17 (on the 1971 Pond Dike)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/27/2014, 6/30/2014*
GEOSYNTEC REPRESENTATIVE: *M. Patinkin, W. Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube/Macro Core*
NORTHING: *199099.6*
EASTING: *2305644.4*
GROUND ELEVATION: *32.5 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
30	0	Top 1': fine to medium SAND (SP) (Road Fill Material); gray; dry Bottom 3': fine to medium SAND (SP) (Soil); brown; moist		4'	
25	-5	fine to medium SAND (SP) (Soil); brown; moist		4'	
	-10	fine to medium SAND (SP) (Soil); brown/white/black; moist		4'	
20	-15	fine to medium SAND (SP) (Soil); brown/gray; moist to wet		4'	
15		fine to medium SAND (SP) (Soil); brown/white/gray; wet		4'	
10	-20	fine to medium SAND (SP) (Soil); brown; wet		3.5'	
5	-25	fine to medium SAND (SP) (Soil); white/brown; wet		4'	
	-30	fine to medium SAND (SP) (Soil); white (occasional orange); wet		4'	

All depths referenced to ground surface.

Total Depth: 60 ft

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BORING LOG

BOREHOLE ID: *GP-17 (on the 1971 Pond Dike)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/27/2014, 6/30/2014*
GEOSYNTEC REPRESENTATIVE: *M. Patinkin, W. Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube/Macro Core*
NORTHING: *199099.6*
EASTING: *2305644.4*
GROUND ELEVATION: *32.5 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
0		fine to medium SAND (SP) (Soil); white; wet	░	4'	
	-35		░		Start using water
-5		fine to medium SAND (SP) (Soil); white/brown; wet	░	2'	
	-40	Top 0.3': fine to medium SAND (SP) (Soil); brown; wet; occasional wood chips Bottom 0.7': organic CLAY (OH) (Soil); gray; moist	░	1'	Switch to Macro Core Sample Collected; Bottom - LL=85, PL=40, PI=45
-10			≈		
	-45	Top 3': organic CLAY (OH) (Soil); dark brown; moist; abundant wood chips; top 1.3' cave-in Bottom 1': fat CLAY (CH) (Soil); gray; moist; abundant wood chips	≈	2.7'	Resume drilling on 6/30/14; Switch to Dual Tube Sample Collected; Top - LL=126, PL=60, PI=66; Bottom - LL=67, PL=31, PI=36
-15			▨		
		fat CLAY (CH) (Soil); gray; moist; occasional wood chips	▨	4'	Sample Collected; LL=50, PL=24, PI=26
	-50		▨		
-20		silty fine to medium SAND (SM) (Soil); gray; wet; occasional wood chips	▦	4'	Sample Collected; 0.1% Gravel, 58.8% Sand, 24.7% Silt, 16.4 Clay; NP
	-55		▦		
-25		silty CLAY to clayey SILT (CL-ML) (Soil); gray; wet	🟥	3.2'	Sample Collected; 44.4% Sand, 33.8% Silt, 21.8% Clay; LL=26, PL=22, PI=4
	-60		🟥		Boring Terminated at 60 ft

All depths referenced to ground surface.

Total Depth: 60 ft

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BORING LOG

BOREHOLE ID: *MB-1 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/25/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *198663.1*
EASTING: *2304987.5*
GROUND ELEVATION: *35.6 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
20	-15	SILT with fine sand (ML) (Ash); gray; moist (wet in the middle 0.3')	▒	2.6'	Start drilling from access path and skip sampling top 12 ft
		SILT with fine sand (ML) (Ash); gray (occasional black); wet	▒	4'	
15	-20	SILT (with fine sand at the bottom 0.3') (ML) (Ash); dark tan (black/dark tan at the bottom); wet	▒	4'	
10	-25	SILT (with fine sand at the bottom 0.5') (ML) (Ash); dark tan/gray/black; wet; scattered wood chips	▒	4'	Sample Collected
5	-30	Top 1': sandy SILT (ML) (Ash); dark tan/gray/black; wet Bottom 1': fine to medium SAND (SP) (Soil); white; wet	▒ ░	2'	
0	-35	fine to medium SAND (SP) (Soil); gray/white; wet	░	3'	Boring Terminated at 36 ft

All depths referenced to ground surface.

Total Depth: 36 ft

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BORING LOG

BOREHOLE ID: *MB-2 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/25/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Patinkin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *198526.3*
EASTING: *2305458.9*
GROUND ELEVATION: *44.6 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
30	-15	SILT with fine sand (ML) (Ash); gray; moist		2.5'	Start drilling from access path and skip sampling top 12 ft
25	-20	SILT with fine sand (ML) (Ash); black/gray; moist		3'	
		SILT (with fine sand at top 1 ft) (ML) (Ash); gray; wet (moist at top 1 ft)		4'	
20	-25	SILT (with fine sand at bottom 0.2 ft) (ML) (Ash); gray; wet		4'	
15	-30	SILT with fine sand (ML) (Ash); dark tan/black/gray; wet		4'	
10	-35	SILT with fine sand (ML) (Ash); dark tan/black/gray; wet		4'	
5	-40	silty SAND (SM) (Ash); black/dark tan/gray; wet		4'	
		Top 2.5 ft: silty SAND (SM) (Ash); black; wet Bottom 1.5': SILT with fine sand (ML) (Ash); dark tan/black; wet		4'	

All depths referenced to ground surface.

Total Depth: 84 ft

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BORING LOG

BOREHOLE ID: *MB-2 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *6/25/2014*
GEOSYNTEC REPRESENTATIVE: *Michael Patinkin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*
RIG TYPE: *6600 Track Rig (Serial # 99103P66)*
BOREHOLE DIA: *2.25"*
SAMPLING METHOD: *Dual Tube*
NORTHING: *198526.3*
EASTING: *2305458.9*
GROUND ELEVATION: *44.6 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
0	-45	SILT (ML) (Ash); dark tan (occasional black); wet		4'	
-5	-50	No Recovery		NR	
-10	-55	SILT (ML) (Ash); dark tan (occasional black/gray); wet; occasional gravel		4'	
-15	-60	No Recovery		NR	
		SILT with fine sand (ML) (Ash); dark tan (occasional black/gray); wet		4'	
-20	-65	SILT (ML) (Ash); dark tan (occasional black/gray); wet		4'	Sample Collected; NP Environmental Sample: SS-MB2 (64.0-68.0)-20140625
-25	-70	No Recovery		NR	
		No Recovery		NR	

All depths referenced to ground surface.

Total Depth: 84 ft

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BORING LOG

BOREHOLE ID: *MB-2 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant

PROJECT NO: *GC5592*

SITE LOCATION: *Wilmington, North Carolina*

BORING DATE: *6/25/2014*

GEOSYNTEC REPRESENTATIVE: *Michael Patinkin*

DRILLING CONTRACTOR: *Mid-Atlantic Drilling*

DRILLER NAME: *Mike Small*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push*

RIG TYPE: *6600 Track Rig (Serial # 99103P66)*

BOREHOLE DIA: *2.25"*

SAMPLING METHOD: *Dual Tube*

NORTHING: *198526.3*

EASTING: *2305458.9*

GROUND ELEVATION: *44.6 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
-30	-75		▒		
		SILT (ML) (Ash); dark tan (occasional black/gray); wet; occasional gravel	▒	3.5'	Sample Collected; NP Environmental Sample: SS-MB2 (76.0-80.0)-20140625
			▒		Clean out the borehole with water
-35	-80	fine to medium SAND with silt (SP-SM) (Soil); gray; wet	▨	2.5'	
			▨		Boring Terminated at 84 ft

All depths referenced to ground surface.

Total Depth: 84 ft

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BORING LOG

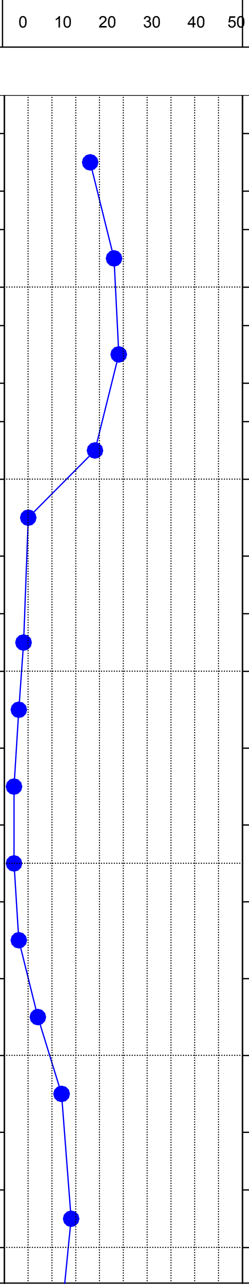
BOREHOLE ID: *SPT-01 (on the 1971 Pond Dike)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/08/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3.5"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198394.35*
EASTING: *2304871.05*
GROUND ELEVATION: *27.53 ft (NAVD88)*



Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery	Comments
25	0	Top 0.6': poorly graded fine to medium SAND with silt (SP-SM) (possible ash); gray; moist; medium dense; Bottom 0.5': poorly graded fine to medium SAND (SP) (soil) (Dike Fill); brown; moist, medium dense		6-7-11		1.1'	
	-5	silty fine to medium SAND (SM) (soil) (Dike Fill); white/brown/black; moist to wet; medium dense		7-11-12		0.7'	Start using drilling mud 25.3% FC
20		poorly graded fine to medium SAND with silt (SP-SM) (soil) (Dike Fill); white/brown/black; moist to wet; medium dense		9-11-13		0.8'	
	-10	Top 0.8': fine to medium SAND with silt (SP-SM) (soil) (Dike Fill); brown (occ. white and black); wet; medium dense; Bottom 0.4': SILT with sand (ML) (ash); dark gray; moist; medium dense		8-9-10		1.2'	5.7% FC
15		SILT (ash) with fine to medium sand (soil) (ML); dark gray/brown; wet; loose		3-3-2-2		0.7'	
		silty fine to medium SAND (SM) (soil & ash); brown/gray; wet; occasional wood chips		2-2-2		0.7'	19.0% FC
	-15	silty fine to medium SAND (SM) (soil & ash); gray/brown; wet; scattered wood chips; very loose		1-2-1-2		0.7'	0.0% Gravel, 57.0% Sand, 38.6% Silt, 4.4% Clay
10		Top 0.6': fine to medium sandy SILT (ML) (soil & ash); brown/gray; wet; very loose Bottom 0.5': silty fine to medium SAND (SM) (ash); gray; wet; very loose		1-1-1-2		1.1'	Top: 0.4% Gravel, 23.1% Sand, 72.1% Silt, 4.4% Clay Bottom: 36.7% FC
	-20	SILT (ML) (ash); gray; wet; very loose; stone at tip		1/12"-1-2		1.3'	65.7% FC; NP
5		fine to medium sandy SILT (ML) (ash with soil); gray; wet; very loose		1-1-2-1		0.7'	51.5% FC
		Top 0.7': fine sandy SILT (ML) (ash); gray; wet; loose Bottom 0.5': poorly graded fine to medium SAND with silt (SP-SM) (soil) (Foundation Soil); white; wet; loose		1-2-5-6		1.2'	Top: 79.5% FC
0	-25	poorly graded fine to medium SAND (SP) (soil) (Foundation Soil) ; trace silt; white; wet; medium dense		4-5-7-7		0.9'	Thicken mud in drilling fluid 0.0% Gravel, 96.7% Sand, 3.3% FC
	-30	poorly graded fine to medium SAND with silt (SP-SM) (soil) (Foundation Soil); dark brown; wet; medium dense		6-8-6		0.9'	

All depths referenced to ground surface.

Total Depth: 40 ft bgs

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BORING LOG

BOREHOLE ID: *SPT-01 (on the 1971 Pond Dike)*

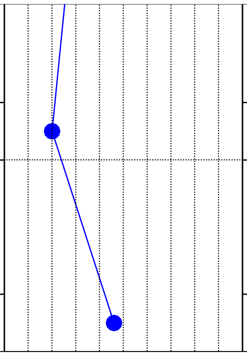
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/08/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3.5"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198394.35*
EASTING: *2304871.05*
GROUND ELEVATION: *27.53 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value 0 10 20 30 40 50	Recovery	Comments
-5							
	-35	silty fine to medium SAND (SM) (soil) (Foundation Soil); brown; wet; loose		4-4-6		0.7'	37.6% FC
-10	-40	silty fine to medium SAND (SM) (soil) (Foundation Soil); white; wet; medium dense		7-9-14		1'	SG=2.683 Boring terminated at 40' bgs



All depths referenced to ground surface.
Total Depth: 40 ft bgs

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BORING LOG

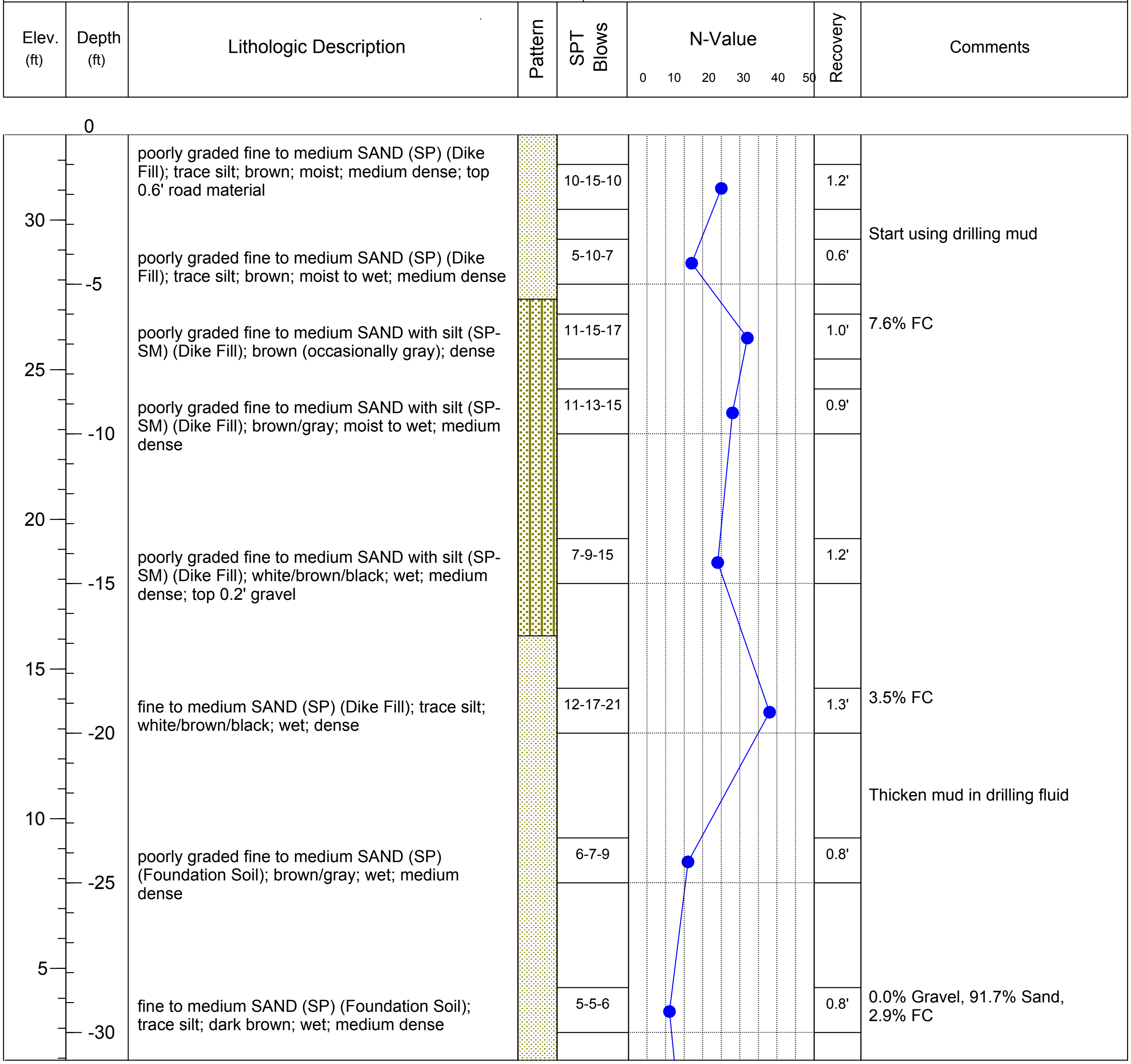
BOREHOLE ID: *SPT-02 (on the 1984 Pond Dike)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/09/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3.5"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *199661.14*
EASTING: *2304983.99*
GROUND ELEVATION: *32.86 ft (NAVD88)*



Lithologic Description	SPT Blows	Recovery	Comments
poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; brown; moist; medium dense; top 0.6' road material	10-15-10	1.2'	
poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; brown; moist to wet; medium dense	5-10-7	0.6'	Start using drilling mud
poorly graded fine to medium SAND with silt (SP-SM) (Dike Fill); brown (occasionally gray); dense	11-15-17	1.0'	7.6% FC
poorly graded fine to medium SAND with silt (SP-SM) (Dike Fill); brown/gray; moist to wet; medium dense	11-13-15	0.9'	
poorly graded fine to medium SAND with silt (SP-SM) (Dike Fill); white/brown/black; wet; medium dense; top 0.2' gravel	7-9-15	1.2'	
fine to medium SAND (SP) (Dike Fill); trace silt; white/brown/black; wet; dense	12-17-21	1.3'	3.5% FC Thicken mud in drilling fluid
poorly graded fine to medium SAND (SP) (Foundation Soil); brown/gray; wet; medium dense	6-7-9	0.8'	
fine to medium SAND (SP) (Foundation Soil); trace silt; dark brown; wet; medium dense	5-5-6	0.8'	0.0% Gravel, 91.7% Sand, 2.9% FC

All depths referenced to ground surface.

Total Depth: 45 ft bgs

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BORING LOG

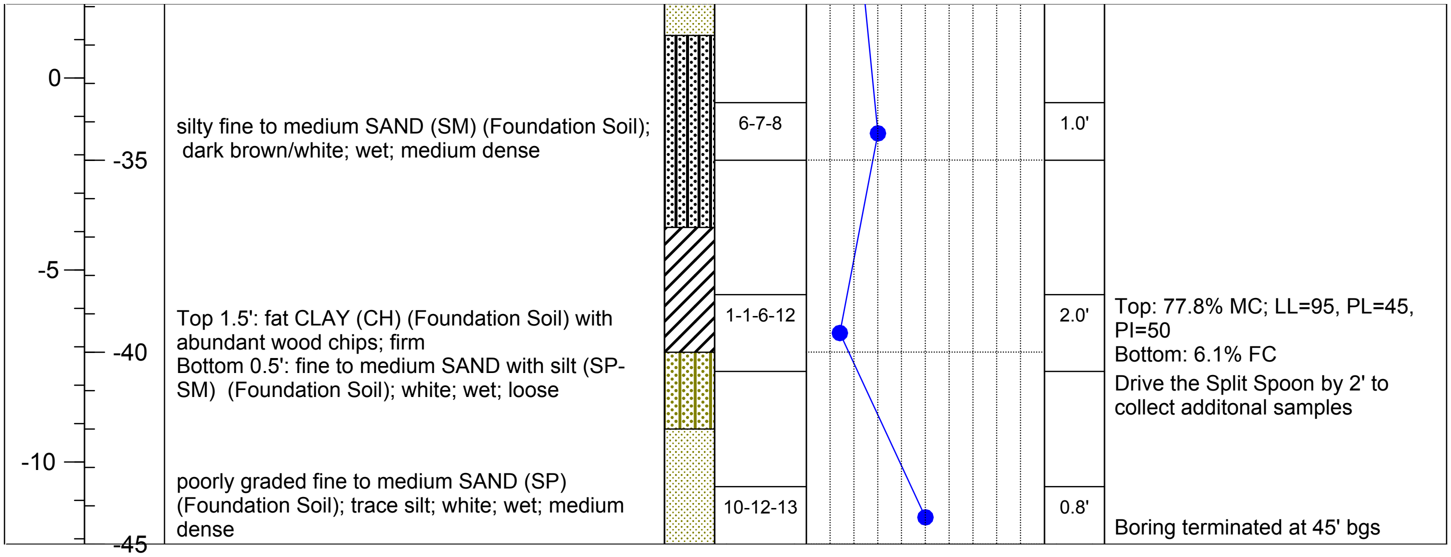
BOREHOLE ID: *SPT-02 (on the 1984 Pond Dike)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/09/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3.5"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *199661.14*
EASTING: *2304983.99*
GROUND ELEVATION: *32.86 ft (NAVD88)*



Lithologic Description	SPT Blows	Recovery	Comments
silty fine to medium SAND (SM) (Foundation Soil); dark brown/white; wet; medium dense	6-7-8	1.0'	
Top 1.5': fat CLAY (CH) (Foundation Soil) with abundant wood chips; firm Bottom 0.5': fine to medium SAND with silt (SP-SM) (Foundation Soil); white; wet; loose	1-1-6-12	2.0'	Top: 77.8% MC; LL=95, PL=45, PI=50 Bottom: 6.1% FC Drive the Split Spoon by 2' to collect additonal samples
poorly graded fine to medium SAND (SP) (Foundation Soil); trace silt; white; wet; medium dense	10-12-13	0.8'	Boring terminated at 45' bgs

All depths referenced to ground surface.

Total Depth: 45 ft bgs

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BORING LOG

BOREHOLE ID: *SPT-03 (within the 1971 Pond)*

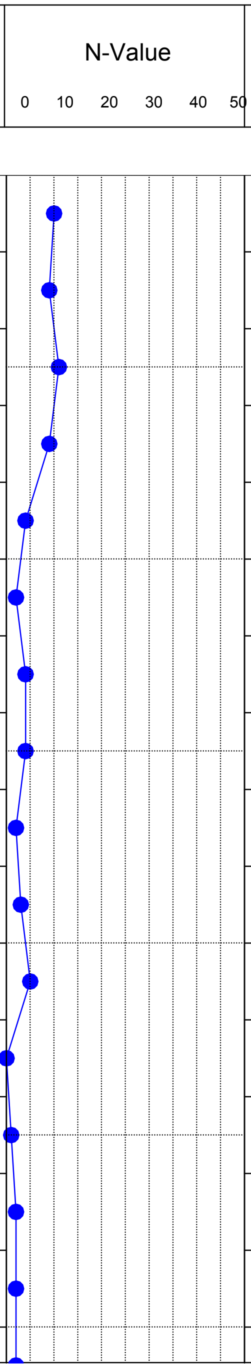
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/09/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Continuous SPT / Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3.5"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198480.27*
EASTING: *2305994.51*
GROUND ELEVATION: *45.15 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	Recovery	Comments
45	0	sandy SILT (ML) (ash); gray; moist; loose		2-4-6-5	1.5'	
		silty fine to medium SAND (SM) (ash); gray; moist; loose		4-4-5-6	1.7'	
40	-5	SILT with fine to medium sand (ML) (ash); gray; moist; medium dense		5-5-6-7	1.7'	26.8% MC; 52.0% FC
		silty fine to medium SAND (SM) (ash); gray; moist; loose		4-4-5-4	1.6'	
		silty fine to medium SAND (SM) (ash); gray; moist; very loose		3-2-2-2	1.7'	
35	-10	SILT with fine to medium sand (ML) (ash); gray; moist; very loose		2-1-1-1	1.5'	28.5% MC; 50.2% FC Environmental Sample: SS-SPT3 (10.0-12.0)-20140509
		silty SAND (SM) (ash); gray; moist; very loose		1-2-2-2	1.2'	
30	-15	silty SAND (SM) (ash); gray; moist; very loose; occasionally iron-oxidized		2-2-2-2	1.5'	9.9% Gravel, 62.4% Sand, 24.3% Silt, 3.4% Clay
		SILT with sand (ML) (ash); gray; moist; very loose		1-1-1-2	1.5'	
		SILT with sand (ML) (ash); trace clay; gray; moist; very loose		2-2-1-3	1.6'	
25	-20	SILT with sand (ML) (ash); gray; moist (wet at tip); loose		1-2-3-2	1.7'	
		SILT (ML) (ash); gray; wet (top 0.2' moist); very loose; scattered brown matter and leaves		WOH/18" -1	1.5'	88.2% FC, NP
20	-25	SILT (ML) (ash); gray (occasionally dark tan); wet; very loose; abundant roots		WOH/12" -1/12"	1.8'	84.7% FC
		Top 1.8': SILT (ML) (ash); gray/dark tan; wet; very loose; Bottom 0.2': fine to medium SAND (SP) (soil); gray; wet; very loose		1/12"-1-1	2.0'	Top: 46.1% MC
		Top 0.5': fine to medium SAND (SP) (soil); gray; wet; very loose; potential cave-in; Bottom 1.5': SILT (ML) (ash); gray/dark tan; wet; very loose		1-1-1-1	2.0'	
15	-30	Top 1': poorly graded fine to medium SAND (SP)		1-1-1-1	2.0'	Drilling using a 3" bit with water



All depths referenced to ground surface.

Total Depth: 49 ft bgs

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BORING LOG

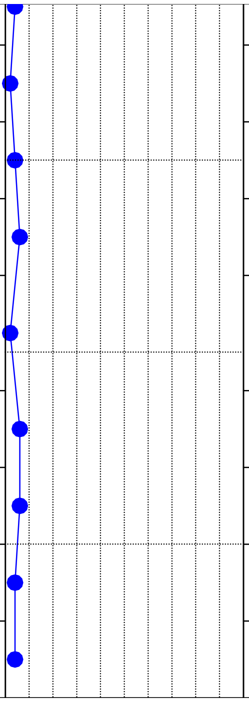
BOREHOLE ID: *SPT-03 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/09/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Continuous SPT / Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3.5"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198480.27*
EASTING: *2305994.51*
GROUND ELEVATION: *45.15 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value 0 10 20 30 40 50	Recovery	Comments
		(soil); trace silt; gray; wet; very loose Bottom 1': SILT (ML) (ash); gray; wet; very loose	▒				Bottom: 92.4% FC
		Top 1': SILT (ML) (ash); gray/dark tan; wet; very loose; Bottom 1': silty SAND (SM) (soil); gray; wet; very loose	▒ ░	1/18"-1		2.0'	Top: 43.4% MC; SG=2.343 Bottom: 1.2% Gravel, 82.5% Sand, 16.3% FC
10	-35	SILT (ML) (ash); gray; wet; very loose; scattered leaves	▒	1-1-1-3		1.4'	0.2% Gravel, 8.8% Sand, 80.5% Silt, 10.5% Clay; NP
		silty fine to medium SAND (SM) (soil); gray; wet; very loose	░	4-2-1-1		1.8'	24.5% FC
5	-40	Top 1': poorly graded fine to medium SAND with silt (SP-SM) (soil); gray; wet; very loose; black ash particles Bottom 2': SILT with sand (ML) (ash); gray/black; wet; very loose	░ ▒	1-1/30"		2.1'	Bottom: 77.3% FC The last blow drives the split spoon by 2.5'
		silty SAND (SM) (ash & soil); gray; wet; very loose	▒	1-2-1-2		2.0'	1.3% Gravel, 64.9% Sand, 32.2% Silt, 1.6% Clay
		SILT with sand (ML) (ash); gray; wet; very loose	▒	2-1-2-1		1.4'	44.9% FC
0	-45	silty SAND (SM) (ash); gray; wet; very loose	▒	2-1-1-1		1.5'	47'-49': NP Boring terminated at 49.0' bgs
		SILT with sand (ML) (ash); gray; wet; very loose	▒	1-1-1-2		2.0'	PZ-1971 installed after completion of boring; Screened from 17.0 - 22.0 ft bgs

All depths referenced to ground surface.

Total Depth: 49 ft bgs

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BORING LOG

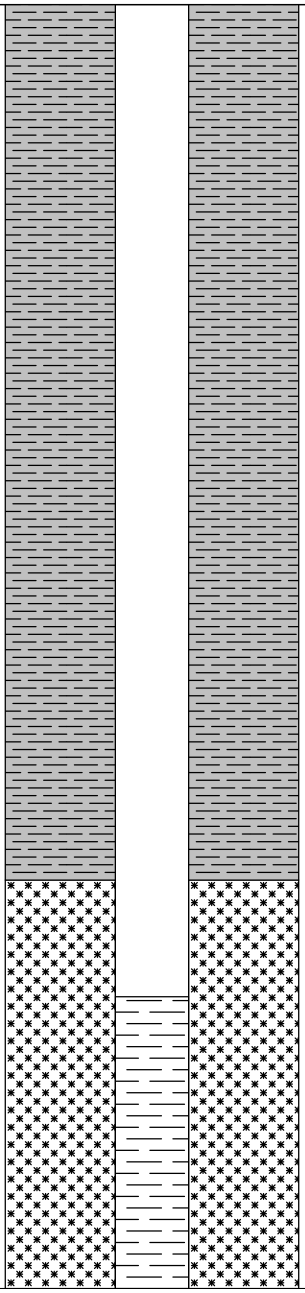
BOREHOLE ID: *PZ-1971 (within the 1971 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/09/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffery Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *Not Sampled*
NORTHING: *198,492.4*
EASTING: *2,305,987.6*
GROUND ELEVATION: *45.3*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Well Construction Details	Comments
45 40 35 30 25	0 -5 -10 -15 -20	PZ-1971 was installed approximately 15 ft from SPT-3. See SPT-3 for lithologic description.		A stickup protective outer casing extends to approximately 3 ft above ground surface.

All depths referenced to ground surface.

Total Depth: 22

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BORING LOG

BOREHOLE ID: *SPT-04 (on the 1984 Pond Dike)*

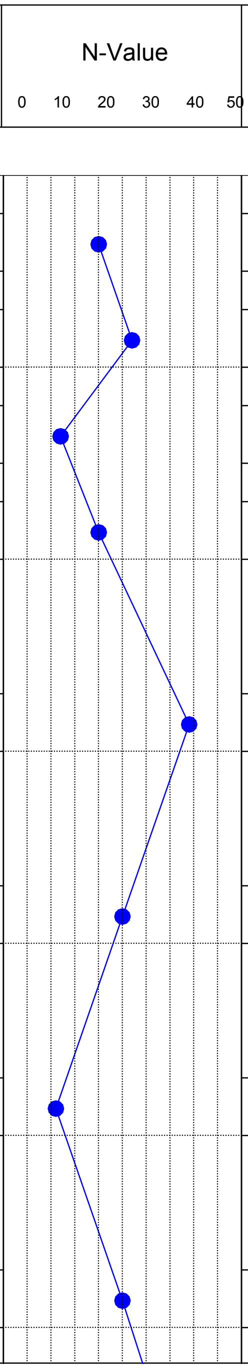
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/06/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3.5"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *199524.41*
EASTING: *2306083.54*
GROUND ELEVATION: *34.29 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	SPT Blows	Recovery	Comments
	0	poorly graded fine to medium SAND (SP) (Dike Fill); brown; moist; medium dense; top 0.3' road material	8-11-9	1.1'	
					Start using drilling mud
30	-5	poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; brown; wet; medium dense	8-10-17	0.7'	
		poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; brown; wet; medium dense	7-6-6	0.7'	3.2% FC
25	-10	poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; brown; wet; medium dense	5-9-11	0.7'	
20	-15	poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; brown (occasionally black); dense	9-17-22	0.8'	
15	-20	poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; brown/black; wet; medium dense	8-11-14	1.0'	0.4% Gravel, 96.6% Sand, 1.6% Silt, 1.4% Clay
10	-25	poorly graded fine to medium SAND (SP) (Foundation Soil); trace silt; light gray; wet; medium dense	7-5-6	0.5'	2.3% FC
					Thicken mud in drilling fluid
5	-30	poorly graded fine to medium SAND (SP) (Foundation Soil); trace silt; brown; wet; medium dense	9-11-14	1.0'	



All depths referenced to ground surface.

Total Depth: 35 ft bgs

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BORING LOG

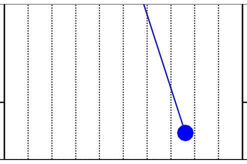
BOREHOLE ID: *SPT-04 (on the 1984 Pond Dike)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/06/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3.5"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *199524.41*
EASTING: *2306083.54*
GROUND ELEVATION: *34.29 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value 0 10 20 30 40 50	Recovery	Comments
0	-35	poorly graded fine to medium SAND (SP) (Foundation Soil); trace silt; brown; wet; dense	▨	11-16-22		1.4'	2.7% FC; SG=2.694 Terminated at 35' bgs

All depths referenced to ground surface.

Total Depth: 35 ft bgs

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BORING LOG

BOREHOLE ID: *SPT-05 (on the 1984 Pond Dike)*

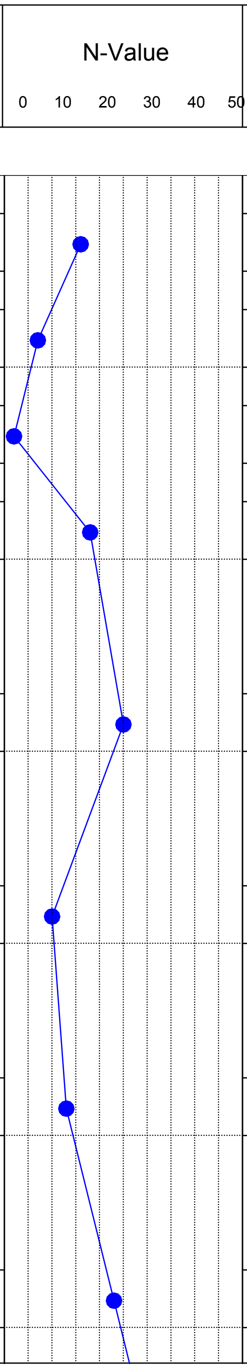
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/08/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3.5"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *200793.06*
EASTING: *2305614.87*
GROUND ELEVATION: *33.84 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery	Comments
	0						
		poorly graded fine to medium SAND with silt (SP-SM) (Dike Fill); brown; dry to moist; medium dense; top 0.3' road material		7-9-7		0.9'	
30	-5	poorly graded fine to medium SAND with silt (SP-SM) (Dike Fill); brown; wet; loose		4-3-4		0.8'	Start using drilling mud
		poorly graded fine to medium SAND with silt (SP-SM) (Dike Fill); brown; wet; very loose		2-1-1		0.5'	8.0% FC
25	-10	poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; gray/brown; wet; medium dense		2-6-12		0.9'	0.0% Gravel, 97.4% Sand, 2.6% FC
20	-15	poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; brown; wet; medium dense		9-11-14		1.0'	
15	-20	poorly graded fine to medium SAND (SP) (Foundation Soil); trace silt; brown; wet; loose		3-5-5		0.7'	0.9% Gravel, 97.4% Sand, 1.1% Silt, 0.6% Clay
10	-25	fine to medium SAND (SP) (Foundation Soil); trace silt; brown; wet; medium dense		5-6-7		0.7'	
5	-30	fine to medium SAND (SP) (Foundation Soil); trace silt; brown; wet; medium dense		12-11-12		0.8'	4.1% FC



All depths referenced to ground surface.

Total Depth: 40 ft bgs

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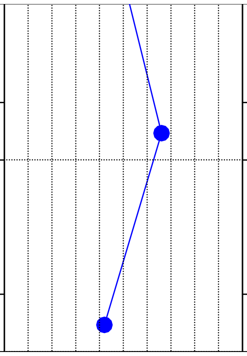
BORING LOG

BOREHOLE ID: *SPT-05 (on the 1984 Pond Dike)*

GENERAL INFORMATION	TECHNICAL INFORMATION
PROJECT NAME: L.V. Sutton Steam Electric Plant	**DRILLING METHOD:** *Rotary Wash*
PROJECT NO: *GC5592*	**RIG TYPE:** *CME 45C Track Rig (Serial # 273964)*
SITE LOCATION: *Wilmington, North Carolina*	**BOREHOLE DIA:** *3.5"*
BORING DATE: *05/08/2014*	**SAMPLING METHOD:** *SPT with Split Spoon*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*	**NORTHING:** *200793.06*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*	**EASTING:** *2305614.87*
DRILLER NAME: *Jeffrey Stewart*	**GROUND ELEVATION:** *33.84 ft (NAVD88)*



Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value 0 10 20 30 40 50	Recovery	Comments
0	-35	silty poorly graded fine to medium SAND (SM) (Foundation Soil); brown; wet; dense	▨	12-14-19	●	0.9'	
-5	-40	silty fine to medium SAND (SM) (Foundation Soil); brown; wet; medium dense	▨	8-10-11	●	1.1'	Boring terminated at 40' bgs

All depths referenced to ground surface.

Total Depth: 40 ft bgs

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BORING LOG

BOREHOLE ID: *SPT-06 (on the 1984 Pond Dike)*

GENERAL INFORMATION

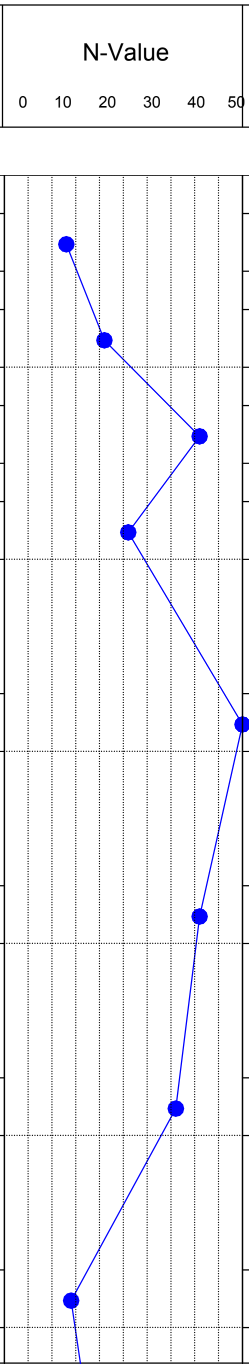
PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/06/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3.5"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *201169.82*
EASTING: *2304341.56*
GROUND ELEVATION: *33.68 ft (NAVD88)*

Lithologic Description	SPT Blows	Recovery	Comments
poorly graded fine to medium SAND (SP) (Dike Fill); brown; dry to moist; medium dense; top 0.3' road material	5-6-7	1.2'	
poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; brown; wet; medium dense; top 0.2' gravel lense	5-9-12	1.0'	Start using drilling mud
fine to medium SAND with clay (SP-SC) (Dike Fill); trace fine gravel; brown; wet; dense	10-17-24	1.3'	
poorly graded fine to medium SAND with silt (SP-SM) (Dike Fill); brown; wet; medium dense	8-12-14	0.9'	
poorly graded fine to medium SAND with silt (SP-SM) (Dike Fill); trace gravel (1" lense); brown; wet; very dense	9-22-32	0.9'	SPT N-value = 54
poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; brown (occasionally gray); wet; dense	12-19-22	0.7'	Thicken mud in drilling fluid 3.9% FC
fine to medium SAND (SP) (Possible Dike Fill); brown (occasionally gray); wet; dense	10-15-21	0.8'	
fine to medium SAND (SP) (Foundation Soil); trace silt; brown/white; wet; medium dense	6-7-7	0.8'	0.1% Gravel, 97.1% Sand, 2.2% Silt, 0.6% Clay

Elev. (ft): 30, 25, 20, 15, 10, 5
Depth (ft): 0, -5, -10, -15, -20, -25, -30



All depths referenced to ground surface.
Total Depth: 50 ft bgs

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BORING LOG

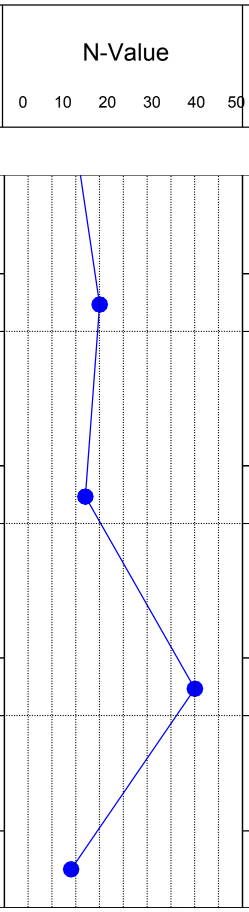
BOREHOLE ID: *SPT-06 (on the 1984 Pond Dike)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/06/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3.5"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *201169.82*
EASTING: *2304341.56*
GROUND ELEVATION: *33.68 ft (NAVD88)*



Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery	Comments
							Thicken mud in drilling fluid
0	-35	fine to medium SAND (SP) (Foundation Soil); dark brown; wet; medium dense		6-8-12		0.8'	SG=2.693
-5	-40	fine to medium SAND (SP) (Foundation Soil); brown; wet; medium dense		5-6-11		0.8'	
-10	-45	fine to medium SAND (SP) (Foundation Soil); trace silt; white/brown; wet; dense		9-19-21		1.0'	4.7% FC
-15	-50	fine to medium SAND (SP) (Foundation Soil); brown; medium dense		5-6-8		1.0'	Boring terminated at 50' bgs

All depths referenced to ground surface.

Total Depth: 50 ft bgs

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BORING LOG

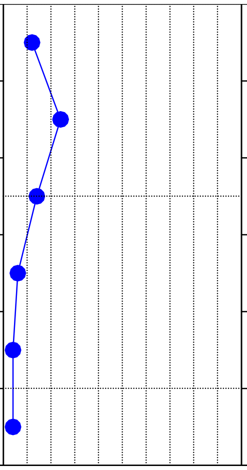
BOREHOLE ID: *SPT-07 (within the 1984 Pond)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/07/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Continuous SPT*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *2.0"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *199252.49*
EASTING: *2305887.88*
GROUND ELEVATION: *32.81 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value 0 10 20 30 40 50	Recovery	Comments
	0	sandy SILT (ML) (ash); gray; moist; scattered wood chips; loose	▨	2-2-4-6		1.5'	
30		SILT with sand (ML) (ash); gray; moist; scattered wood chips; medium dense		5-7-5-8		1.8'	31.1% MC
	-5	SILT (ML) (ash); gray; moist (wet at tip); loose		4-4-3-2		1.8'	Environmental Sample: SS-SPT7 (4.0-6.0)-20140507
25		SILT (ML) (ash); gray; moist (wet at bottom 0.7'); very loose		1-2-1-1		1.7'	52.9% MC; NP
		SILT (ML) (ash); gray; moist; very loose		1-1-1-1		1.1'	0.0% Gravel, 9.5% Sand, 90.5% FC
	-10	SILT (ML) (ash); gray/dark tan; moist (top 0.7' wet); very loose		1/12"-1-1		1.3'	81.2% FC; SG=2.354 Boring terminated at 12' bgs

All depths referenced to ground surface.
Total Depth: 12 ft bgs

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BORING LOG

BOREHOLE ID: *SPT-08 (on the 1984 Pond Dike)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant

PROJECT NO: *GC5592*

SITE LOCATION: *Wilmington, North Carolina*

BORING DATE: *05/07/2014*

GEOSYNTEC REPRESENTATIVE: *Weston Shin*

DRILLING CONTRACTOR: *Mid-Atlantic Drilling*

DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*

RIG TYPE: *CME 45C Track Rig (Serial # 273964)*

BOREHOLE DIA: *3.5"*

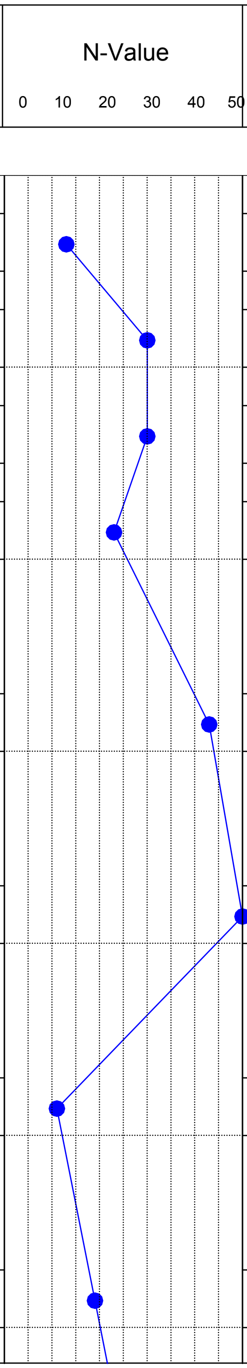
SAMPLING METHOD: *SPT with Split Spoon*

NORTHING: *199898.75*

EASTING: *2304200.60*

GROUND ELEVATION: *33.14 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	Recovery	Comments
	0	poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; brown; dry to moist; medium dense; top 0.4' road material		8-5-8	0.9'	
30	-5	poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; brown; wet; medium dense		10-14-16	0.6'	Start using drilling mud 4.4% FC
		poorly graded fine to medium SAND (SP) (Dike Fill); trace silt; brown/gray; wet; medium dense		10-15-15	0.7'	
25	-10	poorly graded fine to medium SAND with silt (SP-SM) (Dike Fill); brown/white/gray; wet; medium dense		5-10-13	0.9'	
20	-15	poorly graded fine to medium SAND with silt (SP-SM) (Dike Fill); brown; wet; dense		9-19-24	1.1'	
15	-20	poorly graded fine to medium SAND with silt (SP-SM) (Dike Fill); brown; wet; very dense		14-21-30	0.8'	0.0% Gravel, 94.6% Sand, 3.1% Silt, 2.3% Clay SPT N-value = 51
						Thicken mud in drilling fluid
10	-25	poorly graded fine to medium SAND (SP) (Foundation Soil); trace silt; brown/dark brown/white/gray; wet; medium dense		6-6-5	0.6'	0.3% Gravel, 96.3% Sand, 2.5% Silt, 0.9% Clay
5	-30	poorly graded fine to medium SAND (SP) (Foundation Soil); brown; wet; medium dense		6-9-10	0.8'	



All depths referenced to ground surface.

Total Depth: 45 ft bgs

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BORING LOG

BOREHOLE ID: *SPT-08 (on the 1984 Pond Dike)*

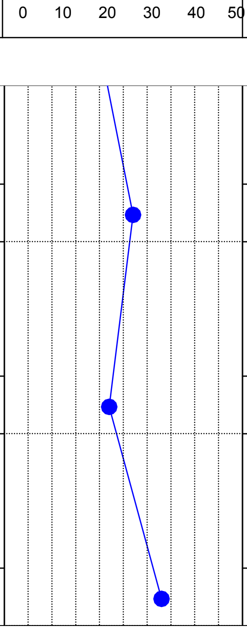
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/07/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3.5"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *199898.75*
EASTING: *2304200.60*
GROUND ELEVATION: *33.14 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery	Comments
0	-35	poorly graded fine to medium SAND (SP) (Foundation Soil); white; wet; medium dense		10-11-16		1.0'	
-5	-40	poorly graded fine to medium SAND (SP) (Foundation Soil); trace silt; white; wet; medium dense		10-12-10		0.7'	3.3% FC
-10	-45	poorly graded fine to medium SAND (SP) (Foundation Soil); white; wet; dense		11-15-18		1.1'	Boring terminated at 45' bgs



All depths referenced to ground surface.
Total Depth: 45 ft bgs

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BORING LOG

BOREHOLE ID: *SPT-09 (in 2006 Containment Area)*

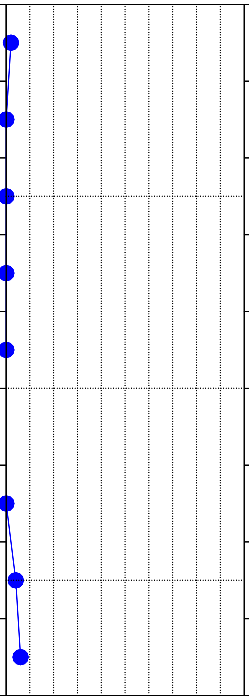
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Electric Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/07/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffrey Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Continuous SPT*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *4.5"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *200420.50*
EASTING: *2304536.30*
GROUND ELEVATION: *39.86 ft (NAVD88)*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value 0 10 20 30 40 50	Recovery	Comments
	0	SILT with fine sand (ML) (ash); gray; moist; very loose; scattered leaves		1/12"-1/12"		1.3'	
		SILT (ML) (ash); gray; moist (bottom 0.4' wet); very loose; scattered leaves		WOH		0.7'	73.7% MC
35	-5	SILT (ML) (ash); gray; wet; very loose		WOH		1.5'	
		SILT (ML) (ash); gray; wet; very loose		WOH		1.6'	NP
		SILT (ML) (ash); gray (occasionally dark tan); wet; very loose		WOH		1.7'	97.0% FC
30	-10					2.0'	Shelby Tube (10.0 to 12.0 ft bgs) 54.8% MC; 6.0% Sand, 88.0% Silt, 6.0% Clay; NP; DD=61.6 pcf; SG=2.268
		SILT (ML) (ash); gray/black; wet; very loose		WOH		1.8'	92.8% FC Environmental Sample: SS-SPT9 (12 to 14)-20140507
25	-15	SILT (ML) (ash); gray; wet; very loose		WOH-1-1-2		1.5'	45.8% MC; NP
		SILT (bottom 0.3' sandier) (ML) (ash); gray; wet; very loose		2-2-1-1		1.7'	Boring terminated at 18' bgs Piezometer PZ-INT installed after completion of boring. Screened depth from 13.0 - 18.0 ft bgs



All depths referenced to ground surface.
Total Depth: 18 ft bgs

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BORING LOG

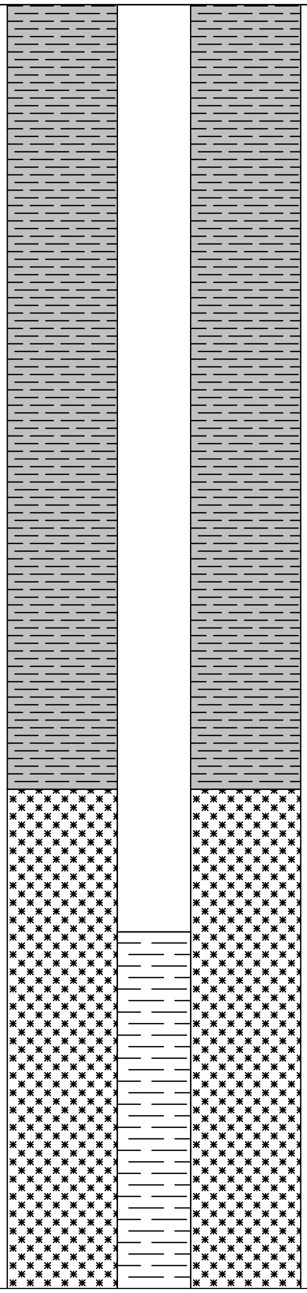
BOREHOLE ID: *PZ-INT (in 2006 Containment Area)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *05/07/2014*
GEOSYNTEC REPRESENTATIVE: *Weston Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *Jeffery Stewart*

TECHNICAL INFORMATION

DRILLING METHOD: *Continuous SPTs/Rotary Wash*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *200,420.5*
EASTING: *2,304,536.3*
GROUND ELEVATION: *39.9*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Well Construction Details	Comments
35 30 25	0 -5 -10 -15	PZ-INT is co-located with SPT-9. See SPT-9 log for lithologic description.		A stickup protective outer casing extends to approximately 3 ft above ground surface.

All depths referenced to ground surface.

Total Depth: 18

Attachment 1.6

Geosyntec 2014 October/November Boring Logs & As-Built Piezometer Construction Details

Legend for Classification Symbols

Pattern	Description
▩	SP – poorly graded sands
▚	SW – well graded sands
⁘	GP – poorly graded gravels
▞	GW – well graded gravels
▥	SM – silty sands
▦	SP-SM – poorly graded sand with silty sand
▧	SP-SC – poorly graded sand with clayey sand
▥	MH – elastic silts
▥	ML – inorganic silts with slight plasticity
▩	SC – clayey sands
▨	CL – lean clays
▨	CH – fat clays
≋	OH – organic clays
■	Ash

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1300 South Mint Street
Suite 410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *PZ-101 (on the 2006 Dike)*

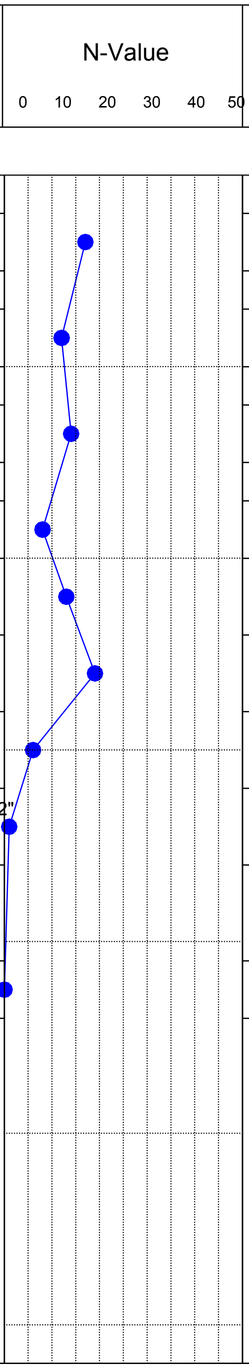
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Dewatering Design
PROJECT NO: *GC5650*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *10/29/2014*
GEOSYNTEC REPRESENTATIVE: *M. Martin, W. Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45B (SN 221904)*
BOREHOLE DIA: *4.0"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *200,675.44*
EASTING: *2,204,779.79*
GROUND ELEVATION: *42.0*

Elev. (ft)	Depth (ft)	Lithologic Description	SPT Blows	Recovery	Comments
	0				
40		Top 0.4' SAND (SW)(soil); grey; moist; medium dense Bottom 0.8' fine sandy SILT (ML) (ash); grey; moist; medium dense; wood chips	6-8-9	1.2'	
					Start using Drilling Mud
	-5	SILT with fine sand (ML) (ash); grey; wet; medium dense	7-6-6	1.0'	
35		SILT with fine sand (ML) (ash); grey; wet; medium dense	6-6-8	1.0'	
	-10	SILT with fine sand (ML) (ash); grey; wet; loose	4-3-5	1.1'	
30		SILT with fine sand (ML) (ash); grey; wet; medium dense; occasional organic matter	4-6-7-8	1.4'	
		SILT with fine sand (ML) (ash); grey; wet; medium dense	6-9-10-12	1.5'	
▽	-15	fine sandy SILT (ML) (ash); grey/ black; wet; loose	4-3-3-2	1.4'	Water level at least 24 hours after piezomenter development: El. 27.9 ft. (NAVD88)
25		SILT with fine sand (ML) (ash); grey/black; wet; very loose	WOH-1-1/12"	1.9'	
	-20				
20		SILT (ML) (ash); trace fine sand; grey; wet; very loose	WOH	1.4'	Boring Terminated at 22.0' BGS
	-25				
15					
	-30				



All depths referenced to ground surface.

Total Depth: 22.0

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BORING LOG

BOREHOLE ID: *PZ-102 (on the 2006 Dike)*

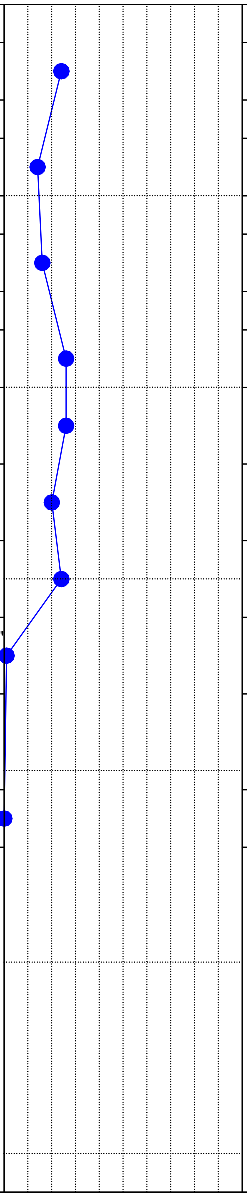
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Dewatering Design
PROJECT NO: *GC5650*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *10/29/2014*
GEOSYNTEC REPRESENTATIVE: *M. Martin, W. Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45B (SN 221904)*
BOREHOLE DIA: *4.0"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *200,868.15*
EASTING: *2,305,186.86*
GROUND ELEVATION: *41.4*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery	Comments
	0						
40		Top 1.0' SAND (SW)(possible soil); grey; moist; medium dense Bottom 0.5' SILT with fine sand (ML) (ash); grey; moist; medium dense; wood chips	⊠ ▒	3-5-7		1.5'	
			▒				Start using Drilling Mud Wood debris was observed in the return fluid between 2'-3' BGS
	-5	SILT with fine sand (ML) (ash); grey; wet; loose	▒	2-3-4		0.9'	
35		SILT with fine sand (ML) (ash); grey; wet; loose	▒	2-2-6		1.1'	
	-10	SILT with fine sand (ML) (ash); grey; wet; medium dense	▒	5-5-8		1.0'	
30		SILT with fine sand (ML) (ash); grey; wet; medium dense	▒	3-7-6-4		1.25'	
▽		SILT with fine sand (ML) (ash); grey; wet; loose	▒	2-5-5-11		1.8'	Water level at least 24 hours after piezometer development: El. 28.5 ft. (NAVD88)
	-15	SILT with fine sand (ML) (ash); grey; wet; medium dense	▒	7-7-5-4		1.1'	
25		SILT (ML) (ash); trace fine sand; black; wet; very loose	▒	1/12"-1/12"		2.0'	
	-20		▒				
20		SILT (ML) (ash); grey; wet; very loose	▒	WOH		2.2'	Boring Terminated at 22.0' BGS
	-25						
15							
	-30						



All depths referenced to ground surface.

Total Depth: 22.0

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BORING LOG

BOREHOLE ID: *NEWHA-005-PZ-103 (on the 1984 Dike)*

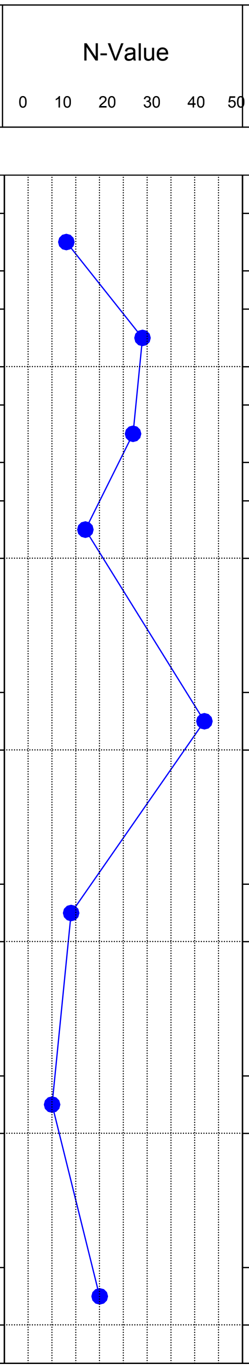
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Dewatering Design
PROJECT NO: *GC5650*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *10/30/2014*
GEOSYNTEC REPRESENTATIVE: *M. Martin, W. Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45B (SN 221904)*
BOREHOLE DIA: *4.0"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *200,329.16*
EASTING: *2,205,784.76*
GROUND ELEVATION: *34.3*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	Recovery	Comments
	0					
		SAND (SW) (dike fill); brown/white; moist; medium dense	⊠	9-6-7	1.4'	Start using Drilling Mud
30	-5	fine to medium SAND (SP) (dike fill); brown; wet; medium dense	▨	7-13-16	1.0'	
		fine to medium SAND (SP) (dike fill); brown; wet; medium dense	▨	9-12-15	1.0'	
25	-10	fine to medium SAND (SP) (dike fill); brown; wet; medium dense	▨	5-8-9	1.0'	
20	-15	fine to medium SAND (SP) (dike fill); brown; wet; dense	▨	5-15-27	0.8'	
15	-20	fine to medium SAND (SP) (foundation soil); brown; wet; medium dense	▨	4-6-8	0.9'	
▽ 10	-25	fine to medium SAND (SP) (foundation soil); brown; wet; loose	▨	4-5-5	0.6'	Water level at least 24 hours after piezometer development: El. 10.5 ft. (NAVD88)
5	-30	fine to medium SAND (SP) (foundation soil); brown; wet; medium dense	▨	9-9-11	0.8'	Boring Terminated at 30.0; BGS



All depths referenced to ground surface.
Total Depth: 30.0

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BORING LOG

BOREHOLE ID: *NEWHA-005-PZ-104 (on the 1984 Dike)*

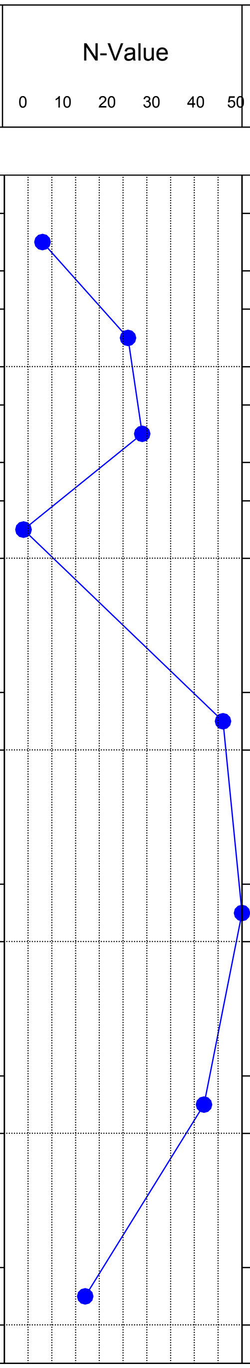
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Dewatering Design
PROJECT NO: *GC5650*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *11/4/2014*
GEOSYNTEC REPRESENTATIVE: *M. Martin, W. Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45B (SN 221904)*
BOREHOLE DIA: *4.0"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *200,008.41*
EASTING: *2,304,134.25*
GROUND ELEVATION: *32.9*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value 0 10 20 30 40 50	Recovery	Comments
	0						
		fine to medium SAND (SP) (dike fill); brown; moist; loose	▨	4-3-5		1.3'	
30			▨				Start using Drilling Mud
	-5	fine to medium SAND (SP) (dike fill); brown; wet; medium dense; organic material	▨	8-11-15		1.0'	
25		fine to medium SAND (SP) (dike fill); brown/grey; wet; medium dense	▨	11-14-15		0.8'	
	-10	fine to medium SAND (SP) (dike fill); grey; wet; very loose	▨	5-2-2		1.1'	
20	-15	fine to medium SAND (SP) (dike fill); brown; wet; dense	▨	11-17-29		1.0'	
15	-20	fine to medium SAND (SP) (dike fill); brown; wet; very dense; trace organic material	▨	13-23-34		1.1'	N=57
10 ▽	-25	fine to medium SAND (SP) (possible dike fill); brown/grey; wet; dense	▨	14-20-22		0.8'	Water level at least 24 hours after piezometer development: El. 8.5 ft. (NAVD88)
5	-30	fine to medium SAND (SP) (foundation soil); dark brown; wet; medium dense	▨	4-7-10		0.9'	Boring Terminated at 30.0' BGS



All depths referenced to ground surface.

Total Depth: 30.0

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BORING LOG

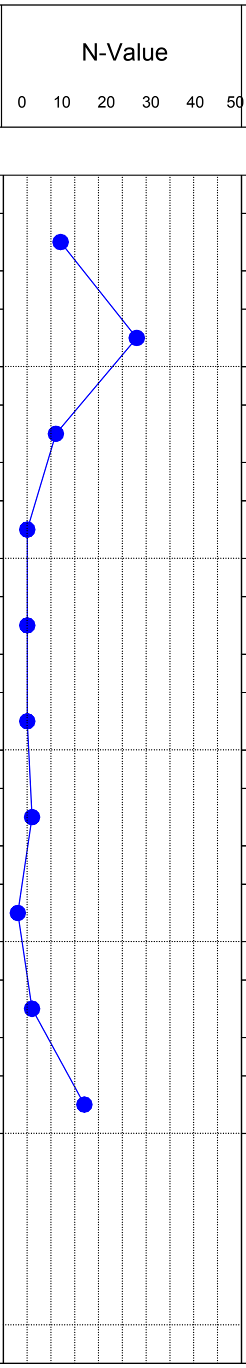
BOREHOLE ID: *NEWHA-004-PZ-105 (on the 1971 Dike)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Dewatering Design
PROJECT NO: *GC5650*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *11/3/2014*
GEOSYNTEC REPRESENTATIVE: *M. Martin, W. Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45B(SN 221904)*
BOREHOLE DIA: *4.0"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198,085.02*
EASTING: *2,305,518.66*
GROUND ELEVATION: *27.7*



Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	Recovery	Comments
	0					
		fine to medium SAND (SP) (dike fill); brown; moist; medium dense	▨	3-5-7	1.2'	
25			▨			Start using Drilling Mud
		fine to medium SAND (SP) (dike fill); trace silt (possible ash); grey; wet; medium dense	▨	12-13-15	1.3'	
	-5		▨			
		fine to medium SAND (SP) (dike fill); grey; wet; medium dense	▨	5-6-5	1.1'	
20			▨			
		fine to medium SAND with silt (SP-SM) (soil and possble ash); grey; wet; loose	▒	3-2-3	0.7'	
	-10		▒			
		fine to medium SAND with silt (SP-SM) (soil and possble ash); grey; wet; loose	▒	2-2-3	0.9'	
15			▒			
		fine to medium SAND with silt (SP-SM) (soil and possble ash); brown/grey; wet; loose	▒	2-2-3	0.7'	
	-15		▒			
		SILT with fine to medium sand (ML) (soil and ash); grey; wet; loose	▒	2-3-3	1.5'	
10			▒			
▽		SILT (ML) (soil and ash); trace fine sand; grey; wet; very loose	▒	1-1-2	1.0'	Water level at least 24 hours after piezometer development: El. 8.5 ft. (NAVD88)
	-20		▒			
		Top 0.4' SILT (ML) (soil and ash); trace fine sand; grey; wet; loose Bottom 0.6' fine to medium SAND (SP) (foundation soil); brown; wet; loose	▒ ▨	1-2-4	1.0'	
5			▨			
		fine to medium SAND (SP) (foundation soil); brown, wet; medium dense	▨	6-8-9	0.8'	
	-25					Boring Terminated at 25.0' BGS
0						
	-30					

All depths referenced to ground surface.

Total Depth: 25.0

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BORING LOG

BOREHOLE ID: *NEWHA-004-PZ-106 (on the 1971 Dike)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Dewatering Design

PROJECT NO: *GC5650*

SITE LOCATION: *Wilmington, North Carolina*

BORING DATE: *11/3/2014*

GEOSYNTEC REPRESENTATIVE: *M. Martin, W. Shin*

DRILLING CONTRACTOR: *Mid-Atlantic Drilling*

DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*

RIG TYPE: *CME 45B(SN 221904)*

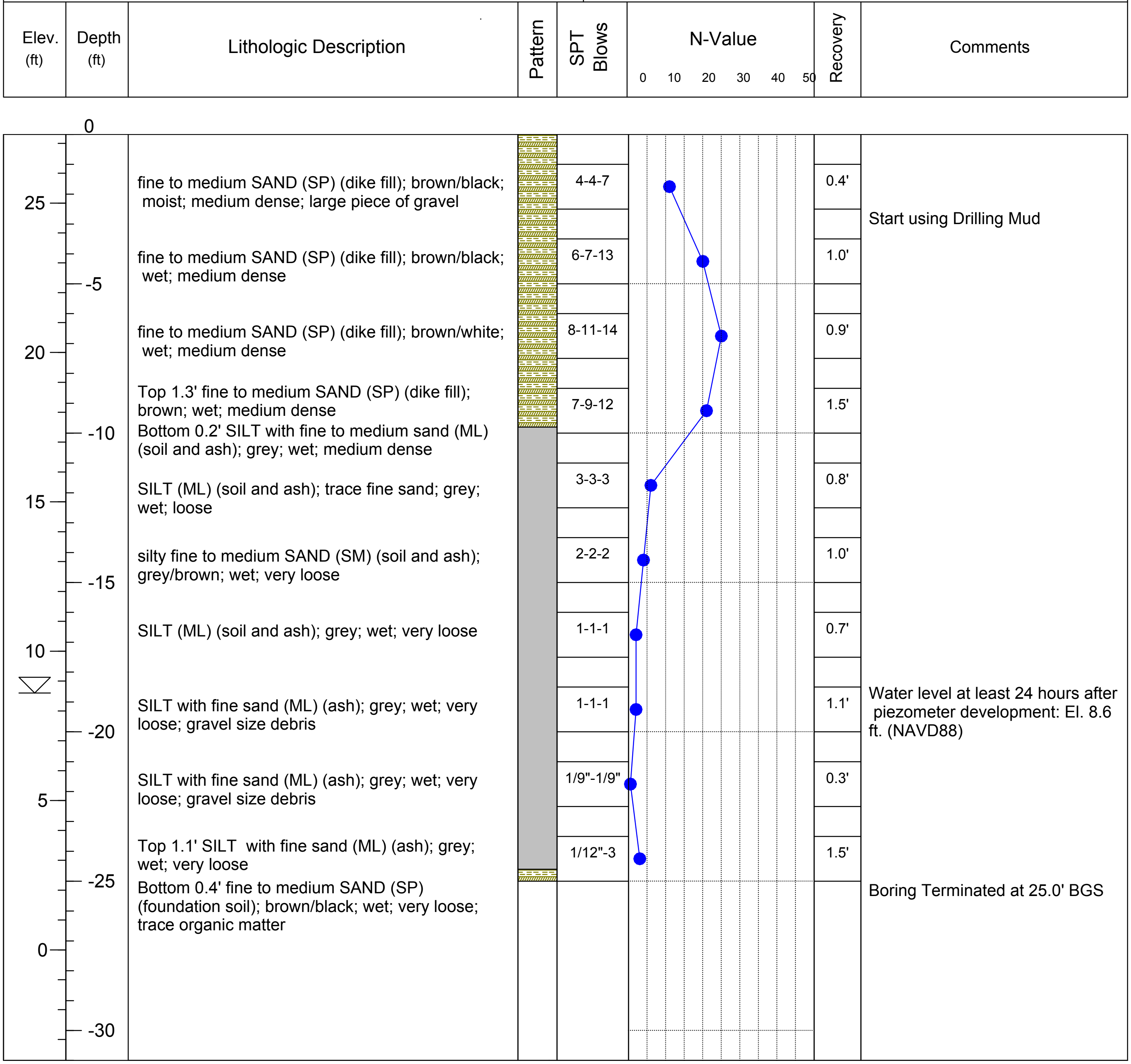
BOREHOLE DIA: *4.0"*

SAMPLING METHOD: *SPT with Split Spoon*

NORTHING: *198,414.87*

EASTING: *2,304,821.39*

GROUND ELEVATION: *27.3*



Lithologic Description	SPT Blows	Recovery	Comments
fine to medium SAND (SP) (dike fill); brown/black; moist; medium dense; large piece of gravel	4-4-7	0.4'	Start using Drilling Mud
fine to medium SAND (SP) (dike fill); brown/black; wet; medium dense	6-7-13	1.0'	
fine to medium SAND (SP) (dike fill); brown/white; wet; medium dense	8-11-14	0.9'	
Top 1.3' fine to medium SAND (SP) (dike fill); brown; wet; medium dense Bottom 0.2' SILT with fine to medium sand (ML) (soil and ash); grey; wet; medium dense	7-9-12	1.5'	
SILT (ML) (soil and ash); trace fine sand; grey; wet; loose	3-3-3	0.8'	
silty fine to medium SAND (SM) (soil and ash); grey/brown; wet; very loose	2-2-2	1.0'	
SILT (ML) (soil and ash); grey; wet; very loose	1-1-1	0.7'	
SILT with fine sand (ML) (ash); grey; wet; very loose; gravel size debris	1-1-1	1.1'	Water level at least 24 hours after piezometer development: El. 8.6 ft. (NAVD88)
SILT with fine sand (ML) (ash); grey; wet; very loose; gravel size debris	1/9"-1/9"	0.3'	
Top 1.1' SILT with fine sand (ML) (ash); grey; wet; very loose Bottom 0.4' fine to medium SAND (SP) (foundation soil); brown/black; wet; very loose; trace organic matter	1/12"-3	1.5'	Boring Terminated at 25.0' BGS

All depths referenced to ground surface.

Total Depth: 25.0

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BORING LOG

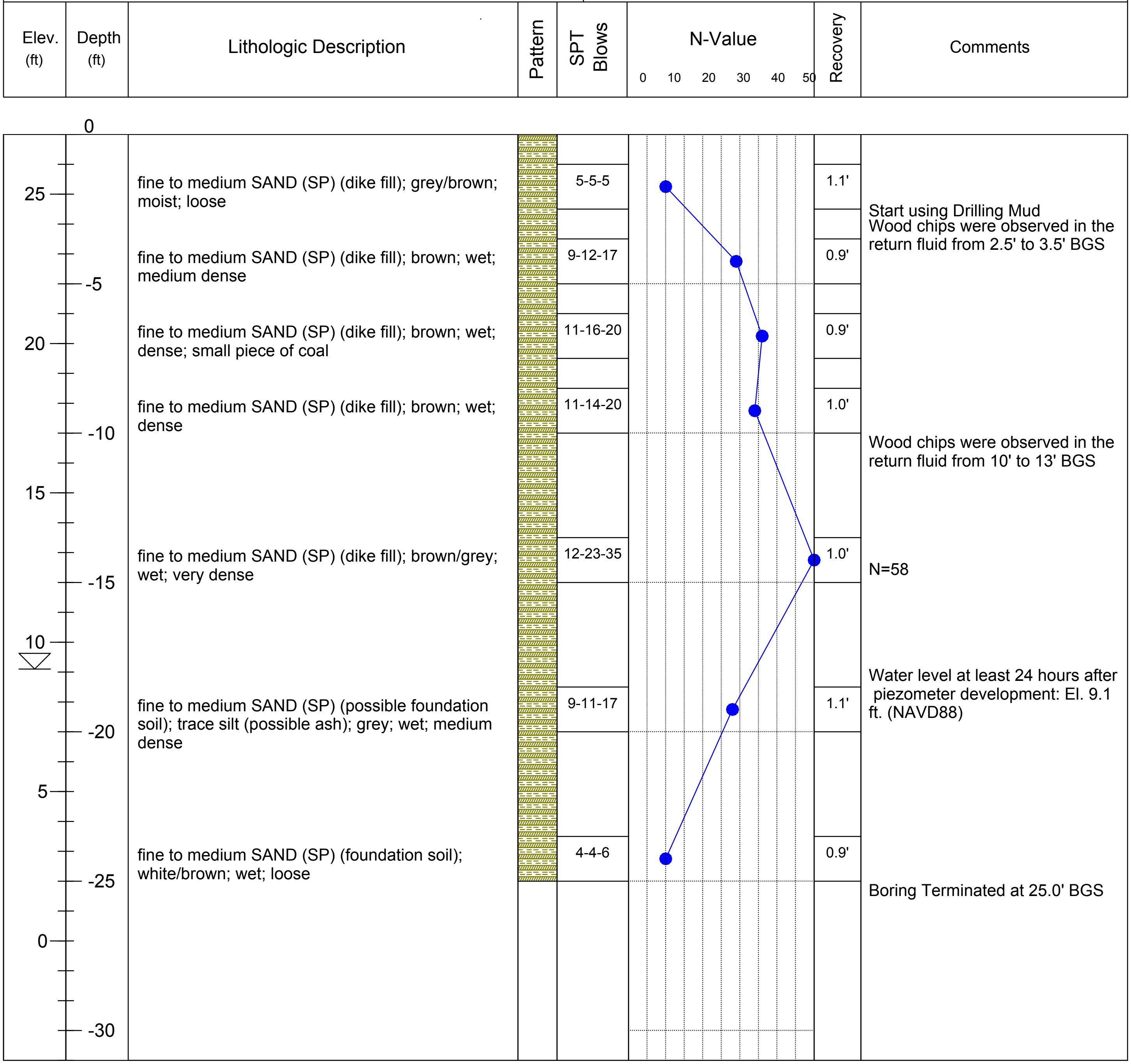
BOREHOLE ID: *NEWHA-004-PZ-107 (on the 1971 Dike)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Dewatering Design
PROJECT NO: *GC5650*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *10/31/2014*
GEOSYNTEC REPRESENTATIVE: *M. Martin, W. Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45B(SN 221904)*
BOREHOLE DIA: *4.0"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198,966.56*
EASTING: *2,304,088.68*
GROUND ELEVATION: *27.0*



Lithologic Description	SPT Blows	Recovery	Comments
fine to medium SAND (SP) (dike fill); grey/brown; moist; loose	5-5-5	1.1'	
fine to medium SAND (SP) (dike fill); brown; wet; medium dense	9-12-17	0.9'	Start using Drilling Mud Wood chips were observed in the return fluid from 2.5' to 3.5' BGS
fine to medium SAND (SP) (dike fill); brown; wet; dense; small piece of coal	11-16-20	0.9'	
fine to medium SAND (SP) (dike fill); brown; wet; dense	11-14-20	1.0'	
			Wood chips were observed in the return fluid from 10' to 13' BGS
fine to medium SAND (SP) (dike fill); brown/grey; wet; very dense	12-23-35	1.0'	N=58
fine to medium SAND (SP) (possible foundation soil); trace silt (possible ash); grey; wet; medium dense	9-11-17	1.1'	Water level at least 24 hours after piezometer development: El. 9.1 ft. (NAVD88)
fine to medium SAND (SP) (foundation soil); white/brown; wet; loose	4-4-6	0.9'	Boring Terminated at 25.0' BGS

All depths referenced to ground surface.

Total Depth: 25.0

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BORING LOG

BOREHOLE ID: *PZ-108S (within the 1971 Ash Basin)*

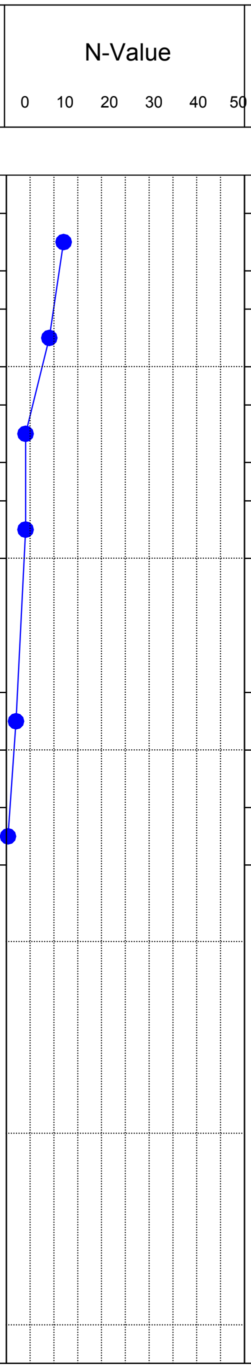
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Dewatering Design
PROJECT NO: *GC5650*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *10/28/2014*
GEOSYNTEC REPRESENTATIVE: *M. Martin, W. Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45B(SN 221904)*
BOREHOLE DIA: *4.0"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198,487.71*
EASTING: *2,304,871.17*
GROUND ELEVATION: *33.8*

Lithologic Description	SPT Blows	Recovery	Comments
sandy SILT (ML) (ash); grey; moist; medium dense	2-5-7	0.8'	Start using Drilling Mud
sandy SILT (ML) (ash); grey; wet; loose	4-5-4	0.6'	
sandy SILT (ML) (ash); grey; wet; very loose	2-2-2	1.2'	
sandy SILT (ML) (ash); black; wet; very loose	2-2-2	1.0'	
sandy SILT (ML) (ash); grey/black; wet; very loose	2-1-1	0.6'	
sandy SILT (ML) (ash); grey; wet; very loose	1/18"	1.4'	
			Boring Terminated at 18.0' BGS. Piezometer was dry at least 24 hours after development.



All depths referenced to ground surface.

Total Depth: 18.0

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BORING LOG

BOREHOLE ID: *PZ-108D (within the 1971 Ash Basin)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Dewatering Design
PROJECT NO: *GC5650*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *10/28/2014*
GEOSYNTEC REPRESENTATIVE: *M. Martin, W. Shin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

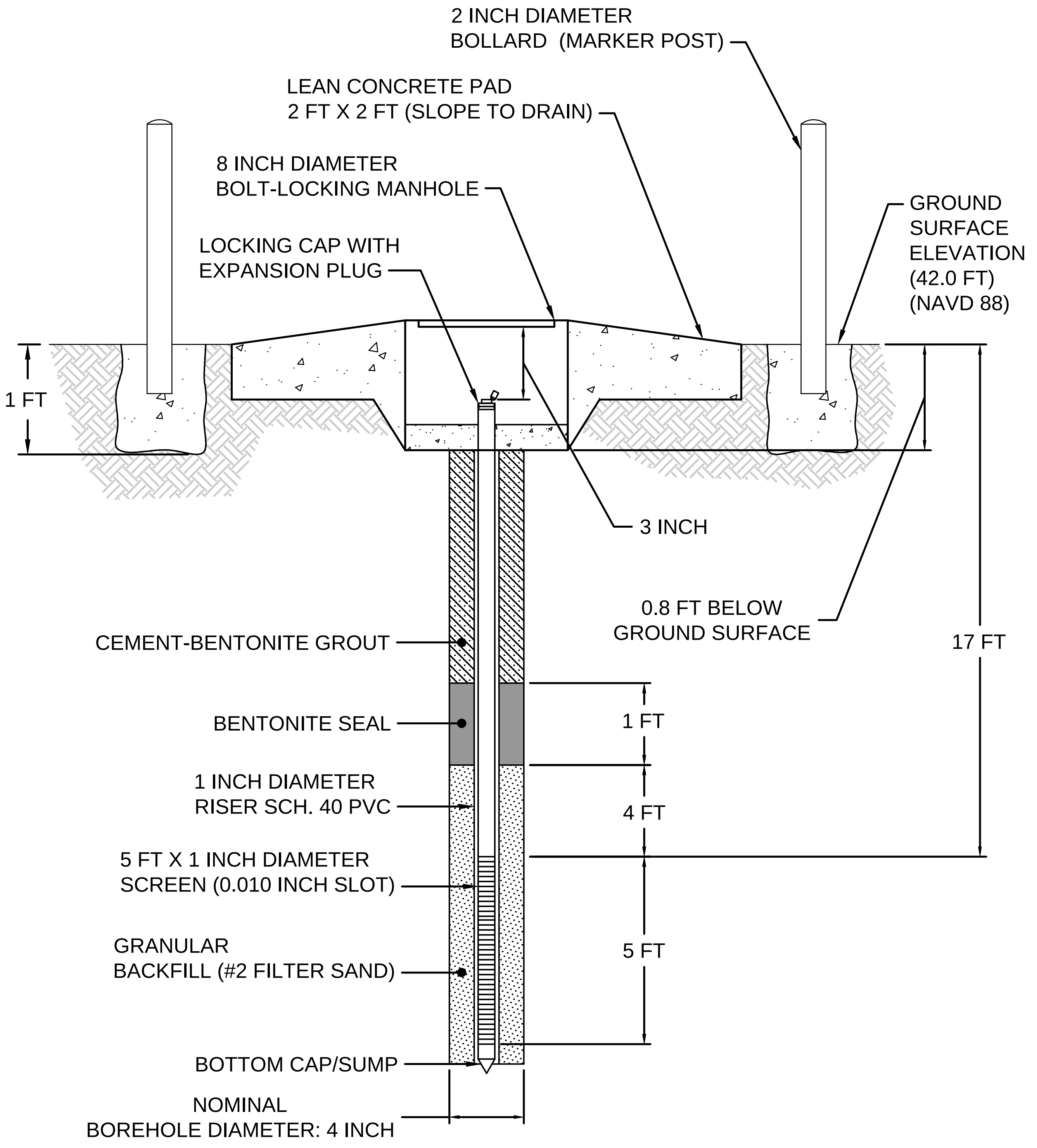
TECHNICAL INFORMATION

DRILLING METHOD: *Rotary Wash*
RIG TYPE: *CME 45B(SN 221904)*
BOREHOLE DIA: *4.0"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198,492.19*
EASTING: *2,304,861.07*
GROUND ELEVATION: *33.8*

Elev. (ft)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value 0 10 20 30 40 50	Recovery	Comments
	0						Start using Drilling Mud See Log for PZ-108S for 0' to 18' BGS
30	-5						
25	-10						
20	-15						
15	-20	fine to medium sandy SILT (ML) (ash); grey; wet; very loose	▨	1/12"-1	●	0.6'	
10 ▽	-25	fine to medium sandy SILT (ML) (ash); grey; wet; very loose; organic material	▨	1-1-1	●	1.5'	Water level at least 24 hours after piezometer development: El. 9.1 ft. (NAVD88)
5	-30	Top 1.8' fine sandy SILT (ML) (ash); grey; wet; very loose; organic material Bottom 0.2' organic CLAY (OH); brown; wet; very soft	▨	1-1-1	●	2.0'	Boring Terminated at 30.0' BGS

All depths referenced to ground surface.

Total Depth: 30.0



NOT TO SCALE

NOTE:

1. THE PIEZOMETER WAS INSTALLED ON THE 2006 DIKE.

PZ-101
AS-BUILT CONSTRUCTION DETAIL
L.V. SUTTON PLANT, WILMINGTON, NC

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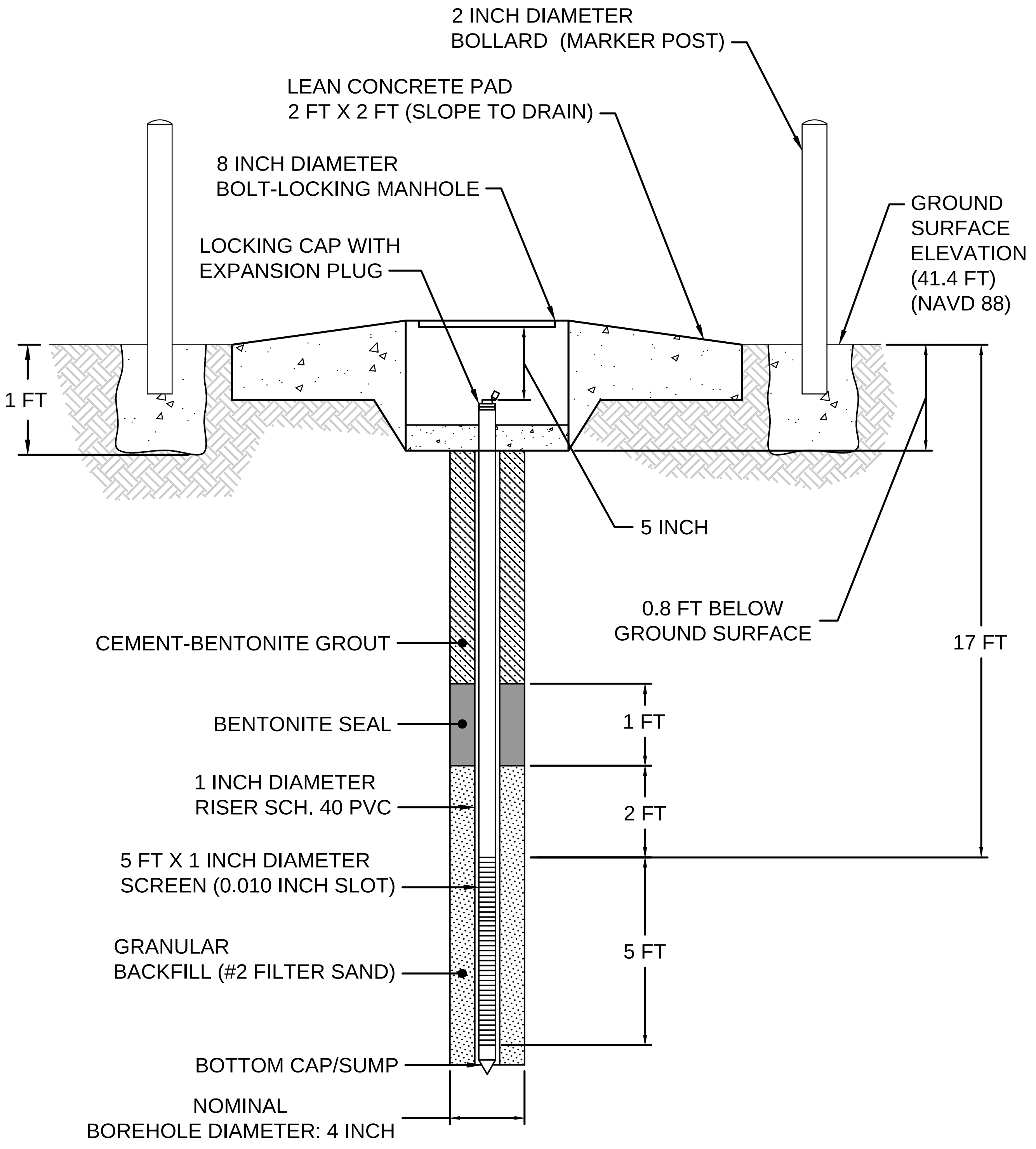
FIGURE
D.1

PROJECT NO: GC5650
NOVEMBER 2014

M:\D\DUKE ENERGY\DUKE-SUTTON\DUKE-SUTTON DE-WATERING-GC5650\FIGURES\5650F029 PIEZOMETER DETAIL



NOT TO SCALE

NOTE:

1. THE PIEZOMETER WAS INSTALLED ON THE 2006 DIKE.

PZ-102
AS-BUILT CONSTRUCTION DETAIL
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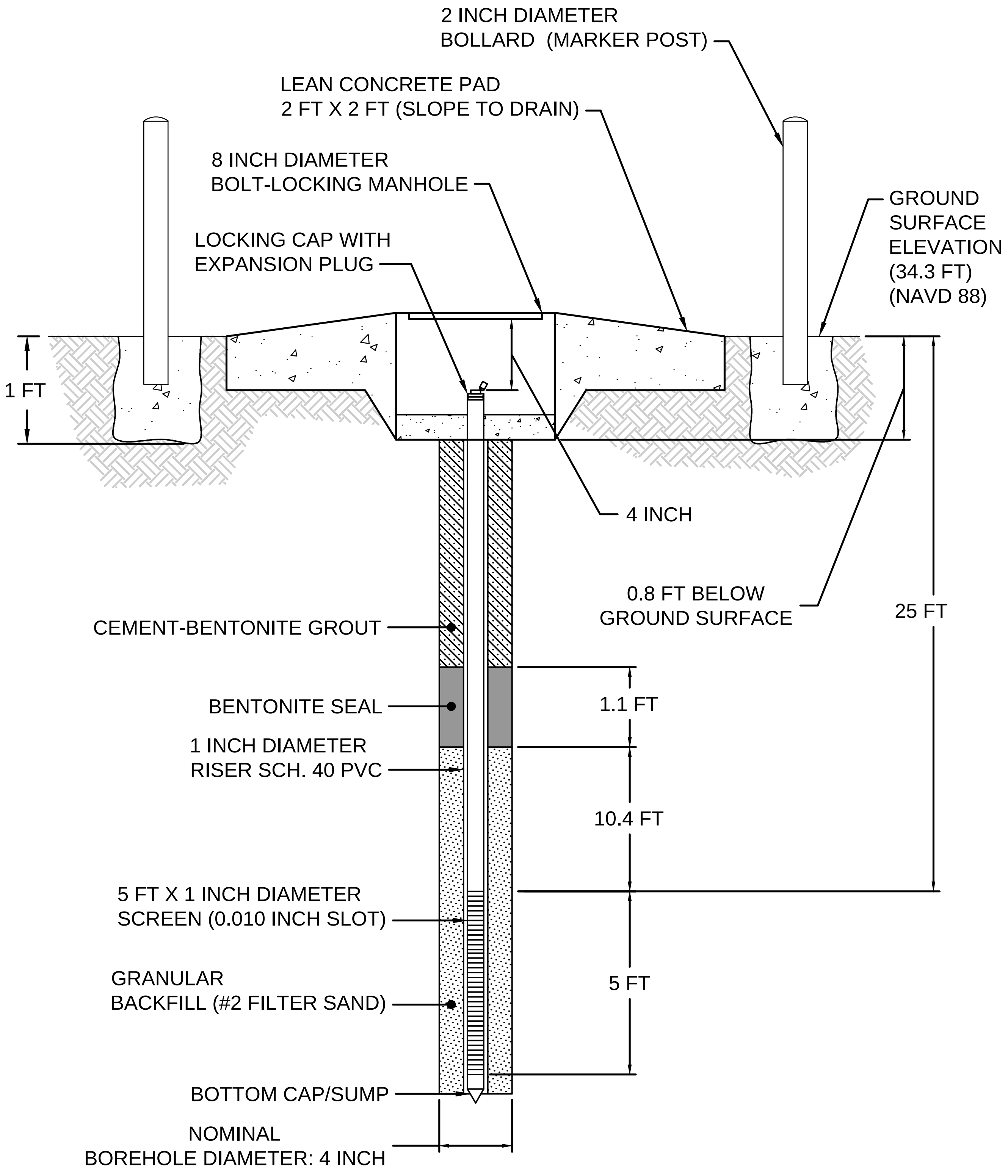
FIGURE
D.2

PROJECT NO: GC5650
NOVEMBER 2014

M:\D\DUKE ENERGY\DUKE-SUTTON\DUKE-SUTTON DE-WATERING-GC5650\FIGURES\5650F030 PIEZOMETER DETAIL



NOT TO SCALE

NOTE:

1. THE PIEZOMETER WAS INSTALLED IN GENERAL ACCORDANCE WITH THE REQUIREMENTS SPECIFIED IN THE APPROVAL OF INSTALLATION OF INSTRUMENTATION GRANTED BY THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL AND NATURAL RESOURCES DATED ON 1 OCTOBER 2014.

NEWHA-005-PZ-103
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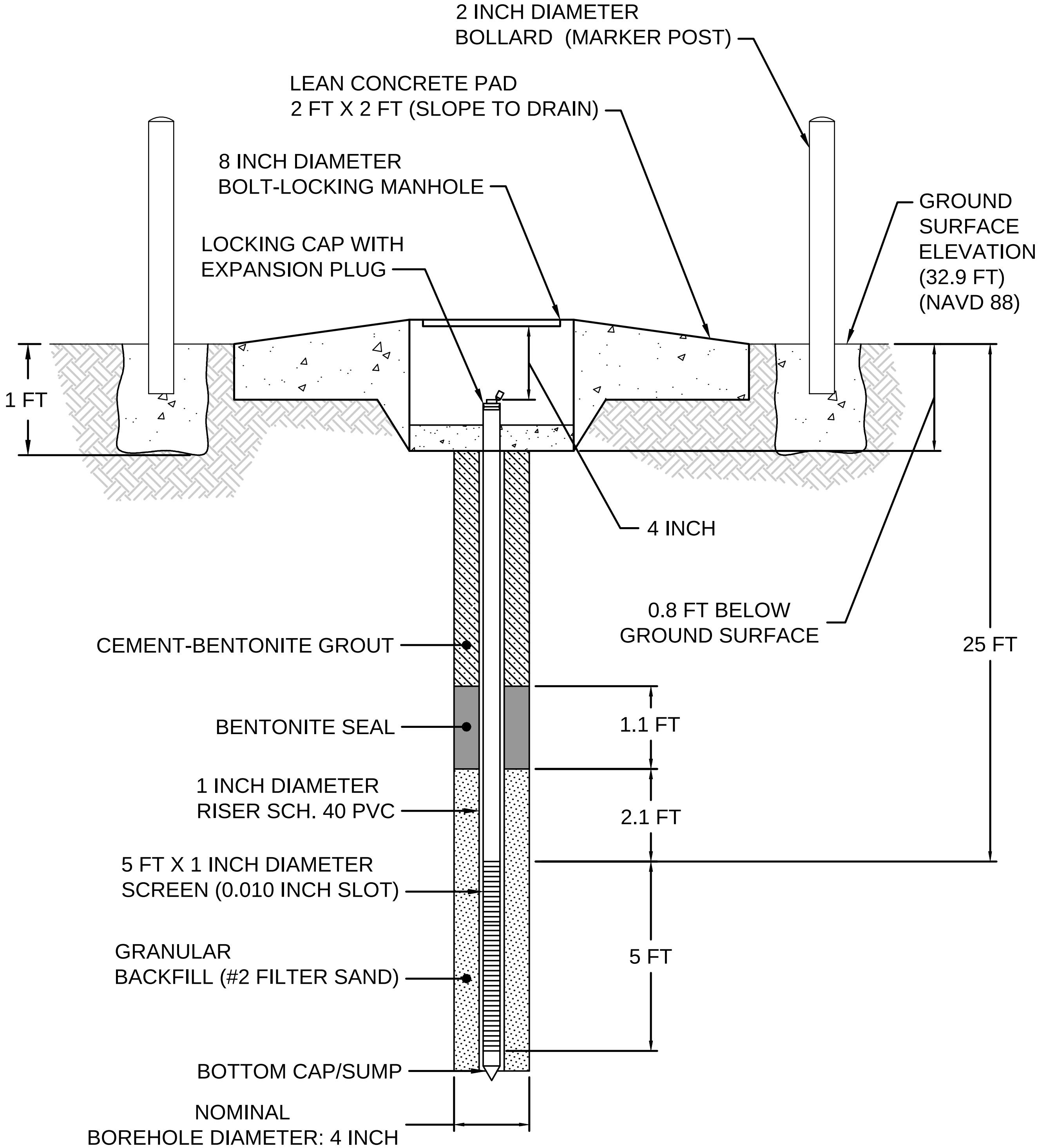
FIGURE
D.3

PROJECT NO: GC5650
NOVEMBER 2014

M:\D\DUKE ENERGY\DUKE-SUTTON\DUKE-SUTTON DE-WATERING-GC5650\FIGURES\5650F036 PIEZOMETER DETAIL



NOT TO SCALE

NOTE:

1. THE PIEZOMETER WAS INSTALLED IN GENERAL ACCORDANCE WITH THE REQUIREMENTS SPECIFIED IN THE APPROVAL OF INSTALLATION OF INSTRUMENTATION GRANTED BY THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL AND NATURAL RESOURCES DATED ON 1 OCTOBER 2014.

NEWHA-005-PZ-104
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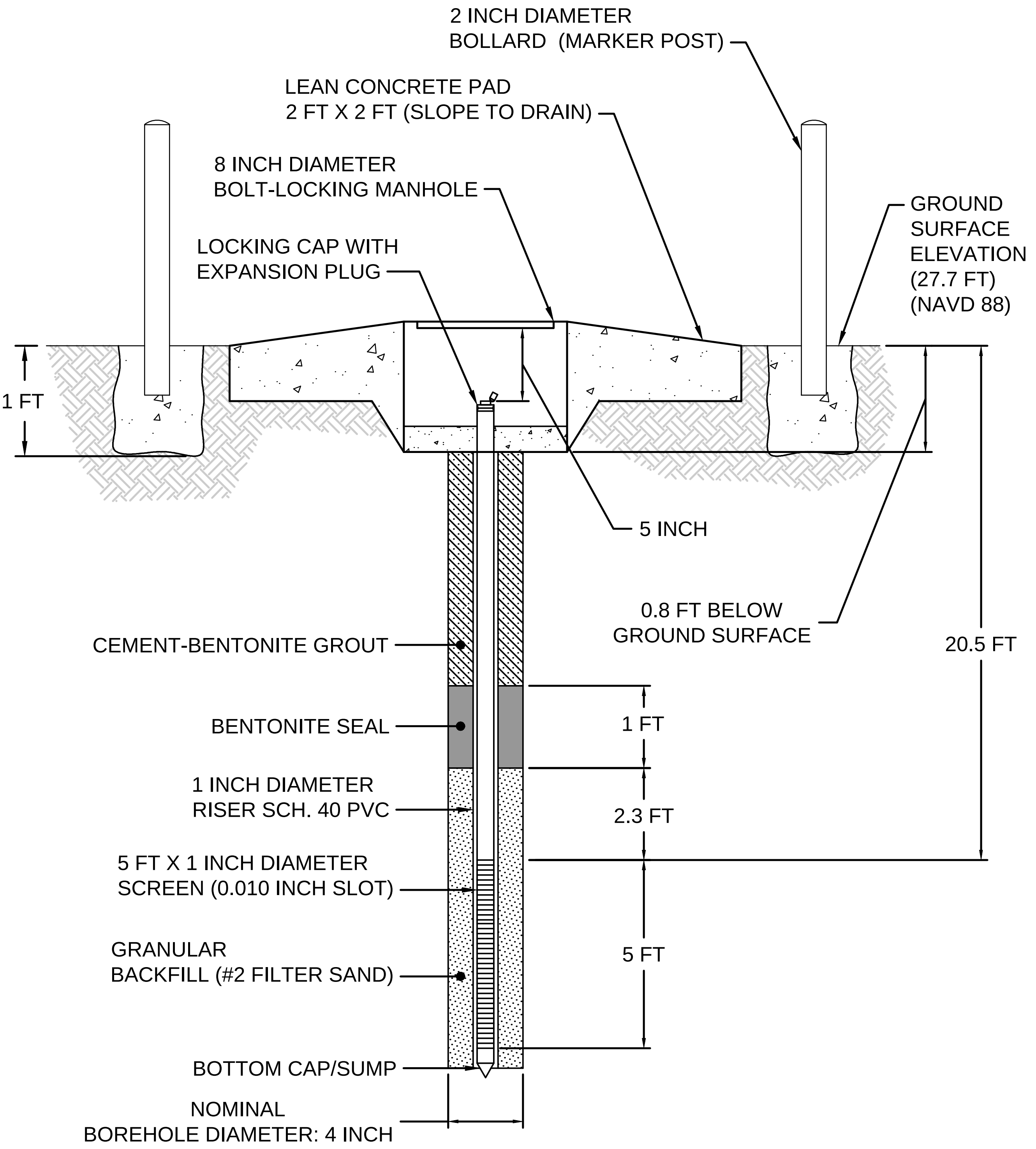
FIGURE
D.4

PROJECT NO: GC5650
NOVEMBER 2014

M:\D\DUKE ENERGY\DUKE-SUTTON\DUKE-SUTTON DE-WATERING-GC5650\FIGURES\5650F037 PIEZOMETER DETAIL



NOT TO SCALE

NEWHA-004-PZ-105
AS-BUILT CONSTRUCTION DETAIL
L.V. SUTTON PLANT, WILMINGTON, NC

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FIGURE D.5

PROJECT NO: GC5650

NOVEMBER 2014

M:\D\DUKE ENERGY\DUKE-SUTTON\DUKE-SUTTON DE-WATERING-GC5650\FIGURES\5650F031 PIEZOMETER DETAIL

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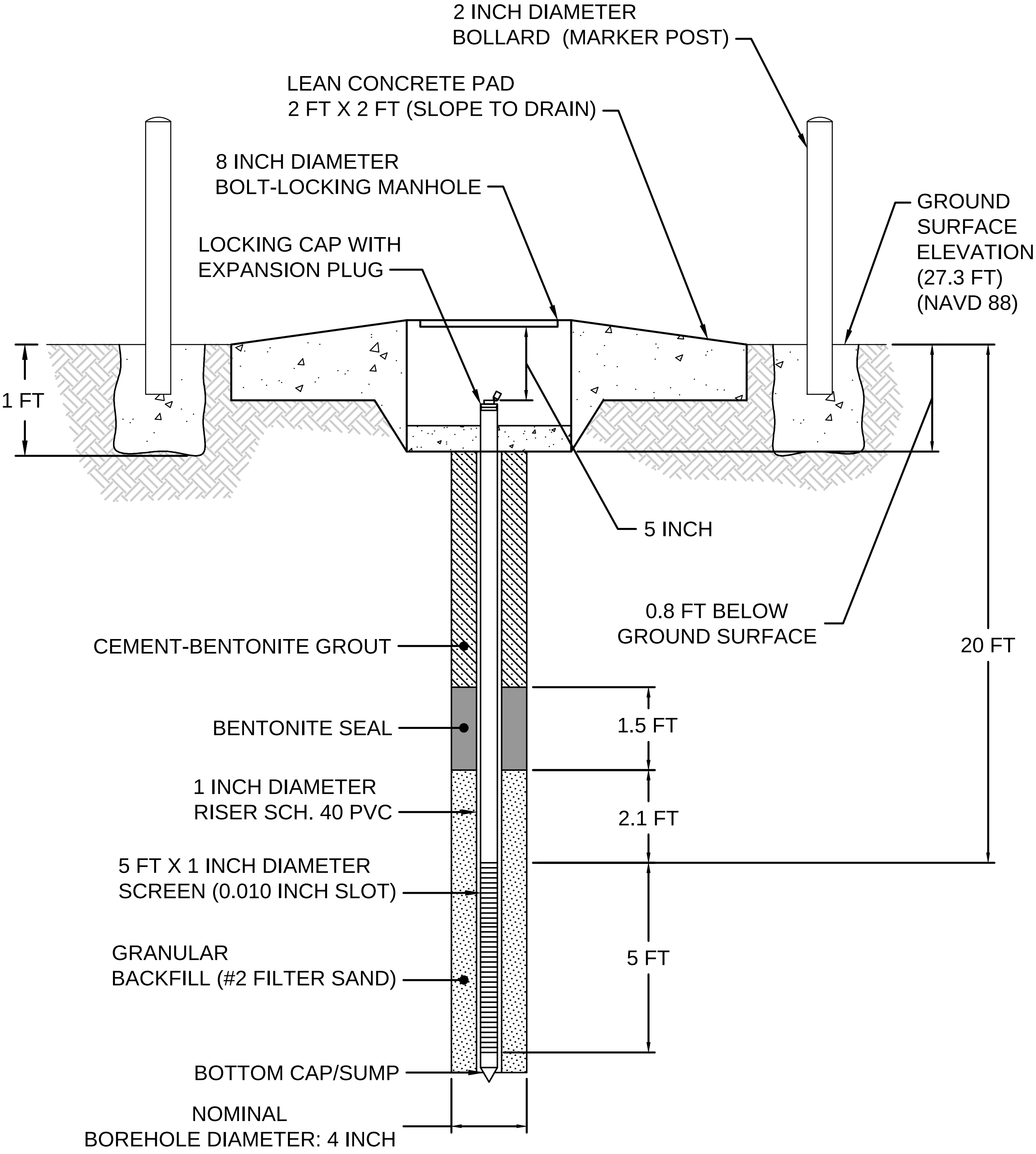
Oct 30 2019



NOT TO SCALE

NEWHA-004-PZ-106
AS-BUILT CONSTRUCTION DETAIL
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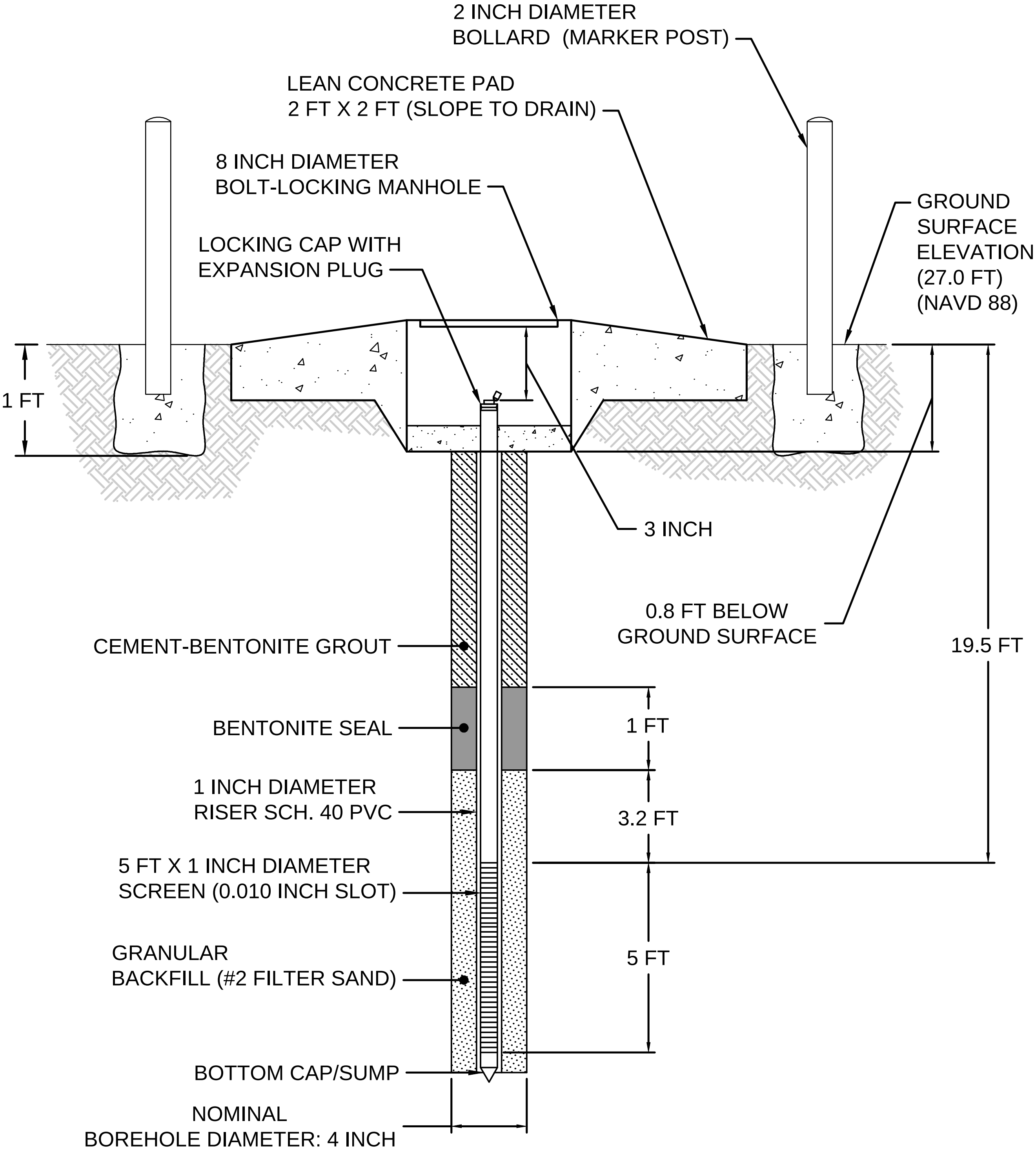
PROJECT NO: GC5650	NOVEMBER 2014	FIGURE D.6

M:\D\DUKE ENERGY\DUKE-SUTTON\DUKE-SUTTON DE-WATERING-GC5650\FIGURES\5650F032 PIEZOMETER DETAIL



NOT TO SCALE

NEWHA-004-PZ-107
AS-BUILT CONSTRUCTION DETAIL
L.V. SUTTON PLANT, WILMINGTON, NC

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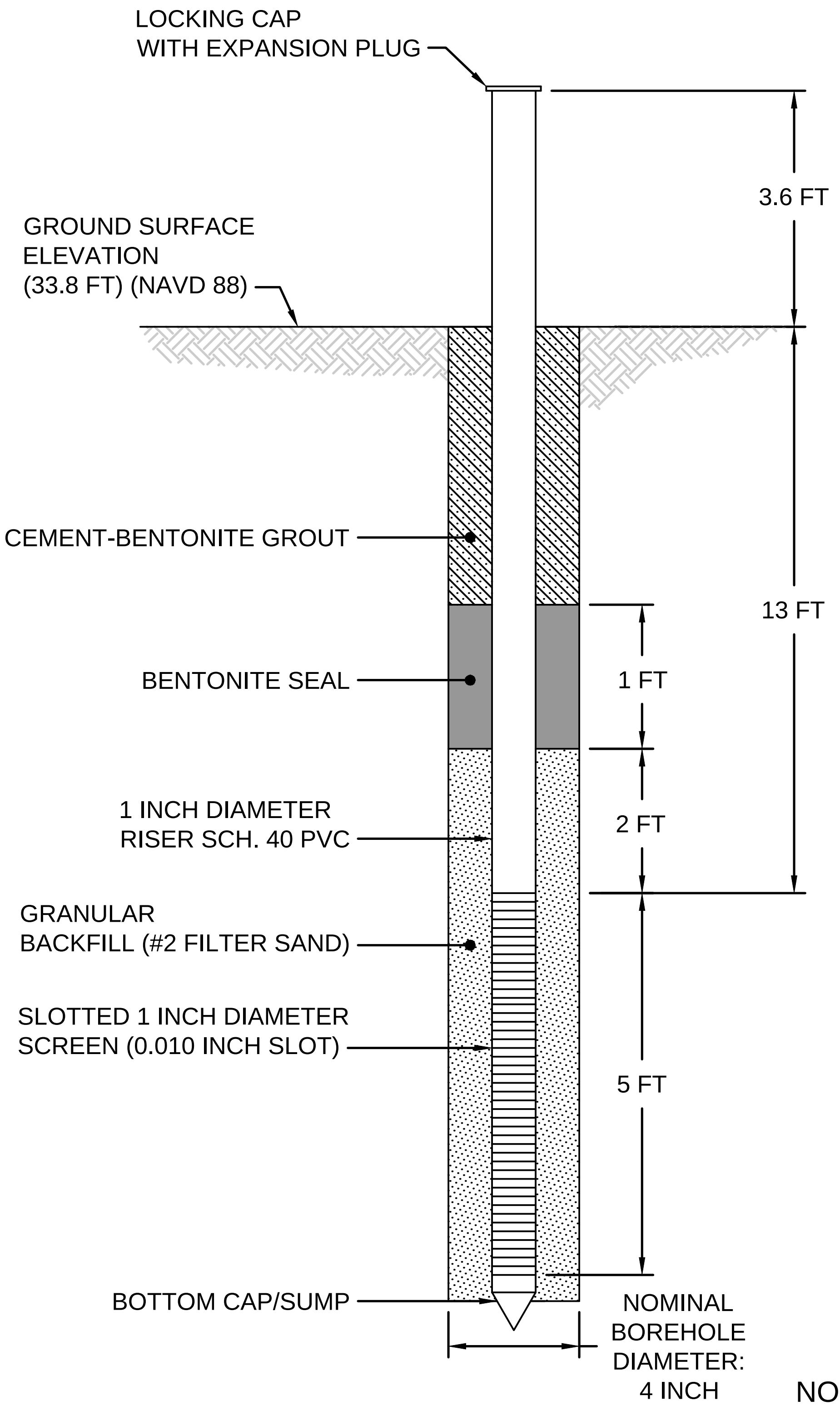
FIGURE
D.7

PROJECT NO: GC5650

NOVEMBER 2014

M:\D\DUKE ENERGY\DUKE-SUTTON\DUKE-SUTTON DE-WATERING-GC5650\FIGURES\5650F033 PIEZOMETER DETAIL



NOT TO SCALE

NOTES:

1. THE PIEZOMETER WAS INSTALLED ON THE INTERNAL ASH BERM OF THE 1971 ASH BASIN.

2. DUE TO TEMPORARY NATURE, THE PIEZOMETER WAS NOT COMPLETED WITHIN A CONCRETE PAD AND/OR PROTECTIVE CASING.

PZ-108S
AS-BUILT CONSTRUCTION DETAIL
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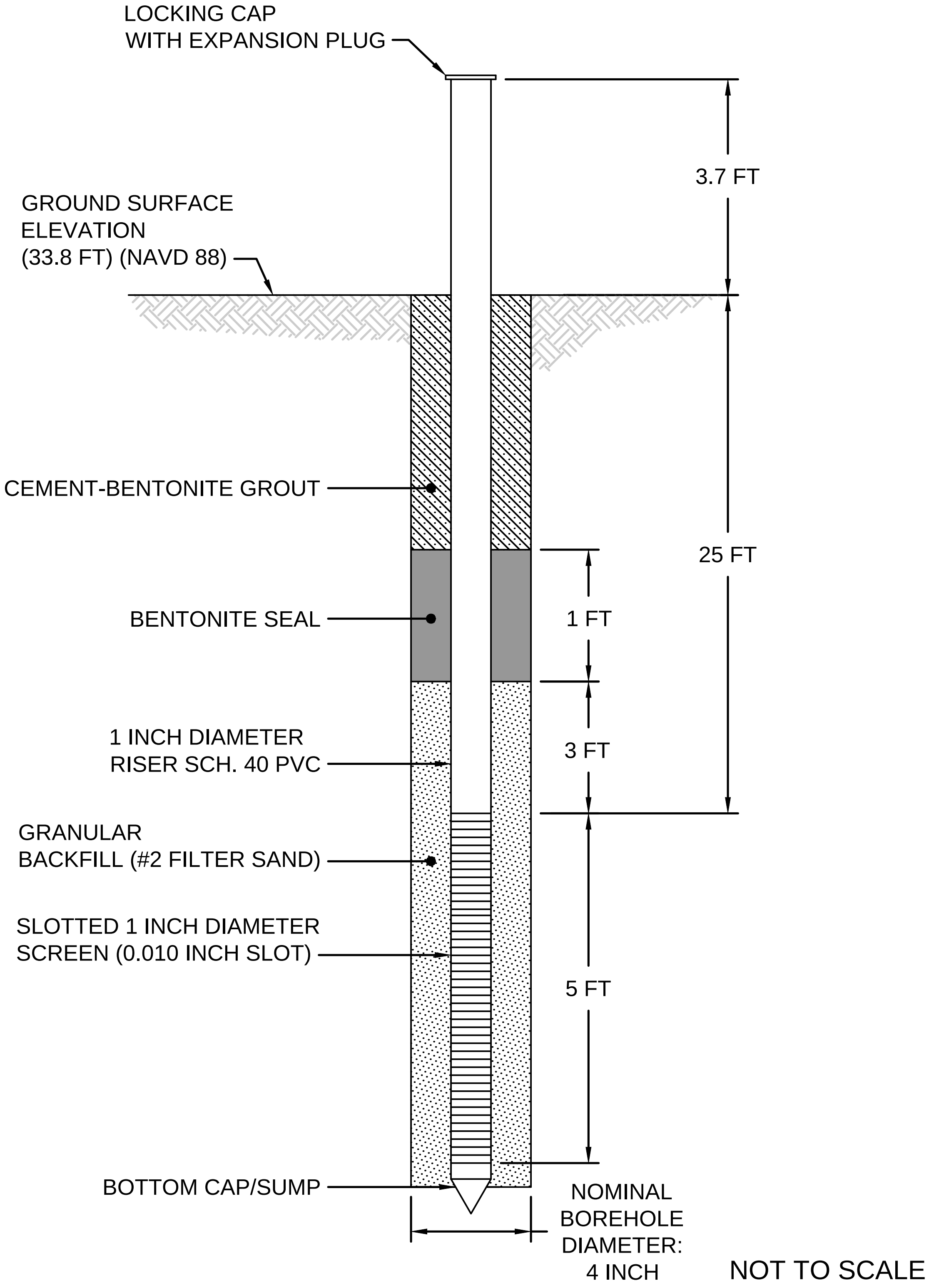
FIGURE

D.8

PROJECT NO: GC5650

NOVEMBER 2014

M:\D\DUKE ENERGY\DUKE-SUTTON\DUKE-SUTTON DE-WATERING-GC5650\FIGURES\5650F034 PIEZOMETER DETAIL



NOT TO SCALE

NOTES:

1. THE PIEZOMETER WAS INSTALLED ON THE INTERNAL ASH BERM OF THE 1971 ASH BASIN.
2. DUE TO TEMPORARY NATURE, THE PIEZOMETER WAS NOT COMPLETED WITHIN A CONCRETE PAD AND/OR PROTECTIVE CASING.

PZ-108D
AS-BUILT CONSTRUCTION DETAIL
L.V. SUTTON PLANT, WILMINGTON, NC

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FIGURE

D.9

PROJECT NO: GC5650

NOVEMBER 2014

M:\D\DUKE ENERGY\DUKE-SUTTON\DUKE-SUTTON DE-WATERING-GC5650\FIGURES\5650F035 PIEZOMETER DETAIL

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1300 South Mint Street
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Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *THB-1*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Dewatering Design
PROJECT NO: *GC5650*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *11/05/2014*
GEOSYNTEC REPRESENTATIVE: *M. Martin, W. Shin*

TECHNICAL INFORMATION

DRILLING METHOD: *Hand Auger*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *Grab*
LOCATION:
Lat: 34.2906, Long: -77.9905 (Handheld GPS)

Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
0	Top SOIL and organic matter fine sandy SILT (ML) (ash); grey; moist	▨		
	silty fine SAND (SM) (ash); grey; wet	▨		Water level observed between 3' to 4' BGS
-5				
				Higher water content in the sample from 6' to 8' BGS. Little sample recovery
				Boring Terminated at 9.0' BGS
-10				

All depths referenced to ground surface.

Total Depth: 9.0

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BORING LOG

BOREHOLE ID: *THB-2*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Dewatering Design
PROJECT NO: *GC5650*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *11/05/2014*
GEOSYNTEC REPRESENTATIVE: *M. Martin, W. Shin*

TECHNICAL INFORMATION

DRILLING METHOD: *Hand Auger*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *Grab*
LOCATION:
Approximately 10 feet Southwest from THB-1

Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
0	Top SOIL and organic matter silty fine SAND (SM) (ash); grey; moist			
	fine sandy SILT (ML) (ash); grey (occasionally black); moist to wet (wet at bottom)			
				Water level observed bwtween 3' to 4' BGS
	SILT with fine sand (ML) (ash); grey; wet			
-5				
				Higher water content in the sample from 6' to 8' BGS. Little sample recovery
				Boring Terminated at 9.5' BGS
-10				

All depths referenced to ground surface.

Total Depth: 9.5

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BORING LOG

BOREHOLE ID: *THB-3*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Dewatering Design
PROJECT NO: *GC5650*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *11/05/2014*
GEOSYNTEC REPRESENTATIVE: *M. Martin, W. Shin*

TECHNICAL INFORMATION

DRILLING METHOD: *Hand Auger*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *Grab*
LOCATION:
Lat: 34.2910, Long: -77.9914 (Handheld GPS)

Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
0	Top SOIL and organic matter silty fine to medium SAND (SM) (ash); grey; moist; brown fine to medium sand (SP) (soil) at 2.5' BGS			
	fine sandy SILT (ML) (ash); grey; wet			Water level observed between 3' to 4' BGS
				Little to No Sample Recovery below 3.5' BGS
-5				Boring Terminated at 5.0' BGS
-10				

All depths referenced to ground surface.

Total Depth: 5.0

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BORING LOG

BOREHOLE ID: *THB-4*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Dewatering Design
PROJECT NO: *GC5650*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *11/05/2014*
GEOSYNTEC REPRESENTATIVE: *M. Martin, W. Shin*

TECHNICAL INFORMATION

DRILLING METHOD: *Hand Auger*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *Grab*
LOCATION:
Approximately 10 feet Southwest from THB-3

Depth (ft)	Lithologic Description	Pattern	Recovery	Comments
0	Top SOIL and organic matter fine sandy SILT (ML) (ash); grey; moist			
	fine sandy SILT (ML) (ash); grey; wet			Water level observed betweeen 3' to 4' BGS
-5				
				Higher water content and little to no sample recovery between 5.5'-7' BGS
				Boring Terminated at 7.0' BGS
-10				

All depths referenced to ground surface.
Total Depth: 7.0

Attachment 1.7

Geosyntec 2015 March Boring Logs

LEGEND FOR SYMBOLS

Pattern	Description
▚	GW – Well graded GRAVEL or Well graded GRAVEL with sand
▒	GP – Poorly graded GRAVEL or Poorly graded GRAVEL with sand
▦	SW – Well graded SAND or Well graded SAND with gravel
░	SP – Poorly graded SAND or Poorly graded SAND with gravel
⁞	SP-SM – Poorly graded SAND with silt or Poorly graded SAND with silt and gravel
▨	SP-SC – Poorly graded SAND with clay or Poorly graded SAND with clay and gravel
⁞	SM – Silty SAND or Silty SAND with gravel
▨	SC – Clayey SAND or Clayey SAND with gravel
▥	ML – SILT, SILT with sand (or with gravel), or Sandy (or Gravelly) SILT
▥	MH – Elastic SILT, Elastic SILT with sand (or with gravel), or Sandy (or Gravelly) elastic SILT
▨	CL – Lean CLAY, Lean CLAY with sand (or with gravel), or Sandy (or Gravelly) lean CLAY
▨	CH – Fat CLAY, Fat CLAY with sand (or with gravel), or Sandy (or Gravelly) fat CLAY
☰	OL – Organic SILT or CLAY with low plasticity
≈	OH – Organic SILT or CLAY with medium to high plasticity
■	Ash
░	Topsoil
▤	Well Screen
▒	Grout
▤	Bentonite
⁘	Granular Backfill
□	PVC Riser

MOSITURE CONTENT DEFINITIONS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

RELATIVE DENSITY

Sands, Gravels, Non-plastic Silts	Blows/Foot (N-Value)
Very Loose	0-4
Loose	5-10
Medium Dense	11-30
Dense	31-50
Very Dense	> 50

CONSISTENCY

Silts & Clays	Blows/Foot (N-Value)
Very Soft	0-2
Soft	3-4
Medium Stiff	5-8
Stiff	9-15
Very Stiff	16-30
Hard	31-50
Very Hard	> 50

SOIL CLASSIFICATION AND LOG KEY

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FIGURE
1.7.1

PROJECT NO: GC5770

April 2015

OFFICIAL COPY

Oct 30 2019

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *PT-2 (within the 1971 Basin)*

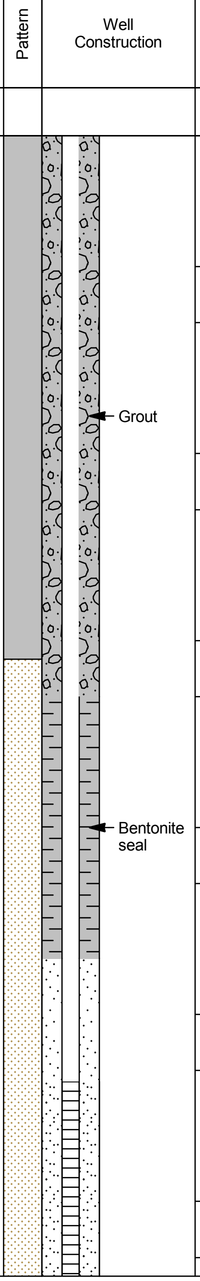
GENERAL INFORMATION

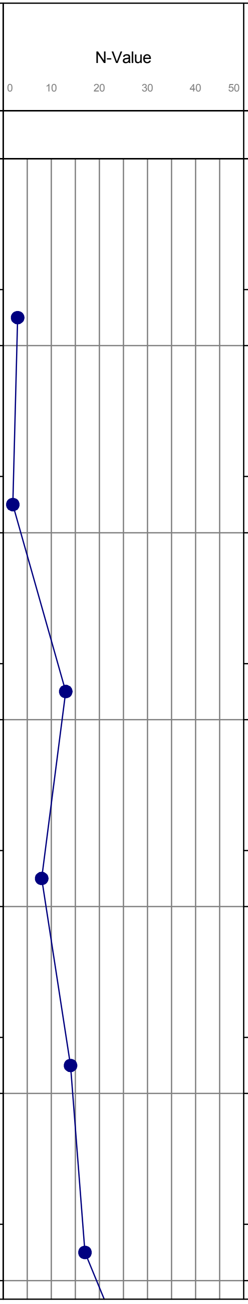
PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/11/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198428 (Hand-held GPS)*
EASTING: *2306217 (Hand-held GPS)*
GROUND ELEVATION: *33 ft (NAVD88) (Approximate)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	SPT Blows	Recovery (ft)	Comments
30					Start using drilling mud at begining of boring
		SILT (ML) (Ash); gray; wet; very loose	1-2-1	0.9	Trace organic wood was observed at 4.9 ft bgs
	-5				
25					
		SILT (ML) (Ash); gray; wet; very loose	1-1-1	1.5	
	-10				
20					
		Top 0.5': Silty SAND (SM) (Ash and Surficial Aquifer); gray; wet; medium dense Bottom 0.6': fine to medium grained SAND (SP) (Surficial Aquifer); brown and gray; wet; medium dense	5-6-7	1.1	
	-15				
15					
		Top 0.75': fine to medium grained SAND (SP) (Surficial Aquifer); gray and tan; wet; loose Bottom 0.15': fine to medium grained SAND (SP) (Surficial Aquifer); tan and brown; wet; loose	4-3-5	0.9	
	-20				
10					
		Fine to medium grained SAND (SP) (Surficial Aquifer); gray and tan; wet; medium dense	5-7-7	1.0	
	-25				
5					
		Fine to coarse grained SAND (SP) (Surficial Aquifer); gray and tan; wet; medium dense	8-7-10	0.9	
	-30				





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All depths referenced to ground surface.

Total Depth: 40.3 ft bgs

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

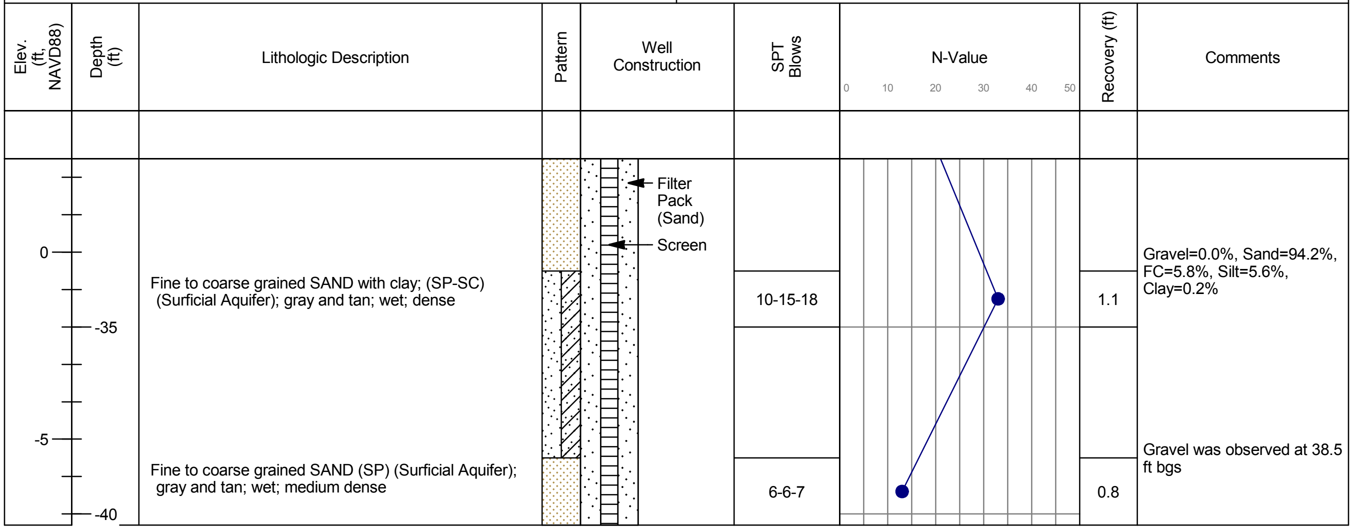
BOREHOLE ID: *PT-2 (within the 1971 Basin)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/11/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198428 (Hand-held GPS)*
EASTING: *2306217 (Hand-held GPS)*
GROUND ELEVATION: *33 ft (NAVD88) (Approximate)*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	SPT Blows	Recovery (ft)	Comments
0					
	-35	Fine to coarse grained SAND with clay; (SP-SC) (Surficial Aquifer); gray and tan; wet; dense	10-15-18	1.1	Gravel=0.0%, Sand=94.2%, FC=5.8%, Silt=5.6%, Clay=0.2%
-5	-40	Fine to coarse grained SAND (SP) (Surficial Aquifer); gray and tan; wet; medium dense	6-6-7	0.8	Gravel was observed at 38.5 ft bgs

End of Boring at 40.3 feet bgs.

All depths referenced to ground surface.

Total Depth: 40.3 ft bgs

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Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

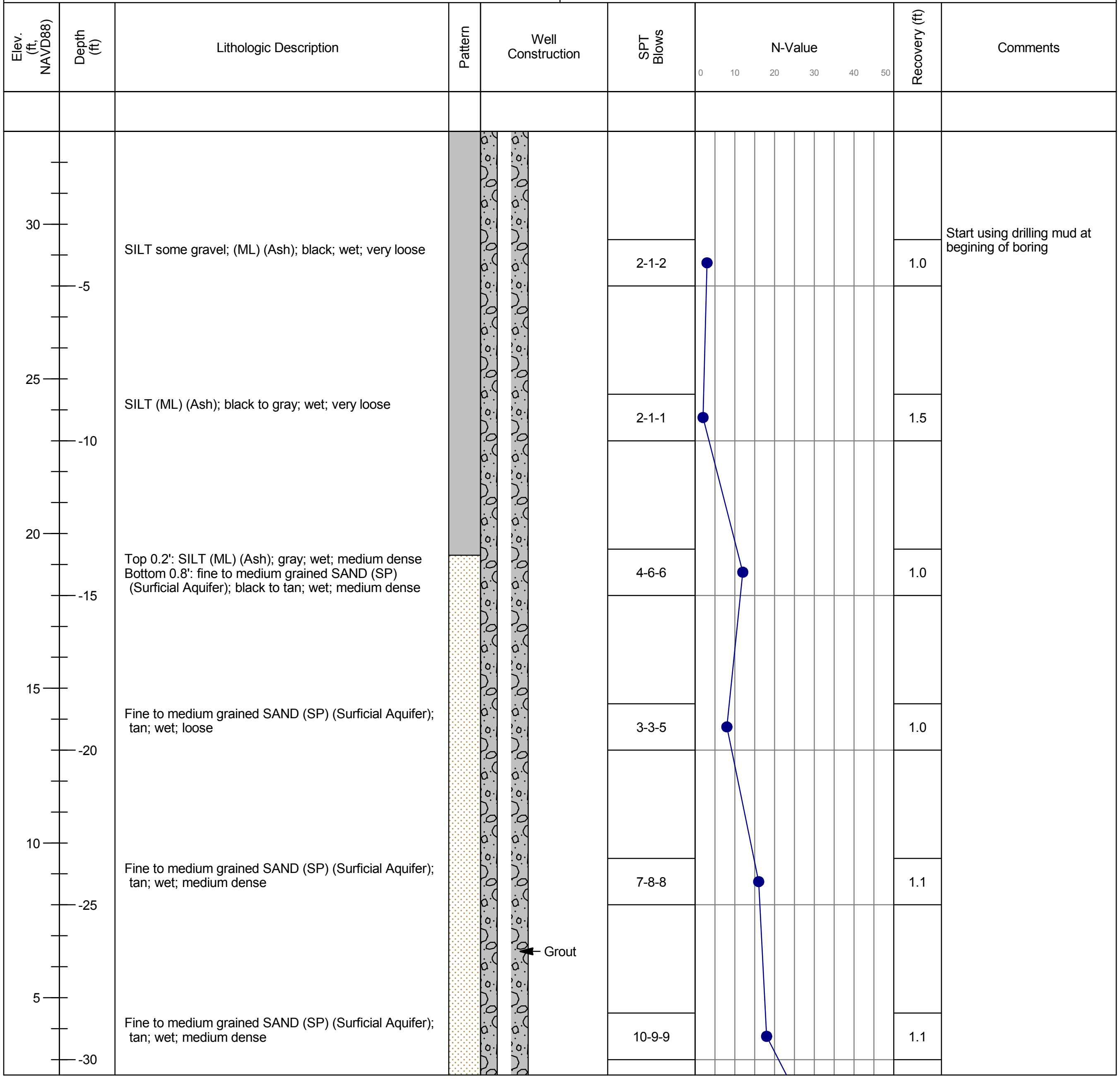
BOREHOLE ID: *PT-3 (within the 1971 Basin)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/9/2015*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *6"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198435 (Hand-held GPS)*
EASTING: *2306226 (Hand-held GPS)*
GROUND ELEVATION: *33 ft (NAVD88) (Approximate)*



Lithologic Description	SPT Blows	Recovery (ft)	Comments
SILT some gravel; (ML) (Ash); black; wet; very loose	2-1-2	1.0	Start using drilling mud at begining of boring
SILT (ML) (Ash); black to gray; wet; very loose	2-1-1	1.5	
Top 0.2': SILT (ML) (Ash); gray; wet; medium dense Bottom 0.8': fine to medium grained SAND (SP) (Surficial Aquifer); black to tan; wet; medium dense	4-6-6	1.0	
Fine to medium grained SAND (SP) (Surficial Aquifer); tan; wet; loose	3-3-5	1.0	
Fine to medium grained SAND (SP) (Surficial Aquifer); tan; wet; medium dense	7-8-8	1.1	
Fine to medium grained SAND (SP) (Surficial Aquifer); tan; wet; medium dense	10-9-9	1.1	

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All depths referenced to ground surface.

Total Depth: 70 ft bgs

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Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

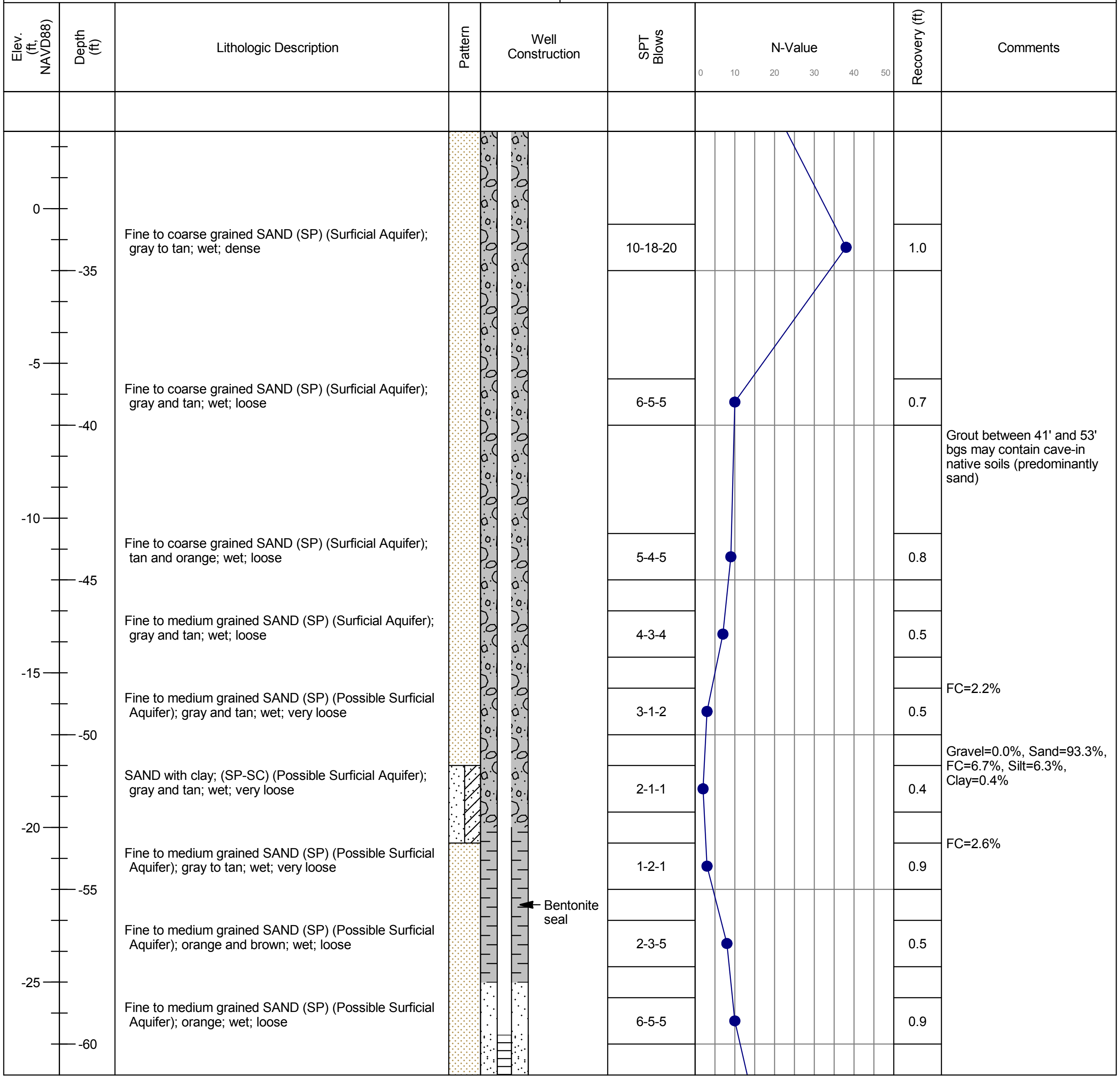
BOREHOLE ID: *PT-3 (within the 1971 Basin)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/9/2015*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *6"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198435 (Hand-held GPS)*
EASTING: *2306226 (Hand-held GPS)*
GROUND ELEVATION: *33 ft (NAVD88) (Approximate)*



Lithologic Description	SPT Blows	Recovery (ft)	Comments
Fine to coarse grained SAND (SP) (Surficial Aquifer); gray to tan; wet; dense	10-18-20	1.0	
Fine to coarse grained SAND (SP) (Surficial Aquifer); gray and tan; wet; loose	6-5-5	0.7	Grout between 41' and 53' bgs may contain cave-in native soils (predominantly sand)
Fine to coarse grained SAND (SP) (Surficial Aquifer); tan and orange; wet; loose	5-4-5	0.8	
Fine to medium grained SAND (SP) (Surficial Aquifer); gray and tan; wet; loose	4-3-4	0.5	
Fine to medium grained SAND (SP) (Possible Surficial Aquifer); gray and tan; wet; very loose	3-1-2	0.5	FC=2.2%
SAND with clay; (SP-SC) (Possible Surficial Aquifer); gray and tan; wet; very loose	2-1-1	0.4	Gravel=0.0%, Sand=93.3%, FC=6.7%, Silt=6.3%, Clay=0.4%
Fine to medium grained SAND (SP) (Possible Surficial Aquifer); gray to tan; wet; very loose	1-2-1	0.9	FC=2.6%
Fine to medium grained SAND (SP) (Possible Surficial Aquifer); orange and brown; wet; loose	2-3-5	0.5	
Fine to medium grained SAND (SP) (Possible Surficial Aquifer); orange; wet; loose	6-5-5	0.9	

(Continued Next Page)

All depths referenced to ground surface.

Total Depth: 70 ft bgs

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

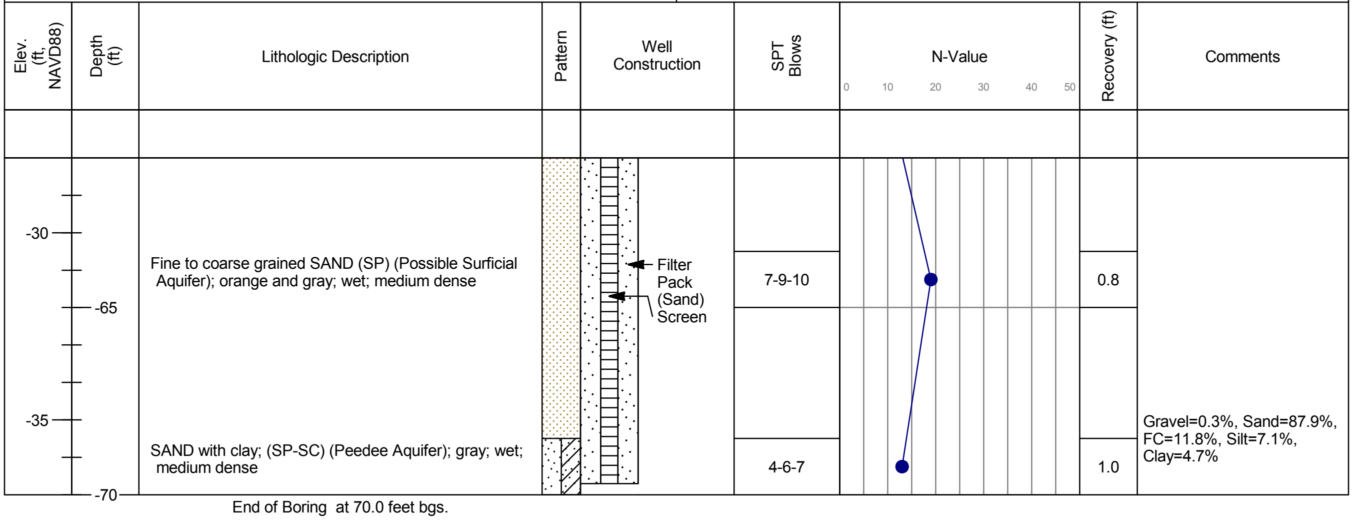
BOREHOLE ID: *PT-3 (within the 1971 Basin)*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/9/2015*
GEOSYNTEC REPRESENTATIVE: *Michael Martin*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *6"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198435 (Hand-held GPS)*
EASTING: *2306226 (Hand-held GPS)*
GROUND ELEVATION: *33 ft (NAVD88) (Approximate)*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	SPT Blows	Recovery (ft)	Comments
-30	-65	Fine to coarse grained SAND (SP) (Possible Surficial Aquifer); orange and gray; wet; medium dense	7-9-10	0.8	
-35	-70	SAND with clay; (SP-SC) (Peedee Aquifer); gray; wet; medium dense	4-6-7	1.0	Gravel=0.3%, Sand=87.9%, FC=11.8%, Silt=7.1%, Clay=4.7%

End of Boring at 70.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 70 ft bgs

Geosyntec consultants

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

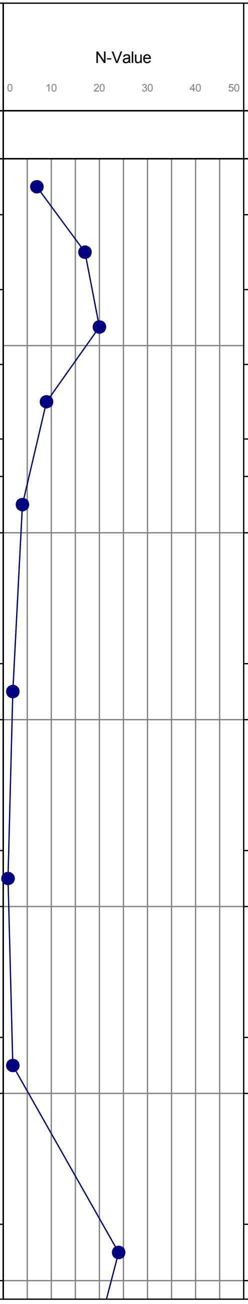
BOREHOLE ID: *SPT-12*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/6/2015*
GEOSYNTEC REPRESENTATIVE: *R. Warrier/M. Erten*
DRILLING CONTRACTOR: *ConeTec*
DRILLER NAME: *David White*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 55LC Track Rig (Serial # 331145)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *199189.79*
EASTING: *2304359.62*
GROUND ELEVATION: *33.4 ft (NAVD88)*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	SPT Blows	Recovery (ft)	Comments
		Top 0.2': TOPSOIL; black; moist; medium stiff Bottom 1.2': Lean CLAY (CL) (Ash and Fill); black and brown; moist; medium stiff	2-4-3	1.4	
		Top 0.8': Clayey SAND (SC) (Ash and Fill); black and brown; moist; medium dense Bottom 0.8': SILT (ML) (Ash); black; moist; medium dense	6-9-8-9	1.6	
30	-5	SILT (ML) (Ash); black; moist; medium dense	5-8-12-15	1.4	MC=24.0%
		SILT (ML) (Ash); black; wet; loose	3-4-5-5	1.5	Start using drilling mud at 5.5 ft bgs
25	-10	SILT (ML) (Ash); black; wet; very loose	2-2-2	1.1	
	▼				Water level was measured to be at 12 ft bgs at the end of boring
20	-15	SILT (ML) (Ash); black; wet; very loose	1-1-1	1.4	
15	-20	SILT (ML) (Ash); black; wet; very loose	WOH-1-WOH	1.5	
10	-25	Elastic SILT (MH) (Possible Fill); black; wet; very soft	WOH-WOH-2	1.5	Gravel=0.0%, Sand=0.6%, FC=99.4%, Silt=27.5%, Clay=71.9%; LL=147, PL=66, PI=81; SG=2.513 MC=102.6%; Gravel=1.1%, Sand=1.8%, FC=97.1%, Silt=30.5%, Clay=66.6%; LL=90, PL=48, PI=42
		Elastic SILT (MH) (Possible Fill); Shelby Tube (25 to 26.3 ft bgs)		1.3	
5	-30	SAND with silt; (SP-SM) (Ash and Fill); black; wet; medium dense	4-9-15	0.3	

(Continued Next Page)

All depths referenced to ground surface.

Total Depth: 100 ft bgs

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *SPT-12*

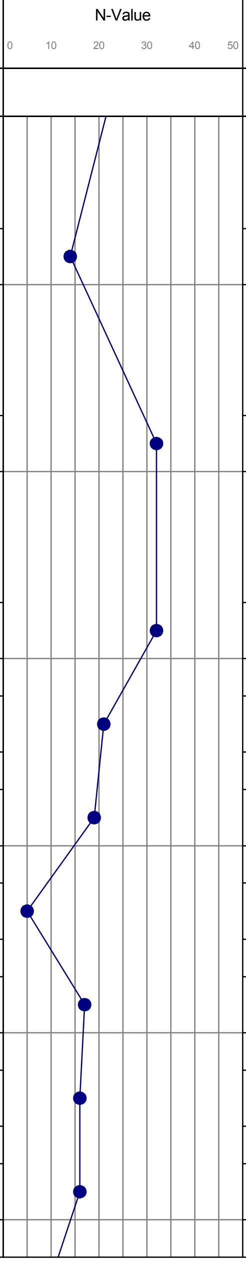
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/6/2015*
GEOSYNTEC REPRESENTATIVE: *R. Warrier/M. Erten*
DRILLING CONTRACTOR: *ConeTec*
DRILLER NAME: *David White*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 55LC Track Rig (Serial # 331145)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *199189.79*
EASTING: *2304359.62*
GROUND ELEVATION: *33.4 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
0							
		Fine to medium grained SAND (SP) (Possible Surficial Aquifer); brown; wet; medium dense		4-6-8		1.0	
	-35						
-5							
		Fine to medium grained SAND (SP) (Possible Peedee Aquifer); gray and tan; wet; dense		9-15-17		1.3	
	-40						
-10							
		Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray; wet; dense		14-15-17		1.3	
	-45						
		Fine to medium grained SAND with clay; (SP-SC) (Peedee Aquifer); greenish gray; wet; medium dense		10-11-10		1.2	Gravel=0.0%, Sand=94.7%, FC=5.3%; SG=2.713
-15							
		Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray; wet; medium dense		14-9-10		1.0	
	-50						
		Clayey SAND (SC) (Peedee Aquifer); greenish gray; wet; loose		5-2-3		0.5	FC=39.0%; LL=30, PL=14, PI=16
-20							
		Fine to coarse grained SAND with gravel; (SP) (Peedee Aquifer); greenish gray; wet; medium dense		8-8-9		0.6	
	-55						
		Fine to coarse grained SAND (SP) (Peedee Aquifer); greenish gray; wet; medium dense		7-7-9		0.5	
-25							
		SAND with clay; (SP-SC) (Peedee Aquifer); greenish gray; wet; medium dense		7-7-9		0.8	Gravel=0.2%, Sand=93.5%, FC=6.3%
	-60						



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All depths referenced to ground surface.

Total Depth: 100 ft bgs

Geosyntec consultants

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

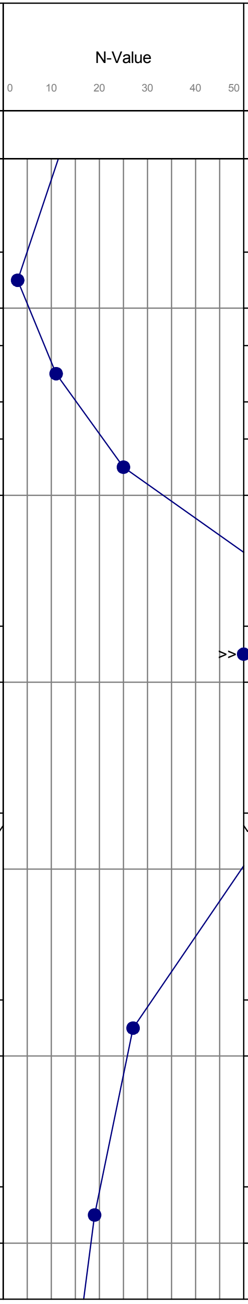
BOREHOLE ID: *SPT-12*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/6/2015*
GEOSYNTEC REPRESENTATIVE: *R. Warrier/M. Erten*
DRILLING CONTRACTOR: *ConeTec*
DRILLER NAME: *David White*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 55LC Track Rig (Serial # 331145)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *199189.79*
EASTING: *2304359.62*
GROUND ELEVATION: *33.4 ft (NAVD88)*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
-30		SAND with clay; (SP-SC) (Peedee Aquifer); dark gray; wet; very loose		2-1-2		0.2	FC=7.0%
	-65	Shelby Tube (65 to 66 ft bgs)				1.0	Sand was observed at the bottom of the Shelby Tube
		Clayey SAND (SC) (Peedee Aquifer); gray and brown; wet; medium dense		3-5-6		1.0	
-35		Clayey SAND (SC) (Peedee Aquifer); dark gray; wet; medium dense		12-12-13		1.2	
	-70						
-40		Clayey SAND (SC) (Peedee Aquifer); dark greenish gray; wet; very dense		31-37-43	>>	1.2	Gravel=0.2%, Sand=82.2%, FC=17.6%, Silt=11.9%, Clay=5.7%; LL=NP, PL=NP, PI=NP Blow Count (N-Value)=80
	-75						
-45		Clayey SAND (SC) (Peedee Aquifer); dark gray; wet; very dense		50/4"		0.3	
	-80						
-50		Clayey SAND (SC) (Peedee Aquifer); dark gray; wet; medium dense		12-11-16		1.4	
	-85						
-55		Clayey SAND (SC) (Peedee Aquifer); dark gray; wet; medium dense		8-7-12		1.5	
	-90						

(Continued Next Page)

All depths referenced to ground surface.

Total Depth: 100 ft bgs

Geosyntec consultants

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *SPT-12*

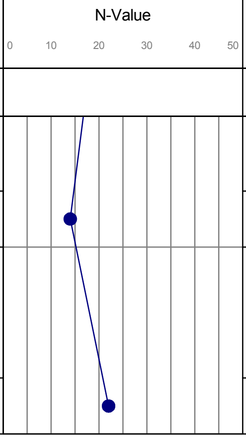
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/6/2015*
GEOSYNTEC REPRESENTATIVE: *R. Warrier/M. Erten*
DRILLING CONTRACTOR: *ConeTec*
DRILLER NAME: *David White*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 55LC Track Rig (Serial # 331145)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *199189.79*
EASTING: *2304359.62*
GROUND ELEVATION: *33.4 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value 0 10 20 30 40 50	Recovery (ft)	Comments
		Clayey SAND (SC) (Peedee Aquifer); dark gray; wet; medium dense *(continued)*	▨				
-60		Clayey SAND (SC) (Peedee Aquifer); dark gray; wet; medium dense	▨	11-7-7		1.5	Gravel=0.0%, Sand=69.7%, FC=30.3%, Silt=22.2%, Clay=8.1%; LL=NP, PL=NP, PI=NP; SG=-2.725
	-95		▨				
-65		Clayey SAND (SC) (Peedee Aquifer); dark gray; wet; medium dense	▨	8-10-12		1.5	
	-100	End of Boring at 100.0 feet bgs.					



All depths referenced to ground surface.

Total Depth: 100 ft bgs

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *SPT-13*

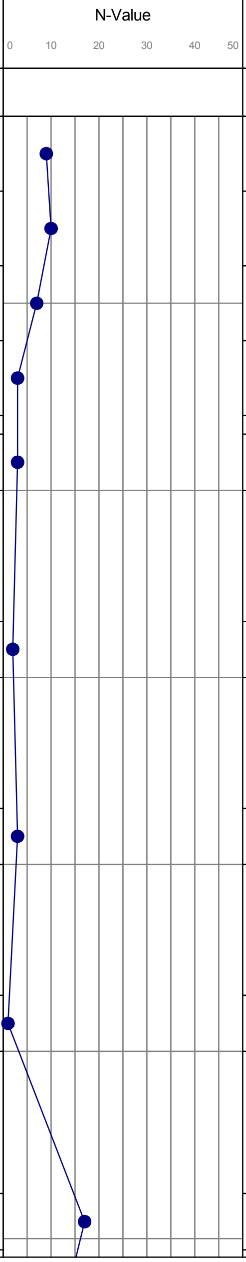
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/5/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198345.9*
EASTING: *2305184.23*
GROUND ELEVATION: *33.5 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
		TOPSOIL; brown; dry; stiff SILT (ML) (Ash); black and gray; dry; loose		2-4-5-6		2.0	
30		SILT (ML) (Ash); black; dry; loose		5-5-5-6		2.0	MC=38.1%
	-5	SILT (ML) (Ash); black; dry; loose		3-4-3-3		2.0	
		SILT (ML) (Ash); black; dry; very loose		2-1-2-2		1.6	Organic wood found in the split spoon at 7.7 ft bgs Start using drilling mud at 8.5 ft bgs
25	-10	SILT (ML) (Ash); dark gray; wet; very loose		1-2-1		0.9	
20	-15	SILT (ML) (Ash); dark gray; wet; very loose		1-1-1		1.2	
15	-20	SILT (ML) (Ash); dark gray; wet; very loose		1-2-1		1.4	
10	-25	SILT (ML) (Ash); dark gray; wet; very loose		1-1-WOH		1.0	
5	-30	Top 0.3': Sandy SILT (ML) (Ash and Fill); dark gray; wet; medium dense Bottom 0.9': fine to coarse grained SAND (SP) (Ash and Fill); gray; wet; medium dense		3-7-10		1.2	



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All depths referenced to ground surface.

Total Depth: 85 ft bgs

Geosyntec consultants

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1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *SPT-13*

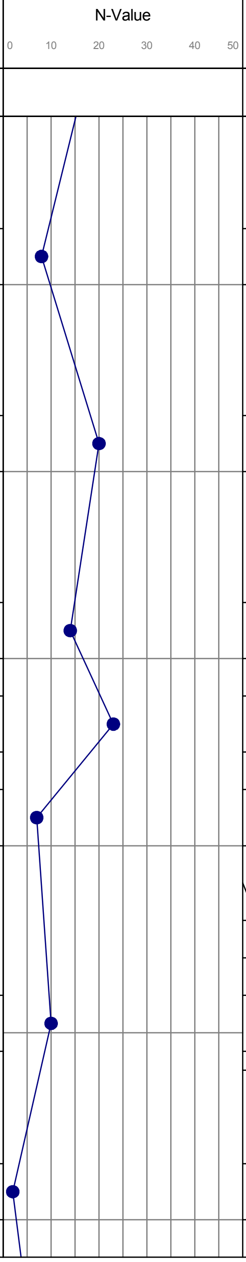
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/5/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198345.9*
EASTING: *2305184.23*
GROUND ELEVATION: *33.5 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	Recovery (ft)	Comments
0	-35	Fine to coarse grained SAND (SP) (Possible Ash and Fill); brown and black; wet; loose	▒	3-4-4	1.1	
-5	-40	Fine to coarse grained SAND (SP) (Surficial Aquifer); gray; wet; medium dense	░	9-8-12	1.1	
-10	-45	Fine to medium grained SAND (SP) (Possible Surficial Aquifer); greenish gray and tan; wet; medium dense	░	7-6-8	1.3	Gravel=0.0%, Sand=95.2%, FC=4.8%; SG=2.668
		Fine to medium grained SAND (SP) (Possible Surficial Aquifer); light gray and tan; wet; medium dense	░	8-11-12	1.1	
-15		Fine to coarse grained SAND (SP) (Possible Surficial Aquifer); light greenish gray; wet; loose	░	4-5-2	1.2	
	-50	Lean CLAY (CL) (Possible Peedee Confining Unit); reddish brown; wet Shelby Tube (50 to 52 ft bgs)	▨		0.0	Clay was observed in the shoe of the sample
-20		Fat CLAY (CH) (Peedee Confining Unit); Shelby Tube (52 to 54 ft bgs)	▧		2.0	Gravel=0.0%, Sand=7.0%, FC=93.0%, Silt=36.0%, Clay=57.0%; LL=50, PL=24, PI=26; SG=2.701
	-55	Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray; wet; loose	░	2-4-6	1.0	
		Shelby Tube (55.5 to 56 ft bgs)	░		0.5	
-25	-60	Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray and dark gray; wet; very loose	░	1-1-1	0.5	Gravel=0.0%, Sand=95.7%, FC=4.3%, Silt=3.3%, Clay=1.0%; LL=NP, PL=NP, PI=NP



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All depths referenced to ground surface.

Total Depth: 85 ft bgs

Geosyntec consultants

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1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

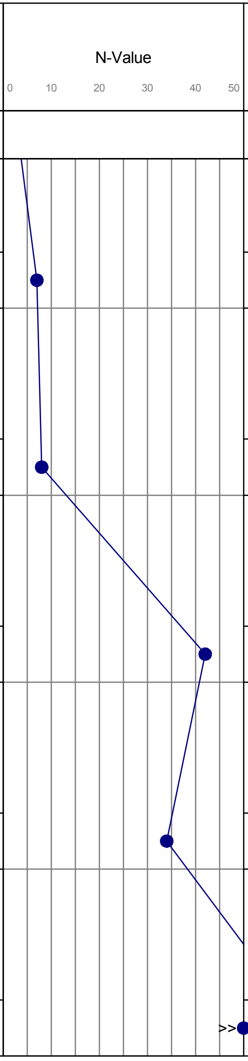
BOREHOLE ID: *SPT-13*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/5/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198345.9*
EASTING: *2305184.23*
GROUND ELEVATION: *33.5 ft (NAVD88)*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
							Lost drilling fluid at 62 ft bgs until the end of boring
-30	-65	Fine to coarse grained SAND (SP) (Peedee Aquifer); greenish gray and brown; wet; loose		3-3-4		0.8	
-35	-70	Clayey SAND (SC) (Peedee Aquifer); dark gray; wet; loose		3-3-5		0.9	
-40	-75	Clayey SAND (SC) (Peedee Aquifer); dark gray; wet; dense		10-13-29		0.9	
-45	-80	Clayey SAND (SC) (Peedee Aquifer); dark gray; wet; dense		10-14-20		1.5	Gravel=0.1%, Sand=85.6%, FC=14.3%; LL=NP, PL=NP, PI=NP
-50	-85	Clayey SAND (SC) (Peedee Aquifer); dark gray; wet; very dense		11-17-46	>>	1.3	Blow Count (N-Value)=63

End of Boring at 85.0 feet bgs.

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Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *SPT-14*

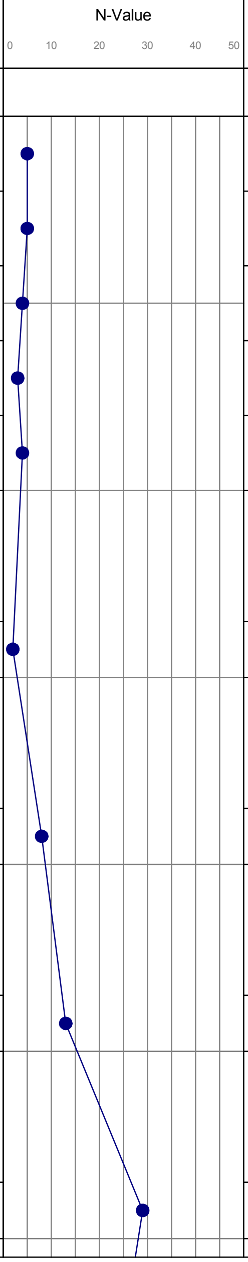
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/4/2015*
GEOSYNTEC REPRESENTATIVE: *Rohit Warrier*
DRILLING CONTRACTOR: *ConeTec*
DRILLER NAME: *David White*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 55LC Track Rig (Serial # 331145)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198316.06*
EASTING: *2306206.33*
GROUND ELEVATION: *32.8 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
		SILT (ML) (Ash); dark gray; moist; loose		4-3-2-4		1.9	
30		SILT (ML) (Ash); dark gray; moist; loose		2-2-3-2		1.3	MC=35.8%
	-5	SILT (ML) (Ash); dark gray; moist; very loose		2-2-2-2		1.5	Start using drilling mud at 6 ft bgs
25		SILT (ML) (Ash); dark gray; wet; very loose		2-2-1-2		1.3	Water level was measured to be at 8 ft bgs at the end of boring
		▼ SILT (ML) (Ash); dark gray; wet; very loose		3-2-2-2		1.8	
	-10						
20							
		SILT (ML) (Ash); dark gray; wet; very loose		WOH-1-1		0.7	
	-15						
15							
		Silty SAND (SM) (Ash and Fill); brown and tan; wet; loose		3-3-5		0.6	
	-20						
10							
		Fine to medium grained SAND trace silt; (SP) (Ash and Fill); gray; wet; medium dense		3-5-8		0.6	
	-25						
5							Gravel=0.0%, Sand=95.0%, FC=5.0%
		Fine to medium grained SAND (SP) (Possible Surficial Aquifer); gray; wet; medium dense		9-13-16		1.3	
	-30						



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All depths referenced to ground surface.

Total Depth: 100 ft bgs

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1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *SPT-14*

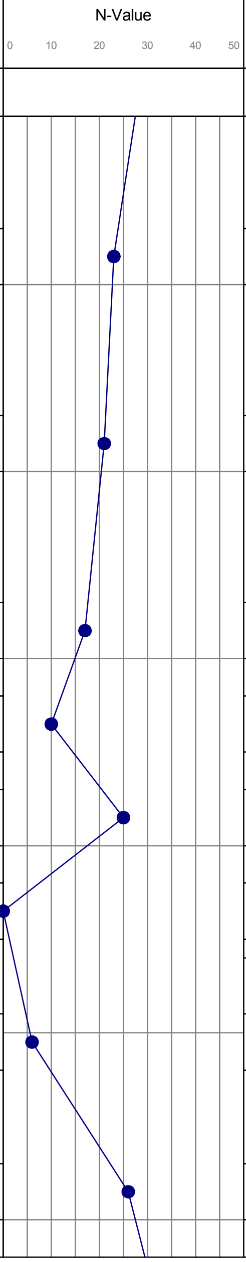
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/4/2015*
GEOSYNTEC REPRESENTATIVE: *Rohit Warrier*
DRILLING CONTRACTOR: *ConeTec*
DRILLER NAME: *David White*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 55LC Track Rig (Serial # 331145)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198316.06*
EASTING: *2306206.33*
GROUND ELEVATION: *32.8 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
0							
		Fine to medium grained SAND (SP) (Possible Surficial Aquifer); gray; wet; medium dense		6-10-13		0.7	
	-35						
-5							
		Fine to medium grained SAND (SP) (Possible Surficial Aquifer); gray; wet; medium dense		10-10-11		0.7	
	-40						
-10							
		Fine to coarse grained SAND (SP) (Possible Surficial Aquifer); dark greenish gray; wet; medium dense		6-6-11		0.8	Gravel=0.4%, Sand=96.6%, FC=3.0%
	-45						
		Fine to coarse grained SAND (SP) (Possible Surficial Aquifer); dark greenish gray and dark gray; wet; loose		6-5-5		0.8	
-15							
		Fine to coarse grained SAND (SP) (Possible Surficial Aquifer); dark gray; wet; medium dense		5-10-15		0.7	
	-50						
		Fat CLAY (CH) (Peedee Confining Unit); dark gray; wet; very soft		WOH-WOH-WOH		1.5	Gravel=0.0%, Sand=4.6%, FC=95.4%, Silt=57.3%, Clay=38.1%; LL=54, PL=24, PI=30
-20		Shelby tube (52.5 to 53.0 ft bgs)				0.5	
	-55						
		Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray; wet; loose		1-3-3		1.3	Organic peat layer of wood was observed in the split spoon between 55.7-56 bgs
-25							
		Clayey SAND (SC) (Peedee Aquifer); greenish gray and dark gray; wet; medium dense		8-15-11		1.0	
	-60	Clayey SAND (SC) (Possible Peedee Aquifer); greenish gray; wet; very stiff					



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All depths referenced to ground surface.

Total Depth: 100 ft bgs

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Oct 30 2019

BORING LOG

BOREHOLE ID: *SPT-14*

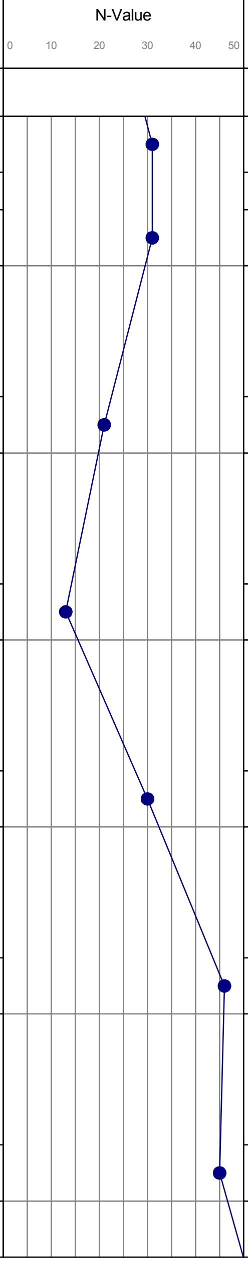
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/4/2015*
GEOSYNTEC REPRESENTATIVE: *Rohit Warrier*
DRILLING CONTRACTOR: *ConeTec*
DRILLER NAME: *David White*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 55LC Track Rig (Serial # 331145)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198316.06*
EASTING: *2306206.33*
GROUND ELEVATION: *32.8 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	Recovery (ft)	Comments
		Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray and dark gray; wet; dense		18-15-16	0.8	
-30						
		Fine to coarse grained SAND (SP) (Peedee Aquifer); gray; wet; dense		13-13-18	0.8	Gravel=0.2%, Sand=95.1%, FC=4.7%
	-65					
-35						
		Clayey SAND (SC) (Peedee Aquifer); dark greenish gray; wet; medium dense		6-11-10	0.8	
	-70					
-40						
		Clayey SAND (SC) (Peedee Aquifer); dark greenish gray; wet; medium dense		6-5-8	1.1	
	-75					
-45						
		Clayey SAND (SC) (Peedee Aquifer); dark greenish gray; wet; medium dense		11-14-16	1.3	
	-80					Driller indicated 6" of cemented sand at 81 ft bgs
-50						Gravel=0.0%, Sand=79.8%, FC=20.2%; LL=NP, PL=NP, PI=NP; SG=2.695
		Clayey SAND (SC) (Peedee Aquifer); dark greenish gray; wet; dense		13-21-25	1.3	
	-85					
-55						
		Clayey SAND (SC) (Peedee Aquifer); dark greenish gray; wet; dense		21-24-21	1.1	
	-90					



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Geosyntec consultants

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *SPT-14*

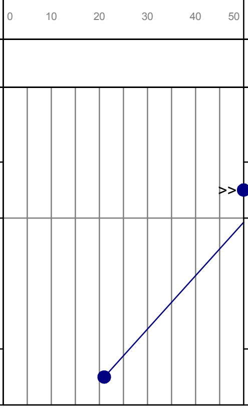
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/4/2015*
GEOSYNTEC REPRESENTATIVE: *Rohit Warrier*
DRILLING CONTRACTOR: *ConeTec*
DRILLER NAME: *David White*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 55LC Track Rig (Serial # 331145)*
BOREHOLE DIA: *4"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *198316.06*
EASTING: *2306206.33*
GROUND ELEVATION: *32.8 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
-60	-95	Clayey SAND (SC) (Peedee Aquifer); dark greenish gray; wet; very dense	▨	18-24-32	>>	1.5	Blow Count (N-Value)=56
-65	-100	Clayey SAND (SC) (Peedee Aquifer); dark greenish gray; wet; medium dense	▨	12-12-9		1.5	



End of Boring at 100.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 100 ft bgs

Attachment 1.8

Geosyntec 2014 July Boring Logs (LOLA Investigation)

Legend for Soil Classification Symbols

Pattern	Description
▦	SP – poorly graded sands
▚	SW – well graded sands
⁘	GP – poorly graded gravels
▞	GW – well graded gravels
▩	SM – silty sands
▦	SP-SM – poorly graded sand with silty sand
▩	SP-SC – poorly graded sand with clayey sand
▥	MH – elastic silts
▥	ML – inorganic silts with slight plasticity
▩	SC – clayey sands
▨	CL – lean clays
▨	CH – fat clays
≋	OH – organic clays
⁘	Sand and CCR Mixture
■	CCR

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Suite 110
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *F-DPT-1*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *06/30/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *196875.5*
EASTING: *2306640.9*
GROUND ELEVATION: *11.9*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
	0	Tan medium SAND (SP), with trace roots and trace CCRs	░		60%	
10			░			
			░			Collected SS-F-DPT-1 (3-4) 20140630 (submitted)
	-5	Very fine gray CCRs, saturated	▒		60%	
5			▒			Collected SS-F-DPT-1 (7-8) 20140630 (submitted)
		Very fine gray to tan CCRs, saturated	▒		90%	
	-10	Fine to medium tan SAND (SP), saturated	░			
0			░			
			░		25%	
	-15		░			

All depths referenced to ground surface.

Total Depth: 16

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BORING LOG

BOREHOLE ID: *F-DPT-2*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *06/30/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *197079.5*
EASTING: *2306716.4*
GROUND ELEVATION: *14.2*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
	0	Medium to fine brown to gray and orange well graded SAND (SW), trace black specks	▨		30%	Collected SS-F-DPT-2 (3-4) 20140630
10	-5	Fine orange to tan SAND (SW), trace black specks, saturated	▨		50%	Collected SS-F-DPT-2 (7-8) 20140630
5	-10		▨		25%	

All depths referenced to ground surface.

Total Depth: 12

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Suite 110
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *F-DPT-3*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *06/30/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *197022.7*
EASTING: *2306385.9*
GROUND ELEVATION: *10.3*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
10	0	Medium brown to tan SAND (SP), dry, trace black specks	▨		75%	Collected SS-F-DPT-3 (1.5-2.5) 20140630 (submitted)
		Medium brown to tan SAND (SP), saturated, trace black specks	▨			
		CCRs, saturated	■			
5	-5				100%	Collected SS-F-DPT-3 (5-6) 20140630 (submitted)
		Medium tan SAND (SP), saturated, trace black specks	▨			
					75%	
0	-10					

All depths referenced to ground surface.

Total Depth: 12

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Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *F-DPT-4*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *07/01/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *196505.8*
EASTING: *2305220.2*
GROUND ELEVATION: *8.7*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
	0	Dark gray medium silty SAND (SM) with a silt layer at 3 ft bgs, some roots, damp			70%	Collected SS-F-DPT-4 (2-3) 20140701
5	-5	Medium to dark gray medium SAND and CCR mixture, saturated, layer of hard silt at 6.5 ft bgs			75%	Collected SS-F-DPT-4 (7-8) 20140701
0	-10	Light gray medium SAND (SP), trace black specs, saturated			75%	
		Dark brown medium silty SAND (SM), saturated				
-5	-15	Dark brown medium silty SAND (SM), saturated, becoming lighter color with depth			60%	
		Gray medium SAND (SP), saturated			75%	
-10	-20	Gray medium SAND (SP), saturated, transitions to dark gray organic silt layer				Collected SS-F-DPT-4 (18-20) 20140701 (submitted)

All depths referenced to ground surface.

Total Depth: 20

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Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *F-DPT-5*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *07/01/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *197182.6*
EASTING: *2305313.3*
GROUND ELEVATION: *9.7*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
	0	Very fine gray black silty material, possibly CCR's, some areas have a sheen	▨		75%	Collected SS-F-DPT-5 (2-4) 20140701 and MS and MSD (submitted)
5	-5	Very fine gray black silty material, possibly CCR's, some areas have a sheen, saturated	▨		100%	Collected SS-F-DPT-5 (6-8) 20140701 and duplicate SS-F-DPT-5 (6-8) 20140701 (submitted)
		No recovery			0%	
0	-10					
					50%	
-5	-15	fine to medium gray SAND (SP) with staining of core at top of core	░			
		Medium brown SAND (SP) with some silt	░		60%	
		Fine to medium light tan SAND (SP)	░			
-10	-20					

All depths referenced to ground surface.

Total Depth: 20

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BORING LOG

BOREHOLE ID: *F-DPT-6*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *07/01/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *197155.9*
EASTING: *2305004.4*
GROUND ELEVATION: *10.9*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
10	0	Fine tan and orange SAND (SP) with some gray silt (possibly CCRs) and trace organics (roots)			100%	Collected SS-F-DPT-6 (3-4) 20140701
5	-5	Gray CCRs, saturated			40% 100%	Collected SS-F-DPT-6 (8-9) 20140701
0	-10	Dark brown medium SAND and CCR mixture				
-5	-15	Medium to dark brown silty SAND (SM), saturated			100% 100%	
	-20					

All depths referenced to ground surface.

Total Depth: 20

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BORING LOG

BOREHOLE ID: *F-DPT-7*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *07/01/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *197035.6*
EASTING: *2305560.4*
GROUND ELEVATION: *9.0*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
	0					
		Medium brown SAND (SP) with some gray silty material (possibly CCRs)	░		100%	
						Collected SS-F-DPT-7 (3-4) 20140701 (submitted)
5						
	-5	Light to dark gray CCRs, compact, saturated	▒		75%	
						Collected SS-F-DPT-7 (7-8) 20140701 (submitted)
					75%	
0						
	-10					
		Medium brown silty SAND (SM), trace black specks	▦		75%	
-5						
	-15					Collected SS-F-DPT-7 (15-16) 20140701 (submitted)
		Dark brown silty SAND (SM)				
		Medium brown SAND (SP), some brown silt	░		60%	
-10						
	-20					

All depths referenced to ground surface.

Total Depth: 20

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BORING LOG

BOREHOLE ID: *F-DPT-8*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *07/01/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *197251.1*
EASTING: *2305892.6*
GROUND ELEVATION: *9.9*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
	0	Fine to medium tan and gray SAND (SP) with gray silty material (possibly CCRs)			50%	Collected SS-F-DPT-8 (3-4) 20140701
5	-5	Gray fine SAND (SP) with CCRs, saturated			75%	Collected SS-F-DPT-8 (3-4) 20140701
		Gray fine CCRs				
		Gray medium SAND (SP) with black staining				
		Medium brown SAND and CCR mixture, transitioning to dark brown silty SAND (SM) at 10 ft bgs			80%	
0	-10					
		Fine tan SAND (SP), saturated, trace black specks			60%	
-5	-15					
					0%	Drill bit got stuck during drilling and core between 16 and 20 ft bgs was unable to be recovered.
-10	-20					

All depths referenced to ground surface.
Total Depth: 20

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BORING LOG

BOREHOLE ID: *F-DPT-9*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *07/01/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *197173.0*
EASTING: *2306258.2*
GROUND ELEVATION: *10.0*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
10	0					
		Dark brown SAND and CCR mixture	▨		100%	Collected SS-F-DPT-9 (1-2) 20140701
		Dark brown SAND and CCR mixture, saturated	▨		75%	Collected SS-F-DPT-9 (3-4) 20140701
5	-5	Fine to medium tan SAND (SP), saturated, some black specks	░		100%	
		Brown SAND and CCR mixture	▨			
		Fine tan SAND (SP), saturated	░		50%	
0	-10					
					30%	
-5	-15					
					75%	
-10	-20					

All depths referenced to ground surface.

Total Depth: 20

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BORING LOG

BOREHOLE ID: *F-DPT-10*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant

PROJECT NO: *GC5592*

SITE LOCATION: *Wilmington, North Carolina*

BORING DATE: *07/02/14*

GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*

DRILLING CONTRACTOR: *SAEDACCO*

DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*

RIG TYPE: *Geoprobe 7822DT*

BOREHOLE DIA: *2"*

SAMPLING METHOD: *Direct Push Technology*

NORTHING: *197915.9*

EASTING: *2305065.0*

GROUND ELEVATION: *13.2*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
10	0	Very fine gray sand and CCR mixture, dry	▨		100%	Collected SS-F-DPT-10 (3-4) 20140702
	-5	Very fine gray SAND and CCR mixture, saturated	▨		50%	
5	-10	Very fine gray SAND and CCR mixture, saturated	▨		100%	Collected SS-F-DPT-10 (8-9) 20140702
0	-15	Gray coarse SAND and CCR mixture, saturated	▨		25%	
-5		Fine to medium tan SAND (SP) transitioning to brown, saturated	▨		50%	
-10	-20	Fine to medium tan SAND (SP), saturated	▨		50%	

All depths referenced to ground surface.

Total Depth: 24

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BORING LOG

BOREHOLE ID: *F-DPT-11*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *07/02/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *197706.3*
EASTING: *2305633.3*
GROUND ELEVATION: *15.0*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
15	0	Fine orange to gray SAND and CCR mixture			100%	
10	-5	fine orange SAND and CCR mixture, damp			50%	
						Collected SS-F-DPT-11 (7-8) 20140702 (sumbitted)
		fine orange SAND and CCR mixture, saturated			50%	
5	-10					
						Collected SS-F-DPT-11 (7-8) 20140702 (submitted)
					50%	
0	-15					
		Medium brown SAND (SP), saturated				
		Medium brown SAND (SP), saturated, trace black specks			50%	
-5	-20					

All depths referenced to ground surface.

Total Depth: 20

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BORING LOG

BOREHOLE ID: *F-DPT-12*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *07/02/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *197519.4*
EASTING: *2305959.0*
GROUND ELEVATION: *11.4*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
	0	Dark brown silty SAND (SM), topsoil			100%	
10		Fine tan SAND (SP)				
		Fine orange SAND (SP)				No samples collected during drilling
	-5	Fine orange SAND (SP), moist			25%	
5						
		Fine tan SAND (SP), saturated, trace black specks			50%	
	-10					
0						
					50%	
	-15					
-5					75%	
	-20					

All depths referenced to ground surface.
Total Depth: 20

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BORING LOG

BOREHOLE ID: *F-DPT-13*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *07/02/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *196602.1*
EASTING: *2306104.6*
GROUND ELEVATION: *7.5*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
5	0	Possible CCRs Medium tan and brown SAND (SP) with some staining, moist			50%	No samples collected during drilling
0	-5	Medium brown SAND (SP) transitioning to tan SAND (SP) with depth, saturated			50%	
	-10	Medium tan SAND (SP), saturated			20%	

All depths referenced to ground surface.

Total Depth: 12

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BORING LOG

BOREHOLE ID: *F-DPT-14*

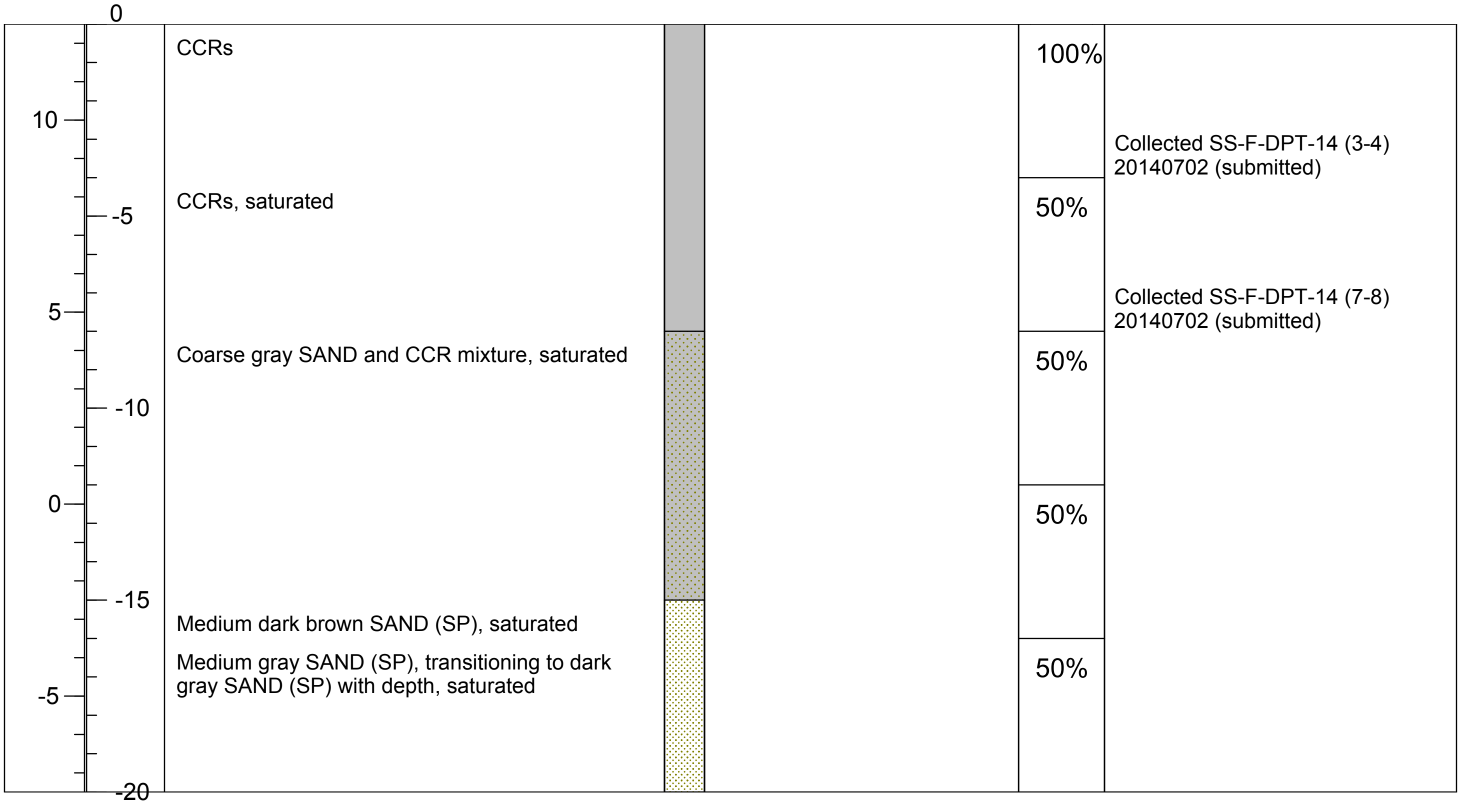
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *07/02/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *197495.7*
EASTING: *2305270.0*
GROUND ELEVATION: *12.5*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments



CCRs

CCRs, saturated

Coarse gray SAND and CCR mixture, saturated

Medium dark brown SAND (SP), saturated

Medium gray SAND (SP), transitioning to dark gray SAND (SP) with depth, saturated

100%

50%

50%

50%

50%

Collected SS-F-DPT-14 (3-4) 20140702 (submitted)

Collected SS-F-DPT-14 (7-8) 20140702 (submitted)

All depths referenced to ground surface.

Total Depth: 20

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BORING LOG

BOREHOLE ID: *F-DPT-15*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Steam Plant
PROJECT NO: *GC5592*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *07/02/14*
GEOSYNTEC REPRESENTATIVE: *Rachel Donahue*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*

TECHNICAL INFORMATION

DRILLING METHOD: *Direct Push Technology*
RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *2"*
SAMPLING METHOD: *Direct Push Technology*
NORTHING: *196723.8*
EASTING: *2305805.9*
GROUND ELEVATION: *7.3*

Elev. (ft NAVD88)	Depth (ft)	Lithologic Description	Pattern	Well Construction Details	Recovery	Comments
5	0	Fine gray SAND and CCR mixture	▨		100%	No samples collected during drilling
0	-5	Coarse gray SAND and CCR mixture, saturated	▨		75%	
		Medium tan SAND (SP), saturated	░		75%	
	-10	Dark brown and black coarse SAND and CCR mixture, iridescent sheen, saturated	▨			
-5	-15	Medium brown SAND (SP), transitioning to tan SAND (SP), saturated	░		75%	

All depths referenced to ground surface.

Total Depth: 16

Attachment 1.9

Geosyntec 2015 March Boring Logs (LOLA Investigation)

LEGEND FOR SYMBOLS

Pattern	Description
▩	GW – Well graded GRAVEL or Well graded GRAVEL with sand
▩	GP – Poorly graded GRAVEL or Poorly graded GRAVEL with sand
▩	SW – Well graded SAND or Well graded SAND with gravel
░	SP – Poorly graded SAND or Poorly graded SAND with gravel
⁘	SP-SM – Poorly graded SAND with silt or Poorly graded SAND with silt and gravel
▨	SP-SC – Poorly graded SAND with clay or Poorly graded SAND with clay and gravel
⁘	SM – Silty SAND or Silty SAND with gravel
▨	SC – Clayey SAND or Clayey SAND with gravel
▥	ML – SILT, SILT with sand (or with gravel), or Sandy (or Gravelly) SILT
▥	MH – Elastic SILT, Elastic SILT with sand (or with gravel), or Sandy (or Gravelly) elastic SILT
▨	CL – Lean CLAY, Lean CLAY with sand (or with gravel), or Sandy (or Gravelly) lean CLAY
▨	CH – Fat CLAY, Fat CLAY with sand (or with gravel), or Sandy (or Gravelly) fat CLAY
☰	OL – Organic SILT or CLAY with low plasticity
≈	OH – Organic SILT or CLAY with medium to high plasticity
■	Ash
░	Topsoil
☰	Well Screen
▒	Grout
☰	Bentonite
⁘	Granular Backfill
□	PVC Riser

MOSITURE CONTENT DEFINITIONS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

RELATIVE DENSITY

Sands, Gravels, Non-plastic Silts	Blows/Foot (N-Value)
Very Loose	0-4
Loose	5-10
Medium Dense	11-30
Dense	31-50
Very Dense	> 50

CONSISTENCY

Silts & Clays	Blows/Foot (N-Value)
Very Soft	0-2
Soft	3-4
Medium Stiff	5-8
Stiff	9-15
Very Stiff	16-30
Hard	31-50
Very Hard	> 50

SOIL CLASSIFICATION AND LOG KEY

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FIGURE 1.7.1

PROJECT NO: GC5770

April 2015

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Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *LO-SPT-1*

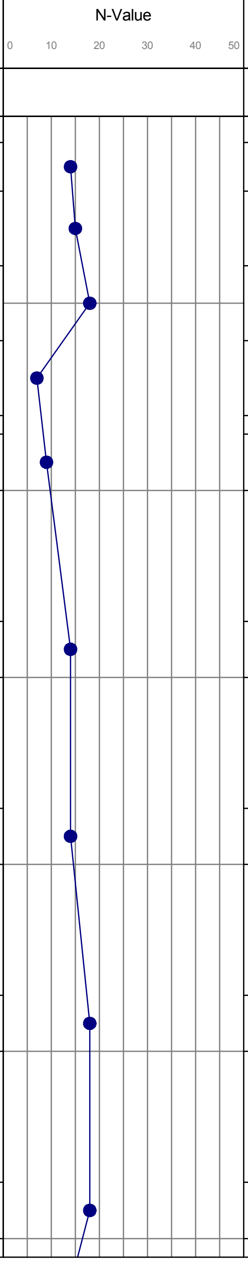
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/10/2015*
GEOSYNTEC REPRESENTATIVE:
DRILLING CONTRACTOR: *ConeTec*
DRILLER NAME: *David White*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 55LC Track Rig (Serial # 331145)*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *196830.72*
EASTING: *2305008.19*
GROUND ELEVATION: *13 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	Recovery (ft)	Comments
		CONCRETE	▨			
		Sandy SILT (ML) (Ash and Fill); gray; moist; medium dense	▒	4-7-7-7	2.0	
10		Silty SAND (SM) (Ash and Fill); gray; moist; medium dense	▒	6-7-8-8	2.0	MC=24.1%; Gravel=1.4%, Sand=55.9%, FC=42.7%; SG=2.418 Water level was measured to be at 4.5 ft bgs at the end of boring Start using drilling mud at 6 ft bgs
	-5	▼ Silty SAND (SM) (Ash and Fill); gray; moist; medium dense	▒	6-8-10-8	1.7	
		Sandy SILT (ML) (Ash and Fill); gray; wet; loose	▒	5-4-3-4	1.7	
5	-10	Sandy SILT (ML) (Ash and Fill); gray; wet; loose	▒	2-3-6	1.3	
0	-15	Fine to medium grained SAND (SP) (Possible Surficial Aquifer); reddish brown; wet; medium dense	░	4-6-8	0.8	
-5	-20	Fine to medium grained SAND (SP) (Surficial Aquifer); brown; wet; medium dense	░	6-7-7	0.8	
-10	-25	Fine to medium grained SAND (SP) (Surficial Aquifer); brown and gray; wet; medium dense	░	5-8-10	0.8	
-15	-30	Fine to medium grained SAND (SP) (Surficial Aquifer); light gray; wet; medium dense	░	9-9-9	1.0	Gravel=0.2%, Sand=96.7%, FC=3.1%; SG=2.693



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All depths referenced to ground surface.

Total Depth: 50 ft bgs

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1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *LO-SPT-1*

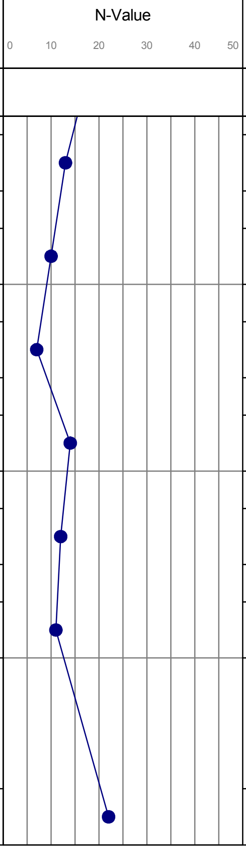
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/10/2015*
GEOSYNTEC REPRESENTATIVE:
DRILLING CONTRACTOR: *ConeTec*
DRILLER NAME: *David White*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 55LC Track Rig (Serial # 331145)*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *196830.72*
EASTING: *2305008.19*
GROUND ELEVATION: *13 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
		Fine to medium grained SAND (SP) (Surficial Aquifer); light gray and tan; wet; medium dense	░	5-6-7		1.0	
-20	-35	Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray; wet; loose	░	4-4-6		0.8	
		Fine to medium grained SAND (SP) (Peedee Aquifer); light greenish gray; wet; loose	░	3-3-4		0.8	FC=2.4%
-25	-40	Fine to medium grained SAND (SP) (Peedee Aquifer); light greenish gray; wet; medium dense	░	4-6-8		0.8	
		Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray; wet; medium dense	░	5-5-7		0.8	
-30	-45	Fine to coarse grained SAND (SP) (Peedee Aquifer); dark gray; wet; medium dense	░	4-4-7		0.8	
-35	-50	Clayey SAND (SC) (Peedee Aquifer); greenish gray; wet; medium dense	▨	8-8-14		1.0	



End of Boring at 50.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 50 ft bgs

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Charlotte, NC 28203

BORING LOG

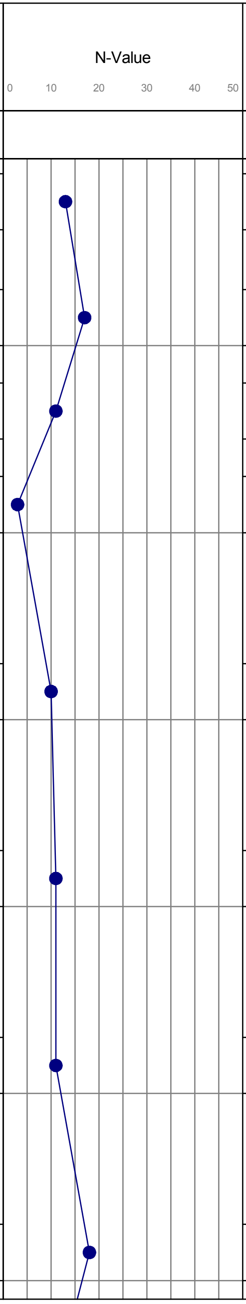
BOREHOLE ID: *LO-SPT-2*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/23/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *Diedrich D-25 Track Rig (Serial # D-25152)*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *197296.27*
EASTING: *2304961.07*
GROUND ELEVATION: *13.1 ft (NAVD88)*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	Recovery (ft)	Comments
		CONCRETE TOPSOIL; light brown; moist; stiff Sandy SILT (ML) (Ash and Fill); gray; moist; medium dense		3-5-8	1.4	
10						Start using drilling mud after 2.5 ft bgs
		Silty SAND (SM) (Ash and Fill); gray; wet; medium dense		7-9-8	1.1	
	-5	▼				Water level was measured to be 5.4 ft bgs at the end of boring
		Silty SAND (SM) (Fill and Ash); gray; wet; medium dense		5-6-5	1.0	Gravel=0.8%, Sand=72.2%, FC=27.0%
5						
		SILT (ML) (Ash); gray; wet; very loose		2-2-1	1.3	
	-10					Organic wood found in split spoon at 10 ft bgs
0						
		Fine to medium grained SAND (SP) (Surficial Aquifer); gray and brown; wet; loose		3-4-6	0.8	
	-15					
-5						Gravel=0.0%, Sand=98.0%, FC=2.0%
		Fine to medium grained SAND (SP) (Surficial Aquifer); brown; wet; medium dense		4-5-6	0.7	
	-20					
-10						
		Fine to medium grained SAND (SP) (Possible Peedee Aquifer); brown and gray; wet; medium dense		3-5-6	0.7	
	-25					
-15						
		Fine to coarse grained SAND (SP) (Peedee Aquifer); tan and greenish gray; wet; medium dense		6-9-9	0.9	
	-30					

(Continued Next Page)

All depths referenced to ground surface.

Total Depth: 50 ft bgs

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1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *LO-SPT-2*

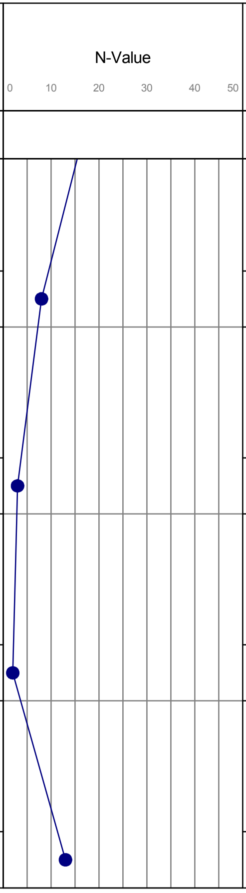
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/23/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *Diedrich D-25 Track Rig (Serial # D-25152)*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *197296.27*
EASTING: *2304961.07*
GROUND ELEVATION: *13.1 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	Recovery (ft)	Comments
-20						
		Fine to medium grained SAND (SP) (Peedee Aquifer); tan and greenish gray; wet; loose		3-4-4	0.8	
	-35					
-25						FC=1.9%
		Fine to coarse grained SAND (SP) (Peedee Aquifer); dark gray; wet; very loose		2-1-2	0.4	
	-40					
-30						FC-2.2%
		Fine to coarse grained SAND (SP) (Peedee Aquifer); dark gray and greenish gray; wet; very loose		1-1-1	0.5	
	-45					
-35						
		Fine to coarse grained SAND some gravel; (SP) (Peedee Aquifer); dark gray; wet; medium dense		4-6-7	0.6	
	-50					



End of Boring at 50.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 50 ft bgs

Geosyntec consultants

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

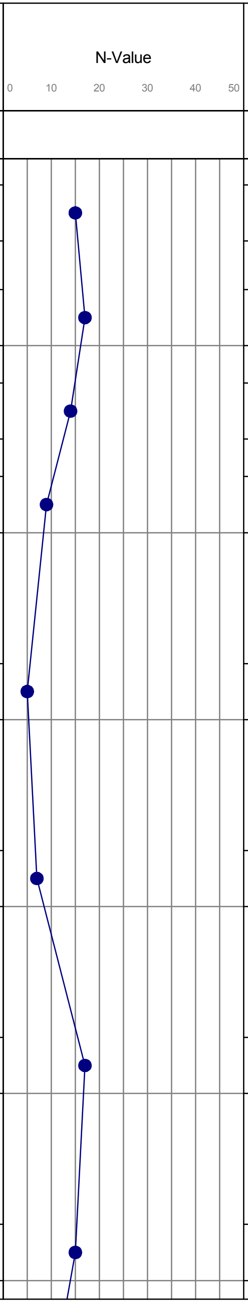
BOREHOLE ID: *LO-SPT-3*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/25/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *Diedrich D-25 Track Rig (Serial # D-25152)*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *197662.01*
EASTING: *2304949.38*
GROUND ELEVATION: *13.3 ft (NAVD88)*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
		CONCRETE					
		Silty SAND (SM) (Ash and Fill); dark gray; dry; medium dense		1-6-9		1.3	Organic wood found in the split spoon at 1.8 ft bgs Started using drilling mud at 2.5 ft bgs Gravel=0.3%, Sand=49.6%, FC=50.1%; SG=2.485
		Sandy SILT (ML) (Ash and Fill); dark gray; wet; medium dense		7-8-9		1.2	Water level was measured to be at 5.5 ft bgs at the end of boring
		Silty SAND (SM) (Ash and Fill); dark gray; wet; medium dense		4-7-7		1.0	
		SILT (ML) (Ash); dark gray; wet; loose		3-5-4		1.0	
		Fine to medium grained SAND (SP) (Surficial Aquifer); gray; wet; loose					
		Fine to medium grained SAND (SP) (Surficial Aquifer); tan; wet; loose		1-2-3		0.9	Gravel=0.0%, Sand=96.8%, FC=3.2%
		Fine to medium grained SAND (SP) (Surficial Aquifer); gray and tan; wet; loose		3-3-4		1.0	
		Fine to medium grained SAND (SP) (Possible Peedee Aquifer); greenish gray; wet; medium dense		8-8-9		0.8	
		Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray and brown; wet; medium dense		5-7-8		1.0	

(Continued Next Page)

All depths referenced to ground surface.

Total Depth: 50 ft bgs

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

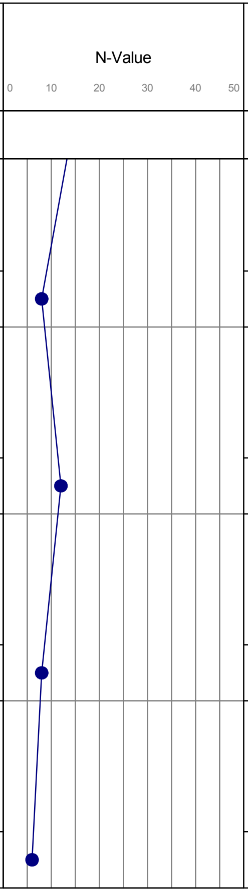
BOREHOLE ID: *LO-SPT-3*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/25/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *Diedrich D-25 Track Rig (Serial # D-25152)*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *197662.01*
EASTING: *2304949.38*
GROUND ELEVATION: *13.3 ft (NAVD88)*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
-20	-35	Fine to medium grained SAND (SP) (Peedee Aquifer); gray; wet; loose		5-4-4		0.7	FC=2.1%; SG=2.678
-25	-40	Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray; wet; medium dense		5-6-6		0.9	
-30	-45	Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray; wet; loose		3-4-4		0.8	
-35	-50	Fine to medium grained SAND (SP) (Peedee Aquifer); dark gray; wet; loose		4-3-3		0.6	

End of Boring at 50.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 50 ft bgs

Geosyntec consultants

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

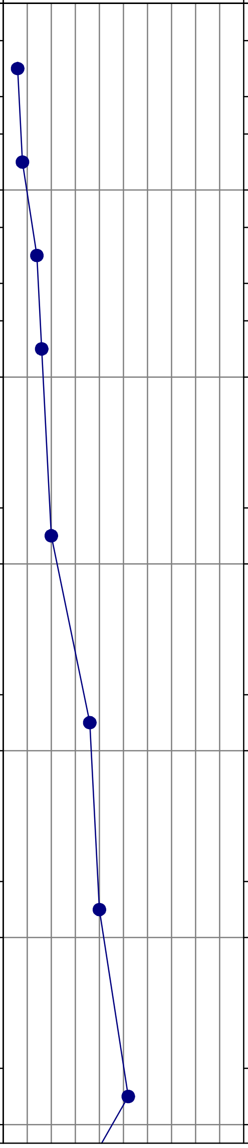
BOREHOLE ID: *LO-SPT-4*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/20/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *197890.43*
EASTING: *2305246*
GROUND ELEVATION: *15.9 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value 0 10 20 30 40 50	Recovery (ft)	Comments
15		Silty SAND (SM) (Ash and Fill); gray and brown; moist; very loose		1-1-2		1.3	Start using drilling mud at 2.5 ft bgs Gravel=1.4%, Sand=70.8%, FC=27.8%
		Silty SAND (SM) (Ash and Fill); gray and brown; wet; very loose		2-2-2		1.2	
10	-5	Silty SAND (SM) (Ash and Fill); gray and brown; wet; loose		2-3-4		1.1	Water level was measured to be at 6.2 ft bgs at the end of boring
5	-10	Sandy SILT (ML) (Ash and Fill); gray and brown; wet; loose		3-3-5		1.0	
0	-15	Fine to medium grained SAND (SP) (Surficial Aquifer); tan and brown; wet; loose		2-5-5		1.0	gravel piece found in the split spoon at 13.5 ft bgs
-5	-20	Fine to medium grained SAND (SP) (Surficial Aquifer); tan and brown; wet; medium dense		6-8-10		1.0	
-10	-25	Fine to medium grained SAND (SP) (Surficial Aquifer); gray and tan; wet; medium dense		8-9-11		0.8	Gravel=0.0%, Sand=97.2%, FC=2.8%
	-30	Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray and tan; wet; medium dense		8-11-15		1.0	

(Continued Next Page)

All depths referenced to ground surface.

Total Depth: 50 ft bgs

Geosyntec consultants

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *LO-SPT-4*

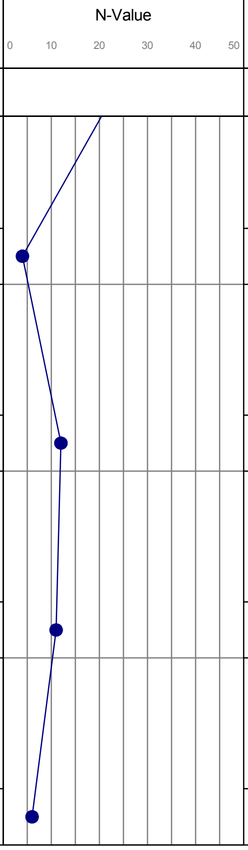
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/20/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *CME 45C Track Rig (Serial # 273964)*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *197890.43*
EASTING: *2305246*
GROUND ELEVATION: *15.9 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
-15							
		Fine to coarse grained SAND (SP) (Peedee Aquifer); greenish gray and tan; wet; very loose	▨	3-2-2		0.7	FC=3.4%
-20	-35						
		Fine to coarse grained SAND (SP) (Peedee Aquifer); gray; wet; medium dense	▨	6-6-6		1.0	
-25	-40						
		Fine to coarse grained SAND (SP) (Peedee Aquifer); greenish gray and dark gray; wet; medium dense	▨	4-5-6		1.0	
-30	-45						
		Fine to coarse grained SAND (SP) (Peedee Aquifer); greenish gray and dark gray; wet; loose	▨	7-4-2		1.0	gravel was found between 49.8 ft bgs and 50 ft bgs
	-50						



End of Boring at 50.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 50 ft bgs

Geosyntec consultants

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *LO-SPT-5*

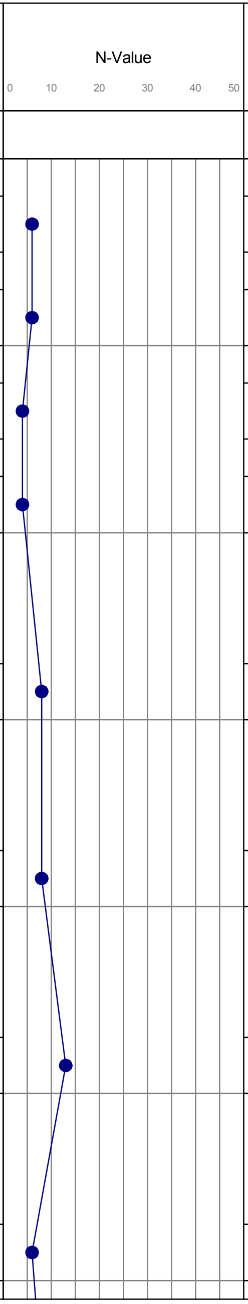
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/25/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *Diedrich D-25 Track Rig (Serial # D-25152)*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *197711.71*
EASTING: *2305633.12*
GROUND ELEVATION: *15.2 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
15		Top 0.4': TOPSOIL; black; moist; loose					
		Bottom 1.0': fine to medium grained SAND (SP) (Ash and Fill); trace silt; brown and gray; moist; loose		1-3-3		1.4	Started using drilling mud at 2.5 ft bgs
10	-5	Fine to medium grained SAND (SP) (Fill); brown and gray; wet; loose		2-3-3		0.9	Water level was measured to be at 5.2 ft bgs at the end of boring
		Top 0.6': fine to medium grained SAND (SP) (Ash and Fill); brown; wet; very loose Bottom 0.2': Sandy SILT (ML) (Ash and Fill); gray and black; wet; very loose		2-2-2		0.8	Between 7.5-8.5 ft bgs return fluid seemed to consist of ash
5	-10	Fine to medium grained SAND (SP) (Surficial Aquifer); gray; wet; very loose		1-2-2		0.6	FC=1.2%; SG=2.673
0	-15	Fine to medium grained SAND (SP) (Surficial Aquifer); gray and tan; wet; loose		2-4-4		0.9	
-5	-20	Fine to medium grained SAND (SP) (Possible Surficial Aquifer); reddish brown; wet; loose		2-4-4		0.7	
-10	-25	SAND with silt; (SP-SM) (Possible Surficial Aquifer); light gray and tan; wet; medium dense		6-6-7		1.3	Gravel=0.0%, Sand=91.3%, FC=8.7%; SG=2.697
-15	-30	Fine to coarse grained SAND (SP) (Possible Peedee Aquifer); gray and tan; wet; loose		2-3-3		1.2	



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All depths referenced to ground surface.

Total Depth: 50 ft bgs

Geosyntec consultants

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

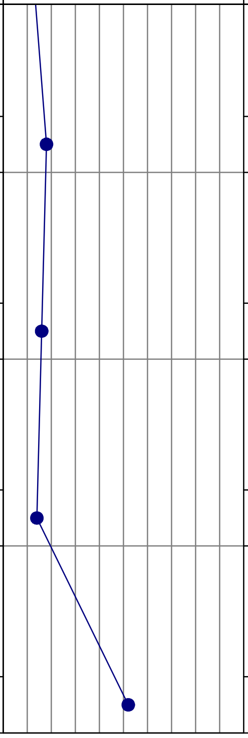
BOREHOLE ID: *LO-SPT-5*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/25/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *Diedrich D-25 Track Rig (Serial # D-25152)*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *197711.71*
EASTING: *2305633.12*
GROUND ELEVATION: *15.2 ft (NAVD88)*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
		Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray; wet; loose	▒	3-5-4		0.9	
-20	-35						
		Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray; wet; loose	▒	3-3-5		0.8	
-25	-40						
		Fine to coarse grained SAND (SP) (Peedee Aquifer); greenish gray and light gray; wet; loose	▒	3-3-4		0.8	
-30	-45						
		Fine to coarse grained SAND (SP) (Peedee Aquifer); with gravel; dark gray and brown; wet; medium dense	▒	4-7-19		1.1	
	-50						

End of Boring at 50.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 50 ft bgs

Geosyntec consultants

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

BOREHOLE ID: *LO-SPT-6*

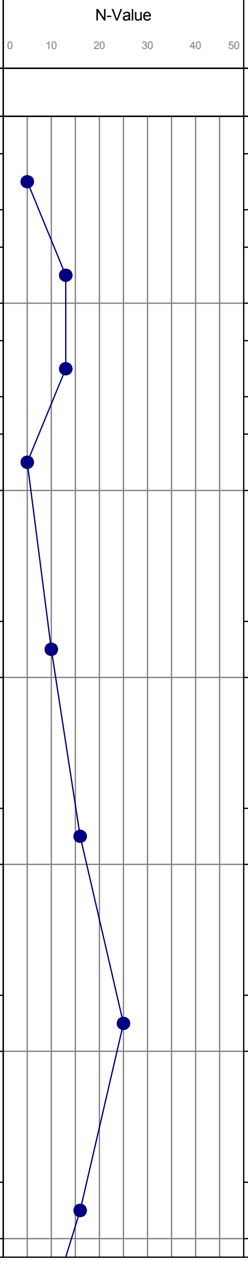
GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/24/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *Diedrich D-25 Track Rig (Serial # D-25152)*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *197519.1*
EASTING: *2306018.74*
GROUND ELEVATION: *15.1 ft (NAVD88)*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
		Top 0.2': SILT (ML) (Ash and Fill); black; moist; loose					
		Bottom 0.9': fine to medium grained SAND (SP) (Fill); reddish brown; moist; loose		1-2-3		1.1	Started using drilling mud at 2.5 ft bgs
10	-5	Fine to medium grained SAND (SP) (Fill); dark yellow and dark brown; wet; medium dense		4-6-7		1.1	
		▼ Fine to medium grained SAND (SP) (Fill); reddish brown; wet; medium dense		5-6-7		0.9	SG=2.681 Water level was measured to be at 6.3 ft bgs at the end of boring
5	-10	Fine to medium grained SAND (SP) (Surficial Aquifer); gray and tan; wet; loose		2-2-3		0.9	FC=2.7%
0	-15	Fine to medium grained SAND (SP) (Surficial Aquifer); light gray; wet; loose		3-5-5		1.0	Gravel=0.0%, Sand=96.7%, FC=3.3%
-5	-20	Fine to medium grained SAND (SP) (Surficial Aquifer); light gray and tan; wet; medium dense		7-8-8		1.1	
-10	-25	Fine to medium grained SAND (SP) (Surficial Aquifer); gray and tan; wet; medium dense		9-12-13		0.9	
-15	-30	Fine to medium grained SAND (SP) (Peedee Aquifer); greenish gray; wet; medium dense		8-8-8		0.8	



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All depths referenced to ground surface.

Total Depth: 50 ft bgs

Geosyntec consultants

Geosyntec Consultants
1300 South Mint Street #410
Charlotte, NC 28203

BORING LOG

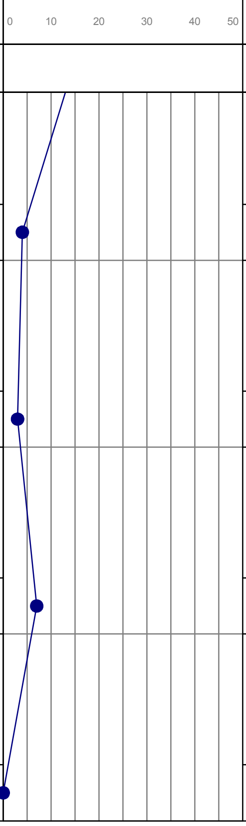
BOREHOLE ID: *LO-SPT-6*

GENERAL INFORMATION

PROJECT NAME: L.V. Sutton Final Closure Plan
PROJECT NO: *GC5770*
SITE LOCATION: *Wilmington, North Carolina*
BORING DATE: *3/24/2015*
GEOSYNTEC REPRESENTATIVE: *Mustafa Erten*
DRILLING CONTRACTOR: *Mid-Atlantic Drilling*
DRILLER NAME: *William Wiggins*

TECHNICAL INFORMATION

DRILLING METHOD: *Mud Rotary*
RIG TYPE: *Diedrich D-25 Track Rig (Serial # D-25152)*
BOREHOLE DIA: *3"*
SAMPLING METHOD: *SPT with Split Spoon*
NORTHING: *197519.1*
EASTING: *2306018.74*
GROUND ELEVATION: *15.1 ft (NAVD88)*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	SPT Blows	N-Value	Recovery (ft)	Comments
		Fine to coarse grained SAND (SP) (Peedee Aquifer); greenish gray; wet; very loose		2-2-2		0.6	FC=2.5%
-20	-35						
		Fine to coarse grained SAND with gravel; (SP) (Peedee Aquifer); greenish gray; wet; very loose		2-1-2		0.6	FC=2.0%
-25	-40						
		Fine to medium grained SAND with gravel; (SP) (Peedee Aquifer); greenish gray; wet; loose		3-4-3		0.6	
-30	-45						
		No Recovery		WOH-WOH-WOH		0.0	
	-50						

End of Boring at 50.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 50 ft bgs

Attachment 2

Historical and Geosyntec CPT Sounding Logs, Dissipation Test Results, and Shear Wave Velocity Measurements

Attachment 2.1

Withers & Ravenel CPT Sounding Logs

Cone Penetration Test

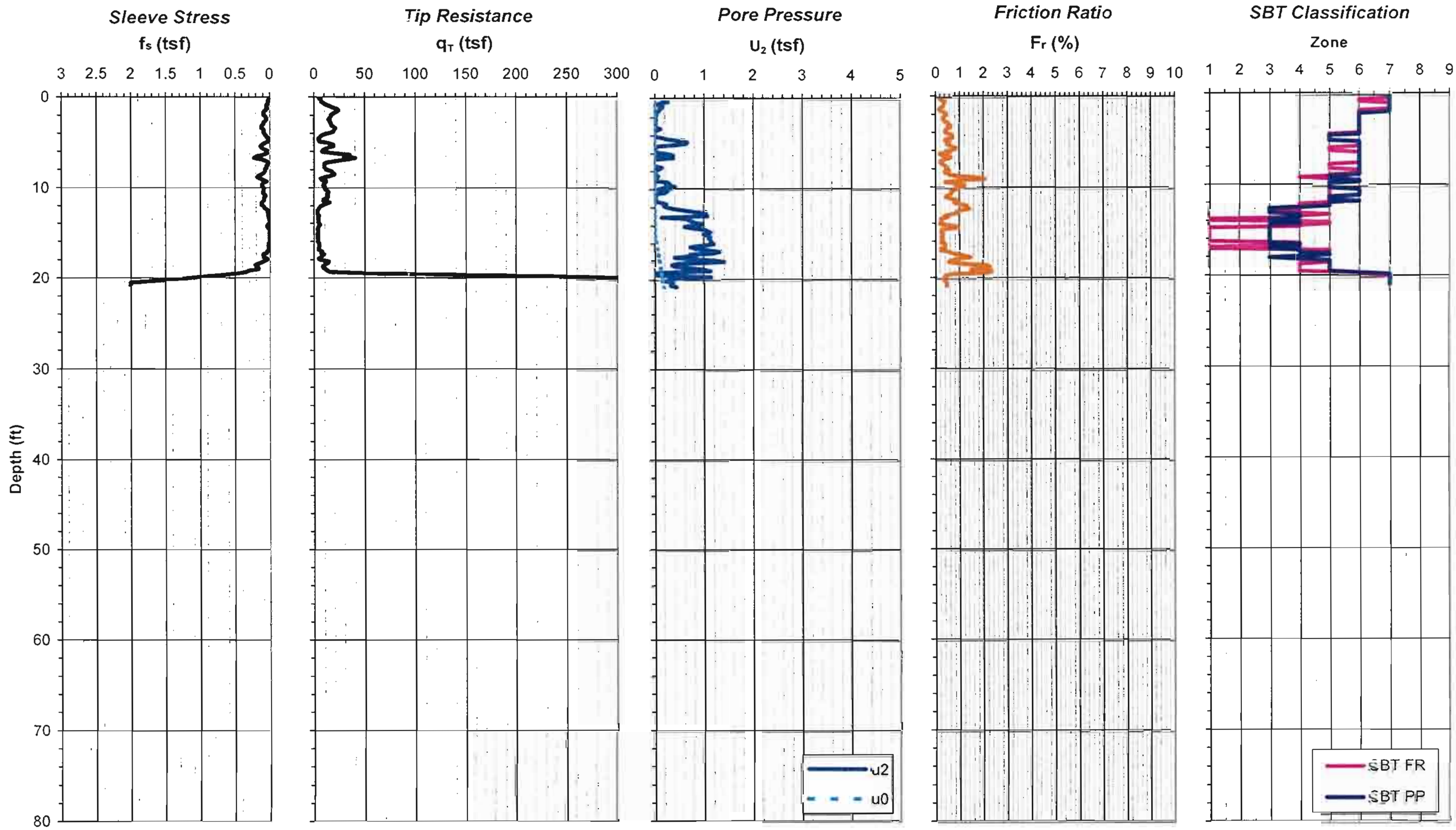
Withers & Ravenel, Inc.
Cary, NC

Test:	WR-1
Date:	4/19/2006
Project:	L.V. Sutton Plant - 84-Pond
Project No.:	0205412.03
Location:	Wilmington, NC
Client:	Progress Energy

Description of SBT Classification Zones

1- Sensitive, fine grained	*6 - Sands; clean sands to silty sands*
2 - Organic soils-peats	*7 - Gravelly sand to sand*
3 - Clays-clay to silty clay	*8 - Very stiff sand to clayey sand*
4 - Silt mixtures clayey silt to silty clay	*9 - Very stiff fine grained*
5 - Sand mixtures; silty sand to sandy silt	*(after Robertson 1990)*

Cone I.D.:	0
Cone Size:	15 cm2
Water Level, ft.	15.0
Northing:	199689.7
Easting:	2305659.7
Elevation, ft:	34.0



Notes:

1. *Water level is estimated based on field measurements and/or correlation with pore pressure da*
2. *Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 19*
3. *Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa*

Maximum sounding depth: 20.8 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

Cone Penetration Test

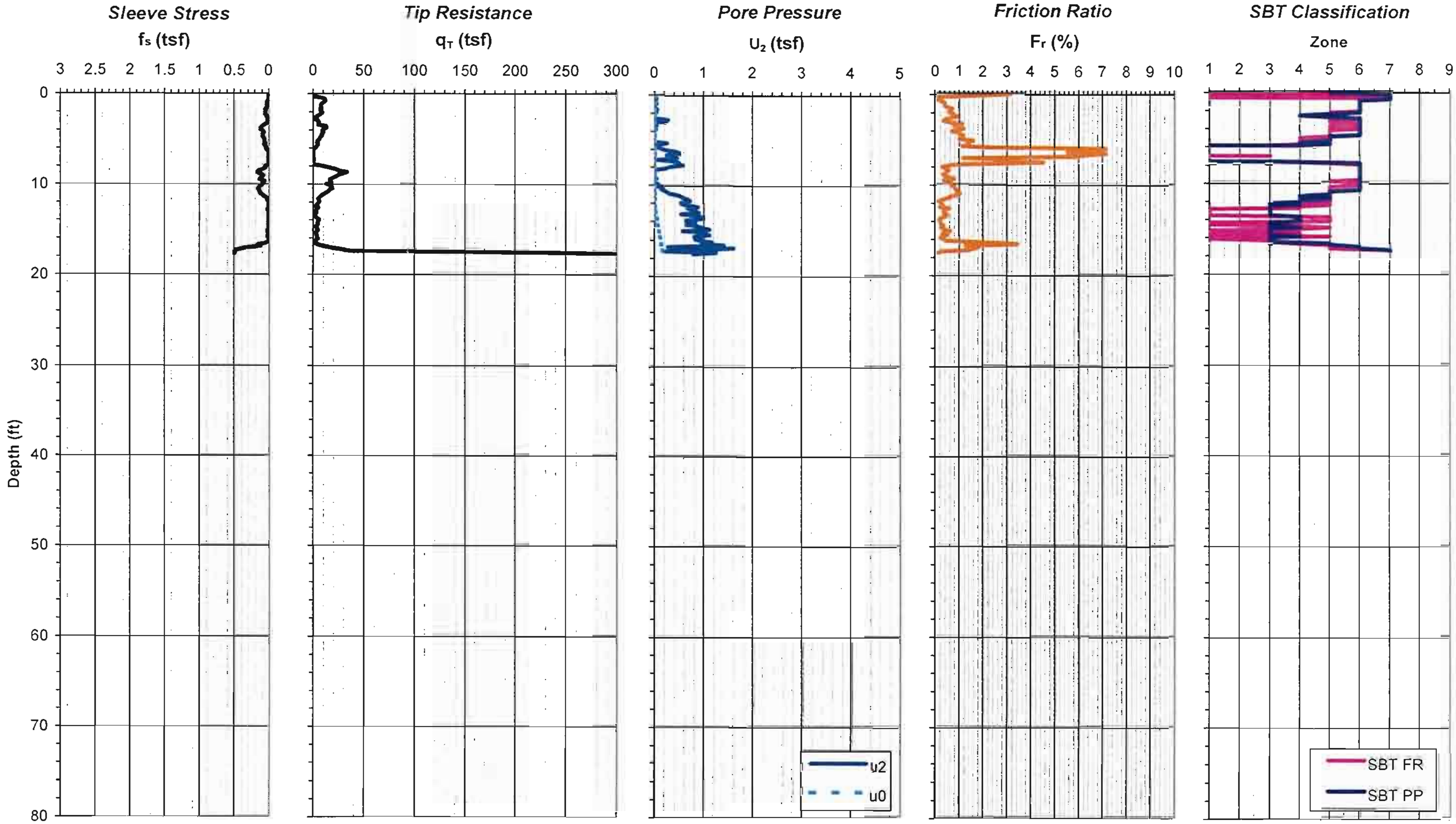
Withers & Ravenel, Inc.
Cary, NC

Test:	WR-2
Date:	4/19/2006
Project:	L.V. Sutton Plant - 84-Pond
Project No.:	0205412.03
Location:	Wilmington, NC
Client:	Progress Energy

Description of SBT Classification Zones

1- Sensitive, fine grained	*6 - Sands; clean sands to silty sands*
2 - Organic soils-peats	*7 - Gravelly sand to sand*
3 - Clays-clay to silty clay	*8 - Very stiff sand to clayey sand*
4 - Silt mixtures clayey silt to silty clay	*9 - Very stiff fine grained*
5 - Sand mixtures; silty sand to sandy silt	*(after Robertson 1990)*

Cone I.D.:	0
Cone Size:	15 cm2
Water Level, ft.	12.5
Northing:	200400.7
Easting:	2305553.9
Elevation, ft:	31.5



Notes:

1. Water level is estimated based on field measurements and/or correlation with pore pressure da

2. Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 19

3. Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa

Maximum sounding depth: 17.7 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

Cone Penetration Test

Wither [illegible] el, Inc.
Cary, NC

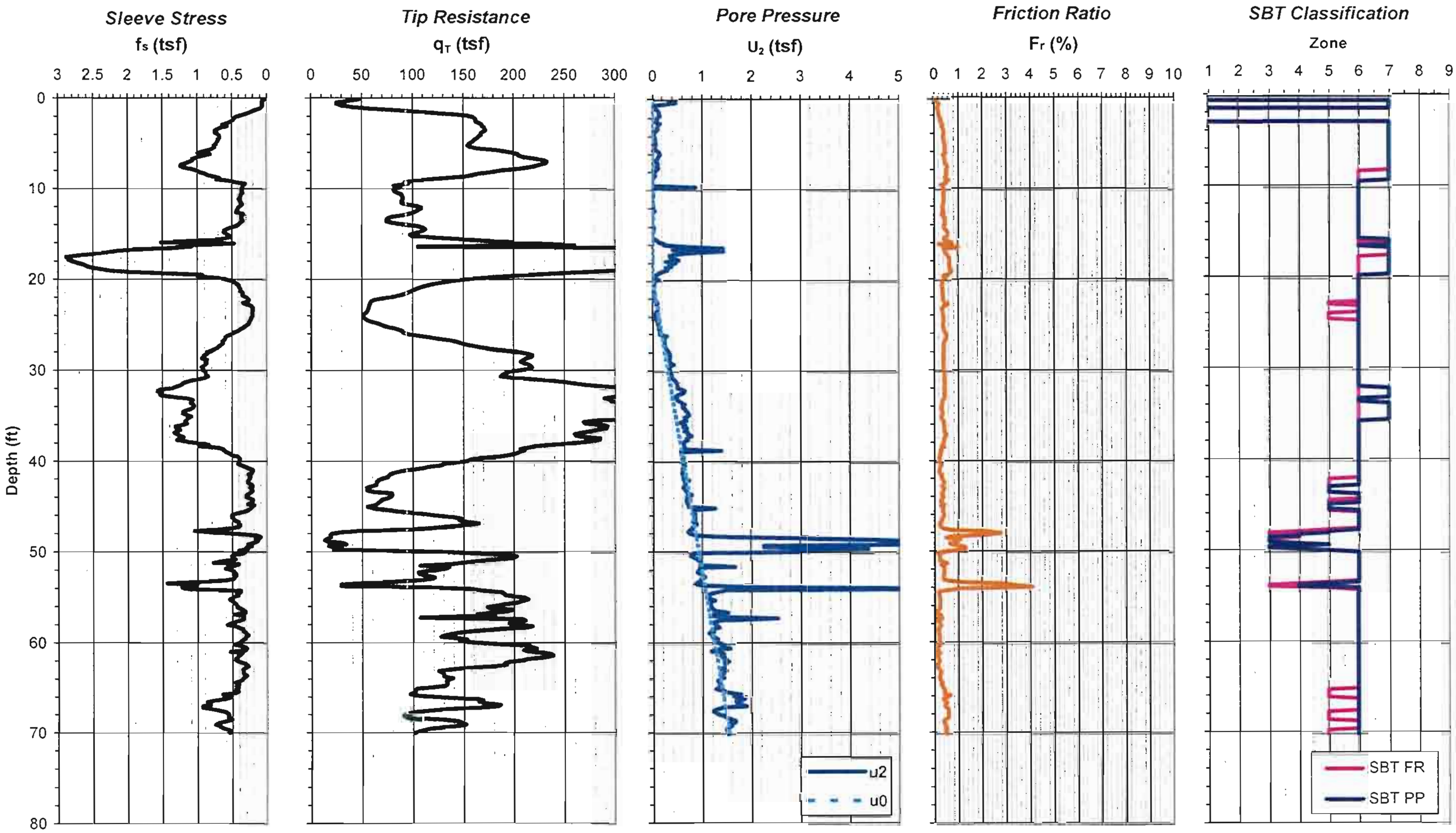
Test: WR-3
Date: 4/19/2006
Project: L.V. Sutton Plant - 84-Pond
Project No.: 0205412.03
Location: Wilmington, NC
Client: Progress Energy

Description of SBT Classification Zones

- *1- Sensitive, fine grained*
- *2 - Organic soils-peats*
- *3 - Clays-clay to silty clay*
- *4 - Silt mixtures clayey silt to silty clay*
- *5 - Sand mixtures; silty sand to sandy silt*
- *6 - Sands; clean sands to silty sands*
- *7 - Gravelly sand to sand*
- *8 - Very stiff sand to clayey sand*
- *9 - Very stiff fine grained*

(after Robertson 1990)

Cone I.D.: 0
Cone Size: 15 cm2
Water Level, ft. 20.0
Northing: 200475.8
Easting: 2305723.6
Elevation, ft: 34.0



Notes:
1. Water level is estimated based on field measurements and/or correlation with pore pressure da
2. Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 199
3. Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa

Maximum sounding depth: 70.0 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

Cone Penetration Test

Withers & Ravenel, Inc.
Cary, NC

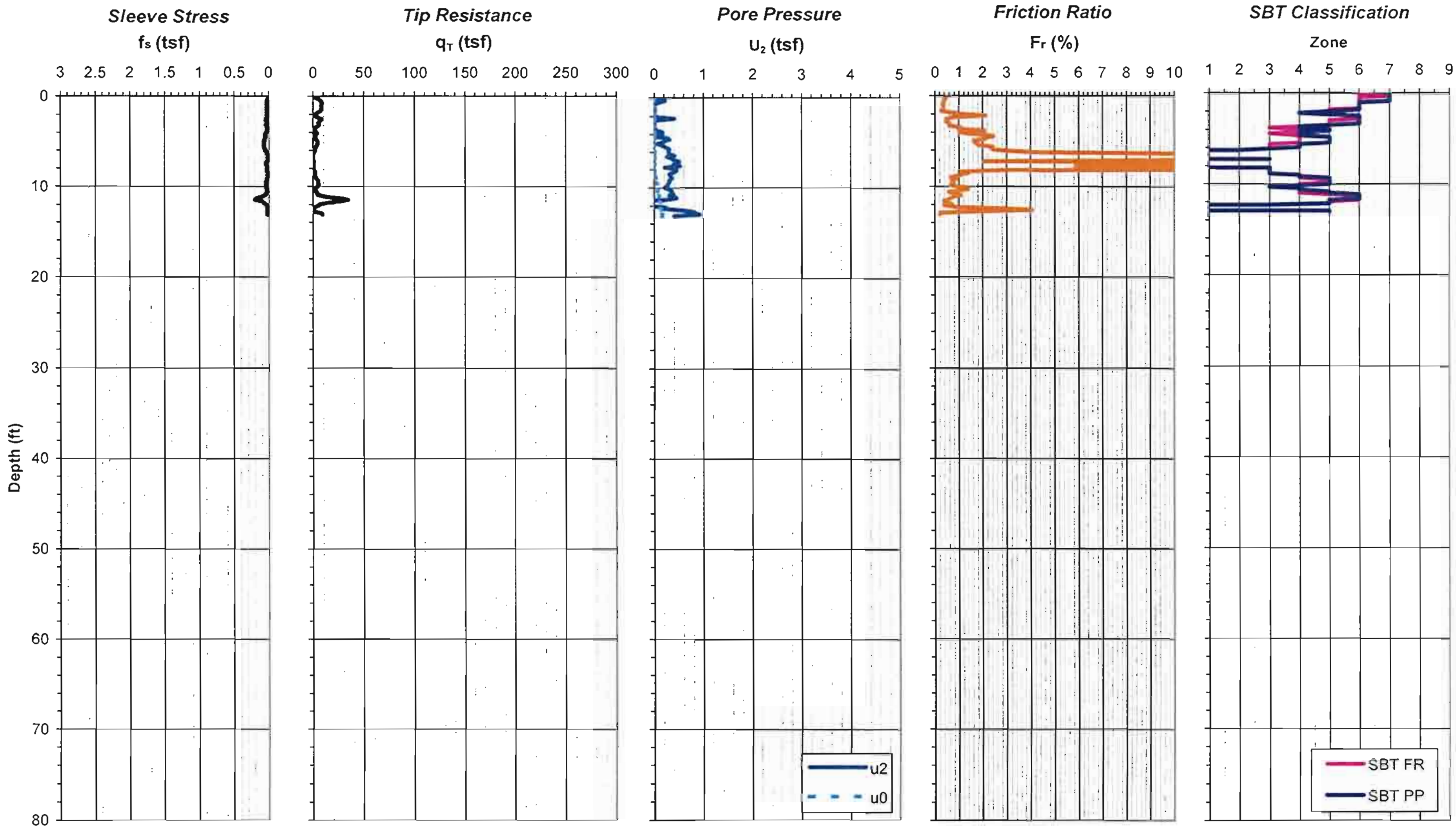
Test: WR-4
Date: 4/19/2006
Project: L.V. Sutton Plant - 84-Pond
Project No.: 0205412.03
Location: Wilmington, NC
Client: Progress Energy

Description of SBT Classification Zones

- *1- Sensitive, fine grained*
- *2 - Organic soils-peats*
- *3 - Clays-clay to silty clay*
- *4 - Silt mixtures clayey silt to silty clay*
- *5 - Sand mixtures; silty sand to sandy silt*
- *6 - Sands; clean sands to silty sands*
- *7 - Gravelly sand to sand*
- *8 - Very stiff sand to clayey sand*
- *9 - Very stiff fine grained*

(after Robertson 1990)

Cone I.D.:	0
Cone Size:	15 cm2
Water Level, ft.	8.0
Northing:	200805.1
Easting:	2305178.0
Elevation, ft:	26.9



Notes:
1. *Water level is estimated based on field measurements and/or correlation with pore pressure da*
2. *Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 199*
3. *Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa*

Maximum sounding depth: 13.1 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

Cone Penetration Test

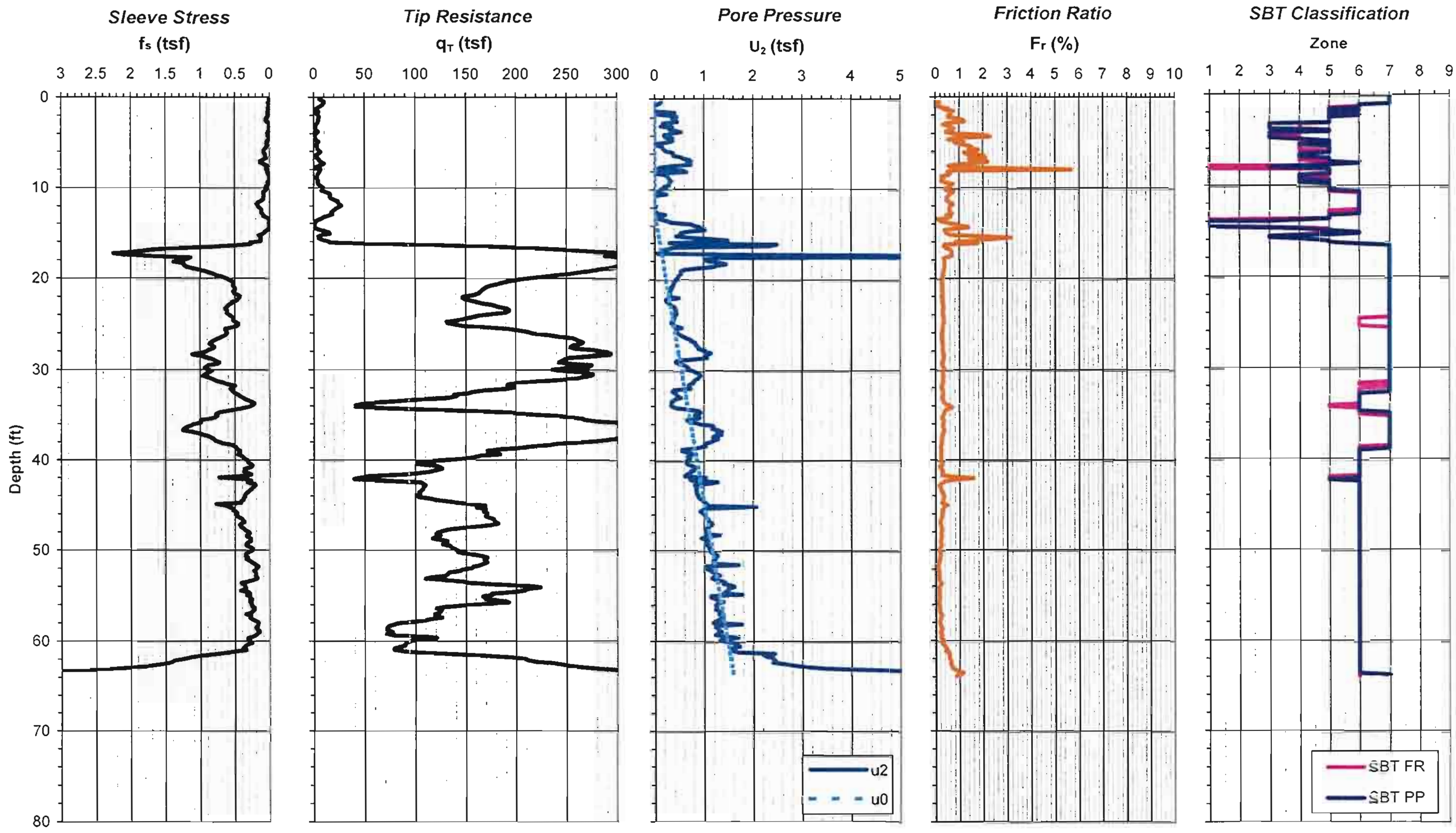
Wither el, Inc.
Cary, NC

Test: WR-5B
Date: 4/18/2006
Project: L.V. Sutton Plant - 84-Pond
Project No.: 0205412.03
Location: Wilmington, NC
Client: Progress Energy

Description of SBT Classification Zones

1- Sensitive, fine grained
2 - Organic soils-peats
3 - Clays-clay to silty clay
4 - Silt mixtures clayey silt to silty clay
5 - Sand mixtures; silty sand to sandy silt
6 - Sands; clean sands to silty sands
7 - Gravelly sand to sand
8 - Very stiff sand to clayey sand
9 - Very stiff fine grained
(after Robertson 1990)

Cone I.D.:	0
Cone Size:	15 cm2
Water Level, ft.	12.5
Northing:	200683.4
Easting:	2304845.4
Elevation, ft:	27.5



Notes:
1. Water level is estimated based on field measurements and/or correlation with pore pressure da
2. Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 199
3. Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa

Maximum sounding depth: 63.8 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

Cone Penetration Test

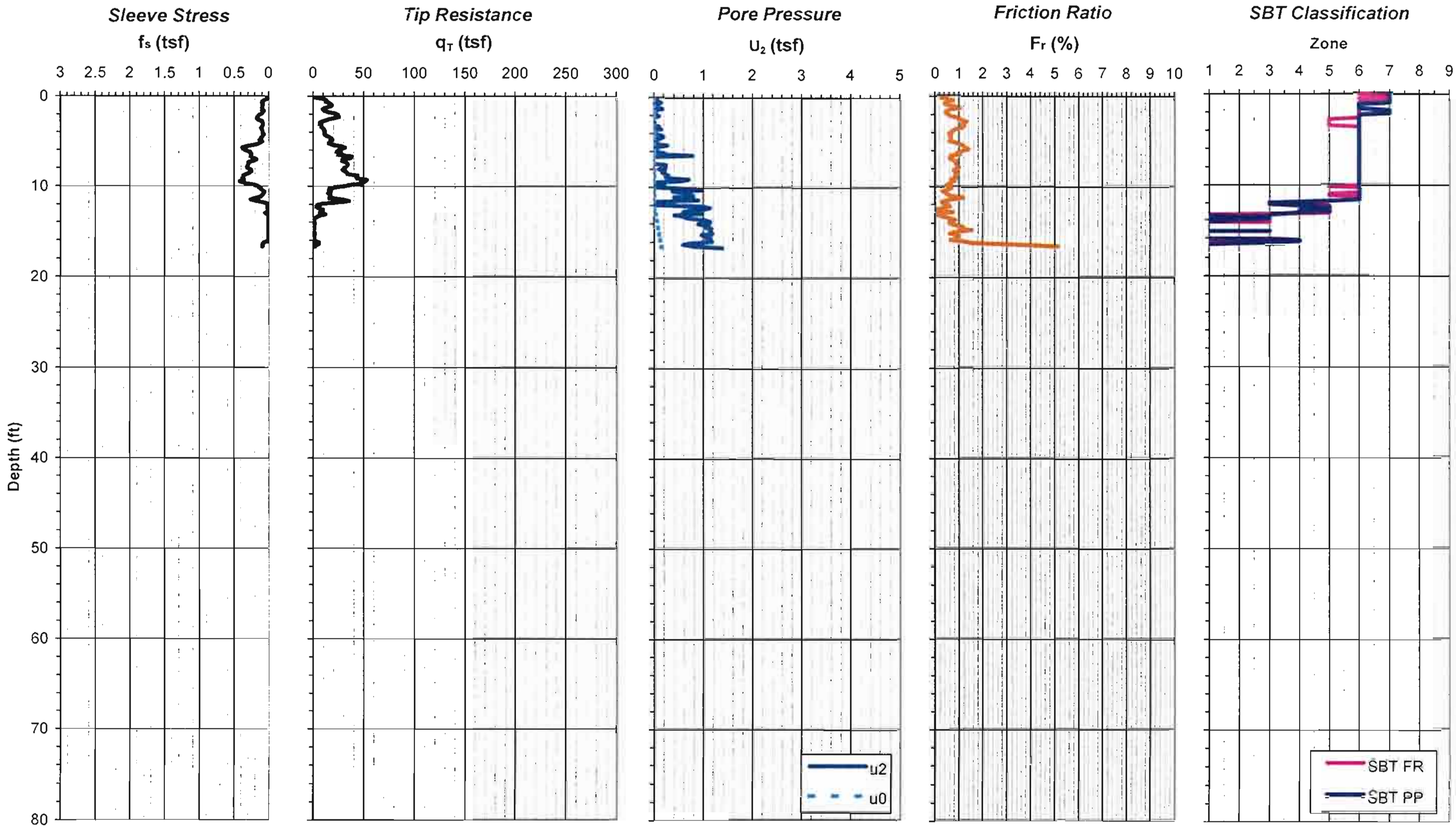
Withers & Ravenel, Inc.
Cary, NC

Test:	WR-6
Date:	4/19/2006
Project:	L.V. Sutton Plant - 84-Pond
Project No.:	0205412.03
Location:	Wilmington, NC
Client:	Progress Energy

Description of SBT Classification Zones

1- Sensitive, fine grained
2 - Organic soils-peats
3 - Clays-clay to silty clay
4 - Silt mixtures clayey silt to silty clay
5 - Sand mixtures; silty sand to sandy silt
6 - Sands; clean sands to silty sands
7 - Gravelly sand to sand
8 - Very stiff sand to clayey sand
9 - Very stiff fine grained
(after Robertson 1990)

Cone I.D.:	0
Cone Size:	15 cm2
Water Level, ft.	12.0
Northing:	200174.0
Easting:	2305092.8
Elevation, ft:	31.0



Notes:
1. *Water level is estimated based on field measurements and/or correlation with pore pressure da*
2. *Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 199*
3. *Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa*

Maximum sounding depth: 16.7 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

Cone Penetration Test

Withers & Ravenel, Inc.
Cary, NC

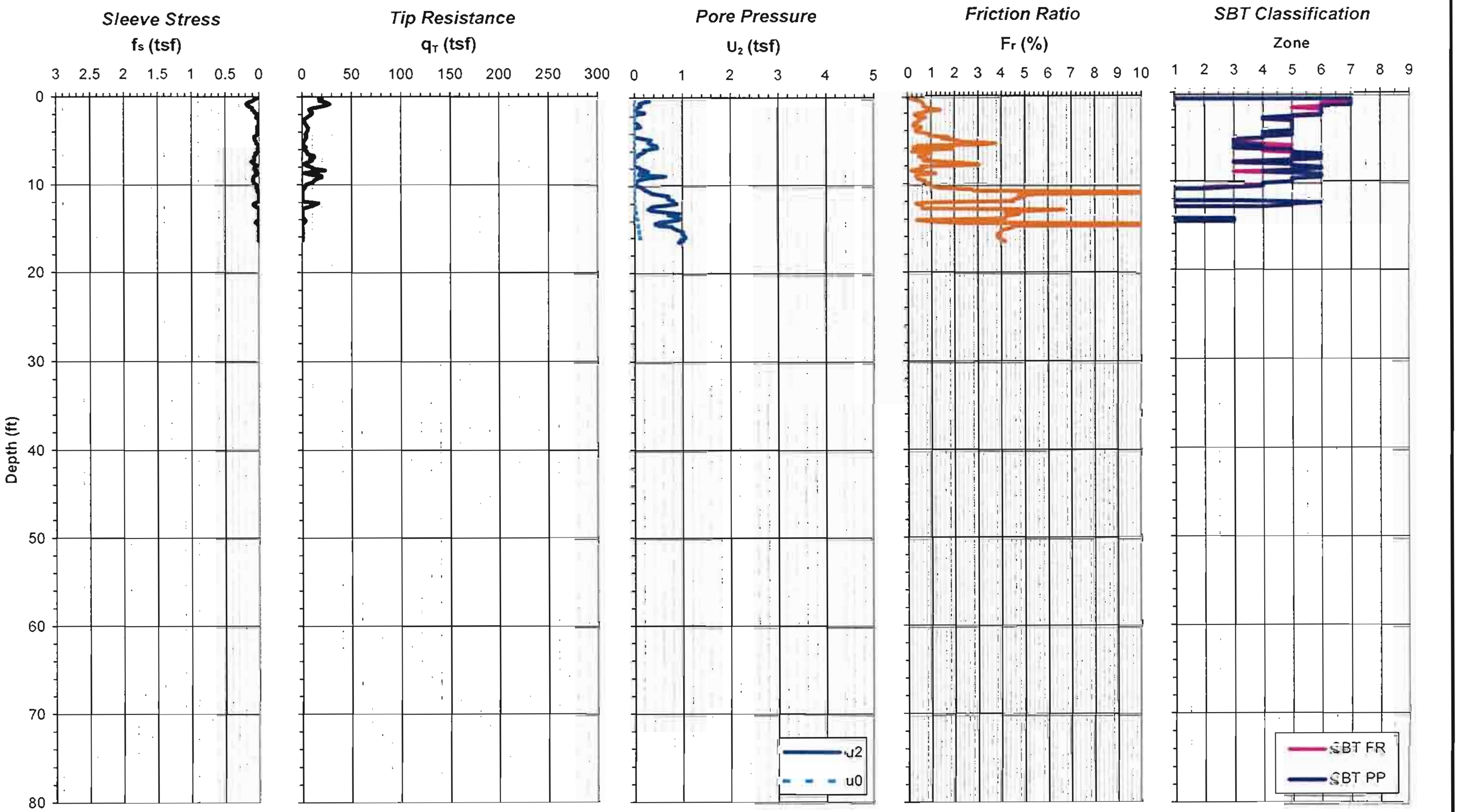
Test: WR-8
Date: 4/19/2006
Project: L.V. Sutton Plant - 84-Pond
Project No.: 0205412.03
Location: Wilmington, NC
Client: Progress Energy

Description of SBT Classification Zones

- *1- Sensitive, fine grained*
- *2 - Organic soils-peats*
- *3 - Clays-clay to silty clay*
- *4 - Silt mixtures clayey silt to silty clay*
- *5 - Sand mixtures; silty sand to sandy silt*
- *6 - Sands; clean sands to silty sands*
- *7 - Gravelly sand to sand*
- *8 - Very stiff sand to clayey sand*
- *9 - Very stiff fine grained*

(after Robertson 1990)

Cone I.D.: 0
Cone Size: 15 cm2
Water Level, ft. 12.0
Northing: 199775.1
Easting: 2304903.0
Elevation, ft: 31.0



Notes:
1. Water level is estimated based on field measurements and/or correlation with pore pressure da
2. Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 199
3. Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa

Maximum sounding depth: 16.4 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

Cone Penetration Test

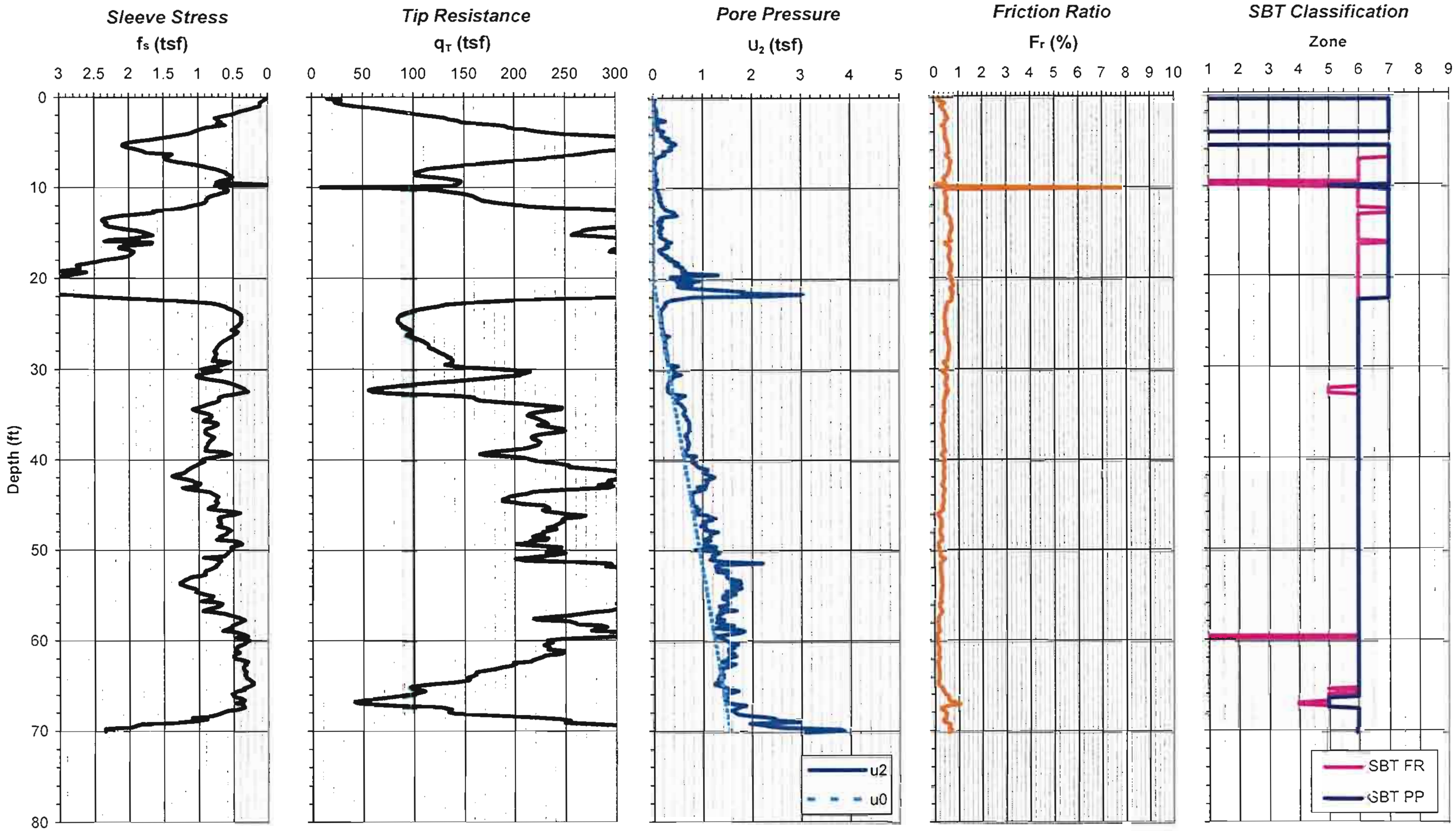
Withers & Ravenel, Inc.
Cary, NC

Test:	WR-10
Date:	4/19/2006
Project:	L.V. Sutton Plant - 84-Pond
Project No.:	0205412.03
Location:	Wilmington, NC
Client:	Progress Energy

Description of SBT Classification Zones

1- Sensitive, fine grained	*6 - Sands; clean sands to silty sands*
2 - Organic soils-peats	*7 - Gravelly sand to sand*
3 - Clays-clay to silty clay	*8 - Very stiff sand to clayey sand*
4 - Silt mixtures clayey silt to silty clay	*9 - Very stiff fine grained*
5 - Sand mixtures; silty sand to sandy silt	*(after Robertson 1990)*

Cone I.D.:	0
Cone Size:	15 cm2
Water Level, ft.	20.0
Northing:	199905.4
Easting:	2304199.2
Elevation, ft:	34.0



Notes:
1. Water level is estimated based on field measurements and/or correlation with pore pressure da
2. Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 199
3. Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa.

Maximum sounding depth: 70.0 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

Cone Penetration Test

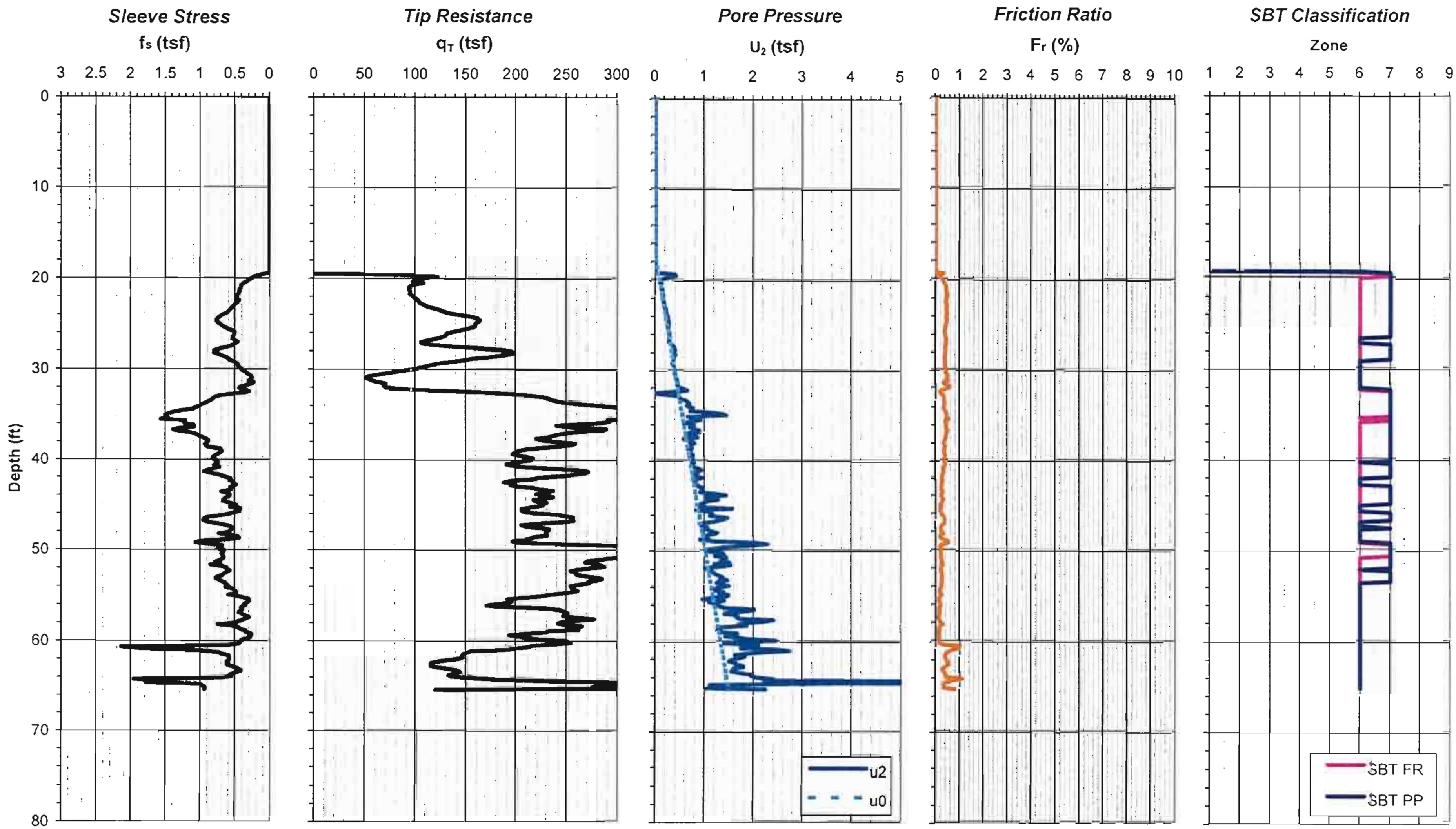
Withers & Ravenel, Inc.
Cary, NC

Test:	WR-11
Date:	4/20/2006
Project:	L.V. Sutton Plant - 84-Pond
Project No.:	0205412.03
Location:	Wilmington, NC
Client:	Progress Energy

Description of SBT Classification Zones

1- Sensitive, fine grained	*6 - Sands; clean sands to silty sands*
2 - Organic soils-peats	*7 - Gravelly sand to sand*
3 - Clays-clay to silty clay	*8 - Very stiff sand to clayey sand*
4 - Silt mixtures clayey silt to silty clay	*9 - Very stiff fine grained*
5 - Sand mixtures; silty sand to sandy silt	*(after Robertson 1990)*

Cone I.D.:	0
Cone Size:	15 cm2
Water Level, ft.	17.5
Northing:	199943.1
Easting:	2304265.7
Elevation, ft:	31.0



Notes:
1. Water level is estimated based on field measurements and/or correlation with pore pressure da
2. Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 199
3. Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa

Maximum sounding depth: 65.5 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

Cone Penetration Test

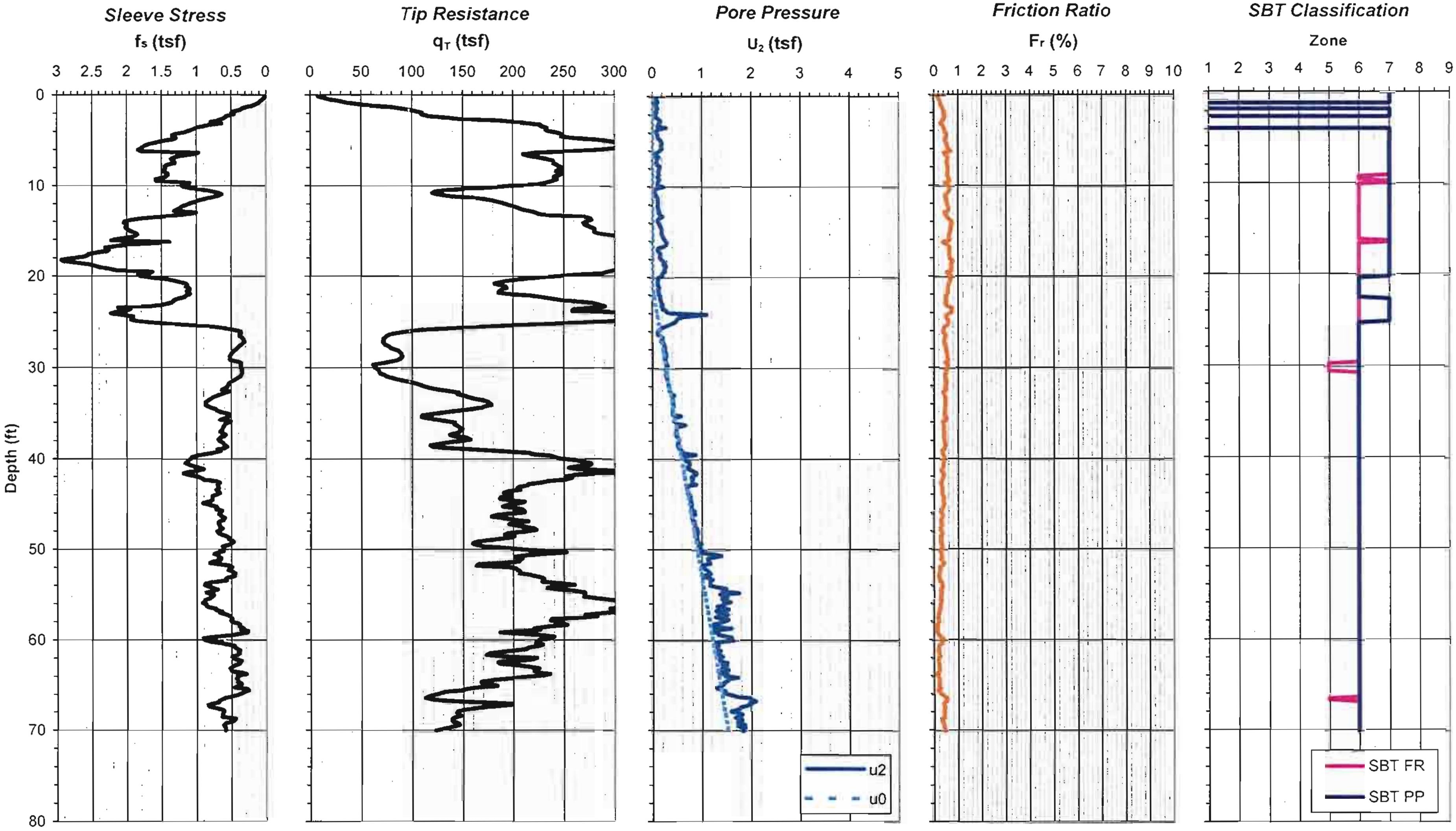
Withers & Ravenel, Inc.
Cary, NC

Test: WR-12
Date: 4/20/2006
Project: L.V. Sutton Plant - 84-Pond
Project No.: 0205412.03
Location: Wilmington, NC
Client: Progress Energy

Description of SBT Classification Zones

1- Sensitive, fine grained	*6 - Sands; clean sands to silty sands*
2 - Organic soils-peats	*7 - Gravelly sand to sand*
3 - Clays-clay to silty clay	*8 - Very stiff sand to clayey sand*
4 - Silt mixtures clayey silt to silty clay	*9 - Very stiff fine grained*
5 - Sand mixtures; silty sand to sandy silt	*(after Robertson 1990)*

Cone I.D.: 0
Cone Size: 15 cm2
Water Level, ft.: 21.0
Northing: 200353.3
Easting: 2304140.0
Elevation, ft: 33.0



Notes:
1. Water level is estimated based on field measurements and/or correlation with pore pressure da
2. Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 199
3. Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa

Maximum sounding depth: 70.0 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

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Cone Penetration Test

Withers & Ravenel, Inc.
Cary, NC

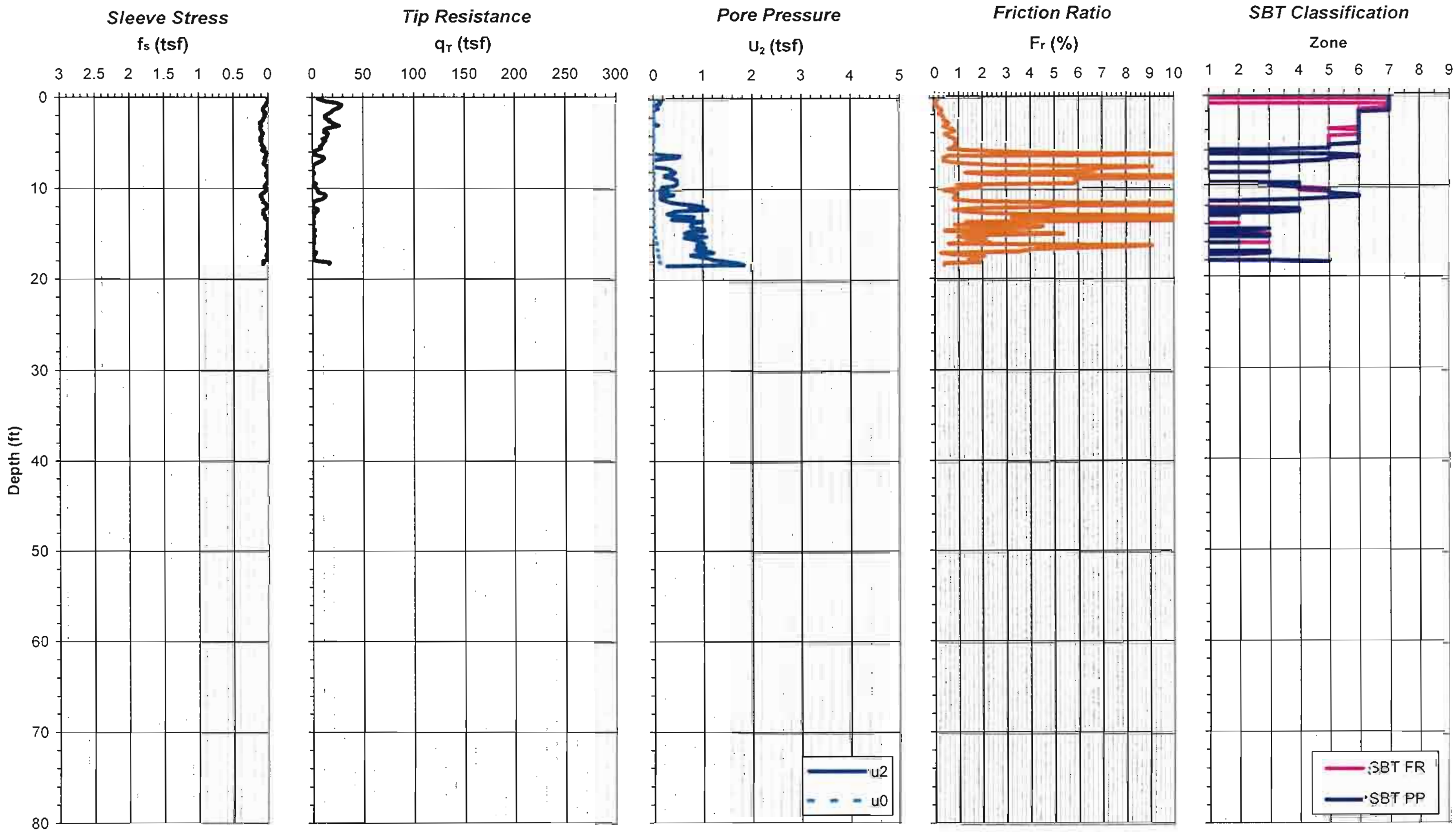
Test: WR-13
Date: 4/20/2006
Project: L.V. Sutton Plant - 84-Pond
Project No.: 0205412.03
Location: Wilmington, NC
Client: Progress Energy

Description of SBT Classification Zones

- *1- Sensitive, fine grained*
- *2 - Organic soils-peats*
- *3 - Clays-clay to silty clay*
- *4 - Silt mixtures clayey silt to silty clay*
- *5 - Sand mixtures; silty sand to sandy silt*
- *6 - Sands; clean sands to silty sands*
- *7 - Gravelly sand to sand*
- *8 - Very stiff sand to clayey sand*
- *9 - Very stiff fine grained*

(after Robertson 1990)

Cone I.D.: 0
Cone Size: 15 cm2
Water Level, ft. 14.0
Northing: 199824.9
Easting: 2305788.3
Elevation, ft: 32.9



Notes:
1. *Water level is estimated based on field measurements and/or correlation with pore pressure da*
2. *Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 19*
3. *Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa*

Maximum sounding depth: 18.4 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

Cone Penetration Test

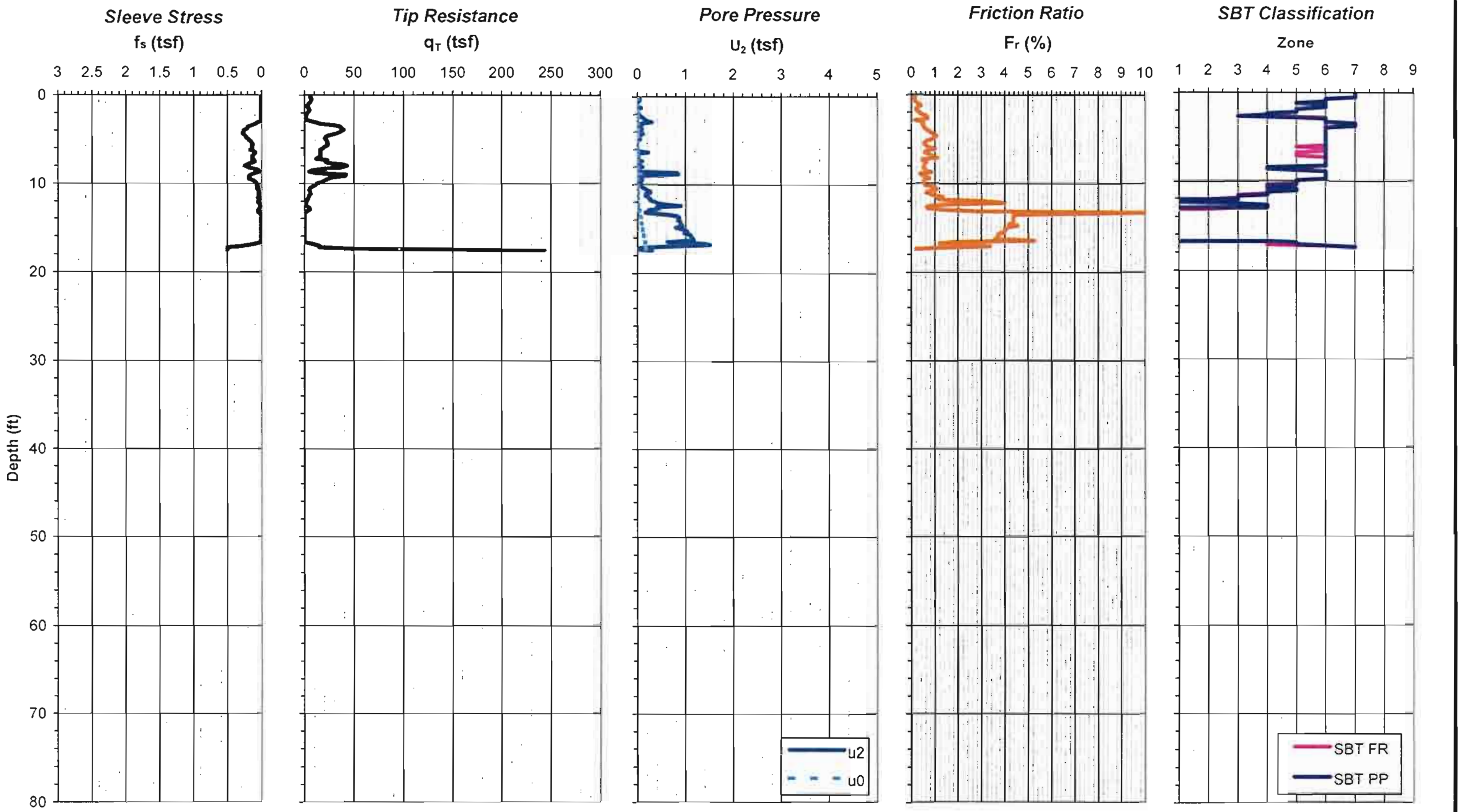
Withers & Ravenel, Inc.
Cary, NC

Test: WR-14
Date: 4/20/2006
Project: L.V. Sutton Plant - 84-Pond
Project No.: 0205412.03
Location: Wilmington, NC
Client: Progress Energy

Description of SBT Classification Zones

1- Sensitive, fine grained
2 - Organic soils-peats
3 - Clays-clay to silty clay
4 - Silt mixtures clayey silt to silty clay
5 - Sand mixtures; silty sand to sandy silt
6 - Sands; clean sands to silty sands
7 - Gravelly sand to sand
8 - Very stiff sand to clayey sand
9 - Very stiff fine grained
(after Robertson 1990)

Cone I.D.: 0
Cone Size: 15 cm2
Water Level, ft. 12.0
Northing: 200549.5
Easting: 2305461.9
Elevation, ft: 30.9



Notes:
1. Water level is estimated based on field measurements and/or correlation with pore pressure da
2. Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 199
3. Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa

Maximum sounding depth: 17.6 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

Cone Penetration Test

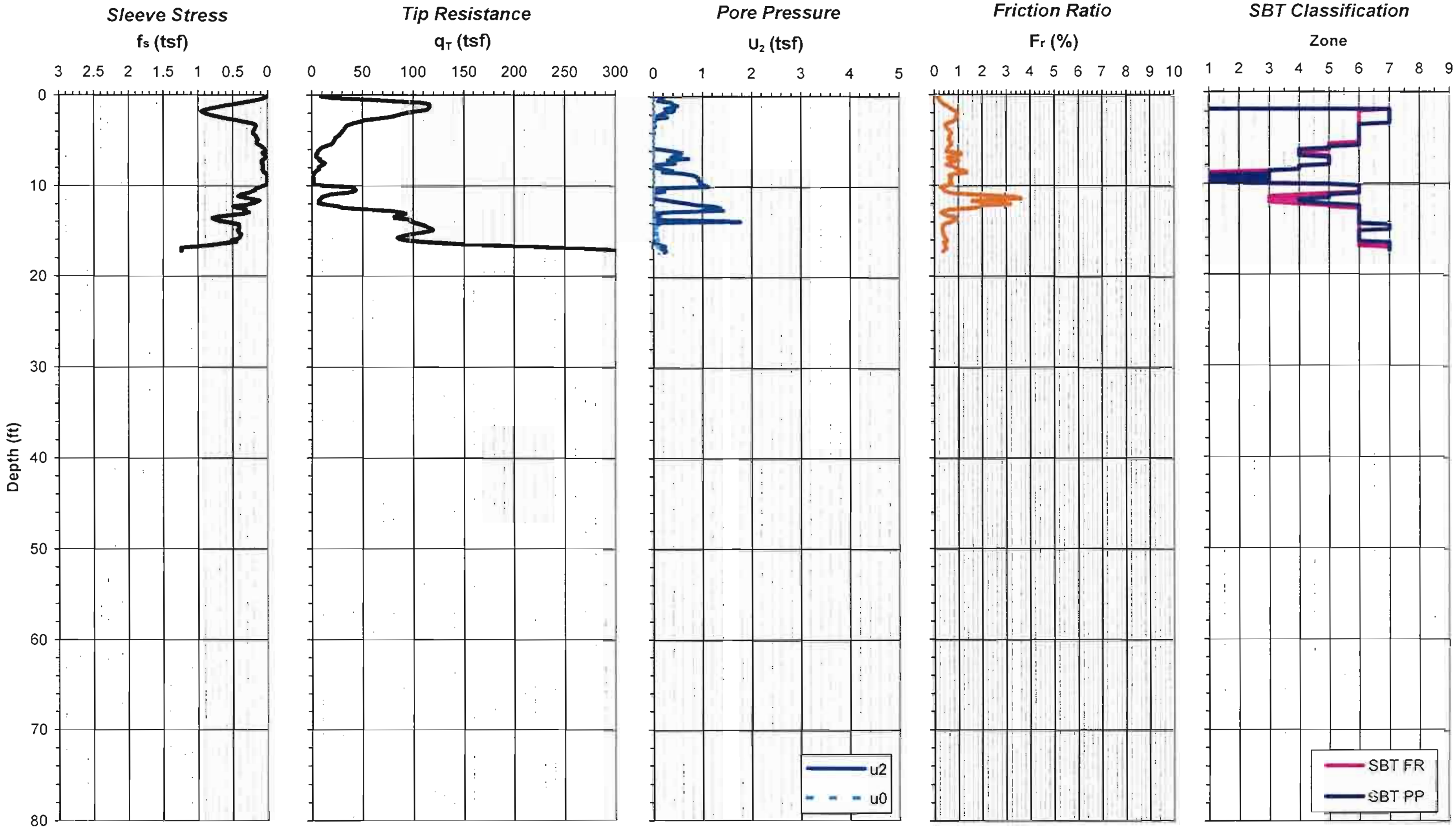
Withers & Ravenel, Inc.
Cary, NC

Test: WR-15
Date: 4/20/2006
Project: L.V. Sutton Plant - 84-Pond
Project No.: 0205412.03
Location: Wilmington, NC
Client: Progress Energy

Description of SBT Classification Zones

1- Sensitive, fine grained
2 - Organic soils-peats
3 - Clays-clay to silty clay
4 - Silt mixtures clayey silt to silty clay
5 - Sand mixtures; silty sand to sandy silt
6 - Sands; clean sands to silty sands
7 - Gravelly sand to sand
8 - Very stiff sand to clayey sand
9 - Very stiff fine grained
(after Robertson 1990)

Cone I.D.: 0
Cone Size: 15 cm2
Water Level, ft. 13.0
Northing: 199830.1
Easting: 2304294.5
Elevation, ft: 32.0



Notes:
1. Water level is estimated based on field measurements and/or correlation with pore pressure da
2. Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 199
3. Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa

Maximum sounding depth: 17.2 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

Cone Penetration Test

Withers & Ravenel, Inc.
Cary, NC

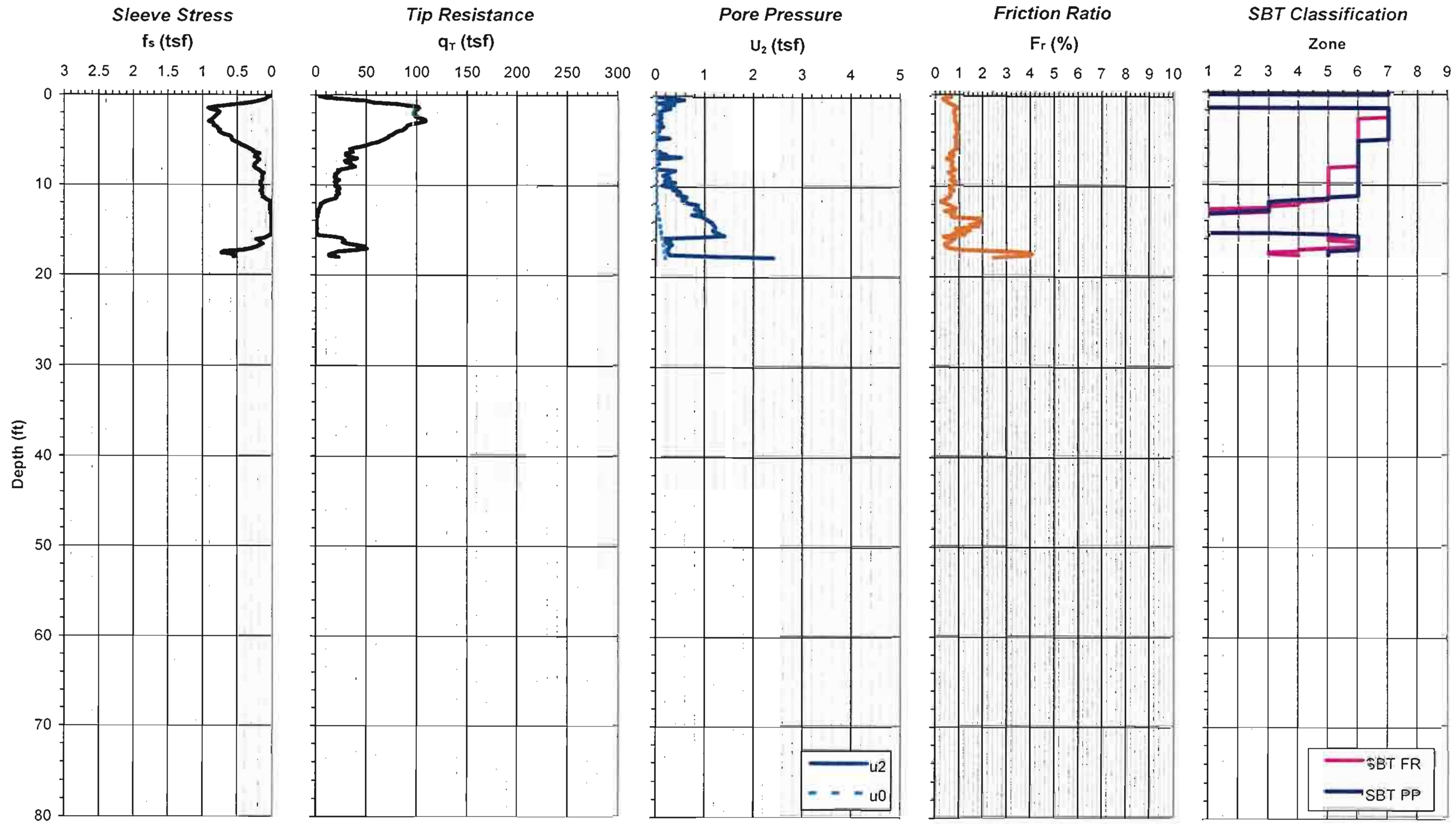
Test:	WR-16
Date:	4/20/2006
Project:	L.V. Sutton Plant - 84-Pond
Project No.:	0205412.03
Location:	Wilmington, NC
Client:	Progress Energy

Description of SBT Classification Zones

- *1- Sensitive, fine grained*
- *2 - Organic soils-peats*
- *3 - Clays-clay to silty clay*
- *4 - Silt mixtures clayey silt to silty clay*
- *5 - Sand mixtures; silty sand to sandy silt*
- *6 - Sands; clean sands to silty sands*
- *7 - Gravelly sand to sand*
- *8 - Very stiff sand to clayey sand*
- *9 - Very stiff fine grained*

(after Robertson 1990)

Cone I.D.:	0
Cone Size:	15 cm2
Water Level, ft.	12.0
Northing:	200051.4
Easting:	2304183.2
Elevation, ft:	31.4



Notes:

1. Water level is estimated based on field measurements and/or correlation with pore pressure da

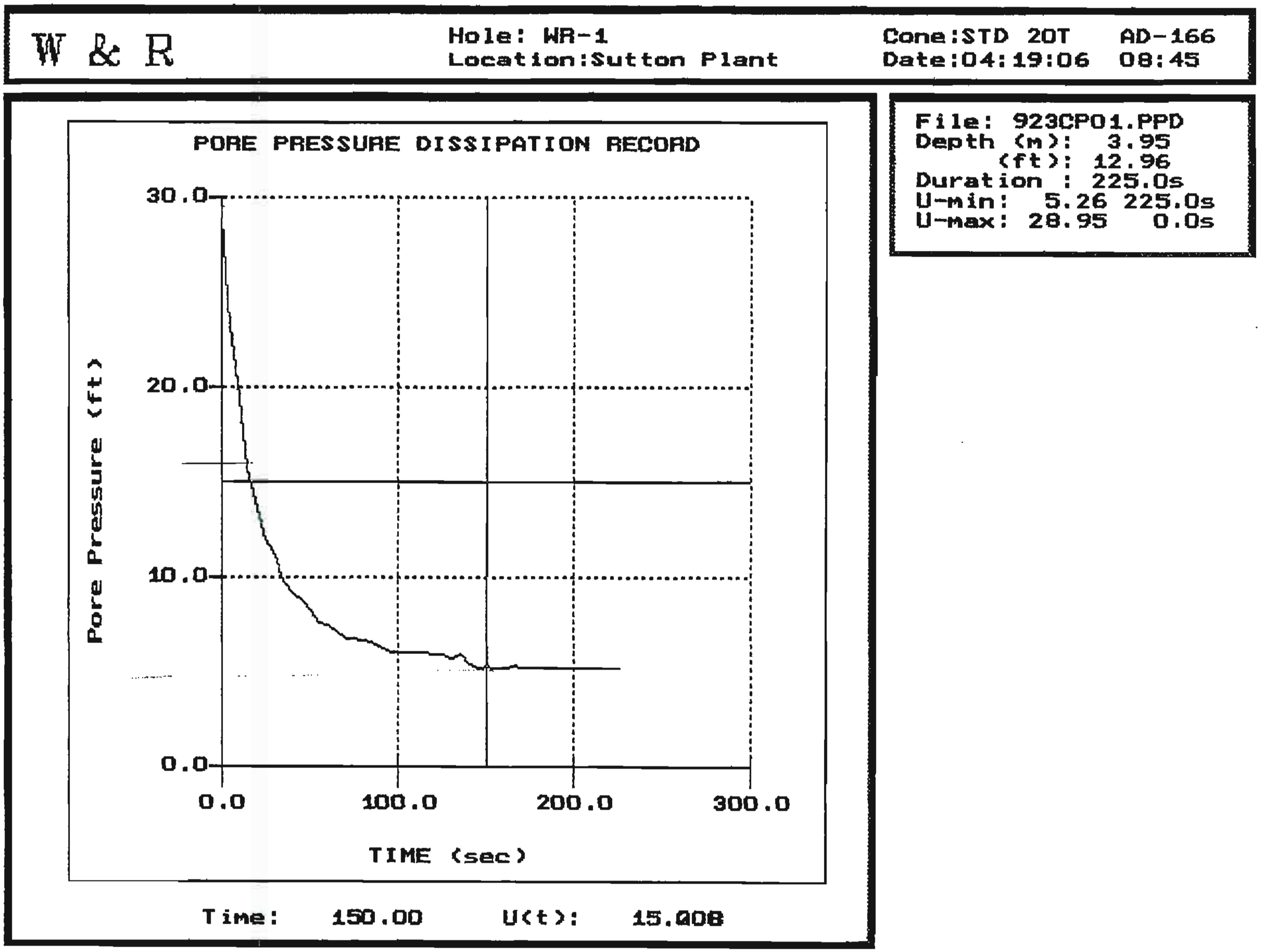
2. Soil Behavior Type (SBT) classification based on normalized CPT data after Robertson 199

3. Ground surface elevation and northing and easting coordinates were determined with GPS unit/softwa

Maximum sounding depth: 18.0 ft
CPT crew: ConeTec (T. Shiflet/S. Lucord)
CPT rig: P4/15-ton Track

Attachment 2.2

Withers & Ravenel Dissipation Test Results



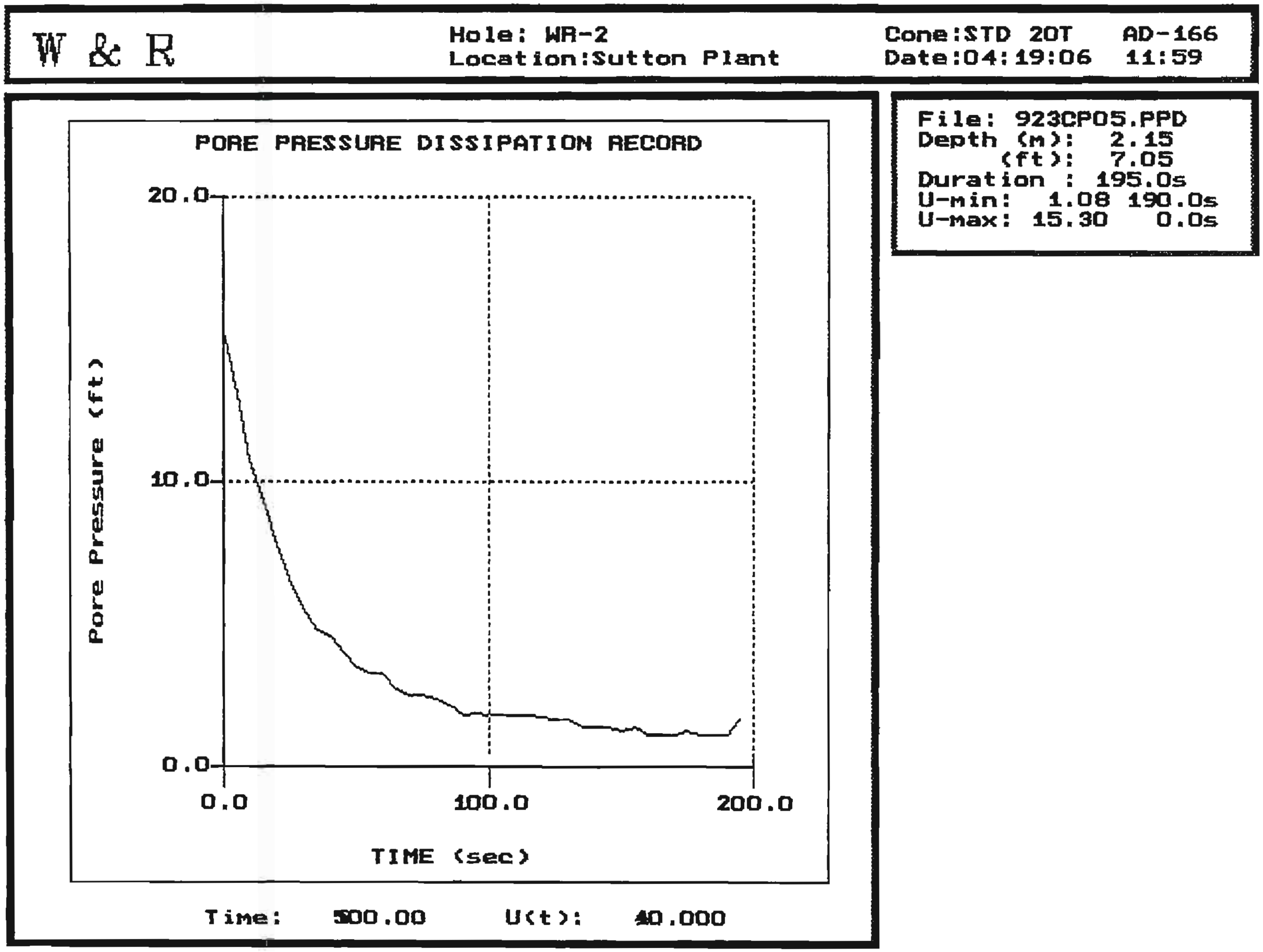
W & R

Hole: WR-1
Location:Sutton Plant

Cone:STD 20T AD-166
Date:04:19:06 08:45

File: 923CP01.PPD
Depth (m): 3.95
(ft): 12.96
Duration : 225.0s
U-min: 5.26 225.0s
U-max: 28.95 0.0s

Time: 150.00 U(t): 15.008



W & R

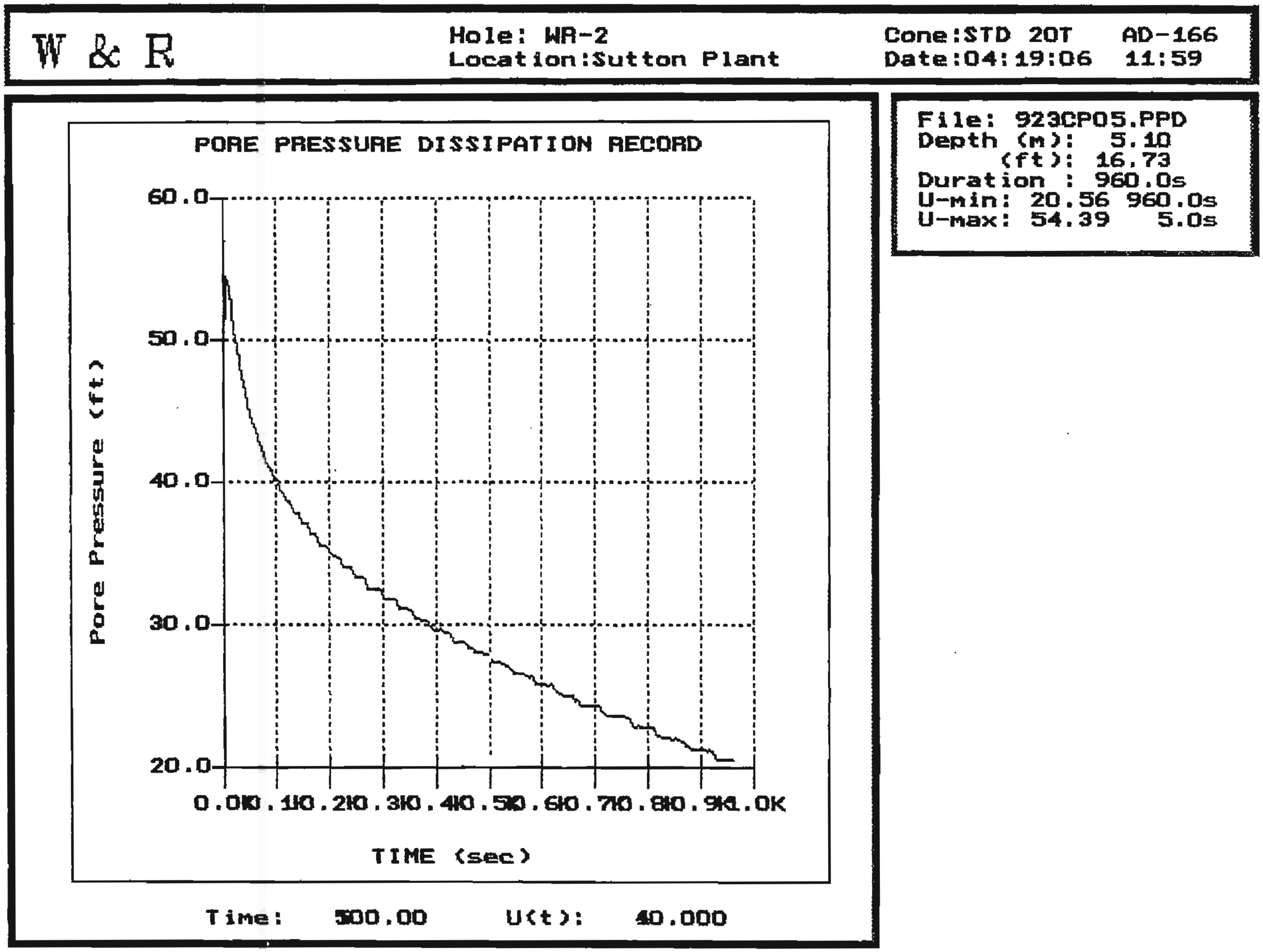
Hole: WR-2
Location:Sutton Plant

Cone:STD 20T AD-166
Date:04:19:06 11:59

File: 923CP05.PPD
Depth (m): 2.15
(ft): 7.05
Duration : 195.0s
U-min: 1.08 190.0s
U-max: 15.30 0.0s

PORE PRESSURE DISSIPATION RECORD

Time: 500.00 U(t): 40.000



W & R

Hole: WR-2
Location:Sutton Plant

Cone:STD 20T AD-166
Date:04:19:06 11:59

File: 923CP05.PPD
Depth (m): 5.10
(ft): 16.73
Duration : 960.0s
U-min: 20.56 960.0s
U-max: 54.39 5.0s

PORE PRESSURE DISSIPATION RECORD

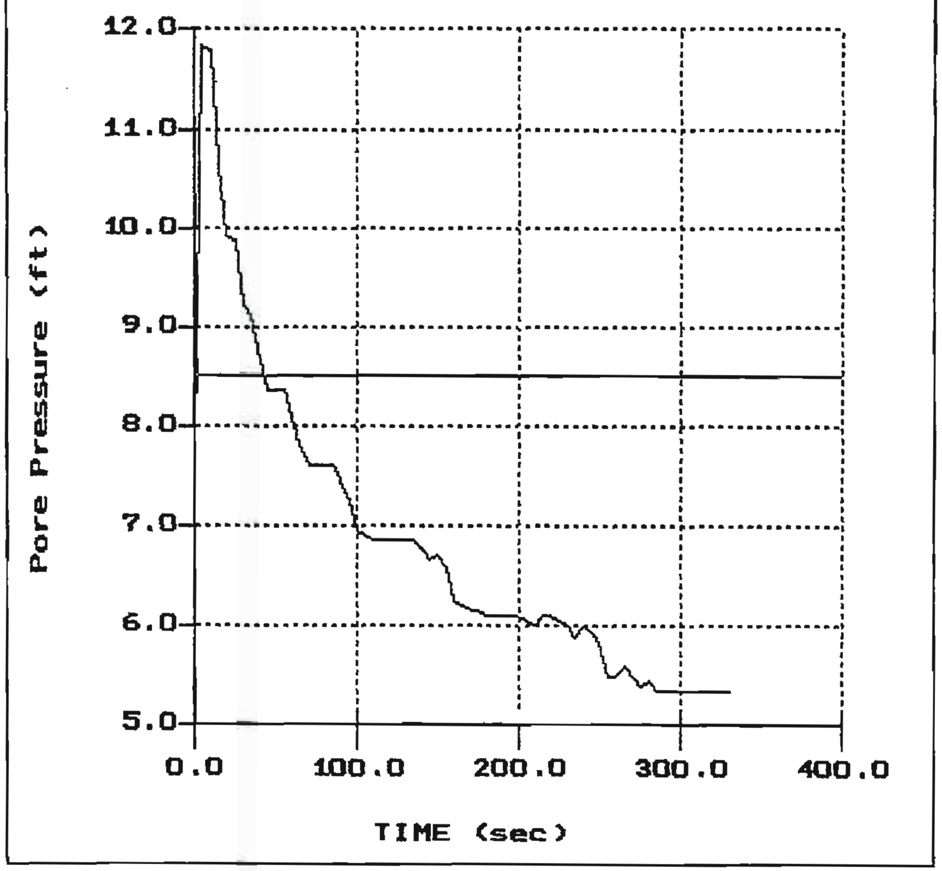
Time: 500.00 U(t): 40.000

W & R

Hole: WR-4
Location:Sutton Plant

Cone:STD 20T AD-166
Date:04:19:06 11:06

PORE PRESSURE DISSIPATION RECORD



File: 923CP04.PPD
Depth (m): 4.00
(ft): 13.12
Duration : 330.0s
U-min: 5.35 330.0s
U-max: 11.83 5.0s

Time: 200.00 U(t): 8.530

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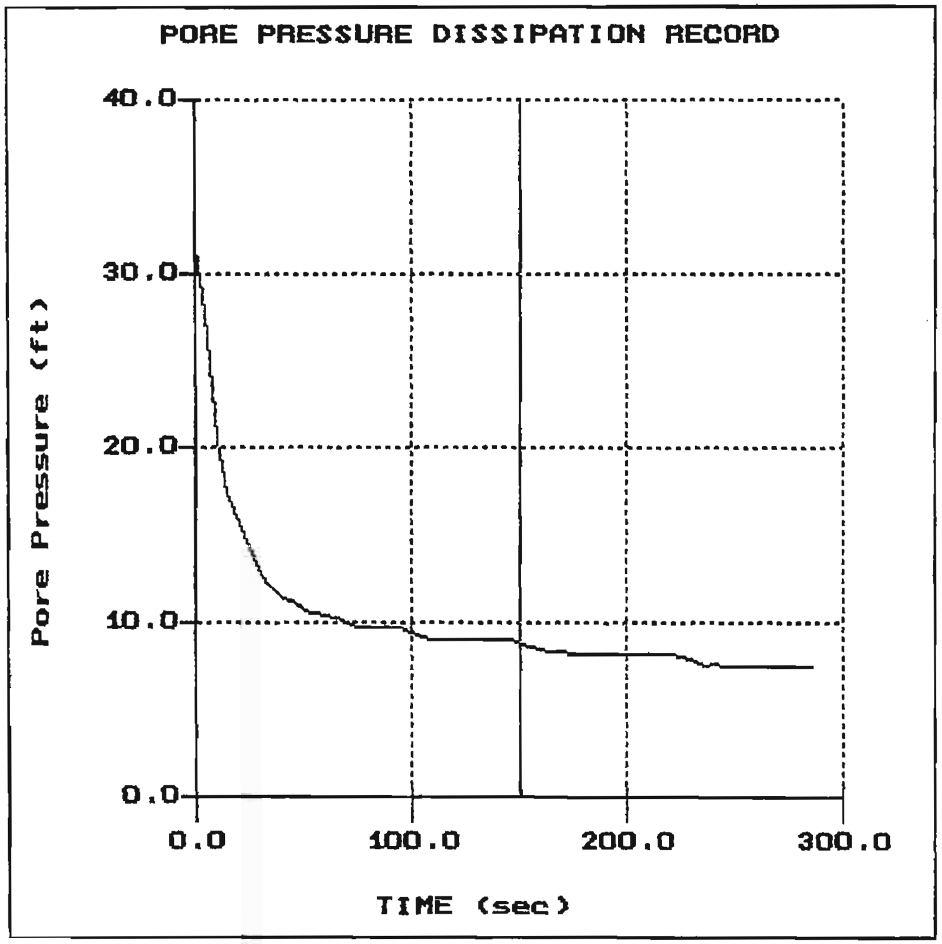
W & R

Hole: WR-6
Location:Sutton Plant

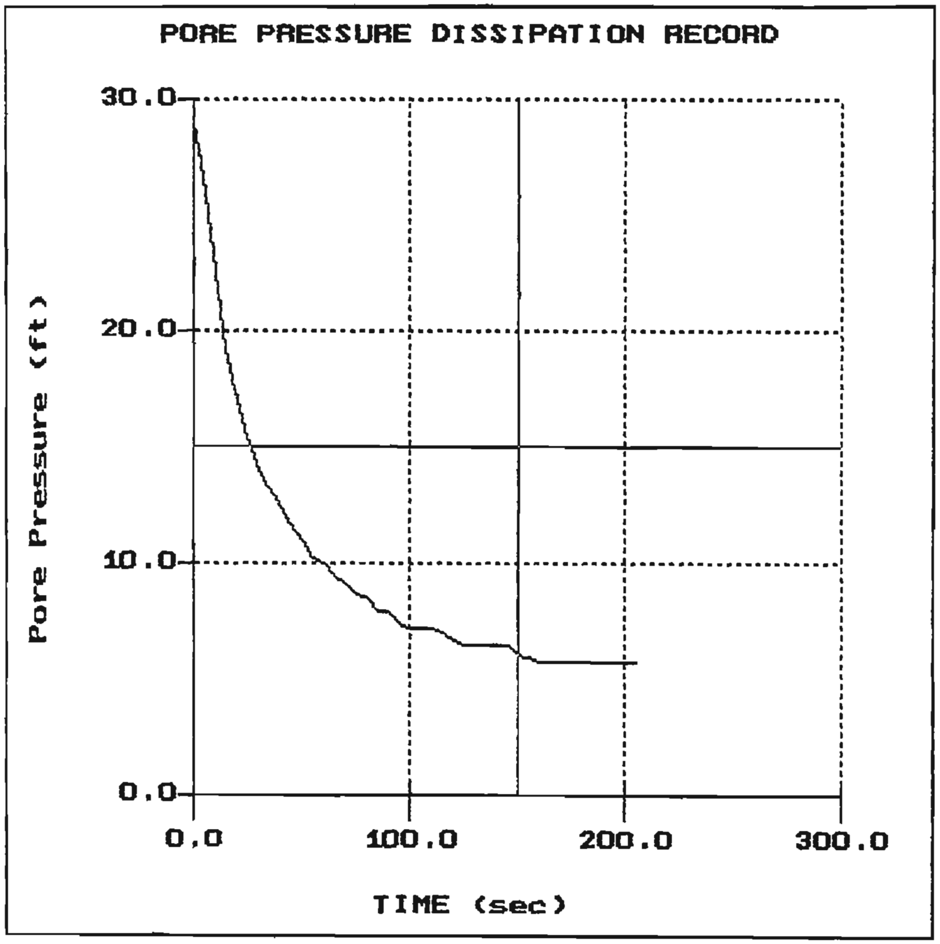
Cone:STD 20T AD-166
Date:04:19:06 09:36

File: 923CP02.PPD
Depth (m): 3.15
(ft): 10.33
Duration : 285.0s
U-min: 7.51 285.0s
U-max: 31.54 0.0s



Time: 156.80 U(t): 20.600

```
W & R            Hole: WR-8                         Cone:STD 20T    AD-166
                 Location:Sutton Plant              Date:04:20:06   12:17
```



```
Time:     150.00        U(t):     15.000
```

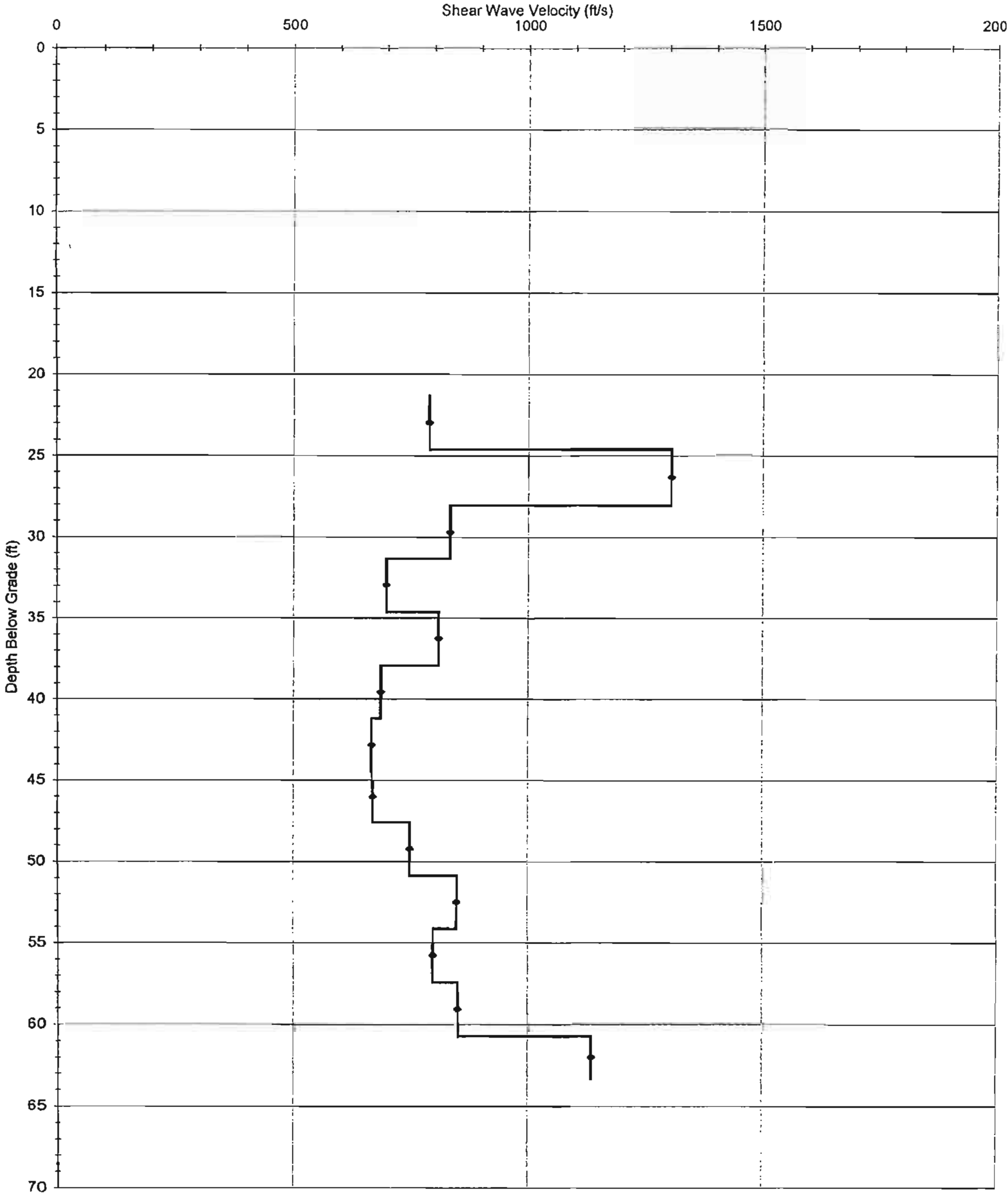
```
File:  923CP09.PPD
Depth (m):    5.00
       (ft):  16.40
Duration : 205.0s
U-min:   5.68 205.0s
U-max:  28.95    0.0s
```

Attachment 2.3

Withers & Ravenel Shear Wave Velocity Measurements

CONETEC

Shear Wave Velocity- WR-5B
L.V. Sutton Ash Pond
06-923
April 20, 2006



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ConeTec Shear Wave Velocity Data Reduction Sheet

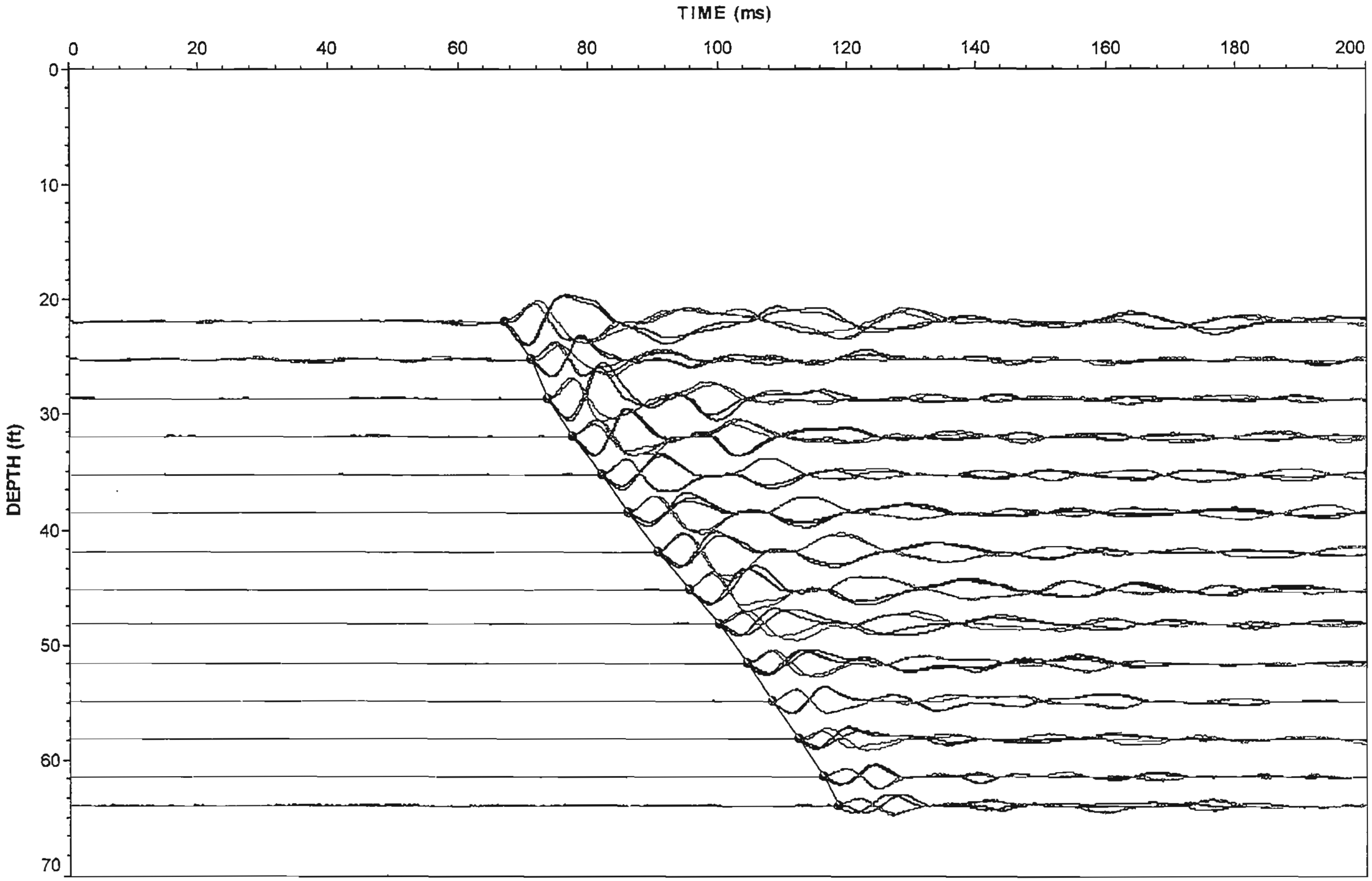
Hole: WR-5B
Location: LV Sutton Ash Pond
Cone: AD 167
Date: 20-Apr-06
Source: Beam

Source Depth 0.00 m
Source Offset 2.15 m

Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
6.70	6.50	6.85					
7.70	7.50	7.80	3.98	240.3	788.5	7.00	22.97
8.75	8.55	8.82	2.55	397.6	1304.3	8.02	26.33
9.75	9.55	9.79	3.83	254.2	834.1	9.05	29.69
10.75	10.55	10.77	4.59	212.9	698.6	10.05	32.97
11.75	11.55	11.75	3.98	246.8	809.8	11.05	36.25
12.75	12.55	12.73	4.70	209.6	687.6	12.05	39.53
13.75	13.55	13.72	4.85	203.6	667.9	13.05	42.81
14.70	14.50	14.66	4.59	204.5	670.8	14.02	46.01
15.70	15.50	15.65	4.34	228.3	748.9	15.00	49.21
16.70	16.50	16.64	3.83	259.0	849.8	16.00	52.49
17.70	17.50	17.63	4.08	243.1	797.4	17.00	55.77
18.70	18.50	18.62	3.83	259.5	851.3	18.00	59.05
19.50	19.30	19.42	2.30	346.2	1135.9	18.90	62.01

ConeTec

Job No: 06-923	Client: Withers & Ravenel	Project Title: Sutton Ash Pond	Operator: TS-EC-SL	Hole: WR-5B
Site: Sutton Plant	Date: 04:20:06 15:32	Cone: STD 20T AD-166		



CONETEC

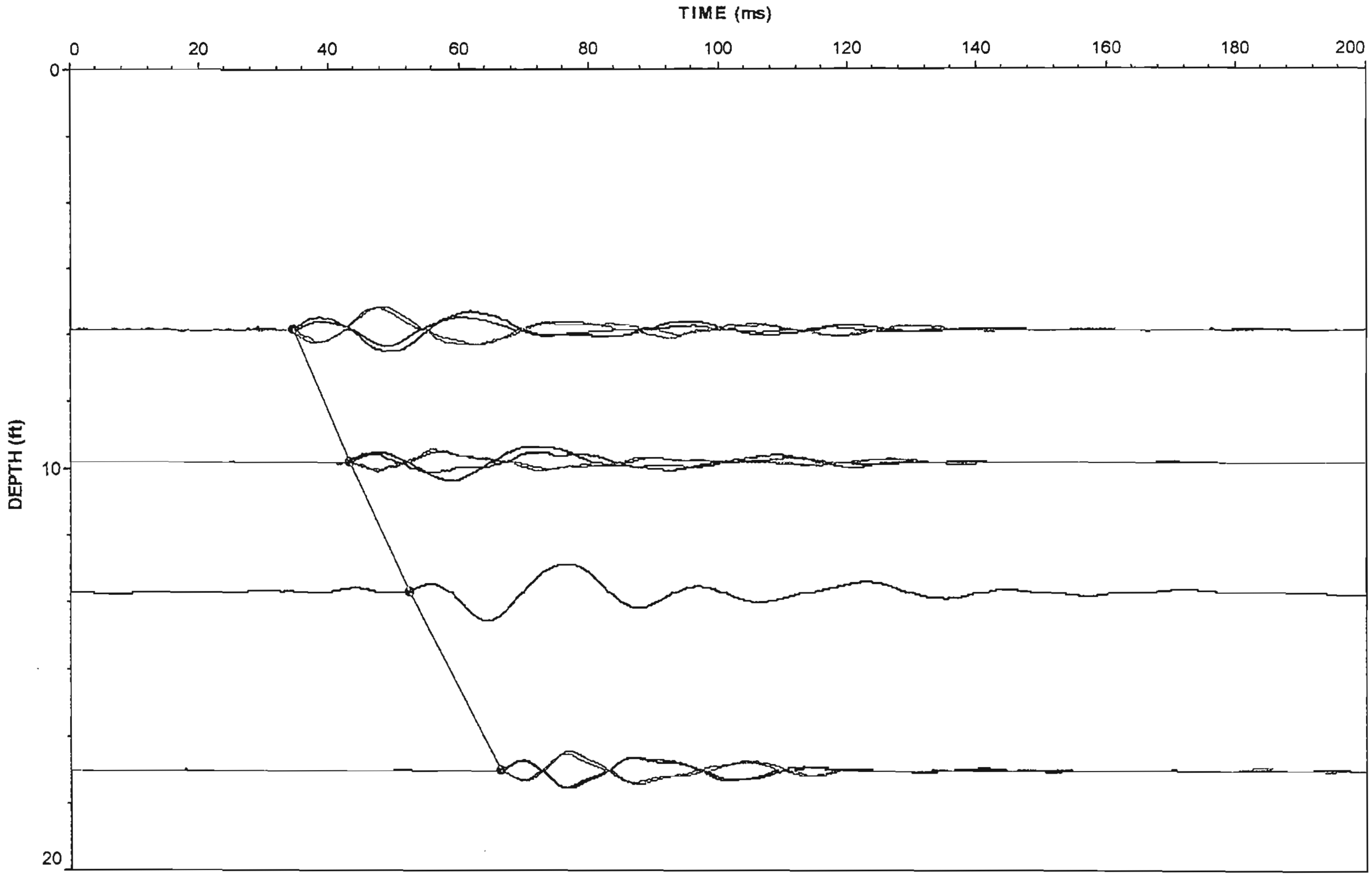
ConeTec Shear Wave Velocity Data Reduction Sheet

Hole:	CPT-2
Location:	LV Sutton Ash Pond
Cone:	AD 167
Date:	20-Apr-06
Source:	Beam
Source Depth	0.00 m
Source Offset	2.15 m

Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
2.00	1.80	2.80					
3.00	2.80	3.53	8.67	83.7	274.7	2.30	7.55
4.00	3.80	4.37	9.18	91.0	298.6	3.30	10.83
5.35	5.15	5.58	14.14	85.9	281.9	4.47	14.68

CONETEC

Job No: 06-923	Client: Withers & Ravenel	Project Title: Sutton Ash Pond	Operator: TS-EC-SL	Hole: CPT-2
Site: Sutton Plant	Date: 04:20:06 14:42	Cone: STD 20T AD-166		



Attachment 2.4

Geosyntec CPT Sounding Logs

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: CPT 1
Cone Used: DSG0867

CPT Date/Time: 5/13/2014 10:17:48 AM
Location: DUKE Sutton
Job Number: GC5592

Maximum Depth = 59.38 feet

Depth Increment = 0.164 feet

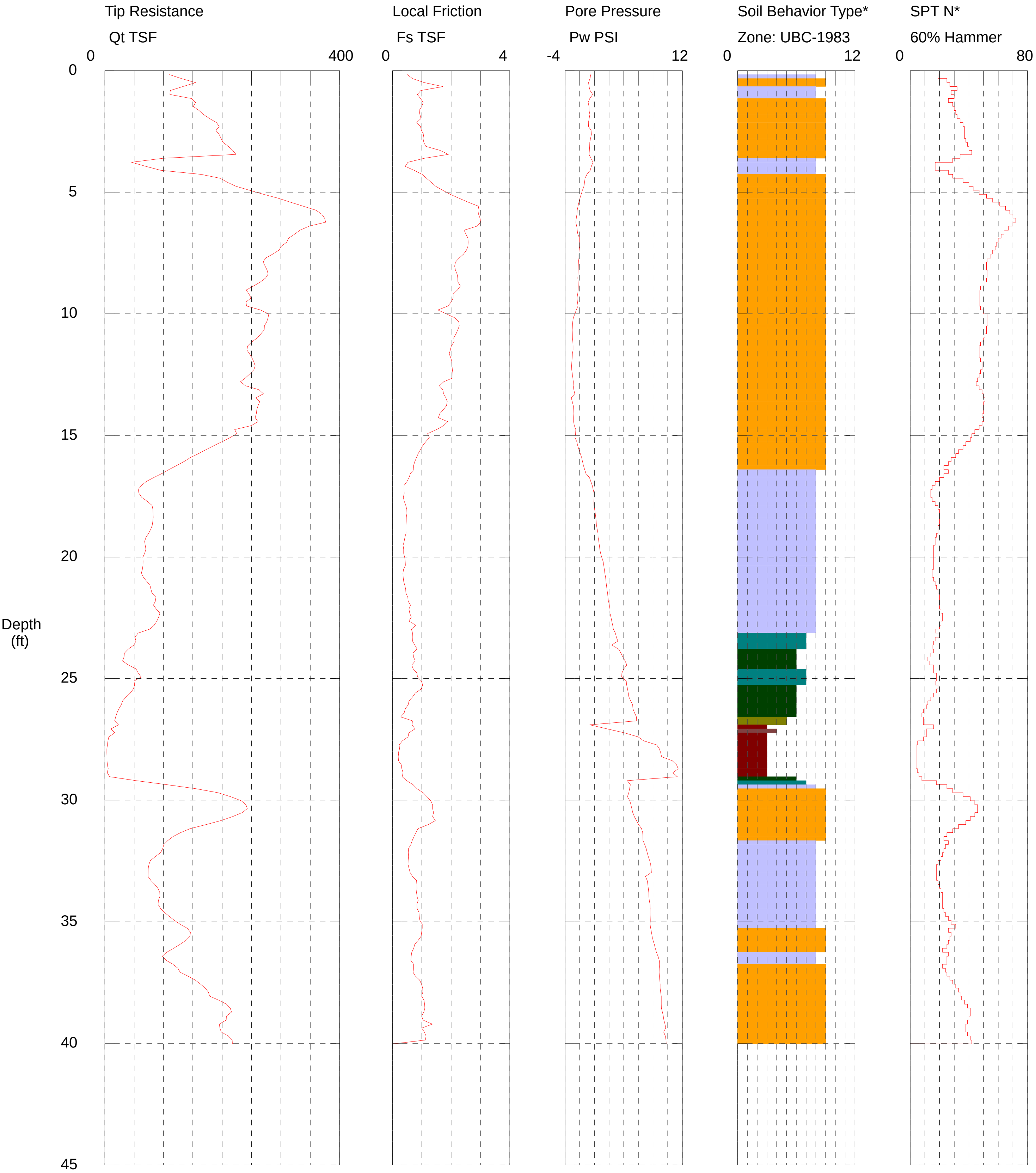
■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: CPT 2
Cone Used: DSG0867

CPT Date/Time: 5/14/2014 7:50:49 AM
Location: DUKE Sutton
Job Number: GC5592



Maximum Depth = 40.03 feet

Depth Increment = 0.164 feet

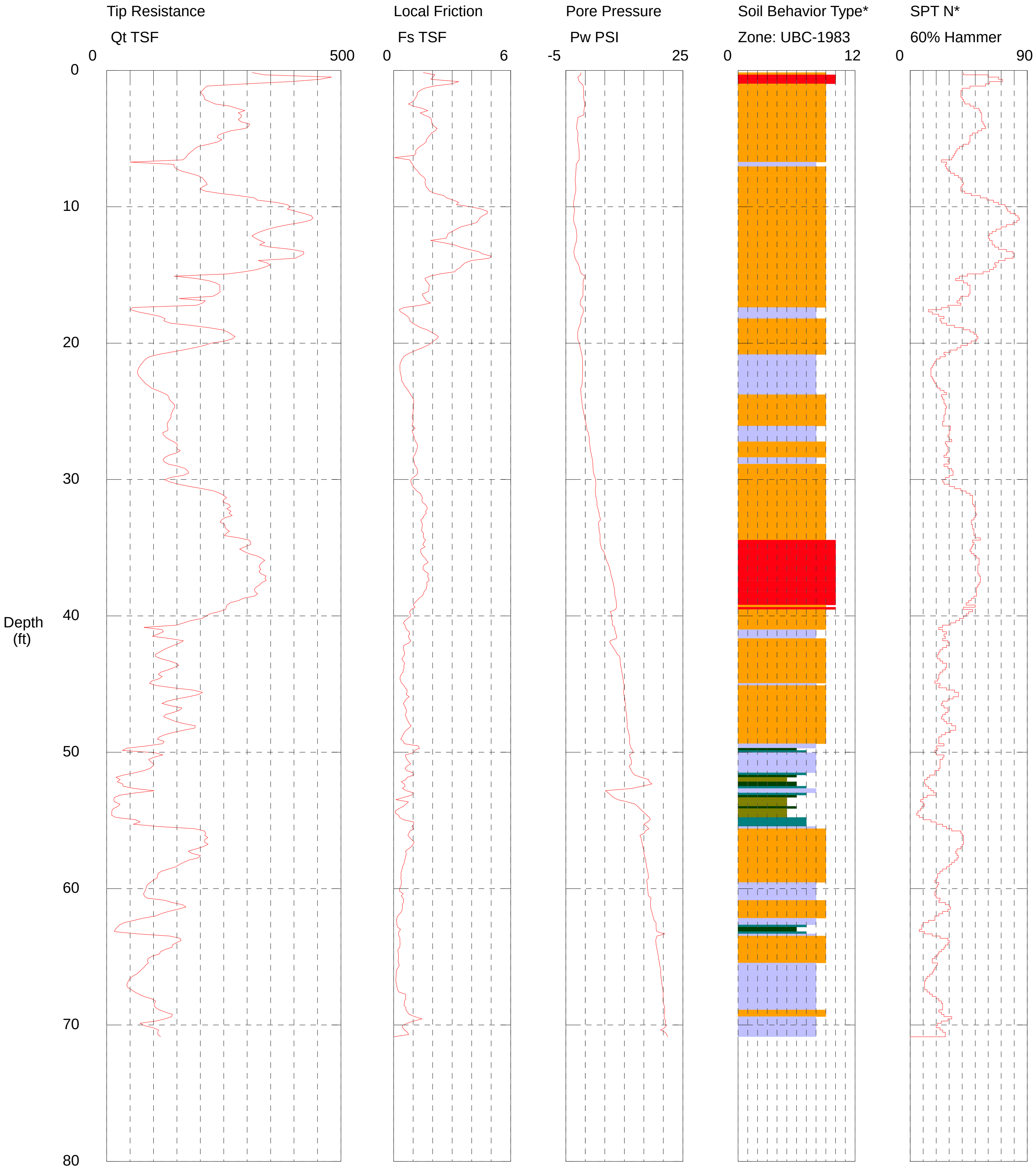
■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: CPT 3
Cone Used: DSG0867

CPT Date/Time: 5/14/2014 9:11:24 AM
Location: DUKE Sutton
Job Number: GC5592



Maximum Depth = 70.87 feet

Depth Increment = 0.164 feet

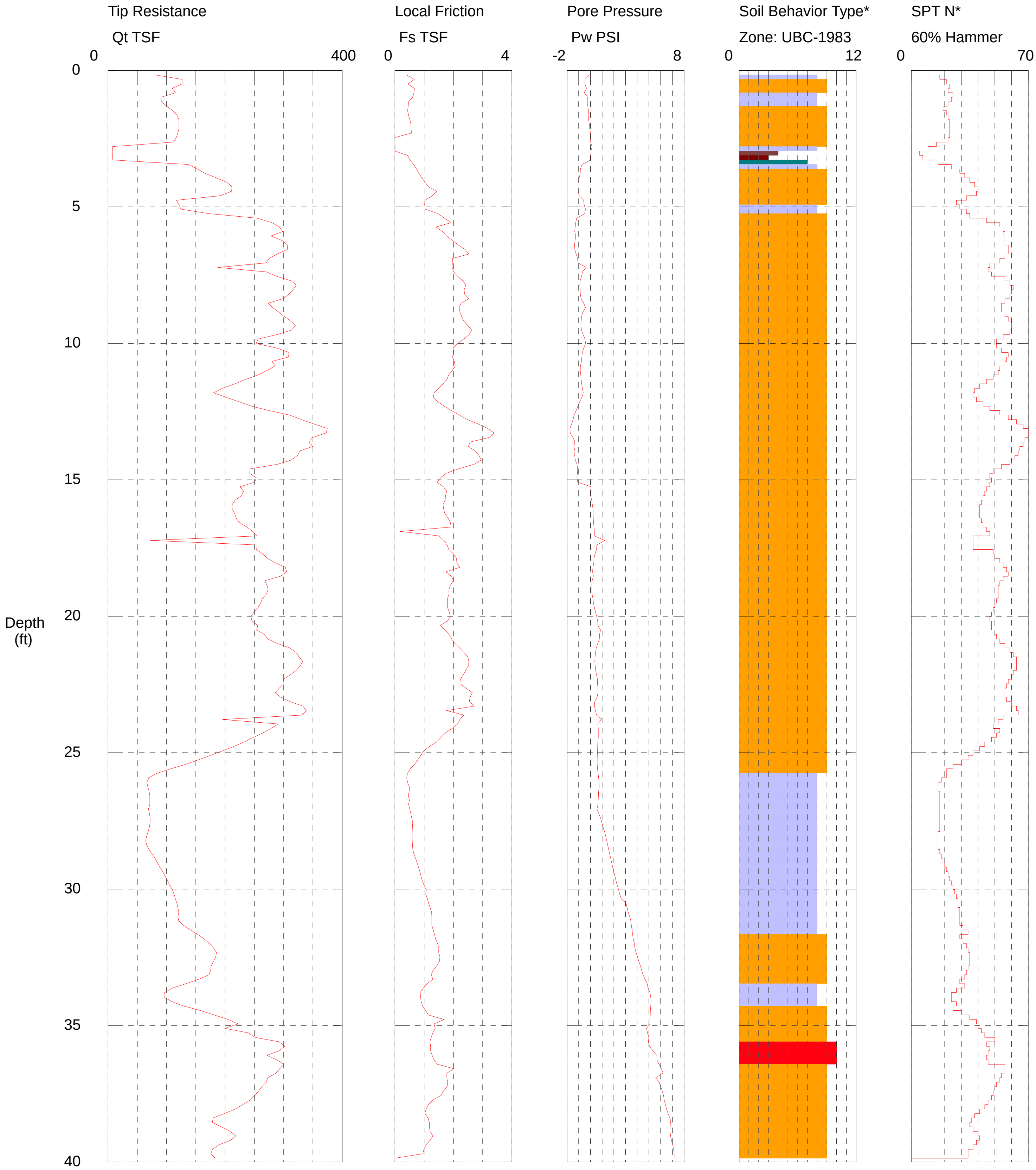
■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: CPT 4
Cone Used: DSG0867

CPT Date/Time: 5/14/2014 3:21:39 PM
Location: DUKE Sutton
Job Number: GC5592



Maximum Depth = 39.86 feet

Depth Increment = 0.164 feet

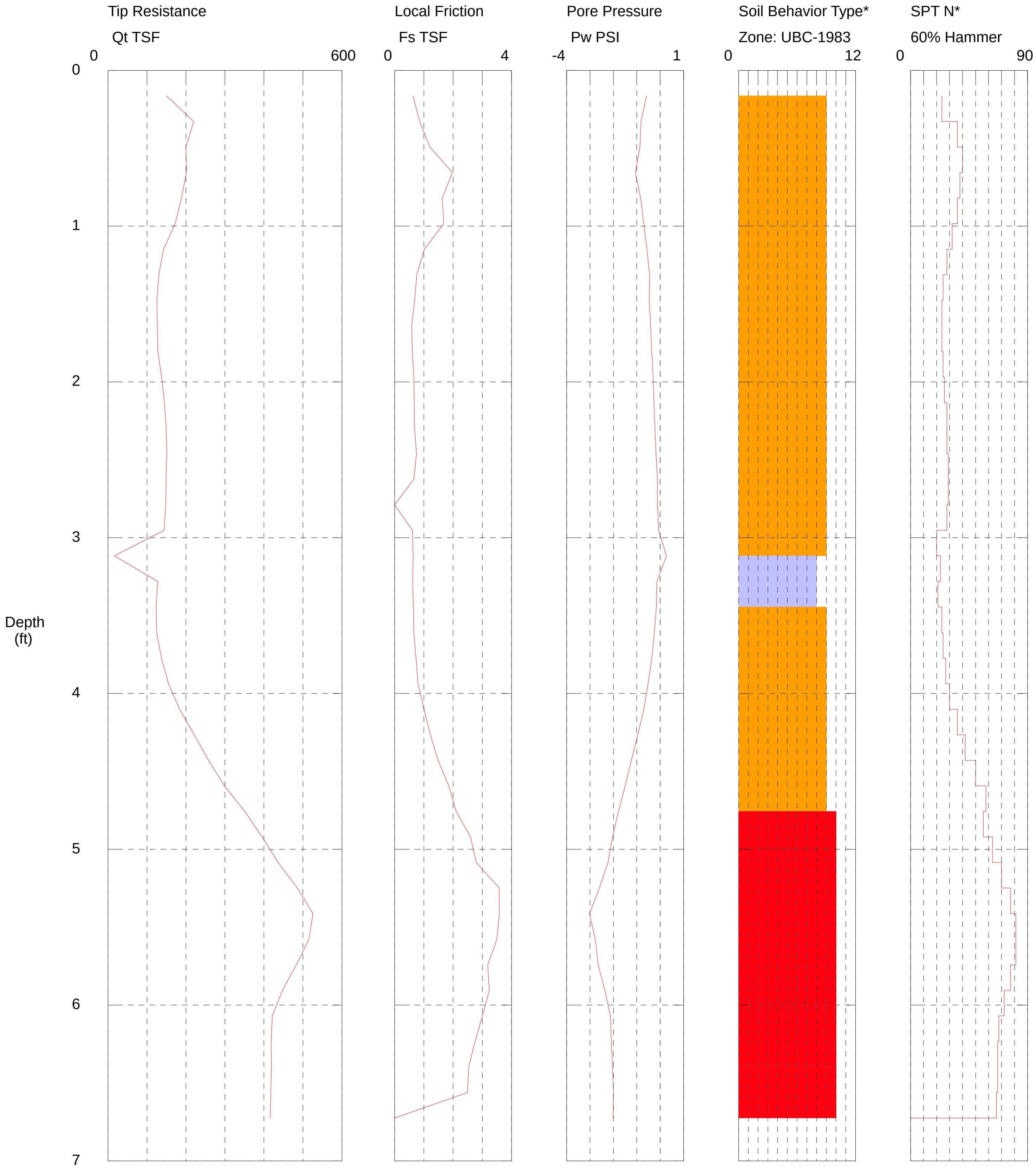
■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: CPT 5
Cone Used: DSG0867

CPT Date/Time: 5/15/2014 7:47:26 AM
Location: DUKE Sutton
Job Number: GC5592



Maximum Depth = 6.73 feet

Depth Increment = 0.164 feet

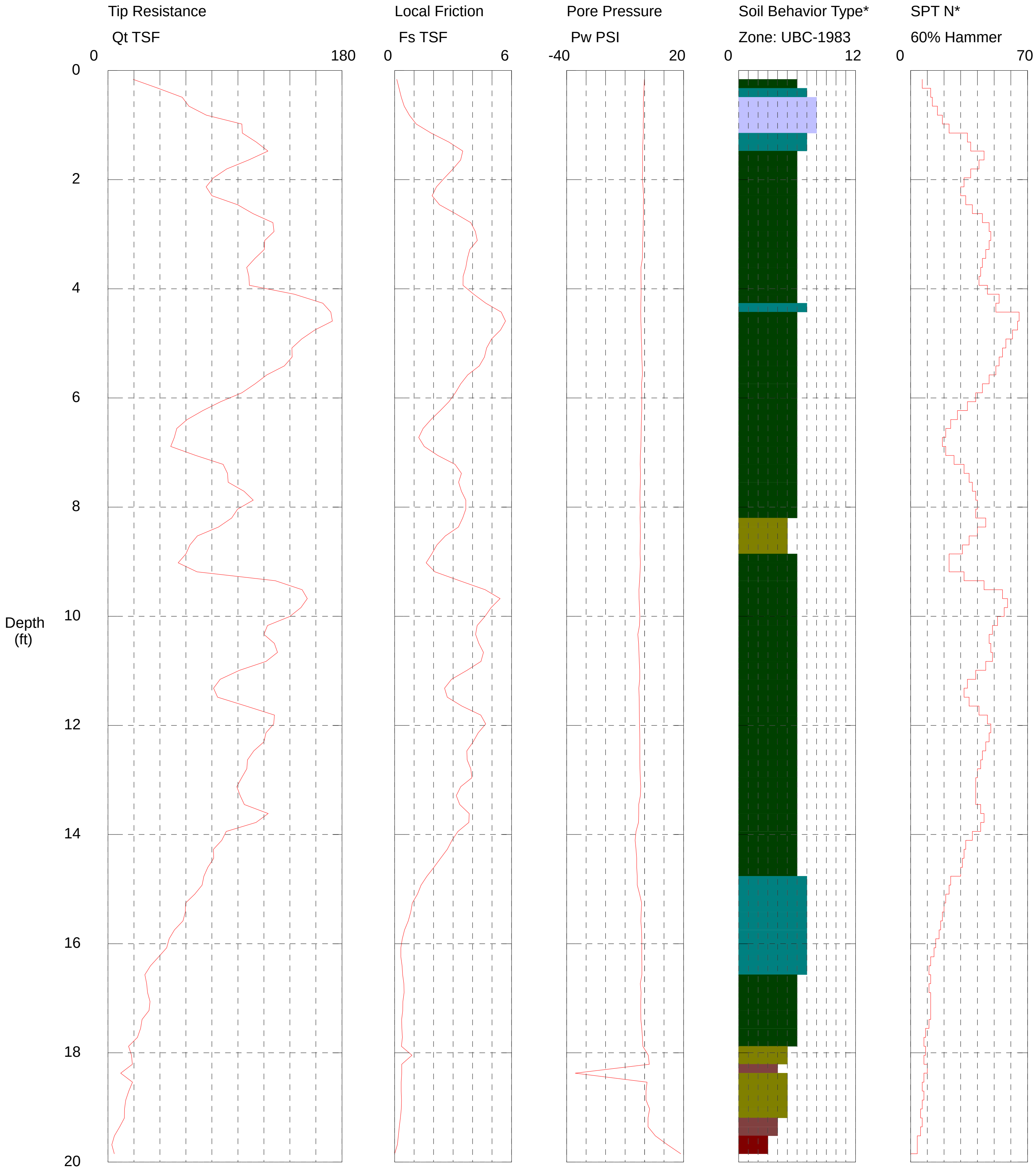
■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: CPT 6a
Cone Used: DSG0867

CPT Date/Time: 5/16/2014 7:37:57 AM
Location: DUKE Sutton
Job Number: GC5592



Maximum Depth = 19.85 feet

Depth Increment = 0.164 feet

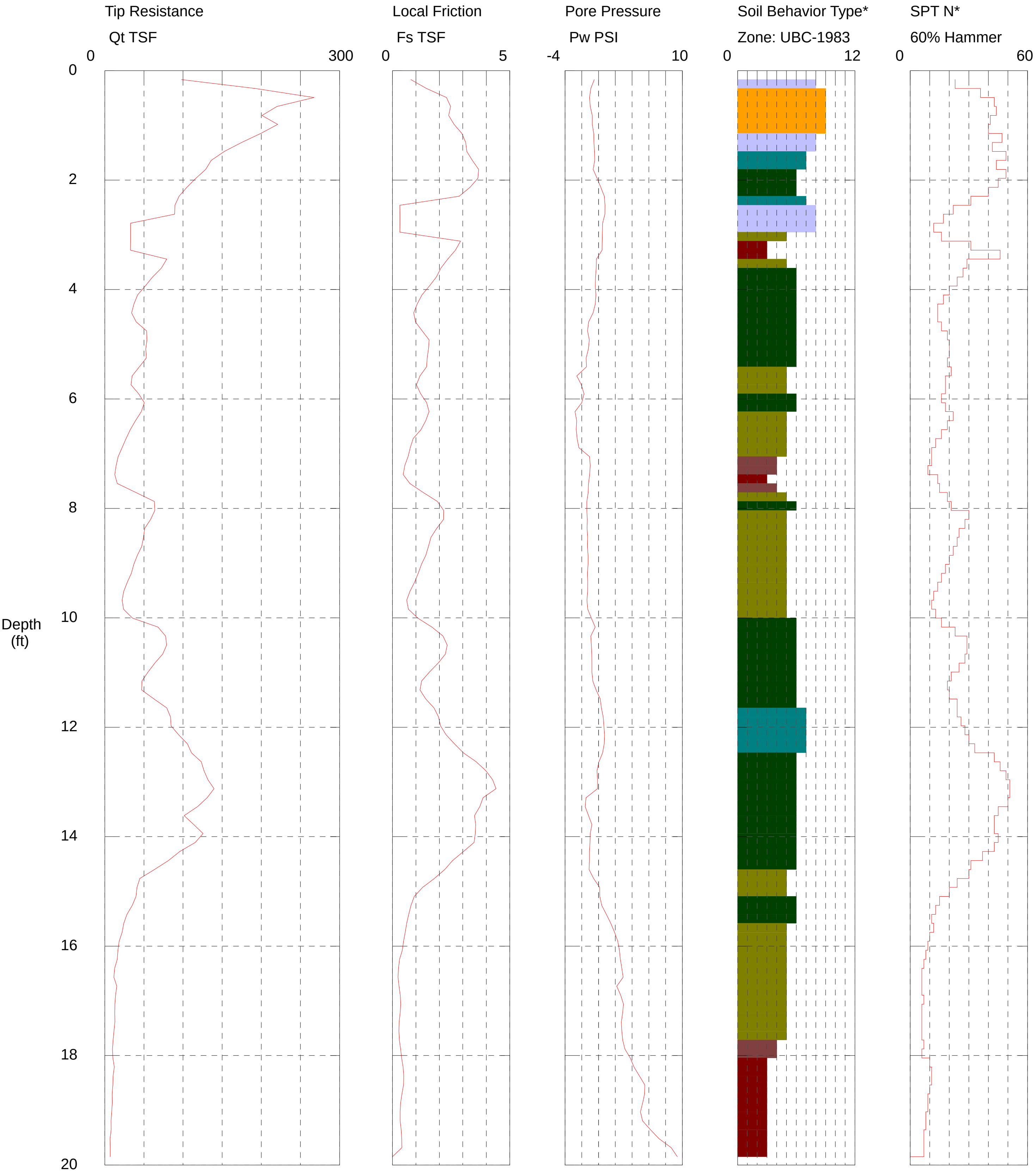
■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: CPT 7A
Cone Used: DSG0867

CPT Date/Time: 5/15/2014 8:53:03 AM
Location: DUKE Sutton
Job Number: GC5592



Maximum Depth = 19.85 feet

Depth Increment = 0.164 feet

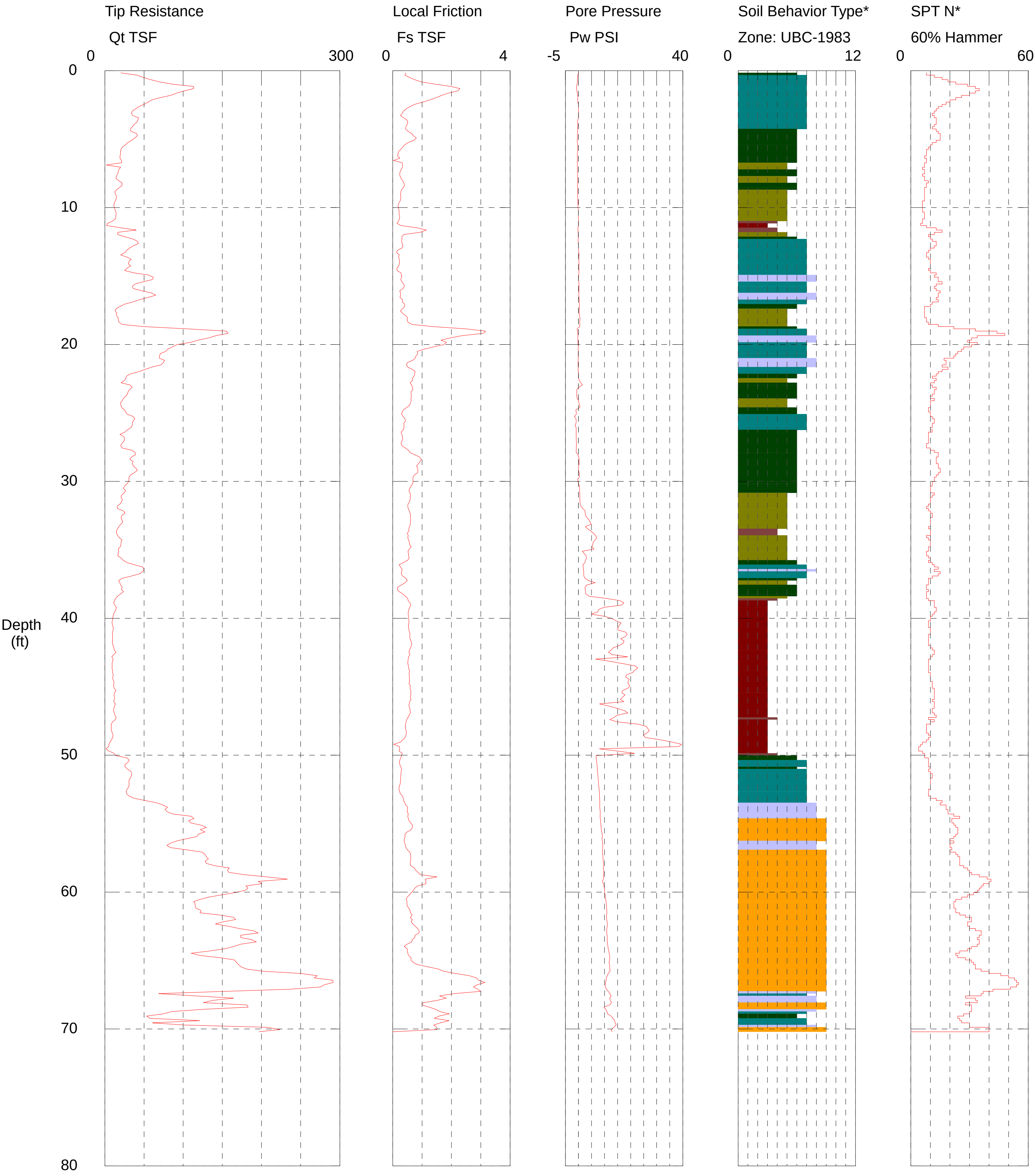
■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: CPT 8
Cone Used: DSG0867

CPT Date/Time: 5/13/2014 9:01:52 AM
Location: DUKE Sutton
Job Number: GC5592



Maximum Depth = 70.21 feet

Depth Increment = 0.164 feet

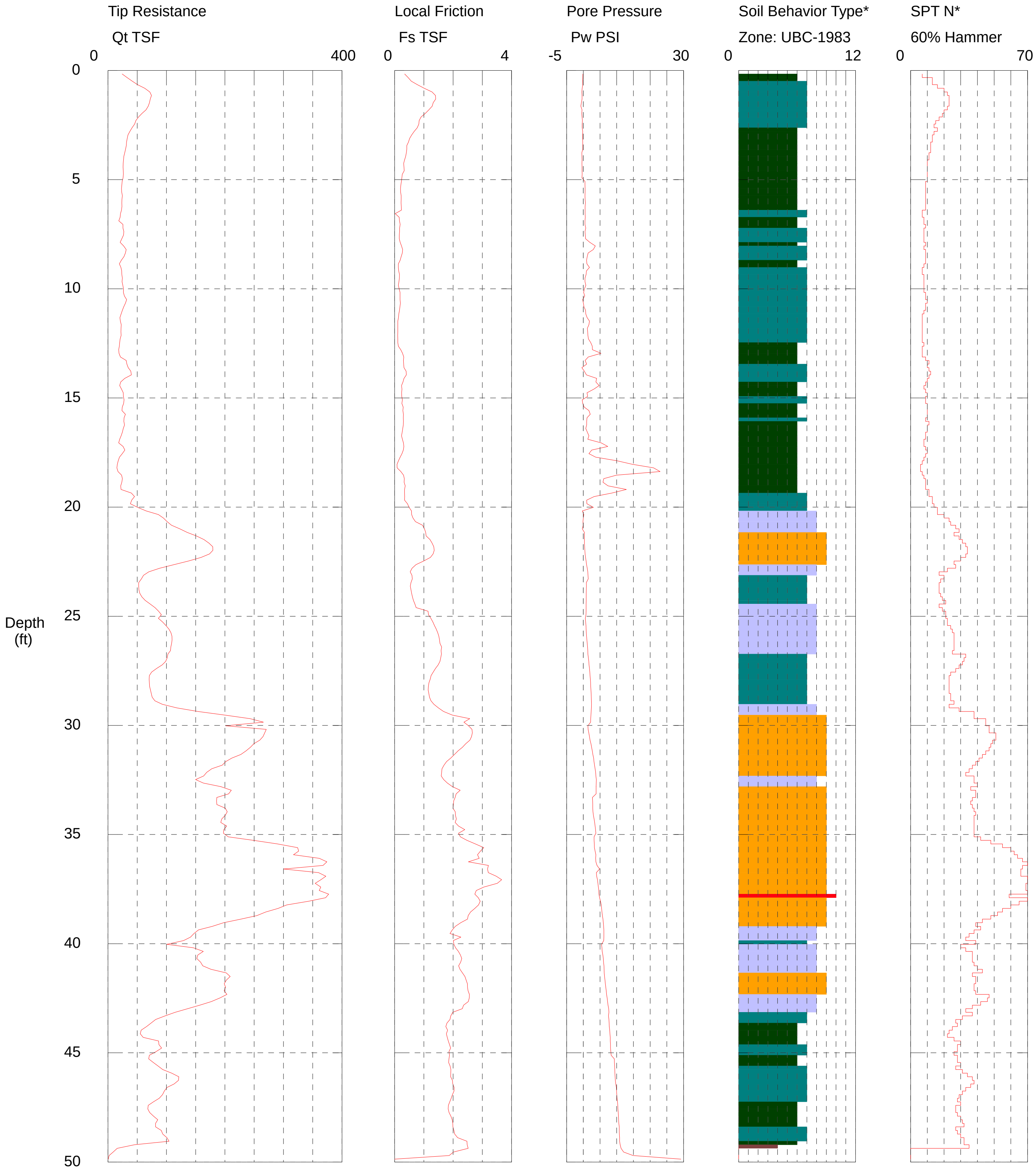
■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: SCPT 1
Cone Used: DSG0867

CPT Date/Time: 5/13/2014 11:41:00 AM
Location: DUKE Sutton
Job Number: GC5592



Maximum Depth = 49.87 feet

Depth Increment = 0.164 feet

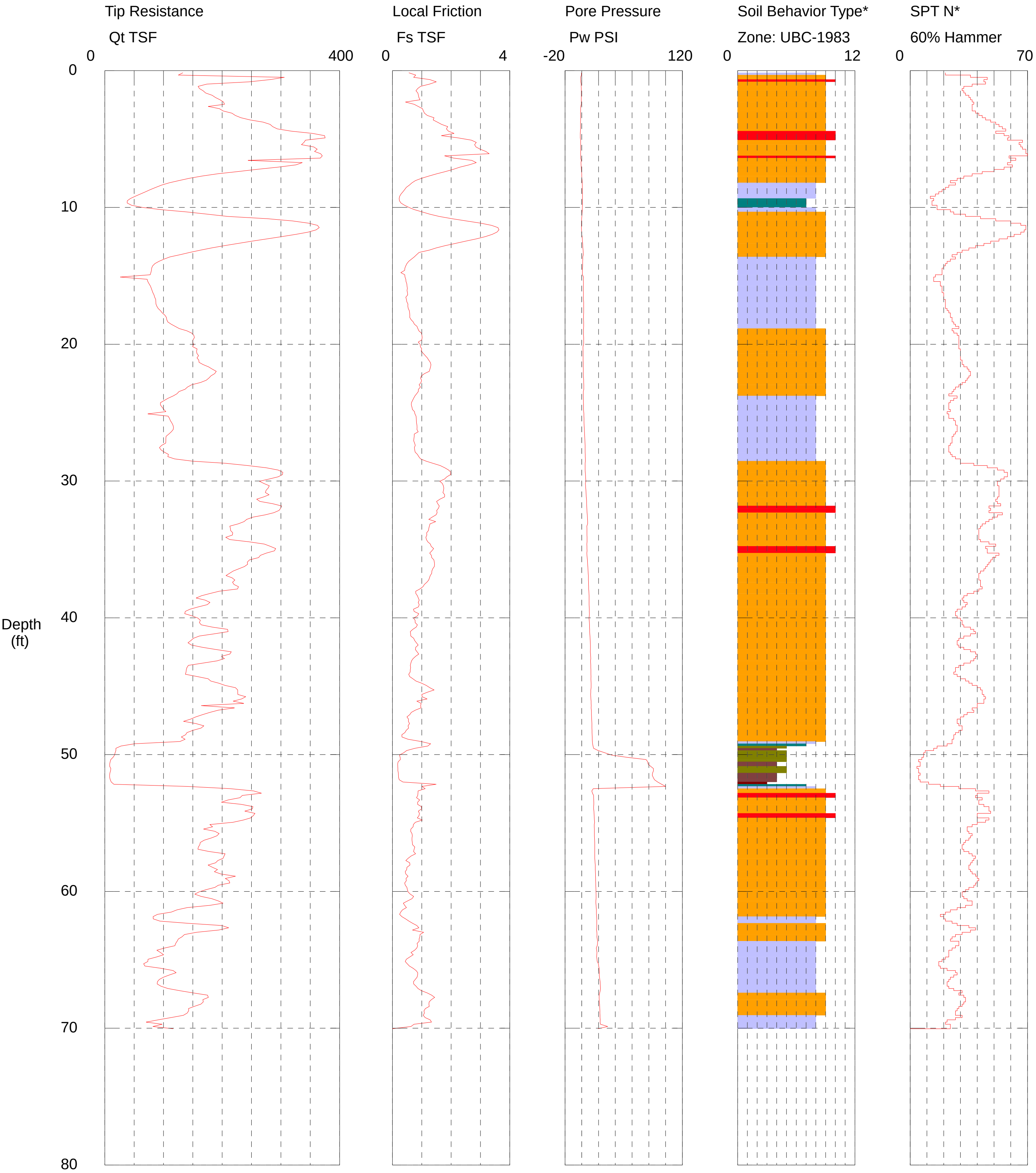
- ■ 1 sensitive fine grained
- ■ 2 organic material
- ■ 3 clay
- ■ 4 silty clay to clay
- ■ 5 clayey silt to silty clay
- ■ 6 sandy silt to clayey silt
- ■ 7 silty sand to sandy silt
- ■ 8 sand to silty sand
- ■ 9 sand
- ■ 10 gravelly sand to sand
- ■ 11 very stiff fine grained (*)
- ■ 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: SCPT 2
Cone Used: DSG0867

CPT Date/Time: 5/14/2014 1:12:36 PM
Location: DUKE Sutton
Job Number: GC5592



Maximum Depth = 70.05 feet

Depth Increment = 0.164 feet

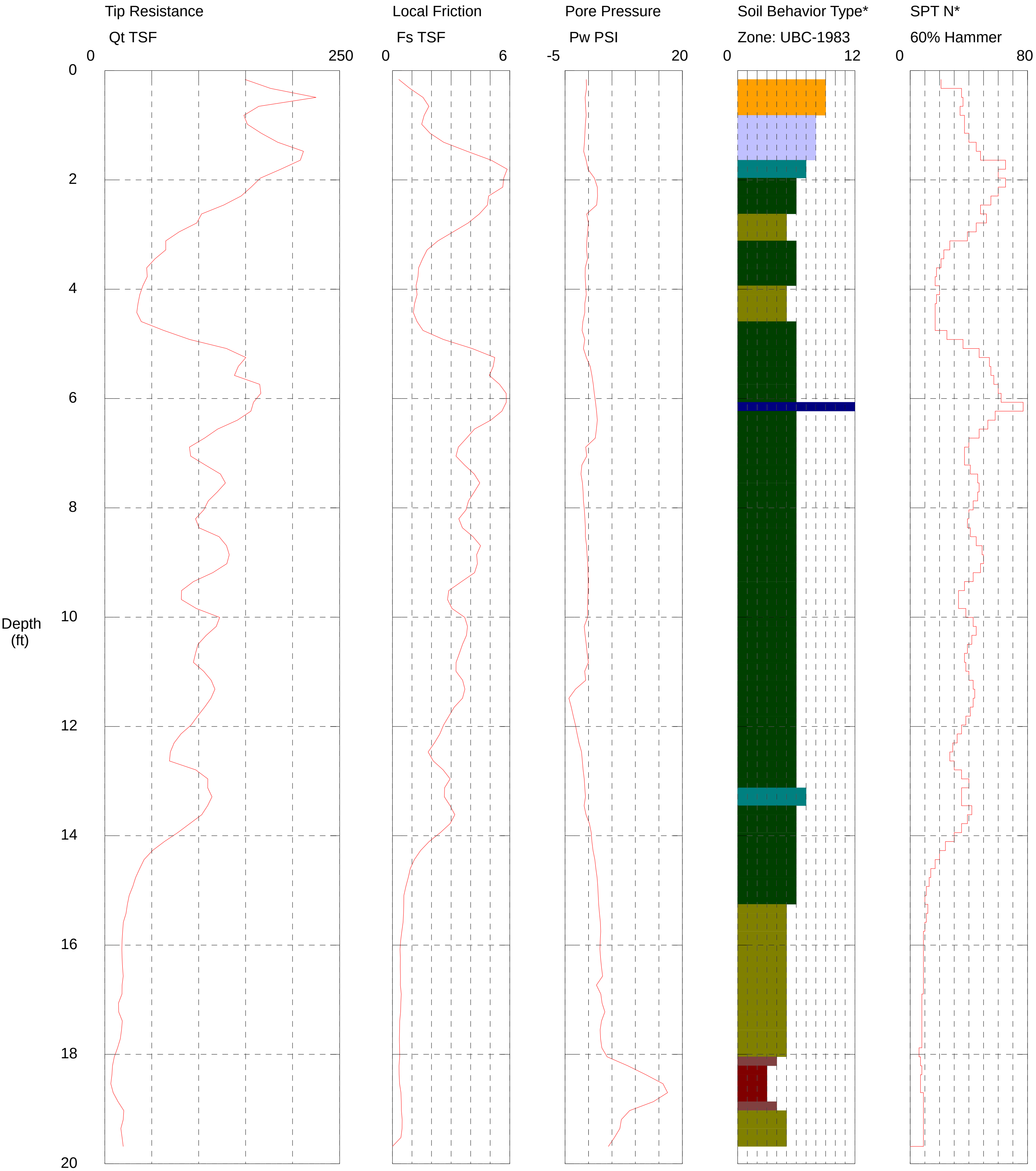
■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: SCPT 3 A
Cone Used: DSG0867

CPT Date/Time: 5/15/2014 9:56:01 AM
Location: DUKE Sutton
Job Number: GC5592



Maximum Depth = 19.69 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay

■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt

■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand

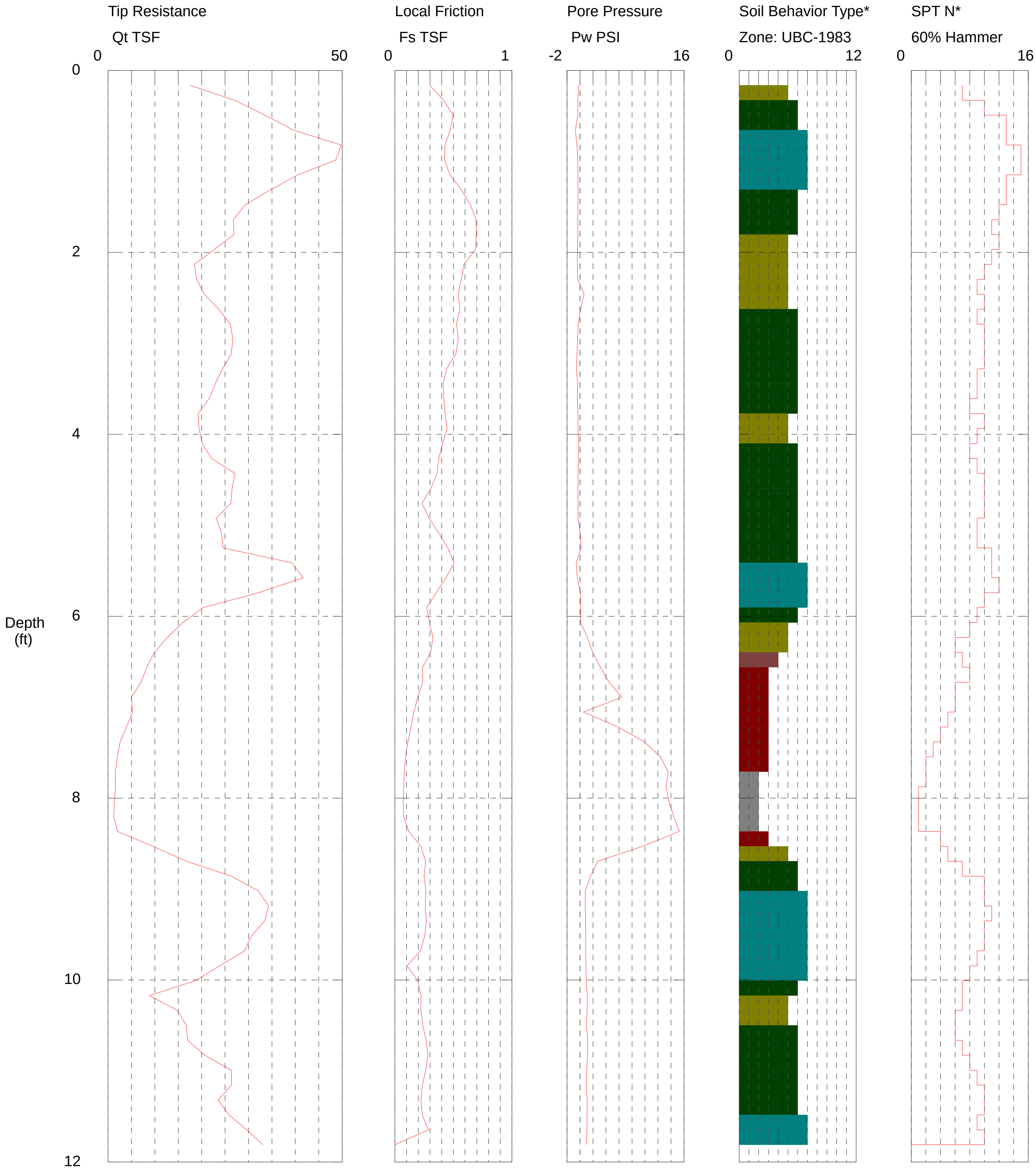
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: SCPT 4
Cone Used: DSG0867

CPT Date/Time: 5/16/2014 8:33:45 AM
Location: DUKE Sutton
Job Number: GC5592



Maximum Depth = 11.81 feet

Depth Increment = 0.164 feet

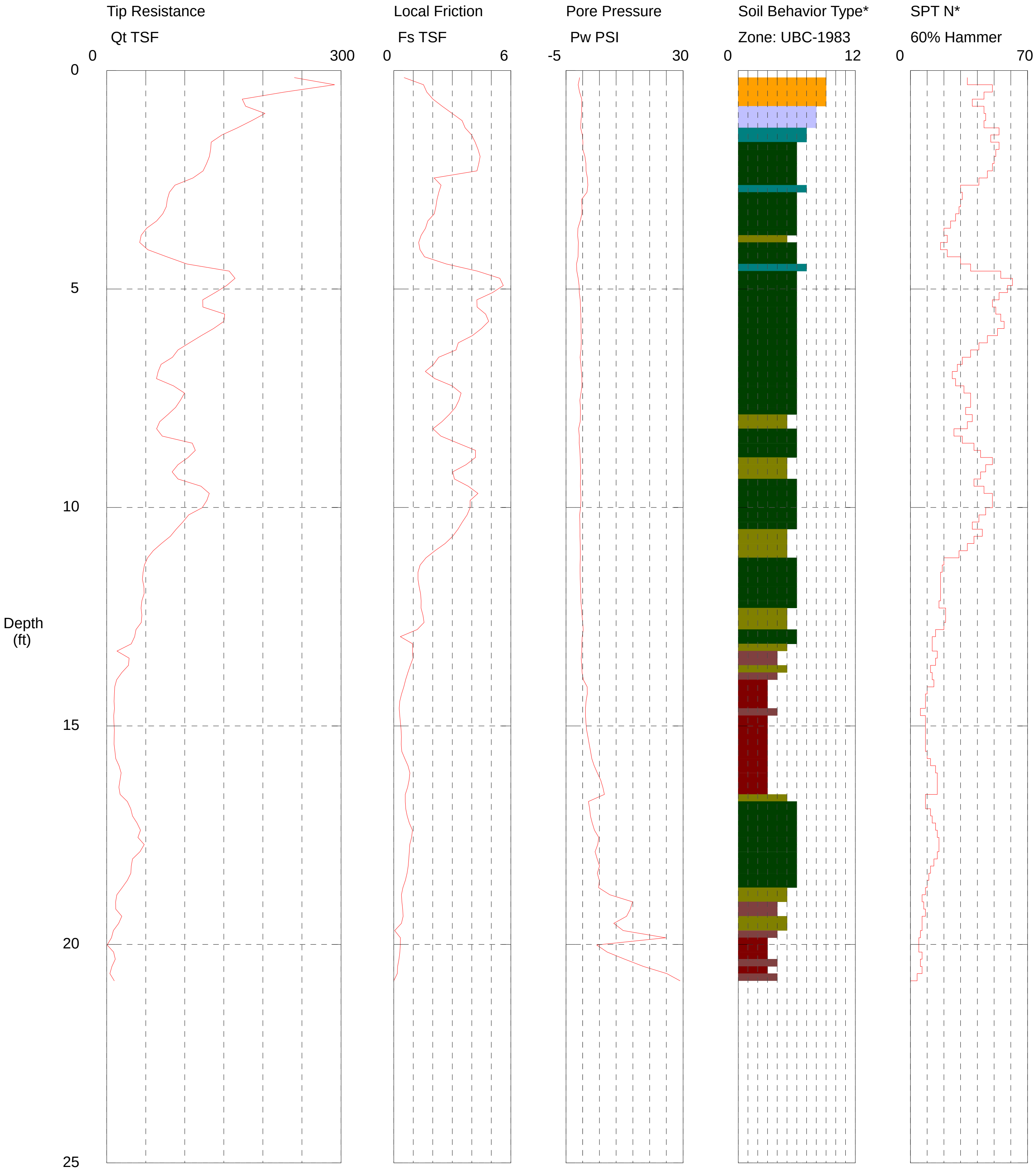
⬜ 1 sensitive fine grained	🟫 4 silty clay to clay	🟦 7 silty sand to sandy silt	🟥 10 gravelly sand to sand
⬛ 2 organic material	🟨 5 clayey silt to silty clay	🟪 8 sand to silty sand	🟦 11 very stiff fine grained (*)
🟥 3 clay	🟩 6 sandy silt to clayey silt	🟧 9 sand	🟦 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: SCPT 5 A
Cone Used: DSG0867

CPT Date/Time: 5/15/2014 10:56:58 AM
Location: DUKE Sutton
Job Number: GC5592



Maximum Depth = 20.83 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay

■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt

■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand

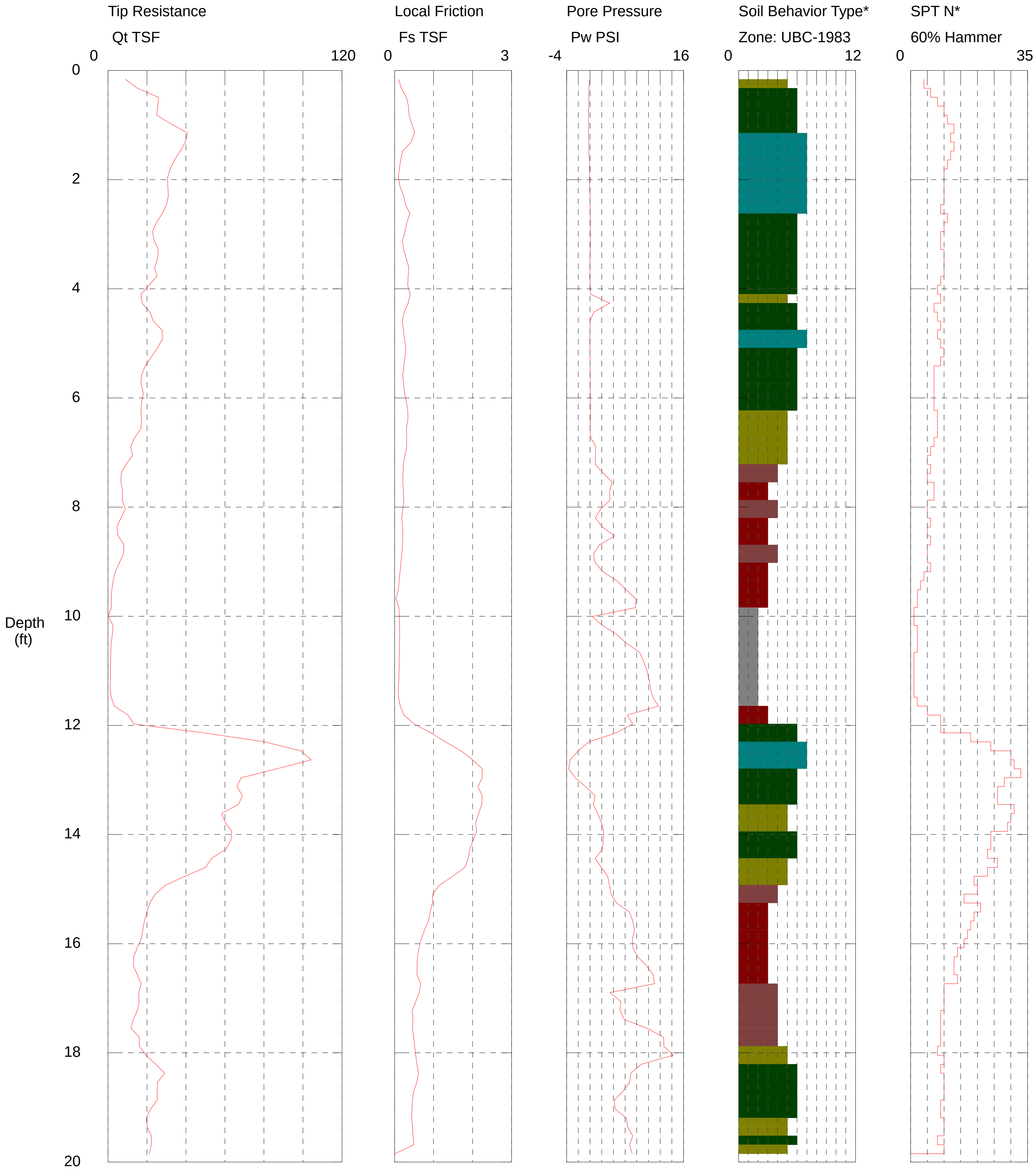
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

MID-ATLANTIC DRILLING

Operator: Ron Stewart
Sounding: SCPT 6
Cone Used: DSG0867

CPT Date/Time: 5/15/2014 12:31:58 PM
Location: DUKE Sutton
Job Number: GC5592



Maximum Depth = 19.85 feet

Depth Increment = 0.164 feet

■ 1 sensitive fine grained	■ 4 silty clay to clay	■ 7 silty sand to sandy silt	■ 10 gravelly sand to sand
■ 2 organic material	■ 5 clayey silt to silty clay	■ 8 sand to silty sand	■ 11 very stiff fine grained (*)
■ 3 clay	■ 6 sandy silt to clayey silt	■ 9 sand	■ 12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

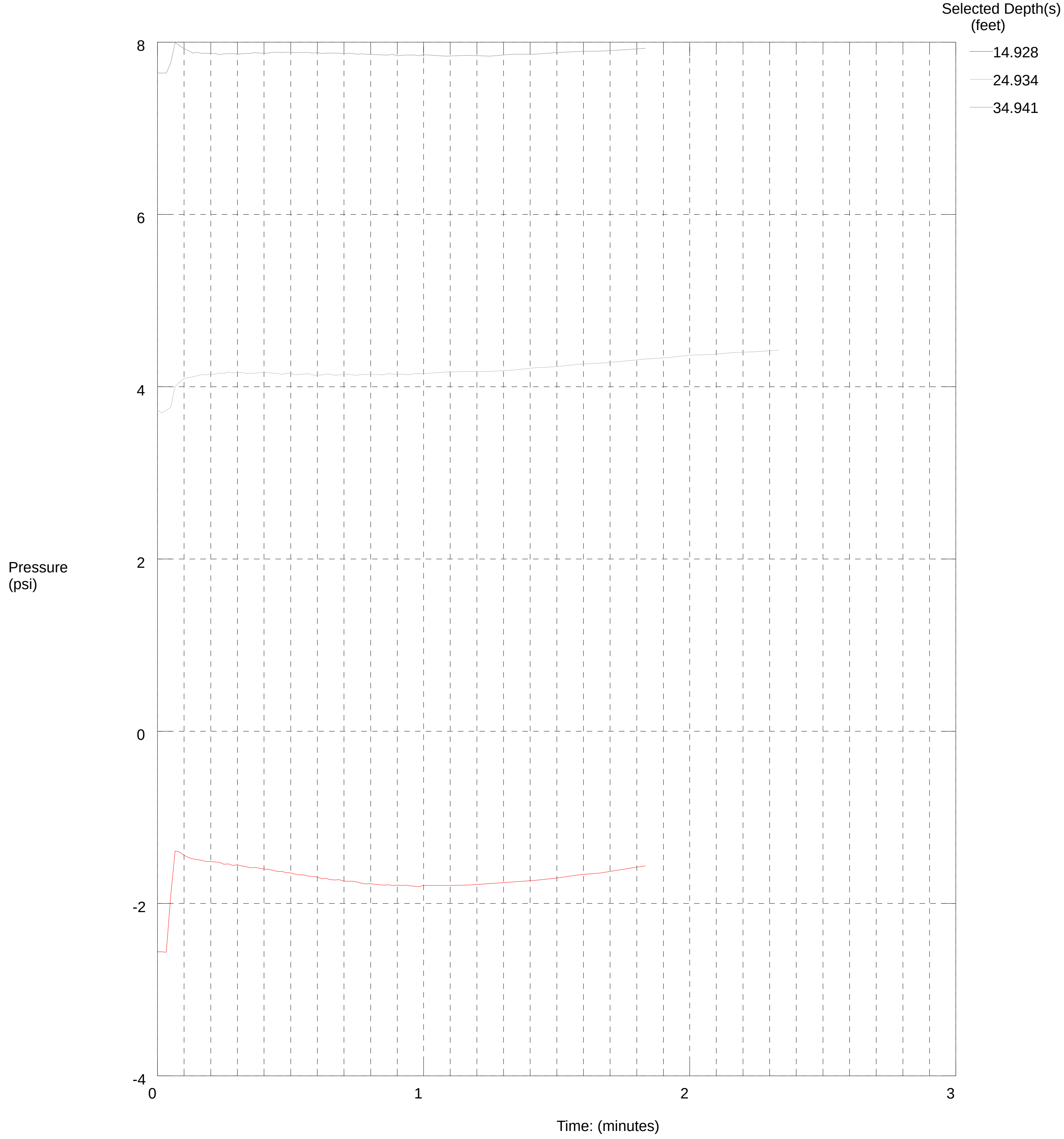
Attachment 2.5

Geosyntec Dissipation Test Results

MID-ATLANTIC DRILLING

Operator Ron Stewart
Sounding: CPT 2
Cone Used: DSG0867

CPT Date/Time: 5/14/2014 7:50:49 AM
Location: DUKE Sutton
Job Number: GC5592



Maximum Pressure = 7.996 psi

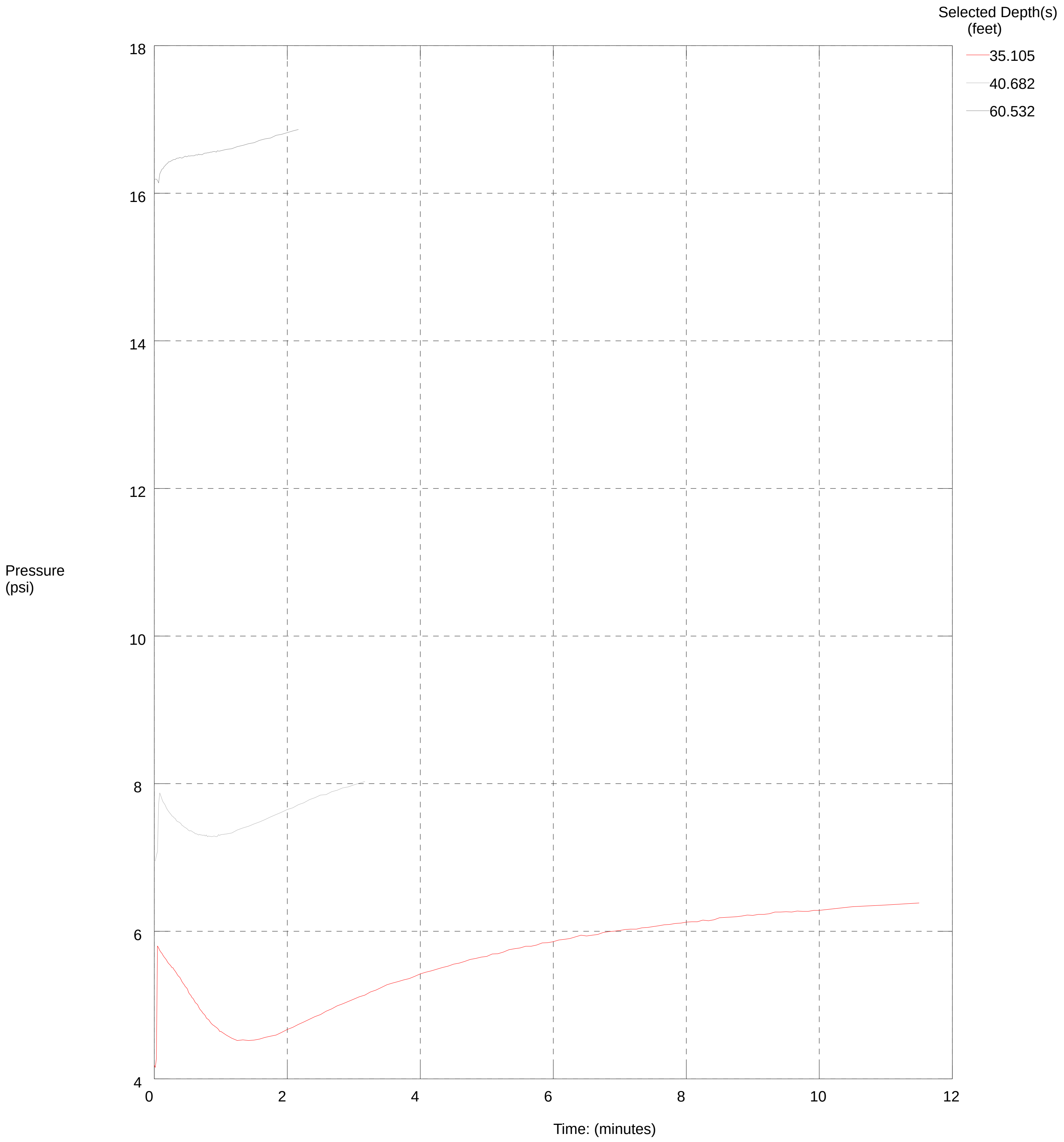
Footer 1
P.S.I.

Footer 2

MID-ATLANTIC DRILLING

Operator   Ron Stewart
Sounding: CPT 3
Cone Used: DSG0867

CPT Date/Time: 5/14/2014 9:11:24 AM
Location: DUKE Sutton
Job Number: GC5592

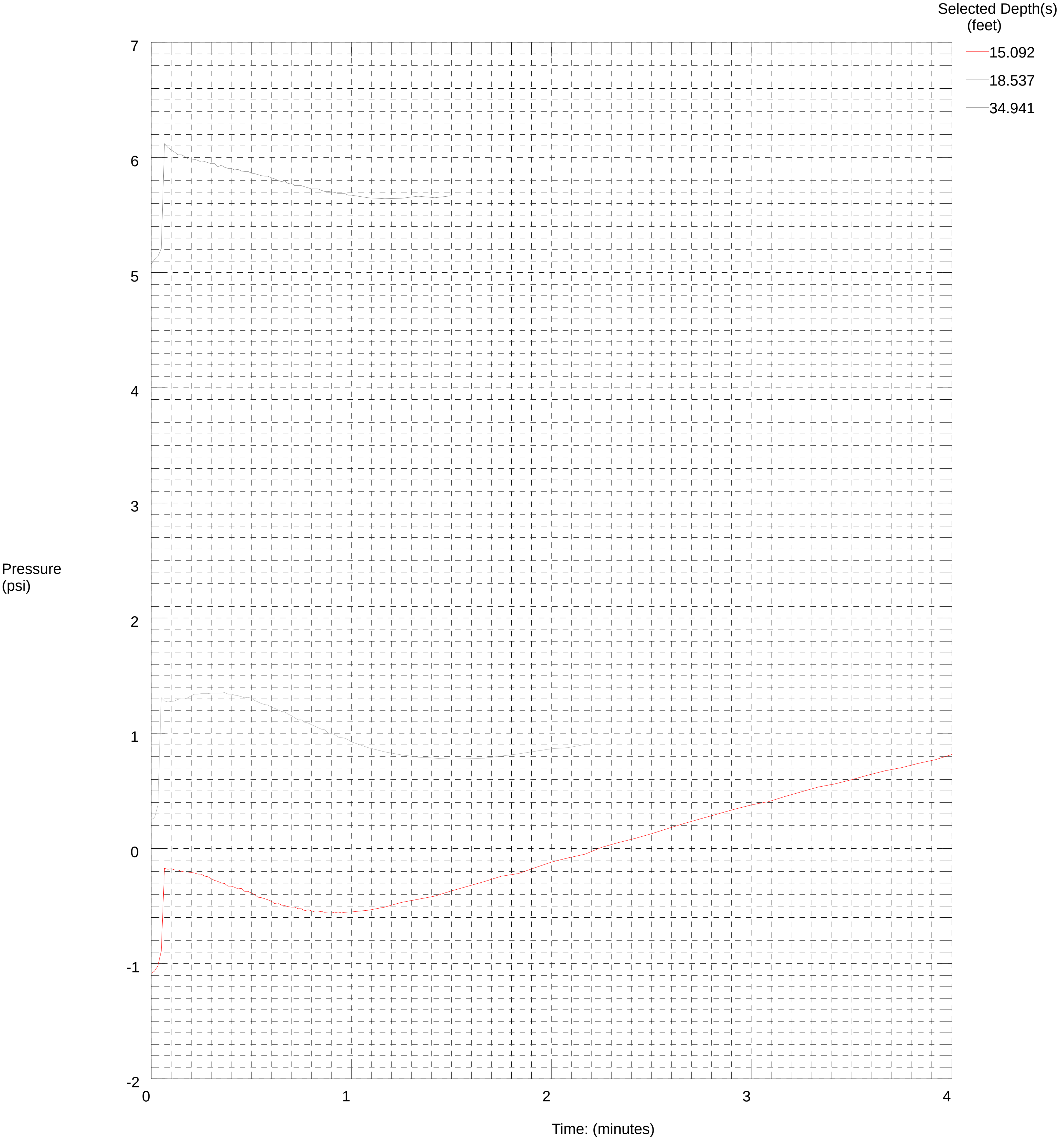


Maximum Pressure = 16.863 psi

MID-ATLANTIC DRILLING

Operator Ron Stewart
Sounding: CPT 4
Cone Used: DSG0867

CPT Date/Time: 5/14/2014 3:21:39 PM
Location: DUKE Sutton
Job Number: GC5592

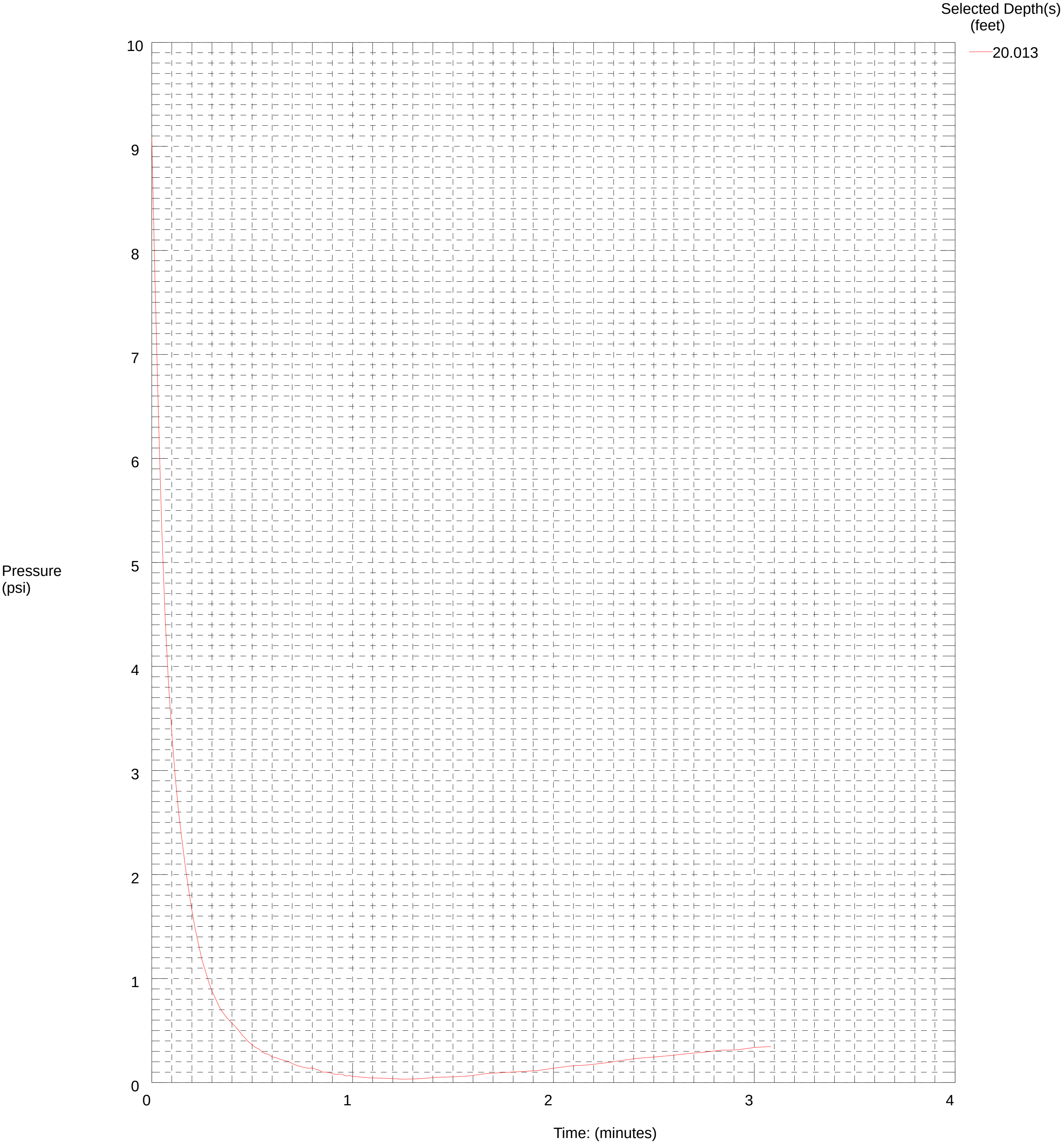


Maximum Pressure = 6.119 psi

MID-ATLANTIC DRILLING

Operator   Ron Stewart
Sounding: CPT 6a
Cone Used: DSG0867

CPT Date/Time: 5/16/2014 7:37:57 AM
Location: DUKE Sutton
Job Number: GC5592

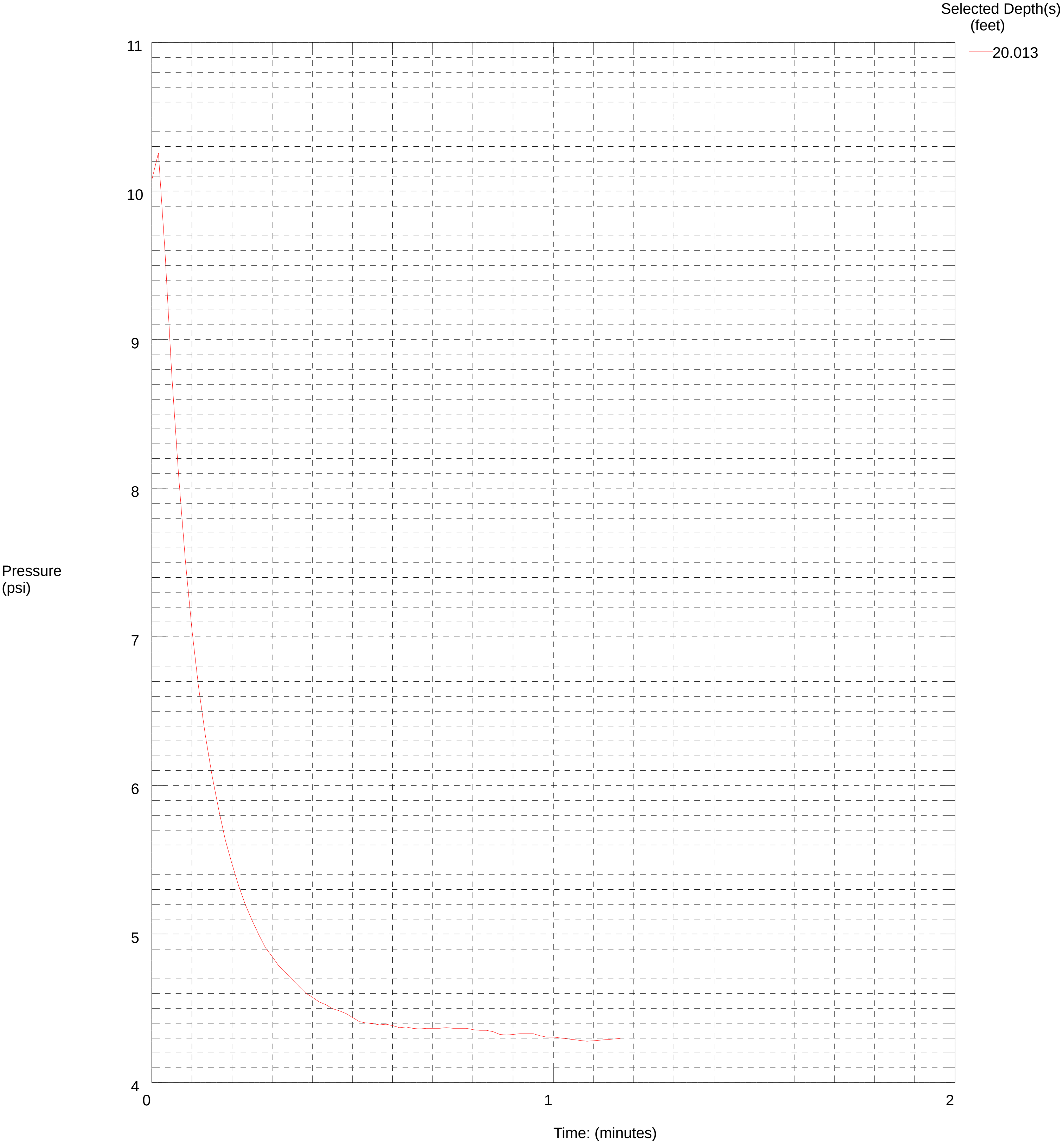


Maximum Pressure = 9.081 psi

MID-ATLANTIC DRILLING

Operator Ron Stewart
Sounding: CPT 7A
Cone Used: DSG0867

CPT Date/Time: 5/15/2014 8:53:03 AM
Location: DUKE Sutton
Job Number: GC5592

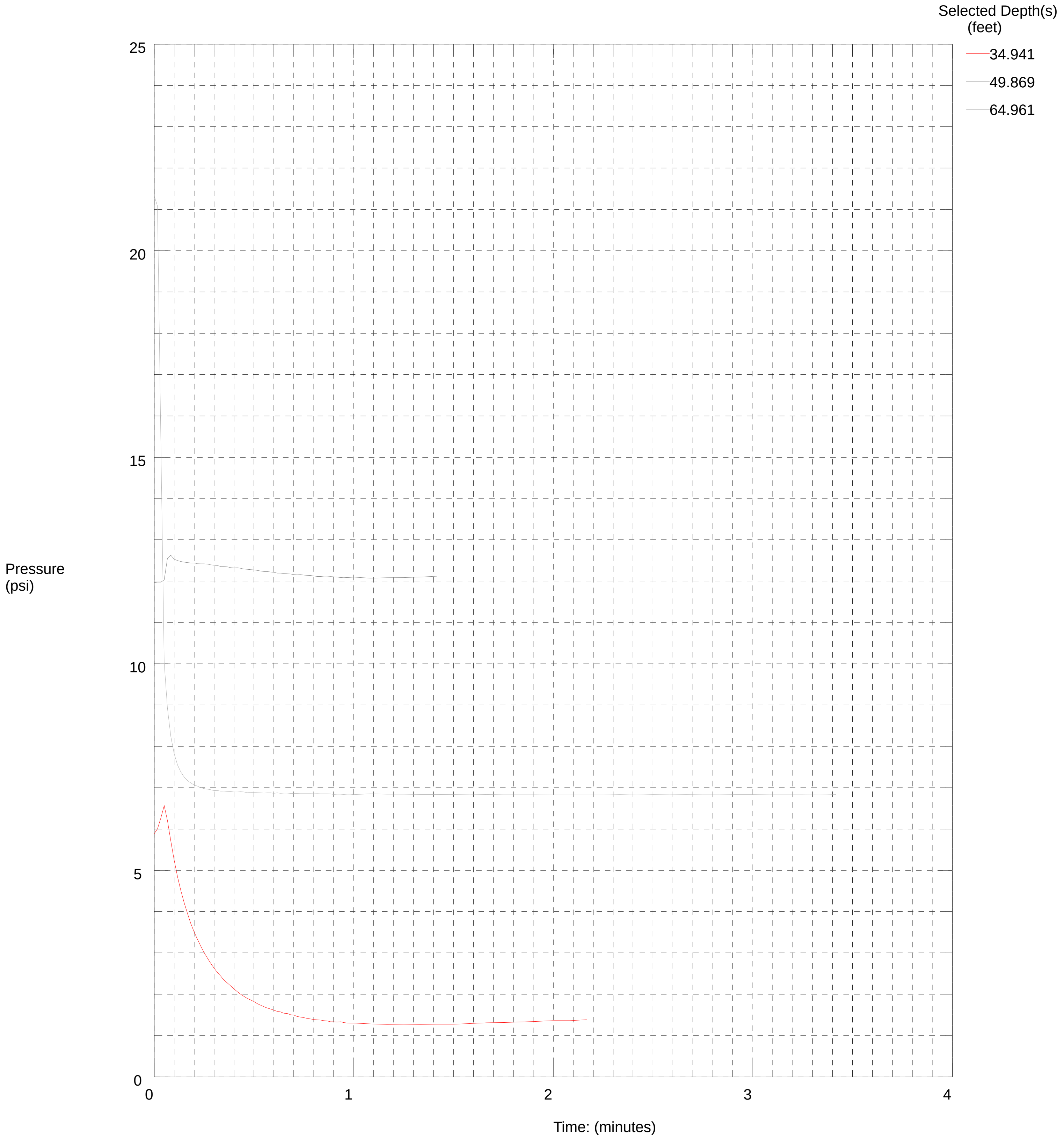


Maximum Pressure = 10.256 psi

MID-ATLANTIC DRILLING

Operator Ron Stewart
Sounding: CPT 8
Cone Used: DSG0867

CPT Date/Time: 5/13/2014 9:01:52 AM
Location: DUKE Sutton
Job Number: GC5592

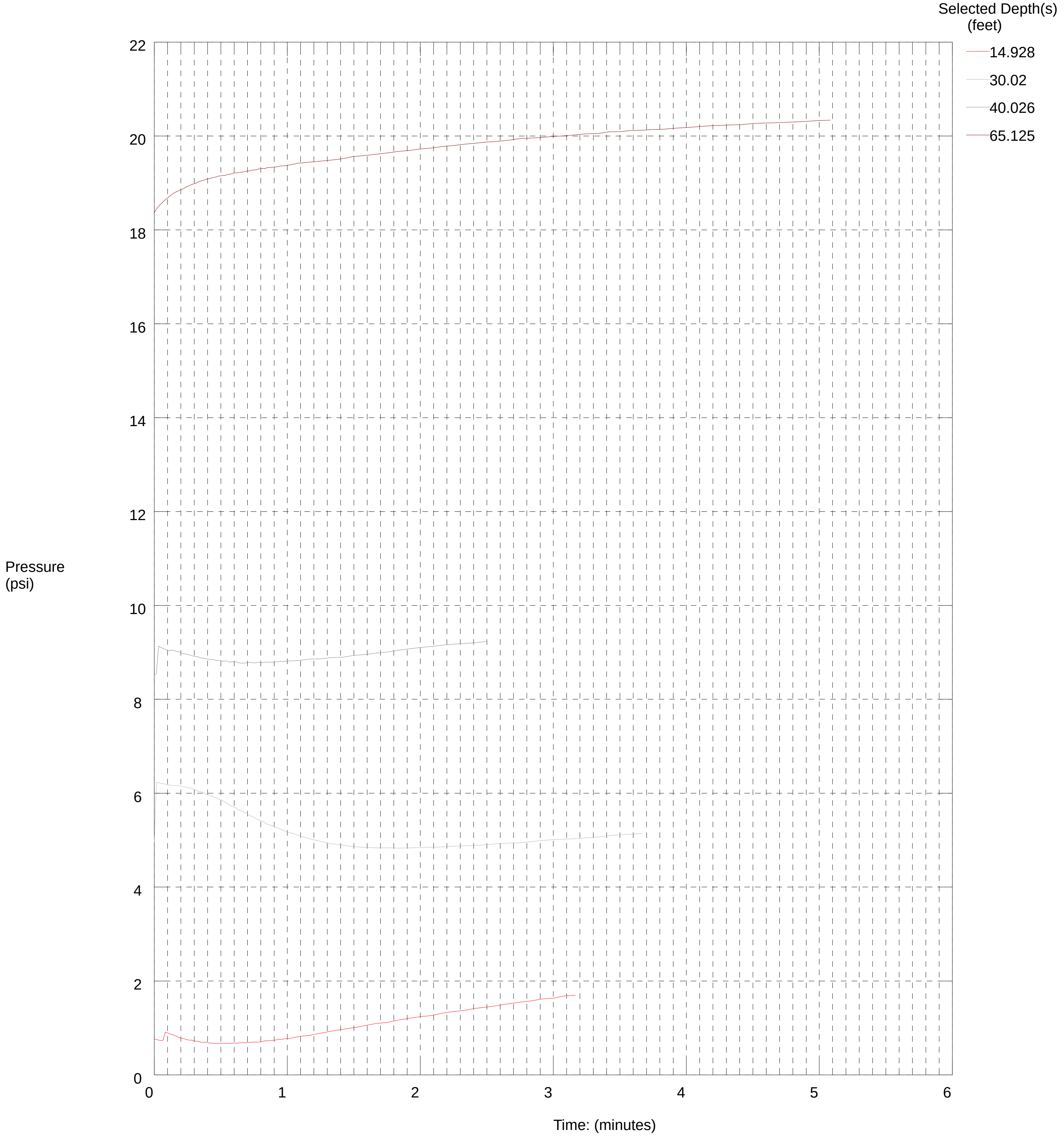


Maximum Pressure = 21.323 psi

MID-ATLANTIC DRILLING

Operator Ron Stewart
Sounding: SCPT 2
Cone Used: DSG0867

CPT Date/Time: 5/14/2014 1:12:36 PM
Location: DUKE Sutton
Job Number: GC5592

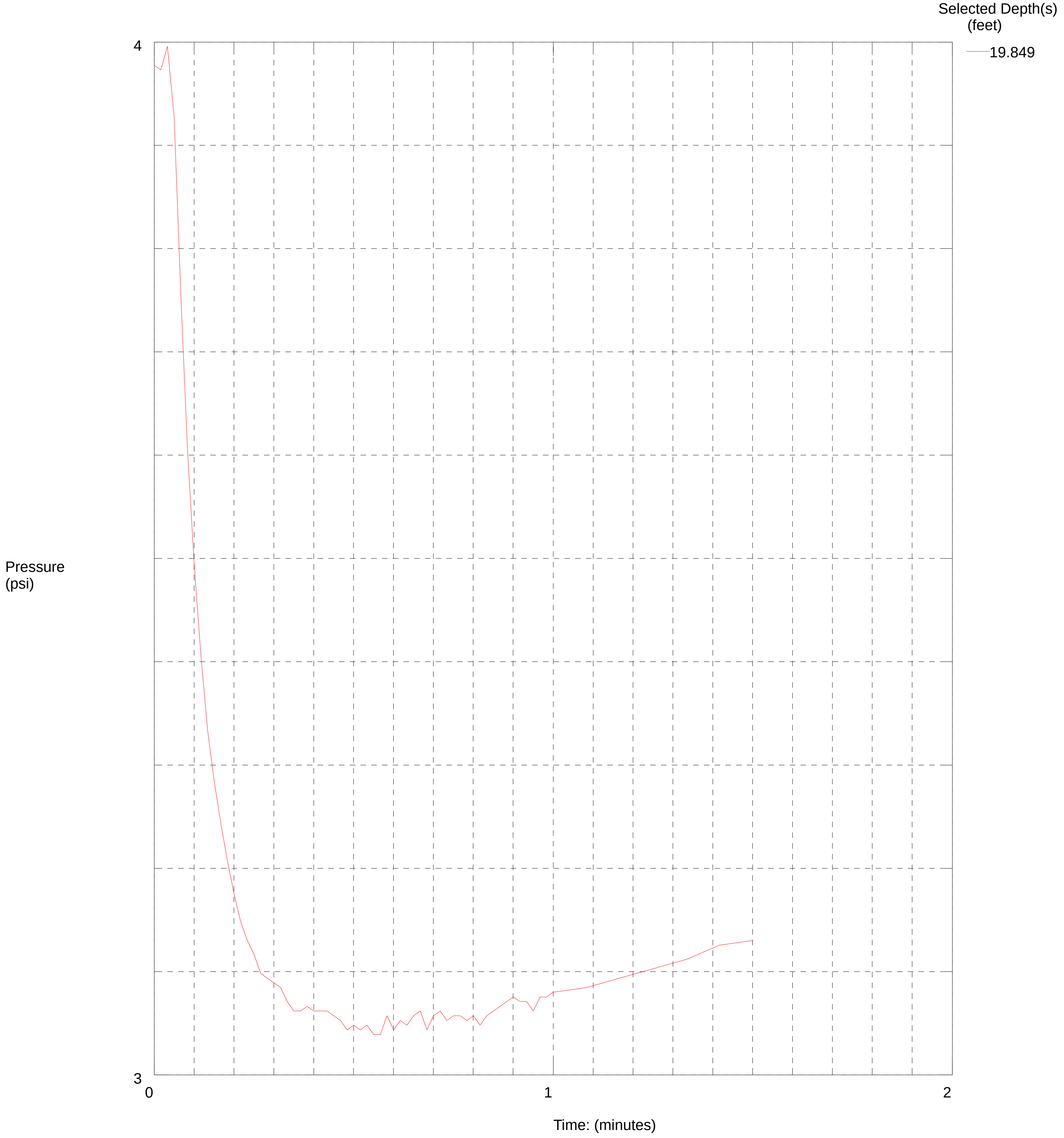


Maximum Pressure = 20.339 psi

MID-ATLANTIC DRILLING

Operator   Ron Stewart
Sounding: SCPT 3 A
Cone Used: DSG0867

CPT Date/Time: 5/15/2014 9:56:01 AM
Location: DUKE Sutton
Job Number: GC5592

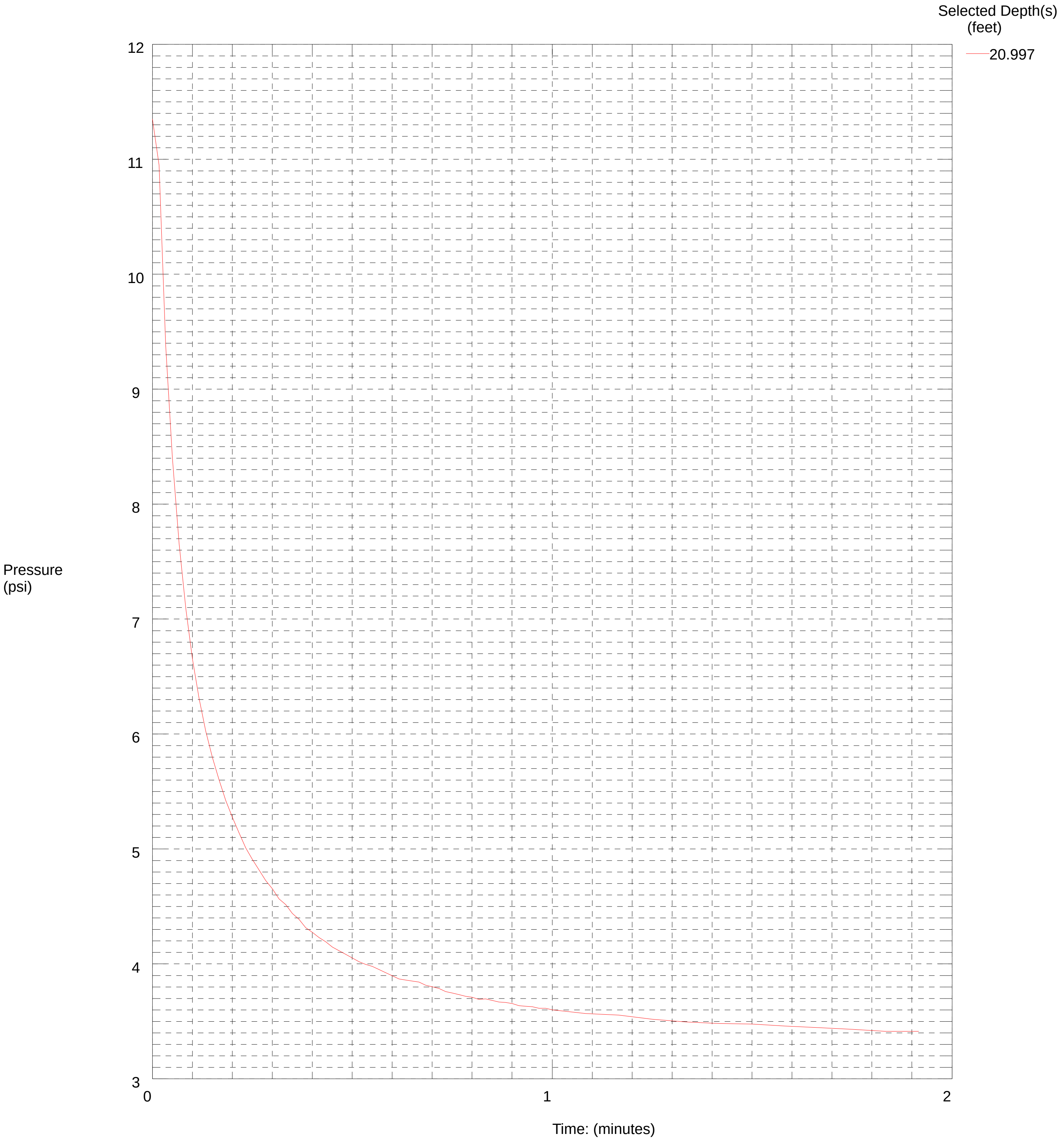


Maximum Pressure = 3.996 psi

MID-ATLANTIC DRILLING

Operator Ron Stewart
Sounding: SCPT 5 A
Cone Used: DSG0867

CPT Date/Time: 5/15/2014 10:56:56 AM
Location: DUKE Sutton
Job Number: GC5592



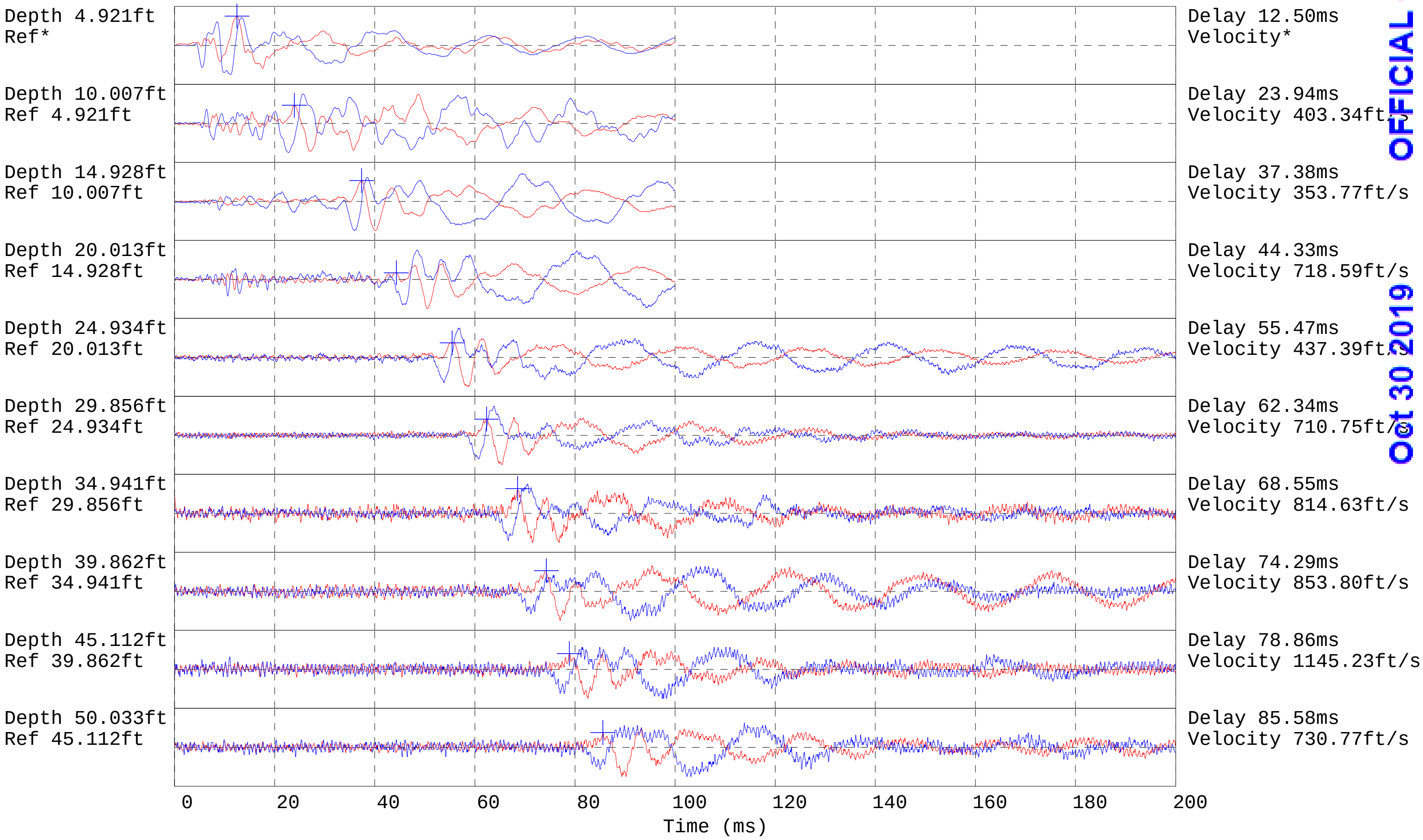
Maximum Pressure = 11.35 psi

Attachment 2.6

Geosyntec Shear Wave Velocity Measurements

Mid-Atlantic Drilling, Inc.

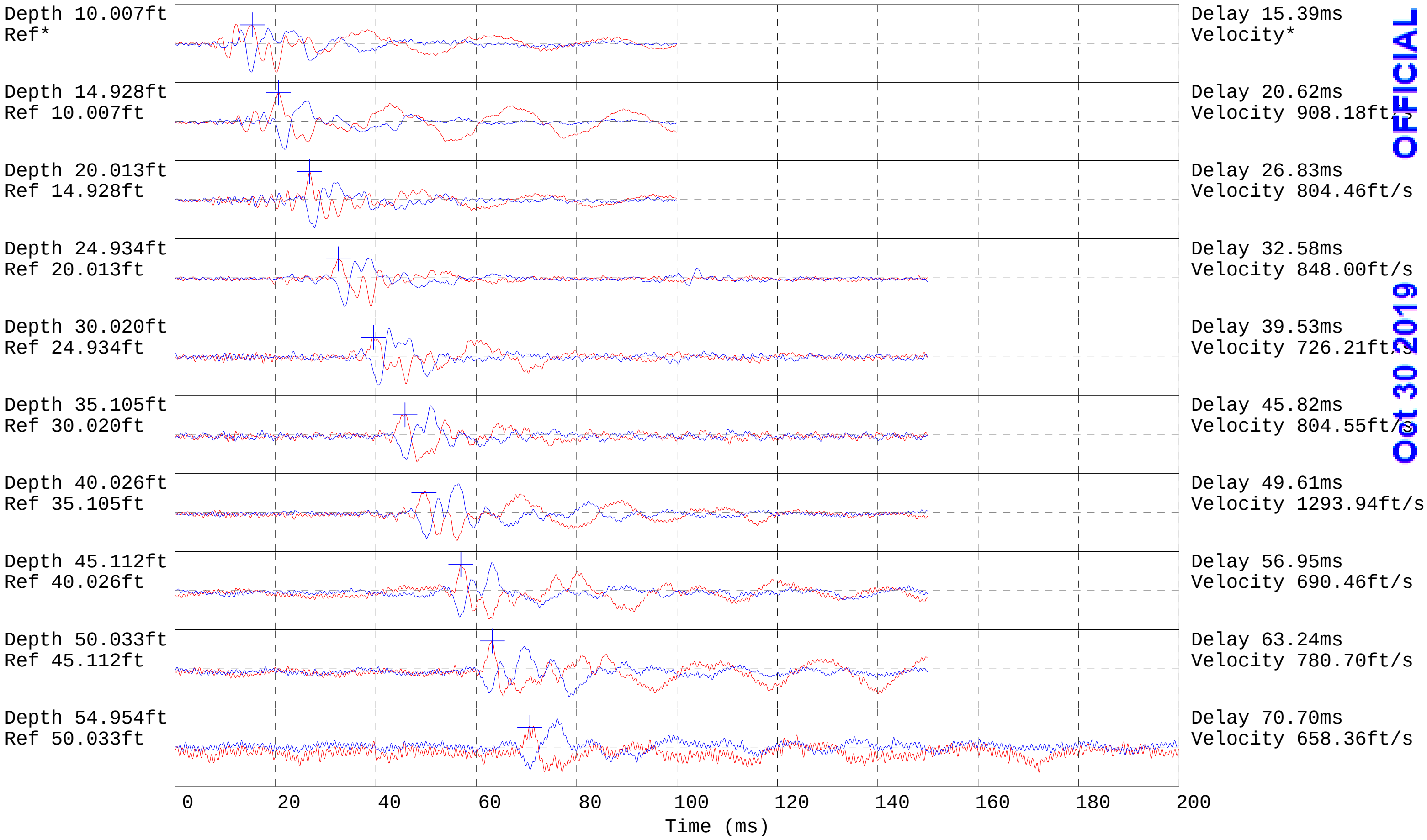
SCPT-1



Hammer to Rod String Distance 1 (m)
* = Not Determined

Mid-Atlantic Drilling, Inc.

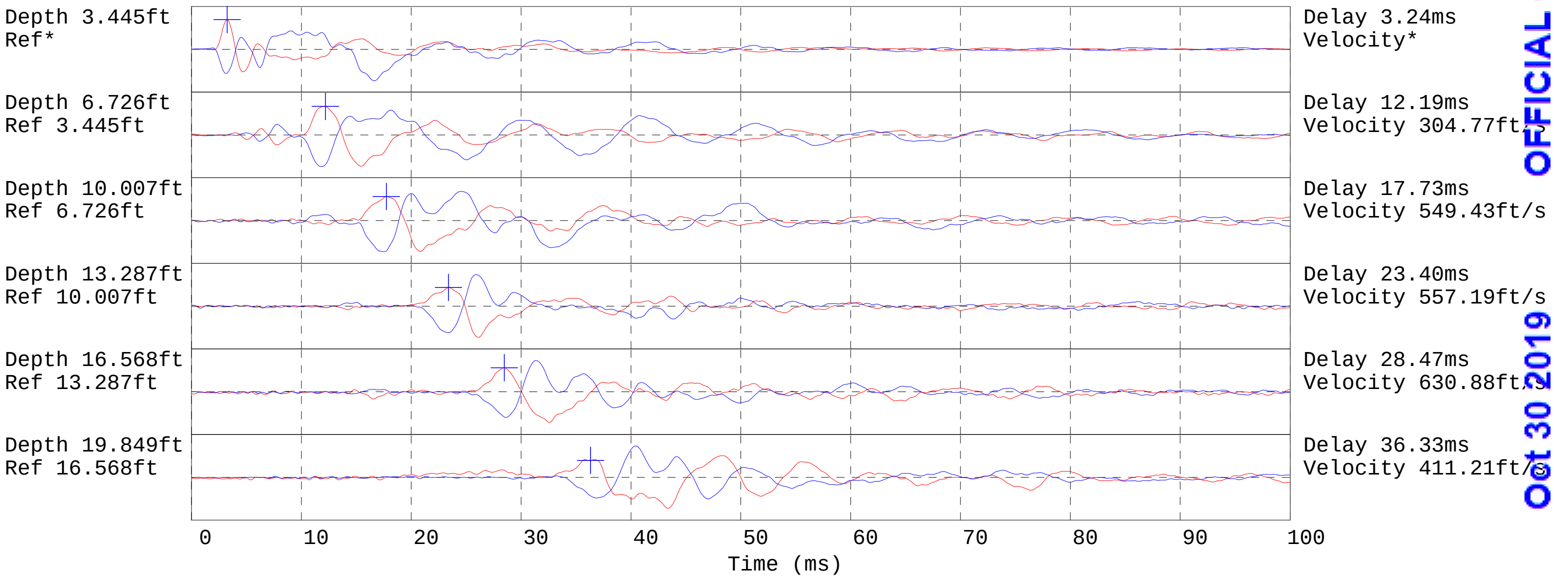
SCPT-2



Hammer to Rod String Distance 1 (m)
* = Not Determined

Mid-Atlantic Drilling, Inc.

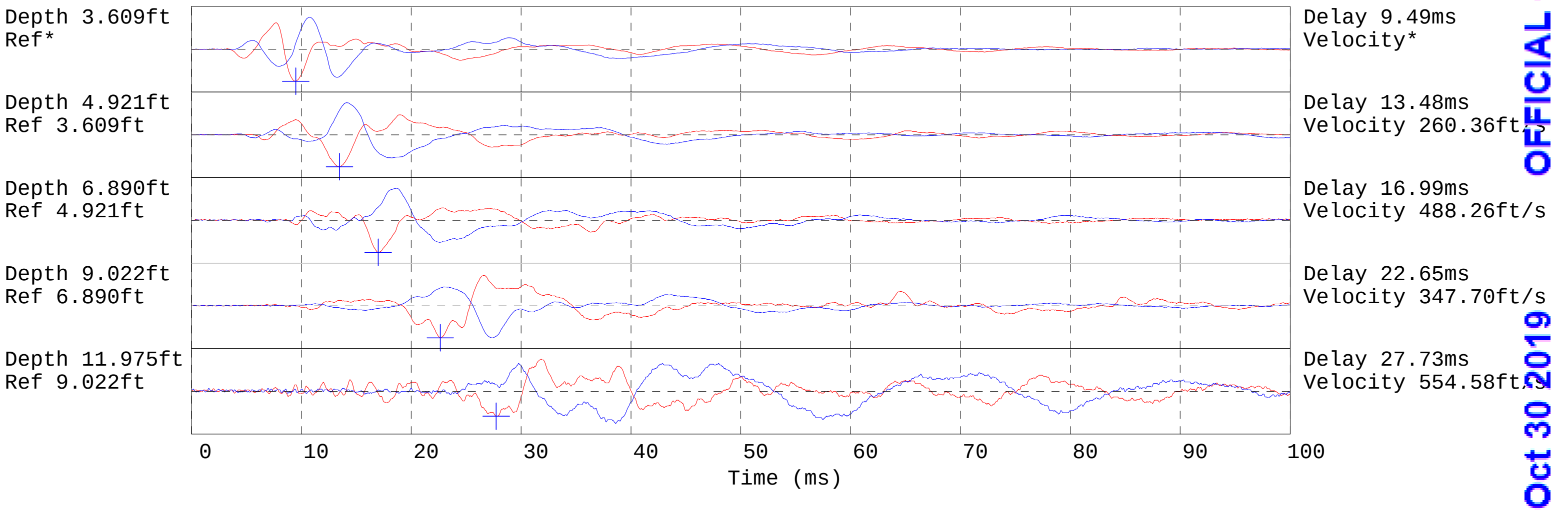
SCPT-3A



Hammer to Rod String Distance 1 (m)
* = Not Determined

Mid-Atlantic Drilling, Inc.

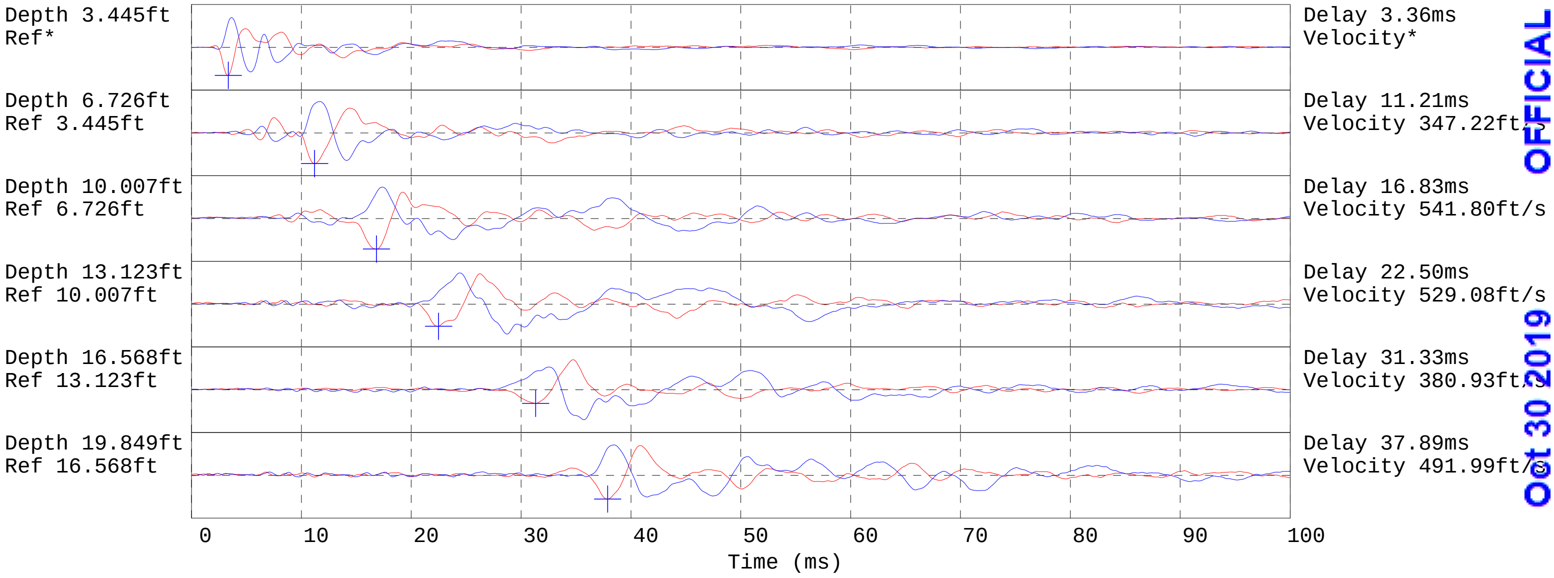
SCPT-4



Hammer to Rod String Distance 1 (m)
* = Not Determined

Mid-Atlantic Drilling, Inc.

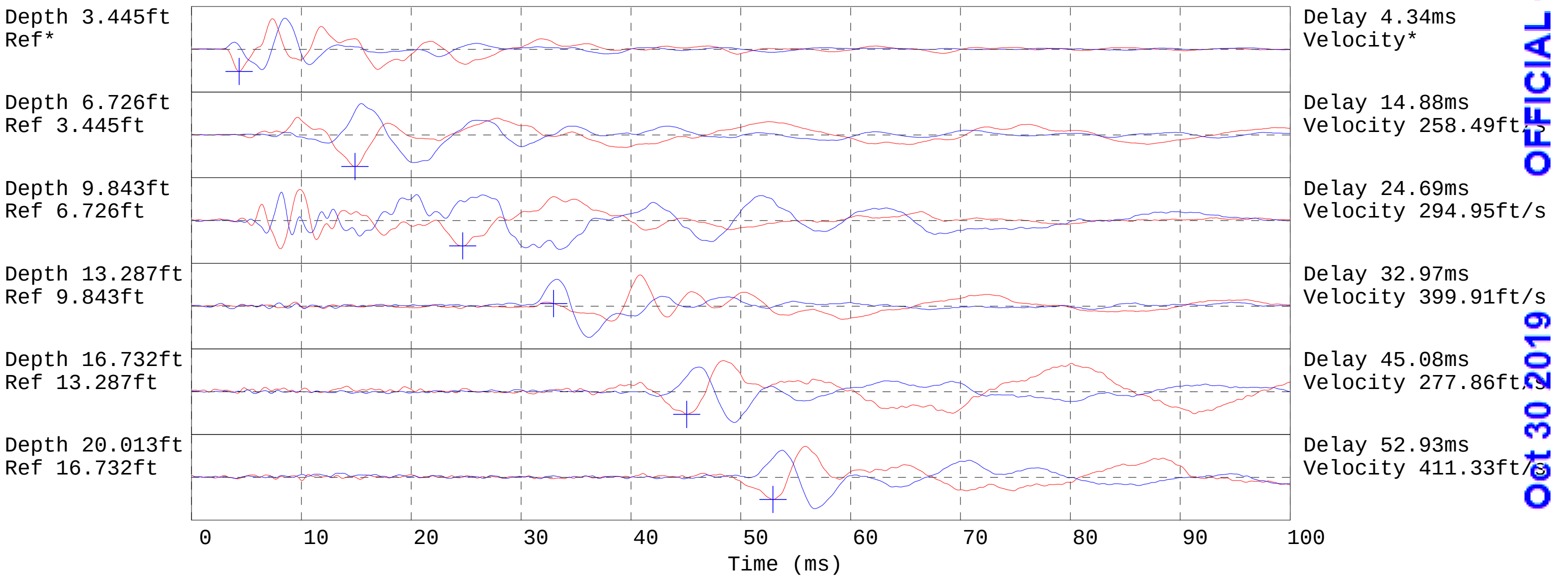
SCPT-5A



Hammer to Rod String Distance 1 (m)
* = Not Determined

Mid-Atlantic Drilling, Inc.

SCPT-6



Hammer to Rod String Distance 1 (m)
* = Not Determined

Attachment 3

Laboratory Testing Results

Attachment 3.1

Withers & Ravenel Laboratory Testing Results

WITHERS & RAVENEL
ENGINEERS | PLANNERS | SURVEYORS

TABLE A1: SUMMARY OF LABORATORY TEST RESULTS

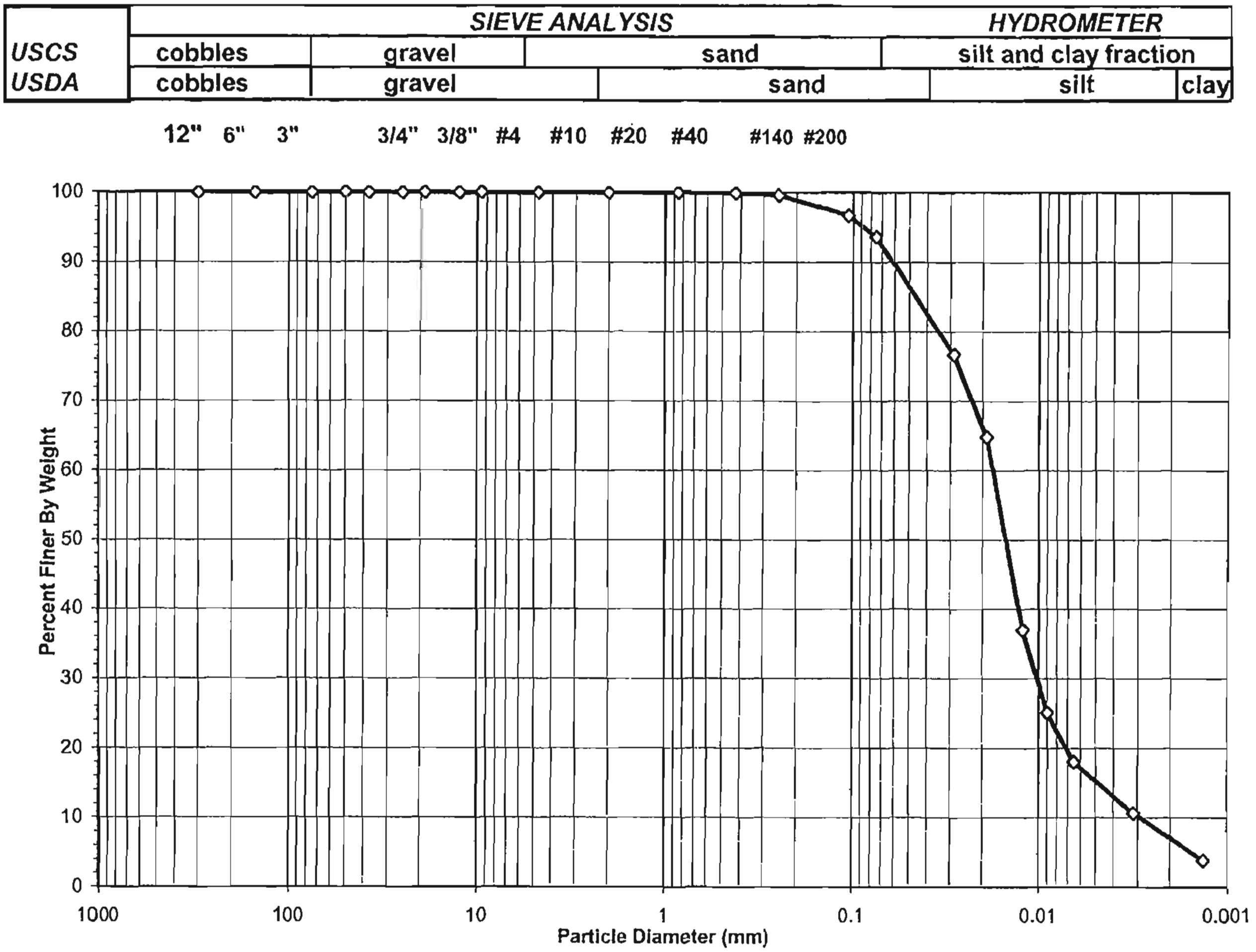
INTERIOR ASH POND DIKE PROJECT
PROGRESS ENERGY
L.V. SUTTON PLANT
New Hanover County, North Carolina
W&R Project No. 02050412.03

				INDEX TESTING RESULTS								COMPACTION, STRENGTH AND DRAINAGE TESTING RESULTS						
SAMPLE	SAMPLE	SAMPLE	UNIT	ATTERBERG LIMITS			GRAIN SIZE ANALYSIS			CLASSIFICATION		STANDARD PROCTOR		C.U. TRIAXIAL		CONSOLIDATION		PERMEABILITY
I.D.	DEPTH (ft.)	DESCRIPTION	WEIGHT (pcf)	LL	PL	PI	% gravel	% sand	% silt/clay	USCS	USDA	Maximum Dry Density	Optimum Moist. Content (%)	Cohesion (psi)	Phi (degerees)	Cc	Cr	(cem/sec)
WR-5A	2.5 - 3.75	Dark Gray Ash	–	–	–	–	0	6.36	93.64	ML	SILT LOAM	–	–	–	–	0.377	0.01	–
WR-5A	8.5 - 9.75	Dark Gray Ash	49.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
WR-5A	12.0 - 14.0	Dark Gray Ash	–	–	–	–	0	7.27	92.73	ML	SILT LOAM	–	–	2.68	31.49	1.16	0.05	–
BULK 1	1.0 - 2.0	Dark Gray Ash	–	NP	NP	NP	0	27.41	72.59	ML	SILT LOAM	51.8	56.1	–	–	–	–	–
BULK 2	5.0 - 10.0	Dark Gray Ash	–	–	–	–	0	34.54	65.46	ML	SILT LOAM	61.2	45.7	0	34.33	–	–	$2.0x10^{-4}$

NOTE:
1) All laboratory testing was performed by sub-consultant laboratory; Geotechnics.
2) – indicates test not performed
3) USCS classification based on grain size analysis results, Atterberg limits results and/or visual observations. USDA classification based on grain size analysis results.
4) % silt/clay indicates percent passing the no. 200 sieve
5) Permeability test was conducted on a remolded sample

SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	WITHERS & RAVENEL	Boring No.	WR-5A
Client Reference	SUTTON PLANT	Depth (ft)	2.5'-3.75'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-02	Soil Color	**DARK GRAY**



USCS Summary

Sieve Sizes (mm)		Percentage
Greater Than #4	*Gravel*	0.00
#4 To #200	*Sand*	6.36
Finer Than #200	*Silt & Clay*	93.64

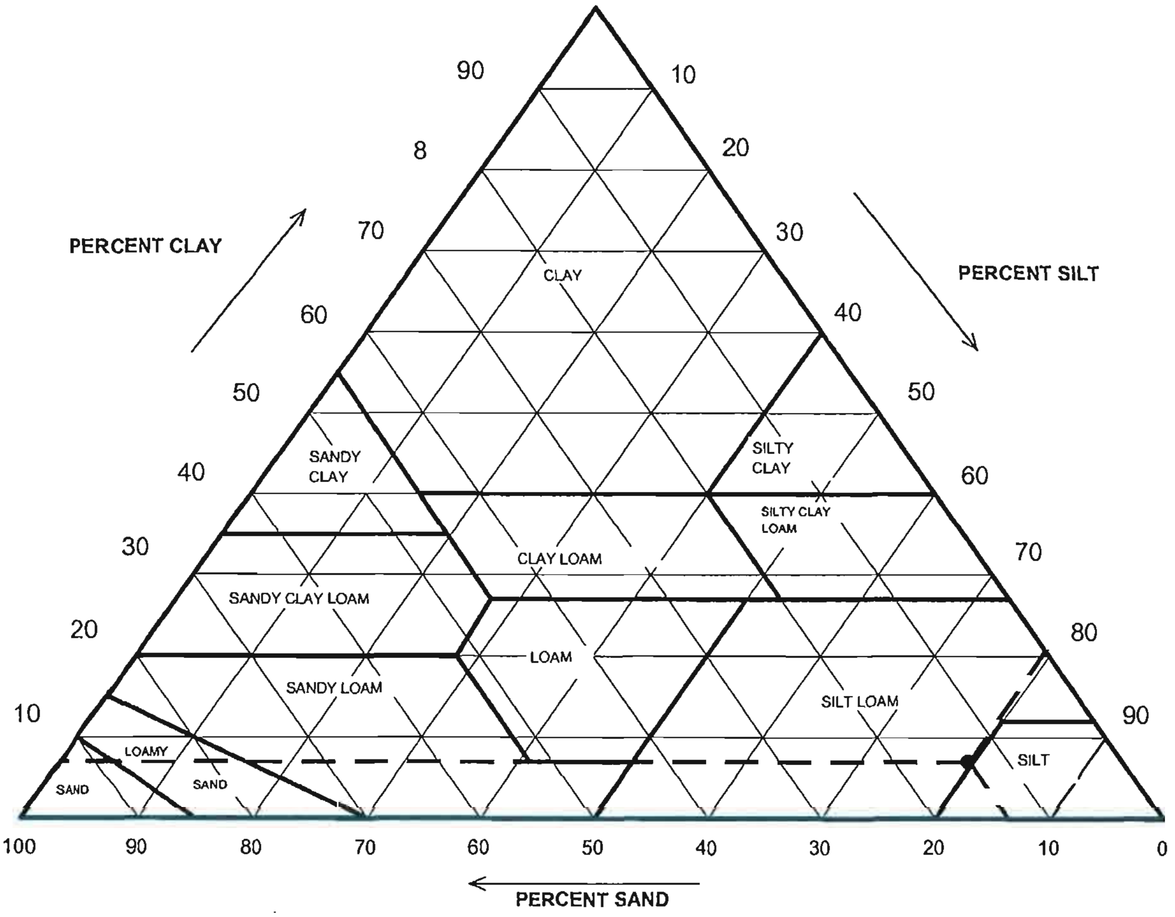
USCS Symbol ***ml, ASSUMED***

USCS Classification *SILT*

geotechnics
INTEGRITY IN TESTING

USDA CLASSIFICATION CHART

Client	WITHERS & RAVENEL	Boring No.	WR-5A
Client Reference	SUTTON PLANT	Depth (ft)	2.5'-3.75'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-02	Soil Color	DARK GRAY



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	0.00	**0.00**
2	100.00	*Sand*	13.51	**13.51**
0.05	86.49	*Silt*	79.49	**79.49**
0.002	7.00	*Clay*	7.00	**7.00**

USDA Classification: ***SILT LOAM***

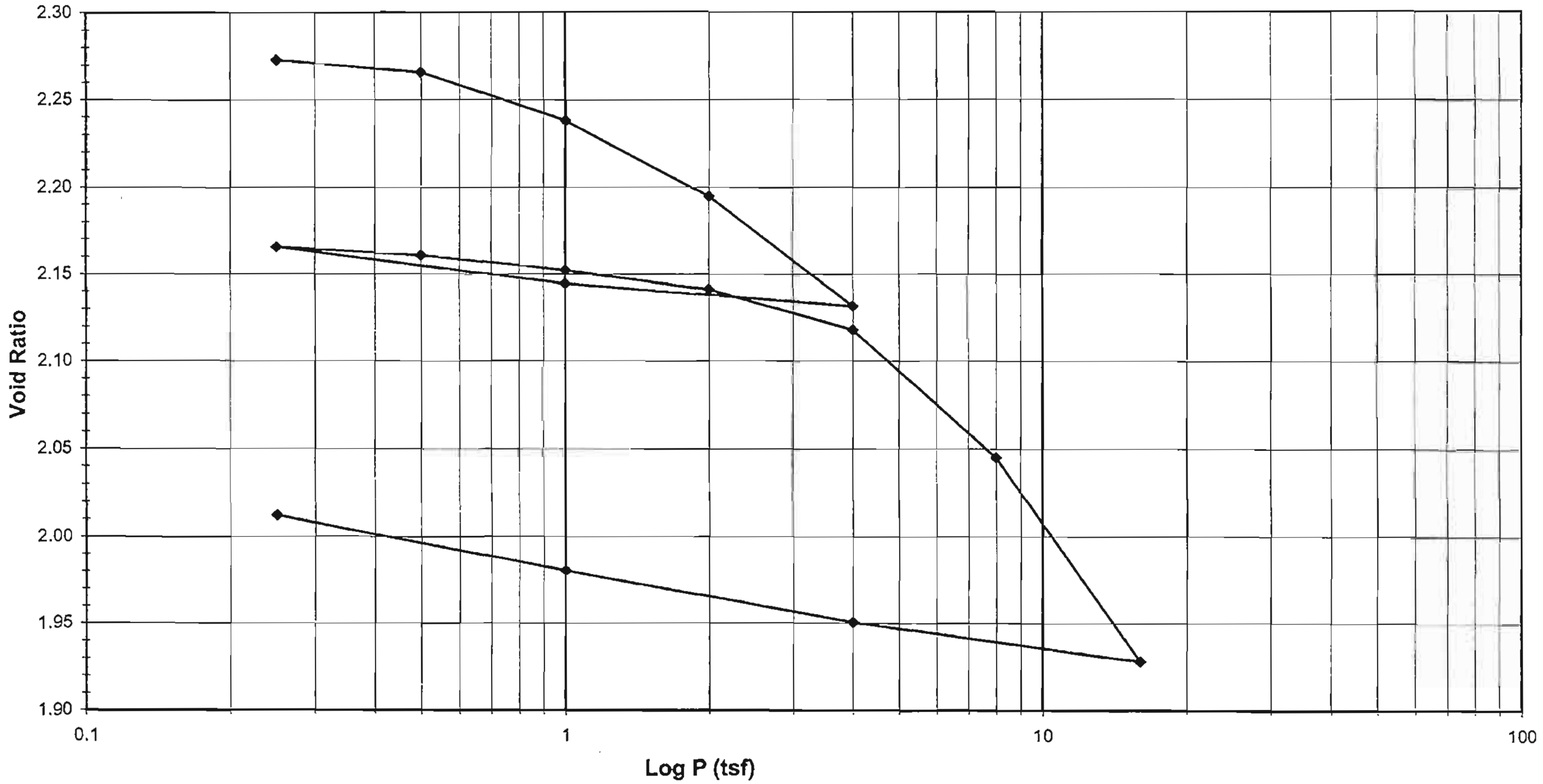
geotechnics

ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-96 (SOP-S24)

Client	WITHERS & RAVENEL	Boring No.	WR-5A
Client Reference	SUTTON PLANT	Depth (ft)	3.3'-3.5'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-02	Visual Description	DARK GRAY ASH

Sample Conditions: UNDISTURBED, INUNDATED AND DOUBLE DRAINED



Tested By MCW Date 5/1/2006 Approved By MHS Date 6-8-06

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ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-96 (SOP-S24)

Client	WITHERS & RAVENEL	Boring No.	WR-5A
Client Reference	SUTTON PLANT	Depth (ft)	3.3'-3.5'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-02	Visual Description	DARK GRAY ASH

Sample Conditions: UNDISTURBED, INUNDATED AND DOUBLE DRAINED
Consolidometer No. 276
1 Division = 0.0001 (in)

Sample Properties	**Initial**	**Final**
Water Content		
Tare Number	313	307
Wt. Tare & WS (gm)	339.95	219.30
Wt. Tare & DS (gm)	239.29	174.98
Wt. Water (gm)	100.66	44.32
Wt. Tare (gm)	110.50	109.97
Wt. DS (gm)	128.79	65.01
Water Content (%)	78.16	68.17
Sample Parameters		
Sample Diameter (in)	2.5	2.5
Sample Height (in)	1.000	0.921
Sample Volume (cc)	80.44	74.06
Wt. Wet Sample + Ring (gm)	328.99	322.36
Wt. of Ring (gm)	210.71	210.71
Wt. of Wet Sample (gm)	118.28	111.65
Wet Density (pcf)	91.75	94.07
Wet Density (g/cc)	1.47	1.51
Water Content (%)	78.16	68.17
Wt. of Dry Sample (gm)	66.39	66.39
Dry Density (pcf)	51.50	55.94
Dry Density (g/cc)	0.83	0.90
Void Ratio	2.2714	2.0119
Saturation (%)	92.91	91.49
Specific Gravity	2.70	*Assumed*

Test Data Summary

Applied Pressure (tsf)	**Final Dial Reading** (div)	**Machine Deflection** (div)	**Corrected Reading** (div)	**Height of Sample** (mm)	**Volume** (cc)	**Dry Density** (g/cc)	**Void Ratio**
Seating	0	0	0	25.400	80.440	0.82534	**2.27137**
0.25	8.1	12.1	-4.0	25.410	80.472	0.82501	**2.27268**
0.5	39.9	23.2	16.7	25.358	80.305	0.82672	**2.26590**
1	142.3	39.8	102.5	25.140	79.615	0.83389	**2.23784**
2	294.0	59.5	234.5	24.804	78.553	0.84516	**2.19465**
4	508.2	81.2	427.0	24.315	77.005	0.86216	**2.13168**
1	443.3	54.9	388.4	24.413	77.316	0.85869	**2.14431**
0.25	354.2	30.3	323.9	24.577	77.834	0.85297	**2.16541**
0.5	373.7	35.6	338.1	24.541	77.720	0.85422	**2.16076**
1	411.9	47.4	364.5	24.474	77.508	0.85656	**2.15213**
2	462.0	63.5	398.5	24.388	77.234	0.85960	**2.14100**
4	550.4	81.7	468.7	24.210	76.670	0.86593	**2.11804**
8	795.2	103.3	691.9	23.643	74.874	0.88669	**2.04502**
16	1176.1	126.5	1049.6	22.734	71.997	0.92213	**1.92801**
4	1082.8	101.7	981.1	22.908	72.548	0.91513	**1.95041**
1	957.5	67.6	889.9	23.140	73.281	0.90596	**1.98025**
0.25	835.3	42.1	793.2	23.385	74.059	0.89645	**2.01188**

Tested By MCW *Date* 5/1/2006 *Input Checked By* MMS *Date* 6-8-06

DCN: CT-S24F Date: 11/26/05 Revision: 5

\\Lab1\C\2006 PROJECTS\2006-549 WITHERS & RAVENEL\[2006-549-01-02 CONFINAL(RALEIGH).xls]Sheet1

geotechnics
INTEGRITY IN TESTING

UNIT WEIGHT

(SOP - S37)

Client	WITHERS & RAVENEL
Client Reference	SUTTON PLANT
Project No.	2006-549-01

MOISTURE CONTENT	
Lab ID	05
Boring No.	WR-5A
Depth	8.9'-9.4'
Sample No.	NA
Tare Number	207
Wt. Tare & WS(gm.)	1080.72
Wt. Tare & DS(gm.)	701.88
Wt. Tare(gm.)	194.67
Moisture Content(%)	74.69

UNIT WEIGHT	
Wt. Mold & WS.(gms.)	1329.86
Wt. Of Mold(gms.)	431.79
Wt. Of WS.(gms.)	898.07
Length 1 (in.)	6.03
Length 2 (in.)	6.04
Length 3 (in.)	6.05
Top Diameter (in.)	2.87
Middle Diameter (in.)	2.89
Bottom Diameter (in.)	2.88
Sample Volume (cc)	644.33
Moisture Content(%)	74.69
Unit Wet Wt.(gms/cc)	1.39
Unit Wet Wt.(pcf.)	87.0
Unit Dry Wt.(gms/cc)	**0.80**
Unit Dry Wt.(pcf.)	**49.8**

Tested By *JGC* Date *5/11/2006* Checked By GEM Date 6-7-06

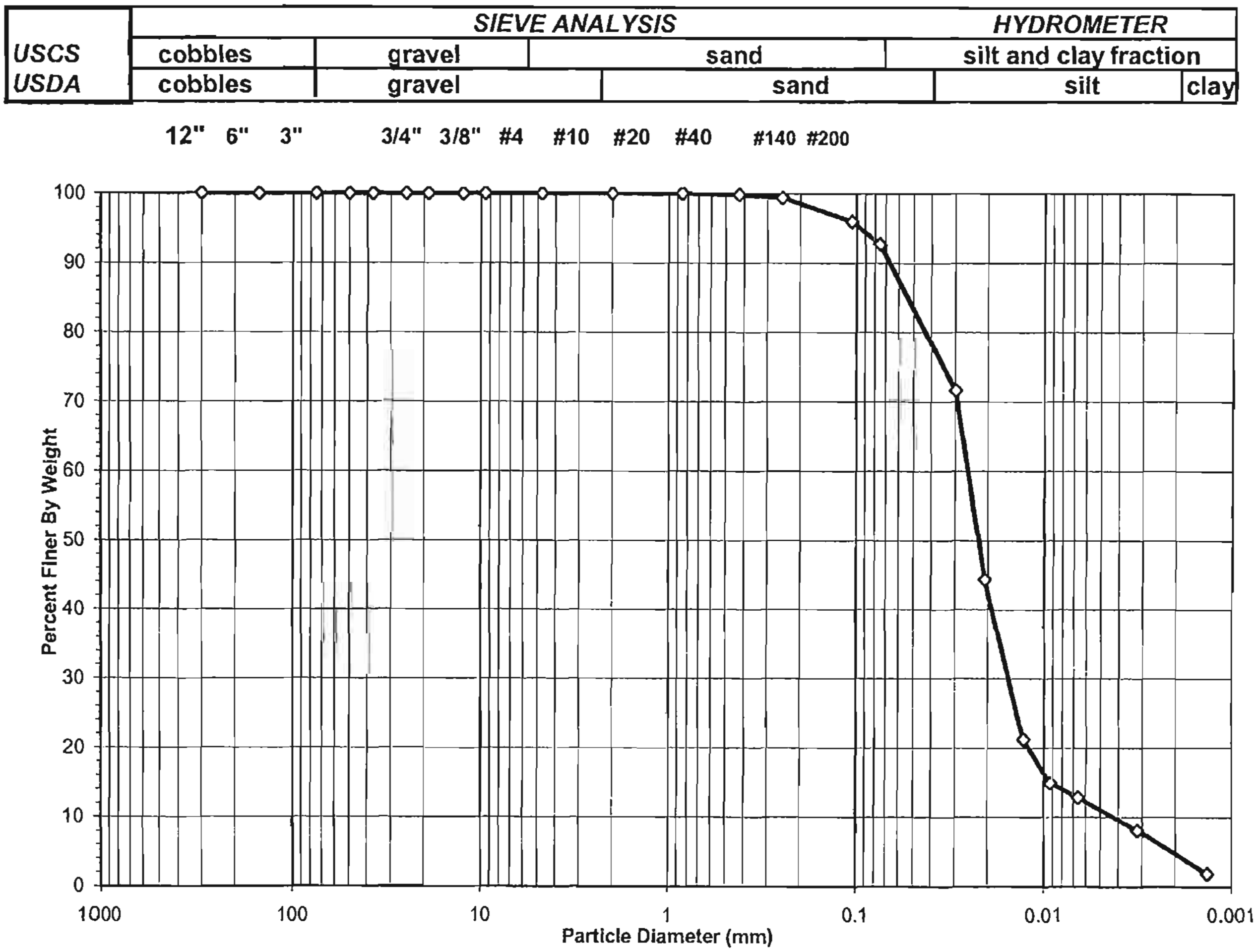
page 1 of 1 DCN: CT-S37A DATE:8-03-99 REVISION: Original

\\Lab1\c\2006 PROJECTS\2006-549 WITHERS & RAVENEL\[2006-549-01 UNIT WEIGHT.XLS]Sheet1

geotechnics
INTEGRITY IN TESTING

SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	WITHERS & RAVENEL	Boring No.	WR-5A
Client Reference	SUTTON PLANT	Depth (ft)	12.0'-14.0'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-01	Soil Color	**DARK GRAY**



USCS Summary		
Sieve Sizes (mm)		**Percentage**
Greater Than #4	*Gravel*	0.00
#4 To #200	*Sand*	7.27
Finer Than #200	*Silt & Clay*	92.73

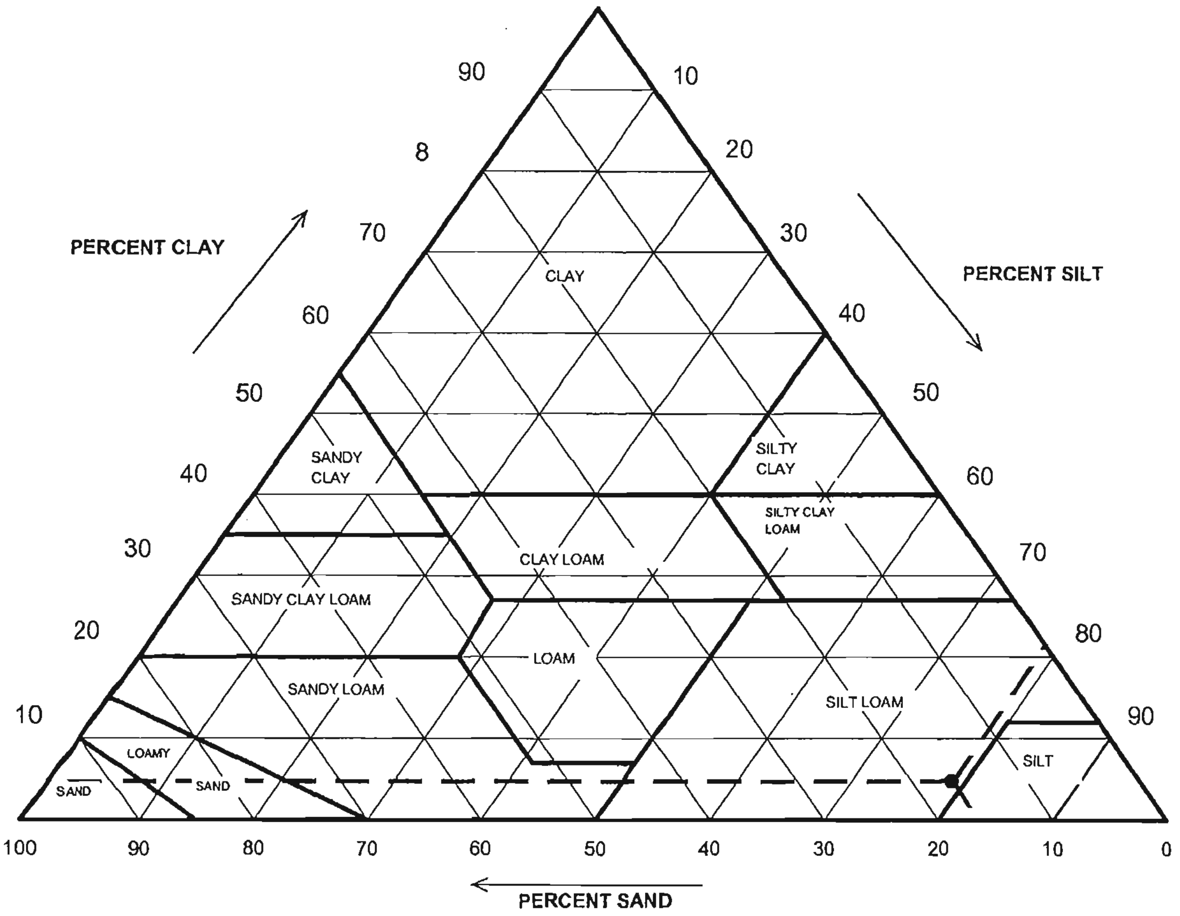
USCS Symbol *ml, ASSUMED*

USCS Classification *SILT*

geotechnics
INTEGRITY IN TESTING

USDA CLASSIFICATION CHART

Client	WITHERS & RAVENEL	Boring No.	WR-5A
Client Reference	SUTTON PLANT	Depth (ft)	12.0'-14.0'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-01	Soil Color	DARK GRAY



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	0.00	**0.00**
2	100.00	*Sand*	16.53	**16.53**
0.05	83.47	*Silt*	78.74	**78.74**
0.002	4.73	*Clay*	4.73	**4.73**

USDA Classification: ***SILT LOAM***

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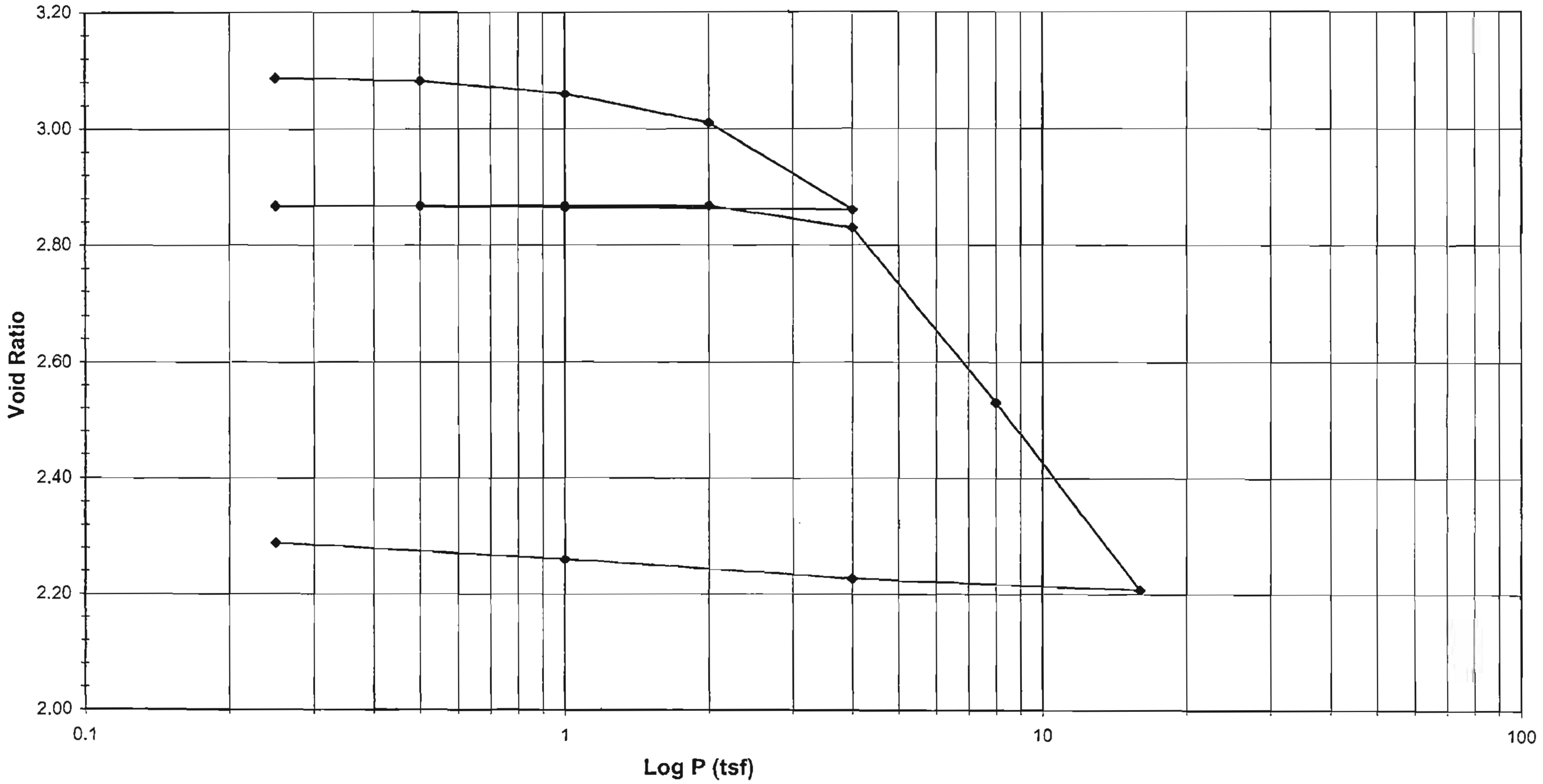
ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-96 (SOP-S24)

Client	WITHERS & RAVENEL	Boring No.	WR-5A
Client Reference	SUTTON PLANT	Depth (ft)	12.1'-12.3'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-01	Visual Description	DARK GRAY ASH

Sample Conditions: UNDISTURBED, INUNDATED AND DOUBLE DRAINED



Tested By MCW *Date* 4/28/2006 *Approved By* MPS *Date* 6-8-06

geotechnics

ONE DIMENSIONAL CONSOLIDATION

ASTM D 2435-96 (SOP-S24)

Client	WITHERS & RAVENEL	Boring No.	WR-5A
Client Reference	SUTTON PLANT	Depth (ft)	12.1'-12.3'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-01	Visual Description	DARK GRAY ASH

Sample Conditions: UNDISTURBED, INUNDATED AND DOUBLE DRAINED
Consolidometer No. 299
1 Division = 0.0001 (in)

Sample Properties	**Initial**	**Final**
Water Content		
Tare Number	Z-14	308
Wt. Tare & WS (gm)	179.57	205.56
Wt. Tare & DS (gm)	139.79	162.01
Wt. Water (gm)	39.78	43.55
Wt. Tare (gm)	100.47	110.94
Wt. DS (gm)	39.32	51.07
Water Content (%)	101.17	85.28
Sample Parameters		
Sample Diameter (in)	2.5	2.5
Sample Height (in)	1.000	0.802
Sample Volume (cc)	80.44	64.54
Wt. Wet Sample + Ring (gm)	318.02	309.60
Wt. of Ring (gm)	211.40	211.40
Wt. of Wet Sample (gm)	106.62	98.20
Wet Density (pcf)	82.71	94.93
Wet Density (g/cc)	1.33	1.52
Water Content (%)	101.17	85.28
Wt. of Dry Sample (gm)	53.00	53.00
Dry Density (pcf)	41.11	51.24
Dry Density (g/cc)	0.66	0.82
Void Ratio	3.0979	2.2881
Saturation (%)	88.18	100.63
Specific Gravity	2.70	*Assumed*

Test Data Summary

Applied Pressure (tsf)	**Final Dial Reading** (div)	**Machine Deflection** (div)	**Corrected Reading** (div)	**Height of Sample** (mm)	**Volume** (cc)	**Dry Density** (g/cc)	**Void Ratio**
Seating	0	0	0	25.400	80.440	0.65888	**3.09788**
0.25	35.1	10.2	24.9	25.337	80.240	0.66052	**3.08768**
0.5	61.0	22.8	38.2	25.303	80.133	0.66140	**3.08222**
1	125.0	33.9	91.1	25.169	79.707	0.66494	**3.06055**
2	260.0	47.0	213.0	24.859	78.726	0.67322	**3.01059**
4	637.6	60.1	577.5	23.933	75.794	0.69926	**2.86123**
1	615.3	45.7	569.6	23.953	75.858	0.69867	**2.86446**
0.25	592.9	30.3	562.6	23.971	75.914	0.69816	**2.86733**
0.5	595.8	33.2	562.6	23.971	75.914	0.69816	**2.86733**
1	601.5	40.4	561.1	23.975	75.926	0.69804	**2.86795**
2	613.1	50.5	562.6	23.971	75.914	0.69816	**2.86733**
4	715.5	61.4	654.1	23.739	75.178	0.70499	**2.82984**
8	1459.8	74.2	1385.6	21.881	69.294	0.76486	**2.53008**
16	2263.7	90.1	2173.6	19.879	62.955	0.84187	**2.20716**
4	2195.3	70.3	2125.0	20.003	63.346	0.83667	**2.22708**
1	2095.8	52.2	2043.6	20.209	64.001	0.82811	**2.26044**
0.25	2012.0	35.8	1976.2	20.380	64.543	0.82115	**2.28806**

Tested By MCW *Date* 4/28/2006 *Input Checked By* MDS *Date* 6-8-06

\\Lab1\c\2006 PROJECTS\2006-549 WITHERS & RAVENEL\[2006-549-01-01 CONSOLIDATION FINAL.xls]Sheet1

geotechnics
INTEGRITY IN TESTING

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

ASTM D - 4767 (SOP-S28)

Client	WITHERS & RAVENEL		
Client Reference	SUTTON PLANT		
Project No.	2006-549-01		
Lab ID	2006-549-01-01	Specific Gravity (assumed)	2.70

Visual Description: DARK GRAY ASH

SAMPLE CONDITION SUMMARY

Boring No.	WR-5A	WR-5A	WR-5A
Depth (ft)	12.3-12.8	13.3-13.8	12.8-13.3
Sample No.	NA	NA	NA
Test No.	T1	T2	T3
Deformation Rate (in/min)	0.007	0.007	0.007
Back Pressure (psi)	22.2	23.2	22.1
Consolidation Time (days)	1	1	1
Initial State (w%)	101.2	55.8	62.5
Total Unit Weight (pcf)	98.8	99.3	101.0
Dry Unit Weight (pcf)	49.1	63.7	62.1
Final State (w%)	48.9	45.3	45.2
Initial State Void Ratio,e	2.432	1.645	1.713

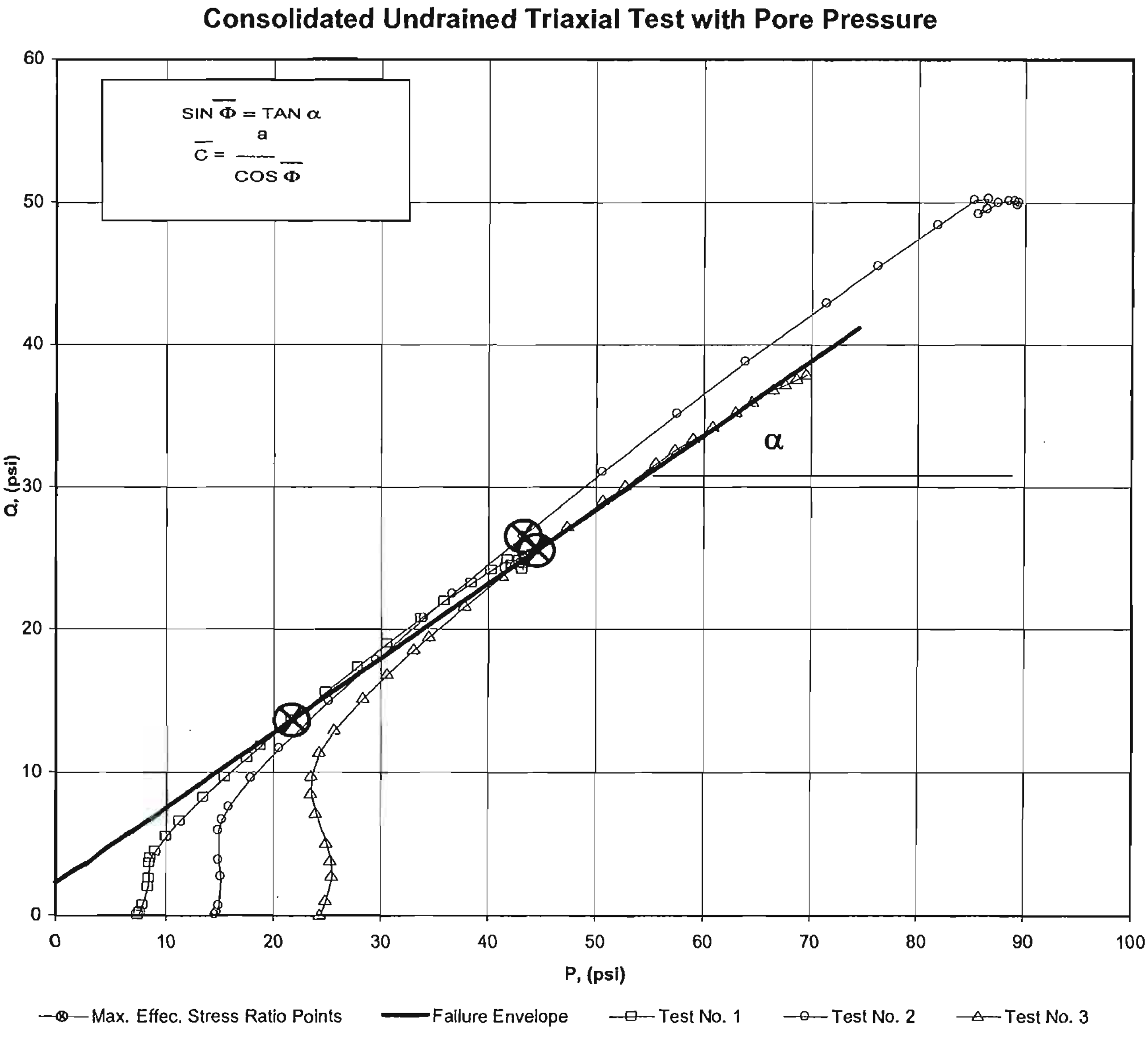
Tested By MPS Date 05/01/06 Input Checked By MCW Date 05/05/06

geotechnics
INTEGRITY IN TESTING

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

Client	WITHERS & RAVENEL	Boring No.	WR-5A
Client Reference	SUTTON PLANT	Depth(ft.)	12.3-13.8
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-01		



a	=	2.29	$\overline{C}$	=	2.68
α	=	27.6	$\overline{\Phi}$	=	31.49

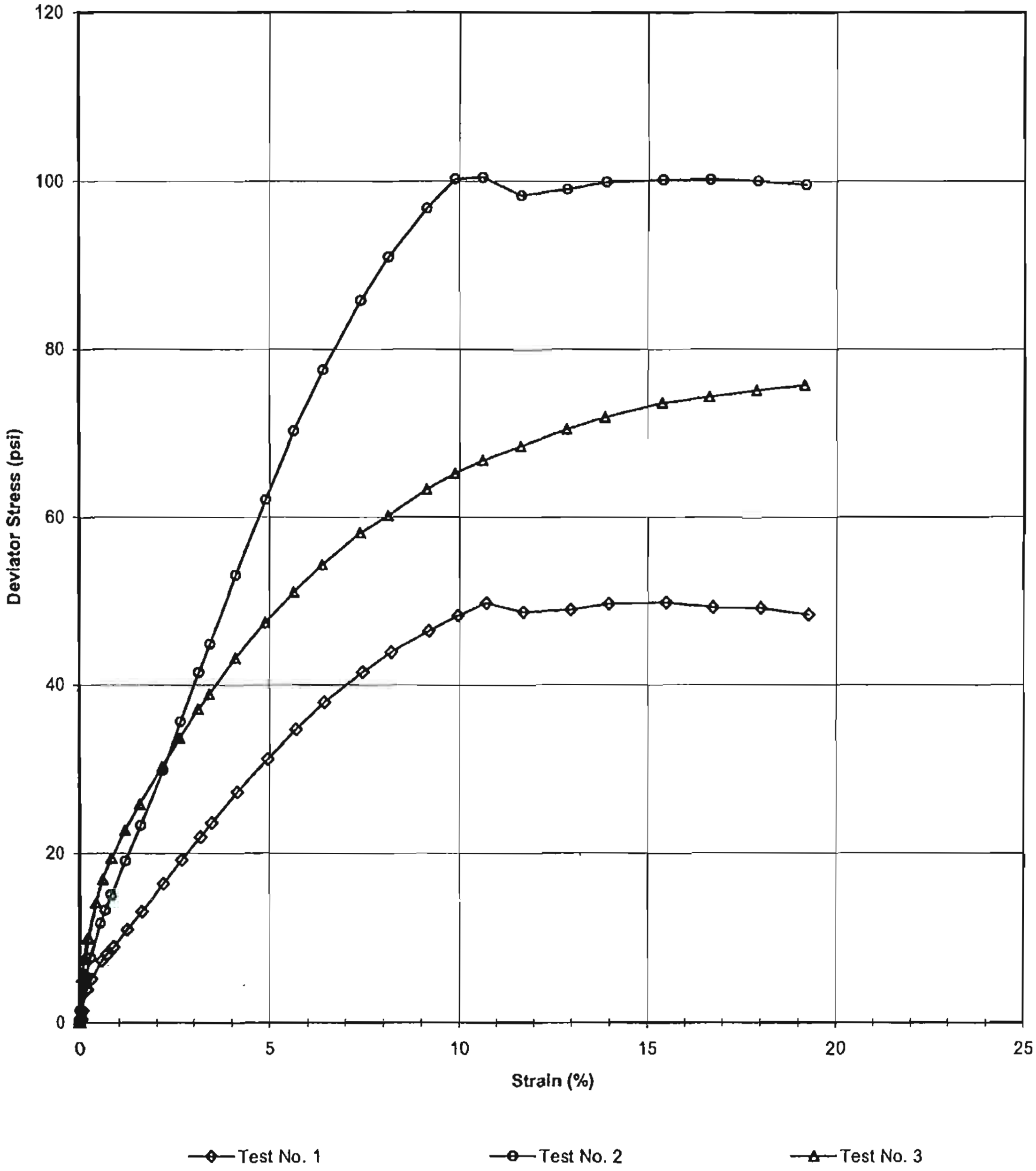
Tested By MPS Date 05/03/06 Approved By DB Date 05/03/06

geotechnics
INTEGRITY IN TESTING

CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS

ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

Client	WITHERS & RAVENEL	Boring No.	WR-5A
Client Reference	SUTTON PLANT	Depth(ft.)	12.3-13.8
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-01		
Visual Description:	DARK GRAY ASH (UNDISTURBED)		



Tested By MPS Date 05/01/06 Approved By DB Date 05/03/06

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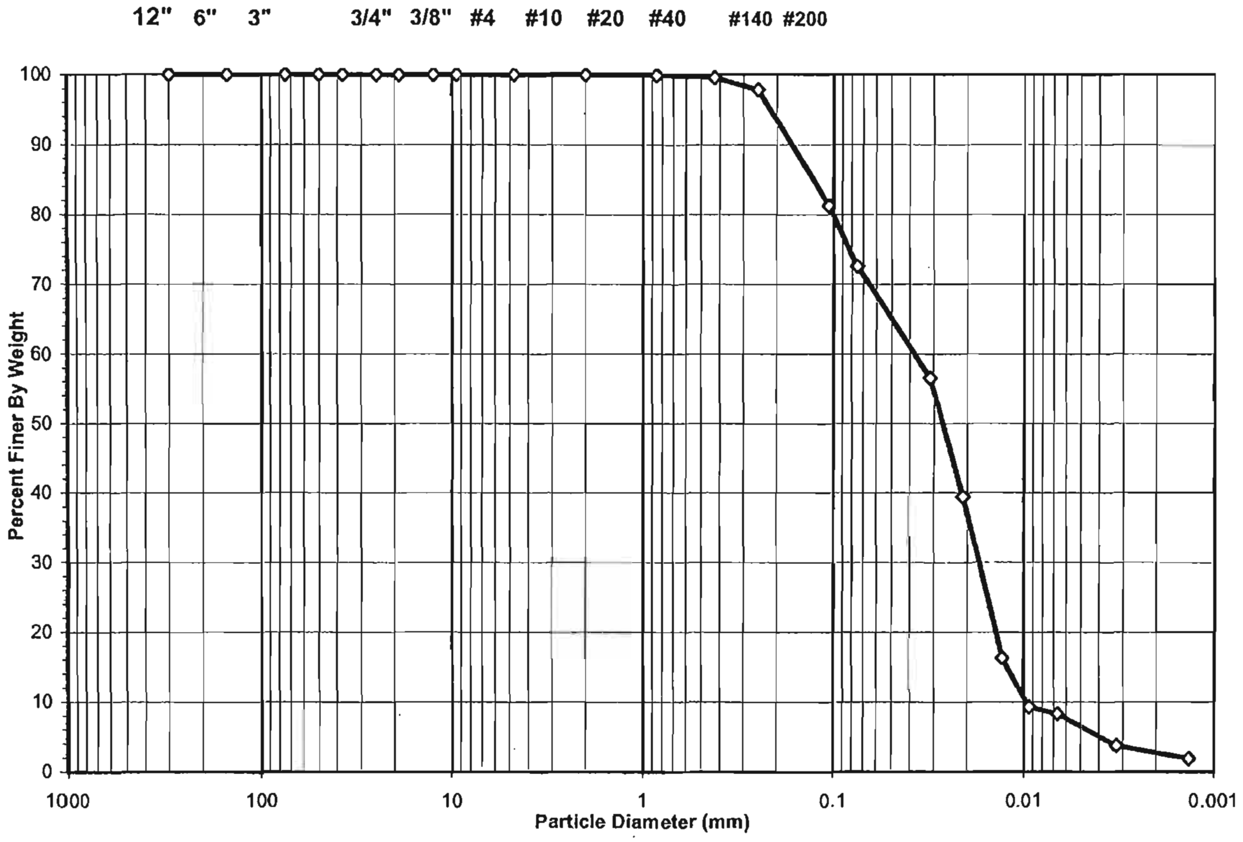
INTEGRITY IN TESTING

SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	WITHERS & RAVENEL	Boring No.	BULK SAMPLE 1
Client Reference	SUTTON PLANT	Depth (ft)	1.0'-2.0'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-03	Soil Color	**DARK GRAY**

	SIEVE ANALYSIS			*HYDROMETER*	
USCS	**cobbles**	**gravel**	**sand**	**silt and clay fraction**	
USDA	**cobbles**	**gravel**	**sand**	**silt**	**clay**



Sieve Sizes (mm)	**USCS Summary**	**Percentage**
Greater Than #4	*Gravel*	0.00
#4 To #200	*Sand*	27.41
Finer Than #200	*Silt & Clay*	72.59

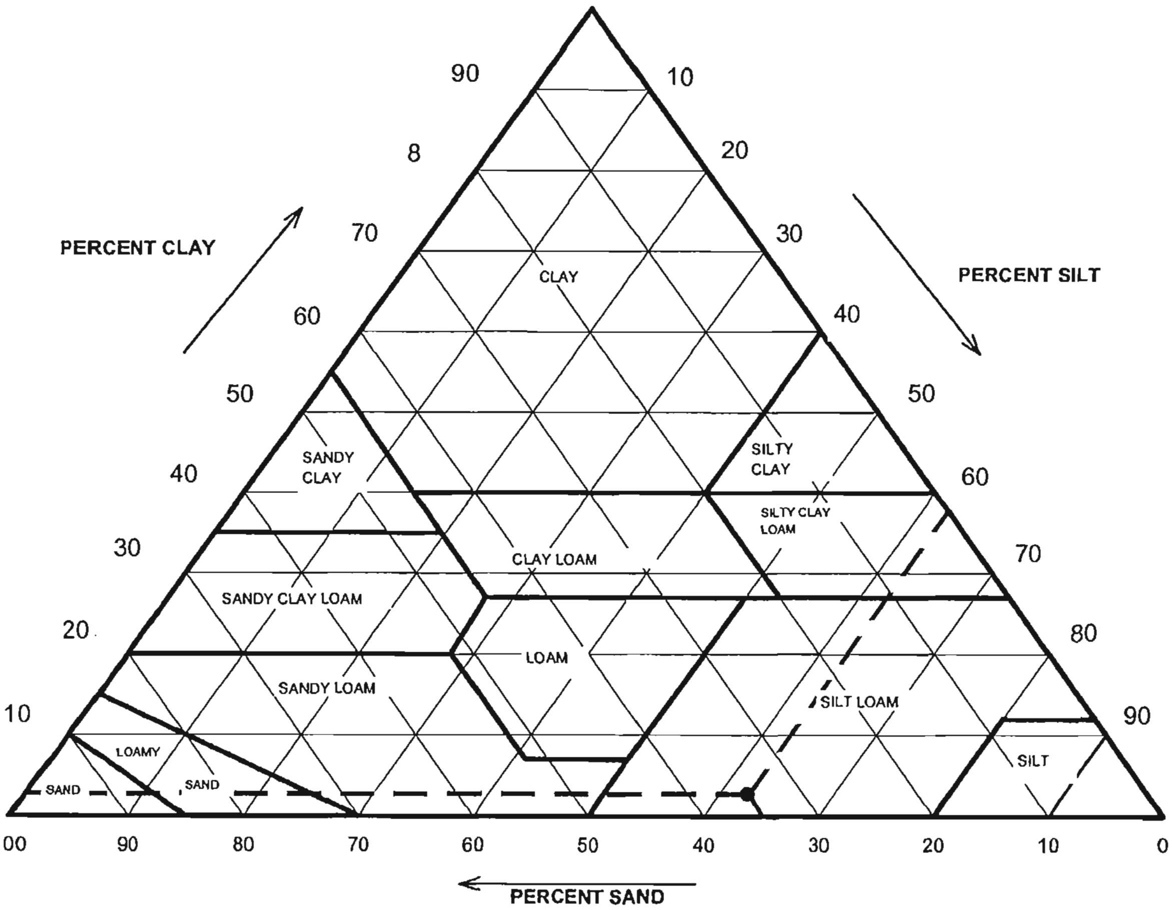
USCS Symbol ***ML, TESTED***

USCS Classification ***SILT WITH SAND***

geotechnics
INTEGRITY IN TESTING

USDA CLASSIFICATION CHART

Client	WITHERS & RAVENEL	Boring No.	BULK SAMPLE 1
Client Reference	SUTTON PLANT	Depth (ft)	1.0'-2.0'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-03	Soil Color	DARK GRAY



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	0.03	**0.00**
2	99.97	*Sand*	34.82	**34.83**
0.05	65.15	*Silt*	62.41	**62.43**
0.002	2.74	*Clay*	2.74	**2.74**

USDA Classification: ***SILT LOAM***

geotechnics
INTEGRITY IN TESTING

ATTERBERG LIMIT

ASTM D 4318-00 (SOP - S4)

Client	WITHERS & RAVENEL	Boring No.	BULK SAMPLE 1
Client Reference	SUTTON PLANT	Depth (ft)	1.0'-2.0'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-03	Visual Description	**BLACK ASH** (Minus No. 40 sieve material, Wet Method)

NON - PLASTIC
MATERIAL

Tested By JGC *Date* 5/3/2006 *Checked By* GEM *Date* 6-7-06

geotechnics
INTEGRITY IN TESTING

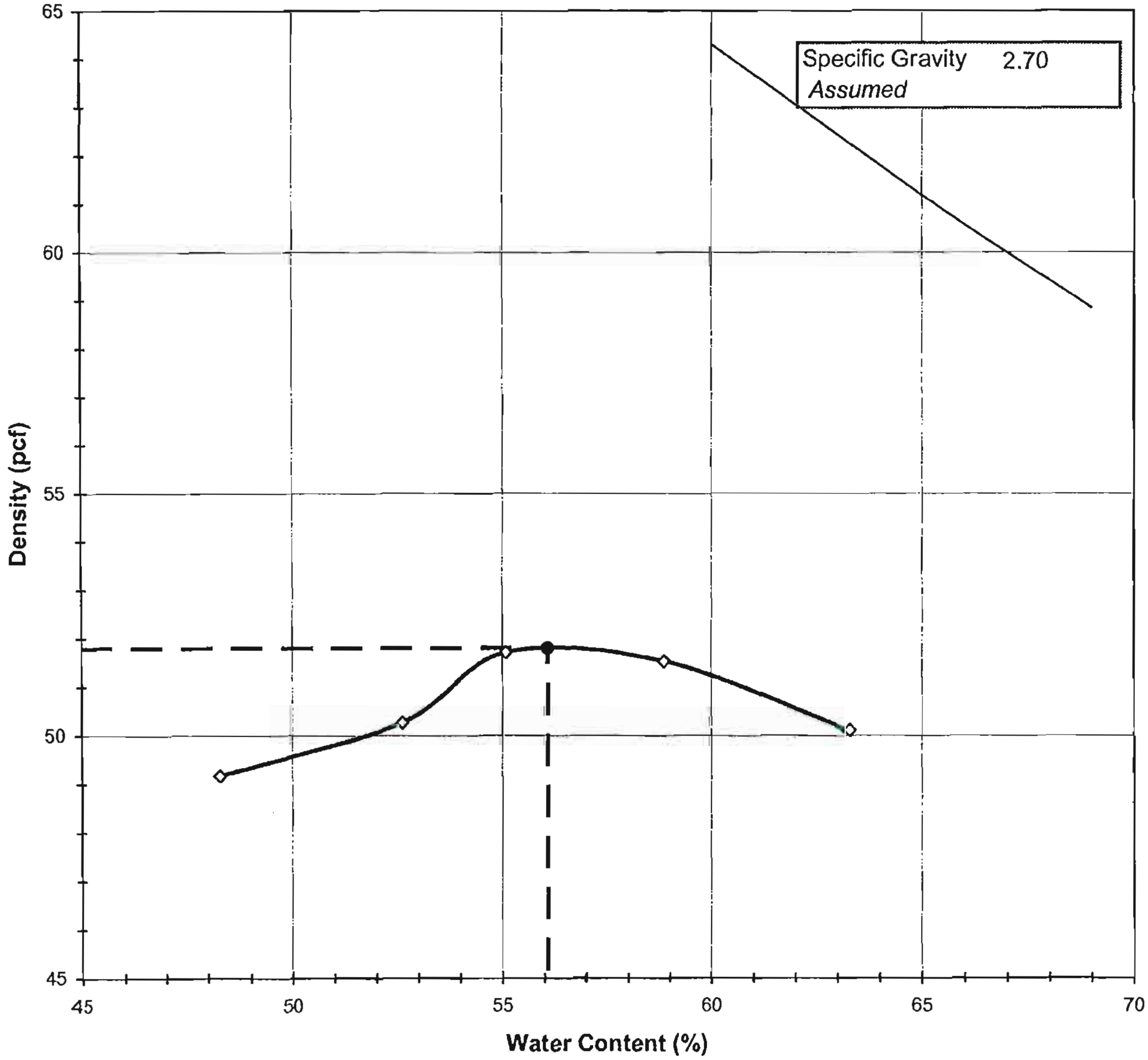
MOISTURE DENSITY RELATIONSHIP

ASTM D698-91 SOP-S12

Client	WITHERS & RAVENEL	Boring No.	BULK SAMPLE 1
Client Reference	SUTTON PLANT	Depth (ft)	1.0'-2.0'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-03	Test Method	**STANDARD**

Visual Description DARK GRAY SILT WITH SAND

Optimum Water Content	**56.1**
Maximum Dry Density	**51.8**

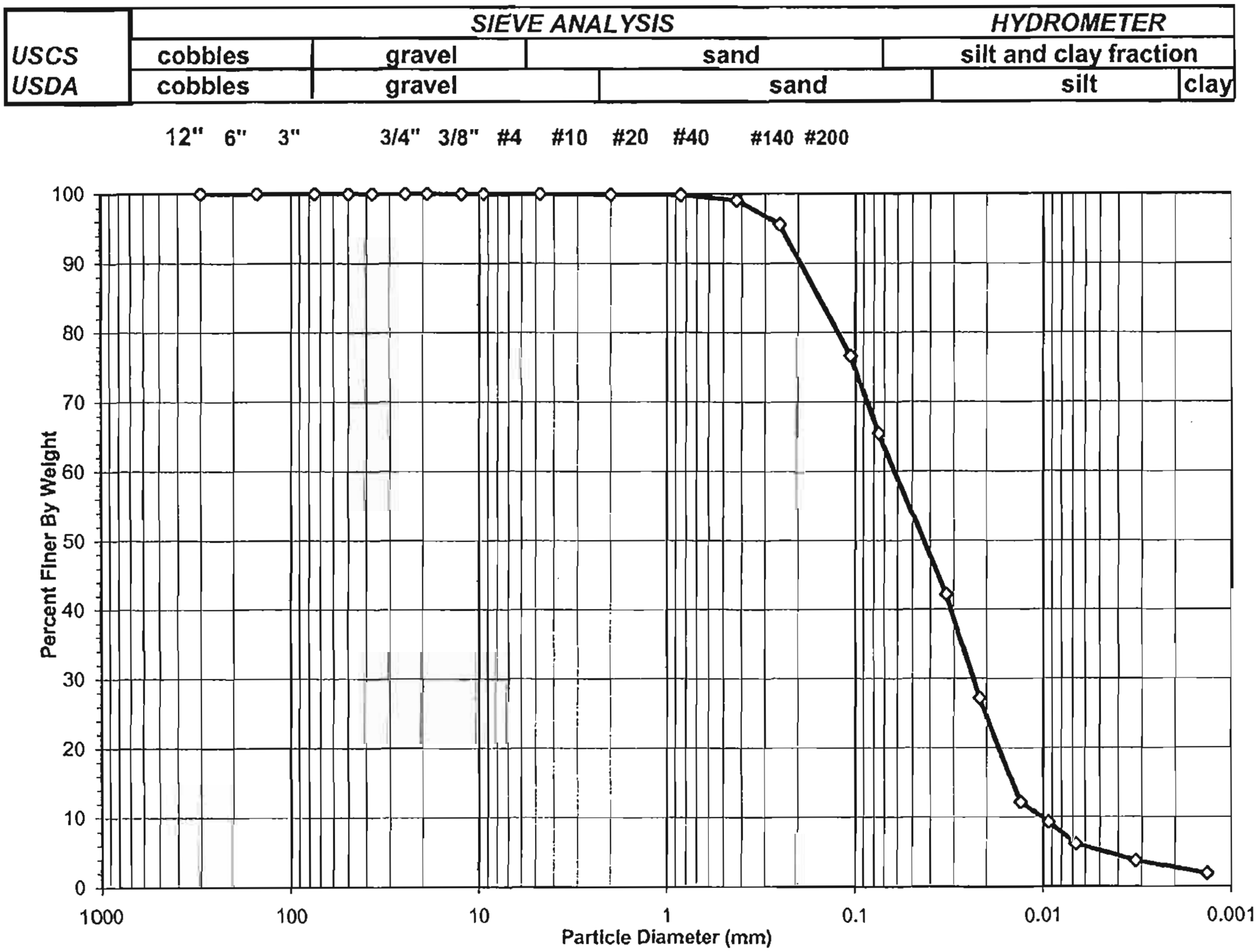


Tested By *DLG* *Date* *5/3/2006* *Checked By* GBm *Date* 6-7-06

geotechnics
INTEGRITY IN TESTING

SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	WITHERS & RAVENEL	Boring No.	BULK SAMPLE 2
Client Reference	SUTTON PLANT	Depth (ft)	5.0'-10.0'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-04	Soil Color	**DARK GRAY**



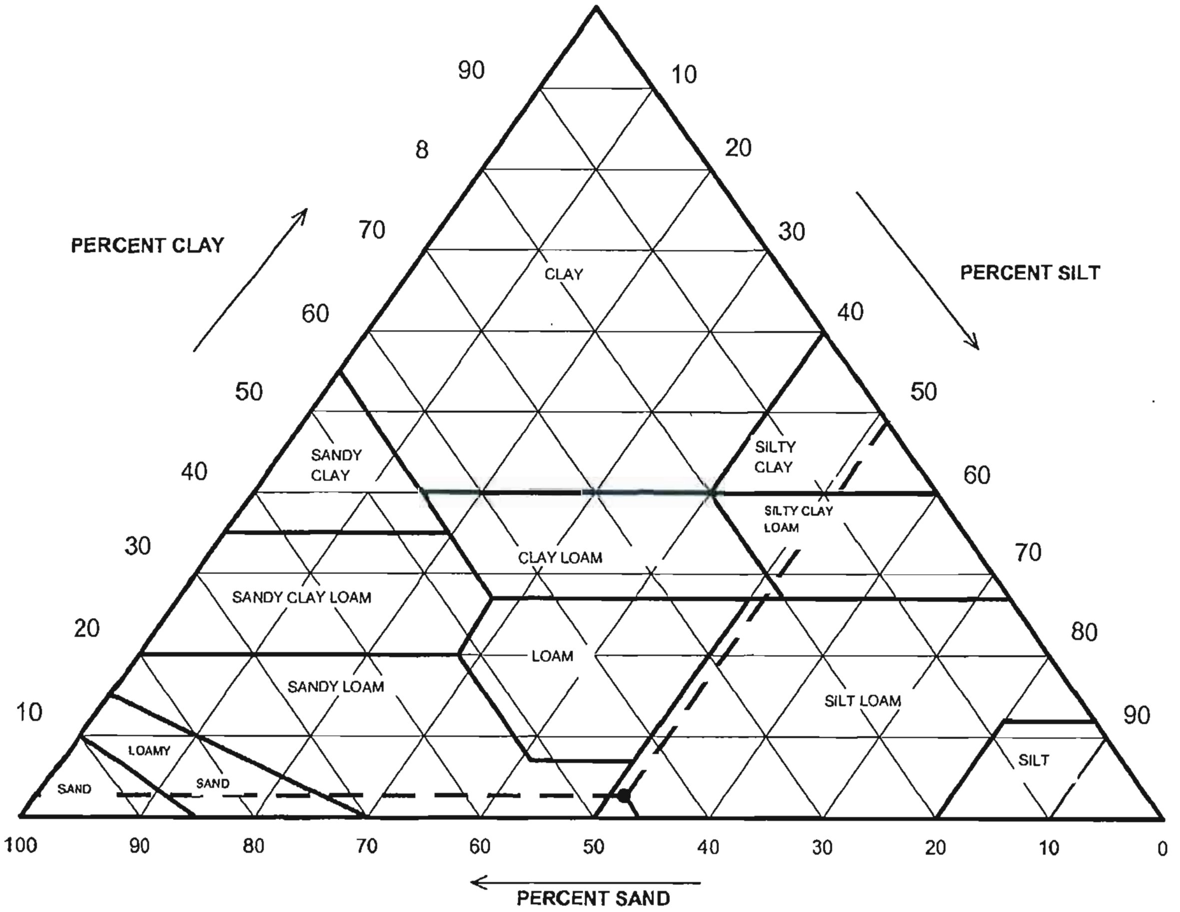
Sieve Sizes (mm)	**USCS Summary**	**Percentage**
Greater Than #4	*Gravel*	0.00
#4 To #200	*Sand*	34.54
Finer Than #200	*Silt & Clay*	65.46

USCS Symbol *ml, ASSUMED*

USCS Classification *SANDY SILT*

USDA CLASSIFICATION CHART

Client	WITHERS & RAVENEL	Boring No.	BULK SAMPLE 2
Client Reference	SUTTON PLANT	Depth (ft)	5.0'-10.0'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-04	Soil Color	DARK GRAY



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	0.08	**0.00**
2	99.92	*Sand*	45.93	**45.97**
0.05	53.99	*Silt*	51.27	**51.31**
0.002	2.72	*Clay*	2.72	**2.72**

USDA Classification: ***SILT LOAM***

geotechnics
INTEGRITY IN TESTING

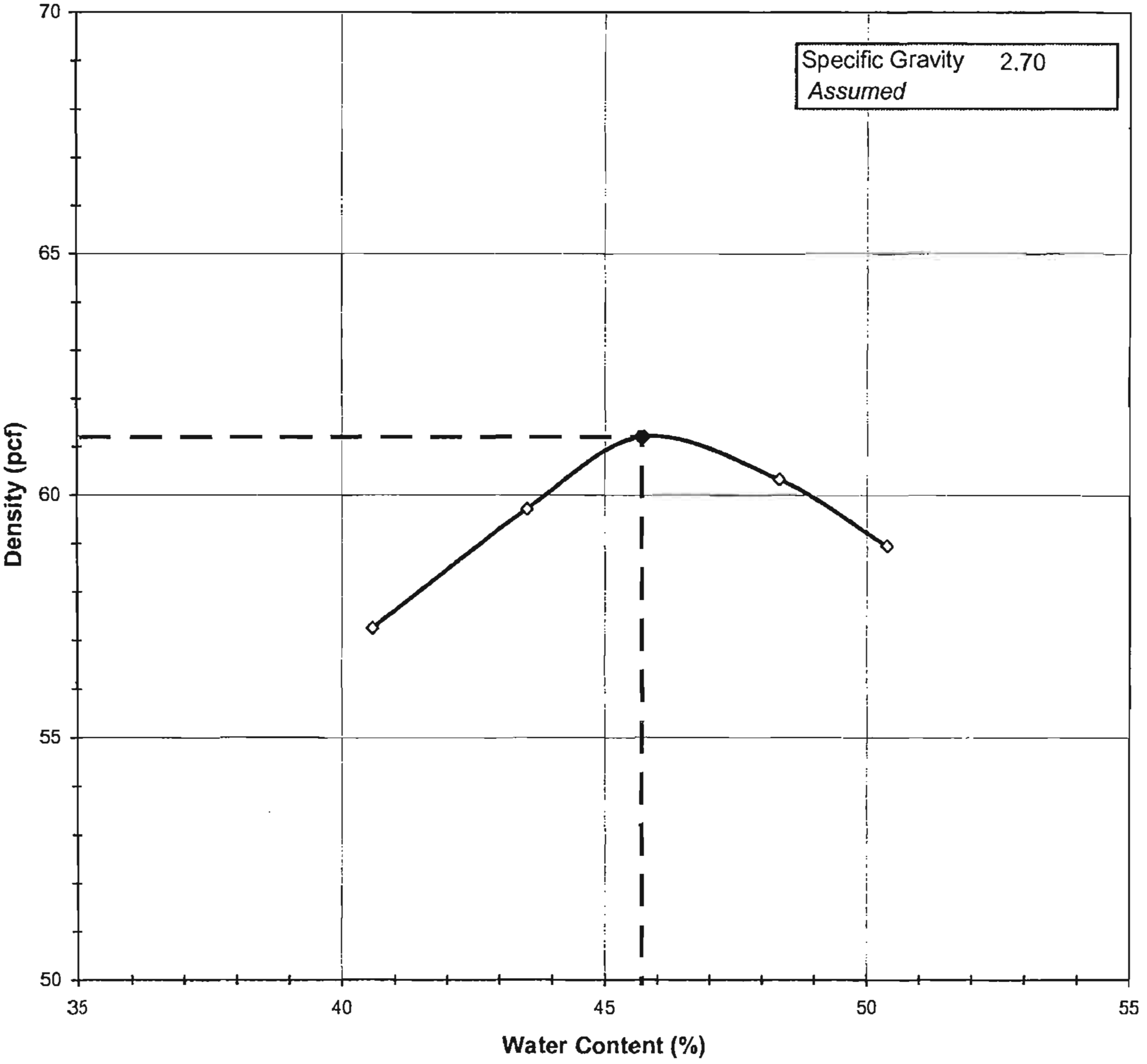
MOISTURE DENSITY RELATIONSHIP

ASTM D698-91 SOP-S12

Client	WITHERS & RAVENEL	Boring No.	BULK SAMPLE 2
Client Reference	SUTTON PLANT	Depth (ft)	5.0'-10.0'
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-04	Test Method	**STANDARD**

Visual Description DARK GRAY SANDY SILT (ASH)

Optimum Water Content	**45.7**
Maximum Dry Density	**61.2**



Tested By DLG *Date* 5/2/2006 *Checked By* GSM *Date* 6-7-06

geotechnics
INTEGRITY IN TESTING

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

Client	WITHERS & RAVENEL		
Client Reference	SUTTON PLANT		
Project No.	2006-549-01		
Lab ID	2006-549-01-04	Specific Gravity (assumed)	2.7

Visual Description: BLACK ASH (REMOLDED)

SAMPLE CONDITION SUMMARY

Boring No.	BULK BAG 2	BULK BAG 2	BULK BAG 2
Depth (ft)	5.0-10.0	5.0-10.0	5.0-10.0
Sample No.	NA	NA	NA
Test No.	T1	T2	T3
Deformation Rate (in/min)	0.002	0.002	0.002
Back Pressure (psi)	60.6	60.6	60.6
Consolidation Time (days)	1	1	1
Initial State (w%)	49.5	49.5	49.5
Total Unit Weight (pcf)	85.2	85.2	85.1
Dry Unit Weight (pcf)	57.0	57.0	56.9
Final State (w%)	63.3	62.2	61.6
Initial State Void Ratio,e	1.958	1.957	1.961

Tested By JCM Date 5/11/2006 Input Checked By KB Date 5-16-06

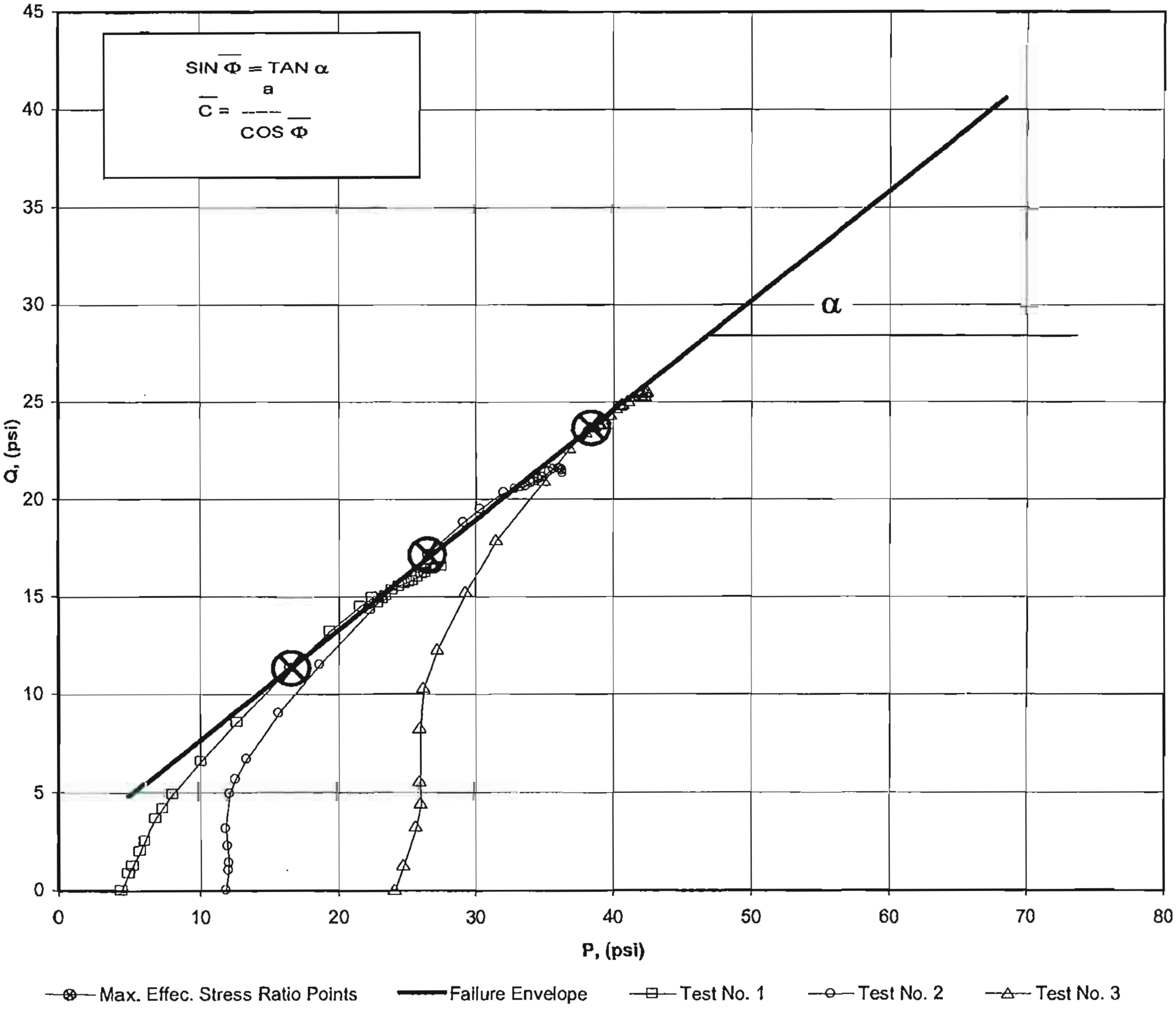
geotechnics
INTEGRITY IN TESTING

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

Client	WITHERS & RAVENEL	Boring No.	BULK BAG 2
Client Reference	SUTTON PLANT	Depth(ft.)	5.0-10.0
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-04		

Consolidated Undrained Triaxial Test with Pore Pressure



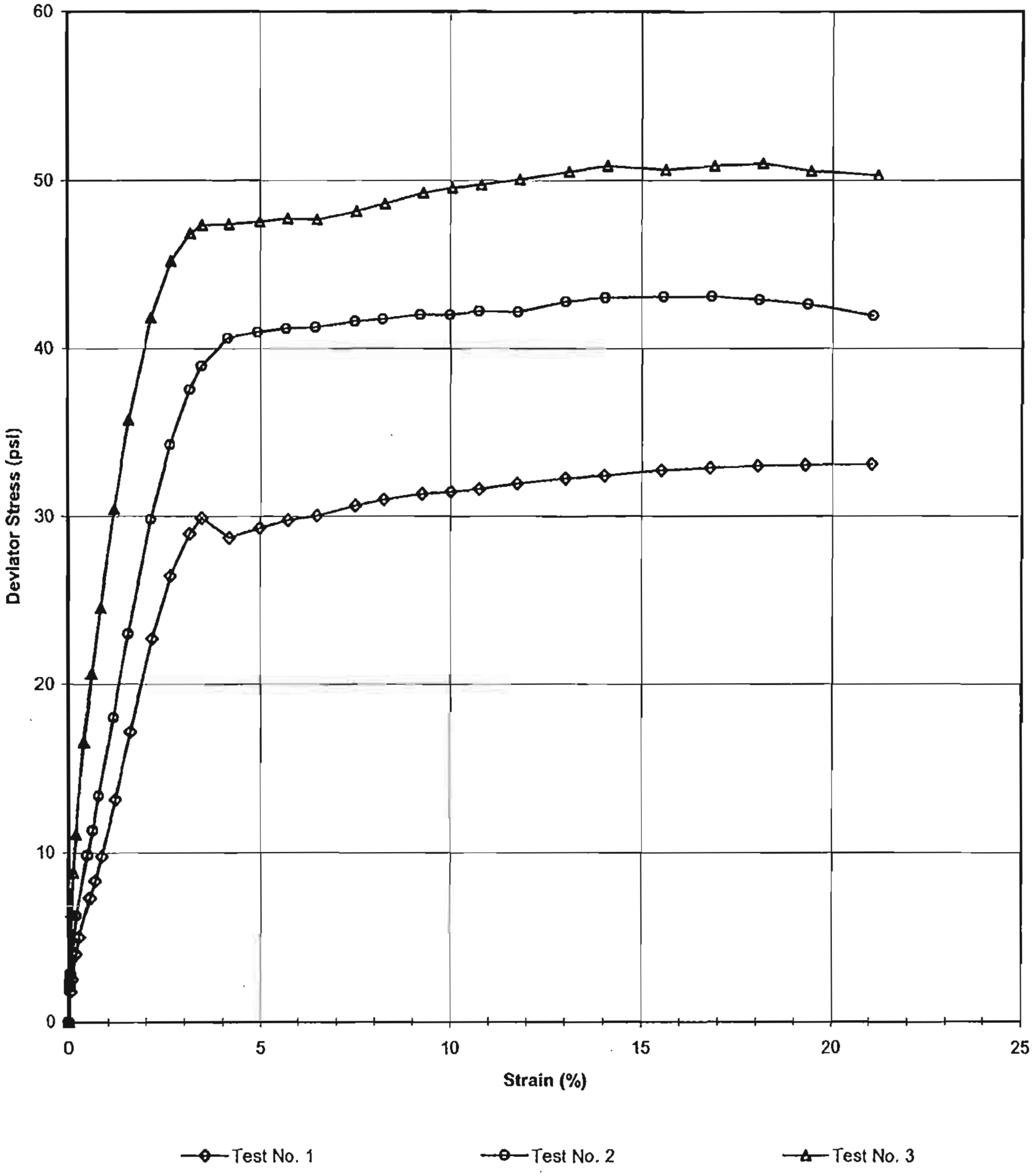
a	=	0.00	$\bar{C}$	=	0.00
α	=	29.4	$\bar{\Phi}$	=	34.33

Tested By JCM Date 5/11/2006 Approved By DB Date 5-16-06

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

Client	WITHERS & RAVENEL	Boring No.	BULK BAG 2
Client Reference	SUTTON PLANT	Depth(ft.)	5.0-10.0
Project No.	2006-549-01	Sample No.	NA
Lab ID	2006-549-01-04		
Visual Description:	BLACK ASH (REMOLDED)		



Tested By JCM Date 5/11/2006 Approved By DB Date 5-16-06

geotechnics
INTEGRITY IN TESTING

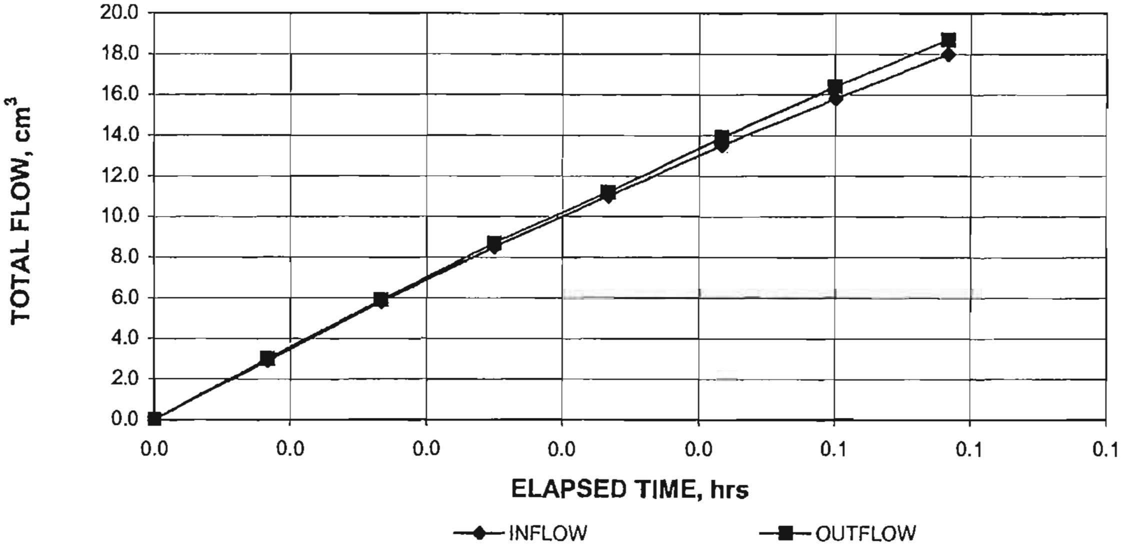
PERMEABILITY TEST

ASTM D 5084-90(Reapproved 1997)
(SOP-S22A & S22B)

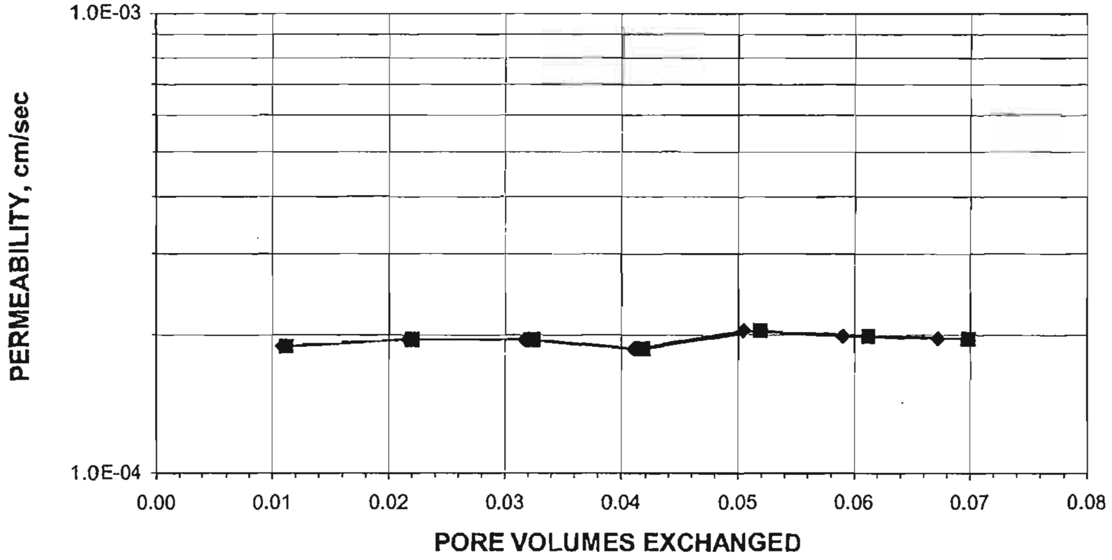
Client	WITHERS & RAVENEL	Boring No.	BULK SAMPLE 2
Client Project	SUTTON PLANT	Depth (ft.)	5.0'-10.0'
Project No.	2006-549-01	Sample No.	NA
Lab ID No.	2006-549-01-04		

AVERAGE PERMEABILITY = 2.0E-04 cm/sec @ 20°C
AVERAGE PERMEABILITY = 2.0E-06 m/sec @ 20°C

TOTAL FLOW vs. ELAPSED TIME



PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: MCW Date: 5/9/2006 Checked By: GEM Date: 6-7-06

Attachment 3.2

MACTEC 2011 Laboratory Testing Results

Summary of Laboratory Test Results-Seepage and Stability Evaluation-Ash Pond Dikes-Sutton Plant, Wilmington, North Carolina

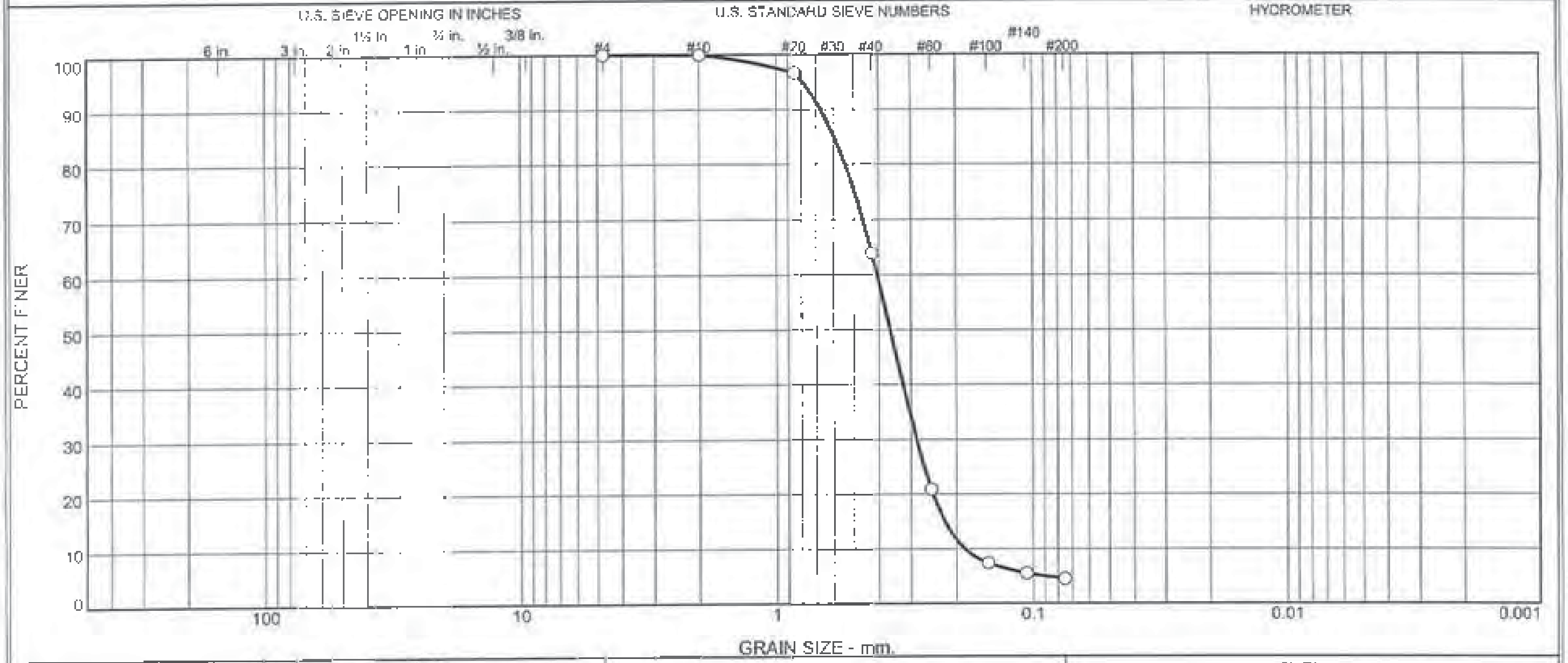
Boring No.	Sample No.	Sample Depth (ft)		Natural Moisture Content (%)	Grain Size	Atterberg Limits			USCS	Visual Description/Comments
		From	To		# 200	PL	LL	PI		
B 1	SS-5	11.0	12.5	17.1	4.5	-	-	-	SP*	Tan slightly silty fine to medium SAND
B-1	SS-10	23.5	25.0	19.0	1.8	-	-	-	SP*	Tan slightly silty fine to medium SAND
B-2	SS-2	3.5	5.0	13.2	4.1	-	-	-	SP*	Light Brown fine to medium SAND with trace of silt
B-2	SS-8	18.5	20.0	71.1	79.8	42	52	10	MH	Gray fine sandy SILT
B-3	SS-4	8.5	10.0	25.0	30.6	NP	NV	NP	SM	Gray slightly clayey silty fine to medium SAND
B-3	SS-5	11.0	12.5	25.3	25.3	NP	NV	NP	SM	Gray slightly clayey silty fine to medium SAND
B-3	SS-6	13.5	15.0	28.7	29.5	NP	NV	NP	SM	Gray silty fine to medium SAND
B 3	SS-8	18.5	20.0	62.1	81.8	40	46	6	MI	Dark gray fine sandy SILT

USCS = Unified Soil Classification System Group Symbol
PL = Plastic Limit
LL = Liquid Limit
P.I. = Plasticity Index
NP = Non Plastic
ND = Not Determined
*Visual Classification

Prepared By: JJT

Checked By: ____________________

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	36.0	59.4	4.5	

	Source	Sample #	Depth/Elev	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-1	SS-5	11.0	12/22/10	SP (visual)	Tan slightly Silty fine to medium SAND (visual)	17.1	ND	ND

Client Progress Energy
Project Sutton Plant Ash Pond Dike Stability
Project No. 6468100274 Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

○ ND = Not Determined

Tested By: CS **Checked By:** IAM

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GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-1
Depth: 11.0 **Sample Number:** SS-5
Material Description: Tan slightly Silty fine to medium SAND (visual)
Date: 12/22/10 **Natural Moisture:** 17.1
USCS Class.: SP
Testing Remarks: ND - Not Determined
Tested by: CS **Checked by:** IAM

Sieve Test Data

Post #200 Wash Test Weights (grams): Dry Sample and Tare = 575.12
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
575.12	0.00	0.00	#4	0.00	100.0
			#10	0.38	99.9
			#20	19.09	96.7
			#40	207.40	63.9
			#60	454.90	20.9
			#100	533.00	7.3
			#140	544.00	5.4
			#200	549.50	4.5

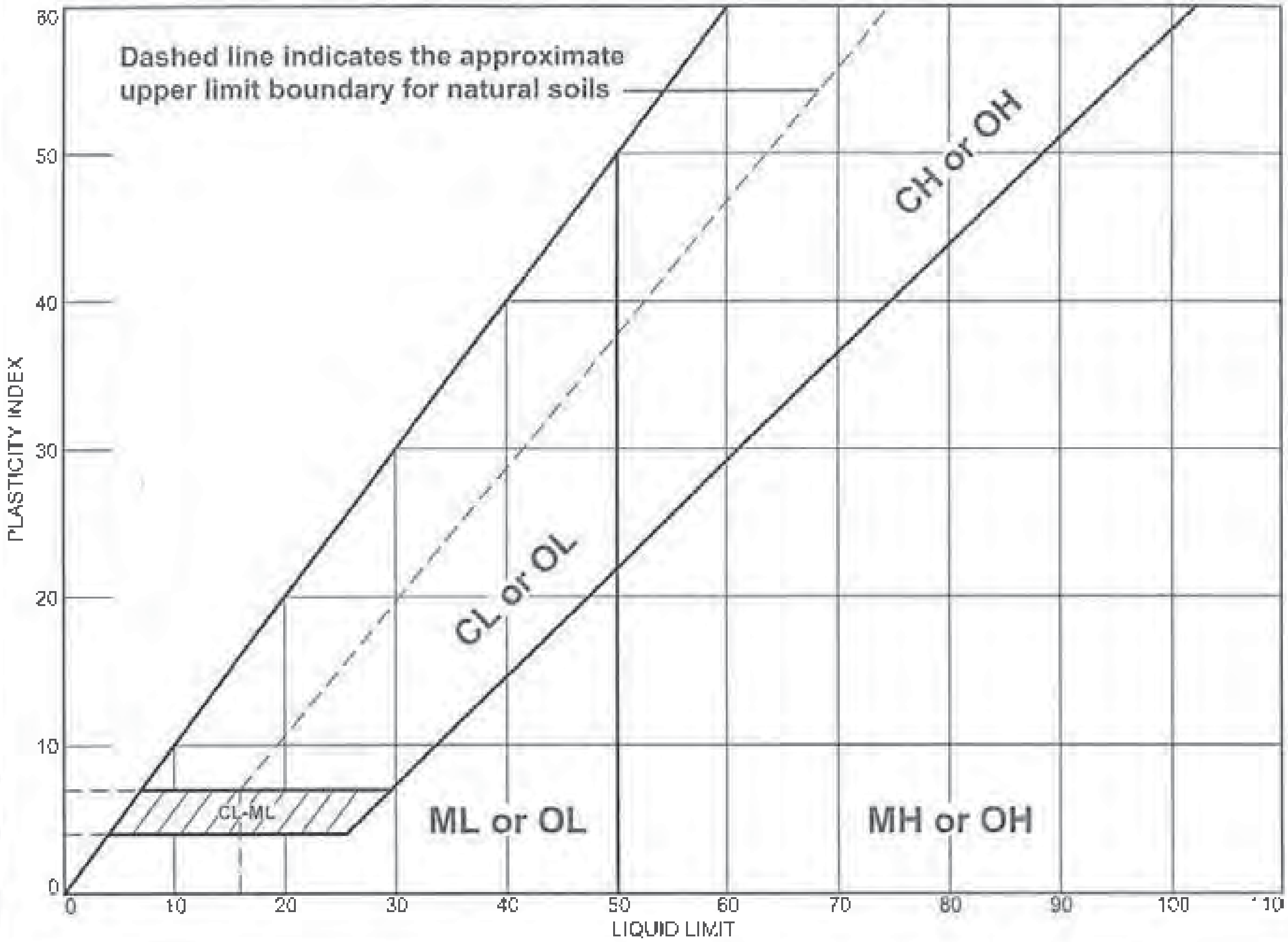
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	36.0	59.4	95.5			4.5

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.1857	0.2214	0.2461	0.2853	0.3605	0.4048	0.5409	0.5967	0.6726	0.7900

Fineness Modulus	C_u	C_c
1.75	2.18	1.08

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Tan slightly Silty fine to medium SAND (visual)				63.9	4.5	SP

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-1 **Depth:** 11.0 **Sample Number:** SS-5

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

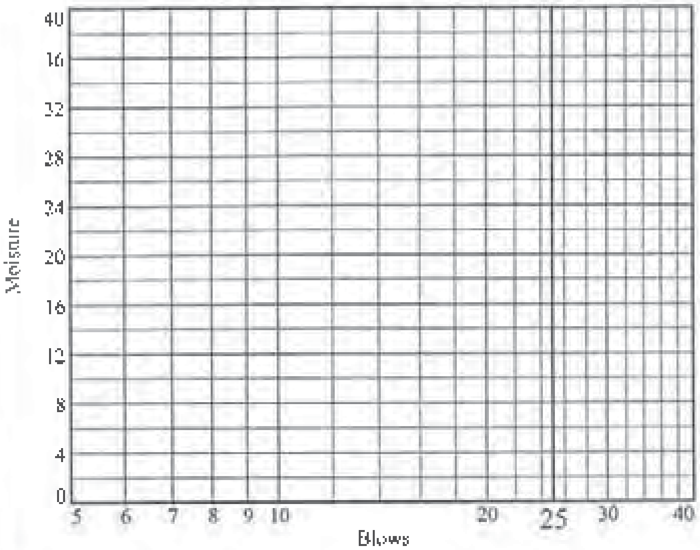
Figure

Tested By: CS **Checked By:** IAM

LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-1
Depth: 11.0
Sample Number: SS-5
Material Description: Tan slightly Silty fine to medium SAND (visual)
%<#40: 63.9
%<#200: 4.5
USCS: SP
AASHTO: ND
Tested by: CS
Checked by: JAM

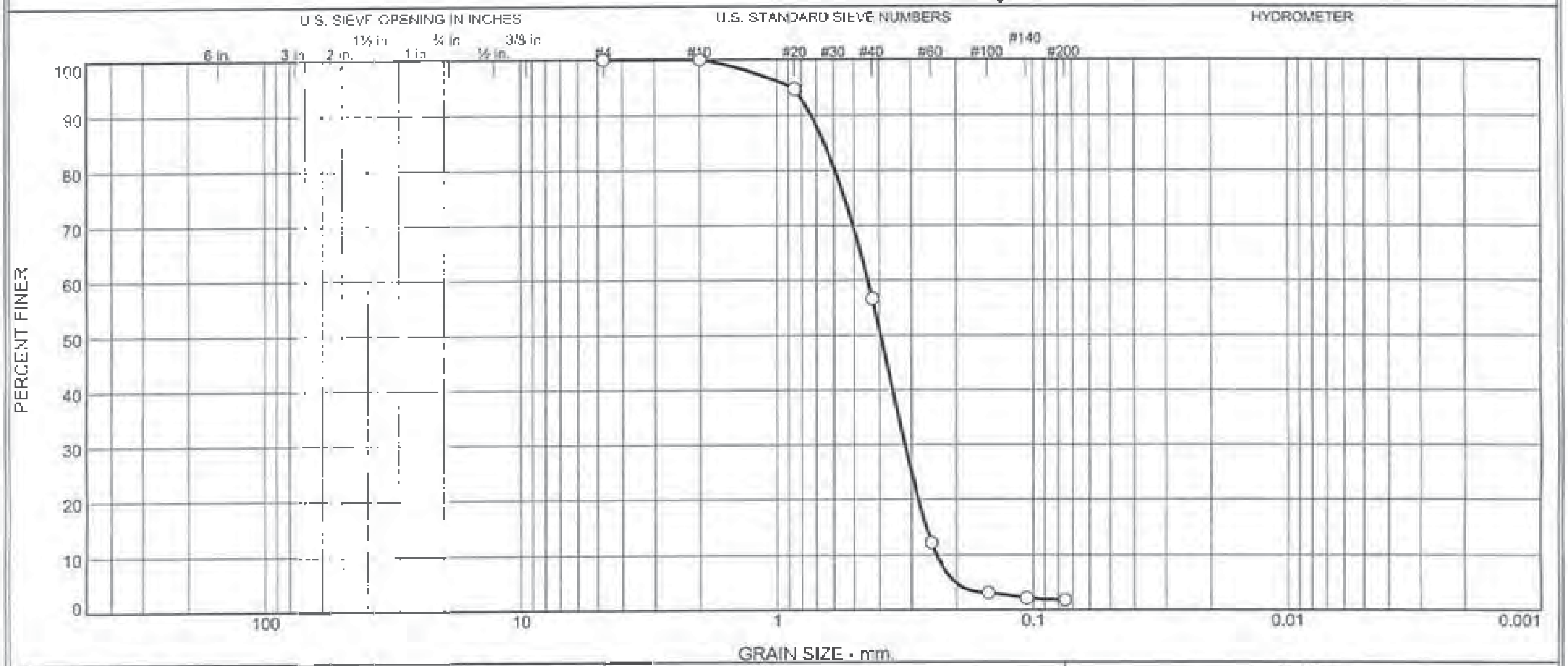


Liquid Limit=
Plastic Limit=
Plasticity Index=
Natural Moisture= 17.1

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
818.15	719.79	144.67	17.1

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	43.4	54.8	1.8	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-1	SS-10	23.5	12/22/10	SP (visual)	Tan slightly Silty fine to medium SAND (visual)	19.0	ND	ND

Client Progress Energy
Project Sutton Plant Ash Pond Dike Stability

Project No. 6468100274 Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

○ ND – Not Determined

Tested By: CS **Checked By:** IAM

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GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-1
Depth: 23.5
Sample Number: SS-10
Material Description: Tan slightly Silty fine to medium SAND (visual)
Date: 12/22/10
Natural Moisture: 19.0
USCS Class.: SP
Testing Remarks: ND = Not Determined
Tested by: CS
Checked by: IAM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
526.50	0.00	0.00	#4	0.00	100.0
			#10	0.06	100.0
			#20	28.11	94.7
			#40	228.70	56.6
			#60	462.10	12.2
			#100	510.00	3.1
			#140	514.80	2.2
			#200	516.80	1.8

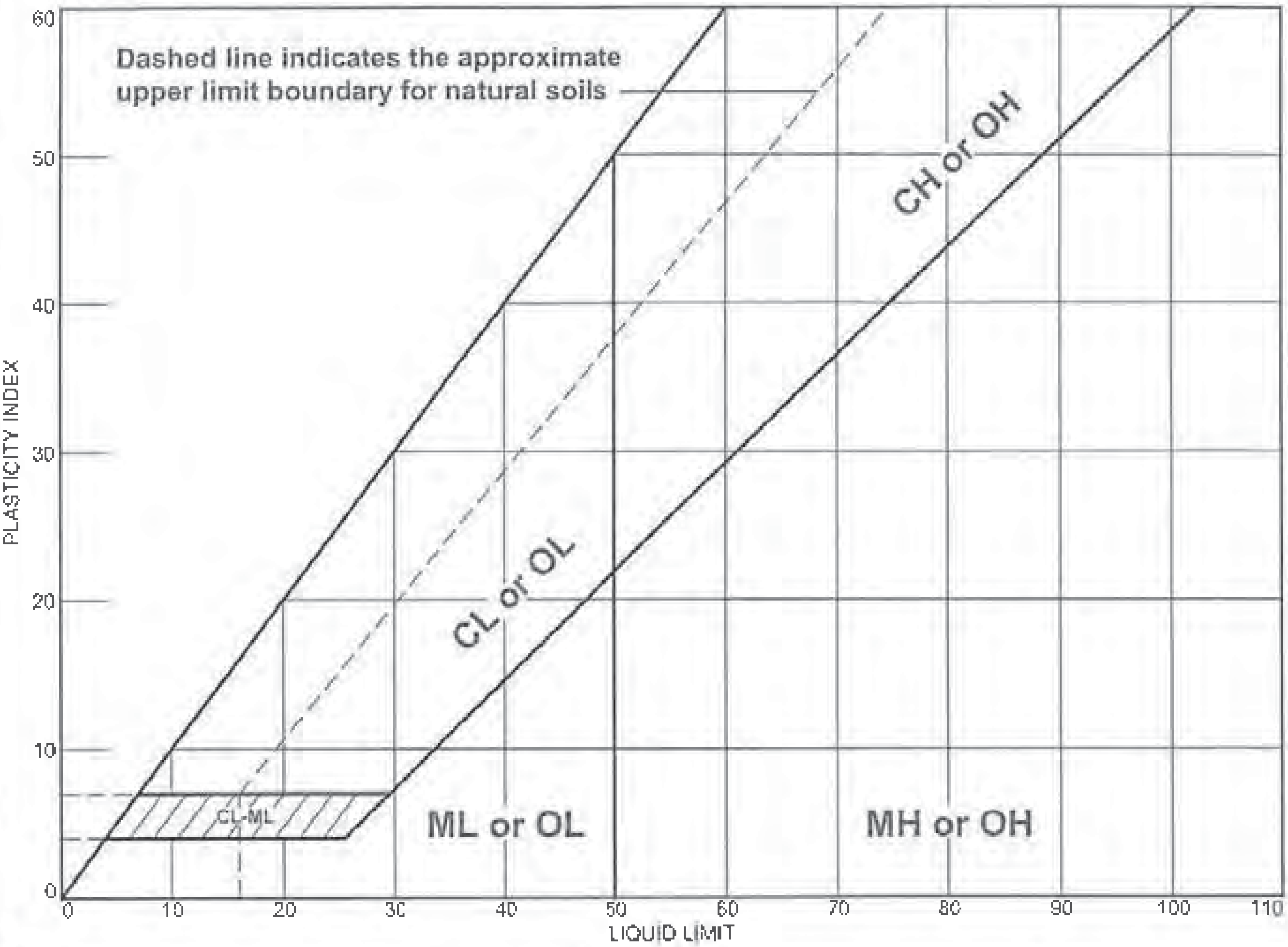
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	43.4	54.8	98.2			1.8

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.2388	0.2621	0.2817	0.3178	0.3947	0.4428	0.5929	0.6535	0.7351	0.8820

Fineness Modulus	C_u	C_c
1.94	1.85	0.96

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Tan slightly Silty fine to medium SAND (visual)				56.6	L8	SP

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-1 **Depth:** 23.5 **Sample Number:** SS-10

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

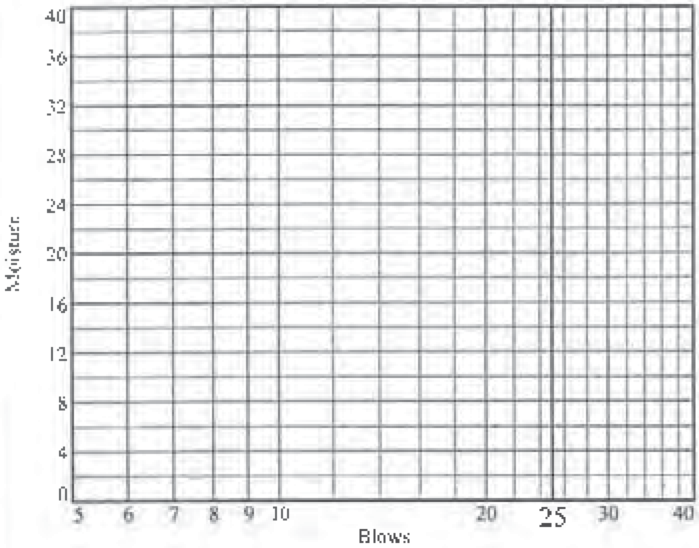
Figure

Tested By: CS **Checked By:** IAM

LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-1
Depth: 23.5 **Sample Number:** SS-10
Material Description: Tan slightly Silty fine to medium SAND (visual)
%<#40: 56.6 **%<#200:** 1.8 **USCS:** SP **AASHTO:** ND
Tested by: CS **Checked by:** IAM

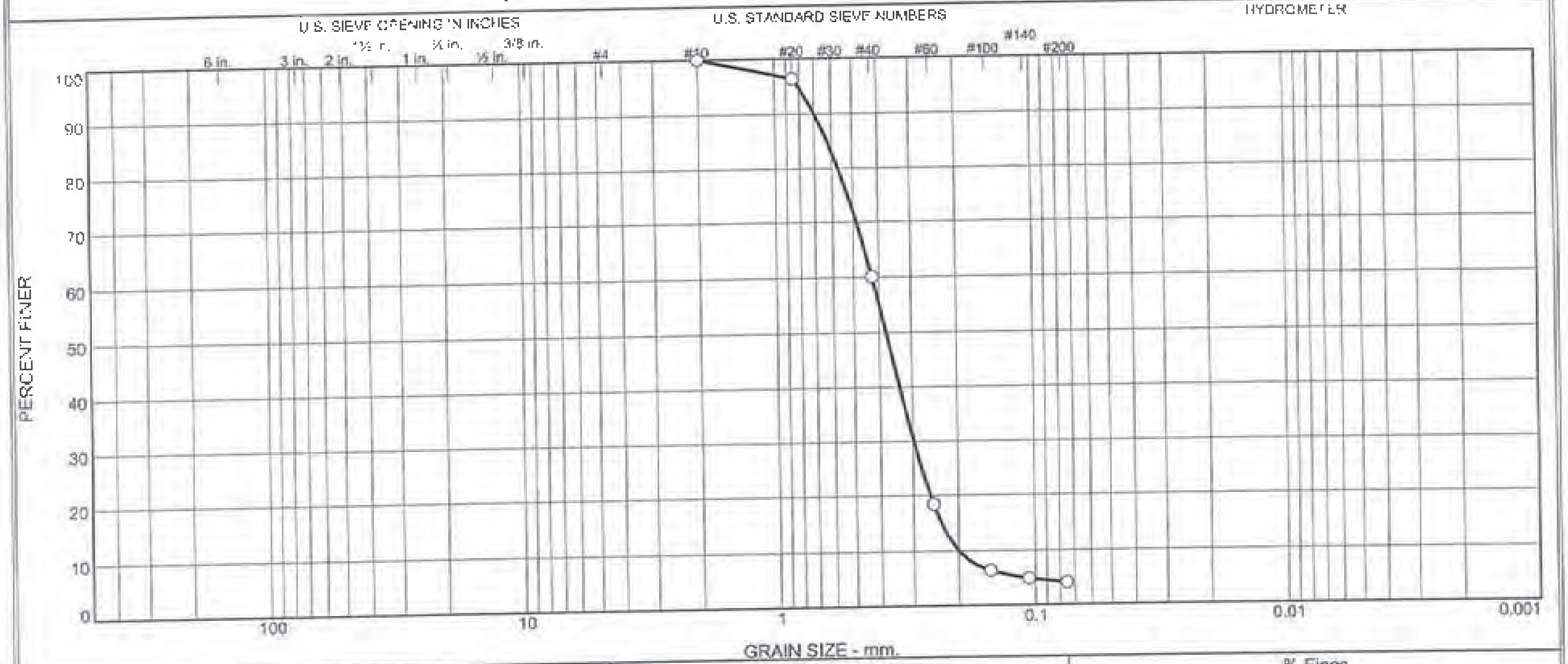


Liquid Limit= ______
Plastic Limit= ______
Plasticity Index= ______
Natural Moisture= 19.0

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
723.37	623.57	97.07	19.0

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	39.9	56.0	4.1	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-2	SS-2	3.5-5.0'	12/22/10	SP (visual)	Light Brown fine to medium SAND with trace of silt (visual)	13.2	ND	ND

○ ND = Not Determined

Client Progress Energy

Project Sutton Plant Ash Pond Dike Stability

Project No. 6468100274

Figure

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Raleigh, North Carolina

Tested By: CS **Checked By:** IAM

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GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-2
Depth: 3.5-5.0' **Sample Number:** SS-2
Material Description: Light Brown fine to medium SAND with trace of silt (visual)
Date: 12/22/10 **Natural Moisture:** 13.2
USCS Class.: SP
Testing Remarks: ND Not Determined
Tested by: CS **Checked by:** IAM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
629.03	0.00	0.00	#10	0.00	100.0
			#20	23.20	96.3
			#40	251.20	60.1
			#60	513.20	18.4
			#100	589.00	6.4
			#140	598.40	4.9
			#200	603.30	4.1

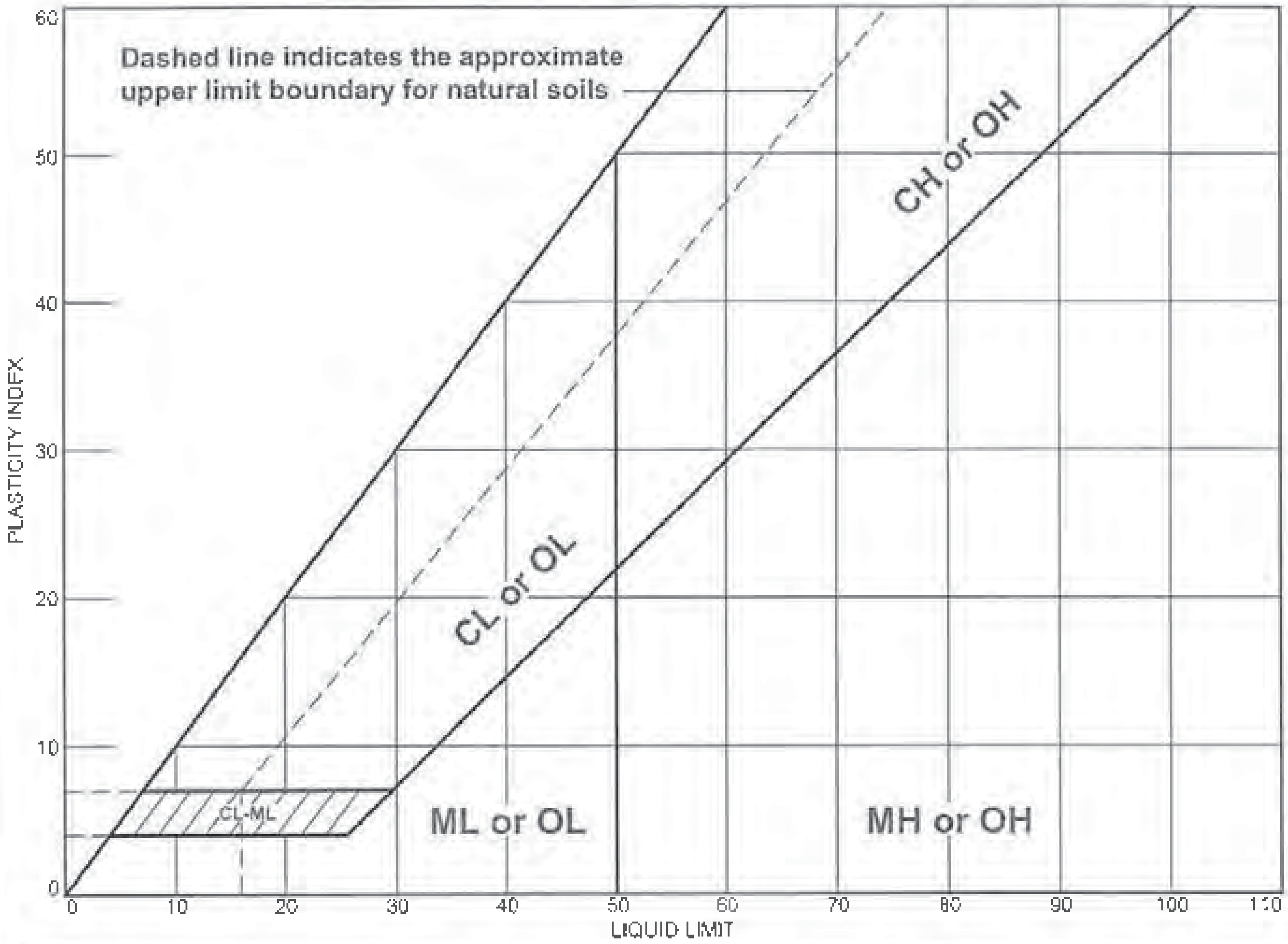
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	39.9	56.0	95.9			4.1

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.2000	0.2331	0.2571	0.2969	0.3767	0.4247	0.5700	0.6270	0.7015	0.8103

Fineness Modulus	C_u	C_c
1.82	2.12	1.04

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light Brown fine to medium SAND with trace of silt (visual)				60.1	4.1	SP

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-2 **Depth:** 3.5-5.0' **Sample Number:** SS-2

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

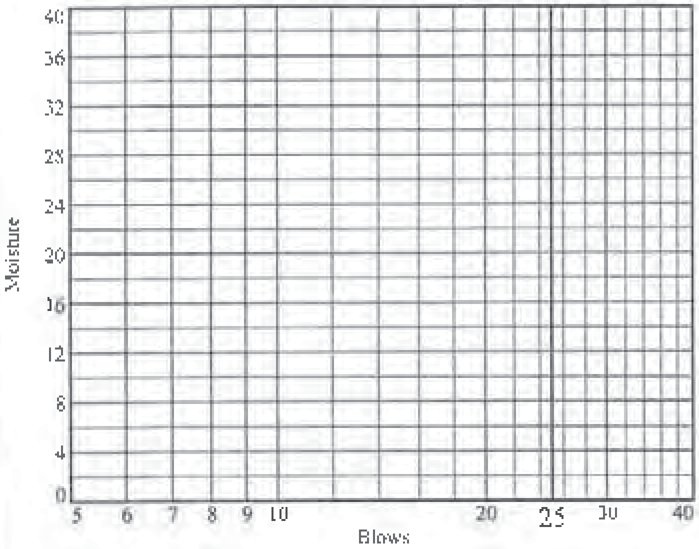
Figure

Tested By: CS **Checked By:** IAM

LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-2
Depth: 3.5-5.0' **Sample Number:** SS-2
Material Description: Light Brown fine to medium SAND with trace of silt (visual)
%<#40: 60.1 **%<#200:** 4.1 **USCS:** SP **AASHTO:** ND
Tested by: CS **Checked by:** IAM

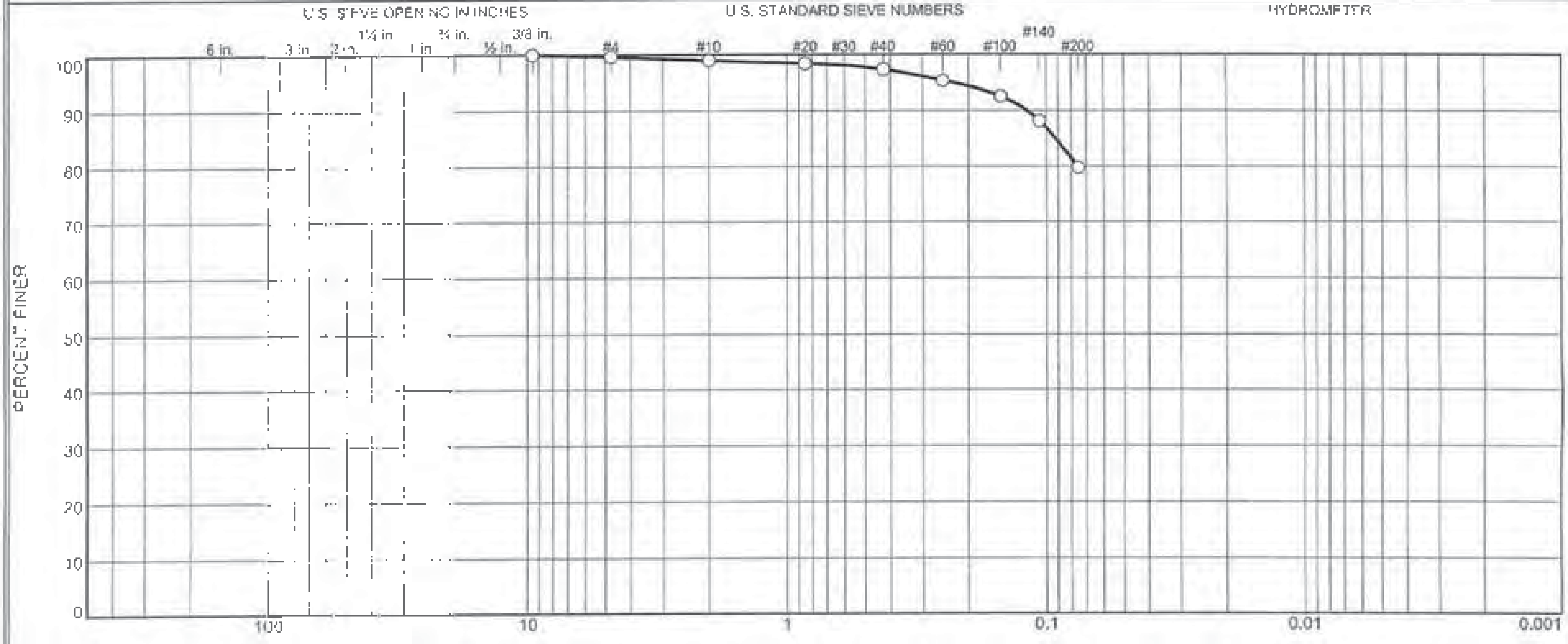


Liquid Limit= ______
Plastic Limit= ______
Plasticity Index= ______
Natural Moisture= 13.2

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
855.04	771.94	142.91	13.2

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.4	0.6	1.7	17.5	79.8	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-2	SS-8	18.5-20.0	12/22/10	MH	Gray fine Sandy SILT (MH)	71.1	52	42

Client Progress Energy
Project Sutton Plant Ash Pond Dike Stability
Project No. 6468100274
Figure

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Raleigh, North Carolina

Tested By: CS **Checked By:** IAM

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GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-2
Depth: 18.5-20.0 **Sample Number:** SS-8
Material Description: Gray fine Sandy SILT (MH)
Date: 12/22/10 **Natural Moisture:** 71.1
Liquid Limit: 52 **Plastic Limit:** 42 **USCS Class.:** MH
Tested by: CS **Checked by:** IAM

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 62.26
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
62.26	0.00	0.00	3/8"	0.00	100.0
			#4	0.25	99.6
			#10	0.65	99.0
			#20	1.01	98.4
			#40	1.66	97.3
			#60	2.92	95.3
			#100	4.65	92.5
			#140	7.39	88.1
			#200	12.60	79.8

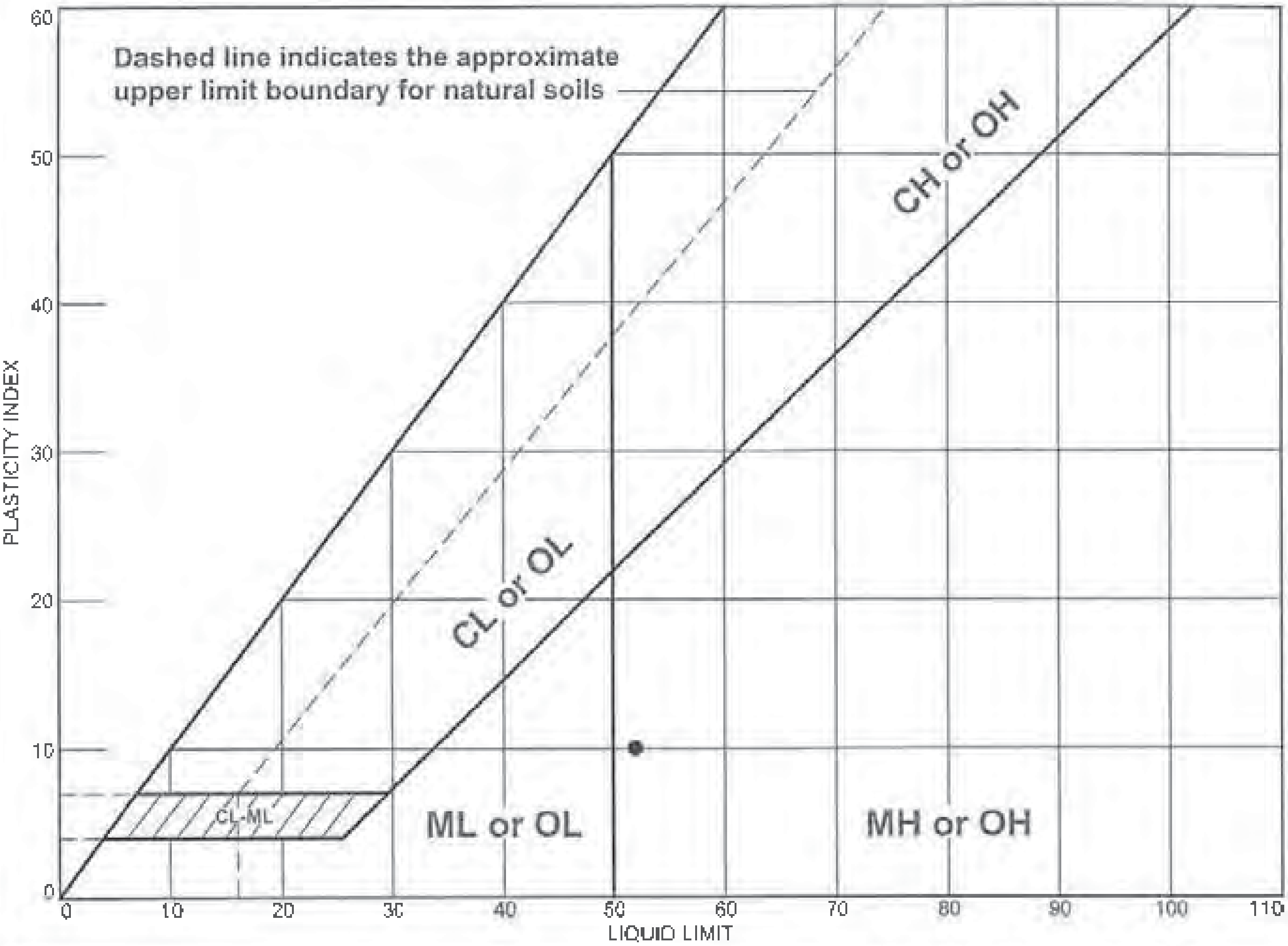
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.4	0.4	0.6	1.7	17.5	19.8			79.8

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
						0.0757	0.0918	0.1187	0.2322

Fineness Modulus
0.16

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray fine Sandy SILT (MH)	52	42	10	97.3	79.8	MH

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-2 **Depth:** 18.5-20.0 **Sample Number:** SS-8

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Figure

Tested By: CS **Checked By:** IAM

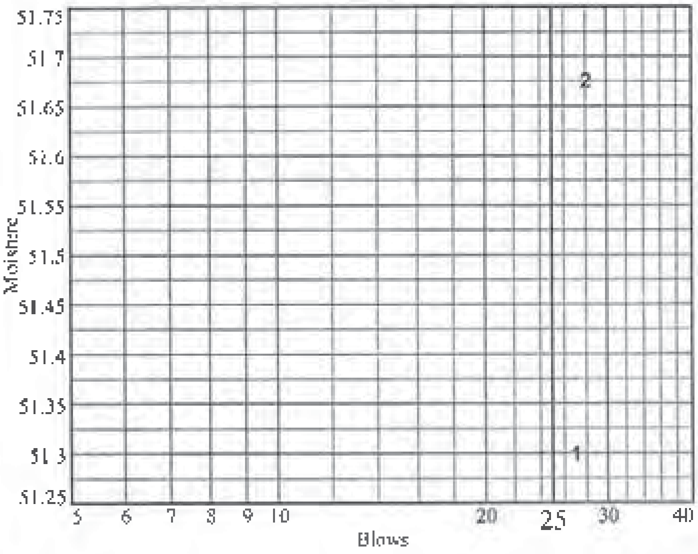
LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-2
Depth: 18.5-20.0
Sample Number: SS-8
Material Description: Gray fine Sandy SILT (MH)
%<#40: 97.3
%<#200: 79.8
USCS: MH
AASHTO: A-5(12)
Tested by: CS
Checked by: IAM

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	22.14	20.98				
Dry+Tare	19.97	19.13				
Tare	15.74	15.55				
# Blows	27	28				
Moisture	51.3	51.7				



Liquid Limit= 52
Plastic Limit= 42
Plasticity Index= 10
Natural Moisture= 71.1
Liquidity Index= 2.9

Plastic Limit Data

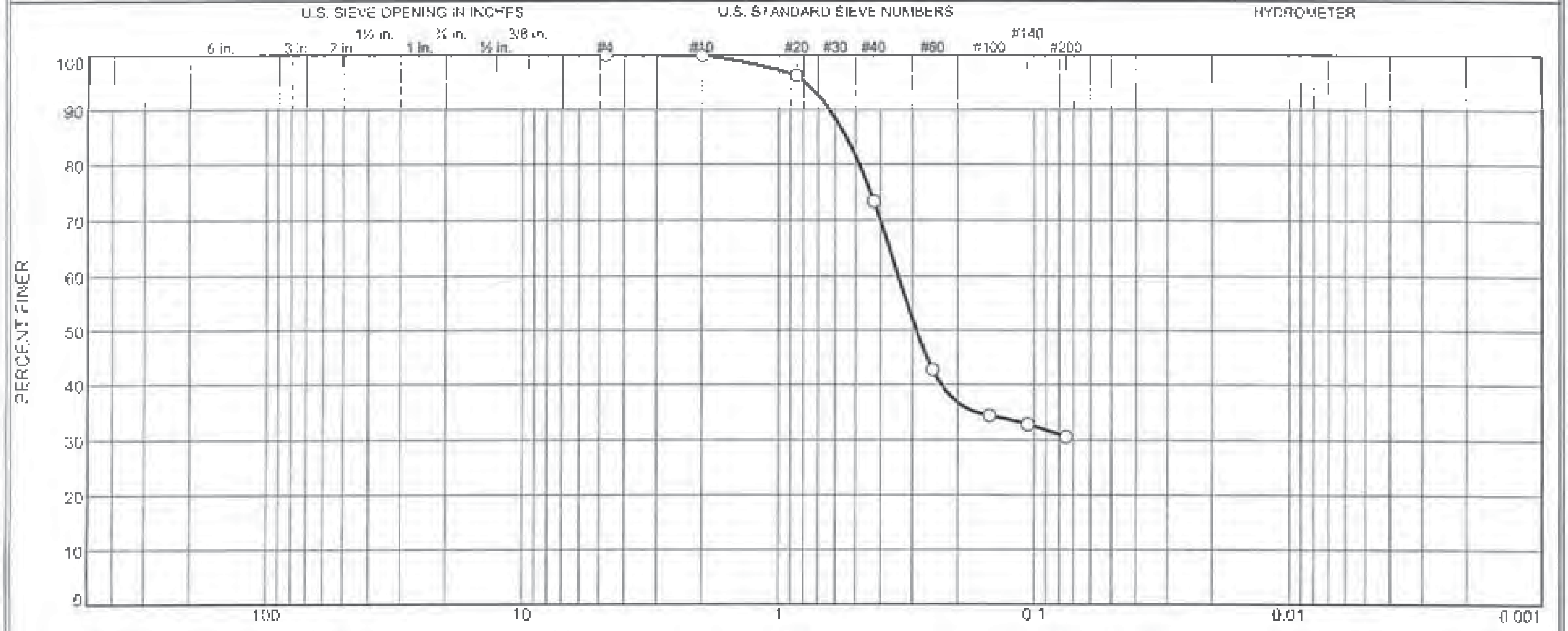
Run No.	1	2	3	4	
Wet+Tare	22.12	21.84			
Dry+Tare	20.23	19.97			
Tare	15.67	15.47			
Moisture	41.4	41.6			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
185.10	140.81	78.55	71.1

MACTEC Engineering and Consulting, Inc.

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	26.4	42.8	30.6	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-3	SS-4	8.5-10.0	12/22/10	SM	Gray slightly Clayey Silty fine to medium SAND	25.0	NV	NP

Client Progress Energy
Project Sutton Plant Ash Pond Dike Stability

Project No. 6468100274 Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Tested By: CS **Checked By:** IAM

Oct 30 2019 **OFFICIAL COPY**

GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-3
Depth: 8.5-10.0 **Sample Number:** SS-4
Material Description: Gray slightly Clayey Silty fine to medium SAND
Date: 12/22/10 **Natural Moisture:** 25.0
Liquid Limit: NV **Plastic Limit:** NP **USCS Class.:** SM
Tested by: CS **Checked by:** IAM

Sieve Test Data

Post #200 Wash Test Weights (grams): Dry Sample and Tare = 166.87
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
166.87	0.00	0.00	#4	0.00	100.0
			#10	0.26	99.8
			#20	6.31	96.2
			#40	44.38	73.4
			#60	95.53	42.8
			#100	109.47	34.4
			#140	112.12	32.8
			#200	115.80	30.6

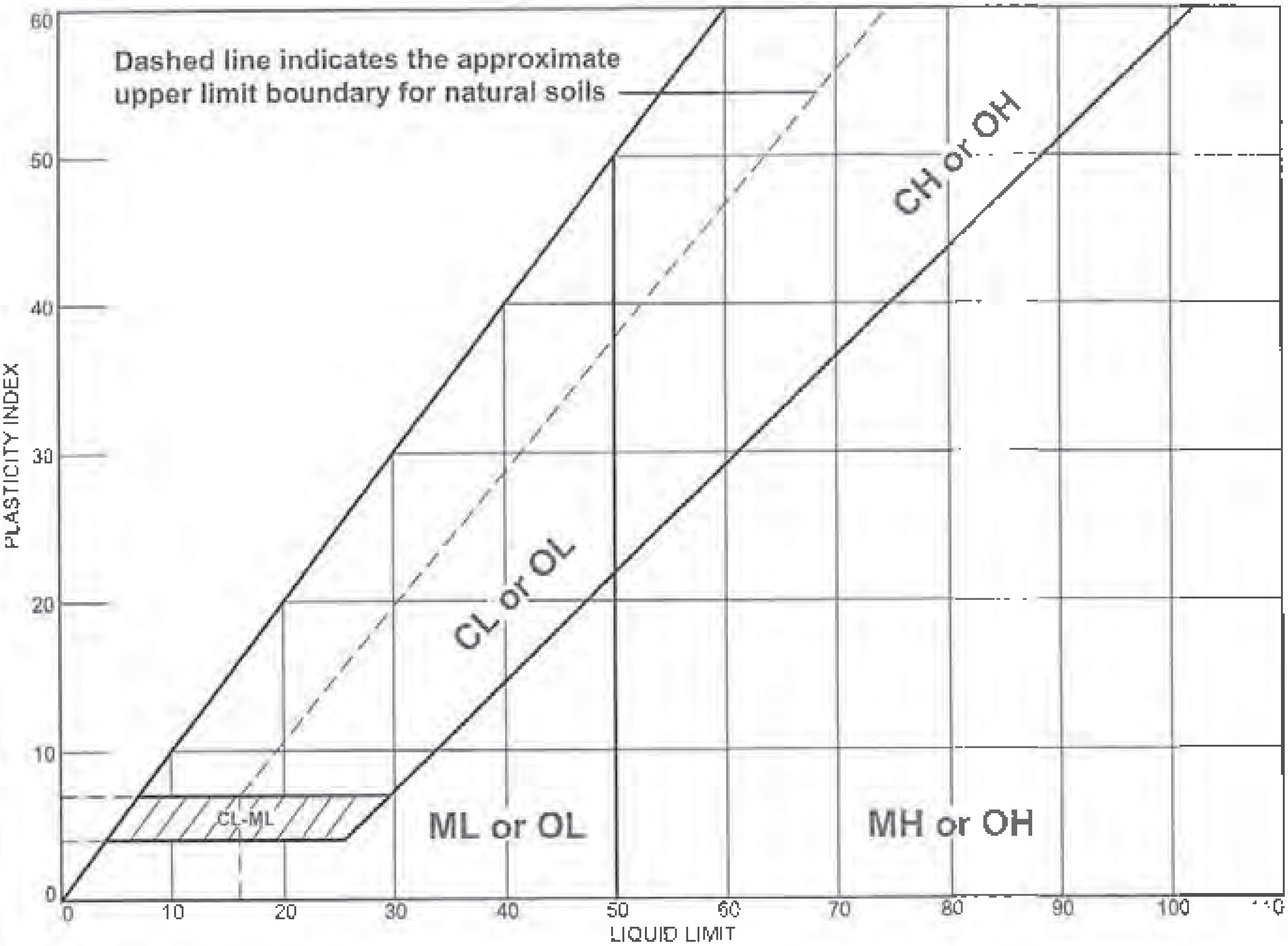
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.2	26.4	42.8	69.4			30.6

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
				0.2898	0.3416	0.4839	0.5453	0.6344	0.7887

Fineness Modulus
1.27

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray slightly Clayey Silty fine to medium SAND	NV	NP	NP	73.4	30.6	SM

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-3 **Depth:** 8.5-10.0 **Sample Number:** SS-4

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Figure

Tested By: CS

Checked By: IAM

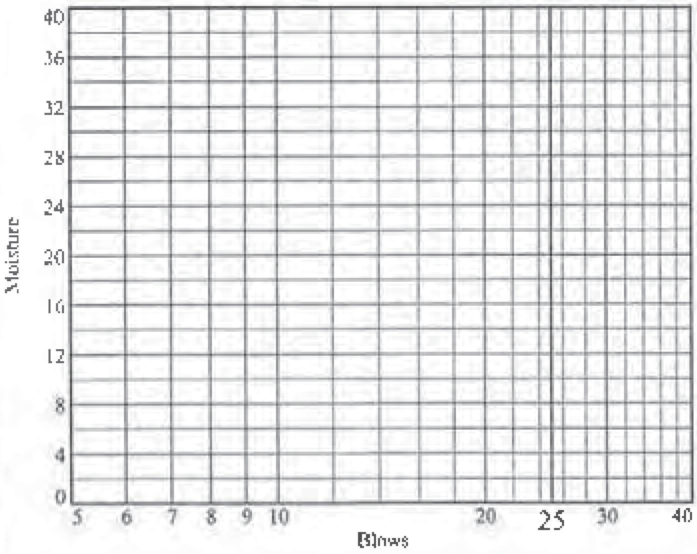
LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-3
Depth: 8.5-10.0 **Sample Number:** SS-4
Material Description: Gray slightly Clayey Silty fine to medium SAND
%<#40: 73.4 **%<#200:** 30.6 **USCS:** SM **AASHTO:** A-2-4(0)
Tested by: CS **Checked by:** IAM

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 25.0

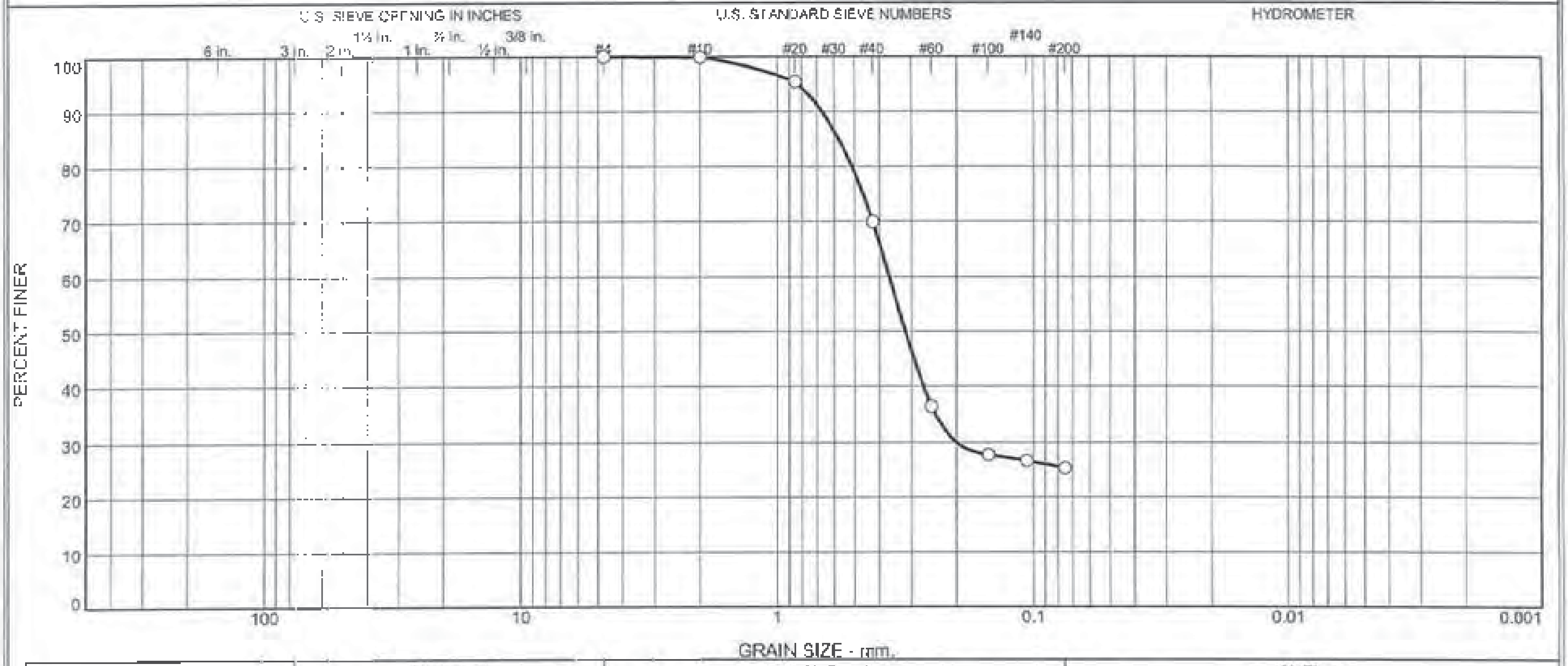
Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
285.17	243.48	76.61	25.0

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	30.0	44.6	25.3	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-3	SS-5	11.0-12.5	12/22/10	SM	Gray slightly Clayey Silty fine to medium SAND	25.3	NV	NP

Client Progress Energy
Project Sutton Plant Ash Pond Dike Stability
Project No. 6468100274
Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Tested By: CS **Checked By:** IAM

Oct 30 2019 **OFFICIAL COPY**

GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-3
Depth: 11.0-12.5 **Sample Number:** SS-5
Material Description: Gray slightly Clayey Silty fine to medium SAND
Date: 12/22/10 **Natural Moisture:** 25.3
Liquid Limit: NV **Plastic Limit:** NP **USCS Class.:** SM
Tested by: CS **Checked by:** JAM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
131.18	0.00	0.00	#4	0.00	100.0
			#10	0.14	99.9
			#20	5.98	95.4
			#40	39.46	69.9
			#60	83.45	36.4
			#100	94.77	27.8
			#140	96.25	26.6
			#200	97.99	25.3

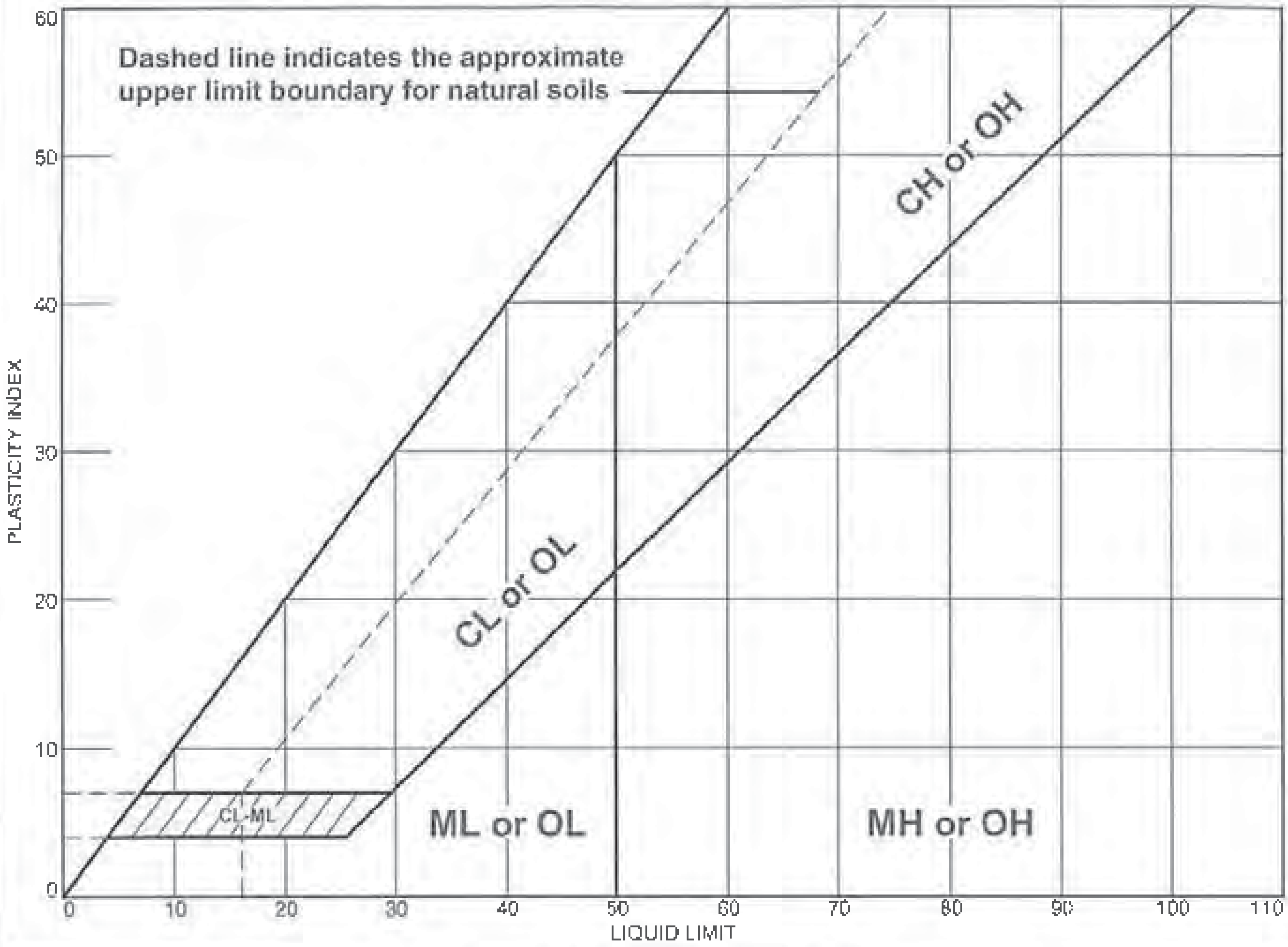
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	30.0	44.6	74.7			25.3

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
			0.2001	0.3168	0.3660	0.5123	0.5764	0.6691	0.8289

Fineness Modulus
1.42

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● Gray slightly Clayey Silty fine to medium SAND	NV	NP	NP	69.9	25.3	SM

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-3 **Depth:** 11.0-12.5 **Sample Number:** SS-5

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Remarks:

Figure

Tested By: CS **Checked By:** IAM

LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

Project Number: 6468100274

Location: Boring B-3

Depth: 11.0-12.5 **Sample Number:** SS-5

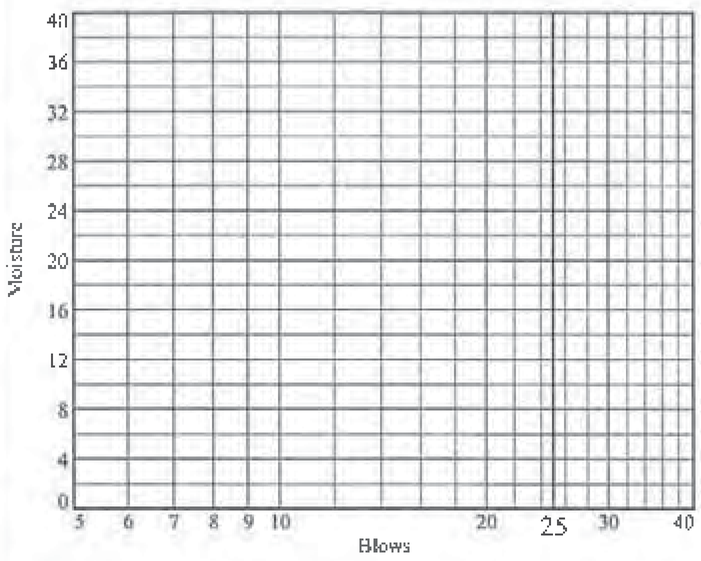
Material Description: Gray slightly Clayey Silty fine to medium SAND

%<#40: 69.9 **%<#200:** 25.3 **USCS:** SM **AASHTO:** A-2-4(0)

Tested by: CS **Checked by:** IAM

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV

Plastic Limit= NP

Plasticity Index= NP

Natural Moisture= 25.3

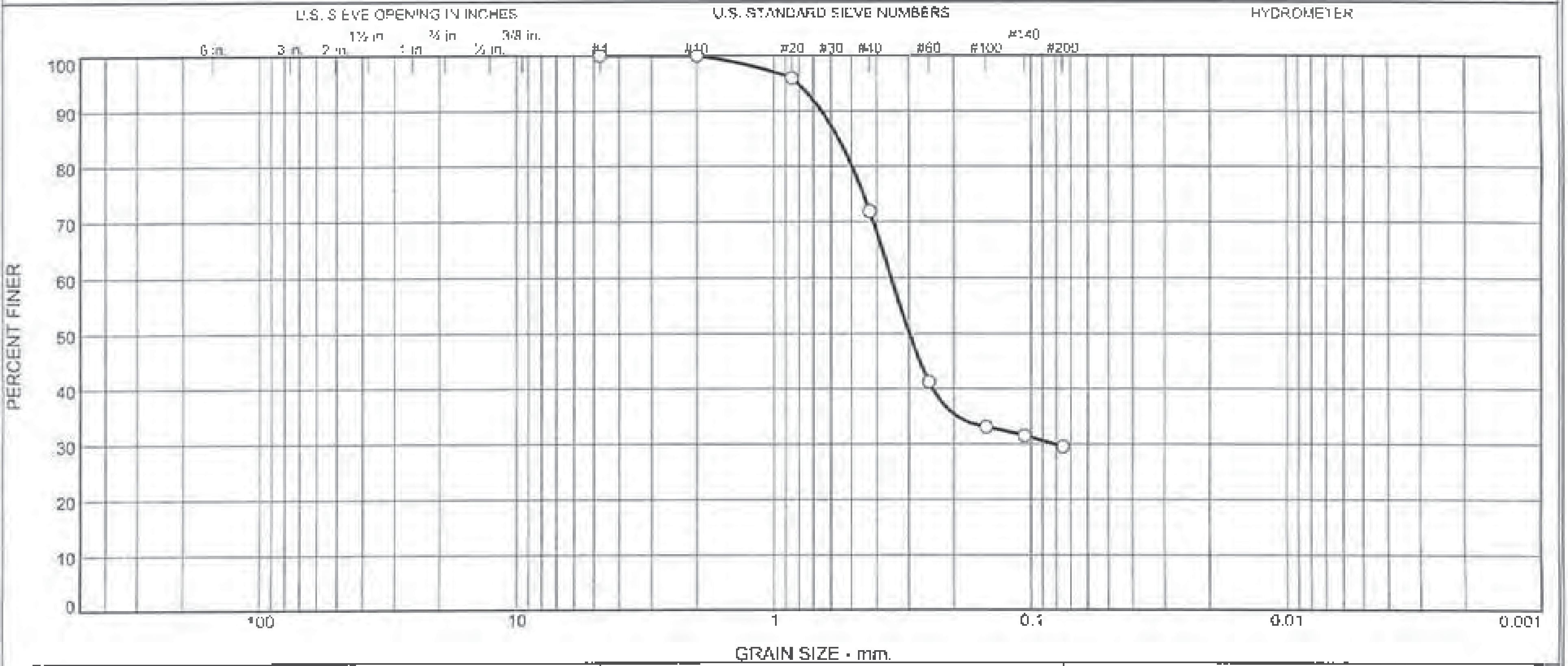
Plastic Limit Data

Run No.	1	2	3	4
Wet+Tare				
Dry+Tare				
Tare				
Moisture				

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
246.89	213.73	82.55	25.3

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	28.1	42.3	29.5	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-3	SS-6	13.5-15.0	12/22/10	SM	Gray Silty fine to medium SAND	28.7	NV	NP

Client Progress Energy
Project Sutton Plant Ash Pond Dike Stability
Project No. 6468100274 Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Tested By: CS **Checked By:** IAM

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GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-3
Depth: 13.5-15.0 **Sample Number:** SS-6
Material Description: Gray Silty fine to medium SAND
Date: 12/22/10 **Natural Moisture:** 28.7
Liquid Limit: NV **Plastic Limit:** NP **USCS Class.:** SM
Tested by: CS **Checked by:** IAM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
121.14	0.00	0.00	#4	0.00	100.0
			#10	0.09	99.9
			#20	4.92	95.9
			#40	34.11	71.8
			#60	71.20	41.2
			#100	81.05	33.1
			#140	82.97	31.5
			#200	85.39	29.5

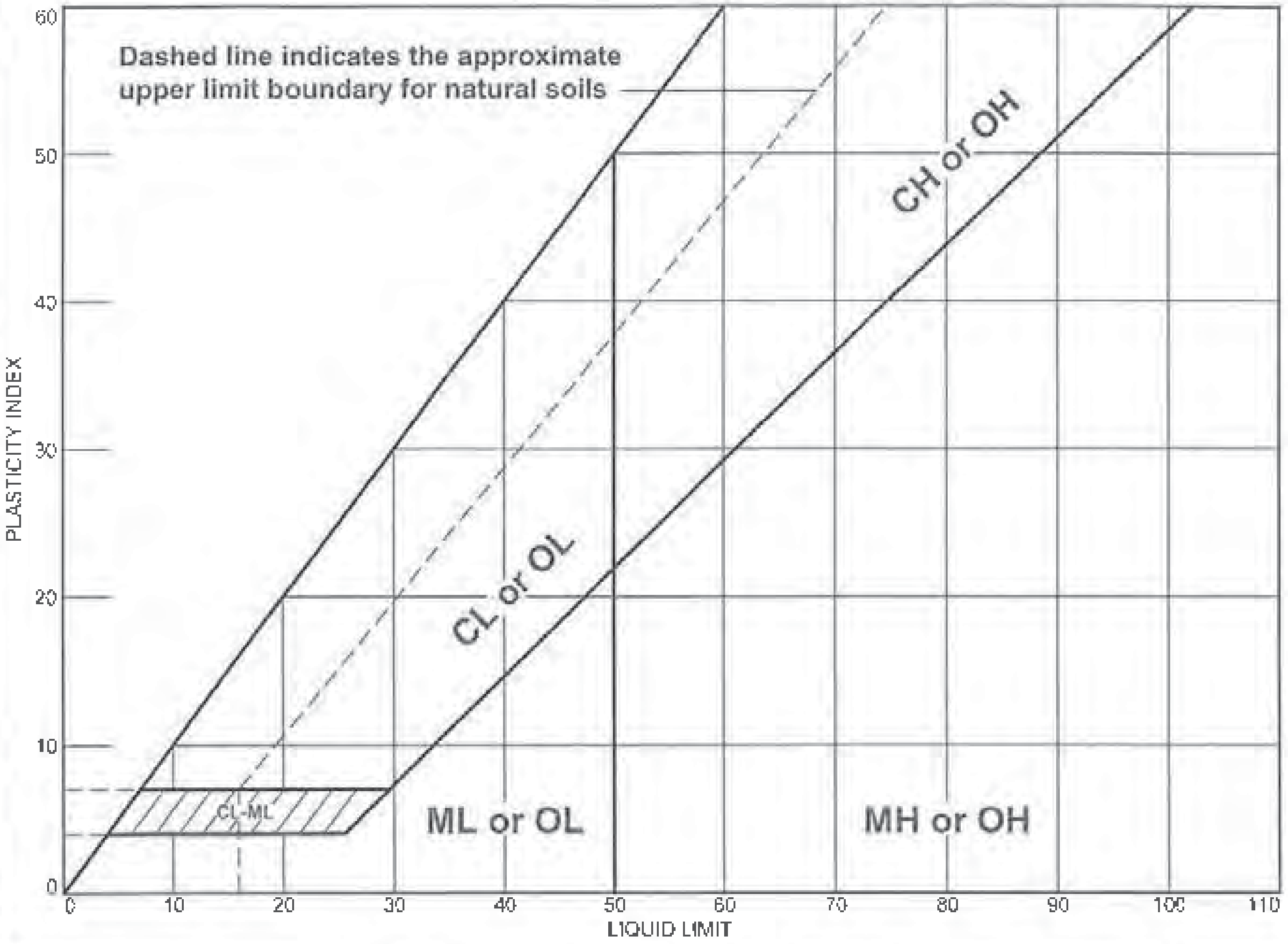
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	28.1	42.3	70.5			29.5

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
			0.0813	0.2982	0.3506	0.4985	0.5621	0.6528	0.8057

Fineness Modulus
1.31

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray Silty fine to medium SAND	NV	NP	NP	71.8	29.5	SM

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-3 **Depth:** 13.5-15.0 **Sample Number:** SS-6

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Figure

Tested By: CS **Checked By:** IAM

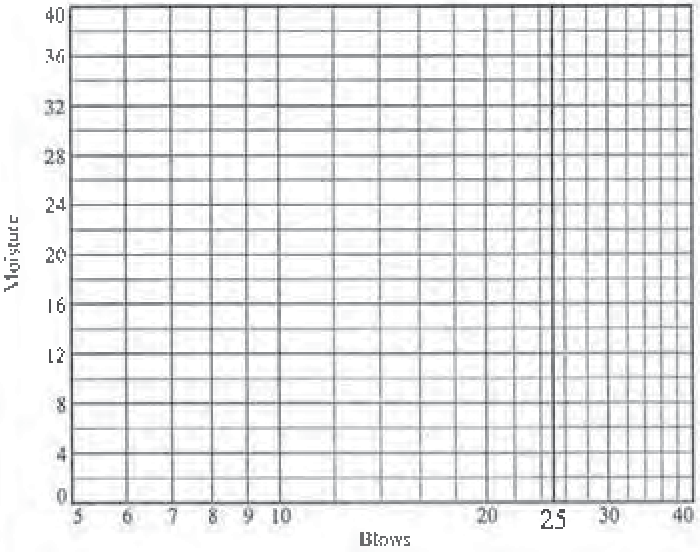
LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-3
Depth: 13.5-15.0 **Sample Number:** SS-6
Material Description: Gray Silty fine to medium SAND
%<#40: 71.8 **%<#200:** 29.5 **USCS:** SM **AASHTO:** A-2-4(0)
Tested by: CS **Checked by:** IAM

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 28.7

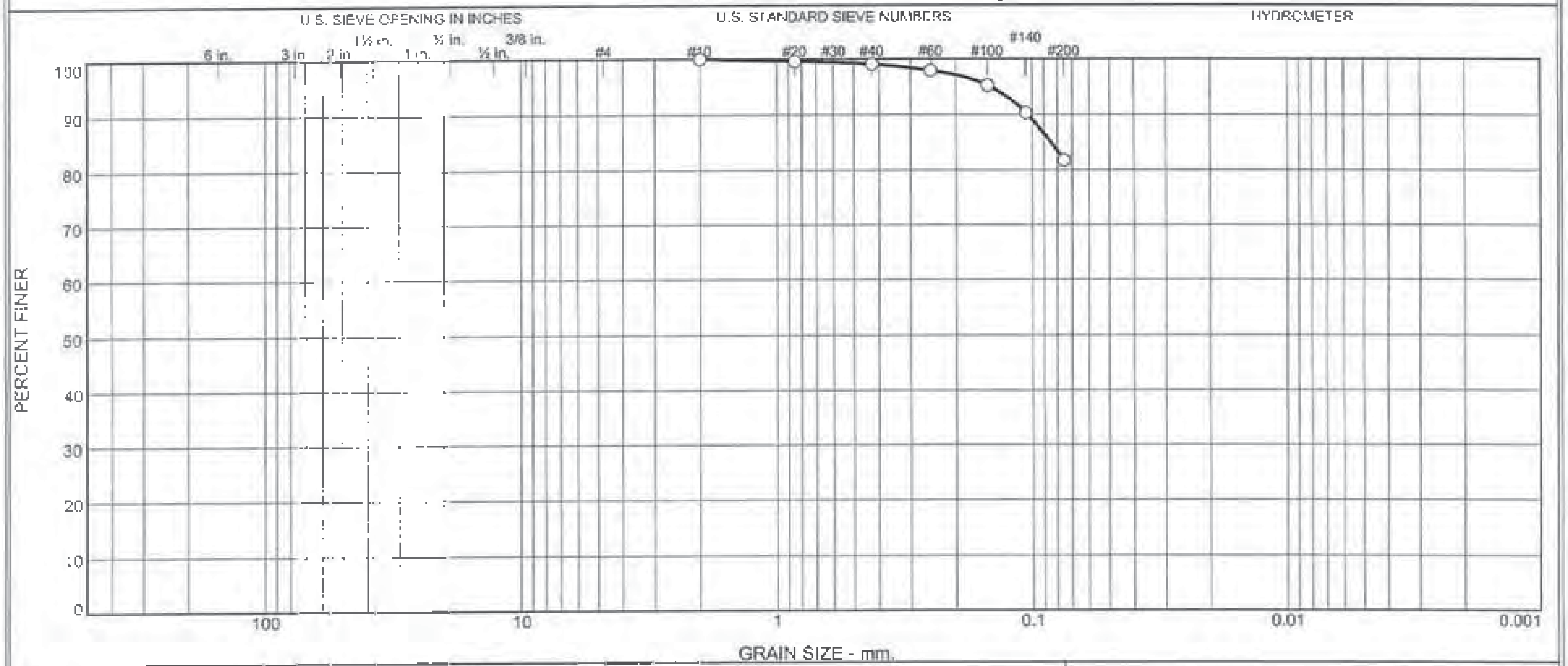
Plastic Limit Data

Run No.	1	2	3	4
Wet+Tare				
Dry+Tare				
Tare				
Moisture				

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
234.01	199.19	78.05	28.7

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.9	17.3	81.8	

	Source	Sample #	Depth/Elev	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-3	SS-8	18.5-20.0	12/22/10	ML	Dark Gray Fine Sandy SILT	62.1	46	40

Client Progress Energy
Project Sutton Plant Ash Pond Dike Stability
Project No. 6468100274 Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Tested By: CS **Checked By:** IAM

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GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-3
Depth: 18.5-20.0 **Sample Number:** SS-8
Material Description: Dark Gray Fine Sandy SILT
Date: 12/22/10 **Natural Moisture:** 62.1
Liquid Limit: 46 **Plastic Limit:** 40 **USCS Class.:** ML
Tested by: CS **Checked by:** IAM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
106.68	0.00	0.00	#10	0.00	100.0
			#20	0.44	99.6
			#40	1.00	99.1
			#60	2.26	97.9
			#100	5.08	95.2
			#140	10.31	90.3
			#200	19.45	81.8

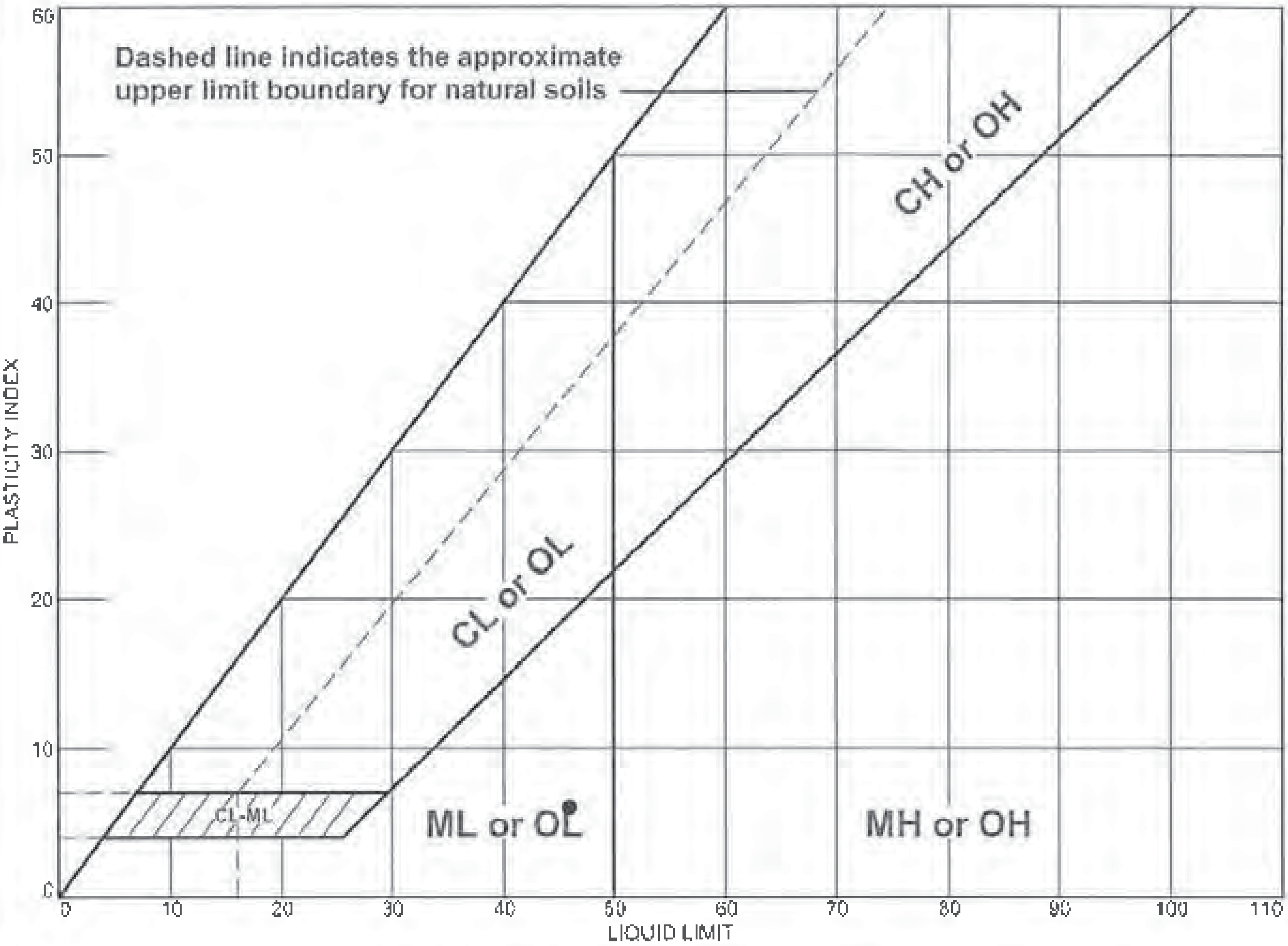
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.9	17.3	18.2			81.8

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
							0.0846	0.1043	0.1463

Fineness Modulus
0.07

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark Gray Fine Sandy SILT	46	40	6	99.1	81.8	ML

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-3 **Depth:** 18.5-20.0 **Sample Number:** SS-8

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Figure

Tested By: CS **Checked By:** IAM

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Oct 30 2019

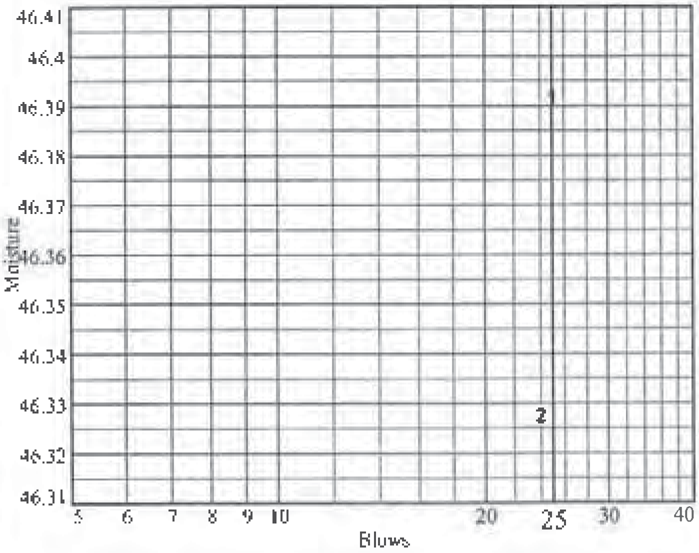
LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-3
Depth: 18.5-20.0 **Sample Number:** SS-8
Material Description: Dark Gray Fine Sandy SILT
%<#40: 99.1 **%<#200:** 81.8 **USCS:** ML **AASHTO:** A-5(8)
Tested by: CS **Checked by:** IAM

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	23.91	25.84				
Dry+Tare	21.21	22.56				
Tare	15.39	15.48				
# Blows	25	24				
Moisture	46.4	46.3				



Liquid Limit= 46
Plastic Limit= 40
Plasticity Index= 6
Natural Moisture= 62.1
Liquidity Index= 3.7

Plastic Limit Data

Run No.	1	2	3	4
Wet+Tare	21.80	22.01		
Dry+Tare	19.99	20.15		
Tare	15.47	15.54		
Moisture	40.0	40.3		

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
257.45	191.25	84.57	62.1

Attachment 3.3

Geosyntec 2014 May through July Laboratory Testing Results

Excel Geotechnical Testing, Inc.
"Excellence in Testing"

953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Test Results Summary

Project Name: Duke Sutton Closure

Project No.: 647

Sample Information		Test Information									Remarks
Site ID	Lab No.	Carbonate Content ASTM D 4373	pH ASTM D 4972 (1)		Bulk Density (Dry Unit Weight) Modified ASTM D 2937			Density		Specific Gravity ASTM D 854	
			Distilled Water	Calcium Chloride	Bulk Unit Weight	Dry Unit Weight	Moisture Content	Minimum	Maximum		
(-)	(-)	(%)	(-)	(-)	(pcf)	(pcf)	(%)	(pcf)	(pcf)	(-)	
SPT-1, S-08 (18.5-19.0')	14E194	0.0	6.1	6.0							
SPT-1, S-9 (19.0-21.0')	14E195	0.0	5.6	5.2							
SPT-1, S-15 (38.5-40.0')	14E202									2.683	
SPT-3, S-13 (24.0-26.0')	14227	0.0	5.0	5.1							
SPT-3, S-17 (32.0-33.0')	14E234									2.343	
SPT-3, S-18 (34.0-36.0')	14E236	0.0	5.4	5.3							
SPT-3, S-23 (45.0-47.0')	14E242	0.0	5.3	5.2							
SPT-4, S-09 (33.5-35.0')	14E252									2.694	
SPT-6, S-09 (33.5-35.0')	14E271									2.693	
SPT-7, S-05 (8.0-10.0')	14E279	0.0	6.5	6.2							
SPT-7, S-06 (10.0-12.0')	14E280									2.354	
SPT-9, S-05 (8.0-10.0')	14E296	0.0	6.4	6.3							
SPT-9, S-06 (10.0-12.0')	14E297				95.3	61.5	54.9			2.268	
SPT-9, S-08 (14.0-16.0')	14E299	0.0	6.0	6.0							
SPT-9, S-09 (16.0-18.0')	14E300	0.0	6.1	6.0							
SPT-10, S-06 (18.5-20.0')	14E306									2.699	
GP-2, S-07 (24.0-28.0')	14E337	0.0	6.1	6.0							
GP-2, S-19 (72.0-75.8')	14E338	0.0	6.0	6.0							
GP-3, S-15 (56.0-60.0')	14E340									2.316	
GP-3, S-20 (76.0-80.0')	14E341	0.0	6.3	6.1						2.31	
GP-3, S-21 (80.0-84.0')	14E342	0.0	6.2	6.1							

Notes:

1 - Method B was used which may not be very accurate.

6-11-14
PD. NSR

Excel Geotechnical Testing, Inc.
"Excellence in Testing"

953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Test Results Summary

Project Name: Duke Sutton Closure

Project No.: 647

Sample Information		Test Information										Remarks
Site ID	Lab No.	Moisture Content ASTM D 2216	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engineering Classification ASTM D 2487	
			Gravel Content	Sand Content	Fines Content	Silt Content	Clay Content	LL	PL	PI		
(-)	(-)	(%)	(%)	(%)	(%)	(%)	(%)	(-)	(-)	(-)	(-)	
SPT-1, S-02 (3.5-5.0')	14E186	10.2			25.3							
SPT-1, S-04 (8.5-9.6')	14E188	15.2			5.7							
SPT-1, S-06 (13.5-15.0')	14E191	21.1			19.0							
SPT-1, S-07 (15.0-17.0')	14E192	39.9	0	57.0	43.0	38.6	4.4					
SPT-1, S-08 (17.0-18.5')	14E193	37.9	0.4	23.1	76.5	72.1	4.4					
SPT-1, S-08 (18.5-19.0')	14E194	28.1			36.7							
SPT-1, S-09 (19.0-21.0')	14E195	58.2			65.7			NP	NP	NP		
SPT-1, S-10 (21.0-23.0')	14E196	52.4			51.5							
SPT-1, S-11 (24.5-25.0')	14E198	37.4			79.5							
SPT-1, S-12 (25.0-27.0')	14E199	20.9	0	96.7	3.3						SP	
SPT-1, S-14 (33.5-35.0')	14E201	23.2			37.6							
SPT-2, S-03 (6.0-7.5')	14E205	5.1			7.6							
SPT-2, S-06 (18.5-20.0')	14E208	15.3			3.5							
SPT-2, S-08 (28.5-30.0')	14E210	22.3	0	97.1	2.9						SP	
SPT-2, S-10 (38.5-40.0')	14E212	77.8						95	45	50		
SPT-2, S-10 (40.0-40.5')	14E213	20.4			6.1							
SPT-3, S-03 (4.0-6.0')	14E217	26.8			52.0							
SPT-3, S-06 (10.0-12.0')	14E220	28.5			50.2							
SPT-3, S-08 (14.0-16.0')	14E222	18.7	9.9	62.4	27.7	24.3	3.4					
SPT-3, S-12 (22.0-24.0')	14E226	45.7			88.2			NP	NP	NP		
SPT-3, S-13 (24.0-26.0')	14E227	55.5			84.7							
SPT-3, S-14 (26.0-27.8')	14E228	46.1										
SPT-3, S-16 (31.0-32.0')	14E233	30.3			92.4							
SPT-3, S-17 (32.0-33.0')	14E234	43.4										
SPT-3, S-17 (33.0-34.0')	14E235	21.0	1.2	82.5	16.3							
SPT-3, S-18 (34.0-36.0')	14E236	51.1	0.2	8.8	91.0	80.5	10.5	NP	NP	NP	ML	
SPT-3, S-19 (36.0-38.0')	14E237	18.9			24.5							
SPT-3, S-20 (39.0-41.0')	14E239	70.1			77.3							
SPT-3, S-21 (41.0-43.0')	14E240	34.6	1.3	64.9	33.8	32.2	1.6					
SPT-3, S-23 (45.0-47.0')	14E242	24.9			44.9							
SPT-3, S-24 (47.0-49.0')	14E243							NP	NP	NP		
SPT-4, S-03 (6.0-7.5')	14E246	12.5			3.2							
SPT-4, S-06 (18.5-20.0')	14E249	19.2	0.4	96.6	3.0	1.6	1.4				SP	
SPT-4, S-07 (23.5-25.0')	14E250	18.4			2.3							
SPT-4, S-09 (33.5-35.0')	14E252	19.9			2.7							
SPT-5, S-03 (6.0-7.5')	14E255	14.0			8.0							

Notes:

6-19-2014
TR, NSR

Excel Geotechnical Testing, Inc.
"Excellence in Testing"

953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Test Results Summary

Project Name: Duke Sutton Closure

Project No.: 647

Sample Information		Test Information										Remarks
Site ID (-)	Lab No. (-)	Moisture Content ASTM D 2216 (%)	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engineering Classification ASTM D 2487 (-)	
			Gravel Content (%)	Sand Content (%)	Fines Content (%)	Silt Content (%)	Clay Content (%)	LL (-)	PL (-)	PI (-)		
SPT-5, S-04 (8.5-10.0')	14E256	13.3	0	97.4	2.6							
SPT-5, S-06 (18.5-20.0')	14E258	16.8	0.9	97.4	1.7	1.1	0.6				SP	
SPT-5, S-08 (28.5-30.0')	14E260	21.7			4.1							
SPT-6, S-06 (18.5-20.0')	14E268	18.4			3.9							
SPT-6, S-08 (28.5-30.0')	14E270	20.7	0.1	97.1	2.8	2.2	0.6				SP	
SPT-6, S-11 (43.5-45.0)	14E273	21.1			4.7							
SPT-7, S-02 (2.0-4.0')	14E276	31.1										
SPT-7, S-04 (6.0-8.0')	14E278	52.9						NP	NP	NP		
SPT-7, S-05 (8.0-10.0')	14E279	41.9	0	9.5	90.5							
SPT-7, S-06 (10.0-12.0')	14E280	37.5			81.2							
SPT-8, S-02 (3.5-5.0')	14E282	10.2			4.4							
SPT-8, S-06 (18.5-20.0')	14E286	16.8	0	94.6	5.4	3.1	2.3					
SPT-8, S-07 (23.5-25.0')	14E287	22.0	0.3	96.3	3.4	2.5	0.9				SP	
SPT-8, S-10 (38.5-40.0')	14E290	21.2			3.3							
SPT-9, S-02 (2.0-4.0')	14E293	73.7										
SPT-9, S-04 (6.0-8.0')	14E295							NP	NP	NP		
SPT-9, S-05 (8.0-10.0')	14E296	48.3			97.0							
SPT-9, S-06 (10.0-12.0')	14E297	54.7	0	6.0	94.0	88.0	6.0	NP	NP	NP	ML	
SPT-9, S-07 (12.0-14.0')	14E298	47.8			92.8							
SPT-9, S-08 (14.0-16.0')	14E299	45.8						NP	NP	NP		
SPT-10, S-03 (6.0-7.5')	14E303	24.6			2.8							
SPT-10, S-04 (8.5-10.0')	14E304	23.0			1.9							
SPT-10, S-05 (13.5-15.0')	14E305	23.2			2.6							
SPT-10, S-06 (18.5-20.0')	14E306	20.4	0.3	97.6	2.1						SP	
SPT-10, S-08 (28.5-29.4')	14E308	29.4						26	24	2		
SPT-10, S-09 (33.5-35.0')	14E310	19.6			3.9							
SPT-11, S-03 (6.0-7.5')	14E314	19.1			4.4							
SPT-11, S-04 (8.5-10.0')	14E315	14.5	0	97.6	2.4						SP	
SPT-11, S-06 (18.5-20.0')	14E317	23.7	0	97.8	2.2						SP	
SPT-11, S-09 (33.5-35.0')	14E320	20.2			2.4							
SPT-11, S-10 (38.5-40.0')	14E321	22.9	0.2	97.8	2.0	1.1	0.9				SP	
SPT-11, S-11 (43.5-45.0')	14E322	20.3			3.9							
GP-1, S-05 (16.0-20.0')	14E335	60.1										
GP-1, S-10 (36.0-40.0')	14E336	20.6			1.0							
GP-2, S-07 (24.0-28.0')	14E337	51.3										
GP-2, S-19 (72.0-75.8')	14E338							32	26	6		

Notes:

6-19-2014
TR, NSR

Excel Geotechnical Testing, Inc.
"Excellence in Testing"

953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Test Results Summary

Project Name: Duke Sutton Closure

Project No.: 647

Sample Information		Test Information										
Site ID	Lab No.	Moisture Content ASTM D 2216	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engineering Classification ASTM D 2487	Remarks
			Gravel Content	Sand Content	Fines Content	Silt Content	Clay Content	LL	PL	PI		
(-)	(-)	(%)	(%)	(%)	(%)	(%)	(%)	(-)	(-)	(-)	(-)	
GP-3, S-15 (56.0-60.0')	14E340							NP	NP	NP		
GP-3, S-20 (76.0-80.0')	14E341	41.1						NP	NP	NP		
GP-3, S-21 (80.0-84.0')	14E342							NP	NP	NP		
GP-4, S-06 (20.0-24.0')	14E343	19.9										
GP-5, S-04 (14.0-16.0')	14E345	106.9						152	57	95		

Notes:

6-19-2014
TR, NSR

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Test Results Summary

Project Name: Duke Sutton Closure

Project No.: 647

Sample Information		Test Information										
Site ID	Lab No.	Moisture Content ASTM D 2216	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engineering Classification ASTM D 2487	Remarks
			Gravel Content	Sand Content	Fines Content	Silt Content	Clay Content	LL	PL	PI		
(-)	(-)	(%)	(%)	(%)	(%)	(%)	(%)	(-)	(-)	(-)	(-)	
GP-13, S-17 (64-68')	14G002							NP	NP	NP		
GP-13, S-18 (68-72)	14G003							NP	NP	NP		
GP-14, S-18 (68-72')	14G004							NP	NP	NP		
GP-14, S-19 (74.5-75.5')	14G005							NP	NP	NP		
GP-15, S-16 (60-64')	14G006							NP	NP	NP		
GP-17, S-11 (43.3-44')	14G007							85	40	45		
GP-17, S-12 (44-45.7')	14G008							126	60	66		
GP-17, S-12 (45.7-46.7')	14G009							67	31	36		
GP-17, S-13 (48-52')	14G010							50	24	26		
GP-17, S-14 (52-56')	14G011		0.1	58.8	41.1	24.7	16.4	NP	NP	NP	SM	
GP-17, S-15 (56-60')	14G012		0	44.4	55.6	33.8	21.8	26	22	4	CL-ML	
MB-2, S-14 (64-68')	14G013							NP	NP	NP		
MB-2, S-17 (76-80')	14G014							NP	NP	NP		

Notes:

7/17/14
AK, NSR

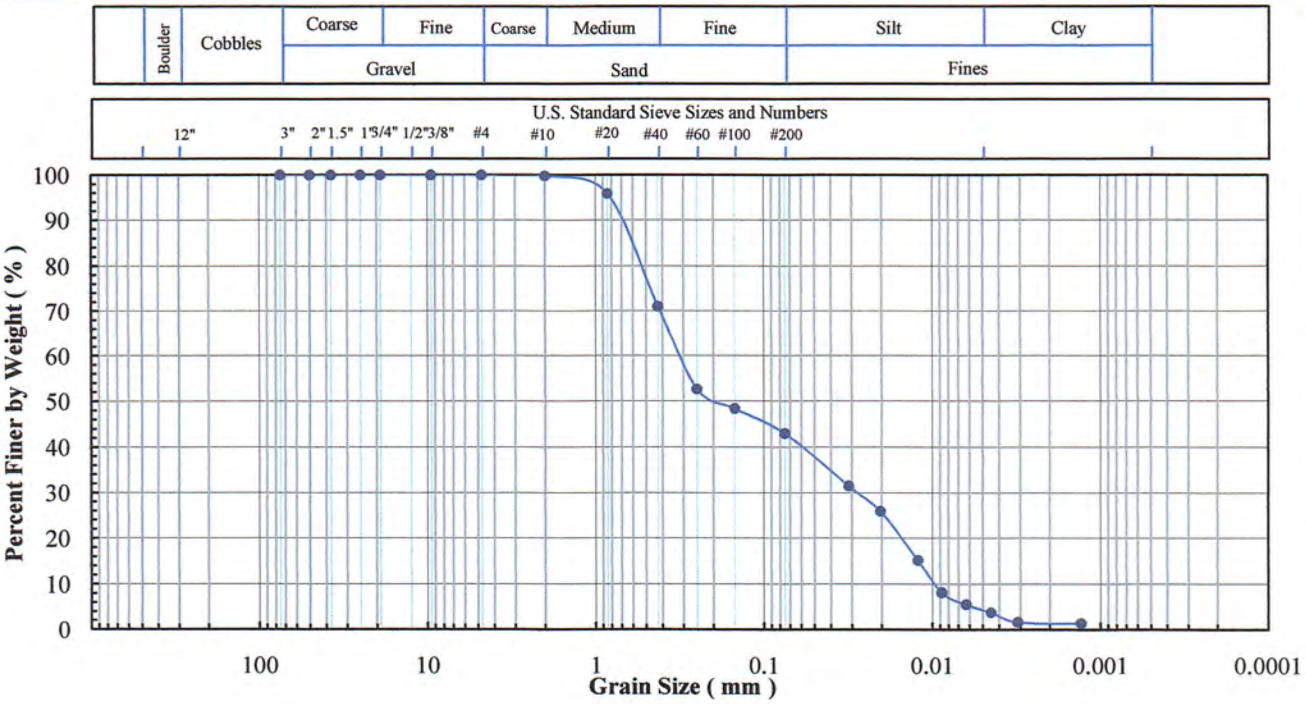
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Duke Sutton Closure
Project No:	647
Client Sample ID:	SPT-1, S-07 (15.0-17.0')
Lab Sample No:	14E192

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



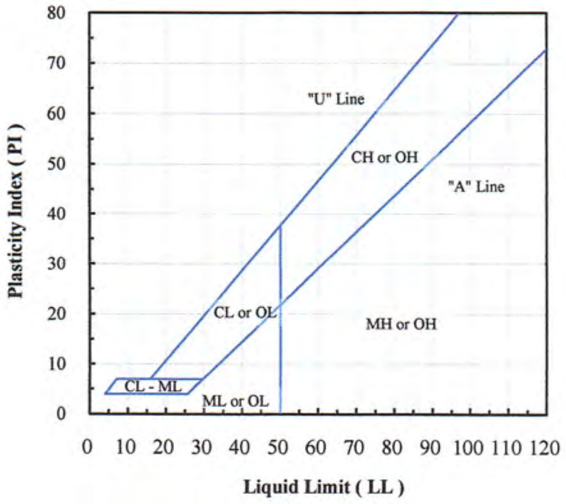
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	99.9
#20	0.850	95.9
#40	0.425	71.0
#60	0.250	52.7
#100	0.150	48.4
#200	0.075	43.0

Specific Gravity (-):	2.70

Hydrometer Particle Diameter (mm)	% Finer
0.0315	31.5
0.0122	15.2
0.0063	5.6
0.0031	1.7
0.0013	1.4

Gravel (%):	
Sand (%):	57.0
Fines (%):	43.0
Silt (%):	38.6
Clay (%):	4.4

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-1, S-07 (15.0-17.0')	14E192	39.9	43.0				

Note(s): An assumed specific gravity of 2.7 was used when analyzing the hydrometer test results.
The test material appears to be mainly soil with minimal amount of ash.

6-6-14
PP, NSR

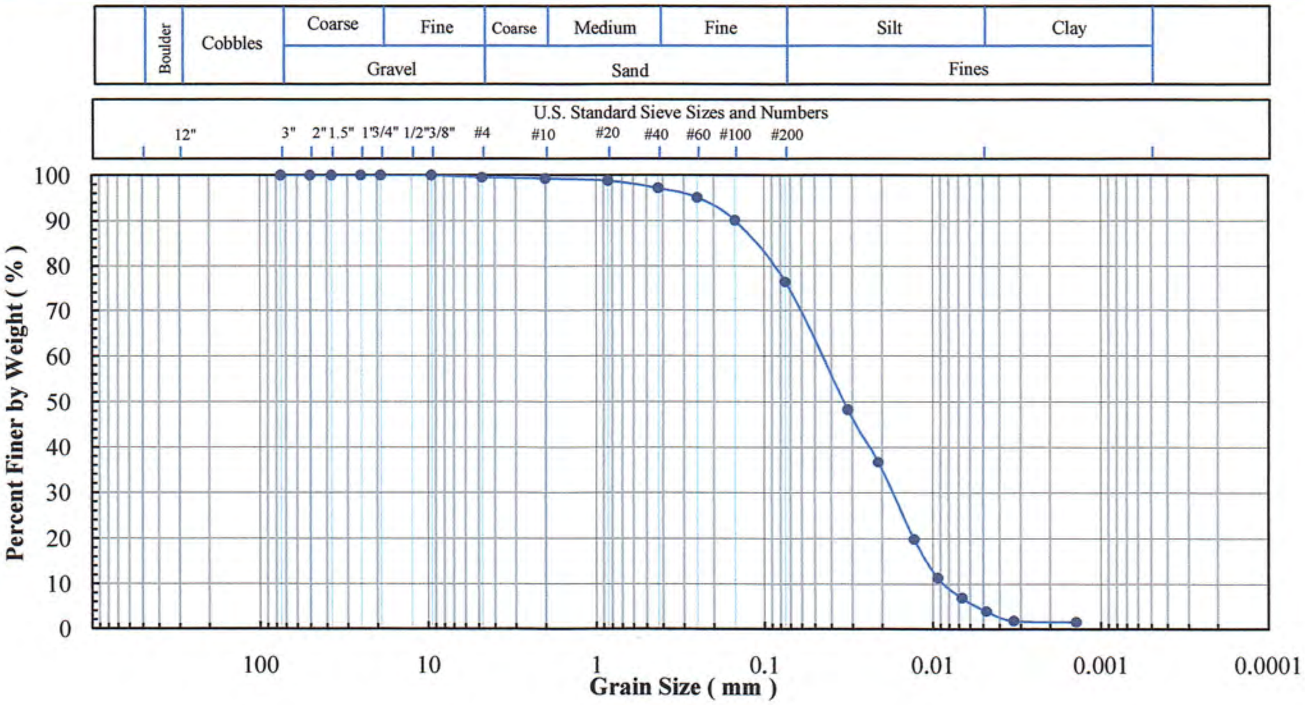
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Duke Sutton Closure
Project No:	647
Client Sample ID:	SPT-1, S-08 (17.0-18.5')
Lab Sample No:	14E193

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



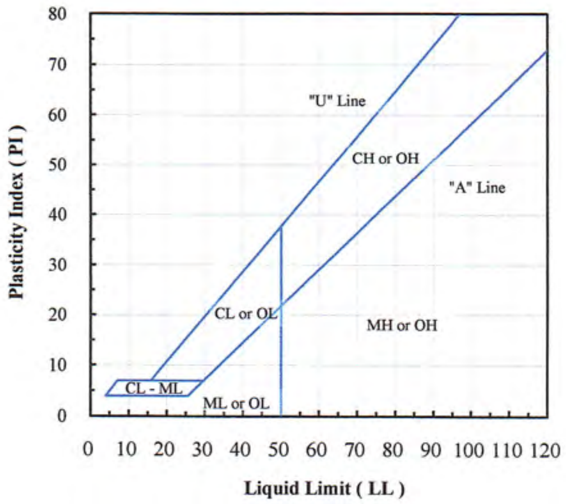
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.6
#10	2.00	99.3
#20	0.850	98.8
#40	0.425	97.2
#60	0.250	95.2
#100	0.150	90.1
#200	0.075	76.5

Specific Gravity (-):	2.50

Hydrometer Particle Diameter (mm)	% Finer
0.0320	48.3
0.0129	20.0
0.0067	7.0
0.0033	1.9
0.0014	1.6

Gravel (%):	0.4
Sand (%):	23.1
Fines (%):	76.5
Silt (%):	72.1
Clay (%):	4.4

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-1, S-08 (17.0-18.5')	14E193	37.9	76.5				

Note(s): An assumed specific gravity of 2.5 was used when analyzing the hydrometer test results.
The test material appears to be a mixture of soil and ash.

6-6-14
PD, NSR

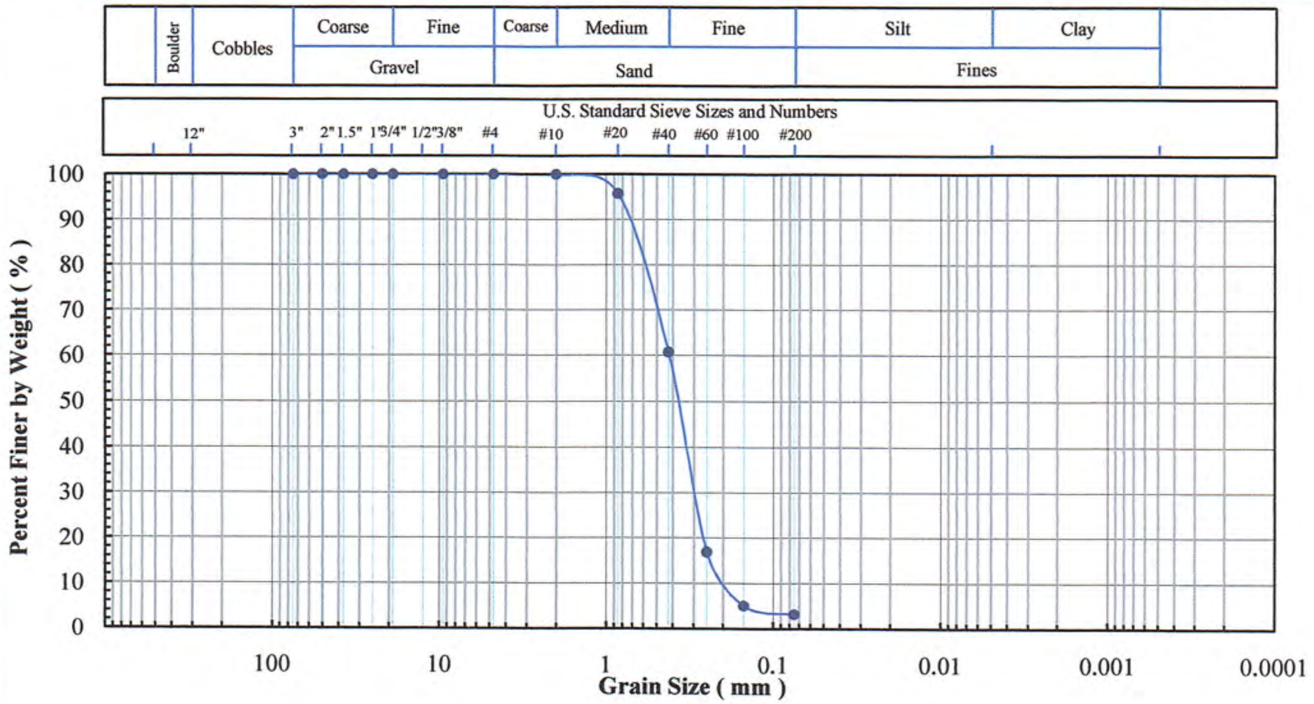
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Duke Sutton Closure
Project No:	647
Client Sample ID:	SPT-1, S-12 (25.0-27.0')
Lab Sample No:	14E199

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



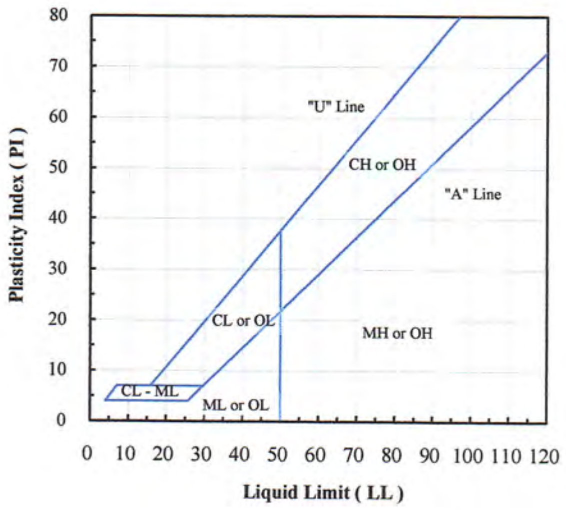
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	95.7
#40	0.425	60.7
#60	0.250	16.9
#100	0.150	5.2
#200	0.075	3.3

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	96.7
Fines (%):	3.3
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	2.0
Coeff. Curv. (Cc):	1.0



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-1, S-12 (25.0-27.0')	14E199	20.9	3.3				SP - Poorly graded sand

Note(s):

6-5-14
PD, NSR

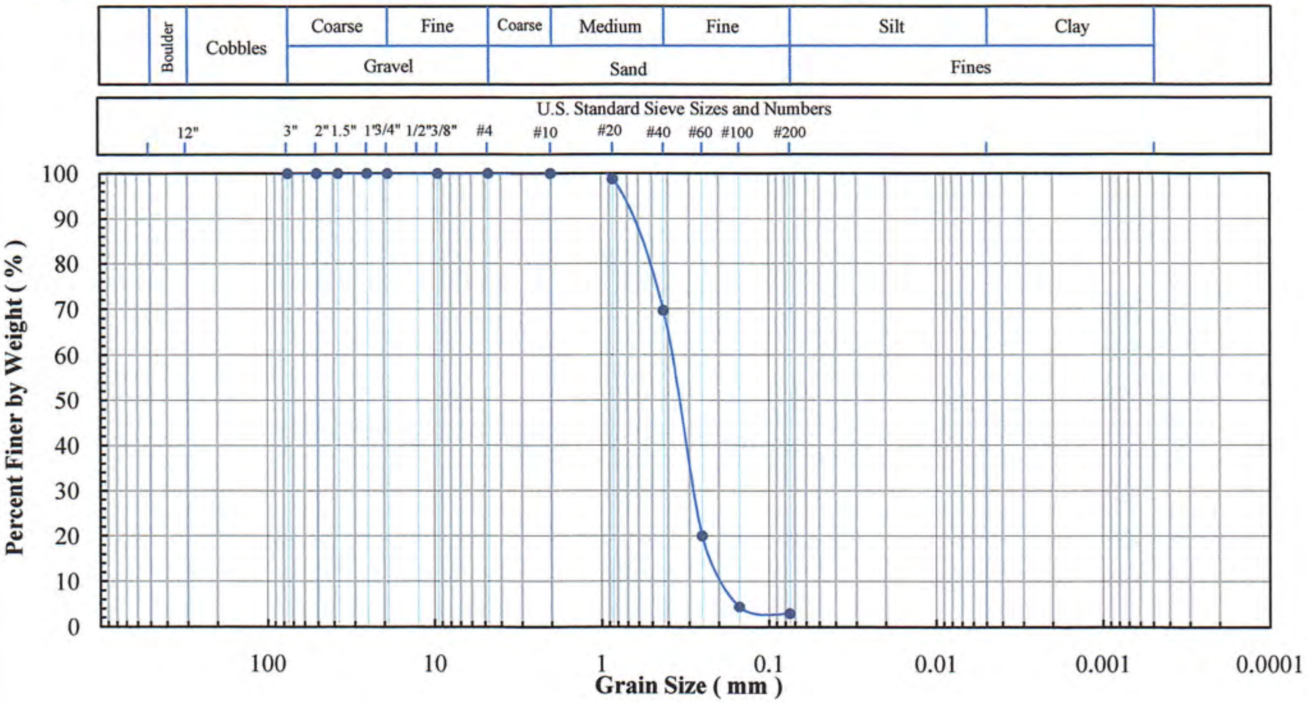
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Duke Sutton Closure
Project No:	647
Client Sample ID:	SPT-2, S-08 (28.5-30.0')
Lab Sample No:	14E210

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



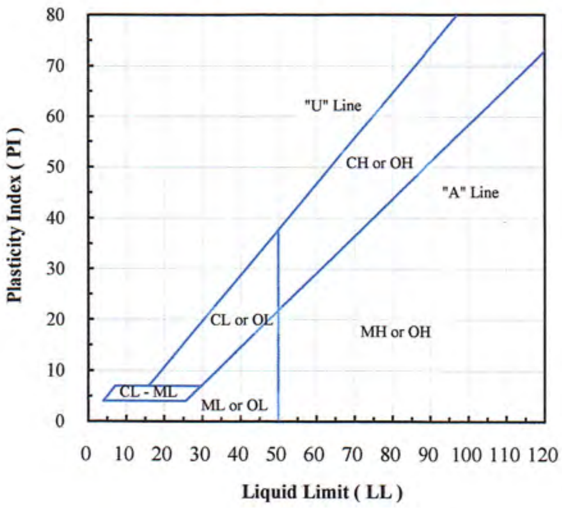
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	98.7
#40	0.425	69.7
#60	0.250	20.0
#100	0.150	4.5
#200	0.075	2.9

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	97.1
Fines (%):	2.9
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	2.0
Coeff. Curv. (Cc):	1.1



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-2, S-08 (28.5-30.0')	14E210	22.3	2.9				SP - Poorly graded sand

Note(s):

6-5-14
PD, NSR

Excel Geotechnical Testing, Inc.
"Excellence in Testing"

953 Forrest Street, Roswell, Georgia 30075
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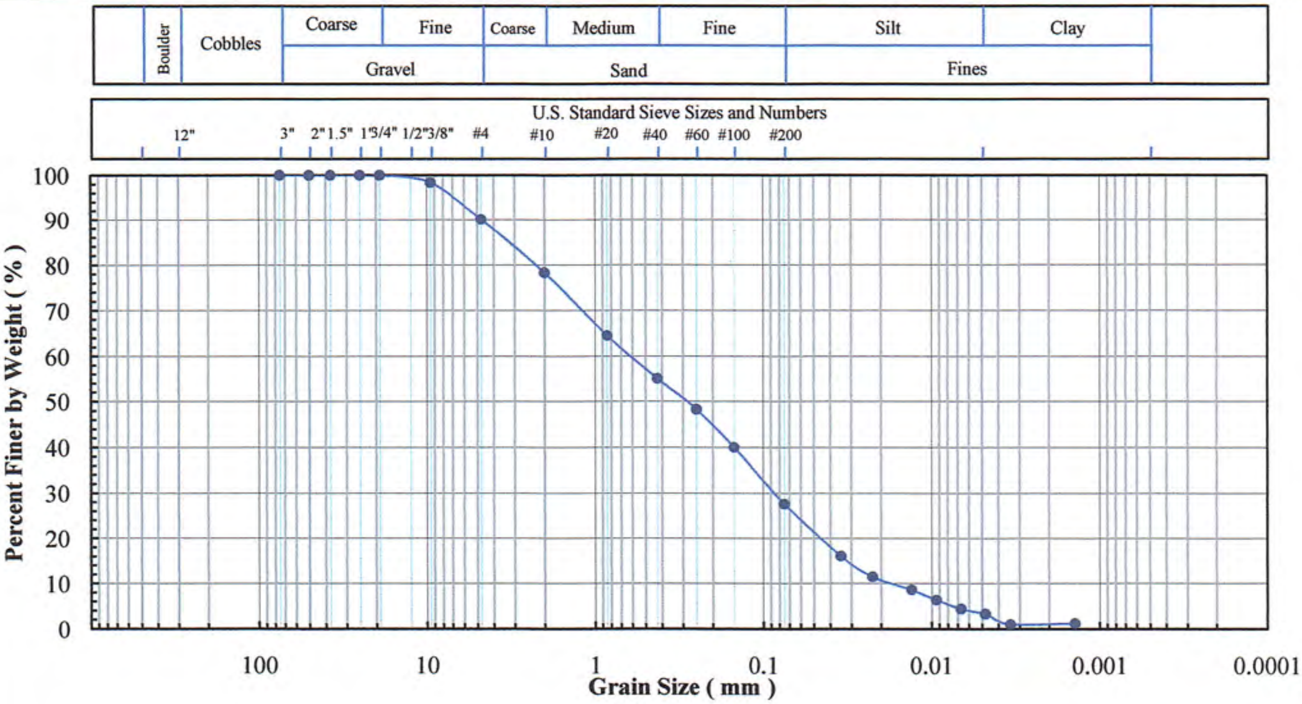
Project Name:	Duke Sutton Closure
Project No:	647
Client Sample ID:	SPT-3, S-08 (14.0-16.0')
Lab Sample No:	14E222

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



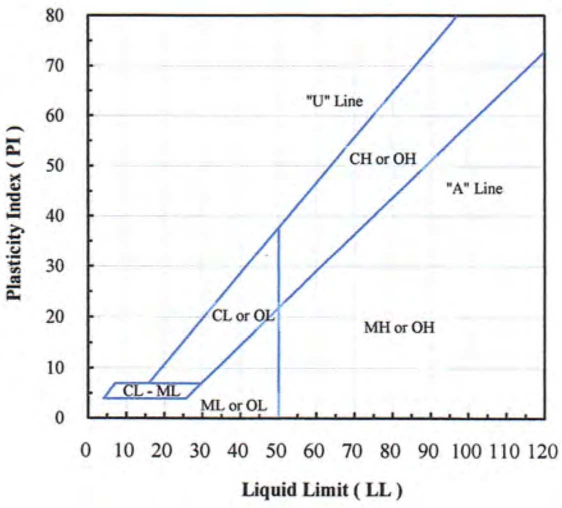
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	98.4
#4	4.75	90.1
#10	2.00	78.3
#20	0.850	64.6
#40	0.425	55.1
#60	0.250	48.3
#100	0.150	40.1
#200	0.075	27.7

Specific Gravity (-):	2.50

Hydrometer Particle Diameter (mm)	% Finer
0.0346	16.1
0.0132	8.6
0.0067	4.4
0.0034	1.1
0.0014	1.3

Gravel (%):	9.9
Sand (%):	62.4
Fines (%):	27.7
Silt (%):	24.3
Clay (%):	3.4

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-3, S-08 (14.0-16.0')	14E222	18.7	27.7				

Note(s): An assumed specific gravity of 2.5 was used when analyzing the hydrometer test results.
The test material appears to be a mixture of soil and ash.

6-6-14
PD, NSR

Excel Geotechnical Testing, Inc.
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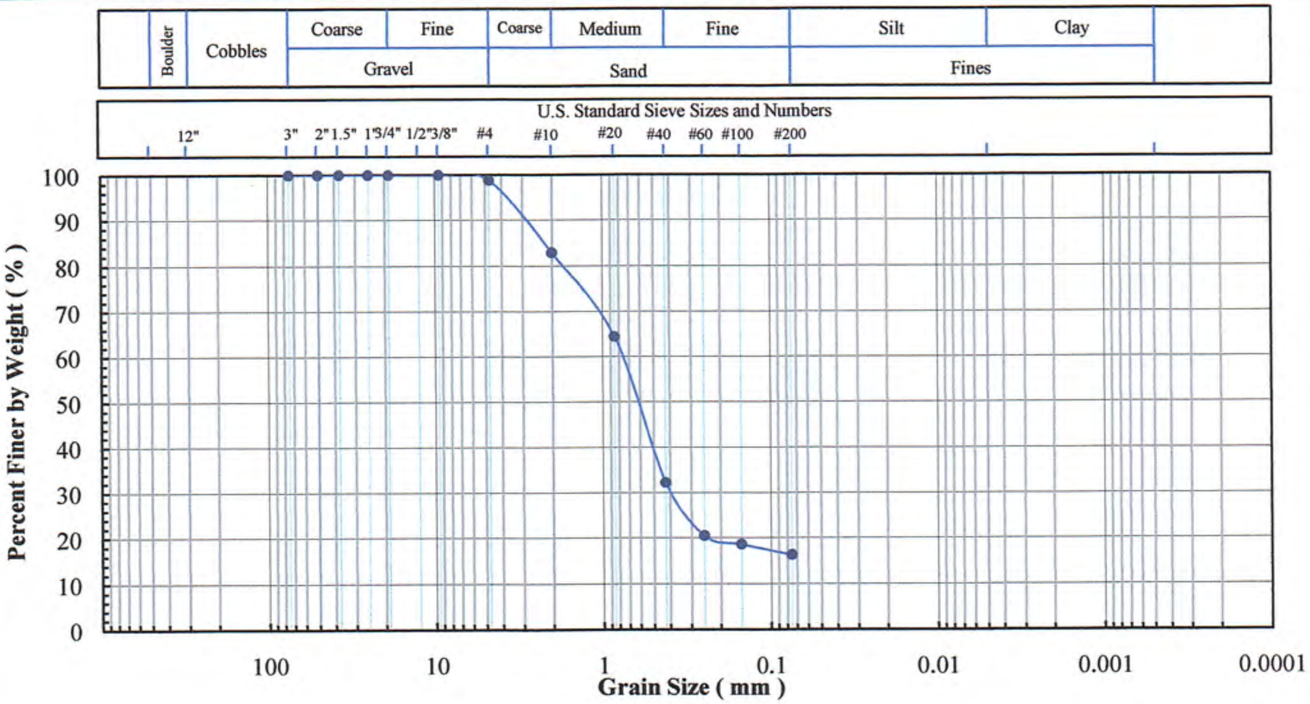
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-3, S-17 (33.0-34.0')
Lab Sample No: 14E235

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



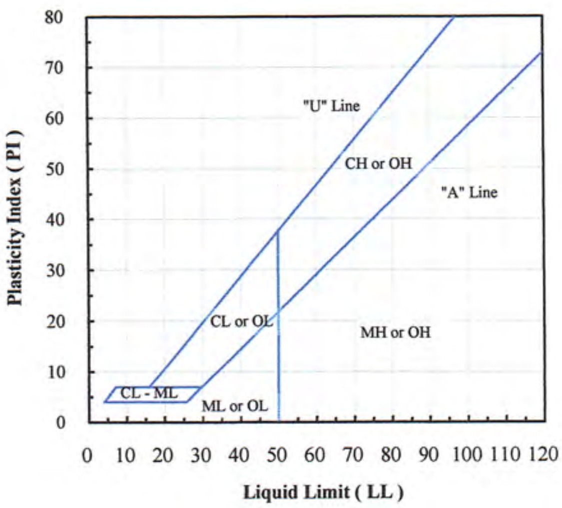
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	98.8
#10	2.00	82.9
#20	0.850	64.5
#40	0.425	32.3
#60	0.250	20.5
#100	0.150	18.6
#200	0.075	16.3

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	1.2
Sand (%):	82.5
Fines (%):	16.3
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Ce):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-3, S-17 (33.0-34.0')	14E235	21.0	16.3				

Note(s):

6-5-14
PD, NSR

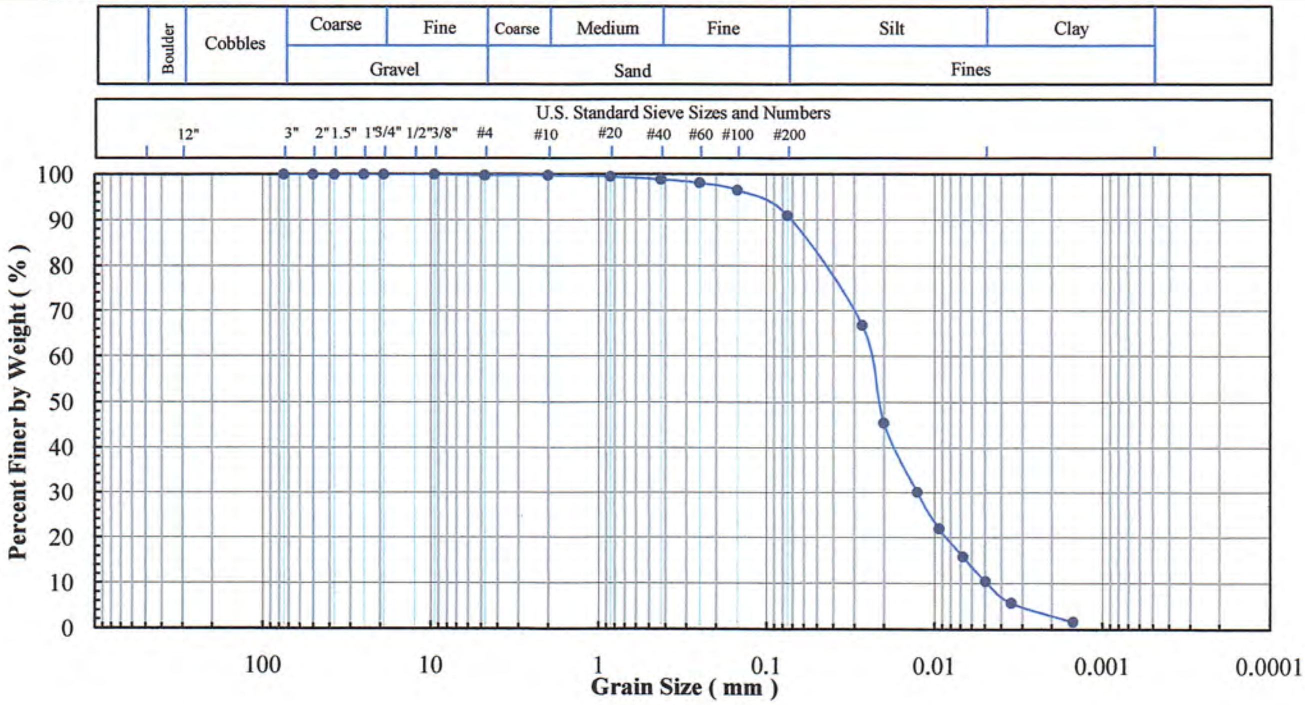
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-3, S-18 (34.0-36.0')
Lab Sample No: 14E236

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



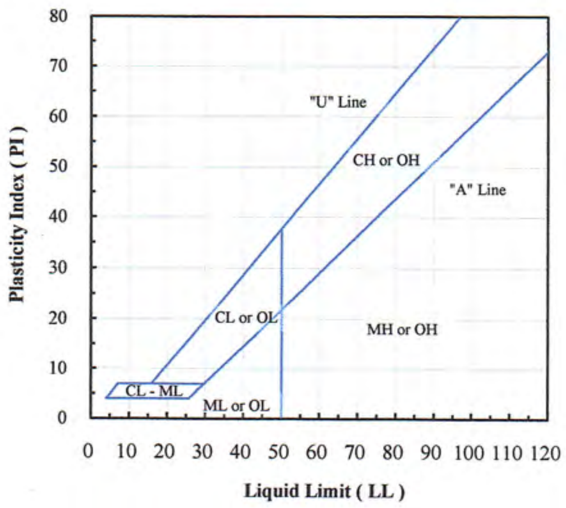
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.8
#10	2.00	99.8
#20	0.850	99.5
#40	0.425	98.9
#60	0.250	98.1
#100	0.150	96.5
#200	0.075	91.0

Specific Gravity (-):	2.30

Hydrometer Particle Diameter (mm)	% Finer
0.0270	66.8
0.0127	30.1
0.0068	16.0
0.0035	5.8
0.0015	1.7

Gravel (%):	0.2
Sand (%):	8.8
Fines (%):	91.0
Silt (%):	80.5
Clay (%):	10.5

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits LL (-)	PL (-)	PI (-)	Engineering Classification
SPT-3, S-18 (34.0-36.0')	14E236	51.1	91.0	NP	NP	NP	ML - Silt

Note(s): An assumed specific gravity of 2.3 was used when analyzing the hydrometer test results.

6-6-14
PD, NSR

Excel Geotechnical Testing, Inc.
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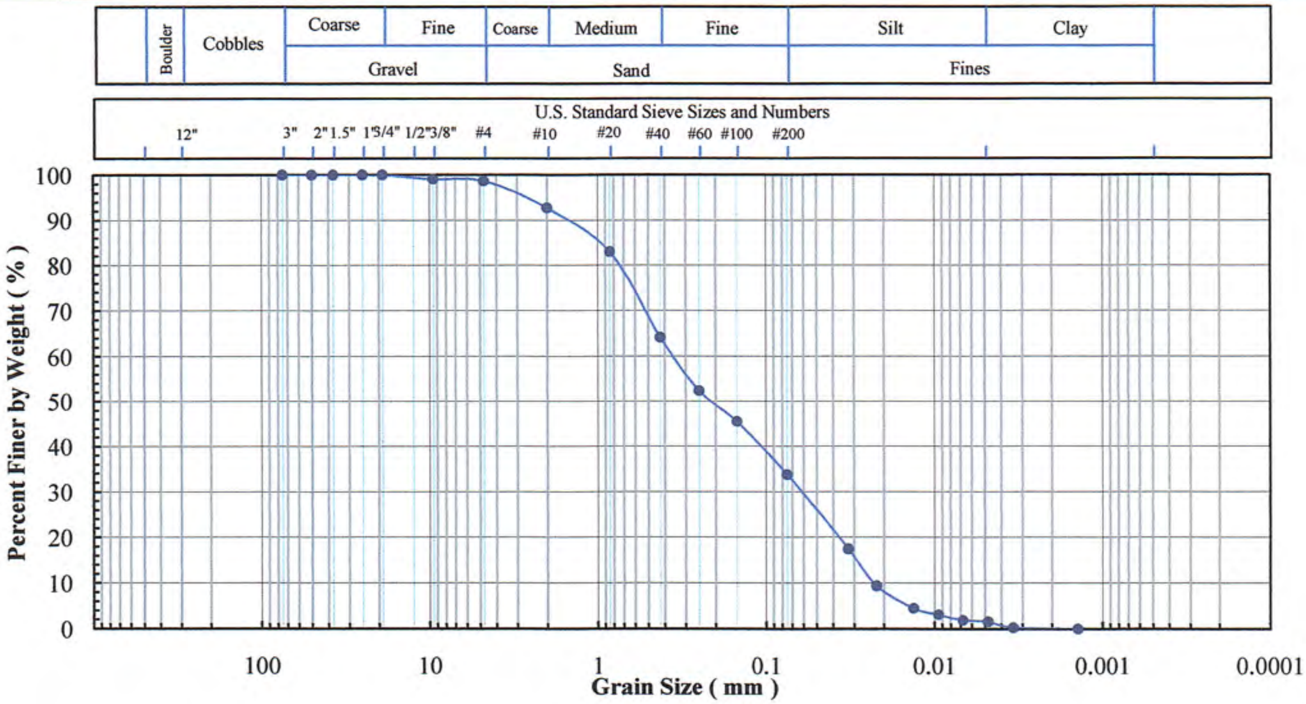
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-3, S-21 (41.0-43.0')
Lab Sample No: 14E240

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



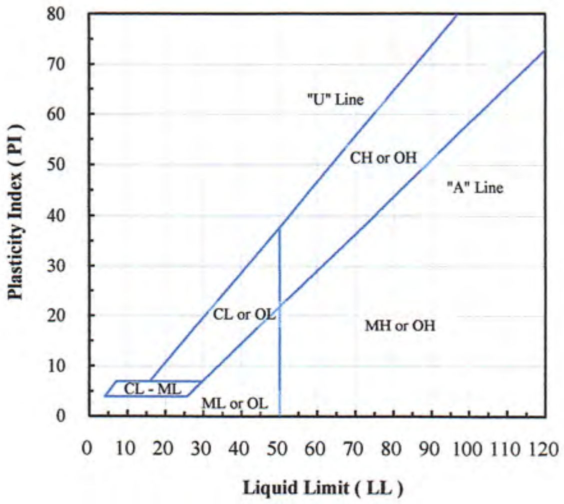
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	99.1
#4	4.75	98.7
#10	2.00	92.8
#20	0.850	83.0
#40	0.425	64.2
#60	0.250	52.4
#100	0.150	45.5
#200	0.075	33.8

Specific Gravity (-):	2.50

Hydrometer Particle Diameter (mm)	% Finer
0.0326	17.5
0.0133	4.6
0.0068	2.0
0.0034	0.4
0.0014	0.1

Gravel (%):	1.3
Sand (%):	64.9
Fines (%):	33.8
Silt (%):	32.2
Clay (%):	1.6

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-3, S-21 (41.0-43.0')	14E240	34.6	33.8				

Note(s): An assumed specific gravity of 2.5 was used when analyzing the hydrometer test results.
The test material appears to be a mixture of soil and ash.

6-6-14
PP, NSR

Excel Geotechnical Testing, Inc.
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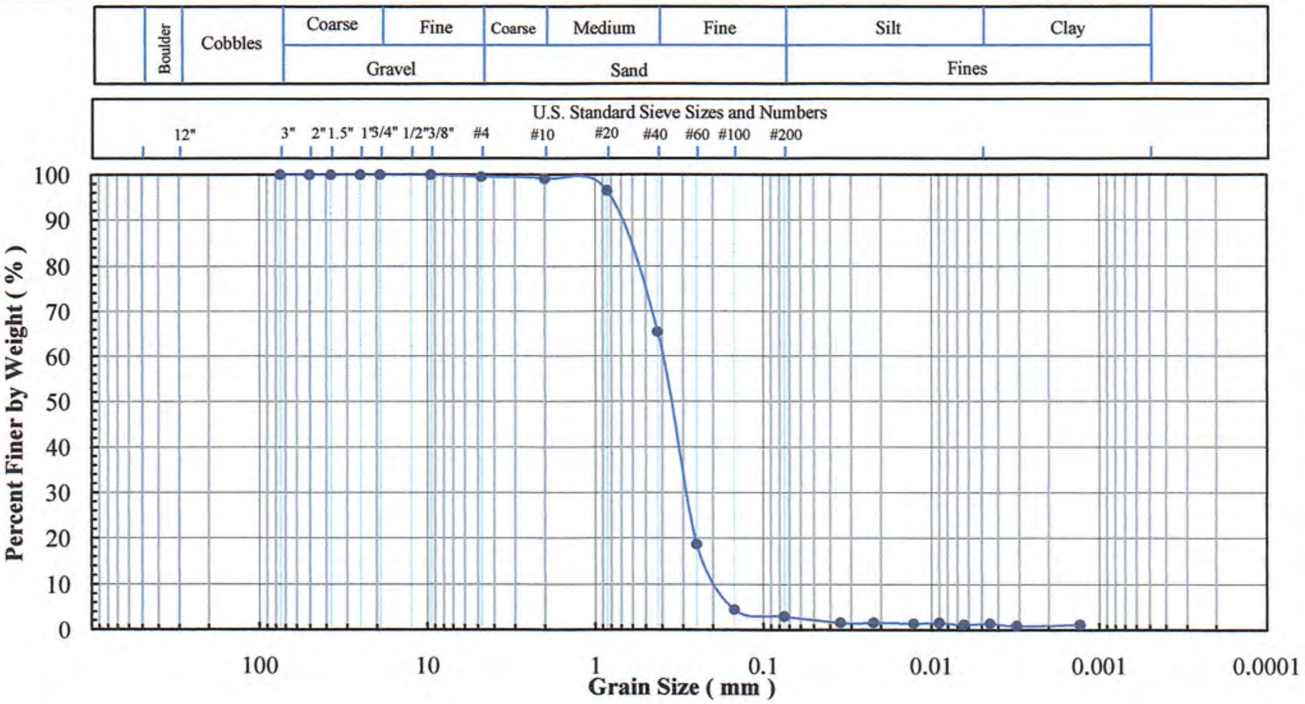
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-4, S-06 (18.5-20.0')
Lab Sample No: 14E249

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont, Eng. Classification, Atterberg Limits



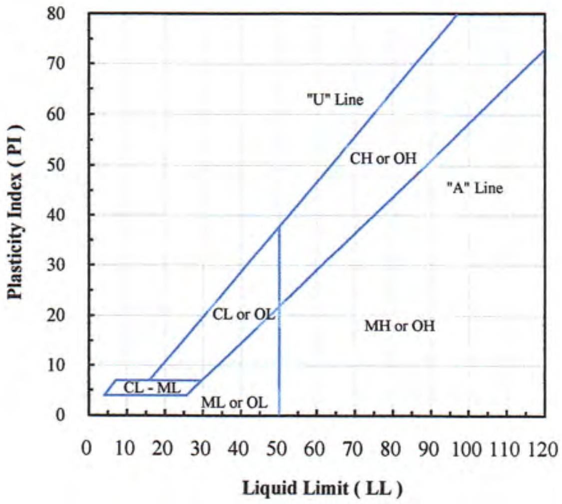
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.6
#10	2.00	99.2
#20	0.850	96.5
#40	0.425	65.5
#60	0.250	18.8
#100	0.150	4.6
#200	0.075	3.0

Specific Gravity (-):	2.70

Hydrometer Particle Diameter (mm)	% Finer
0.0350	1.6
0.0128	1.5
0.0064	1.2
0.0031	0.9
0.0013	1.2

Gravel (%):	0.4
Sand (%):	96.6
Fines (%):	3.0
Silt (%):	1.6
Clay (%):	1.4

Coeff. Unif. (Cu):	2.0
Coeff. Curv. (Cc):	1.1



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-4, S-06 (18.5-20.0')	14E249	19.2	3.0				SP - Poorly graded sand

Note(s): An assumed specific gravity of 2.7 was used when analyzing the hydrometer test results.

6-6-14
PD, NSR

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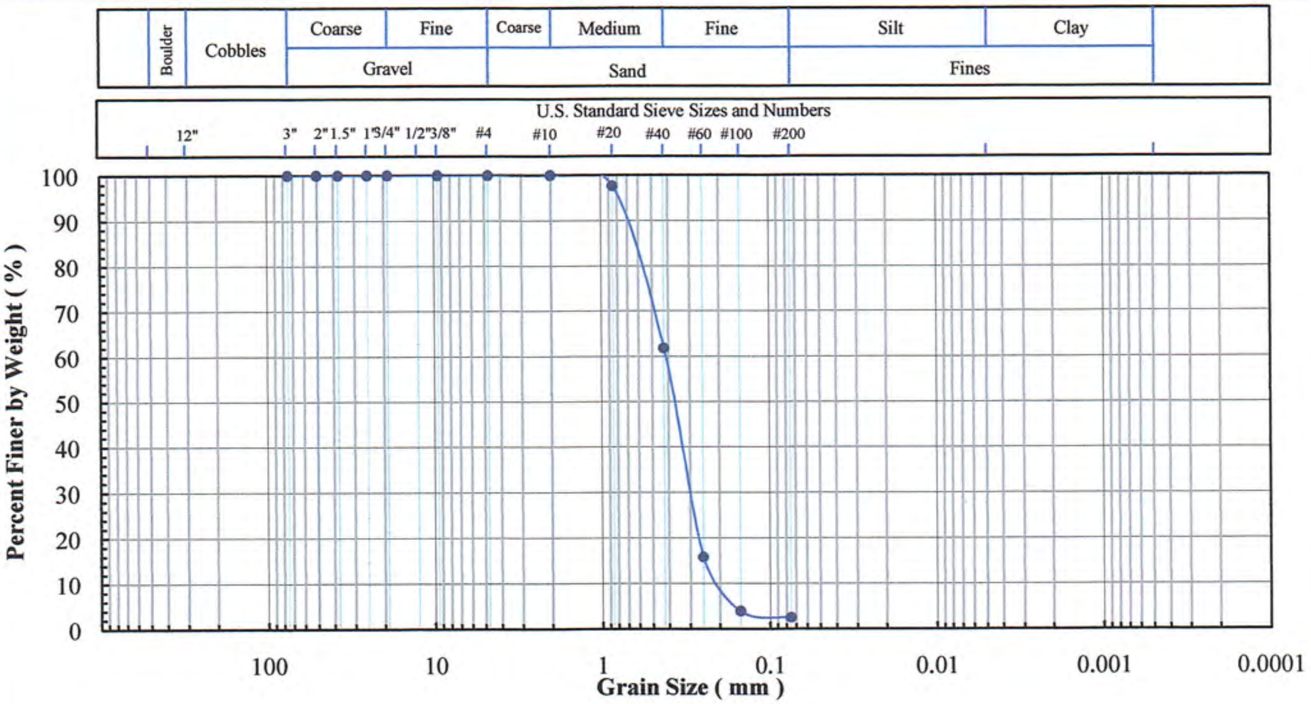
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Duke Sutton Closure
Project No:	647
Client Sample ID:	SPT-5, S-04 (8.5-10.0')
Lab Sample No:	14E256

ASTM C 136, D 422, D 854, D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content, Eng. Classification, Atterberg Limits



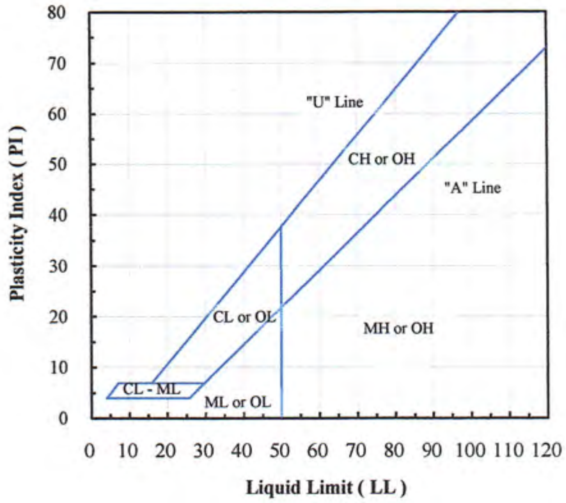
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	97.7
#40	0.425	61.9
#60	0.250	15.9
#100	0.150	3.9
#200	0.075	2.6

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	97.4
Fines (%):	2.6
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-5, S-04 (8.5-10.0')	14E256	13.3	2.6				

Note(s):

6-5-14
PDI, NSR

Excel Geotechnical Testing, Inc.
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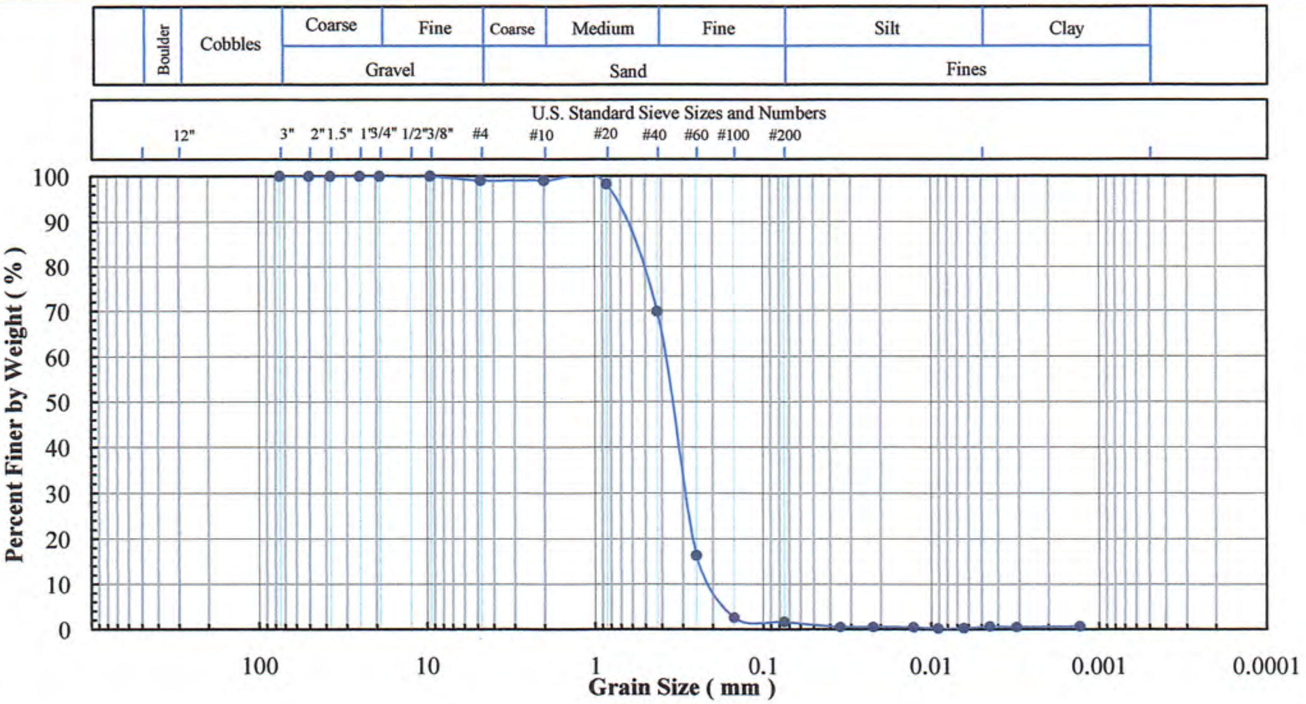
Project Name:	Duke Sutton Closure
Project No:	647
Client Sample ID:	SPT-5, S-06 (18.5-20.0')
Lab Sample No:	14E258

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



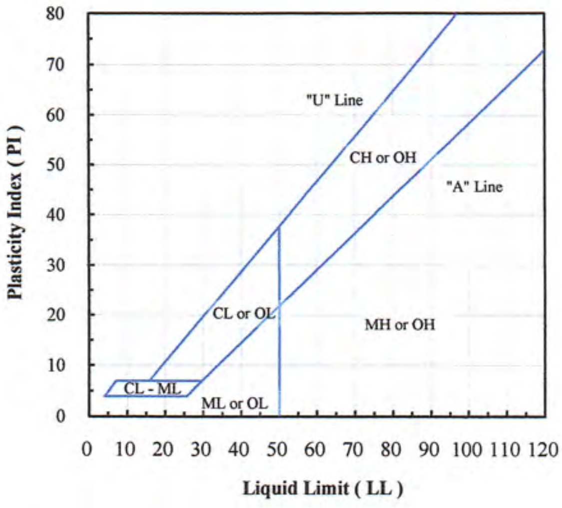
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.1
#10	2.00	99.1
#20	0.850	98.3
#40	0.425	69.9
#60	0.250	16.4
#100	0.150	2.7
#200	0.075	1.7

Specific Gravity (-):	2.70

Hydrometer Particle Diameter (mm)	% Finer
0.0350	0.6
0.0128	0.5
0.0064	0.3
0.0031	0.6
0.0013	0.7

Gravel (%):	0.9
Sand (%):	97.4
Fines (%):	1.7
Silt (%):	1.1
Clay (%):	0.6

Coeff. Unif. (Cu):	1.9
Coeff. Curv. (Cc):	1.1



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-5, S-06 (18.5-20.0')	14E258	16.8	1.7				SP - Poorly graded sand

Note(s): An assumed specific gravity of 2.7 was used when analyzing the hydrometer test results.

6-6-14
PD, NSR

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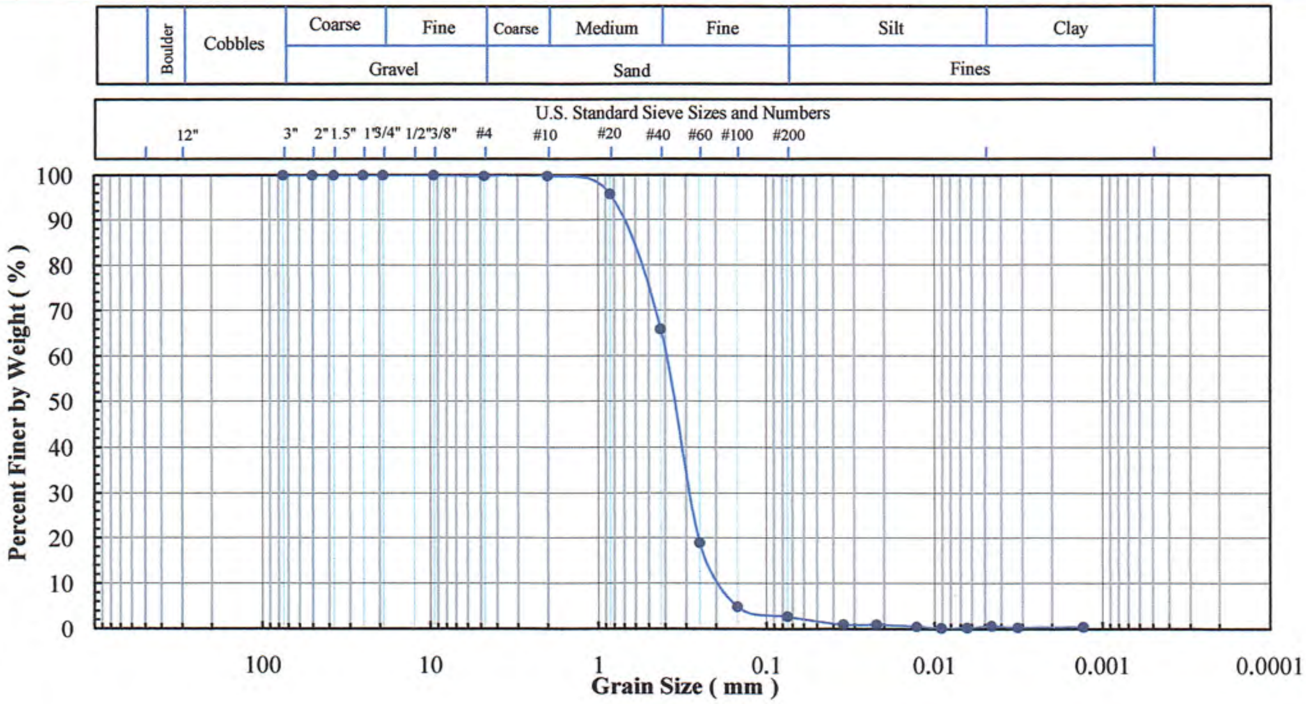
Project Name:	Duke Sutton Closure
Project No:	647
Client Sample ID:	SPT-6, S-08 (28.5-30.0')
Lab Sample No:	14E270

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



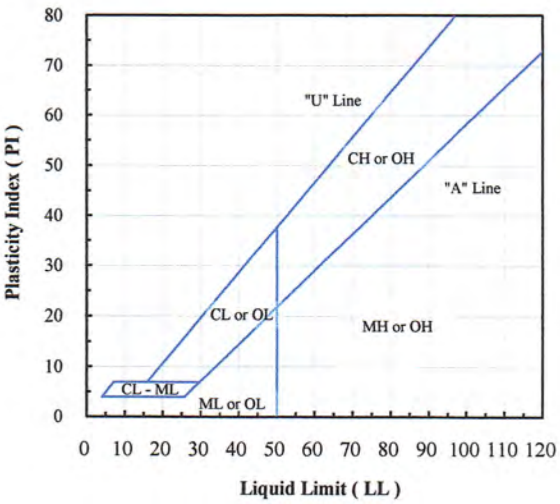
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.9
#10	2.00	99.9
#20	0.850	95.8
#40	0.425	65.9
#60	0.250	19.0
#100	0.150	5.0
#200	0.075	2.8

Specific Gravity (-):	2.70

Hydrometer Particle Diameter (mm)	% Finer
0.0349	1.0
0.0128	0.6
0.0064	0.3
0.0032	0.4
0.0013	0.5

Gravel (%):	0.1
Sand (%):	97.1
Fines (%):	2.8
Silt (%):	2.2
Clay (%):	0.6

Coeff. Unif. (Cu):	2.0
Coeff. Curv. (Cc):	1.1



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-6, S-08 (28.5-30.0')	14E270	20.7	2.8				SP - Poorly graded sand

Note(s): An assumed specific gravity of 2.7 was used when analyzing the hydrometer test results.

6-6-14
PD, NSR

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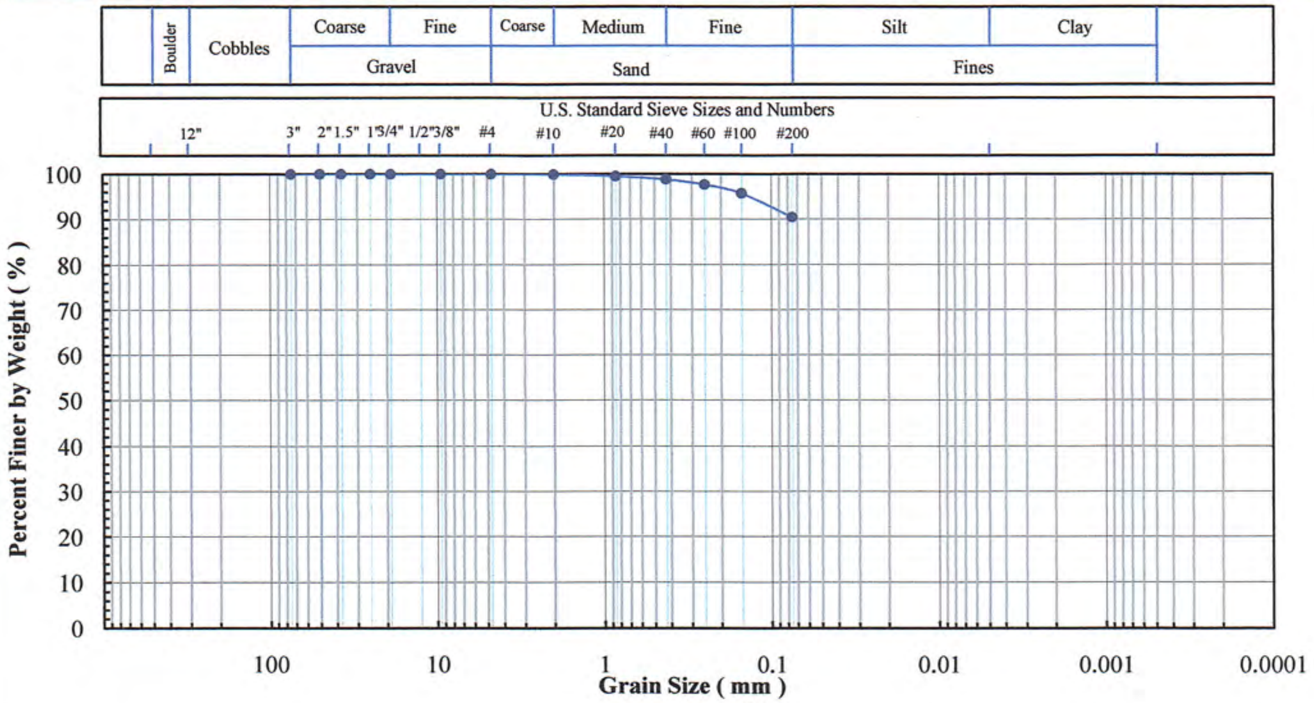
Project Name:	Duke Sutton Closure
Project No:	647
Client Sample ID:	SPT-7, S-05 (8.0-10.0')
Lab Sample No:	14E279

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



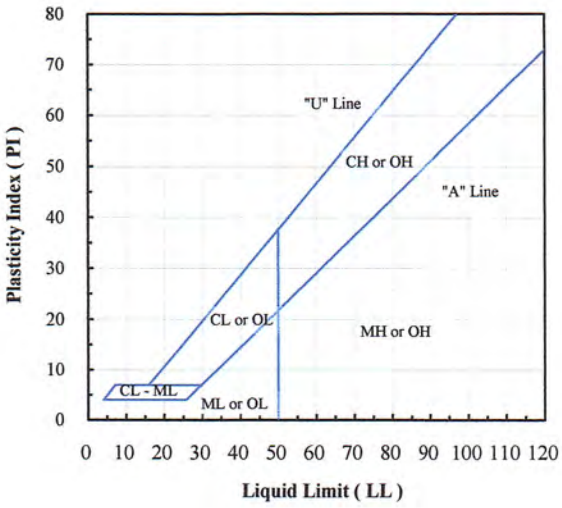
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	99.9
#20	0.850	99.5
#40	0.425	98.8
#60	0.250	97.7
#100	0.150	95.7
#200	0.075	90.5

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	9.5
Fines (%):	90.5
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits LL (-)	PL (-)	PI (-)	Engineering Classification
SPT-7, S-05 (8.0-10.0')	14E279	41.9	90.5				

Note(s): Test material appears to be fly ash.

6-5-14
PD, NSR

Excel Geotechnical Testing, Inc.
"Excellence in Testing"

953 Forrest Street, Roswell, Georgia 30075
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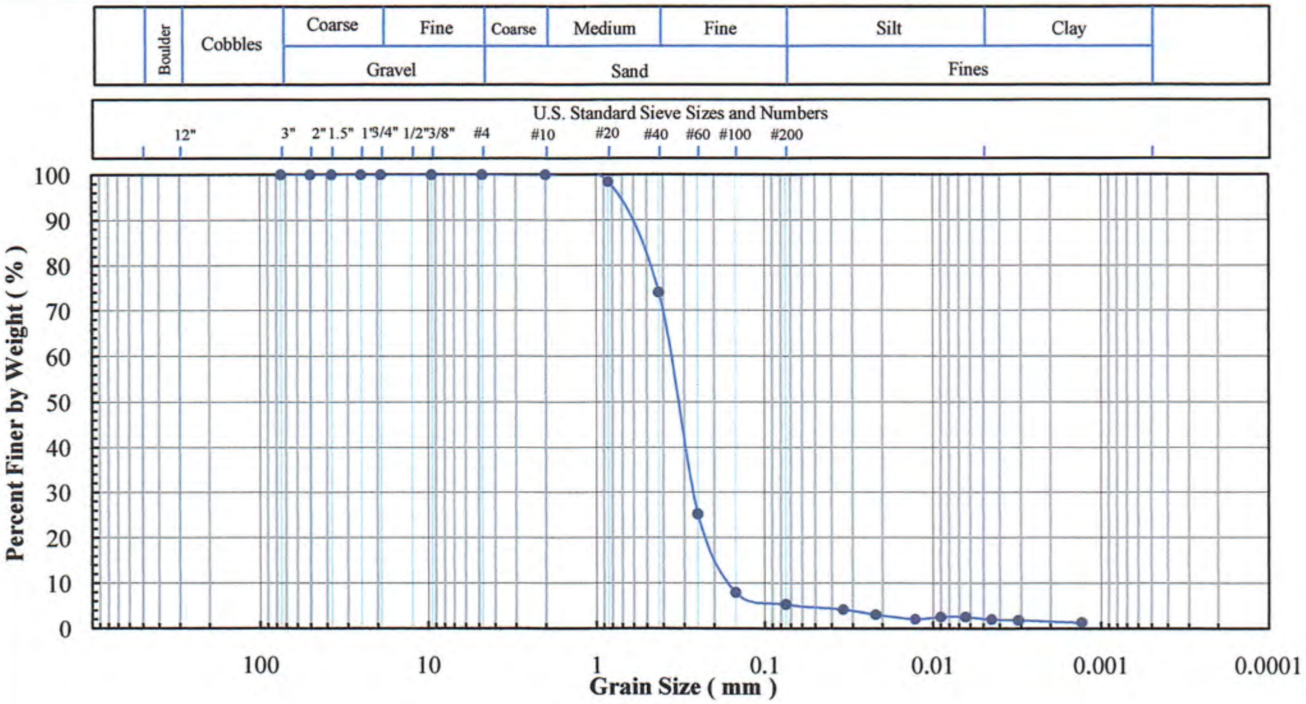
Project Name:	Duke Sutton Closure
Project No:	647
Client Sample ID:	SPT-8, S-06 (18.5-20.0')
Lab Sample No:	14E286

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



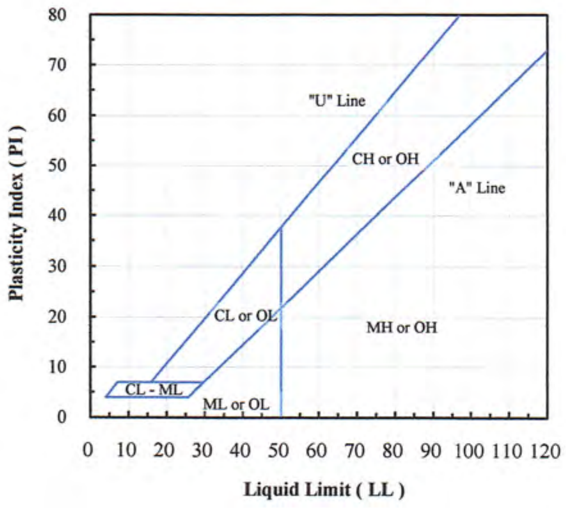
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	98.5
#40	0.425	74.1
#60	0.250	25.2
#100	0.150	8.0
#200	0.075	5.4

Specific Gravity (-):	2.70

Hydrometer Particle Diameter (mm)	% Finer
0.0344	4.3
0.0128	2.2
0.0064	2.7
0.0031	1.9
0.0013	1.4

Gravel (%):	
Sand (%):	94.6
Fines (%):	5.4
Silt (%):	3.1
Clay (%):	2.3

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-8, S-06 (18.5-20.0')	14E286	16.8	5.4				

Note(s): An assumed specific gravity of 2.7 was used when analyzing the hydrometer test results.

6-6-14
PD, NSR

Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
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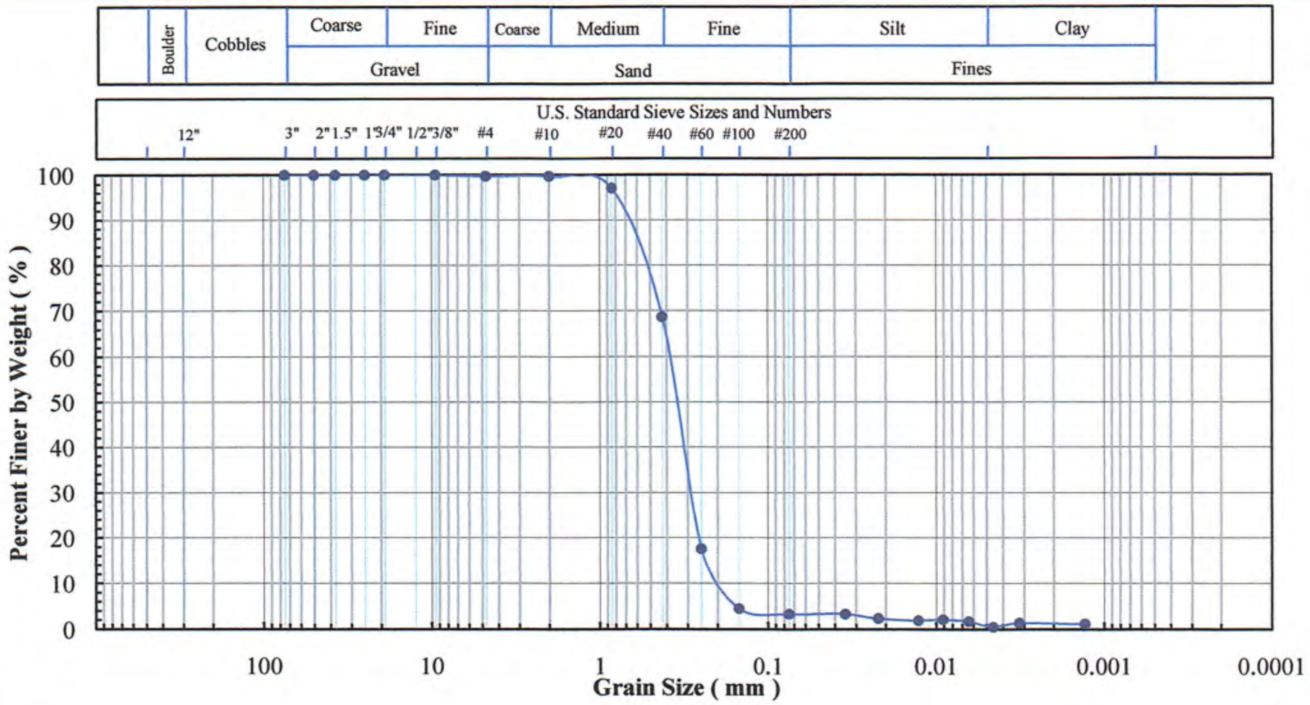
Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-8, S-07 (23.5-25.0')
Lab Sample No: 14E287

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



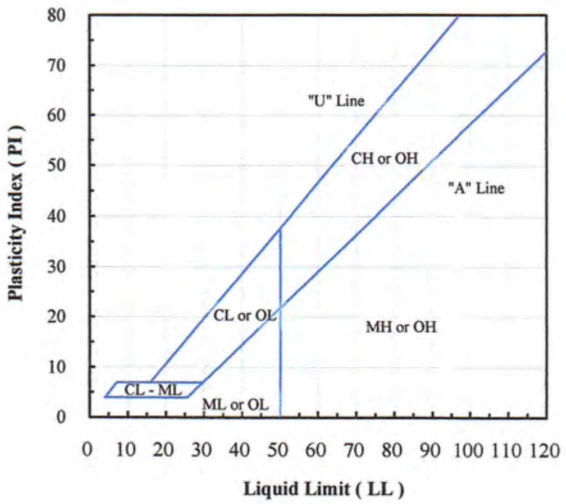
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.7
#10	2.00	99.7
#20	0.850	97.1
#40	0.425	68.8
#60	0.250	17.6
#100	0.150	4.6
#200	0.075	3.4

Specific Gravity (-):	2.70

Hydrometer Particle Diameter (mm)	% Finer
0.0348	3.4
0.0128	2.0
0.0064	1.8
0.0032	1.4
0.0013	1.2

Gravel (%):	0.3
Sand (%):	96.3
Fines (%):	3.4
Silt (%):	2.5
Clay (%):	0.9

Coeff. Unif. (Cu):	1.9
Coeff. Curv. (Cc):	1.0



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits LL (-)	PL (-)	PI (-)	Engineering Classification
SPT-8, S-07 (23.5-25.0')	14E287	22.0	3.4				SP - Poorly graded sand

Note(s): An assumed specific gravity of 2.7 was used when analyzing the hydrometer test results.

6-6-14
PD, NSR

Excel Geotechnical Testing, Inc.
"Excellence in Testing"
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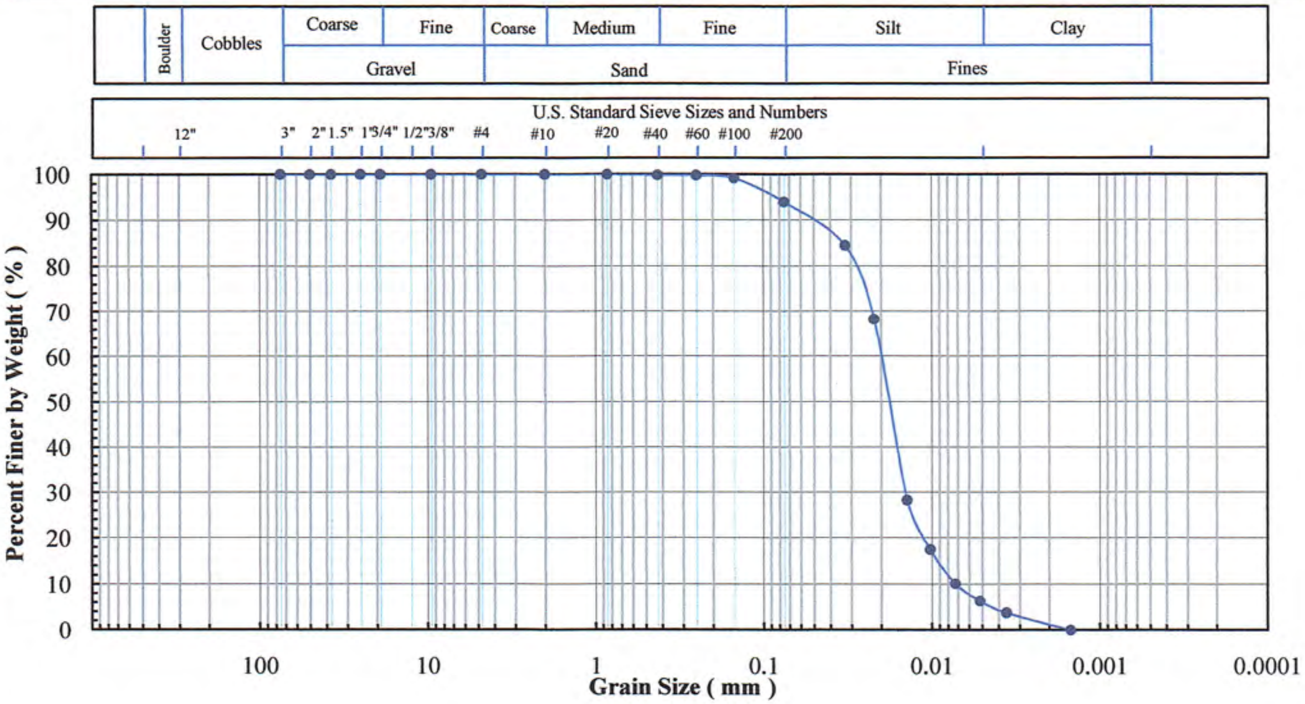
Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-9, S-06 (10.0-12.0')
Lab Sample No: 14E297

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



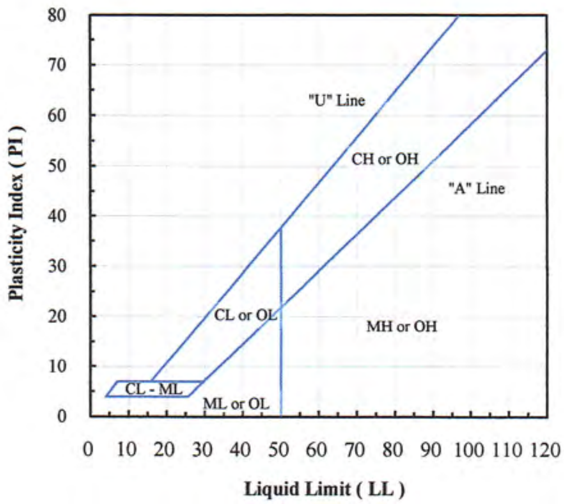
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	100.0
#40	0.425	99.9
#60	0.250	99.8
#100	0.150	99.2
#200	0.075	94.0

Specific Gravity (-):	2.27

Hydrometer Particle Diameter (mm)	% Finer
0.0328	84.5
0.0140	28.2
0.0073	10.2
0.0036	3.8
0.0015	

Gravel (%):	
Sand (%):	6.0
Fines (%):	94.0
Silt (%):	88.0
Clay (%):	6.0

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-9, S-06 (10.0-12.0')	14E297		94.0	NP	NP	NP	ML - Silt

Note(s): The test material appears to be ash.

6-6-14
PD, NSR

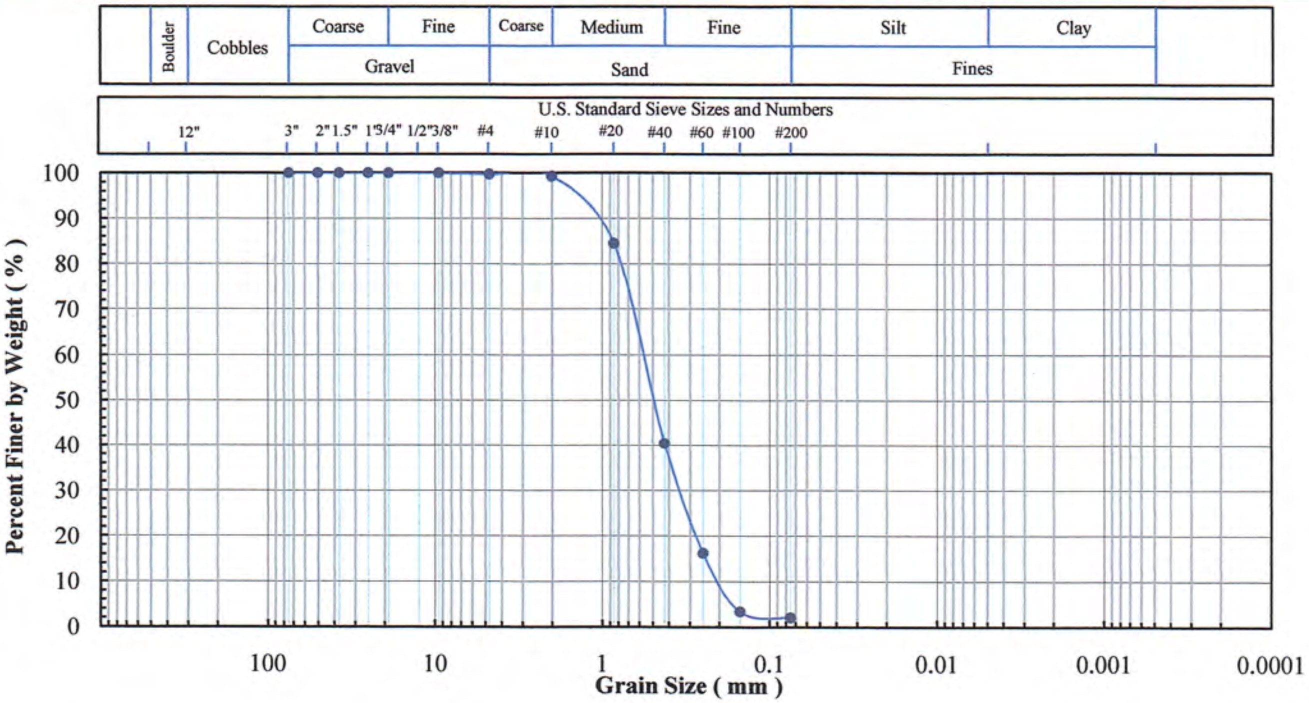
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Duke Sutton Closure
Project No:	647
Client Sample ID:	SPT-10, S-06 (18.5-20.0')
Lab Sample No:	14E306

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



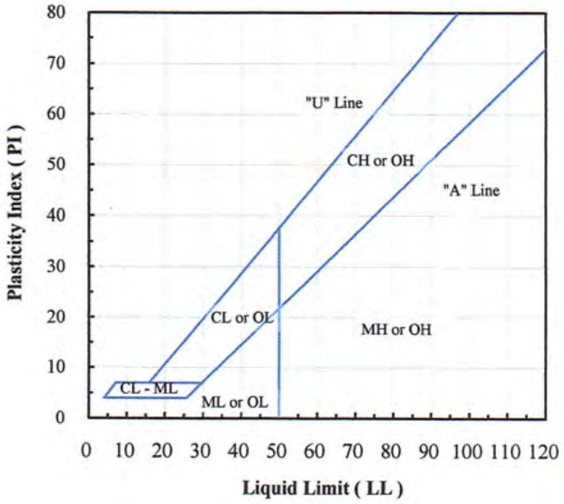
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.7
#10	2.00	99.3
#20	0.850	84.5
#40	0.425	40.5
#60	0.250	16.2
#100	0.150	3.4
#200	0.075	2.1

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	0.3
Sand (%):	97.6
Fines (%):	2.1
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	2.6
Coeff. Curv. (Cc):	0.9



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-10, S-06 (18.5-20.0')	14E306	20.4	2.1				SP - Poorly graded sand

Note(s):

6-5-14
PDI NSR

Excel Geotechnical Testing, Inc.
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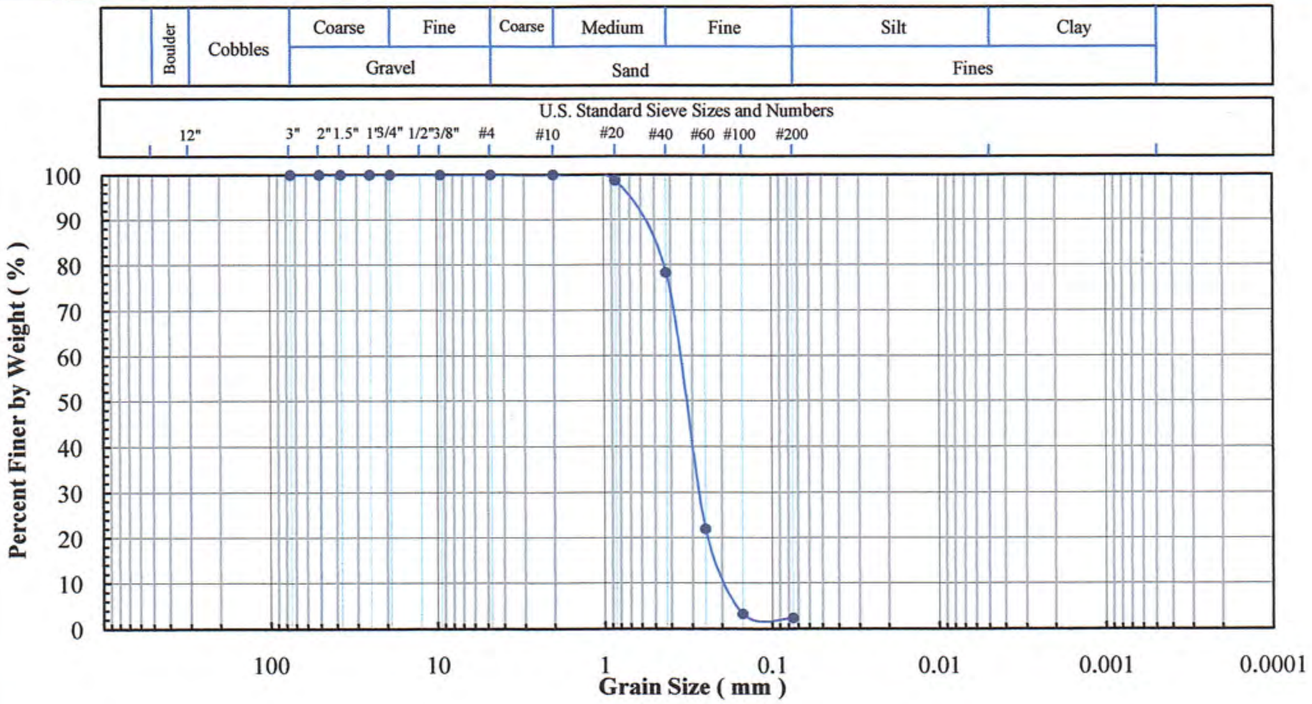
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-11, S-04 (8.5-10.0')
Lab Sample No: 14E315

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



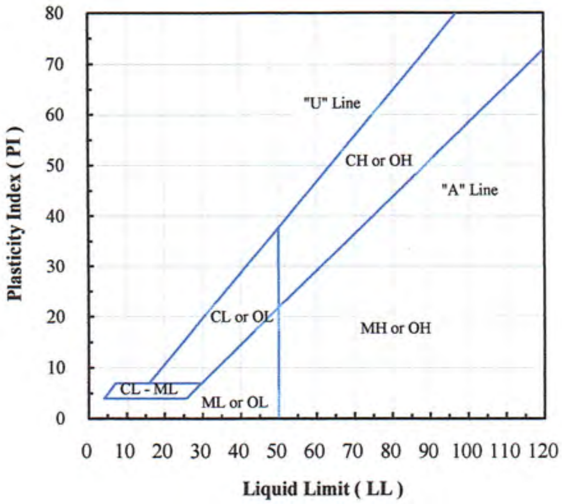
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	98.7
#40	0.425	78.2
#60	0.250	22.0
#100	0.150	3.3
#200	0.075	2.4

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	97.6
Fines (%):	2.4
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	1.8
Coeff. Curv. (Cc):	1.1



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-11, S-04 (8.5-10.0')	14E315	14.5	2.4				SP - Poorly graded sand

Note(s):

6-5-14
PD, NSR

Excel Geotechnical Testing, Inc.
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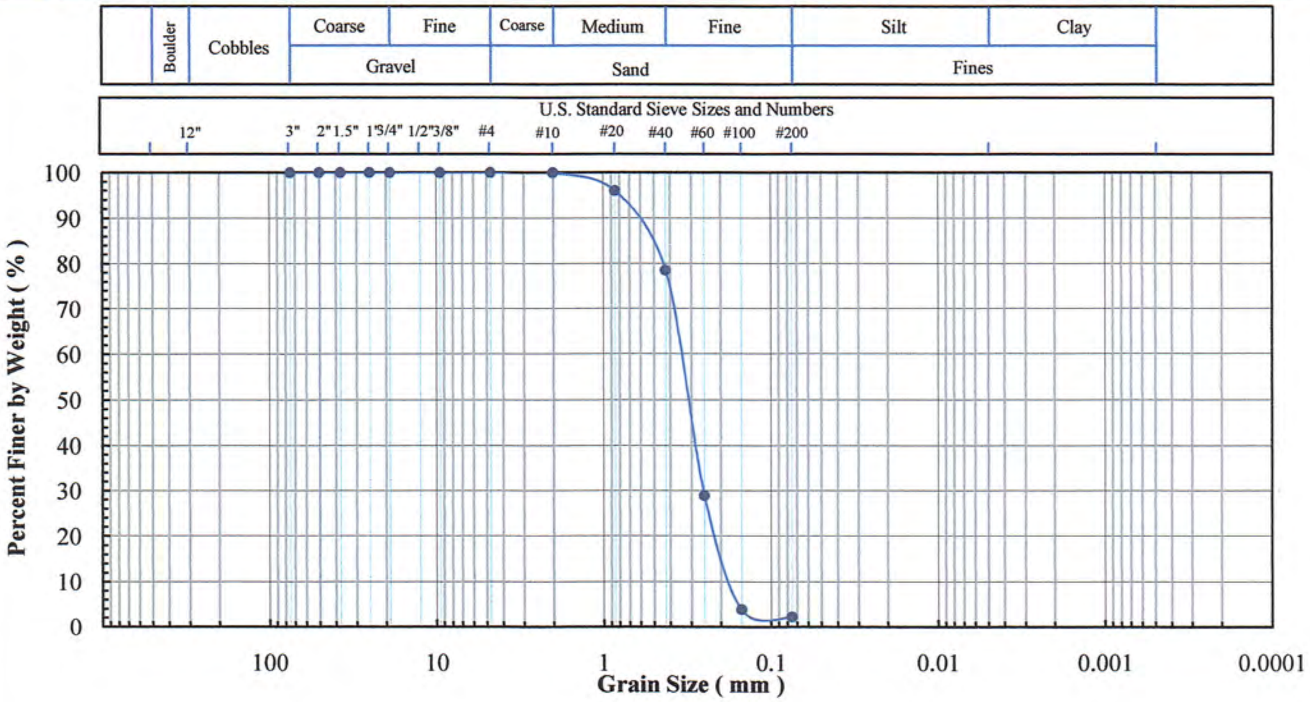
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-11, S-06 (18.5-20.0')
Lab Sample No: 14E317

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



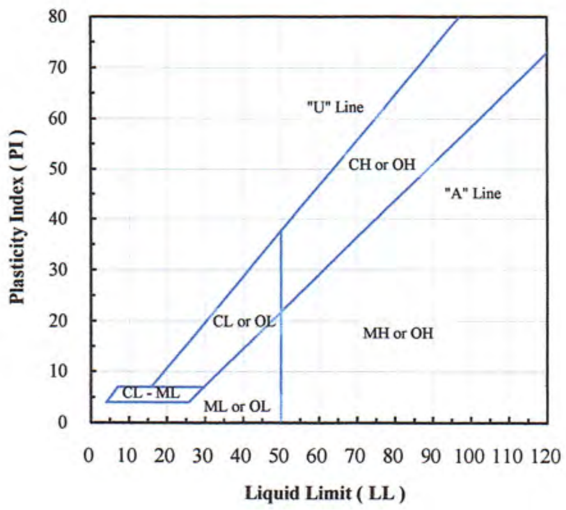
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	96.0
#40	0.425	78.5
#60	0.250	28.9
#100	0.150	3.9
#200	0.075	2.2

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	97.8
Fines (%):	2.2
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	1.8
Coeff. Curv. (Cc):	1.1



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-11, S-06 (18.5-20.0')	14E317	23.7	2.2				SP - Poorly graded sand

Note(s):

6-5-14
PD, NSR

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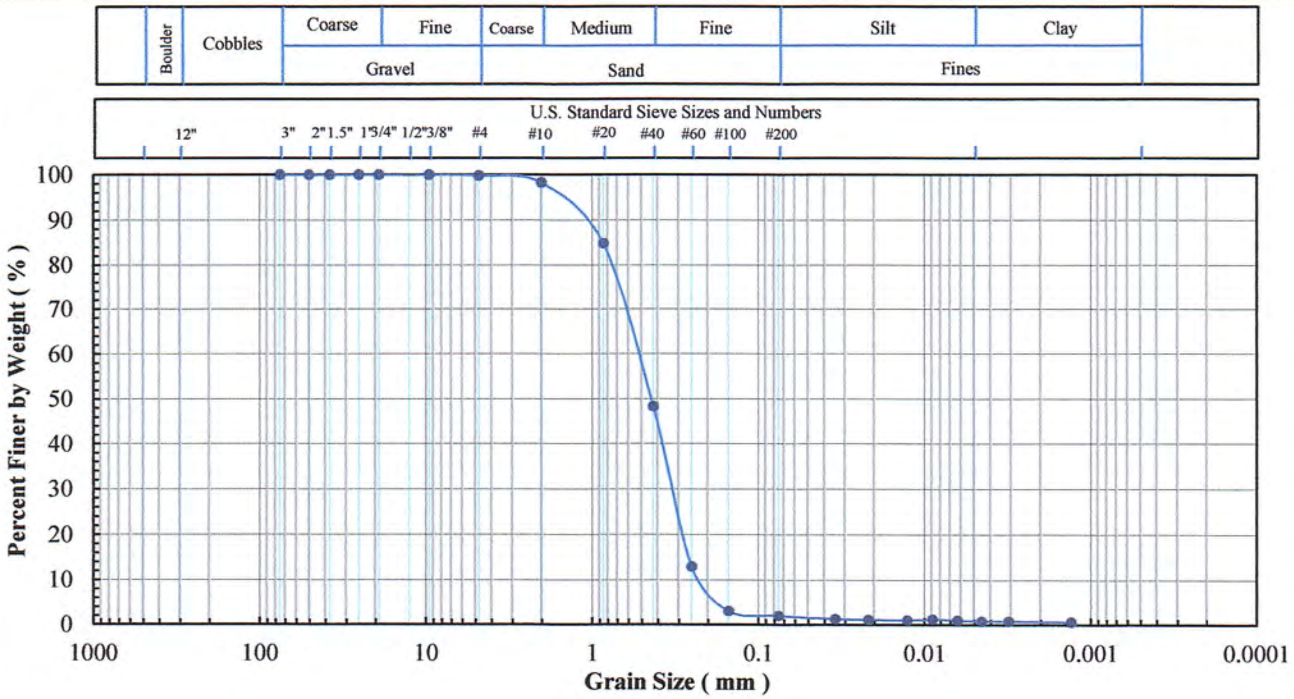
Project Name:	Duke Sutton Closure
Project No:	647
Client Sample ID:	SPT-11, S-10 (38.5-40.0')
Lab Sample No:	14E321

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



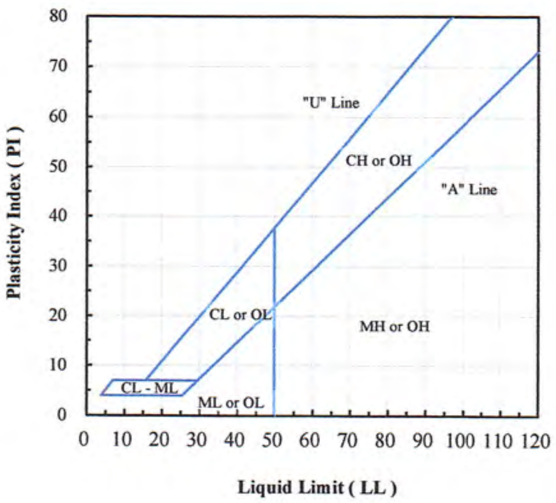
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.8
#10	2.00	98.3
#20	0.850	84.9
#40	0.425	48.4
#60	0.250	13.0
#100	0.150	3.1
#200	0.075	2.0

Specific Gravity (-):	2.70

Hydrometer Particle Diameter (mm)	% Finer
0.0342	1.3
0.0126	1.0
0.0063	1.0
0.0031	0.8
0.0013	0.6

Gravel (%):	0.2
Sand (%):	97.8
Fines (%):	2.0
Silt (%):	1.1
Clay (%):	0.9

Coeff. Unif. (Cu):	2.3
Coeff. Curv. (Cc):	0.9



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-11, S-10 (38.5-40.0')	14E321	22.9	2.0				SP - Poorly graded sand

Note(s): An assumed specific gravity of 2.7 was used when analyzing the hydrometer test results.

6-6-14
JD, NSR

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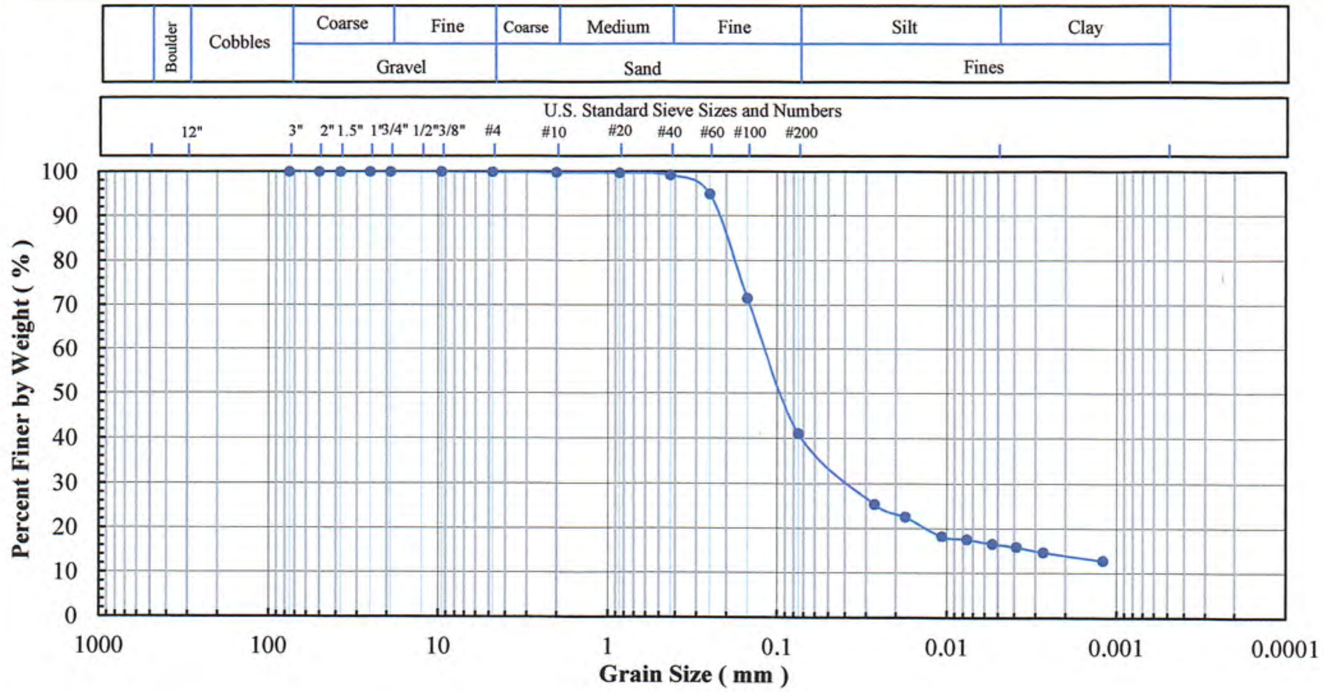
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Duke Sutton Closure
Project No:	647
Client Sample ID:	GP-17, S-14 (52-56)
Lab Sample No:	14G011

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



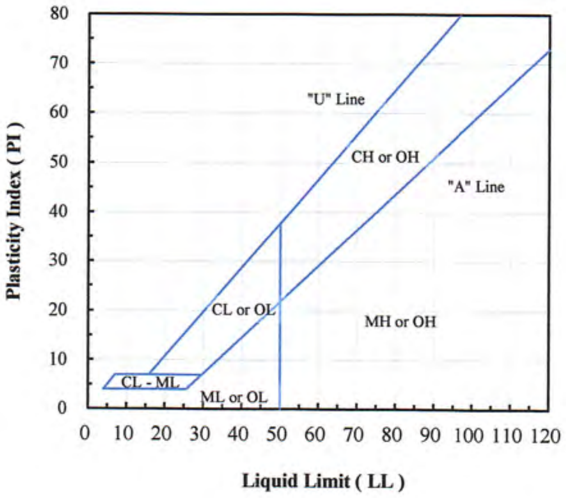
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.9
#10	2.00	99.8
#20	0.850	99.7
#40	0.425	99.2
#60	0.250	94.9
#100	0.150	71.5
#200	0.075	41.1

Specific Gravity (-):	2.70

Hydrometer Particle Diameter (mm)	% Finer
0.0267	25.4
0.0107	18.3
0.0054	16.6
0.0027	14.7
0.0012	12.8

Gravel (%):	0.1
Sand (%):	58.8
Fines (%):	41.1
Silt (%):	24.7
Clay (%):	16.4

Coeff. Unif. (Cu):	2.2
Coeff. Curv. (Cc):	0.7



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
GP-17, S-14 (52-56)	14G011	32.9	41.1	NP	NP	NP	SM - Silty Sand

Note(s): Engineering classification is based on the assumption that the fines are either ML or MH.
An assumed specific gravity of 2.70 was used when analyzing the hydrometer test results.

7/17/14
AK, NSB

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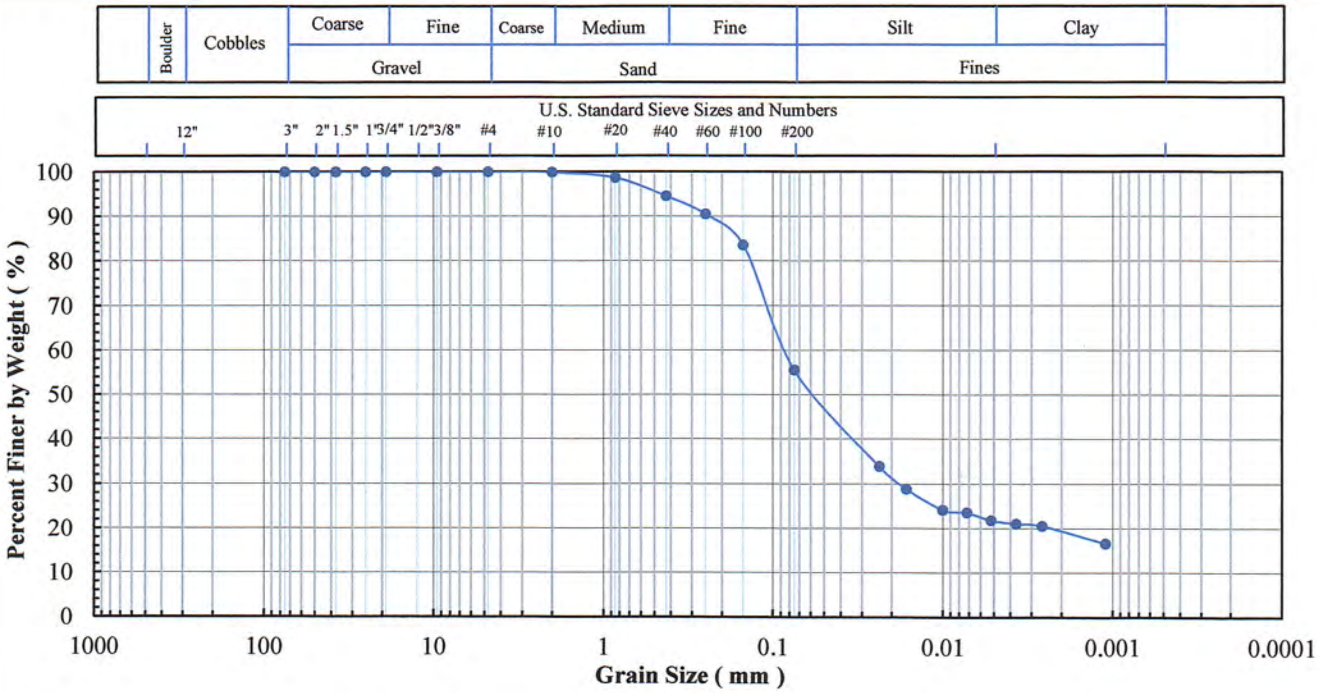
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: GP-17, S-15 (56-60)
Lab Sample No: 14G012

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



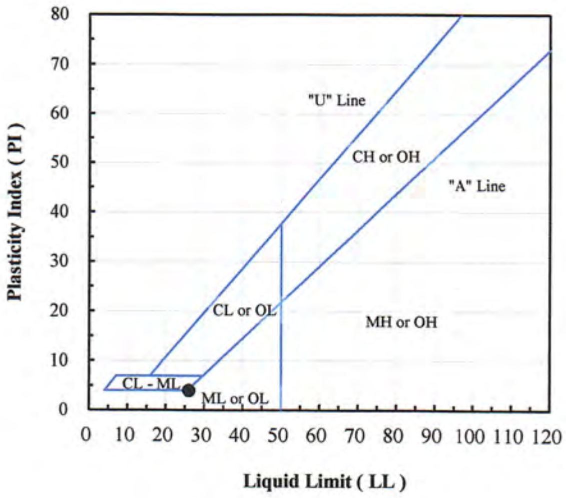
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	99.9
#20	0.850	98.7
#40	0.425	94.5
#60	0.250	90.5
#100	0.150	83.5
#200	0.075	55.6

Specific Gravity (-):	2.70

Hydrometer Particle Diameter (mm)	% Finer
0.0237	33.9
0.0100	24.2
0.0052	21.9
0.0026	20.6
0.0011	16.7

Gravel (%):	
Sand (%):	44.4
Fines (%):	55.6
Silt (%):	33.8
Clay (%):	21.8

Coeff. Unif. (Cu):	1.6
Coeff. Curv. (Cc):	1.3



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
GP-17, S-15 (56-60)	14G012	34.6	55.6	26	22	4	CL-ML - Sandy Silty Clay

Note(s): An assumed specific gravity of 2.70 was used when analyzing the hydrometer test results.

7/17/14
AK NSR

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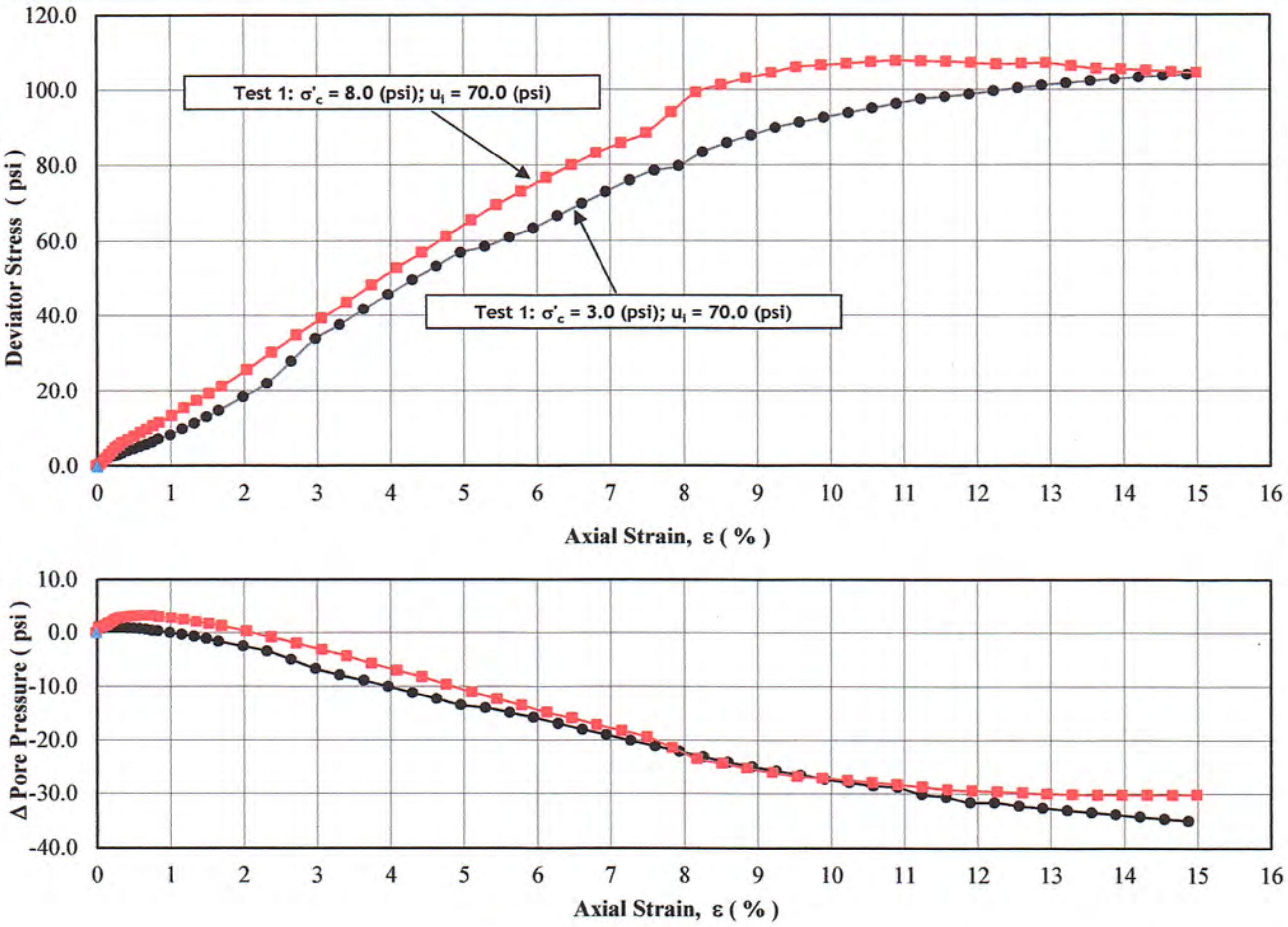
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Duke Sutton Closure
Project No: 647
Site Sample ID: SPT-9, S-06 (10.0-12.0')
Lab Sample No: 14E297

ASTM D 4767

CONSOLIDATED-UNDRAINED (CU) TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENTS

Figure 1



Test Specimen No.	Maximum Strength				
	Deviator Stress (σ'₁ - σ'₃) (psi)	Effective Axial Stress (σ'₁) (psi)	Effective Radial Stress (σ'₃) (psi)	Pore Pressure (u) (psi)	Axial Strain (εₐ) (%)
1	104.0	141.9	37.9	35.1	14.9
2	107.8	144.1	36.3	41.7	10.9

Test Specimen No.	Strength at App. 15% Axial Strain				
	Deviator Stress (σ'₁ - σ'₃) (psi)	Effective Axial Stress (σ'₁) (psi)	Effective Radial Stress (σ'₃) (psi)	Pore Pressure (u) (psi)	Axial Strain (εₐ) (%)
1	104.0	141.9	37.9	35.1	14.9
2	104.5	142.6	38.1	39.9	15.0

Notes:

σ'_c = Consolidation pressure, (psi) u_i = Initial pore pressure,(psi)

6-04-14
NSR

EGT

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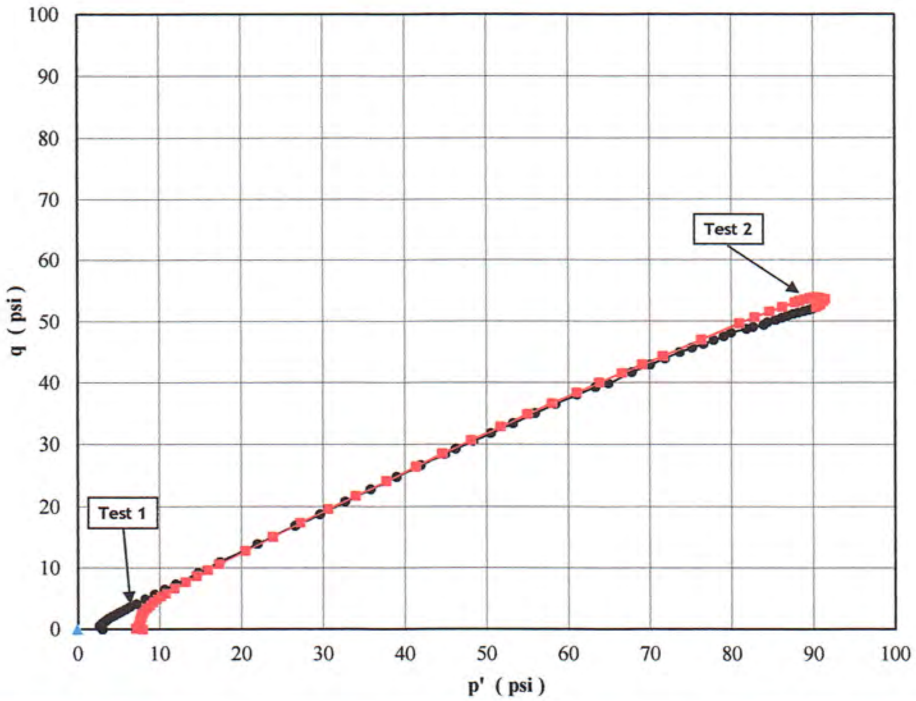
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Duke Sutton Closure
Project No: 647
Site Sample ID: SPT-9, S-06 (10.0-12.0')
Lab Sample No: 14E297

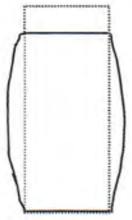
ASTM D 4767

CONSOLIDATED-UNDRAINED (CU) TRIAXIAL TEST
WITH PORE PRESSURE MEASUREMENTS

Figure 2

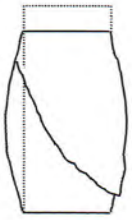


Test	Specimen	Initial Conditions							Consolidation Stage		Loading
Specimen Number (-)	Quality Bad to Good (1 to 10)	Height (in .)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	B Parameter (-)	Initial Pore Pressure (u_i) (psi)	Consolidation Pressure (σ'_c) (psi)	Axial Strain (%)	Volumetric Strain (%)	Axial Rate (% / min)
1	7	6.08	2.83	55.3	62.1	0.98	70.0	3.0	0.48	1.00	0.099
2	7	5.91	2.83	54.5	62.4	0.99	70.0	8.0	0.81	1.78	0.101



Specimen No.1

Gray silt (Fly Ash)



Specimen No. 2

Gray silt (Fly Ash)

Specimen No. 3

Notes:

6-04-14
NSK

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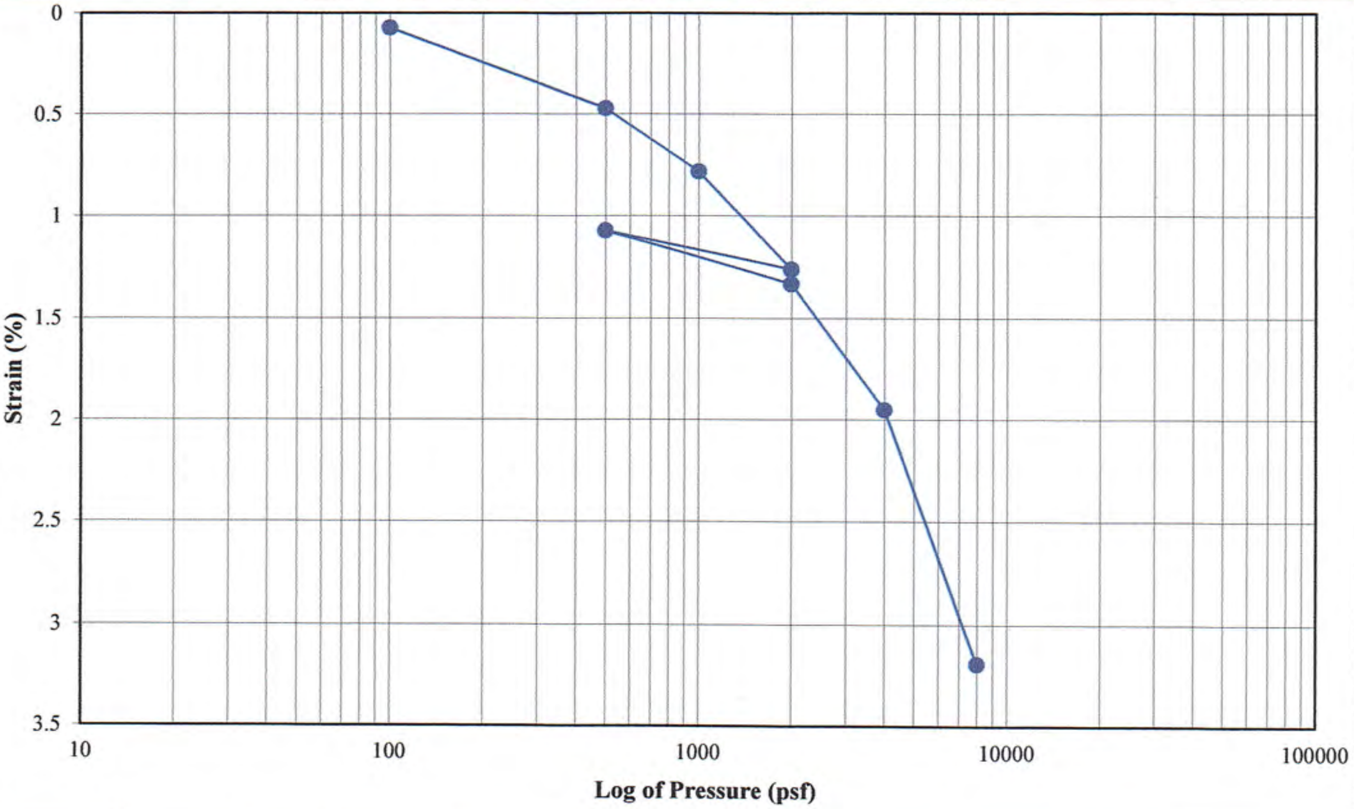
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-09, S-06 (10.0-12.0')
Lab Sample No: 14E297

ASTM D 2435

ONE-DIMENSIONAL CONSOLIDATION TEST



Client Sample ID	Lab Sample No.	Specimen Quality 1-10 (Bad to Good)	Test Specimen Initial Conditions				Consolidation Pressure (psf)	Pressure Increment Duration (min)	Accumu.(1) Vertical Strain (%)	Figure No.	Remarks
			Height (cm)	Diameter (cm)	Dry Unit Weight (pcf)	Moisture Content (%)					
SPT-09, S-06 (10.0-12.0')	14E297	6	2.54	6.35	60.3	54.6	100	214	0.07	1	
							500	240	0.47	2	
							1000	1201	0.78	3	
							2000	1262	1.26	4	
							500	148	1.07	5	
							2000	1273	1.33	6	
							4000	240	1.95	7	
							8000	1210	3.19	8	

Notes:

For each pressure increment, the vertical strain values were calculated based on the final deformation measurements.

6-5-14
NSR

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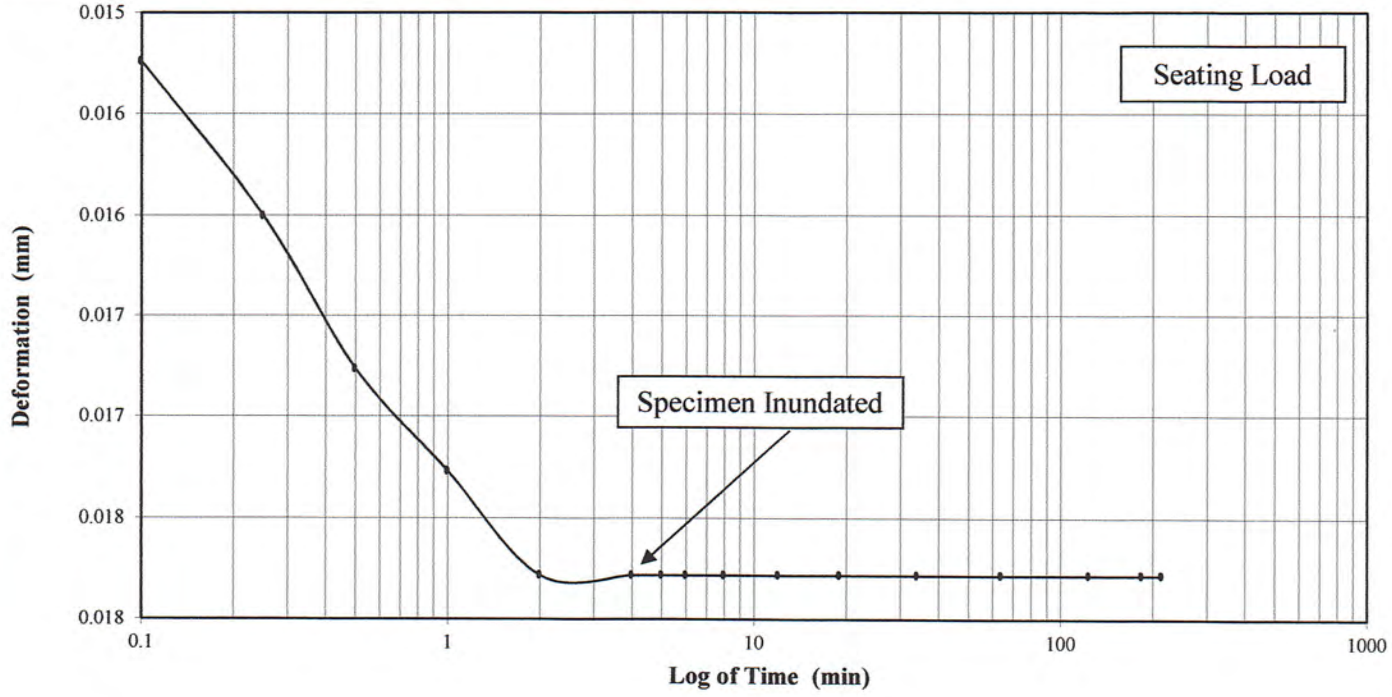
Tel: (770) 910 7537 Fax: (770) 910 7538

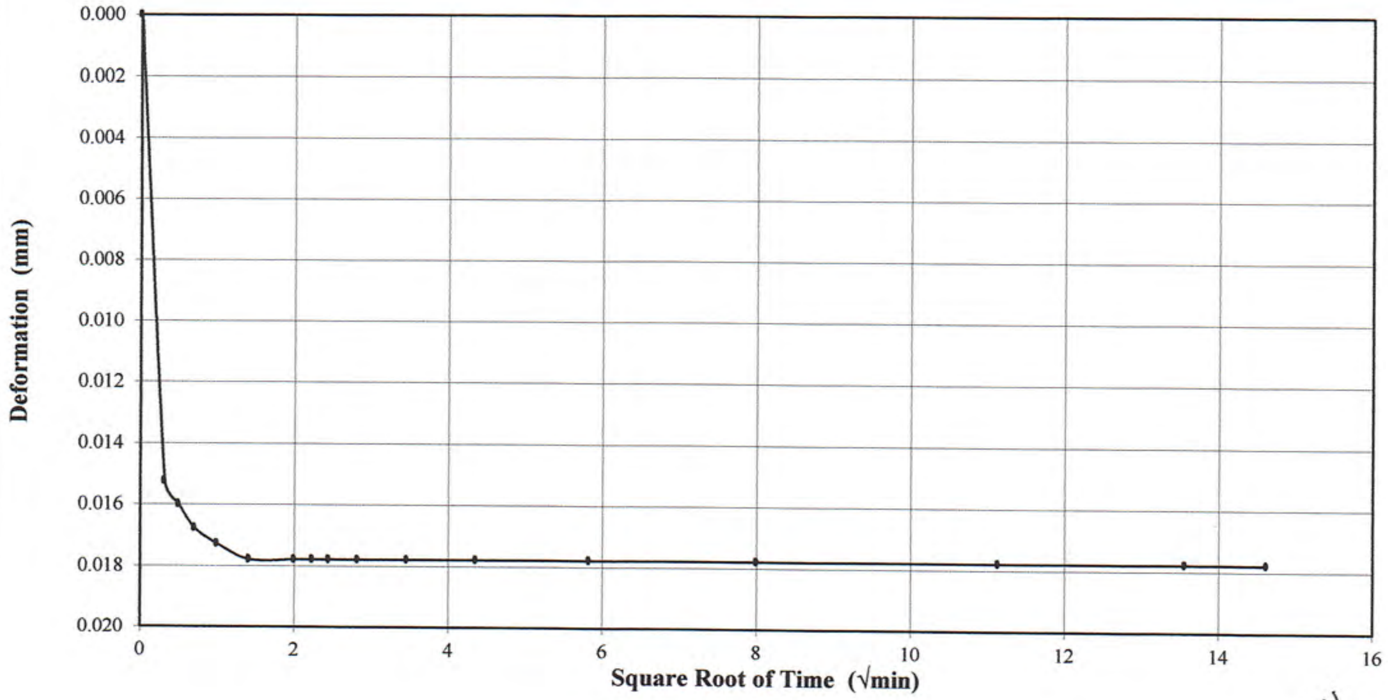
Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-09, S-06 (10.0-12.0')
Lab Sample No: 14E297

ASTM D 2435

ONE-DIMENSIONAL CONSOLIDATION TEST

Figure 1 - 100 psf





6-5-14
NSR

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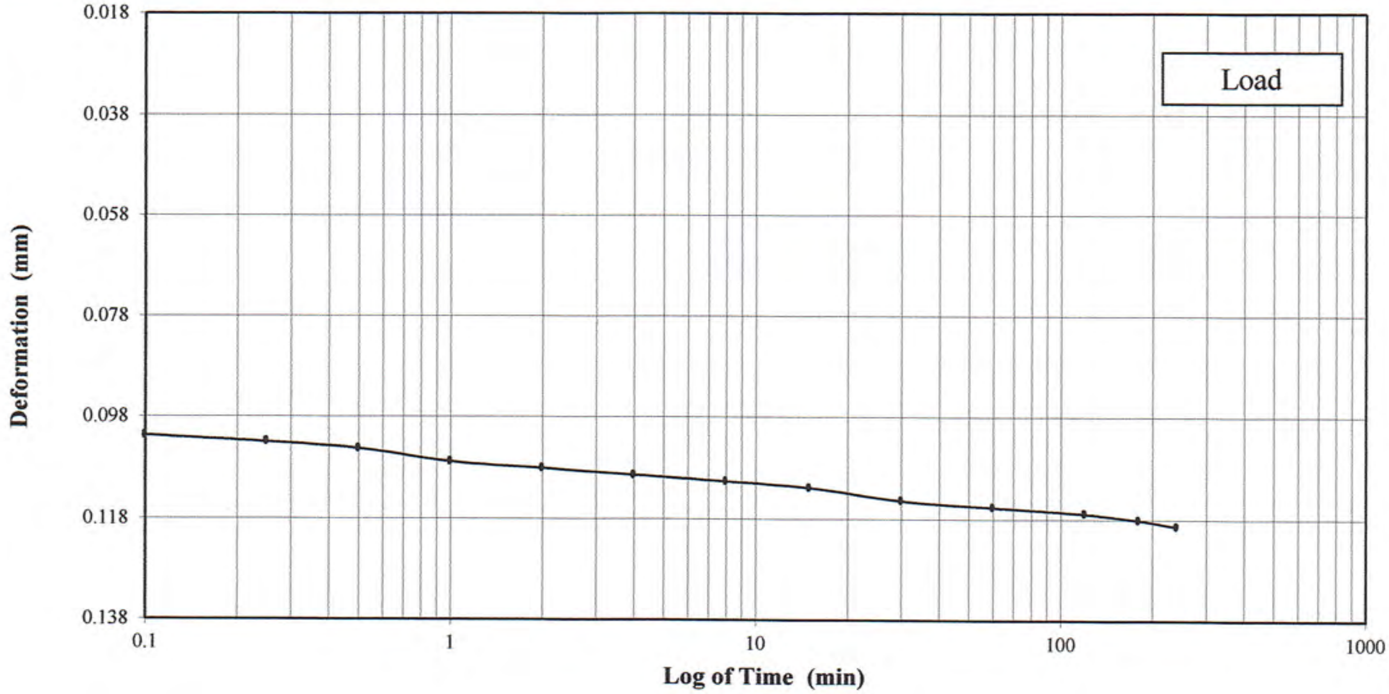
Tel: (770) 910 7537 Fax: (770) 910 7538

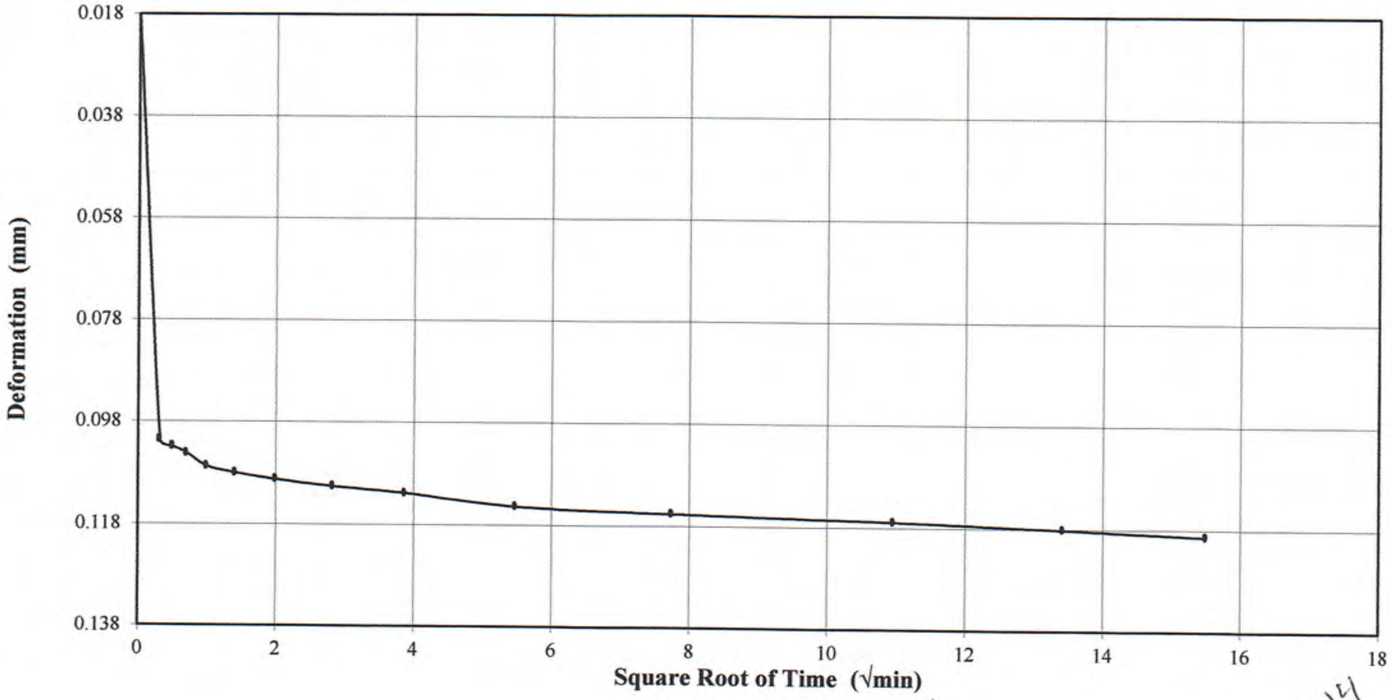
Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-09, S-06 (10.0-12.0')
Lab Sample No: 14E297

ASTM D 2435

ONE-DIMENSIONAL CONSOLIDATION TEST

Figure 2 - 500 psf





6-5-14
NSR

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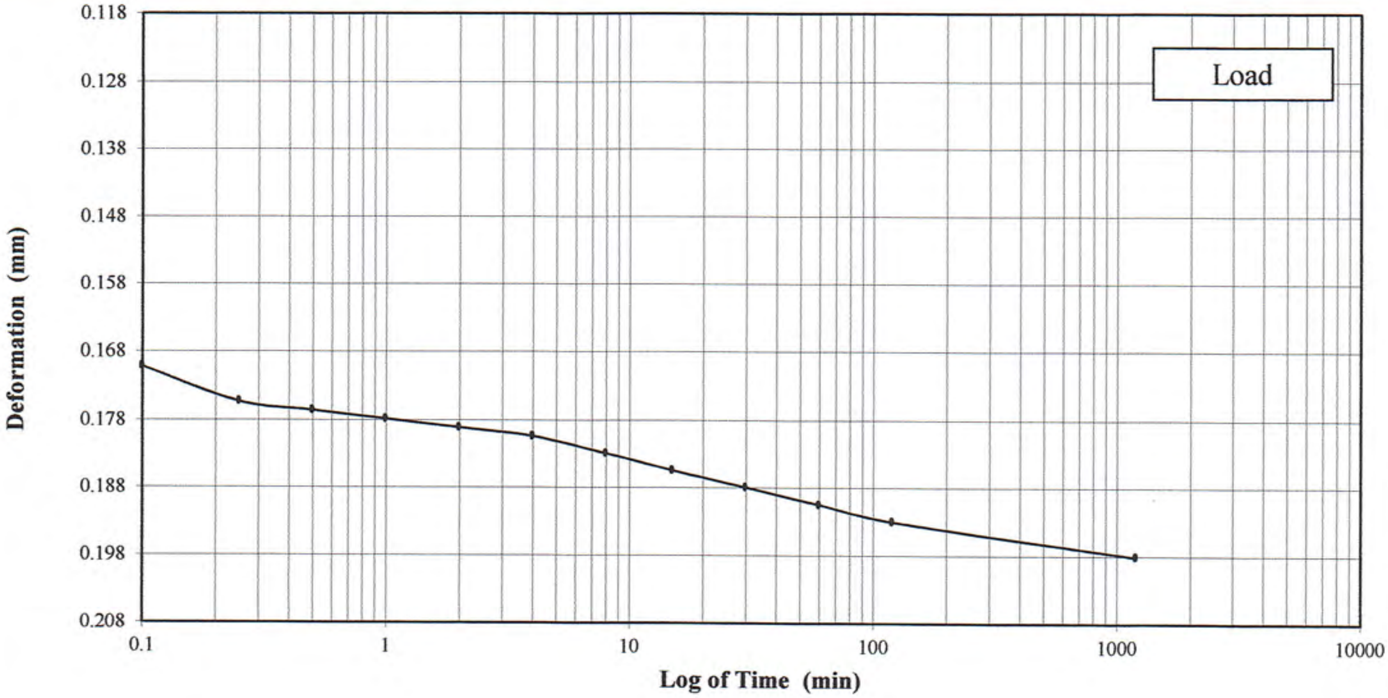
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

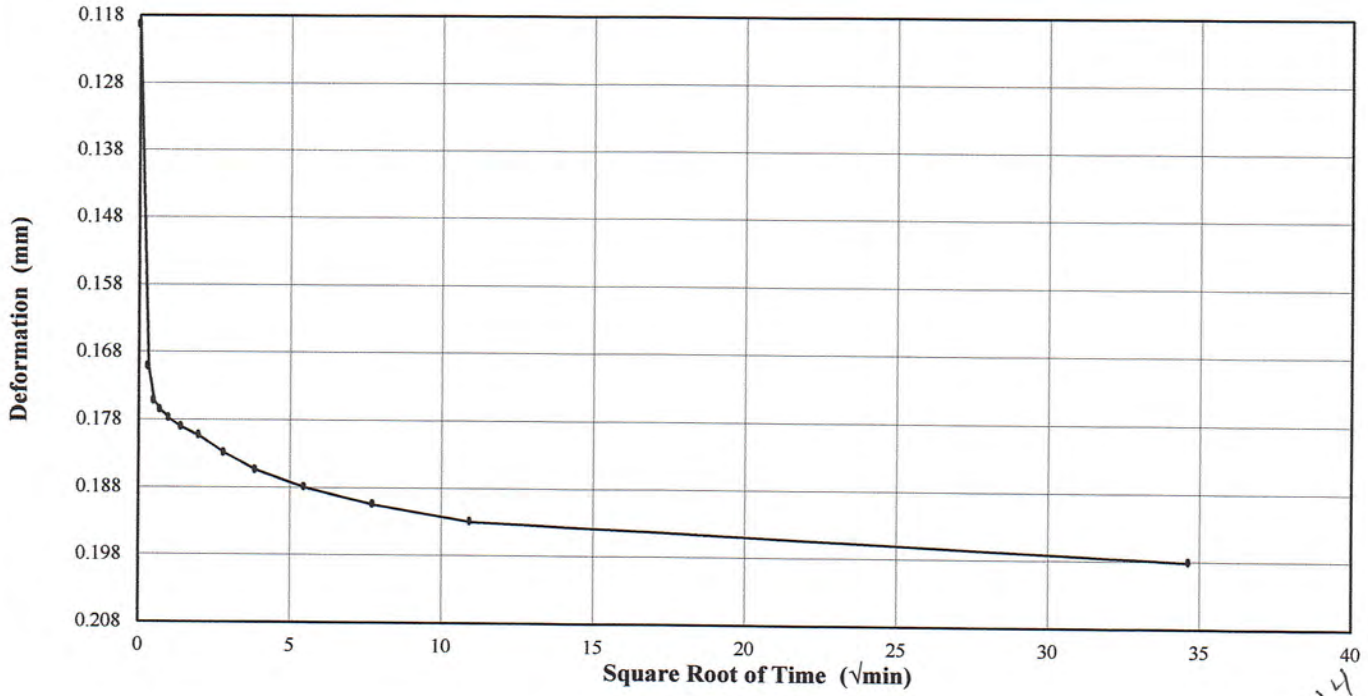
Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-09, S-06 (10.0-12.0')
Lab Sample No: 14E297

ASTM D 2435

ONE-DIMENSIONAL CONSOLIDATION TEST

Figure 3 - 1000 psf





6-5-14
NSR

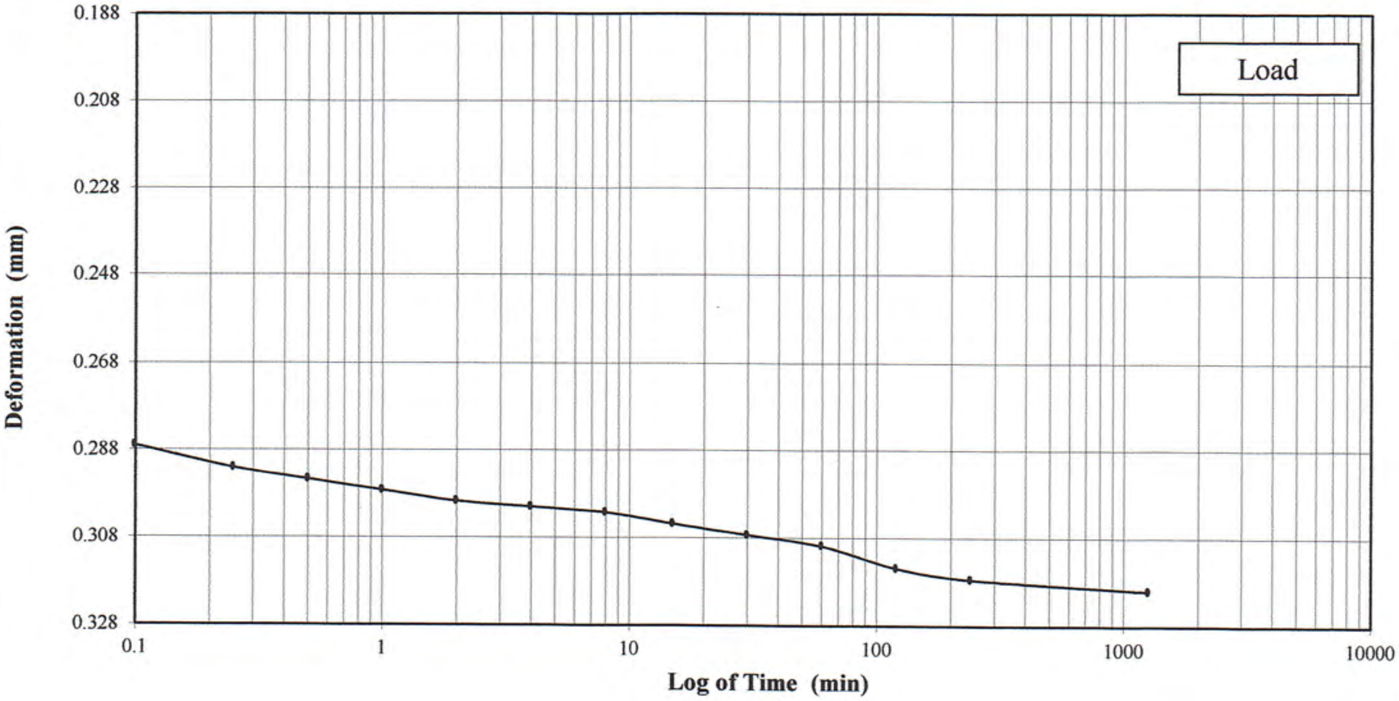
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

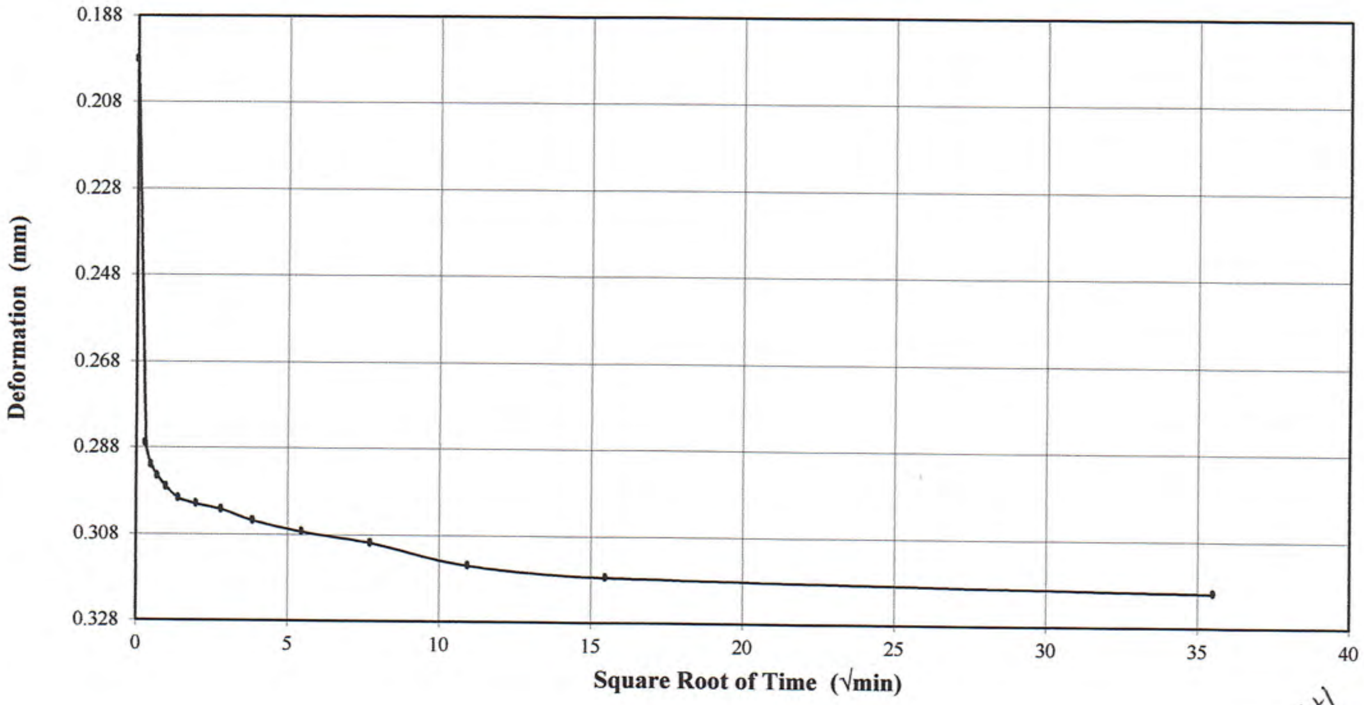
Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-09, S-06 (10.0-12.0')
Lab Sample No: 14E297

ASTM D 2435

ONE-DIMENSIONAL CONSOLIDATION TEST

Figure 4 - 2000 psf





6-5-14
NSR

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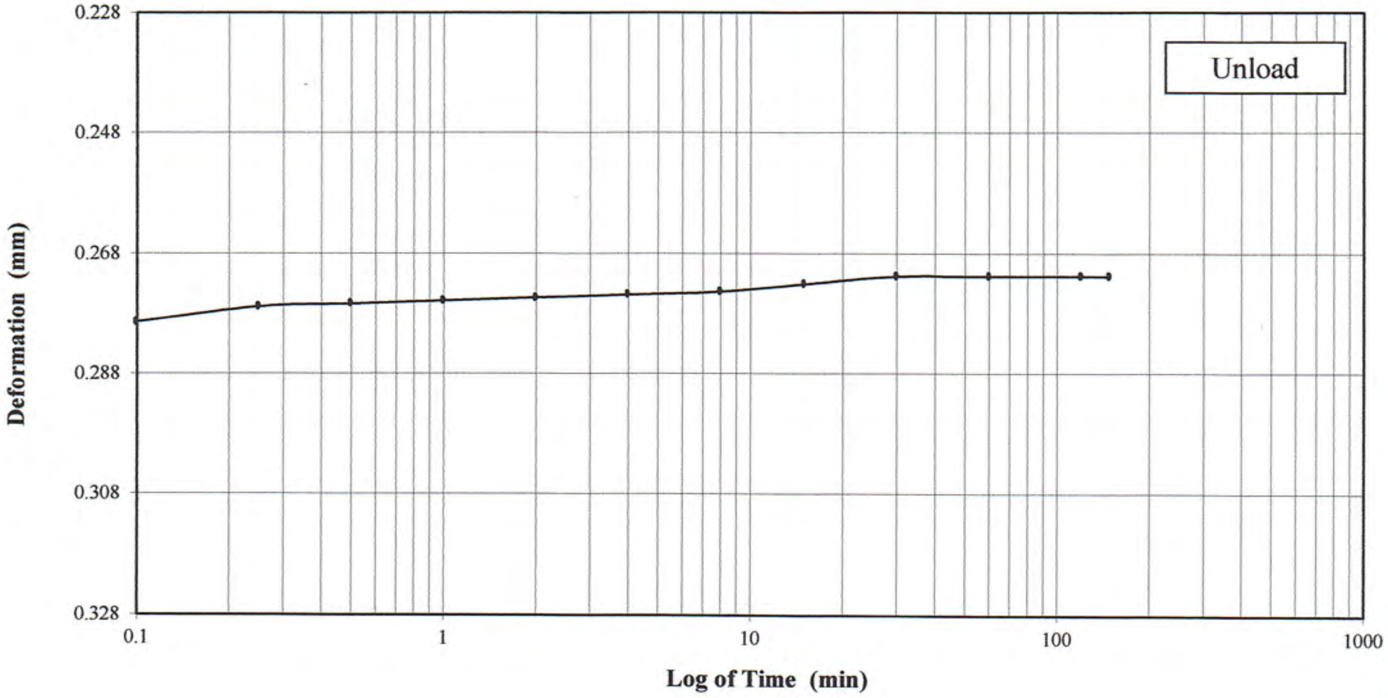
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

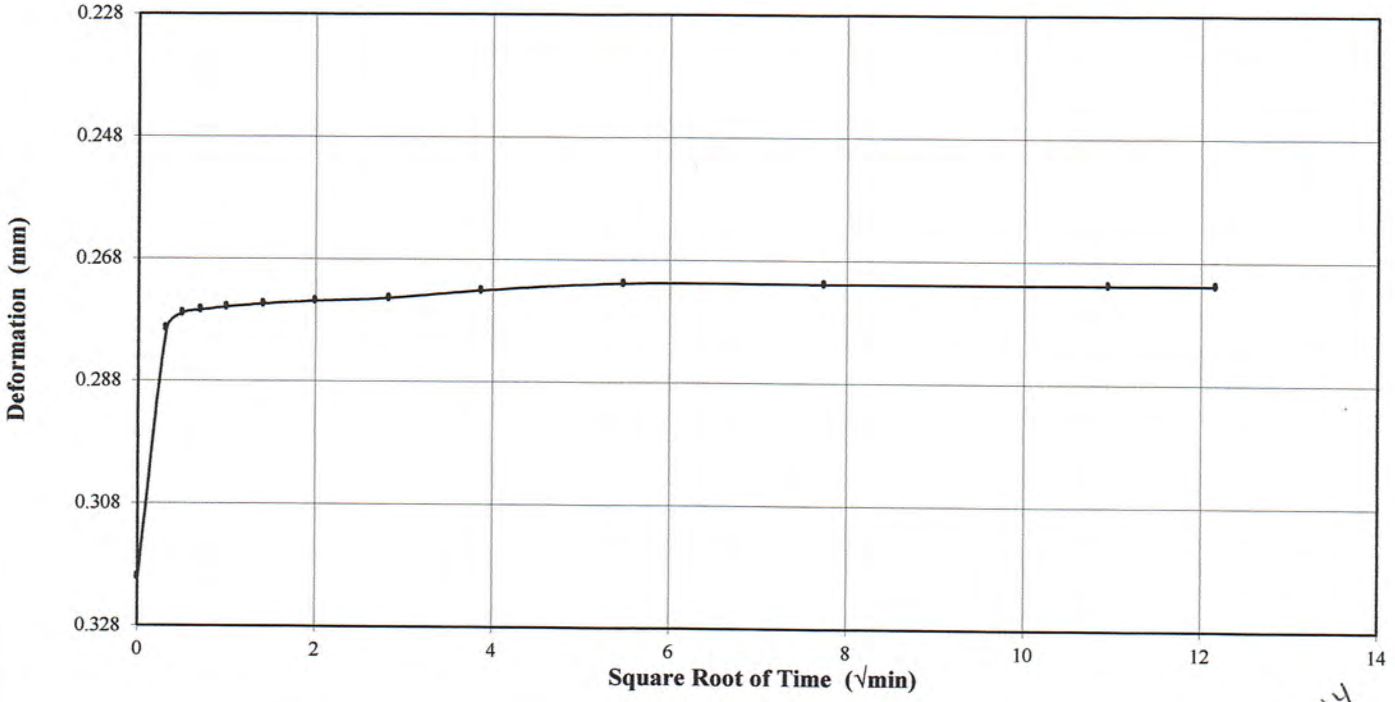
Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-09, S-06 (10.0-12.0')
Lab Sample No: 14E297

ASTM D 2435

ONE-DIMENSIONAL CONSOLIDATION TEST

Figure 5 - 500 psf





6-5-14
NSR

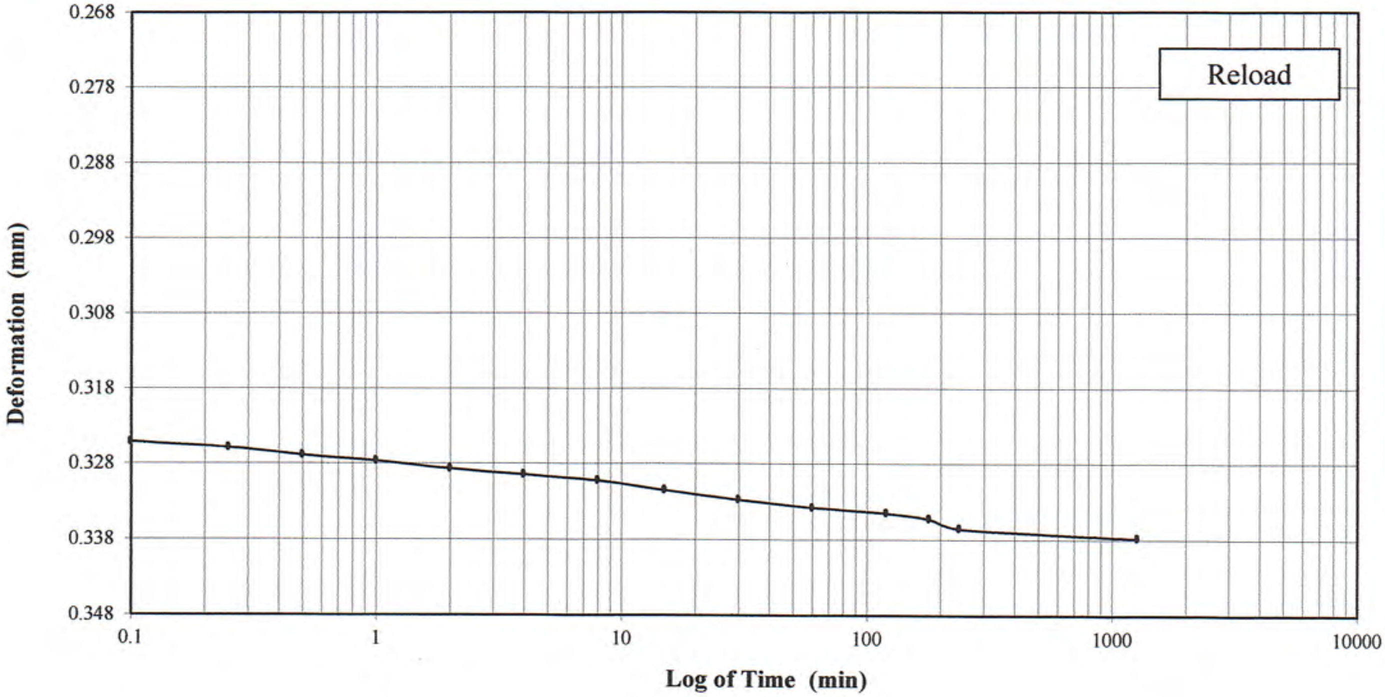
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

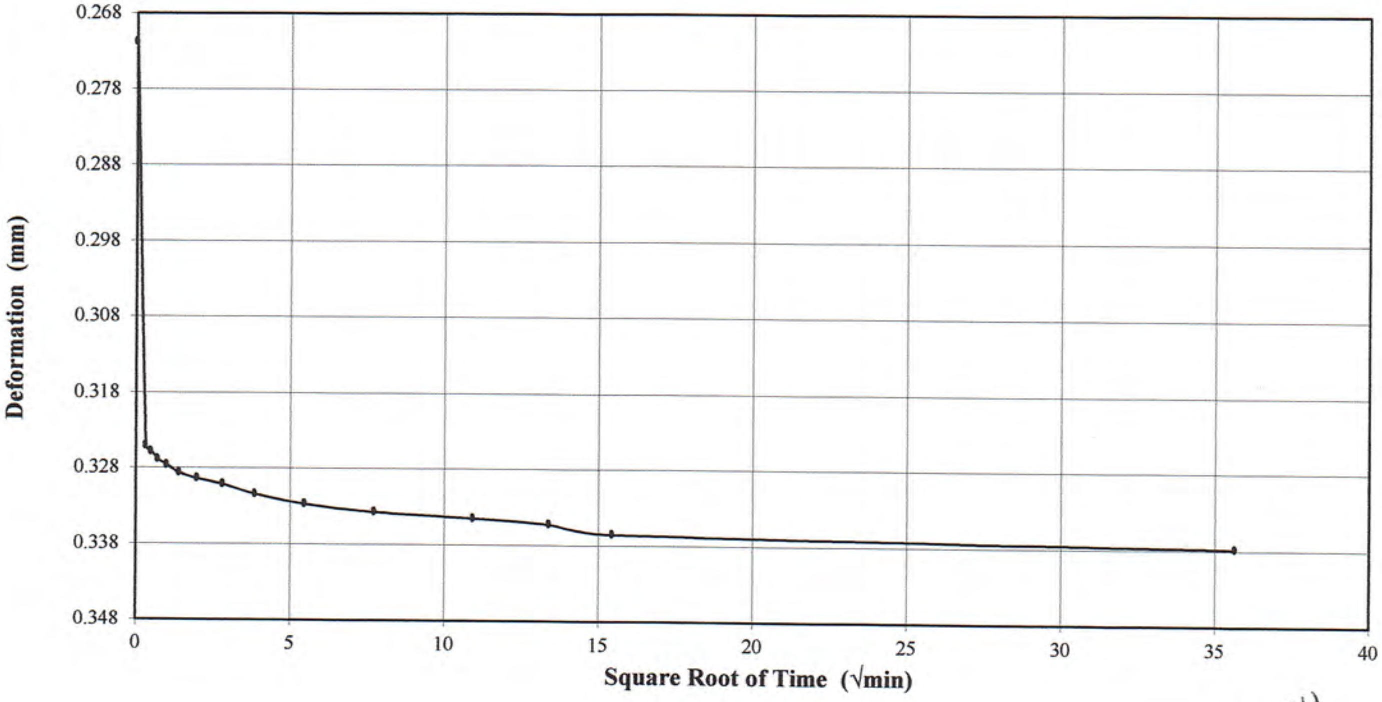
Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-09, S-06 (10.0-12.0')
Lab Sample No: 14E297

ASTM D 2435

ONE-DIMENSIONAL CONSOLIDATION TEST

Figure 6 - 2000 psf





6-5-14
NSR

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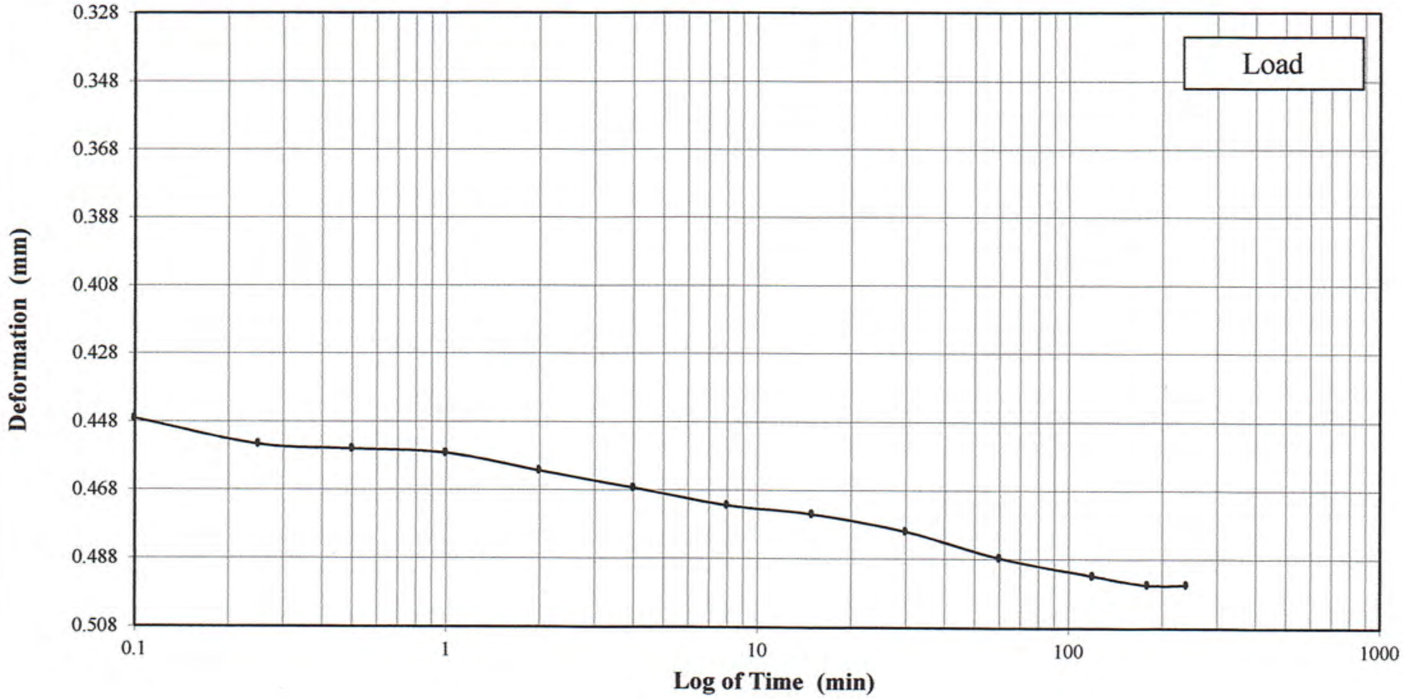
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

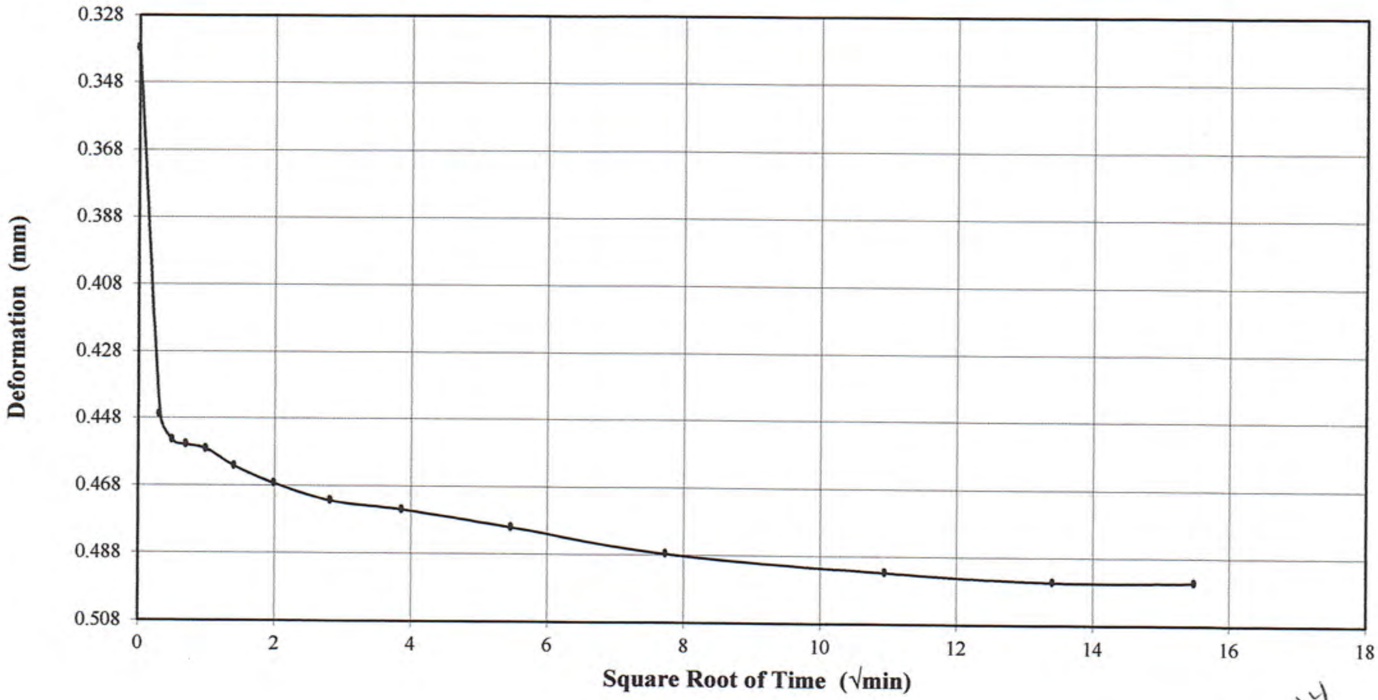
Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-09, S-06 (10.0-12.0')
Lab Sample No: 14E297

ASTM D 2435

ONE-DIMENSIONAL CONSOLIDATION TEST

Figure 7 -4000 psf





6-5-14
NSR

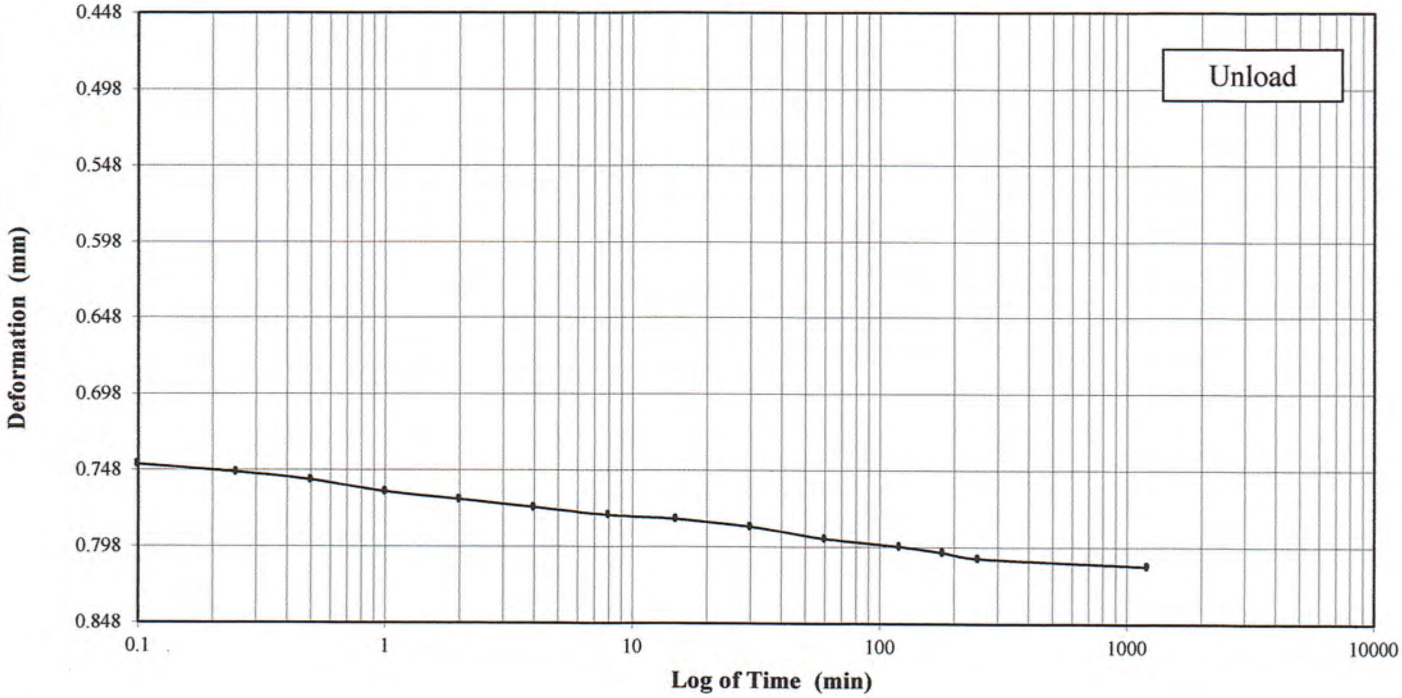
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

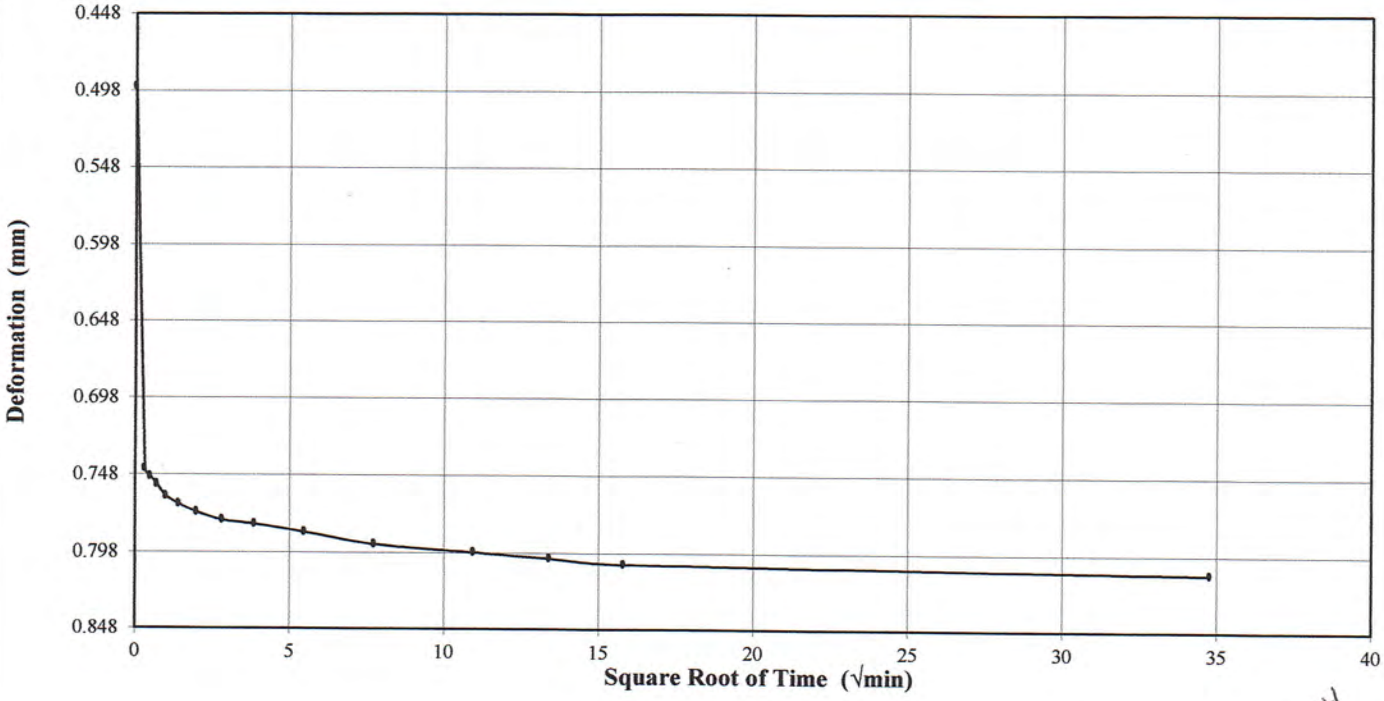
Project Name: Duke Sutton Closure
Project No: 647
Client Sample ID: SPT-09, S-06 (10.0-12.0')
Lab Sample No: 14E297

ASTM D 2435

ONE-DIMENSIONAL CONSOLIDATION TEST

Figure 8 - 8000 psf





6-5-14
NSR

Attachment 3.4

Geosyntec 2015 March Laboratory Testing Results

Excel Geotechnical Testing, Inc.
"Excellence in Testing"

953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Test Results Summary

Project Name: Sutton Final Closure

Project No.: 697

Sample Information		Test Information															Remarks
Site ID	Lab No.	Moisture Content ASTM D 2216	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engine. Classifi. ASTM D 2487	Specific Gravity ASTM D 854	Organic Content ASTM D 2974	Dry Unit Weight Modified ASTM D 2937		Other Tests	
			Gravel Content	Sand Content	Fines Content	Silt Content	Clay Content	LL	PL	PI				Dry Unit Weight	Moisture Content		
(-)	(-)	(%)	(%)	(%)	(%)	(%)	(%)	(-)	(-)	(-)	(-)	(-)	(%)	(pcf)	(%)		
SPT-12 S-1 (0-1.5)	15C581																
SPT-12 S-2 (1.5-3.5)	15C582																
SPT-12 S-3 (3.5-5.5)	15C583	24.0															
SPT-12 S-4 (5.5-7.5)	15C584																
SPT-12 S-5 (8.5-10)	15C585																
SPT-12 S-6 (13.5-15)	15C586																
SPT-12 S-7 (18.5-20)	15C587																
SPT-12 S-8 (23.5-25)	15C588		0.0	0.6	99.4	27.5	71.9	147	66	81	MH	2.513					
SPT-12 S-9 (25-27)	15C589	102.6	1.1	1.8	97.1	30.5	66.6	90	48	42	MH			Note 1	Note 1		
SPT-12 S-10 (28.5-30)	15C590																
SPT-12 S-11 (33.5-35)	15C591																
SPT-12 S-12 (38.5-40)	15C592																
SPT-12 S-13 (43.5-45)	15C593																
SPT-12 S-14 (46-47.5)	15C594		0.0	94.7	5.3							2.713					
SPT-12 S-15 (48.5-50)	15C595																
SPT-12 S-15 (51-52.5)	15C596				39.0			30	14	16	SC						
SPT-12 S-16 (53.5-55)	15C597																
SPT-12 S-17 (56-57.5)	15C598																
SPT-12 S-18 (58.5-60)	15C599	18.2	0.2	93.5	6.3												
SPT-12 S-19 (63.5-65)	15C600				7.0												

Notes:

1 - Sample was disturbed and was not suitable for dry unit weight evaluation.

Excel Geotechnical Testing, Inc.
"Excellence in Testing"

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Test Results Summary

Project Name: Sutton Final Closure

Project No.: 697

Sample Information		Test Information															
Site ID	Lab No.	Moisture Content ASTM D 2216	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engine. Classifi. ASTM D 2487	Specific Gravity ASTM D 854	Organic Content ASTM D 2974	Dry Unit Weight Modified ASTM D 2937		Other Tests	Remarks
			Gravel Content	Sand Content	Fines Content	Silt Content	Clay Content	LL	PL	PI				Dry Unit Weight	Moisture Content		
(-)	(-)	(%)	(%)	(%)	(%)	(%)	(%)	(-)	(-)	(-)	(-)	(-)	(%)	(pcf)	(%)		
SPT-12 S-20 (65-66)	15C601																
SPT-12 S-21 (66-67.5)	15C602																
SPT-12 S-22 (68.5-70)	15C603																
SPT-12 S-23 (73.5-75)	15C604		0.2	82.2	17.6	11.9	5.7	NP	NP	NP	SC						
SPT-12 S-24 (78.5-80)	15C605																
SPT-12 S-25 (83.5-85)	15C606																
SPT-12 S-26 (88.5-90)	15C607																
SPT-12 S-27 (93.5-95)	15C608		0.0	69.7	30.3	22.2	8.1	NP	NP	NP	SC	2.725					
SPT-12 S-28 (98.5-100)	15C609																
SPT-13 S-1 (0-0.3)	15C610																
SPT-13 S-1 (0.3-2)	15C610																
SPT-13 S-2 (2-4)	15C611	38.1															
SPT-13 S-3 (4-6)	15C612																
SPT-13 S-4 (6-8)	15C613																
SPT-13 S-5 (8.5-10)	15C614																
SPT-13 S-6 (13.5-15)	15C615																
SPT-13 S-7 (18.5-20)	15C616																
SPT-13 S-8 (23.5-25)	15C617																
SPT-13 S-9 (28.5-30)	15C618																
SPT-13 S-9 (28.5-30)	15C618																

Notes:

Excel Geotechnical Testing, Inc.
"Excellence in Testing"

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Test Results Summary

Project Name: Sutton Final Closure

Project No.: 697

Sample Information		Test Information															
Site ID	Lab No.	Moisture Content ASTM D 2216	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engine. Classifi. ASTM D 2487	Specific Gravity ASTM D 854	Organic Content ASTM D 2974	Dry Unit Weight Modified ASTM D 2937		Other Tests	Remarks
			Gravel Content	Sand Content	Fines Content	Silt Content	Clay Content	LL	PL	PI				Dry Unit Weight	Moisture Content		
(-)	(-)	(%)	(%)	(%)	(%)	(%)	(%)	(-)	(-)	(-)	(-)	(-)	(%)	(pcf)	(%)		
SPT-13 S-10 (33.5-35)	15C619																
SPT-13 S-11 (38.5-40)	15C620																
SPT-13 S-12 (43.5-45)	15C621		0.0	95.2	4.8							2.668					
SPT-13 S-13 (46-47.5)	15C622																
SPT-13 S-14 (48.5-50)	15C623																
SPT-13 S-15 (50)	15C624																
SPT-13 S-16 (50-52)	15C625																
SPT-13 S-17 (52-54)	15C626		0.0	7.0	93.0	36.0	57.0	50	24	26	CH	2.701		86.8	33.8		
SPT-13 S-18 (54-55.5)	15C627																
SPT-13 S-19 (55.5-57.5)	15C629																
SPT-13 S-20 (58.5-60)	15C630		0.0	95.7	4.3	3.3	1.0	NP	NP	NP	SP						
SPT-13 S-21 (63.5-65)	15C631																
SPT-13 S-22 (68.5-70)	15C632																
SPT-13 S-23 (73.5-75)	15C633																
SPT-13 S-24 (78.5-80)	15C634		0.1	85.6	14.3			NP	NP	NP	SC						
SPT-13 S-25 (83.5-85)	15C635																
SPT-14 S-1 (0-2)	15C636																
SPT-14 S-2 (2-4)	15C637																
SPT-14 S-3 (4-6)	15C638	35.8															
SPT-14 S-4 (6-8)	15C639																

Notes:

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Test Results Summary

Project Name: Sutton Final Closure

Project No.: 697

Sample Information		Test Information															
Site ID	Lab No.	Moisture Content ASTM D 2216	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engine. Classifi. ASTM D 2487	Specific Gravity ASTM D 854	Organic Content ASTM D 2974	Dry Unit Weight Modified ASTM D 2937		Other Tests	Remarks
			Gravel Content	Sand Content	Fines Content	Silt Content	Clay Content	LL	PL	PI				Dry Unit Weight	Moisture Content		
(-)	(-)	(%)	(%)	(%)	(%)	(%)	(%)	(-)	(-)	(-)	(-)	(-)	(%)	(pcf)	(%)		
SPT-14 S-5 (8-10)	15C640																
SPT-14 S-6 (13.5-15)	15C641																
SPT-14 S-7 (18.5-20)	15C642																
SPT-14 S-8 (23.5-25)	15C643																
SPT-14 S-9 (28.5-30)	15C644		0.0	95.0	5.0												
SPT-14 S-10 (33.5-35)	15C645																
SPT-14 S-11 (38.5-40)	15C646																
SPT-14 S-12 (43.5-45)	15C647		0.4	96.6	3.0												
SPT-14 S-13 (46-47.5)	15C648																
SPT-14 S-14 (48.5-50)	15C649																
SPT-14 S-15 (51-52.5)	15C650		0.0	4.6	95.4	57.3	38.1	54	24	30	CH						
SPT-14 S-27 (52.5-54.5)	15C662																
SPT-14 S-16 (54.5-56)	15C651																
SPT-14 S-17 (58.5-60)	15C652																
SPT-14 S-18 (61-62.5)	15C653																
SPT-14 S-19 (63.5-65)	15C654		0.2	95.1	4.7												
SPT-14 S-20 (68.5-70)	15C655																
SPT-14 S-21 (73.5-75)	15C656																
SPT-14 S-22 (78.5-80)	15C657																
SPT-14 S-23 (83.5-85)	15C658		0.0	79.8	20.2			NP	NP	NP	SC		2.695				

Notes:

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Test Results Summary

Project Name: Sutton Final Closure

Project No.: 697

Sample Information		Test Information															Remarks
Site ID	Lab No.	Moisture Content ASTM D 2216	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engine. Classifi. ASTM D 2487	Specific Gravity ASTM D 854	Organic Content ASTM D 2974	Dry Unit Weight Modified ASTM D 2937		Other Tests	
			Gravel Content	Sand Content	Fines Content	Silt Content	Clay Content	LL	PL	PI				Dry Unit Weight	Moisture Content		
(-)	(-)	(%)	(%)	(%)	(%)	(%)	(%)	(-)	(-)	(-)	(-)	(-)	(%)	(pcf)	(%)		
SPT-14 S-24 (88.5-90)	15C659																
SPT-14 S-25 (93.5-95)	15C660																
SPT-14 S-26 (98.5-100)	15C661																
PT-2 S-1 (3.5-5)	15C478																
PT-2 S-2 (8.5-10)	15C479																
PT-2 S-3 (13.5-15)	15C480																
PT-2 S-3 (13.5-15)	15C481																
PT-2 S-4 (18.5-20)	15C482																
PT-2 S-5 (23.5-25)	15C483																
PT-2 S-6 (28.5-30)	15C484																
PT-2 S-7 (33.5-35)	15C485	18.0	0.0	94.2	5.8	5.6	0.2										
PT-2 S-8 (38.5-40)	15C486																
PT-3 S-1 (3.5-5)	15C487																
PT-3 S-2 (8.5-10)	15C488																
PT-3 S-3 (13.5-15)	15C489																
PT-3 S-4 (18.5-20)	15C490																
PT-3 S-5 (23.5-25)	15C491																
PT-3 S-6 (28.5-30)	15C492																
PT-3 S-7 (33.5-35)	15C493																
PT-3 S-8 (38.5-40)	15C494																

Notes

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Test Results Summary

Project Name: Sutton Final Closure

Project No.: 697

Sample Information		Test Information															
Site ID	Lab No.	Moisture Content ASTM D 2216	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engine. Classifi. ASTM D 2487	Specific Gravity ASTM D 854	Organic Content ASTM D 2974	Dry Unit Weight Modified ASTM D 2937		Other Tests	Remarks
			Gravel Content	Sand Content	Fines Content	Silt Content	Clay Content	LL	PL	PI				Dry Unit Weight	Moisture Content		
(-)	(-)	(%)	(%)	(%)	(%)	(%)	(%)	(-)	(-)	(-)	(-)	(-)	(%)	(pcf)	(%)		
PT-3 S-9 (43.5-45)	15C495																
PT-3 S-10 (46-47.5)	15C496																
PT-3 S-11 (48.5-50)	15C497				2.2												
PT-3 S-12 (51-52.5)	15C498		0.0	93.3	6.7	6.3	0.4										
PT-3 S-13 (53.5-55)	15C499				2.6												
PT-3 S-14 (56-57.5)	15C500																
PT-3 S-15 (58.5-60)	15C501																
PT-3 S-16 (63.5-65)	15C502																
PT-3 S-17 (68.5-70)	15C503		0.3	87.9	11.8	7.1	4.7										
LO-SPT-1 S-1 (0.7-2)	15C504																
LO-SPT-1 S-2 (2-4)	15C505																
LO-SPT-1 S-3 (4-6)	15C506	24.1	1.4	55.9	42.7							2.418					
LO-SPT-1 S-4 (6-8)	15C507																
LO-SPT-1 S-5 (8.5-10)	15C508																
LO-SPT-1 S-6 (13.5-15)	15C509																
LO-SPT-1 S-7 (18.5-20)	15C510																
LO-SPT-1 S-8 (23.5-25)	15C511																
LO-SPT-1 S-9 (28.5-30)	15C512		0.2	96.7	3.1							2.693					
LO-SPT-1 S-10 (31-32.5)	15C513																
LO-SPT-1 S-11 (33.5-35)	15C514																

Notes:

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Test Results Summary

Project Name: Sutton Final Closure

Project No.: 697

Sample Information		Test Information															
Site ID (-)	Lab No. (-)	Moisture Content ASTM D 2216 (%)	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engine. Classifi. ASTM D 2487 (-)	Specific Gravity ASTM D 854 (-)	Organic Content ASTM D 2974 (%)	Dry Unit Weight Modified ASTM D 2937		Other Tests	Remarks
			Gravel Content (%)	Sand Content (%)	Fines Content (%)	Silt Content (%)	Clay Content (%)	LL (-)	PL (-)	PI (-)				Dry Unit Weight (pcf)	Moisture Content (%)		
LO-SPT-1 S-12 (36-37.5)	15C515				2.4												
LO-SPT-1 S-13 (38.5-40)	15C516																
LO-SPT-1 S-14 (41-42.5)	15C517																
LO-SPT-1 S-15 (43.5-45)	15C518																
LO-SPT-1 S-16 (48.5-50)	15C519																
LO-SPT-2 S-1 (1-2.5)	15C520																
LO-SPT-2 S-2 (3.5-5)	15C521																
LO-SPT-2 S-3 (6-7.5)	15C522		0.8	72.2	27.0												
LO-SPT-2 S-4 (8.5-10)	15C523																
LO-SPT-2 S-5 (13.5-15)	15C524																
LO-SPT-2 S-6 (18.5-20)	15C525		0.0	98.0	2.0												
LO-SPT-2 S-7 (23.5-25)	15C526																
LO-SPT-2 S-8 (28.5-30)	15C527																
LO-SPT-2 S-9 (33.5-35)	15C528																
LO-SPT-2 S-10 (38.5-40)	15C529				1.9												
LO-SPT-2 S-11 (43.5-45)	15C530				2.2												
LO-SPT-2 S-12 (48.5-50)	15C531																
LO-SPT-3 S-1 (1-2.5)	15C532																
LO-SPT-3 S-2 (3.5-5)	15C533		0.3	49.6	50.1							2.485					
LO-SPT-3 S-3 (6-7.5)	15C534																

Notes:

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Test Results Summary

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Project No.: 697

Sample Information		Test Information															
Site ID	Lab No.	Moisture Content ASTM D 2216	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engine. Classifi. ASTM D 2487	Specific Gravity ASTM D 854	Organic Content ASTM D 2974	Dry Unit Weight Modified ASTM D 2937		Other Tests	Remarks
			Gravel Content	Sand Content	Fines Content	Silt Content	Clay Content	LL	PL	PI				Dry Unit Weight	Moisture Content		
(-)	(-)	(%)	(%)	(%)	(%)	(%)	(%)	(-)	(-)	(-)	(-)	(-)	(%)	(pcf)	(%)		
LO-SPT-3 S-4 (8.5-9.3)	15C535																
LO-SPT-3 S-4 (9.3-10)	15C536																
LO-SPT-3 S-5 (13.5-15)	15C537		0.0	96.8	3.2												
LO-SPT-3 S-6 (18.5-20)	15C538																
LO-SPT-3 S-7 (23.5-25)	15C539																
LO-SPT-3 S-8 (28.5-30)	15C540																
LO-SPT-3 S-9 (33.5-35)	15C541				2.1							2.678					
LO-SPT-3 S-10 (38.5-40)	15C542																
LO-SPT-3 S-11 (43.5-45)	15C543																
LO-SPT-3 S-12 (48.5-50)	15C544																
LO-SPT-4 S-1 (1-2.5)	15C545																
LO-SPT-4 S-2 (3.5-5)	15C546		1.4	70.8	27.8												
LO-SPT-4 S-3 (6-7.5)	15C547																
LO-SPT-4 S-4 (8.5-10)	15C548																
LO-SPT-4 S-5 (13.5-15)	15C549																
LO-SPT-4 S-6 (18.5-20)	15C550																
LO-SPT-4 S-7 (23.5-25)	15C551		0.0	97.2	2.8												
LO-SPT-4 S-8 (28.5-30)	15C552																
LO-SPT-4 S-9 (33.5-35)	15C553				3.4												
LO-SPT-4 S-10 (38.5-40)	15C554																

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Test Results Summary

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Project No.: 697

Sample Information		Test Information															Remarks
Site ID (-)	Lab No. (-)	Moisture Content ASTM D 2216 (%)	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engine. Classifi. ASTM D 2487 (-)	Specific Gravity ASTM D 854 (-)	Organic Content ASTM D 2974 (%)	Dry Unit Weight Modified ASTM D 2937		Other Tests	
			Gravel Content (%)	Sand Content (%)	Fines Content (%)	Silt Content (%)	Clay Content (%)	LL (-)	PL (-)	PI (-)				Dry Unit Weight (pcf)	Moisture Content (%)		
LO-SPT-4 S-11 (43.5-45)	15C555																
LO-SPT-4 S-12 (48.5-50)	15C556																
LO-SPT-5 S-1 (1-2.5)	15C557																
LO-SPT-5 S-2 (3.5-5)	15C558																
LO-SPT-5 S-3 (6-7.5)	15C559																
LO-SPT-5 S-4 (8.5-10)	15C560				1.2							2.673					
LO-SPT-5 S-5 (13.5-15)	15C561																
LO-SPT-5 S-6 (18.5-20)	15C562																
LO-SPT-5 S-7 (23.5-25)	15C563		0.0	91.3	8.7							2.697					
LO-SPT-5 S-8 (28.5-30)	15C564																
LO-SPT-5 S-9 (33.5-35)	15C565																
LO-SPT-5 S-10 (38.5-40)	15C566																
LO-SPT-5 S-11 (43.5-45)	15C567																
LO-SPT-5 S-12 (48.5-50)	15C568																
LO-SPT-6 S-1 (1-2.5)	15C569																
LO-SPT-6 S-2 (3.5-5)	15C570																
LO-SPT-6 S-3 (6-7.5)	15C571											2.681					
LO-SPT-6 S-4 (8.5-10)	15C572				2.7												
LO-SPT-6 S-5 (13.5-15)	15C573		0.0	96.7	3.3												
LO-SPT-6 S-6 (18.5-20)	15C574																

Notes:

Excel Geotechnical Testing, Inc.
"Excellence in Testing"

953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Test Results Summary

Project Name: Sutton Final Closure

Project No.: 697

Sample Information		Test Information															Remarks
Site ID	Lab No.	Moisture Content ASTM D 2216	Grain Size Analysis ASTM D 422					Atterberg Limits ASTM D 4318			Engine. Classifi. ASTM D 2487	Specific Gravity ASTM D 854	Organic Content ASTM D 2974	Dry Unit Weight Modified ASTM D 2937		Other Tests	
			Gravel Content	Sand Content	Fines Content	Silt Content	Clay Content	LL	PL	PI				Dry Unit Weight	Moisture Content		
(-)	(-)	(%)	(%)	(%)	(%)	(%)	(%)	(-)	(-)	(-)	(-)	(-)	(%)	(pcf)	(%)		
LO-SPT-6 S-7 (23.5-25)	15C575																
LO-SPT-6 S-8 (28.5-30)	15C576																
LO-SPT-6 S-9 (33.5-35)	15C577				2.5												
LO-SPT-6 S-10 (38.5-40)	15C578				2.0												
LO-SPT-6 S-11 (43.5-45)	15C579																
LO-SPT-6 S-12 (48.5-50)	15C580																

Notes:

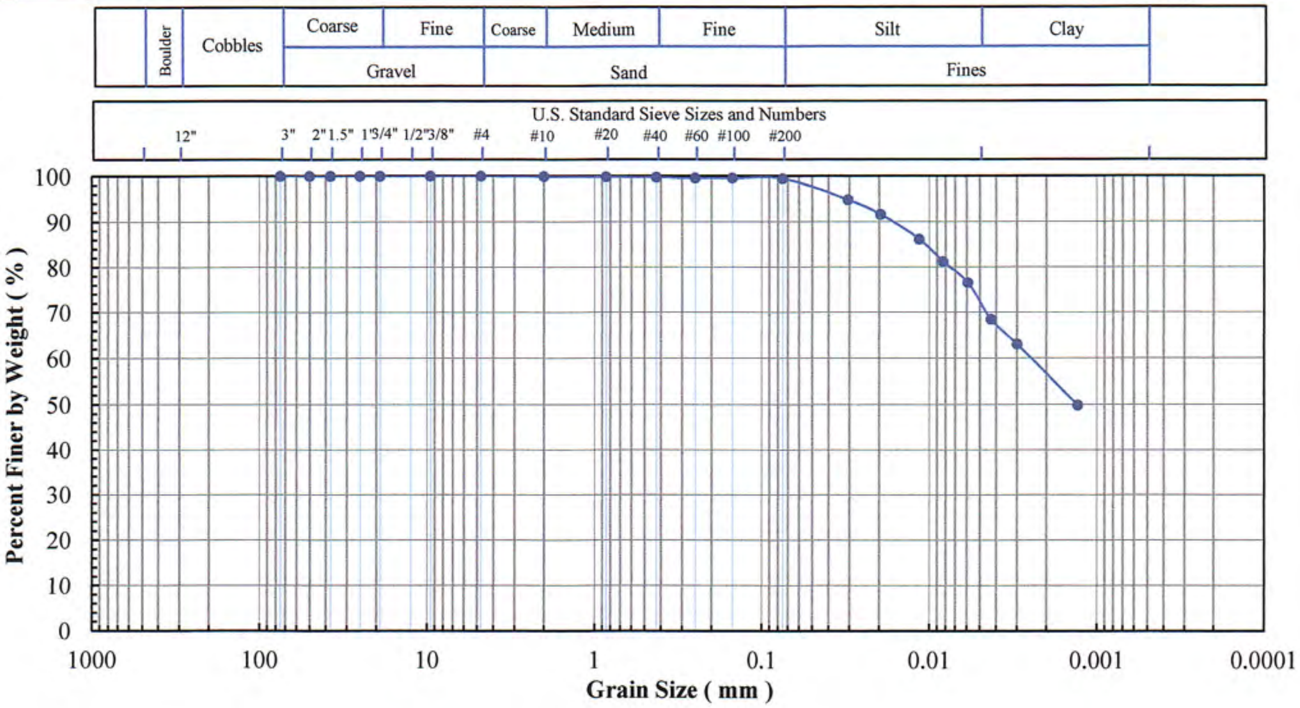
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	SPT-12, S-8 (23.5-25')
Lab Sample No:	15C588

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



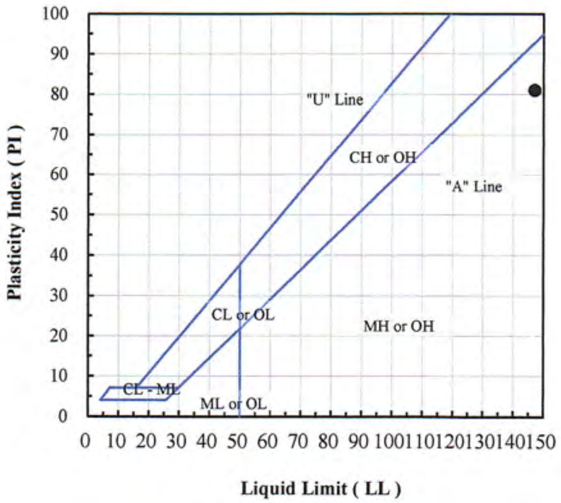
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	99.9
#20	0.850	99.8
#40	0.425	99.7
#60	0.250	99.5
#100	0.150	99.5
#200	0.075	99.4

Specific Gravity (-):	2.513

Hydrometer Particle Diameter (mm)	% Finer
0.0307	94.7
0.0115	86.1
0.0059	76.5
0.0030	63.0
0.0013	49.8

Gravel (%):	
Sand (%):	0.6
Fines (%):	99.4
Silt (%):	27.5
Clay (%):	71.9

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-12, S-8 (23.5-25')	15C588	100.1	99.4	147	66	81	MH - Elastic silt

Note(s):

4-24-15
APK, NSR

Excel Geotechnical Testing, Inc.
"Excellence in Testing"

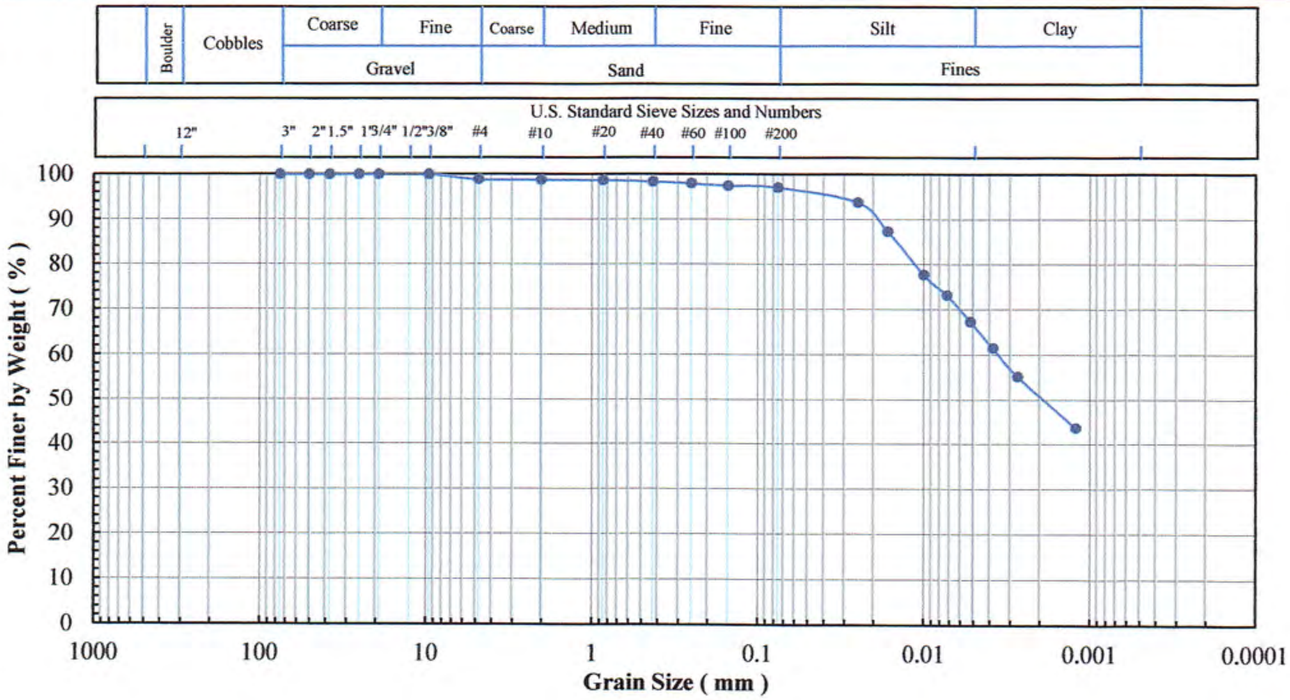
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	SPT-12, S-9 (25-27')
Lab Sample No:	15C589

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



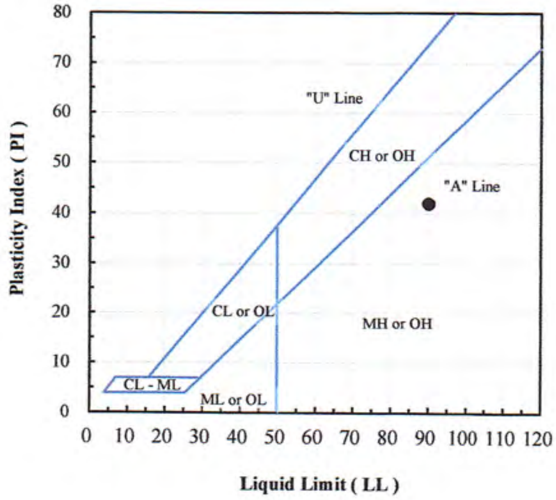
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	98.9
#10	2.00	98.8
#20	0.850	98.7
#40	0.425	98.4
#60	0.250	98.0
#100	0.150	97.5
#200	0.075	97.1

Specific Gravity (-):	2.65

Hydrometer Particle Diameter (mm)	% Finer
0.0248	93.8
0.0099	77.7
0.0052	67.4
0.0027	55.3
0.0012	43.7

Gravel (%):	1.1
Sand (%):	1.8
Fines (%):	97.1
Silt (%):	30.5
Clay (%):	66.6

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-12, S-9 (25-27')	15C589	102.6	97.1	90	48	42	MH - Elastic silt

Note(s): An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

5-01-15
NSR

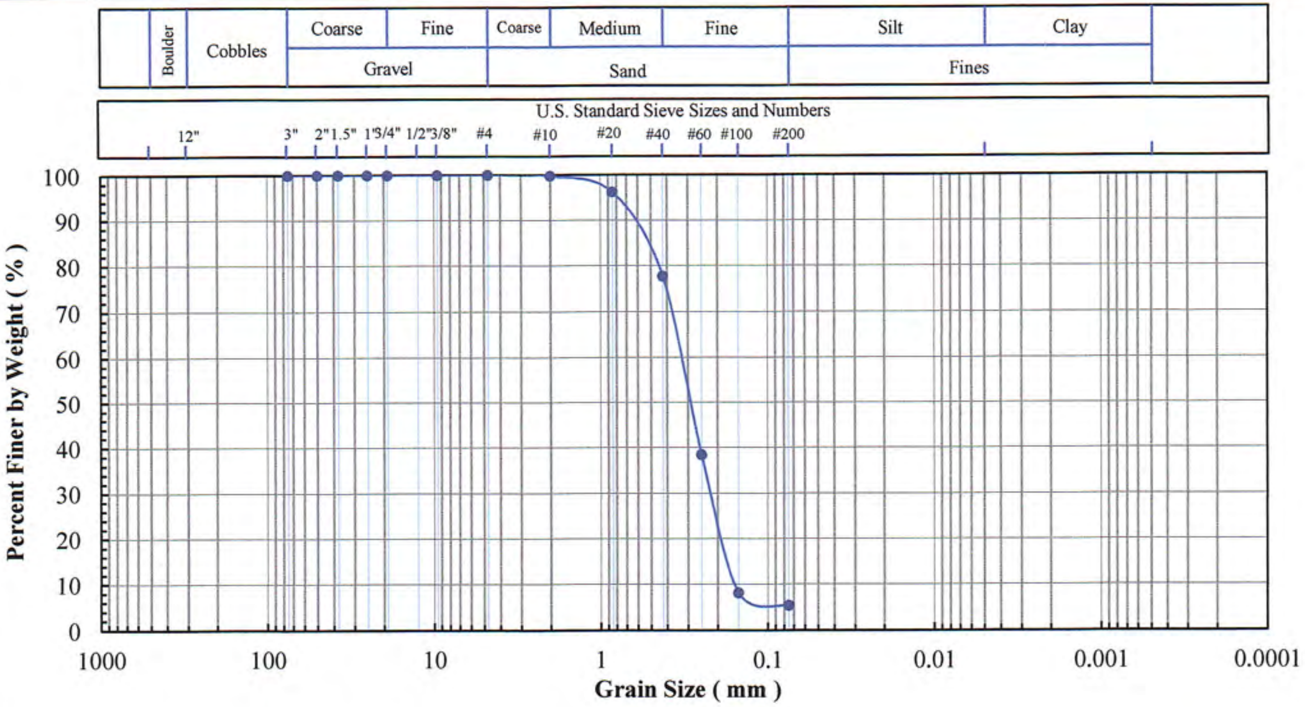
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Sutton Final Closure
Project No: 697
Client Sample ID: SPT-12, S-14 (46-47.5')
Lab Sample No: 15C594

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



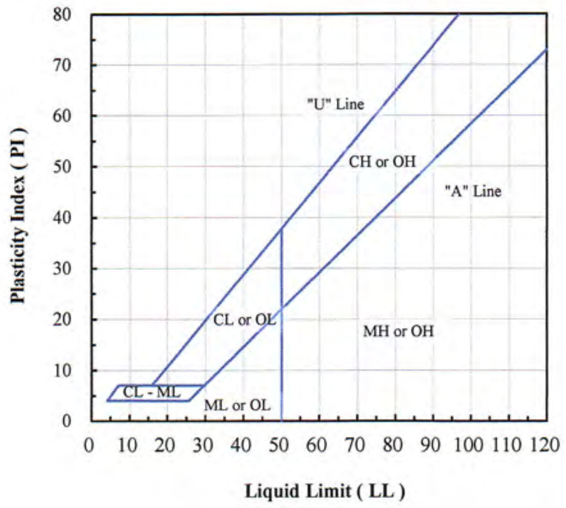
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	99.8
#20	0.850	96.2
#40	0.425	77.6
#60	0.250	38.4
#100	0.150	8.1
#200	0.075	5.3

Specific Gravity (-):	2.713

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	94.7
Fines (%):	5.3
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-12, S-14 (46-47.5')	15C594	23.3	5.3				

Note(s):

4-24-15
APK, NSA

Excel Geotechnical Testing, Inc.

"Excellence in Testing"

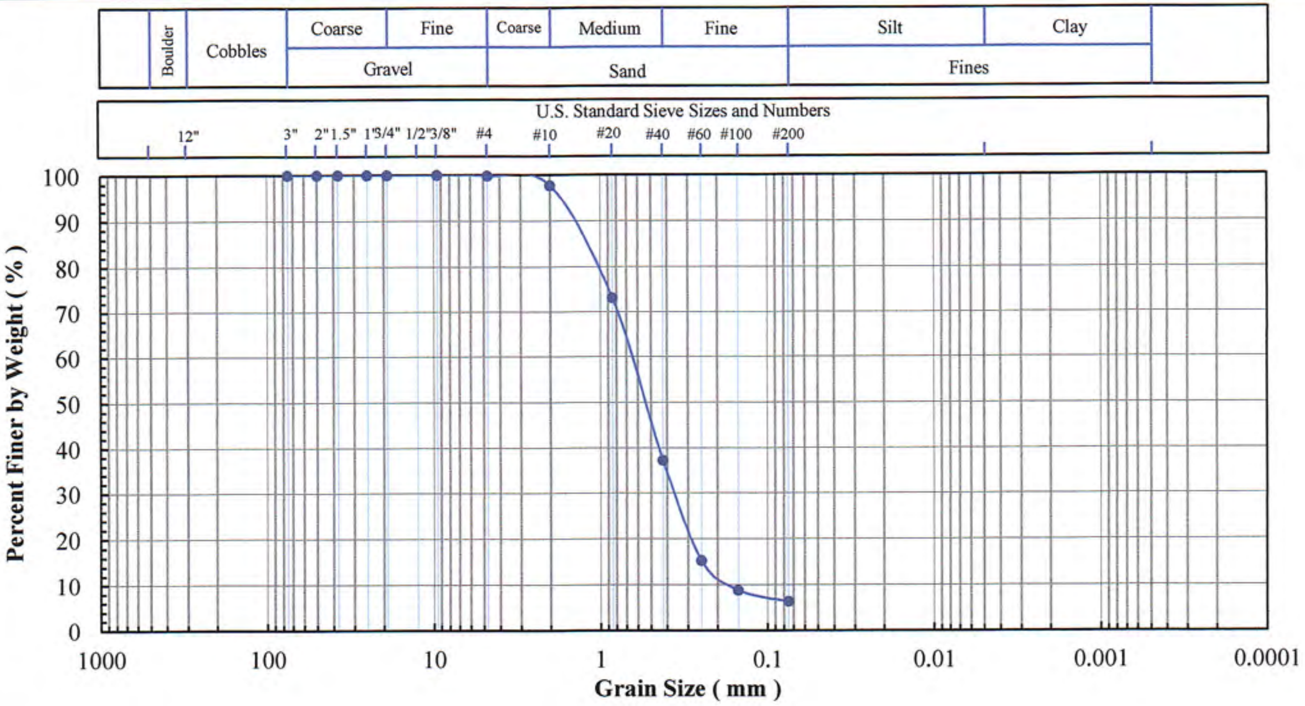
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Sutton Final Closure
Project No: 697
Client Sample ID: SPT-12, S-18 (58.5-60')
Lab Sample No: 15C599

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



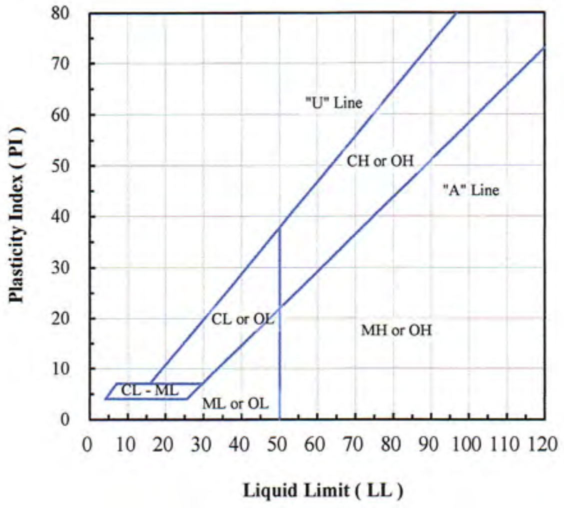
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.8
#10	2.00	97.7
#20	0.850	73.1
#40	0.425	37.2
#60	0.250	15.3
#100	0.150	8.8
#200	0.075	6.3

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	0.2
Sand (%):	93.5
Fines (%):	6.3
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-12, S-18 (58.5-60')	15C599	18.2	6.3				

Note(s):

11-24-15
APK, NSA

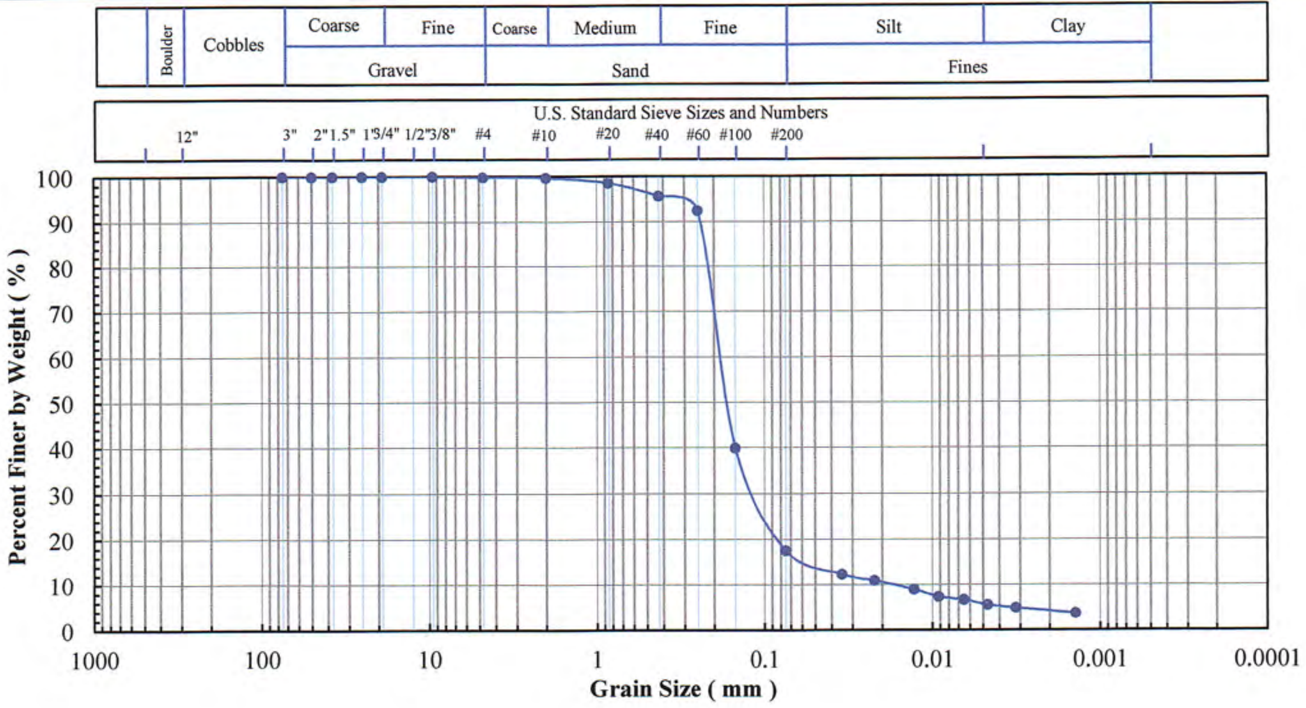
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Sutton Final Closure
Project No: 697
Client Sample ID: SPT-12, S-23 (73.5-75')
Lab Sample No: 15C604

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



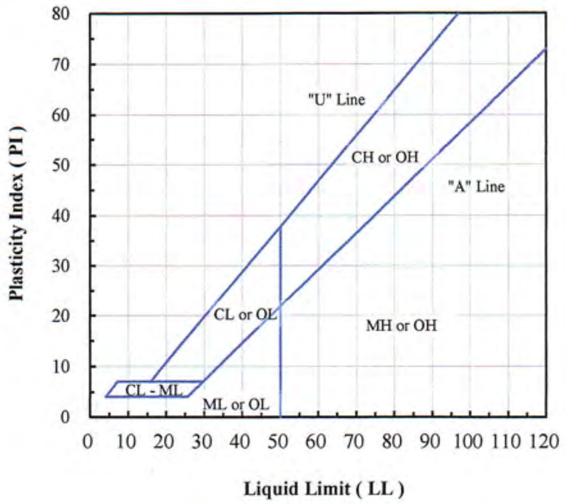
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.8
#10	2.00	99.7
#20	0.850	98.5
#40	0.425	95.6
#60	0.250	92.4
#100	0.150	39.8
#200	0.075	17.6

Specific Gravity (-):	2.65

Hydrometer Particle Diameter (mm)	% Finer
0.0347	12.3
0.0129	8.9
0.0065	6.6
0.0032	4.8
0.0014	3.6

Gravel (%):	0.2
Sand (%):	82.2
Fines (%):	17.6
Silt (%):	11.9
Clay (%):	5.7

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-12, S-23 (73.5-75')	15C604	24.0	17.6	NP	NP	NP	SC - Clayey sand

Note(s): An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.
Engineering classification is based on the assumption that the fines are either CL or CH.

4-24-15
APK, NSR

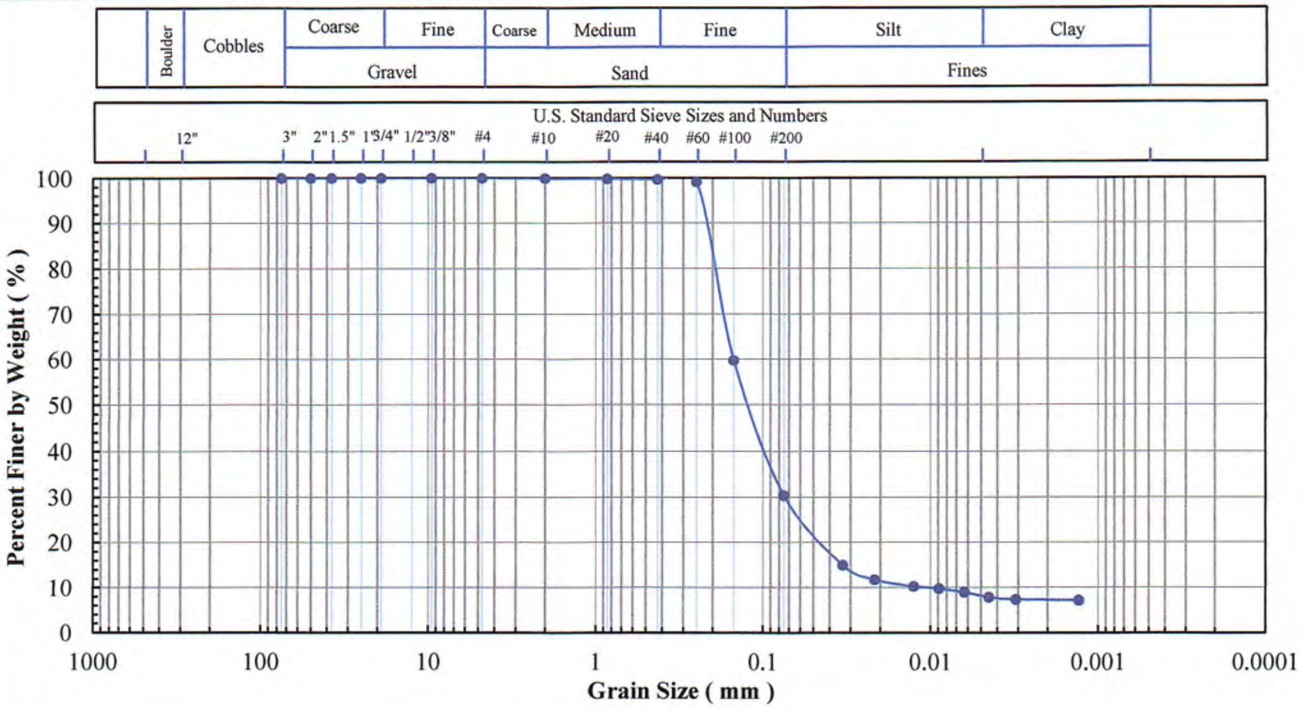
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Sutton Final Closure
Project No: 697
Client Sample ID: SPT-12, S-27 (93.5-95')
Lab Sample No: 15C608

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



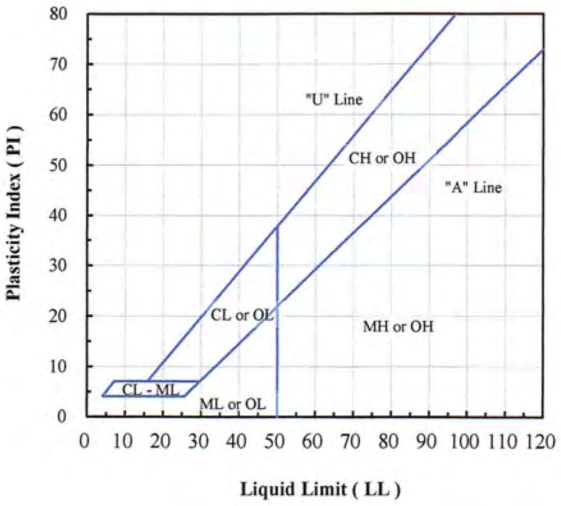
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	99.9
#20	0.850	99.8
#40	0.425	99.6
#60	0.250	99.1
#100	0.150	59.7
#200	0.075	30.3

Specific Gravity (-):	2.725

Hydrometer Particle Diameter (mm)	% Finer
0.0335	14.9
0.0126	10.2
0.0063	8.9
0.0031	7.3
0.0013	7.1

Gravel (%):	
Sand (%):	69.7
Fines (%):	30.3
Silt (%):	22.2
Clay (%):	8.1

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-12, S-27 (93.5-95')	15C608	29.5	30.3	NP	NP	NP	SC - Clayey sand

Note(s): Engineering classification is based on the assumption that the fines are either CL or CH.

4-24-15
APK, NSR

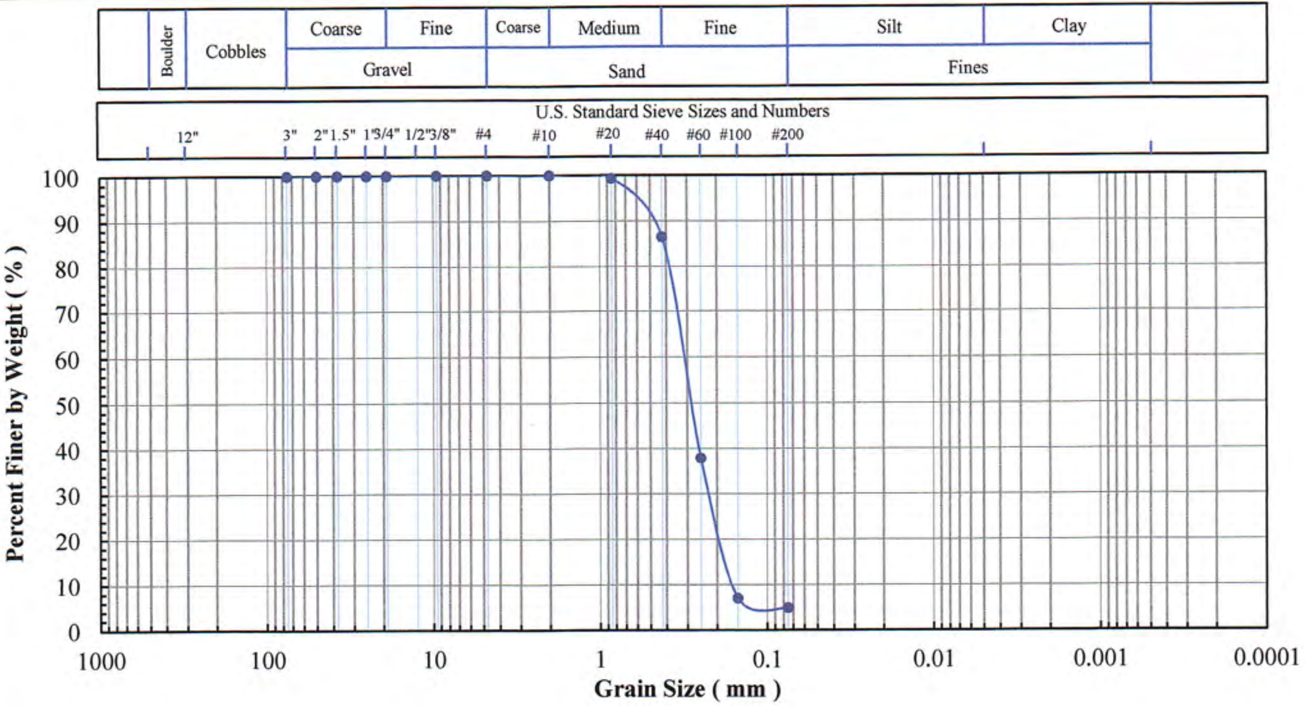
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Sutton Final Closure
Project No: 697
Client Sample ID: SPT-13, S-12 (43.5-45')
Lab Sample No: 15C621

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



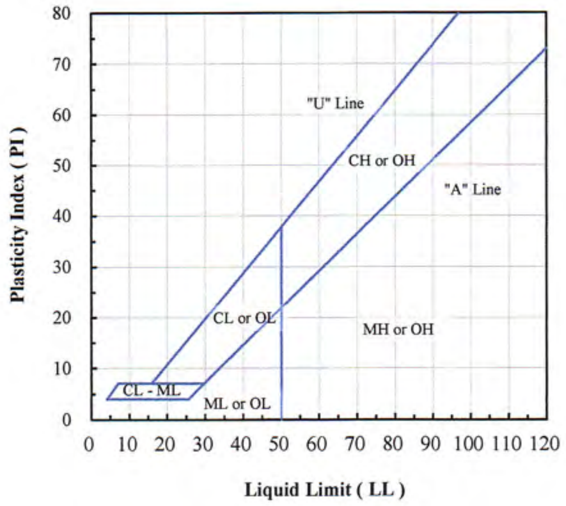
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	99.3
#40	0.425	86.5
#60	0.250	37.8
#100	0.150	7.0
#200	0.075	4.8

Specific Gravity (-):	2.668

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	95.2
Fines (%):	4.8
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-13, S-12 (43.5-45')	15C621	24.1	4.8				

Note(s):

4-24-15
APK/NSR

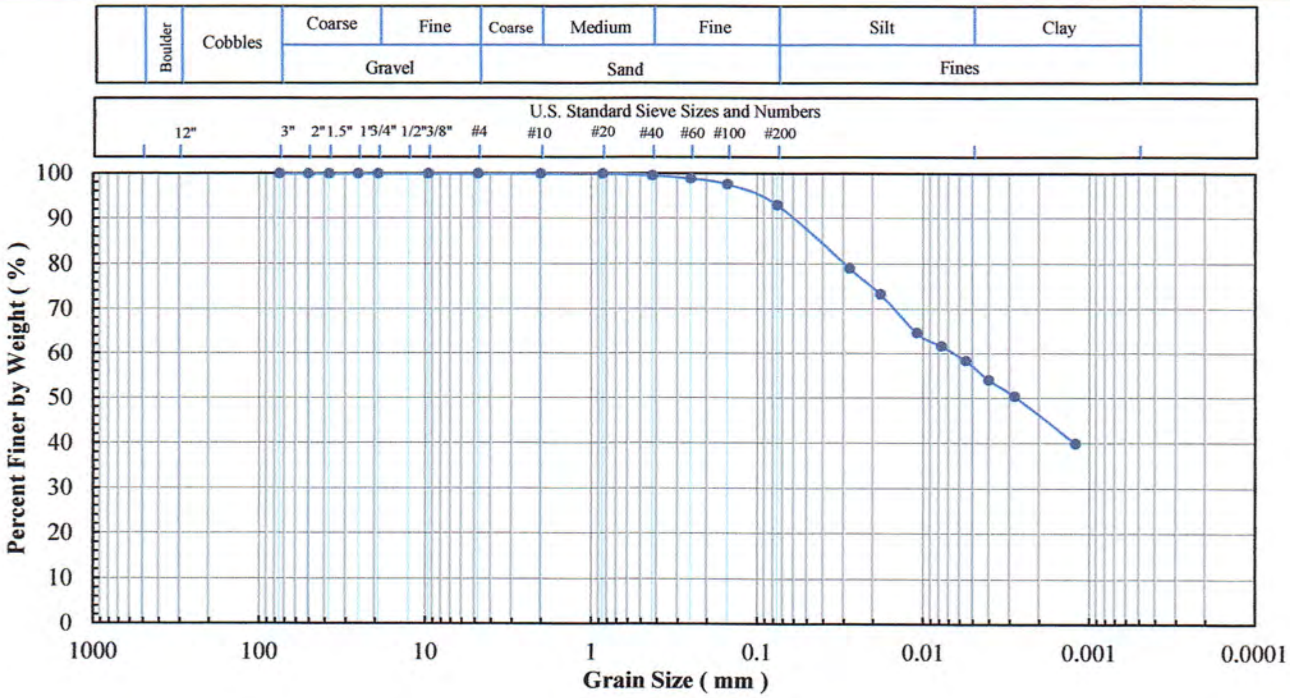
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	SPT-13 S-17 (52-54')
Lab Sample No:	15C626

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont, Eng. Classification, Atterberg Limits



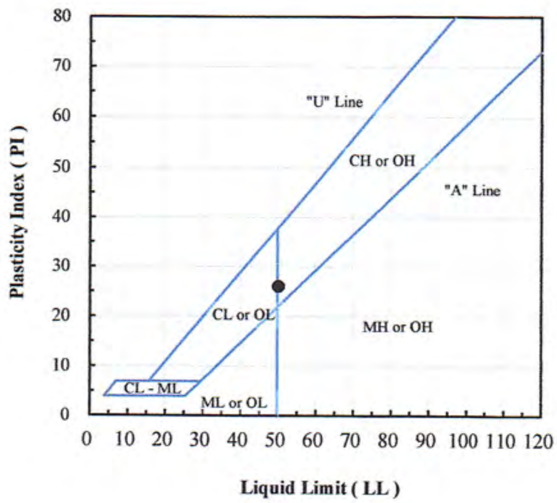
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	100.0
#40	0.425	99.6
#60	0.250	98.9
#100	0.150	97.6
#200	0.075	93.0

Specific Gravity (-):	2.701

Hydrometer Particle Diameter (mm)	% Finer
0.0276	79.1
0.0108	64.7
0.0055	58.4
0.0028	50.4
0.0012	40.0

Gravel (%):	
Sand (%):	7.0
Fines (%):	93.0
Silt (%):	36.0
Clay (%):	57.0

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-13 S-17 (52-54')	15C626		93.0	50	24	26	CH - Fat clay

Note(s):

5-01-15
NSR

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Oct 30 2019

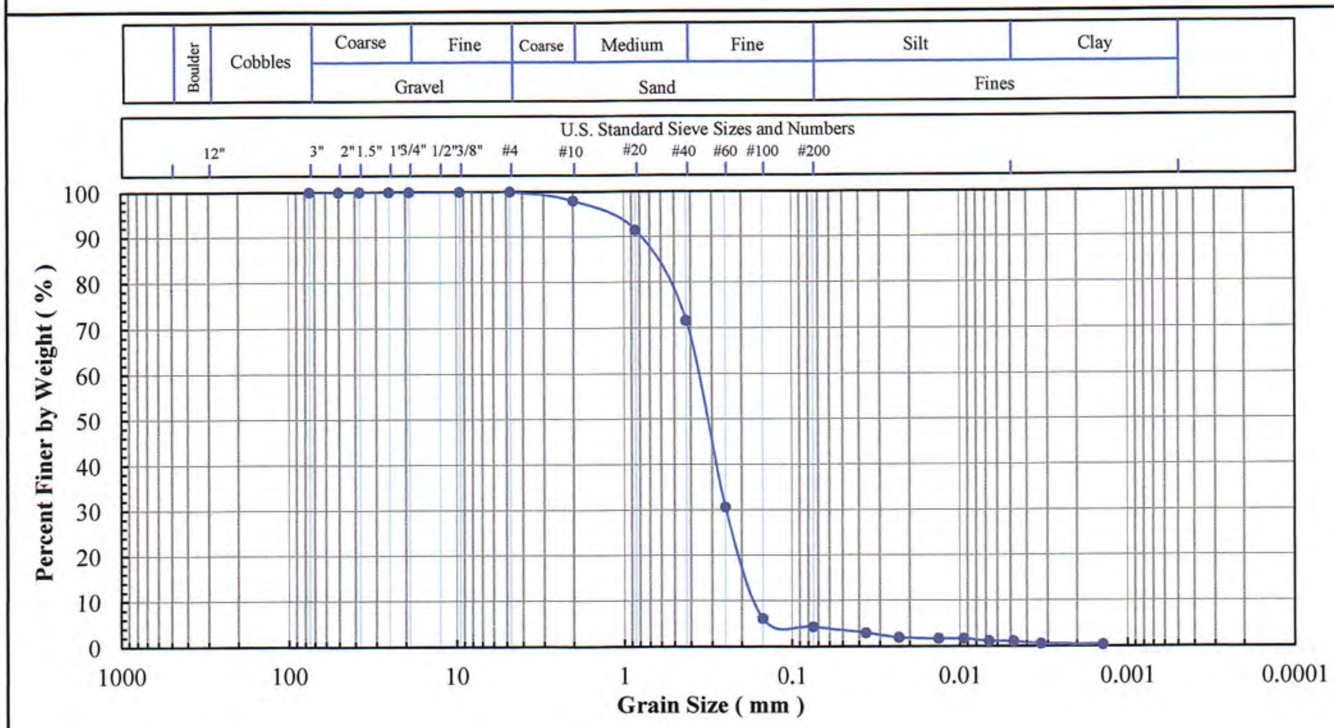
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	SPT-13, S-20 (58.5-60')
Lab Sample No:	15C630

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



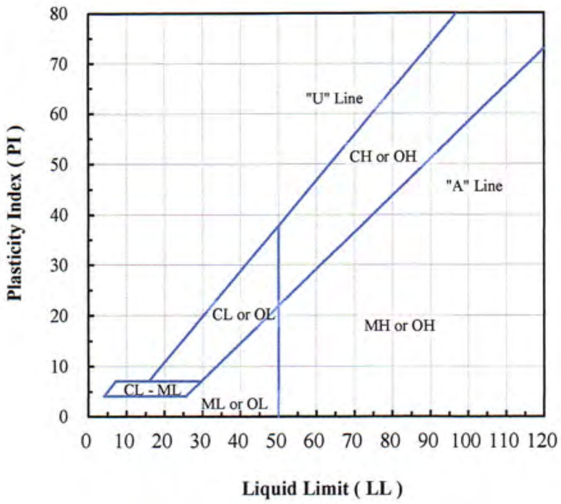
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	98.0
#20	0.850	91.4
#40	0.425	71.6
#60	0.250	30.6
#100	0.150	6.1
#200	0.075	4.3

Specific Gravity (-):	2.65

Hydrometer Particle Diameter (mm)	% Finer
0.0365	2.9
0.0134	1.6
0.0067	1.1
0.0033	0.5
0.0014	0.3

Gravel (%):	
Sand (%):	95.7
Fines (%):	4.3
Silt (%):	3.3
Clay (%):	1.0

Coeff. Unif. (Cu):	2.1
Coeff. Curv. (Cc):	0.9



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-13, S-20 (58.5-60')	15C630	26.6	4.3	NP	NP	NP	SP - Poorly graded sand

Note(s): An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

4-24-15
APK, NSR

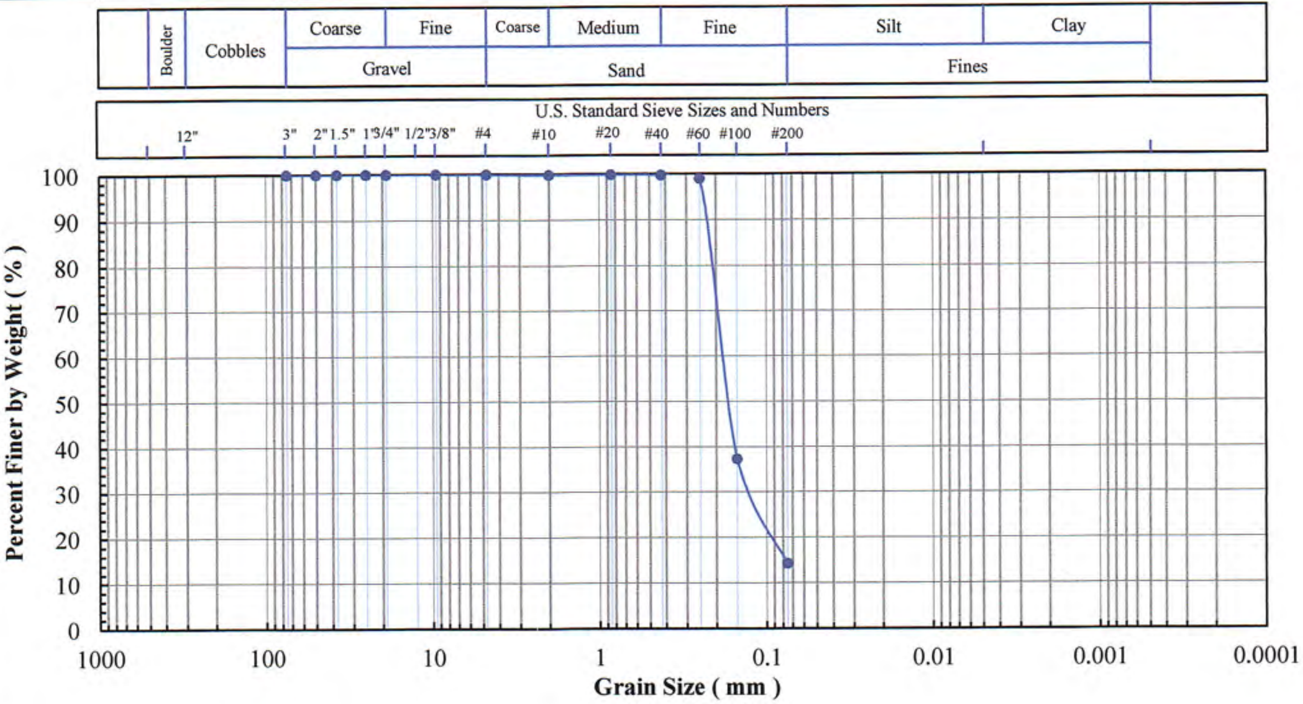
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	SPT-13, S-24 (78.5-80')
Lab Sample No:	15C634

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



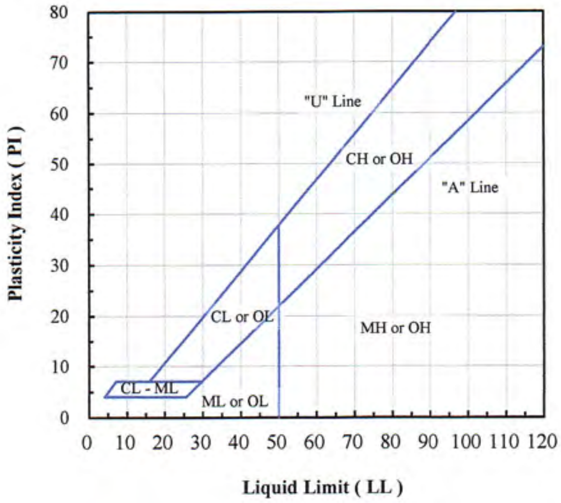
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.9
#10	2.00	99.8
#20	0.850	99.8
#40	0.425	99.7
#60	0.250	98.9
#100	0.150	37.3
#200	0.075	14.3

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	0.1
Sand (%):	85.6
Fines (%):	14.3
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-13, S-24 (78.5-80')	15C634	25.5	14.3	NP	NP	NP	SC - Clayey sand

Note(s):

Engineering classification is based on the assumption that the fines are either CL or CH.

4-24-15
APK/NSL

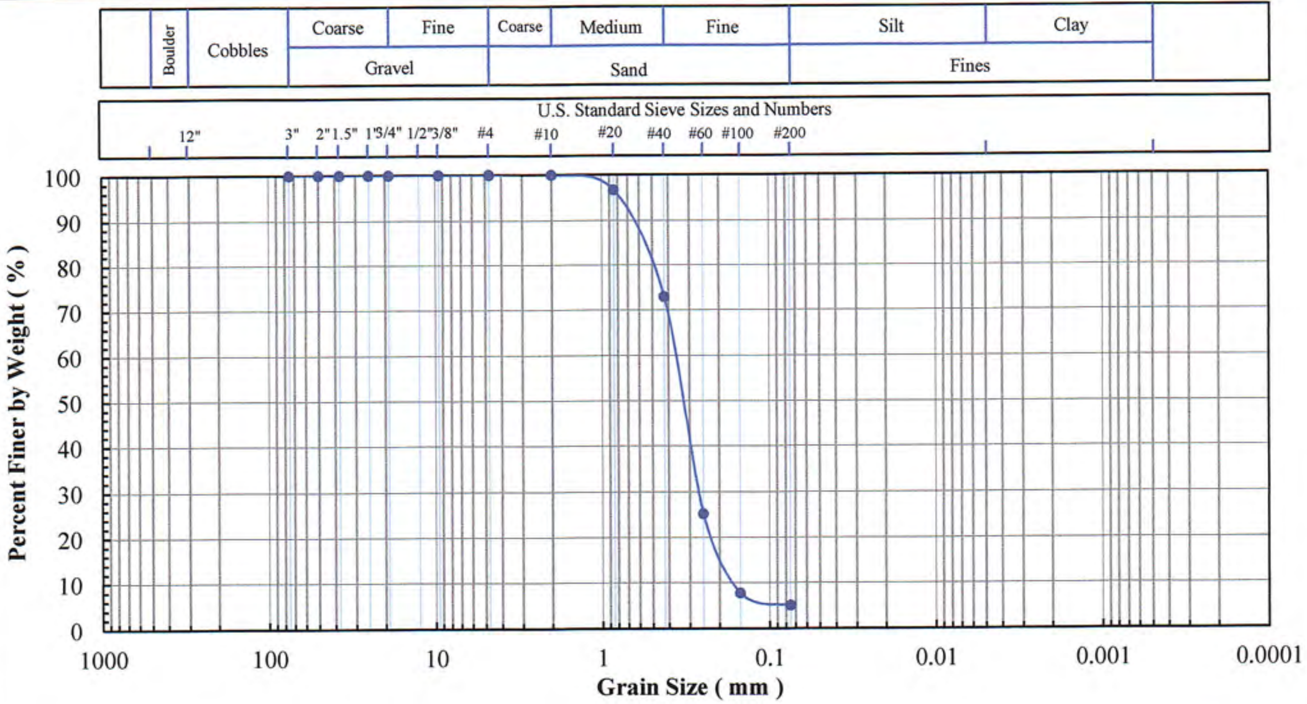
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Sutton Final Closure
Project No: 697
Client Sample ID: SPT-14, S-9 (28.5-30')
Lab Sample No: 15C644

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



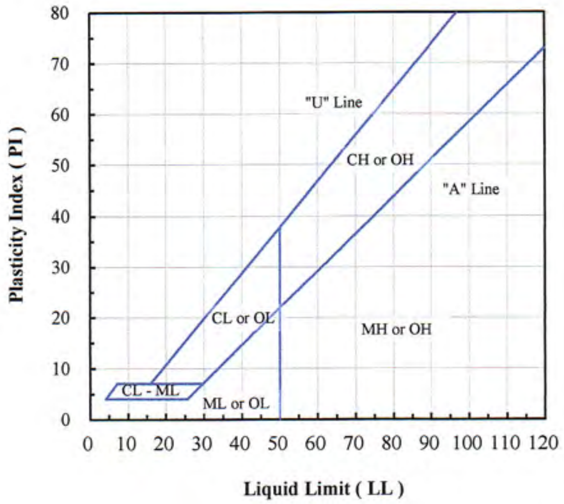
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	96.7
#40	0.425	72.9
#60	0.250	25.2
#100	0.150	7.7
#200	0.075	5.0

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	95.0
Fines (%):	5.0
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits LL (-)	Atterberg Limits PL (-)	Atterberg Limits PI (-)	Engineering Classification
SPT-14, S-9 (28.5-30')	15C644	23.1	5.0				

Note(s):

4-24-15
APK/NJR

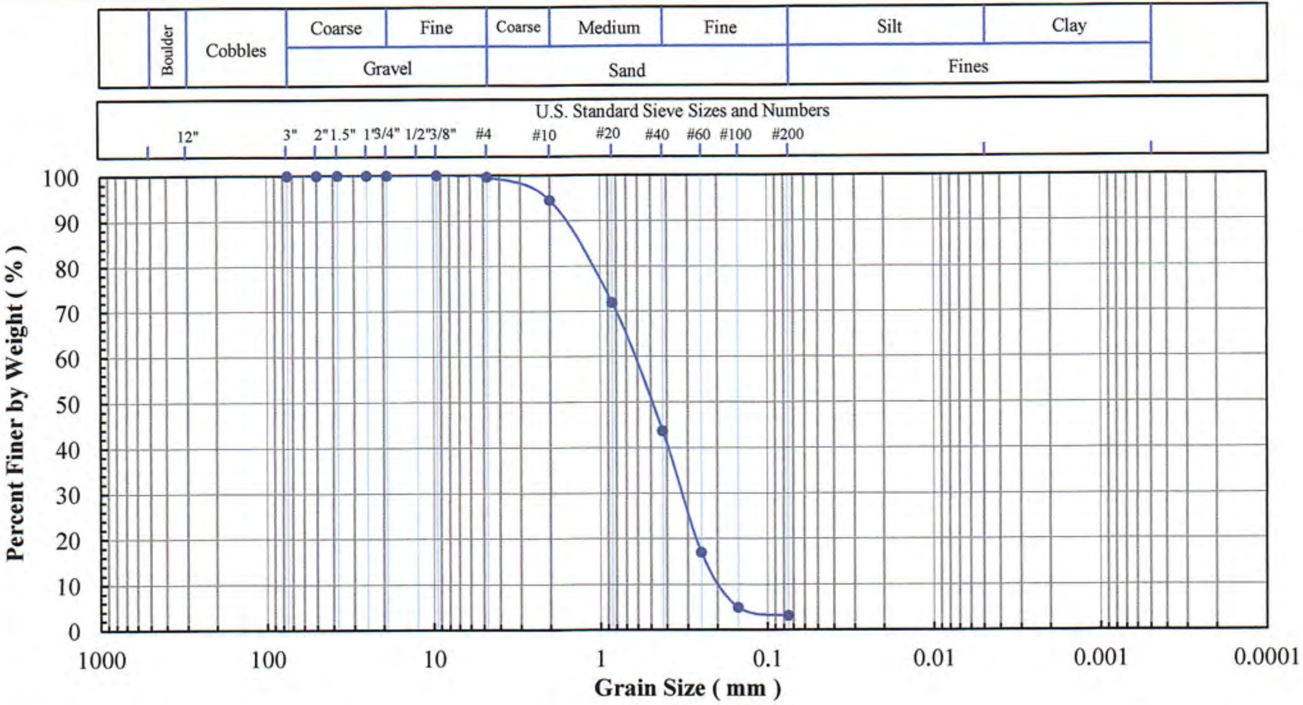
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	SPT-14, S-12 (43.5-45')
Lab Sample No:	15C647

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



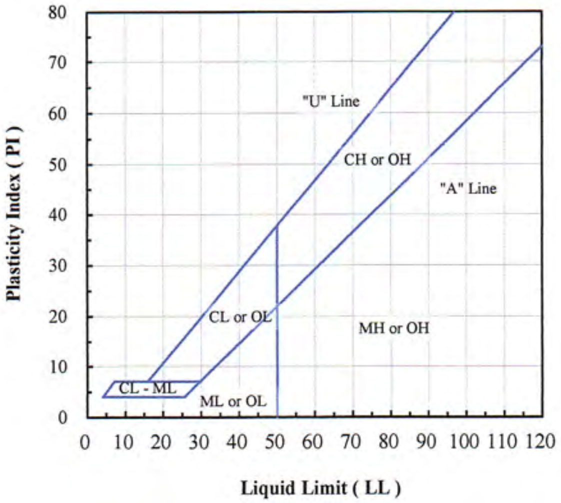
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.6
#10	2.00	94.5
#20	0.850	71.9
#40	0.425	43.6
#60	0.250	17.0
#100	0.150	4.9
#200	0.075	3.0

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	0.4
Sand (%):	96.6
Fines (%):	3.0
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-14, S-12 (43.5-45')	15C647	18.9	3.0				

Note(s):

4-24-15
APK, NSR

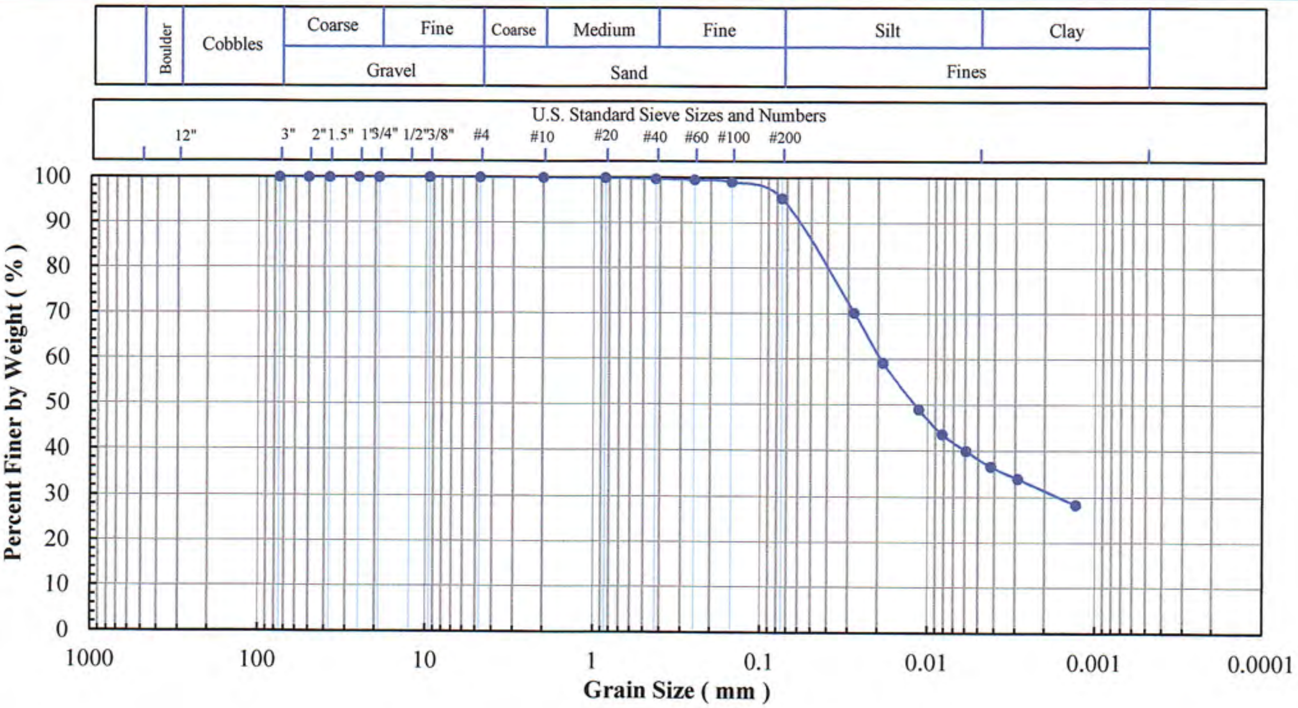
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	SPT-14, S-15 (51-52.5')
Lab Sample No:	15C650

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont, Eng. Classification, Atterberg Limits



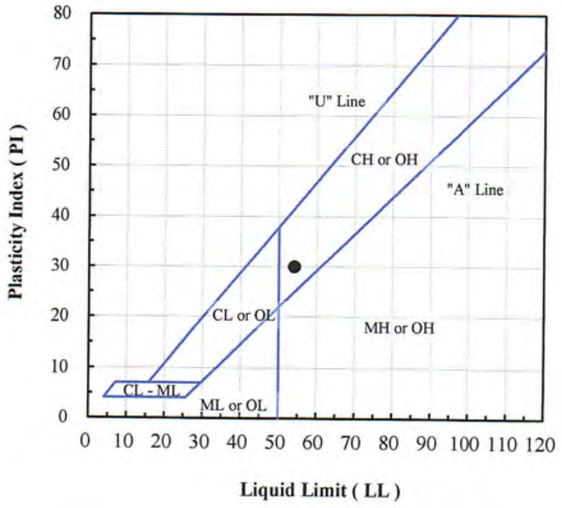
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	99.9
#40	0.425	99.7
#60	0.250	99.5
#100	0.150	99.0
#200	0.075	95.4

Specific Gravity (-):	2.65

Hydrometer Particle Diameter (mm)	% Finer
0.0278	70.1
0.0113	48.9
0.0059	39.9
0.0029	33.9
0.0013	28.3

Gravel (%):	
Sand (%):	4.6
Fines (%):	95.4
Silt (%):	57.3
Clay (%):	38.1

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits LL (-)	PL (-)	PI (-)	Engineering Classification
SPT-14, S-15 (51-52.5')	15C650	40.6	95.4	54	24	30	CH - Fat clay

Note(s): An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.

6-01-15
NSR

Excel Geotechnical Testing, Inc.
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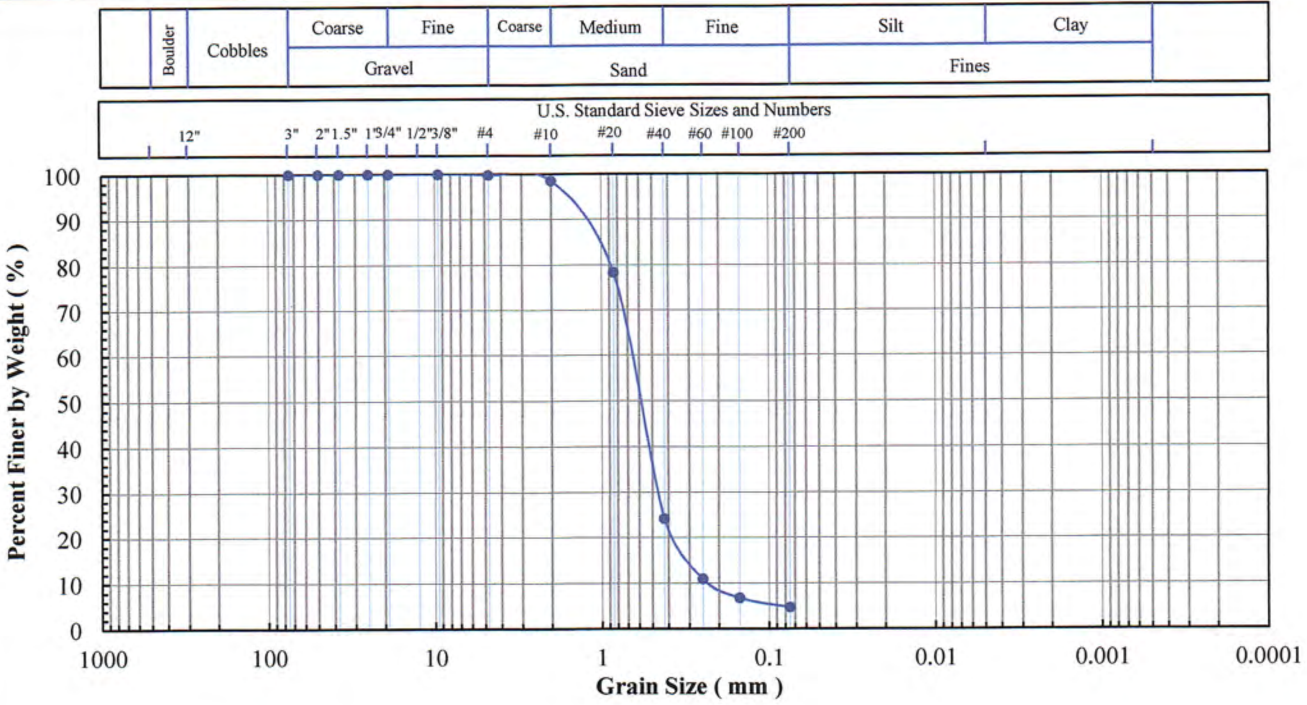
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	SPT-14, S-19 (63.5-65')
Lab Sample No:	15C654

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



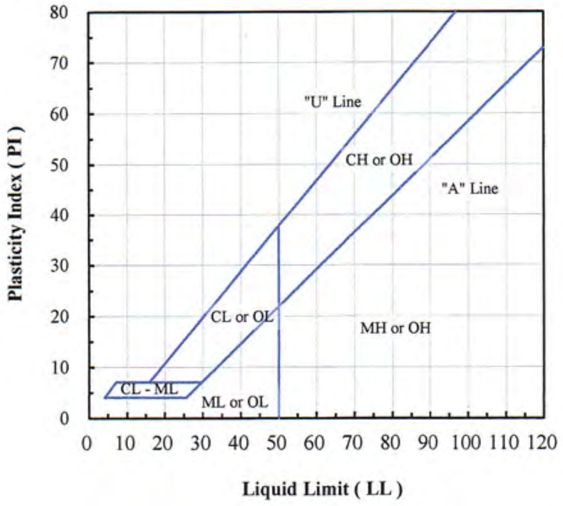
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.8
#10	2.00	98.5
#20	0.850	78.3
#40	0.425	24.1
#60	0.250	10.9
#100	0.150	6.8
#200	0.075	4.7

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	0.2
Sand (%):	95.1
Fines (%):	4.7
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-14, S-19 (63.5-65')	15C654	19.6	4.7				

Note(s):

4-24-15
APK NSR

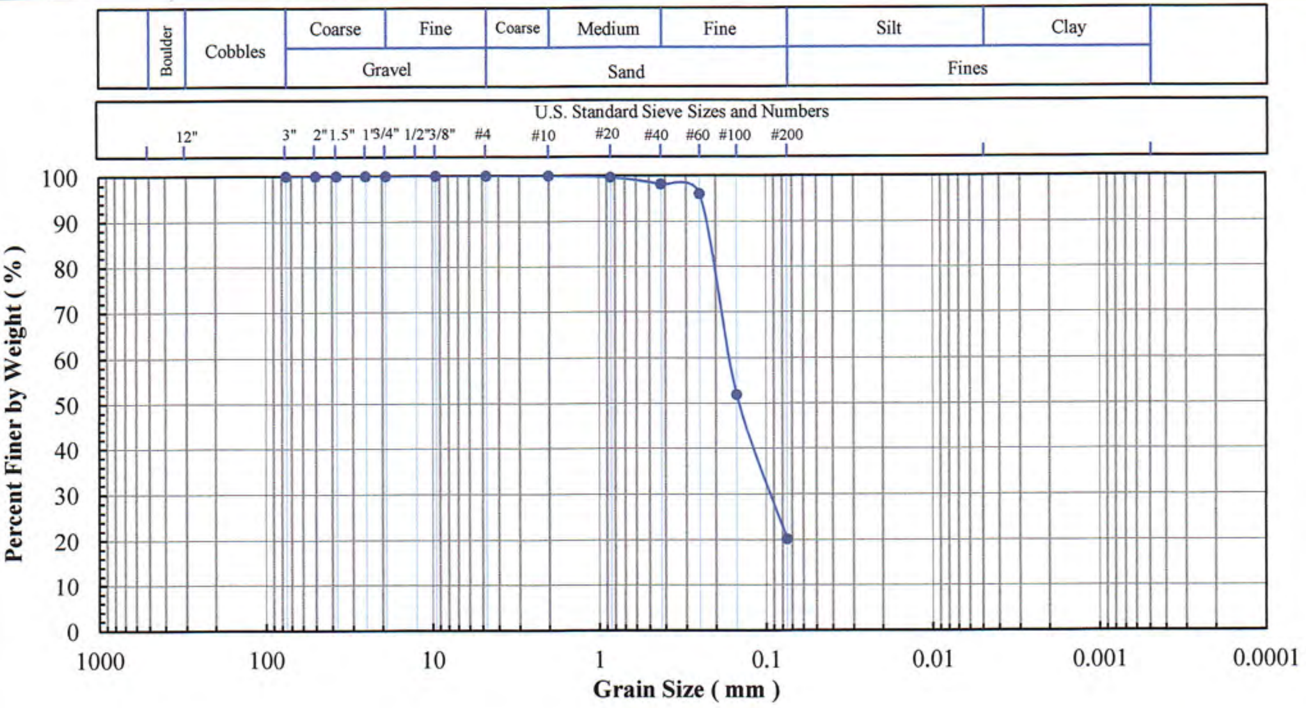
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	SPT-14, S-23 (83.5-85')
Lab Sample No:	15C658

ASTM C 136, D 422, D 854, D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content, Eng. Classification, Atterberg Limits



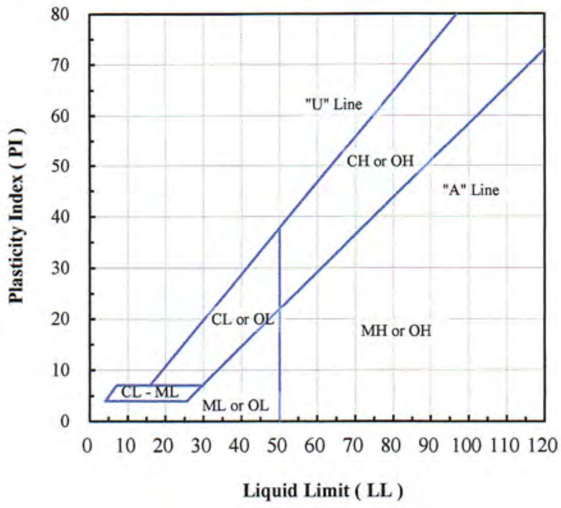
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	99.6
#40	0.425	98.1
#60	0.250	96.0
#100	0.150	51.9
#200	0.075	20.2

Specific Gravity (-):	2.695

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	79.8
Fines (%):	20.2
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
SPT-14, S-23 (83.5-85')	15C658	24.3	20.2	NP	NP	NP	SC - Calyey sand

Note(s):

Engineering classification is based on the assumption that the fines are either CL or CH.

4-24-15
APK/NSR

Excel Geotechnical Testing, Inc.
"Excellence in Testing"

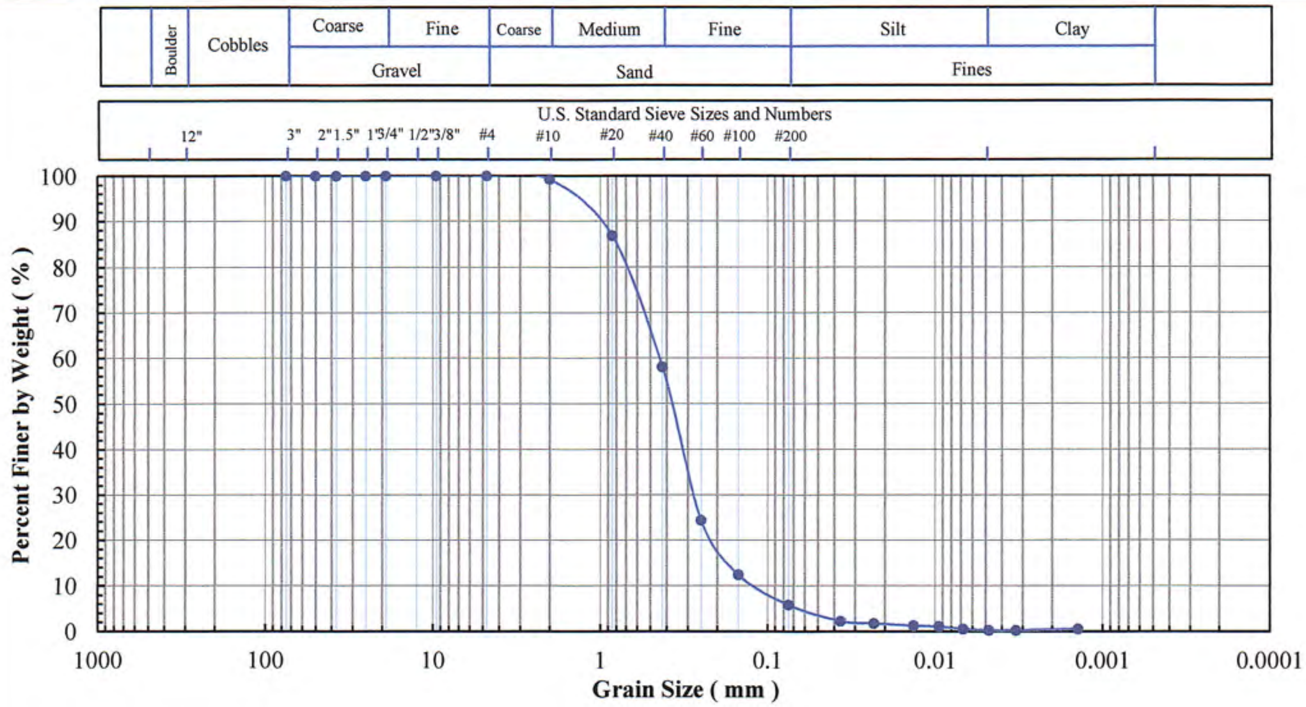
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Sutton Final Closure
Project No: 697
Client Sample ID: PT-2, S-7 (33.5-35')
Lab Sample No: 15C485

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



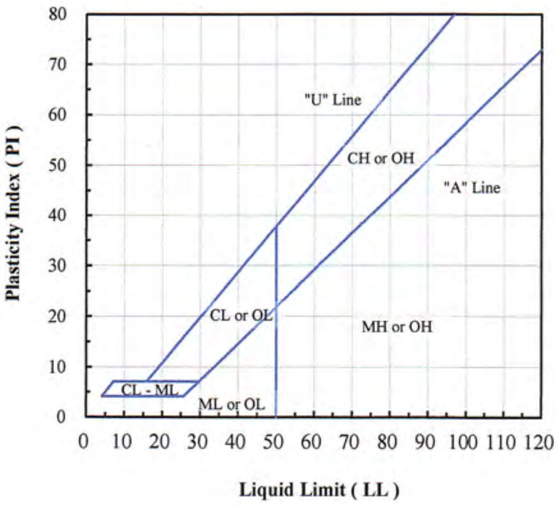
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	99.2
#20	0.850	86.8
#40	0.425	58.0
#60	0.250	24.3
#100	0.150	12.4
#200	0.075	5.8

Specific Gravity (-):	2.65

Hydrometer Particle Diameter (mm)	% Finer
0.0367	2.2
0.0135	1.2
0.0068	0.5
0.0033	0.2
0.0014	0.5

Gravel (%):	
Sand (%):	94.2
Fines (%):	5.8
Silt (%):	5.6
Clay (%):	0.2

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits LL (-)	Atterberg Limits PL (-)	Atterberg Limits PI (-)	Engineering Classification
PT-2, S-7 (33.5-35')	15C485	18.0	5.8				

Note(s): An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.
Engineering classification is based on the assumption that the fines are either ML or MH.

4-24-15
APK NSR

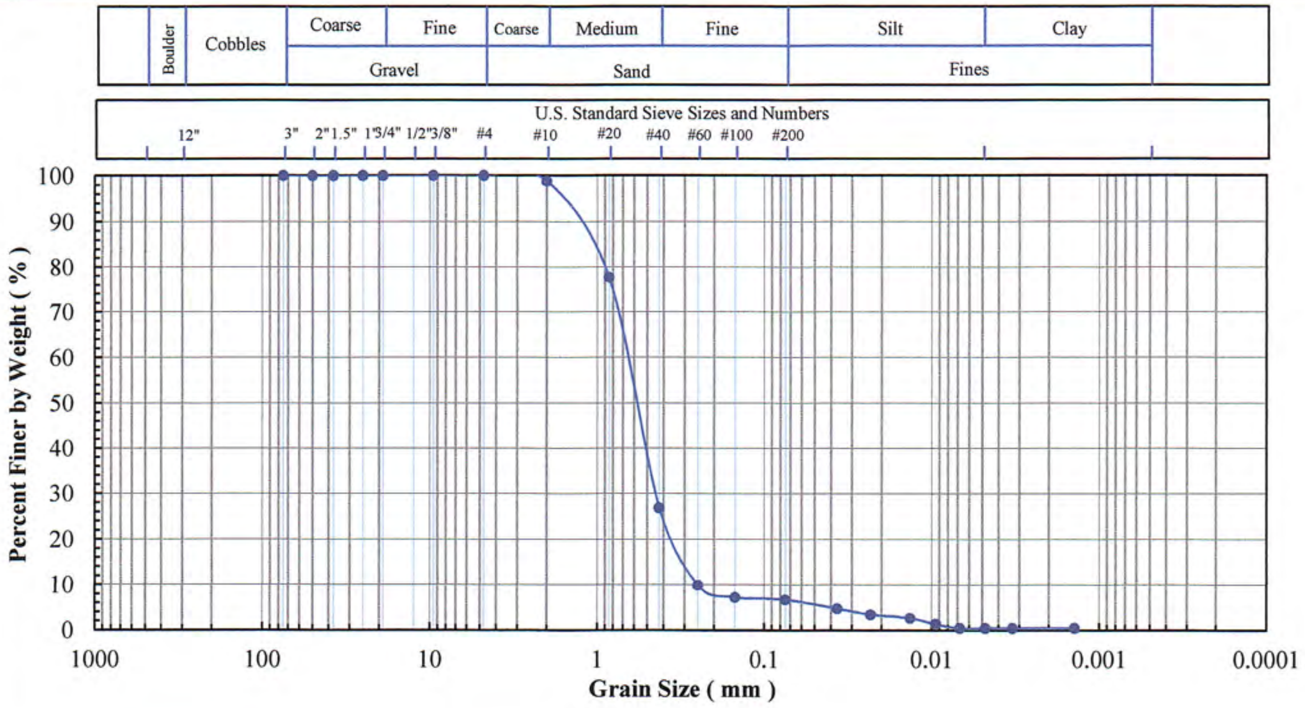
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Sutton Final Closure
Project No: 697
Client Sample ID: PT-3, S-12 (51-52.5')
Lab Sample No: 15C498

ASTM C 136, D 422, D 854,
D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont,
Eng. Classification, Atterberg Limits



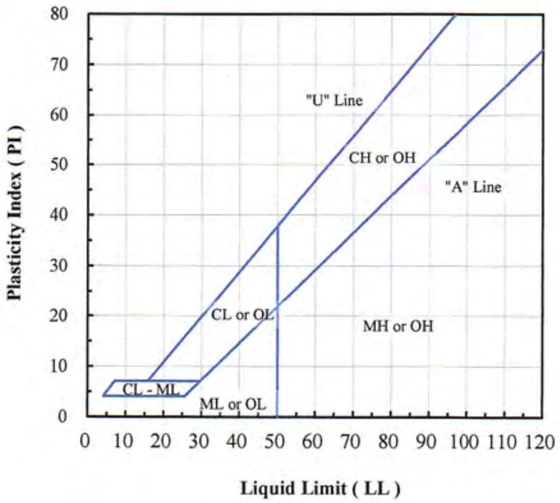
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	98.8
#20	0.850	77.7
#40	0.425	26.8
#60	0.250	9.9
#100	0.150	7.2
#200	0.075	6.7

Specific Gravity (-):	2.65

Hydrometer Particle Diameter (mm)	% Finer
0.0367	4.7
0.0135	2.6
0.0068	0.4
0.0033	0.4
0.0014	0.4

Gravel (%):	
Sand (%):	93.3
Fines (%):	6.7
Silt (%):	6.3
Clay (%):	0.4

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
PT-3, S-12 (51-52.5')	15C498	18.6	6.7				

Note(s): An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.
Engineering classification is based on the assumption that the fines are either ML or MH.

4-24-15
APK NSR

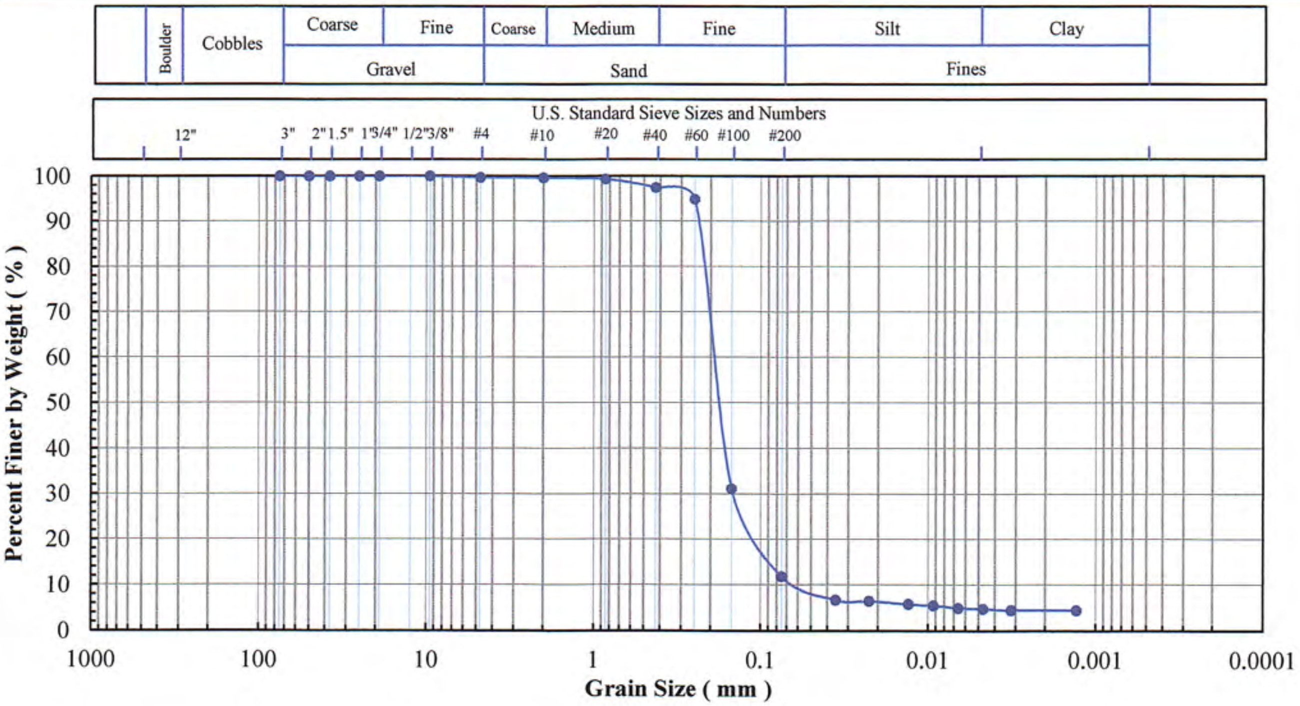
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	PT-3, S-17 (68.5-70')
Lab Sample No:	15C503

ASTM C 136, D 422, D 854, D 1140, D 2216, D 2487, D 4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Cont, Eng. Classification, Atterberg Limits



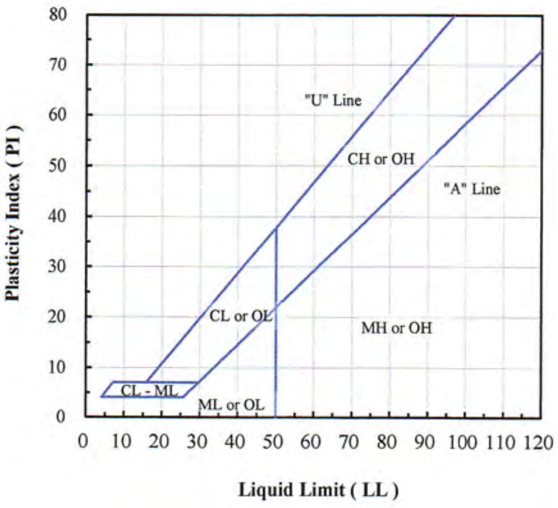
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.7
#10	2.00	99.6
#20	0.850	99.3
#40	0.425	97.4
#60	0.250	94.8
#100	0.150	31.1
#200	0.075	11.8

Specific Gravity (-):	2.65

Hydrometer Particle Diameter (mm)	% Finer
0.0357	6.6
0.0131	5.7
0.0066	4.9
0.0032	4.4
0.0013	4.4

Gravel (%):	0.3
Sand (%):	87.9
Fines (%):	11.8
Silt (%):	7.1
Clay (%):	4.7

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
PT-3, S-17 (68.5-70')	15C503	28.8	11.8				

Note(s): An assumed specific gravity of 2.65 was used when analyzing the hydrometer test results.
Engineering classification is based on the assumption that the fines are either ML or MH.

4-24-15
APK, NSR

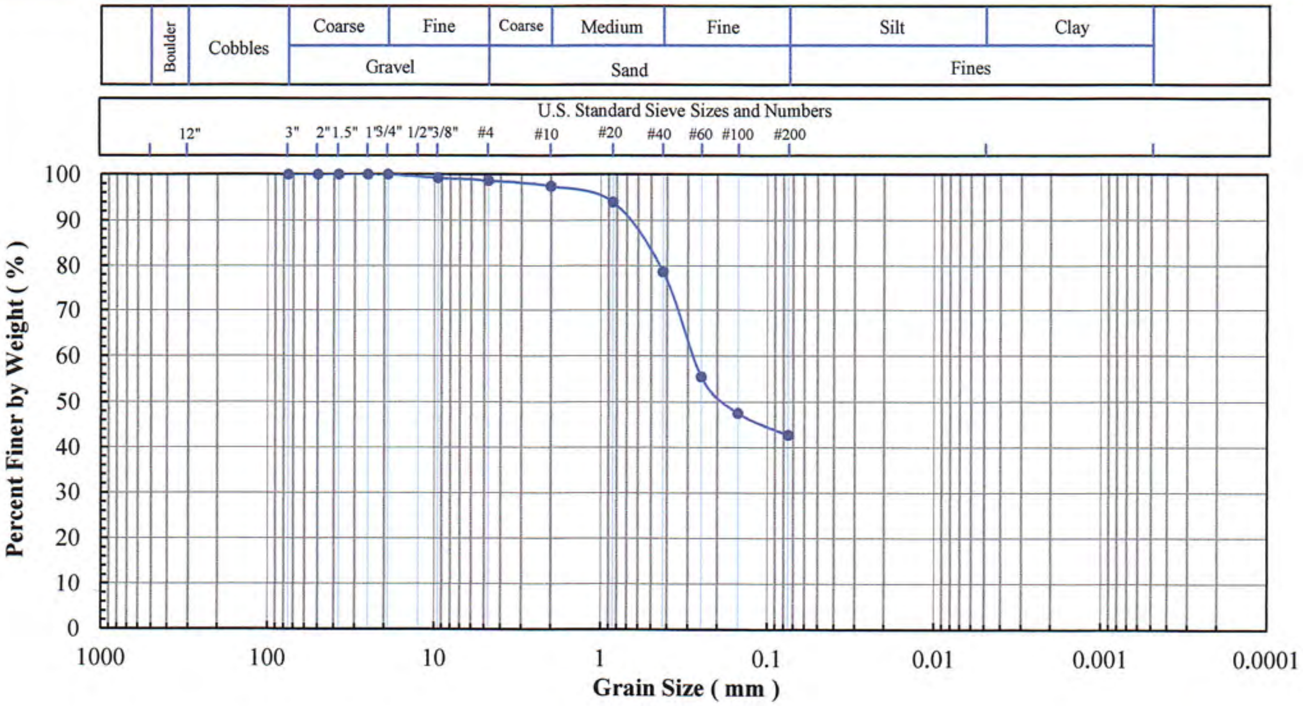
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Sutton Final Closure
Project No: 697
Client Sample ID: LO-SPT-1, S-3 (4-6')
Lab Sample No: 15C506

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content, Eng. Classification, Atterberg Limits



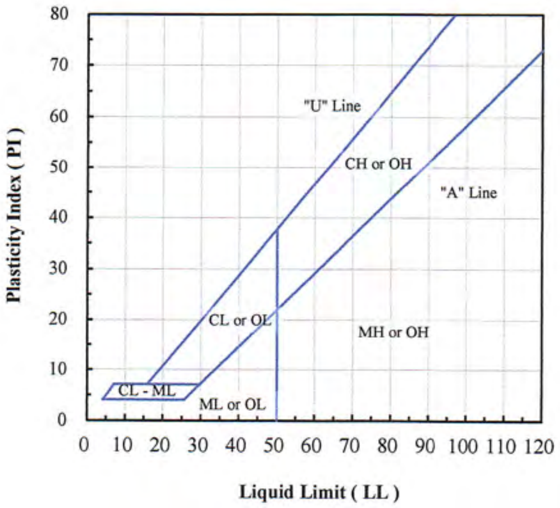
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	99.2
#4	4.75	98.6
#10	2.00	97.4
#20	0.850	93.9
#40	0.425	78.6
#60	0.250	55.5
#100	0.150	47.5
#200	0.075	42.7

Specific Gravity (-):	2.418

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	1.4
Sand (%):	55.9
Fines (%):	42.7
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
LO-SPT-1, S-3 (4-6')	15C506	24.1	42.7				

Note(s):

4-24-15
APK/NSR

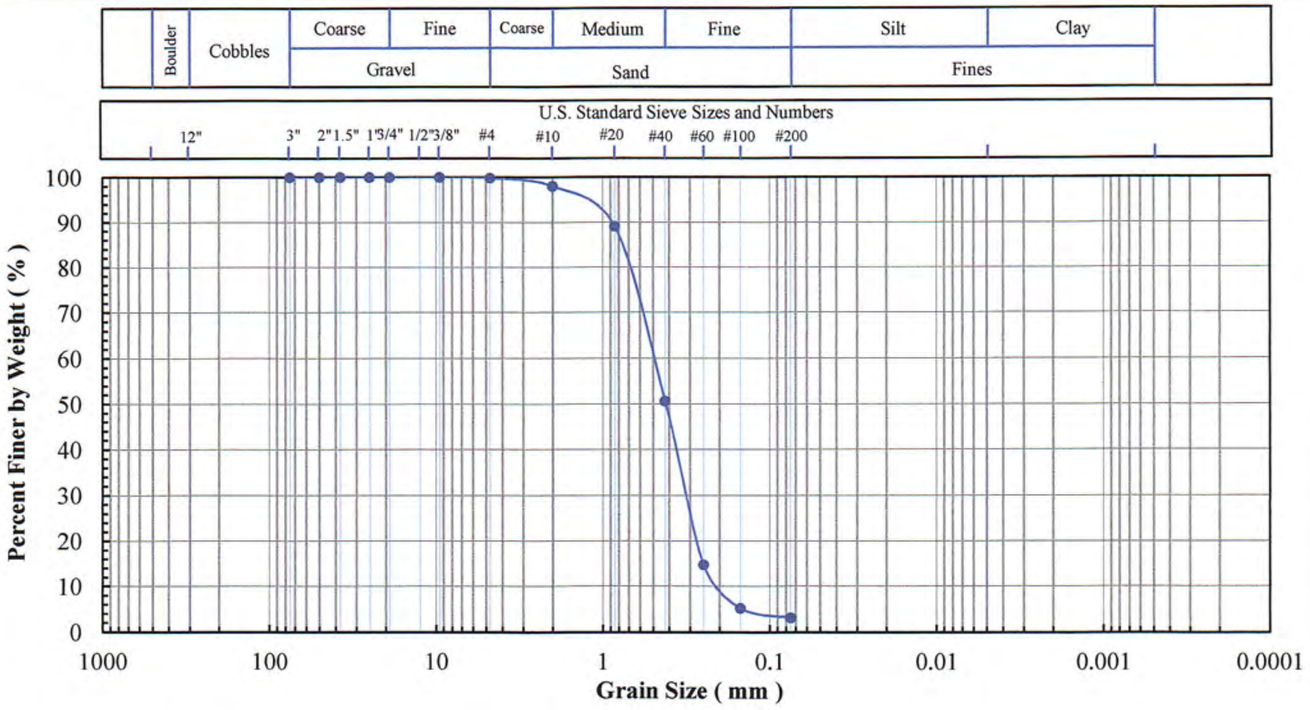
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	LO-SPT-1, S-9 (28.5-30')
Lab Sample No:	15C512

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



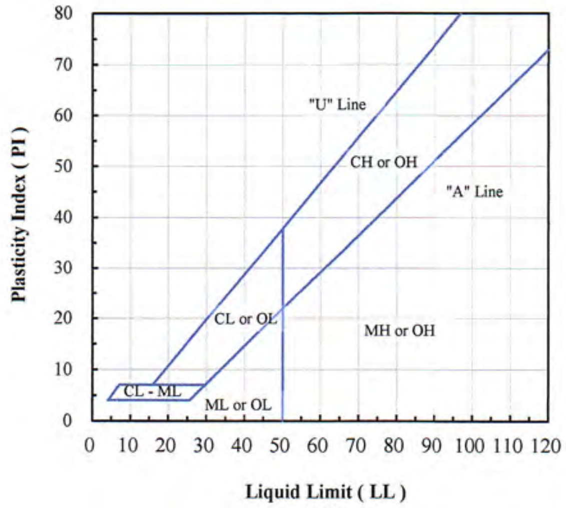
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.8
#10	2.00	98.0
#20	0.850	89.1
#40	0.425	50.6
#60	0.250	14.7
#100	0.150	5.2
#200	0.075	3.1

Specific Gravity (-):	2.693

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	0.2
Sand (%):	96.7
Fines (%):	3.1
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
LO-SPT-1, S-9 (28.5-30')	15C512	21.8	3.1				

Note(s):

4-24-15
APK/NSR

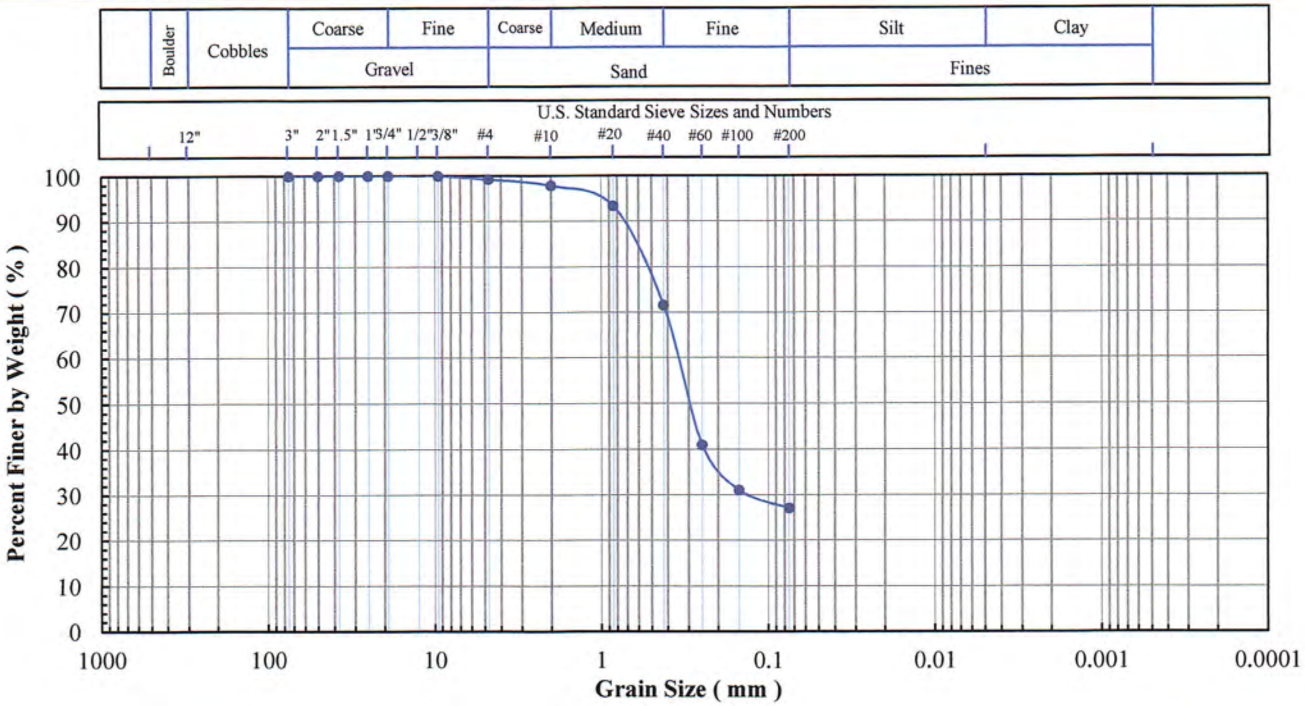
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	LO-SPT-2, S-3 (6-7.5')
Lab Sample No:	15C522

ASTM C 136, D 422, D 854, D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content, Eng. Classification, Atterberg Limits



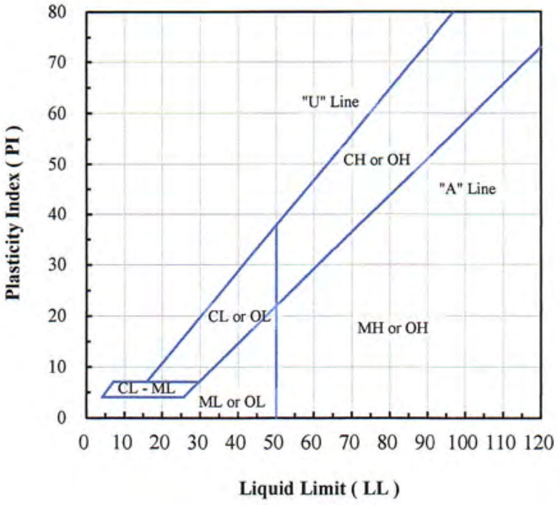
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.2
#10	2.00	97.8
#20	0.850	93.3
#40	0.425	71.5
#60	0.250	40.9
#100	0.150	31.0
#200	0.075	27.0

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	0.8
Sand (%):	72.2
Fines (%):	27.0
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
LO-SPT-2, S-3 (6-7.5')	15C522	24.5	27.0				

Note(s):

4-24-15
APK, NSR

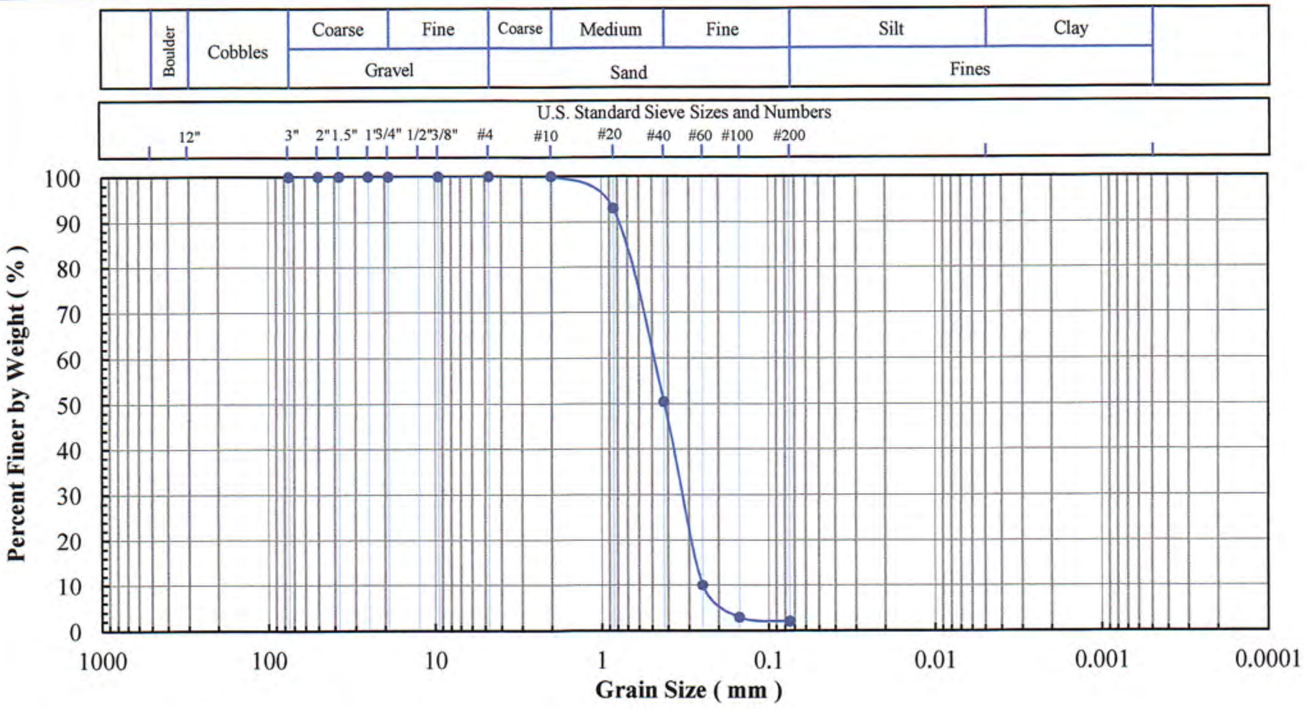
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Sutton Final Closure
Project No: 697
Client Sample ID: LO-SPT-2, S-6 (18.5-20')
Lab Sample No: 15C525

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



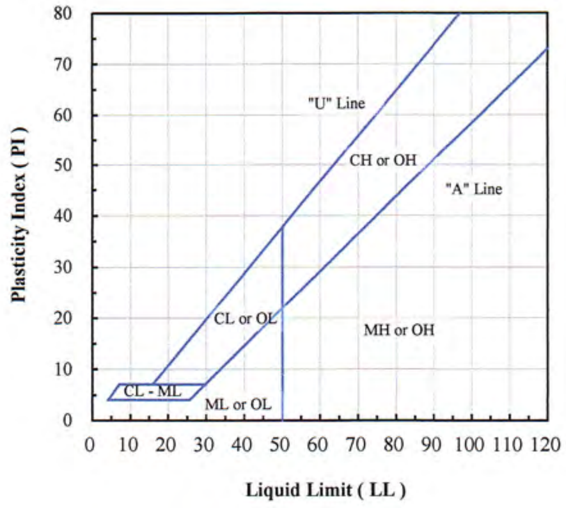
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	93.0
#40	0.425	50.4
#60	0.250	10.0
#100	0.150	2.9
#200	0.075	2.0

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	98.0
Fines (%):	2.0
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
LO-SPT-2, S-6 (18.5-20')	15C525	22.6	2.0				

Note(s):

4-24-15
APK, NSR

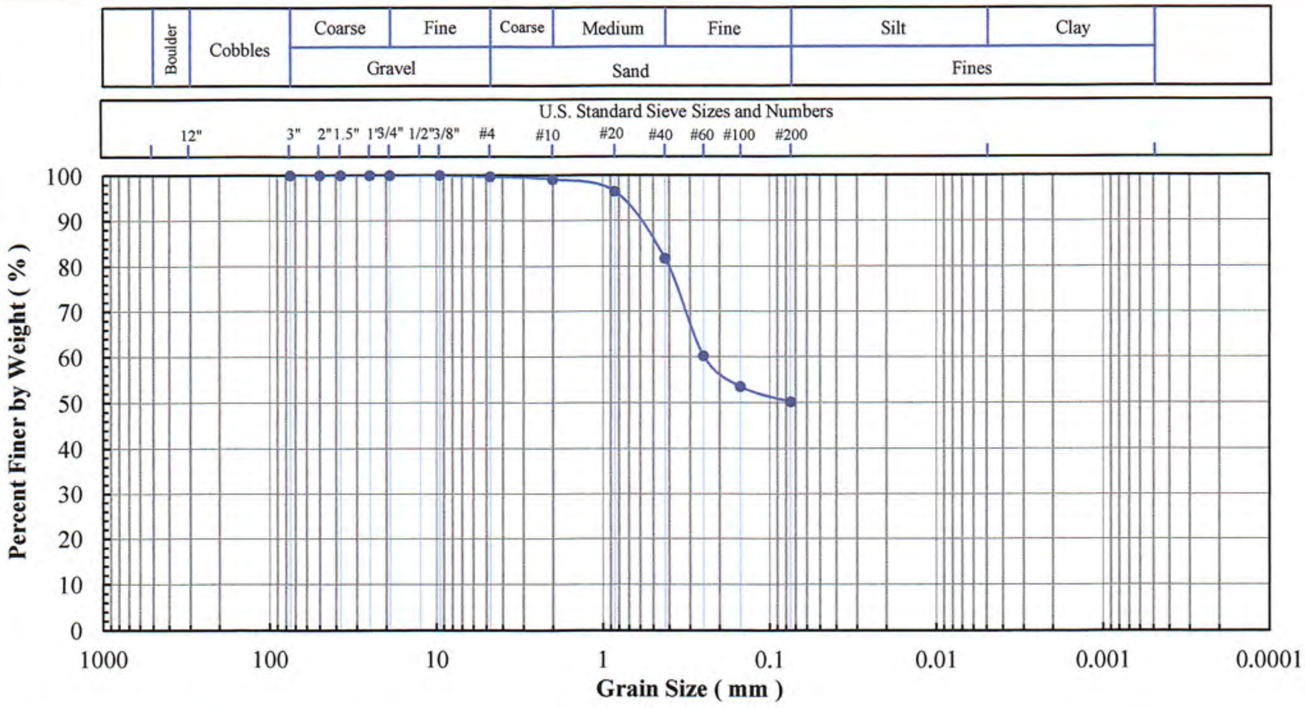
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	LO-SPT-3, S-2 (3.5-5')
Lab Sample No:	15C533

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



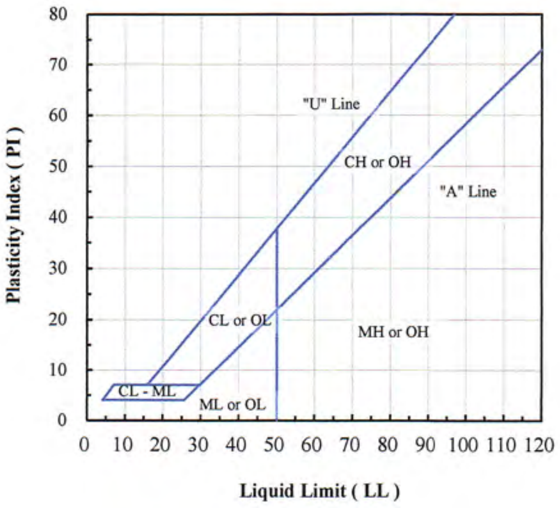
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	99.7
#10	2.00	99.1
#20	0.850	96.4
#40	0.425	81.6
#60	0.250	60.2
#100	0.150	53.5
#200	0.075	50.1

Specific Gravity (-):	2.485

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	0.3
Sand (%):	49.6
Fines (%):	50.1
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
LO-SPT-3, S-2 (3.5-5')	15C533	24.7	50.1				

Note(s):

4-24-15
APK/NSR

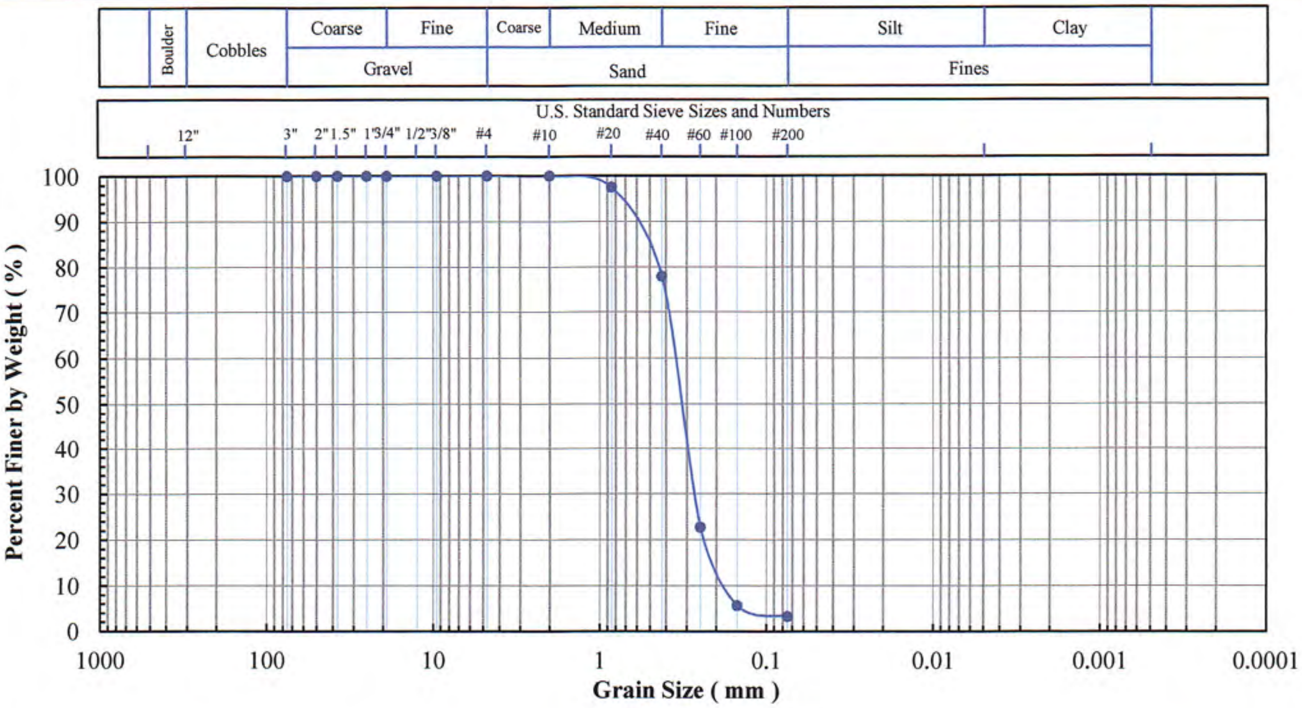
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Sutton Final Closure
Project No: 697
Client Sample ID: LO-SPT-3, S-5 (13.5-15')
Lab Sample No: 15C537

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



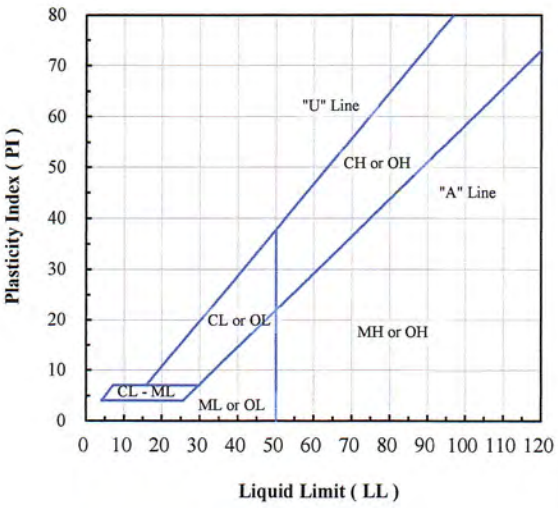
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	97.5
#40	0.425	77.9
#60	0.250	22.7
#100	0.150	5.6
#200	0.075	3.2

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	96.8
Fines (%):	3.2
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits LL (-)	PL (-)	PI (-)	Engineering Classification
LO-SPT-3, S-5 (13.5-15')	15C537	23.2	3.2				

Note(s):

4-24-15
APK, NSR

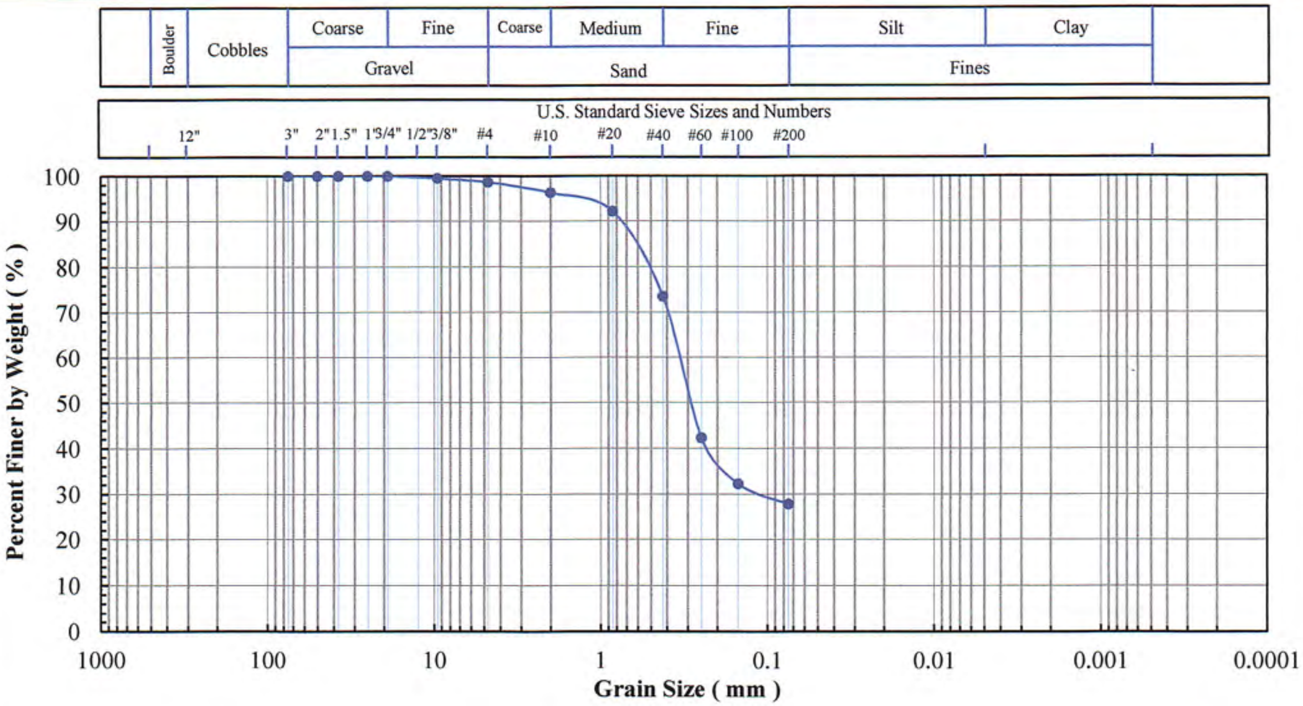
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	LO-SPT-4, S-2 (3.5-5')
Lab Sample No:	15C546

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

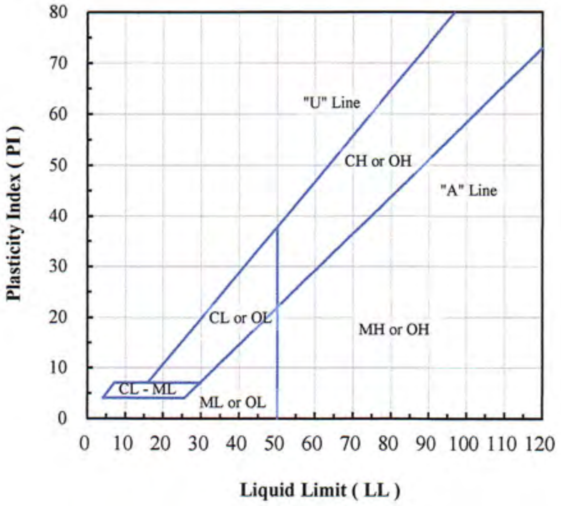
Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	99.5
#4	4.75	98.6
#10	2.00	96.3
#20	0.850	92.1
#40	0.425	73.5
#60	0.250	42.2
#100	0.150	32.2
#200	0.075	27.8

Hydrometer Particle Diameter (mm)	**% Finer**

Gravel (%):	1.4
Sand (%):	70.8
Fines (%):	27.8
Silt (%):	
Clay (%):	



Specific Gravity (-):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	

Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
LO-SPT-4, S-2 (3.5-5')	15C546	27.1	27.8				

Note(s):

4-24-15
ADK/NSR

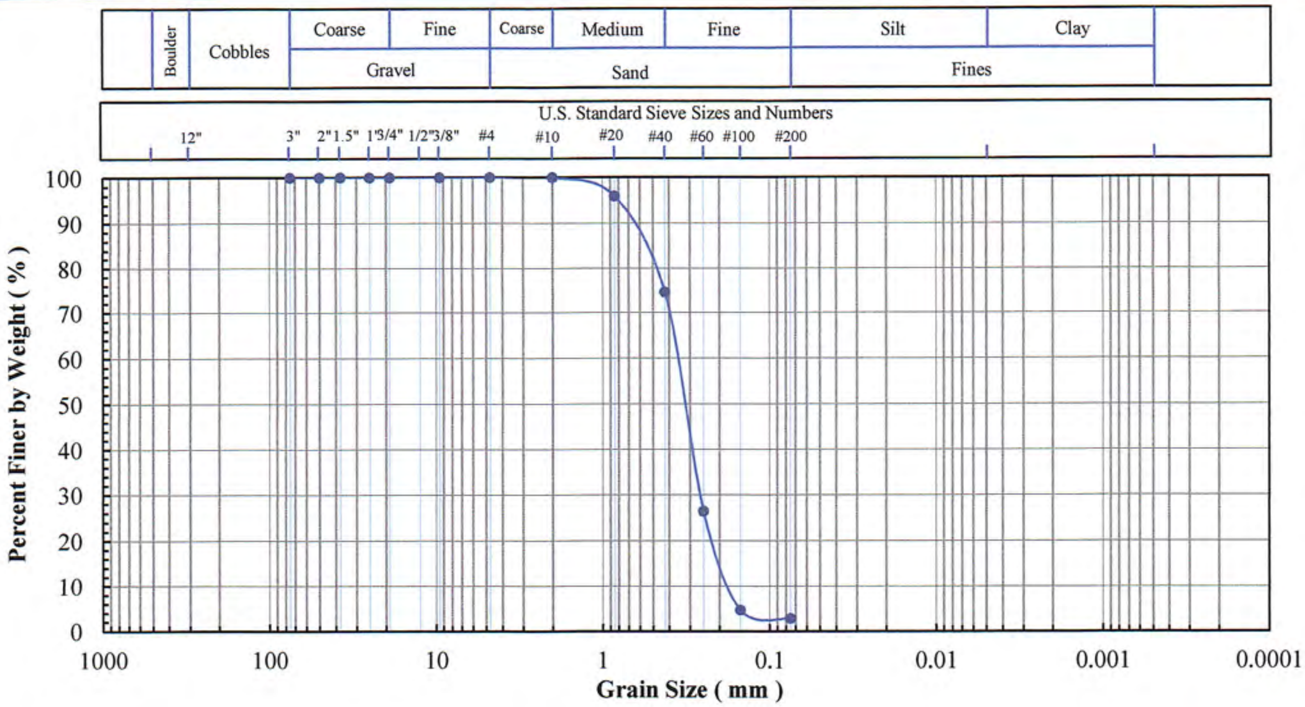
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Sutton Final Closure
Project No: 697
Client Sample ID: LO-SPT-4, S-7 (23.5-25')
Lab Sample No: 15C551

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



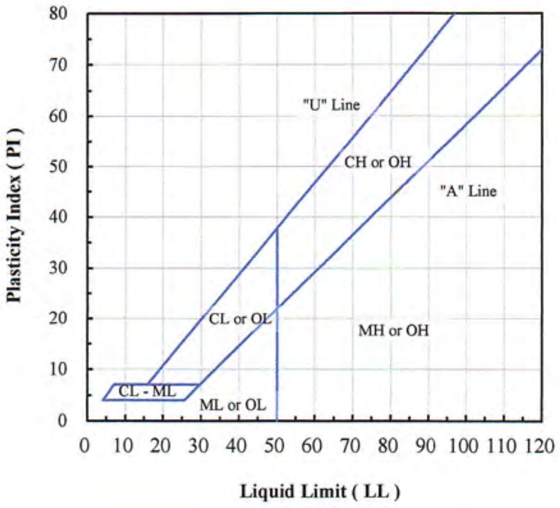
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	95.9
#40	0.425	74.5
#60	0.250	26.4
#100	0.150	4.7
#200	0.075	2.8

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	97.2
Fines (%):	2.8
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
LO-SPT-4, S-7 (23.5-25')	15C551	22.4	2.8				

Note(s):

4-24-15
RPK, NSR

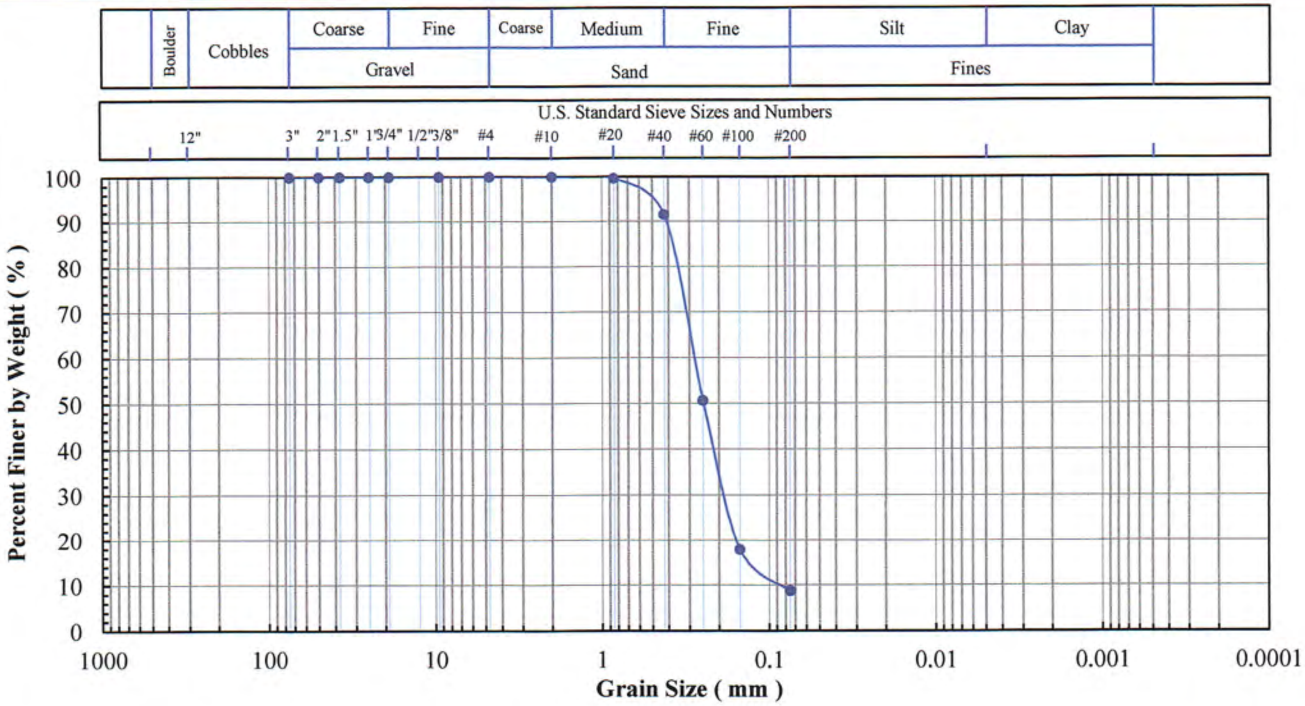
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	LO-SPT-5, S-7 (23.5-25')
Lab Sample No:	15C563

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



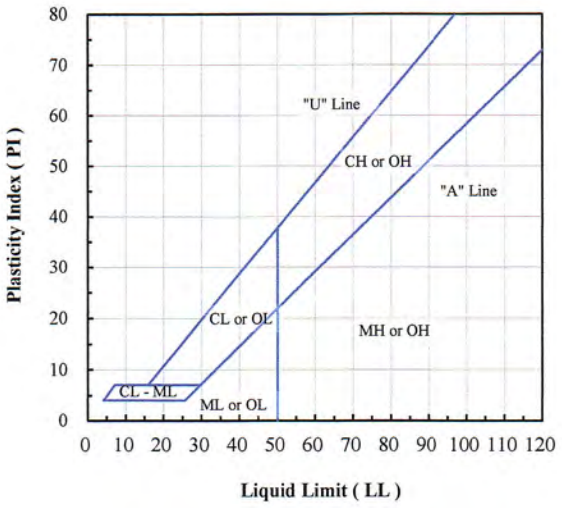
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	100.0
#20	0.850	99.6
#40	0.425	91.5
#60	0.250	50.6
#100	0.150	17.9
#200	0.075	8.7

Specific Gravity (-):	2.697

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	91.3
Fines (%):	8.7
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
LO-SPT-5, S-7 (23.5-25')	15C563	25.3	8.7				

Note(s):

4-24-15
APK, NSR

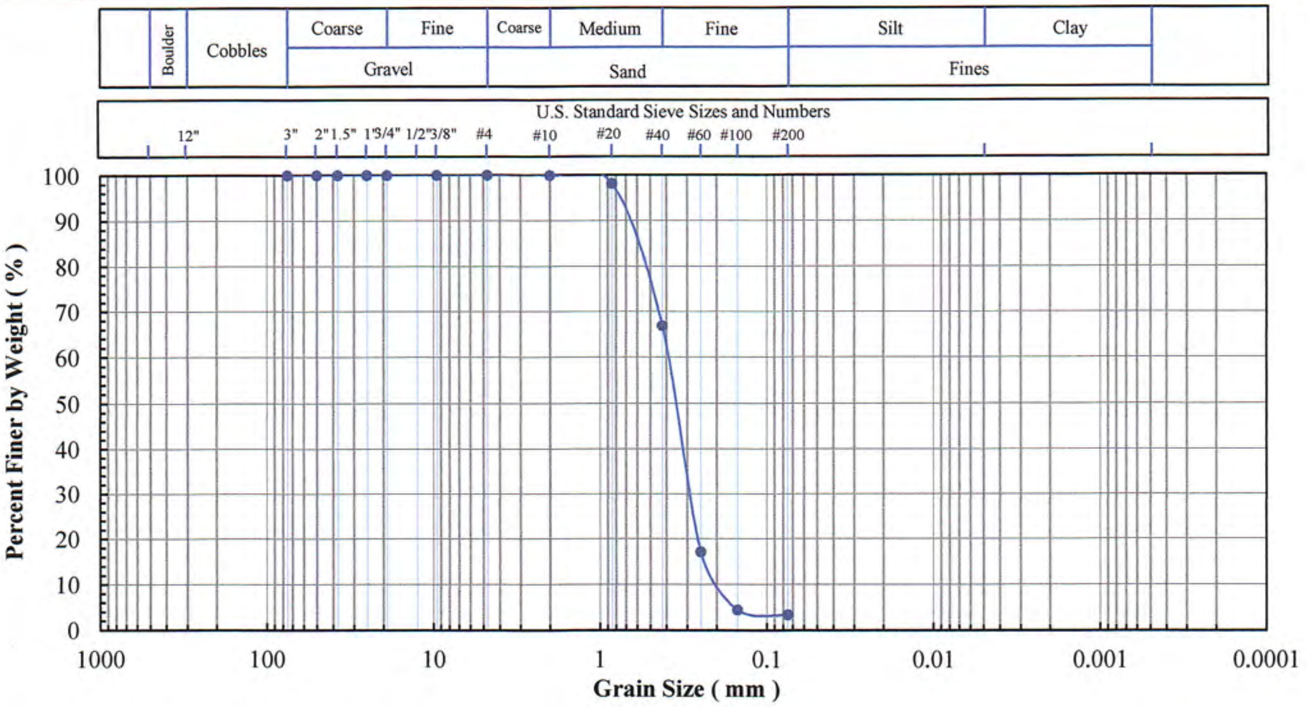
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name:	Sutton Final Closure
Project No:	697
Client Sample ID:	LO-SPT-6, S-5 (13.5-15')
Lab Sample No:	15C573

ASTM C 136, D 422, D 854,
D 1140, D2216, D 2487, D4318

SOIL INDEX PROPERTIES

Grain Size, Spec. Gravity, Moist. Content,
Eng. Classification, Atterberg Limits



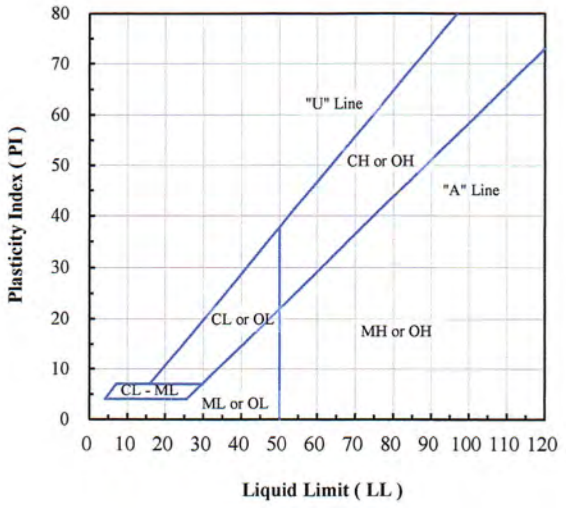
Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2.00	99.9
#20	0.850	98.1
#40	0.425	66.8
#60	0.250	17.1
#100	0.150	4.4
#200	0.075	3.3

Specific Gravity (-):	

Hydrometer Particle Diameter (mm)	% Finer

Gravel (%):	
Sand (%):	96.7
Fines (%):	3.3
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	
Coeff. Curv. (Cc):	



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (-)	PL (-)	PI (-)	
LO-SPT-6, S-5 (13.5-15')	15C573	26.4	3.3				

Note(s):

4-24-15
APK/NSK

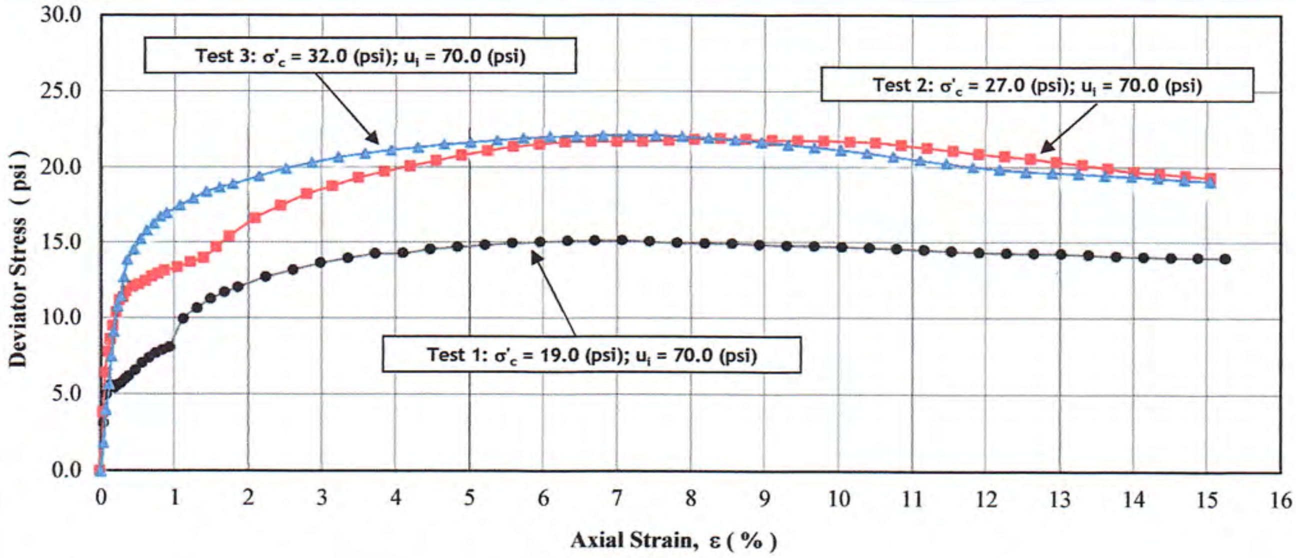
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

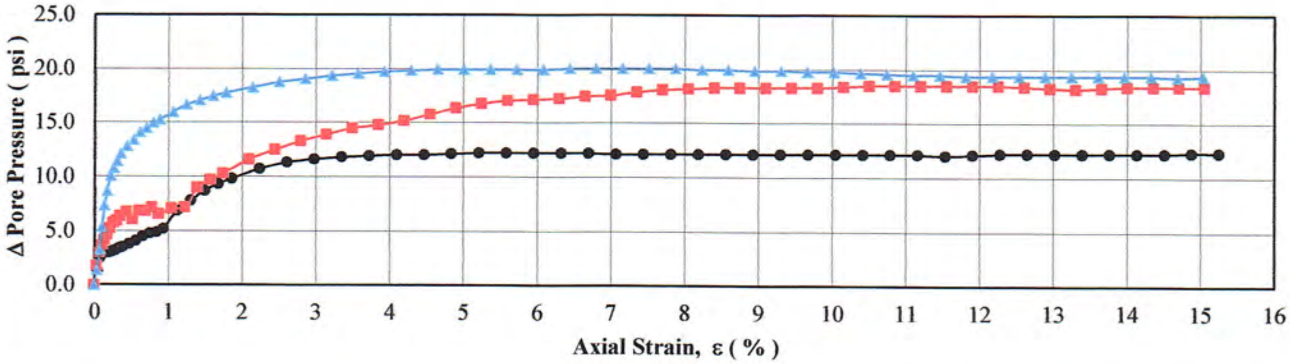
Project Name: Sutton Final Closure
Project No: 697
Site Sample ID: SPT-13, S-17 (52-54')
Lab Sample No: 15C626

ASTM D 4767

CONSOLIDATED-UNDRAINED (CU) TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENTS

Figure 1





Test Specimen No.	Maximum Strength				
	Deviator Stress $(\sigma'_1 - \sigma'_3)$ (psi)	Effective Axial Stress (σ'_1) (psi)	Effective Radial Stress (σ'_3) (psi)	Pore Pressure (u) (psi)	Axial Strain (ε_a) (%)
1	15.1	21.9	6.8	82.2	6.7
2	21.9	30.6	8.7	88.3	8.4
3	22.1	34.0	11.9	90.1	7.2

Test Specimen No.	Strength at App. 15% Axial Strain				
	Deviator Stress $(\sigma'_1 - \sigma'_3)$ (psi)	Effective Axial Stress (σ'_1) (psi)	Effective Radial Stress (σ'_3) (psi)	Pore Pressure (u) (psi)	Axial Strain (ε_a) (%)
1	14.0	20.7	6.7	82.3	15.2
2	19.3	27.9	8.6	88.4	15.1
3	19.1	31.7	12.6	89.4	15.0

Notes:

σ'_c = Consolidation pressure, (psi) u_i = Initial pore pressure,(psi)

5-01-15
NSR

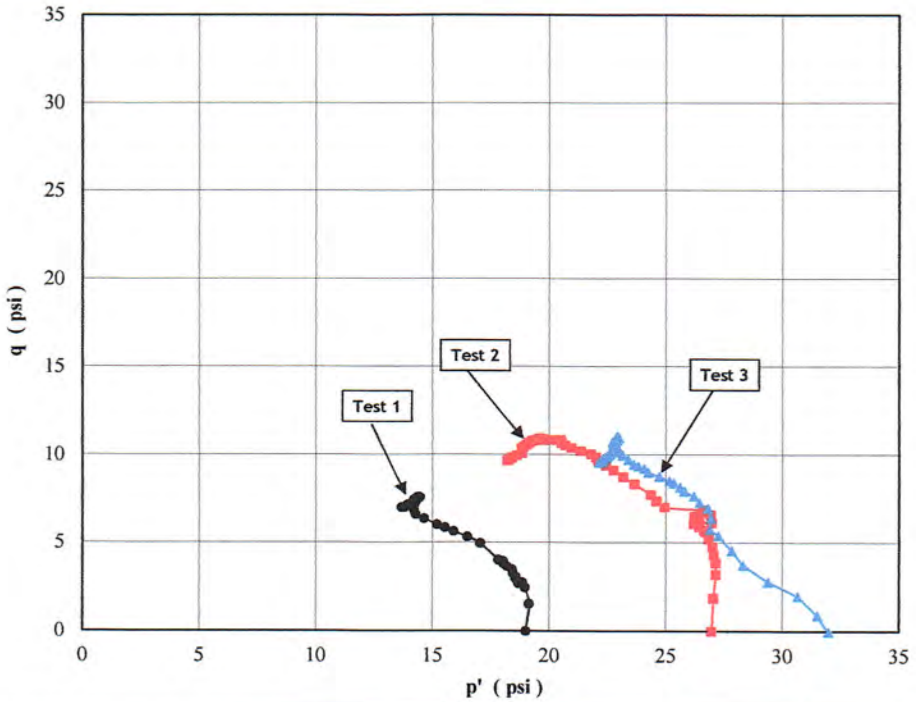
Excel Geotechnical Testing, Inc.
"Excellence in Testing"
953 Forrest Street, Roswell, Georgia 30075
Tel: (770) 910 7537 Fax: (770) 910 7538

Project Name: Sutton Final Closure
Project No: 697
Site Sample ID: SPT-13, S-17 (52-54')
Lab Sample No: 15C626

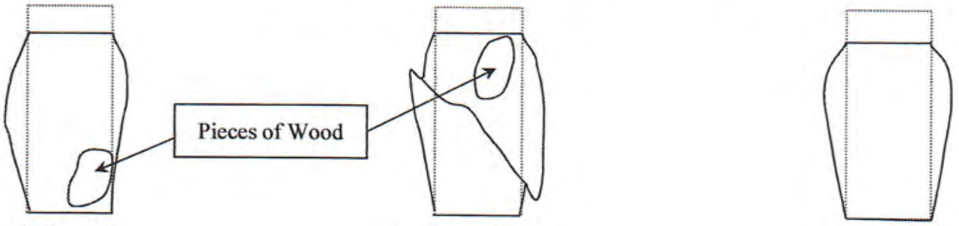
ASTM D 4767

CONSOLIDATED-UNDRAINED (CU) TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENTS

Figure 2



Test Specimen Number (-)	Specimen Quality Bad to Good (1 to 10)	Initial Conditions							Consolidation Stage		Loading
		Height (in.)	Diameter (in.)	Moisture Content (%)	Dry Unit Weight (pcf)	B Parameter (-)	Initial Pore Pressure (u_i) (psi)	Consolidation Pressure (σ'_c) (psi)	Axial Strain (%)	Volumetric Strain (%)	Axial Rate (% / min)
1	5	5.66	2.80	53.5	67.9	0.99	70.0	19.0	5.05	15.08	0.053
2	5	6.03	2.86	48.2	64.6	0.98	70.0	27.0	5.32	12.58	0.050
3	7	5.98	2.81	33.8	88.0	0.96	70.0	32.0	6.70	7.27	0.050



Specimen No.1
Gray, brown silty clay

Specimen No. 2
Gray, brown silty clay

Specimen No. 3
Brown silty clay with sublayers of sandy clay

Notes:

5-01-15
NSR