Paul C. Rizzo Associates, Inc.
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SUPPLEMENTAL FIELD INVESTIGATION DATA REPORT

TURKEY POINT NUCLEAR POWER PLANT UNITS 6 & 7

REVISION 2

Engineering & Construction Management
Hydro-Nuclear-Fossil
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Seismic & Structural Engineering
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Tunnel Engineering
Environmental Engineering & Permitting

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REVISION NO.	DATE	DESCRIPTIONS OF CHANGES/AFFECTED PAGES
0	January 23, 2014	Initial Draft Submittal
1	January 31, 2014	Updated Appendix in-text citations. Added Section 2.2.1 Continuously Sampled Borings. Minor corrections to Tables 2 and 3. Re-ordered samples by depth in Table 4. Pore Pressure Dissipation Test results added to Appendix E.
2	April 15, 2014	Removed references to proprietary RIZZO procedures. Minor corrections to Table 2. Changes made in Revision 2 do not impact any subsequent reports, RAIs, or calculations.

TABLE OF CONTENTS

PAGE

TABLE OF CONTENTS
(CONTINUED)

PAGE

APPENDICES:

LIST OF TABLES AND FIGURES

SUPPLEMENTAL FIELD INVESTIGATION DATA REPORT
TURKEY POINT NUCLEAR POWER PLANT UNITS 6 & 7

1.0 INTRODUCTION

This Supplemental Field Investigation Data Report describes the supplementary geological, geotechnical, and geophysical field investigation that was performed by Paul C. Rizzo Associates, Inc. (RIZZO) at the Turkey Point Nuclear Power Plant (PTN) Units 6 & 7 Site between July 30, 2013 and October 21, 2013.

The overall objective of the additional geological, geotechnical, and geophysical field investigation is to supplement characterization of the subsurface conditions at the PTN Units 6 & 7 footprints. The supplemental field investigation and subsequent laboratory testing was performed in general accordance with Regulatory Guide (RG) 1.132, "Site Investigations for Foundations of Nuclear Power Plants" and RG 1.138, "Laboratory Investigation of Soils and Rocks for Engineering Analysis and Design of Nuclear Power Plants."

1.1 GEOLOGIC PROFILE

The upper 600 feet (ft) of the Turkey Point Units 6 & 7 Site subsurface consists of eight soil and rock formations. These formations include: a surficial muck layer, Miami Limestone, Key Largo Limestone, the Fort Thompson Formation, the Upper Tamiami Formation, the Lower Tamiami Formation, the Peace River Formation, and the Arcadia Formation. Muck is a soft surficial soil layer. Miami Limestone, Key Largo Limestone, and the Fort Thompson formations are relatively porous limestone rock layers. Underneath these rock layers are the Upper Tamiami, the Lower Tamiami, and the Peace River formations that are composed of quartzitic sands, silts, and clays deposited as a result of carbonate and clastic processes during the Neogene period. Due to their geotechnical properties, the Tamiami and Peace River formations are referred as soil formations, hereafter. Underneath the Tamiami and Peace River formations, lies the Arcadia Formation, a limestone layer with occasional dolostone and thin silty-sand layers near the top of this unit.

2.0 FIELD AND LABORATORY INVESTIGATION

2.1 OVERVIEW

Field work consisted of soil sampling and drilling through Standard Penetration Test (SPT) and rock coring, pressuremeter testing, cone penetration testing (CPTu), and geophysical surveying including high resolution acoustic televiewer and compressional (P) and shear (S) wave velocity survey using P-S Suspension logging. In addition, undisturbed soil samples and special care rock samples were collected. Inclined coring was used to identify potential vertical fractures. Destructive drilling was used in combination with CPTu and pressuremeter testing.

For at least one boring at each unit, sampling in soil and rock layers was performed continuously. In soil layers, split spoon (SPT) samples and Shelby tubes samples were taken. In rock layers, rock coring was performed continuously.

Additionally, RIZZO has collected muck deposits (soft, surficial soil, and sediment layers) near the anticipated PTN Units 6 & 7 Site. Data from these Holocene-age muck deposits will be used to provide additional information related to the recent geologic history at the Site. Surficial muck collection activities, data, and results will be presented in a separate report.

All work was performed in accordance with USNRC 10 CFR 50 Appendix B, USNRC 10 CFR 21, and ASME NQA-1-1994.

RIZZO Staff (one geologist/engineer for each rig location) was on-site full-time to perform geotechnical field logging and drill inspection duties during all of the drilling operations and data acquisition. One RIZZO staff member independent from the rig geologists/geotechnical engineers was also on site to ensure that all local quality, health, safety, and environmental requirements are met.

The RIZZO Subcontractors for this Scope of Work and the QA program each subcontractor worked under are presented in ***Table 1***.

Boring logs prepared by RIZZO are provided in ***Appendix A***.

Kleinfelder laboratory testing results (resonant column torsional shear (RCTS) testing) are provided in ***Appendix B.*** Geotechnics laboratory testing results (index testing, triaxial testing, consolidation testing, and chemical testing) are provided in ***Appendix C.***

The GRL final report (SPT Energy Measurement) is provided in ***Appendix D.*** The ConeTec final report (CPTu) is provided in ***Appendix E***. The In-Situ Engineering final report (pressuremeter testing) is provided in ***Appendix F.*** The GEOVision final report (geophysical testing) is provided in ***Appendix G***.

Figure 1 shows the as-built boring and testing locations. Surveying of the final boring and testing locations was performed by Ford, Armenteros, and Fernandez, Inc. located in Doral, Florida. The final survey report is provided in ***Appendix H***. ***Table 2*** shows a summary of the drilling and testing program.

2.2 GEOTECHNICAL DRILLING AND CORING

Geotechnical drilling and coring was performed as listed in ***Table 2***. Geotechnical drilling was performed by Huss Drilling. Soil boreholes were advanced using wash rotary methods with 5 inch side-discharge bits, in accordance with ASTM D 1586-11, "Standard Test Method for SPT and Split-Barrel Sampling of Soils." Testing was conducted on a DR-16 "Failing 1500" truck-mounted drilling rig and an NWJ rod. The hammer had a 0.1406 kip ram weight. The SPT system utilized a cathead-rope safety type hammer. The operator used an indentation on the hammer rod as a guide to control the hammer height of 30 inches. SPT was performed advancing the split barrel sampler in four successive 0.5 ft increments. RIZZO boring logs (***Appendix A***) show the SPT N-values (N1) and additionally the sum of the number of blows required for the third and fourth 0.5 ft increments of penetration (N2).

Calibration of the SPT rig hammer to determine the energy transferred by the SPT hammer (Method B) to the SPT rod was performed on all drill rigs that performed SPT sampling by direct energy measurements according to the Commercial Grade Dedication (CGD) plan. The energy transferred by the SPT hammer system was measured in accordance with ASTM D 4633-10, "Standard Test Method for Energy Measurement for Dynamic Penetrometers." Energy measurements were performed by GRL Engineers and Pile Dynamics, Inc., of Orlando, Florida, and Cleveland, Ohio, respectively. The energy measurement report is provided in ***Appendix D***. The average energy transfer ratio was 62.1 percent, corresponding to an average energy ratio correction of 1.035.

All samples were logged in general accordance with ASTM D 6032-08, ASTM D 4220-95(2007), ASTM D 5079-08, ASTM D 5434-12, ASTM D 2488-09a, and applicable RIZZO field procedures.

Undisturbed soil samples were collected using a thin-wall tube (Shelby tube) (ASTM D 1587-08(2012) e1, "Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes"). Shelby tube samples were collected primarily using a pitcher barrel sampler. In some cases, where the pitcher barrel sampler yielded no recovery in the Shelby tube, a second attempt was made using the Osterberg sampler to push the Shelby tube.

Rock and over-consolidated soil coring were advanced using diamond-tipped rock core tools, in accordance with ASTM D 2113-08, "Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation." Rock coring through Miami, Key Largo and Fort Thompson layers up to the approximate depth of 115 ft was conducted using PQ size coring equipment with a triple barrel and split inner barrel for continuous sampling. The drilling rate, mud thickness, and core run length was adjusted by the RIZZO geologist/engineer to aim at least 80 percent recovery.

Temporary casing was occasionally used to prevent caving and to keep a clean boring. In saturated soils, drill rods were withdrawn slowly to prevent sloughing into the hole. The holes were re-cleaned to the bottom if the split-barrel sampler did not rest on the bottom prior to sampling.

For Boring R-6-1b, PQ-coring was conducted in the shallow limestone layers to a depth of 120.5 ft, and SPT testing and SPT/Shelby Tube sampling was conducted in the Tamiami and Peace River formations to a depth of 464.1 ft For Boring R-7-1, PQ-coring was performed in shallow limestone layers to a depth of 118.7 ft, and SPT testing and SPT/Shelby Tube sampling was conducted in the Tamiami and Peace River formations to a depth of 459.4 ft Borings R-6-1a, R-6-1a-A, and R-7-4, inclined PQ-coring was performed in the shallow limestone layers to a depth of approximately 115 ft For Borings R-6-2 and R-7-2, destructive drilling and NWD4-coring were conducted to a depth of approximately 365 ft to allow for subsequent pressuremeter testing. For Borings R-6-3 and R-7-3, destructive drilling was used to a depth of 125 ft to allow for CPTu testing in the Tamiami and Peace River formations.

2.2.1 Continuously Sampled Borings

A vertical Boring, R-6-1b, included core drilling of the limestone layers, followed by continuous sampling through the underlying soil layers. Continuous sampling was in the form of either split spoon SPT sampling or Shelby tube sampling. At Boring R-6-1b, the frequency of SPT testing was not less than every 6 ft for the depth interval of 115 to 215 ft, and every 9 ft for the depth interval of 215 to 450 ft.

2.2.2 Inclined Borings

The inclined borings were performed as listed in ***Table 2***. They were drilled with a BK Dutch 51 model track mounted rig utilizing a PQ triple barrel mud rotary assembly. All inclined borings were performed in lithified rock units performing rock core sampling in accordance with ASTM D 2113-08 to investigate the presence of vertical or near-vertical fractures.

The inclined borings were advanced into the shallow limestone units of the Miami, Key Largo, and Fort Thompson formations. They were terminated when the Upper Tamiami formation was reached. Each boring was drilled with an targeted deviation of 15-16 degrees from vertical. Boring R-6-1a and R-7-4 were the only two original inclined borings planned. However, there was poor recovery between the depths of approximately 70 and 110 ft in Boring R-6-1a due to mechanical issues with the core barrel. Therefore, an adjacent boring, R-6-1a-A, was drilled to obtain core of the depths of poor recovery after the mechanical issues were rectified.

The inclined borings were intended to intersect zones of suspected fractures due to surface features, such as drains and vegetated depressions. No fractures were observed in the previous investigations because of the sub-vertical nature of the fracture orientations and because none of the borings were in the location of the drains and vegetated depressions. R-6-1a and R-6-1a-A were drilled across a drain and R-7-4 was drilled across a vegetated depression. The borings were successful in encountering these discontinuities within the subsurface below the drain and vegetated depression. The depth and physical characteristics of the discontinuities were recorded in the boring logs.

2.2.3 Pressuremeter Testing

In-Situ Engineering performed pressuremeter testing (PMT) in three boreholes at the Site: R-6-2, R-6-1b, and R-7-2. The main objective of the PMT program was to obtain large strain shear modulus for the sub-surface materials of the Key Largo, Fort Thompson, Upper Tamiami, Lower Tamiami, and Peace River formations. Drilling activities for pressuremeter testing were performed by Huss Drilling of Dade City, Florida using a “Failing 1500” truck-mounted mud rotary drilling rig. Both mud rotary destructive drilling and coring were used. The field work was carried out between August 12, 2013 and September 23, 2013. Pressuremeter testing was performed in accordance with the testing procedures if In-Situ Engineering of Snohomish Washington:

- Technical Procedure TP-01, Collection of Borehole Pressuremeter Data in Soil and Rock, Version TP-01-06, August 20, 2013.
- Technical Procedure TP-02, Standard Technical Procedure for Correcting Pressuremeter Data for Membrane Effects, Version TP-02-03, August 20, 2013.
- Technical Procedure TP-03, Standard Technical Procedure for Calibrating Electronic Pressuremeter Instruments Manufactured by In-Situ Engineering, Version TP-03-02, August 20, 2013.

The instrument used for this investigation is a Cambridge style pre-bored high pressure pressuremeter (PBPM). The pressuremeter is of the monocell type, with a testing range of 2,000 pounds per square inch (psi) and 18 percent strain. It has three electronic displacement sensors spaced 120 degrees apart and located at the center of a flexible membrane, and a pressure cell. The flexible membrane is placed over the sensors, clamped at each end. The membrane is covered by a protective sheet of stainless steel strips. The unit is pressurized using compressed air to expand the membrane and deform the adjacent material. The electronic signals from displacement sensors and the pressure sensor are transmitted by cable to the surface.

In the pressuremeter test, the membrane is expanded by controlling the flow of compressed gas into the pressuremeter, increasing the pressure smoothly until the membrane starts to expand against the borehole wall. During the test, the average expansion versus pressure is displayed on a computer screen. Once the instrument has deformed the borehole sidewall and the response curve appears to be deforming intact material, the pressure is reduced to no more than 40 percent of the highest applied pressure, then increased again to form an unload-reload loop. The resulting unload-reload loop can be used to evaluate the elastic behavior of the material.

The test pocket is the actual location within the borehole where a pressuremeter test is performed. The quality of the test pocket is most important in the PMT program. RIZZO's Geotechnical Engineer coordinated the effort of fine-tuning the drilling techniques that worked best for different materials encountered on Site. Two drilling techniques were used which were successful in creating the test pockets for the different formations, as described below.

For the Key Largo and Fort Thompson test pockets, the driller used a 4-inch diameter tricone bit to destructively advance the hole from the surface to the top of the first test pocket and to advance the hole between test pockets. An NWD4 sized core barrel was used to create a 5 foot long test pocket into which the pressuremeter instrument was inserted.

For the Upper Tamiami, Lower Tamiami, and Peace River formations mud rotary drilling was used. The hole was advanced with the 4-inch tricone bit and the test pockets were drilled using a 2 15/16 inch diameter tricone bit. After the 2 15/16 bit was removed from the hole, the instrument was lowered into the pocket for testing. After the testing was complete, the instrument was removed and the hole was advanced to the top of the next test pocket with the larger diameter drill bit. Two improvements were made along the course of the investigation that resulted in increased success in the soil layers. One was to advance casing to a few feet above the test pocket to stabilize the hole and prevent caving. Another improvement was to increase the bentonite content in the drilling mud, resulting in a heavier mud and the formation of a mud cake in the walls of the hole.

The measures taken to achieve a test pocket of high quality, namely the coring technique in the limestone layers and the casing advancement and thicker drill mud in the soil layers, had the effect of forming smooth test pockets (limestone tests) and shortening the duration of drilling, thus minimizing the disturbance of the hole walls (soil tests).

A total of 96 pressuremeter tests were attempted in the investigation; 48 tests were conducted in borehole R-6-2; 6 tests were conducted in borehole R-6-1b, and 42 tests were conducted in borehole R-7-2. Approximately 2/3 of the test attempts were successful and produced useful data for stiffness characterization. The remaining tests resulted in oversized test pockets due to the combination of drilling conditions and the deformation limit of the apparatus, which has a 6.35mm radial displacement range.

2.2.4 Cone Penetration Testing

CPTu testing was performed as listed in ***Table 2***. CPTu testing was performed by ConeTec, Inc. A CPTu cone cannot advance into the shallow limestone formations, Miami, Key Largo, and Fort Thompson formations. Pre-drilling, using 2-7/8 and 2-15/16 inch diameter bits, was necessary within these formations, so that the CPTu test could be initiated within the Tamiami and Peace River formations underneath the Fort Thompson Formation. The CPTu data was collected in the Tamiami and Peace River formations until the refusal depth was reached (i.e., the pushing capacity of the CPTu truck).

The cone penetrometer tests were carried out using an integrated electronic seismic piezocone. The piezocone used was a compression model cone penetrometer with a 15 centimeter (cm^2) tip and a 225 cm^2 friction sleeve. The cone is designed with an equal end area friction sleeve and a tip end area ratio of 0.80. The piezocone dimensions and the operating procedure were in accordance with ASTM Standard D 5778-12.

The cone was advanced using a 25-ton truck cone penetration rig. The tip resistance, sleeve friction, and dynamic pore pressure were recorded every 5 cm as the cone was advanced into the ground.

Baseline readings for the cone were taken before and after each sounding, and the shift in the baseline reading was compared against the requirements per ASTM D 5778-12. The baseline shift from sounding to sounding was small, typically less than 0.1percent of full scale.

2.2.5 Geophysical Surveying

Borehole geophysics measurements were collected in two cased and two uncased borings by GEOVision, of Corona, California. The final GEOVision Report is provided in ***Appendix G***.

2.2.5.1 P-S Suspension Velocity Logging Surveys

In-situ P- and S-wave velocities were measured in borings R-6-1b and R-7-1 at 1.6 ft intervals with the OYO/Robertson Suspension P-S Logging System as listed in ***Table 2***. As an industry standard for nuclear power plant site characterization, the P-S logging method directly determines the average P-wave and S- wave velocity of a 3.3-ft (1.0 meter [m]) segment of the soil/rock column surrounding the boring using a downhole source. During P-S logging, seismic velocities calculated between each receiver and source (i.e., receiver to receiver and source to receiver) enables an independent check of measured velocities.

Procedures outlined in the "Procedure for OYO P-S Suspension Seismic Velocity Logging," were followed.

2.2.5.2 Acoustic Televiewer and Deviation (Verticality) Survey

Acoustic televiewer imaging was performed in two borings, R-6-1b and R-7-1, as indicated in ***Table 2***. When performing acoustic televiewer imaging, the borehole was uncased and fluid filled. The logging procedures for acoustic televiewer imaging conformed to ASTM D 5753-05(2010), "Standard Guide for Planning and Conducting Borehole Geophysical Logging."

Vertical deviation surveys were performed at all borings where P-S Suspension logging surveys were conducted, as well as for Borings R-6-1a-A and R-7-4. Geophysical logging began after all drilling tools were removed from the borehole. The geophysical testing procedures followed ASTM D 4428/D 4428M-07, Section 7.2.1.

2.3 Borehole Abandonment

A cement-bentonite grout was used to abandon the above referenced boreholes. Boreholes were backfilled using the tremie pipe method, always from bottom depth to top. Borings were grouted immediately after completion unless left open for geophysical testing. This mixture was a maximum of 7 gallons of water per 94-pound bag of Portland cement. No more than 5 percent by weight of bentonite powder was added to reduce shrinkage of backfill grout.

There were significant amounts of grout take during the abandonment of the boreholes. Large quantities (up to 40 gals) were being pumped into the borehole with no raise in the grout level, so the decision was made to add additives (e.g. "hole Plug") and let the grout set in steps, in order to help plugging and clogging the open spaces that were causing the loss of grout into the formations. When let set, the grout was leveling only in the formation contacts, or even raising up to 10 ft overnight, meaning that part of the grout already pumped into the formations was returning to the borehole. The intervals, at which the grout level showed no change, were observed between: Upper Tamiami and Fort Thompson formations, at the base of the Key Largo Formation, and between Miami Limestone and Key Largo formations.

2.4 Sample Handling and Storage

Samples were stored on Site in a temperature controlled facility monitored by electronic temperature data loggers. Samples were transported in a manner to avoid excessive shock or freezing that may damage the samples. Sample crates included shock indicators and minimum/maximum thermometers to indicate disturbance during transport. Minimum/maximum thermometer data indicates that no samples experienced freezing or temperatures greater than 125^0F. The shock indicator for Sample R-7-1 ST-15 was tripped during placement of a sample crate at Geotechnics, Inc. This sample was not tested.

Sample handling, preservation, storage, and transport were in accordance with ASTM D 4220-95 (2007) and applicable RIZZO Procedures.

2.5 Surveying

Surveying services were provided by Ford, Armenteros & Fernandez, Inc., a registered land surveyor in Florida. The surveyor performed two functions in the course of the investigation: the initial layout of the investigation points, followed, eventually, by their final as-built locations after all installations were completed. The results of the as-built survey are provided in ***Appendix H***.

Horizontal and vertical control was performed with conventional (optical) surveying techniques for geodetic control, using the data in the NAVD 1988 (vertical) and North American Datum (NAD) 1983 (horizontal) coordinate systems.

Survey equipment consisted of a "Total Station" (i.e., an electronic theodolite [transit]) integrated with an electronic distance meter or level. Global Positioning Systems (GPS) were not used.

2.6 Laboratory Testing

The laboratory testing performed by Geotechnics, Inc., located in Pittsburgh, Pennsylvania and Kleinfelder Laboratory located in Albuquerque, New Mexico, focused on testing soil and rock samples through index testing, triaxial testing, consolidation testing, chemical testing, and RCTS testing. ***Table 3*** shows a summary of the laboratory testing program. ***Table 4*** shows a summary of the laboratory testing results.

2.6.1 Unit Weight

Unit weight testing was used to determine the unit weight of soil and rock samples. Unit weight testing was performed by Geotechnics, Inc., according to ASTM D 2937-10 and ASTM D 7263-09. Unit weights are also determined during the RCTS testing performed by Kleinfelder Laboratory. Unit weight testing was performed on 46 soil samples and 4 rock samples.

2.6.2 Sieve and Hydrometer Analysis

Sieve and hydrometer analysis were used to determine the distribution of particle sizes. Sieve and hydrometer testing was performed by Geotechnics, Inc., according to ASTM D 422-63 (2007). Sieve and hydrometer analysis was performed on 41 soil samples.

2.6.3 Atterberg Limits

Atterberg limit testing was used to determine the plasticity of samples. Atterberg limit testing was performed by Geotechnics, Inc., according to ASTM D 4318-10. Atterberg limit testing was performed on 41 soil samples.

2.6.4 Moisture Content

Moisture content testing was used to determine the moisture content of soil and rock samples. Moisture content testing was performed by Geotechnics, Inc., according to ASTM D 2216-10. Moisture contents were also determined during RCTS testing performed by Kleinfelder Laboratory. Moisture content testing was performed on 46 soil samples and 4 rock samples.

2.6.5 Specific Gravity

Specific gravity testing was used to determine the specific gravity of soil samples. Specific gravity testing was performed by Geotechnics, Inc., according to ASTM D 854-10. Specific gravity testing was performed on 49 soil samples.

2.6.6 Consolidated Undrained (CU) Triaxial Test

Triaxial testing was used to determine the static strength and stiffness of soil samples. Triaxial testing was performed by Geotechnics, Inc., according to ASTM D 4767-11. Triaxial testing was performed on 20 soil samples.

2.6.7 One Dimensional Consolidation

Consolidation testing was used to determine the consolidation properties of soil samples. Consolidation testing was performed by Geotechnics, Inc., according to ASTM D 2435/ D 2435M-11. Consolidation testing was performed on 16 soil samples.

2.6.8 Chemical Testing

Chemical testing was used to determine the pH, chloride content, and sulfate content of rock samples. Chemical testing was performed by Geotechnics, Inc., according to AASHTO T-290-95, AASHTO T-291-94, and ASTM D 4972-01. Chemical testing was performed on 8 rock samples.

2.6.9 Resonant Column Torsional Shear (RCTS) Testing

RCTS testing was used to determine the dynamic properties of soil and rock samples. RCTS testing was performed by Kleinfelder Laboratory according to the Kleinfelder procedure 50051.LAB-ALB12OP010. RCTS testing was performed on 3 soil samples and 4 rock samples. Three of the RCTS rock samples tested were obtained from the previous investigation in 2008 (***Figure 1***).

3.0 SUMMARY/FUTURE WORK

This Supplemental Field Investigation Data Report describes the supplementary geological, geotechnical, and geophysical field investigation that was performed by RIZZO at the PTN Units 6 & 7 Site. Based on this information and information collected by others, RIZZO will revise the PTN Final Safety Analysis Report (FSAR) Section 2.5.4 and respond to associated Requests for Additional Information (RAI) from the United States Nuclear Regulatory Commission (NRC).

REFERENCES

AASHTO T-290-95, “Standard Method of Test for Determining Water-Soluble Sulfate Ion Content in Soil,” American Association of State Highway and Transportation Officials, Washington, DC, 2003.

AASHTO T-291-94, “Standard Method of Test for Determining Water-Soluble Chloride Ion Content in Soil,” American Association of State Highway and Transportation Officials, Washington, DC, 2004.

ASME NQA-1-1994, “Quality Assurance Program for Nuclear Facilities,” American Society of Mechanical Engineers, 1994.

ASTM Standard D 422-63, 2007, “Standard Test Method for Particle-Size Analysis of Soils,” DOI: 10.1520/D0422-63R07, ASTM International, West Conshohocken, PA, 2007.

ASTM Standard D 854-10, 2010, “Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer,” DOI: 10.1520/D0854-10, ASTM International, West Conshohocken, PA, 2010.

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

ASTM Standard D 1587-08(2012) e1, 2012, “Standard Test Method for Thin-Wall Tube Sampling of Soils,” DOI: 10.1520/D1587-08R12E01, ASTM International, West Conshohocken, PA, 2012.

ASTM Standard D 2113-08, 2008, “Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation,” DOI: 10.1520/D 2113-08, ASTM International, West Conshohocken, PA, 2008.

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

ASTM Standard D 2435/D 2435 M-11, 2011, “Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading,” DOI: 10.1520/D2435_D2435M-11, ASTM International, West Conshohocken, PA, 2011.

ASTM Standard D 2488-09a, 2009, “Standard Practice for Description and Identification of Soils (Visual-Manual Procedure),” DOI: 10.1520/D 2488-09A, ASTM International, West Conshohocken, PA, 2009.

ASTM Standard D 2937-10, 2010, “Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method,” DOI: 10.1520/D2937-10, ASTM International, West Conshohocken, PA, 2010.

ASTM Standard D 2974-07a, 2007, "Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils," DOI: 10.1520/D2974-07A, ASTM International, West Conshohocken, PA, 2007.

ASTM Standard D 4220-95, 2007, "Standard Practice for Preserving and Transporting Soil Samples," DOI: 10.1520/D 4220-95R07, ASTM International, West Conshohocken, PA, 2007.

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

ASTM Standard D 4428/D 4428M-074, 2007, "Standard Test Methods for Crosshole Seismic Testing," DOI: 10.1520/D 4428/ 4428M-07, ASTM International, West Conshohocken, PA, 2007.

ASTM Standard D 4633-10, 2010, "Standard Test Method for Energy Measurement for Dynamic Penetrometers," DOI: 10.1520/D4633-10, ASTM International, West Conshohocken, PA, 2010.

ASTM Standard D 4719-07, 2007, "Standard Test Method for Prebored Pressuremeter Testing in Soils," DOI: 10.1520/D 4719-07, ASTM International, West Conshohocken, PA, 2007.

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

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

ASTM Standard D 5079-08, 2008, "Standard Practices for Preserving and Transporting Rock Core Samples," DOI: 10.1520/D 5079-08, ASTM International, West Conshohocken, PA, 2008.

ASTM Standard D 5434-12, 2012, "Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock," ASTM International, DOI: 10.1520/D 5434-12, 2012.

ASTM Standard D 5753-05, 2010, "Standard Guide for Planning and Conducting Borehole Geophysical Logging," DOI: 10.1520/D 5753-05, ASTM International, West Conshohocken, PA, 2010.

ASTM Standard D 5778-12, 2012, "Standard Test Method for Electric Friction Cone and Piezocone Penetration Testing," DOI: 10.1520/D 5778-12, ASTM International, West Conshohocken, PA, 2012.

ASTM Standard D 6032-08, 2008, "Standard Test Method for Determining Rock Quality Designation of Rock Core," DOI: 10.1520/D 6032-08, ASTM International, West Conshohocken, PA, 2008.

ASTM Standard D 7263-09, 2009, "Standard Test Methods for Laboratory Determination of Density (Unit Weight) of Soil Specimens," DOI: 10.1520/D7263-09, ASTM International, West Conshohocken, PA, 2009.

ConeTec, Inc., 2013, "Presentation of In-Situ Testing Program Results, Turkey Point NPP Units 6 & 7, Job#13-5054," Revision 2, January 20, 2014.

Ford, Armenteros & Fernandez, Inc., "PNT 6 & 7 – Turkey Point, Specific Purpose Survey, Sketch of Survey and Surveyor's Notes," Revision 2, October 30, 2013.

Geotechnics, 2013, "Laboratory Test Results, Turkey Point Nuclear Power Plant Units 6 & 7, Project Number #13-5054," Revision 2, January 21, 2014.

GEOVision, 2010, "Procedure for OYO P-S Suspension Seismic Velocity Logging," Revision 1.5, October 7, 2010.

GEOVision, 2013, "Turkey Point NPP Borehole Geophysics, Borings R-6-1a-A, R-6-1b, R-7-1, and R-7-4, Report 13331-01," Revision 1, January 17, 2014.

GRL Engineers, Inc., 2013, "Report of SPT Energy Measurements, Boring R-6-1b, Turkey Point Nuclear Power Plant Units 6 and 7," Revision 1, January 16, 2014.

In-Situ Engineering, 2013a, "Report of In-Situ Pressuremeter Testing, Turkey Point Nuclear Power Plant Site Units 6 & 7," January 14, 2014.

In-Situ Engineering, 2013b, "Technical Procedure TP-01 Collection of Borehole Pressuremeter Data in Soil and Rock," Version TP-01-06, August 20, 2013.

In-Situ Engineering, 2013c, "Technical Procedure TP-02 Standard Technical Procedure for Correcting Electronic Pressuremeter Data for Membrane Effects," Version TP-02-03, August 20, 2013.

In-Situ Engineering, 2013d, "Technical Procedure TP-03 Standard Technical Procedure for Calibrating Electronic Pressuremeter Instruments Manufactured by In-Situ Engineering," Version TP-03-02, August 20, 2013.

Kleinfelder, 2012, "Measurement of Soil and Rock Dynamic Properties by the Resonant Column and Torsional Shear (RCTS) Method," 50051.LAB-ALB12OP010, Revision 4, May 30, 2012.

Kleinfelder, 2014, "Laboratory Data Report, Resonant Column and Torsional Shear (RCTS) Testing, Turkey Point Units 6 & 7 Site, Miami-Dade County, FL, Kleinfelder Project No. 136473," Revision 1, February 5, 2014.

Nuclear Regulatory Commission (NRC), 2003a, "Site Investigations for Foundations of Power Plants," Revision 2, Regulatory Guide 1.132, NRC, Washington, DC, October 2003.

Nuclear Regulatory Commission (NRC), 2003b, “Laboratory Investigations of Soils and Rocks for Engineering Analysis and Design of Power Plants,” Revision 2, Regulatory Guide 1.138, NRC, Washington, DC, December 2003

Paul C. Rizzo Associates, Inc. (RIZZO), 2013a, “Work Plan, Supplemental Geological, Geotechnical, and Geophysical Field Investigation Program, Turkey Point Nuclear Power Plant Units 6 and 7,” current revision, RIZZO, Pittsburgh, PA, 2013.

Paul C. Rizzo Associates, Inc. (RIZZO), 2013b, “Quality Assurance Project Plan, Supplemental Geological, Geotechnical, and Geophysical Field Investigation Program, Turkey Point Nuclear Power Plant Units 6 and 7,” current revision, RIZZO, Pittsburgh, PA, 2013.

Paul C. Rizzo Associates, Inc. (RIZZO), 2013c, “Work Plan, Collection, In-Field Evaluation, and Sampling of Surficial Muck Deposits, Turkey Point Nuclear Power Plant Units 6 and 7,” current revision, RIZZO, Pittsburgh, PA, 2013.

TABLES

TABLE 1
RIZZO'S SUBCONTRACTORS PROVIDING SAFETY RELATED ACTIVITIES FOR FPL TURKEY POINT UNITS 6 & 7

SUBCONTRACTOR	LOCATION	ACTIVITY	SAFETY RELATED	QA PROGRAM
Huss Drilling	Dade City, FL	Drilling	Yes	RIZZO QA Program
ConeTec, Inc.	Charles City, VA	CPTu testing	Yes	RIZZO QA Program
		CPTu calibration	Yes	Commercial Grade Dedication (CGD)
In-Situ Engineering	Snohomish, WA	Pressuremeter testing	Yes	RIZZO QA Program
GEOVision Geophysical Services	Corona, CA	Geophysical testing	Yes	RIZZO QA Program
Geotechnics, Inc.	Pittsburgh, PA	Laboratory testing	Yes	Geotechnics QA Program (1)
Kleinfelder Laboratory	Albuquerque, NM	Dynamic testing	Yes	Kleinfelder QA Program (1)
Ford, Armenteros, & Fernandez, Inc.	Doral, FL	Survey: locate borings	Yes	CGD
GRL Engineers and Pile Dynamics, Inc. (PDI)	Orlando, FL and Cleveland, OH	Energy ratio of Standard Penetration Test (SPT) hammer	Yes	CGD

NOTE:

(1) Approved by RIZZO QA Program in compliance with NQA-1:1994, 10CFR50 App B, 10CFR21

TABLE 2
SUMMARY OF THE BOREHOLE DRILLING AND TESTING PROGRAM

Boring No.	Activity	Description	Depth Range	No. of Samples/Tests
R-6-1a	Destructive Drilling	Destructive Drilling	0-3 ft. (1)	N/A
	Coring	Inclined PQ-coring in shallow limestone	3-122 ft.(1)	5 Special Care Samples
R-6-1a-A	Destructive Drilling	Destructive Drilling	0-2 ft. (1)	N/A
	Coring	Inclined PQ-coring in shallow limestone	2-112 ft.(1)	3 Special Care Samples
	Testing	Borehole Deviation	3-106 ft. (1)	0.04 ft. intervals
R-6-1b	Destructive Drilling	Destructive Drilling	0-3 ft.	N/A
	Testing	Acoustic televiewer	3-464 ft.	0.04 ft intervals (down) and 0.004 ft intervals (up)
		P-S Suspension	7-449 ft.	1.64 ft. intervals
		Pressuremeter testing	33-156 ft.	6 Pressuremeter tests
		Borehole deviation	3-464 ft.	0.04 ft intervals (down) and 0.004 ft intervals (up)
	Testing/Sampling	SPT/undisturbed sampling in soil	3-15 ft.	6 SPT Samples
			120-464 ft.	45 SPT and 102 Shelby Tube and 6, 3-inch Split Spoon Samples
	Coring	PQ-coring in shallow limestone	15-120 ft.	6 Special Care Samples
R-6-2	Testing/Sampling	SPT/undisturbed sampling in soil	2-8 ft.	2 SPT Samples
	Destructive Drilling	Destructive Drilling	0-2 ft. 8-46 ft. 66-70 ft. 75-80 ft. 85-100 ft. 112-360 ft.	N/A
	Coring	NWD4 Coring	46-66 ft. 70-75 ft. 80-85 ft. 100-112 ft.	Continuous Sampling
	Testing	Pressuremeter testing	29-328 ft.	48 Pressuremeter tests

TABLE 2
SUMMARY OF THE BOREHOLE DRILLING AND TESTING PROGRAM (CONTINUED)

Boring No.	Activity	Description	Depth Range	No. of Samples/Tests
R-6-3	Destructive Drilling	Destructive drilling through limestone	0-125 ft.	N/A
	Testing	CPTu testing in soil	125-289 ft.	Continuous data collection
R-7-1	Destructive Drilling	Destructive Drilling	0-5 ft.	N/A
	Coring	PQ-coring in shallow limestone	5-120 ft.	9 Special Care Samples
		NWD4 Coring	453-458 ft.	No Recovery
	Testing/Sampling	SPT/undisturbed sampling in soil	120-453 ft. 458-459 ft.	37 SPT & 30 Shelby Tube Samples
	Testing	Acoustic televiewer	3-454 ft.	0.04 ft intervals (down) and 0.004 ft intervals (up)
		P-S Suspension	7-441 ft.	1.64 ft. intervals
		Borehole Deviation	3-454 ft.	0.04 ft intervals (down) and 0.004 ft intervals (up)
R-7-2	Destructive Drilling	Destructive drilling	0-27 ft. 58-65 ft. 78-90 ft. 95-370 ft.	N/A
	Coring	NWD4 Coring	27-58 ft. 65-78 ft. 90-95 ft.	Continuous Sampling
	Testing	Pressuremeter testing	31-304 ft.	42 Pressuremeter tests
R-7-3	Destructive Drilling	Destructive drilling	0-20 ft. 120-125 ft.	N/A
	Coring	NWD4 Coring	20-120 ft.	Continuous Sampling
	Testing	CPTu testing in soil	125-288 ft.	Continuous data collection
R-7-4	Destructive Drilling	Destructive Drilling	0-2 ft. (1)	N/A
	Coring	Inclined PQ-coring in shallow limestone	2-126 ft.(1)	4 Special Care Samples
	Testing	Borehole Deviation	4-122 ft.(1)	0.04 ft intervals (down) and 0.004 ft intervals (up)

NOTE:

(1) Indicates measured depth in boring. The angle of borings R-6-1a and R-6-1a-A is15 degrees from vertical, and the angle of R-7-4 is 16 degrees from vertical.

TABLE 3
SUMMARY OF LABORATORY TESTING PROGRAM

TEST	LABORATORY	TEST STANDARD	PURPOSE OF TEST	TEST QUANTITY[1]
Unit Weight	Geotechnics	ASTM D 7263-09 ASTM D 2937-10	To measure unit weight of samples	43
Sieve Analysis	Geotechnics	ASTM D 422-63 (2007)	To determine the distribution of particle sizes	41
Hydrometer Analysis	Geotechnics	ASTM D 422-63 (2007)	To determine the distribution of particle sizes	41
Atterberg Limits	Geotechnics	ASTM D 4318-10	For general classification and soil index	41
Moisture Content	Geotechnics	ASTM D 2216-10	For moisture content, saturation, void ratio, porosity	43
Specific Gravity of Soil Solids	Geotechnics	ASTM D 854-10	To determine the specific gravity of soil samples	35
Consolidated Undrained (CU) Triaxial Test	Geotechnics	ASTM D 4767-11	To determine the static strength and stiffness of soil and rock samples	20
One Dimensional Consolidation	Geotechnics	ASTM D 2435/ D 2435M-11	To determine consolidation properties of soil samples	16
Resonant Column Torsional Shear Test	Kleinfelder	Kleinfelder: 50051.LAB-ALB12OP010, Rev. 4, May 30, 2012	To determine dynamic properties of soil and rock samples	7
Chemical Tests	Geotechnics	AASHTO T-290-95, AASHTO T-291-94, ASTM D4972-01	To determine the chemical properties of rock samples	8

NOTE:

(1) Quantity of tests is based on number of samples, not number of sections tested. Quantity of unit weight and moisture content tests do not include unit weight and moisture content determined during RCTS testing.

TABLE 4
SUMMARY OF THE LABORATORY TESTING RESULTS

Boring	Sample	Depth (ft)	Bottom Depth (ft)	Gravel (%)	Sand (%)	Fines (%)	LL	PL	PI	w (%)	Dry Unit Weight γ (pcf)	Bulk Unit Weight (pcf)	Specific Gravity	USCS Symbol	c' (psi)	φ' (^{0})	pH	Chloride (mg/kg)	Sulfate (mg/kg)	RCTS	C_c	C_r
B-714	714-CS-01	29.4	29.9							9	119.4	129.8								X		
B-615	615-CS-01	32.6	33.1							10	126.3	138.4								X		
R-6-1a	SC-1	33	33.7														8.73	3111	259			
R-7-1	SC-2	37.5	37.9														8.85	1960	257			
R-7-1	SC-4	46.9	47.7														8.72	2991	364			
R-6-1b	SC-3	47.6	48.1							4	146.5	151.8								X		
R-7-4	SC-2	48.2	49														8.86	2766	252			
B-728	728-CS-04	53.7	54.2							8	134	144.3								X		
R-6-1a-A	SC-1	72.6	73.5														8.24	1974	198			
R-7-1	SC-6	74.3	75														8.98	1863	399			
R-6-1b	SC-4A	81	81.7														8.84	1833	315			
R-6-1a	SC-5	114.7	115														8.75	3404	457			
R-6-1b	ST-1	136	136.5							27	94.6	119.9		SM						X		
R-7-1	ST-1 (3)	137.9	138.1								106.3	127.9										
R-7-1	ST-1 (2)	138.1	138.6	7	57	36	NP	NP	0				2.64	SM								
R-7-1	ST-1 (1)	138.6	138.7							20												
R-6-1b	ST-3 (4)	148.2	148.7	5	63	32	NP	NP	0		89.5	116.1	2.63	SM	0	34.65						
R-6-1b	ST-3 (3)	148.7	149.2								89.7	116.7			0	34.65						
R-6-1b	ST-3 (2)	149.2	149.7								89.5	116.1			0	34.65						
R-6-1b	ST-3 (1)	149.7	149.8							30												
R-7-1	ST-2	159.6	160.7	0	36	64	NP	NP	0	33			2.64	ML								
R-6-1b	ST-5 (5)	163.4	163.6																		0.263	0.002
R-6-1b	ST-5 (4)	163.6	164.1								90.8	117.9			1.71	32.93						
R-6-1b	ST-5 (3)	164.1	164.6								91.3	118.6			1.71	32.93						
R-6-1b	ST-5 (2)	164.6	165.1	0	38	62	NP	NP	0		90.4	117.3	2.66	ML	1.71	32.93						
R-6-1b	ST-5 (1)	165.1	165.2							30												
R-6-1b	ST-7	171.7	172.2							29	93	119.9								X		
R-6-1b	ST-9 (3)	179.2	179.7	0	36	64	NP	NP	0		87.4	114.8	2.65	ML								
R-6-1b	ST-9 (2)	179.7	179.9							31	88.3	116.1									0.306	0.003
R-6-1b	ST-9 (1)	179.9	180							32												

TABLE 4
SUMMARY OF THE LABORATORY TESTING RESULTS
(CONTINUED)

Boring	Sample	Depth (ft)	Bottom Depth (ft)	Gravel (%)	Sand (%)	Fines (%)	LL	PL	PI	w (%)	Dry Unit Weight γ (pcf)	Bulk Unit Weight (pcf)	Specific Gravity	USCS Symbol	c' (psi)	φ' (^{0})	pH	Chloride (mg/kg)	Sulfate (mg/kg)	RCTS	C_c	C_r
R-6-1b	ST-11 (5)	185.7	185.8							34												
R-6-1b	ST-11 (4)	185.8	186.3								86.2	115.4			3.17	31.37						
R-6-1b	ST-11 (3)	186.3	186.8	0	43	57	NP	NP	0		87.8	116.7	2.62	ML	3.17	31.37						
R-6-1b	ST-11 (2)	186.8	187.3								87.4	116.1			3.17	31.37						
R-6-1b	ST-11 (1)	187.3	187.4							33												
R-7-1	ST-4 (5)	188.9	189.4								86	114.8			2.56	30.6						
R-7-1	ST-4 (4)	189.4	189.6							34	85.7	114.8									0.251	0.004
R-7-1	ST-4 (3)	189.6	190.1	0	39	61	NP	NP	0		87.7	115.4	2.63	ML	2.56	30.6						
R-7-1	ST-4 (2)	190.1	190.6								88.9	116.7			2.56	30.6						
R-7-1	ST-4 (1)	190.6	190.7							32												
R-6-1b	ST-13 (2)	194.1	194.6	0	39	61					89.6	116.7	2.64	ML								
R-6-1b	ST-13 (1)	194.6	194.8				NP	NP	0	30												
R-6-1b	ST-15 (5)	200.5	200.6							33												
R-6-1b	ST-15 (4)	200.6	201.1								98.2	117.9			6.86	28.79						
R-6-1b	ST-15 (3)	201.1	201.6								99.5	119.2			6.86	28.79						
R-6-1b	ST-15 (2)	201.6	202.1	0	33	67	NP	NP	0		100.1	119.8		ML	6.86	28.79						
R-6-1b	ST-15 (1)	202.1	202.2							20												
R-7-1	ST-5	207.9	208.4							32	89.6	118.2		SM						X		
R-6-1b	ST-17 (3)	208.7	209.2	0	22	78	NP	NP	0		86.5	114.8	2.64	ML								
R-6-1b	ST-17 (2)	209.2	209.4							33	88.1	116.7									0.397	0.004
R-6-1b	ST-17 (1)	209.4	209.6							33												
R-7-1	ST-6 (2)	223.1	223.6	6	60	34	NP	NP	0		102.8	123.6	2.7	SM								
R-7-1	ST-6 (1)	223.6	223.7							20												
R-6-1b	ST-22 (4)	225	225.2							19											0.169	0.005
R-6-1b	ST-22 (3)	225.2	225.7	0	73	28	NP	NP	0		103.5	126.7	2.64	SM	4.82	35.19						
R-6-1b	ST-22 (2)	225.7	226.2								102	124.8			4.82	35.19						
R-6-1b	ST-22 (1)	226.2	226.3							22												
R-7-1	ST-7 (5)	233	233.1							31												
R-7-1	ST-7 (4)	233.1	233.6								100.2	119.8			5.78	31.51						
R-7-1	ST-7 (3)	233.6	234.1	0	60	40	NP	NP	0		101.4	121.7	2.65	SM	5.78	31.51						
R-7-1	ST-7 (2)	234.1	234.6								101.8	121.7			5.78	31.51						

TABLE 4
SUMMARY OF THE LABORATORY TESTING RESULTS
(CONTINUED)

BORING	SAMPLE	DEPTH (ft)	BOTTOM DEPTH (ft)	GRAVEL (%)	SAND (%)	FINES (%)	LL	PL	PI	w (%)	DRY UNIT WEIGHT γ (pcf)	BULK UNIT WEIGHT (pcf)	SPECIFIC GRAVITY	USCS SYMBOL	c' (psi)	φ' (^{0})	pH	CHLORIDE (mg/kg)	SULFATE (mg/kg)	RCTS	C_c	C_r
R-7-1	ST-7 (1)	234.6	234.7							20												
R-6-1b	ST-25 (2)	234.7	235.2	0	61	39	NP	NP	0		93	119.2	2.66	SM								
R-6-1b	ST-25 (1)	235.2	235.4							28												
R-7-1	ST-8 (3)	245.5	246	0	78	22	NP	NP	0	23	101.1	124.2	2.63	SM								
R-7-1	ST-8 (2)	246	246.3							23	100.1	122.9									0.087	0.004
R-7-1	ST-8 (1)	246.3	246.5							23												
R-6-1b	ST-31 (4)	251.7	252.2								104.4	125.4			0.55	33.49						
R-6-1b	ST-31 (3)	252.2	252.7	0	72	28	NP	NP	0		102.8	123.6	2.65	SM	0.55	33.49						
R-6-1b	ST-31 (2)	252.7	253.2								104.6	126.0			0.55	33.49						
R-6-1b	ST-31 (1)	253.2	253.3							20												
R-7-1	ST-9 (4)	255.9	256.4								96.3	120.4			7.72	26.52						
R-7-1	ST-9 (3)	256.4	256.9	0	74	26	NP	NP	0		97.4	122.3	2.64	SM	7.72	26.52						
R-7-1	ST-9 (2)	256.9	257.4								95.9	120.4			7.72	26.52						
R-7-1	ST-9 (1)	257.4	257.5							25												
R-6-1b	ST-33 (3)	259.7	260.1	0	74	26	NP	NP	0		95.8	119.8	2.64	SM								
R-6-1b	ST-33 (2)	260.1	260.3							25	96	120.4									0.137	0.002
R-6-1b	ST-33 (1)	260.3	260.5							26												
R-7-1	ST-10 (5)	266.9	267.1							28											0.268	0.004
R-7-1	ST-10 (4)	267.1	267.6								93.9	119.8			26.77	19.85						
R-7-1	ST-10 (3)	267.6	268.1	0	63	37	NP	NP	0		90.3	114.8	2.67	SM	26.77	19.85						
R-7-1	ST-10 (2)	268.1	268.6								94.1	119.8			26.77	19.85						
R-7-1	ST-10 (1)	268.6	268.7							27												
R-6-1b	ST-37 (2)	271.8	272.3	0	50	50	NP	NP	0		97.5	120.4		SM								
R-6-1b	ST-37 (1)	272.3	272.5							23												
R-7-1	ST-11 (5)	277.9	278.1							30											0.163	0.005
R-7-1	ST-11 (4)	278.1	278.6	0	45	55	31	25	6		90.8	118.6	2.63	ML	6.5	30.56						
R-7-1	ST-11 (3)	278.6	279.1								90.8	118.6			6.5	30.56						
R-7-1	ST-11 (2)	279.1	279.6								91	118.6			6.5	30.56						
R-7-1	ST-11 (1)	279.6	279.7							31												
R-6-1b	ST-40 (5)	280.7	280.9							31											0.213	0.005
R-6-1b	ST-40 (4)	280.9	281.4	0	54	46	30	20	10		91.3	118.6	2.65	SC	5.7	30.36						

TABLE 4
SUMMARY OF THE LABORATORY TESTING RESULTS
(CONTINUED)

BORING	SAMPLE	DEPTH (ft)	BOTTOM DEPTH (ft)	GRAVEL (%)	SAND (%)	FINES (%)	LL	PL	PI	w (%)	DRY UNIT WEIGHT γ (pcf)	BULK UNIT WEIGHT (pcf)	SPECIFIC GRAVITY	USCS SYMBOL	c' (psi)	φ' (⁰)	PH	CHLORIDE (mg/kg)	SULFATE (mg/kg)	RCTS	C_c	C_r
R-6-1b	ST-40 (3)	281.4	281.9								91.5	118.6			5.7	30.36						
R-6-1b	ST-40 (2)	281.9	282.4								91.4	118.6			5.7	30.36						
R-6-1b	ST-40 (1)	282.4	282.5							30												
R-7-1	ST-12 (5)	288.7	288.9										2.66									
R-7-1	ST-12 (4)	288.9	289.1	0	76	24								SM								
R-7-1	ST-12 (3)	289.1	289.6				NP	NP	0													
R-7-1	ST-12 (2)	289.6	290							24	96.2	119.2									0.124	0.003
R-7-1	ST-12 (1)	290	290.2							25												
R-7-1	ST-13 (7)	298.2	298.3							27												
R-7-1	ST-13 (6)	298.3	298.7								96.2	122.3			5.69	32.01						
R-7-1	ST-13 (5)	298.7	299.2								98.8	125.4			5.69	32.01						
R-7-1	ST-13 (4)	299.2	299.7								98.2	124.8			5.69	32.01						
R-7-1	ST-13 (3)	299.7	300.3	0	84	16	NP	NP	0		97.2	121.1	2.66	SM								
R-7-1	ST-13 (2)	300.3	300.5							25	96.8	121.1									0.134	0.003
R-7-1	ST-13 (1)	300.5	300.7							26												
R-6-1b	ST-46 (4)	300.7	301.2	0	89	11	NP	NP	0		109.8	127.3	2.61	SW-SM	2.67	32.55						
R-6-1b	ST-46 (3)	301.2	301.7								108.7	126.0			2.67	32.55						
R-6-1b	ST-46 (2)	301.7	302.2								111.8	129.8			2.67	32.55						
R-6-1b	ST-46 (1)	302.2	302.3							16												
R-7-1	ST-14 (2)	310.5	311	0	88	12	NP	NP	0		91.7	116.7	2.62	SM								
R-7-1	ST-14 (1)	311	311.2							27												
R-6-1b	ST-52 (3)	319	319.5	0	94	6	NP	NP	0		95.4	119.2	2.62	SP-SM								
R-6-1b	ST-52 (2)	319.5	319.7							25												
R-7-1	ST-16 (5)	320.3	320.5	3	88	10								SP-SM								
R-7-1	ST-16 (4)	320.5	321								96.9	120.4			56.97	26.7						
R-7-1	ST-16 (3)	321	321.5								98.4	122.3			56.97	26.7						
R-7-1	ST-16 (2)	321.5	322				NP	NP	0		100.3	124.8	2.61		56.97	26.7						
R-7-1	ST-16 (1)	322	322.2							24												
R-6-1b	ST-55 (4)	326.4	326.9								93.8	115.4			26.54	32.84						
R-6-1b	ST-55 (3)	326.9	327.4								99.6	122.9			26.54	32.84						
R-6-1b	ST-55 (2)	327.4	327.9								99.3	122.3			26.54	32.84						

TABLE 4
SUMMARY OF THE LABORATORY TESTING RESULTS
(CONTINUED)

Boring	Sample	Depth (ft)	Bottom Depth (ft)	Gravel (%)	Sand (%)	Fines (%)	LL	PL	PI	w (%)	Dry Unit Weight γ (pcf)	Bulk Unit Weight (pcf)	Specific Gravity	USCS Symbol	c' (psi)	φ' (^{0})	pH	Chloride (mg/kg)	Sulfate (mg/kg)	RCTS	C_c	C_r
R-6-1b	ST-55 (1)	327.9	328							23												
R-7-1	ST-17 (2)	329.7	330.2	0	95	5	NP	NP	0		96.6	121.7		SP-SM								
R-7-1	ST-17 (1)	330.2	330.4							26												
R-7-1	ST-18 (4)	338	338.2										2.63									
R-7-1	ST-18 (3)	338.2	338.7	0	95	5	NP	NP	0		93.3	115.4		SP								
R-7-1	ST-18 (2)	338.7	338.9							24											0.031	0.001
R-7-1	ST-18 (1)	338.9	339							25												
R-6-1b	ST-61 (2)	343.5	344	0	94	7	NP	NP	0		94.2	121.7		SP-SM								
R-6-1b	ST-61 (1)	344	344.2							29												
R-7-1	ST-19 (2)	346.3	346.8	0	95	5	NP	NP	0		95	119.2		SP-SM								
R-7-1	ST-19 (1)	346.8	347							26												
R-7-1	ST-20 (4)	354.4	354.9								119.4	119.2			1.02	34.74						
R-7-1	ST-20 (3)	354.9	355.4	0	90	10	NP	NP	0		121.7	121.7	2.61	SP-SM	1.02	34.74						
R-7-1	ST-20 (2)	355.4	355.9								121.5	121.7			1.02	34.74						
R-7-1	ST-20 (1)	355.9	356							25												
R-6-1b	ST-66 (5)	356.8	357							26	93.9	118.6									0.057	0.001
R-6-1b	ST-66 (4)	357	357.5								94.4	119.2	2.62		7.76	32.54						
R-6-1b	ST-66 (3)	357.5	358								95.9	121.1			7.76	32.54						
R-6-1b	ST-66 (2)	358	358.5								95.9	121.1			7.76	32.54						
R-6-1b	ST-66 (1)	358.5	358.6							26												
R-6-1b	ST-67 (2)	360.6	361.1	0	93	7	NP	NP	0		95	119.8	2.62	SP-SM								
R-6-1b	ST-67 (1)	361.1	361.3							26												
R-7-1	ST-22 (2)	373.8	374.3	0	93	7	NP	NP	0		94	118.6		SP-SM								
R-7-1	ST-22 (1)	374.3	374.5							26												
R-6-1b	ST-75 (2)	383.4	383.9	0	90	10	NP	NP	0		87.9	117.3	2.61	SP-SM								
R-6-1b	ST-75 (1)	383.9	384.1							33												
R-7-1	ST-23 (4)	390.7	390.9								97	122.9			0	36.72						
R-7-1	ST-23 (5)	390.7	390.9																		0.047	0.003
R-7-1	ST-23 (3)	391.4	391.9								95.3	121.1			0	36.72						
R-7-1	ST-23 (2)	391.9	392.4	0	86	14	NP	NP	0		91.5	116.1	2.6	SM	0	36.72						
R-7-1	ST-23 (1)	392.4	392.5							27												

TABLE 4
SUMMARY OF THE LABORATORY TESTING RESULTS
(CONTINUED)

BORING	SAMPLE	DEPTH (ft)	BOTTOM DEPTH (ft)	GRAVEL (%)	SAND (%)	FINES (%)	LL	PL	PI	w (%)	DRY UNIT WEIGHT γ (pcf)	BULK UNIT WEIGHT (pcf)	SPECIFIC GRAVITY	USCS SYMBOL	c' (psi)	φ' (^{0})	pH	CHLORIDE (mg/kg)	SULFATE (mg/kg)	RCTS	C_c	C_r
R-6-1b	ST-82 (5)	402.8	403							20	84.8	102.3									0.058	0.002
R-6-1b	ST-82 (4)	403	403.5	0	86	14	NP	NP	0		90.1	115.4	2.6	SM	0	34.46						
R-6-1b	ST-82 (3)	403.5	404								94.6	121.1			0	34.46						
R-6-1b	ST-82 (2)	404	404.5								91.8	117.9			0	34.46						
R-6-1b	ST-82 (1)	404.5	404.6							28												
R-6-1b	ST-88 (2)	421.5	422	0	95	5	NP	NP	0		96.5	121.1		SP-SM								
R-6-1b	ST-88 (1)	422	422.2							26												
R-7-1	ST-25 (2)	436.8	437.3	0	91	9	NP	NP	0		88.9	117.3	2.61	SP-SM								
R-7-1	ST-25 (1)	437.3	437.5							32												
R-6-1b	ST-97 (2)	447.9	448.4	0	85	15	NP	NP	0		92.6	117.9	2.62	SM								
R-6-1b	ST-97 (1)	448.4	448.6							27												

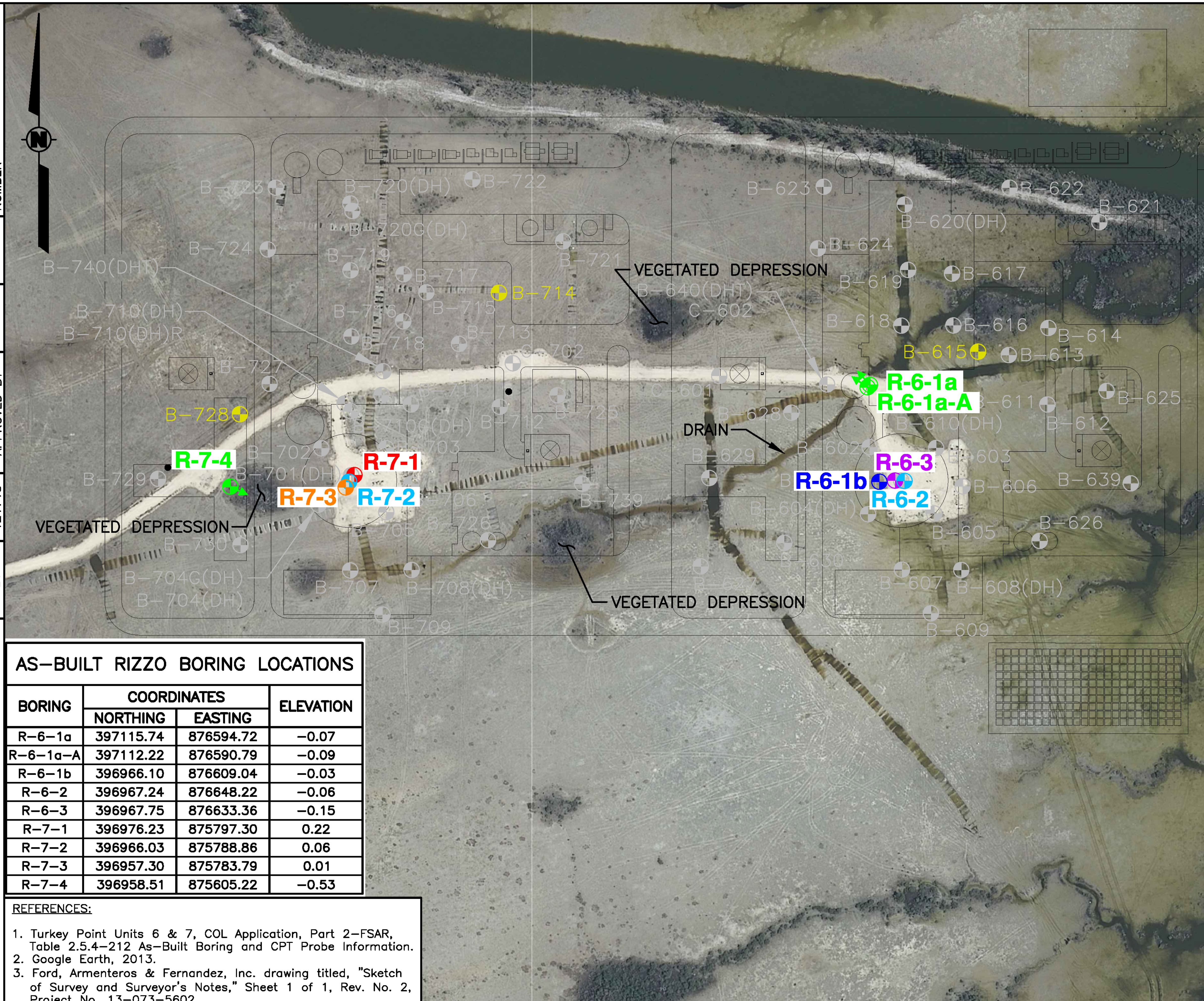
ABBREVIATIONS:

LL – Liquid Limit
PL – Plastic Limit
PI – Plasticity Index
W (%) – Moisture Content
USCS – United Soil Classification System

C’ – Effective cohesion
φ’ – Effective internal friction angle
RCTS – Resonant Column Torsional Shear
C_c – Compression index
C_r – Recompression index

ML – Silt
SC – Clayey sand
SM – Silty sand
SP – Poorly graded sand
SW – Well graded sand

FIGURE



LEGEND:

R-7-1	RIZZO SPT BORING AND LIMESTONE ROCK CORING (CONTINUOUS SAMPLING) WITH ACOUSTIC TELEVIEWER AND P-S SUSPENSION LOGGING
R-6-2 R-7-2	RIZZO DESTRUCTIVELY DRILLED BORING (INTERMITTENT LIMESTONE ROCK CORING) WITH PRESSUREMETER TESTING
R-6-3	RIZZO CPT BORING
R-7-3	RIZZO CPT BORING WITH INTERMITTENT LIMESTONE ROCK CORING
R-6-1a, R-6-1a-A R-7-4	RIZZO INCLINED BORING – LIMESTONE ROCK CORING
R-6-1b	RIZZO SPT BORING AND LIMESTONE ROCK CORING (CONTINUOUS SAMPLING) WITH ACOUSTIC TELEVIEWER AND P-S SUSPENSION LOGGING AND PRESSUREMETER TESTING
	AS-BUILT BORING AND CPT PROBE FROM PREVIOUS INVESTIGATION
	RCTS TESTING – B-615, B-714 & B-728 AS-BUILT BORING FROM PREVIOUS INVESTIGATION

NOTES:

1. SITE COORDINATE SYSTEM IS NAD83, FLORIDA STATE PLANE, U.S. FOOT, EAST ZONE.
2. NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88, FEET).

SCALE
150 0 150 FEET

AS-BUILT RIZZO BORING LOCATIONS

BORING	COORDINATES		ELEVATION
	NORTHING	EASTING	
R-6-1a	397115.74	876594.72	-0.07
R-6-1a-A	397112.22	876590.79	-0.09
R-6-1b	396966.10	876609.04	-0.03
R-6-2	396967.24	876648.22	-0.06
R-6-3	396967.75	876633.36	-0.15
R-7-1	396976.23	875797.30	0.22
R-7-2	396966.03	875788.86	0.06
R-7-3	396957.30	875783.79	0.01
R-7-4	396958.51	875605.22	-0.53

REFERENCES:

1. Turkey Point Units 6 & 7, COL Application, Part 2-FSAR, Table 2.5.4-212 As-Built Boring and CPT Probe Information.
2. Google Earth, 2013.
3. Ford, Armenteros & Fernandez, Inc. drawing titled, "Sketch of Survey and Surveyor's Notes," Sheet 1 of 1, Rev. No. 2, Project No. 13-073-5602.

FIGURE 1

AS-BUILT BORING LOCATIONS

TURKEY POINT UNITS 6 & 7 SITE

PREPARED FOR

FLORIDA POWER & LIGHT
MIAMI-DADE COUNTY, FLORIDA

Paul C. Rizzo Associates, Inc.
ENGINEERS / CONSULTANTS / CM

CAD FILE NUMBER 13-5054-B5

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