FUGRO CONSULTANTS, INC.

OFFSHORE AND NEARSHORE GEOTECHNICAL FIELD DATA REPORT VOWTAP DEMONSTRATION PROJECT

OFFSHORE VIRGINIA OUTER CONTINENTAL SHELF

Prepared for:
DOMINION RESOURCES

September 2014
Fugro Project No. 04.81140004

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Fugro Consultants, Inc. (Fugro) has recently completed a geotechnical and geophysical field exploration program in support of the Virginia Offshore Wind Technology Advancement Project (VOWTAP). The program comprised of marine drilling and in-situ testing offshore in federal and state waters off the coast of Virginia along the proposed VOWTAP marine Export and Inter-Array Cable routes and at the proposed wind turbine generator (WTG) locations. Onshore drilling and test pit exploration were also conducted along the proposed VOWTAP Interconnection Cable Route and Interconnection Substation location. This report is provided under separate cover.

The field activities discussed herein consist of marine drilling at the turbine sites and at the horizontal directional drilling (HDD) cable site. The geotechnical surveys were conducted under an agency reviewed protocol that conforms to the Bureau of Ocean Energy Management (BOEM) Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information GGARCH; November 9, 2012), as discussed in a Pre-Survey meeting with BOEM on May 19, 2014 Surveys were also conducted in compliance with the following permits and approvals:

- U.S. Army Corps of Engineers (USACE) PCN: Nationwide Permit 6, Survey Activities (Permit No. NAO-2013-0418);
- Commonwealth of Virginia Marine Resource Commission (VRMC) (Permit No. 13-0614); and
- National Oceanic and Atmospheric Administration (NOAA) - approved Marine Mammal and Sea Turtle Harassment Avoidance Plan (NOAA, 2014).

The drilling was conducted by Fugro McClelland Marine Geosciences, Inc. (FMMG) using marine techniques. In addition to marine drilling, onshore drilling in the proximity of the HDD cable entry point was conducted under subcontract to Fugro by Fishburne drilling Inc. (FDI). The findings of the onshore site investigation are presented in our Onshore Geotechnical Field Data Report (Fugro, 2014a). In-situ piezocone penetration test (PCPT) soundings were performed using Fugro Alluvial Offshore Limited (FAOL) Seascout 10 (Seascout) seabed system.

The geotechnical and geophysical field program was conducted in support of the development of a grid-connected, 12 megawatt (MW) offshore wind facility comprising two

ISO 9001 REGISTERED UKAS Certificate No. 7105
OHSAS 18001 WCS Certificate No. OH 1256

Alstom HALIADE™ 150, 6 MW direct drive WTGs. The work was authorized by Purchase Order 70273227 dated March 20, 2014.

The seabed PCPT soundings were conducted from the Megan Miller vessel, owned and operated by Miller Marine, between June 26, 2014 and July 10, 2014. Thirty (30) locations along the offshore cable route were tested. The nominal spacing between testing locations was about 1km. Two additional tests were conducted along the proposed inner-array cable route between turbine sites T1A and T2A. Penetration depths between 5.8 and 1.2m were achieved depending on the density or stiffness of the subsurface layers. When shallow refusal was associated with a sharp increase in tip resistance, this may be occasionally due to subsurface obstructions such as debris or rock. In such cases, the Seascout was offset about 1 m and redeployed in an attempt to achieve deeper penetrations. A total of seven retests were performed. The depths reached in all retests were not considerably different than the initial CPT tests indicating that refusal most likely occurred due to very dense soil layers as oppose to obstructions. The water depth at the offshore cable route CPT locations ranged from 8.9 to 25.9 m referenced to mean lower low water (MLLW).

The marine borings along the marine portion of the Export Cable route to be installed used HDD and at the turbine sites were conducted using FMMG drilling equipment outfitted on the Inez H. Eymard (Inez) liftboat. The liftboat is owned by Offshore Marine Contractors (OMC) and was operated between June 23 and July 22, 2014 to drill and sample offshore and nearshore boreholes. At the turbine sites, the initial site investigation plan was to drill and sample two primary locations, which are the preferred sites for the two turbines (T1A and T2A), and two alternate borehole locations. These locations were selected by the project engineer after reviewing the 2013 geophysical and vibracore data and determining that the bathymetry of the seabed is generally flat with predominant fine sand in the upper part of the seabed, which has been interpreted to be dense. After drilling and sampling two primary and one of the alternate turbine locations, Fugro concluded that the subsurface conditions and soil properties are fairly uniform across the turbine sites confirming that the preferred sites for the two turbines are optimum. As a result, the second alternate location (T1B) was not drilled and sampled. The offshore turbine boreholes were terminated between 110.1 m and 112.7m with an offset distance ranging from 0.57 to 4.36 m from the proposed locations. The water depth at the turbine sites ranged from 25.0 to 26.4 m (MLLW).

The initial site investigation plan for the nearshore HDD borings was to drill and sample 11 boreholes to 25 m below the seafloor at 100m spacing. Due to the uniformity of the nearshore subsurface conditions as shown on Figure 4b, only 6 borings were drilled and sampled at approximately 200 m spacing. This is still in compliance with the BOEM’s guidelines, which require a boring and/or in-situ testing every kilometer of the transmission cable route to shore. Three of the six boreholes were advanced deeper than 25 m in an attempt to tag specific geologic unit and provide a better correlation to the onshore boring. The nearshore HDD borings were terminated between 24.4 and 30.5 m, with an offset distance ranging from 0.23 to 1.24 m from the proposed locations. The water depth at the HDD locations varied from 3.8 to 8.5 m (MLLW).

Index and strength laboratory tests were conducted onboard the Inez during drilling operations. A total of 275 moisture content, 271 saturated unit weight, 55 torvane, 153 pocket penetrometer, 64 miniature vane, 44 undrained unconsolidated undisturbed and remolded triaxial tests were completed.

Dominion proposes to land the VOWTAP Export Cable via HDD within an existing parking lot located within the boundaries of the Camp Pendleton State Military Reservation (Camp Pendleton), in the City of Virginia Beach. Fugro conducted one deep boring at the proposed location of the onshore Export Cable HDD entry point. This borehole was terminated at about 35.2 m. Along the onshore cable route, Fugro drilled and sampled 2 shallow boreholes at the east and west sides of Lake Christine. Fugro also logged five test pits and collected representative soil samples along the proposed onshore cable route corridor. Three tests pits were located along Gate 10 access road and two where located along Rifle Range road. The borehole log and field data from the deep borehole is presented in this report as it relates to the design of the HDD cable. The shallow borehole, hand auger boring, and tests pit results are presented separately in our Onshore Geotechnical Field Data Report (Fugro, 2014a).

This Field Report (1) documents the methods, equipment, and procedures used for the field exploration, (2) includes maps showing areas of investigation and locations of explorations, (3) provides tabulations listing pertinent factual details for each exploration, and (4) presents factual data in the form of CPT soundings and borehole logs.

It has been a pleasure working with you through this phase of the project. We look forward to receiving your comments regarding this report, as well as the opportunity to provide continued support as the project progresses.

Sincerely,

FUGRO CONSULTANTS, INC.

Mohamed Mekkawy, Ph.D., P.E.
Senior Engineer

David Sackett, P.G.
Vice President

Issue	Description	Date	Preparer	QC
1	Draft Field Data Report	August 6, 2014	M. Mekkawy	D. Sackett
2	Field Data Report Rev02	September 17, 2014	M. Mekkawy	D. Sackett
3	Final Field Data Report	September 26, 2014	M. Mekkawy	D. Sackett

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1.0 INTRODUCTION

The Virginia Offshore Wind Technology Advancement Project (VOWTAP) provides a necessary step towards cost effective commercial scale offshore wind deployment. The objective of the project is to design, develop, and demonstrate a grid-connected 12 megawatt (MW) offshore wind facility off the coast of Virginia. Dominion has proposed deploying two Alstom HALIADE™ 150 gearless, 6 MW direct drive wind turbine generators (WTGs) combined with other significant innovations, such as integrated substructures, installation techniques, and advanced wind farm controls, to make this a world-class demonstration facility.

The WTGs will be installed within the proposed VOWTAP Research Lease Area located approximately 43 km (24 nm) off the coast of Virginia, in OCS Lease Block 6111, Aliquot H (Figure 1). Figure 2 shows the two primary WTG locations identified as sites T1A and T2A. The figure also shows two alternate borings locations that could have served as the WTG locations should the soil conditions at T1A and T2A be deemed as unfavorable. The selection of those four borehole locations is based on the data collected during the VOWTAP 2013 geophysical and shallow geotechnical surveys (Tetra Tech, 2013), which indicated favorable bathymetry and seabed conditions with predominant fine sand soil in the upper part of the seabed.

Only one of the two alternate locations (T2B) was drilled and sampled to evaluate the subsurface soils in case better soil properties were encountered that would provide be advantageous to the turbine foundation. The foundation soils at T2B, however, were similar in thickness and properties to those sampled at the first two turbine locations. No considerable benefit would be recognized by moving one of the turbines to this alternate location. Further, Fugro reviewed the 2013 geophysical data at the turbines area and concluded that the soil conditions are generally uniform across the four turbine locations. Accordingly, and based on the information obtained from the first three borings, the fourth borehole location was not drilled and sampled. The demonstration turbines will therefore be located at T1A and T2A.

Each WTG will be supported by an Inward Battered Guide Structure (IBGS) foundation. The IBGS foundation consists of one approximately 3.1 m diameter central caisson, the structural jacket, and three through-the-leg inward battered piles approximately 1.8 m in diameter. The caisson will be driven into the seafloor to its design penetration depth of approximately 30 m to 40 m. Design penetration depth for the three through-the-leg inward battered piles is estimated to be approximately 50 m to 75 m. Design penetration depths for both the caisson and inward battered piles are dependent upon the soil conditions encountered at the borehole locations. The VOWTAP will be comprised of the following offshore components:

- Two 6 MW Alstom HALIADE™ 150 WTGs;
- Two IBGS foundations;
- One, 1 km buried Inter-Array Cable;
- One, 45 km Export Cable buried beneath the seabed for protection; and,

- One 1-2 km long Horizontal Directional Drilled (HDD) cable route in the beach/nearshore area.

In support of planning and design of the demonstration turbines, Fugro conducted a geotechnical and geophysical field exploration program. The program comprised of marine drilling, in-situ testing offshore Virginia, and one onshore borehole at the proposed Export Cable HDD entry point within the within the boundaries of an existing parking lot at the Camp Pendleton State Military Reservation (Camp Pendleton), in Virginia Beach, Virginia. Marine drilling at the turbine sites and along the portion of the Export Cable to be installed using HDD was conducted by Fugro McClelland Marine Geosciences, Inc. (FMMG). FMMG's marine drilling spread was outfitted to the *Inez H. Eymard (Inez)* liftboat, owned and operated by Offshore Marine Contractors (OMC). Index and strength testing were conducted onboard the liftboat. The onboard laboratory test results are shown on our boring logs.

In support of these nearshore drilling activities Fugro also conducted a nearshore shallow hazards assessment. As documented in Fugro's Final 2014 Survey Protocol (Fugro, 2014b) the purpose of this nearshore geophysical survey was to measure water depths, map the seafloor, and identify potential obstructions and/or sensitivity (e.g., cultural, benthic, and/or unexploded ordinances [UXO]) that should be avoided during survey activities. Fugro has documented the findings of this shallow-hazard survey in a report to be provided under separate cover.

In-situ piezocone penetration test (PCPT) soundings were performed using the Fugro Alluvial Offshore Limited (FAOL) Seascout 10 (Seascout) seabed system. The seabed PCPT soundings were conducted from the Megan Miller vessel, owned and operated by Miller Marine. Thirty (30) locations along the offshore cable route were tested with a nominal spacing between testing locations of approximately 1 km. Two additional tests were conducted along the proposed inner-array cable route between turbine sites T1A and T2A.

All survey activities were conducted under an agency reviewed protocol that conforms to the Bureau of Ocean Energy Management (BOEM) Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information (GGARCH; November 9, 2012), as discussed in a Pre-Survey meeting with BOEM on May 19, 2014. Surveys were also conducted in compliance with the following permits and approvals:

- U.S. Army Corps of Engineers (USACE) PCN: Nationwide Permit 6, Survey Activities (Permit No. NAO-2013-0418);

- Commonwealth of Virginia Marine Resource Commission (VRMC) (Permit No. 13-0614); and

- National Oceanic and Atmospheric Administration (NOAA) - approved Marine Mammal and Sea Turtle Harassment Avoidance Plan (NOAA, 2014).

In accordance with the aforementioned protocols and approvals, the proposed testing sites were reviewed to ensure the proposed activities would not impact areas of benthic and/or cultural significance. As detailed in Appendices L and M, no sensitive benthic or cultural resources were affected by the survey activities. In addition, no incidental harassment of any species of marine mammals or sea turtles occurred during the survey period (Tetra Tech 2014).

2.0 SCOPE OF SERVICES

The scope of the geotechnical site investigation includes multiple activities comprised nearshore marine sample borings, offshore cone penetration tests (CPTs), and up to four WTG borings. Our initial scope of services included:

- Survey Area A (Turbine Sites): Up to four borings in the offshore turbine area. These borings include alternative soil sampling and in-situ testing to a nominal depth of 100 m below the seafloor (Figure 2)
- Survey Area B (Offshore Cable Route): Thirty (30) CPT soundings to 5 m depth along the offshore cable route from the turbine site to within about 1 km from landfall at Camp Pendleton (Figures 3a and 3b). Two PCPT soundings along the inner-array cable route between T1A and T2A (Figure 3c). The PCPTs were performed adjacent to the 2013 vibracore locations and at locations where surficial soil variability is anticipated. Areas of soil non-uniformity were selected after reviewing the 2013 Marine Site Characterization sub-bottom survey data.
- Survey Area C (HDD Cable Route): Up to 11 borings to 25 m depth in the nearshore approach section where the cable will be installed beneath the seafloor and beach using HDD technology. This route extends from the western extent of Survey Area B to landfall (Figure 4a). The scope of work at Survey Area C also included a marine survey to measure the water depths, map the seafloor, and identify potential obstructions located at the seafloor or shallowly buried along the proposed HDD alignment. The marine survey used a multibeam echosounder, side scan sonar, and a magnetometer to collect data. The details of the marine survey are discussed in Fugro's Geophysical Survey Report, HDD Cable Route (Fugro 2014b).
- HDD Onshore Entry Point: One borehole in the vicinity of the entry point of the HDD cable that was terminated at about 35 m deep (Figure 5).
- Laboratory testing conducted on board the Inez and at onshore-based laboratory testing facilities.

3.0 SURVEY AREA A: OFFSHORE TURBINE SITES

The geotechnical investigation initially involved the execution of geotechnical borings at up to four (4) proposed locations to evaluate sub-seabed conditions for pile capacity analysis. Due to similar soil conditions between the primary locations T1A and T2A and the alternate location T2B, the client representative and Fugro agreed not to drill the fourth borehole. The borings were located approximately 110 m deep. This depth is considerably deeper than the anticipated 75 m pile length and should provide sufficient geotechnical information below the anticipated pile tip depth for pile design. A summary of the borehole information is tabulated below and the borehole logs are presented in Appendix A. Photographs of recovered soil samples are shown in Appendix C, whereas the operation photographs are shown in Appendix D.

Location	Easting[a], m	Northing[a], m	Termination Depth Below Mudline (m)	Water Depth (m), MLLW			
				Echo Sounder	Clumped Line	Pipe Tally	2013 Multibeam
BH-T1A	456,197.47	4,083,478.64	110.1	23.9	24.9	25.1	24.2
BH-T2A	456,197.51	4,082,430.26	111.1	25.3	25.1	24.2	24.9
BH-T2B	456,481.76	4,082,431.01	112.7	24.7	26.4	26.4	26.0

[a] Northing and Easting coordinates are Universal Transverse Mercator, Zone 18 North, NAD83, meters

3.1 DRILLING PLATFORM

Fugro used the *Inez H. Eymard (Inez)* liftboat, which is a Class 175 based in the Gulf of Mexico (GOM). The Class 175 L/B has three, 53 m, 1.4 m-diameter legs. Each leg has a 7.9 m by 4.3 m pad to facilitate jacking up in soft soil conditions and minimize leg penetration. Once on location, the *Inez* was preloaded by filling the ballast tanks with water. This reduced settlement and the potential for punching while drilling. Preloading the vessel generally lasted between 8 and 12 hours depending on the location, water depth, air-gap between the sea and drilling platform, and anticipated drilling time at each location.

3.2 POSITIONING AND WATER DEPTH MEASUREMENTS

As the liftboat approached the final position and prior to lowering the legs, Fugro deployed a sector scan sonar system to survey the seafloor for potential hazards or debris that may affect leg stability or drilling. The real-time data was used to determine the approaches to the borehole location. Positioning of the liftboat was done using wide-area differential global positioning system (DGPS) with Fugro StarFix Satellite Positioning System corrections as the primary navigation system. The survey navigation system is capable of achieving a surface position of sub-meter accuracy. The primary navigation system uses survey-grade DGPS to correct raw satellite data. Differentially-corrected positions are passed to the onboard navigation computer running integrated navigational software. The DGPS corrections are supplied to the system using the Fugro STARFIX II. At each borehole location, a survey report documenting the borehole location and positions of the legs was created (Appendix F). A sector scan image was also developed.

Water depth at the boring locations was measured by using three methods: drill string length, the vessel echo sounder, and clumped line. The water depths were corrected for tide and compared to the 2013 multibeam data.

3.3 DRILLING SYSTEM

A Fugro Failing DMX 1500 drilling rig was used to advance the borings using a wet, rotary drilling method. The drilling equipment included the attendant mud pump and mud mixing systems for use offshore. Fugro used open-hole drilling advanced using 4.5-in-IF connection drill pipe and natural clay-based, drilling mud. Sampling was conducted using wire-line techniques.

3.4 SOIL SAMPLING METHODS AND INTERVAL

Drilling of boreholes consisted of soil sampling and downhole PCPTs. The calibration certificate for the downhole piezocones are shown in Appendix I. Further, P-S suspension was conducted after drilling and sampling was complete. P-S suspension logging is a wireline technique for determining the in-situ compressional (P) and shear (S) wave velocity profile of the subsurface. This velocity data profile is then used to determine dynamic soil properties.

In clayey soils, Fugro utilized a 5 m sampling cycle. This cycle comprised of 1x3 m PCPT followed by 2x1 m samples. The following clay samplers were available onboard:

- Hydraulic piston sampler (standard 76mm diameter);
- Latch-in, thin and thick walled push sampler (76mm diameter). Thin wall tubes were used whenever possible;

In sandy soils, Fugro utilized a 4 m sampling cycle. This cycle comprised 1x 3 m PCPT followed by 1 m sample.

A high capacity cone penetrometer with pore water pressure measurements was used. When CPT refusal occurred, we drilled 1 m and repeat the PCPT. This procedure was repeated three times until the full 3 m depth is covered.

Fugro primarily used the thin and thick-walled wireline 57 mm percussion sampler in sands. The sampler provides relatively undisturbed driven tube samples. These samples were collected by connecting 57 mm (2-1/4 inch) thin-walled tube to drill rods which were then lowered to the desired sample depth. A hammer was used to drive the rods into the soil. The number of hammer blows to advance the sampler to the full 0.75 m penetration or until refusal occurred was recorded. The sample quality was considered adequate for strength testing and onboard density measurements. For very dense cohesionless material, thick-walled tubes were used.

Following sampling and in situ testing, P-S suspension logging was used to measure the P- and S-wave velocities along the entire depth of the borehole. The data can be reduced to derive important engineering parameters such as Poisson’s ratio, Young’s modulus and Shear modulus. The data is shown in Appendix A.

The boring termination depths were determined based on axial pile capacity calculations performed by Fugro and the client representative using the API design procedure. This was to ensure that the borehole terminated at a sufficient depth and is at least 10 m below the anticipated pile tip elevation. Conservative scour depth and shear strength parameters were adopted for axial capacity calculations. Further, a 30 percent contingency (both for tension and compression loads) was added to the 1000-year period loads.

3.5 ONBOARD LABORATORY TESTING

Some soil samples were extruded after retrieval and classified and tested onboard the liftboat. Onboard testing comprised 275 moisture content, 271 saturated unit weight, 55 torvane, 153 pocket penetrometer, 64 miniature vane, 44 undrained unconsolidated undisturbed and remolded triaxial tests. A summary of the results is show in Appendix J. Samples that were not tested were saved in quarts and transported onshore for advanced laboratory testing. The laboratory tests assigned to soil samples retrieved from boreholes at the turbines area are shown in Appendix H.

3.6 OPERATIONS PERSONNEL

Operations were conducted 24 hours per day. Work was divided between a Day Shift (0:00 to 12:00) and Night Shift (1200 to 24:00).

Key personnel for operations included:

Fugro:

- Mohamed Mekkawy – Project Manager
- Bob Mosher – Project HSE
- Sam Pant – Lead Engineer (Day Shift)
- Manuel De Garcia Penaloza – Shift Engineer (Night Shift)
- Jeffery Guidry – Shift Surveyor
- James Walker – Lead Driller

Offshore Marine Contractors, Inc.

- Mark Segura – Vessel Captain

Kellogg, Brown, and Root:

- Ricardo Argiolas – Client Representatives

Other main personnel onboard included CPT operators, P-S suspension logger and three protected species observers.

3.7 BOREHOLE TERMINATION CRITERIA

The boreholes at each turbine location were terminated in accordance with Bureau of Ocean Energy and Management (BOEM) Guidelines for Providing Geological and Geophysical, Hazard, and Archaeological Information. Fugro performed pile capacity calculations using the American Petroleum Institute Recommended Practice 2GEO (2011) method to ensure that the boreholes were terminated at least 10 m below the anticipated pile tip elevations. Conservative preliminary geotechnical parameters from our offshore laboratory tests and downhole CPTs were the basis for the pile capacity calculations. The criteria used to terminate the borehole were:

- Use pile head loads based on the 1000-yr return period for robustness. The pile loads were equal to 30,5852 kN in compression, and 27,194.8 kN in tension;
- Conservatively increase the pile head loads by 30 percent to account for any uncertainty (i.e. compression = 39,756.6 kN and tension = 35,353.2 kN);
- Assume a pile diameter of 1.52 m (60-inches) and a wall thickness of 50 mm (2-inches);
- Drill an additional 10 m below the depth at which the 1.3 x pile head load is reached (the higher depth of the tension or compression capacity);
- Drill approximately 1 to 1.5 m below the termination depth established above to allow for suspension of the P-S logging tool (the source of S- and P-waves) below the termination point and measurement of the seismic wave velocities at the bottom of the borehole.
- Incorporate a conservative local scour in the pile capacity calculations. Scour was incorporated using one of the following conditions:
  - If surficial sand is underlain by a clay layer at a depth less than 4D, where D is the pile diameter, the surficial sand is assumed to entirely scour;
  - If the surficial sand is deeper than 4D, the scour depth is assumed to be equal to 4D;
  - If clay is encountered at the surface, no scour was considered; and
  - If silt was encountered, scour was evaluated based on the behavior of the silt layer (i.e. drained or undrained).

The preliminary pile capacity results and soil parameters are shown in Appendix E. The scour depth was assumed to be about 5.2 m at T1A, ignoring the cohesive sediments encountered at about 2 m. At T2A, the scour depth was assumed to extend to the top of the underlying clay layer at 4 m. Similarly, at T2B the scour depth was assumed to extend 3m to the top of the underlying clay. Overall, the compression capacity governed the borehole termination depths.

3.8 SUMMARY OF OFFSHORE SOIL CONDITIONS AT SURVEY AREA A

The soil conditions at the turbine sites are relatively similar both in terms of thickness and engineering properties. A summary of the soil conditions is provided below and shown on our borehole logs in Appendix A. The unit roman numerals correspond to those shown on our pile capacity plots. Preliminary undrained shear strength (S_u) is shown in our boring logs based on a cone area ratio (N_{kt}) range of 15 to 20. A site specific N_{kt} should be determined after the laboratory tests are complete to compute more representative S_u values.

- Unit I – Loose to medium dense sand. This layer is nominally 3 to 5 m thick and interbedded with shell fragments and clay lenses.

- Unit II – Firm to very stiff sandy clay. This layer is about 4 to 8 m thick with interbedded sand seams and shell fragments. At T1A and T2B, the S_u increased with depth from about 20 to 80 kPa. At T2A, the S_u showed more scatter due to the interbedded silts and sands evidenced in the classification of the CPT data with friction ratio (F_r) values alternating above and below 1. This layer, however, will have a predominantly undrained response.
- Unit III – Firm to very stiff sandy clay. Unit III was separated from the overlying clay unit because of an observed increase in moisture content accompanied by a reduction in submerged unit weight. Therefore it was idealized separately in our pile capacity calculations. This layer is about 13 m thick with interbedded sand lensed and gas blisters. The CPT data show a linearly increasing strength with depth from about 60 to140 kPa. On average, the normalized pore pressure parameter, B_q, is about 0.6, indicative of intact soft to firm clay. The scatter in the B_q values towards the bottom of the layer demonstrates the presence of silt and sand lenses.
- Unit IV – Medium dense to dense silty fine sand. This unit is approximately 22 to 31 m thick, and has an average unit weight between 9 and 10 kN/m^3 based on preliminary offshore tests. The soil unit is interbedded with silty clay layers, many shells, shall fragments, coarse sands and gravels. The excess pore pressure and B_q confirm the field classification. However, negative excess pore pressure and B_q values were measured. This can be explained as dilative behavior commonly associated with sand consistencies of dense to very dense or dense fine sands with high fines content. This behavior, which is important in controlling the static and dynamic response, will be evaluated and confirmed using advanced laboratory testing and further evaluation of the CPT data.
- Unit V – Very stiff to hard clay. This layer is approximately 13 to 25 m thick, with an average unit weight between 8 and 9 kN/m^3. This layer is thinnest at T1A and increases in thickness at the southern turbine. Similar to overlying layers, this layer is heterogeneous with interbedded silts, sand pockets and shells. This heterogeneity is represented by the discrepancy between the results of the CPT-derived S_u and the Undrained Unconsolidated Triaxial (UUTX) S_u. Unlike the CPT, the UU test results can be influenced by the presence of sand pockets and silt layers. In such cases, excess pore pressure may not be equal to the deviator stress decreasing the S_u. Advanced triaxial testing should be used to estimate, which is more representative of the in-situ strength.
- Unit VI – Medium dense to dense silty fine sand. This layer is 9 to 16 m thick across the turbine sites. The layer is thickest at T1A and decreases in thickness at the south turbines. Unit VI has an average unit weight of about 10 to 11 kN/m^3 with moisture contents ranging from 20 to 23 percent. Similar to Unit IV, negative excess pore pressures were measured and corresponding negative B_q values were computed. This sand layer is similarly demonstrating dilative behavior. Further understanding and characterization of this soil response is important through additional evaluation of CPT-derived properties and monotonic and dynamic laboratory testing.

- Unit VII – Very stiff to hard fat clay. This layer extended from approximately 80 m below the seafloor to the borehole termination depth. The moisture content increases with depth from about 20 to 30 percent. The submerged unit weight decreases with depth from about 10 to 8 kN/m^3. The layer is interbedded with sand partings and pockets, shell fragments, and gas blisters. A discrepancy between the CPT-derived and the UUTX-derived S_u was therefore noted similar to Unit V. Advanced triaxial testing should be used to estimate a more representative in-situ strength and calculate a layer-specific N_{kt}. Preliminary pile capacity calculations should be reviewed and/or updated if warranted.

Generally, the layers enclosing the upper 20 m will provide most of the resistance to the pile lateral loads. Therefore, the static and dynamic properties are essential. Fugro is conducting advanced laboratory tests to measure these properties. Preliminary analyses conducted during the site investigation or shortly afterwards will be updated or reviewed when the laboratory tests are done. Final analyses pertinent to the engineering design will be provided in support of the FCR/FIR in Q1 2016

The P-S suspension logging was conducted in the open-borehole after completion of drilling and sampling. The logging probe, measuring 8.25 m in length, is lowered into the drill pipe, and its depth measured with an electronic encoder. Once lowered to the base of the boring, the seismic source is actuated. During each actuation, three individual actuations 'shots' are made, which are recorded by both the near and far hydrophones. During the first and second of these 'shots', the source actuates in two opposing directions, allowing measurements of the shear waves to be made with the primary particle motion in two opposing polarizations. During the third shot, the transit times of the compressional waves are measured. By analyzing the difference in arrival times between the near and far hydrophones, the interval velocity can be calculated for a 1 m section of soil column. The logging probe is then raised, and held at the next test elevation for the next source actuation. This sequence is repeated until the probe exits the boring. The shear and compression wave velocity profiles at each turbine location are shown in Appendix A. Preliminary soil properties and engineering parameters such as Poisson's ratio, small strain shear modulus, Young's modulus and bulk modulus were derived from this data. This data will be updated once the soil unit weight tests are done and any final revisions to the boring logs are made. The shear and compression wave velocities were fairly uniform for each layer. On average, the shear and compression wave velocities ranged from 300 to 400 m/s and 1500 to 1800 m/s, respectively. Between 35 and 47 m below the seafloor (Unit IV), the seismic wave velocities increased due to the presence of coarse sands and gravels. The engineering properties of this layer should be determined and evaluated with respect to pile drivability.

Because of the uniform soil conditions, the preliminary pile capacities and estimated pile tip elevations were similar at all three evaluated turbine sites (T1A, T2A, and T1B). It was judged that the subsurface conditions at the fourth turbine location, T1B, will not significantly improve compared to the three drilled and sampled location to positively influence the foundation design. Accordingly, the project team agreed not to drill and sample location T1B. The two demonstration turbines will therefore be located at T1A and T2A.

3.9 PRELIMINARY ENGINEERING DESIGN

Preliminary engineering analyses were performed based on the field results of borehole T1A. The findings of the analyses are presented in Appendix F and discussed herein. The engineering analyses included preliminary axial and lateral load-transfer data for 1524, 1829, 2743, and 3048 mm-diameter driven pipe piles. Load-transfer data was computed using the API RP 2GEO (2011) design method. Further, ultimate pile capacity curves were developed for 1524 and 1829 mm-diameter pipe piles driven on 1-on-3.5 and 1-on-3 batters using API RP 2GEO (2011) and the same preliminary soil and properties estimated during offshore drilling. The four pile capacity CPT-based methods for granular soils were also used to develop ultimate pile capacity curves for 1524, 1829, 2743, and 3048 mm diameter pipe piles.

The CPT-based pile capacity methods demonstrated lower ultimate pile capacity values compared to the API method. The Fugro and NGI design methods demonstrated similar ultimate pile capacity results to API in granular layers; however, in clayey soils the magnitude was lower resulting in an overall lower pile capacity profile. The simplified ICP and offshore UWA methods provided were considerable lower values. As a result, the pile length will increase should the results of the offshore CPT-based methods be adopted. It is generally accepted that these methods cover a wider range of cohesionless soils, are better correlated to pile load tests, and therefore remove potential unconservatism and are fundamentally more reliable in predicting pile capacity (API, 2011). Further, the API procedure is known to over-predict the ultimate pile capacity as the pile tip depth increase and under-predict the capacity as the soil density (represented as the cone tip resistance) along the pile shaft increase (Schneider et al., 2008). The discrepancy between the API and CPT-based methods appear to decrease with increasing pile diameter. This may be attributed to not reaching the limiting end bearing values for API at larger pile diameters, which diminishes the difference between pile capacity estimates for larger pile diameters. We recommend revising the ultimate bearing capacity and load transfer data once the laboratory tests are complete. This is of particular importance to the API, ICP and NGI methods.

The soil conditions at T2A are similar to T1A. We expect that pile capacity plots and load-transfer data to be similar at the second turbine location. In the final engineering report, separate pile ultimate capacity plots and load-transfer data will be generated at each turbine.

3.9.1 Pile Installation Considerations

Pile driving difficulties are not anticipated at this location. Pile drivability will be evaluated using the wave equation method of analysis to investigate the hammer-pile combination best suited to achieve full penetration. Pile monitoring can be used to help install piles where a drivability study indicates hard driving or possible pile refusal.

During driving, it will be necessary to interrupt driving operations in order to make pile add-ons or hammer changes. Such interruptions to driving operations usually last 6 to 8 hours. Delays on the order of several days may result from bad weather or equipment breakdown. During this time, many clays will gain strength as excess pore pressure dissipates and the soil particles reorient themselves. This phenomenon is commonly referred to as set-up. A similar phenomenon may also occur in fine-grained granular deposits. After set-up has occurred, increased blow counts may be experienced while attempting to restart driving the piles. The soil resistance to driving may increase to the point of refusal. Therefore, the driving program should be scheduled so as to reduce the number and duration of delays.

3.9.2 Pile Group Effects

API RP 2A recommends that a pile spacing of less than eight pile diameters be evaluated for group effects. Group effects will be evaluated when the pile spacing and structural plans are determined.

3.9.3 Soil Liquefaction Susceptibility

Soil liquefaction is a phenomenon in which saturated loose cohesionless soils are subjects to a temporary, but essentially total loss of strength induced by severe earthquakes. Significant factors known to affect the liquefaction potential of these soils are: the characteristics of the material, such as grain size distribution and relative density, the initial stresses acting on the soils; and the characteristics of the earthquake, such as the intensity and duration of the ground shaking.

Liquefaction susceptibility is evaluated by calculating a factor of safety against liquefaction. The factor of safety against liquefaction is calculated based on the Idriss and Boulanger (2008) procedure. The factor of safety is determined from the ratio of soil resistance to liquefaction (Cyclic Resistance Ratio CRR) to the Cyclic Stress Ratio (CSR) generated by an earthquake. CSR is a function of maximum shear stress and effective vertical overburden stress. It can also be expressed in terms of PGA, acceleration due to gravity, total stress, effective stress, and a stress reduction coefficient. The CRR is a function of the normalized corrected CPT tip resistance and fines content. Volumetric strain and settlement can be calculated in accordance with Tokimatsu and Seed (1987).

Liquefaction is not expected to be a source of concern at this project site. Nonetheless, liquefaction analysis will be performed as part of the engineering evaluations for the foundation structure. Fugro will analyze liquefaction potential for three design earthquakes with 10, 5, and 2 percent probability of exceedance in 50 years (approximately 500-year, 1000-year, and 2500-year return periods). The factor of safety and volumetric strain will be computed.

Liquefaction can also occur due to increase in excess pore pressures during cyclic loading in low to medium dense and silty sands (e.g. Units IV and VI). Fugro is currently conducting cyclic direct simple shear tests at a loading frequency of 0.25 Hz that represents the combined spectrum of wind and wave loading and the turbine natural frequency. If liquefaction is observed, the lateral and axial load-transfer data must be revised to account for this soil response.

3.9.4 Mud Mat Bearing Capacity

While the twisted jacket platform is temporarily resting on the seafloor prior to pile installation, seafloor support is provided by the soil bearing capacity on the jacket legs mud mats and skin friction and end bearing on the jacket leg extensions.

Due to the presence of the top 3 to 5 m of granular soils, the ultimate bearing capacity should be evaluated based on the drained bearing capacity procedures recommended by Terzhagi (1943) and later evaluated by Terzaghi and Peck (1967). The ultimate bearing capacity will most likely be limited by the strength of the underling clay in Unit II. When the final configuration and loading of the mud mats are determined, bearing capacity should be evaluated.

Only the spudcan tips generally penetrate through sandy soils leaving spudcan depressions. Degraded or uneven bearing capacity of mud mats located near such depressions may be encountered. This degradation is a function of spudcan penetration, configuration, soil properties, distance between spudcan depressions and depth of scour. When the final configuration and loading of the mud mats are determined, and the locations of spudcan depressions are estimated, the potential for uneven bearing capacity and its implications should be evaluated.

3.10 SEABED SCOUR

Scour occurs when the seafloor shear stress exceeds the threshold shear resistance of the seafloor sediments. The installation of different components of the jacket structure interacting with the seafloor introduces obstructions that create localized areas of increased bottom currents. This increases the scour susceptibility of seafloor sediments. The amount of scour in an offshore environment commonly been observed to vary depending on the interrelationship among: 1) hydrodynamic flow regime, 2) seafloor sediment type and conditions, 3) seafloor bed features (e.g. sand waves), and 4) seafloor disturbance caused by either: a) cable installation, b) substructure and foundation installation, and/or c) disturbance due to construction vessel anchors and barge legs. The lateral extent and depth of seafloor scour will depend on the magnitude of the bottom velocity for the different flow regimes.

Whenever the near-surface soils are comprised of granular soils, such as at T1A and T2A, they may be susceptible to scour. Scour effects are considered insignificant to axial capacity but can have a large influence on lateral capacity. When scour is considered likely, the p-y data are reduced to reflect the potential loss of lateral support from the material scoured away near the seafloor around the pile. General scour indicates that installation of the structure may cause a layer of material to be removed throughout the area of the platform. Local scour indicates that scour is likely to occur only in the near vicinity of the piles.

Because scour is the result of the interrelationship between hydraulic flow and seafloor conditions and materials, a variety of data are required to predict scour. The information and data that are required to estimate the magnitude of scour includes:

- Wind, wave characteristics, current velocity, and tidal data (including direction) for developing bottom flow conditions,
- Water depth and water density,
- Seafloor morphology,
- Seafloor slope and topography,
- Seafloor sediment characteristics such as the mean grain size, and
- Pile shape and size.

Typical analyses used to estimate the scour dimensions around circular piles are based on published empirical correlations and physical results to predict scour depth, lateral extent of scour, and the rate of scour development in cohesionless soils. Scour depth and scour rate predictions can be predicted based on equations provided by Sumer and Fredsøe (2002) as well as European Codes such as DNV (2007). The method proposed by Nielsen and Hansen (2007), which correlates the shape and extent of the scour depression around the pile to the internal friction angle of the cohesionless seabed material can be used to predict the lateral extent of scour.

4.0 SURVEY AREA B: OFFSHORE CABLE ROUTE

Survey Area B extends from the WTG area to within 1 km of the landfall site. The mean lower low water (MLLW) depth ranged from 8.9 to 25.9 m. The scope of services consisted of performing 32 shallow PCPTs to a depth of 5m below the seafloor (Figure 3). Thirty PCPTs were conducted along the offshore cable route at a nominal spacing of 1 km. Two additional tests were conducted along the proposed inner-array cable route between WTGs T1A and T2A. Penetration depths varied between 5.8 and 1.2 m depending on the density or stiffness of the subsurface layers. Refusal due to an underlying dense/stiff layer occurred when the Seascout thrust exceeded 10 kN equating to 10 MPa. When shallow refusal was encountered due to, what was interpreted from the tip resistance signature, as shallow subsurface or surface obstructions, the Seascout was offset and redeployed in an attempt to achieve deeper penetrations. A total of 7 retests were performed.

4.1 IN SITU TESTING VESSEL AND SEABED SYSTEM

Fugro used the utility boat, *Megan Miller* from Miller Marine Services. The Megan Miller is 30 m long with a 7.3 m beam and 2.7 m draft vessel. The vessel is equipped with an A-frame that was used to deploy and retrieve the Seascout system. The vessel used a four-point anchor system outfitted with Fugro's navigation and positioning equipment for accurate positioning. The anchors were deployed in areas cleared of any hazards or possible archeological artifacts as identified in the 2013 survey report (Tetra Tech, 2013).

Fugro used the FAOL Seascout 10 seabed PCPT system. The Seascout 10 is a light-weight system used for rapid and accurate determination of subsurface conditions up to a maximum penetration depth of 8 m. Push rod handling is by a mechanical coiling/straightening device. This permitted very low apparatus height while maintaining continuous rather than stroke based penetration. The Seascout 10 was equipped with 5 cm^2 piezo-cones and was used to measure tip resistance, sleeve friction, and pore water pressure. The calibration certificate for the piezocones are shown in Appendix I.

4.2 ANCHORING AND POSITIONING

Anchors were set and retrieved by the vessel's individual 18,000 lb. line pull hydraulic winches. The winches were mounted on each quarter, and had approximately 460 m of wire rope allowing the vessel to move laterally, forward and or aft, within the anchor set, to retrieve and set its own anchors. The scope was generally 5:1. A marker buoy was attached and a 360 degree white light marked the "down position" of the anchor used at night when the operation was on standby.

The vessel positioning comprised a wide-area DGPS with Fugro StarFix Satellite Positioning System corrections is the primary navigation system. USCG DGPS corrections was be available as a backup secondary positioning system. The survey navigation system is capable of achieving a surface position accuracy of better than 1 m. The primary navigation system used survey-grade DGPS to correct raw satellite data. Differentially-corrected positions are passed to the onboard navigation computer running integrated navigational software. The DGPS corrections are supplied to the system using the Fugro STARFIX II. The navigation screen made available to the surveyor and vessel captain is shown on Figure D-4. A survey report was generated at each location documenting the test location and the deployment and retrieval position of each anchor (Appendix F).

4.3 OPERATIONS PERSONNEL

Operations were conducted 12 hours per day (day shift)

Key personnel for operations included:

Fugro:

- Mohamed Mekkawy – Project Manager
- Bob Mosher – Project HSE
- Will Cupples – Shift Engineer
- Brendyn Meisinger – Shift Surveyor
- Ben Miller – CPT Operator

Miller Marine

- Brad Primer – Vessel Captain (Day)
- Brian Cormier – Vessel Captain (Night)

Other main personnel onboard included three protected species observers.

4.4 SUMMARY OF PCPT SOUNDINGS

The PCPTs were conducted at the 2013 vibracore locations, in-fill locations identified by Fugro, and along the WTG inner-array cable route. A summary of the actual PCPT locations, termination depth and targeted geologic feature are tabulated below. The CPT soundings are shown in Appendix B, and the operation photos are shown in Appendix D.

Location	Easting[a], m	Northing[a], m	MLLW Water Depth (m)	Completion Depth (m)	Geologic Feature
C-1	416,220.83	4,075,014.26	8.1	4.870	2013 vibracore location
C-2	417,610.79	4,075,149.99	9.1	4.468	In-fill
C-2A	417,610.76	4,075,150.14	9.1	2.909	Re-test
C-3	420,162.14	4,075,204.03	9.7	4.756	2013 vibracore location
C-4	421,143.63	4,075,165.54	12.6	2.359	2013 vibracore location
C-4A	421,147.43	4,075,166.01	12.6	3.532	Re-test
C-5	421,869.27	4,075,181.92	14.1	3.245	2013 vibracore location
C-6	422,904.29	4,075,083.28	15.1	3.370	2013 vibracore location
C-6A	422,906.91	4,075,084.12	15.1	2.700	Re-test
C-7	424,024.66	4,074,822.35	15.8	5.093	2013 vibracore location
C-8	424,617.43	4,074,695.91	15.1	5.730	Possible channeling
C-9	425,611.55	4,074,471.06	15.8	4.201	Possible channeling
C-9A	425,611.39	4,074,471.01	15.8	4.157	Re-test
C-10	426,994.79	4,074,142.03	15.9	4.262	2013 vibracore location
C-11	428,078.85	4,074,006.65	16.2	3.606	Possible material change
C-12	429,946.33	4,073,887.75	18.9	2.290	2013 vibracore location
C-12A	429,949.23	4,073,886.80	18.9	2.514	Re-test
C-13	431,259.01	4,073,820.86	18.6	2.279	Possible channeling
C-13A	431,261.07	4,073,819.81	18.6	1.209	Re-test
C-14	433,327.11	4,073,723.77	19.6	1.605	2013 vibracore location
C-15	435,902.15	4,074,285.61	17.9	4.758	2013 vibracore location
C-16	436,903.23	4,074,512.20	18.2	2.163	Possible interlayering
C-17	438,828.11	4,074,927.20	19.3	5.733	2013 vibracore location
C-18	439,806.76	4,075,130.02	20.2	5.480	Possible channeling
C-19	440,958.33	4,075,374.19	19.8	5.765	Possible channeling
C-20	441,861.25	4,075,571.34	17.4	1.717	2013 vibracore location
C-20A	441,860.91	4,075,568.38	17.4	1.545	Retest
C-21	443,527.96	4,075,920.71	23.8	2.150	Swale; possible transgressive Pleistocene deposits
C-22	444,778.06	4,076,208.75	17.8	1.775	2013 vibracore location
C-23	446,159.47	4,077,008.72	18.3	1.592	Shoal massif
C-24	447,331.11	4,077,705.68	18.3	2.083	2013 vibracore location
C-25	449,119.10	4,078,786.63	18.5	1.160	Shoal massif
C-26	449,920.74	4,079,248.83	18.0	1.152	2013 vibracore location

Location	Easting[a], m	Northing[a], m	MLLW Water Depth (m)	Completion Depth (m)	Geologic Feature
C-27	451,811.48	4,080,380.80	25.5	2.028	Swale; possible transgressive Pleistocene
C-28	452,539.33	4,080,797.09	24.5	1.906	2013 vibracore location
C-29	454,051.59	4,081,717.76	24.8	3.340	Possible transgressive deposits
C-30	455,042.85	4,082,298.52	25.5	5.465	2013 vibracore location
C-31	456,196.97	4,082,766.51	24.6	3.025	Inter-array cable
C-32	456,196.97	4,083,204.05	24.5	2.222	Inter-array cable

[a] Northing and Easting coordinates are Universal Transverse Mercator, Zone 18 North, NAD83, meters

4.5 INTEGRATION OF GEOPHYSICAL AND GEOTECHNICAL DATA

The PCPTs were conducted at the 2013 vibracore locations for verification of the geotechnical data measured from the vibracore samples. Since vibracore samples are disturbed, strength test results are qualitative and generally used for classification purposes as oppose to design. Conducting PCPTs provide an opportunity to better estimate strength and relative density of surficial soils. Preliminary evaluations indicate that the vibracore and CPT data are in reasonable agreement. Some layers may have been logged in the field as clay, but were classified as predominantly silt using the CPT classification method Robertson 1990. The difference in classification is not expected to affect the overall undrained soil response nor the idealized engineering properties of these layers.

In addition to the vibracore locations, Fugro conducted PCPTs at in-fill locations after reviewing the sub-bottom chirp data and seafloor bathymetry in the Site Characterization Survey Report (Tetra Tech, 2013). The in-fill locations targeted specific geologic features, which are of importance to the cable route design, burial depth and construction. Some of these geologic features include channeling, interlayered soils, shoal massif and transgressive deposits. Other in-fill locations targeted areas where initial interpretation of the sub-bottom chirp data showed shallow penetrations on the order of 2 m. For example, between vibracores VC001 and VC002B, a reflector at about 3 m below the seafloor was traced indicating material change. Material above and below this reflector was targeted using CPT C-2. The change in soil type from sand to silt occurred at about 3.6 m, which matched the sub-bottom interpretation.

Fugro is currently integrating the CPT, vibracore logs, grab samples data and sub-bottom geophysical data to fully integrate the geotechnical and geophysical information as part of a more in-depth site characterization and cable burial risk assessment studies. Preliminary results of this integration are shown in Chart 1. By further filtering the data, Fugro was able to map deeper reflectors along the cable route where the cone penetrometer did not penetrate. The data is used to divide the cable route into regions of similar soil characteristics for idealization and development of engineering properties.

4.6 SUMMARY OF SOIL CONDITIONS ALONG THE CABLE ROUTE

Preliminary site characterization results indicate that there are generally four geologic units. These units are the coarse-grained top marine sands, the fine-grained transgressive deposits, predominantly coarse-grained Pleistocene sands, and pre-Pleistocene material that is interbedded material. The cone penetrometer generally penetrated through the marine sands and transgressive deposits. At the first 11 km from shore (C-1 to C-8), the marine sands are about 1 to 4 m thick with tip resistance ranging from 3 to 8 MPa. , The marine sands are underlain by transgressive deposits where the tip resistance decreases to 0.2 to 0.5 MPa. High excess pore pressures are noted in this geologic unit. The cone penetrometer did not penetrate the full depth of this unit to accurately define its thickness. However, the sub-bottom data indicate that thickness of lower upper transgressive units may be on the order of 6 to 9 m. From about 11 to 14 km (C-9 to C-10), a channelized zone is noted where the upper marine sands are eroded. The alternating fine and coarse-grained transgressive deposits in this region are on the order of 5 to 6m thick with tip resistance between 0.5 and 6 MPa. From about 14 to 28 km from the shoreline, the depositional sequence is similar to the firs 9km where marine sands overlie layers of fine-grained and coarse-grained transgressive deposits. Along this region channeling zones near C-13 and C-19 are observed where the marine sands are eroded. From C-11 to C-18, the thickness of the marine sands is about 1 to 3 m. The underlying fine-grained deposits can be up to 5m thick according to the seismic data. The CPTs did not penetrate into the underlying Pleistocene sands. However, the properties of the Pleistocene sand unit can generally be determined from the nearshore borings.

The shoal feature extending from about C-20 to C-27 defines the limits of the next zone along the cable route. The CPTs conducted in this zone have high tip resistances exceeding 14 MPa. CPT refusal typically occurred between 1.5 to 2 m. The seismic data indicate that this very dense unit may be on the order of 3 to 4 m thick with an underlying fine-grained unit that is predominantly silt. Channeling was observed at C-28 where the top 2 m were clay in-filled. Underlying the clay is coarse-grained transgressive unit with maximum tip resistance of 4 MPa. The CPT did not penetrate through this layer, but reviewing the seismic data indicate that the thickness of this unit may be about 3 m with an underlying fine-grained unit that is possibly silt. Marine sands are encountered again at C-29 with a maximum tip resistance of about 5 MPa. The marine sands transition into coarse-grained transgressive sands at approximately 2 m below the seafloor. The last CPT conducted along the offshore cable route shows a clay in-filled channel under the marine sands. Alternating sand and silt transgressive units underlie this channel. Along the inter-array cable route, dense sands were encountered at the top 2 to 3 m, which is in agreement with the vibracore logs.

Fugro’s integrated geotechnical and geophysical data for the cable route will include computation of relevant soil parameters and idealized soil profile to aid the cable route design and burial depth. Parameters such as relative density, friction angle, undrained shear strength and soil unit weights will be recommended.

5.0 SURVEY AREA C: HDD CABLE ROUTE

The initial investigation scope of services consist of drilling 11, 100 m spaced borings along the nearshore cable route. Initially, the odd-numbered borings (every-other boring) were drilled. Based a review of the preliminary boring data, the project team (Dominion, KBR, and Fugro) judged that the provided a good representation of the subsurface conditions and subsequently the scope of services was reduced to drilling and sampling 6 boreholes (Figure 4).

The borings were terminated between 24.5 and 30.4 m below the seafloor (Appendix A). The water depth ranged from 3.7 to 7.9 m. The soil samples are show in Appendix C, whereas the operation photos are shown in Appendix D.

Location	Easting[a], m	Northing[a], m	Termination Depth Below Mudline (m)	Water Depth (m), MLLW[b]
BH-NB1	414,026	4,074,817	24.7	3.7
BH-NB3	414,230	4,074,909	30.4	6.1
BH-NB5	414,403	4,074,939	30.3	7.6
BH-NB7	414,554	4,074,965	30.5	7.4
BH-NB9	414,691	4,074,991	25.1	7.8
BH-NB11	414,827	4,075,015	24.5	7.9

[a] Northing and Easting coordinates are Universal Transverse Mercator, Zone 18 North, NAD83, meters

[b]Water depth based on 2014 Fugro multibeam survey.

5.1 DRILLING PLATFORM

Fugro used the same liftboat used to drill and sample the HDD borings. The Class 175 liftobat, *Inez,* has a draft of about 3 m, which enabled it to access the HDD borehole locations. Preloading generally lasted between 2 to 4 hours.

5.2 POSITIONING AND WATER DEPTH MEASUREMENTS

Fugro deployed the sector scan sonar system to survey the seafloor for potential for hazards or debris. The results were used to determine the best approach and orientation to get to the final position. A wide-area differential global positioning system (DGPS) with Fugro StarFix Satellite Positioning System corrections was used as the primary navigation system.

Water depth at the boring locations was measured by using three methods at the time of drilling: drill string length, the vessel echo sounder, and clumped line. The water depths were corrected for tide and compared to Fugro's multibeam data. The multibeam data was the primary source for determining the seafloor elevation at each location.

5.3 DRILLING SYSTEM

A Fugro Failing DMX 1500 drilling rig was used to advance the borings using a wet, rotary drilling method. The drilling equipment included the attendant mud pump and mud mixing systems for use offshore. Fugro used open-hole drilling advanced using 4.5-in-IF drill pipe and natural clay-based, drilling mud. Sampling was conducted using wire-line techniques.

5.4 SOIL SAMPLING METHODS AND INTERVAL

The HDD boreholes were drilled and sampled using latch-in thin and thick walled push sampler and thin and thick walled 57 mm percussion sampler for clayey and sandy soils, respectively. The percussion sampler provides significant advantages over SPT sampling because it retrieves relatively undisturbed soil samples that are adequate for strength and density measurements. Further, the blow counts can be correlated to the SPT blow counts when warranted. The sampling interval was about 1.5 m. The boreholes were grouted upon completion.

5.5 ONBOARD LABORATORY TESTING

Selected soil samples were extruded after retrieval and classified and tested onboard the liftboat. Onboard laboratory testing included moisture content, unit weight, and strength tests. Samples that were not tested were saved in sample containers, quarts, and transported onshore for advanced laboratory testing.

5.6 OPERATIONS PERSONNEL

Operations were conducted 24 hours per day. Work was divided between a Day Shift (0:00 to 12:00) and Night Shift (1200 to 24:00).

Key personnel for operations included:

Fugro:

- Mohamed Mekkawy – Project Manager
- Bob Mosher – Project HSE
- Sam Pant – Lead Engineer (Day Shift)
- Manuel De Garcia Penaloza – Shift Engineer (Night Shift)
- Jeffery Guidry – Shift Surveyor
- James Walker – Lead Driller

Offshore Marine Contractors, Inc.

- Mark Segura – Vessel Captain

Kellogg, Brown, and Root:

- Ricardo Argiolas – Client Representatives

Other main personnel onboard included CPT operators, P-S suspension logger and three protected species observers.

5.7 SUMMARY OF NEARSHORE SOIL CONDITIONS

The soil conditions encountered at the nearshore HDD site are presented in our boring logs in Appendix A. A cross section of the nearshore subsurface is shown on Figure 4b summarizing the moisture contents, submerged unit weight, S_u and blow counts from our wireline marine hammer. The blow counts are not equivalent to the Standard Penetration Test (SPT) blow counts commonly used onshore; however, the wireline blowcounts can be converted to equivalent SPT N-values using empirical correlations. The soil conditions at the nearshore site generally comprise alternating silty sand and clayey sand layers at the top 13 to 20 m. The sand layers are interbedded with clay seams and shell fragments. Onshore laboratory is in progress and will be used to better characterize the properties of these sand layers in terms of percent fines, plasticity, and permeability. The laboratory tests assigned for the nearshore area are shown in Appendix G. A sandy lean to fat clay layer underlies the sand layer. This layer is generally 2 to 4 m thick with an average submerged unit weight of approximately 7 kN/m^3 and an S_u of about 100 kPa. The plasticity of this layer decreases towards the east end of the HDD area. At NB-9 and NB-11, the clay layer transitions into a clayey sand. Because marginal soils can sometimes be difficult to classify offshore, onshore laboratory testing will better characterize this transition. Poorly graded fine to medium coarse sand with gravels and many shell fragments underlies the clay layer. The average moisture content and submerged unit weight for this layer is about 20-30 percent and 10-11 kN/m^3, respectively. Except for NB-1, the nearshore boreholes were terminated in this geologic unit.

The initial site investigation program included drilling 11 nearshore borings at 100 m spacing to a depth of about 25 m. Due to the uniformity of the nearshore subsurface conditions, only 6 borings were drilled and sampled at approximately 200 m spacing. This is still in compliance with the BOEM's guidelines, which require a boring and/or in-situ testing every kilometer of the transmission cable route to shore.

6.0 ONSHORE CABLE ROUTE

The scope of services for the onshore portion of the cable route consisted of drilling one borehole at the entry point of the HDD cable by the sand dunes. This borehole was terminated at about 35 m. A summary of the onshore boring information is tabulated below. The boring log is shown in Appendix A.

Location	Easting[a], m	Northing[a], m	Termination Depth below Ground Surface (m)	Groundwater Depth Measure During Drilling (m)
B-1	413,723	4,074,824	35.2	1.4

[a] Northing and Easting coordinates are Universal Transverse Mercator, Zone 18 North, NAD83, meters

6.1 DRILLING SYSTEM AND SAMPLING METHODS

A CME-55 drilling rig operated by Fishburne was used to advance the boring using a wet, rotary drilling method. Sampling was conducted using rod-based techniques, which are standard for onshore drilling. Fugro used SPT and push tubes to test and sample sandy and clayey soils, respectively. The boreholes were grouted upon completion and soil cuttings were drummed and removed offsite.

6.2 OPERATIONS PERSONNEL

Key personnel for operations included:

Fugro

- Mohamed Mekkawy – Project Manager
- Bob Mosher – Project HSE

- Bill Mack – Senior Engineer (supervising drilling operations)

Fishburne Drilling, Inc.

- Mike Young – Project Manager
- Timothy Donahue – Lead Driller

Kellogg, Brown, and Root

- David Chisnall – Client Representatives

6.3 SUMMARY OF ONSHORE SITE CONDITIONS

The subsurface soil layers encountered onshore at boring B-1 was in good agreement with the nearshore soil information (Figure 4b). The clay layer through which the HDD will most likely drill through in the nearshore environment was encountered at approximately elevation -22 m. Above that layer, alternating layers of sand and clay was observed. The SPT N-values measured at about 1.5 m intervals are shown on the boring logs. Low blow counts indicating soft soil conditions were noted at the various clay layers. The results of the onshore laboratory testing, currently in progress, will be used to refine the classification of the different subsurface layers and better characterize their behavior.

7.0 HEALTH, SAFETY, AND ENVIRONMENTAL MANAGEMENT

A Health, Safety and Environmental (HSE) Plan was established for the geotechnical site investigation. The purpose of the plan was to:

- Provide assurance of the effective working of the interface between the HSE Management Systems of Fugro Atlantic and its Subcontractors at the project specific level and to document this interface.
- Demonstrate that all parties have the necessary procedures and controls in place to achieve the work program without compromising HSE performance.
- Document any project specific hazards that are not covered in the Crew HSE Plan.
- Document the Project Emergency and Contingency Plans.

Health, Safety, and Environmental oversight during CPT testing and Marine drilling operations was successfully managed by Fugro's shift engineers. Daily Progress Reports (DPRs) were recorded during each shift. Toolbox safety meetings were conducted aboard each vessel at the start of each shift. Copies of DPRs were provided to the project team daily and are summarized in Appendix K. Hazard Observation Cards (HOCs) are furnished upon request.

8.0 REFERENCES

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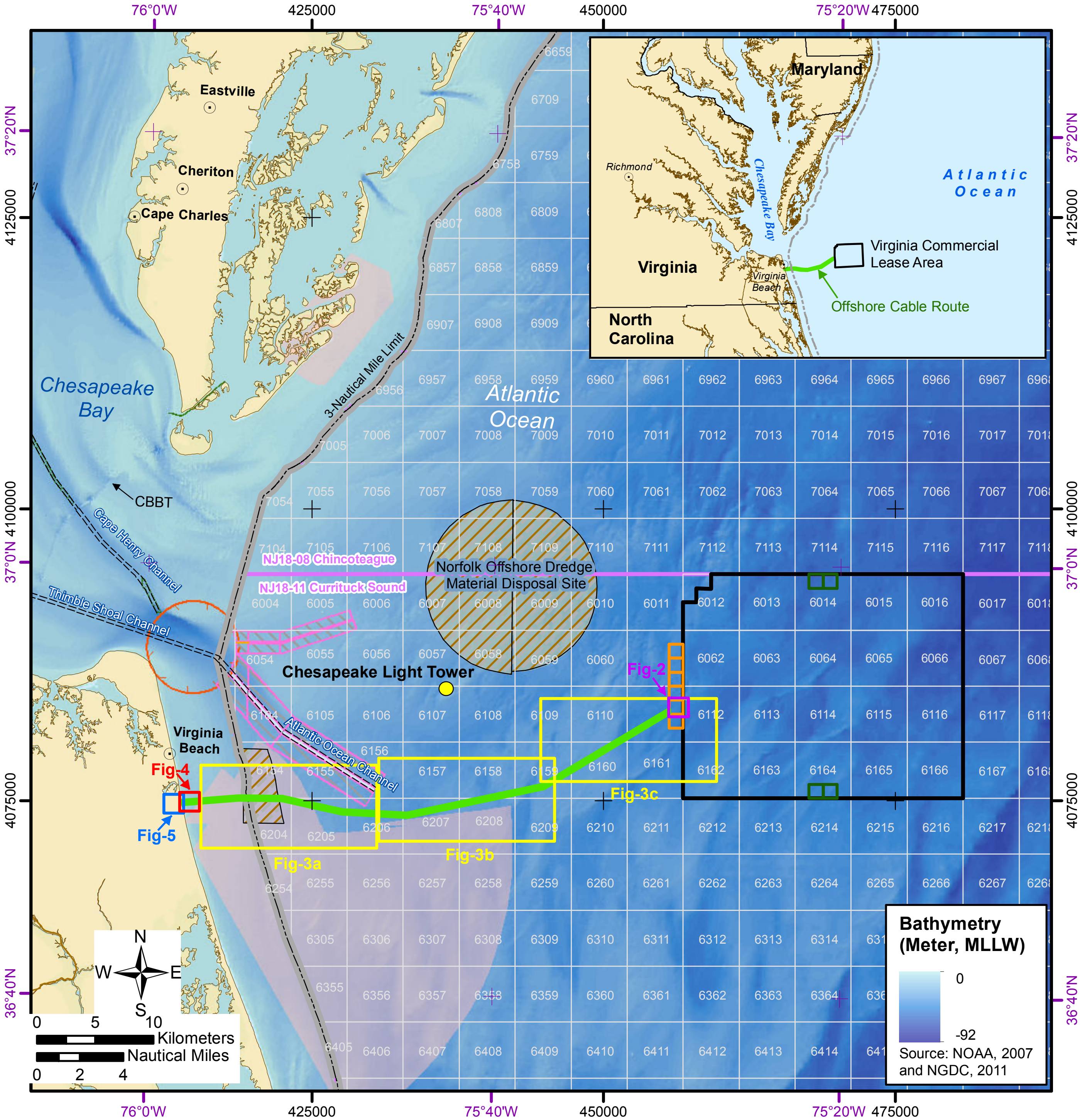
FIGURES

Dominion Resources
Project No. 04.81140004



LEGEND

- Offshore Cable Route (300m Wide Corridor)
- Virginia Commercial Lease Area
- 6015 OCS Lease Block (Virginia Commercial Lease Area OCS blocks are highlighted in yellow.)
- DMME Research Aliquots
- VOWTAP Research Lease Aliquots
- Precautionary Area
- Coordinate Grid is NAD 1983, UTM Zone 18N, Meters
- Coordinate Grid is NAD 1983, Lat/Long Degree
- Military Practice Area
- Vessel Navigational Traffic Area
- Dumping Ground Area
- Onshore Cable Route
- HDD Cable Route
- Offshore Cable Route
- Turbine Site

PROJECT LOCATION MAP
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE 1

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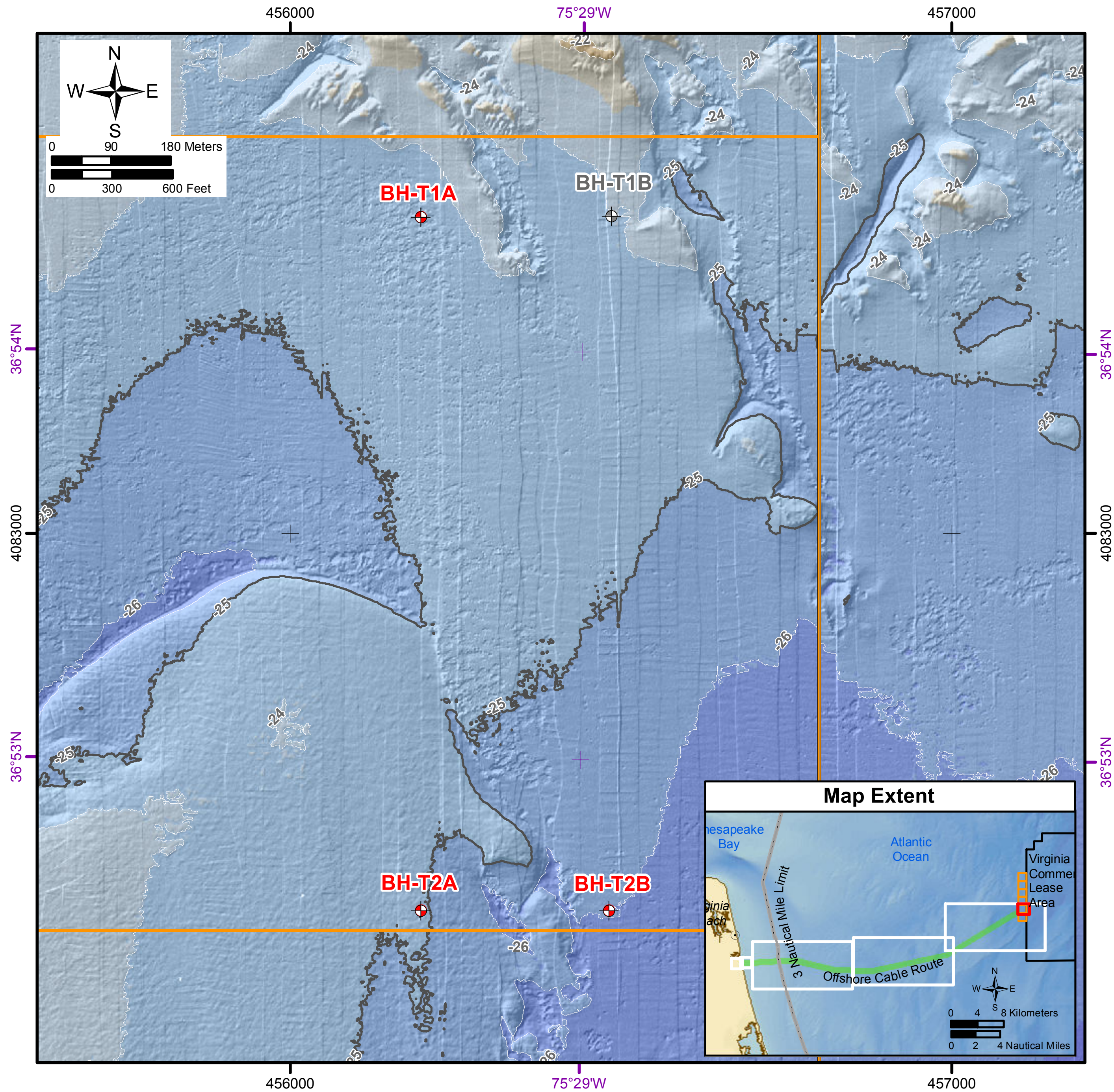

LEGEND

BH-T1A Offshore Boring

BH-T1B Offshore Boring Not Drilled

VOWTAP Research Lease Aliquots

Offshore Cable Route (300m Wide Corridor)

Virginia Commerical Lease Area

Coordinate Grid is NAD 1983, UTM Zone 18N, Meters.

Coordinate Grid is NAD 1983, Lat/Long Degree

Bathymetric Contours (Meter, MLLW)

Major contour interval is 10 meters.
Minor contour interval is 2 meters.

Bathymetry (Meter, MLLW)
Source: Tetra Tech, 2013

- -22 to -23
- -23 to -24
- -24 to -25
- -25 to -26
- -26 to -27
- -27 to -28
- < -28

OFFSHORE BORING LOCATIONS

Turbine Site
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE 2

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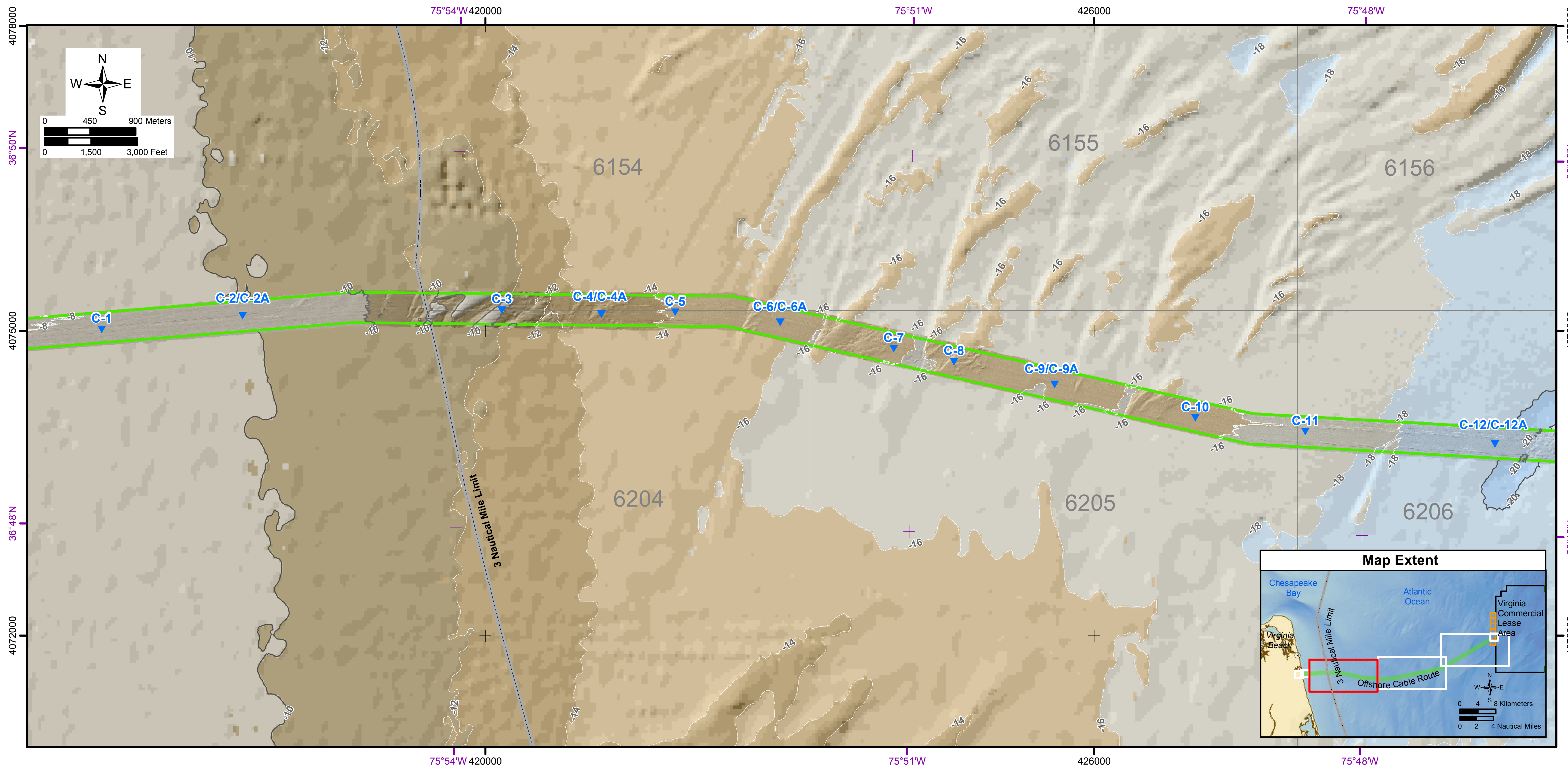

LEGEND

- C-1 Cable Route CPT
- 6204 Wind Energy Area OCS Lease Block
- Offshore Cable Route (300m Wide Corridor)
- Virginia Commerical Lease Area
- VOWTAP Research Lease Aliquots
- Coordinate Grid is NAD 1983, UTM Zone 18N, Meters.
- Coordinate Grid is NAD 1983, Lat/Long Degree

Bathymetry (Meter, MLLW)

- -6 to -8
- -8 to -10
- -10 to -12
- -12 to -14
- -14 to -16
- -16 to -18
- -18 to -20
- -20 to -22
- -22 to -24
- -24 to -26
- -26 to -28
- -28 to -30
- < -30

Bathymetric Contours (Meter, MLLW)

- Major contour interval is 10 meters.
- Minor contour interval is 2 meters.

Note: Regional bathymetry data are from NOAA/NGDC, 2007 compiled from multiple surveys completed from 1934 to 2007. Bathymetric data within the 300m offshore cable route corridor was surveyed by Tetra Tech in 2013.

CABLE ROUTE CPT LOCATIONS
Offshore Cable Route
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE 3a

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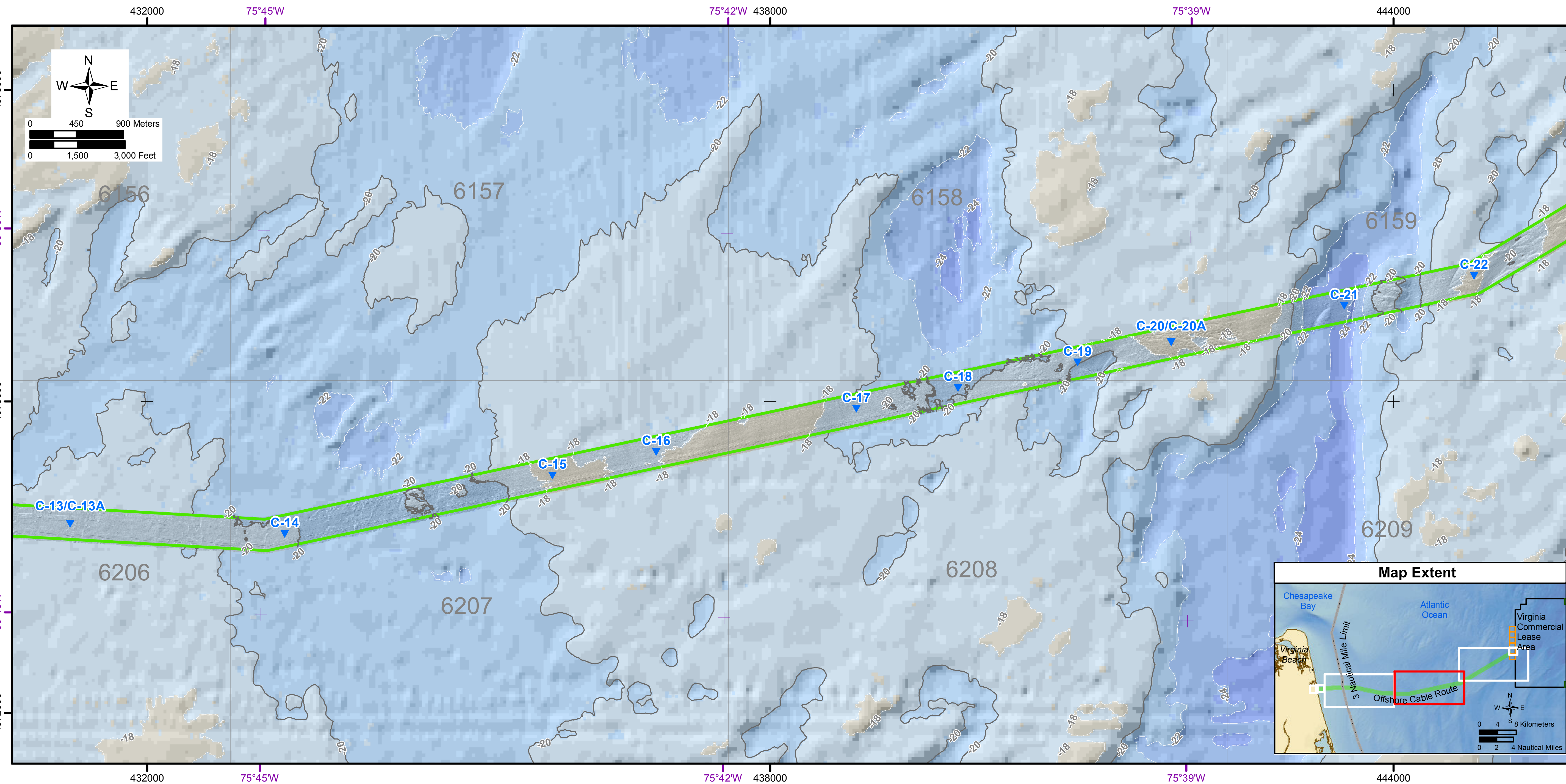

LEGEND

- C-13 Cable Route CPT
- 6204 Wind Energy Area OCS Lease Block
- Offshore Cable Route (300m Wide Corridor)
- Virginia Commerical Lease Area
- VOWTAP Research Lease Aliquots
- \+ Coordinate Grid is NAD 1983, UTM Zone 18N, Meters.
- \+ Coordinate Grid is NAD 1983, Lat/Long Degree

Bathymetry (Meter, MLLW)

-6 to -8	-20 to -22
-8 to -10	-22 to -24
-10 to -12	-24 to -26
-12 to -14	-26 to -28
-14 to -16	-28 to -30
-16 to -18	< -30
-18 to -20	

Bathymetric Contours (Meter, MLLW)

Major contour interval is 10 meters.
Minor contour interval is 2 meters.

Note: Regional bathymetry data are from NOAA/NGDC, 2007 compiled from multiple surveys completed from 1934 to 2007. Bathymetric data within the 300m offshore cable route corridor was surveyed by Tetra Tech in 2013.

CABLE ROUTE CPT LOCATIONS
Offshore Cable Route
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE 3b

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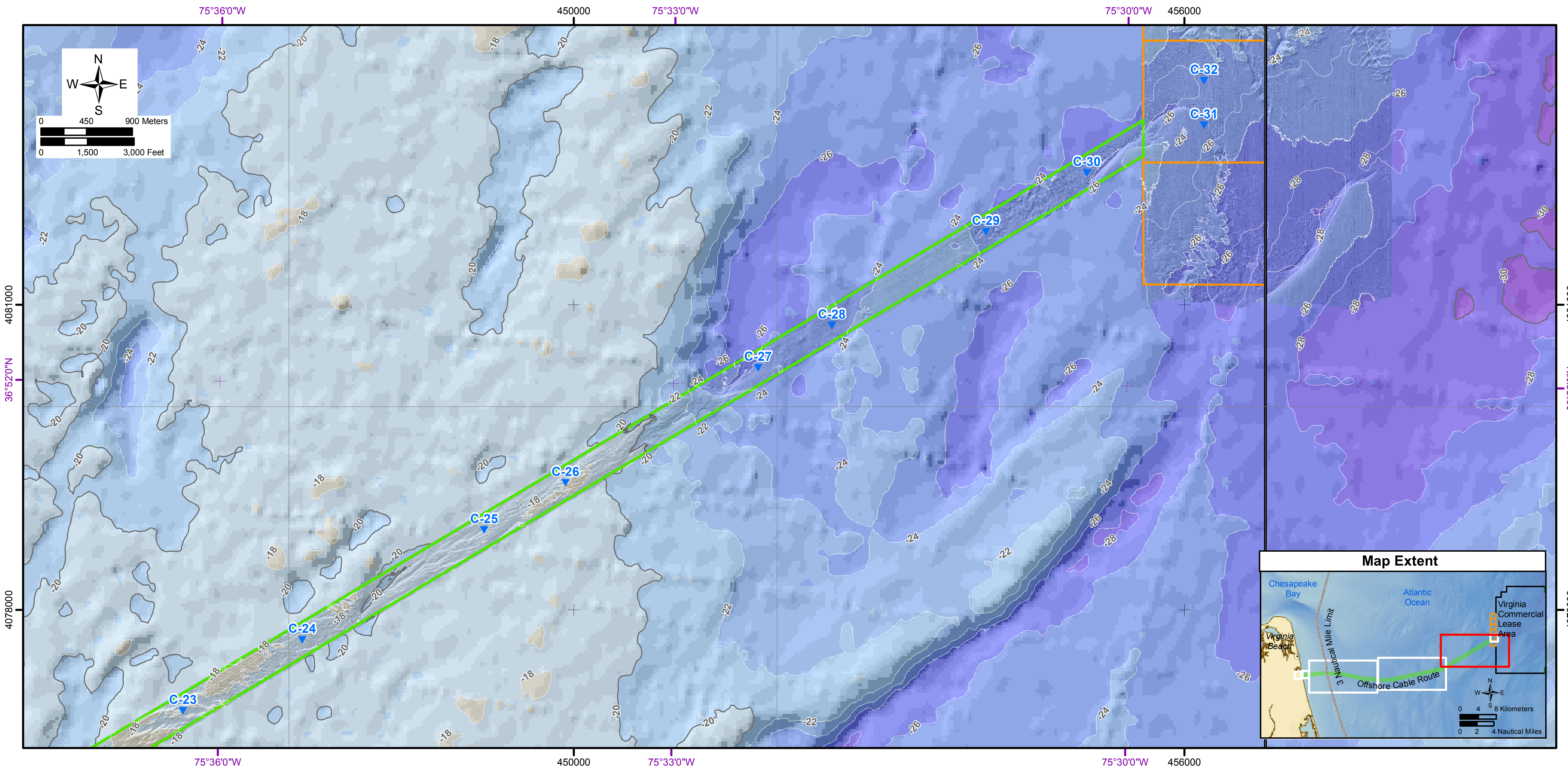

LEGEND

- C-23 Cable Route CPT
- 6204 Wind Energy Area OCS Lease Block
- Offshore Cable Route (300m Wide Corridor)
- Virginia Commerical Lease Area
- VOWTAP Research Lease Aliquots
- Coordinate Grid is NAD 1983, UTM Zone 18N, Meters.
- Coordinate Grid is NAD 1983, Lat/Long Degree

Bathymetry (Meter, MLLW)

- -6 to -8
- -8 to -10
- -10 to -12
- -12 to -14
- -14 to -16
- -16 to -18
- -18 to -20
- -20 to -22
- -22 to -24
- -24 to -26
- -26 to -28
- -28 to -30
- < -30

Bathymetric Contours (Meter, MLLW)

- Major contour interval is 10 meters.
- Minor contour interval is 2 meters.

Note: Regional bathymetry data are from NOAA/NGDC, 2007 compiled from multiple surveys completed from 1934 to 2007. Bathymetric data within the 300m offshore cable route corridor was surveyed by Tetra Tech in 2013.

CABLE ROUTE CPT LOCATIONS
Offshore Cable Route
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE 3c

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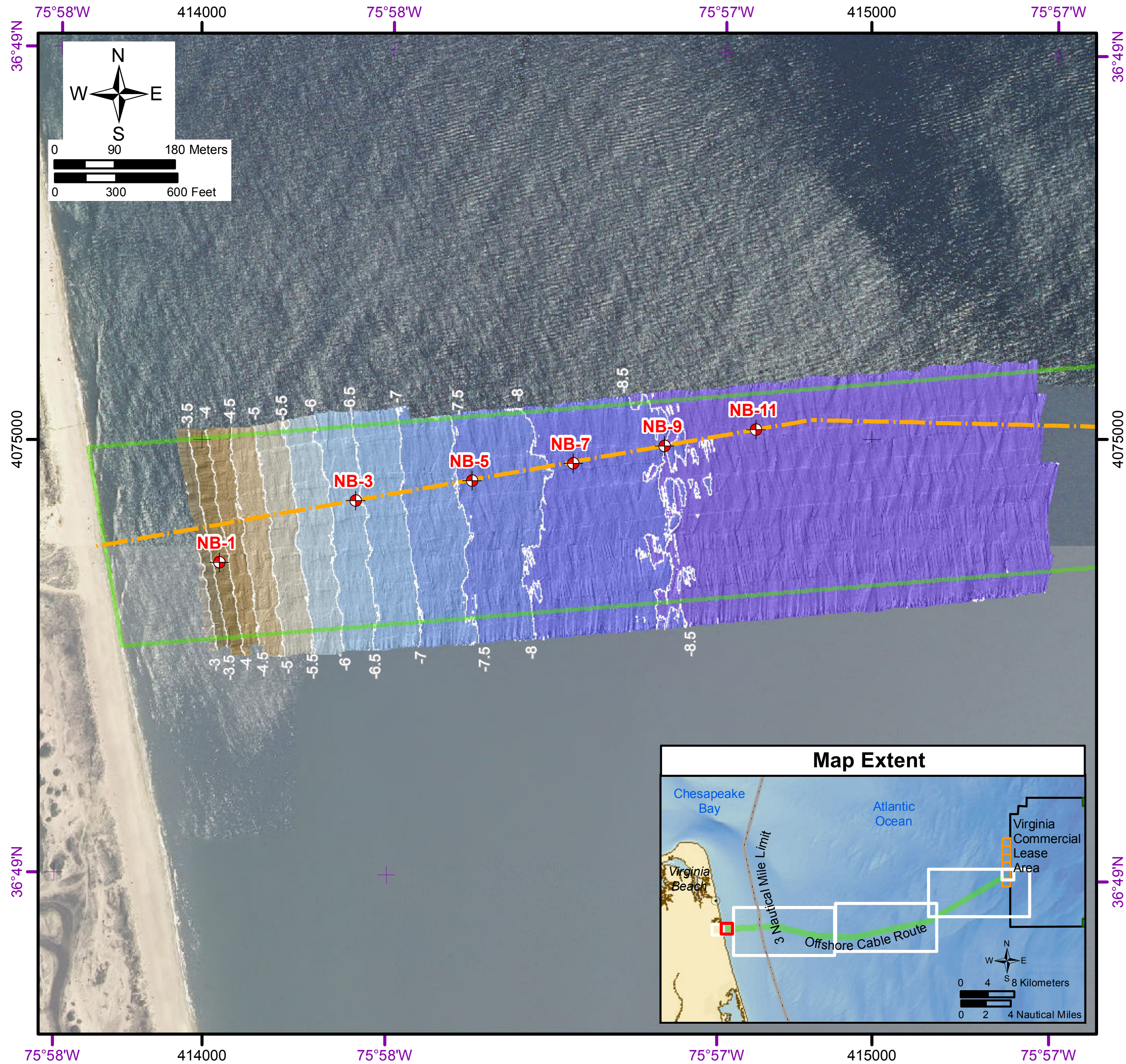
Dominion Resources
Proposal No. 04.81140004



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LEGEND

NB-1 Nearshore Boring Location

Offshore Cable Route (300m Wide Corridor)

Proposed Cable Route

Coordinate Grid is NAD 1983, UTM Zone 18N, Meters

Coordinate Grid is NAD 1983, Lat/Long Degree

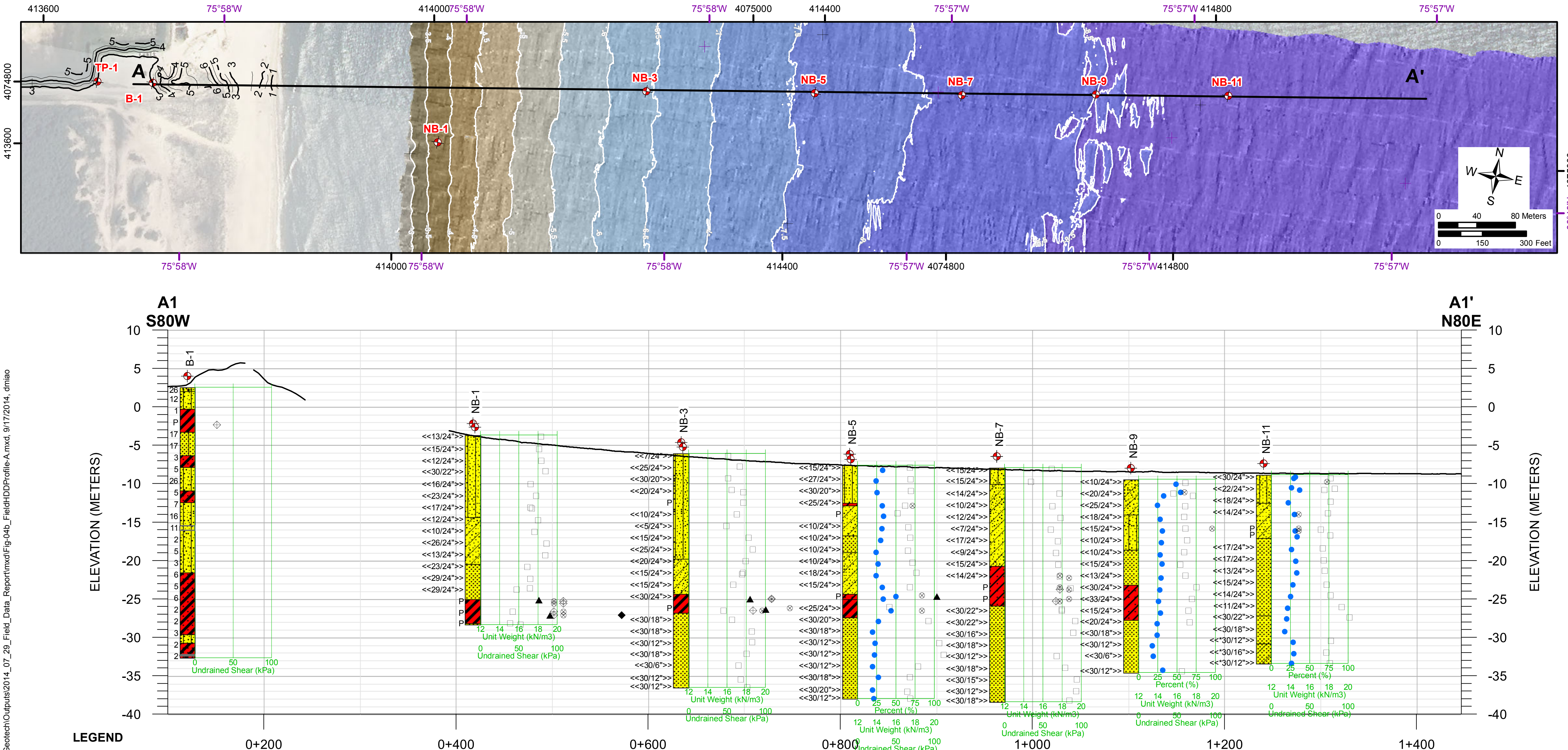
Bathymetry (Meter, MLLW)
Source: Fugro, 2014

-2.5 to -3.0
-3.0 to -3.5
-3.5 to -4.0
-4.0 to -4.5
-4.5 to -5.0
-5.0 to -5.5
-5.5 to -6.0
-6.0 to -6.5
-6.5 to -7.0
-7.0 to -7.5
-7.5 to -8.0
-8.0 to -8.5
-8.5 to -9.0

Bathymetric Contours (Meter, MLLW)
Contour interval is 0.5 meters.

NEARSHORE BORING LOCATIONS
HDD Cable Route
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE 4a



LEGEND

NB-1 Boring Location

+ Coordinate Grid is NAD 1983, UTM Zone 18N, Meters.

+ Coordinate Grid is NAD 1983, Lat/Long Degree

Topographic Contours (Meter, MLLW)
Contour interval is 0.5 meters.

Bathymetric Contours (Meter, MLLW)
Contour interval is 0.5 meters.

Bathymetry (Meter, MLLW)
Source: Fugro, 2014

- -2.5 to -3.0
- -3.0 to -3.5
- -3.5 to -4.0
- -4.0 to -4.5
- -4.5 to -5.0
- -5.0 to -5.5
- -5.5 to -6.0
- -6.0 to -6.5
- -6.5 to -7.0
- -7.0 to -7.5
- -7.5 to -8.0
- -8.0 to -8.5
- -8.5 to -9.0

Lithology Type

- Fat CLAY (CH)
- Sandy Lean Clay (CL)
- Poorly-Graded SAND (SP)
- Poorly-Graded SAND with Clay (SP-SC)
- Clayey SAND (SC)
- Silty SAND (SM)

Laboratory Test Data

- Submerged Unit Weight
- Water Content

Undrained Shear Strength

- UUTx
- Minivane
- Torvane
- Pocket Penetrometer

5 m / 40 m
Vertical Exaggeration = 8x

16.4 feet / 131.2 feet
Vertical Exaggeration = 8x

Note: P = Push Sample
<<17/24">> Marine Wireline Sample: blow counts per driven length are shown for 79.4 kg downhole wireline hammer with 1.5 m drop.

NEARSHORE HDD SUBSURFACE PROFILE
Dominon VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE 4b

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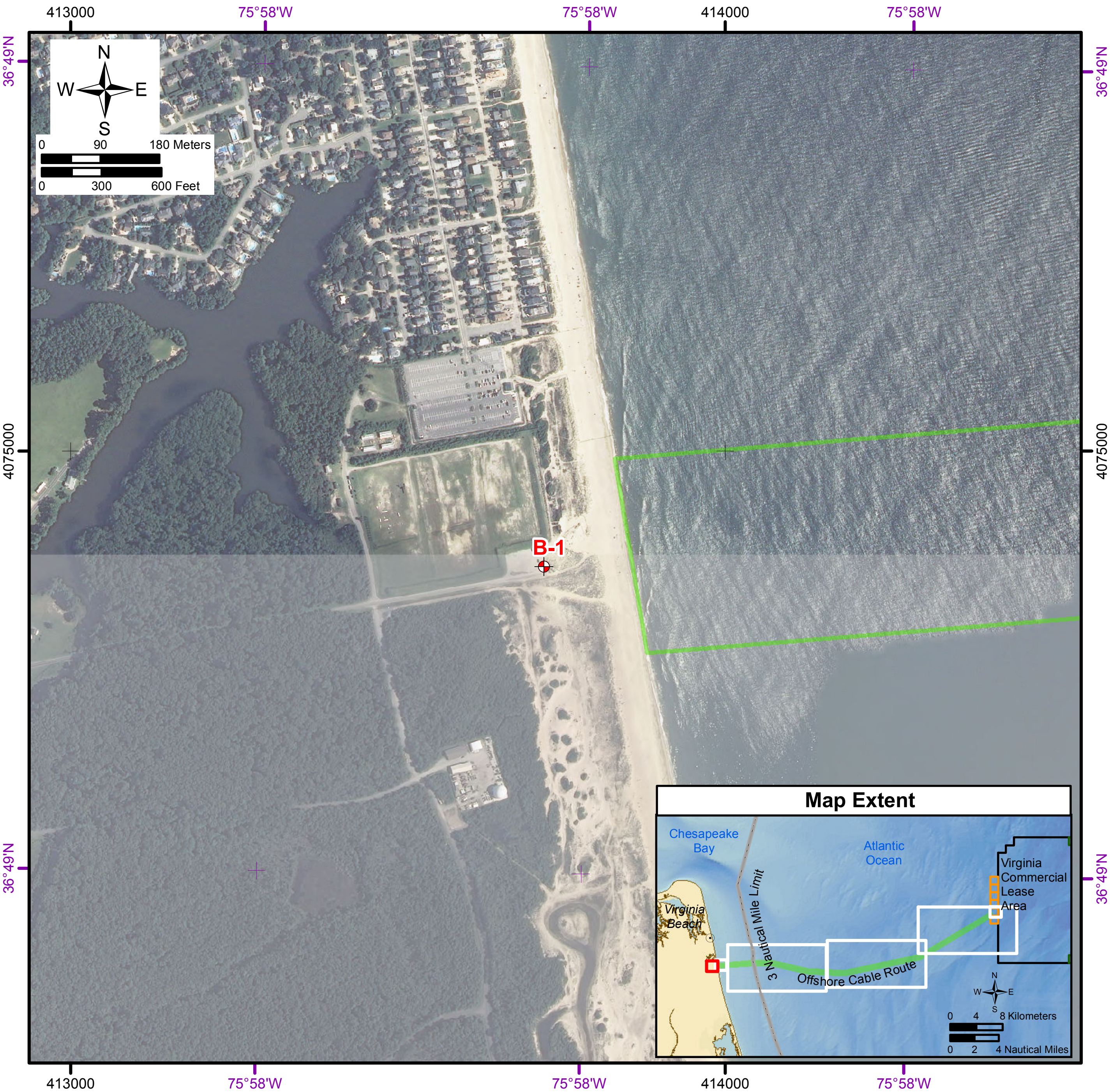

Aerial Photo Source: NAIP imagery, 2008

LEGEND

B-1 Onshore Boring Location

Offshore Cable Route (300m Wide Corridor)

Coordinate Grid is NAD 1983, UTM Zone 18N, Meters.

Coordinate Grid is NAD 1983, Lat/Long Degree

ONSHORE BOREHOLE LOCATION
Onshore Cable Route
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

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CHARTS

LEGEND

NB-9 — 2014 Fugro Boring

C-29 — 2014 Fugro CPT

VC-017 — 2013 Tetra Tech Vibracore

43 — Cable Route Centerline and Kilometer Post Stationing

Offshore Cable Route Survey Corridor (300m Wide Corridor)

Bathymetry (Meters, MLLW)

High : -2.60

Low : -28.26

Soil Descriptions

- Poorly-Graded SAND (SP)
- Poorly-Graded SAND with Clay (SP-SC)
- Poorly-Graded SAND with Silt (SP-SM)
- Well-Graded SAND (SW)
- Well-Graded SAND with Silt (SW-SM)
- Clayey SAND (SC)
- Silty SAND (SM)
- Lean CLAY (CL)
- Fat CLAY (CH)
- Fat CLAY with SAND (CH)
- Silt (ML)

Stratigraphic Units

MD — **Marine Deposits**
Predominately Coarse-Grained Deposits

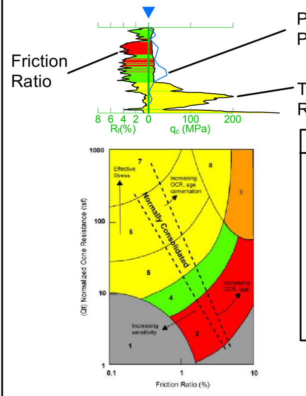
TD1 — **Transgressive Deposits Unit 1**
Interbedded Fine-Grained and Coarse-Grained Deposits

TD2 — **Transgressive Deposits Unit 2**
Predominately Coarse-Grained Deposits with Fine-Grained Interbedding

TD3 — **Transgressive Deposits Unit 3**
Predominately Fine-Grained Deposits with Coarse-Grained Seams and Layers

Qal(?) — **Late Pleistocene Alluvium (?)**
Predominately Coarse-Grained Deposits

KEY TO CPT SOUNDINGS



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay to Silty Clay	CL-CH
4	Clayey Silt to Silty Clay	MH-CL
5	Silty Sand to Sandy Silt	SM-ML
6	Sand to Silty Sand	SP-SM
7	Gravelly Sand to Sand	GP-SP
8	Sand to Clayey Sand	SP-SC
9	Very Stiff Fine-grained*	CH-CL

*overconsolidated or cemented

CPT CORRELATION CHART
ROBERTSON, 1990

NOTES:
1) Bathymetric data (solid black line) from 2013 Tetra Tech survey (water depth greater than 7m) and 2014 Fugro survey (water depth shallower than 7m).
2) Bathymetry elevation reference to mean lower low water (MLLW).
3) Stratigraphic contacts are approximate, and interpreted from borings, CPTs, and seismic reflection data. Conditions vary both along and perpendicular to the section line.
4) Boring and CPT data are projected onto the cross section line, therefore, stratigraphic contacts may not correspond to the indications (lithology, shear strength, etc.) in the logs.
5) Material descriptions are generalized. Materials may vary within the stratigraphic unit and include layers of material that differ from the general description.
6) Seismic data interpreted by Fugro collected by Tetra Tech during 2013 survey using Chirp sub-bottom profiler. Seismic data two-way travel times were converted to depth based on Vp=1500 m/sec.

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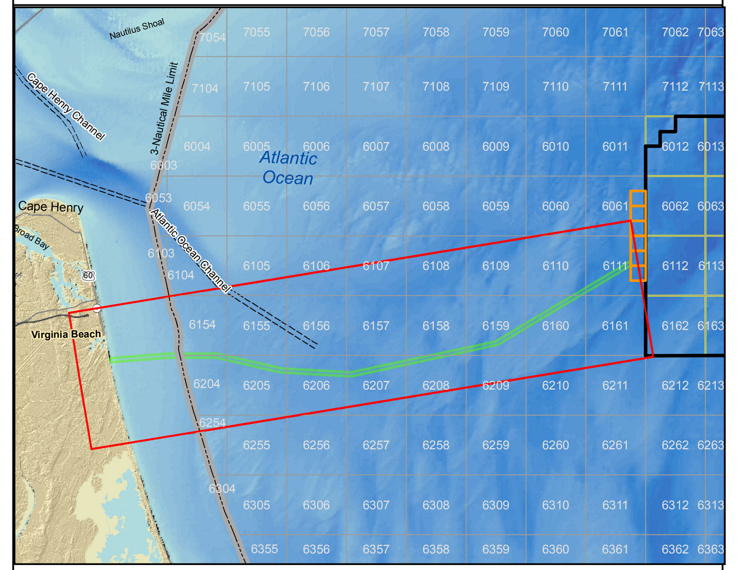

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Norfolk, Virginia 23510
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www.fugroconsultants.com

INTEGRATION OF GEOPHYSICAL AND GEOTECHNICAL DATA ALONG THE PROPOSED CABLE CORRIDOR

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

NO:	DATE:	DESCRIPTION:	DRAWN:	CHKD:	APPR:
1	Sept. 2014				
2					
3					

JOB NUMBER: 04.81140004 | CHART NO.: 1

APPENDIX A

BOREHOLE LOGS

SOIL TYPES

Well graded GRAVEL (GW)
Poorly graded GRAVEL (GP)
GRAVEL with sand (GP or GW)
GRAVEL with clay (GP or GW)
Clayey GRAVEL (GC)
GRAVEL with silt (GP or GW)
Silty GRAVEL (GM)
Well graded SAND (SW)
Poorly graded SAND (SP)
SAND with gravel (SP or SW)
Clayey SAND (SC)
SAND with clay (SP-SC)
Silty SAND (SM)
SAND with silt (SP-SM)
Fat CLAY (CH)
Sandy Fat CLAY (CH)
Lean Clay (CL)
Sandy Lean CLAY (CL)
Silty CLAY (CL-ML)
SHELLS, Shelly Material
Elastic SILT (MH)
SILT (ML)
Sandy SILT (ML)
PEAT
High Plasticity ORGANICS (OH)
Low Plasticity ORGANICS (OL)
Surficial Soil
Artificial Fill
Asphalt Concrete
Base Material

SAMPLERS

Thin-Walled Shelby Tube
Piston Sampler
Wireline
Rock Core (interior symbol represents percent recovery)
Modified California
Thick-Wall Wireline
SPT
Downhole SPT
Vibracore
Bulk Bag
No Recovery

CLASSIFICATION TEST/BLOW COUNTS

■ Percent Passing No. 200 Sieve
● Water Content (%)
□ Submerged Unit Weight (kN/m^3)
○ Theoretical Submerged Unit Weight (kN/m^3)

Plastic Limit Liquid Limit

Non-Plastic

Water Level Symbols

Initial or perched water level
Final ground water level

STRENGTH TESTS

Pocket Penetrometer
Torvane
Remote Vane
◆ Miniature Vane
Residual Vane
▲ Unconsolidated Undrained Triaxial
Unconfined Compression (soil)
◇△ (Open symbols indicate remolded tests)
CPT (Nk = 15 and 20)

KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE A-1a

TUBE AND LINER SAMPLERS

DROP	Liner sample advanced with the weight of an 80 kg hammer.
PUSH	Pushed thin-walled 7.5 cm-tube.
15/60c	Number of blows required to produce the indicated penetration using a 5.7 cm tube sampler. The sampler was driven with an 80 kg downhole hammer dropped approximately 1.5 m.

SPT AND MODIFIED CALIFORNIA LINER SAMPLERS

Sampler is driven with a 63.5 kg hammer dropped approximately 760 mm.

WOR, WOH	Weight of Rod, Weight of Hammer.
20	Number of blows to produce 30 cm penetration after an initial 15 cm seating.
86/28c	Number of blows required to produce the indicated penetration after an initial 15 cm seating.
Ref/8c	50 blows produced the indicated penetration during the initial 15 cm interval.

SOIL GRAIN SIZE

U.S. STANDARD SIEVE

12" | 3" | 3/4" | 4 | 10 | 40 | 200

BOULDER	COBBLE	GRAVEL		SAND			SILT	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		

300 | 75 | 19 | 4.75 | 2.00 | 0.425 | 0.075 | 0.002

SOIL GRAIN SIZE IN MILLIMETERS

STRENGTH OF COHESIVE SOILS

Consistency	N-Value	Undrained Shear Strenth, kPa
Very Soft	0 to 2	less than 12
Soft	3 to 4	12 to 25
Firm	5 to 8	25 to 50
Stiff	3 to 16	50 to 100
Very Stiff	16 to 32	100 to 200
Hard	>32	greater than 200

DENSITY OF GRANULAR SOILS

Descriptive Term	N-Value	Relative Density (%)*
Very Loose	0 to 4	less than 15
Loose	5 to 10	15 to 35
Medium Dense	11 to 30	35 to 65
Dense	31 to 50	65 to 85
Very Dense	>50	greater than 85

* Estimated from sampler driving record and PCPT tip resistance.

SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the ease of breaking along these planes.
Fissured	Containing shrinkage of relief crack, often filled with fine sand or silt, usually more or less vertical.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 3 mm thick extending through the sample.
Seam	Inclusion 3 to 75 mm thick extending through the sample.
Layer	Inclusion greater than 75 mm thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil types.
Interlayered	Soil sample composed of alternating layers of different soil types.
Intermixed	Soil sample composed of pockets of different soil types and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of carbonate.

KEY TO TERMS AND SYMBOLS USED ON BORING LOGS

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE A-1b

09/15/2014 09:22

PROJECT NO: 04.81140004
BORING: BH-T1A

START DATE: 6/27/2014
COMPLETION DATE: 6/29/2014

DRILLER: FMMG
DRILLING METHOD: Mud Rotary Wash

Coordinates: N 4,083,479m E 456,197m
NAD 1983, UTM Zone 18 North, Meters

ELEVATION: -24.9 m +/- (rel. MLLW datum)

SAMPLE NO.	BLOW COUNT
1	PUSH
2	PUSH
3	PUSH
4	PUSH
5	
6	PISTON
7	10/61c
8	PUSH
9	PUSH
10	PUSH
11	PUSH
12	PUSH
13	30/61c
14	30/61c
15	PUSH
16	30/36c
17	25/61c
18	30/61c
19	30/30c
20	30/46c
21	30/43c
22	30/43c
23	30/61c
24	PUSH
25	PUSH
26	PUSH
27	PUSH
28	PUSH
29	PUSH
30	PUSH
31	22/61c
32	28/61c
33	22/61c
34	25/61c
35	25/66c
36	30/61c
37	PUSH
38	PUSH
39	PUSH
40	PUSH
41	PUSH
42	PUSH

MATERIAL DESCRIPTION

Silty Fine SAND (SM): loose to medium dense, very dark greenish gray (5GY3/1).
-with white coarse sand size shell fragments, 0.9m to 5.2m
-medium to coarse grained, with coarse sand to coarse gravel sized white shell fragments, at 1.5m
-Fat CLAY (CH), very dark greenish gray, with partings of sand, 1.8m to 2.8m

5.2m

Fat CLAY (CH): firm to stiff, very dark gray (5Y3/1).
-with sand partings, 5.2m to 6.4m
-with many pockets of fine sand, trace shell fragments, at 11.0m
-with sand and shell fragments at 12.5m
-with a few sand pockets, gas blisters and shell fragments, 16.5m to 18.0m
-with sand lenses at 17.7m
-very stiff, greenish gray (5G4/2), below 21.0m
-with few shell fragments, 21.0m to 22.6m
-silty sand seam at 22.6m

24.4m

Silty Fine to Medium SAND (SM): medium dense to dense, dark greenish gray (5G4/1).
-with many shell and shell fragments, 26.5m to 35.4m
-coarse at 45.1m
-fine grained below 48.8m
-with a few shell fragments, 48.8m to 56.1m
-with a few shell fragments and few carbonate nodules, 48.8m to 53.0m
-with a few pieces of gravel at 49.1m

56.1m

Lean CLAY (CL): very stiff to hard, dark greenish gray (5GY4/1).
-with many shells and shell fragments, 56.1m to 57.6m
-with a few shell fragments, 60.7m to 62.2m
-with many sand pockets, and partings and shell fragments, below 69.8m

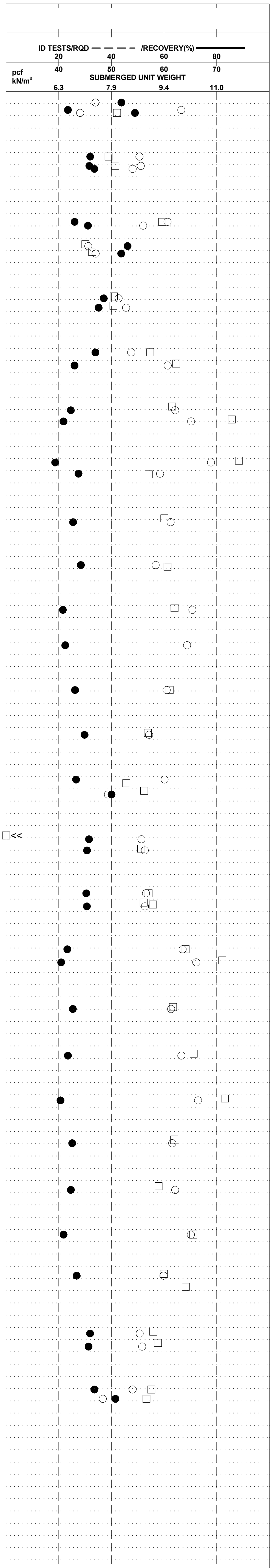
71.6m

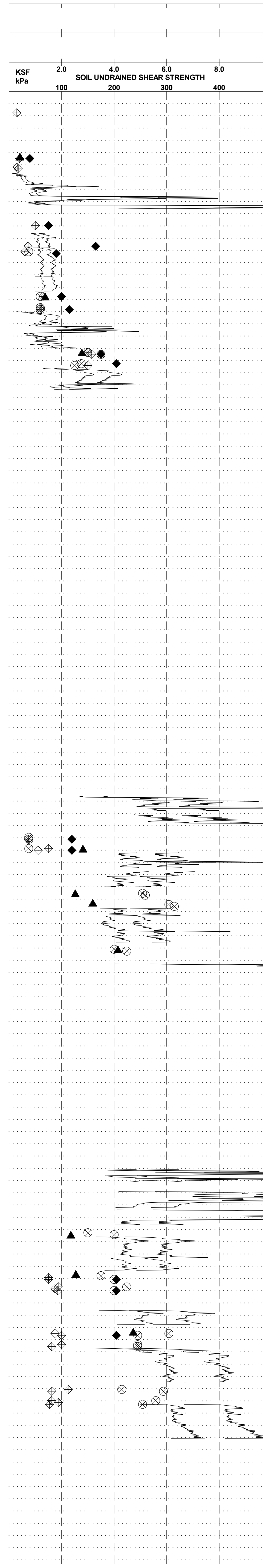
Silty Fine SAND (SM): medium dense to dense, very dark greenish gray (10G3/1).
-with shell fragments at 74.7m
-with many shell fragments, 78.9m to 85.6m

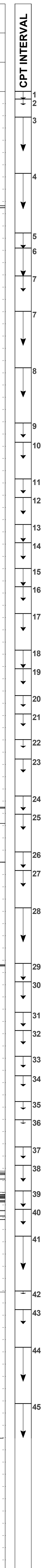
88.1m

Fat CLAY (CH): very stiff to hard, dark greenish gray (10G4/1).
-sandy, 88.1m to 93.6m
-with many shell fragments, 88.1m to 93.3m
-with silt below 96.6m
-with a few shell fragments and silt partings, 101.2m to 103.6m

TD = 110.1m







The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.
For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING BH-T1A

Dominion VOWTAP Geotechnical Survey

FIGURE A-2.1

09/15/2014 09:24

PROJECT NO: 04.81140004
BORING: BH-T1A

START DATE: 6/27/2014
COMPLETION DATE: 6/29/2014

DRILLER: FMMG
DRILLING METHOD: Mud Rotary Wash

Coordinates: N 4,083,479 E 456,197

ELEVATION, m | DEPTH, m | MATERIAL SYMBOL | SAMPLE NO. | SAMPLER | BLOW COUNT

MATERIAL DESCRIPTION

MUDLINE ELEVATION: -24.9 m +/- (rel. MLLW datum)

Silty Fine SAND (SM): loose to medium dense, very dark greenish gray (5GY3/1).
-with white coarse sand size shell fragments, 0.9m to 5.2m

2.8m

-medium to coarse grained, with coarse sand to coarse gravel sized white shell fragments, at 1.5m
-Fat CLAY (CH), very dark greenish gray, with partings of sand, 1.8m to 2.8m

5.2m
6.4m

Fat CLAY (CH): firm to stiff, very dark gray (5Y3/1).
-with sand partings, 5.2m to 6.4m
-with many pockets of fine sand, trace shell fragments, at 11.0m
-with sand and shell fragments at 12.5m

18.0m

-with a few sand pockets, gas blisters and shell fragments, 16.5m to 18.0m
-with sand lenses at 17.7m
-very stiff, greenish gray (5G4/2), below 21.0m

22.6m
24.4m

-with few shell fragments, 21.0m to 22.6m
-silty sand seam at 22.6m

Silty Fine to Medium SAND (SM): medium dense to dense, dark greenish gray (5G4/1).
-with many shell and shell fragments, 26.5m to 35.4m

35.4m

-coarse at 45.1m

-fine grained below 48.8m
-with a few shell fragments, 48.8m to 56.1m
-with a few shell fragments and few carbonate nodules, 48.8m to 53.0m
-with a few pieces of gravel at 49.1m

53.0m
56.1m
57.6m

Lean CLAY (CL): very stiff to hard, dark greenish gray (5GY4/1).
-with many shells and shell fragments, 56.1m to 57.6m
-with a few shell fragments, 60.7m to 62.2m

62.2m

-with many sand pockets, and partings and shell fragments, below 69.8m

71.6m

Silty Fine SAND (SM): medium dense to dense, very dark greenish gray (10G3/1).
-with shell fragments at 74.7m

-with many shell fragments, 78.9m to 85.6m

85.6m
88.1m

Fat CLAY (CH): very stiff to hard, dark greenish gray (10G4/1).
-sandy, 88.1m to 93.6m
-with many shell fragments, 88.1m to 93.3m

93.3m
93.6m

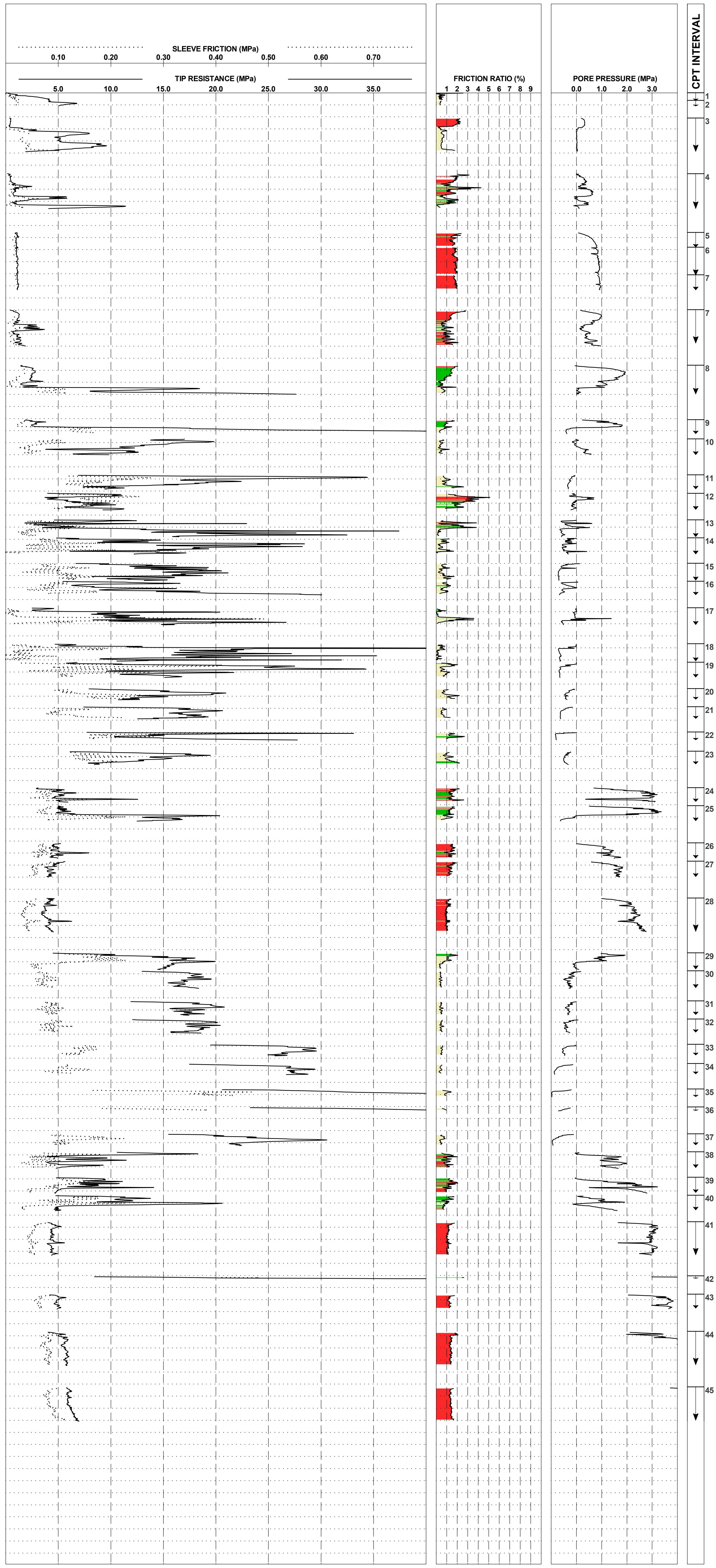
-with silt below 96.6m

-with a few shell fragments and silt partings, 101.2m to 103.6m

103.6m

TD = 110.1m

SAMPLE NO.	BLOW COUNT
1	PUSH
2	PUSH
3	PUSH
4	PUSH
5	
6	PISTON
7	10|61c
8	PUSH
9	PUSH
10	PUSH
11	PUSH
12	PUSH
13	30|61c
14	30|61c
15	PUSH
16	30|36c
17	25|61c
18	30|61c
19	30|30c
20	30|46c
21	30|43c
22	30|43c
23	30|61c
24	PUSH
25	PUSH
26	PUSH
27	PUSH
28	PUSH
29	PUSH
30	PUSH
31	22|61c
32	28|61c
33	22|61c
34	25|61c
35	25|66c
36	30|61c
37	PUSH
38	PUSH
39	PUSH
40	PUSH
41	PUSH
42	PUSH



The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

CONE PENETRATION TEST RESULTS

BORING BH-T1A

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FUGRO

FIGURE A-2.2

PROJECT NO: 04.81140004
BORING: BH-T1A

START DATE: 6/27/2014
COMPLETION DATE: 6/29/2014

DRILLER: FMMG
DRILLING METHOD: Mud Rotary Wash

Coordinates: N 4,083,479 E 456,197

MATERIAL DESCRIPTION

MUDLINE ELEVATION: -24.9 m +/- (rel. MLLW datum)

Silty Fine SAND (SM): loose to medium dense, very dark greenish gray (5GY3/1).
-with white coarse sand size shell fragments, 0.9m to 5.2m (2.8m)
-medium to coarse grained, with coarse sand to coarse gravel sized white shell fragments, at 1.5m (5.2m, 6.4m)
-Fat CLAY (CH), very dark greenish gray, with partings of sand, 1.8m to 2.8m

Fat CLAY (CH): firm to stiff, very dark gray (5Y3/1).
-with sand partings, 5.2m to 6.4m
-with many pockets of fine sand, trace shell fragments, at 11.0m
-with sand and shell fragments at 12.5m (18.0m)
-with a few sand pockets, gas blisters and shell fragments, 16.5m to 18.0m
-with sand lenses at 17.7m (22.6m)
-very stiff, greenish gray (5G4/2), below 21.0m (24.4m)
-with few shell fragments, 21.0m to 22.6m
-silty sand seam at 22.6m

Silty Fine to Medium SAND (SM): medium dense to dense, dark greenish gray (5G4/1).
-with many shell and shell fragments, 26.5m to 35.4m (35.4m)
-coarse at 45.1m
-fine grained below 48.8m
-with a few shell fragments, 48.8m to 56.1m
-with a few shell fragments and few carbonate nodules, 48.8m to 53.0m (53.0m)
-with a few pieces of gravel at 49.1m (56.1m)

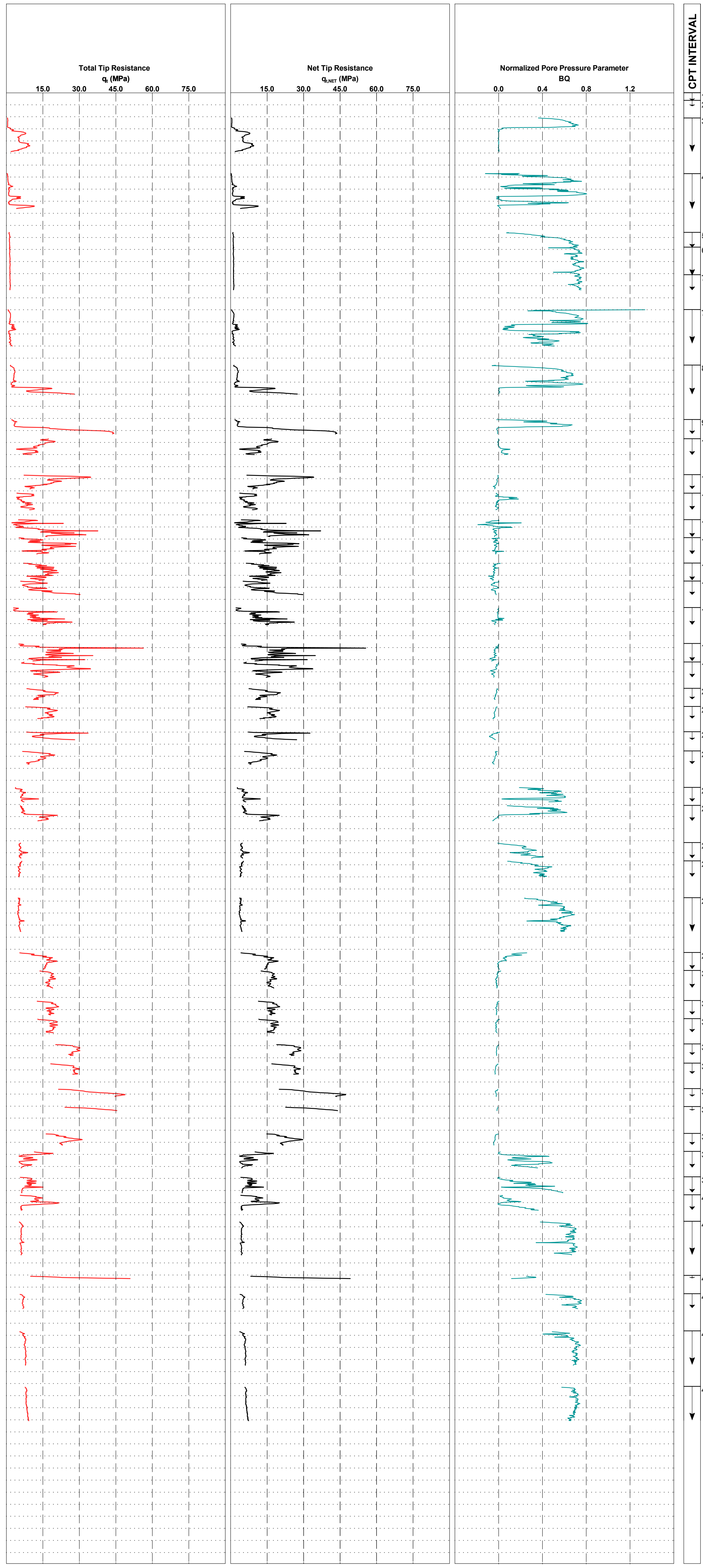
Lean CLAY (CL): very stiff to hard, dark greenish gray (5GY4/1). (57.6m)
-with many shells and shell fragments, 56.1m to 57.6m
-with a few shell fragments, 60.7m to 62.2m (62.2m)
-with many sand pockets, and partings and shell fragments, below 69.8m (71.6m)

Silty Fine SAND (SM): medium dense to dense, very dark greenish gray (10G3/1).
-with shell fragments at 74.7m
-with many shell fragments, 78.9m to 85.6m (85.6m)

Fat CLAY (CH): very stiff to hard, dark greenish gray (10G4/1). (88.1m)
-sandy, 88.1m to 93.6m
-with many shell fragments, 88.1m to 93.3m (93.3m, 93.6m)
-with silt below 96.6m
-with a few shell fragments and silt partings, 101.2m to 103.6m (103.6m)

TD = 110.1m

SAMPLE NO.	SAMPLER / BLOW COUNT
1	PUSH
2	PUSH
3	PUSH
4	PUSH
5	
6	PISTON
7	10/61c
8	PUSH
9	PUSH
10	PUSH
11	PUSH
12	PUSH
13	30/61c
14	30/61c
15	PUSH
16	30/36c
17	25/61c
18	30/61c
19	30/30c
20	30/46c
21	30/43c
22	30/43c
23	30/61c
24	PUSH
25	PUSH
26	PUSH
27	PUSH
28	PUSH
29	PUSH
30	PUSH
31	22/61c
32	28/61c
33	22/61c
34	25/61c
35	25/66c
36	30/61c
37	PUSH
38	PUSH
39	PUSH
40	PUSH
41	PUSH
42	PUSH



The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

CONE PENETRATION TEST RESULTS

BORING BH-T1A

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE A-2.3

PROJECT NO: 04.81140004	**START DATE:** 6/27/2014	**DRILLER:** FMMG	
BORING: BH-T1A	**COMPLETION DATE:** 6/29/2014	**DRILLING METHOD:** Mud Rotary Wash	

Coordinates: N 4,083,479 E 456,197

MATERIAL DESCRIPTION

MUDLINE ELEVATION: -24.9 m +/- (rel. MLLW datum)

Silty Fine SAND (SM): loose to medium dense, very dark greenish gray (5GY3/1).
-with white coarse sand size shell fragments, 0.9m to 5.2m
-medium to coarse grained, with coarse sand to coarse gravel sized white shell fragments, at 1.5m
-Fat CLAY (CH), very dark greenish gray, with partings of sand, 1.8m to 2.8m

2.8m

Fat CLAY (CH): firm to stiff, very dark gray (5Y3/1).
-with sand partings, 5.2m to 6.4m
-with many pockets of fine sand, trace shell fragments, at 11.0m
-with sand and shell fragments at 12.5m

5.2m
6.4m

-with a few sand pockets, gas blisters and shell fragments, 16.5m to 18.0m
-with sand lenses at 17.7m

18.0m

-very stiff, greenish gray (5G4/2), below 21.0m
-with few shell fragments, 21.0m to 22.6m
-silty sand seam at 22.6m

22.6m
24.4m

Silty Fine to Medium SAND (SM): medium dense to dense, dark greenish gray (5G4/1).
-with many shell and shell fragments, 26.5m to 35.4m

35.4m

-coarse at 45.1m

-fine grained below 48.8m
-with a few shell fragments, 48.8m to 56.1m
-with a few shell fragments and few carbonate nodules, 48.8m to 53.0m
-with a few pieces of gravel at 49.1m

53.0m
56.1m

Lean CLAY (CL): very stiff to hard, dark greenish gray (5GY4/1).
-with many shells and shell fragments, 56.1m to 57.6m

57.6m

-with a few shell fragments, 60.7m to 62.2m

62.2m

-with many sand pockets, and partings and shell fragments, below 69.8m

71.6m

Silty Fine SAND (SM): medium dense to dense, very dark greenish gray (10G3/1).
-with shell fragments at 74.7m

-with many shell fragments, 78.9m to 85.6m

85.6m
88.1m

Fat CLAY (CH): very stiff to hard, dark greenish gray (10G4/1).
-sandy, 88.1m to 93.6m
-with many shell fragments, 88.1m to 93.3m

93.3m
93.6m

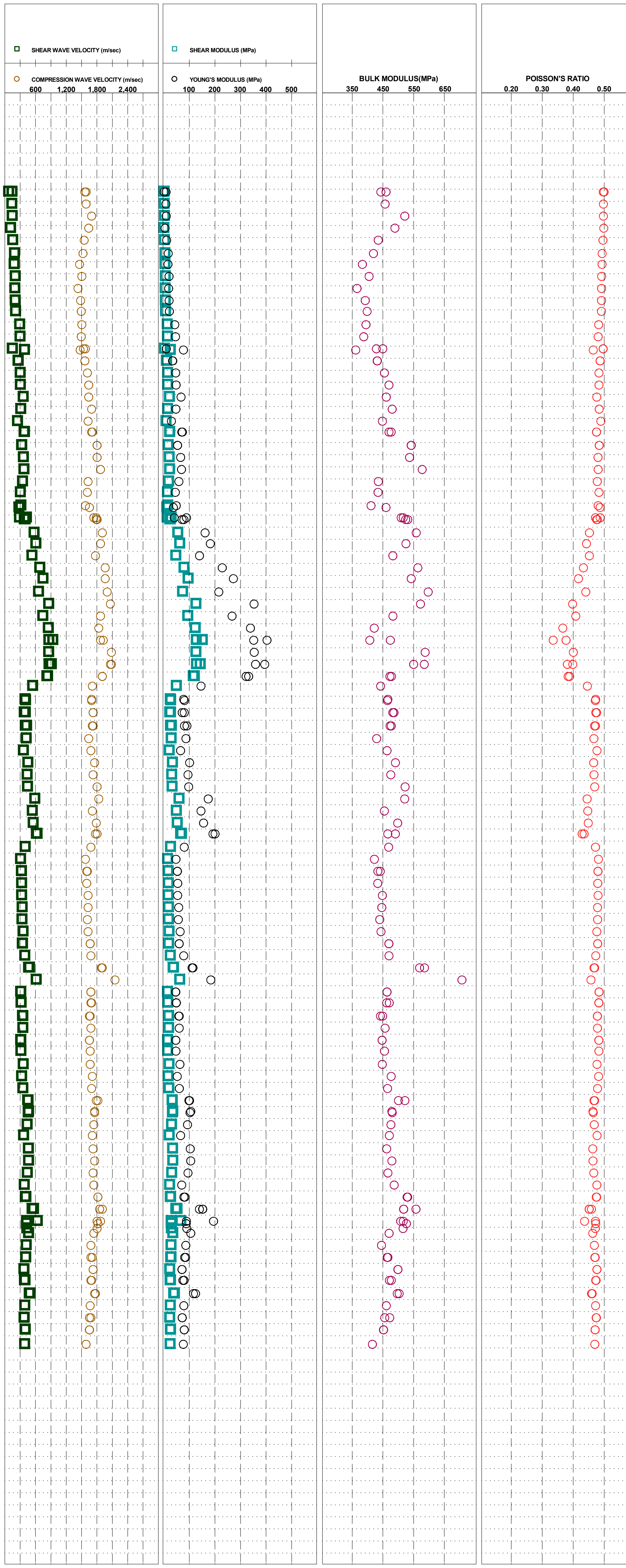
-with silt below 96.6m

-with a few shell fragments and silt partings, 101.2m to 103.6m

103.6m

TD = 110.1m

SAMPLE NO.	BLOW COUNT
1	PUSH
2	PUSH
3	PUSH
4	PUSH
5	
6	PISTON
7	10/61c
8	PUSH
9	PUSH
10	PUSH
11	PUSH
12	PUSH
13	30/61c
14	30/61c
15	PUSH
16	30/36c
17	25/61c
18	30/61c
19	30/30c
20	30/46c
21	30/43c
22	30/43c
23	30/61c
24	PUSH
25	PUSH
26	PUSH
27	PUSH
28	PUSH
29	PUSH
30	PUSH
31	22/61c
32	28/61c
33	22/61c
34	25/61c
35	25/66c
36	30/61c
37	PUSH
38	PUSH
39	PUSH
40	PUSH
41	PUSH
42	PUSH



The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND SUSPENSION LOGGING DATA

BORING BH-T1A

Dominion VOWTAP Geotechnical Survey

FIGURE A-2.4

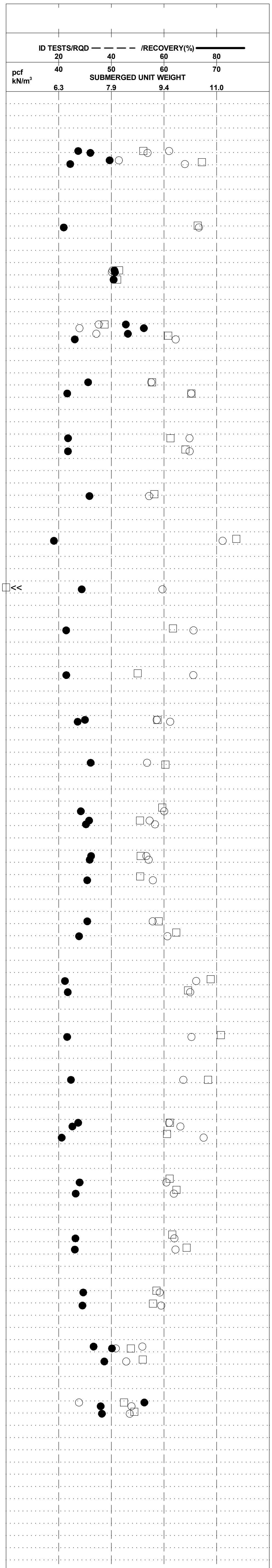
09/10/2014 15:23

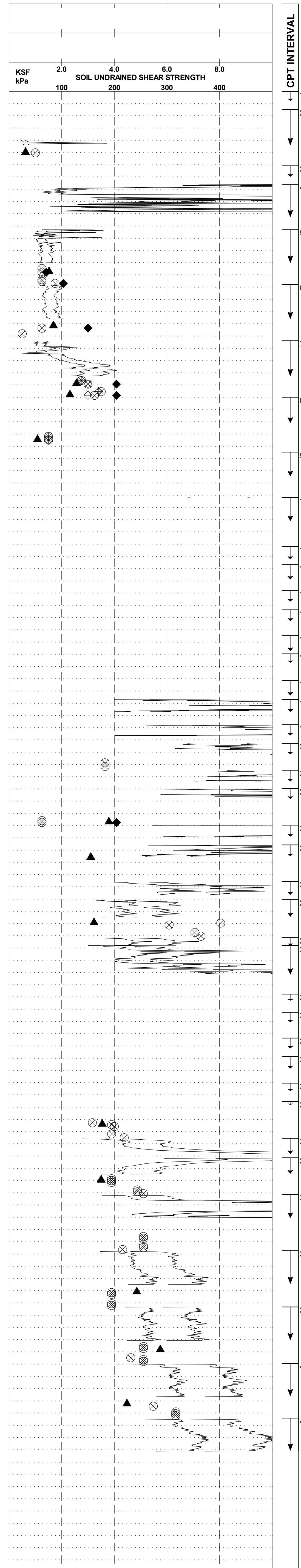
PROJECT NO: 04.81140004
BORING: BH-T2A
START DATE: 7/13/2014
COMPLETION DATE: 7/15/2014
DRILLER: FMMG
DRILLING METHOD: Mud Rotary Wash

Coordinates: N 4,082,430m E 456,198m
NAD 1983, UTM Zone 18 North, Meters

ELEVATION: -25.1 m +/- (rel. MLLW datum)

SAMPLE NO.	BLOW COUNT	MATERIAL DESCRIPTION
		Silty SAND (SM): loose to medium dense, gray.
1	PUSH	-CLAY layer, very dark greenish gray, with sand partings, 4.0m to 5.9m
2	PUSH	-with many shell fragments at 6.1m
		7.6m — Sandy Fat CLAY (CH): stiff to very stiff, gray, (possible clayey sand).
3	10/61c	-with a few shell fragments below 11.0m
		11.9m — Fat CLAY (CH): stiff to very stiff, dark gray (N4).
4	PUSH	-expansive, with gas blister and few shell fragments, 14.3m to 15.8m
5	PUSH	
6	PUSH	-with sand pockets snd shell fragments at 19.5m
7	PUSH	-soft, with few shell fragments, at 19.8m
8	PUSH	-silt partings and seams, few shell fragments, below 23.8m
9	PUSH	
		25.0m — Silty Fine SAND (SM): medium dense to dense, dark greenish gray (5G4/1), with a few shell fragments.
10	PUSH	-clayey, 25.0m to 28.0m
11	PUSH	-Fat CLAY (CH), 28.0m to 28.7m -with many shell fragments at 29.3m
12	22/61c	-Lean CLAY (CL), 32.6m to 33.2m
13	PUSH PUSH	-greenish gray (10GY5/1), Clayey SAND (SC), with many fine gravel, shells and shell fragments, 36.3m to 36.9m
14	30/61c	-with clay partings and laminae at 40.5m
15	30/30c	-with many cemented nodules (pieces of sandstones), 43.9m to 48.2m
16	30/46c	
		49.7m — Lean CLAY (CL): very stiff to hard, dark greenish gray (10G4/1).
17	PUSH	-with sand (possible sandy), 49.7m to 59.1m -with many shell fragments at 51.5m
18	30/46c	-greenish gray below 54.9m -with a few shell fragments, 54.9m to 58.8m
19	25/46c	
20	PUSH	-with sand partings, 59.4m to 64.6m
21	20/46c PUSH	
22	30/53c	-with a few shell fragments at 64.3m
23	PUSH	-expansive, with gas blisters, 67.7m to 69.2m
24	PUSH	-with sand partings and a few shell fragments at 68.9m
		72.2m — Silty Fine SAND (SM): medium dense to dense, greenish gray (5BG5/1).
25	PUSH	-with many shells and shell fragments, 72.2m to 72.8m
26	19/61c	-with a few shell fragments, 73.2m to 84.1m
27	22/61c	
28	13/61c	
		84.1m — Fat CLAY (CH): very stiff to hard, greenish gray (10G5/1).
29	PUSH	-with a few sand pockets and partings, 84.1m to 85.6m
30	PUSH	
31	PUSH	
32	PUSH	-expansive, with glas blisters, 89.6m to 93.9m
33	PUSH	-with sand partings and a few shell fragments, 93.3m to 108.5m
34	PUSH	
35	PUSH	
36	PUSH	
37	PUSH	
38	PUSH	
39	PUSH	
40	PUSH	
		TD = 111.1m





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For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING BH-T2A

Dominion VOWTAP Geotechnical Survey

FUGRO

NEARSHORE LOG (11X17) C:\USERS\DAWOODH\DESKTOP\VOWTAP_FB14B.GPJ 9/10/14 03:23 p

FIGURE A-3.1

09/10/2014 15:27

PROJECT NO: 04.81140004
BORING: BH-T2A

START DATE: 7/13/2014
COMPLETION DATE: 7/15/2014

DRILLER: FMMG
DRILLING METHOD: Mud Rotary Wash

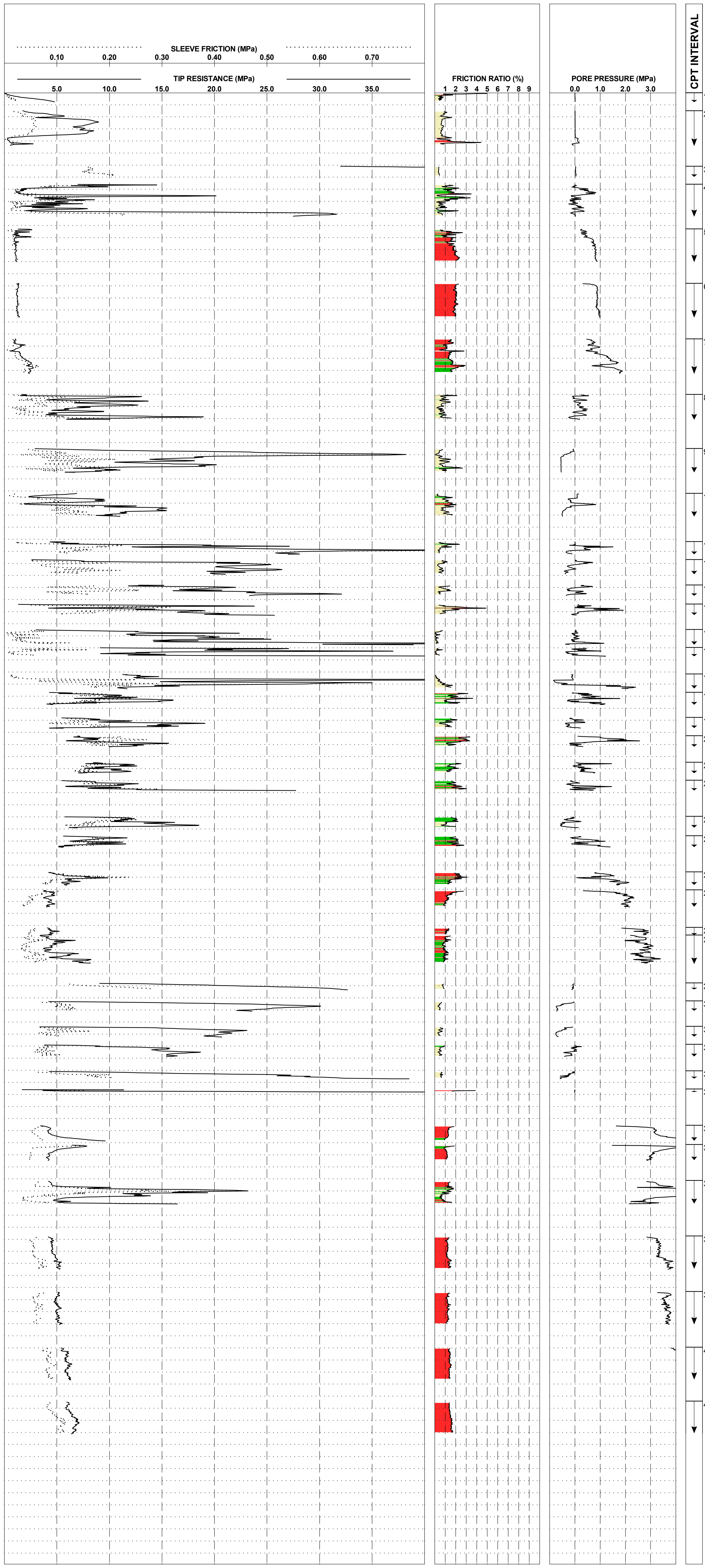
Coordinates: N 4,082,430 E 456,198

MATERIAL DESCRIPTION
MUDLINE ELEVATION: -25.1 m +/- (rel. MLLW datum)

- Silty SAND (SM): loose to medium dense, gray.
- -CLAY layer, very dark greenish gray, with sand partings, 4.0m to 5.9m — *5.9m*
- -with many shell fragments at 6.1m — *7.6m*
- Sandy Fat CLAY (CH): stiff to very stiff, gray, (possible clayey sand).
- -with a few shell fragments below 11.0m — *11.9m*
- Fat CLAY (CH): stiff to very stiff, dark gray (N4).
- -expansive, with gas blister and few shell fragments, 14.3m to 15.8m — *15.8m*
- -with sand pockets snd shell fragments at 19.5m
- -soft, with few shell fragments, at 19.8m
- -silt partings and seams, few shell fragments, below 23.8m — *25.0m*
- Silty Fine SAND (SM): medium dense to dense, dark greenish gray (5G4/1), with a few shell fragments. — *28.0m*, *28.7m*
- -clayey, 25.0m to 28.0m
- -Fat CLAY (CH), 28.0m to 28.7m
- -with many shell fragments at 29.3m — *33.2m*
- -Lean CLAY (CL), 32.6m to 33.2m
- -greenish gray (10GY5/1), Clayey SAND (SC), with many fine gravel, shells and shell fragments, 36.3m to 36.9m — *36.9m*
- -with clay partings and laminae at 40.5m
- -with many cemented nodules (pieces of sandstones), 43.9m to 48.2m — *48.2m*, *49.7m*
- Lean CLAY (CL): very stiff to hard, dark greenish gray (10G4/1).
- -with sand (possible sandy), 49.7m to 59.1m
- -with many shell fragments at 51.5m
- -greenish gray below 54.9m
- -with a few shell fragments, 54.9m to 58.8m — *58.8m*, *59.1m*
- -with sand partings, 59.4m to 64.6m — *64.6m*
- -with a few shell fragments at 64.3m
- -expansive, with gas blisters, 67.7m to 69.2m — *69.2m*
- -with sand partings and a few shell fragments at 68.9m — *72.2m*, *72.8m*
- Silty Fine SAND (SM): medium dense to dense, greenish gray (5BG5/1).
- -with many shells and shell fragments, 72.2m to 72.8m
- -with a few shell fragments, 73.2m to 84.1m — *84.1m*
- Fat CLAY (CH): very stiff to hard, greenish gray (10G5/1). — *85.6m*
- -with a few sand pockets and partings, 84.1m to 85.6m
- -expansive, with glas blisters, 89.6m to 93.9m — *93.9m*
- -with sand partings and a few shell fragments, 93.3m to 108.5m — *108.5m*

TD = 111.1m

SAMPLE NO.	BLOW COUNT
1	PUSH
2	PUSH
3	10|61c
4	PUSH
5	PUSH
6	PUSH
7	PUSH
8	PUSH
9	PUSH
10	PUSH
11	PUSH
12	22|61c
13	PUSH
14	30|61c
15	30|30c
16	30|46c
17	PUSH
18	30|46c
19	25|46c
20	PUSH
21	20|46c
22	30|53c
23	PUSH
24	PUSH
25	PUSH
26	19|61c
27	22|61c
28	13|61c
29	PUSH
30	PUSH
31	PUSH
32	PUSH
33	PUSH
34	PUSH
35	PUSH
36	PUSH
37	PUSH
38	PUSH
39	PUSH
40	PUSH



The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

CONE PENETRATION TEST RESULTS
BORING BH-T2A
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

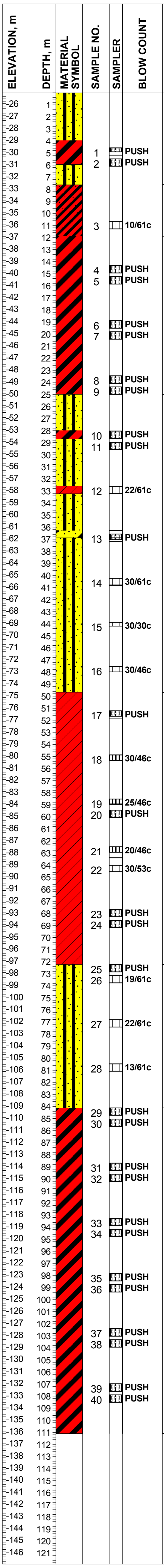
FUGRO

FIGURE A-3.2

PROJECT NO: 04.81140004
BORING: BH-T2A

START DATE: 7/13/2014
COMPLETION DATE: 7/15/2014

DRILLER: FMMG
DRILLING METHOD: Mud Rotary Wash



Coordinates: N 4,082,430 E 456,198

MATERIAL DESCRIPTION

MUDLINE ELEVATION: -25.1 m +/- (rel. MLLW datum)

Silty SAND (SM): loose to medium dense, gray.
-CLAY layer, very dark greenish gray, with sand partings, 4.0m to 5.9m *5.9m*
-with many shell fragments at 6.1m *7.6m*
Sandy Fat CLAY (CH): stiff to very stiff, gray, (possible clayey sand). *11.9m*
-with a few shell fragments below 11.0m
Fat CLAY (CH): stiff to very stiff, dark gray (N4). *15.8m*
-expansive, with gas blister and few shell fragments, 14.3m to 15.8m
-with sand pockets snd shell fragments at 19.5m
-soft, with few shell fragments, at 19.8m
-silt partings and seams, few shell fragments, below 23.8m *25.0m*
Silty Fine SAND (SM): medium dense to dense, dark greenish gray (5G4/1), with a few shell fragments. *28.0m* *28.7m*
-clayey, 25.0m to 28.0m
-Fat CLAY (CH), 28.0m to 28.7m
-with many shell fragments at 29.3m *33.2m*
-Lean CLAY (CL), 32.6m to 33.2m
-greenish gray (10GY5/1), Clayey SAND (SC), with many fine gravel, shells and shell fragments, 36.3m to 36.9m *36.9m*
-with clay partings and laminae at 40.5m
-with many cemented nodules (pieces of sandstones), 43.9m to 48.2m *48.2m*

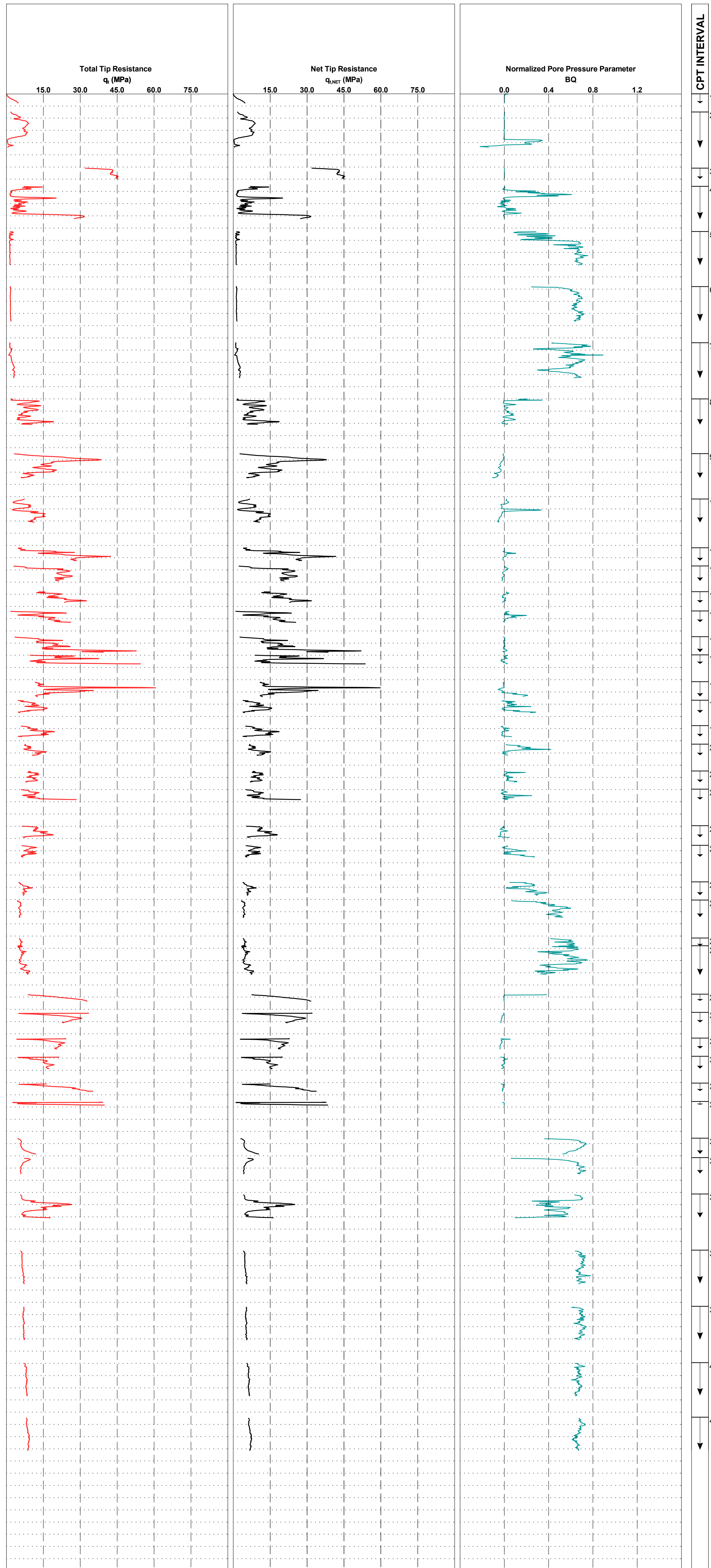
49.7m
Lean CLAY (CL): very stiff to hard, dark greenish gray (10G4/1).
-with sand (possible sandy), 49.7m to 59.1m
-with many shell fragments at 51.5m
-greenish gray below 54.9m
-with a few shell fragments, 54.9m to 58.8m *58.8m* *59.1m*
-with sand partings, 59.4m to 64.6m
-with a few shell fragments at 64.3m *64.6m*
-expansive, with gas blisters, 67.7m to 69.2m *69.2m*
-with sand partings and a few shell fragments at 68.9m *72.2m*
Silty Fine SAND (SM): medium dense to dense, greenish gray (5BG5/1). *72.8m*
-with many shells and shell fragments, 72.2m to 72.8m
-with a few shell fragments, 73.2m to 84.1m

84.1m
Fat CLAY (CH): very stiff to hard, greenish gray (10G5/1). *85.6m*
-with a few sand pockets and partings, 84.1m to 85.6m
-expansive, with glas blisters, 89.6m to 93.9m
-with sand partings and a few shell fragments, 93.3m to 108.5m *93.9m*

108.5m

TD = 111.1m

SAMPLE NO.	SAMPLER / BLOW COUNT
1	PUSH
2	PUSH
3	10/61c
4	PUSH
5	PUSH
6	PUSH
7	PUSH
8	PUSH
9	PUSH
10	PUSH
11	PUSH
12	22/61c
13	PUSH
14	30/61c
15	30/30c
16	30/46c
17	PUSH
18	30/46c
19	25/46c
20	PUSH
21	20/46c
22	30/53c
23	PUSH
24	PUSH
25	PUSH
26	19/61c
27	22/61c
28	13/61c
29	PUSH
30	PUSH
31	PUSH
32	PUSH
33	PUSH
34	PUSH
35	PUSH
36	PUSH
37	PUSH
38	PUSH
39	PUSH
40	PUSH



The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

CONE PENETRATION TEST RESULTS

BORING BH-T2A

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE A-3.3

PROJECT NO: 04.81140004
BORING: BH-T2A

START DATE: 7/13/2014
COMPLETION DATE: 7/15/2014

DRILLER: FMMG
DRILLING METHOD: Mud Rotary Wash

Coordinates: N 4,082,430 E 456,198

MATERIAL DESCRIPTION

MUDLINE ELEVATION: -25.1 m +/- (rel. MLLW datum)

SAMPLE NO.	SAMPLER / BLOW COUNT
1	PUSH
2	PUSH
3	10/61c
4	PUSH
5	PUSH
6	PUSH
7	PUSH
8	PUSH
9	PUSH
10	PUSH
11	PUSH
12	22/61c
13	PUSH
14	30/61c
15	30/30c
16	30/46c
17	PUSH
18	30/46c
19	25/46c
20	PUSH
21	20/46c
22	30/53c
23	PUSH
24	PUSH
25	PUSH
26	19/61c
27	22/61c
28	13/61c
29	PUSH
30	PUSH
31	PUSH
32	PUSH
33	PUSH
34	PUSH
35	PUSH
36	PUSH
37	PUSH
38	PUSH
39	PUSH
40	PUSH

Silty SAND (SM): loose to medium dense, gray.

-CLAY layer, very dark greenish gray, with sand partings, 4.0m to 5.9m *5.9m*
-with many shell fragments at 6.1m *7.6m*

Sandy Fat CLAY (CH): stiff to very stiff, gray, (possible clayey sand).

-with a few shell fragments below 11.0m *11.9m*

Fat CLAY (CH): stiff to very stiff, dark gray (N4).
-expansive, with gas blister and few shell fragments, 14.3m to 15.8m *15.8m*

-with sand pockets snd shell fragments at 19.5m
-soft, with few shell fragments, at 19.8m

-silt partings and seams, few shell fragments below 23.8m *25.0m*

Silty Fine SAND (SM): medium dense to dense, dark greenish gray (5G4/1), with a few shell fragments. *28.0m* *28.7m*
-clayey, 25.0m to 28.0m
-Fat CLAY (CH), 28.0m to 28.7m
-with many shell fragments at 29.3m

-Lean CLAY (CL), 32.6m to 33.2m *33.2m*

-greenish gray (10GY5/1), Clayey SAND (SC), with many fine gravel, shells and shell fragments, 36.3m to 36.9m *35.9m*

-with clay partings and laminae at 40.5m

-with many cemented nodules (pieces of sandstones), 43.9m to 48.2m

48.2m
49.7m

Lean CLAY (CL): very stiff to hard, dark greenish gray (10G4/1).
-with sand (possible sandy), 49.7m to 59.1m
-with many shell fragments at 51.5m

-greenish gray below 54.9m
-with a few shell fragments, 54.9m to 58.8m

58.8m
59.1m

-with sand partings, 59.4m to 64.6m

-with a few shell fragments at 64.3m *64.6m*

-expansive, with gas blisters, 67.7m to 69.2m
-with sand partings and a few shell fragments at 68.9m *69.2m*

72.2m
72.8m

Silty Fine SAND (SM): medium dense to dense, greenish gray (5BG5/1).
-with many shells and shell fragments, 72.2m to 72.8m
-with a few shell fragments, 73.2m to 84.1m

84.1m

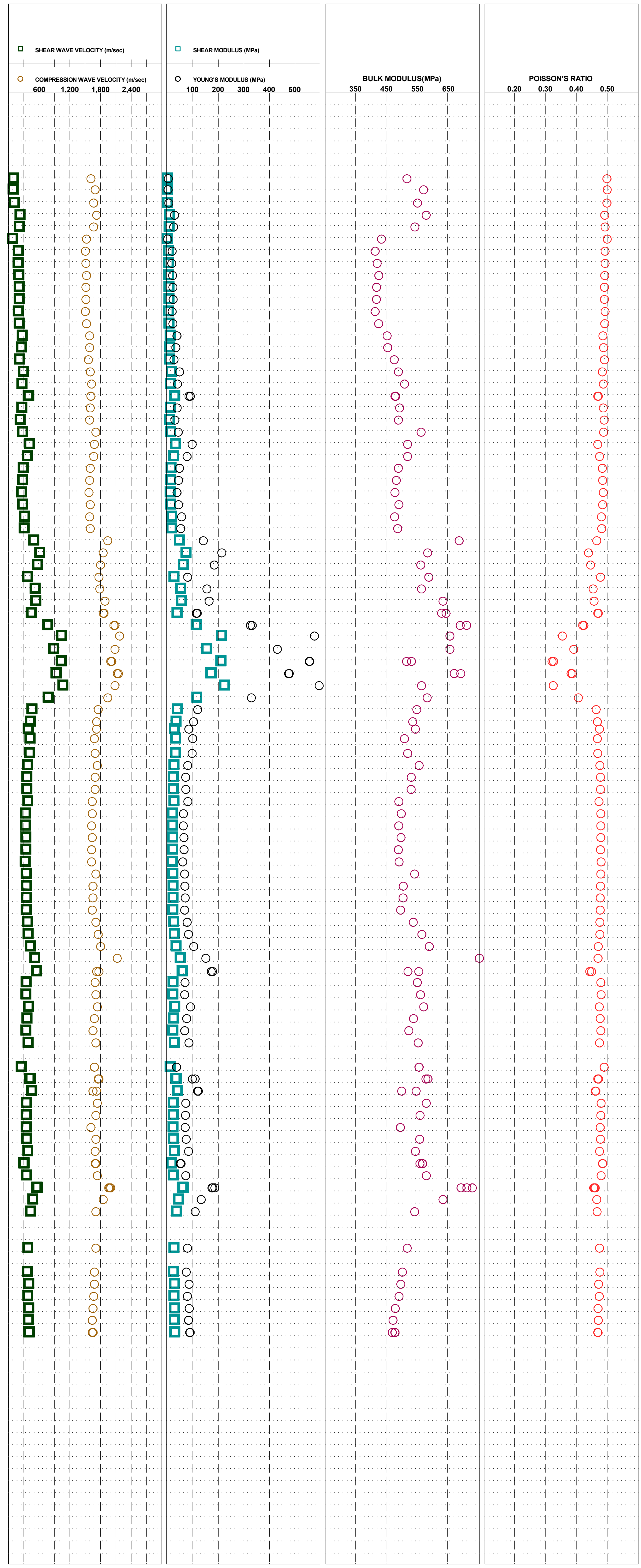
Fat CLAY (CH): very stiff to hard, greenish gray (10G5/1). *85.6m*
-with a few sand pockets and partings, 84.1m to 85.6m

-expansive, with glas blisters, 89.6m to 93.9m

-with sand partings and a few shell fragments, 93.3m to 108.5m *93.9m*

108.5m

TD = 111.1m



The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND SUSPENSION LOGGING DATA

BORING BH-T2A

Dominion VOWTAP Geotechnical Survey

FIGURE A-3.4

09/10/2014 15:23

PROJECT NO: 04.81140004
BORING: BH-T2B
START DATE: 7/18/2014
COMPLETION DATE: 7/19/2014
DRILLER: FMMG
DRILLING METHOD: Mud Rotary Wash

Coordinates: N 4,082,430m E 456,482m
NAD 1983, UTM Zone 18 North, Meters

ELEVATION, m | DEPTH, m | MATERIAL SYMBOL | SAMPLE NO. | SAMPLER | BLOW COUNT

MATERIAL DESCRIPTION

ELEVATION: -26.4 m +/- (rel. MLLW datum)

Silty Fine SAND (SM): loose to medium dense, very dark gray (N3).
-with a few shell fragments at 1.5m
-with clay laminae and lenses, 2.0m to 3.0m
-with pockets of organic matters and H2S odor at 2.7m
3.0m

Sandy Fat CLAY (CH): firm to very stiff, dark gray (N4).
-with shell fragments, 6.1m to 7.6m
-with a sand seam at 7.6m
-with sand laminae and lenses at 11.0m
11.6m

Fat CLAY (CH): firm to very stiff, dark gray (N4).
-with a few sand pockets and a few shell fragments, 11.6m to 16.5m
-with many shell fragments at 17.1m
-with many silt pockets and partings at 20.7m
24.7m

Clayey Fine SAND (SC): medium dense to dense, gray (N5).
-with a few shell fragments, 24.7m to 25.6m
-silty clay layer, 32.3m to 32.9m
-medium grained, with many gravel pieces and shell fragments, at 36.0m
-with a few cemented nodules (pieces of sandstone), 39.6m to 47.5m
-with a few shell fragments, 42.7m to 47.5m
-medium sand, 43.3m to 47.5m
47.5m

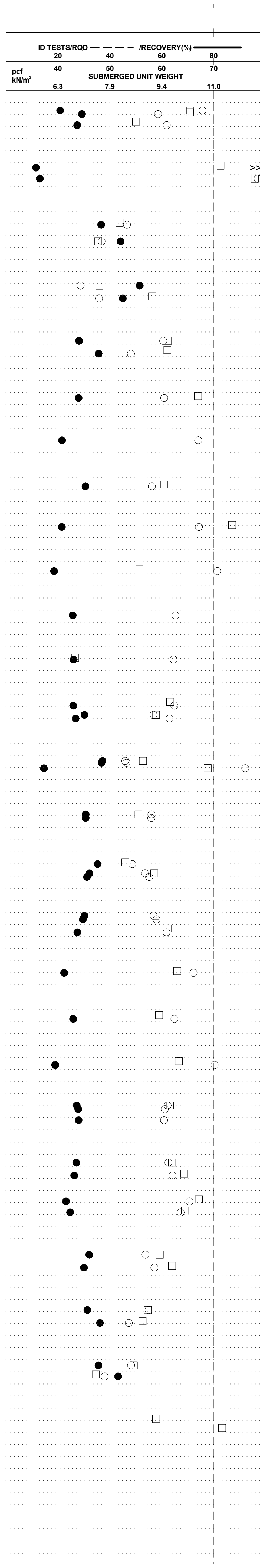
Lean CLAY (CL): very stiff to hard, gray (N5).
-sandy, 47.6m to 55.2m
-with few shell fragments, 50.6m to 69.8m
-greenish gray below 51.5m
-with sand partings, 55.2m to 69.8m
-with sand seams and cemented nodules (piece of sandstone) at 56.1m
-with gas blisters, 64.6m to 69.8m
72.8m

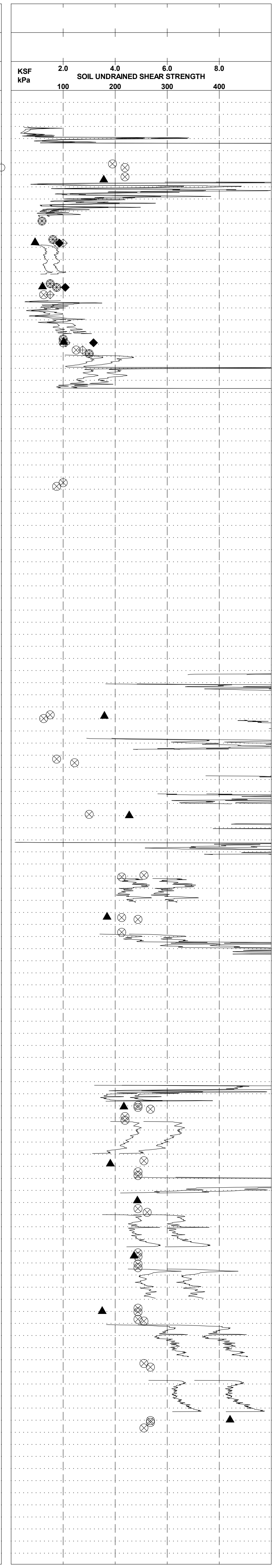
Silty Fine SAND (SM): medium dense to dense, greenish gray (10GY5/1), with many shell fragments.
82.3m

Lean CLAY (CL): very stiff to hard, greenish gray (10GY5/1).
-with sand partings at 84.1m
-with sand partings and laminae and many shell fragments at 91.7m
-with a few shell fragments, 92.4m to 96.6m
-with a few sand pockets at 92.7m
-expansive, with gas blisters, 96.9m to 102.1m
-with a few shell fragments, 100.6m to 102.1m
-with a few sand pockets and a few shell fragments at 110.0m
-with many sand partings and laminae and many shells and shell fragments at 363' at 110.6m

TD = 112.7m

Sample No.	Sampler / Blow Count
1	15/61c
2	PUSH
3	PUSH
4	PUSH
5	PUSH
	PUSH
6	PUSH
7	PUSH
8	PUSH
9	PUSH
10	PUSH
11	19/61c
12	30/46c
13	17/61c
14	24/56c
15	21/41c
16	30/51c
17	30/51c
18	30/46c
19	PUSH
20	PUSH
21	30/30c
22	PUSH
23	25/61c
24	PUSH
25	PUSH
26	PUSH
27	30/46c
28	20/46c
29	25/61c
30	PUSH
31	PUSH
32	PUSH
33	PUSH
34	PUSH
35	PUSH
36	PUSH
37	PUSH
38	PUSH
39	PUSH
40	PUSH
41	PUSH
42	PUSH
43	PUSH





CPT INTERVAL

The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING BH-T2B

Dominion VOWTAP Geotechnical Survey

FUGRO

NEARSHORE LOG (11X17) C:\USERS\DAWOODH\DESKTOP\VOWTAP_FB14B.GPJ 9/10/14 03:23 p

FIGURE A-4.1

09/10/2014 15:27

PROJECT NO: 04.81140004
BORING: BH-T2B

START DATE: 7/18/2014
COMPLETION DATE: 7/19/2014

DRILLER: FMMG
DRILLING METHOD: Mud Rotary Wash

Coordinates: N 4,082,430 E 456,482

SAMPLE NO.	SAMPLER	BLOW COUNT
1		15|61c
2		PUSH
3		PUSH
4		PUSH
5		PUSH
6		PUSH
7		PUSH
8		PUSH
9		PUSH
10		PUSH
11		19|61c
12		30|46c
13		17|61c
14		24|56c
15		21|41c
16		30|51c
17		30|51c
18		30|46c
19		PUSH
20		PUSH
21		30|30c
22		PUSH
23		25|61c
24		PUSH
25		PUSH
26		PUSH
27		30|46c
28		20|46c
29		25|61c
30		PUSH
31		PUSH
32		PUSH
33		PUSH
34		PUSH
35		PUSH
36		PUSH
37		PUSH
38		PUSH
39		PUSH
40		PUSH
41		PUSH
42		PUSH
43		PUSH

MATERIAL DESCRIPTION

MUDLINE ELEVATION: -26.4 m +/- (rel. MLLW datum)

Silty Fine SAND (SM): loose to medium dense, very dark gray (N3).
-with a few shell fragments at 1.5m
-with clay laminae and lenses, 2.0m to 3.0m
-with pockets of organic matters and H2S odor at 2.7m

3.0m

Sandy Fat CLAY (CH): firm to very stiff, dark gray (N4).
-with shell fragments, 6.1m to 7.6m
-with a sand seam at 7.6m
-with sand laminae and lenses at 11.0m

7.6m

11.6m

Fat CLAY (CH): firm to very stiff, dark gray (N4).
-with a few sand pockets and a few shell fragments, 11.6m to 16.5m
-with many shell fragments at 17.1m
-with many silt pockets and partings at 20.7m

16.5m

24.7m

25.6m

Clayey Fine SAND (SC): medium dense to dense, gray (N5).
-with a few shell fragments, 24.7m to 25.6m

-silty clay layer, 32.3m to 32.9m

32.9m

-medium grained, with many gravel pieces and shell fragments, at 36.0m

-with a few cemented nodules (pieces of sandstone), 39.6m to 47.5m
-with a few shell fragments, 42.7m to 47.5m
-medium sand, 43.3m to 47.5m

47.5m

Lean CLAY (CL): very stiff to hard, gray (N5).
-sandy, 47.6m to 55.2m
-with few shell fragments, 50.6m to 69.8m
-greenish gray below 51.5m

55.2m

-with sand partings, 55.2m to 69.8m
-with sand seams and cemented nodules (piece of sandstone) at 56.1m

-with gas blisters, 64.6m to 69.8m

69.8m

72.8m

Silty Fine SAND (SM): medium dense to dense, greenish gray (10GY5/1), with many shell fragments.

82.3m

Lean CLAY (CL): very stiff to hard, greenish gray (10GY5/1).
-with sand partings at 84.1m

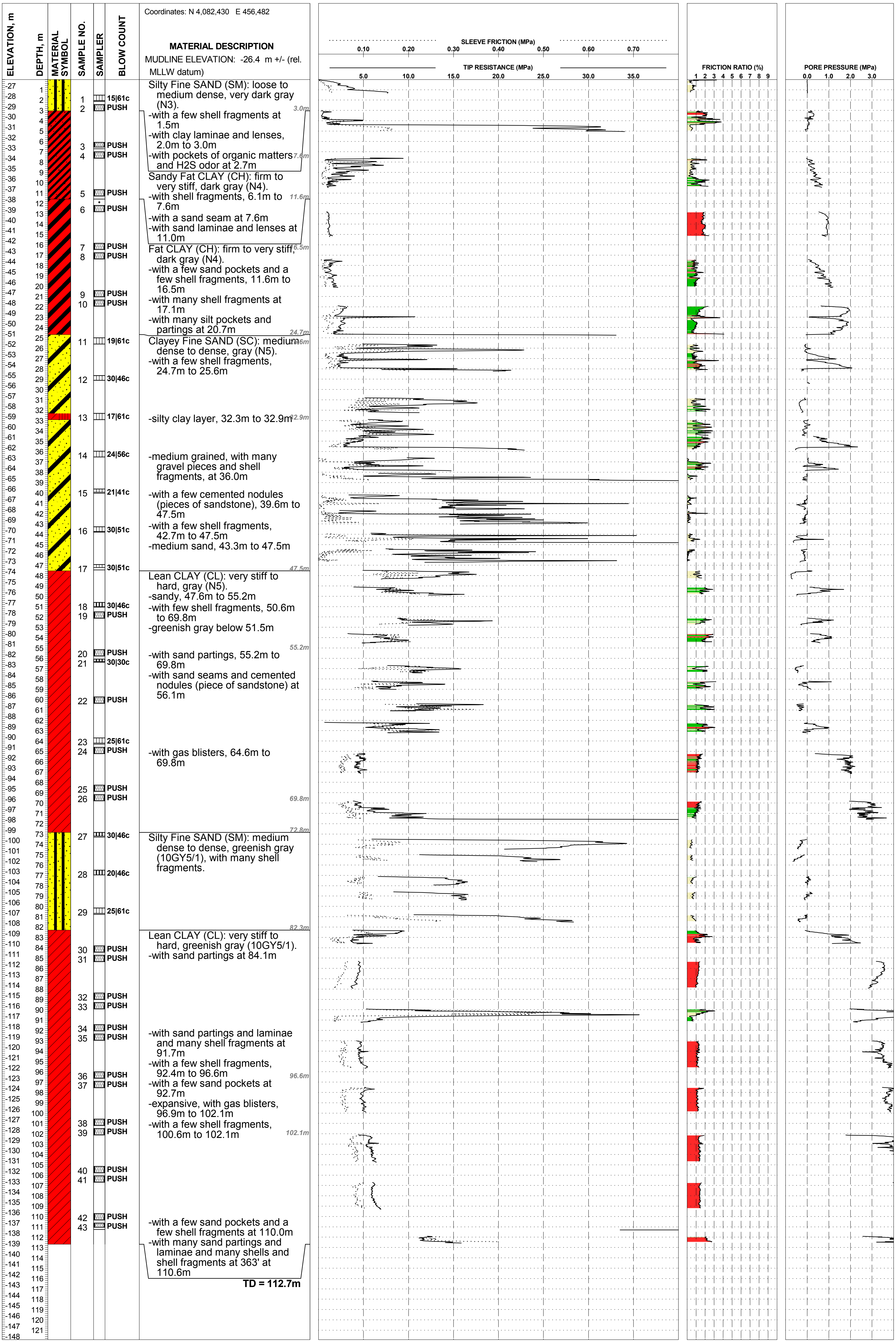
-with sand partings and laminae and many shell fragments at 91.7m
-with a few shell fragments, 92.4m to 96.6m
-with a few sand pockets at 92.7m
-expansive, with gas blisters, 96.9m to 102.1m
-with a few shell fragments, 100.6m to 102.1m

96.6m

102.1m

-with a few sand pockets and a few shell fragments at 110.0m
-with many sand partings and laminae and many shells and shell fragments at 363' at 110.6m

TD = 112.7m



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For symbol identification, refer to Key to Terms & Symbols Used on Logs.

CONE PENETRATION TEST RESULTS

BORING BH-T2B

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

FUGRO

FIGURE A-4.2

PROJECT NO:	04.81140004	START DATE:	7/18/2014	DRILLER:	FMMG
BORING:	BH-T2B	COMPLETION DATE:	7/19/2014	DRILLING METHOD:	Mud Rotary Wash

Coordinates: N 4,082,430 E 456,482

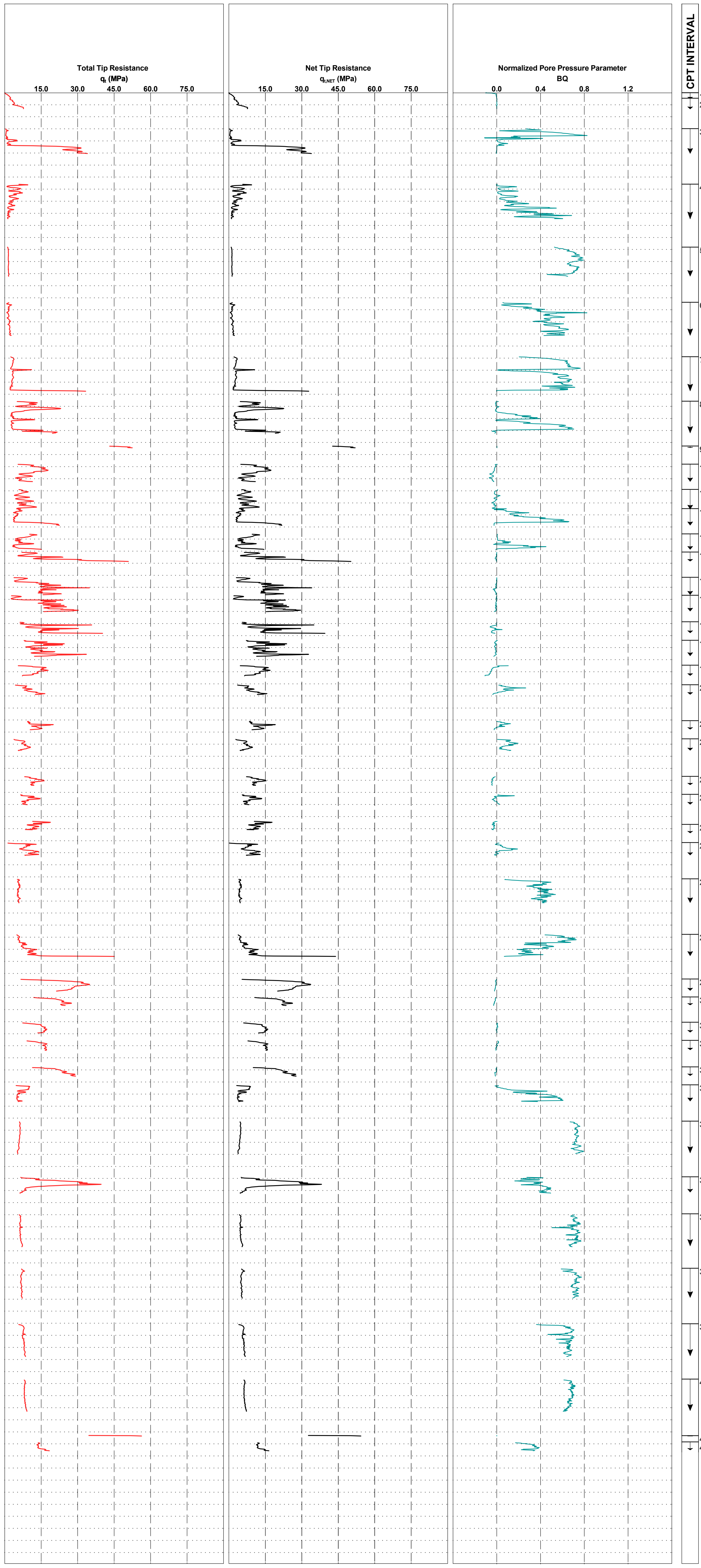
MATERIAL DESCRIPTION

MUDLINE ELEVATION: -26.4 m +/- (rel. MLLW datum)

SAMPLE NO.	BLOW COUNT
1	15/61c
2	PUSH
3	PUSH
4	PUSH
5	PUSH
6	PUSH
7	PUSH
8	PUSH
9	PUSH
10	PUSH
11	19/61c
12	30/46c
13	17/61c
14	24/56c
15	21/41c
16	30/51c
17	30/51c
18	30/46c
19	PUSH
20	PUSH
21	30/30c
22	PUSH
23	25/61c
24	PUSH
25	PUSH
26	PUSH
27	30/46c
28	20/46c
29	25/61c
30	PUSH
31	PUSH
32	PUSH
33	PUSH
34	PUSH
35	PUSH
36	PUSH
37	PUSH
38	PUSH
39	PUSH
40	PUSH
41	PUSH
42	PUSH
43	PUSH

Silty Fine SAND (SM): loose to medium dense, very dark gray (N3).
-with a few shell fragments at 1.5m
3.0m
-with clay laminae and lenses, 2.0m to 3.0m
-with pockets of organic matters and H2S odor at 2.7m
7.6m
Sandy Fat CLAY (CH): firm to very stiff, dark gray (N4).
-with shell fragments, 6.1m to 7.6m
11.6m
-with a sand seam at 7.6m
-with sand laminae and lenses at 11.0m
16.5m
Fat CLAY (CH): firm to very stiff, dark gray (N4).
-with a few sand pockets and a few shell fragments, 11.6m to 16.5m
-with many shell fragments at 17.1m
-with many silt pockets and partings at 20.7m
24.7m
25.6m
Clayey Fine SAND (SC): medium dense to dense, gray (N5).
-with a few shell fragments, 24.7m to 25.6m
-silty clay layer, 32.3m to 32.9m *32.9m*
-medium grained, with many gravel pieces and shell fragments, at 36.0m
-with a few cemented nodules (pieces of sandstone), 39.6m to 47.5m
-with a few shell fragments, 42.7m to 47.5m
-medium sand, 43.3m to 47.5m
47.5m
Lean CLAY (CL): very stiff to hard, gray (N5).
-sandy, 47.6m to 55.2m
-with few shell fragments, 50.6m to 69.8m
-greenish gray below 51.5m
55.2m
-with sand partings, 55.2m to 69.8m
-with sand seams and cemented nodules (piece of sandstone) at 56.1m
-with gas blisters, 64.6m to 69.8m
69.8m
72.8m
Silty Fine SAND (SM): medium dense to dense, greenish gray (10GY5/1), with many shell fragments.
82.3m
Lean CLAY (CL): very stiff to hard, greenish gray (10GY5/1).
-with sand partings at 84.1m
-with sand partings and laminae and many shell fragments at 91.7m
-with a few shell fragments, 92.4m to 96.6m *96.6m*
-with a few sand pockets at 92.7m
-expansive, with gas blisters, 96.9m to 102.1m
-with a few shell fragments, 100.6m to 102.1m *102.1m*
-with a few sand pockets and a few shell fragments at 110.0m
-with many sand partings and laminae and many shells and shell fragments at 363' at 110.6m

TD = 112.7m



The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

CONE PENETRATION TEST RESULTS

BORING BH-T2B

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

FIGURE A-4.3

CPT METRIC-SCALED COLUMNS (QTNET-Q-BQ) N:\PROJECTS\04_2014\04_8114_0004_VOWTAP_GEOTECH\EXPLORATIONS\GINT\2014\VOWTAP_FB14B.GPJ 9/15/14 09:29 a

PROJECT NO:	04.81140004	**START DATE:**	7/18/2014	**DRILLER:**	FMMG
BORING:	BH-T2B	**COMPLETION DATE:**	7/19/2014	**DRILLING METHOD:**	Mud Rotary Wash

Coordinates: N 4,082,430 E 456,482

MATERIAL DESCRIPTION

MUDLINE ELEVATION: -26.4 m +/- (rel. MLLW datum)

SAMPLE NO.	BLOW COUNT
1	15/61c
2	PUSH
3	PUSH
4	PUSH
5	PUSH
6	PUSH
7	PUSH
8	PUSH
9	PUSH
10	PUSH
11	19/61c
12	30/46c
13	17/61c
14	24/56c
15	21/41c
16	30/51c
17	30/51c
18	30/46c
19	PUSH
20	PUSH
21	30/30c
22	PUSH
23	25/61c
24	PUSH
25	PUSH
26	PUSH
27	30/46c
28	20/46c
29	25/61c
30	PUSH
31	PUSH
32	PUSH
33	PUSH
34	PUSH
35	PUSH
36	PUSH
37	PUSH
38	PUSH
39	PUSH
40	PUSH
41	PUSH
42	PUSH
43	PUSH

Silty Fine SAND (SM): loose to medium dense, very dark gray (N3).
-with a few shell fragments at 1.5m
-with clay laminae and lenses, 2.0m to 3.0m
-with pockets of organic matters and H2S odor at 2.7m *3.0m*

Sandy Fat CLAY (CH): firm to very stiff, dark gray (N4).
-with shell fragments, 6.1m to 7.6m
-with a sand seam at 7.6m *7.6m*

-with sand laminae and lenses at 11.0m *11.6m*

Fat CLAY (CH): firm to very stiff, dark gray (N4).
-with a few sand pockets and a few shell fragments, 11.6m to 16.5m *16.5m*
-with many shell fragments at 17.1m
-with many silt pockets and partings at 20.7m *24.7m*

Clayey Fine SAND (SC): medium dense to dense, gray (N5). *25.6m*
-with a few shell fragments, 24.7m to 25.6m
-silty clay layer, 32.3m to 32.9m *32.9m*
-medium grained, with many gravel pieces and shell fragments, at 36.0m
-with a few cemented nodules (pieces of sandstone), 39.6m to 47.5m
-with a few shell fragments, 42.7m to 47.5m
-medium sand, 43.3m to 47.5m *47.5m*

Lean CLAY (CL): very stiff to hard, gray (N5).
-sandy, 47.6m to 55.2m
-with few shell fragments, 50.6m to 69.8m
-greenish gray below 51.5m *55.2m*
-with sand partings, 55.2m to 69.8m
-with sand seams and cemented nodules (piece of sandstone) at 56.1m
-with gas blisters, 64.6m to 69.8m *69.8m*

72.8m

Silty Fine SAND (SM): medium dense to dense, greenish gray (10GY5/1), with many shell fragments. *82.3m*

Lean CLAY (CL): very stiff to hard, greenish gray (10GY5/1).
-with sand partings at 84.1m
-with sand partings and laminae and many shell fragments at 91.7m
-with a few shell fragments, 92.4m to 96.6m
-with a few sand pockets at 92.7m *96.6m*
-expansive, with gas blisters, 96.9m to 102.1m
-with a few shell fragments, 100.6m to 102.1m *102.1m*
-with a few sand pockets and a few shell fragments at 110.0m
-with many sand partings and laminae and many shells and shell fragments at 363' at 110.6m

TD = 112.7m

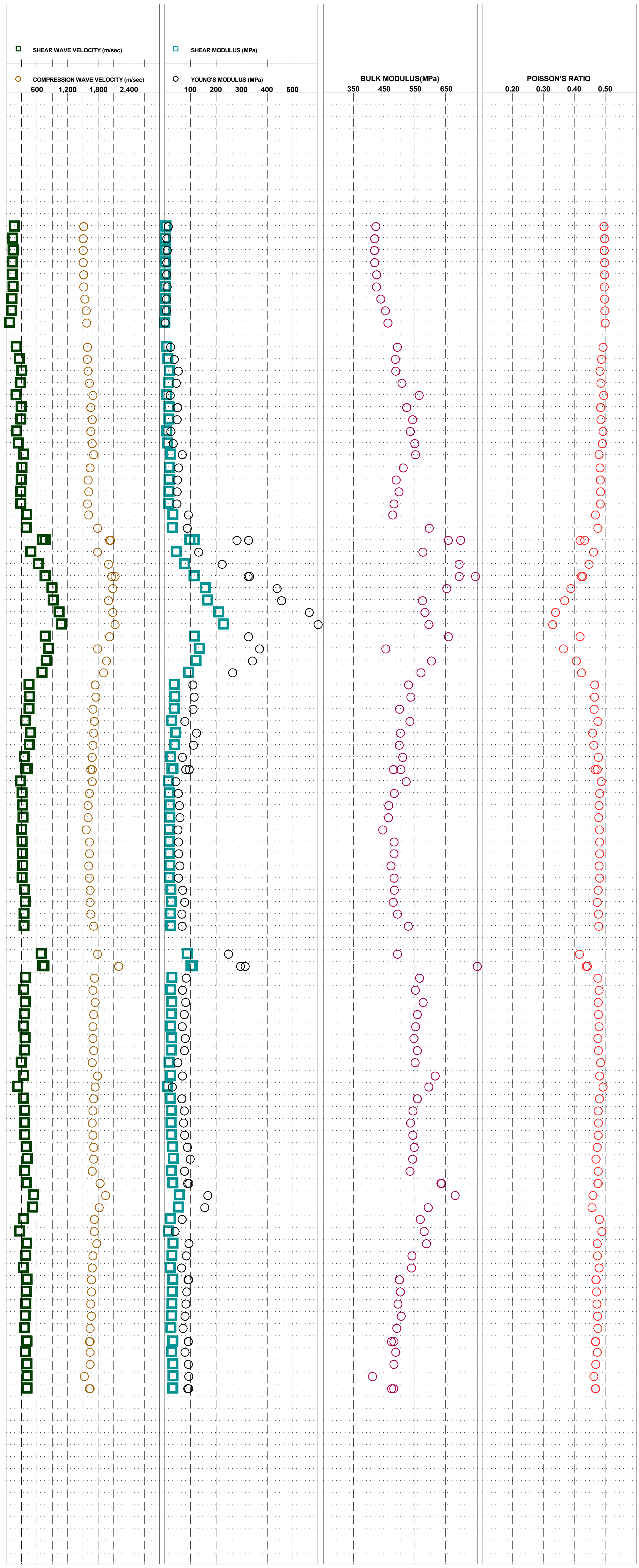


FIGURE A-4.4

The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND SUSPENSION LOGGING DATA

BORING BH-T2B

Dominion VOWTAP Geotechnical Survey

FUGRO

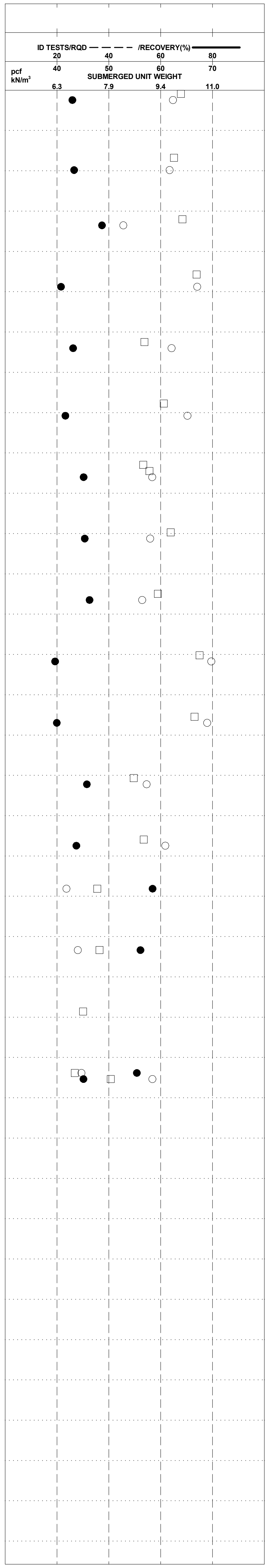
PROJECT NO: 04.81140004
BORING: NB-1
START DATE: 7/11/2014
COMPLETION DATE: 7/11/2014
DRILLER: FMMG
DRILLING METHOD: Mud Rotary Wash

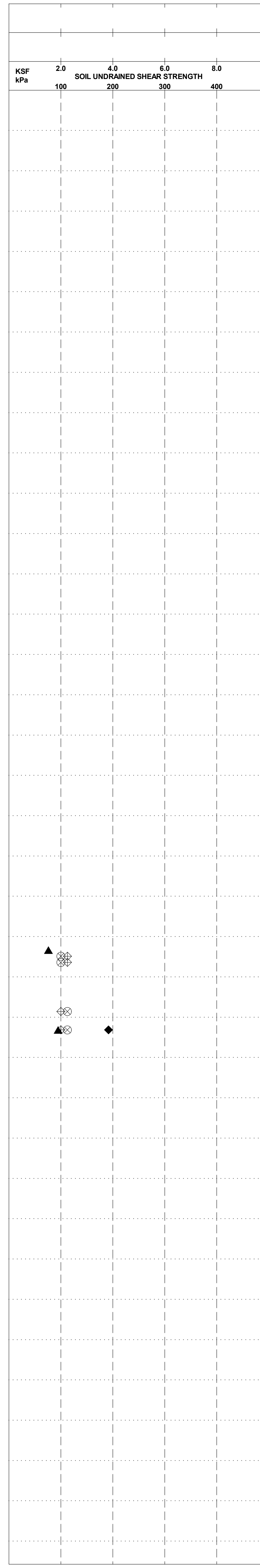
Coordinates: N 4,074,817m E 414,026m
NAD 1983, UTM Zone 18 North, Meters

ELEVATION: -3.7 m +/- (rel. MLLW datum)

SAMPLE NO.	BLOW COUNT	MATERIAL DESCRIPTION
1	13/24"	Silty Fine SAND (SM): loose to medium dense, dark gray (N4). -with a few shell fragments at 0.0m -with clay partings at 0.4m
2	15/24"	-with many clay laminae and lenses at 1.8m -with shell fragments at 2.1m
3	12/24"	-with clay lenses and seams at 3.4m
4	30/22"	
5	16/24"	-with clay laminae and lenses, 6.1m to 10.7m
6	23/24"	-with clay seams at 7.9m
7	17/24"	-with shell fragments at 9.4m
8	12/24"	10.7m Clayey SAND (SC): loose to medium dense, dark gray (N4).
9	10/24"	Silty SAND (SM). -with a few shell fragments, 12.2m to 16.8m
10	26/24"	
11	13/24"	-with a piece of sandstone at 15.5m
12	23/24"	16.8m Poorly graded Fine SAND (SP): medium dense to dense, dark gray (N4), with many clay partings and laminae.
13	29/24"	
14	29/24"	-with clay lenses at 20.1m
15	PUSH	21.3m Fat CLAY with sand (CH): stiff to very stiff, dark greenish gray (10Y4/1), expansive, with gas bliseters, and with silt and sand partings.
16	PUSH	
17	PUSH	24.5m Poorly graded Fine SAND (SP).

TD = 24.7m





CPT INTERVAL

The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING NB-1

Dominion VOWTAP Geotechnical Survey

FIGURE A-5

PROJECT NO: 04.81140004
BORING: NB-3

START DATE: 7/12/2014
COMPLETION DATE: 7/12/2014

DRILLER: FMMG
DRILLING METHOD: Mud Rotary Wash

Coordinates: N 4,074,909m E 414,230m
NAD 1983, UTM Zone 18 North, Meters

ELEVATION: -6.1 m +/- (rel. MLLW datum)

SAMPLE NO.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION
1		7/24"	Silty Fine SAND (SM): loose to medium dense, gray (N5). -dark at mudline at 0.0m -with very soft, high plasticity clay seams, 0.1m to 3.7m
2		25/24"	
3		30/20"	-with shell fragments, 3.0m to 12.8m
4		20/24"	-with clay partings and laminae, 4.6m to 5.2m
5		PUSH	-with clay lenses, 6.1m to 6.4m -dark greenish gray (10Y4/1) at 6.1m
6		10/24"	
7		5/24"	-with clay partings and laminae, and pockets of organic matter, at 9.4m
8		15/24"	-with few shell fragments, 10.7m to 12.8m
9		25/24"	-with clay pockets at 12.5m
			13.7m
10		20/24"	Clayey SAND (SC): loose to medium dense, gray (N5), with shell fragments.
11		15/24"	-with clay partings, laminae and lenses, 15.2m to 17.4m -with a seam of fine to medium sand at 15.5m
12		15/24"	
			18.3m
13		30/24"	Fat CLAY (CH): stiff to very stiff, dark greenish gray (10Y4/1), expansive, with sand partings.
14		PUSH	
			20.7m
15		30/18"	Poorly graded Fine to Medium SAND (SP): dense to very dense, gray (N5). -with clay partings, 20.8m to 23.5m
16		30/18"	
17		30/12"	-with clay pockets and a few shell fragments at 24.4m -medium sand, 24.4m to 29.0m
18		30/18"	
19		30/6"	
20		30/12"	-with laminae and lenses of clay at 29.0m
21		30/12"	-medium sand at 30.3m

ELEVATION, m: -7 to -42; DEPTH, m: 1 to 36

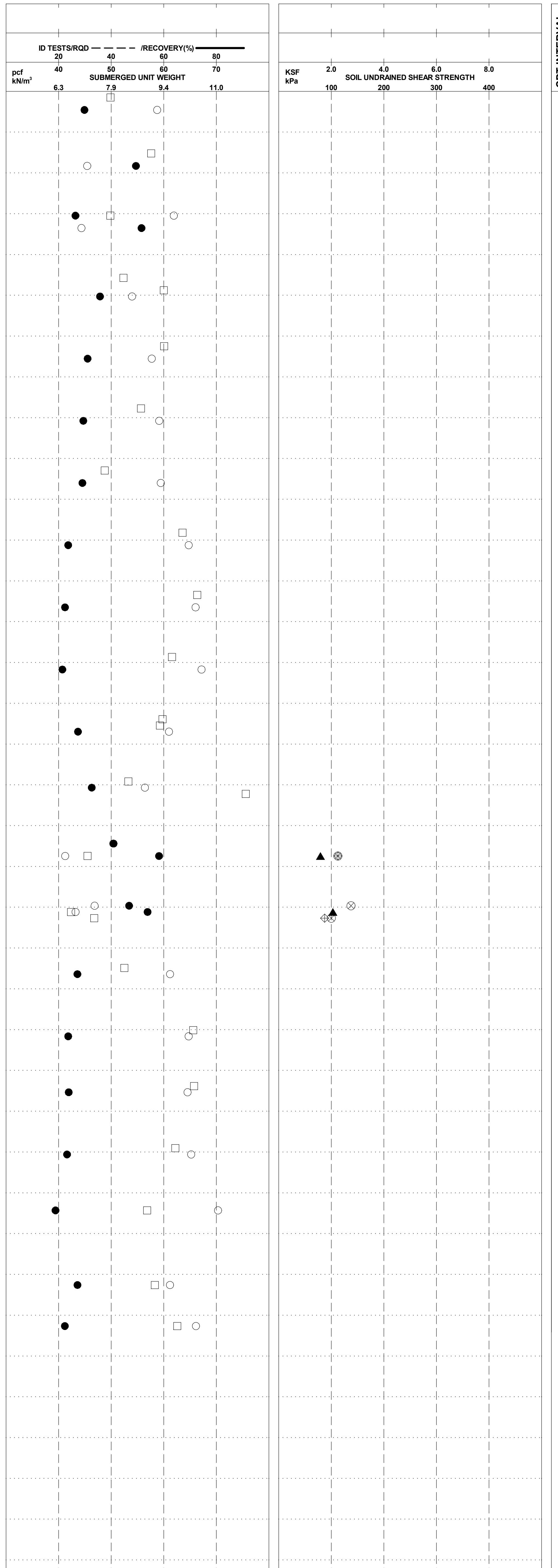


FIGURE A-6

The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING NB-3

Dominion VOWTAP Geotechnical Survey

FUGRO

08/05/2014 23:40

PROJECT NO:	04.81140004	**START DATE:**	7/11/2014	**DRILLER:**	FMMG
BORING:	NB-5	**COMPLETION DATE:**	7/11/2014	**DRILLING METHOD:**	Mud Rotary Wash

Coordinates: N 4,074,939m E 414,403m
NAD 1983, UTM Zone 18 North, Meters

ELEVATION: -7.6 m +/- (rel. MLLW datum)

SAMPLE NO.	BLOW COUNT	MATERIAL DESCRIPTION
1	15/24"	Silty Fine SAND (SM): loose to medium dense, very dark bluish gray (10B3/1). -with shell fragments, 0.0m to 2.1m -clayey, 0.0m to 0.6m
2	27/24"	-with clay lenses, 1.5m to 3.7m
3	30/20"	
4	25/24"	-with shell fragments and a seam of medium sand at 4.6m (4.9m)
		(5.7m) Clayey SAND (SC): loose to medium dense, very dark bluish gray (10B3/1), possible sandy clay. -with shell fragments, 4.9m to 15.8m
5	PUSH	Clayey SAND (SC): very dark bluish gray (10B3/1). -with a few shell fragments at 6.2m
6	10/24"	-with a few shell frgments at 7.9m
7	10/24"	(9.1m) Poorly graded Fine SAND (SP): very dark bluish gray (10B3/1), with a few shell frgments.
8	10/24"	
		(11.3m) Clayey Fine SAND (SC): very dark bluish gray (10B3/1), with a few shell fragments.
9	10/24"	
10	18/24"	
11	15/24"	-seam of medium sand at 15.2m -medium grains below 15.5m -sandy Fat CLAY s(CL), 15.7m to 15.8m
12	PUSH	(16.8m) Sandy Lean CLAY (CL): stiff to very stiff, gray (N5), with many shell fragments. (17.4m) Fat CLAY (CH): dark gray (N4).
13	25/24"	-with sand partings at 18.6m
14	30/20"	(19.8m) Poorly graded Medium SAND (SP): medium dense to dense, dark gray (N4). -with clay lenses, 19.8m to 20.1m
15	30/18"	-black (N25), with clay partings, at 21.3m
16	30/12"	
17	30/12"	-with clay partings and a few shell fragments at 24.4m
18	30/12"	
19	30/18"	-silty, fine to medium, gray (N4) and grayish green (5G4/2), at 27.4m
20	30/20"	-with a few shell frgments at 29.0m -fine to medium, gray (N4) and grayish green (5G4/2), below 29.3m
21	30/12"	

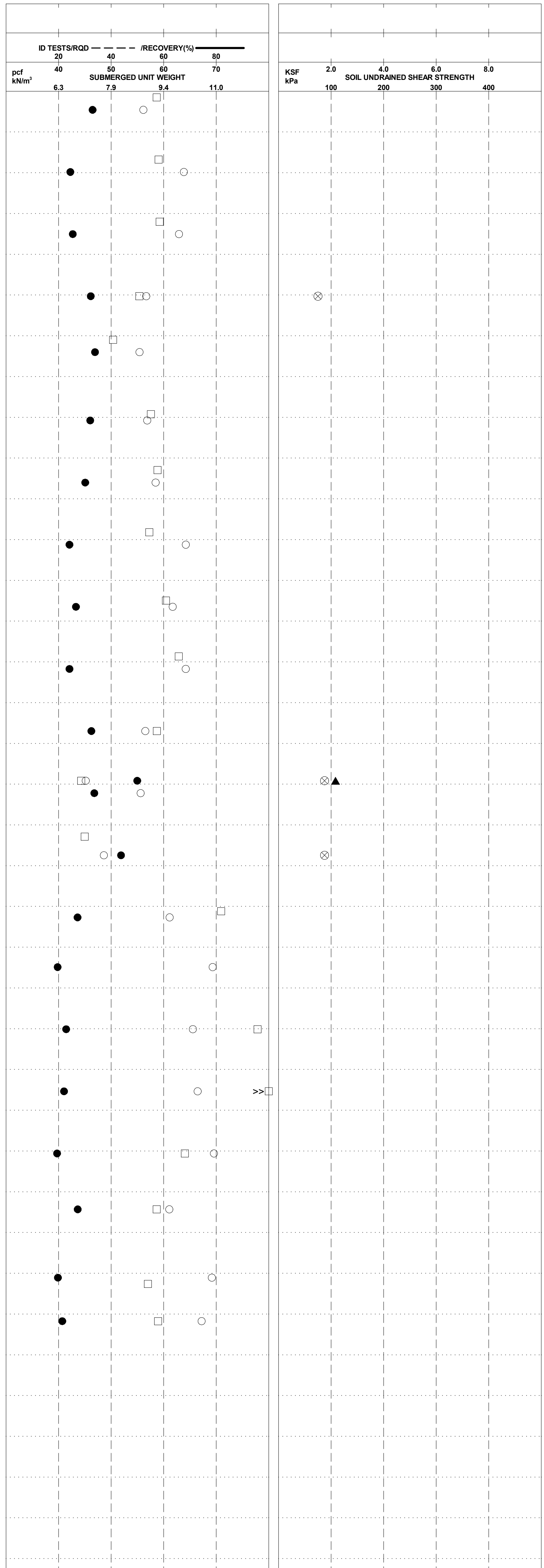


FIGURE A-7

The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING NB-5

Dominion VOWTAP Geotechnical Survey

FUGRO

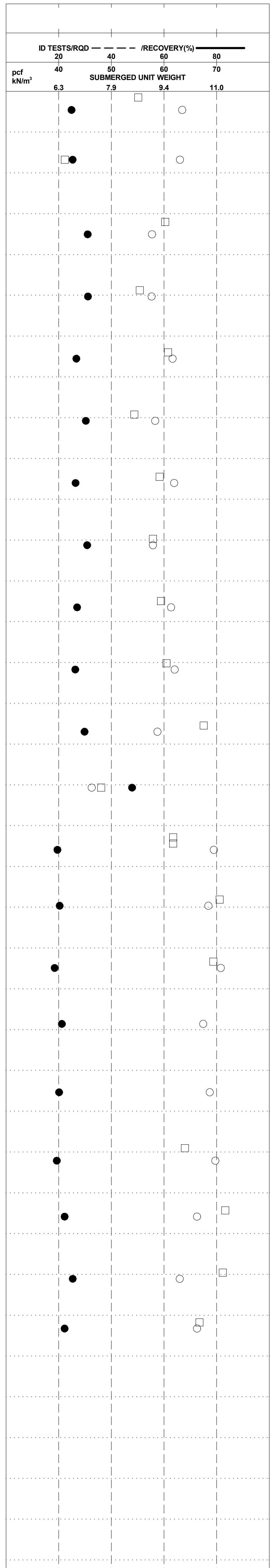
NEARSHORE LOG (11X17) N:\PROJECTS\04 2014\04 8114 0004 VOWTAP GEOTECH\EXPLORATIONS\GINT\2014\VOWTAP FB14B.GPJ 08/05/14 11:40 p

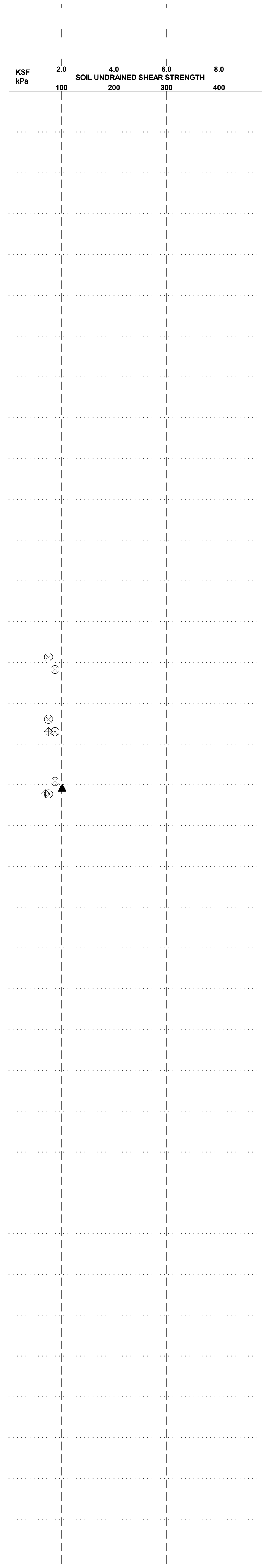
PROJECT NO:	04.81140004	**START DATE:**	7/10/2014	**DRILLER:**	FMMG
BORING:	NB-7	**COMPLETION DATE:**	7/10/2014	**DRILLING METHOD:**	Mud Rotary Wash

Coordinates: N 4,074,965m E 414,554m
NAD 1983, UTM Zone 18 North, Meters

ELEVATION, m	DEPTH, m	SAMPLE NO.	SAMPLER	BLOW COUNT	MATERIAL DESCRIPTION
					ELEVATION: -7.4 m +/- (rel. MLLW datum)
	0.0	1		15/24"	Silty Fine SAND (SM): loose, dark bluish gray (10B4/1). -clayey at 0.0m -with a few shell fragments, 0.0m to 0.6m
		2		15/24"	-with clay laminae and lenses at 1.5m
	2.1m				Clayey Fine SAND (SC): loose, dark bluish gray (10B4/1).
		3		14/24"	
		4		10/24"	-with a few shell fragments, 4.6m to 12.8m
		5		12/24"	
		6		7/24"	
		7		17/24"	
		8		9/24"	
		9		15/24"	
	12.8m				Sandy Lean CLAY (CL): firm to stiff, dark bluish gray (10B4/1), with a few shell fragments.
		10		14/24"	
		11		PUSH	
	16.8m	12		PUSH	Fat CLAY (CH): with many sand laminae and lenses and shell fragments.
	18.0m	13		30/22"	Clayey Fine SAND (SC): medium dense to dense, dark bluish gray (10B4/1). -with a few shell fragments, 18.0m to 21.6m -with clay and a few pieces of gravel at 18.3m
		14		30/22"	-fine to medium grained below 19.8m
		15		30/16"	
		16		30/18"	-with a few pieces of gravel, 22.9m to 24.7m
		17		30/12"	
		18		30/18"	
		19		30/15"	
		20		30/12"	-with a few shell fragments at 29.0m
		21		30/18"	

Elevation scale: -8 to -43 m; depth scale: 1 to 36 m.





CPT INTERVAL

The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING NB-7

Dominion VOWTAP Geotechnical Survey

FUGRO

FIGURE A-8

PROJECT NO:	04.81140004	**START DATE:**	7/10/2014
BORING:	NB-9	**COMPLETION DATE:**	7/10/2014
DRILLER:	FMMG	**DRILLING METHOD:**	Mud Rotary Wash

Coordinates: N 4,074,991m E 414,691m
NAD 1983, UTM Zone 18 North, Meters

ELEVATION: -7.8 m +/- (rel. MLLW datum)

SAMPLE NO.	BLOW COUNT
1	10/24"
2	20/24"
3	25/24"
4	18/24"
5	15/24"
6	10/24"
7	10/24"
8	15/24"
9	13/24"
10	30/24"
11	33/24"
12	15/24"
13	20/24"
14	30/18"
15	30/12"
16	30/6"
17	30/17"

MATERIAL DESCRIPTION

Poorly graded SAND (SP): greenish black (10Y2.5/1), with shell fragments. *0.3m*

Fat CLAY (CH): dark greenish gray (10G4/1), with partings of sand.
-sandy at 0.3m *1.8m*

Clayey SAND (SC): loose to medium dense, greenish black (10Y2.5/1), with parting of clay.
-with a few shell fragments at 3.4m
-greenish black (10Y25/1) clay seam at 3.7m *4.6m*

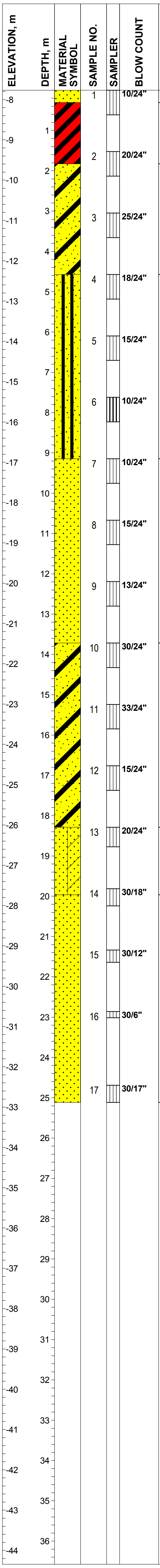
Silty Fine SAND (SM): loose to medium dense, greenish black (10Y2.5/1).
-with a few shell fragments, 4.6m to 8.2m *9.1m*

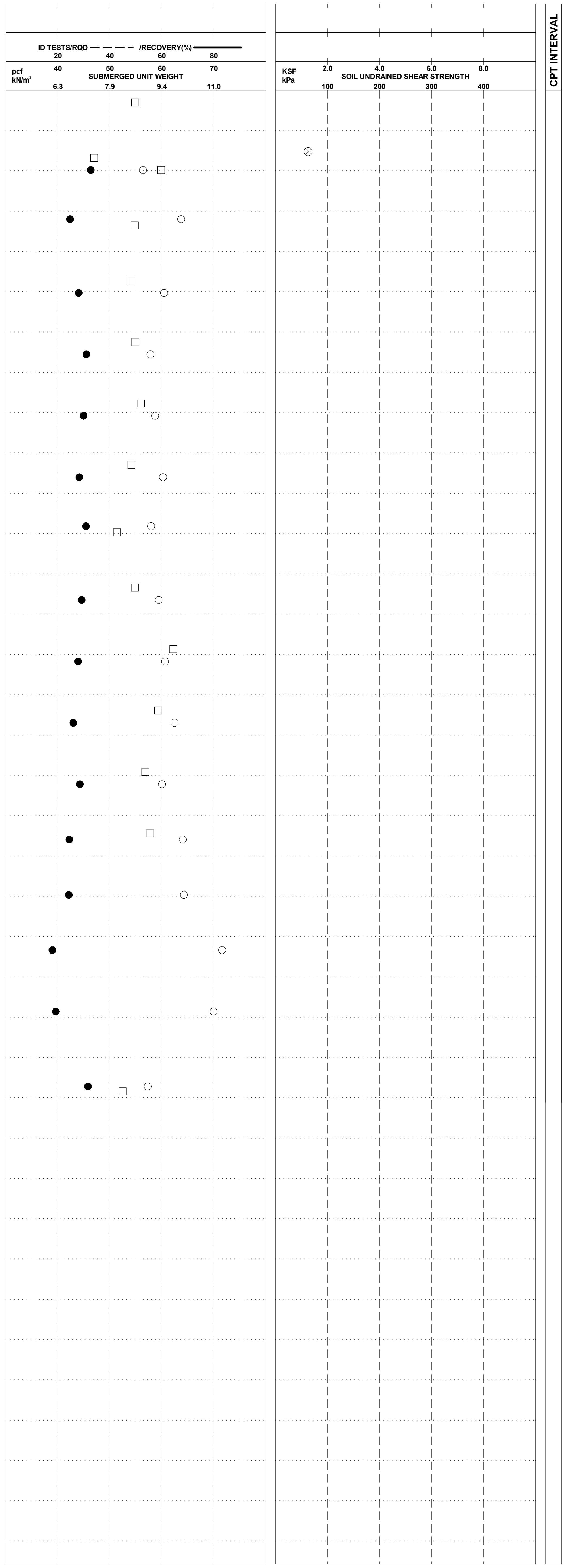
Poorly graded Fine SAND (SP): loose to medium dense, greenish black (10Y2.5/1).
-with shell fragments, 9.1m to 12.8m *13.7m*

Clayey Fine SAND (SC): medium dense to dense, very dark greenish gray (10Y3/1).
-with a few shell fragments, 15.2m to 18.3m
-with pockets of organic matter and clay partings at 17.1m *18.3m*

Poorly graded Medium SAND with clay (SP-SC): medium dense to dense, greenish gray (10Y5/1).
-with parting of clay and shell fragments, 18.3m to 20.1m *20.0m*

Poorly graded Coarse SAND (SP): greenish gray (10Y5/1).
-with many shell fragments at 21.3m
-medium grained, with quartz fragments, at 22.9m
-fine to medium grained, with seam of clay, at 25.0m





The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING NB-9

Dominion VOWTAP Geotechnical Survey

FUGRO

08/05/2014 23:40

PROJECT NO:	04.81140004	**START DATE:**	6/30/2014	**DRILLER:**	FMMG
BORING:	NB-11	**COMPLETION DATE:**	6/30/2014	**DRILLING METHOD:**	Mud Rotary Wash

Coordinates: N 4,075,015m E 414,827m
NAD 1983, UTM Zone 18 North, Meters

MATERIAL DESCRIPTION

ELEVATION: -7.9 m +/- (rel. MLLW datum)

SAMPLE NO.	BLOW COUNT
1	30/24"
2	22/24"
3	18/24"
4	14/24"
5	PUSH
6	PUSH
7	17/24"
8	17/24"
9	13/24"
10	15/24"
11	13/24"
12	11/24"
13	30/22"
14	30/22"
15	30/17"
16	30/17"
17	30/12"

Silty Fine SAND (SM): medium dense, bluish gray (10B5/1), with shell fragments.
-dense, 0.1m to 0.6m
-clayey at 0.3m
-with clay pockets at 1.5m
-clayey at 2.0m
-with many clay pockets at 3.4m

3.7m

Sandy Fat CLAY (CH): dark bluish gray (10B4/1), possible clayey sand.
-with few shell fragments, 3.7m to 5.2m

8.2m

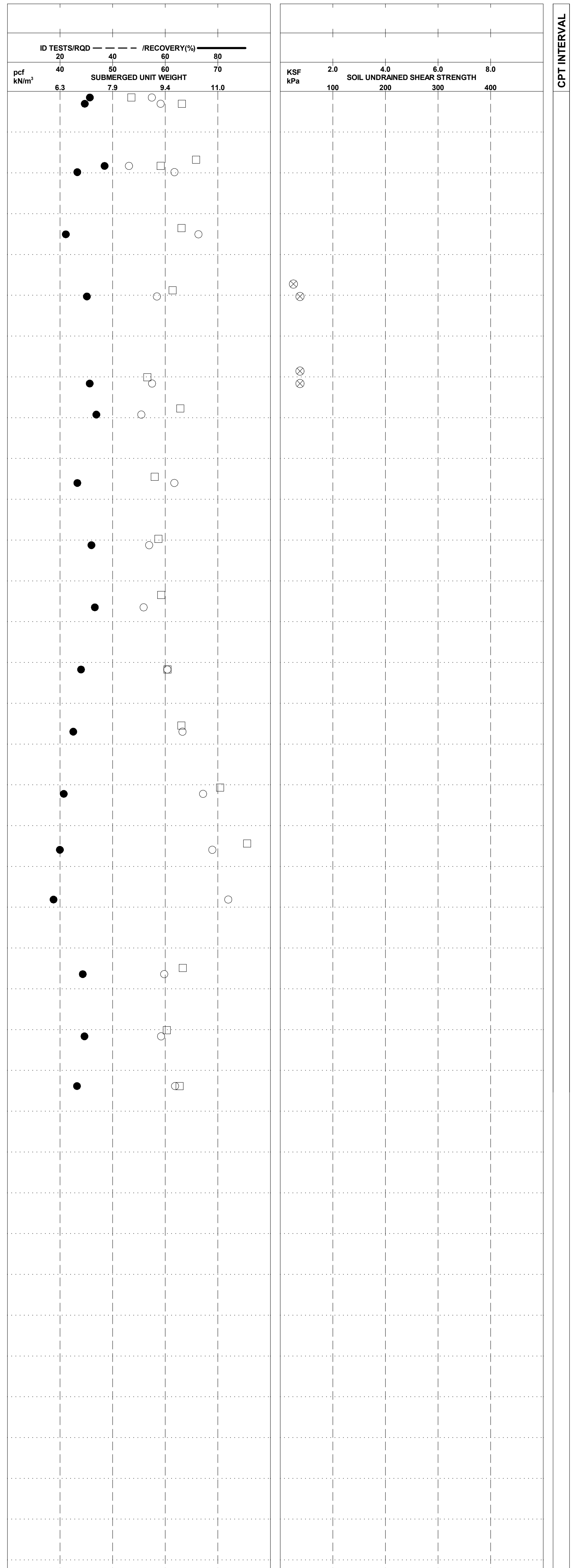
Clayey Fine SAND (SC): loose to medium dense, dark bluish gray (10B4/1).
-with shell fragments, 13.7m to 17.4m

18.3m

Poorly graded Fine to Medium SAND (SP): medium dense to dense, dark bluish gray (10B4/1), with shell fragments.
-with a few pieces of gravel at 18.3m
-medium to coarse grained, with many shell fragments, at 20.1m
-fine to medium grained, with pockets and parting of clay, at 21.3m

21.9m

Clayey Fine SAND (SC): dense, dark bluish gray (10B4/1), with few shell fragments.



The log and data presented are a simplification of actual conditions encountered at the time of sampling at the sample location. Subsurface conditions may differ at other locations and with the passage of time.

For symbol identification, refer to Key to Terms & Symbols Used on Logs.

LOG OF BORING AND TEST RESULTS

BORING NB-11

Dominion VOWTAP Geotechnical Survey

FUGRO

FIGURE A-10

NEARSHORE LOG (11X17) N:\PROJECTS\04 2014\04 8114 0004 VOWTAP GEOTECH\EXPLORATIONS\GINT\2014\VOWTAP FB14B.GPJ 08/05/14 11:40 p

LOCATION: N 4,074,824 E 413,723
NAD 1983, UTM Zone 18 North, Meters

SURFACE EL: 3 m +/- (rel. NAVD88 datum)

ELEVATION, m: 2, 1, 0, -1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -20, -21, -22, -23, -24, -25, -26, -27, -28, -29, -30, -31, -32, -33

DEPTH, m: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36

SAMPLE NO.	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION
1	26	**ARTIFICIAL FILL (af)**
2	12	Silty Medium SAND with gravel (SM): medium dense, olive gray, moist.
3	1	Silty Medium SAND (SM): medium dense, yellowish red, moist. -mottled yellowish brown and gray below 1.2m
4		Fat CLAY (CH): very soft, gray.
5	17	Poorly graded Fine to Medium SAND with silt (SP-SM): medium dense, gray.
6	17	
7	3	Sandy Fat CLAY (CH): soft, gray.
8	5	Silty Fine SAND (SM): loose, gray, wet.
9	26	-medium dense below 11.9m
10	5	Sandy Fat CLAY (CH): firm, gray.
11	7	Silty Fine SAND (SM): loose, gray, wet.
12	16	-medium dense below 16.5m
13	11	-contains laminations of clay, 18.0m to 18.6m
14	2	-contains shell hash at 19.5m -very loose below 19.5m
15	5	-loose below 21.0m
16	3	-very loose, contains few small shell fragments, below 22.6m
17	6	Sandy Fat CLAY (CH): firm, gray, (possible SC).
18	5	
19	6	
20	2	-soft, contains sand laminations, below 28.7m
21	2	
22	3	Silty Medium SAND (SM): very loose, gray, trace of shells.
23	2	Sandy Fat CLAY (CH): soft, gray, with lenses of fine sand.
24	2	-with little organic odor, 34.7m to 35.0m
		TD = 35.2m

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 35.2 m
DRILLING DATE: July 15, 2014

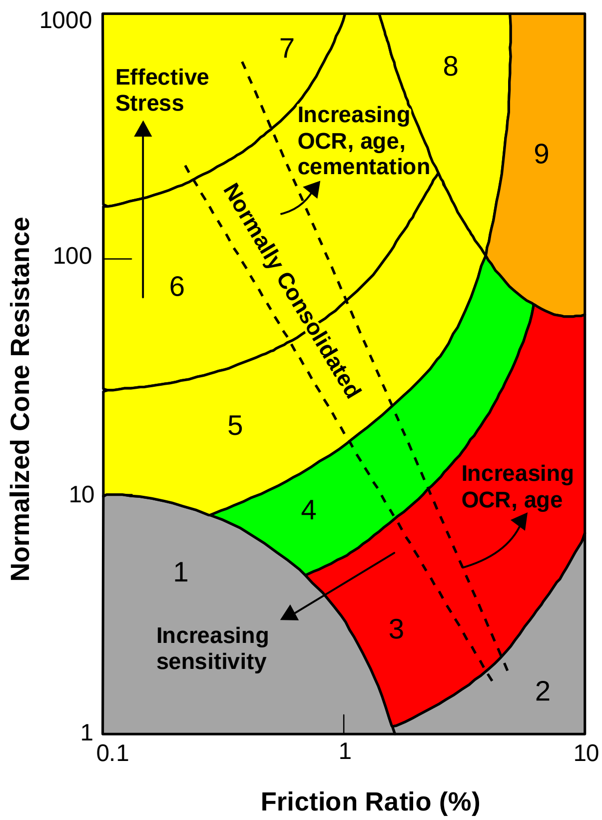
DRILLING METHOD: 114.3 mm dia. Mud Rotary Wash
HAMMER TYPE: Automatic Trip
DRILLED BY: Fishburne Drilling Inc.
LOGGED BY: HD
RIG TYPE: CME 55

LOG OF BORING NO. B-1

FIGURE A-11

APPENDIX B

PCPT LOGS



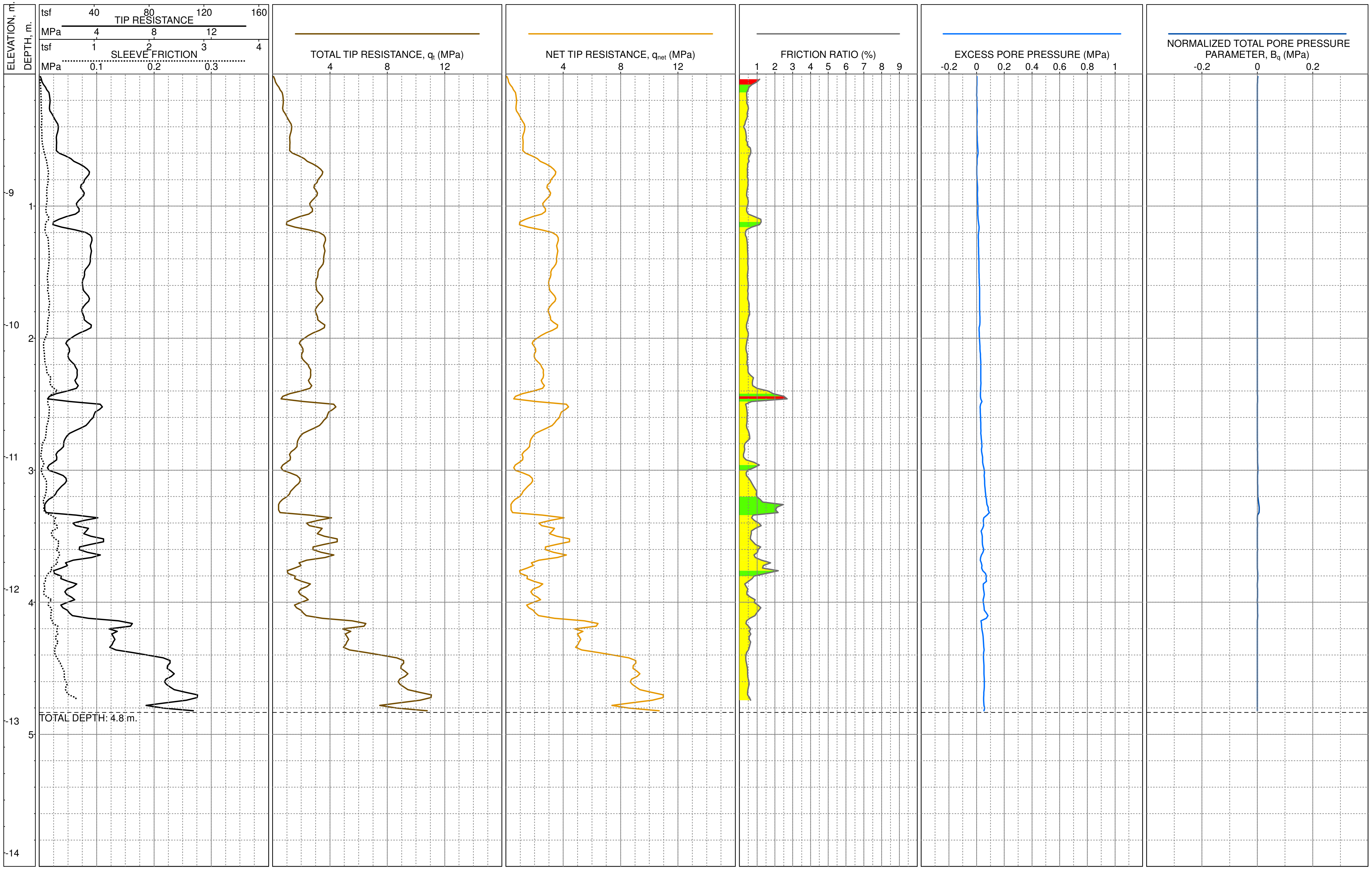
Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay to Silty Clay	CL-CH
4	Clayey Silt to Silty Clay	MH-CL
5	Silty Sand to Sandy Silt	SM-ML
6	Sand to Silty Sand	SP-SM
7	Gravelly Sand to Sand	GP-SP
8	Sand to Clayey Sand	SP-SC
9	Very Stiff Fine-grained*	CH-CL

*overconsolidated or cemented

SBT CORRELATION CHART
ROBERTSON, 1990

KEY TO CONE PENETRATION LOGS
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Outputs\2014_07_29_Field_Data_Report\mxd\AppendixA\A-01_CPTKey_FR90.mxd, 8/4/2014, dmiao



LOCATION: E: 416,221m, N: 4,075,014m (NAD83, UTM 18N)
MUDLINE EL.: -8.1m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 4.8m (MLLW)
TEST DATE: 7/1/2014

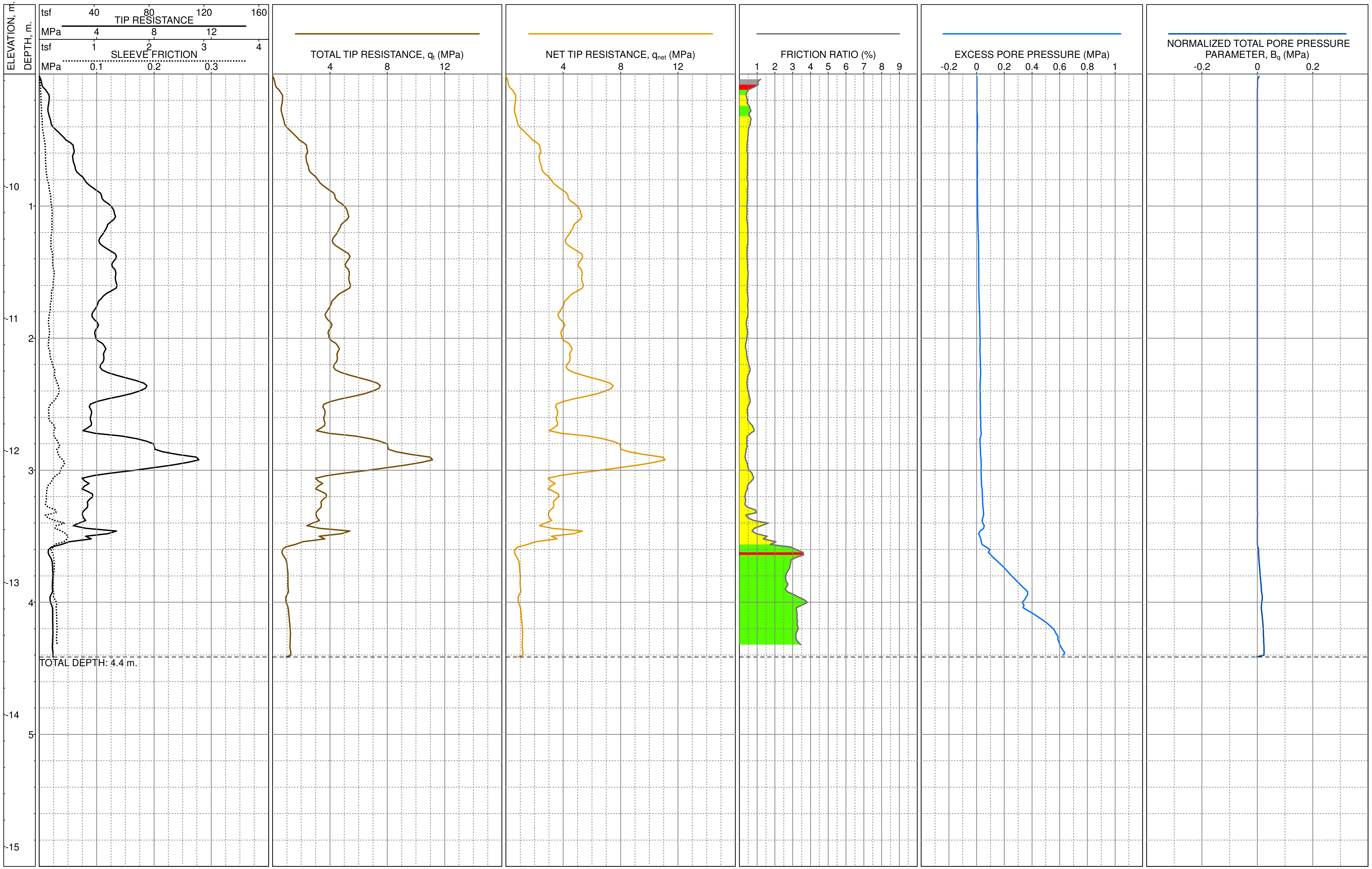
SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-1
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-2

N:\Projects\04_201404_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao

Dominion Resources
Project No. 04.81140004



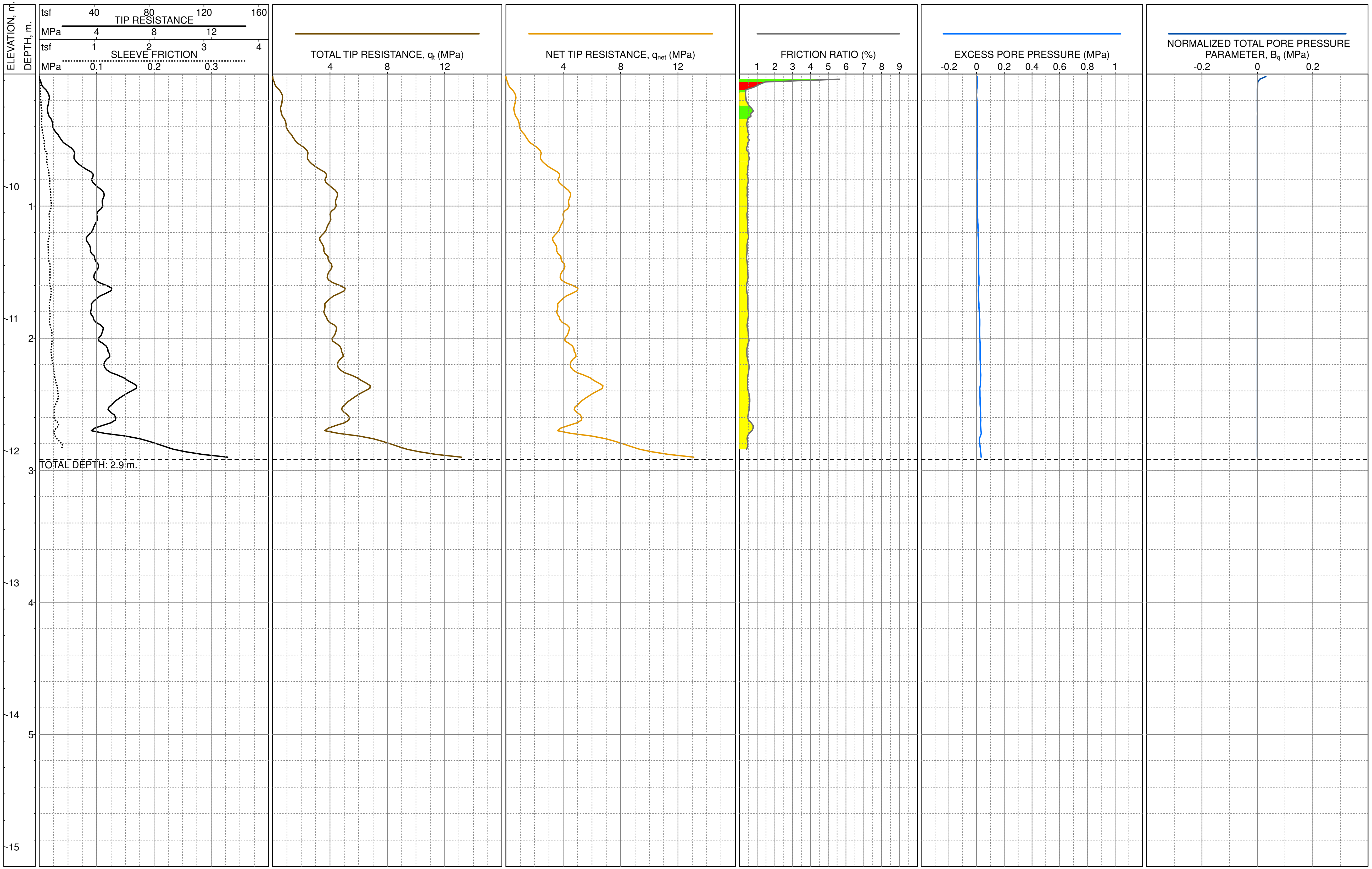
LOCATION: E: 417,611m, N: 4,075,150m (NAD83, UTM 18N)
MUDLINE EL.: -9.2m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 4.4m (MLLW)
TEST DATE: 7/1/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-2
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-3

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 417,611m, N: 4,075,150m (NAD83, UTM 18N)
MUDLINE EL.: -9.1m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 2.9m (MLLW)
TEST DATE: 7/1/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

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Dominion VOWTAP Geotechnical Survey
Offshore Virginia

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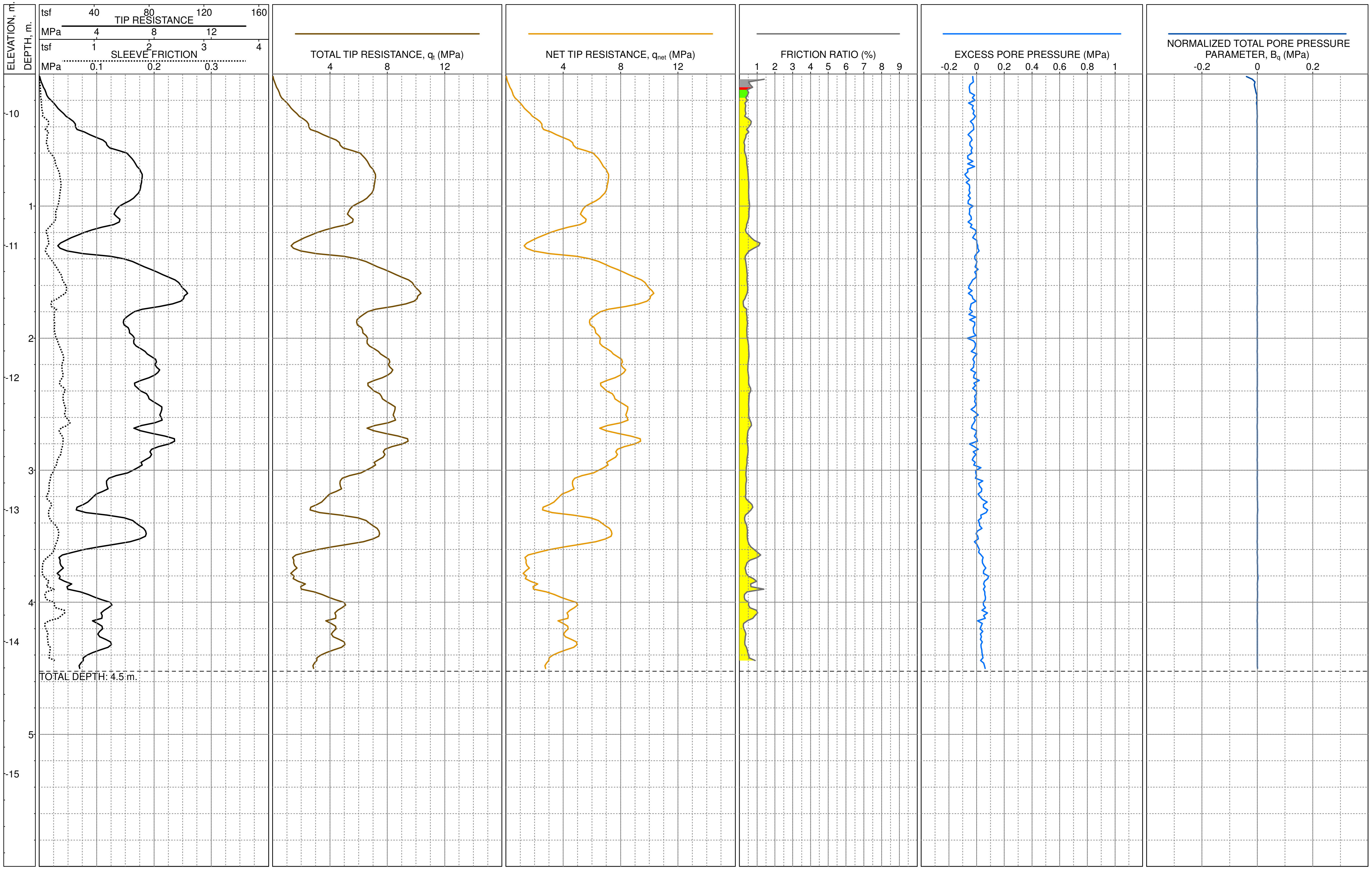


LOCATION: E: 420,162m, N: 4,075,204m (NAD83, UTM 18N)
MUDLINE EL.: -9.7m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 4.5m (MLLW)
TEST DATE: 6/30/2014

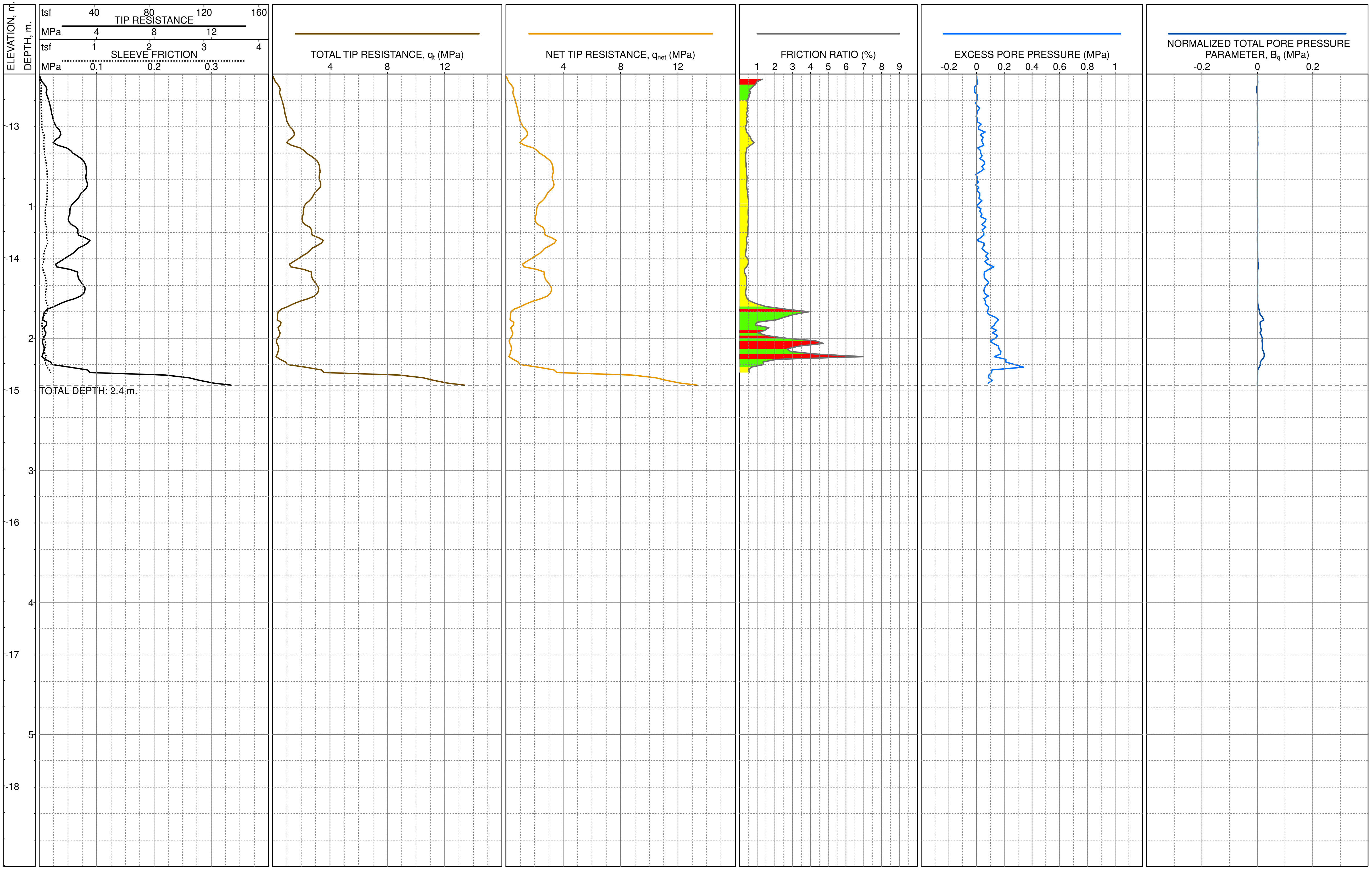
SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m³
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-3

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-5

N:\Projects\04_201404_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 421,144m, N: 4,075,166m (NAD83, UTM 18N)
MUDLINE EL.: -12.6m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 2.4m (MLLW)
TEST DATE: 6/30/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

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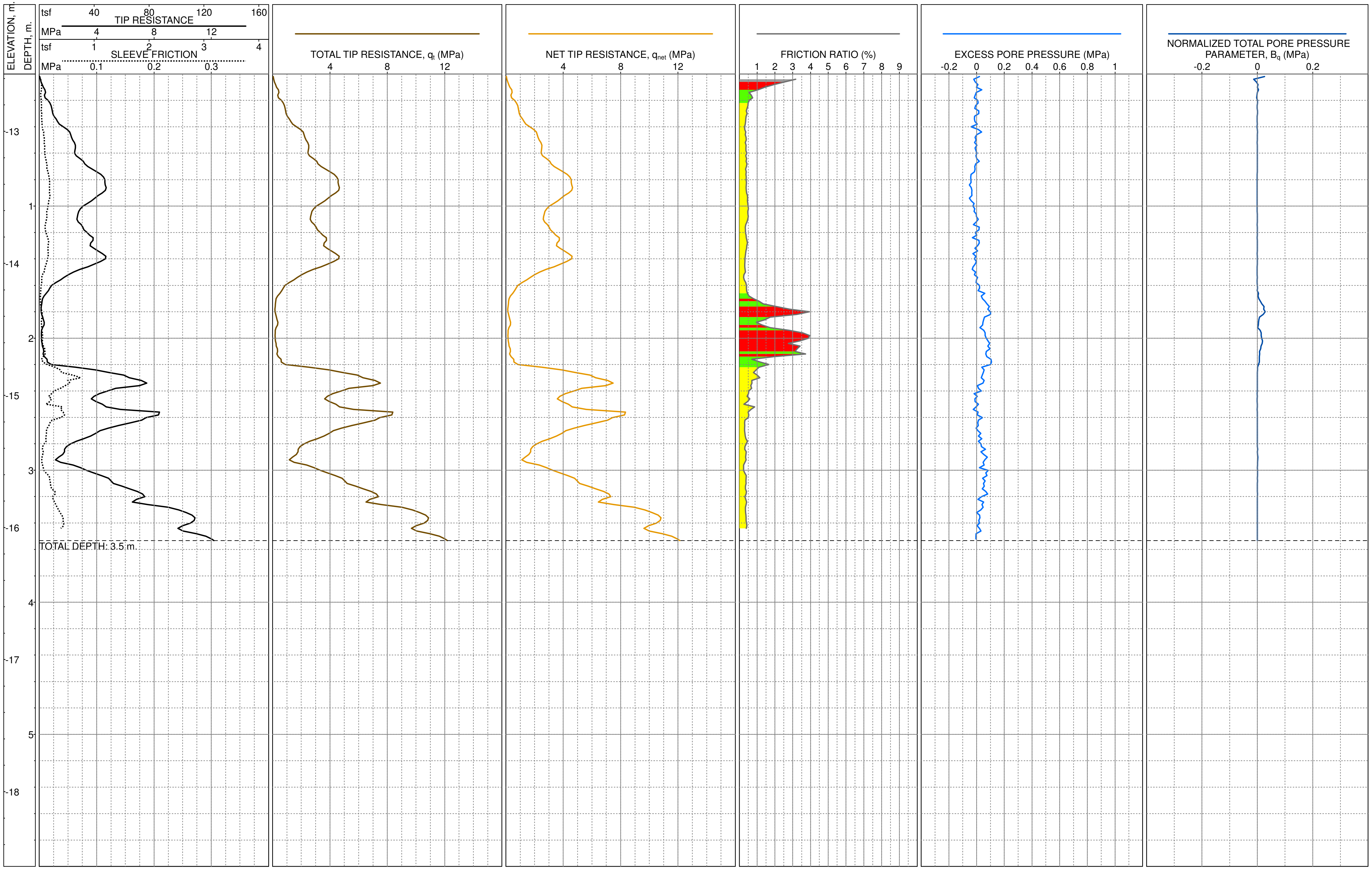
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 421,147m, N: 4,075,166m (NAD83, UTM 18N)
MUDLINE EL.: -12.6m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 3.5m (MLLW)
TEST DATE: 6/30/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m³
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-4A
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-7

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao

Dominion Resources
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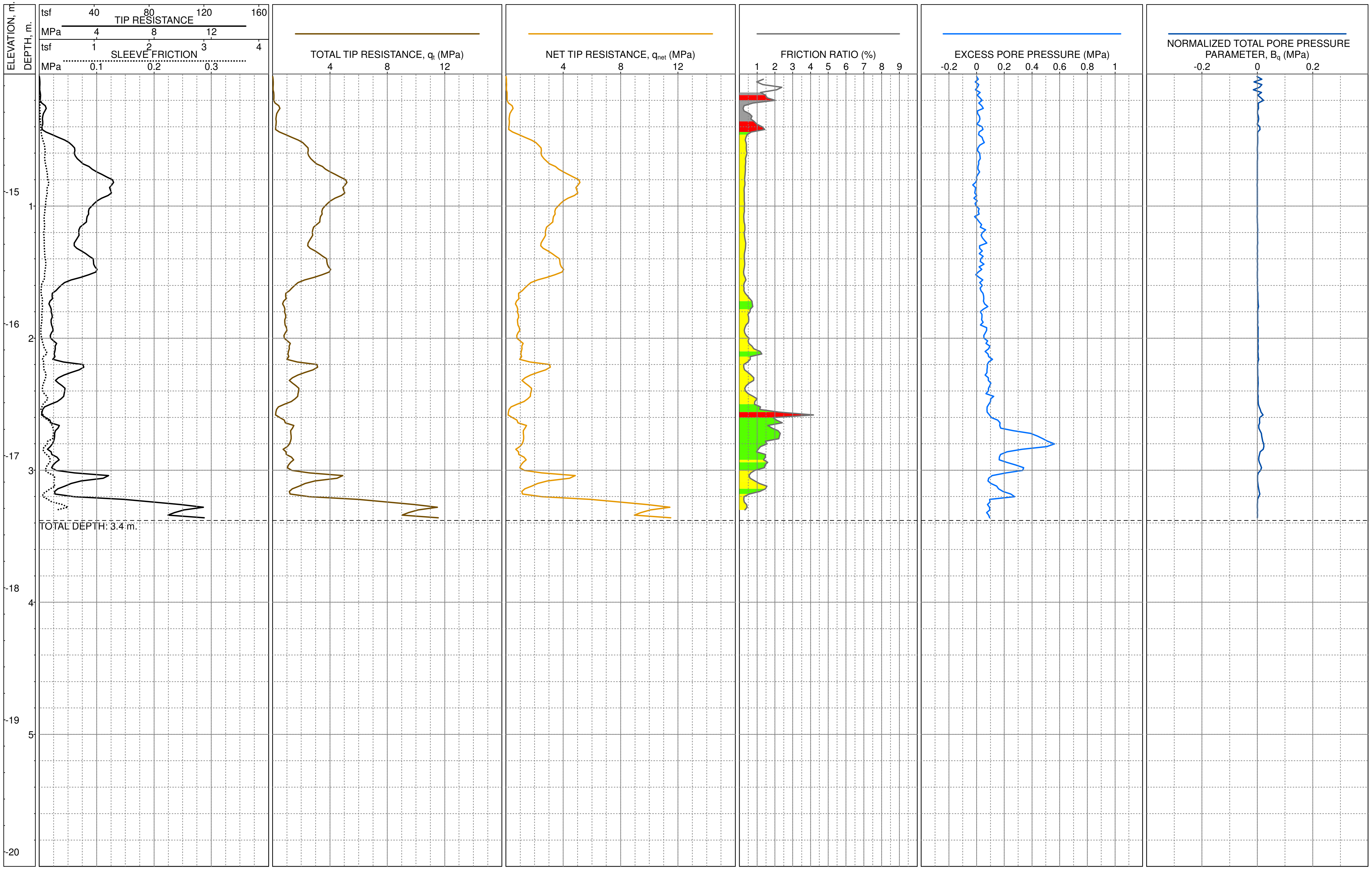


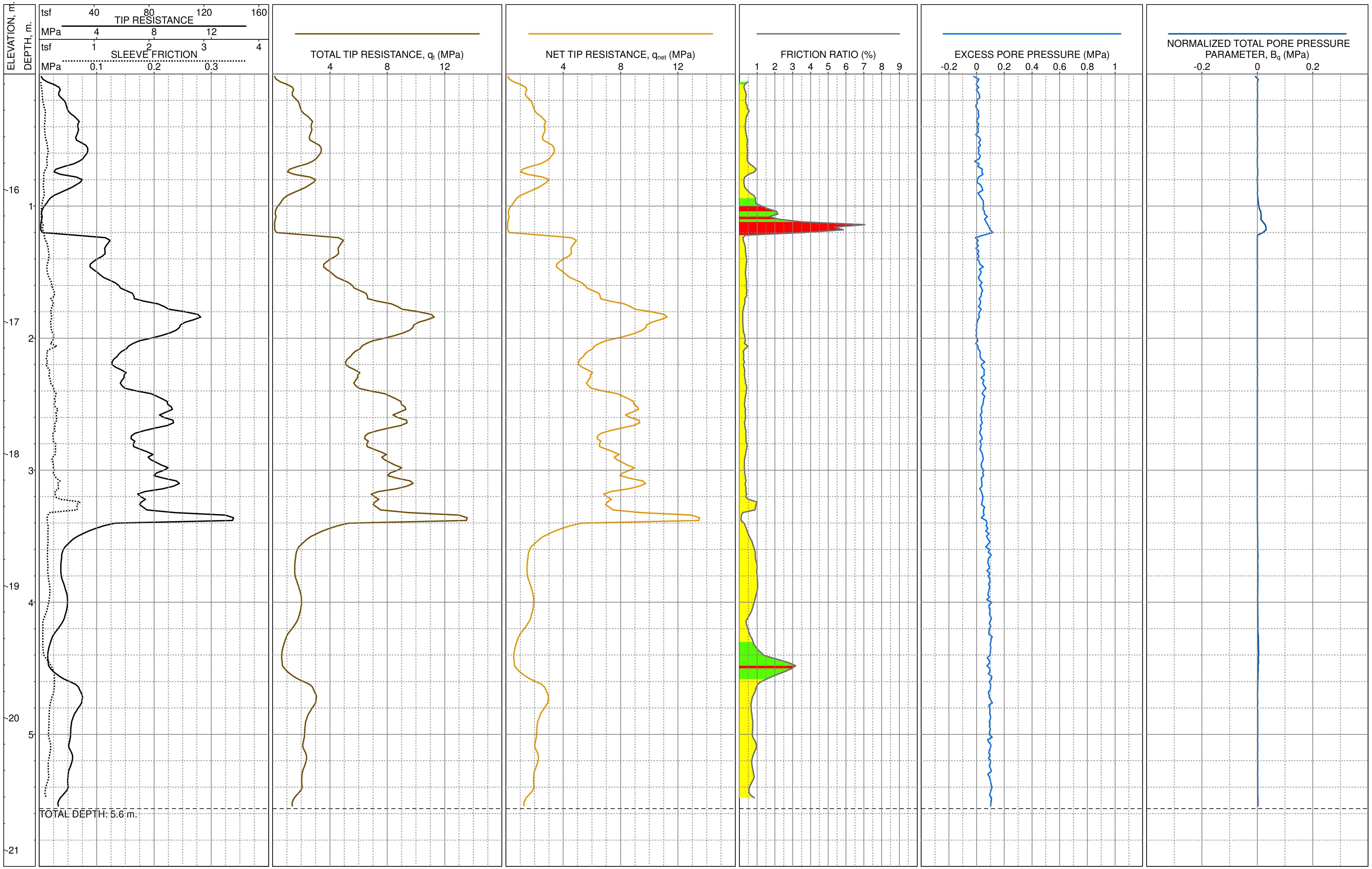
LOCATION: E: 421,869m, N: 4,075,182m (NAD83, UTM 18N)
MUDLINE EL.: -14.1m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 3.4m (MLLW)
TEST DATE: 6/30/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-5
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-8

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



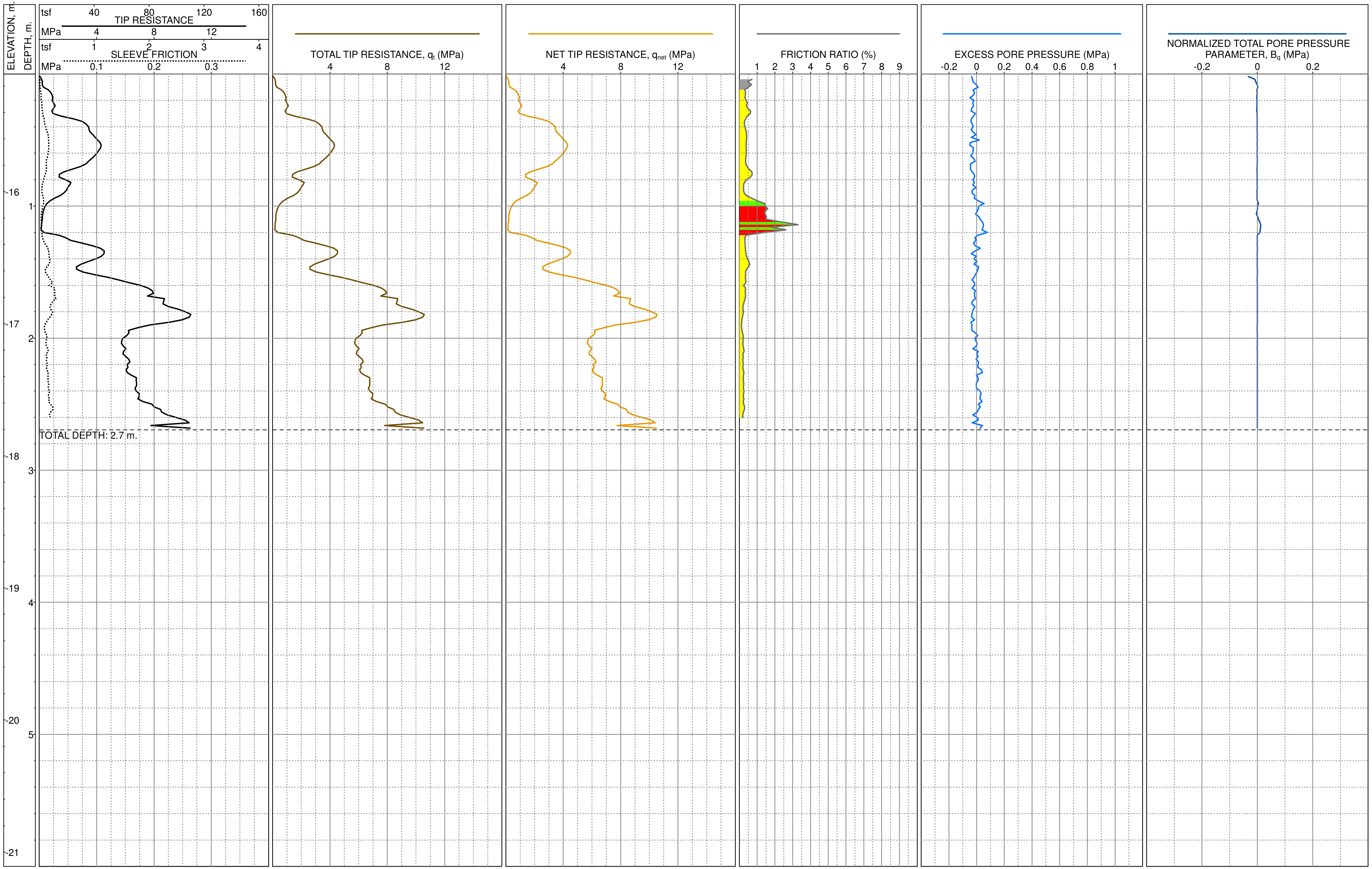
LOCATION: E: 422,904m, N: 4,075,083m (NAD83, UTM 18N)
MUDLINE EL.: -15.1m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 5.6m (MLLW)
TEST DATE: 6/30/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-6
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-9

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 422,907m, N: 4,075,084m (NAD83, UTM 18N)
MUDLINE EL.: -15.1m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 2.7m (MLLW)
TEST DATE: 6/30/2014

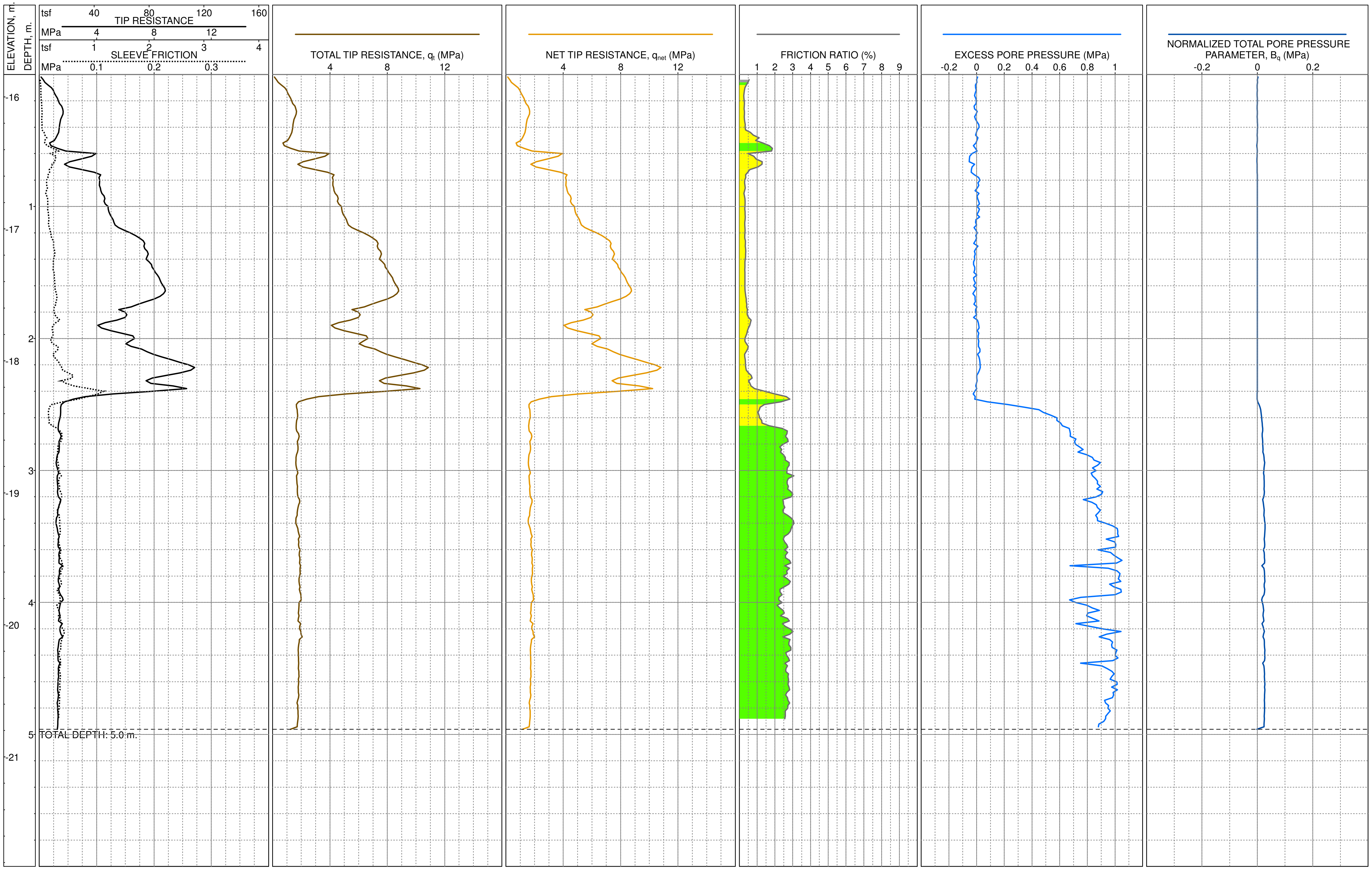
SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-6A

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-10

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 424,025m, N: 4,074,822m (NAD83, UTM 18N)
MUDLINE EL.: -15.8m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 5.0m (MLLW)
TEST DATE: 6/29/2014

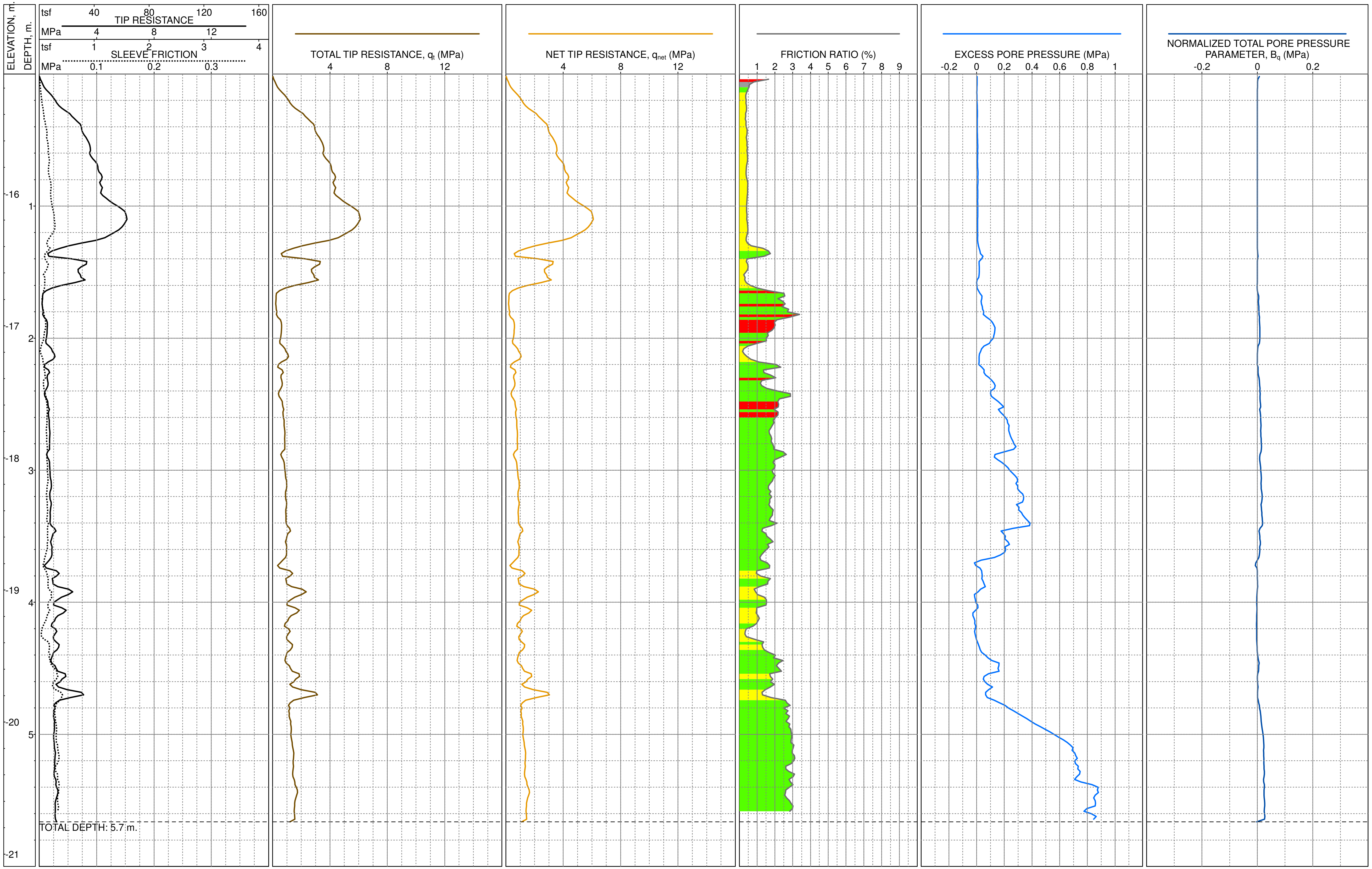
SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-7

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-11

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 424,617m, N: 4,074,696m (NAD83, UTM 18N)
MUDLINE EL.: -15.1m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 5.7m (MLLW)
TEST DATE: 7/1/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m³
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-8
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

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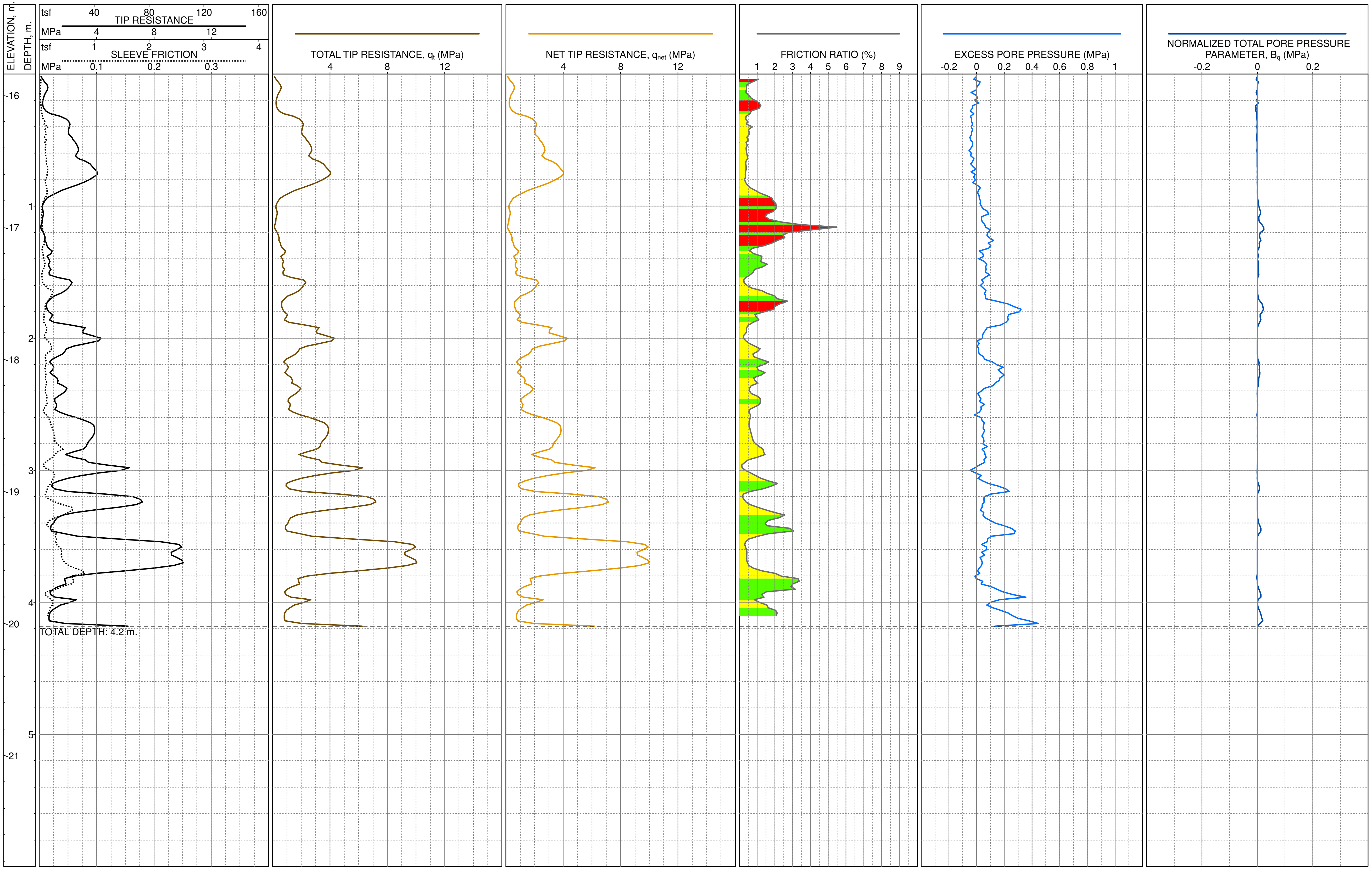
Dominion Resources
Project No. 04.81140004



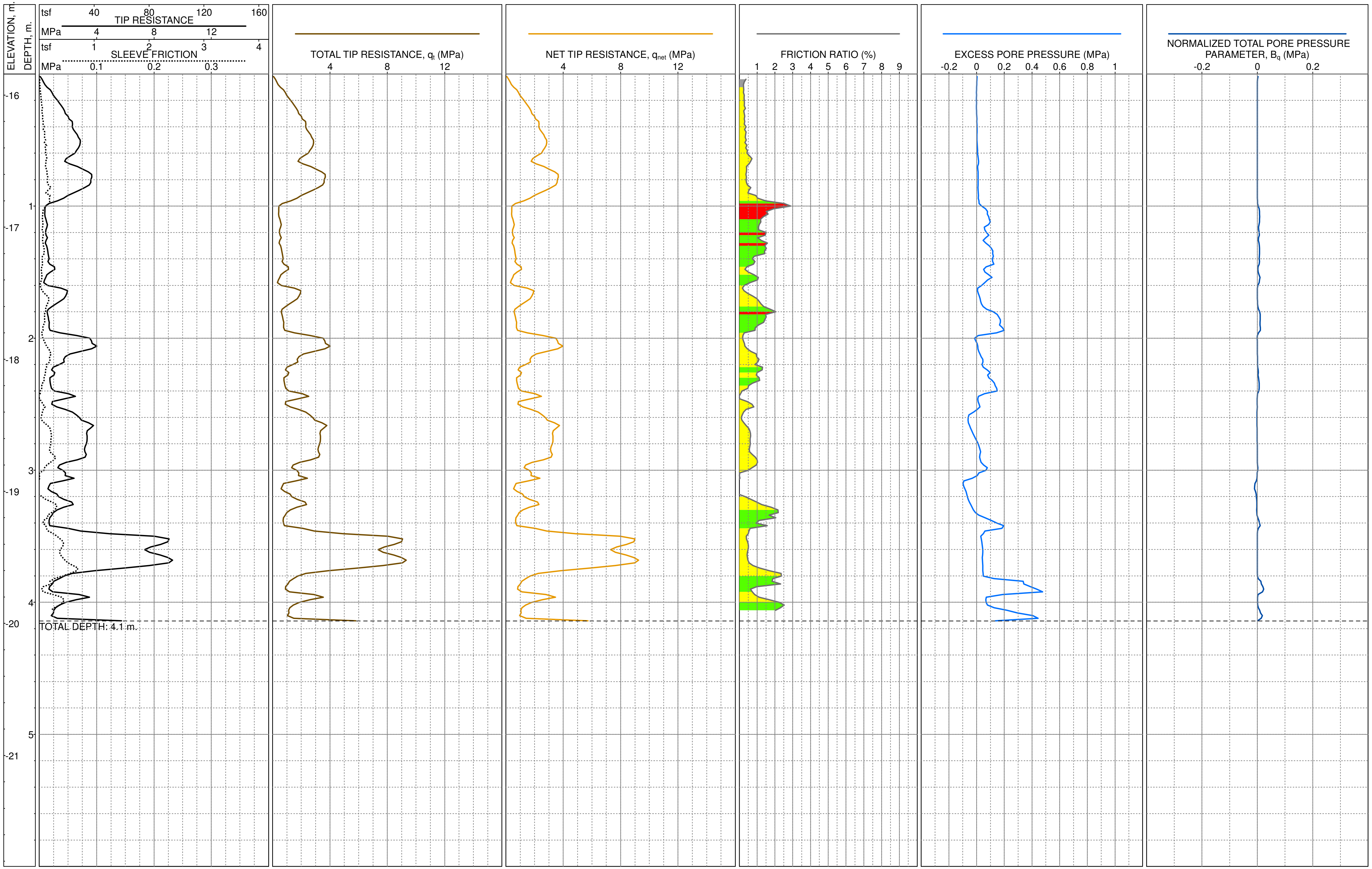
LOCATION: E: 425,612m, N: 4,074,471m (NAD83, UTM 18N)
MUDLINE EL.: -15.8m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 4.2m (MLLW)
TEST DATE: 7/1/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-9
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-13

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



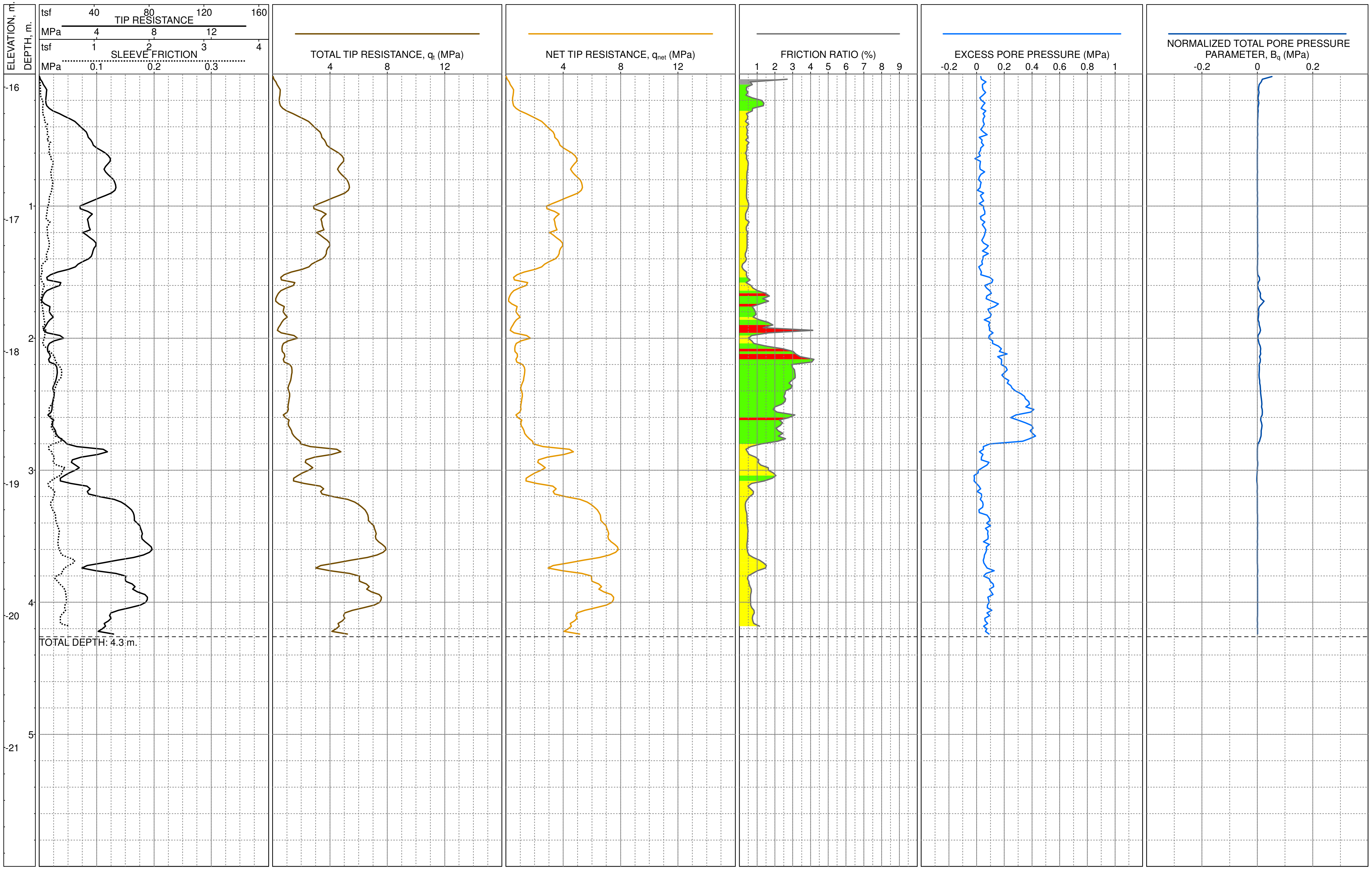
LOCATION: E: 425,611m, N: 4,074,471m (NAD83, UTM 18N)
MUDLINE EL.: -15.8m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 4.1m (MLLW)
TEST DATE: 7/1/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-9A
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-14

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 426,995m, N: 4,074,142m (NAD83, UTM 18N)
MUDLINE EL.: -15.9m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 4.3m (MLLW)
TEST DATE: 6/30/2014

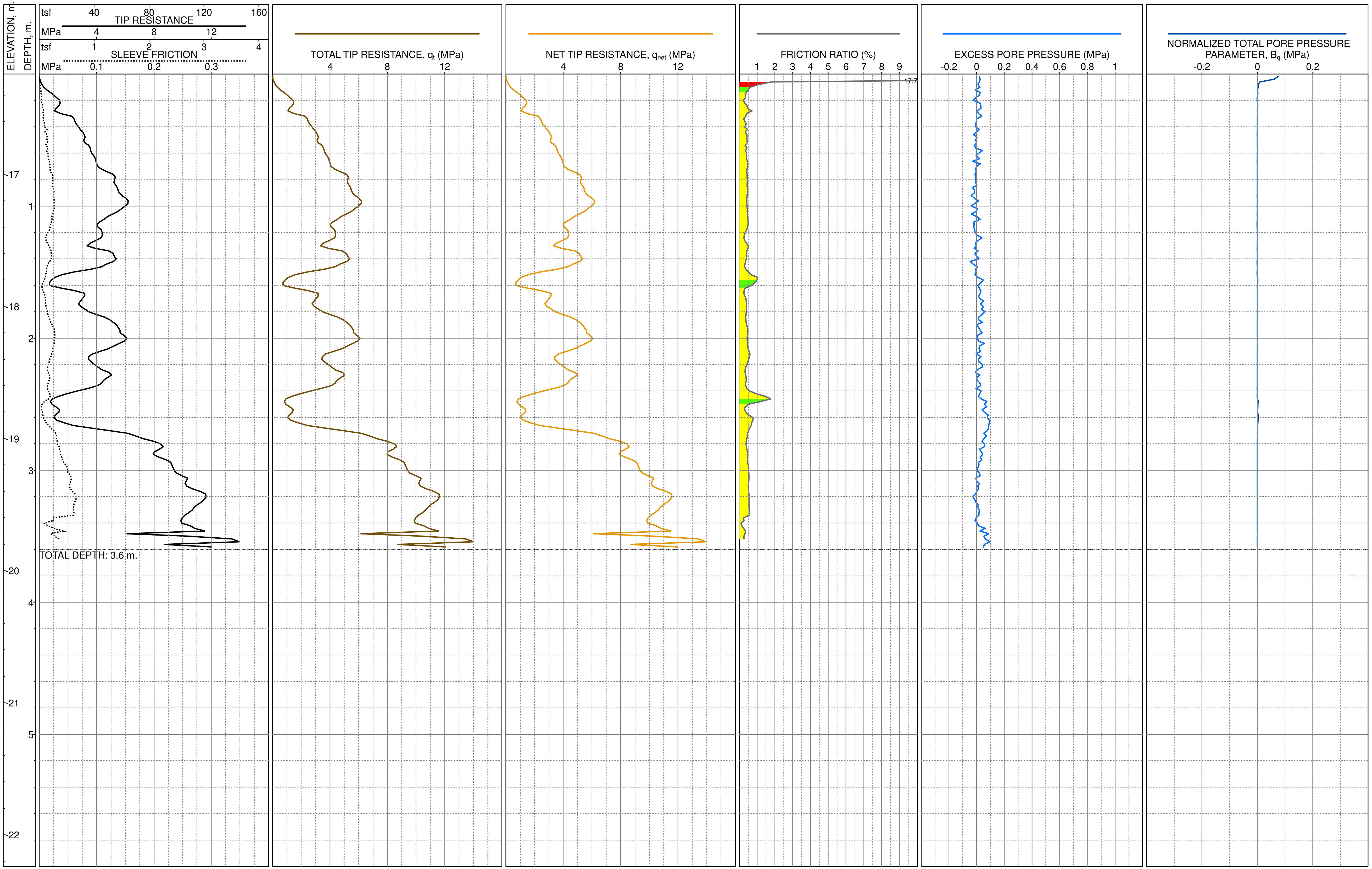
SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-10
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-15

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao

Dominion Resources
Project No. 04.81140004



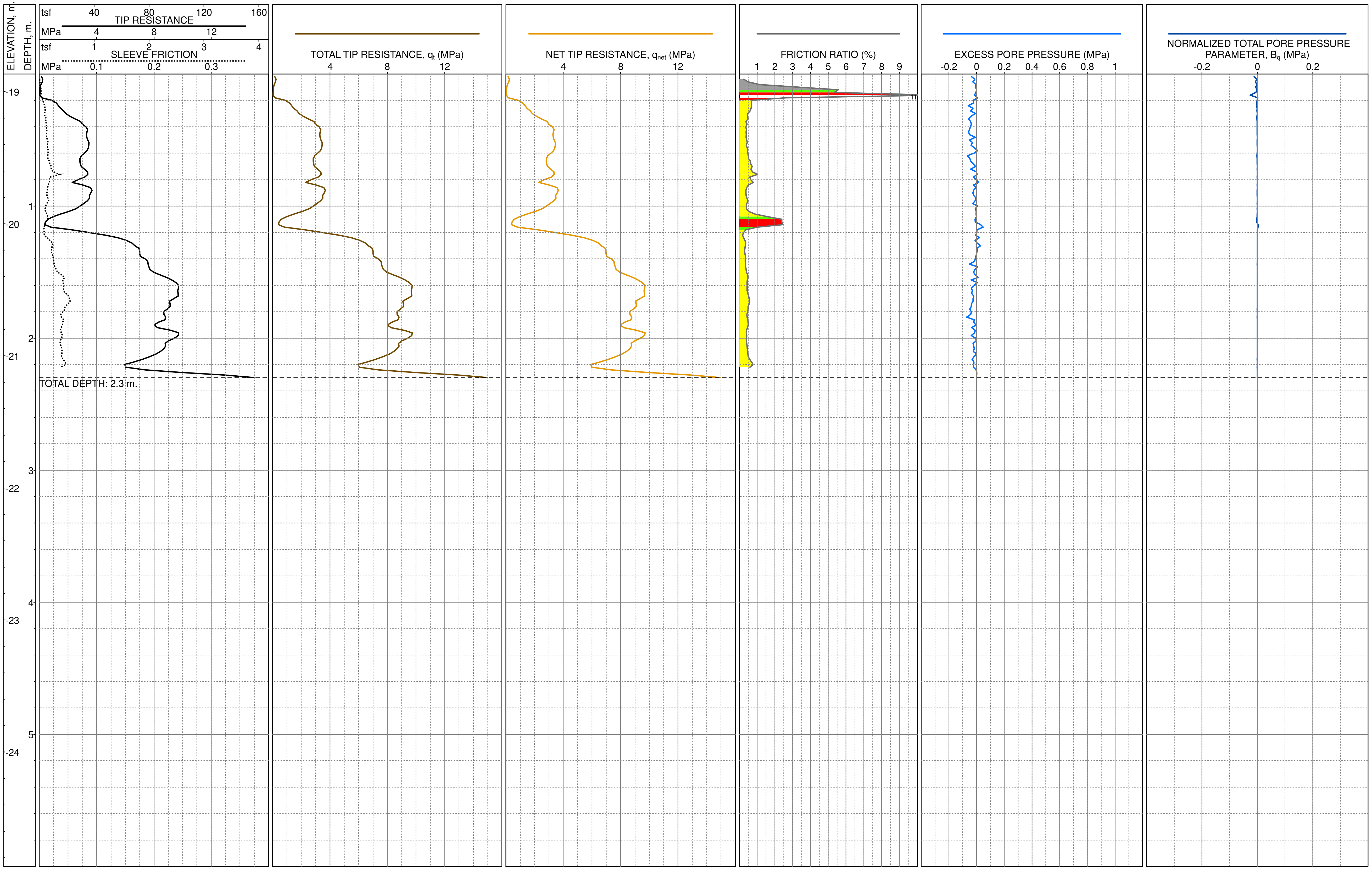
LOCATION: E: 428,079m, N: 4,074,007m (NAD83, UTM 18N)
MUDLINE EL.: -16.2m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 3.6m (MLLW)
TEST DATE: 6/30/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-11
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-16

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 429,946m, N: 4,073,888m (NAD83, UTM 18N)
MUDLINE EL.: -18.9m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 2.3m (MLLW)
TEST DATE: 6/30/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

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Dominion VOWTAP Geotechnical Survey
Offshore Virginia

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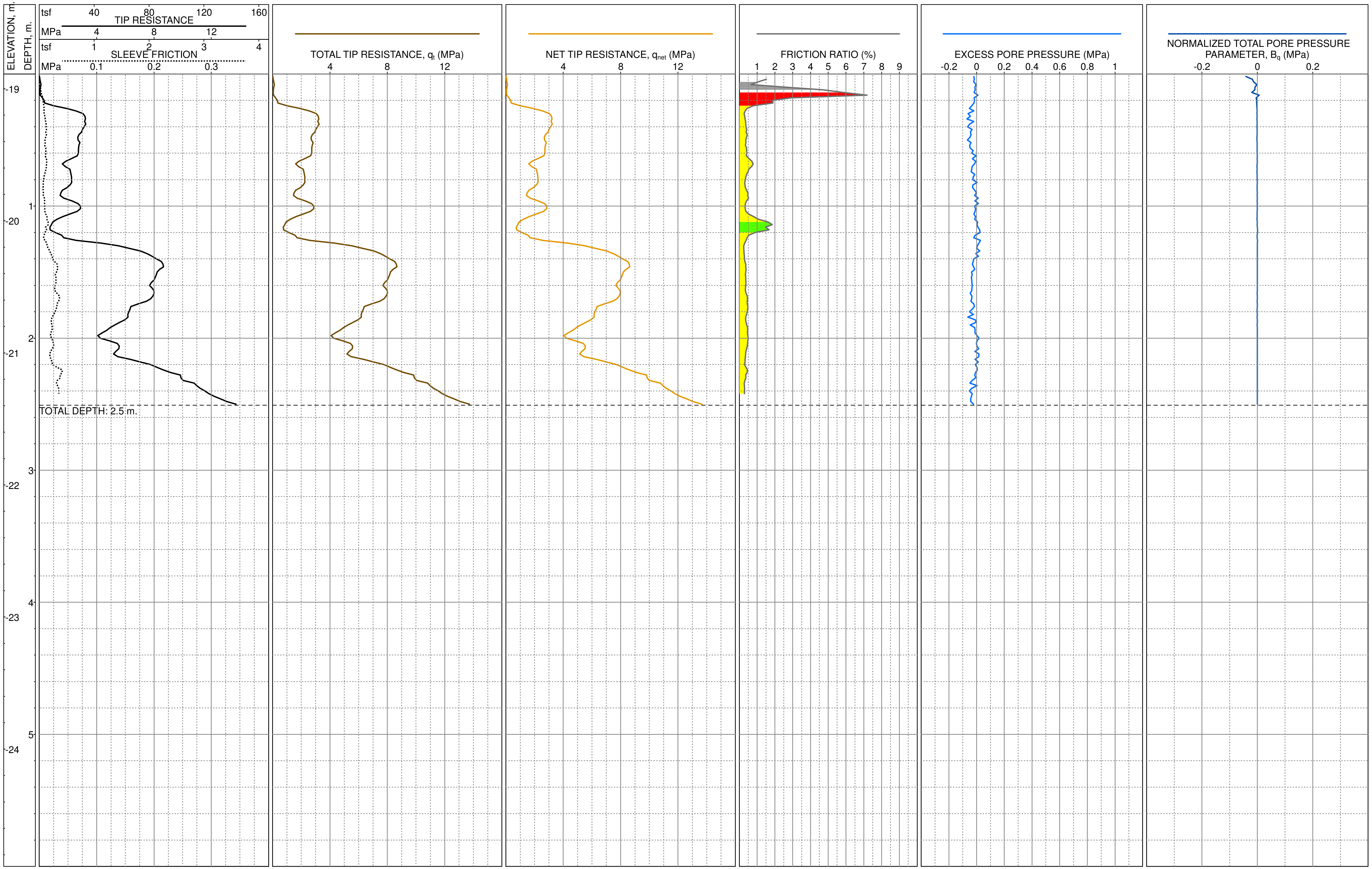


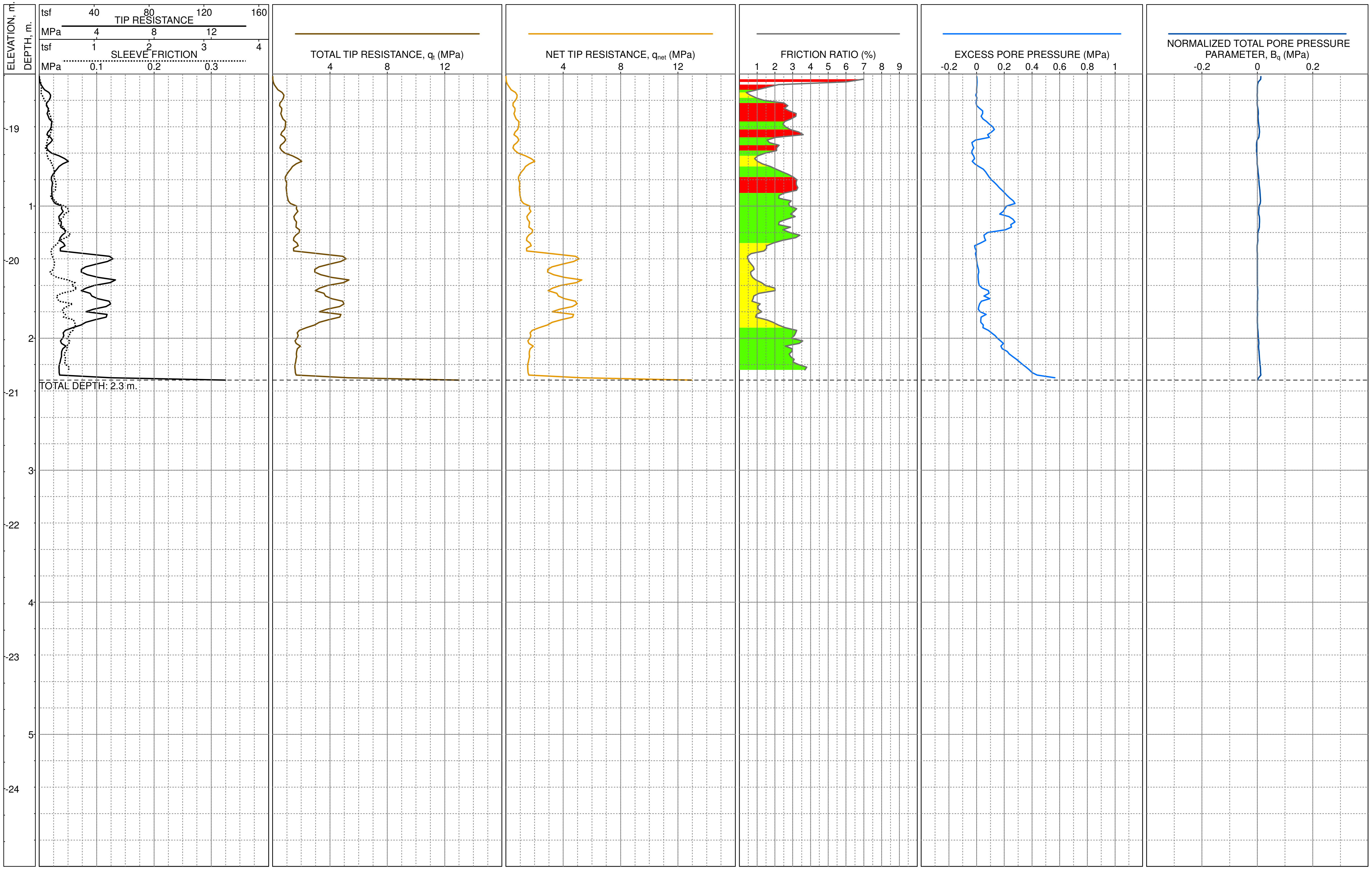
LOCATION: E: 429,949m, N: 4,073,887m (NAD83, UTM 18N)
MUDLINE EL.: -18.9m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 2.5m (MLLW)
TEST DATE: 6/30/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-12A
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-18

N:\Projects\04_201404_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 431,259m, N: 4,073,821m (NAD83, UTM 18N)
MUDLINE EL.: -18.6m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 2.3m (MLLW)
TEST DATE: 7/1/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m³
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-13
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

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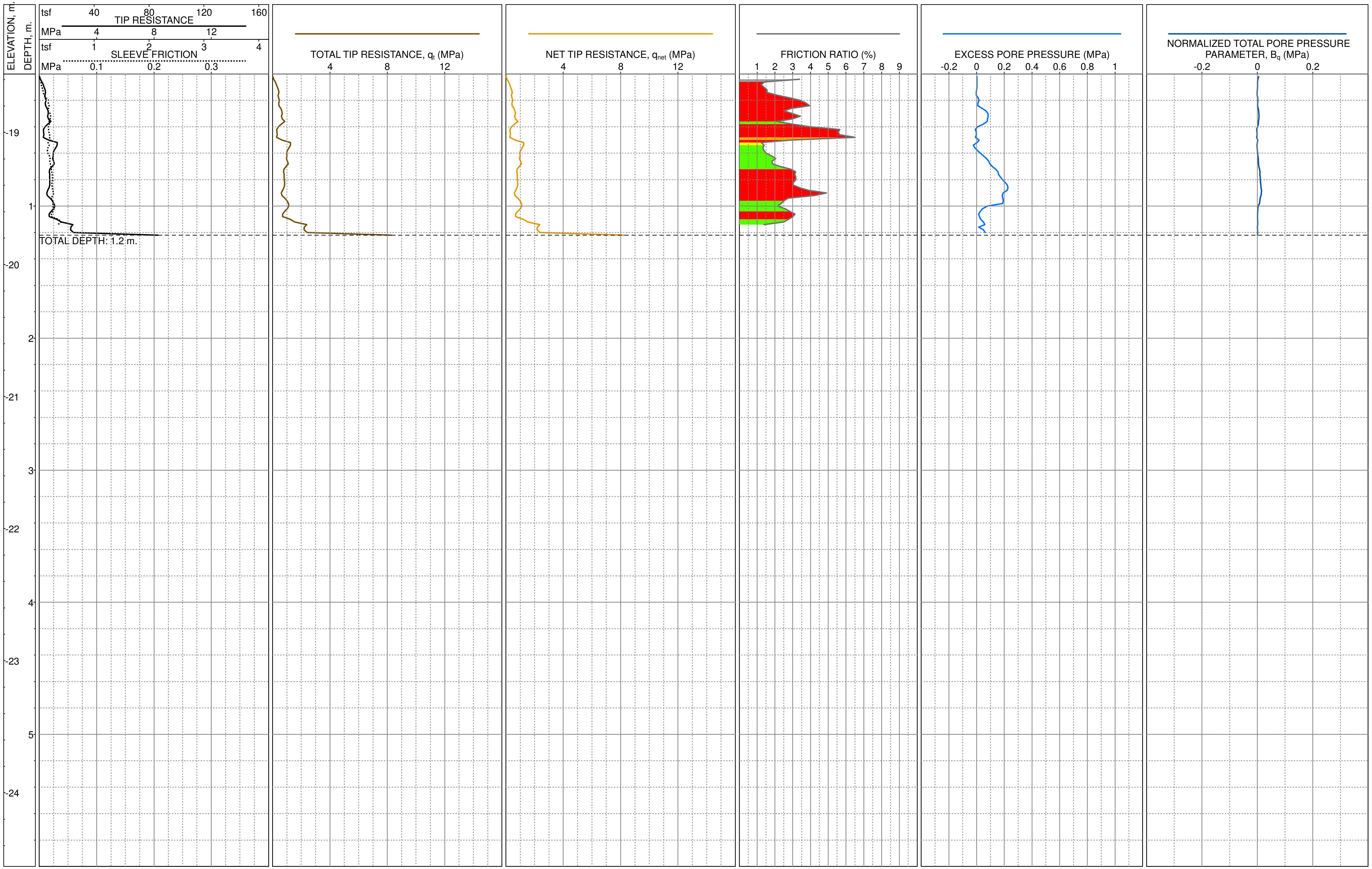


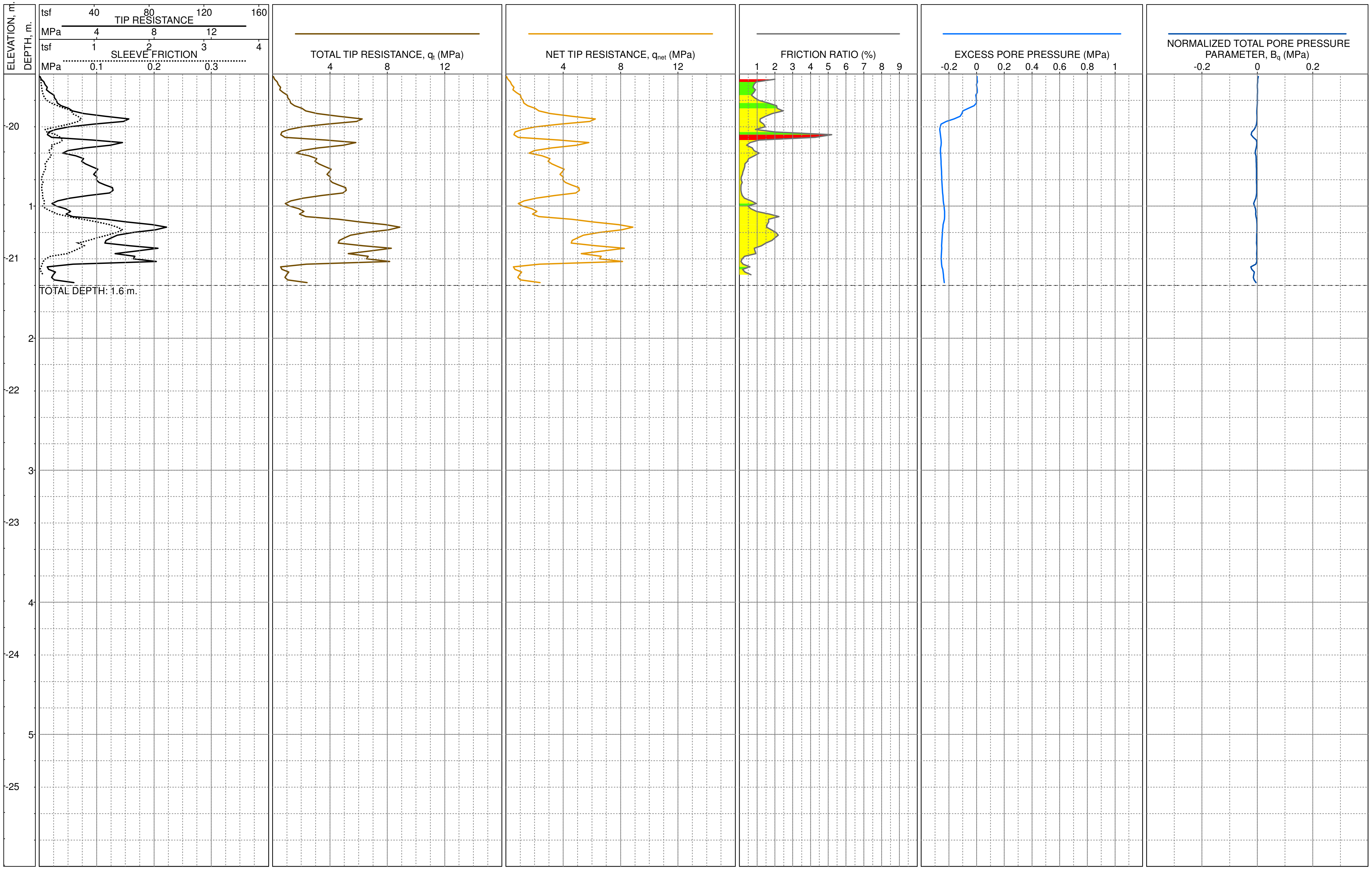
LOCATION: E: 431,261m, N: 4,073,820m (NAD83, UTM 18N)
MUDLINE EL.: -18.6m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 1.2m (MLLW)
TEST DATE: 7/1/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-13A
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-20

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



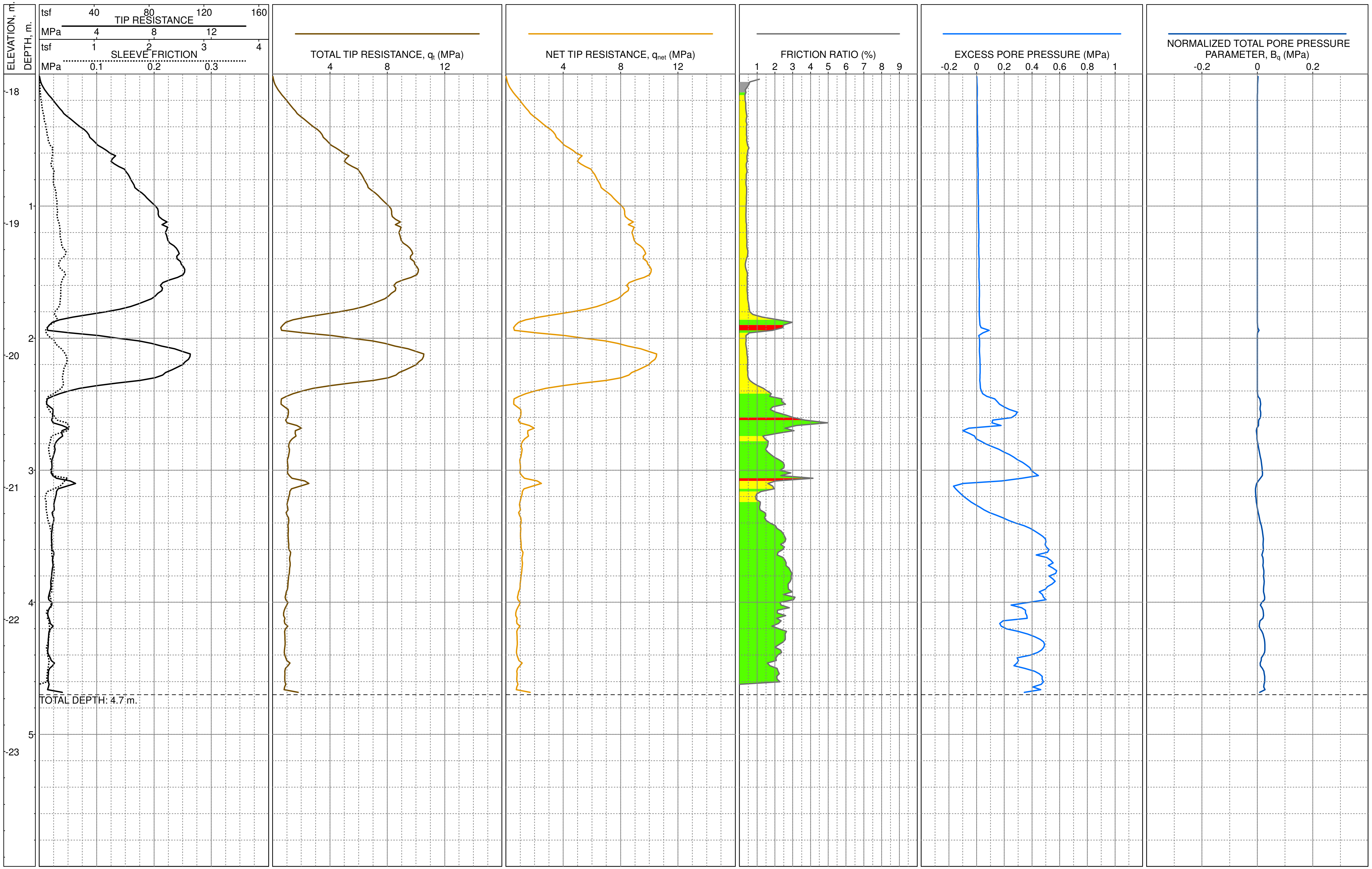
LOCATION: E: 433,327m, N: 4,073,724m (NAD83, UTM 18N)
MUDLINE EL.: -19.6m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 1.6m (MLLW)
TEST DATE: 7/1/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-14
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-21

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



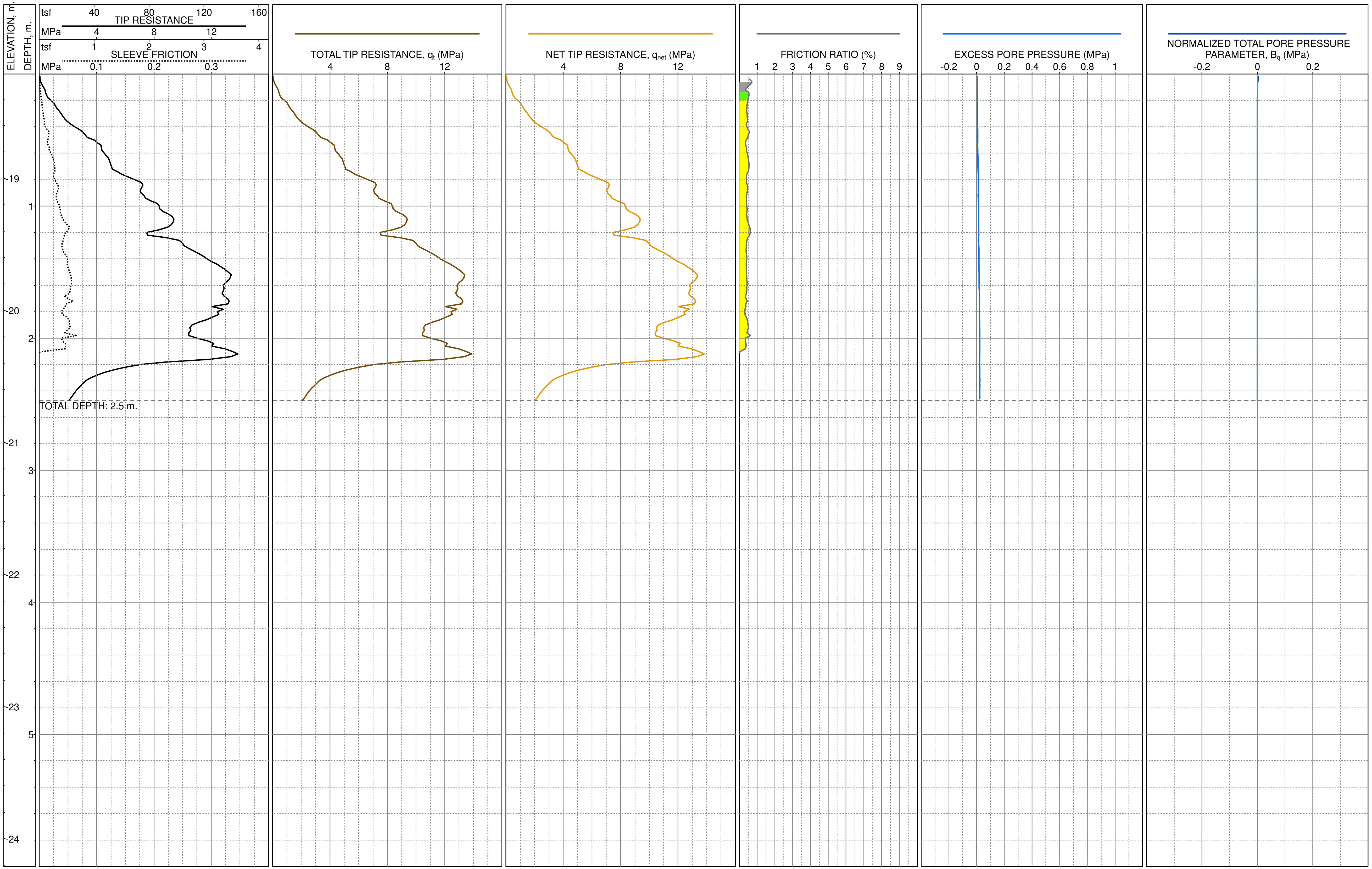
LOCATION: E: 435,902m, N: 4,074,286m (NAD83, UTM 18N)
MUDLINE EL.: -17.9m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 4.7m (MLLW)
TEST DATE: 7/2/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-15
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-22

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 436,903m, N: 4,074,512m (NAD83, UTM 18N)
MUDLINE EL.: -18.2m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 2.5m (MLLW)
TEST DATE: 7/2/2014

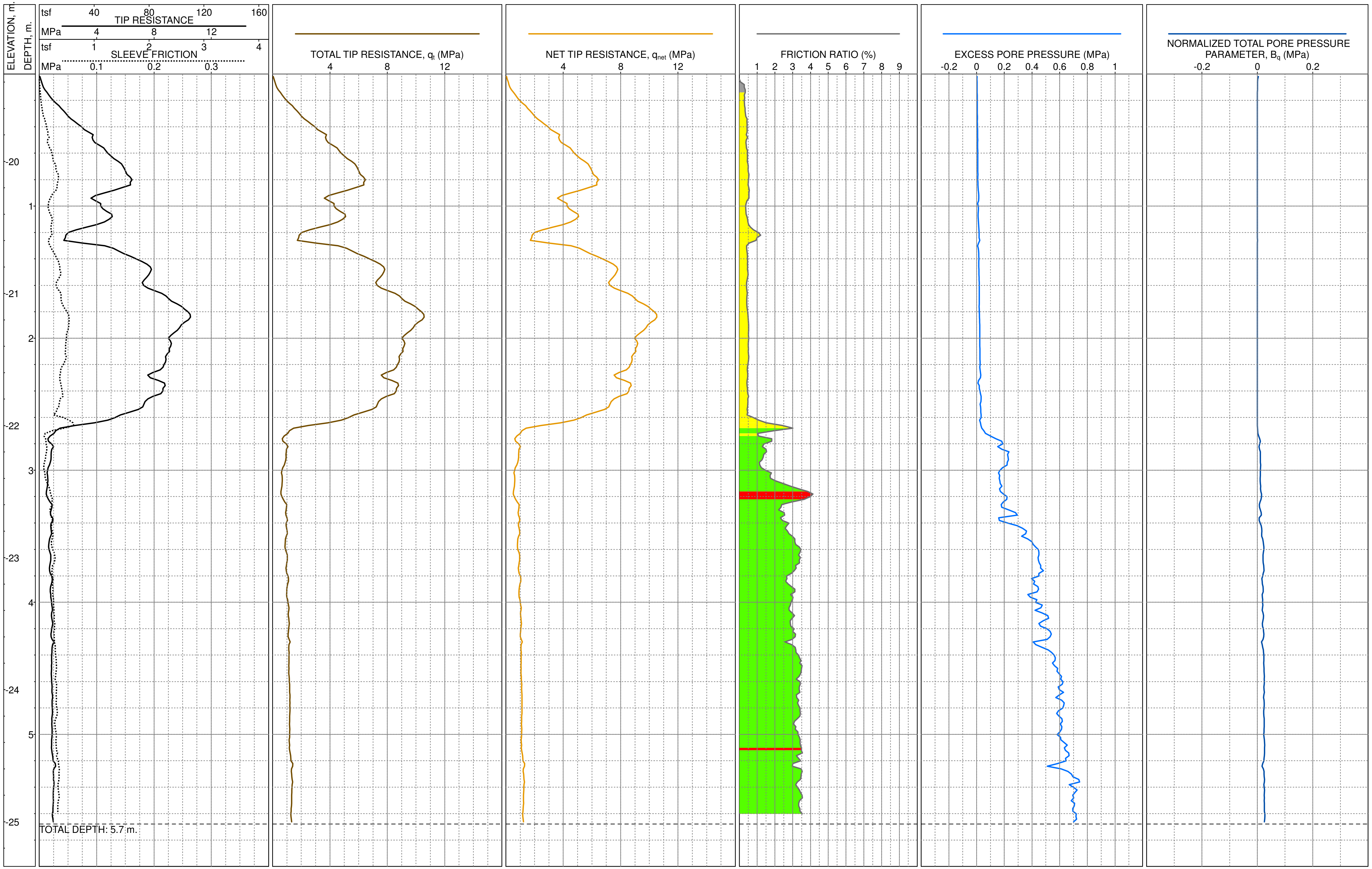
SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-16

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-23

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



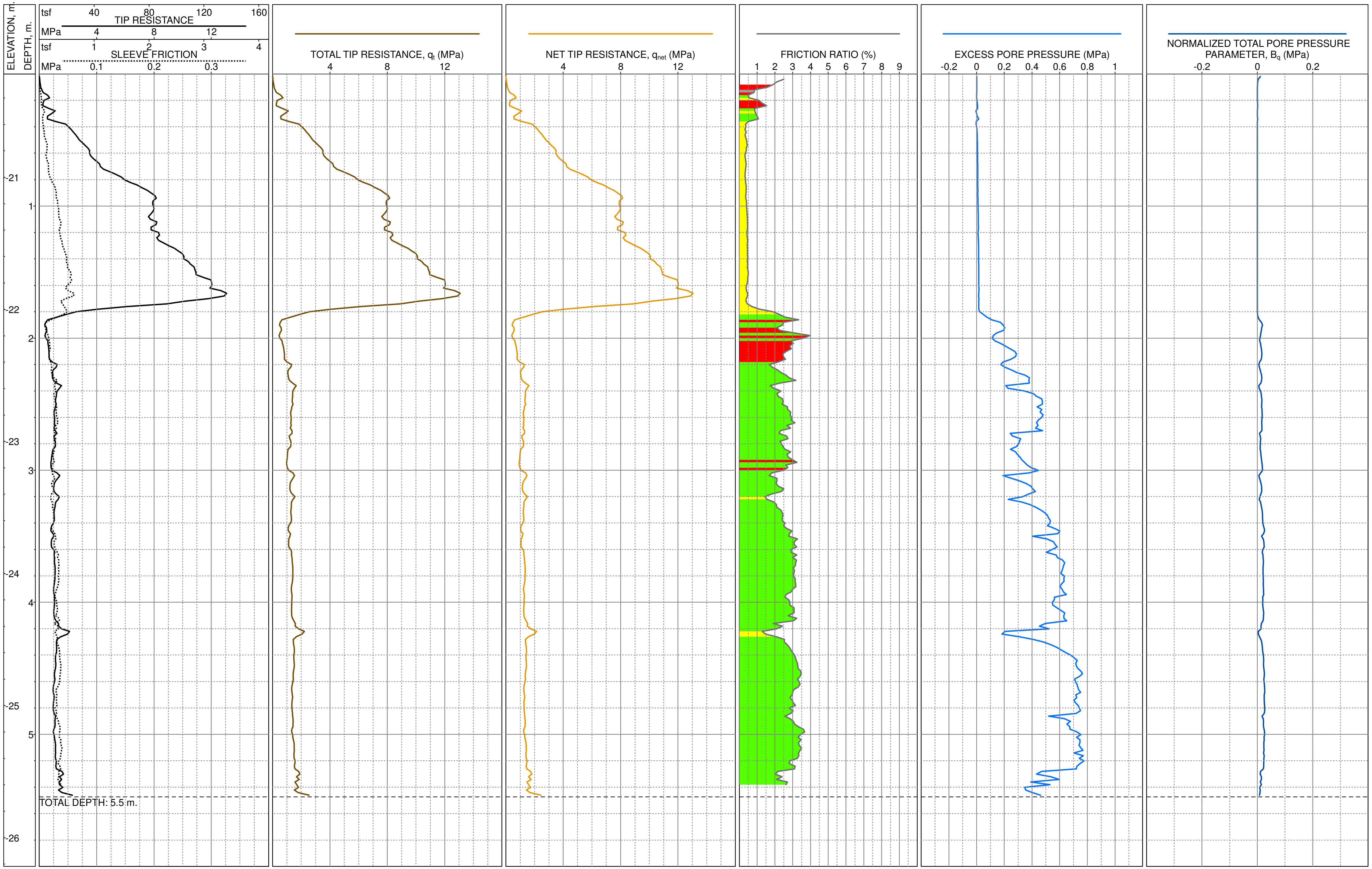
LOCATION: E: 438,828m, N: 4,074,927m (NAD83, UTM 18N)
MUDLINE EL.: -19.3m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 5.7m (MLLW)
TEST DATE: 7/2/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-17
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-24

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 439,807m, N: 4,075,130m (NAD83, UTM 18N)
MUDLINE EL.: -20.2m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 5.5m (MLLW)
TEST DATE: 7/2/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m³
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-18

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

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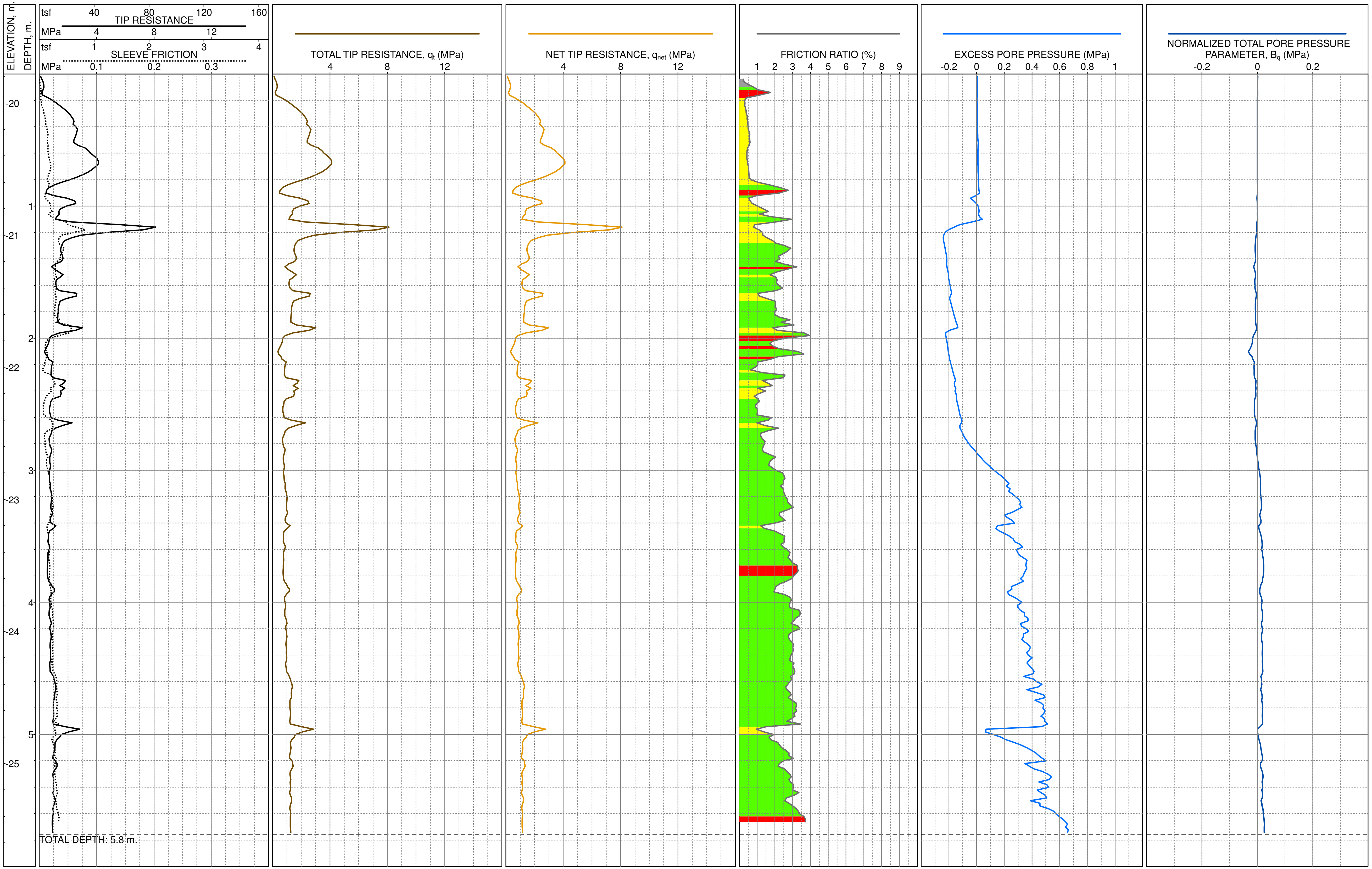


LOCATION: E: 440,958m, N: 4,075,374m (NAD83, UTM 18N)
MUDLINE EL.: -19.8m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 5.8m (MLLW)
TEST DATE: 7/2/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

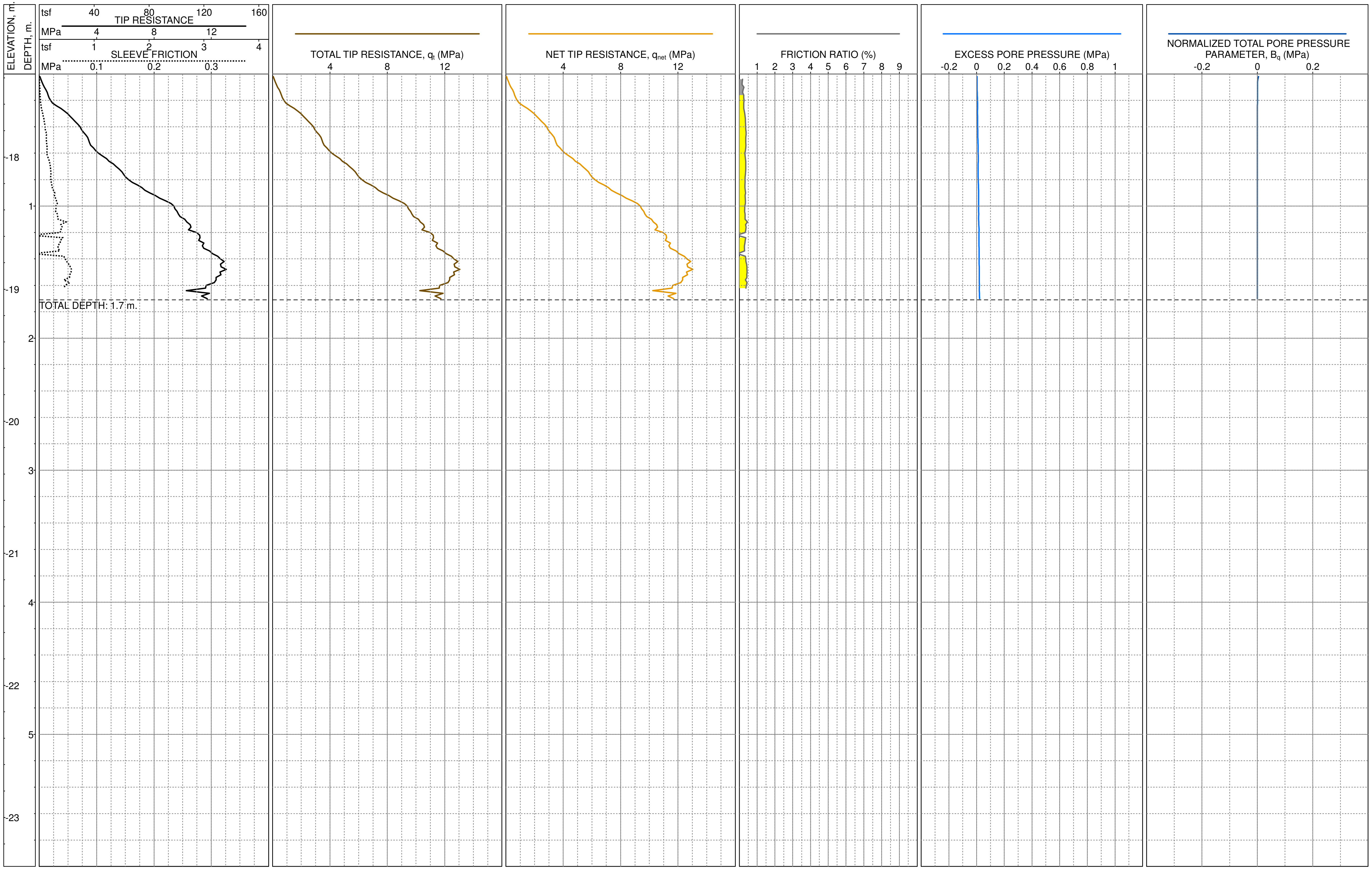
LOG OF CPT C-19

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

FIGURE B-26

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 441,861m, N: 4,075,571m (NAD83, UTM 18N)
MUDLINE EL.: -17.4m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 1.7m (MLLW)
TEST DATE: 7/2/2014

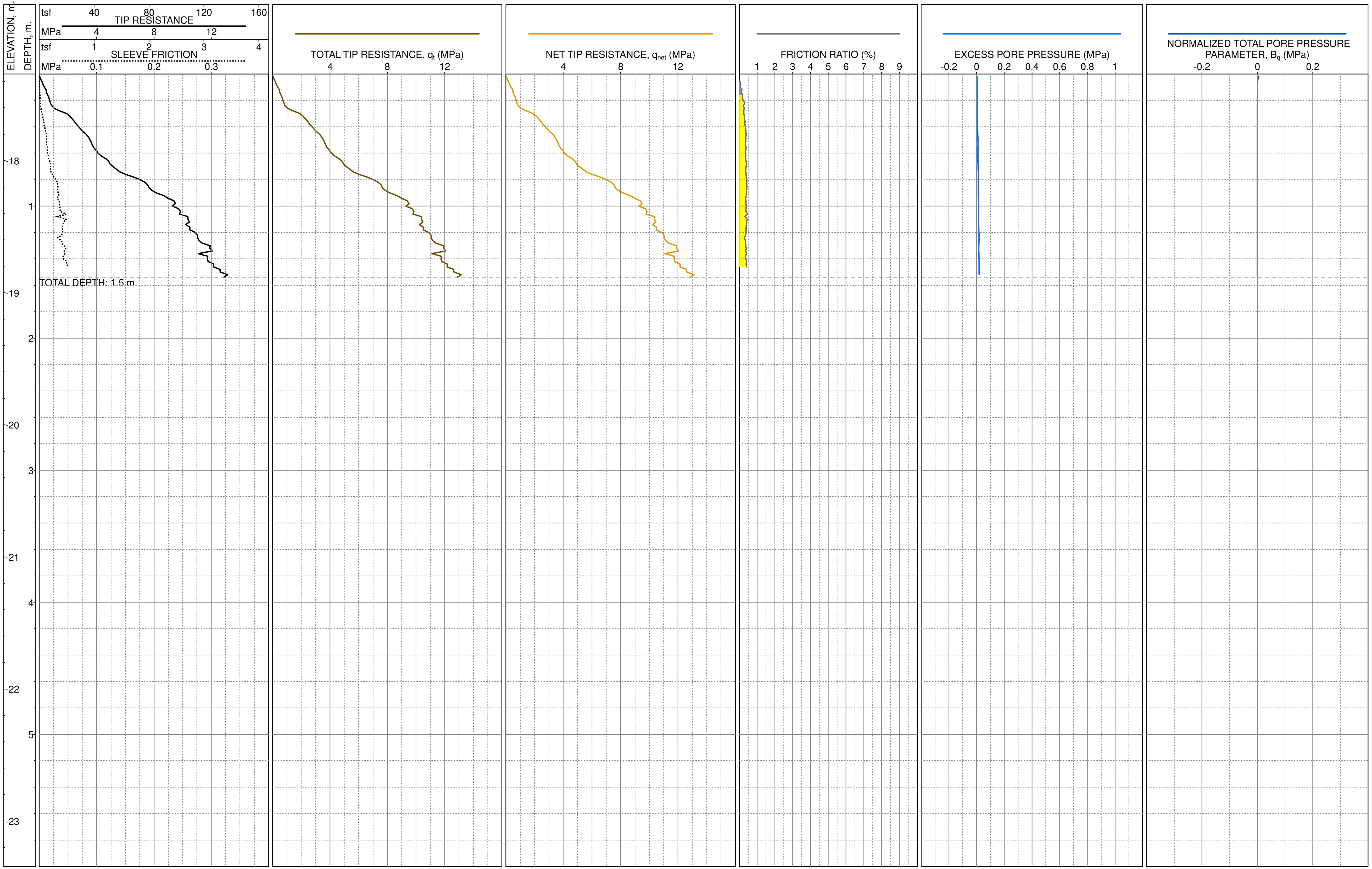
SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-20

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-27

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



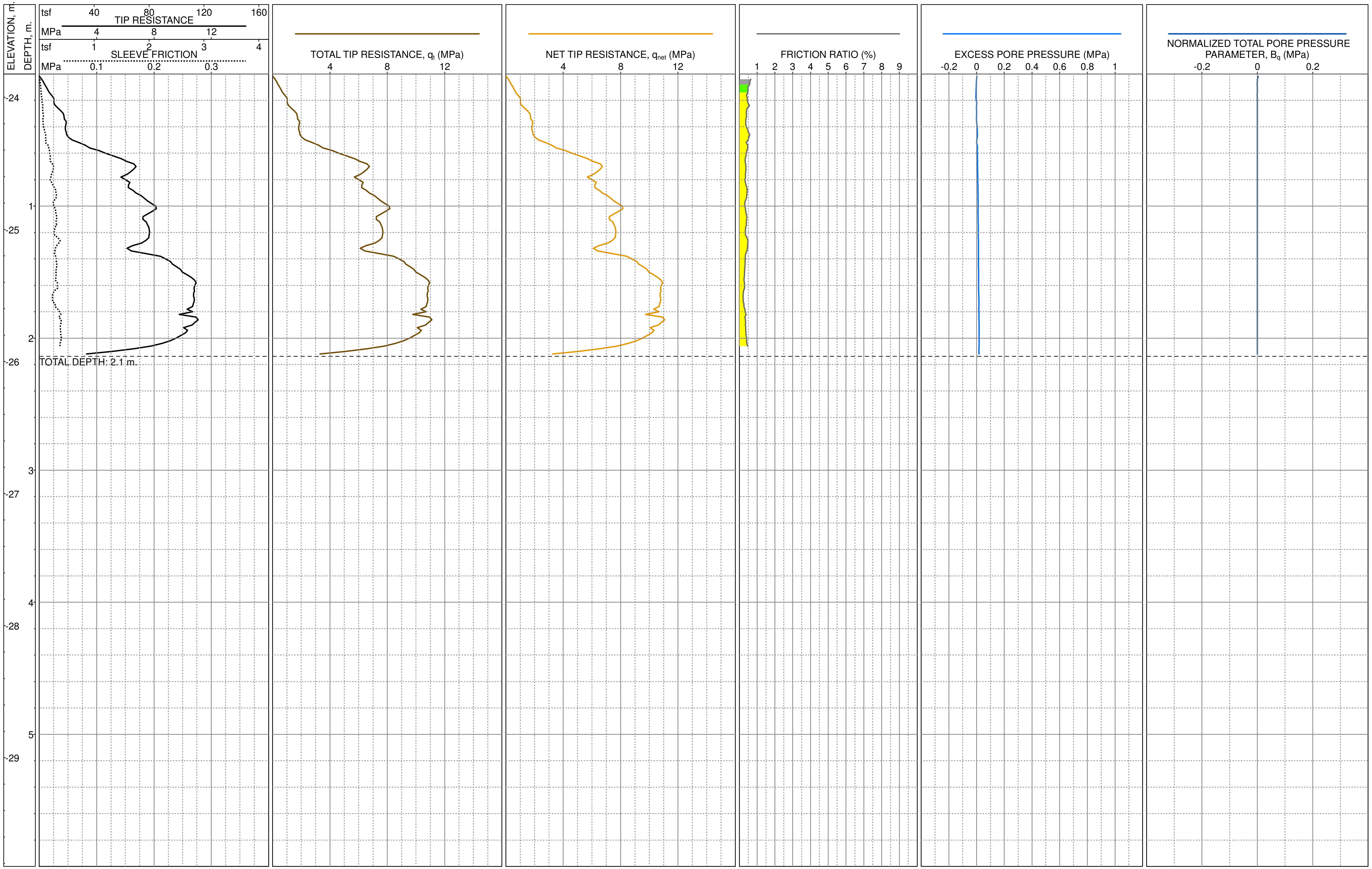
LOCATION: E: 441,861m, N: 4,075,568m (NAD83, UTM 18N)
MUDLINE EL.: -17.3m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 1.5m (MLLW)
TEST DATE: 7/2/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-20A
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-28

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



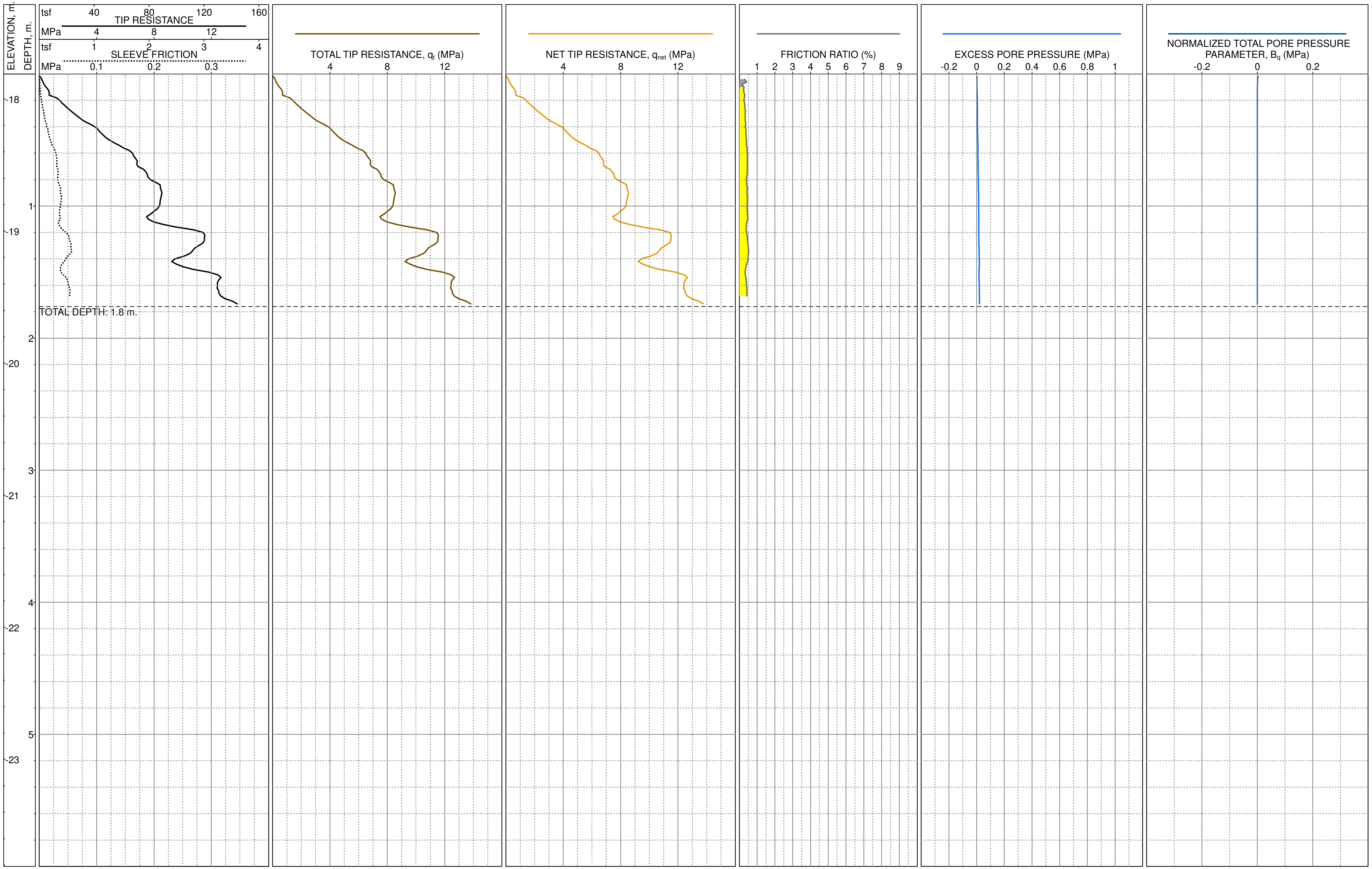
LOCATION: E: 443,528m, N: 4,075,921m (NAD83, UTM 18N)
MUDLINE EL.: -23.8m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 2.1m (MLLW)
TEST DATE: 7/6/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m³
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-21
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-29

N:\Projects\04_201404_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 444,778m, N: 4,076,209m (NAD83, UTM 18N)
MUDLINE EL.: -17.8m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 1.8m (MLLW)
TEST DATE: 7/6/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

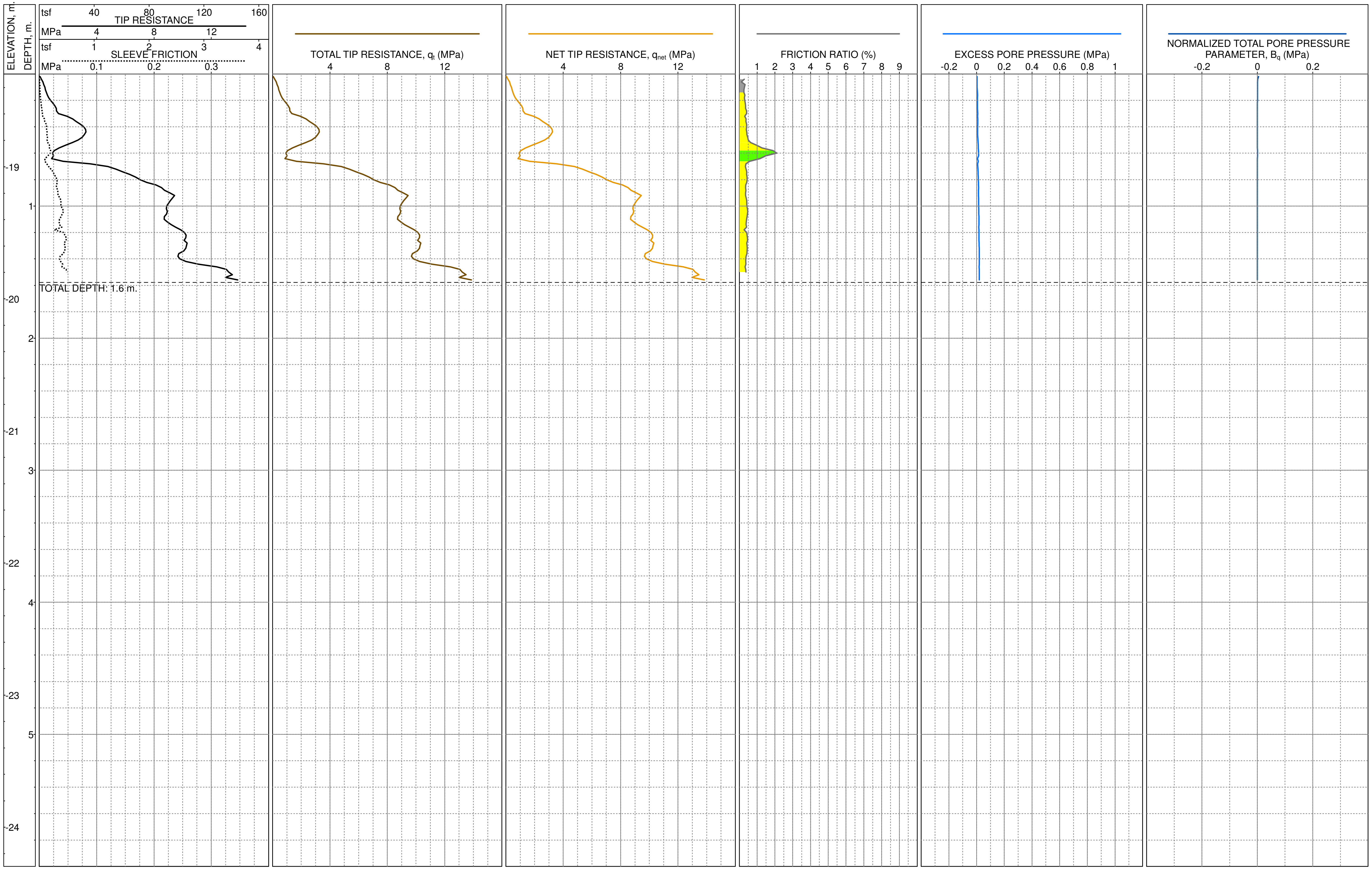
LOG OF CPT C-22

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-30

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao

Dominion Resources
Project No. 04.81140004



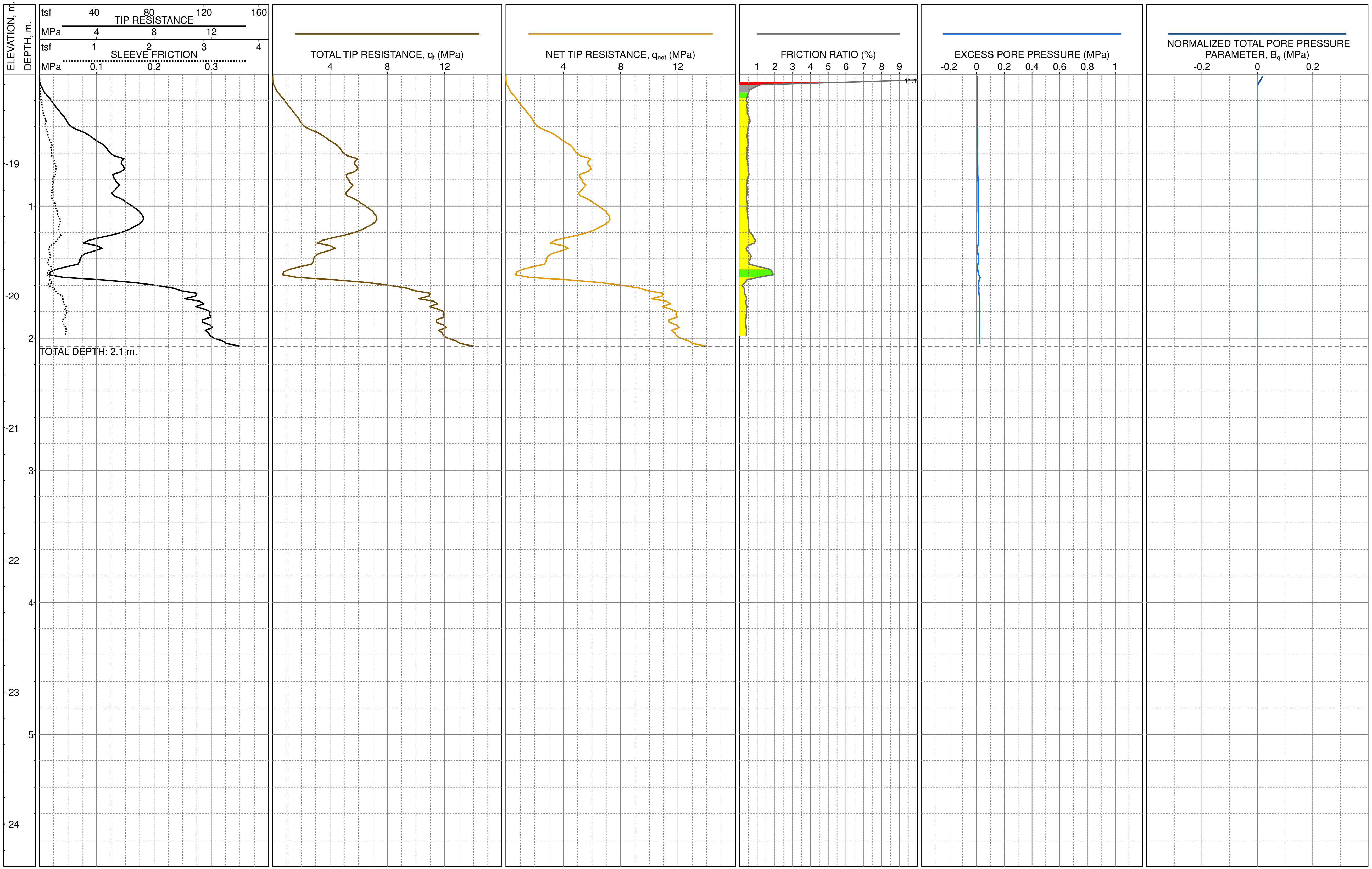
LOCATION: E: 446,159m, N: 4,077,009m (NAD83, UTM 18N)
MUDLINE EL.: -18.3m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 1.6m (MLLW)
TEST DATE: 7/6/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-23
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-31

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao

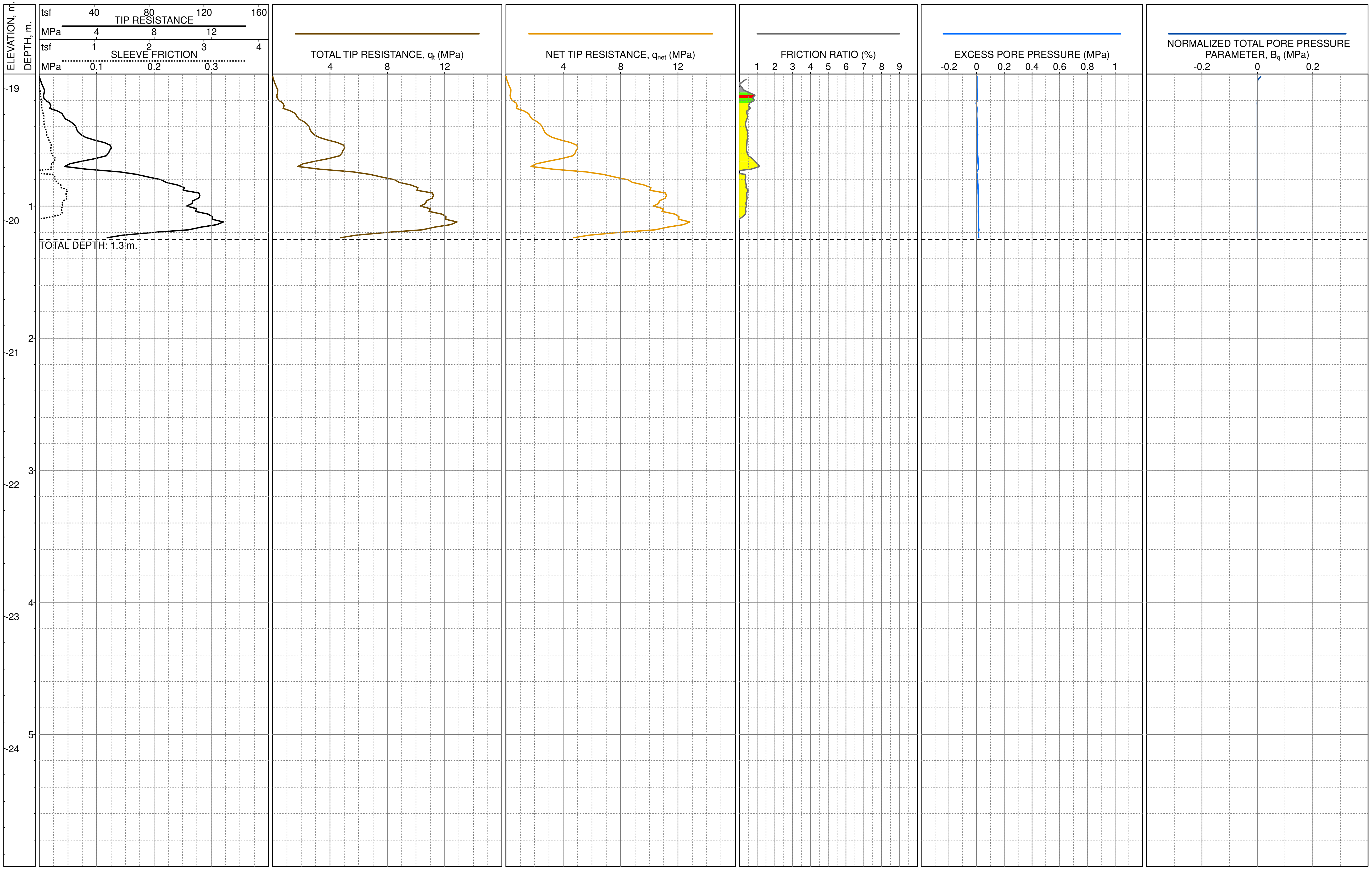


LOCATION: E: 447,331m, N: 4,077,706m (NAD83, UTM 18N)
MUDLINE EL.: -18.3m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 2.1m (MLLW)
TEST DATE: 7/6/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m³
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-24
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 449,119m, N: 4,078,787m (NAD83, UTM 18N)
MUDLINE EL.: -18.9m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 1.3m (MLLW)
TEST DATE: 7/6/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-25
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

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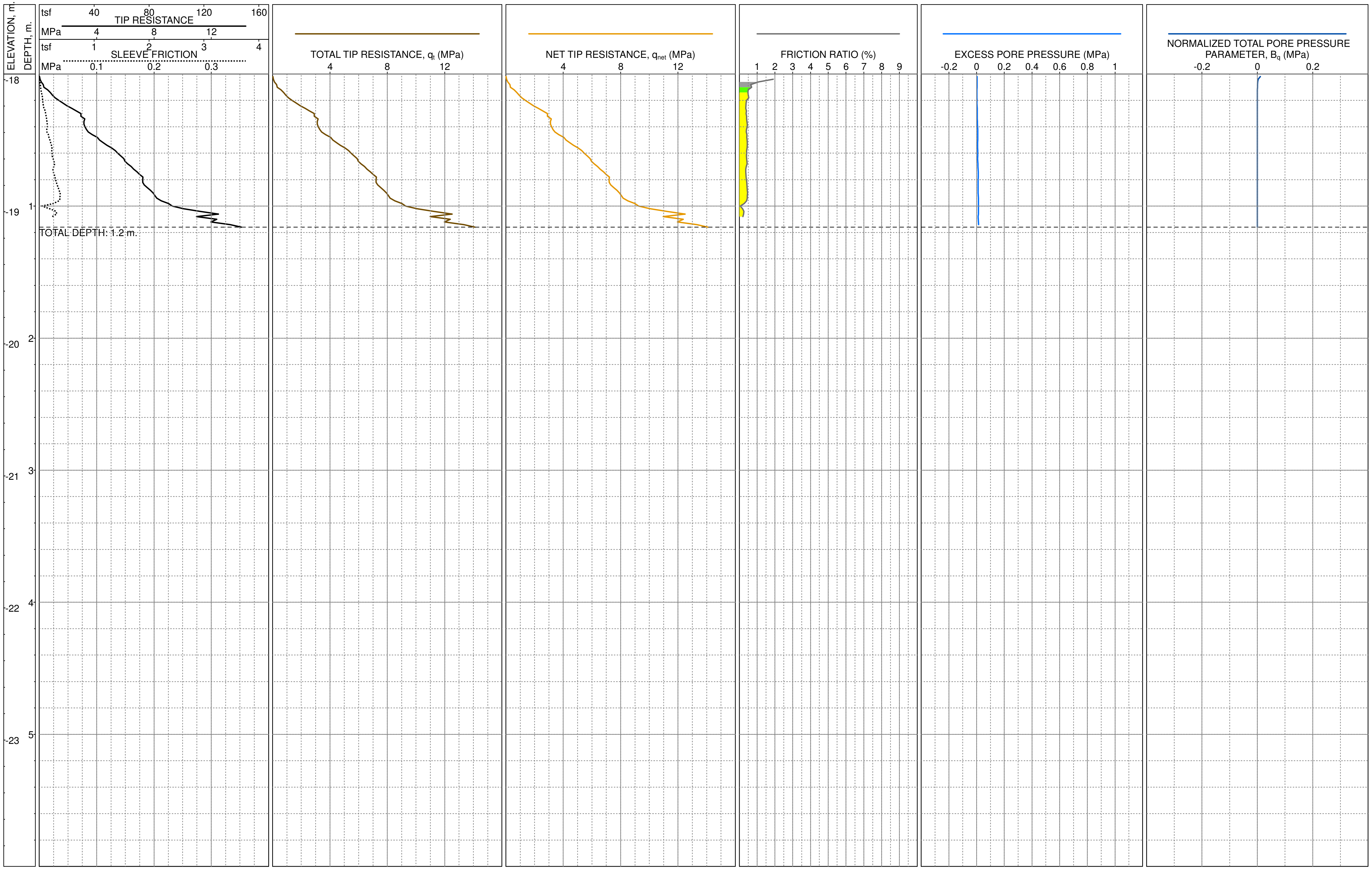

LOCATION: E: 449,921m, N: 4,079,249m (NAD83, UTM 18N)
MUDLINE EL.: -18.0m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 1.2m (MLLW)
TEST DATE: 7/6/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-26

Dominion VOWTAP Geotechnical Survey
Offshore Virginia

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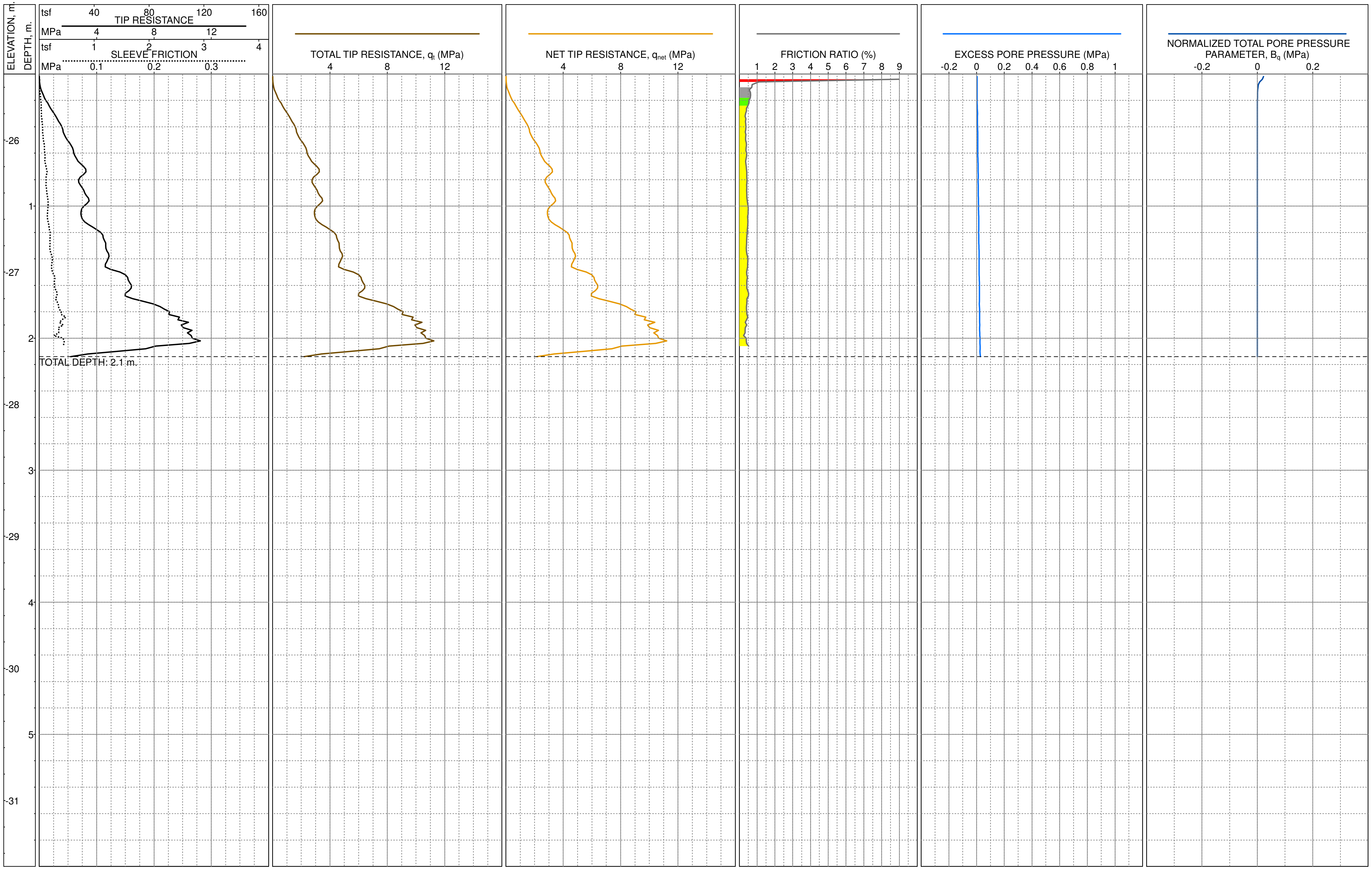

LOCATION: E: 451,811m, N: 4,080,381m (NAD83, UTM 18N)
MUDLINE EL.: -25.5m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 2.1m (MLLW)
TEST DATE: 7/6/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-27
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

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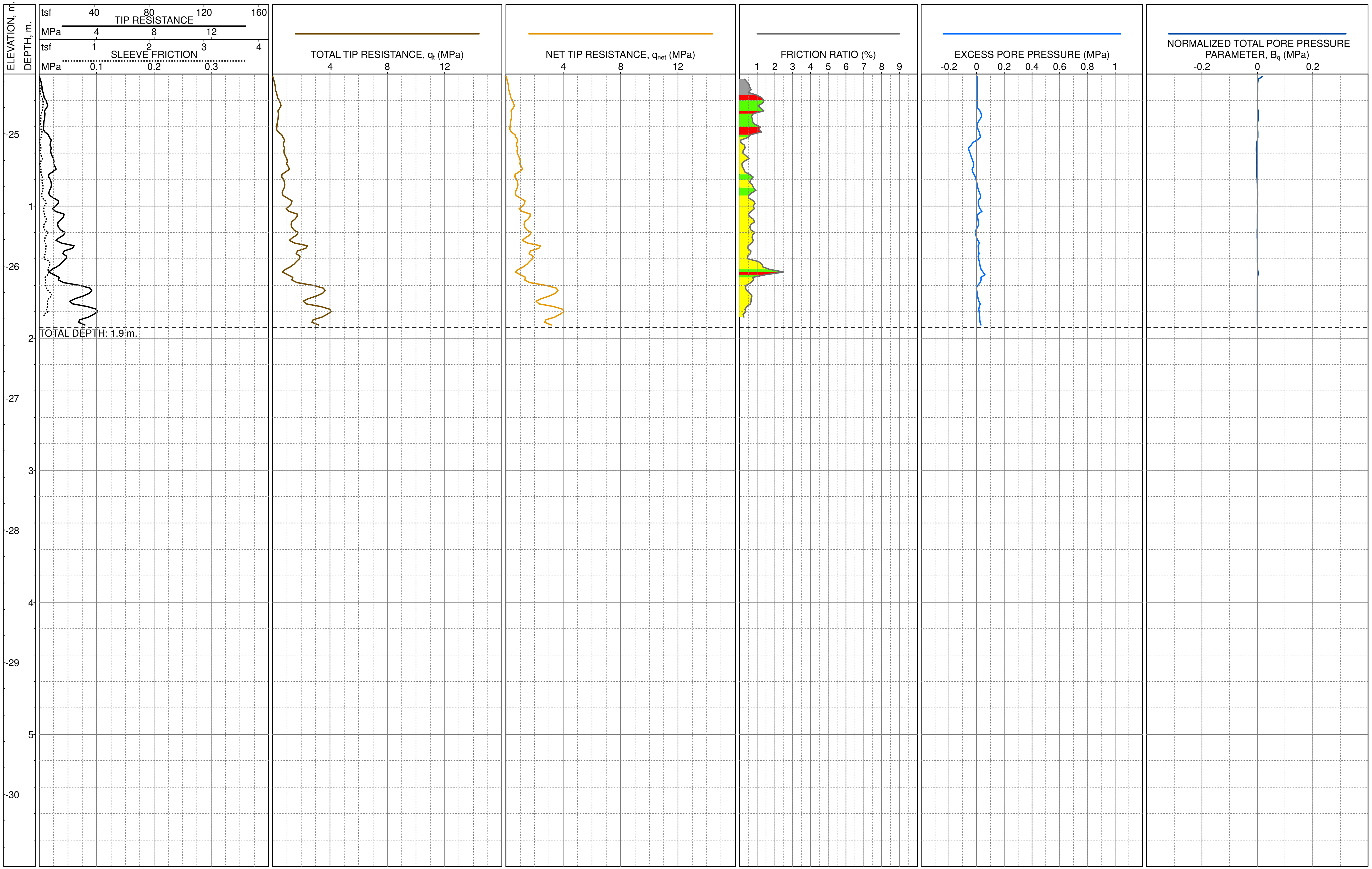


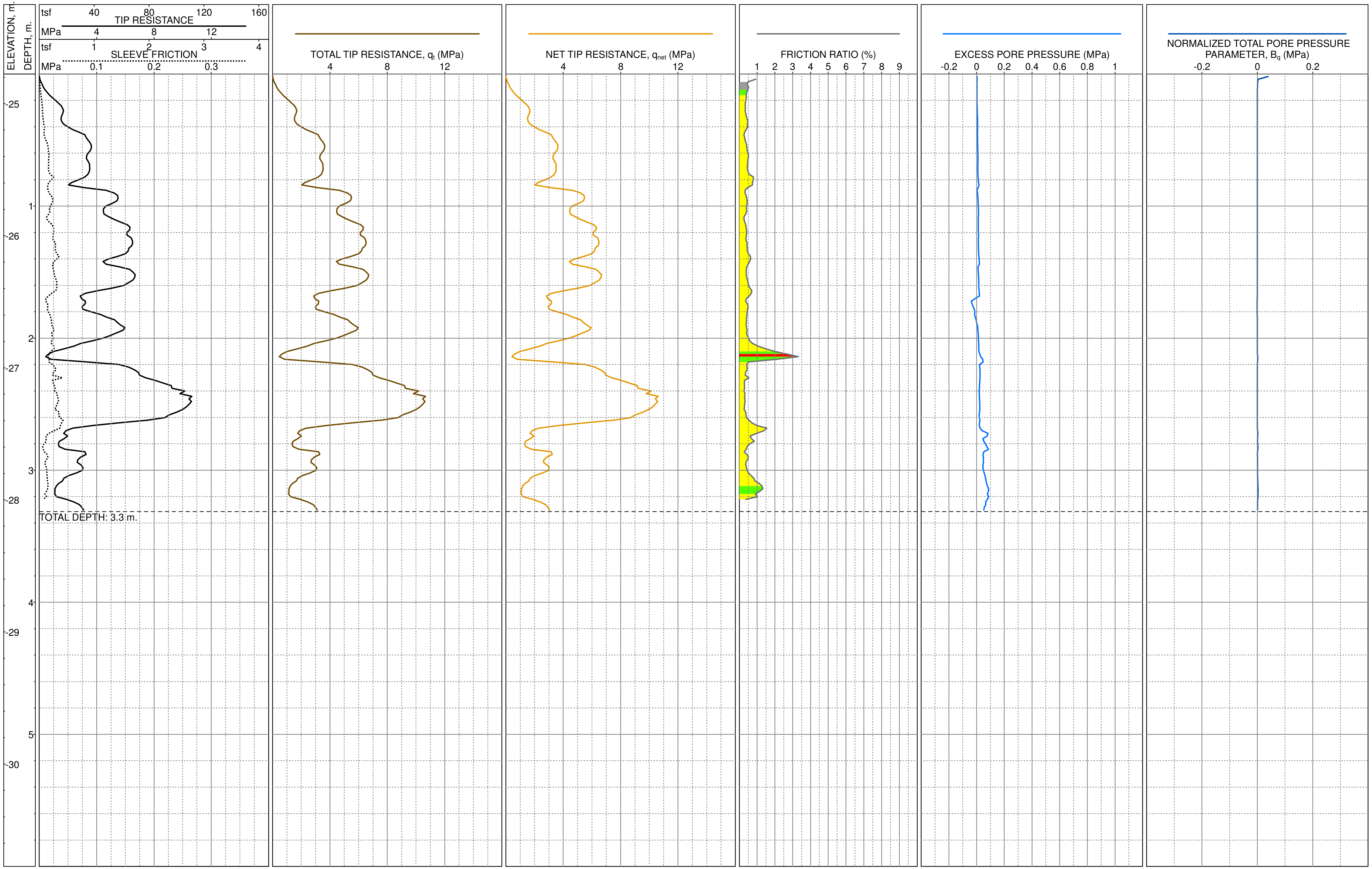
LOCATION: E: 452,539m, N: 4,080,797m (NAD83, UTM 18N)
MUDLINE EL.: -24.5m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 1.9m (MLLW)
TEST DATE: 7/6/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-28
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-36

N:\Projects\04_201404_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



LOCATION: E: 454,052m, N: 4,081,718m (NAD83, UTM 18N)
MUDLINE EL.: -24.8m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 3.3m (MLLW)
TEST DATE: 7/7/2014

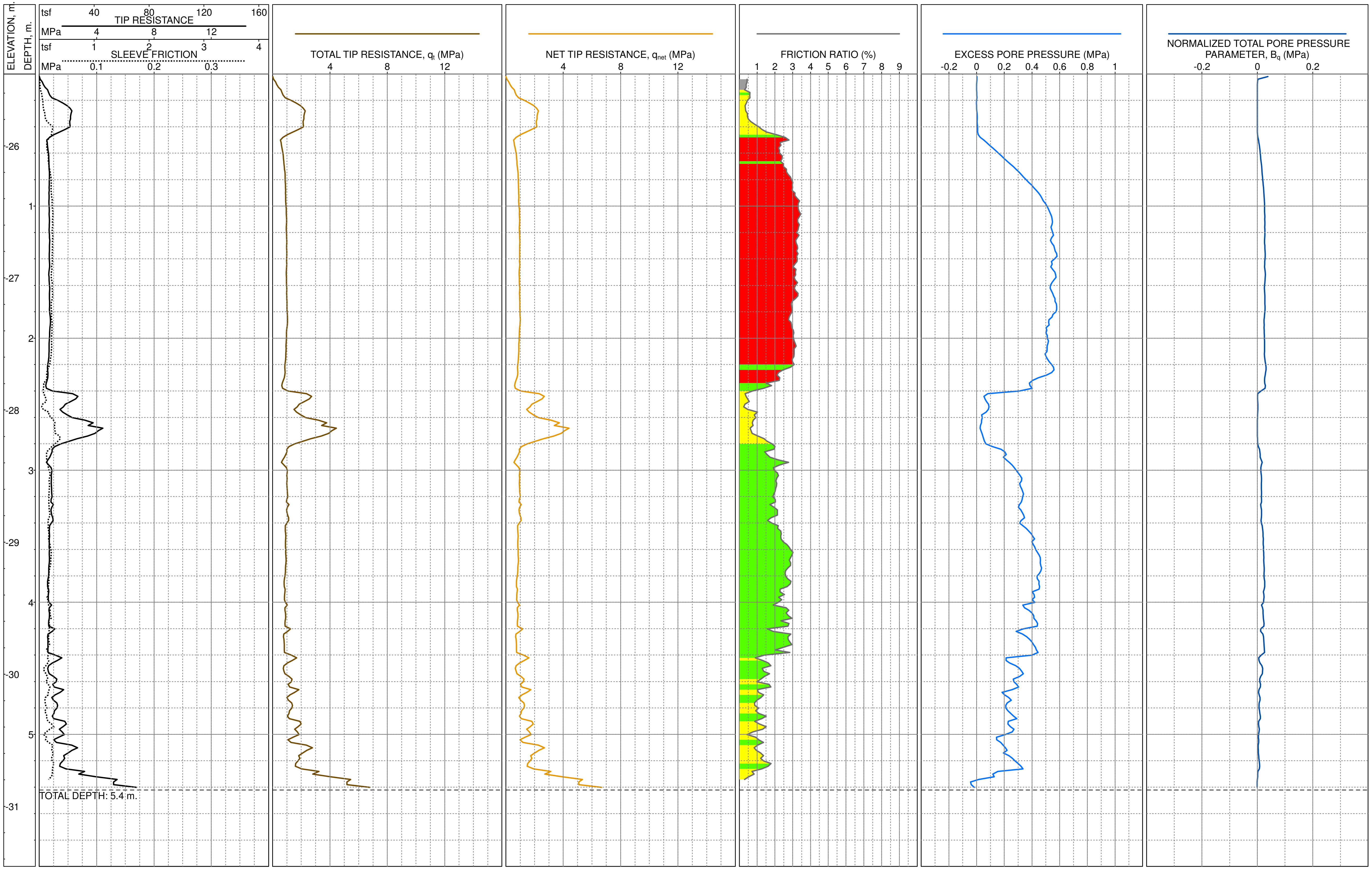
SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-29
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-37

N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao

Dominion Resources
Project No. 04.81140004



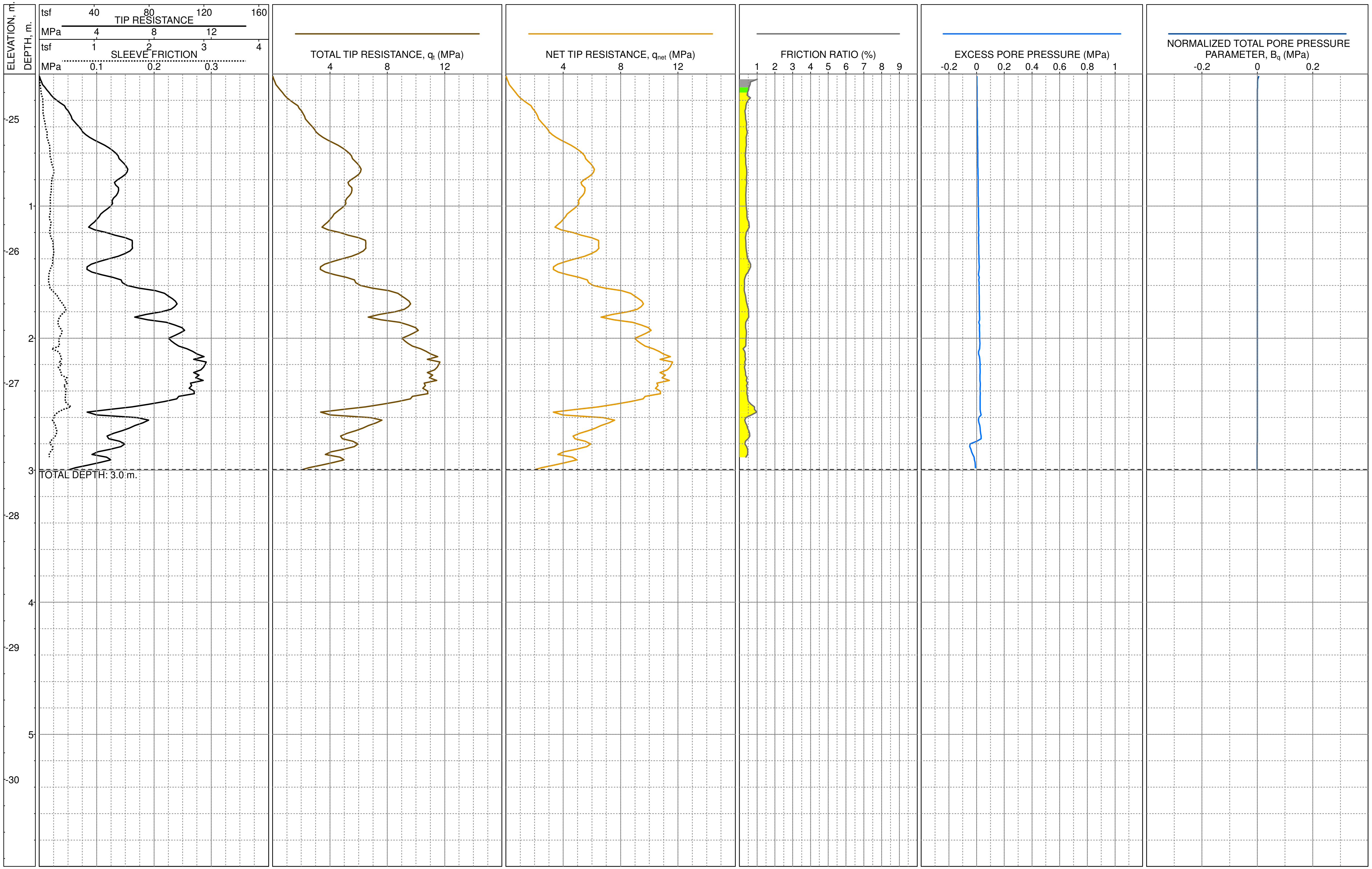
LOCATION: E: 455,043m, N: 4,082,299m (NAD83, UTM 18N)
MUDLINE EL.: -25.5m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 5.4m (MLLW)
TEST DATE: 7/7/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-30
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-38

N:\Projects\04_201404_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao



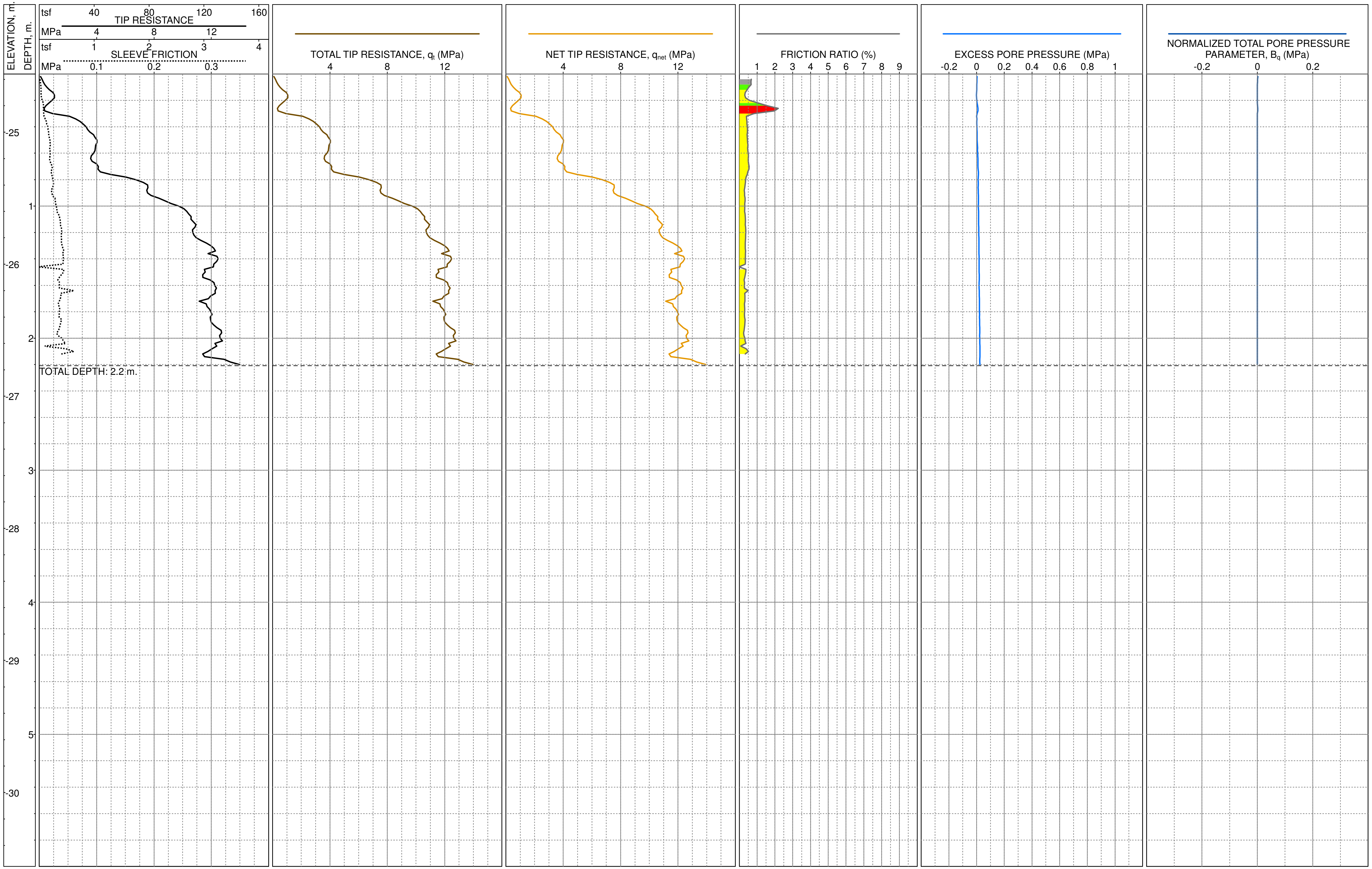
LOCATION: E: 456,197m, N: 4,082,767m (NAD83, UTM 18N)
MUDLINE EL.: -24.7m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 3.0m (MLLW)
TEST DATE: 7/7/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

LOG OF CPT C-31
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-39

Dominion Resources
Project No. 04.81140004



LOCATION: E: 456,197m, N: 4,083,204m (NAD83, UTM 18N)
MUDLINE EL.: -24.6m (MLLW)
MUDLINE EL. REFERENCE: Tetra Tech, 2013
COMPLETION DEPTH: 2.2m (MLLW)
TEST DATE: 7/7/2014

SOIL BEHAVIOR TYPE: Robertson, 1990
CONE AREA RATIO: 0.50
UNIT WEIGHT: 18 kN/m^3
PERFORMED BY: FAOL
REVIEWED BY: M. Mekkawy

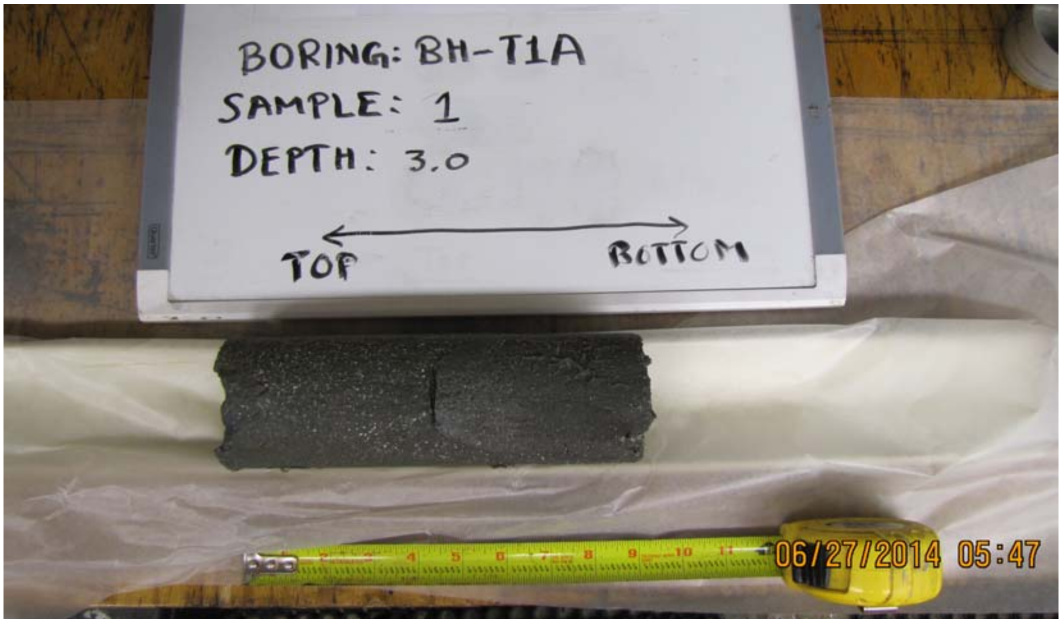
LOG OF CPT C-32
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE B-40

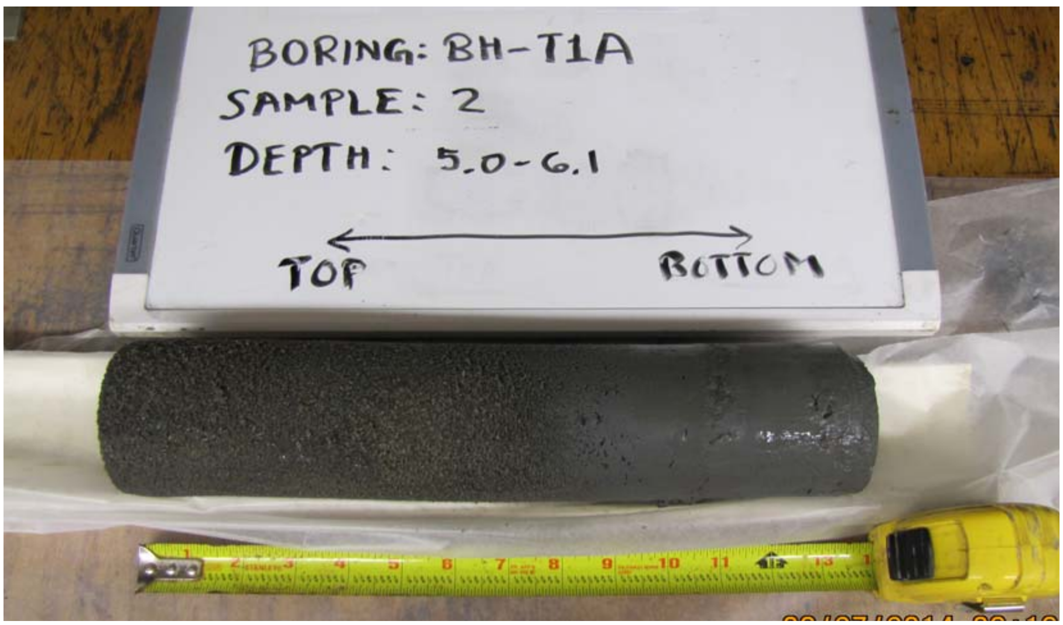
N:\Projects\04_2014\04_8114_0004_VOWTAP_Geotech\Explorations\CPT\2014\Seacalf\Logs\2014_07_29_Logs_FieldRpt\MXD\VOWTAP_CPT_20140916_FieldRptLogs.mxd,09/16/2014,dmiao

APPENDIX C

BORING SAMPLE PHOTOGRAPHS



BH-T1A Sample 1 Depth: 3.0 ft



BH-T1A Sample 2 Depth: 5.0 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C1-1

BH-T1A Sample 3 Depth: 17 ft

BH-T1A Sample 4 Depth: 20 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

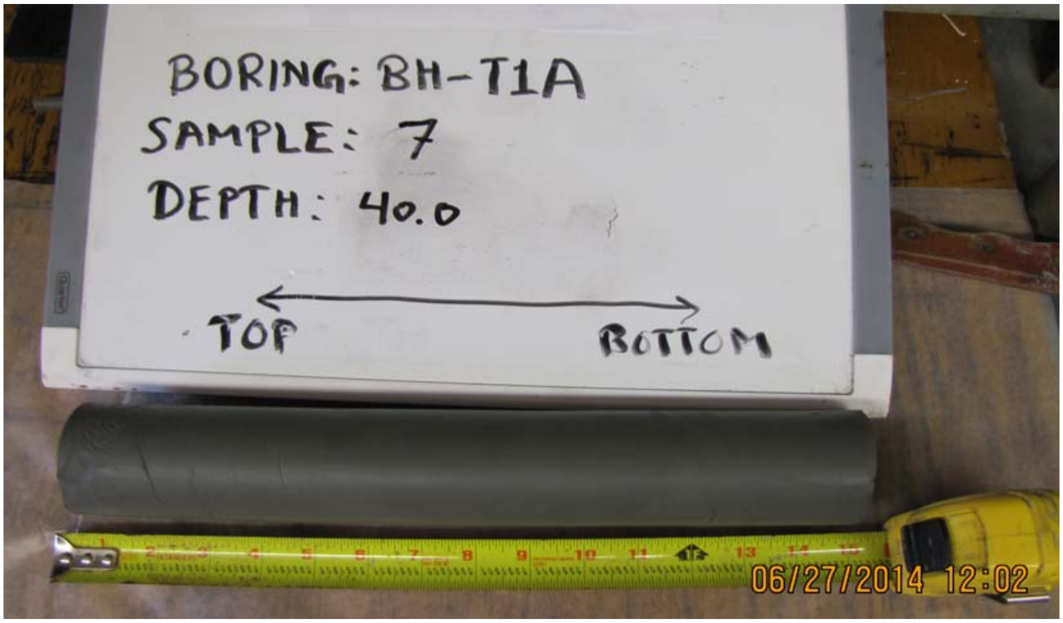
FIGURE C1-2

BH-T1A Sample 5 Depth: 32 ft

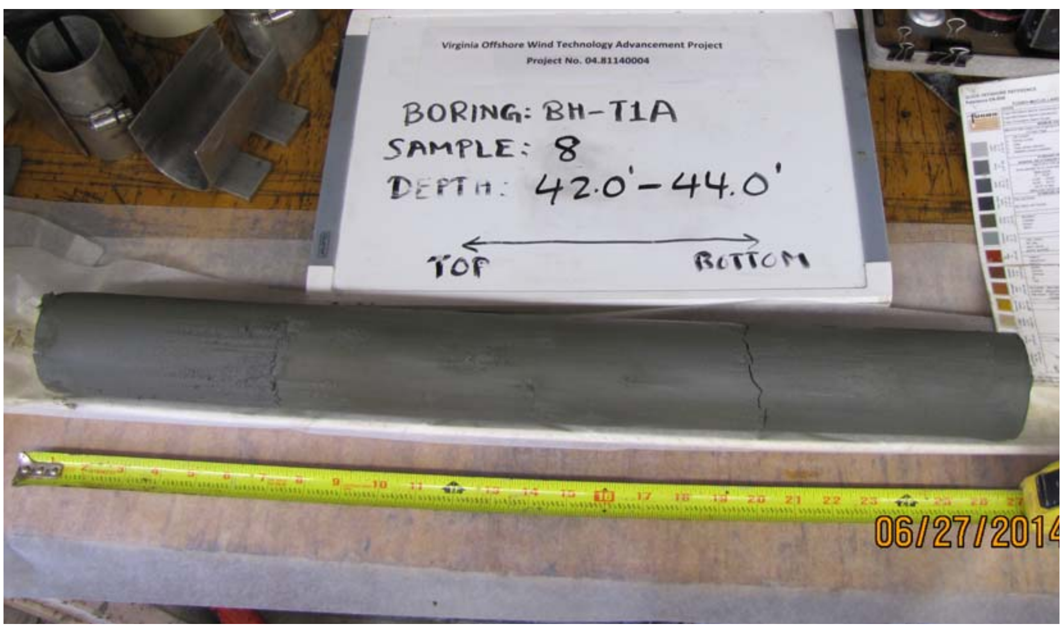
BH-T1A Sample 6 Depth: 35 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C1-3



BH-T1A Sample 7 Depth: 40 ft



BH-T1A Sample 8 Depth: 42 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C1-4

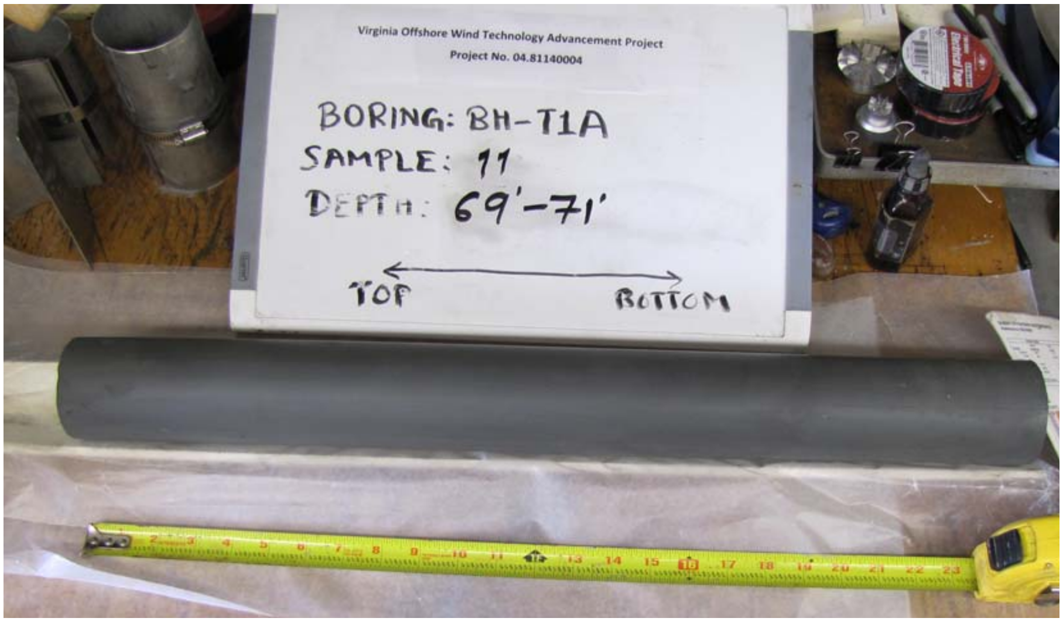
Photograph not available

BH-T1A Sample 9 Depth: ft

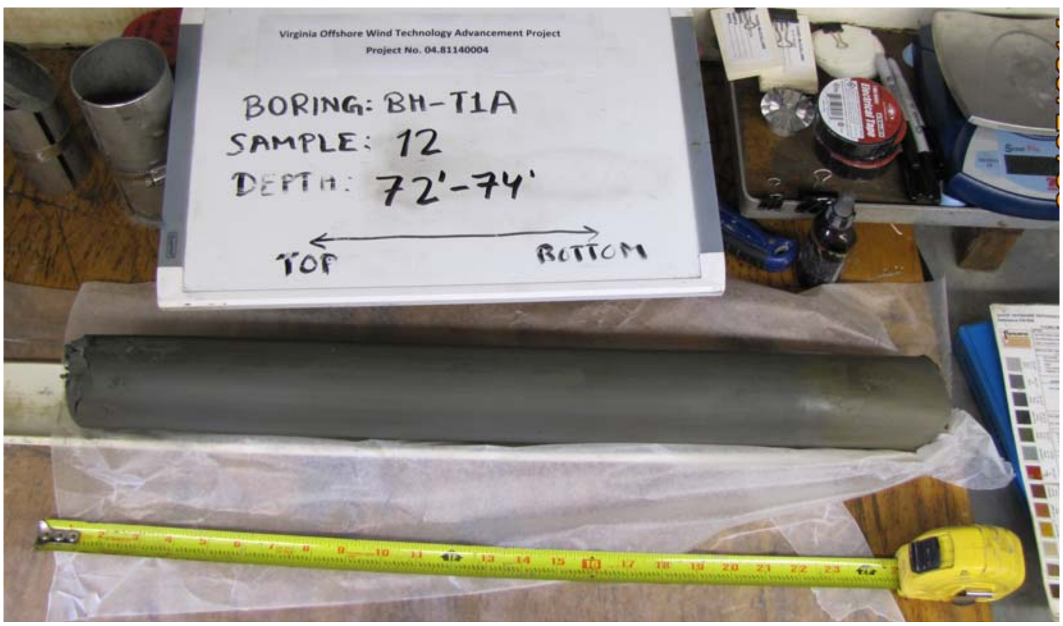
Photograph not available

BH-T1A Sample 10 Depth: ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia



BH-T1A Sample 11 Depth: 69 ft

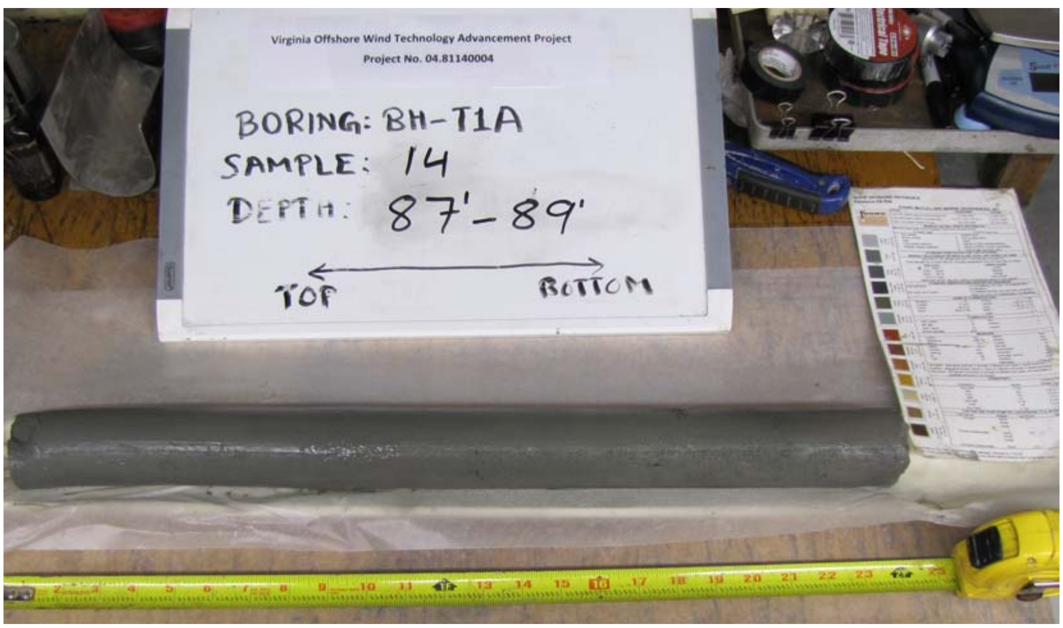


BH-T1A Sample 12 Depth: 72 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C1-6

BH-T1A Sample 13 Depth: 84 ft

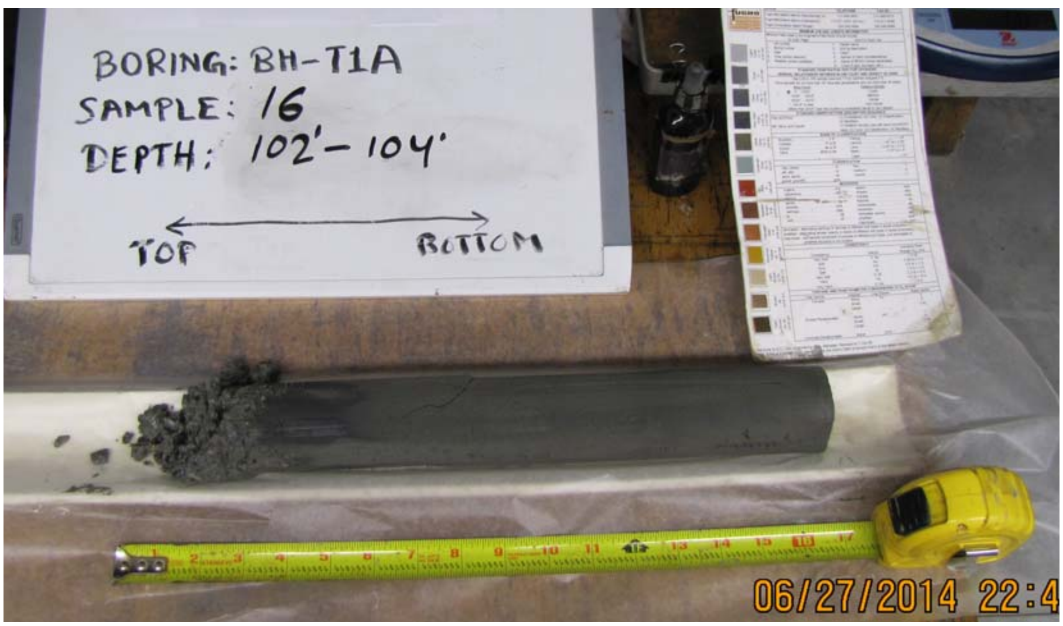


BH-T1A Sample 14 Depth: 87 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C1-7

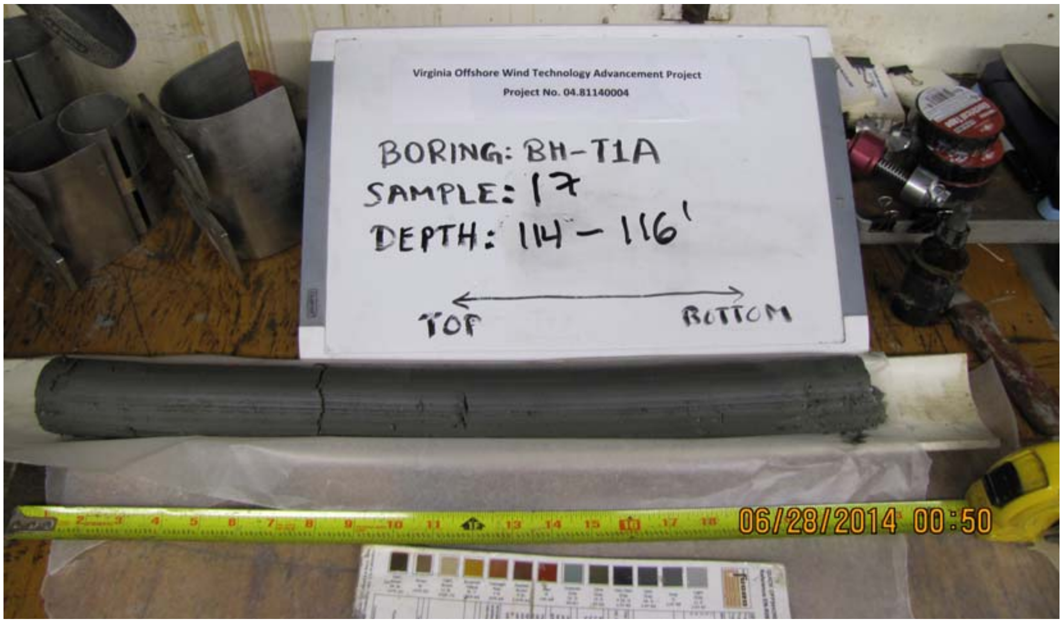
BH-T1A Sample 15 Depth: 99 ft



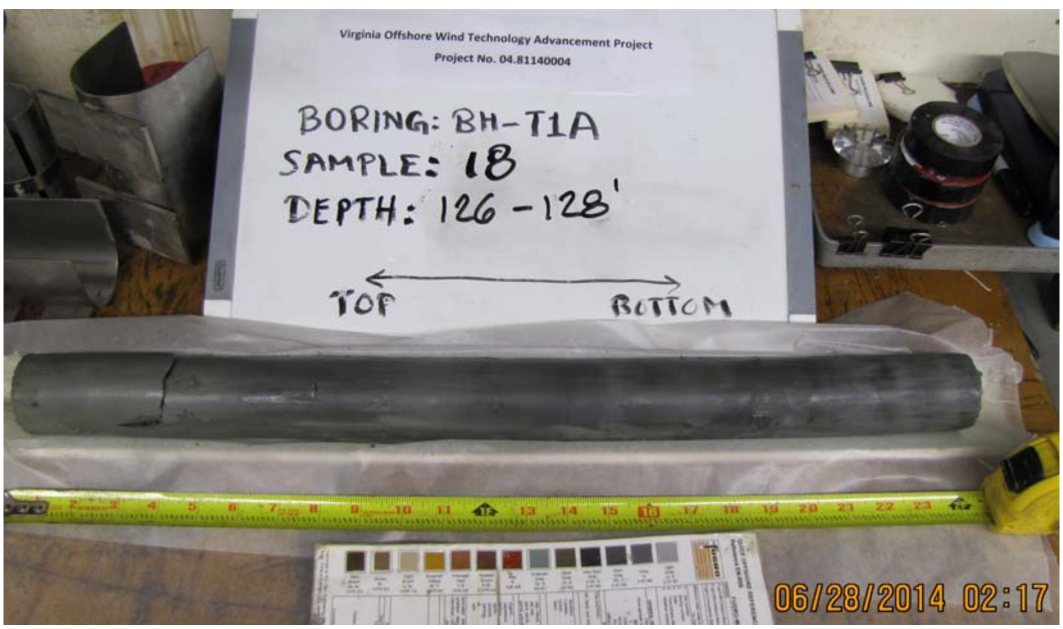
BH-T1A Sample 16 Depth: 102 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C1-8



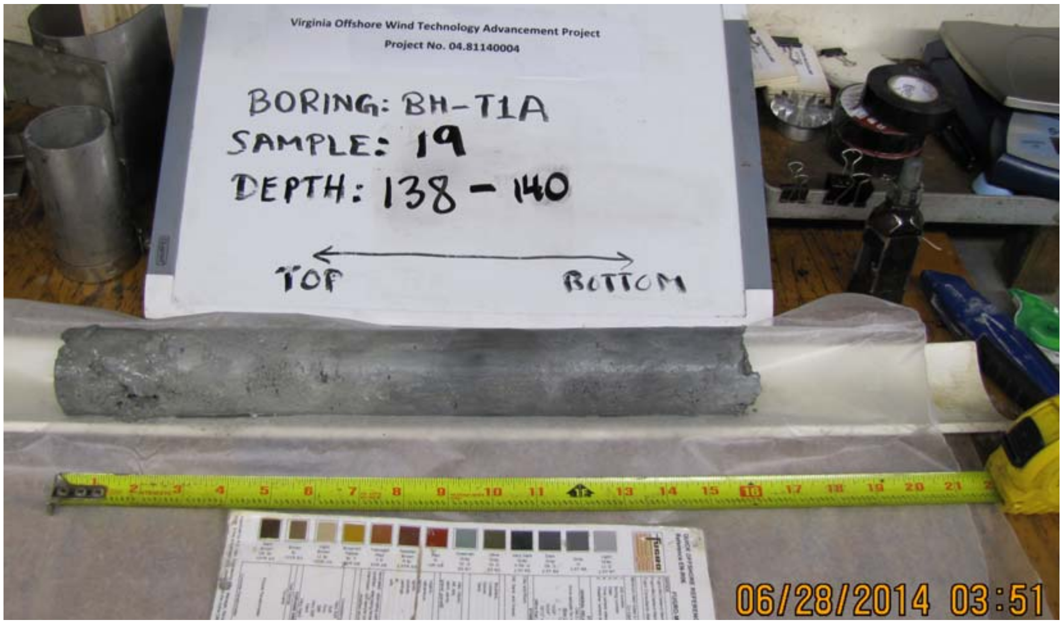
BH-T1A Sample 17 Depth: 114 ft



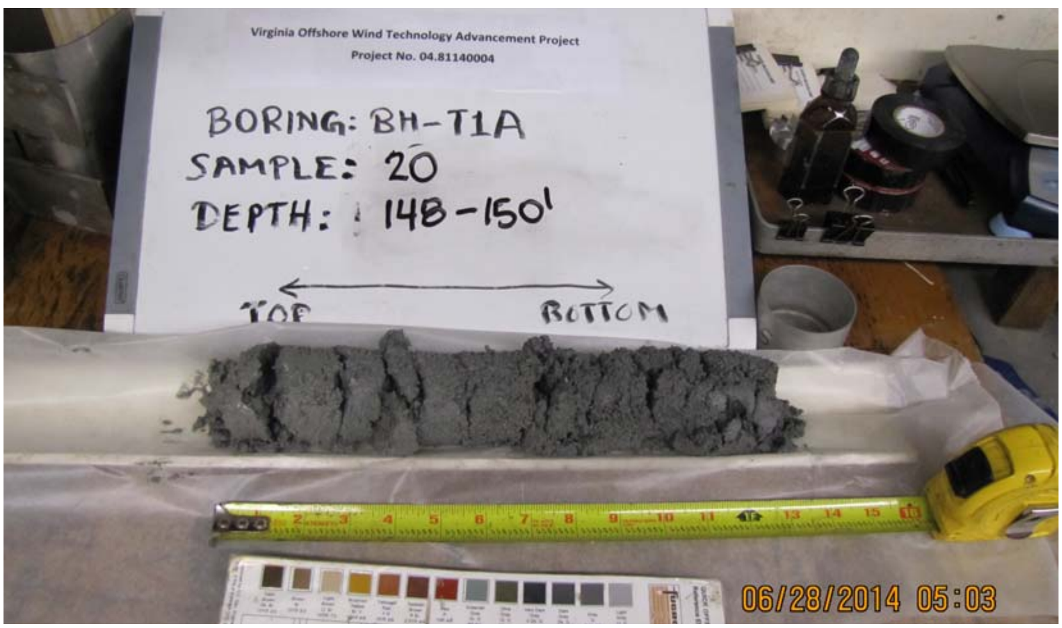
BH-T1A Sample 18 Depth: 126 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C1-9



BH-T1A Sample 19 Depth: 138 ft

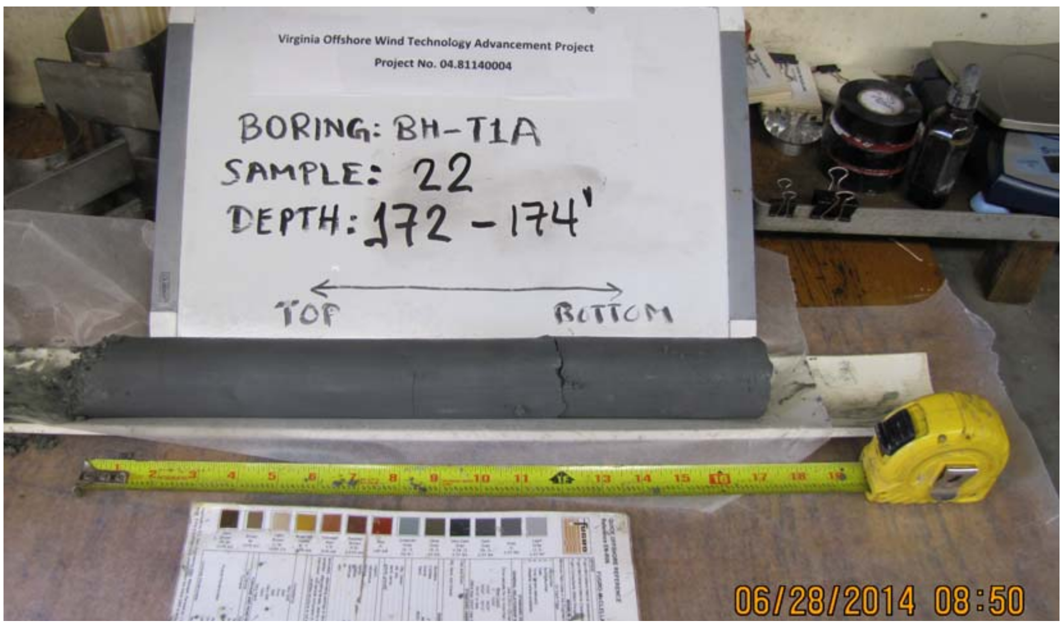


BH-T1A Sample 20 Depth: 148 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C1-10

BH-T1A Sample 21 Depth: 160 ft



BH-T1A Sample 22 Depth: 172 ft

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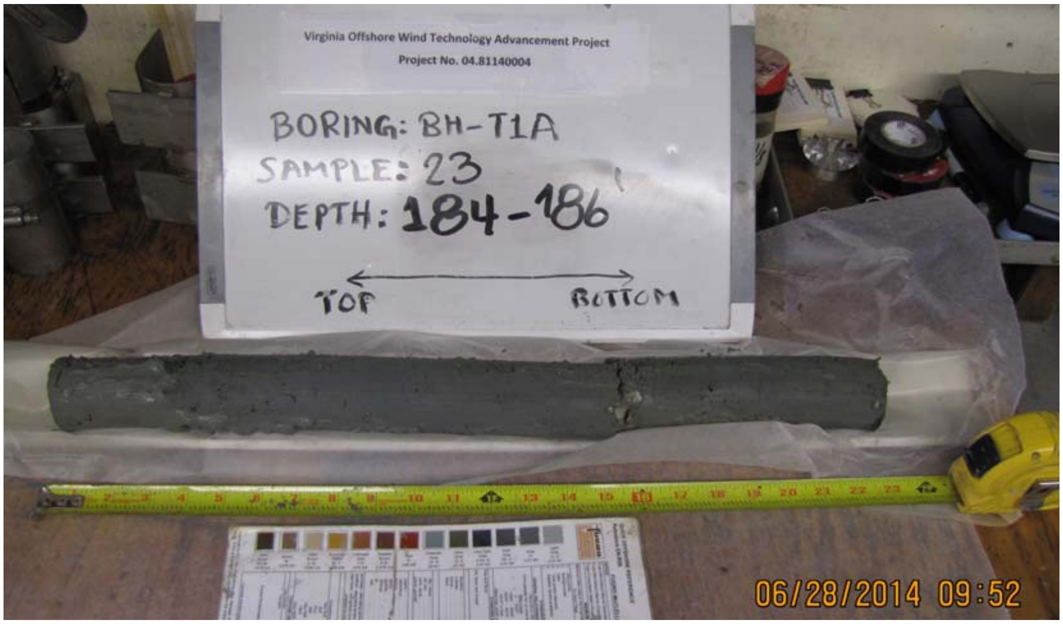
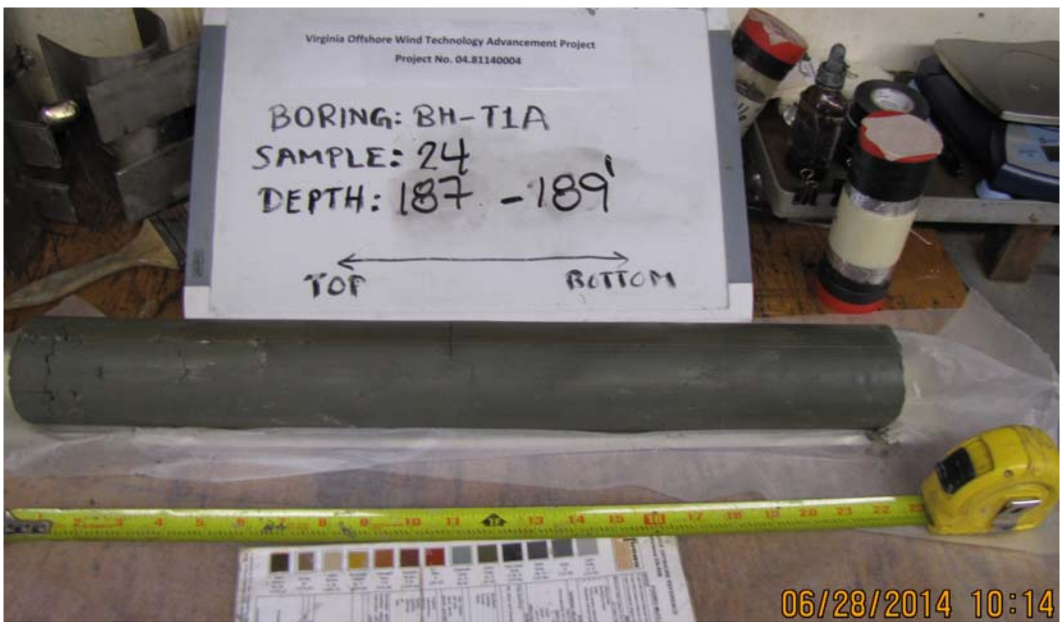
Offshore Virginia

FIGURE C1-11



BH-T1A Sample 23 Depth: 184 ft



BH-T1A Sample 24 Depth: 187 ft

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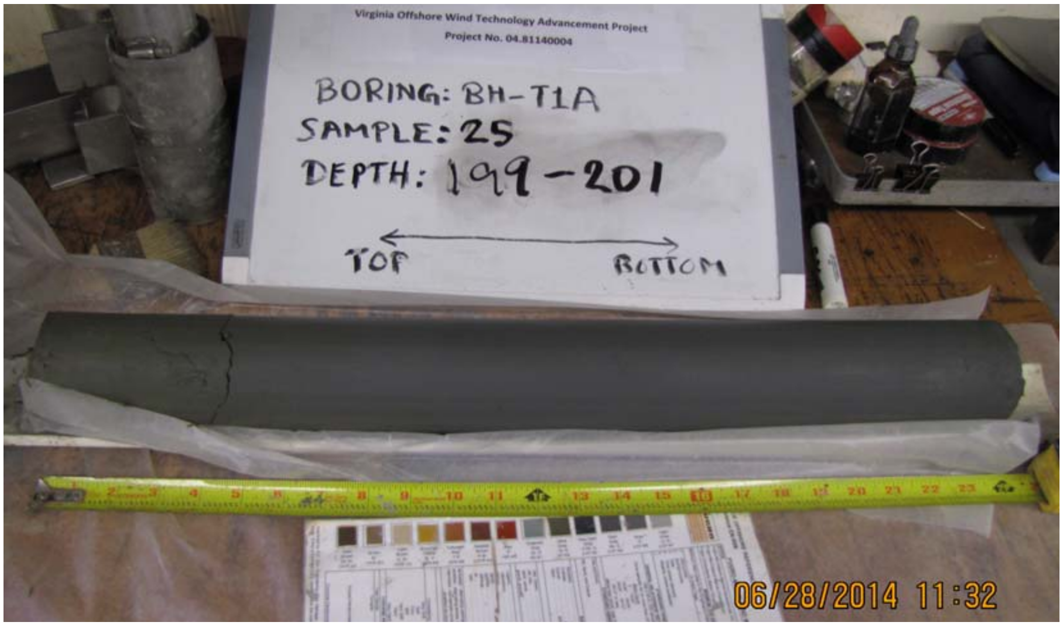
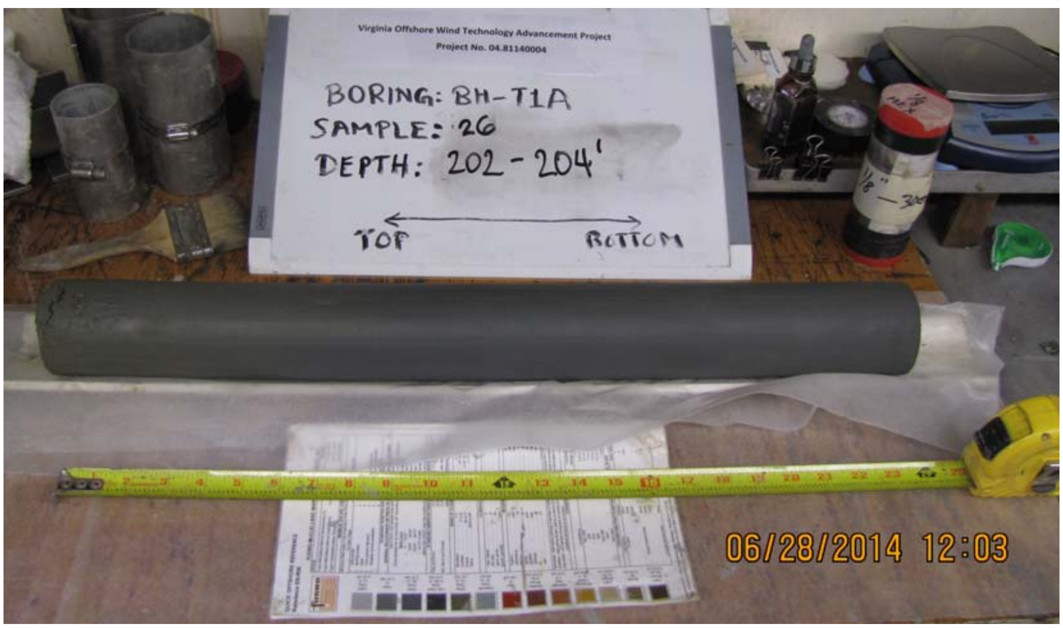
FIGURE C1-12



BH-T1A Sample 25 Depth: 199 ft



BH-T1A Sample 26 Depth: 202 ft

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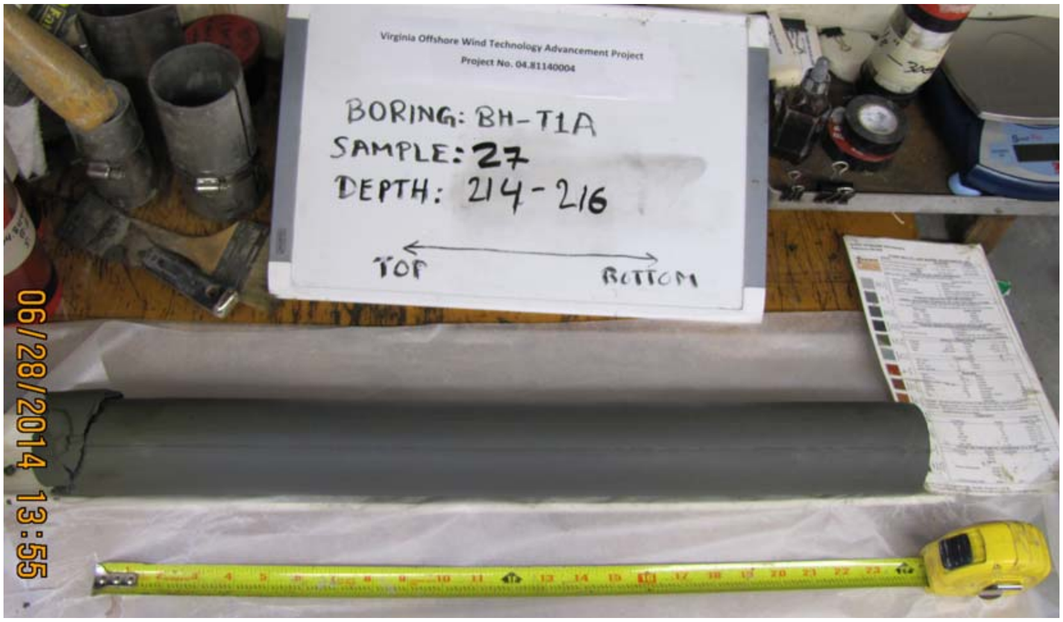
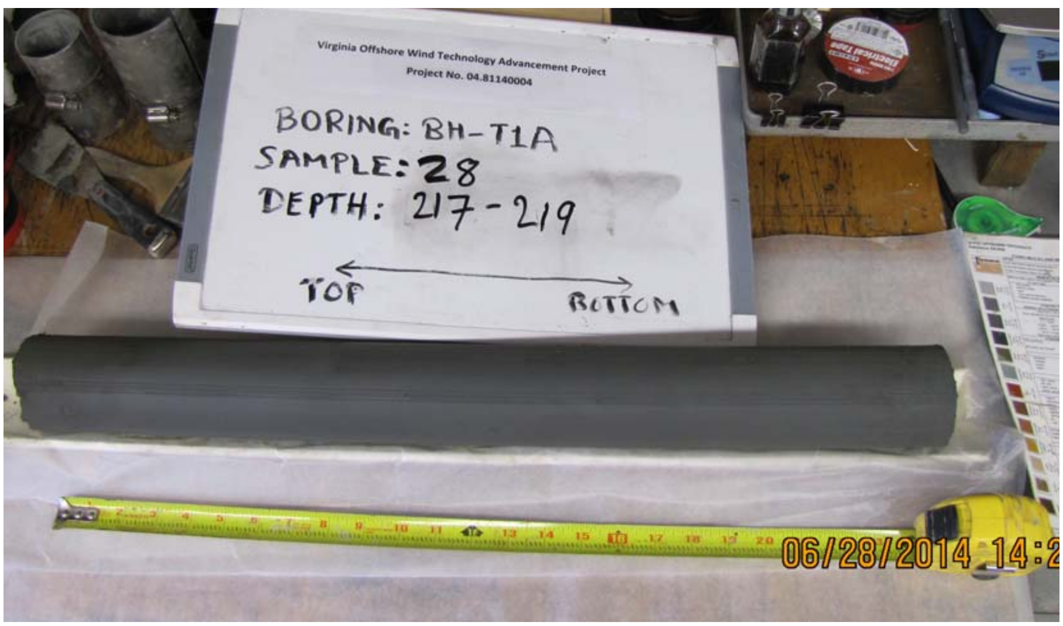
FIGURE C1-13



BH-T1A Sample 27 Depth: 214 ft



BH-T1A Sample 28 Depth: 217 ft

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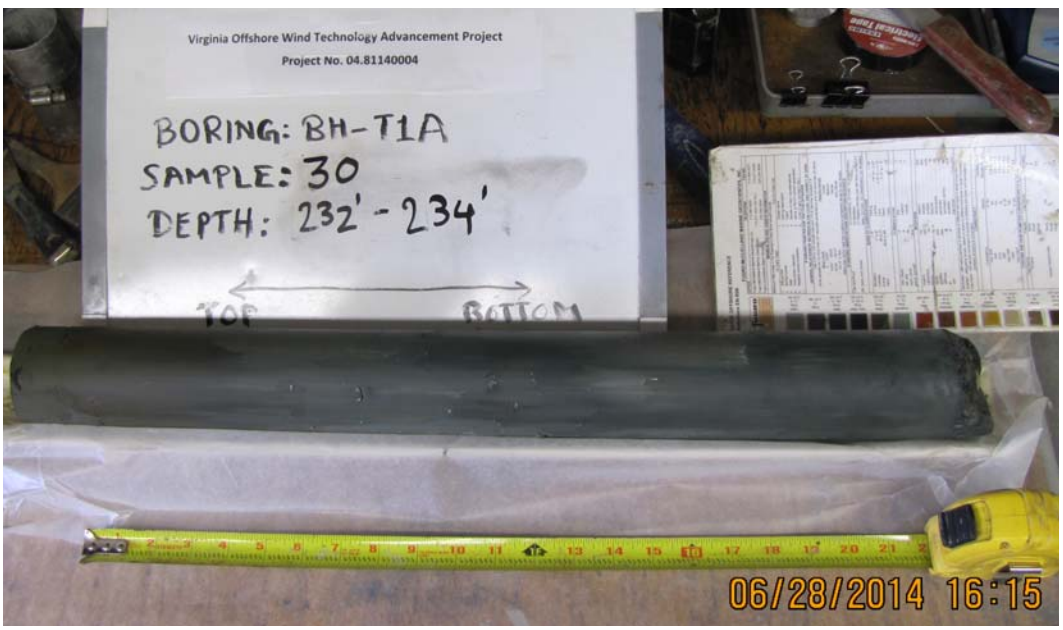
FIGURE C1-14

Photograph not available

BH-T1A Sample 29 Depth: ft



BH-T1A Sample 30 Depth: 232 ft

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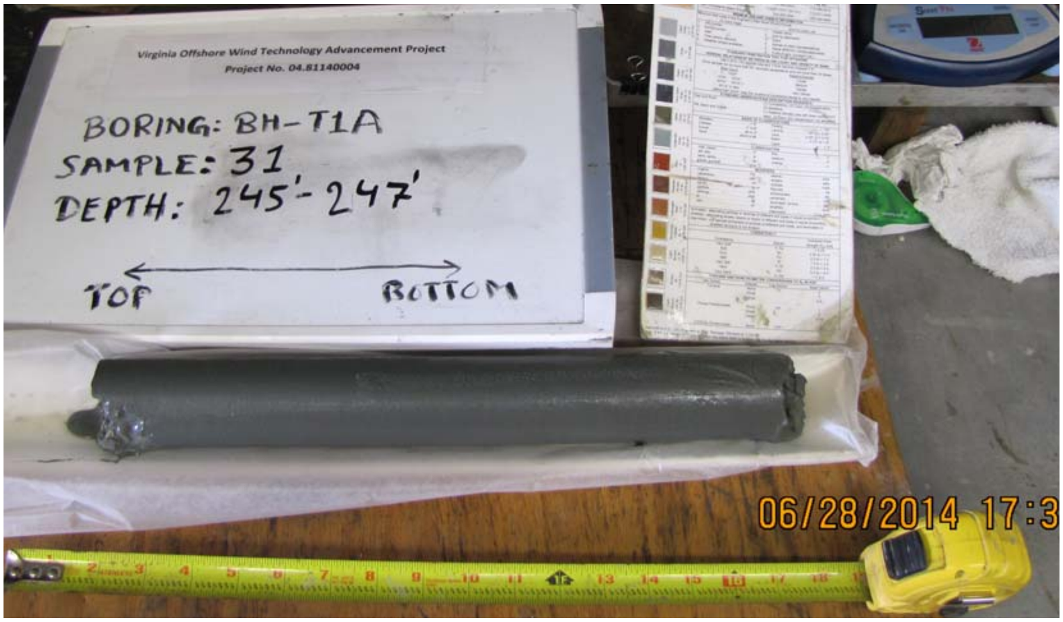
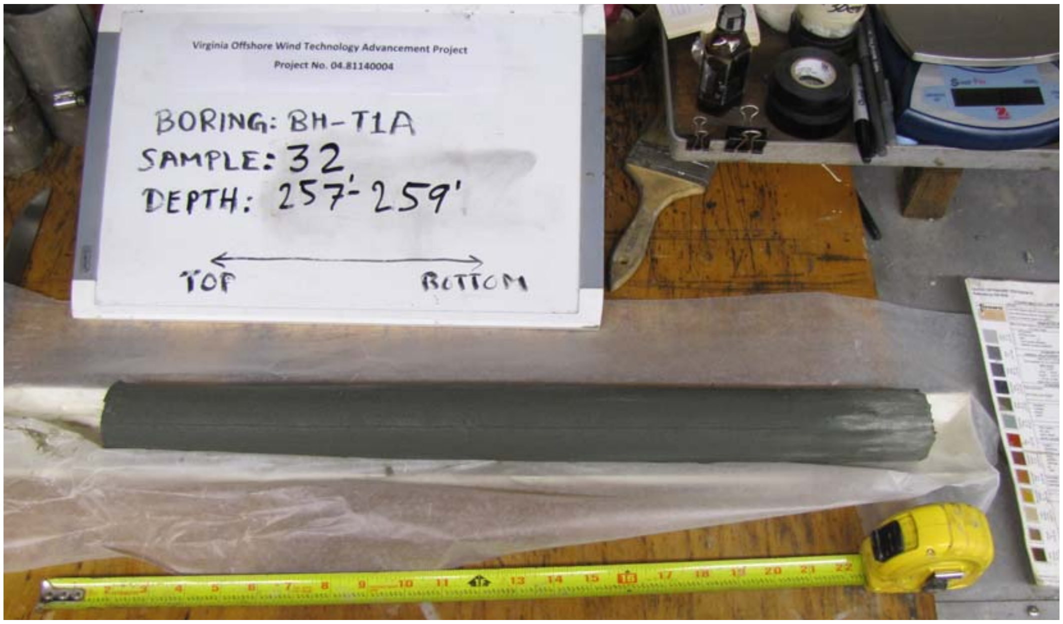


BH-T1A Sample 31 Depth: 245 ft



BH-T1A Sample 32 Depth: 257 ft

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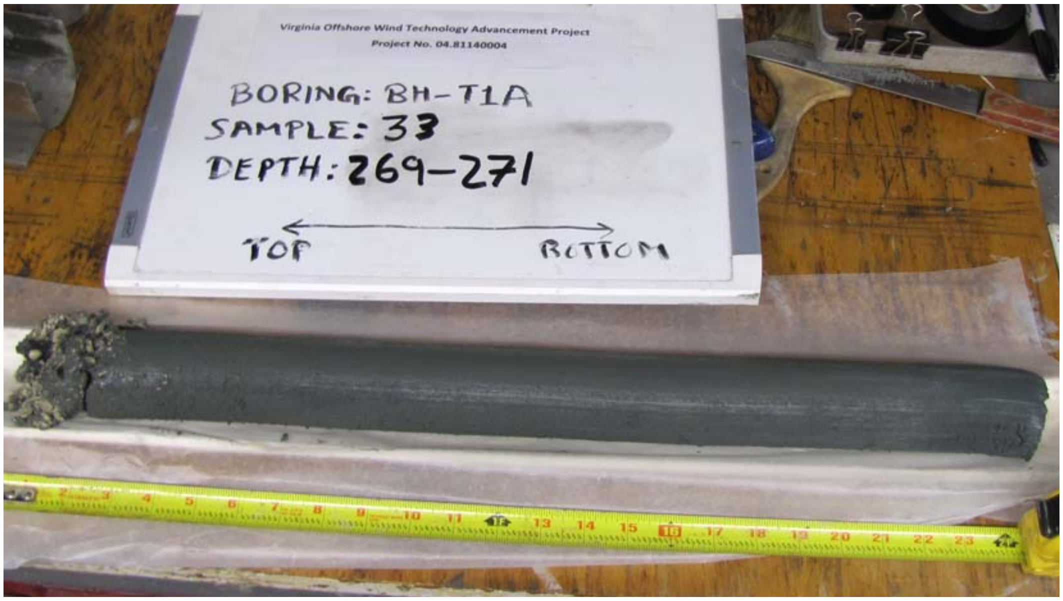
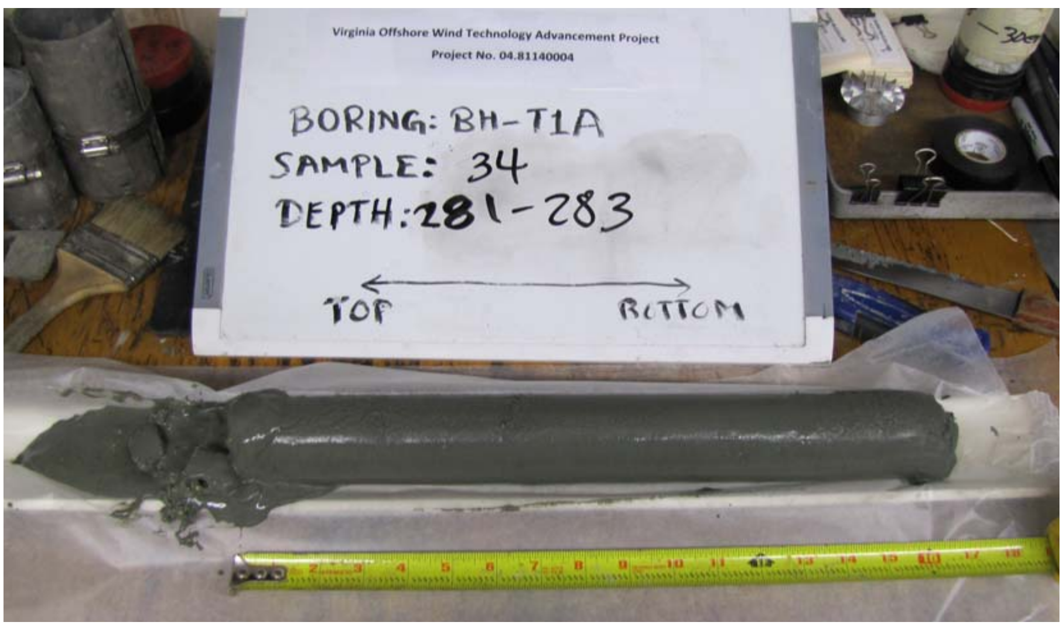
FIGURE C1-16



BH-T1A Sample 33 Depth: 269 ft



BH-T1A Sample 34 Depth: 281 ft

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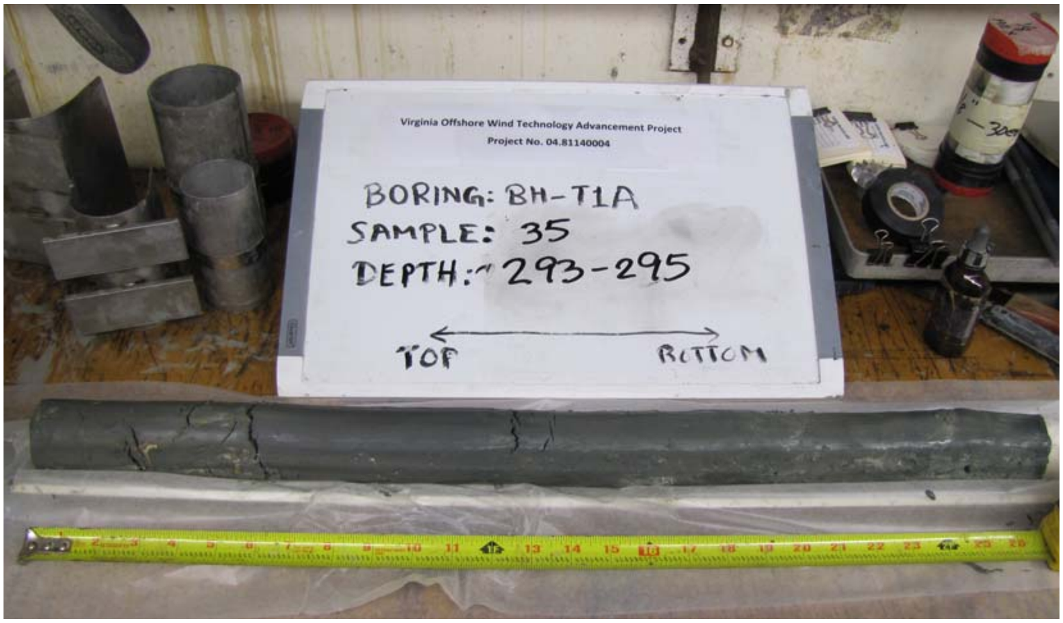
FIGURE C1-17



BH-T1A Sample 35 Depth: 293 ft

BH-T1A Sample 36 Depth: 305 ft

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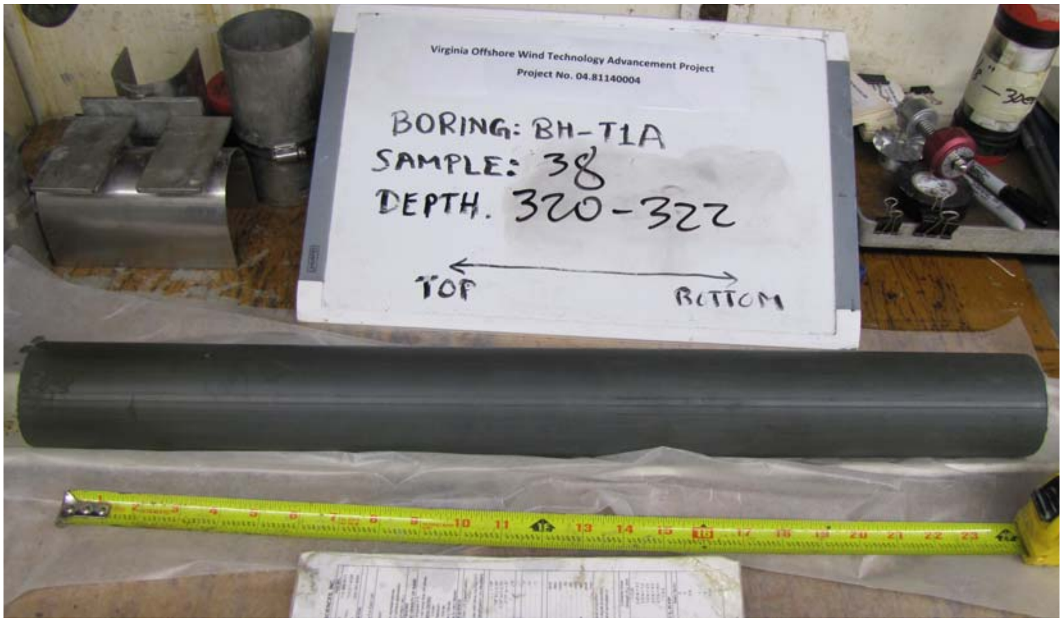
FIGURE C1-18

BH-T1A Sample 37 Depth: 317 ft



BH-T1A Sample 38 Depth: 320 ft

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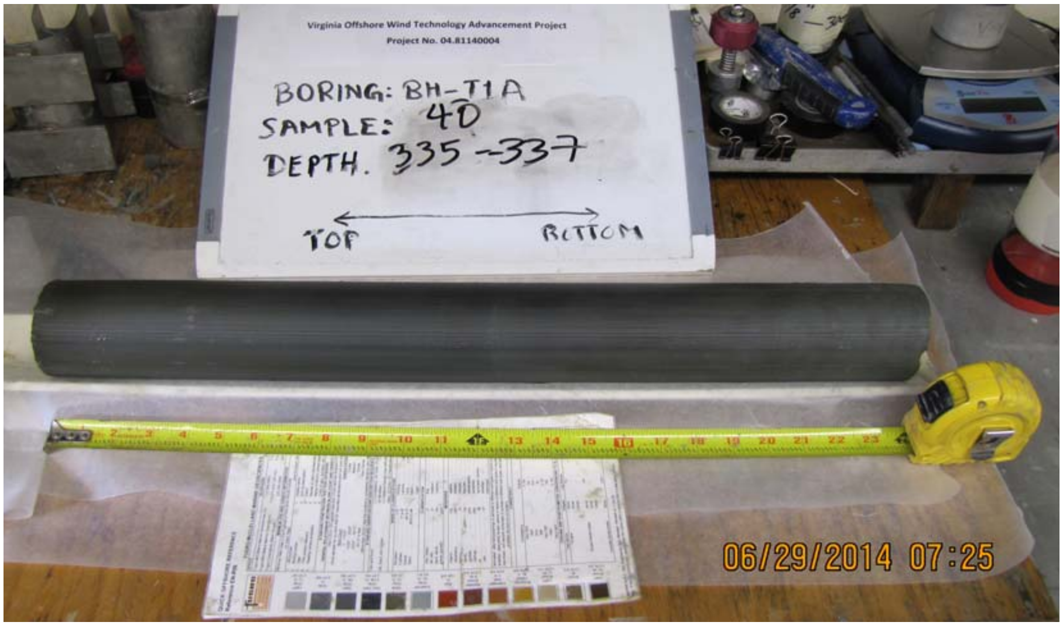
FIGURE C1-19

BH-T1A Sample 39 Depth: 332 ft



BH-T1A Sample 40 Depth: 335 ft

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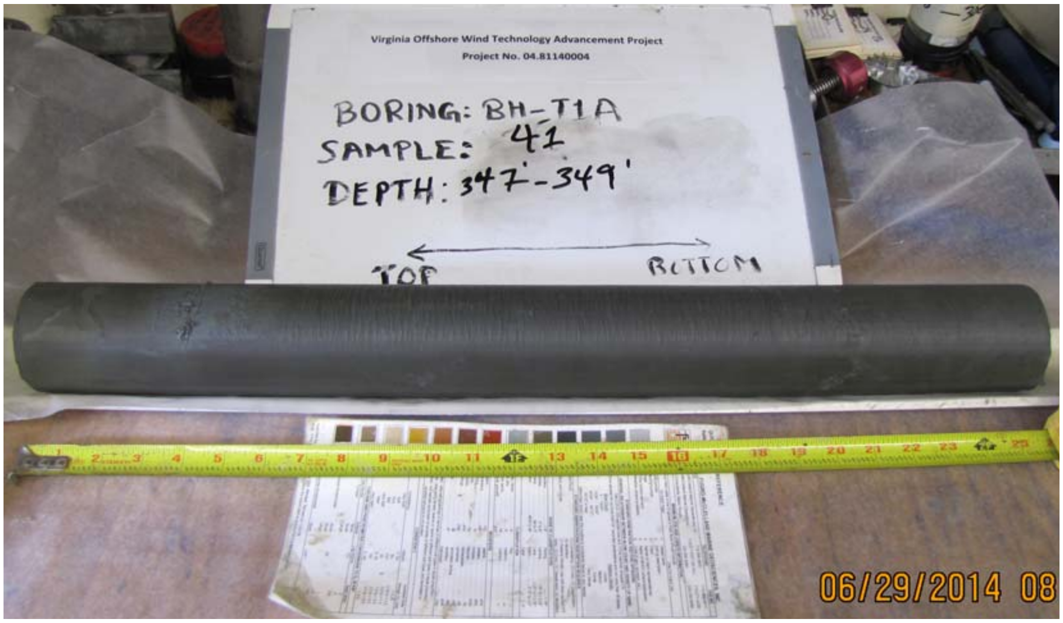
FIGURE C1-20



BH-T1A Sample 41 Depth: 347 ft

BH-T1A Sample 42 Depth: 350 ft

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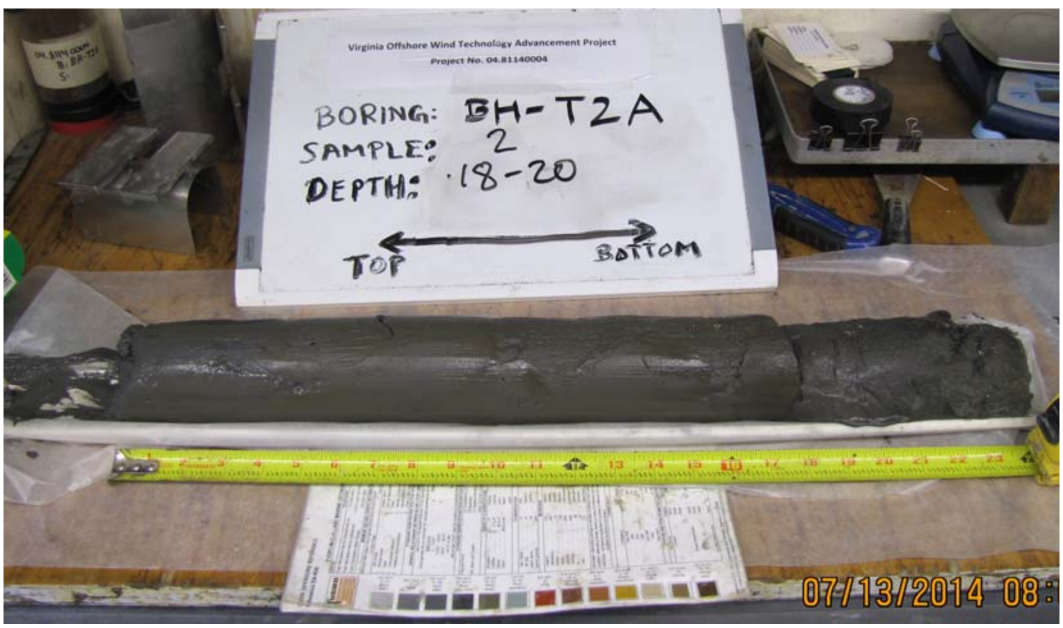
FIGURE C1-21

BH-T2A Sample 1 Depth: 15 ft



BH-T2A Sample 2 Depth: 18 ft

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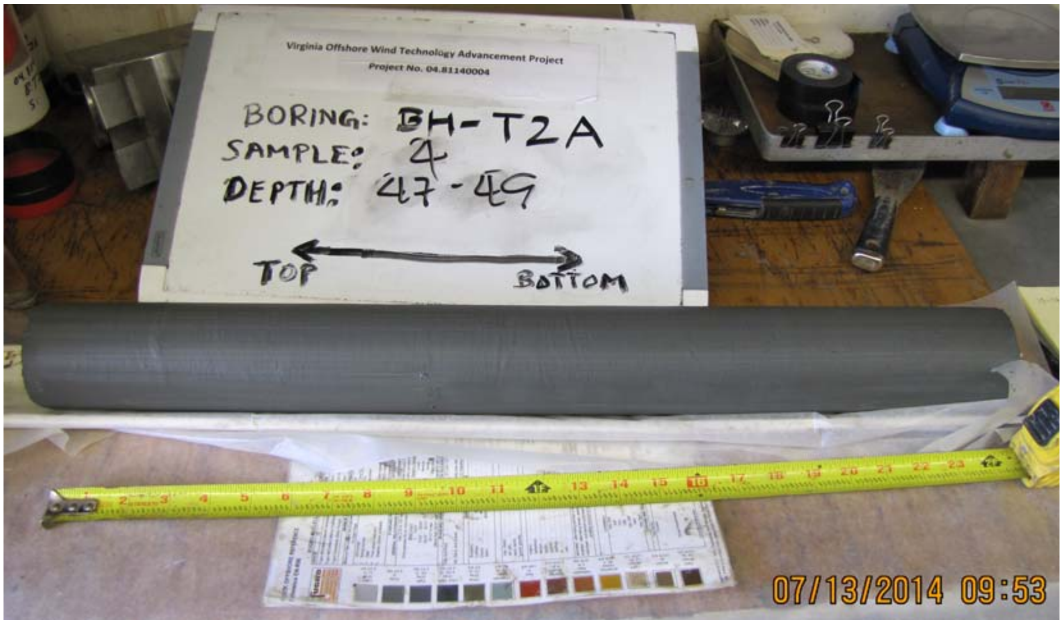
FIGURE C2-1

BH-T2A Sample 3 Depth: 35 ft



BH-T2A Sample 4 Depth: 47 ft

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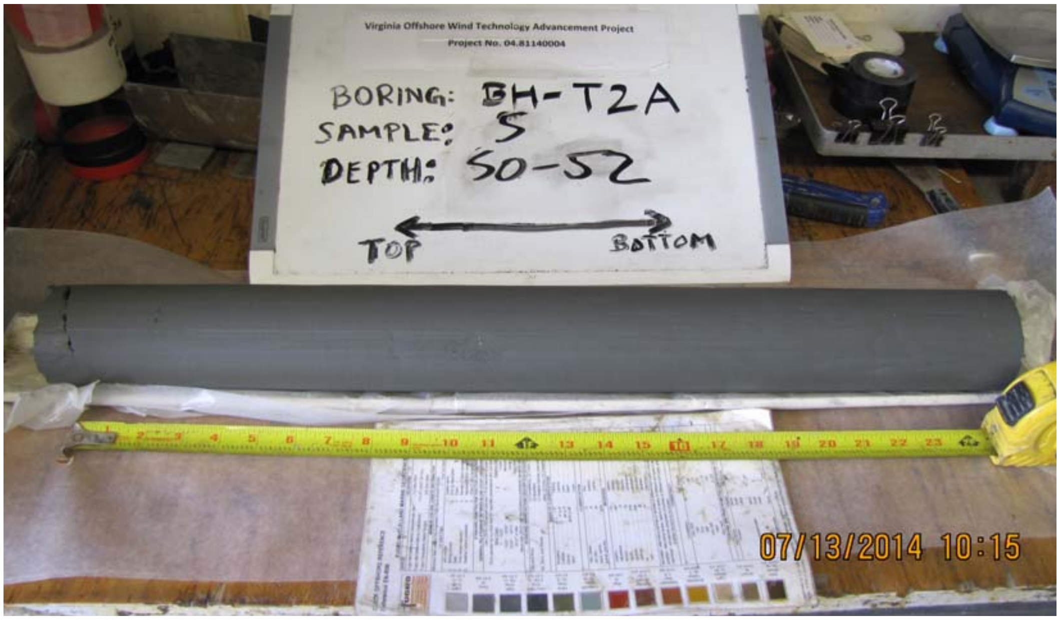
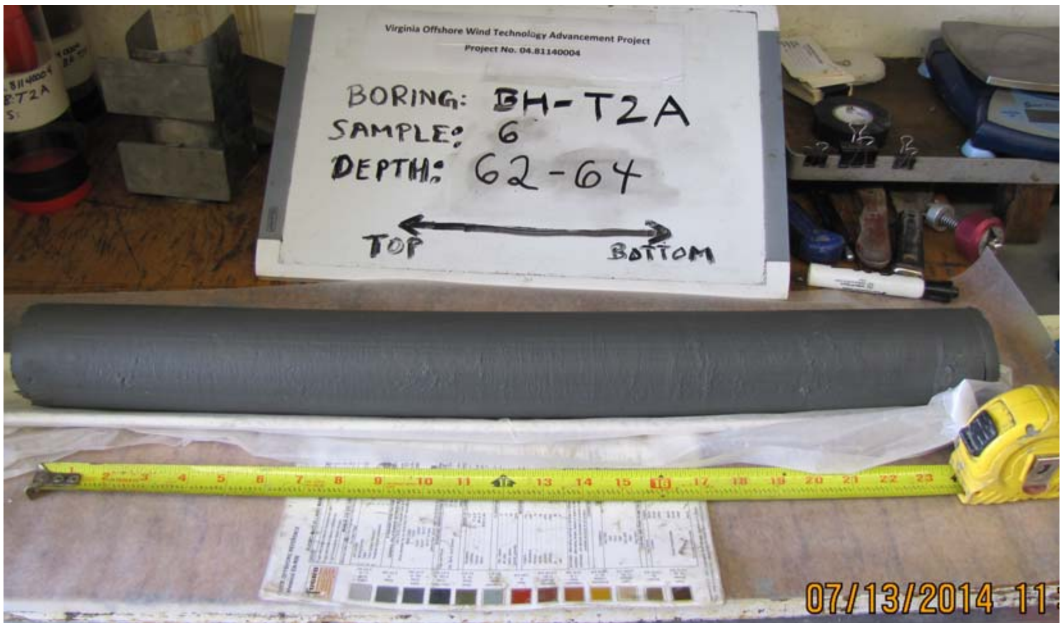
FIGURE C2-2



BH-T2A Sample 5 Depth: 50 ft



BH-T2A Sample 6 Depth: 62 ft

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FIGURE C2-3

BH-T2A Sample 7 Depth: 65 ft

BH-T2A Sample 8 Depth: 77 ft

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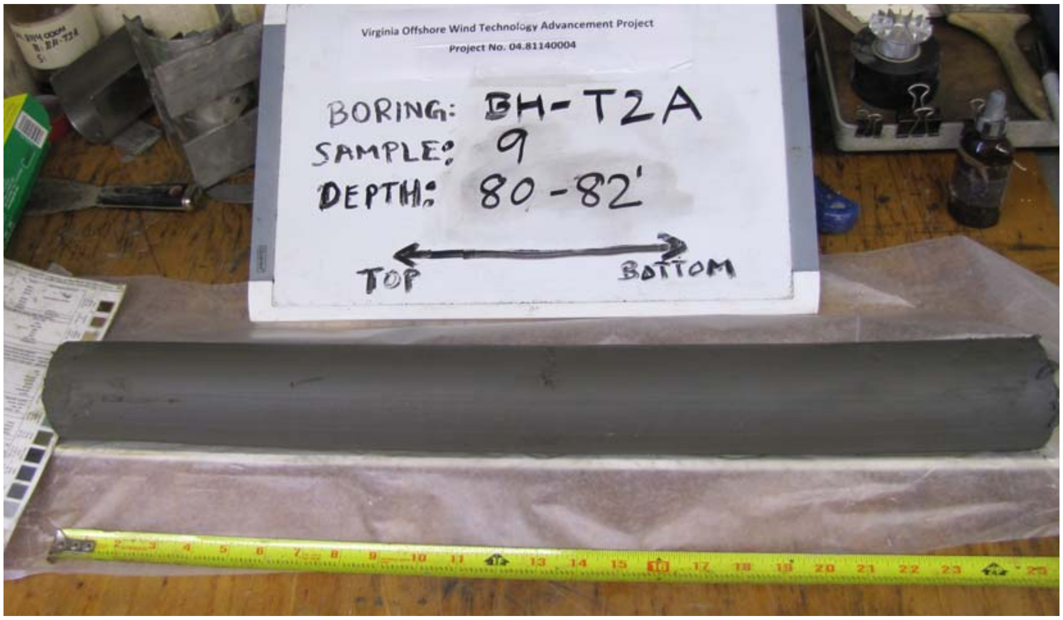
Offshore Virginia

FIGURE C2-4



BH-T2A Sample 9 Depth: 80 ft

BH-T2A Sample 10 Depth: 92 ft

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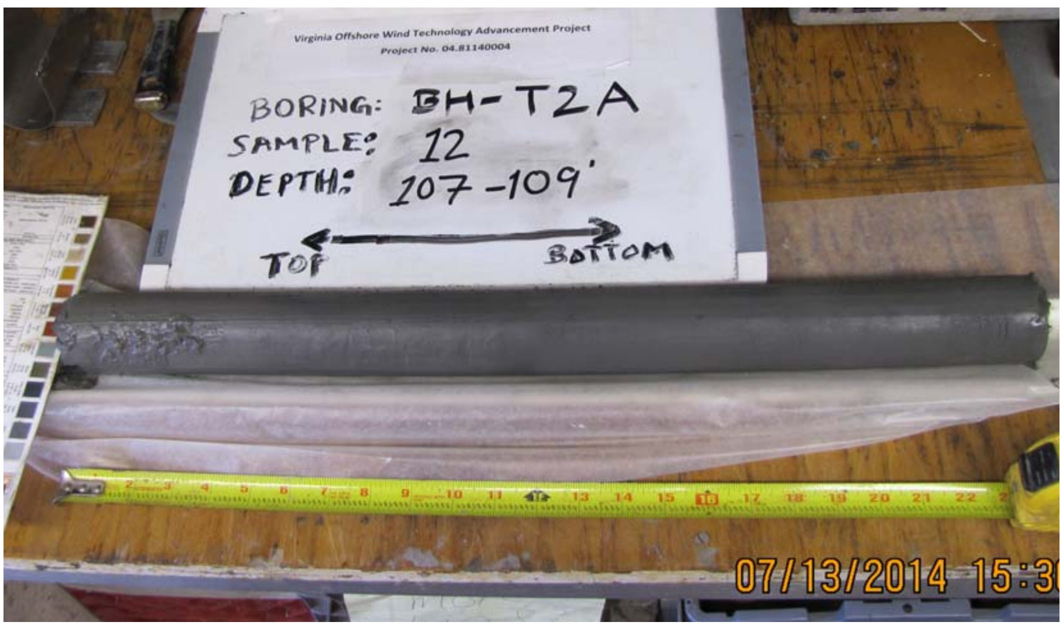
FIGURE C2-5

BH-T2A Sample 11 Depth: 95 ft



BH-T2A Sample 12 Depth: 107 ft

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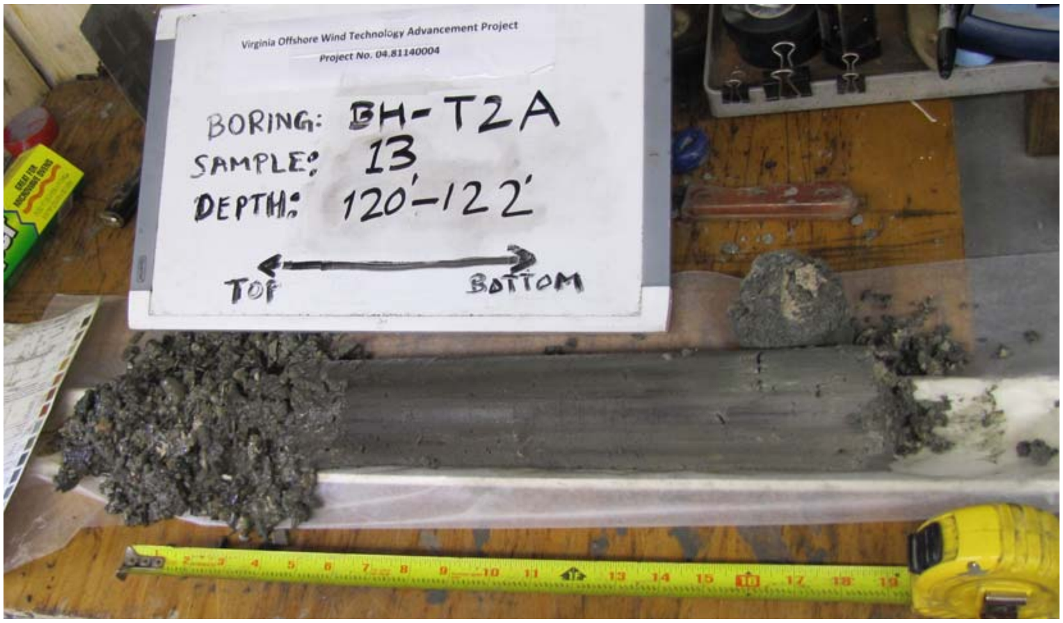
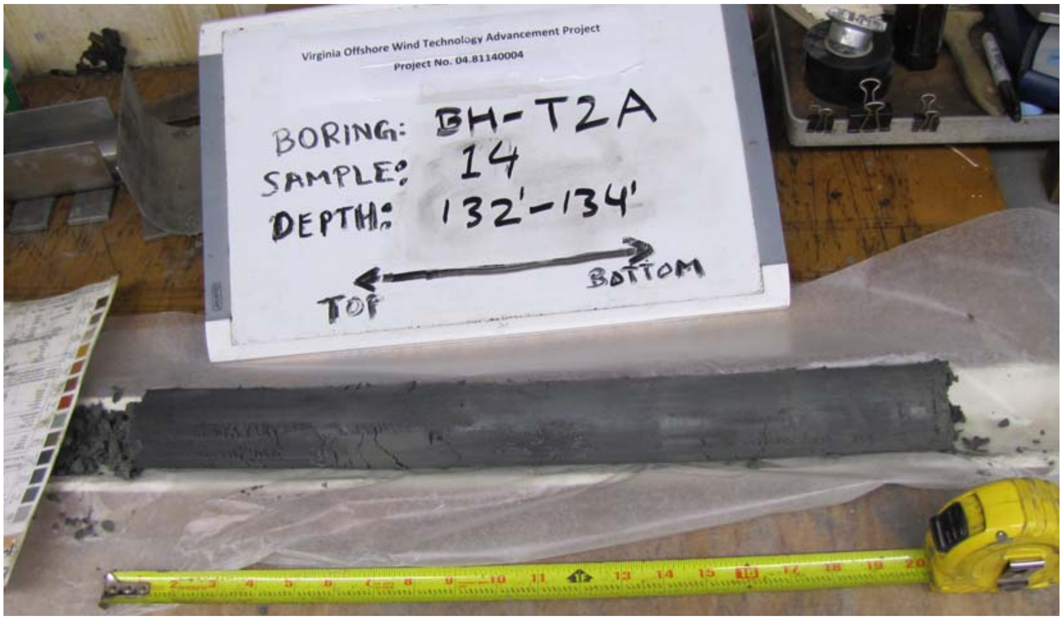
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C2-6



BH-T2A Sample 13 Depth: 120 ft



BH-T2A Sample 14 Depth: 132 ft

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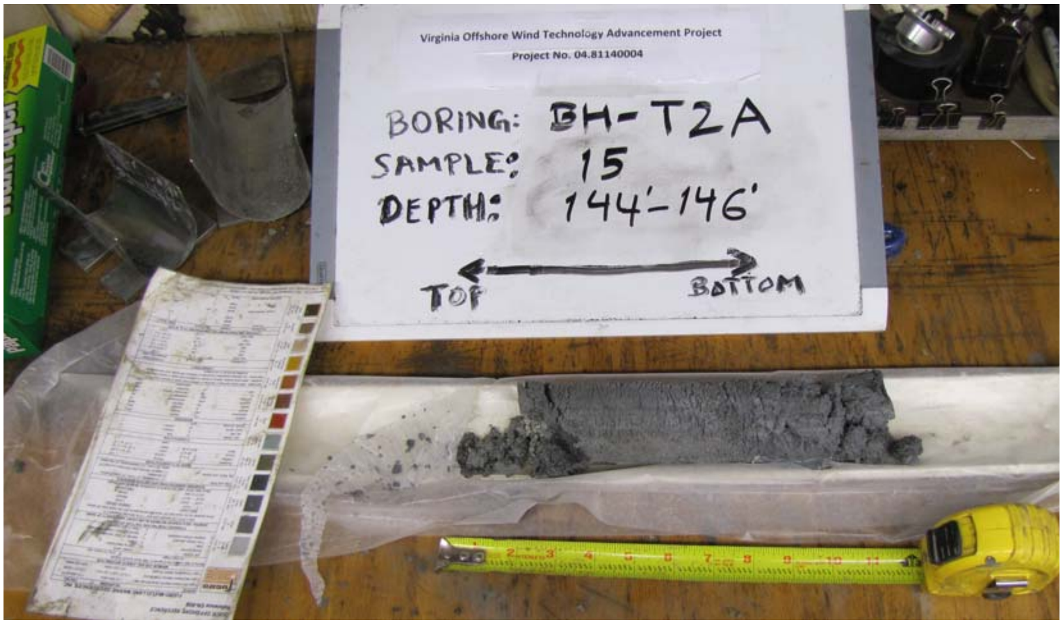
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C2-7



BH-T2A Sample 15 Depth: 144 ft

Photograph not available

BH-T2A Sample 16 Depth: ft

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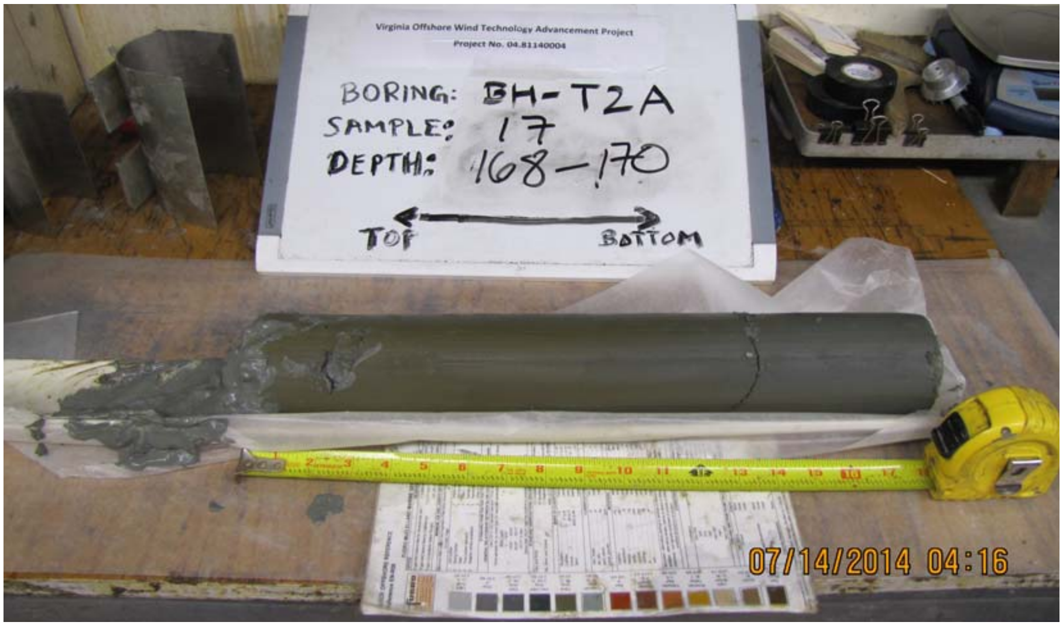
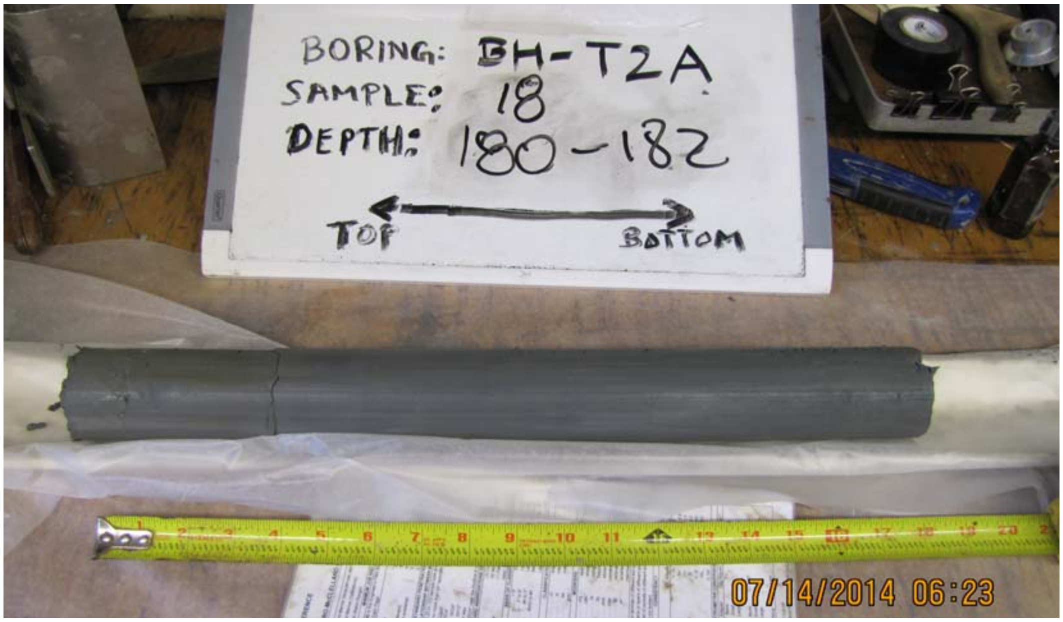
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C2-8



BH-T2A Sample 17 Depth: 168 ft



BH-T2A Sample 18 Depth: 180 ft

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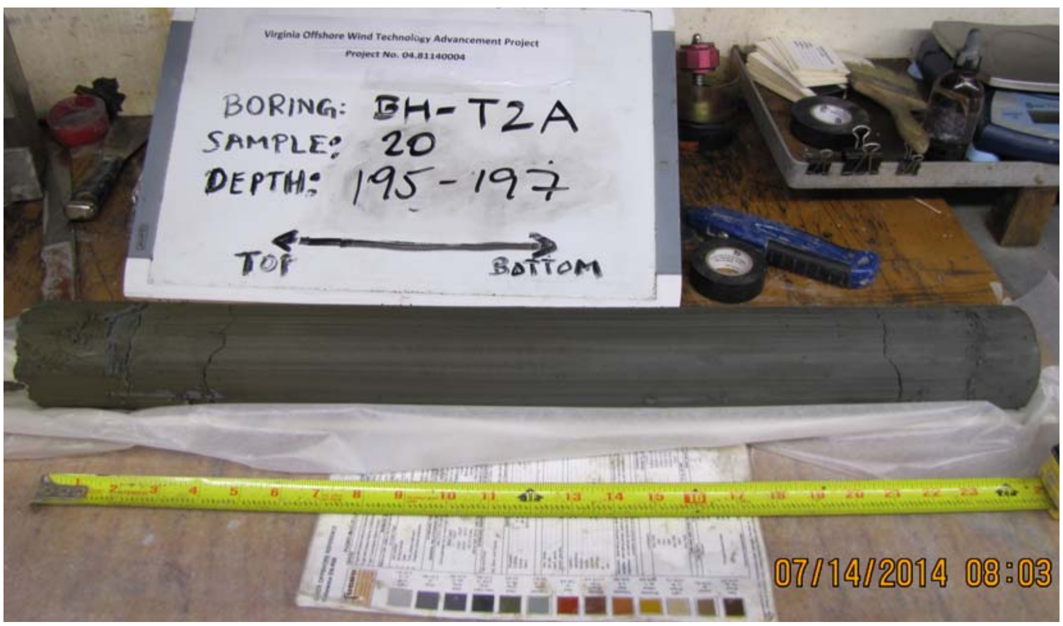
Offshore Virginia

FIGURE C2-9

BH-T2A Sample 19 Depth: 192 ft



BH-T2A Sample 20 Depth: 195 ft

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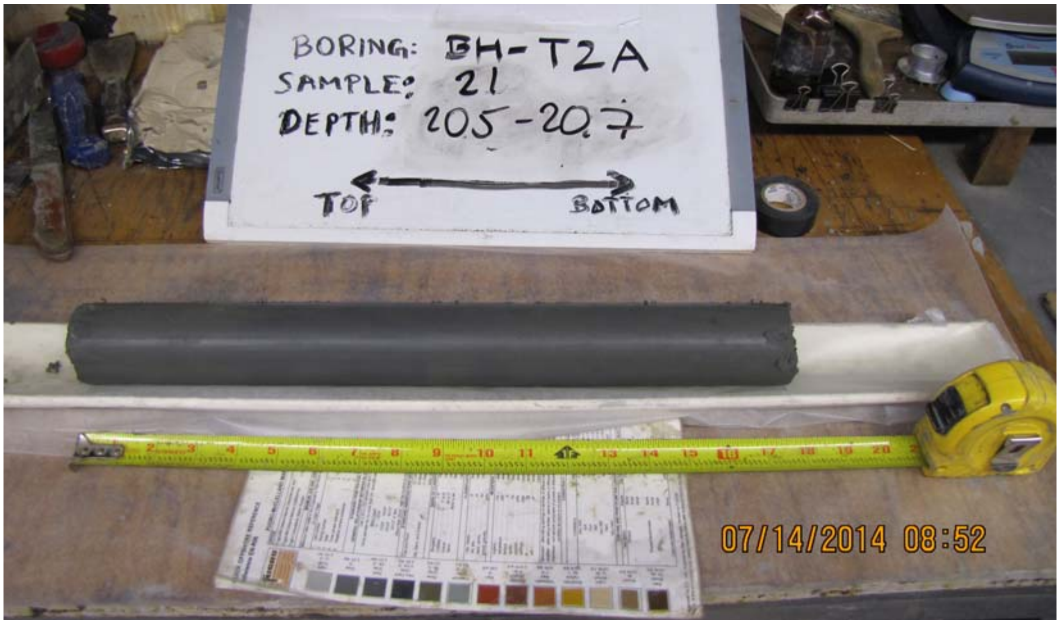
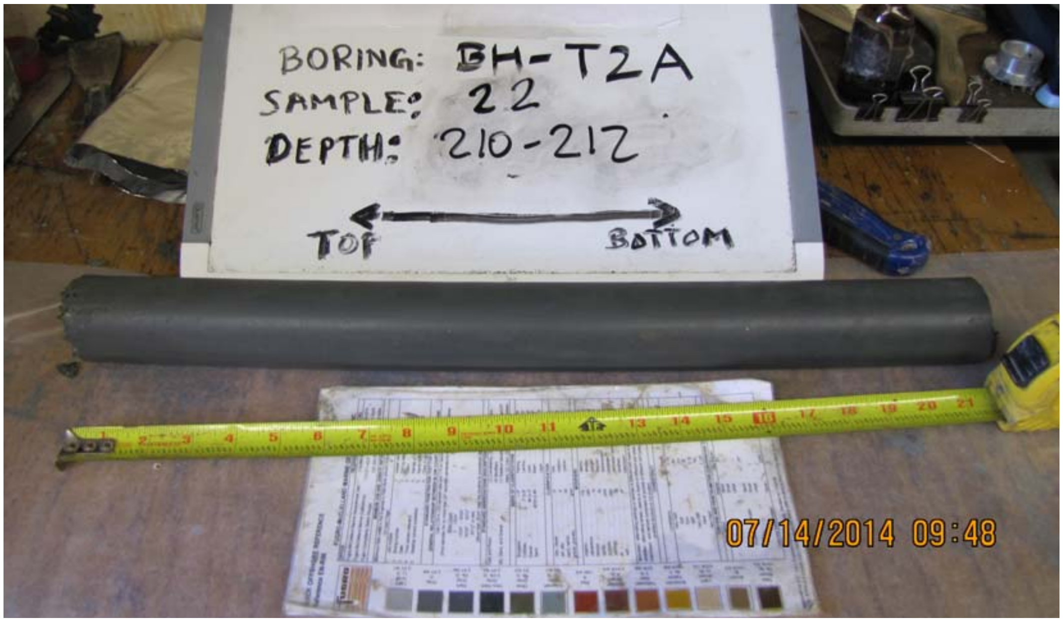
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C2-10



BH-T2A Sample 21 Depth: 205 ft



BH-T2A Sample 22 Depth: 210 ft

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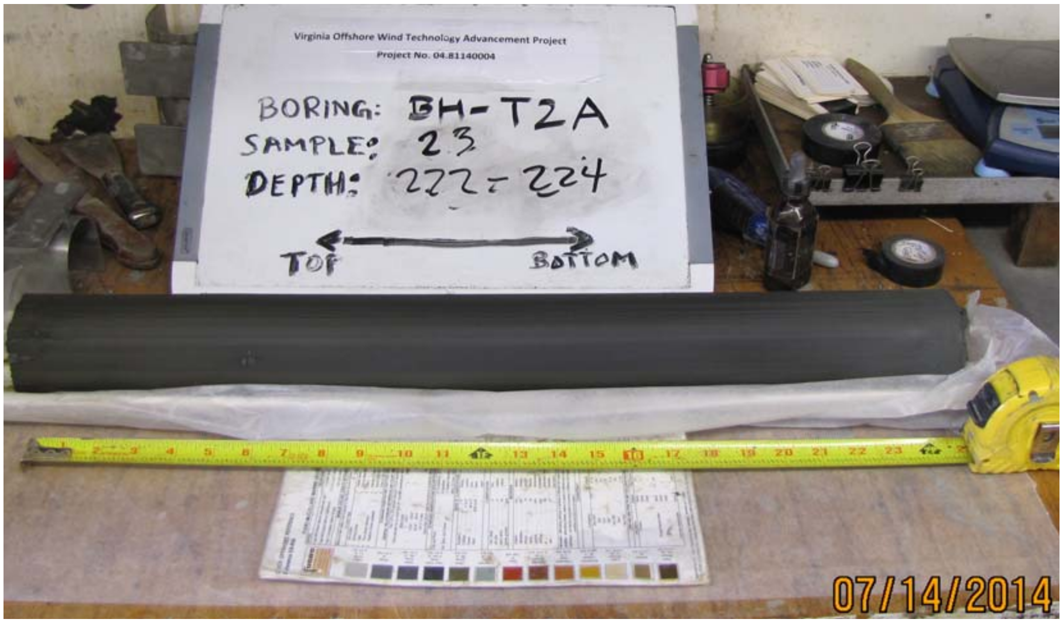
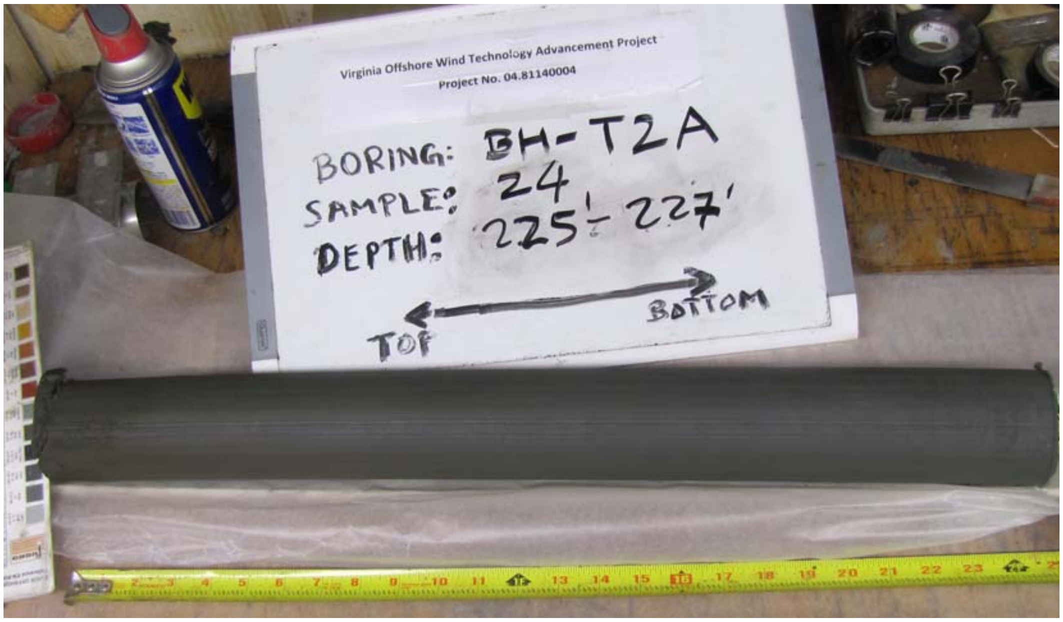
FIGURE C2-11



BH-T2A Sample 23 Depth: 222 ft



BH-T2A Sample 24 Depth: 225 ft

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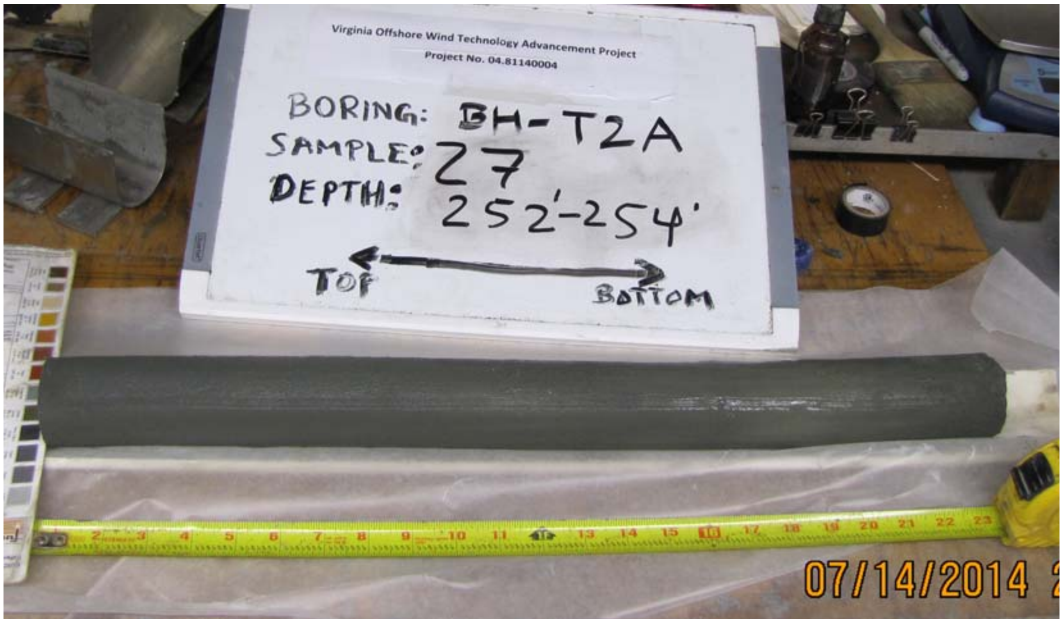
FIGURE C2-12

BH-T2A Sample 25 Depth: 237 ft

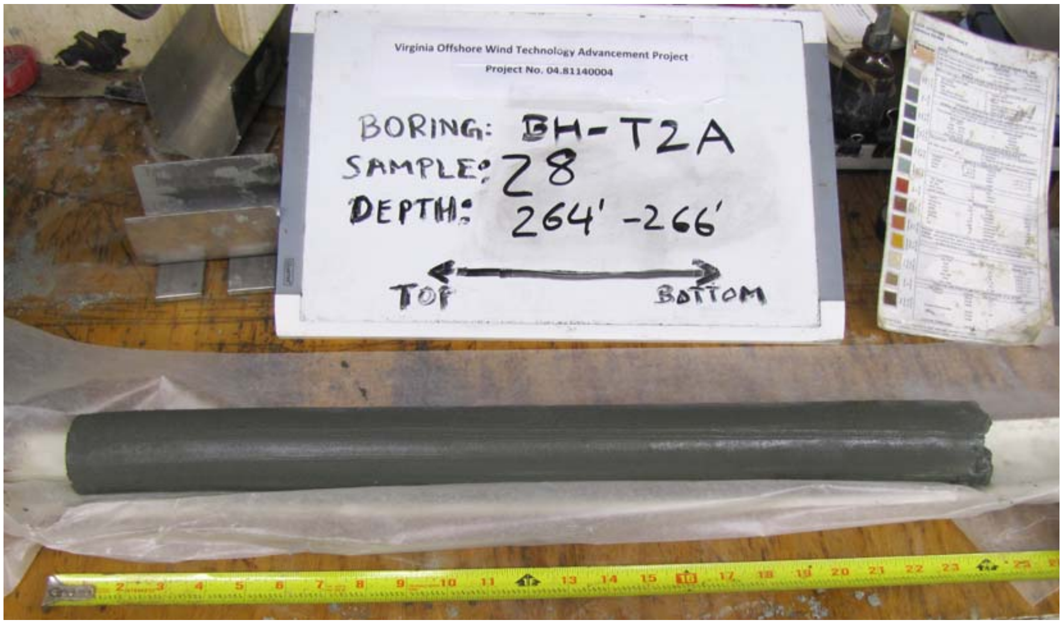
BH-T2A Sample 26 Depth: 240 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C2-13



BH-T2A Sample 27 Depth: 252 ft



BH-T2A Sample 28 Depth: 264 ft

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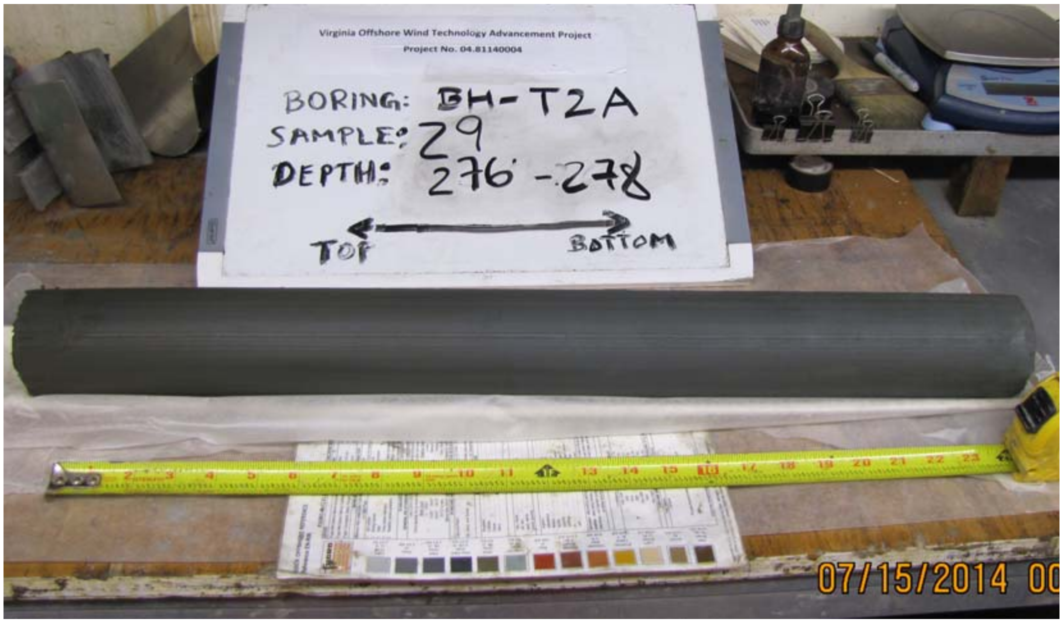
Offshore Virginia

FIGURE C2-14



BH-T2A Sample 29 Depth: 276 ft

BH-T2A Sample 30 Depth: 279 ft

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FIGURE C2-15

BH-T2A Sample 31 Depth: 291 ft

BH-T2A Sample 32 Depth: 294 ft

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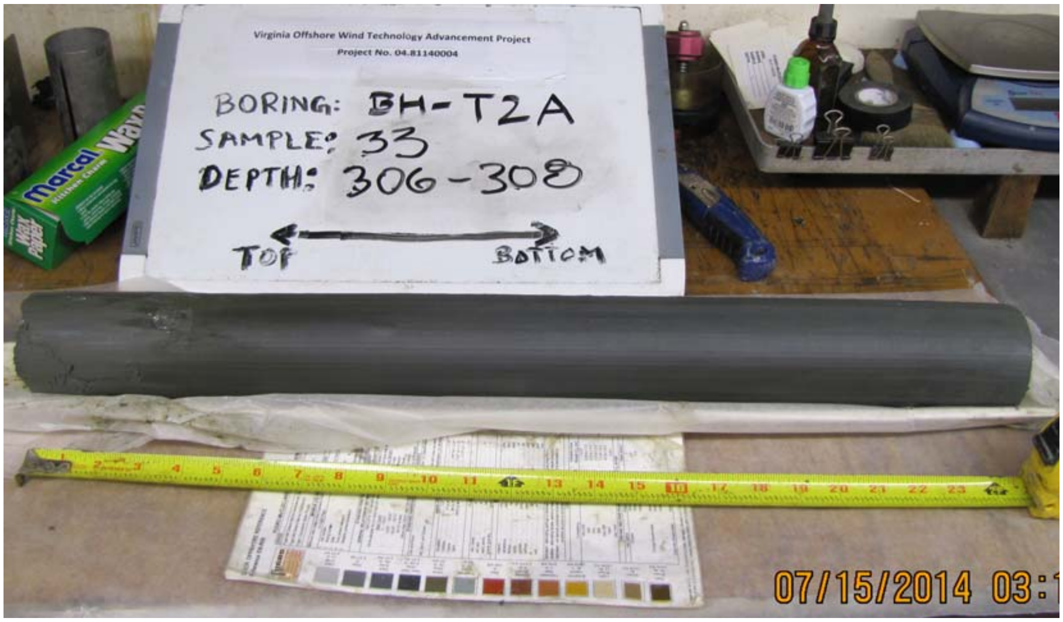
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C2-16



BH-T2A Sample 33 Depth: 306 ft

BH-T2A Sample 34 Depth: 309 ft

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Offshore Virginia

FIGURE C2-17

BH-T2A Sample 35 Depth: 321 ft

BH-T2A Sample 36 Depth: 324 ft

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Offshore Virginia

FIGURE C2-18

BH-T2A Sample 37 Depth: 336 ft

BH-T2A Sample 38 Depth: 339 ft

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Turbine Sites
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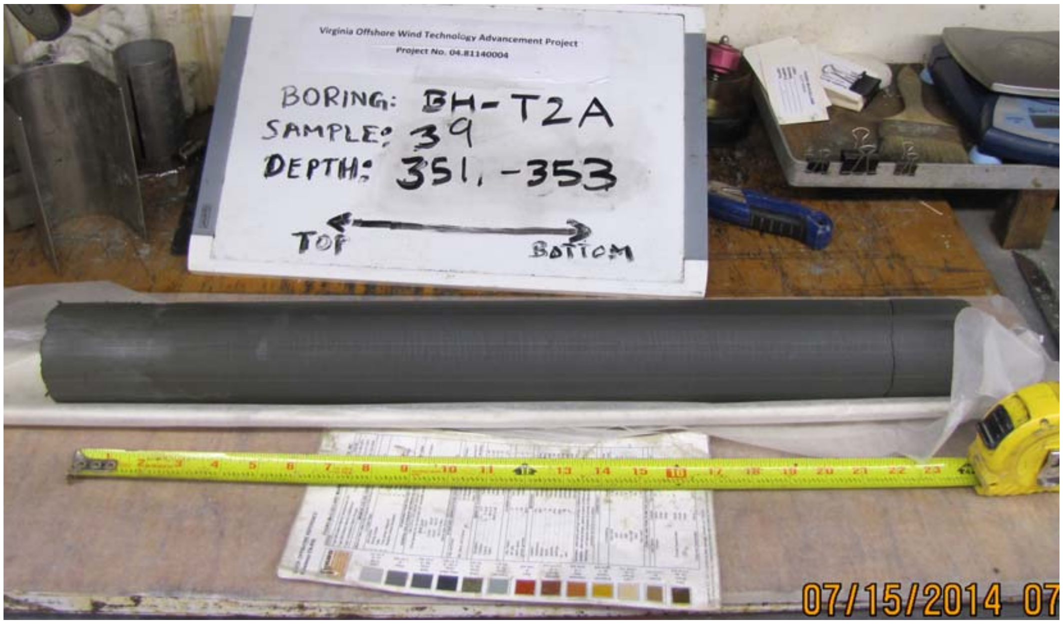
Offshore Virginia

FIGURE C2-19



BH-T2A Sample 39 Depth: 351 ft

BH-T2A Sample 40 Depth: 354 ft

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FIGURE C2-20

BH-T2B Sample 1 Depth: 5 ft

BH-T2B Sample 2 Depth: 8 ft

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FIGURE C3-1

BH-T2B Sample 3 Depth: 20 ft

BH-T2B Sample 4 Depth: 23 ft

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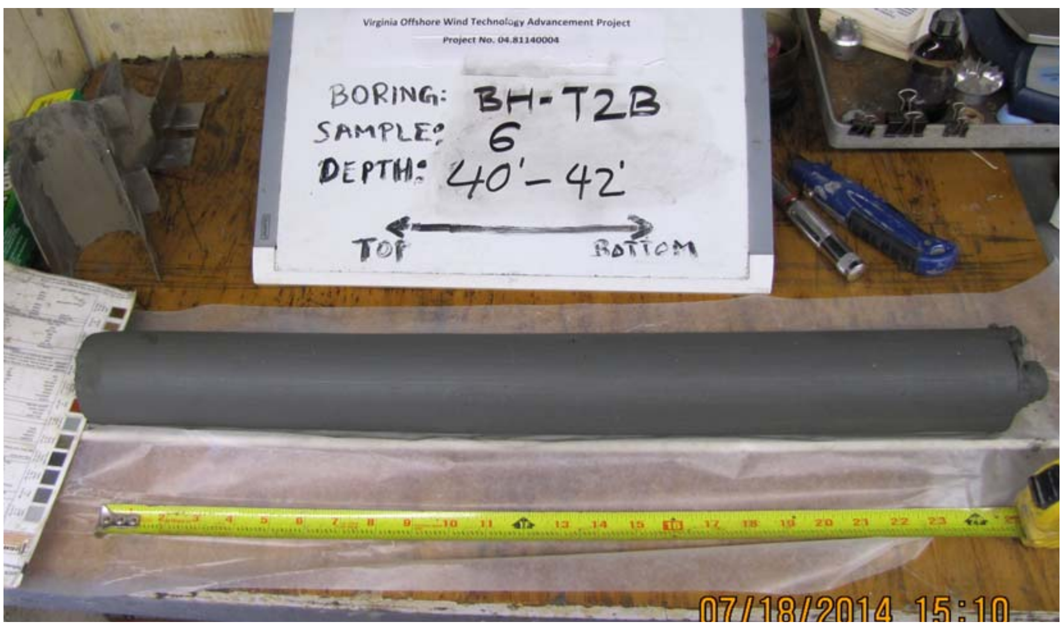
Offshore Virginia

FIGURE C3-2

BH-T2B Sample 5 Depth: 35 ft



BH-T2B Sample 6 Depth: 40 ft

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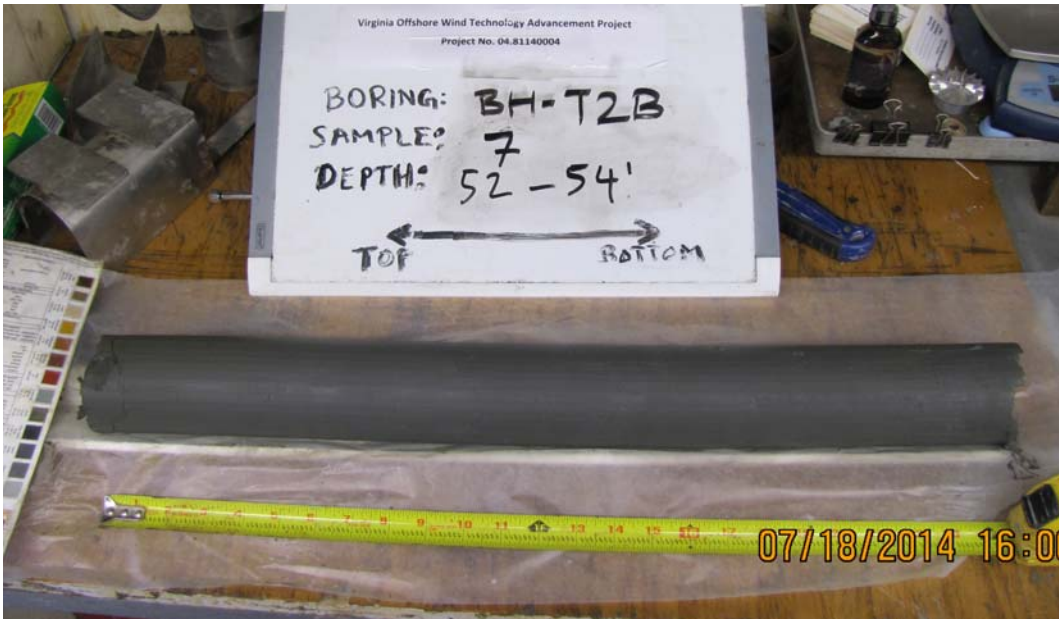
FIGURE C3-3



BH-T2B Sample 7 Depth: 52 ft

BH-T2B Sample 8 Depth: 55 ft

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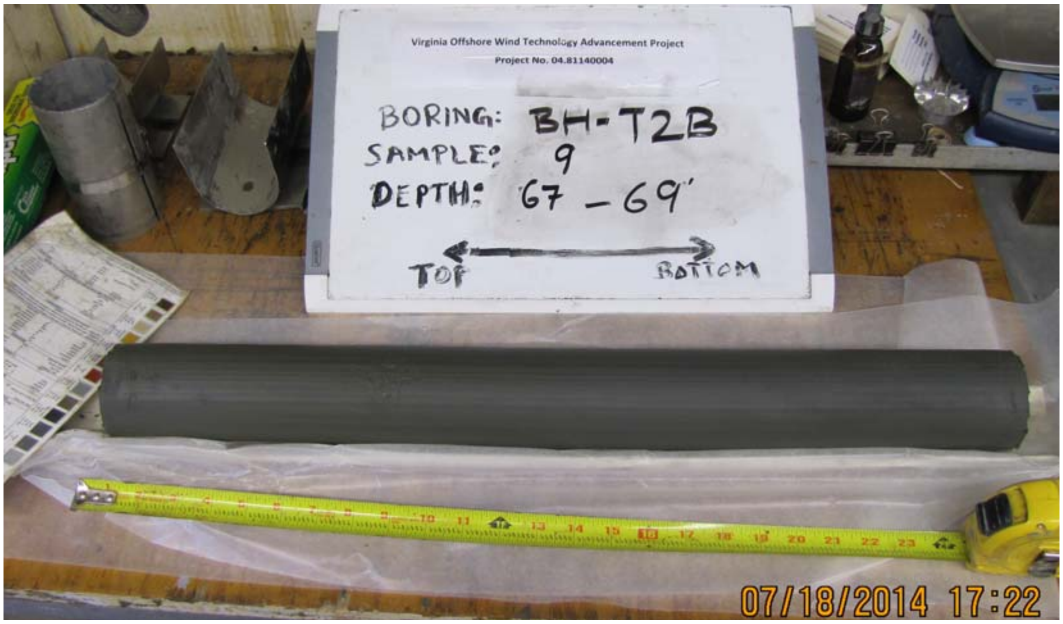
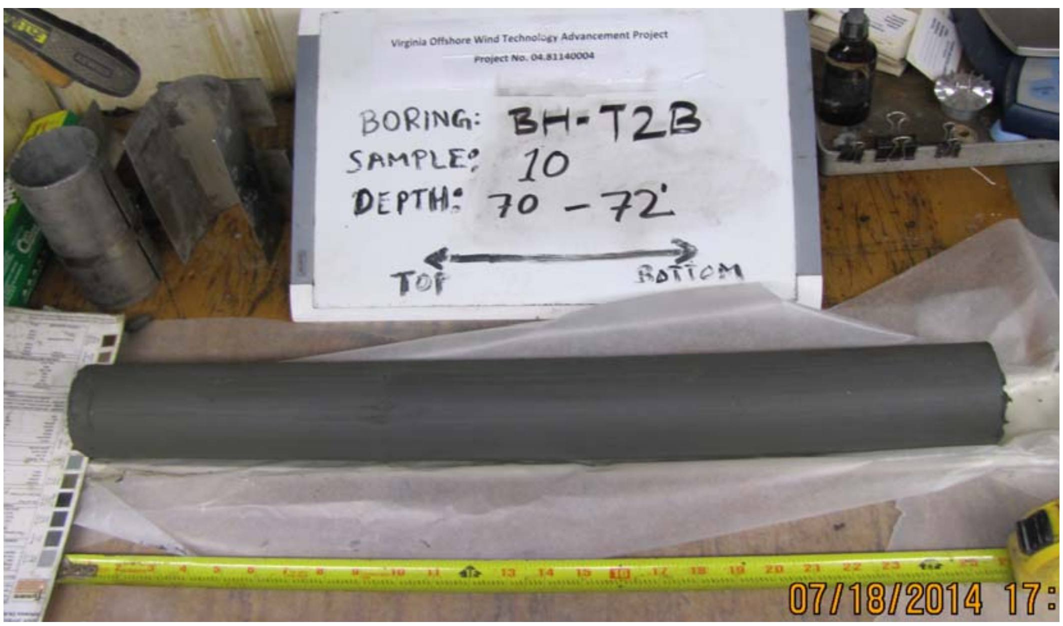
FIGURE C3-4



BH-T2B Sample 9 Depth: 67 ft



BH-T2B Sample 10 Depth: 70 ft

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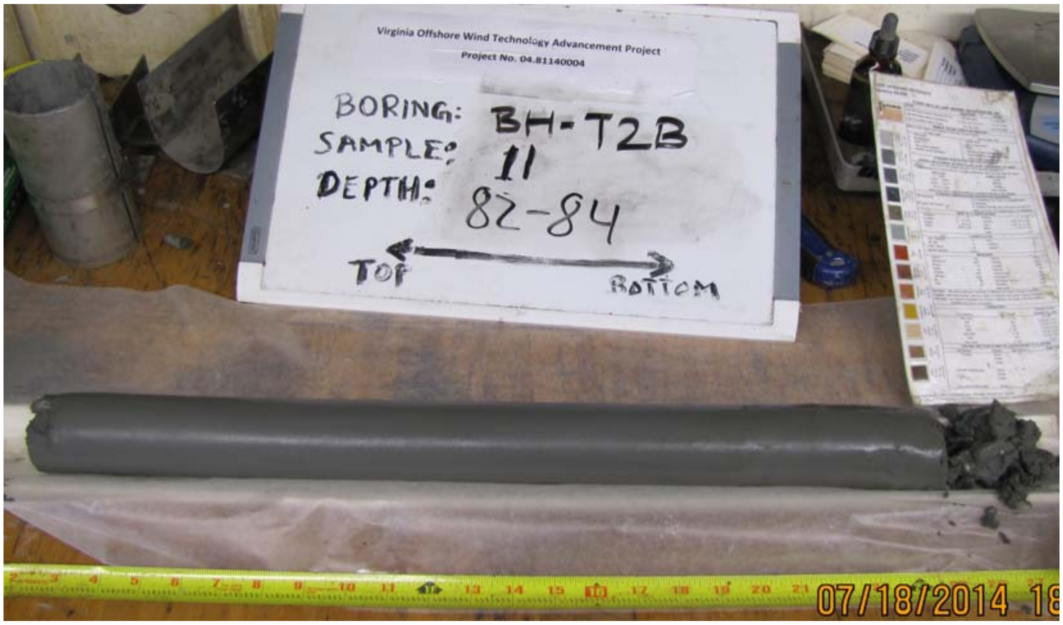
Offshore Virginia

FIGURE C3-5



BH-T2B Sample 11 Depth: 82 ft

BH-T2B Sample 12 Depth: 94 ft

SAMPLE CORE PHOTOGRAPHS
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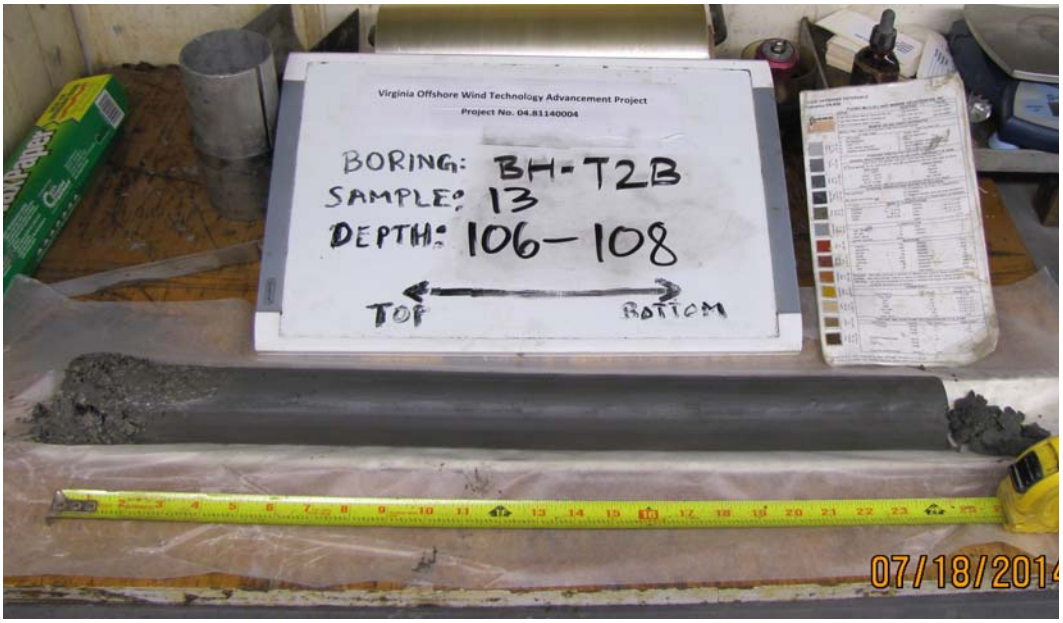
Offshore Virginia

FIGURE C3-6



BH-T2B Sample 13 Depth: 106 ft

BH-T2B Sample 14 Depth: 118 ft

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Offshore Virginia

FIGURE C3-7

BH-T2B Sample 15 Depth: 130 ft

BH-T2B Sample 16 Depth: 142 ft

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Offshore Virginia

FIGURE C3-8

Photograph not available

BH-T2B | Sample 17 | Depth: ft

BH-T2B | Sample 18 | Depth: 166 ft

SAMPLE CORE PHOTOGRAPHS
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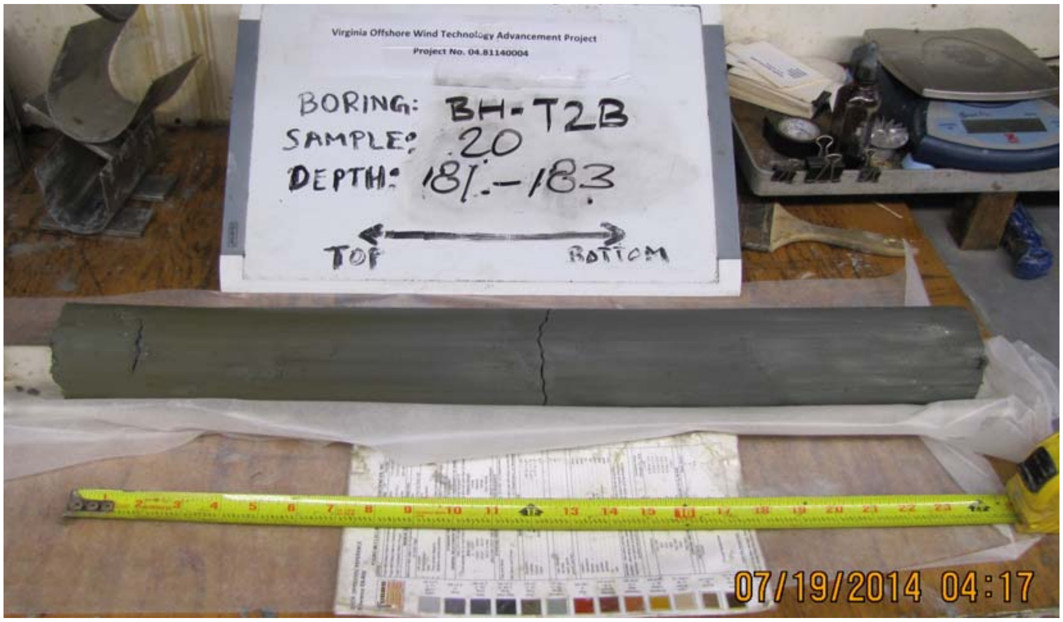
FIGURE C3-9

BH-T2B Sample 19 Depth: 169 ft



BH-T2B Sample 20 Depth: 181 ft

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Offshore Virginia

FIGURE C3-10

BH-T2B Sample 21 Depth: 184 ft

BH-T2B Sample 22 Depth: 196 ft

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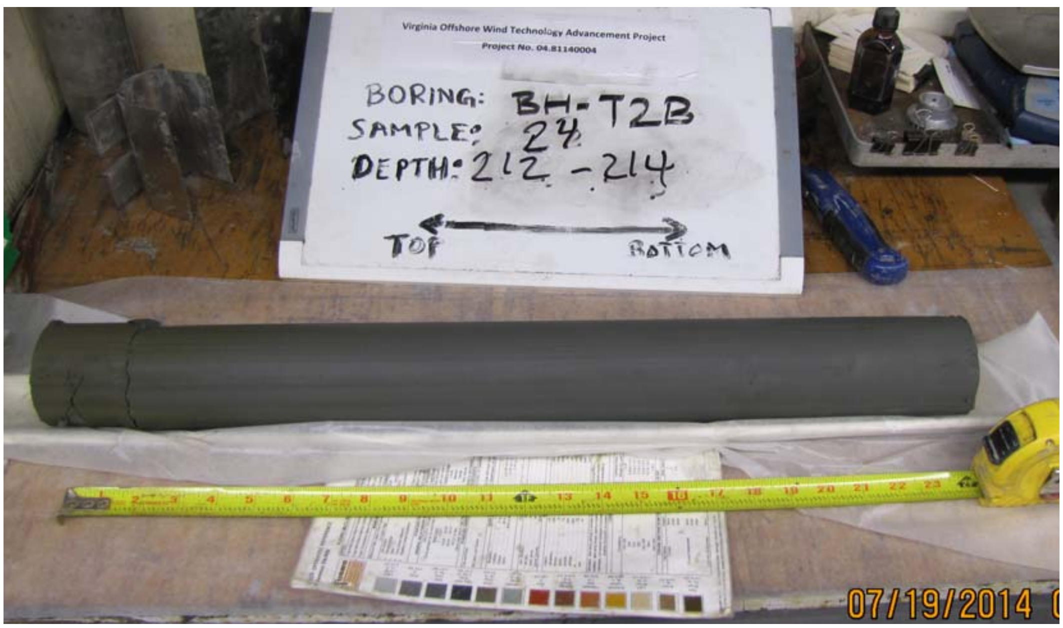
Offshore Virginia

FIGURE C3-11

BH-T2B Sample 23 Depth: 209 ft



BH-T2B Sample 24 Depth: 212 ft

SAMPLE CORE PHOTOGRAPHS
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Offshore Virginia

FIGURE C3-12

BH-T2B Sample 25 Depth: 224 ft

BH-T2B Sample 26 Depth: 227 ft

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FIGURE C3-13

BH-T2B Sample 27 Depth: 239 ft

BH-T2B Sample 28 Depth: 251 ft

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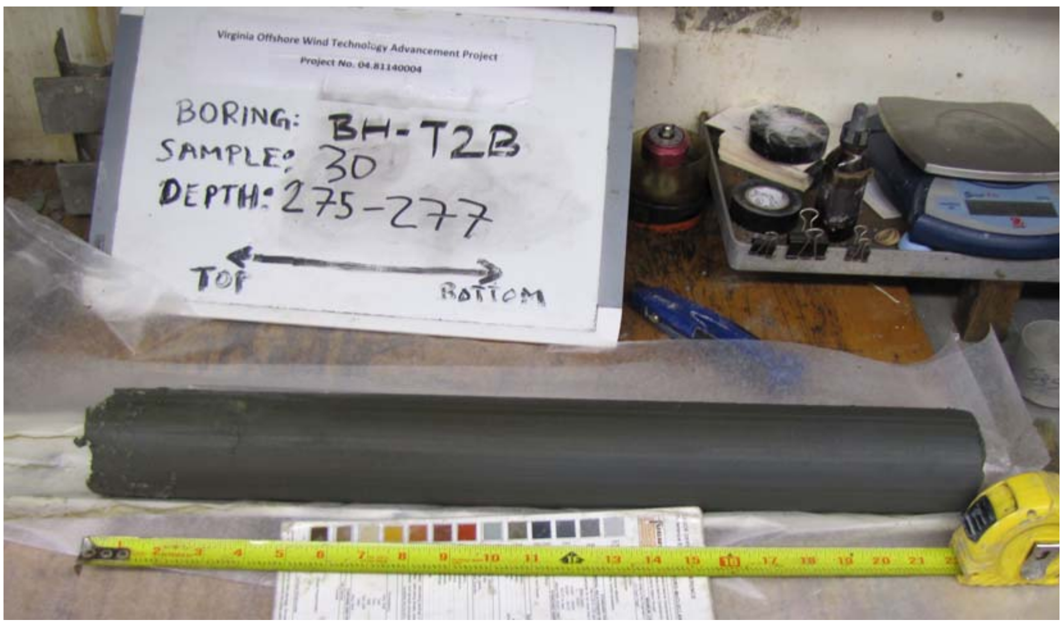
Offshore Virginia

FIGURE C3-14

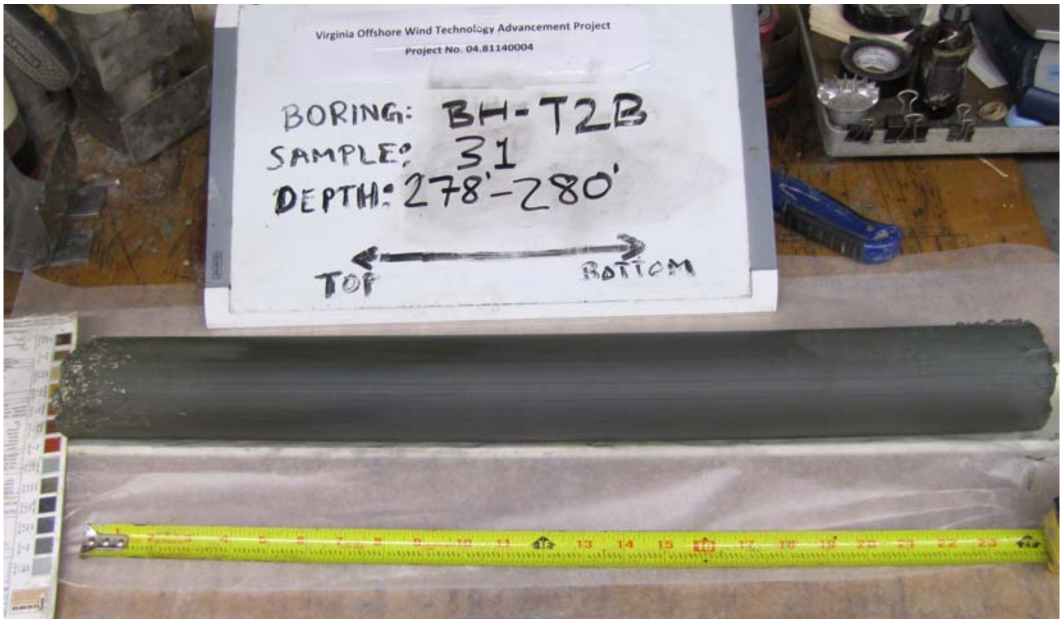
BH-T2B Sample 29 Depth: 263 ft



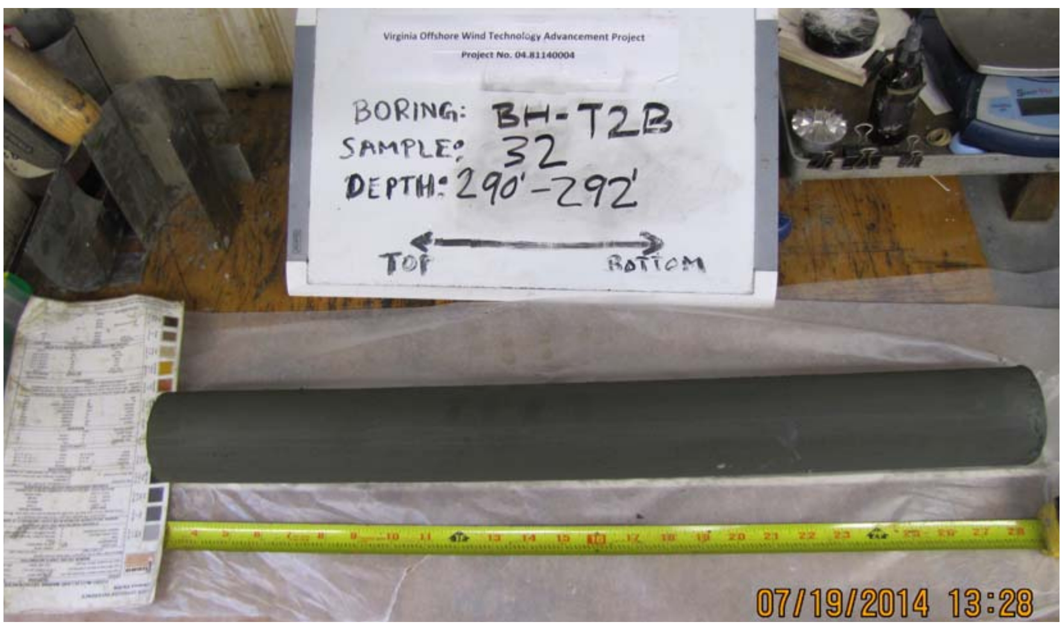
BH-T2B Sample 30 Depth: 275 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C3-15



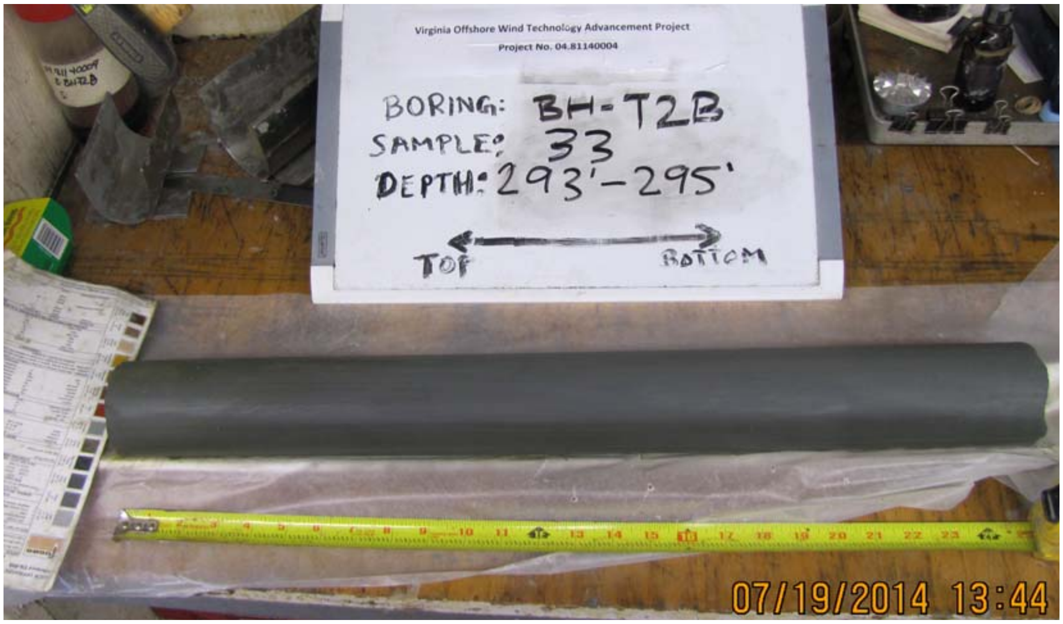
BH-T2B Sample 31 Depth: 278 ft



BH-T2B Sample 32 Depth: 290 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C3-16



BH-T2B Sample 33 Depth: 293 ft

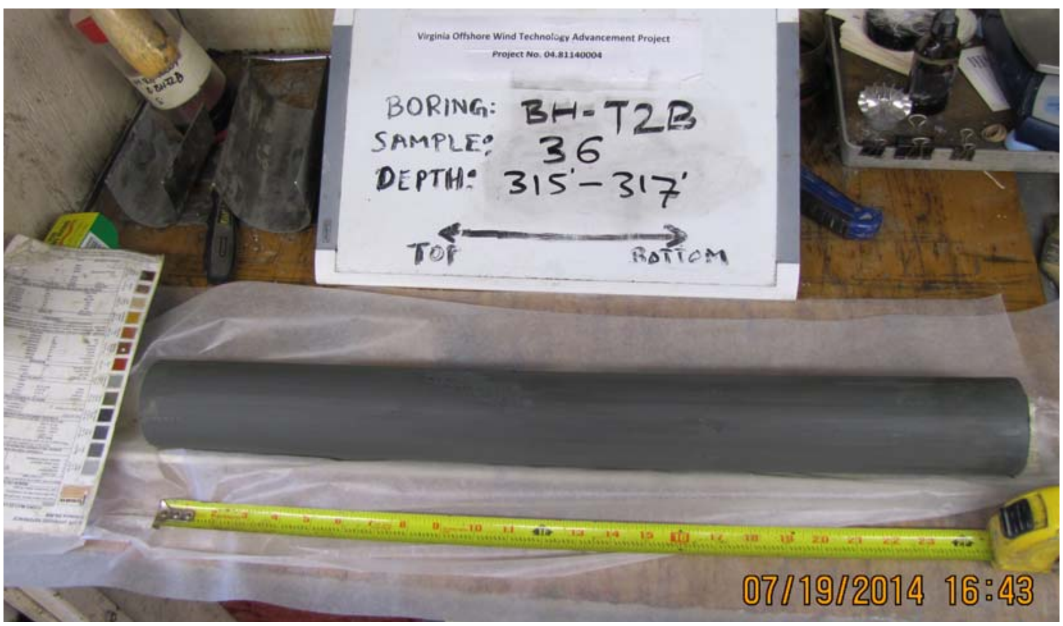
BH-T2B Sample 34 Depth: 300 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C3-17

Photograph not available

BH-T2B Sample 35 Depth: ft



BH-T2B Sample 36 Depth: 315 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C3-18

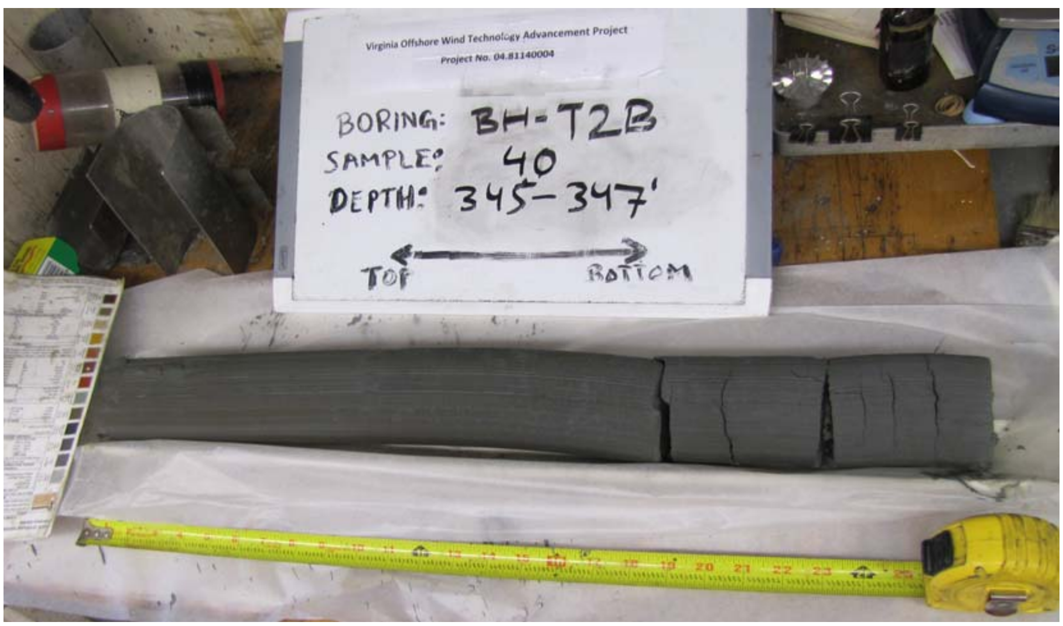
BH-T2B Sample 37 Depth: 318 ft

BH-T2B Sample 38 Depth: 330 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C3-19

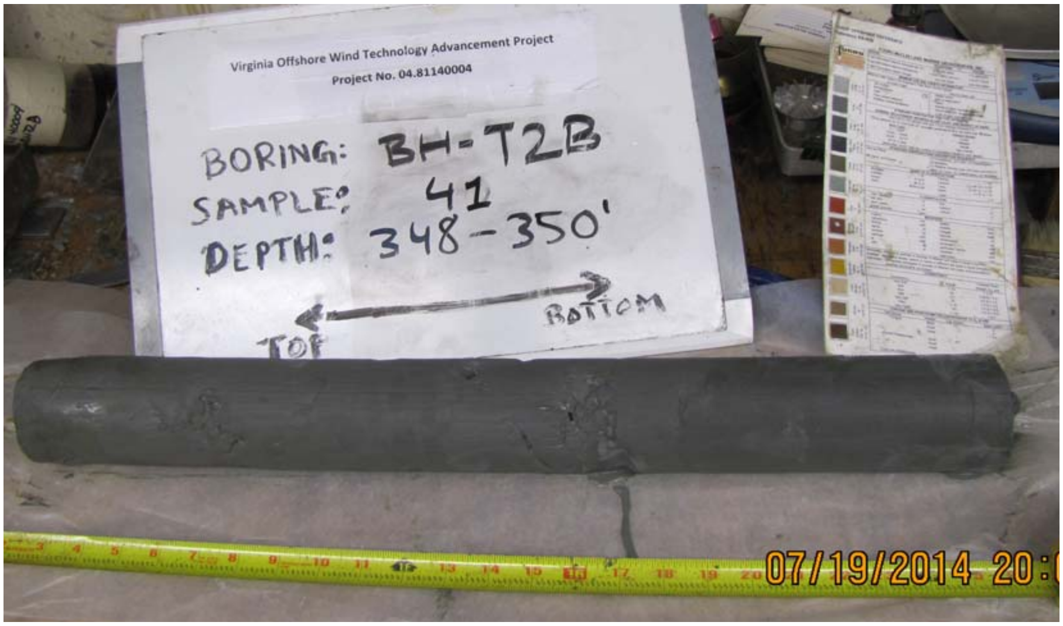
BH-T2B Sample 39 Depth: 333 ft



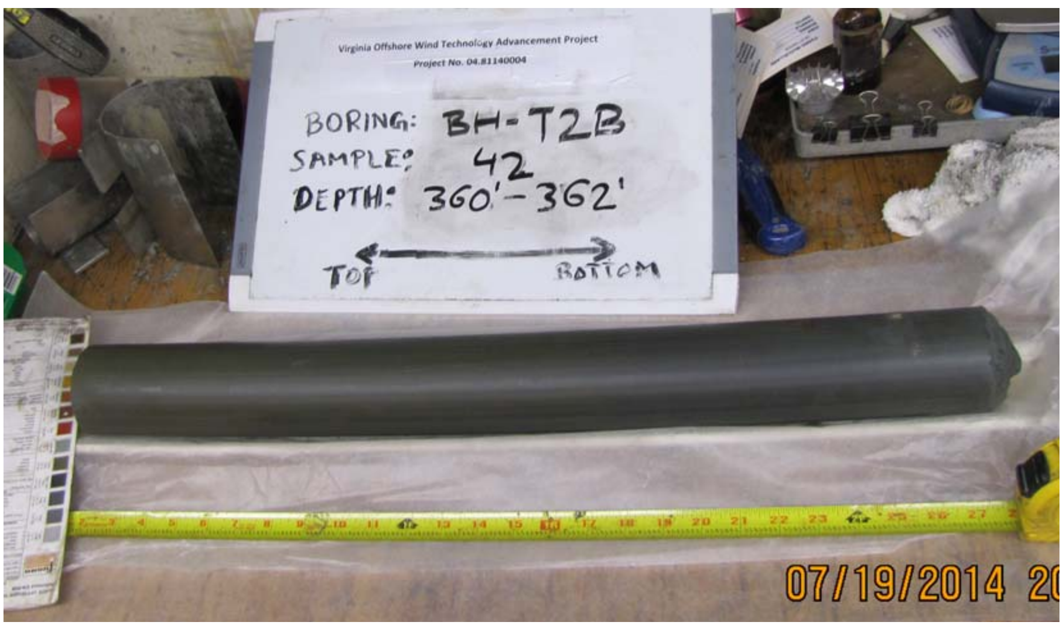
BH-T2B Sample 40 Depth: 345 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C3-20



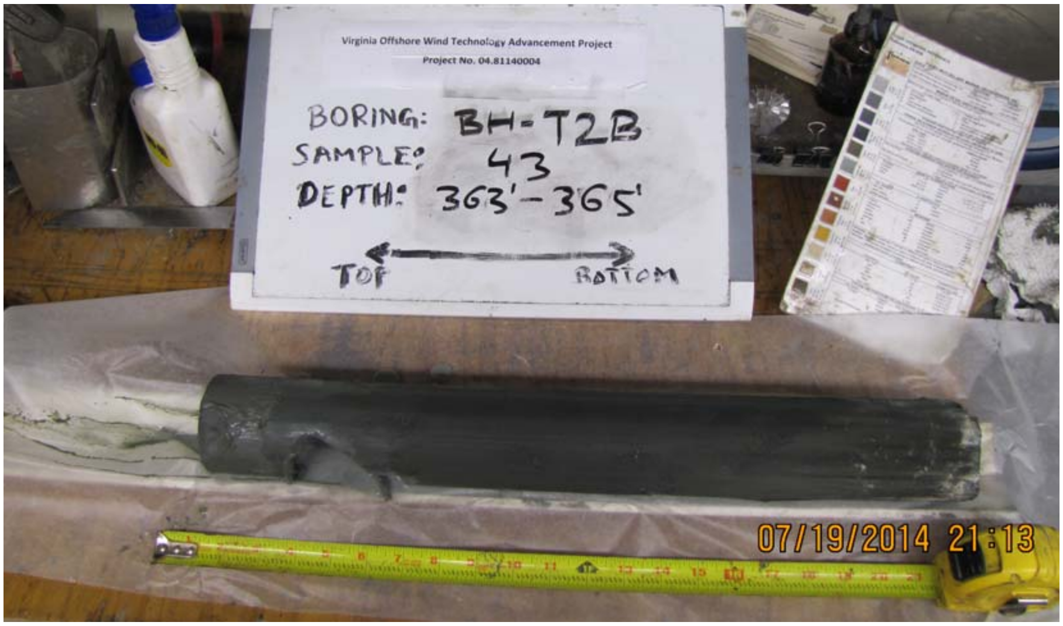
BH-T2B Sample 41 Depth: 348 ft



BH-T2B Sample 42 Depth: 360 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

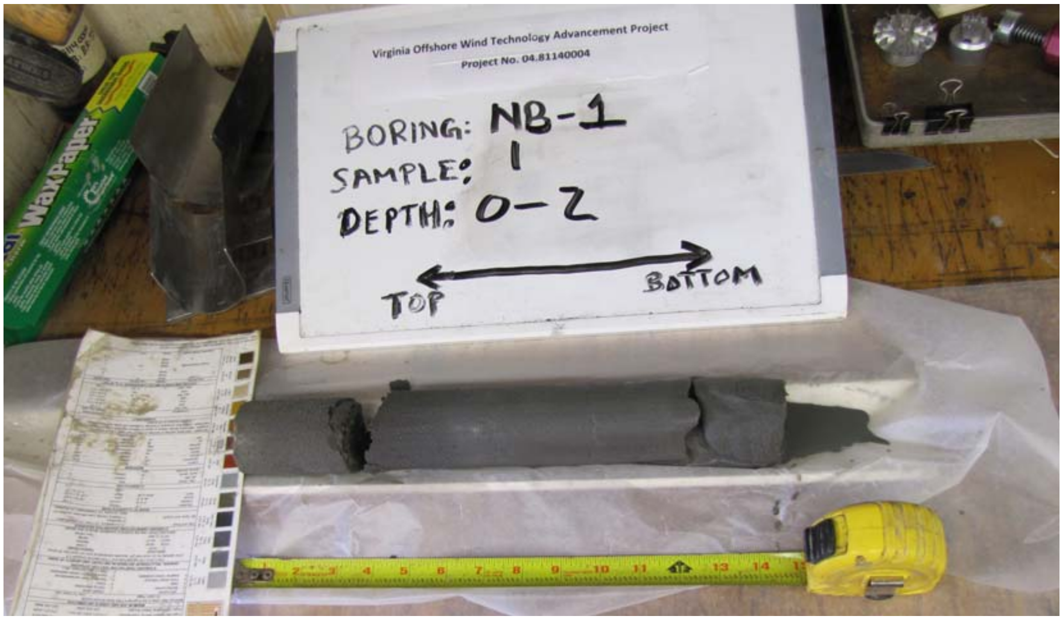
FIGURE C3-21



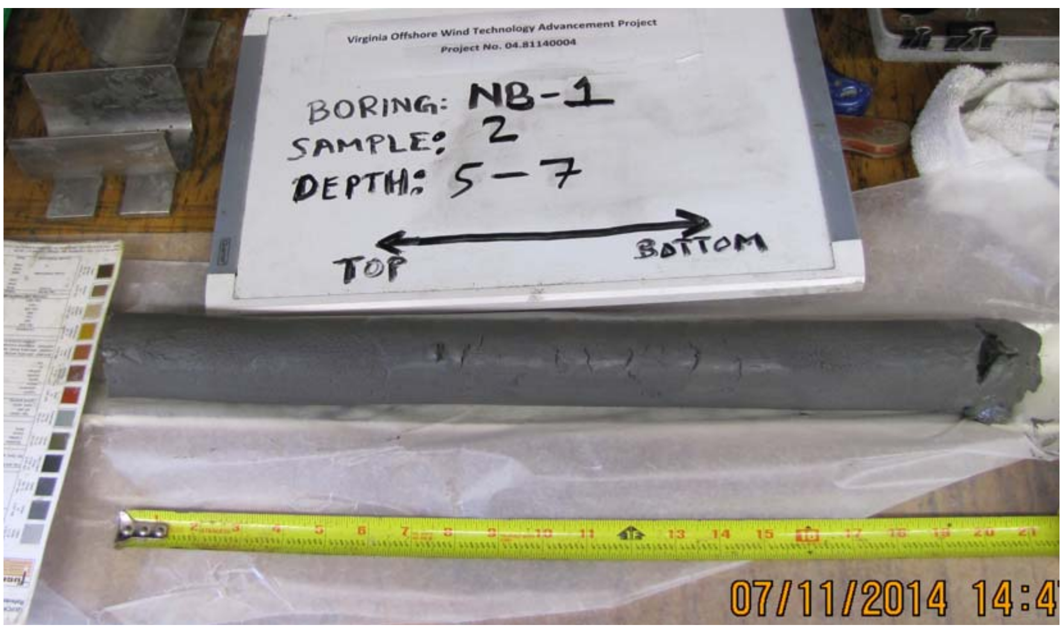
BH-T2B Sample 43 Depth: 363 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C3-22



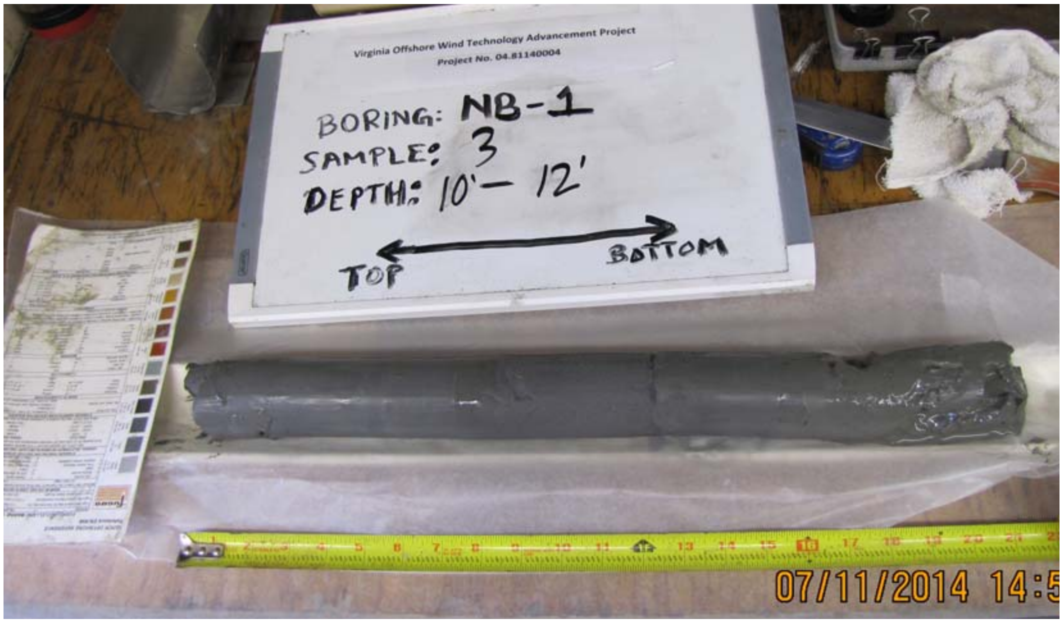
NB-1 Sample 1 Depth: 0 ft



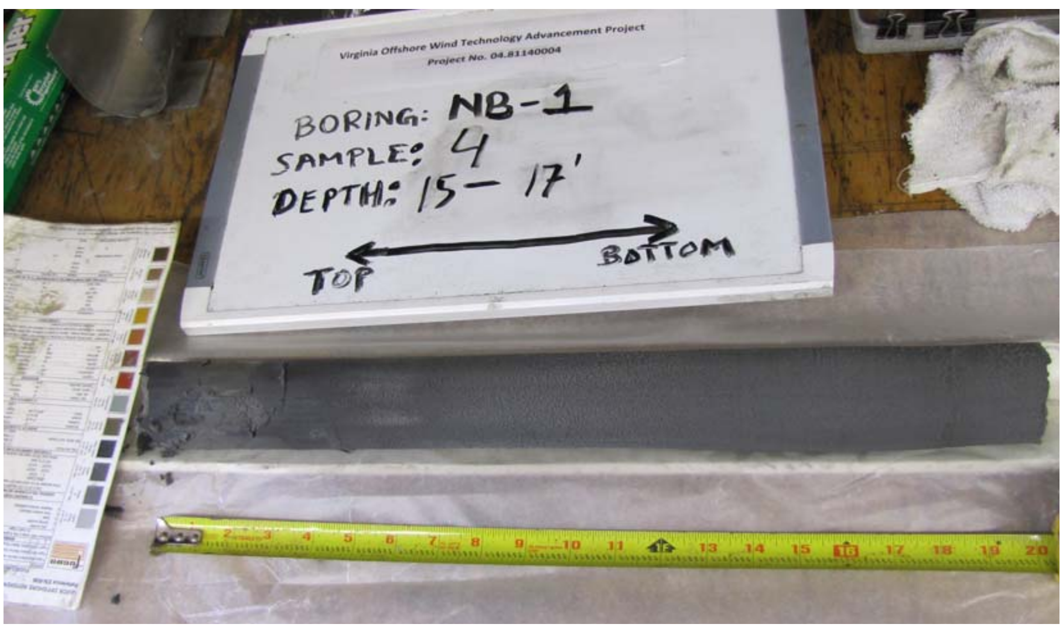
NB-1 Sample 2 Depth: 5 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C4-1



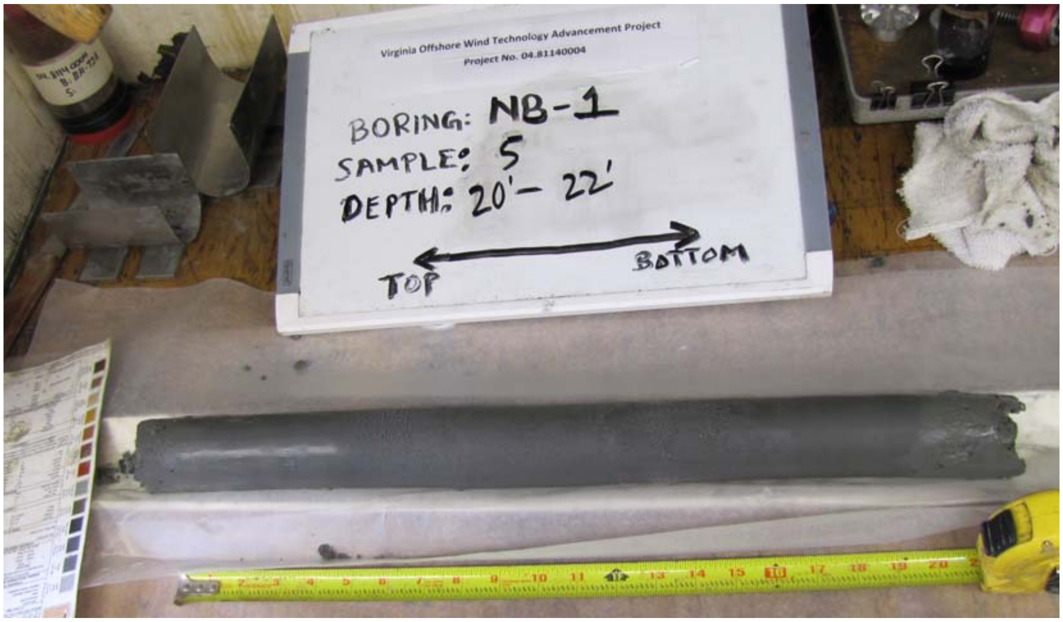
NB-1 Sample 3 Depth: 10 ft



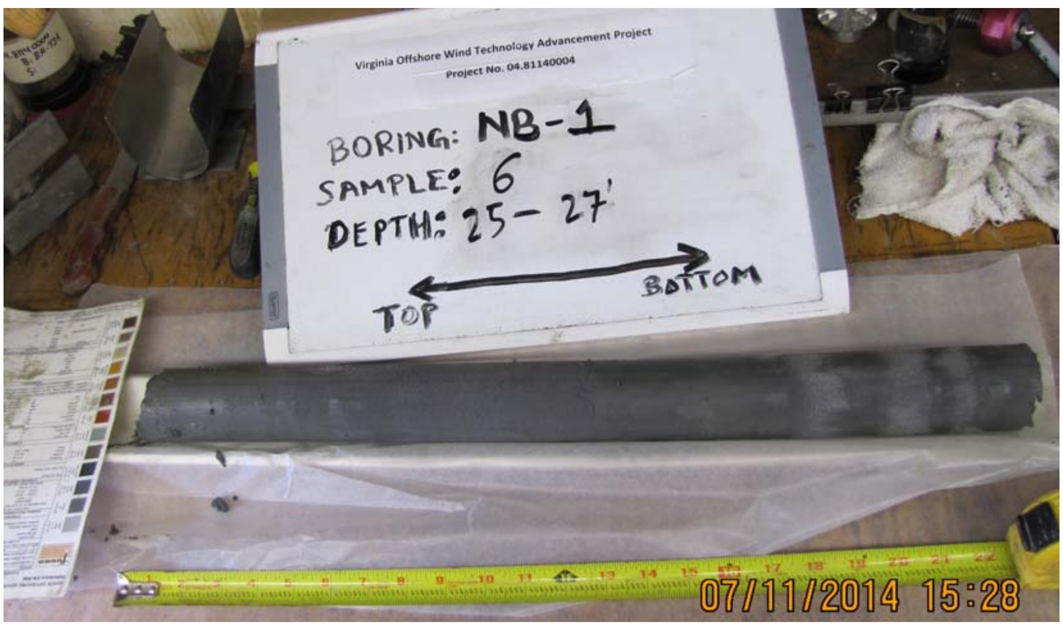
NB-1 Sample 4 Depth: 15 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C4-2



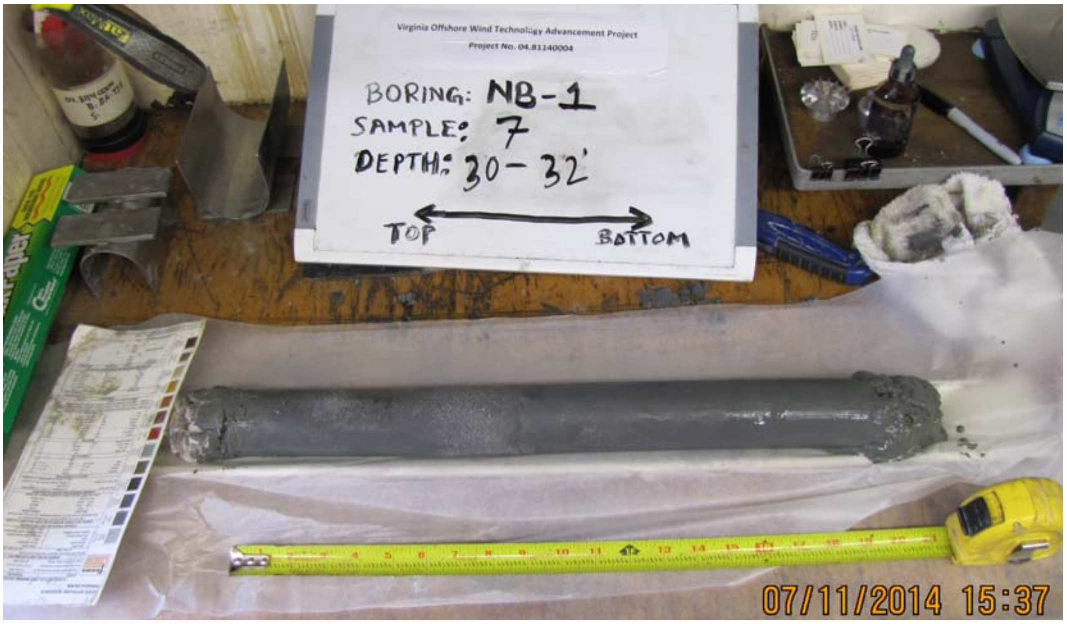
NB-1 Sample 5 Depth: 20 ft



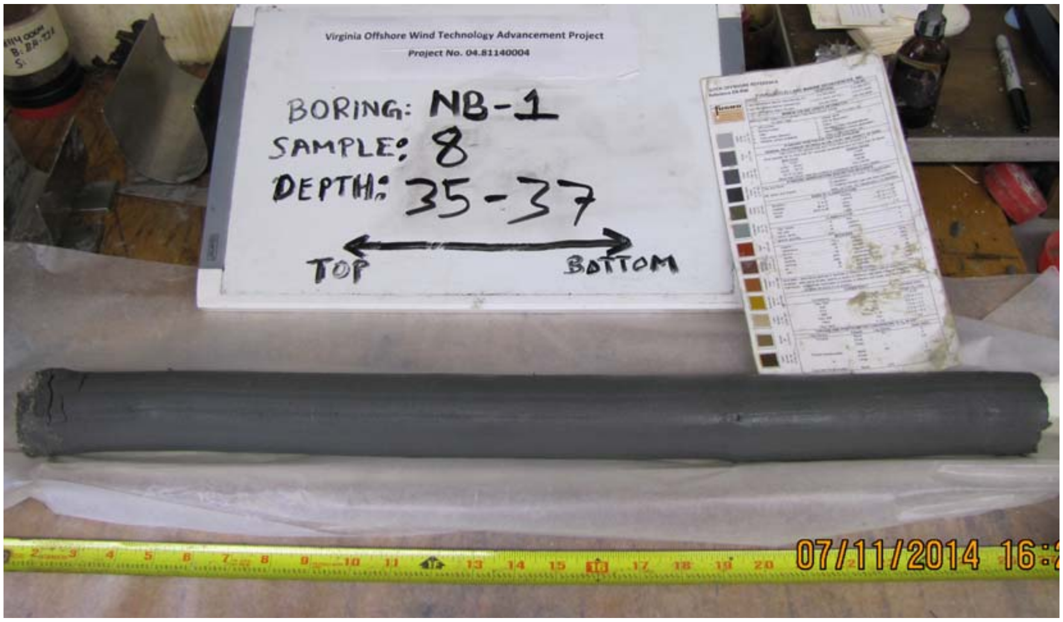
NB-1 Sample 6 Depth: 25 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C4-3



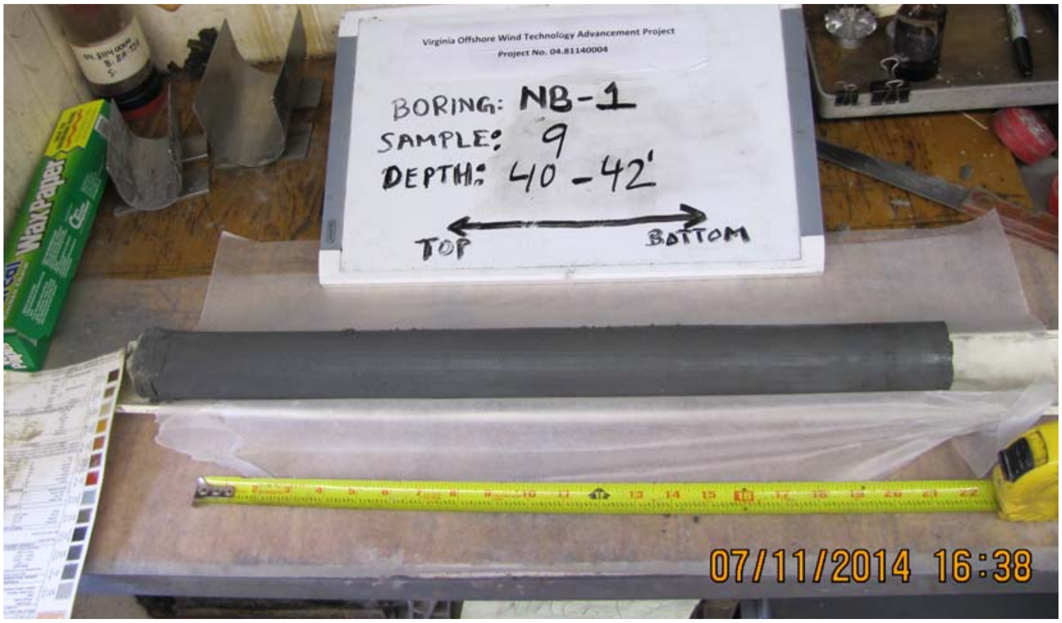
NB-1 Sample 7 Depth: 30 ft



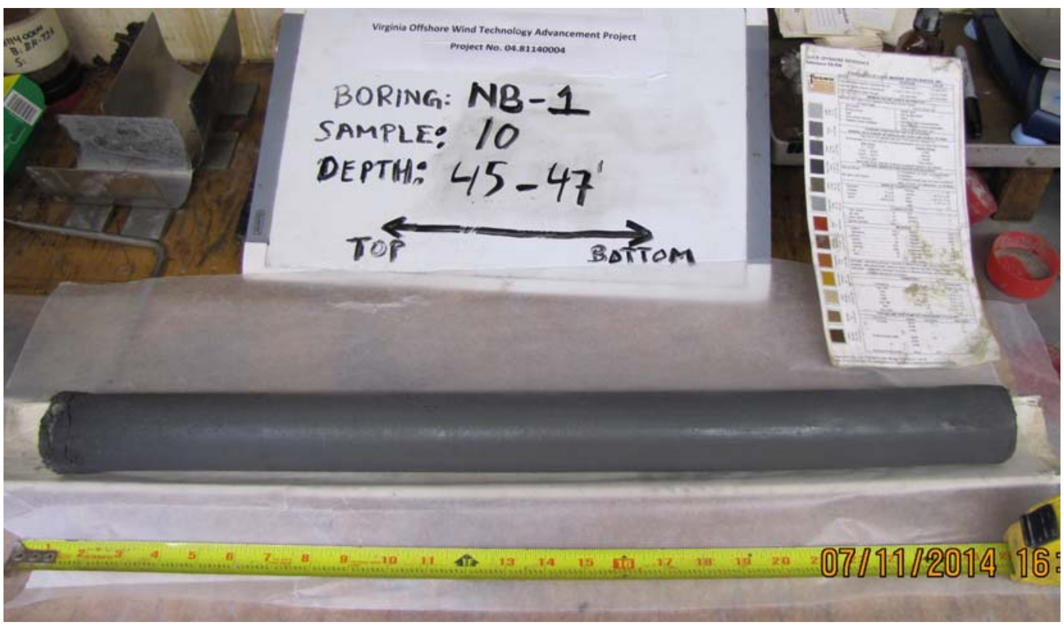
NB-1 Sample 8 Depth: 35 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C4-4



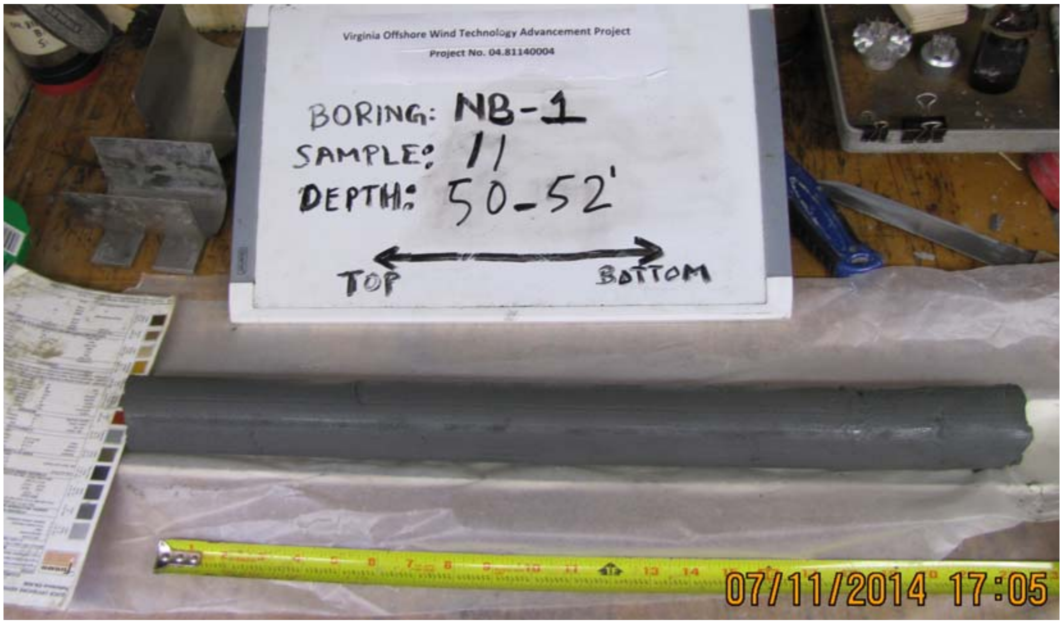
NB-1 Sample 9 Depth: 40 ft



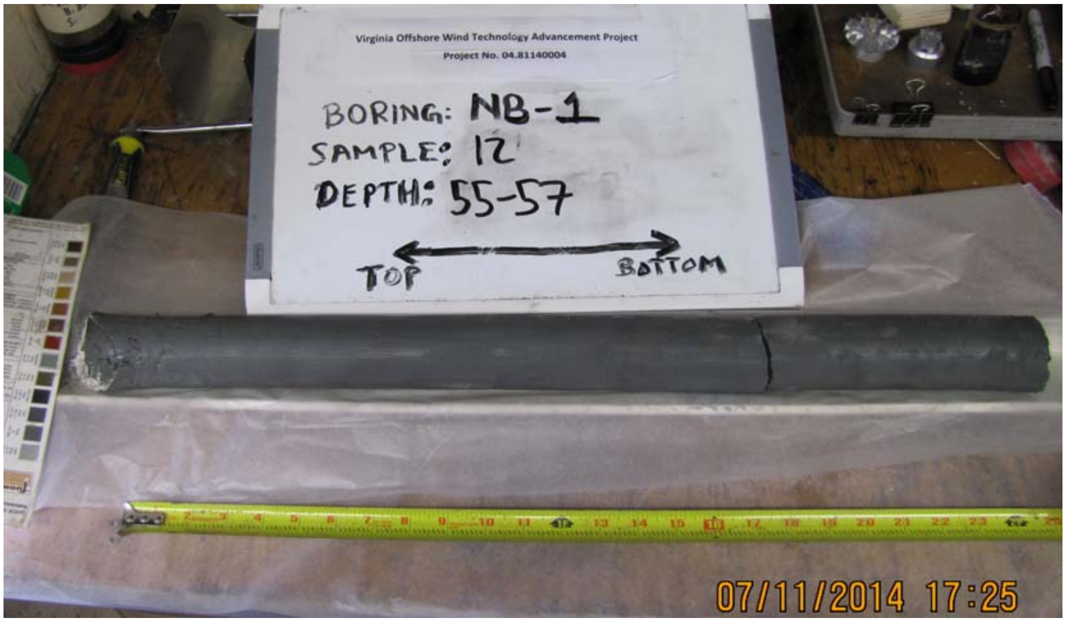
NB-1 Sample 10 Depth: 45 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C4-5



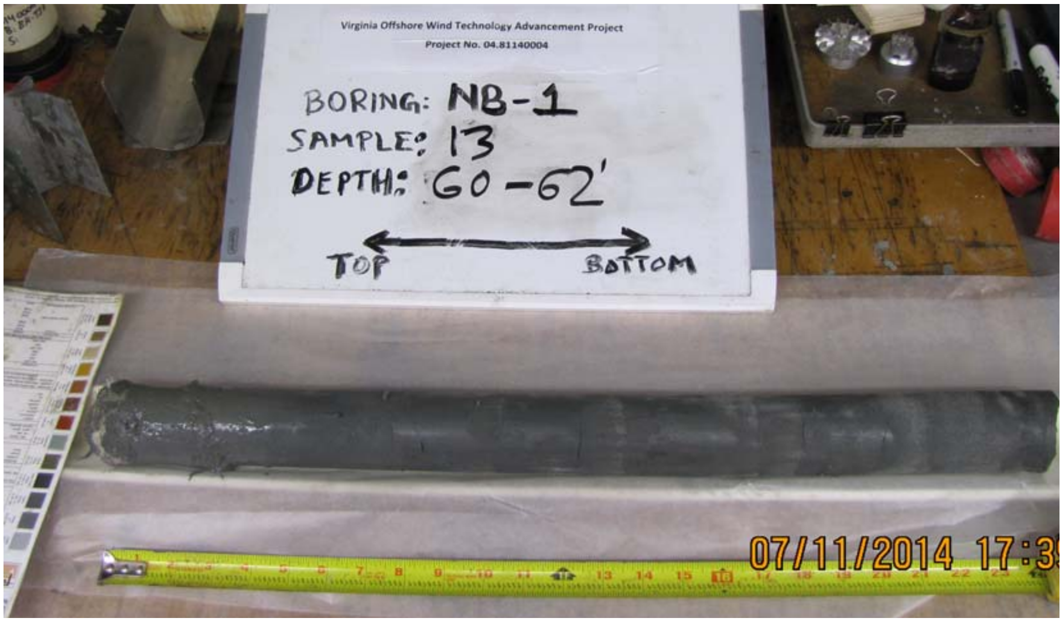
NB-1 Sample 11 Depth: 50 ft



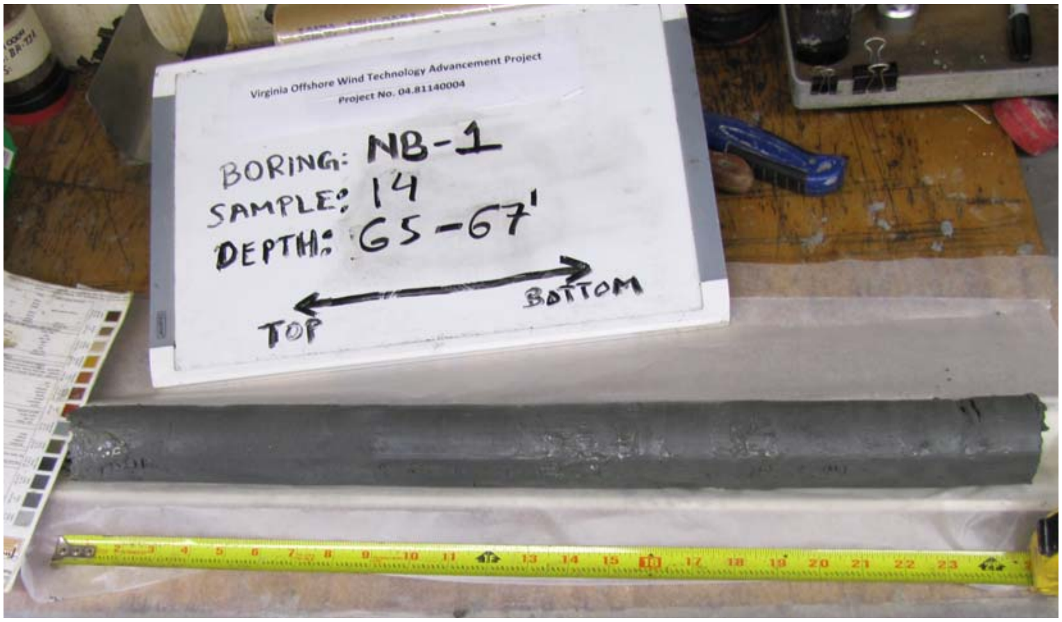
NB-1 Sample 12 Depth: 55 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C4-6



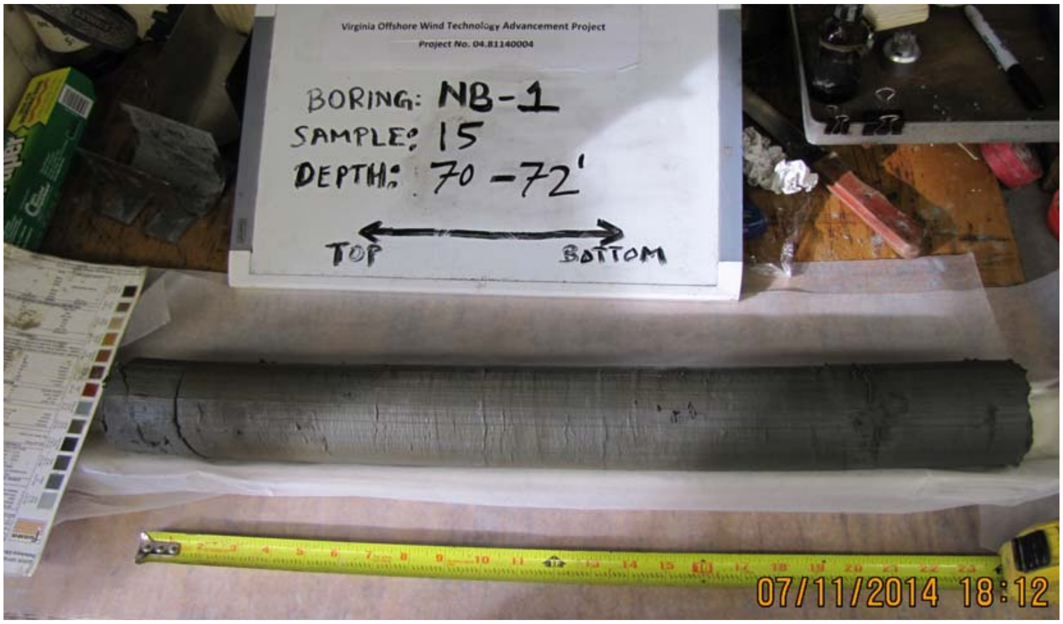
NB-1 Sample 13 Depth: 60 ft



NB-1 Sample 14 Depth: 65 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C4-7



NB-1 Sample 15 Depth: 70 ft

NB-1 Sample 16 Depth: 75 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

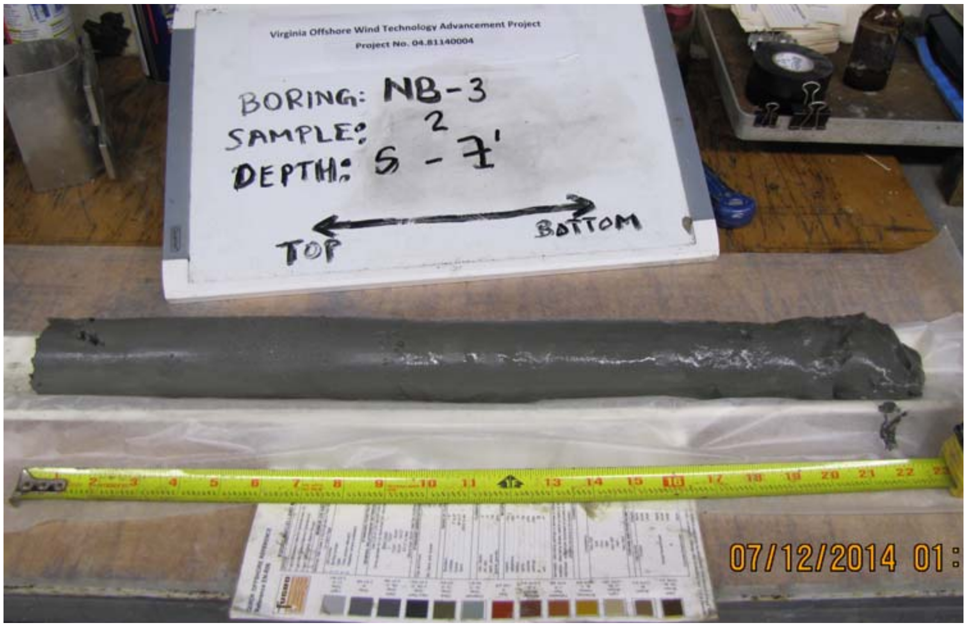
FIGURE C4-8

NB-1 Sample 17 Depth: 80 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C4-9

NB-3 Sample 1 Depth: 0 ft



NB-3 Sample 2 Depth: 5 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C5-1

NB-3 Sample 3 Depth: 10 ft

NB-3 Sample 4 Depth: 15 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C5-2

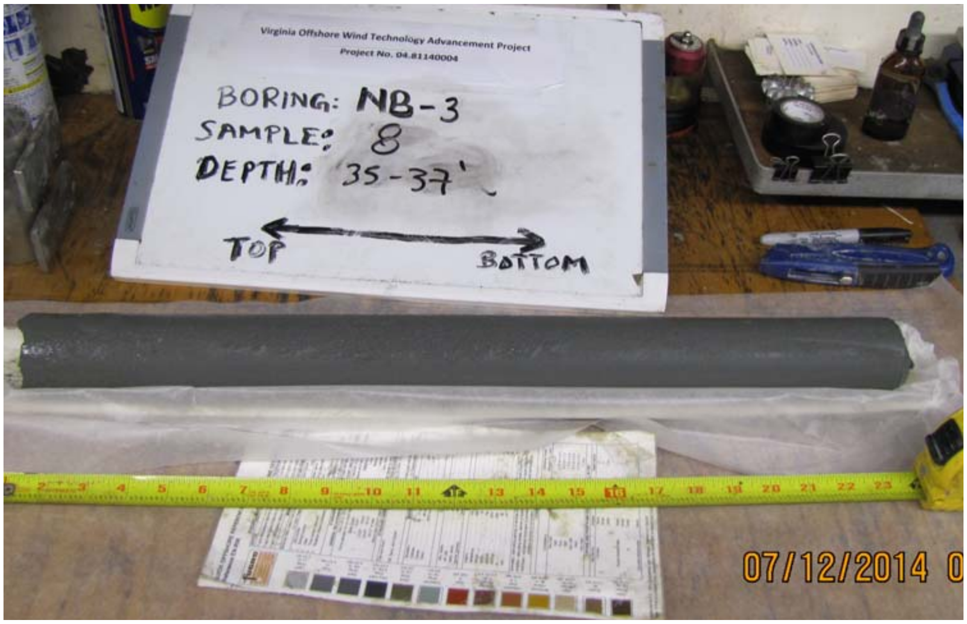
NB-3 Sample 5 Depth: 20 ft

NB-3 Sample 6 Depth: 25 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C5-3

NB-3 Sample 7 Depth: 30 ft



NB-3 Sample 8 Depth: 35 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C5-4

NB-3 Sample 9 Depth: 40 ft

NB-3 Sample 10 Depth: 45 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C5-5

NB-3 Sample 11 Depth: 50 ft

NB-3 Sample 12 Depth: 55 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C5-6

NB-3 Sample 13 Depth: 60 ft

NB-3 Sample 14 Depth: 65 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C5-7

NB-3 Sample 15 Depth: 70 ft

Photograph not available

NB-3 Sample 16 Depth: ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

NB-3 Sample 17 Depth: 80 ft

NB-3 Sample 18 Depth: 85 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C5-9

NB-3 Sample 19 Depth: 90 ft

NB-3 Sample 20 Depth: 95 ft

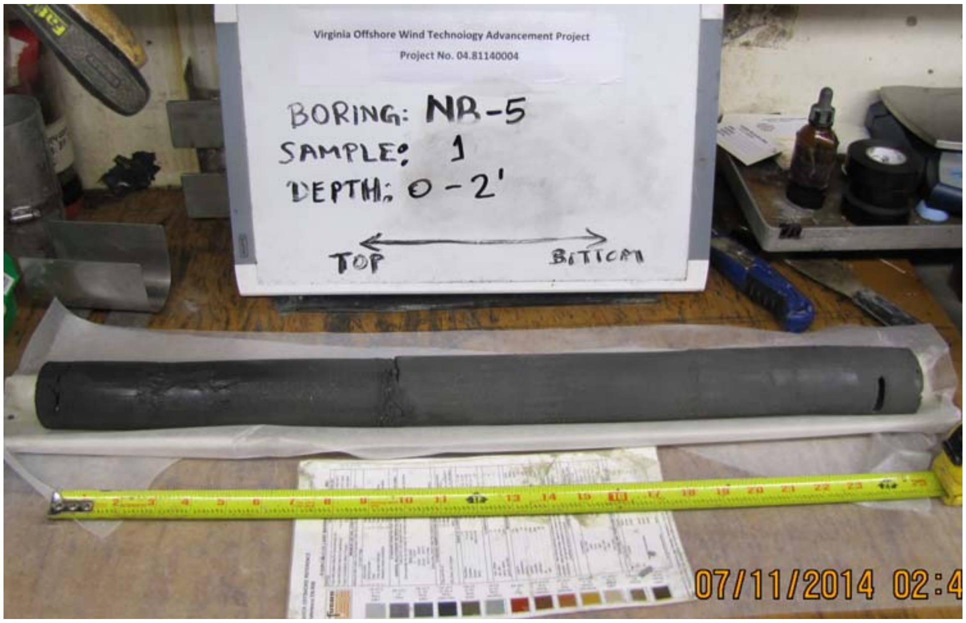
SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C5-10

NB-3 Sample 21 Depth: 99 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C5-11

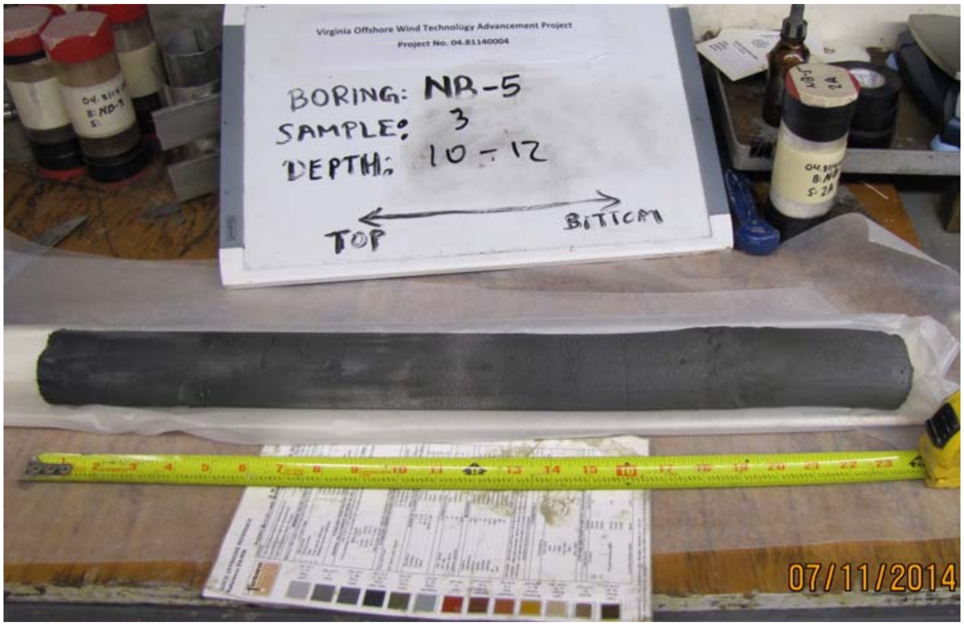


NB-5 Sample 1 Depth: 0 ft

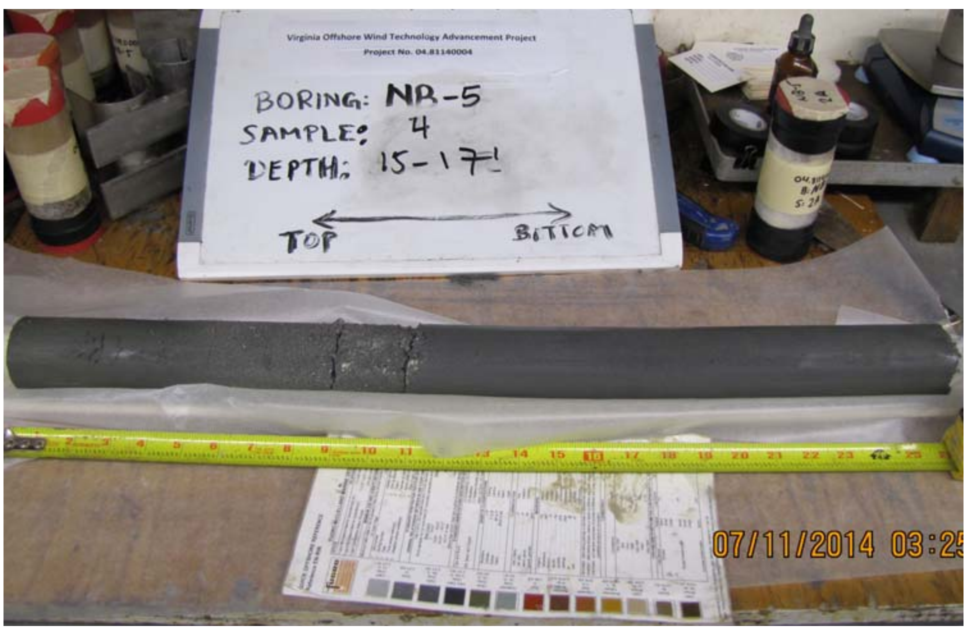
NB-5 Sample 2 Depth: 5 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C6-1



NB-5 Sample 3 Depth: 10 ft



NB-5 Sample 4 Depth: 15 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C6-2

NB-5 Sample 5 Depth: 20 ft

NB-5 Sample 6 Depth: 25 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

NB-5 Sample 7 Depth: 30 ft

NB-5 Sample 8 Depth: 35 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C6-4

NB-5 Sample 9 Depth: 40 ft

NB-5 Sample 10 Depth: 45 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

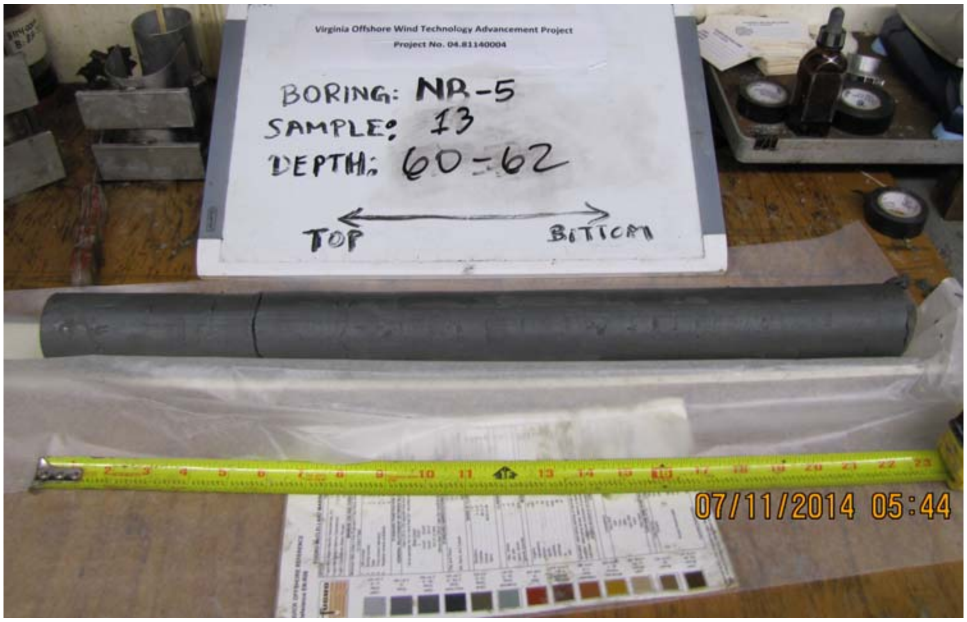
FIGURE C6-5

NB-5 Sample 11 Depth: 50 ft

NB-5 Sample 12 Depth: 55 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C6-6



NB-5 Sample 13 Depth: 60 ft

NB-5 Sample 14 Depth: 65 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C6-7

NB-5 Sample 15 Depth: 70 ft

NB-5 Sample 16 Depth: 75 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C6-8

NB-5 Sample 17 Depth: 80 ft

NB-5 Sample 18 Depth: 85 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C6-9

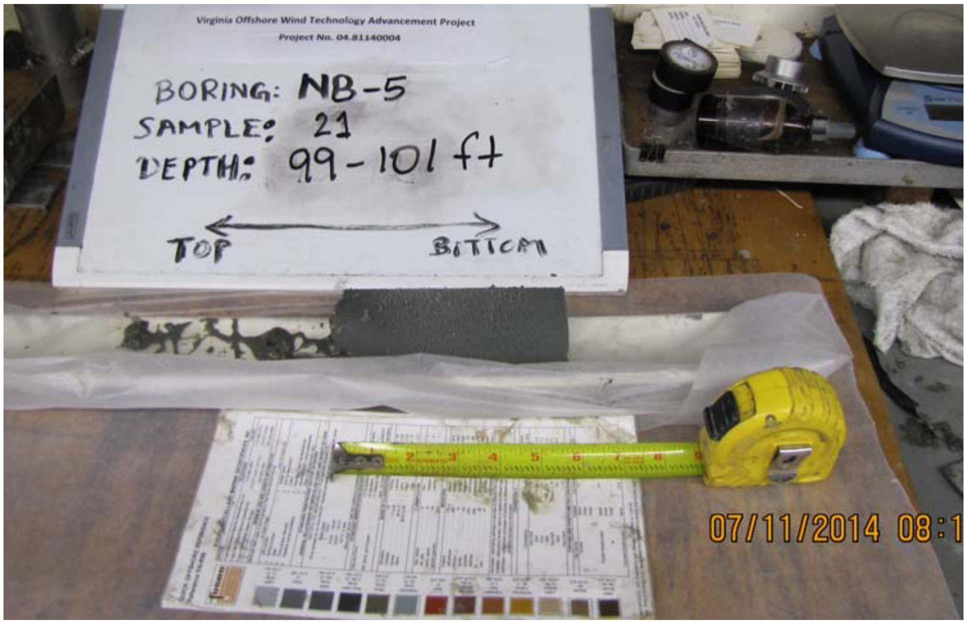
NB-5 Sample 19 Depth: 90 ft

Photograph not available

NB-5 Sample 20 Depth: ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

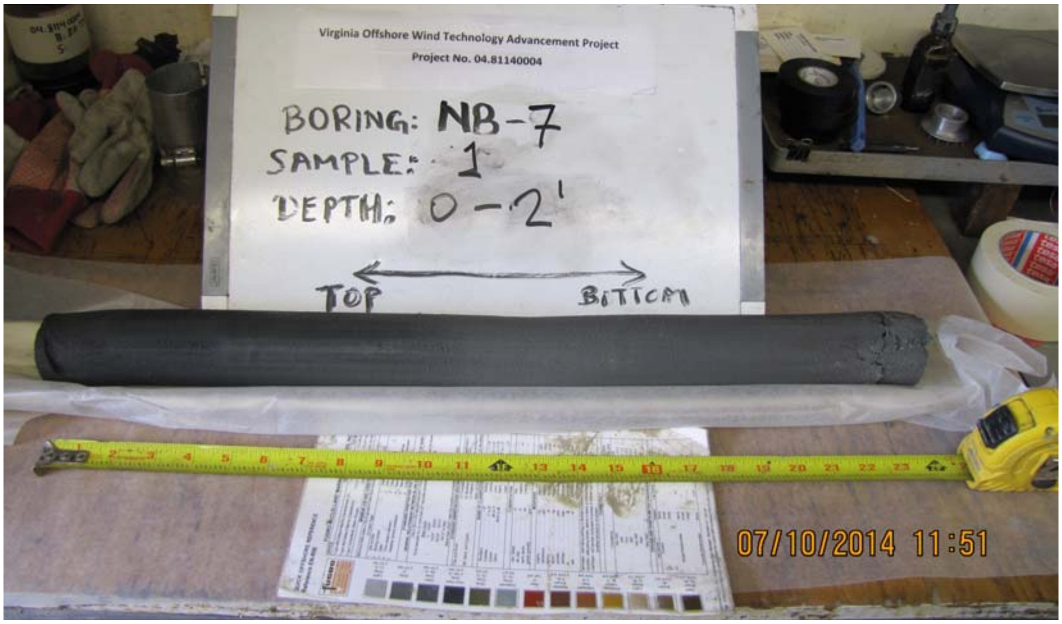
FIGURE C6-10



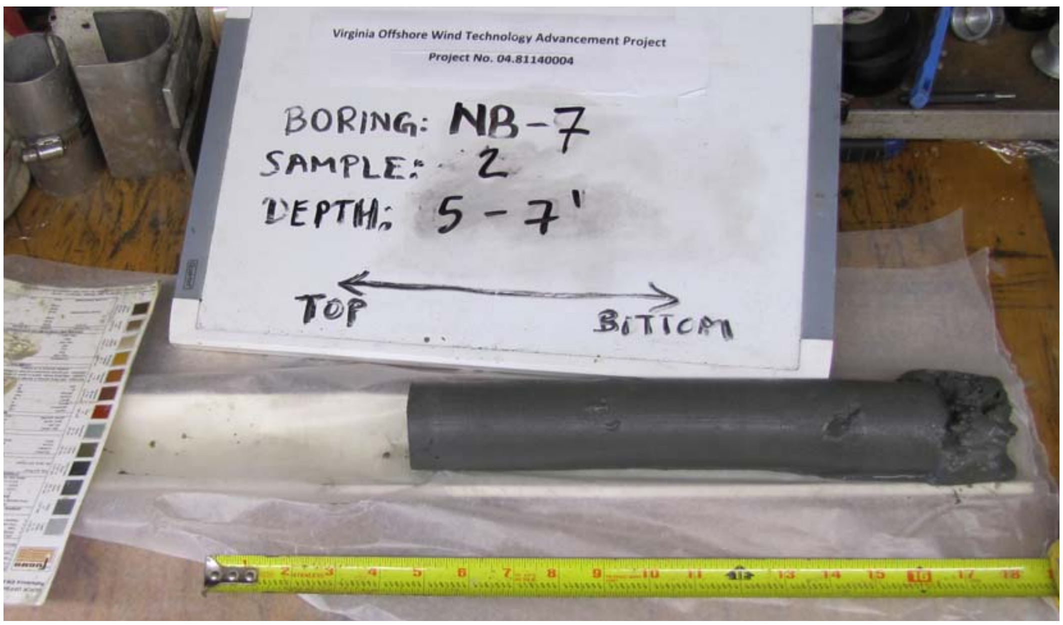
NB-5 Sample 21 Depth: 99 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C6-11



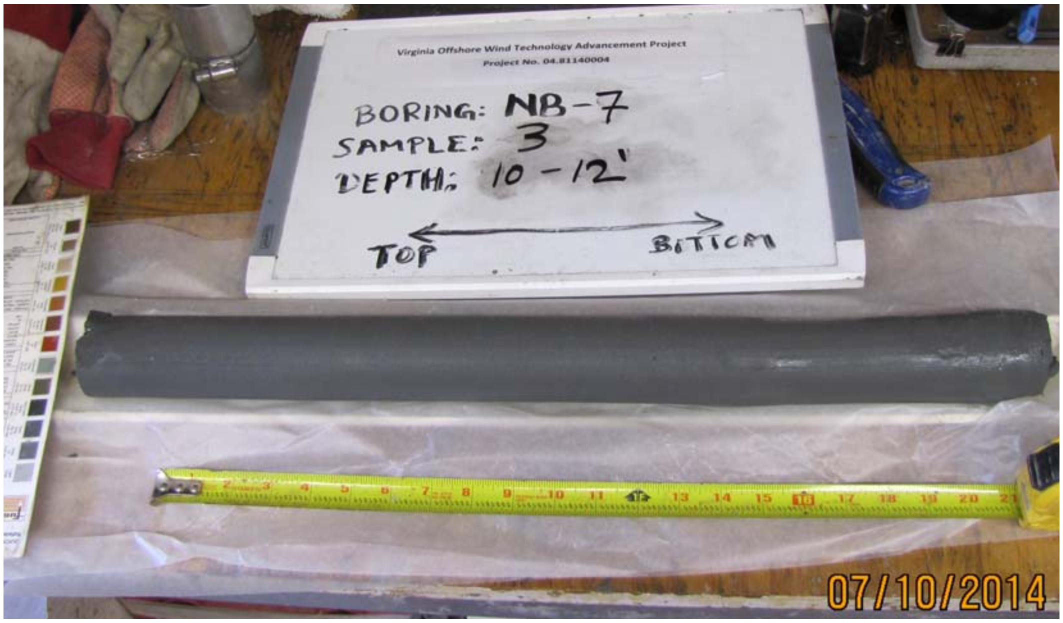
NB-7 Sample 1 Depth: 0 ft



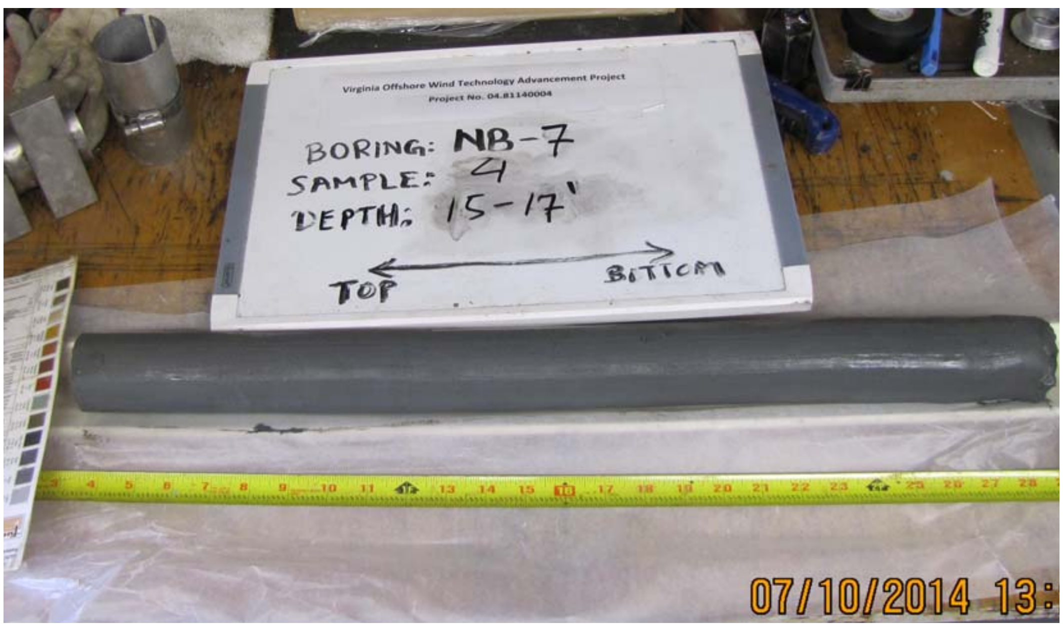
NB-7 Sample 2 Depth: 5 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C7-1



NB-7 Sample 3 Depth: 10 ft

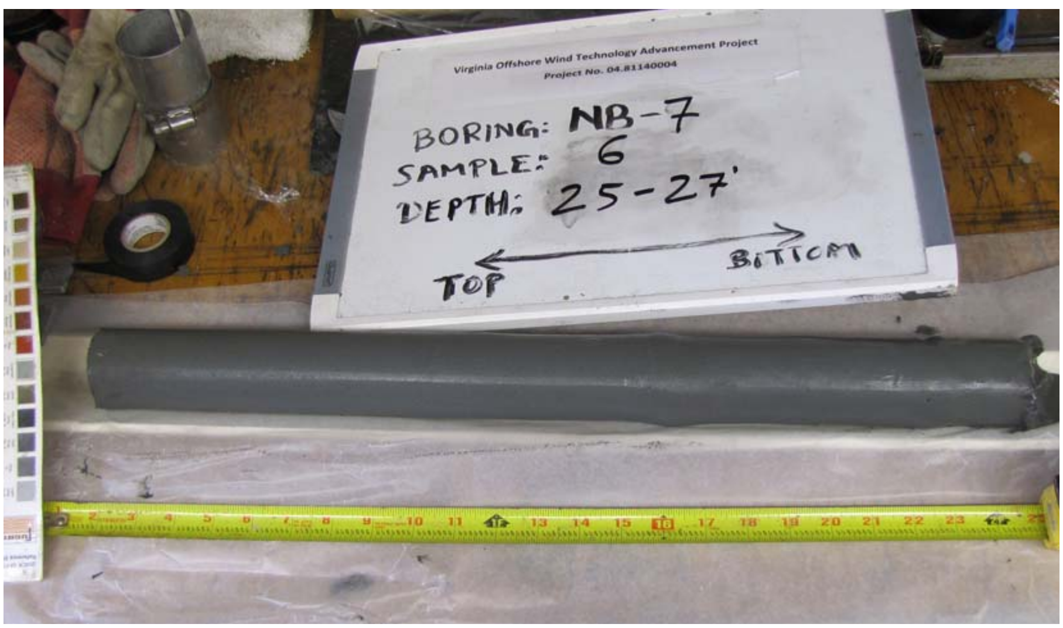


NB-7 Sample 4 Depth: 15 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C7-2

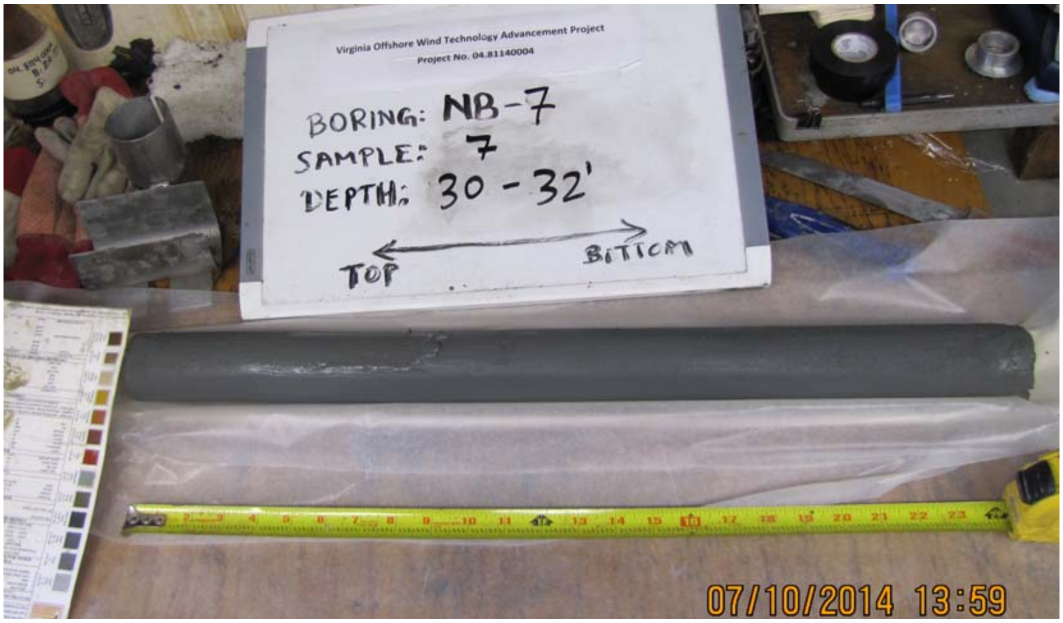
NB-7 Sample 5 Depth: 20 ft



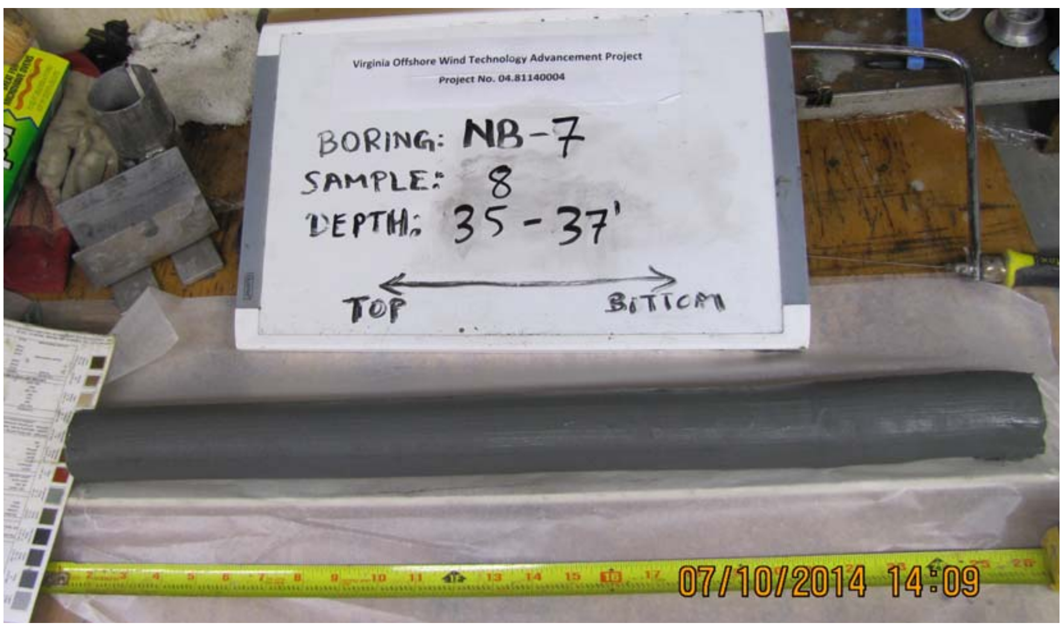
NB-7 Sample 6 Depth: 25 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C7-3



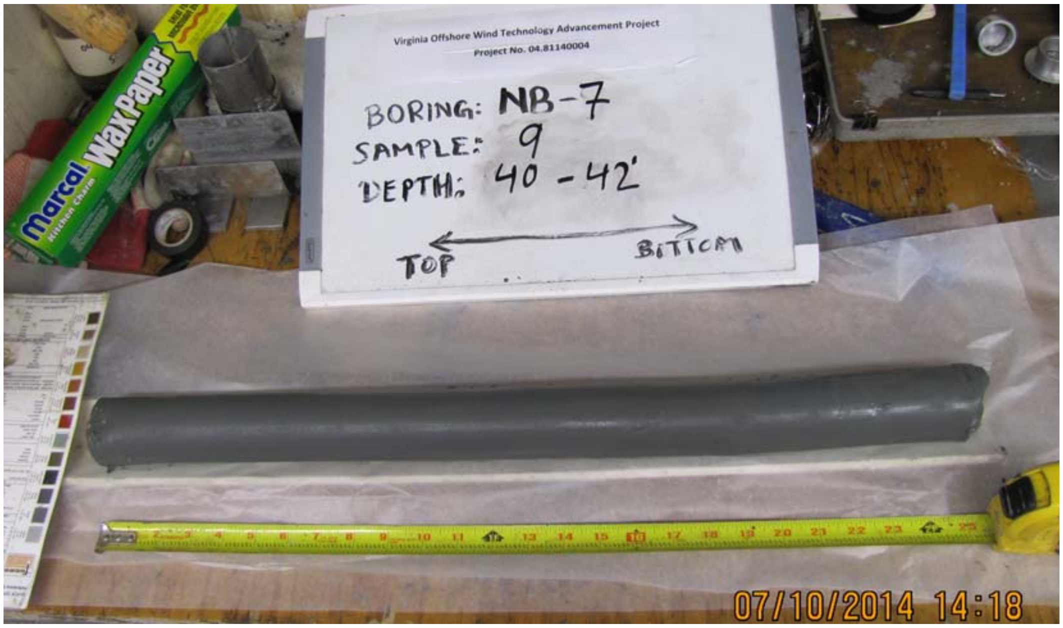
NB-7 Sample 7 Depth: 30 ft



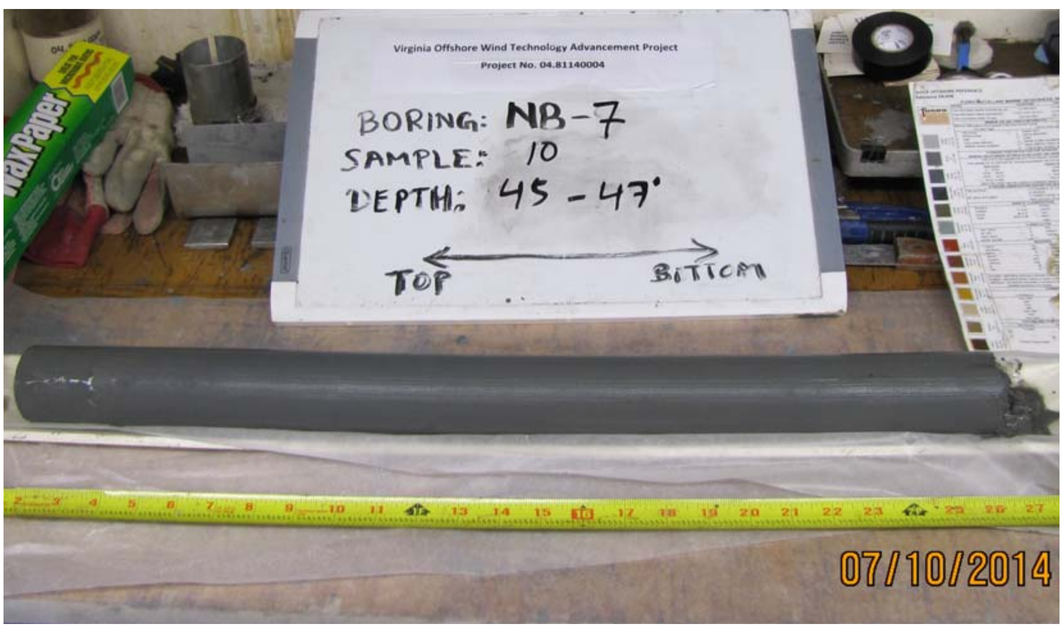
NB-7 Sample 8 Depth: 35 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C7-4



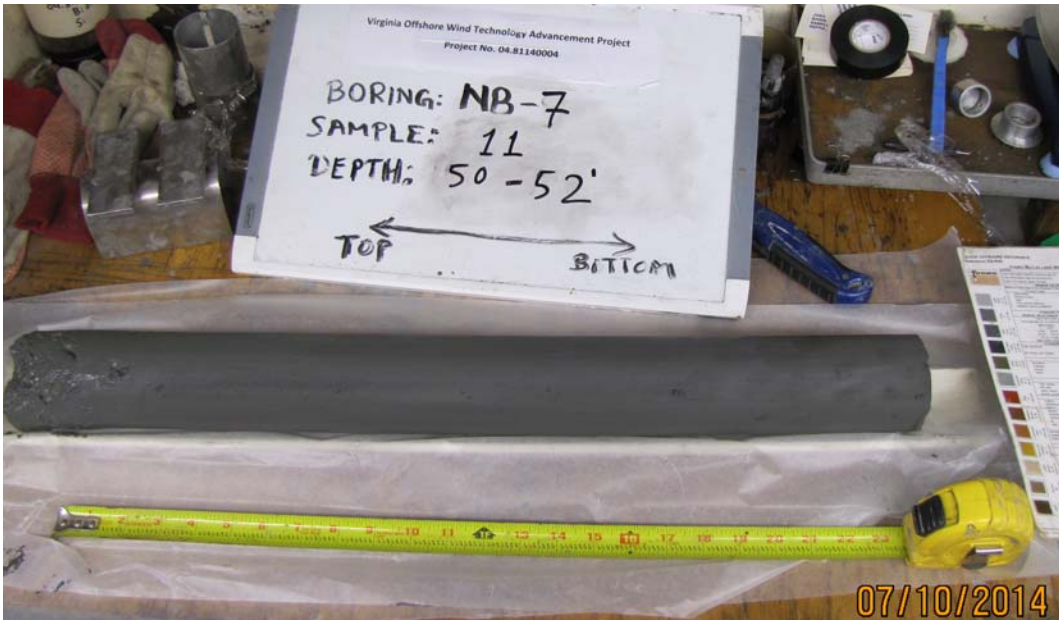
NB-7 Sample 9 Depth: 40 ft



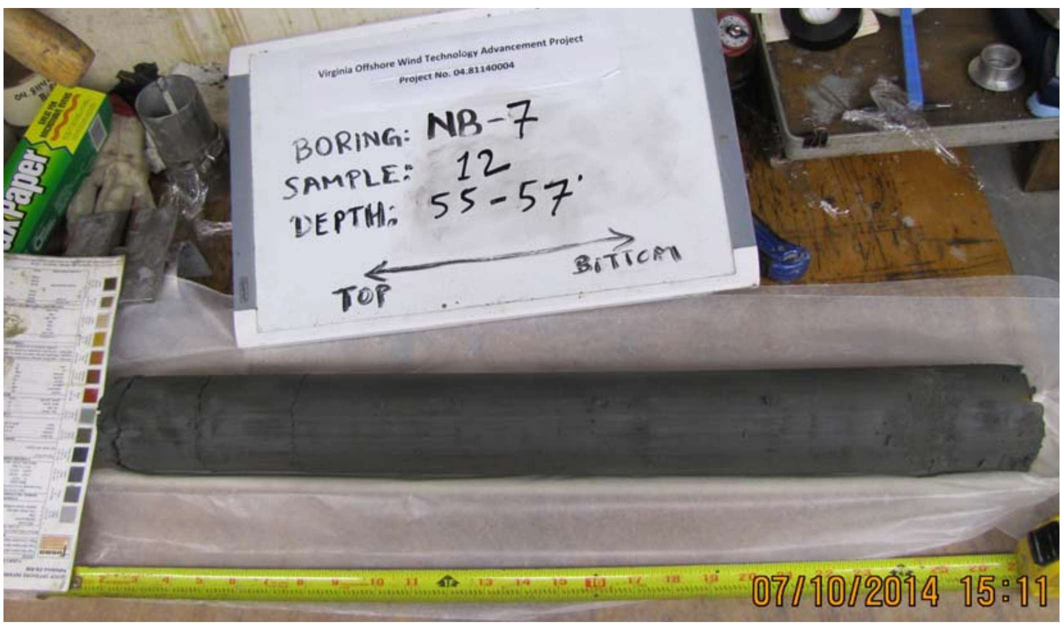
NB-7 Sample 10 Depth: 45 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C7-5



NB-7 Sample 11 Depth: 50 ft

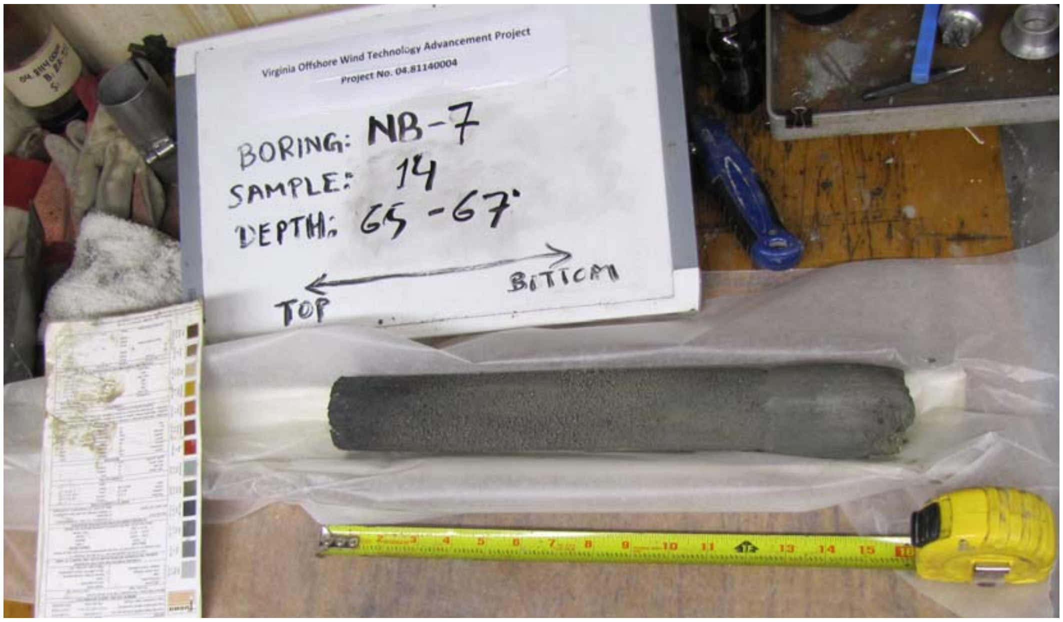


NB-7 Sample 12 Depth: 55 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C7-6

NB-7 Sample 13 Depth: 60 ft



NB-7 Sample 14 Depth: 65 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C7-7

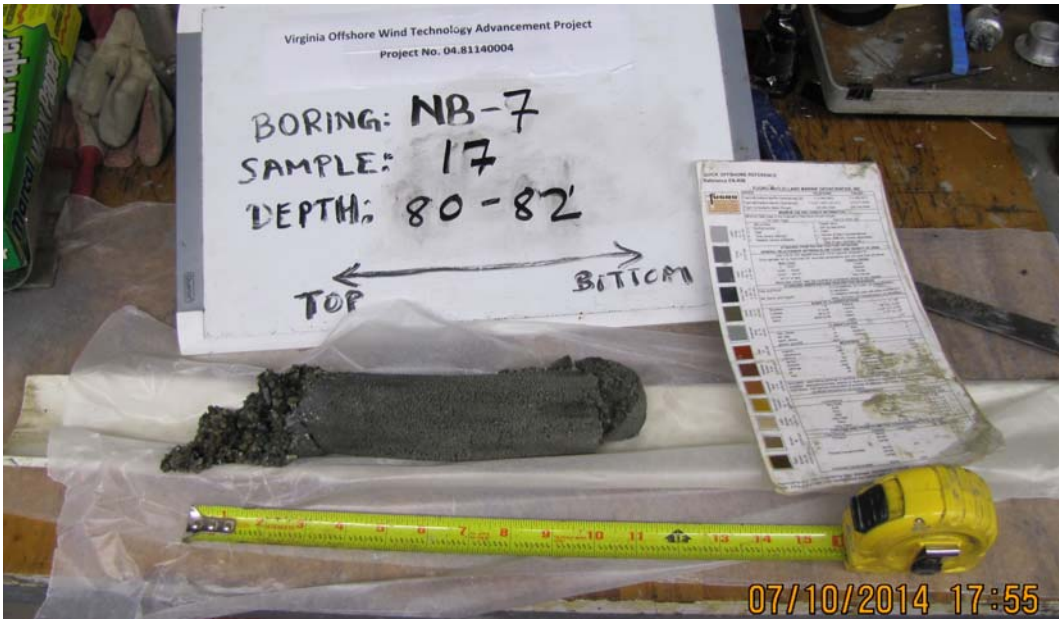
NB-7 Sample 15 Depth: 70 ft

Photograph not available

NB-7 Sample 16 Depth: ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C7-8



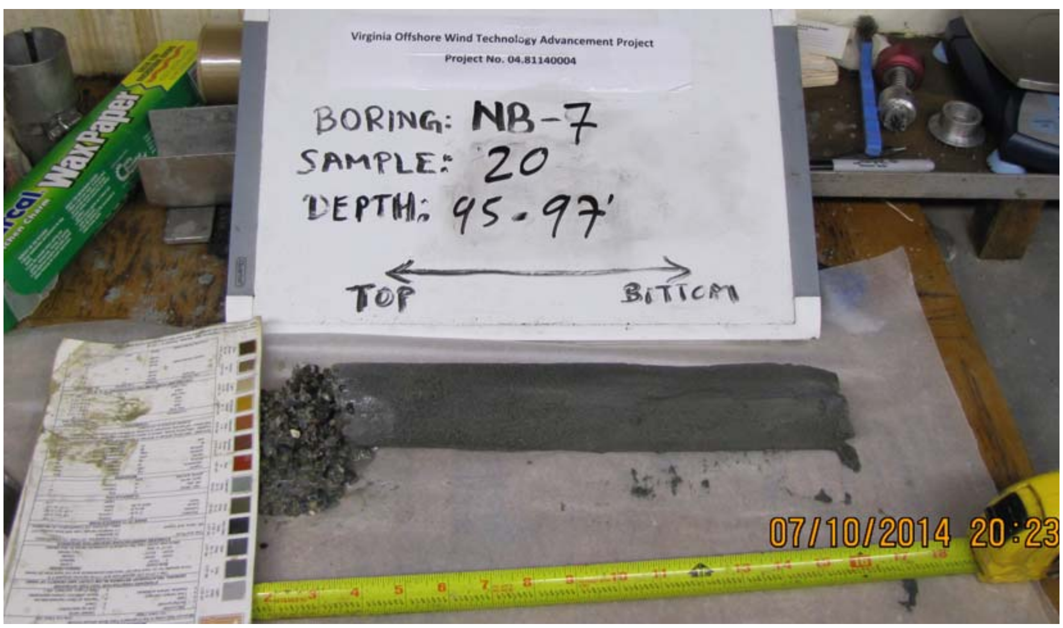
NB-7	Sample 17	Depth: 80 ft

NB-7	Sample 18	Depth: 85 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C7-9

NB-7 Sample 19 Depth: 90 ft



NB-7 Sample 20 Depth: 95 ft

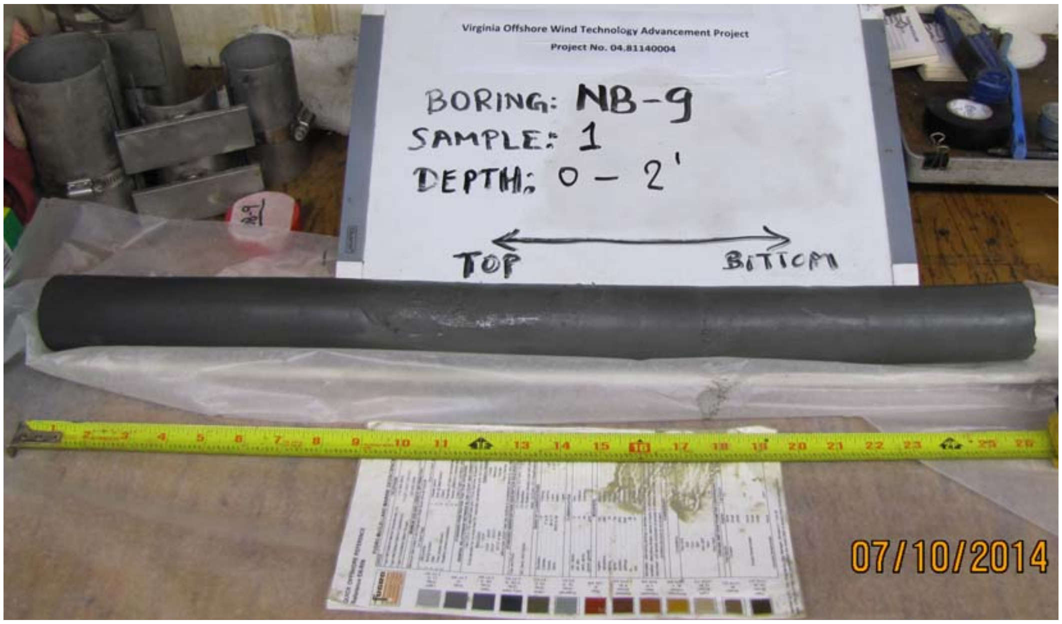
SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C7-10

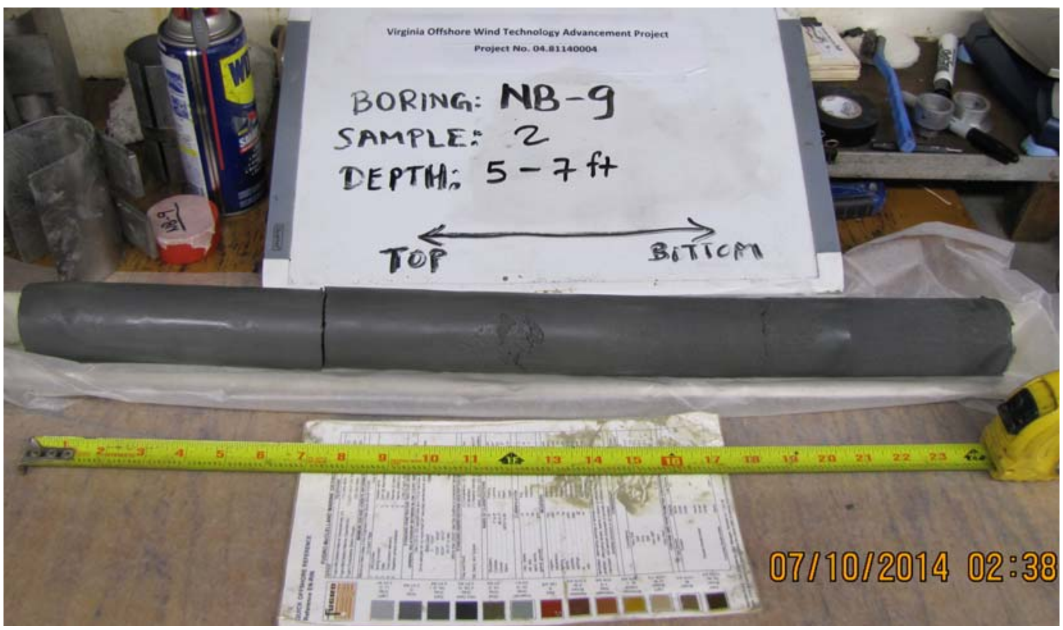
NB-7 Sample 21 Depth: 99 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C7-11



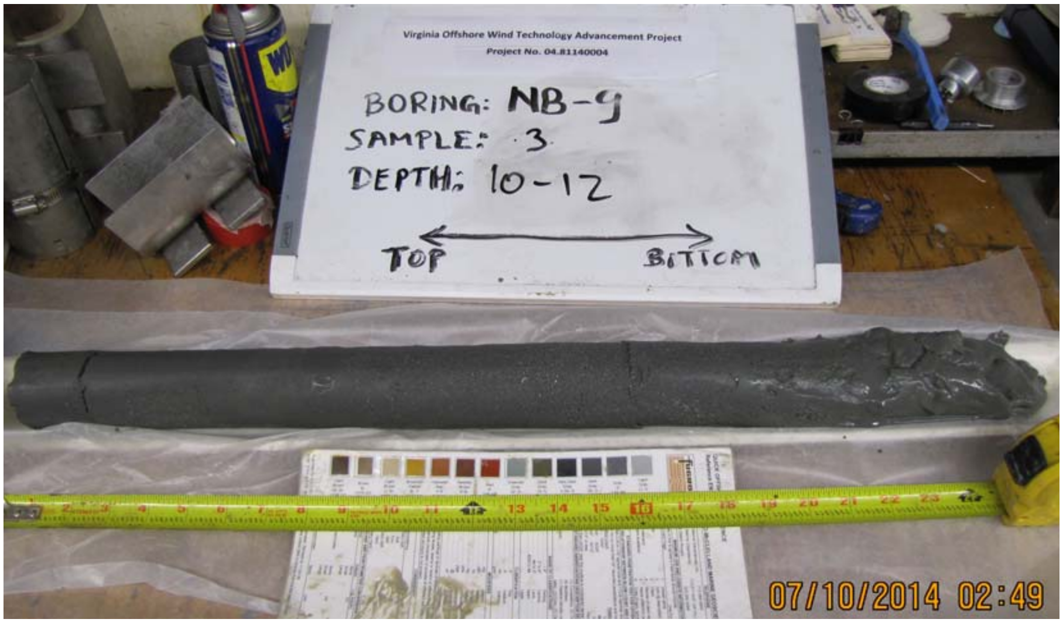
NB-9 Sample 1 Depth: 0 ft



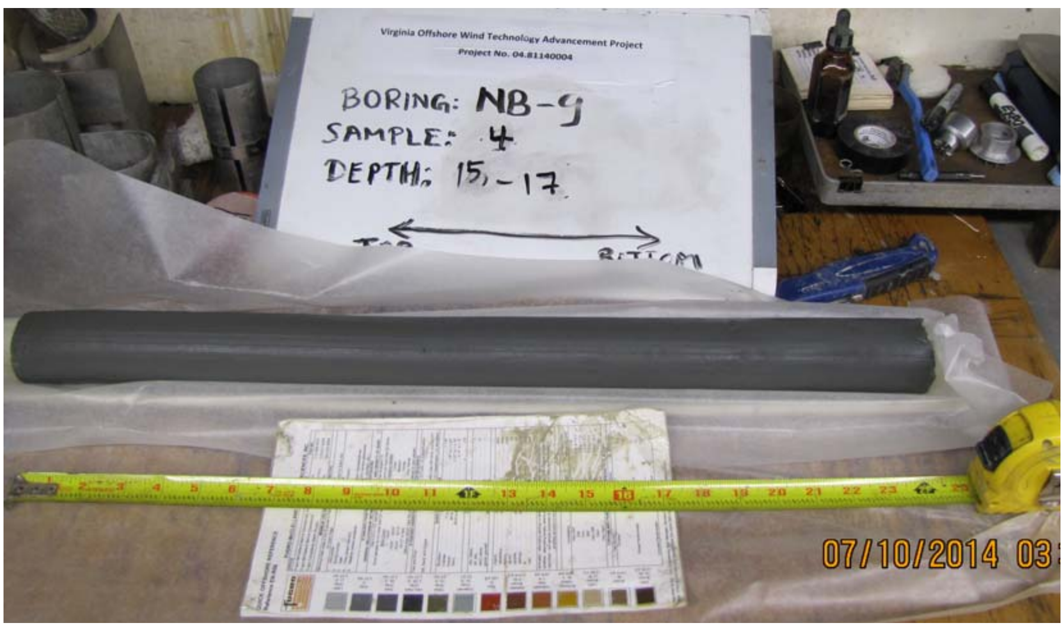
NB-9 Sample 2 Depth: 5 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C8-1



NB-9 Sample 3 Depth: 10 ft



NB-9 Sample 4 Depth: 15 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C8-2

NB-9 Sample 5 Depth: 20 ft

NB-9 Sample 6 Depth: 25 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

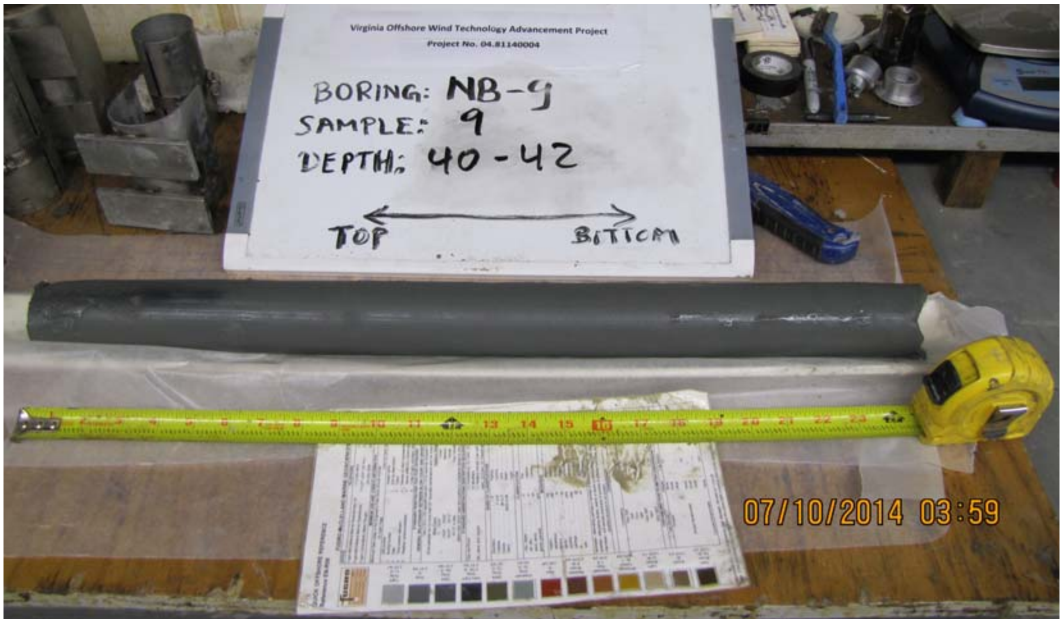
FIGURE C8-3

NB-9 Sample 7 Depth: 30 ft

NB-9 Sample 8 Depth: 35 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C8-4

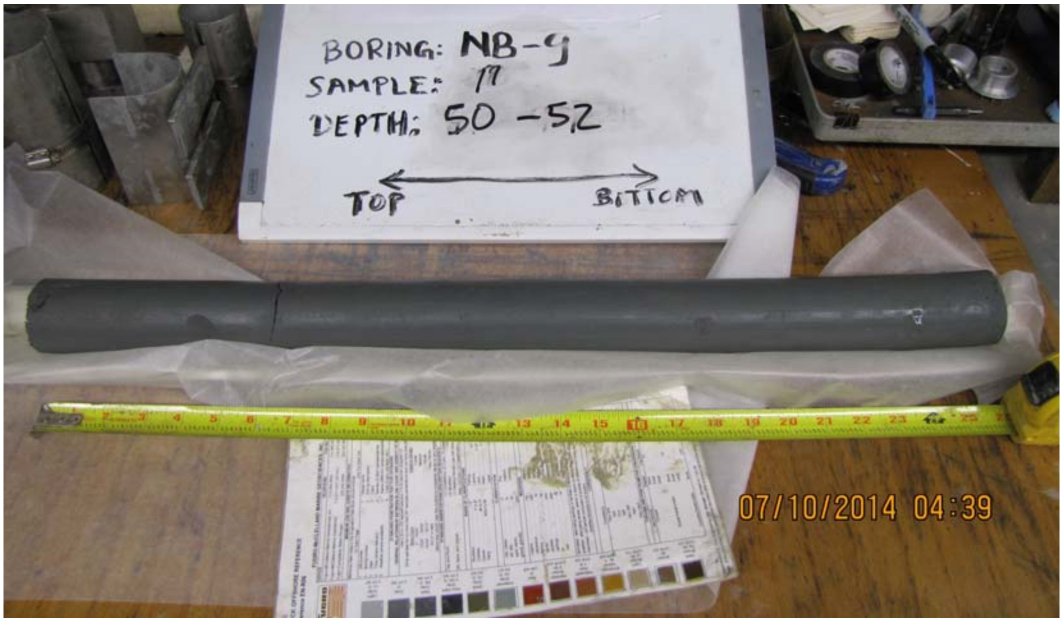


NB-9 Sample 9 Depth: 40 ft

NB-9 Sample 10 Depth: 45 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C8-5



NB-9 Sample 11 Depth: 50 ft

Photograph not available

NB-9 Sample 12 Depth: ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C8-6

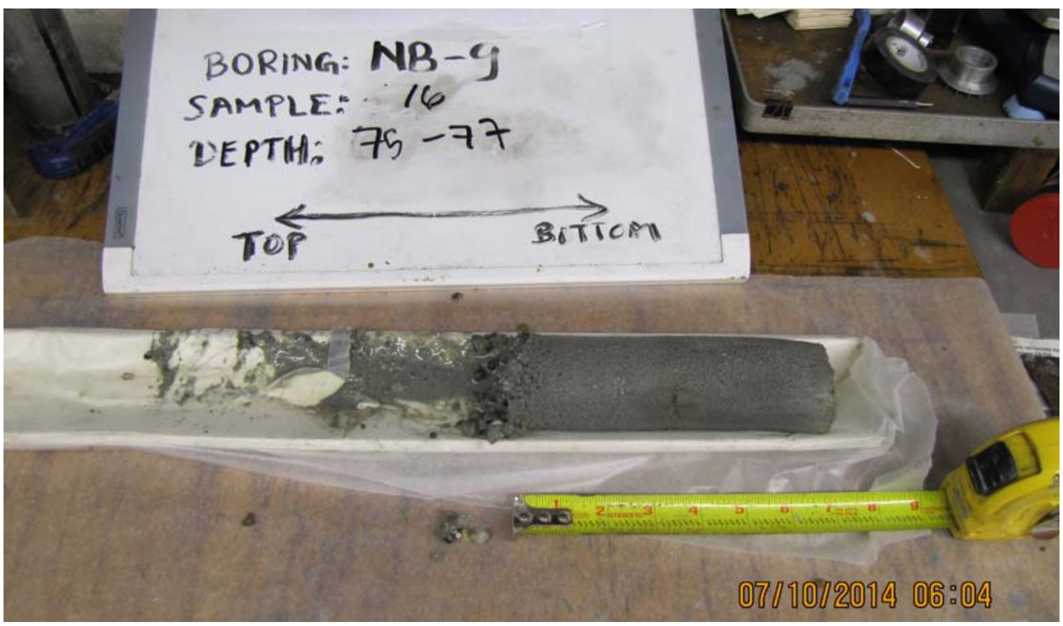
NB-9 Sample 13 Depth: 60 ft

NB-9 Sample 14 Depth: 65 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C8-7

NB-9 Sample 15 Depth: 70 ft



NB-9 Sample 16 Depth: 75 ft

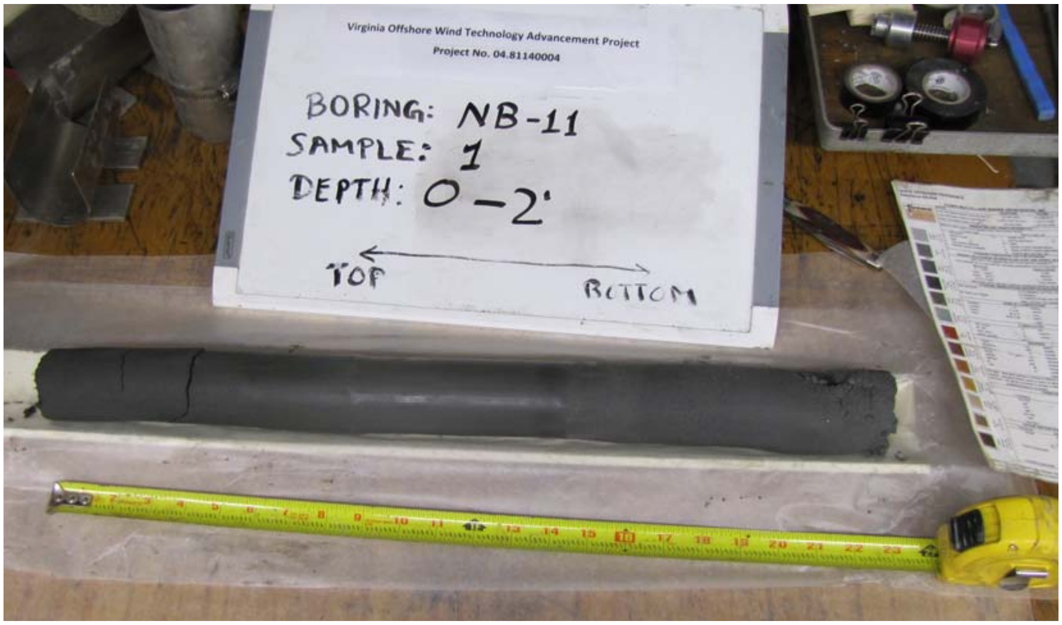
SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C8-8

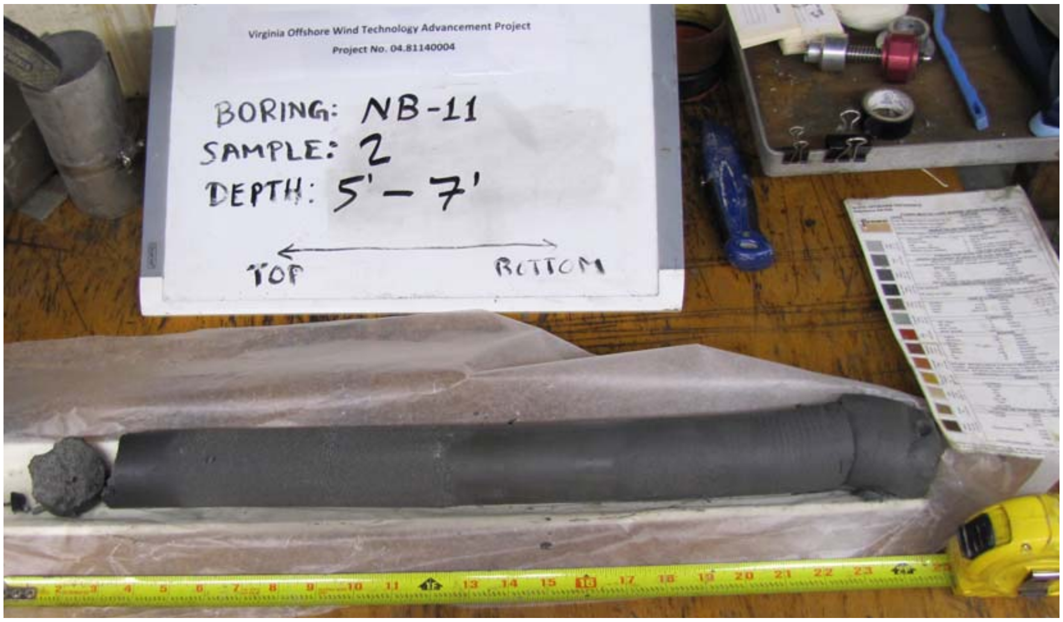
NB-9 Sample 17 Depth: 81 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C8-9



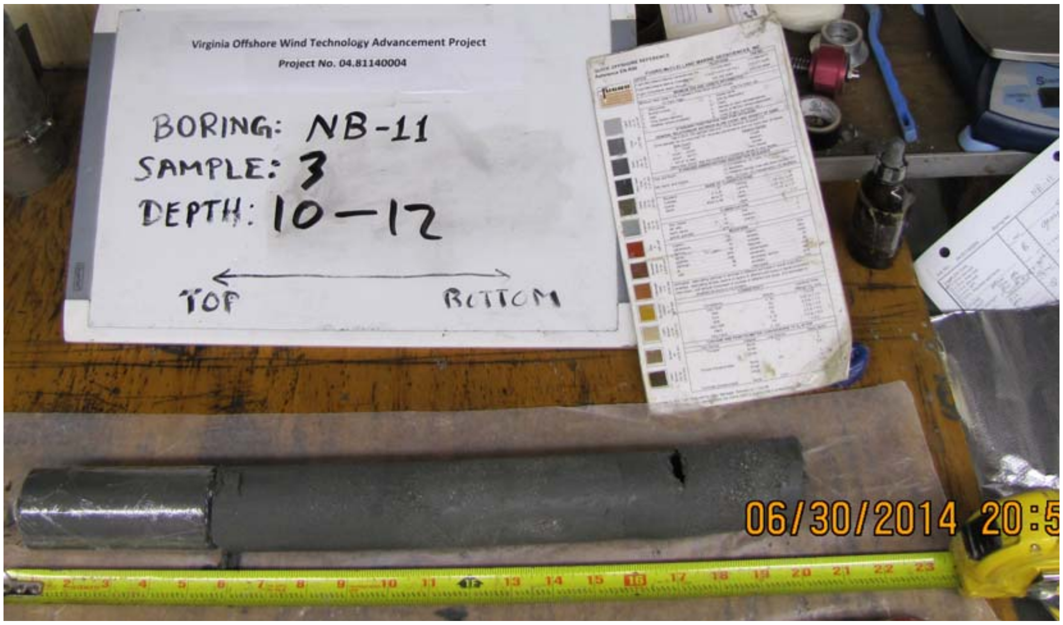
NB-11 Sample 1 Depth: 0 ft



NB-11 Sample 2 Depth: 5 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C9-1

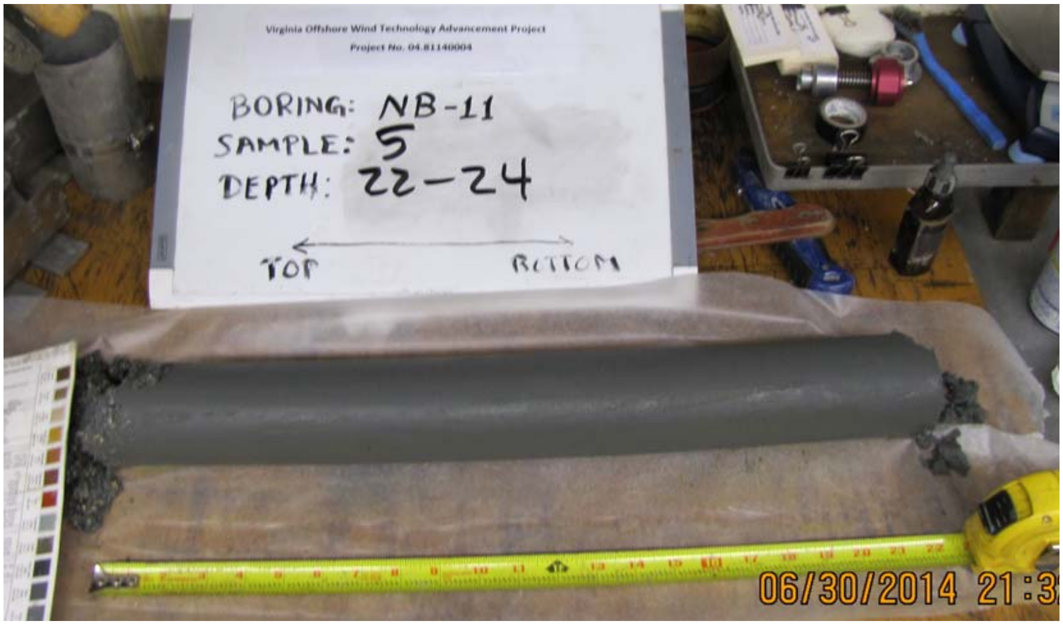


NB-11 Sample 3 Depth: 10 ft

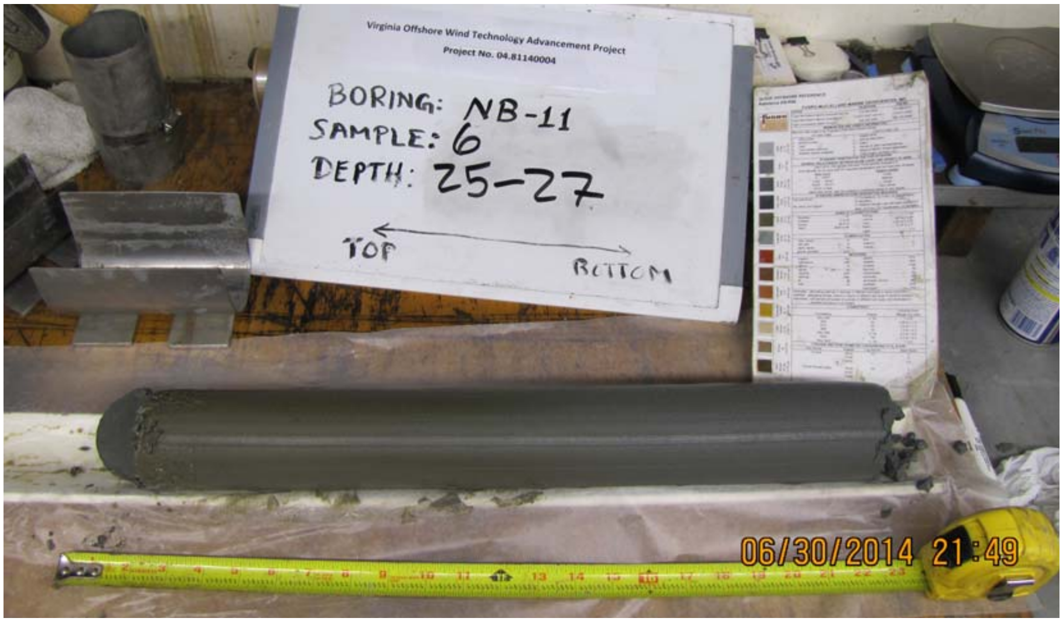
NB-11 Sample 4 Depth: 15 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C9-2



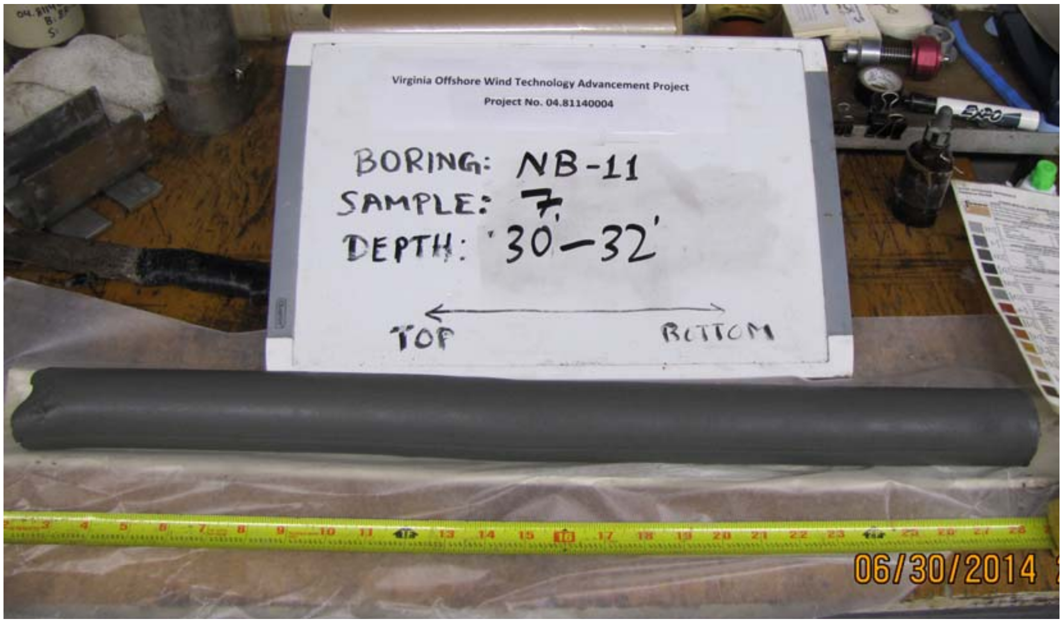
NB-11 Sample 5 Depth: 22 ft



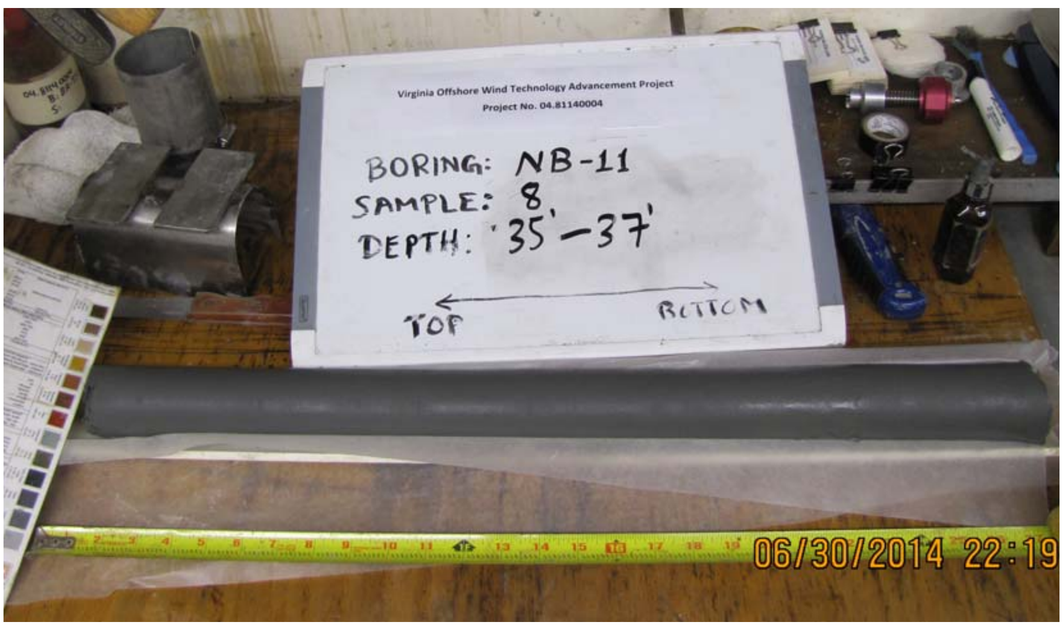
NB-11 Sample 6 Depth: 25 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C9-3



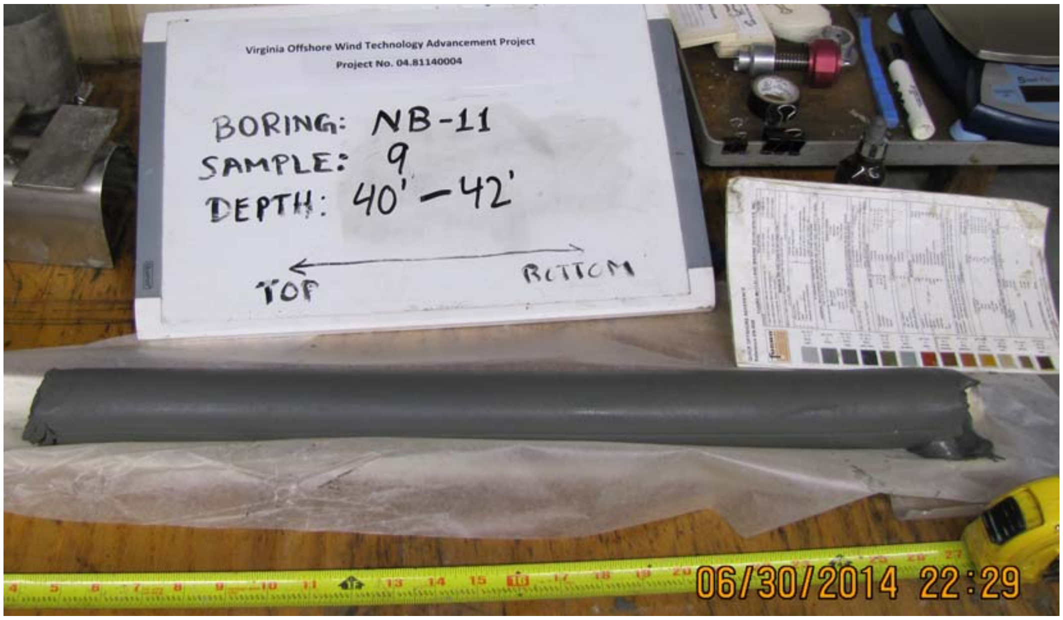
NB-11 Sample 7 Depth: 30 ft



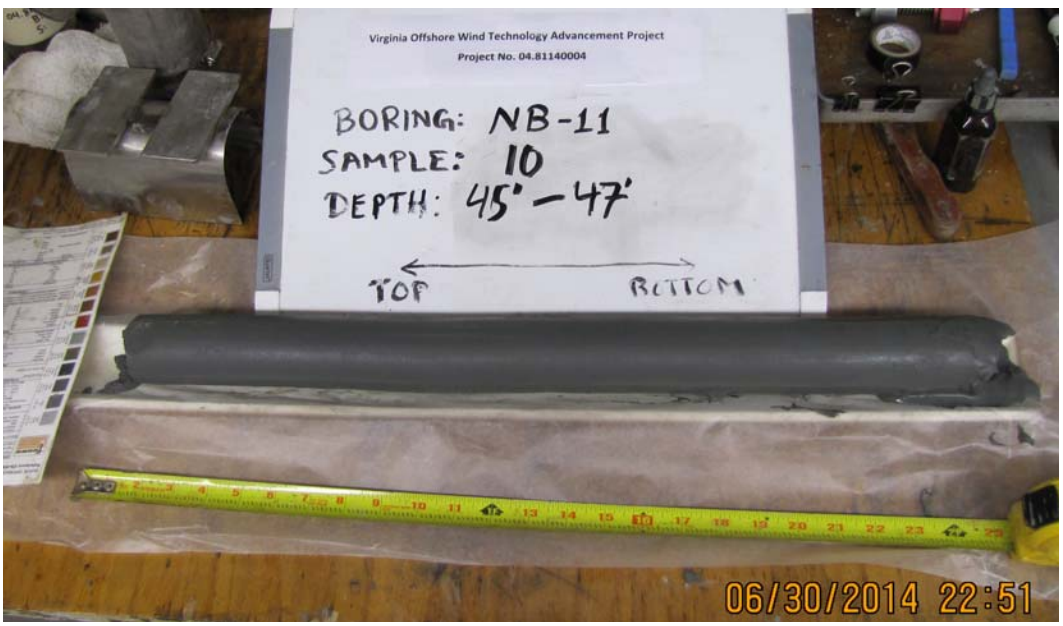
NB-11 Sample 8 Depth: 35 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C9-4



NB-11 Sample 9 Depth: 40 ft

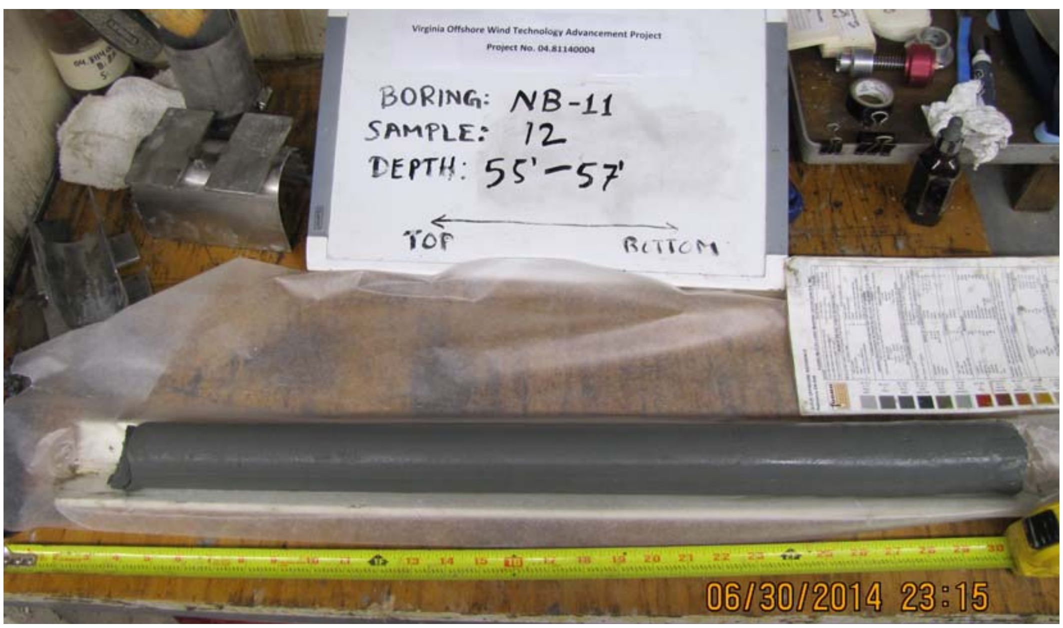


NB-11 Sample 10 Depth: 45 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C9-5

NB-11 Sample 11 Depth: 50 ft



NB-11 Sample 12 Depth: 55 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

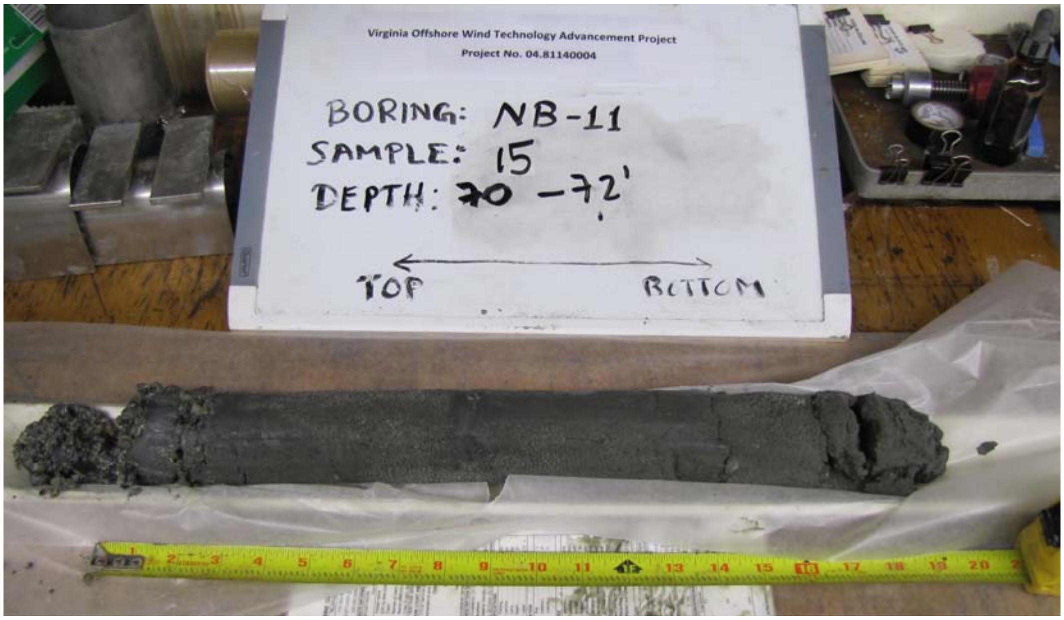
FIGURE C9-6

NB-11 Sample 13 Depth: 60 ft

NB-11 Sample 14 Depth: 65 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C9-7



NB-11 Sample 15 Depth: 70 ft

NB-11 Sample 16 Depth: 75 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C9-8

NB-11 Sample 17 Depth: 80 ft

SAMPLE CORE PHOTOGRAPHS
Turbine Sites
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE C9-9

APPENDIX D

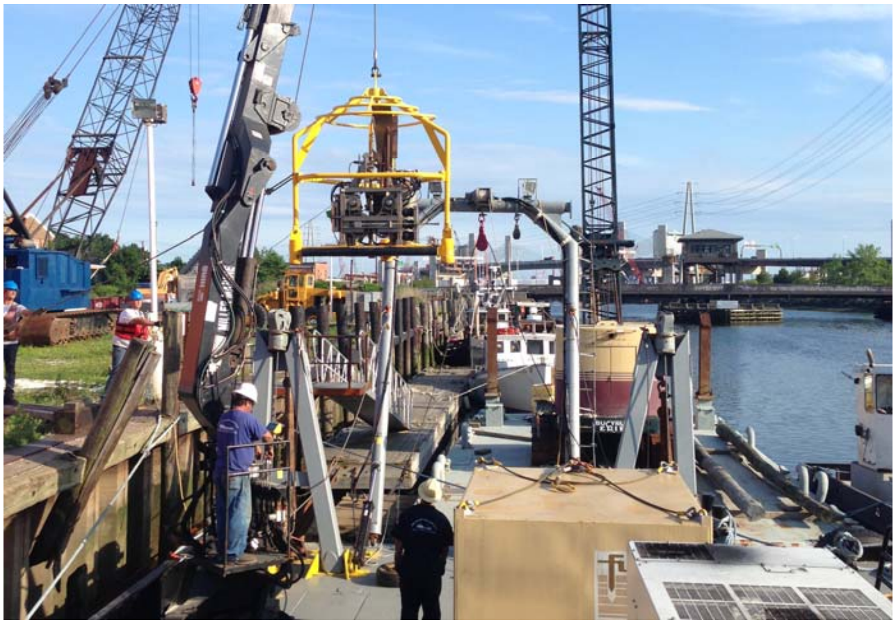
OPERATIONS PHOTOGRAPHS

Megan T. Miller, Vessel used for PCPT Operations

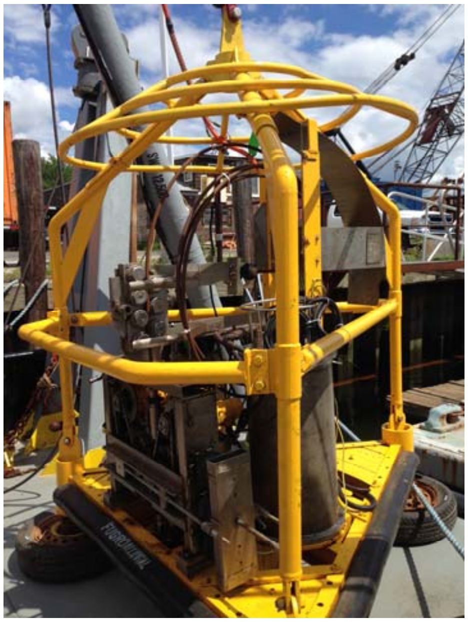
Mobilization of PCPT Data Acquisition System

OPERATIONS PHOTOGRAPHS
Marine Drilling—Megan T. Miller
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE D-1



Mobilization and Wet Test of the Seascout 10

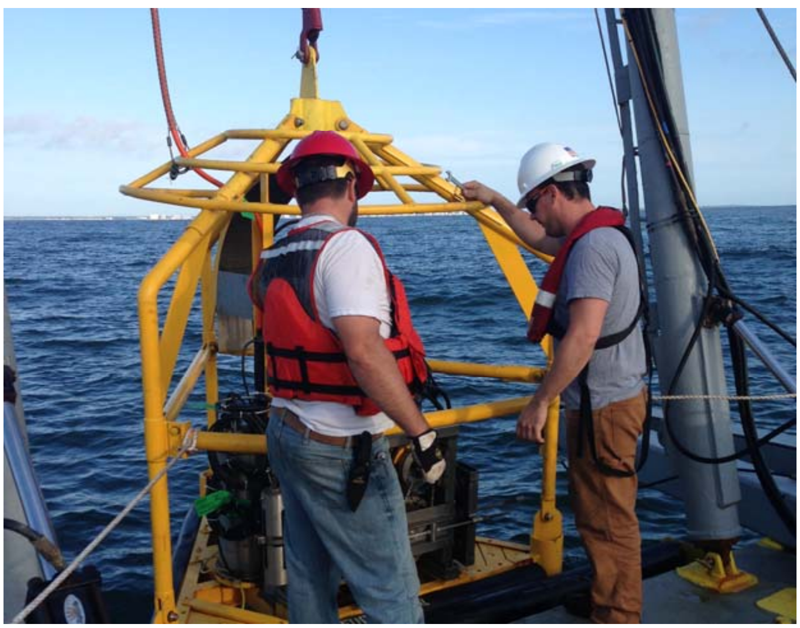


Seascout 10 on Deck after Wet Test

OPERATIONS PHOTOGRAPHS
Marine Drilling—Megan T. Miller
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE D-2

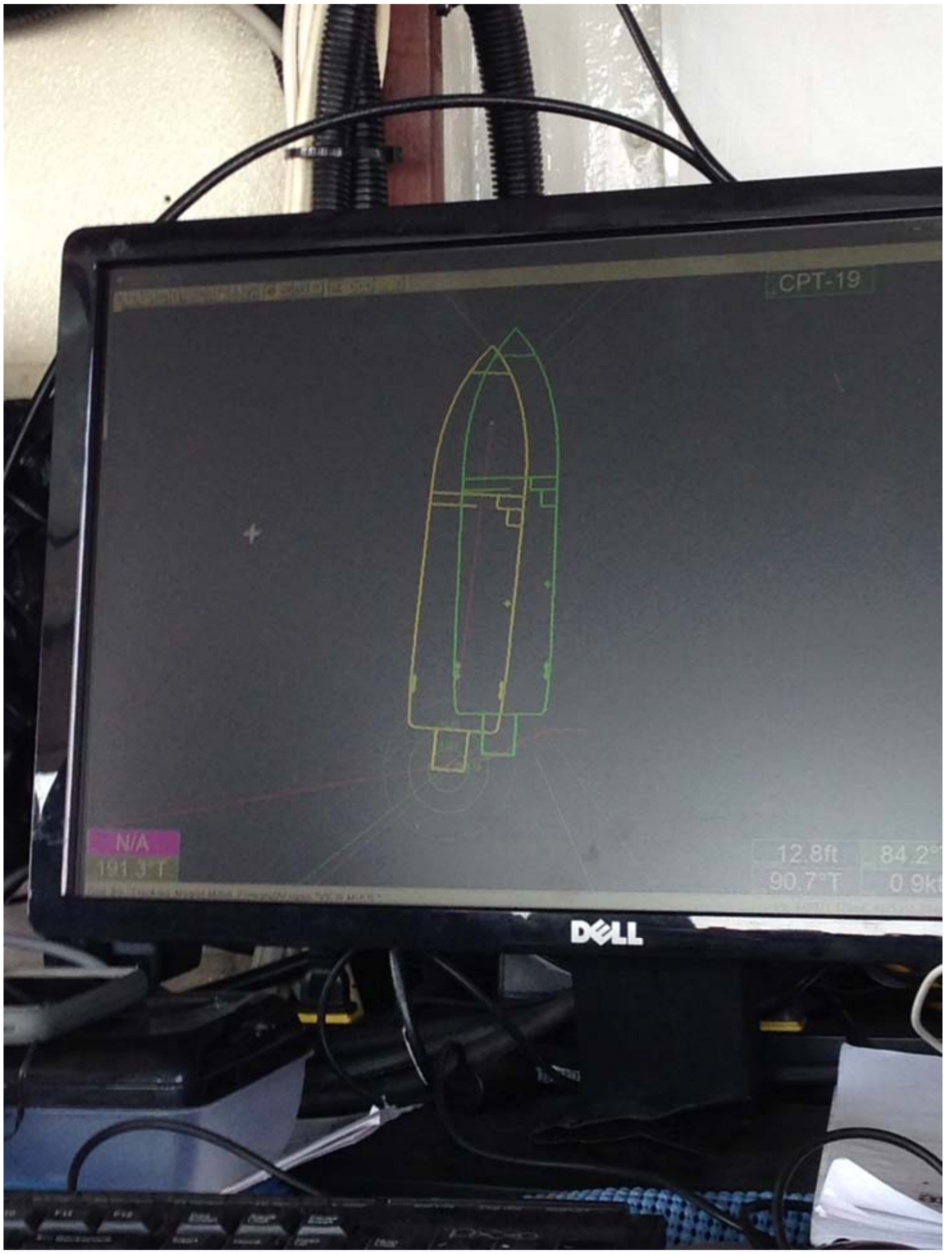
Megan T. Miller Deck Layout during PCPT Operations



Deployment of the Seascout using an A-Frame and Tag Lines

OPERATIONS PHOTOGRAPHS
Marine Drilling—Megan T. Miller
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE D-3



Fugro StarFix Survey Positioning and Real-time Display during PCPT Operations

OPERATIONS PHOTOGRAPHS
Marine Drilling—Inez
VOWTAP Geotechnical Survey
Offshore Virginia

General Deck Layout onboard the *Inez H. Eymard*

Safety Equipment on the *Inez H. Eymard*

OPERATIONS PHOTOGRAPHS
Marine Drilling—Inez
VOWTAP Geotechnical Survey
Offshore Virginia

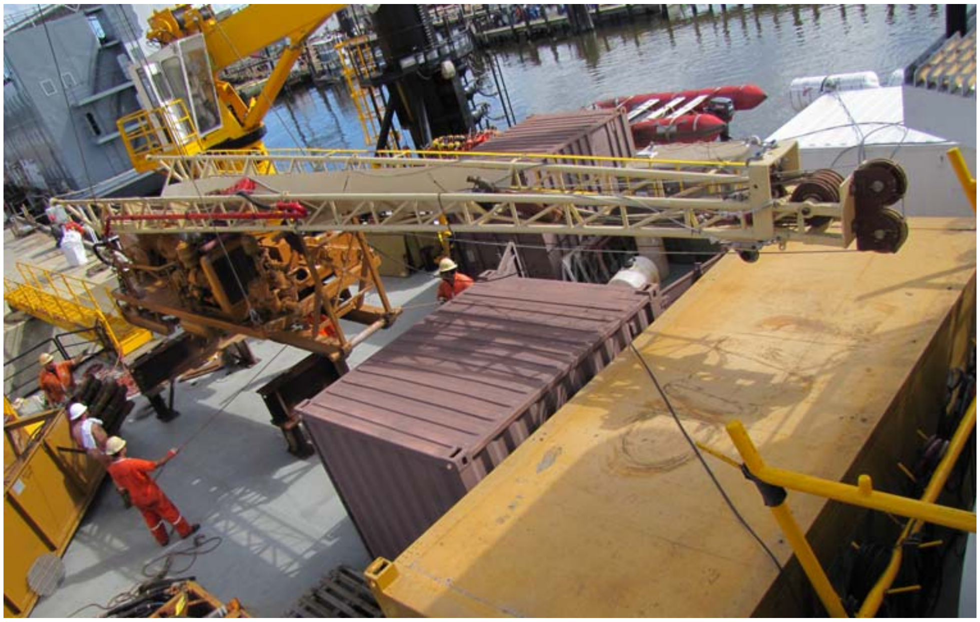
The *Inez H. Eymard* Wheelhouse

The *Inez H. Eymard* Jacked Up and Drilling at NB-11

OPERATIONS PHOTOGRAPHS
Marine Drilling—Inez
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE D-6

Mobilization of Failing DMX 1500 Drill Rig



Mobilization of Failing DMX 1500 Drill Rig

OPERATIONS PHOTOGRAPHS
Marine Drilling—Inez
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE D-7

Drilling Operations

OPERATIONS PHOTOGRAPHS
Marine Drilling—Inez
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE D-8

Disassembling Rods during Drilling Operations

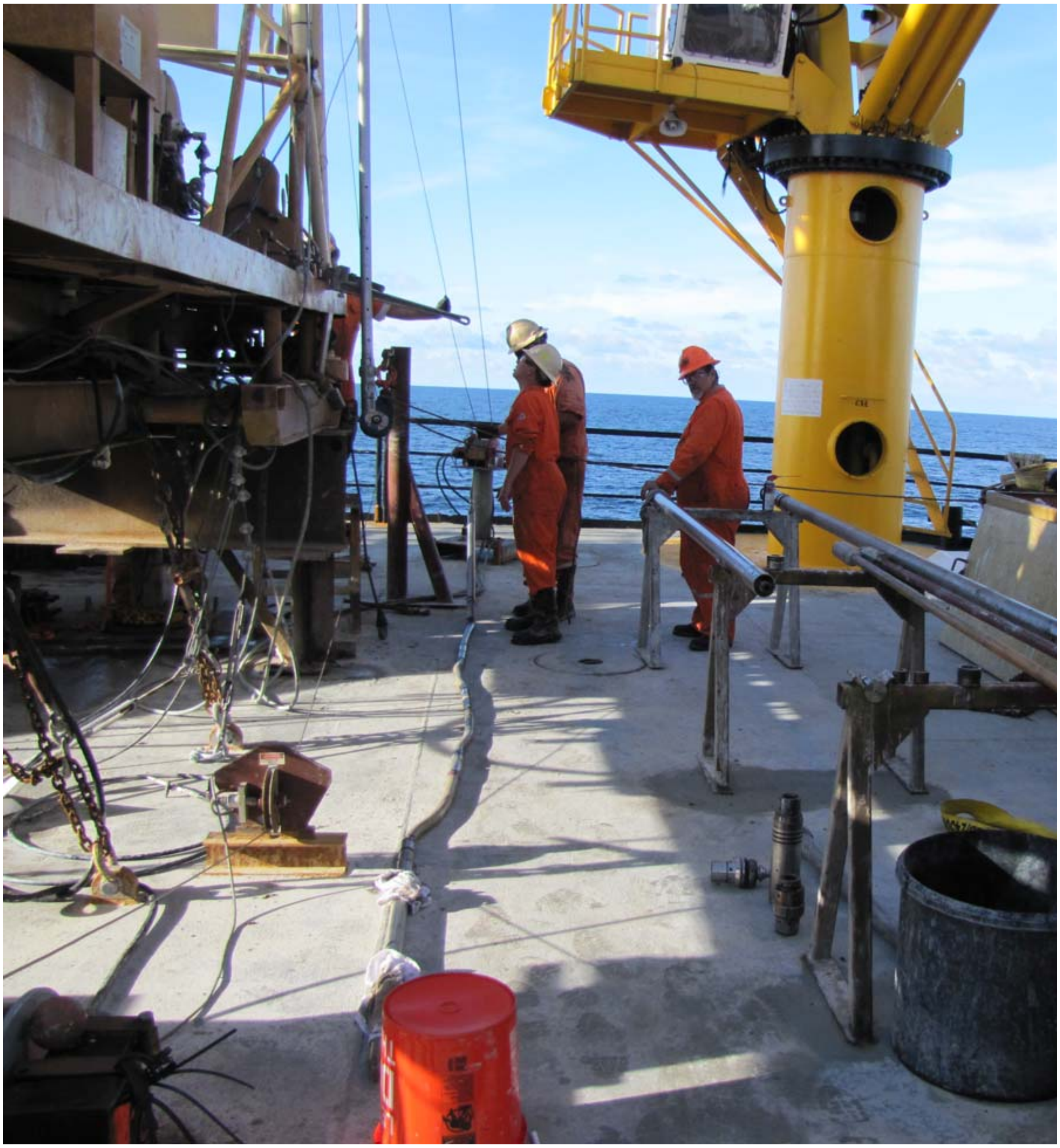
OPERATIONS PHOTOGRAPHS
Marine Drilling—Inez
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE D-9

Downhole PCPT Dolphin System

OPERATIONS PHOTOGRAPHS
Marine Drilling—Inez
VOWTAP Geotechnical Survey
Offshore Virginia

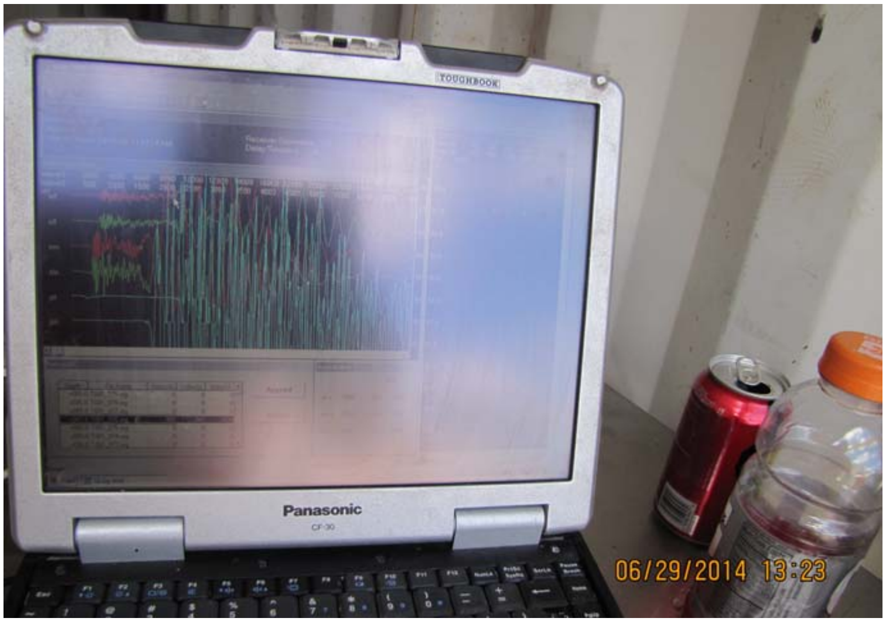
FIGURE D-10



Deployment of P-S Logging Equipment

OPERATIONS PHOTOGRAPHS
Marine Drilling—Inez
VOWTAP Geotechnical Survey
Offshore Virginia

Real-time Display of Downhole PCPT Data



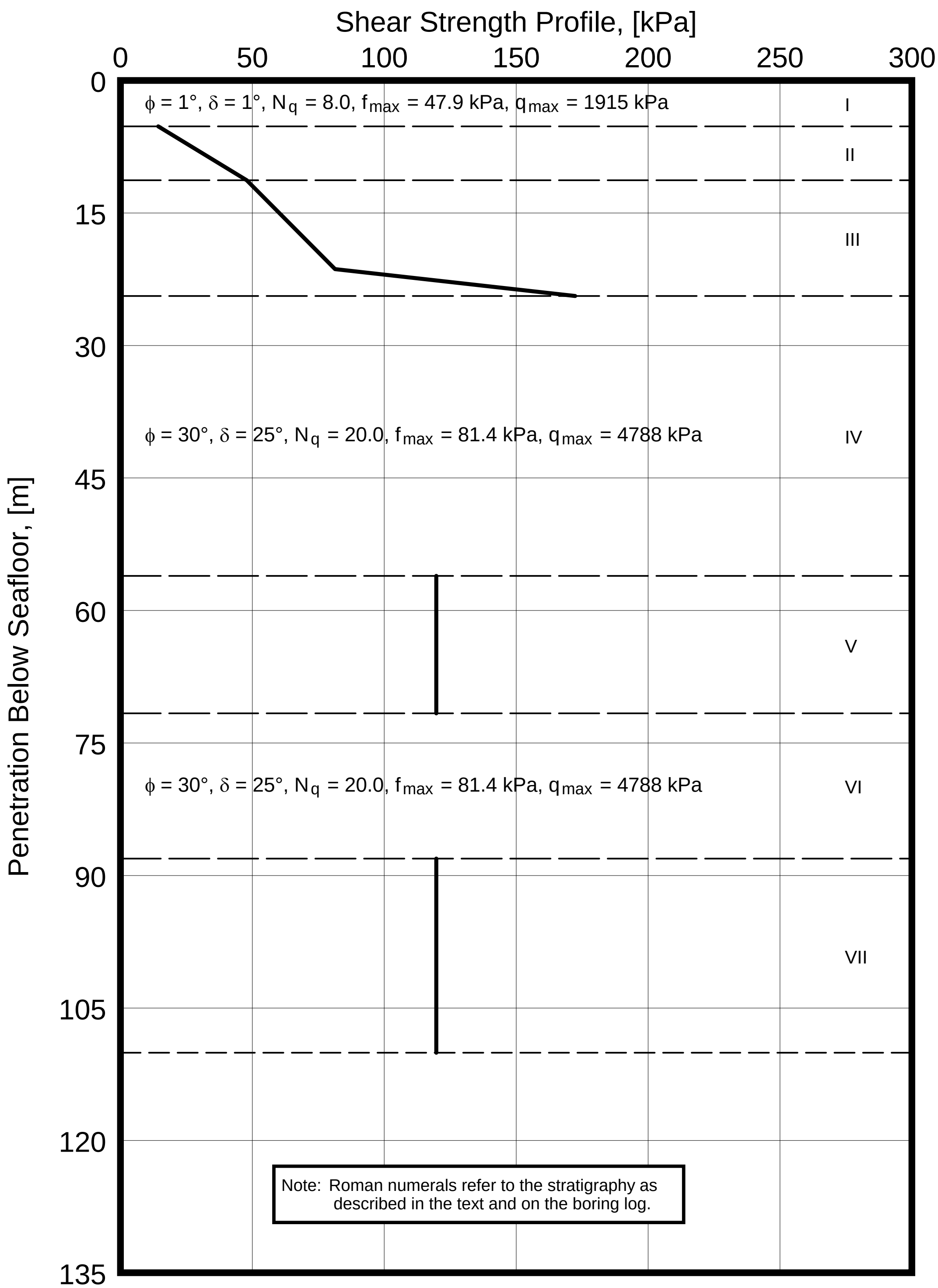
Real-time Display of P-S Logging Data

OPERATIONS PHOTOGRAPHS
Marine Drilling—Megan T. Miller
VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE D-12

APPENDIX E

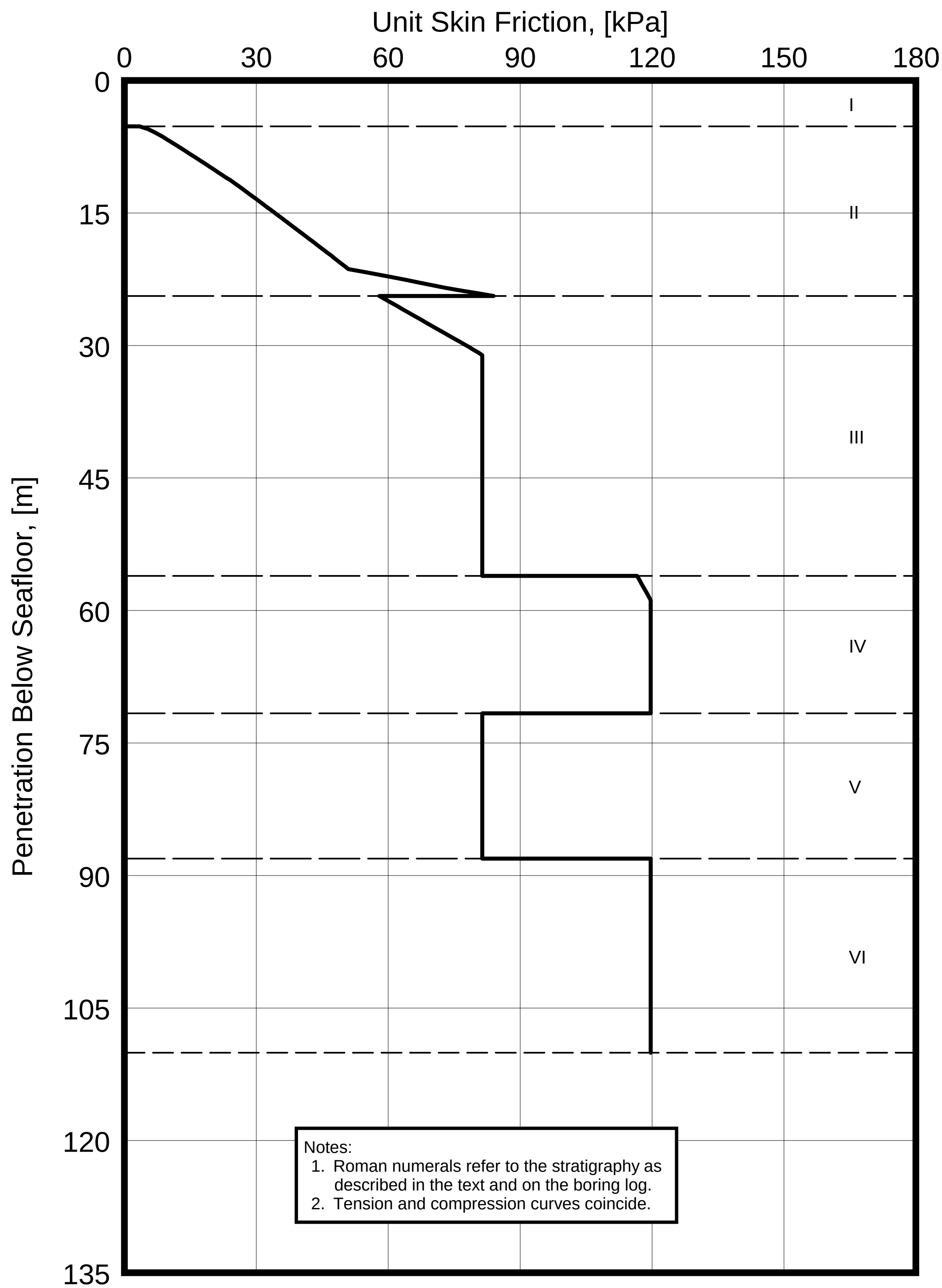
PRELIMINARY PILE CAPACITY



PRELIMINARY DESIGN STRENGTH PARAMETERS
ESTIMATED ONBOARD THE LIFTBOAT

Boring: BH-T1A

Date:
Drawn By:
Date:
Date:
Checked By:
Approved By:



PRELIMINARY UNIT SKIN FRICTION ESTIMATED ONBOARD THE LIFTBOAT

API RP 2GEO (2011)

Boring: BH-T1A

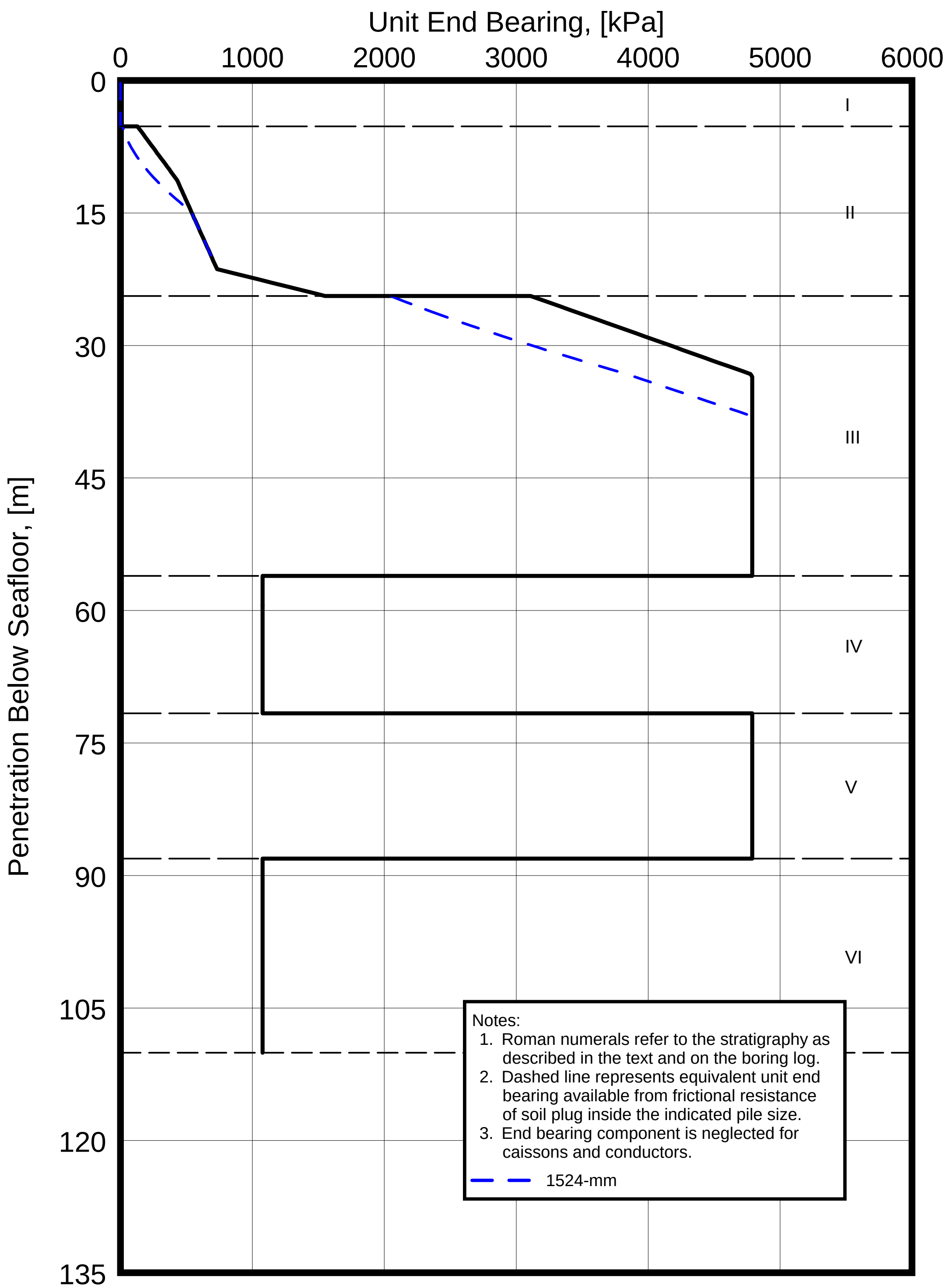
Date:

Drawn By:

Date: Date:

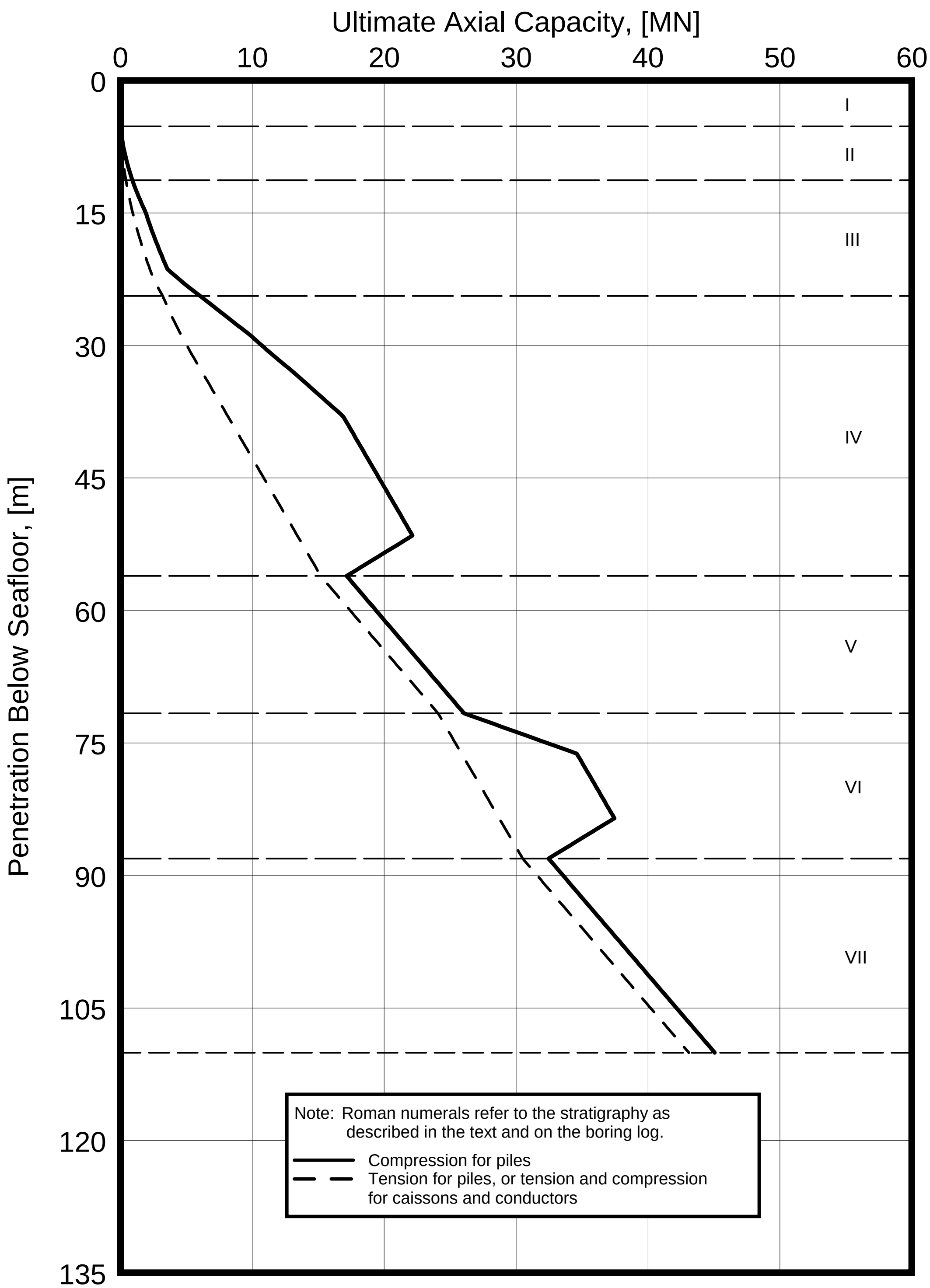
Checked By: Approved By:

Date:
Drawn By:
Date: Date:
Checked By: Approved By:



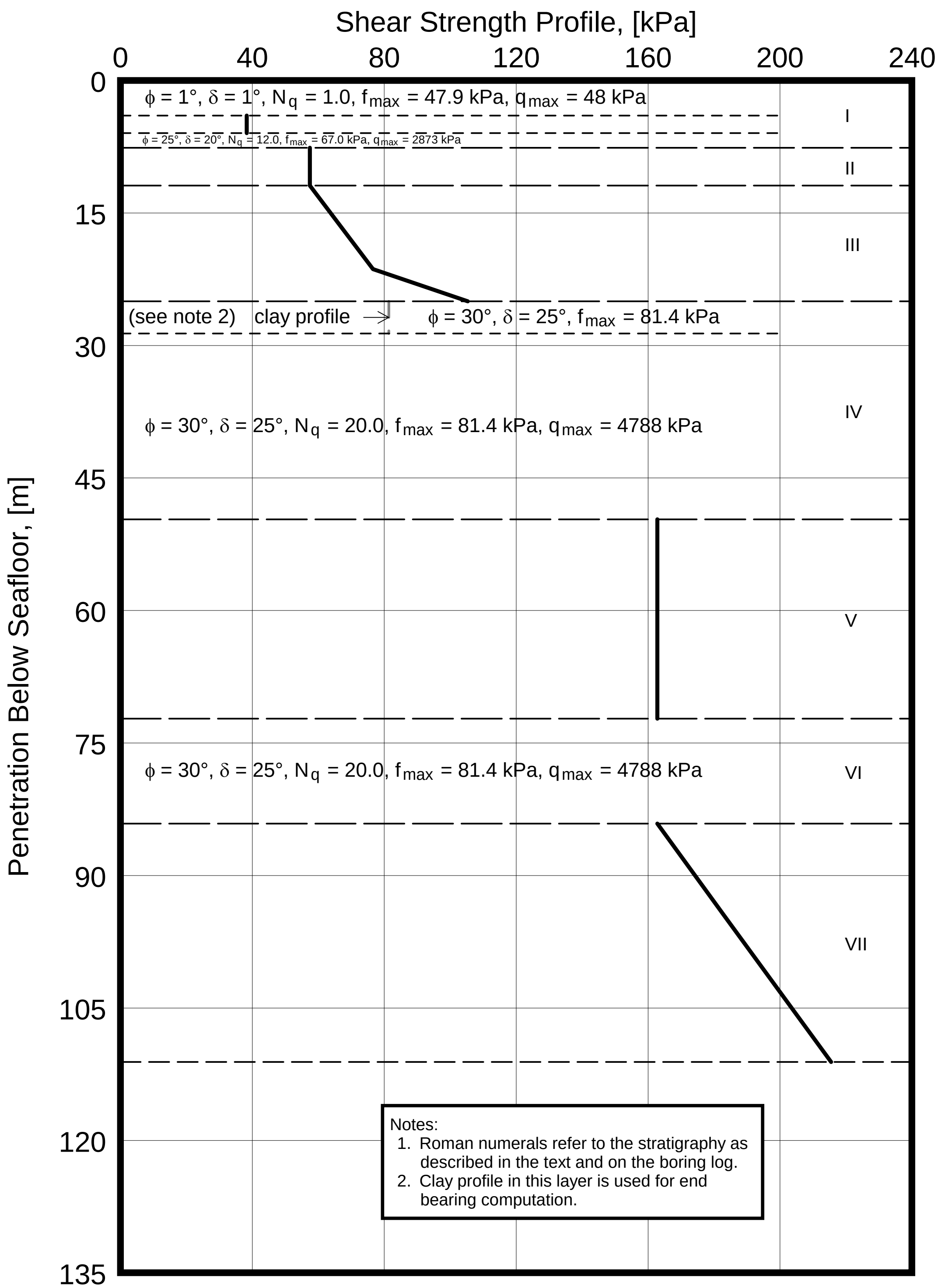
PRELIMINARY UNIT END BEARING ESTIMATED ONBOARD THE LIFTBOAT
API RP 2GEO (2011)

Boring: BH-T1A



PRELIMINARY ULTIMATE AXIAL CAPACITY CALCULATED ONBOARD THE LIFTBOAT
API RP 2GEO (2011)
1524-mm (60-in.)-Diameter Driven Pipe Piles Boring:
BH-T1A

Date:
Drawn By:
Date:
Date:
Checked By:
Approved By:

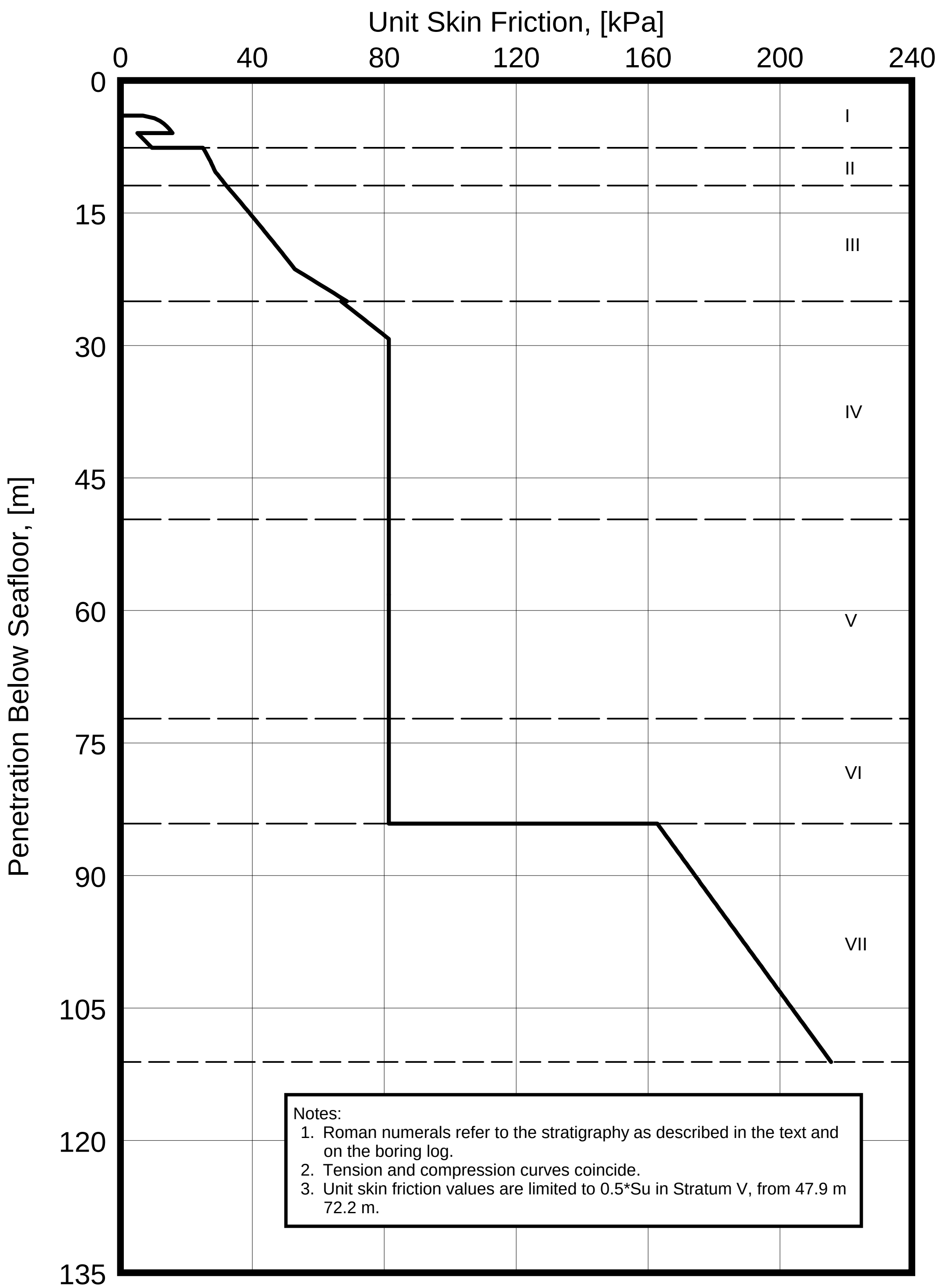


PRELIMINARY DESIGN STRENGTH PARAMETERS

ESTIMATED ONBOARD THE LIFTBOAT

Boring: BH-T2A

Date: Drawn By: Date: Date: Checked By: Approved By:



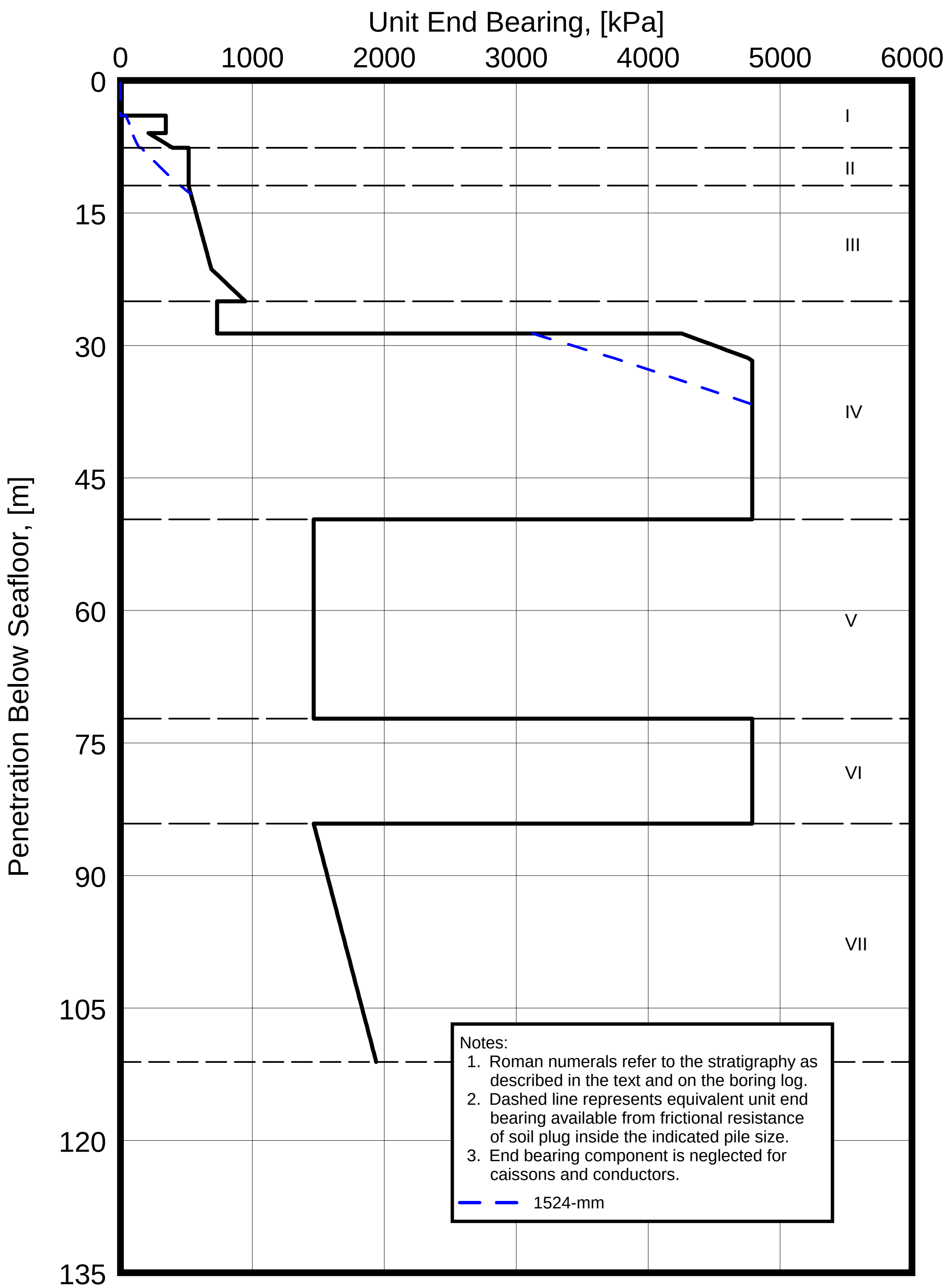
Notes:
1. Roman numerals refer to the stratigraphy as described in the text and on the boring log.
2. Tension and compression curves coincide.
3. Unit skin friction values are limited to 0.5*Su in Stratum V, from 47.9 m 72.2 m.

PRELIMINARY UNIT SKIN FRICTION ESTIMATED ONBOARD THE LIFTBOAT

API RP 2GEO (2011)

Boring: BH-T2A

Date:
Drawn By:
Date:
Date:
Checked By:
Approved By:

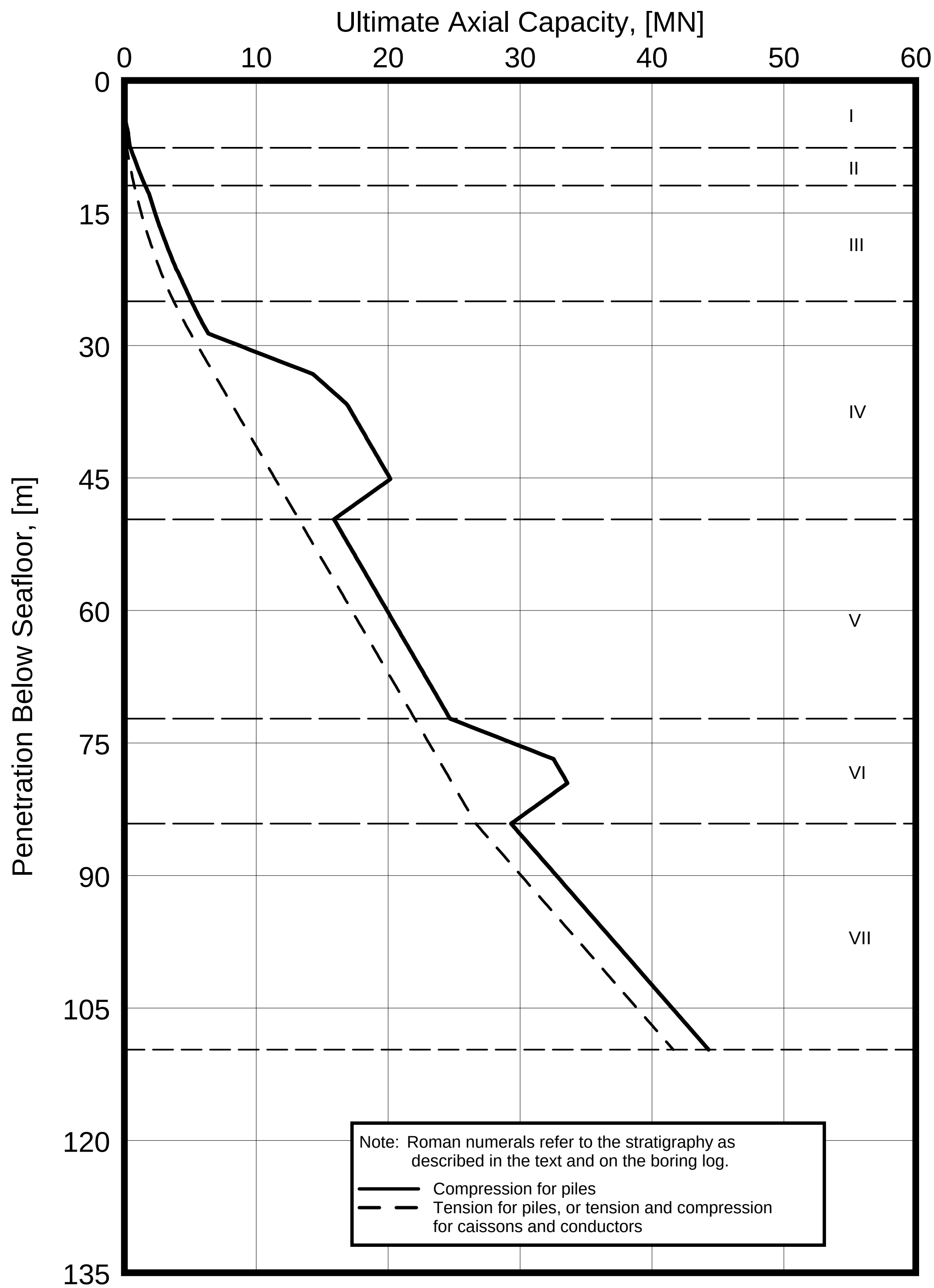


Notes:
1. Roman numerals refer to the stratigraphy as described in the text and on the boring log.
2. Dashed line represents equivalent unit end bearing available from frictional resistance of soil plug inside the indicated pile size.
3. End bearing component is neglected for caissons and conductors.

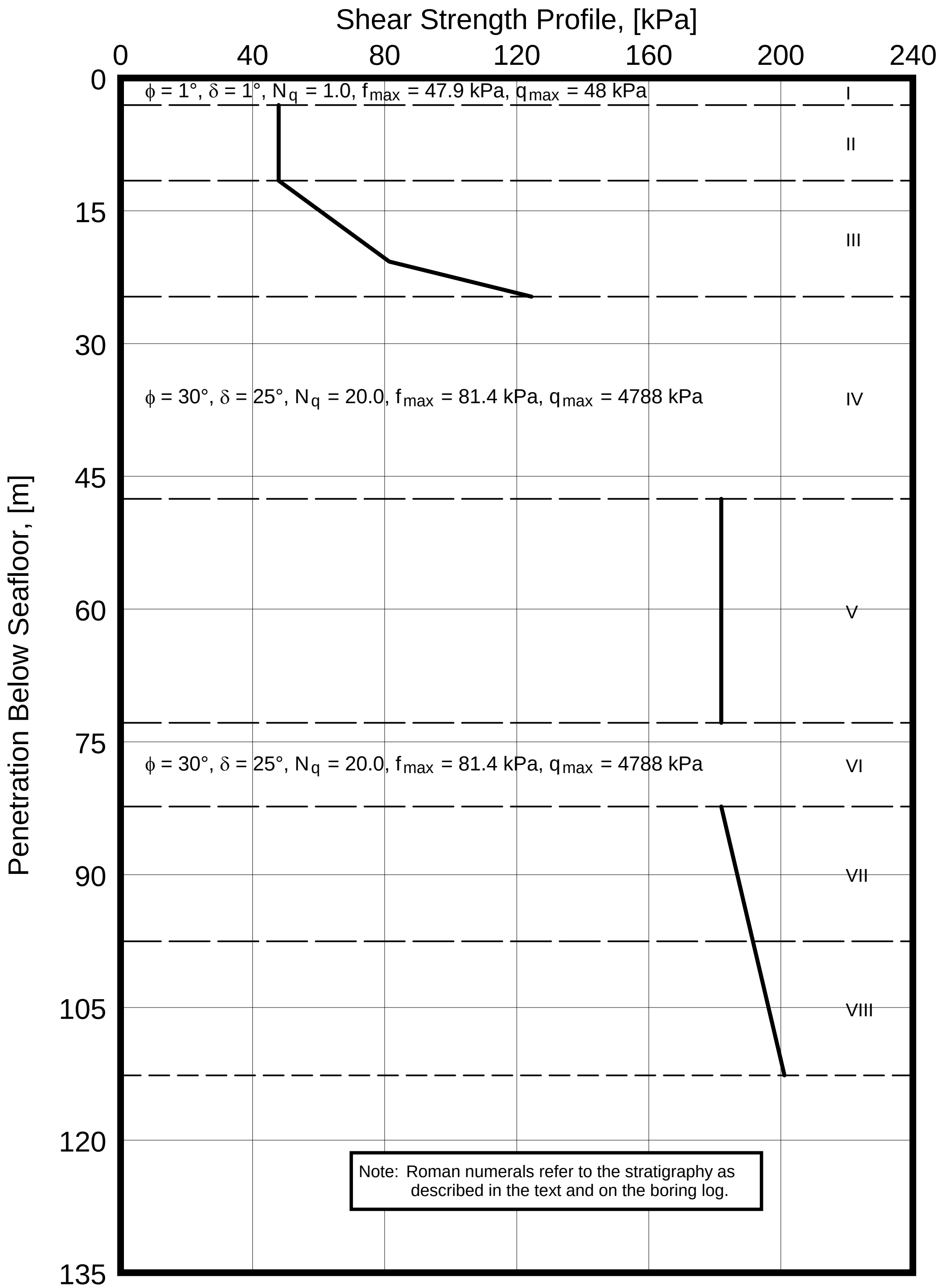
PRELIMINARY UNIT END BEARING ESTIMATED ONBOARD THE LIFTBOAT

API RP 2GEO (2011)

Boring: BH-T2A



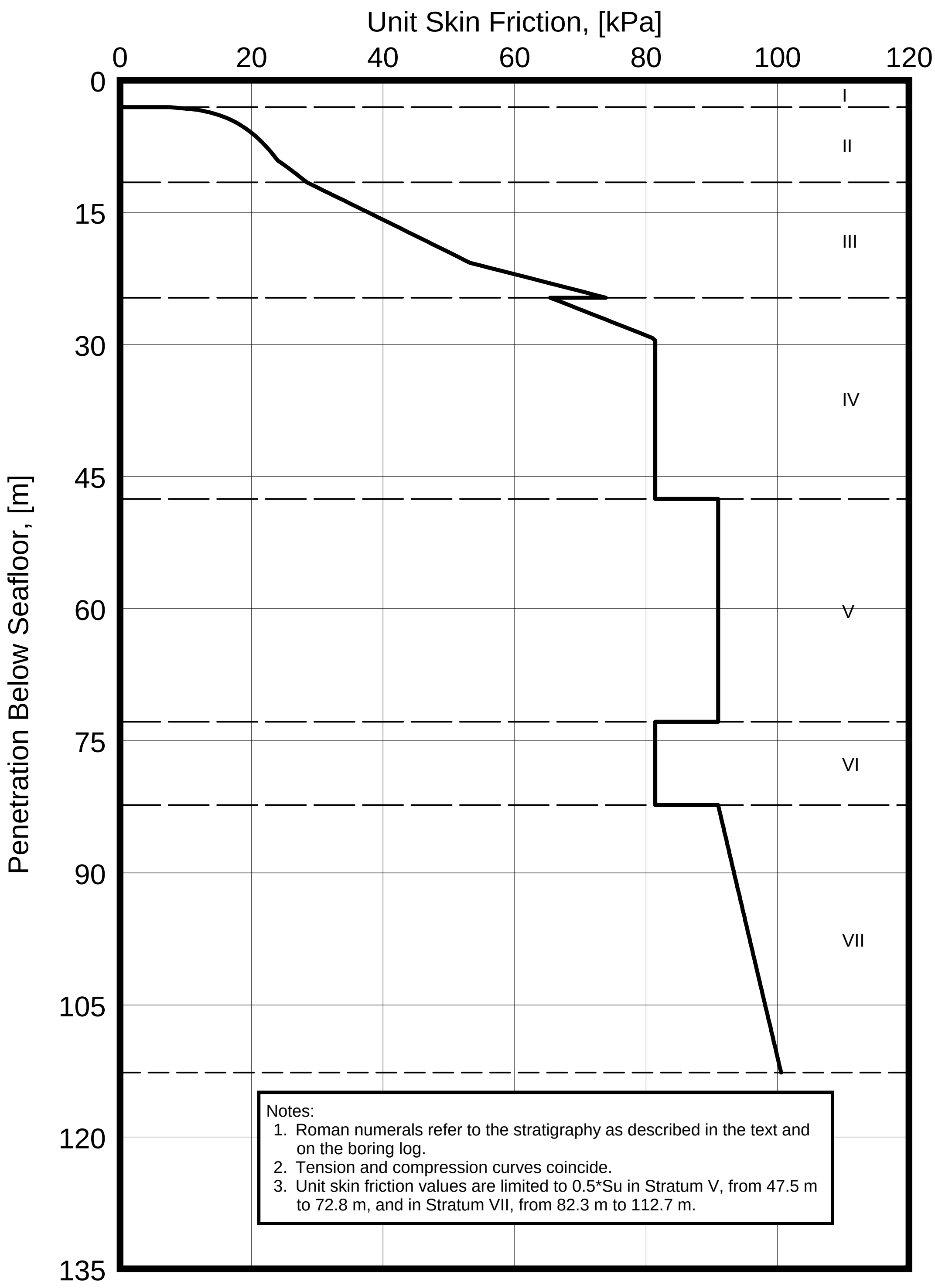
PRELIMINARY ULTIMATE AXIAL CAPACITY CALCULATED ONBOARD THE LIFTBOAT
API RP 2GEO (2011)
1524-mm (60-in.)-Diameter Driven Pipe Piles Boring: BH-T2A



PRELIMINARY DESIGN STRENGTH PARAMETERS
ESTIMATED ONBOARD THE LIFTBOAT

Boring: BH-T2B

Date:
Drawn By:
Date: Date:
Checked By: Approved By:

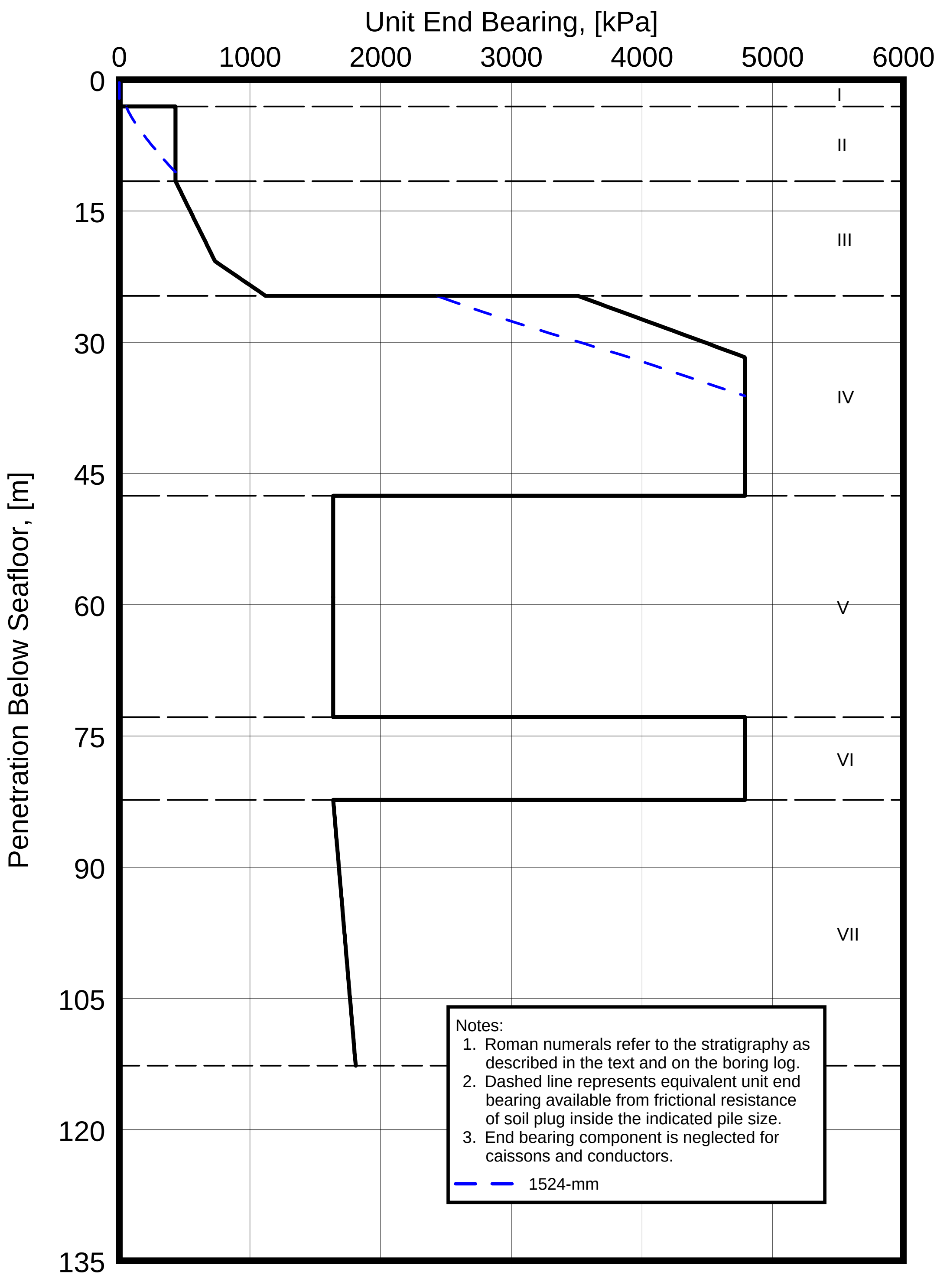


PRELIMINARY UNIT SKIN FRICTION ESTIMATED ONBOARD THE LIFTBOAT

API RP 2GEO (2011)

Boring: BH-T2B

Date: Drawn By: Date: Date: Checked By: Approved By:

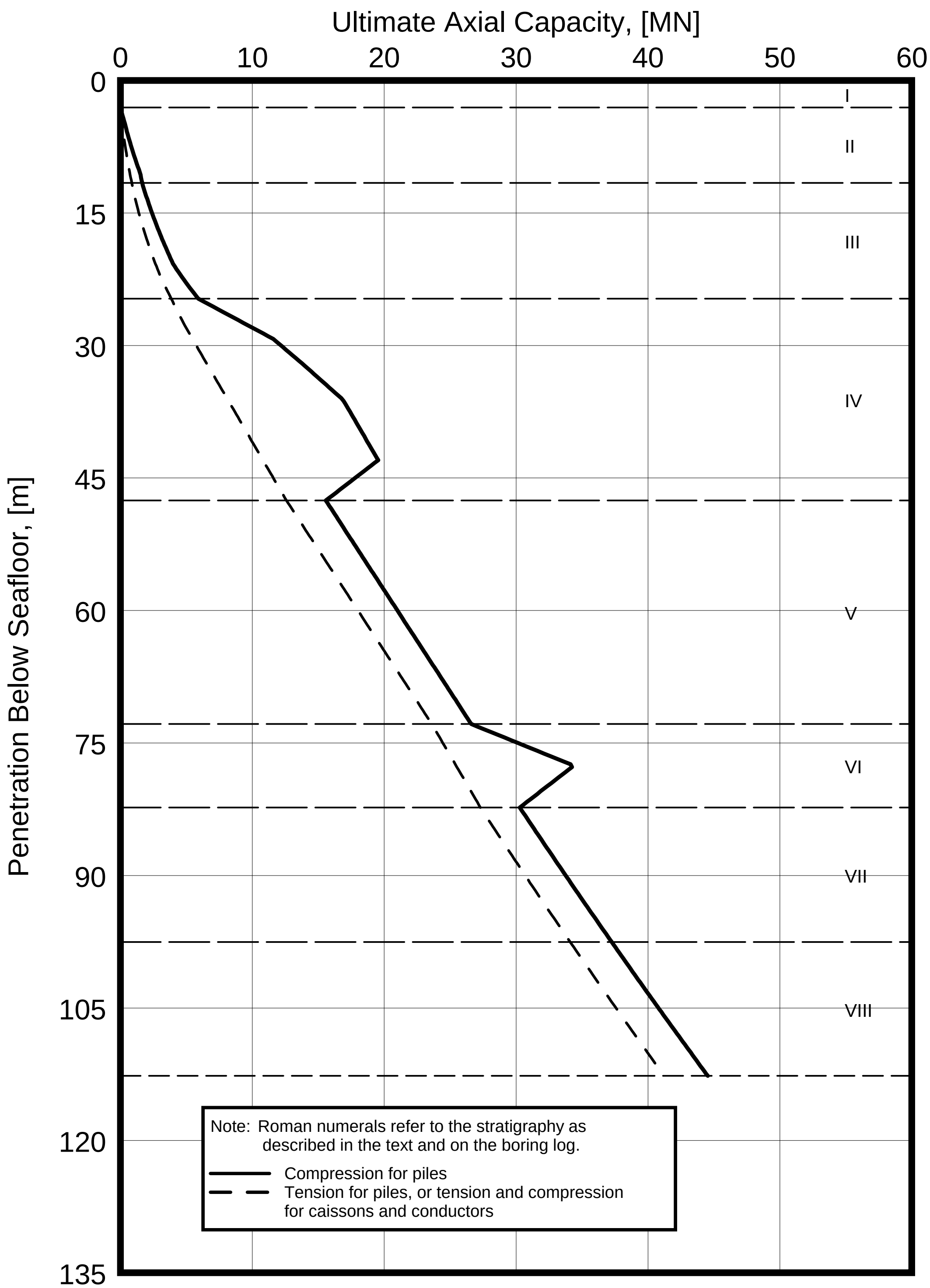


PRELIMINARY UNIT END BEARING ESTIMATED ONBOARD THE LIFTBOAT

API RP 2GEO (2011)

Boring: BH-T2B

Date:
Drawn By:
Date:
Date:
Checked By:
Approved By:



PRELIMINARY ULTIMATE AXIAL CAPACITY CALCULATED ONBOARD THE LIFTBOAT

API RP 2GEO (2011)

1524-mm (60-in.)-Diameter Driven Pipe Piles Boring: BH-T2B

Date: Drawn By: Date: Date: Checked By: Approved By:

APPENDIX F

PRELIMINARY ENGINEERING ANALYSIS

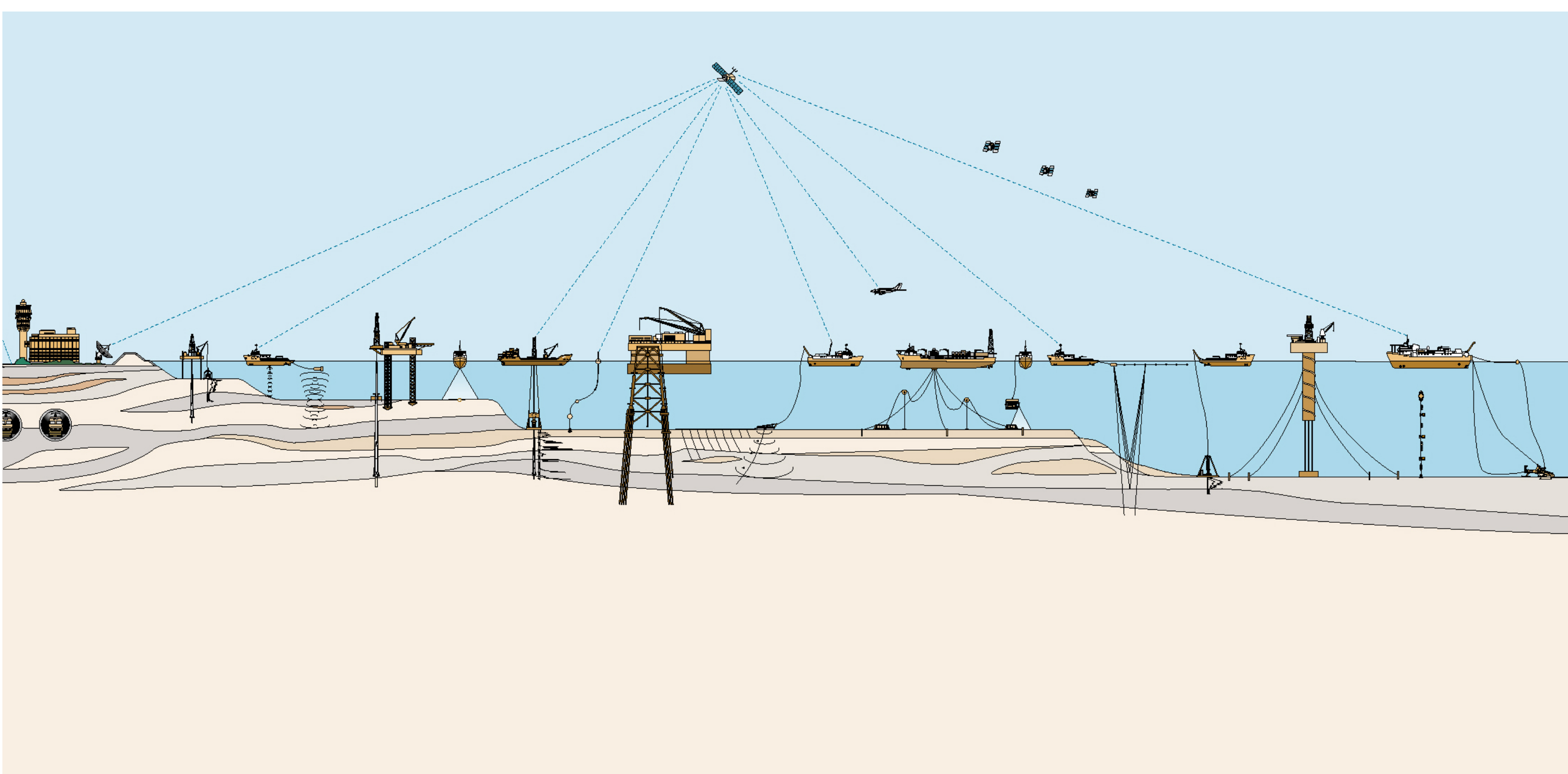
FUGRO-McCLELLAND MARINE GEOSCIENCES, INC.

PRELIMINARY ENGINEERING ANALYSES
BORING: BH-T1A
OFFSHORE VIRGINIA

Report No. 0201-7761

KEYSTONE ENGINEERING INC.

Metairie, Louisiana



PRELIMINARY ENGINEERING ANALYSES
BORING: BH-T1A
OFFSHORE VIRGINIA

REPORT NO.: 0201-7761

Client: Keystone Engineering Inc.
3500 North Causeway Boulevard, Suite 1100
Metairie, Louisiana 70002

Date of Report: September 5, 2014

6100 Hillcroft (77081)
P.O. Box 740010
Houston, TX 77274
Phone: 713-369-5600
Fax: 713-369-5570

Report No. 0201-7761
September 5, 2014

Keystone Engineering Inc.
3500 North Causeway Boulevard, Suite 1100
Metairie, Louisiana 70002

Attention: Mr. Rudy Hall

PRELIMINARY ENGINEERING ANALYSES
BORING: BH-T1A
OFFSHORE VIRGINIA

Fugro-McClelland Marine Geosciences, Inc. (FMMG) is pleased to submit this report presenting the results of our preliminary engineering analyses for the above referenced location. This study was authorized and performed in accordance with FMMG Proposal No. PP14-223, dated August 5, 2014. Advance preliminary pile design data was provided on August 8, 12 and 18, 2014.

We appreciate the opportunity to be of service to you on this project. Please call us if you have any questions or if we can be of any additional assistance.

Sincerely,

FUGRO-McCLELLAND
MARINE GEOSCIENCES, INC.
Texas Registered Engineering Firm F-4719

Lawrence Soosainathan, P.E.
Senior Supervising Engineer

Robert F. Stevens

Robert F. Stevens, Ph.D., P.E.
Senior Technical Manager

STATE OF TEXAS
L. SOOSAINATHAN
94956
LICENSED
PROFESSIONAL ENGINEER

Copies Submitted: (3) Addressee
(1) Electronic PDF report copy to addressee

OHSAS 18001 REGISTERED Certificate No. OH 1261
ISO 9001 REGISTERED UKAS CERTIFICATE NO. 6364

CONTENTS

ILLUSTRATIONS

Plate

SUMMARY

Fugro-McClelland Marine Geosciences, Inc. (FMMG) performed preliminary engineering analyses for Boring BH-T1A, drilled to 110.1-m penetration, for the Virginia Offshore Wind Technology Advancement Project (VOWTAP). The boring was located at UTM Zone 18 North, NAD83 Coordinates X = 456,197.47 m and Y = 4,083,478.64 m. The recorded water depth was 24.9 m MLLW.

Soil conditions at the site were determined by drilling three soil borings. The soil stratigraphy determined for Boring BH-T1A is tabulated below.

Stratum	Penetration, m From	Penetration, m To	Description
I	0	5.2	Loose to medium dense silty fine to coarse sand
II	5.2	24.4	Firm to very stiff fat clay
III	24.4	56.1	Medium dense to dense silty fine to medium sand
IV	56.1	71.6	Very stiff to hard lean clay
V	71.6	88.1	Medium dense to dense silty fine sand
VI	88.1	110.1	Very stiff to hard fat clay

For the purposes of discussion and presentation, “driven pipe pile” is used in this report to represent foundation piles, caissons and conductors, unless otherwise specified.

This report presents axial and lateral design data for 1524-, 1829-, 2743- and 3048-mm (60-, 72-, 108- and 120-in.)-diameter driven pipe piles using methods and recommendations presented in API RP 2GEO (2011). Ultimate axial capacity curves for 1524- and 1829-mm (60- and 72-in.)-diameter pipe piles driven on 1-on-3.5 and 1-on-3 batters are also presented. Additionally, ultimate axial capacity curves for 1524-, 1829-, 2743- and 3048-mm (60-, 72-, 108- and 120-in.)-diameter driven pipe piles are also computed using the four CPT-based methods for granular soils based on site-specific cone tip resistances. Pile penetrations should be based on allowable capacities with appropriate safety or load resistance factors.

The ultimate seafloor bearing capacity for mud mat and tubular members bearing on the seafloor was computed using general bearing capacity methods and recommendations presented in API RP 2GEO (2011). A seafloor bearing capacity equation is presented in the main text of this report to facilitate design of a temporary jacket support, if required.

Pile driving difficulties are not anticipated at this location. Pile drivability will be evaluated using the wave equation method of analysis to investigate the hammer-pile combination best suited to achieve full penetration. Pile monitoring can be used as an aid to help install piles where a drivability study indicates hard driving or possible pile refusal.

INTRODUCTION

Purpose and Scope

Fugro-McClelland Marine Geosciences, Inc. (FMMG) performed preliminary engineering analyses for Boring BH-T1A, as requested by Keystone Engineering Inc. The following tasks were performed:

(1) Axial and lateral design data for 1524-, 1829-, 2743- and 3048-mm (60-, 72-, 108- and 120-in.)-diameter driven pipe piles was generated using methods and recommendations presented in API RP 2GEO (2011);

(2) Ultimate axial pile capacity curves for 1524- and 1829-mm (60- and 72-in.)-diameter pipe piles driven on 1-on-3.5 and 1-on-3 batters were generated;

(3) Ultimate axial pile capacity curves for 1524-, 1829-, 2743- and 3048-mm (60-, 72-, 108- and 120-in.)-diameter driven pipe piles were also generated using the four CPT-based methods presented in API RP 2GEO (2011) for cohesionless soils based on site-specific cone tip resistances; and

(4) The ultimate seafloor bearing capacity for mud mat and tubular members bearing on the seafloor was computed using general bearing capacity methods and recommendations presented in API RP 2GEO (2011).

Report Format

For the purposes of discussion and presentation, "driven pipe pile" is used in this report to represent foundation piles, caissons and conductors, unless otherwise specified.

The initial sections of this report contain brief descriptions of the field and laboratory phases of the study. A general description of the soils is then presented; followed by discussions of axial pile design, lateral pile analyses, and platform jacket support. A section on pile installation considerations follows. Appendix A contains discussions of analytical procedures used in our engineering analyses.

FIELD AND LABORATORY INVESTIGATIONS

Exploratory Boring

Fugro Consultants, Inc. (FCI) recently completed a geophysical and geotechnical field exploration program in support of the Virginia Offshore Wind Technology Advancement Project (VOWTAP). The program included marine drilling, sampling, and in-situ testing with supplemental onshore drilling, sampling and test pit exploration. FMMG personnel drilled the soil boring with a Failing DMX 1500 rig positioned over the front of the L/B *"Inez H. Eymard"*. The vessel was positioned at the boring location by a hydraulic jack-up leg system. Soil conditions at the site of the wind turbine generators were explored by drilling three soil borings to penetrations ranging from 110.1 to 112.7 m below the seafloor (FCI, 2014). Preliminary pile design data are presented in this report for Boring BH-T1A. This boring was located at UTM Zone 18 North, NAD83 Coordinates X = 456,197.47 m and Y = 4,083,478.64 m. Fugro Chance, Inc., of Lafayette, Louisiana, conducted surveying utilizing STARFIX II and DGPS, and performed a 360-degree scanning sonar survey.

Water depths at the boring locations were measured using three methods, namely the length of the drill string, the vessel echo sounder, and a clumped line. A water depth of 24.9 m MLLW was measured at Boring BH-T1A, and compared to the multibeam data collected in 2013.

In clayey soils, a 5-m sampling cycle consisting of a 3-m long PCPT followed by two 1-m long push samples obtained using either a 76-mm-diameter hydraulic piston sampler or a 76-mm-diameter thin- or thick-walled tube was carried out. In sandy soils, a 4-m sampling cycle consisting of a 3-m long PCPT followed by a 1-m long driven sample obtained using a 57-mm-diameter thin- or thick-walled tube was carried out. In-situ piezocone penetration tests (PCPT) were performed using the Fugro Alluvial Offshore Limited (FAOL) Seascout 10 seabed system.

Field Laboratory Tests

The soil testing program was designed to evaluate pertinent index and engineering properties of the foundation soils. During the field operation, all samples were extruded from the sampler and classified by the soil technician or field engineer. Moisture content, torvane, pocket penetrometer, miniature vane and unconsolidated-undrained triaxial compression tests were performed in the field on selected cohesive samples. Unit weights were measured on all cohesive soil samples, and wherever possible, on cohesionless soil samples. All of the samples were shipped to Fugro's onshore laboratory where atterberg limit tests, water content tests, and grain-size analyses, as well as additional density tests, unconsolidated-undrained triaxial compression tests, and miniature vane tests, will be performed.

GENERAL SOIL CONDITIONS

Soil Stratigraphy

The soil stratigraphy is based on the classification of soil samples recovered from the boring, analysis of PCPT data, and observations made during drilling operations. A generalized summary of the major soil strata is tabulated below.

	Penetration, m		
Stratum	From	To	Description
I	0	5.2	Loose to medium dense silty fine to coarse sand
II	5.2	24.4	Firm to very stiff fat clay
III	24.4	56.1	Medium dense to dense silty fine to medium sand
IV	56.1	71.6	Very stiff to hard lean clay
V	71.6	88.1	Medium dense to dense silty fine sand
VI	88.1	110.1	Very stiff to hard fat clay

A Roman numeral representing each stratum is shown in the above tabulation, as well as on the relevant plates. A fat clay layer was encountered from 1.8- to 2.8-m penetration.

Interpretation of Soil Properties

The shear strength and submerged unit weight profiles shown on Plates 1 and 2, respectively, best represent the assembled field laboratory and PCPT test results. Due to the presence of surficial granular sediments at the boring location, a local scour depth of 5.2 m was incorporated in the analysis performed for axial and lateral pile design. These profiles were used in the engineering analyses.

In developing the shear strength profile for the cohesive soils, undrained shear strength test results from miniature vane and unconsolidated-undrained triaxial compression tests and PCPT-derived shear strengths were analyzed. The selection of shear strength profiles for clay soils and the effects of the type of sampling procedure on the profiles are discussed by Dennis and Olson (1983) and Quiros, et al. (1983). Strength parameters for granular soils were selected based on their gradation and relative density estimated from sampler blow count information and PCPT data. The submerged unit weight profile was developed from actual density measurements and calculated unit weight values based on sample moisture content and the assumption of 100 percent sample saturation.

Recommendations for foundation design and installation were developed with the assumption that the soil conditions revealed by Boring BH-T1A are continuous throughout the general area of the proposed platform. Consideration of possible stratigraphic changes, faulting, or geologic conditions which may influence foundation design was beyond the scope of this investigation. Variations in soil conditions may become evident during jacket or pile installation. If variations are found, a re-evaluation of the recommendations in this report may be necessary. In addition, there may be a need to drill additional borings to investigate soil variability at the site.

PILE DESIGN INFORMATION

The pile design information developed for this study includes ultimate axial capacities, axial load-pile movement (t-z and Q-z) data, and lateral soil resistance-pile deflection (p-y) characteristics. The analytical methods used to develop this information are presented briefly in the following paragraphs and in more detail in Appendix A.

Axial Pile Design

Method of Analysis. The ultimate axial capacity of piles was computed using the static method of analysis described in API RP 2GEO (2011). In this method, the ultimate compressive capacity of a pile for a given penetration is taken as the sum of the skin friction on the pile wall and the end bearing on the pile tip. The weight of the pile and soil plug is neglected in the computations. When computing the ultimate tensile capacity of piles, as well as the compressive capacity of conductors or caissons, the end bearing component is also neglected.

Ultimate Axial Capacity. The unit skin friction and unit end bearing values plotted on Plates 3 and 4, respectively, were calculated using the API RP 2GEO methods (Sec. 8.1.3 and Sec. 8.1.4) described in Appendix A. These values were used to calculate the ultimate axial compressive and tensile capacities for 1524-, 1829-, 2743- and 3048-mm (60-, 72-, 108- and 120-in.)-diameter driven pipe piles, driven to final penetration at the boring location. Capacity curves for driven pipe piles are presented on Plates 5 through 8. Ultimate axial capacity curves for 1524- and 1829-mm (60- and 72-in.)-diameter pipe piles driven on 1-on-3.5 and 1- on-3 batters are also presented on Plates 9 and 10. For comparison, the capacity curves of the corresponding vertical piles are also included on Plates 9 and 10.

Pile capacity was also computed using the four CPT-based methods for granular soils based on site-specific cone tip resistances. The Simplified ICP-05, Offshore UWA-05, Fugro-05, and NGI-05 methods are described in API RP 2GEO, Sec. C.8.1.4.2. The methods are also discussed in Appendix A. The shaft resistance computed using the four methods gives different values of shaft resistance in tension and compression. The tensile and compressive capacities are a function of the pile penetration, assumed to be 110.1 m for each of the pile sizes. Ultimate axial capacity curves for 1524-, 1829-, 2743- and 3048-mm (60-, 72-, 108- and 120-in.)-diameter pipe piles driven to 110.1-m penetration are presented on Plates 11 through 14, with the tension and compression friction capacity curves presented on the "a" and "b" plates, respectively, and the compressive capacity presented on the “c” plates.

API RP 2GEO recommends that pile penetrations be selected using appropriate factors of safety or pile resistance factors. For working stress design (WSD), API RP 2A recommends that pile penetrations be selected to provide factors of safety of at least 2.0 with respect to normal operating loads and at least 1.5 with respect to maximum design storm loads. These factors of safety should be applied to the design compressive and tensile loads.

Axial Load Transfer Data. Axial load-pile movement analyses are usually performed using a computer solution based on methods developed by Reese (1964) or Matlock, et al. (1976). These programs treat the pile as a series of discrete elements, represented by linear springs, that are acted upon by nonlinear springs representing the soil. The nonlinear soil springs are referred to as t-z and Q-z curves. Input data for the program include: (1) pile dimensions and material properties, (2) load transfer characteristics of the soil surrounding the pile, and (3) the pile tip load-tip movement relationship. The axial load transfer curves were computed using procedures described in API RP 2GEO and outlined in Appendix A.

Plates 15 through 18 present the results as side load-side movement (t-z) and tip load-tip movement (Q-z) data for 1524-, 1829-, 2743- and 3048-mm (60-, 72-, 108- and 120-in.)-diameter driven pipe piles based on unit skin friction and unit end bearing values plotted on Plates 3 and 4, respectively. The presented Q-z data should be used for foundation piles and neglected for caissons and conductor design. In developing the axial load transfer data in the cohesive soils, a post-peak adhesion ratio of 0.90 was utilized to model strain-softening behavior. Note that the maximum ultimate axial capacities computed using the axial load transfer data will be less than the ultimate capacities given on Plates 5 through 8.

Lateral Pile Design Data

Lateral Load Transfer Data. The soil resistance-pile deflection (p-y) characteristics of the soils at the boring location were developed for individual 1524-, 1829-, 2743- and 3048-mm (60-, 72-, 108- and 120-in.)-diameter driven pipe piles. These data may be used in lateral load analyses of driven piles, conductors and caissons. The p-y data for cyclic loading were developed to 30.5- to 61-m penetration using the procedures proposed by Matlock (1970) for soft clays and O'Neill and Murchison (1983) for sands. Due to the presence of surficial granular sediments at the boring location, a local scour depth of 5.2 m was incorporated in the analysis. These procedures have been outlined in API RP 2GEO and briefly explained in Appendix A. The stratigraphy and parameters used to develop the p-y data are presented on Plate 19. The p-y data for 1524-, 1829-, 2743- and 3048-mm (60-, 72-, 108- and 120-in.)-diameter driven pipe piles are presented on Plates 20 through 23. The p-y values presented at final penetration may be used for lateral load analyses at greater depths.

Scour Potential. The scour potential at a site depends on the pile size, grain-size distribution, relative density or consistency of the surficial soil deposits, current velocity, direction of flow and water depth. Considering the environmental conditions at this location and the presence of granular sediments at the seafloor, scour may occur at this location. A study undertaken by Fugro Atlantic (2011), specifically for the Atlantic Outer Continental Shelf (OCS), prepared for the Bureau of Ocean Energy Management, Regulation and Enforcement, has indicated that several different current flows occur on the Atlantic OCS. The presence of a pile, acting as an obstacle forms a pressure gradient in the vicinity, which eventually creates a vortex. This vortex, primarily dependent on the velocity of flow, may create either a zone of deposition or depression (local scour) on the seafloor. If left unattended, local scour around a wind turbine substructure occurs when the sediment is eroded from the seafloor in response to the wave and current forces modified by the presence of a structure. The formation of scour can reduce the foundation capacity, soften the load-deformation characteristics of the foundation and substructure, and change the fundamental period of vibration of the foundation and substructure.

The study by Fugro Atlantic (2011) has also identified the migration of varying sizes of sand waves in different areas of the Mid-Atlantic OCS as another form of sediment transport. Sand waves have been documented to migrate at rates of about 45 m (150 ft) per year. These migrating sand waves can either mitigate scour or create a condition of extreme scour, where the elevation of the seafloor has been lowered (general scour). The extreme scour developed could potentially affect the performance of the pile.

Scour protection, although recommended, have also been documented by Fugro Atlantic (2011) as being the cause of secondary scour. It is recommended that mapping of the seafloor prior to construction, and continued with periodic mapping of the seafloor during the life of the structure to assess the extent of changes to the elevation of the seafloor.

Pile Group Effects

API RP 2GEO recommends that a pile spacing of less than eight pile diameters be evaluated for group effects. This additional analysis can be performed by FMMG when pile spacing has been selected.

Pile and Spudcan Interaction

On a sandy seafloor, only the spudcan tips may penetrate into the seafloor and a scour zone may be created around the spudcans. The footprint left by the spudcan is called a spudcan depression. Mud mats located in, or near, existing depressions may have reduced (degraded) or uneven bearing capacity. This degradation is a function of spudcan diameter, depth of scour, depth of spudcan penetration, distance between spudcan depression and mud mat, and soil type. FMMG can perform this additional evaluation when the geometry and layout of the mud mats and spudcan depressions have been determined.

PLATFORM JACKET SUPPORT

While the platform jacket is temporarily resting on the seafloor prior to pile installation, seafloor support is provided by the soil resistance (skin friction and end bearing) on the jacket leg extensions and the bearing capacity of the soil supporting the lowest horizontal (mudline) bracing members and mud mats.

Bearing Capacity

For mud mats and bracing members resting on granular soils, the ultimate bearing capacity is estimated in general accordance with procedures recommended by Terzhagi (1943) and later examined by Terzaghi and Peck (1967) for the design of shallow foundations. The ultimate bearing capacity is limited to the capacity of the clay soil encountered in Stratum II. The ultimate net bearing capacity (q_u) may be computed using the following expression:

$$q_u = (26\ B)\ (1\text{-}0.4B/L) \leq 74 \text{ kPa for tubular members and mud mats,}$$

where: q_u = ultimate bearing capacity, kPa;

B = width of mud mat, m; and

L = length of mud mat, m.

For horizontal tubular members penetrating less than one radius, the projected area at the mudline should be used to calculate the ultimate bearing capacity of the members. For members penetrating one radius or more, the diameter should be used. For triangular-shaped mud mats, B should be taken as the least altitude and L should be taken as the longest side.

The ultimate bearing capacity of the near-seafloor soils is a function of the size and configuration of the mud mats and jacket structure. A more detailed analysis of soil deformation and bearing capacity can be undertaken when the actual configuration and loading conditions are determined.

For Working Stress Design (WSD), API RP 2A recommends that a safety factor of at least 2.0 be used with the ultimate bearing capacity determined from the above equations. The ultimate bearing (load-carrying) capacity of a horizontal tubular member or mud mat may be calculated as the ultimate bearing capacity of the soil multiplied by the base area of the mat or member. The equations for ultimate bearing capacity presented above are based on static bearing capacity conditions. Significant vertical platform velocities at the time of jacket placement could cause large or uneven jacket settlements.

Degraded Bearing Capacity

On a sandy seafloor, only the spudcan tips may penetrate into the seafloor and a scour zone may be created around the spudcans. The footprint left by the spudcan is called a spudcan depression. Mud mats located in, or near, existing depressions may have reduced (degraded) or uneven bearing capacity. This degradation is a function of spudcan diameter, depth of scour, depth of spudcan penetration, distance between spudcan depression and mud mat, and soil type. FMMG can perform this additional evaluation when the geometry and layout of the mud mats and spudcan depressions have been determined.

PILE INSTALLATION CONSIDERATIONS

Pile driving difficulties are not anticipated at this location. Pile drivability will be evaluated using the wave equation method of analysis to investigate the hammer-pile combination best suited to achieve full penetration. Pile monitoring can be used as an aid to help install piles where a drivability study indicates hard driving or possible pile refusal.

Delays and Redriving

During driving, it will be necessary to interrupt driving operations in order to make pile add-ons or hammer changes. Such interruptions to driving operations usually last 6 to 8 hours. Delays on the order of several days may result from bad weather or equipment breakdown. During this time, many clays will gain strength as excess pore pressure dissipates and the soil particles reorient themselves. This phenomenon is commonly referred to as set-up. A similar phenomenon may also occur in fine-grained granular deposits. After set-up has occurred, increased blow counts may be experienced while attempting to restart driving the piles. The soil resistance to driving may increase to the point of refusal. Therefore, the driving program should be scheduled so as to reduce the number and duration of delays.

Supplementary Installation Techniques

The most economical pile installation procedure is driving alone, without resorting to supplementary procedures. The computed ultimate capacity of driven pipe piles is based on the assumption that the pile will be driven to the desired penetration without supplementary drilling or jetting. When techniques other than driving are used to aid pile installation, conditions assumed in computations based on driving alone may not be met. In such cases, computed capacities must frequently be adjusted to fit actual installation conditions.

Supplementary pile installation procedures, as well as the possible effects that these procedures may have on pile capacity, have been presented by Sullivan and Ehlers (1972). Application of these or other procedures to aid ordinary driving requires field decisions that take into account many factors beyond the scope of this report. If used, supplementary procedures should be chosen and applied under close engineering supervision. Supplementary procedures should be selected considering not only construction expediency, but also the effects of the procedures on pile capacity.

CONCLUSIONS AND RECOMMENDATIONS

Preliminary engineering analyses for Boring BH-T1A were performed. A summary of the pertinent conclusions and recommendations follows:

- A water depth of 24.9 m MLLW was recorded at the boring location.
- Preliminary engineering design data are presented for 1524-, 1829-, 2743- and 3048-mm (60-, 72-, 108- and 120-in.)-diameter driven pipe piles. Pile capacity curves for 1524- and 1829-mm (60- and 72-in.)-diameter pipe piles driven on 1 on 3.5 and 1 on 3 batters are presented. Pile capacity curves for 1524-, 1829-, 2743- and 3048-mm (60-, 72-, 108- and 120-in.)-diameter driven pipe piles are also presented computed using the four CPT-based methods for granular soils based on site-specific cone tip resistances.
- The safety factors should be carefully reviewed based on API RP 2A (WSD) guidelines and appropriately applied to the engineering analyses presented in this report.
- Pile group effects and pile interaction with spudcan depressions should be evaluated when the geometry and location of these elements are determined.
- Mud mat bearing capacities should be reviewed when the final size and configurations and proximity to spudcan depressions are determined.
- A pile drivability analysis can be performed to select an appropriate hammer-pile combination.

FMMG would be pleased to assist in re-evaluations and additional analyses.

SERVICE WARRANTY

The section entitled "Service Warranty" at the end of Appendix A outlines the limitations and constraints of this report in terms of a range of considerations including, but not limited to, its purpose, its scope, the data on which it is based, its use by third parties, possible future changes in design procedures and possible changes in the conditions at the site with time. This section represents a clear description of the constraints, which apply to all reports issued by FMMG. It should be noted that the Service Warranty does not in any way supersede the terms and conditions of the contract between FMMG and the Client.

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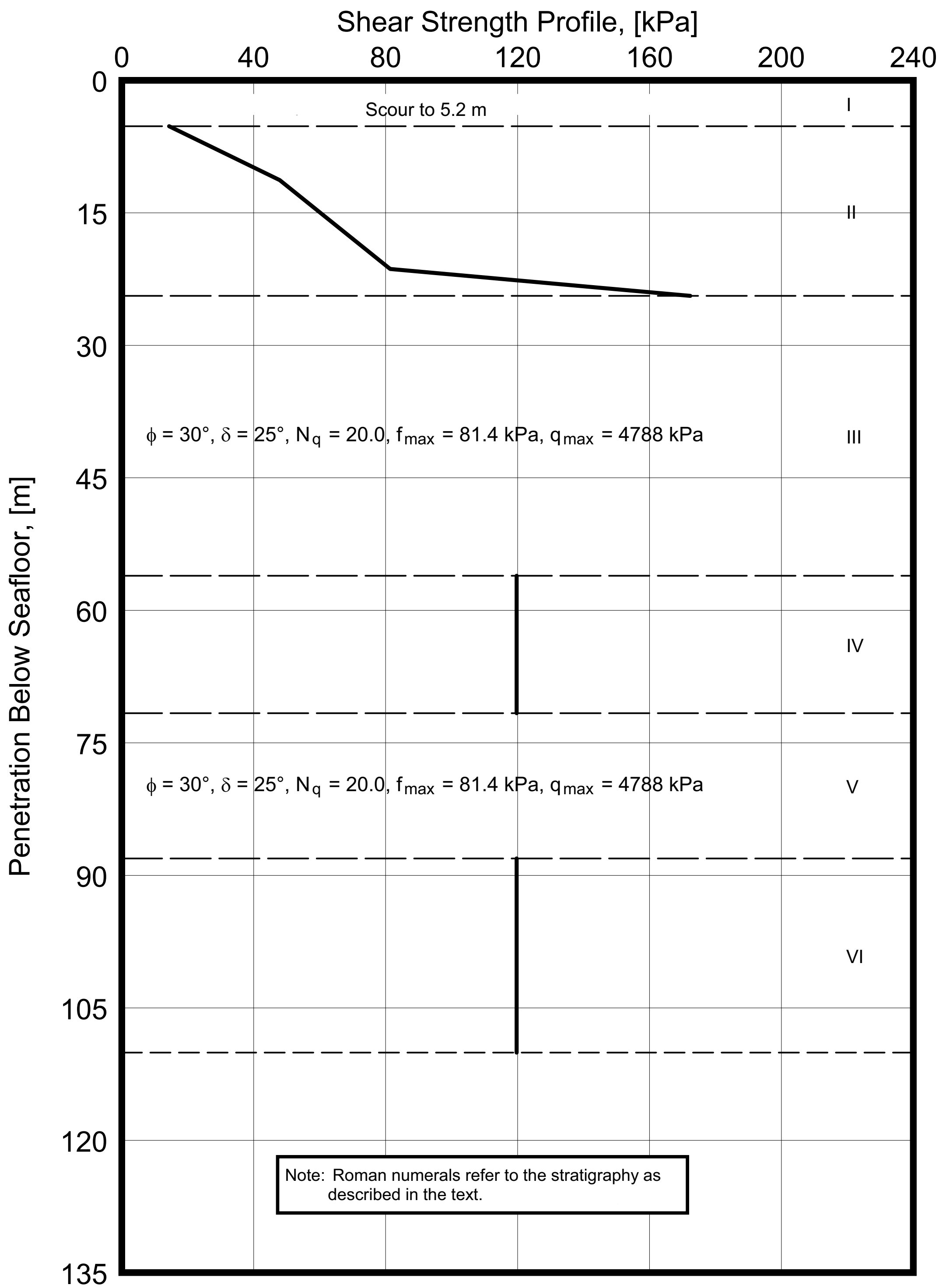
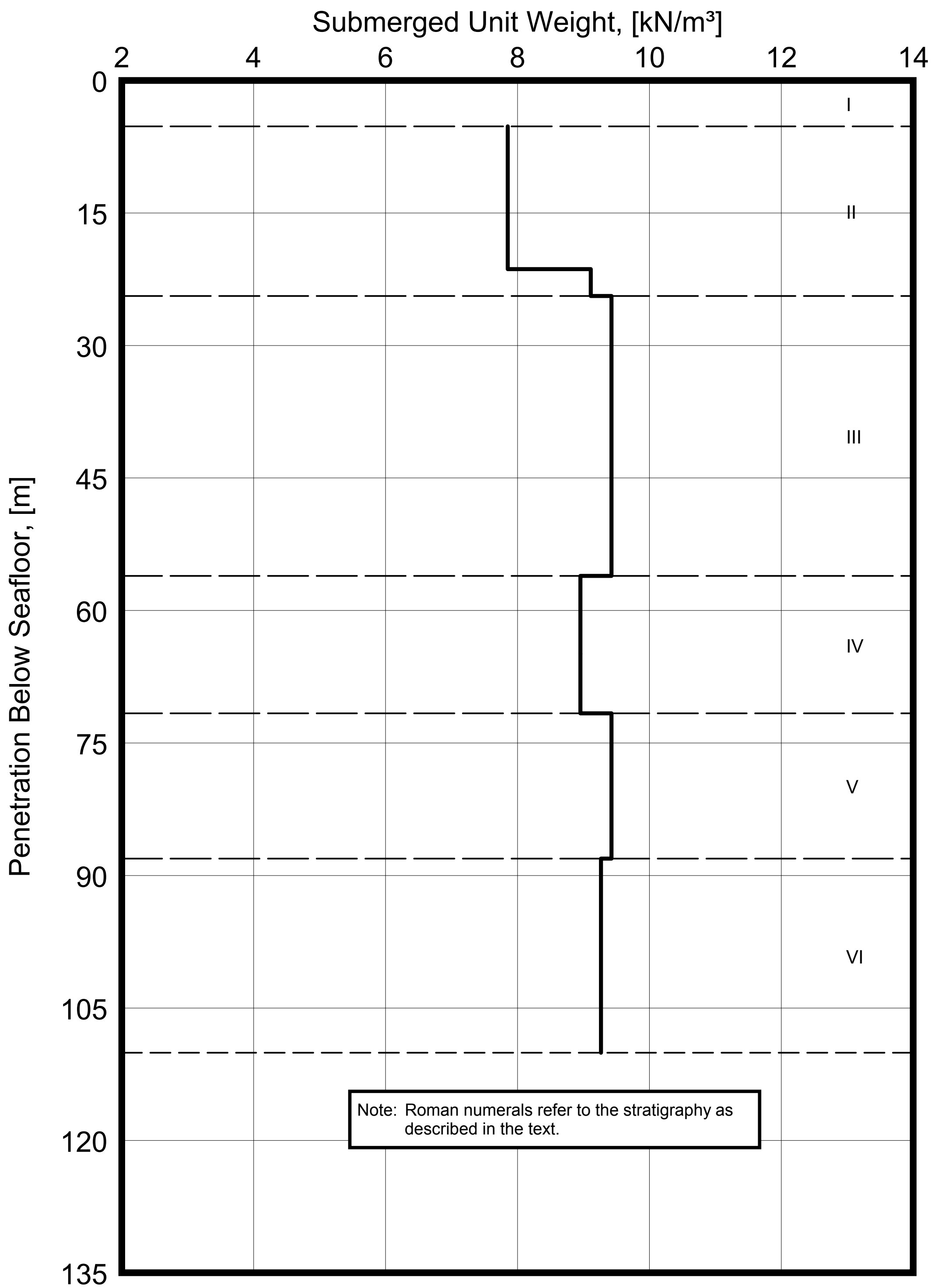
ILLUSTRATIONS



DESIGN STRENGTH PARAMETERS

Boring: BH-T1A
Offshore Virginia

Drawn By: Date:
Checked By: Date:
Approved By: Date:



DESIGN SUBMERGED UNIT WEIGHT

Boring: BH-T1A
Offshore Virginia

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Drawn By:

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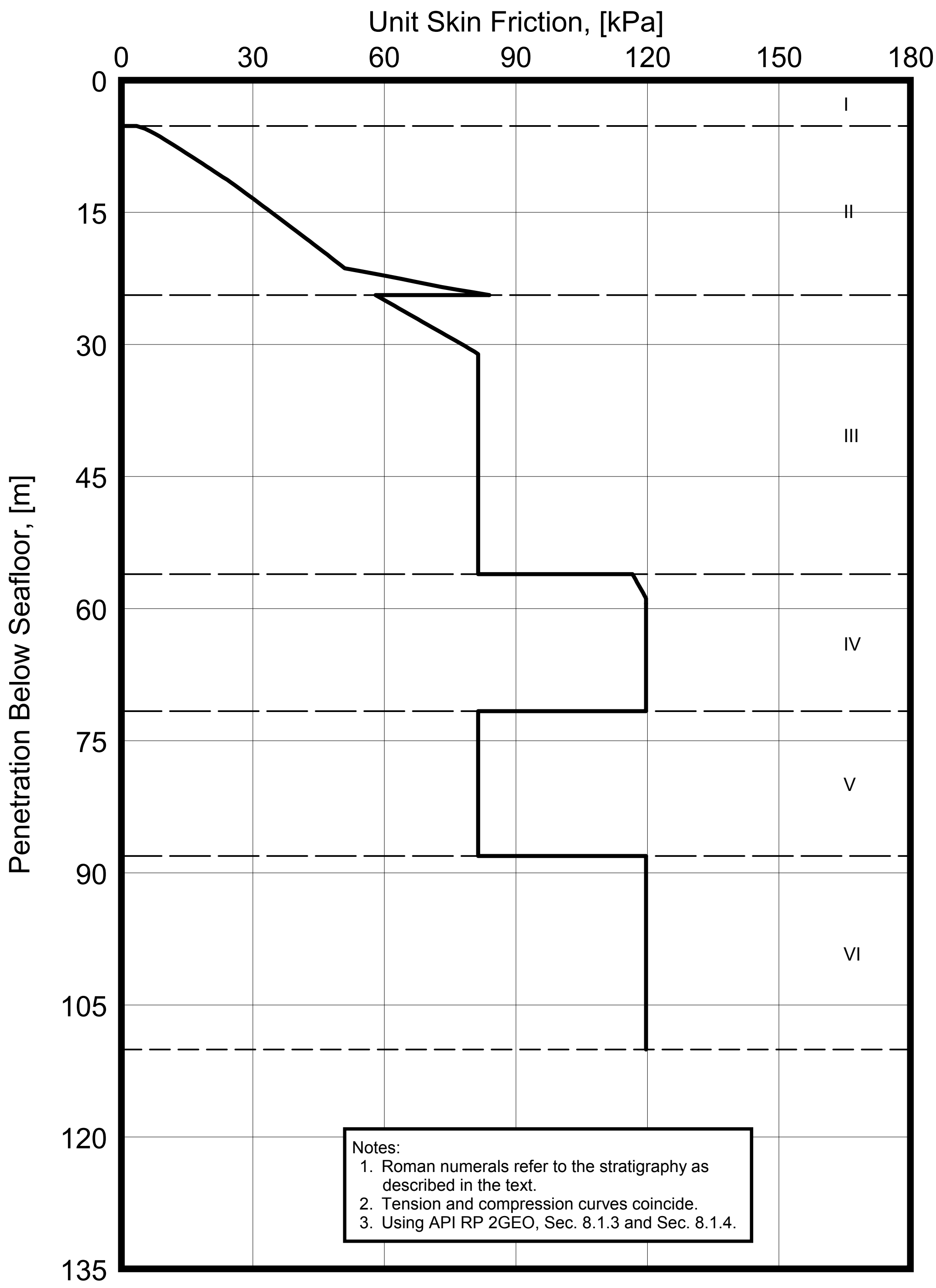
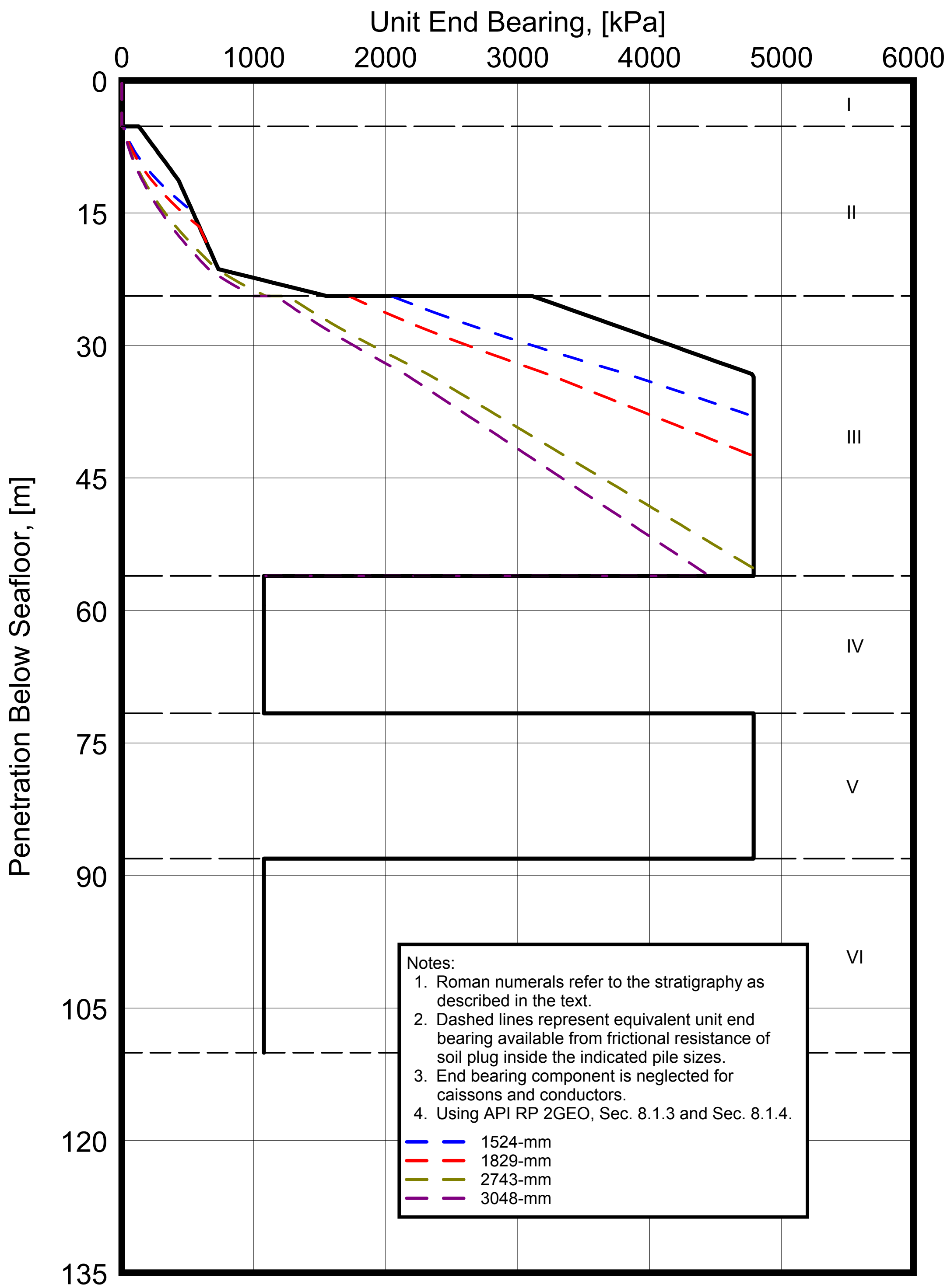


UNIT SKIN FRICTION
API RP 2GEO (2011)

Boring: BH-T1A
Offshore Virginia



UNIT END BEARING
API RP 2GEO (2011)

Boring: BH-T1A
Offshore Virginia

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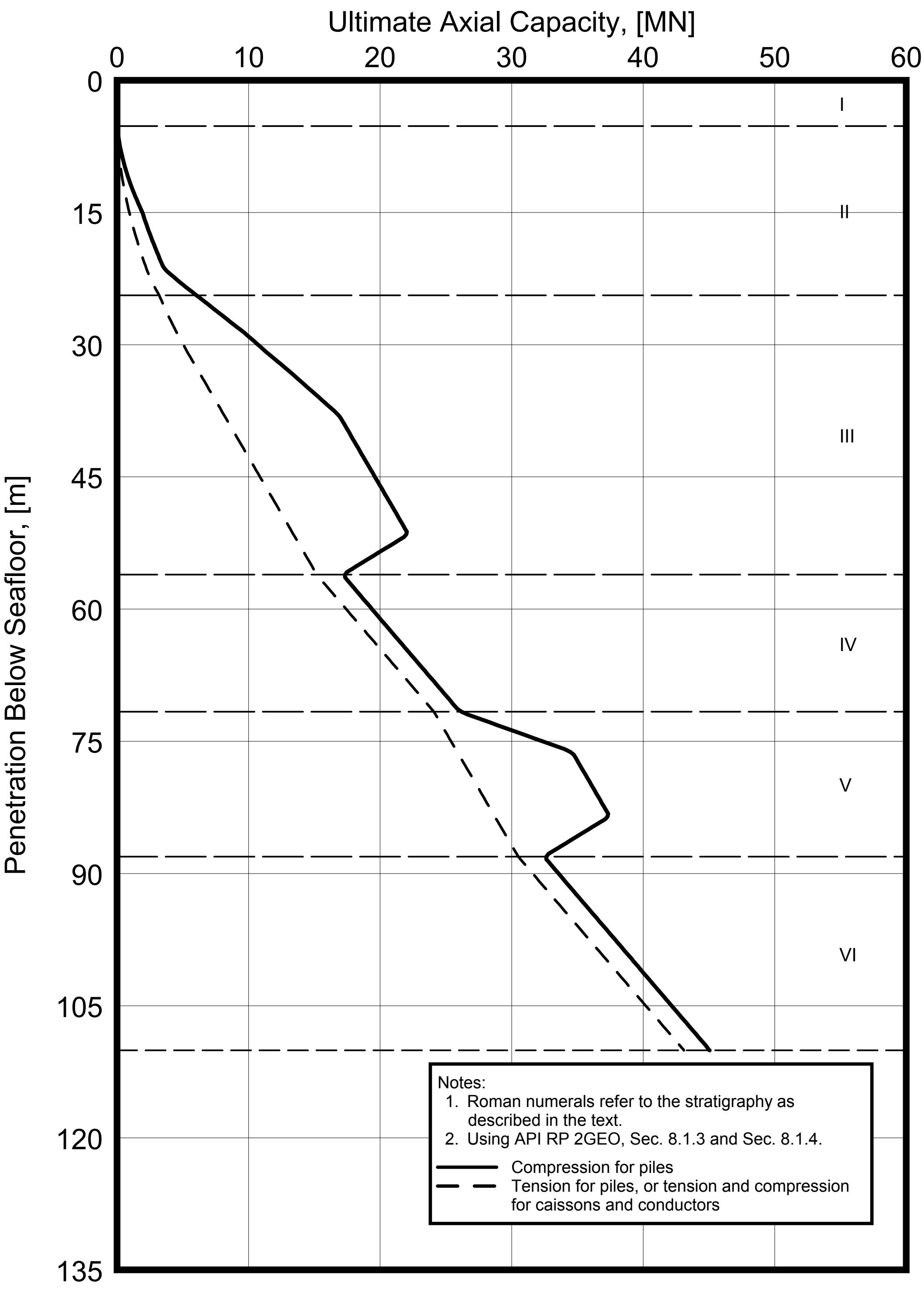
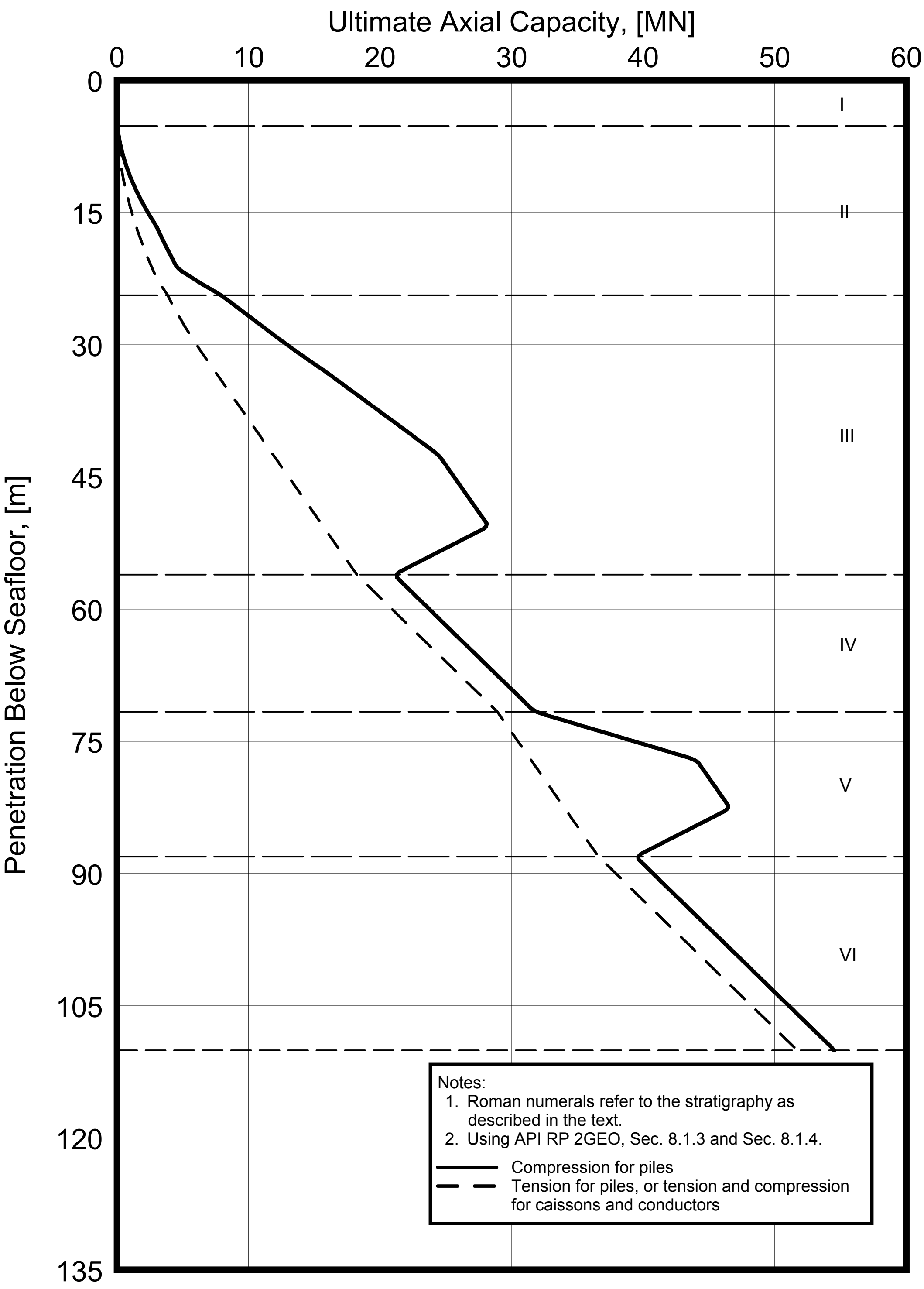


ULTIMATE AXIAL CAPACITY
API RP 2GEO (2011)
1524-mm (60-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia



ULTIMATE AXIAL CAPACITY
API RP 2GEO (2011)
1829-mm (72-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

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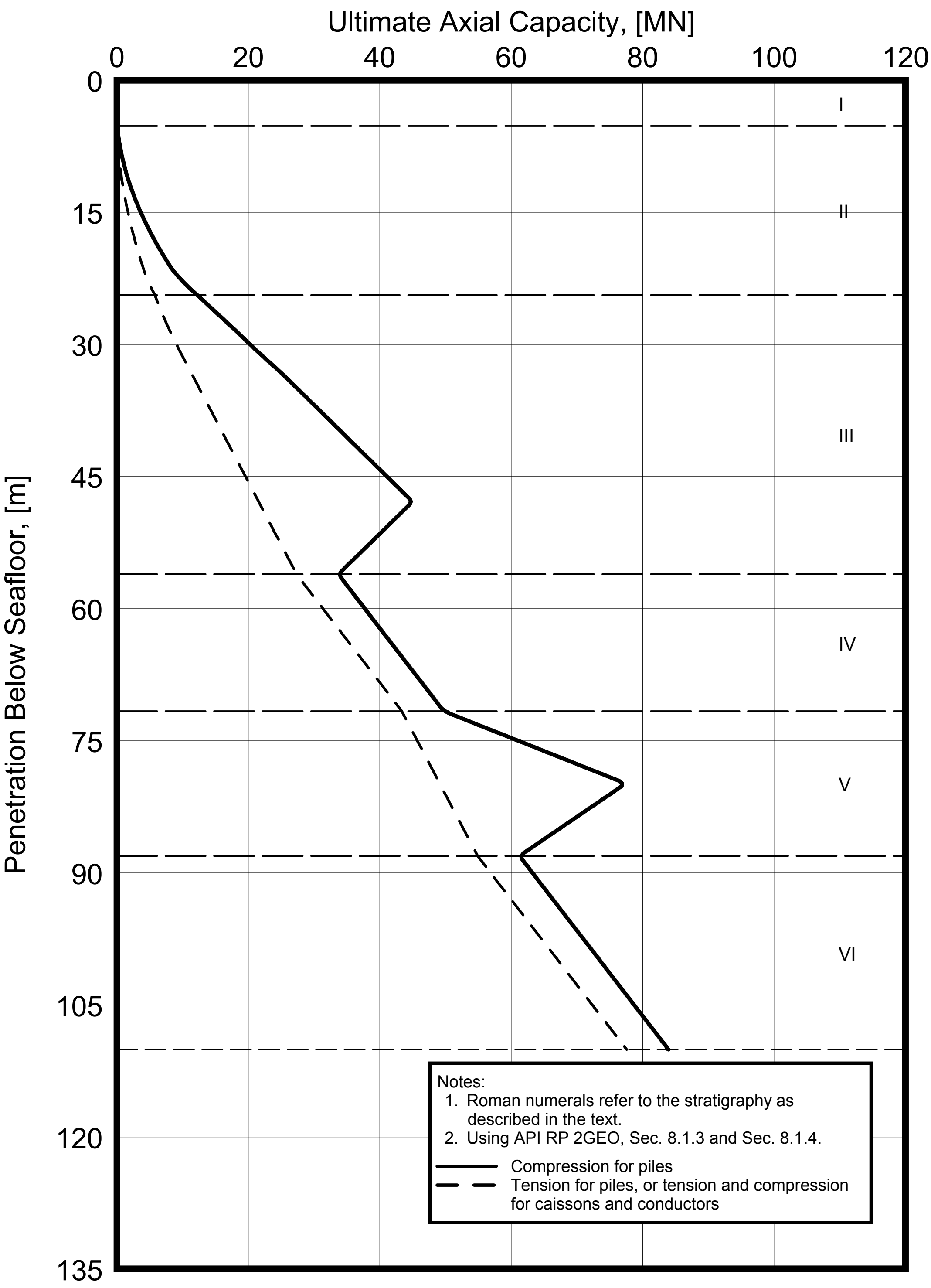
Checked By:
Approved By:



ULTIMATE AXIAL CAPACITY
API RP 2GEO (2011)
2743-mm (108-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

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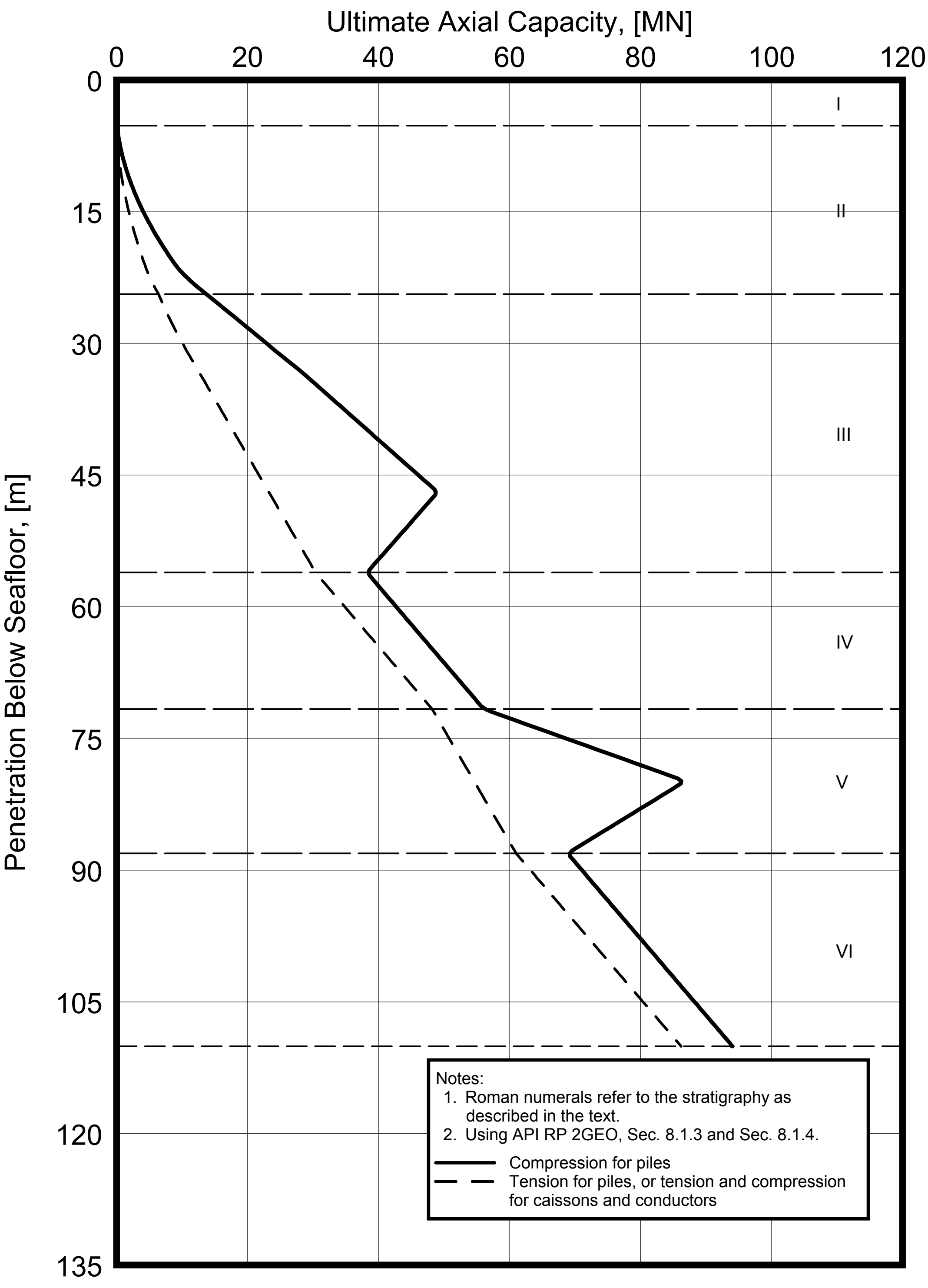
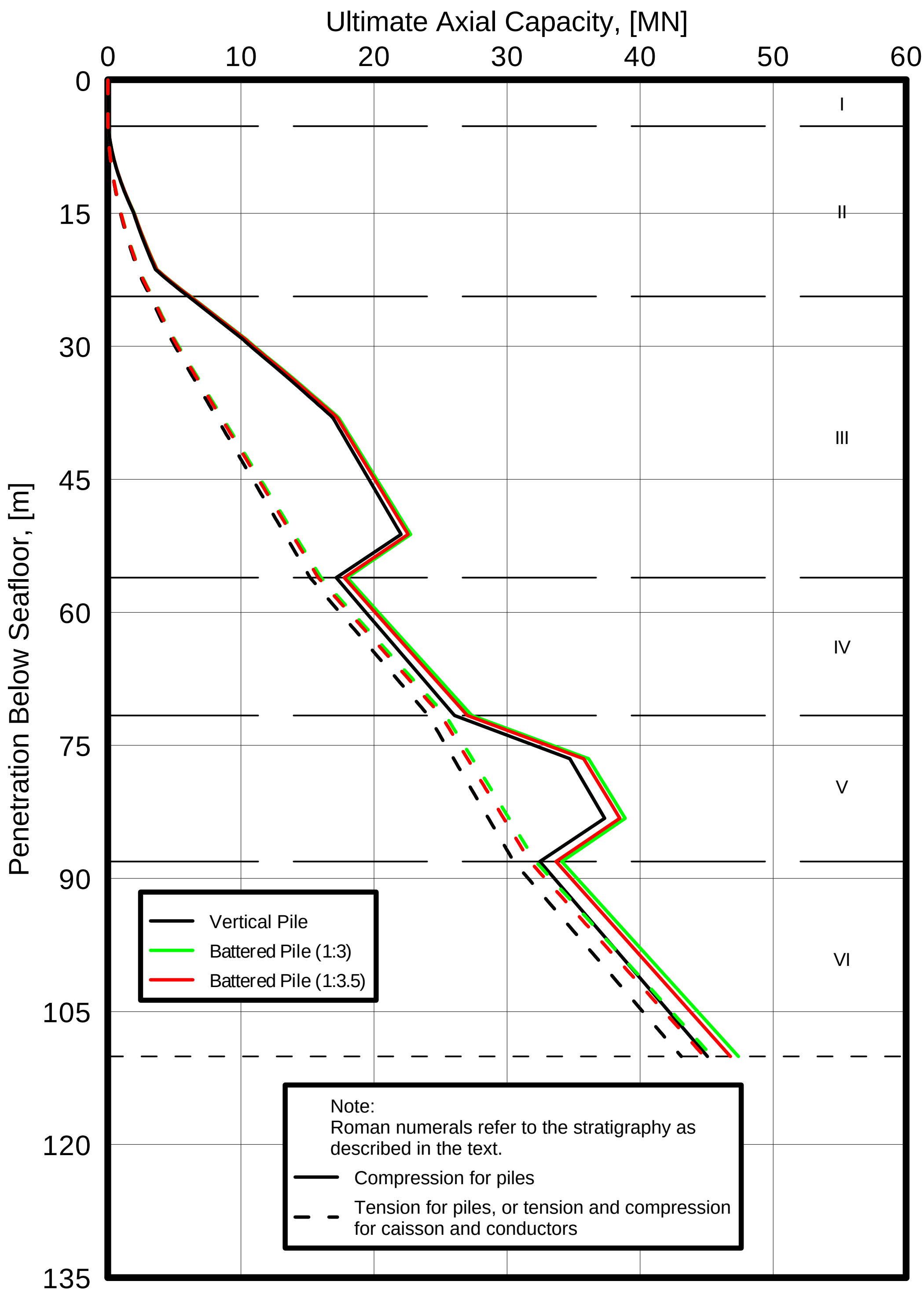


ULTIMATE AXIAL CAPACITY
API RP 2GEO (2011)
3048-mm (120-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia



ULTIMATE AXIAL CAPACITY
API RP 2GEO (2011)
1524-mm (60-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

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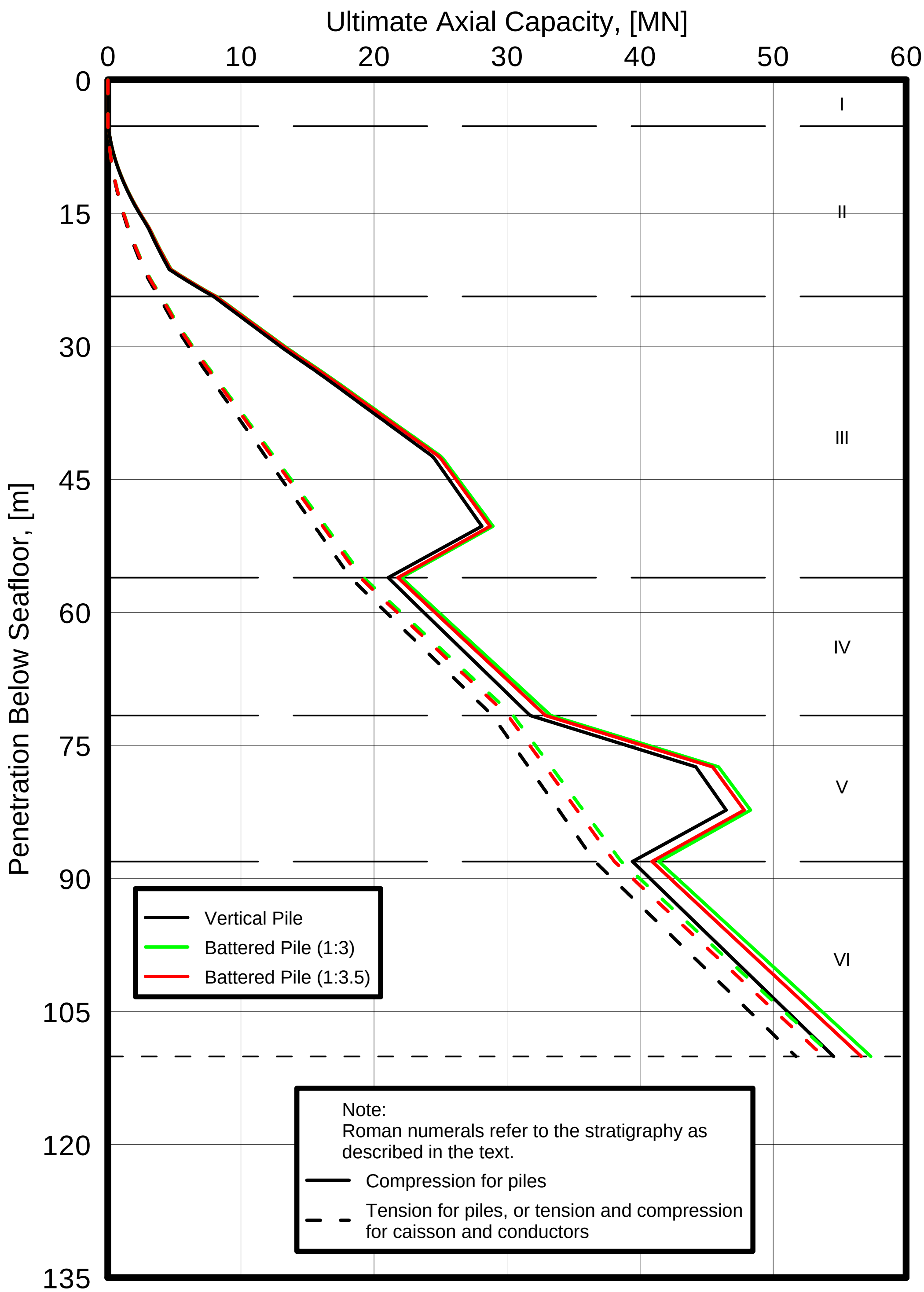
Checked By:
Approved By:



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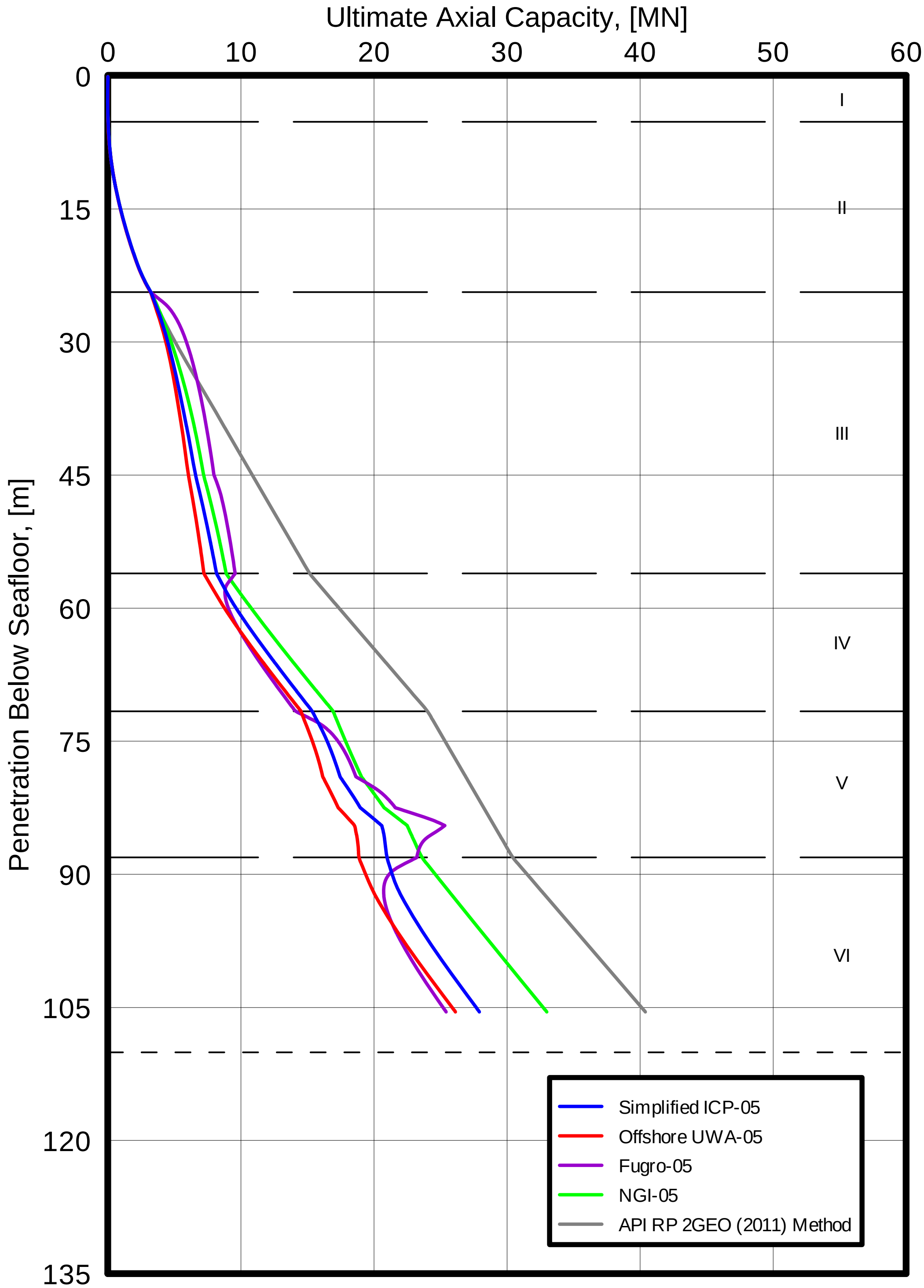
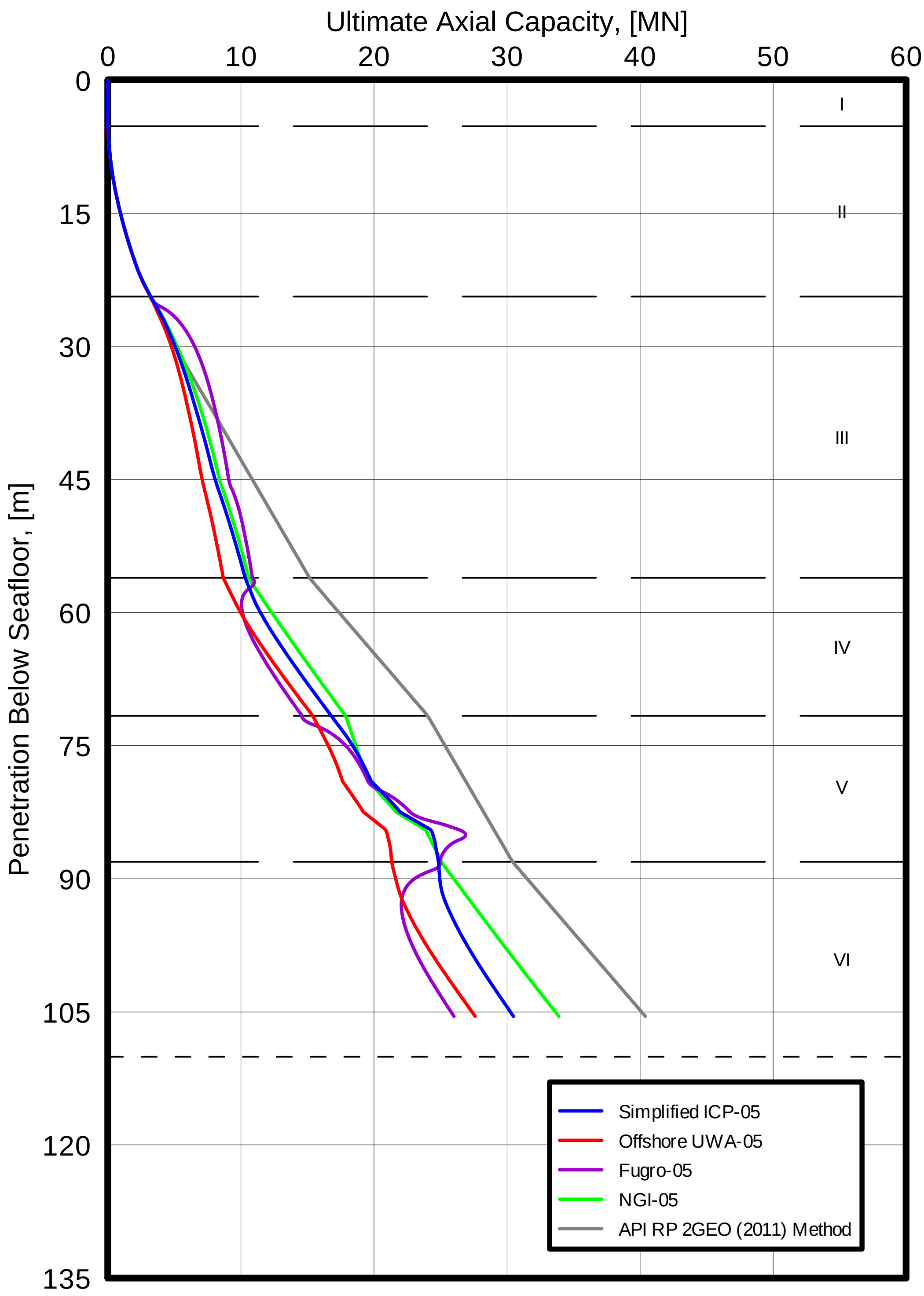
ULTIMATE AXIAL CAPACITY
API RP 2GEO (2011)
1829-mm (72-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

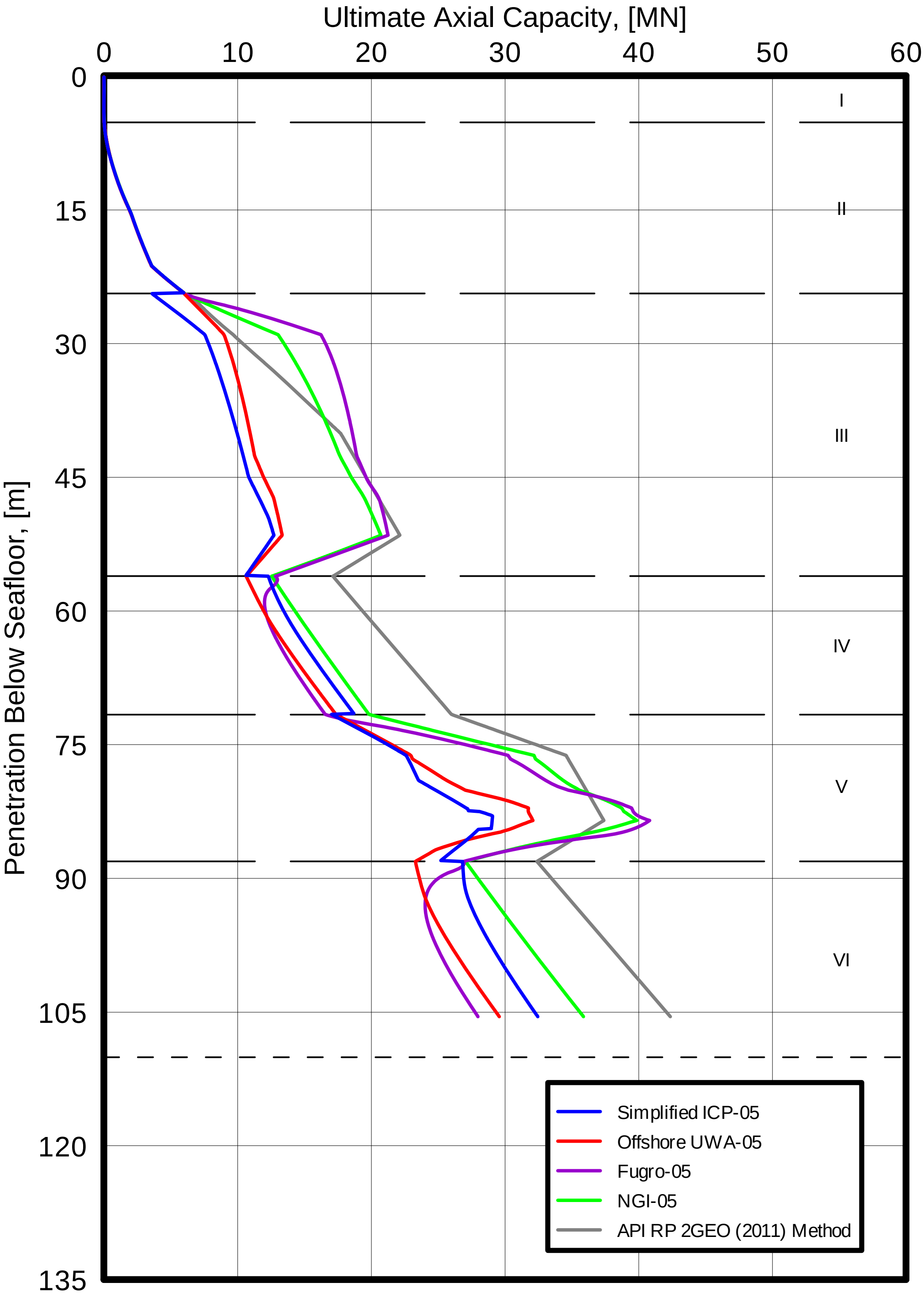


ULTIMATE AXIAL CAPACITY
(TOTAL FRICTION CAPACITY IN TENSION)
API RP 2GEO (2011)
1524-mm (60-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

Date:
Drawn By:
Date: Date:
Checked By: Approved By:



ULTIMATE AXIAL CAPACITY
(TOTAL FRICTION CAPACITY IN COMPRESSION)
API RP 2GEO (2011)
1524-mm (60-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia



Date:

Drawn By:

Date: Date:

Checked By: Approved By:

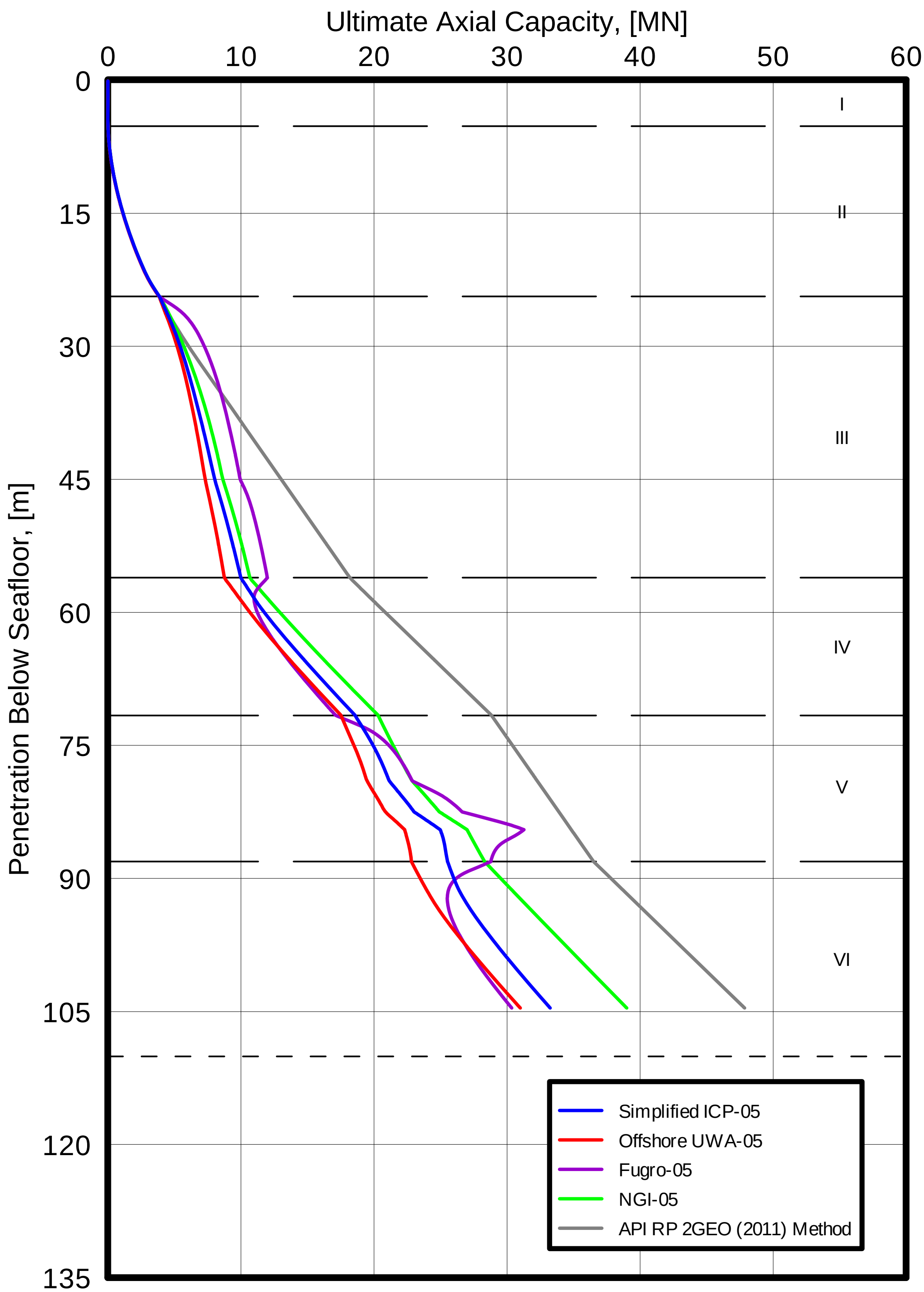
ULTIMATE AXIAL CAPACITY (COMPRESSION)

API RP 2GEO (2011)

1524-mm (60-in.)-Diameter Driven Pipe Piles

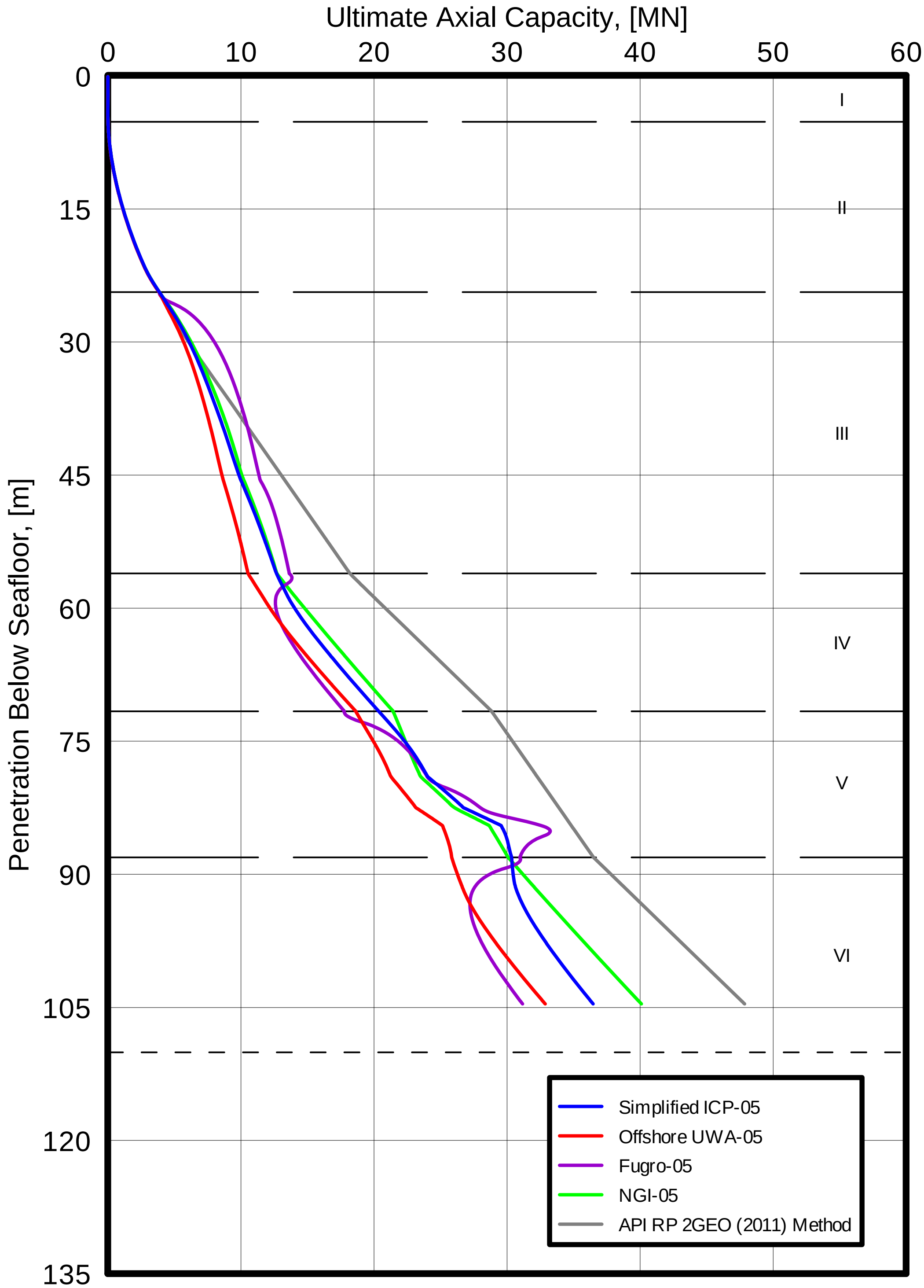
Boring: BH-T1A

Offshore Virginia



ULTIMATE AXIAL CAPACITY
(TOTAL FRICTION CAPACITY IN TENSION)
API RP 2GEO (2011)
1829-mm (72-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

Date:
Drawn By:
Date: Date:
Checked By: Approved By:



ULTIMATE AXIAL CAPACITY
(TOTAL FRICTION CAPACITY IN COMPRESSION)
API RP 2GEO (2011)
1829-mm (72-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

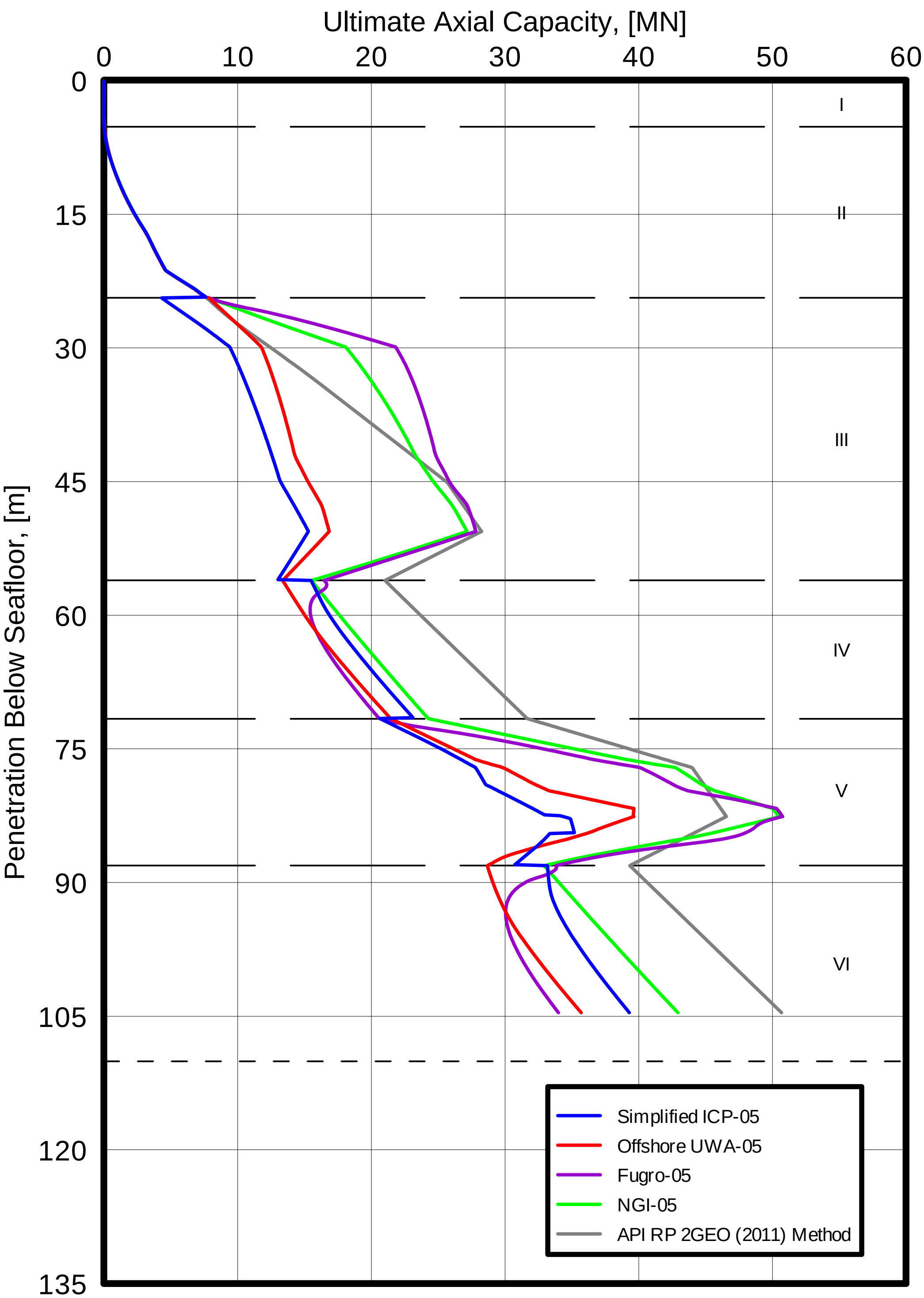
Date: Drawn By: Date: Date: Checked By: Approved By:

Date:

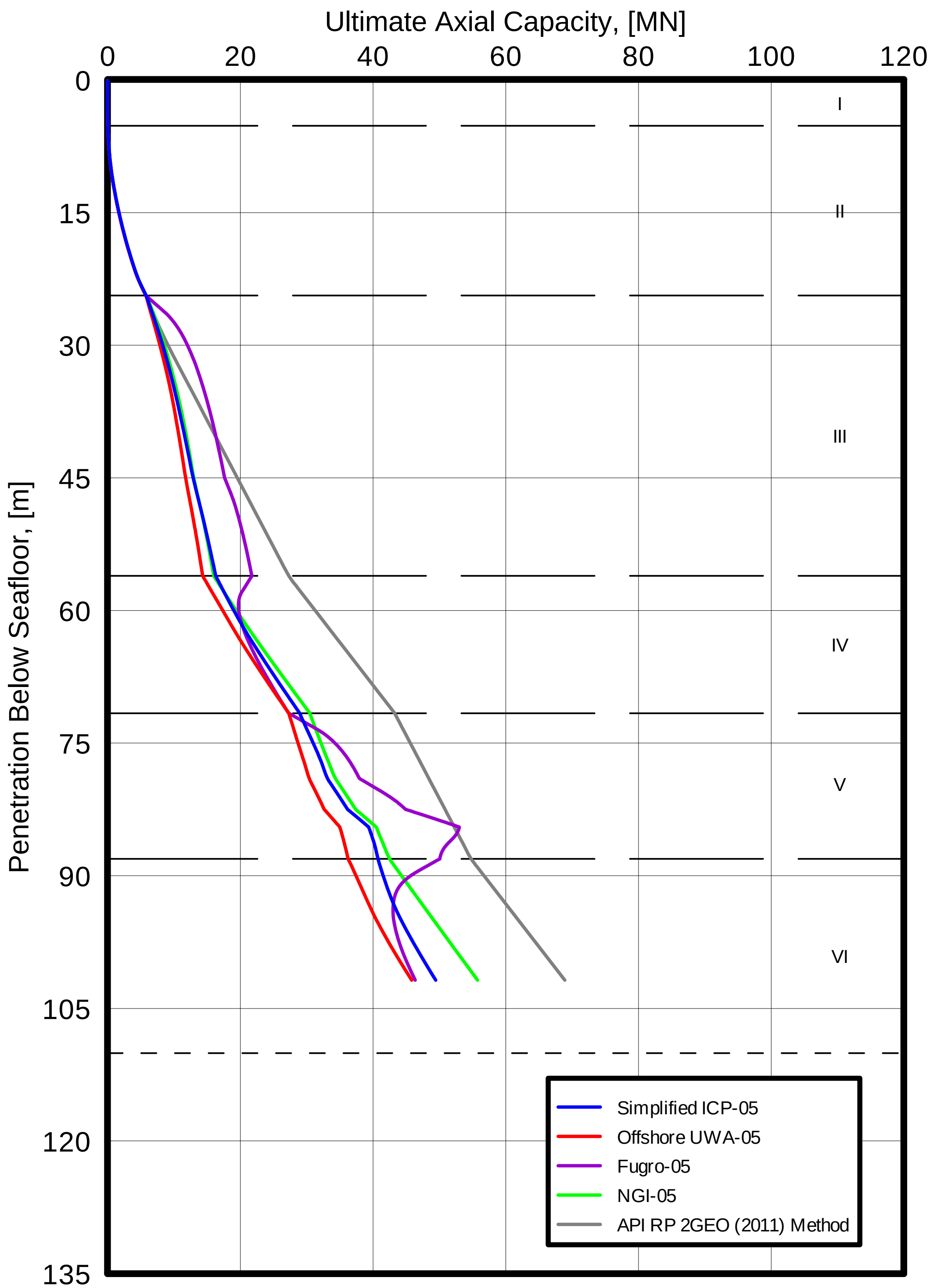
Drawn By:

Date: Date:

Checked By: Approved By:

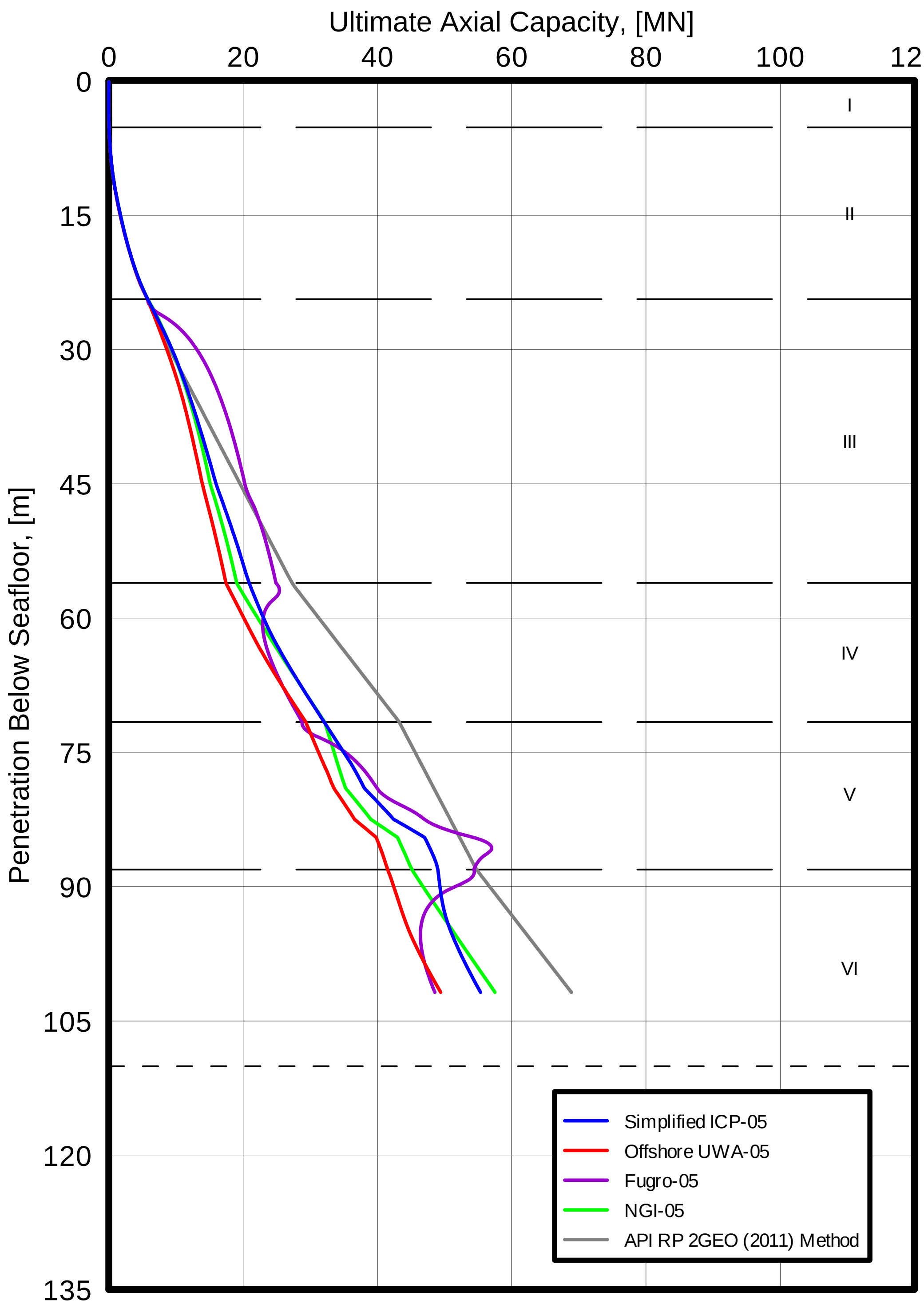


ULTIMATE AXIAL CAPACITY
(COMPRESSION)
API RP 2GEO (2011)
1829-mm (72-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia



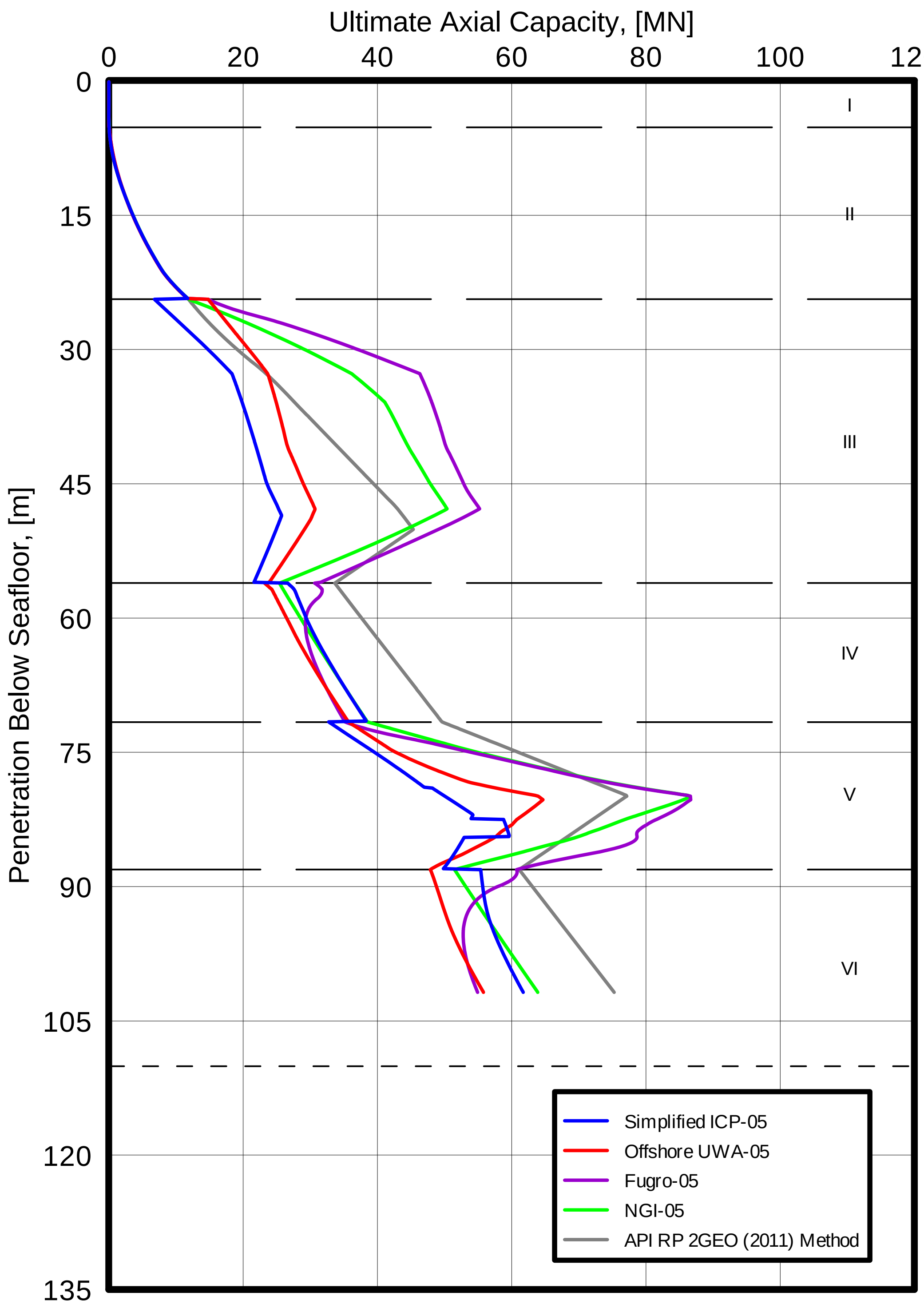
ULTIMATE AXIAL CAPACITY
(TOTAL FRICTION CAPACITY IN TENSION)
API RP 2GEO (2011)
2743-mm (108-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

Date:
Drawn By:
Date: Date:
Checked By: Approved By:



Date:
Drawn By:
Date:
Date:
Checked By:
Approved By:

ULTIMATE AXIAL CAPACITY
(TOTAL FRICTION CAPACITY IN COMPRESSION)
API RP 2GEO (2011)
2743-mm (108-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia



ULTIMATE AXIAL CAPACITY (COMPRESSION)

API RP 2GEO (2011)

2743-mm (108-in.)-Diameter Driven Pipe Piles

Boring: BH-T1A

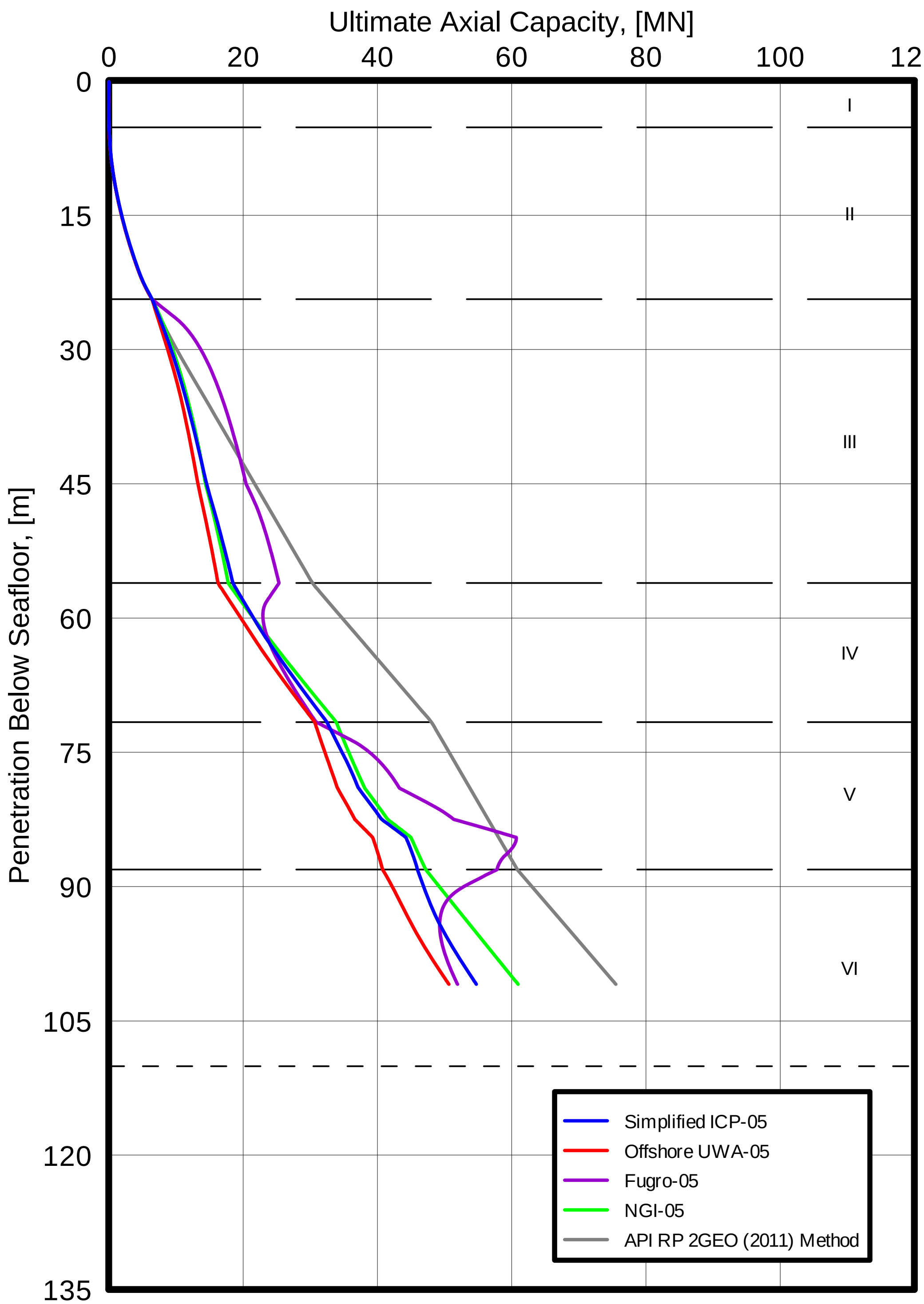
Offshore Virginia

Date:

Drawn By:

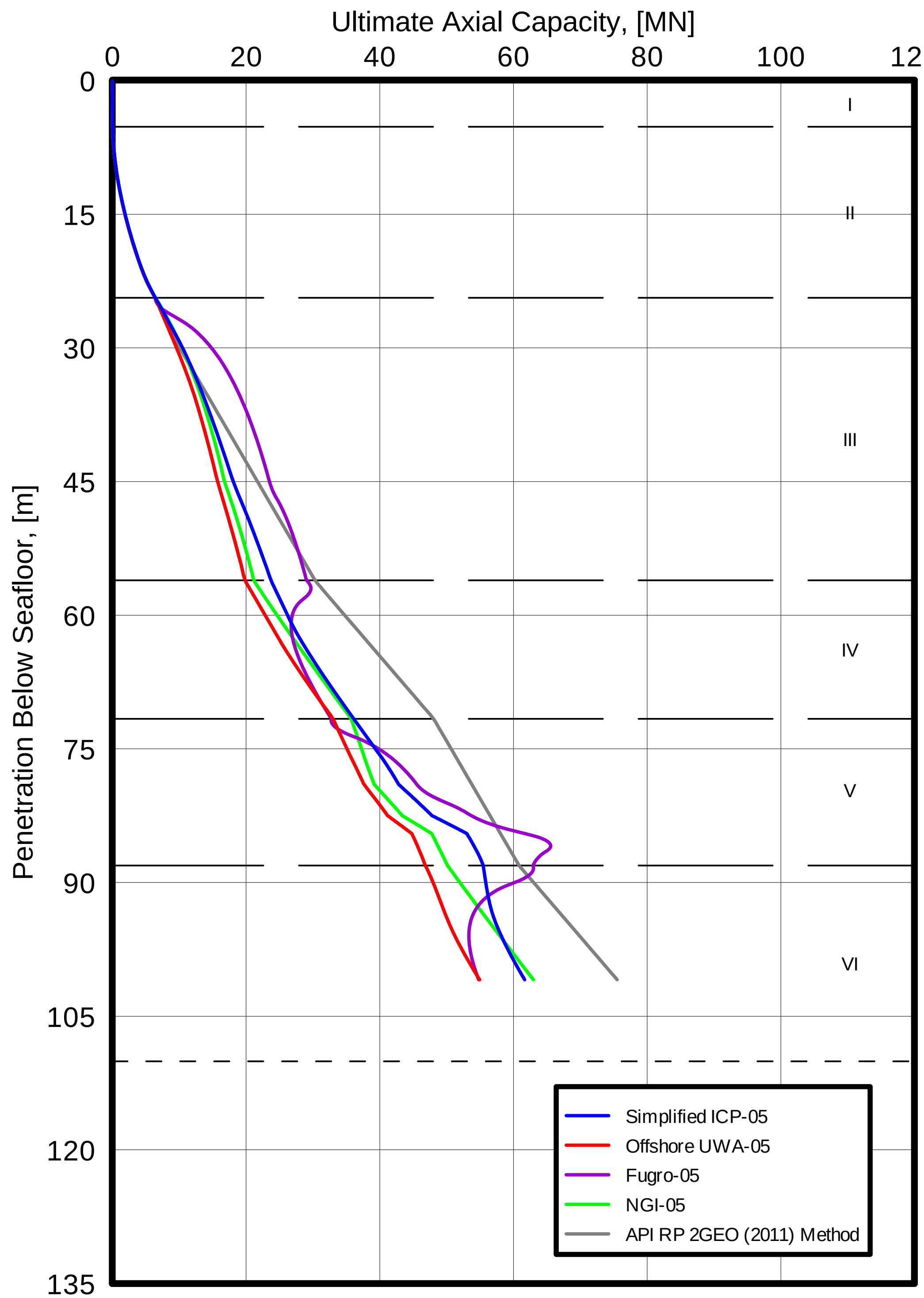
Date: Date:

Checked By: Approved By:



Date:
Drawn By:
Date:
Date:
Checked By:
Approved By:

ULTIMATE AXIAL CAPACITY
(TOTAL FRICTION CAPACITY IN TENSION)
API RP 2GEO (2011)
3048-mm (120-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia



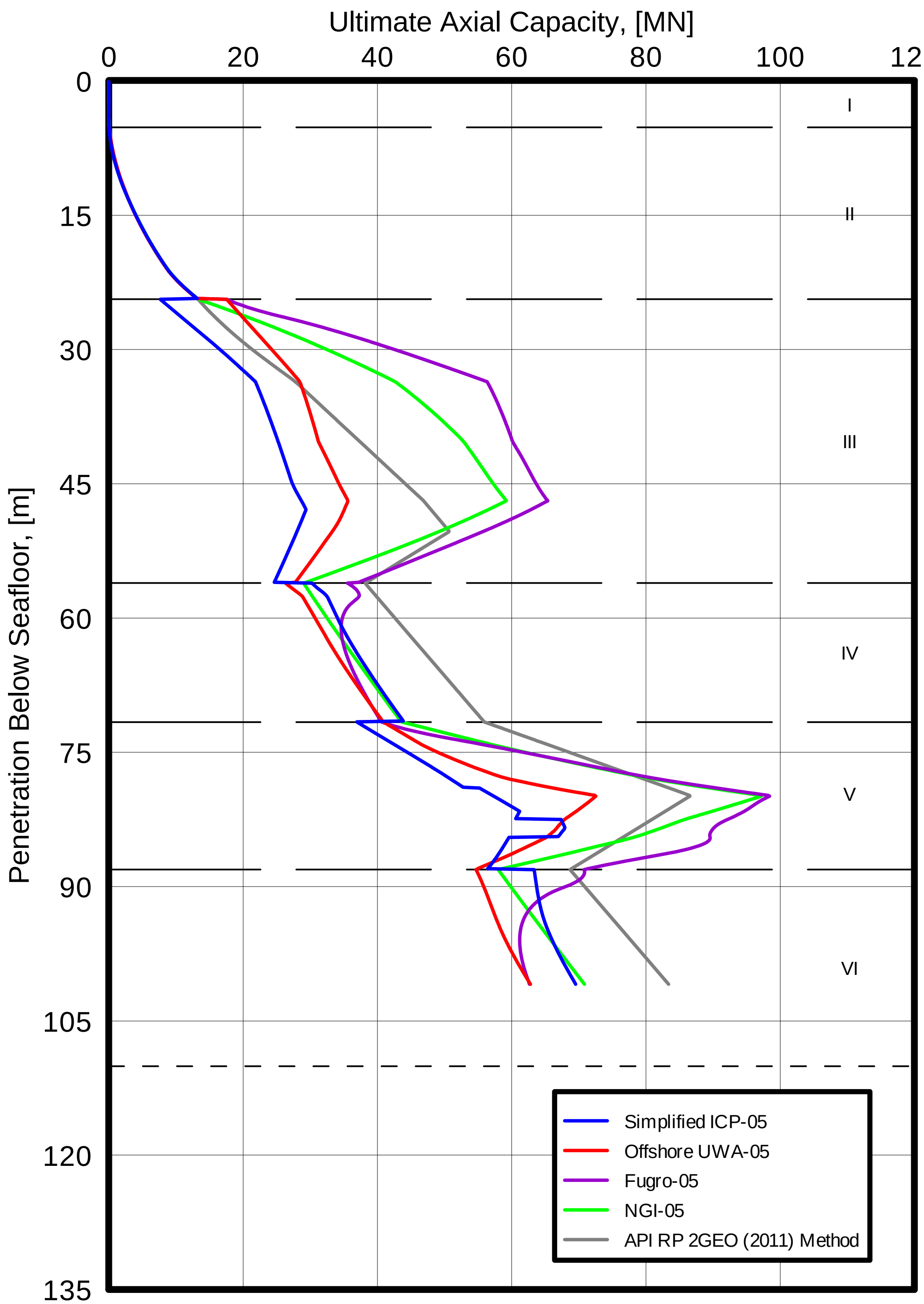
Date:

Drawn By:

Date: Date:

Checked By: Approved By:

ULTIMATE AXIAL CAPACITY
(TOTAL FRICTION CAPACITY IN COMPRESSION)
API RP 2GEO (2011)
3048-mm (120-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia



ULTIMATE AXIAL CAPACITY
(COMPRESSION)

API RP 2GEO (2011)
3048-mm (120-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

Date:
Drawn By:
Date:
Date:
Checked By:
Approved By:

PENETRATION BELOW MUDLINE (m)		CURVE POINTS							
		1	2	3	4	5	6	7	8
0.00	t	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
5.18	t	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
5.18	t	0.0	1.1	1.8	2.6	3.2	3.5	3.2	3.2
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
5.79	t	0.0	2.0	3.3	5.0	6.0	6.6	6.0	6.0
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
10.97	t	0.0	6.9	11.6	17.3	20.8	23.1	20.8	20.8
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
11.28	t	0.0	7.2	12.1	18.1	21.7	24.1	21.7	21.7
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
21.34	t	0.0	15.3	25.5	38.2	45.9	51.0	45.9	45.9
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
24.38	t	0.0	25.2	42.0	63.0	75.6	84.0	75.6	75.6
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
24.38	t	0.0	17.4	29.0	43.5	52.2	58.0	58.0	58.0
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
31.09	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
56.08	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
56.08	t	0.0	35.0	58.3	87.4	104.9	116.6	104.9	104.9
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
58.83	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
71.63	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
71.63	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
88.09	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
88.09	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0
110.06	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	2.4	4.7	8.7	12.2	15.2	30.5	1524.0

Notes: 1. "t" is mobilized soil-pile adhesion, [kPa].
2. "z" is axial pile displacement, [mm].
3. Data for tension and compression coincide.

AXIAL LOAD TRANSFER DATA
(T-Z DATA)
API RP 2GEO (2011)
1524-mm (60-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

Date:
Drawn By:
Date: Date:
Checked By: Approved By:

PENETRATION BELOW MUDLINE (m)		CURVE POINTS						
		1	2	3	4	5	6	7
24.38	Q	0.000	0.707	1.415	2.122	2.547	2.830	2.830
	z	0.0	3.0	19.8	64.0	111.3	152.4	1524.0
28.96	Q	0.000	1.322	2.643	3.965	4.758	5.287	5.287
	z	0.0	3.0	19.8	64.0	111.3	152.4	1524.0
30.48	Q	0.000	1.469	2.939	4.408	5.289	5.877	5.877
	z	0.0	3.0	19.8	64.0	111.3	152.4	1524.0
33.53	Q	0.000	1.777	3.554	5.331	6.397	7.108	7.108
	z	0.0	3.0	19.8	64.0	111.3	152.4	1524.0
38.10	Q	0.000	2.184	4.367	6.551	7.861	8.734	8.734
	z	0.0	3.0	19.8	64.0	111.3	152.4	1524.0
51.51	Q	0.000	2.184	4.367	6.551	7.861	8.734	8.734
	z	0.0	3.0	19.8	64.0	111.3	152.4	1524.0
56.08	Q	0.000	0.491	0.983	1.474	1.769	1.965	1.965
	z	0.0	3.0	19.8	64.0	111.3	152.4	1524.0
71.63	Q	0.000	0.491	0.983	1.474	1.769	1.965	1.965
	z	0.0	3.0	19.8	64.0	111.3	152.4	1524.0
76.20	Q	0.000	2.184	4.367	6.551	7.861	8.734	8.734
	z	0.0	3.0	19.8	64.0	111.3	152.4	1524.0
83.52	Q	0.000	2.184	4.367	6.551	7.861	8.734	8.734
	z	0.0	3.0	19.8	64.0	111.3	152.4	1524.0
88.09	Q	0.000	0.491	0.983	1.474	1.769	1.965	1.965
	z	0.0	3.0	19.8	64.0	111.3	152.4	1524.0
110.06	Q	0.000	0.491	0.983	1.474	1.769	1.965	1.965
	z	0.0	3.0	19.8	64.0	111.3	152.4	1524.0

Notes: 1. "Q" is mobilized end bearing capacity, [MN].
2. "z" is axial tip displacement, [mm].

AXIAL LOAD TRANSFER DATA
(Q-Z DATA)
API RP 2GEO (2011)
1524-mm (60-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

Date: Drawn By: Date: Date: Checked By: Approved By:

PENETRATION BELOW MUDLINE (m)		CURVE POINTS							
		1	2	3	4	5	6	7	8
0.00	t	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
5.18	t	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
5.18	t	0.0	1.1	1.8	2.6	3.2	3.5	3.2	3.2
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
5.79	t	0.0	2.0	3.3	5.0	6.0	6.6	6.0	6.0
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
10.97	t	0.0	6.9	11.6	17.3	20.8	23.1	20.8	20.8
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
11.28	t	0.0	7.2	12.1	18.1	21.7	24.1	21.7	21.7
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
21.34	t	0.0	15.3	25.5	38.2	45.9	51.0	45.9	45.9
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
24.38	t	0.0	25.2	42.0	63.0	75.6	84.0	75.6	75.6
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
24.38	t	0.0	17.4	29.0	43.5	52.2	58.0	58.0	58.0
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
31.09	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
56.08	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
56.08	t	0.0	35.0	58.3	87.4	104.9	116.6	104.9	104.9
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
58.83	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
71.63	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
71.63	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
88.09	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
88.09	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8
110.06	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	2.9	5.7	10.4	14.6	18.3	36.6	1828.8

Notes: 1. "t" is mobilized soil-pile adhesion, [kPa].
2. "z" is axial pile displacement, [mm].
3. Data for tension and compression coincide.

AXIAL LOAD TRANSFER DATA
(T-Z DATA)
API RP 2GEO (2011)
1829-mm (72-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

Date: Drawn By: Date: Date: Checked By: Approved By:

PENETRATION BELOW MUDLINE (m)		CURVE POINTS						
		1	2	3	4	5	6	7
24.38	Q	0.000	1.019	2.037	3.056	3.667	4.075	4.075
	z	0.0	3.7	23.8	76.8	133.5	182.9	1828.8
29.87	Q	0.000	1.709	3.419	5.128	6.154	6.837	6.837
	z	0.0	3.7	23.8	76.8	133.5	182.9	1828.8
42.67	Q	0.000	3.144	6.289	9.433	11.319	12.577	12.577
	z	0.0	3.7	23.8	76.8	133.5	182.9	1828.8
50.60	Q	0.000	3.144	6.289	9.433	11.319	12.577	12.577
	z	0.0	3.7	23.8	76.8	133.5	182.9	1828.8
56.08	Q	0.000	0.707	1.415	2.122	2.547	2.830	2.830
	z	0.0	3.7	23.8	76.8	133.5	182.9	1828.8
71.63	Q	0.000	0.707	1.415	2.122	2.547	2.830	2.830
	z	0.0	3.7	23.8	76.8	133.5	182.9	1828.8
77.11	Q	0.000	3.144	6.289	9.433	11.319	12.577	12.577
	z	0.0	3.7	23.8	76.8	133.5	182.9	1828.8
82.60	Q	0.000	3.144	6.289	9.433	11.319	12.577	12.577
	z	0.0	3.7	23.8	76.8	133.5	182.9	1828.8
88.09	Q	0.000	0.707	1.415	2.122	2.547	2.830	2.830
	z	0.0	3.7	23.8	76.8	133.5	182.9	1828.8
110.06	Q	0.000	0.707	1.415	2.122	2.547	2.830	2.830
	z	0.0	3.7	23.8	76.8	133.5	182.9	1828.8

Notes: 1. "Q" is mobilized end bearing capacity, [MN].
2. "z" is axial tip displacement, [mm].

AXIAL LOAD TRANSFER DATA
(Q-Z DATA)
API RP 2GEO (2011)
1829-mm (72-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

Date: Drawn By: Date: Date: Checked By: Approved By:

Date:

Drawn By:

Date:

Date:

Checked By:

Approved By:

PENETRATION BELOW MUDLINE (m)		CURVE POINTS							
		1	2	3	4	5	6	7	8
0.00	t	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
5.18	t	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
5.18	t	0.0	1.1	1.8	2.6	3.2	3.5	3.2	3.2
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
5.79	t	0.0	2.0	3.3	5.0	6.0	6.6	6.0	6.0
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
10.97	t	0.0	6.9	11.6	17.3	20.8	23.1	20.8	20.8
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
11.28	t	0.0	7.2	12.1	18.1	21.7	24.1	21.7	21.7
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
21.34	t	0.0	15.3	25.5	38.2	45.9	51.0	45.9	45.9
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
24.38	t	0.0	25.2	42.0	63.0	75.6	84.0	75.6	75.6
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
24.38	t	0.0	17.4	29.0	43.5	52.2	58.0	58.0	58.0
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
31.09	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
56.08	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
56.08	t	0.0	35.0	58.3	87.4	104.9	116.6	104.9	104.9
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
58.83	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
71.63	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
71.63	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
88.09	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
88.09	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2
110.06	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	4.4	8.5	15.6	21.9	27.4	54.9	2743.2

Notes: 1. "t" is mobilized soil-pile adhesion, [kPa].
2. "z" is axial pile displacement, [mm].
3. Data for tension and compression coincide.

AXIAL LOAD TRANSFER DATA

(T-Z DATA)

API RP 2GEO (2011)

2743-mm (108-in.)-Diameter Driven Pipe Piles

Boring: BH-T1A

Offshore Virginia

PENETRATION BELOW MUDLINE (m)		CURVE POINTS						
		1	2	3	4	5	6	7
24.38	Q	0.000	1.613	3.226	4.839	5.806	6.452	6.452
	z	0.0	5.5	35.7	115.2	200.3	274.3	2743.2
32.61	Q	0.000	3.307	6.614	9.921	11.905	13.228	13.228
	z	0.0	5.5	35.7	115.2	200.3	274.3	2743.2
47.85	Q	0.000	5.854	11.707	17.561	21.073	23.414	23.414
	z	0.0	5.5	35.7	115.2	200.3	274.3	2743.2
56.08	Q	0.000	1.592	3.184	4.775	5.730	6.367	6.367
	z	0.0	5.5	35.7	115.2	200.3	274.3	2743.2
71.63	Q	0.000	1.592	3.184	4.775	5.730	6.367	6.367
	z	0.0	5.5	35.7	115.2	200.3	274.3	2743.2
79.86	Q	0.000	7.075	14.149	21.224	25.469	28.298	28.298
	z	0.0	5.5	35.7	115.2	200.3	274.3	2743.2
88.09	Q	0.000	1.592	3.184	4.775	5.730	6.367	6.367
	z	0.0	5.5	35.7	115.2	200.3	274.3	2743.2
110.06	Q	0.000	1.592	3.184	4.775	5.730	6.367	6.367
	z	0.0	5.5	35.7	115.2	200.3	274.3	2743.2

Notes: 1. "Q" is mobilized end bearing capacity, [MN].
2. "z" is axial tip displacement, [mm].

AXIAL LOAD TRANSFER DATA
(Q-Z DATA)
API RP 2GEO (2011)
2743-mm (108-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

Date: Drawn By: Date: Date: Checked By: Approved By:

PENETRATION BELOW MUDLINE (m)		CURVE POINTS							
		1	2	3	4	5	6	7	8
0.00	t	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
5.18	t	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
5.18	t	0.0	1.1	1.8	2.6	3.2	3.5	3.2	3.2
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
5.79	t	0.0	2.0	3.3	5.0	6.0	6.6	6.0	6.0
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
10.97	t	0.0	6.9	11.6	17.3	20.8	23.1	20.8	20.8
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
11.28	t	0.0	7.2	12.1	18.1	21.7	24.1	21.7	21.7
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
21.34	t	0.0	15.3	25.5	38.2	45.9	51.0	45.9	45.9
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
24.38	t	0.0	25.2	42.0	63.0	75.6	84.0	75.6	75.6
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
24.38	t	0.0	17.4	29.0	43.5	52.2	58.0	58.0	58.0
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
31.09	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
56.08	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
56.08	t	0.0	35.0	58.3	87.4	104.9	116.6	104.9	104.9
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
58.83	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
71.63	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
71.63	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
88.09	t	0.0	24.4	40.7	61.0	73.3	81.4	81.4	81.4
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
88.09	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0
110.06	t	0.0	35.9	59.9	89.8	107.7	119.7	107.7	107.7
	z	0.0	4.9	9.4	17.4	24.4	30.5	61.0	3048.0

Notes: 1. "t" is mobilized soil-pile adhesion, [kPa].
2. "z" is axial pile displacement, [mm].
3. Data for tension and compression coincide.

AXIAL LOAD TRANSFER DATA
(T-Z DATA)
API RP 2GEO (2011)
3048-mm (120-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

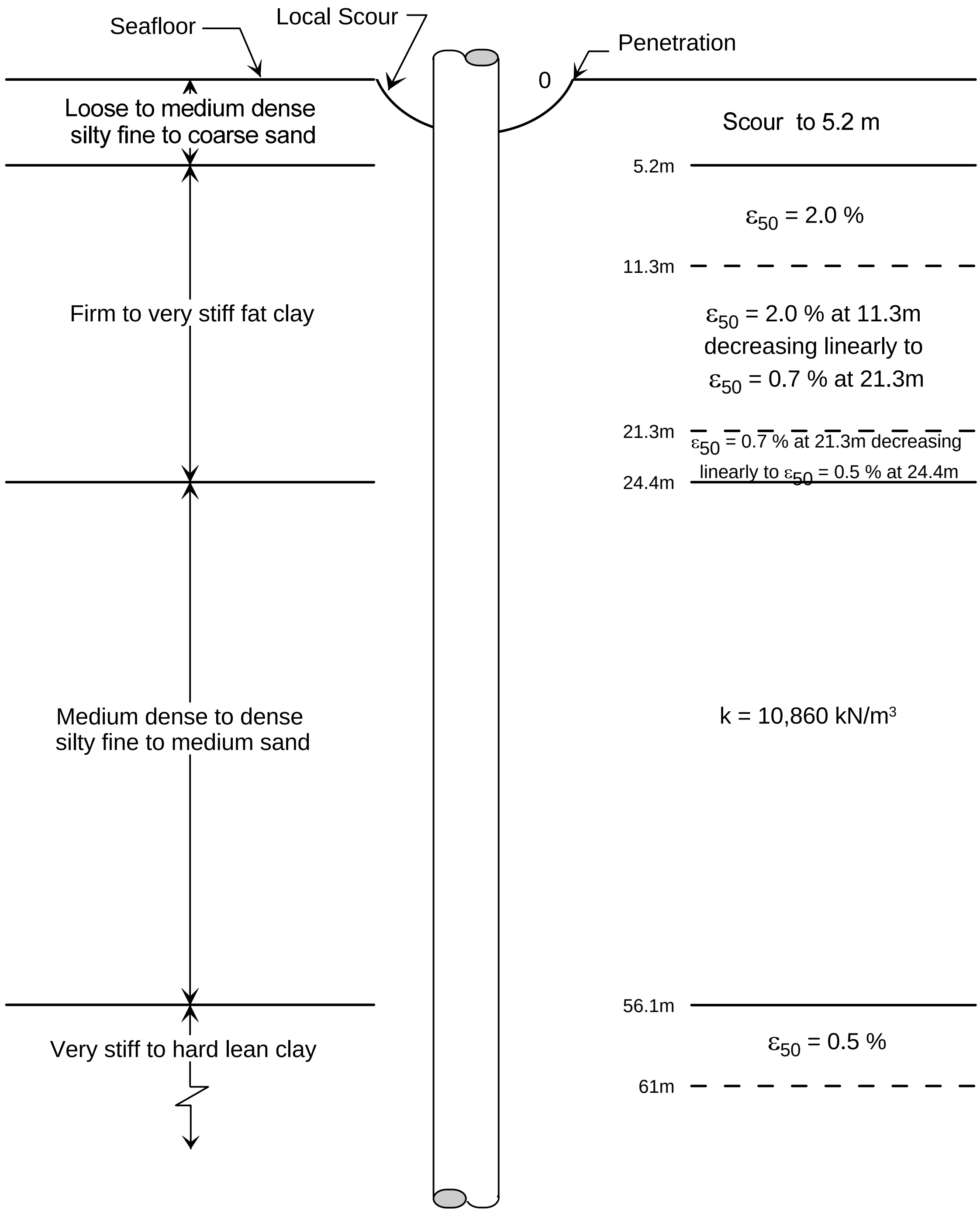
Date: Drawn By: Date: Date: Checked By: Approved By:

PENETRATION BELOW MUDLINE (m)		CURVE POINTS						
		1	2	3	4	5	6	7
24.38	Q	0.000	1.827	3.653	5.480	6.576	7.307	7.307
	z	0.0	6.1	39.6	128.0	222.5	304.8	3048.0
33.53	Q	0.000	3.974	7.948	11.921	14.306	15.895	15.895
	z	0.0	6.1	39.6	128.0	222.5	304.8	3048.0
46.94	Q	0.000	6.441	12.882	19.323	23.188	25.765	25.765
	z	0.0	6.1	39.6	128.0	222.5	304.8	3048.0
56.08	Q	0.000	1.965	3.930	5.895	7.075	7.861	7.861
	z	0.0	6.1	39.6	128.0	222.5	304.8	3048.0
71.63	Q	0.000	1.965	3.930	5.895	7.075	7.861	7.861
	z	0.0	6.1	39.6	128.0	222.5	304.8	3048.0
79.86	Q	0.000	8.057	16.114	24.172	29.006	32.229	32.229
	z	0.0	6.1	39.6	128.0	222.5	304.8	3048.0
88.09	Q	0.000	1.965	3.930	5.895	7.075	7.861	7.861
	z	0.0	6.1	39.6	128.0	222.5	304.8	3048.0
110.06	Q	0.000	1.965	3.930	5.895	7.075	7.861	7.861
	z	0.0	6.1	39.6	128.0	222.5	304.8	3048.0

Notes: 1. "Q" is mobilized end bearing capacity, [MN].
2. "z" is axial tip displacement, [mm].

AXIAL LOAD TRANSFER DATA
(Q-Z DATA)
API RP 2GEO (2011)
3048-mm (120-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

Date: Drawn By: Date: Date: Checked By: Approved By:



Notes:

1. ε_{50} is axial strain at half of peak deviator stress for cohesive soils.
2. Design strength parameters are shown on Plate 1.
3. Design submerged unit weights are shown on Plate 2.
4. k is the modulus of horizontal subgrade reaction for siliceous granular soils.

STRATIGRAPHY AND PARAMETERS FOR P-Y DATA

Boring: BH-T1A
Offshore Virginia

Date: Drawn By: Date: Date: Checked By: Approved By:

PENETRATION BELOW MUDLINE (m)		CURVE POINTS							
		1	2	3	4	5	6	7	8
0.00	p	0	0						
	y	0.0	1524.0						
5.18	p	0	0						
	y	0.0	1524.0						
5.18	p	0	10	15	22	33	47	0	0
	y	0.0	2.1	7.6	22.9	76.2	228.6	1143.0	1524.0
6.71	p	0	29	45	67	98	141	62	62
	y	0.0	2.1	7.6	22.9	76.2	228.6	1143.0	1524.0
8.23	p	0	46	70	104	153	221	127	127
	y	0.0	2.1	7.6	22.9	76.2	228.6	1143.0	1524.0
9.75	p	0	64	99	146	215	309	213	213
	y	0.0	2.1	7.6	22.9	76.2	228.6	1143.0	1524.0
11.28	p	0	84	130	191	282	405	319	319
	y	0.0	2.1	7.6	22.9	76.2	228.6	1143.0	1524.0
12.80	p	0	101	155	229	337	485	432	432
	y	0.0	1.9	6.9	20.6	68.7	206.1	1030.4	1524.0
14.63	p	0	121	186	275	405	583	583	
	y	0.0	1.6	6.0	17.9	59.7	179.1	1524.0	
15.85	p	0	130	199	294	433	623	623	
	y	0.0	1.4	5.4	16.1	53.7	161.1	1524.0	
20.42	p	0	161	247	365	537	774	774	
	y	0.0	0.8	3.1	9.4	31.2	93.5	1524.0	
21.34	p	0	167	257	380	558	804	804	
	y	0.0	0.7	2.7	8.0	26.7	80.0	1524.0	
24.38	p	0	355	544	804	1182	1702	1702	
	y	0.0	0.5	1.9	5.7	19.1	57.2	1524.0	
24.38	p	0	1839	3065	4046	5088	5823	6068	6130
	y	0.0	7.2	12.7	18.4	27.5	42.4	61.3	1524.0
30.48 (and below)	p	0	2518	4197	5541	6968	7975	8311	8395
	y	0.0	7.9	13.9	20.1	30.1	46.5	67.1	1524.0

Notes: 1. "p" is soil resistance, [kN/m].
2. "y" is lateral deflection, [mm].

Date:
Drawn By:
Date:
Date:
Checked By:
Approved By:

P-Y DATA
(CYCLIC LOADING)
API RP 2GEO (2011)
1524-mm (60-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

PENETRATION BELOW MUDLINE (m)		CURVE POINTS							
		1	2	3	4	5	6	7	8
0.00	p	0	0						
	y	0.0	1828.8						
5.18	p	0	0						
	y	0.0	1828.8						
5.18	p	0	12	18	27	39	57	0	0
	y	0.0	2.5	9.1	27.4	91.4	274.3	1371.6	1828.8
7.01	p	0	36	56	83	122	175	71	71
	y	0.0	2.5	9.1	27.4	91.4	274.3	1371.6	1828.8
8.84	p	0	59	91	134	197	283	153	153
	y	0.0	2.5	9.1	27.4	91.4	274.3	1371.6	1828.8
10.06	p	0	76	116	171	252	363	223	223
	y	0.0	2.5	9.1	27.4	91.4	274.3	1371.6	1828.8
11.28	p	0	93	143	211	311	448	306	306
	y	0.0	2.5	9.1	27.4	91.4	274.3	1371.6	1828.8
13.11	p	0	115	176	260	383	551	436	436
	y	0.0	2.2	8.1	24.2	80.6	241.9	1209.5	1828.8
14.94	p	0	138	212	313	460	662	593	593
	y	0.0	1.9	7.0	20.9	69.8	209.5	1047.4	1828.8
17.07	p	0	166	254	376	553	796	796	
	y	0.0	1.5	5.7	17.2	57.2	171.7	1828.8	
18.59	p	0	178	274	404	595	856	856	
	y	0.0	1.3	4.8	14.5	48.2	144.6	1828.8	
21.34	p	0	201	308	456	670	965	965	
	y	0.0	0.9	3.2	9.6	32.0	96.0	1828.8	
24.38	p	0	426	653	965	1419	2043	2043	
	y	0.0	0.6	2.3	6.9	22.9	68.6	1828.8	
24.38	p	0	2161	3602	4755	5980	6845	7133	7205
	y	0.0	8.4	14.9	21.6	32.3	49.8	72.0	1828.8
24.99	p	0	2288	3814	5034	6331	7246	7551	7627
	y	0.0	8.7	15.4	22.3	33.4	51.5	74.4	1828.8
30.48 (and below)	p	0	3022	5037	6649	8361	9570	9973	10074
	y	0.0	9.4	16.7	24.1	36.2	55.8	80.6	1828.8

Notes: 1. "p" is soil resistance, [kN/m].
2. "y" is lateral deflection, [mm].

P-Y DATA

(CYCLIC LOADING)

API RP 2GEO (2011)

1829-mm (72-in.)-Diameter Driven Pipe Piles

Boring: BH-T1A

Offshore Virginia

Date: Drawn By: Date: Date: Checked By: Approved By:

PENETRATION BELOW MUDLINE (m)		CURVE POINTS							
		1	2	3	4	5	6	7	8
0.00	p y	0 0.0	0 2743.2						
5.18	p y	0 0.0	0 2743.2						
5.18	p y	0 0.0	18 3.7	27 13.7	40 41.1	59 137.2	85 411.5	0 2057.4	0 2743.2
7.92	p y	0 0.0	62 3.7	96 13.7	141 41.1	208 137.2	300 411.5	107 2057.4	107 2743.2
10.67	p y	0 0.0	108 3.7	166 13.7	246 41.1	361 137.2	520 411.5	252 2057.4	252 2743.2
11.28	p y	0 0.0	119 3.7	183 13.7	271 41.1	398 137.2	573 411.5	292 2057.4	292 2743.2
13.41	p y	0 0.0	150 3.2	230 11.8	340 35.5	500 118.2	721 354.7	437 1773.7	437 2743.2
16.15	p y	0 0.0	193 2.5	295 9.4	437 28.2	642 93.9	925 281.8	663 1409.0	663 2743.2
18.90	p y	0 0.0	239 1.9	366 7.0	542 20.9	797 69.6	1147 208.9	942 1044.3	942 2743.2
21.34	p y	0 0.0	283 1.3	434 4.8	642 14.4	944 48.0	1360 144.0	1237 720.1	1237 2743.2
24.38	p y	0 0.0	592 0.9	908 3.4	1342 10.3	1973 34.3	2841 102.9	2532 514.4	2532 2743.2
24.38	p y	0 0.0	2264 8.8	3773 15.7	4980 22.6	6263 33.9	7169 52.2	7470 75.4	7546 2743.2
29.87	p y	0 0.0	3603 11.5	6006 20.3	7928 29.4	9970 44.0	11411 67.8	11891 98.0	12011 2743.2
35.36	p y	0 0.0	5236 14.1	8727 25.0	11519 36.0	14486 54.0	16581 83.3	17279 120.3	17453 2743.2
37.49	p y	0 0.0	5940 15.1	9900 26.7	13068 38.6	16434 57.8	18810 89.1	19602 128.7	19800 2743.2
56.08	p y	0 0.0	9671 16.4	16118 29.1	21276 42.0	26756 62.9	30625 97.0	31914 140.1	32237 2743.2
56.08 (and below)	p y	0 0.0	443 0.9	680 3.4	1005 10.3	1478 34.3	2128 102.9	2128 2743.2	

Notes: 1. "p" is soil resistance, [kN/m].
2. "y" is lateral deflection, [mm].

P-Y DATA

(CYCLIC LOADING)

API RP 2GEO (2011)

2743-mm (108-in.)-Diameter Driven Pipe Piles

Boring: BH-T1A

Offshore Virginia

Date: Drawn By: Date: Date: Checked By: Approved By:

Date:

Drawn By:

Date: Date:

Checked By: Approved By:

PENETRATION BELOW MUDLINE (m)		CURVE POINTS							
		1	2	3	4	5	6	7	8
0.00	p	0	0						
	y	0.0	3048.0						
5.18	p	0	0						
	y	0.0	3048.0						
5.18	p	0	20	30	45	66	95	0	0
	y	0.0	4.1	15.2	45.7	152.4	457.2	2286.0	3048.0
8.23	p	0	73	111	164	242	348	122	122
	y	0.0	4.1	15.2	45.7	152.4	457.2	2286.0	3048.0
11.28	p	0	128	196	290	427	615	292	292
	y	0.0	4.1	15.2	45.7	152.4	457.2	2286.0	3048.0
14.33	p	0	175	269	397	584	841	505	505
	y	0.0	3.3	12.2	36.7	122.4	367.1	1835.7	3048.0
17.37	p	0	227	347	514	755	1087	773	773
	y	0.0	2.5	9.2	27.7	92.4	277.1	1385.5	3048.0
20.42	p	0	283	433	640	942	1356	1105	1105
	y	0.0	1.7	6.2	18.7	62.3	187.0	935.2	3048.0
21.34	p	0	300	460	681	1001	1441	1218	1218
	y	0.0	1.4	5.3	16.0	53.3	160.0	800.1	3048.0
24.38	p	0	623	955	1412	2076	2989	2442	2442
	y	0.0	1.0	3.8	11.4	38.1	114.3	571.5	3048.0
24.38	p	0	2298	3830	5055	6358	7277	7583	7660
	y	0.0	9.0	15.9	22.9	34.4	53.0	76.6	3048.0
26.52	p	0	2788	4647	6135	7715	8830	9202	9295
	y	0.0	10.0	17.7	25.6	38.4	59.1	85.4	3048.0
32.61	p	0	4434	7390	9755	12268	14042	14633	14781
	y	0.0	12.9	22.9	33.1	49.6	76.5	110.5	3048.0
38.71	p	0	6442	10736	14171	17822	20398	21257	21472
	y	0.0	15.8	28.1	40.5	60.7	93.6	135.2	3048.0
41.76	p	0	7551	12586	16613	20892	23913	24920	25171
	y	0.0	17.2	30.5	44.0	66.0	101.7	146.9	3048.0
56.08	p	0	10746	17909	23640	29729	34028	35460	35818
	y	0.0	18.2	32.3	46.6	69.9	107.7	155.7	3048.0
56.08	p	0	493	755	1116	1642	2364	2364	
	y	0.0	1.0	3.8	11.4	38.1	114.3	3048.0	
60.96 (and below)	p	0	493	755	1116	1642	2364	2364	
	y	0.0	1.0	3.8	11.4	38.1	114.3	3048.0	

Notes: 1. "p" is soil resistance, [kN/m].
2. "y" is lateral deflection, [mm].

P-Y DATA
(CYCLIC LOADING)
API RP 2GEO (2011)
3048-mm (120-in.)-Diameter Driven Pipe Piles
Boring: BH-T1A
Offshore Virginia

APPENDIX A

ANALYTICAL PROCEDURES

ANALYTICAL PROCEDURES
CONTENTS

ILLUSTRATIONS

CRITERIA FOR AXIAL PILE LOAD ANALYSIS

In this report, "pile" is used as a generic term for foundation piles, caissons and conductors. The installation of caissons and conductors is the same as that of foundation piles, except that the soil plug is later removed or disturbed, thus reducing the end bearing component. For this reason, the end bearing of caissons and conductors is neglected in capacity computations.

Method of Analysis

The static method of computing axial pile capacity described in API RP 2GEO (2011) is used to compute ultimate compressive and tensile capacities of pipe piles installed to a given penetration. In this method, the ultimate compressive capacity, Q, for a given penetration is taken as the sum of the skin friction on the pile wall, Q_s, and the end bearing on the pile tip, Q_p, so that:

$$Q = Q_s + Q_p = fA_s + qA_p$$

where A_s and A_p represent, respectively, the embedded surface area and pile end area; f and q represent, respectively, the unit skin friction and unit end bearing. Procedures used to compute values of f and q are discussed in the following paragraphs. When computing ultimate tensile capacity or compressive capacity of conductors and caissons, the end bearing term in the above equation is neglected.

Unit Skin Friction

Cohesive Soils. Computation of Q_s for pipe piles embedded in cohesive soils is done in accordance with the API RP 2GEO method (Sec. 8.1.3). The unit skin friction (f) may be expressed as:

$$f = \alpha S_u$$

where: α = a dimensionless factor; and

S_u = undrained shear strength of the soil at the point in question.

The factor α is computed by:

$$\alpha = 0.5\, \psi^{-0.5} \quad \text{for } \psi \leq 1.0, \text{ or}$$

$$\alpha = 0.5\, \psi^{-0.25} \quad \text{for } \psi > 1.0$$

with the constraint that $\alpha \leq 1.0$,

where: ψ = S_u/σ'_v at the point in question, and

σ'_{vo} = effective vertical stress at the point in question.

The undrained shear strength used in our computations and the values of submerged unit weight used to compute effective vertical stress are presented in the main report along with the resulting skin friction values.

Granular Soils. The procedure recommended by API RP 2GEO, Sec. 8.1.4 is used to determine unit skin friction in granular soils. Unit skin friction (f) for granular soils is computed from the expression:

$$f = K \sigma'_v \tan \delta$$

where: K = coefficient of lateral earth pressure,

σ'_{vo} = effective vertical stress at the point in question, and

δ = angle of friction between soil and pile.

API RP 2GEO introduces a shaft friction factor, β**,** equivalent to $K\tan\delta$ from previous editions of API RP 2A. Plate A-1 presents β using values for K of 0.8 for open-ended piles driven unplugged and values of δ recommended in prior editions of API RP 2A. The recommended values of δ and limiting values of unit skin friction, which are for granular soils composed primarily of silica, are related to the relative density of the formation and gradation of soil grains, and are presented on Plate A-1. Values from Plate A-1 are selected on the basis of grain-size analyses and relative density interpreted from PCPT data (if performed) and from the number of blows required to advance the sampler into the soils. The δ values used in our computations and the values of submerged unit weight used to compute the effective vertical stress are presented in the main text illustrations.

Unit End Bearing

Cohesive Soils. The procedure recommended by API RP 2GEO (Sec. 8.1.3) is used to determine unit end bearing, q, in clays. Unit end bearing (q) in clays can be estimated by the following equation:

$$q = 9 \ S_u$$

where: S_u = undrained shear strength.

Granular Soils. Unit end bearing (q) in granular soils is computed by API RP 2GEO (Sec. 8.1.4) using the expression:

$$q = \sigma'_v N_q$$

where: σ'_{vo} = effective vertical stress at the point in question, and

N_q = a dimensionless bearing capacity factor that is a function of ϕ, the angle of internal friction of the material.

Recommended bearing capacity factors (N_q) for granular soils composed primarily of silica given by API RP 2GEO and used in our computations are presented on Plate A-1. Also shown on Plate A-1 are the limiting unit end bearing values. In this static method of analysis, the ultimate compressive capacity of a pipe pile for a given penetration is taken as the sum of the skin friction on the pile wall and the end bearing on the pile tip. The undrained shear strength and N_q values used in our computations and the values of submerged unit weight used to compute the effective vertical stress are presented in the main text illustrations.

Equivalent Unit End Bearing. For open-ended driven pipe piles, the end bearing is limited to the frictional resistance of a soil plug developed inside the pile. The total skin friction on the inside of the pile is assumed equal to the total skin friction on the outside of the pile. Any influence of the driving shoe on the internal skin friction is neglected. The end bearing on the steel end area of the pile is also neglected. The assumptions made in the analyses make no difference in the unit end bearing below the point where the pile plugs (i.e., equivalent unit end bearing becomes equal to unit end bearing). Above this point, the unit end bearing is limited by the frictional resistance of the soil plug.

CRITERIA FOR CPT-BASED METHODS FOR PILE CAPACITY

Previous paragraphs discuss a simple method for assessing pile capacity in cohesionless soils. When detailed site specific CPT records are available, the following pile capacity methods are recommended. Four methods of CPT-based design are recommended in the API RP 2GEO (2011), for assessing pile capacity in granular material. More experience is required with these methods before a single one can be recommended for routine design. Caution and considerable engineering judgment should be exercised when selecting appropriate methods and design parameters, and when considering factors of safety discussed in the main text. The four methods are:

Simplified ICP-05;
Offshore UWA-05;
Fugro-05; and
NGI-05.

Ultimate Bearing Capacity

Following are the design equations for the four CPT-based methods for assessing pile capacity in sand. It is assumed that friction and end bearing components are uncoupled. According to API RP 2GEO (2011), Sec. C.8.1.4.2.1 ultimate bearing capacity in compression (Q_d) and tensile capacity (Q_t) of plugged open-ended piles are determined by the following equations:

$$Q_d = Q_f + Q_p = P_o \int f_{c,z} dz + A_p q_p$$

$$Q_t = P_o \int f_{t,z} dz$$

where Q_f and Q_p represent, respectively, pile ultimate skin friction capacity in compression and ultimate end bearing resistance; P_o represents the pile outer perimeter; $f_{c,z}$ and $f_{t,z}$ represents, respectively, the pile-soil unit skin friction capacity in compression and tension, a function of depth (z) and pile geometry; A_p represents the pile gross end area and q_p represents the unit end bearing at the pile tip embedment depth (fully plugged).

Unit Skin Friction. The unit skin friction (f_z) formulas for open-ended steel pile pipes for the following CPT-based design methods, Simplified ICP-05, Offshore UWA-05 and Fugro-05, can be considered as special cases of the general formula below (API RP 2GEO (2011), Sec. C.8.1.4.2.1):

$$f_z = u\, q_{c,z}\, (\sigma'_{v,o} / p_a)^a\, A_r^{\,b}\, [\max((L-z) / D), v]^{-c}\, [\tan \delta_{cv}]^d \times [\min(((L-z) / D)\, (1/v), 1)]^e$$

where $q_{c,z}$ represents the CPT cone tip resistance q_c at depth z; $\sigma'_{v,o}$ represents the soil effective vertical in-situ stress at depth z; p_a equals atmospheric pressure; A_r represents the pile displacement ratio, $1-(D_i/D_o)^2$; L represents the pile embedment length (below original seabed); D represents the pile outer diameter; δ_{cv} represents the pile-soil constant volume interface friction angle; and D_i and D_o represent the inside and outside pipe diameters, respectively. Recommended values for the parameters a, b, c, d, e, u, and v for compression and tension are given in the following table.

CPT-Based Method	Parameter						
	a	b	c	d	e	u	
Simplified ICP-05							
compression	0.1	0.2	0.4	1	0	0.023	$4A_r^{0.5}$
tension	0.1	0.2	0.4	1	0	0.016	$4A_r^{0.5}$
Offshore UWA-05							
compression	0	0.3	0.5	1	0	0.030	2
tension	0	0.3	0.5	1	0	0.022	2
Fugro-05							
compression	0.05	0.45	0.90	0	1	0.043	$2A_r^{0.5}$
tension	0.15	0.42	0.85	0	0	0.025	$2A_r^{0.5}$

Ultimate unit skin friction values for tension ($f_{t,z}$) and compression ($f_{c,z}$) for the NGI-05 method are given below (API RP 2GEO (2011), Sec. C.8.1.4.2.5.1):

$$f_{t,z} = (z/L)p_a F_{sig} F_{Dr} > 0.1\sigma'_{v,o}$$

$$f_{c,z} = 1.3(z/L)p_a F_{sig} F_{Dr} > 0.1\sigma'_{v,o}$$

where: $F_{sig} = (\sigma'_{v,o}/p_a)^{0.25}$

$$F_{Dr} = 2.1(D_r - 0.1)^{1.7}$$

$$D_r = 0.4\ln[q_{c,z}/(22(\sigma'_{v,o}p_a)^{0.5})] > 0.1$$

D_r = sand relative density (0-1).

Unit End Bearing. The ultimate unit end bearing for plugged open-ended pipe piles, q_p, computed by the four CPT-based methods are given below.

The following equation is used for the Simplified ICP-05 method (API RP 2GEO (2011), Sec. C.8.1.4.2.2.2):

$$q_p = q_{c,av,1.5D}(0.5 - 0.25\log_{10}(D/D_{CPT})) \geq 0.15q_{c,av,1.5D}$$

where $q_{c,av,1.5D}$ = average $q_{c,z}$ value between $1.5D_o$ above pile tip to $1.5D_o$ below pile tip. The equation is only valid if the pile is considered plugged as specified by the following conditions:

$$D_i < 2(Dr - 0.3)$$

$D_i / D_{CPT} < 0.083 q_{c,z} / p_a$.

If either condition is not met, then the pile will behave unplugged and the following equation should be used:

$$Q_p = 3.14WT(D_o - WT)q_{c,z}$$

where WT is the pile wall thickness at the pile tip (including drive shoe).

The following equation is used for the Offshore UWA-05 method (API RP 2GEO (2011), Sec. C.8.1.4.2.3.2):

$$q_p = q_{c,av,1.5D}(0.15 + 0.45A_r)$$

The following equation is used for the Fugro-05 method (API RP 2GEO (2011), Sec. C.8.1.4.2.4.2):

$$q_p = 8.5p_a(q_{c,av,1.5D}/p_a)^{0.5} A_r^{0.25}$$

limited to: $Q_p \leq Q_{f,i,clay}e^{L_s/D}$

where: L_s is the length of the sand plug.

The following equation is used for the NGI-05 method (API RP 2GEO (2011), Sec. C.8.1.4.2.5.2):

$$q_p = (0.7\, q_{c,av,1.5D})/(1 + 3D_r^2)$$

where: $D_r = 0.4\ln[q_{c,av,1.5D} / (22(\sigma'_{v,o}p_a)^{0.5})] > 0.1$

Additional recommendations for computing unit skin friction and end bearing of all four CPT-based methods are presented in API RP 2GEO (2011).

Discussions

Piles described in this section on CPT-based methods for pile capacity are assumed to be open-ended pipe piles of uniform outer diameter. These piles generally act as fully plugged while under static loading. Friction and end bearing should not be taken from different methods. Caution should be taken in use of q_c and $q_{c,av,1.5D}$ parameters, based on quality and continuity of CPT data, soil variability and CPT "max outs". Lehane et al. (2005) suggests alternatives on selection of an appropriate q_c average for use in place of $q_{c,av,1.5D}$. CPT-based methods should only be used by qualified engineers with CPT interpretation experience and with an understanding of the limitations and reliability of these CPT-based methods. The δ_{cv} parameter should be measured directly in laboratory interface shear tests. If site specific test data are not available, δ_{cv} can be estimated based on mean effective particle diameter (D_{50}), with an upper limit of $\tan \delta_{cv} = 0.55$ ($\delta_{cv} = 28.8$ degrees). API RP 2GEO (2011), Figure C.1, presents this relationship.

CRITERIA FOR AXIAL LOAD TRANSFER DATA

An axial load-pile movement analysis requires load transfer data on the skin friction along the side of the pile (t-z data) and the end bearing on the pile tip (Q-z data). Recommended procedures are given in API RP 2GEO (2011).

Side Load Transfer (t-z) Data

Axial side load transfer curves are different for cohesive soils (clay) and granular soils (sand). Typical axial side load transfer-displacement (t-z) curves for both material types are illustrated on Plate A-2 and discussed below.

Cohesive Soils. The side friction versus pile movement (t-z) curve for cohesive soils is given in API RP 2GEO (2011), Sec. 8.4.2, and is the same for compressive and tensile loading. The maximum side friction, t_{max}, at the pile-soil interface is taken as the ultimate unit skin friction, f, as determined by API RP 2GEO (2011).

The post peak adhesion ratio for clays can range from 0.90 to 0.70 for highly plastic, normally consolidated clays, to as low as 0.50 for low plasticity, highly over consolidated clays. The recommended adhesion ratios beyond peak values for static loading conditions are given in the report text.

Granular Soils. The side friction versus pile movement (t-z) curve for granular soils is presented in API RP 2GEO (2011), Sec. 8.4.3. The maximum side friction, t_{max}, at the pile-soil interface is the ultimate unit skin friction, f, determined by API RP 2GEO (2011). According to API RP 2GEO (2011), the peak unit skin friction in compression and tension computed from CPT-based methods at a given depth are dependent on pile diameter, wall thickness and pile penetration.

Tip Load Transfer (Q-z) Data

Relatively large axial movements may be required to mobilize full end bearing resistance. End bearing or tip load increases with displacement of the pile tip. The development of full end bearing occurs at a displacement equal to 10 percent of the pile diameter according to API RP 2A. The tip load versus tip movement curve is given in API RP 2GEO (2011), Sec. 8.4.3. The end bearing is determined by API RP 2GEO (2011). The end bearing component should not be considered when tensile loads are applied to a pile. Typical pile tip-load-displacement (Q-z) curves are presented on Plate A-3.

CRITERIA FOR LATERAL SOIL RESISTANCE-PILE DEFLECTION DATA

API RP 2GEO (2011) recommends that pile foundations be designed for lateral loading conditions. The lateral soil structure interaction is complex and the soil response to lateral loading is generally nonlinear. To analyze this complex interaction, a computer program based on the finite difference or finite element method is normally used. The nonlinear soil response is input into these methods with lateral soil resistance-pile deflection (p-y) curves. The methods for constructing p-y curves follow.

Cohesive Soils

Lateral soil resistance-pile deflection (p-y) data for siliceous cohesive soils are developed using the procedures outlined by Matlock (1970) and API RP 2GEO (2011) for clays subjected to static or cyclic (storm wave loading) loads. The primary difference between procedures for static and cyclic loads is that the ultimate lateral resistance for cyclic loads is limited to 72 percent of the ultimate lateral resistance for static loads.

The ultimate lateral soil resistance (p_{us}) increases from $3S_uD$ to $9S_uD$ as X increases from 0 to X_R according to:

$$p_{us} = 3S_uD + \gamma' XD + JS_uX$$

and

$$p_{ud} = 9S_uD \text{ for } X \geq X_R$$

where:

p_u	=	ultimate resistance (s = shallow, d = deep);
S_u	=	undrained shear strength for undisturbed clay soil samples;
D	=	pile diameter;
γ'	=	effective unit weight of soil;
J	=	dimensionless empirical constant with values ranging from 0.25 to 0.5 having been determined by field testing. A value of 0.5 is appropriate for Gulf of Mexico clays;
X	=	depth below soil surface; and
X_R	=	depth below soil surface to bottom of reduced resistance zone.

The deflection values (y) are a function of the pile diameter and ε_{50}. Typical p-y curve shapes for cohesive soils are shown on Plate A-4.

The interpreted shear strengths, submerged unit weights, and strain values at one-half the maximum deviator stress (ε_{50}) used in the computations are presented in the main text illustrations. These strain values are selected based on data from UU triaxial compression tests.

Granular Soils

Lateral soil resistance-pile deflection (p-y) data for siliceous granular soils are developed using procedures outlined by O'Neill and Murchison (1983) and API RP 2GEO (2011) for sands subjected to static or cyclic (storm wave) loading; the procedures are the same for both types of loading.

At a given depth, the following equation giving the smallest value of p_u should be used as the ultimate lateral bearing capacity in siliceous granular soils.

$$p_{us} = (C_1 H + C_2 D)\, \gamma' H$$

and

$$p_{ud} = C_3 D\, \gamma' H$$

where:

p_u	=	ultimate resistance (s = shallow, d = deep);
γ'	=	effective soil weight;
H	=	depth below soil surface;
C_1, C_2, C_3	=	coefficients determined from Figure 4 in API RP 2GEO (2011), as a function of ϕ; and
D	=	average pile diameter from surface to depth.

The shape of the p-y curve in siliceous granular soil is defined by the following equation:

$$P = A\, p_u \tanh \left[\frac{k\, H}{A\, p_u}\, y \right]$$

where:

A	=	factor to account for cyclic or static loading condition;
p_u	=	ultimate bearing capacity at depth H;
k	=	initial modulus of subgrade reaction;
y	=	lateral deflection; and
H	=	depth below soil surface.

Typical p-y curve shapes for siliceous granular soils are shown on Plate A-4.

Input parameters used in the computations are submerged unit weight (γ'), angle of internal friction (ϕ) and modulus of horizontal subgrade reaction (k). Values of k and ϕ required for the analyses are selected on the basis of soil textural classification and relative density. Relative density is estimated from PCPT data, if performed, and from the number of blows required to advance the sampler into the soils.

Scour Effects

Whenever the near-surface soils are comprised of granular material, they may be susceptible to scour. Scour effects are considered insignificant to axial capacity but can have a large influence on lateral capacity. When scour is considered likely, the p-y data are reduced to reflect the potential loss of lateral support from the material scoured away near the seafloor around the pile. General scour indicates that installation of the structure may cause a layer of material to be removed throughout the area of the platform. Local scour indicates that scour is likely to occur only in the near vicinity of the piles.

CRITERIA FOR MUD MAT BEARING CAPACITY ANALYSIS

Mud mats vary in size and shape and are normally designed to rest on the seafloor with minimum penetration. The lowest horizontal (mudline) bracing members may be analyzed in a similar fashion. The following paragraphs present design criteria used to determine the ultimate bearing or load-carrying capacities of the mud mat or bracing member resting on the seafloor. The ultimate bearing or load-carrying capacity of the mud mat or bracing member is the ultimate net bearing capacity multiplied by the base area of the mud mat or bracing member.

Cohesive Soils

The bearing capacity of mud mats and horizontal bracing members resting on the cohesive soils at the seafloor is computed using the methods recommended by Skempton (1951) and Davis and Booker (1973). According to the Skempton (1951) method, the ultimate net bearing capacity (q_u) is given by the following expression:

$$q_u = 5.14\ S_u\ (1 + 0.2\ B/L)$$

where: S_u = average undrained shear strength of the soil over a distance of B/2 beneath the mud mat or bracing member;

B = mud mat or bracing member width; and

L = mud mat or bracing member length.

The Davis and Booker (1973) method was developed specifically for a linearly increasing shear strength profile. According to this procedure, q_u of circular and strip footings on cohesive soils may be calculated by the following equations:

$$q_u = F(6\ S_{uo} + \rho\ B/4) \quad \text{.................... for circular footings, or}$$

$$q_u = F(5.14\ S_{uo} + \rho\ B/4) \quad \text{................ for strip footings,}$$

where: S_{uo} = undrained shear strength at mudline;

ρ = rate of increase in shear strength with depth;

F = theoretical correction factor (Plate A-5); and

B = mud mat or tubular member width.

With either the Skempton or Davis and Booker methods, if the base of the mud mats penetrate below the seafloor, an additional depth factor, equal to (1 + 0.2 D/B) where D is the depth of the base below the seafloor, is applied in the computation of the ultimate net bearing capacity. For the Davis and Booker method, a theoretical correction factor (F) for “rough” foundations was assumed considering typical installation conditions for a Temporary Jacket Support structure. Additionally, Fugro’s experience over many years of practice has been that the “rough” solution can be applied also to unpainted steel plates installed as mud mats beneath the lowest level of horizontal tubular bracing. Thousands of platforms have been installed successfully using this approach. It is not standard practice in the industry to paint the bottom face of steel-plate mud mats. However, if they are painted, then the “smooth” solution will need to be used in lieu of the presented recommendations.

Granular Soils

For mud mats and bracing members resting on granular soils, the ultimate bearing capacity is estimated in general accordance with procedures recommended by Terzaghi (1943) and later examined by Terzaghi and Peck (1967) for the design of shallow foundations. The ultimate net bearing capacity (q_u) may be computed using the following expression:

$$q_u = \gamma_1' D (N_q - 1) + 0.5 \gamma_2' B N_\gamma (1 - 0.4 B/L)$$

where:

N_q, N_γ = dimensionless bearing capacity factors determined from Plate A-6 (functions of ϕ, the angle of internal friction);

γ_1' = average submerged unit weight of soil above the base of the mud mat or bracing member;

D = depth to the base of the mud mat or bracing member below the seafloor;

γ_2' = average submerged effective unit weight of soil within depth B beneath the mud mat or bracing member;

B = mud mat or bracing member width; and

L = mud mat or bracing member length.

For mud mats or bracing members resting on the seafloor itself, the depth term D is zero and the first expression in the above equation is eliminated.

Layered Soils

A layered soil profile may be generalized into two-layer soil profile consisting of soft soils overlying hard soils or hard soils overlying soft soils. The ultimate bearing capacity (q_u) of a shallow foundation supported on a soft-over-hard or hard-over-soft soil profile can be computed using the following equation proposed by Brown and Meyerhof (1969):

$$q_u = S_{ut} N_m$$

where:

S_{ut} = undrained shear strength of the upper layer; and

N_m = a dimensionless bearing capacity factor that is a function of the ratio of lower to upper layer shear strengths (S_{ub}/S_{ut}), the ratio of upper layer thickness to foundation width, and foundation shape.

The factor N_m for a strip footing on soft soil overlying hard soil can be conservatively estimated using the following expressions:

$$N_m = 5.14 \qquad \text{for } H/B \geq 0.514$$

$$N_m = 5.14\,(2 - \sin \square) \qquad \text{for } H/B < 0.514$$

where:

$\square$ = arccos (1 – H/(0.514B));

H = thickness of the upper layer below the foundation level; and

B = width of mud mat.

SERVICE WARRANTY

The "Service Warranty" outlines the limitations and constraints of this report in terms of a range of considerations including, but not limited to, its purpose, its scope, the data on which it is based, its use by third parties, possible future changes in design procedures and possible changes in the conditions at the site with time. This section represents a clear description of the constraints, which apply to all reports issued by FMMG. It should be noted that the Service Warranty does not in any way supersede the terms and conditions of the contract between FMMG and the Client.

1. This report and the assessment carried out in connection with the report (together the "Services") were compiled and carried out by Fugro-McClelland Marine Geosciences, Inc. (FMMG) for the Client in accordance with the terms of the Contract. Further, and in particular, the Services were performed by FMMG taking into account the limits of the scope of works required by the Client, the time scale involved, and the resources, including financial and manpower resources, agreed between FMMG and the Client. FMMG has not performed any observations, investigations, studies or testing not specifically set out or required by the Contract between the Client and FMMG.

2. The Services were performed by FMMG exclusively for the purposes of the Client. Should this report or any part of this report, or details of the Services or any part of the Services be made known to any third party, such third party shall not rely on the report unless FMMG provides guidance required to interpret the report, i.e., respond to non-operational questions. If such third party does rely on the report without obtaining FMMG's guidance, it does so wholly at its sole risk and FMMG disclaims all liability resulting from third party use of the report.

3. It is FMMG's understanding that this report is to be used for the purpose described in the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, and/or should the Client's proposed development or use of the site change (including in particular any change in any design and/or specification relating to the proposed use or development of the site), this report may no longer be valid or appropriate and any further use of, or reliance upon, the report in those circumstances by the Client without FMMG's review and advice shall be at the Client's sole and own risk. Should FMMG be requested, and FMMG agree, to review the report after the date hereof, FMMG shall be entitled to additional payment at the then existing rates or such other terms as may be agreed between FMMG and Client.

4. The passage of time may result in changes (whether man-made or otherwise) in site conditions and changes in regulatory or other legal provisions, technology, methods of analysis, or economic conditions, which could render the information and results presented in the report inaccurate or unreliable. The information, recommendations and conclusions contained in this report should not be relied upon if any such changes have taken place, without the written agreement of FMMG. In the absence of such written agreement of FMMG, reliance on the report after any such changes have occurred shall be at the Client's own and sole risk. Should FMMG agree to review the report after such changes have taken place, FMMG shall be entitled to additional payment at the then existing rates or such other terms as may be agreed between FMMG and the Client.

5. Where the Services have involved FMMG's interpretation and/or other use of any information (including documentation or materials, analyses, recommendations and conclusions) provided by third parties (including independent testing and/or information, services or laboratories) or the Client and upon which FMMG was reasonably entitled to rely or involved FMMG's observations of existing physical conditions of any site involved in the Services, then the Services clearly are limited by the accuracy of such information and the observations which were reasonably possible of the said site. Unless

otherwise stated, FMMG was not authorized and did not attempt to independently verify the accuracy or completeness of such information, received from the Client or third parties during the performance of the Services. FMMG is not liable for any inaccuracies (including any incompleteness) in the said information, save as otherwise provided in the terms of the contract between the Client and FMMG.

6. The soil and ground conditions information provided in the Services are based solely on evaluations of the soil and ground condition samples (and in situ tests) at determined sample test locations and elevations. That information cannot be extrapolated to any area or elevation outside those locations and elevations unless specifically so stated in the report. In the light of the information available to FMMG, the soil and ground conditions information is considered appropriate for use in relation to the geotechnical design and installation aspects of the structures addressed in the report, but they may not be appropriate for the design of other structures.

APPENDIX A

ILLUSTRATIONS

Checked By: Date:
Approved By: Date:
Drawn By: Date:

Relative Density, D_R %	Soil Description	Soil-Pile Friction Angle, δ, Degrees (API RP 2A-WSD)	Shaft Friction Factor[a], β (–)	Limiting Shaft Friction Values kPa (kips/ft^2)	End Bearing Factor N_q (–)	Limiting Unit End Bearing Values MPa (kips/ft^2)
Very loose, 0 - 15 % Loose, 15 - 35 % Loose, 15 - 35 % Medium Dense, 35 - 65 % Dense, 65 - 85 %	Sand Sand Sand-silt[b] Silt Silt	15	Not applicable[c]	Not applicable[c]	Not applicable[c]	Not applicable[c]
Medium Dense, 35 - 65 %	Sand-silt[b]	20	0.29	67 (1.4)	12	3 (60)
Medium Dense, 35 - 65 % Dense, 65 - 85 %	Sand Sand-silt[b]	25	0.37	81 (1.7)	20	5 (100)
Dense, 65 - 85 % Very Dense, 85 - 100 %	Sand Sand-silt[b]	30	0.46	96 (2.0)	40	10 (200)
Very Dense, 85 - 100 %	Sand	35	0.56	115 (2.4)	50	12 (250)

NOTE: The parameters listed in this table are intended as guidelines only. Where detailed information, such as CPT records, strength tests on high quality samples, model tests, or pile driving performance, is available, other values may be justified.

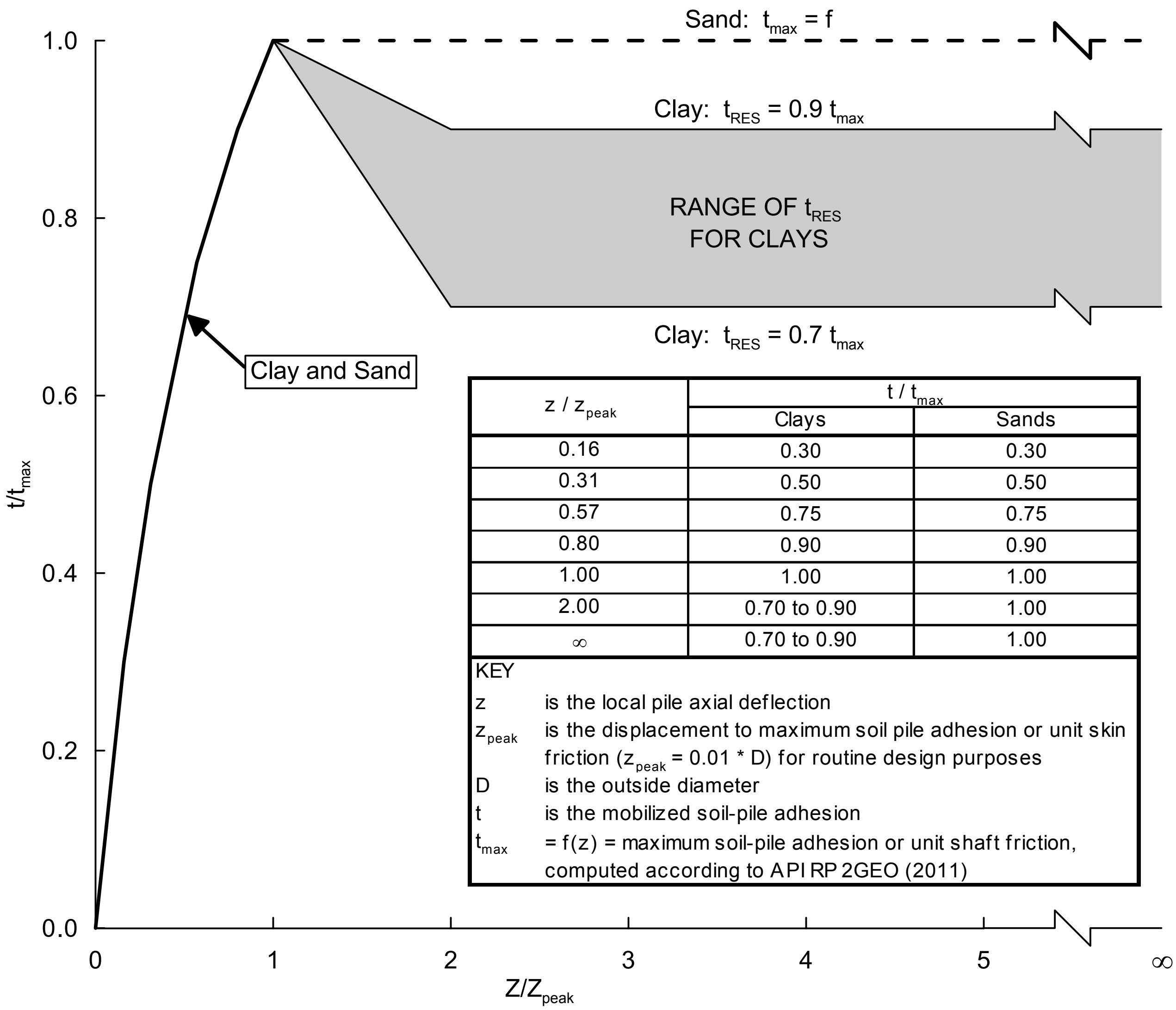
a) The shaft friction factor β (equivalent to the "K tan δ" term used in previous editions of API RP 2A-WSD) is introduced in API RP 2GEO (2011) to avoid confusion with the δ parameter used in CPT-based methods in Annex C of API RP 2GEO (2011).

b) Sand-silt includes those soils with significant fractions of both sand and silt. Strength values generally increase with increasing sand fractions and decrease with increasing silt fractions.

c) Design parameters given in previous editions of API RP 2A-WSD for these soil/relative density combinations may be unconservative. Hence, it is recommended to use CPT-based methods for these soils.

**SUMMARY OF RECOMMENDED DESIGN PARAMETERS
(API RP 2GEO, 2011) FOR COHESIONLESS SILICEOUS SOILS**

Date:
Drawn By:
Date:
Date:
Checked By:
Approved By:

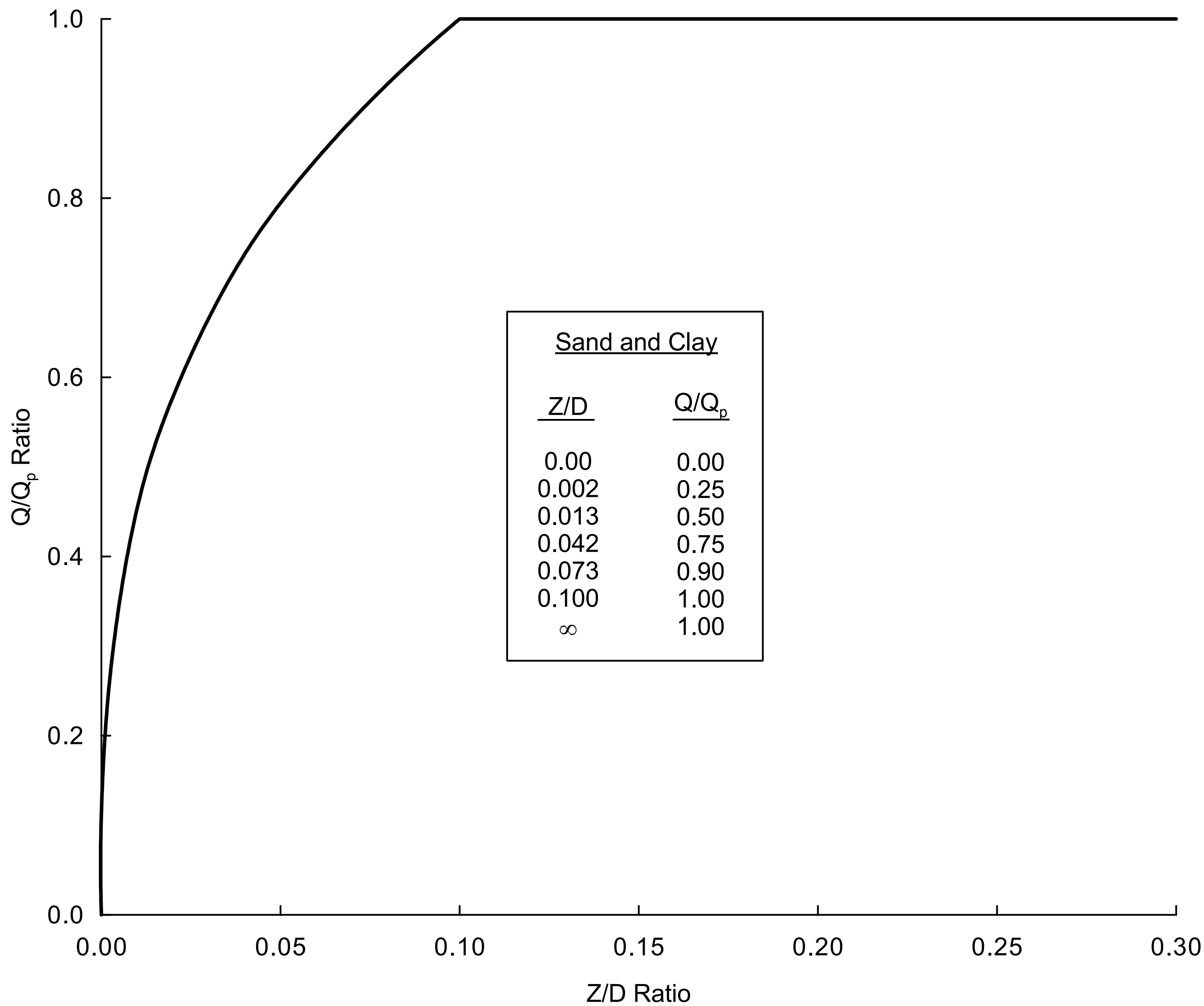


z / z_{peak}	t / t_{max}	
	Clays	Sands
0.16	0.30	0.30
0.31	0.50	0.50
0.57	0.75	0.75
0.80	0.90	0.90
1.00	1.00	1.00
2.00	0.70 to 0.90	1.00
∞	0.70 to 0.90	1.00

KEY

z	is the local pile axial deflection
z_{peak}	is the displacement to maximum soil pile adhesion or unit skin friction (z_{peak} = 0.01 * D) for routine design purposes
D	is the outside diameter
t	is the mobilized soil-pile adhesion
t_{max}	= f(z) = maximum soil-pile adhesion or unit shaft friction, computed according to API RP 2GEO (2011)

TYPICAL AXIAL PILE LOAD TRANSFER-DISPLACEMENT (t-z) CURVES FOR COHESIVE SOILS AND SILICEOUS SANDS

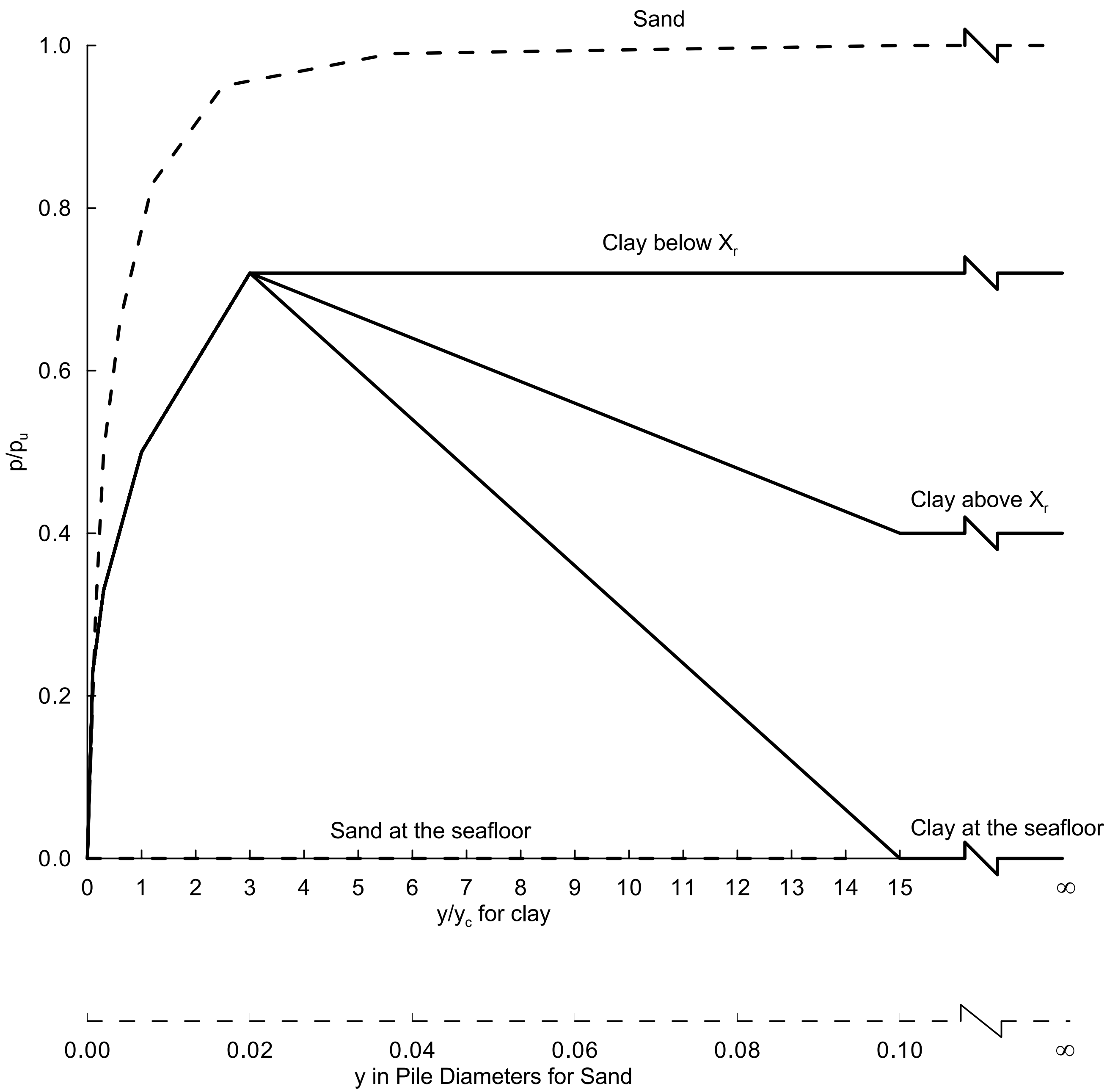


Z/D	Q/Q_p
0.00	0.00
0.002	0.25
0.013	0.50
0.042	0.75
0.073	0.90
0.100	1.00
∞	1.00

Date: Date:

Checked By: Approved By:

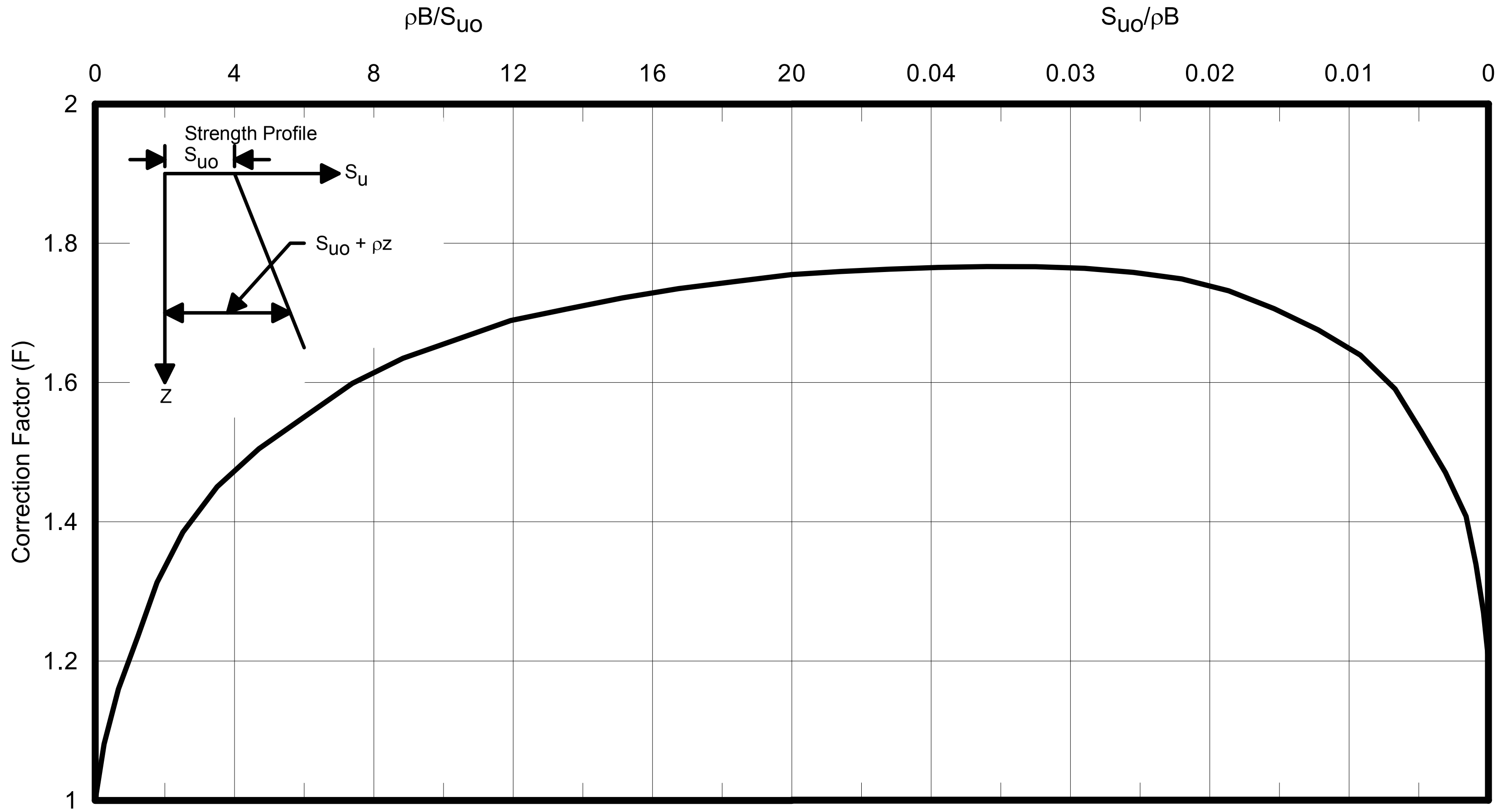
TYPICAL PILE TIP LOAD TRANSFER (Q-z) CURVES



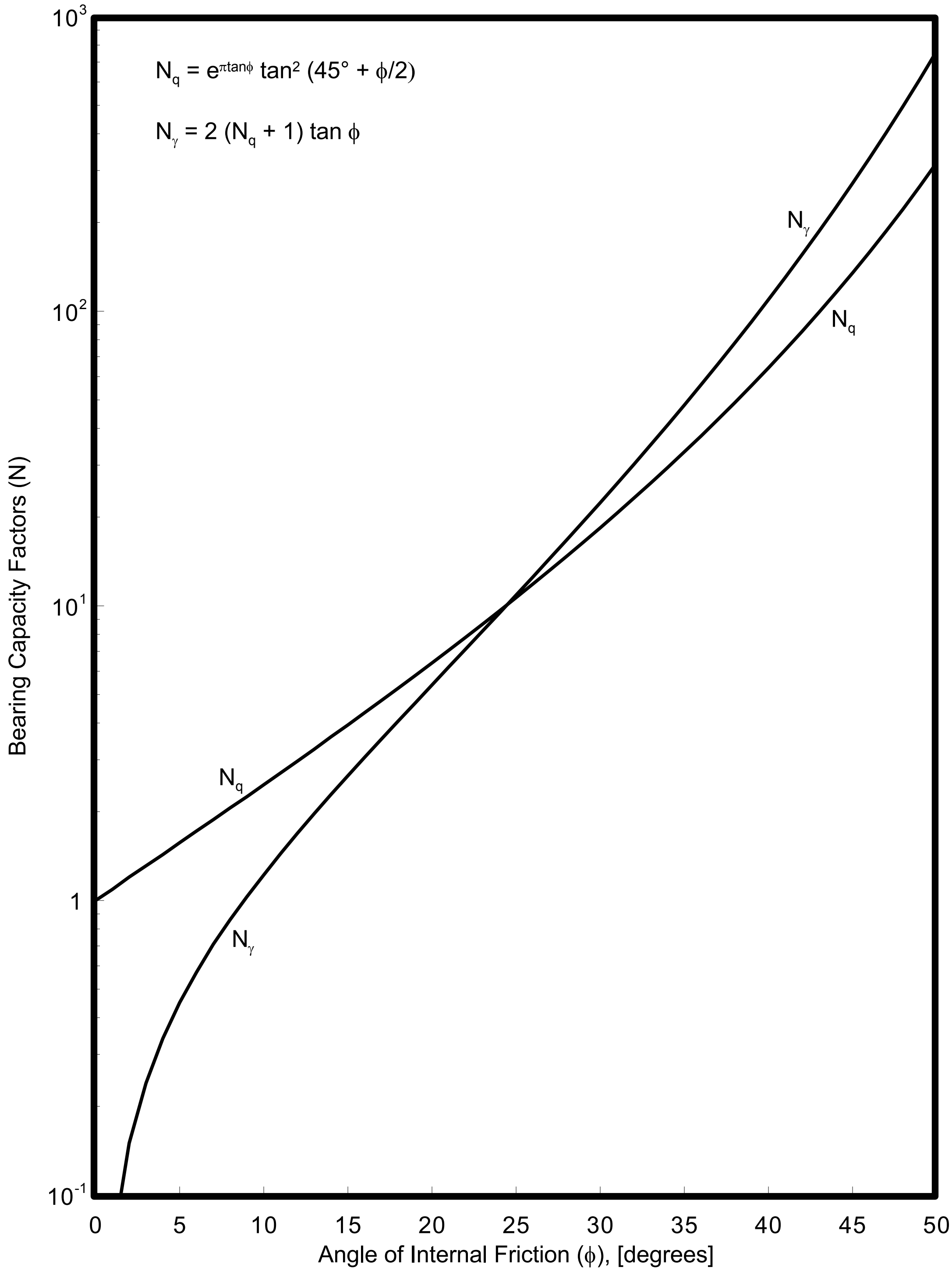
Date: Drawn By: Date: Date: Checked By: Approved By:

TYPICAL LATERAL LOAD - PILE DEFLECTION (p-y) CURVES

Checked By: Date:
Approved By: Date:
Drawn By: Date:



CORRECTION FACTOR FOR DAVIS AND BOOKER EQUATION



Drawn By: Date:
Checked By: Date:
Approved By: Date:

BEARING CAPACITY FACTORS FOR TERZAGHI EQUATION

APPENDIX G

SURVEY POSITIONING REPORTS

Date:26 Jun 2014 Time:15:38:18

AVERAGE POSITION PRELIMINARY FIELD REPORT
Fugro Chance Inc.
A Fugro Company
StarFix.NAV

Note: This information is based on calculations from unadjusted field data and is subject to revisions, information should be verified through your local Fugro Office.

Job Number: 1401092_06_17_2014
Area/Lease Block: CURRICITUCK SOUND BLKS 6111 6112 6164
Client: FUGRO CONSULTANTS, INC.
Client Representative: Sam Pant
Project Description: PROPOSED SOIL BORINGS
Personnel:
Name: LEE SONNIER , Title: SURVEY ANALYST
Name: Jeff Guidry , Title: APC

GEODESY SETTINGS

Spheroid: WGS 84

Datum: USER DEFINED
Transformation From WGS84 to USER DEFINED
Dx: 0.000m Dy: 0.000m Dz: 0.000m
Rx: 0.000m Ry: 0.000m Rz: 0.000m dS:0.000000

Projection Type: Transverse Mercator, Name: Zone 18

Operating Units: Meters
Ratio To One Meter: 1.000000000

PROPOSED LOCATION INFORMATION
Y: 4083480.00 X: 456197.00
Lat:N 36 53 46.6307" Lon:W 075 29 29.8763"

Vessel: InezEymard Offset: CL DRILL

SESSIONS USED: 1, 2, 3, 4,

FINAL POSITION INFORMATION
Y:4083478.64m X:456197.47m Z:-25.73m
Lat:N 36 53 46.5866" Lon:W 075 29 29.8570"
Final Hdg: True 25.79°Degs Grid 26.09Degs

BLOCK CALLS
From North: 1321.36m From East: 602.53m
From South: 3478.64m From West: 4197.47m

FINAL POSITION QC INFORMATION
4 Sessions Used Time:01:00:02
Avg Deltas:Y:1.36 X:-0.47 Z.25.73
Avg Range\Az to Location: Range: 1.44 Azimuth: 340.75Degs

POSITIONING SURVEY REPORT
Boring BH T1-A
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-1

Date:12 Jul 2014 Time:18:00:37

AVERAGE POSITION PRELIMINARY FIELD REPORT
Fugro Chance Inc.
A Fugro Company
StarFix.NAV

Note: This information is based on calculations from unadjusted field data and is subject to revisions, information should be verified through your local Fugro Office.

Job Number: 1401092_07_12_2014
Area/Lease Block: CURRICITUCK SOUND BLKS 6111 6112 6164
Client: FUGRO CONSULTANTS, INC.
Client Representative: Sam Pant
Project Description: PROPOSED SOIL BORINGS
Personnel:
Name: LEE SONNIER , Title: SURVEY ANALYST
Name: Jeff Guidry , Title: APC

GEODESY SETTINGS

Spheroid: WGS 84

Datum: USER DEFINED
Transformation From WGS84 to USER DEFINED
Dx: 0.000m Dy: 0.000m Dz: 0.000m
Rx: 0.000m Ry: 0.000m Rz: 0.000m dS:0.000000

Projection Type: Transverse Mercator, Name: Zone 18

Operating Units: Meters
Ratio To One Meter: 1.000000000

PROPOSED LOCATION INFORMATION
Y: 4082430.00 X: 456197.00
Lat:N 36 53 12.5567" Lon:W 075 29 29.6577"

Vessel: InezEymard Offset: CL DRILL

SESSIONS USED: 1, 2, 3, 4,

FINAL POSITION INFORMATION
Y:4082430.26m X:456197.51m Z:-24.63m
Lat:N 36 53 12.5653" Lon:W 075 29 29.6372"
Final Hdg: True 226.60°Degs Grid 226.90Degs

BLOCK CALLS
From North: 2369.74m From East: 602.49m
From South: 2430.26m From West: 4197.51m
FINAL POSITION QC INFORMATION
4 Sessions Used Time:01:00:01
Avg Deltas:Y:-0.26 X:-0.51 Z:24.63
Avg Range\Az to Location: Range: 0.57 Azimuth: 242.65Degs

POSITIONING SURVEY REPORT
Boring BH T2-A
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-2

Date:17 Jul 2014 Time:14:22:05

AVERAGE POSITION PRELIMINARY FIELD REPORT

Fugro Chance Inc.
A Fugro Company
StarFix.NAV

Note: This information is based on calculations from unadjusted field data and is subject to revisions, information should be verified through your local Fugro Office.

Job Number: 1401092_07_12_2014A
Area/Lease Block: CURRICITUCK SOUND BLKS 6111 6112 6164
Client: FUGRO CONSULTANTS, INC.
Client Representative: Sam Pant
Project Description: PROPOSED SOIL BORINGS
Personnel:
Name: LEE SONNIER , Title: SURVEY ANALYST
Name: Jeff Guidry , Title: APC

GEODESY SETTINGS

Spheroid: WGS 84

Datum: USER DEFINED
Transformation From WGS84 to USER DEFINED
Dx: 0.000m Dy: 0.000m Dz: 0.000m
Rx: 0.000m Ry: 0.000m Rz: 0.000m dS:0.000000

Projection Type: Transverse Mercator, Name: Zone 18

Operating Units: Meters
Ratio To One Meter: 1.000000000

PROPOSED LOCATION INFORMATION
Y: 4082430.00 X: 456486.00
Lat:N 36 53 12.6049" Lon:W 075 29 17.9824"

Vessel: InezEymard Offset: CL DRILL

SESSIONS USED: 1, 2, 3, 4,

FINAL POSITION INFORMATION
Y:4082431.01m X:456481.76m Z:-22.70m
Lat:N 36 53 12.6370" Lon:W 075 29 18.1539"
Final Hdg: True 89.23°Degs Grid 89.52Degs

BLOCK CALLS
From North: 2368.99m From East: 318.24m
From South: 2431.01m From West: 4481.76m
FINAL POSITION QC INFORMATION
4 Sessions Used Time:01:00:04
Avg Deltas:Y:-1.01 X:4.24 Z:22.70
Avg Range\Az to Location: Range: 4.36 Azimuth: 103.32Degs

POSITIONING SURVEY REPORT
Boring BH T2-B
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

Date:11 Jul 2014 Time:12:32:34

AVERAGE POSITION PRELIMINARY FIELD REPORT
Fugro Chance Inc.
A Fugro Company
StarFix.NAV

Note: This information is based on calculations from unadjusted field data and is subject to revisions, information should be verified through your local Fugro Office.

Job Number: 1401092_07_11_2014
Area/Lease Block: CURRICITUCK SOUND BLKS 6111 6112 6164
Client: FUGRO CONSULTANTS, INC.
Client Representative: Sam Pant
Project Description: PROPOSED SOIL BORINGS
Personnel:
Name: LEE SONNIER , Title: SURVEY ANALYST
Name: Jeff Guidry , Title: APC

GEODESY SETTINGS

Spheroid: WGS 84

Datum: USER DEFINED
Transformation From WGS84 to USER DEFINED
Dx: 0.000m Dy: 0.000m Dz: 0.000m
Rx: 0.000m Ry: 0.000m Rz: 0.000m dS:0.000000

Projection Type: Transverse Mercator, Name: Zone 18

Operating Units: Meters
Ratio To One Meter: 1.000000000

PROPOSED LOCATION INFORMATION
Y: 4074815.40 X: 414026.40
Lat:N 36 48 55.0377" Lon:W 075 57 50.0967"

Vessel: InezEymard Offset: CL DRILL

SESSIONS USED: 1, 2, 3, 4,

FINAL POSITION INFORMATION
Y:4074816.52m X:414026.39m Z:-23.61m
Lat:N 36 48 55.0740" Lon:W 075 57 50.0976"
Final Hdg: True 225.10°Degs Grid 225.68Degs

FINAL POSITION QC INFORMATION
4 Sessions Used Time:01:00:04
Avg Deltas:Y:-1.12 X:0.02 Z:23.61

Avg Range\Az to Location: Range: 1.12 Azimuth: 179.23Degs

POSITIONING SURVEY REPORT
Boring BH NB-01
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-4

Date:12 Jul 2014 Time:01:26:10

AVERAGE POSITION PRELIMINARY FIELD REPORT
Fugro Chance Inc.
A Fugro Company
StarFix.NAV

Note: This information is based on calculations from unadjusted field data and is subject to revisions, information should be verified through your local Fugro Office.

Job Number: 1401092_07_11_2014
Area/Lease Block: CURRICITUCK SOUND BLKS 6111 6112 6164
Client: FUGRO CONSULTANTS, INC.
Client Representative: Sam Pant
Project Description: PROPOSED SOIL BORINGS
Personnel:
Name: LEE SONNIER , Title: SURVEY ANALYST
Name: Jeff Guidry , Title: APC

GEODESY SETTINGS

Spheroid: WGS 84

Datum: USER DEFINED
Transformation From WGS84 to USER DEFINED
Dx: 0.000m Dy: 0.000m Dz: 0.000m
Rx: 0.000m Ry: 0.000m Rz: 0.000m dS:0.000000

Projection Type: Transverse Mercator, Name: Zone 18

Operating Units: Meters
Ratio To One Meter: 1.000000000

PROPOSED LOCATION INFORMATION
Y: 4074909.00 X: 414229.20
Lat:N 36 48 58.1411" Lon:W 075 57 41.9503"

Vessel: InezEymard Offset: CL DRILL

SESSIONS USED: 1, 2, 3, 4,

FINAL POSITION INFORMATION
Y:4074908.69m X:414229.83m Z:-23.11m
Lat:N 36 48 58.1313" Lon:W 075 57 41.9247"
Final Hdg: True 224.70°Degs Grid 225.28Degs

FINAL POSITION QC INFORMATION
4 Sessions Used Time:01:00:03
Avg Deltas:Y:0.31 X:-0.63 Z:23.11

Avg Range\Az to Location: Range: 0.70 Azimuth: 296.20Degs

POSITIONING SURVEY REPORT
Boring BH NB-03
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-5

Date:11 Jul 2014 Time:02:22:21

AVERAGE POSITION PRELIMINARY FIELD REPORT
Fugro Chance Inc.
A Fugro Company
StarFix.NAV

Note: This information is based on calculations from unadjusted field data and is subject to revisions, information should be verified through your local Fugro Office.

Job Number: 1401092_07_09_2014
Area/Lease Block: CURRICITUCK SOUND BLKS 6111 6112 6164
Client: FUGRO CONSULTANTS, INC.
Client Representative: Sam Pant
Project Description: PROPOSED SOIL BORINGS
Personnel:
Name: LEE SONNIER , Title: SURVEY ANALYST
Name: Jeff Guidry , Title: APC

GEODESY SETTINGS

Spheroid: WGS 84

Datum: USER DEFINED
Transformation From WGS84 to USER DEFINED
Dx: 0.000m Dy: 0.000m Dz: 0.000m
Rx: 0.000m Ry: 0.000m Rz: 0.000m dS:0.000000

Projection Type: Transverse Mercator, Name: Zone 18

Operating Units: Meters
Ratio To One Meter: 1.000000000

PROPOSED LOCATION INFORMATION
Y: 4074939.70 X: 414402.70
Lat:N 36 48 59.1939" Lon:W 075 57 34.9607"

Vessel: InezEymard Offset: CL DRILL

SESSIONS USED: 1, 2, 3, 4,

FINAL POSITION INFORMATION
Y:4074939.11m X:414403.29m Z:-24.50m
Lat:N 36 48 59.1749" Lon:W 075 57 34.9366"
Final Hdg: True 232.75°Degs Grid 233.33Degs

FINAL POSITION QC INFORMATION
4 Sessions Used Time:01:00:01
Avg Deltas:Y:0.59 X:-0.59 Z:24.50
Avg Range\Az to Location: Range: 0.83 Azimuth: 315.00Degs

POSITIONING SURVEY REPORT
Boring BH NB-05
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-6

Date:10 Jul 2014 Time:12:31:02

AVERAGE POSITION PRELIMINARY FIELD REPORT
Fugro Chance Inc.
A Fugro Company
StarFix.NAV

Note: This information is based on calculations from unadjusted field data and is subject to revisions, information should be verified through your local Fugro Office.

Job Number: 1401092_07_09_2014
Area/Lease Block: CURRICITUCK SOUND BLKS 6111 6112 6164
Client: FUGRO CONSULTANTS, INC.
Client Representative: Sam Pant
Project Description: PROPOSED SOIL BORINGS
Personnel:
Name: LEE SONNIER , Title: SURVEY ANALYST
Name: Jeff Guidry , Title: APC

GEODESY SETTINGS

Spheroid: WGS 84

Datum: USER DEFINED
Transformation From WGS84 to USER DEFINED
Dx: 0.000m Dy: 0.000m Dz: 0.000m
Rx: 0.000m Ry: 0.000m Rz: 0.000m dS:0.000000

Projection Type: Transverse Mercator, Name: Zone 18

Operating Units: Meters
Ratio To One Meter: 1.000000000

PROPOSED LOCATION INFORMATION
Y: 4074966.20 X: 414552.90
Lat:N 36 49 00.1026" Lon:W 075 57 28.9096"

Vessel: InezEymard Offset: CL DRILL

SESSIONS USED: 1, 2, 3, 4,

FINAL POSITION INFORMATION
Y:4074965.42m X:414553.80m Z:-22.93m
Lat:N 36 49 00.0776" Lon:W 075 57 28.8730"
Final Hdg: True 224.49°Degs Grid 225.06Degs

FINAL POSITION QC INFORMATION
4 Sessions Used Time:01:00:02
Avg Deltas:Y:0.78 X:-0.90 Z:22.93
Avg Range\Az to Location: Range: 1.19 Azimuth: 310.74Degs

POSITIONING SURVEY REPORT
Boring BH NB-07
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-7

Date:09 Jul 2014 Time:15:17:31

AVERAGE POSITION PRELIMINARY FIELD REPORT
Fugro Chance Inc.
A Fugro Company
StarFix.NAV

Note: This information is based on calculations from unadjusted field data and is subject to revisions, information should be verified through your local Fugro Office.

Job Number: 1401092_06_30_2014
Area/Lease Block: CURRICITUCK SOUND BLKS 6111 6112 6164
Client: FUGRO CONSULTANTS, INC.
Client Representative: Sam Pant
Project Description: PROPOSED SOIL BORINGS
Personnel:
Name: LEE SONNIER , Title: SURVEY ANALYST
Name: Jeff Guidry , Title: APC

GEODESY SETTINGS

Spheroid: WGS 84

Datum: USER DEFINED
Transformation From WGS84 to USER DEFINED
Dx: 0.000m Dy: 0.000m Dz: 0.000m
Rx: 0.000m Ry: 0.000m Rz: 0.000m dS:0.000000

Projection Type: Transverse Mercator, Name: Zone 18

Operating Units: Meters
Ratio To One Meter: 1.000000000

PROPOSED LOCATION INFORMATION
Y: 4074990.80 X: 414690.90
Lat:N 36 49 00.9457" Lon:W 075 57 23.3502"

Vessel: InezEymard Offset: CL DRILL

SESSIONS USED: 1, 2, 3, 4,

FINAL POSITION INFORMATION
Y:4074990.74m X:414690.92m Z:-23.04m
Lat:N 36 49 00.9438" Lon:W 075 57 23.3493"
Final Hdg: True 228.23°Degs Grid 228.80Degs

FINAL POSITION QC INFORMATION
4 Sessions Used Time:01:00:04
Avg Deltas:Y:0.06 X:-0.02 Z:23.04

Avg Range\Az to Location: Range: 0.07 Azimuth: 340.20Degs

POSITIONING SURVEY REPORT
Boring BH NB-09
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

Date:30 Jun 2014 Time:17:25:16

AVERAGE POSITION PRELIMINARY FIELD REPORT
Fugro Chance Inc.
A Fugro Company
StarFix.NAV

Note: This information is based on calculations from unadjusted field data and is subject to revisions, information should be verified through your local Fugro Office.

Job Number: 1401092_06_17_2014
Area/Lease Block: CURRICITUCK SOUND BLKS 6111 6112 6164
Client: FUGRO CONSULTANTS, INC.
Client Representative: Sam Pant
Project Description: PROPOSED SOIL BORINGS
Personnel:
Name: LEE SONNIER , Title: SURVEY ANALYST
Name: Jeff Guidry , Title: APC

GEODESY SETTINGS

Spheroid: WGS 84

Datum: USER DEFINED
Transformation From WGS84 to USER DEFINED
Dx: 0.000m Dy: 0.000m Dz: 0.000m
Rx: 0.000m Ry: 0.000m Rz: 0.000m dS:0.000000

Projection Type: Transverse Mercator, Name: Zone 18

Operating Units: Meters
Ratio To One Meter: 1.000000000

PROPOSED LOCATION INFORMATION
Y: 4075014.70 X: 414826.90
Lat:N 36 49 01.7653" Lon:W 075 57 17.8711"

Vessel: InezEymard Offset: CL DRILL

SESSIONS USED: 1, 2, 3, 4,

FINAL POSITION INFORMATION
Y:4075015.46m X:414826.94m Z:-25.80m
Lat:N 36 49 01.7900" Lon:W 075 57 17.8698"
Final Hdg: True 268.51°Degs Grid 269.08Degs

FINAL POSITION QC INFORMATION
4 Sessions Used Time:01:00:02
Avg Deltas:Y:-0.76 X:-0.04 Z:25.80

Avg Range\Az to Location: Range: 0.76 Azimuth: 183.38Degs

POSITIONING SURVEY REPORT
Boring BH NB-11
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	01 Jul 2014 4:54:59 PM (UTC+00:00)
Sampling Ended	01 Jul 2014 5:04:59 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°49'02.2071"N
      Longitude    75°56'21.6034"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       416221.100 m
      Northing     4075014.500 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°49'02.1991"N
      Longitude    75°56'21.6142"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       416220.830 m
      Northing     4075014.258 m
      Height           -39.605 m (ellipsoidal)
Final Rig Heading   79.42 °T
                    79.98 °G (Convergence -0.56° World Standard)
Gyro C-O            90.31 °
Position is 0.36 m @ 227.60 °T (228.16 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	416340.2	4075124.1	137.0	41.4
SB	416355.6	4074939.1	131.2	126.6
PS	416111.8	4075073.4	122.3	297.5
SS	416155.6	4074912.7	118.7	213.7

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	01 Jul 2014 3:19:41 PM (UTC+00:00)
Sampling Ended	01 Jul 2014 3:29:41 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
    Latitude 36°49'07.0075"N
    Longitude 75°55'25.5734"W
Projection Transverse Mercator (UTM) Zone: 18
    Easting 417610.700 m
    Northing 4075148.900 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
    Starboard 1.556 m
    Forward -24.030 m
    Up -7.140 m
Geodetic Datum WGS84
    Latitude 36°49'07.0428"N
    Longitude 75°55'25.5702"W
Projection Transverse Mercator (UTM) Zone: 18
    Easting 417610.791 m
    Northing 4075149.987 m
    Height -39.891 m (ellipsoidal)
Final Rig Heading 255.22 °T
    255.77 °G (Convergence -0.55° World Standard)
Gyro C-O 90.31 °
Position is 1.09 m @ 4.22 °T (4.78 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	417514.2	4075046.4	116.6	215.9
SB	417493.5	4075223.6	118.3	311.8
PS	417720.5	4075096.8	120.2	114.8
SS	417671.2	4075263.1	126.1	29.0

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT- 2
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-11

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	01 Jul 2014 3:38:34 PM (UTC+00:00)
Sampling Ended	01 Jul 2014 3:48:34 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°49'07.0075"N
      Longitude    75°55'25.5734"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       417610.700 m
      Northing     4075148.900 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°49'07.0479"N
      Longitude    75°55'25.5716"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       417610.757 m
      Northing     4075150.143 m
      Height           -39.673 m (ellipsoidal)
Final Rig Heading  255.20 °T
                   255.75 °G (Convergence -0.55° World Standard)
Gyro C-O            90.31 °
Position is 1.24 m @ 2.06 °T (2.62 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	417514.2	4075046.4	116.7	215.8
SB	417493.5	4075223.6	118.2	311.8
PS	417720.5	4075096.8	120.3	114.9
SS	417671.2	4075263.1	126.0	29.0

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

```
Fugro Job Number              VOWTAP CPT
Job Name                      VOWTAP CPT 0481140004
Fugro Personnel               Will Cupples,Brendyn Me
Client Name                   Dominion
Client Representative
Sampling Started              30 Jun 2014 4:20:21 PM (UTC+00:00)
Sampling Ended                30 Jun 2014 4:30:21 PM (UTC+00:00)
Comment
```

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°49'09.6026"N
      Longitude    75°53'42.6129"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       420162.300 m
      Northing     4075204.600 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

```
AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°49'09.5839"N
      Longitude    75°53'42.6191"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       420162.142 m
      Northing     4075204.025 m
      Height           -40.288 m (ellipsoidal)
Final Rig Heading   79.33 °T
                    79.86 °G (Convergence -0.54° World Standard)
Gyro C-O            90.31 °
Position is 0.60 m @ 194.87 °T (195.41 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	420249.7	4075305.1	110.9	32.0
SB	420286.4	4075135.5	118.9	127.1
PS	420077.3	4075267.0	103.6	305.5
SS	420056.6	4075120.8	133.1	232.8

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	30 Jun 2014 2:25:58 PM (UTC+00:00)
Sampling Ended	30 Jun 2014 2:35:58 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
    Latitude 36°49'08.6304"N
    Longitude 75°53'02.9606"W
Projection Transverse Mercator (UTM) Zone: 18
    Easting 421144.400 m
    Northing 4075165.500 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
    Starboard 1.556 m
    Forward -24.030 m
    Up -7.140 m
Geodetic Datum WGS84
    Latitude 36°49'08.6314"N
    Longitude 75°53'02.9915"W
Projection Transverse Mercator (UTM) Zone: 18
    Easting 421143.634 m
    Northing 4075165.537 m
    Height -40.065 m (ellipsoidal)
Final Rig Heading 75.85 °T
    76.38 °G (Convergence -0.53° World Standard)
Gyro C-O 90.31 °
Position is 0.77 m @ 272.22 °T (272.75 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	421247.2	4075245.5	103.6	46.6
SB	421278.0	4075088.4	133.4	128.0
PS	421052.6	4075225.9	107.2	302.5
SS	421042.8	4075084.7	128.1	232.4

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	30 Jun 2014 2:45:06 PM (UTC+00:00)
Sampling Ended	30 Jun 2014 2:55:06 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
Latitude 36°49'08.6601"N
Longitude 75°53'02.8424"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 421147.337 m
Northing 4075166.386 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
Starboard 1.556 m
Forward -24.030 m
Up -7.140 m
Geodetic Datum WGS84
Latitude 36°49'08.6478"N
Longitude 75°53'02.8386"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 421147.427 m
Northing 4075166.006 m
Height -40.132 m (ellipsoidal)
Final Rig Heading 69.61 °T
70.14 °G (Convergence -0.53° World Standard)
Gyro C-O 90.31 °
Position is 0.39 m @ 166.10 °T (166.63 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	421247.2	4075245.5	99.3	47.0
SB	421278.0	4075088.4	133.3	130.0
PS	421052.6	4075225.9	109.9	301.4
SS	421042.8	4075084.7	131.7	233.3

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-4A
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-15

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	30 Jun 2014 1:17:51 PM (UTC+00:00)
Sampling Ended	30 Jun 2014 1:27:51 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°49'09.4148"N
      Longitude    75°52'33.7181"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       421869.100 m
      Northing     4075183.000 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°49'09.3799"N
      Longitude    75°52'33.7109"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       421869.269 m
      Northing     4075181.923 m
      Height           -40.483 m (ellipsoidal)
Final Rig Heading   76.88 °T
                    77.41 °G (Convergence -0.52° World Standard)
Gyro C-O            90.31 °
Position is 1.09 m @ 170.56 °T (171.08 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	421965.6	4075272.4	106.6	39.6
SB	422038.1	4075096.4	166.1	122.8
PS	421762.4	4075267.2	134.6	307.8
SS	421801.9	4075083.2	117.6	215.3

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-5
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-16

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	29 Jun 2014 10:25:40 PM (UTC+00:00)
Sampling Ended	29 Jun 2014 10:35:40 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°49'06.4723"N
      Longitude    75°51'51.9127"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       422904.000 m
      Northing     4075082.900 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°49'06.4846"N
      Longitude    75°51'51.9010"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       422904.292 m
      Northing     4075083.276 m
      Height           -40.829 m (ellipsoidal)
Final Rig Heading   79.33 °T
                    79.85 °G (Convergence -0.52° World Standard)
Gyro C-O            90.31 °
Position is 0.48 m @ 37.25 °T (37.77 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	423010.4	4075185.9	123.0	39.0
SB	423052.1	4075004.4	144.0	124.8
PS	422817.2	4075159.2	113.3	310.2
SS	422820.7	4074975.4	134.7	218.7

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-6
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-17

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	30 Jun 2014 11:15:48 AM (UTC+00:00)
Sampling Ended	30 Jun 2014 11:25:48 AM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum     WGS84
      Latitude      36°49'06.4900"N
      Longitude     75°51'51.7867"W
Projection         Transverse Mercator (UTM) Zone: 18
      Easting        422907.126 m
      Northing      4075083.416 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard       1.556 m
      Forward       -24.030 m
      Up             -7.140 m
Geodetic Datum     WGS84
      Latitude      36°49'06.5128"N
      Longitude     75°51'51.7958"W
Projection         Transverse Mercator (UTM) Zone: 18
      Easting        422906.908 m
      Northing      4075084.121 m
      Height            -40.614 m (ellipsoidal)
Final Rig Heading   77.89 °T
                    78.41 °G (Convergence -0.52° World Standard)
Gyro C-O            90.31 °
Position is 0.74 m @ 342.27 °T (342.79 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	423010.4	4075185.9	120.2	38.6
SB	423052.1	4075004.4	142.9	125.8
PS	422817.2	4075159.2	114.8	309.1
SS	422820.7	4074975.4	137.0	219.3

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	29 Jun 2014 8:23:54 PM (UTC+00:00)
Sampling Ended	29 Jun 2014 8:33:54 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°48'58.3619"N
      Longitude    75°51'06.5917"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       424024.600 m
      Northing     4074822.900 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°48'58.3441"N
      Longitude    75°51'06.5889"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       424024.664 m
      Northing     4074822.352 m
      Height           -41.058 m (ellipsoidal)
Final Rig Heading   78.71 °T
                    79.22 °G (Convergence -0.51° World Standard)
Gyro C-O            90.31 °
Position is 0.55 m @ 172.78 °T (173.29 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	424144.7	4074943.6	146.0	38.7
SB	424160.3	4074731.2	142.3	131.7
PS	423921.8	4074894.9	123.9	304.3
SS	423932.8	4074710.7	142.8	220.3

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-7
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-19

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	01 Jul 2014 1:29:54 PM (UTC+00:00)
Sampling Ended	01 Jul 2014 1:39:54 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°48'54.3629"N
      Longitude    75°50'42.6170"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       424617.500 m
      Northing     4074694.400 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°48'54.4119"N
      Longitude    75°50'42.6202"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       424617.434 m
      Northing     4074695.912 m
      Height           -39.185 m (ellipsoidal)
Final Rig Heading  109.54 °T
                   110.05 °G (Convergence -0.51° World Standard)
Gyro C-O            90.31 °
Position is 1.51 m @ 356.98 °T (357.49 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	424776.5	4074661.6	133.2	101.2
SB	424633.3	4074543.4	141.0	184.6
PS	424613.7	4074821.5	123.1	357.8
SS	424496.2	4074711.8	121.7	278.7

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-8
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-20

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	01 Jul 2014 11:27:08 AM (UTC+00:00)
Sampling Ended	01 Jul 2014 11:37:08 AM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°48'47.3742"N
      Longitude    75°50'02.4218"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       425611.500 m
      Northing     4074470.300 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°48'47.3987"N
      Longitude    75°50'02.4202"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       425611.548 m
      Northing     4074471.056 m
      Height           -40.726 m (ellipsoidal)
Final Rig Heading  124.48 °T
                   124.98 °G (Convergence -0.50° World Standard)
Gyro C-O            90.31 °
Position is 0.76 m @ 3.10 °T (3.60 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	425771.3	4074505.7	143.5	69.6
SB	425661.4	4074322.4	132.7	168.4
PS	425589.6	4074613.0	141.6	350.4
SS	425494.2	4074467.4	115.8	269.3

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	01 Jul 2014 11:55:28 AM (UTC+00:00)
Sampling Ended	01 Jul 2014 12:05:29 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
Latitude 36°48'47.3742"N
Longitude 75°50'02.4218"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 425611.500 m
Northing 4074470.300 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
Starboard 1.556 m
Forward -24.030 m
Up -7.140 m
Geodetic Datum WGS84
Latitude 36°48'47.3973"N
Longitude 75°50'02.4266"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 425611.387 m
Northing 4074471.014 m
Height -40.576 m (ellipsoidal)
Final Rig Heading 124.06 °T
124.56 °G (Convergence -0.50° World Standard)
Gyro C-O 90.31 °
Position is 0.72 m @ 350.53 °T (351.03 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	425771.3	4074505.7	143.4	69.7
SB	425661.4	4074322.4	132.9	168.4
PS	425589.6	4074613.0	141.6	350.5
SS	425494.2	4074467.4	115.6	269.4

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-9A
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-22

Starfix Final Fix Report

Fugro Job Number	VOWTAP pCPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	30 Jun 2014 6:29:53 PM (UTC+00:00)
Sampling Ended	30 Jun 2014 6:39:53 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°48'37.0895"N
      Longitude    75°49'06.4735"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       426995.000 m
      Northing     4074141.400 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°48'37.1098"N
      Longitude    75°49'06.4822"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       426994.790 m
      Northing     4074142.028 m
      Height           -40.821 m (ellipsoidal)
Final Rig Heading   82.07 °T
                    82.56 °G (Convergence -0.49° World Standard)
Gyro C-O            90.31 °
Position is 0.66 m @ 341.00 °T (341.49 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	427091.1	4074248.7	121.3	33.7
SB	427124.0	4074063.1	128.2	129.0
PS	426905.4	4074246.8	135.3	318.9
SS	426953.3	4074038.0	109.6	202.5

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	30 Jun 2014 8:19:16 PM (UTC+00:00)
Sampling Ended	30 Jun 2014 8:29:16 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°48'33.0109"N
      Longitude    75°48'22.6774"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       428079.100 m
      Northing     4074006.500 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°48'33.0158"N
      Longitude    75°48'22.6877"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       428078.845 m
      Northing     4074006.654 m
      Height           -40.980 m (ellipsoidal)
Final Rig Heading  109.04 °T
                   109.52 °G (Convergence -0.48° World Standard)
Gyro C-O            90.31 °
Position is 0.30 m @ 300.73 °T (301.21 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	428228.5	4074062.4	136.9	62.2
SB	428157.7	4073875.4	130.2	156.6
PS	427995.5	4074117.6	137.2	322.1
SS	427966.9	4073950.2	123.3	244.1

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-11
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-24

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	30 Jun 2014 9:41:26 PM (UTC+00:00)
Sampling Ended	30 Jun 2014 9:51:26 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°48'29.6633"N
      Longitude    75°47'07.2856"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       429946.300 m
      Northing     4073887.800 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°48'29.6616"N
      Longitude    75°47'07.2845"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       429946.329 m
      Northing     4073887.745 m
      Height           -40.710 m (ellipsoidal)
Final Rig Heading  108.85 °T
                   109.32 °G (Convergence -0.47° World Standard)
Gyro C-O            90.31 °
Position is 0.06 m @ 151.95 °T (152.43 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	430103.3	4073951.6	147.2	60.8
SB	430006.1	4073769.7	111.2	163.0
PS	429877.0	4073996.4	127.2	326.5
SS	429826.5	4073862.4	121.1	259.2

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-12
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-25

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	30 Jun 2014 10:08:56 PM (UTC+00:00)
Sampling Ended	30 Jun 2014 10:18:56 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
- Latitude 36°48'29.6208"N
- Longitude 75°47'07.1590"W

Projection Transverse Mercator (UTM) Zone: 18
- Easting 429949.426 m
- Northing 4073886.464 m

Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
- Starboard 1.556 m
- Forward -24.030 m
- Up -7.140 m

Geodetic Datum WGS84
- Latitude 36°48'29.6315"N
- Longitude 75°47'07.1671"W

Projection Transverse Mercator (UTM) Zone: 18
- Easting 429949.230 m
- Northing 4073886.796 m
- Height -40.823 m (ellipsoidal)

Final Rig Heading 110.44 °T
110.91 °G (Convergence -0.47° World Standard)

Gyro C-O 90.31 °

Position is 0.39 m @ 328.94 °T (329.41 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	430103.3	4073951.6	145.7	59.7
SB	430006.1	4073769.7	108.9	164.0
PS	429877.0	4073996.4	129.6	325.6
SS	429826.5	4073862.4	123.7	259.8

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-12A
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-26

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	01 Jul 2014 7:22:02 PM (UTC+00:00)
Sampling Ended	01 Jul 2014 7:32:03 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°48'27.8452"N
      Longitude    75°46'14.3297"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       431258.000 m
      Northing     4073821.100 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°48'27.8377"N
      Longitude    75°46'14.2888"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       431259.011 m
      Northing     4073820.861 m
      Height           -40.935 m (ellipsoidal)
Final Rig Heading  120.65 °T
                   121.12 °G (Convergence -0.46° World Standard)
Gyro C-O            90.31 °
Position is 1.04 m @ 102.83 °T (103.29 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	431418.9	4073868.3	146.9	65.4
SB	431344.3	4073702.5	118.3	148.9
PS	431192.0	4073940.8	136.0	329.8
SS	431126.0	4073765.3	141.9	248.0

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-13
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-27

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	01 Jul 2014 8:41:22 PM (UTC+00:00)
Sampling Ended	01 Jul 2014 8:51:22 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
    Latitude 36°48'27.8067"N
    Longitude 75°46'14.1745"W
Projection Transverse Mercator (UTM) Zone: 18
    Easting 431261.835 m
    Northing 4073819.882 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
    Starboard 1.556 m
    Forward -24.030 m
    Up -7.140 m
Geodetic Datum WGS84
    Latitude 36°48'27.8041"N
    Longitude 75°46'14.2055"W
Projection Transverse Mercator (UTM) Zone: 18
    Easting 431261.067 m
    Northing 4073819.809 m
    Height -41.007 m (ellipsoidal)
Final Rig Heading 159.78 °T
    160.24 °G (Convergence -0.46° World Standard)
Gyro C-O 90.31 °
Position is 0.77 m @ 264.11 °T (264.57 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	431367.0	4073679.7	147.1	140.2
SB	431194.2	4073692.0	124.5	217.0
PS	431302.2	4073897.3	85.7	26.7
SS	431160.5	4073903.7	129.6	310.9

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-13A
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-28

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	01 Jul 2014 10:38:45 PM (UTC+00:00)
Sampling Ended	01 Jul 2014 10:48:45 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
  Latitude 36°48'25.2338"N
  Longitude 75°44'50.7957"W
Projection Transverse Mercator (UTM) Zone: 18
  Easting 433327.200 m
  Northing 4073724.200 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
  Starboard 1.556 m
  Forward -24.030 m
  Up -7.140 m
Geodetic Datum WGS84
  Latitude 36°48'25.2197"N
  Longitude 75°44'50.7990"W
Projection Transverse Mercator (UTM) Zone: 18
  Easting 433327.114 m
  Northing 4073723.767 m
  Height -41.208 m (ellipsoidal)
Final Rig Heading 176.11 °T
  176.56 °G (Convergence -0.45° World Standard)
Gyro C-O 90.31 °
Position is 0.44 m @ 190.75 °T (191.20 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	433439.9	4073653.2	116.6	110.7
SB	433286.2	4073594.2	107.9	202.1
SS	433312.0	4073784.7	62.3	348.6

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	02 Jul 2014 12:17:02 PM (UTC+00:00)
Sampling Ended	02 Jul 2014 12:27:02 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°48'44.0888"N
      Longitude    75°43'07.0309"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       435902.700 m
      Northing     4074285.500 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard       1.556 m
      Forward       -24.030 m
      Up             -7.140 m
Geodetic Datum    WGS84
      Latitude     36°48'44.0924"N
      Longitude    75°43'07.0532"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       435902.146 m
      Northing     4074285.613 m
      Height            -40.980 m (ellipsoidal)
Final Rig Heading  182.76 °T
                   183.19 °G (Convergence -0.43° World Standard)
Gyro C-O            90.31 °
Position is 0.56 m @ 281.06 °T (281.49 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	435985.9	4074175.0	116.4	134.1
SB	435820.8	4074153.2	129.1	217.0
PS	436003.1	4074433.7	177.8	33.5
SS	435836.4	4074398.5	129.1	330.8

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-15
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-30

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	02 Jul 2014 1:50:40 PM (UTC+00:00)
Sampling Ended	02 Jul 2014 2:00:40 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°48'51.6780"N
      Longitude    75°42'26.6717"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       436904.400 m
      Northing     4074511.900 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°48'51.6875"N
      Longitude    75°42'26.7190"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       436903.231 m
      Northing     4074512.202 m
      Height           -39.780 m (ellipsoidal)
Final Rig Heading  191.42 °T
                   191.84 °G (Convergence -0.42° World Standard)
Gyro C-O            90.31 °
Position is 1.21 m @ 284.07 °T (284.49 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	436958.4	4074380.8	118.1	149.8
SB	436782.6	4074422.0	128.4	241.3
PS	437018.7	4074572.2	128.0	61.7
SS	436849.6	4074638.2	135.3	337.9

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT- 16
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-31

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	02 Jul 2014 3:45:36 PM (UTC+00:00)
Sampling Ended	02 Jul 2014 3:55:36 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°49'05.5934"N
      Longitude    75°41'09.1402"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       438828.400 m
      Northing     4074926.700 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°49'05.6097"N
      Longitude    75°41'09.1521"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       438828.110 m
      Northing     4074927.203 m
      Height           -39.518 m (ellipsoidal)
Final Rig Heading  198.02 °T
                   198.43 °G (Convergence -0.41° World Standard)
Gyro C-O            90.31 °
Position is 0.58 m @ 329.61 °T (330.02 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	438869.3	4074807.5	103.3	151.9
SB	438692.0	4074847.2	135.5	247.1
PS	438926.1	4074973.7	106.4	63.6
SS	438788.7	4075045.2	122.7	342.6

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-17
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-32

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	02 Jul 2014 5:24:15 PM (UTC+00:00)
Sampling Ended	02 Jul 2014 5:34:15 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
Latitude 36°49'12.3939"N
Longitude 75°40'29.7081"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 439806.800 m
Northing 4075129.300 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
Starboard 1.556 m
Forward -24.030 m
Up -7.140 m
Geodetic Datum WGS84
Latitude 36°49'12.4172"N
Longitude 75°40'29.7101"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 439806.756 m
Northing 4075130.017 m
Height -40.549 m (ellipsoidal)
Final Rig Heading 200.79 °T
201.19 °G (Convergence -0.40° World Standard)
Gyro C-O 90.31 °
Position is 0.72 m @ 356.12 °T (356.52 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	439845.9	4074998.9	113.5	155.0
SB	439666.7	4075062.8	133.7	252.4
PS	439928.8	4075183.5	131.3	65.5
SS	439773.1	4075272.7	145.0	347.6

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	02 Jul 2014 6:45:21 PM (UTC+00:00)
Sampling Ended	02 Jul 2014 6:55:21 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°49'20.5991"N
      Longitude    75°39'43.3070"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       440958.100 m
      Northing     4075374.100 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°49'20.6021"N
      Longitude    75°39'43.2980"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       440958.325 m
      Northing     4075374.190 m
      Height           -40.615 m (ellipsoidal)
Final Rig Heading  196.31 °T
                   196.70 °G (Convergence -0.40° World Standard)
Gyro C-O            90.31 °
Position is 0.24 m @ 67.76 °T (68.16 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	441005.2	4075250.2	109.2	150.7
SB	440826.6	4075271.0	142.9	238.1
PS	441079.8	4075434.7	133.7	62.7
SS	440920.1	4075494.2	124.4	343.4

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-19
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-34

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	02 Jul 2014 8:13:41 PM (UTC+00:00)
Sampling Ended	02 Jul 2014 8:23:41 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum		WGS84
	Latitude	36°49'27.1903"N
	Longitude	75°39'06.8681"W
Projection		Transverse Mercator (UTM) Zone: 18
	Easting	441862.200 m
	Northing	4075571.000 m
Intended Rig Heading		0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP

	Starboard	1.556 m
	Forward	-24.030 m
	Up	-7.140 m
Geodetic Datum		WGS84
	Latitude	36°49'27.2011"N
	Longitude	75°39'06.9066"W
Projection		Transverse Mercator (UTM) Zone: 18
	Easting	441861.250 m
	Northing	4075571.340 m
	Height	-41.019 m (ellipsoidal)
Final Rig Heading		185.39 °T
		185.78 °G (Convergence -0.39° World Standard)
Gyro C-O		90.31 °

Position is 1.01 m @ 289.32 °T (289.71 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	441912.9	4075430.3	123.3	154.7
SB	441759.6	4075469.1	121.1	232.9
PS	441962.1	4075636.6	117.9	56.3
SS	441794.1	4075667.4	115.4	326.1

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	02 Jul 2014 8:27:22 PM (UTC+00:00)
Sampling Ended	02 Jul 2014 8:37:23 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°49'27.0976"N
      Longitude    75°39'06.9002"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       441861.385 m
      Northing     4075568.150 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°49'27.1050"N
      Longitude    75°39'06.9193"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       441860.913 m
      Northing     4075568.382 m
      Height           -40.918 m (ellipsoidal)
Final Rig Heading  183.43 °T
                   183.82 °G (Convergence -0.39° World Standard)
Gyro C-O            90.31 °
Position is 0.53 m @ 295.76 °T (296.15 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	441912.9	4075430.3	120.3	154.3
SB	441759.6	4075469.1	119.8	234.3
PS	441962.1	4075636.6	119.8	55.2
SS	441794.1	4075667.4	117.8	327.1

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-20A
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-36

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	06 Jul 2014 10:32:59 AM (UTC+00:00)
Sampling Ended	06 Jul 2014 10:42:59 AM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°49'38.8985"N
      Longitude    75°37'59.7134"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       443528.200 m
      Northing     4075920.600 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°49'38.9022"N
      Longitude    75°37'59.7231"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       443527.960 m
      Northing     4075920.714 m
      Height           -40.504 m (ellipsoidal)
Final Rig Heading  166.06 °T
                   166.43 °G (Convergence -0.38° World Standard)
Gyro C-O            90.31 °
Position is 0.27 m @ 295.04 °T (295.42 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	443673.5	4075864.5	139.6	101.5
SB	443482.2	4075766.4	135.0	202.1
PS	443561.6	4076040.4	122.9	14.6
SS	443413.0	4075994.4	134.7	303.5

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT- 21
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-37

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	06 Jul 2014 12:17:06 PM (UTC+00:00)
Sampling Ended	06 Jul 2014 12:27:07 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
 Latitude 36°49'48.4903"N
 Longitude 75°37'09.4107"W
Projection Transverse Mercator (UTM) Zone: 18
 Easting 444776.200 m
 Northing 4076208.000 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
 Starboard 1.556 m
 Forward -24.030 m
 Up -7.140 m
Geodetic Datum WGS84
 Latitude 36°49'48.5151"N
 Longitude 75°37'09.3360"W
Projection Transverse Mercator (UTM) Zone: 18
 Easting 444778.055 m
 Northing 4076208.753 m
 Height -38.338 m (ellipsoidal)
Final Rig Heading 174.12 °T
 174.49 °G (Convergence -0.37° World Standard)
Gyro C-O 90.31 °
Position is 2.00 m @ 67.53 °T (67.90 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	444871.8	4076113.8	110.6	126.4
SB	444716.1	4076069.2	126.6	209.7
PS	444850.8	4076302.0	116.3	36.9
SS	444710.4	4076299.4	111.7	324.5

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	06 Jul 2014 2:19:07 PM (UTC+00:00)
Sampling Ended	06 Jul 2014 2:29:07 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°50'14.7545"N
      Longitude    75°36'13.7854"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       446159.200 m
      Northing     4077008.500 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°50'14.7616"N
      Longitude    75°36'13.7744"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       446159.473 m
      Northing     4077008.718 m
      Height           -40.594 m (ellipsoidal)
Final Rig Heading  211.67 °T
                   212.03 °G (Convergence -0.36° World Standard)
Gyro C-O            90.31 °
Position is 0.35 m @ 51.04 °T (51.40 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	446164.3	4076846.0	137.9	172.1
SB	446003.0	4076946.5	144.2	254.6
PS	446281.8	4077063.3	132.5	65.0
SS	446144.2	4077122.2	112.8	353.4

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number VOWTAP CPT
Job Name VOWTAP CPT 0481140004
Fugro Personnel Will Cupples,Brendyn Me
Client Name Dominion
Client Representative
Sampling Started 06 Jul 2014 3:27:54 PM (UTC+00:00)
Sampling Ended 06 Jul 2014 3:37:54 PM (UTC+00:00)
Comment

Intended Offset / Well Location
Geodetic Datum WGS84
Latitude 36°50'37.6139"N
Longitude 75°35'26.6349"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 447331.400 m
Northing 4077705.600 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
Starboard 1.556 m
Forward -24.030 m
Up -7.140 m
Geodetic Datum WGS84
Latitude 36°50'37.6164"N
Longitude 75°35'26.6468"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 447331.107 m
Northing 4077705.678 m
Height -40.808 m (ellipsoidal)
Final Rig Heading 223.40 °T
223.75 °G (Convergence -0.35° World Standard)
Gyro C-O 90.31 °
Position is 0.30 m @ 284.49 °T (284.85 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	447328.8	4077579.4	104.9	170.8
SB	447158.6	4077672.9	151.1	265.1
PS	447449.5	4077741.9	122.5	71.8
SS	447354.1	4077822.2	117.3	12.3

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	06 Jul 2014 4:53:27 PM (UTC+00:00)
Sampling Ended	06 Jul 2014 5:03:27 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°51'13.0462"N
      Longitude    75°34'14.7118"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       449119.200 m
      Northing     4078786.600 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°51'13.0472"N
      Longitude    75°34'14.7160"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       449119.095 m
      Northing     4078786.632 m
      Height           -40.634 m (ellipsoidal)
Final Rig Heading  241.59 °T
                   241.94 °G (Convergence -0.34° World Standard)
Gyro C-O            90.31 °
Position is 0.11 m @ 286.77 °T (287.11 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	449050.0	4078628.2	149.5	197.1
SB	448958.9	4078808.0	137.4	284.1
PS	449224.5	4078768.2	105.3	98.7
SS	449155.9	4078901.9	119.1	18.7

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	06 Jul 2014 6:02:25 PM (UTC+00:00)
Sampling Ended	06 Jul 2014 6:12:25 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
    Latitude 36°51'28.1928"N
    Longitude 75°33'42.4561"W
Projection Transverse Mercator (UTM) Zone: 18
    Easting 449920.700 m
    Northing 4079248.600 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
    Starboard 1.556 m
    Forward -24.030 m
    Up -7.140 m
Geodetic Datum WGS84
    Latitude 36°51'28.2004"N
    Longitude 75°33'42.4546"W
Projection Transverse Mercator (UTM) Zone: 18
    Easting 449920.737 m
    Northing 4079248.832 m
    Height -40.414 m (ellipsoidal)
Final Rig Heading 238.96 °T
    239.29 °G (Convergence -0.34° World Standard)
Gyro C-O 90.31 °
Position is 0.23 m @ 8.73 °T (9.06 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	449870.6	4079118.6	116.4	192.8
SB	449796.5	4079282.7	108.6	295.8
PS	450061.4	4079214.8	142.8	102.8
SS	449955.8	4079363.5	118.0	18.0

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	06 Jul 2014 7:14:18 PM (UTC+00:00)
Sampling Ended	06 Jul 2014 7:24:18 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°52'05.2817"N
      Longitude    75°32'26.3579"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       451811.500 m
      Northing     4080380.600 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°52'05.2881"N
      Longitude    75°32'26.3588"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       451811.479 m
      Northing     4080380.798 m
      Height           -40.510 m (ellipsoidal)
Final Rig Heading  234.88 °T
                   235.21 °G (Convergence -0.32° World Standard)
Gyro C-O            90.31 °
Position is 0.20 m @ 353.50 °T (353.82 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	451802.2	4080256.9	106.4	172.5
SB	451660.1	4080401.1	130.8	285.7
PS	451941.0	4080343.4	132.6	105.3
SS	451827.3	4080486.0	104.4	9.6

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	06 Jul 2014 8:22:49 PM (UTC+00:00)
Sampling Ended	06 Jul 2014 8:32:49 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
Latitude 36°52'18.9271"N
Longitude 75°31'57.0647"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 452539.100 m
Northing 4080797.000 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
Starboard 1.556 m
Forward -24.030 m
Up -7.140 m
Geodetic Datum WGS84
Latitude 36°52'18.9300"N
Longitude 75°31'57.0553"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 452539.334 m
Northing 4080797.087 m
Height -40.288 m (ellipsoidal)
Final Rig Heading 165.62 °T
165.94 °G (Convergence -0.32° World Standard)
Gyro C-O 90.31 °
Position is 0.25 m @ 69.28 °T (69.60 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	452664.4	4080727.3	123.3	109.7
SB	452500.7	4080643.2	132.2	199.4
PS	452582.4	4080915.6	124.5	18.9
SS	452435.2	4080856.6	117.9	300.7

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	07 Jul 2014 12:17:46 PM (UTC+00:00)
Sampling Ended	07 Jul 2014 12:27:46 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
Latitude 36°52'49.0517"N
Longitude 75°30'56.1659"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 454051.800 m
Northing 4081717.000 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
Starboard 1.556 m
Forward -24.030 m
Up -7.140 m
Geodetic Datum WGS84
Latitude 36°52'49.0763"N
Longitude 75°30'56.1748"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 454051.586 m
Northing 4081717.759 m
Height -40.785 m (ellipsoidal)
Final Rig Heading 208.14 °T
208.45 °G (Convergence -0.31° World Standard)
Gyro C-O 90.31 °
Position is 0.79 m @ 343.91 °T (344.22 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	454052.2	4081579.8	111.8	173.3
SB	453936.7	4081646.5	109.3	245.0
PS	454178.1	4081739.9	126.3	79.3
SS	454036.7	4081836.2	117.8	353.9

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-29
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-45

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	07 Jul 2014 1:44:42 PM (UTC+00:00)
Sampling Ended	07 Jul 2014 1:54:42 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
Latitude 36°53'08.0842"N
Longitude 75°30'16.2621"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 455042.700 m
Northing 4082298.200 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
Starboard 1.556 m
Forward -24.030 m
Up -7.140 m
Geodetic Datum WGS84
Latitude 36°53'08.0947"N
Longitude 75°30'16.2562"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 455042.848 m
Northing 4082298.521 m
Height -41.448 m (ellipsoidal)
Final Rig Heading 242.91 °T
243.22 °G (Convergence -0.30° World Standard)
Gyro C-O 90.31 °
Position is 0.35 m @ 24.44 °T (24.74 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	454993.7	4082142.4	143.0	189.5
SB	454869.9	4082317.8	148.9	281.9
PS	455197.2	4082287.4	153.3	93.2
SS	455079.1	4082471.0	174.0	12.4

Party Chief:____________________ Client Representative:____________________

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	07 Jul 2014 3:16:23 PM (UTC+00:00)
Sampling Ended	07 Jul 2014 3:26:23 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

Geodetic Datum WGS84
Latitude 36°53'23.4766"N
Longitude 75°29'29.7278"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 456197.000 m
Northing 4082766.500 m
Intended Rig Heading 0.00 °T

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

AFrame Offset From CRP
Starboard 1.556 m
Forward -24.030 m
Up -7.140 m
Geodetic Datum WGS84
Latitude 36°53'23.4769"N
Longitude 75°29'29.7289"W
Projection Transverse Mercator (UTM) Zone: 18
Easting 456196.973 m
Northing 4082766.507 m
Height -41.291 m (ellipsoidal)
Final Rig Heading 219.54 °T
219.83 °G (Convergence -0.30° World Standard)
Gyro C-O 90.31 °
Position is 0.03 m @ 284.72 °T (285.01 °G) FROM intended location

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	456183.8	4082612.2	130.5	178.1
SB	456025.8	4082727.5	151.7	263.3
PS	456326.1	4082790.1	129.5	78.7
SS	456187.1	4082893.8	125.7	356.5

Party Chief:____________________ Client Representative:____________________

POSITIONING SURVEY REPORT
CPT-31
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

FIGURE G-47

Starfix Final Fix Report

Fugro Job Number	VOWTAP CPT
Job Name	VOWTAP CPT 0481140004
Fugro Personnel	Will Cupples,Brendyn Me
Client Name	Dominion
Client Representative	
Sampling Started	07 Jul 2014 4:33:12 PM (UTC+00:00)
Sampling Ended	07 Jul 2014 4:43:12 PM (UTC+00:00)
Comment	

Intended Offset / Well Location

```
Geodetic Datum    WGS84
      Latitude     36°53'37.6676"N
      Longitude    75°29'29.8188"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       456197.000 m
      Northing     4083203.800 m
Intended Rig Heading    0.00 °T
```

Final DGNSS Position Fix Summary for Megan Miller_Primary

AFrame computed from PriGPS (Primary)

```
AFrame Offset From CRP
      Starboard      1.556 m
      Forward      -24.030 m
      Up            -7.140 m
Geodetic Datum    WGS84
      Latitude     36°53'37.6756"N
      Longitude    75°29'29.8200"W
Projection        Transverse Mercator (UTM) Zone: 18
      Easting       456196.971 m
      Northing     4083204.047 m
      Height           -40.610 m (ellipsoidal)
Final Rig Heading  217.12 °T
                   217.41 °G (Convergence -0.30° World Standard)
Gyro C-O            90.31 °
Position is 0.25 m @ 352.98 °T (353.28 °G) FROM intended location
```

The approximate positions of the rig anchors are:

Anchor	Easting (m)	Northing (m)	Range (m)	Bearing (°G)
PB	456195.2	4083054.7	125.6	173.3
SB	456035.3	4083169.7	142.7	265.1
PS	456330.0	4083228.0	133.3	78.9
SS	456198.0	4083327.2	121.5	1.5

Party Chief:____________________ Client Representative:____________________

APPENDIX H

LABORATORY TEST ASSIGNMENT FORMS

OFFSHORE AND NEARSHORE GEOTECHNICAL LAB ASSIGNMENT SHEET

JOB NO. 04.81140004 CLIENT: Dominion Resources PROJECT SUPERVISOR

ASSIGNED BY Mohamed Mekkawy PROJECT ENGINEER DATE ASSIGNED 18-Aug-14 DATE DUE

				INDEX TESTS							STRENGTH													CONSOLIDATION		OTHER						
HOLE NO.	SAMPLE NO.	DEPTH (M)	SAMPLE TYPE	WATER CONTENT	UNIT WEIGHT	SP. GRAVITY	LIMITS	SIEVE	% FINES	HYDROMETER	Minivane	MV Remolded	UU Tx	UU Remolded	CU Tx	CD Tx	RESONANT COLUMN	CYCLIC Tx	Small Strain Cyclic TX	CU-DSS	CD Direct Shear	CYCLIC DSS	RING SHEAR	Incremental	Constant Rate Strain	PERMEABILITY	$CaCO_3$ CONTENT	ORGANIC CONTENT	SOLUBLE SALT	ELECTRIC RESISTIVITY	LAB	REMARKS
BH-NB01	1A	0	Bag																													
BH-NB01	1B	0.1	Quart2																													
BH-NB01	1C	0.2	Bag					1		1																						
BH-NB01	2A	1.7	Quart2																													
BH-NB01	2B	1.8	Quart2																													
BH-NB01	2C	2	Bag																													
BH-NB01	3A	3	Quart2																													
BH-NB01	3B	3.2	Quart2																													
BH-NB01	3C	3.4	Bag					1		1																						
BH-NB01	4A	4.6	Quart2													1																
BH-NB01	4B	4.7	Quart2																													
BH-NB01	4C	4.9	Bag																													
BH-NB01	5A	6.1	Quart2																													
BH-NB01	5B	6.3	Quart2																													
BH-NB01	5C	6.4	Bag																													
BH-NB01	6A	7.8	Quart2																													
BH-NB01	6B	7.9	Quart2																													
BH-NB01	6C	8.1	Bag																													
BH-NB01	7A	9.3	Quart2			1		1																								
BH-NB01	7B	9.5	Quart2																													
BH-NB01	7C	9.6	Bag																													
BH-NB01	8A	10.8	Quart2																													
BH-NB01	8B	11	Quart2																													
BH-NB01	8C	11.1	Bag																													
BH-NB01	9A	12.3	Quart2																													
BH-NB01	9B	12.5	Quart2																							1						
BH-NB01	9C	12.7	Bag					1		1																	1					
BH-NB01	10A	13.9	Quart2																													
BH-NB01	10B	14	Quart2																													
BH-NB01	10C	14.2	Bag																													
BH-NB01	11A	15.4	Quart2																													
BH-NB01	11B	15.5	Quart2													1																
BH-NB01	11C	15.7	Bag					1																								
BH-NB01	12A	16.9	Quart2																													
BH-NB01	12B	17.1	Quart2																													
BH-NB01	12C	17.2	Bag																													
BH-NB01	13A	18.4	Quart2																													
BH-NB01	13B	18.6	Quart2			1																										
BH-NB01	13C	18.8	Bag																													
BH-NB01	14A	19.8	Quart2					1		1																1						
BH-NB01	14B	20	Quart2																													
BH-NB01	14C	20.1	Bag																													
BH-NB01	15A	21.3	Bag																													
BH-NB01	15B	21.5	Quart3																													
BH-NB01	15C	21.6	Bag				1			1																		1				
BH-NB01	16A	22.9	Quart3																							1						
BH-NB01	16B	23	Bag																													
BH-NB01	16C	23.3	Bag				1			1																						
BH-NB01	17A	24.4	Quart3												1																	
BH-NB01	17B	24.5	Bag																													
BH-NB03	1A	0	Bag																													
BH-NB03	1B	0.2	Quart2																													
BH-NB03	1C	0.3	Quart2																													
BH-NB03	1D	0.5	Bag																													
BH-NB03	2A	1.5	Quart2																													
BH-NB03	2B	1.7	Quart2																													
BH-NB03	2C	1.8	Bag																													
BH-NB03	3A	3	Quart2																													
BH-NB03	3B	3.2	Bag																													
BH-NB03	3C	3.4	Bag																													
BH-NB03	4A	4.6	Quart2					1		1																						
BH-NB03	4B	4.7	Bag																													
BH-NB03	4C	4.9	Bag																													
BH-NB03	4D	5	Bag																													
BH-NB03	5A	6.3	Quart3													1																
BH-NB03	5B	6.4	Quart3																													
BH-NB03	5C	6.6	Bag																													
BH-NB03	6A	7.8	Quart2			1		1		1																						

Figure H-1

OFFSHORE AND NEARSHORE GEOTECHNICAL LAB ASSIGNMENT SHEET

JOB NO. 04.81140004 CLIENT: Dominion Resources PROJECT SUPERVISOR

ASSIGNED BY Mohamed Mekkawy PROJECT ENGINEER DATE ASSIGNED 18-Aug-14 DATE DUE

				INDEX TESTS							STRENGTH													CONSOLIDATION		OTHER						
HOLE NO.	SAMPLE NO.	DEPTH (M)	SAMPLE TYPE	WATER CONTENT	UNIT WEIGHT	SP. GRAVITY	LIMITS	SIEVE	% FINES	HYDROMETER	Minivane	MV Remolded	UU Tx	UU Remolded	CU Tx	CD Tx	RESONANT COLUMN	CYCLIC Tx	Small Strain Cyclic TX	CU-DSS	CD Direct Shear	CYCLIC DSS	RING SHEAR	Incremental	Constant Rate Strain	PERMEABILITY	$CaCO_3$ CONTENT	ORGANIC CONTENT	SOLUBLE SALT	ELECTRIC RESISTIVITY	LAB	REMARKS
BH-NB03	6B	7.9	Quart2																													
BH-NB03	6C	8.1	Bag																													
BH-NB03	7A	9.3	Quart2																													
BH-NB03	7B	9.5	Quart2																													
BH-NB03	7C	9.6	Bag																													
BH-NB03	8A	10.8	Quart2																							1						
BH-NB03	8B	11	Quart2																													
BH-NB03	8C	11.1	Bag					1																								
BH-NB03	9A	12.3	Quart2																													
BH-NB03	9B	12.5	Quart2																													
BH-NB03	9C	12.7	Bag																													
BH-NB03	10A	13.9	Quart2			1																										
BH-NB03	10B	14	Quart2																													
BH-NB03	10C	14.2	Bag																													
BH-NB03	11A	15.4	Quart2																							1						
BH-NB03	11B	15.5	Quart2					1		1																						
BH-NB03	11C	15.7	Bag																													
BH-NB03	12A	16.9	Quart2													1																
BH-NB03	12B	17.1	Bag																													
BH-NB03	12C	17.2	Bag																													
BH-NB03	13A	18.4	Bag																													
BH-NB03	13B	18.6	Quart2																													
BH-NB03	13C	18.8	Bag				1			1																						
BH-NB03	14A	20	Bag																													
BH-NB03	14B	20.1	Bag				1			1																						
BH-NB03	14C	20.3	Bag																													
BH-NB03	15A	21.3	Quart2																													
BH-NB03	15B	21.5	Quart2																													
BH-NB03	15C	21.6	Bag																													
BH-NB03	16A	23	Quart2													1																
BH-NB03	16B	23.2	Bag																													
BH-NB03	17A	24.4	Quart2					1		1																						
BH-NB03	17B	24.5	Bag																													
BH-NB03	18A	25.9	Quart2																													
BH-NB03	18B	26.1	Bag																													
BH-NB03	19A	27.4	Quart2																													
BH-NB03	20A	29.1	Bag																													
BH-NB03	20B	29.3	Quart2																													
BH-NB03	21A	30.3	Quart2																													
BH-NB05	1A	0	Bag																													
BH-NB05	1B	0.2	Quart2																													
BH-NB05	1C	0.3	Quart2																													
BH-NB05	1D	0.5	Bag																													
BH-NB05	2D	1.5	Bag																													
BH-NB05	2A	1.7	Quart2																													
BH-NB05	2B	1.8	Quart2																													
BH-NB05	2C	2	Bag																													
BH-NB05	3A	3	Quart2																													
BH-NB05	3B	3.2	Quart2			1		1																								
BH-NB05	3C	3.4	Quart2																													
BH-NB05	3D	3.5	Bag																													
BH-NB05	4A	4.7	Bag																													
BH-NB05	4B	4.9	Quart2																													
BH-NB05	4C	5	Quart2																													
BH-NB05	5A	6.1	Quart3													1																
BH-NB05	5B	6.3	Quart3																													
BH-NB05	5C	6.4	Bag																													
BH-NB05	6A	7.8	Quart2																													
BH-NB05	6B	7.9	Quart2					1		1																						
BH-NB05	6C	8.1	Bag																													
BH-NB05	7A	9.3	Quart2																													
BH-NB05	7B	9.5	Bag																													
BH-NB05	7C	9.6	Quart2																													
BH-NB05	8A	10.8	Quart2					1		1																						
BH-NB05	8B	11	Quart2																													
BH-NB05	8C	11.1	Bag																													
BH-NB05	9A	12.2	Quart2																													
BH-NB05	9B	12.5	Quart2																							1						

Figure H-2

OFFSHORE AND NEARSHORE GEOTECHNICAL LAB ASSIGNMENT SHEET

JOB NO. 04.81140004 CLIENT: Dominion Resources PROJECT SUPERVISOR

ASSIGNED BY Mohamed Mekkawy PROJECT ENGINEER DATE ASSIGNED 18-Aug-14 DATE DUE

				INDEX TESTS							STRENGTH													CONSOLIDATION		OTHER						
HOLE NO.	SAMPLE NO.	DEPTH (M)	SAMPLE TYPE	WATER CONTENT	UNIT WEIGHT	SP. GRAVITY	LIMITS	SIEVE	% FINES	HYDROMETER	Minivane	MV Remolded	UU Tx	UU Remolded	CU Tx	CD Tx	RESONANT COLUMN	CYCLIC Tx	Small Strain Cyclic TX	CU-DSS	CD Direct Shear	CYCLIC DSS	RING SHEAR	Incremental	Constant Rate Strain	PERMEABILITY	$CaCO_3$ CONTENT	ORGANIC CONTENT	SOLUBLE SALT	ELECTRIC RESISTIVITY	LAB	REMARKS
BH-NB05	9C	12.7	Bag																													
BH-NB05	10A	13.9	Quart2																													
BH-NB05	10B	14	Quart2																													
BH-NB05	10C	14.2	Bag					1		1																						
BH-NB05	11A	15.4	Quart2																													
BH-NB05	11B	15.5	Bag																													
BH-NB05	11C	15.7	Quart2																							1						
BH-NB05	12D	16.8	Bag																													
BH-NB05	12A	16.9	Bag																													
BH-NB05	12B	17.1	Quart2																													
BH-NB05	12C	17.2	Bag				1			1																						
BH-NB05	13A	18.3	Quart2												1																	
BH-NB05	13B	18.6	Quart2																													
BH-NB05	13C	18.8	Bag				1			1																						
BH-NB05	14A	20	Quart2																													
BH-NB05	14B	20.1	Quart2																													
BH-NB05	14C	20.3	Bag																													
BH-NB05	15A	21.5	Bag																													
BH-NB05	16A	22.9	Bag					1		1																						
BH-NB05	16B	23	Quart2																													
BH-NB05	17A	24.5	Quart2					1																								
BH-NB05	18A	26.1	Quart2																													
BH-NB05	19A	27.4	Quart2																													
BH-NB05	19B	27.6	Bag																													
BH-NB05	20A	29.1	Bag					1		1																						
BH-NB05	20B	29.3	Quart2																													
BH-NB05	21A	30.2	Quart2																													
BH-NB07	1A	0.2	Quart2																													
BH-NB07	1B	0.3	Quart2																													
BH-NB07	1C	0.5	Bag																													
BH-NB07	2A	1.5	Quart2																													
BH-NB07	2B	1.7	Quart2			1																										
BH-NB07	2C	1.8	Bag																													
BH-NB07	3A	3.2	Quart2																													
BH-NB07	3B	3.4	Quart2																													
BH-NB07	3C	3.5	Bag																													
BH-NB07	4A	4.7	Quart2																													
BH-NB07	4B	4.9	Quart2													1																
BH-NB07	4C	5	Bag																													
BH-NB07	5A	6.3	Quart2																													
BH-NB07	5B	6.4	Quart2					1		1																						
BH-NB07	5C	6.6	Bag																													
BH-NB07	6A	7.8	Quart2																													
BH-NB07	6B	7.9	Quart2			1																										
BH-NB07	6C	8.1	Bag					1																								
BH-NB07	7A	9.3	Quart2																													
BH-NB07	7B	9.5	Quart2																							1						
BH-NB07	7C	9.6	Bag																								1					
BH-NB07	8A	10.8	Quart2																													
BH-NB07	8B	11	Quart2																													
BH-NB07	8C	11.1	Bag					1		1																						
BH-NB07	9A	12.3	Quart2																													
BH-NB07	9B	12.5	Quart2																							1						
BH-NB07	9C	12.7	Bag																													
BH-NB07	10A	13.9	Quart2																													
BH-NB07	10B	14	Quart2																						1							
BH-NB07	10C	14.2	Bag				1			1																						
BH-NB07	11A	15.4	Quart3																													
BH-NB07	11B	15.5	Quart3												1																	
BH-NB07	11C	15.7	Bag																													
BH-NB07	12A	16.9	Quart3																													
BH-NB07	12B	17.1	Bag				1			1																						
BH-NB07	12C	17.2	Bag																													
BH-NB07	13A	18.3	Quart2																													
BH-NB07	13B	18.4	Quart2																							1						
BH-NB07	13C	18.6	Bag																								1					
BH-NB07	14A	19.8	Quart2			1																										
BH-NB07	14B	20	Bag																													

Figure H-3

OFFSHORE AND NEARSHORE GEOTECHNICAL LAB ASSIGNMENT SHEET

JOB NO. 04.81140004 | CLIENT: Dominion Resources | PROJECT SUPERVISOR

ASSIGNED BY Mohamed Mekkawy | PROJECT ENGINEER | DATE ASSIGNED 18-Aug-14 | DATE DUE

				INDEX TESTS							STRENGTH													CONSOLIDATION		OTHER						
HOLE NO.	SAMPLE NO.	DEPTH (M)	SAMPLE TYPE	WATER CONTENT	UNIT WEIGHT	SP. GRAVITY	LIMITS	SIEVE	% FINES	HYDROMETER	Minivane	MV Remolded	UU Tx	UU Remolded	CU Tx	CD Tx	RESONANT COLUMN	CYCLIC Tx	Small Strain Cyclic TX	CU-DSS	CD Direct Shear	CYCLIC DSS	RING SHEAR	Incremental	Constant Rate Strain	PERMEABILITY	$CaCO_3$ CONTENT	ORGANIC CONTENT	SOLUBLE SALT	ELECTRIC RESISTIVITY	LAB	REMARKS
BH-NB07	15A	21.3	Quart2					1		1																						
BH-NB07	15B	21.5	Bag																													
BH-NB07	16A	22.9	Bag																													
BH-NB07	17A	24.4	Quart2																													
BH-NB07	17B	24.5	Bag																													
BH-NB07	18A	25.9	Quart2													1																
BH-NB07	18B	26.1	Quart2																													
BH-NB07	18C	26.2	Bag																													
BH-NB07	19A	27.4	Quart2					1		1																						
BH-NB07	19B	27.6	Bag																													
BH-NB07	20A	29	Quart2																													
BH-NB07	20B	29.1	Bag																													
BH-NB07	21A	30.2	Quart2																													
BH-NB07	21B	30.3	Bag																													
BH-NB09	1A	0.2	Quart2					1																			1					
BH-NB09	1B	0.3	Quart2																													
BH-NB09	1C	0.5	Bag				1																									
BH-NB09	2A	1.5	Bag																													
BH-NB09	2B	1.7	Quart2												1																	
BH-NB09	2C	1.8	Bag				1																									
BH-NB09	2D	2	Quart2																													
BH-NB09	3A	3.2	Bag																													
BH-NB09	3B	3.4	Quart2																													
BH-NB09	3C	3.5	Bag																													
BH-NB09	4A	4.7	Quart2													1																
BH-NB09	4B	4.9	Quart2																													
BH-NB09	4C	5	Bag																													
BH-NB09	5A	6.3	Quart2					1		1																						
BH-NB09	5B	6.4	Quart2																													
BH-NB09	5C	6.6	Bag																													
BH-NB09	6A	7.8	Quart2																													
BH-NB09	6B	7.9	Quart2																									1						
BH-NB09	6C	8.1	Bag																													
BH-NB09	7A	9.3	Quart2																													
BH-NB09	7B	9.5	Quart2																													
BH-NB09	7C	9.6	Bag					1		1																						
BH-NB09	8A	10.8	Quart2																													
BH-NB09	8B	11	Quart2																													
BH-NB09	8C	11.1	Bag																										1					
BH-NB09	9A	12.2	Quart2																									1						
BH-NB09	9B	12.3	Quart2																													
BH-NB09	9C	12.5	Quart2		1			1																								
BH-NB09	9D	12.7	Bag																													
BH-NB09	10A	13.7	Bag																													
BH-NB09	10B	13.9	Quart2																													
BH-NB09	10C	14	Quart2													1																
BH-NB09	10D	14.2	Quart2					1		1																						
BH-NB09	11A	15.4	Quart2																									1						
BH-NB09	11B	15.5	Quart2																													
BH-NB09	11C	15.7	Bag				1																									
BH-NB09	12A	16.9	Quart2					1		1																						
BH-NB09	12B	17.1	Quart2																									1						
BH-NB09	12C	17.2	Bag				1																					1				
BH-NB09	13A	18.4	Bag																													
BH-NB09	13B	18.6	Bag																													
BH-NB09	14A	19.8	Bag					1																								
BH-NB09	14B	20	Bag																													
BH-NB09	15A	21.3	Bag																													
BH-NB09	16A	22.9	Bag																													
BH-NB09	17C	24.7	Bag																													
BH-NB09	17A	24.8	Quart2																													
BH-NB09	17B	25	Quart2																													
BH-NB11	1A	0	Quart2																													
BH-NB11	1B	0.2	Quart2			1																										
BH-NB11	1C	0.3	Quart2																													
BH-NB11	1D	0.5	Bag																													
BH-NB11	2A	1.5	Bag																													
BH-NB11	2B	1.7	Quart2																													

Figure H-4

OFFSHORE AND NEARSHORE GEOTECHNICAL LAB ASSIGNMENT SHEET

JOB NO. 04.81140004 CLIENT: Dominion Resources PROJECT SUPERVISOR

ASSIGNED BY Mohamed Mekkawy PROJECT ENGINEER DATE ASSIGNED 18-Aug-14 DATE DUE

				INDEX TESTS							STRENGTH													CONSOLIDATION		OTHER						
HOLE NO.	SAMPLE NO.	DEPTH (M)	SAMPLE TYPE	WATER CONTENT	UNIT WEIGHT	SP. GRAVITY	LIMITS	SIEVE	% FINES	HYDROMETER	Minivane	MV Remolded	UU Tx	UU Remolded	CU Tx	CD Tx	RESONANT COLUMN	CYCLIC Tx	Small Strain Cyclic TX	CU-DSS	CD Direct Shear	CYCLIC DSS	RING SHEAR	Incremental	Constant Rate Strain	PERMEABILITY	$CaCO_3$ CONTENT	ORGANIC CONTENT	SOLUBLE SALT	ELECTRIC RESISTIVITY	LAB	REMARKS
BH-NB11	2C	1.8	Quart2					1		1																						
BH-NB11	2D	2	Bag																													
BH-NB11	3A	3.2	Quart2																													
BH-NB11	3B	3.4	Quart2													1																
BH-NB11	3C	3.5	Bag					1		1																						
BH-NB11	4A	4.7	Quart2																													
BH-NB11	4B	4.9	Quart2																							1						
BH-NB11	4C	5	Bag				1			1																						
BH-NB11	5A	6.9	Quart3																													
BH-NB11	5B	7	Quart3												1																	
BH-NB11	5C	7.2	Bag																													
BH-NB11	6A	7.6	Quart3																													
BH-NB11	6B	7.8	Quart3																						1							
BH-NB11	6C	7.9	Bag				1			1																						
BH-NB11	7A	9.3	Bag																													
BH-NB11	7B	9.5	Quart2																													
BH-NB11	7C	9.6	Quart2																													
BH-NB11	8A	10.8	Quart2																													
BH-NB11	8B	11	Quart2																							1						
BH-NB11	8C	11.1	Bag																													
BH-NB11	9A	12.3	Quart2					1		1																						
BH-NB11	9B	12.5	Quart2																													
BH-NB11	9C	12.7	Bag																													
BH-NB11	10A	13.9	Bag																													
BH-NB11	10B	14	Quart2																													
BH-NB11	10C	14.2	Quart2			1																										
BH-NB11	11A	15.4	Quart2																													
BH-NB11	11B	15.5	Quart2													1																
BH-NB11	11C	15.7	Bag																								1					
BH-NB11	12A	16.9	Quart2																													
BH-NB11	12B	17.1	Quart2																													
BH-NB11	12C	17.2	Bag																													
BH-NB11	13A	18.3	Quart2																													
BH-NB11	13B	18.4	Quart2					1		1																1						
BH-NB11	13C	18.6	Bag																													
BH-NB11	14A	19.8	Bag																													
BH-NB11	15A	21.3	Bag																													
BH-NB11	15B	21.5	Quart2																													
BH-NB11	15C	21.6	Quart2																													
BH-NB11	16A	22.9	Bag																													
BH-NB11	16B	23	Quart2																													
BH-NB11	16C	23.2	Bag																													
BH-NB11	17A	24.4	Quart2																													
BH-T1A	1A	0.9	Bag					1		1																	1					
BH-T1A	2A	1.5	Bag																													
BH-T1A	2B	1.8	Bag					1		1																						
BH-T1A	3A	5.3	Bag																													
BH-T1A	3B	5.5	Quart3																													
BH-T1A	3C	5.6	Bag				1			1																						
BH-T1A	4A	6.1	Bag																													
BH-T1A	4B	6.2	Quart3														1															
BH-T1A	4C	6.3	Bag																													
BH-T1A	5A	9.8	Bag				1																									
BH-T1A	6A	10.7	Bag																													
BH-T1A	6B	10.8	Quart3																				1									
BH-T1A	6C	11.0	Bag																													
BH-T1A	7A	12.3	Quart2												1																	
BH-T1A	7B	12.5	Bag																													
BH-T1A	7C	12.6	Bag																													
BH-T1A	8A	13.0	Bag							1																						
BH-T1A	8B	13.1	Quart3																	1												
BH-T1A	8C	13.3	Quart3																			1										
BH-T1A	9A	16.6	Quart3															1														
BH-T1A	9B	16.8	Bag																													
BH-T1A	9C	16.9	Bag				1			1																						
BH-T1A	10A	17.5	Quart3														1															
BH-T1A	10B	17.7	Bag																													
BH-T1A	10C	17.8	Quart3																			1										
BH-T1A	11A	21.2	Quart3																1													
BH-T1A	11B	21.3	Bag				1																									

OFFSHORE AND NEARSHORE GEOTECHNICAL LAB ASSIGNMENT SHEET

JOB NO.	04.81140004	CLIENT:	Dominion Resources	PROJECT SUPERVISOR	
ASSIGNED BY	Mohamed Mekkawy	PROJECT ENGINEER		DATE ASSIGNED	18-Aug-14
DATE DUE					

				INDEX TESTS							STRENGTH													CONSOLIDATION		OTHER						
HOLE NO.	SAMPLE NO.	DEPTH (M)	SAMPLE TYPE	WATER CONTENT	UNIT WEIGHT	SP. GRAVITY	LIMITS	SIEVE	% FINES	HYDROMETER	Minivane	MV Remolded	UU Tx	UU Remolded	CU Tx	CD Tx	RESONANT COLUMN	CYCLIC Tx	Small Strain Cyclic TX	CU-DSS	CD Direct Shear	CYCLIC DSS	RING SHEAR	Incremental	Constant Rate Strain	PERMEABILITY	$CaCO_3$ CONTENT	ORGANIC CONTENT	SOLUBLE SALT	ELECTRIC RESISTIVITY	LAB	REMARKS
BH-T1A	11C	21.5	Bag																													
BH-T1A	12A	22.1	Quart3																			1										
BH-T1A	12B	22.3	Quart3															1														
BH-T1A	12C	22.4	Bag				1																									
BH-T1A	13A	25.8	Quart2																	1												
BH-T1A	13B	25.9	Quart2																													
BH-T1A	13C	26.1	Bag					1		1																						
BH-T1A	14A	26.7	Quart2																			1										
BH-T1A	14B	26.8	Quart2														1															
BH-T1A	14C	27.0	Bag																													
BH-T1A	15A	30.2	Quart3																			1										
BH-T1A	15B	30.3	Bag																													
BH-T1A	16A	31.1	Quart2													1																
BH-T1A	16B	31.2	Bag					1		1																						
BH-T1A	16C	31.3	Quart2																	1												
BH-T1A	17A	34.9	Quart2																			1										
BH-T1A	17B	35.1	Quart2																			1										
BH-T1A	17C	35.2	Bag																													
BH-T1A	18A	38.7	Bag																													
BH-T1A	18B	38.9	Quart2														1															
BH-T1A	19A	42.2	Bag					1		1																						
BH-T1A	19B	42.4	Bag																													
BH-T1A	20A	45.3	Bag																													
BH-T1A	21C	48.8	Bag																													
BH-T1A	21A	48.9	Quart2													1											1					
BH-T1A	21B	49.1	Quart2					1		1																						
BH-T1A	22A	52.4	Quart2																													
BH-T1A	22B	52.6	Bag																													
BH-T1A	22C	52.7	Quart2														1															
BH-T1A	23A	56.2	Bag				1			1																						
BH-T1A	23B	56.5	Quart2												1																	
BH-T1A	24A	57.2	Bag																													
BH-T1A	24B	57.3	Quart3															1														
BH-T1A	24C	57.5	Bag				1			1																						
BH-T1A	25A	60.8	Quart3																			1										
BH-T1A	25B	61.0	Quart3														1															
BH-T1A	25C	61.1	Bag				1																									
BH-T1A	26A	61.7	Quart3																1													
BH-T1A	26B	61.9	Bag																													
BH-T1A	26C	62.0	Bag																													
BH-T1A	27A	65.4	Quart3																	1												
BH-T1A	27B	65.5	Bag				1			1																						
BH-T1A	27C	65.7	Bag																													
BH-T1A	28A	66.3	Bag																													
BH-T1A	28B	66.4	Quart3																			1										
BH-T1A	28C	66.6	Bag				1																									
BH-T1A	29A	70.0	Quart3																				1									
BH-T1A	29B	70.1	Bag																													
BH-T1A	29C	70.3	Bag																													
BH-T1A	30A	70.9	Quart3																													
BH-T1A	30B	71.0	Quart3												1																	
BH-T1A	30C	71.2	Bag																													
BH-T1A	31A	74.7	Quart2																													
BH-T1A	31B	74.8	Quart2																													
BH-T1A	31C	75.0	Bag					1		1																						
BH-T1A	32A	78.5	Quart2													1																
BH-T1A	32B	78.6	Quart2																													
BH-T1A	32C	78.8	Bag																								1					
BH-T1A	33A	82.1	Quart2																													
BH-T1A	33B	82.3	Quart2																													
BH-T1A	33C	82.4	Bag					1		1																						
BH-T1A	34A	85.6	Quart2																													
BH-T1A	34B	85.8	Quart2																													
BH-T1A	34C	86.0	Bag																													
BH-T1A	35A	89.5	Quart2																													
BH-T1A	35B	89.6	Quart2				1								1																	
BH-T1A	35C	89.8	Bag							1																						
BH-T1A	36A	93.1	Quart2																													

OFFSHORE AND NEARSHORE GEOTECHNICAL LAB ASSIGNMENT SHEET

JOB NO. 04.81140004 CLIENT: Dominion Resources PROJECT SUPERVISOR

ASSIGNED BY Mohamed Mekkawy PROJECT ENGINEER DATE ASSIGNED 18-Aug-14 DATE DUE

				INDEX TESTS							STRENGTH													CONSOLIDATION		OTHER						
HOLE NO.	SAMPLE NO.	DEPTH (M)	SAMPLE TYPE	WATER CONTENT	UNIT WEIGHT	SP. GRAVITY	LIMITS	SIEVE	% FINES	HYDROMETER	Minivane	MV Remolded	UU Tx	UU Remolded	CU Tx	CD Tx	RESONANT COLUMN	CYCLIC Tx	Small Strain Cyclic TX	CU-DSS	CD Direct Shear	CYCLIC DSS	RING SHEAR	Incremental	Constant Rate Strain	PERMEABILITY	$CaCO_3$ CONTENT	ORGANIC CONTENT	SOLUBLE SALT	ELECTRIC RESISTIVITY	LAB	REMARKS
BH-T1A	36B	93.3	Bag																													
BH-T1A	36C	93.4	Bag				1																									
BH-T1A	37A	96.6	Bag																													
BH-T1A	37B	96.8	Quart3																													
BH-T1A	37C	96.9	Quart3																													
BH-T1A	37D	97.1	Bag				1			1																						
BH-T1A	38A	97.5	Quart3																													
BH-T1A	38B	97.7	Quart3																													
BH-T1A	38C	97.8	Quart3																													
BH-T1A	38D	98.0	Bag																													
BH-T1A	39D	101.2	Quart3																													
BH-T1A	39A	101.3	Bag				1																									
BH-T1A	39B	101.5	Quart3																													
BH-T1A	39C	101.7	Bag																													
BH-T1A	40A	102.3	Quart3												1																	
BH-T1A	40B	102.4	Quart3																													
BH-T1A	40C	102.6	Bag				1			1																						
BH-T1A	41A	105.9	Bag																													
BH-T1A	41B	106.1	Bag				1			1																						
BH-T1A	41C	106.2	Bag																													
BH-T1A	42A	106.8	Quart3																													
BH-T1A	42B	107.0	Quart3																													
BH-T1A	42C	107.1	Bag				1																									
BH-T2A	1A	4.9	Bag																													
BH-T2A	1B	5	Bag																													
BH-T2A	2A	5.6	Bag				1			1																	1					
BH-T2A	2B	5.8	Quart3												1																	
BH-T2A	2C	5.9	Bag																													
BH-T2A	3A	10.8	Quart2																					1								
BH-T2A	3B	11	Quart2																				1									
BH-T2A	3C	11.1	Bag				1																	1								
BH-T2A	4A	14.5	Quart3																1													
BH-T2A	4B	14.6	Bag																													
BH-T2A	4C	14.8	Bag																													
BH-T2A	5A	15.4	Quart3															1														
BH-T2A	5B	15.5	Quart3										1	1																		
BH-T2A	5C	15.7	Bag				1																									
BH-T2A	6A	19.1	Bag																													
BH-T2A	6B	19.2	Quart3														1															
BH-T2A	6C	19.4	Bag																													
BH-T2A	7D	19.8	Bag																													
BH-T2A	7A	20	Quart3										1	1																		
BH-T2A	7B	20.1	Bag																													
BH-T2A	7C	20.3	Quart3																	1												
BH-T2A	8A	23.6	Quart3																			1										
BH-T2A	8B	23.8	Bag																													
BH-T2A	8C	23.9	Bag																													
BH-T2A	9A	24.5	Quart3																													
BH-T2A	9B	24.7	Bag																													
BH-T2A	9C	24.8	Bag				1			1																						
BH-T2A	10A	28.2	Quart3										1	1																		
BH-T2A	10B	28.4	Bag																													
BH-T2A	10C	28.5	Bag																													
BH-T2A	11A	29.1	Quart3																													
BH-T2A	11B	29.3	Quart3																													
BH-T2A	11C	29.4	Bag				1			1																						
BH-T2A	12A	32.8	Quart2													1																
BH-T2A	12B	32.9	Quart2																													
BH-T2A	12C	33.1	Bag																													
BH-T2A	13A	36.6	Quart3																													
BH-T2A	13B	36.7	Bag																								1					
BH-T2A	14A	40.4	Bag																													
BH-T2A	14B	40.5	Quart2																													
BH-T2A	14C	40.7	Quart2																													
BH-T2A	15A	43.9	Quart2																													
BH-T2A	15B	44.1	Bag				1			1																						
BH-T2A	16A	47.7	Quart2													1																
BH-T2A	16B	47.9	Bag																													

OFFSHORE AND NEARSHORE GEOTECHNICAL LAB ASSIGNMENT SHEET

JOB NO. 04.81140004 | CLIENT: Dominion Resources | PROJECT SUPERVISOR

ASSIGNED BY Mohamed Mekkawy | PROJECT ENGINEER | DATE ASSIGNED 18-Aug-14 | DATE DUE

				INDEX TESTS							STRENGTH													CONSOLIDATION		OTHER						
HOLE NO.	SAMPLE NO.	DEPTH (M)	SAMPLE TYPE	WATER CONTENT	UNIT WEIGHT	SP. GRAVITY	LIMITS	SIEVE	% FINES	HYDROMETER	Minivane	MV Remolded	UU Tx	UU Remolded	CU Tx	CD Tx	RESONANT COLUMN	CYCLIC Tx	Small Strain Cyclic TX	CU-DSS	CD Direct Shear	CYCLIC DSS	RING SHEAR	Incremental	Constant Rate Strain	PERMEABILITY	$CaCO_3$ CONTENT	ORGANIC CONTENT	SOLUBLE SALT	ELECTRIC RESISTIVITY	LAB	REMARKS
BH-T2A	17A	51.4	Bag																													
BH-T2A	17B	51.5	Bag				1			1																						
BH-T2A	18A	54.9	Bag																													
BH-T2A	18B	55	Quart2										1																			
BH-T2A	18C	55.2	Quart2																						1							
BH-T2A	19A	58.5	Quart2																													
BH-T2A	19B	58.7	Quart2																					1								
BH-T2A	19C	58.8	Bag																					1								
BH-T2A	20A	59.6	Bag																													
BH-T2A	20B	59.8	Quart3												1																	
BH-T2A	20C	59.9	Bag				1																									
BH-T2A	21A	62.5	Bag																								1					
BH-T2A	21B	62.7	Quart2										1																			
BH-T2A	21C	62.8	Bag																													
BH-T2A	22A	64.2	Quart2																													
BH-T2A	22B	64.3	Quart2																													
BH-T2A	22C	64.5	Bag																													
BH-T2A	23A	67.8	Bag																													
BH-T2A	23B	68	Quart3																													
BH-T2A	23C	68.1	Bag																													
BH-T2A	24A	68.8	Quart3																													
BH-T2A	24B	68.9	Quart3																													
BH-T2A	24C	69.1	Bag				1																									
BH-T2A	25A	72.4	Quart3																													
BH-T2A	25B	72.6	Quart3																													
BH-T2A	25C	72.7	Bag					1		1																						
BH-T2A	26A	73.3	Quart2													1																
BH-T2A	26B	73.5	Quart2																													
BH-T2A	26C	73.6	Bag																													
BH-T2A	27A	77	Quart2																													
BH-T2A	27B	77.1	Quart2																													
BH-T2A	27C	77.3	Bag																								1					
BH-T2A	28A	80.6	Quart2					1		1																						
BH-T2A	28B	80.8	Bag																													
BH-T2A	28C	80.9	Quart2																													
BH-T2A	29A	84.3	Quart3																													
BH-T2A	29B	84.5	Quart3																													
BH-T2A	29C	84.6	Bag																													
BH-T2A	30A	85.2	Bag																													
BH-T2A	30B	85.4	Quart3				1								1																	
BH-T2A	30C	85.5	Bag																													
BH-T2A	31A	88.9	Bag																													
BH-T2A	31B	89	Bag																													
BH-T2A	31C	89.2	Quart3																													
BH-T2A	32A	89.8	Quart3																													
BH-T2A	32B	89.9	Quart3																													
BH-T2A	32C	90.1	Bag																													
BH-T2A	33A	93.4	Bag				1			1																						
BH-T2A	33B	93.6	Quart3																													
BH-T2A	33C	93.8	Bag																													
BH-T2A	34A	94.4	Quart3																													
BH-T2A	34B	94.5	Quart3																													
BH-T2A	34C	94.7	Bag																													
BH-T2A	35A	98	Bag																													
BH-T2A	35B	98.2	Bag																													
BH-T2A	35C	98.3	Quart3																													
BH-T2A	36A	98.9	Quart3																													
BH-T2A	36B	99.1	Quart3																													
BH-T2A	36C	99.2	Bag																													
BH-T2A	37A	102.6	Bag																													
BH-T2A	37B	102.7	Bag																													
BH-T2A	37C	102.9	Quart3																													
BH-T2A	38A	103.5	Quart3																													
BH-T2A	38B	103.7	Quart3																													
BH-T2A	38C	103.8	Bag				1																									
BH-T2A	39A	107.2	Bag																													
BH-T2A	39B	107.3	Quart3																													
BH-T2A	39C	107.5	Quart3																													

OFFSHORE AND NEARSHORE GEOTECHNICAL LAB ASSIGNMENT SHEET

JOB NO. 04.81140004 CLIENT: Dominion Resources PROJECT SUPERVISOR

ASSIGNED BY Mohamed Mekkawy PROJECT ENGINEER DATE ASSIGNED 18-Aug-14 DATE DUE

HOLE NO.	SAMPLE NO.	DEPTH (M)	SAMPLE TYPE	INDEX TESTS: WATER CONTENT	UNIT WEIGHT	SP. GRAVITY	LIMITS	SIEVE	% FINES	HYDROMETER	STRENGTH: Minivane	MV Remolded	UU Tx	UU Remolded	CU Tx	CD Tx	RESONANT COLUMN	CYCLIC Tx	Small Strain Cyclic TX	CU-DSS	CD Direct Shear	CYCLIC DSS	RING SHEAR	CONSOLIDATION: Incremental	Constant Rate Strain	OTHER: PERMEABILITY	$CaCO_3$ CONTENT	ORGANIC CONTENT	SOLUBLE SALT	ELECTRIC RESISTIVITY	LAB	REMARKS
BH-T2A	40A	108.1	Quart3																													
BH-T2A	40B	108.2	Quart3																													
BH-T2A	40C	108.4	Bag																													
BH-T2B	1A	1.7	Bag					1																			1					
BH-T2B	1B	1.8	Quart2																													
BH-T2B	1C	2.0	Bag																													
BH-T2B	2A	2.6	Quart3													1																
BH-T2B	2B	2.7	Quart3																													
BH-T2B	2C	2.9	Bag					1		1																		1				
BH-T2B	3A	6.1	Quart3										1	1																		
BH-T2B	3B	6.3	Quart3																													
BH-T2B	3C	6.4	Bag				1																									
BH-T2B	4A	7.2	Quart3												1																	
BH-T2B	4B	7.3	Bag																													
BH-T2B	4C	7.5	Bag																													
BH-T2B	5A	10.8	Quart3																													
BH-T2B	5B	11.0	Quart3																													
BH-T2B	5C	11.1	Bag				1			1																	1					
BH-T2B	6A	12.3	Quart3																													
BH-T2B	6B	12.5	Bag																													
BH-T2B	6C	12.7	Bag																													
BH-T2B	7A	16.0	Quart3																													
BH-T2B	7B	16.2	Bag																													
BH-T2B	7C	16.3	Bag																													
BH-T2B	8A	16.9	Quart3																													
BH-T2B	8B	17.1	Quart3												1																	
BH-T2B	8C	17.2	Bag																													
BH-T2B	9A	20.6	Quart3																													
BH-T2B	9B	20.7	Bag																													
BH-T2B	9C	20.9	Bag				1																									
BH-T2B	10A	21.5	Quart3																													
BH-T2B	10B	21.6	Quart3																													
BH-T2B	10C	21.8	Bag																													
BH-T2B	11A	25.2	Quart2																													
BH-T2B	11B	25.3	Quart2																													
BH-T2B	11C	25.5	Bag					1		1																	1					
BH-T2B	12A	28.7	Quart2																													
BH-T2B	12B	28.8	Quart2													1																
BH-T2B	12C	29.0	Bag																													
BH-T2B	13A	32.5	Quart2																													
BH-T2B	13B	32.6	Quart2																													
BH-T2B	13C	32.8	Bag																													
BH-T2B	14A	36.0	Quart2																													
BH-T2B	14B	36.1	Bag					1		1																						
BH-T2B	15A	39.6	Quart2													1																
BH-T2B	15B	39.8	Bag																													
BH-T2B	16A	43.3	Quart2																													
BH-T2B	16B	43.4	Bag																													
BH-T2B	17A	47.0	Quart2																													
BH-T2B	17B	47.1	Bag					1																								
BH-T2B	18A	50.6	Quart2																													
BH-T2B	18B	50.8	Quart2												1																	
BH-T2B	18C	50.9	Bag																													
BH-T2B	19A	51.7	Bag																													
BH-T2B	19B	51.8	Bag				1			1																						
BH-T2B	19C	52.0	Quart3																													
BH-T2B	20A	55.3	Quart3																													
BH-T2B	20B	55.5	Bag																													
BH-T2B	20C	55.6	Bag																													
BH-T2B	21A	56.1	Bag																													
BH-T2B	21B	56.3	Quart2																													
BH-T2B	22A	59.9	Bag				1																				1					
BH-T2B	22B	60.1	Quart3												1																	
BH-T2B	22C	60.2	Bag																													
BH-T2B	23A	63.9	Quart2																													
BH-T2B	23B	64.0	Bag																													
BH-T2B	24A	64.8	Bag				1																									
BH-T2B	24B	64.9	Quart3																													

Figure H-9

OFFSHORE AND NEARSHORE GEOTECHNICAL LAB ASSIGNMENT SHEET

FUGRO

JOB NO. 04.81140004 CLIENT: Dominion Resources PROJECT SUPERVISOR

ASSIGNED BY Mohamed Mekkawy PROJECT ENGINEER DATE ASSIGNED 18-Aug-14 DATE DUE

				INDEX TESTS							STRENGTH													CONSOLIDATION		OTHER						
HOLE NO.	SAMPLE NO.	DEPTH (M)	SAMPLE TYPE	WATER CONTENT	UNIT WEIGHT	SP. GRAVITY	LIMITS	SIEVE	% FINES	HYDROMETER	Minivane	MV Remolded	UU Tx	UU Remolded	CU Tx	CD Tx	RESONANT COLUMN	CYCLIC Tx	Small Strain Cyclic TX	CU-DSS	CD Direct Shear	CYCLIC DSS	RING SHEAR	Incremental	Constant Rate Strain	PERMEABILITY	$CaCO_3$ CONTENT	ORGANIC CONTENT	SOLUBLE SALT	ELECTRIC RESISTIVITY	LAB	REMARKS
BH-T2B	24C	65.1	Bag																													
BH-T2B	25A	68.3	Bag																													
BH-T2B	25B	68.4	Quart3																													
BH-T2B	25C	68.6	Quart3																													
BH-T2B	25D	68.8	Bag																													
BH-T2B	26A	69.2	Quart3																													
BH-T2B	26B	69.4	Quart3																													
BH-T2B	26C	69.5	Quart3																													
BH-T2B	26D	69.7	Bag				1																									
BH-T2B	27A	72.9	Quart2																													
BH-T2B	27B	73.0	Bag																													
BH-T2B	28A	76.5	Quart2													1																
BH-T2B	28B	76.7	Quart2																													
BH-T2B	28C	76.8	Bag					1																								
BH-T2B	29A	80.3	Quart2																													
BH-T2B	29B	80.5	Quart2																													
BH-T2B	29C	80.6	Bag					1		1																						
BH-T2B	30A	84.0	Bag																													
BH-T2B	30B	84.1	Quart3																													
BH-T2B	30C	84.3	Bag																													
BH-T2B	31A	84.9	Quart3																													
BH-T2B	31B	85.1	Quart3																													
BH-T2B	31C	85.2	Bag				1																									
BH-T2B	32A	88.6	Quart3																													
BH-T2B	32B	88.7	Bag																													
BH-T2B	32C	88.9	Bag																													
BH-T2B	33A	89.5	Quart3																													
BH-T2B	33B	89.6	Quart3																													
BH-T2B	33C	89.8	Bag																													
BH-T2B	34A	91.6	Bag																													
BH-T2B	34B	91.8	Quart3																													
BH-T2B	34C	91.9	Bag																													
BH-T2B	35A	92.5	Quart3																													
BH-T2B	35B	92.7	Quart3																													
BH-T2B	35C	92.8	Bag				1																									
BH-T2B	36A	96.2	Quart3																													
BH-T2B	36B	96.3	Bag																													
BH-T2B	36C	96.5	Bag																													
BH-T2B	37A	97.1	Quart3																													
BH-T2B	37B	97.3	Quart3																													
BH-T2B	37C	97.4	Bag																													
BH-T2B	38A	100.8	Quart3																													
BH-T2B	38B	100.9	Bag																													
BH-T2B	38C	101.1	Bag																													
BH-T2B	39A	101.7	Quart3																													
BH-T2B	39B	101.8	Quart3																													
BH-T2B	39C	102.0	Bag				1																									
BH-T2B	40A	105.3	Quart3																													
BH-T2B	40B	105.5	Bag																													
BH-T2B	40C	105.6	Bag																													
BH-T2B	41A	106.3	Quart3																													
BH-T2B	41B	106.4	Bag																													
BH-T2B	41C	106.7	Quart3																													
BH-T2B	42A	109.9	Bag																													
BH-T2B	42B	110.1	Quart3																													
BH-T2B	42C	110.2	Bag				1																									
BH-T2B	43A	110.7	Quart3																													
BH-T2B	43B	110.8	Bag																													

Figure H-10

APPENDIX I

CPT CALIBRATION CERTIFICATES

CALIBRATION CERTIFICATE OF A CONE PENETROMETER

Applicant	**FUGRO MCCLELLAND MARINE GEOSCIENCES INC**	Certificate nr.	FCL14000665
Manufacturer	Fugro Engineers B.V.	Type	CONE, A10F5CKEW2/B, 100 bar, DOLPHIN, XP
Instrument	**A Cone Penetrometer**	Identification	1706-0792

Calibration method:
The cone penetrometer was calibrated according to Fugro Engineers procedures using a comparison technique against a Fugro reference standard. Fugro reference standards are periodically recertified and traceable to the National Standards and Technology (NIST) (RVA). It is derived from accepted values of natural physical constants according to the International System of units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2000 and ISO/IEC 17025:2005.

Cone and Friction Sleeve Calibration Reference

Equipment Serial Number	6034-0002
Equipment Manufacturer	ZWICK GMBH & CO
Equipment Calibration Valid till	04/11/2014
Equipment Certificate	13203713.1000.1EN
Procedure used : in-house	FEBV.CAL.PRO.003

Cone and Friction Sleeve Sensor

Manufacturer	Fugro Engineers BV
Force Application Mode	Compression
Calibrated Range	0 – 50 kN
Nominal Range	0 – 100 kN

Note 1) Details are specified on Force Calibration Data sheet, page 2 of 2.

Pressure Calibration Reference

Equipment Serial Number	3257-0002
Equipment Manufacturer	KELLER MEETTECH
Equipment Calibration Valid till	14/05/2014
Equipment Certificate	45403
Procedure used : in-house	FEBV.CAL.PRO.004

Pressure Sensor

Manufacturer	Keller
Pressure Application Mode	Compression and tension
Calibrated Range	Nominal Range
Nominal Range	0 –10.0 MPa

Inclinometer Calibration Reference

Equipment Serial Number	2109-0003
Equipment Manufacturer	FEBV
Equipment Calibration Valid till	14/05/2014
Procedure used : in-house	FEBV.CAL.PRO.005

Inclinometer

Manufacturer	FEBV	ADXL
Calibrated Range	0°– 1 5°	-10°- 10°
Nominal Range	0°– 30°	-15°- 15°

Environmental Conditions

Temperature during calibration	21 ± 3 °C
Pressure during calibration	1000 ± 100 mbar

Remarks.
The values given in this calibration certificate only relate to the submitted device, and to the values measured at the time of the test. Any uncertainty defined here does not include allowances for environmental changes, variation and shock during transportation, or the capability of other laboratories to repeat the measurement.

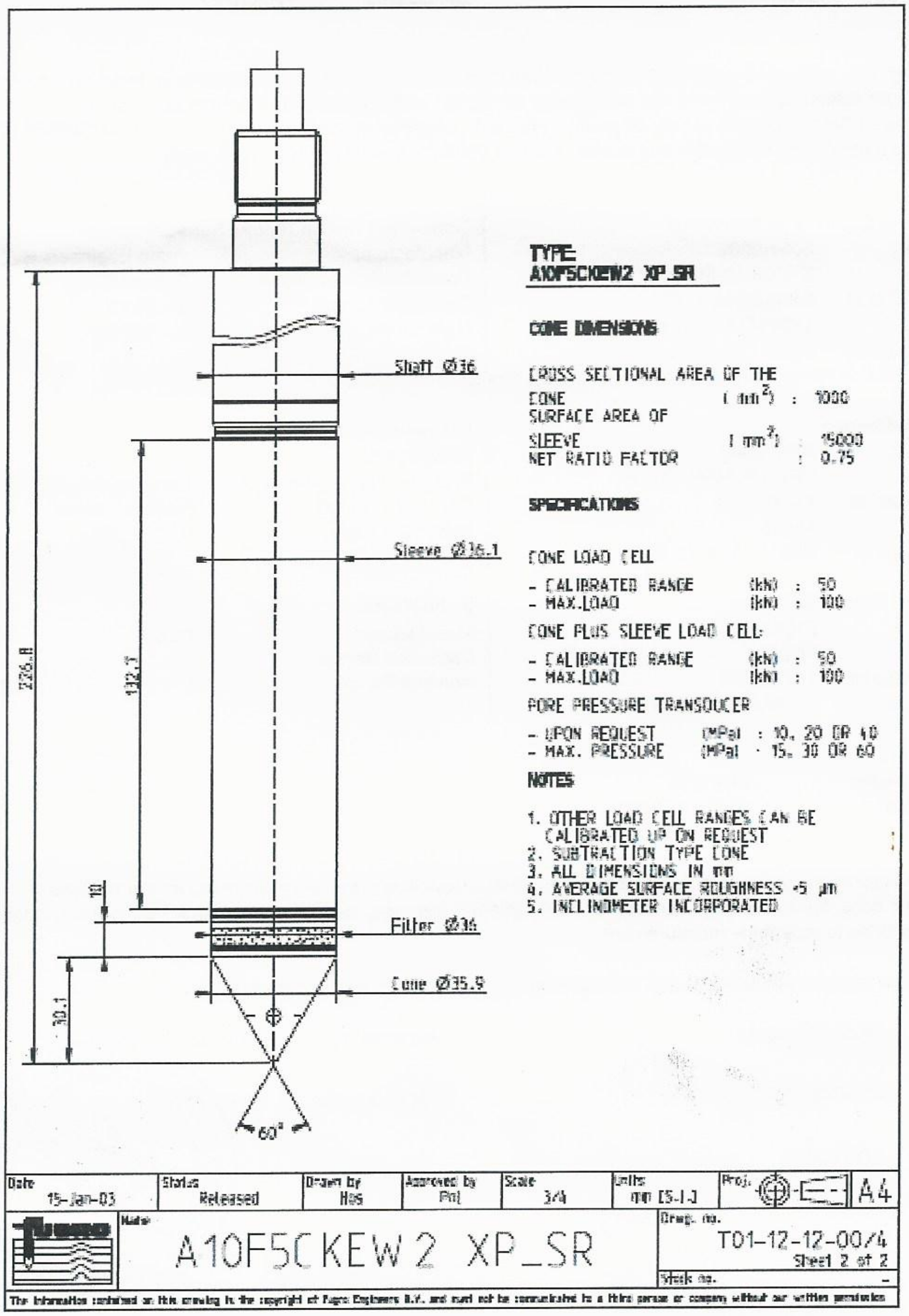
This certificate shall not be reproduced, except in full, without written approval from Fugro Engineers B.V.

Calibration technician	Boer, Kimmo de	Approved by :	Sinjorgo, Gerry
Calibration date:	25/03/2014	Approval date:	25/03/2014
Calibrate before:	25/03/2015		

FUGRO ENGINEERS B.V. * Veurse Achterweg 10 - 2264 SG Leidschendam

COPY

Applicant	**FUGRO MCCLELLAND MARINE GEOSCIENCES INC**	Certificate nr.	FCL14000665
Manufacturer	Fugro Engineers B.V.	Type	CONE, A10F5CKEW2/B, 100 bar, DOLPHIN, XP
Instrument	**A Cone Penetrometer**	Identification	1706-0792



COPY

Fugro Engineers BV
Veurse Achterweg 10 Tel: +31703111444
2264 SG Leidschendam Fax: +31703203640

CALIBRATION CERTIFICATE OF A CONE PENETROMETER

Applicant	**FUGRO MCCLELLAND MARINE GEOSCIENCES INC**	Certificate nr.	FCL14000664
Manufacturer	Fugro Engineers B.V.	Type	CONE, A10F5CKEW2/B, 100 bar, DOLPHIN, XP
Instrument	**A Cone Penetrometer**	Identification	1706-1176

Calibration method:
The cone penetrometer was calibrated according to Fugro Engineers procedures using a comparison technique against a Fugro reference standard. Fugro reference standards are periodically recertified and traceable to the National Standards and Technology (NIST) (RVA). It is derived from accepted values of natural physical constants according to the International System of units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2000 and ISO/IEC 17025:2005.

Cone and Friction Sleeve Calibration Reference

Equipment Serial Number	6034-0002
Equipment Manufacturer	ZWICK GMBH & CO
Equipment Calibration Valid till	04/11/2014
Equipment Certificate	13203713.1000.1EN
Procedure used : in-house	FEBV.CAL.PRO.003

Cone and Friction Sleeve Sensor

Manufacturer	Fugro Engineers BV
Force Application Mode	Compression
Calibrated Range	0 – 50 kN
Nominal Range	0 – 100 kN

Note 1) Details are specified on Force Calibration Data sheet, page 2 of 2.

Pressure Calibration Reference

Equipment Serial Number	3257-0002
Equipment Manufacturer	KELLER MEETTECH
Equipment Calibration Valid till	14/05/2014
Equipment Certificate	45403
Procedure used : in-house	FEBV.CAL.PRO.004

Pressure Sensor

Manufacturer	Keller
Pressure Application Mode	Compression and tension
Calibrated Range	Nominal Range
Nominal Range	0 –10.0 MPa

Inclinometer Calibration Reference

Equipment Serial Number	2109-0003
Equipment Manufacturer	FEBV
Equipment Calibration Valid till	14/05/2014
Procedure used : in-house	FEBV.CAL.PRO.005

Inclinometer

Manufacturer	FEBV	ADXL
Calibrated Range	0°– 1 5°	-10°- 10°
Nominal Range	0°– 30°	-15°- 15°

Environmental Conditions

Temperature during calibration	21 ± 3 °C
Pressure during calibration	1000 ± 100 mbar

Remarks.
The values given in this calibration certificate only relate to the submitted device, and to the values measured at the time of the test. Any uncertainty defined here does not include allowances for environmental changes, variation and shock during transportation, or the capability of other laboratories to repeat the measurement.

This certificate shall not be reproduced, except in full, without written approval from Fugro Engineers B.V.

Calibration technician	Boer, Kimmo de	Approved by :	Sinjorgo, Gerry
Calibration date:	25/03/2014	Approval date:	25/03/2014
<u>Calibrate before:</u>	25/03/2015		

FUGRO ENGINEERS B.V. ★ 2264 SG Leidschendam ★ Veurse Achterweg 10

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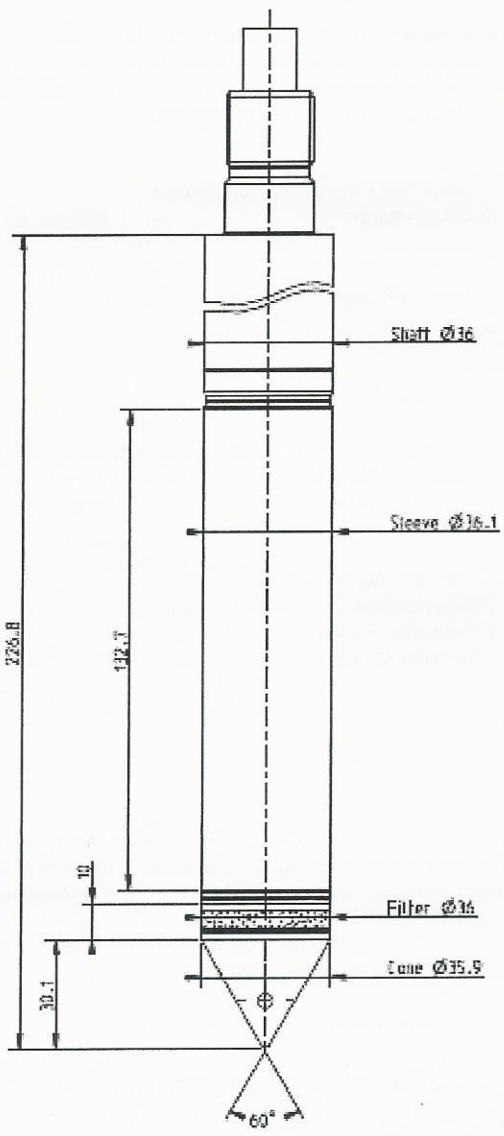
Applicant	**FUGRO MCCLELLAND MARINE GEOSCIENCES INC**	Certificate nr.	FCL14000664
Manufacturer	Fugro Engineers B.V.	Type	CONE, A10F5CKEW2/B, 100 bar, DOLPHIN, XP
Instrument	**A Cone Penetrometer**	Identification	1706-1176



TYPE
A10F5CKEW2 XP_SR

CONE DIMENSIONS

CROSS SECTIONAL AREA OF THE CONE (mm^2) : 1000
SURFACE AREA OF SLEEVE (mm^2) : 15000
NET RATIO FACTOR : 0.75

SPECIFICATIONS

CONE LOAD CELL
- CALIBRATED RANGE (kN) : 50
- MAX.LOAD (kN) : 100

CONE PLUS SLEEVE LOAD CELL
- CALIBRATED RANGE (kN) : 50
- MAX.LOAD (kN) : 100

PORE PRESSURE TRANSDUCER
- UPON REQUEST (MPa) : 10, 20 OR 40
- MAX. PRESSURE (MPa) : 15, 30 OR 60

NOTES

1. OTHER LOAD CELL RANGES CAN BE CALIBRATED UP ON REQUEST
2. SUBTRACTION TYPE CONE
3. ALL DIMENSIONS IN mm
4. AVERAGE SURFACE ROUGHNESS <5 μm
5. INCLINOMETER INCORPORATED

Date	Status	Drawn by	Approved by	Scale	Units	Proj.	
15-Jan-03	Released	Hos	Pnl	3/4	mm [S.I.]		A4

Name: A10F5CKEW2 XP_SR
Drwg. no. T01-12-12-00/4 Sheet 1 of 2
Stock no. -

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Fugro Engineers BV
Veurse Achterweg 10 Tel: +31703111444
2264 SG Leidschendam Fax: +31703203640

CALIBRATION CERTIFICATE OF A CONE PENETROMETER

Applicant	**FUGRO MCCLELLAND MARINE GEOSCIENCES INC**	Certificate nr.	FCL14000660
Manufacturer	Fugro Engineers B.V.	Type	CONE, A10F5CKEW2/B, 100 bar, DOLPHIN, XP
Instrument	**A Cone Penetrometer**	Identification	1706-1258

Calibration method:
The cone penetrometer was calibrated according to Fugro Engineers procedures using a comparison technique against a Fugro reference standard. Fugro reference standards are periodically recertified and traceable to the National Standards and Technology (NIST) (RVA). It is derived from accepted values of natural physical constants according to the International System of units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2000 and ISO/IEC 17025:2005.

Cone and Friction Sleeve Calibration Reference

Equipment Serial Number	6034-0002
Equipment Manufacturer	ZWICK GMBH & CO
Equipment Calibration Valid till	04/11/2014
Equipment Certificate	13203713.1000.1EN
Procedure used : in-house	FEBV.CAL.PRO.003

Note 1) Details are specified on Force Calibration Data sheet, page 2 of 2.

Cone and Friction Sleeve Sensor

Manufacturer	Fugro Engineers BV
Force Application Mode	Compression
Calibrated Range	0 – 50 kN
Nominal Range	0 – 100 kN

Pressure Calibration Reference

Equipment Serial Number	3257-0002
Equipment Manufacturer	KELLER MEETTECH
Equipment Calibration Valid till	14/05/2014
Equipment Certificate	45403
Procedure used : in-house	FEBV.CAL.PRO.004

Pressure Sensor

Manufacturer	Keller
Pressure Application Mode	Compression and tension
Calibrated Range	Nominal Range
Nominal Range	0 –10.0 MPa

Inclinometer Calibration Reference

Equipment Serial Number	2109-0003
Equipment Manufacturer	FEBV
Equipment Calibration Valid till	14/05/2014
Procedure used : in-house	FEBV.CAL.PRO.005

Inclinometer

Manufacturer	FEBV	ADXL
Calibrated Range	0°– 1 5°	-10°- 10°
Nominal Range	0°– 30°	-15°- 15°

Environmental Conditions

Temperature during calibration	21 ± 3 °C
Pressure during calibration	1000 ± 100 mbar

Remarks.
The values given in this calibration certificate only relate to the submitted device, and to the values measured at the time of the test. Any uncertainty defined here does not include allowances for environmental changes, variation and shock during transportation, or the capability of other laboratories to repeat the measurement.

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Calibration technician	Boer, Kimmo de	Approved by :	Sinjorgo, Gerry
Calibration date:	25/03/2014	Approval date:	25/03/2014
Calibrate before:	25/03/2015		

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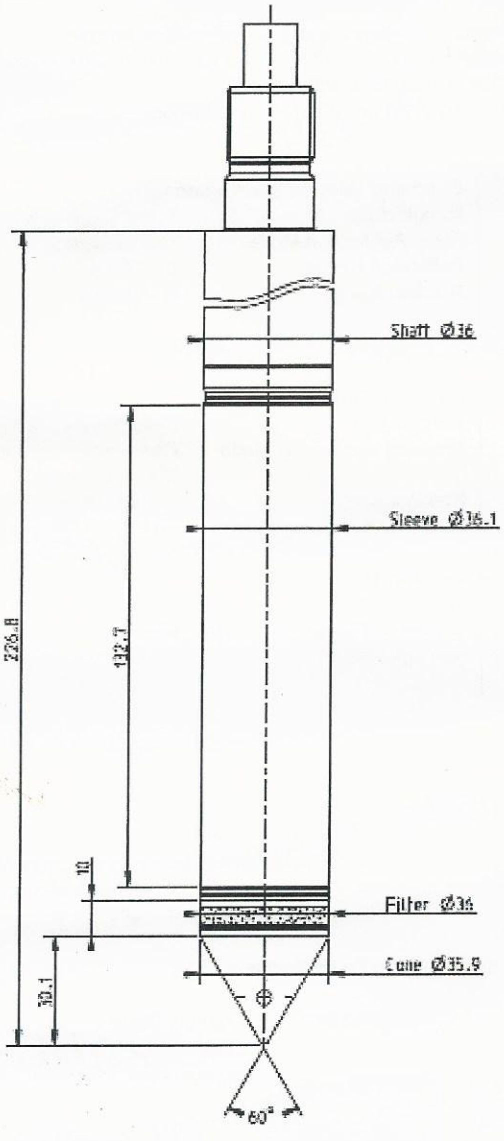
Applicant	**FUGRO MCCLELLAND MARINE GEOSCIENCES INC**	Certificate nr.	FCL14000660
Manufacturer	Fugro Engineers B.V.	Type	CONE, A10F5CKEW2/B, 100 bar, DOLPHIN, XP
Instrument	**A Cone Penetrometer**	Identification	1706-1258



TYPE:
A10F5CKEW2 XP_SR

CONE DIMENSIONS

CROSS SECTIONAL AREA OF THE CONE (mm²) : 1000
SURFACE AREA OF SLEEVE (mm²) : 15000
NET RATIO FACTOR : 0.75

SPECIFICATIONS

CONE LOAD CELL
- CALIBRATED RANGE (kN) : 50
- MAX.LOAD (kN) : 100

CONE PLUS SLEEVE LOAD CELL
- CALIBRATED RANGE (kN) : 50
- MAX.LOAD (kN) : 100

PORE PRESSURE TRANSDUCER
- UPON REQUEST (MPa) : 10, 20 OR 40
- MAX. PRESSURE (MPa) : 15, 30 OR 60

NOTES

1. OTHER LOAD CELL RANGES CAN BE CALIBRATED UP ON REQUEST
2. SUBTRACTION TYPE CONE
3. ALL DIMENSIONS IN mm
4. AVERAGE SURFACE ROUGHNESS <5 µm
5. INCLINOMETER INCORPORATED

Date	Status	Drawn by	Approved by	Scale	Units	Proj.	
15-Jan-03	Released	Hos	Pnl	3/4	mm [S.I.]		A4

Name: A10F5CKEW2 XP_SR
Drwg. no. T01-12-12-00/4
Sheet 2 of 2
Stock no. -

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Fugro Engineers BV
Veurse Achterweg 10
2264 SG Leidschendam

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CALIBRATION CERTIFICATE OF A CONE PENETROMETER

Applicant	FUGRO MCCLELLAND MARINE GEOSCIENCES INC	Certificate nr.	FCL14000656
Manufacturer	Fugro Engineers B.V.	Type	CONE, A10F5CKEW2/B, 100 bar, DOLPHIN, XP
Instrument	**A Cone Penetrometer**	Identification	1706-1295

Calibration method:
The cone penetrometer was calibrated according to Fugro Engineers procedures using a comparison technique against a Fugro reference standard. Fugro reference standards are periodically recertified and traceable to the National Standards and Technology (NIST) (RVA). It is derived from accepted values of natural physical constants according to the International System of units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2000 and ISO/IEC 17025:2005.

Cone and Friction Sleeve Calibration Reference

Equipment Serial Number	6034-0002
Equipment Manufacturer	ZWICK GMBH & CO
Equipment Calibration Valid till	04/11/2014
Equipment Certificate	13203713.1000.1EN
Procedure used : in-house	FEBV.CAL.PRO.003

Note 1) Details are specified on Force Calibration Data sheet, page 2 of 2.

Cone and Friction Sleeve Sensor

Manufacturer	Fugro Engineers BV
Force Application Mode	Compression
Calibrated Range	0 – 50 kN
Nominal Range	0 – 100 kN

Pressure Calibration Reference

Equipment Serial Number	3257-0002
Equipment Manufacturer	KELLER MEETTECH
Equipment Calibration Valid till	14/05/2014
Equipment Certificate	45403
Procedure used : in-house	FEBV.CAL.PRO.004

Pressure Sensor

Manufacturer	Keller
Pressure Application Mode	Compression and tension
Calibrated Range	Nominal Range
Nominal Range	0 –10.0 MPa

Inclinometer Calibration Reference

Equipment Serial Number	2109-0003
Equipment Manufacturer	FEBV
Equipment Calibration Valid till	14/05/2014
Procedure used : in-house	FEBV.CAL.PRO.005

Inclinometer

Manufacturer	FEBV	ADXL
Calibrated Range	0° – 1 5°	-10° - 10°
Nominal Range	0° – 30°	-15° - 15°

Environmental Conditions

Temperature during calibration	21 ± 3 °C
Pressure during calibration	1000 ± 100 mbar

Remarks.
The values given in this calibration certificate only relate to the submitted device, and to the values measured at the time of the test. Any uncertainty defined here does not include allowances for environmental changes, variation and shock during transportation, or the capability of other laboratories to repeat the measurement.

This certificate shall not be reproduced, except in full, without written approval from Fugro Engineers B.V.

Calibration technician	Boer, Kimmo de	Approved by :	Sinjorgo, Gerry
Calibration date:	25/03/2014	Approval date:	25/03/2014
Calibrate before:	25/03/2015		

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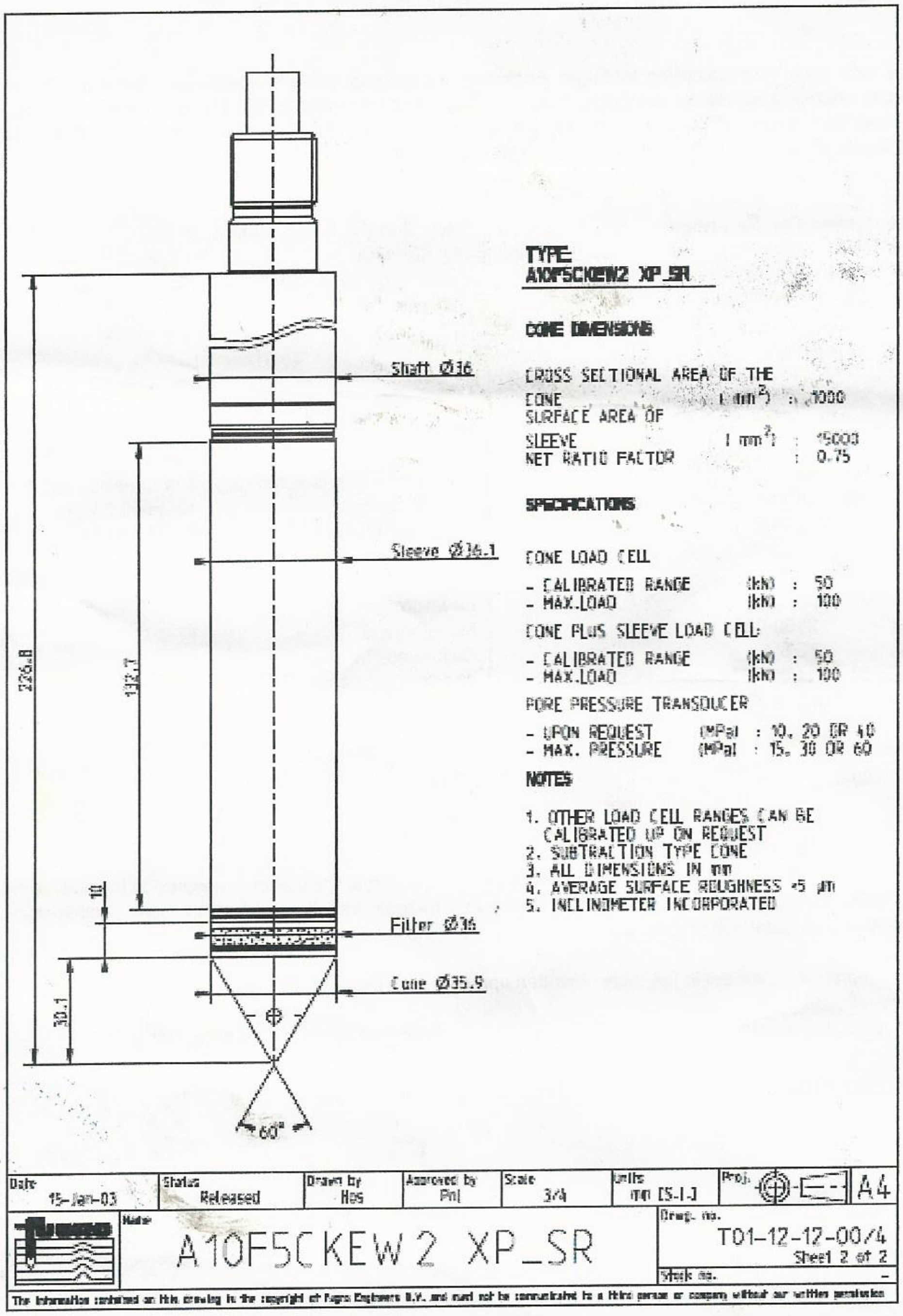
Applicant	**FUGRO MCCLELLAND MARINE GEOSCIENCES INC**	Certificate nr.	FCL14000656
Manufacturer	Fugro Engineers B.V.	Type	CONE, A10F5CKEW2/B, 100 bar, DOLPHIN, XP
Instrument	**A Cone Penetrometer**	Identification	1706-1295



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CALIBRATION CERTIFICATE OF A CONE PENETROMETER

Applicant	**FUGRO MCCLELLAND MARINE GEOSCIENCES INC**	Certificate nr.	FCL14000658
Manufacturer	Fugro Engineers B.V.	Type	CONE, A10F5CKEW2/B, 100 bar, DOLPHIN, XP
Instrument	**A Cone Penetrometer**	Identification	1706-1823

Calibration method:
The cone penetrometer was calibrated according to Fugro Engineers procedures using a comparison technique against a Fugro reference standard. Fugro reference standards are periodically recertified and traceable to the National Standards and Technology (NIST) (RVA). It is derived from accepted values of natural physical constants according to the International System of units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2000 and ISO/IEC 17025:2005.

Cone and Friction Sleeve Calibration Reference

Equipment Serial Number	6034-0002
Equipment Manufacturer	ZWICK GMBH & CO
Equipment Calibration Valid till	04/11/2014
Equipment Certificate	13203713.1000.1EN
Procedure used : in-house	FEBV.CAL.PRO.003

Note 1) Details are specified on Force Calibration Data sheet, page 2 of 2.

Cone and Friction Sleeve Sensor

Manufacturer	Fugro Engineers BV
Force Application Mode	Compression
Calibrated Range	0 – 50 kN
Nominal Range	0 – 100 kN

Pressure Calibration Reference

Equipment Serial Number	3257-0002
Equipment Manufacturer	KELLER MEETTECH
Equipment Calibration Valid till	14/05/2014
Equipment Certificate	45403
Procedure used : in-house	FEBV.CAL.PRO.004

Pressure Sensor

Manufacturer	Keller
Pressure Application Mode	Compression and tension
Calibrated Range	Nominal Range
Nominal Range	0 –10.0 MPa

Inclinometer Calibration Reference

Equipment Serial Number	2109-0003
Equipment Manufacturer	FEBV
Equipment Calibration Valid till	14/05/2014
Procedure used : in-house	FEBV.CAL.PRO.005

Inclinometer

Manufacturer	FEBV	ADXL
Calibrated Range	0°– 1 5°	-10°- 10°
Nominal Range	0°– 30°	-15°- 15°

Environmental Conditions

Temperature during calibration	21 ± 3 ºC
Pressure during calibration	1000 ± 100 mbar

Remarks.
The values given in this calibration certificate only relate to the submitted device, and to the values measured at the time of the test. Any uncertainty defined here does not include allowances for environmental changes, variation and shock during transportation, or the capability of other laboratories to repeat the measurement.

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Calibration technician	Boer, Kimmo de	Approved by :	Sinjorgo, Gerry
Calibration date:	25/03/2014	Approval date:	25/03/2014
Calibrate before:	25/03/2015		

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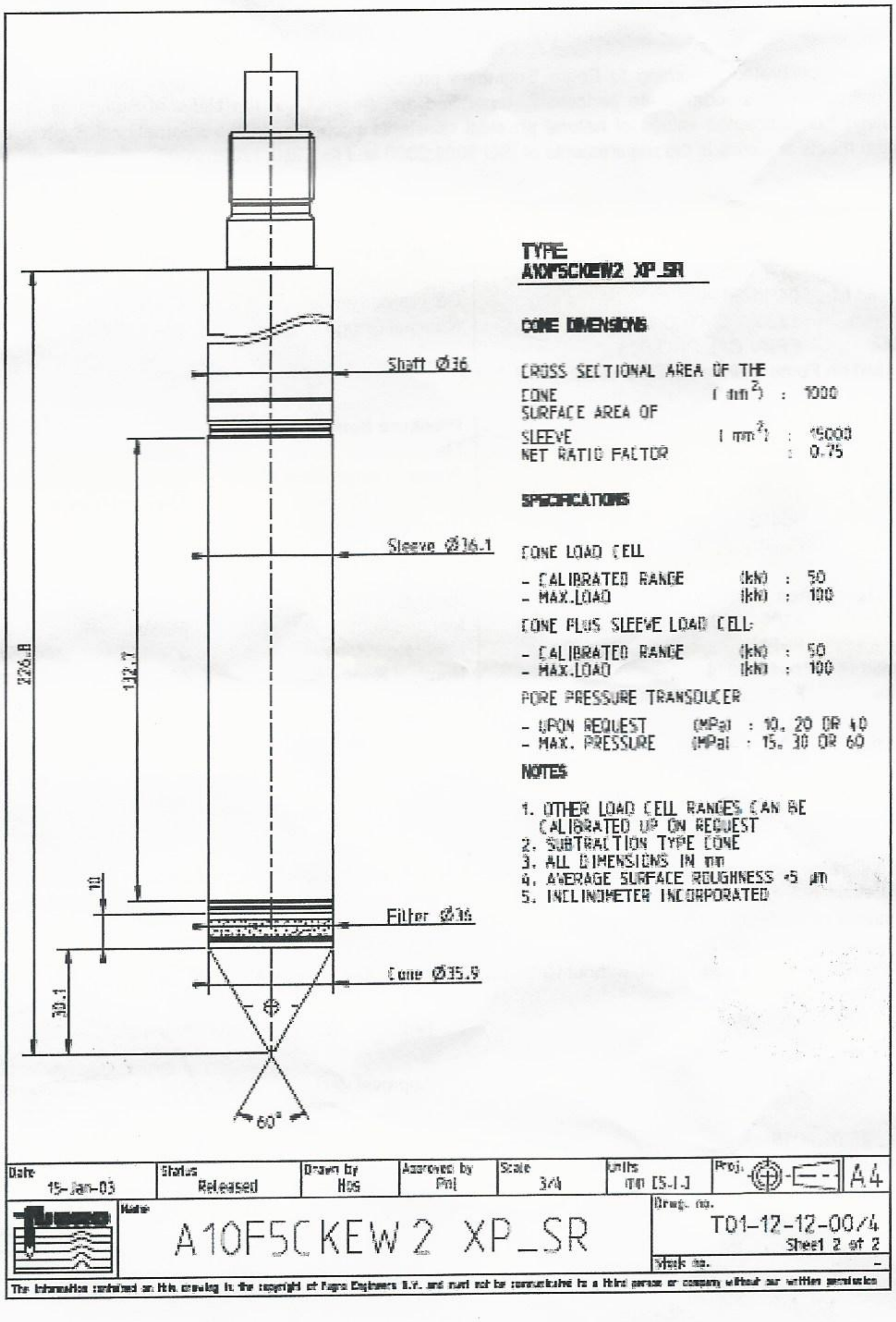
Applicant	**FUGRO MCCLELLAND MARINE GEOSCIENCES INC**	Certificate nr.	FCL14000658
Manufacturer	Fugro Engineers B.V.	Type	CONE, A10F5CKEW2/B, 100 bar, DOLPHIN, XP
Instrument	**A Cone Penetrometer**	Identification	1706-1823



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CALIBRATION CERTIFICATE OF A CONE PENETROMETER

Applicant	**FUGRO MCCLELLAND MARINE GEOSCIENCES INC**	Certificate nr.	FCL14000657
Manufacturer	Fugro Engineers B.V.	Type	CONE, A10F5CKEW2/B, 100 bar, DOLPHIN, XP
Instrument	**A Cone Penetrometer**	Identification	1706-1953

Calibration method:
The cone penetrometer was calibrated according to Fugro Engineers procedures using a comparison technique against a Fugro reference standard. Fugro reference standards are periodically recertified and traceable to the National Standards and Technology (NIST) (RVA). It is derived from accepted values of natural physical constants according to the International System of units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2000 and ISO/IEC 17025:2005.

Cone and Friction Sleeve Calibration Reference

Equipment Serial Number	6034-0002
Equipment Manufacturer	ZWICK GMBH & CO
Equipment Calibration Valid till	04/11/2014
Equipment Certificate	13203713.1000.1EN
Procedure used : in-house	FEBV.CAL.PRO.003

Note 1) Details are specified on Force Calibration Data sheet, page 2 of 2.

Cone and Friction Sleeve Sensor

Manufacturer	Fugro Engineers BV
Force Application Mode	Compression
Calibrated Range	0 – 50 kN
Nominal Range	0 – 100 kN

Pressure Calibration Reference

Equipment Serial Number	3257-0002
Equipment Manufacturer	KELLER MEETTECH
Equipment Calibration Valid till	14/05/2014
Equipment Certificate	45403
Procedure used : in-house	FEBV.CAL.PRO.004

Pressure Sensor

Manufacturer	Keller
Pressure Application Mode	Compression and tension
Calibrated Range	Nominal Range
Nominal Range	0 –10.0 MPa

Inclinometer Calibration Reference

Equipment Serial Number	2109-0003
Equipment Manufacturer	FEBV
Equipment Calibration Valid till	14/05/2014
Procedure used : in-house	FEBV.CAL.PRO.005

Inclinometer

Manufacturer	FEBV	ADXL
Calibrated Range	0°– 1 5°	-10°- 10°
Nominal Range	0°– 30°	-15°- 15°

Environmental Conditions

Temperature during calibration	21 ± 3 °C
Pressure during calibration	1000 ± 100 mbar

Remarks.
The values given in this calibration certificate only relate to the submitted device, and to the values measured at the time of the test. Any uncertainty defined here does not include allowances for environmental changes, variation and shock during transportation, or the capability of other laboratories to repeat the measurement.

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Calibration technician	Boer, Kimmo de	Approved by :	Sinjorgo, Gerry
Calibration date:	25/03/2014	Approval date:	25/03/2014
Calibrate before:	25/03/2015		

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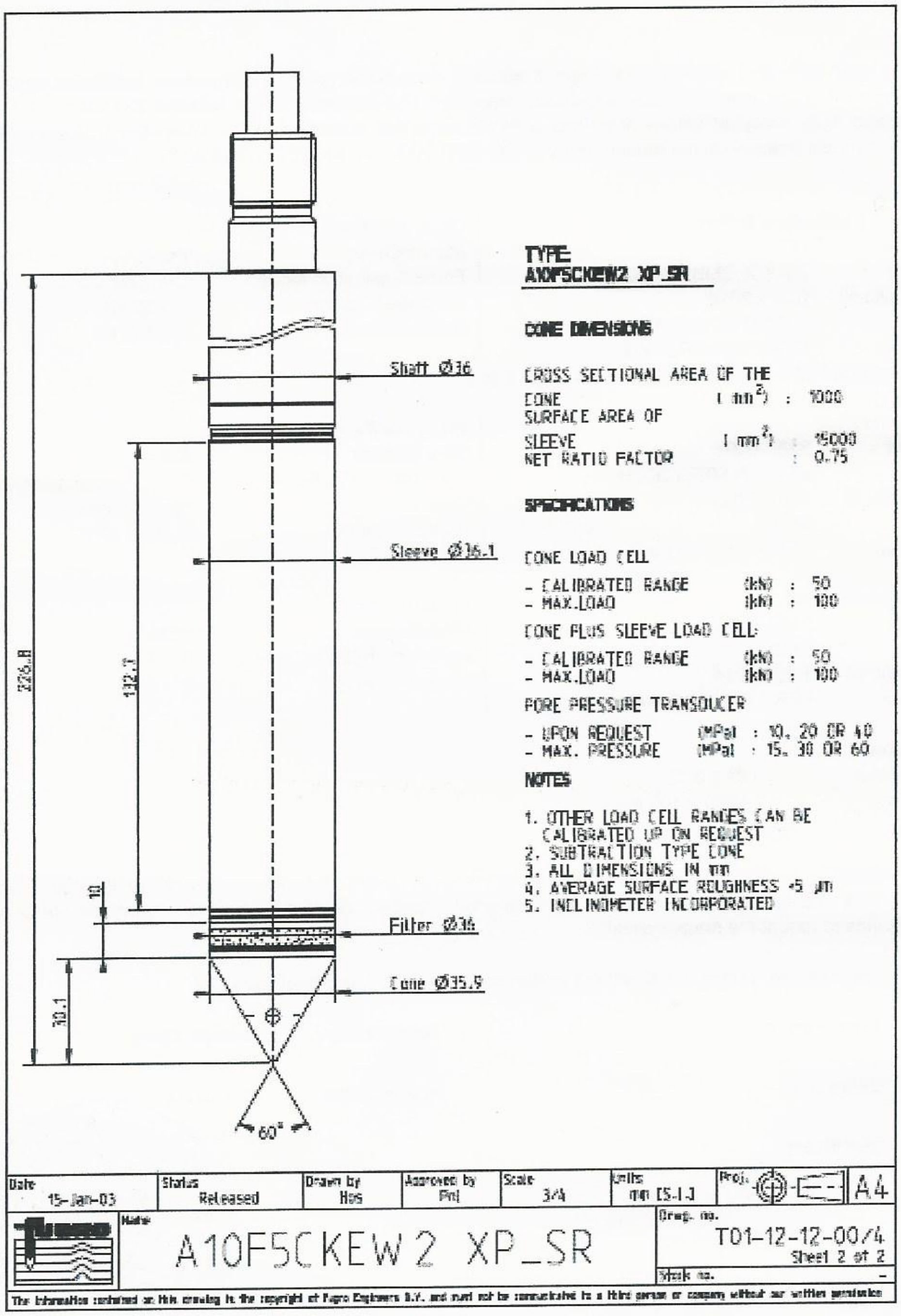
Applicant	**FUGRO MCCLELLAND MARINE GEOSCIENCES INC**	Certificate nr.	FCL14000657
Manufacturer	Fugro Engineers B.V.	Type	CONE, A10F5CKEW2/B, 100 bar, DOLPHIN, XP
Instrument	**A Cone Penetrometer**	Identification	1706-1953



CALIBRATION CERTIFICATE

APPLICANT	FAOLG	Certificate number	FCL14000829
SUBMITTED	**A Piezo Cone Penetrometer**	Manufacturer	Fugro Engineers B.V.
Device type	CONE, A05F3.5CKE2HAW2/B ,100 bar, Micro Impulse	Serial number	1717-1523

The device contains an electronic data sheet which contains, amongst others, the characteristics of all the sensors inside the device. The data acquisition system calculates the measured value from these known characteristics. All calibration results are conform the values specified below.

Force calibration

Calibration reference : 548 FRE.001
Procedure : FEBV.CAL.PRO.003 KALIBRATIE KRACHT
Title of channel(s) : Cone and Cone+Fric.
Max. load 80 kN

Range	Calibration range From	to	Sensitivity Deviation	Zero load output
1	0	35 kN	< 0.5 %	< 0.7 kN
Calibration uncertainty			0.3 %	0.008 kN

Pressure test :

Deviation from specified Alpha factor at 2.5 MPa	< 5 %

Cone quality control values :

Max. deviation from reference	< 1 %
Max. Tip to Sleeve friction Crosstalk	< 1 %

Pressure calibration

Calibration reference: 3257-0001
Procedure: FEBV.CAL.PRO.004 KALIBRATIE DRUK
Title of channel : Pore 2
Max. load 15 Mpa

Range	Calibration range From	to	Sensitivity Deviation	Zero load output
1	0	2.5 MPa	< 1.0 %	< 0.4 MPa
Calibration uncertainty			0.6 %	0.003 MPa

Pore 2 transducer : Entran EPX-S470A-100bar
SN : P08040

Calibration of the DUAL axis slope sensors

Calibration reference:
Procedure:FEBV.CAL.PRO.006 KALIBRATIE HELLING
Title of channel : Slope x, Slope y

Range	Calibration range From	to	Sensitivity Deviation	Zero load output
1	-10 deg	10 deg	< 3 %	< 0.5 deg
Calibration uncertainty			1 %	0.5 deg

Typical values for this type of device

Cone diameter (mm)	25.4	Pore 2 position	2	Alpha factor	0.50
Cone area (square cm)	5	Sleeve length (mm)	93.6	Cone - Sleeve distance (mm)	9
Sleeve diameter (mm)	25.5	Sleeve area (square cm)	75	Cone - Pore 2 distance (mm)	4.0

TRACEABILITY The measurements have been executed using standards for which the traceability to primary and/or (inter)national standards has been demonstrated.

Calibrated by: Noordmans, Pieter

Calibration date: 15/04/2014

Calibrate before: 15/04/2015

Approved by : Sinjorgo, Gerry

Approval date: 15/04/2014

FUGRO ENGINEERS B.V. * Veurse Achterweg 10 - 2264 SG Leidschendam *

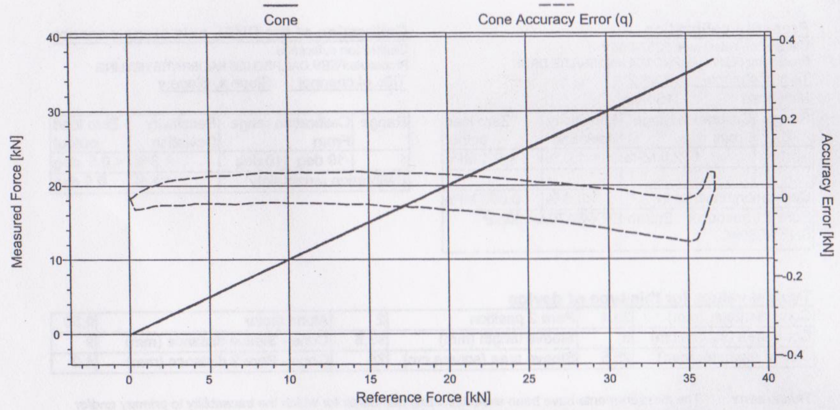
Template : F3.5F3.5CKE2HAW2 100bar Updated : 20/07/2011 12:08:00 PM

FORCE CALIBRATION CERTIFICATE [CONE]

Certificate Number FCL14000829

Calibration Reference ID	548FRE.002	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Zwick/Roell	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	34
Electronics Serial Number	1089	**Date**	15 April 2014
Device Serial Number	1717-1523	**Time**	09:18:25

Characteristics	Unit	Cone
Accuracy error (q)	[kN]	0.069
Repeatability error (b)	[kN]	0.175
Reversibility error (v)	[kN]	0.099
Zero load error (Fc0)	[kN]	0.003
Zero load offset (F0)	[kN]	0.008
Resolution	[kN]	8.42E-06
Noise RMS	[kN]	0.000



Applied force [kN]	Measured Force 1 [kN]	Measured Force 2 [kN]	Measured Force 3 [kN]	Measured average [kN]	Accuracy error [kN]	Repeatability error [kN]	Reversibility error [kN]
0.000	0.011	-0.007	-0.014	-0.003	-0.003	0.025	0.011
7.000	7.153	7.016	7.018	7.062	0.062	0.137	0.075
14.000	14.172	14.018	14.017	14.069	0.069	0.155	0.083
21.000	21.166	21.006	21.005	21.059	0.059	0.161	0.090
28.000	28.144	27.980	27.977	28.034	0.034	0.168	0.099
35.000	35.114	34.942	34.938	34.998	-0.002	0.175	
28.000	27.819	27.992	27.992	27.934	-0.066	0.174	
21.000	20.860	21.023	21.023	20.969	-0.031	0.163	
14.000	13.888	14.035	14.036	13.986	-0.014	0.148	
7.000	6.902	7.030	7.031	6.988	-0.012	0.129	
0.000	0.007	0.007	0.008	0.007	0.007	0.001	

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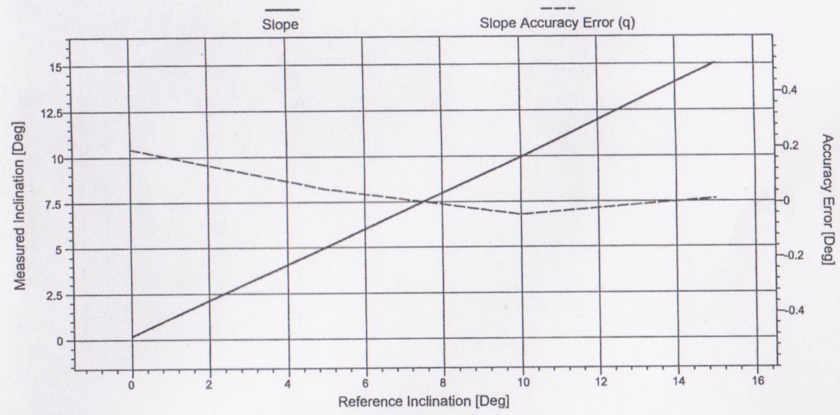
INCLINATION CALIBRATION CERTIFICATE

Certificate Number FCL14000829

Calibration Reference ID	2109-0001	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Hoek-O-Mat	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	34
Electronics Serial Number	1089	**Date**	15 April 2014
Device Serial Number	1717-1523	**Time**	09:51:48

Characteristics	Unit	Slope
Accuracy error (q)	[Deg]	0.198
Repeatability error (b)	[Deg]	0.225
Zero load error (Fc0)	[Deg]	0.074
Zero load offset (F0)	[Deg]	0.130
Resolution	[Deg]	1.39E-05
Noise RMS	[Deg]	0.021



Applied Inclination [Deg]	Measured Inclination 1 [Deg]	Measured Inclination 2 [Deg]	Measured Inclination 3 [Deg]	Measured average [Deg]	Accuracy error [Deg]	Repeatability error [Deg]
0.000	0.103	0.328	0.162	0.198	0.198	0.225
5.000	5.019	5.042	5.089	5.050	0.050	0.069
10.000	9.942	9.918	10.008	9.956	-0.044	0.091
15.000	14.966	14.944	15.129	15.013	0.013	0.185

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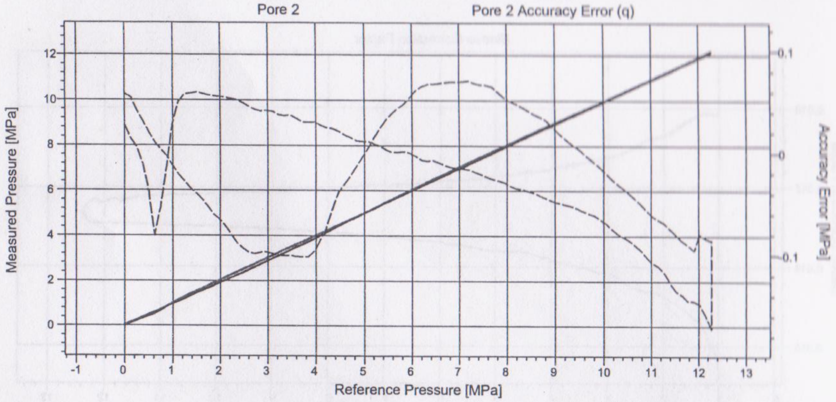
PRESSURE CALIBRATION CERTIFICATE [PORE 2]

Certificate Number FCL14000829

Calibration Reference ID	3257-0001	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Stratham	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	34
Electronics Serial Number	1089	**Date**	15 April 2014
Device Serial Number	1717-1523	**Time**	11:43:03

Characteristics	Unit	Pore 2
Accuracy error (q)	[MPa]	0.093
Repeatability error (b)	[MPa]	0.052
Reversibility error (v)	[MPa]	0.123
Zero load error (Fc0)	[MPa]	-0.054
Zero load offset (F0)	[MPa]	0.070
Resolution	[MPa]	3.19E-06
Noise RMS	[MPa]	0.000



Applied pressure [MPa]	Measured Pressure 1 [MPa]	Measured Pressure 2 [MPa]	Measured Pressure 3 [MPa]	Measured average [MPa]	Accuracy error [MPa]	Repeatability error [MPa]	Reversibility error [MPa]
0.000	0.069	0.059	0.045	0.058	0.058	0.023	0.031
2.000	1.947	1.932	1.924	1.934	-0.066	0.024	0.121
4.000	3.882	3.904	3.934	3.907	-0.093	0.052	0.123
6.000	6.058	6.049	6.064	6.057	0.057	0.016	0.057
8.000	8.070	8.062	8.026	8.053	0.053	0.044	0.083
10.000	10.004	9.989	9.956	9.983	-0.017	0.048	
8.000	7.971	7.966	7.973	7.970	-0.030	0.007	
6.000	6.006	5.995	5.999	6.000	0.000	0.011	
4.000	4.044	4.027	4.019	4.030	0.030	0.026	
2.000	2.080	2.048	2.039	2.055	0.055	0.041	
0.000	0.034	0.024	0.022	0.027	0.027	0.012	

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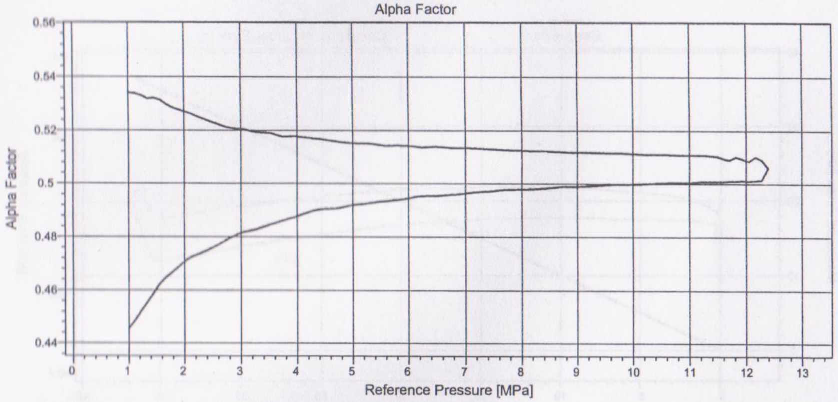
ALPHA FACTOR MEASUREMENT

Certificate Number FCL14000829

Calibration Reference ID	3257-0001	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Stratham	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	34
Electronics Serial Number	1089	**Date**	15 April 2014
Device Serial Number	1717-1523	**Time**	11:43:03

Characteristics	Unit	
Alpha Factor	[-]	0.51



Applied pressure [MPa]	Measured alpha factor 1	Measured alpha factor 2	Measured alpha factor 3	Measured average alpha factor
2.000	0.471	0.470	0.471	0.471
4.000	0.488	0.488	0.488	0.488
6.000	0.495	0.495	0.495	0.495
8.000	0.498	0.498	0.498	0.498
10.000	0.500	0.500	0.500	0.500
8.000	0.513	0.512	0.513	0.513
6.000	0.514	0.514	0.515	0.514
4.000	0.518	0.518	0.518	0.518
2.000	0.527	0.526	0.528	0.527

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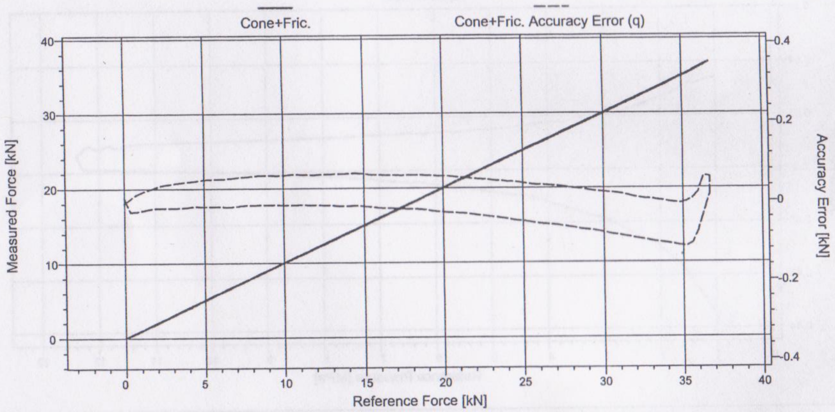
FORCE CALIBRATION CERTIFICATE [CONE+FRIC.]

Certificate Number FCL14000829

Calibration Reference ID	548FRE.002	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Zwick/Roell	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	34
Electronics Serial Number	1089	**Date**	15 April 2014
Device Serial Number	1717-1523	**Time**	09:18:25

Characteristics	Unit	Cone+Fric.
Accuracy error (q)	[kN]	0.071
Repeatability error (b)	[kN]	0.178
Reversibility error (v)	[kN]	0.099
Zero load error (Fc0)	[kN]	0.017
Zero load offset (F0)	[kN]	0.000
Resolution	[kN]	8.63E-06
Noise RMS	[kN]	0.000
Tip-Sleeve Interaction	[kPa]	1.0
Tip-Sleeve Interaction %	[%]	0.21



Applied force [kN]	Measured Force 1 [kN]	Measured Force 2 [kN]	Measured Force 3 [kN]	Measured average [kN]	Accuracy error [kN]	Repeatability error [kN]	Reversibility error [kN]
0.000	0.009	-0.008	-0.013	-0.004	-0.004	0.022	0.013
7.000	7.150	7.015	7.018	7.061	0.061	0.134	0.072
14.000	14.172	14.021	14.020	14.071	0.071	0.152	0.082
21.000	21.166	21.008	21.008	21.061	0.061	0.158	0.090
28.000	28.141	27.980	27.978	28.033	0.033	0.163	0.099
35.000	35.108	34.939	34.936	34.995	-0.005	0.172	
28.000	27.816	27.992	27.994	27.934	-0.066	0.178	
21.000	20.860	21.025	21.027	20.971	-0.029	0.167	
14.000	13.888	14.039	14.040	13.989	-0.011	0.152	
7.000	6.901	7.031	7.034	6.988	-0.012	0.133	
0.000	0.007	0.008	0.011	0.009	0.009	0.004	

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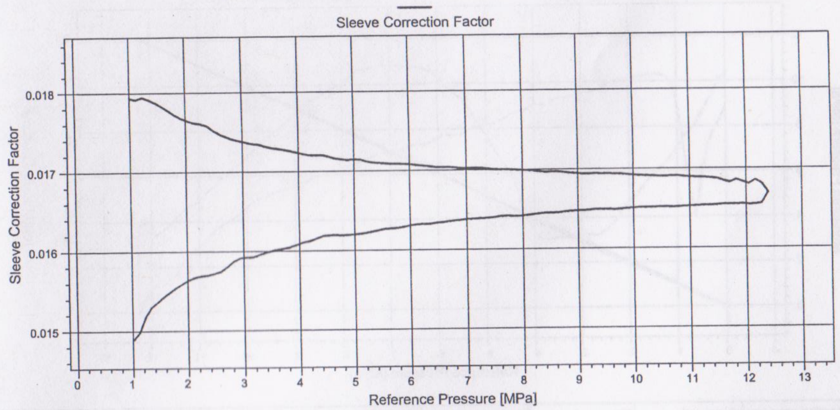
SLEEVE CORRECTION FACTOR MEASUREMENT

Certificate Number FCL14000829

Calibration Reference ID	3257-0001	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Stratham	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	34
Electronics Serial Number	1089	**Date**	15 April 2014
Device Serial Number	1717-1523	**Time**	11:43:04

Characteristics	Unit	
Sleeve correction factor	[-]	0.01669



Applied pressure [MPa]	Measured sleeve correction factor 1	Measured sleeve correction factor 2	Measured sleeve correction factor 3	Measured average sleeve correction factor
2.000	0.016	0.016	0.016	0.016
4.000	0.016	0.016	0.016	0.016
6.000	0.016	0.016	0.016	0.016
8.000	0.016	0.016	0.016	0.016
10.000	0.016	0.017	0.017	0.017
8.000	0.017	0.017	0.017	0.017
6.000	0.017	0.017	0.017	0.017
4.000	0.017	0.017	0.017	0.017
2.000	0.018	0.018	0.018	0.018

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MAINTENANCE REPORT CONE

FUGRO

CONE		
	Type:	CONE, A05F3.5CKE2HAW2/B ,100 bar, Micro Impulse
	Serial nr:	1717-1523
	Calibration date:	15 April 2014
	Calibration valid untill:	15 April 2015

MAINTENANCE REPORT	REMARKS	
FAILURE		
Cone channel		
Friction channel		
Pore channel		
Inclination X		
Inclination Y		
Conductivity		
Mag. X		
Mag. Y		
Mag. Z		
WEAR		
Tip		
Sleeve		
Adaptor		
OTHER		
Bent		
Connector damaged		
Calibration date expired		
....		

*** Tick appropriate box:**

Example

Cone channel	X	Cone signal unstable, therefore not reliable

RIG No./ VESSEL:		Remarks/ Request:
PROJECT NO.:		
Operator:		
Date:		

Completed form to be returned with Cone to: Transducer Department of Fugro Engineers B.V.

CALIBRATION CERTIFICATE

APPLICANT	FAOLG	Certificate number	FCL14000826 Page 1 of 1
SUBMITTED	**A Piezo Cone Penetrometer**	Manufacturer	Fugro Engineers B.V.
Device type	CONE, A05F3.5CKE2HAW2/B ,100 bar, Micro Impulse	Serial number	1717-1526

The device contains an electronic data sheet which contains, amongst others, the characteristics of all the sensors inside the device. The data acquisition system calculates the measured value from these known characteristics. All calibration results are conform the values specified below.

Force calibration

Calibration reference : 548 FRE.001
Procedure : FEBV.CAL.PRO.003 KALIBRATIE KRACHT
Title of channel(s) : Cone and Cone+Fric.
Max. load 80 kN

Range	Calibration range From	to	Sensitivity Deviation	Zero load output
1	0	35 kN	< 0.5 %	< 0.7 kN
Calibration uncertainty			0.3 %	0.008 kN

Pressure test :

Deviation from specified Alpha factor at 2.5 MPa	< 5 %

Cone quality control values :

Max. deviation from reference	< 1 %
Max. Tip to Sleeve friction Crosstalk	< 1 %

Pressure calibration

Calibration reference: 3257-0001
Procedure: FEBV.CAL.PRO.004 KALIBRATIE DRUK
Title of channel : Pore 2
Max. load 15 Mpa

Range	Calibration range From		Sensitivity Deviation	Zero load output
1	0	2.5 MPa	< 1.0 %	< 0.4 MPa
Calibration uncertainty			0.6 %	0.003 MPa

Pore 2 transducer : Entran EPX-S470A-100bar
SN : S080JV

Calibration of the DUAL axis slope sensors

Calibration reference:
Procedure:FEBV.CAL.PRO.006 KALIBRATIE HELLING
Title of channel : Slope x, Slope y

Range	Calibration range From		Sensitivity Deviation	Zero load output
1	-10 deg	10 deg	< 3 %	< 0.5 deg
Calibration uncertainty			1 %	0.5 deg

Typical values for this type of device

Cone diameter (mm)	25.4	Pore 2 position	2	Alpha factor	0.50
Cone area (square cm)	5	Sleeve length (mm)	93.6	Cone - Sleeve distance (mm)	9
Sleeve diameter (mm)	25.5	Sleeve area (square cm)	75	Cone - Pore 2 distance (mm)	4.0

TRACEABILITY The measurements have been executed using standards for which the traceability to primary and/or (inter)national standards has been demonstrated.

Calibrated by: Noordmans, Pieter
Approved by : Sinjorgo, Gerry

Calibration date: 15/04/2014
Approval date: 15/04/2014

Calibrate before: 15/04/2015

FUGRO ENGINEERS B.V. Veurse Achterweg 10 - 2264 SG Leidschendam

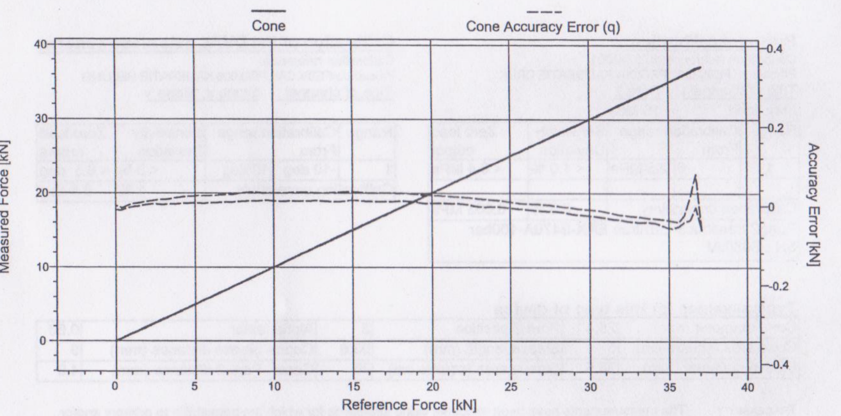
Template : F3.5F3.5CKE2HAW2 100bar Updated : 20/07/2011 12:08:00 PM

FORCE CALIBRATION CERTIFICATE [CONE]

Certificate Number FCL14000826

Calibration Reference ID	548FRE.002	Device	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Zwick/Roell	Hardware Version	3.00
Calibration SW Version	1.7.6.11383	Software Version	4.01
Node Type	7001	Working Hours	124
Electronics Serial Number	1120	Date	15 April 2014
Device Serial Number	1717-1526	Time	08:56:25

Characteristics	Unit	Cone
Accuracy error (q)	[kN]	0.057
Repeatability error (b)	[kN]	0.022
Reversibility error (v)	[kN]	0.024
Zero load error (Fc0)	[kN]	0.008
Zero load offset (F0)	[kN]	0.004
Resolution	[kN]	8.47E-06
Noise RMS	[kN]	0.000



Applied force [kN]	Measured Force 1 [kN]	Measured Force 2 [kN]	Measured Force 3 [kN]	Measured average [kN]	Accuracy error [kN]	Repeatability error [kN]	Reversibility error [kN]
0.000	-0.017	-0.010	-0.008	-0.011	-0.011	0.009	0.011
7.000	7.009	7.008	7.007	7.008	0.008	0.001	0.019
14.000	14.009	14.011	14.009	14.009	0.009	0.002	0.024
21.000	21.005	21.005	21.007	21.006	0.006	0.002	0.018
28.000	27.983	27.987	27.985	27.985	-0.015	0.003	0.014
35.000	34.949	34.928	34.951	34.943	-0.057	0.022	
28.000	27.999	27.999	28.000	27.999	-0.001	0.001	
21.000	21.023	21.024	21.024	21.024	0.024	0.001	
14.000	14.031	14.033	14.034	14.033	0.033	0.003	
7.000	7.026	7.028	7.027	7.027	0.027	0.002	
0.000	0.000	0.000	0.001	0.000	0.000	0.001	

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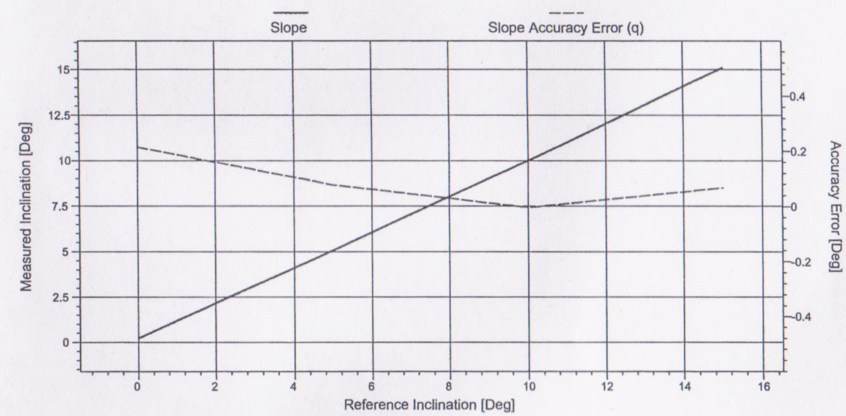
INCLINATION CALIBRATION CERTIFICATE

Certificate Number FCL14000826

Calibration Reference ID	2109-0001	Device	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Hoek-O-Mat	Hardware Version	3.00
Calibration SW Version	1.7.6.11383	Software Version	4.01
Node Type	7001	Working Hours	124
Electronics Serial Number	1120	Date	15 April 2014
Device Serial Number	1717-1526	Time	10:13:58

Characteristics	Unit	Slope
Accuracy error (q)	[Deg]	0.215
Repeatability error (b)	[Deg]	0.111
Zero load error (Fc0)	[Deg]	-0.053
Zero load offset (F0)	[Deg]	0.183
Resolution	[Deg]	1.4E-05
Noise RMS	[Deg]	0.017



Applied Inclination [Deg]	Measured Inclination 1 [Deg]	Measured Inclination 2 [Deg]	Measured Inclination 3 [Deg]	Measured average [Deg]	Accuracy error [Deg]	Repeatability error [Deg]
0.000	0.230	0.260	0.154	0.215	0.215	0.106
5.000	5.096	5.032	5.105	5.078	0.078	0.073
10.000	10.070	9.960	9.961	9.997	-0.003	0.111
15.000	15.122	15.012	15.066	15.067	0.067	0.110

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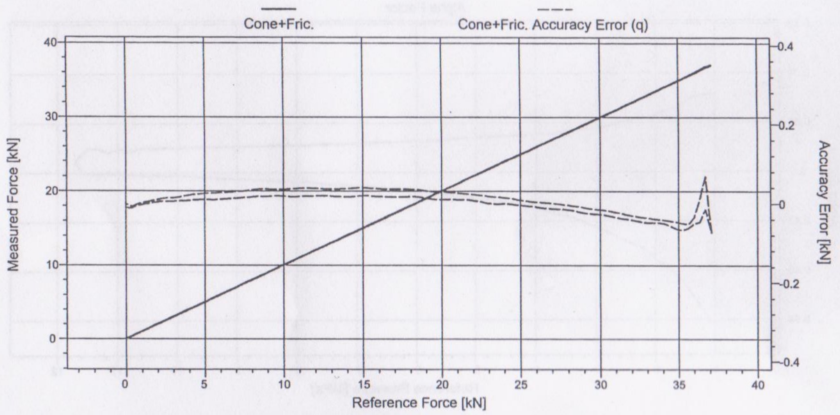
FORCE CALIBRATION CERTIFICATE [CONE+FRIC.]

Certificate Number FCL14000826

Calibration Reference ID	548FRE.002	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Zwick/Roell	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	124
Electronics Serial Number	1120	**Date**	15 April 2014
Device Serial Number	1717-1526	**Time**	08:56:25

Characteristics	Unit	Cone+Fric.
Accuracy error (q)	[kN]	0.066
Repeatability error (b)	[kN]	0.022
Reversibility error (v)	[kN]	0.021
Zero load error (Fc0)	[kN]	0.008
Zero load offset (F0)	[kN]	0.003
Resolution	[kN]	8.62E-06
Noise RMS	[kN]	0.000
Tip-Sleeve Interaction	[kPa]	1.7
Tip-Sleeve Interaction %	[%]	0.34



Applied force [kN]	Measured Force 1 [kN]	Measured Force 2 [kN]	Measured Force 3 [kN]	Measured average [kN]	Accuracy error [kN]	Repeatability error [kN]	Reversibility error [kN]
0.000	-0.016	-0.010	-0.009	-0.012	-0.012	0.008	0.010
7.000	7.013	7.013	7.011	7.012	0.012	0.002	0.017
14.000	14.016	14.017	14.016	14.016	0.016	0.001	0.021
21.000	21.010	21.009	21.011	21.010	0.010	0.002	0.016
28.000	27.982	27.986	27.985	27.984	-0.016	0.003	0.012
35.000	34.940	34.920	34.942	34.934	-0.066	0.022	
28.000	27.996	27.995	27.996	27.996	-0.004	0.001	
21.000	21.025	21.027	21.027	21.026	0.026	0.002	
14.000	14.036	14.037	14.038	14.037	0.037	0.002	
7.000	7.028	7.030	7.029	7.029	0.029	0.002	
0.000	-0.001	-0.002	-0.001	-0.001	-0.001	0.001	

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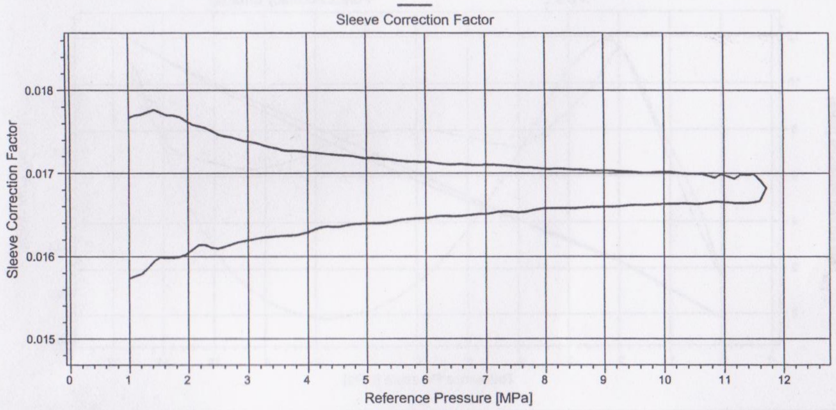
SLEEVE CORRECTION FACTOR MEASUREMENT

Certificate Number FCL14000826

Calibration Reference ID	3257-0001	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Stratham	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	124
Electronics Serial Number	1120	**Date**	15 April 2014
Device Serial Number	1717-1526	**Time**	12:02:35

Characteristics	Unit	
Sleeve correction factor	[-]	0.01682



Applied pressure [MPa]	Measured sleeve correction factor 1	Measured sleeve correction factor 2	Measured sleeve correction factor 3	Measured average sleeve correction factor
2.000	0.016	0.016	0.016	0.016
4.000	0.016	0.016	0.016	0.016
6.000	0.016	0.016	0.016	0.016
8.000	0.017	0.017	0.017	0.017
10.000	0.017	0.017	0.017	0.017
8.000	0.017	0.017	0.017	0.017
6.000	0.017	0.017	0.017	0.017
4.000	0.017	0.017	0.017	0.017
2.000	0.018	0.018	0.018	0.018

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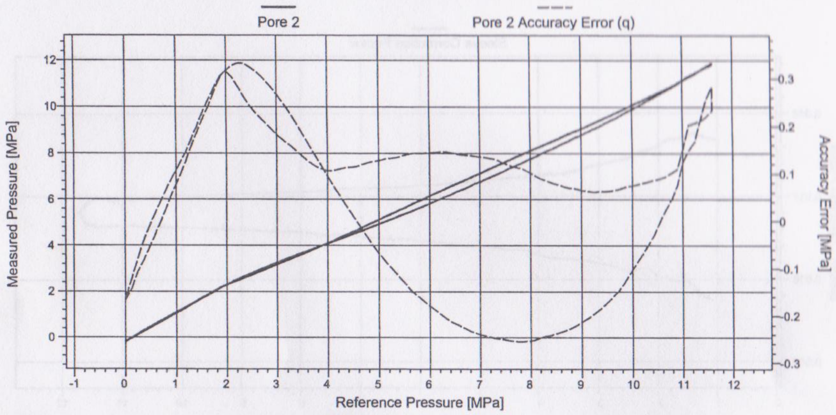
PRESSURE CALIBRATION CERTIFICATE [PORE 2]

Certificate Number FCL14000826

Calibration Reference ID	3257-0001	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Stratham	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	124
Electronics Serial Number	1120	**Date**	15 April 2014
Device Serial Number	1717-1526	**Time**	12:02:34

Characteristics	Unit	Pore 2
Accuracy error (q)	[MPa]	0.318
Repeatability error (b)	[MPa]	0.163
Reversibility error (v)	[MPa]	0.355
Zero load error (Fc0)	[MPa]	0.010
Zero load offset (F0)	[MPa]	-0.162
Resolution	[MPa]	4.67E-06
Noise RMS	[MPa]	0.000



Applied pressure [MPa]	Measured Pressure 1 [MPa]	Measured Pressure 2 [MPa]	Measured Pressure 3 [MPa]	Measured average [MPa]	Accuracy error [MPa]	Repeatability error [MPa]	Reversibility error [MPa]
0.000	-0.163	-0.162	-0.161	-0.162	-0.162	0.002	0.005
2.000	2.320	2.308	2.316	2.315	0.315	0.012	0.003
4.000	4.106	4.102	4.109	4.106	0.106	0.007	0.011
6.000	6.107	6.143	6.181	6.144	0.144	0.074	0.322
8.000	8.057	8.094	8.156	8.102	0.102	0.099	0.355
10.000	9.994	10.075	10.157	10.076	0.076	0.163	
8.000	7.662	7.758	7.820	7.747	-0.253	0.158	
6.000	5.758	5.840	5.866	5.821	-0.179	0.108	
4.000	4.043	4.115	4.127	4.095	0.095	0.084	
2.000	2.323	2.320	2.310	2.318	0.318	0.013	
0.000	-0.169	-0.167	-0.165	-0.167	-0.167	0.004	

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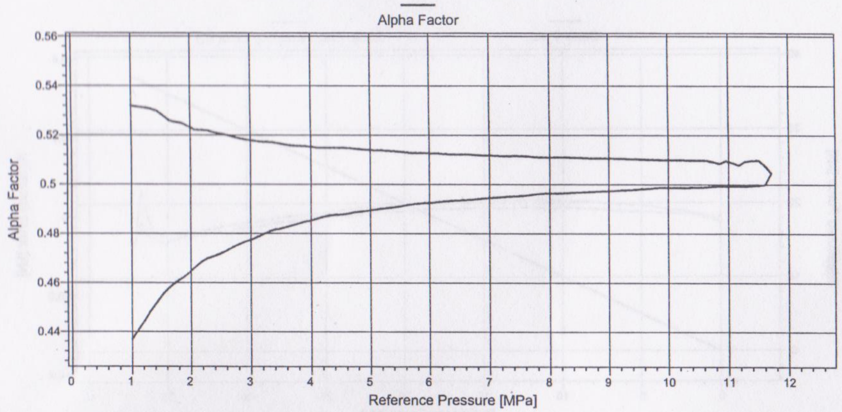
ALPHA FACTOR MEASUREMENT

Certificate Number FCL14000826

Calibration Reference ID	3257-0001	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Stratham	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	124
Electronics Serial Number	1120	**Date**	15 April 2014
Device Serial Number	1717-1526	**Time**	12:02:35

Characteristics	Unit	
Alpha Factor	[-]	0.50



Applied pressure [MPa]	Measured alpha factor 1	Measured alpha factor 2	Measured alpha factor 3	Measured average alpha factor
2.000	0.465	0.464	0.465	0.465
4.000	0.486	0.486	0.485	0.485
6.000	0.492	0.493	0.493	0.493
8.000	0.497	0.496	0.497	0.496
10.000	0.499	0.499	0.499	0.499
8.000	0.511	0.511	0.511	0.511
6.000	0.513	0.513	0.513	0.513
4.000	0.515	0.515	0.516	0.515
2.000	0.523	0.522	0.523	0.523

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MAINTENANCE REPORT CONE

CONE		
	Type:	CONE, A05F3.5CKE2HAW2/B ,100 bar, Micro Impulse
	Serial nr:	1717-1526
	Calibration date:	15 April 2014
	Calibration valid untill:	15 April 2015

MAINTENANCE REPORT — **REMARKS**

FAILURE		
Cone channel		
Friction channel		
Pore channel		
Inclination X		
Inclination Y		
Conductivity		
Mag. X		
Mag. Y		
Mag. Z		

WEAR		
Tip		
Sleeve		
Adaptor		

OTHER		
Bent		
Connector damaged		
Calibration date expired		
....		

**** Tick appropriate box:***

Example

Cone channel	X	Cone signal unstable, therefore not reliable

RIG No./ VESSEL:		Remarks/ Request:
PROJECT NO.:		
Operator:		
Date:		

Completed form to be returned with Cone to: Transducer Department of Fugro Engineers B.V.

CALIBRATION CERTIFICATE

Applicant	**FUGRO ALLUVIAL OFFSHORE LTD**	Certificate nr.	FCL14001036
Manufacturer	Fugro Engineers B.V.	Identification	1717-1647
Instrument	**A Cone Penetrometer**		

Calibration method:
The device was calibrated according to Fugro Engineers procedures using a comparison technique against a Fugro reference standard. Fugro reference standards are periodically recertified and traceable to the National Standards and Technology (NIST) (RVA). It is derived from accepted values of natural physical constants according to the International System of units (SI). Fugro's calibration system meets or exceeds the requirements of ISO 9001:2000 and ISO/IEC 17025:2005.

Cone and Friction Sleeve Calibration Reference

Equipment Serial Number	6034-0001
Equipment Manufacturer	SCHENCK
Equipment Calibration Valid till	17/02/2015
Equipment Certificate	14200527.1000.1EN
Procedure used : in-house	FEBV.CAL.PRO.003

Cone and Friction Sleeve Sensor

Manufacturer	Fugro Engineers BV
Force Application Mode	Compression
Calibrated Range	0 – 35 kN
Max Load	0 – 80 kN

Pressure Calibration Reference

Equipment Serial Number	3257-0002
Equipment Manufacturer	KELLER MEETTECH
Equipment Calibration Valid till	14/05/2014
Equipment Certificate	45403
Procedure used : in-house	FEBV.CAL.PRO.004

Pressure Sensor

Manufacturer	Kistler
Pressure Application Mode	Compression and tension
Calibrated Range	Nominal Range
Nominal Range	0 – MPa

Inclinometer Calibration Reference

Equipment Serial Number	2109-0004
Equipment Manufacturer	FEBV
Equipment Calibration Valid till	14/05/2015
Procedure used : in-house	FEBV.CAL.PRO.005

Inclinometer

Manufacturer	FEBV	ADXL
Calibrated Range	0° – 15°	-10° - 10°
Max Output	0° – 30°	-15° - 15°

Environmental Conditions

Temperature during calibration	21 ± 3 °C
Pressure during calibration	1000 ± 100 mbar

Remarks.
The values given in this calibration certificate only relate to the submitted device, and to the values measured at the time of the test. Any uncertainty defined here does not include allowances for environmental changes, variation and shock during transportation, or the capability of other laboratories to repeat the measurement.

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Calibration technician	Tempelaar, Rolf	Approved by :	Sinjorgo, Gerry
Calibration date:	14/05/2014	Approval date:	14/05/2014
Calibrate before:	14/05/2015		

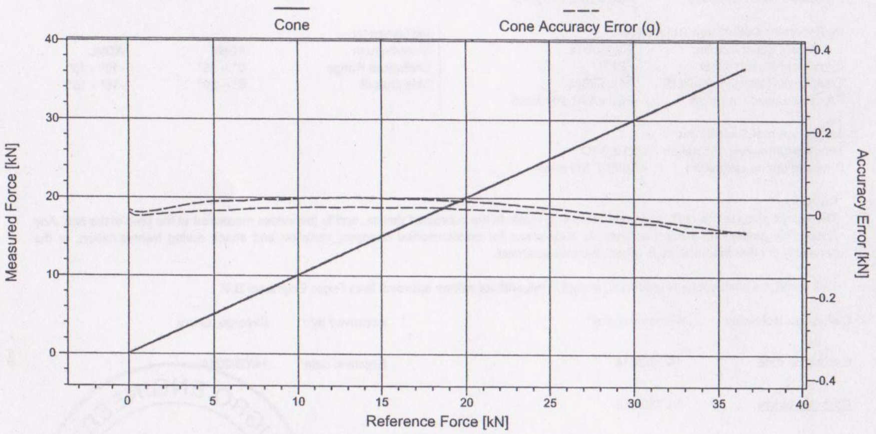
FUGRO ENGINEERS B.V.
Veurse Achterweg 10 - 2264 SG Leidschendam

FORCE CALIBRATION CERTIFICATE [CONE]

Certificate Number FCL14001036

Calibration Reference ID	548FRE.001	**Device**	CP5-CF35PB25SN2-P1E3M5-V1
Reference Manufacturer	SchenkTrebel	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	940
Electronics Serial Number	2228	**Date**	13 May 2014
Device Serial Number	1717-1647	**Time**	08:24:34

Characteristics	**Unit**	**Cone**
Accuracy error (q)	[kN]	0.045
Repeatability error (b)	[kN]	0.005
Reversibility error (v)	[kN]	0.023
Zero load error (Fc0)	[kN]	0.000
Zero load offset (F0)	[kN]	-0.024
Resolution	[kN]	8.39E-06
Noise RMS	[kN]	0.001



Applied force [kN]	Measured Force 1 [kN]	Measured Force 2 [kN]	Measured Force 3 [kN]	Measured average [kN]	Accuracy error [kN]	Repeatability error [kN]	Reversibility error [kN]
0.000	0.003	-0.003	0.000	0.000	0.000	0.005	0.006
7.000	7.007	7.009	7.008	7.008	0.008	0.002	0.021
14.000	14.012	14.015	14.013	14.014	0.014	0.003	0.023
21.000	21.007	21.009	21.007	21.008	0.008	0.002	0.018
28.000	27.983	27.984	27.984	27.984	-0.016	0.000	0.015
35.000	34.955	34.957	34.952	34.955	-0.045	0.005	
28.000	27.999	27.998	27.998	27.998	-0.002	0.002	
21.000	21.026	21.026	21.026	21.026	0.026	0.001	
14.000	14.037	14.036	14.036	14.037	0.037	0.000	
7.000	7.031	7.027	7.028	7.029	0.029	0.004	
0.000	0.008	0.006	0.005	0.006	0.006	0.003	

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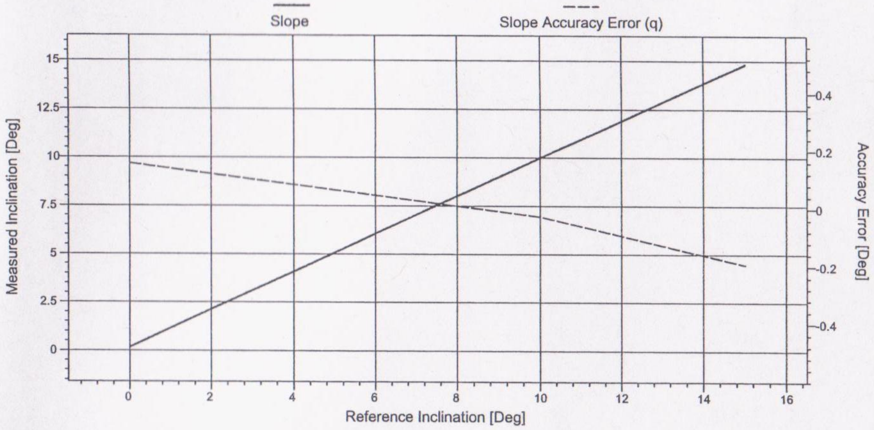
INCLINATION CALIBRATION CERTIFICATE

Certificate Number FCL14001036

Calibration Reference ID	2109-0002	**Device**	CP5-CF35PB25SN2-P1E3M5-V1
Reference Manufacturer	Hoek-O-Mat	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	940
Electronics Serial Number	2228	**Date**	13 May 2014
Device Serial Number	1717-1647	**Time**	08:29:45

Characteristics	**Unit**	**Slope**
Accuracy error (q)	[Deg]	0.194
Repeatability error (b)	[Deg]	0.209
Zero load error (Fc0)	[Deg]	0.007
Zero load offset (F0)	[Deg]	0.092
Resolution	[Deg]	1.32E-05
Noise RMS	[Deg]	0.013



Applied inclination [Deg]	Measured Inclination 1 [Deg]	Measured Inclination 2 [Deg]	Measured Inclination 3 [Deg]	Measured average [Deg]	Accuracy error [Deg]	Repeatability error [Deg]
0.000	0.104	0.285	0.080	0.156	0.156	0.206
5.000	5.039	5.100	5.057	5.065	0.065	0.061
10.000	10.013	9.951	9.955	9.973	-0.027	0.063
15.000	14.943	14.741	14.734	14.806	-0.194	0.209

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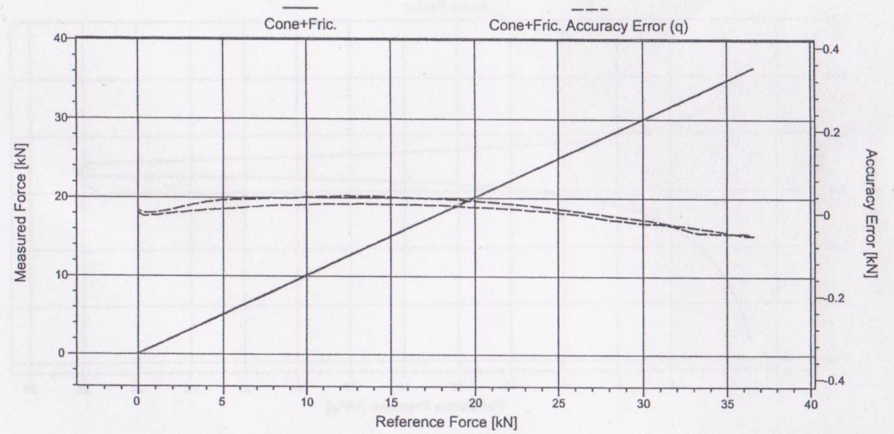
FORCE CALIBRATION CERTIFICATE [CONE+FRIC.]

Certificate Number FCL14001036

Calibration Reference ID	548FRE.001	**Device**	CP5-CF35PB25SN2-P1E3M5-V1
Reference Manufacturer	SchenkTrebel	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	940
Electronics Serial Number	2228	**Date**	13 May 2014
Device Serial Number	1717-1647	**Time**	08:24:34

Characteristics	Unit	Cone+Fric.
Accuracy error (q)	[kN]	0.050
Repeatability error (b)	[kN]	0.006
Reversibility error (v)	[kN]	0.019
Zero load error (Fc0)	[kN]	0.006
Zero load offset (F0)	[kN]	-0.029
Resolution	[kN]	8.62E-06
Noise RMS	[kN]	0.001
Tip-Sleeve Interaction	[kPa]	1.4
Tip-Sleeve Interaction %	[%]	0.29



Applied force [kN]	Measured Force 1 [kN]	Measured Force 2 [kN]	Measured Force 3 [kN]	Measured average [kN]	Accuracy error [kN]	Repeatability error [kN]	Reversibility error [kN]
0.000	0.001	-0.005	-0.002	-0.002	-0.002	0.006	0.007
7.000	7.013	7.015	7.014	7.014	0.014	0.001	0.018
14.000	14.020	14.022	14.021	14.021	0.021	0.002	0.019
21.000	21.012	21.013	21.012	21.012	0.012	0.001	0.014
28.000	27.983	27.984	27.984	27.984	-0.016	0.001	0.010
35.000	34.949	34.952	34.947	34.950	-0.050	0.005	
28.000	27.995	27.994	27.992	27.994	-0.006	0.002	
21.000	21.026	21.025	21.026	21.026	0.026	0.001	
14.000	14.039	14.040	14.040	14.040	0.040	0.001	
7.000	7.034	7.030	7.032	7.032	0.032	0.004	
0.000	0.007	0.005	0.004	0.005	0.005	0.004	

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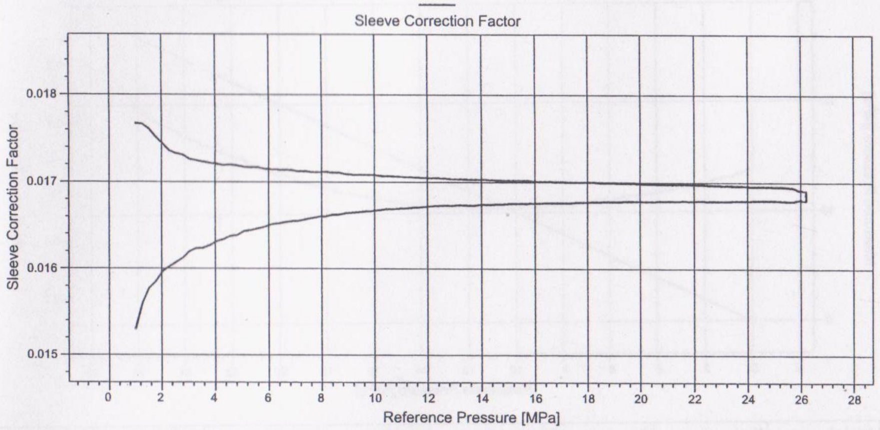
SLEEVE CORRECTION FACTOR MEASUREMENT

Certificate Number FCL14001036

Calibration Reference ID	3257-0001	**Device**	CP5-CF35PB25SN2-P1E3M5-V1
Reference Manufacturer	Stratham	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	940
Electronics Serial Number	2228	**Date**	13 May 2014
Device Serial Number	1717-1647	**Time**	11:40:08

Characteristics	Unit	
Sleeve correction factor	[-]	0.01685



Applied pressure [MPa]	Measured sleeve correction factor 1	Measured sleeve correction factor 2	Measured sleeve correction factor 3	Measured average sleeve correction factor
5.000	0.016	0.016	0.016	0.016
10.000	0.017	0.017	0.017	0.017
15.000	0.017	0.017	0.017	0.017
20.000	0.017	0.017	0.017	0.017
25.000	0.017	0.017	0.017	0.017
20.000	0.017	0.017	0.017	0.017
15.000	0.017	0.017	0.017	0.017
10.000	0.017	0.017	0.017	0.017
5.000	0.017	0.017	0.017	0.017

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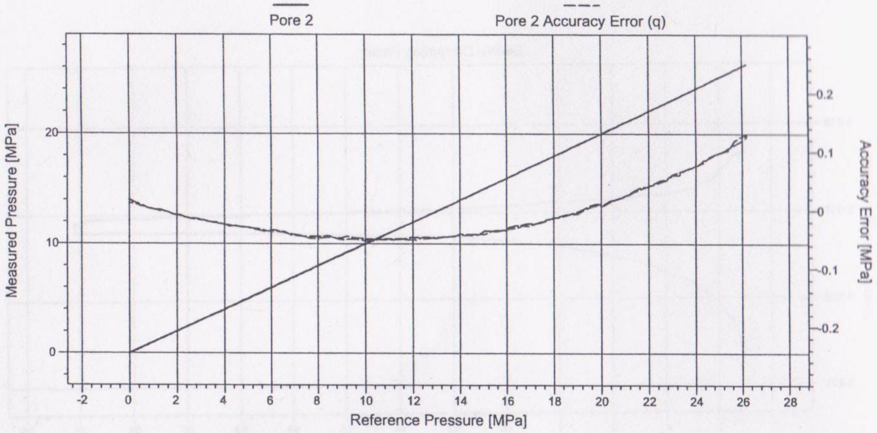
PRESSURE CALIBRATION CERTIFICATE [PORE 2]

Certificate Number FCL14001036

Calibration Reference ID	3257-0001	**Device**	CP5-CF35PB25SN2-P1E3M5-V1
Reference Manufacturer	Stratham	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	940
Electronics Serial Number	2228	**Date**	13 May 2014
Device Serial Number	1717-1647	**Time**	11:40:08

Characteristics	Unit	Pore 2
Accuracy error (q)	[MPa]	0.097
Repeatability error (b)	[MPa]	0.014
Reversibility error (v)	[MPa]	0.006
Zero load error (Fc0)	[MPa]	-0.001
Zero load offset (F0)	[MPa]	0.011
Resolution	[MPa]	6.87E-06
Noise RMS	[MPa]	0.000



Applied pressure [MPa]	Measured Pressure 1 [MPa]	Measured Pressure 2 [MPa]	Measured Pressure 3 [MPa]	Measured average [MPa]	Accuracy error [MPa]	Repeatability error [MPa]	Reversibility error [MPa]
0.000	0.015	0.013	0.027	0.019	0.019	0.014	0.006
5.000	4.974	4.969	4.968	4.970	-0.030	0.006	0.001
10.000	9.952	9.954	9.948	9.952	-0.048	0.006	0.004
15.000	14.964	14.964	14.961	14.963	-0.037	0.003	0.005
20.000	20.011	20.010	20.008	20.010	0.010	0.002	0.003
25.000	25.096	25.097	25.099	25.097	0.097	0.002	
20.000	20.009	20.004	20.008	20.007	0.007	0.004	
15.000	14.957	14.956	14.962	14.958	-0.042	0.005	
10.000	9.946	9.951	9.947	9.948	-0.052	0.005	
5.000	4.973	4.968	4.972	4.971	-0.029	0.005	
0.000	0.013	0.013	0.013	0.013	0.013	0.000	

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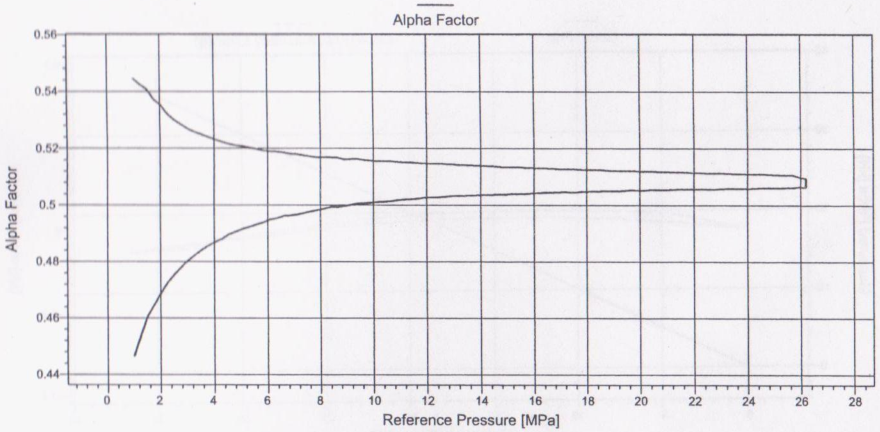
ALPHA FACTOR MEASUREMENT

Certificate Number FCL14001036

Calibration Reference ID	3257-0001	**Device**	CP5-CF35PB25SN2-P1E3M5-V1
Reference Manufacturer	Stratham	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	940
Electronics Serial Number	2228	**Date**	13 May 2014
Device Serial Number	1717-1647	**Time**	11:40:08

Characteristics	Unit	
Alpha Factor	[-]	0.51



Applied pressure [MPa]	Measured alpha factor 1	Measured alpha factor 2	Measured alpha factor 3	Measured average alpha factor
5.000	0.492	0.491	0.491	0.491
10.000	0.501	0.501	0.501	0.501
15.000	0.504	0.504	0.504	0.504
20.000	0.505	0.505	0.505	0.505
25.000	0.506	0.506	0.506	0.506
20.000	0.512	0.512	0.512	0.512
15.000	0.513	0.513	0.514	0.514
10.000	0.516	0.516	0.516	0.516
5.000	0.521	0.521	0.521	0.521

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MAINTENANCE REPORT CONE

FUGRO

CONE		
	Type:	CONE, A05F3.5CKE2HAW2/B, 250 bar, Micro Impulse Kistler
	Serial nr:	1717-1647
	Calibration date:	14 May 2014
	Calibration valid untill:	14 May 2015

MAINTENANCE REPORT		REMARKS
FAILURE		
Cone channel		
Friction channel		
Pore channel		
Inclination X		
Inclination Y		
Conductivity		
Mag. X		
Mag. Y		
Mag. Z		
WEAR		
Tip		
Sleeve		
Adaptor		
OTHER		
Bent		
Connector damaged		
Calibration date expired		
....		

Tick appropriate box:

Example

Cone channel	X	Cone signal unstable, therefore not reliable

RIG No./ VESSEL:		Remarks/ Request:
PROJECT NO.:		
Operator:		
Date:		

Completed form to be returned with Cone to: Transducer Department of Fugro Engineers B.V.

CALIBRATION CERTIFICATE

APPLICANT	FAOLG	Certificate number	FCL14000830 Page 1 of 1
SUBMITTED	**A Piezo Cone Penetrometer**	Manufacturer	Fugro Engineers B.V.
Device type	CONE, A05F3.5CKE2HAW2/B, 100 bar, Micro Impulse	Serial number	1717-1821

The device contains an electronic data sheet which contains, amongst others, the characteristics of all the sensors inside the device. The data acquisition system calculates the measured value from these known characteristics. All calibration results are conform the values specified below.

Force calibration

Calibration reference : 548 FRE.001
Procedure : FEBV.CAL.PRO.003 KALIBRATIE KRACHT
Title of channel(s) : Cone and Cone+Fric.
Max. load 80 kN

Range	Calibration range From	to	Sensitivity Deviation	Zero load output
1	0	35 kN	< 0.5 %	< 0.7 kN
Calibration uncertainty			0.3 %	0.008 kN

Pressure test :

Deviation from specified Alpha factor at 2.5 MPa	< 5 %

Cone quality control values :

Max. deviation from reference	< 1 %
Max. Tip to Sleeve friction Crosstalk	< 1 %

Pressure calibration

Calibration reference: 3257-0001
Procedure: FEBV.CAL.PRO.004 KALIBRATIE DRUK
Title of channel : Pore 2
Max. load 30 Mpa

Range	Calibration range From		Sensitivity Deviation	Zero load output
1	0	2.5 MPa	< 1.0 %	< 0.8 MPa
Calibration uncertainty			0.6 %	0.003 MPa
Pore 2 transducer : Entran EPX-S470A-100bar SN : X0800K				

Calibration of the DUAL axis slope sensors

Calibration reference:
Procedure:FEBV.CAL.PRO.006 KALIBRATIE HELLING
Title of channel : Slope x, Slope y

Range	Calibration range From		Sensitivity Deviation	Zero load output
1	-10 deg	10 deg	< 3 %	< 0.5 deg
Calibration uncertainty			1 %	0.5 deg

Typical values for this type of device

Cone diameter (mm)	25.4	Pore 2 position	2	Alpha factor	0.50
Cone area (square cm)	5	Sleeve length (mm)	93.6	Cone - Sleeve distance (mm)	9
Sleeve diameter (mm)	25.5	Sleeve area (square cm)	75	Cone - Pore 2 distance (mm)	4.0

TRACEABILITY The measurements have been executed using standards for which the traceability to primary and/or (inter)national standards has been demonstrated.

Calibrated by: Noordmans, Pieter — Approved by : Sinjorgo, Gerry

Calibration date: 15/04/2014 — Approval date: 15/04/2014

Calibrate before: 15/04/2015

FUGRO ENGINEERS B.V. * Veurse Achterweg 10 2264 SG Leidschendam *

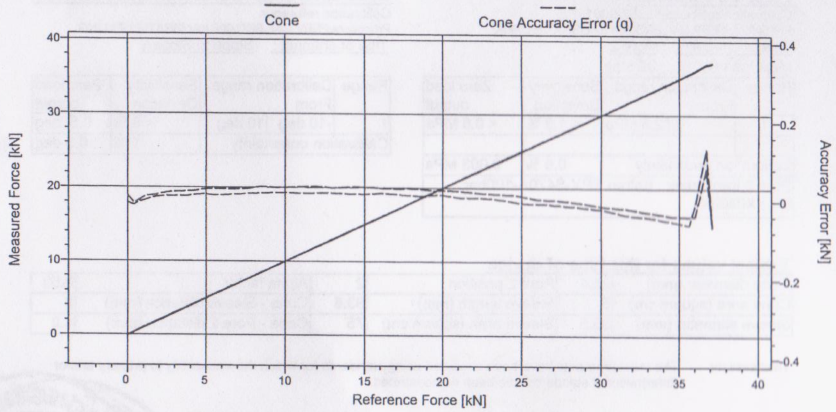
Template : F3.5F3.5CKE2HAW2 200bar Updated : 20/07/2011 12:08:00 PM

FORCE CALIBRATION CERTIFICATE [CONE]

Certificate Number FCL14000830

Calibration Reference ID	548FRE.002	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Zwick/Roell		
Calibration SW Version	1.7.6.11383	**Hardware Version**	3.00
Node Type	7001	**Software Version**	4.01
Electronics Serial Number	2388	**Working Hours**	0
Device Serial Number	1717-1821	**Date**	15 April 2014
		Time	09:27:13

Characteristics	Unit	Cone
Accuracy error (q)	[kN]	0.056
Repeatability error (b)	[kN]	0.003
Reversibility error (v)	[kN]	0.018
Zero load error (Fc0)	[kN]	0.006
Zero load offset (F0)	[kN]	0.015
Resolution	[kN]	8.52E-06
Noise RMS	[kN]	0.000



Applied force [kN]	Measured Force 1 [kN]	Measured Force 2 [kN]	Measured Force 3 [kN]	Measured average [kN]	Accuracy error [kN]	Repeatability error [kN]	Reversibility error [kN]
0.000	-0.010	-0.008	-0.008	-0.009	-0.009	0.002	0.018
7.000	7.012	7.013	7.014	7.013	0.013	0.001	0.013
14.000	14.015	14.016	14.015	14.015	0.015	0.000	0.017
21.000	21.005	21.007	21.008	21.007	0.007	0.003	0.016
28.000	27.985	27.986	27.986	27.985	-0.015	0.001	0.011
35.000	34.942	34.944	34.945	34.944	-0.056	0.002	
28.000	27.995	27.997	27.998	27.997	-0.003	0.003	
21.000	21.023	21.023	21.023	21.023	0.023	0.001	
14.000	14.033	14.032	14.033	14.033	0.033	0.001	
7.000	7.027	7.027	7.025	7.026	0.026	0.002	
0.000	0.010	0.009	0.009	0.009	0.009	0.001	

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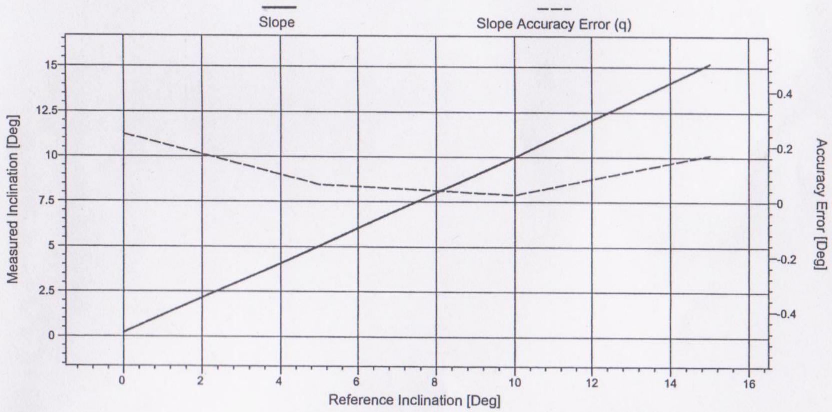
INCLINATION CALIBRATION CERTIFICATE

Certificate Number FCL14000830

Calibration Reference ID	2109-0001	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Hoek-O-Mat		
Calibration SW Version	1.7.6.11383	**Hardware Version**	3.00
Node Type	7001	**Software Version**	4.01
Electronics Serial Number	2388	**Working Hours**	0
Device Serial Number	1717-1821	**Date**	15 April 2014
		Time	09:45:38

Characteristics	Unit	Slope
Accuracy error (q)	[Deg]	0.242
Repeatability error (b)	[Deg]	0.220
Zero load error (Fc0)	[Deg]	-0.026
Zero load offset (F0)	[Deg]	0.185
Resolution	[Deg]	1.32E-05
Noise RMS	[Deg]	0.013



Applied Inclination [Deg]	Measured Inclination 1 [Deg]	Measured Inclination 2 [Deg]	Measured Inclination 3 [Deg]	Measured average [Deg]	Accuracy error [Deg]	Repeatability error [Deg]
0.000	0.190	0.319	0.216	0.242	0.242	0.129
5.000	5.137	5.000	5.040	5.059	0.059	0.137
10.000	10.086	9.979	10.007	10.024	0.024	0.106
15.000	15.268	15.192	15.048	15.169	0.169	0.220

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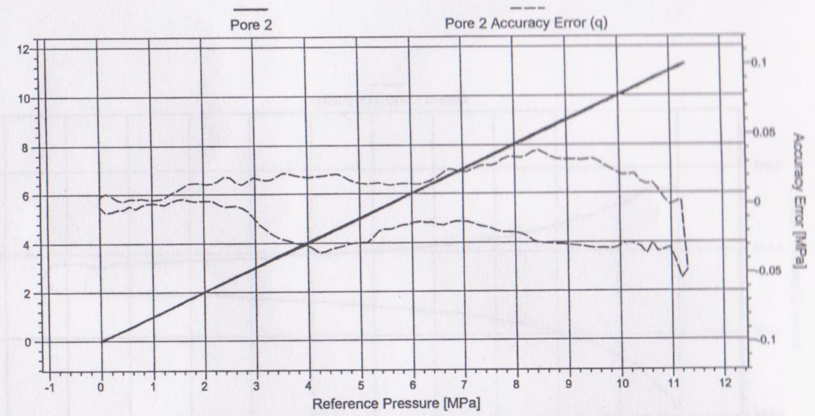
PRESSURE CALIBRATION CERTIFICATE [PORE 2]

Certificate Number FCL14000830

Calibration Reference ID	3257-0001	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Stratham	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	0
Electronics Serial Number	2388	**Date**	15 April 2014
Device Serial Number	1717-1821	**Time**	12:15:29

Characteristics	Unit	Pore 2
Accuracy error (q)	[MPa]	0.034
Repeatability error (b)	[MPa]	0.015
Reversibility error (v)	[MPa]	0.054
Zero load error (Fc0)	[MPa]	-0.003
Zero load offset (F0)	[MPa]	0.005
Resolution	[MPa]	2.91E-06
Noise RMS	[MPa]	0.000



Applied pressure [MPa]	Measured Pressure 1 [MPa]	Measured Pressure 2 [MPa]	Measured Pressure 3 [MPa]	Measured average [MPa]	Accuracy error [MPa]	Repeatability error [MPa]	Reversibility error [MPa]
0.000	0.007	0.006	0.004	0.005	0.005	0.003	0.007
2.000	2.017	2.017	2.010	2.015	0.015	0.008	0.012
4.000	4.021	4.019	4.019	4.020	0.020	0.002	0.049
6.000	6.015	6.015	6.014	6.015	0.015	0.002	0.028
8.000	8.032	8.042	8.028	8.034	0.034	0.015	0.054
10.000	10.022	10.025	10.019	10.022	0.022	0.005	
8.000	7.980	7.981	7.978	7.980	-0.020	0.004	
6.000	5.992	5.985	5.982	5.986	-0.014	0.010	
4.000	3.973	3.969	3.969	3.970	-0.030	0.005	
2.000	2.010	1.997	2.001	2.003	0.003	0.014	
0.000	0.000	-0.002	-0.004	-0.002	-0.002	0.004	

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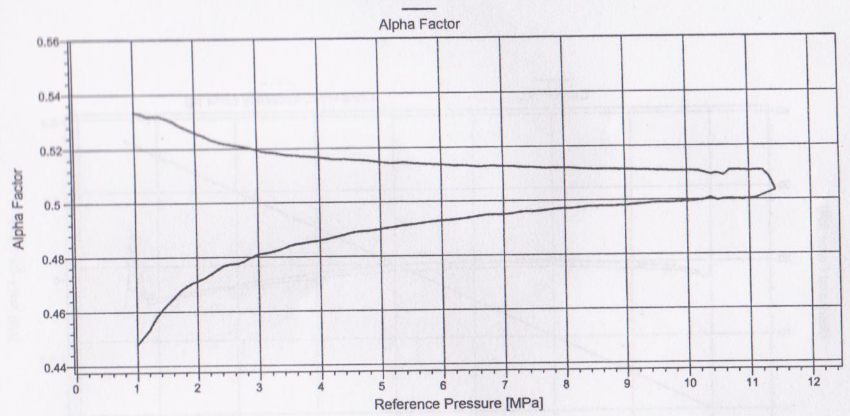
ALPHA FACTOR MEASUREMENT

Certificate Number FCL14000830

Calibration Reference ID	3257-0001	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Stratham	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	0
Electronics Serial Number	2388	**Date**	15 April 2014
Device Serial Number	1717-1821	**Time**	12:15:29

Characteristics	Unit	
Alpha Factor	[-]	0.50



Applied pressure [MPa]	Measured alpha factor 1	Measured alpha factor 2	Measured alpha factor 3	Measured average alpha factor
2.000	0.471	0.472	0.470	0.471
4.000	0.486	0.487	0.486	0.486
6.000	0.493	0.493	0.493	0.493
8.000	0.497	0.498	0.497	0.497
10.000	0.499	0.500	0.499	0.499
8.000	0.512	0.512	0.513	0.512
6.000	0.514	0.514	0.514	0.514
4.000	0.517	0.517	0.517	0.517
2.000	0.527	0.525	0.526	0.526

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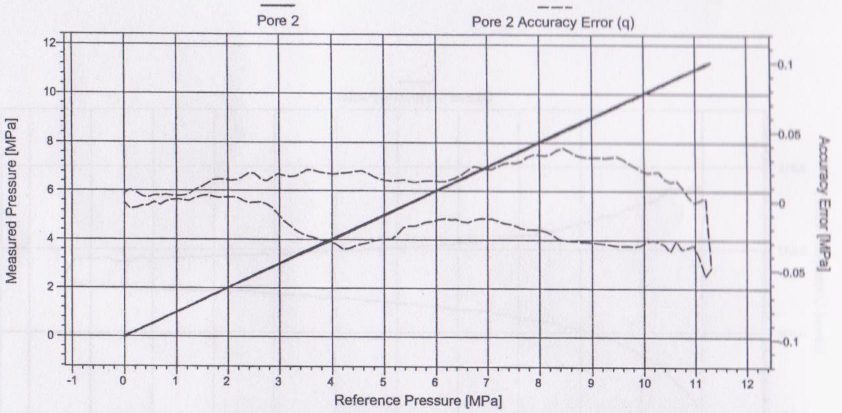
PRESSURE CALIBRATION CERTIFICATE [PORE 2]

Certificate Number FCL14000830

Calibration Reference ID	3257-0001	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Stratham	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	0
Electronics Serial Number	2388	**Date**	15 April 2014
Device Serial Number	1717-1821	**Time**	12:15:29

Characteristics	Unit	Pore 2
Accuracy error (q)	[MPa]	0.034
Repeatability error (b)	[MPa]	0.015
Reversibility error (v)	[MPa]	0.054
Zero load error (Fc0)	[MPa]	-0.003
Zero load offset (F0)	[MPa]	0.005
Resolution	[MPa]	2.91E-06
Noise RMS	[MPa]	0.000



Applied pressure [MPa]	Measured Pressure 1 [MPa]	Measured Pressure 2 [MPa]	Measured Pressure 3 [MPa]	Measured average [MPa]	Accuracy error [MPa]	Repeatability error [MPa]	Reversibility error [MPa]
0.000	0.007	0.006	0.004	0.005	0.005	0.003	0.007
2.000	2.017	2.017	2.010	2.015	0.015	0.008	0.012
4.000	4.021	4.019	4.019	4.020	0.020	0.002	0.049
6.000	6.015	6.015	6.014	6.015	0.015	0.002	0.028
8.000	8.032	8.042	8.028	8.034	0.034	0.015	0.054
10.000	10.022	10.025	10.019	10.022	0.022	0.005	
8.000	7.980	7.981	7.978	7.980	-0.020	0.004	
6.000	5.992	5.985	5.982	5.986	-0.014	0.010	
4.000	3.973	3.969	3.969	3.970	-0.030	0.005	
2.000	2.010	1.997	2.001	2.003	0.003	0.014	
0.000	0.000	-0.002	-0.004	-0.002	-0.002	0.004	

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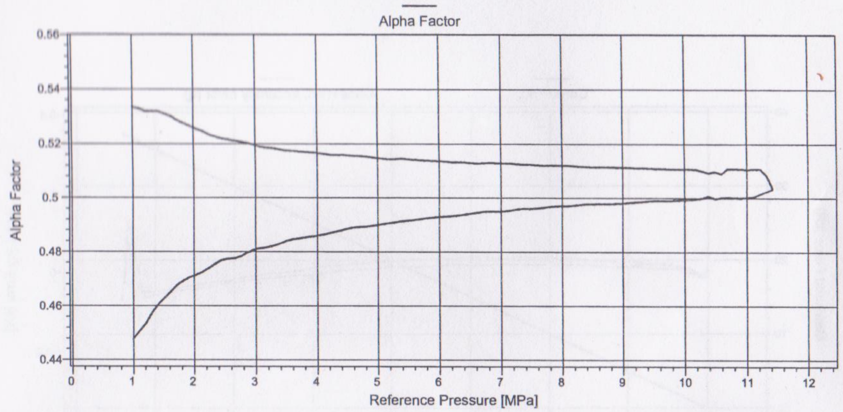
ALPHA FACTOR MEASUREMENT

Certificate Number FCL14000830

Calibration Reference ID	3257-0001	**Device**	CP5-CF35PB10SN2-P1E3M5-V1
Reference Manufacturer	Stratham	**Hardware Version**	3.00
Calibration SW Version	1.7.6.11383	**Software Version**	4.01
Node Type	7001	**Working Hours**	0
Electronics Serial Number	2388	**Date**	15 April 2014
Device Serial Number	1717-1821	**Time**	12:15:29

Characteristics	Unit	
Alpha Factor	[-]	0.50



Applied pressure [MPa]	Measured alpha factor 1	Measured alpha factor 2	Measured alpha factor 3	Measured average alpha factor
2.000	0.471	0.472	0.470	0.471
4.000	0.486	0.487	0.486	0.486
6.000	0.493	0.493	0.493	0.493
8.000	0.497	0.498	0.497	0.497
10.000	0.499	0.500	0.499	0.499
8.000	0.512	0.512	0.513	0.512
6.000	0.514	0.514	0.514	0.514
4.000	0.517	0.517	0.517	0.517
2.000	0.527	0.525	0.526	0.526

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MAINTENANCE REPORT CONE

CONE	Type:	CONE, A05F3.5CKE2HAW2/B, 100 bar, Micro Impulse
	Serial nr:	1717-1821
	Calibration date:	15 April 2014
	Calibration valid untill:	15 April 2015

MAINTENANCE REPORT **REMARKS**

FAILURE		
Cone channel		
Friction channel		
Pore channel		
Inclination X		
Inclination Y		
Conductivity		
Mag. X		
Mag. Y		
Mag. Z		

WEAR		
Tip		
Sleeve		
Adaptor		

OTHER		
Bent		
Connector damaged		
Calibration date expired		
....		

**** Tick appropriate box:***

Example

Cone channel	X	Cone signal unstable, therefore not reliable

RIG No./ VESSEL:		Remarks/ Request:
PROJECT NO.:		
Operator:		

CALIBRATION CERTIFICATE

APPLICANT	FMMG HOUSTON	CERTIFICATE NUMBER	FCL14000409 Page 1 of 1
SUBMITTED	A Piezo Cone Penetrometer	MANUFACTURER	Fugro Engineers B.V.
Device type	CONE, A05F8CKE/B, WISON®	SERIAL NUMBER	1721-1682

The device contains an electronic data sheet which contains, amongst others, the characteristics of all the sensors inside the device. The data acquisition system calculates the measured value from these known characteristics. All calibration results are conform the values specified below.

Force calibration

Calibration reference: 548 FRE.002
Procedure: FEBV.CAL.PRO.003 KALIBRATIE KRACHT
Title of channel(s) : Cone and Cone+Fric.
Max. load 80 kN

Range	Calibration range From	to	Sensitivity Deviation	Zero load output
1	0	80 kN	< 0.5 %	< 1.6 kN
Calibration uncertainty			0.3 %	0.008 kN

Pressure test :

Deviation from specified Alpha factor at 2.5 MPa	< 5 %

Cone quality control values :

Max. deviation from reference	< 1 %
Max. Tip to Sleeve friction Crosstalk	< 1 %

Typical values for this type of device

Cone diameter (mm)	25.40			Alpha factor	0.50
Cone area (square cm)	5.00	Sleeve length (mm)	93.60	Cone - Sleeve distance (mm)	8.90
Sleeve diameter (mm)	25.50	Sleeve area (square cm)	75.00		

TRACEABILITY The measurements have been executed using standards for which the traceability to primary and/or (inter)national standards has been demonstrated.

Calibrated by: Boer, Kimmo de

Calibration date: 03/03/2014

Calibrate before: 03/03/2015

Approved by: Sinjorgo, Gerry

Approval date: 03/03/2014

FUGRO ENGINEERS B.V. Veurse Achterweg 10 - 2264 SG Leidschendam

Template: 8CKE 002 Updated: 06/12/2010

CALIBRATION CERTIFICATE

APPLICANT	FMMG HOUSTON	CERTIFICATE NUMBER	FCL14000412 Page 1 of 1
SUBMITTED	A Piezo Cone Penetrometer	MANUFACTURER	Fugro Engineers B.V.
Device type	CONE, A05F8CKE/B, WISON®	SERIAL NUMBER	1721-1683

The device contains an electronic data sheet which contains, amongst others, the characteristics of all the sensors inside the device. The data acquisition system calculates the measured value from these known characteristics. All calibration results are conform the values specified below.

Force calibration

Calibration reference: 548 FRE.001
Procedure: FEBV.CAL.PRO.003 KALIBRATIE KRACHT
Title of channel(s) : Cone and Cone+Fric.
Max. load 80 kN

Range	Calibration range From	to	Sensitivity Deviation	Zero load output
1	0	80 kN	< 0.5 %	< 1.6 kN
Calibration uncertainty			0.3 %	0.008 kN

Pressure test :

Deviation from specified Alpha factor at 2.5 MPa	< 5 %

Cone quality control values :

Max. deviation from reference	< 1 %
Max. Tip to Sleeve friction Crosstalk	< 1 %

Typical values for this type of device

Cone diameter (mm)	25.40			Alpha factor	0.50
Cone area (square cm)	5.00	Sleeve length (mm)	93.60	Cone - Sleeve distance (mm)	8.90
Sleeve diameter (mm)	25.50	Sleeve area (square cm)	75.00		

TRACEABILITY The measurements have been executed using standards for which the traceability to primary and/or (inter)national standards has been demonstrated.

Calibrated by: Boer, Kimmo de

Approved by : Sinjorgo, Gerry

Calibration date: 25/02/2014

Approval date: 25/02/2014

Calibrate before: 25/02/2015

Template: 8CKE Updated: 29/08/2013 1:55:00 PM

FUGRO ENGINEERS B.V.

CALIBRATION CERTIFICATE

APPLICANT	FMMG HOUSTON	CERTIFICATE NUMBER	FCL14000411 Page 1 of 1
SUBMITTED	A Piezo Cone Penetrometer	MANUFACTURER	Fugro Engineers B.V.
Device type	CONE, A05F8CKE/B, WISON®	SERIAL NUMBER	1721-1684

The device contains an electronic data sheet which contains, amongst others, the characteristics of all the sensors inside the device. The data acquisition system calculates the measured value from these known characteristics. All calibration results are conform the values specified below.

Force calibration

Calibration reference: 548 FRE.001
Procedure: FEBV.CAL.PRO.003 KALIBRATIE KRACHT
Title of channel(s) : Cone and Cone+Fric.
Max. load 80 kN

Range	Calibration range From	to	Sensitivity Deviation	Zero load output
1	0	80 kN	< 0.5 %	< 1.6 kN
Calibration uncertainty			0.3 %	0.008 kN

Pressure test :

Deviation from specified Alpha factor at 2.5 MPa	< 5 %

Cone quality control values :

Max. deviation from reference	< 1 %
Max. Tip to Sleeve friction Crosstalk	< 1 %

Typical values for this type of device

Cone diameter (mm)	25.40			Alpha factor	0.50
Cone area (square cm)	5.00	Sleeve length (mm)	93.60	Cone - Sleeve distance (mm)	8.90
Sleeve diameter (mm)	25.50	Sleeve area (square cm)	75.00		

TRACEABILITY The measurements have been executed using standards for which the traceability to primary and/or (inter)national standards has been demonstrated.

Calibrated by: Boer, Kimmo de

Calibration date: 25/02/2014

Calibrate before: 25/02/2015

Approved by : Sinjorgo, Gerry

Approval date: 25/02/2014

FUGRO ENGINEERS B.V. Veurse Achterweg 10 - 2264 SG Leidschendam

Template: 8CKE Updated: 29/08/2013 1:55:00 PM

APPENDIX J

OFFSHORE LABORATORY TEST RESULTS

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-NB01	0.1	1B		20	10								
BH-NB01	0.2	1C	26										
BH-NB01	1.7	2A		20	10								
BH-NB01	2	2C	27										
BH-NB01	3.2	3B		20	10								
BH-NB01	3.4	3C	37										
BH-NB01	4.6	4A		20	11								
BH-NB01	4.9	4C	22										
BH-NB01	6.3	5B		19	9								
BH-NB01	6.4	5C	26										
BH-NB01	7.8	6A		19	10								
BH-NB01	8.1	6C	23										
BH-NB01	9.3	7A		19	9								
BH-NB01	9.5	7B		19	9								
BH-NB01	9.6	7C	30										
BH-NB01	11	8B		20	10								
BH-NB01	11.1	8C	31										
BH-NB01	12.5	9B		19	9								
BH-NB01	12.7	9C	33										
BH-NB01	14	10B		20	11								
BH-NB01	14.2	10C	19										
BH-NB01	15.5	11B		20	10								
BH-NB01	15.7	11C	20										
BH-NB01	17.1	12B		18	9								
BH-NB01	17.2	12C	32										

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-NB01	18.6	13B		19	9								
BH-NB01	18.8	13C	27										
BH-NB01	19.8	14B	57	17	8								
BH-NB01	21.3	15A	52	17	8	3376	73.0		11.1	3.4			
BH-NB01	21.5	15B									108	96	
BH-NB01	21.6	15C									108	96	
BH-NB01	22.9	16A		17	7						96	108	
BH-NB01	23.3	16C				3652	91.0		6.0	3.2	96	108	182
BH-NB01	24.4	17A	51	17	7								
BH-NB01	24.5	17B	30	18	8								
BH-NB03	0.2	1B		18	8								
BH-NB03	0.5	1D	30										
BH-NB03	1.5	2A		19	9								
BH-NB03	1.8	2C	49										
BH-NB03	3	3A	26	18	8								
BH-NB03	3.4	3C	52										
BH-NB03	4.6	4A		18	8								
BH-NB03	4.9	4C		19	9								
BH-NB03	5	4D	36										
BH-NB03	6.3	5A		19	9								
BH-NB03	6.6	5C	31										
BH-NB03	7.8	6A		19	9								
BH-NB03	8.1	6C	29										
BH-NB03	9.3	7A		17	8								
BH-NB03	9.6	7C	29										

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u, Torvane}$ (kPa)	$S_{u, pocket Pen}$ (kPa)	$S_{u, Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u, REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-NB03	10.8	8A		20	10								
BH-NB03	11.1	8C	24										
BH-NB03	12.3	9A		20	10								
BH-NB03	12.7	9C	22										
BH-NB03	13.9	10A		19	10								
BH-NB03	14.2	10C	21										
BH-NB03	15.4	11A		19	9								
BH-NB03	15.5	11B		19	9								
BH-NB03	15.7	11C	27										
BH-NB03	16.9	12A		18	8								
BH-NB03	17.1	12B	33										
BH-NB03	17.2	12C		22	12								
BH-NB03	18.4	13A	41										
BH-NB03	18.8	13C	58	17	7	2953	76.0		14.9	2.4	108	108	
BH-NB03	20	14A	47									132	
BH-NB03	20.1	14B	54	16	7	3158	99.0		8.2	4.1			
BH-NB03	20.3	14C		17	7						84	96	
BH-NB03	21.5	15B		18	8								
BH-NB03	21.6	15C	27										
BH-NB03	23	16A		20	10								
BH-NB03	23.2	16B	24										
BH-NB03	24.4	17A		20	10								
BH-NB03	24.5	17B	24										
BH-NB03	25.9	18A		20	10								
BH-NB03	26.1	18B	23										

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-NB03	27.4	19A	19	19	9								
BH-NB03	29.3	20B	27	19	9								
BH-NB03	30.3	21A	22	20	10								
BH-NB05	0.2	1B		19	9								
BH-NB05	0.5	1D	33										
BH-NB05	1.7	2A		19	9								
BH-NB05	2	2C	24										
BH-NB05	3.2	3B		19	9								
BH-NB05	3.5	3D	25										
BH-NB05	5	4C	32	19	9							72	
BH-NB05	6.1	5A		18	8								
BH-NB05	6.4	5C	34										
BH-NB05	7.9	6B		19	9								
BH-NB05	8.1	6C	32										
BH-NB05	9.3	7A		19	9								
BH-NB05	9.6	7C	30										
BH-NB05	10.8	8A		19	9								
BH-NB05	11.1	8C	24										
BH-NB05	12.5	9B		19	9								
BH-NB05	12.7	9C	27										
BH-NB05	13.9	10A		20	10								
BH-NB05	14.2	10C	24										
BH-NB05	15.7	11C	32	19	9								
BH-NB05	16.9	12A	50	17	7	2712	104.0		7.1	3.3		84	
BH-NB05	17.2	12C	34										

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u, Torvane}$ (kPa)	$S_{u, pocket Pen}$ (kPa)	$S_{u, Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u, REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-NB05	18.3	13A		17	7								
BH-NB05	18.8	13C	44									84	
BH-NB05	20.1	14B		21	11								
BH-NB05	20.3	14C	27										
BH-NB05	21.5	15A	20										
BH-NB05	23	16B	23	22	12								
BH-NB05	24.5	17A	22	23	13								
BH-NB05	26.1	18A	19	20	10								
BH-NB05	27.4	19A	27	19	9								
BH-NB05	29.1	20A	20										
BH-NB05	29.3	20B		19	9								
BH-NB05	30.2	21A	21	19	9								
BH-NB07	0.2	1A		18	9								
BH-NB07	0.5	1C	25										
BH-NB07	1.7	2B	25	16	6								
BH-NB07	3.2	3A		19	9								
BH-NB07	3.5	3C	31										
BH-NB07	4.9	4B		19	9								
BH-NB07	5	4C	31										
BH-NB07	6.4	5B		19	10								
BH-NB07	6.6	5C	27										
BH-NB07	7.9	6B		18	9								
BH-NB07	8.1	6C	30										
BH-NB07	9.5	7B		19	9								
BH-NB07	9.6	7C	26										

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-NB07	11	8B		19	9								
BH-NB07	11.1	8C	31										
BH-NB07	12.5	9B		19	9								
BH-NB07	12.7	9C	27										
BH-NB07	13.9	10A										72	
BH-NB07	14	10B		19	10								
BH-NB07	14.2	10C	26									84	
BH-NB07	15.4	11A										72	
BH-NB07	15.5	11B		20	11								
BH-NB07	15.7	11C	30								72	84	
BH-NB07	16.9	12A										84	
BH-NB07	17.1	12B	48	17	8	2638	97.0		9.7	4.7			
BH-NB07	17.2	12C									67	72	
BH-NB07	18.3	13A		19	10								
BH-NB07	18.4	13B		19	10								
BH-NB07	18.6	13C	20										
BH-NB07	19.8	14A		21	11								
BH-NB07	20	14B	20										
BH-NB07	21.3	15A		21	11								
BH-NB07	21.5	15B	18										
BH-NB07	22.9	16A	21										
BH-NB07	24.5	17B	20										
BH-NB07	25.9	18A		20	10								
BH-NB07	26.2	18C	19										
BH-NB07	27.4	19A		21	11								

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

Figure J-6

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-NB07	27.6	19B	22										
BH-NB07	29	20A		21	11								
BH-NB07	29.1	20B	25										
BH-NB07	30.2	21A		20	10								
BH-NB07	30.3	21B	22										
BH-NB09	0.3	1B		18	9								
BH-NB09	1.5	2A										60	
BH-NB09	1.7	2B		17	7								
BH-NB09	2	2D	33	19	9								
BH-NB09	3.2	3A	25										
BH-NB09	3.4	3B		18	9								
BH-NB09	4.7	4A		18	9								
BH-NB09	5	4C	28										
BH-NB09	6.3	5A		18	9								
BH-NB09	6.6	5C	31										
BH-NB09	7.8	6A		19	9								
BH-NB09	8.1	6C	30										
BH-NB09	9.3	7A		18	8								
BH-NB09	9.6	7C	28										
BH-NB09	10.8	8A	31										
BH-NB09	11	8B		18	8								
BH-NB09	12.3	9B		18	9								
BH-NB09	12.7	9D	29										
BH-NB09	13.9	10B		20	10								
BH-NB09	14.2	10D	28										

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-NB09	15.4	11A		19	9								
BH-NB09	15.7	11C	26										
BH-NB09	16.9	12A		19	9								
BH-NB09	17.2	12C	28										
BH-NB09	18.4	13A		19	9								
BH-NB09	18.6	13B	24										
BH-NB09	20	14B	24										
BH-NB09	21.3	15A	18										
BH-NB09	22.9	16A	19										
BH-NB09	24.7	17C	32										
BH-NB09	24.8	17A		18	8								
BH-NB11	0.2	1B	31	18	8								
BH-NB11	0.3	1C	29	20	10								
BH-NB11	1.7	2B		20	10								
BH-NB11	1.8	2C	37	19	9								
BH-NB11	2	2D	27										
BH-NB11	3.4	3B		20	10								
BH-NB11	3.5	3C	22										
BH-NB11	4.7	4A										24	
BH-NB11	4.9	4B		19	10								
BH-NB11	5	4C	30									36	
BH-NB11	6.9	5A										36	
BH-NB11	7	5B		19	9								
BH-NB11	7.2	5C	31									36	
BH-NB11	7.8	6B		20	10								

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-NB11	7.9	6C	34										
BH-NB11	9.5	7B		19	9								
BH-NB11	9.6	7C	27										
BH-NB11	11	8B		19	9								
BH-NB11	11.1	8C	32										
BH-NB11	12.3	9A		19	9								
BH-NB11	12.7	9C	33										
BH-NB11	14.2	10C	28	19	9								
BH-NB11	15.5	11B		20	10								
BH-NB11	15.7	11C	25										
BH-NB11	17.1	12B		21	11								
BH-NB11	17.2	12C	21										
BH-NB11	18.4	13B		22	12								
BH-NB11	18.6	13C	20										
BH-NB11	19.8	14A	18										
BH-NB11	21.5	15B		20	10								
BH-NB11	21.6	15C	29										
BH-NB11	23	16B		19	9								
BH-NB11	23.2	16C	29										
BH-NB11	24.4	17A	26	20	10								
BH-T01A	0.9	1A	44										
BH-T01A	1.5	2A	24										
BH-T01A	1.8	2B	49		8						14		
BH-T01A	5.3	3A	32	18	8	1910	20.0		4.8	2.1			
BH-T01A	5.5	3B									21		38

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u, Torvane}$ (kPa)	$S_{u, pocket Pen}$ (kPa)	$S_{u, Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u, REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-T01A	6.1	4A	32	18	8								
BH-T01A	6.2	4B									15		
BH-T01A	6.3	4C	34								17		
BH-T01A	10.7	6A	26	19	9								
BH-T01A	11	6C	31										
BH-T01A	11	6C									48		72
BH-T01A	12.5	7B		17	7								
BH-T01A	12.7	7C	46								35		158
BH-T01A	13.1	8B		17	7						29	36	
BH-T01A	13.3	8C	44										86
BH-T01A	16.8	9B		18	8	2638	66.0		9.1	4.4	62	57	
BH-T01A	16.8	9B				2638		8.0	15.0	3.1			
BH-T01A	16.9	9C	37								62	57	96
BH-T01A	17.5	10A		18	8								
BH-T01A	17.7	10B	35								57	57	
BH-T01A	17.8	10C									57	57	110
BH-T01A	21.3	11B	34	19	9	3328	133.0		5.4	8.9	144	144	
BH-T01A	21.5	11C									151	168	168
BH-T01A	22.3	12B		20	10							132	196
BH-T01A	22.4	12C	26								144	120	
BH-T01A	25.8	13A		20	10								
BH-T01A	26.1	13C	25										
BH-T01A	26.8	14B		21	11								
BH-T01A	27	14C	22										
BH-T01A	30.2	15A		22	12								

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-T01A	30.3	15B	19										
BH-T01A	31.3	16B	28										
BH-T01A	31.3	16C		19	9								
BH-T01A	34.9	17A		19	9								
BH-T01A	35.2	17C	25										
BH-T01A	38.7	18A	28										
BH-T01A	38.9	18B		20	10								
BH-T01A	42.2	19A		20	10								
BH-T01A	42.4	19B	22										
BH-T01A	45.3	20A	22										
BH-T01A	48.9	21A	26	20	10								
BH-T01A	52.4	22A		19	9								
BH-T01A	52.6	22B	30										
BH-T01A	56.3	23A	27										
BH-T01A	56.6	23B		18	8								
BH-T01A	57.2	24A		19	9								
BH-T01A	57.5	24C	40										
BH-T01A	60.8	25A		2	-8								
BH-T01A	61	25B										36	
BH-T01A	61.1	25C	32								36	36	115
BH-T01A	61.9	26B		19	9	5746	135.0		14.8	8.6			
BH-T01A	61.9	26B									72	36	
BH-T01A	62	26C	31								53		115
BH-T01A	65.5	27B	30	19	9	5458	121.0		14.8	9.1		244	
BH-T01A	65.7	27C										249	

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-T01A	66.3	28A		19	9	5741	153.0		14.3	6.3			
BH-T01A	66.3	28A				5722		63.0	15.0	8.1			
BH-T01A	66.5	28B		19	9							292	
BH-T01A	66.6	28C	31										
BH-T01A	66.6	28C										302	
BH-T01A	70.1	29B	23	20	10	5698	199.0		14.1	6.8		192	
BH-T01A	70.3	29C										215	
BH-T01A	71	30B		21	11								
BH-T01A	71.2	30C	21										
BH-T01A	74.8	31B		20	10								
BH-T01A	75	31C	25										
BH-T01A	78.7	32B		20	10								
BH-T01A	78.8	32C	23										
BH-T01A	82.3	33B		21	11								
BH-T01A	82.5	33C	21										
BH-T01A	85.7	34A		20	10								
BH-T01A	86	34C	25										
BH-T01A	89.5	35A		19	9								
BH-T01A	89.8	35C	25										
BH-T01A	93.3	36B										144	
BH-T01A	93.4	36B	22	20	10	5707	113.0		15.0	6.3			
BH-T01A	93.4	36C										192	
BH-T01A	96.6	37A		19	9	5655	122.0		5.9	2.7			
BH-T01A	96.8	37C	27									168	
BH-T01A	97	37C									72		

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-T01A	97.1	37D									72	192	196
BH-T01A	97.7	38B		20	10						90	215	
BH-T01A	97.9	38C									84		
BH-T01A	98	38D									89	192	196
BH-T01A	101.4	39A		19	9	5664	227.0		8.1	4.1			
BH-T01A	101.5	39B	32								84	292	
BH-T01A	101.7	39C									96	235	196
BH-T01A	102.3	40A		19	9								
BH-T01A	102.6	40B	31								96	235	
BH-T01A	102.6	40C									78	235	
BH-T01A	106.1	41A	34	19	9						108	206	
BH-T01A	106.3	41C									78	282	
BH-T01A	106.9	42A	42	19	9								
BH-T01A	107	42B									78	268	
BH-T01A	107.2	42C									90		
BH-T01A	107.3	42C									74	244	
BH-T02A	4.9	1A	27	19	9	1912	30.0		11.1	2.5			
BH-T02A	5	1B	32									48	
BH-T02A	5.6	2A	39										
BH-T02A	5.8	2B		20	11								
BH-T02A	5.9	2C	24										
BH-T02A	11	3B		20	10								
BH-T02A	11.1	3C	22										
BH-T02A	14.5	4A										60	
BH-T02A	14.6	4B	41	18	8	2313	73.0		6.1	3.3			

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-T02A	14.6	4B				2318		14.0	15.0	3.8			
BH-T02A	14.8	4C	41									60	196
BH-T02A	15.4	5A	41	18	8							60	
BH-T02A	15.5	5B										60	
BH-T02A	15.7	5C										84	101
BH-T02A	19.1	6A	46	17	8	3015	81.0		7.3	3.5			
BH-T02A	19.4	6C	52									60	144
BH-T02A	19.8	7D	46									24	
BH-T02A	20	7A		19	10								
BH-T02A	20.3	7C	26										
BH-T02A	23.6	8A									132	132	
BH-T02A	23.8	8B	31	19	9	3746	123.0		9.4	3.7			
BH-T02A	23.9	8C									144	144	196
BH-T02A	24.5	9A									163	168	
BH-T02A	24.7	9B	23	20	10	4679	111.0		13.8	4.8			
BH-T02A	24.8	9C									144	156	196
BH-T02A	28.2	10A									72	72	
BH-T02A	28.4	10B	24	19	10	5113	52.0		15.0	4.8			
BH-T02A	28.5	10C									72	72	
BH-T02A	29.3	11B		20	10								
BH-T02A	29.4	11C	24										
BH-T02A	32.9	12B		19	9								
BH-T02A	33.1	12C	32										
BH-T02A	36.6	13A		21	12								
BH-T02A	36.7	13B	18										

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-T02A	40.5	14B		8	-1								
BH-T02A	40.7	14C	29										
BH-T02A	43.9	15A		19	10								
BH-T02A	44.1	15B	23										
BH-T02A	47.6	16A		18	9								
BH-T02A	47.7	16B	23										
BH-T02A	51.4	17A	30	19	9								
BH-T02A	51.4	17A				5746		41.0	15.1	4.8			
BH-T02A	51.5	17B	27										
BH-T02A	54.9	18A	32									175	
BH-T02A	55	18B		19	9								
BH-T02A	55.2	18C										175	
BH-T02A	58.5	19A		19	9								
BH-T02A	58.8	19C	28										
BH-T02A	59.6	20A	32	19	9	5738	182.0		11.9	6.5		60	
BH-T02A	59.8	20B										60	196
BH-T02A	59.9	20C	30										
BH-T02A	62.5	21A	32	19	9	5773	149.0		15.0	4.9			
BH-T02A	62.5	21A				5765		65.0	14.8	6.2			
BH-T02A	62.8	21C	32										
BH-T02A	64.2	22A		19	9								
BH-T02A	64.5	22C	31										
BH-T02A	67.8	23A	31	19	9	5761	155.0		15.0	5.7			
BH-T02A	68	23B										386	
BH-T02A	68.1	23C										292	

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-T02A	68.8	24A		20	10							339	
BH-T02A	69.1	24C	28									350	
BH-T02A	72.6	25B		21	11								
BH-T02A	72.7	25C	22										
BH-T02A	73.5	26B		20	10								
BH-T02A	73.6	26C	23										
BH-T02A	77.1	27B		21	11								
BH-T02A	77.3	27C	23										
BH-T02A	80.8	28B	25	21	11								
BH-T02A	84.3	29A	27	19	10	5764	170.0		12.3	5.9		152	
BH-T02A	84.5	29B										187	
BH-T02A	84.6	29C	25									192	
BH-T02A	85.2	30A		19	10							187	
BH-T02A	85.5	30C	21									210	
BH-T02A	88.9	31A		19	10	5759	168.0		6.4	3.4		187	
BH-T02A	89	31B										187	
BH-T02A	89.2	31C	28									187	
BH-T02A	89.8	32A		20	10							234	
BH-T02A	89.9	32B										234	
BH-T02A	90.1	32C	26									245	
BH-T02A	93.4	33A		19	10								
BH-T02A	93.6	33B										245	
BH-T02A	93.8	33C	26									245	
BH-T02A	94.4	34A										245	
BH-T02A	94.5	34B		20	10							245	

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-T02A	94.7	34C	26									207	
BH-T02A	98	35A		19	9	5734	233.0		6.8	2.9			
BH-T02A	98	35A				5736		117.0	13.9	1.6			
BH-T02A	98.2	35B	29									187	
BH-T02A	98.3	35C										187	
BH-T02A	99.1	36B		19	9							187	
BH-T02A	99.2	36C	29									187	
BH-T02A	102.6	37A	33									245	
BH-T02A	102.7	37B	40	18	8	5610	276.0		9.3	3.9		245	
BH-T02A	102.7	37B						129.0	14.9	1.2			
BH-T02A	103.5	38A										222	
BH-T02A	103.7	38B		19	9							245	
BH-T02A	103.8	38C	37									245	
BH-T02A	107.2	39A	53	18	8	5690	215.0		6.0	3.1			
BH-T02A	107.2	39A				5722		63.0	14.9	2.8			
BH-T02A	107.5	39C	36									263	
BH-T02A	107.9	40B		18	9							304	
BH-T02A	108.1	40C	36									304	
BH-T02A	108.2	40C										304	
BH-T02B	1.7	1A	21		10								
BH-T02B	1.8	1B		20	10								
BH-T02B	2	1C	29										
BH-T02B	2.6	2A		18	9								
BH-T02B	2.9	2C	27										
BH-T02B	6.1	3A										187	

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

Figure J-17

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u, Torvane}$ (kPa)	$S_{u, pocket Pen}$ (kPa)	$S_{u, Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u, REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-T02B	6.3	3B		21	11								
BH-T02B	6.4	3C	12									210	
BH-T02B	7.2	4A										210	
BH-T02B	7.3	4B	13	22	12	1912	171.0		14.8	4.7			
BH-T02B	10.8	5A									57	57	
BH-T02B	11	5B		18	8								
BH-T02B	11.1	5C	37										
BH-T02B	12.3	6A									77	77	
BH-T02B	12.5	6B	44	17	8	1988	44.0		11.6	2.1			
BH-T02B	12.5	6B				1987	0.0	8.0	14.8	4.2			
BH-T02B	12.7	6C									96	86	91
BH-T02B	16	7A									72	72	
BH-T02B	16.2	7B	52	17	8	2554	58.0		7.4	3.3			
BH-T02B	16.3	7C									84	84	101
BH-T02B	16.9	8A									72	60	
BH-T02B	17.1	8B		19	9								
BH-T02B	17.2	8C	45										
BH-T02B	20.6	9A									96	96	
BH-T02B	20.7	9B	28	19	10	3275	97.0		8.8	3.7			
BH-T02B	20.7	9B				3278	0.0	14.0	15.0	4.3			
BH-T02B	20.9	9C									101	96	153
BH-T02B	21.5	10A		19	10						132	120	
BH-T02B	21.8	10C	36								144	144	196
BH-T02B	25.3	11B		20	11								
BH-T02B	25.5	11C	28										

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u,\ Torvane}$ (kPa)	$S_{u,\ pocket\ Pen}$ (kPa)	$S_{u,\ Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u,\ REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-T02B	28.8	12B		21	11								
BH-T02B	29	12C	22										
BH-T02B	32.5	13A										96	
BH-T02B	32.6	13B		19	9								
BH-T02B	32.8	13C	31									84	
BH-T02B	36	14A		21	12								
BH-T02B	36.1	14B	21										
BH-T02B	39.6	15A		19	9								
BH-T02B	39.8	15B	19										
BH-T02B	43.3	16A		19	9								
BH-T02B	43.4	16B	26										
BH-T02B	47	17A		17	7								
BH-T02B	47.1	17B	26										
BH-T02B	50.6	18A		19	10								
BH-T02B	50.9	18C	26										
BH-T02B	51.7	19A	30	19	9	5725	172.0		14.8	6.6		72	
BH-T02B	52	19C	27									60	
BH-T02B	55.3	20A										84	
BH-T02B	55.5	20B	37	19	9	5699	0.0	25.0	15.0	4			
BH-T02B	55.6	20C	37									117	
BH-T02B	56.1	21A	15	21	11								
BH-T02B	59.9	22A										144	
BH-T02B	60.2	22C	31										
BH-T02B	63.9	23A		18	8								
BH-T02B	64	23B	35										

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u, Torvane}$ (kPa)	$S_{u, pocket Pen}$ (kPa)	$S_{u, Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u, REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-T02B	64.8	24A	32	19	9	5749	0.0	49.0	14.8	5.6			
BH-T02B	64.9	24B										245	
BH-T02B	65.1	24C	31									204	196
BH-T02B	68.3	25A	30	19	9	5732	177.0		7.6	4.2			
BH-T02B	68.4	25B										204	
BH-T02B	68.6	25C	30									234	
BH-T02B	69.4	26B		20	10								
BH-T02B	69.7	26D	27									204	
BH-T02B	72.9	27A		20	10								
BH-T02B	73	27B	22										
BH-T02B	76.5	28A		19	9								
BH-T02B	76.8	28C	26										
BH-T02B	80.3	29A		20	10								
BH-T02B	80.6	29C	19										
BH-T02B	84	30A	27	19	10	5746	208.0		14.5	3.5		234	
BH-T02B	84.1	30B										234	
BH-T02B	84.3	30C										257	
BH-T02B	84.9	31A										210	
BH-T02B	85.1	31B		20	10								
BH-T02B	85.2	31C										210	
BH-T02B	88.6	32A										245	
BH-T02B	88.7	32B	27	20	10	5712	183.0		15.0	7.1			
BH-T02B	88.7	32B				5774	0.0	76.0	15.1	5.7			
BH-T02B	89.5	33A										234	
BH-T02B	89.6	33B		20	10								

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT
Dominion VOWTAP Geotechnical Survey
Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u, Torvane}$ (kPa)	$S_{u, pocket Pen}$ (kPa)	$S_{u, Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u, REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-T02B	89.8	33C										234	
BH-T02B	91.8	34B		20	11	5749	233.0		15.0	5.2			
BH-T02B	91.9	34C	23										
BH-T02B	92.5	35A										234	
BH-T02B	92.7	35B		20	10								
BH-T02B	92.8	35C	25									251	
BH-T02B	96.2	36A										234	
BH-T02B	96.3	36B	32	19	9	6035	227.0		10.5	3.5			
BH-T02B	96.5	36C										234	
BH-T02B	97.1	37A										234	
BH-T02B	97.3	37B		20	10								
BH-T02B	97.4	37C	30									234	
BH-T02B	100.8	38A										234	
BH-T02B	100.9	38B	31	19	9	5744	168.0		6.9	2.6			
BH-T02B	100.9	38B				5746	0.0	75.0	15.0	2.6			
BH-T02B	101.1	38C										234	
BH-T02B	101.7	39A										234	
BH-T02B	101.8	39B		19	9							245	
BH-T02B	102	39C	36										
BH-T02B	105.3	40A										245	
BH-T02B	105.5	40B	36	18	9	5363	0.0	122.0	11.6	2.2			
BH-T02B	105.6	40C										257	
BH-T02B	106.3	41A		17	7								
BH-T02B	106.4	41B	43										
BH-T02B	109.9	42A		19	9	5758	404.0		7.6	2.8			

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

BORING	DEPTH (FT)	SPECIMEN	MOISTURE CONTENT (%)	WET UNIT WEIGHT (pcf)	SUBMERGED UNIT WEIGHT (pcf)	UU TRIAXIAL					$S_{u, Torvane}$ (kPa)	$S_{u, pocket Pen}$ (kPa)	$S_{u, Minivane}$ (kPa)
						CONFINING PRESSURE (kPa)	S_u (kPa)	$S_{u, REMOLDED}$ (kPa)	STRAIN AT FAILURE (%)	E_{50} (%)			
BH-T02B	110.1	42B										257	
BH-T02B	110.2	42C										257	
BH-T02B	110.7	43A		21	11							245	

SUMMARY OF LABORATORY TEST RESULTS CONDUCTED ONBOARD THE LIFTBOAT

Dominion VOWTAP Geotechnical Survey

Offshore Virginia

Figure J-22

APPENDIX K

DAILY PROGRESS REPORTS

OFFSHORE AND NEARSHORE DRILLING

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	23 Jun 2014 Monday	REPORT NO.: 1
FCL PROJECT NO.:	04.81140004			
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia			
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant	
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154	
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy	
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111	

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	1	1
First Aid Treatment	0	0	Tool Box Talk Meetings	1	1
Lost/Damaged Equipment	0	0	HSE Meetings	1	1
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	1	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

Vessel induction conducted for onsigning crew. HAZID meeting conducted

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	in port	in port	in port	in port	
Wave Height (ft)					
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	12	Engineer (AM)	Sam Pant	12	12
Captain	Kaston Fluke	12	12	Driller (AM)	Thomas Jones	12	12
Mate	Timmy Finch	12	12	Drill Helper 1 (AM)	Dustin Lyles	12	12
A/B	Todd Darnell	12	12	Drill Helper 2 (AM)	Colin English	12	12
O/S	Patrick Landry	12	12	Soil Technician (AM)	Andrew Edgerton	12	12
Day Cook	Richard Daigle	12	12	EM Technician (AM)	Terry Langsdorf	12	12
Night Cook	Timmy Harvey	12	12	Engineer (PM)	Bill Mack	12	12
MMO	Kelly Gracie	12	12	Driller (PM)	James Walker	12	12
MMO	Dawn McCullough	12	12	Drill Helper 1 (PM)	Louis Salinas	12	12
MMO	Javier Franceschi	12	12	Drill Helper 2 (PM)	David Ramirez	12	12
Surveyor	Jeffery Guidry	12	12	Soil Technician (PM)	Tiffany Engle	12	12
PSS logger	David Valentine	12	12	EM Technician (PM)	Brett Lang	12	12

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	0	0
Deep Borings	0	0	4	MOB	Mob/Demob	8.5	8.5
Shallow Borings	0	0	11	TRAN	Transit To/From Site	9.5	9.5
API Drilling (m)	0	0		OP1	Operational - Testing/Sampling	0	0
Downhole CPT (m)	0	0		OFF	Off-hire	0	0
Piston Sample	0	0		WOW	Standby - Weather	0	0
Push (WIP) Sample	0	0		MMO	Marine Mammal Observation	0	0
SPTs	0	0					
P-S logging (m)	0	0					
					Total Hours	18	18

Daily Progress Report: (Time in GMT-5) REPORT NO.: 1
04.81140004 DATE: 23 Jun 2014

Start	End	Task	Description
0:00	9:30	TRAN	LB Inez H. Eymard in transit to ECRF dock, Portsmouth, VA.
9:30	13:30	MOB	Mobilize vessel. Tetra Tech met Captain Mark to discuss details of acoustic program
13:30	14:15	MOB	Conduct HAZID meeting
14:15	17:00	MOB	Continue with mobilization activities and loading the deck
17:00	18:00	MOB	Waiting on chemical test results to start welding and NDT

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Mobilze vessel. Conduct kick off meeting. Sail to site if time permits

Fugro Representative Comments		**Client Representative Comments**	
Fugro Site Manager: Sam Pant		Client Representative: Ricardo Argiolas	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	24 Jun 2014 Tuesday	REPORT NO.:	2
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	1	2
Lost/Damaged Equipment	0	0	HSE Meetings	1	2
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

Project kick off meeting conducted

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	in port	in port	in port	in port	
Wave Height (ft)					
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	24	Engineer (AM)	Sam Pant	12	24
Captain	Kaston Fluke	12	24	Driller (AM)	Thomas Jones	12	24
Mate	Timmy Finch	12	24	Drill Helper 1 (AM)	Dustin Lyles	12	24
A/B	Todd Darnell	12	24	Drill Helper 2 (AM)	Colin English	12	24
O/S	Patrick Landry	12	24	Soil Technician (AM)	Andrew Edgerton	12	24
Day Cook	Richard Daigle	12	24	EM Technician (AM)	Terry Langsdorf	12	24
Night Cook	Timmy Harvey	12	24	Engineer (PM)	Bill Mack	12	24
MMO	Kelly Gracie	12	24	Driller (PM)	James Walker	12	24
MMO	Dawn McCullough	12	24	Drill Helper 1 (PM)	Louis Salinas	12	24
MMO	Javier Franceschi	12	24	Drill Helper 2 (PM)	David Ramirez	12	24
Surveyor	Jeffery Guidry	12	24	Soil Technician (PM)	Tiffany Engle	12	24
PSS logger	David Valentine	12	24	EM Technician (PM)	Brett Lang	12	24

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	0	4	HSE	Health, Safety, Environment	0.25	0.25
Shallow Borings	0	0	11	MOB	Mob/Demob	23.75	32.25
API Drilling (m)	0	0		TRAN	Transit To/From Site	0	9.50
Downhole CPT (m)	0	0		OP1	Operational - Testing/Sampling	0	0.00
Piston Sample	0	0		OFF	Off-hire	0	0.00
Push (WIP) Sample	0	0		WOW	Standby - Weather	0	0.00
SPTs	0	0		MMO	Marine Mammal Observation	0	0.00
P-S logging (m)	0	0					
					Total Hours	24	42

Daily Progress Report: (Time in GMT-5) REPORT NO.: 2

04.81140004 DATE: 24 Jun 2014

Start	End	Task	Description
0:00	7:00	MOB	Offhire
7:00	7:15	HSE	Conduct toolbox talk
7:15	12:00	MOB	Mobilize vessel. Set drill rig on deck
12:00	12:15	MOB	Conduct kick off meeting
12:15	14:50	MOB	Mobilize vessel
14:50	15:25	MOB	Chemist on site. Perform inspection.
15:25	20:00	MOB	Perform welding activity
20:00	21:00	MOB	Welders at lunch
21:00	24:00	MOB	Perform welding activity. Load mud and drill collars.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Complete mobilization. Sail to the site.

Fugro Representative Comments	**Client Representative Comments**
Total mud onboard: 10 pallets	
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	25 Jun 2014 Wednesday	REPORT NO.:	3
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	0	2
Lost/Damaged Equipment	0	0	HSE Meetings	0	2
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	in port	in port	in port	in port	
Wave Height (ft)					
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	36	Engineer (AM)	Sam Pant	12	36
Captain	Kaston Fluke	12	36	Driller (AM)	Thomas Jones	12	36
Mate	Timmy Finch	12	36	Drill Helper 1 (AM)	Dustin Lyles	12	36
A/B	Todd Darnell	12	36	Drill Helper 2 (AM)	Colin English	12	36
O/S	Patrick Landry	12	36	Soil Technician (AM)	Andrew Edgerton	12	36
Day Cook	Richard Daigle	12	36	EM Technician (AM)	Terry Langsdorf	12	36
Night Cook	Timmy Harvey	12	36	Engineer (PM)	Bill Mack	12	36
MMO	Kelly Gracie	12	36	Driller (PM)	James Walker	12	36
MMO	Dawn McCullough	12	36	Drill Helper 1 (PM)	Louis Salinas	12	36
MMO	Javier Franceschi	12	36	Drill Helper 2 (PM)	David Ramirez	12	36
Surveyor	Jeffery Guidry	12	36	Soil Technician (PM)	Tiffany Engle	12	36
PSS logger	David Valentine	12	36	EM Technician (PM)	Brett Lang	12	36

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	0	4	HSE	Health, Safety, Environment	0	0.25
Shallow Borings	0	0	11	MOB	Mob/Demob	14.417	46.67
API Drilling (m)	0	0		TRAN	Transit To/From Site	4.0833	13.58
Downhole CPT (m)	0	0		OP1	Operational - Testing/Sampling	0	0.00
Piston Sample	0	0		OFF	Off-hire	0	0.00
Push (WIP) Sample	0	0		WOW	Standby - Weather	5.5	5.50
SPTs	0	0		MMO	Marine Mammal Observation	0	0.00
P-S logging (m)	0	0					
					Total Hours	24	66

Daily Progress Report: (Time in GMT-5) REPORT NO.: 3

04.81140004 DATE: 25 Jun 2014

Start	End	Task	Description
0:00	3:30	MOB	Perform welding activity. Load mud and drill collars.
3:30	6:00	MOB	Raise derrick. Set guy wires for derrick
6:00	9:15	MOB	Perform pipe test. Sea fasten equipment
9:15	11:30	MOB	Move drill collars and mud pallets to SB side of the vessel for balancing purpose
11:30	11:45	MOB	Remove gangway and secure
11:45	14:25	MOB	Jack down
14:25	18:30	TRAN	Transit to job site
18:30	18:30	WOW	Weather condition. Seas: 5-6 ft.
18:30	18:30	WOW	Wind:24 knts.
18:30	24:00	WOW	Wait on weather

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Assess weather condition in the morning. Sail to site if weather permits.

Fugro Representative Comments

Client Representative Comments

Fugro Site Manager: Sam Pant

Client Representative: Ricardo Argiolas

Signed: Date:

Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	26 Jun 2014	REPORT NO.:	4
FCL PROJECT NO.:	04.81140004		Thursday		
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	4
Lost/Damaged Equipment	0	0	HSE Meetings	0	2
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	17 S	16 SW	14 WSW	8 WNW	5 to 10 kts NNW to NE to E Winds. 1 to 3 ft Swells
Wave Height (ft)	4.5	3.9	3.5	2.2	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	48	Engineer (AM)	Sam Pant	12	48
Captain	Kaston Fluke	12	48	Driller (AM)	Thomas Jones	12	48
Mate	Timmy Finch	12	48	Drill Helper 1 (AM)	Dustin Lyles	12	48
A/B	Todd Darnell	12	48	Drill Helper 2 (AM)	Colin English	12	48
O/S	Patrick Landry	12	48	Soil Technician (AM)	Andrew Edgerton	12	48
Day Cook	Richard Daigle	12	48	EM Technician (AM)	Terry Langsdorf	12	48
Night Cook	Timmy Harvey	12	48	Engineer (PM)	Bill Mack	12	48
MMO	Kelly Gracie	12	48	Driller (PM)	James Walker	12	48
MMO	Dawn McCullough	12	48	Drill Helper 1 (PM)	Louis Salinas	12	48
MMO	Javier Franceschi	12	48	Drill Helper 2 (PM)	David Ramirez	12	48
Surveyor	Jeffery Guidry	12	48	Soil Technician (PM)	Tiffany Engle	12	48
PSS logger	David Valentine	12	48	EM Technician (PM)	Brett Lang	12	48

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	0	4	HSE	Health, Safety, Environment	1	1.25
Shallow Borings	0	0	11	MOB	Mob/Demob	0	46.67
API Drilling (m)	0	0		TRAN	Transit To/From Site	4.25	17.83
Downhole CPT (m)	0	0		OP1	Operational - Testing/Sampling	9.0833	9.08
Piston Sample	0	0		OFF	Off-hire	0	0.00
Push (WIP) Sample	0	0		WOW	Standby - Weather	8.6667	14.17
SPTs	0	0		MMO	Marine Mammal Observation	1	1.00
P-S logging (m)	0	0					
					Total Hours	24	90

Daily Progress Report: (Time in GMT-5) REPORT NO.: 4

04.81140004 DATE: 26 Jun 2014

Start	End	Task	Description
0:00	8:40	WOW	WOW
8:40	12:25	TRAN	Transit to job site
12:25	12:30	OP1	Tag bottom with lift boat's legs ~100 ft from the BH-T1A location.
12:30	13:30	MMO	Marine mammal watch
13:30	13:45	OP1	Deploy sector scan sonar survey equipment and perform scan.
13:45	14:15	TRAN	Move LB to BH-T1A location. Deploy legs to touch bottom
14:15	14:45	OP1	Perform sector scan sonar survey.
14:45	21:15	OP1	Preload. BH-T1A: X = 456,197.5m; Y = 4,083,478.6m.
21:15	21:30	HSE	Perform safety meeting for jacking up
21:30	21:45	OP1	Jack up 30 ft from the water level
21:45	22:00	HSE	Perform safety meeting
22:00	23:30	OP1	Rig up to drill and sample
23:30	24:00	HSE	Perform pre-shift safety meeting

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Drill, Sample and CPT. Perform crew change. Engineer and water tech off; engineer on.

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	27 Jun 2014 Friday	REPORT NO.:	5
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	6
Lost/Damaged Equipment	0	0	HSE Meetings	1	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

Crew Change performed. JSA conducted by boat crew before transfer

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	10 knts	10 knts	15 knts	21 knts	
Wave Height (ft)	1-2 ft	1-2 ft	2-3 ft	4-5 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	60	Engineer (AM)	Sam Pant	12	60
Captain	Kaston Fluke	12	60	Driller (AM)	Thomas Jones	12	60
Mate	Timmy Finch	12	60	Drill Helper 1 (AM)	Dustin Lyles	12	60
A/B	Todd Darnell	12	60	Drill Helper 2 (AM)	Colin English	12	60
O/S	Patrick Landry	12	60	Soil Technician (AM)	Andrew Edgerton	12	60
Day Cook	Richard Daigle	12	60	EM Technician (AM)	Terry Langsdorf	12	60
Night Cook	Timmy Harvey	12	60	Engineer (PM)	Bill Mack	12	60
MMO	Kelly Gracie	12	60	Driller (PM)	James Walker	12	60
MMO	Dawn McCullough	12	60	Drill Helper 1 (PM)	Louis Salinas	12	60
MMO	Javier Franceschi	12	60	Drill Helper 2 (PM)	David Ramirez	12	60
Surveyor	Jeffery Guidry	12	60	Soil Technician (PM)	Tiffany Engle	12	60
PSS logger	David Valentine	12	60	EM Technician (PM)	Brett Lang	12	60

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	0	4	HSE	Health, Safety, Environment	0.5	1.8
Shallow Borings	0	0	11	MOB	Mob/Demob	0	46.7
API Drilling (m)	33.2	33.2		TRAN	Transit To/From Site	0	17.8
Downhole CPT (m)	20.59	20.59		OP1	Operational - Testing/Sampling	23.5	32.6
Piston Sample	1	1		OFF	Off-hire	0	0.0
Push (WIP) Sample	11	11		WOW	Standby - Weather	0	14.2
SPTs	4	4		MMO	Marine Mammal Observation	0	1.0
P-S logging (m)	0	0					
					Total Hours	24	114

Daily Progress Report: (Time in GMT-5) REPORT NO.: 5

04.81140004 DATE: 27 Jun 2014

Start	End	Task	Description
0:00	0:15	OP1	Rig up to drill and sample. DTM=112ft, DTW=29ft, WD=83ft.
0:15	0:30	OP1	Continue rigging up to drill and sample, mixing mud and lowering drill pipe.
0:30	3:50	OP1	Mix mud. Lower pipe to mudline. Perform deck test for CPT
3:50	12:00	OP1	BH-T1A: Drill, sample and perform CPT from mudline to 42 ft
12:00	16:00	OP1	BH-T1A: Drill, sample and perform CPT from 42 ft to 69 ft
16:00	16:20	OP1	Perform crew transfer
16:20	23:30	OP1	BH-T1A: Drill, sample and perform CPT from 69 ft to 109 ft
23:30	24:00	HSE	Conduct pre-shift safety meeting

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Crew change performed. Bill Mack and water maker technician got off. Manuel (shift engineer) on

Program for Next 24 Hours: Drill, sample and perform CPT

Fugro Representative Comments	Client Representative Comments
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	28 Jun 2014 Saturday	REPORT NO.:	6
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	8
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	21 NE	27 NE	33 NE	23 E	10-15 knts E; 3-5 ft seas
Wave Height (ft)	4-5 ft	4-5 ft	4-5 ft	5-7 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	72	Engineer (AM)	Sam Pant	12	72
Captain	Kaston Fluke	12	72	Driller (AM)	Thomas Jones	12	72
Mate	Timmy Finch	12	72	Drill Helper 1 (AM)	Dustin Lyles	12	72
A/B	Todd Darnell	12	72	Drill Helper 2 (AM)	Colin English	12	72
O/S	Patrick Landry	12	72	Soil Technician (AM)	Andrew Edgerton	12	72
Day Cook	Richard Daigle	12	72	EM Technician (AM)	Terry Langsdorf	12	72
Night Cook	Timmy Harvey	12	72	Engineer (PM)	Bill Mack	12	72
MMO	Kelly Gracie	12	72	Driller (PM)	James Walker	12	72
MMO	Dawn McCullough	12	72	Drill Helper 1 (PM)	Louis Salinas	12	72
MMO	Javier Franceschi	12	72	Drill Helper 2 (PM)	David Ramirez	12	72
Surveyor	Jeffery Guidry	12	72	Soil Technician (PM)	Tiffany Engle	12	72
PSS logger	David Valentine	12	72	EM Technician (PM)	Brett Lang	12	72

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	0	1.8
Deep Borings	0	0	4	MOB	Mob/Demob	0	46.7
Shallow Borings	0	0	11	TRAN	Transit To/From Site	0	17.8
API Drilling (m)	33.2	66.4		OP1	Operational - Testing/Sampling	23.5	56.1
Downhole CPT (m)	31.59	52.18		OFF	Off-hire	0	0.0
Piston Sample	0	1		WOW	Standby - Weather	0	14.2
Push (WIP) Sample	11	22		MMO	Marine Mammal Observation	0.5	1.5
SPTs	4	8					
P-S logging (m)	0	0					
					Total Hours	24	138

Daily Progress Report: (Time in GMT-5) REPORT NO.: 6

04.81140004 DATE: 28 Jun 2014

Start	End	Task	Description
0:00	12:00	OP1	BH-T1A: Drill, sample and perform CPT from 109 ft to 204 ft
12:00	19:15	OP1	BH-T1A: Drill, sample and perform CPT from 204 ft to 252 ft
19:15	19:45	MMO	Spotted sea turtle. Stop work for 30 minutes
19:45	24:00	OP1	BH-T1A: Drill, sample and perform CPT from 252 ft to 273 ft

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Drill, sample and perform CPT. Terminate hole at 360 ft. Perform PS logging

Fugro Representative Comments		**Client Representative Comments**	
Fugro Site Manager: Sam Pant		Client Representative: Ricardo Argiolas	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	29 Jun 2014 Sunday	REPORT NO.:	7
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	10
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	22 E	18 E	15 E	14 E	7-15 knts E; 2-4 ft seas
Wave Height (ft)	3-4 ft	3-4 ft	2-3 ft	2-3 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	84	Engineer (AM)	Sam Pant	12	84
Captain	Kaston Fluke	12	84	Driller (AM)	Thomas Jones	12	84
Mate	Timmy Finch	12	84	Drill Helper 1 (AM)	Dustin Lyles	12	84
A/B	Todd Darnell	12	84	Drill Helper 2 (AM)	Colin English	12	84
O/S	Patrick Landry	12	84	Soil Technician (AM)	Andrew Edgerton	12	84
Day Cook	Richard Daigle	12	84	EM Technician (AM)	Terry Langsdorf	12	84
Night Cook	Timmy Harvey	12	84	Engineer (PM)	Bill Mack	12	84
MMO	Kelly Gracie	12	84	Driller (PM)	James Walker	12	84
MMO	Dawn McCullough	12	84	Drill Helper 1 (PM)	Louis Salinas	12	84
MMO	Javier Franceschi	12	84	Drill Helper 2 (PM)	David Ramirez	12	84
Surveyor	Jeffery Guidry	12	84	Soil Technician (PM)	Tiffany Engle	12	84
PSS logger	David Valentine	12	84	EM Technician (PM)	Brett Lang	12	84

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	1	1	4	HSE	Health, Safety, Environment	0	1.8
Shallow Borings	0	0	11	MOB	Mob/Demob	0	46.7
API Drilling (m)	43.7	110.1		TRAN	Transit To/From Site	0	17.8
Downhole CPT (m)	10.83	63.01		OP1	Operational - Testing/Sampling	23.417	79.5
Piston Sample	0	1		OFF	Off-hire	0	0.0
Push (WIP) Sample	2	24		WOW	Standby - Weather	0	14.2
SPTs	9	17		MMO	Marine Mammal Observation	0.5833	2.1
P-S logging (m)	100	100					
					Total Hours	24	162

Daily Progress Report: (Time in GMT-5) REPORT NO.: 7
04.81140004 DATE: 29 Jun 2014

Start	End	Task	Description
0:00	9:00	OP1	BH-T1A: Drill, sample and perform CPT from 273 ft to 362 ft. EOH
9:00	12:00	OP1	Pull pipe. Rig up to perform PS logging
12:00	16:55	OP1	Perform PS logging
16:55	17:30	MMO	Spotted sea turtle. Stop work for 30 minutes
17:30	18:30	OP1	Perform PS logging
18:30	21:00	OP1	Pull drill pipe to deck
21:00	21:30	OP1	Deploy side scan sonar
21:30	22:00	OP1	Secure equipment for travel
22:00	22:30	OP1	Transfer collar to SB side of vessel to balance out load during transit
22:30	24:00	OP1	Preparing deck for transit

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Sail to anchorage. Wait on coordinates. Sail to shallow site. Preload

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	30 Jun 2014	REPORT NO.:	8
FCL PROJECT NO.:	04.81140004		Monday		
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	12
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction			15 E	14 E	12-20 knts S; 2-3 ft seas
Wave Height (ft)			2-3 ft	2-3 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	96	Engineer (AM)	Sam Pant	12	96
Captain	Kaston Fluke	12	96	Driller (AM)	Thomas Jones	12	96
Mate	Timmy Finch	12	96	Drill Helper 1 (AM)	Dustin Lyles	12	96
A/B	Todd Darnell	12	96	Drill Helper 2 (AM)	Colin English	12	96
O/S	Patrick Landry	12	96	Soil Technician (AM)	Andrew Edgerton	12	96
Day Cook	Richard Daigle	12	96	EM Technician (AM)	Terry Langsdorf	12	96
Night Cook	Timmy Harvey	12	96	Engineer (PM)	Bill Mack	12	96
MMO	Kelly Gracie	12	96	Driller (PM)	James Walker	12	96
MMO	Dawn McCullough	12	96	Drill Helper 1 (PM)	Louis Salinas	12	96
MMO	Javier Franceschi	12	96	Drill Helper 2 (PM)	David Ramirez	12	96
Surveyor	Jeffery Guidry	12	96	Soil Technician (PM)	Tiffany Engle	12	96
PSS logger	David Valentine	12	96	EM Technician (PM)	Brett Lang	12	96

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	1	4	HSE	Health, Safety, Environment	0	1.8
Shallow Borings	0	0	11	MOB	Mob/Demob	0	46.7
API Drilling (m)	20.43	130.53		TRAN	Transit To/From Site	10.833	28.7
Downhole CPT (m)	0	63.01		OP1	Operational - Testing/Sampling	8.1667	87.7
Piston Sample	0	1		OFF	Off-hire	0	0.0
Push (WIP) Sample	2	26		WOW	Standby - Weather	3.5	17.7
SPTs/2.5 hammer	12	29		MMO	Marine Mammal Observation	1.5	3.6
P-S logging (m)	0	100					
					Total Hours	24	186

Daily Progress Report: (Time in GMT-5) REPORT NO.: 8

04.81140004 DATE: 30 Jun 2014

Start	End	Task	Description
0:00	0:30	OP1	Prepare deck for transit
0:30	0:45	OP1	Jack down
0:45	8:30	TRAN	Sail to South anchor location
8:30	12:00	WOW	Evaluate weather and wait on final cable route from KBR
12:00	14:45	TRAN	Sail to site NB-11
14:45	15:45	MMO	Spotted dolphin wait for an hour
15:45	16:05	OP1	Deploy side scan sonar
16:05	16:25	TRAN	Move to local drilling location
16:25	17:00	OP1	Deploy sonar
17:00	18:40	OP1	Preload/rig up to drill
18:40	18:45	OP1	Rig up to drill
18:45	19:15	MMO	Spotted sea a turtle. Drilling on hold
19:15	24:00	OP1	BH-NB11: Drill and sample from 0.00 ft to 67 ft.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours:

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	1 Jul 2014 Tuesday	REPORT NO.: 9
FCL PROJECT NO.:	04.81140004			
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia			
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant	
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154	
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy	
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111	

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	1	13
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	**night**	**0600**	**noon**	**1800**	Forecast next 24 hrs:
Wind Speed (kts) / Direction			in transit	in port	Wind: 13-22 knts SSW Seas: 3-7 ft
Wave Height (ft)					
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	108	Engineer (AM)	Sam Pant	12	108
Captain	Kaston Fluke	12	108	Driller (AM)	Thomas Jones	12	108
Mate	Timmy Finch	12	108	Drill Helper 1 (AM)	Dustin Lyles	12	108
A/B	Todd Darnell	12	108	Drill Helper 2 (AM)	Colin English	12	108
O/S	Patrick Landry	12	108	Soil Technician (AM)	Andrew Edgerton	12	108
Day Cook	Richard Daigle	12	108	EM Technician (AM)	Terry Langsdorf	12	108
Night Cook	Timmy Harvey	12	108	Engineer (PM)	Bill Mack	12	108
MMO	Kelly Gracie	12	108	Driller (PM)	James Walker	12	108
MMO	Dawn McCullough	12	108	Drill Helper 1 (PM)	Louis Salinas	12	108
MMO	Javier Franceschi	12	108	Drill Helper 2 (PM)	David Ramirez	12	108
Surveyor	Jeffery Guidry	12	108	Soil Technician (PM)	Tiffany Engle	12	108
PSS logger	David Valentine	12	108	EM Technician (PM)	Brett Lang	12	108

PRODUCTION SUMMARY	Today	Total	Planned	**Task**	**DEFINITION OF TASKS**	**Today**	**Total**
				HSE	Health, Safety, Environment	0	1.8
Deep Borings	0	1	4	MOB	Mob/Demob	0	46.7
Shallow Borings	1	1	11	TRAN	Transit To/From Site	6	34.7
API Drilling (m)	4.10	134.63		OP1	Operational - Testing/Sampling	3	90.7
Downhole CPT (m)	0	63.01		OFF	Off-hire	0	0.0
Piston Sample	0	1		WOW	Standby - Weather	15	32.7
Push (WIP) Sample	0	26		MMO	Marine Mammal Observation	0	3.6
SPTs/2.5 hammer	3	32					
P-S logging (m)	0	100					
					Total Hours	24	210

Daily Progress Report: (Time in GMT-5) REPORT NO.: 9

04.81140004 DATE: 1 Jul 2014

Start	End	Task	Description
0:00	1:00	OP1	NB-11: Drill and sample from 67 ft to 80.5 ft. EOH
1:00	2:15	OP1	Pull drill pipe
2:15	3:00	OP1	Secure equipment.
3:00	7:00	WOW	WOW
7:00	7:30	WOW	Jack down
7:30	13:30	TRAN	In transit to ECRF dock in Portmouth, Virginia
13:30	14:45	WOW	WOW
14:45	24:00	WOW	Standby at dock. Wait for new weather update regarding development of storm Arthur

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Stand by at dock

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	2 Jul 2014 Wednesday	REPORT NO.:	10
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	0	13
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	in port	in port	in port	in port	
Wave Height (ft)					
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	120	Engineer (AM)	Sam Pant	12	120
Captain	Kaston Fluke	12	120	Driller (AM)	Thomas Jones	12	120
Mate	Timmy Finch	12	120	Drill Helper 1 (AM)	Dustin Lyles	12	120
A/B	Todd Darnell	12	120	Drill Helper 2 (AM)	Colin English	12	120
O/S	Patrick Landry	12	120	Soil Technician (AM)	Andrew Edgerton	12	120
Day Cook	Richard Daigle	12	120	EM Technician (AM)	Terry Langsdorf	12	120
Night Cook	Timmy Harvey	12	120	Engineer (PM)	Bill Mack	12	120
MMO	Kelly Gracie	12	120	Driller (PM)	James Walker	12	120
MMO	Dawn McCullough	12	120	Drill Helper 1 (PM)	Louis Salinas	12	120
MMO	Javier Franceschi	12	120	Drill Helper 2 (PM)	David Ramirez	12	120
Surveyor	Jeffery Guidry	12	120	Soil Technician (PM)	Tiffany Engle	12	120
PSS logger	David Valentine	12	120	EM Technician (PM)	Brett Lang	12	120

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	1	4	HSE	Health, Safety, Environment	0	1.8
Shallow Borings	0	1	11	MOB	Mob/Demob	0	46.7
API Drilling (m)	0.00	134.63		TRAN	Transit To/From Site	0	34.7
Downhole CPT (m)	0	63.01		OP1	Operational - Testing/Sampling	0	90.7
Piston Sample	0	1		OFF	Off-hire	0	0.0
Push (WIP) Sample	0	26		WOW	Standby - Weather	24	56.7
SPTs/2.5 hammer	0	32		MMO	Marine Mammal Observation	0	3.6
P-S logging (m)	0	100					
					Total Hours	24	234

Daily Progress Report: (Time in GMT-5) REPORT NO.: 10

04.81140004 DATE: 2 Jul 2014

Start	End	Task	Description
0:00	10:15	WOW	Standby at dock. Wait for weather. Monitor development of storm Arthur
10:15	14:45	WOW	Refuel the vessel
14:45	15:15	WOW	Load polymer, salt gel, grout, satellite phone and other equipment on boat
15:15	24:00	WOW	Standby at dock. Wait for weather. Monitor development of storm Arthur

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: WOW

Fugro Representative Comments		**Client Representative Comments**	
Fugro Site Manager: Sam Pant		Client Representative: Ricardo Argiolas	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	3 Jul 2014 Thursday	REPORT NO.:	11
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	1	14
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

Pre-hurricane safety meeting conducted

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	in port	in port	in port	in port	
Wave Height (ft)					
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	132	Engineer (AM)	Sam Pant	12	132
Captain	Kaston Fluke	12	132	Driller (AM)	Thomas Jones	12	132
Mate	Timmy Finch	12	132	Drill Helper 1 (AM)	Dustin Lyles	12	132
A/B	Todd Darnell	12	132	Drill Helper 2 (AM)	Colin English	12	132
O/S	Patrick Landry	12	132	Soil Technician (AM)	Andrew Edgerton	12	132
Day Cook	Richard Daigle	12	132	EM Technician (AM)	Terry Langsdorf	12	132
Night Cook	Timmy Harvey	12	132	Engineer (PM)	Bill Mack	12	132
MMO	Kelly Gracie	12	132	Driller (PM)	James Walker	12	132
MMO	Dawn McCullough	12	132	Drill Helper 1 (PM)	Louis Salinas	12	132
MMO	Javier Franceschi	12	132	Drill Helper 2 (PM)	David Ramirez	12	132
Surveyor	Jeffery Guidry	12	132	Soil Technician (PM)	Tiffany Engle	12	132
PSS logger	David Valentine	12	132	EM Technician (PM)	Brett Lang	12	132

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	1	4	HSE	Health, Safety, Environment	0	1.8
Shallow Borings	0	1	11	MOB	Mob/Demob	0	46.7
API Drilling (m)	0.00	134.63		TRAN	Transit To/From Site	0	34.7
Downhole CPT (m)	0	63.01		OP1	Operational - Testing/Sampling	0	90.7
Piston Sample	0	1		OFF	Off-hire	0	0.0
Push (WIP) Sample	0	26		WOW	Standby - Weather	24	80.7
SPTs/2.5 hammer	0	32		MMO	Marine Mammal Observation	0	3.6
P-S logging (m)	0	100					
					Total Hours	24	258

Daily Progress Report: (Time in GMT-5) REPORT NO.: 11

04.81140004 DATE: 3 Jul 2014

Start	End	Task	Description
0:00	11:00	WOW	Standby at dock. Wait for weather. Monitor development of storm Arthur
11:00	12:00	WOW	Secure equipment.
12:00	17:30	WOW	Conduct safety meeting for weather awareness
17:30	24:00	WOW	Waiting on Weather

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: WOW

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas

Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	4 Jul 2014 Friday	REPORT NO.:	12
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	1	15
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	in port	in port	in port	in port	3 to 5 ft swells with 10 to 20 kt winds from the NE
Wave Height (ft)					
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	144	Engineer (AM)	Sam Pant	12	144
Captain	Kaston Fluke	12	144	Driller (AM)	Thomas Jones	12	144
Mate	Timmy Finch	12	144	Drill Helper 1 (AM)	Dustin Lyles	12	144
A/B	Todd Darnell	12	144	Drill Helper 2 (AM)	Colin English	12	144
O/S	Patrick Landry	12	144	Soil Technician (AM)	Andrew Edgerton	12	144
Day Cook	Richard Daigle	12	144	EM Technician (AM)	Terry Langsdorf	12	144
Night Cook	Timmy Harvey	12	144	Engineer (PM)	Bill Mack	12	144
MMO	Kelly Gracie	12	144	Driller (PM)	James Walker	12	144
MMO	Dawn McCullough	12	144	Drill Helper 1 (PM)	Louis Salinas	12	144
MMO	Javier Franceschi	12	144	Drill Helper 2 (PM)	David Ramirez	12	144
Surveyor	Jeffery Guidry	12	144	Soil Technician (PM)	Tiffany Engle	12	144
PSS logger	David Valentine	12	144	EM Technician (PM)	Brett Lang	12	144

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	1	4	HSE	Health, Safety, Environment	0	1.8
Shallow Borings	0	1	11	MOB	Mob/Demob	0	46.7
API Drilling (m)	0.00	134.63		TRAN	Transit To/From Site	0	34.7
Downhole CPT (m)	0	63.01		OP1	Operational - Testing/Sampling	0	90.7
Piston Sample	0	1		OFF	Off-hire	0	0.0
Push (WIP) Sample	0	26		WOW	Standby - Weather	24	104.7
SPTs/2.5 hammer	0	32		MMO	Marine Mammal Observation	0	3.6
P-S logging (m)	0	100					
					Total Hours	24	282

Daily Progress Report: (Time in GMT-5) REPORT NO.: 12
04.81140004 DATE: 4 Jul 2014

Start	End	Task	Description
0:00	24:00	WOW	Waiting on weather dock side. Monitor Hurricane Arthur

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: WOW

Fugro Representative Comments		**Client Representative Comments**	
Fugro Site Manager: Sam Pant		Client Representative: Ricardo Argiolas	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	5 Jul 2014 Saturday	REPORT NO.:	13
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	0	15
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	in port	in port	in port	in port	
Wave Height (ft)					
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	156	Engineer (AM)	Sam Pant	12	156
Captain	Kaston Fluke	12	156	Driller (AM)	Thomas Jones	12	156
Mate	Timmy Finch	12	156	Drill Helper 1 (AM)	Dustin Lyles	12	156
A/B	Todd Darnell	12	156	Drill Helper 2 (AM)	Colin English	12	156
O/S	Patrick Landry	12	156	Soil Technician (AM)	Andrew Edgerton	12	156
Day Cook	Richard Daigle	12	156	EM Technician (AM)	Terry Langsdorf	12	156
Night Cook	Timmy Harvey	12	156	Engineer (PM)	Bill Mack	12	156
MMO	Kelly Gracie	12	156	Driller (PM)	James Walker	12	156
MMO	Dawn McCullough	12	156	Drill Helper 1 (PM)	Louis Salinas	12	156
MMO	Javier Franceschi	12	156	Drill Helper 2 (PM)	David Ramirez	12	156
Surveyor	Jeffery Guidry	12	156	Soil Technician (PM)	Tiffany Engle	12	156
PSS logger	David Valentine	12	156	EM Technician (PM)	Brett Lang	12	156

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	1	4	HSE	Health, Safety, Environment	0	1.8
Shallow Borings	0	1	11	MOB	Mob/Demob	0	46.7
API Drilling (m)	0.00	134.63		TRAN	Transit To/From Site	0	34.7
Downhole CPT (m)	0	63.01		OP1	Operational - Testing/Sampling	0	90.7
Piston Sample	0	1		OFF	Off-hire	0	0.0
Push (WIP) Sample	0	26		WOW	Standby - Weather	24	128.7
SPTs/2.5 hammer	0	32		MMO	Marine Mammal Observation	0	3.6
P-S logging (m)	0	100					
					Total Hours	24	306

Daily Progress Report: (Time in GMT-5) REPORT NO.: 13
04.81140004 DATE: 5 Jul 2014

Start	End	Task	Description
0:00	24:00	WOW	Standby at dock. Wait on weather.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Sail to CBBT anchor area and evaluate weather conditions on site

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	6 Jul 2014 Sunday	REPORT NO.: 14
FCL PROJECT NO.:	04.81140004			
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia			
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant	
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154	
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy	
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111	

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	0	15
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	in port	in port	in port	in port	
Wave Height (ft)					
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	168	Engineer (AM)	Sam Pant	12	168
Captain	Kaston Fluke	12	168	Driller (AM)	Thomas Jones	12	168
Mate	Timmy Finch	12	168	Drill Helper 1 (AM)	Dustin Lyles	12	168
A/B	Todd Darnell	12	168	Drill Helper 2 (AM)	Colin English	12	168
O/S	Patrick Landry	12	168	Soil Technician (AM)	Andrew Edgerton	12	168
Day Cook	Richard Daigle	12	168	EM Technician (AM)	Terry Langsdorf	12	168
Night Cook	Timmy Harvey	12	168	Engineer (PM)	Bill Mack	12	168
MMO	Kelly Gracie	12	168	Driller (PM)	James Walker	12	168
MMO	Dawn McCullough	12	168	Drill Helper 1 (PM)	Louis Salinas	12	168
MMO	Javier Franceschi	12	168	Drill Helper 2 (PM)	David Ramirez	12	168
Surveyor	Jeffery Guidry	12	168	Soil Technician (PM)	Tiffany Engle	12	168
PSS logger	David Valentine	12	168	EM Technician (PM)	Brett Lang	12	168

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	1	4	HSE	Health, Safety, Environment	0	1.8
Shallow Borings	0	1	11	MOB	Mob/Demob	0	46.7
API Drilling (m)	0.00	134.63		TRAN	Transit To/From Site	0	34.7
Downhole CPT (m)	0	63.01		OP1	Operational - Testing/Sampling	0	90.7
Piston Sample	0	1		OFF	Off-hire	0	0.0
Push (WIP) Sample	0	26		WOW	Standby - Weather	24	152.7
SPTs/2.5 hammer	0	32		MMO	Marine Mammal Observation	0	3.6
P-S logging (m)	0	100					
					Total Hours	24	330

Daily Progress Report: (Time in GMT-5) REPORT NO.: 14

04.81140004 DATE: 6 Jul 2014

Start	End	Task	Description
0:00	24:00	WOW	WOW

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Free legs. Sail to Anchorage. Assess weather. Sail to job site if weather permitted

Fugro Representative Comments	**Client Representative Comments**
Onboard: Salt gel 11 pallets; Barite 2 pallets; Polymer 15 sacks; Grout 1 pallet (16 sacks) Vessel Fuel: 300 gallon shy of a full tank	
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas

Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	7 Jul 2014 Monday	REPORT NO.:	15
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	1	16
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	**night**	**0600**	**noon**	**1800**	Forecast next 24 hrs:
Wind Speed (kts) / Direction	in port	in port	in port	28 SW	4 to 6 ft seas. 15 to 25 kt S to SW winds
Wave Height (ft)				4 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	180	Engineer (AM)	Sam Pant	12	180
Captain	Kaston Fluke	12	180	Driller (AM)	Thomas Jones	12	180
Mate	Timmy Finch	12	180	Drill Helper 1 (AM)	Dustin Lyles	12	180
A/B	Todd Darnell	12	180	Drill Helper 2 (AM)	Colin English	12	180
O/S	Patrick Landry	12	180	Soil Technician (AM)	Andrew Edgerton	12	180
Day Cook	Richard Daigle	12	180	EM Technician (AM)	Terry Langsdorf	12	180
Night Cook	Timmy Harvey	12	180	Engineer (PM)	Bill Mack	12	180
MMO	Kelly Gracie	12	180	Driller (PM)	James Walker	12	180
MMO	Dawn McCullough	12	180	Drill Helper 1 (PM)	Louis Salinas	12	180
MMO	Javier Franceschi	12	180	Drill Helper 2 (PM)	David Ramirez	12	180
Surveyor	Jeffery Guidry	12	180	Soil Technician (PM)	Tiffany Engle	12	180
PSS logger	David Valentine	12	180	EM Technician (PM)	Brett Lang	12	180

PRODUCTION SUMMARY	Today	Total	Planned	**Task**	**DEFINITION OF TASKS**	**Today**	**Total**
Deep Borings	0	1	4	HSE	Health, Safety, Environment	0	1.8
Shallow Borings	0	1	11	MOB	Mob/Demob	0	46.7
API Drilling (m)	0.00	134.63		TRAN	Transit To/From Site	3.75	38.4
Downhole CPT (m)	0	63.01		OP1	Operational - Testing/Sampling	0	90.7
Piston Sample	0	1		OFF	Off-hire	0	0.0
Push (WIP) Sample	0	26		WOW	Standby - Weather	20.25	172.9
SPTs/2.5 hammer	0	32		MMO	Marine Mammal Observation	0	3.6
P-S logging (m)	0	100					
					Total Hours	24	354

Daily Progress Report: (Time in GMT-5) REPORT NO.: 15
04.81140004 DATE: 7 Jul 2014

Start	End	Task	Description
0:00	11:00	WOW	WOW
11:00	14:30	WOW	WOW
14:30	14:30	TRAN	Start sailing to the CBBT anchor area
14:30	15:30	TRAN	HDD nearshore area is restricted until Sunday
15:30	18:15	TRAN	Arrive at CBBT Anchor area and assess weather conditions. 28 mph winds and 4 ft seas
18:15	18:30	WOW	WOW
18:30	24:00	WOW	Standby. Waiting on weather

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Waiting on weather or permission to access the HDD site

Fugro Representative Comments		**Client Representative Comments**	
Fugro Site Manager: Sam Pant		Client Representative: Ricardo Argiolas	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	8 Jul 2014	REPORT NO.: 16
FCL PROJECT NO.:	04.81140004		Tuesday	
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia			
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant	
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154	
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy	
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111	

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	1	17
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	2	2

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction			30 SW	27 SW	22 - 32 kts SW, 4 ft seas
Wave Height (ft)			2-3 ft	2-3 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	192	Engineer (AM)	Sam Pant	12	192
Captain	Kaston Fluke	12	192	Driller (AM)	Thomas Jones	12	192
Mate	Timmy Finch	12	192	Drill Helper 1 (AM)	Dustin Lyles	12	192
A/B	Todd Darnell	12	192	Drill Helper 2 (AM)	Colin English	12	192
O/S	Patrick Landry	12	192	Soil Technician (AM)	Andrew Edgerton	12	192
Day Cook	Richard Daigle	12	192	EM Technician (AM)	Terry Langsdorf	12	192
Night Cook	Timmy Harvey	12	192	Engineer (PM)	Bill Mack	12	192
MMO	Kelly Gracie	12	192	Driller (PM)	James Walker	12	192
MMO	Dawn McCullough	12	192	Drill Helper 1 (PM)	Louis Salinas	12	192
MMO	Javier Franceschi	12	192	Drill Helper 2 (PM)	David Ramirez	12	192
Surveyor	Jeffery Guidry	12	192	Soil Technician (PM)	Tiffany Engle	12	192
PSS logger	David Valentine	12	192	EM Technician (PM)	Brett Lang	12	192

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	1	4	HSE	Health, Safety, Environment	0	1.8
Shallow Borings	0	1	11	MOB	Mob/Demob	0	46.7
API Drilling (m)	0.00	134.63		TRAN	Transit To/From Site	0	38.4
Downhole CPT (m)	0	63.01		OP1	Operational - Testing/Sampling	0	90.7
Piston Sample	0	1		OFF	Off-hire	0	0.0
Push (WIP) Sample	0	26		WOW	Standby - Weather	24	196.9
SPTs/2.5 hammer	0	32		MMO	Marine Mammal Observation	0	3.6
P-S logging (m)	0	100					
					Total Hours	24	378

Daily Progress Report: (Time in GMT-5) REPORT NO.: 16

04.81140004 DATE: 8 Jul 2014

Start	End	Task	Description
0:00	12:00	WOW	Standby. Waiting on weather
12:00	14:00	WOW	Regular Maintenance to drill rig
14:00	24:00	WOW	Standby. Waiting on weather

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Wait at anchorage on weather.

Fugro Representative Comments		**Client Representative Comments**	
Fugro Site Manager: Sam Pant		Client Representative: Ricardo Argiolas	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	9 Jul 2014 Wednesday	REPORT NO.:	17
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	19
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	2

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	35 mph SW	20 mph	10 mph	30 mph	10-17 knts SW; 4-8 ft
Wave Height (ft)	2-3 ft	2-3 ft	1-2 ft	2-3 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	204	Engineer (AM)	Sam Pant	12	204
Captain	Kaston Fluke	12	204	Driller (AM)	Thomas Jones	12	204
Mate	Timmy Finch	12	204	Drill Helper 1 (AM)	Dustin Lyles	12	204
A/B	Todd Darnell	12	204	Drill Helper 2 (AM)	Colin English	12	204
O/S	Patrick Landry	12	204	Soil Technician (AM)	Andrew Edgerton	12	204
Day Cook	Richard Daigle	12	204	EM Technician (AM)	Terry Langsdorf	12	204
Night Cook	Timmy Harvey	12	204	Engineer (PM)	Bill Mack	12	204
MMO	Kelly Gracie	12	204	Driller (PM)	James Walker	12	204
MMO	Dawn McCullough	12	204	Drill Helper 1 (PM)	Louis Salinas	12	204
MMO	Javier Franceschi	12	204	Drill Helper 2 (PM)	David Ramirez	12	204
Surveyor	Jeffery Guidry	12	204	Soil Technician (PM)	Tiffany Engle	12	204
PSS logger	David Valentine	12	204	EM Technician (PM)	Brett Lang	12	204

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	1	4	HSE	Health, Safety, Environment	0.7	2.4
Shallow Borings	0	1	11	MOB	Mob/Demob	0.0	46.7
API Drilling (m)	0.00	134.63		TRAN	Transit To/From Site	1.7	40.1
Downhole CPT (m)	0	63.01		OP1	Operational - Testing/Sampling	2.7	93.3
Piston Sample	0	1		OFF	Off-hire	0.0	0.0
Push (WIP) Sample	0	26		WOW	Standby - Weather	18.7	215.6
SPTs/2.5 hammer	0	32		MMO	Marine Mammal Observation	0.3	3.9
P-S logging (m)	0	100					
					Total Hours	24	402

Daily Progress Report: (Time in GMT-5) REPORT NO.: 17

04.81140004 DATE: 9 Jul 2014

Start	End	Task	Description
0:00	7:30	WOW	Standby at south anchor location, waiting on weather
7:30	7:45	WOW	WOW
7:45	8:45	WOW	WOW
8:45	12:00	WOW	Wait on weather
12:00	13:40	TRAN	In transit to NB-9 location
13:40	14:20	OP1	Setup on location NB-9: X = 414690.92m; Y = 4074990.74m
14:20	14:40	MMO	Marine mammal observation from 1340 hr to 1440 hr
14:40	14:50	HSE	Perform pre-shift safety meeting
14:50	15:10	OP1	Perform sector scan survey
15:10	16:20	OP1	Rig up to drill and sample. Re-fuel drill rig
16:20	16:20	OP1	NB-9: Water depth using clumped line = 31 ft. Tide = 3.4 ft. Corrected WD = 27.6 ft
16:20	16:50	OP1	Lower drill pipe
16:50	23:30	WOW	Wait on weather. Storm producing wind 30 mph, heavy rain and lightning
23:30	24:00	HSE	Perform pre-shift safety meeting

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Monitor weather. Start drilling when weather passes. Drill and sample. Move to NB-7 and drill.

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	10 Jul 2014	REPORT NO.:	18
FCL PROJECT NO.:	04.81140004		Thursday		
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	21
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	2

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	35 mph SW	20 mph	10 mph	30 mph	6-13 knts SE. 2.5 to 4.9 ft Seas
Wave Height (ft)	2-3 ft	2-3 ft	1-2 ft	2-3 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	216	Engineer (AM)	Sam Pant	12	216
Captain	Kaston Fluke	12	216	Driller (AM)	Thomas Jones	12	216
Mate	Timmy Finch	12	216	Drill Helper 1 (AM)	Dustin Lyles	12	216
A/B	Todd Darnell	12	216	Drill Helper 2 (AM)	Colin English	12	216
O/S	Patrick Landry	12	216	Soil Technician (AM)	Andrew Edgerton	12	216
Day Cook	Richard Daigle	12	216	EM Technician (AM)	Terry Langsdorf	12	216
Night Cook	Timmy Harvey	12	216	Engineer (PM)	Bill Mack	12	216
MMO	Kelly Gracie	12	216	Driller (PM)	James Walker	12	216
MMO	Dawn McCullough	12	216	Drill Helper 1 (PM)	Louis Salinas	12	216
MMO	Javier Franceschi	12	216	Drill Helper 2 (PM)	David Ramirez	12	216
Surveyor	Jeffery Guidry	12	216	Soil Technician (PM)	Tiffany Engle	12	216
PSS logger	David Valentine	12	216	EM Technician (PM)	Brett Lang	12	216

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	1	4	HSE	Health, Safety, Environment	0.0	2.4
Shallow Borings	2	3	11	MOB	Mob/Demob	0.0	46.7
API Drilling (m)	55.60	190.23		TRAN	Transit To/From Site	0.8	40.8
Downhole CPT (m)	0	63.01		OP1	Operational - Testing/Sampling	18.7	112.0
Piston Sample	0	1		OFF	Off-hire	0.0	0.0
Push (WIP) Sample	2	28		WOW	Standby - Weather	3.6	219.2
SPTs/2.5 hammer	36	68		MMO	Marine Mammal Observation	1.0	4.9
P-S logging (m)	0	100					
					Total Hours	24	426

Daily Progress Report: (Time in GMT-5) REPORT NO.: 18
04.81140004 DATE: 10 Jul 2014

Start	End	Task	Description
0:00	2:00	WOW	Wait on weather. Storm producing wind 30 mph, heavy rain and lightning
2:00	6:30	OP1	NB-9: Drill and sample from mudline to 82.4 ft. EOH
6:30	9:00	OP1	NB-9: Grout the hole
9:00	9:45	TRAN	Move to location NB-7. Set up on location. NB-7: X = 414553.8m; Y = 4074965.42m
9:45	10:45	MMO	Marine mammal watch
10:45	11:30	OP1	Deploy sector scan sonar
11:30	11:30	OP1	NB-7: Measure water depth with clumped line = 26 ft. Tide = -0.3 ft MLLW
11:30	12:00	OP1	Rig up to drill and sample
12:00	15:15	OP1	NB-7: Drill and sample from mudline to 62 ft
15:15	16:50	WOW	Wait on storm producing lightning, heavy rain and strong wind (40 mph; gust 60 mph)
16:50	20:45	OP1	NB-7: Drill and sample from 62 ft to 100 ft. EOH
20:45	23:30	OP1	NB-7: Grout the hole
23:30	24:00	OP1	Pull pipe.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Client requested to drill NB-7 to 30m TD instead of 25m TD

Program for Next 24 Hours: Move and setup on location NB-5. Drill and sample. Move and setup on NB-3. Drill and sample.

Fugro Representative Comments		**Client Representative Comments**	
Fugro Site Manager: Sam Pant		Client Representative: Ricardo Argiolas	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	11 Jul 2014 Friday	REPORT NO.:	19
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	23
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	2

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	12mph SW	8 mph N	7 mph SW	8 mph SE	7-12 knts SE. 2.5-5 ft
Wave Height (ft)	2 ft	1 - 2 ft	1-2 ft	1-2 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	228	Engineer (AM)	Sam Pant	12	228
Captain	Kaston Fluke	12	228	Driller (AM)	Thomas Jones	12	228
Mate	Timmy Finch	12	228	Drill Helper 1 (AM)	Dustin Lyles	12	228
A/B	Todd Darnell	12	228	Drill Helper 2 (AM)	Colin English	12	228
O/S	Patrick Landry	12	228	Soil Technician (AM)	Andrew Edgerton	12	228
Day Cook	Richard Daigle	12	228	EM Technician (AM)	Terry Langsdorf	12	228
Night Cook	Timmy Harvey	12	228	Engineer (PM)	Bill Mack	12	228
MMO	Kelly Gracie	12	228	Driller (PM)	James Walker	12	228
MMO	Dawn McCullough	12	228	Drill Helper 1 (PM)	Louis Salinas	12	228
MMO	Javier Franceschi	12	228	Drill Helper 2 (PM)	David Ramirez	12	228
Surveyor	Jeffery Guidry	12	228	Soil Technician (PM)	Tiffany Engle	12	228
PSS logger	David Valentine	12	228	EM Technician (PM)	Brett Lang	12	228

PRODUCTION SUMMARY	Today	Total	Planned
Deep Borings	0	1	4
Shallow Borings	2	5	11
API Drilling (m)	55.01	245.24	
Downhole CPT (m)	0	63.01	
Piston Sample	0	1	
Push (WIP) Sample	5	33	
SPTs/2.5 hammer	33	101	
P-S logging (m)	0	100	

Task	DEFINITION OF TASKS	Today	Total
HSE	Health, Safety, Environment	0.0	2.4
MOB	Mob/Demob	0.0	46.7
TRAN	Transit To/From Site	0.0	40.8
OP1	Operational - Testing/Sampling	22.3	134.3
OFF	Off-hire	0.0	0.0
WOW	Standby - Weather	0.0	219.2
MMO	Marine Mammal Observation	1.8	6.7
	Total Hours	24	450

Daily Progress Report: (Time in GMT-5) REPORT NO.: 19
04.81140004 DATE: 11 Jul 2014

Start	End	Task	Description
0:00	0:35	OP1	Secure equipment. Prepare to move to NB-5
0:35	1:30	OP1	Move to location NB-5. Set up on location. NB-5: X = 414403 m; Y = 4074939 m
1:30	1:50	MMO	Marine mammal watch
1:50	2:15	OP1	Deploy sector scan sonar
2:15	2:25	OP1	Rig up to drill and sample
2:25	2:25	OP1	NB-5: Measure water depth with clumped line = 25 ft. Tide = 0.02 ft MLLW
2:25	8:30	OP1	NB-5: Drill and sample from mudline to 99.5 ft EOH
8:30	10:30	OP1	NB-5: Grout the hole
10:30	11:00	OP1	secure equipment. Prepare to move to NB-1
11:00	11:50	OP1	Move to location NB-1. Set up on location. NB-1: X = 414026.39m; Y = 4074816.52m
11:50	12:30	MMO	Marine mammal watch. Watch started at 11:30
12:30	13:00	OP1	Deploy sector scan sonar
13:00	13:45	OP1	Rig up to drill and sample
13:45	13:45	OP1	NB-1: Measure water depth with clumped line = 12 ft. Tide = -0.1 ft MLLW
13:45	14:25	OP1	Run drill pipe to mudline
14:25	18:30	OP1	NB-1: Drill and sample from mudline to 81 ft. EOH
18:30	19:05	OP1	Mix grout
19:05	19:30	OP1	Crew boat alongside to deliver grout
19:30	20:30	OP1	NB-1: Grout the hole
20:30	20:35	OP1	NB-1: Grout the hole
20:35	21:45	OP1	NB-1: Grout the hole
21:45	22:30	OP1	Secure equipment. Prepare to move
22:30	22:55	OP1	Move to location NB-3. Set up on location. NB-3: X = m; Y = m
22:55	23:40	MMO	Marine mammal watch
23:40	24:00	OP1	Deploy sector scan sonar

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Move and setup on location NB-5. Drill and sample. Move and setup on NB-3. Drill and sample.

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	12 Jul 2014 Saturday	REPORT NO.:	20
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	25
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	2

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	9 mph SE	9 mph SE	in transit	8 mph SE	Wind: 15 mph SE Seas: 6 ft
Wave Height (ft)	1-2 ft	1-2 ft		1-2 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	240	Engineer (AM)	Sam Pant	12	240
Captain	Kaston Fluke	12	240	Driller (AM)	Thomas Jones	12	240
Mate	Timmy Finch	12	240	Drill Helper 1 (AM)	Dustin Lyles	12	240
A/B	Todd Darnell	12	240	Drill Helper 2 (AM)	Colin English	12	240
O/S	Patrick Landry	12	240	Soil Technician (AM)	Andrew Edgerton	12	240
Day Cook	Richard Daigle	12	240	EM Technician (AM)	Terry Langsdorf	12	240
Night Cook	Timmy Harvey	12	240	Engineer (PM)	Bill Mack	12	240
MMO	Kelly Gracie	12	240	Driller (PM)	James Walker	12	240
MMO	Dawn McCullough	12	240	Drill Helper 1 (PM)	Louis Salinas	12	240
MMO	Javier Franceschi	12	240	Drill Helper 2 (PM)	David Ramirez	12	240
Surveyor	Jeffery Guidry	12	240	Soil Technician (PM)	Tiffany Engle	12	240
PSS logger	David Valentine	12	240	EM Technician (PM)	Brett Lang	12	240

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	0.0	2.4
Deep Borings	0	1	4	MOB	Mob/Demob	0.0	46.7
Shallow Borings	1	6	11	TRAN	Transit To/From Site	4.7	45.5
API Drilling (m)	30.40	275.64		OP1	Operational - Testing/Sampling	17.8	152.1
Downhole CPT (m)	0	63.01		OFF	Off-hire	0.0	0.0
Piston Sample	0	1		WOW	Standby - Weather	0.0	219.2
Push (WIP) Sample	2	35		MMO	Marine Mammal Observation	1.5	8.2
SPTs/2.5 hammer	19	120					
P-S logging (m)	0	100					
					Total Hours	24	474

Daily Progress Report: (Time in GMT-5) REPORT NO.: 20

04.81140004 DATE: 12 Jul 2014

Start	End	Task	Description
0:00	0:30	OP1	Rig up to drill and sample
0:30	0:30	OP1	NB-3: Measure water depth with clumped line = 20 ft. Tide = 0.15 ft MLLW
0:30	0:55	OP1	NB-3: Run drill pipe to mudline
0:55	5:35	OP1	NB-3: Drill and sample from mudline to 99.8 ft EOH
5:35	7:30	OP1	NB-3: Grout the hole
7:30	8:10	OP1	Secure Equipment for travel
8:10	11:45	OP1	Wait on crew boat for groceries
11:45	12:20	OP1	Offload samples
12:20	17:00	TRAN	In transit to BH-T2A
17:00	18:30	MMO	MMO planned from 1700 to 1800. Spotted turtle. Wait until 1830
18:30	19:00	OP1	BH-T2A: Deploy sector scan sonar
19:00	24:00	OP1	BH-T2A: Preload. X = 456,197.51m; Y = 4,082,430.26m

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Drill and sample at BH-T2A location

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	13 Jul 2014 Sunday	REPORT NO.:	21
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	27
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	2	4

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	10 mph NE	8 mph N	10 mphSE	25 mphSE	Wind: 15 mph SE Seas: 6 ft
Wave Height (ft)	1-2 ft	2-3 ft	2-3 ft	3-4 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	252	Engineer (AM)	Sam Pant	12	252
Captain	Kaston Fluke	12	252	Driller (AM)	Thomas Jones	12	252
Mate	Timmy Finch	12	252	Drill Helper 1 (AM)	Dustin Lyles	12	252
A/B	Todd Darnell	12	252	Drill Helper 2 (AM)	Colin English	12	252
O/S	Patrick Landry	12	252	Soil Technician (AM)	Andrew Edgerton	12	252
Day Cook	Richard Daigle	12	252	EM Technician (AM)	Terry Langsdorf	12	252
Night Cook	Timmy Harvey	12	252	Engineer (PM)	Bill Mack	12	252
MMO	Kelly Gracie	12	252	Driller (PM)	James Walker	12	252
MMO	Dawn McCullough	12	252	Drill Helper 1 (PM)	Louis Salinas	12	252
MMO	Javier Franceschi	12	252	Drill Helper 2 (PM)	David Ramirez	12	252
Surveyor	Jeffery Guidry	12	252	Soil Technician (PM)	Tiffany Engle	12	252
PSS logger	David Valentine	12	252	EM Technician (PM)	Brett Lang	12	252

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	1	4	HSE	Health, Safety, Environment	0.2	2.6
Shallow Borings	0	6	11	MOB	Mob/Demob	0.0	46.7
API Drilling (m)	47.55	323.19		TRAN	Transit To/From Site	0.0	45.5
Downhole CPT (m)	27.15	90.16		OP1	Operational - Testing/Sampling	23.3	175.4
Piston Sample	0	1		OFF	Off-hire	0.0	0.0
Push (WIP) Sample	11	46		WOW	Standby - Weather	0.0	219.2
SPTs/2.5 hammer	4	124		MMO	Marine Mammal Observation	0.5	8.7
P-S logging (m)	0	100					
					Total Hours	24	498

Daily Progress Report: (Time in GMT-5) REPORT NO.: 21

04.81140004 DATE: 13 Jul 2014

Start	End	Task	Description
0:00	0:30	OP1	BH-T2A: Continue Preload. X = 456,197.51m; Y = 4,082,430.26m
0:30	0:45	OP1	Jack up ft from the water level
0:45	2:00	OP1	Rig up to drill and sample.
2:00	3:05	OP1	Mix mud. Lower pipe to mudline. Perform deck test for CPT
3:05	3:05	OP1	BH-T2A: Measure water depth with clumped line = 82 ft. Tide = ft MLLW
3:05	3:20	OP1	Continue Rigging up to drill and sample.
3:20	3:30	OP1	BH-T2A: Perform deck test for CPT
3:30	11:20	OP1	BH-T2A: Drill, sample and perform CPT from mudline to 64 ft
11:20	11:50	MMO	Spotted sea turtle. Stop work for 40 minutes
11:50	12:00	OP1	BH-T2A: Drill, sample and perform CPT from mudline to 67 ft
12:00	12:10	HSE	Vessel muster drill performed
12:10	24:00	OP1	BH-T2A: Drill, sample and perform CPT from 67 ft to 156 ft

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Drill and sample at BH-T2A location

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	14 Jul 2014 Monday	REPORT NO.:	22
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	29
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	4

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	27 mph SE	9 mph N	8 mph S	25 mph	Wind: 18-29 knts SW. Seas: 4-10 ft
Wave Height (ft)	3-4 ft	2-3 ft	3-4 ft	3-4 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	264	Engineer (AM)	Sam Pant	12	264
Captain	Kaston Fluke	12	264	Driller (AM)	Thomas Jones	12	264
Mate	Timmy Finch	12	264	Drill Helper 1 (AM)	Dustin Lyles	12	264
A/B	Todd Darnell	12	264	Drill Helper 2 (AM)	Colin English	12	264
O/S	Patrick Landry	12	264	Soil Technician (AM)	Andrew Edgerton	12	264
Day Cook	Richard Daigle	12	264	EM Technician (AM)	Terry Langsdorf	12	264
Night Cook	Timmy Harvey	12	264	Engineer (PM)	Bill Mack	12	264
MMO	Kelly Gracie	12	264	Driller (PM)	James Walker	12	264
MMO	Dawn McCullough	12	264	Drill Helper 1 (PM)	Louis Salinas	12	264
MMO	Javier Franceschi	12	264	Drill Helper 2 (PM)	David Ramirez	12	264
Surveyor	Jeffery Guidry	12	264	Soil Technician (PM)	Tiffany Engle	12	264
PSS logger	David Valentine	12	264	EM Technician (PM)	Brett Lang	12	264

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	1	4	HSE	Health, Safety, Environment	0.0	2.6
Shallow Borings	0	6	11	MOB	Mob/Demob	0.0	46.7
API Drilling (m)	35.05	358.24		TRAN	Transit To/From Site	0.0	45.5
Downhole CPT (m)	15.9	106.06		OP1	Operational - Testing/Sampling	16.2	191.6
Piston Sample	0	1		OFF	Off-hire	7.3	7.3
Push (WIP) Sample	5	51		WOW	Standby - Weather	0.0	219.2
SPTs/2.5 hammer	8	132		MMO	Marine Mammal Observation	0.5	9.2
P-S logging (m)	0	100					
					Total Hours	24	522

Daily Progress Report: (Time in GMT-5) REPORT NO.: 22
04.81140004 DATE: 14 Jul 2014

Start	End	Task	Description
0:00	0:45	OP1	BH-T2A: Drill, sample and perform CPT from 156 ft to 158 ft
0:45	3:15	OFF	Rig maintenance
3:15	12:00	OP1	BH-T2A: Drill, sample and perform CPT from 158 ft to 222 ft
12:00	13:25	OP1	BH-T2A: Drill, sample and perform CPT from 222 ft to 227 ft
13:25	15:45	OFF	Rig maintenance
15:45	16:00	OP1	BH-T2A: Attempt to perform CPT at 227 ft
16:00	18:30	OFF	Rig maintenance
18:30	19:00	OP1	BH-T2A: Perform CPT at 227 ft
19:00	19:30	MMO	Sea turtle sighting. Wait for half an hour
19:30	24:00	OP1	BH-T2A: Drill, sample and perform CPT from 227 ft to 271 ft

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Drill and sample at BH-T2A location

Fugro Representative Comments		**Client Representative Comments**	
Fugro Site Manager: Sam Pant		Client Representative: Ricardo Argiolas	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	15 Jul 2014 Tuesday	REPORT NO.:	23
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	31
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	4

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	14 mph SE	14 mph NW	8 mph S\	15 mphSW	Wind: 11-26 knts SW; Seas: 3-8 ft
Wave Height (ft)	2-3 ft	2-3 ft	2-3 ft	3-5 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	276	Engineer (AM)	Sam Pant	12	276
Captain	Kaston Fluke	12	276	Driller (AM)	Thomas Jones	12	276
Mate	Timmy Finch	12	276	Drill Helper 1 (AM)	Dustin Lyles	12	276
A/B	Todd Darnell	12	276	Drill Helper 2 (AM)	Colin English	12	276
O/S	Patrick Landry	12	276	Soil Technician (AM)	Andrew Edgerton	12	276
Day Cook	Richard Daigle	12	276	EM Technician (AM)	Terry Langsdorf	12	276
Night Cook	Timmy Harvey	12	276	Engineer (PM)	Bill Mack	12	276
MMO	Kelly Gracie	12	276	Driller (PM)	James Walker	12	276
MMO	Dawn McCullough	12	276	Drill Helper 1 (PM)	Louis Salinas	12	276
MMO	Javier Franceschi	12	276	Drill Helper 2 (PM)	David Ramirez	12	276
Surveyor	Jeffery Guidry	12	276	Soil Technician (PM)	Tiffany Engle	12	276
PSS logger	David Valentine	12	276	EM Technician (PM)	Brett Lang	12	276

PRODUCTION SUMMARY

	Today	Total	Planned
Deep Borings	1	2	4
Shallow Borings	0	6	11
API Drilling (m)	28.50	386.74	
Downhole CPT (m)	15.2	121.26	
Piston Sample	0	1	
Push (WIP) Sample	12	63	
SPTs/2.5 hammer	0	132	
P-S logging (m)	96	196	

Task	DEFINITION OF TASKS	Today	Total
HSE	Health, Safety, Environment	0.0	2.6
MOB	Mob/Demob	0.0	46.7
TRAN	Transit To/From Site	0.0	45.5
OP1	Operational - Testing/Sampling	21.3	212.8
OFF	Off-hire	0.0	7.3
WOW	Standby - Weather	2.3	221.4
MMO	Marine Mammal Observation	0.5	9.7
	Total Hours	24	546

Daily Progress Report: (Time in GMT-5) REPORT NO.: 23
04.81140004 DATE: 15 Jul 2014

Start	End	Task	Description
0:00	8:20	OP1	BH-T2A: Drill, sample and perform CPT from 271 ft to 364.5 ft. EOH
8:20	9:00	OP1	Rig up for P-S logging
9:00	12:40	OP1	BH-T2A: Perform PS logging
12:40	13:10	MMO	Sea turtle sighting. Stop work 30 minutes
13:10	14:30	OP1	BH-T2A: Perform PS logging
14:30	17:00	OP1	Pull piple.
17:00	17:00	OP1	BH-T2A: Measure water depth of 82 ft
17:00	21:45	OP1	Secure equipment, perform regular rig maintenance
21:45	24:00	WOW	WOW

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Wait on weather. Sail to dock when weather becomes favorable

Fugro Representative Comments		**Client Representative Comments**	
Fugro Site Manager: Sam Pant		Client Representative: Ricardo Argiolas	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	16 Jul 2014 Wednesday	REPORT NO.:	24
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	0	31
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	4

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction		20 mph SW	12-15mph	10 mph	Wind: 7-20 knts NE; Seas: 3-6 ft
Wave Height (ft)		3-4 ft	3-4ft	2-3 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	288	Engineer (AM)	Sam Pant	12	288
Captain	Kaston Fluke	12	288	Driller (AM)	Thomas Jones	12	288
Mate	Timmy Finch	12	288	Drill Helper 1 (AM)	Dustin Lyles	12	288
A/B	Todd Darnell	12	288	Drill Helper 2 (AM)	Colin English	12	288
O/S	Patrick Landry	12	288	Soil Technician (AM)	Andrew Edgerton	12	288
Day Cook	Richard Daigle	12	288	EM Technician (AM)	Terry Langsdorf	12	288
Night Cook	Timmy Harvey	12	288	Engineer (PM)	Bill Mack	12	288
MMO	Kelly Gracie	12	288	Driller (PM)	James Walker	12	288
MMO	Dawn McCullough	12	288	Drill Helper 1 (PM)	Louis Salinas	12	288
MMO	Javier Franceschi	12	288	Drill Helper 2 (PM)	David Ramirez	12	288
Surveyor	Jeffery Guidry	12	288	Soil Technician (PM)	Tiffany Engle	12	288
PSS logger	David Valentine	12	288	EM Technician (PM)	Brett Lang	12	288

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	2	4	HSE	Health, Safety, Environment	0.0	2.6
Shallow Borings	0	6	11	MOB	Mob/Demob	0.0	46.7
API Drilling (m)	0.00	386.74		TRAN	Transit To/From Site	0.0	45.5
Downhole CPT (m)	0	121.26		OP1	Operational - Testing/Sampling	0.0	212.8
Piston Sample	0	1		OFF	Off-hire	0.0	7.3
Push (WIP) Sample	0	63		WOW	Standby - Weather	24.0	245.4
SPTs/2.5 hammer	0	132		MMO	Marine Mammal Observation	0.0	9.7
P-S logging (m)	0	196					
					Total Hours	24	570

Daily Progress Report: (Time in GMT-5) REPORT NO.: 24

04.81140004 DATE: 16 Jul 2014

Start	End	Task	Description
0:00	24:00	WOW	Wait on weather.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Wait on weather. When weather gets suitable jack down and move to location BH-T2B

Fugro Representative Comments	**Client Representative Comments**
Onboard: Salt gel 4.5 pallets; Barite 2 pallets; Polymer 4 sacks; Grout 94 sacks Fuel onboard: 5800 gal	
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas

Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	17 Jul 2014 Thursday	REPORT NO.:	25
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	0	31
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	4

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	10-12mphNW	10 mph NE	8 mph N	7 mph NE	Wind: 7-15 knts NE; Seas: 2-5 ft
Wave Height (ft)	2-3 ft	2-3 ft	2-3 ft	1-2 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	300	Engineer (AM)	Sam Pant	12	300
Captain	Kaston Fluke	12	300	Driller (AM)	Thomas Jones	12	300
Mate	Timmy Finch	12	300	Drill Helper 1 (AM)	Dustin Lyles	12	300
A/B	Todd Darnell	12	300	Drill Helper 2 (AM)	Colin English	12	300
O/S	Patrick Landry	12	300	Soil Technician (AM)	Andrew Edgerton	12	300
Day Cook	Richard Daigle	12	300	EM Technician (AM)	Terry Langsdorf	12	300
Night Cook	Timmy Harvey	12	300	Engineer (PM)	Bill Mack	12	300
MMO	Kelly Gracie	12	300	Driller (PM)	James Walker	12	300
MMO	Dawn McCullough	12	300	Drill Helper 1 (PM)	Louis Salinas	12	300
MMO	Javier Franceschi	12	300	Drill Helper 2 (PM)	David Ramirez	12	300
Surveyor	Jeffery Guidry	12	300	Soil Technician (PM)	Tiffany Engle	12	300
PSS logger	David Valentine	12	300	EM Technician (PM)	Brett Lang	12	300

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	2	4	HSE	Health, Safety, Environment	0.0	2.6
Shallow Borings	0	6	11	MOB	Mob/Demob	0.0	46.7
API Drilling (m)	0.00	386.74		TRAN	Transit To/From Site	0.0	45.5
Downhole CPT (m)	0	121.26		OP1	Operational - Testing/Sampling	10.8	223.6
Piston Sample	0	1		OFF	Off-hire	0.0	7.3
Push (WIP) Sample	0	63		WOW	Standby - Weather	12.3	257.7
SPTs/2.5 hammer	0	132		MMO	Marine Mammal Observation	1.0	10.7
P-S logging (m)	0	196					
					Total Hours	24	594

Daily Progress Report: (Time in GMT-5) REPORT NO.: 25
04.81140004 DATE: 17 Jul 2014

Start	End	Task	Description
0:00	12:15	WOW	Wait on weather.
12:15	12:50	OP1	Jack down at BH-T2A location and move to BH-T2B location
12:50	13:50	MMO	Marine mammal observation
13:50	14:20	OP1	BH-T2B: Deploy sector scan survey
14:20	14:20	OP1	BH-T2B: Measure water depth with clumped line = 89 ft. Tide = ft MLLW
14:20	17:03	OP1	Supply boat Diamond alongside to transfer mud and spares.
17:03	24:00	OP1	BH-T2B: Preload. X = 456,481.76m; Y = 4,082,431.01m

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Offset between proposed and final position for BH-T2B location = 4m. Could not setup closer due to weather condition. Approved by client rep onboard.

Program for Next 24 Hours: Drill and sample at BH-T2B location

Fugro Representative Comments	Client Representative Comments
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas

Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	18 Jul 2014 Friday	REPORT NO.:	26
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	33
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	4

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction		14 mph NE	12mphNE	18mphNE	Wind: 12-20 knts NE; Seas: 3-7 ft
Wave Height (ft)		2-3 ft	2-3ft	2-3 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	312	Engineer (AM)	Sam Pant	12	312
Captain	Kaston Fluke	12	312	Driller (AM)	Thomas Jones	12	312
Mate	Timmy Finch	12	312	Drill Helper 1 (AM)	Dustin Lyles	12	312
A/B	Todd Darnell	12	312	Drill Helper 2 (AM)	Colin English	12	312
O/S	Patrick Landry	12	312	Soil Technician (AM)	Andrew Edgerton	12	312
Day Cook	Richard Daigle	12	312	EM Technician (AM)	Terry Langsdorf	12	312
Night Cook	Timmy Harvey	12	312	Engineer (PM)	Bill Mack	12	312
MMO	Kelly Gracie	12	312	Driller (PM)	James Walker	12	312
MMO	Dawn McCullough	12	312	Drill Helper 1 (PM)	Louis Salinas	12	312
MMO	Javier Franceschi	12	312	Drill Helper 2 (PM)	David Ramirez	12	312
Surveyor	Jeffery Guidry	12	312	Soil Technician (PM)	Tiffany Engle	12	312
PSS logger	David Valentine	12	312	EM Technician (PM)	Brett Lang	12	312

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	2	4	HSE	Health, Safety, Environment	0.0	2.6
Shallow Borings	0	6	11	MOB	Mob/Demob	0.0	46.7
API Drilling (m)	39.62	426.36		TRAN	Transit To/From Site	0.0	45.5
Downhole CPT (m)	23.31	144.57		OP1	Operational - Testing/Sampling	22.9	246.5
Piston Sample	0	1		OFF	Off-hire	0.0	7.3
Push (WIP) Sample	10	73		WOW	Standby - Weather	0.0	257.7
SPTs/2.5 hammer	4	136		MMO	Marine Mammal Observation	1.1	11.8
P-S logging (m)	0	196					
					Total Hours	24	618

Daily Progress Report: (Time in GMT-5) REPORT NO.: 26

04.81140004 DATE: 18 Jul 2014

Start	End	Task	Description
0:00	6:15	OP1	BH-T2B: Preload. X = 456,481.76m; Y = 4,082,431.01m
6:15	6:30	OP1	Jack up 34 ft from the water level
6:30	7:30	OP1	Rig up to drill and sample. Lift/move drill collar to have work space.
7:30	8:45	OP1	BH-T2B: Perform deck test and pipe test for CPT
8:45	10:00	OP1	Rig up to drill and sample. Mix mud
10:00	11:25	OP1	BH-T2B: Drill, sample and perform CPT from mudline to 20 ft
11:25	12:00	MMO	Sea turtle sighting. Wait for 30 minutes
12:00	13:00	OP1	BH-T2B: Drill, sample and perform CPT from 20 ft to 22 ft
13:00	13:30	MMO	Sea turtle sighting. Wait for 30 minutes
13:30	24:00	OP1	BH-T2B: Drill, sample and perform CPT from 22 ft to 130 ft

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Drill, sample and perform CPT at BH-T2B location

Program for Next 24 Hours: Drill and sample at BH-T2B location

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	19 Jul 2014	REPORT NO.:	27
FCL PROJECT NO.:	04.81140004		Saturday		
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	2	35
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	3	7

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	13 mph NE	14 mph NE	2 mph N	15 mph NE	Wind: 12-22 knts NE: Seas: 3-7.5 ft
Wave Height (ft)	2-3 ft	2-3 ft	2-3 ft	2-3 ft	
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	324	Engineer (AM)	Sam Pant	12	324
Captain	Kaston Fluke	12	324	Driller (AM)	Thomas Jones	12	324
Mate	Timmy Finch	12	324	Drill Helper 1 (AM)	Dustin Lyles	12	324
A/B	Todd Darnell	12	324	Drill Helper 2 (AM)	Colin English	12	324
O/S	Patrick Landry	12	324	Soil Technician (AM)	Andrew Edgerton	12	324
Day Cook	Richard Daigle	12	324	EM Technician (AM)	Terry Langsdorf	12	324
Night Cook	Timmy Harvey	12	324	Engineer (PM)	Bill Mack	12	324
MMO	Kelly Gracie	12	324	Driller (PM)	James Walker	12	324
MMO	Dawn McCullough	12	324	Drill Helper 1 (PM)	Louis Salinas	12	324
MMO	Javier Franceschi	12	324	Drill Helper 2 (PM)	David Ramirez	12	324
Surveyor	Jeffery Guidry	12	324	Soil Technician (PM)	Tiffany Engle	12	324
PSS logger	David Valentine	12	324	EM Technician (PM)	Brett Lang	12	324

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	2	4	HSE	Health, Safety, Environment	0.0	2.6
Shallow Borings	0	6	11	MOB	Mob/Demob	0.0	46.7
API Drilling (m)	73.06	499.42		TRAN	Transit To/From Site	0.0	45.5
Downhole CPT (m)	37.14	181.71		OP1	Operational - Testing/Sampling	23.5	270.0
Piston Sample	0	1		OFF	Off-hire	0.0	7.3
Push (WIP) Sample	20	93		WOW	Standby - Weather	0.0	257.7
SPTs/2.5 hammer	9	145		MMO	Marine Mammal Observation	0.5	12.3
P-S logging (m)	0	196					
					Total Hours	24	642

Daily Progress Report: (Time in GMT-5) REPORT NO.: 27

04.81140004 DATE: 19 Jul 2014

Start	End	Task	Description
0:00	12:00	OP1	BH-T2B: Drill, sample and perform CPT from 130 ft to 275 ft
12:00	15:20	OP1	BH-T2B: Drill, sample and perform CPT from 275 ft to 305 ft
15:20	15:50	MMO	Sea turtle sighting. Stop for 30 minutes
15:50	22:15	OP1	BH-T2B: Drill, sample and perform CPT from 305 ft to 369.7 ft. EOH
22:15	24:00	OP1	Pull pipe. Rig up to perform PS logging

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Perform PS logging. Secure equipment. Wait until weather gets favorable to jack down and move.

Fugro Representative Comments		**Client Representative Comments**	
Fugro Site Manager: Sam Pant		Client Representative: Ricardo Argiolas	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	20 Jul 2014 Sunday	REPORT NO.: 28
FCL PROJECT NO.:	04.81140004			
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia			
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant	
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154	
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy	
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111	

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	0	35
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	0	7

HSE Details

0

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	13 mph N	14 mph NE	13mph NE		Wind: 8-17 knots NE; Seas: 3-7 ft
Wave Height (ft)	2-3 ft	2-3 ft	3-4 ft		
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	336	Engineer (AM)	Sam Pant	12	336
Captain	Kaston Fluke	12	336	Driller (AM)	Thomas Jones	12	336
Mate	Timmy Finch	12	336	Drill Helper 1 (AM)	Dustin Lyles	12	336
A/B	Todd Darnell	12	336	Drill Helper 2 (AM)	Colin English	12	336
O/S	Patrick Landry	12	336	Soil Technician (AM)	Andrew Edgerton	12	336
Day Cook	Richard Daigle	12	336	EM Technician (AM)	Terry Langsdorf	12	336
Night Cook	Timmy Harvey	12	336	Engineer (PM)	Bill Mack	12	336
MMO	Kelly Gracie	12	336	Driller (PM)	James Walker	12	336
MMO	Dawn McCullough	12	336	Drill Helper 1 (PM)	Louis Salinas	12	336
MMO	Javier Franceschi	12	336	Drill Helper 2 (PM)	David Ramirez	12	336
Surveyor	Jeffery Guidry	12	336	Soil Technician (PM)	Tiffany Engle	12	336
PSS logger	David Valentine	12	336	EM Technician (PM)	Brett Lang	12	336

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	1	3	4	HSE	Health, Safety, Environment	0.0	2.6
Shallow Borings	0	6	11	MOB	Mob/Demob	0.0	46.7
API Drilling (m)	0.00	499.42		TRAN	Transit To/From Site	0.0	45.5
Downhole CPT (m)	0	181.71		OP1	Operational - Testing/Sampling	8.8	278.8
Piston Sample	0	1		OFF	Off-hire	0.0	7.3
Push (WIP) Sample	0	93		WOW	Standby - Weather	15.2	272.8
SPTs/2.5 hammer	0	145		MMO	Marine Mammal Observation	0.0	12.3
P-S logging (m)	99	295					
					Total Hours	24	666

Daily Progress Report: (Time in GMT-5) REPORT NO.: 28
04.81140004 DATE: 20 Jul 2014

Start	End	Task	Description
0:00	3:45	OP1	Perform PS logging
3:45	5:45	OP1	Pull pipe to deck
5:45	6:30	OP1	Wash deck, secure equipment, perform regular rig maintenance
6:30	6:30	OP1	BH-T2B: Measure water depth with clumped line = 89 ft. Tide = 1.85 ft MLLW
6:30	7:30	OP1	Secure equipment, perform regular rig maintenance
7:30	8:00	OP1	Deploy side scan sonar
8:00	8:50	OP1	Continue washing deck, secure equipment, perform regular rig maintenance
8:50	24:00	WOW	Waiting for weather to sail to the dock.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Wait until weather gets favorable to jack down and move.

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	21 Jul 2014 Monday	REPORT NO.:	29
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	0	35
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	2	9

HSE Details

HOC: 1. Low ceiling in the TV area less than 6.5'. 2. Broken glasses from a lamp in working area. Clean up glasses.

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	13 mph N	14 mph NE	13mph NE		Wind: 8-17 knots NE; Seas: 3-7 ft
Wave Height (ft)	2-3 ft	2-3 ft	3-4 ft		
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	348	Engineer (AM)	Sam Pant	12	348
Captain	Kaston Fluke	12	348	Driller (AM)	Thomas Jones	12	348
Mate	Timmy Finch	12	348	Drill Helper 1 (AM)	Dustin Lyles	12	348
A/B	Todd Darnell	12	348	Drill Helper 2 (AM)	Colin English	12	348
O/S	Patrick Landry	12	348	Soil Technician (AM)	Andrew Edgerton	12	348
Day Cook	Richard Daigle	12	348	EM Technician (AM)	Terry Langsdorf	12	348
Night Cook	Timmy Harvey	12	348	Engineer (PM)	Bill Mack	12	348
MMO	Kelly Gracie	12	348	Driller (PM)	James Walker	12	348
MMO	Dawn McCullough	12	348	Drill Helper 1 (PM)	Louis Salinas	12	348
MMO	Javier Franceschi	12	348	Drill Helper 2 (PM)	David Ramirez	12	348
Surveyor	Jeffery Guidry	12	348	Soil Technician (PM)	Tiffany Engle	12	348
PSS logger	David Valentine	12	348	EM Technician (PM)	Brett Lang	12	348

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	3	4	HSE	Health, Safety, Environment	0.0	2.6
Shallow Borings	0	6	11	MOB	Mob/Demob	0.0	46.7
API Drilling (m)	0.00	499.42		TRAN	Transit To/From Site	11.5	57.0
Downhole CPT (m)	0	181.71		OP1	Operational - Testing/Sampling	0.0	278.8
Piston Sample	0	1		OFF	Off-hire	0.0	7.3
Push (WIP) Sample	0	93		WOW	Standby - Weather	12.5	285.3
SPTs/2.5 hammer	0	145		MMO	Marine Mammal Observation	0.0	12.3
P-S logging (m)	0	295					
					Total Hours	24	690

Daily Progress Report: (Time in GMT-5) REPORT NO.: 29
04.81140004 DATE: 21 Jul 2014

Start	End	Task	Description
0:00	12:30	WOW	Waiting for weather to sail to the dock.
12:30	18:30	TRAN	Transit to anchorage
18:30	24:00	TRAN	Wait at anchorage

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours: Wait for day light to transit to dock, and start demob.

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Sam Pant	Client Representative: Ricardo Argiolas

Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion Resources, Inc.	DATE:	22 Jul 2014 Tuesday	REPORT NO.:	30
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	Geotechnical Investigation - VOWTAP - Offshore Virginia				
VESSEL:	L/B Inez H. Eymard	FUGRO PARTY CHIEF:	Sam Pant		
KEY OPERATIONS:	Marine Drilling / Sampling	TELEPHONE:	(757) 202-4154		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	1
First Aid Treatment	0	0	Tool Box Talk Meetings	1	36
Lost/Damaged Equipment	0	0	HSE Meetings	0	3
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	1
Regulatory Audits	0	0	Hazard Observation Cards	2	11

HSE Details

WEATHER	night	0600	noon	1800	Forecast next 24 hrs:
Wind Speed (kts) / Direction	13 mph N	14 mph NE	13mph NE		Wind: 8-17 knots NE; Seas: 3-7 ft
Wave Height (ft)	2-3 ft	2-3 ft	3-4 ft		
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Captain	Mark Segura	12	360	Engineer (AM)	Sam Pant	12	360
Captain	Kaston Fluke	12	360	Driller (AM)	Thomas Jones	12	360
Mate	Timmy Finch	12	360	Drill Helper 1 (AM)	Dustin Lyles	12	360
A/B	Todd Darnell	12	360	Drill Helper 2 (AM)	Colin English	12	360
O/S	Patrick Landry	12	360	Soil Technician (AM)	Andrew Edgerton	12	360
Day Cook	Richard Daigle	12	360	EM Technician (AM)	Terry Langsdorf	12	360
Night Cook	Timmy Harvey	12	360	Engineer (PM)	Bill Mack	12	360
MMO	Kelly Gracie	12	360	Driller (PM)	James Walker	12	360
MMO	Dawn McCullough	12	360	Drill Helper 1 (PM)	Louis Salinas	12	360
MMO	Javier Franceschi	12	360	Drill Helper 2 (PM)	David Ramirez	12	360
Surveyor	Jeffery Guidry	12	360	Soil Technician (PM)	Tiffany Engle	12	360
PSS logger	David Valentine	12	360	EM Technician (PM)	Brett Lang	12	360

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Deep Borings	0	3	4	HSE	Health, Safety, Environment	0.0	2.6
Shallow Borings	0	6	11	MOB	Mob/Demob	13.8	60.5
API Drilling (m)	0.00	499.42		TRAN	Transit To/From Site	10.2	67.2
Downhole CPT (m)	0	181.71		OP1	Operational - Testing/Sampling	0.0	278.8
Piston Sample	0	1		OFF	Off-hire	0.0	7.3
Push (WIP) Sample	0	93		WOW	Standby - Weather	0.0	285.3
SPTs/2.5 hammer	0	145		MMO	Marine Mammal Observation	0.0	12.3
P-S logging (m)	0	295					
					Total Hours	24	714

Daily Progress Report: (Time in GMT-5) REPORT NO.: 30

04.81140004 DATE: 22 Jul 2014

Start	End	Task	Description
0:00	6:00	TRAN	Wait at the anchorage for daylight.
6:00	10:10	TRAN	In transit to ECRF dock.
10:10	24:00	MOB	Demob

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours:

Fugro Representative Comments		**Client Representative Comments**	
Fugro Site Manager: Sam Pant		Client Representative: Ricardo Argiolas	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORTS

OFFSHORE CPT

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	26 Jun 2014 Thursday	REPORT NO.:	1
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN CHARGE:	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	3	3
Lost/Damaged Equipment	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspections	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

Conduct toolbox talks

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Direction		8.4/S	6/NW	12/NNW	Sunny, High of 77
Wave Height (ft)		n/a	n/a	n/a	
Air Temperature (°F)		71	73	84	

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	12	Engineer			
Surveyor	Brendyn Meisinger	12	12	Surveyor			
CPT Operator	Ben Miller	12	12	CPT Operator			
Master	Brad Pimer	12	12	Master			
Mate, Engineer	Brian Cormier	12	12	Mate, Engineer			
2nd Mate	Dave Hammill	12	12	2nd Mate			
Deck-Engineer	Sam Manning	12	12	Deck-Engineer			
Deckhand	Mike Owney	12	12	Deckhand			
Deckhand	Nicholas Bembenek	12	12	Deckhand			
Cook	Mike Arnold	12	12	Cook			
Lead PSO	Chris Ellert	12	12	Lead PSO			
PSO	Matt Lybolt	12	12	PSO			
				0			

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	0.00	0.00
Seabed CPTs	0	0	32	MOB	Mob/Demob	10.80	10.80
CPT Recovery (feet)	0	0	1575	TRAN	Transit To/From Site	7.20	7.20
				OP1	Operational - Testing/Sampling	0.00	0.00
				OP2	Operational move/setup	0.00	0.00
				WOW	Standby - Weather	0.00	0.00
				STBYF	Standby - Fugro	0.00	0.00
				STBYO	Standby - other	0.00	0.00
				OFF	Off-hire	6.00	6.00
					Total Hours	24.00	24.00

Daily Progress Report: (Time in GMT-5) REPORT NO.: 1

04.81140004 DATE: 26 Jun 2014

Start	End	Task	Description
0:00	6:00	OFF	Off hire.
6:00	16:48	MOB	Mobilization
16:48	17:22	TRAN	Deck secured. Boat begins transit to Virginia.
17:22	24:00	TRAN	Sail from New Haven, CT to project site in VA

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Program for Next 24 Hours:

Fugro Representative Comments	**Client Representative Comments**
Mobilization went smoothly and safely	
Fugro Site Manager: Will Cupples	Client Representative:

Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	27 Jun 2014 Friday	REPORT NO.:	2
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	0	3
Lost/Damaged Equipmer	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspectio	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

During the night around 3:45am, Captain Brad noticed a spark under the transformer, possibly due to the wet deck. Ben and the crew were awoken and the equipment on deck was powered down to be safe. Nothing seems to be damaged. Rough seas during the night, smoother during the day.

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Direc	10/E	5/E	5-10/E	5-10/E	For Virginia: Drizzle/Mist in the morning with isolated showers in the afternooon.
Wave Height (ft)	6	3	3	3	
Air Temperature (°F)		70	74	74	

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	24	Engineer			
Surveyor	Brendyn Meisinger	12	24	Surveyor			
CPT Operator	Ben Miller	12	24	CPT Operator			
Master	Brad Pimer	12	24	Master			
Mate, Engineer	Brian Cormier	12	24	Mate, Engineer			
2nd Mate	Dave Hammill	12	24	2nd Mate			
Deck-Engineer	Sam Manning	12	24	Deck-Engineer			
Deckhand	Mike Owney	12	24	Deckhand			
Deckhand	Nicholas Bembenek	12	24	Deckhand			
Cook	Mike Arnold	12	24	Cook			
Lead PSO	Chris Ellert	12	24	Lead PSO			
PSO	Matt Lybolt	12	24	PSO			

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	0.00	0.0
Seabed CPTs	0	0	32	MOB	Mob/Demob	0.00	10.8
CPT Recovery (feet)	0	0	1575	TRAN	Transit To/From Site	24.00	31.2
				OP1	Operational - Testing/Sampling	0.00	0.0
				OP2	Operational move/setup	0.00	0.0
				WOW	Standby - Weather	0.00	0.0
				STBYF	Standby - Fugro	0.00	0.0
				STBYO	Standby - other	0.00	0.0
				OFF	Off-hire	0.00	6.0
					Total Hours	24.00	48.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 2
04.81140004 DATE: 27 Jun 2014

Start	End	Task	Description
0:00	24:00	TRAN	Sail from New Haven, CT to project site in VA

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Hours:

Fugro Representative Comment	**Client Representative Comments**
Fugro Site Manager: Will Cupples	Client Representative:

Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	28 Jun 2014 Saturday	REPORT NO.:	3
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	1	4
Lost/Damaged Equipmer	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspectio	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Direc	15-20/ENE	12/ENE	15/ENE	15/E	Fair weather, but easterly winds that could cause large swells.
Wave Height (ft)	3	8	5	3	
Air Temperature (°F)	77	74	73	83	

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	36	Engineer			
Surveyor	Brendyn Meisinger	12	36	Surveyor			
CPT Operator	Ben Miller	12	36	CPT Operator			
Master	Brad Pimer	12	36	Master			
Mate, Engineer	Brian Cormier	12	36	Mate, Engineer			
2nd Mate	Dave Hammill	12	36	2nd Mate			
Deck-Engineer	Sam Manning	12	36	Deck-Engineer			
Deckhand	Mike Owney	12	36	Deckhand			
Deckhand	Nicholas Bembenek	12	36	Deckhand			
Cook	Mike Arnold	12	36	Cook			
Lead PSO	Chris Ellert	12	36	Lead PSO			
PSO	Matt Lybolt	12	36	PSO			

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	0.67	0.7
Seabed CPTs	0	0	32	MOB	Mob/Demob	0.00	10.8
CPT Recovery (feet)	0	0	1575	TRAN	Transit To/From Site	6.33	37.5
				OP1	Operational - Testing/Sampling	0.00	0.0
				OP2	Operational move/setup	1.50	1.5
				WOW	Standby - Weather	15.50	15.5
				STBYF	Standby - Fugro	0.00	0.0
				STBYO	Standby - other	0.00	0.0
				OFF	Off-hire	0.00	6.0
					Total Hours	24.00	72.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 3
04.81140004 DATE: 28 Jun 2014

Start	End	Task	Description
0:00	6:20	TRAN	Transit to first location at CPT-7.
6:20	7:00	HSE	Toolbox talk
7:00	8:30	OP2	Vessel maintenance
8:30	10:15	WOW	large swells of 6-8 feet prevent any testing for the day.
10:15	12:30	WOW	Moving near CBBT for a calmer place to anchor.
12:30	20:00	WOW	After testing out the generator, transformer pops and quits working. Captain picks up a replacement
20:00	24:00	WOW	3-4' swells in sheltered anchor area.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Hours:

Fugro Representative Comment	**Client Representative Comments**
Fugro Site Manager: Will Cupples	Client Representative:

Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	29 Jun 2014 Sunday	REPORT NO.:	4
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	1	5
Lost/Damaged Equipmer	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspectio	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Direc	15-20/ENE	12/ENE	15/ENE	15/E	Fair weather, but easterly winds that could cause large swells.
Wave Height (ft)	3	8	5	3	
Air Temperature (°F)	77	74	73	83	

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	48	Engineer			
Surveyor	Brendyn Meisinger	12	48	Surveyor			
CPT Operator	Ben Miller	12	48	CPT Operator			
Master	Brad Pimer	12	48	Master			
Mate, Engineer	Brian Cormier	12	48	Mate, Engineer			
2nd Mate	Dave Hammill	12	48	2nd Mate			
Deck-Engineer	Sam Manning	12	48	Deck-Engineer			
Deckhand	Mike Owney	12	48	Deckhand			
Deckhand	Nicholas Bembenek	12	48	Deckhand			
Cook	Mike Arnold	12	48	Cook			
Lead PSO	Chris Ellert	12	48	Lead PSO			
PSO	Matt Lybolt	12	48	PSO			

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	0.33	1.0
Seabed CPTs	2	2	32	MOB	Mob/Demob	0.00	10.8
CPT Recovery (feet)	37.68	37.68	1575	TRAN	Transit To/From Site	5.50	43.0
				OP1	Operational - Testing/Sampling	0.63	0.6
				OP2	Operational move/setup	8.28	9.8
				WOW	Standby - Weather	0.00	15.5
				STBYF	Standby - Fugro	0.00	0.0
				STBYO	Standby - other	0.00	0.0
				OFF	Off-hire	9.25	15.3
					Total Hours	24.00	96.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 4

04.81140004 DATE: 29 Jun 2014

Start	End	Task	Description
0:00	6:00	OFF	Anchored near CBBT.
6:00	6:40	TRAN	Anchored near CBBT.
6:40	11:30	TRAN	Anchored near CBBT.
11:30	14:30	OP2	Preparing to move to first CPT location and meet Tetratech acoustic crew.
14:30	15:20	OP2	Arrive at CPT 7, deploy 4 point anchor system-total time from arrival to within 1m of CPT7 = 16 min.
15:20	15:40	HSE	Toolbox talk
15:40	16:22	OP2	Conditioning rods and adjusting Seascout unit.
16:22	16:45	OP1	Launch, run test to depth of 5.5m. UTM 18N, N: 4074822.35m E: 424024.66m
16:45	17:00	OP2	Seascout on deck, pulling anchors, moving to CPT-6
17:00	18:25	OP2	Arrive at CPT 6, deployed 4 anchors in 29 min.
18:25	18:40	OP1	Launch, run test to 6m, encountered hard layer at 3.74, retracted and pushed again. Rod bent
18:40	20:45	OP2	Replaced rod and put cone back on. Ready for possible retest at CPT 6
20:45	24:00	OFF	Waiting at CPT 6

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Hours:

Fugro Representative Comment	**Client Representative Comments**
Fugro Site Manager: Will Cupples	Client Representative:
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	30 Jun 2014 Monday	REPORT NO.:	5
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	1	6
Lost/Damaged Equipmen	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspectio	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

Toolbox talk was conducted at 7am prior to beginning CPT operations. Tag lines on the Seascout have been working well to stabilize any swinging and communication between A-frame, winch operator, and CPT operator is good.

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Direc	5/SE	3/WSW	9/ESE	12/SSE	Fair conditions with winds from the SE and SW at 15-20 knots.
Wave Height (ft)	2	2	1	1	
Air Temperature (°F)	72	73	76	78	

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	60	Engineer			
Surveyor	Brendyn Meisinger	12	60	Surveyor			
CPT Operator	Ben Miller	12	60	CPT Operator			
Master	Brad Pimer	12	60	Master			
Mate, Engineer	Brian Cormier	12	60	Mate, Engineer			
2nd Mate	Dave Hammill	12	60	2nd Mate			
Deck-Engineer	Sam Manning	12	60	Deck-Engineer			
Deckhand	Mike Owney	12	60	Deckhand			
Deckhand	Nicholas Bembenek	12	60	Deckhand			
Cook	Mike Arnold	12	60	Cook			
Lead PSO	Chris Ellert	12	60	Lead PSO			
PSO	Matt Lybolt	12	60	PSO			

PRODUCTION SUMMARY	Today	Total	Planned
Seabed CPTs	9	11	32
CPT Recovery (feet)	99.17	136.85	1575

Task	DEFINITION OF TASKS	Today	Total
HSE	Health, Safety, Environment	0.17	1.2
MOB	Mob/Demob	0.00	10.8
TRAN	Transit To/From Site	0.00	43.0
OP1	Operational - Testing/Sampling	1.72	2.4
OP2	Operational move/setup	10.62	20.4
WOW	Standby - Weather	0.00	15.5
STBYF	Standby - Fugro	0.00	0.0
STBYO	Standby - other	0.00	0.0
OFF	Off-hire	11.50	26.8
	Total Hours	24.00	120.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 5

04.81140004 DATE: 30 Jun 2014

Start	End	Task	Description
0:00	7:00	OFF	Anchored at CPT 6.
7:00	7:10	HSE	Toolbox talk on CPT launch and recovery
7:10	7:15	OP2	Moving to offset location CPT 6A approx. 10 feet east of CPT 6
7:15	7:49	OP2	On location. Conditioning rods
7:49	8:05	OP1	Launch, run test to depth 2.6m refused at 14MPa, with safety cutoff setting of 11.5 MPa
8:05	9:19	OP2	Seascout on deck. UTM 18N N: 4075084.12m E: 422906.91m. Moving to CPT-5
9:19	9:31	OP1	Launch, run test to 3.5m at CPT 5. UTM 18N, N: 4075181.92m, E: 421869.27m
9:31	10:25	OP2	Seascout on deck. Pulling anchors moving to CPT 4.
10:25	10:30	OP2	On location at CPT 4. deploy anchors.
10:30	10:40	OP1	Launch, run test to 2.62m at CPT 4. UTM 18N, N: 4075165.54m, E: 421143.63m
10:40	10:44	OP2	Seascout back on deck. Offsetting to CPT 4A, 10 feet east of CPT 4 for a re-test.
10:44	10:45	OP2	On location at CPT 4A.
10:45	10:55	OP1	Launch run test to 3.76m at CPT 4A. UTM 18N, N: 4075166m, E: 421147.42m
10:55	12:20	OP2	Pulling anchors moving to CPT 3
12:20	12:35	OP2	On location at CPT 3, conditioning rods
12:35	12:45	OP1	Launch,run test to 4.6m at CPT 3. UTM 18N, N: 4075204.025m, E: 420162.142m
12:45	14:29	OP2	Seascout on deck. Moving to CPT 10 to meet with acoustic boat
14:29	14:51	OP2	On location at CPT 10. conditioning rods
14:51	15:03	OP1	Launch run test to 4.16m, UTM 18N N: 4074142.028m, E: 426994.790m
15:03	16:20	OP2	Seascout back on deck. Moving to CPT-11.
16:20	16:25	OP2	On location at CPT-11
16:25	16:35	OP1	Launch, run test at CPT-11 to 3.79m depth. UTM 18N: N: 4074006.654m E: 428078.845m
16:35	17:40	OP2	Seascout pulled to deck. Moving to CPT-12.
17:40	17:42	OP2	On location at CPT-12
17:42	17:55	OP1	Launch, run test at CPT-12 to 2.50m depth. UTM 18N: N: 4073887.74m, E: 429946.33m
17:55	18:00	OP2	Seascout pulled to deck. Fugro personnell decide to retest at CPT-12A, approx. 10 feet away.
18:00	18:10	OP1	Launch, run test at CPT 12A to 2.7m depth. UTM 18N N: 4073886.80m, E: 429949.23m
18:10	19:30	OP2	Seascout on deck and secured for transit to CPT-9
19:30	24:00	OFF	On location at CPT-9. Wait here til morning to run test.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Hours:

Fugro Representative Comment	**Client Representative Comments**
Fugro Site Manager: Will Cupples	Client Representative:
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	1 Jul 2014 Tuesday	REPORT NO.: 6
FCL PROJECT NO.:	04.81140004			
JOB DESCRIPTION:	VOWTAP CPT Cable Route			
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples	
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273	
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy	
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111	

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	1	7
Lost/Damaged Equipmer	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspectio	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Direc	5/SE	3/WSW	9/ESE	12/SSE	Fair conditions with winds from the SE and SW at 15-20 knots.
Wave Height (ft)	2	2	1	1	
Air Temperature (°F)	72	73	76	78	

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	72	Engineer			
Surveyor	Brendyn Meisinger	12	72	Surveyor			
CPT Operator	Ben Miller	12	72	CPT Operator			
Master	Brad Pimer	12	72	Master			
Mate, Engineer	Brian Cormier	12	72	Mate, Engineer			
2nd Mate	Dave Hammill	12	72	2nd Mate			
Deck-Engineer	Sam Manning	12	72	Deck-Engineer			
Deckhand	Mike Owney	12	72	Deckhand			
Deckhand	Nicholas Bembenek	12	72	Deckhand			
Cook	Mike Arnold	12	72	Cook			
Lead PSO	Chris Ellert	12	72	Lead PSO			
PSO	Matt Lybolt	12	72	PSO			

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Seabed CPTs	9	20	32	HSE	Health, Safety, Environment	1.28	2.5
CPT Recovery (feet)	107	243.85	1575	MOB	Mob/Demob	0.00	10.8
				TRAN	Transit To/From Site	2.17	45.2
				OP1	Operational - Testing/Sampling	1.62	4.0
				OP2	Operational move/setup	8.85	29.3
				WOW	Standby - Weather	0.00	15.5
				STBYF	Standby - Fugro	0.00	0.0
				STBYO	Standby - other	0.00	0.0
				OFF	Off-hire	10.08	36.8
					Total Hours	24.00	144.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 6
04.81140004 DATE: 1 Jul 2014

Start	End	Task	Description
0:00	7:05	OFF	Anchored at CPT 9.
7:05	7:33	HSE	Toolbox talk on safety during CPT Ops as well as the approaching tropical storm/hurricane.
7:33	7:44	OP1	Launch, run test at CPT-9 to depth of 4.14m. UTM 18N N: 4074471.06m E: 425611.55m
7:44	8:06	OP2	Seascout on deck. Cone switched out
8:06	8:14	OP1	Re-launch, run test at CPT-9A to depth of 4.12m. On same location as CPT-9.
8:14	9:27	OP2	Seascout on deck. Transit to CPT-8.
9:27	9:30	OP2	On location at CPT-8
9:30	9:43	OP1	Launch, run test at CPT-8 to 6m depth. UTM 18N, N: 4074695.91m E: 424617.43m
9:43	10:40	OP2	Seascout back on deck, moving to CPT-2
10:40	11:14	HSE	Man overboard drill conducted during transit to CPT-2
11:14	11:23	OP2	On location at CPT-2
11:23	11:40	OP1	Launch, run test at CPT-2 to 4.5m depth. UTM 18N, N: 4075149.98m E: 417610.75m
11:40	11:51	OP1	Questionable data for CPT-2, Launch, retest to verify, second test (CPT-2A) refuses at 3.16m depth
11:51	12:56	OP2	Seascout back on deck, moving to CPT-1
12:56	12:58	OP2	On location for CPT-1
12:58	13:08	OP1	Launch, run test at CPT-1 to 5.13m depth UTM 18N, N: 4075014.25m E: 416220.83m
13:08	15:22	OP2	Seascout back on deck, moving to CPT-13
15:22	15:35	OP2	On location for CPT-13
15:35	15:40	OP1	Launch, run test at CPT-13 to 2.5m depth (hit obstruction) UTM 18N, N:4073820.8m E: 431259.01m
15:40	15:55	HSE	Seascout back on deck. Safety meeting to discuss tag lines, anchor slip, and swinging loads
15:55	16:43	OP2	Moving to CPT-13A for retest after hitting obstruction.
16:43	16:55	OP1	On location, Launch, run CPT-13A to 1.45m (obstruction/hard layer) UTM 18N N: 4073819.8m E: 431261.06m
16:55	18:38	OP2	Seascout back on deck, moving to CPT-14.
18:38	18:40	OP2	On location at CPT-14
18:40	18:50	OP1	Launch, run test at CPT-14 to 1.84m depth. UTM 18N, N:4073723.77m, E: 433327.11m
18:50	21:00	TRAN	Seascout back on deck, heading closer to shore to anchor down for tonight
21:00	24:00	OFF	Anchored for the night.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Hours:

Fugro Representative Comment	**Client Representative Comments**
Fugro Site Manager: Will Cupples	Client Representative:
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	2 Jul 2014 Wednesday	REPORT NO.:	7
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	1	8
Lost/Damaged Equipmer	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspectio	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Direc	8/S	10/SSW	12/S	15/S	Fair weather turning to light rain in the late afternoon
Wave Height (ft)	3	2	2	2	with isolated thunderstorms Thursday morning.
Air Temperature (°F)	79	77	86	92	

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	84	Engineer			
Surveyor	Brendyn Meisinger	12	84	Surveyor			
CPT Operator	Ben Miller	12	84	CPT Operator			
Master	Brad Pimer	12	84	Master			
Mate, Engineer	Brian Cormier	12	84	Mate, Engineer			
2nd Mate	Dave Hammill	12	84	2nd Mate			
Deck-Engineer	Sam Manning	12	84	Deck-Engineer			
Deckhand	Mike Owney	12	84	Deckhand			
Deckhand	Nicholas Bembenek	12	84	Deckhand			
Cook	Mike Arnold	12	84	Cook			
Lead PSO	Chris Ellert	12	84	Lead PSO			
PSO	Matt Lybolt	12	84	PSO			

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	0.27	2.7
Seabed CPTs	7	27	32	MOB	Mob/Demob	0.00	10.8
CPT Recovery (feet)	95.63	339.48	1575	TRAN	Transit To/From Site	3.00	48.2
				OP1	Operational - Testing/Sampling	1.28	5.3
				OP2	Operational move/setup	9.45	38.7
				WOW	Standby - Weather	0.00	15.5
				STBYF	Standby - Fugro	0.00	0.0
				STBYO	Standby - other	0.00	0.0
				OFF	Off-hire	10.00	46.8
					Total Hours	24.00	168.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 7

04.81140004 DATE: 2 Jul 2014

Start	End	Task	Description
0:00	6:30	OFF	Anchored
6:30	8:10	OP2	Transit out to first locaiton CPT-15
8:10	8:26	HSE	On location at CPT-15. Toolbox talk
8:26	8:35	OP1	Launch, run test at CPT-15 to 4.98m depth. UTM 18N, N: 4074285.5m E: 435902.15m
8:35	9:50	OP2	Seascout back on deck, moving to CPT-16.
9:50	9:54	OP2	On location at CPT-16.
9:54	10:05	OP1	Launch, run test at CPT-16 to 2.73m depth, UTM 18N, N: 4074512.2m E: 436903.23m
10:05	10:29	OP2	Rods bent during test. Rods conditioned
10:29	11:48	OP2	Seascout back on deck, moving to CPT-17.
11:48	11:50	OP2	On location at CPT-17
11:50	12:06	OP1	Launch, run test at CPT-17 to 6.02m depth, UTM 18N, N: 4074927.2m E: 438828.11m
12:06	13:25	OP2	Seascout back on deck, moving to CPT-18
13:25	13:29	OP2	On location at CPT-18
13:29	13:40	OP1	Launch, run test at CPT-18 to 5.65m depth, UTM 18N, N:4075130.02m E: 439806.76m
13:40	14:45	OP2	Seascout back on deck, moving to CPT-19
14:45	14:47	OP2	On location at CPT-19
14:47	15:01	OP1	Launch, run test at CPT-19 to 6.02m depth, UTM 18N, N: E:
15:01	16:14	OP2	Seascout back on deck, moving to CPT-20
16:14	16:16	OP2	On location at CPT-20
16:16	16:25	OP1	Launch, run test at CPT-20 to 2m depth, UTM 18N, N: E:
16:25	16:28	OP2	Seascout back on deck, offset 10 feet forward to retest at CPT-20A
16:28	16:35	OP1	Launch, run test at CPT-20A to 1.8m, UTM 18N, N: E:
16:35	17:30	OP2	Seascout back on deck
17:30	20:30	TRAN	Heading into Little Creek to ride out the tropical storm.
20:30	24:00	OFF	Waiting in Little Creek until storm passes.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Hours:

Fugro Representative Comment		**Client Representative Comments**	
Fugro Site Manager: Will Cupples		Client Representative:	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	3 Jul 2014 Thursday	REPORT NO.:	8
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	1	9
Lost/Damaged Equipmer	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspectio	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

Toolbox talk was conducted at 7:00 to discuss weather safety, safety while doing routine maintenance on the ship. A vessel inspection was also completed by Fugro and Megan Miller captains. Also, it was decided that everyone would be back on board at noon on Saturday in preparation for CPT Ops Sunday morning.

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Direc	10/S	12/SSW	8/SSW	n/a	Hurricane Arthur should make landfall along the Outer
Wave Height (ft)	3	n/a	n/a	n/a	Banks of North Carolina and cause 6-10' waves for the
Air Temperature (°F)	91	79	80	n/a	project area, with large swells lasting until late

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	96	Engineer			
Surveyor	Brendyn Meisinger	12	96	Surveyor			
CPT Operator	Ben Miller	12	96	CPT Operator			
Master	Brad Pimer	12	96	Master			
Mate, Engineer	Brian Cormier	12	96	Mate, Engineer			
2nd Mate	Dave Hammill	12	96	2nd Mate			
Deck-Engineer	Sam Manning	12	96	Deck-Engineer			
Deckhand	Mike Owney	12	96	Deckhand			
Deckhand	Nicholas Bembenek	12	96	Deckhand			
Cook	Mike Arnold	12	96	Cook			
Lead PSO	Chris Ellert	12	96	Lead PSO			
PSO	Matt Lybolt	12	96	PSO			

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	3.50	6.2
Seabed CPTs	0	27	32	MOB	Mob/Demob	0.00	10.8
CPT Recovery (feet)	0	339.48	1575	TRAN	Transit To/From Site	0.00	48.2
				OP1	Operational - Testing/Sampling	0.00	5.3
				OP2	Operational move/setup	0.00	38.7
				WOW	Standby - Weather	8.50	24.0
				STBYF	Standby - Fugro	0.00	0.0
				STBYO	Standby - other	0.00	0.0
				OFF	Off-hire	12.00	58.8
					Total Hours	24.00	192.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 8

04.81140004 DATE: 3 Jul 2014

Start	End	Task	Description
0:00	7:00	OFF	Anchored in Little Creek for weather.
7:00	9:00	HSE	Waiting on Hurrican Arthur to pass through the area
9:00	10:30	HSE	Vessel inspection form filled out.
10:30	19:00	WOW	Waiting on weather
19:00	24:00	OFF	Anchored in Little Creek for weather.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Hours:

Fugro Representative Comment	**Client Representative Comments**
Fugro Site Manager: Will Cupples	Client Representative:
Signed: / Date:	Signed: / Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	4 Jul 2014 Friday	REPORT NO.:	9
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	1	10
Lost/Damaged Equipmen	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspectio	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

Toolbox talk conducted at 7:00am

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Direc	10/S	12/SSW	8/SSW	n/a	
Wave Height (ft)	3	n/a	n/a	n/a	
Air Temperature (°F)	91	79	80	n/a	

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	108	Engineer			
Surveyor	Brendyn Meisinger	12	108	Surveyor			
CPT Operator	Ben Miller	12	108	CPT Operator			
Master	Brad Pimer	12	108	Master			
Mate, Engineer	Brian Cormier	12	108	Mate, Engineer			
2nd Mate	Dave Hammill	12	108	2nd Mate			
Deck-Engineer	Sam Manning	12	108	Deck-Engineer			
Deckhand	Mike Owney	12	108	Deckhand			
Deckhand	Nicholas Bembenek	12	108	Deckhand			
Cook	Mike Arnold	12	108	Cook			
Lead PSO	Chris Ellert	12	108	Lead PSO			
PSO	Matt Lybolt	12	108	PSO			

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	0.50	6.7
Seabed CPTs	0	27	32	MOB	Mob/Demob	0.00	10.8
CPT Recovery (feet)	0	339.48	1575	TRAN	Transit To/From Site	0.00	48.2
				OP1	Operational - Testing/Sampling	0.00	5.3
				OP2	Operational move/setup	0.00	38.7
				WOW	Standby - Weather	11.50	35.5
				STBYF	Standby - Fugro	0.00	0.0
				STBYO	Standby - other	0.00	0.0
				OFF	Off-hire	12.00	70.8
					Total Hours	24.00	216.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 9

04.81140004 DATE: 4 Jul 2014

Start	End	Task	Description
0:00	7:00	OFF	Anchored in Little Creek for weather.
7:00	7:30	HSE	Toolbox talk
7:30	19:00	WOW	Waiting on weather to pass. Routine vessel maintenance.
19:00	24:00	OFF	Anchored in Little Creek for weather.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Hours:

Fugro Representative Comment		**Client Representative Comments**	
Fugro Site Manager: Will Cupples		Client Representative:	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	5 Jul 2014 Saturday	REPORT NO.:	**10**
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	1	11
Lost/Damaged Equipmer	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspectio	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

Toolbox talk conducted at 7:00am

WEATHER	**night**	**0700**	**noon**	**1900**	Forecast next 24 hrs:
Wind Speed (kts) / Direc	20-25/NNW	13/NNE	13/NNW	5/NNW	Fair weather, sunny, with variable winds of 5-10 knots
Wave Height (ft)	5	4	4	4	
Air Temperature (°F)	77	72	73	77	

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	120	Engineer			
Surveyor	Brendyn Meisinger	12	120	Surveyor			
CPT Operator	Ben Miller	12	120	CPT Operator			
Master	Brad Pimer	12	120	Master			
Mate, Engineer	Brian Cormier	12	120	Mate, Engineer			
2nd Mate	Dave Hammill	12	120	2nd Mate			
Deck-Engineer	Sam Manning	12	120	Deck-Engineer			
Deckhand	Mike Owney	12	120	Deckhand			
Deckhand	Nicholas Bembenek	12	120	Deckhand			
Cook	Mike Arnold	12	120	Cook			
Lead PSO	Chris Ellert	12	120	Lead PSO			
PSO	Matt Lybolt	12	120	PSO			

PRODUCTION SUMMARY	Today	Total	Planned	**Task**	**DEFINITION OF TASKS**	**Today**	**Total**
Seabed CPTs	0	27	32	HSE	Health, Safety, Environment	0.50	7.2
CPT Recovery (feet)	0	339.48	1575	MOB	Mob/Demob	0.00	10.8
				TRAN	Transit To/From Site	3.50	51.7
				OP1	Operational - Testing/Sampling	0.00	5.3
				OP2	Operational move/setup	0.00	38.7
				WOW	Standby - Weather	8.00	43.5
				STBYF	Standby - Fugro	0.00	0.0
				STBYO	Standby - other	0.00	0.0
				OFF	Off-hire	12.00	82.8
					Total Hours	24.00	240.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 10

04.81140004 DATE: 5 Jul 2014

Start	End	Task	Description
0:00	7:00	OFF	Anchored in Little Creek for weather.
7:00	7:30	HSE	Toolbox talk while in Little Creek
7:30	9:30	TRAN	Heading out to location CPT-21 to check weather/wave conditions.
9:30	11:00	TRAN	Waves/Swells to high for safe working conditions (4-5'). Heading back to CBBT anchor area
11:00	19:00	WOW	Waiting near CBBT on weather.
19:00	24:00	OFF	Off hire, waiting near CBBT.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Hours:

Fugro Representative Comment	**Client Representative Comments**
Fugro Site Manager: Will Cupples	Client Representative:
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	6 Jul 2014 Sunday	REPORT NO.:	11
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	1	12
Lost/Damaged Equipmer	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspectio	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

Toolbox talk conducted at 6:40am

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Direc	8/SW	9/SW	5-10/S	5-10/S	Fair weather, winds out of the southwest at 10-15 knots.
Wave Height (ft)	3	1	1	1	Sunny.
Air Temperature (°F)	79	75	81	84	

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	132	Engineer			
Surveyor	Brendyn Meisinger	12	132	Surveyor			
CPT Operator	Ben Miller	12	132	CPT Operator			
Master	Brad Pimer	12	132	Master			
Mate, Engineer	Brian Cormier	12	132	Mate, Engineer			
2nd Mate	Dave Hammill	12	132	2nd Mate			
Deck-Engineer	Sam Manning	12	132	Deck-Engineer			
Deckhand	Mike Owney	12	132	Deckhand			
Deckhand	Nicholas Bembenek	12	132	Deckhand			
Cook	Mike Arnold	12	132	Cook			
Lead PSO	Chris Ellert	12	132	Lead PSO			
PSO	Matt Lybolt	12	132	PSO			

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	0.08	7.3
Seabed CPTs	8	35	32	MOB	Mob/Demob	0.00	10.8
CPT Recovery (feet)	52.21	391.69	1575	TRAN	Transit To/From Site	3.67	55.4
				OP1	Operational - Testing/Sampling	1.20	6.5
				OP2	Operational move/setup	9.40	48.1
				WOW	Standby - Weather	0.00	43.5
				STBYF	Standby - Fugro	0.65	0.6
				STBYO	Standby - other	0.00	0.0
				OFF	Off-hire	9.00	91.8
					Total Hours	24.00	264.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 11

04.81140004 DATE: 6 Jul 2014

Start	End	Task	Description
0:00	3:00	OFF	Anchored near CBBT Thimble Shoals channel.
3:00	6:40	TRAN	Transit from CBBT to CPT-21
6:40	6:45	HSE	Toolbox talk on safety during CPT Ops
6:45	7:00	OP2	Making deck ready for launch and recovery
7:00	7:11	OP1	Launch, run test at CPT-21 to 2.37m depth, UTM 18N, N: 4075920.714m E: 443527.960m
7:11	8:16	OP2	Seascout back on deck, moving to CPT-22
8:16	8:55	OP2	Seascout maitenance
8:55	9:00	OP2	On location at CPT-22
9:00	9:10	OP1	Launch, run test at CPT-22 to 2m depth, UTM 18N, N: 4076208.753m E: 444778.055m
9:10	10:18	OP2	Seascout back on deck, moving to CPT-23
10:18	10:20	OP2	On location at CPT-23
10:20	10:28	OP1	Launch, run test at CPT-23 to 1.85m depth, UTM 18N, N: 4077008.72m E: 446159.47m
10:28	11:25	OP2	Seascout back on deck, moving to CPT-24
11:25	11:30	OP2	On location at CPT-24
11:30	11:39	OP1	Launch, run test at CPT-24 to 2.29m depth, UTM 18N, N: 4077705.678m E: 447331.107m
11:39	12:54	OP2	Seascout back on deck, moving to CPT-25
12:54	12:56	OP2	On location at CPT-25
12:56	13:04	OP1	Launch, run test at CPT-25 to 1.48m depth, UTM 18N, N: 4078786.632m E: 449119.045m
13:04	14:02	OP2	Seascout back on deck, moving to CPT-26
14:02	14:04	OP2	On location at CPT-26
14:04	14:11	OP1	Launch, run test at CPT-26 to 1.40m depth, UTM 18N, N: 4079248.832m E: 449920.737m
14:11	15:14	OP2	Seascout back on deck, moving to CPT-27
15:14	15:16	OP2	On location at CPT-27
15:16	15:26	OP1	Launch, run test at CPT-27 to 2.35m depth, UTM 18N, N: 4080380.798m E: 451811.479m
15:26	16:23	OP2	Seascout back on deck, moving to CPT-28
16:23	16:25	OP2	On location at CPT-28
16:25	16:34	OP1	Launch, run test at CPT-28 to 2.18m depth, UTM 18N, N: 4080797.087m E: 452539.334m
16:34	18:00	OP2	Seascout back on deck, heading back into cell phone range.
18:00	24:00	OFF	Anchored for the night.

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

Hours:

Fugro Representative Comment	**Client Representative Comments**

Fugro Site Manager: Will Cupples		Client Representative:	
Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	7 Jul 2014 Monday	REPORT NO.:	12
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	1	13
Lost/Damaged Equipmen	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspection	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Directi	5-10/S	10/SW	8/SSW	10-15/SSW	Fair weather, with winds 15-20 knots from the SSW.
Wave Height (ft)	2	3	1	1	Sunny.
Air Temperature (°F)	73	74	83	88	

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	144	Engineer			
Surveyor	Brendyn Meisinger	12	144	Surveyor			
CPT Operator	Ben Miller	12	144	CPT Operator			
Master	Brad Pimer	12	144	Master			
Mate, Engineer	Brian Cormier	12	144	Mate, Engineer			
2nd Mate	Dave Hammill	12	144	2nd Mate			
Deck-Engineer	Sam Manning	12	144	Deck-Engineer			
Deckhand	Mike Owney	12	144	Deckhand			
Deckhand	Nicholas Bembenek	12	144	Deckhand			
Cook	Mike Arnold	12	144	Cook			
Lead PSO	Chris Ellert	12	144	Lead PSO			
PSO	Matt Lybolt	12	144	PSO			

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
Seabed CPTs	4	39	32	HSE	Health, Safety, Environment	0.10	7.4
CPT Recovery (feet)	49.49	441.18	1575	MOB	Mob/Demob	0.00	10.8
				TRAN	Transit To/From Site	7.00	62.4
				OP1	Operational - Testing/Sampling	0.61	7.1
				OP2	Operational move/setup	5.62	53.7
				WOW	Standby - Weather	0.00	43.5
				STBYF	Standby - Fugro	0.00	0.6
				STBYO	Standby - other	0.67	0.7
				OFF	Off-hire	10.00	101.8
					Total Hours	24.00	288.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 12
04.81140004 DATE: 7 Jul 2014

Start	End	Task	Description
0:00	5:00	OFF	Anchored.
5:00	7:00	TRAN	Transit to CPT-29
7:00	7:40	STBYO	Vessel maitenance
7:40	8:11	OP2	Transit to CPT-29
8:11	8:17	HSE	Toolbox talk
8:17	8:20	OP1	Launch, run test at CPT-29 to 3.61m depth, UTM 18N, N: 4081717.759m E: 454051.586m
8:20	9:40	OP2	Seascout back on deck, moving to CPT-30
9:40	9:45	OP2	On location at CPT-30
9:45	10:02	OP1	Launch, run test at CPT-30 to 5.72m depth, UTM 18N, N: 4082298.521m E: 455042.898m
10:02	11:17	OP2	Seascout back on deck, moving to CPT-31
11:17	11:20	OP2	On location at CPT-31
11:20	11:29	OP1	Launch, run test at CPT-31 to 3.3m depth, UTM 18N, N: 40827766.507m E: 456196.973m
11:29	12:34	OP2	Seascout back on deck, moving to CPT-32
12:34	12:36	OP2	On location at CPT-32
12:36	12:44	OP1	Launch, run test at CPT-32 to 2.46m depth, UTM 18N, N: 4083204.047m E: 456196.971m
12:44	14:00	OP2	Seascout back on deck. Securing deck to head to shore, pulling up stern anchor frames.
14:00	19:00	TRAN	Transit from CPT-32 to Little Creek
19:00	24:00	OFF	Tied up in Little Creek. PSO crew transfer complete

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

DPR, CPT raw files, final fixes for each location

Hours:

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Will Cupples	Client Representative:
Signed: Date:	Signed: Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	8 Jul 2014 Tuesday	REPORT NO.:	13
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	1	14
Lost/Damaged Equipmen	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspection	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Directi	8/SSW	10/SSW	8/SW	10-15/SSW	Sunny, with winds 20-25 knots, swells of 3-4 feet.
Wave Height (ft)	2	2	3	4	
Air Temperature (°F)	81	76	87	91	

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	156	Engineer			
Surveyor	Brendyn Meisinger	12	156	Surveyor			
CPT Operator	Ben Miller	12	156	CPT Operator			
Master	Brad Pimer	12	156	Master			
Mate, Engineer	Brian Cormier	12	156	Mate, Engineer			
2nd Mate	Dave Hammill	12	156	2nd Mate			
Deck-Engineer	Sam Manning	12	156	Deck-Engineer			
Deckhand	Mike Owney	12	156	Deckhand			
Deckhand	Nicholas Bembenek	12	156	Deckhand			
Cook	Mike Arnold	12	156	Cook			
Lead PSO	Chris Ellert	12	156	Lead PSO			
PSO	Matt Lybolt	12	156	PSO			

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	0.00	7.4
Seabed CPTs	0	39	32	MOB	Mob/Demob	0.00	10.8
CPT Recovery (feet)	0	441.18	1575	TRAN	Transit To/From Site	17.00	79.4
				OP1	Operational - Testing/Sampling	0.00	7.1
				OP2	Operational move/setup	0.00	53.7
				WOW	Standby - Weather	0.00	43.5
				STBYF	Standby - Fugro	0.00	0.6
				STBYO	Standby - other	0.00	0.7
				OFF	Off-hire	7.00	108.8
					Total Hours	24.00	312.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 13
04.81140004 DATE: 8 Jul 2014

Start	End	Task	Description
0:00	7:00	OFF	Anchored in Little Creek
7:00	24:00	TRAN	Begin transit back to New Haven, CT

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions
DPR, CPT raw files, final fixes for each location

Hours:

Fugro Representative Comments	**Client Representative Comments**
Next 24 hours: Continue transit to New Haven, CT	
Fugro Site Manager: Will Cupples	Client Representative:

Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	9 Jul 2014 Wednesday	REPORT NO.:	14
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	1	15
Lost/Damaged Equipmen	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspection	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Directi	9/SW	8/SW	8/SSW	6/SW	Scattered thunderstorms tonight with mostly sunny skies
Wave Height (ft)	1	1	1	1	tomorrow, high of 76, stray showers possible in the
Air Temperature (°F)	74	70	74	75	afternoon.

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	168	Engineer			
Surveyor	Brendyn Meisinger	12	168	Surveyor			
CPT Operator	Ben Miller	12	168	CPT Operator			
Master	Brad Pimer	12	168	Master			
Mate, Engineer	Brian Cormier	12	168	Mate, Engineer			
2nd Mate	Dave Hammill	12	168	2nd Mate			
Deck-Engineer	Sam Manning	12	168	Deck-Engineer			
Deckhand	Mike Owney	12	168	Deckhand			
Deckhand	Nicholas Bembenek	12	168	Deckhand			
Cook	Mike Arnold	12	168	Cook			
Lead PSO	Chris Ellert	12	168	Lead PSO			
PSO	Matt Lybolt	12	168	PSO			

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	0.00	7.4
Seabed CPTs	0	39	32	MOB	Mob/Demob	0.00	10.8
CPT Recovery (feet)	0	441.18	1575	TRAN	Transit To/From Site	22.00	101.4
				OP1	Operational - Testing/Sampling	0.00	7.1
				OP2	Operational move/setup	0.00	53.7
				WOW	Standby - Weather	0.00	43.5
				STBYF	Standby - Fugro	0.00	0.6
				STBYO	Standby - other	0.00	0.7
				OFF	Off-hire	2.00	110.8
					Total Hours	24.00	336.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 14
04.81140004 DATE: 9 Jul 2014

Start	End	Task	Description
0:00	22:00	TRAN	Transit from Virginia to New Haven, CT
22:00	24:00	OFF	Offload at the dock in New Haven

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions
DPR

Hours:

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Will Cupples	Client Representative:

Signed:	Date:	Signed:	Date:

DAILY PROGRESS REPORT

Fugro Consultants, Inc.
101 West Main Street, Suite 350, Norfolk VA 23510
757-625-3350

CLIENT:	Dominion	DATE:	10 Jul 2014 Thursday	REPORT NO.:	15
FCL PROJECT NO.:	04.81140004				
JOB DESCRIPTION:	VOWTAP CPT Cable Route				
VESSEL:	Megan T. Miller	FUGRO PARTY CHIEF:	Will Cupples		
KEY OPERATIONS:	SeaScout CPT	TELEPHONE:	(901) 596-9273		
PRINCIPAL IN	Ray Wood	PROJECT MANAGER:	Mohamed Mekkawy		
TELEPHONE:	(352) 378-3717	TELEPHONE:	(757) 679-4111		

HEALTH, SAFETY AND ENVIRONMENT SUMMARY

	Today	Total		Today	Total
Lost Time Incident	0	0	Vessel Inductions	0	0
First Aid Treatment	0	0	Tool Box Talk Meetings	0	15
Lost/Damaged Equipment	0	0	HSE Meetings	0	0
Spills / Releases	0	0	Safety Drills	0	0
Near Miss	0	0	Permits to Work	0	0
Internal Audits/ Inspection	0	0	Risk Assessments completed	0	0
Regulatory Audits	0	0	Hazard Observation Cards	0	0

HSE Details

WEATHER	night	0700	noon	1900	Forecast next 24 hrs:
Wind Speed (kts) / Directi	In port	In port		In port	
Wave Height (ft)					
Air Temperature (°F)					

Personnel	Name	Today	Total	Personnel	Name	Today	Total
Engineer	Will Cupples	12	180	Engineer			
Surveyor	Brendyn Meisinger	12	180	Surveyor			
CPT Operator	Ben Miller	12	180	CPT Operator			
Master	Brad Pimer	8	176	Master			
Mate, Engineer	Brian Cormier	8	176	Mate, Engineer			
2nd Mate	Dave Hammill	8	176	2nd Mate			
Deck-Engineer	Sam Manning	8	176	Deck-Engineer			
Deckhand	Mike Owney	0	168	Deckhand			
Deckhand	Nicholas Bembenek	0	168	Deckhand			
Cook	Mike Arnold	0	168	Cook			
Lead PSO	Chris Ellert	0	168	Lead PSO			
PSO	Matt Lybolt	0	168	PSO			

PRODUCTION SUMMARY	Today	Total	Planned	Task	DEFINITION OF TASKS	Today	Total
				HSE	Health, Safety, Environment	0.00	7.4
Seabed CPTs	0	39	32	MOB	Mob/Demob	11.00	21.8
CPT Recovery (feet)	0	441.18	1575	TRAN	Transit To/From Site	0.00	101.4
				OP1	Operational - Testing/Sampling	0.00	7.1
				OP2	Operational move/setup	0.00	53.7
				WOW	Standby - Weather	0.00	43.5
				STBYF	Standby - Fugro	0.00	0.6
				STBYO	Standby - other	0.00	0.7
				OFF	Off-hire	8.00	118.8
					Total Hours	19.00	355.0

Daily Progress Report: (Time in GMT-5) REPORT NO.: 15

04.81140004 DATE: 10 Jul 2014

Start	End	Task	Description
0:00	8:00	OFF	Offhire
8:00	19:00	MOB	Demobilization

COMMUNICATIONS: e.g. data transmittal records, confirmation of verbal instructions

DPR

Hours:

Fugro Representative Comments	**Client Representative Comments**
Fugro Site Manager: Will Cupples	Client Representative:
Signed: Date:	Signed: Date:

APPENDIX L

BENTHIC CLEARANCE OF MARINE GEOPHYSICAL AND GEOTECHNICAL SURVEY ACTIVITIES

TETRA TECH

TO:	Kimberly Lanterman and Corwin Chamberlain, Dominion Resources, Inc.
FROM:	Tetra Tech, Inc.
DATE:	April 25, 2014
PROJECT:	Virginia Offshore Wind Technology Advancement Project (VOWTAP)
RE:	Benthic Clearance of Marine Geophysical and Geotechnical Survey Activities

The benthic and fisheries resources assessment team at Tetra Tech, Inc. (Tetra Tech) reviewed the proposed Marine Geophysical and Geotechnical Site Investigation Plan for the Virginia Offshore Wind Technology Advancement Project (VOWTAP or Project). Project activities will include nearshore marine geophysical investigations, shallow cone penetration testing (CPT), offshore borings, and piezocone penetrometer testing (PCPT). The focus of the benthic and fisheries resource review was placed on bottom-disturbing activities that have the potential to impact both infaunal organisms and benthic habitat within the VOWTAP Export Cable corridor and Research Lease Area. Results from the previous geophysical, shallow geotechnical, and benthic surveys, conducted in June 2013 and covering the Project Area, were considered when addressing the potential impacts of this planned site investigation.

The VOWTAP Benthic Survey Report and Marine Site Characterization Survey Report (Tetra Tech 2013a; Tetra Tech 2013b) analyzed the benthic infaunal organisms, sediment grain size, and total organic carbon of the benthic sediment within the Project Area, allowing for an overall characterization of the benthic ecology at the site. The combined results of the benthic as well as the geophysical and shallow geotechnical surveys determined that all benthic habitats within the Research Lease Area and Export Cable corridor were softbottom, dominated by sand (91.5%), followed by silt and clay (6.3%), and gravel (2.2%). This type of sandy substrate provides habitat for infaunal polychaete annelids and molluscs, and does not support any seagrasses, hardbottom, livebottom, or any other unique habitat features. Results of this survey provided Dominion with important information in siting Project components to avoid impacts to sensitive habitats and species.

Along the nearshore Export Cable HDD alignment, a desktop analysis of coastal habitats and grain size indicate that, similar to the offshore portions of the Project Area, sand is also the dominate bottom type. No eelgrass or other important habitats have been identified along this proposed alignment. For these reasons, the proposed geophysical and geotechnical surveys in this area are unlikely to result in impacts to important benthic resources (BOEM 2014; Northeast Ocean Data 2014). Furthermore, the Virginia Marine Resources Commission (VMRC) has reviewed the proposed activities within this area of their jurisdiction, and on April 22, 2014 provided formal authorization of the survey activities to Dominion under a modification to VMRC Permit No. VRMC#13-0614 that was issued for the marine survey activities conducted in 2013.

The VOWTAP Export Cable corridor and Research Lease Area support a variety of demersal and pelagic fish species, with several having identified Essential Fish Habitats (EFH) within these sites. Desktop analysis was further utilized to address the potential for coastal EFH habitats within the proposed geophysical and geotechnical survey sites. Though the coastal area was determined to contain EFHs, many of the species are listed as Atlantic Highly Migratory Species, are widely distributed throughout the coastal Virginia waters, and have abundances that vary with both season and life stage (NOAA 2014a; NOAA 2014b). Desktop analysis further addressed the potential locations of Habitat Areas of

Particular Concern (HAPC), with none found in the proposed locations. It is, therefore, unlikely that the proposed geophysical and geotechnical surveys will result in significant impacts to EFH habitats and associated species.

This memo serves as a certification that our analysis considered all surveyed portions of the seafloor within the Project Area, where disturbance of the benthic habitat is likely to occur, as they pertain to the proposed geophysical and geotechnical survey activities. It is our conclusion that, provided the benthic habitat disturbance due to the proposed survey activities is limited to the area associated with the previously surveyed 300-meter Export Cable corridor and Research Lease Area, there is little potential that benthic resources will be affected.

REFERENCES

Bureau of Ocean Energy Management (BOEM). 2014. Marine Cadastre: Planning Tools. http://csc.noaa.gov/mmcviewer. Accessed 25 April 2014.

National Oceanic and Atmospheric Administration (NOAA). 2014a. Essential Fish Habitat (EFH) Mapper. Http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html. Accessed 25 April 2014.

NOAA. 2014b. Guide to Essential Fish Habitat Designations in the Northeastern United States. Http://www.nero.noaa.gov/hcd/webintro.html. Accessed 25 April 2014.

Northeast Ocean Data. 2014. Data Explorer. http://northeastoceanviewer.org. Accessed 25 April 2014.

Tetra Tech. 2013a. Virginia Offshore Wind Technology Advancement Project (VOWTAP): Benthic Survey Report. Dominion, Glen Allen, VA. 184 pp.

Tetra Tech. 2013b. VOWTAP: Marine Site Characterization Survey Report. Dominion, Glen Allen, VA. 89 pp.

APPENDIX M

OFFSHORE AND NEARSHORE ARCHEOLOGICAL RESOURCES CLEARANCE REPORTS

R. CHRISTOPHER GOODWIN & ASSOCIATES, INC.

To: Tetra Tech, Inc.

From: James Schmidt, Senior Nautical Archeologist/Senior Project Manager

Date: April 10, 2014

RE: Dominion VOWTAP Cone Penetration Test Locations

Christopher Goodwin & Associates, Inc. (RCG&A) reviewed the proposed Marine Geotechnical Site Investigation Plan for the VOWTAP Demonstration Project, Offshore Virginia Outer Continental Shelf. The scope of the geotechnical site investigation includes multiple activities comprised of nearshore marine sample borings, offshore cone penetration tests (CPTs), and up to four wind turbine generator (WTG) borings. Our review focused on bottom-disturbing activities that have the potential to impact submerged archeological resources identified within the VOWTAP Area of Potential Affect (APE). To accomplish this review, we synthesized high-resolution geophysical survey data reported in the Marine Archeological Resources Assessment report prepared by RCG&A in December 2013 and provided as an attachment to the VOWTAP Research Activities Plan (RAP).

This memo serves as a certification that our analyses considered all portions of the seafloor within the APE where bottom disturbing activities are likely to occur, as they pertain to CPT and WTG borehole drillings. It is our conclusion, that provided that the geotechnical site investigation limits bottom disturbing activities (which include, but are not limited to, all anchor touchdown points, chain/wire on the seafloor to lift off point), to within the APE and outside the previously established cultural resource avoidance zones, no potential archeological resources will be affected by the proposed borehole drilling activity.

If you have questions, please do not hesitate to contact us.

With best regards, I remain

Yours faithfully,

James S. Schmidt

James S. Schmidt
Senior Nautical Archeologist/Senior Project Manager

R. CHRISTOPHER GOODWIN & ASSOCIATES, INC.

To: Tetra Tech, Inc.

From: Kathryn Ryberg, Remote Sensing Specialist/Archeologist

Date: August 4, 2014

RE: VOWTAP Nearshore Boring Locations

R. Christopher Goodwin & Associates, Inc. (RCG&A) reviewed the proposed nearshore borehole locations in support of the VOWTAP Demonstration project. The scope of the geotechnical site investigation included collection of bathymetric data, side scan sonar data, and magnetometer data. This review focused on bottom-disturbing activities that have the potential to impact submerged archeological resources within the Area of Impact/Boat Footprint. To accomplish this review, we synthesized high-resolution geophysical survey data provided by Fugro Consultants, Inc.

This memo serves as a certification that our analyses considered all portions of the seafloor within the areas of impact where bottom disturbing activities are likely to occur, as they pertain to six borehole drilling locations, NB-1, NB-3, NB-5, NB-7, NB-9 and NB-11. The area of impact (provided by Fugro) of each boring location encompasses the footprint of the lift boat used to conduct the borings.

Magnetic anomaly MA-58 is adjacent to the vessel footprint for boring NB-1. However, the low amplitude (9.8 nT) of the anomaly and its medium duration (25.9 m) indicate that it is not a submerged cultural resource.

Magnetic anomaly MA-29 is adjacent to the vessel footprint for boring NB-3. However, the low amplitude (2.9 nT) of the anomaly and its medium duration (20.7 m) indicate that it is not a submerged cultural resource.

No side scan sonar anomalies were recorded within the six areas of impact. No anthropogenic objects were detected in the bathymetric data within the six boring areas of impact.

It is our conclusion, that provided that the geotechnical site investigation limited bottom disturbing activities to within the areas of impact, no potential archeological resources were affected by the borehole drilling activity.

If you have questions, please do not hesitate to contact us.

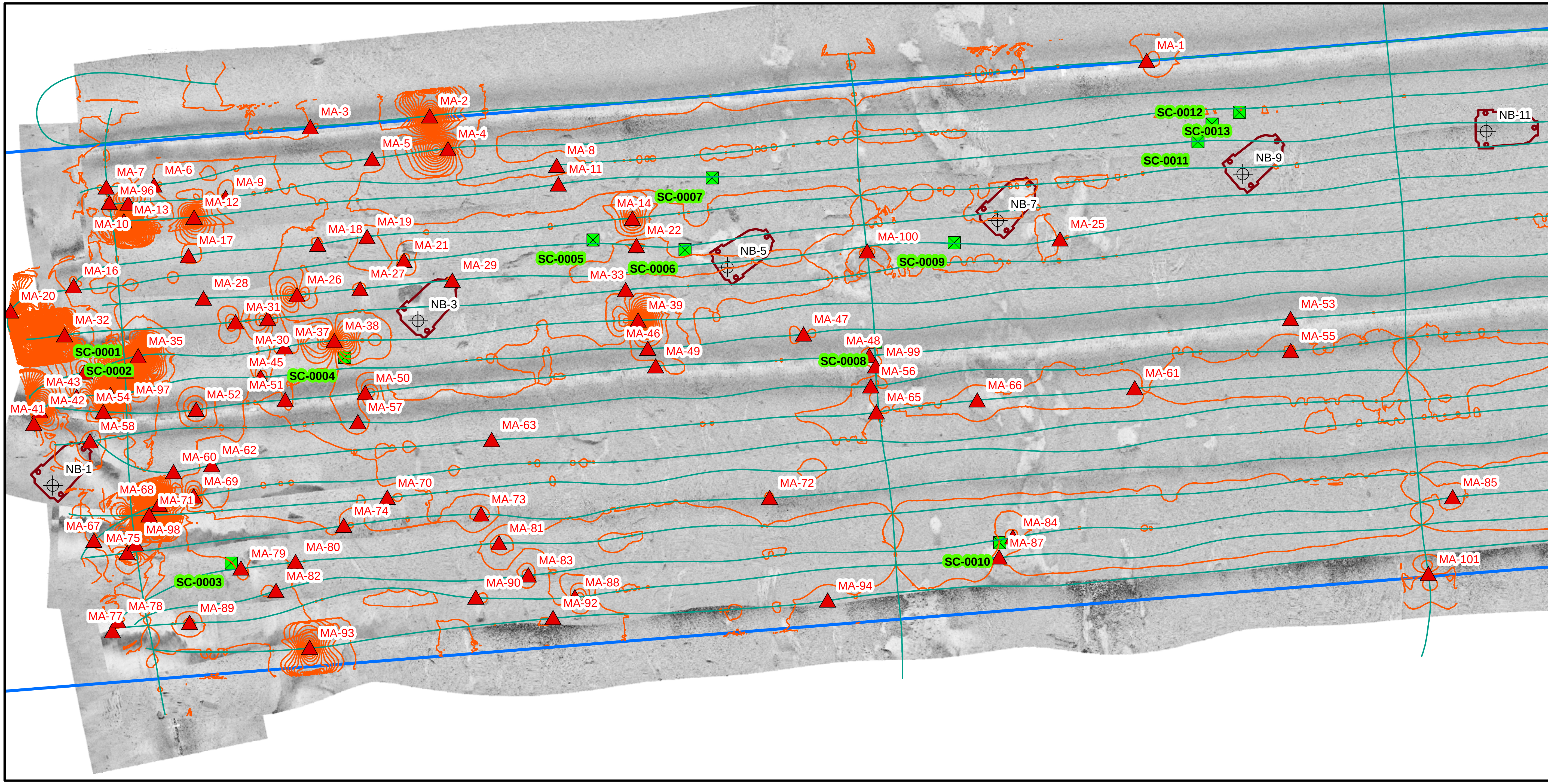
With best regards, I remain

Yours faithfully,

Kathryn Ryberg

Kathryn Ryberg
Remote Sensing Specialist/Archeologist

Cc: James S. Schmidt



N
W E
S

Spatial Reference System: UTM 18N / NAD83

Map Scale: 1:130,000

0 0.02 0.04 0.06 0.08 Kilometers

0 0.02 0.04 0.06 0.08 Miles

Magnetic Anomalies

Tracklines

Magnetic Contours (3 nT)

Area of Imapact/Boat Footprint

Boring Location

APE

Side scan anomalies

Virginia Offshore Wind Technology Advancement Project

Nearshore Boring Locations

R. Christopher Goodwin & Associates, Inc. | 241 East Fourth Street, Suite 100 | Frederick, MD 21701

DATE: 10.2.2013 PREPARED BY: KFM