Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

June 26, 2107
File No.: 17-55-9581B

The Richman Group of Florida, Inc.
477 South Rosemary Avenue, Suite 301
West Palm Beach, Florida 33401

Attention: Mr. Jesse Woeppel

Subject: **Preliminary Geotechnical Engineering Services Report**
Site at Trask and McCoy
Tampa, Florida

Dear Mr. Woeppel:

Ardaman & Associates, Inc. is pleased to submit this report presenting the results of our subsurface soil exploration program for the above referenced project. Our services were provided in general accordance with those outlined in our Proposal No. 17-p177, dated May 19, 2017, and authorized by Mr. Jesse Woeppel of The Richman Group, with the signing of our Proposal/Project Acceptance form on June 2, 2017. The purpose of this exploration was to evaluate the general stratification and engineering properties of the subsurface soils at the subject site, and to provide preliminary foundation and pavement design recommendations, as well as stormwater design considerations. In addition, preliminary general site preparation recommendations have been provided.

This Report of Geotechnical Engineering Services was prepared for the exclusive use of **The Richman Group of Florida, Inc**. and their consultants. The conclusions and recommendations made herein are applicable only to those structures and facilities described herein. This geotechnical study was performed in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

PROJECT INFORMATION

Project information was provided by Mr. Jesse Woeppel on May 17, 2017. Supplemental information was received after Ardaman was provided with a Notice to Proceed. We understand that the subject site includes a parcel of land measuring about 790 feet long in the north south direction and about 450 feet long in the east west direction. The site is located at the intersection of Trask and McCoy in south Tampa, Florida. Some of property was previously developed, with buildings on the north side of the site and some pavement throughout the site. Much of the site is covered with grass, with a few scattered trees also present. Railroad tracks are present along the west property line. The site is relatively flat. Google Earth indicates it slopes toward the north, with the elevation ranging from about +10' at the southeast corner to +7' in the northwest corner. Google Earth vertical datum is approximately NAVD 1988.

We understand the proposed construction will include six 4-story wood frame buildings covering areas ranging from approximately 30 by 90 feet in plan with a 1-story clubhouse covering an area approximately 50 by 50 feet in plan. Pavement is planned around the perimeter of the site. A stormwater pond covering about 2.4 acres a Flood Plain Mitigation pond covering about 0.5 acres are also planned. Design loads listed below were provided to Ardaman for previous similar projects:

Wall Load:	6.5 kips/linear ft
Column Load:	120 kips

It is assumed that less than 3.0 feet of fill will be required to achieve finished floor elevations.

FIELD EXPLORATION

Boring Locations

The soil boring locations and depths were selected by our office. The actual boring locations were established in the field by Ardaman & Associates representatives referencing landmarks identified on aerial photos and near structures. The approximate boring locations are shown on the Test Location Plan (see Figure 1). The boring locations should be considered accurate only to the degree implied by the method used. If more precise locations are desired, we suggest that you contact a registered surveyor. It is important to note that ground surface elevations at the boring locations were neither furnished nor determined.

Standard Penetration Test

Six (6) Standard Penetration Test (SPT) soil borings (B-01 through B-06) were drilled to depths ranging from 30 to 40 feet deep to evaluate the stratification and engineering properties of the subsurface soils within the footprint of the proposed structures. The SPT soil borings were initially drilled to a depth of 4 feet below existing grades with a hand auger at each boring location in order to avoid damaging possible underground utilities. The SPT soil borings were then drilled with the use of a CME Power Drill Rig using Bentonite "Mud" drilling procedures. The SPT soil borings extended to the approximate depth of 30 to 40 feet below the existing ground surface (bgs). Boring B-03 was drilled to the approximate depth of 40 feet, due to very weak soil encountered at the proposed termination depth of 30 feet. Soil sampling was performed in general accordance with the procedures outlined in ASTM Standard D-1586. These procedures are also summarized in the Appendix of this report. The boreholes were grouted upon completion

Double-Ring Infiltration Testing

One (1) Double-Ring Infiltration (DRI) test was performed at the approximate location illustrated on the Test Location Plan (Figure 1). The DRI test was performed for a total duration of about four hours in general accordance with the procedures outlined in ASTM Standard D-3385. These procedures are also summarized in the Appendix of this report. A shallow hand auger boring was drilled prior to the DRI test, to an approximate depth of 4.2 feet below the existing ground surface to evaluate the subsurface conditions at the chosen testing location.

LABORATORY TESTING

The field soil boring logs and recovered soil samples were transported to our Tampa office following the completion of the field exploration activities. Each representative sample was examined by a geotechnical engineer in our laboratory to identify the engineering classification of the soil and/or rock. The visual classification of the samples was performed using the current Unified Soil Classification System in general accordance with the procedures outlined in ASTM Standard D-2488. Since the samples obtained were granular in nature, and otherwise readily identifiable, laboratory testing was deemed unnecessary at the time of our analysis.

SUBSURFACE CONDITIONS

The delineation of the vertical extent of individual soil strata, the identification of pertinent soil engineering properties, where applicable, and a description of each geologic layer discovered in the course of this geotechnical study, is illustrated on the soil boring profiles presented in the Appendix of this report. The soil boring profiles were prepared by a geotechnical engineer based upon a technical review of the field soil boring logs and visual classification of the recovered soil samples. It should be noted that the stratification lines shown are used to indicate a transition from one soil type to another. The actual boundary between the illustrated soil strata may be gradual or indistinct. Consequently, the stratification boundary lines, shown on the soil boring profiles, represent our best estimate of the location of the transition between distinct soil strata. They are in no way intended to designate a depth of exact geological change. Furthermore, the recommendations contained in this report are based on the contents of the soil boring profiles. While the borings are representative of subsurface conditions at their respective locations and vertical reaches, local variations which are characteristic of the subsurface materials of the region, or which may be due to man-made alteration of the native geologic conditions, may be encountered.

In general, a layer of fine sand to slightly silty fine sand (Unified Classification SP/SP-SM), clayey fine sand (SC) and silty fine sand (SM) was present from the ground surface to a depth ranging from 6 to 22 feet. These sandy soils were generally medium dense to dense, with the results of Standard Penetration Test (SPT) borings within these sandy soils yielded N-values ranging from 3 to 61 blows per foot. Silty clay to clay soils (ML, CL/CH) were then encountered, to depths ranging from 18 to 38 feet. These clayey soils were generally soft to stiff, with N-values ranging from 3 to 32 blows per foot. Limestone was encountered in 5 of 6 borings to boring termination at depths ranging from 30 to 40 feet deep. N-values within the limestone ranged from 9 to greater than 50 blows per foot.

Boring B-01 appears to be in an area that may have been filled. We found significant major root at a depth of 4 to 8 feet below the existing ground surface. This issue is further discussed later in this report.

<u>Groundwater</u>

As indicated on the soil profiles, the measured borehole water levels ranged from 3 to 5 feet below the ground surface at the time of the field exploration. These water level readings may differ from the actual stable groundwater table due to variations in the permeability of soil layers. The degree of accuracy of the reported water levels is also related to the time allowed for the borehole water level to come to equilibrium.

It should be noted that fluctuations in the ground water level may occur due to variations in rainfall and other environmental or physical factors at the time measurements are made. We estimate the seasonal high groundwater level is about 2 to 4 feet below the ground surface.

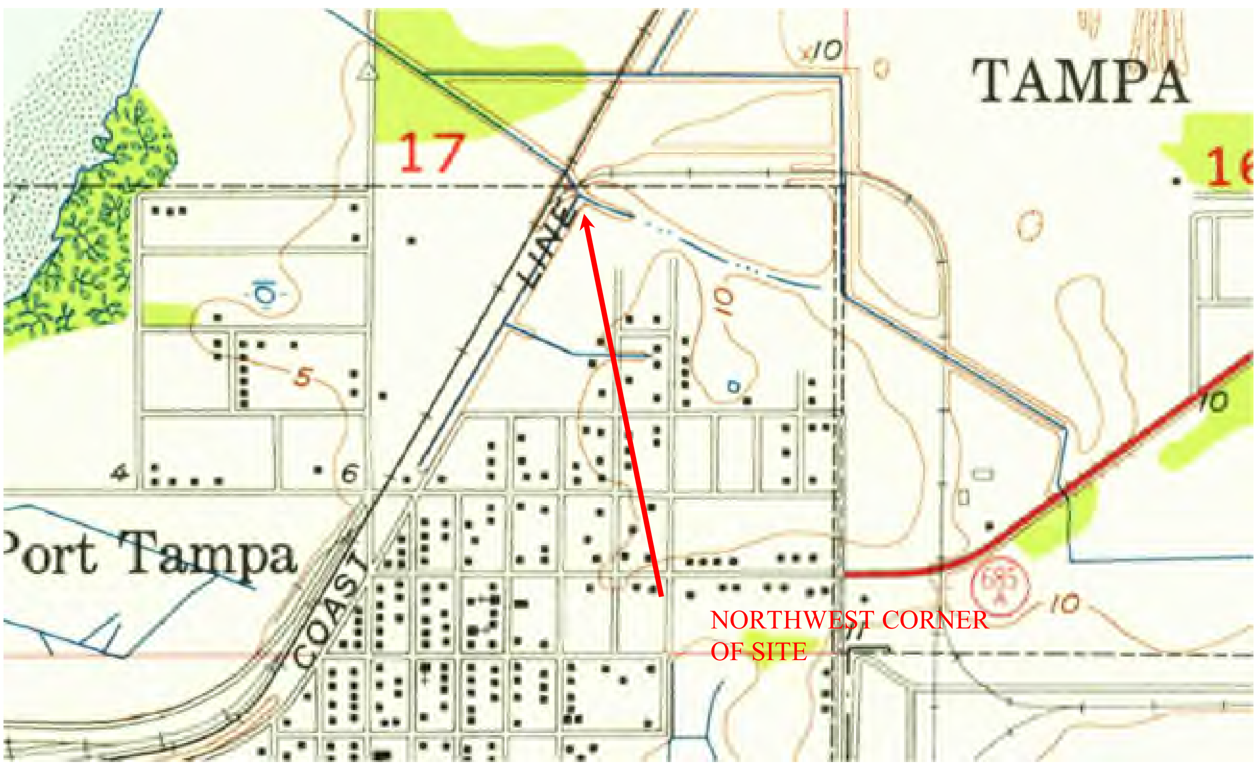
Double Ring Infiltration (DRI) Test Results

The results of the DRI test are presented in the Appendix. A summary of the results are summarized below:

Location	Infiltration Results, Inches per Hour (Feet per Day)
DRI-01	4.9

Historical Review of Site

Since the site slopes from the southeast down to the northwest, and buried organics were found in the northwest corner of the site, further evaluation was performed to determine if significant fill had been placed in the northwest corner of the site.



The above excerpt from a 1956 United States Geologic Survey map indicates two creeks converged at the northwest corner of this site.

A 1995 aerial view of the site shows the railroad siding at the north end of the site. On the eastern portion of the picture, a creek that formerly extended to the northwest corner of the site can be seen. East of this site, this creek appears to have been diverted to the north. This would allow the creek that is shown in the 1956 USGS map to have been filled. This is consistent with the soils data found from about 4 to 8 feet in boring B-01, performed in the northwest corner of this site. We have marked the approximate former route of the filled in creek on the 1995 aerial photo shown below.

EVALUATION AND RECOMMENDATIONS

The following evaluation and recommendations are based on the project information provided and the subsurface soil conditions encountered during this geotechnical study.

Soil Evaluation

The SPT soil borings generally encountered sandy soils except at boring B-01. The area where this soil boring was performed may have been filled. Significant roots and cemented sand fragments were found from 4 to 8 feet in this boring. The roots indicate that buried organics are present. These materials can decompose and cause settlement of overlying pavement or structures. Current plans indicate this area will have a building. Further evaluation of soils for potential buildings in this area should be performed to verify these excessively organic soils are not present in building areas. Areas where organics are found can be excavated and backfilled as stated below in our Site Preparation recommendations.

The remaining areas of this site included predominantly sandy soils. Based on our evaluation and analyses, these soils will be capable of supporting the anticipated structural loads on a conventionally designed shallow foundation system after the completion of the following recommended site preparation program.

<u>Site Preparation Recommendations</u>

The existing surficial soils should be prepared, prior to placement of structural fill and foundation construction on the soils, in accordance with the following site preparation recommendations. The recommended procedures should be covered in the project specifications, and completed prior to construction of the foundation system.

1. The construction area should be cleared with any organic soils excavated and removed if found within proposed pavement or building areas. As a minimum, clearing operations should extend at least 5 feet beyond the perimeter of the foundation system. Strippings, debris and organic soils should be properly disposed. Any holes larger than 3 feet in diameter, resulting from the removal of any object, should be ramped to allow compaction of the bottom and sides with mechanical equipment prior to filling.

2. Following the clearing operations, the exposed subgrade should be evaluated and proof-rolled. The proof-rolling should consist of compaction with a large diameter, heavy vibratory drum roller. The vibratory drum roller should have a static drum weight on the order of 20,000 pounds. Careful observations should be made during proof-rolling to help identify any areas of soft yielding soils that may require additional compaction or over-excavation and replacement. If there are sensitive receptors (buildings or personnel) within 100 feet of compaction operations, excessive vibrations may be generated. In that case, consideration should be given to using smaller equipment or reducing vibrations with the compaction equipment. Consideration should also be given to performing vibration monitoring to document vibration levels adjacent to sensitive receptors.

   A minimum of six overlapping passes should be made by the vibratory roller over the building area (including the 5-foot margin beyond the foundation perimeter) and pavement areas, with the successive passes aligned perpendicular. It is recommended that within the building area, the natural ground be compacted to a dry density of at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557) to a minimum depth of 12 inches below the stripped grade. Within parking areas the natural ground should be compacted to a dry density of at least 98 percent of the Modified Proctor maximum dry density (ASTM D-1557) to a minimum depth of 12 inches below the stripped grade. It is recommended that at least one in-place density test be taken for each 2,500 square feet of building area and 5,000 square feet of parking area.

3. During the compaction process, soil moisture contents may need to be controlled in order to facilitate proper compaction. If additional moisture is necessary to achieve compaction objectives of imported structural fill, then water should be applied in such a way that it will not cause erosion or removal of the subgrade soils. In the event that applied water does not penetrate sufficiently deep into natural soils to act as a lubricant in the compaction process, it will be necessary to disk or otherwise break up the soils before and during application of water. Moisture content within two percentage points of the optimum indicated by the modified Proctor test (ASTM D-1557) is recommended prior to compaction of the natural ground and structural fill.

4. After satisfactory completion of the proof-rolling of the exposed subgrade in accordance with the above, the proposed construction area may be brought up to finished subgrade levels, if required. Acceptable structural fill should consist of fine sand (SP) to slightly silty fine sand (SP-SM) or slightly clayey fine sand (SP-SC) with less than 12 percent passing the No. 200 sieve, free of significant rubble, organics, clay balls, debris and other unsuitable material. Any off-site structural fill should be tested and approved prior to acquisition. The structural fill material should be placed in loose lifts not exceeding 12 inches in thickness. Each lift should be compacted by repeated passes with appropriate equipment to achieve a minimum of 95 percent of the Modified Proctor maximum dry density (ASTM D-1557) in the structure areas, while a maximum dry density of 98 percent should be achieved in the pavement areas. Density tests to confirm compaction should be performed in each fill lift before the next lift is placed. The placement of structural fill and compaction operations should continue until the desired elevation is achieved. At least one in-place density test should be taken for each 2,500 square feet of structural fill placed within the building area per lift, while at least one test for 5,000 square feet of parking area per lift.

5. Continuous wall footing trenches and individual footing pits should be excavated to footing line and bottom grade. Bearing soils should be compacted with suitable mechanical equipment to achieve the specified level of density to the required depth. Foundation bottom grade should be tested to confirm that a minimum density of 95 percent of the Modified Proctor maximum dry density (ASTM D-1557) exists to a depth of 12 inches below footing bottom. If necessary, the bottom of the footing excavation shall be over-excavated, refilled, and re-compacted with mechanical equipment to achieve the necessary minimum field density to the required depth. It is recommended that at least one in-place density test be taken per 50 linear foot of continuous wall footing, and at-least one in-place density test be taken in each individual footing pit.

   If groundwater is encountered during construction, dewatering measures should be implemented to adequately lower the groundwater levels to a depth of at least one-foot below footing excavations.

6. Immediately prior to placement of the reinforcing steel, the bearing surfaces of all footing and floor slab areas should be compacted using hand operated mechanical tampers. In this manner, any localized areas that have been loosened by excavation operations should be adequately re-compacted.

Foundation Recommendations

Following the preparation of the subgrade soils as described above, the shallow foundations may be proportioned for a maximum net allowable soil bearing pressure of 3,000 pounds per square foot for individual and continuous footings.

Continuous footings should be a minimum of 18 inches wide, while pad or column footings should be a minimum of 24 inches wide. The minimum footing sizes should be used regardless of whether the allowable bearing pressures are fully developed. These minimum footing sizes are intended to provide adequate bearing area to develop bearing capacity and account for minor variations in the bearing materials. It is important that the structural elements be centered on the footings such that the load is transferred evenly, in accordance with Florida Building Code requirements, unless the footings are proportioned for eccentric loads.

We recommend embedding all footings so that the bottom of each foundation is a minimum of 18 inches below adjacent compacted grades for the exterior of the structure. This embedment is recommended to reduce the potential that exterior foundations are undermined by adjacent excavations. Interior foundations may bear at 12 inches below grade, if desired. In addition, all footings should be constructed in a "dry" fashion; the building grades should be selected so that normal seasonal high groundwater levels remain at least one foot below footing bases.

Settlement

For wall and column loads not exceeding 6.5 kips/linear ft and 120 kips, respectively, we estimate that a total settlement of less than one inch will occur, with an estimated differential settlement of one-half inch. This degree of settlement is based upon a foundation bearing pressure of 3,000 psf, and assumes the site is prepared in accordance with the above recommendations.

Floor Slab Recommendations

The floor slab may be safely supported as a slab-on-grade provided any undesirable materials are removed and replaced with controlled structural fill as specified above. In this regard, it is recommended that all ground floor slabs be "floating", that is, generally ground supported and not rigidly connected to walls or foundations. This is to minimize the possibility of cracking and displacement of the floor slabs because of differential movements between the slab and the foundation.

It is also recommended that in areas where floor finishes will be used, the floor slab bearing soils should be covered by a lapped polyethylene sheeting in order to reduce the potential for floor dampness which can affect the performance of glued tile and carpet. This membrane should consist of a minimum 6-mil single layer of non-corroding, non-deteriorating sheeting material placed to minimize seams and to cover all of the soil below the building floor. This membrane should be cut in cross shape for pipes or other penetrations; the membrane should extend to within one-half inch of all pipes or other penetrations. All seams of the membrane should be lapped at least 12 inches. Punctures or tears in the membrane should be repaired with the same or compatible material.

Pavement Design Considerations

The following pavement design guidelines are based on the favorable performance of asphalt pavements at other projects under similar service conditions. The near surface soils appear favorable for a conventional asphalt pavement system. For the planned parking areas, we recommend the following pavement section:

Layer	**Minimum Thickness**
Asphaltic Concrete (SP-9.5)	1.5 inches
Limerock, Crushed Concrete or Soil Cement base course compacted to at least 98% of the Modified Proctor (ASTM D-1557) to yield a min. LBR = 100	6 inches
Sub-base compacted to at least 98% of the Modified Proctor (ASTM D-1557) to yield a min. LBR = 40	12 inches

If the site soils do not yield an LBR value of 40, they should be stabilized to obtain a minimum LBR value of 40. In the areas receiving high traffic loads from delivery trucks and trash collection, we recommend increasing the asphaltic concrete thickness to a minimum of 2 inches and the base course to 8 inches. A minimum of 24 inches should be maintained between the bottom of the base course and the normal seasonal high water level. Due to the anticipated seasonal high water levels, we recommend utilizing crushed concrete or soil cement base course, unless an underdrain system is utilized. Crush concrete and soil cement are more resistant to deterioration under intermittent wet conditions than limerock. A minimum of 12 inches should be maintained between the bottom of the crushed concrete or soil cement base course and the normal seasonal high water level.

It is important to note that no Limerock Bearing Ratio (LBR) tests were requested or performed during this subsurface exploration program. It is recommended that during the pavement design phase, LBR testing be performed on the natural subgrade materials and/or the proposed structural fill materials, as appropriate.

The pavement recommendations are considered minimum for the site soils and limited traffic conditions expected. However, the final pavement thickness design should be determined by the project civil engineer using the information obtained during this geotechnical study and actual anticipated traffic conditions.

Stormwater Facility Geotechnical Design Parameters

Stormwater pond design parameters for this site are provided below.

Parameter	Recommended Value
Double Ring Infiltration Rate	4.9 inches per hour (9.8 feet per day)
Depth to Seasonal High Water Level, Feet	2 to 4 feet
Depth to Initial Confining Formation, Feet	4 to 22 feet
Porosity	0.2 to 0.3

The appropriate factor of safety should be applied to the infiltration rates provided in this report.

Field Observations

Site preparation operations, including preparation of foundation bearing surfaces and compaction of any structural fill, should be observed by an **Ardaman & Associates** geotechnical engineer or his representative. Observations by our representative are necessary to verify that subsurface conditions, which are revealed during the site preparation operations, are consistent with those found during this geotechnical study, to confirm that the foundation design is being constructed as indicated in the approved construction documents, and to confirm that the earthwork procedures are completed in accordance with the recommendations contained in this report.

CLOSURE

The preliminary recommendations provided above are based in part on project information provided to us, and they only apply to this specific project and site. If any of the project information is incorrect or if additional information becomes available, the correct or additional data should be conveyed to us for review. As project plans develop, we anticipate additional soil borings, site testing and geotechnical engineering analysis will be required.

We appreciate the opportunity to be of service to The Richman Group of Florida, Inc. on this important project. Should you have any questions in regards to this report, or if we can be of any further assistance, please contact this office. We also have great interest in providing materials testing and inspection services during the construction of this project, and will be pleased to meet with you at your convenience to discuss these engineering services.

Very truly yours,

ARDAMAN & ASSOCIATES, INC.

Maria M. Chess
Assistant Project Engineer

Martin E. Millburg, P.E.
Senior Geotechnical Engineer
Florida License No. 36584

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Appendix: Figure 1 - Test Location Plan
Figure 2 - Soil Boring Profiles
Double Ring Infiltration Test Results
Field Testing Procedures

Distribution: 2 – Addressee
1 – File

MARTIN E. MILLBURG
LICENSE
No. 36584
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

Digitally signed by: Martin E Millburg
DN: CN = Martin E Millburg email = mmillburg@ardaman.com C = US O = Ardaman & Associates Inc OU = Geotechnical Engineering Department
Date: 2017.06.26 16:15:17 -05'00'

APPENDIX

REFERENCE: GOOGLE EARTH PRO 2017

LEGEND

APPROXIMATE LOCATION OF SPT BORING

0 50 100

APPROXIMATE SCALE: 1"=100'

TEST LOCATION PLAN

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

RICHMAN GROUP
TRASK SITE
TRASK STREET AND MCCOY STREET
TAMPA, FLORIDA

DRAWN BY: ajd	CHECKED BY: MEM	DATE: 6/26/17
FILE NO. 17-55-9581B	APPROVED BY: WAS	FIGURE: 1

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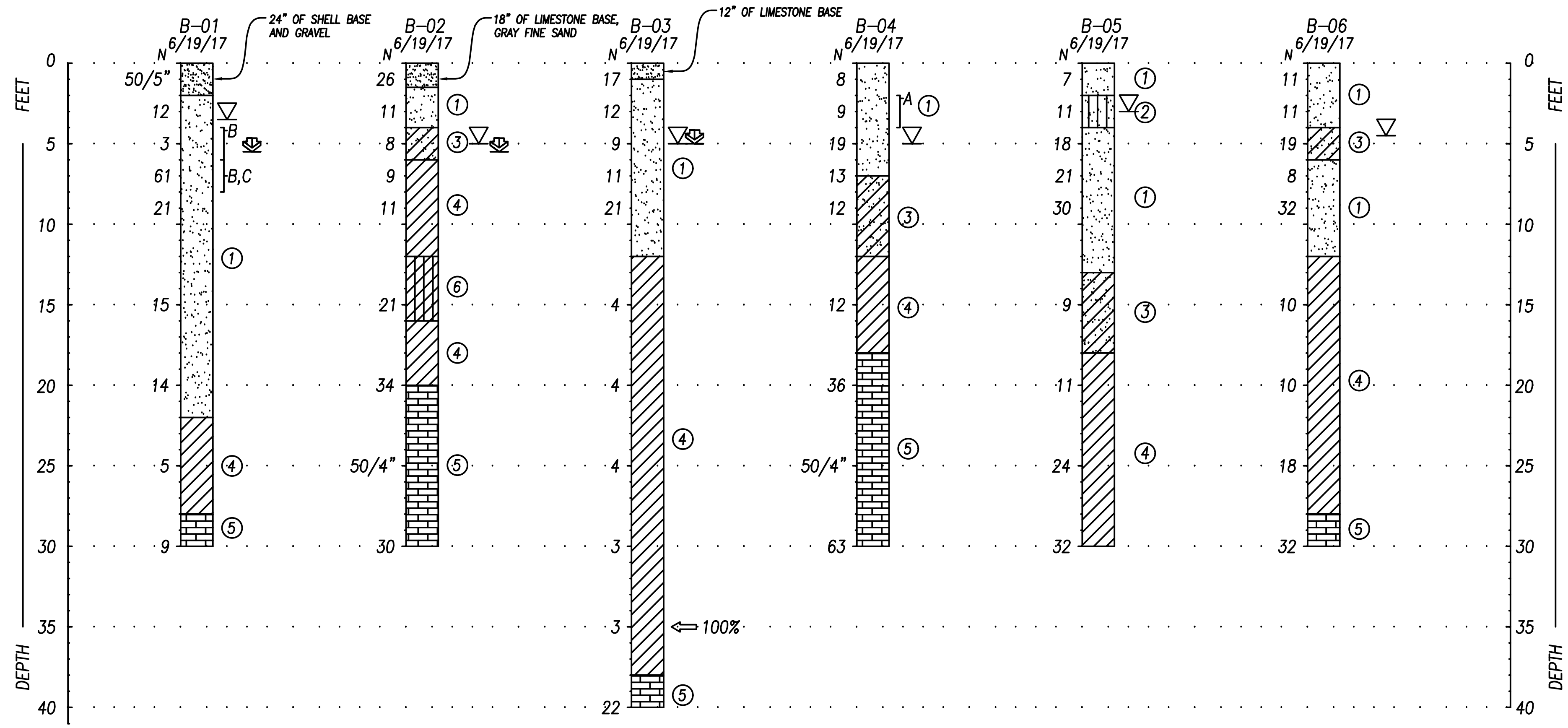


LEGEND

- ① GRAY TO BROWN SLIGHTLY SILTY FINE SAND (SP/SP-SM)
- ② DARK BROWN SILTY FINE SAND (SM)
- ③ GRAY TO GRAY-GREEN CLAYEY FINE SAND (SC)
- ④ BROWN, GRAY AND GRAY-GREEN FINE SANDY CLAY (CL/CH)
- ⑤ LIGHT GRAY CLAYEY WEATHERED LIMESTONE
- ⑥ LIGHT GREEN CLAYEY SILTY TO SILTY CLAY (ML/CL)

A WITH FINE ROOTS
B TREE ROOTS, WOOD
C CEMENTED FRAGMENTS, MAJOR ROOTS

HAMMER TYPE: SAFETY
RIG TYPE: D-25
DRILLED BY: (A & S) M. ABARE

(SP) UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) SYMBOL
▽ GROUNDWATER LEVEL MEASURED ON DATE DRILLED
WATER LEVEL MEASURED AT TERMINATION OF BORING
N SPT N-VALUE IN BLOWS PER FOOT
50/2" 50 BLOWS PER 2 INCHES OF SAMPLER PENETRATION
⇦ LOSS OF DRILLING FLUID CIRCULATION (%)

SOIL BORING PROFILES

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

RICHMAN GROUP
TRASK SITE
TRASK STREET AND MCCOY STREET
TAMPA, FLORIDA

DRAWN BY: ajd	CHECKED BY: MEM	DATE: 6/26/17
FILE NO. 17-55-9581B	APPROVED BY: WAS	FIGURE: 2

ARDAMAN & ASSOCIATES, INC.
Geotechnical, Environmental and Materials Consultants

DOUBLE-RING INFILTRATION TEST RESULTS

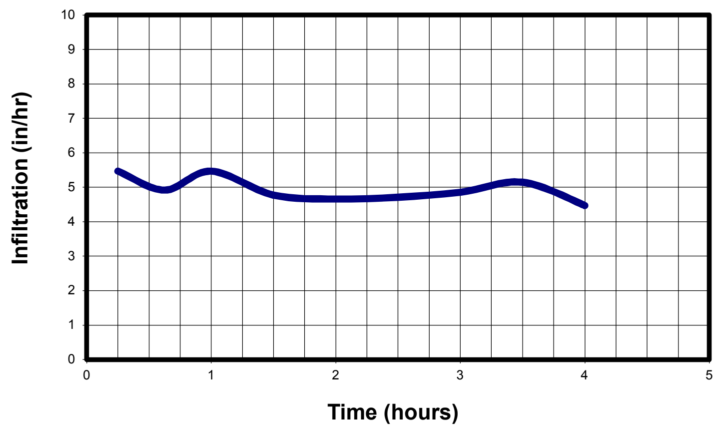
(ASTM STANDARD D-3385)

Project Name:	**Richman Group- Trask Site**	**Test Date:**	**6/16/2017**
Project Location:	**Tampa, Florida**	**Test Location:**	**DRI-01 (see plan)**
Project Number:	**17-55-9581B**	**Test Depth:**	**3" below existing ground surface**
Outer Ring Diameter:	**24-inches**	**Test Duration:**	**4 hours**
Inner Ring Diameter:	**12-inches**	**Test Head:**	**4 inches**

INFILTRATION RATE: 4.9 inches per hour

Time Increment (minutes)	Infiltration per Time Period (in)
15	1.4
15	1.2
15	1.2
15	1.4
30	2.4
30	2.3
30	2.4
30	2.4
30	2.6

INFILTRATION RATE



SUBSURFACE SOIL DATA

Depth (ft.) From	To	BORING DATA
0	0.8	Brown fine sand (SP) (topsoil)
0.8	4.2	Light to Dark Gray to Brown Fine Sand to Slightly Silty Fine Sand (SP/SP-SM)

Groundwater level encountered at a depth of 3.5 feet below the existing ground surface at time of test.

SOIL SURVEY OF HILLSBOROUGH COUNTY DATA

Soil ID & Soil Name	Hydrologic Group	SHWL (inches bls)	Drainage	Soil Location
Wabasso- Urban Land Complex	C/D	6 to 18	Poorly drained	Drainageways on marine terraces

TEST PROCEDURES:

The double-ring infiltration test was performed in general accordance with procedures outlined in the ASTM Standard D-3385. Two 18-inch tall concentric rings were placed on a prepared test surface and driven into the ground 4 to 6 inches. The inner ring used in the test had an inside diameter of approximately 12 inches, while the outer ring had an inside diameter of approximately 24 inches. The test was performed by filling both rings with water to a height of 6 inches. A head of 6 inches was then maintained in both rings, and the amount of water required to maintain the head in the inner ring was recorded.

FIELD TESTING PROCEDURES

Prior to initiating the field activities, the Sunshine State One-Call of Florida, Inc. Call Center (Call Sunshine) was notified of our intent to perform soil test boring, utilizing a drill rig. The location, date, and other operation particulars were provided to allow participating utility companies the opportunity to mark the location of their buried lines, prior to our field activities. No conflicts with underground utilities were encountered at the boring locations.

STANDARD PENETRATION TEST

The Standard Penetration Test is a widely accepted method of in-situ testing of foundation soils (ASTM D 1586). A 2-foot long, 2-inch outside diameter (1-3/8-inch inside diameter), split-barrel ("spoon") sampler, attached to the end of drilling rods, is driven 18 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each six inches of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch increments of penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual examination and classification of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load. The N-value is considered to be indicative of the relative density of cohesionless soils and the consistency of cohesive soils.

The tests are usually performed at 5-foot intervals. However, more frequent or continuous testing is done by our firm through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. Usually, the circulating fluid, which is a bentonite drilling mud, also serves to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or to prevent the loss of circulating fluid.

Representative split-spoon samples from soils at every 5 feet of drilled depth and from different stratum are brought to our laboratory in airtight jars for further evaluation and testing, if necessary. Samples not used in testing are stored for at least 60 days prior to being discarded. After completion of a test boring, the hole is kept open until a steady state ground water level is recorded. The hole is then sealed if necessary, and backfilled.

DOUBLE-RING INFILTRATION (DRI) TEST

The double-ring infiltration test was performed in general accordance with procedures outlined in ASTM Standard D-3385. Two 18-inch high concentric rings were placed on a prepared test surface and driven into the ground to the specified depth. The inner ring used in the test had an inside diameter of approximately 12 inches. The outer ring was approximately 24 inches in diameter. The test was performed by filling both rings with water to a depth of 12 inches. The 3 to 6-inch head was maintained in both rings and the amount of water required to maintain the head in the inner ring was recorded. The test location, depth of test, and test results are included with this report.

Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

July 10, 2107
File No.: 17-55-9581B
Report #02

The Richman Group of Florida, Inc.
477 South Rosemary Avenue, Suite 301
West Palm Beach, Florida 33401

Attention: Mr. Jesse Woeppel

Subject: **Supplemental Geotechnical Engineering Services - Interim Report**
Site at Trask and McCoy
Tampa, Florida

Dear Mr. Woeppel:

Soil Evaluation

The zone of compressible soils from about 2 to 7 feet deep in 6 of 8 CPT soundings. The area of CPTs 104, 106 and 108 included the most compressible soils. Settlement as a result of these soils is expected to be in excess of 1 to 2 inches. This degree of settlement is higher than typically considered tolerable. Compaction of these materials will be relatively difficult to achieve due to their clayey nature and the ability of the overlying gravel to absorb compactor loads such that little if any compaction effort reaches this compressible soil layer. We recommend the compressible soils in this area be removed and replaced compacted Structural Fill as described below. Effective compaction of backfilled soils will not be able to be achieved unless groundwater levels are lowered 2 feet below the surface being compacted. With an estimated seasonal high water level of 2 to 4 feet deep, groundwater levels may need to be lowered about 5 feet or more.

We think removal of unsuitable soils and replacement with compacted structural fill as described above will be required for most of the building where CPT-103 through CPT-108 were performed. We recommend excavation start in the area of CPT-104, 106 and 108 and work east and west until the entire building area plus at least 5 feet beyond the perimeter has been treated or until the soils within this zone are found to be acceptable for support this proposed 4 story building.

The data currently indicates the building where CPT-01 was performed does not need to have soil excavation and replacement as described above. We recommend the north end of the building area south of CPT-105 be evaluated to determine if unsuitable soils are present. Additional soil borings/cone soundings in building areas is recommended as no soil borings were performed within the footprint of 2 of the 6 buildings proposed for this site.

Site Preparation Recommendations

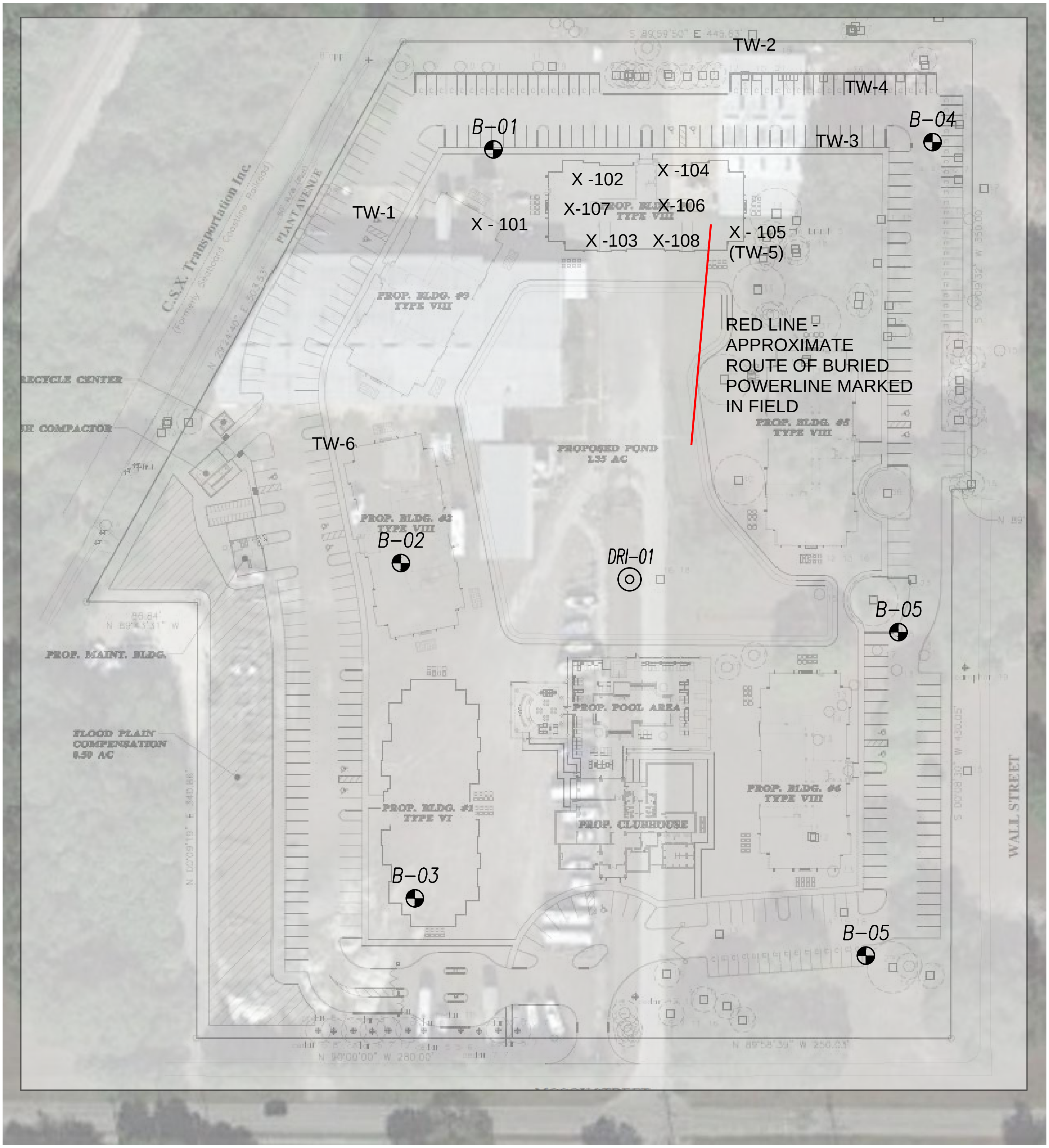
The existing surficial soils should be prepared, prior to placement of structural fill and foundation construction on the soils, in accordance with the following site preparation recommendations. The recommended procedures should be covered in the project specifications, and completed prior to construction of the foundation system.

1. The proposed building area where CPT-103 through CPT-108 were performed should have the compressible soils found about 2 to 7 feet deep removed and replaced with compacted structural backfill. To facilitate effective compaction of backfilled soils, groundwater will need to lowered to a maximum height at least 2 feet below the ground surface being compacted. Since groundwater is estimated to be at a season high depth ranging from 2 to 4 feet at this, we estimate groundwater will need to be lowered about 5 feet or more. The building area area should be cleared with any clayey compressible soils previously identified excavated and removed if found within proposed building areas. As a minimum, clearing operations should extend at least 5 feet beyond the perimeter of the foundation system. Strippings, debris and organic soils should be properly disposed.

2. Acceptable structural fill should consist of fine sand (SP) to slightly silty fine sand (SP-SM) or slightly clayey fine sand (SP-SC) with less than 12 percent passing the No. 200 sieve, free of significant rubble, organics, clay balls, debris and other unsuitable material. Any off-site structural fill should be tested and approved prior to acquisition. The structural fill material should be placed in loose lifts not exceeding 12 inches in thickness. Each lift should be compacted by repeated passes with appropriate equipment to achieve a minimum of 95 percent of the Modified Proctor maximum dry density (ASTM D-1557) in the structure areas, while a maximum dry density of 98 percent should be achieved in the pavement areas. Density tests to confirm compaction should be performed in each fill lift before the next lift is placed. The placement of structural fill and compaction operations should continue until the desired elevation is achieved. At least one in-place density test should be taken for each 2,500 square feet of structural fill placed within the building area per lift.

3. If desired, FDOT No. 57 or 67 rock may be used as backfill. This material can be placed without dewatering. However, voids will remain present within this material such that overlying sands can migrate down possibly causing subsidence of these overlying sandy soils. If coarse aggegate fill such as No. 57 or 67 rock is placed, a separation geotextile such as a Mirafi 140N should be placed on top of the coarse aggregate to prevent sand migration down into the rock.

4. After removal of the compressible soil and backfilling with as described above, the site preparation, foundation, pavement and other recommendations presented in our previous report should be implemented.



REFERENCE: GOOGLE EARTH PRO 2017

LEGEND

APPROXIMATE LOCATION OF SPT BORING

0 50 100

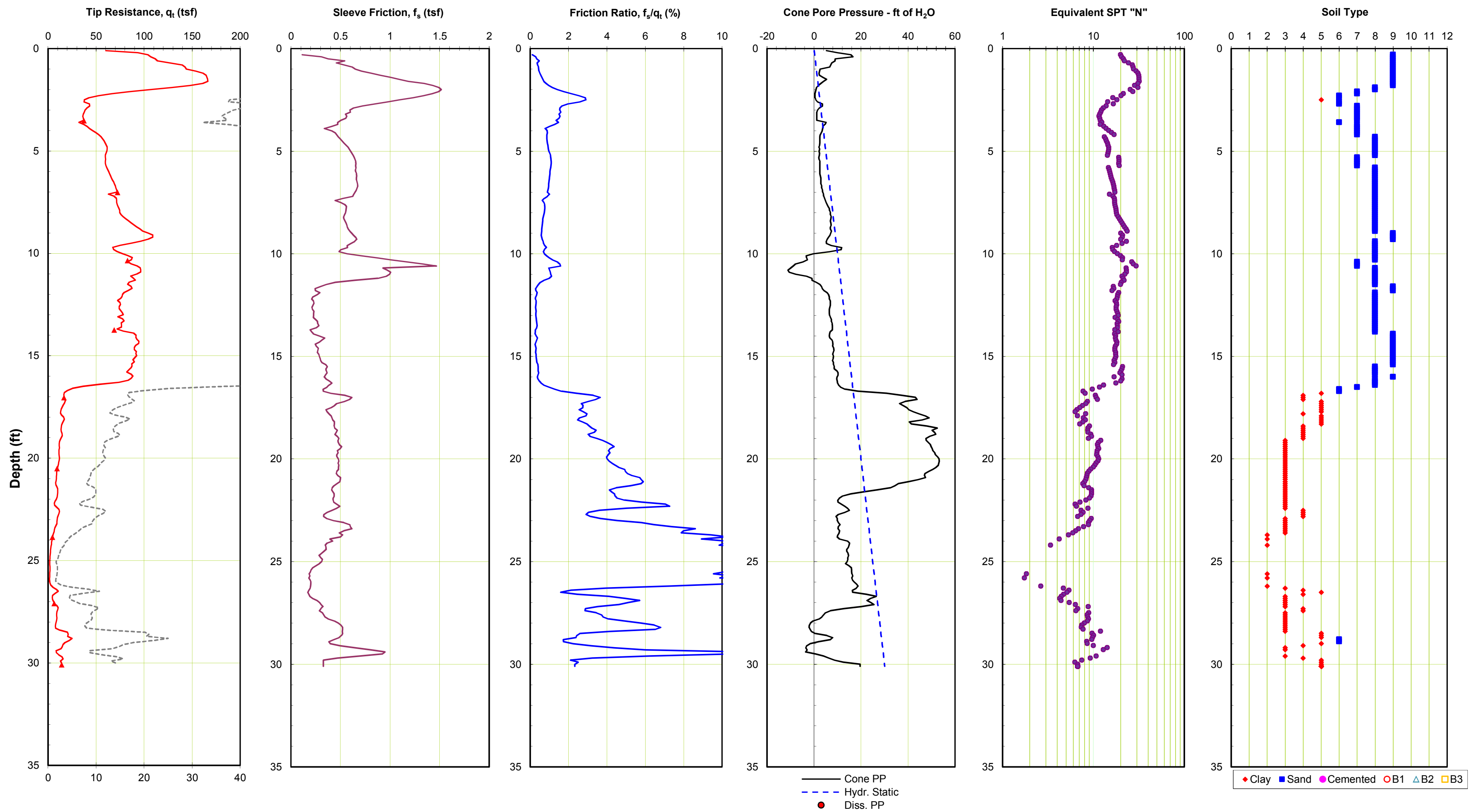
APPROXIMATE SCALE: 1"=100'

TEST LOCATION PLAN

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

RICHMAN GROUP
TRASK SITE
TRASK STREET AND MCCOY STREET
TAMPA, FLORIDA

DRAWN BY:	CHECKED BY:	DATE:
ajd	MEM	6/26/17
FILE NO. 17-55-9581B	APPROVED BY: WAS	FIGURE: 1



Soil I.D. #	Soil Description
1	Sensitive Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay
6	Sandy Silt to Clayey Silt

Soil I.D. #	Soil Description
7	Silty Sand to Sandy Silt
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained (OC Clay)
12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-101

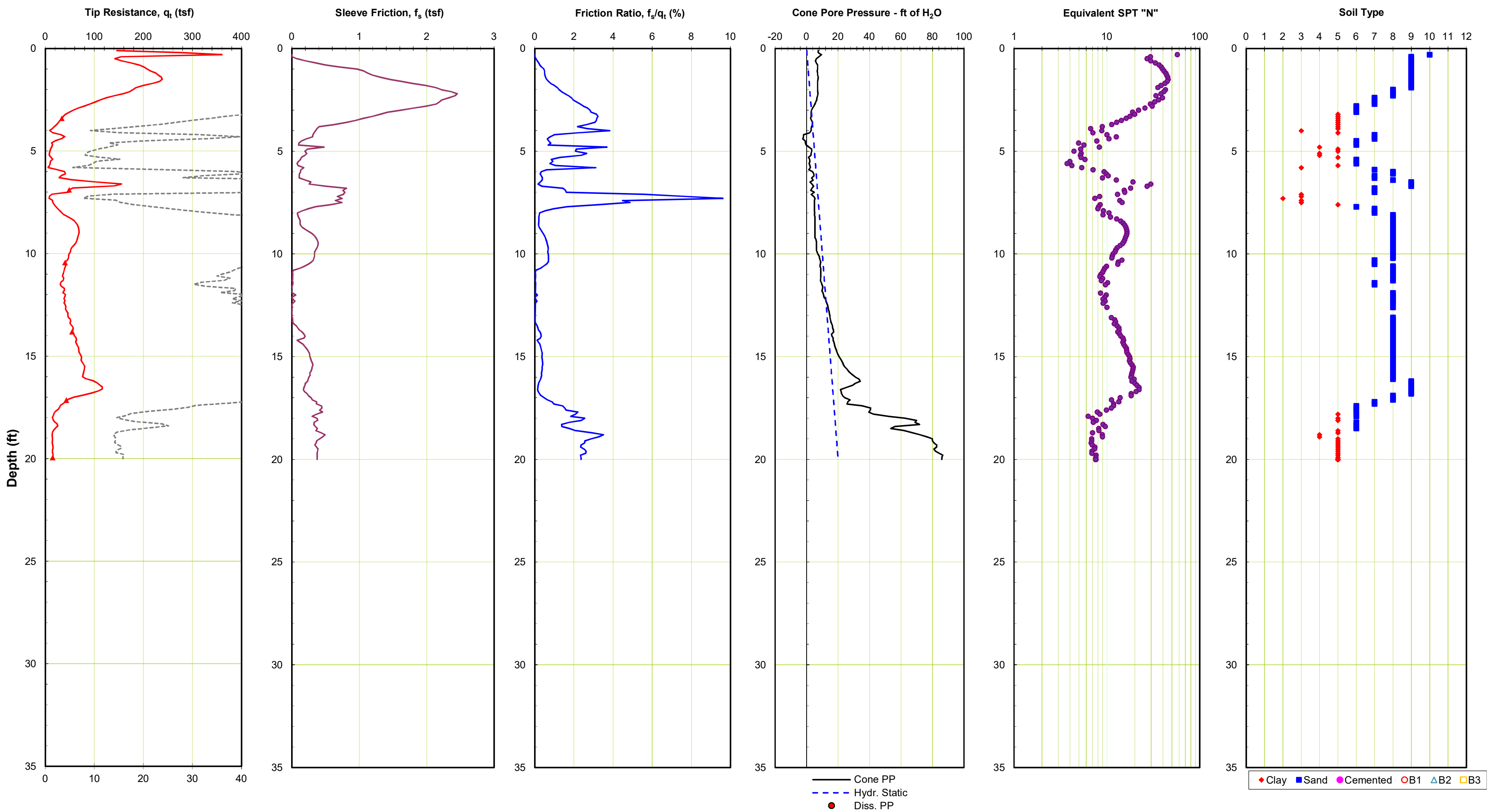
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description	Soil I.D. #	Soil Description
1	Sensitive Fine Grained	7	Silty Sand to Sandy Silt
2	Organic Material	8	Sand to Silty Sand
3	Clay	9	Sand
4	Silty Clay to Clay	10	Gravelly Sand to Sand
5	Clayey Silt to Silty Clay	11	Very Stiff Fine Grained (OC Clay)
6	Sandy Silt to Clayey Silt	12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-103

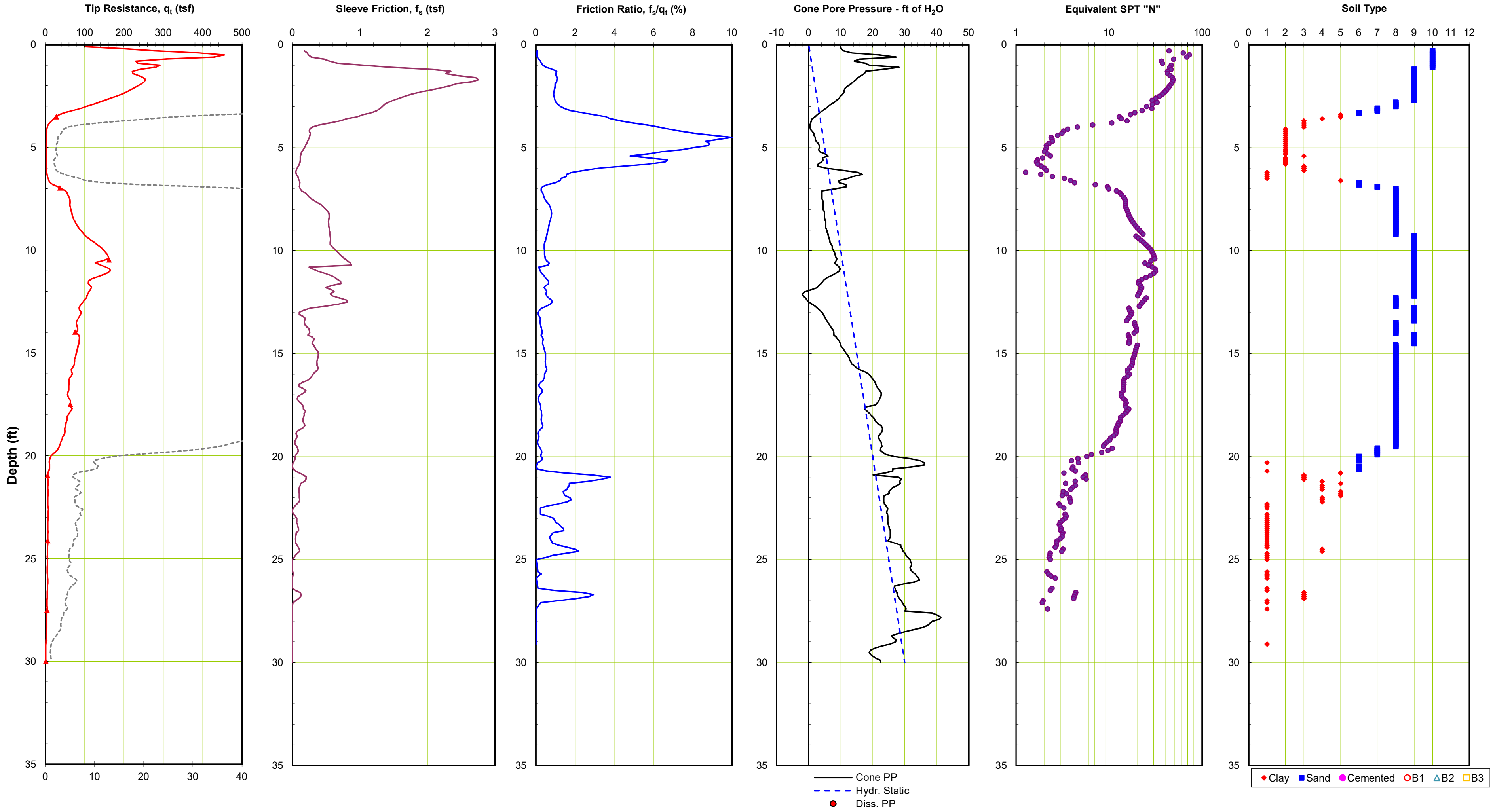
Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017



Soil I.D. #	Soil Description
1	Sensitive Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay
6	Sandy Silt to Clayey Silt

Soil I.D. #	Soil Description
7	Silty Sand to Sandy Silt
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained (OC Clay)
12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-104

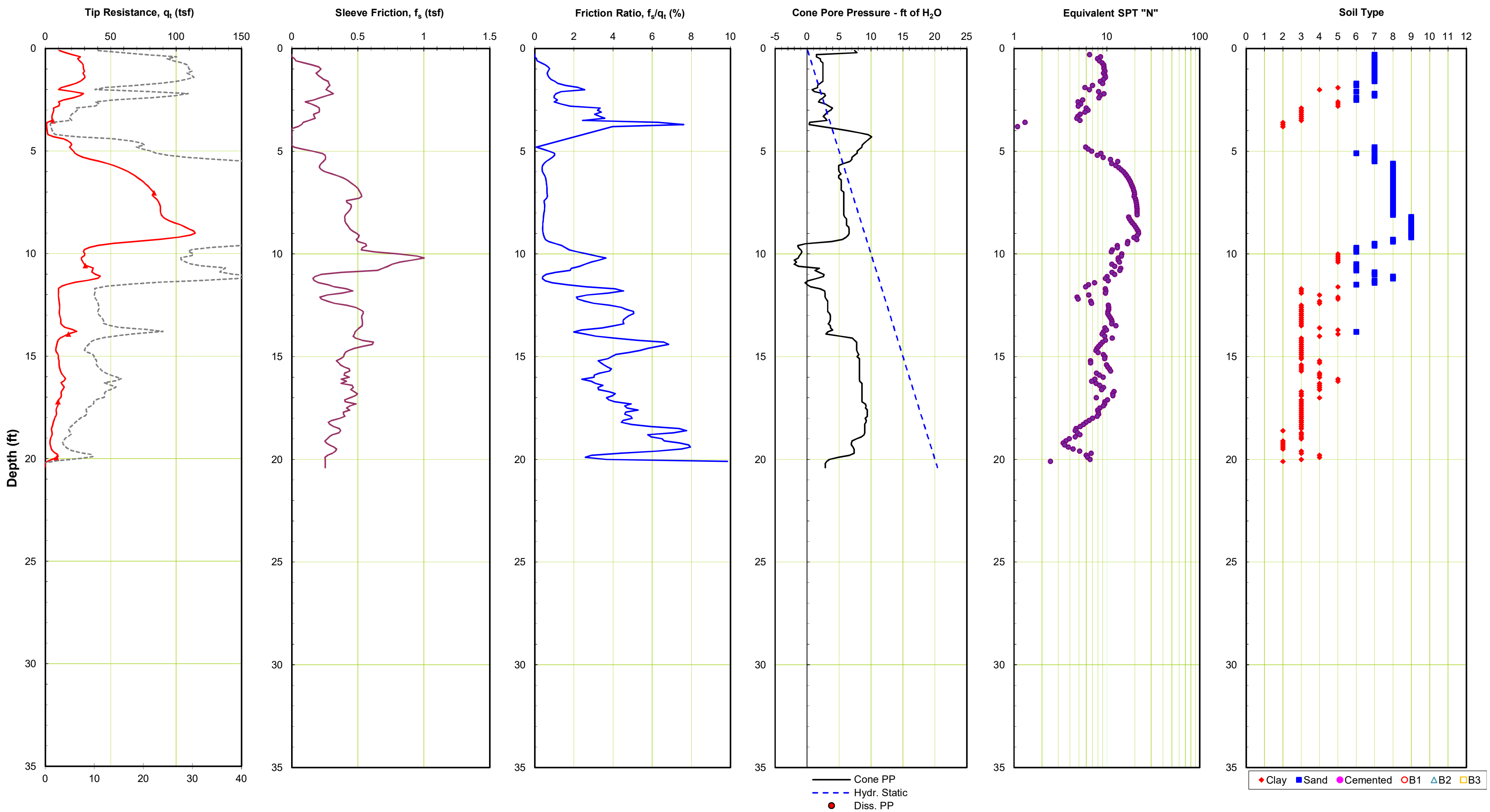
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description	Soil I.D. #	Soil Description
1	Sensitive Fine Grained	7	Silty Sand to Sandy Silt
2	Organic Material	8	Sand to Silty Sand
3	Clay	9	Sand
4	Silty Clay to Clay	10	Gravelly Sand to Sand
5	Clayey Silt to Silty Clay	11	Very Stiff Fine Grained (OC Clay)
6	Sandy Silt to Clayey Silt	12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-105

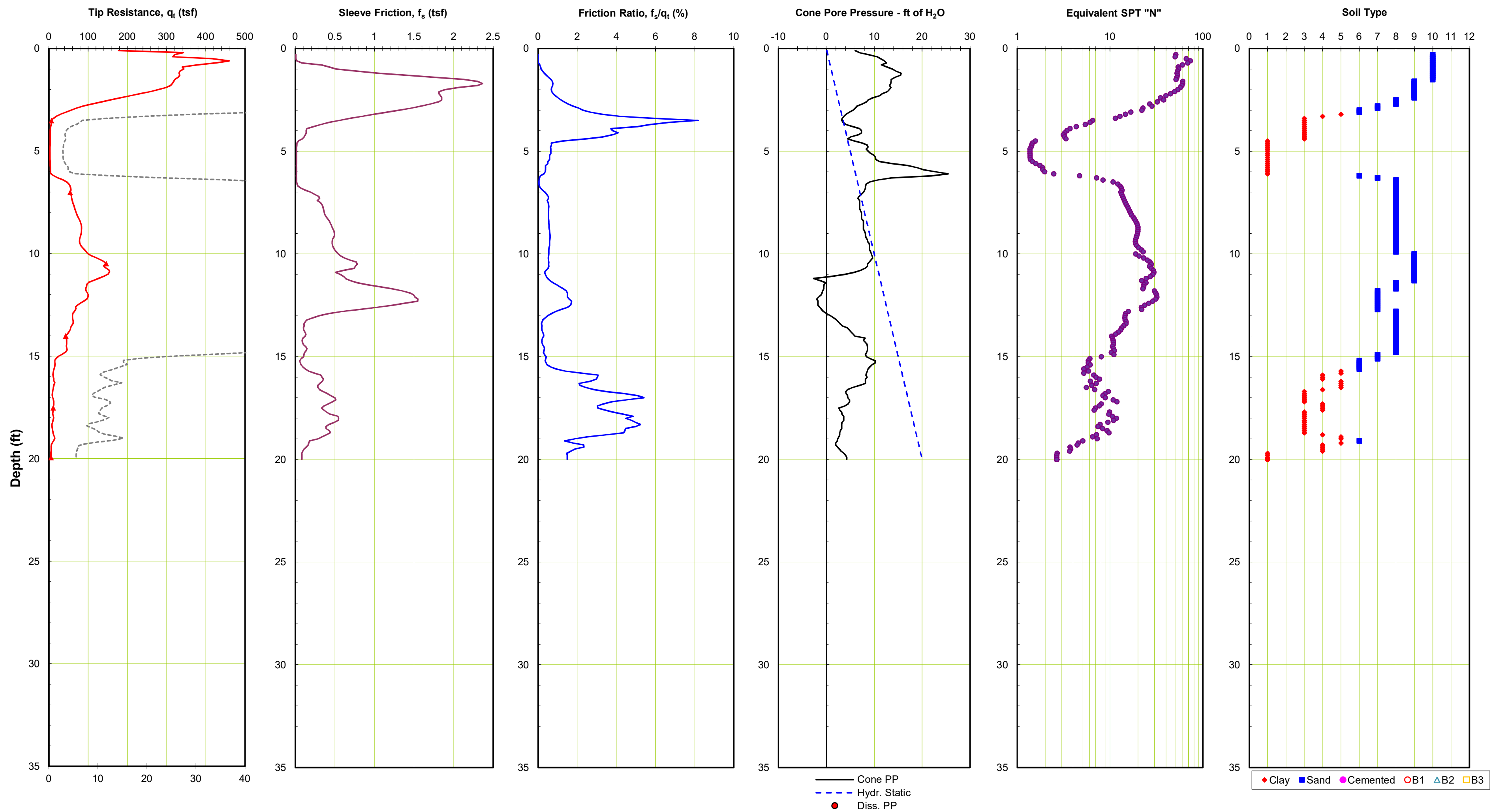
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description
1	Sensitive Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay
6	Sandy Silt to Clayey Silt

Soil I.D. #	Soil Description
7	Silty Sand to Sandy Silt
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained (OC Clay)
12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-106

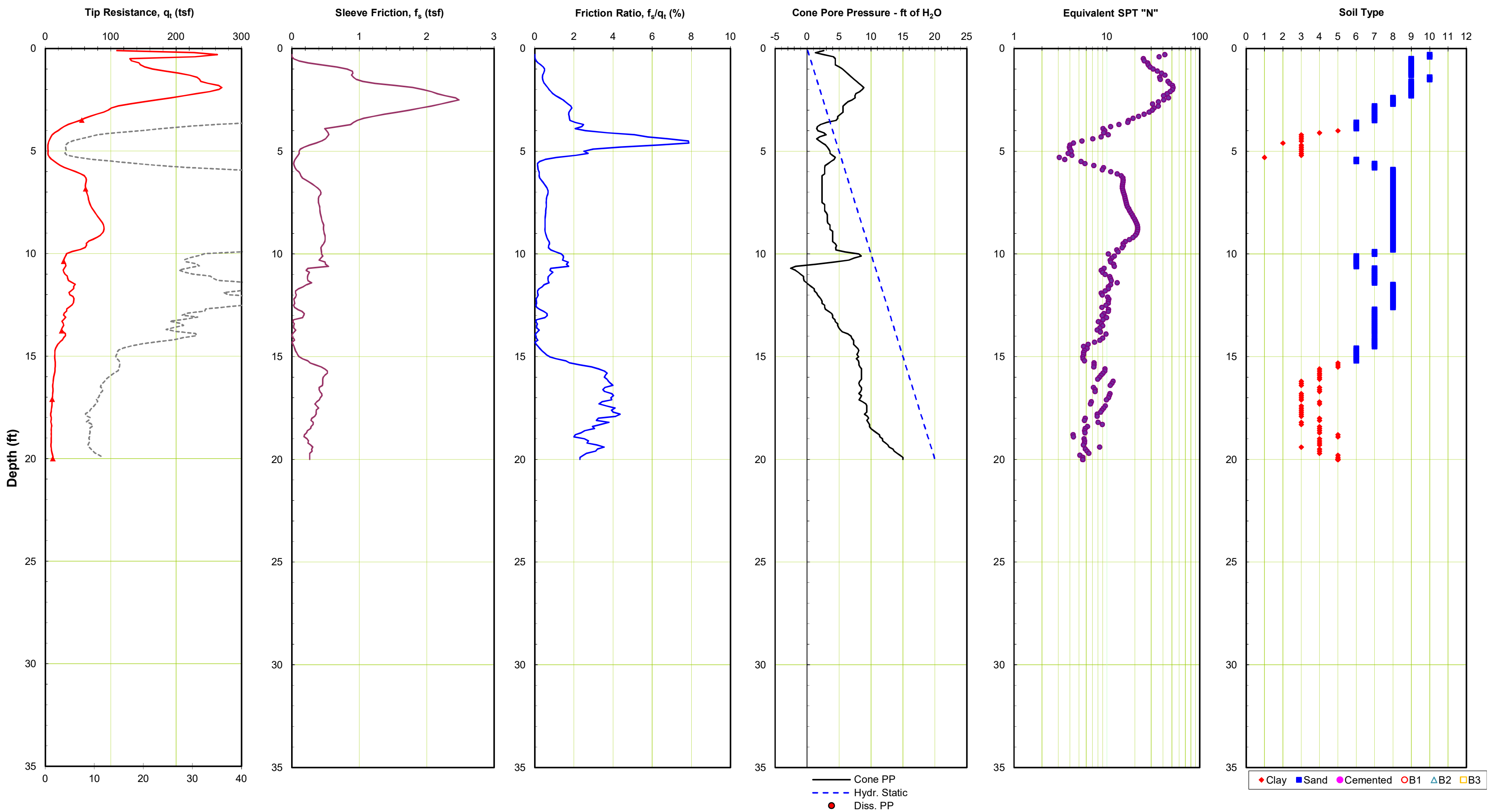
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description
1	Sensitive Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay
6	Sandy Silt to Clayey Silt

Soil I.D. #	Soil Description
7	Silty Sand to Sandy Silt
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained (OC Clay)
12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-107

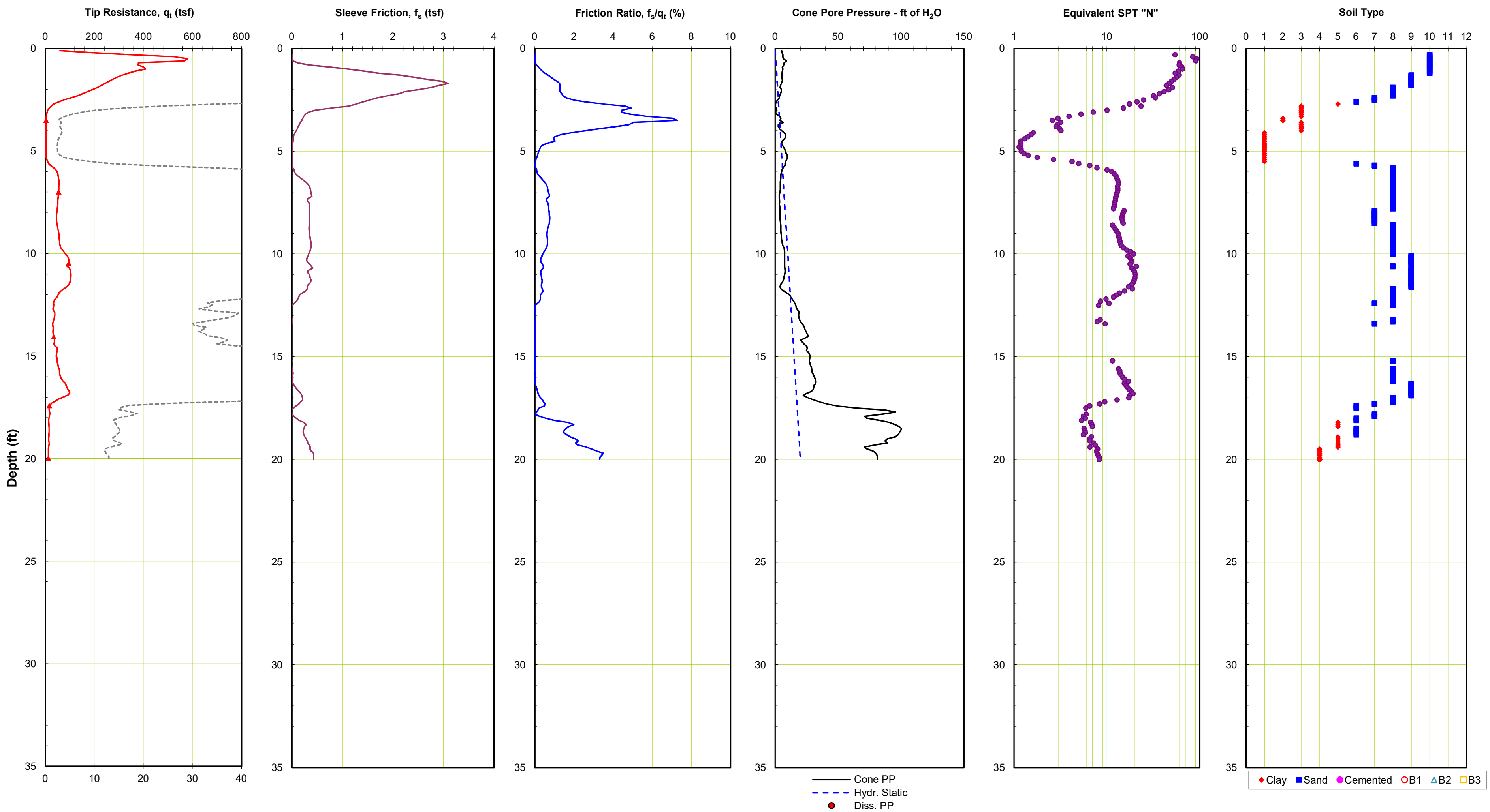
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description	Soil I.D. #	Soil Description
1	Sensitive Fine Grained	7	Silty Sand to Sandy Silt
2	Organic Material	8	Sand to Silty Sand
3	Clay	9	Sand
4	Silty Clay to Clay	10	Gravelly Sand to Sand
5	Clayey Silt to Silty Clay	11	Very Stiff Fine Grained (OC Clay)
6	Sandy Silt to Clayey Silt	12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-108

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented

Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

July 18, 2107
File No.: 17-55-9581B
Report #03

The Richman Group of Florida, Inc.
477 South Rosemary Avenue, Suite 301
West Palm Beach, Florida 33401

Attention: Mr. Jesse Woeppel

Subject: **Supplemental Geotechnical Engineering Services Report**
Site at Trask and McCoy
Tampa, Florida

Dear Mr. Woeppel:

Ardaman & Associates, Inc. is pleased to submit this report presenting the results of our supplemental subsurface soil exploration program for the above referenced project. Our services were provided in general accordance with those outlined in our Proposal No. 17-p177 Supplemental, dated July 10, 2017, and authorized by Mr. Jesse Woeppel of The Richman Group, with the signing of our Proposal/Project Acceptance form on July 11, 2017.

This Report of Geotechnical Engineering Services was prepared for the exclusive use of **The Richman Group of Florida, Inc**. and their consultants. The conclusions and recommendations made herein are applicable only to those structures and facilities described herein. This geotechnical study was performed in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

PROJECT INFORMATION

Ardaman previously issued the result of our Preliminary Site Geotechnical Evaluation on June 26, 2017. The results of that study found predominantly sandy soils capable of supporting the anticipated project loads with settlements typically within tolerable limits. However, organic soils believed to be associated with a former creek that traversed the north end of the site were found from 4 to 8 feet deep in boring B-01. These soils are compressible and could result in future settlement in building and pavement areas.

Because pavement does not impose significant additional loads upon soils and pavement can be more readily repaired, the presence of these compressible soils was not a significant concern in proposed pavement areas. However, since the proposed buildings will impose significant stresses on this soil zone, and excessive settlement of the proposed 4 story buildings is not acceptable, we recommended further study to evaluate the extent of these soils within proposed buildings areas at the north end of the site.

Design loads listed below were used to estimate settlement of the proposed buildings:

Wall Load:	6.5 kips/linear ft
Column Load:	120 kips

It is assumed that less than 3.0 feet of fill will be required to achieve finished floor elevations.

FIELD EXPLORATION

Sounding Locations

The proposed sounding locations and depths were selected by our office. The actual sounding locations were established in the field by Ardaman & Associates representatives referencing landmarks identified on aerial photos and near structures. The approximate sounding locations are shown on the Test Location Plan (see Figure 1). The sounding locations should be considered accurate only to the degree implied by the method used. Ardaman staked the sounding locations as we understand a surveyor will determine their locations. It is important to note that ground surface elevations at the sounding locations were neither furnished nor determined.

Piezo-Cone Penetrometer Test

Thirteen (13) Piezo-Cone Penetrometer Test (CPTu) penetrations (CPT-101 through CPT-113) were performed for the north end of this project. Cone exploration techniques were selected in order to improve the quality and continuity of data for evaluation of subsurface conditions. CPT soundings do not obtain soil samples, nor are they able to penetrate very hard layers such as rock. The depths of the CPT soundings ranged from 20 to 31 feet. CPT testing was performed in general accordance with the procedures outlined in ASTM Standard D-5778. The general procedures for performing the CPT penetrations are summarized in Appendix B of this report.

SUBSURFACE CONDITIONS

The delineation of the vertical extent of individual soil strata, the identification of pertinent soil engineering properties, where applicable, and a description of each geologic layer discovered in the course of this geotechnical study, is illustrated on the CPT sounding profiles presented in the Appendix of this report. The CPT sounding profiles are based upon the data obtained during CPT testing. The recommendations contained in this report are based on the contents of the CPT soundings and the data from our previous study performed at this site. While the soundings are representative of subsurface conditions at their respective locations and vertical reaches, local variations which are characteristic of the subsurface materials of the region, or which may be due to man-made alteration of the native geologic conditions, may be encountered.

Except for CPT-105 and CPT-111 through CPT-113 which were performed in an unpaved areas, a layer of compacted gravel 2 to 3 feet thick was present at all test locations. A summary of the findings at each CPT sounding is presented below:

CPT Sounding No.	Summary	CPT Sounding No.	Summary
101	No Muck	108	Muck 2.5'- 6'
102	Muck 4'– 6'	109	Moderate Muck 7.5'- 9'
103	Moderate Muck 3'- 7.5'	110	Muck 3'- 5'
104	Muck 3.5'- 7'	111	No Muck
105	Moderate Muck 3'- 4.5'	112	Moderate Muck 2.5'- 3.5'
106	Muck 3'- 6.5'	113	No Muck
107	Muck 4'- 5.5'		

We interpreted the very soft soils found in the upper 10 feet in 9 of the 12 soundings to be muck, based upon the organic material recovered from SPT boring B-01 at that depth. In addition, the soundings with the highest muck concentrations had soil types 1 and 2, which is consistent with muck and organic soils. Except for the muck zones, sandy soils were present to a depth ranging from 10 to 20 feet. Clayey soils were then encountered below these upper sandy soils to the termination depth of the borings at 20 to 30 feet below the existing ground surface (bgs).

Tip resistance qt values range from about 50 to 100 tons per square foot (tsf) within these sandy soils indicating medium dense sands. A clay layer was then found to the termination depth of the soundings ranging from 20 to 30 feet bgs. Tip resistance qt values in the clay were typically lower, within a range of 10 to 20 tsf, indicating soft clay.

EVALUATION AND RECOMMENDATIONS

The following evaluation and recommendations are based on the project information provided and the subsurface soil conditions encountered during this geotechnical study.

Soil Evaluation

Settlement as a result of these soils is expected to be in excess of 1 to 2 inches. This degree of settlement is higher than typically considered tolerable. Compaction of these materials will be relatively difficult to achieve due to their clayey nature and the ability of the overlying gravel to absorb compactor loads such that little if any compaction effort reaches this compressible soil layer. Much of the north central end of this site should be considered to have compressible muck soils that will need to be removed and replaced prior to construction of the proposed 4 story structures. We recommend the compressible soils in this area be removed and replaced compacted Structural Fill as described below. Effective compaction of backfilled soils will not be able to be achieved unless groundwater levels are lowered 2 feet below the surface being compacted. With an estimated seasonal high water level of 2 to 4 feet deep, groundwater levels may need to be lowered about 5 feet or more.

We think removal of unsuitable soils and replacement with compacted structural fill as described above will be required for most of the building where muck and moderate muck was indicated. Additional soil borings/cone soundings in building areas is recommended as no soil borings were performed within the footprint of 2 of the 6 buildings proposed for this site.

Site Preparation Recommendations

The existing surficial soils should be prepared, prior to placement of structural fill and foundation construction on the soils, in accordance with the following site preparation recommendations. The recommended procedures should be covered in the project specifications, and completed prior to construction of the foundation system.

1. The proposed building areas with muck or moderate muck should have the compressible soils found about 2.5 to 9 feet deep removed and replaced with compacted structural backfill. To facilitate effective compaction of backfilled soils, groundwater will need to lowered to a maximum height at least 2 feet below the ground surface being compacted. Since groundwater is estimated to be at a season high depth ranging from 2 to 4 feet at this, we estimate groundwater will need to be lowered about 5 feet or more. The building area should be cleared with any clayey compressible soils previously identified excavated and removed if found within proposed building areas. As a minimum, clearing operations should extend at least 5 feet beyond the perimeter of the foundation system. Strippings, debris and organic soils should be properly disposed.

2. Acceptable structural fill should consist of fine sand (SP) to slightly silty fine sand (SP-SM) or slightly clayey fine sand (SP-SC) with less than 12 percent passing the No. 200 sieve, free of significant rubble, organics, clay balls, debris and other unsuitable material. Any off-site structural fill should be tested and approved prior to acquisition. The structural fill material should be placed in loose lifts not exceeding 12 inches in thickness. Each lift should be compacted by repeated passes with appropriate equipment to achieve a minimum of 95 percent of the Modified Proctor maximum dry density (ASTM D-1557) in the structure areas, while a maximum dry density of 98 percent should be achieved in the pavement areas. Density tests to confirm compaction should be performed in each fill lift before the next lift is placed. The placement of structural fill and compaction operations should continue until the desired elevation is achieved. At least one in-place density test should be taken for each 2,500 square feet of structural fill placed within the building area per lift.

3. If desired, FDOT No. 57 or 67 rock may be used as backfill. This material can be placed without dewatering. However, voids will remain present within this material such that overlying sands can migrate down possibly causing subsidence of these overlying sandy soils. If coarse aggegate fill such as No. 57 or 67 rock is placed, a separation geotextile such as a Mirafi 140N should be placed on top of the coarse aggregate to prevent sand migration down into the rock.

4. After removal of the compressible soil and backfilling with as described above, the site preparation, foundation, pavement and other recommendations presented in our previous report should be implemented.

CLOSURE

The supplemental recommendations provided above are based in part on project information provided to us, and they only apply to this specific project and site. If any of the project information is incorrect or if additional information becomes available, the correct or additional data should be conveyed to us for review. As project plans develop, we anticipate additional soil borings, site testing and geotechnical engineering analysis will be required.

We appreciate the opportunity to be of service to The Richman Group of Florida, Inc. on this important project. Should you have any questions regarding this report, or if we can be of any further assistance, please contact this office. We also have great interest in providing materials testing and inspection services during the construction of this project, and will be pleased to meet with you at your convenience to discuss these engineering services.

Very truly yours,

ARDAMAN & ASSOCIATES, INC.

Maria M. Chess
Assistant Project Engineer

Martin E. Millburg, P.E.
Senior Geotechnical Engineer
Florida License No. 36584

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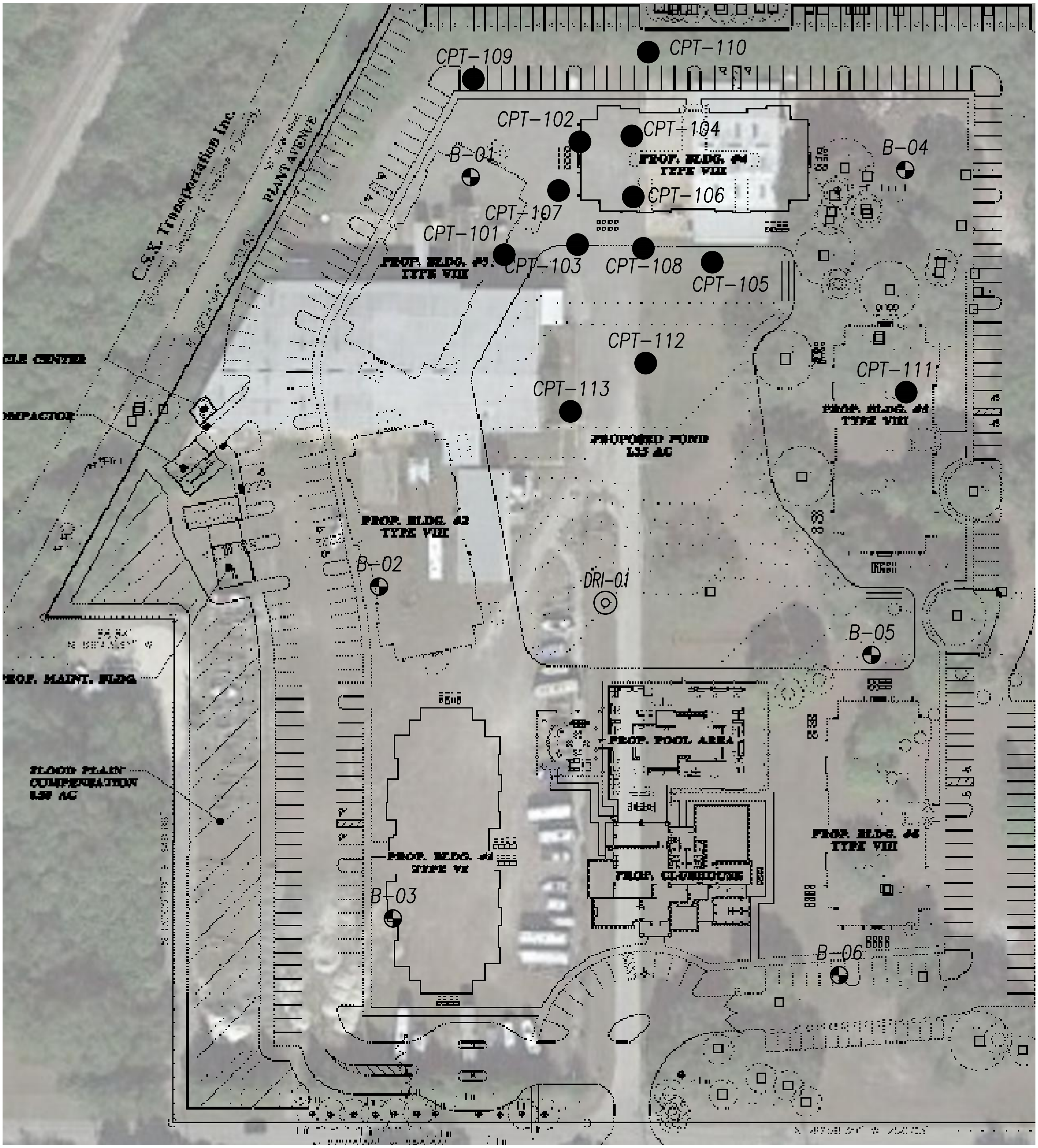
Appendix: Figure 1 - Test Location Plan
Figure 2 – SPT Boring Soil Profiles
CPT Sounding Results
Field Testing Procedures

Distribution: 2 – Addressee
1 – File

MARTIN E. MILLBURG
LICENSE
No. 36584
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

Digitally signed by: Martin E Millburg
DN: CN = Martin E Millburg email = mmillburg@ardaman.com C = US O = Ardaman & Associates Inc OU = Geotechnical Engineering Department
Date: 2017.07.18 15:58:33 -05'00'

APPENDIX



REFERENCE: GOOGLE EARTH PRO 2017

LEGEND

- APPROXIMATE LOCATION OF SPT BORING
- APPROXIMATE LOCATION OF CPT SOUNDING

0 50 100

APPROXIMATE SCALE: 1"=100'

TEST LOCATION PLAN

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

RICHMAN GROUP
TRASK SITE
TRASK STREET AND MCCOY STREET
TAMPA, FLORIDA

DRAWN BY: ajd	CHECKED BY: MEM	DATE: 7/14/17
FILE NO. 17-55-9581B	APPROVED BY: WAS	FIGURE: 1

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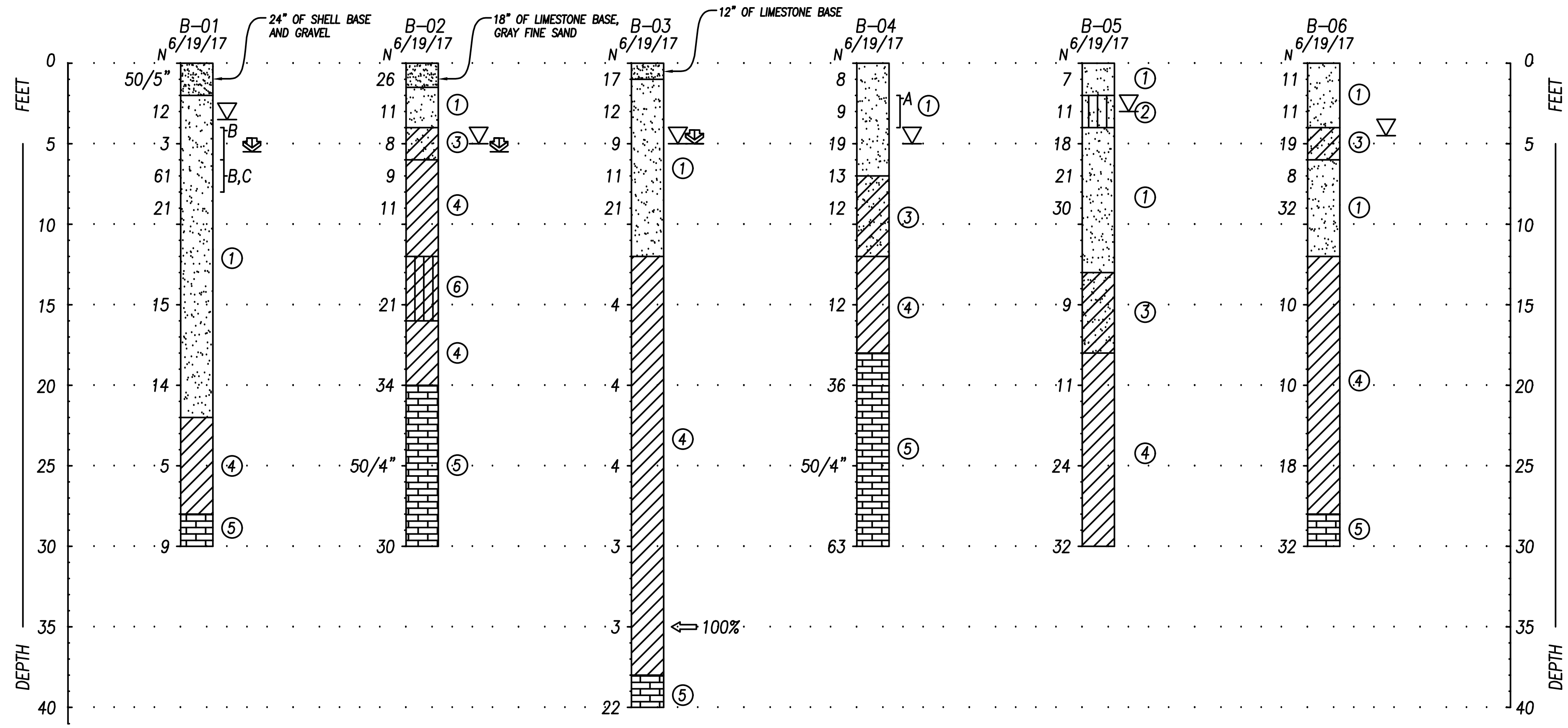

LEGEND

- ① GRAY TO BROWN SLIGHTLY SILTY FINE SAND (SP/SP-SM)
- ② DARK BROWN SILTY FINE SAND (SM)
- ③ GRAY TO GRAY-GREEN CLAYEY FINE SAND (SC)
- ④ BROWN, GRAY AND GRAY-GREEN FINE SANDY CLAY (CL/CH)
- ⑤ LIGHT GRAY CLAYEY WEATHERED LIMESTONE
- ⑥ LIGHT GREEN CLAYEY SILTY TO SILTY CLAY (ML/CL)

A WITH FINE ROOTS
B TREE ROOTS, WOOD
C CEMENTED FRAGMENTS, MAJOR ROOTS
HAMMER TYPE: SAFETY
RIG TYPE: D-25
DRILLED BY: (A & S) M. ABARE
(SP) UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) SYMBOL
▽ GROUNDWATER LEVEL MEASURED ON DATE DRILLED
WATER LEVEL MEASURED AT TERMINATION OF BORING
N SPT N-VALUE IN BLOWS PER FOOT
50/2" 50 BLOWS PER 2 INCHES OF SAMPLER PENETRATION
⇦ LOSS OF DRILLING FLUID CIRCULATION (%)

SOIL BORING PROFILES

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

RICHMAN GROUP
TRASK SITE
TRASK STREET AND MCCOY STREET
TAMPA, FLORIDA

DRAWN BY: ajd	CHECKED BY: MEM	DATE: 6/26/17
FILE NO. 17-55-9581B	APPROVED BY: WAS	FIGURE: 2

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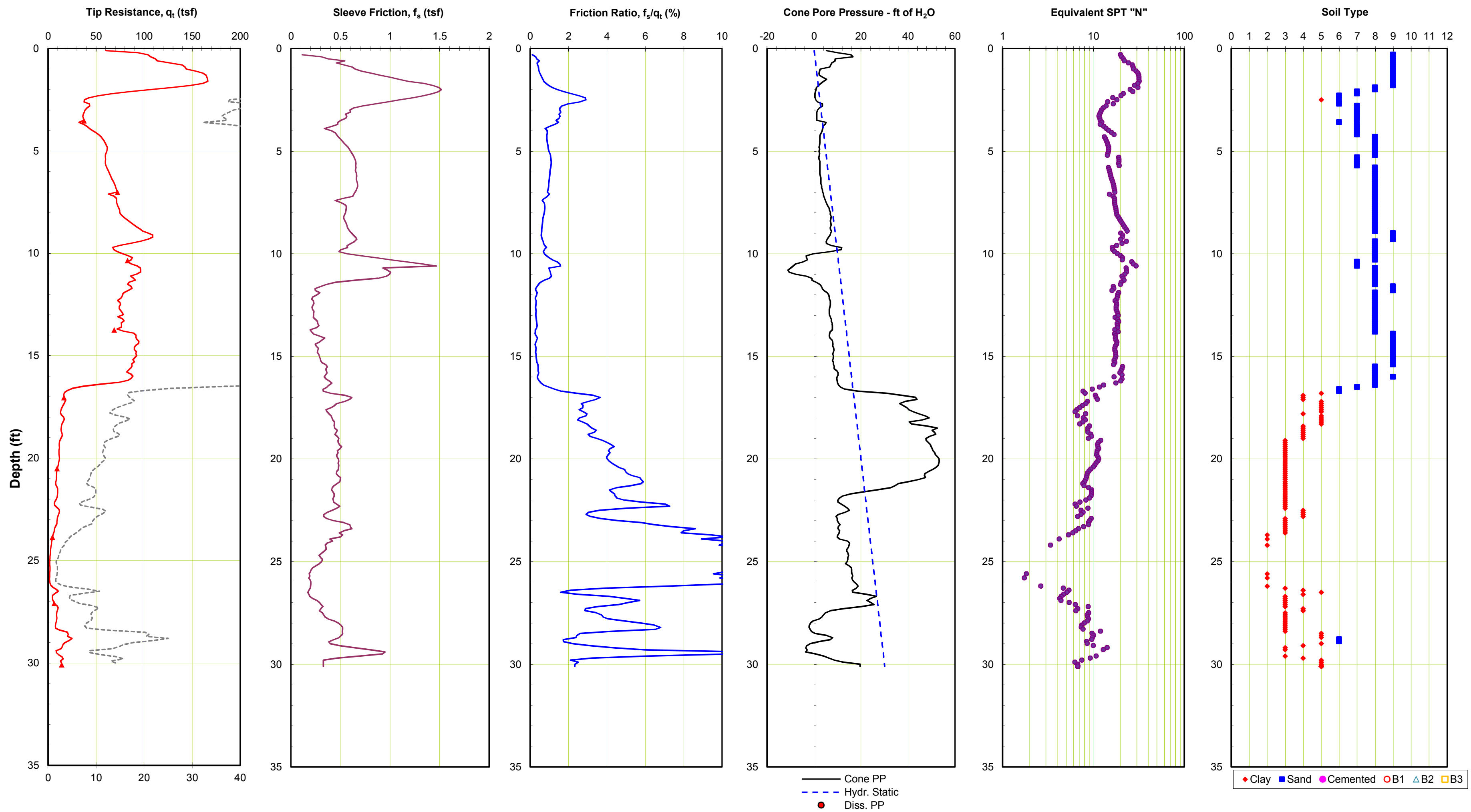


Soil I.D. #	Soil Description	Soil I.D. #	Soil Description
1	Sensitive Fine Grained	7	Silty Sand to Sandy Silt
2	Organic Material	8	Sand to Silty Sand
3	Clay	9	Sand
4	Silty Clay to Clay	10	Gravelly Sand to Sand
5	Clayey Silt to Silty Clay	11	Very Stiff Fine Grained (OC Clay)
6	Sandy Silt to Clayey Silt	12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-101

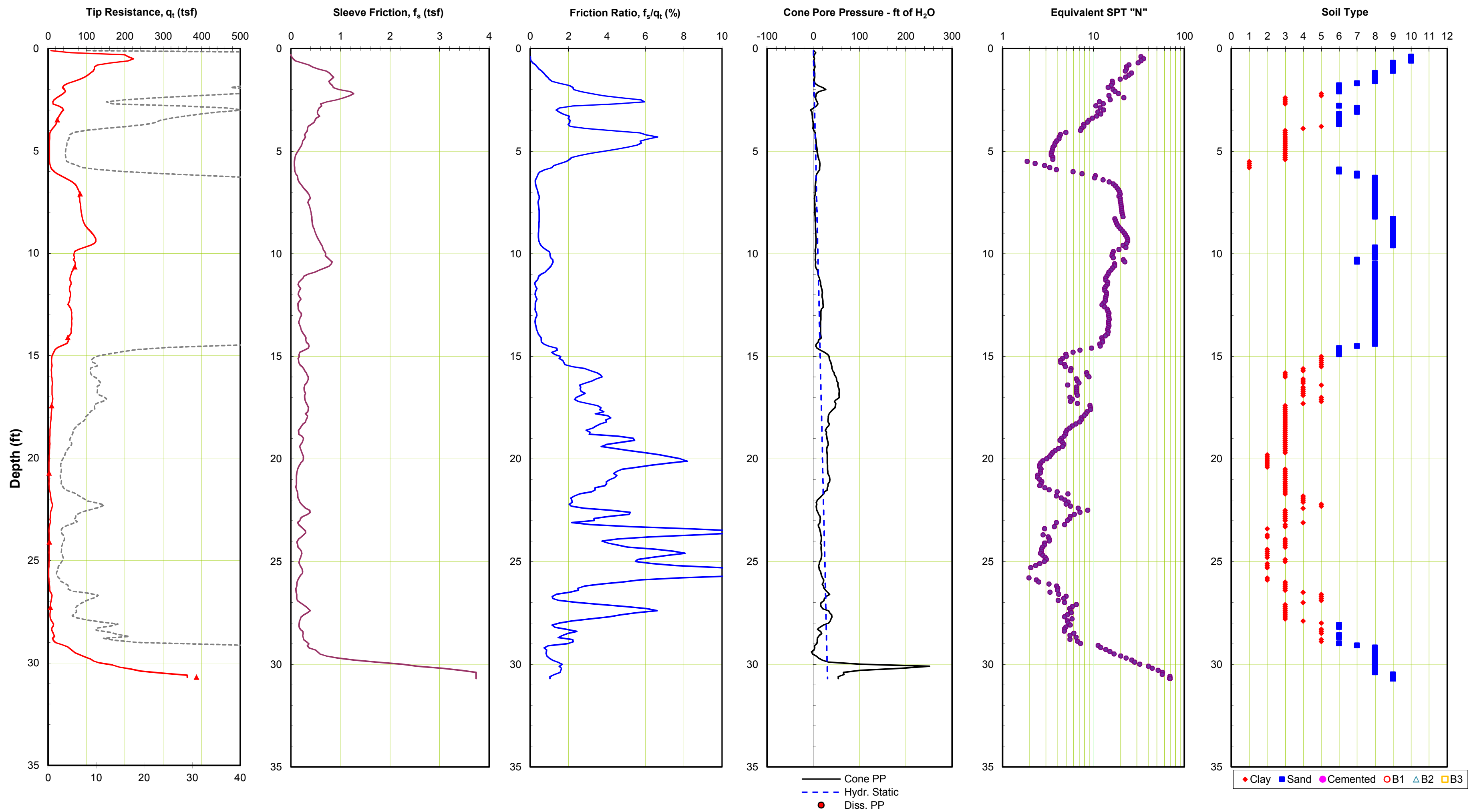
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description	Soil I.D. #	Soil Description
1	Sensitive Fine Grained	7	Silty Sand to Sandy Silt
2	Organic Material	8	Sand to Silty Sand
3	Clay	9	Sand
4	Silty Clay to Clay	10	Gravelly Sand to Sand
5	Clayey Silt to Silty Clay	11	Very Stiff Fine Grained (OC Clay)
6	Sandy Silt to Clayey Silt	12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3340.103XX

CPT-102 +

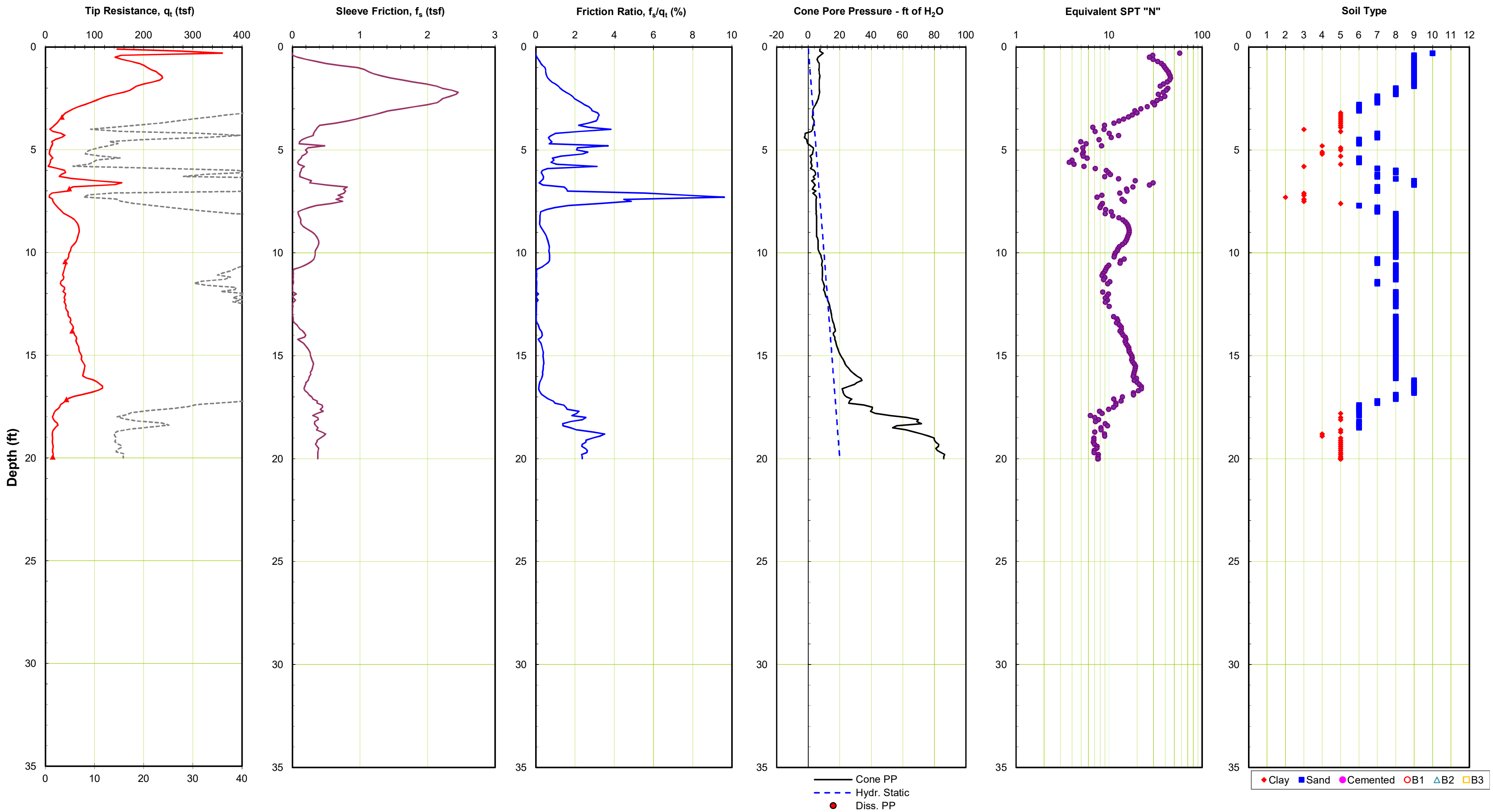
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581-b | Test Date: 7/13/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description	Soil I.D. #	Soil Description
1	Sensitive Fine Grained	7	Silty Sand to Sandy Silt
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6	Sandy Silt to Clayey Silt	12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-103

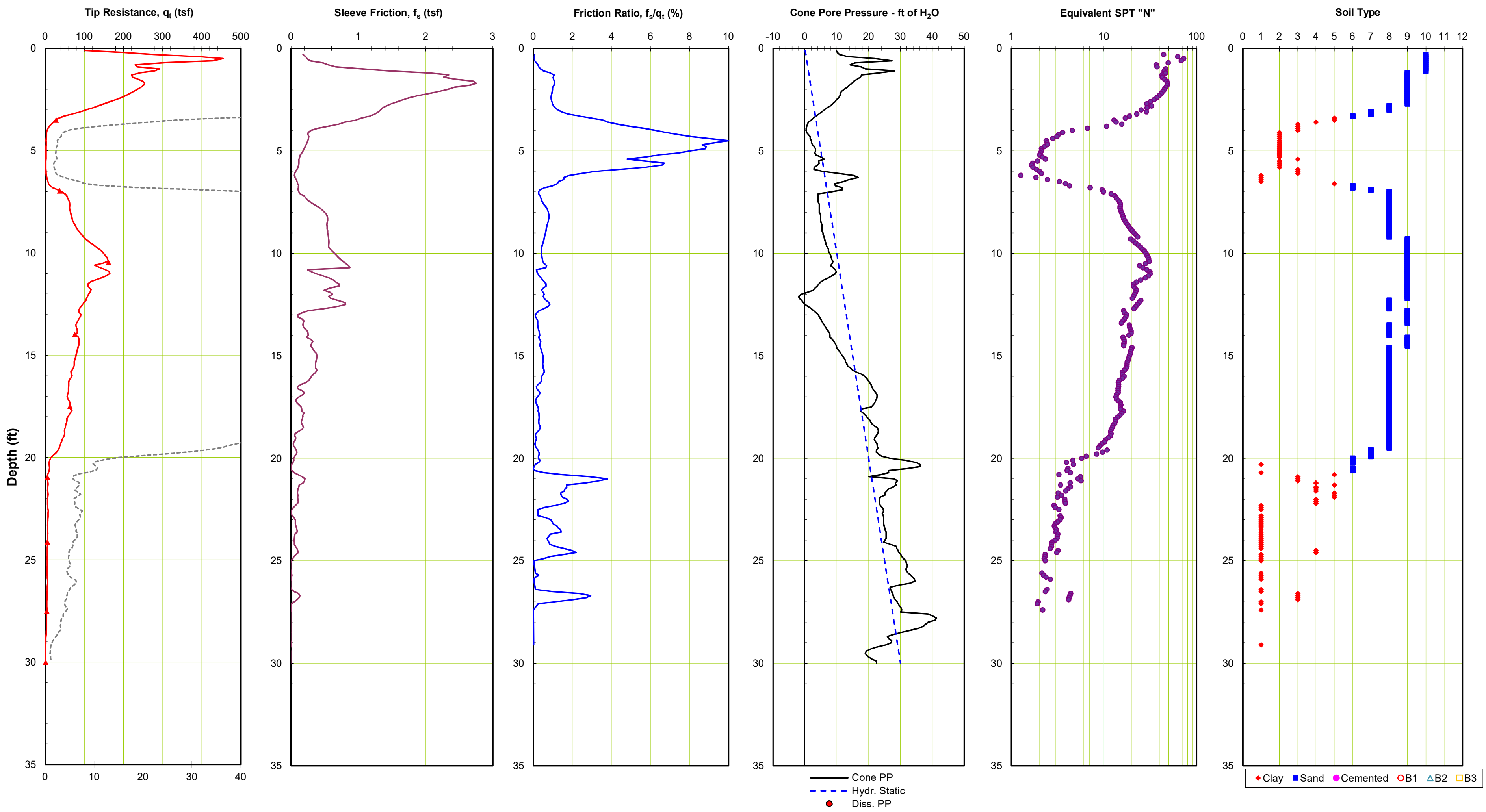
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description	Soil I.D. #	Soil Description
1	Sensitive Fine Grained	7	Silty Sand to Sandy Silt
2	Organic Material	8	Sand to Silty Sand
3	Clay	9	Sand
4	Silty Clay to Clay	10	Gravelly Sand to Sand
5	Clayey Silt to Silty Clay	11	Very Stiff Fine Grained (OC Clay)
6	Sandy Silt to Clayey Silt	12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-104

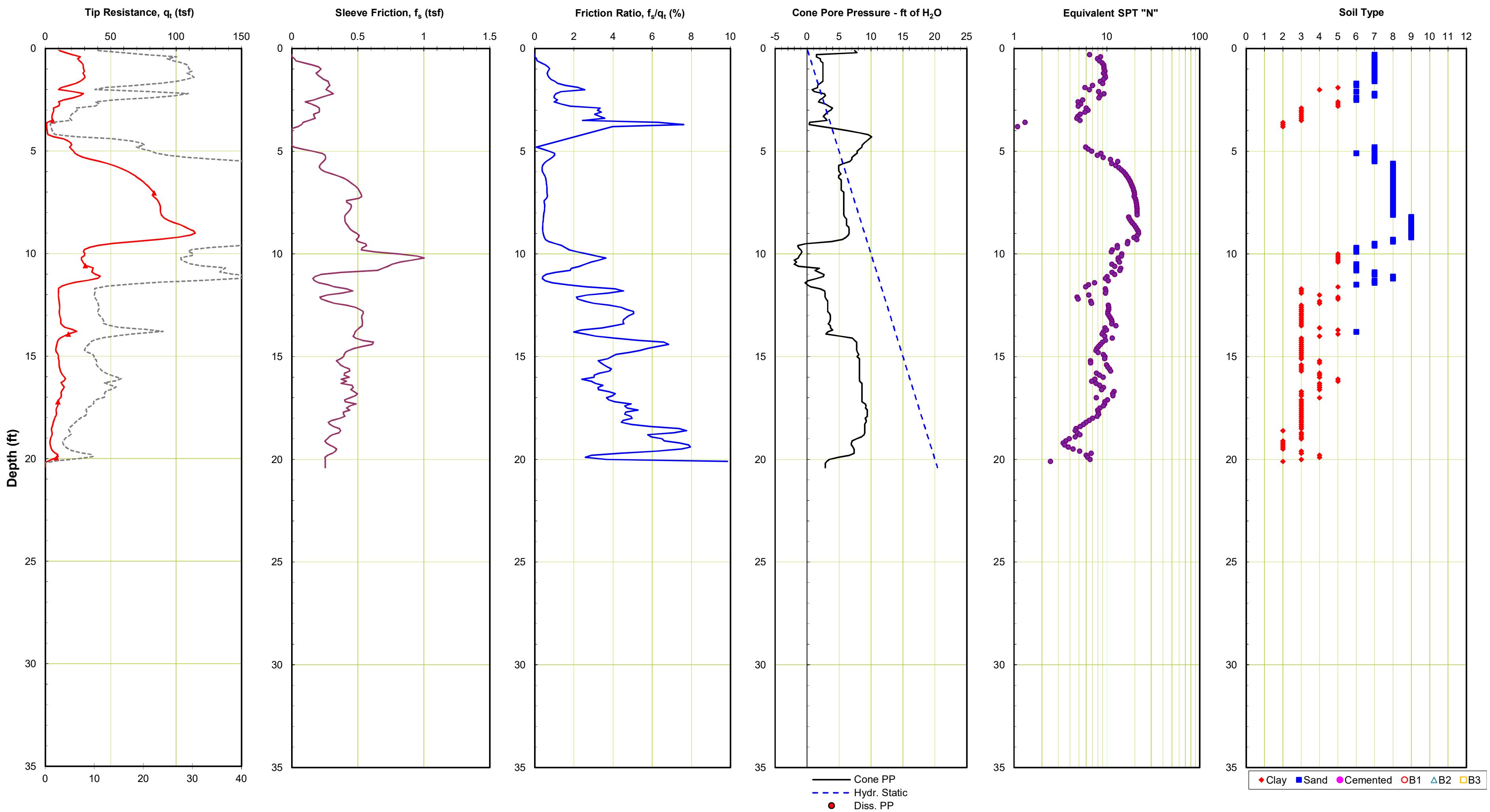
Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017



Soil I.D. #	Soil Description
1	Sensitive Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay
6	Sandy Silt to Clayey Silt

Soil I.D. #	Soil Description
7	Silty Sand to Sandy Silt
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained (OC Clay)
12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-105

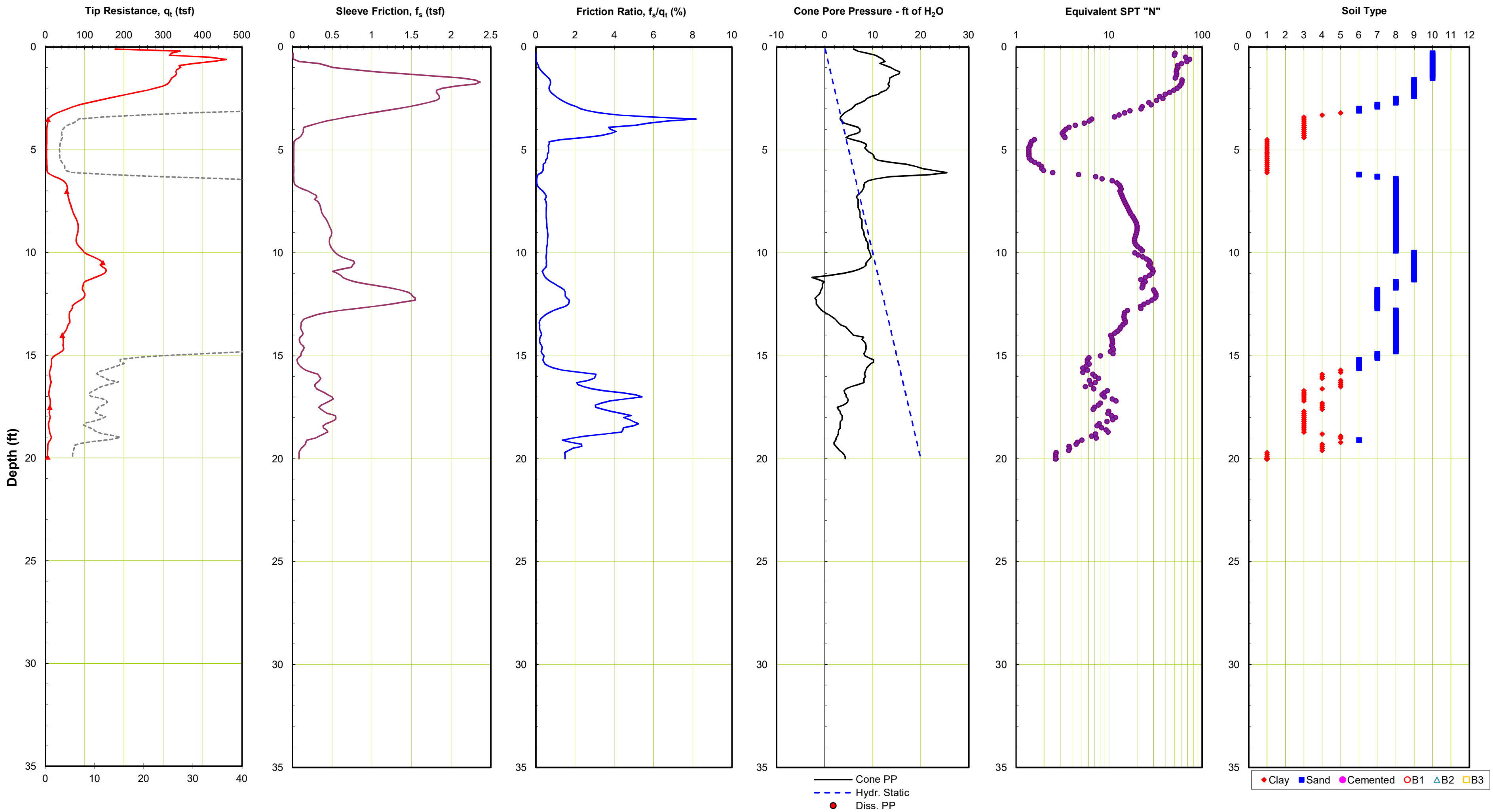
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description
1	Sensitive Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay
6	Sandy Silt to Clayey Silt

Soil I.D. #	Soil Description
7	Silty Sand to Sandy Silt
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained (OC Clay)
12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-106

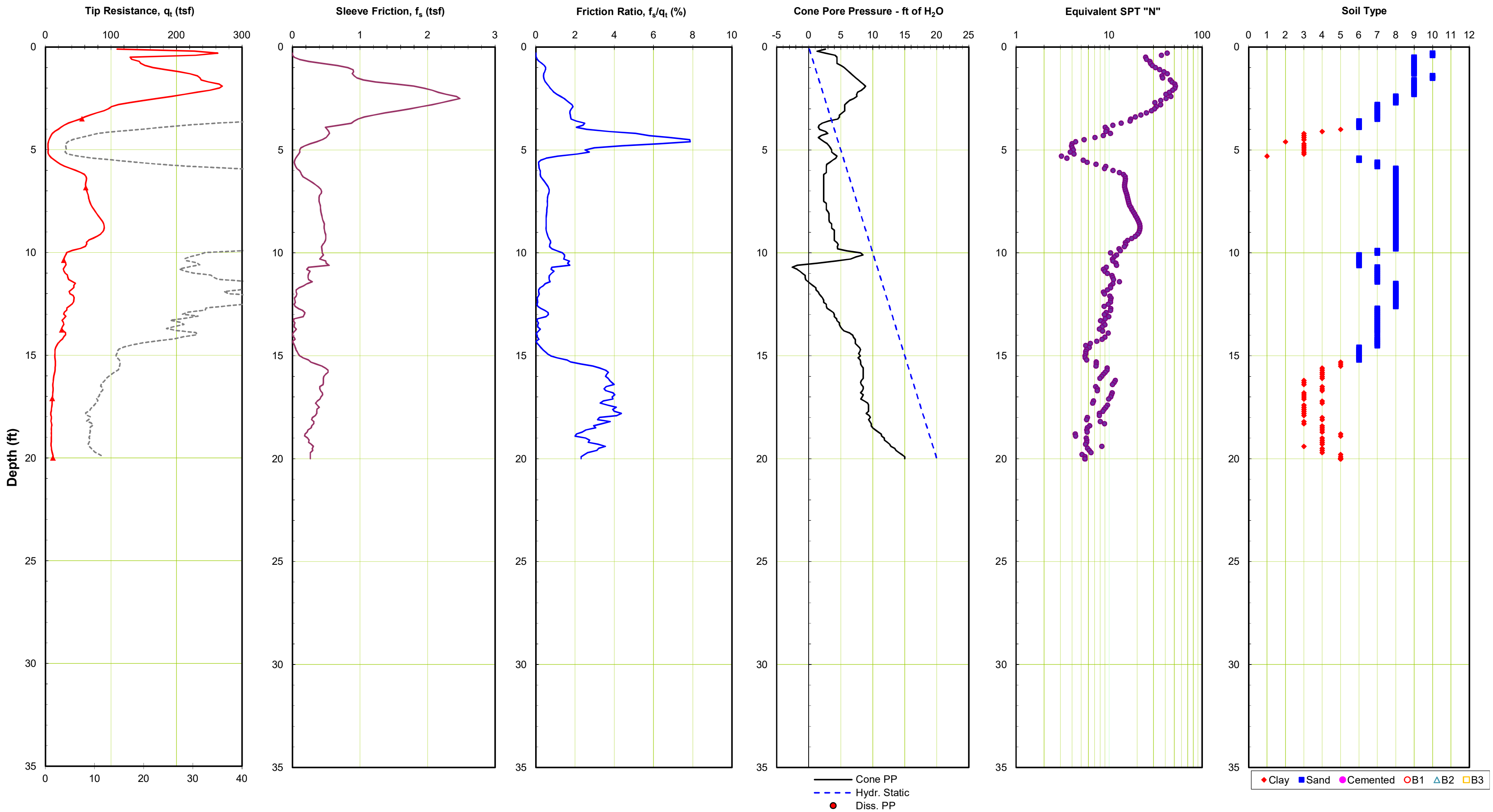
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description
1	Sensitive Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay
6	Sandy Silt to Clayey Silt

Soil I.D. #	Soil Description
7	Silty Sand to Sandy Silt
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained (OC Clay)
12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-107

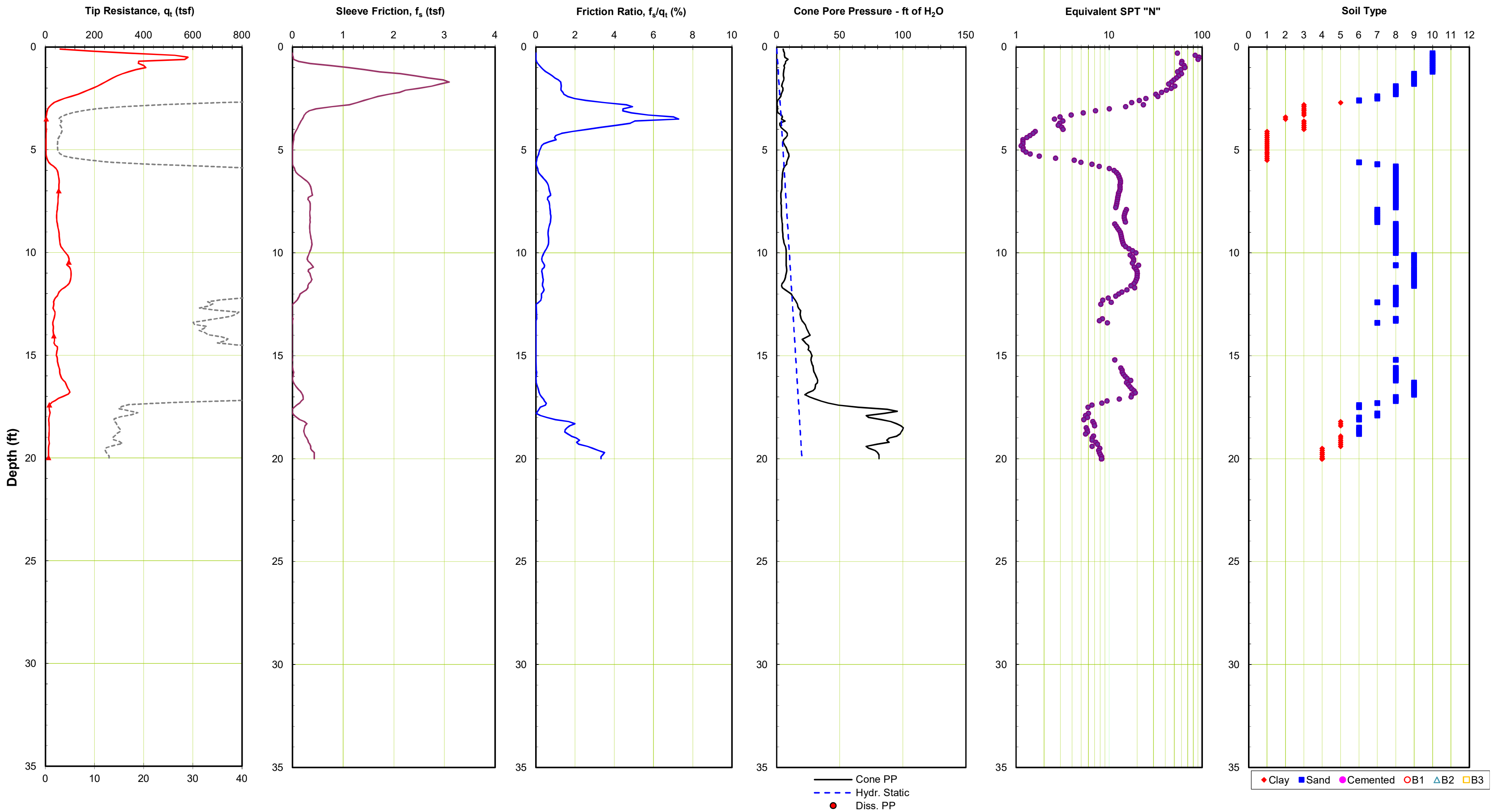
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description
1	Sensitive Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay
6	Sandy Silt to Clayey Silt

Soil I.D. #	Soil Description
7	Silty Sand to Sandy Silt
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained (OC Clay)
12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3045.121xx

CPT-108

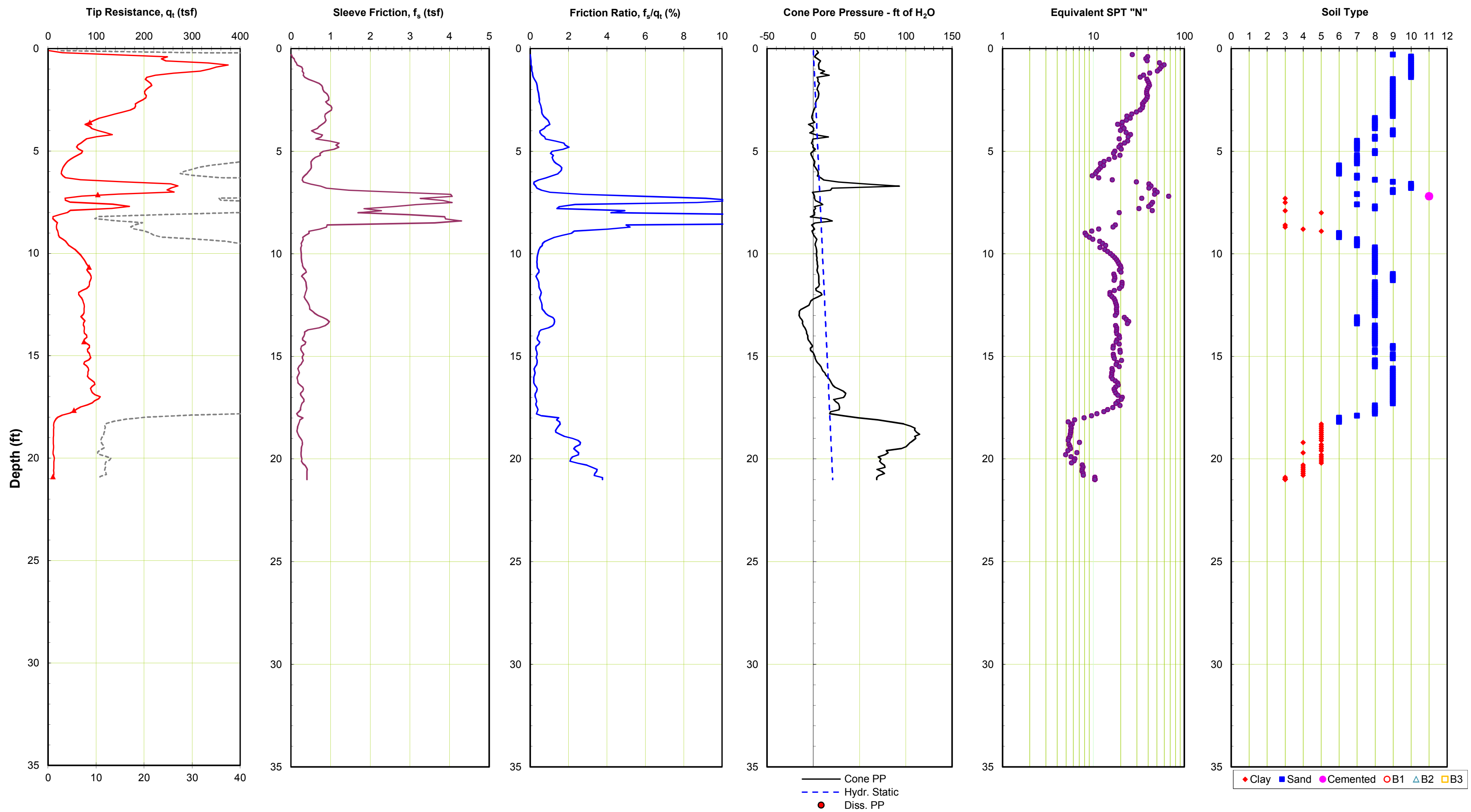
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581B | Test Date: 7/7/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description
1	Sensitive Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay
6	Sandy Silt to Clayey Silt

Soil I.D. #	Soil Description
7	Silty Sand to Sandy Silt
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained (OC Clay)
12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3340.103XX

CPT-109

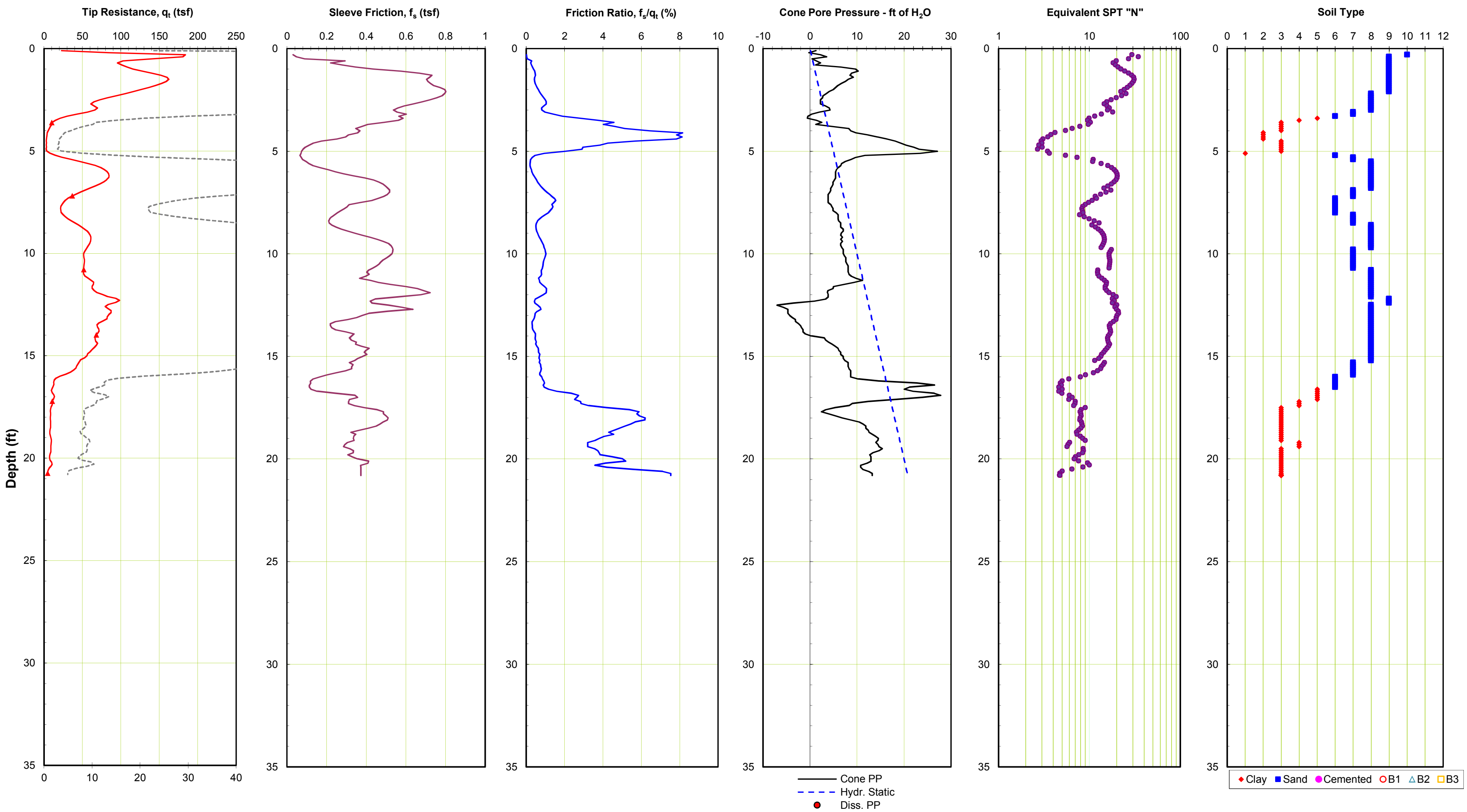
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581-b | Test Date: 7/13/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description	Soil I.D. #	Soil Description
1	Sensitive Fine Grained	7	Silty Sand to Sandy Silt
2	Organic Material	8	Sand to Silty Sand
3	Clay	9	Sand
4	Silty Clay to Clay	10	Gravelly Sand to Sand
5	Clayey Silt to Silty Clay	11	Very Stiff Fine Grained (OC Clay)
6	Sandy Silt to Clayey Silt	12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3340.103XX

CPT-110

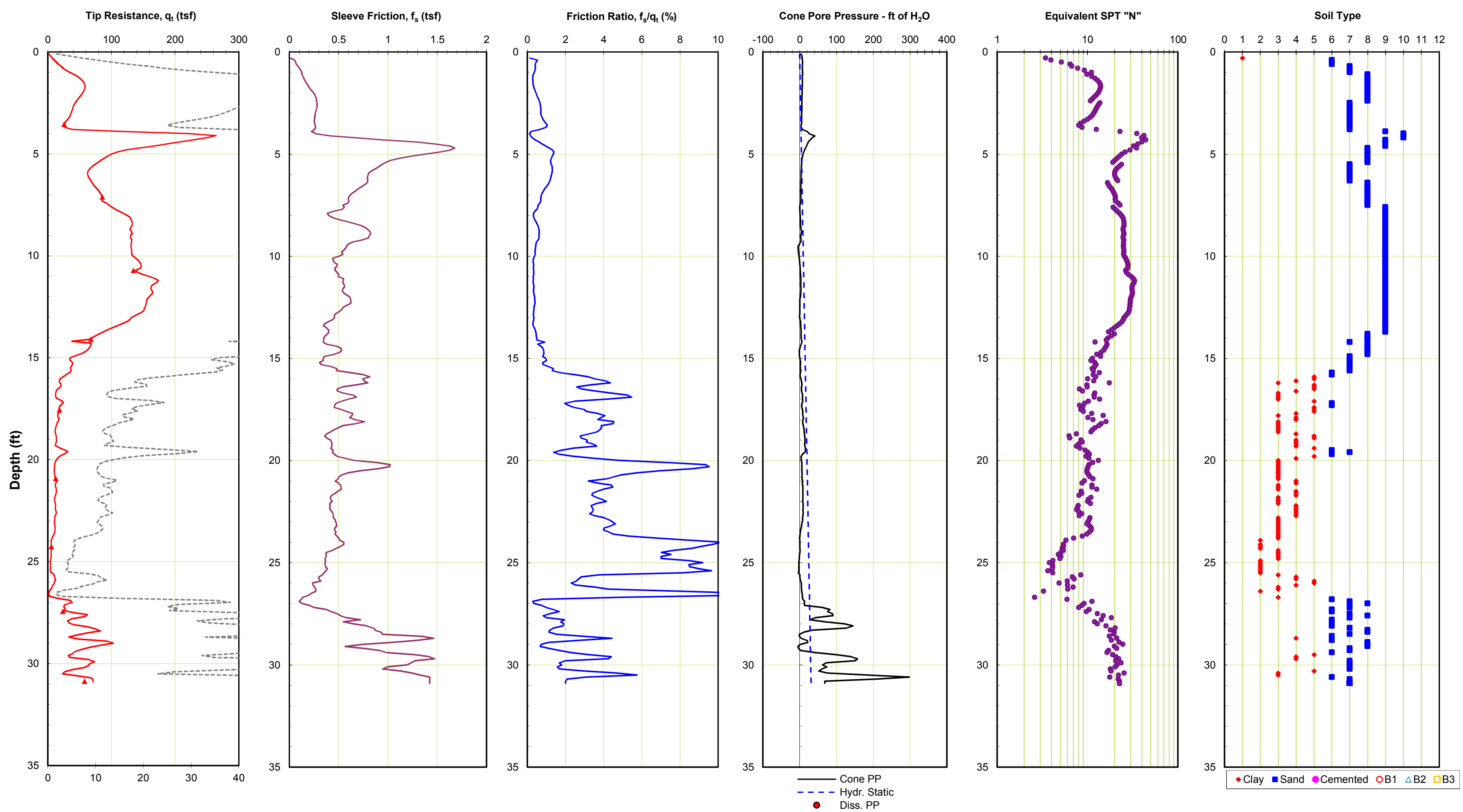
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, Fl

Job No. 17-55-9581-b | Test Date: 7/13/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description
1	Sensitive Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay
6	Sandy Silt to Clayey Silt

Soil I.D. #	Soil Description
7	Silty Sand to Sandy Silt
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained (OC Clay)
12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3340.103XX

CPT-111

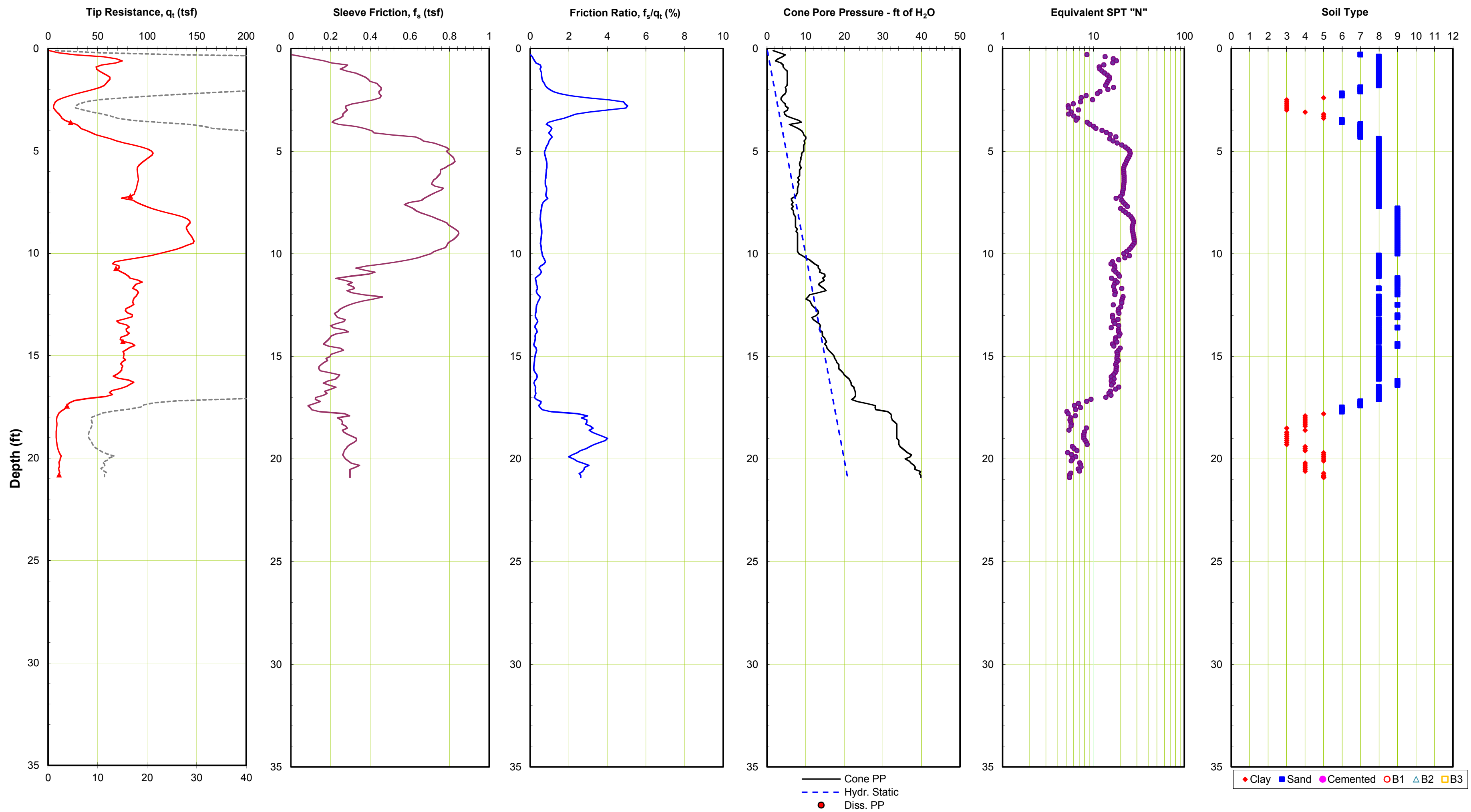
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581-b | Test Date: 7/13/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description	Soil I.D. #	Soil Description
1	Sensitive Fine Grained	7	Silty Sand to Sandy Silt
2	Organic Material	8	Sand to Silty Sand
3	Clay	9	Sand
4	Silty Clay to Clay	10	Gravelly Sand to Sand
5	Clayey Silt to Silty Clay	11	Very Stiff Fine Grained (OC Clay)
6	Sandy Silt to Clayey Silt	12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3340.103XX

CPT-112-c

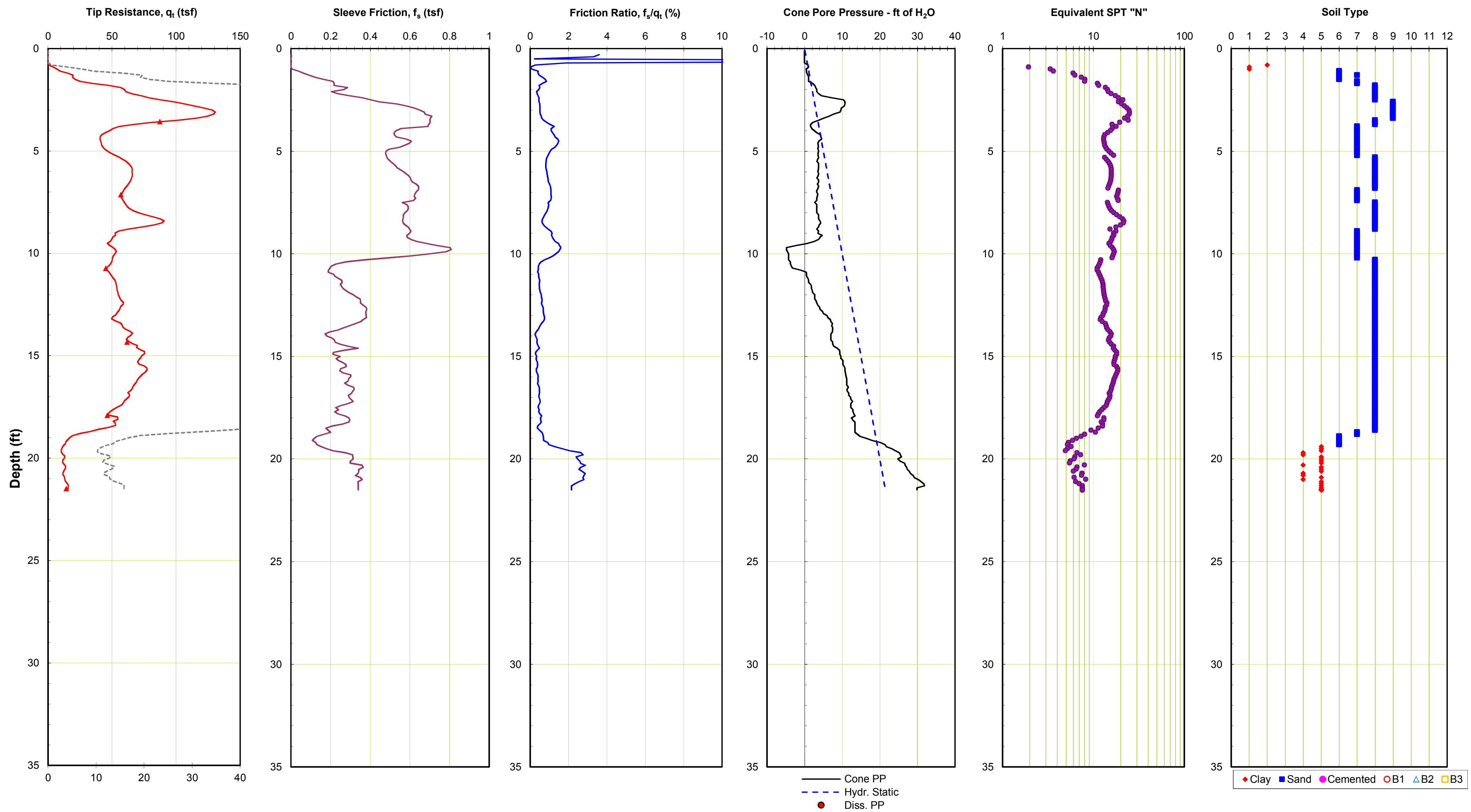
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581-b | Test Date: 7/13/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented



Soil I.D. #	Soil Description	Soil I.D. #	Soil Description
1	Sensitive Fine Grained	7	Silty Sand to Sandy Silt
2	Organic Material	8	Sand to Silty Sand
3	Clay	9	Sand
4	Silty Clay to Clay	10	Gravelly Sand to Sand
5	Clayey Silt to Silty Clay	11	Very Stiff Fine Grained (OC Clay)
6	Sandy Silt to Clayey Silt	12	Sand to Clayey Sand (Cemented)

Notes: Vertek Cone, Pore Pressure at u2
S/N 3340.103XX

CPT-113

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

Trask
Tampa, FL

Job No. 17-55-9581-b | Test Date: 7/13/2017

Soil Classification by Robertson et al, 1986

I.D. #'s 11 and 12 are Over Consolidated or Cemented

FIELD TESTING PROCEDURES

Prior to initiating the field activities, the Sunshine State One-Call of Florida, Inc. Call Center (Call Sunshine) was notified of our intent to perform soil test boring, utilizing a drill rig. The location, date, and other operation particulars were provided to allow participating utility companies the opportunity to mark the location of their buried lines, prior to our field activities. No conflicts with underground utilities were encountered at the boring locations.

STANDARD PENETRATION TEST

The Standard Penetration Test is a widely accepted method of in-situ testing of foundation soils (ASTM D 1586). A 2-foot long, 2-inch outside diameter (1-3/8-inch inside diameter), split-barrel ("spoon") sampler, attached to the end of drilling rods, is driven 18 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each six inches of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch increments of penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual examination and classification of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load. The N-value is considered to be indicative of the relative density of cohesionless soils and the consistency of cohesive soils.

The tests are usually performed at 5-foot intervals. However, more frequent or continuous testing is done by our firm through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. Usually, the circulating fluid, which is a bentonite drilling mud, also serves to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or to prevent the loss of circulating fluid.

Representative split-spoon samples from soils at every 5 feet of drilled depth and from different stratum are brought to our laboratory in airtight jars for further evaluation and testing, if necessary. Samples not used in testing are stored for at least 60 days prior to being discarded. After completion of a test boring, the hole is kept open until a steady state ground water level is recorded. The hole is then sealed if necessary, and backfilled.

PIEZOCONE PENETROMETER TEST SOUNDINGS

The site exploration program for this project included the performance of Piezocone Penetration Test ($CPTu_2$) soundings in general accordance with ASTM Standard D-5778. Piezocone exploration techniques were selected in order to improve the quality and continuity of data for evaluation of subsurface conditions. CPT technology is in wide use nationally and internationally, and is recognized as a superior method for site soils characterization, especially when thin layers of soft soil might affect foundation performance or excavation safety. Additionally, $CPTu_2$ soundings allow the collection of pore pressure data that is very useful when evaluating the presence of a vertical seepage gradient which may be indicative of sinkhole activity. The system utilized by Ardaman & Associates, Inc. for this project includes a pore pressure element mounted between the cone tip and the friction sleeve (u_2) to measure water pressures induced by pushing the cone through the soil.

Procedures for use of the friction sleeve cone penetrometer in Florida were developed at the University of Florida in the early 1970's. [1] In 1974, Ardaman & Associates, Inc. developed a Piezocone system for site explorations in difficult soils, [2] and has been a leader in the application of Piezocone technology for site characterization and foundation design. Many others have recognized that the cone penetrometer is the best system for exploration of soil conditions for foundation design [3 4 5].

The characteristics of the Piezocone Penetrometer used by Ardaman for this project are as follows:

Tip Area:	10.0 cm^2
Friction Sleeve:	150 cm^2
Piezometric Element:	U_2, a filter element mounted above the cone tip and below the friction sleeve

The cone is typically inserted and extracted by a high capacity hydraulic jack mounted in a heavy truck, but in certain applications, the cone may be inserted using a drill rig. The cone data acquisition system consists of electronic load cells to measure tip resistance, sleeve friction and pore water pressure. A portable computer is used to collect the load cell data. A complete suite of load cell readings is recorded at least every one second. The correlation with soil properties is detailed in Reference 4, and in a subsequent paper presented to the Transportation Research Board 77th Annual Meeting, Committee A2K01, Soil and Rock Instrumentation by Kurup and Tumay. Calibration testing by Ardaman & Associates, Inc. and many university researchers has shown that cone techniques provided finer resolution of soil profile variations than SPT borings due to the continuity of the measurements. In addition, cone techniques were proven to provide reliable measurement of soil strength.

Extensive testing using cone techniques by Ardaman & Associates in Florida with correlations between SPT borings and CPT data has proven that CPT exploration techniques can provide more vertically detailed site characterization data and better data for definition of soil engineering properties than Standard Penetration Test borings.

1 The Piezometer Probe", In-Situ Measurement of Soil Properties, Vol. I (ASCE), NC State, Raleigh, Wissa, A.E.Z, Martin, R.T., and Garlanger, J.E., 1975

2 Guidelines for Cone Penetration Test Performance and Design" Report FHWA-TS-78-209, Federal Highway Administration, Washington, D.C., Schmertmann, J.H., 1978

3 Penetrometers for Soil Permeability and Chemical detection, P. W. Mayne, PhD, PE and S. E. Burns, PhD, PE; Report to National Science Foundation and U.S. Army Research Office, Georgia Institute of Technology School of Civil and Environmental Engineering, July 1998.

4 A Continuous Intrusion Electronic Miniature Cone Penetration Test System, M. T. Tumay, PhD, P. U. Kurup, PhD and R. L. Boggess; Geotechnical Site Characterization, Robertson & Mayne (eds) © 1998 Balkema, Rotterdam, ISBN 90 54 10 939 4

5 National Report on CPT, Mayne, P.W., Mitchell, J. K., Auxt, J.A. and Yilmaz, R. "Proceedings, Cone Penetration Testing (CPT'95), Vol. 1, Linkoping, Sweden, USNS/ISSMFE, Oct 1995, 263-276.