SECTION 02 32 00 - GEOTECHNICAL DATA

A copy of the Geotechnical Report dated July 5, 2024 and Geotechnical Engineering Services – Addendum 1 dated February 20, 2025 is bound into this Project Manual following this page.

ATTACHMENTS
Section 02 32 00.1 – Geotechnical Engineering Services Report – 722 Pages
Section 02 32 00.2 – Geotechnical Engineering Services Report – Addendum 1 – 136 Pages

END OF SECTION 02 32 00

July 5, 2024

LDMSE24001

Landmark Science & Engineering
Attn: Ted C. Williams, PE, FACEC, President
200 Continental Drive, Suite 400
Newark, DE 19713

RE: Geotechnical Engineering Services
Appoquinimink School District Summit Campus – Infiltration Testing Summary
Middletown, Delaware

Dear Mr. Williams:

We are pleased to submit our infiltration testing summary report for the Appoquinimink School District Summit Campus stormwater management study located in Middletown, DE. Work was initiated in general accordance with the scope of work presented in our proposal dated May 2, 2024, and your subsequent notice to proceed on May 7, 2024.

As you are aware, Pennoni is also providing geotechnical engineering services for this project.

To assist with this report development, Pennoni reviewed the following documents:

- A Drawing No. CR-01 titled "Appoquinimink Summit Campus – St. Georges Hundred – New Castle County – Delaware," prepared by Landmark Science & Engineering, dated April 21, 2021;
- An untitled RFP titled "P8582 – Appoquinimink School District," dated March 28, 2024;
- An undated Drawing titled "Boring Exhibit for Summit Campus – Phase 2," prepared by Landmark Science & Engineering; and
- Survey and stake information plan titled "2024-05-13 Survey bores," prepared by Landmark Science & Engineering, provided on May 13, 2024.

BACKGROUND

We understand the project consists of the construction of Phases B through D of the Appoquinimink School Districts (ASD) Summit Campus located in Middletown, Delaware. We understand that the construction consists of an approximate two story, 385,473 square feet (SF) middle and high school, one story, 10,800 SF field house, 2,957 SF greenhouse / AG building, athletic fields, stormwater management (SWM) facilities, and parking areas surrounding the proposed buildings. This report summarizes infiltration testing performed in support of design of the proposed SWM facilities.

A Geotechnical Engineering Services Report is also being prepared which summarizes the proposed construction of the middle/high school, field house, and associated parking areas separate from this report. SWM facilities consisting of subsurface basins are proposed throughout the parking areas and south of the existing roundabout. As the SWM facilities are still in the conceptual design phase the number, location, and size of the proposed SWM facilities has not yet been determined. We have assumed the inverts of the facilities are a maximum of 5 feet below existing grades.

The existing project site consists of the Crystal Run Elementary School, from Phase A of the project, and an agricultural field. The site is bound by residential properties to the north and south, an agricultural field to the east, and Route 896 to the west. Based on the provided topography the project site generally slopes downward from northwest to southeast with elevations ranging from approximately 66 to 55 feet (NAVD88) as indicated on the attached Site Location Sketch, SK-1. Existing utilities were noted to consist of an overhead electric line running west to east parallel with Beaston Road. An artesian water main was noted to run west to east along the northern perimeter of the site.

FIELD EXPLORATION

Twenty-five Standard Penetration Test (SPT, ASTM D1586) borings labeled "B-1" through "B-25" and fifty Cone Penetration Test (CPT, ASTM D5778) soundings labeled "C-1" through "C-50" were performed within the general footprints of the proposed middle/high school, field house, and football stadium bleachers. A summary of the SPT borings and CPT soundings are provided under a separate cover titled, "Geotechnical Engineering Services – Appoquinimink School district Summit Campus," prepared by Pennoni.

Forty (40) test pits labeled ("TP-1 through TP-40") and thirty-nine (39) single ring infiltration tests labeled ("INF-1" through "INF-40") were performed from May 13, 2024, to May 23, 2024. The test pits were performed by CGC Geoservices, LLC using a backhoe at the approximate locations selected by Landmark Engineering and indicated on the attached Testing Location Sketch, SK-2. The test locations were selected and established in the field by Pennoni personnel. Test pits "TP-1" through "TP-40" were performed to a minimum of three feet below the proposed SWM facilities invert elevations to estimate the soil horizons and determine if restricting layers such as groundwater table (GWT), seasonal high-water table (SHWT), and/or hardpan were present. Proposed inverts for the SWM facilities were assumed to be a maximum of 5 feet below the existing ground surface; therefore, the test pit excavations were performed to a minimum of 8 feet below the existing ground surface in general accordance with the Delaware Administrative Code Title 7, Section 5101, Sub-Section 12.0. Test pit logs are attached.

Concurrently with test pits "TP-1" through "TP-40," an adjacent pit was excavated to the proposed invert elevations for infiltration testing. Locations for the single ring infiltration tests were established a maximum of 5 feet away from their corresponding Test Pits "TP-1" through "TP-40." Thirty-nine single ring in-situ infiltration tests labeled ("INF-1" through "INF-40") were performed by Pennoni personnel at the approximate locations indicated on the attached Testing Location Sketch, SK-2. Grab samples were collected at the invert elevation of each infiltration test. Infiltration test "INF-33" was not performed due to shallow groundwater observed at 3 feet below the ground surface (Elev. 52.1 feet, NAVD88). Infiltration operations were directed by our T. Thomson, Jr. PhD, PE, BC. GE, LEED AP, and observed by our A. Spencer, PE, N. Francois, and N. Fisher.

The infiltration testing was performed in general accordance with the testing as described in the Delaware Administrative Code Title 7, Section 5101, Sub-Section 12.0. Following a one-hour pre-soak, two consistent test periods consisting of 15-minute time intervals and meeting one of the following was performed:

- A minimum of one hour;
- A drop of at least 12 inches in 15 minutes or less for a minimum of two time intervals;
- A difference of 0.25 inches or less of drop between the highest and lowest reading of four (4) consecutive time intervals for infiltration rates greater than two (2.0) inches per hour; or
- A difference of 0.125 inches or less of drop between the highest and lowest reading of four (4) consecutive readings for infiltration rates equal to or less than two (2.0) inches per hour.

Site conditions at the time of the infiltration testing on May 13, 2024 through May 23, 2024 were cloudy to sunny with temperatures ranging from 68 to 88 degrees Fahrenheit. No rainfall greater than one-half inch occurred in the general site area in the 24 hours prior to infiltration testing.

LABORATORY PROGRAM

Following conclusion of the infiltration testing, the soil samples were delivered to our laboratory for visual classification and testing. The geotechnical laboratory program for the stormwater management facilities consisted of the following:

- Moisture Content (ASTM D 2216) 39 tests
- Sieve Analysis (w/out hydrometer, ASTM D 422) 39 tests

Samples for testing were selected by Pennoni's geotechnical engineer and were generally selected at the estimated invert location of the basins. Results of the laboratory testing are attached.

GEOLOGY

According to the Physiographic Province of Delaware created by USGS, the project site is located within the Coastal Plain. The Coastal Plain is characterized by gently rolling hills and valleys. It is underlain by a southeastwardly thickening sequence of sediments that consists of sand and gravel aquifers interlayered with silt and clay confining units.

According to the Geologic Map (GM13) of New Castle County (Ramsey, K.W., 2005) the project site is located within the Columbia Formation. The Columbia Formation is described as yellow to red to brown, fine to coarse, feldspathic quartz sand with varying amounts of gravel. Typically, cross-bedded with cross-sets ranging from a few inches to over three feet in thickness. Scattered beds of tan to red to gray clayey silt is common. In places, the upper 5 to 25 feet consists of a gray to red to brown silt to very fine sand overlying medium to coarse sand. Near base of unit, clasts of cobbles to small boulders are found in gravel beds ranging from a few inches to three feet thick. Gravel fraction consists primarily of quartz with lesser amounts of chert. Clasts of sandstone, siltstone, and shale from the Valley and Ridge Province, and pegmatite, micaceous schist, and amphibolite from the Piedmont are present. The Columbia fills an eroded surface and ranges from less than 10 feet thick to over 100 feet thick.

According to USDA Web Soil Survey mapping, the project site consists of mainly Reybold silt loam (ReB), Reybold-Queponco Complex (RdA), Woodstown loam (WocA), and Sassafras sandy loam (SacC). Reybold silt loam is generally described as silt loam underlain by gravelly coarse sandy loam with linear down slope shape. Reybold silt loam is classified as hydrologic soil group B with moderately high to high infiltration rates of approximately 0.20 to 2.00 inches per hour. The depth to water table and restrictive features both exceed 80 inches. Reybold-Queponco Complex is generally described as silt loam underlain by gravelly coarse sandy loam with linear down slope shapes. Reybold-Queponco Complex is classified as hydrologic soil group B with moderately high to high infiltration rates of approximately 0.20 to 2.00 inches per hour. The depth to water table and restrictive features both exceed 80 inches. Woodstown loam is generally described as loam to sandy loam to fine sandy loam underlain by loamy sand with linear to concave down slope shapes. Woodstown sandy loam is classified as hydrologic soil group C with moderately high to high infiltration rates of approximately 0.57 to 1.98 inches per hour. Depth to water table is noted as 20 to 40 inches with depth to restrictive feature exceeding 80 inches. Sassafras sandy loam is generally described as sandy loam to sandy clay loam to loamy sand underlain by sand with linear down slope shape. Sassafras sandy loam is classified as hydrologic soil group B with moderately high to high infiltration rates of approximately 0.20 to 2.00 inches per hour. The depth to water table and restrictive features both exceed 80 inches. Approximate ground surface elevation was not provided in the mapping report prepared by the USDA. The USDA Web Soil Survey Report is attached.

SOIL STRATIGRAPHY

Subsurface stratigraphy encountered by the test pits generally consisted of a surficial layer of topsoil approximately 8 to 15 inches thick. This surficial layer of topsoil is generally underlain by fine to medium sand with trace to and silt/clay and trace fine to coarse gravel (Stratum B). Stratum A was only observed in six of the test pits beneath the topsoil and consisted of clay/silt with trace to little fine to medium sand, trace fine to coarse gravel. Underlying Strata A and B was a fine to medium to coarse sand with little to and fine to coarse gravel with trace to little silt or a fine to coarse gravel with little to and fine to medium to coarse sand and trace to little silt (Stratum C). Following Stratum C was a fine to medium to coarse sand with trace to little silt, and trace fine to coarse gravel (Stratum D). For descriptive purposes the soil layers can be classified as follows:

Stratum	Approximate Thickness (ft)	Description	USCS Classification
T	0.3	Topsoil	--
A[1]	1.0 – 3.0	Orange to gray SILT, trace to little fine sand (moist) OR Orange to brown to gray CLAY, trace to some fine to medium sand, trace fine to coarse gravel (moist)	ML CL
B[2]	1.0 – 8.5 +	Gray to orange to tan to brown to black to red fine to medium to coarse SAND, trace to and clay/silt, trace to some fine to coarse gravel (moist to wet)	SP to SM
C[3]	0.5 – 4.0 +	Brown to tan to orange fine to coarse GRAVEL, little to and fine to medium to coarse SAND, trace to little silt (moist to wet) OR Brown to orange to tan to black to gray fine to medium to coarse SAND, little to and fine to coarse gravel, trace to little silt (moist to wet)	GP SP
D[4]	0.5 – 4.5+	Tan to orange to brown to gray fine to medium to coarse SAND, trace to little silt, trace fine to coarse gravel (moist to wet)	SP

Notes:
[1] Stratum A was only encountered in test pits "TP-29," "TP-30," "TP-31," "TP-33," "TP-34" and "TP-37";
[2] Stratum B was not fully penetrated in test pits "TP-4," "TP-13," "TP-33," "TP-38,"and "TP-39". Stratum B was not encountered in Test Pit "TP-31";
[3] Stratum C was not fully penetrated in test pits "TP-1," "TP-3," "TP-5" through "TP-12," "TP-14" through "TP-22," "TP-25," and "TP-29". Stratum C was not encountered in test pits "TP-4," "TP-13," "TP-33," "TP-36," "TP-38," and "TP-39"; and
[4] Stratum D was not fully penetrated. Stratum D was only encountered in test pits "TP-2," "TP-23," TP-24," "TP-26," "TP-27," "TP-28," "TP-30," 'TP-31," "TP-32," "TP-34" through "TP-37," and "TP-40".

GROUNDWATER

Groundwater observations were made in each test pit during excavations and shortly after completion of each adjacent infiltration test. Apparent groundwater was encountered in test pits "TP-1," "TP-2," "TP-6," "TP-15" through "TP-18," and "TP-20" through "TP-36" at depths ranging approximately 3 feet to 10 feet below the ground surface (Elev. 50.4 feet to 56.9 feet, NAVD88). Groundwater was not encountered in the remaining test pits. These observations are for the times indicated and may not be indicative of seasonal or daily variations in the ground water levels. Seasonal variations on the order of several feet should be anticipated.

According to the Delaware Geologic Information Resource website, groundwater depths below the ground surface at the project site are noted to vary from 10 feet (Elev. 52.96 feet, relative to NAVD88) during "wet conditions" to 20 feet (Elev. 41.94.38 feet, relative to NAVD88) during "dry conditions."

Seasonal Highwater Table (SWHT)

Results from the field exploration were reviewed for soil composition and redoximorphic features (RMF). RMF, are defined as color patterns in a soil that are caused by loss or gain of pigment compared to the matrix color due to oxidation/reduction of iron and or manganese coupled with their removal, translocation, or accrual typically indicating the seasonal high-water table or a perched water condition. RMFs were observed within test pit "TP-37" at approximately 8 feet below the ground surface (Elev. 53.8 feet, NAVD88). RMFs were not observed within the remaining test pits at the site.

INFILTRATION TEST RESULTS

The following tables represent a summary of the field results for the thirty-nine single ring infiltration tests conducted at depths ranging from approximately 3 feet to 5 feet below the existing ground surface at approximate elevations ranging from 52.63 feet to 61.54 feet (NAVD88). Individual infiltration testing logs and infiltration rate graphs are attached.

Infiltration Test	Corresponding Test Pit	Date Tested	Corresponding Stratum	Testing Depth /Elevation (NAVD88)	Field Infiltration Rate (in/hr)	Design Infiltration Rate (in/hr)[1]
INF-1	TP-1	5/23/2024	B	3.0 / 59.86	0.25	N/A
INF-2	TP-2	5/23/2024	B	8.0 / 58.57	1.0	0.5
INF-3	TP-3	5/13/2024	B	5.0 / 57.11	0.5	N/A
INF-4	TP-4	5/13/2024	B	5.0 / 58.02	9.9	4.95
INF-5	TP-5	5/13/2024	B	5.0 / 56.96	13.0	6.5
INF-6	TP-6	5/13/2024	B	5.0 / 58.25	11.25	5.6
INF-7	TP-7	5/13/2024	B	5.0 / 57.39	10.0	5.0
INF-8	TP-8	5/13/2024	B	5.0 / 58.14	8.5	4.25
INF-9	TP-9	5/14/2024	B	5.0 / 59.46	12.0	6.0
INF-10	TP-10	5/14/2024	B	5.0 / 59.49	10.0	5.0
INF-11	TP-11	5/14/2024	B	5.0 / 59.89	10.0	5.0
INF-12	TP-12	5/14/2024	B	5.0 / 61.54	10.0	5.0
INF-13	TP-13	5/14/2024	B	5.0 / 60.47	10.0	5.0
INF-14	TP-14	5/16/2024	B	5.0 / 58.83	2.0	1.0
INF-15	TP-15	5/16/2024	B	5.0 / 57.46	8.0	4.0
INF-16	TP-16	5/16/2024	B	5.0 / 56.31	12.0	6.0
INF-17	TP-17	5/16/2024	B	5.0 / 55.79	2.0	1.0
INF-18	TP-18	5/16/2024	B	5.0 / 57.12	2.0	1.0
INF-19	TP-19	5/17/2024	B	5.0 / 58.09	8.0	4.0
INF-20	TP-20	5/17/2024	B	5.0 / 57.49	14.0	7.0
INF-21	TP-21	5/17/2024	B	5.0 / 57.36	12.0	6.0
INF-22	TP-22	5/17/2024	B	5.0 / 56.03	8.0	4.0
INF-23	TP-23	5/20/2024	B	5.0 / 55.57	2.2	1.1
INF-24	TP-24	5/20/2024	B	5.0 / 54.30	2.0	1.0
INF-25	TP-25	5/17/2024	B	5.0 / 54.98	8.0	4.0
INF-26	TP-26	5/20/2024	B	4.0 / 54.63	1.7	0.85
INF-27	TP-27	5/20/2024	B	3.0 / 54.66	3.5	1.75

(continued next page)

Infiltration Test	Corresponding Test Pit	Date Tested	Corresponding Stratum	Testing Depth /Elevation (NAVD88)	Field Infiltration Rate (in/hr)	Design Infiltration Rate (in/hr)[1]
INF-28	TP-28	5/20/2024	B	4.0 / 54.98	6.0	3.0
INF-29	TP-29	5/22/2024	B	5.0 / 54.71	9.0	4.5
INF-30	TP-30	5/22/2024	B	3.5 / 53.69	5.0	2.5
INF-31	TP-31	5/22/2024	A	3.0 / 52.63	0.0	N/A
INF-32	TP-32	5/21/2024	D	3.0 / 54.19	13.5	6.75
INF-34	TP-34	5/22/2024	B	3.0 / 54.32	1.0	0.5
INF-35	TP-35	5/22/2024	D	4.0 / 53.43	2.75	1.375
INF-36	TP-36	5/21/2024	D	3.0 / 54.68	21.0	10.5
INF-37	TP-37	5/21/2024	B	5.0 / 56.77	7.0	3.5
INF-38	TP-38	5/21/2024	B	5.0 / 57.90	4.0	2.0
INF-39	TP-39	5/21/2024	B	5.0 / 56.28	2.0	1.0
INF-40	TP-40	5/21/2024	B	5.0 / 58.02	0.5	N/A

[1] Design infiltration rate includes a factor of safety of 2.0 in accordance with Delaware Administrative Code Title 7, Section 5101, Sub-Section 12.0

Field infiltration rates were observed ranging from approximately 0.0 to 21.0 inches per hour within the site. Specifically, field infiltration rates of 0.0 incher per were observed within Stratum A. Field infiltration rates within Stratum B were observed to range from approximately 0.5 to 14.0 inches per hour. Within Stratum D field infiltration rates were observed to range from approximately 2.75 to 21.0 inches per hour. Design infiltration rates for single ring infiltration testing require a minimum factor of safety of two applied to the field infiltration rates.

CONCLUSIONS AND RECOMMENDATIONS

A completed DNREC Soil Investigation Report Submittal Checklist is attached. Based on the results of the field exploration, laboratory analysis, and review of published data the following has been concluded:

Groundwater Table

Observations for groundwater were performed in all test pits. Apparent groundwater was encountered in test pits “TP-1,” “TP-2,” “TP-6,” “TP-15” through “TP-18,” and “TP-20” through “TP-36” at depths ranging approximately 3.0 feet to 10.0 feet below the ground surface (Elev. 50.4 feet to 56.9 feet, NAVD88). All other test pits did not encounter groundwater throughout the excavations.

Groundwater, where encountered during this exploration, was generally higher than those mapped by the Delaware Geologic Survey. These observations are for the times indicated and may not be indicative of seasonal or daily variations in the ground water levels. Seasonal variations on the order of several feet should be anticipated.

Soil Conditions

- Indications of seasonal high-water table (SWHT) include redoximorphic features, defined as color patterns in a soil that are caused by loss or gain of pigment compared to the matrix color due to oxidation/reduction of iron and or manganese coupled with their removal, translocation, or accrual, were observed in test pit “TP-37.” RMFs were not observed within the remaining test pits.
- Observations of restrictive hardpan (cemented sand) were encountered within test pit “TP-3”. Restrictive hardpan was not observed within the remaining Test Pits.

- The strata found during the field explorations were generally consistent with those described in the USDA NRCS Web Soil Survey Report for Reybold silt loam (Reb). The field observations generally agree with the reported depth of the groundwater table exceeding 80 inches. Test pits "TP-1," "TP-27," "TP-30" through "TP-34," and "TP-36" were performed at lower elevations than the remainder of the test pits at the site and apparent groundwater was encountered approximately 36 to 72 inches below the ground surface.

Feasibility of Proposed Facilities

The field infiltration rates observed within Stratum A were observed to be 0.0 inches per hour. The field infiltration rates varied across the site due to the varying amounts of fine-grained materials within Stratum B and were observed to range from approximately 0.5 to 14.0 inches per hour. Field infiltration rates less than 1 inch per hour within Stratum B were observed in infiltration tests "INF-1," "INF-3," "INF-31," and "INF-40" due to percentage of fine-grained materials and the apparent groundwater table observed. Within Stratum D field infiltration rates were observed to range from approximately 2.75 to 21.0 inches per hour. The field infiltration rates observed within Strata B and D were generally higher than the rates reported for the Reybold Silt loam (0.2 to 2.0 inches per hour), as the material within these areas of testing generally appear more granular than the mapped soils.

According to the subsection 11.1.3.3 of the Delaware Sediment and Stormwater Regulations for native soils to meet infiltration feasibility criteria they must have a minimum field infiltration rate of 1 inch per hour. In general, the observed field infiltration rates indicate that the site is conducive to infiltration within Strata B and D soils. Strata B and D soils were observed between elevations 50.1 to 65.5 feet, NAVD88, and 47.6 to 54.8 feet, NAVD88, respectively. However, within Stratum B field infiltration rates less than 1 inch per hour were observed in infiltration tests "INF-1," "INF-3," "INF-31," and "INF-40" and indicate that these areas are not conducive to infiltration. Field infiltration rates observed within stratum A soils indicate that it is not conducive to infiltration. Shallow groundwater was observed at 3 feet below the ground surface (Elev. 52.1 feet, NAVD88) within test pit "TP-33" and indicates that this area is not conducive to infiltration.

As the invert elevation of each facility has not yet been finalized, we recommend that the facility inverts be designed between 3 and 5 feet below existing grade to avoid shallow groundwater observed at depths ranging approximately 3.0 feet to 10.0 feet below the ground surface (Elev. 50.4 feet to 56.9 feet, NAVD88).

These observations are based on the test results from the specific test locations only.

Earthwork

Prior to placing any new fill, and before the construction of the proposed stormwater management (SWM) facilities, construction debris, vegetation, and associated topsoil must be removed from the proposed construction areas. These materials can remain in proposed landscaped areas provided that future plans do not include building in those areas. SWM facilities shall be designed and constructed in accordance with the Delaware Sediment and Stormwater Regulations.

Our experience indicates that the on-site soils of Strata A, B, C, and D can be reused for the construction, provided all organics and debris larger than 3 inches in its greatest dimension be removed prior to reuse. Strata A and B soils were observed to contain a significant amount of fine-grained material (silts/clays). These types of soils are sensitive to moisture and may therefore require wetting or drying prior to compaction. Drying "wet" soil is difficult during wet periods and during lower temperatures. Therefore, provisions for importing structural fill should be included in the contract documents. If necessary, granular fill should consist of well-graded material with a maximum particle size less than 3 inches, not more than 20 percent passing the No. 200 sieve and have plasticity index (PI) not greater than 8 percent.

Fills should be placed in layers not exceeding 10 to 12 inches loose measure. This criterion might be adjusted by the geotechnical engineer in the field depending on the conditions present at the time of construction, on the compaction equipment used, and on the fill materials selected. Compaction of fill material and subgrade

will be highly dependent on whether the area will be utilized for infiltration. Where infiltration is being utilized, excessive compaction of the subgrade and fill is discouraged as this will tend to lower the infiltration rate. Specific guidance can be provided once the final design has been determined. Fills should extend and have side slopes not steeper than 2 horizontal to 1 vertical. Otherwise, settlement of the fill may occur.

Ground and Surface Water Management

The groundwater observations made in the test pits suggest that free standing water is not anticipated in excavations for the proposed SWM facilities. If wet conditions and/or seepage are encountered due to perched water, sumps and pumps should be adequate to maintain stable conditions during construction. During construction, surface runoff should be prevented from entering the basin excavations by creating soil berms or diversion swales along the perimeter if the excavations are expected to be open for a long period of time. Where ponding does occur, the water should be pumped immediately, and grades should then be established to prevent further ponding.

LIMITATIONS

This work has been done in accordance with our authorized scope of work and in accordance with generally accepted professional practice in the fields of geotechnical and foundation engineering. This warranty is in lieu of all other warranties either expressed or implied. Our conclusions and recommendations are based on the data revealed by this exploration. We are not responsible for any conclusions or opinions drawn from the data included herein, other than those specifically stated, nor are the recommendations presented in this report intended for direct use as construction specifications. This report is intended for use with regard to the specific project described herein; any changes in invert elevations and locations should be brought to our attention so that we may determine how they may affect our conclusions. An attempt has been made to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction. If this should occur, or if additional or contradictory data are revealed in the future, we should be notified so that modifications to this report can be made, if necessary. If we do not review relevant construction documents and witness the relevant construction operations, then we cannot be responsible for any problems that may result from misinterpretation or misunderstanding of this report or failure to comply with our recommendations.

We trust that the information presented in this report is what you require at this time and we thank you for the opportunity to assist you with this project. If you have any questions, or if you need any further assistance with this project, please contact this office at your earliest convenience.

Sincerely,
PENNONI ASSOCIATES INC.

Nicholas Fisher
Graduate Geotechnical Engineer

Theodore A. Thomson, Jr., PhD, PE, BC. GE, LEED AP
Associate Vice President/Geotechnical Division Manager

Attachments: Site Location Sketch, SK-1 (1 page)
Testing Location Sketch, SK-2 (1 page)
Test Pit Logs (40 pages)
Laboratory Testing Results (12 pages)
Single Ring Infiltration Data Graphs (41 pages)
Soil Investigation Report Submittal Checklist (7 pages)
USDA Web Soil Survey Report (35 pages)



SITE LOCATION SKETCH



Site Location Sketch adapted from a Google Earth Image Dated April 12, 2023

Pennoni Associates, Inc.
121 Continental Drive, Suite 207
Newark, DE 19713

ALL DOCUMENTS PREPARED BY PENNONI ASSOCIATES ARE INSTRUMENTS OF SERVICE IN RESPECT OF THE PROJECT. THEY ARE NOT INTENDED OR REPRESENTED TO BE SUITABLE FOR REUSE BY OWNER OR OTHERS ON EXTENSIONS OF THE PROJECT OR ON ANY OTHER PROJECT. ANY REUSE WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY PENNONI ASSOCIATES FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT OWNERS SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO PENNONI ASSOCIATES; AND OWNER SHALL INDEMNIFY AND HOLD HARMLESS PENNONI ASSOCIATES FROM ALL CLAIMS, DAMAGES, LOSSES, AND EXPENSES ARISING OUT OF OR RESULTING THEREFROM.

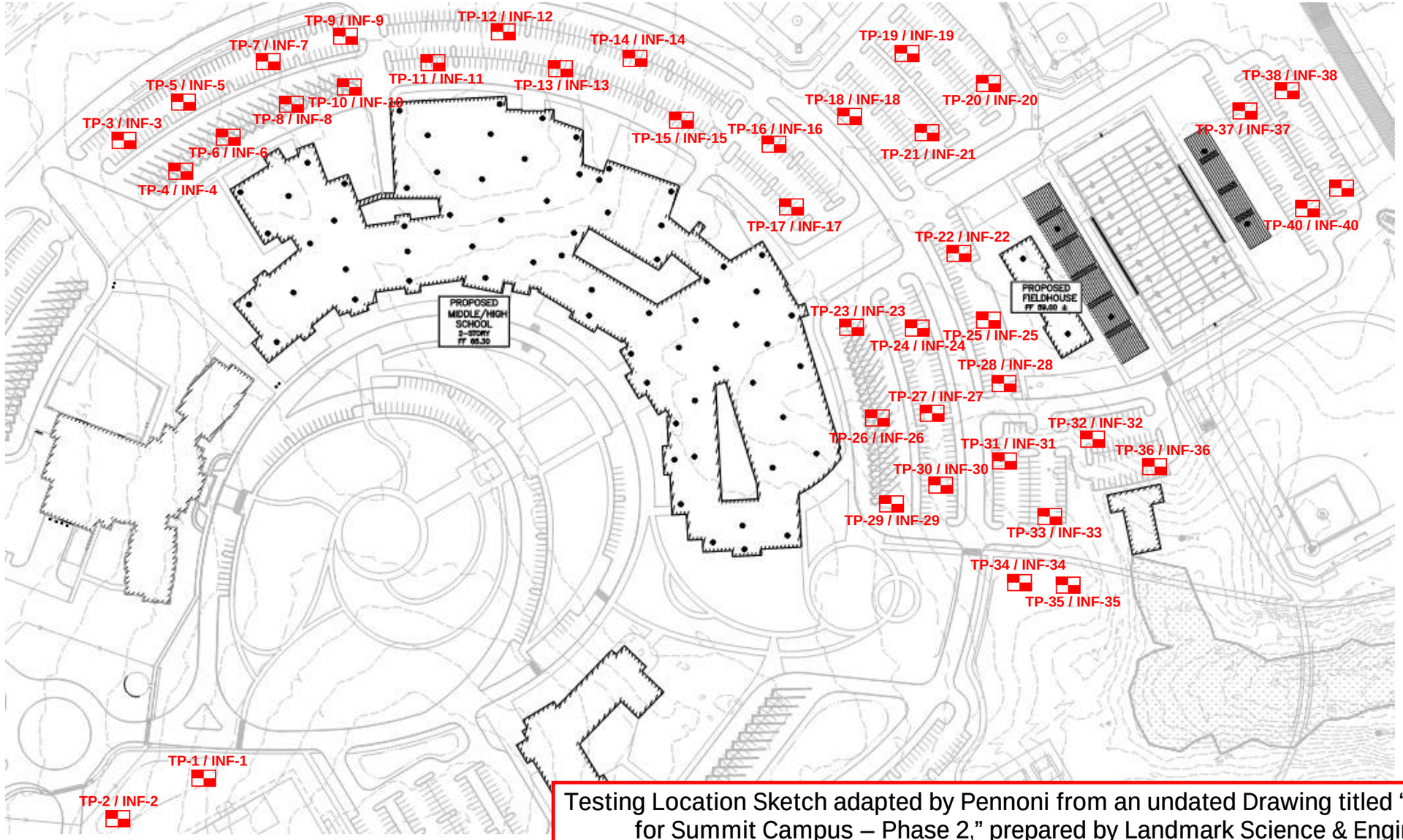
DRAWN BY:	SCALE:	DATE:
NPF	AS SHOWN	7/5/2024
CHECKED BY:	FIGURE No.	
TAT	SK-1	
PROJECT No:		
LDMSE24001		

ASD Summit Campus - Middletown, Delaware

TESTING LOCATION SKETCH

LEGEND

- Approximate Test Pit and Infiltration Test Location



Testing Location Sketch adapted by Pennoni from an undated Drawing titled “Boring Exhibit for Summit Campus – Phase 2,” prepared by Landmark Science & Engineering.

Pennoni Associates, Inc.
121 Continental Drive, Suite 207
Newark, DE 19713

ALL DOCUMENTS PREPARED BY PENNONI ASSOCIATES ARE INSTRUMENTS OF SERVICE IN RESPECT OF THE PROJECT. THEY ARE NOT INTENDED OR REPRESENTED TO BE SUITABLE FOR REUSE BY OWNER OR OTHERS ON EXTENSIONS OF THE PROJECT OR ON ANY OTHER PROJECT. ANY REUSE WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY PENNONI ASSOCIATES FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT OWNERS SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO PENNONI ASSOCIATES; AND OWNER SHALL INDEMNIFY AND HOLD HARMLESS PENNONI ASSOCIATES FROM ALL CLAIMS, DAMAGES, LOSSES, AND EXPENSES ARISING OUT OF OR RESULTING THEREFROM.

DRAWN BY:	SCALE:	DATE:
NPF	NTS	7/5/2024
CHECKED BY: TAT	FIGURE No. SK-2	
PROJECT No: LDMSE24001		

ASD Summit Campus - Middletown, Delaware

TEST PIT LOG

Test Pit TP-1

NORTHING 555020.9774

EASTING 571898.2232

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/23/24 **COMPLETED** 5/23/24

GROUND ELEVATION 62.9' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 6.0' / Elev 56.9'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 6.0' / Elev 56.9'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	1.0	12" TOPSOIL	61.9	
				2.0	Gray fine to medium SAND, some clay		
	S-1				Orange medium to fine to coarse SAND, little silt		Infiltration test INF-1 set at 3 ft
5			B	6.0	Tan fine to medium to coarse SAND, trace silt		
				8.0		54.9	
			C	8.5	Brown to tan fine to coarse GRAVEL and fine to medium to coarse SAND, trace silt	54.4	

Test Pit terminated at 8.5 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-2 (B)

NORTHING 554952.3572

EASTING 571755.9665

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/23/24 **COMPLETED** 5/23/24

GROUND ELEVATION 63.6' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 8.0' / Elev 55.6'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Measured

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION 8.0' / Elev 55.6'

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	12" TOPSOIL 1.0 / 62.6	
			B	Gray fine to medium SAND, some clay 2.0 Orange fine to medium to coarse SAND, little silt, trace fine gravel	
5	S-1			6.0 / 57.6	Infiltration test INF-2 set at 5 ft
			C	Brown to orange fine to coarse GRAVEL and fine to medium SAND, trace silt 8.0 / 55.6	
			D	Tan fine to medium to coarse SAND, trace silt 9.0 / 54.6	
				Test Pit terminated at 9.0 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.
Test pit offset 5 feet Northeast due to encountered utility.

TEST PIT LOG

Test Pit TP-3

NORTHING 556075.1078

EASTING 571764.7218

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/13/24 **COMPLETED** 5/13/24

GROUND ELEVATION 62.1' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T		15" TOPSOIL		
				1.3		60.9	
					Brown to black fine to medium SAND and CLAY		Moist
				4.0			
			B		Tan to brown fine to medium SAND, some silt		
5	S-1						Infiltration test INF-3 set at 5 ft Micaceous
				7.5		54.6	Cemented sand
			C	8.0	Brown to orange fine to medium to coarse SAND and fine to coarse GRAVEL, trace silt	54.1	
					Test Pit terminated at 8.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-4

NORTHING 556021.5946

EASTING 571860.26

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/13/24 **COMPLETED** 5/13/24

GROUND ELEVATION 63.0' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	12" TOPSOIL 1.0 / 62.0	
			B	Dark brown fine to medium SAND, some clay 2.5 Tan to brown medium to fine to coarse SAND, trace silt	Moist
5	S-1				Infiltration test INF-4 set at 5 ft
				8.0 / 55.0 Test Pit terminated at 8.0 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-5

NORTHING 556138.5597

EASTING 571864.8854

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/13/24 **COMPLETED** 5/13/24

GROUND ELEVATION 62.0' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	1.0	12" TOPSOIL	61.0	
			B	3.5	Dark brown fine to medium SAND, some clay Tan to brown fine to medium SAND, little silt		
5	S-1						Infiltration test INF-5 set at 5 ft
			C	7.0		55.0	Cobbles / Boulders
				8.0	Tan to brown fine to medium to coarse SAND, little silt, little fine to coarse gravel	54.0	Moist
					Test Pit terminated at 8.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-6

NORTHING 556077.9751

EASTING 571939.6653

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/13/24 **COMPLETED** 5/13/24

GROUND ELEVATION 63.3' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

▽ **DURING EXCAVATION** 10.0' / Elev 53.3'

OPERATOR / HELPER Gene Blemings

▼ **AT END OF EXCAVATION** 10.0' / Elev 53.3'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	12" TOPSOIL 1.0 / 62.3	
			B	Brown to tan fine to medium to coarse SAND, little silt	Moist
5	S-1				Infiltration test INF-6 set at 5 ft
				9.0 / 54.3	Wet
10 ▼			C	10.0 Brown to black fine to medium to coarse SAND and fine to coarse GRAVEL, trace silt / 53.3	Boulders / cobbles
				Test Pit terminated at 10.0 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-7

NORTHING 556205.68

EASTING 572004.5285

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/13/24 **COMPLETED** 5/13/24

GROUND ELEVATION 62.4' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION		REMARKS
0				Depth	Elev.	
			T	0.8 9" TOPSOIL	61.6	
			B	Brown to tan fine to medium SAND, little silt		Moist
5	S-1			5.0 Brown to tan medium to fine to coarse SAND, trace silt		Infiltration test INF-7 set at 5 ft
				6.0	56.4	
			C	Brown to black fine to medium to coarse SAND and fine to coarse GRAVEL, little silt		Boulders / Cobbles
				9.0	53.4	
				Test Pit terminated at 9.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-8

NORTHING 556133.1713

EASTING 572043.5084

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/13/24 **COMPLETED** 5/13/24

GROUND ELEVATION 63.1' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	10" TOPSOIL 0.8 / 62.3	
			B	Dark brown fine to medium SAND, some clay 2.5 Tan to brown medium to fine to coarse SAND, little silt, trace fine gravel	Moist
5	S-1				Infiltration test INF-8 set at 5 ft
				6.5 / 56.6	
			C	Tan to brown fine to medium to coarse SAND and fine to coarse GRAVEL, little silt	Boulders / Cobbles
				9.0 / 54.1	Wet
				Test Pit terminated at 9.0 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-9

NORTHING 556244.9813

EASTING 572134.2113

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/14/24 **COMPLETED** 5/14/24

GROUND ELEVATION 64.5' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	1.1	13" TOPSOIL	63.4	
			B		Brown medium to fine SAND and SILT		
5	S-1			5.0	Brown medium to fine to coarse SAND, little silt, trace fine gravel		Infiltration test INF-9 set at 5 ft
				8.0		56.5	
			C	9.0	Brown to gray medium to fine to coarse SAND and coarse to fine GRAVEL	55.5	
					Test Pit terminated at 9.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-10

NORTHING 556162.882

EASTING 572138.4103

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/14/24 **COMPLETED** 5/14/24

GROUND ELEVATION 64.5' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.9	11" TOPSOIL	63.6	
			B		Brown medium to fine SAND and SILT		
5	S-1			5.0	Brown medium to fine to coarse SAND, little silt, trace fine gravel		Infiltration test INF-10 set at 5 ft
				8.0		56.5	
			C	9.0	Brown to gray medium to fine to coarse SAND and coarse to fine GRAVEL	55.5	
					Test Pit terminated at 9.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-11

NORTHING 556201.9896

EASTING 572277.892

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/14/24 **COMPLETED** 5/14/24

GROUND ELEVATION 64.9' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION		REMARKS
0				Depth	Elev.	
			T	12" TOPSOIL 1.0	63.9	
			B	Brown to light brown fine to medium SAND and SILT 3.0 Brown to light brown fine to medium SAND, little silt		
5	S-1					Infiltration test INF-11 set at 5 ft
				7.0	57.9	
			C	Brown to gray medium to fine to coarse SAND and coarse to fine GRAVEL 9.0	55.9	
				Test Pit terminated at 9.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-12

NORTHING 556255.3831

EASTING 572392.2194

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/14/24 **COMPLETED** 5/14/24

GROUND ELEVATION 66.5' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T		12" TOPSOIL		
				1.0		65.5	
			B		Brown to light brown medium to fine SAND and SILT		
5	S-1			5.0	Brown medium to fine SAND, trace silt, trace fine gravel		Infiltration test INF-12 set at 5 ft
				9.0		57.5	
			C	9.5	Brown to gray medium to fine to coarse SAND and coarse to fine GRAVEL	57.0	
					Test Pit terminated at 9.5 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-13

PAGE 1 OF 1

NORTHING 556193.0617

EASTING 572487.3449

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/14/24 **COMPLETED** 5/14/24

GROUND ELEVATION 65.5' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	0.7 — 8" TOPSOIL — 64.8	
				Brown medium to fine SAND and SILT	
				2.0 — Brown to light brown fine to medium to coarse SAND, some silt	
5	S-1		B		Infiltration test INF-13 set at 5 ft
				9.0 — 56.5	
				Test Pit terminated at 9.0 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-14

NORTHING 556209.4369

EASTING 572611.8362

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/16/24 **COMPLETED** 5/16/24

GROUND ELEVATION 63.8' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	13" TOPSOIL 1.1 / 62.8	
			B	Brown medium to fine SAND, little fine gravel 4.0	
5	S-1		B	Brown to light brown fine to medium SAND, little silt 8.0 / 55.8	Infiltration test INF-14 set at 5 ft
			C	Brown medium to fine SAND and fine to coarse GRAVEL, trace silt 9.0 / 54.8	

Test Pit terminated at 9.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-15

PAGE 1 OF 1

NORTHING 556107.9536

EASTING 572688.9258

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/16/24 **COMPLETED** 5/16/24

GROUND ELEVATION 62.5' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

▽ **DURING EXCAVATION** 8.0' / Elev 54.5'

OPERATOR / HELPER Gene Blemings

▼ **AT END OF EXCAVATION** 8.0' / Elev 54.5'

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION		REMARKS
0				Depth	Elev.	
			T	12" TOPSOIL 1.0	61.5	
			B	Brown medium to fine SAND, trace to little fine gravel, trace silt 4.0		
5	S-1			Brown fine to medium SAND, trace silt 5.0	57.5	Infiltration test INF-15 set at 5 ft
			C	Brown coarse SAND and fine GRAVEL, trace silt 9.0	53.5	
				Test Pit terminated at 9.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-16

NORTHING 556068.6144

EASTING 572840.4508

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/16/24 **COMPLETED** 5/16/24

GROUND ELEVATION 61.3' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 8.0' / Elev 53.3'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 8.0' / Elev 53.3'

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.7	8" TOPSOIL	60.6	
			B		Brown to dark brown SAND, some fine gravel, trace silt		
				4.0			
5	S-1		B		Brown to light brown fine to medium to coarse SAND, little silt		Infiltration test INF-16 set at 5 ft
				8.0		53.3	
			C		Brown to light brown medium to fine SAND and fine to coarse GRAVEL, trace silt		
				9.5		51.8	

Test Pit terminated at 9.5 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-17

NORTHING 555963.3796

EASTING 572869.952

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/16/24 **COMPLETED** 5/16/24

GROUND ELEVATION 60.8' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 8.0' / Elev 52.8'

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	0.7 — 8" TOPSOIL — 60.1	
			B	Brown to black medium to fine to coarse SAND, trace fine gravel, trace silt	
5	S-1			5.0 — Brown to light brown fine to medium to coarse SAND and SILT	Infiltration test INF-17 set at 5 ft
				8.0 — 52.8	
			C	Brown medium to fine SAND and fine to coarse GRAVEL, trace silt	
				9.5 — 51.3	
				Test Pit terminated at 9.5 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-18

NORTHING 556114.3253

EASTING 572962.8363

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/16/24 **COMPLETED** 5/16/24

GROUND ELEVATION 62.1' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 8.0' / Elev 54.1'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 8.0' / Elev 54.1'

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	12" TOPSOIL 1.0 / 61.1	
			B	Brown medium to fine SAND, some silt	
				3.0 Brown fine SAND, some silty clay	
5	S-1			5.0 Brown fine to medium to coarse SAND and Silty CLAY	Infiltration test INF-18 set at 5 ft
				7.0 / 55.1	
			C	Brown medium to fine SAND, little fine gravel, trace silt 8.0 / 54.1	
				Test Pit terminated at 8.0 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-19

PAGE 1 OF 1

NORTHING 556218.2202

EASTING 573060.5771

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/17/24 **COMPLETED** 5/17/24

GROUND ELEVATION 63.1' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.7	8" TOPSOIL	62.4	
					Brown medium to fine SAND, some silt, little fine gravel		
			B	4.0			
5	S-1				Brown to light brown fine to medium to coarse SAND, little silt		Infiltration test INF-19 set at 5 ft
				7.0		56.1	
			C		Brown medium to fine to coarse SAND and fine GRAVEL, trace silt		
				9.0		54.1	
					Test Pit terminated at 9.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-20

NORTHING 556167.6914

EASTING 573196.4072

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/17/24 **COMPLETED** 5/17/24

GROUND ELEVATION 62.5' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 8.0' / Elev 54.5'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 8.0' / Elev 54.5'

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.8	10" TOPSOIL	61.7	
			B	4.0	Brown medium to fine SAND, some silt		
5	S-1				Brown to light brown medium to fine to coarse SAND, trace silt, trace fine gravel		Infiltration test INF-20 set at 5 ft
				7.0		55.5	
			C		Brown fine to medium SAND and fine to coarse GRAVEL, trace silt		
				9.0		53.5	

Test Pit terminated at 9.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-21

NORTHING 556085.1287

EASTING 573092.2806

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/17/24 **COMPLETED** 5/17/24

GROUND ELEVATION 62.4' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 8.0' / Elev 54.4'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 8.0' / Elev 54.4'

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.7	8" TOPSOIL	61.7	
			B		Brown fine to medium SAND, some silt		
5	S-1			5.0		57.4	Infiltration test INF-21 set at 5 ft
			C		Brown fine SAND, some fine gravel, trace silt		
				8.0			
					Brown medium to fine SAND and fine GRAVEL, trace silt		
				9.0		53.4	
					Test Pit terminated at 9.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-22

NORTHING 555887.0436

EASTING 573146.0222

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/17/24 **COMPLETED** 5/17/24

GROUND ELEVATION 61.0' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 8.0' / Elev 53.0'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 8.0' / Elev 53.0'

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.5	6" TOPSOIL	60.5	
			B		Brown to dark brown medium to fine SAND, some silt, trace fine gravel		
				3.0	Brown to light brown fine to medium SAND, little silt		
5	S-1						Infiltration test INF-22 set at 5 ft
				7.0		54.0	
			C	8.0	Brown to light brown coarse to medium to fine SAND and fine GRAVEL, trace silt	53.0	

Test Pit terminated at 8.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-23

NORTHING 555767.6145

EASTING 572967.111

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/20/24 **COMPLETED** 5/20/24

GROUND ELEVATION 60.6' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

▽ **DURING EXCAVATION** 9.0' / Elev 51.6'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Measured

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

▼ **AFTER EXCAVATION** 9.0' / Elev 51.6'

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	1.0	12" TOPSOIL	59.6	
			B	2.0	Brown fine to medium SAND, some clay Orange to brown fine to medium SAND, little silt, trace fine gravel		
5	S-1			5.0	Orange to brown fine to medium SAND, some silt		Infiltration test INF-23 set at 5 ft
				7.0		53.6	
			C	7.5	Brown fine to medium SAND and fine to coarse GRAVEL, trace silt	53.1	
			D		Tan fine to medium SAND, trace silt		
▼				9.0		51.6	
					Test Pit terminated at 9.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-24

NORTHING 555762.8482

EASTING 573075.2998

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/20/24 **COMPLETED** 5/20/24

GROUND ELEVATION 59.3' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

▽ **DURING EXCAVATION** 8.0' / Elev 51.3'

OPERATOR / HELPER Gene Blemings

▼ **AT END OF EXCAVATION** 8.0' / Elev 51.3'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION		REMARKS
0				Depth	Elev.	
			T	12" TOPSOIL 1.0	58.3	
			B	Brown fine to medium SAND, some clay 3.0		
5	S-1		B	Brown to orange fine to medium to coarse SAND, little silt, trace fine gravel 6.0	53.3	Infiltration test INF-24 set at 5 ft
			C	Brown fine to coarse GRAVEL and fine to medium SAND, trace silt 7.0	52.3	
▼			D	Tan fine to medium SAND, trace silt 8.0	51.3	
				Test Pit terminated at 8.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-25

NORTHING 555778.776

EASTING 573196.3805

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/17/24 **COMPLETED** 5/17/24

GROUND ELEVATION 60.0' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 8.0' / Elev 52.0'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 8.0' / Elev 52.0'

LOGGED BY N. Francois **CHECKED BY** A. Spencer

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth — Elev.	
			T	12" TOPSOIL 1.0 — 59.0	
			B	Brown medium to fine SAND, some silt 4.0	
5	S-1			Brown fine to medium SAND, little silt	Infiltration test INF-25 set at 5 ft
				7.0 — 53.0	
			C	Brown medium to fine SAND and fine GRAVEL, trace silt 9.0 — 51.0	
				Test Pit terminated at 9.0 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-26

NORTHING 555617.565

EASTING 573008.9161

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/20/24 **COMPLETED** 5/20/24

GROUND ELEVATION 58.6' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 8.0' / Elev 50.6'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 8.0' / Elev 50.6'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	12" TOPSOIL 1.0 / 57.6	
			B	Tan to gray fine to medium SAND, some silt 3.0 Brown fine to medium SAND, little silt	
	S-1				Infiltration test INF-26 set at 4 ft
5				5.0 / 53.6	
			C	Dark brown fine to coarse GRAVEL, little to some fine to medium sand 6.0 / 52.6	
			D	Orange fine to medium SAND, little silt, trace fine to coarse gravel 8.0 / 50.6	
				Test Pit terminated at 8.0 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-27

NORTHING 555627.1004

EASTING 573103.3025

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/20/24 **COMPLETED** 5/20/24

GROUND ELEVATION 57.7' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 6.0' / Elev 51.7'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 6.0' / Elev 51.7'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	12" TOPSOIL 1.0 / 56.7	
			B	Brown fine to medium SAND, some silt 2.0 Orange fine to medium to coarse SAND, some silt	
	S-1			3.5 / 54.2	Infiltration test INF-27 set at 3 ft
			C	Orange to brown fine to coarse GRAVEL and fine to medium to coarse SAND, trace silt 4.5 Orange to brown fine to medium SAND and fine to coarse GRAVEL, trace silt	
5				6.0 / 51.7	
			D	Tan fine to medium SAND, trace silt	
				8.0 / 49.7	

Test Pit terminated at 8.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-28

NORTHING 555671.9759

EASTING 573219.4274

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/20/24 **COMPLETED** 5/20/24

GROUND ELEVATION 59.0' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 8.0' / Elev 51.0'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 8.0' / Elev 51.0'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0			T	12" TOPSOIL Depth 1.0 — Elev. 58.0	
			B	Orange fine to medium SAND, some to and CLAY 3.0 Orange fine to medium SAND, little silt	
	S-1			4.0 — Elev. 55.0	Infiltration test INF-28 set at 4 ft
5			C	Orange to brown fine to medium SAND, some to and fine to coarse GRAVEL, trace silt 7.0 — Elev. 52.0	
			D	Tan fine to medium SAND, trace silt 8.0 — Elev. 51.0	
				Test Pit terminated at 8.0 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-29

NORTHING 555473.9041

EASTING 573036.2586

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/22/24 **COMPLETED** 5/22/24

GROUND ELEVATION 59.7' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 8.0' / Elev 51.7'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 8.0' / Elev 51.7'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	12" TOPSOIL 1.0 / 58.7	
			A	Orange SILT 3.0 Orange CLAY, trace to little fine to medium sand 4.0 / 55.7	
5	S-1		B	Orange to brown fine to medium to coarse SAND, little silt, trace fine gravel 6.0 / 53.7	Infiltration test INF-29 set at 5 ft
			C	Orange to brown fine to medium SAND and fine to coarse GRAVEL, little silt 8.0 / 51.7	
				Test Pit terminated at 8.0 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-30

PAGE 1 OF 1

NORTHING 555502.6575

EASTING 573115.818

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/22/24 **COMPLETED** 5/22/24

GROUND ELEVATION 57.2' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

▽ **DURING EXCAVATION** 6.0' / Elev 51.2'

OPERATOR / HELPER Gene Blemings

▼ **AT END OF EXCAVATION** 6.0' / Elev 51.2'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0			T	Depth 12" TOPSOIL 1.0 / Elev. 56.2	
			A	Orange to brown CLAY 3.5 / 53.7	
	S-1		B	Orange fine to medium SAND, little silt 5.0	Infiltration test INF-30 set at 3.5 ft
5				5.5 Brown fine to medium to coarse SAND, some fine to coarse gravel, little silt / 51.7	
▼			C	Brown to orange fine to coarse GRAVEL, some fine to medium to coarse sand, little silt 7.5 / 49.7	
			D	Tan to orange fine to medium SAND, trace silt 9.0 / 48.2	
				Test Pit terminated at 9.0 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-31

NORTHING 555542.1548

EASTING 573222.3957

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/22/24 **COMPLETED** 5/22/24

GROUND ELEVATION 55.6' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

▽ **DURING EXCAVATION** 5.0' / Elev 50.6'

OPERATOR / HELPER Gene Blemings

▼ **AT END OF EXCAVATION** 5.0' / Elev 50.6'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	12" TOPSOIL 1.0 / 54.6	
			A	Brown CLAY 2.0 Gray to brown CLAY and fine to medium SAND	
	S-1			4.0 / 51.6	Infiltration test INF-31 set at 3 ft
5 ▼			C	Brown fine to medium to coarse SAND and fine to coarse GRAVEL 6.0 / 49.6	
			D	Brown fine to medium SAND, little silt 8.0 / 47.6	

Test Pit terminated at 8.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-32

NORTHING 555579.4342

EASTING 573365.7053

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/21/24 **COMPLETED** 5/21/24

GROUND ELEVATION 57.2' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 6.0' / Elev 51.2'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 6.0' / Elev 51.2'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION		REMARKS
				Depth	Elev.	
0			T	12" TOPSOIL 1.0	56.2	
			B	Brown fine to medium SAND, little silt 2.0	55.2	
			C	Brown fine to medium SAND and fine to coarse GRAVEL, little silt 3.0	54.2	
	S-1		D	Tan to orange fine to medium SAND, little fine gravel, trace silt		Infiltration test INF-32 set at 3 ft
5						
				8.0	49.2	

Test Pit terminated at 8.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-33

NORTHING 555451.5355

EASTING 573298.0031

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/22/24 **COMPLETED** 5/22/24

GROUND ELEVATION 55.1' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

▽ **DURING EXCAVATION** 4.0' / Elev 51.1'

OPERATOR / HELPER Gene Blemings

▼ **AT END OF EXCAVATION** 3.0' / Elev 52.1'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION		REMARKS
0				Depth	Elev.	
			T	12" TOPSOIL 1.0	54.1	
			A	Brown CLAY 2.0	53.1	
			B	Orange fine to medium SAND, some silt, trace fine to coarse gravel		No infiltration test due to shallow groundwater
				4.0 Orange fine to medium SAND, trace silt		
5				5.0 Test Pit terminated at 5.0 feet.	50.1	Excavation terminated due to perpetual cave in

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-34

NORTHING 555342.9244

EASTING 573247.9353

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/22/24 **COMPLETED** 5/22/24

GROUND ELEVATION 57.3' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

▽ **DURING EXCAVATION** 6.0' / Elev 51.3'

OPERATOR / HELPER Gene Blemings

▼ **AT END OF EXCAVATION** 6.0' / Elev 51.3'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	1.0	12" TOPSOIL	56.3	
			A	3.0	Brown CLAY, little to some fine to medium sand, trace fine to coarse gravel	54.3	Infiltration test INF-34 set at 3 ft
	S-1		B	4.0	Orange fine to medium to coarse SAND and SILT	53.3	
			C	4.5	Brown fine to medium to coarse SAND and fine to coarse GRAVEL, trace silt	52.8	
5			D	8.0	Orange fine to medium SAND, little silt	49.3	

Test Pit terminated at 8.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-35

NORTHING 555339.046

EASTING 573324.8237

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/22/24 **COMPLETED** 5/22/24

GROUND ELEVATION 57.4' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

▽ **DURING EXCAVATION** 7.0' / Elev 50.4'

OPERATOR / HELPER Gene Blemings

▼ **AT END OF EXCAVATION** 7.0' / Elev 50.4'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION		REMARKS
				Depth	Elev.	
0			T	12" TOPSOIL 1.0	56.4	
			B	Brown to orange fine to medium SAND, trace silt, trace fine to coarse gravel 3.0	54.4	
			C	3.5 Orange to brown fine to medium SAND and fine to coarse GRAVEL	53.9	
	S-1			Orange to brown fine to medium to coarse SAND, little silt		Infiltration test INF-35 set at 4 ft
5			D			
				8.0	49.4	

Test Pit terminated at 8.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-36

NORTHING 555534.7658

EASTING 573468.0706

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/21/24 **COMPLETED** 5/21/24

GROUND ELEVATION 57.7' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION 6.0' / Elev 51.7'

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION 6.0' / Elev 51.7'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	1.0	12" TOPSOIL	56.7	
			B	2.0	Orange to red fine to medium to coarse SAND, little silt, trace fine to coarse gravel		
				3.0	Orange to brown fine to medium to coarse SAND, some fine to coarse gravel, trace silt	54.7	Infiltration test INF-36 set at 3 ft
	S-1				Tan to orange medium to fine to coarse SAND, little silt, trace fine gravel		
5			D				
				8.0		49.7	

Test Pit terminated at 8.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-37

NORTHING 556121.421

EASTING 573620.1385

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/21/24 **COMPLETED** 5/21/24

GROUND ELEVATION 61.8' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	1.0	12" TOPSOIL	60.8	
			B	2.0	Brown fine to medium SAND, some silt	59.8	
			A	4.0	Gray SILT, little fine sand	57.8	
5	S-1		B	6.0	Orange fine to medium to coarse SAND, little silt, trace fine gravel	55.8	Infiltration test INF-37 set at 5 ft
			C	8.0	Brown to orange fine to medium to coarse SAND and fine to coarse GRAVEL, trace silt	53.8	
			D	8.5	Gray to orange fine to medium SAND, trace silt	53.3	Mottling
					Test Pit terminated at 8.5 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-38

NORTHING 556154.7741

EASTING 573686.8144

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/21/24 **COMPLETED** 5/21/24

GROUND ELEVATION 62.9' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	12" TOPSOIL 1.0 / 61.9	
			B	Orange to gray fine to medium SAND, some clayey silt	
				4.0 Orange to tan fine to medium to coarse SAND, little silt, trace fine gravel	
5	S-1				Infiltration test INF-38 set at 5 ft
				7.0 Orange to brown fine to medium SAND, some fine to coarse gravel, little silt	
				8.0 8.5 Orange fine to medium SAND, little silt, trace fine to coarse gravel / 54.4	
				Test Pit terminated at 8.5 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-39

NORTHING 555997.181

EASTING 573779.1954

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/21/24 **COMPLETED** 5/21/24

GROUND ELEVATION 61.3' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	12" TOPSOIL 1.0 / 60.3	
			B	Orange to brown fine to medium SAND, some clay 3.0 Orange fine to medium SAND, little silt	
5	S-1				Infiltration test INF-39 set at 5 ft
				6.0 Orange fine to medium SAND, some fine to coarse gravel, trace silt 8.0 / 53.3	
				Test Pit terminated at 8.0 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-40

NORTHING 555963.8889

EASTING 573722.5978

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 5/21/24 **COMPLETED** 5/21/24

GROUND ELEVATION 60.8' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not Encountered

OPERATOR / HELPER Gene Blemings

AT END OF EXCAVATION Not Encountered

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER EXCAVATION Not Encountered

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	12" TOPSOIL 1.0 / 59.8	
			B	Brown fine to medium SAND, some clay, trace fine to coarse gravel 3.0 Orange fine to medium SAND, some silt	
	S-1				Infiltration test INF-40 set at 4 ft
5				5.0 / 55.8	
			C	Brown to orange fine to medium SAND and fine to coarse GRAVEL, trace silt 6.0 / 54.8	
			D	Orange fine to medium SAND, trace silt 8.0 / 52.8	
				Test Pit terminated at 8.0 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION				PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			Organic Content (%)			SHEAR STRENGTH		
				GRAVEL %	SAND %	SILT %	CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_p	LIQUIDITY INDEX I_L		SPECIFIC GRAVITY (G)	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)
TP-1	S-1	3'		0	89	11						9.1													
TP-2(B)	S-1	5'		5	84	11						12.0													
TP-3	S-1	5'		0	79	21						24.8													
TP-4	S-1	5'		0	51	9						9.3													
TP-5	S-1	5'		0	87	13						10.2													
TP-6	S-1	5'		0	88							8.5													
TP-7	S-1	5'		0	91	9						7.1													
TP-8	S-1	5'		1	87	12						7.7													
TP-9	S-1	5'		2	85	13						10.1													
TP-10	S-1	5'		1	89	10						8.6													
TP-11	S-1	5'		0	89	11						8.1													
TP-12	S-1	5'		1	91	8						6.7													

PENNONI ASSOCIATES INC.	DRAWN BY: JTR CHECKED BY:	DATE: 7/2/2024 DATE:
PROJECT: **Appoquinimink School District Campus** LOCATION: **Middletown, DE**	JOB No.: **LDMSE24001** TABLE No.: **L-1**	

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION				PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			Organic Content (%)			SHEAR STRENGTH		
				GRAVEL %	SAND %	SILT %	CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_p	LIQUIDITY INDEX I_L		SPECIFIC GRAVITY (G)	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)
TP-13	S-1	5'		0	69	31						14.3													
TP-14	S-1	5'		0	88	12						12.7													
TP-15	S-1	5'		0	97	3						6.3													
TP-16	S-1	5'		0	85	15						10.5													
TP-17	S-1	5'		0	51	49						12.4													
TP-18	S-1	5'		0	63	37						10.0													
TP-19	S-1	5'		0	86	14						9.4													
TP-20	S-1	5'		5	86	9						8.3													
TP-21	S-1	5'		0	75	25						12.3													
TP-22	S-1	5'		0	85	15						11.7													
TP-23	S-1	5'		0	74	26						14.4													
TP-24	S-1	5'		3	84	13						14.5													

PENNONI ASSOCIATES INC.	DRAWN BY: JTR	DATE: 7/2/2024	PROJECT: **Appoquinimink School District Campus**
	CHECKED BY:	DATE:	LOCATION: **Middletown, DE**

JOB No.: **LDMSE24001**

TABLE No.: **L-1**

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION				PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			Organic Content (%)			SHEAR STRENGTH		
				GRAVEL %	SAND %	SILT %	CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_p	LIQUIDITY INDEX I_L		SPECIFIC GRAVITY (G)	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)
TP-25	S-1	5'		0	85	15						15.1													
TP-26	S-1	4'		0	85	15						13.8													
TP-27	S-1	3'		0	79	21						15.4													
TP-28	S-1	4'		0	87	13						9.7													
TP-29	S-1	5'		4	80	16						10.4													
TP-30	S-1	3.5'		0	84	16						13.1													
TP-31	S-1	3'		0	47	53						15.8													
TP-32	S-1	3'		14	79	7						9.2													
TP-34	S-1	3'		0	60	40						13.7													
TP-35	S-1	4'		0	86	14						9.6													
TP-36	S-1	3'		5	85	10						6.1													
TP-37	S-1	5'		1	84	15						11.5													

PENNONI ASSOCIATES INC.	DRAWN BY: JTR CHECKED BY:	DATE: 7/3/2024 DATE:
PROJECT: **Appoquinimink School District Campus** LOCATION: **Middletown, DE**	JOB No.: **LDMSE24001** TABLE No.: **L-1**	

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION				PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			Organic Content (%)			SHEAR STRENGTH		
				GRAVEL %	SAND %	SILT %	CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_p	LIQUIDITY INDEX I_L		SPECIFIC GRAVITY (G)	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)
TP-38	S-1	5'		4	78	18						10.4													
TP-39	S-1	4'		0	85	15						14.2													
TP-40	S-1	3'		0	78	22						18.3													

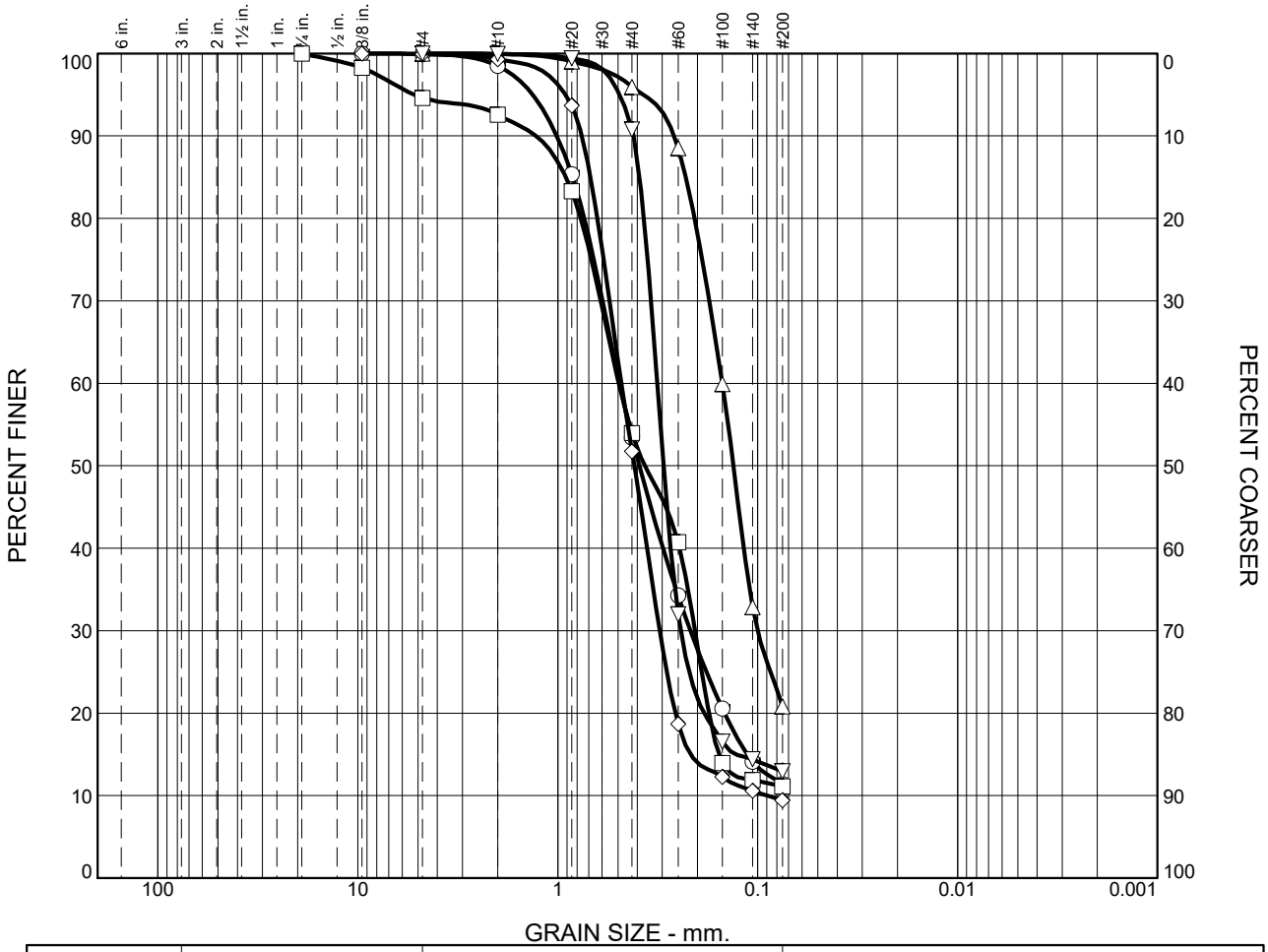
PENNONI ASSOCIATES INC.	DRAWN BY: JTR	DATE: 7/3/2024	PROJECT: **Appoquinimink School District Campus**
	CHECKED BY:	DATE:	LOCATION: **Middletown, DE**

JOB No.: **LDMSE24001**

TABLE No.: **L-1**

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	2	45	42	11	
□	0	0	5	2	39	43	11	
△	0	0	0	0	4	75	21	
◇	0	0	0	1	47	43	9	
▽	0	0	0	0	9	78	13	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-1	S-1	3'	M/F/C SAND, LITTLE SILT/CLAY	
□	TP-2(B)	S-1	5'	F/M/C SAND, LITTLE SILT/CLAY, TRACE FINE GRAVEL	
△	TP-3	S-1	5'	F/M SAND, SOME SILT/CLAY	
◇	TP-4	S-1	5'	M/F/C SAND, TRACE SILT/CLAY	
▽	TP-5	S-1	5'	F/M SAND, LITTLE SILT/CLAY	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

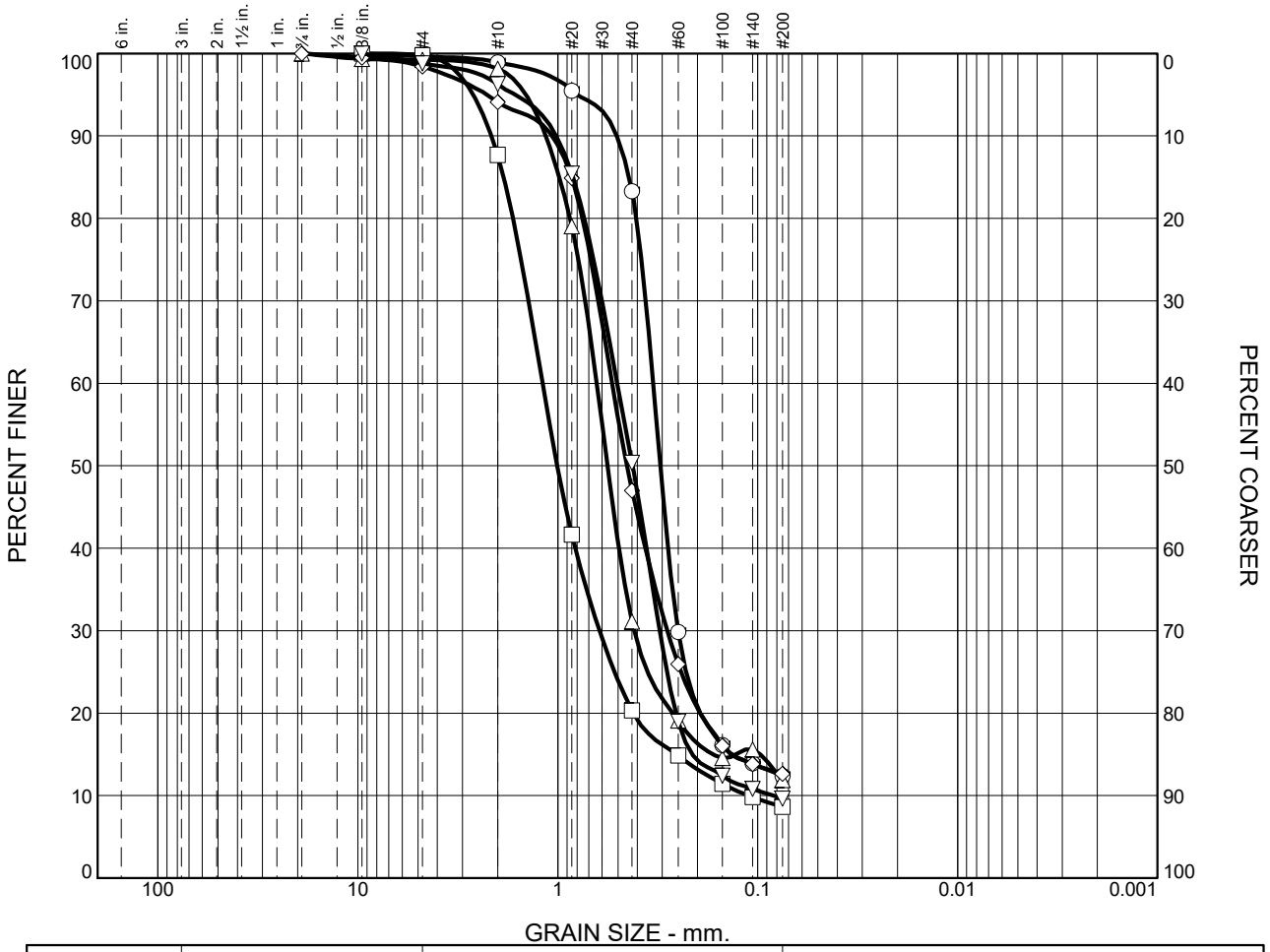
Project: Appoquinimink School District Summit Campus

Project No.: LDMSE24001 **Figure** S-1

Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	1	16	71	12	
□	0	0	0	12	68	11	9	
△	0	0	1	1	67	19	12	
◇	0	0	2	4	47	34	13	
▽	0	0	1	3	46	40	10	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-6	S-1	5'	F/M/C SAND, LITTLE SILT/CLAY	
□	TP-7	S-1	5'	M/C/F SAND, TRACE SILT/CLAY	
△	TP-8	S-1	5'	M/F/C SAND, LITTLE SILT/CLAY, TRACE FINE GRAVEL	
◇	TP-9	S-1	5'	M/F/C SAND, LITTLE SILT/CLAY, TRACE FINE GRAVEL	
▽	TP-10	S-1	5'	M/F/C SAND, LITTLE SILT/CLAY, TRACE FINE GRAVEL	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

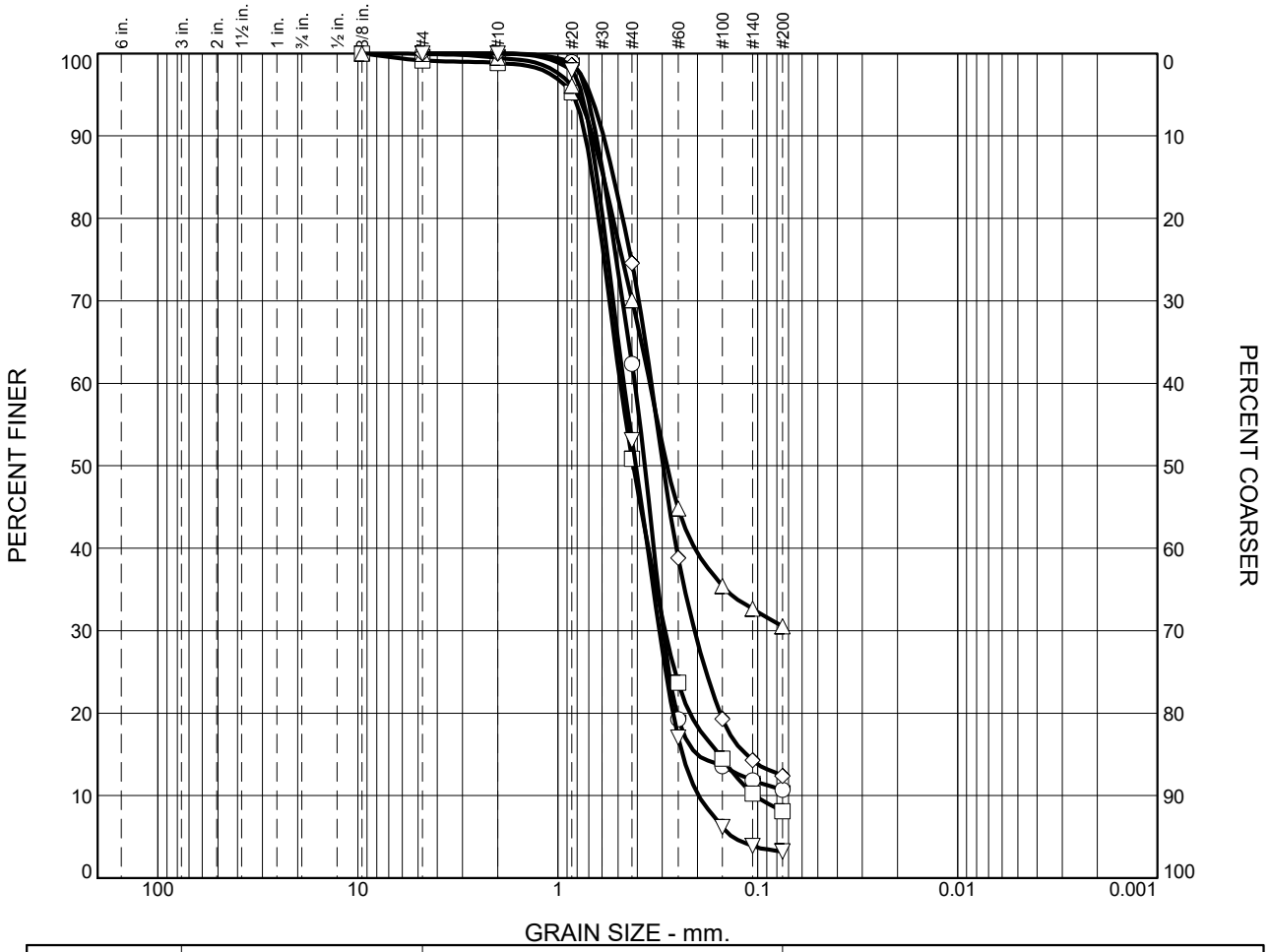
Project: Appoquinimink School District Summit Campus

Project No.: LDMSE24001 **Figure** S-2

Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	38	51	11	
□	0	0	1	0	48	43	8	
△	0	0	0	1	29	39	31	
◇	0	0	0	0	25	63	12	
▽	0	0	0	0	47	50	3	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-11	S-1	5'	F/M SAND, LITTLE SILT/CLAY	
□	TP-12	S-1	5'	M/F SAND, TRACE SILT/CLAY, TRACE FINE GRAVEL	
△	TP-13	S-1	5'	F/M/C SAND, SOME SILT/CLAY	
◇	TP-14	S-1	5'	F/M SAND, LITTLE SILT/CLAY	
▽	TP-15	S-1	5'	F/M SAND, TRACE SILT/CLAY	SP

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

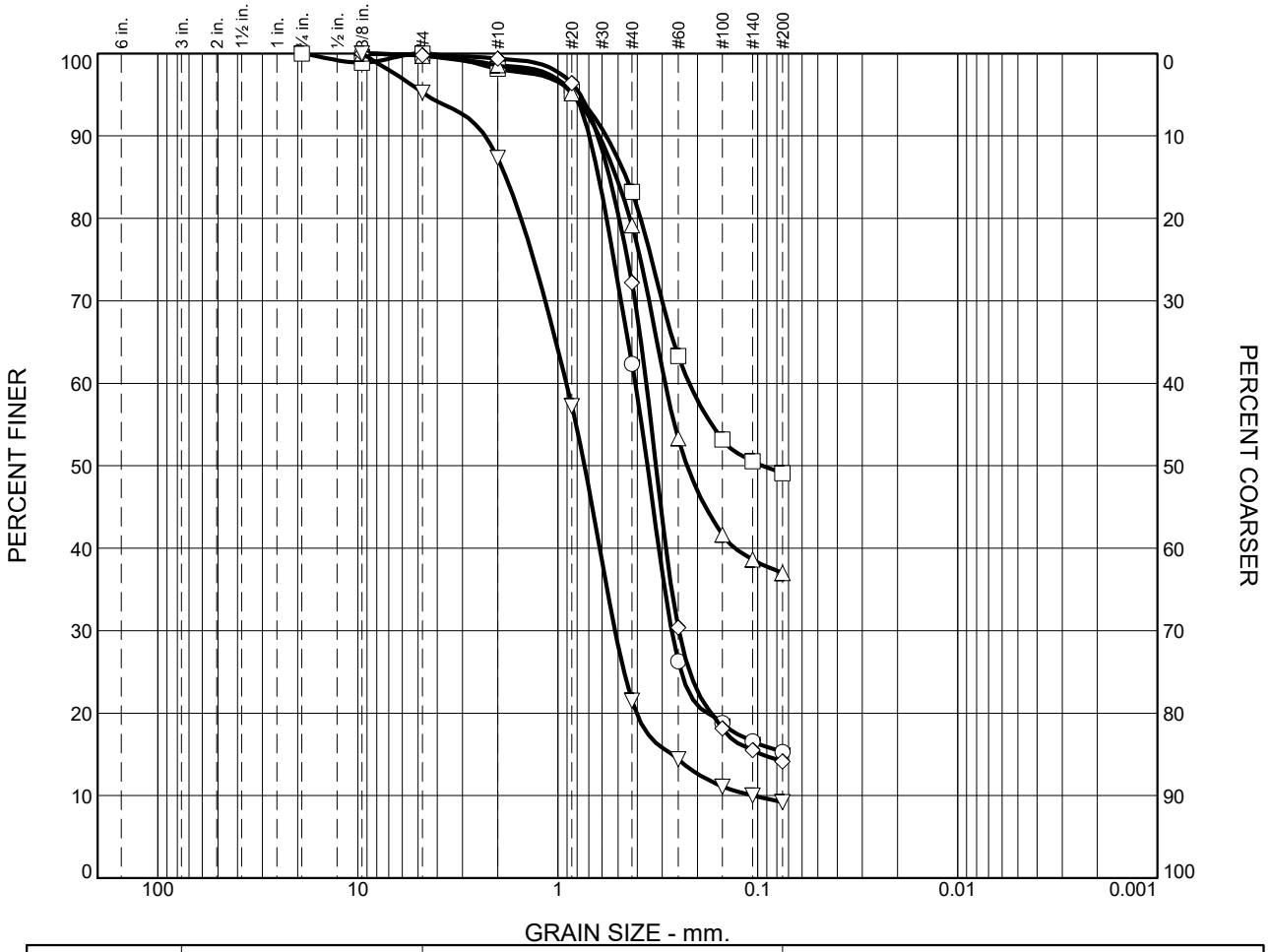
Project: Appoquinimink School District Summit Campus

Project No.: LDMSE24001 **Figure** S-3

Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	1	37	47	15	
□	0	0	0	2	15	34	49	
△	0	0	0	1	20	42	37	
◇	0	0	0	1	27	58	14	
▽	0	0	5	8	65	13	9	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-16	S-1	5'	F/M/C SAND, LITTLE SILT/CLAY	
□	TP-17	S-1	5'	F/M/C SAND, AND SILT/CLAY	
△	TP-18	S-1	5'	F/M/C SAND, AND SILT/CLAY	
◇	TP-19	S-1	5'	F/M/C SAND, LITTLE SILT/CLAY	
▽	TP-20	S-1	5'	M/F/C SAND, TRACE SILT/CLAY, TRACE FINE GRAVEL	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

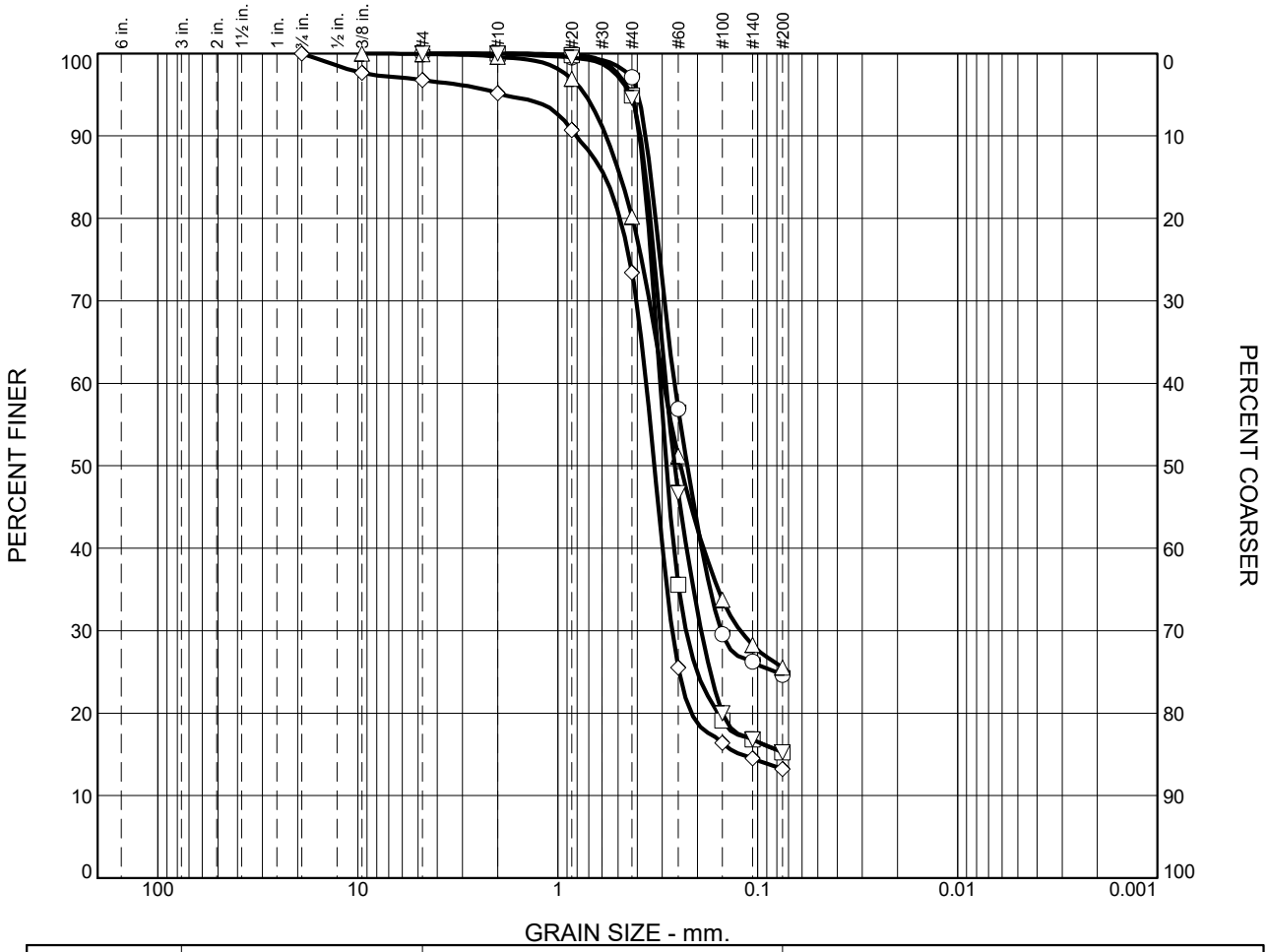
Project: Appoquinimink School District Summit Campus

Project No.: LDMSE24001 **Figure** S-4

Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	3	72	25	
□	0	0	0	0	5	80	15	
△	0	0	0	0	20	54	26	
◇	0	0	3	2	22	60	13	
▽	0	0	0	0	5	80	15	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-21	S-1	5'	F/M SAND, SOME SILT/CLAY	
□	TP-22	S-1	5'	F/M SAND, LITTLE SILT/CLAY	
△	TP-23	S-1	5'	F/M SAND, SOME SILT/CLAY	
◇	TP-24	S-1	5'	F/M/C SAND, LITTLE SILT/CLAY, TRACE FINE GRAVEL	
▽	TP-25	S-1	5'	F/M SAND, LITTLE SILT/CLAY	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

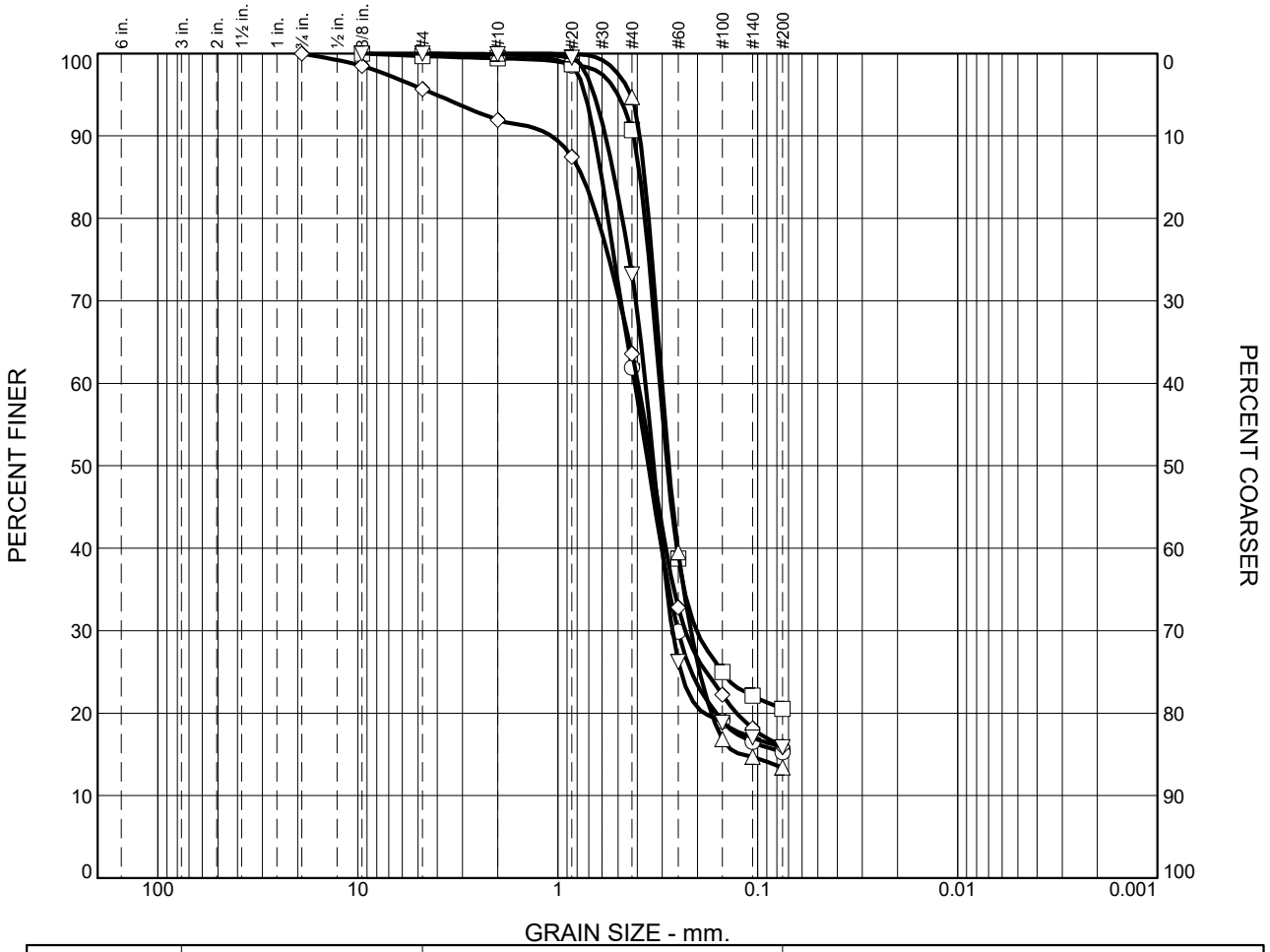
Project: Appoquinimink School District Summit Campus

Project No.: LDMSE24001 **Figure** S-5

Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	38	47	15	
□	0	0	0	1	8	70	21	
△	0	0	0	0	5	82	13	
◇	0	0	4	4	28	48	16	
▽	0	0	0	0	27	57	16	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-26	S-1	4'	F/M SAND, LITTLE SILT/CLAY	
□	TP-27	S-1	3'	F/M/C SAND, SOME SILT/CLAY	
△	TP-28	S-1	4'	F/M SAND, LITTLE SILT/CLAY	
◇	TP-29	S-1	5'	F/M/C SAND, LITTLE SILT/CLAY, TRACE FINE GRAVEL	
▽	TP-30	S-1	3.5'	F/M SAND, LITTLE SILT/CLAY	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

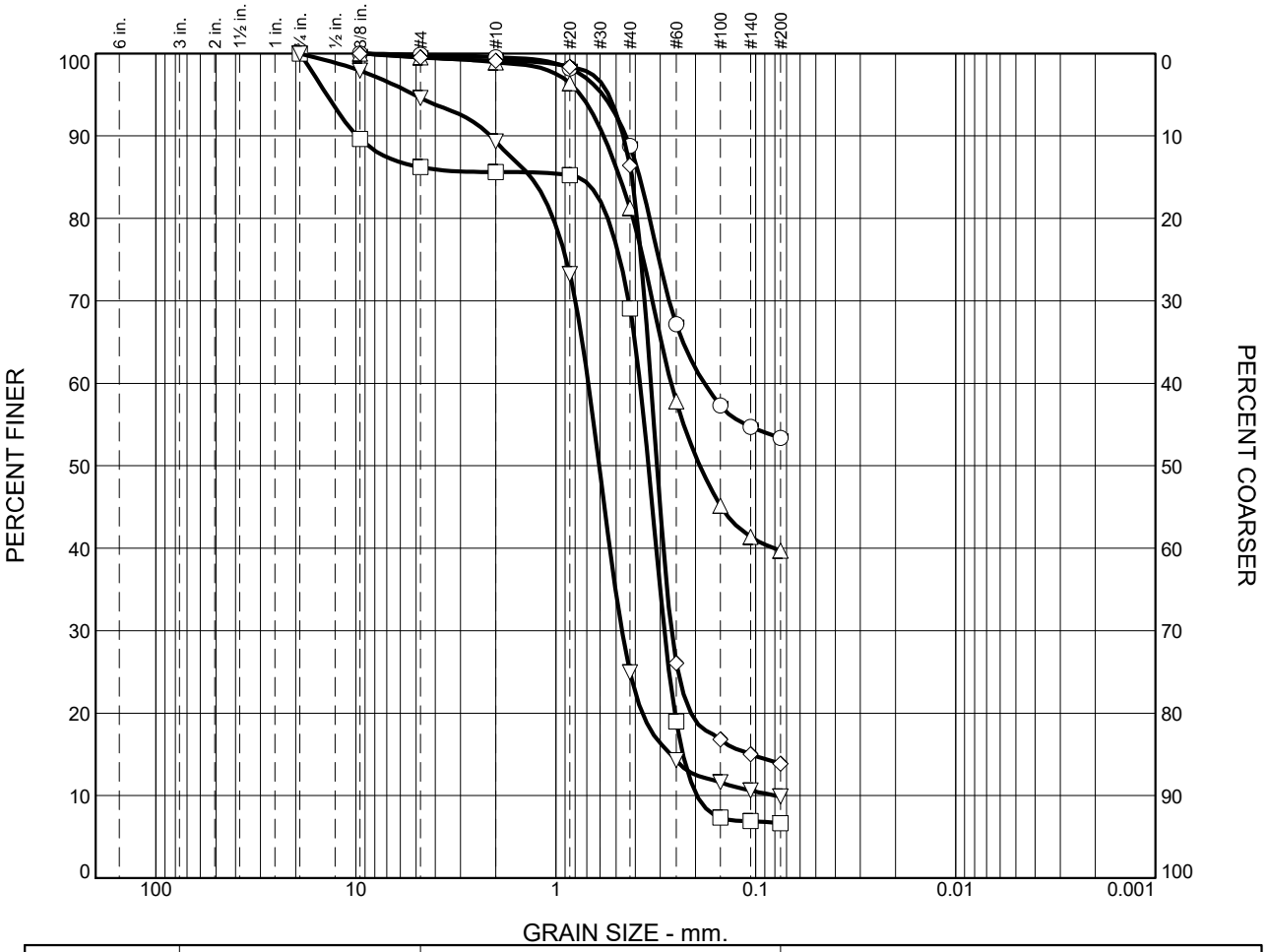
Project: Appoquinimink School District Summit Campus

Project No.: LDMSE24001 **Figure** S-6

Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	11	36	53	
□	0	0	14	0	17	62	7	
△	0	0	0	1	18	41	40	
◇	0	0	0	1	13	72	14	
▽	0	0	5	6	64	15	10	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-31	S-1	3'	SILT/CLAY, AND F/M SAND	
□	TP-32	S-1	3'	F/M SAND, LITTLE FINE GRAVEL, TRACE SILT/CLAY	
△	TP-34	S-1	3'	F/M/C SAND, AND SILT/CLAY	
◇	TP-35	S-1	4'	F/M/C SAND, LITTLE SILT/CLAY	
▽	TP-36	S-1	3'	M/F/C SAND, LITTLE SILT/CLAY, TRACE FINE GRAVEL	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

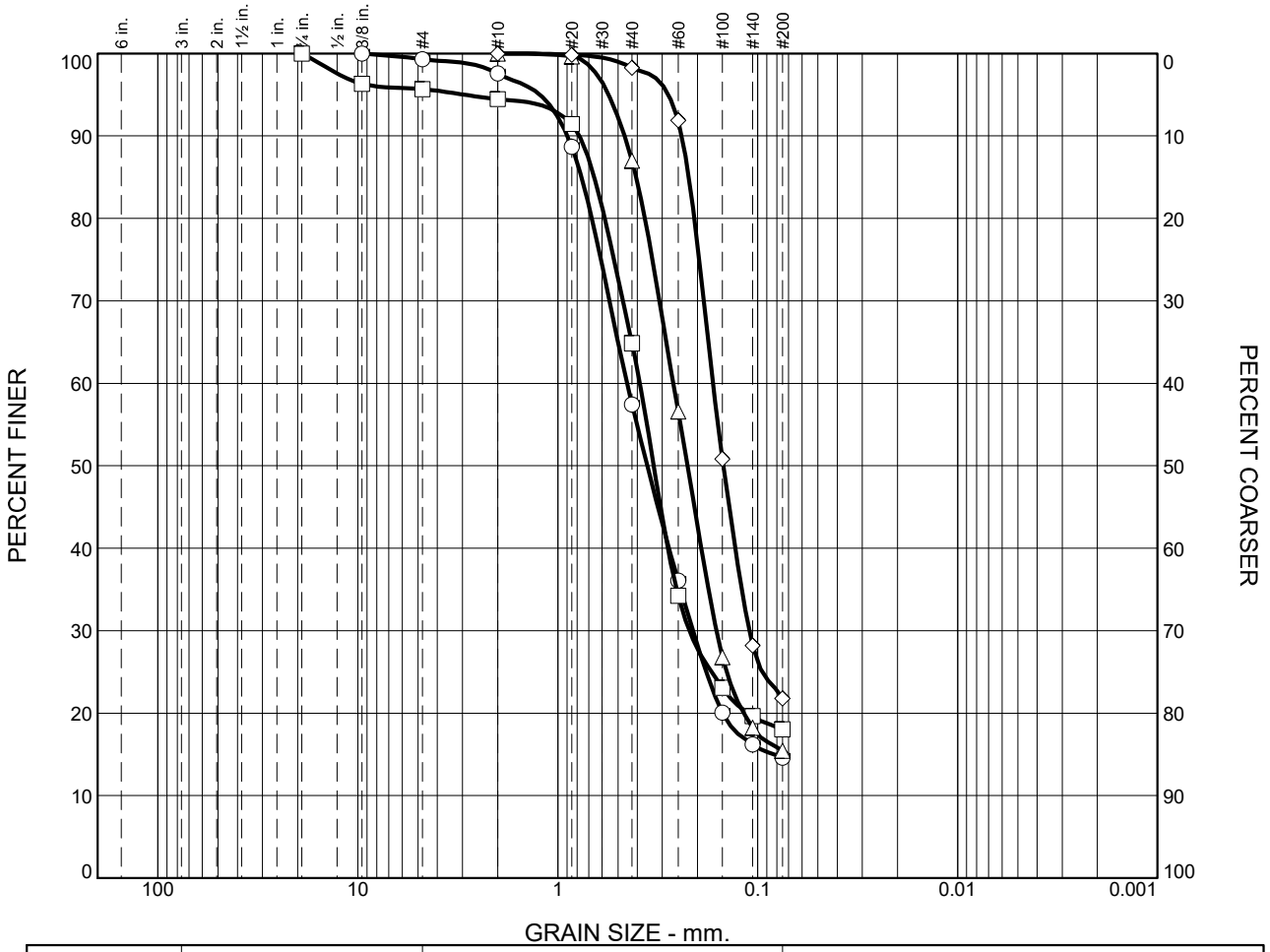
Project: Appoquinimink School District Summit Campus

Project No.: LDMSE24001 **Figure** S-7

Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	1	1	41	42	15	
□	0	0	4	2	29	47	18	
△	0	0	0	0	13	72	15	
◇	0	0	0	0	2	76	22	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-37	S-1	5'	F/M/C SAND, LITTLE SILT/CLAY, TRACE FINE GRAVEL	
□	TP-38	S-1	5'	F/M/C SAND, LITTLE SILT/CLAY, TRACE FINE GRAVEL	
△	TP-39	S-1	5'	F/M SAND, LITTLE SILT/CLAY	
◇	TP-40	S-1	4'	F/M SAND, SOME SILT/CLAY	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

Project: Appoquinimink School District Summit Campus

Project No.: LDMSE24001 **Figure** S-8

Checked By: JTR

Single Ring Infiltration Log

INF - 1

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/23/2024 Completed 5/23/2024	Testing Depth / Elev.	3 ft / 59.86 ft
Test Performed By	N. Fisher	Water Depth /Elev.	6 ft / 56.86 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	8:36	9:36	60	4.00	2.8750	1.1250	--
P2							
1	9:36	9:51	15	4.00	3.813	0.188	0.75
2	9:51	10:06	15	4.00	3.813	0.188	0.75
3	10:06	10:21	15	4.00	3.813	0.188	0.75
4	10:21	10:36	15	4.00	3.875	0.125	0.50
5	10:36	10:51	15	4.00	3.875	0.125	0.50
6	10:51	11:06	15	4.00	3.938	0.063	0.25
7	11:06	11:21	15	4.00	3.938	0.063	0.25
8	11:21	11:36	15	4.00	3.938	0.063	0.25
					Field Infiltration Rate:		**0.25**

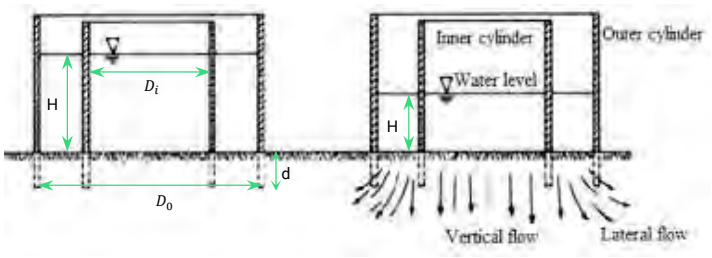
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

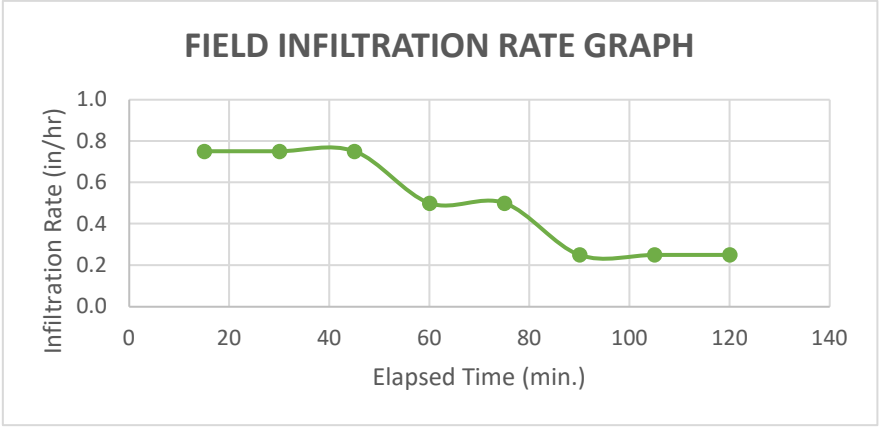
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 1





Single Ring Infiltration Log

INF - 2

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/23/2024 Completed 5/23/2024	Testing Depth / Elev.	5 ft / 58.57 ft
Test Performed By	N. Fisher	Water Depth /Elev.	8 ft / 55.57 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	9:30	10:30	60	4.00	2.4375	1.5625	--
P2							
1	9:36	9:51	15	4.00	3.625	0.375	1.50
2	9:51	10:06	15	4.00	3.750	0.250	1.00
3	10:06	10:21	15	4.00	3.750	0.250	1.00
4	10:21	10:36	15	4.00	3.750	0.250	1.00
5	10:36	10:51	15	4.00	3.750	0.250	1.00
6	10:51	11:06	15	4.00	3.750	0.250	1.00
7	11:06	11:21	15	4.00	3.750	0.250	1.00
8	11:21	11:36	15	4.00	3.750	0.250	1.00
					Field Infiltration Rate:		**1.0**

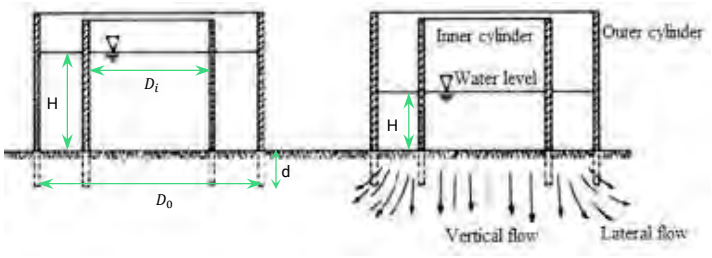
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

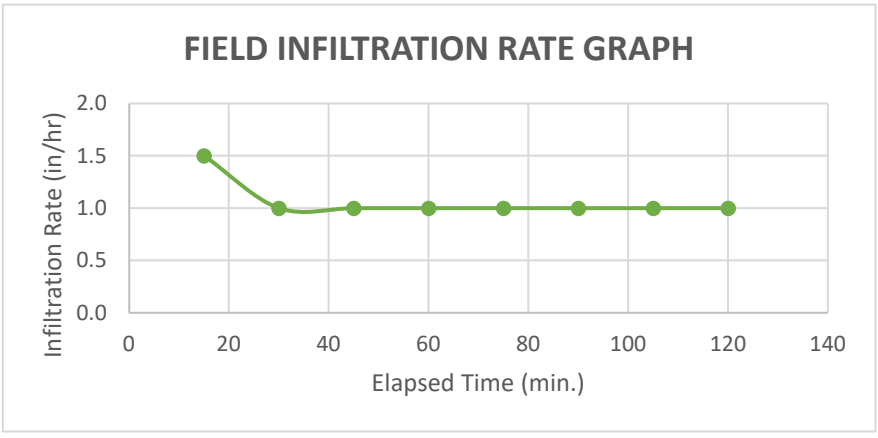
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 2





Single Ring Infiltration Log

INF - 3

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/13/2024 Completed 5/13/2024	Testing Depth / Elev.	5 ft / 57.11 ft
Test Performed By	A. Spencer	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	9:38	10:08	30	3.00	2.7500	0.2500	--
P2	10:08	10:38	30	3.00	2.7500	0.2500	--
1	10:38	10:53	15	3.00	2.875	0.125	0.50
2	10:53	11:08	15	3.00	2.875	0.125	0.50
3	11:08	11:23	15	3.00	2.875	0.125	0.50
4	11:23	11:38	15	3.00	2.875	0.125	0.50
5	11:38	11:53	15	3.00	2.875	0.125	0.50
6	11:53	12:08	15	3.00	2.875	0.125	0.50
7	12:08	12:23	15	3.00	2.875	0.125	0.50
8	12:23	12:38	15	3.00	2.875	0.125	0.50
					Field Infiltration Rate:		**0.5**

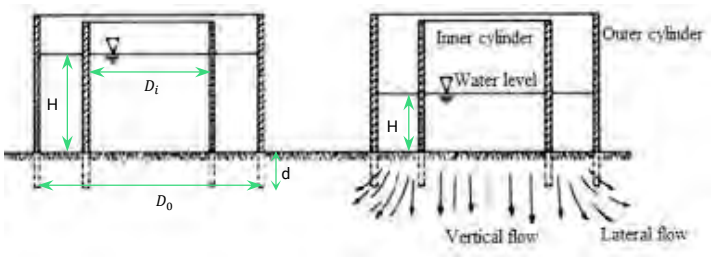
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

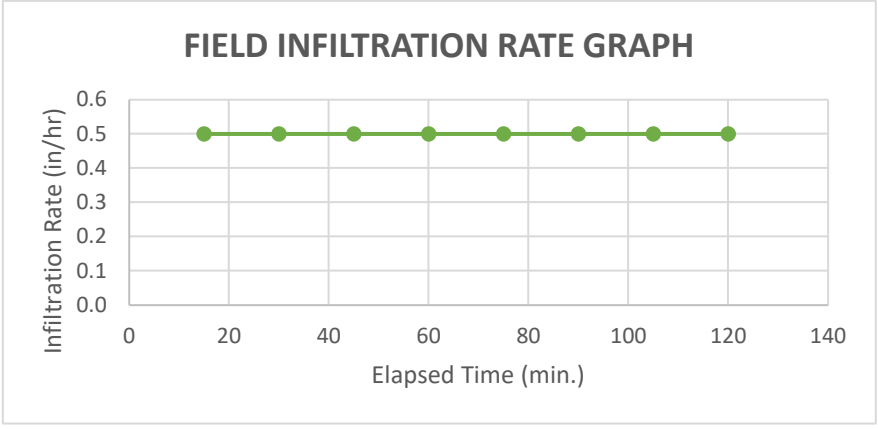
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 3





Single Ring Infiltration Log

INF - 4

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/13/2024 Completed 5/13/2024	Testing Depth / Elev.	5 ft / 58.02 ft
Test Performed By	A. Spencer	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	9:03	9:33	30	4.00	0.0000	4.0000	--
P2	9:33	10:03	30	4.00	0.0000	4.0000	--
1	10:03	10:18	15	4.00	1.250	2.750	11.00
2	10:18	10:33	15	4.00	1.250	2.750	11.00
3	10:33	10:48	15	4.00	1.250	2.750	11.00
4	10:48	11:03	15	4.00	1.375	2.625	10.50
5	11:03	11:18	15	4.00	1.500	2.500	10.00
6	11:18	11:33	15	4.00	1.500	2.500	10.00
7	11:33	11:48	15	4.00	1.500	2.500	10.00
8	11:48	12:03	15	4.00	1.625	2.375	9.50
					Field Infiltration Rate:		**9.9**

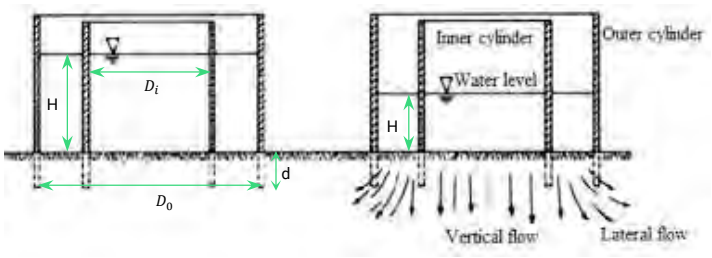
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

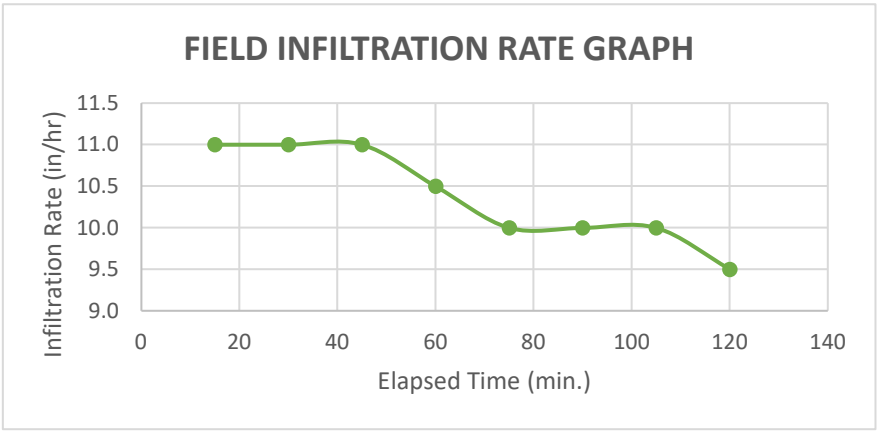
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 4





Single Ring Infiltration Log

INF - 5

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/13/2024 Completed 5/13/2024	Testing Depth / Elev.	5 ft / 56.96 ft
Test Performed By	A. Spencer	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	10:25	10:55	30	4.00	0.0000	5.0000	--
P2	10:55	11:25	30	4.00	0.0000	5.0000	--
1	11:25	11:40	15	4.00	0.250	3.750	15.00
2	11:40	11:55	15	4.00	0.250	3.750	15.00
3	11:55	12:10	15	4.00	0.250	3.750	15.00
4	12:10	12:25	15	4.00	0.750	3.250	13.00
5	12:25	12:40	15	4.00	0.750	3.250	13.00
6	12:40	12:55	15	4.00	0.750	3.250	13.00
7	12:55	1:10	15	4.00	0.750	3.250	13.00
8	1:10	1:25	15	4.00	0.750	3.250	13.00
					Field Infiltration Rate:		**13.0**

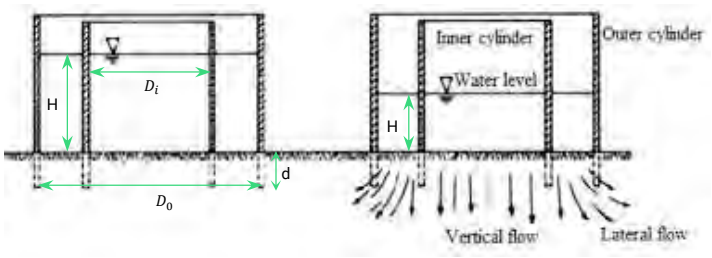
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

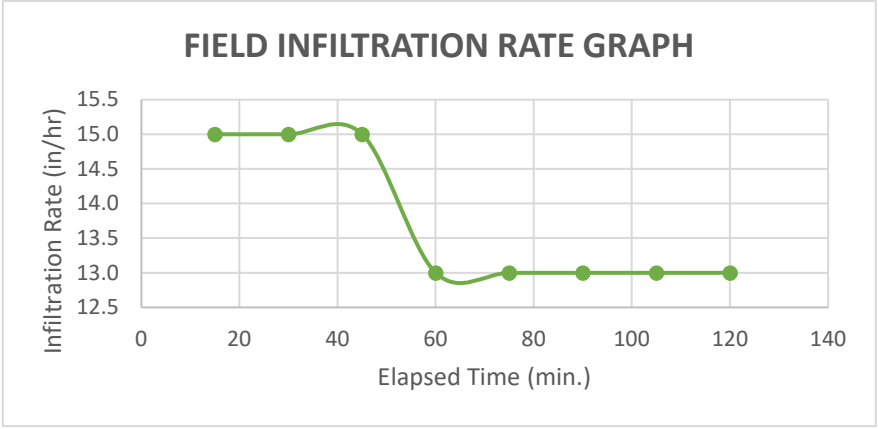
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 5





Single Ring Infiltration Log

INF - 6

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/13/2024 Completed 5/13/2024	Testing Depth / Elev.	5 ft / 58.25 ft
Test Performed By	A. Spencer	Water Depth /Elev.	10 ft / 53.25 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	10:57	11:27	30	4.00	0.0000	5.0000	--
P2	11:27	11:57	30	4.00	0.0000	5.0000	--
1	11:57	12:12	15	4.00	0.750	3.250	13.00
2	12:12	12:27	15	4.00	1.000	3.000	12.00
3	12:27	12:42	15	4.00	1.000	3.000	12.00
4	12:42	12:57	15	4.00	1.125	2.875	11.50
5	12:57	1:12	15	4.00	1.125	2.875	11.50
6	1:12	1:27	15	4.00	1.125	2.875	11.50
7	1:27	1:42	15	4.00	1.250	2.750	11.00
8	1:42	1:57	15	4.00	1.250	2.750	11.00
					Field Infiltration Rate:		**11.25**

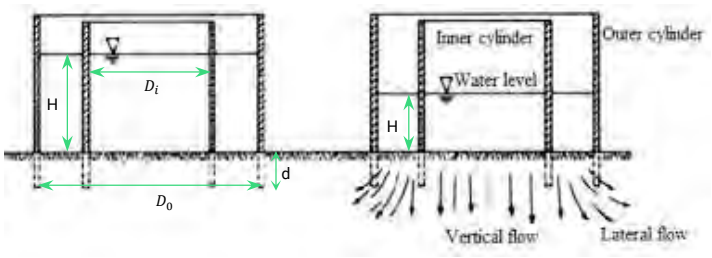
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

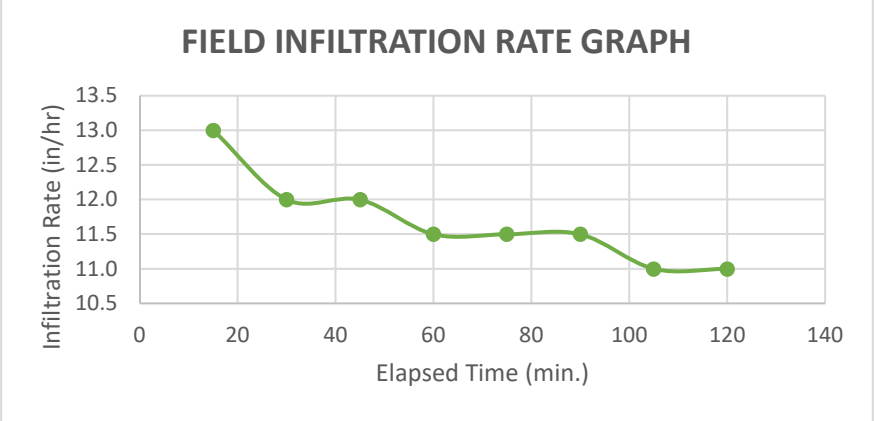
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 6





Single Ring Infiltration Log

INF - 7

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/13/2024 Completed 5/13/2024	Testing Depth / Elev.	5 ft / 57.39 ft
Test Performed By	A. Spencer	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	11:35	12:05	30	5.00	0.0000	5.0000	--
P2	12:05	12:35	30	5.00	0.0000	5.0000	--
1	12:35	12:50	15	5.00	1.750	3.250	13.00
2	12:50	1:05	15	5.00	1.750	3.250	13.00
3	1:05	1:20	15	5.00	2.125	2.875	11.50
4	1:20	1:35	15	5.00	2.250	2.750	11.00
5	1:35	1:50	15	5.00	2.250	2.750	11.00
6	1:50	2:05	15	5.00	2.500	2.500	10.00
7	2:05	2:20	15	5.00	2.500	2.500	10.00
8	2:20	2:35	15	5.00	2.500	2.500	10.00
					Field Infiltration Rate:		**10.0**

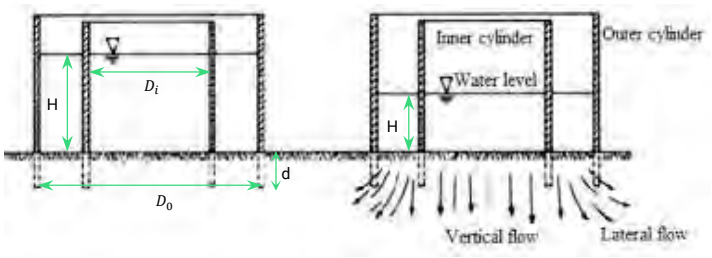
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

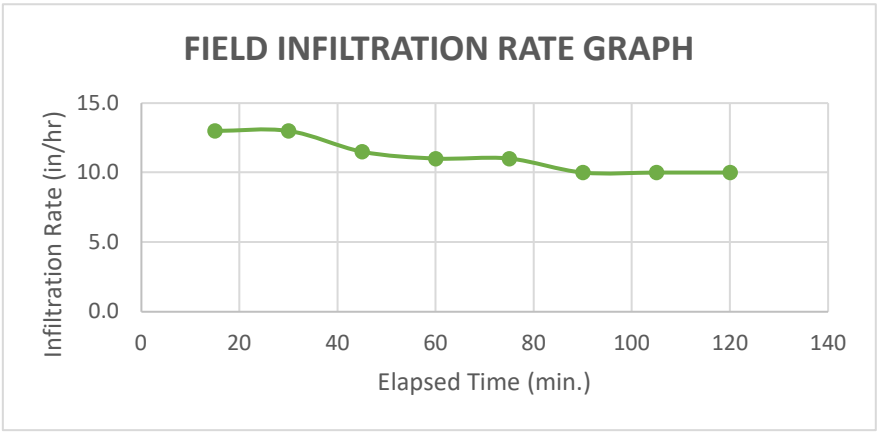
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 7





Single Ring Infiltration Log

INF - 8

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/13/2024 Completed 5/13/2024	Testing Depth / Elev.	5 ft / 58.14 ft
Test Performed By	A. Spencer	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	1:00	1:30	30	4.00	0.0000	5.0000	--
P2	1:30	2:00	30	4.00	0.0000	5.0000	--
1	2:00	2:15	15	4.00	1.250	2.750	11.00
2	2:15	2:30	15	4.00	1.750	2.250	9.00
3	2:30	2:45	15	4.00	1.750	2.250	9.00
4	2:45	3:00	15	4.00	1.875	2.125	8.50
5	3:00	3:15	15	4.00	1.875	2.125	8.50
6	3:15	3:30	15	4.00	1.875	2.125	8.50
7	3:30	3:45	15	4.00	1.875	2.125	8.50
8	3:45	4:00	15	4.00	1.875	2.125	8.50
					Field Infiltration Rate:		**8.5**

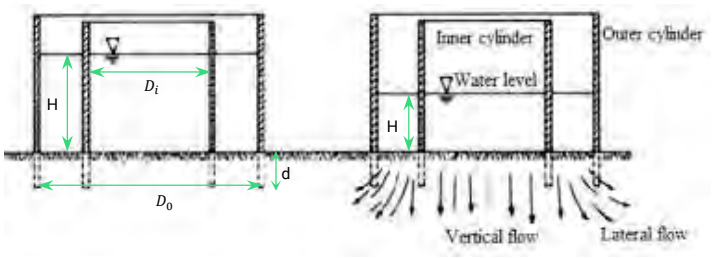
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

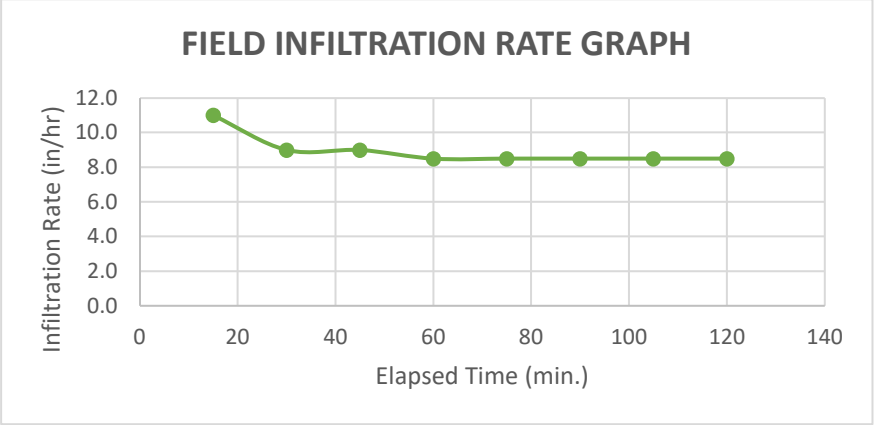
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 8





Single Ring Infiltration Log

INF - 9

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/14/2024 Completed 5/14/2024	Testing Depth / Elev.	5 ft / 59.46 ft
Test Performed By	N. Francois	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	8:56	9:26	30	3.00	0.00	3.00	--
P2	9:26	9:56	30	3.00	0.00	3.00	--
1	9:56	10:11	15	3.00	0.00	3.00	12.0
2	10:11	10:26	15	3.00	0.00	3.00	12.0
3	10:26	10:41	15	3.00	0.00	3.00	12.0
4	10:41	10:56	15	3.00	0.00	3.00	12.0
5	10:56	11:11	15	3.00	0.00	3.00	12.0
6	11:11	11:26	15	3.00	0.00	3.00	12.0
7	11:26	11:41	15	3.00	0.00	3.00	12.0
8	11:41	11:56	15	3.00	0.00	3.00	12.0
					Field Infiltration Rate:		**12.0**

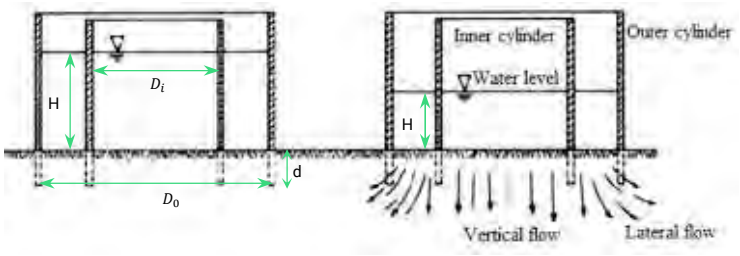
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

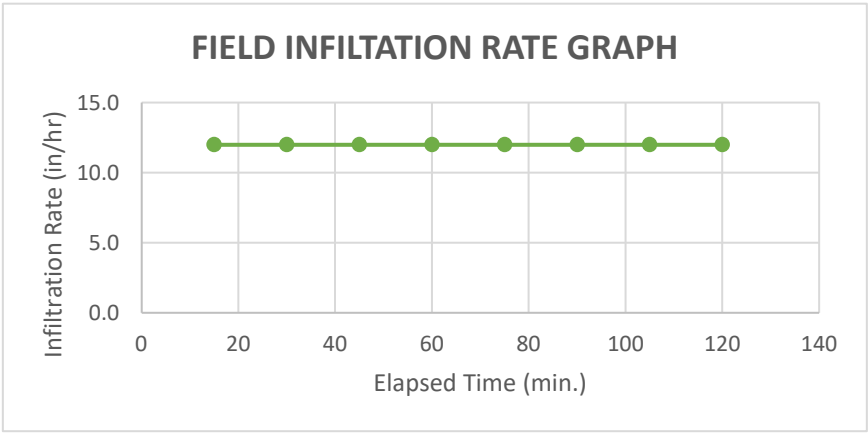
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 9





Single Ring Infiltration Log

INF - 10

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/14/2024 Completed 5/14/2024	Testing Depth / Elev.	5 ft / 59.49 ft
Test Performed By	N. Francois	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	9:10	9:40	30	3.00	0.00	3.00	--
P2	9:40	10:10	30	3.00	0.00	3.00	--
1	10:10	10:25	15	3.00	0.00	3.00	12.0
2	10:25	10:40	15	3.00	0.50	2.50	10.0
3	10:40	10:55	15	3.00	0.00	3.00	12.0
4	10:55	11:10	15	3.00	0.00	3.00	12.0
5	11:10	11:25	15	3.00	0.50	2.50	10.0
6	11:25	11:40	15	3.00	0.50	2.50	10.0
7	11:40	11:55	15	3.00	0.50	2.50	10.0
8	11:55	12:10	15	3.00	0.50	2.50	10.0
					Field Infiltration Rate:		**10.0**

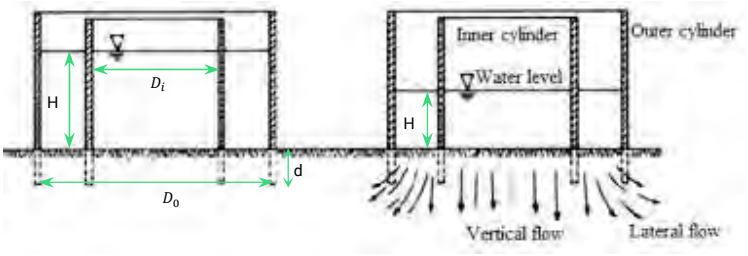
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

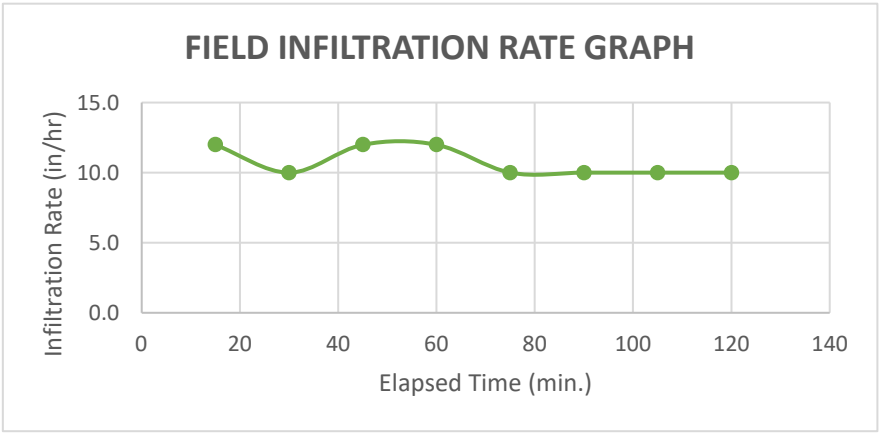
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 10





Single Ring Infiltration Log

INF - 11

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/14/2024 Completed 5/14/2024	Testing Depth / Elev.	5 ft / 59.89 ft
Test Performed By	N. Francois	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	11:36	12:06	30	3.00	0.00	3.00	--
P2	12:06	12:36	30	3.00	0.00	3.00	--
1	12:36	12:51	15	3.00	0.00	3.00	12.0
2	12:51	1:06	15	3.00	0.00	3.00	12.0
3	1:06	1:21	15	3.00	0.50	2.50	10.0
4	1:21	1:36	15	3.00	0.50	2.50	10.0
5	1:36	1:51	15	3.00	0.50	2.50	10.0
6	1:51	2:06	15	3.00	0.50	2.50	10.0
7	2:06	2:21	15	3.00	0.50	2.50	10.0
8	2:21	2:36	15	3.00	0.50	2.50	10.0
					Field Infiltration Rate:		**10.0**

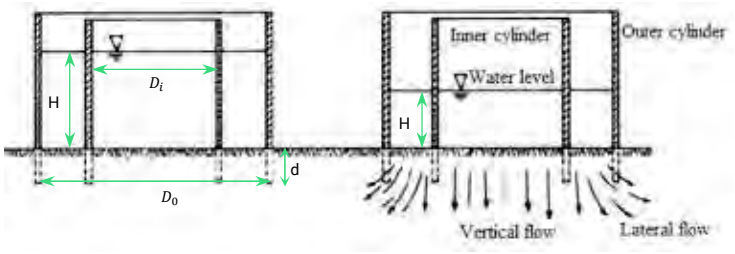
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

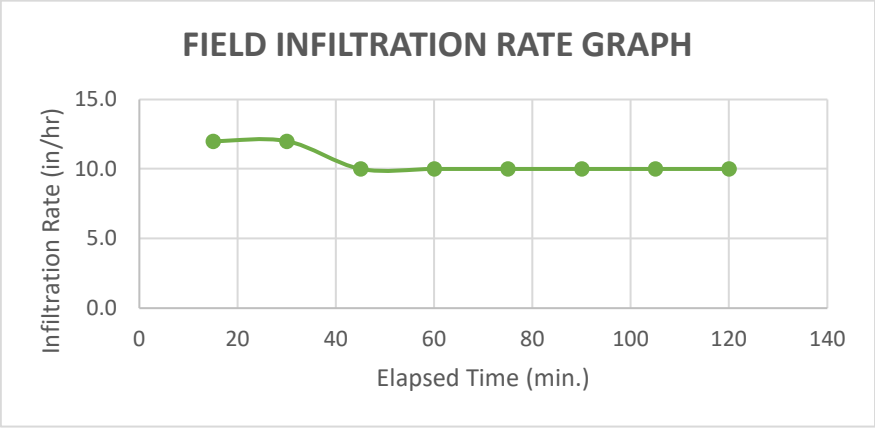
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 11





Single Ring Infiltration Log

INF - 12

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/14/2024 Completed 5/14/2024	Testing Depth / Elev.	5 ft / 61.54 ft
Test Performed By	N. Francois	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	11:42	12:12	30	3.00	0.00	3.00	--
P2	12:12	12:42	30	3.00	0.00	3.00	--
1	12:42	12:57	15	3.00	0.00	3.00	12.0
2	12:57	1:12	15	3.00	0.00	3.00	12.0
3	1:12	1:27	15	3.00	0.50	2.50	10.0
4	1:27	1:42	15	3.00	0.50	2.50	10.0
5	1:42	1:57	15	3.00	0.50	2.50	10.0
6	1:57	2:12	15	3.00	0.50	2.50	10.0
7	2:12	2:21	15	3.00	0.50	2.50	10.0
8	2:21	2:36	15	3.00	0.50	2.50	10.0
					Field Infiltration Rate:		**10.0**

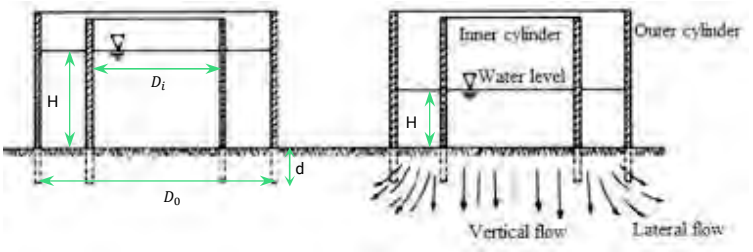
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

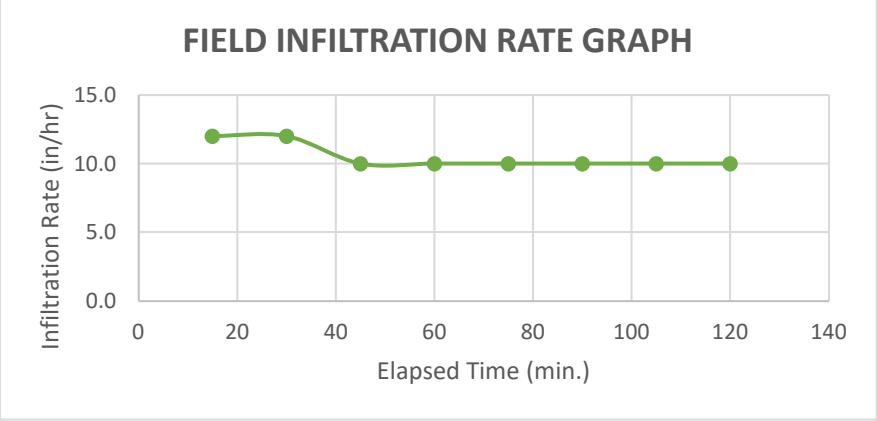
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 12





Single Ring Infiltration Log

INF - 13

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/14/2024 Completed 5/14/2024	Testing Depth / Elev.	5 ft / 60.47 ft
Test Performed By	N. Francois	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	12:20	12:50	30	3.00	0.50	2.50	--
P2	12:50	1:20	30	3.00	0.50	2.50	--
1	1:20	1:35	15	3.00	0.50	2.50	10.0
2	1:35	1:50	15	3.00	0.50	2.50	10.0
3	1:50	2:05	15	3.00	0.50	2.50	10.0
4	2:05	2:20	15	3.00	0.50	2.50	10.0
5	2:20	2:35	15	3.00	0.50	2.50	10.0
6	2:35	2:50	15	3.00	0.50	2.50	10.0
7	2:50	3:05	15	3.00	0.50	2.50	10.0
8	3:05	3:20	15	3.00	0.50	2.50	10.0
						Field Infiltration Rate:	**10.0**

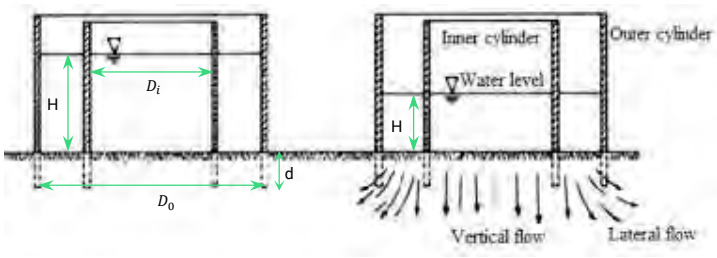
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

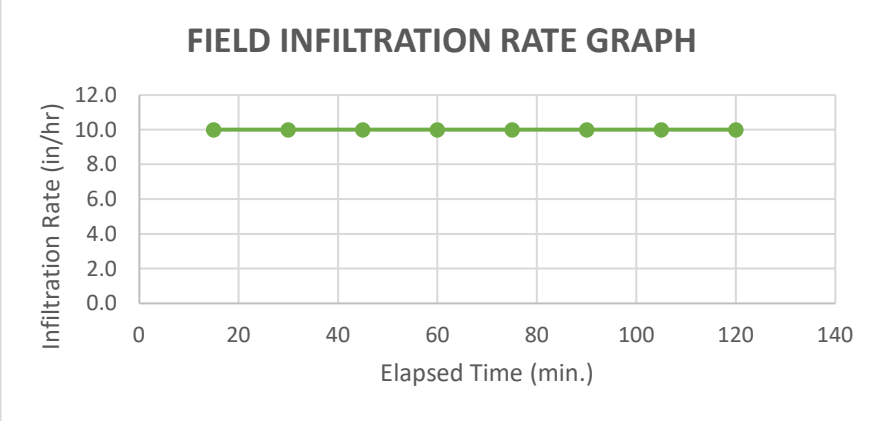
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 13





Single Ring Infiltration Log

INF - 14

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/16/2024 Completed 5/16/2024	Testing Depth / Elev.	5 ft / 58.83 ft
Test Performed By	N. Francois	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	8:32	9:02	30	4.00	2.00	2.00	--
P2	9:02	9:32	30	4.00	1.50	2.50	--
1	9:32	9:47	15	4.00	3.00	1.00	4.0
2	9:47	10:02	15	4.00	3.50	0.50	2.0
3	10:02	10:17	15	4.00	3.50	0.50	2.0
4	10:17	10:32	15	4.00	3.50	0.50	2.0
5	10:32	10:47	15	4.00	3.50	0.50	2.0
6	10:47	11:02	15	4.00	3.50	0.50	2.0
7	11:02	11:17	15	4.00	3.50	0.50	2.0
8	11:17	11:32	15	4.00	3.50	0.50	2.0
					Field Infiltration Rate:		**2.0**

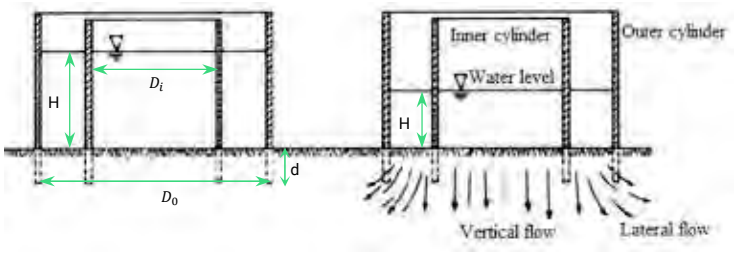
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

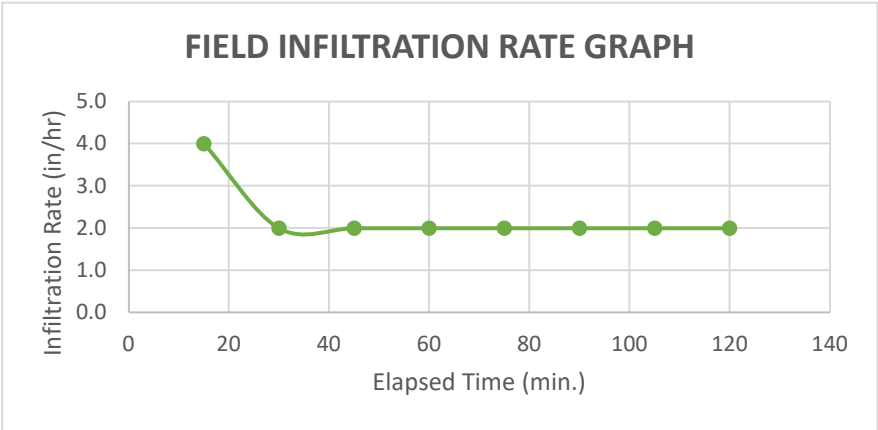
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 14





Single Ring Infiltration Log

INF - 15

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/16/2024 Completed 5/16/2024	Testing Depth / Elev.	5 ft / 57.46 ft
Test Performed By	N. Francois	Water Depth /Elev.	8 ft / 54.46 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	8:47	9:17	30	4.00	0.00	4.00	--
P2	9:17	9:47	30	4.00	0.00	4.00	--
1	9:47	10:02	15	4.00	0.38	3.63	14.5
2	10:02	10:17	15	4.00	0.50	3.50	14.0
3	10:17	10:32	15	4.00	0.50	3.50	14.0
4	10:32	10:47	15	4.00	0.50	3.50	14.0
5	10:47	11:02	15	4.00	2.00	2.00	8.0
6	11:02	11:17	15	4.00	2.00	2.00	8.0
7	11:17	11:32	15	4.00	2.00	2.00	8.0
8	11:32	11:47	15	4.00	2.00	2.00	8.0
					Field Infiltration Rate:		**8.0**

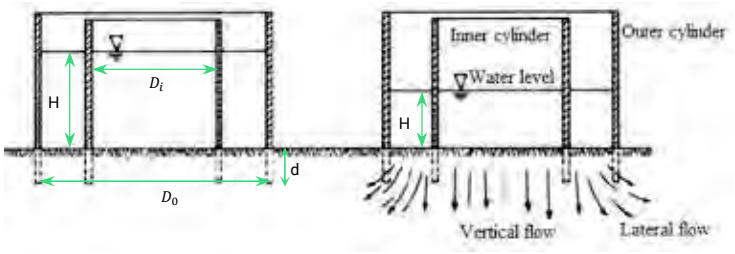
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

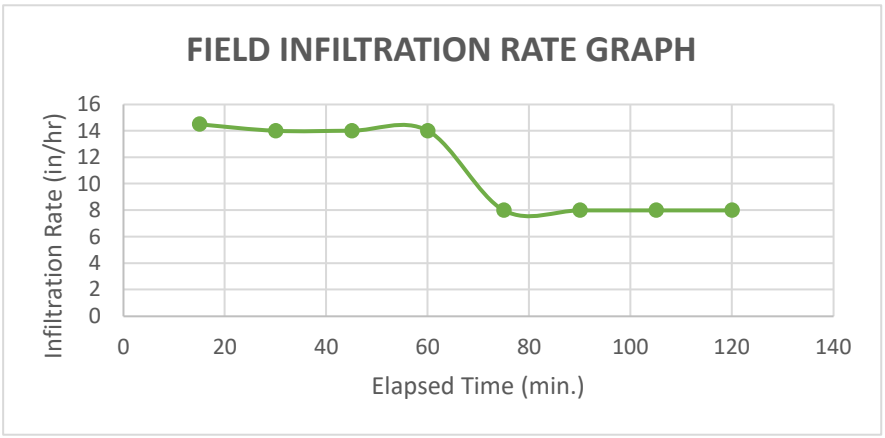
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 15





Single Ring Infiltration Log

INF - 16

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/16/2024 Completed 5/16/2024	Testing Depth / Elev.	5 ft / 56.31 ft
Test Performed By	N. Francois	Water Depth /Elev.	8 ft / 53.31 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	8:57	9:23	30	4.00	0.00	4.00	--
P2	9:23	9:53	30	4.00	0.00	4.00	--
1	9:53	10:08	15	4.00	0.25	3.75	15.0
2	10:08	10:23	15	4.00	1.00	3.00	12.0
3	10:23	10:38	15	4.00	1.00	3.00	12.0
4	10:38	10:53	15	4.00	1.00	3.00	12.0
5	10:53	11:08	15	4.00	1.00	3.00	12.0
6	11:08	11:23	15	4.00	1.00	3.00	12.0
7	11:23	11:38	15	4.00	1.00	3.00	12.0
8	11:38	11:53	15	4.00	1.00	3.00	12.0
					Field Infiltration Rate:		**12.0**

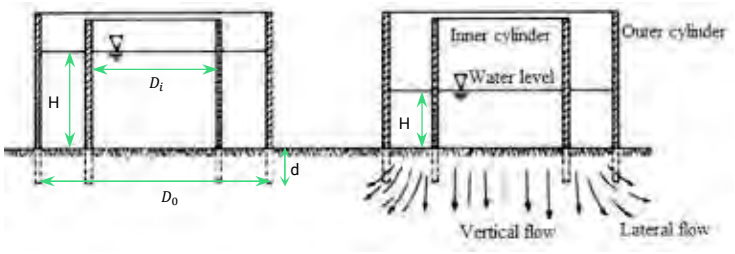
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

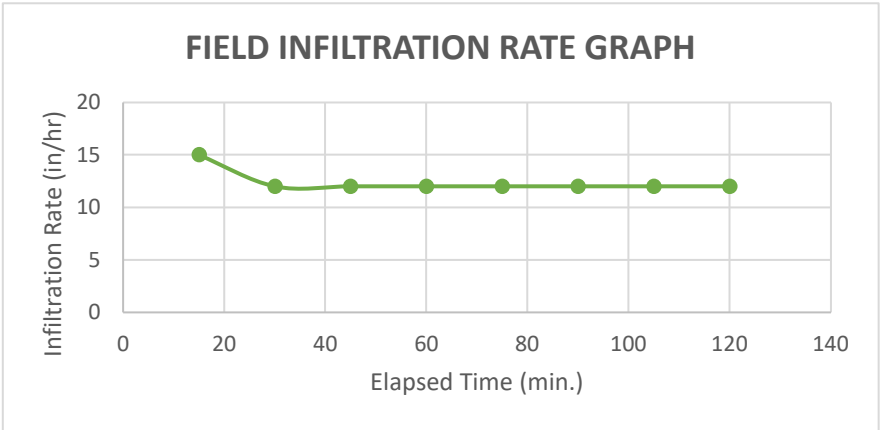
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 16





Single Ring Infiltration Log

INF - 17

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/16/2024 Completed 5/16/2024	Testing Depth / Elev.	5 ft / 55.79 ft
Test Performed By	N. Francois	Water Depth /Elev.	8 ft / 52.79 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	11:43	12:13	30	4.00	3.00	1.00	--
P2	12:43	1:13	30	4.00	3.00	1.00	--
1	1:13	1:28	15	4.00	3.00	1.00	4.0
2	1:28	1:43	15	4.00	3.50	0.50	2.0
3	1:43	1:58	15	4.00	3.50	0.50	2.0
4	1:58	2:13	15	4.00	3.50	0.50	2.0
5	2:13	2:28	15	4.00	3.50	0.50	2.0
6	2:28	2:43	15	4.00	3.50	0.50	2.0
7	2:43	2:58	15	4.00	3.50	0.50	2.0
8	2:58	3:13	15	4.00	3.50	0.50	2.0
					Field Infiltration Rate:		**2.0**

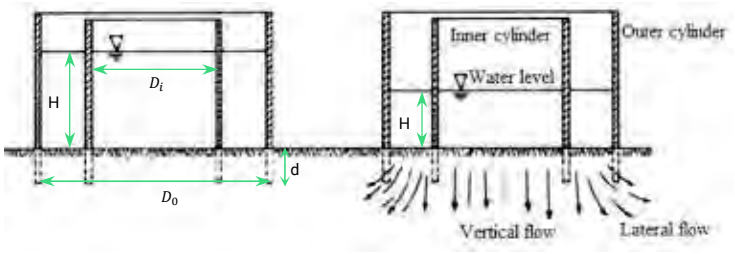
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

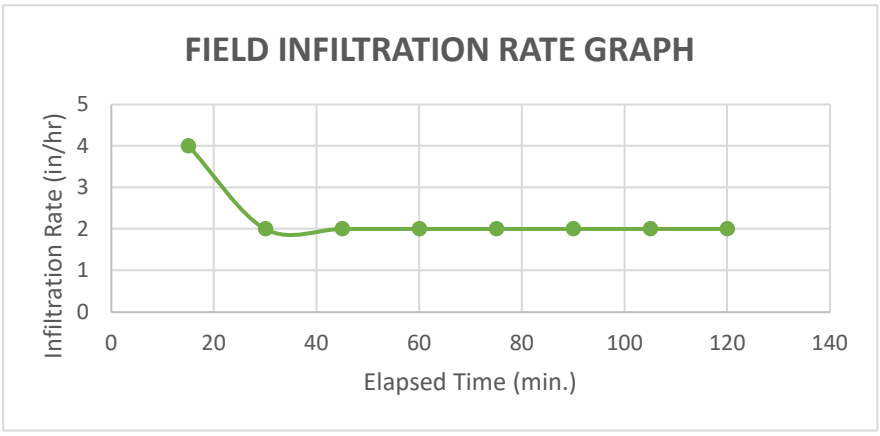
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 17





Single Ring Infiltration Log

INF - 18

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/16/2024 Completed 5/16/2024	Testing Depth / Elev.	5 ft / 57.12 ft
Test Performed By	N. Francois	Water Depth /Elev.	8 ft / 54.12 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	11:48	12:18	30	4.00	2.00	2.00	--
P2	12:18	1:18	30	4.00	2.00	2.00	--
1	1:18	1:33	15	4.00	3.00	1.00	4.0
2	1:33	1:48	15	4.00	3.00	1.00	4.0
3	1:48	2:03	15	4.00	3.00	1.00	4.0
4	2:03	2:18	15	4.00	3.50	0.50	2.0
5	2:18	2:33	15	4.00	3.50	0.50	2.0
6	2:33	2:48	15	4.00	3.50	0.50	2.0
7	2:48	3:03	15	4.00	3.50	0.50	2.0
8	3:03	3:18	15	4.00	3.50	0.50	2.0
					Field Infiltration Rate:		**2.0**

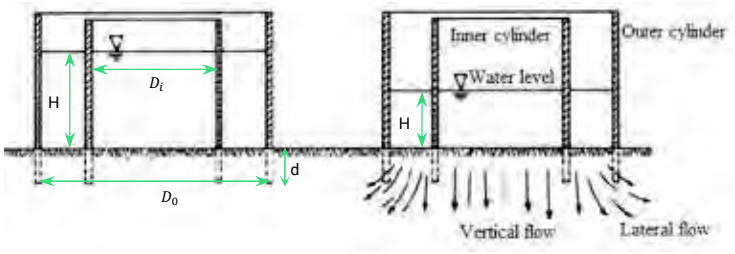
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

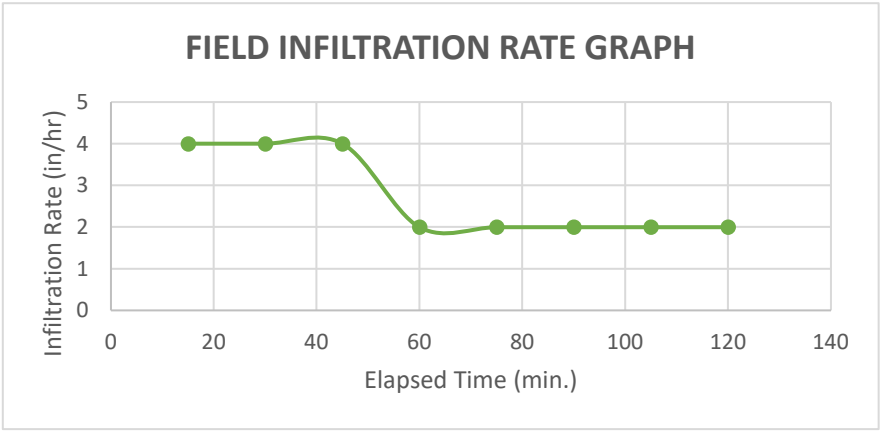
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 18





Single Ring Infiltration Log

INF - 19

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/17/2024 Completed 5/17/2024	Testing Depth / Elev.	5 ft / 58.09 ft
Test Performed By	N. Francois	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	8:26	8:56	30	4.00	0.00	4.00	--
P2	8:56	9:26	30	4.00	0.50	3.50	--
1	9:26	9:41	15	4.00	2.00	2.00	8.0
2	9:41	9:56	15	4.00	2.00	2.00	8.0
3	9:56	10:11	15	4.00	2.00	2.00	8.0
4	10:11	10:26	15	4.00	2.00	2.00	8.0
5	10:26	10:41	15	4.00	2.00	2.00	8.0
6	10:41	10:56	15	4.00	2.00	2.00	8.0
7	10:56	11:11	15	4.00	2.00	2.00	8.0
8	11:11	11:26	15	4.00	2.00	2.00	8.0
					Field Infiltration Rate:		**8.0**

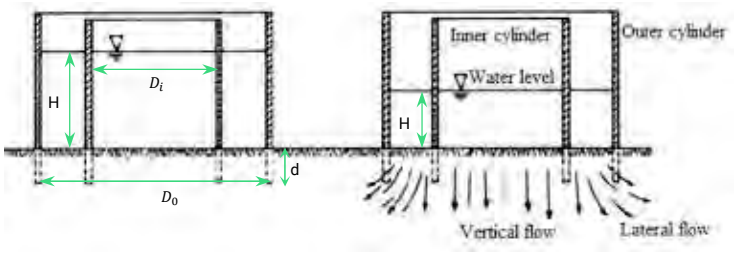
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

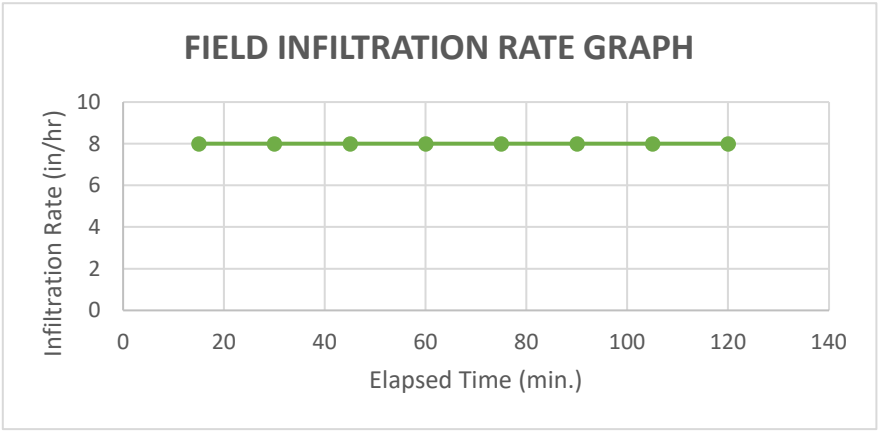
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 19





Single Ring Infiltration Log

INF - 20

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/17/2024 Completed 5/17/2024	Testing Depth / Elev.	5 ft / 57.49 ft
Test Performed By	N. Francois	Water Depth /Elev.	8 ft / 54.49 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	8:58	9:28	30	4.00	0.00	4.00	--
P2	9:28	9:58	30	4.00	0.00	4.00	--
1	9:58	10:13	15	4.00	0.00	4.00	16.0
2	10:13	10:28	15	4.00	0.00	4.00	16.0
3	10:28	10:43	15	4.00	0.00	4.00	16.0
4	10:43	10:58	15	4.00	0.00	4.00	16.0
5	10:58	11:13	15	4.00	0.50	3.50	14.0
6	11:13	11:28	15	4.00	0.50	3.50	14.0
7	11:28	11:43	15	4.00	0.50	3.50	14.0
8	11:43	11:58	15	4.00	0.50	3.50	14.0
					Field Infiltration Rate:		**14.0**

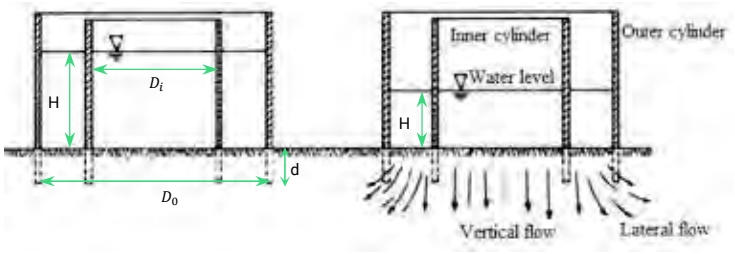
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

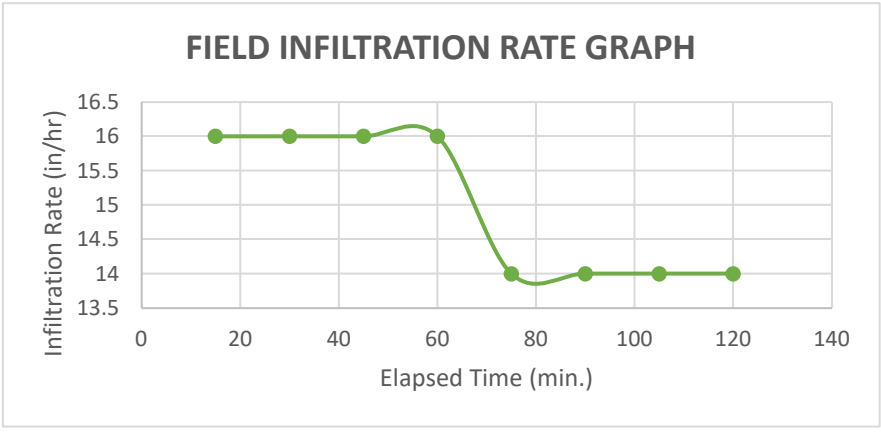
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 20





Single Ring Infiltration Log

INF - 21

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/17/2024 Completed 5/17/2024	Testing Depth / Elev.	5 ft / 57.36 ft
Test Performed By	N. Francois	Water Depth /Elev.	8 ft / 54.36 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	8:39	9:09	30	4.00	0.00	4.00	--
P2	9:09	9:39	30	4.00	0.50	3.50	--
1	9:39	9:54	15	4.00	0.50	3.50	14.0
2	9:54	10:09	15	4.00	1.00	3.00	12.0
3	10:09	10:24	15	4.00	1.00	3.00	12.0
4	10:24	10:39	15	4.00	1.00	3.00	12.0
5	10:39	10:54	15	4.00	1.00	3.00	12.0
6	10:54	11:09	15	4.00	1.00	3.00	12.0
7	11:09	11:24	15	4.00	1.00	3.00	12.0
8	11:24	11:39	15	4.00	1.00	3.00	12.0
					Field Infiltration Rate:		**12.0**

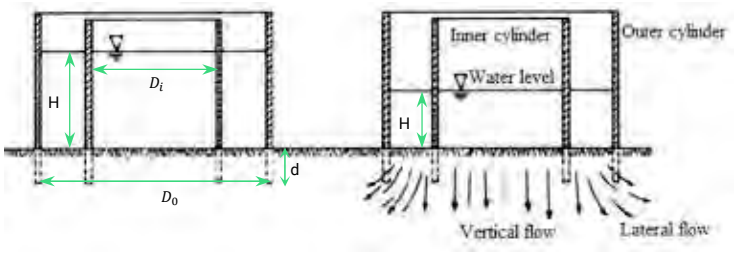
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

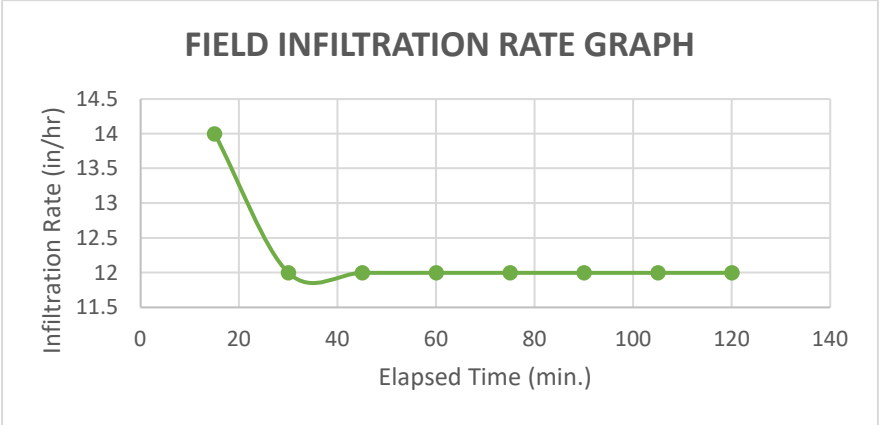
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 21





Single Ring Infiltration Log

INF - 22

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/17/2024 Completed 5/17/2024	Testing Depth / Elev.	5 ft / 56.03 ft
Test Performed By	N. Francois	Water Depth /Elev.	8 ft / 53.03 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	9:20	9:50	30	4.00	0.00	4.00	--
P2	9:50	10:20	30	4.00	0.00	4.00	--
1	10:20	10:35	15	4.00	0.00	4.00	16.0
2	10:35	10:50	15	4.00	0.00	4.00	16.0
3	10:50	11:05	15	4.00	1.00	3.00	12.0
4	11:05	11:20	15	4.00	2.00	2.00	8.0
5	11:20	11:35	15	4.00	2.00	2.00	8.0
6	11:35	11:50	15	4.00	2.00	2.00	8.0
7	11:50	12:05	15	4.00	2.00	2.00	8.0
8	12:05	12:20	15	4.00	2.00	2.00	8.0
					Field Infiltration Rate:		**8.0**

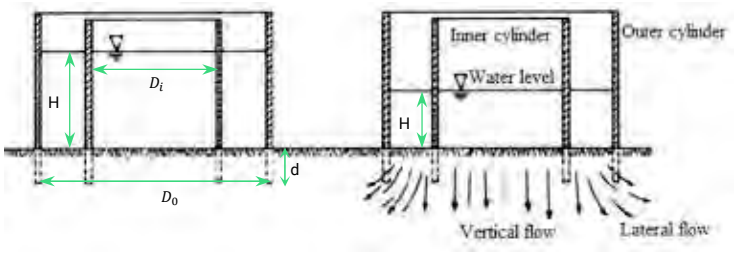
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

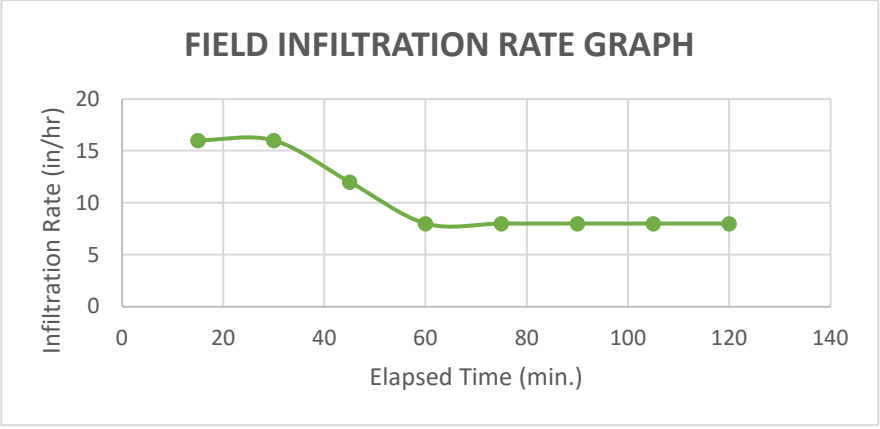
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 22





Single Ring Infiltration Log

INF - 23

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/20/2024 Completed 5/20/2024	Testing Depth / Elev.	5 ft / 55.57 ft
Test Performed By	N. Fisher	Water Depth /Elev.	9 ft / 51.57 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	8:50	9:50	60	5.00	3.0000	2.0000	--
P2							
1	9:50	10:05	15	5.00	4.000	1.000	4.00
2	10:05	10:20	15	5.00	4.250	0.750	3.00
3	10:20	10:35	15	5.00	4.313	0.687	2.75
4	10:35	10:50	15	5.00	4.313	0.687	2.75
5	10:50	11:05	15	5.00	4.375	0.625	2.50
6	11:05	11:20	15	5.00	4.375	0.625	2.50
7	11:20	11:35	15	5.00	4.375	0.625	2.50
8	11:35	11:50	15	5.00	4.438	0.563	2.25
9	11:50	12:05	15	5.00	4.500	0.500	2.00
10	12:05	12:20	15	5.00	4.500	0.500	2.00
					Field Infiltration Rate:		**2.2**

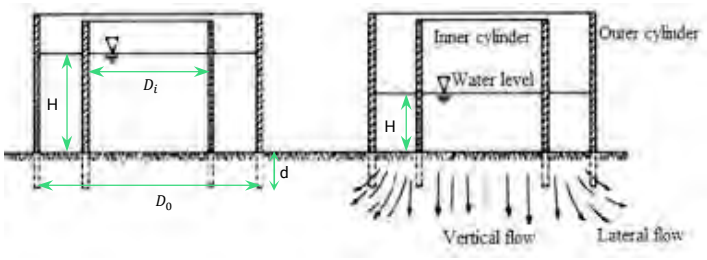
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

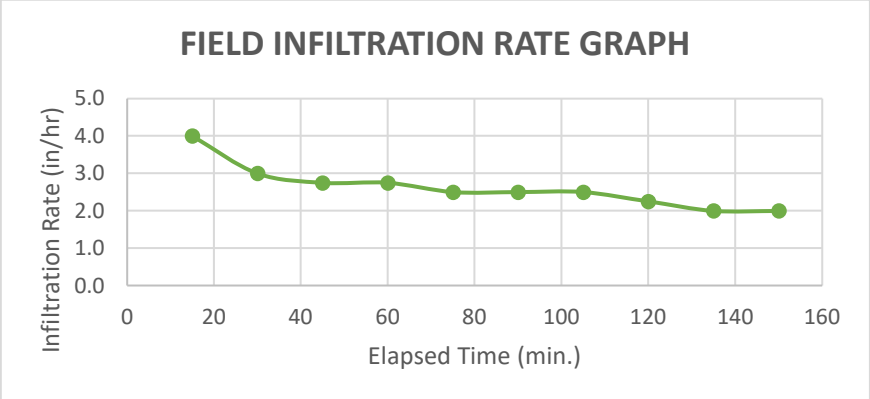
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 23





Single Ring Infiltration Log

INF - 24

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/20/2024 Completed 5/20/2024	Testing Depth / Elev.	5 ft / 54.30 ft
Test Performed By	N. Fisher	Water Depth /Elev.	8 ft / 51.30 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	8:30	9:30	60	3.50	1.0000	2.5000	--
P2							
1	9:30	9:45	15	3.50	2.750	0.750	3.00
2	9:45	10:00	15	3.50	2.938	0.563	2.25
3	10:00	10:15	15	3.50	2.938	0.563	2.25
4	10:15	10:30	15	3.50	2.938	0.563	2.25
5	10:30	10:45	15	3.50	3.000	0.500	2.00
6	10:45	11:00	15	3.50	3.000	0.500	2.00
7	11:00	11:15	15	3.50	3.000	0.500	2.00
8	11:15	11:30	15	3.50	3.000	0.500	2.00
					Field Infiltration Rate:		**2.0**

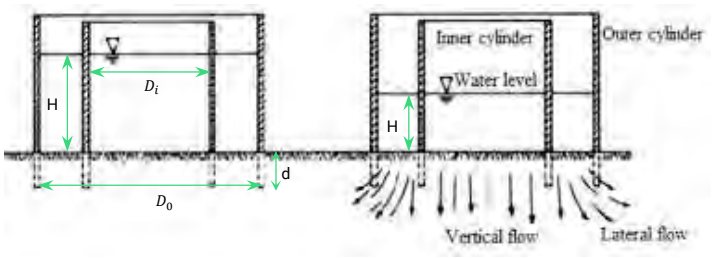
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

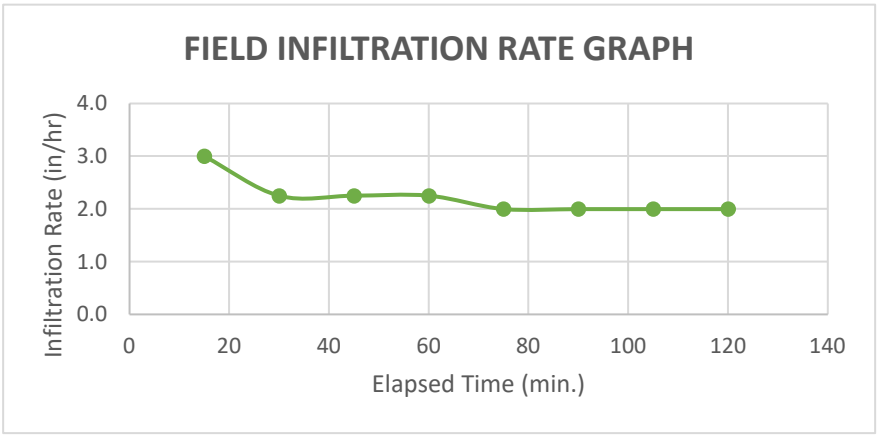
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 24





Single Ring Infiltration Log

INF - 25

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/17/2024 Completed 5/17/2024	Testing Depth / Elev.	5 ft / 54.98 ft
Test Performed By	N. Francois	Water Depth /Elev.	8 ft / 51.98 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	11:51	12:21	30	4.00	0.50	3.50	--
P2	12:21	12:51	30	4.00	0.50	3.50	--
1	12:51	1:06	15	4.00	2.50	1.50	6.0
2	1:06	1:21	15	4.00	2.00	2.00	8.0
3	1:21	1:36	15	4.00	2.00	2.00	8.0
4	1:36	1:51	15	4.00	2.00	2.00	8.0
5	1:51	2:06	15	4.00	2.00	2.00	8.0
6	2:06	2:21	15	4.00	2.00	2.00	8.0
7	2:21	2:36	15	4.00	2.00	2.00	8.0
8	2:36	2:51	15	4.00	2.00	2.00	8.0
					Field Infiltration Rate:		**8.0**

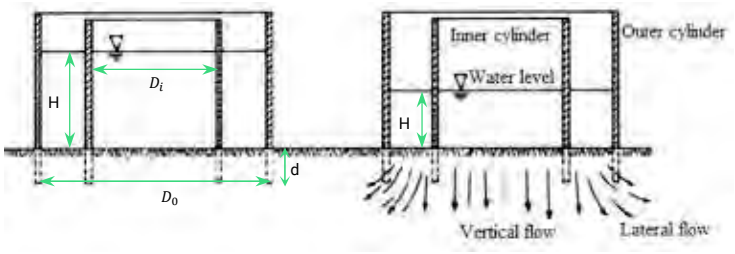
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

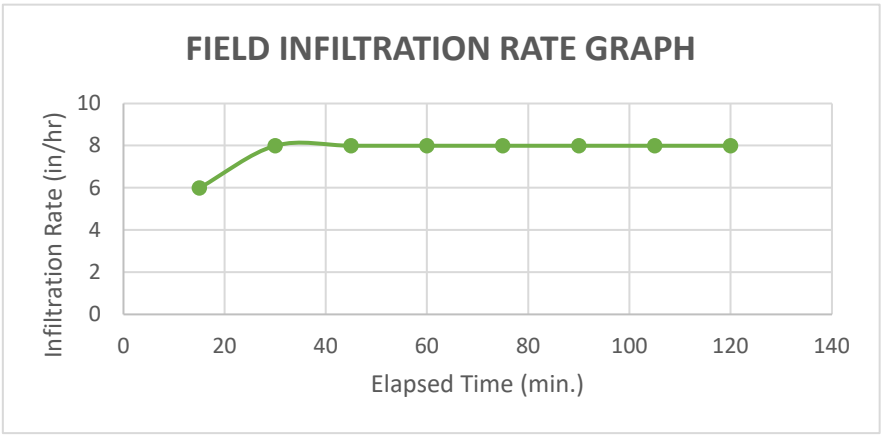
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 25





Single Ring Infiltration Log

INF - 26

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/20/2024 Completed 5/20/2024	Testing Depth / Elev.	4 ft / 54.63 ft
Test Performed By	N. Fisher	Water Depth /Elev.	8 ft / 50.63 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	9:25	10:25	60	5.50	2.0000	3.5000	--
P2							
1	10:25	10:40	15	5.50	4.750	0.750	3.00
2	10:40	10:55	15	5.50	4.875	0.625	2.50
3	10:55	11:10	15	5.50	4.938	0.563	2.25
4	11:10	11:25	15	5.50	5.000	0.500	2.00
5	11:25	11:40	15	5.50	5.000	0.500	2.00
6	11:40	11:55	15	5.50	5.000	0.500	2.00
7	11:55	12:10	15	5.50	5.063	0.438	1.75
8	12:10	12:25	15	5.50	5.125	0.375	1.50
9	12:25	12:40	15	5.50	5.125	0.375	1.50
					Field Infiltration Rate:		**1.7**

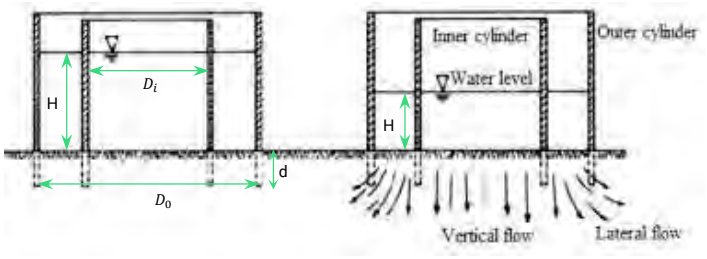
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

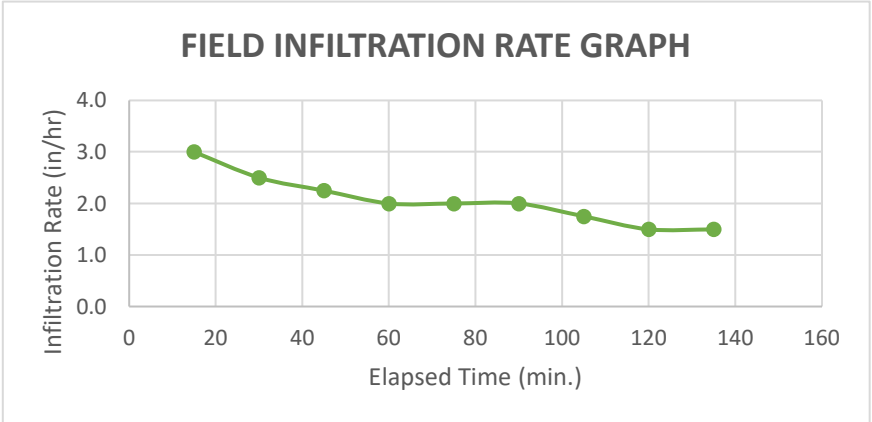
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 26





Single Ring Infiltration Log

INF - 27

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/20/2024 Completed 5/20/2024	Testing Depth / Elev.	3 ft / 54.66 ft
Test Performed By	N. Fisher	Water Depth /Elev.	6 ft / 51.66 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	11:15	12:15	60	4.00	0.0000	4.0000	--
P2							
1	12:15	12:30	15	4.00	3.000	1.000	4.00
2	12:30	12:45	15	4.00	3.125	0.875	3.50
3	12:45	1:00	15	4.00	3.125	0.875	3.50
4	1:00	1:15	15	4.00	3.125	0.875	3.50
5	1:15	1:30	15	4.00	3.125	0.875	3.50
6	1:30	1:45	15	4.00	3.125	0.875	3.50
7	1:45	2:00	15	4.00	3.125	0.875	3.50
8	2:00	2:15	15	4.00	3.125	0.875	3.50
					Field Infiltration Rate:		**3.5**

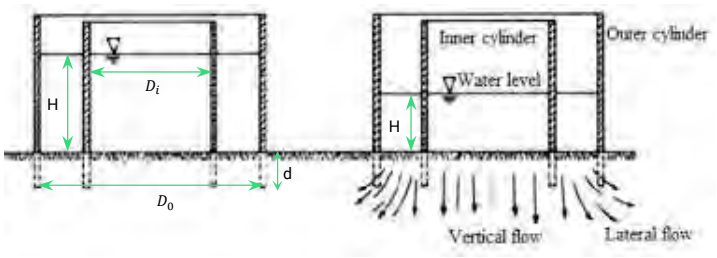
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

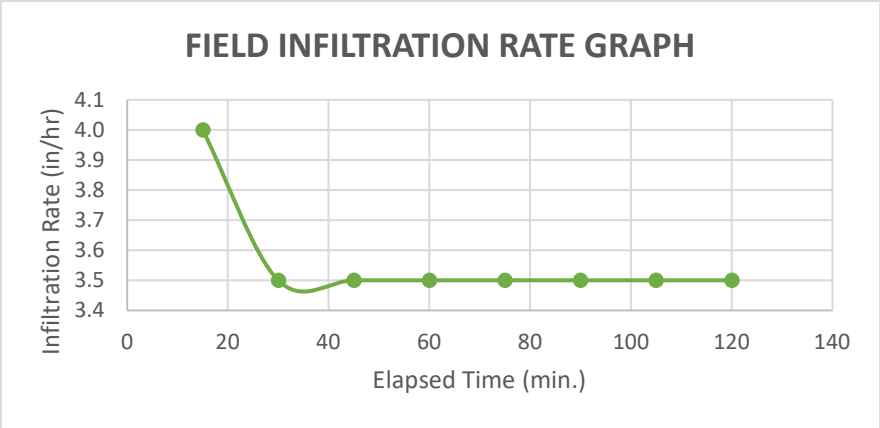
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 27





Single Ring Infiltration Log

INF - 28

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/20/2024 Completed 5/20/2024	Testing Depth / Elev.	4 ft / 54.98 ft
Test Performed By	N. Fisher	Water Depth /Elev.	8 ft / 50.98 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	11:50	12:50	60	3.00	0.0000	3.0000	--
P2							
1	12:50	1:05	15	3.00	0.750	2.250	9.00
2	1:05	1:20	15	3.00	0.750	2.250	9.00
3	1:20	1:35	15	3.00	1.500	1.500	6.00
4	1:35	1:50	15	3.00	1.500	1.500	6.00
5	1:50	2:05	15	3.00	1.500	1.500	6.00
6	2:05	2:20	15	3.00	1.500	1.500	6.00
7	2:20	2:35	15	3.00	1.500	1.500	6.00
8	2:35	2:50	15	3.00	1.500	1.500	6.00
9	2:50	3:05	15	3.00	1.500	1.500	6.00
					Field Infiltration Rate:		**6.0**

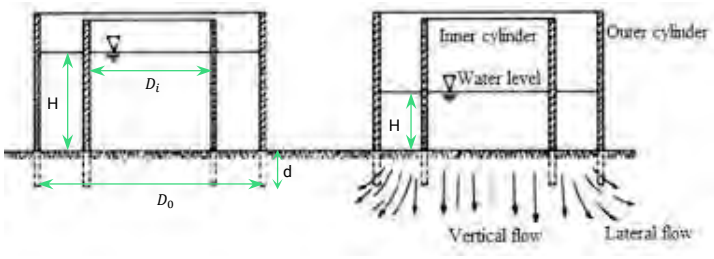
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

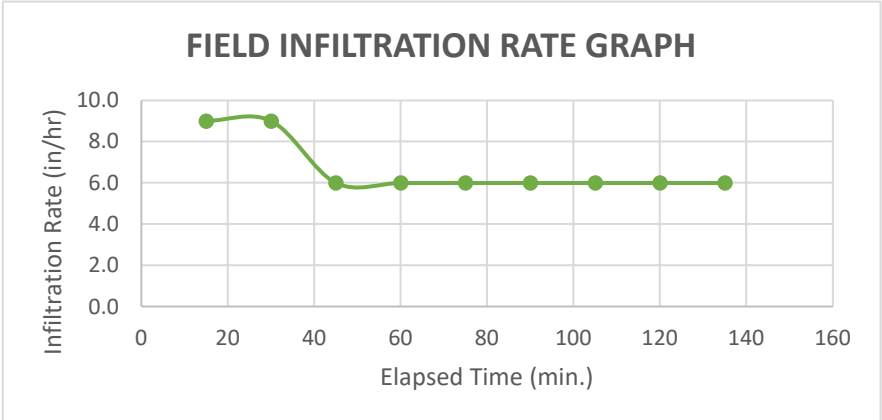
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 28





Single Ring Infiltration Log

INF - 29

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/22/2024 Completed 5/22/2024	Testing Depth / Elev.	5 ft / 54.71 ft
Test Performed By	N. Fisher	Water Depth /Elev.	8 ft / 51.71 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	8:33	9:33	60	5.00	0.0000	5.0000	--
P2							
1	9:33	9:48	15	5.00	2.000	3.000	12.00
2	9:48	10:03	15	5.00	2.000	3.000	12.00
3	10:03	10:18	15	5.00	2.000	3.000	12.00
4	10:18	10:33	15	5.00	2.125	2.875	11.50
5	10:33	10:48	15	5.00	2.250	2.750	11.00
6	10:48	11:03	15	5.00	2.250	2.750	11.00
7	11:03	11:18	15	5.00	2.250	2.750	11.00
8	11:18	11:33	15	5.00	2.650	2.350	9.40
9	11:33	11:48	15	5.00	2.750	2.250	9.00
10	11:48	12:03	15	5.00	2.750	2.250	9.00
11	12:03	12:18	15	5.00	2.750	2.250	9.00
					Field Infiltration Rate:		**9.0**

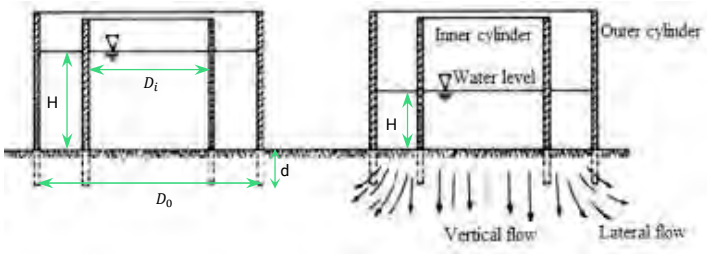
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

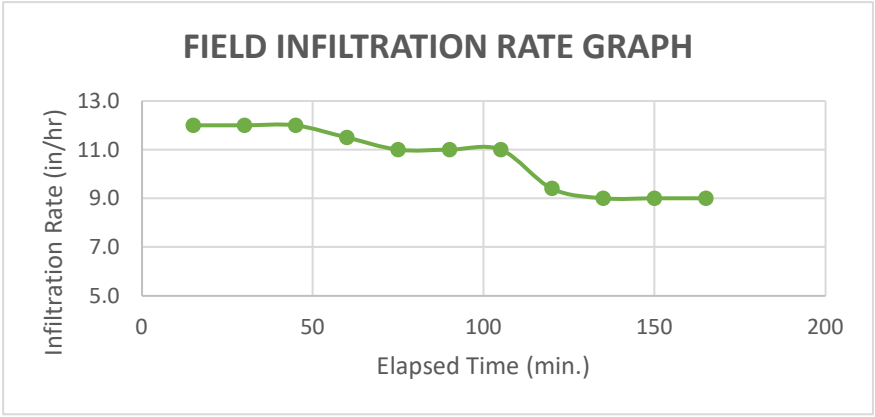
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 29





Single Ring Infiltration Log

INF - 30

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/22/2024 Completed 5/22/2024	Testing Depth / Elev.	3.5 ft / 53.69 ft
Test Performed By	N. Fisher	Water Depth /Elev.	6 ft / 51.19 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	8:36	9:36	60	4.00	0.0000	4.0000	--
P2							
1	9:36	9:51	15	4.00	2.500	1.500	6.00
2	9:51	10:06	15	4.00	2.500	1.500	6.00
3	10:06	10:21	15	4.00	2.625	1.375	5.50
4	10:21	10:36	15	4.00	2.625	1.375	5.50
5	10:36	10:51	15	4.00	2.750	1.250	5.00
6	10:51	11:06	15	4.00	2.750	1.250	5.00
7	11:06	11:21	15	4.00	2.750	1.250	5.00
8	11:21	11:36	15	4.00	2.750	1.250	5.00
					Field Infiltration Rate:		**5.0**

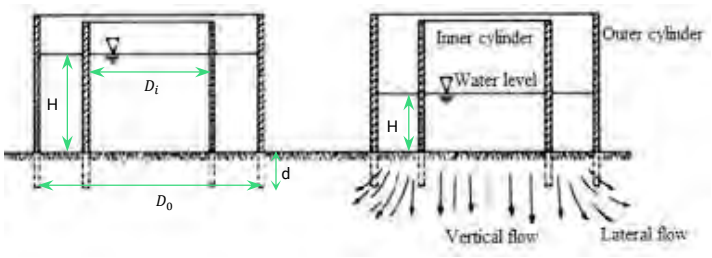
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

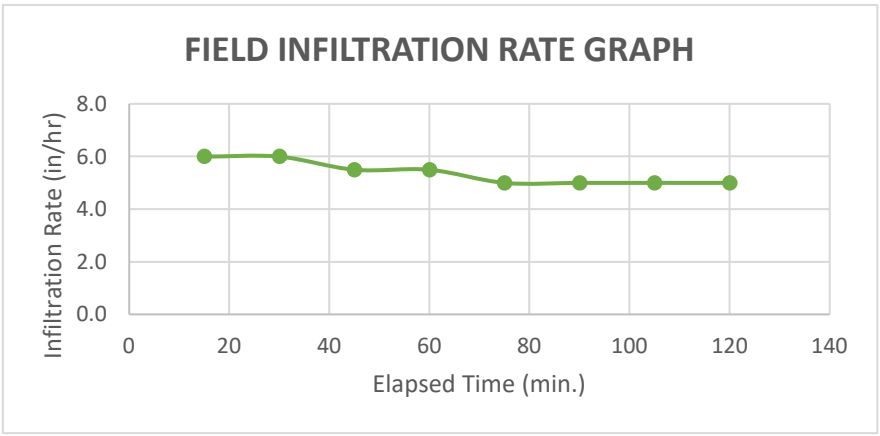
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 30





Single Ring Infiltration Log

INF - 31

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/22/2024 Completed 5/22/2024	Testing Depth / Elev.	3 ft / 52.63 ft
Test Performed By	N. Fisher	Water Depth /Elev.	5 ft / 50.63 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	8:39	9:39	60	4.00	4.0000	0.0000	--
P2							
1	9:39	9:54	15	4.00	4.000	0.000	0.00
2	9:54	10:09	15	4.00	4.000	0.000	0.00
3	10:09	10:24	15	4.00	4.000	0.000	0.00
4	10:24	10:39	15	4.00	4.000	0.000	0.00
5	10:39	10:54	15	4.00	4.000	0.000	0.00
6	10:54	11:09	15	4.00	4.000	0.000	0.00
7	11:09	11:24	15	4.00	4.000	0.000	0.00
8	11:24	11:39	15	4.00	4.000	0.000	0.00
					Field Infiltration Rate:		**0.0**

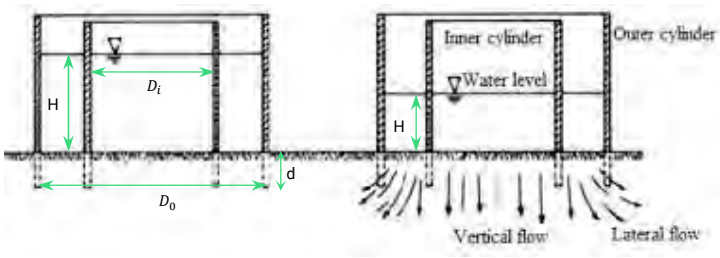
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

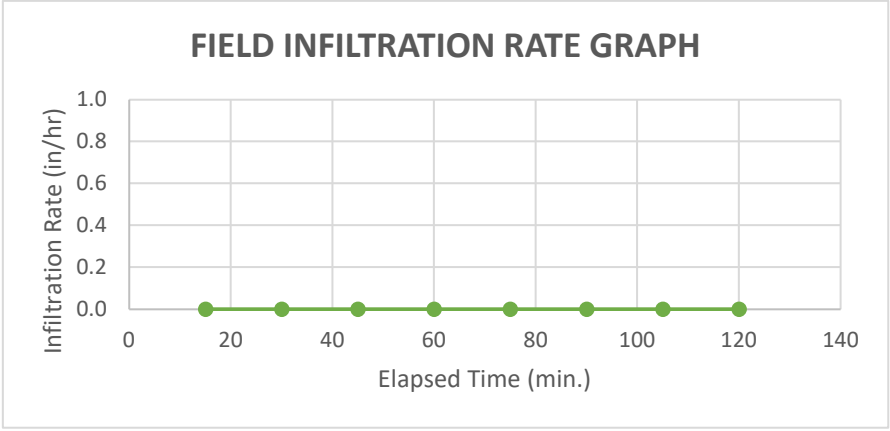
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 31





Single Ring Infiltration Log

INF - 32

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/21/2024 Completed 5/22/2024	Testing Depth / Elev.	3 ft / 54.19 ft
Test Performed By	N. Fisher	Water Depth /Elev.	6 ft / 51.19 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

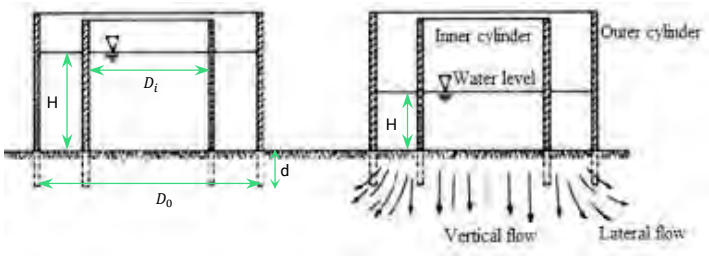
Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	12:05	12:10	5	4.00	0.0000	4.0000	--
P2	12:15	12:25	10	4.00	0.0000	4.0000	--
P3	12:27	12:37	10	4.00	0.0000	4.0000	--
P4	12:37	12:47	10	4.00	0.0000	4.0000	--
P5	12:50	1:02	12	4.00	0.0000	4.0000	--
1	1:05	1:10	5	4.00	2.500	1.500	18.00
2	1:10	1:15	5	4.00	2.500	1.500	18.00
3	1:15	1:20	5	4.00	2.625	1.375	16.50
4	1:20	1:25	5	4.00	2.625	1.375	16.50
5	1:25	1:30	5	4.00	2.625	1.375	16.50
6	1:30	1:35	5	4.00	2.625	1.375	16.50
7	1:35	1:40	5	4.00	2.750	1.250	15.00
8	1:40	1:45	5	4.00	2.750	1.250	15.00
9	1:45	1:50	5	4.00	2.750	1.250	15.00
10	1:50	1:55	5	4.00	2.750	1.250	15.00
11	1:55	2:00	5	4.00	2.750	1.250	15.00
12	2:00	2:05	5	4.00	2.750	1.250	15.00
13	2:05	2:10	5	4.00	2.875	1.125	13.50
14	2:10	2:15	5	4.00	2.875	1.125	13.50
15	2:15	2:20	5	4.00	2.875	1.125	13.50
16	2:20	2:25	5	4.00	2.875	1.125	13.50
17	2:25	2:30	5	4.00	2.875	1.125	13.50
18	2:30	2:35	5	4.00	2.875	1.125	13.50
19	2:35	2:40	5	4.00	2.875	1.125	13.50
20	2:40	2:45	5	4.00	2.875	1.125	13.50
21	2:45	2:50	5	4.00	2.875	1.125	13.50
22	2:50	2:55	5	4.00	2.875	1.125	13.50
23	2:55	3:00	5	4.00	2.875	1.125	13.50
24	3:00	3:05	5	4.00	2.875	1.125	13.50
					Field Infiltration Rate:		**13.5**

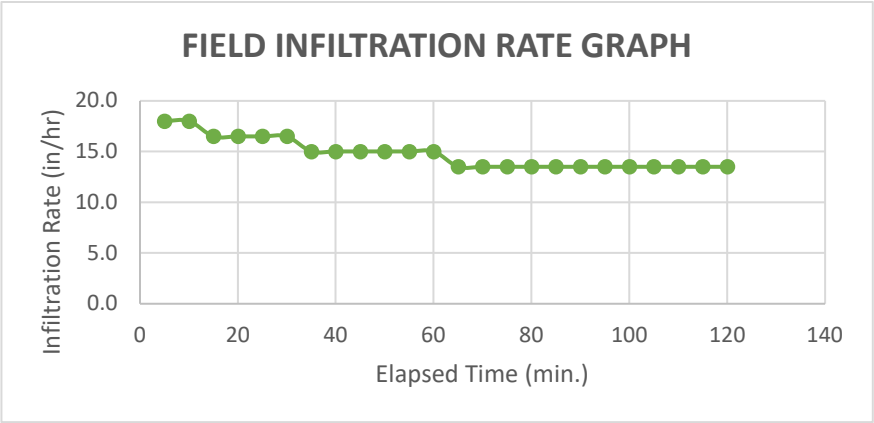
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

Notes:

Diameter Inner Ring, Di: 6 in
Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 32





Single Ring Infiltration Log

INF - 34

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/22/2024 Completed 5/22/2024	Testing Depth / Elev.	3 ft / 54.32 ft
Test Performed By	N. Fisher	Water Depth /Elev.	6 ft / 51.32 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	11:46	12:46	60	3.00	0.0000	3.0000	--
P2							
1	9:33	9:48	15	3.00	2.500	0.500	2.00
2	9:48	10:03	15	3.00	2.625	0.375	1.50
3	10:03	10:18	15	3.00	2.750	0.250	1.00
4	10:18	10:33	15	3.00	2.750	0.250	1.00
5	10:33	10:48	15	3.00	2.750	0.250	1.00
6	10:48	11:03	15	3.00	2.750	0.250	1.00
7	11:03	11:18	15	3.00	2.750	0.250	1.00
8	11:18	11:33	15	3.00	2.750	0.250	1.00
9	11:33	11:48	15	3.00	2.750	0.250	1.00
					Field Infiltration Rate:		**1.0**

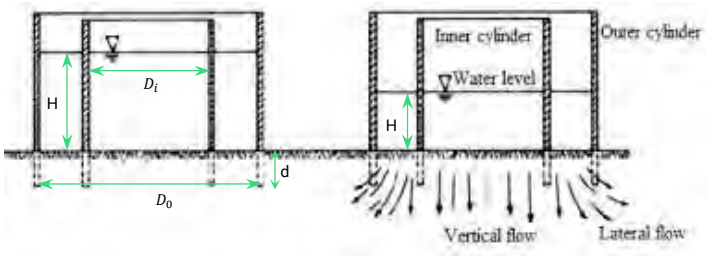
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

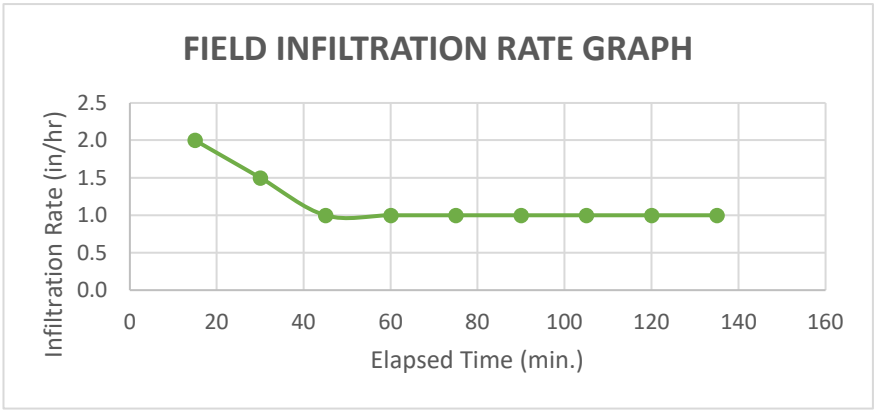
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 34





Single Ring Infiltration Log

INF - 35

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/22/2024 Completed 5/22/2024	Testing Depth / Elev.	4 ft / 53.43 ft
Test Performed By	N. Fisher	Water Depth /Elev.	7 ft / 50.43 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	11:49	12:49	60	4.00	0.8750	3.1250	--
P2							
1	12:49	1:04	15	4.00	3.063	0.938	3.75
2	1:04	1:19	15	4.00	3.125	0.875	3.50
3	1:19	1:34	15	4.00	3.125	0.875	3.50
4	1:34	1:49	15	4.00	3.188	0.813	3.25
5	1:49	2:04	15	4.00	3.250	0.750	3.00
6	2:04	2:19	15	4.00	3.313	0.688	2.75
7	2:19	2:34	15	4.00	3.313	0.688	2.75
8	2:34	2:49	15	4.00	3.313	0.688	2.75
					Field Infiltration Rate:		**2.75**

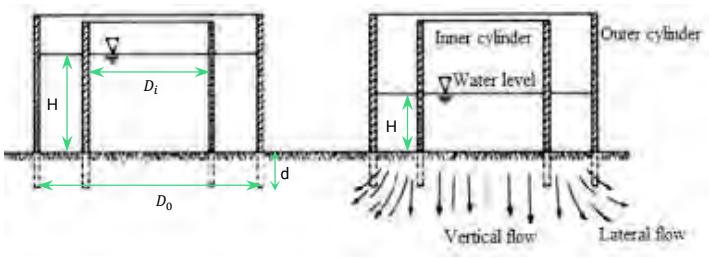
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

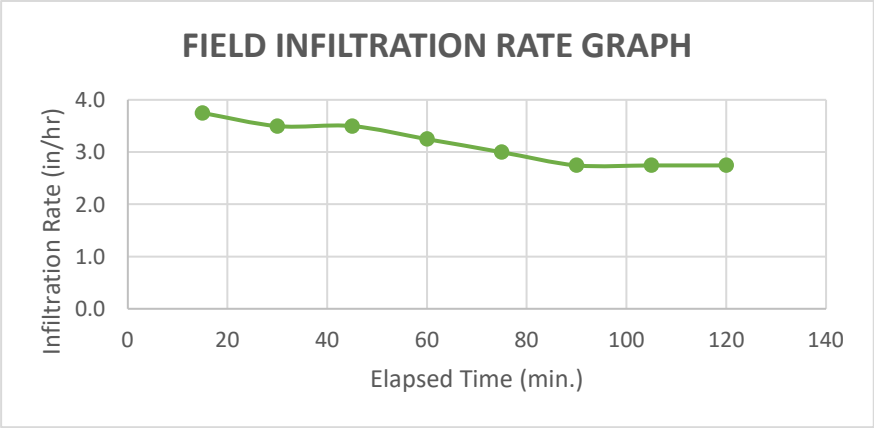
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 35





Single Ring Infiltration Log

INF - 36

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/21/2024 Completed 5/22/2024	Testing Depth / Elev.	3 ft / 54.68 ft
Test Performed By	N. Fisher	Water Depth /Elev.	6 ft / 51.68 ft
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

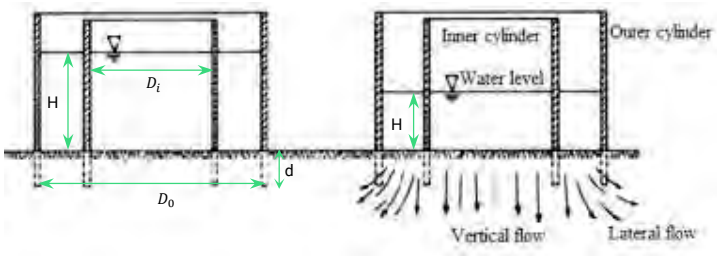
Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	12:10	12:14	4	4.00	0.0000	4.0000	--
P2	12:20	12:26	6	4.00	0.0000	4.0000	--
P3	12:29	12:37	8	4.00	0.0000	4.0000	--
P4	12:37	12:47	10	4.00	0.0000	4.0000	--
P5	12:50	1:02	12	4.00	0.0000	4.0000	--
1	1:08	1:13	5	4.00	1.625	2.375	28.50
2	1:18	1:23	5	4.00	1.625	2.375	28.50
3	1:28	1:33	5	4.00	1.625	2.375	28.50
4	1:33	1:38	5	4.00	1.750	2.250	27.00
5	1:38	1:43	5	4.00	2.000	2.000	24.00
6	1:43	1:48	5	4.00	2.000	2.000	24.00
7	1:48	1:53	5	4.00	2.000	2.000	24.00
8	1:53	1:58	5	4.00	2.000	2.000	24.00
9	1:58	2:03	5	4.00	2.000	2.000	24.00
10	2:03	2:08	5	4.00	2.000	2.000	24.00
11	2:08	2:13	5	4.00	2.063	1.938	23.25
12	2:13	2:18	5	4.00	2.063	1.937	23.24
13	2:18	2:23	5	4.00	2.125	1.875	22.50
14	2:23	2:28	5	4.00	2.250	1.750	21.00
15	2:28	2:33	5	4.00	2.250	1.750	21.00
16	2:33	2:38	5	4.00	2.250	1.750	21.00
17	2:38	2:43	5	4.00	2.250	1.750	21.00
18	2:43	2:48	5	4.00	2.250	1.750	21.00
19	2:48	2:53	5	4.00	2.250	1.750	21.00
20	2:53	2:58	5	4.00	2.250	1.750	21.00
21	2:58	3:03	5	4.00	2.250	1.750	21.00
22	3:03	3:08	5	4.00	2.250	1.750	21.00
23	3:08	3:13	5	4.00	2.250	1.750	21.00
24	3:13	3:18	5	4.00	2.250	1.750	21.00
					Field Infiltration Rate:		**21.0**

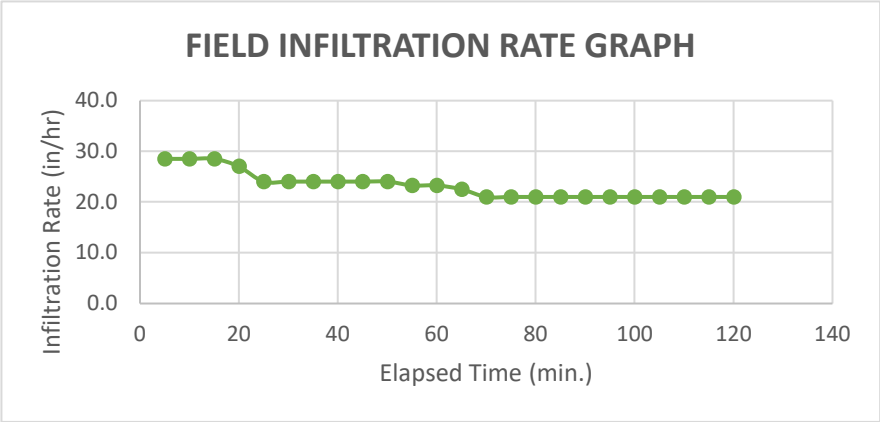
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

Notes:

Diameter Inner Ring, Di: 6 in
Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 36





Single Ring Infiltration Log

INF - 37

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/21/2024 Completed 5/21/2024	Testing Depth / Elev.	5 ft / 56.77 ft
Test Performed By	N. Fisher	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	8:56	9:56	60	4.00	0.0000	4.0000	--
P2							
1	9:56	10:11	15	4.00	2.000	2.000	8.00
2	10:11	10:26	15	4.00	2.125	1.875	7.50
3	10:26	10:41	15	4.00	2.125	1.875	7.50
4	10:41	10:56	15	4.00	2.250	1.750	7.00
5	10:56	11:11	15	4.00	2.250	1.750	7.00
6	11:11	11:26	15	4.00	2.250	1.750	7.00
7	11:26	11:41	15	4.00	2.250	1.750	7.00
8	11:41	11:56	15	4.00	2.250	1.750	7.00
					Field Infiltration Rate:		**7.0**

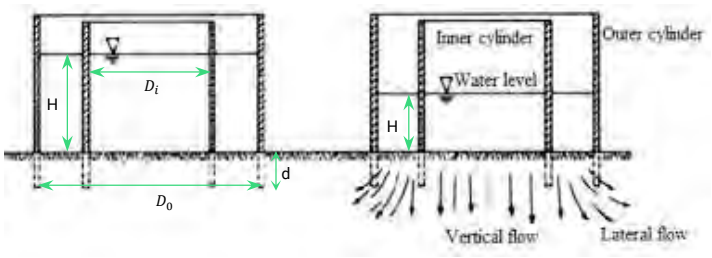
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

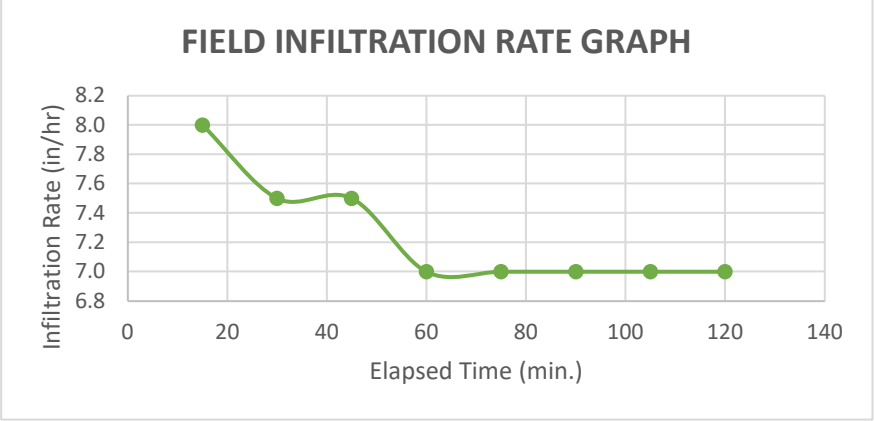
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 37





Single Ring Infiltration Log

INF - 38

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/21/2024 Completed 5/21/2024	Testing Depth / Elev.	5 ft / 57.90 ft
Test Performed By	N. Fisher	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	8:52	9:52	60	4.00	0.0000	4.0000	--
P2							
1	9:52	10:07	15	4.00	2.625	1.375	5.50
2	10:07	10:22	15	4.00	2.875	1.125	4.50
3	10:22	10:37	15	4.00	2.875	1.125	4.50
4	10:37	10:52	15	4.00	2.875	1.125	4.50
5	10:52	11:07	15	4.00	3.000	1.000	4.00
6	11:07	11:22	15	4.00	3.000	1.000	4.00
7	11:22	11:37	15	4.00	3.000	1.000	4.00
8	11:37	11:52	15	4.00	3.000	1.000	4.00
					Field Infiltration Rate:		**4.0**

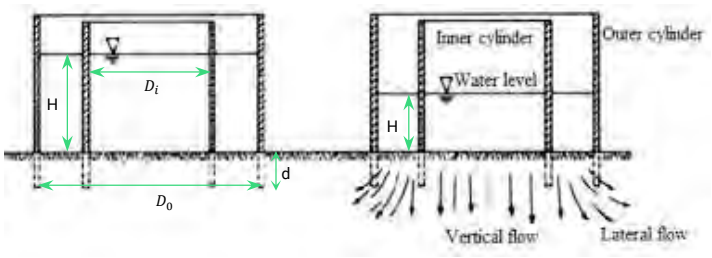
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

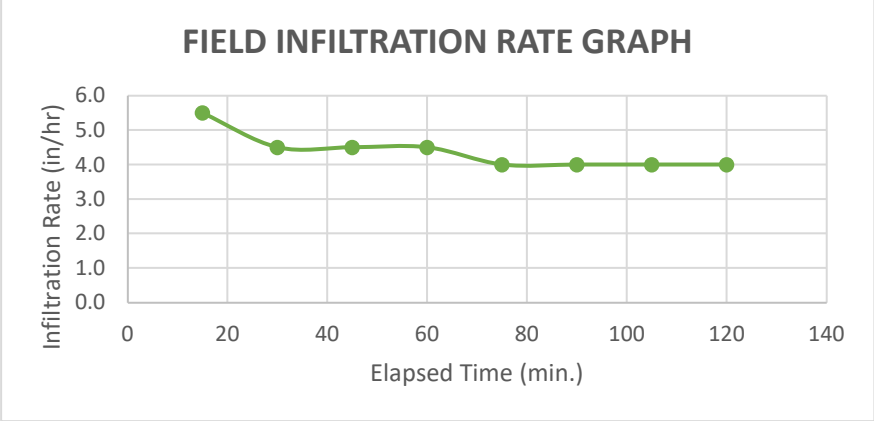
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 38





Single Ring Infiltration Log

INF - 39

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/21/2024 Completed 5/22/2024	Testing Depth / Elev.	5 ft / 56.28 ft
Test Performed By	N. Fisher	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	8:48	9:48	60	3.50	0.0000	3.5000	--
P2							
1	9:48	10:03	15	3.50	3.000	0.500	2.00
2	10:03	10:18	15	3.50	3.000	0.500	2.00
3	10:18	10:33	15	3.50	3.000	0.500	2.00
4	10:33	10:48	15	3.50	3.000	0.500	2.00
5	10:48	11:03	15	3.50	3.000	0.500	2.00
6	11:03	11:18	15	3.50	3.000	0.500	2.00
7	11:18	11:33	15	3.50	3.000	0.500	2.00
8	11:33	11:48	15	3.50	3.000	0.500	2.00
					Field Infiltration Rate:		**2.0**

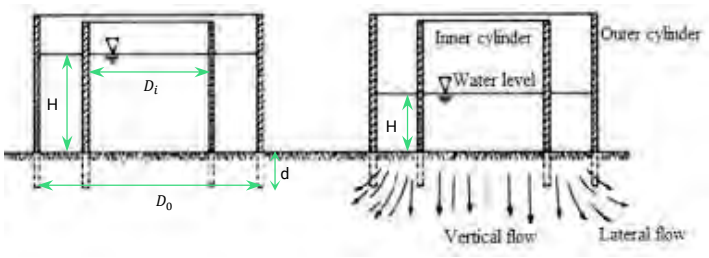
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

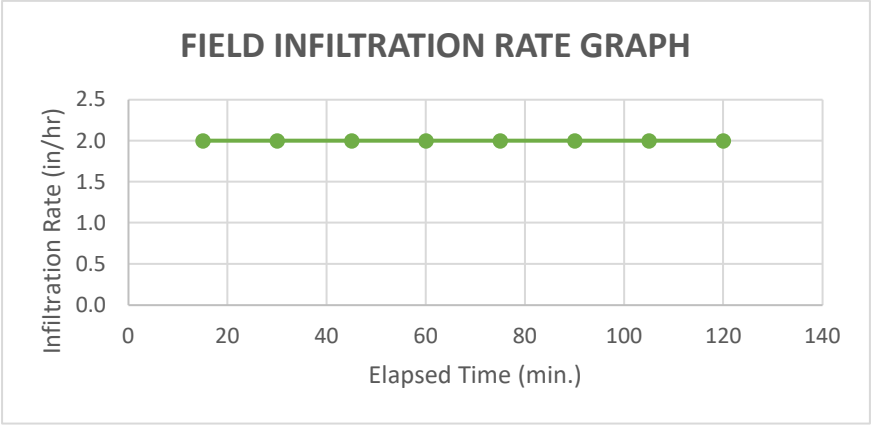
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 39





Single Ring Infiltration Log

INF - 40

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	5/21/2024 Completed 5/22/2024	Testing Depth / Elev.	4 ft / 56.8 ft
Test Performed By	N. Fisher	Water Depth /Elev.	Not Encountered
Excavator / Operator	Gene Blemings	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	8:45	9:45	60	5.00	3.2500	1.7500	--
P2							
1	9:45	10:00	15	5.00	4.750	0.250	1.00
2	10:00	10:15	15	5.00	4.750	0.250	1.00
3	10:15	10:30	15	5.00	4.875	0.125	0.50
4	10:30	10:45	15	5.00	4.875	0.125	0.50
5	10:45	11:00	15	5.00	4.875	0.125	0.50
6	11:00	11:15	15	5.00	4.875	0.125	0.50
7	11:15	11:30	15	5.00	4.875	0.125	0.50
8	11:30	11:45	15	5.00	4.875	0.125	0.50
					Field Infiltration Rate:		**0.5**

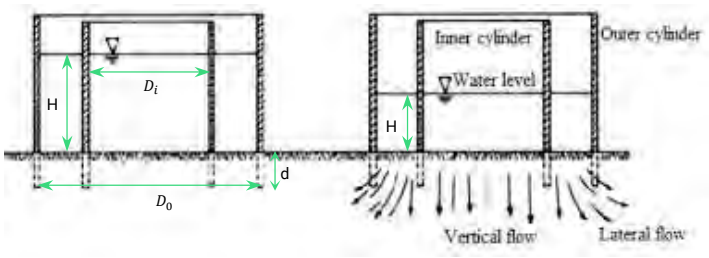
* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

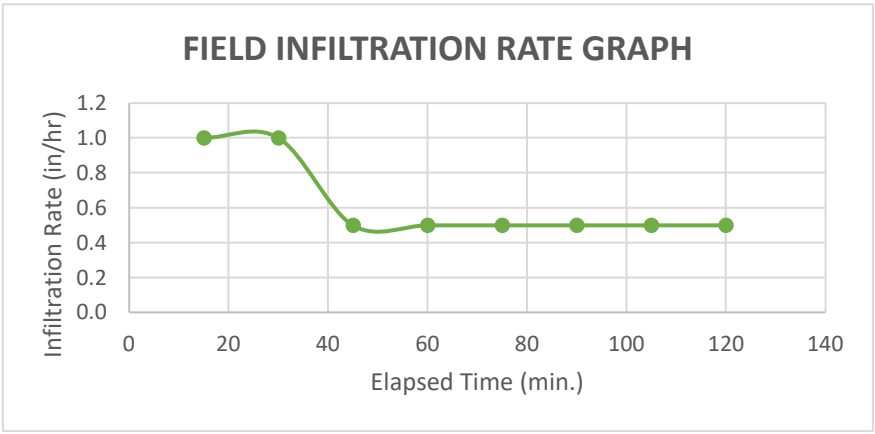
Notes:

Diameter Inner Ring, Di: 6 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 40





DNREC Division of Watershed Stewardship
89 Kings Highway
Dover, DE 19901
(302) 739-9921

Soil Investigation Report Submittal Checklist

DATE RECEIVED: 7/5/2024 **PROJECT NUMBER:** LDMSE24001

PROJECT NAME: Appoquinimink School District Summit Campus – Infiltration Testing

The items contained on this checklist are necessary to properly evaluate and determine the completeness of any Soil Investigation Report submitted under subsection 12.1 of the Delaware Sediment and Stormwater Regulations. Complete all items. It is understood not all items will be applicable to all projects and as such marking an item "N/A" is acceptable.

I. ✓ **General Soil Investigation Reports.** The following information, as applicable, should be submitted for all projects.

1) ✓ The signature, seal and date of a professional engineer or professional geologist experienced in soils licensed in the State of Delaware.

2) ✓ General description of the project, project elements, and project background.

3) ✓ Project site surface conditions and current use.

4) ✓ Regional and site geology. An initial screening of readily available data to determine feasibility of infiltration practices, if applicable, including:

a) ✓ Site topography

b) ✓ Soil characteristics as defined in the USDA NRCS Web Soil Survey

c) ✓ Depth to groundwater and seasonal high water table

d) ✓ Historical groundwater level data from the nearest Delaware Geological Survey (DGS) monitoring well or wells

5) ✓ Minimum number of borings or test pits conducted in accordance with the following:

a) ____ Surface area BMPs:

i) ____ Two (2) borings or pits for the first 8,000 square feet

ii) ___ Three (3) borings or pits for up to 16,000 square feet

iii) ____ Four (4) borings or pits for up to 25,000 square feet

iv) ___ One (1) additional boring or pit for each additional 25,000 square feet beyond the first 25,000 square feet

v) ____ Boring or pit locations distributed within the facility and sufficient to determine soil variability

b) ✓ Linear BMPS:

i) ____ Two (2) borings or pits up to 500 linear feet, and

ii) ✓ One (1) additional boring or pit per additional 500 linear feet of trench

iii) ✓ Boring or pit locations distributed and sufficient to determine soil variability

Soil Investigation Report Submittal Checklist

6) ✓ Borings or test pits advanced to the depth of the limiting layer or a minimum of three (3) feet below bottom of the proposed facility, whichever is encountered first.

7) ✓ Borehole or test pit logs including the following information:

a) ✓ Project name

b) ✓ Name of individual collecting the field data

c) ✓ Date field data was collected

d) ✓ Type of boring or test pit excavation method and equipment used

e) ✓ Air temperature and precipitation, including significant precipitation prior to investigation

f) ✓ Elevation of ground at boring location based on site benchmark

g) ✓ Visual description of soil profile layers, and depths below grade encountered

h) ✓ Sample numbers

i) ✓ Depths to any indications of instability such as cave in, sloughing, flowing sands, or obstructions

j) ✓ Blow counts if Standard Penetration Test (SPT) borings are performed

k) ✓ Depth of seasonal high water table indicators such as mottling

l) ✓ Depth of encountered free water during and after excavation

m) N/A Depth to bedrock if encountered

n) ✓ General observations

o) ✓ Testing standards

8) ✓ Depth and type of field testing performed. A summary of the laboratory testing conducted, if applicable.

9) ✓ Project soil and rock conditions including a description of the soil and rock units encountered, and how the units tie into the site geology.

10) ✓ Description of groundwater conditions, including the identification of any of the following:

a) N/A Confined aquifers

b) N/A Artesian pressures

c) ✓ Perched water tables

d) ✓ Potential seasonal variations, if known

e) ✓ Any influences on the ground water levels observed

f) ✓ Direction and gradient of groundwater, if known

11) N/A Discussion of rock structure, if applicable, including but not limited to:

a) ____ The results of any field structure mapping using photographs as needed,

b) ____ Joint condition

c) ____ Rock strength

d) ____ Potential for seepage.

12) N/A Summary of geological hazards identified and their impact on the project design, if any. Description of the location and extent of the geological hazard.

13) N/A For analysis of unstable slopes including existing settlement areas, cuts, and fills, include background regarding the analysis approach, assessment of failure mechanisms, and determination of design parameters. Include a description of any back-analyses conducted, the results of those analyses, comparison of those results to any laboratory test data obtained, and the conclusions made regarding the parameters to be used for final design.

14) ✓ Geotechnical recommendations for structural earthwork including:

a) N/A Embankment design recommendations, as applicable, including but not limited to the following:

i)____ Slope required for stability

ii) ___ Need and extent of removal of any unsuitable materials beneath the proposed fills

iii)____ Any other measures that need to be taken to provide a stable embankment

iv) ___ Embankment settlement magnitude and rate

b) N/A Cut design recommendations, as applicable, including but not limited to the following:

i)____ Slope required for stability

ii) ___ Seepage and piping control

iii)____ Erosion control measures

iv) ___ Any special measures required to provide a stable slope

c) ✓ Determination of adequacy of excavated material for use as structural fill or spoil

d) N/A Data for structural designs of BMP outlet works

15) N/A Long-term or construction monitoring needs, if applicable.

a) ____ Recommendation for types of instrumentation needed to evaluate long-term performance or to control construction

b) ____ Specify the reading schedule required

c) ____ Specify how the data should be used to control construction or to evaluate long-term performance

d) ____ Specify the zone of influence for each instrument.

16) ✓ Address issues of construction staging, shoring needs and potential installation difficulties, temporary slopes, potential foundation installation problems, earthwork constructability issues, and dewatering, as applicable.

17) ✓ Appendices to support geotechnical recommendations.

Soil Investigation Report Submittal Checklist

II.__✓__ **Infiltration Test Reports.** The following information, as applicable, should be submitted for all stormwater management BMPs that rely upon infiltration.

18)__✓__ Description of approved infiltration testing method.

a) __✓__ Field Permeability Testing conducted in accordance with ASTM-D5126 "Comparison of Field Methods for Determining Hydraulic Conductivity in the Vadose Zone".

b) __✓__ Single Ring or Double Ring Infiltrometer test method

c) N/A Cased Borehole Permeameter test method

i)____ Department or Delegated Agency approval granted prior to conducting the test

ii) ___ Minimum four (4) inch diameter casing used

d) __✓__ Any deviation from infiltration testing procedures approved by the Department or Delegated Agency noted in the report.

19)__✓__ Summary table of location of test, depth of test, elevation of test if available and field verified infiltration rate.

20)__✓__ The minimum number of field measured infiltration tests are based on the proposed facility's dimensions as follows:

a) ____ For an infiltration trench with less than 10,000 square feet of impervious drainage area:

i)____ One (1) test up to 500 linear feet, and

ii) ___ One (1) additional test per 250 linear feet of trench, and

iii)____ Sufficient to determine variability.

b) ____ For an infiltration trench with greater than 10,000 square feet of impervious drainage area:

i)____ One (1) test up to 250 linear feet, and

ii) ___ One (1) additional test per 250 linear feet of trench, and

iii)____ Sufficient to determine variability.

c) ____ For an infiltration trench used with roadway perforated pipe layouts:

i)____ One (1) test up to 500 linear feet, and

ii) ___ One (1) additional test per 500 linear feet of trench, and

iii)____ Sufficient to determine variability.

d) ____ For an infiltrating bioretention system:

i)____ One (1) test for the first 8,000 square feet

ii) ___ Two (2) tests for up to 16,000 square feet

iii)____ Three (3) tests for up to 25,000 square feet

iv) ___ One (1) additional test for each additional 25,000 square feet beyond the first 25,000 square feet

v)____ Test locations distributed within the facility and sufficient to determine variability.

e) ____ For a surface infiltration basin:

i)____ One (1) test for the first 8,000 square feet

ii) ___ Two (2) tests for up to 16,000 square feet

iii)____ Three (3) tests for up to 25,000 square feet

iv) ___ One (1) additional test for each additional 25,000 square feet beyond the first 25,000 square feet.

v)____ Test locations distributed within the facility and sufficient to determine variability.

f) ✓ For a subsurface infiltrating practice:

i)____ One (1) test per infiltration area

ii) ___ One (1) additional test for every 8,000 square feet of infiltration area

iii) ✓ Test locations distributed within the facility and Sufficient to determine variability

21) ✓ Infiltration test log, including:

a) ____ Name and license number of individual performing test. Individuals in responsible charge of infiltration testing possesses a Class D On-Site License issued by DNREC Division of Water Groundwater Discharges Section or be licensed in the State of Delaware as a Professional Engineer or Professional Geologist.

b) ✓ Date test was performed

c) ✓ Type of test method

d) ✓ Air temperature and precipitation

e) ✓ Depth of test below ground surface and elevation. Separation to a limiting layer such as bedrock or groundwater of at least two (2) feet maintained.

f) ✓ Diameters of boring and casing

g) ✓ Depth of casing penetration

h) ✓ Time and depth from reference point for each time increment.

i) ✓ A saturation period of one hour or a drop of 12 inches or 30.5 centimeters achieved. Saturation period not used in determining field verified infiltration rate.

ii) ✓ After the saturation period, a minimum of two (2) test periods completed or until at least two (2) consecutive test periods are consistent and achieve a stabilized infiltration rate. Each test period has a maximum reading interval of 15 minutes and meets one (1) of the following criteria:

(1) ✓ A minimum of one hour as determined by the sum of the interval times

(2)____ A drop of at least 12 inches in 15 minutes or less for a minimum of 30 minutes as determined by the sum of the interval times

iii)_✓_ Stabilized infiltration rate met as defined as one of the following:

(1)_✓_ A difference of 0.25 inches or less of drop between the highest and lowest reading of four (4) consecutive readings for infiltration rates greater than two (2.0) inches per hour

(2)_✓_ A difference of 0.125 inches or less of drop between the highest and lowest reading of four (4) consecutive readings for infiltration rates equal to or less than two (2.0) inches per hour.

iv)_✓_ When using the constant head test method, water level inside the casing maintained at a constant level or refilled to the starting level after each reading throughout the test period at no more than 15 minute intervals.

v)____ When using the falling head test method each test period starts with the same initial head.

22)_✓_ Infiltration rate graph for each test charting the field verified infiltration rate versus elapsed time of test. Append to each graph a table of the testing results. The field verified infiltration rate is the final steady state reading of the test performed.

23)_✓_ Geotechnical recommendations for each stormwater management facility, including the following:

a) _✓_ Recommended design infiltration rate based on the following:

i)_✓_ Apply a minimum factor of safety of 2.0 to field results from Single Ring or Double Ring Infiltrometer testing

ii)____ Apply a minimum factor of safety of 2.5 to field results from Cased Borehole Permeameter testing.

iii)_✓_ Provide an elevation range over which the recommended design rates are applicable.

iv)_✓_ The maximum design infiltration rate is less than or equal to 15 inches per hour.

b) N/A Impact of infiltration on adjacent facilities

c) N/A Effect of infiltration on slope stability

d) N/A If the facility is located on a slope, stability of slopes within the facility

e) _✓_ Foundation bearing resistance

f) N/A If steady state conditions for a given test are not achieved, provide an explanation as to why steady state could not be achieved and the professional's opinion regarding the use of the results for design purposes. If steady state is not achieved for a given test and a reasonable professional opinion is not provided, the Department or Delegated Agency may require additional testing.

Soil Investigation Report Submittal Checklist

III. N/A **Geotechnical Reports for Embankments.** The following information, as applicable, should be submitted for all stormwater management BMPs containing an embankment.

24)____ The signature, seal and date of a professional engineer licensed in the State of Delaware.

25)____ Subsurface Exploration

a) ____ Explorations every 200 feet on center along the length of the embankment.

b) ____ Unless bedrock is encountered at a shallower depth, explorations at a depth twice the proposed height from bottom of pond to top of embankment.

c) ____ If bedrock is encountered, a minimum five (5) foot rock core performed. If organic, plastic, or soils with an actual or estimated N-value less than four (4) are encountered, extended exploration to a depth of four (4) times the proposed embankment height.

d) ____ If there is a potential for a significant groundwater gradient beneath an embankment or surface water levels are significantly higher on one side of the embankment than the other, the effect of reduced soil strength caused by water seepage has been evaluated.

e) ____ Seepage effects considered when an embankment is placed on or near the top of a slope that has known or potential seepage through it.

26)____ Summary of design analyses, which provide the project description and basis of the design recommendations.

27)____ Summary of stability analyses, which provide the results of the stability analyses performed for the given embankment dimensions.

28)____ Summary of settlement analyses, including design assumptions and settlement results for above-grade embankments.

29)____ Design recommendations for embankment construction identifying the following actions:

a) ____ Construction procedures for placement of material in embankment widening areas

b) ____ Embankment cut-off and core trench materials for above-grade embankments

c) ____ Special notes for excavation of unsuitable material, with specific backfill requirements

d) ____ Specific measures required prior to placing embankment material

e) ____ Installation of appropriate erosion control and vegetative cover

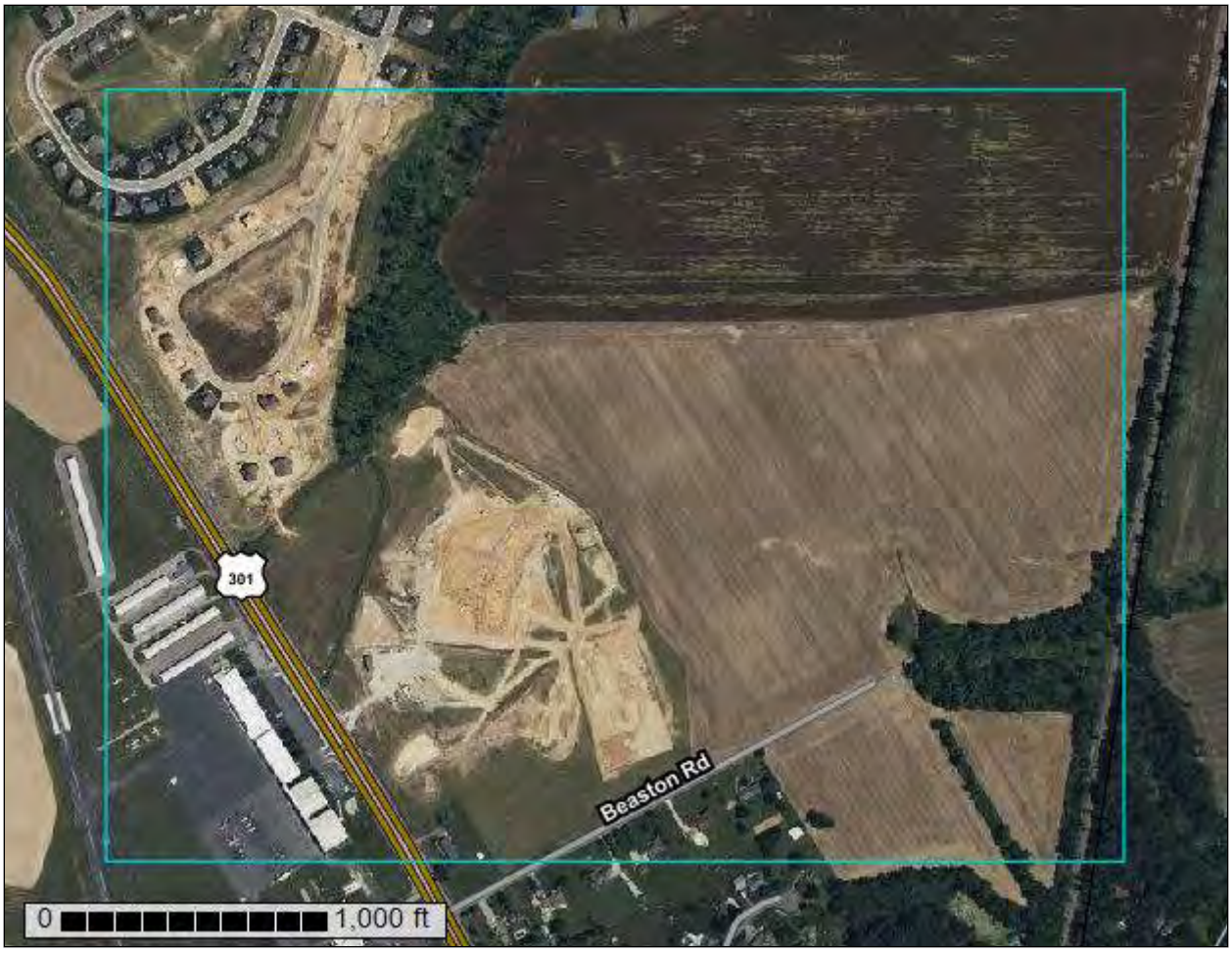
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for New Castle County, Delaware



June 20, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....8
Soil Map.....9
Legend.....10
Map Unit Legend.....11
Map Unit Descriptions.....11
New Castle County, Delaware.....14
LO—Longmarsh and Indiantown soils, frequently flooded.....14
MkA—Matapeake silt loam, 0 to 2 percent slopes.....16
OtcA—Othello silt loams, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain.....17
RdA—Reybold-Queponco complex, 0 to 2 percent slopes.....20
ReB—Reybold silt loam, 2 to 5 percent slopes.....22
ReC—Reybold silt loam, 5 to 10 percent slopes.....23
SacB—Sassafras sandy loam, 2 to 5 percent slopes, Mid-Atlantic Coastal Plain.....25
SacC—Sassafras sandy loam, 5 to 10 percent slopes, Mid-Atlantic Coastal Plain.....26
SaD—Sassafras sandy loam, 10 to 15 percent slopes.....28
WdcA—Woodstown sandy loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain.....29
WocA—Woodstown loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain.....31
References.....34

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:7,470 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: New Castle County, Delaware
Survey Area Data: Version 18, Sep 12, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 5, 2022—Jul 4, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
LO	Longmarsh and Indiantown soils, frequently flooded	3.7	1.4%
MkA	Matapeake silt loam, 0 to 2 percent slopes	2.2	0.8%
OtcA	Othello silt loams, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain	23.6	9.3%
RdA	Reybold-Queponco complex, 0 to 2 percent slopes	46.0	18.0%
ReB	Reybold silt loam, 2 to 5 percent slopes	122.4	48.0%
ReC	Reybold silt loam, 5 to 10 percent slopes	10.5	4.1%
SacB	Sassafras sandy loam, 2 to 5 percent slopes, Mid-Atlantic Coastal Plain	5.7	2.2%
SacC	Sassafras sandy loam, 5 to 10 percent slopes, Mid-Atlantic Coastal Plain	6.8	2.7%
SaD	Sassafras sandy loam, 10 to 15 percent slopes	4.8	1.9%
WdcA	Woodstown sandy loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain	1.9	0.7%
WocA	Woodstown loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain	27.5	10.8%
Totals for Area of Interest		**255.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made

up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

New Castle County, Delaware

LO—Longmarsh and Indiantown soils, frequently flooded

Map Unit Setting

National map unit symbol: 2p7dm
Elevation: 0 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Longmarsh and similar soils: 43 percent
Indiantown and similar soils: 37 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Longmarsh

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 19 inches: mucky loam
Cg1 - 19 to 34 inches: sandy loam
Cg2 - 34 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: R149AY060DE - Wet Alluvial Floodplain
Hydric soil rating: Yes

Description of Indiantown

Setting

Landform: Flood plains

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 25 inches: mucky silt loam
Cg - 25 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: R149AY060DE - Wet Alluvial Floodplain
Hydric soil rating: Yes

Minor Components

Zekiah

Percent of map unit: 10 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R149AY060DE - Wet Alluvial Floodplain
Hydric soil rating: Yes

Manahawkin

Percent of map unit: 5 percent
Landform: Flood plains, swamps
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153DY110NJ - Mucky Swamp
Hydric soil rating: Yes

Klej

Percent of map unit: 5 percent
Landform: Flats
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153DY150NJ - Moist Sandy Upland
Hydric soil rating: No

MkA—Matapeake silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2p7gt
Elevation: 10 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Matapeake and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Matapeake

Setting

Landform: Flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty eolian deposits over fluviomarine sediments

Typical profile

Ap - 0 to 5 inches: silt loam
E - 5 to 11 inches: silt loam
Bt - 11 to 34 inches: silt loam
2BC - 34 to 38 inches: sandy loam
2C - 38 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

Minor Components

Nassawango
Percent of map unit: 10 percent
Landform: Terraces, flats
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

Butlertown
Percent of map unit: 5 percent
Landform: Flats, broad interstream divides, interfluves
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Mattapex
Percent of map unit: 5 percent
Landform: Depressions, swales, flats
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

OtcA—Othello silt loams, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting
National map unit symbol: 2thwn
Elevation: 0 to 100 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 210 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Othello, drained, and similar soils: 48 percent
Othello, undrained, and similar soils: 28 percent
Minor components: 24 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Othello, Drained

Setting
Landform: Swales, depressions, flats

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Silty eolian deposits over fluviomarine deposits

Typical profile

Ap - 0 to 9 inches: silt loam
Btg - 9 to 29 inches: silt loam
2BCg - 29 to 34 inches: sandy loam
2Cg - 34 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 10 to 20 inches
Frequency of flooding: None
Frequency of ponding: Rare
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Description of Othello, Undrained

Setting

Landform: Drainageways, swales, depressions, flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Silty eolian deposits over fluviomarine deposits

Typical profile

Oe - 0 to 2 inches: peat
A - 2 to 4 inches: silt loam
Eg - 4 to 10 inches: silt loam
Btg - 10 to 29 inches: silt loam
2BCg - 29 to 35 inches: sandy loam
2Cg - 35 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: None

Frequency of ponding: Occasional
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Minor Components

Mattapex

Percent of map unit: 7 percent
Landform: Broad interstream divides, swales, depressions, flats
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Crosiadore

Percent of map unit: 7 percent
Landform: Depressions, fluviomarine terraces, flats
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Kentuck, undrained

Percent of map unit: 5 percent
Landform: Swales, depressions, flats
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Fallsington, undrained

Percent of map unit: 5 percent
Landform: Drainageways, swales, depressions, flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

RdA—Reybold-Queponco complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2p7g5
Elevation: 10 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 180 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Reybold and similar soils: 45 percent
Queponco and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reybold

Setting

Landform: Interfluves, flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: High silt loamy eolian deposits over fluviomarine deposits

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 30 inches: silt loam
2BC - 30 to 39 inches: gravelly coarse sandy loam
2C - 39 to 80 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Description of Queponco

Setting

Landform: Swales, flats
Down-slope shape: Concave, linear
Across-slope shape: Linear
Parent material: High silt loamy eolian deposits over fluviomarine deposits

Typical profile

Ap - 0 to 10 inches: silt loam
Bt1 - 10 to 17 inches: silt loam
2Bt2 - 17 to 31 inches: loam
2CB - 31 to 36 inches: sandy loam
2C - 36 to 80 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 40 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Unicorn

Percent of map unit: 10 percent
Landform: Swales, flats
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Matapeake

Percent of map unit: 5 percent
Landform: Rises
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

ReB—Reybold silt loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2p7g7
Elevation: 10 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 180 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Reybold and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reybold

Setting

Landform: Interfluves, flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: High silt loamy eolian deposits over fluviomarine deposits

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 30 inches: silt loam
2BC - 30 to 39 inches: gravelly coarse sandy loam
2C - 39 to 80 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Sassafras
Percent of map unit: 10 percent
Landform: Knolls, flats
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Unicorn
Percent of map unit: 5 percent
Landform: Swales, flats
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Queponco
Percent of map unit: 5 percent
Landform: Swales, flats
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Matapeake
Percent of map unit: 5 percent
Landform: Flats
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

ReC—Reybold silt loam, 5 to 10 percent slopes

Map Unit Setting
National map unit symbol: 2p7g8
Elevation: 10 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Reybold and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reybold

Setting
Landform: Interfluves, flats
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: High silt loamy eolian deposits over fluviomarine deposits

Typical profile
Ap - 0 to 10 inches: silt loam

Bt - 10 to 30 inches: silt loam
2BC - 30 to 39 inches: gravelly coarse sandy loam
2C - 39 to 80 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Sassafras

Percent of map unit: 10 percent
Landform: Knolls, flats
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Unicorn

Percent of map unit: 5 percent
Landform: Swales, flats
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Matapeake

Percent of map unit: 5 percent
Landform: Flats
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

Queponco

Percent of map unit: 5 percent
Landform: Swales, flats
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

SacB—Sassafras sandy loam, 2 to 5 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting

National map unit symbol: 2thxf
Elevation: 0 to 100 feet
Mean annual precipitation: 42 to 46 inches
Mean annual air temperature: 55 to 59 degrees F
Frost-free period: 210 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sassafras and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sassafras

Setting

Landform: Fluviomarine terraces, flats
Landform position (three-dimensional): Riser, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 12 inches: sandy loam
Bt1 - 12 to 18 inches: sandy loam
Bt2 - 18 to 28 inches: sandy clay loam
BC - 28 to 40 inches: loamy sand
C1 - 40 to 58 inches: sand
C2 - 58 to 80 inches: sand

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Ingleside

Percent of map unit: 10 percent
Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Downer

Percent of map unit: 5 percent
Landform: Flats, low hills, knolls
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve, rise
Down-slope shape: Linear, convex
Across-slope shape: Linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Woodstown

Percent of map unit: 5 percent
Landform: Flats, depressions, broad interstream divides, fluviomarine terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

SacC—Sassafras sandy loam, 5 to 10 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting

National map unit symbol: 2thxt
Elevation: 0 to 100 feet
Mean annual precipitation: 42 to 46 inches
Mean annual air temperature: 55 to 59 degrees F
Frost-free period: 210 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sassafras and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sassafras

Setting

Landform: Fluviomarine terraces, flats
Landform position (three-dimensional): Riser, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 9 inches: sandy loam
Bt1 - 9 to 18 inches: sandy loam
Bt2 - 18 to 28 inches: sandy clay loam
BC - 28 to 40 inches: loamy sand
C1 - 40 to 58 inches: sand
C2 - 58 to 80 inches: sand

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Ingleside

Percent of map unit: 10 percent
Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Downer

Percent of map unit: 5 percent
Landform: Flats, low hills, knolls
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve, rise
Down-slope shape: Linear, convex
Across-slope shape: Linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Woodstown

Percent of map unit: 5 percent
Landform: Flats, depressions, broad interstream divides, fluviomarine terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

SaD—Sassafras sandy loam, 10 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2p7fd
Elevation: 0 to 330 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Sassafras and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sassafras

Setting

Landform: Fluviomarine terraces, knolls, low hills, hillslopes
Landform position (three-dimensional): Riser, dip
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex

Typical profile

Ap - 0 to 9 inches: sandy loam
E - 9 to 15 inches: sandy loam
Bt - 15 to 30 inches: loam
BC - 30 to 37 inches: sandy loam
C - 37 to 80 inches: loamy sand

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Downer

Percent of map unit: 10 percent
Landform: Fluviomarine terraces, knolls, flats
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Evesboro

Percent of map unit: 5 percent
Landform: Flats, dunes, fluviomarine terraces, knolls
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Ecological site: F153DY170NJ - Sandy, Excessively Drained Upland
Hydric soil rating: No

Ingleside

Percent of map unit: 5 percent
Landform: Depressions, flats, fluviomarine terraces
Landform position (three-dimensional): Talf
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Zekiah

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R149AY060DE - Wet Alluvial Floodplain
Hydric soil rating: Yes

WdcA—Woodstown sandy loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting

National map unit symbol: 2thvt
Elevation: 0 to 90 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Woodstown and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodstown

Setting

Landform: Flats, broad interstream divides, depressions, fluviomarine terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 7 inches: sandy loam
E - 7 to 11 inches: sandy loam
Bt - 11 to 29 inches: sandy loam
BCg - 29 to 45 inches: fine sandy loam
Cg - 45 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

Minor Components

Hammonton

Percent of map unit: 6 percent
Landform: Broad interstream divides, flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

Fallsington

Percent of map unit: 6 percent

Landform: Flats, swales, depressions, drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Mattapex

Percent of map unit: 4 percent
Landform: Broad interstream divides, swales, depressions, flats
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Hambrook

Percent of map unit: 4 percent
Landform: Flats, fluviomarine terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

WocA—Woodstown loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting

National map unit symbol: 2thx4
Elevation: 0 to 90 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 55 to 59 degrees F
Frost-free period: 210 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodstown and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodstown

Setting

Landform: Flats, broad interstream divides, depressions, fluviomarine terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread, talf, dip

Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 7 inches: loam
E - 7 to 11 inches: sandy loam
Bt - 11 to 29 inches: sandy loam
BCg - 29 to 45 inches: fine sandy loam
Cg - 45 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

Minor Components

Fallsington

Percent of map unit: 6 percent
Landform: Swales, depressions, flats, drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Hammonton

Percent of map unit: 6 percent
Landform: Broad interstream divides, flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

Mattapex

Percent of map unit: 4 percent
Landform: Depressions, flats, broad interstream divides, swales
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Dip, talf

Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Hambrook

Percent of map unit: 4 percent
Landform: Flats, fluviomarine terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Pennoni

121 Continental Drive, Suite 207
Newark, DE 19713
T: 302-655-4451

www.pennoni.com

July 25, 2024

LDMSE24001

Mr. Ted C. Williams, PE, FACEC
President
Landmark Science & Engineering
200 Continental Drive, Suite 400
Newark, DE 19713

RE: Geotechnical Engineering Services
Appoquinimink School District Summit Campus – Phases B to F
Middletown, Delaware

Dear Mr. Williams:

We are pleased to submit our geotechnical engineering report for the proposed middle/high school located east of Summit Bridge Road within the Appoquinimink School District Summit Campus located in Middletown, Delaware. Work was initiated in general accordance with the scope of work presented in our proposal dated May 2, 2024 and your notice to proceed dated May 7, 2024.

We trust that the information presented in this report is what you require at this time and we thank you for the opportunity to assist you with this project. If you have any questions, or if you need any further assistance with this project, please contact this office at your earliest convenience.

Respectfully yours,

PENNONI ASSOCIATES INC.

Austin R. Spencer, PE
Staff Geotechnical Engineer II

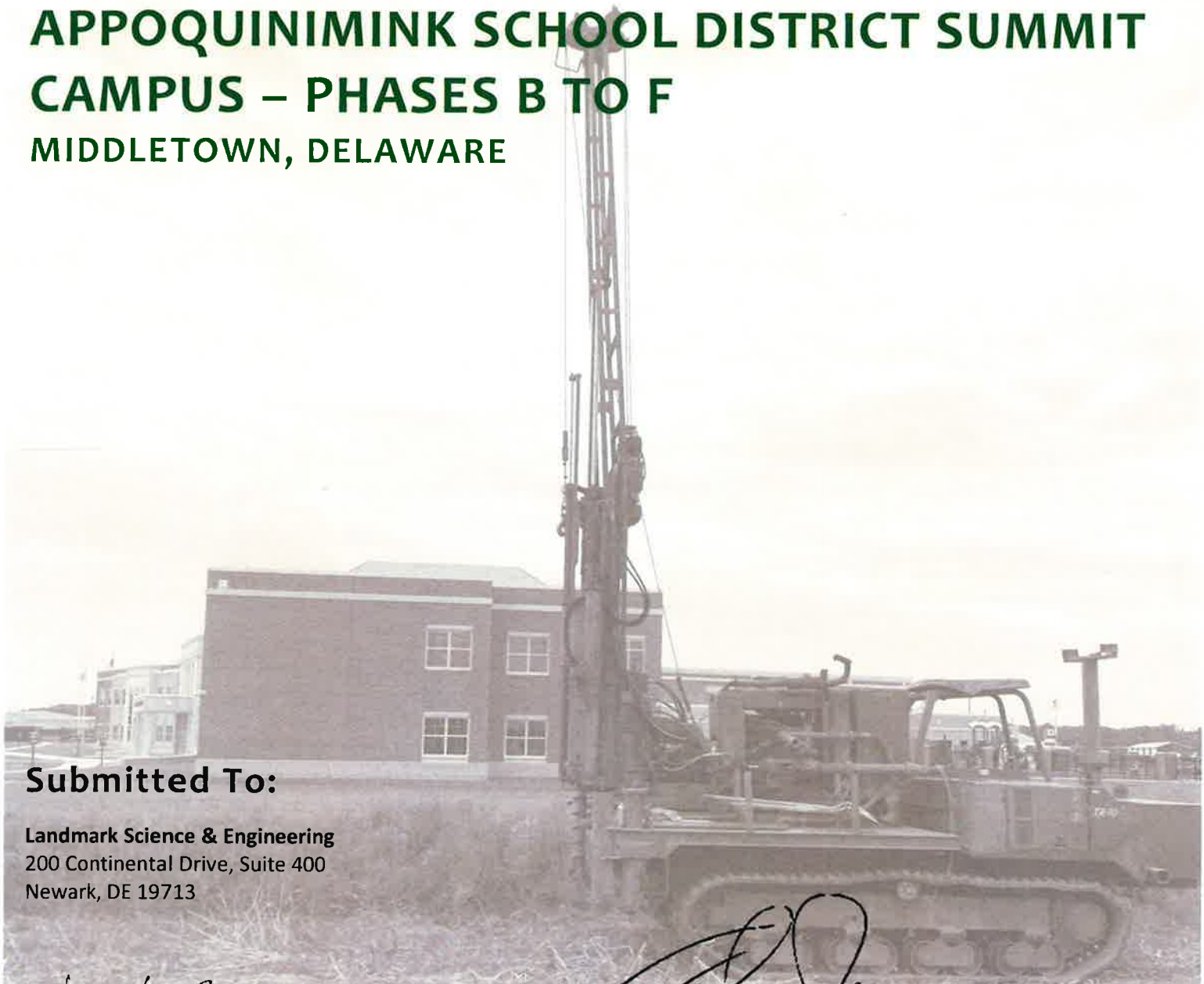
Theodore A. Thomson, Jr., Ph.D., PE, LEED AP
Associate Vice President / Geotechnical Division Manager

Attachments: Geotechnical Engineering Services Report

GEOTECHNICAL ENGINEERING SERVICES

APPOQUINIMINK SCHOOL DISTRICT SUMMIT CAMPUS – PHASES B TO F

MIDDLETOWN, DELAWARE



Submitted To:

Landmark Science & Engineering
200 Continental Drive, Suite 400
Newark, DE 19713

Austin R. Spencer, PE
Staff Geotechnical Engineer II

Theodore A. Thomson, Jr., Ph.D., PE, LEED AP
Associate Vice President / Geotechnical Division Manager

July 25, 2024
LDMSE24001

THEODORE A. THOMSON JR. LICENSE No. 12928 DELAWARE PROFESSIONAL ENGINEER
7/24/24

Pennoni
PARTNERS FOR WHAT'S POSSIB

TABLE OF CONTENTS

SECTION **PAGE**

1. EXECUTIVE SUMMARY 1
2. INTRODUCTION 3
2.1. PROJECT DESCRIPTION 3
2.2. INFORMATION REVIEWED 3
2.3. EXISTING SITE CONDITIONS 3
2.4. OBJECTIVES 4
3. FIELD AND LABORATORY WORK 4
3.1. FIELD WORK 4
3.1.1. STANDARD PENETRATION TEST BORINGS 4
3.1.2. CONE PENETRATION TEST SOUNDINGS 4
3.1.3. TEST PITS / INFILTRATION TESTING 5
3.2. LABORATORY WORK 5
4. SUBSURFACE CHARACTERISTICS 6
4.1. GEOLOGY 6
4.2. SUBSURFACE STRATIGRAPHY 6
4.3. GROUNDWATER 7
5. ANALYSES AND RECOMMENDATIONS 8
5.1. FOUNDATIONS 8
5.1.1. MIDDLE/HIGH SCHOOL BUILDING SETTLEMENT 9
5.1.2. FIELDHOUSE BUILDING SETTLEMENT 9
5.2. GROUND FLOOR SLAB 9
5.3. SEISMIC SITE CLASSIFICATION 9
5.3.1. LIQUEFACTION POTENTIAL 10
5.4. PAVEMENT DESIGN RECOMMENDATIONS 10
5.4.1. PAVEMENT DESIGN 10
5.5. EARTHWORK 11
5.6. GROUND WATER AND SURFACE WATER MANAGEMENT 12
5.7. LATERAL EARTH PRESSURE PARAMETERS 12
5.8. EXISTING AND PROPOSED UTILITIES 13
6. RECOMMENDATIONS FOR FURTHER GEOTECHNICAL SERVICES 13
7. LIMITATIONS 13

APPENDICES

APPENDIX A – LOCATION SKETCHES

Site Location Sketch	SK-1
Field Exploration Location Sketch	SK-2

APPENDIX B – FIELD EXPLORATION DATA

Test Boring Logs	B-1 through B-25
Cone Penetration Test (CPT) Logs	C-1 through C-50
Subsurface Stratigraphy Cross Sections	

APPENDIX C – GEOTECHNICAL LABORATORY TEST RESULTS

Summary Of Laboratory Test Data	Table L-1 through L-4
Gradation Curves	S-1 Through S-11
Atterberg Limits	A-1 Through A-2
Compaction Testing Results	C-1 And C-3
Bearing Ratio Test Report	CBR-1 through CBR-3

APPENDIX D – USDA WEB SOIL SURVEY

APPENDIX E – IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT

1. EXECUTIVE SUMMARY

Pennoni has completed our geotechnical evaluation for Phases B through F of the Appoquinimink School Districts (ASD) Summit Campus located in Middletown, Delaware. The results of our study are summarized below. The executive summary should be used in conjunction with the body of the report as it details our recommendations below.

Proposed Construction and Site Conditions		Section(s)
Proposed Construction	We understand that construction consists of an approximate two story, 385,473 square foot (SF) middle and high school, one story, 10,800 SF field house, athletic fields, and stormwater management (SWM) facilities located in proposed parking areas surrounding the proposed buildings.	2.1
Field Work	- 25 SPT borings advanced to depths ranging from approximately 20 to 50 feet below the existing ground surface; - 50 CPT soundings advanced to depths ranging from approximately 20 to 30 feet below the existing ground surface; and - 40 test pits excavated to depths ranging from 5 to 10 feet below the existing ground surface within proposed SWM facilities. Concurrently with test pit excavations 39 single ring infiltration tests were performed at depths ranging from 3 to 5 feet below ground surface. (Test pits and infiltration testing summarized under a separate cover)	3.1.1 3.1.2 3.1.3
Surface Soils	Topsoil ranging in thickness from 6 to 15 inches encountered in all borings / test pits	4.2
Subsoils	Stratum A – CLAY: silty CLAY, trace to and fine to medium sand (very soft to firm); Stratum B – SAND: fine to medium to coarse SAND, trace to and clay/silt, trace to little fine to coarse gravel (very loose to medium dense); Stratum C – GRAVEL: fine to coarse GRAVEL, little to and fine to medium to coarse sand, trace to little silt (medium dense to dense) TO SAND: fine to medium to coarse SAND, some to and fine to coarse gravel, little silt (loose to dense); Stratum D – SAND: fine to medium to coarse SAND, trace to and silt, trace to little fine to coarse gravel (very loose to dense)	4.2
Cuts/Fills	Site Grading – Based on the proposed finished floor elevation (65.30 feet, NAVD88) for the proposed middle/high school and existing grading it appears that cuts and fills on the order of 1 to 4 feet will be required. Based on the proposed finished floor elevation (59.00 feet, NAVD88) for the proposed fieldhouse and existing grading it appears that cuts on the order of 2 to 3 feet will be required.	2.1

Recommendations		Section(s)
Building Foundations	Shallow spread foundations bearing in stiff Stratum A, medium dense Stratum B, or newly compacted structural fill can be designed with for a maximum net allowable bearing capacity of 3,000 psf.	5.1
Settlement	Maximum settlement for the proposed middle/high school is estimated to be 1.5 inches within the northwestern portion of the structure. Settlement induced by fill placement is estimated to be approximately 0.75 within the southern portion of the footprint with total settlement of 1.0 inches due to structural loading across the remaining footprint. Differential settlement is not anticipated to exceed 0.50 inches between similarly founded foundations.	5.1.1

Recommendations (Cont.)		Section(s)
Frost Depth	32 inches below adjacent exposed grades or otherwise protected against frost action as specified by the New Castle County Building Code.	5.1
Ground Floor Slab	Provided the subgrade is properly prepared, constructing the ground floor slab on grade is considered feasible. A modulus of subgrade reaction of 150 pci can be used in slab design.	5.2
Seismic Site Class	A Site Class D as classified in general accordance with Table 20.3-1 of ASCE 7 and referenced in Section 1613.3 of the 2015 International Building Code.	5.3
Pavement Design	See Section 5.4.1 for recommended pavement sections. Materials and construction for new pavement should be in accordance with Delaware Department of Transportation Standard Specifications for Road and Bridge Construction.	5.4
Infiltration Results	A summary of the test pit excavations and infiltration testing is provided under a separate cover titled "Appoquinimink School District Summit Campus," prepared by Pennoni Associates Inc., dated July 5, 2024.	3.1.3
Lift Thickness and Compaction Requirements	Granular Soil – 10 to 12 in. thick layers loose measure; Foundations and floor slab 98% (standard proctor) or 95% (modified proctor) depending on compaction equipment used.	5.5
Groundwater (GW)	Groundwater was encountered in all borings at depths ranging from approximately 10.2 to 18.0 feet (Elev. 45.8 to 52.3 feet, NAVD88) below existing grades. The observations made in the borings suggests that free-standing groundwater is not anticipated in excavations for the proposed at-grade facility and associated SWM facilities.	4.3, 5.6
Lateral Earth Pressure Parameters	The soil parameters provided in Section 5.7 can be used to estimate earth pressures for the design of retaining walls or below grade structures (Elevator pits) for near surface soils.	5.7

2. INTRODUCTION

2.1. PROJECT DESCRIPTION

Based on our review of the documents referenced below, it our understanding that the project consists of the construction of an approximate two story 385,473 square foot (SF) middle and high school, one story 10,800 SF fieldhouse, athletic fields, and stormwater management (SWM) facilities located in proposed parking areas surrounding the proposed buildings. The proposed middle/ high school and fieldhouse have a finished floor elevation (FFE) of approximately 65.30 and 59.00 feet (NAVD88), respectively. At the time of this report the anticipated building loading was unknown; we have assumed, building loading to consists of maximum column loads of 300 kips with maximum continuous footing loads on the order of 4 to 6 kips per foot. Based on the proposed FFE for the proposed middle/high school and existing grading it appears that cuts and fills on the order of 1 to 4 feet will be required, respectively. Based on the FFE for the proposed fieldhouse and existing grading it appears that cuts on the order of 2 to 3 feet will be required.

The site plan referenced below shows proposed parking spaces to the north and east of the middle/ high school, north, south and west of the proposed field house, and northeast of the proposed football field. A total of 1,081 parking spaces are proposed with 40 bus parking spaces proposed north and east of the middle/ high school. Stormwater management (SWM) facilities consisting of subsurface basins are proposed throughout the parking areas and south of the existing roundabout. Landmark Science & Engineering provided inverts of the facilities to be a maximum of 5 feet below existing grades. The SWM facilities and infiltration testing results are summarized under a separate cover referenced below.

2.2. INFORMATION REVIEWED

To assist with the development of this report, we reviewed the following:

- A Drawing No. CR-01 titled “Appoquinimink Summit Campus – St. Georges Hundred – New Castle County – Delaware,” prepared by Landmark Science & Engineering, dated April 21, 2021;
- An untitled RFP titled “P8582 – Appoquinimink School District,” dated March 28, 2024;
- An undated Drawing titled “Boring Exhibit for Summit Campus – Phase 2,” prepared by Landmark Science & Engineering;
- Survey and stake information plan titled “2024-05-13 Survey bores,” prepared by Landmark Science & Engineering, provided on May 13, 2024; and
- Infiltration Testing Summary Report titled “Appoquinimink School District Summit Campus,” prepared by Pennoni Associates Inc., dated July 5, 2024.

2.3. EXISTING SITE CONDITIONS

The site appears to consist of the Crystal Run Elementary School, from Phase A of the project, as well as an existing agricultural field. The site is bound by residential properties to the north and south, agricultural field to the east, and Route 896 to the west. Based on the provided topography the project site generally slopes downward from northwest to southeast with elevations ranging from approximately 66 to 55 feet (NAVD88). Existing utilities were noted to consist of an overhead electric line running west to east parallel with Beaston Road. An artesian water main was noted to run west to east along the northern perimeter of the site.

2.4. OBJECTIVES

The objectives of this geotechnical study were to determine subsurface conditions at the project site, evaluate these conditions with respect to the proposed construction, and present our conclusions and recommendations regarding:

- foundation design of the proposed structures, including discussion of alternate solutions, if necessary;
- design frost depth;
- discussion of potential for consolidation and/or differential settlements of substrata encountered;
- groundwater conditions and their influence on design and construction;
- subgrade preparation;
- pavement design recommendations;
- removal or treatment of objectionable material;
- use and treatment of in-situ materials for controlled fill; and
- quality assurance and field-testing and observations during construction.

3. FIELD AND LABORATORY WORK

3.1. FIELD WORK

3.1.1. STANDARD PENETRATION TEST BORINGS

Twenty-five Standard Penetration Test (SPT, ASTM D1586) borings labeled “B-1” through “B-25” were performed at the project site between May 14 through May 23, 2024, at locations shown on the Field Exploration Location Sketch provided in Appendix A.

Borings “B-1” through “B-22” were performed within the general footprint of the proposed middle/high school to depths ranging from approximately 20 to 50 feet below existing grades. Boring “B-23” was performed within the footprint of the proposed fieldhouse and Borings “B-24” and “B-25” were performed within the footprint of the proposed football stadium bleachers. Borings “B-23” to “B-25” were performed to depths of approximately 20 feet below existing grades. Continuous sampling was performed to a depth of 10 feet below the existing ground surface and then in five feet intervals to termination depth.

Test borings were performed CGC Geoservices using a track mounted auger rig with 3¼ inch hollow stem augers and an automatic hammer. The test borings were backfilled with the excavated soil cuttings and bentonite chips with excess soil mounded over the hole. It should be noted that settlement and softening of the replaced soil often takes place leading to depressions or holes at the ground surface. Our T. Thomson, PE directed the field work and A. Spencer, PE, and A. Sposato, observed the test drilling. Test boring logs and subsurface stratigraphy profiles are provided in Appendix B.

3.1.2. CONE PENETRATION TEST SOUNDINGS

Fifty Cone Penetration Test (CPT, ASTM D5778) soundings labeled “C-1” through “C-50” were performed at the project site between May 13 through May 16, 2024, at locations shown on the Field Exploration Location Sketch provided in Appendix A.

Soundings "C-1" through "C-47" were performed within the general footprint of the proposed middle/high school to depths ranging from approximately 20 to 30 feet below existing grades. Soundings "C-48" was performed within the footprint of the proposed fieldhouse and Soundings "C-49" and "C-50" were performed within the footprint of the proposed football stadium bleachers. Soundings "C-48" to "C-50" were performed to depths of approximately 20 feet below existing grades. Soundings were performed by SGI using a Geoprobe. Our A. Spencer, PE directed the field work. The Sounding Logs are provided in Appendix B.

3.1.3. TEST PITS / INFILTRATION TESTING

Forty test pit excavations labeled "TP-1" through "TP-40" and 39 infiltration tests labeled "INF-1" through "INF-40" were performed at the project site between May 13, 2024, to May 23, 2024 at locations shown on the Field Exploration Location Sketch provided in Appendix A. Test pits were performed to depths ranging from approximately 5 to 10 feet below existing grades. Test pit and infiltration testing locations were determined and provided by Landmark Science & Engineering. Landmark Science & Engineering provided the proposed inverts for the SWM facilities to be a maximum of 5 feet below the existing ground surface; therefore, the test pit excavations were performed to a minimum of 8 feet below existing ground surface in general accordance with the Delaware Administrative Code Title 7, Section 5101, Sub-Section 12.0, with in exception of Test Pit "TP-33" where groundwater was encountered at 3 feet below existing grade. Following the conclusion of the test pit excavation an adjacent pit was excavated to the proposed invert elevations for infiltration testing. Pennoni performed in-situ infiltration testing consisting of 39 single sing infiltration tests in general accordance with testing as described in the Delaware Administrative Code Title 7, Section 5101, Sub-Section 12.0. Concurrent with the test pit excavations, bulk samples were collected of the near surface material for laboratory testing consisting of California Bearing Ratio to be utilized in the pavement design summarized below.

A summary of the test pit excavations and infiltration testing is provided under a separate cover titled "Appoquinimink School District Summit Campus," prepared by Pennoni Associates Inc., dated July 5, 2024.

3.2. LABORATORY WORK

Following conclusion of the SPT drilling and test pit excavations, the soil samples were delivered to our laboratory for visual classification and testing. The total geotechnical laboratory program consisted of the following:

- California Bearing Ratio (CBR) (ASTM D 1883) 3 tests
- Modified Proctor (ASTM D 1557) 3 tests
- Moisture Content (ASTM D 2216) 92 tests
- Sieve Analysis (ASTM D 6913) 92 tests
- Atterberg Limits (ASTM D 4318) 7 tests

Samples for testing were selected by Pennoni's geotechnical engineer. Results of the laboratory testing for the borings and CBRs are provided in Appendix C of this report. Results of the laboratory testing for the test pits are summarized under a separate cover titled "Appoquinimink School District Summit Campus," prepared by Pennoni Associates Inc., dated July 5, 2024.

4. SUBSURFACE CHARACTERISTICS

4.1. GEOLOGY

According to the Physiographic Province of Delaware created by USGS, the project site is located within the Coastal Plain. The Coastal Plain is characterized by gently rolling hills and valleys. It is underlain by a southeastwardly thickening sequence of sediments that consists of sand and gravel aquifers interlayered with silt and clay confining units.

According to the Geologic Map (GM13) of New Castle County (Ramsey, K.W., 2005) the project site is located within the Columbia Formation. The Columbia Formation is described as yellow to red to brown, fine to coarse, feldspathic quartz sand with varying amounts of gravel. Typically, cross-bedded with cross-sets ranging from a few inches to over three feet in thickness. Scattered beds of tan to red to gray clayey silt is common. In places, the upper 5 to 25 feet consists of a gray to red to brown silt to very fine sand overlying medium to coarse sand. Near base of unit, clasts of cobbles to small boulders are found in gravel beds ranging from a few inches to three feet thick. Gravel fraction consists primarily of quartz with lesser amounts of chert. Clasts of sandstone, siltstone, and shale from the Valley and Ridge Province, and pegmatite, micaceous schist, and amphibolite from the Piedmont are present. The Columbia fills an eroded surface and ranges from less than 10 feet thick to over 100 feet thick.

According to USDA Web Soil Survey mapping, the project site consists of mainly Reybold silt loam (ReB), Reybold-Queponco Complex (RdA), Woodstown loam (WocA), and Sassafras sandy loam (SacC). Reybold silt loam is generally described as silt loam underlain by gravelly coarse sandy loam with linear down slope shape. Reybold silt loam is classified as hydrologic soil group B with moderately high to high infiltration rates of approximately 0.20 to 2.00 inches per hour. The depth to water table and restrictive features both exceed 80 inches. Reybold-Queponco Complex is generally described as silt loam underlain by gravelly coarse sandy loam with linear down slope shapes. Reybold-Queponco Complex is classified as hydrologic soil group B with moderately high to high infiltration rates of approximately 0.20 to 2.00 inches per hour. The depth to water table and restrictive features both exceed 80 inches. Woodstown loam is generally described as loam to sandy loam to fine sandy loam underlain by loamy sand with linear to concave down slope shapes. Woodstown sandy loam is classified as hydrologic soil group C with moderately high to high infiltration rates of approximately 0.57 to 1.98 inches per hour. Depth to water table is noted as 20 to 40 inches with depth to restrictive feature exceeding 80 inches. Sassafras sandy loam is generally described as sandy loam to sandy clay loam to loamy sand underlain by sand with linear down slope shape. Sassafras sandy loam is classified as hydrologic soil group B with moderately high to high infiltration rates of approximately 0.20 to 2.00 inches per hour. The depth to water table and restrictive features both exceed 80 inches. A soils report from the USDA is provided in Appendix D.

4.2. SUBSURFACE STRATIGRAPHY

Subsurface stratigraphy encountered within the SPT borings and CPT soundings generally consists of a surficial layer of topsoil underlain by very soft to firm clay. The clay layer was generally underlain by a very loose to medium dense sand layer with varying amounts of silt and gravel. This sand layer was generally underlain by a loose to dense gravel layer with cobbles to boulders encountered in the test pit excavations. The gravel layer was underlain by a loose to medium dense sand layer with varying amounts of silt. The friction ratio (R_f) of the CPT soundings generally averaged below 2.0% with some layers between 2.0 to 5.0%. Per Tabe 1. Soil Classification Based on friction ratio (Sanglerat, 1972) these ratios would classify as sands or gravels and clay sand mixture, respectively. The interpreted CPT soil profiles

generally agreed with the stratigraphy encountered in the SPT borings. For descriptive purposes, the soil layers can be classified as follows:

Stratum	Approximate Thickness (ft)	Description	USCS Classification
T	0.5 – 1.25	Topsoil	--
A[1]	1.0 – 4.2	Brown to tan to gray CLAY, trace to and fine to medium sand, trace root fragments (damp, very soft to medium stiff)	CL
B[2]	3.0 – 18.0+	Brown to tan to black to orange to white fine to medium to coarse SAND, trace to and clay/silt, trace to little fine to coarse gravel (damp to wet, very loose to medium dense)	SP-SM to SM/SC
C[3]	2.0 – 10.0+	Brown to black to white fine to coarse GRAVEL, little to and fine to medium to coarse sand, trace to little silt (moist to wet, medium dense to dense) OR Tan to brown to purple fine to medium to coarse SAND, some to and fine to coarse gravel, little silt, trace fine gravel sized rock fragments (moist to wet, loose to dense)	GP to GM SP-SM to SM
D[4]	2.0 – 32.0+	Brown to orange to red to maroon to black to gray fine to medium to coarse SAND, trace to and silt, trace to little fine to coarse gravel (moist to wet, very loose to dense)	SP to SP-SM

Notes:
[1] Stratum A was not encountered in Borings "B-4," "B-6," and "B-22";
[2] Stratum B was not fully penetrated in Borings "B-7," "B-10" "B-11," "B-12," "B-14," and "B-17";
[3] Stratum C was not encountered in Borings "B-6," "B-7," "B-8," "B-9," "B-10," "B-11," "B-12," "B-14," "B-17," "B-18," "B-20," and "B-22". Stratum C was not fully penetrated in Boring "B-3"; and
[4] Stratum D was not encountered in Borings "B-3," "B-10," "B-11," "B-12," "B-14," and "B-17". Stratum D was not fully penetrated.

See attached Subsurface Stratigraphy Profiles provided in Appendix B, showing varying soil profiles across the project site.

4.3. GROUNDWATER

Observations for apparent groundwater were made in the borings during sampling and shortly after completion of drilling. Groundwater was encountered in all borings at depths ranging from approximately 10.2 to 18.0 feet (Elev. 45.8 to 52.3 feet, NAVD88) below existing grades. Groundwater depths were estimated from the CPT data to range from approximately 7 to 12 feet (Elev. 50.48 to 56.36, NAVD88) below existing ground surface. These observations are for the times indicated and may not be indicative of seasonal or daily variations in the ground water levels. Seasonal variations on the order of several feet should be anticipated.

According to the Delaware Geologic Information Resource (DGIR) depth to water table is noted to be approximately 12 feet (Elev. 49.42 feet, NAVD88) during wet conditions, and approximately 16 feet (Elev. 45.42 feet, NAVD88) during dry conditions.

See attached Subsurface Stratigraphy Cross Sections provided in Appendix B, showing varying soil profiles and groundwater elevations across the project site. Groundwater generally appears to slope downward from northwest to southeast towards Beaston Road.

5. ANALYSES AND RECOMMENDATIONS

5.1. FOUNDATIONS

Factors effecting foundation construction and behavior for this project consist of subsurface soils with variable consistencies, fill heights, and anticipated structural loading. **As structural loading was not available at the time of this report, we have assumed maximum column loads of 300 kips. Should this actual column loads be higher than this, Pennoni should be afforded the opportunity to revise our settlement estimates.** The following are recommendations for foundation systems based on our evaluation of these factors and our experience. Based on the proposed FFE for the proposed middle/high school and fieldhouse (Elev. 65.3 and 59 feet NAVD88, respectively) and existing grading it appears that cuts and fills on the order of 1 to 4 feet will be required at the middle/high school and cuts on the order of 2 to 3 feet will be required at the fieldhouse.

Based on our understanding of the project and data obtained during the field exploration, it is our opinion that the proposed construction can be founded on traditional shallow foundation systems (e.g., strip and/or spread footings). It is our opinion that shallow foundations bearing in the stiff Stratum A clay, medium dense Stratum B Sand, or newly placed structural fill can be sized for a maximum net, allowable bearing capacity of 3,000 psf (see Settlement subsection below).

Due to the variable density /consistency of the subsurface stratigraphy that may be encountered at bearing elevation (soft Stratum A clay or loose Stratum B sand), the foundation subgrades may require densification in place prior to footing/foundation construction and/or localized undercuts to reach the bearing conditions suitable to achieve the allowable bearing capacity. Foundations should be constructed in accordance with the recommendations contained in the Earthwork section below. Foundation subgrades should be checked by a representative of the Geotechnical Engineer to confirm conditions suitable for support of the design.

Continuous and isolated footings should be at least 2 feet wide and 3 feet square, respectively, to prevent localized shear failure in the soil. The subgrades of all foundations exposed to freezing temperatures during construction and/or the life of the structure should be established at least 32 inches below adjacent exposed grades, or otherwise protected against frost action. Foundation subgrades should be checked by a representative of the Geotechnical Engineer to confirm conditions suitable for support of the design bearing pressure. Where an area is questionable, it should be further explored and/or remedied by removal and replacement of unsuitable material.

5.1.1. MIDDLE/HIGH SCHOOL BUILDING SETTLEMENT

Settlement is a significant consideration in the selection of a foundation system. Settlement is a function of the building loads, subsurface soil consistency, and amount of cut/fill required. As indicated above, **we have assumed maximum column loads of 300 kips. Should this actual column loads be higher than this, Pennoni should be afforded the opportunity to revise our settlement estimates.** Based on the subsurface conditions encountered, the proposed grading (fills on the order of 4 feet in the southern portion of the footprint), and allowable foundation bearing pressure as noted above.

We estimate maximum total settlement for the proposed construction on the order of 1.5 inches. This maximum settlement is estimated to occur in the northwestern portion of the middle high school (i.e., area in the proximity of testing boring, B-1). Maximum settlement induced by fill placement is estimated to be approximately 0.75 inches and located within the southern portion of the footprint (i.e., area in the proximity of testing boring, B-19). Differential settlement is not anticipated to exceed 0.50 inches between similarly founded foundations.

In order to reduce the potential for detrimental post construction settlement, we recommend that fill be placed as far in advance as possible prior to construction of the settlement sensitive portions of the building. We estimate that fill placement a minimum of 1 month in advance of construction of the building will result in post construction building settlement on the order of 1 inch.

5.1.2. FIELDHOUSE BUILDING SETTLEMENT

Based on the subsurface conditions encountered, the proposed grading (cuts on the order of 2 to 3 feet), and allowable foundation bearing pressure as noted above, we estimate total settlement for the proposed construction on the order of less than 1 inch. Differential settlement is not anticipated to exceed 0.50 inches between similarly founded foundations.

5.2. GROUND FLOOR SLAB

Similar to foundation considerations, the performance of the slab on grade will also be influenced by the slab loading, volume of cuts and fills, and subgrade soil consistency. The proposed subgrades are anticipated to primarily consist of the Stratum A clay, Stratum B sand, or newly placed structural fill. Provided the subgrades are prepared as discussed in the Earthwork section below, the concrete slabs on grade can be designed using a modulus of vertical subgrade reaction (k_v) of 150 pci. We recommend that the slabs be designed as “fully floating” (not connected to the structural elements of the building) in order to reduce potential cracking due to differential settlement between the building’s structural elements and slab on grade. A 4 to 6-inch-thick free-draining granular base course should be placed beneath the slabs to provide a uniform bearing surface and to aid in the proper curing of the concrete.

5.3. SEISMIC SITE CLASSIFICATION

The SPT borings and CPT soundings disclosed subsurface conditions generally described according to the Table 20.3-1 of ASCE 7 and referenced in Section 1613.3 of the 2018 International Building Code (IBC) as having a soil-profile corresponding to Site Class D – a stiff soil profile. Site Class determination is based on the properties in the upper 100 feet of the ground surface. The borings performed herein were

advanced to a maximum depth of 50 feet and CPT soundings were advanced to a maximum depth of 30 feet. Values beyond 30 and 50 feet were estimated based on our local experience in this area. Based on Figures 1613.3.1(1) and 1613.3.1(2) of the 2015 International Building Code, parameters Ss and S1 for the site can be assumed to be 0.164 g and 0.045 g, respectively.

5.3.1. LIQUEFACTION POTENTIAL

Liquefaction occurs in loose, saturated, cohesionless soils (sands and silts) when a sudden loss of stiffness and/or strength is experienced from earthquake actions. Several screening criteria are used to assess the potential for liquefaction:

- depth of the soil below the ground surface
- fines content of cohesionless soils
- saturation of the subsoils
- proximity of site to known major earthquakes, faults, or sources; and
- Standard Penetration resistance.

The SPT borings and CPT soundings revealed the subsoils generally consisting of a very loose to loose cohesionless layer between approximately 15 to 45 feet. The laboratory testing results indicate the granular deposits within this depth generally have 5 to 16% passing the #200 sieve with moisture contents ranging from 29.6 to 41.3%.

To evaluate the potential for soil liquefaction, the procedure outlined by the technical report NCEER-97-0022 (1997) and The Guide to Cone Penetration Testing for Geotechnical Engineering 6th Edition (Robertson, 2014) was used. This evaluation presents an empirical relationship between the earthquake demand, represented by the Cyclic Stress Ratio (CSR), and the soil resistance to dynamic loading, represented by the Cyclic Resistance Ratio (CRR). The CSR is correlated to the design earthquake event, as well as the in-situ soil stresses, whereas the CRR is correlated to the CPT normalized clean sand equivalent cone resistance ($Q_{tn, cs}$) estimated from the CPT data obtained in the field.

Our analysis parameters included a 7.5 magnitude earthquake, a 1.0 minimum factor of safety, and a PGA of 0.09g. Based on the resulting factor of safety of 6, liquefaction does not need to be considered in the foundation design.

5.4. PAVEMENT DESIGN RECOMMENDATIONS

Based on the soils observed within the subsurface investigation and associated laboratory testing results, a California Bearing Ratio (CBR) of 7 can be utilized for the proposed site pavements. Due to the variable density of the Stratum B soils that may be encountered at bearing elevations where pavements are proposed outside of areas receiving new fill, the pavement subgrades may require stabilization in accordance with our Earthwork section below.

5.4.1. PAVEMENT DESIGN

Pennoni utilized the “AASHTO Guide for Design of Pavement Structures,” developed by the American Association of State Highway and Transportation Officials, dated 1993 and Chapter 9 of the DelDOT Road Design Manual dated July 2011, to determine a recommended paving section

for the proposed site pavements. Pennoni considered traffic loading consisting primarily of passenger vehicles and busses with daily delivery van/trucks and semi-tractor trailers over a 25-year design life period. A minimum recommended pavement section for the site pavements is as follows:

- 1 ¼ inches of Type C Asphalt Pavement;
- 2 ¼ inches of Type B Asphalt Pavement; and
- 6 inches of Graded Aggregate Base Coarse (GABC).

In areas where higher volume of truck traffic will be present (e.g., bus lanes, delivery areas, trash pick up, etc.), we recommend the following pavement section:

- 1 ½ inches of Type C Asphalt Pavement;
- 2 ¾ inches of Type B Asphalt Pavement; and
- 8 inches of Graded Aggregate Base Coarse (GABC).

Materials and construction for new pavement should be in accordance with Delaware Department of Transportation Standard Specifications for Road and Bridge Construction.

5.5. EARTHWORK

Prior to placing any new fill, and before the construction of the proposed foundations, any construction debris, vegetation, and associated topsoil must be removed from within the areas of proposed construction. These materials can remain in proposed landscaped areas provided that future plans do not include building in those areas.

Exposed subgrades should be thoroughly proofrolled using a minimum 10-ton vibratory roller operated in static mode or a fully loaded dump truck in an attempt to identify unstable (soft, yielding, etc.) surface areas. During proofrolling any unstable area found should be stabilized by excavating and replacing those soils with suitable soil (adequately compacted, see below), by lowering the moisture content of the subgrade soils and compacting them, or by other methods (placing a geotextile and stone layer, etc.). To reduce the potential for damage to the subgrade, we recommend that construction traffic over the subgrade be kept to a minimum. Also, site pavements and concrete for foundations and/or slabs on grade should be placed as soon as possible following the subgrade preparation.

Our experience indicates that the on-site, near surface soils of Strata A/B/C can be reused for the construction, provided all organics and debris larger than 3 inches in its greatest dimension be removed prior to reuse and provided there are no additional environmental concerns with the material. Stratum A soils were observed to contain a significant amount of fine-grained material (silts/clays). These types of soils are sensitive to moisture and may therefore require wetting or drying prior to compaction. Drying "wet" soil is difficult during wet periods and during lower temperatures. Therefore, provisions for importing structural fill should be included in the contract documents. If necessary, granular fill should consist of well-graded material with a maximum particle size less than 3 inches, not more than 20 percent passing the No. 200 sieve and have a plasticity index (PI) not greater than 8 percent.

Fills should be placed in layers not exceeding 10 to 12 inch loose measure. This criterion might be adjusted by the geotechnical engineer in the field depending on the conditions present at the time of construction, on the compaction equipment used, and on the fill materials selected. Fills for support of foundations/floor slabs/pavements should be compacted to at least 98 percent of the laboratory

determined dry density, ASTM D-698, when small, hand-operated compaction equipment is used, and to at least 95 percent of the laboratory determined maximum dry density, ASTM D-1557, when self-propelled, heavy-duty construction equipment is used. Fills should extend a minimum of 5 feet beyond the exterior edge of a loaded area and have side slopes not steeper than 2 horizontal to 1 vertical.

Specifications should indicate that the percentage of maximum dry density attained in the field is not the only criteria to be used for assessing fill compaction. Observation of the behavior of the fill under the loads of construction equipment should also be used. If the test results indicate that the percentage of compaction is being achieved, but the soil mass is moving under the equipment, placement of additional fill should not be continued until the movement is stabilized. Otherwise, settlement of the fill may occur.

5.6. GROUND WATER AND SURFACE WATER MANAGEMENT

The groundwater observations made in the borings suggests that free-standing groundwater is not anticipated in excavations for the proposed structures shallow foundations. In the event that wet conditions and/or seepage are encountered due to perched water, sumps and pumps should be adequate to maintain stable conditions during foundation construction. The foundation excavations should not be used as a detention basin or sump. During construction, surface runoff should be prevented from entering the excavations by creating soil berms or diversion swales along the perimeter if the excavation is expected to be open for a long period of time. Where ponding does occur, the water should be pumped immediately and grades should then be established to prevent further ponding.

5.7. LATERAL EARTH PRESSURE PARAMETERS

The soil parameters provided in the table below can be used to estimate earth pressures for the design of retaining walls or below grade structures (Elevator pits) for near surface soils. If the top of the structure is restrained from movement, thereby preventing the mobilization of active soil pressures, the structure should be designed using the at-rest pressure coefficient, K_o.

The earth pressure coefficients are based on the assumption of vertical walls, horizontal backfill, no surcharges, no wall friction, and a safety factor of 1.0. To alleviate hydrostatic stress behind the retaining walls (if applicable), we recommend drainage boards extending down to a drainage tile be installed along the back and base of the wall, respectively, and installing drains (weep holes) through the face of the wall.

Design Parameter	***Stratum A***	***Stratum B***	***Stratum C***	***Newly Compacted Granular Fill***
Total Unit Weight (pcf)	105	115	120	125
Angle of Internal Friction, ϕ	0	30	32	34
Cohesion, c (psf)	750	0	0	0
Active Earth Pressure Coefficient, K_a	1.0	0.33	0.31	0.28
Passive Earth Pressure Coefficient, K_p	1.0	3.0	3.25	3.54
At-rest Earth Pressure Coefficient, K_o	1.0	0.50	0.47	0.44

Excavations during subgrade preparation and foundation construction should be in accordance with Occupational Safety and Health Administration (OSHA) regulations. If site restrictions prevent excavations from being adequately sloped, the use of temporary shoring should be expected.

If the contractor is responsible for the design of temporary or permanent retaining structures, then the contract documents should clearly require that the design be performed by a competent registered engineer and that the responsibility for satisfactory earth support is solely the contractor's. Also, the contract documents should require the contractor to notify the engineer immediately if differing of unforeseen subsurface conditions are encountered during construction.

5.8. EXISTING AND PROPOSED UTILITIES

Several existing utilities were delineated adjacent to the project site. These include (but may not be limited to): an overhead electric line running west to east parallel with Beaston Road. An artesian water main was noted to run west to east along the northern perimeter of the site. We recommend that load bearing elements of the proposed construction not bear over existing utilities in order to reduce the potential for damage.

6. RECOMMENDATIONS FOR FURTHER GEOTECHNICAL SERVICES

Our experience on numerous construction projects is that the interests of the project team are best served by retaining the Geotechnical Engineer to provide construction observations during earthwork and foundation construction operations. To determine if soils, other materials, and ground water conditions encountered during construction are similar to those encountered in the borings, and that they have comparable engineering properties or influences on the design of the structure, we recommend that Pennoni should provide field observation services during excavation; preparation of foundation subgrades; and installation/construction of foundations. Pennoni's Geotechnical Technology should review specifications for earthwork and foundation design/construction when they are prepared.

7. LIMITATIONS

This work has been done in accordance with our authorized scope of work and in accordance with generally accepted professional practice in the fields of geotechnical and foundation engineering. This warranty is in lieu of all other warranties either expressed or implied. Our conclusions and recommendations are based on the data revealed by this exploration. We are not responsible for any conclusions or opinions drawn from the data included herein, other than those specifically stated, nor are the recommendations presented in this report intended for direct use as construction specifications. This report is intended for use with regard to the specific project described herein; any changes in loads, structures, or locations should be brought to our attention so that we may determine how they may affect our conclusions. An attempt has been made to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction. If this should occur, or if additional or contradictory data are revealed in the future, we should be notified so that modifications to this report can be made, if necessary. If we do not review relevant construction documents and witness the relevant construction operations, then we cannot be responsible for any problems that may result from misinterpretation or misunderstanding of this report or failure to comply with our recommendations.

Appendix E provides additional information related to this report.

APPENDICES

APPENDIX A – Location Sketches

SITE LOCATION SKETCH



Site Location Sketch adapted from a Google Earth Image Dated April 12, 2023

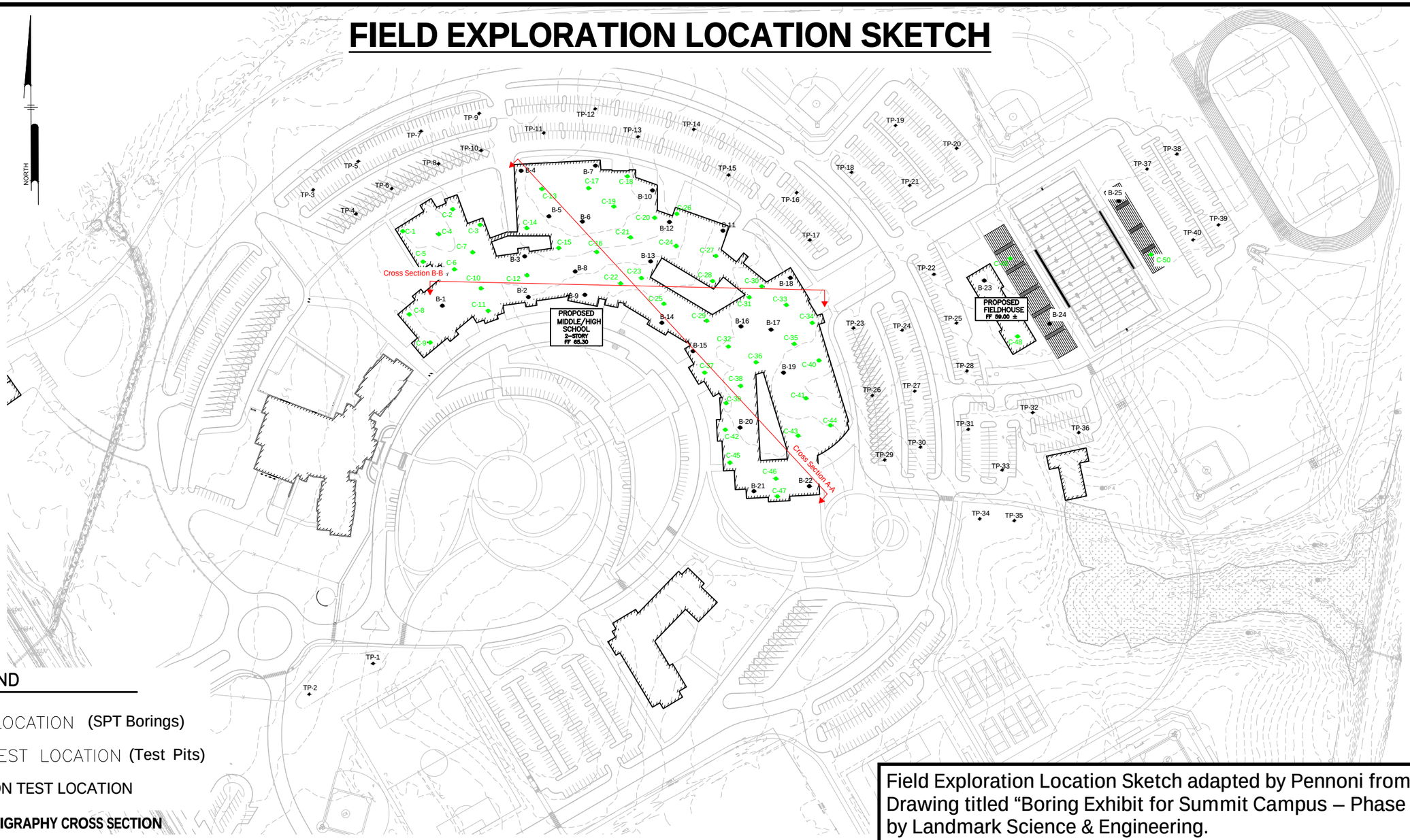
Pennoni Associates, Inc.
121 Continental Drive, Suite 207
Newark, DE 19713

ALL DOCUMENTS PREPARED BY PENNONI ASSOCIATES ARE INSTRUMENTS OF SERVICE IN RESPECT OF THE PROJECT. THEY ARE NOT INTENDED OR REPRESENTED TO BE SUITABLE FOR REUSE BY OWNER OR OTHERS ON EXTENSIONS OF THE PROJECT OR ON ANY OTHER PROJECT. ANY REUSE WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY PENNONI ASSOCIATES FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT OWNERS SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO PENNONI ASSOCIATES; AND OWNER SHALL INDEMNIFY AND HOLD HARMLESS PENNONI ASSOCIATES FROM ALL CLAIMS, DAMAGES, LOSSES, AND EXPENSES ARISING OUT OF OR RESULTING THEREFROM.

DRAWN BY:	SCALE:	DATE:
ARS	As Shown	7/25/2025
CHECKED BY:	FIGURE No.	
TAT	SK-1	
PROJECT No.		
LDMSE24001		

ASD Summit Campus – Middletown, DE

FIELD EXPLORATION LOCATION SKETCH



LEGEND

- SOIL BORING LOCATION (SPT Borings)
- INFILTRATION TEST LOCATION (Test Pits)
- CONE PENETRATION TEST LOCATION
- SUBSURFACE STRATIGRAPHY CROSS SECTION

Field Exploration Location Sketch adapted by Pennoni from an undated Drawing titled “Boring Exhibit for Summit Campus – Phase 2,” prepared by Landmark Science & Engineering.

Pennoni Associates, Inc.
121 Continental Drive, Suite 207
Newark, DE 19713

ALL DOCUMENTS PREPARED BY PENNONI ASSOCIATES ARE INSTRUMENTS OF SERVICE IN RESPECT OF THE PROJECT. THEY ARE NOT INTENDED OR REPRESENTED TO BE SUITABLE FOR REUSE BY OWNER OR OTHERS ON EXTENSIONS OF THE PROJECT OR ON ANY OTHER PROJECT. ANY REUSE WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY PENNONI ASSOCIATES FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT OWNERS SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO PENNONI ASSOCIATES; AND OWNER SHALL INDEMNIFY AND HOLD HARMLESS PENNONI ASSOCIATES FROM ALL CLAIMS, DAMAGES, LOSSES, AND EXPENSES ARISING OUT OF OR RESULTING THEREFROM.

DRAWN BY:	SCALE:	DATE:
AS	NTS	7/24/2024
CHECKED BY: TAT	FIGURE No. TL-1	
PROJECT No: LDMSE24001		

Appoquinimink School District Summit Campus - Phases B to F

APPENDIX B – Field Data

TEST BORING LOG

TEST BORING B-1

PAGE 1 OF 1

NORTHING 555817.0924

EASTING 572052.1435

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/14/24 **COMPLETED** 5/14/24

GROUND ELEVATION 64.0' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 51.0'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 11.3' / Elev 52.7'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0					T	Depth 0.8 — 9" TOPSOIL — Elev. 63.2	
	S-1	18	2-3-2-2		A	2.0 — Brown CLAY and fine to medium to coarse SAND, trace fine gravel	
	S-2	10	1-3-2-2			Brown silty CLAY, trace fine sand	
5	S-3	20	1-2-6-8			5.0 — Elev. 59.0	
	S-4	20	4-7-7-6		B	6.0 — Brown to tan fine to medium SAND, little silt Brown to tan to black fine to medium SAND, little silt	Moist
10	S-5	20	7-5-4-5			8.0 — Brown to tan fine SAND, little to some silt	Wet
						13.0 — Elev. 51.0	
15	S-6	12	5-7-10-9		C	Brown to black coarse to fine GRAVEL and medium to fine to coarse SAND, trace silt	Wet on spoon
						18.0 — Elev. 46.0	
20	S-7	12	5-6-4-7		D	20.0 — Brown to orange fine to medium to coarse SAND, little to some silt — Elev. 44.0	Iron staining

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-2

PAGE 1 OF 1

NORTHING 555836.2566

EASTING 572243.4844

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/14/24 **COMPLETED** 5/14/24

GROUND ELEVATION 63.7' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 50.7'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 12.8' / Elev 50.9'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	15	1-2-1-3		T A	0.8 — 9" TOPSOIL — 62.9 2.0 — Brown CLAY, trace fine to medium sand — 61.7	
	S-2	20	4-4-5-5		B	Brown fine to medium to coarse SAND, little silt 4.0	
5	S-3	20	1-5-7-7			Brown fine to medium to coarse SAND, trace silt 6.0	Moist
	S-4	20	6-6-5-5			Brown to black fine to medium SAND, little silt	
	S-5	12	3-2-3-10			9.0 — 54.7	Wet Rock caught in spoon
10					C	Brown to black fine to coarse GRAVEL, some medium to fine to coarse sand, little silt 13.0	
15	S-6	18	5-6-4-4			Brown to black fine to coarse GRAVEL and medium to fine to coarse SAND, little silt	Saturated
						18.0 — 45.7	
20	S-7	4	3-3-3-3			Brown fine to medium SAND, little silt	
						23.0	
25	S-8	20	2-2-1-1			Brown to orange fine to medium SAND, trace silt	Water introduced to borehole
					D		
30	S-9	20	2-2-2-4				
						33.0	
35	S-10	8	6-9-8-8			Brown to orange fine to medium SAND, little silt, trace coarse gravel 35.0 — 28.7	
						Borehole terminated at 35.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-3

NORTHING 555926.9542

EASTING 572235.3634

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/14/24 **COMPLETED** 5/14/24

GROUND ELEVATION 64.6' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 51.6'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 13.0' / Elev 51.6'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	18	1-1-2-3		T	1.0 — 12" TOPSOIL — 63.6	
					A	2.0 — Brown CLAY, trace fine to medium sand — 62.6	
	S-2	22	5-7-7-7		B	4.0 — Brown fine to medium to coarse SAND, some clay, trace fine gravel	Moist
5	S-3	20	2-5-5-6			Brown fine to medium SAND, little silt	
	S-4	20	5-4-5-5			8.0 — Tan to brown fine to medium SAND, some silt	
	S-5	20	4-4-4-4				
10						13.0 — 51.6	
	S-6	18	5-13-12-4		C	Tan to brown to purple medium to fine to coarse SAND and fine to coarse GRAVEL, little silt	Wet on spoon
15							
	S-7	0	6-7-5-4			20.0 — 44.6	
20						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-4

NORTHING 556117.6221

EASTING 572227.3385

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/21/24 **COMPLETED** 5/21/24

GROUND ELEVATION 65.7' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 18.0' / Elev 47.7'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 17.9' / Elev 47.8'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0					T	Depth 0.8 — 9" TOPSOIL — Elev. 65.0	
	S-1	20	1-1-2-2		B	2.0 — Brown fine to medium SAND and CLAY	
	S-2	16	4-6-5-5			Brown to tan fine to medium SAND, some silty clay	Moist
5	S-3	13	2-3-5-5			4.0 — Brown to tan fine to medium SAND, little silt	
	S-4	20	6-5-5-5				
C	S-5	20	4-3-3-3			8.0 — Tan to orange fine to medium SAND, trace to little silt	Micaceous
10							
						13.0 — 52.7	
15	S-6	10	9-16-12-13		C	Tan to brown to purple fine to medium to coarse SAND, little silt, trace fine gravel sized rock fragments	
▼						18.0 — 47.7	
20	S-7	8	6-3-3-2		D	Brown fine to medium SAND, little silt	Wet on spoon Saturated
						23.0 — Brown to red fine to medium SAND, trace silt	
25	S-8	12	5-5-4-4			25.0 — 40.7	
						Borehole terminated at 25.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-5

NORTHING 556016.3183

EASTING 572289.3617

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/14/24 **COMPLETED** 5/14/24

GROUND ELEVATION 66.0' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 14.0' / Elev 52.0'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 14.0' / Elev 52.0'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	21	1-1-1-2		T	1.0 / 65.0 — 12" TOPSOIL	
					A	2.0 / 64.0 — Brown CLAY, trace fine sand	
	S-2	20	5-5-6-4		B	Brown fine to medium SAND, little silt	
5	S-3	24	1-7-8-8				Moist
	S-4	24	6-5-8-6			6.0 — Brown to tan fine to medium to coarse SAND, little silt, trace fine gravel	
10	S-5	24	6-7-5-5				
						13.0 / 53.0	
15	S-6	12	9-9-7-8		C	Brown medium to fine to coarse SAND, some fine to coarse gravel, little silt	Saturated Rock caught in spoon
						18.0 / 48.0	
20	S-7	18	2-3-4-5		D	20.0 / 46.0 — Brown to maroon fine to medium to coarse SAND, little to some silt	
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-6

NORTHING 556004.5264

EASTING 572363.8827

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/14/24 **COMPLETED** 5/14/24

GROUND ELEVATION 66.3' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 14.0' / Elev 52.3'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 14.8' / Elev 51.5'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	6	2-2-2-3		T	0.5 / 65.8 — 6" TOPSOIL	
	S-2	0	10-11-13-12			Brown to tan medium to fine to coarse SAND, little silt, trace fine gravel	Rock caught in spoon
5	S-3	24	1-5-5-5			6.0	
	S-4	24	5-3-4-4			Brown to tan to black fine to medium SAND, trace to little silt	Moist
10	S-5	20	4-6-5-7		B		
	C					13.0	
15 ▽▼	S-6	20	2-3-5-15			Brown to white medium to fine to coarse SAND, little fine gravel, trace silt	Wet on spoon
						18.0 / 48.3	
20	S-7	2	16-19-12-8		D	Brown fine to medium SAND, little silt	Saturated
						20.0 / 46.3	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-7

PAGE 1 OF 1

NORTHING 556128.9233

EASTING 572392.7629

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/21/24 **COMPLETED** 5/21/24

GROUND ELEVATION 66.1' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 14.0' / Elev 52.1'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 15.3' / Elev 50.8'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0					T	Depth 0.8 — 10" TOPSOIL — Elev. 65.2	
	S-1	17	1-1-1-3		A	2.0 — Brown CLAY, little fine to medium sand — 64.1	
	S-2	18	4-5-7-5			Brown fine to medium SAND, little silt	
5	S-3	16	2-5-5-4			4.0 — Brown to orange fine to medium to coarse SAND, little silt	
	S-4	22	5-5-5-3		B	8.0 — Brown to tan fine SAND, little silt	
10	S-5	16	2-3-2-2				Moist
						13.0 — 53.1	
15 ▽▼	S-6	13	6-6-4-5			Brown to red fine to medium SAND, little silt	Iron staining Wet on spoon Saturated
						18.0	
20	S-7	24	3-2-3-3			Brown to red fine to medium SAND, little silt	Water introduced to borehole
					D		
25	S-8	24	1-2-1-2				
						28.0	
30	S-9	24	1-2-1-2			Brown to red fine to medium SAND, some silt	
						30.0 — 36.1	
						Borehole terminated at 30.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-8

PAGE 1 OF 1

NORTHING 555893.5694

EASTING 572347.7514

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/14/24 **COMPLETED** 5/14/24

GROUND ELEVATION 64.0' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 14.0' / Elev 50.0'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 13.0' / Elev 51.0'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	20	WOH-1-1-3		T	0.8 — 9" TOPSOIL — 63.3	
					A	2.0 — Brown CLAY, little silt — 62.0	
	S-2	20	3-3-3-3			Brown fine to medium SAND, little silt	
						4.0	
5	S-3	16	1-3-5-4			Brown to tan medium to fine to coarse SAND, little silt, trace fine gravel	Moist
						6.0	
	S-4	20	5-4-5-5			Brown to tan fine to medium to coarse SAND, trace silt	
					B	8.0	
10	S-5	20	5-4-5-5			Brown to tan to black fine to medium to coarse SAND, little silt	
						13.0 — 51.0	
15	S-6	2	29-27-18-12			Brown to black fine to medium SAND, little silt	Saturated
						18.0	
20	S-7	24	4-3-2-3			Brown to black fine to medium SAND, little silt	Water introduced to borehole
					D	23.0	
25	S-8	20	3-1-1-1			Brown to black to maroon fine to medium SAND, trace silt	
						30.0 — 34.0	
30	S-9	20	2-3-3-6			Borehole terminated at 30.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-9

NORTHING 555841.3951

EASTING 572369.2784

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/14/24 **COMPLETED** 5/14/24

GROUND ELEVATION 63.4' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 50.4'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 15.3' / Elev 48.2'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0					T	Depth 0.8 — 10" TOPSOIL — Elev. 62.6	
	S-1	20	WOH-2-2-2		A	2.0 — Brown CLAY, some fine sand — 61.4	
	S-2	16	3-4-7-9			4.0 — Brown fine to medium to coarse SAND, little silt, trace fine gravel	
5	S-3	16	1-7-8-7			Brown to tan fine to medium SAND, trace silt	
	S-4	20	4-7-6-4		B	6.0 — Brown to tan fine to medium to coarse SAND, little to some silt — 8.0	
10	S-5	20	2-6-10-9			Brown to black coarse to medium to fine SAND, little silt	Wet on spoon
						13.0 — 50.4	
15	S-6	5	3-6-6-7		D	Brown to black fine to medium SAND, little silt	Saturated
20	S-7	9	3-6-5-5			20.0 — 43.4	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-10

PAGE 1 OF 1

NORTHING 556073.8615

EASTING 572519.8548

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/21/24 **COMPLETED** 5/21/24

GROUND ELEVATION 65.2' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 14.1' / Elev 51.1'

DRILLER / HELPER Jason / Nelson / Cecil

AT END OF DRILLING Not Encountered

LOGGED BY A. Sposato **CHECKED BY** A. Spencer

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	16	1-1-1-2		T	0.8 — 10" TOPSOIL — 64.4	Damp
	S-2	14	3-5-8-8		A	Brown CLAY, trace fine sand — 3.0 — 62.2	
5	S-3	20	2-6-6-8			Brown to tan fine to medium to coarse SAND, some silt, trace fine gravel	
	S-4 ©	20	7-7-6-5			8.0	Moist
10	S-5	18	3-3-3-4			Brown to tan to black fine to medium to coarse SAND, trace silt, trace coarse gravel	
					B	13.0	
15 ▽	S-6	16	2-4-3-3			Brown to tan fine to medium SAND, trace silt	Wet
20	S-7	14	2-1-2-2			20.0 — 45.2	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-11

NORTHING 555984.1554

EASTING 572676.7633

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/22/24 **COMPLETED** 5/22/24

GROUND ELEVATION 62.6' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 16.8' / Elev 45.8'

DRILLER / HELPER Jason / Nelson / Cecil

AT END OF DRILLING Not Encountered

LOGGED BY A. Sposato **CHECKED BY** A. Spencer

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	16	1-2-1-2		T	0.7 — 8" TOPSOIL — 61.9	Damp
					A	2.0 — Brown CLAY, trace fine sand — 60.6	
	S-2	20	3-6-6-6			Brown fine to medium SAND, trace silt	
						4.0	
5	S-3	18	2-6-6-6			Brown to tan fine to medium SAND, little silt	
						6.0	
	S-4	18	8-5-4-4			Brown fine to medium SAND, some silt	
	S-5	16	4-3-7-25				Wet
10							
					B		
						13.0	
	S-6	10	6-3-4-4			Brown to tan fine to medium SAND, little silt	
15							
▽						18.0	
	S-7	12	2-1-2-2			Brown to tan fine to medium SAND, little silt	
20						20.0 — 42.6	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-12

NORTHING 556003.6791

EASTING 572557.4667

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/21/24 **COMPLETED** 5/21/24

GROUND ELEVATION 64.5' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.3' / Elev 51.3'

DRILLER / HELPER Jason / Nelson / Cecil

AT END OF DRILLING Not Encountered

LOGGED BY A. Sposato **CHECKED BY** A. Spencer

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	14	1-1-1-2		T	0.6 — 7" TOPSOIL — 63.9	Damp
						2.0 — Brown fine to medium SAND and CLAY	
	S-2	18	2-2-3-5			Brown to tan fine to medium SAND, trace silt	
						4.0	
5	S-3	10	3-6-4-5			Brown to tan fine to medium SAND, trace silt, trace coarse gravel	
	S-4	16	5-7-7-6			8.0	
	S-5	16	6-5-4-10			Brown to tan fine to medium SAND, trace silt, trace coarse gravel	Moist
10					B		
						13.0	
▽	S-6	18	3-3-4-5			Brown to tan fine to medium SAND, trace silt	Wet
15							
						18.0	
	S-7	12	3-3-4-5			Brown to tan fine to medium to coarse SAND, little silt	
20						20.0 — 44.5	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-13

NORTHING 555915.7315

EASTING 572515.6701

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/21/24 **COMPLETED** 5/21/24

GROUND ELEVATION 63.7' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 50.7'

DRILLER / HELPER Jason / Nelson / Cecil

AT END OF DRILLING Not Measured

LOGGED BY A. Sposato **CHECKED BY** A. Spencer

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	16	1-1-1-1		T	1.0 / 62.7 — 12" TOPSOIL	Damp
					A	2.0 / 61.7 — Brown CLAY, little fine sand	
	S-2	14	2-2-3-2		B	Brown to tan medium to fine to coarse SAND, trace silt	
5	S-3	16	2-5-8-7			6.0 — Tan fine to medium SAND, trace silt	
	S-4	16	6-5-4-2			8.0 — Brown to tan fine to medium to coarse SAND, trace silt	
10	S-5	12	8-11-11-10				Moist
						13.0 / 50.7	
15	S-6	13	2-3-3-5		C	Brown fine to medium to coarse SAND and fine to coarse GRAVEL, trace silt	Wet
						18.0 / 45.7	
20	S-7	14	2-3-2-2		D	Brown to tan fine to medium SAND, little silt	
						23.0	
25	S-8	14	1-2-3-5			Brown to tan fine to medium SAND, little silt, trace fine gravel	Water introduced to borehole
						28.0	
30	S-9	16	1-1-4-5			Brown to tan to gray fine to medium to coarse SAND, trace silt	
						33.0	
35	S-10	20	2-1-2-2			Brown fine to medium SAND, little silt	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

(Continued Next Page)

TEST BORING LOG

CLIENT Landmark Science & Engineering **PROJECT NAME** Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001 **PROJECT LOCATION** Middletown, DE

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
						Depth 38.0	
40	S-11	16	2-3-4-6			Brown to tan fine to medium SAND, little silt	
						43.0	
45	S-12	12	1-1-3-7		D	Brown fine to medium to coarse SAND, trace fine gravel, trace silt	
						48.0	
50	S-13	16	2-4-5-11			Gray fine to medium SAND and SILT	
						50.0 Elev. 13.7	
						Borehole terminated at 50.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-14

NORTHING 555779.0855

EASTING 572540.4752

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/22/24 **COMPLETED** 5/22/24

GROUND ELEVATION 62.3' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 14.0' / Elev 48.3'

DRILLER / HELPER Jason / Nelson / Cecil

AT END OF DRILLING Not Measured

LOGGED BY A. Sposato **CHECKED BY** A. Spencer

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	14	1-2-1-2		T	0.7 — 8" TOPSOIL — 61.6	Damp
					A	2.0 — Tan CLAY, trace fine sand — 60.3	
	S-2	26	5-9-7-8			Brown to tan fine to medium SAND, some clay	
						4.0	
5	S-3	16	2-6-7-7			Brown fine to medium SAND, little silt	
	S-4	22	6-5-5-8			8.0	Moist
10	S-5	14	10-9-8-6			Brown to tan medium to fine to coarse SAND, little fine gravel, little silt	
					B	13.0	
15	S-6	16	4-4-3-3			Brown fine SAND, some silt	Wet
						18.0	
20	S-7	18	3-2-2-3			Brown to tan fine to medium SAND, little silt	Water introduced to borehole
						20.0 — 42.3	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-15

PAGE 1 OF 1

NORTHING 555715.9594

EASTING 572609.695

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/22/24 **COMPLETED** 5/22/24

GROUND ELEVATION 62.2' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 14.0' / Elev 48.2'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 14.6' / Elev 47.6'

LOGGED BY A. Sposato **CHECKED BY** A. Spencer

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	18	1-2-2-2		T / A	0.8 / 61.4: 10" TOPSOIL 2.0 / 60.2: Tan CLAY, some fine to medium to coarse sand	Damp
	S-2	16	4-5-6-6		B	Brown to gray fine to medium SAND, some clay	
5	S-3	18	3-5-7-9		B	4.0: Brown to tan fine to medium to coarse SAND, little silt	
	S-4	19	8-7-9-13		B	6.0: Brown fine to medium to coarse SAND, trace fine to coarse gravel, trace silt 8.0 / 54.2	Moist
10	S-5	14	7-11-10-11		C	Brown medium to fine to coarse SAND, some fine to coarse gravel, little silt	
					C	13.0 / 49.2	
15 ▼	S-6	10	4-7-7-8		D	Brown fine to medium SAND, little silt, trace fine to coarse gravel	Wet
					D	18.0: Brown fine to medium SAND, some silt	
20	S-7	12	3-2-1-2		D	20.0 / 42.2	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-16

NORTHING 555771.3312

EASTING 572716.7135

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/22/24 **COMPLETED** 5/22/24

GROUND ELEVATION 61.6' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 48.6'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 14.0' / Elev 47.6'

LOGGED BY A. Sposato **CHECKED BY** A. Spencer

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	14	1-2-1-3		T	0.8 — 10" TOPSOIL — 60.8	Moist
					A	2.0 — Brown CLAY, little fine sand — 59.6	
	S-2	18	2-3-4-8			Brown fine to medium SAND and CLAY	
						4.0	
5	S-3	18	2-6-8-8		B	Brown to tan fine to medium SAND, little silt	
	S-4	23	8-8-9-7			8.0 — 53.6	
10	S-5	16	5-21-15-18		C	Brown to tan fine to medium to coarse SAND and fine to coarse GRAVEL, trace silt	
						13.0 — 48.6	
15	S-6	16	5-4-4-5		D	Brown to tan fine to medium SAND, trace silt	Wet
20	S-7	18	3-1-2-2			20.0 — 41.6	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-17

NORTHING 555764.0366

EASTING 572783.4374

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/22/24 **COMPLETED** 5/22/24

GROUND ELEVATION 61.2' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 48.2'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 14.2' / Elev 47.1'

LOGGED BY A. Sposato **CHECKED BY** A. Spencer

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	16	1-2-2-2		T	0.8 — 9" TOPSOIL — 60.5	Damp
					A	2.0 — Brown CLAY, trace fine sand — 59.2	
	S-2	22	4-6-8-12			Brown fine to medium SAND, some clay	
						4.0	
5	S-3	18	1-10-9-10			Brown to tan fine to medium to coarse SAND, trace silt, trace fine gravel	
						6.0	
	S-4	22	8-6-7-6			Brown fine SAND, little silt	
						8.0	
10	S-5	18	4-6-17-20			Brown fine to medium to coarse SAND, some coarse to fine gravel, little silt	Moist
					B		
						13.0	
▽							
15 ▼ C	S-6	23	4-5-4-5			Brown to tan fine to medium SAND, some silt	Wet
						18.0	
20	S-7	17	3-2-1-3			Brown to tan fine to medium to coarse SAND, some silt — 20.0 — 41.2	
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-18

PAGE 1 OF 1

NORTHING 555879.1145

EASTING 572826.5883

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/22/24 **COMPLETED** 5/22/24

GROUND ELEVATION 61.1' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 11.2' / Elev 49.9'

DRILLER / HELPER Jason / Nelson / Cecil

AT END OF DRILLING Not Encountered

LOGGED BY A. Sposato **CHECKED BY** A. Spencer

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	16	1-1-2-2		T	0.8 — 10" TOPSOIL — 60.3	Damp
					A	2.0 — Brown CLAY, trace fine sand, trace root fragments — 59.1	
	S-2	23	3-4-5-6		B	Brown fine to medium SAND, little silty clay	
5	S-3	20	1-5-8-9			4.0 — Brown to tan fine to medium SAND, little silt — 6.0 — 55.1	
	S-4	18	4-5-4-3		D	Tan fine SAND, some silt	
	S-5	18	3-4-6-8			8.0 — Tan to brown fine to medium SAND, little silt	Moist
10							
						13.0	
	S-6	16	3-3-3-3			Tan to brown fine to medium to coarse SAND, little silt	Wet
15							
						18.0	
	S-7	12	3-3-2-2			Tan to brown fine to medium SAND, little silt, trace coarse gravel	
20						20.0 — 41.1	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-19

NORTHING 555668.2611

EASTING 572811.3577

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/22/24 **COMPLETED** 5/22/24

GROUND ELEVATION 60.6' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 10.2' / Elev 50.5'

DRILLER / HELPER Jason / Nelson / Cecil

AT END OF DRILLING Not Encountered

LOGGED BY A. Sposato **CHECKED BY** A. Spencer

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	14	1-2-2-4		T / A	0.5 / 60.1 — 6" TOPSOIL 2.0 / 58.6 — Brown to gray CLAY, trace fine to medium sand	Damp
	S-2	16	5-9-11-9		B	Brown fine to medium SAND, little silt 4.0 — Brown to tan fine to medium SAND, little silt	
5	S-3	18	2-6-5-4				
	S-4 ©	16	4-5-6-5			8.0 / 52.6	
	S-5	24	7-11-11-11		C	Brown medium to fine to coarse SAND and fine to coarse GRAVEL, little silt	Moist
10 ▽						13.0 — Brown fine to medium SAND, some fine to coarse gravel, trace silt	Wet
	S-6	2	3-3-2-3				
15						18.0 / 42.6	
	S-7	19	2-2-3-3		D	Brown fine to medium to coarse SAND, little silt	
20						20.0 / 40.6	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-20

NORTHING 555545.8735

EASTING 572714.5887

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/23/24 **COMPLETED** 5/23/24

GROUND ELEVATION 61.8' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 48.8'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 10.3' / Elev 51.5'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	16	1-1-2-1		T	1.0 — 12" TOPSOIL — 60.8	
	S-2	24	3-5-8-11		A	Brown to tan silty CLAY, trace fine to medium sand — 3.5 — 58.3	Moist
						4.0 — Brown fine to medium SAND, little to some silt	
5	S-3	24	2-7-5-4		B	Brown to tan fine to medium to coarse SAND, little silt, trace fine gravel — 6.0	
	S-4	24	4-4-5-11			Brown to tan to black fine SAND, some silt — 8.0 — 53.8	Moist Micaceous
	S-5	16	8-6-7-5			Brown to orange fine to medium SAND, little silt	Iron staining
10							
						13.0	
	S-6	16	3-2-4-4		D	Brown to orange fine to medium SAND, trace silt	Saturated
15							
	S-7	0	3-3-2-3			20.0 — 41.8	
20						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-21

NORTHING 555404.3665

EASTING 572745.3137

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/23/24 **COMPLETED** 5/23/24

GROUND ELEVATION 62.3' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 49.3'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 12.8' / Elev 49.5'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	16	1-1-1-2		T / A	0.8 — 9" TOPSOIL — 61.5 2.0 — Brown to tan silty CLAY and fine to medium SAND — 60.3	
	S-2	24	4-3-4-5		B	Brown to tan fine to medium SAND, little silt 4.0	Moist
5	S-3	14	3-3-4-5		B	Brown to tan to black fine to medium SAND, little silt 6.0	
	S-4	18	4-3-5-11		B	Brown to orange fine to medium SAND, little to some silt 8.0 — 54.3	Moist
10	S-5	18	12-13-5-7		C	Brown fine to medium to coarse SAND, some fine to coarse gravel, little silt	Fine gravel seam @8' Wet on spoon
					C	13.0 — 49.3	
15	S-6	18	2-2-3-4		D	Brown to orange fine to medium SAND, little silt	Saturated
					D		
20	S-7	24	WOH-1-2-2		D	20.0 — 42.3	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-22

NORTHING 555415.6355

EASTING 572868.5336

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/23/04 **COMPLETED** 5/23/24

GROUND ELEVATION 62.3' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 14.0' / Elev 48.3'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 13.0' / Elev 49.3'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0					T	Depth 0.7 — 8" TOPSOIL — Elev. 61.6	
	S-1	18	1-1-1-3			2.0 — Brown fine to medium SAND and CLAY	
	S-2	18	2-3-3-2			Brown to orange fine to medium SAND, little silt	Moist
5	S-3	20	1-2-4-3			4.0 — Brown to orange fine to medium SAND, little to some silt	
	S-4	24	4-4-3-1		B	6.0 — Brown to orange fine SAND, some silt	Moist Micaceous
	S-5	24	2-2-2-5			8.0 — Brown to orange to black fine to medium SAND, little silt	
10							Wet on spoon
						13.0	49.3
15	S-6	20	3-3-6-7		D	Brown to orange fine to medium SAND, little silt	Saturated
20	S-7	24	3-6-7-7			20.0	42.3

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-23

NORTHING 555873.1345

EASTING 573257.9807

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/23/24 **COMPLETED** 5/23/24

GROUND ELEVATION 61.6' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 14.0' / Elev 47.6'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 13.0' / Elev 48.6'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	16	1-1-2-3		T	0.8 — 9" TOPSOIL — 60.9	
					A	2.0 — Brown silty CLAY, trace fine to medium sand — 59.6	
	S-2	20	3-6-8-7		B	4.0 — Brown to orange fine to medium to coarse SAND, some silt, trace fine gravel	
5	S-3	21	1-4-4-4			Tan to orange fine SAND, little silt	
	S-4	24	4-9-13-12			7.0 — 54.6	
					C	9.0 — Brown to white fine to coarse GRAVEL, some fine to medium to coarse sand, little silt — 52.6	
10	S-5	12	14-8-5-5			Brown to orange fine to medium SAND, trace silt	Moist Iron staining
15	S-6	24	4-2-3-4		D		Wet on spoon Saturated
						18.0	
20	S-7	24	2-1-2-2			Brown to orange to gray fine to medium SAND, little silt — 20.0 — 41.6	
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-24

NORTHING 555777.2899

EASTING 573403.7288

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/23/24 **COMPLETED** 5/23/24

GROUND ELEVATION 61.3' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 15.0' / Elev 46.3'

DRILLER / HELPER Jason / Nelson / Cecil

▼ **AT END OF DRILLING** 14.5' / Elev 46.8'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0					T	Depth 0.8 — 9" TOPSOIL — Elev. 60.5	
	S-1	16	1-1-2-2		A	Brown silty CLAY, little fine to medium sand	
	S-2	16	2-5-2-3			3.0 — Elev. 58.3	
					B	4.0 Brown fine to medium to coarse SAND, little silt	
5	S-3	24	1-5-8-11			Brown to black to white fine to medium to coarse SAND, little silt	Moist
						6.0 — Elev. 55.3	
	S-4	18	13-15-15-17		C	Brown to white to black medium to fine to coarse SAND and fine to coarse GRAVEL, little silt	
						8.0 — Elev. 53.3	
10	S-5	20	9-9-8-7		D	Brown to orange fine to medium SAND, little silt	Moist
						13.0	
15	S-6	12	3-4-3-4			Brown to orange to maroon fine to medium SAND, little silt	Wet on spoon Saturated
						18.0	
20	S-7	24	2-1-2-2			Brown to orange to gray fine to medium SAND, some silt	
						20.0 — Elev. 41.3	
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-25

NORTHING 556050.0766

EASTING 573557.0556

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 5/23/24 **COMPLETED** 5/23/24

GROUND ELEVATION 61.1' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

DURING DRILLING 13.0' / Elev 48.1'

DRILLER / HELPER Jason / Nelson / Cecil

AT END OF DRILLING 12.5' / Elev 48.6'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	18	1-1-1-2		T	0.8 — 9" TOPSOIL — 60.4	
					A	2.0 — Brown silty CLAY — 59.1	
	S-2	18	4-4-10-10		B	Brown to white medium to fine to coarse SAND, little silt, trace fine gravel	
5	S-3	18	2-4-6-4			6.0 — 55.1	
	S-4	18	10-14-14-9		C	Brown to tan to white fine to medium to coarse SAND, some fine gravel, trace silt — 8.0 — 53.1	Moist
10	S-5	20	5-5-6-4			Brown to orange fine to medium SAND, little to some silt	Wet on spoon
						13.0	
15	S-6	24	2-2-2-3		D	Brown to orange fine to medium SAND, little silt	Saturated
						18.0	
20	S-7	24	2-1-2-1			Brown to orange to gray fine to medium SAND, little silt — 20.0 — 41.1	
						Borehole terminated at 20.0 feet.	

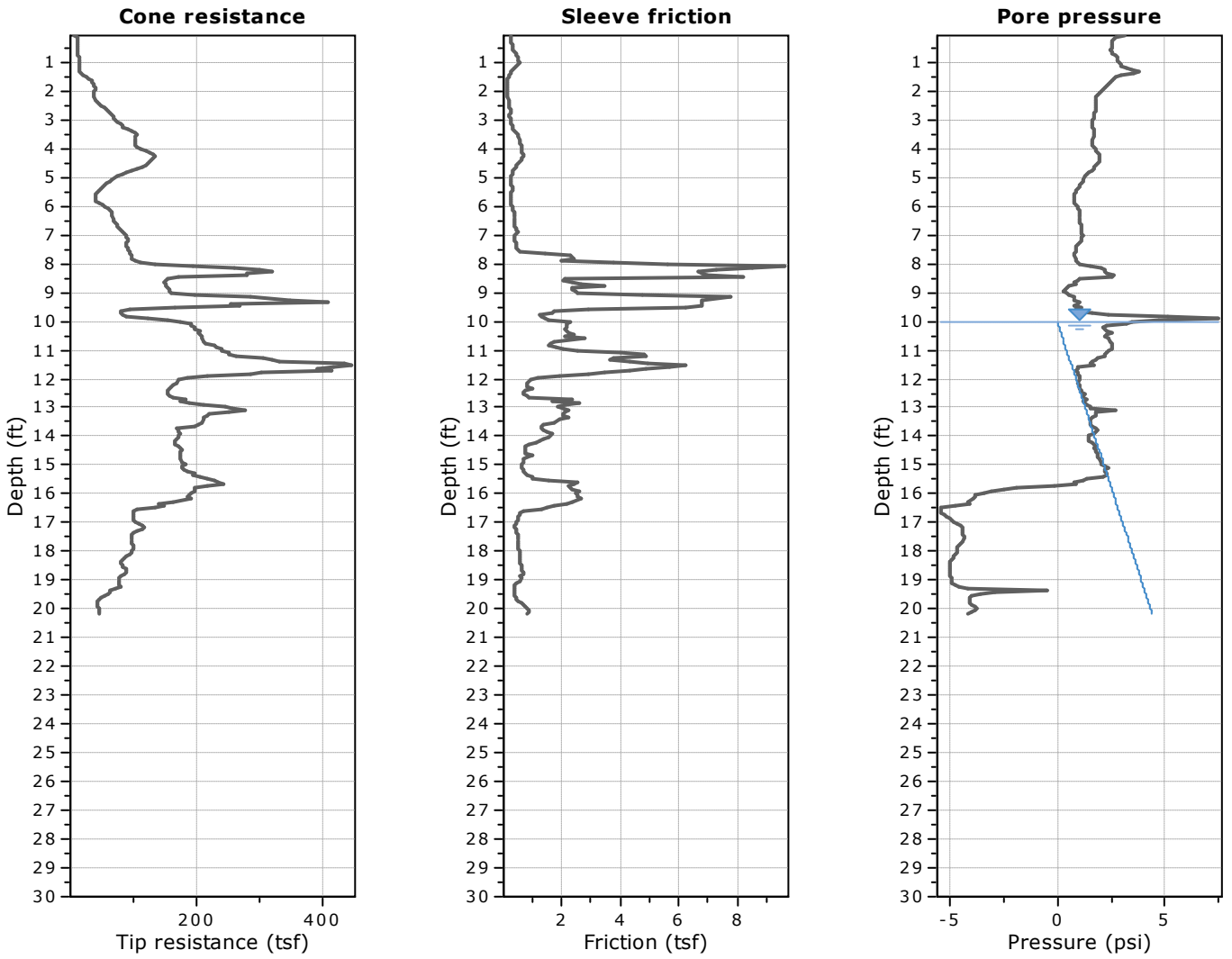
NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

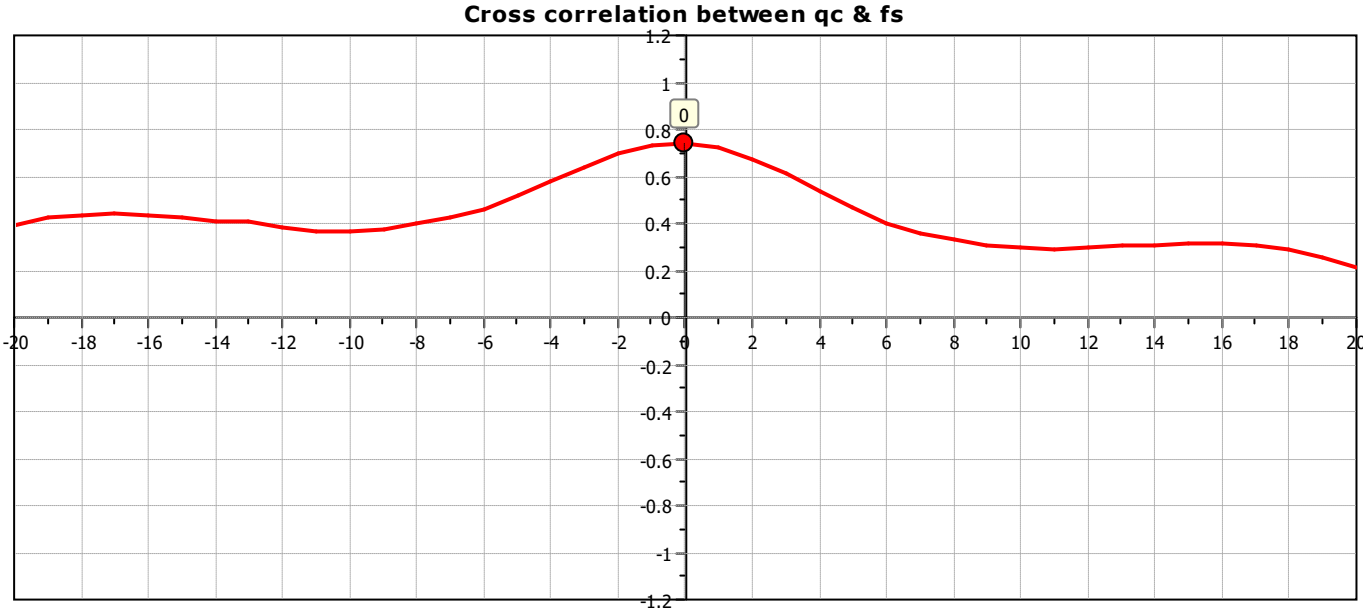
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-1
Total depth: 20.19 ft, Date: 5/13/2024
Surface Elevation: 64.69 ft
Coords: X:571964.33, Y:555982.75
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: ASD Summit Campus
Location: Middletown, Delaware



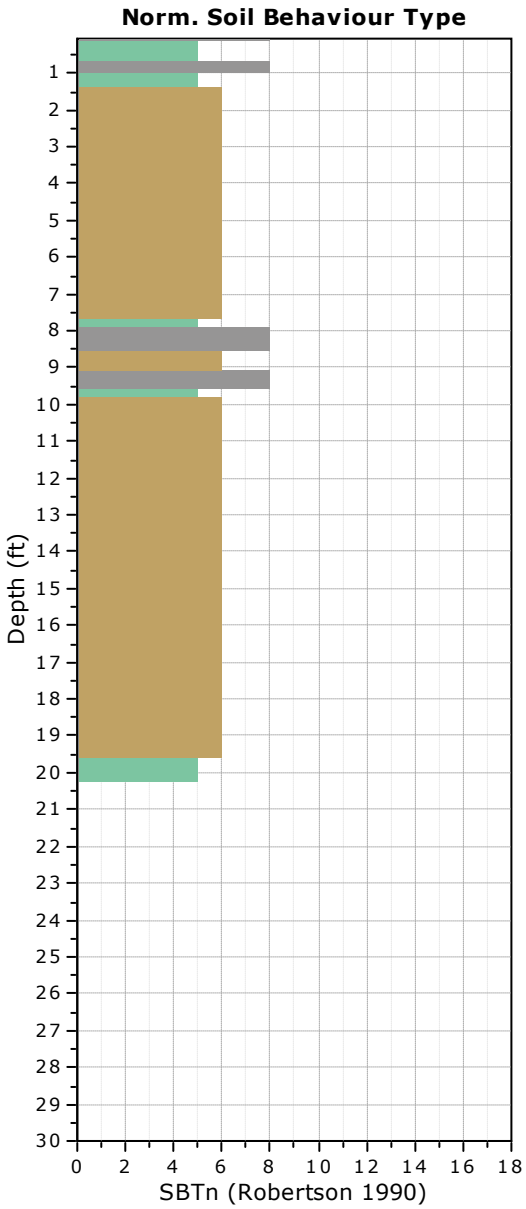
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

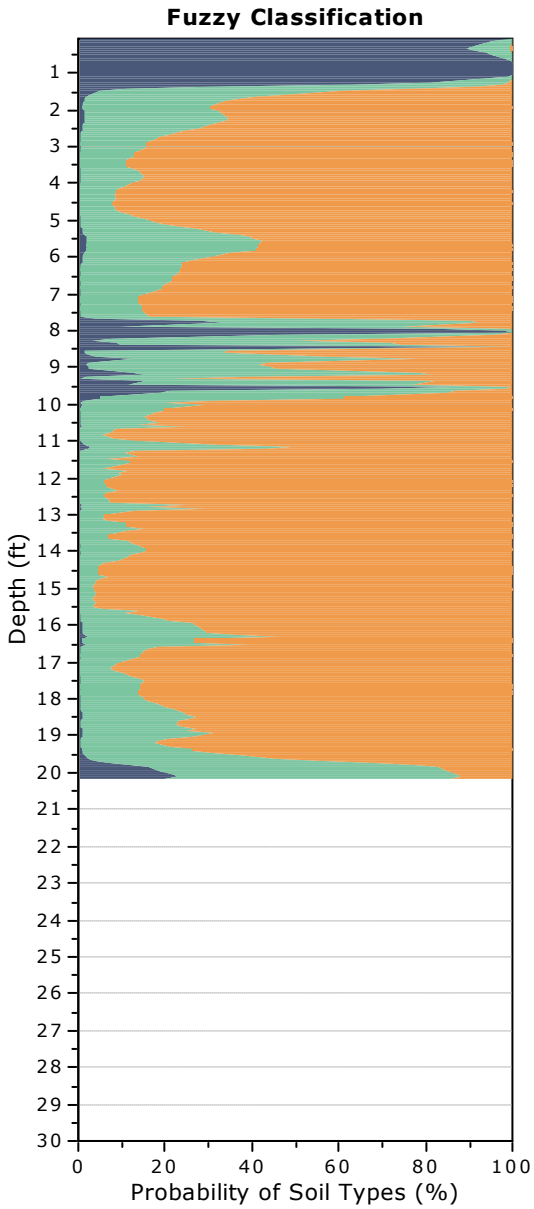


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-1
Total depth: 20.19 ft, Date: 5/13/2024
Surface Elevation: 64.69 ft
Coords: X:571964.33, Y:555982.75
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



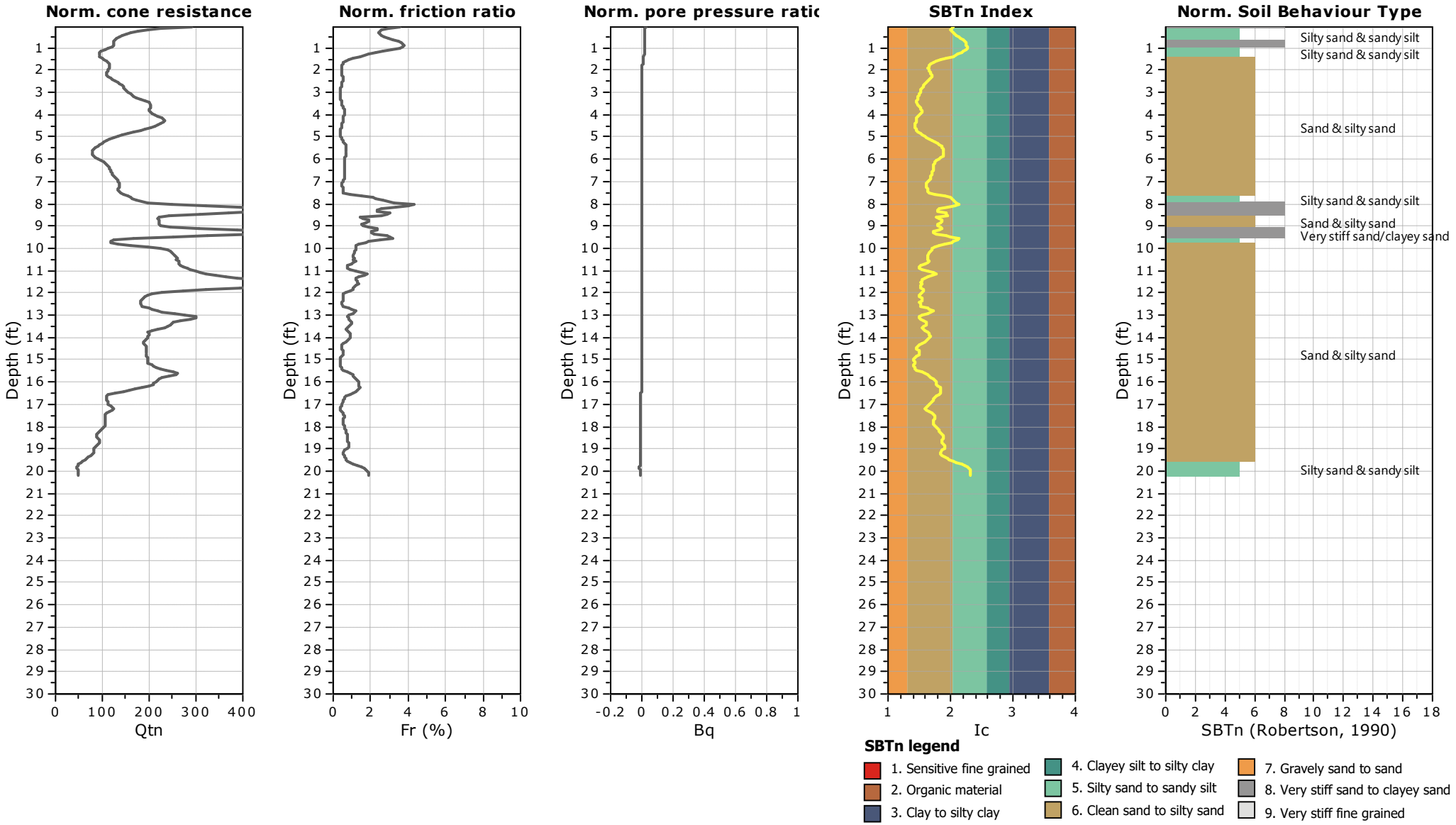


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-1
Total depth: 20.19 ft, Date: 5/13/2024
Surface Elevation: 64.69 ft
Coords: X:571964.33, Y:555982.75
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

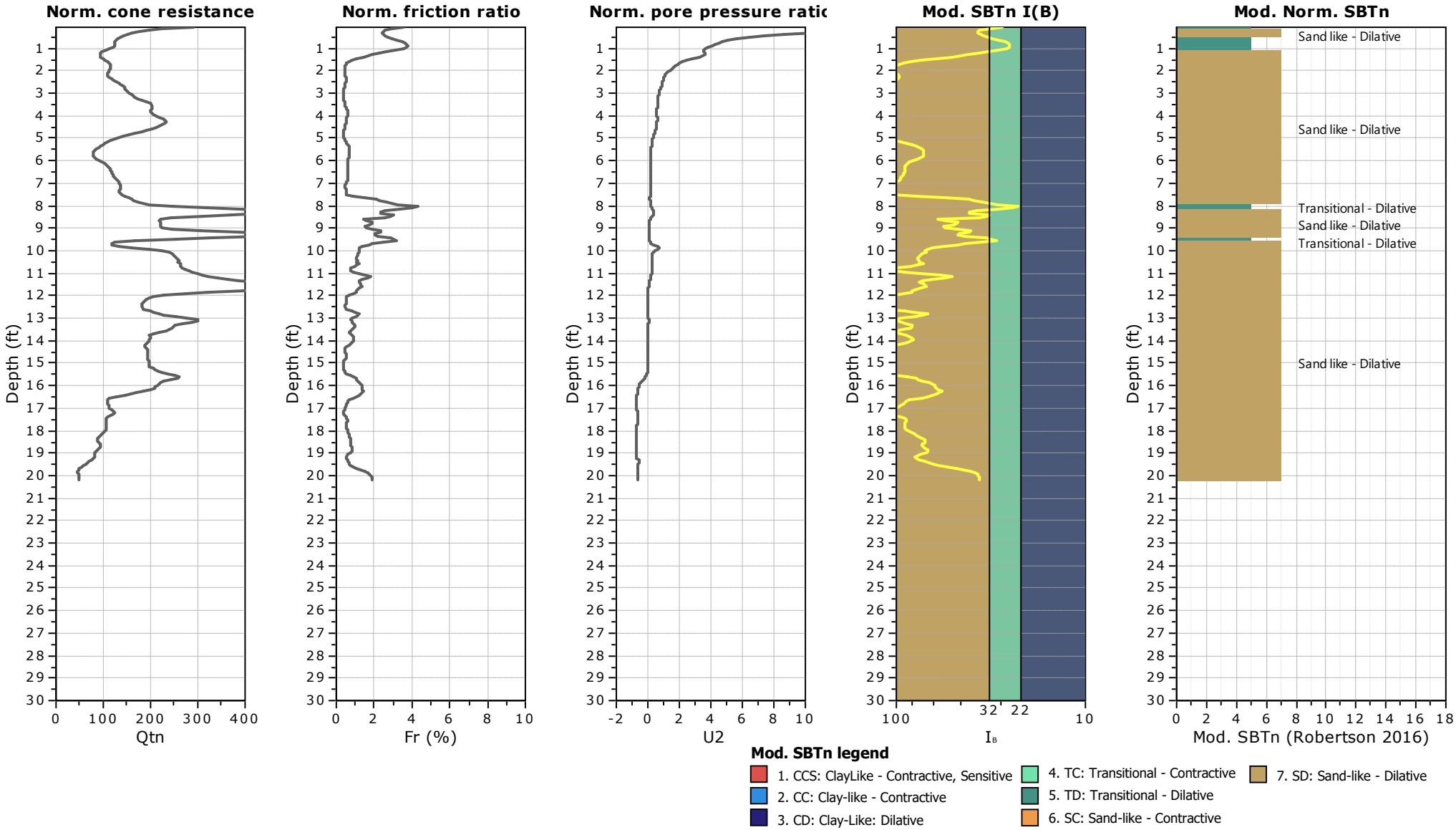
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-1
Total depth: 20.19 ft, Date: 5/13/2024
Surface Elevation: 64.69 ft
Coords: X:571964.33, Y:555982.75
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

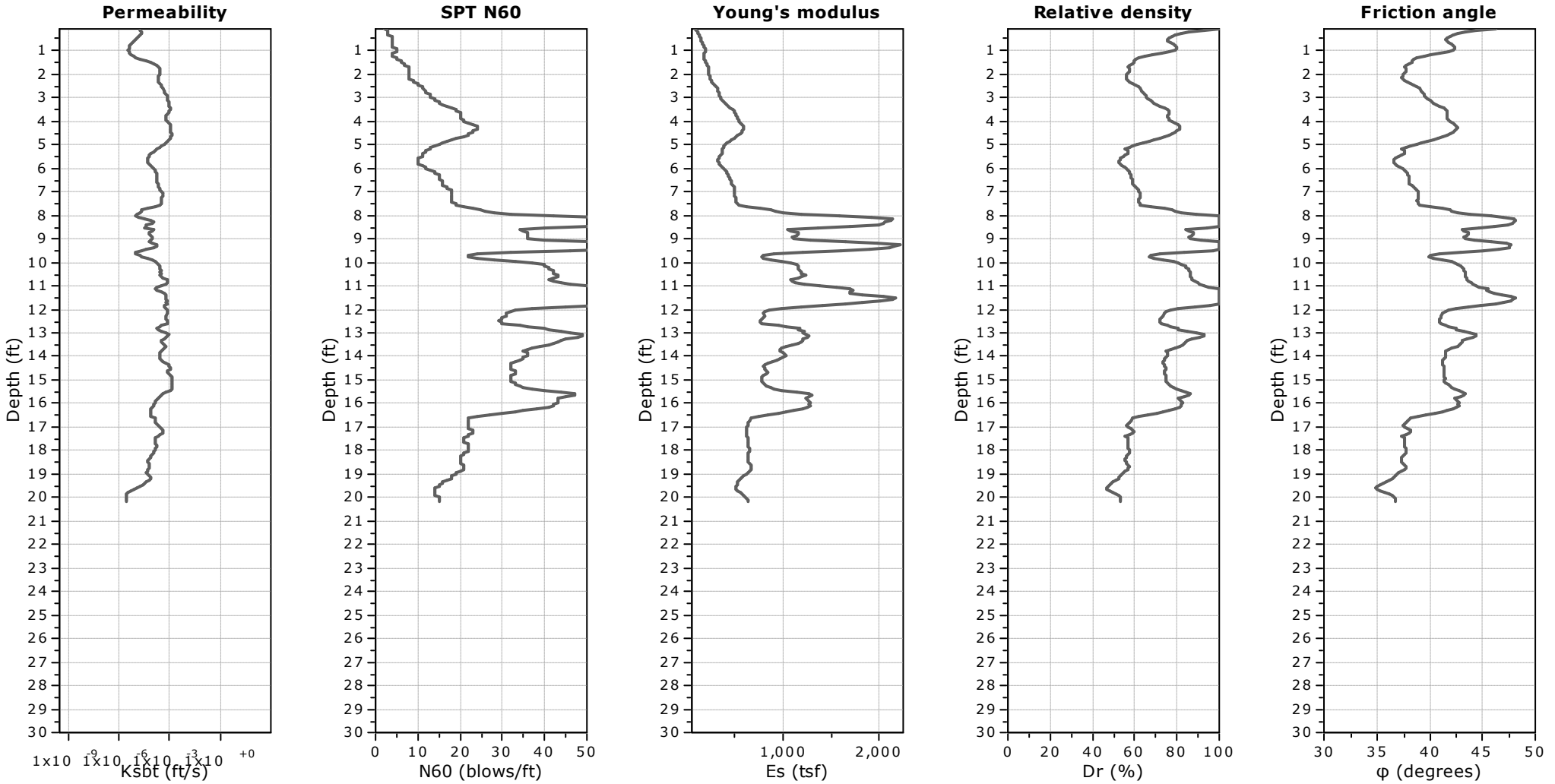
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-1
Total depth: 20.19 ft, Date: 5/13/2024
Surface Elevation: 64.69 ft
Coords: X:571964.33, Y:555982.75
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



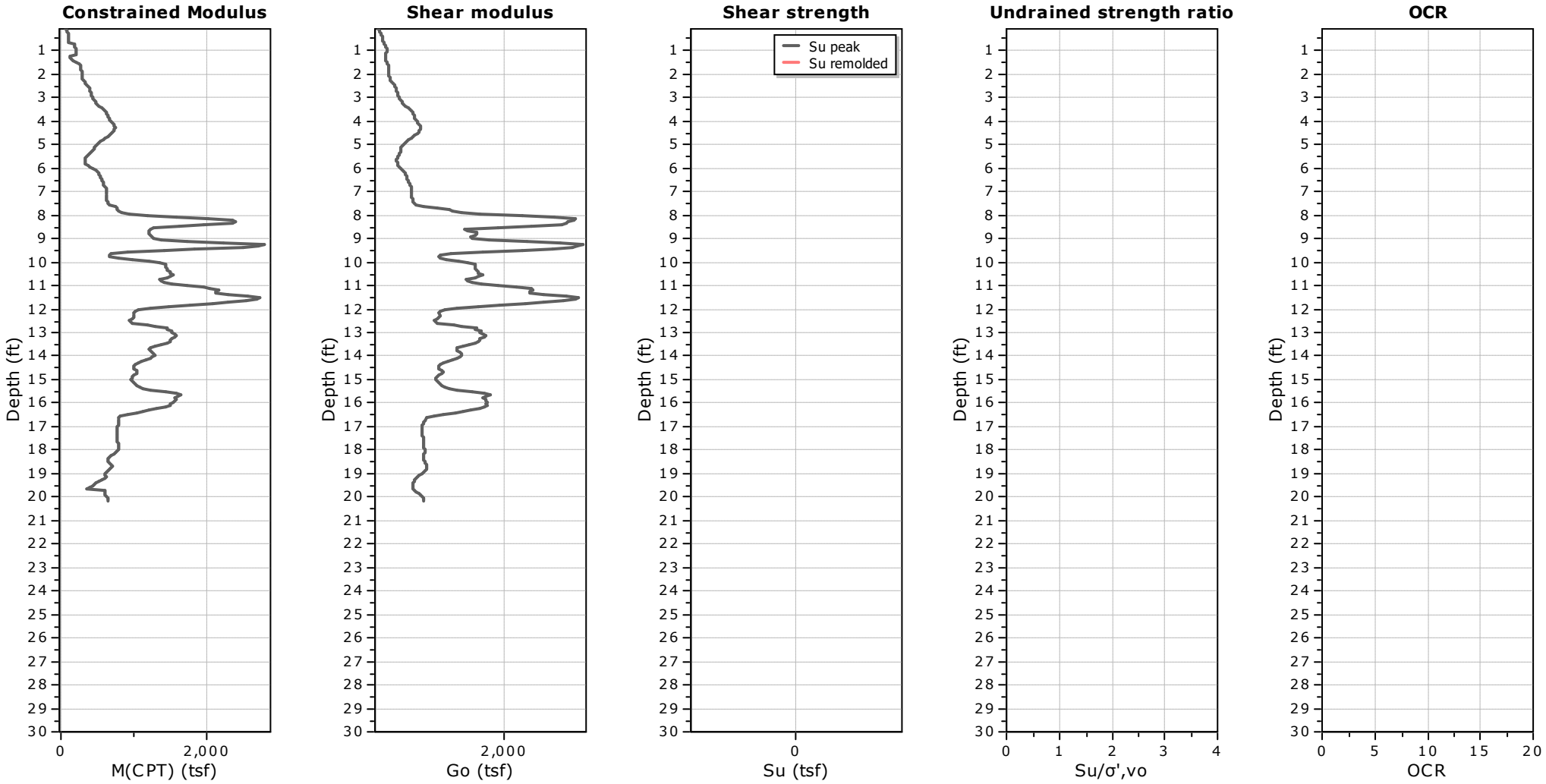
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-1
Total depth: 20.19 ft, Date: 5/13/2024
Surface Elevation: 64.69 ft
Coords: X:571964.33, Y:555982.75
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



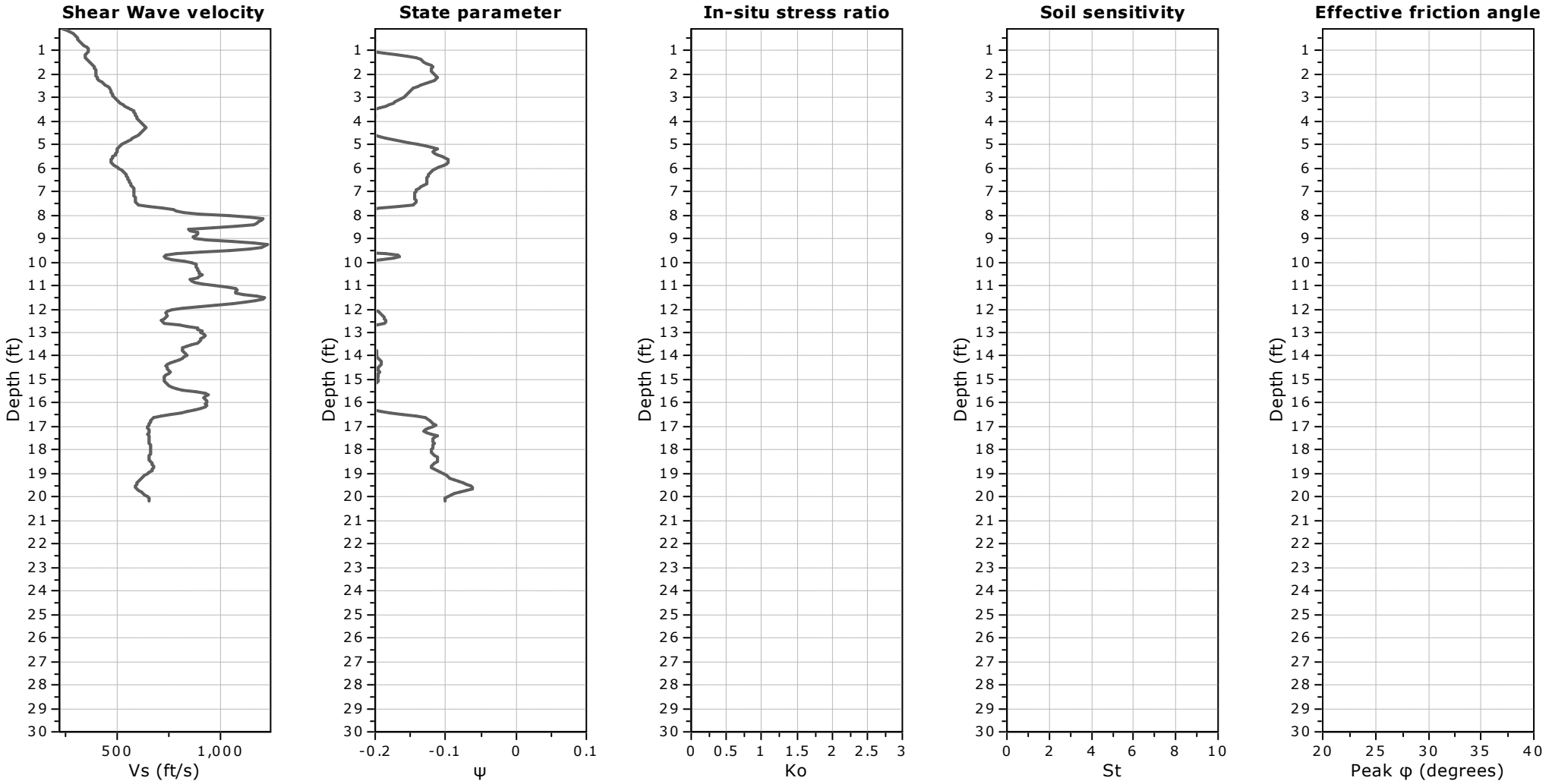
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-1
Total depth: 20.19 ft, Date: 5/13/2024
Surface Elevation: 64.69 ft
Coords: X:571964.33, Y:555982.75
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



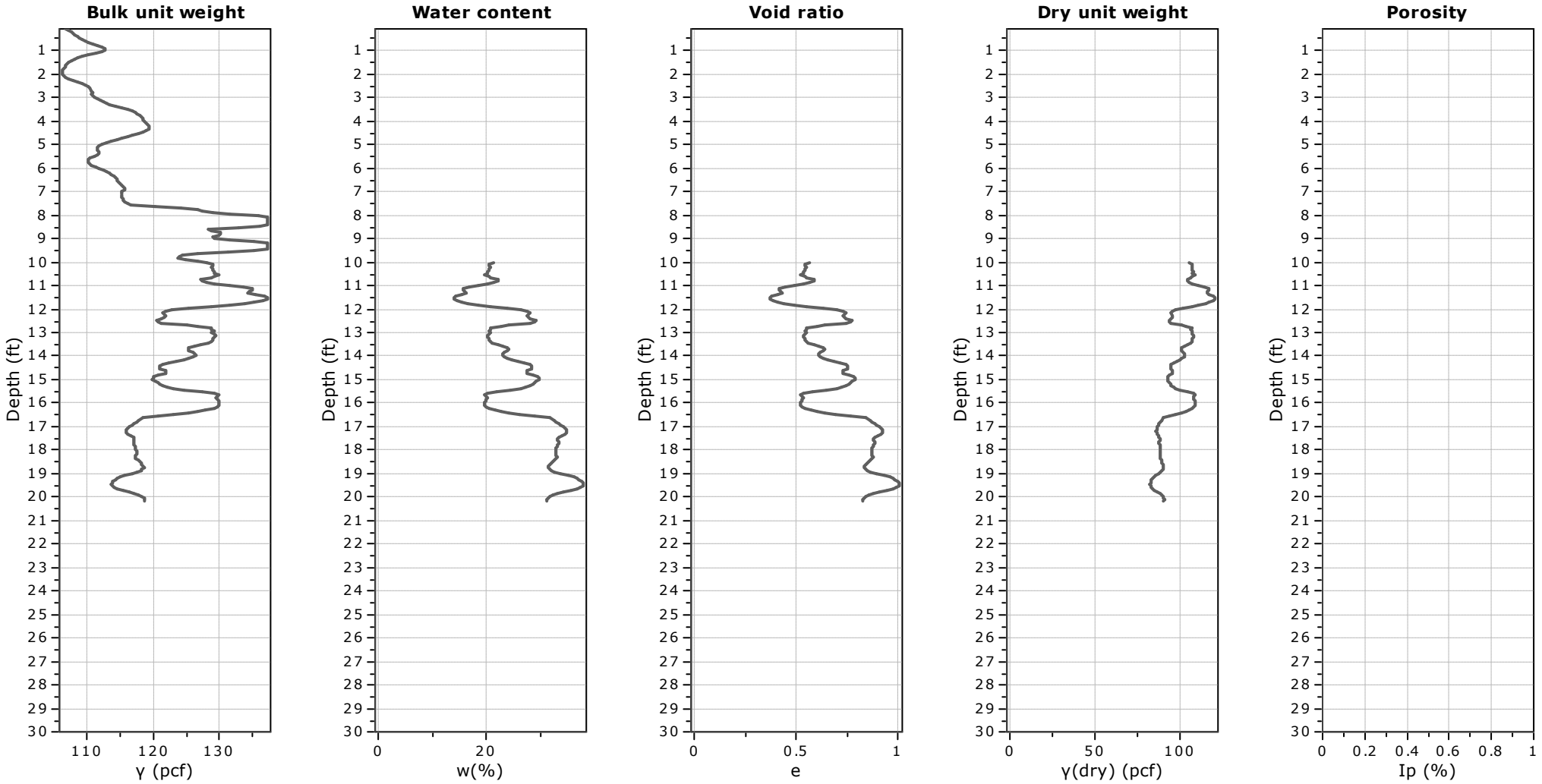
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-1
Total depth: 20.19 ft, Date: 5/13/2024
Surface Elevation: 64.69 ft
Coords: X:571964.33, Y:555982.75
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

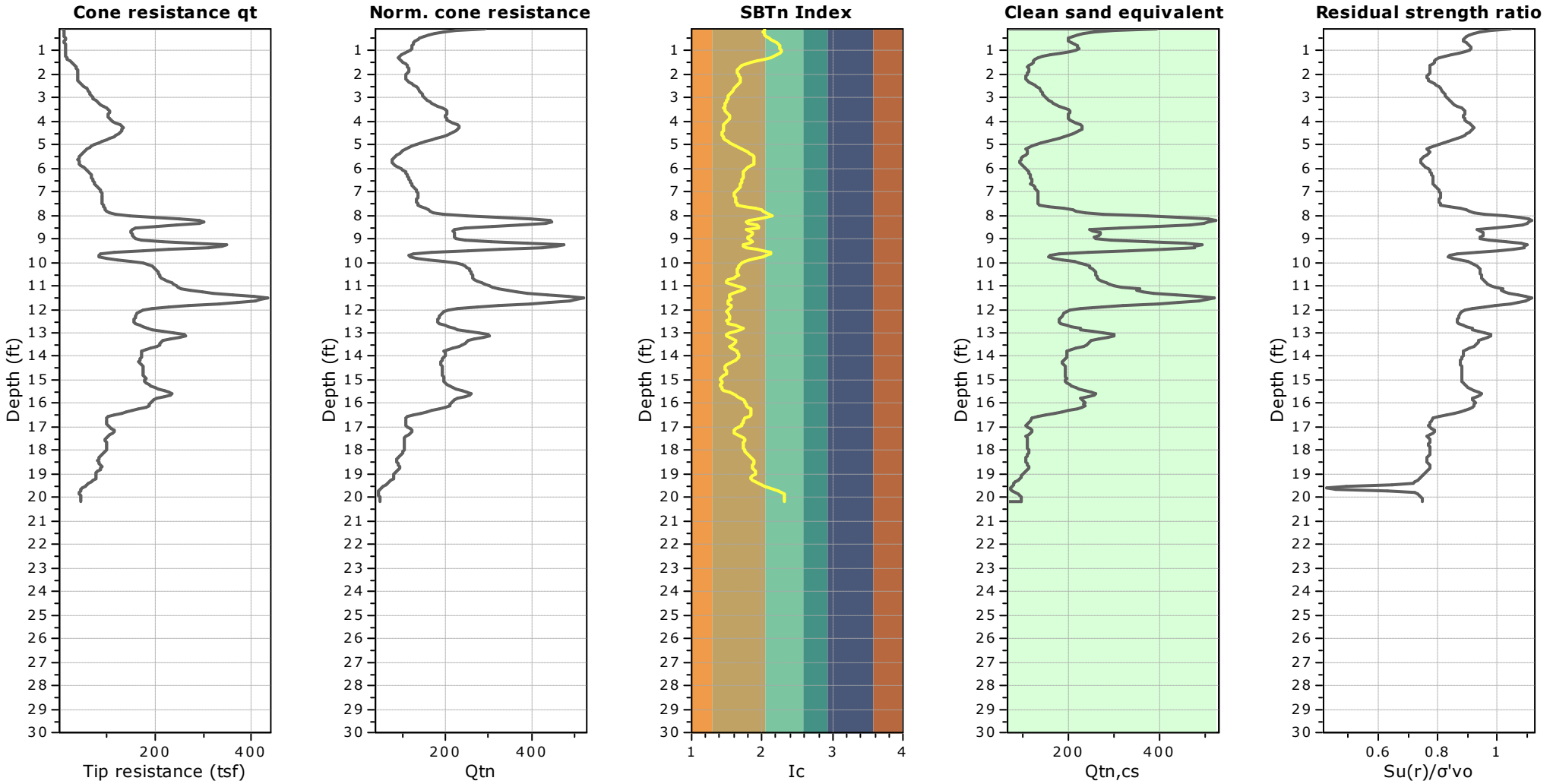
Project: ASD Summit Campus
Location: Middletown, Delaware



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-1
Total depth: 20.19 ft, Date: 5/13/2024
Surface Elevation: 64.69 ft
Coords: X:571964.33, Y:555982.75
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

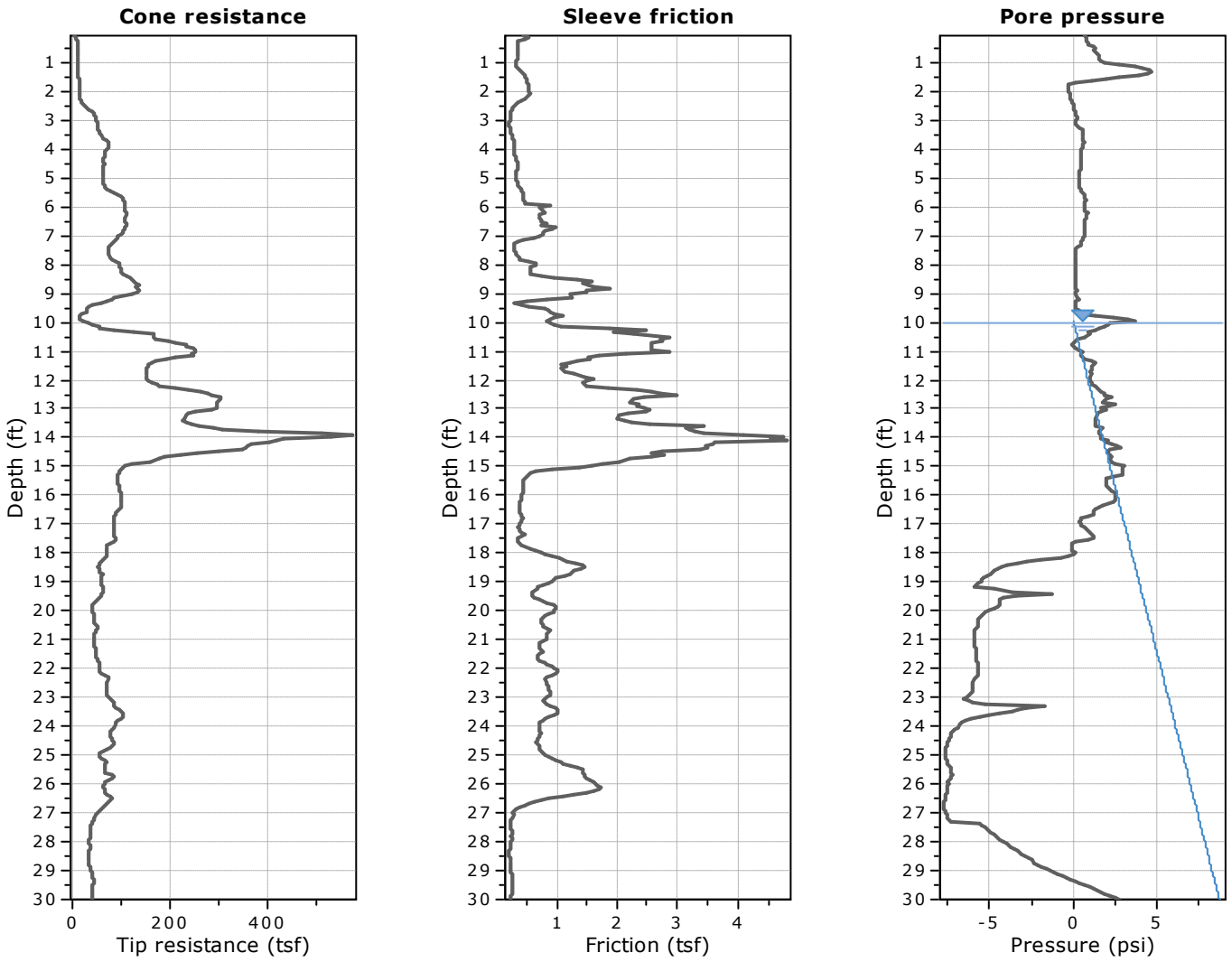
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



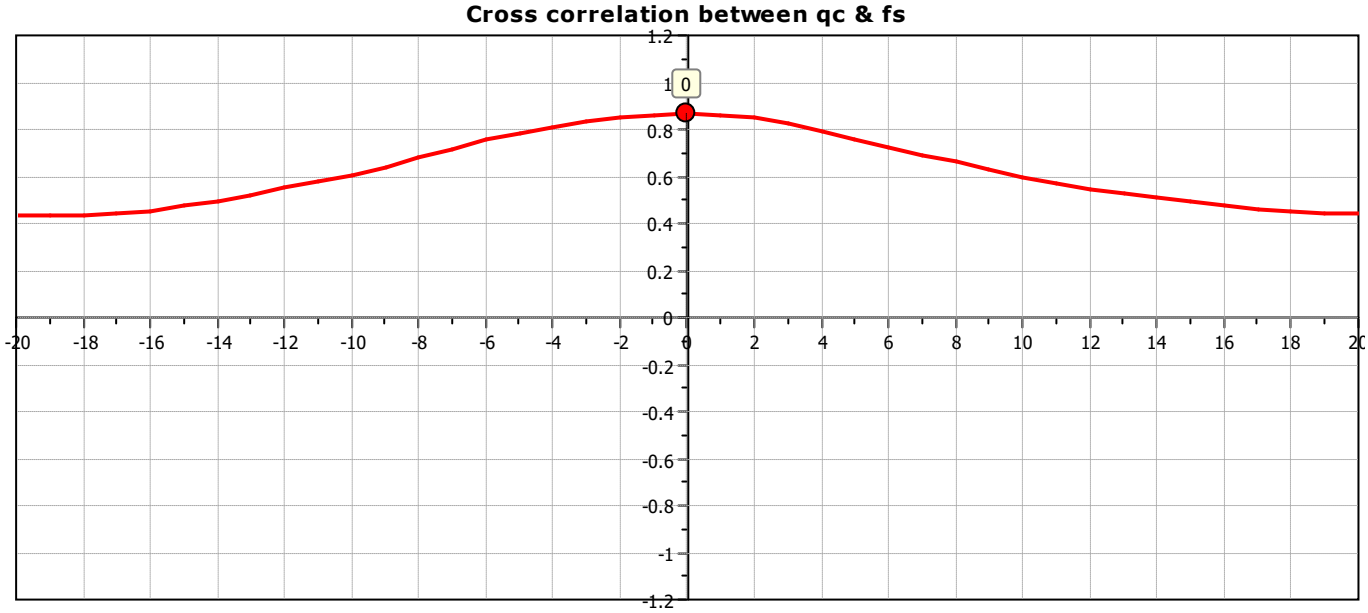
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

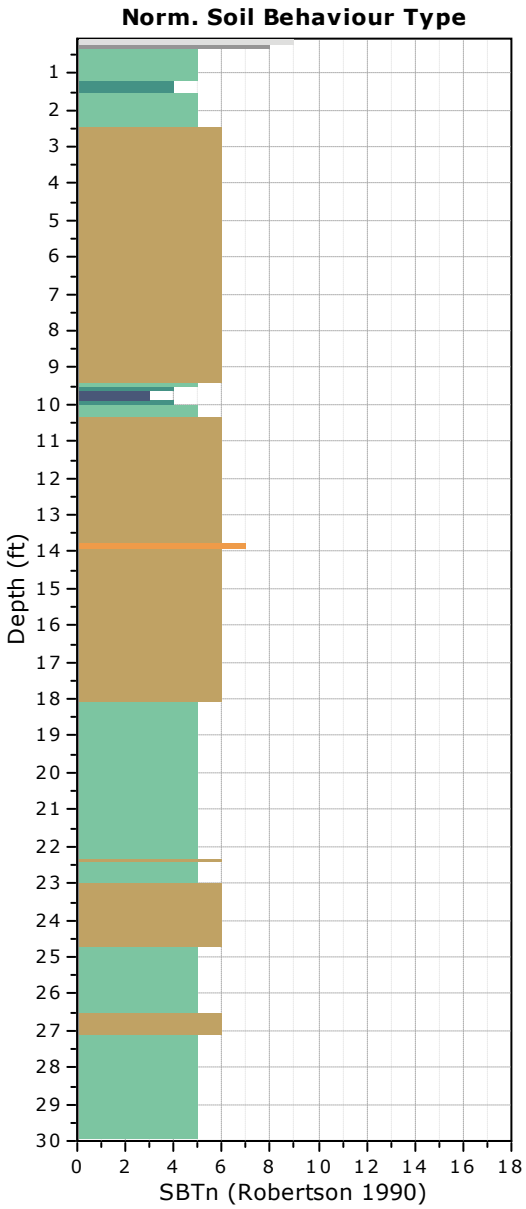
C-2
Total depth: 30.35 ft, Date: 5/13/2024
Surface Elevation: 64.18 ft
Coords: X:572075.39, Y:556031.84
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

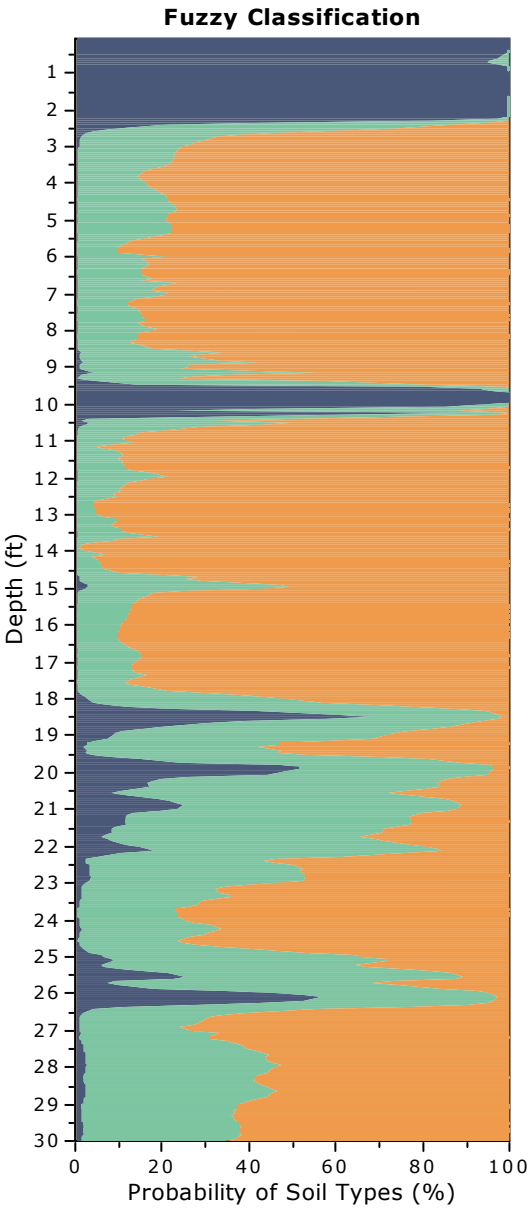
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







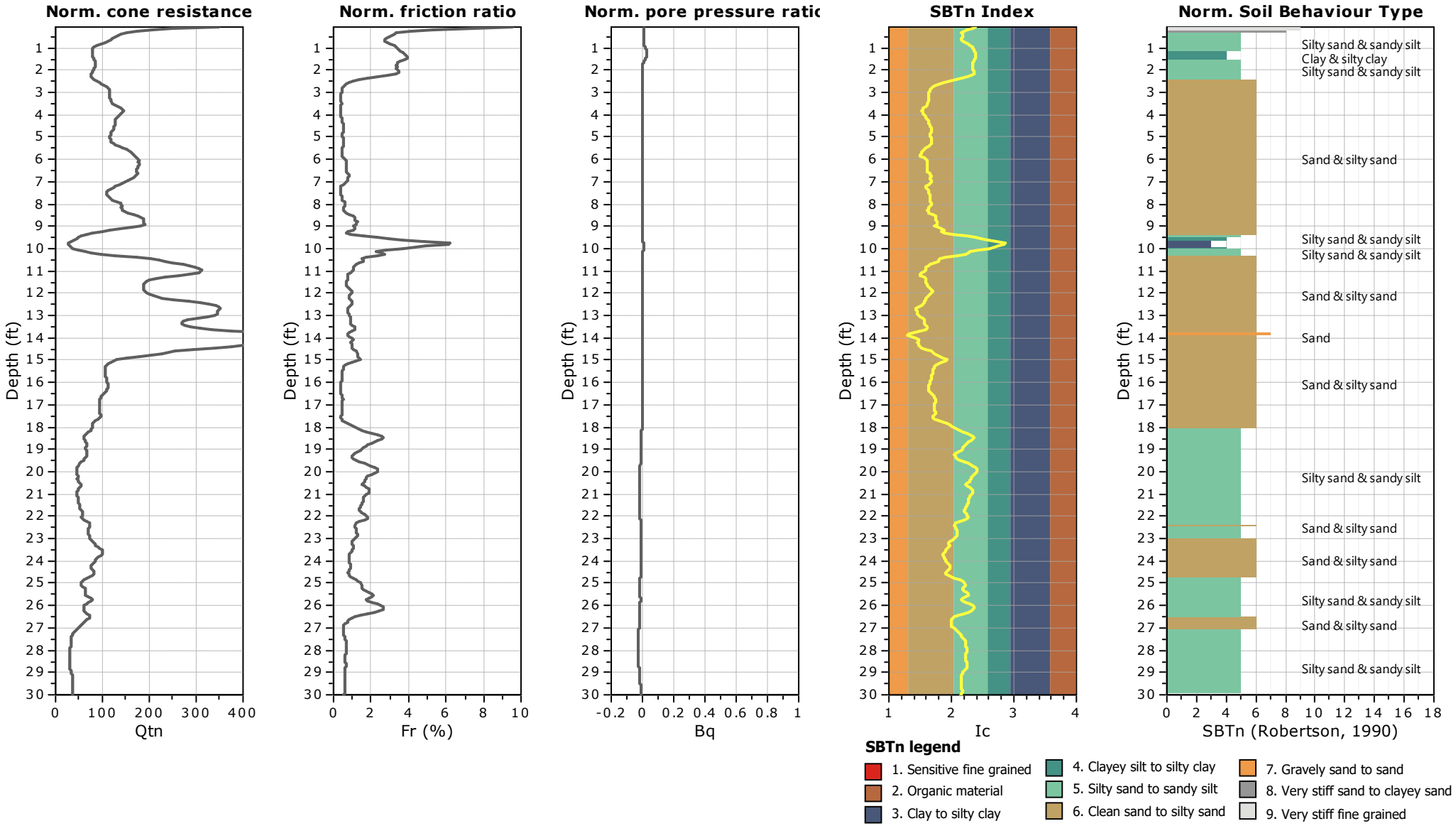
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-2
Total depth: 30.35 ft, Date: 5/13/2024
Surface Elevation: 64.18 ft
Coords: X:572075.39, Y:556031.84
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

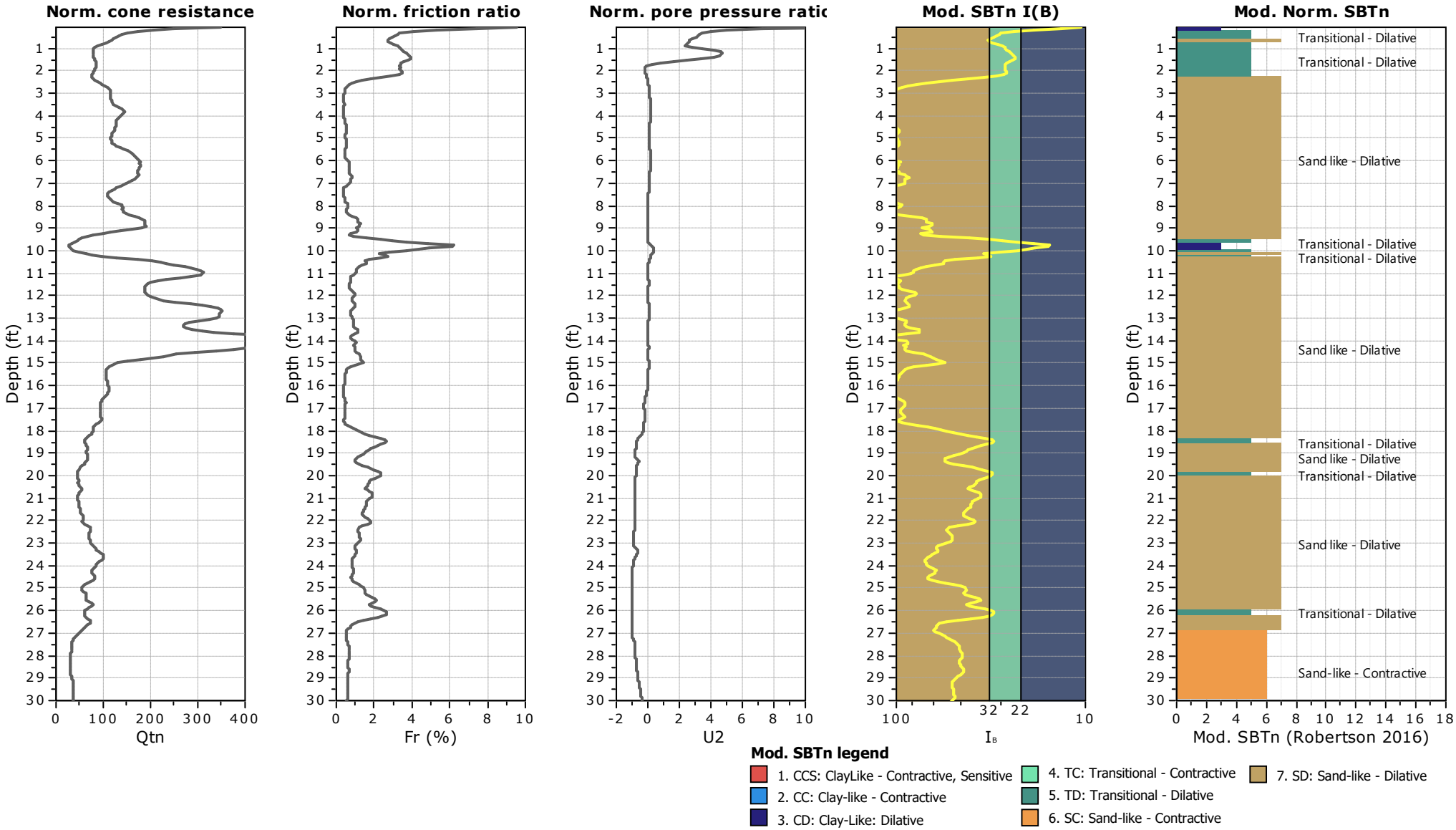
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-2
Total depth: 30.35 ft, Date: 5/13/2024
Surface Elevation: 64.18 ft
Coords: X:572075.39, Y:556031.84
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

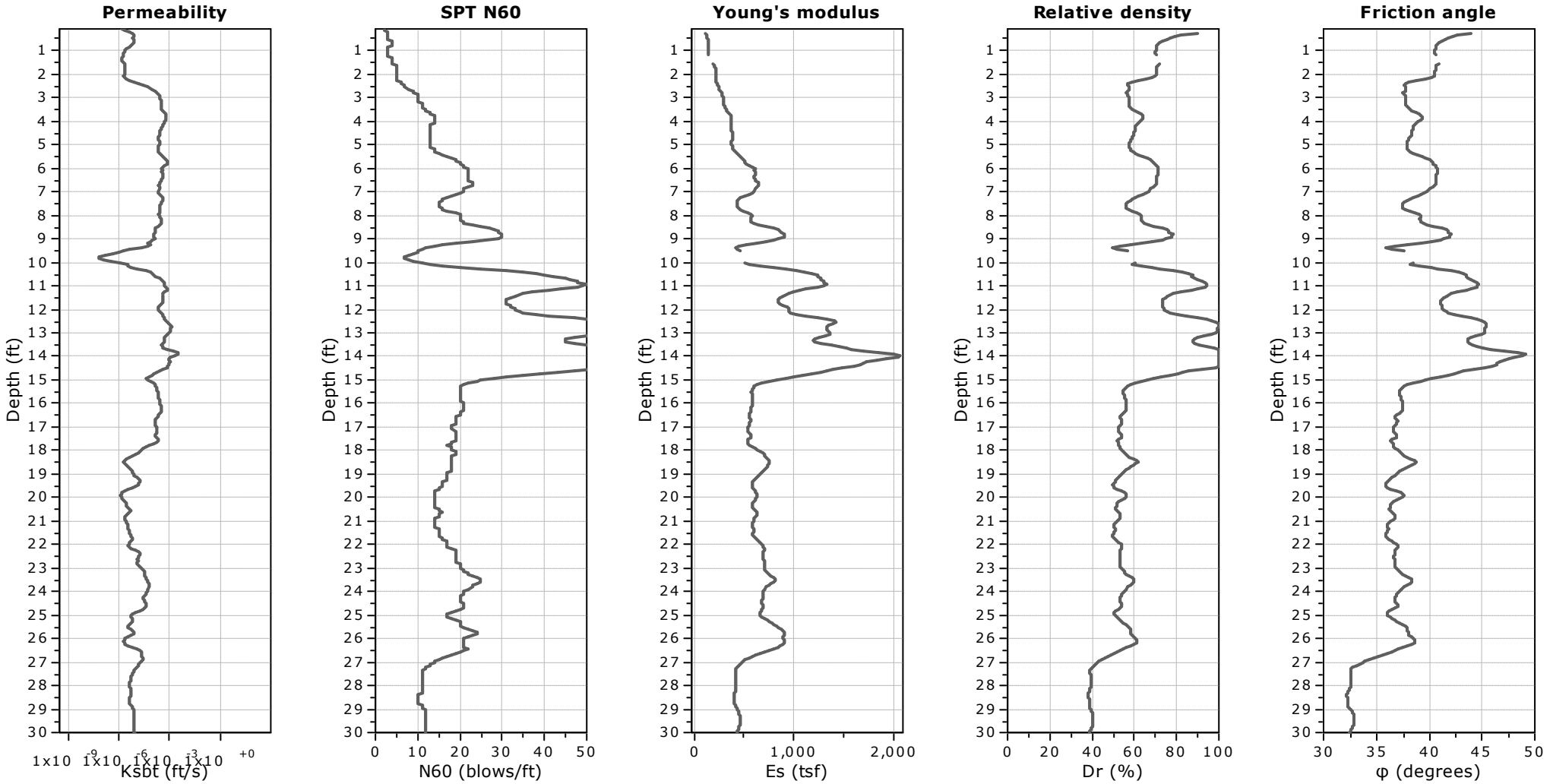
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-2
Total depth: 30.35 ft, Date: 5/13/2024
Surface Elevation: 64.18 ft
Coords: X:572075.39, Y:556031.84
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



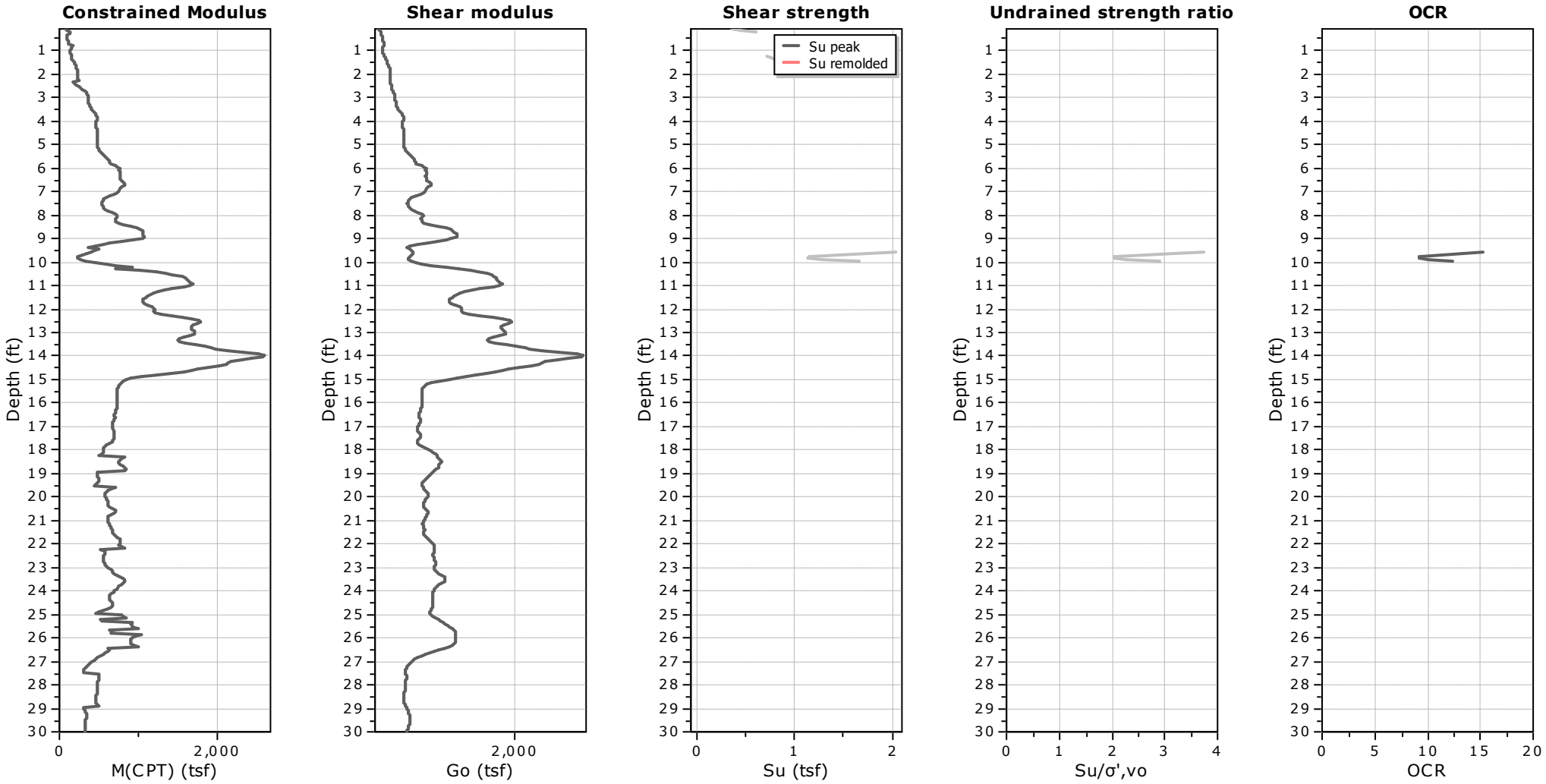
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-2
Total depth: 30.35 ft, Date: 5/13/2024
Surface Elevation: 64.18 ft
Coords: X:572075.39, Y:556031.84
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



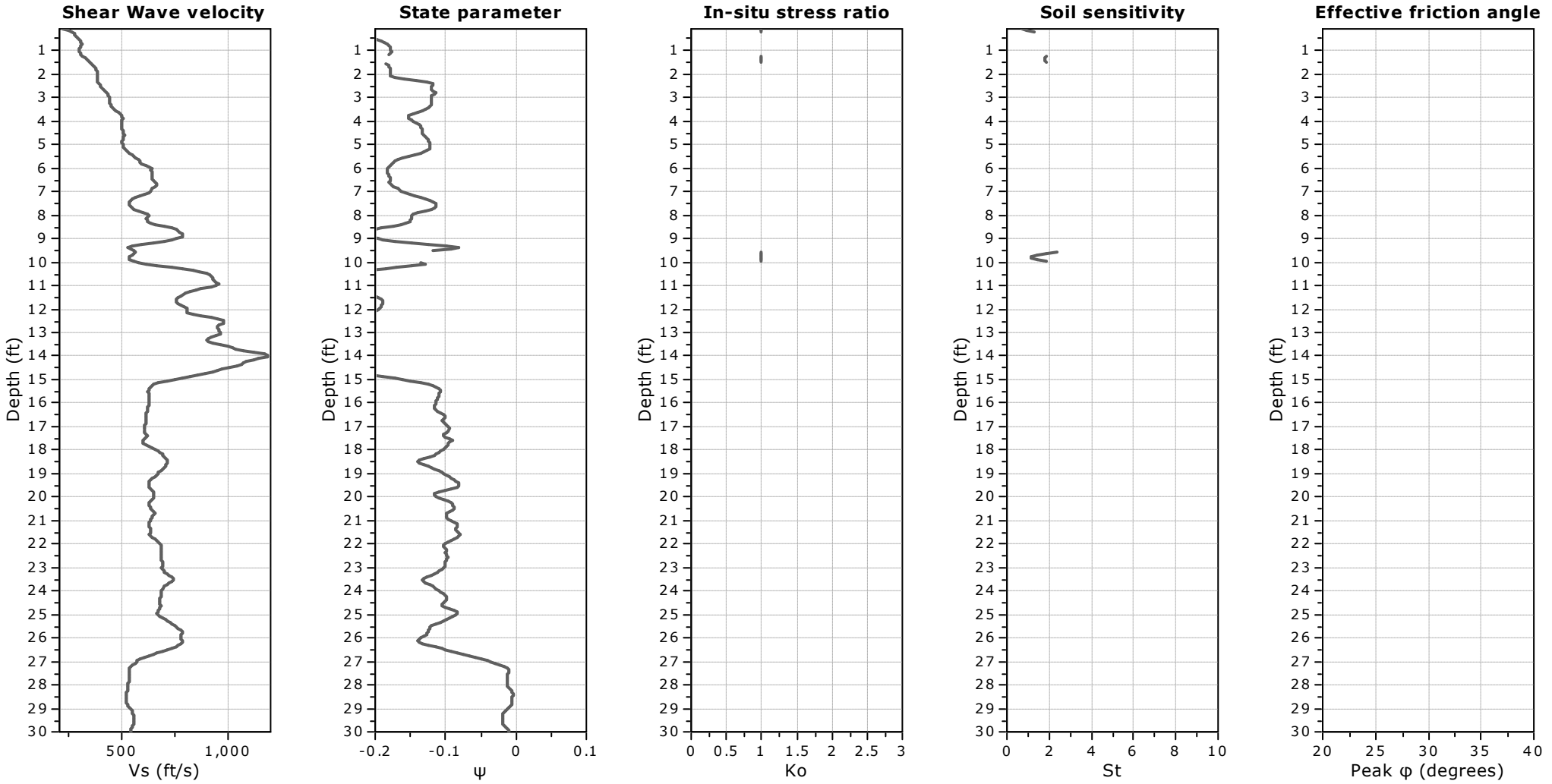
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-2
Total depth: 30.35 ft, Date: 5/13/2024
Surface Elevation: 64.18 ft
Coords: X:572075.39, Y:556031.84
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



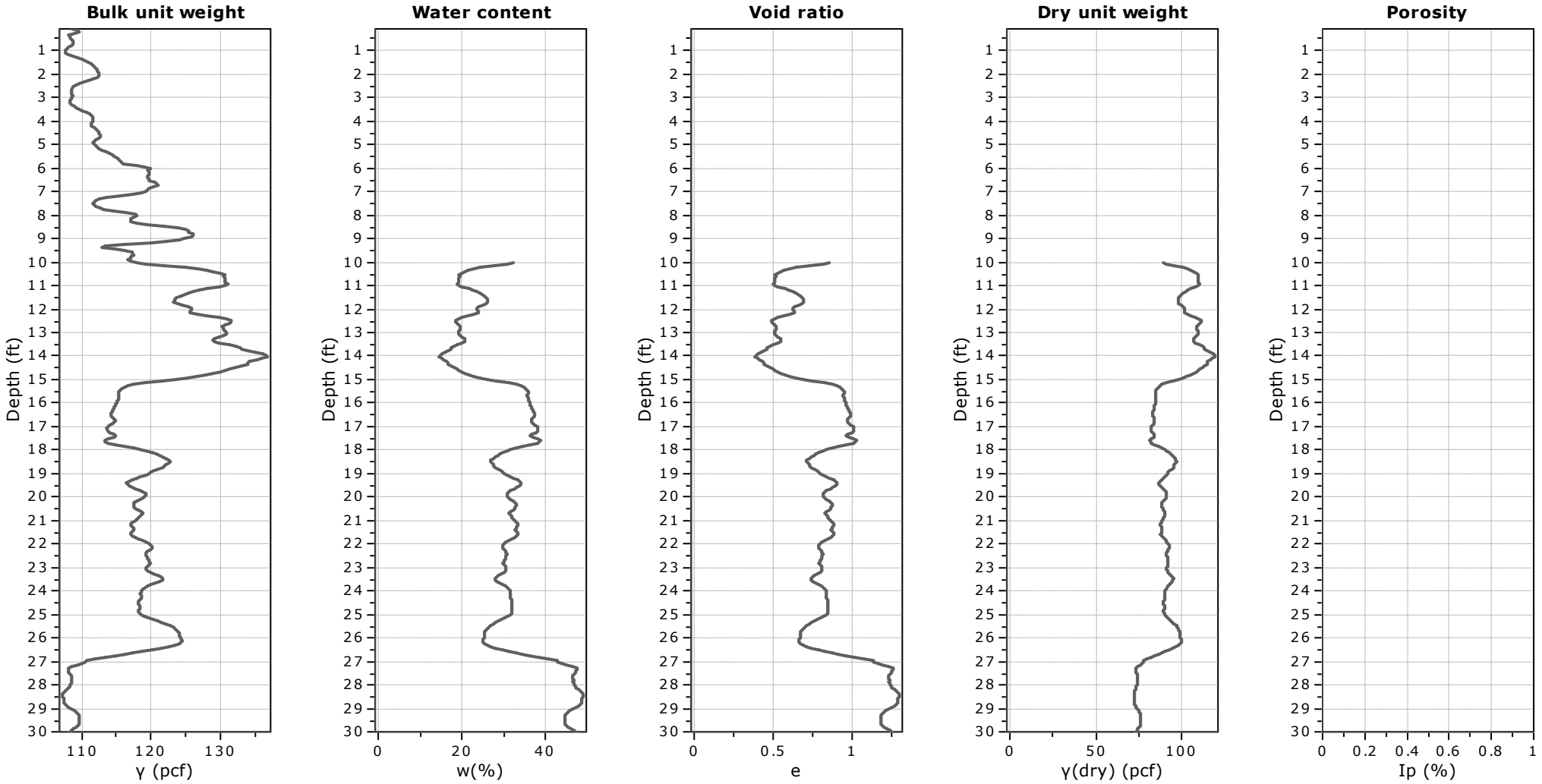
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-2
Total depth: 30.35 ft, Date: 5/13/2024
Surface Elevation: 64.18 ft
Coords: X:572075.39, Y:556031.84
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

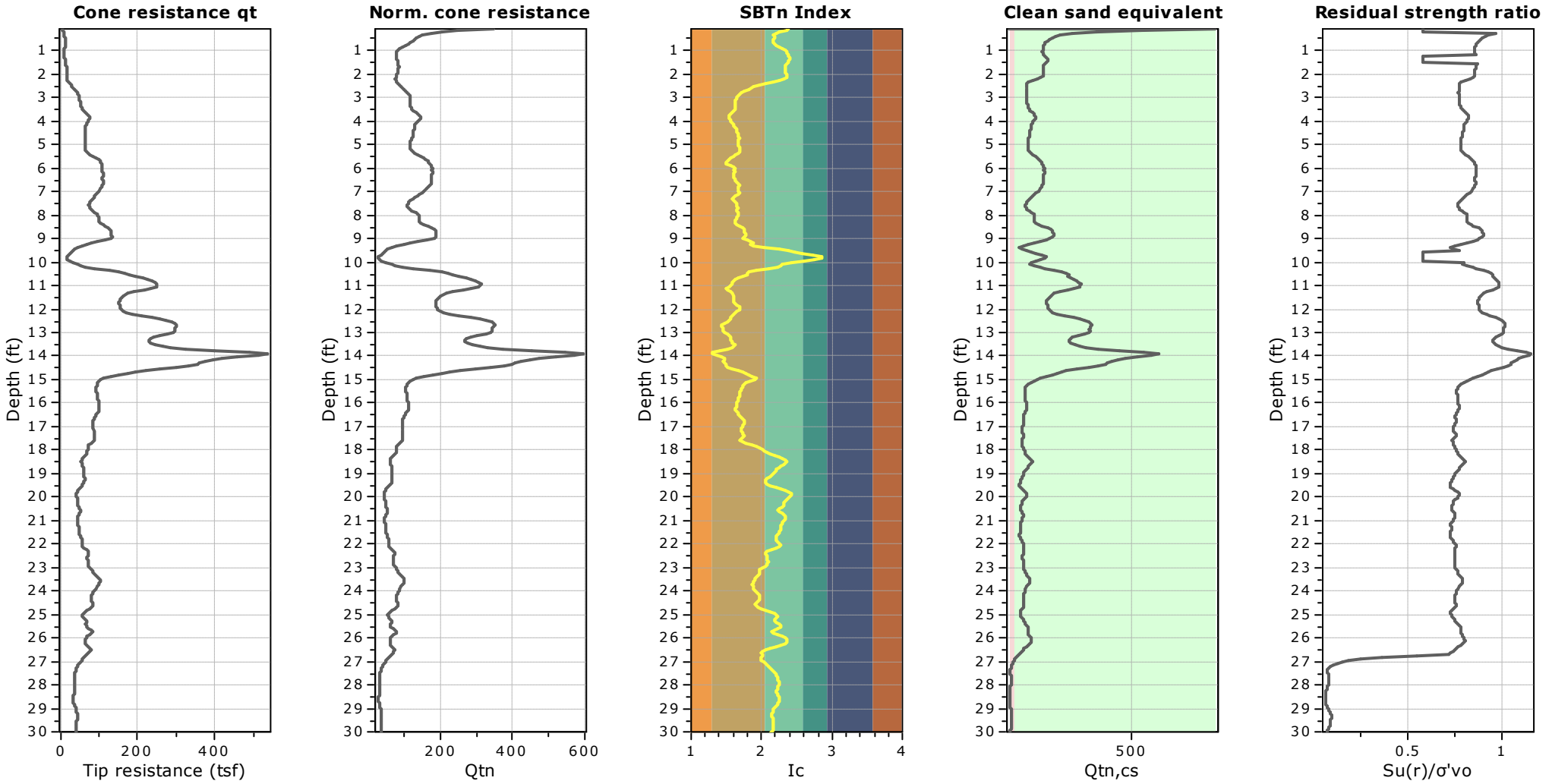
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

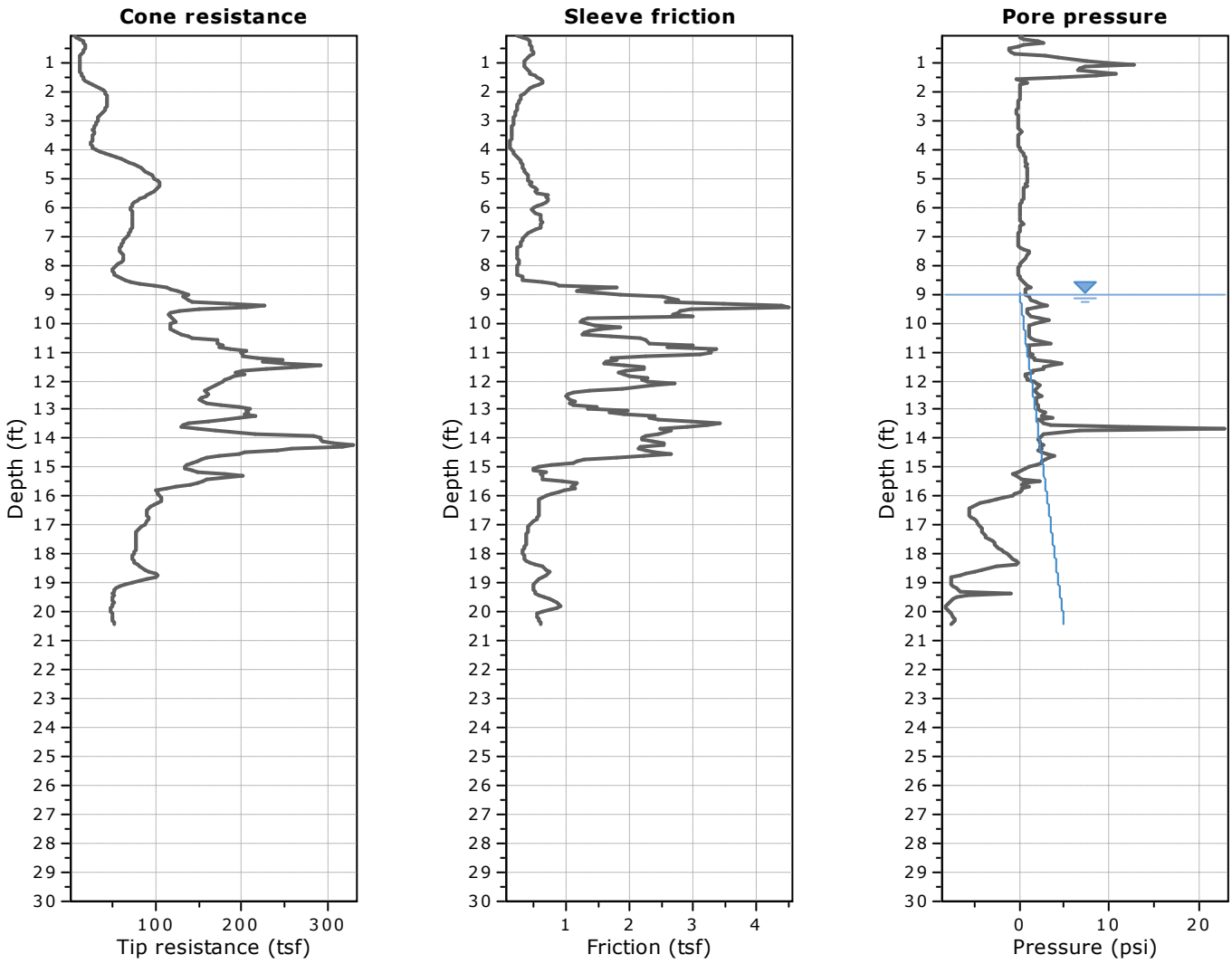


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

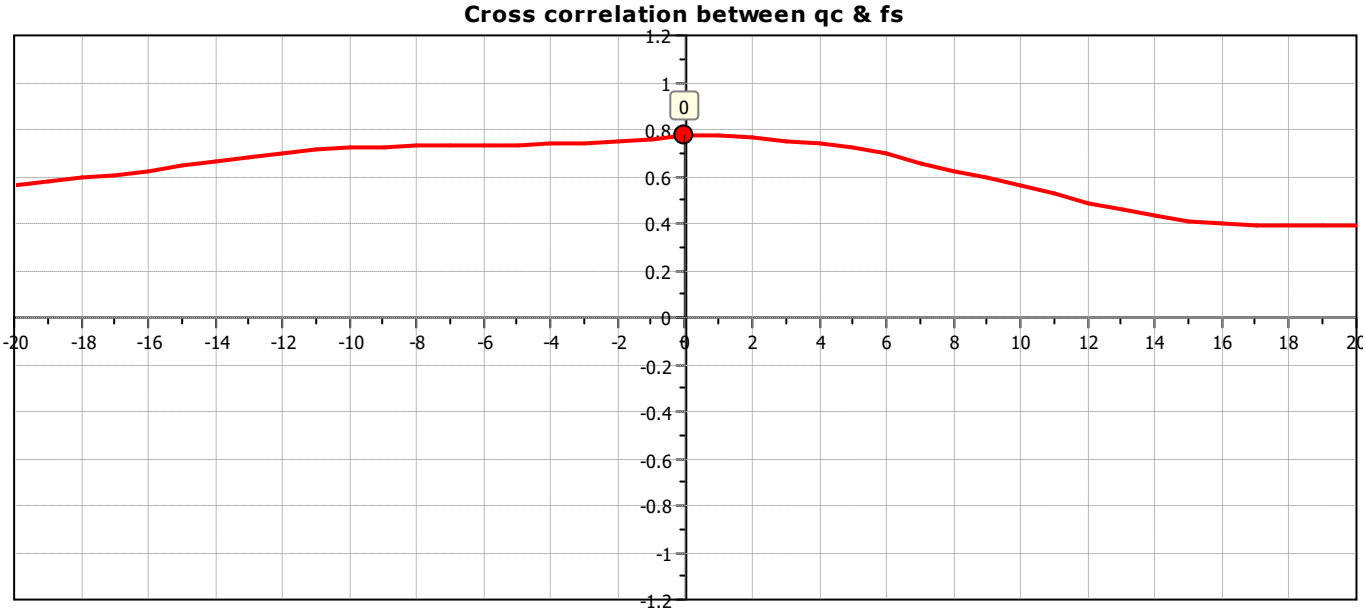
C-2
Total depth: 30.35 ft, Date: 5/13/2024
Surface Elevation: 64.18 ft
Coords: X:572075.39, Y:556031.84
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

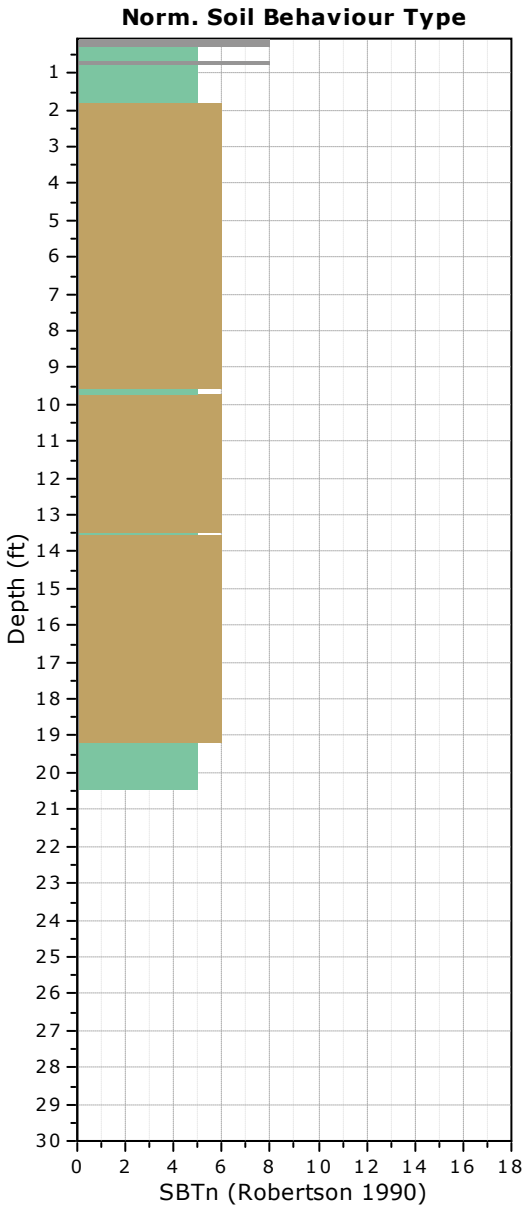
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

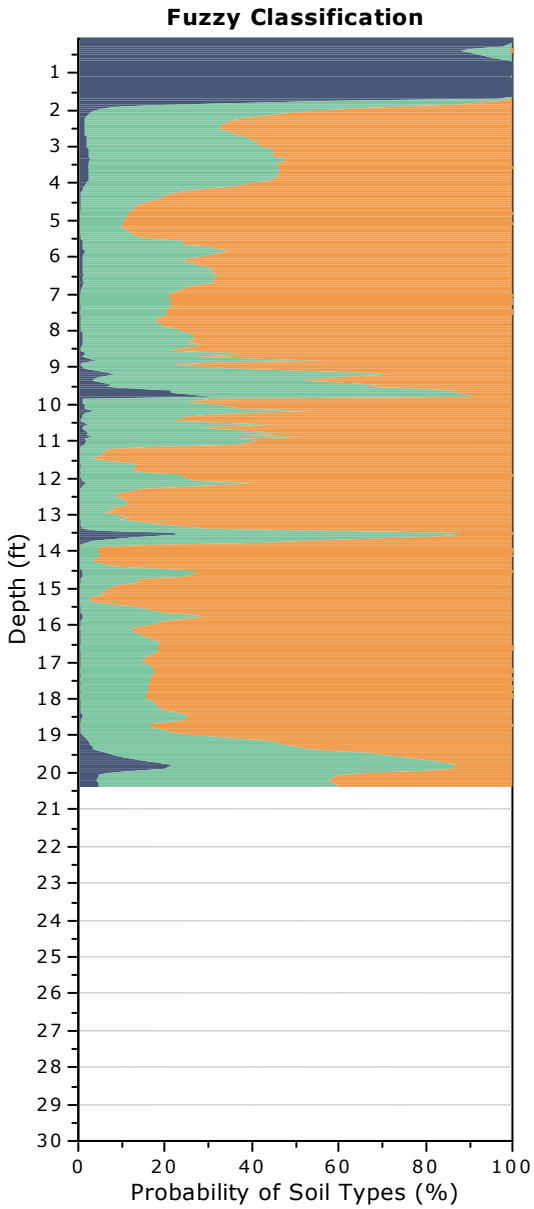




The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







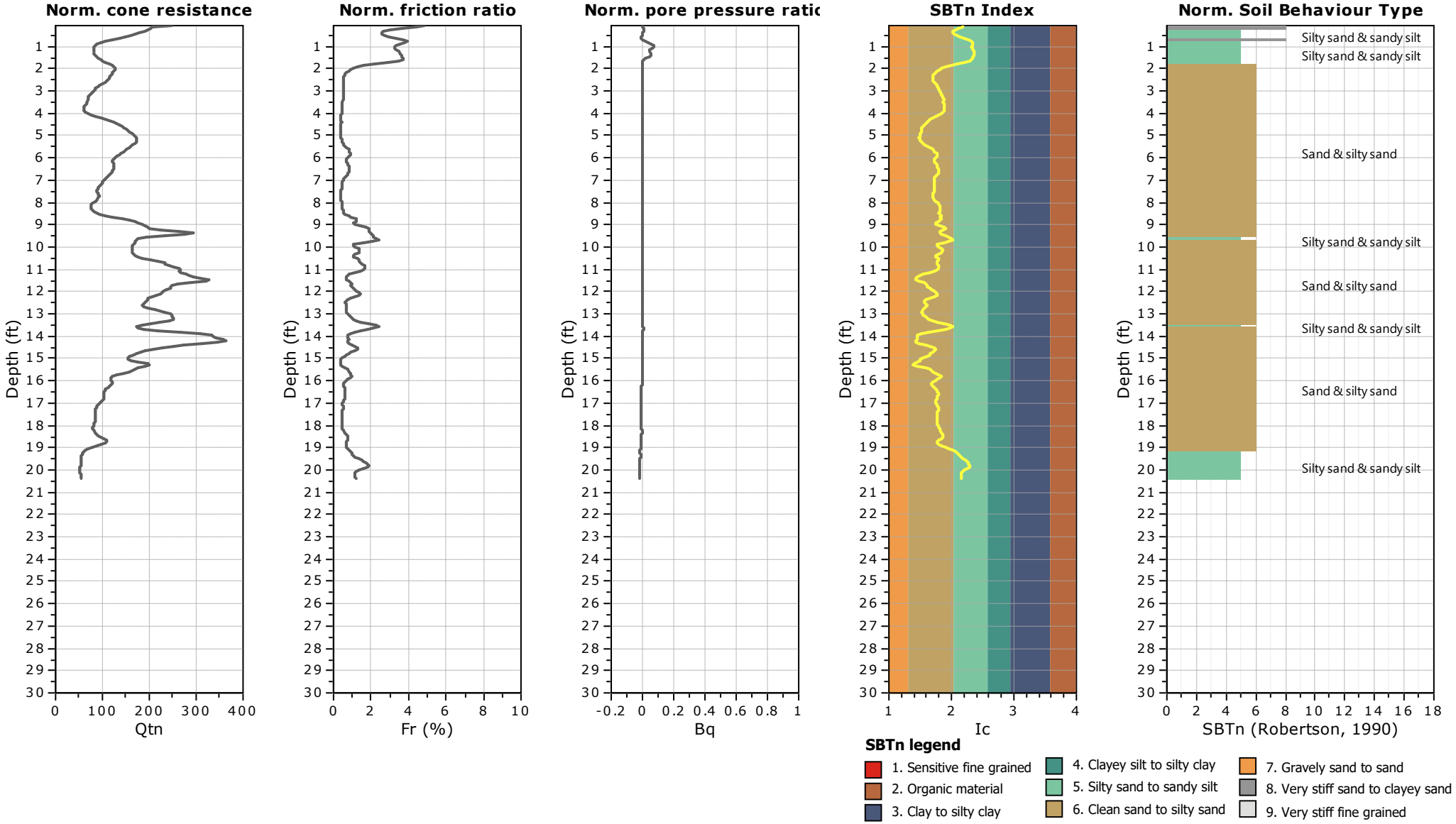
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-3
Total depth: 20.40 ft, Date: 5/13/2024
Surface Elevation: 64.20 ft
Coords: X:572136.62, Y:555997.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

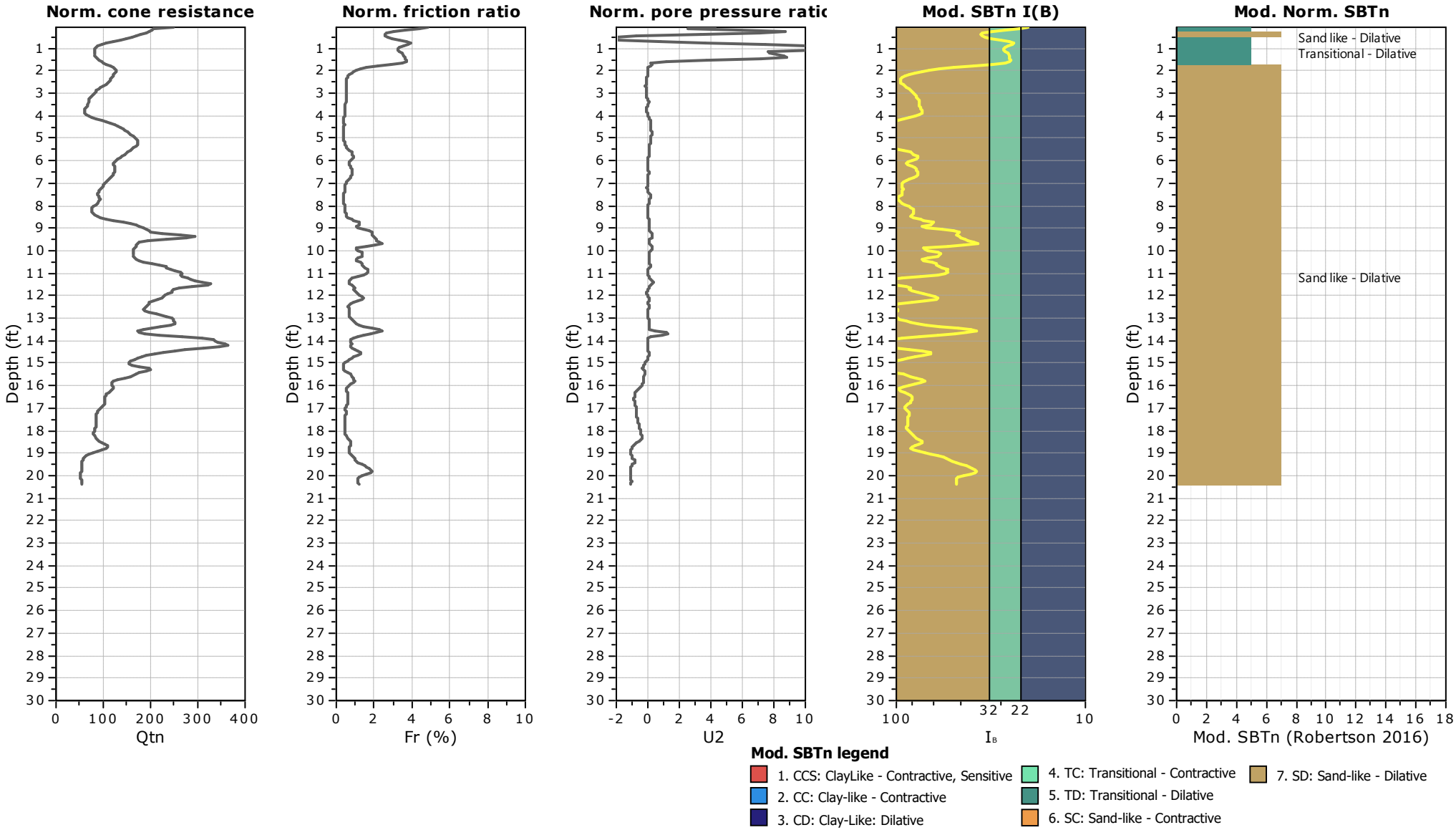
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-3
Total depth: 20.40 ft, Date: 5/13/2024
Surface Elevation: 64.20 ft
Coords: X:572136.62, Y:555997.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

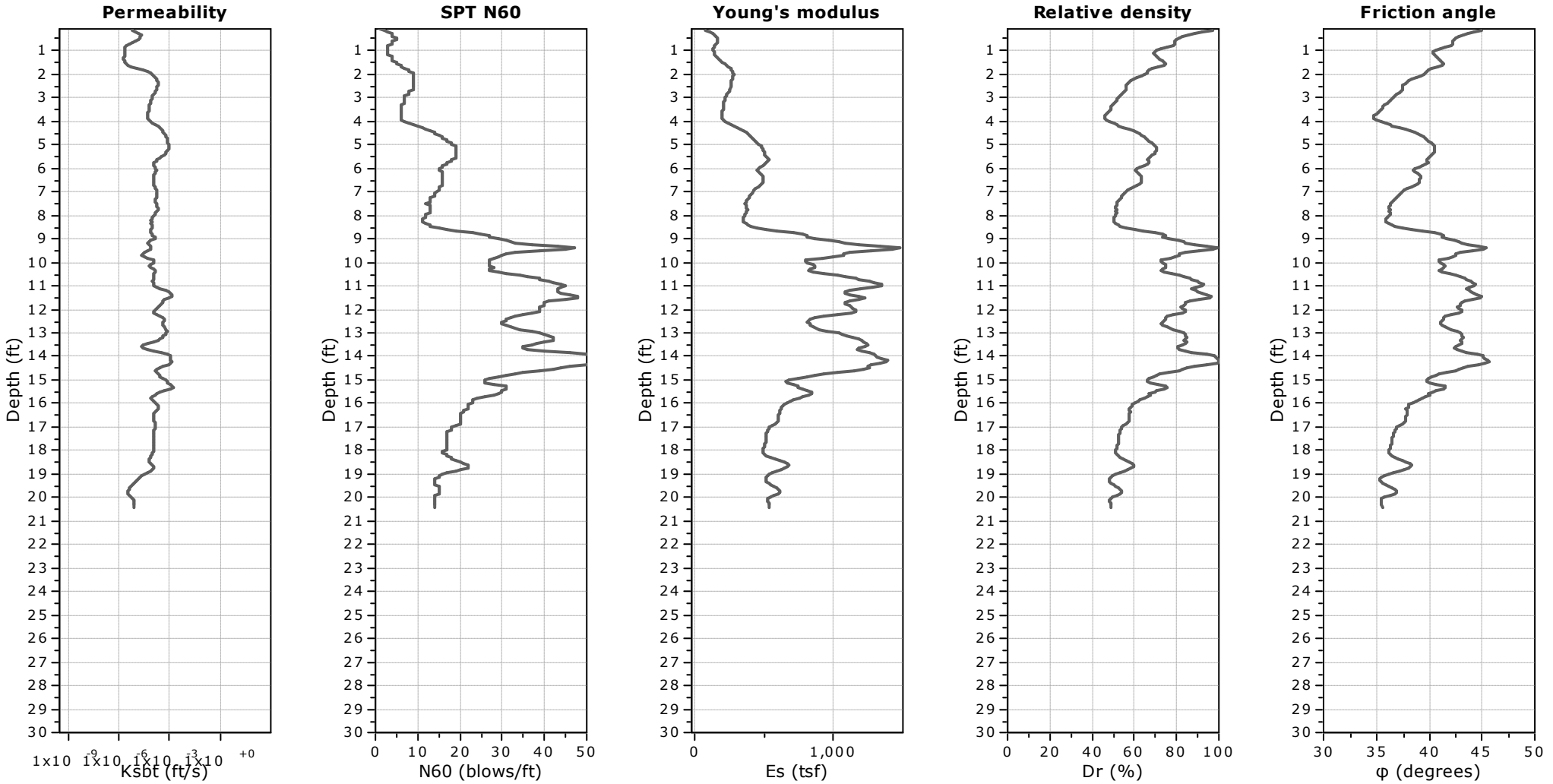
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-3
Total depth: 20.40 ft, Date: 5/13/2024
Surface Elevation: 64.20 ft
Coords: X:572136.62, Y:555997.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



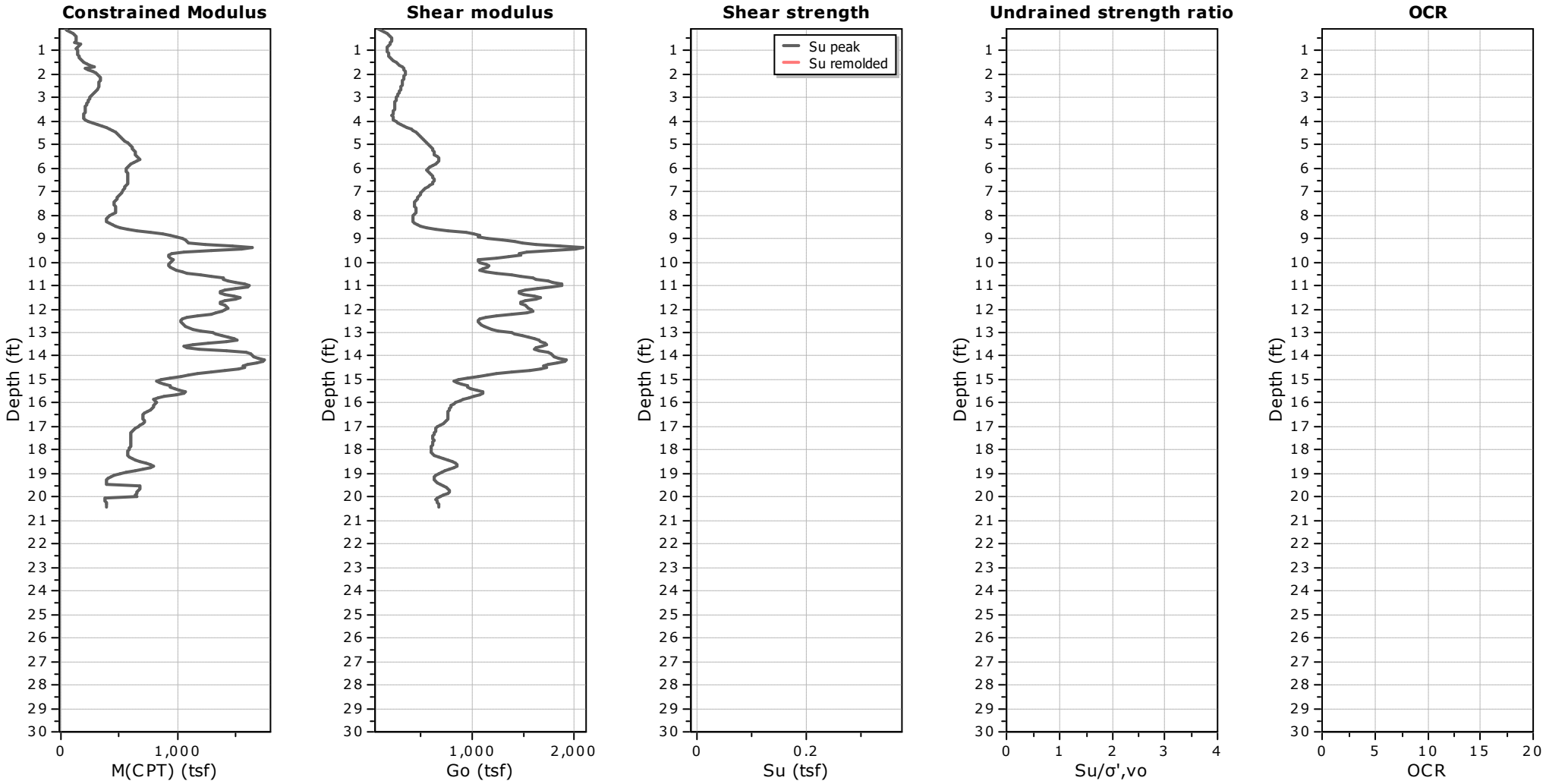
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-3
Total depth: 20.40 ft, Date: 5/13/2024
Surface Elevation: 64.20 ft
Coords: X:572136.62, Y:555997.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



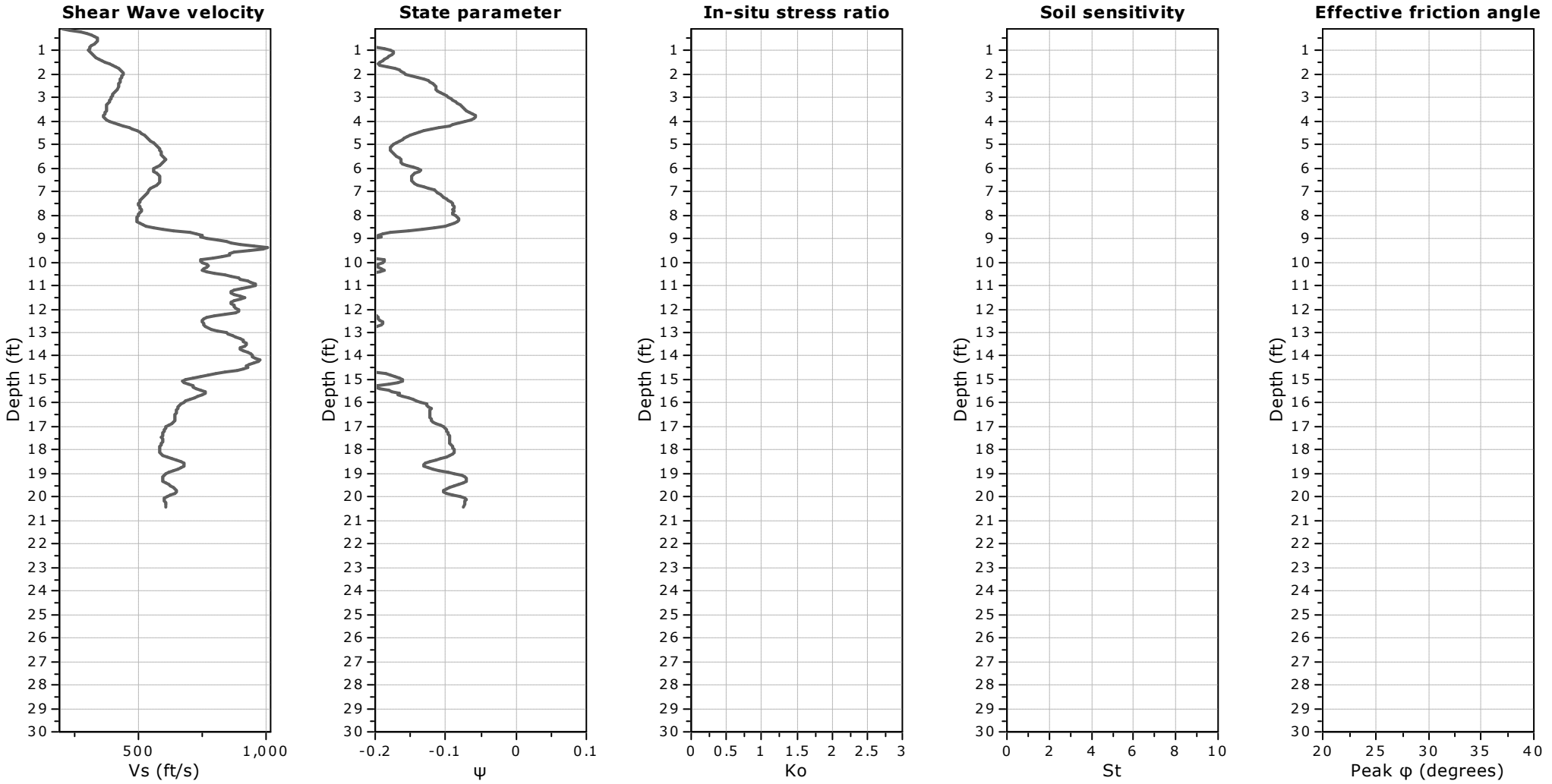
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-3
Total depth: 20.40 ft, Date: 5/13/2024
Surface Elevation: 64.20 ft
Coords: X:572136.62, Y:555997.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



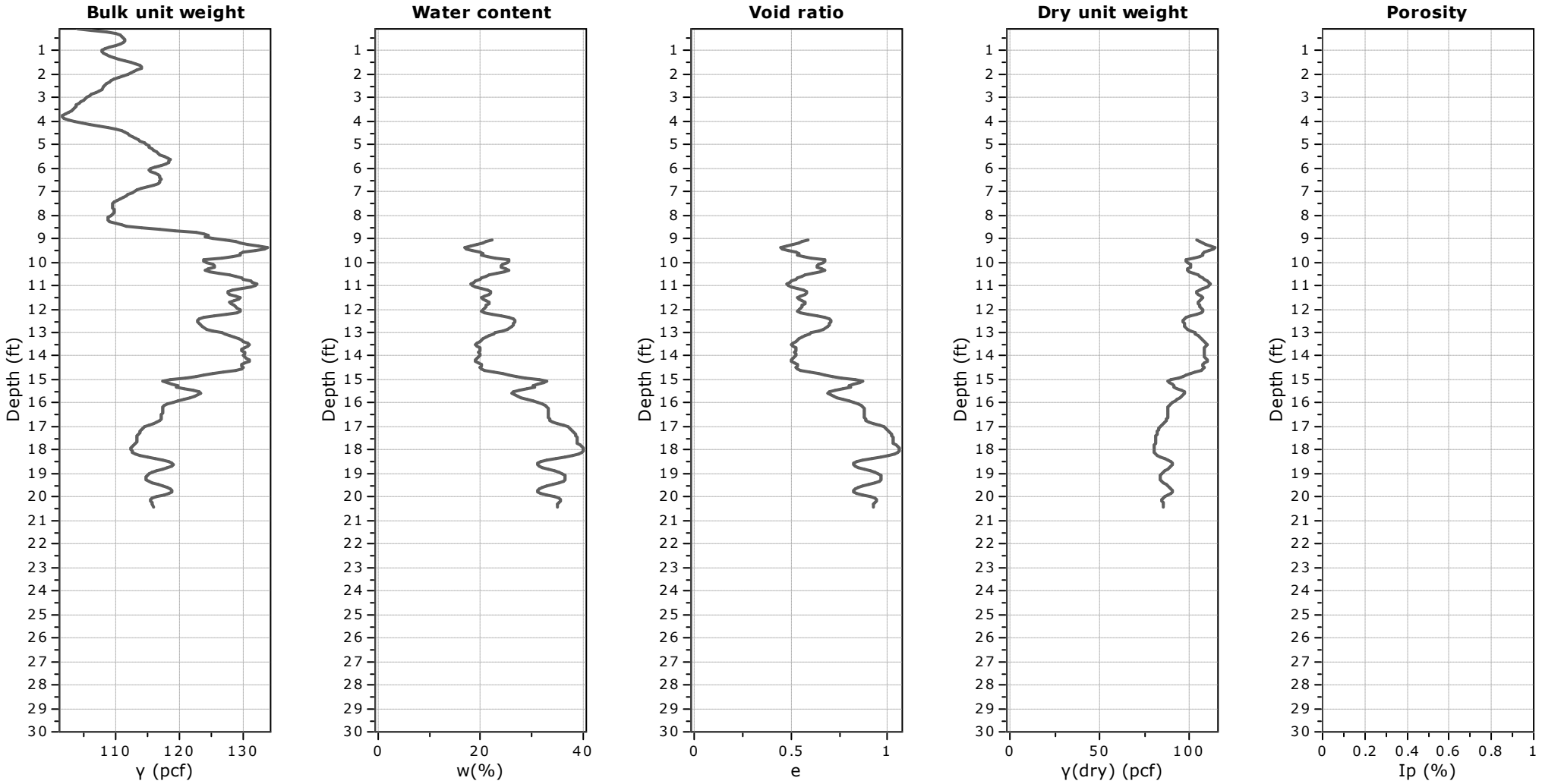
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-3
Total depth: 20.40 ft, Date: 5/13/2024
Surface Elevation: 64.20 ft
Coords: X:572136.62, Y:555997.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

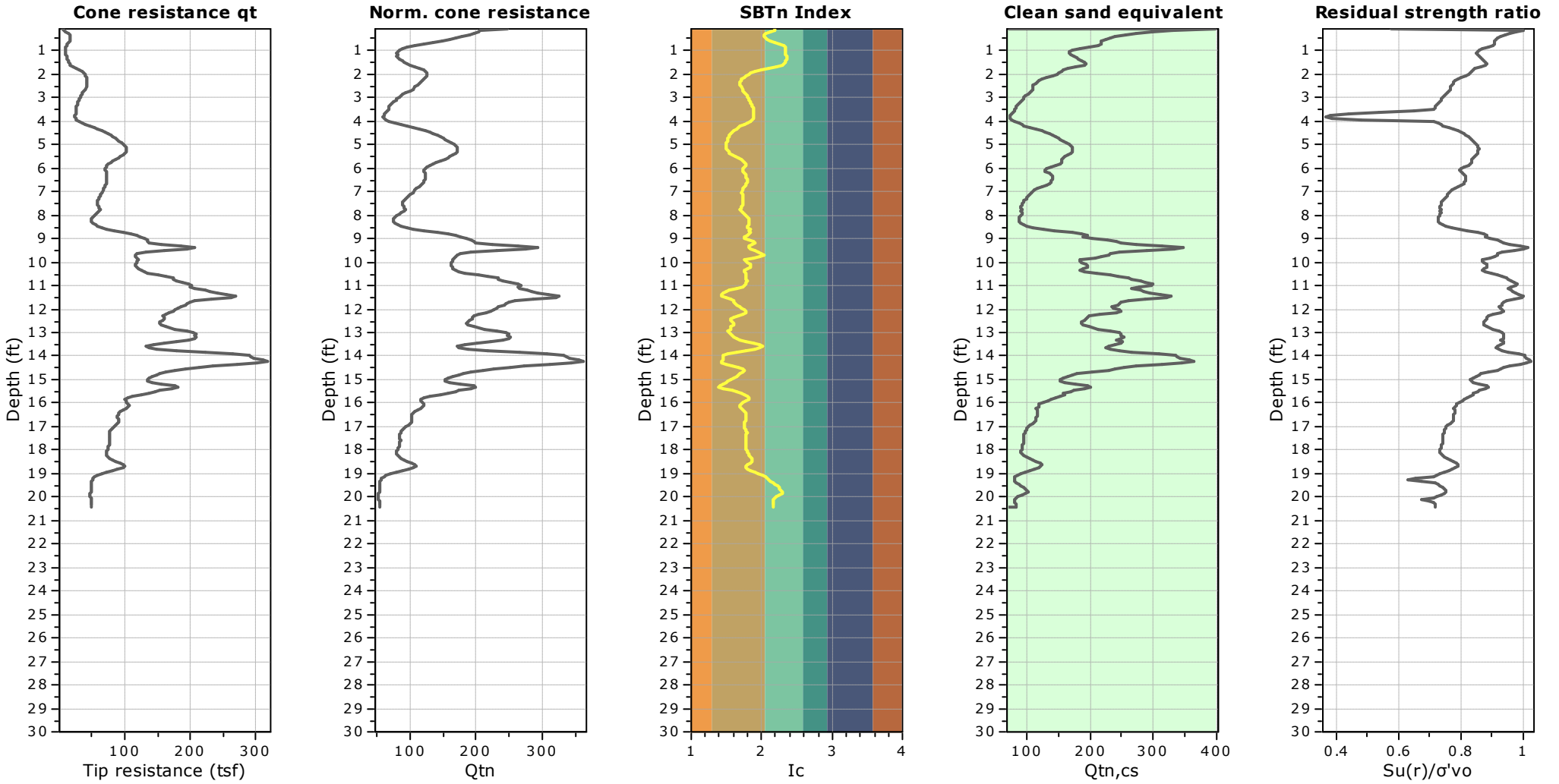
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

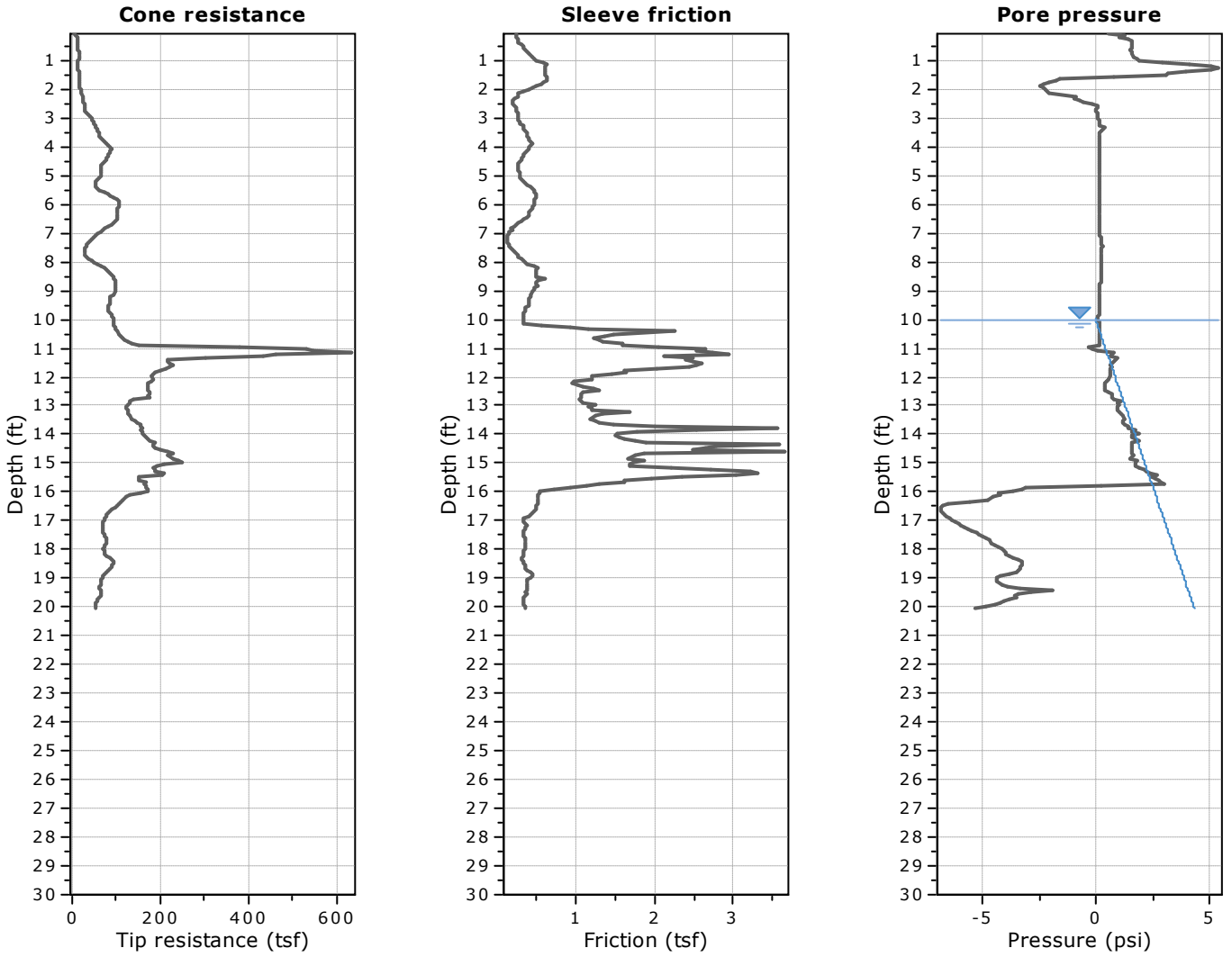


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

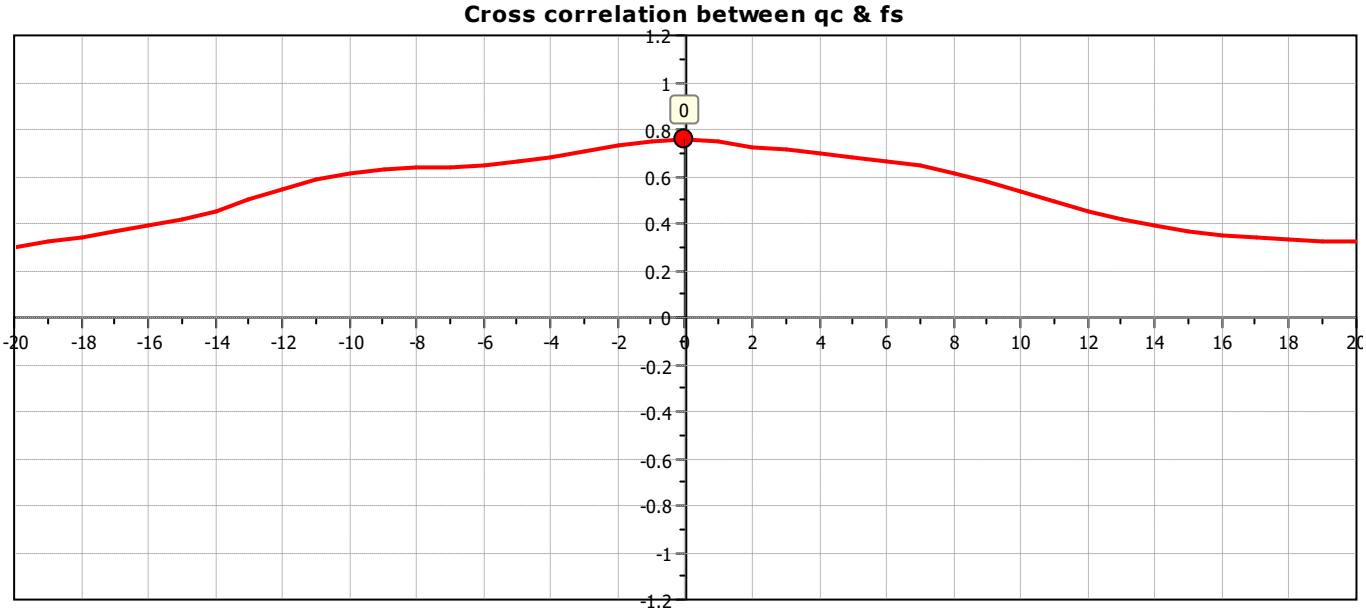
C-3
Total depth: 20.40 ft, Date: 5/13/2024
Surface Elevation: 64.20 ft
Coords: X:572136.62, Y:555997.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

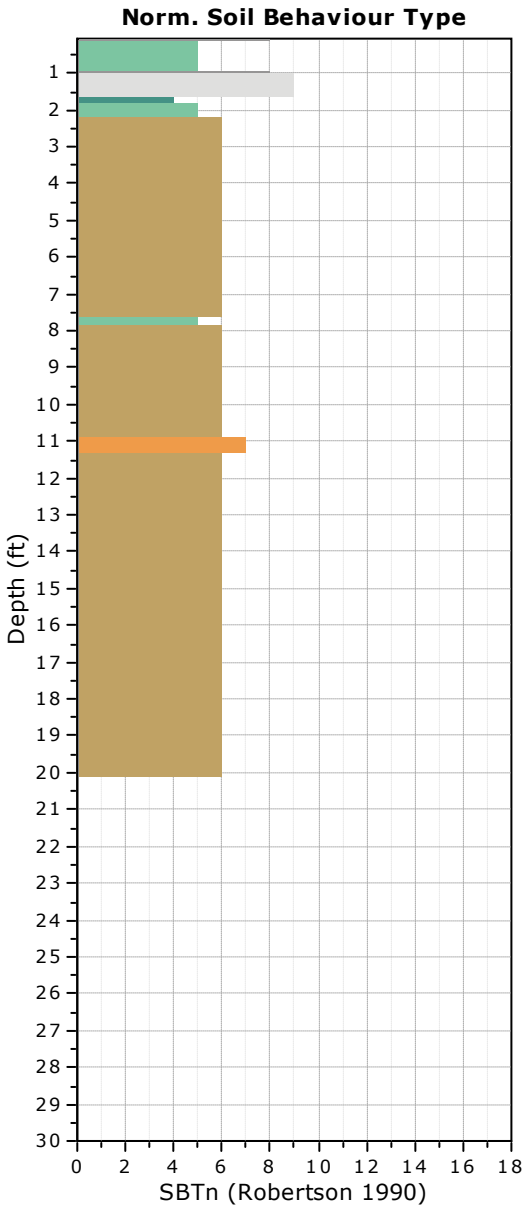
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

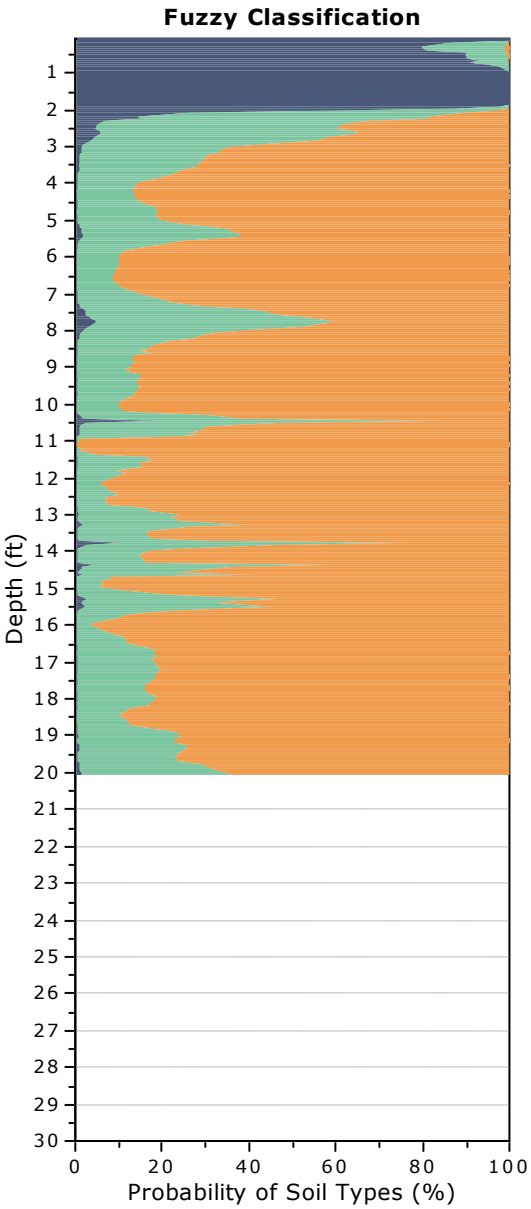




The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







Fuzzy classifiaction legend

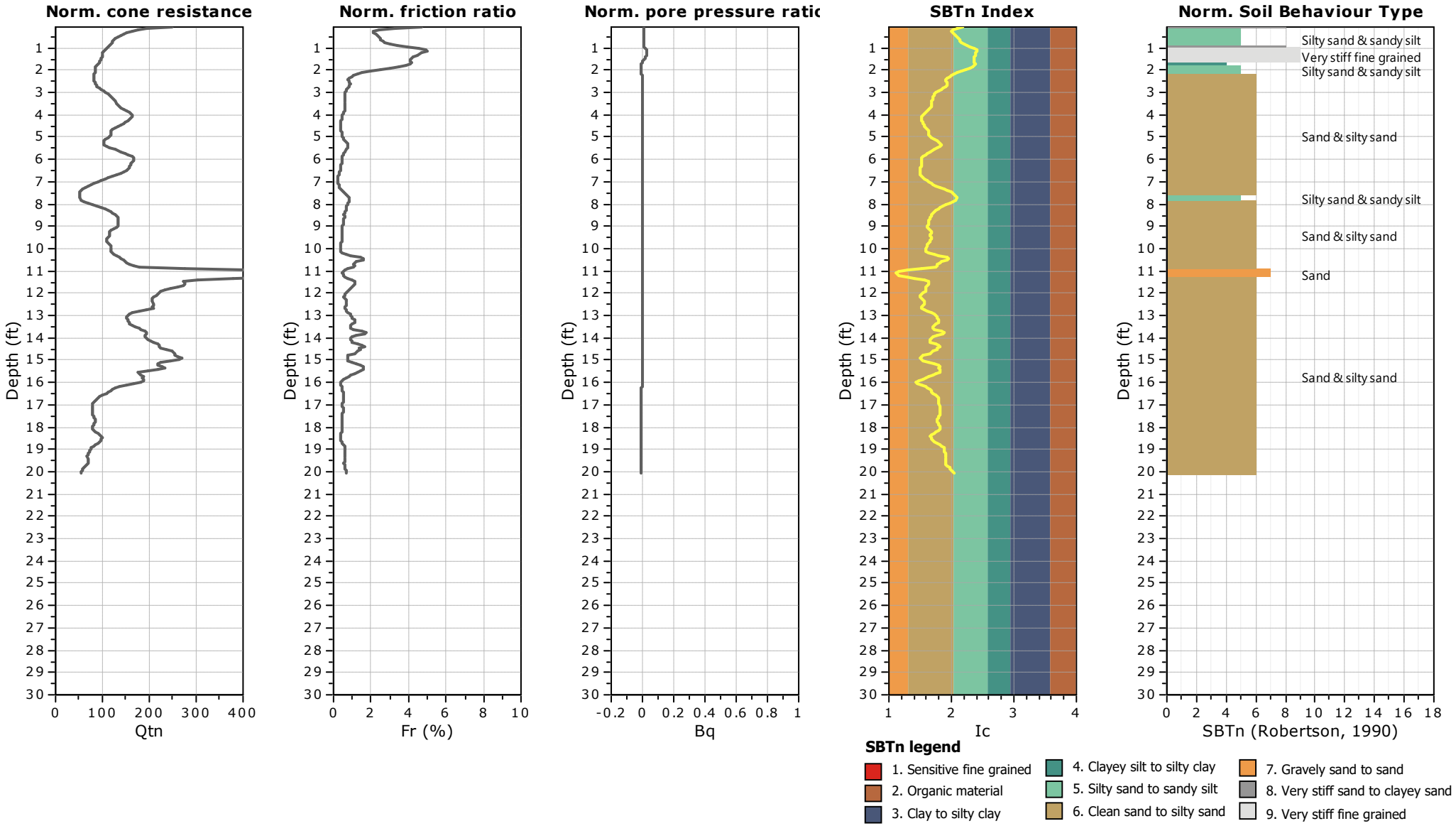
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-4

Total depth: 20.05 ft, Date: 5/13/2024
Surface Elevation: 65.24 ft
Coords: X:572043.89, Y:555976.94
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

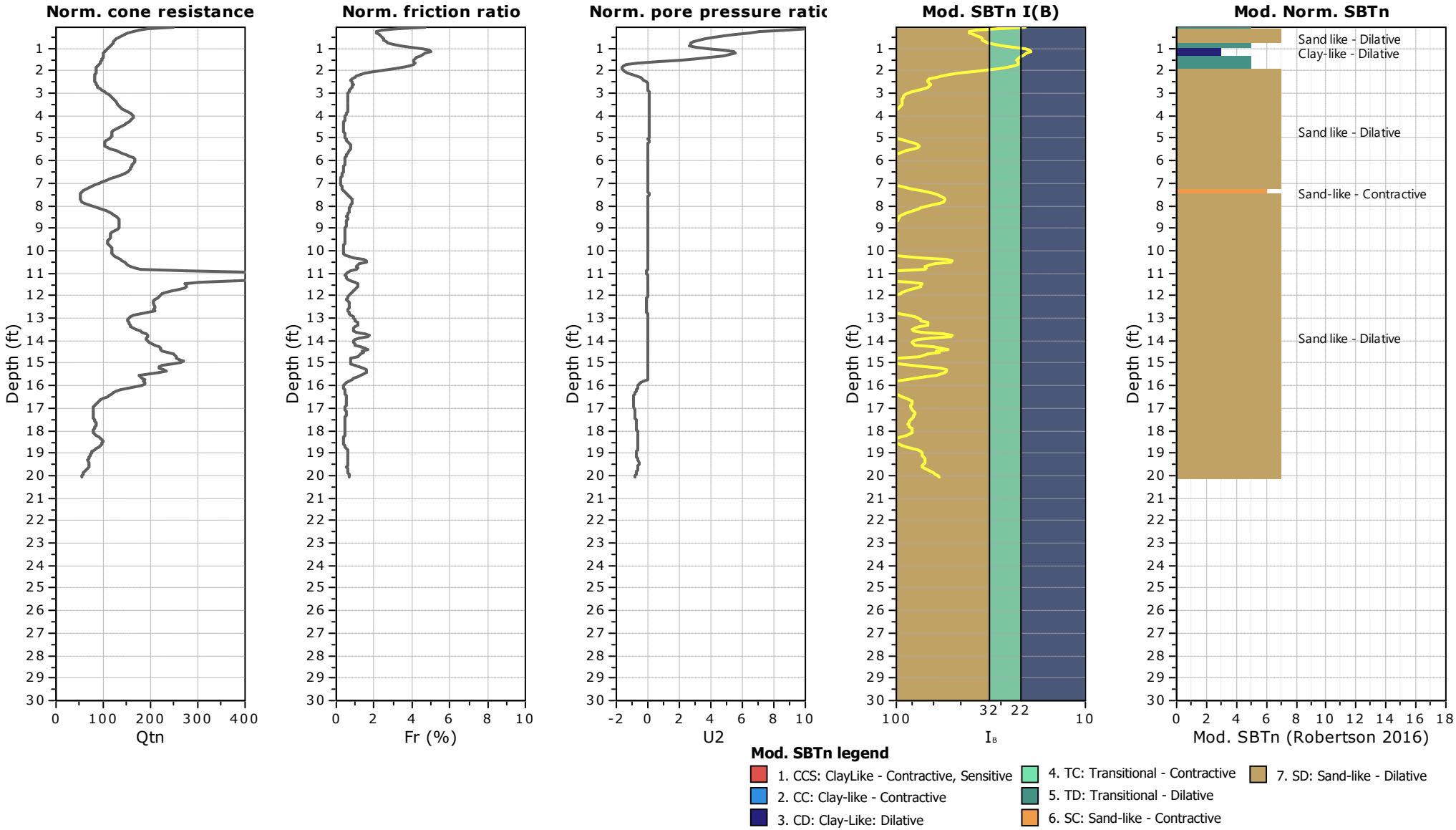
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-4
Total depth: 20.05 ft, Date: 5/13/2024
Surface Elevation: 65.24 ft
Coords: X:572043.89, Y:555976.94
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

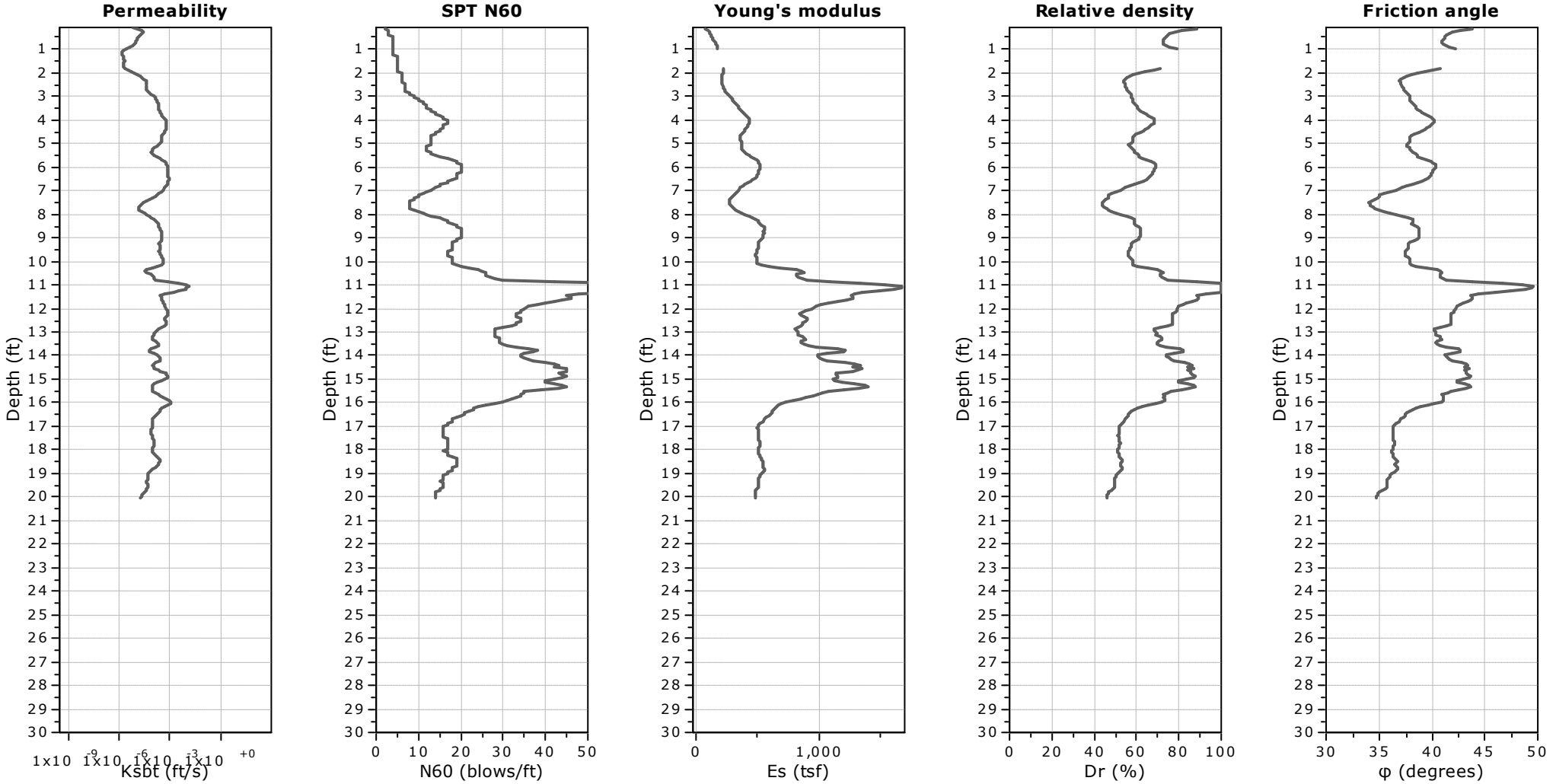
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-4
Total depth: 20.05 ft, Date: 5/13/2024
Surface Elevation: 65.24 ft
Coords: X:572043.89, Y:555976.94
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



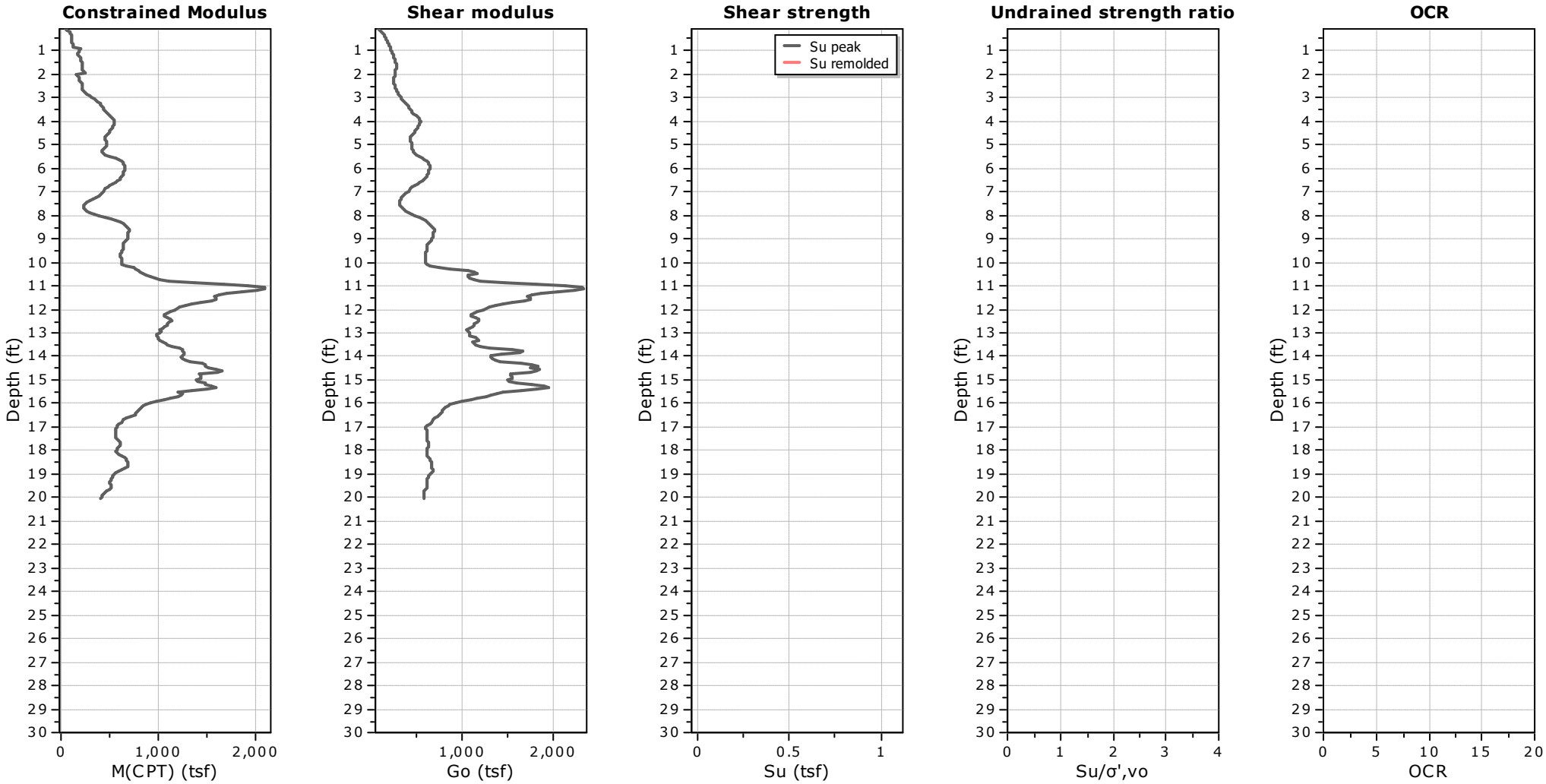
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-4
Total depth: 20.05 ft, Date: 5/13/2024
Surface Elevation: 65.24 ft
Coords: X:572043.89, Y:555976.94
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



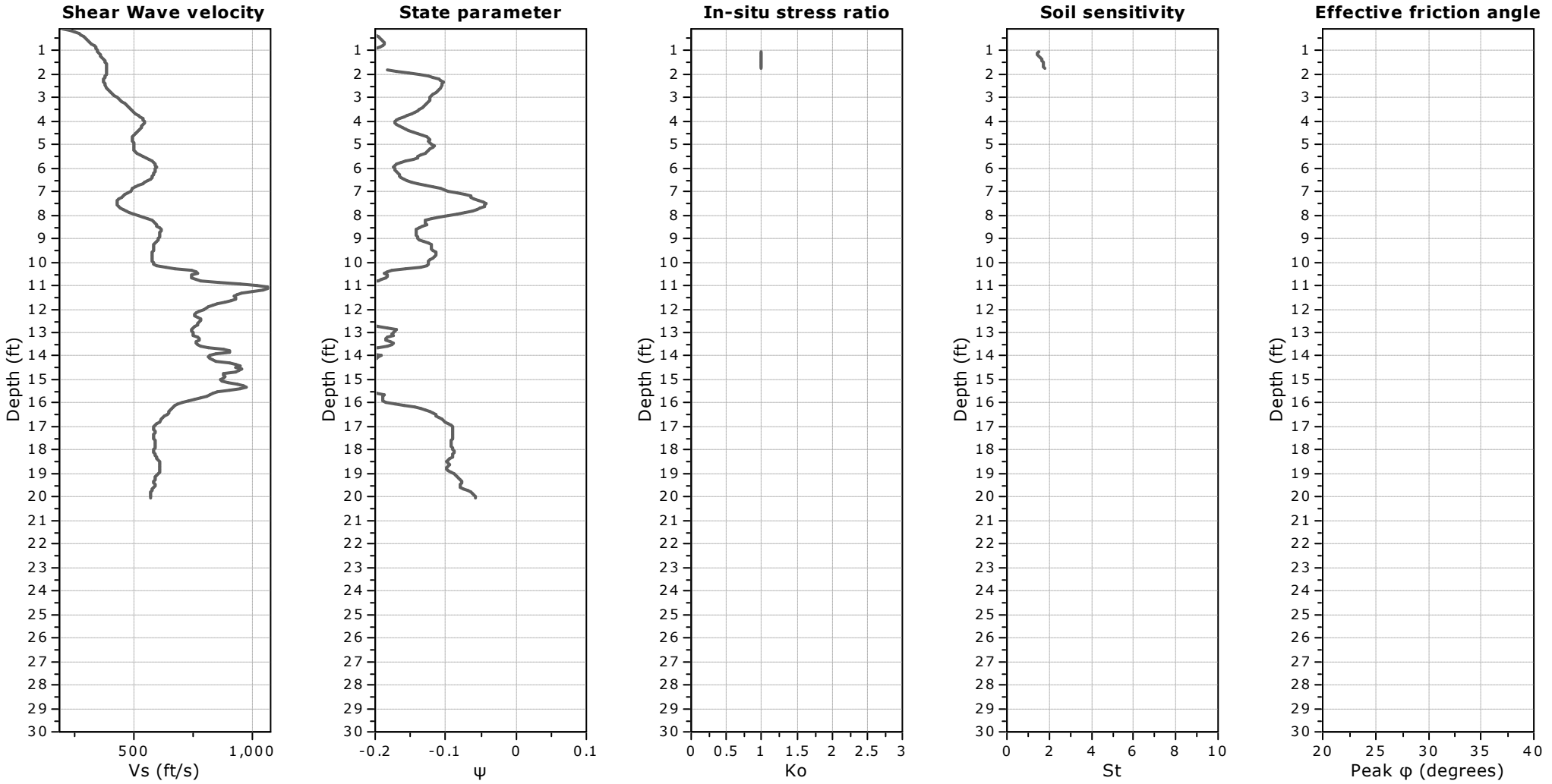
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-4
Total depth: 20.05 ft, Date: 5/13/2024
Surface Elevation: 65.24 ft
Coords: X:572043.89, Y:555976.94
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Calculation parameters

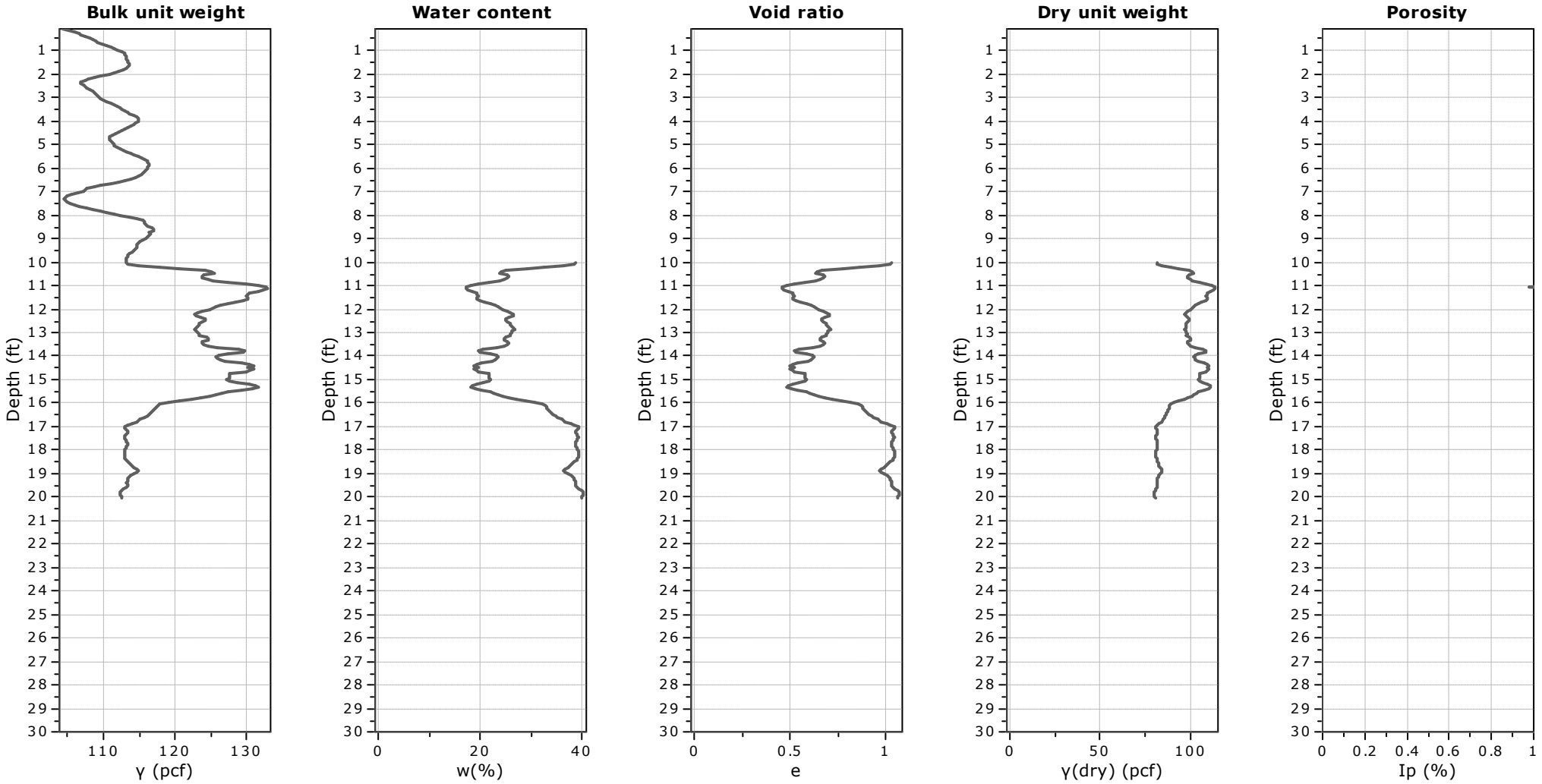
Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-4

Total depth: 20.05 ft, Date: 5/13/2024
Surface Elevation: 65.24 ft
Coords: X:572043.89, Y:555976.94
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

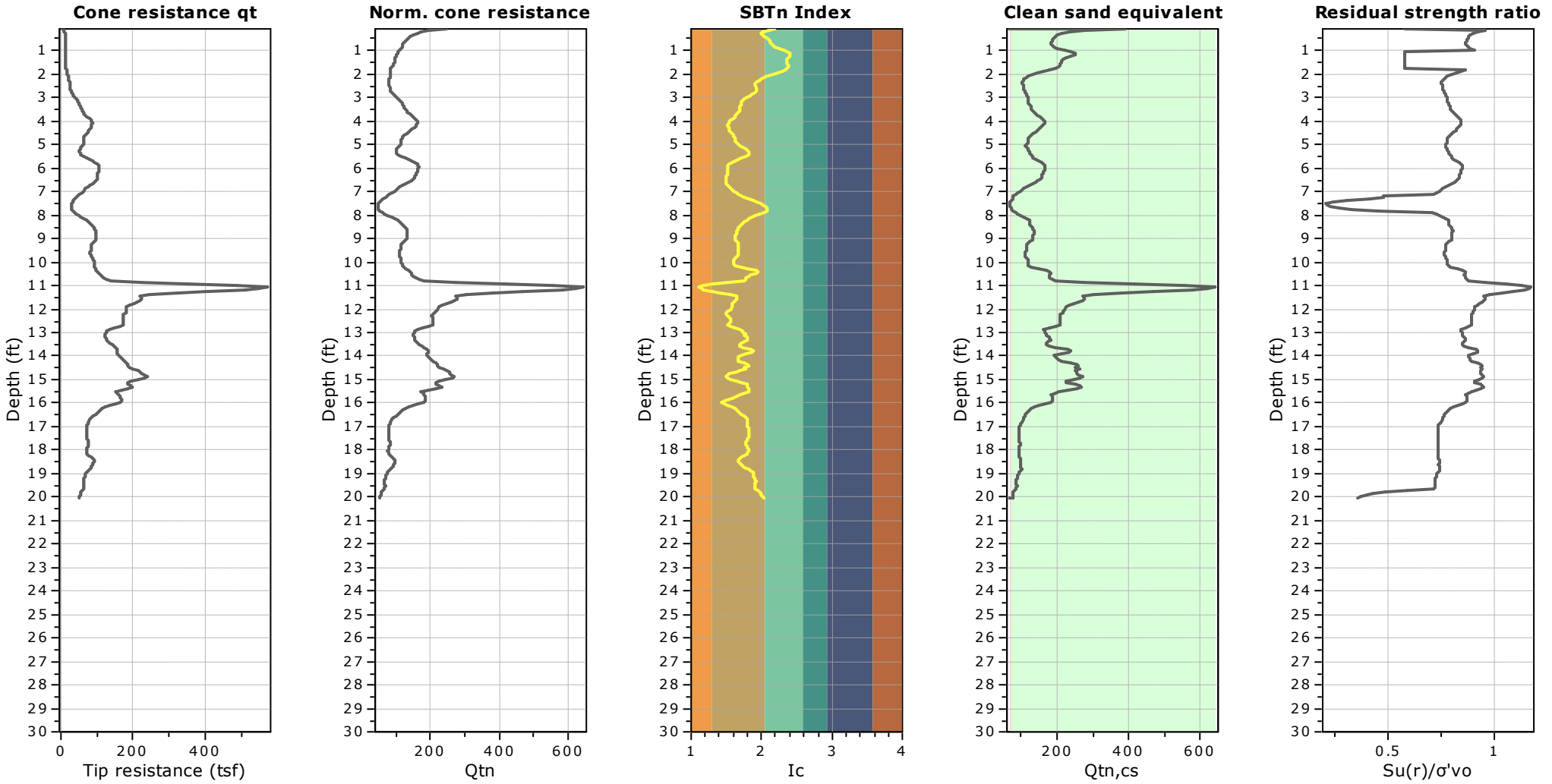


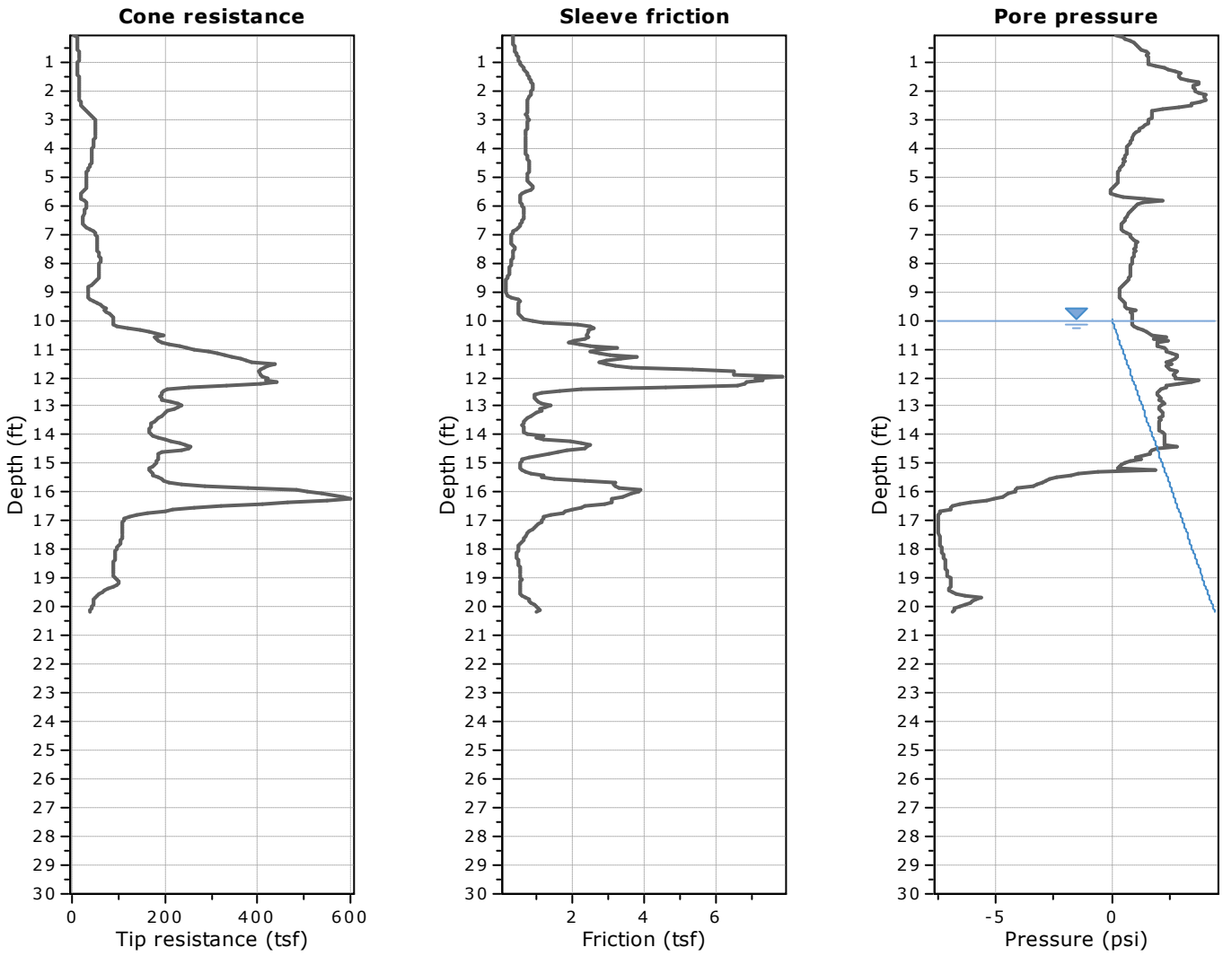
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-4

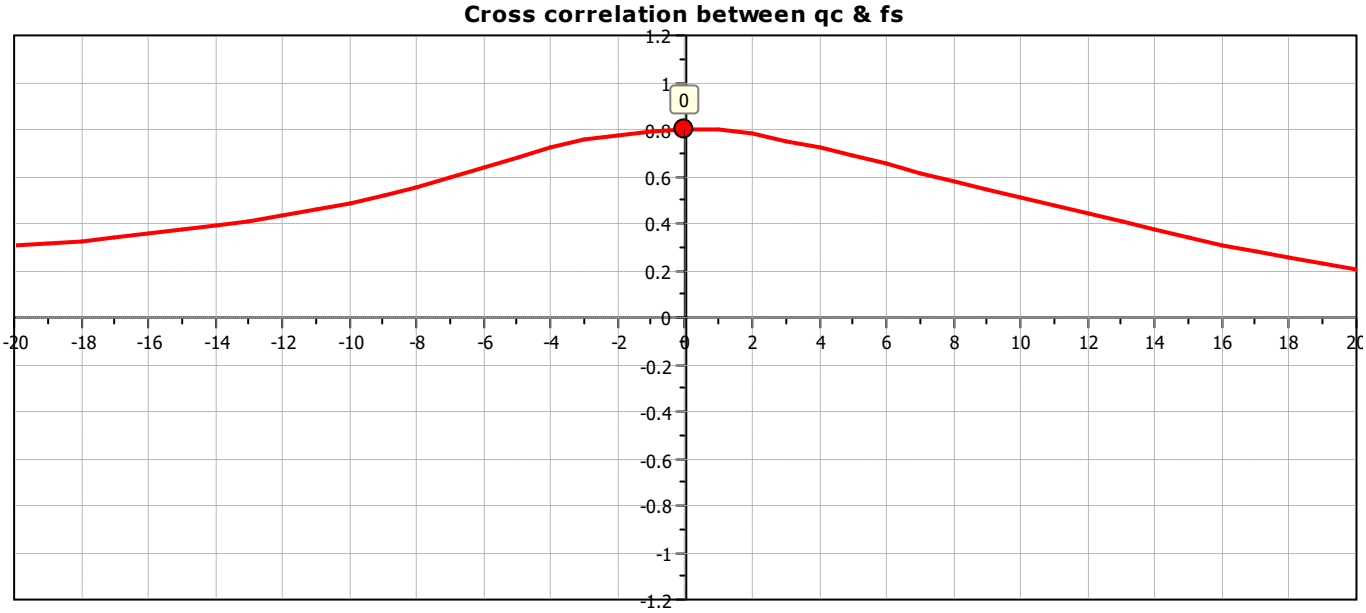
Total depth: 20.05 ft, Date: 5/13/2024
Surface Elevation: 65.24 ft
Coords: X:572043.89, Y:555976.94
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

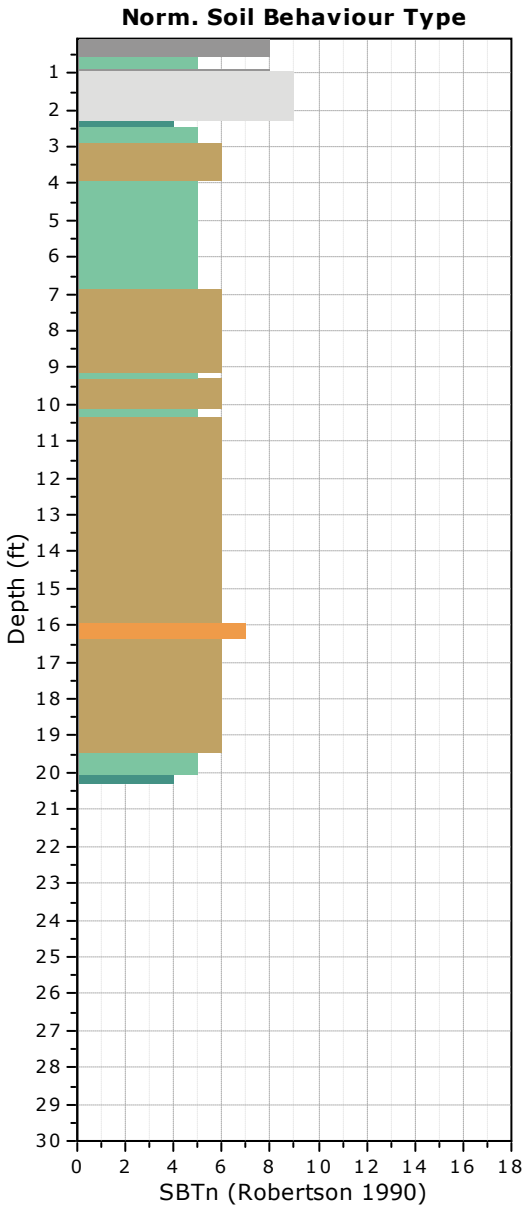
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

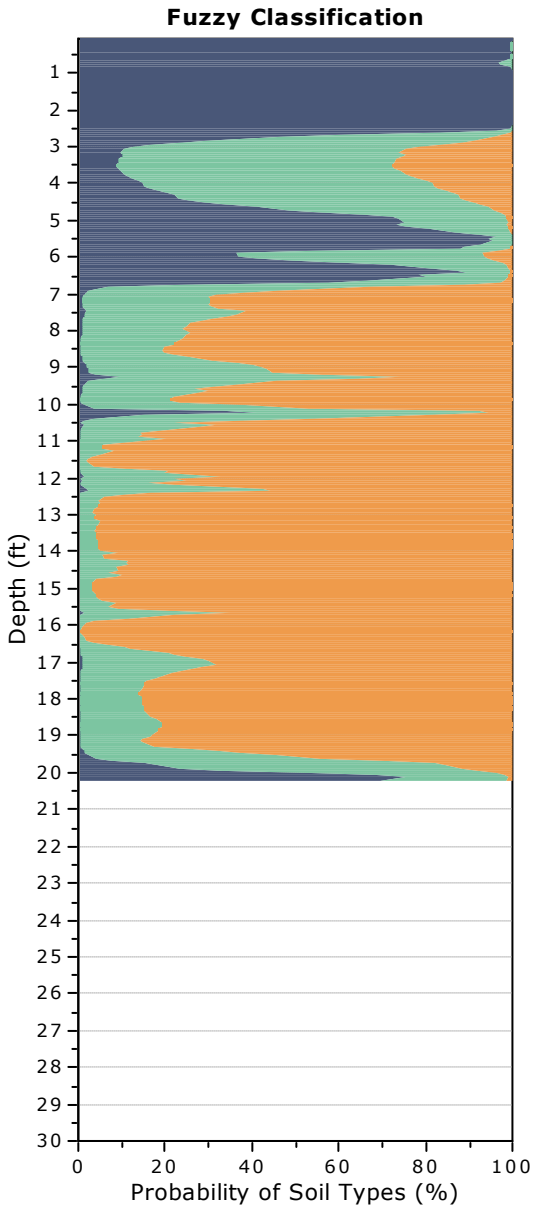




The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







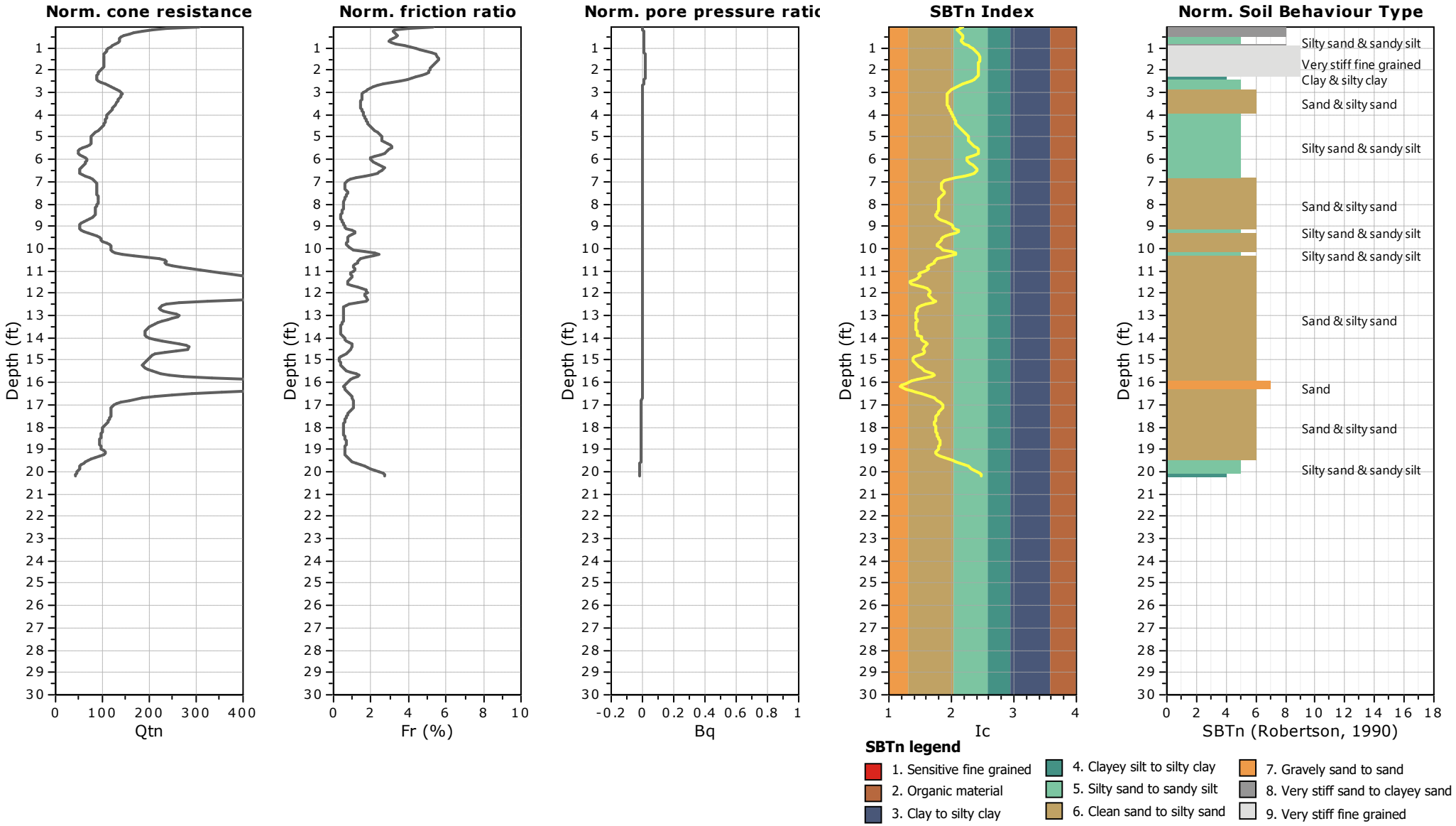
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-5
Total depth: 20.20 ft, Date: 5/13/2024
Surface Elevation: 64.40 ft
Coords: X:572009.87, Y:555914.62
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

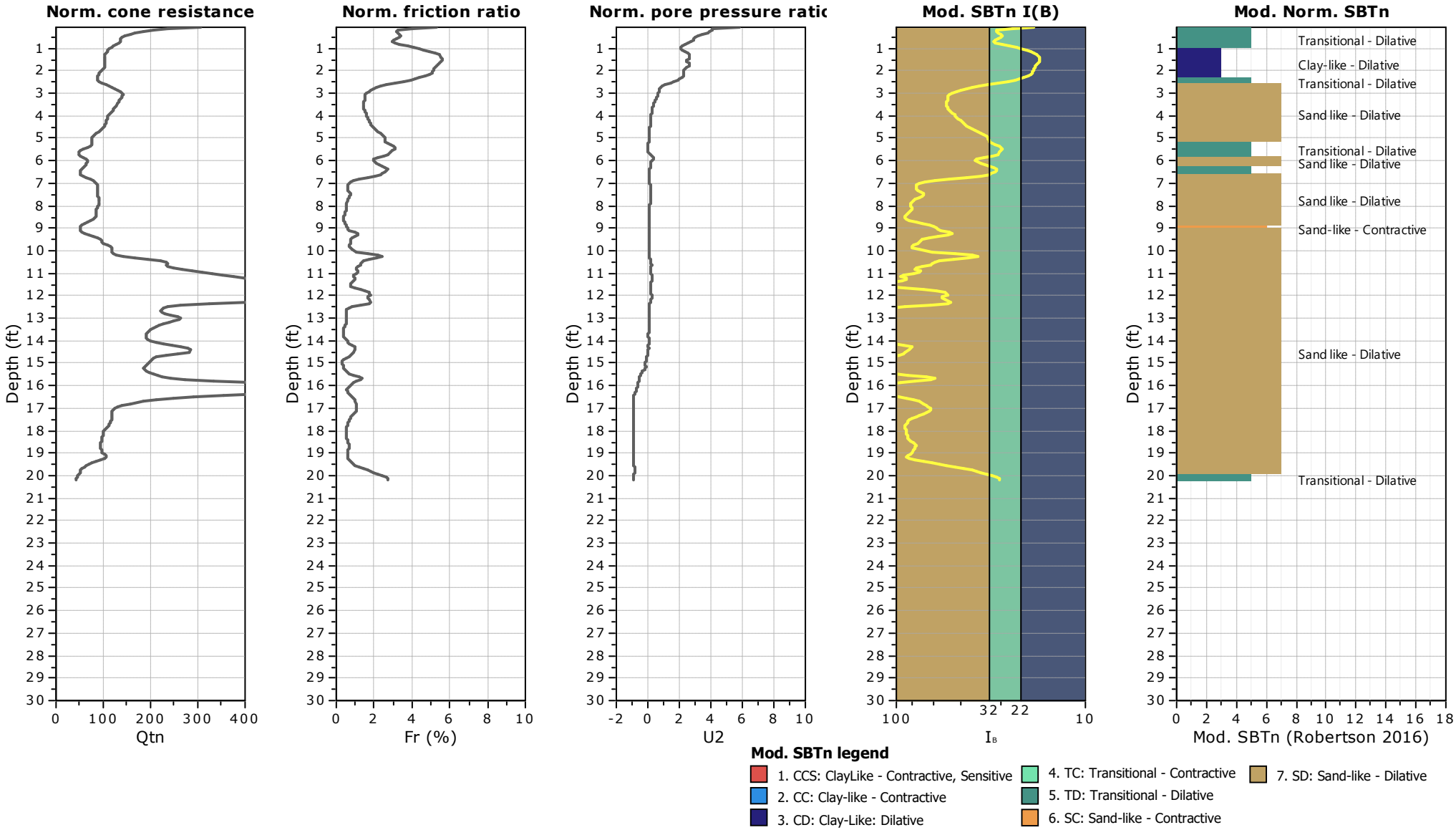
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-5
Total depth: 20.20 ft, Date: 5/13/2024
Surface Elevation: 64.40 ft
Coords: X:572009.87, Y:555914.62
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

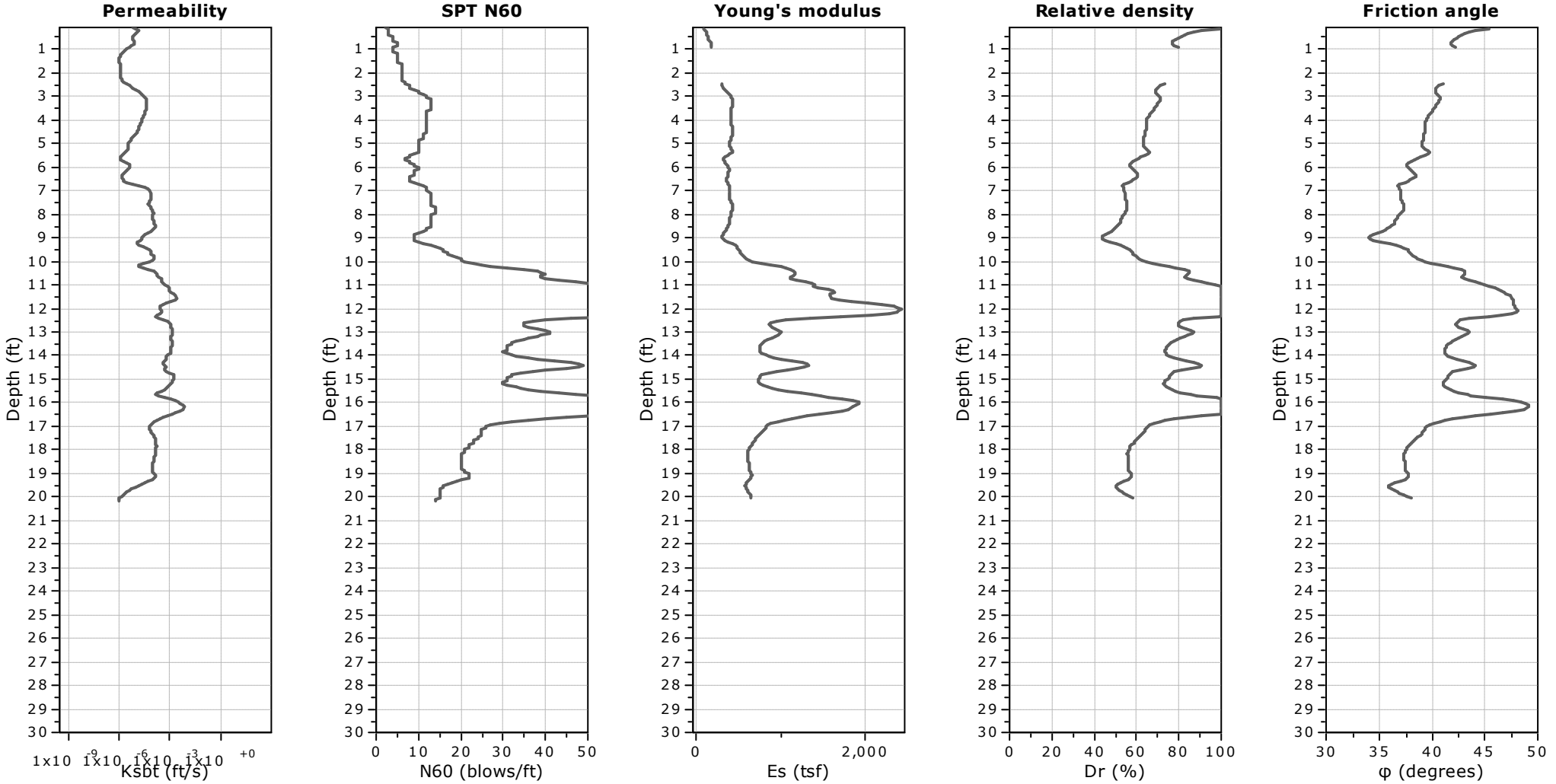
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-5
Total depth: 20.20 ft, Date: 5/13/2024
Surface Elevation: 64.40 ft
Coords: X:572009.87, Y:555914.62
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



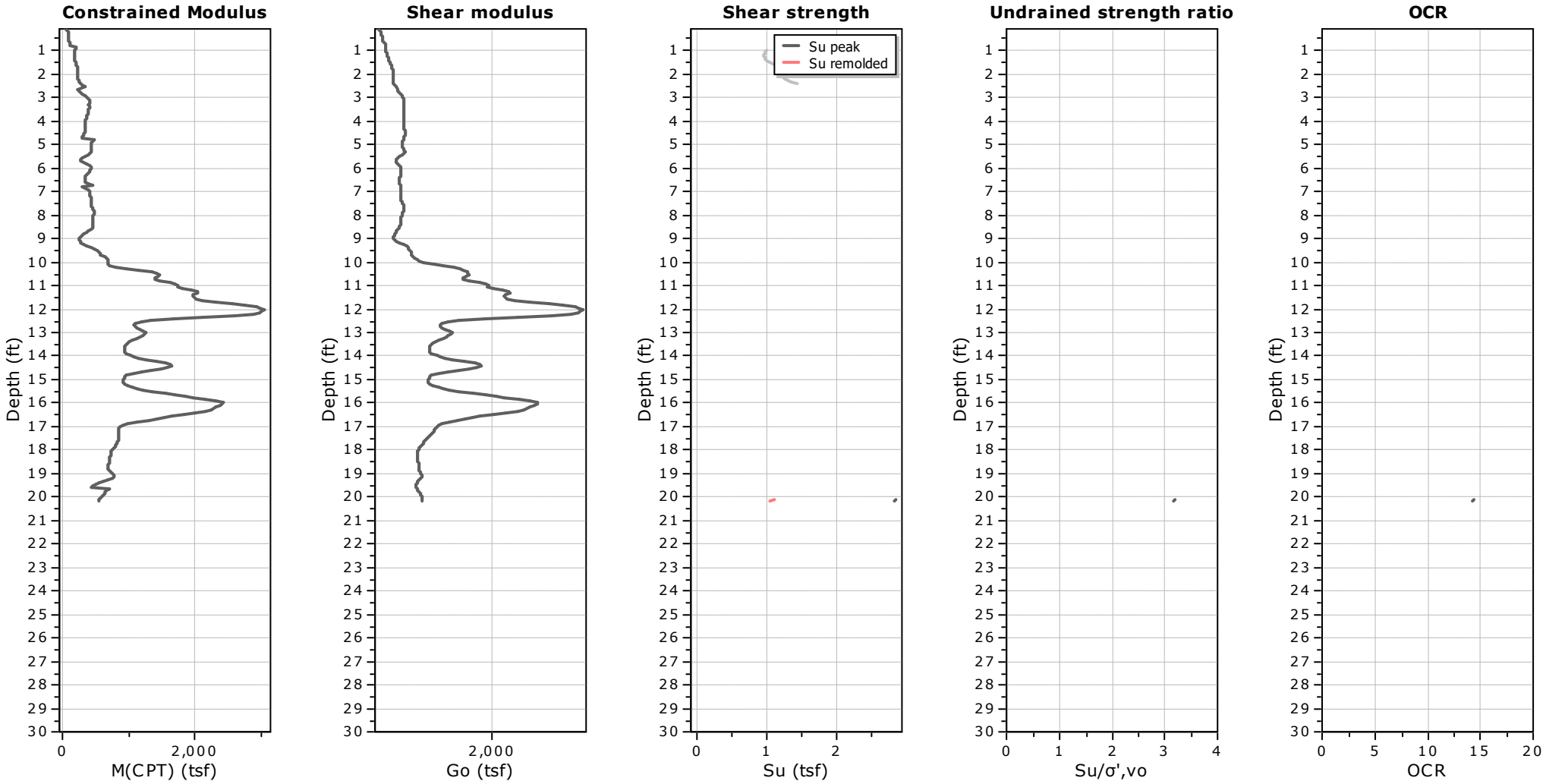
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-5
Total depth: 20.20 ft, Date: 5/13/2024
Surface Elevation: 64.40 ft
Coords: X:572009.87, Y:555914.62
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



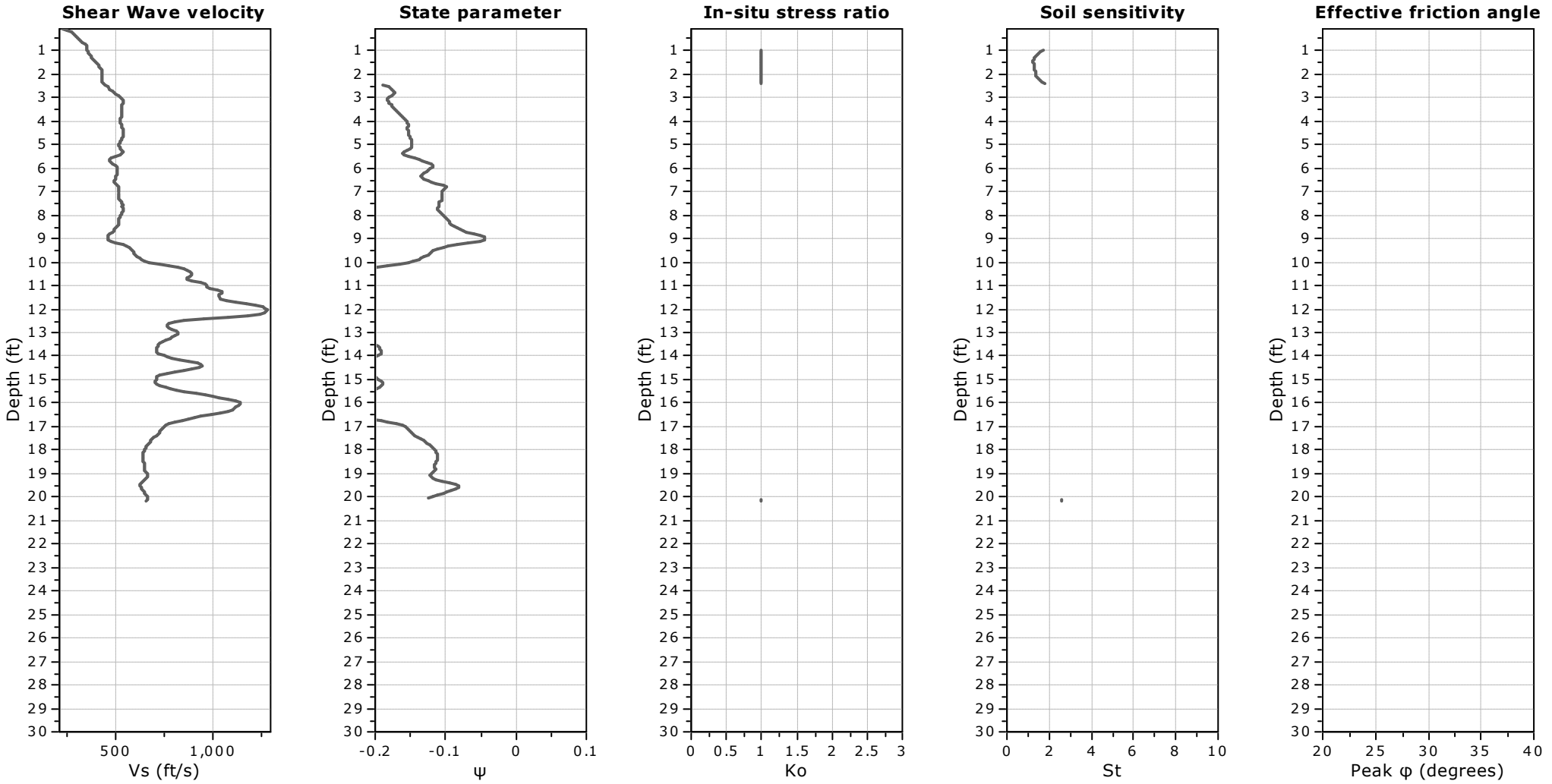
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-5
Total depth: 20.20 ft, Date: 5/13/2024
Surface Elevation: 64.40 ft
Coords: X:572009.87, Y:555914.62
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



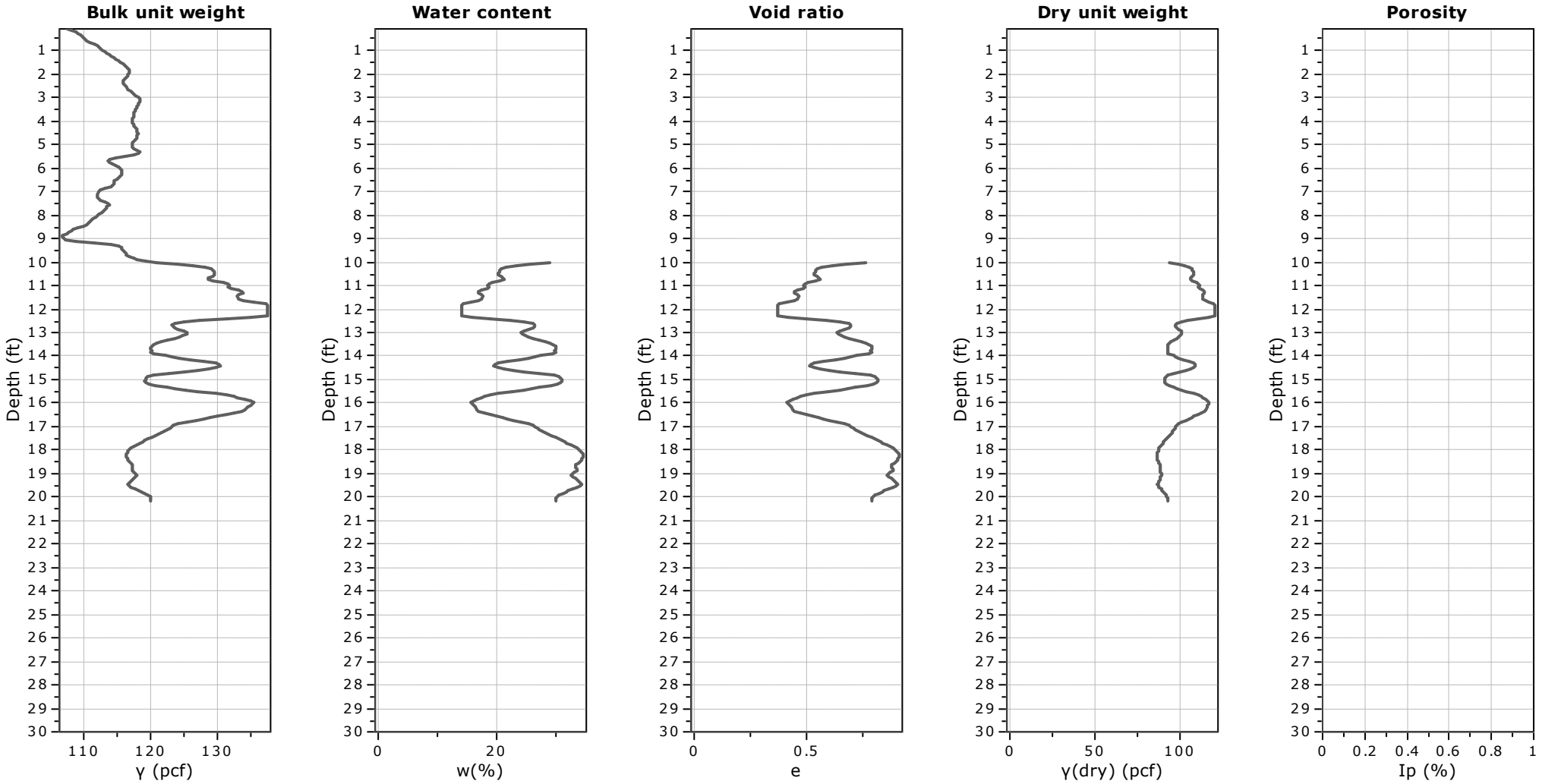
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-5
Total depth: 20.20 ft, Date: 5/13/2024
Surface Elevation: 64.40 ft
Coords: X:572009.87, Y:555914.62
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

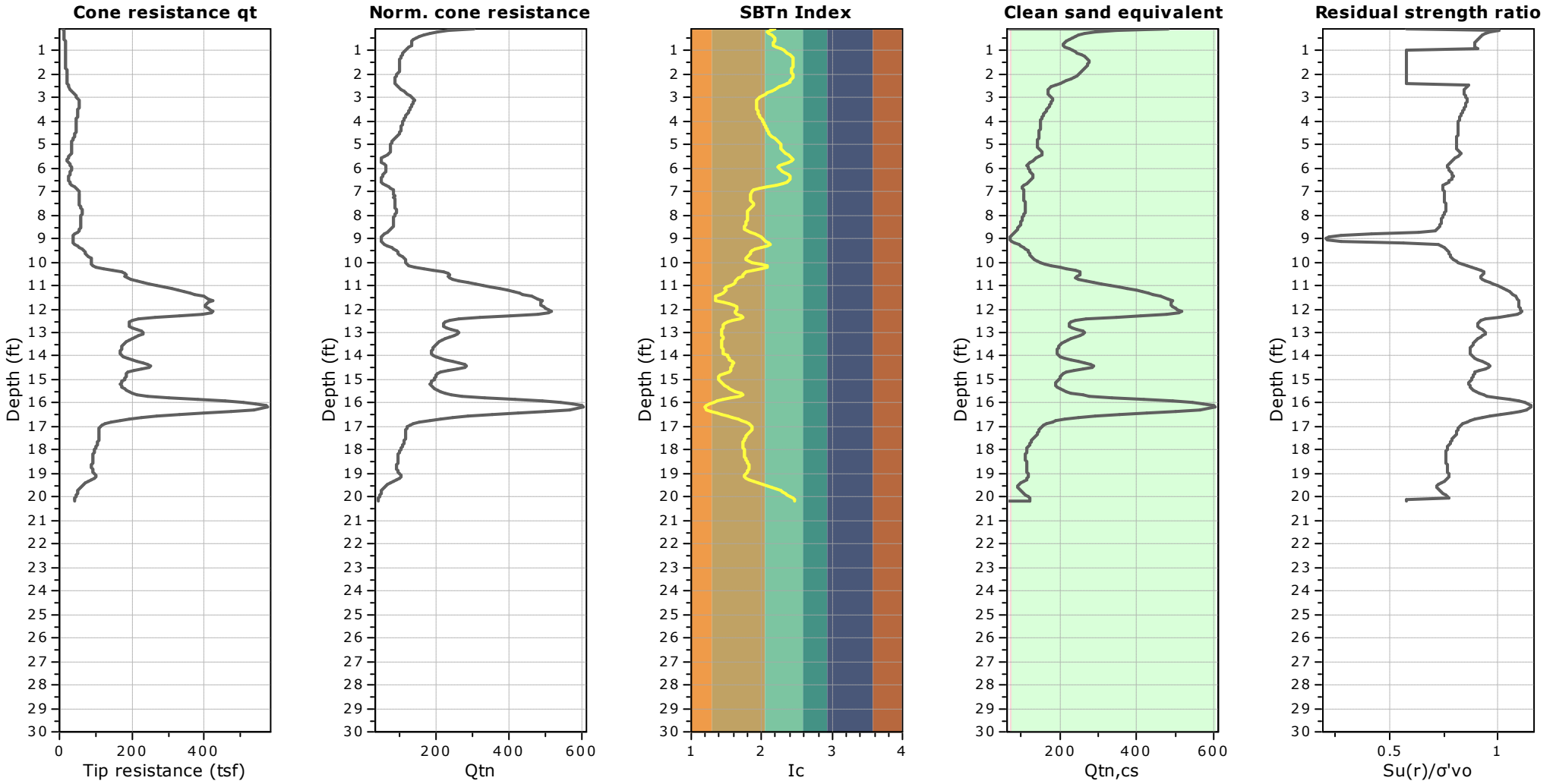
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-5
Total depth: 20.20 ft, Date: 5/13/2024
Surface Elevation: 64.40 ft
Coords: X:572009.87, Y:555914.62
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

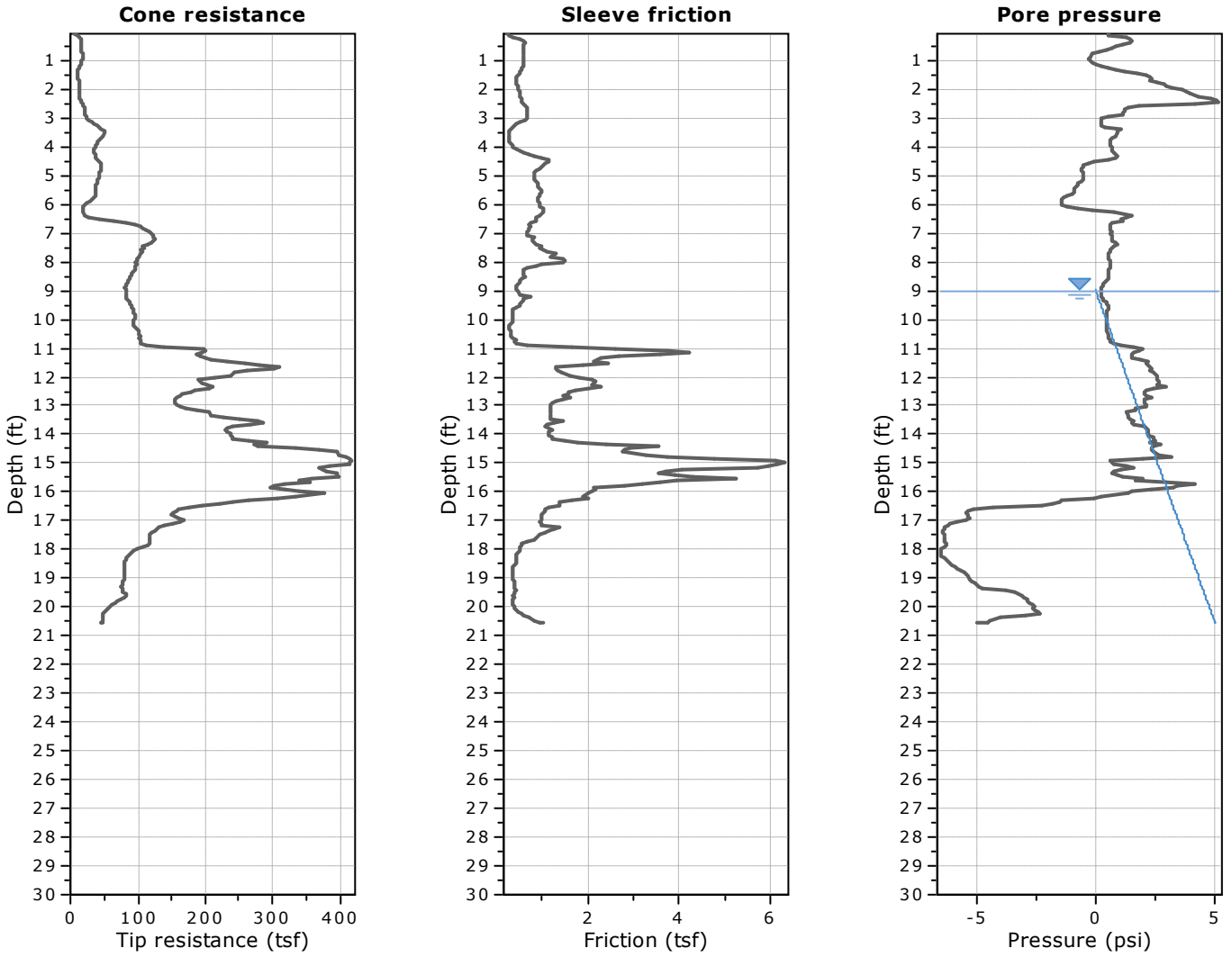
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



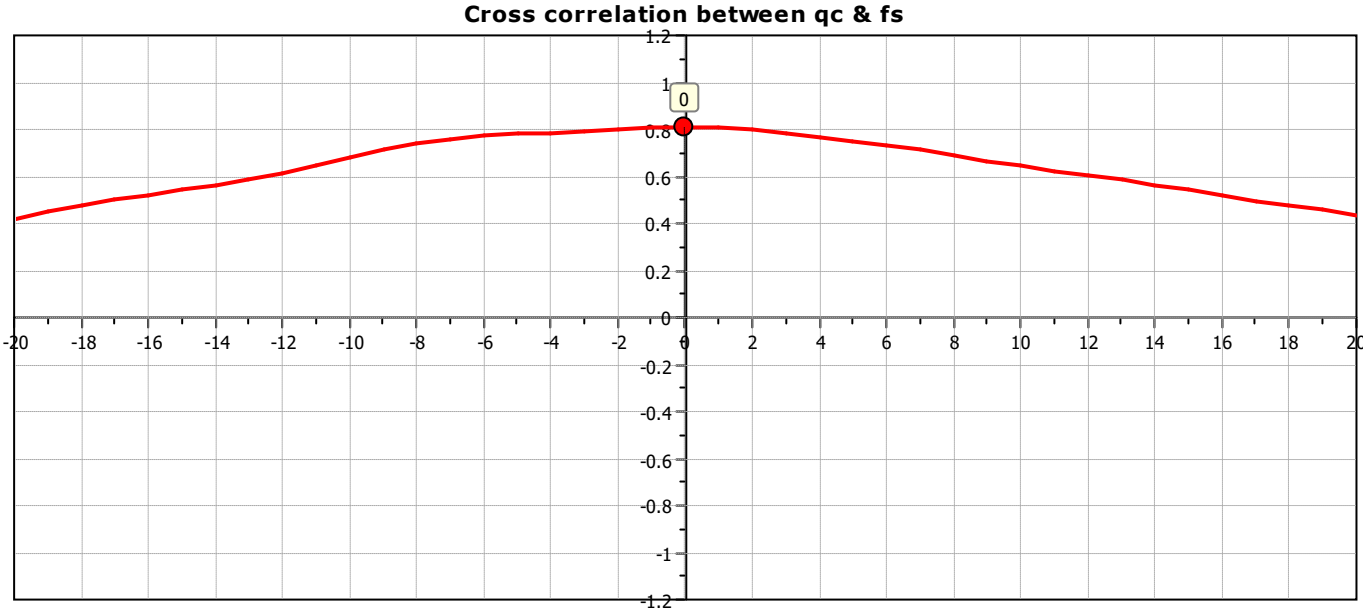
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

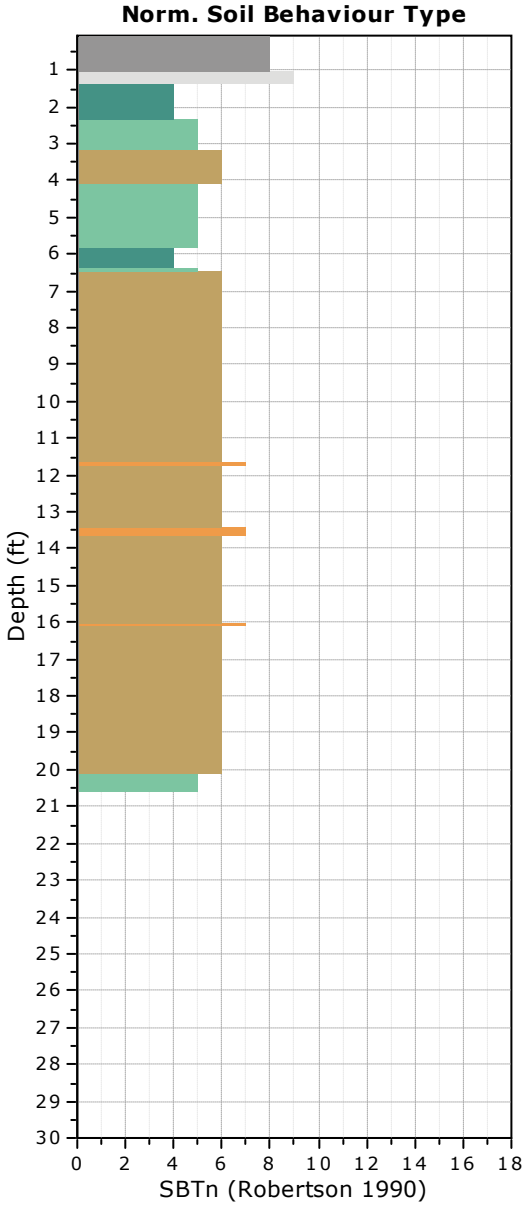
C-6
Total depth: 20.57 ft, Date: 5/13/2024
Surface Elevation: 64.54 ft
Coords: X:572079.45, Y:555898.33
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

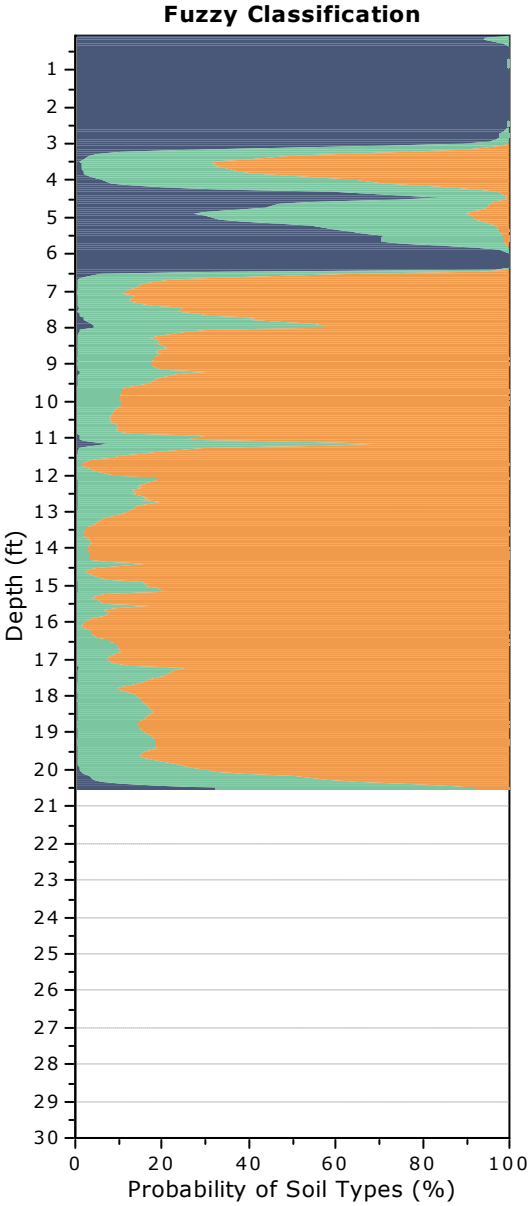
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







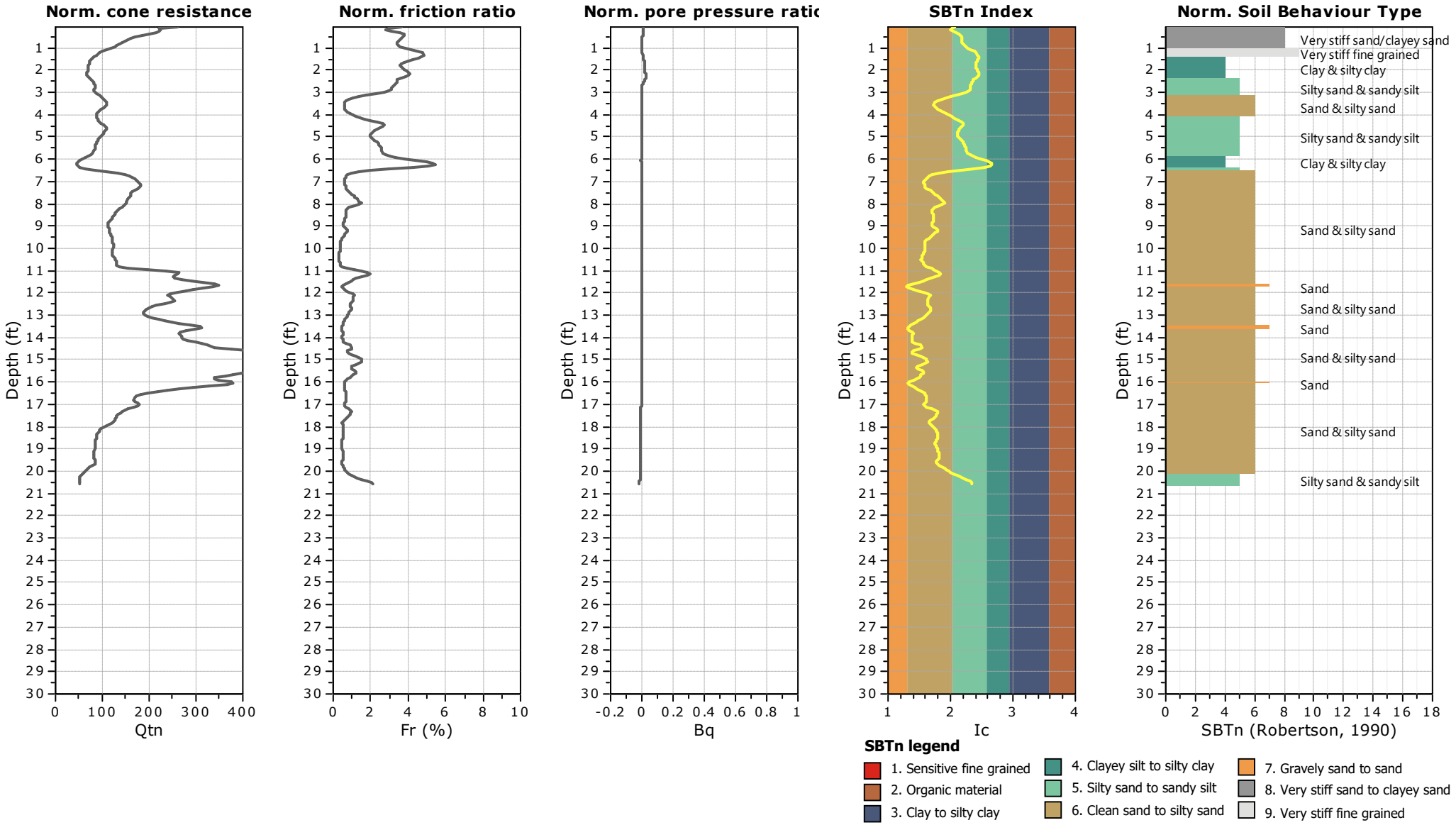
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-6
Total depth: 20.57 ft, Date: 5/13/2024
Surface Elevation: 64.54 ft
Coords: X:572079.45, Y:555898.33
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

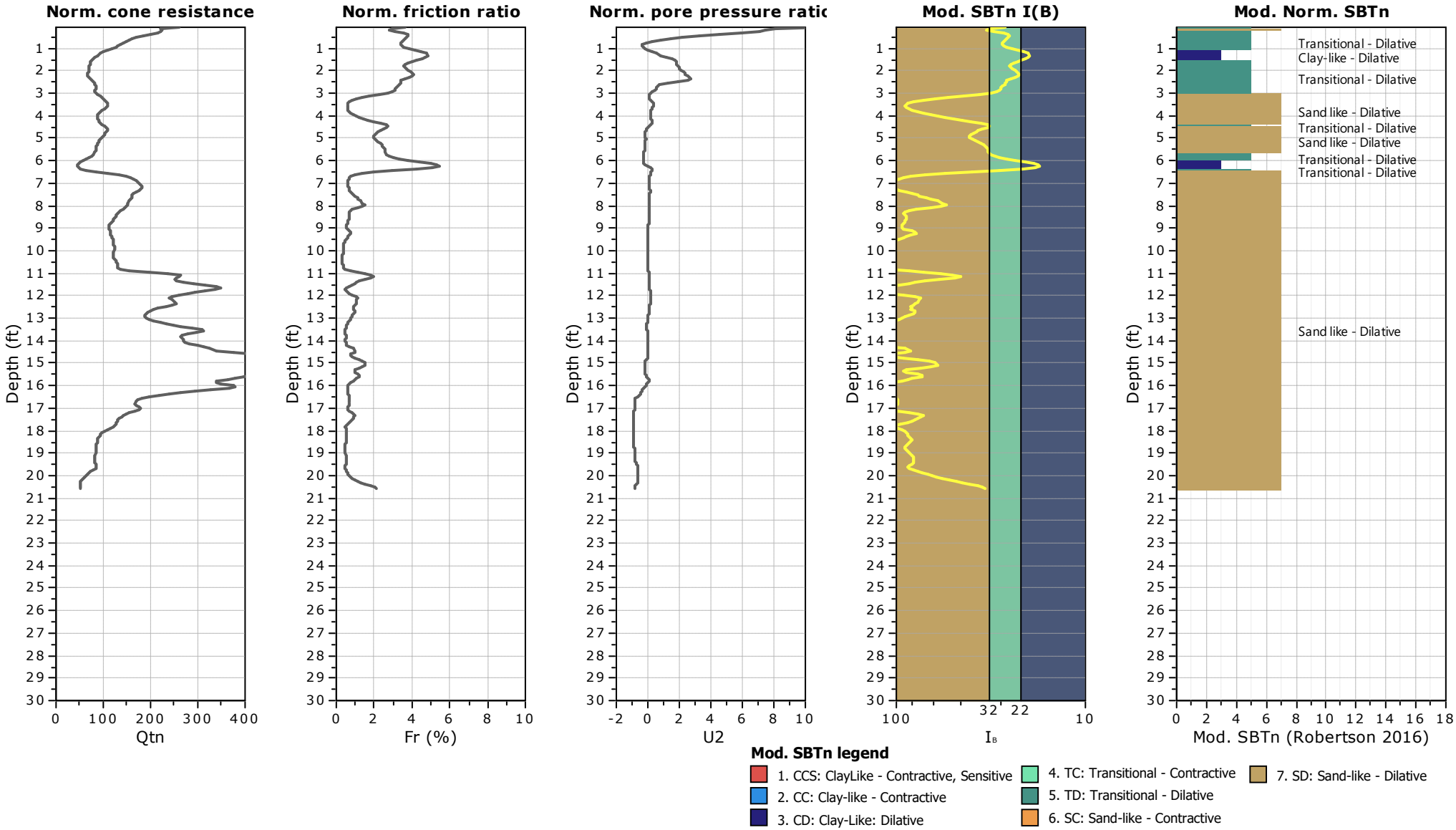
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-6
Total depth: 20.57 ft, Date: 5/13/2024
Surface Elevation: 64.54 ft
Coords: X:572079.45, Y:555898.33
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

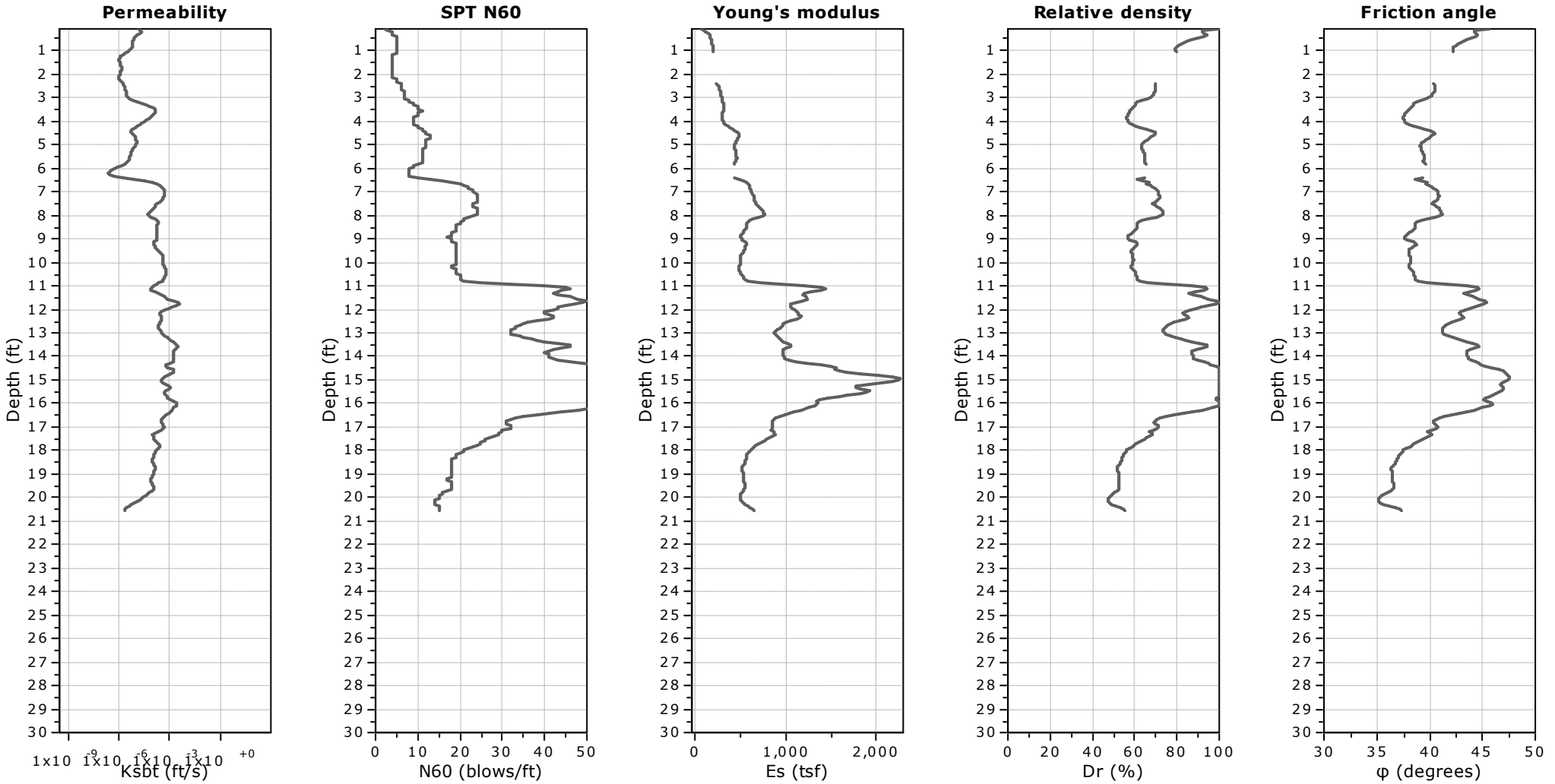
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-6
Total depth: 20.57 ft, Date: 5/13/2024
Surface Elevation: 64.54 ft
Coords: X:572079.45, Y:555898.33
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



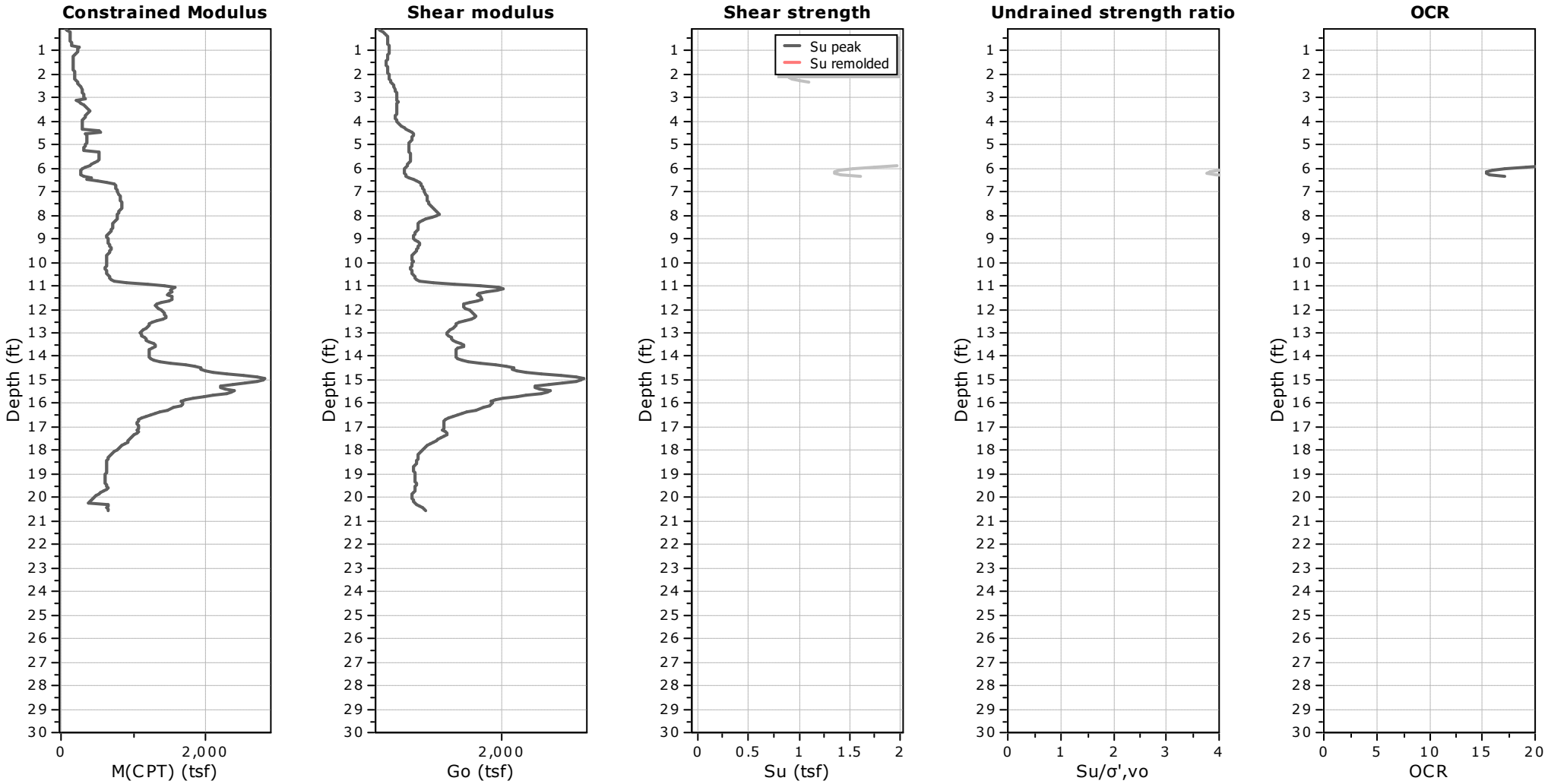
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-6
Total depth: 20.57 ft, Date: 5/13/2024
Surface Elevation: 64.54 ft
Coords: X:572079.45, Y:555898.33
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



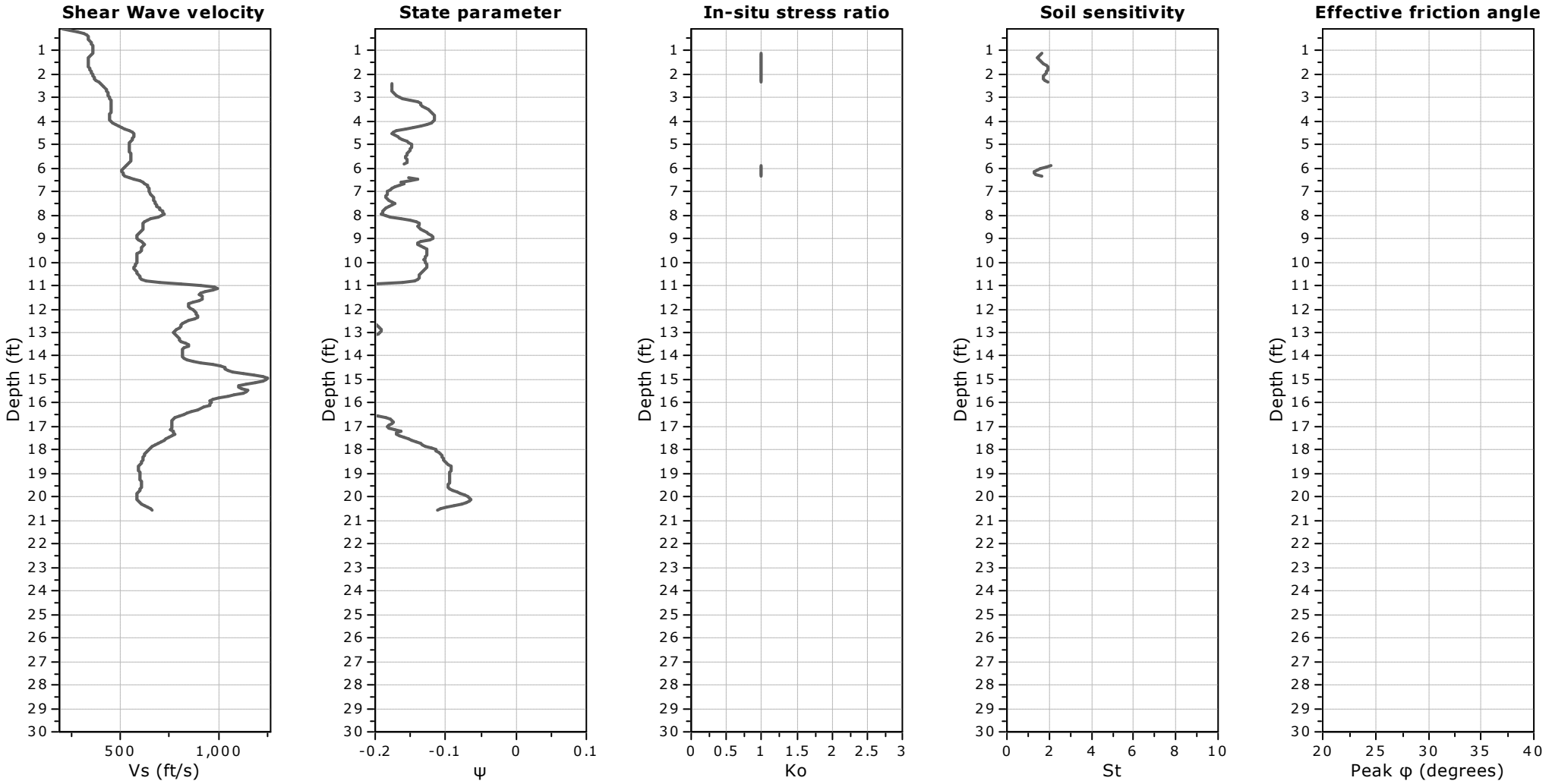
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-6
Total depth: 20.57 ft, Date: 5/13/2024
Surface Elevation: 64.54 ft
Coords: X:572079.45, Y:555898.33
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



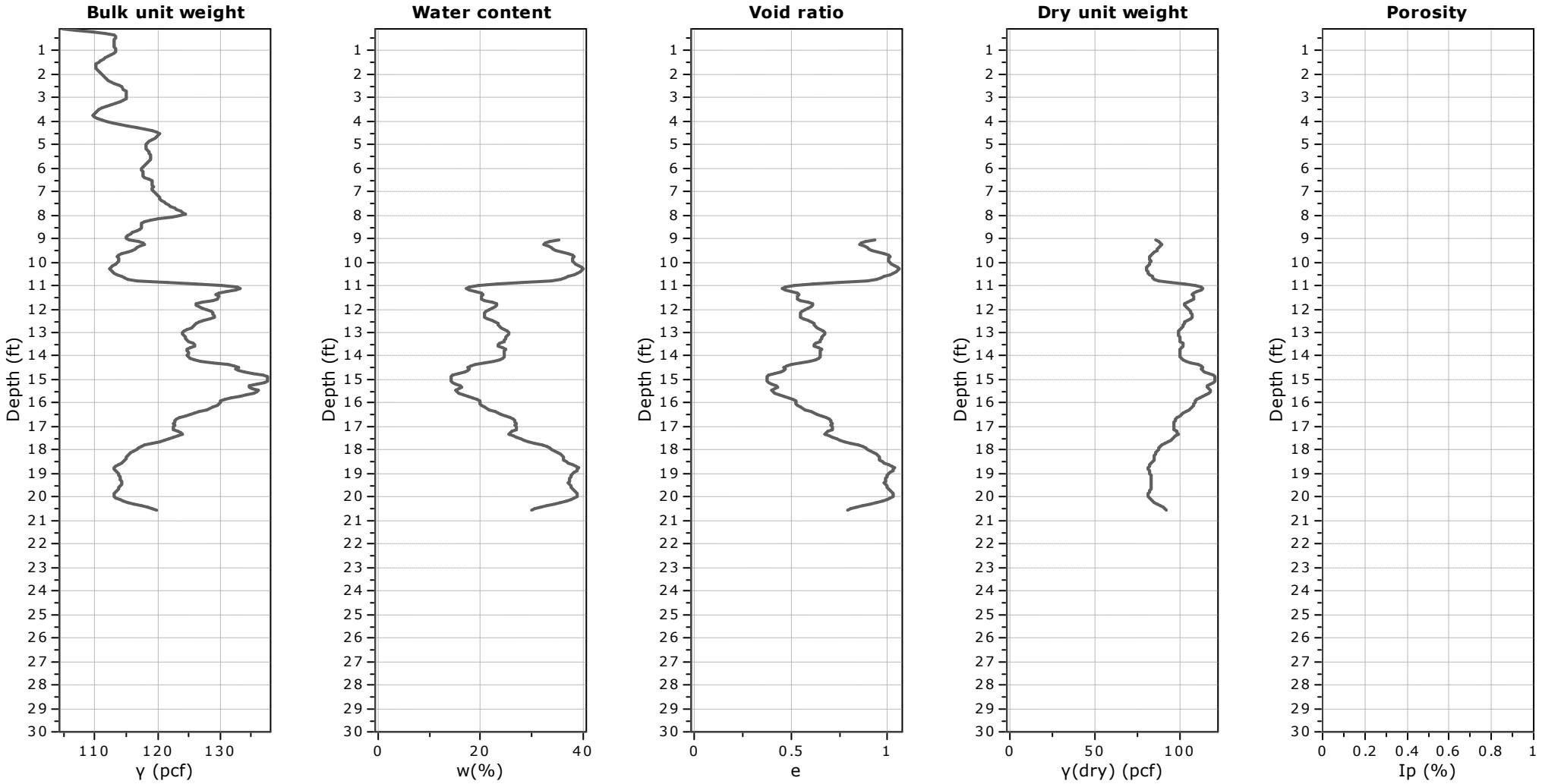
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-6
Total depth: 20.57 ft, Date: 5/13/2024
Surface Elevation: 64.54 ft
Coords: X:572079.45, Y:555898.33
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

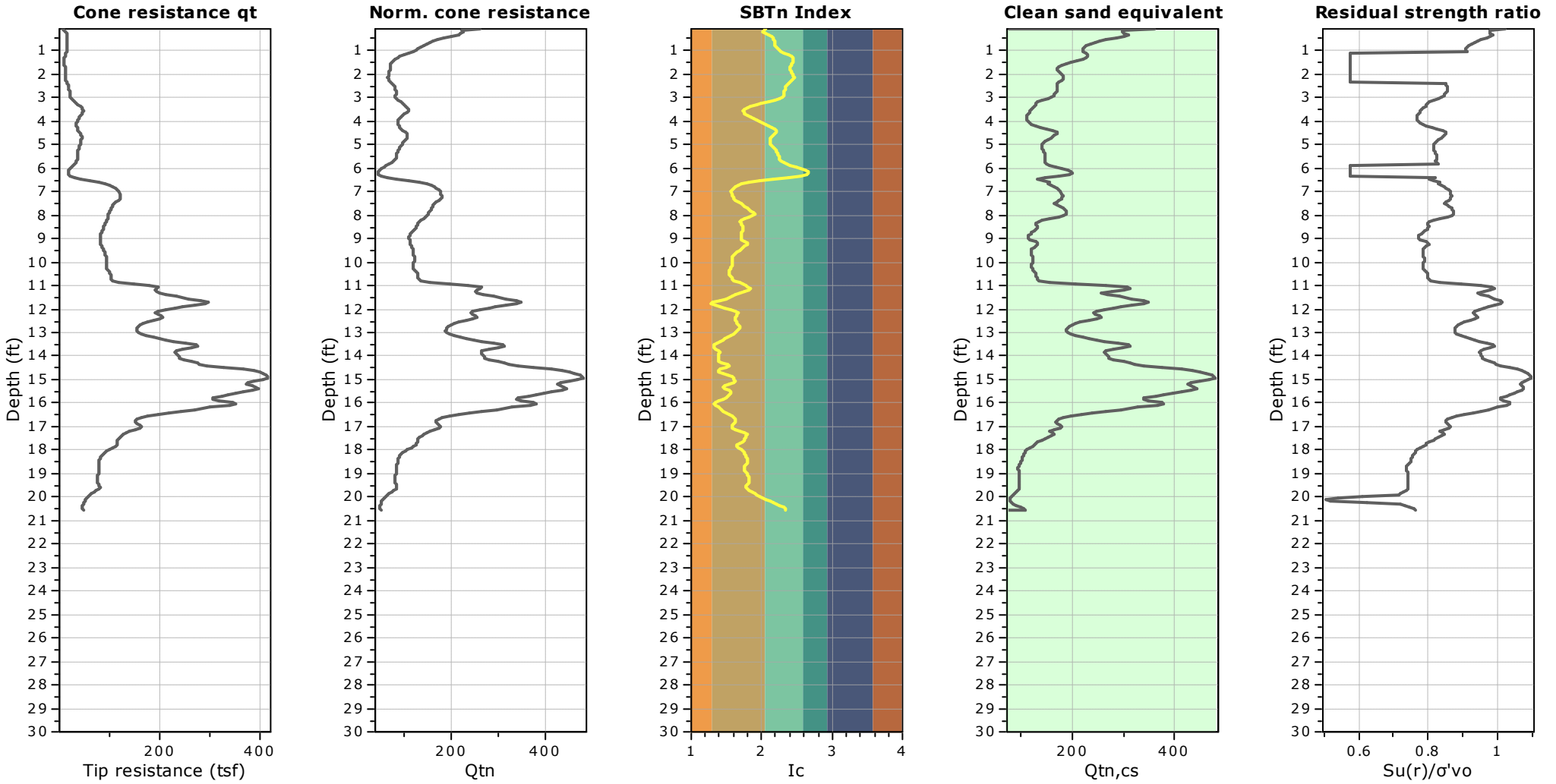
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

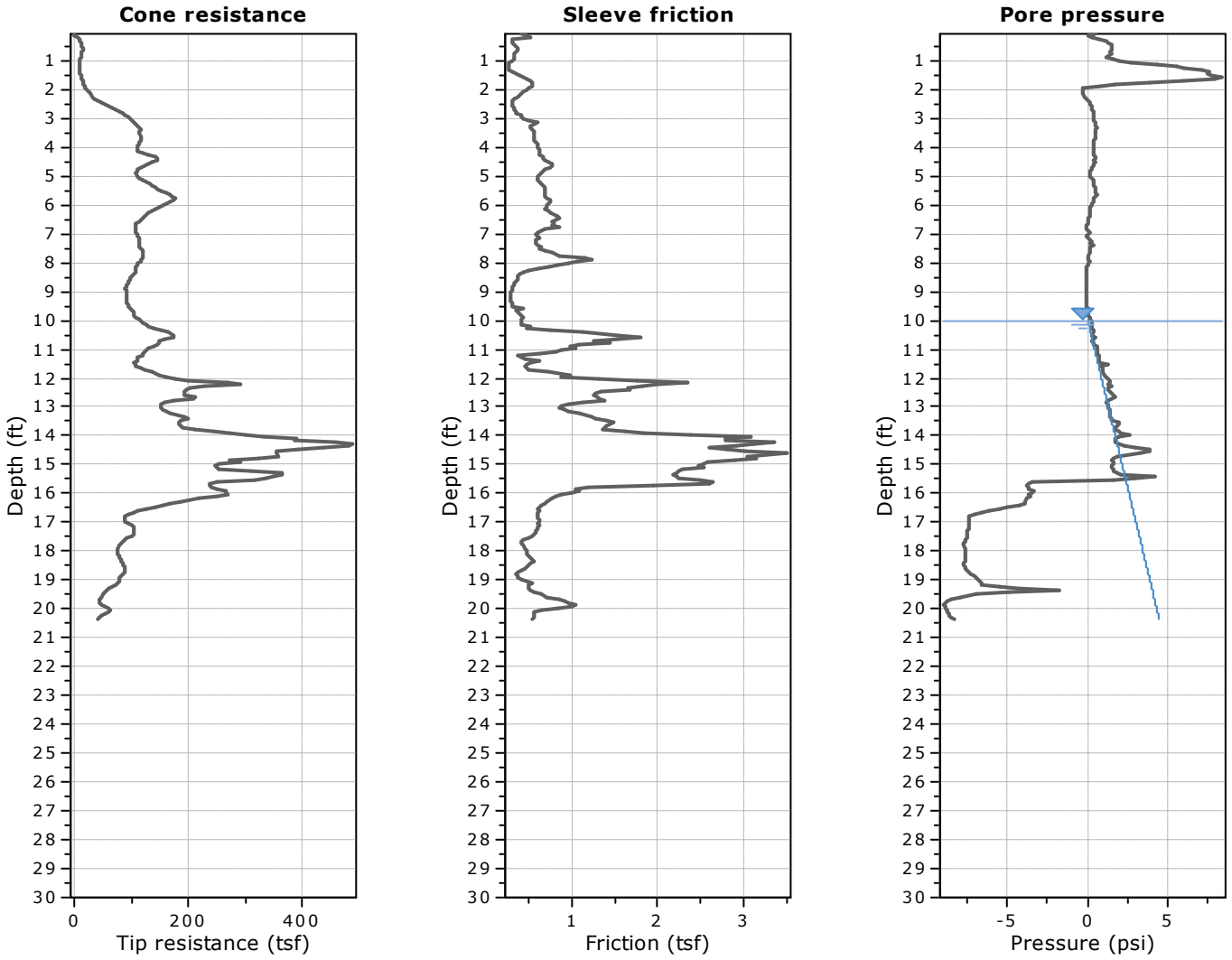


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

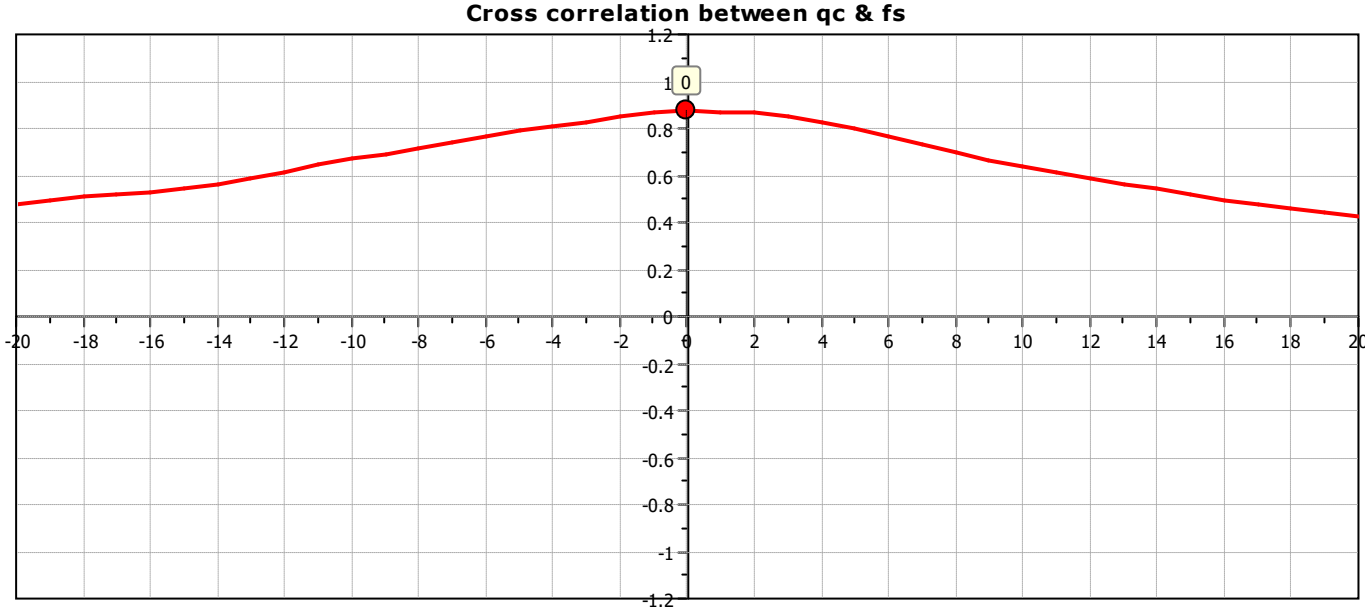
C-6
Total depth: 20.57 ft, Date: 5/13/2024
Surface Elevation: 64.54 ft
Coords: X:572079.45, Y:555898.33
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

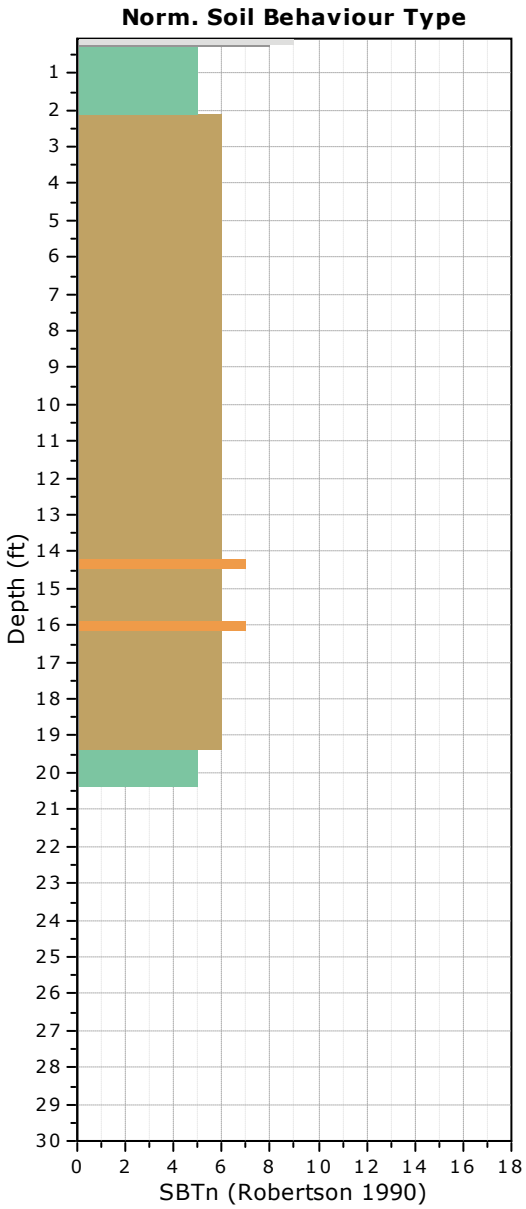
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

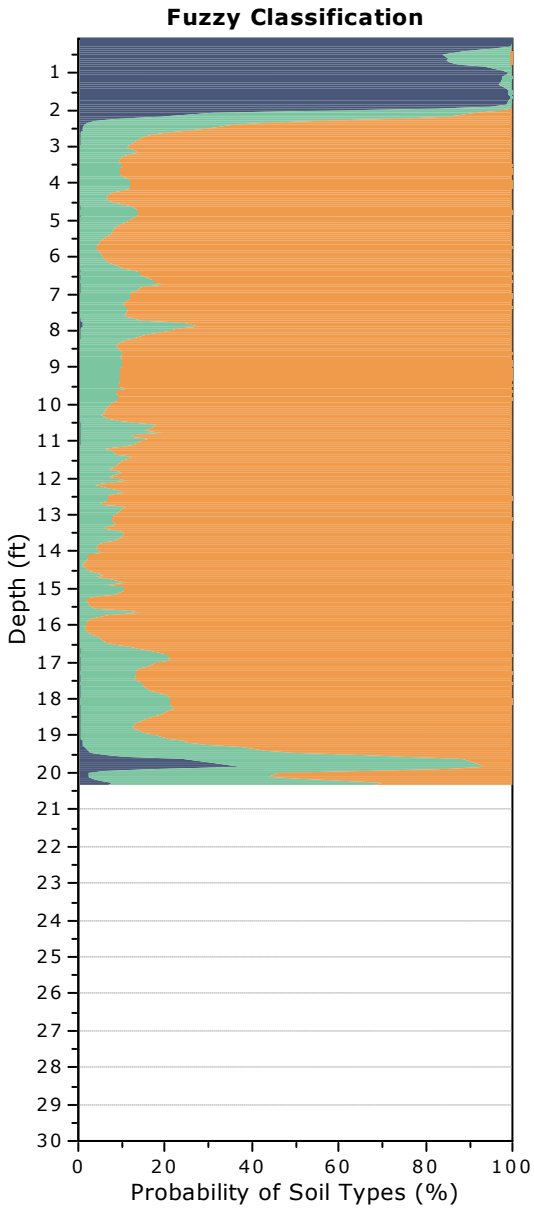




The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







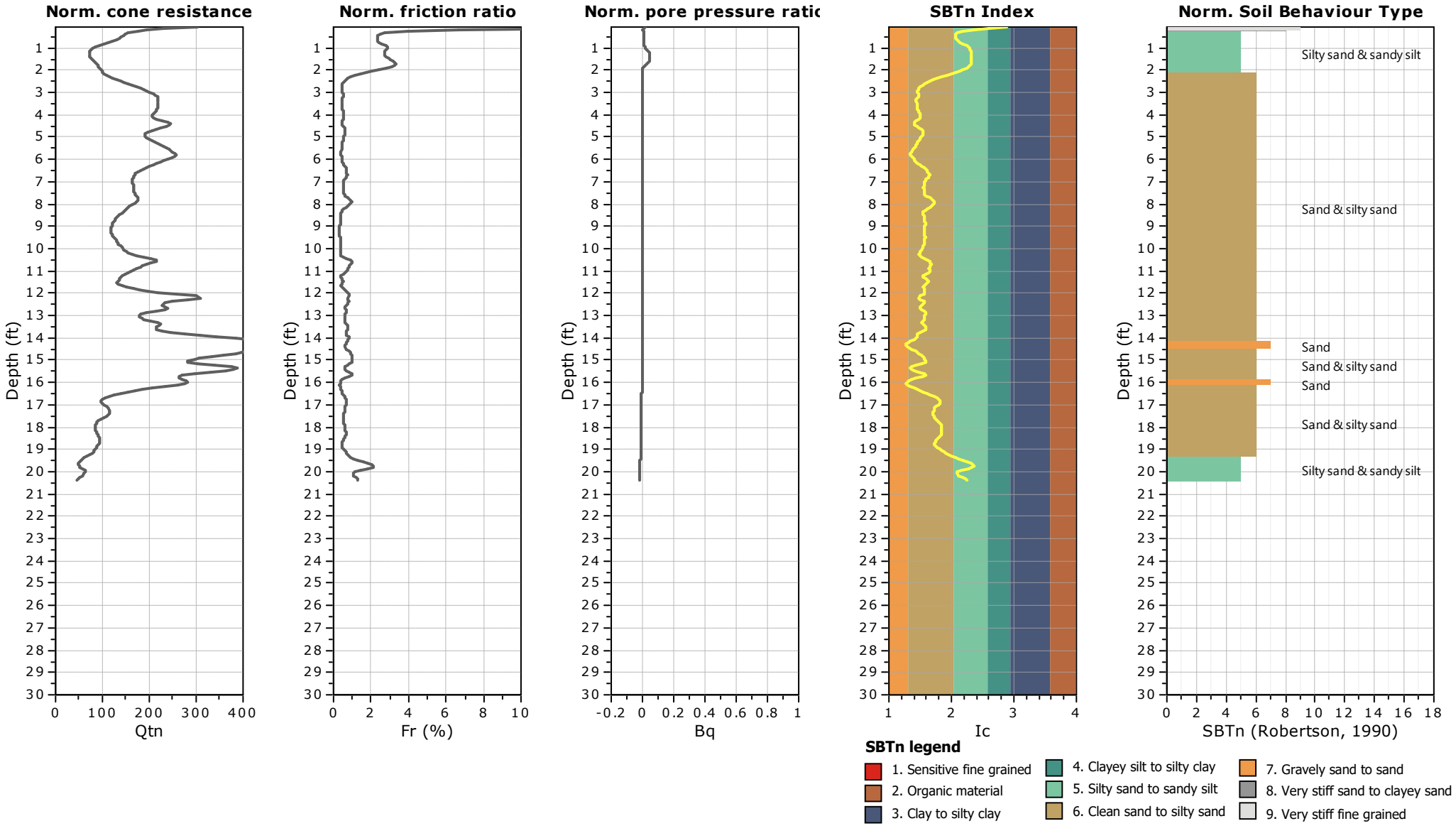
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-7
Total depth: 20.36 ft, Date: 5/13/2024
Surface Elevation: 64.37 ft
Coords: X:572119.23, Y:555936.17
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

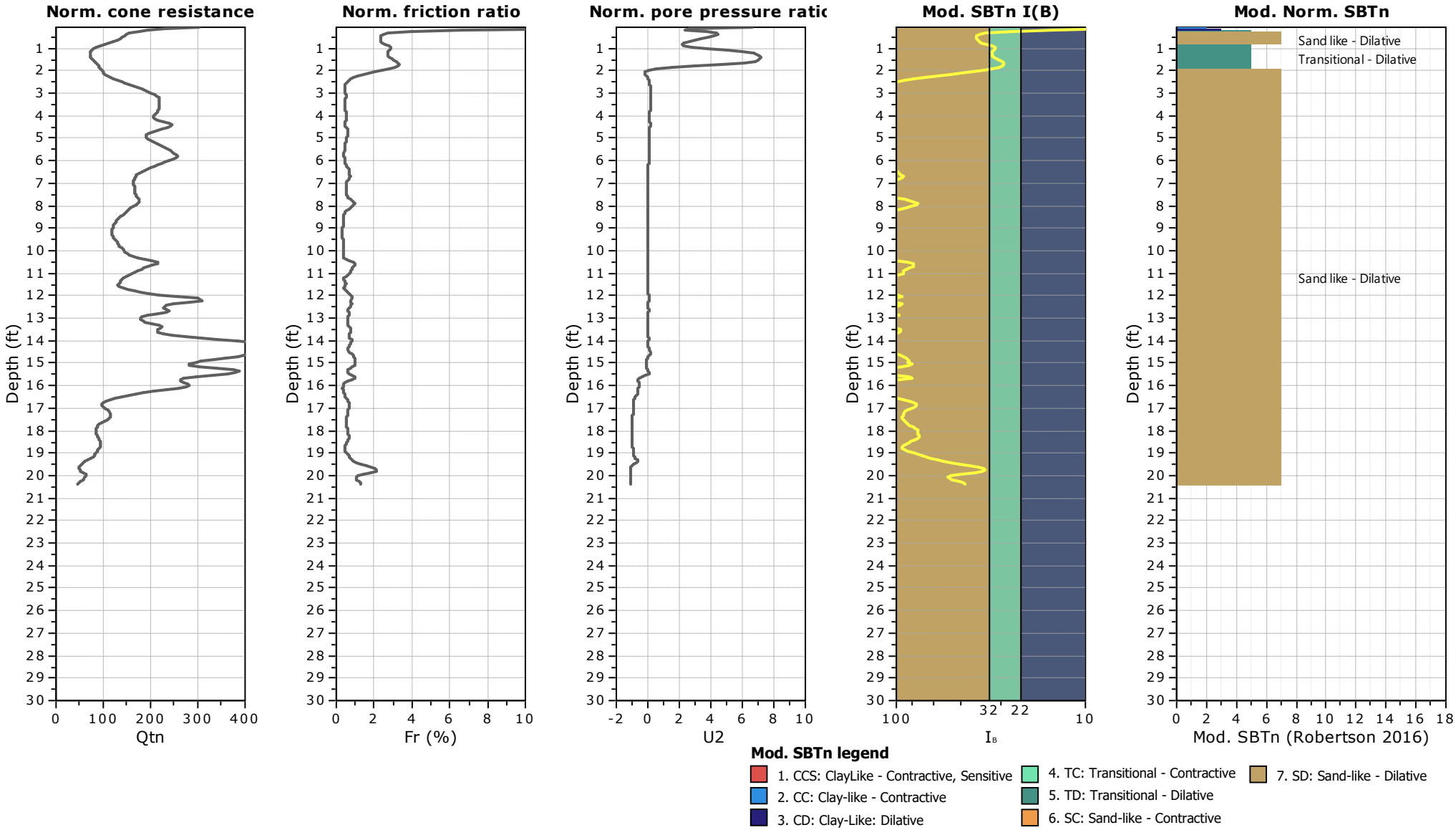
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-7
Total depth: 20.36 ft, Date: 5/13/2024
Surface Elevation: 64.37 ft
Coords: X:572119.23, Y:555936.17
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

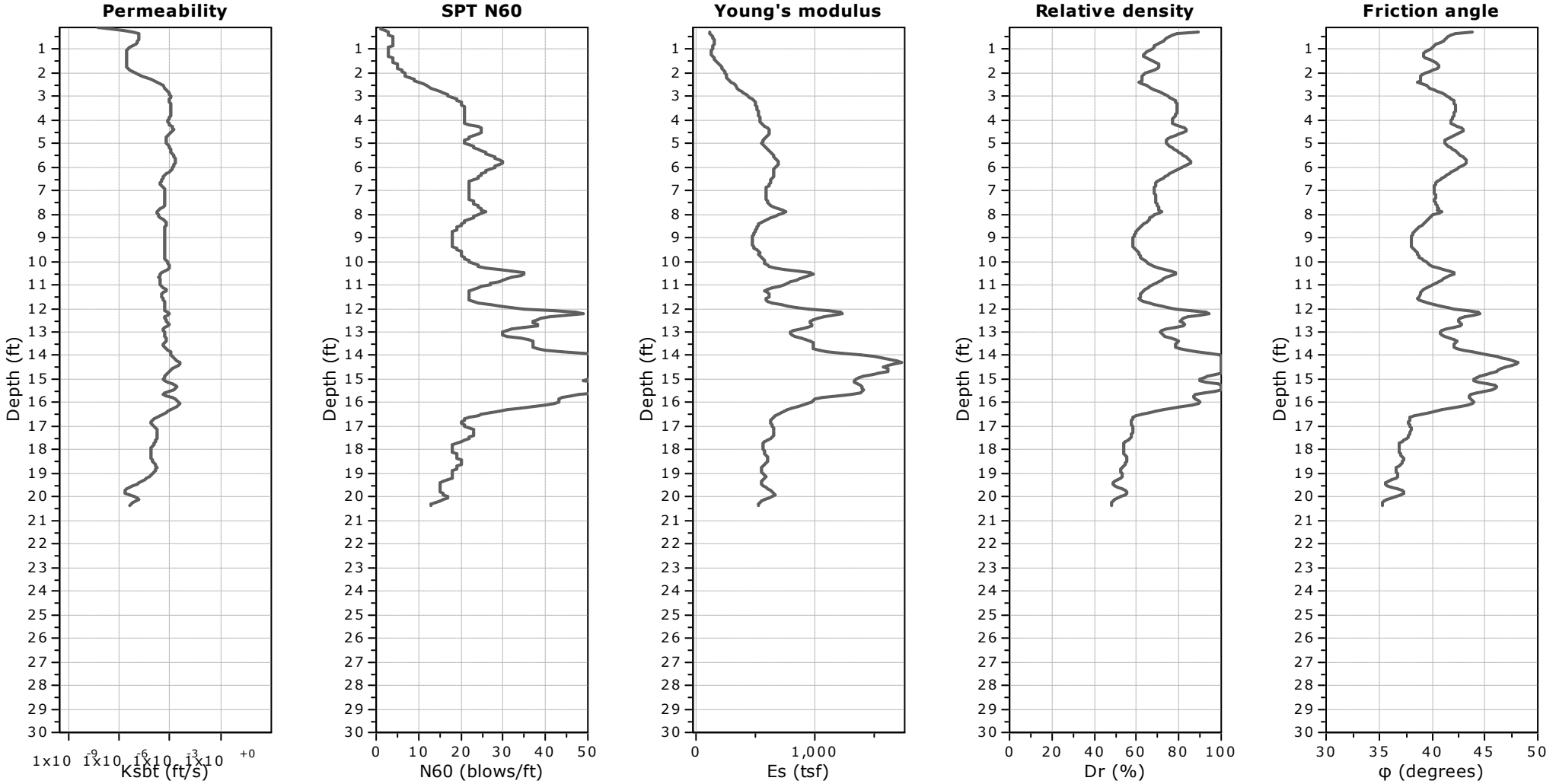
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-7
Total depth: 20.36 ft, Date: 5/13/2024
Surface Elevation: 64.37 ft
Coords: X:572119.23, Y:555936.17
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



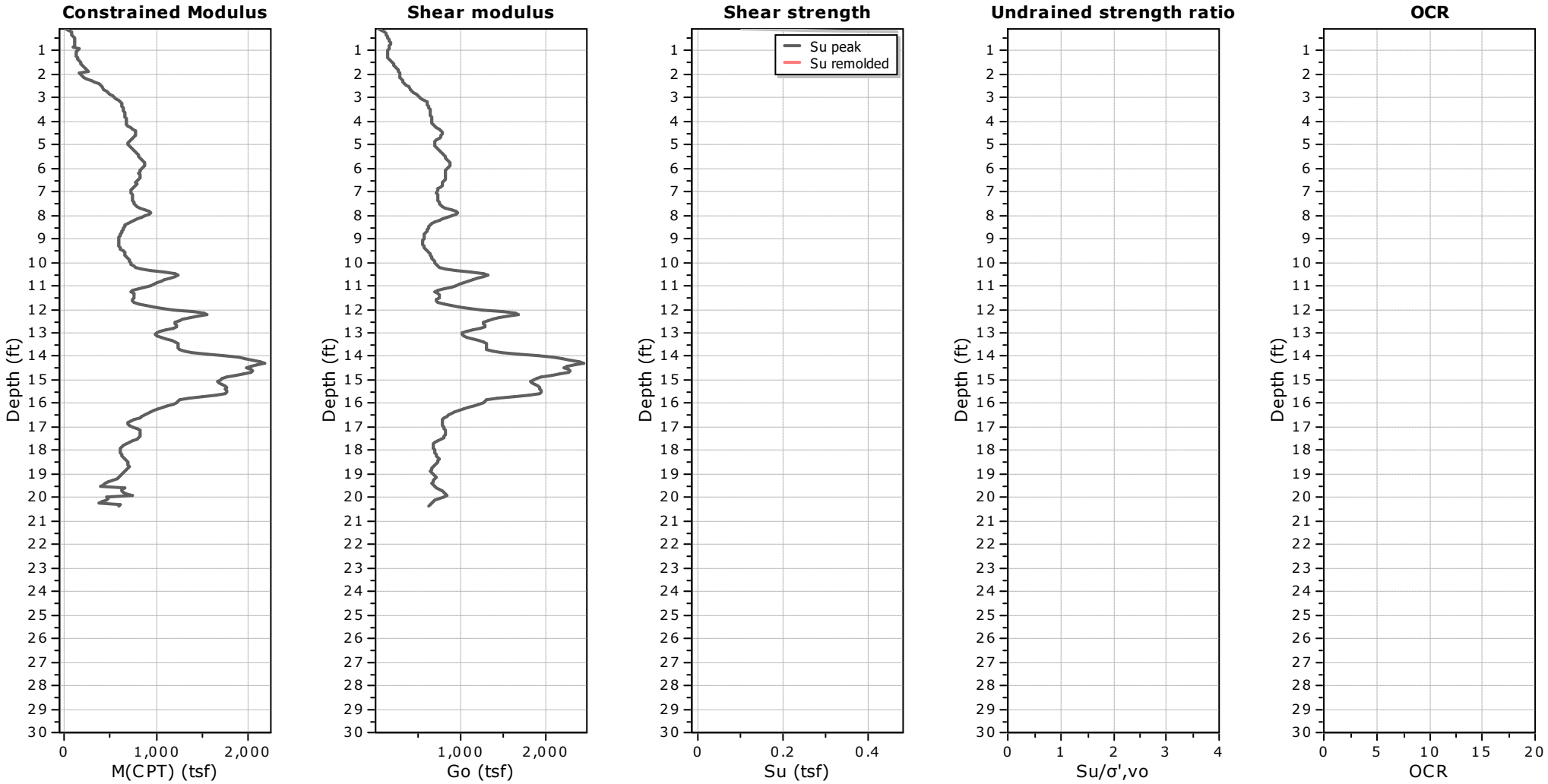
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-7
Total depth: 20.36 ft, Date: 5/13/2024
Surface Elevation: 64.37 ft
Coords: X:572119.23, Y:555936.17
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



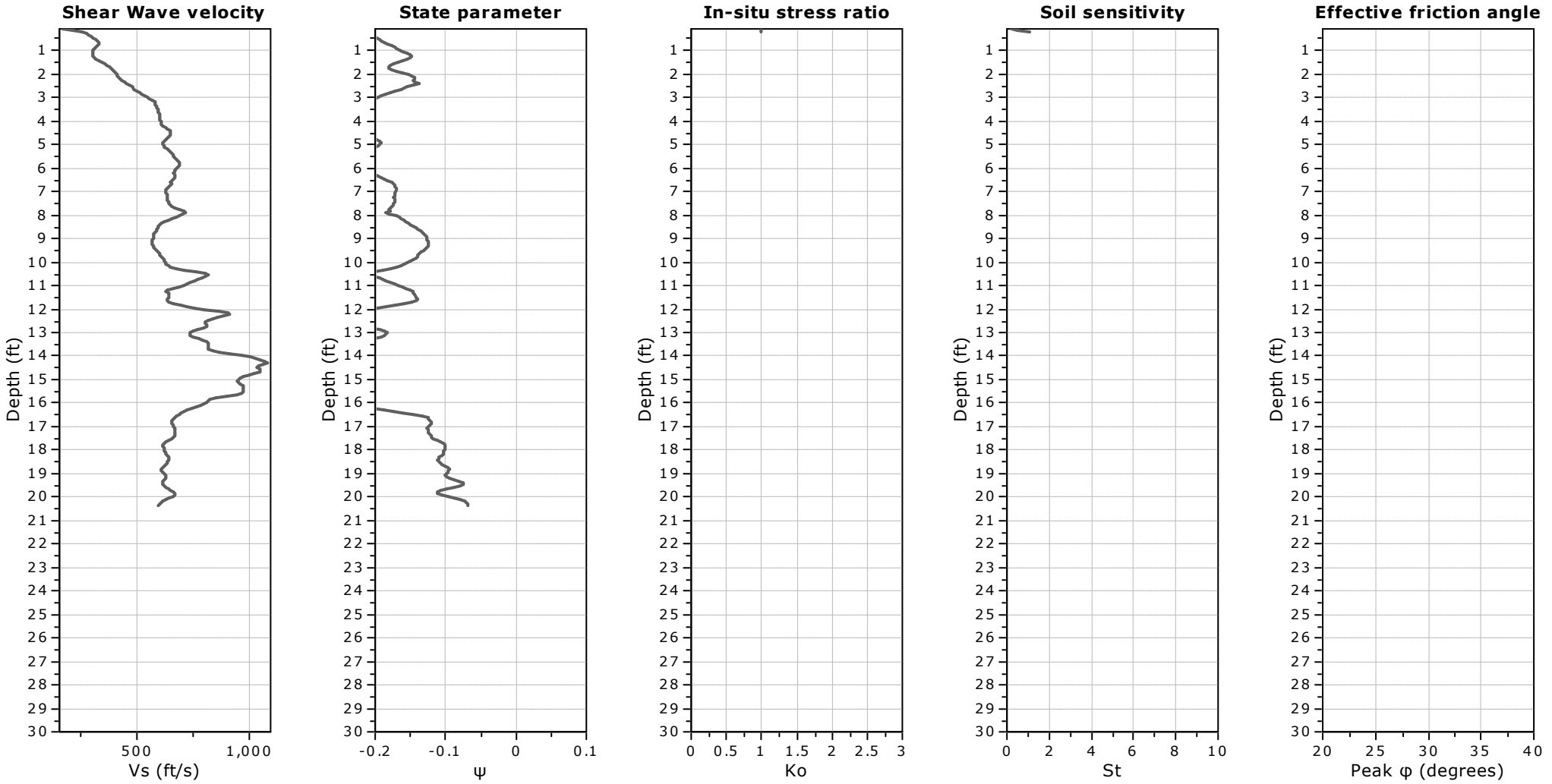
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-7
Total depth: 20.36 ft, Date: 5/13/2024
Surface Elevation: 64.37 ft
Coords: X:572119.23, Y:555936.17
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



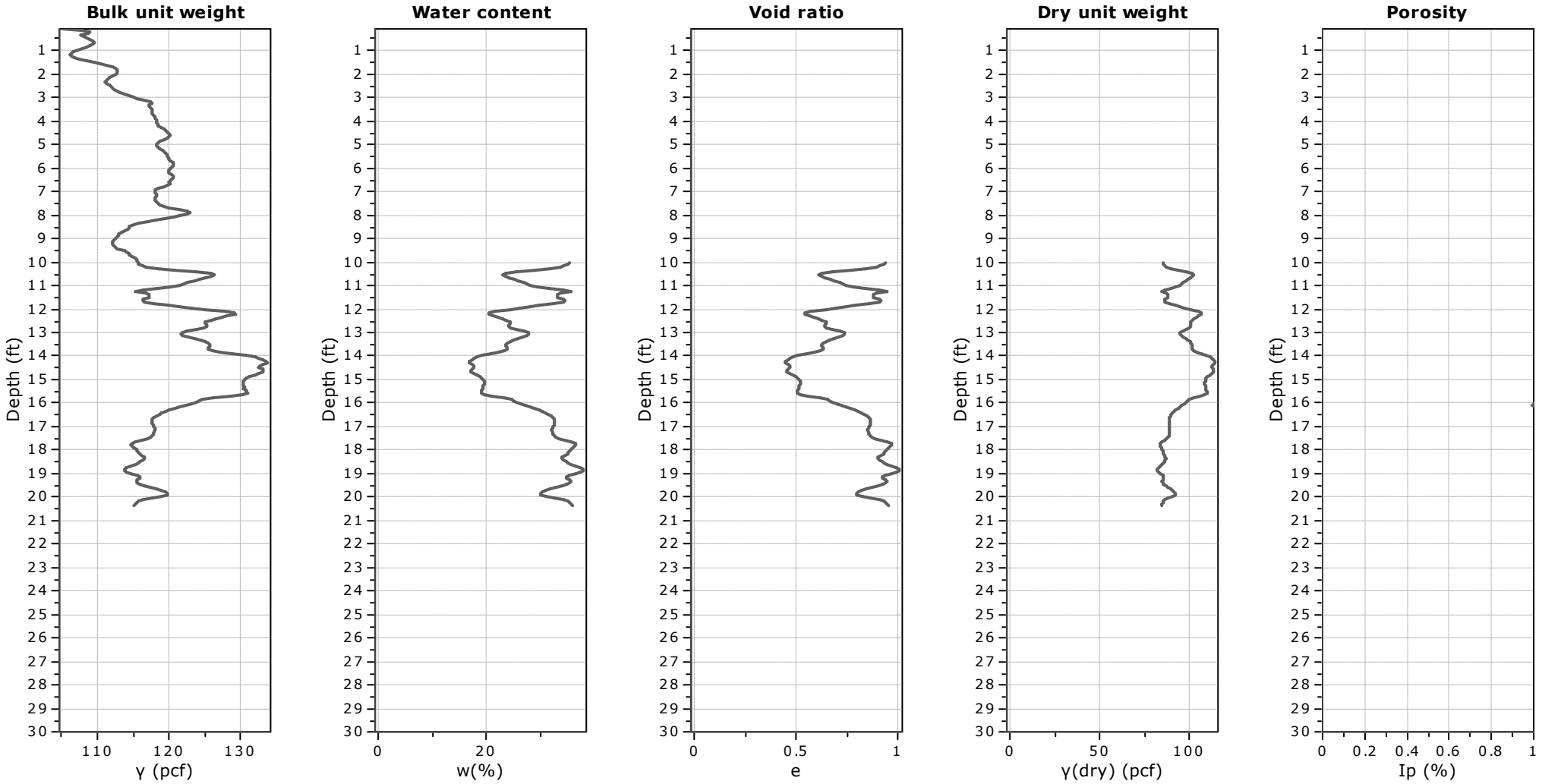
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-7
Total depth: 20.36 ft, Date: 5/13/2024
Surface Elevation: 64.37 ft
Coords: X:572119.23, Y:555936.17
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

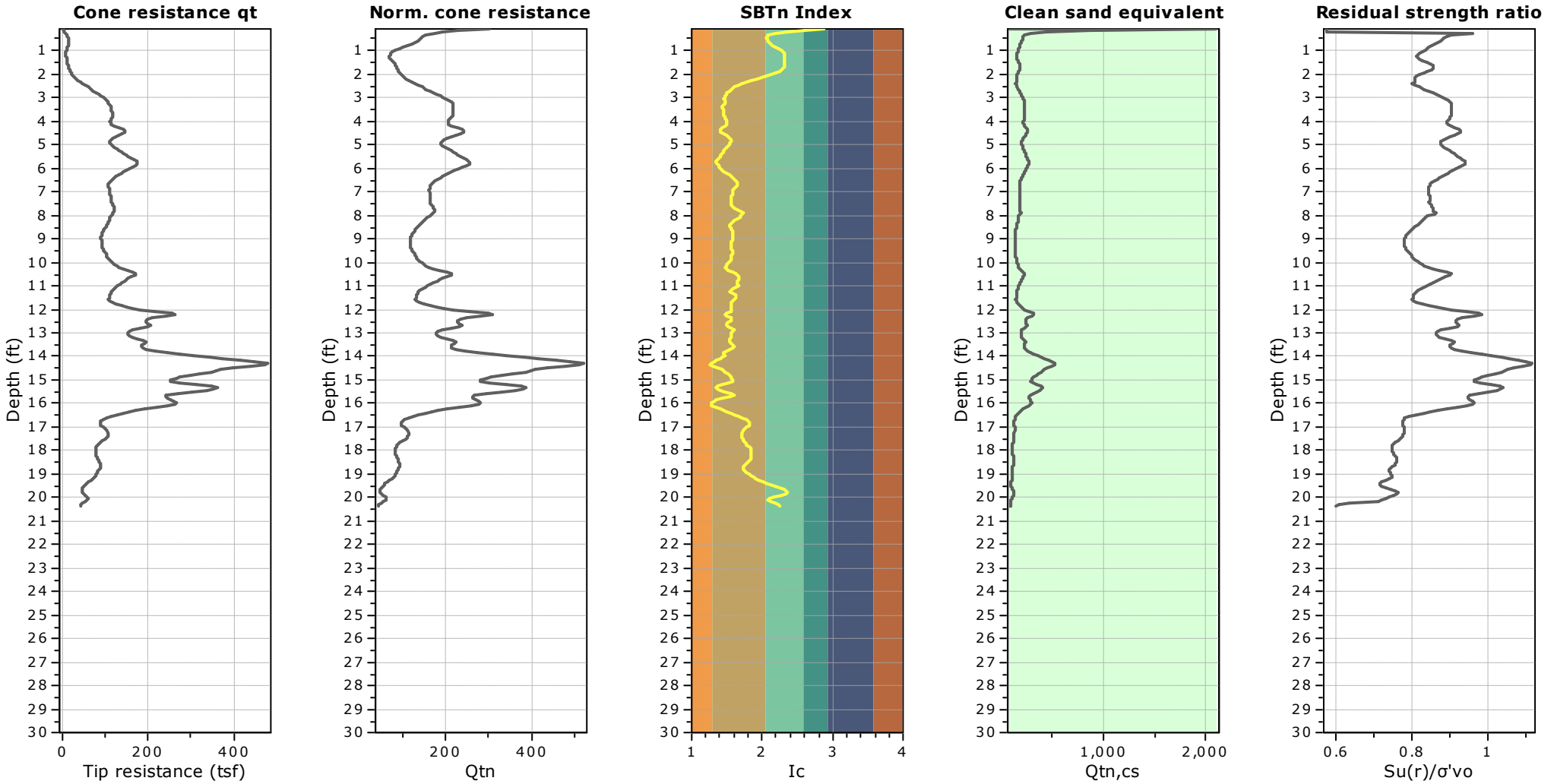
Project: ASD Summit Campus
Location: Middletown, Delaware



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-7
Total depth: 20.36 ft, Date: 5/13/2024
Surface Elevation: 64.37 ft
Coords: X:572119.23, Y:555936.17
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

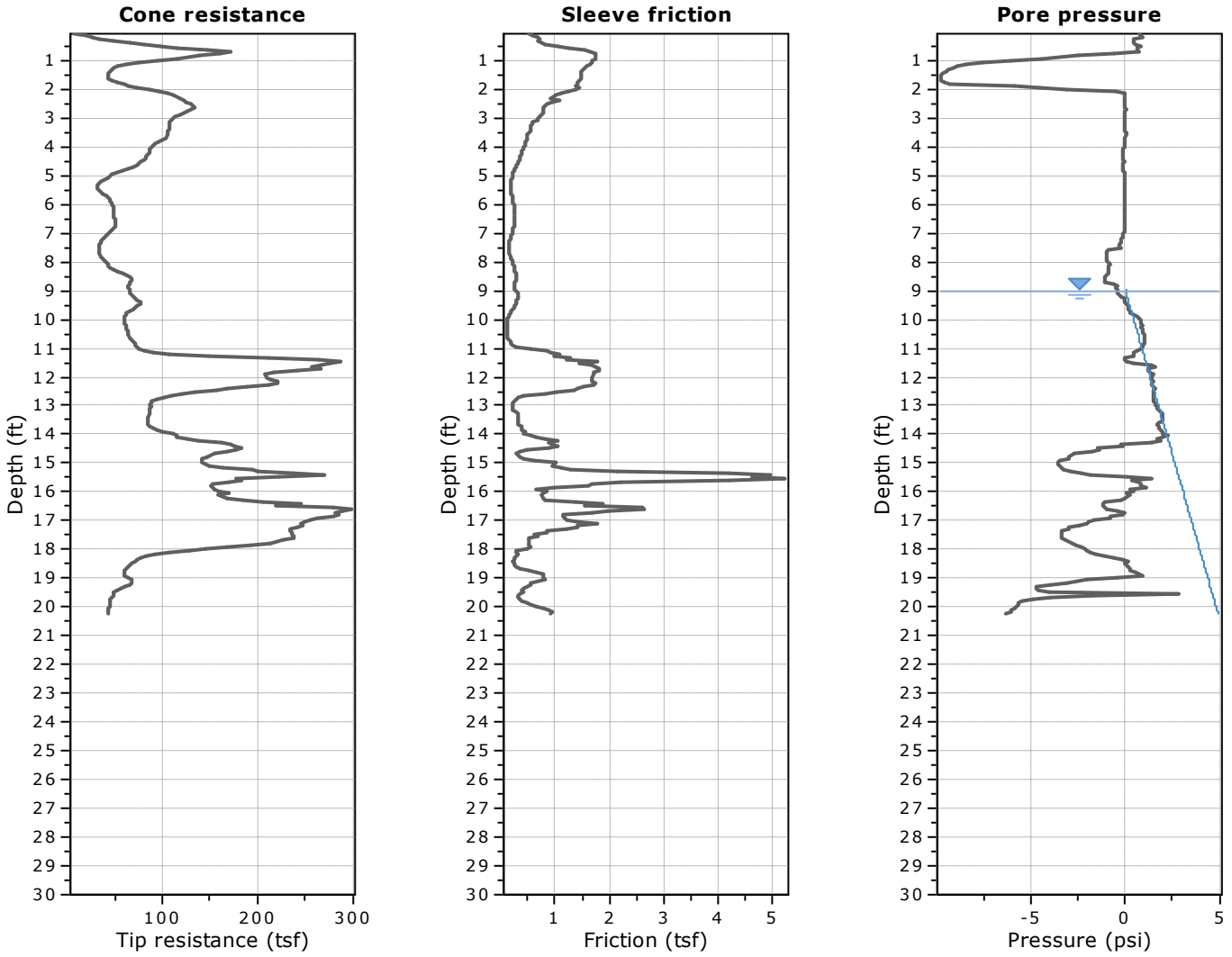
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



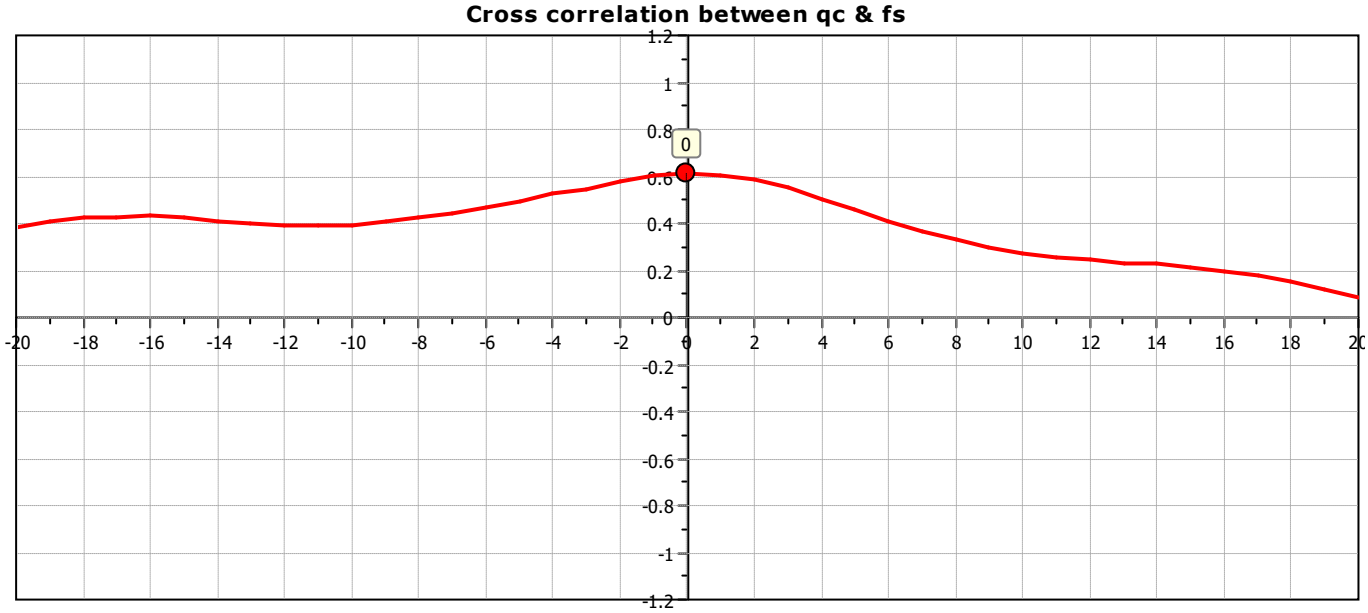
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

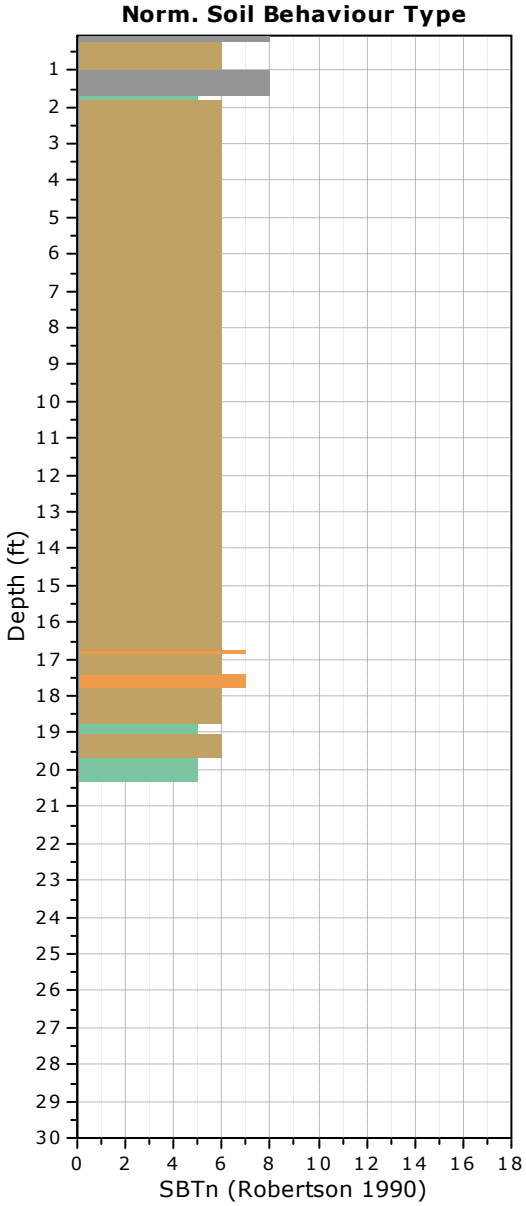
C-8
Total depth: 20.25 ft, Date: 5/13/2024
Surface Elevation: 63.48 ft
Coords: X:571978.60, Y:555797.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

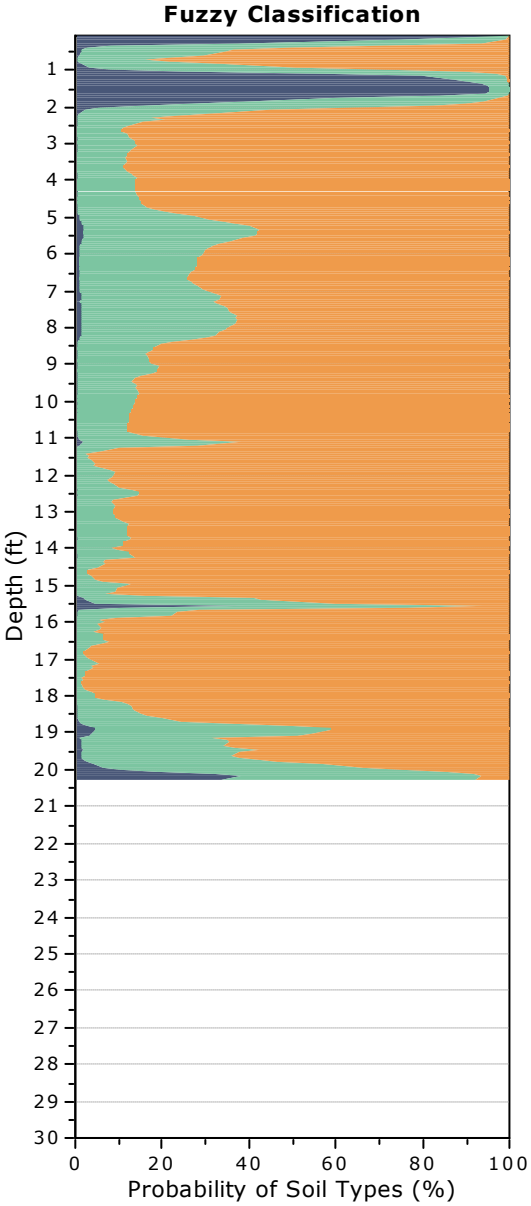
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







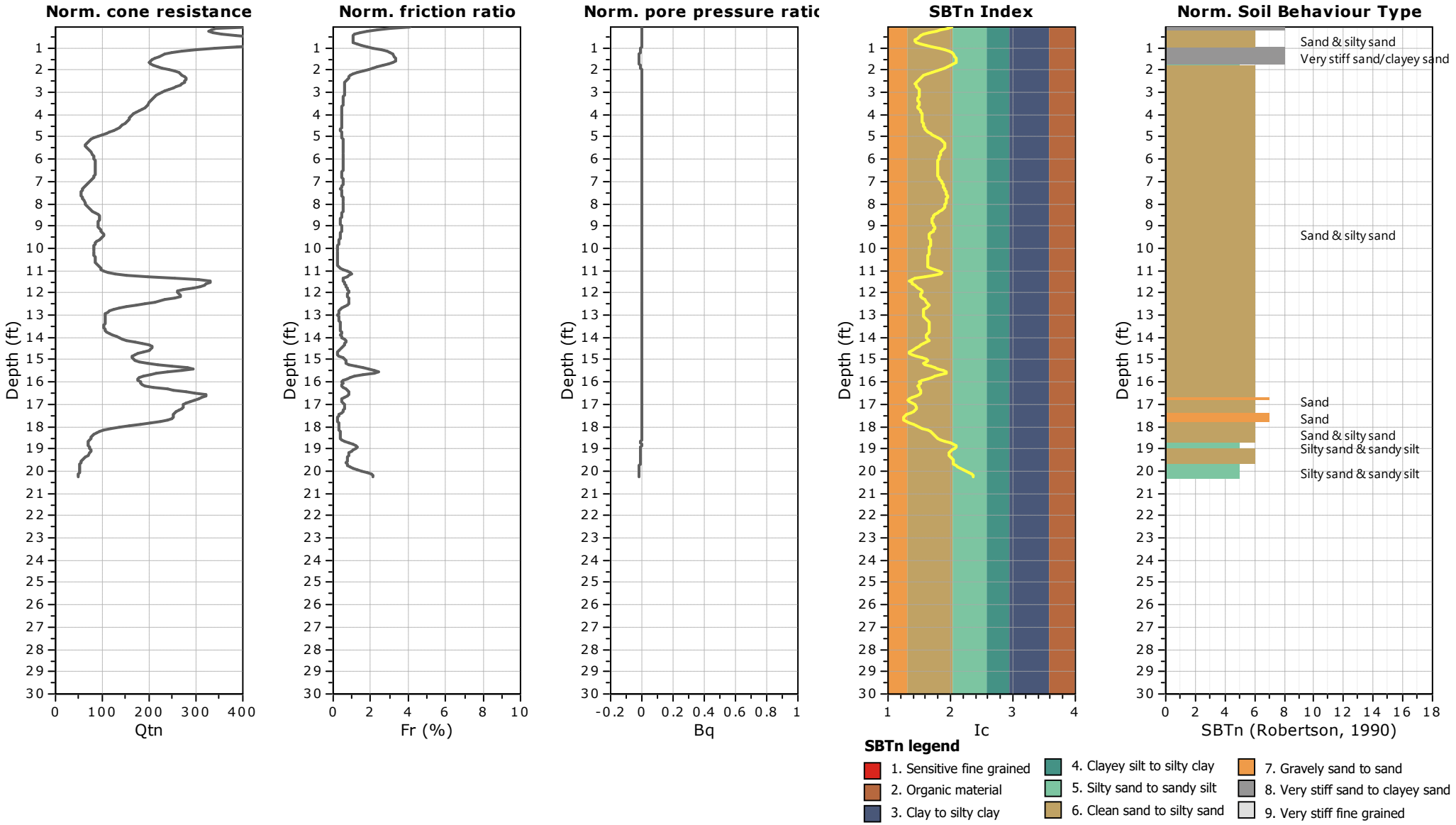
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-8
Total depth: 20.25 ft, Date: 5/13/2024
Surface Elevation: 63.48 ft
Coords: X:571978.60, Y:555797.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

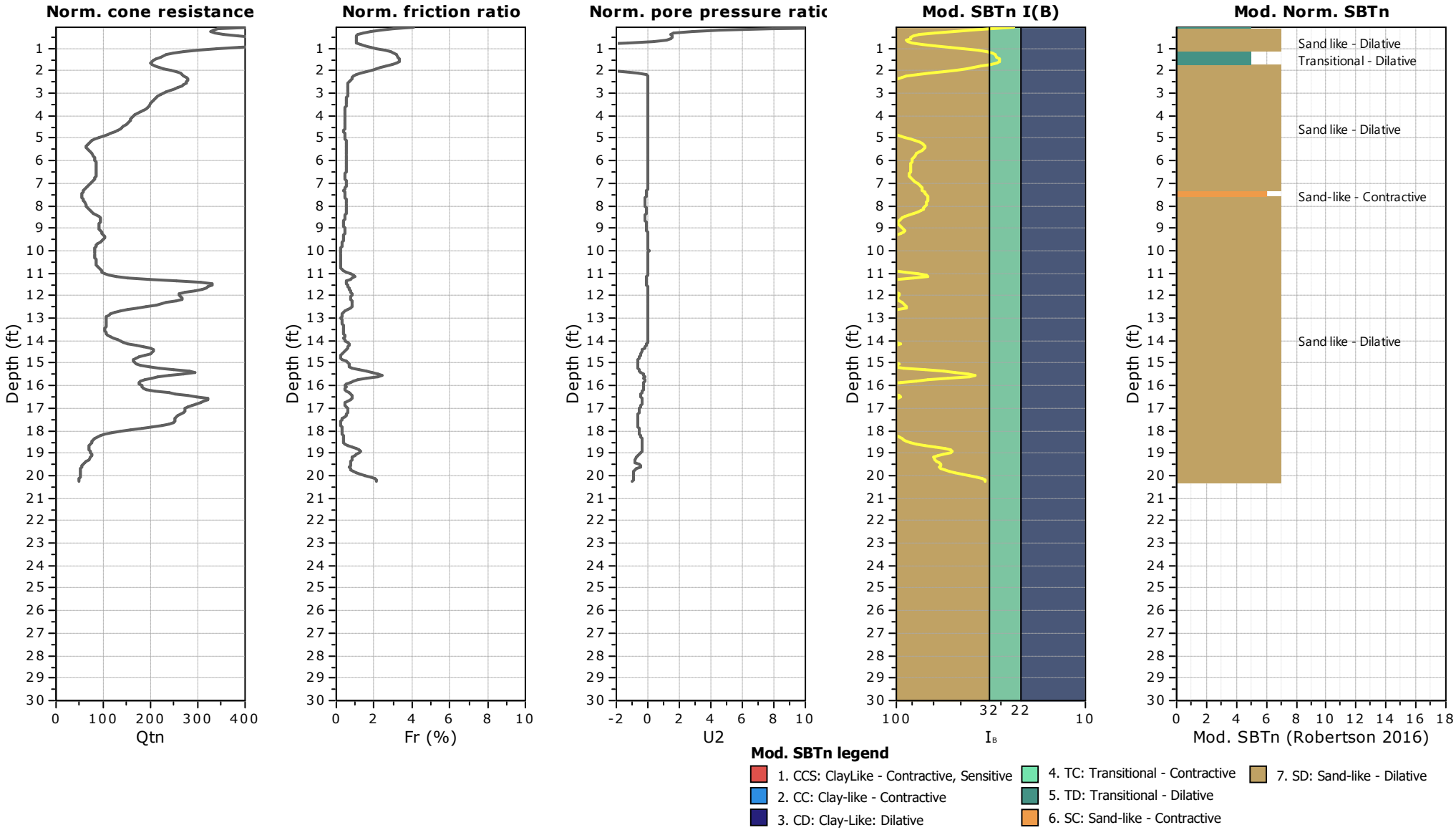
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-8
Total depth: 20.25 ft, Date: 5/13/2024
Surface Elevation: 63.48 ft
Coords: X:571978.60, Y:555797.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

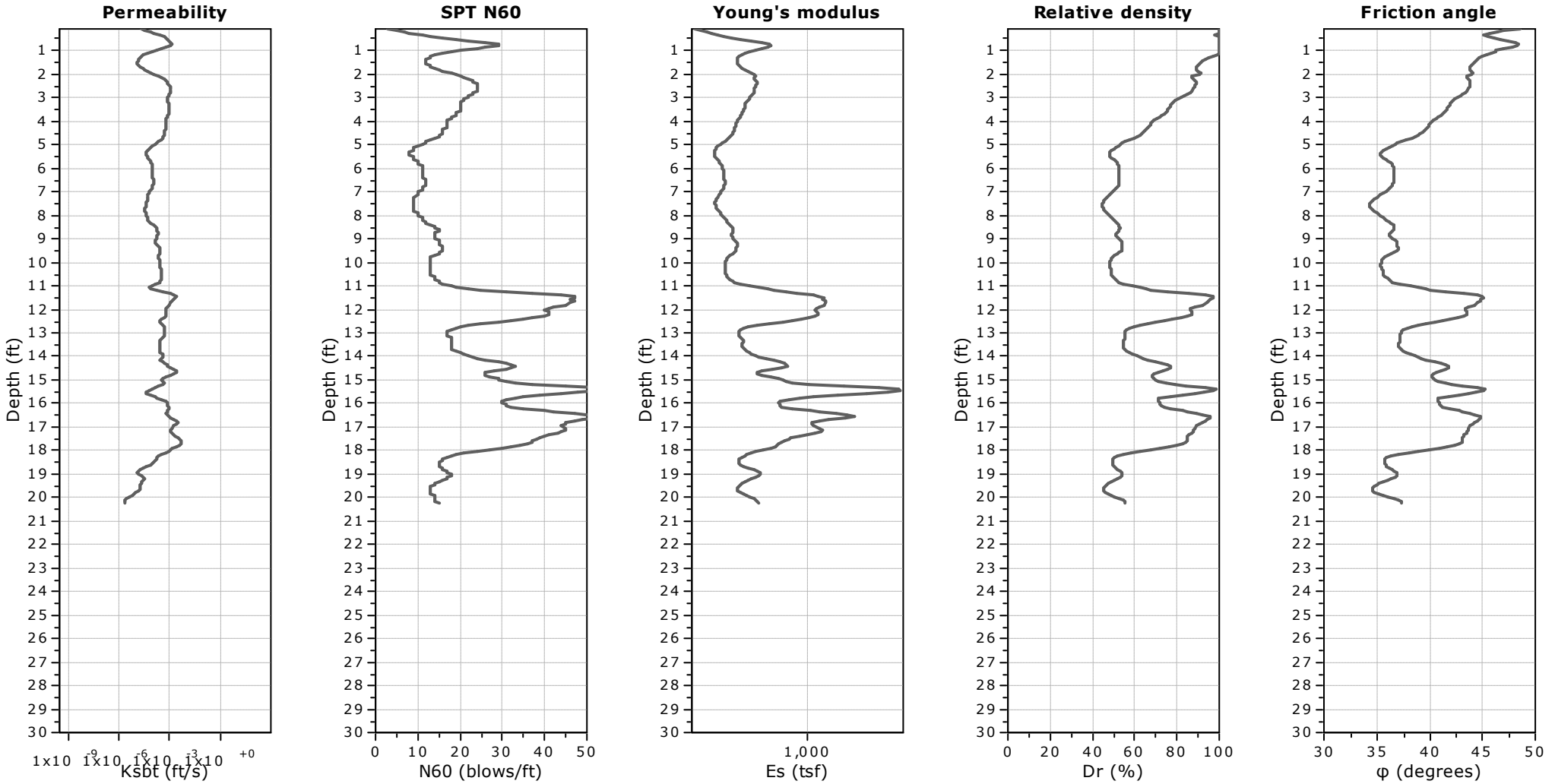
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-8
Total depth: 20.25 ft, Date: 5/13/2024
Surface Elevation: 63.48 ft
Coords: X:571978.60, Y:555797.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



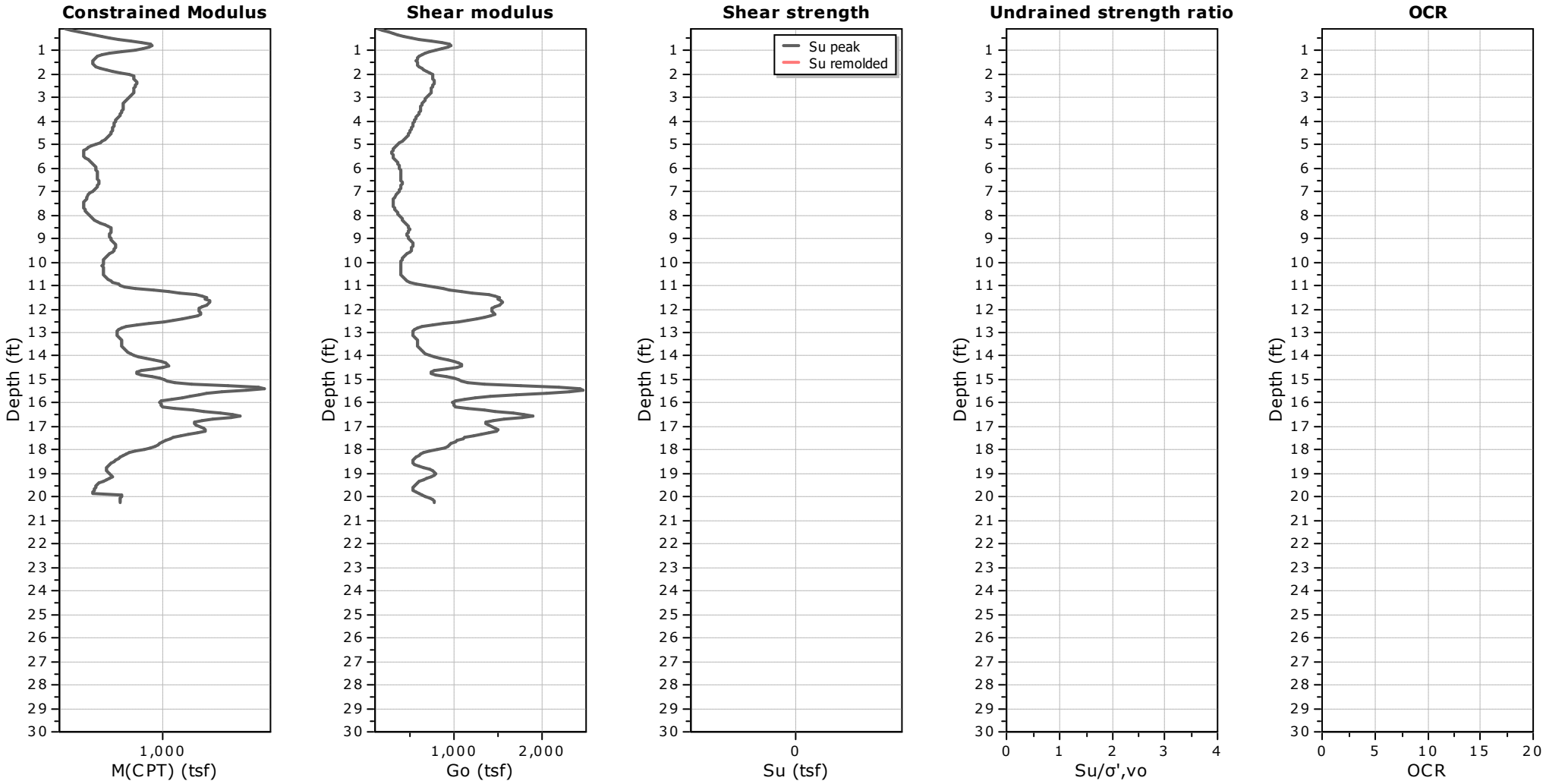
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-8
Total depth: 20.25 ft, Date: 5/13/2024
Surface Elevation: 63.48 ft
Coords: X:571978.60, Y:555797.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



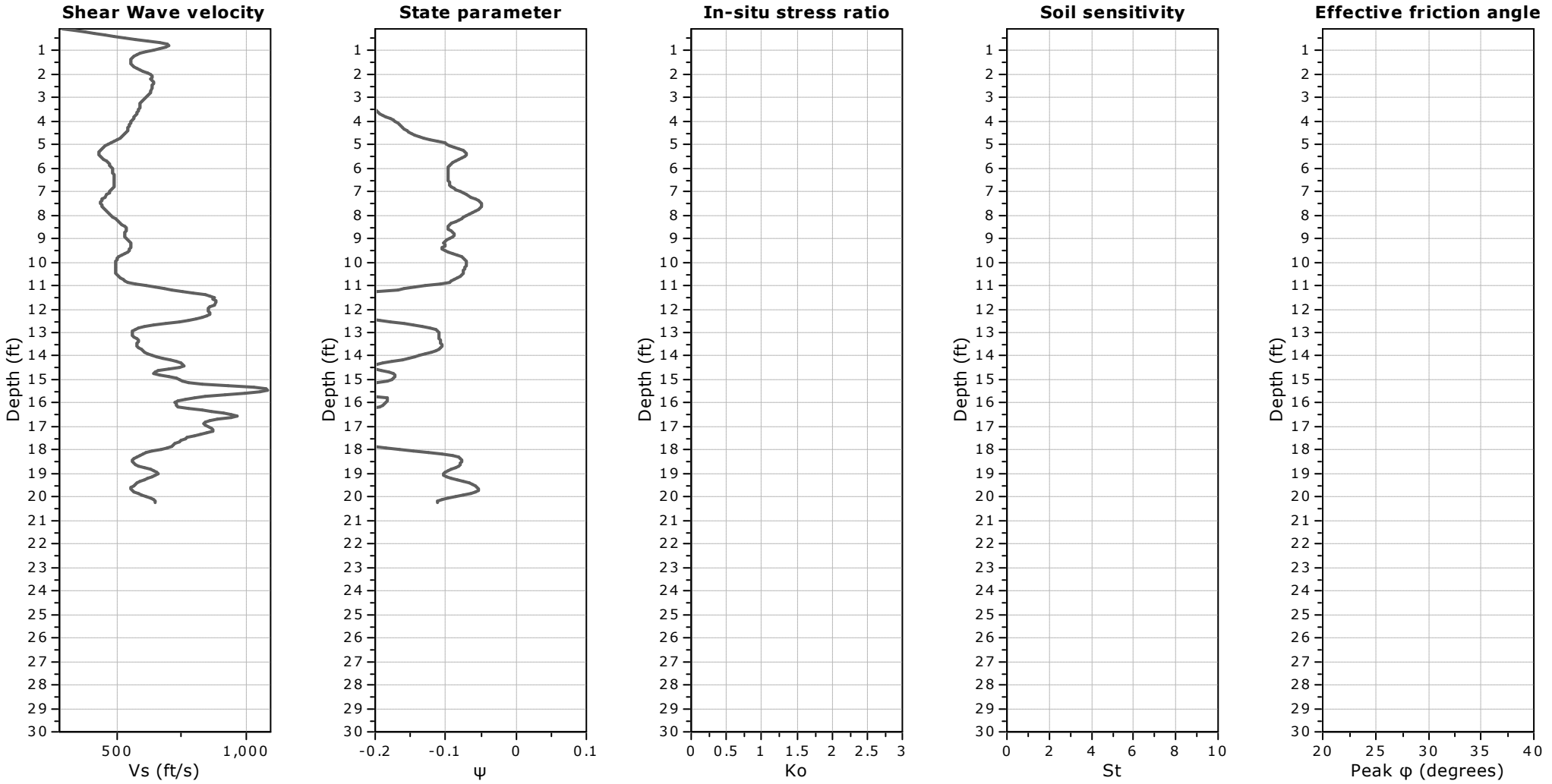
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-8
Total depth: 20.25 ft, Date: 5/13/2024
Surface Elevation: 63.48 ft
Coords: X:571978.60, Y:555797.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



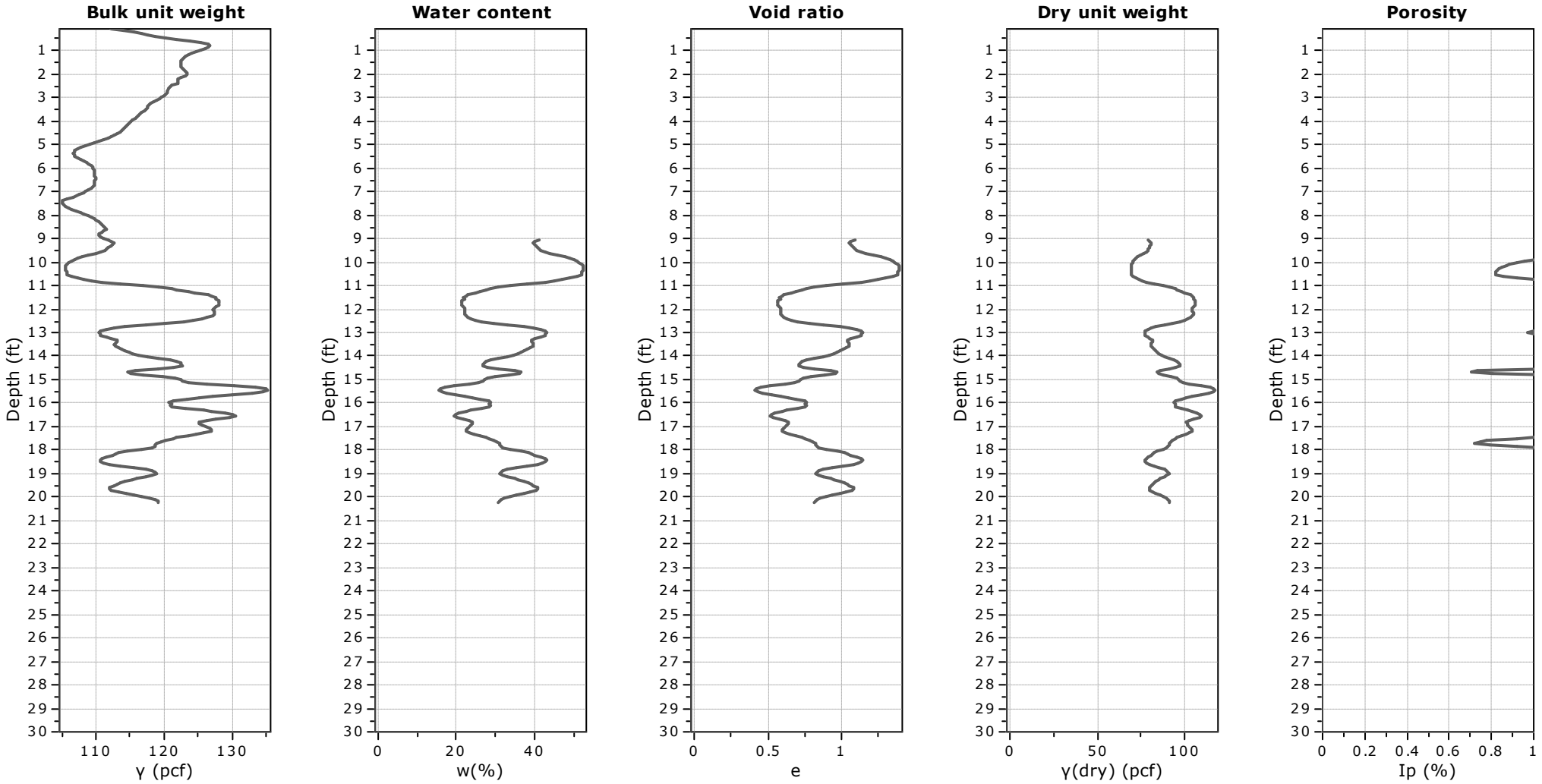
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-8
Total depth: 20.25 ft, Date: 5/13/2024
Surface Elevation: 63.48 ft
Coords: X:571978.60, Y:555797.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

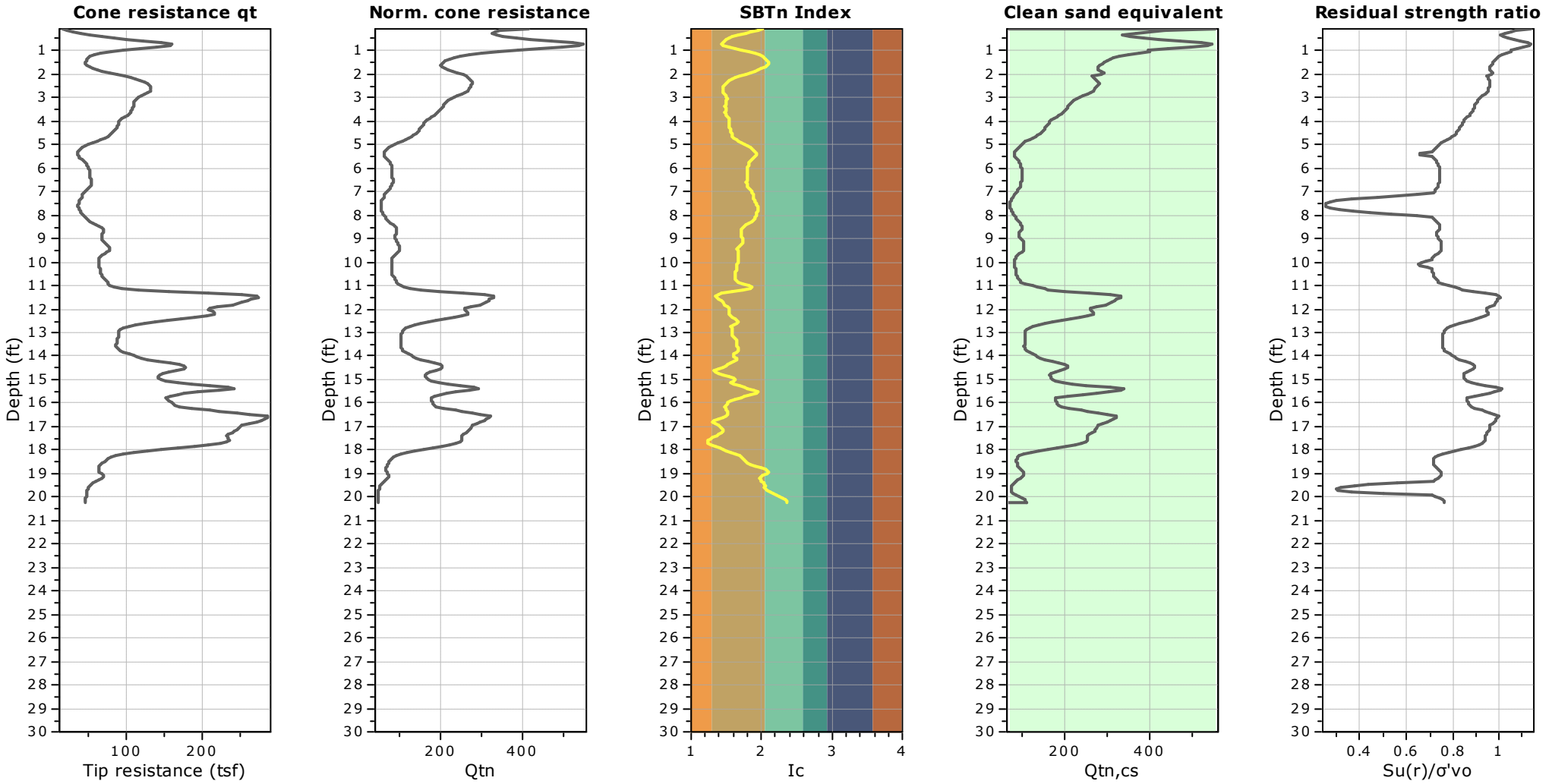
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-8
Total depth: 20.25 ft, Date: 5/13/2024
Surface Elevation: 63.48 ft
Coords: X:571978.60, Y:555797.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

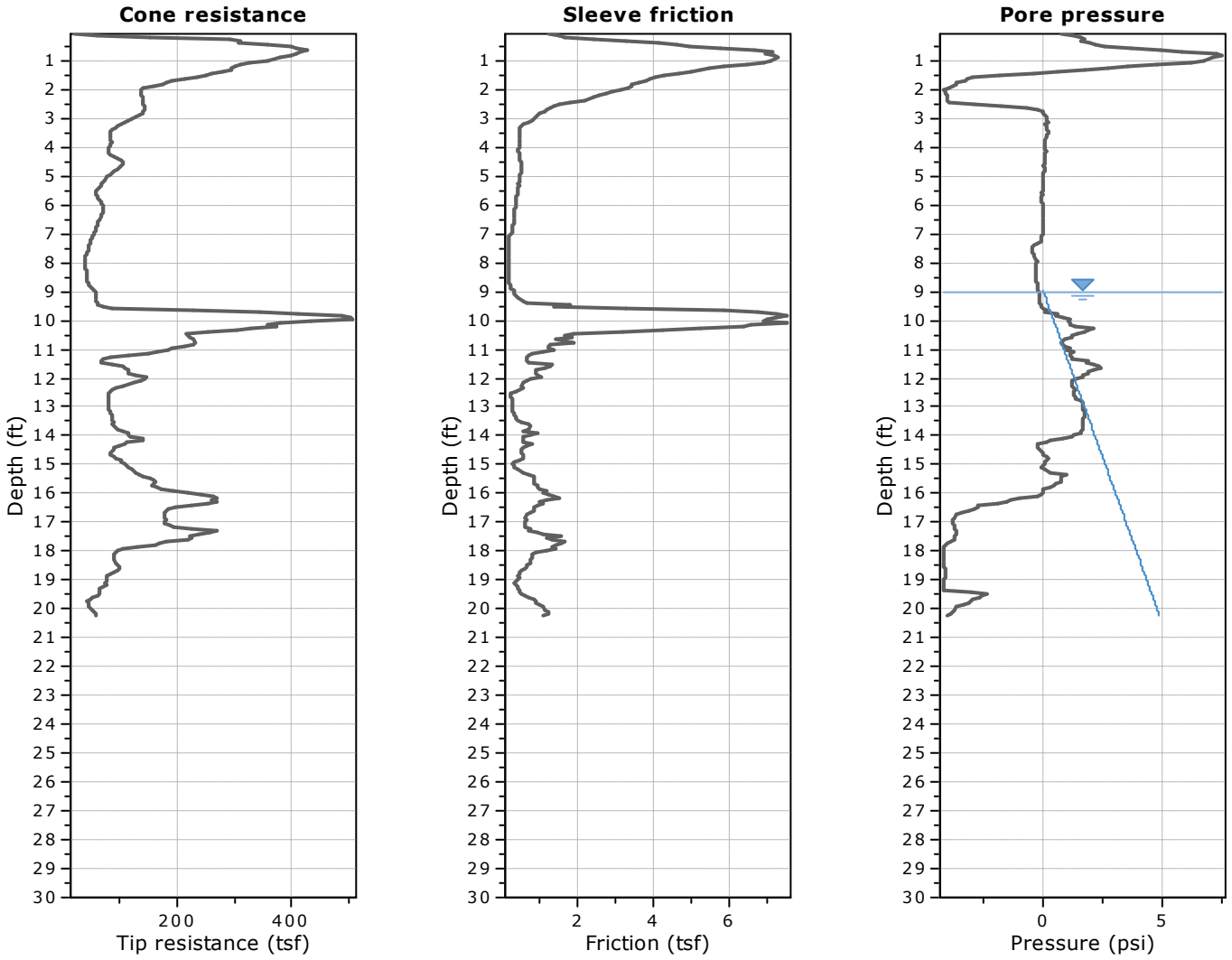


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

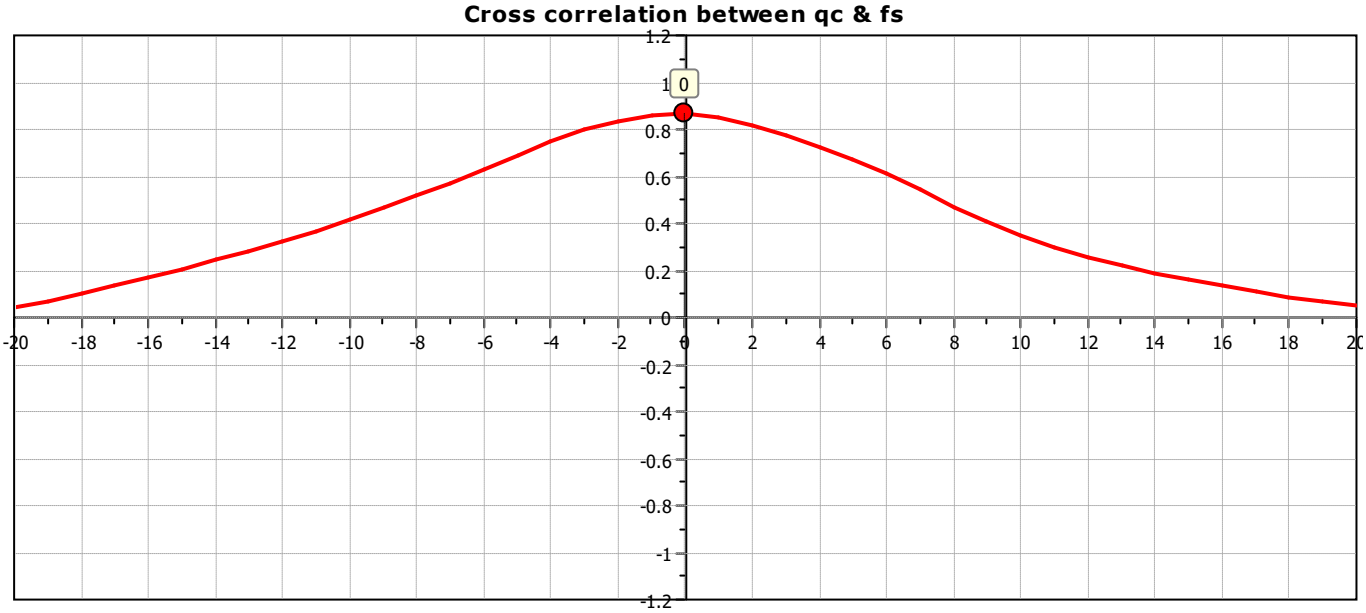
C-9

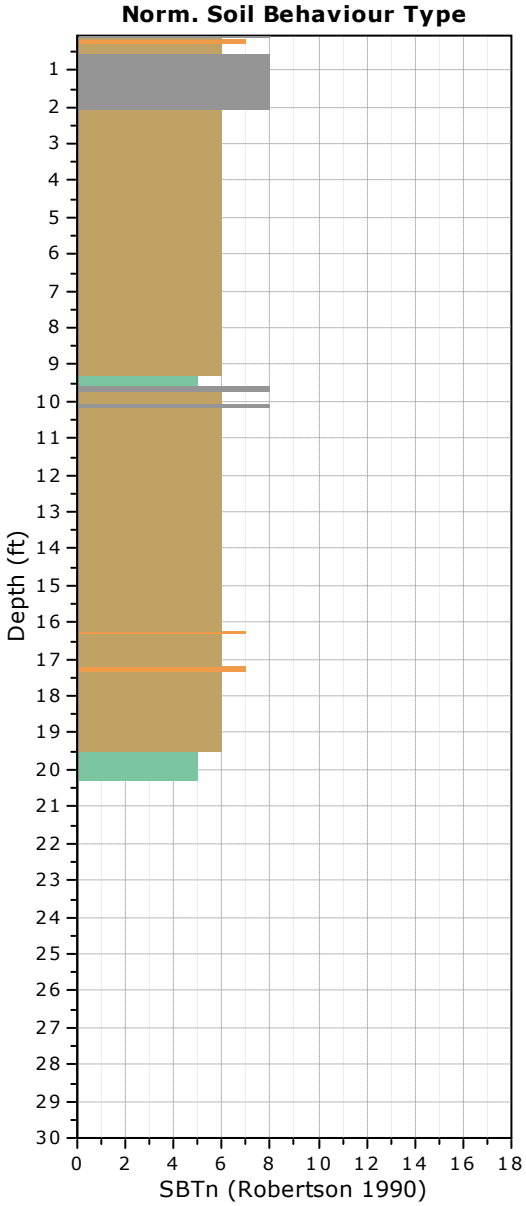
Total depth: 20.21 ft, Date: 5/13/2024
Surface Elevation: 63.71 ft
Coords: X:572024.50, Y:555735.32
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

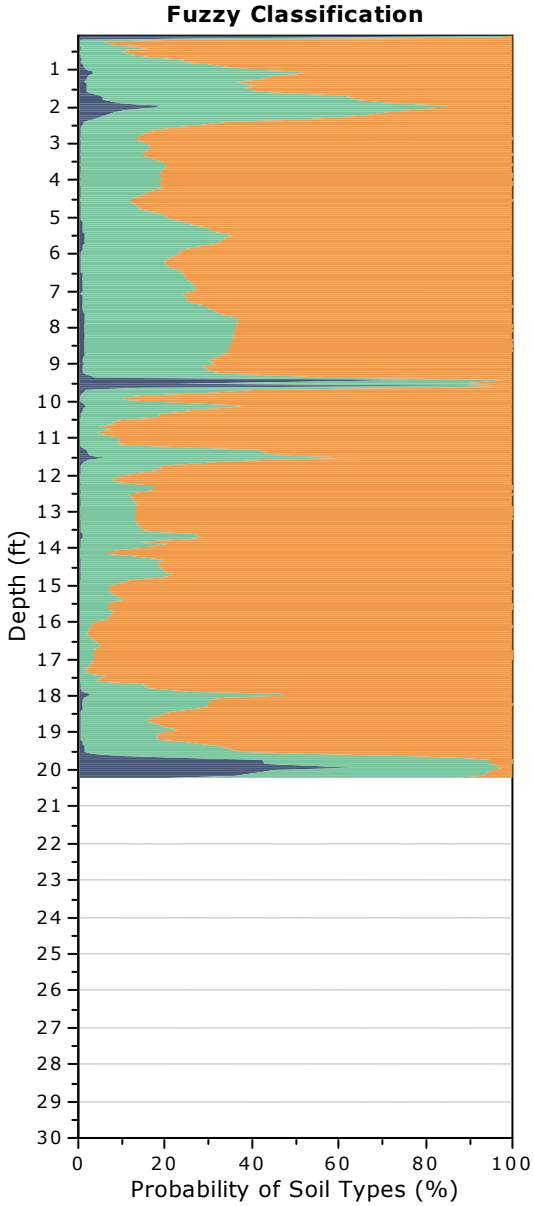
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







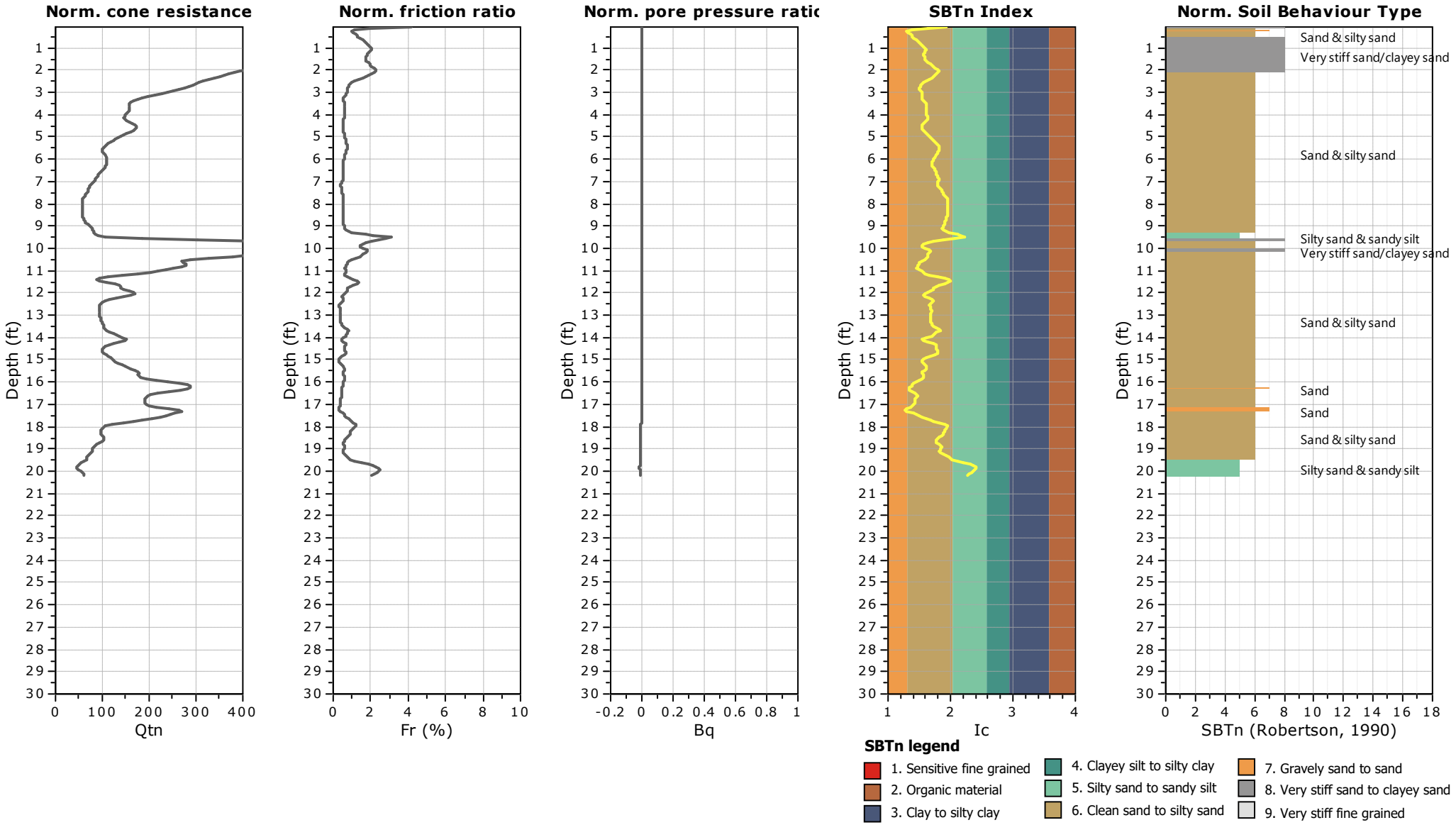
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-9
Total depth: 20.21 ft, Date: 5/13/2024
Surface Elevation: 63.71 ft
Coords: X:572024.50, Y:555735.32
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

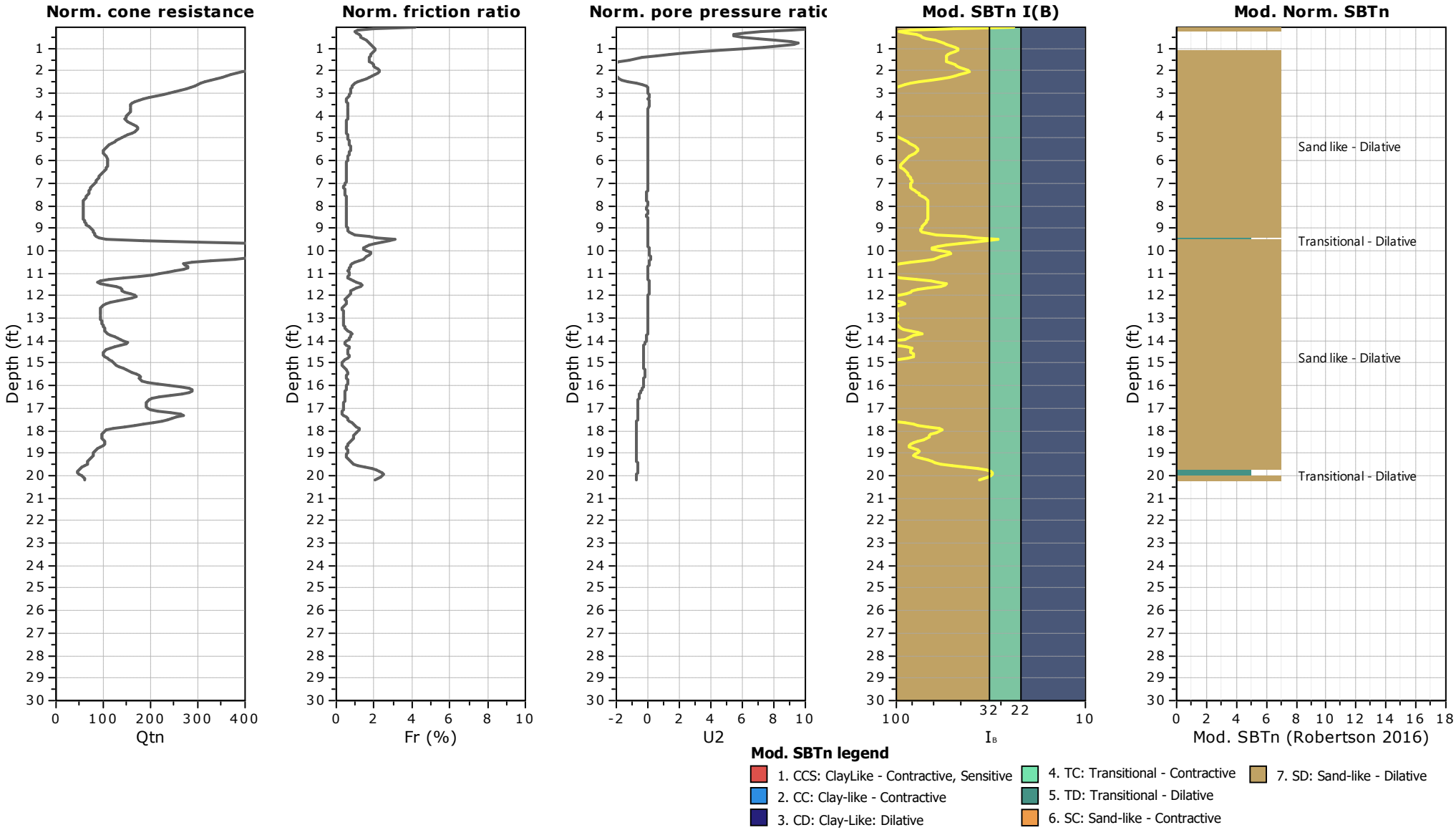


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-9

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

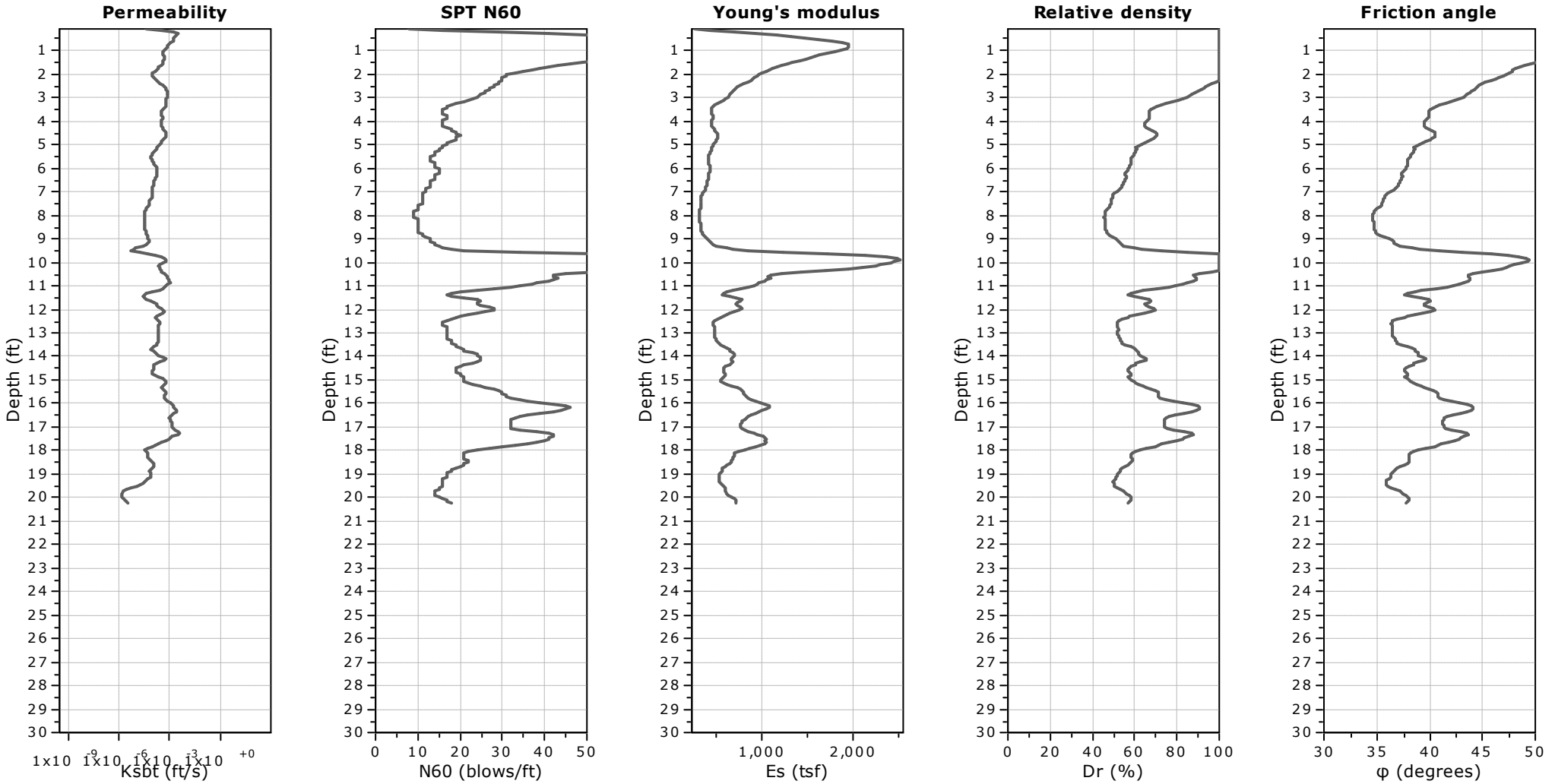
Total depth: 20.21 ft, Date: 5/13/2024
Surface Elevation: 63.71 ft
Coords: X:572024.50, Y:555735.32
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-9
Total depth: 20.21 ft, Date: 5/13/2024
Surface Elevation: 63.71 ft
Coords: X:572024.50, Y:555735.32
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



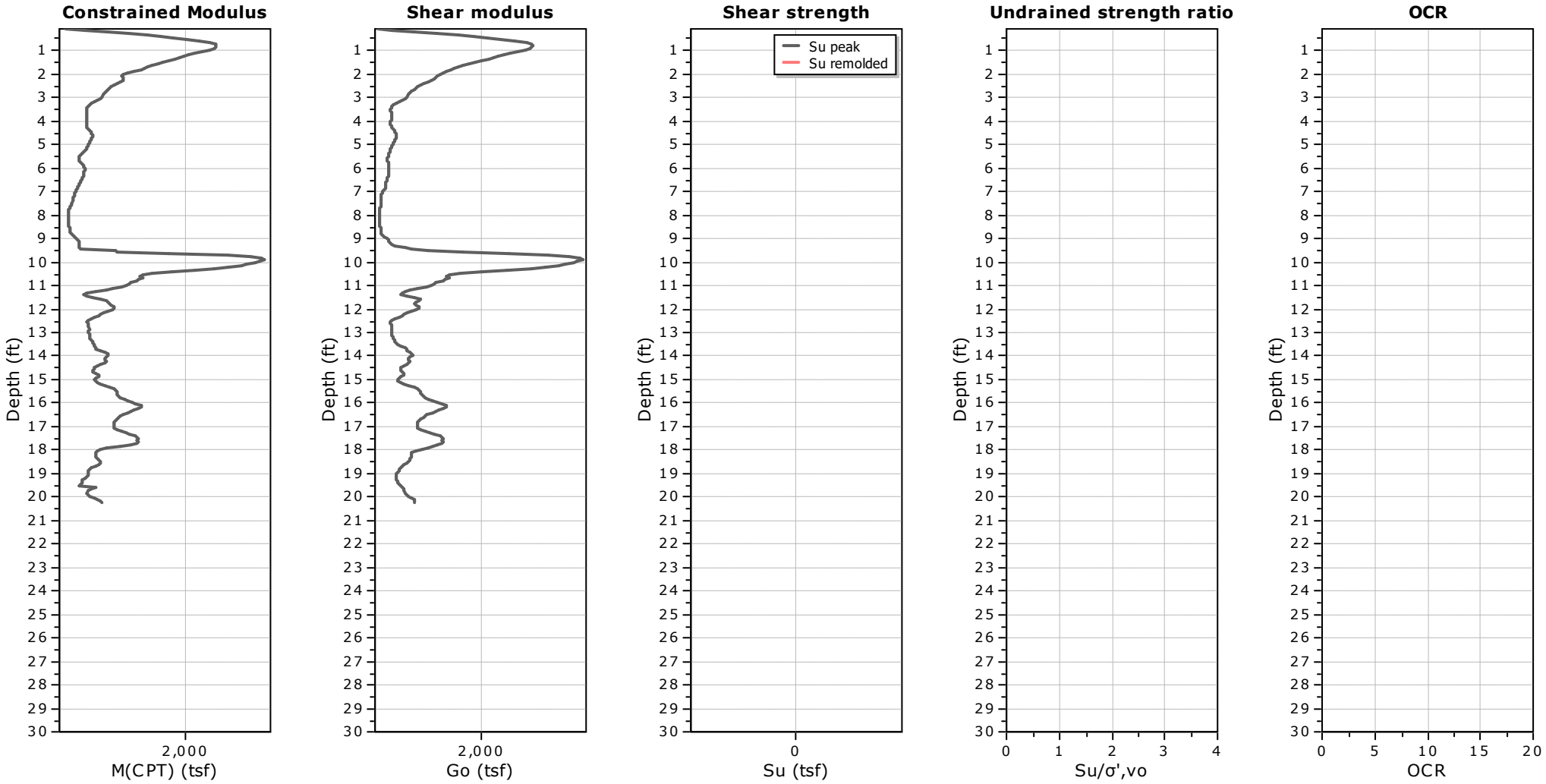
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-9
Total depth: 20.21 ft, Date: 5/13/2024
Surface Elevation: 63.71 ft
Coords: X:572024.50, Y:555735.32
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



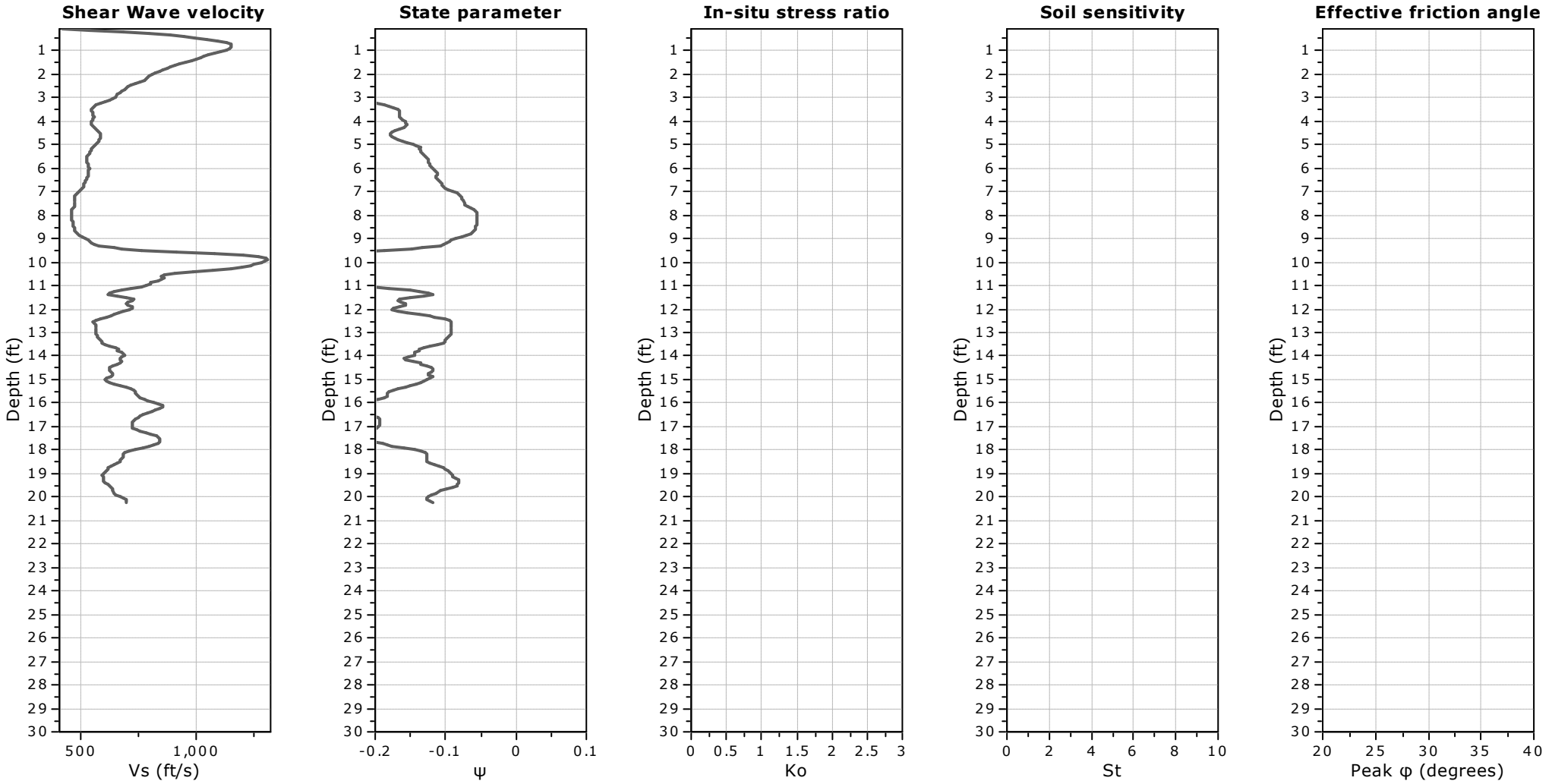
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-9
Total depth: 20.21 ft, Date: 5/13/2024
Surface Elevation: 63.71 ft
Coords: X:572024.50, Y:555735.32
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



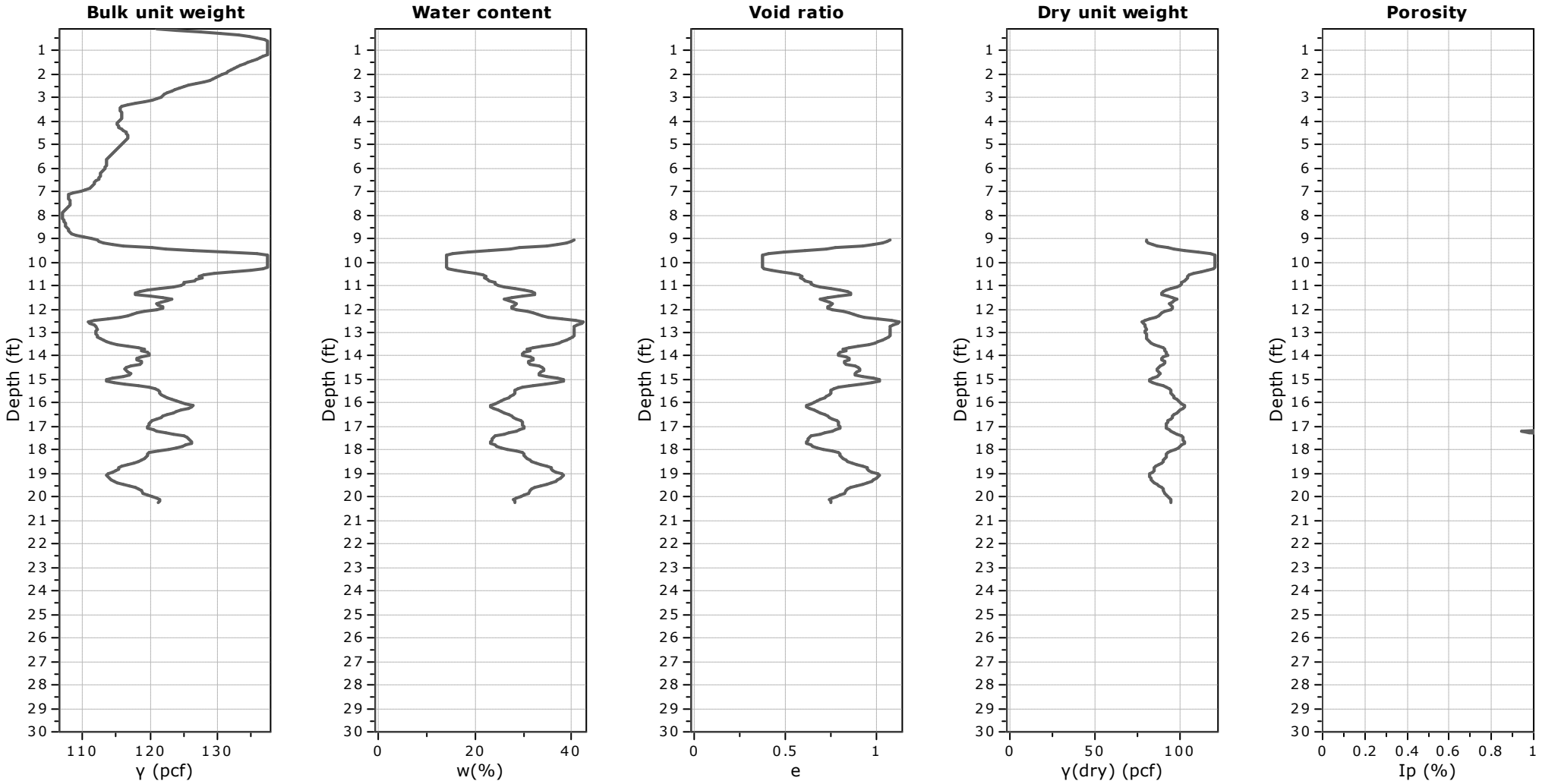
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-9
Total depth: 20.21 ft, Date: 5/13/2024
Surface Elevation: 63.71 ft
Coords: X:572024.50, Y:555735.32
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

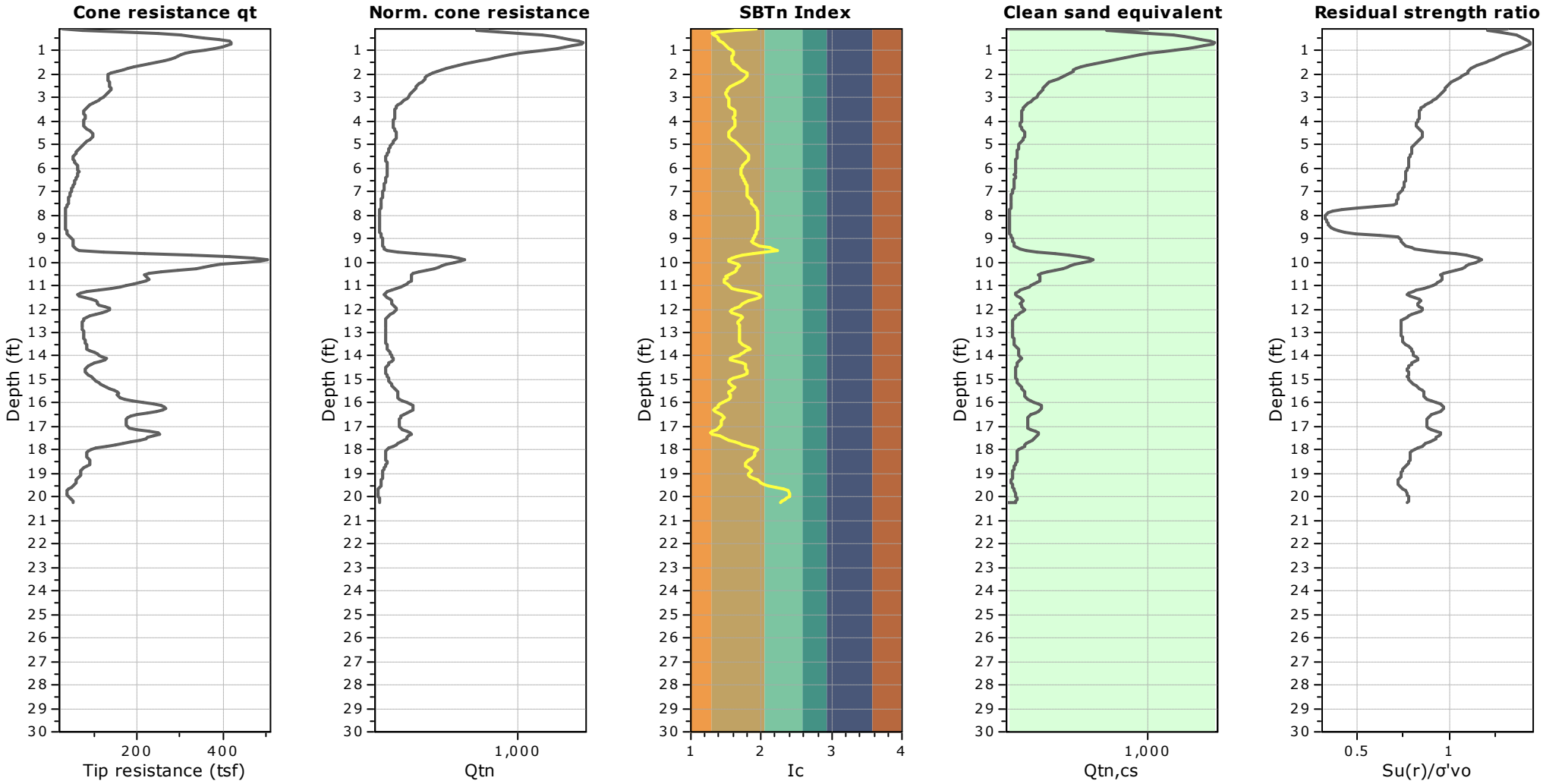
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

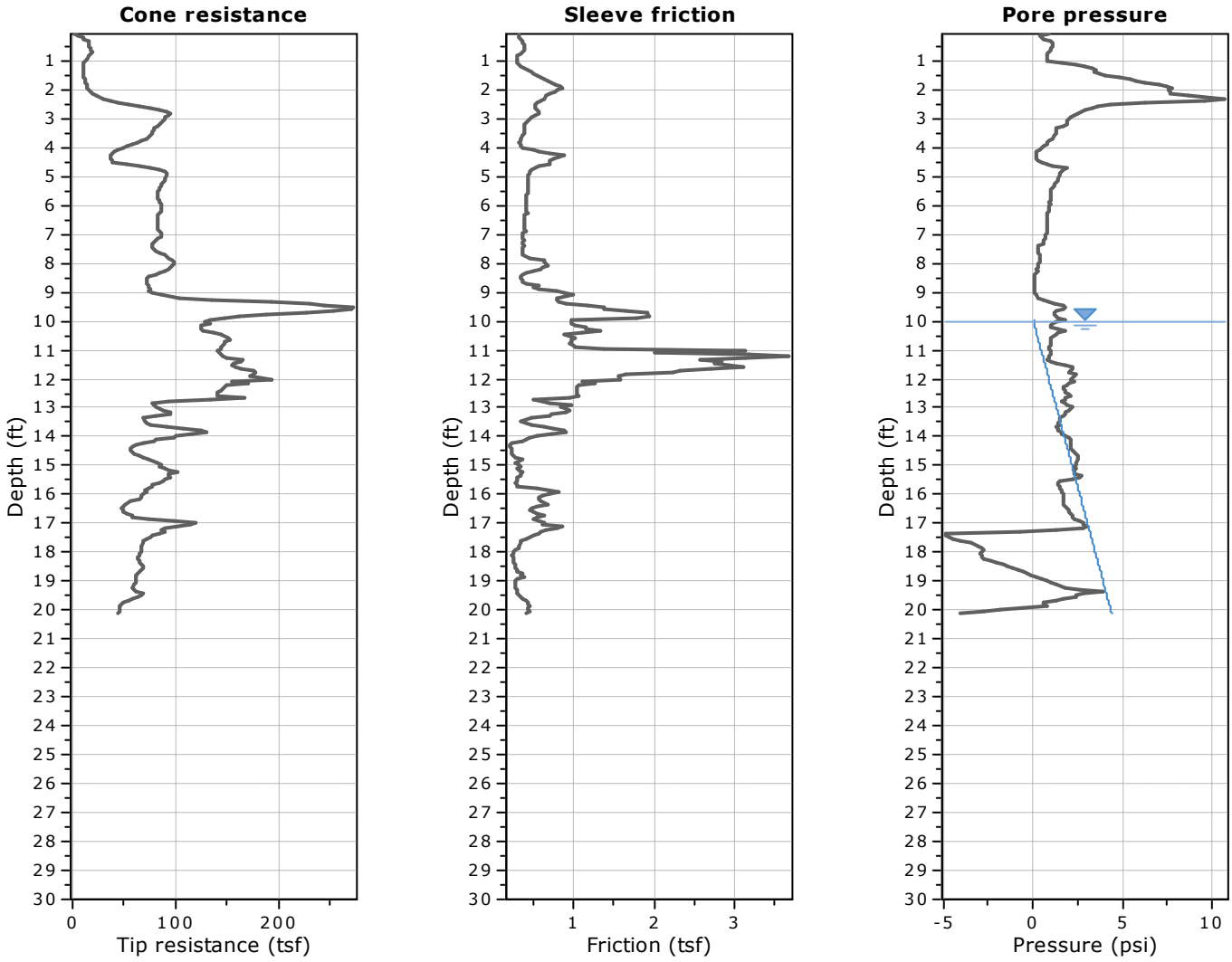


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

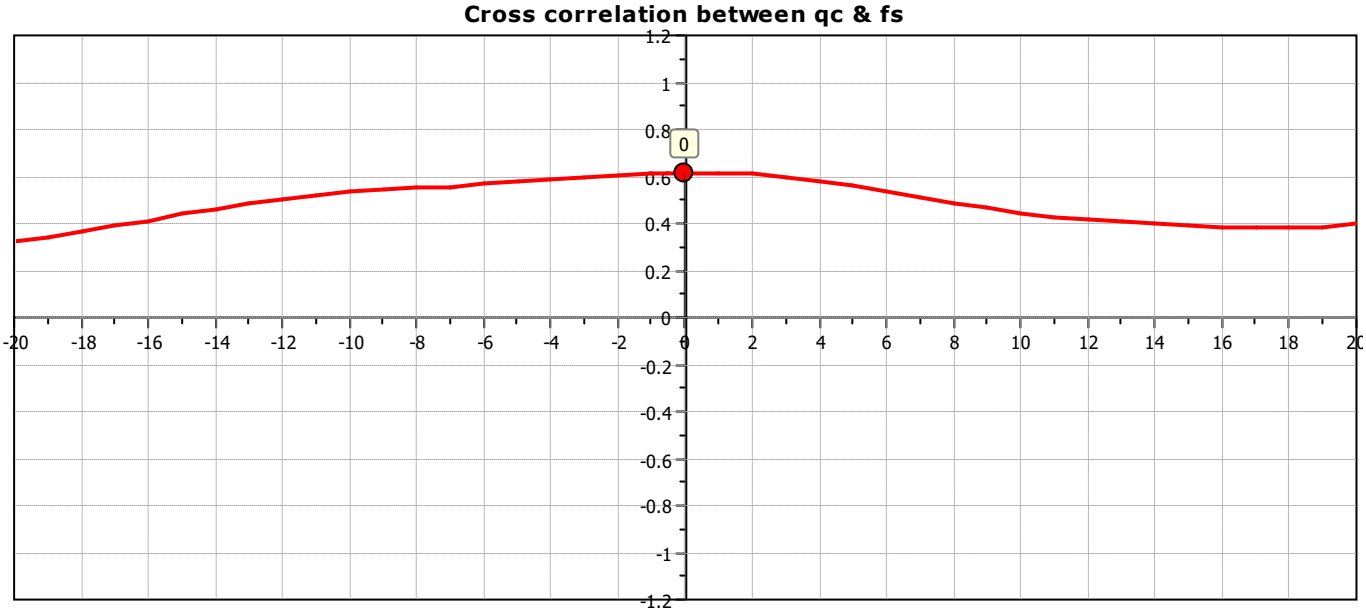
C-9
Total depth: 20.21 ft, Date: 5/13/2024
Surface Elevation: 63.71 ft
Coords: X:572024.50, Y:555735.32
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

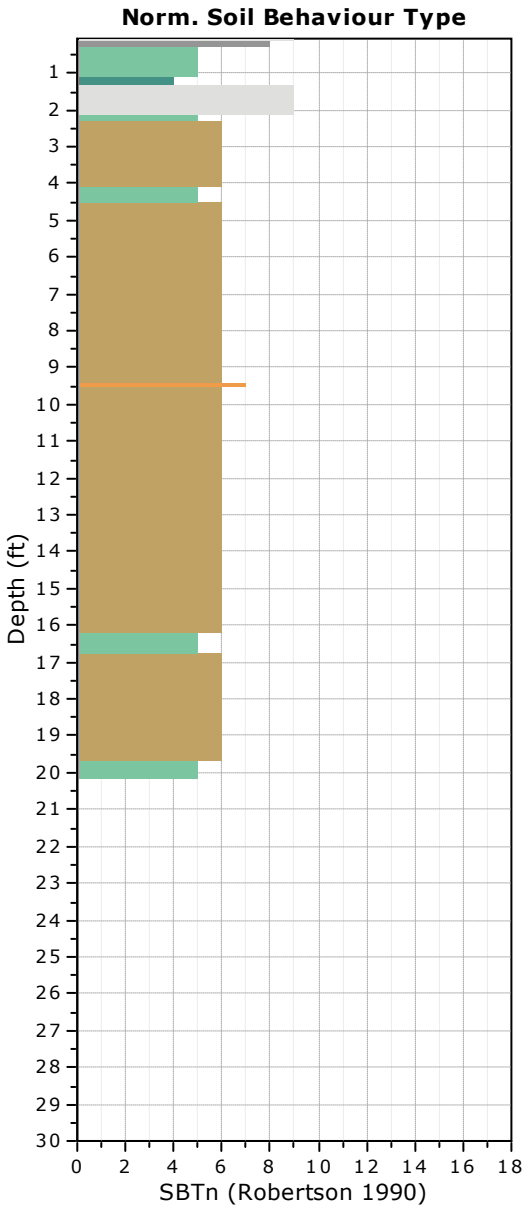
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

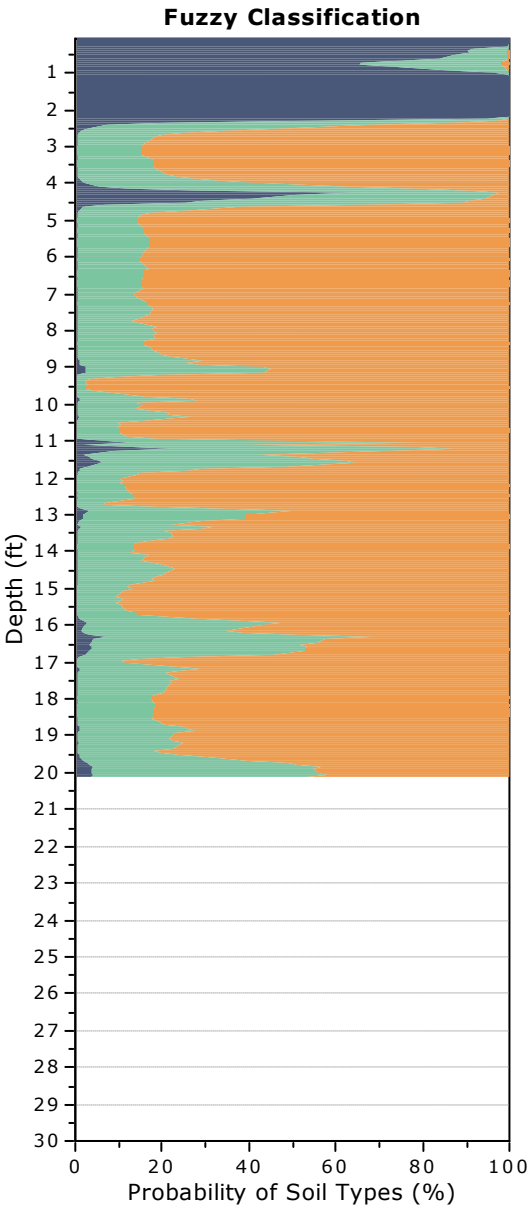




The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







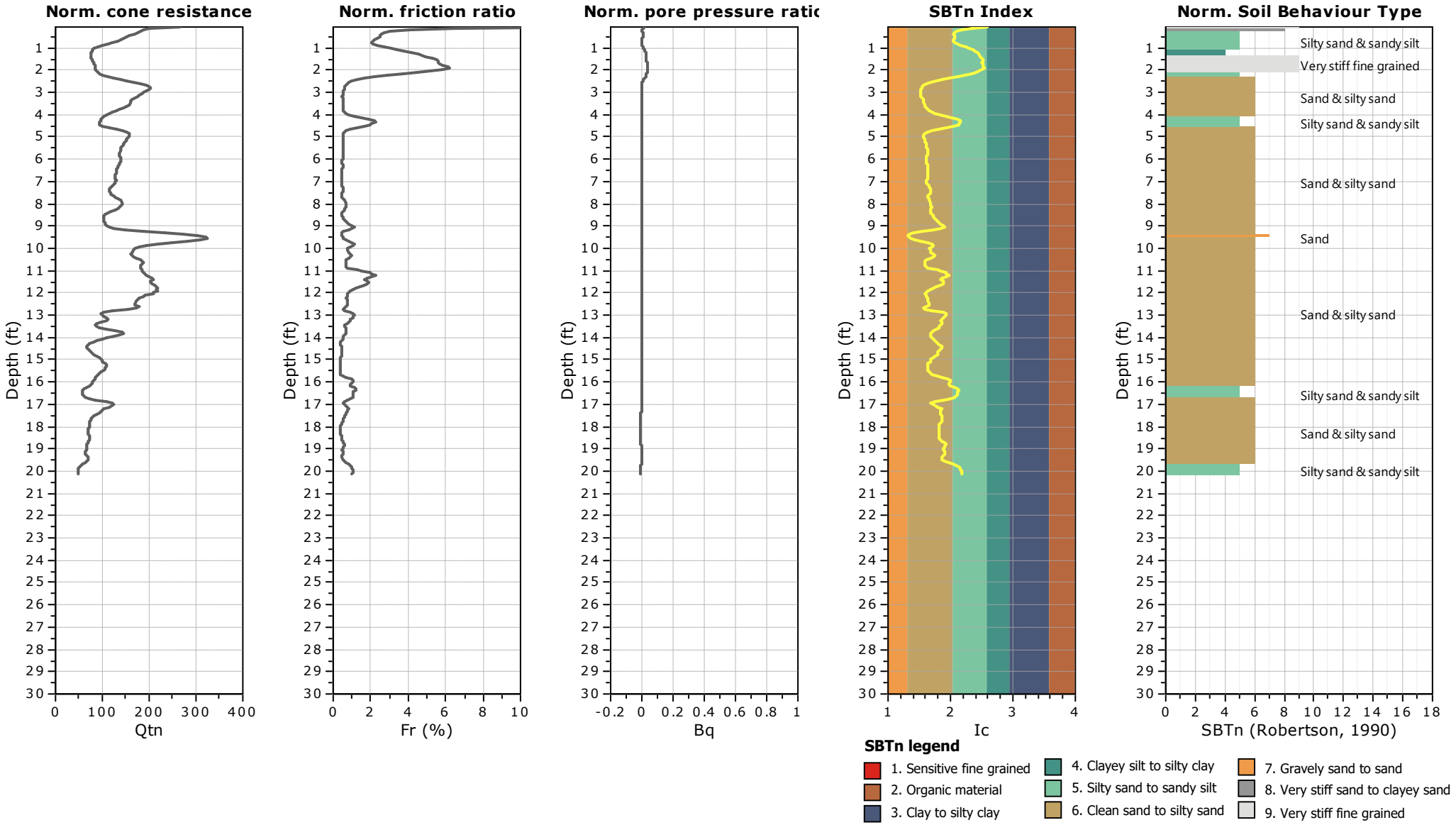
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-10
Total depth: 20.12 ft, Date: 5/13/2024
Surface Elevation: 64.49 ft
Coords: X:572138.55, Y:555855.71
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

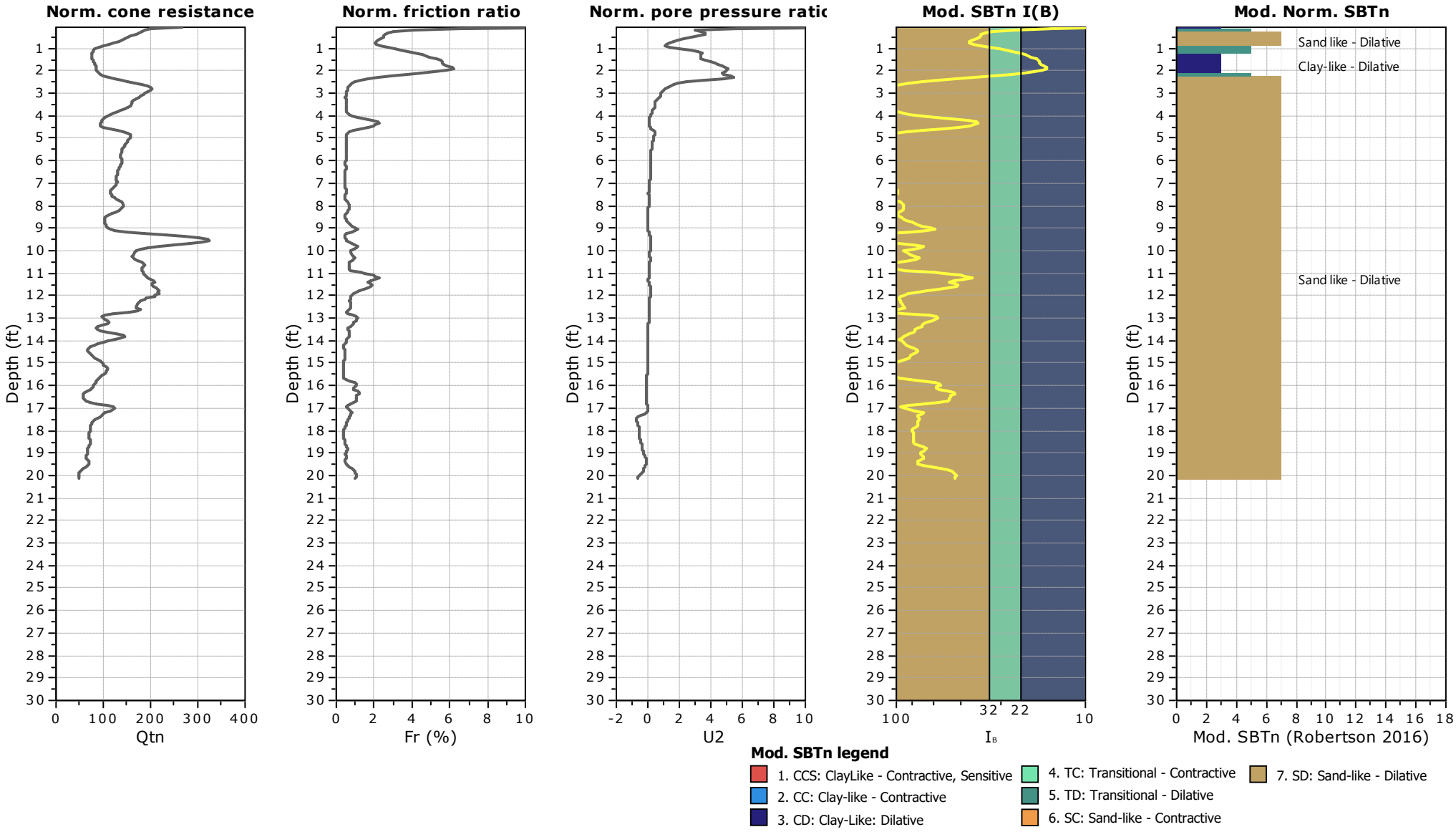
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-10
Total depth: 20.12 ft, Date: 5/13/2024
Surface Elevation: 64.49 ft
Coords: X:572138.55, Y:555855.71
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

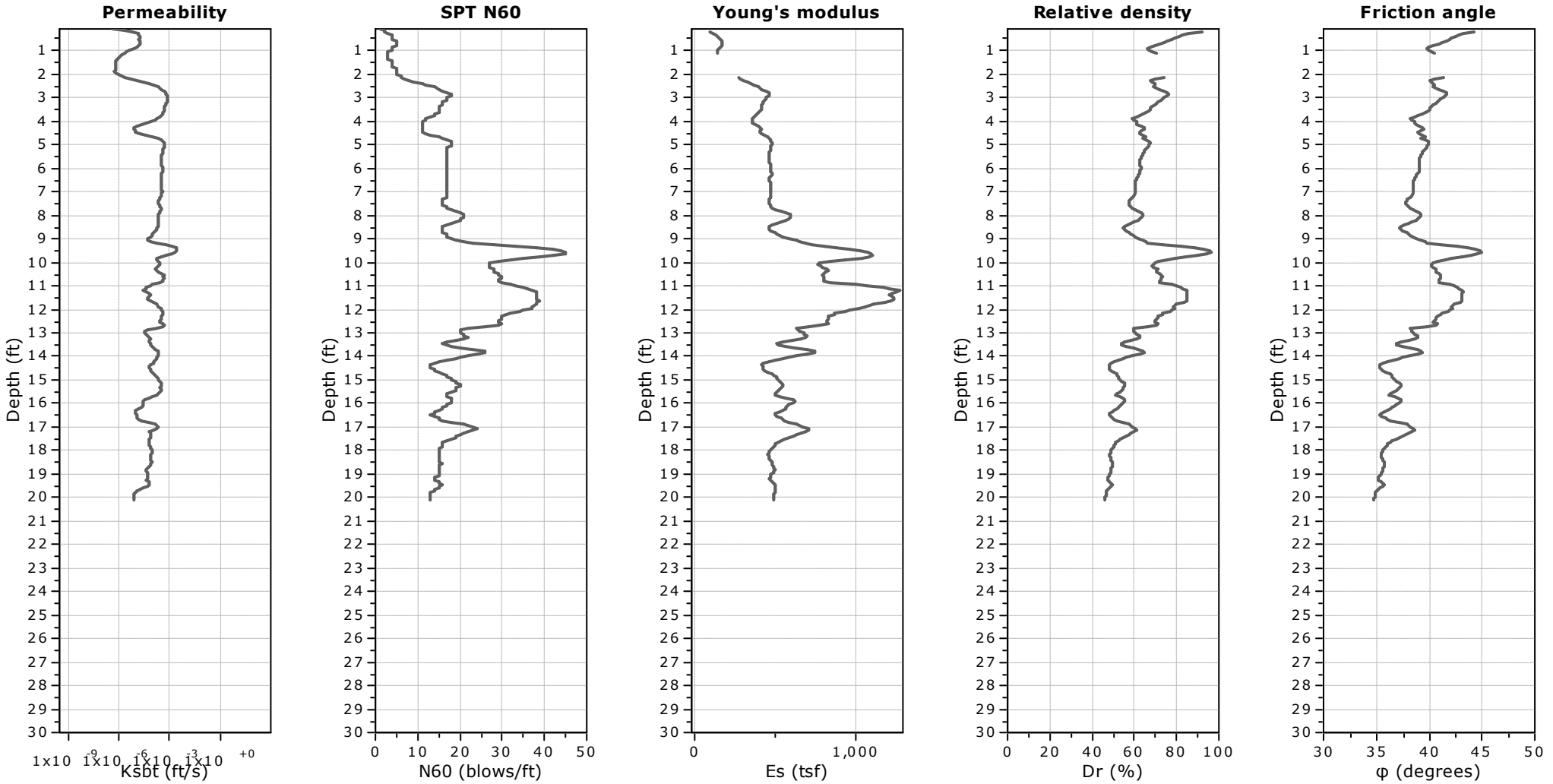
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-10
Total depth: 20.12 ft, Date: 5/13/2024
Surface Elevation: 64.49 ft
Coords: X:572138.55, Y:555855.71
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



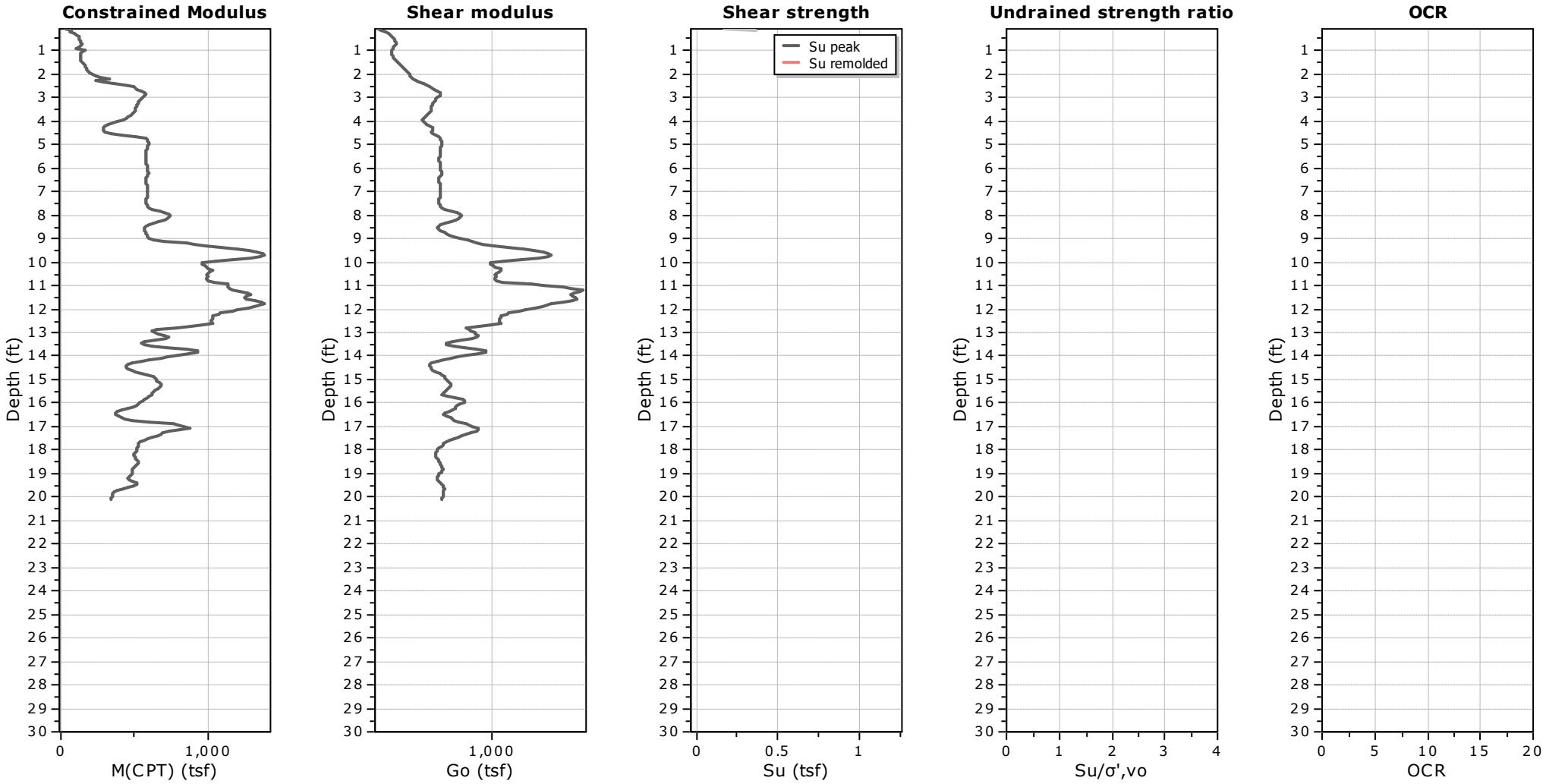
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-10
Total depth: 20.12 ft, Date: 5/13/2024
Surface Elevation: 64.49 ft
Coords: X:572138.55, Y:555855.71
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



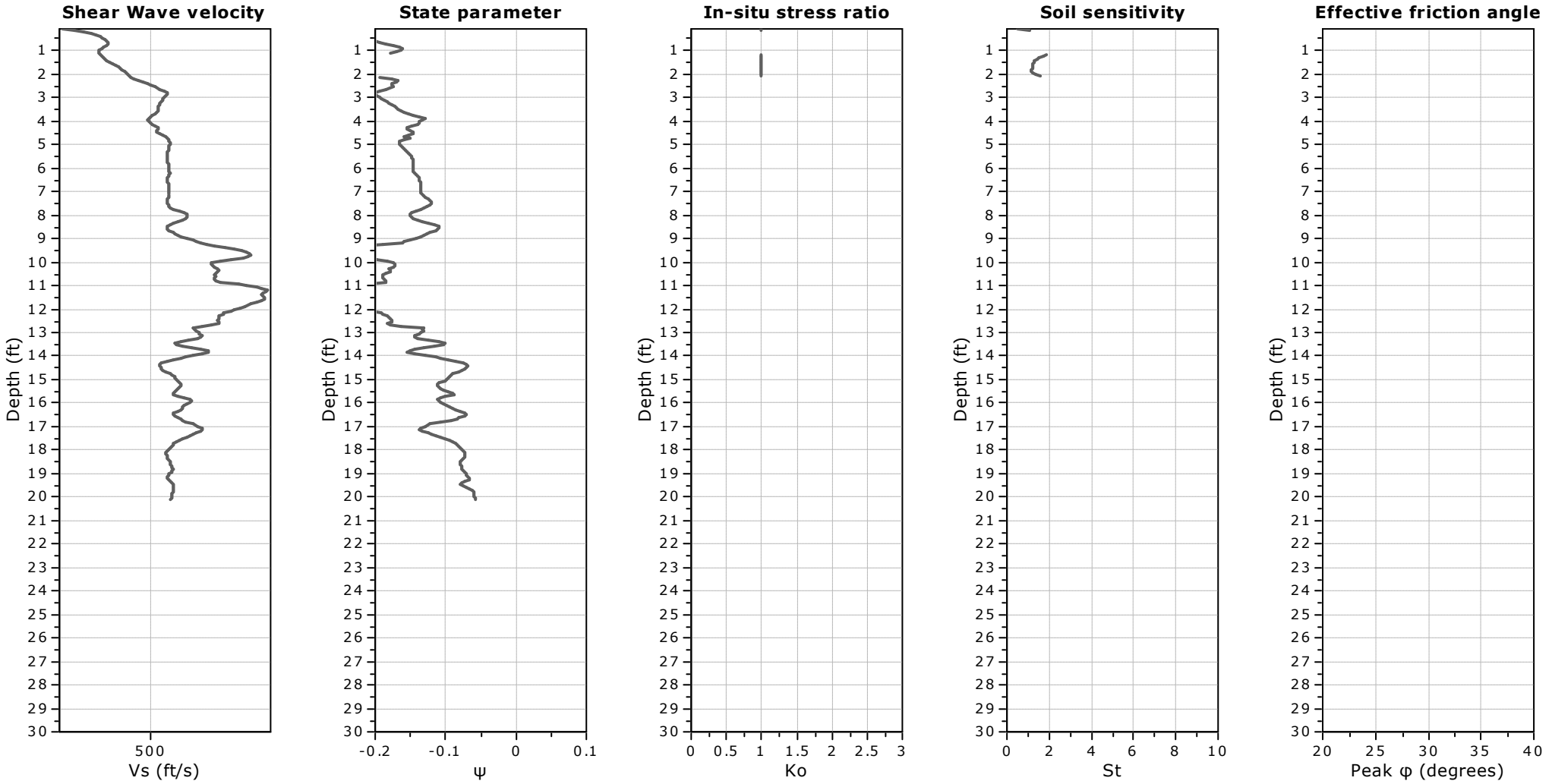
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-10
Total depth: 20.12 ft, Date: 5/13/2024
Surface Elevation: 64.49 ft
Coords: X:572138.55, Y:555855.71
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



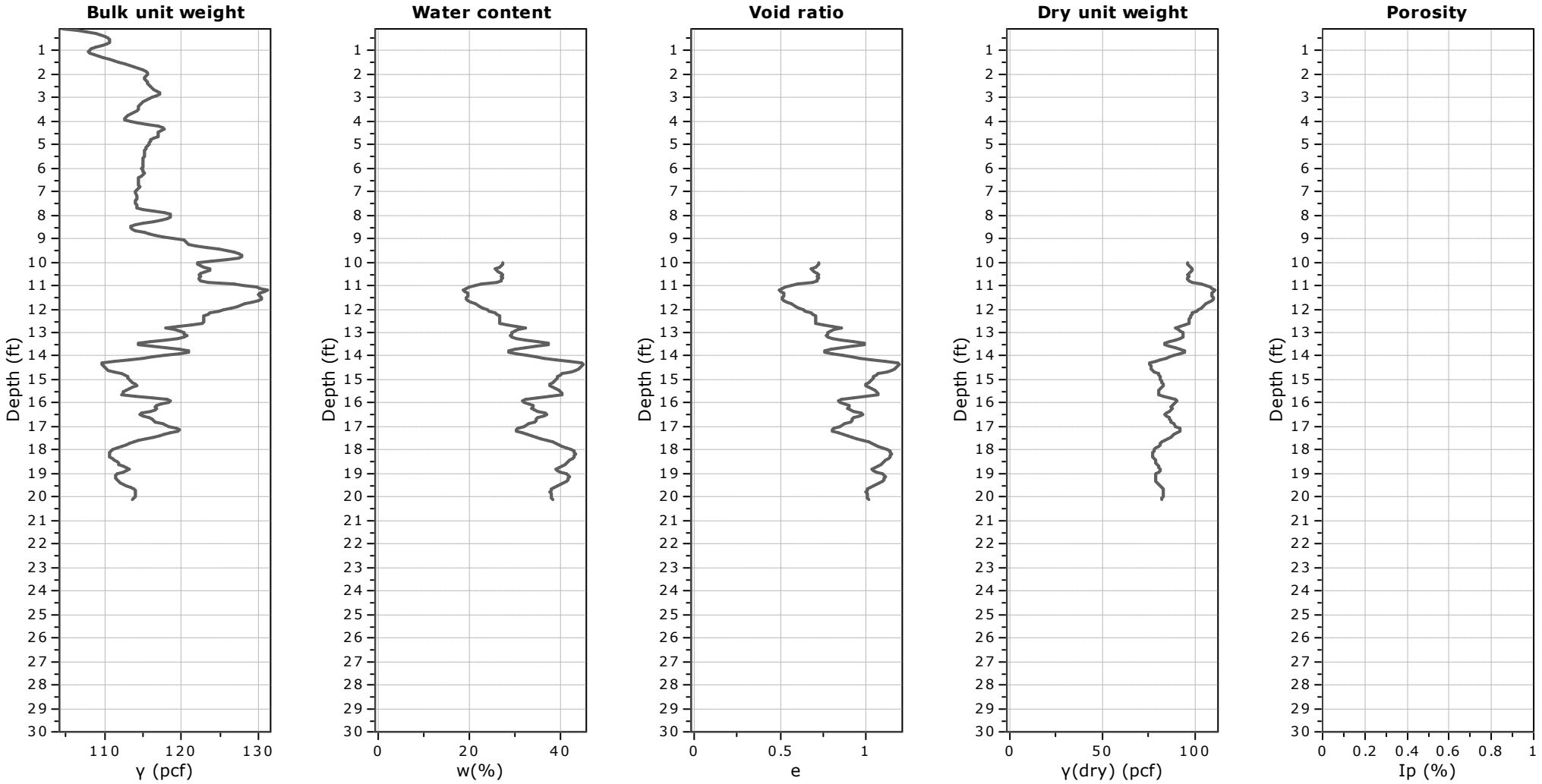
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-10
Total depth: 20.12 ft, Date: 5/13/2024
Surface Elevation: 64.49 ft
Coords: X:572138.55, Y:555855.71
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

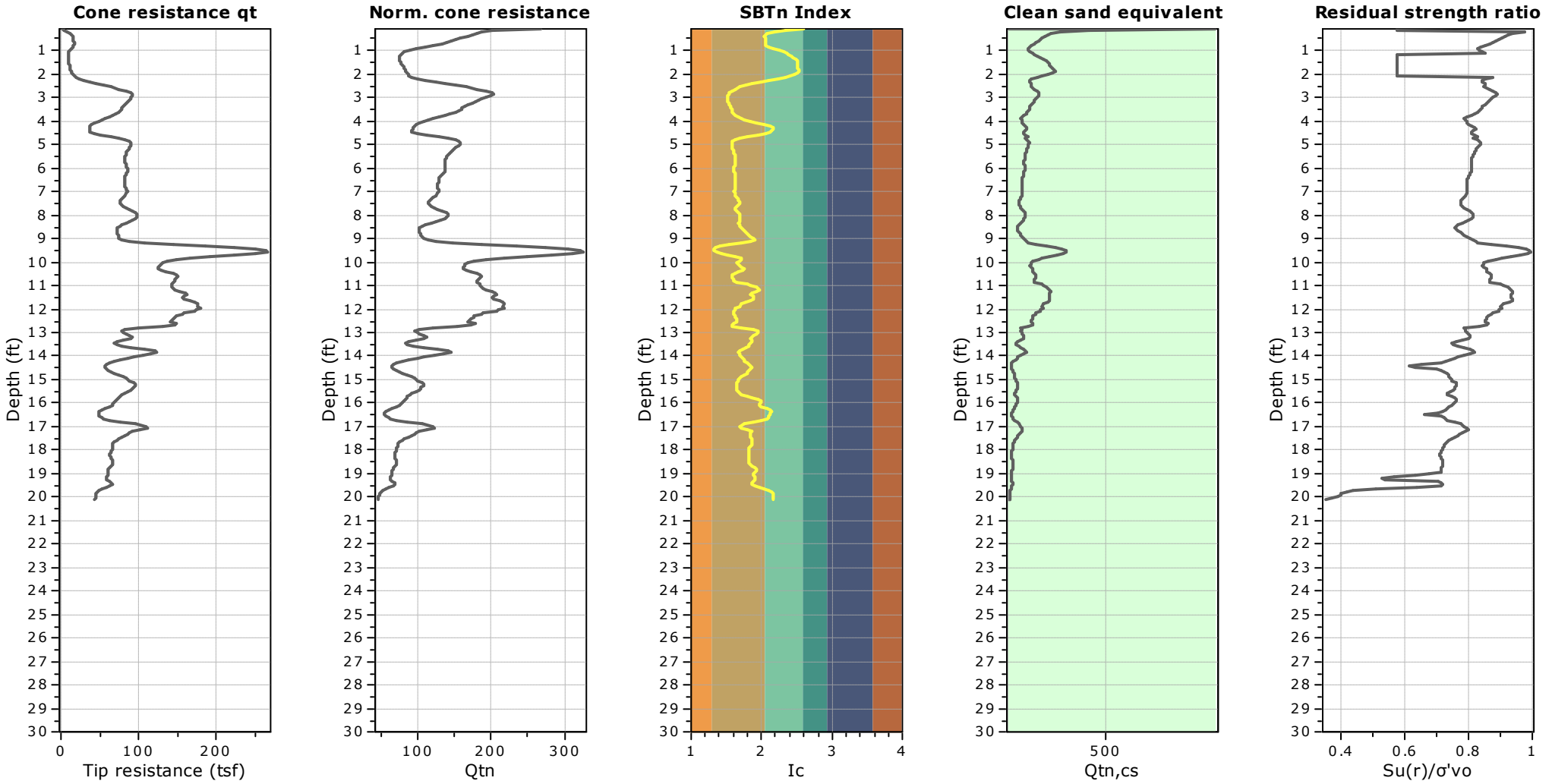
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-10
Total depth: 20.12 ft, Date: 5/13/2024
Surface Elevation: 64.49 ft
Coords: X:572138.55, Y:555855.71
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

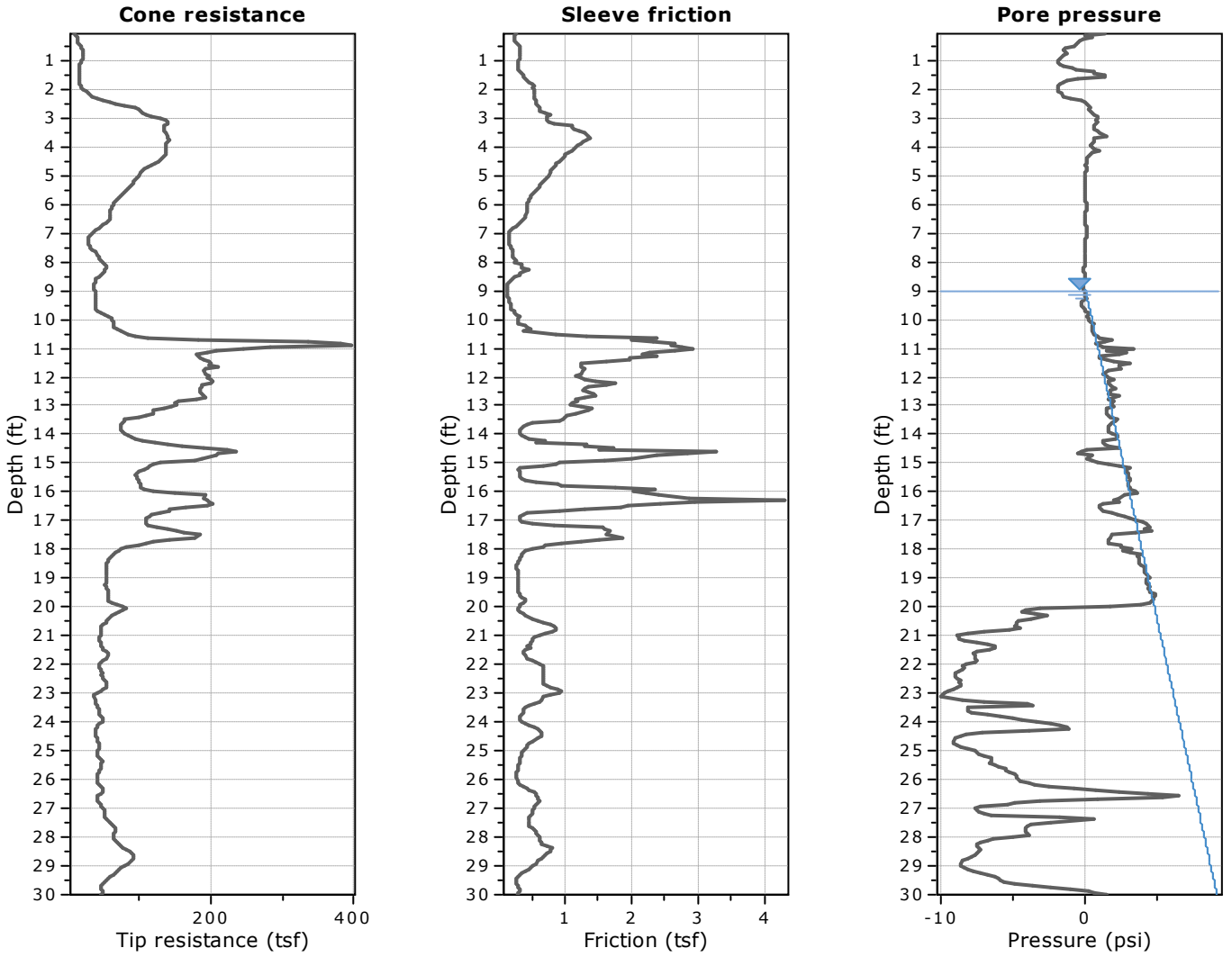
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



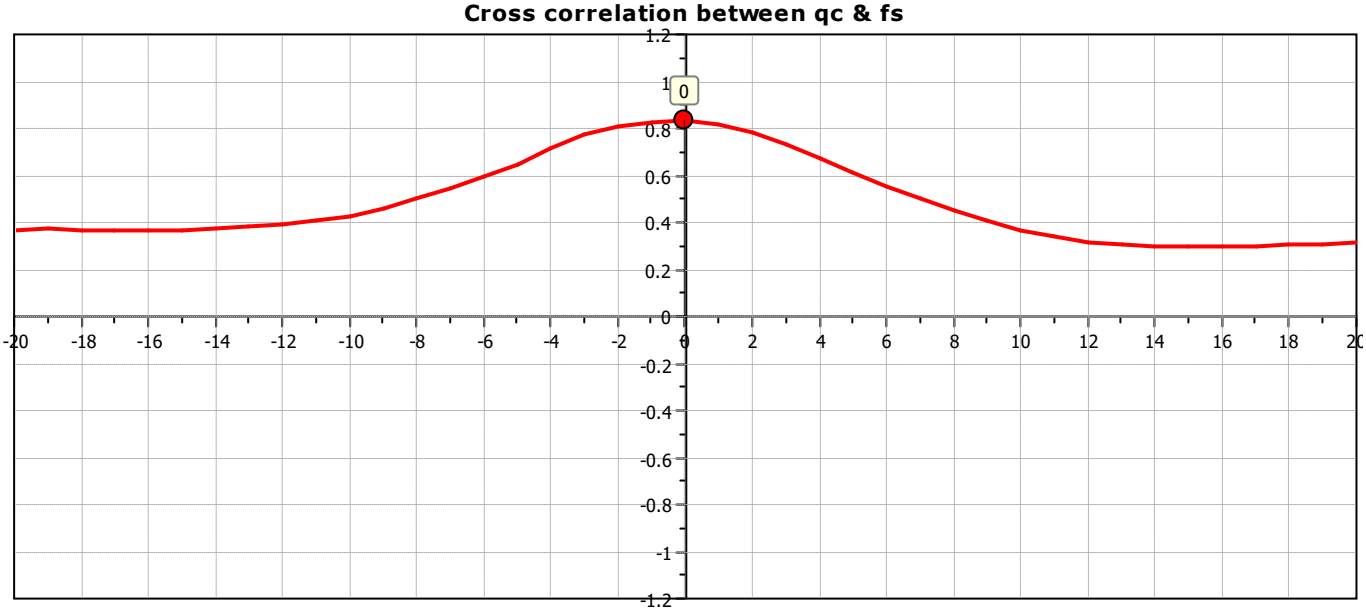
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

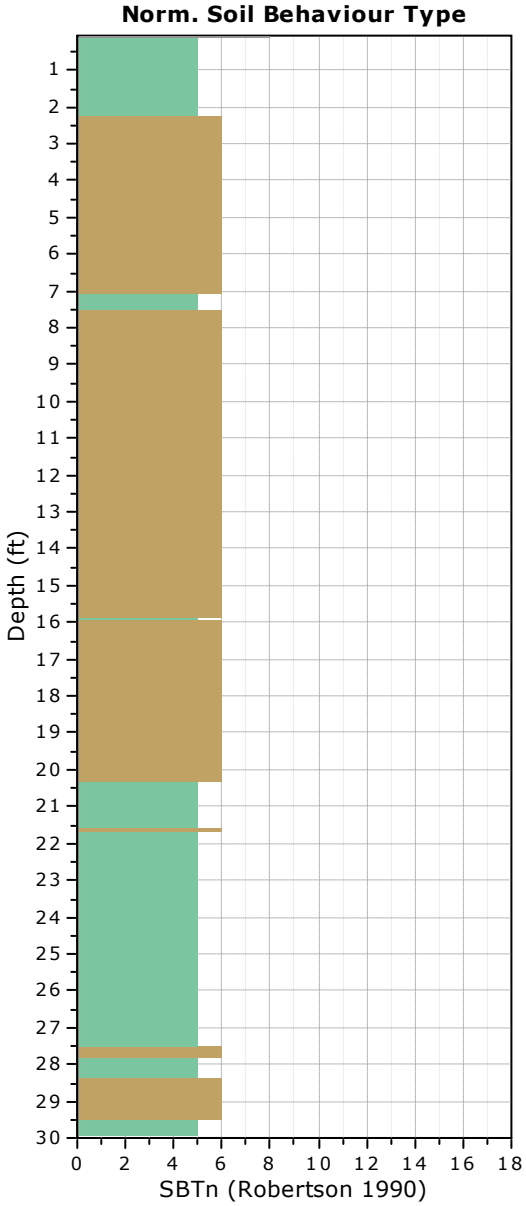
C-11
Total depth: 30.21 ft, Date: 5/13/2024
Surface Elevation: 64.66 ft
Coords: X:572153.91, Y:555805.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

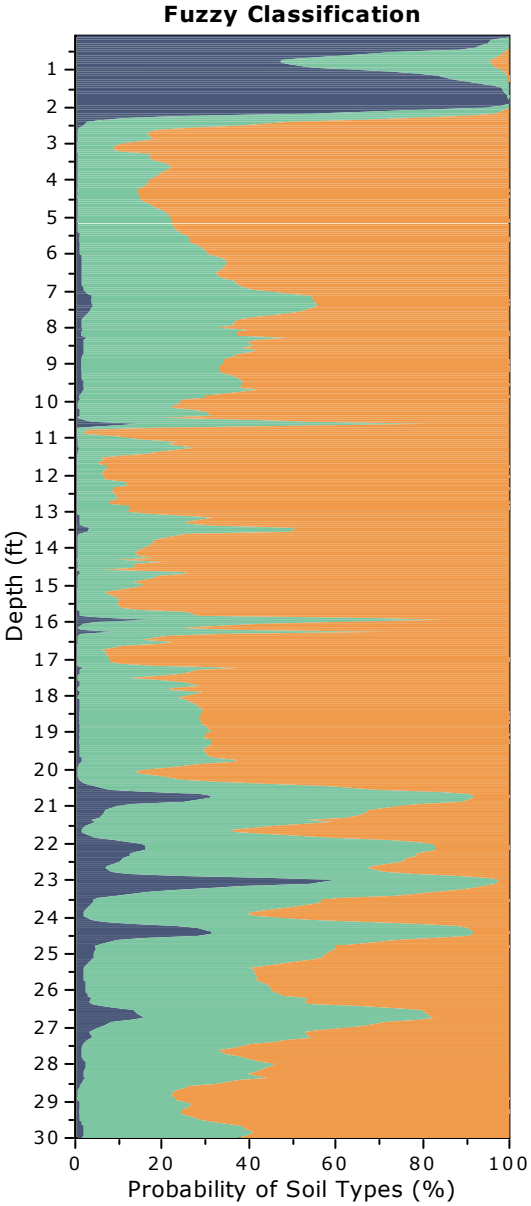
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







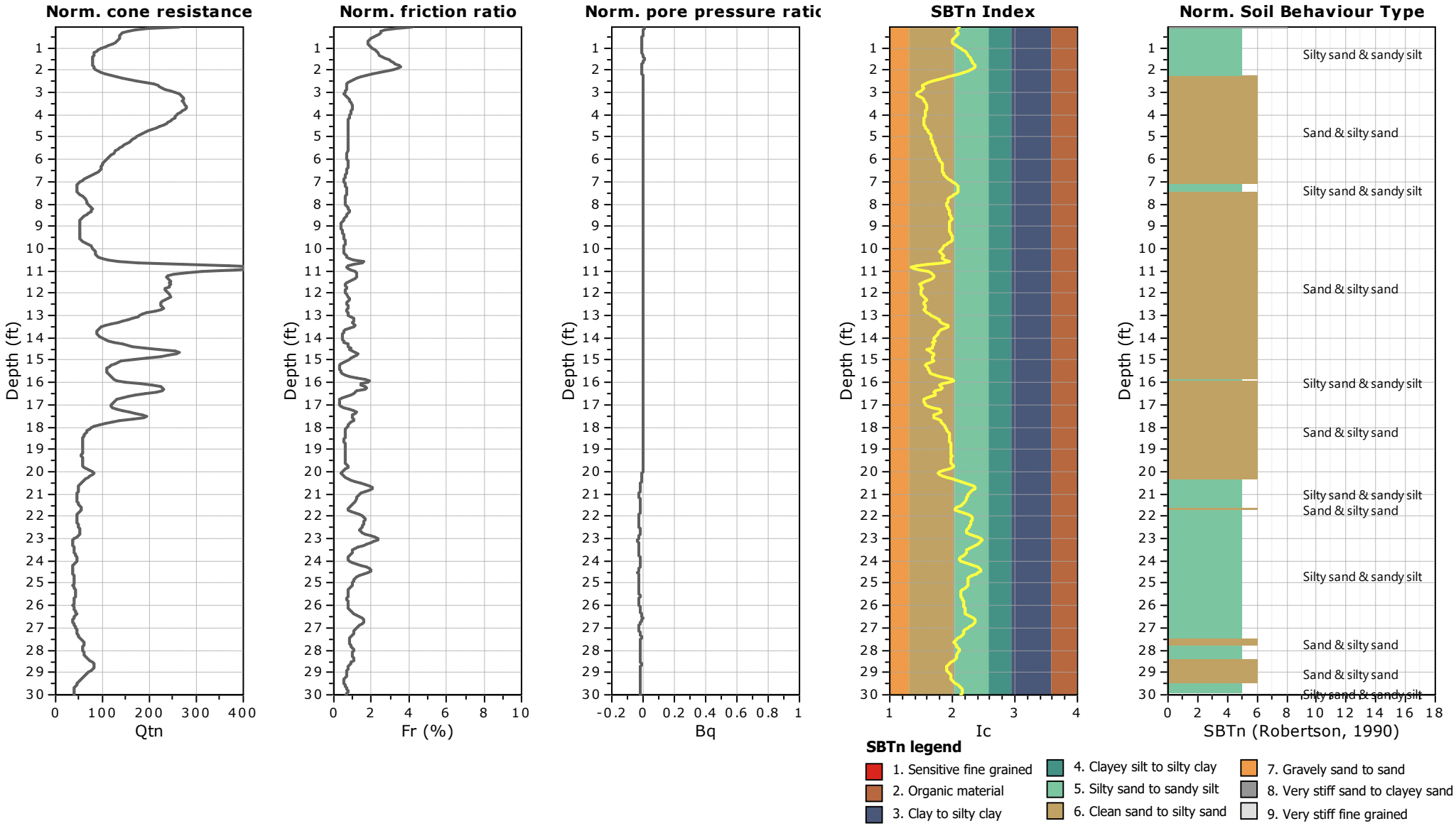
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-11
Total depth: 30.21 ft, Date: 5/13/2024
Surface Elevation: 64.66 ft
Coords: X:572153.91, Y:555805.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

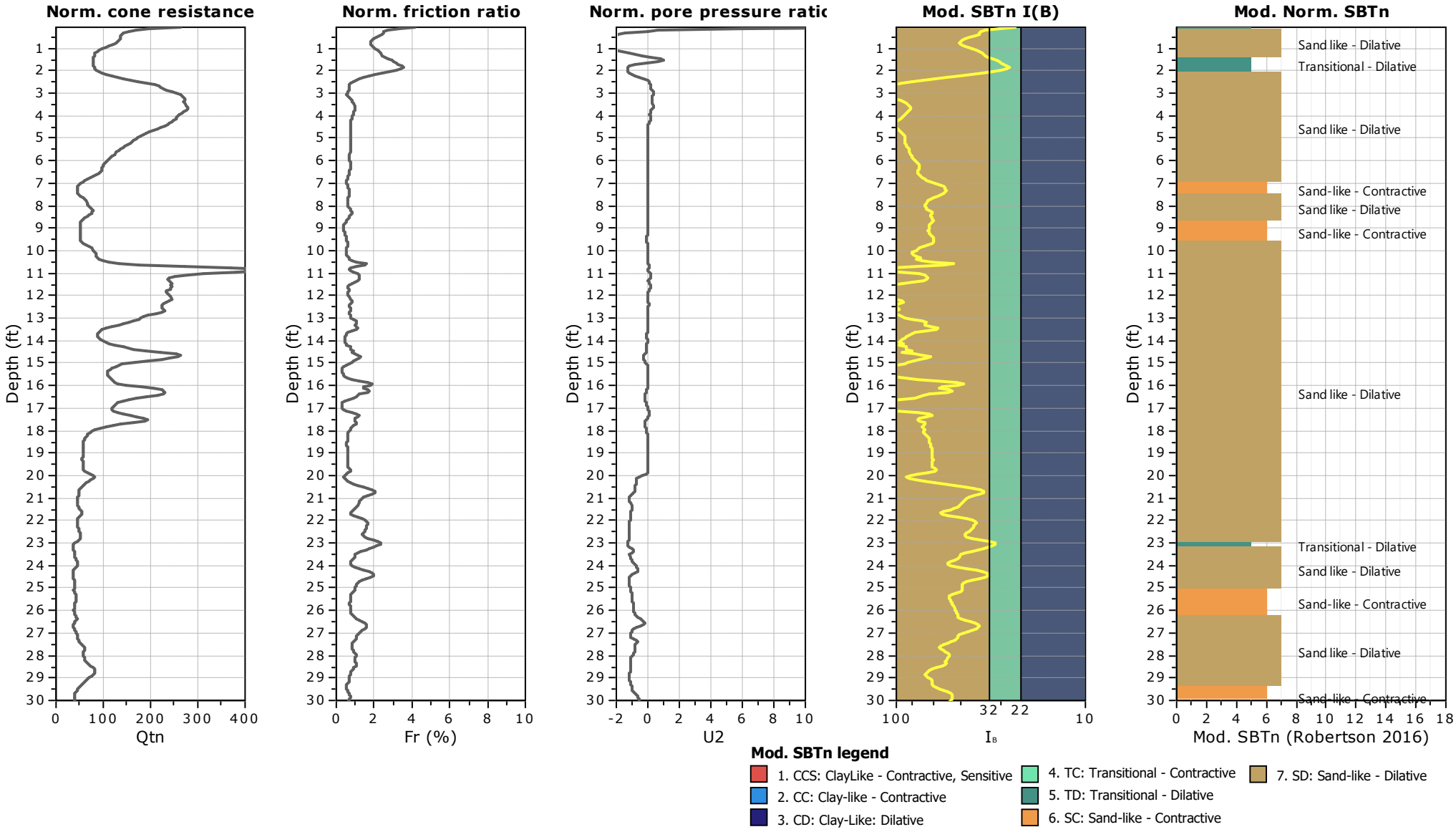
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

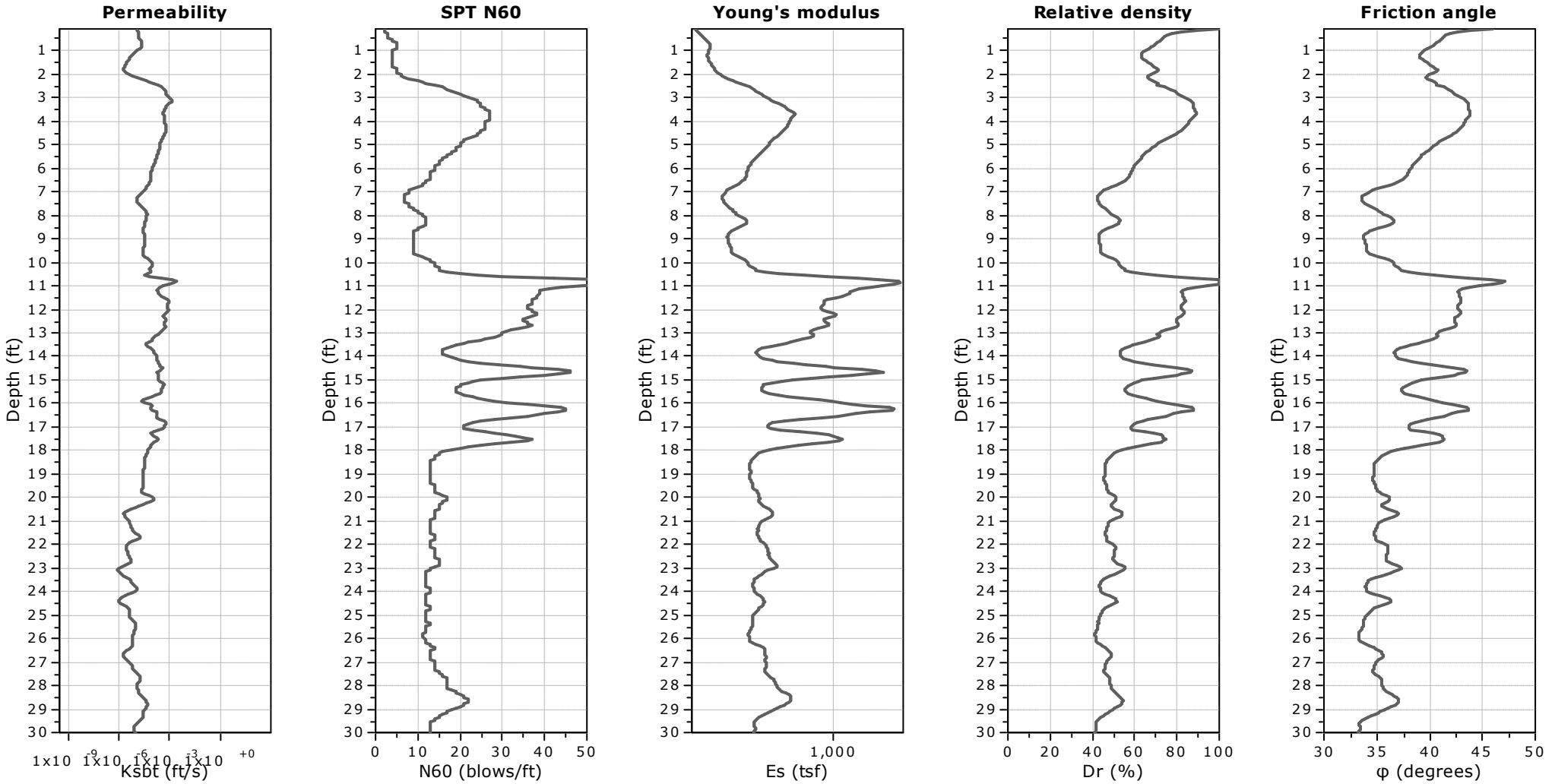
C-11
Total depth: 30.21 ft, Date: 5/13/2024
Surface Elevation: 64.66 ft
Coords: X:572153.91, Y:555805.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-11
Total depth: 30.21 ft, Date: 5/13/2024
Surface Elevation: 64.66 ft
Coords: X:572153.91, Y:555805.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



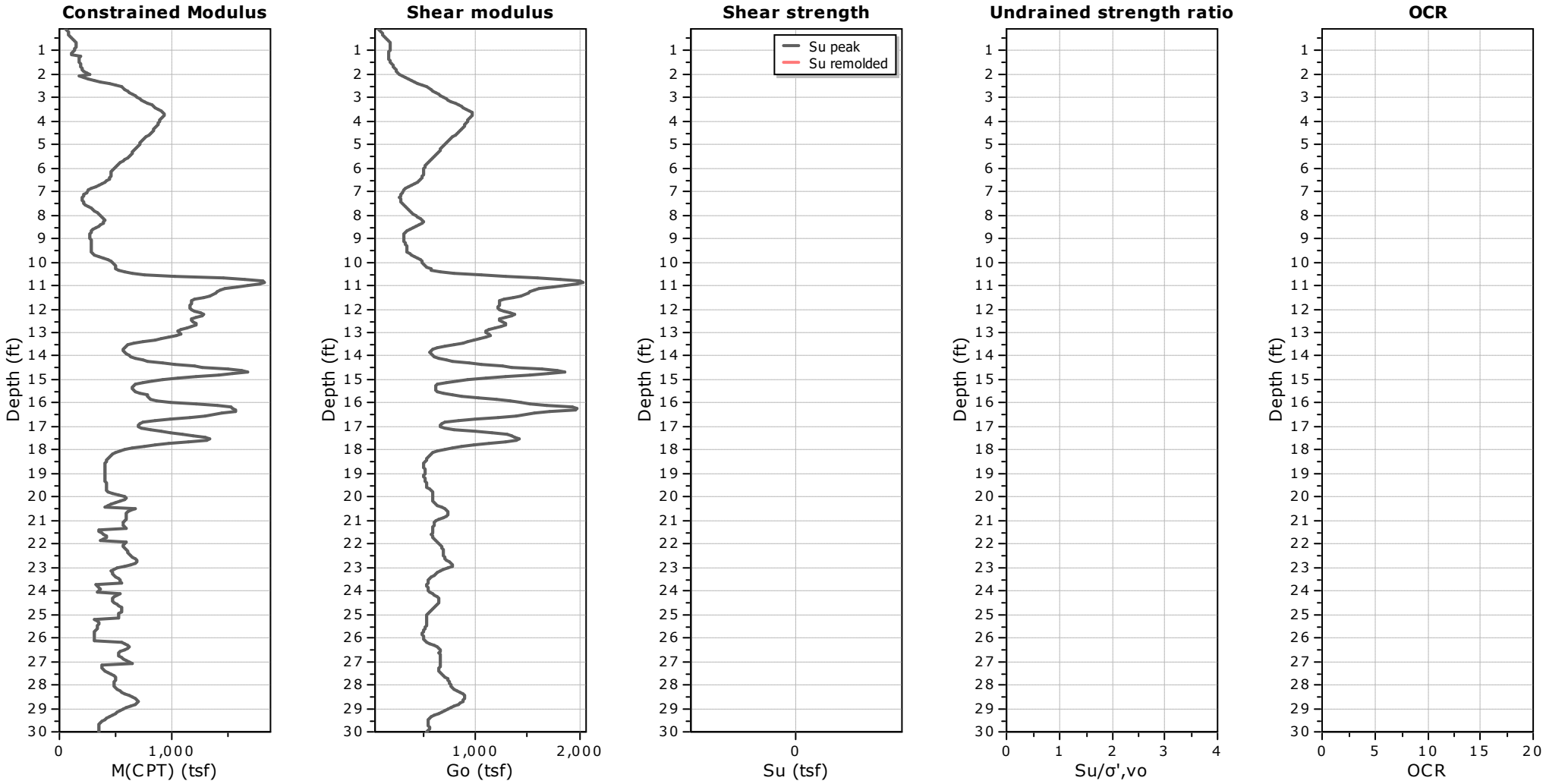
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-11
Total depth: 30.21 ft, Date: 5/13/2024
Surface Elevation: 64.66 ft
Coords: X:572153.91, Y:555805.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



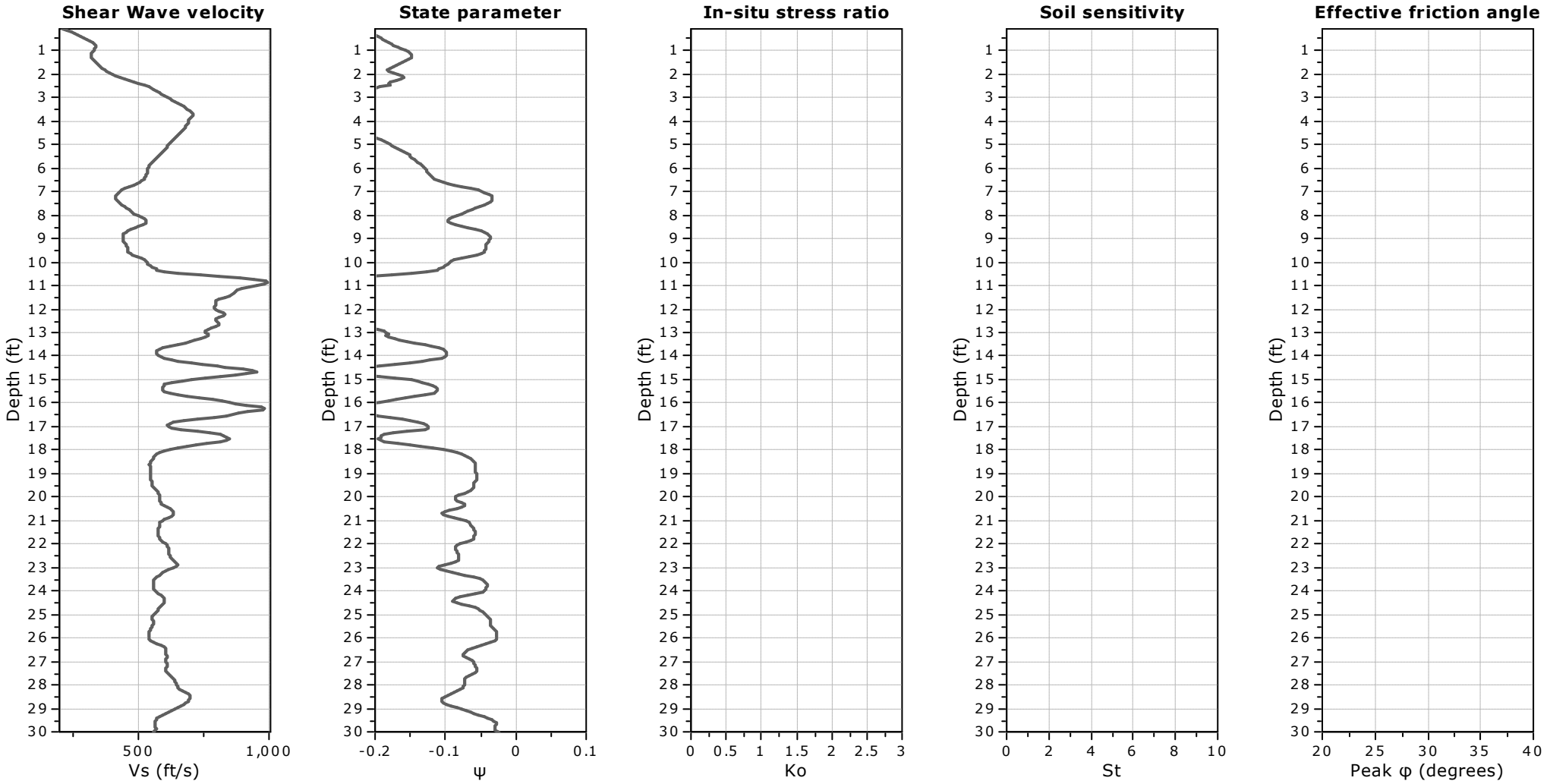
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-11
Total depth: 30.21 ft, Date: 5/13/2024
Surface Elevation: 64.66 ft
Coords: X:572153.91, Y:555805.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



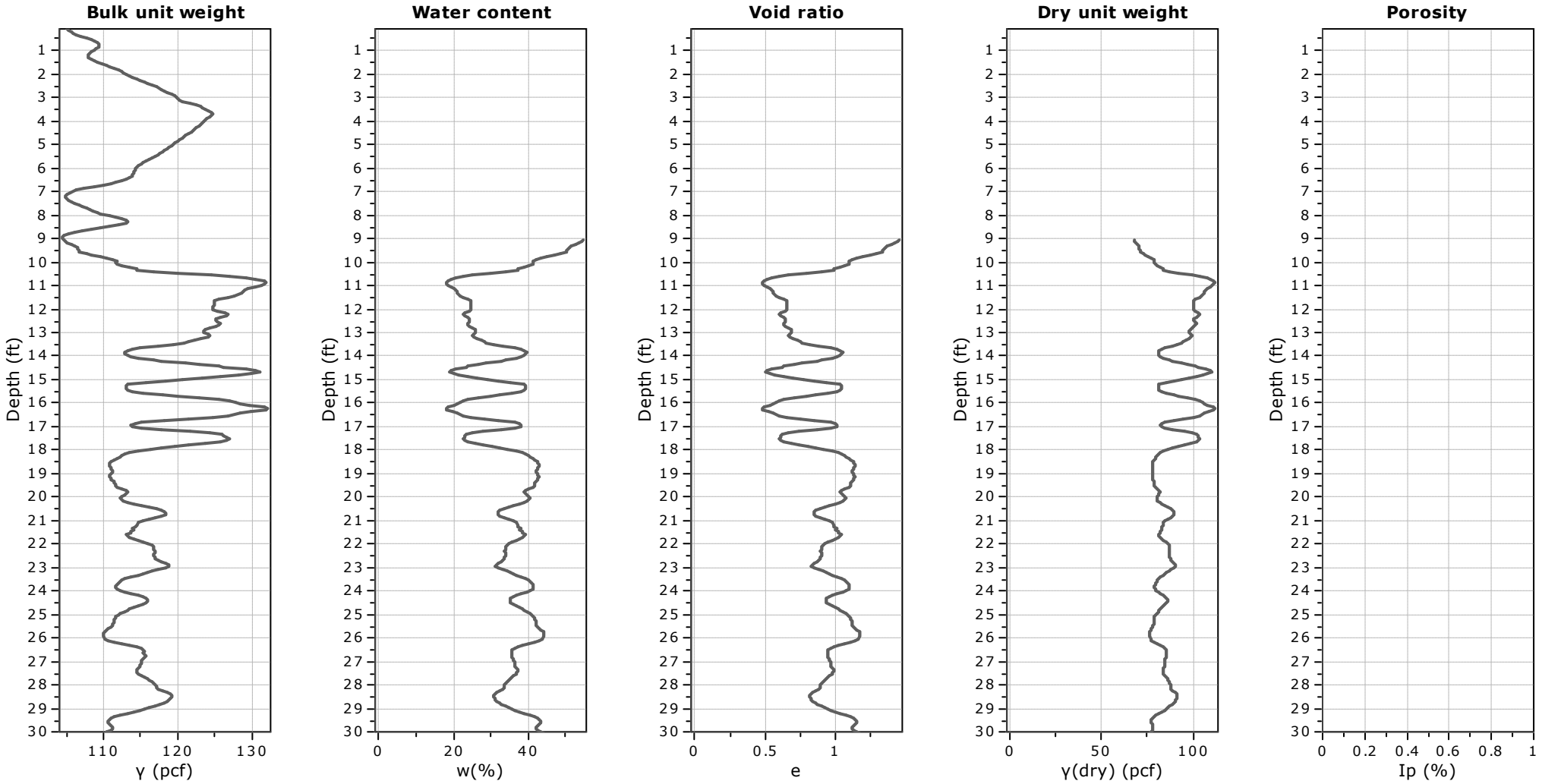
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-11
Total depth: 30.21 ft, Date: 5/13/2024
Surface Elevation: 64.66 ft
Coords: X:572153.91, Y:555805.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

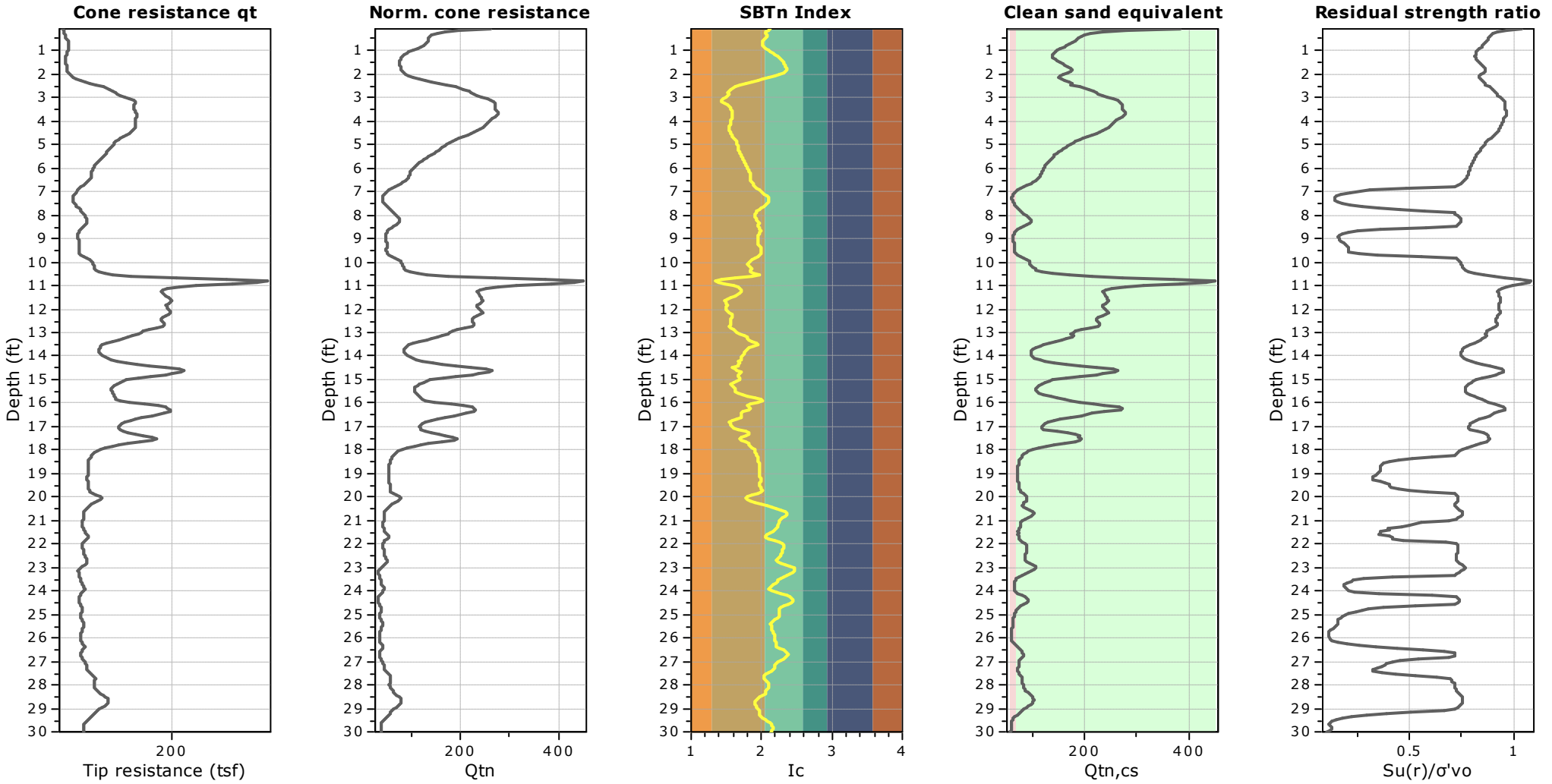
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-11
Total depth: 30.21 ft, Date: 5/13/2024
Surface Elevation: 64.66 ft
Coords: X:572153.91, Y:555805.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

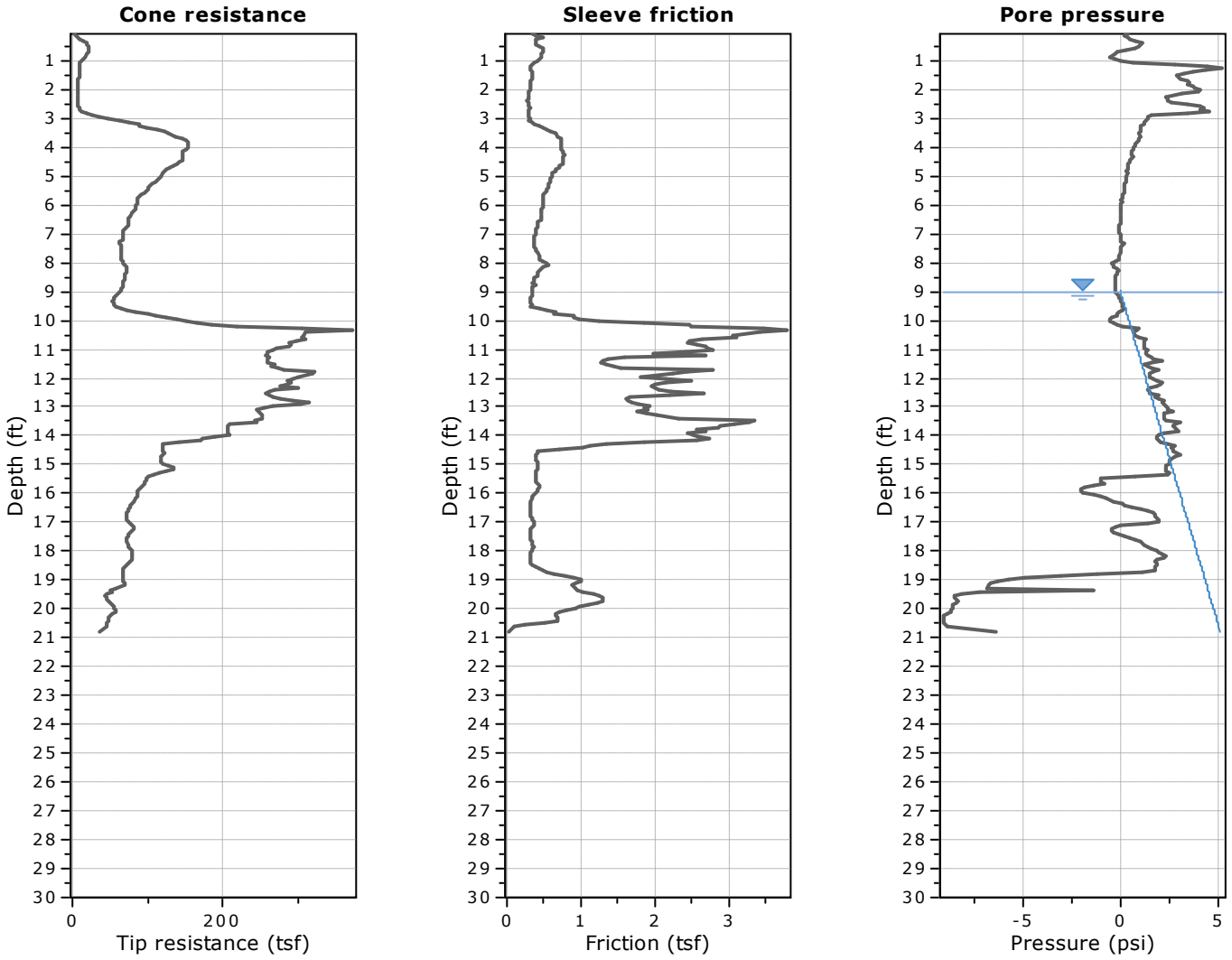
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



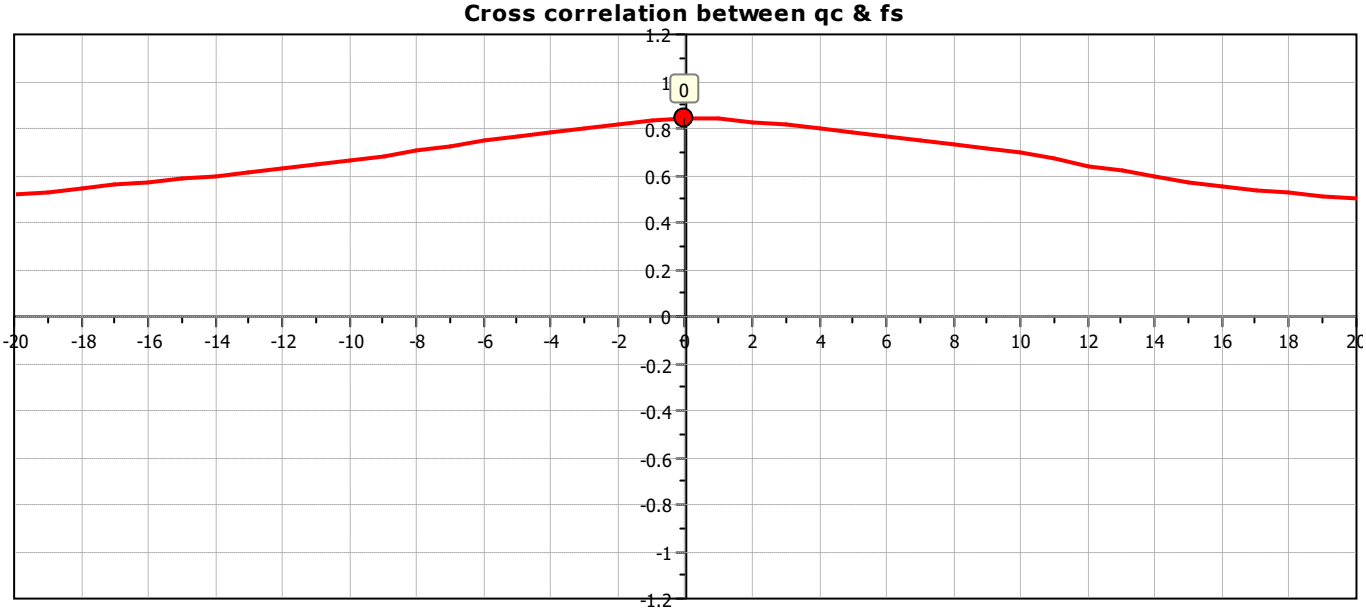
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

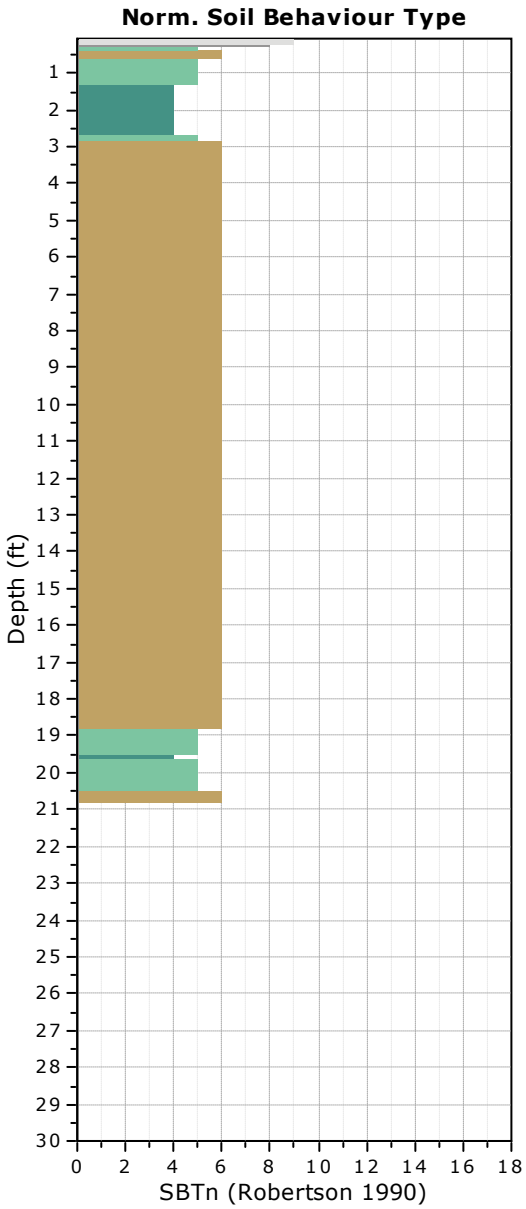
C-12
Total depth: 20.77 ft, Date: 5/13/2024
Surface Elevation: 64.19 ft
Coords: X:572240.61, Y:555885.06
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

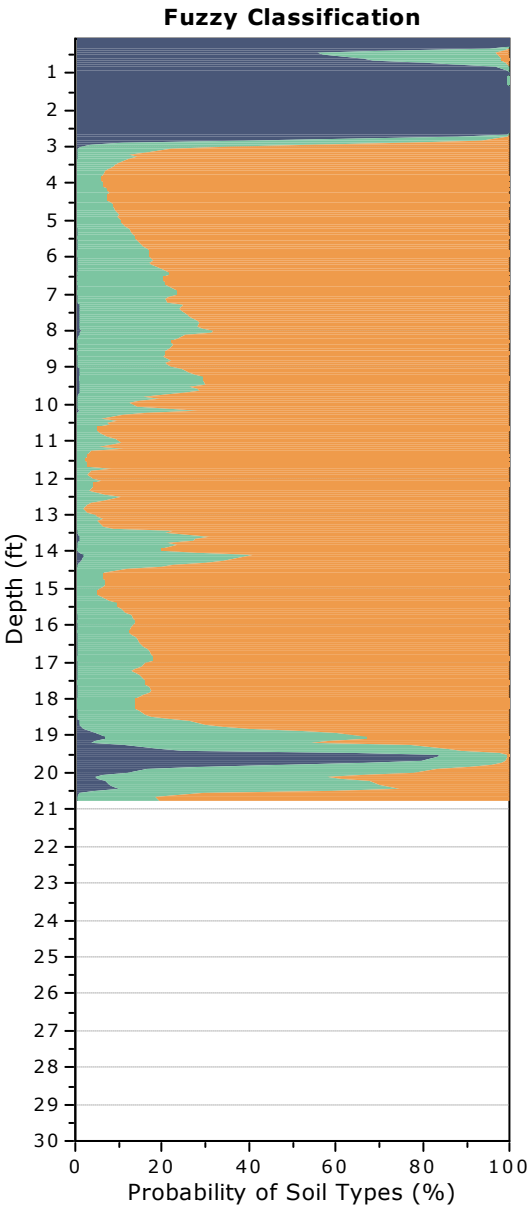
Project: ASD Summit Campus
Location: Middletown, Delaware



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







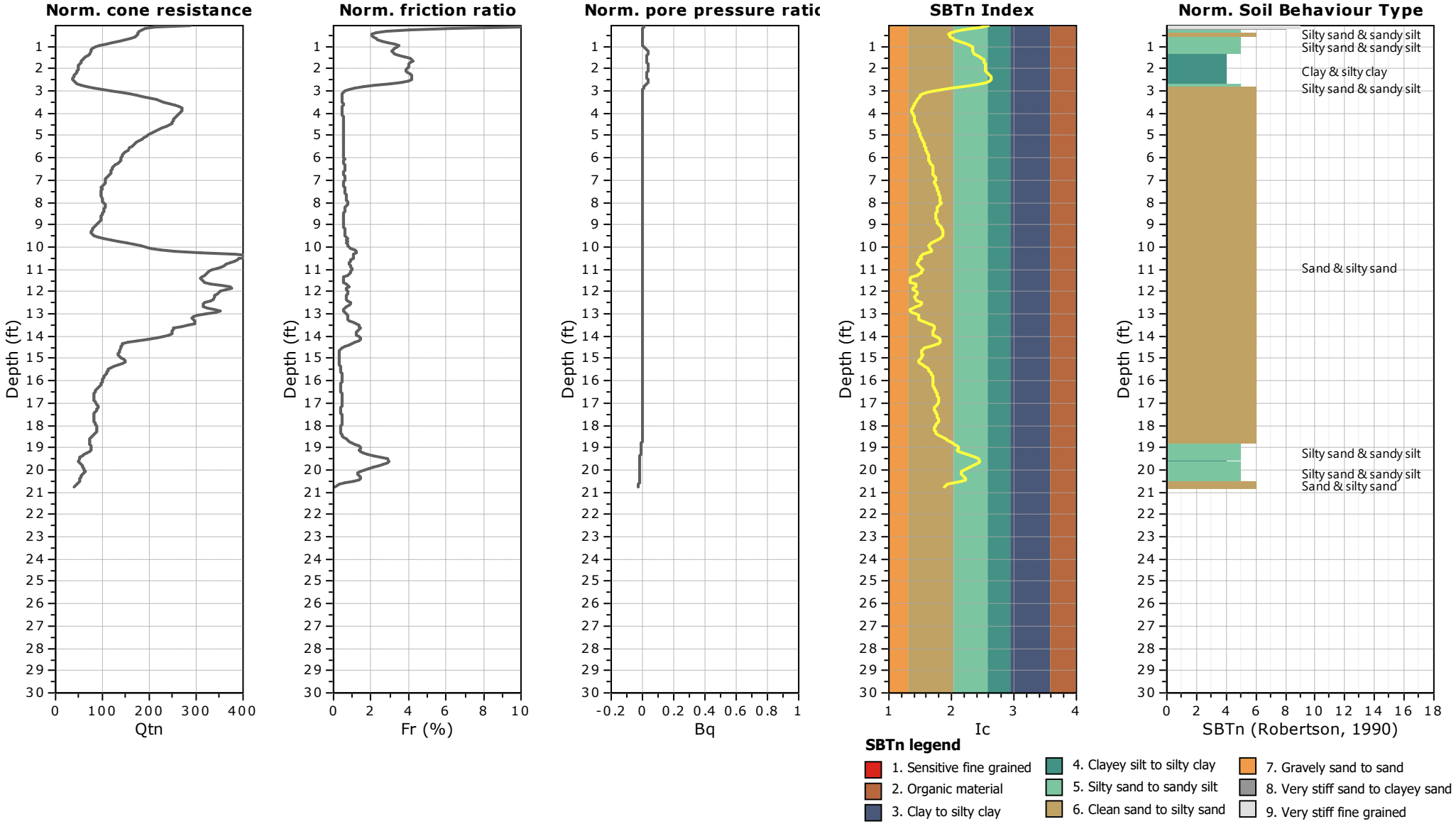
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-12
Total depth: 20.77 ft, Date: 5/13/2024
Surface Elevation: 64.19 ft
Coords: X:572240.61, Y:555885.06
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

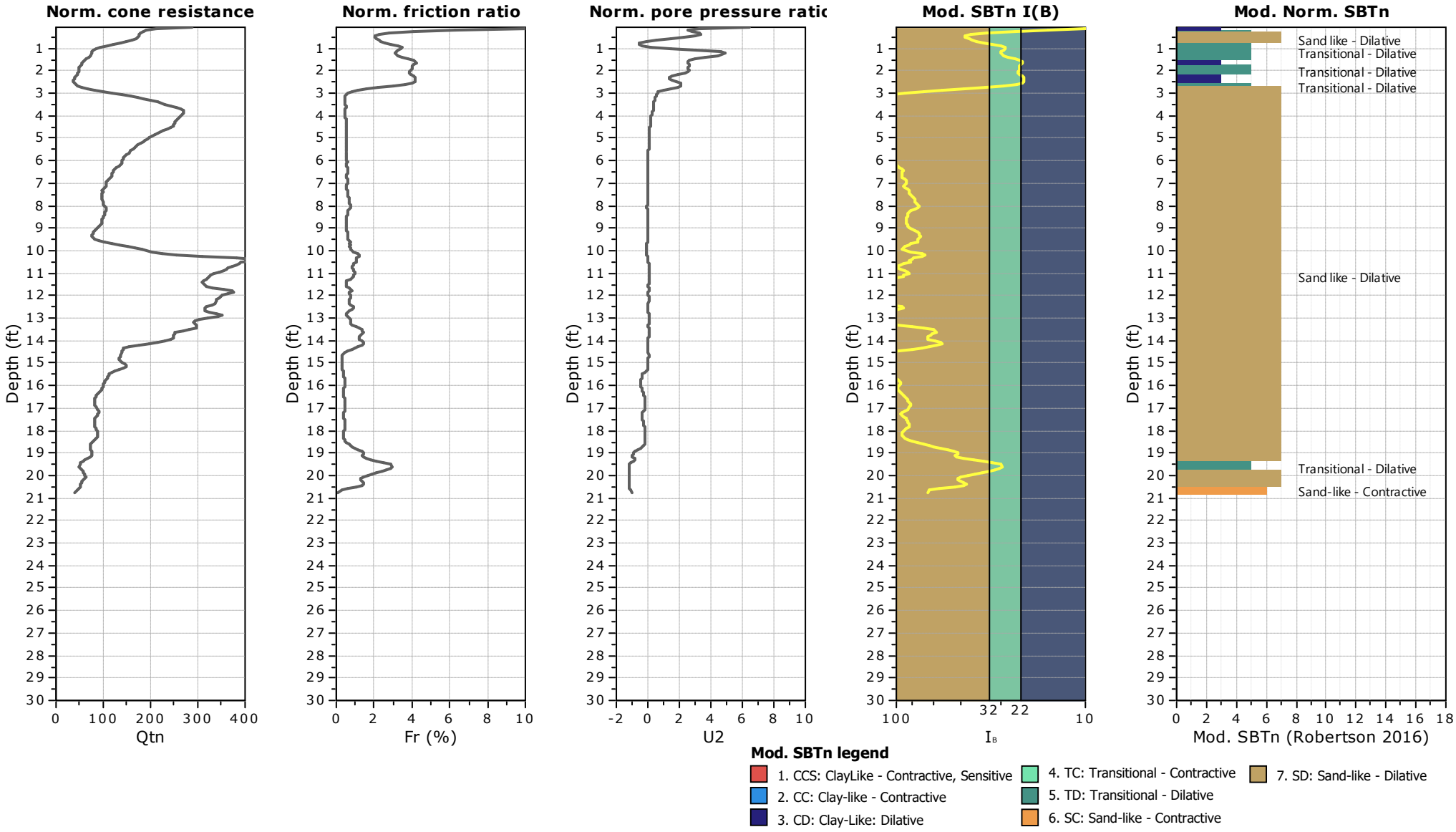
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-12
Total depth: 20.77 ft, Date: 5/13/2024
Surface Elevation: 64.19 ft
Coords: X:572240.61, Y:555885.06
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

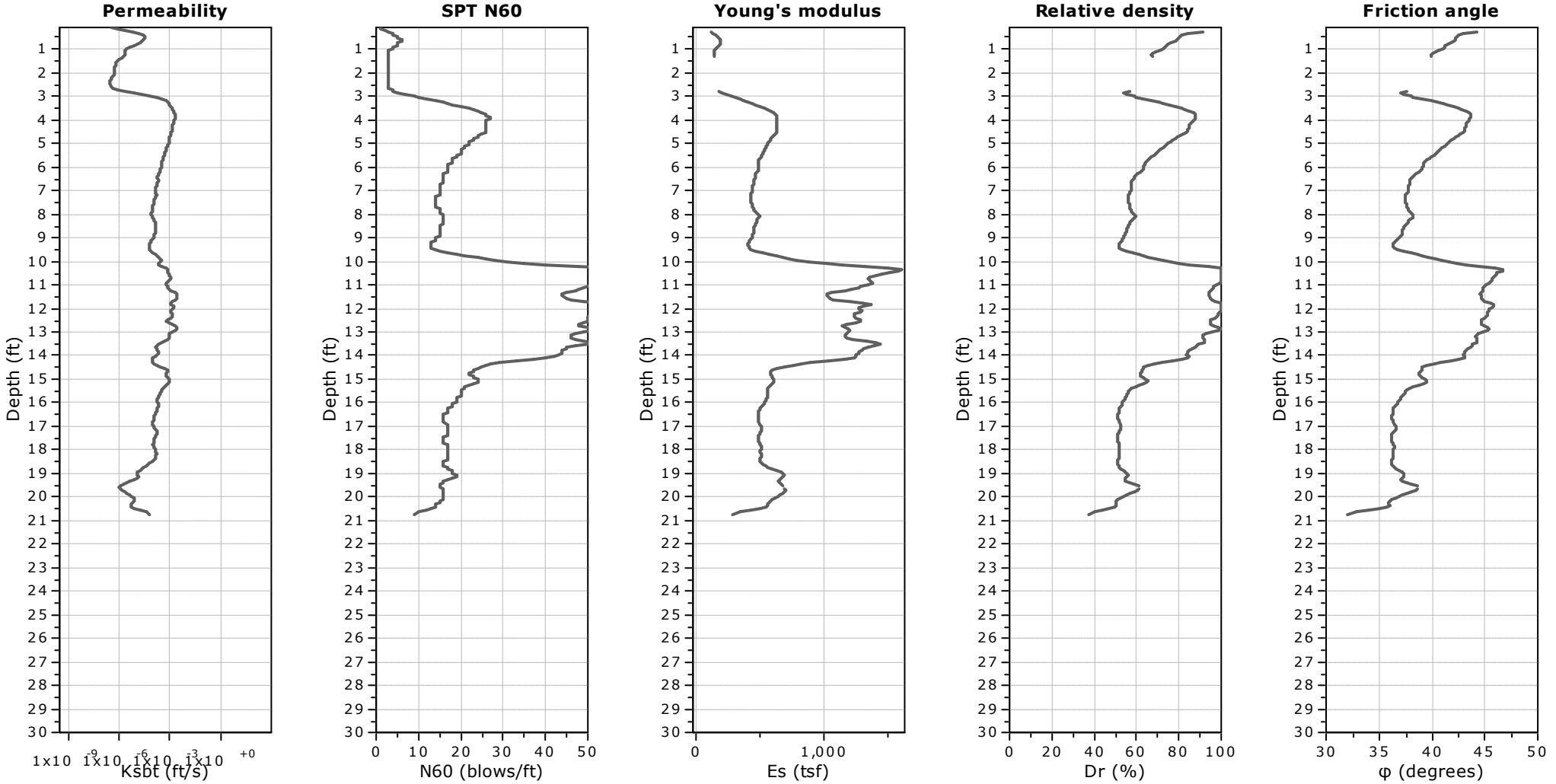
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-12
Total depth: 20.77 ft, Date: 5/13/2024
Surface Elevation: 64.19 ft
Coords: X:572240.61, Y:555885.06
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



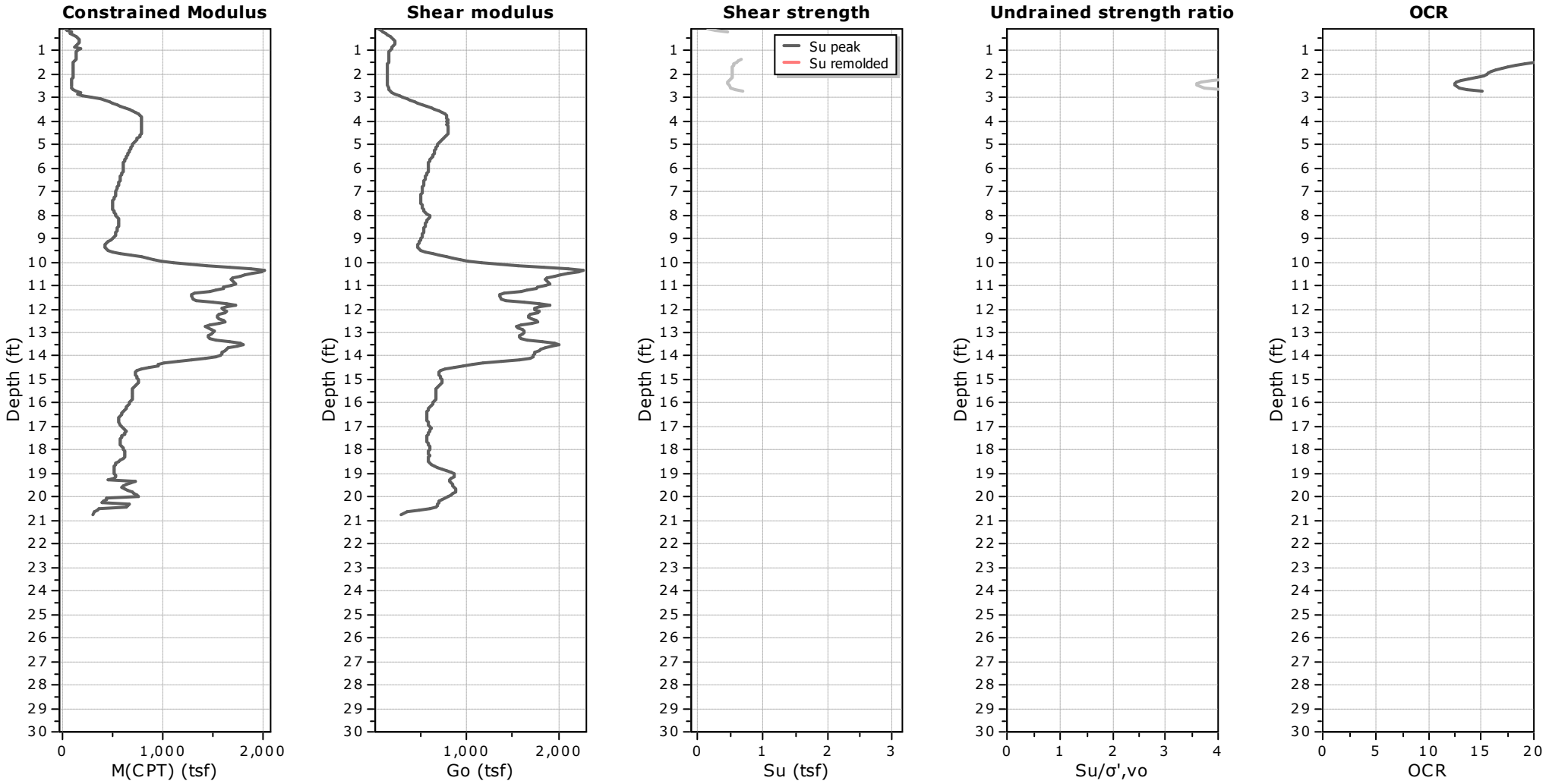
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-12
Total depth: 20.77 ft, Date: 5/13/2024
Surface Elevation: 64.19 ft
Coords: X:572240.61, Y:555885.06
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



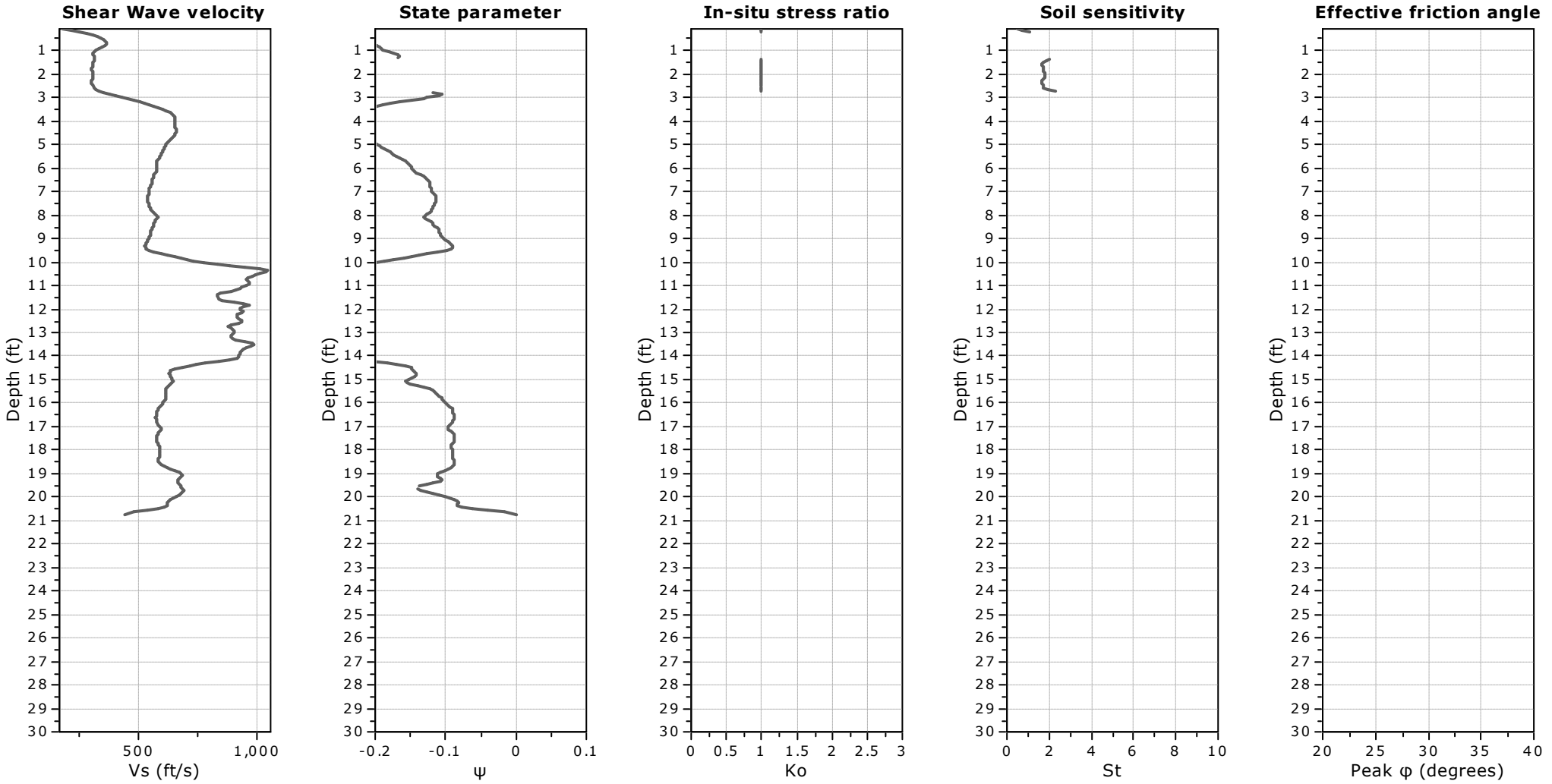
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-12
Total depth: 20.77 ft, Date: 5/13/2024
Surface Elevation: 64.19 ft
Coords: X:572240.61, Y:555885.06
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



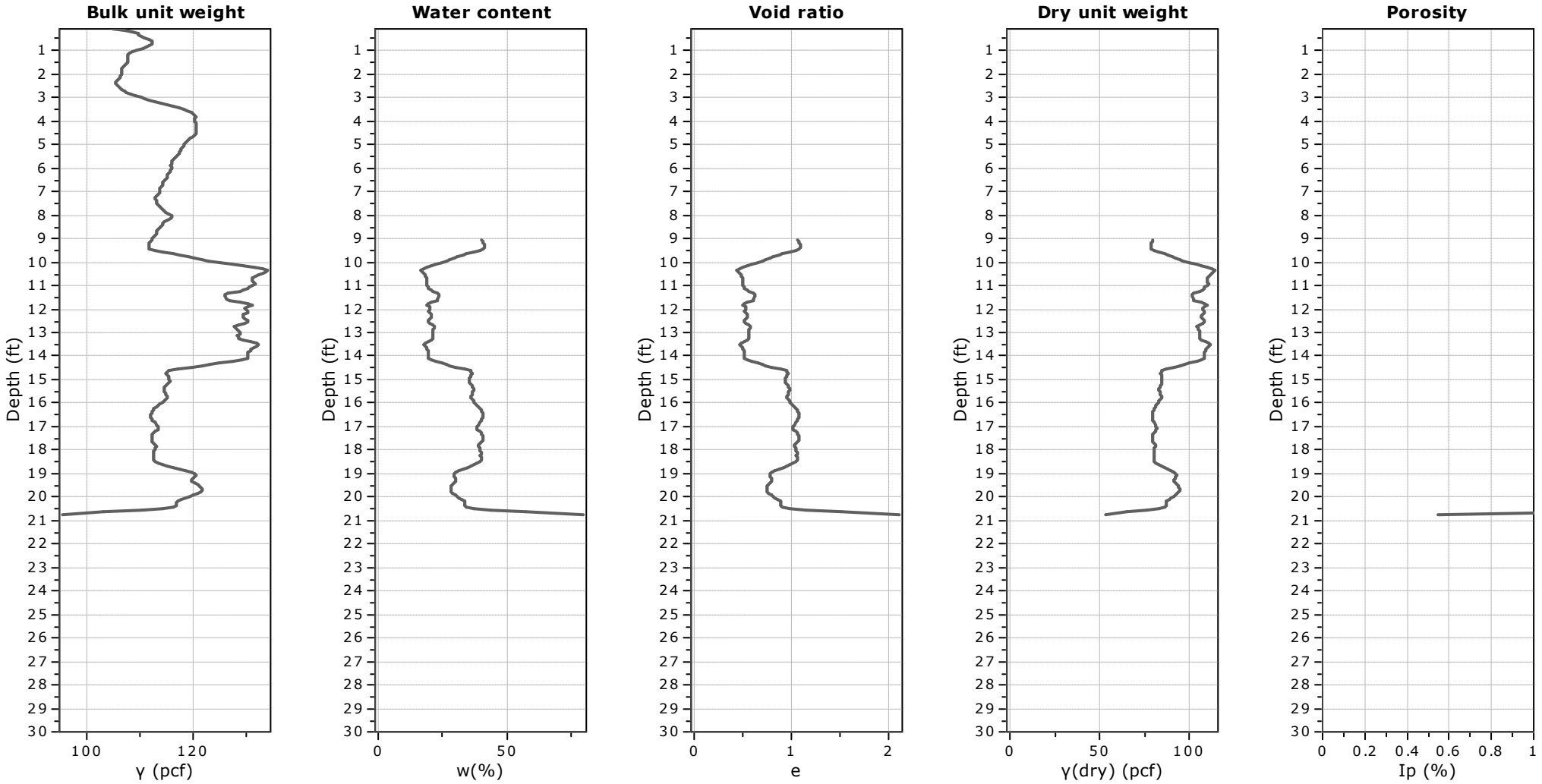
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-12
Total depth: 20.77 ft, Date: 5/13/2024
Surface Elevation: 64.19 ft
Coords: X:572240.61, Y:555885.06
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

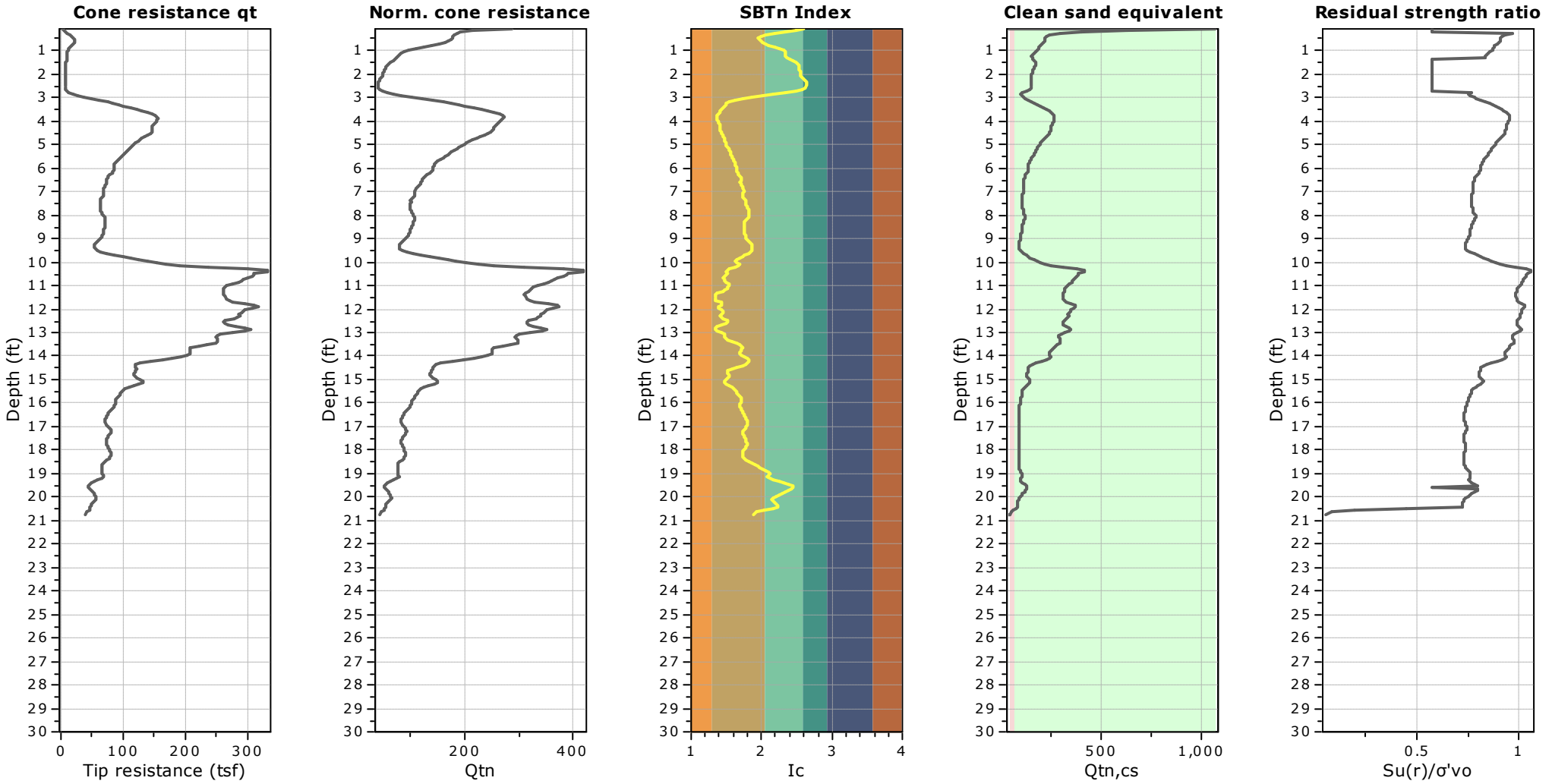
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-12
Total depth: 20.77 ft, Date: 5/13/2024
Surface Elevation: 64.19 ft
Coords: X:572240.61, Y:555885.06
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

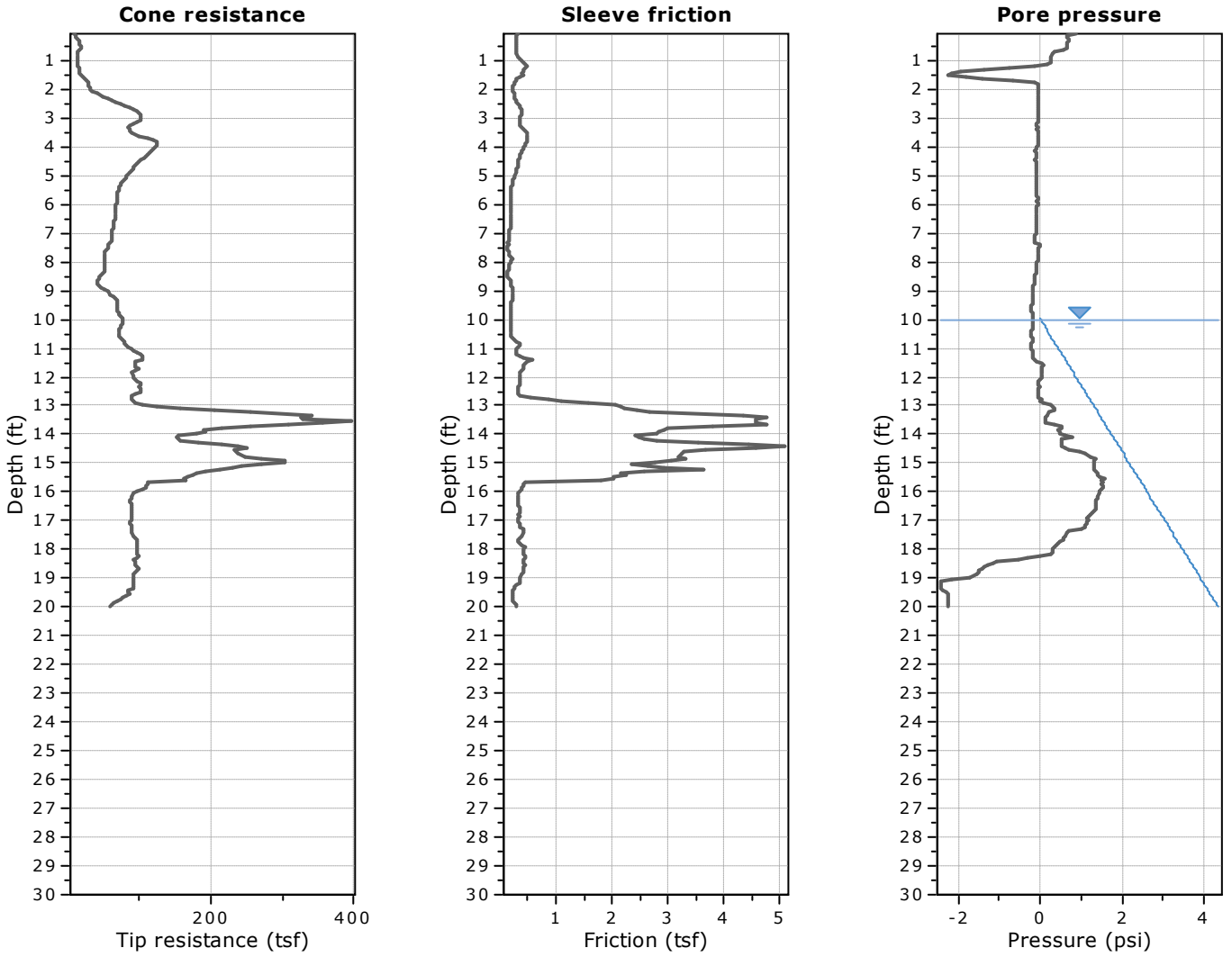
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



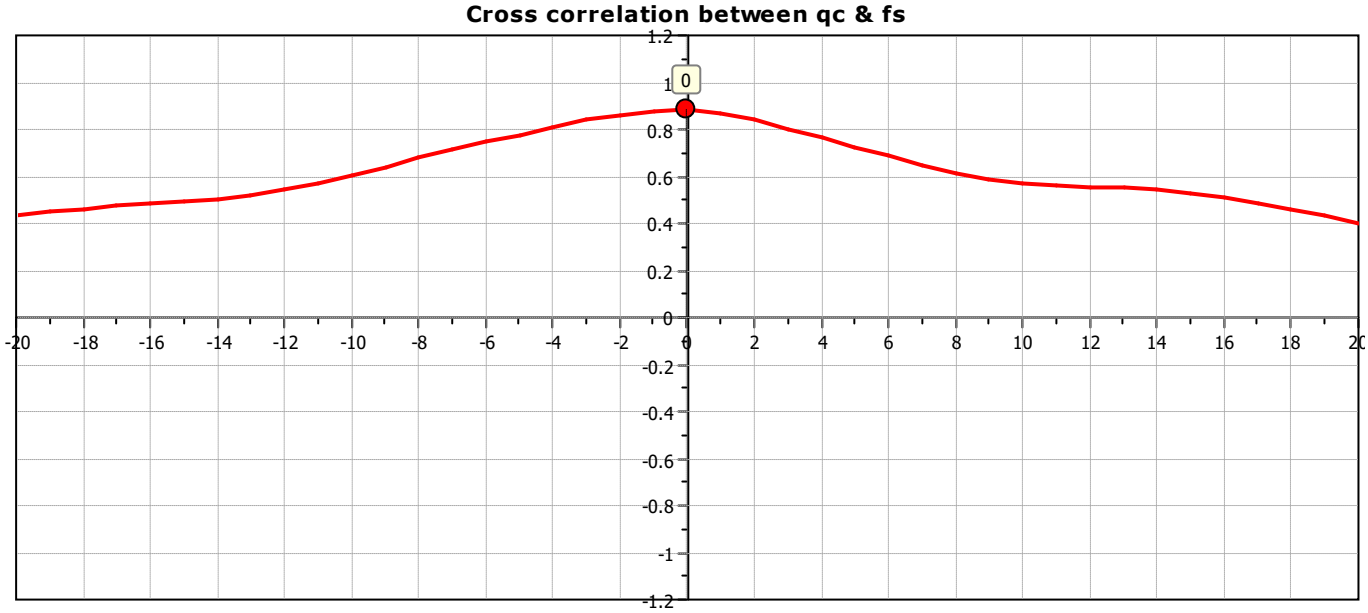
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

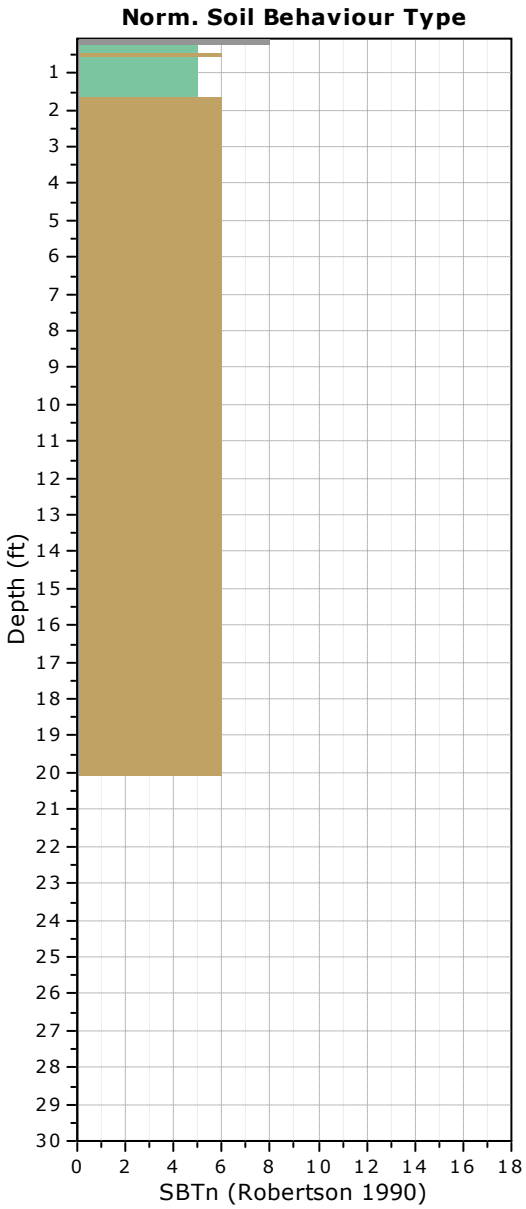
C-13
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 66.36 ft
Coords: X:572273.90, Y:556077.41
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

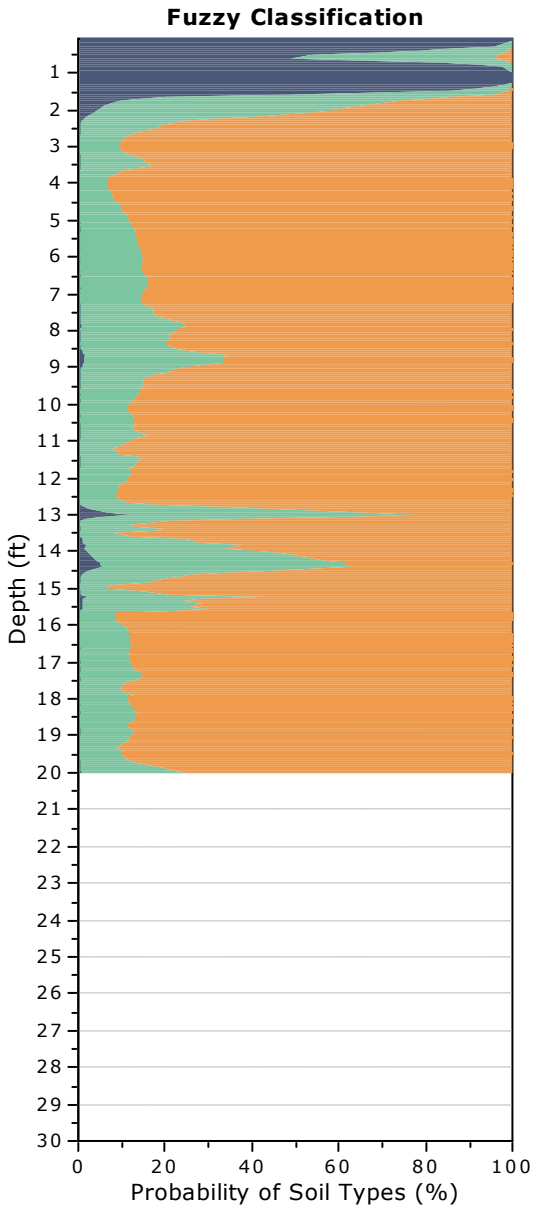
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







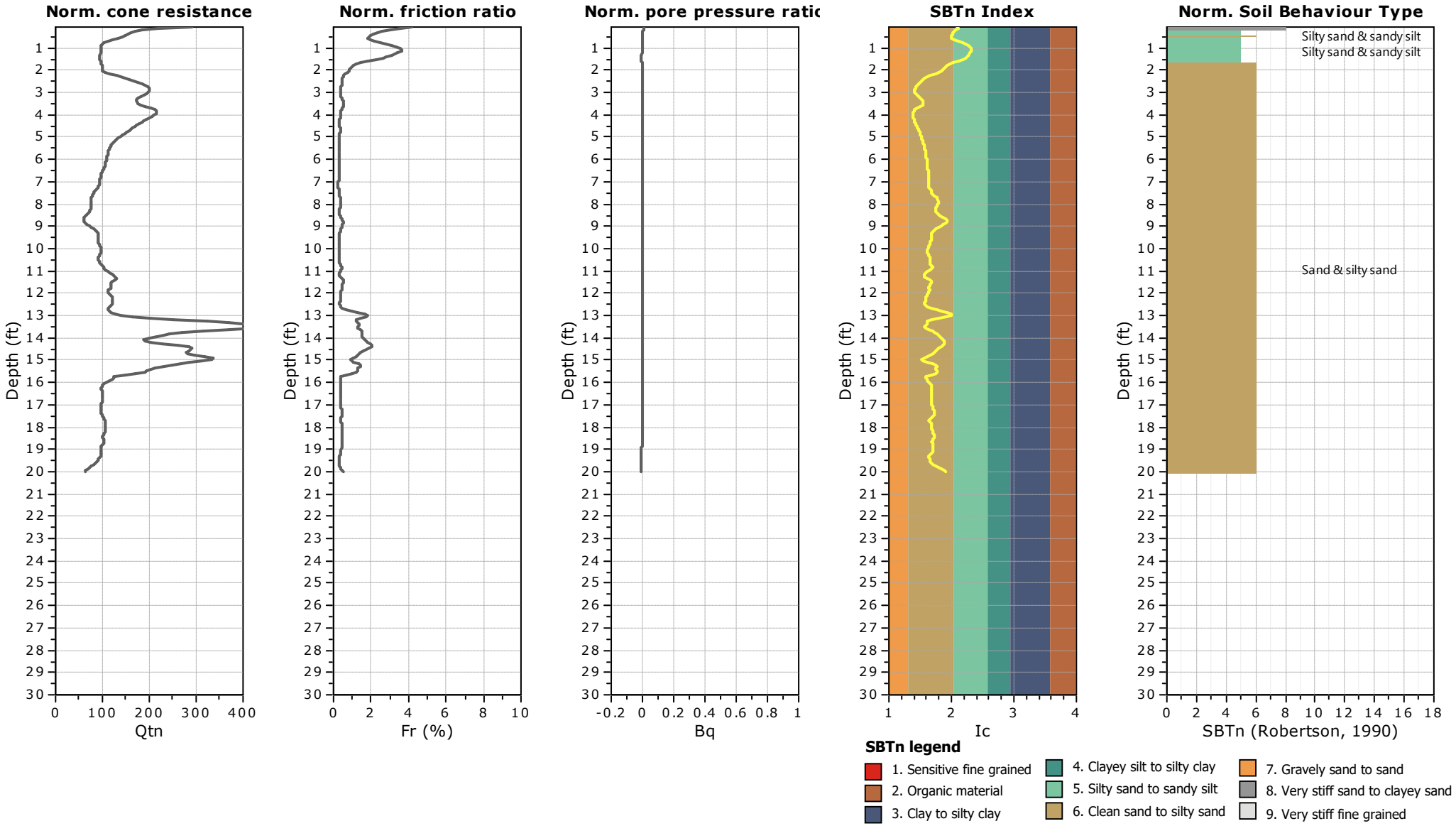
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-13
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 66.36 ft
Coords: X:572273.90, Y:556077.41
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

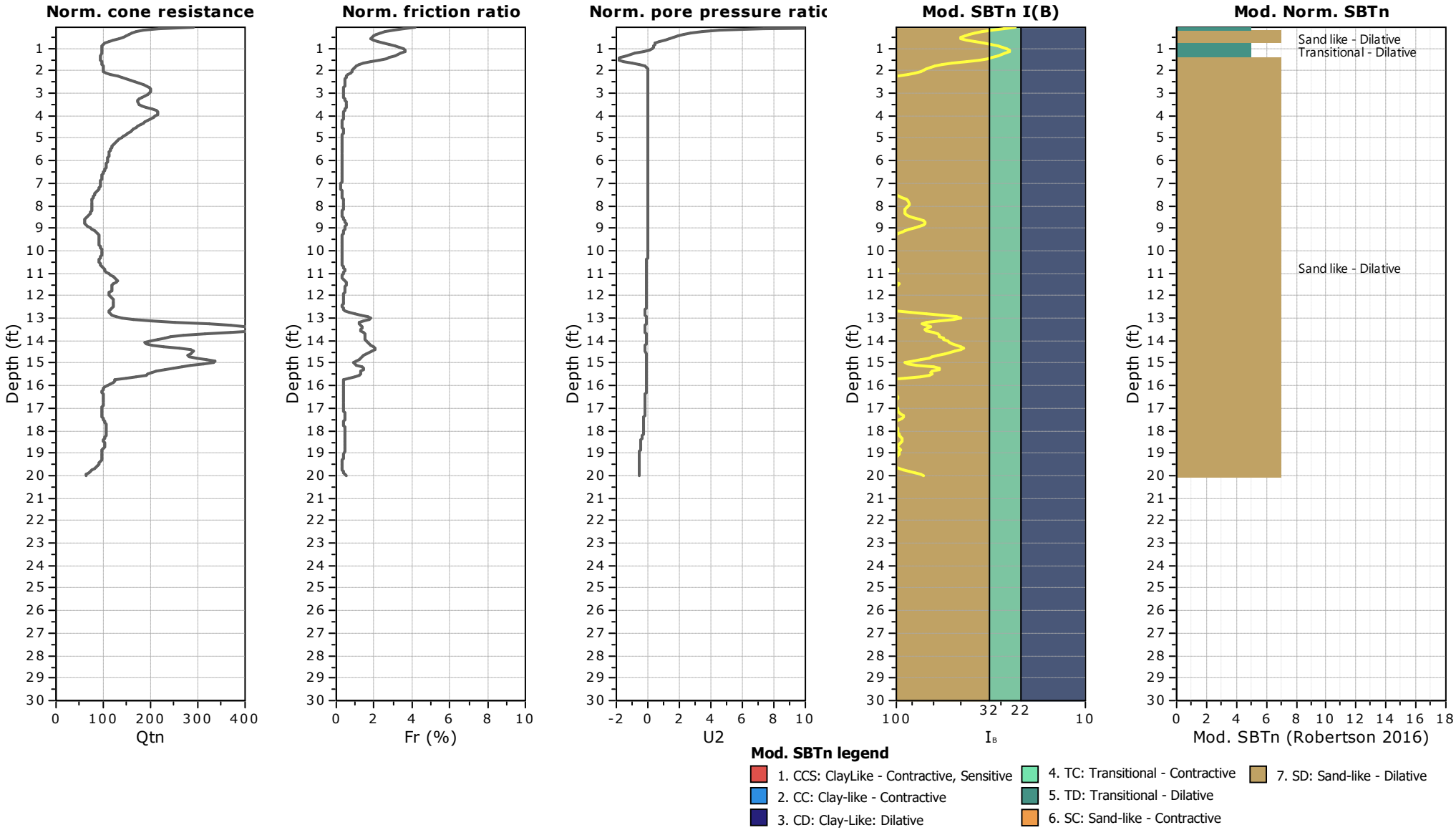
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-13
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 66.36 ft
Coords: X:572273.90, Y:556077.41
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

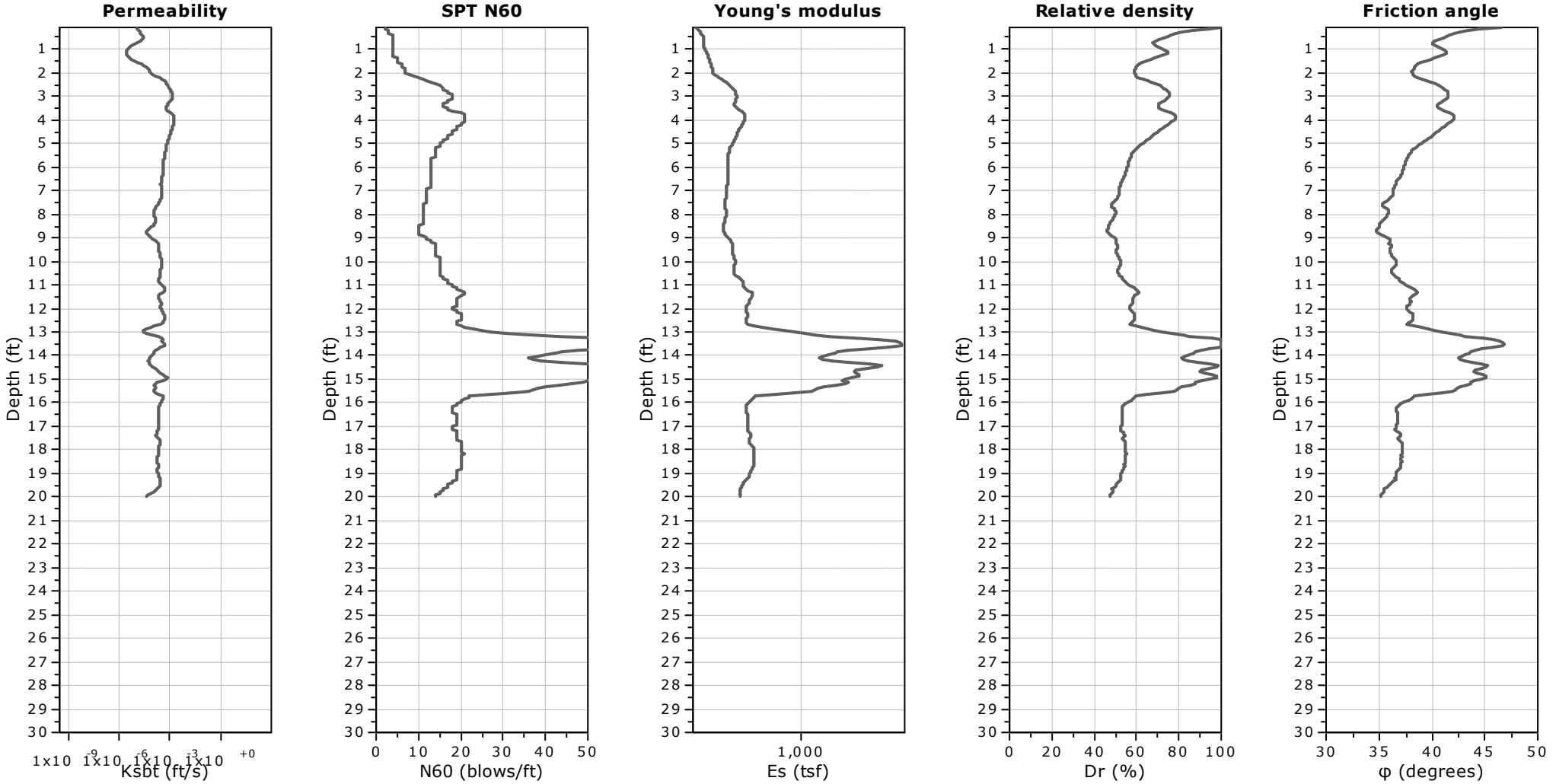
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-13
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 66.36 ft
Coords: X:572273.90, Y:556077.41
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



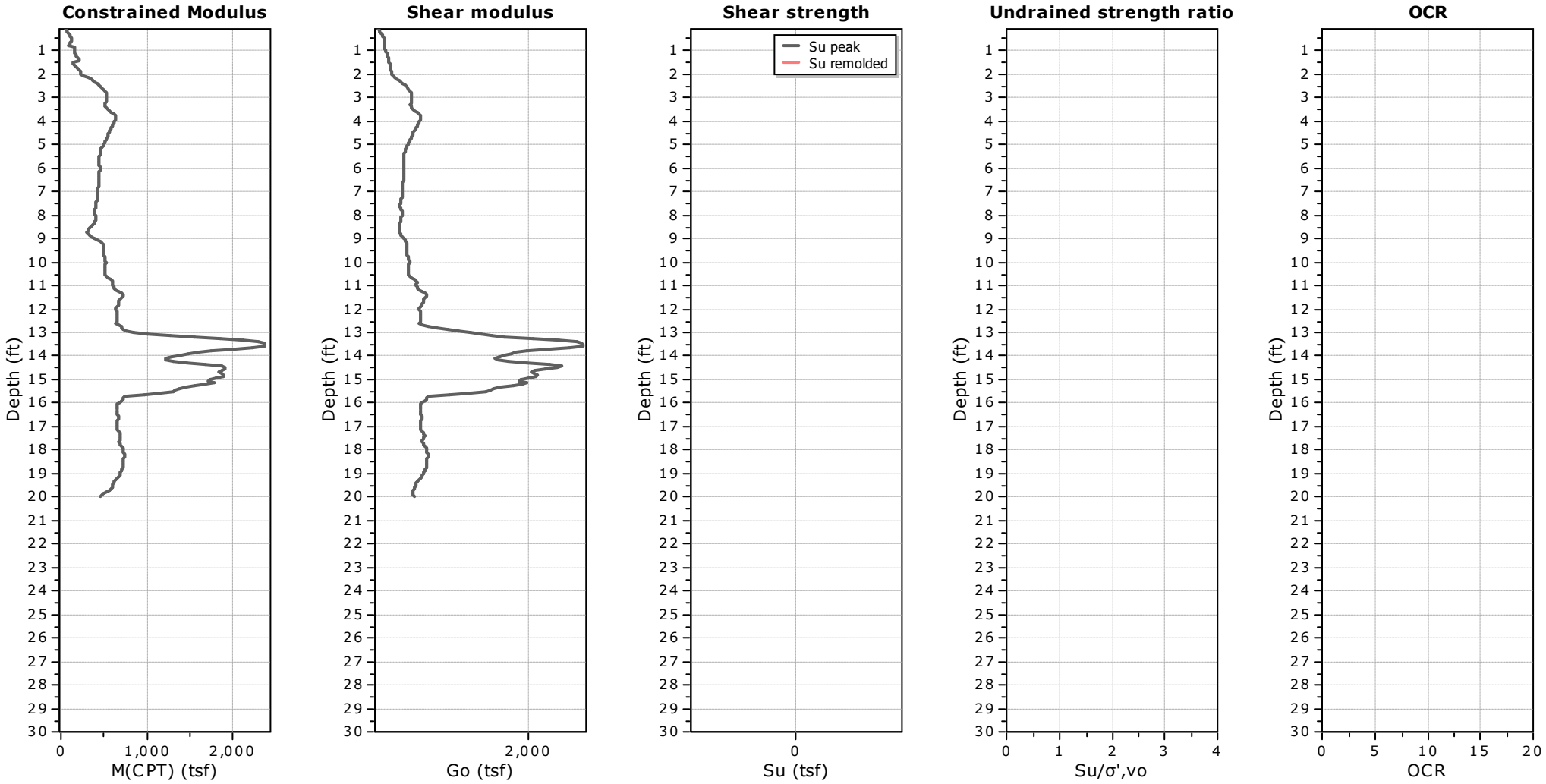
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-13
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 66.36 ft
Coords: X:572273.90, Y:556077.41
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



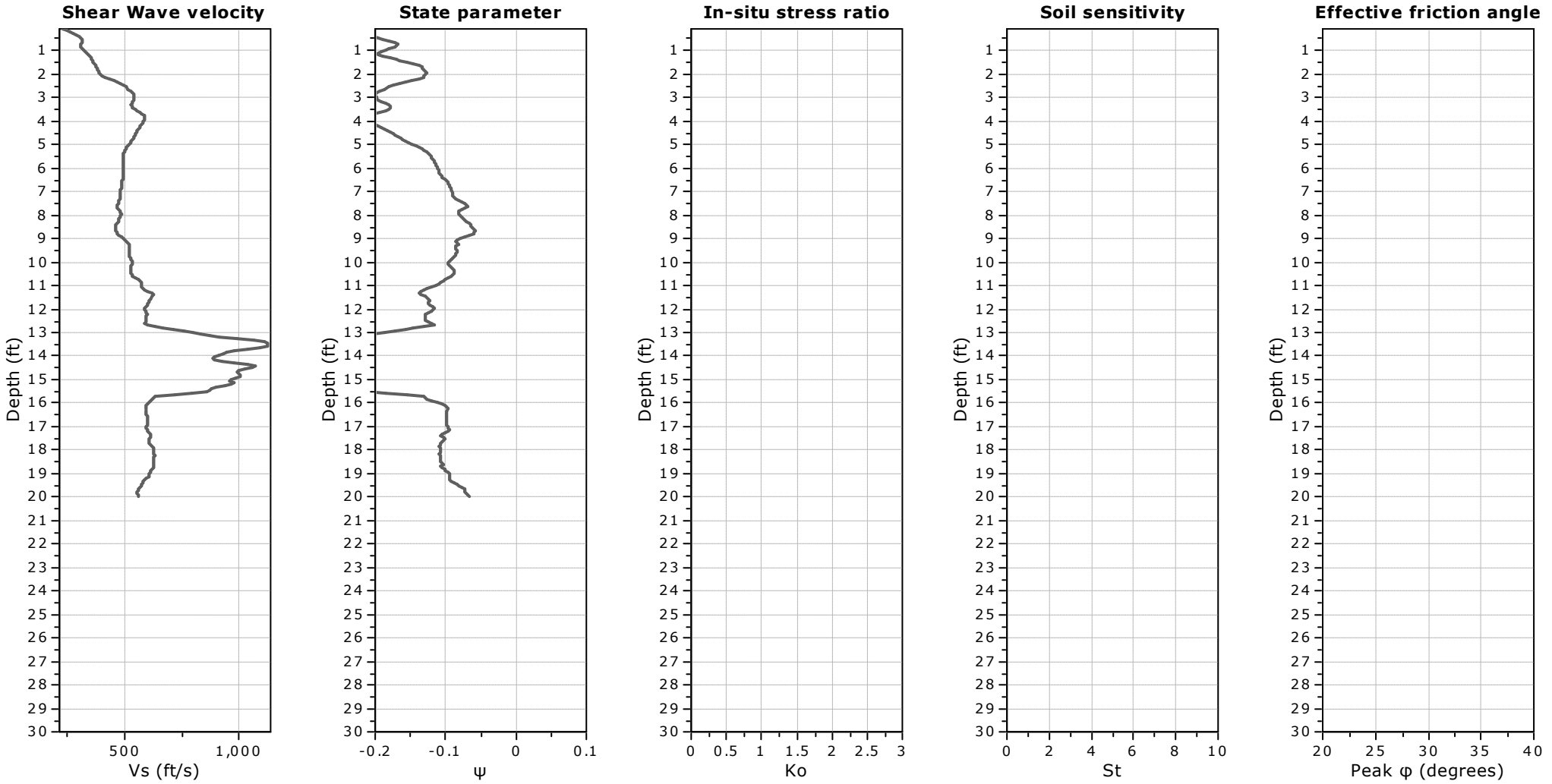
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-13
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 66.36 ft
Coords: X:572273.90, Y:556077.41
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



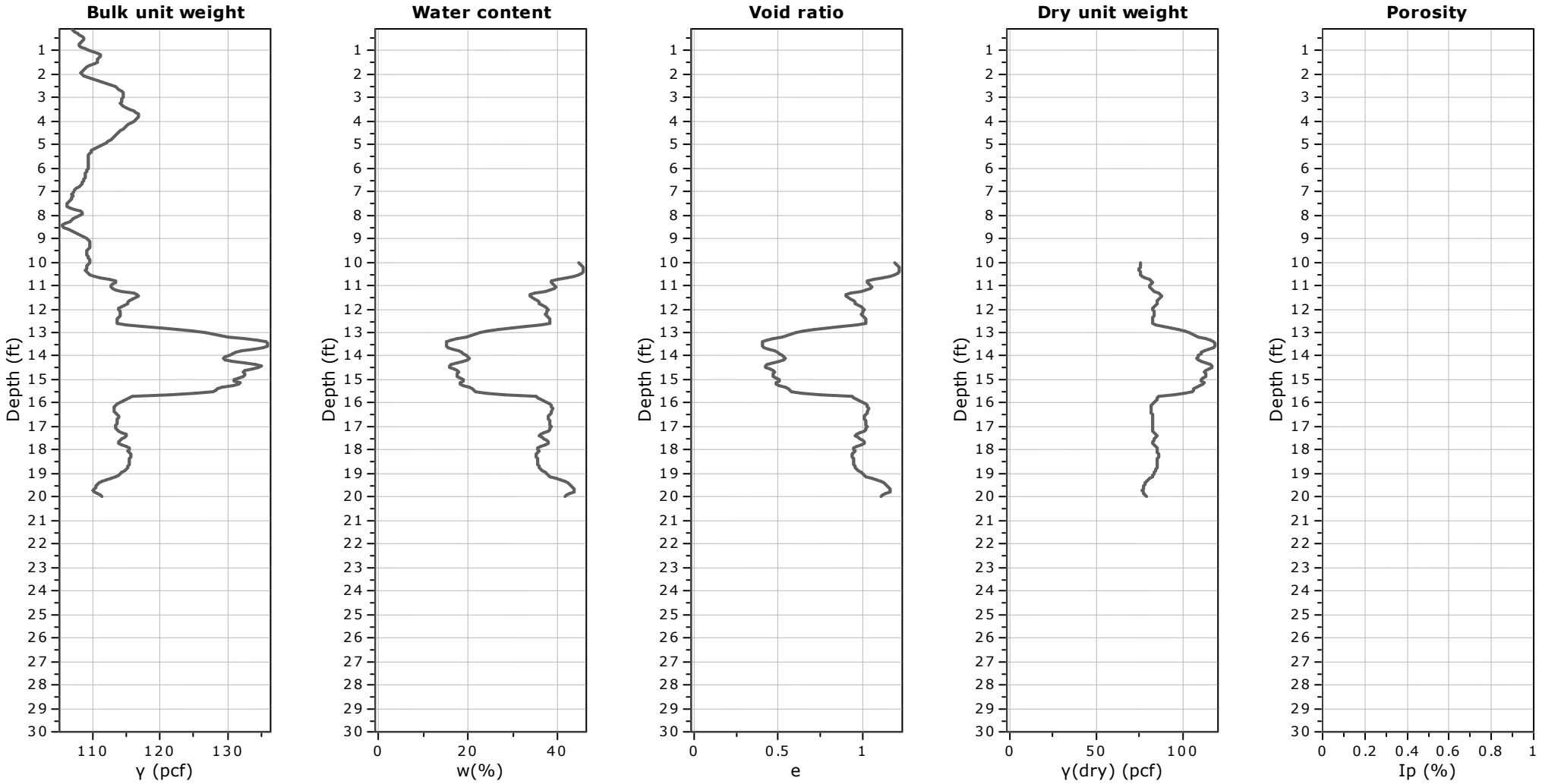
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-13
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 66.36 ft
Coords: X:572273.90, Y:556077.41
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

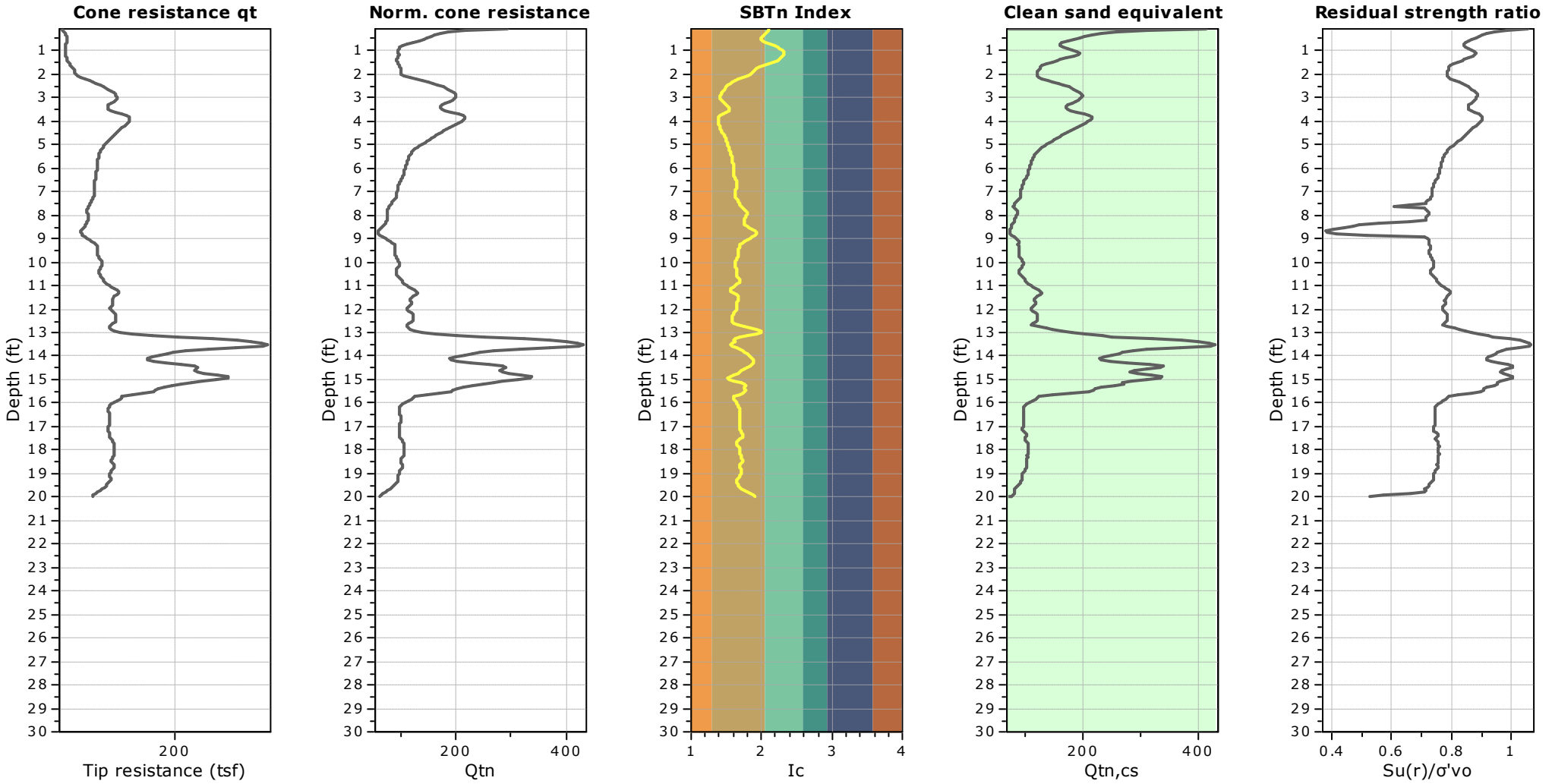
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-13
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 66.36 ft
Coords: X:572273.90, Y:556077.41
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

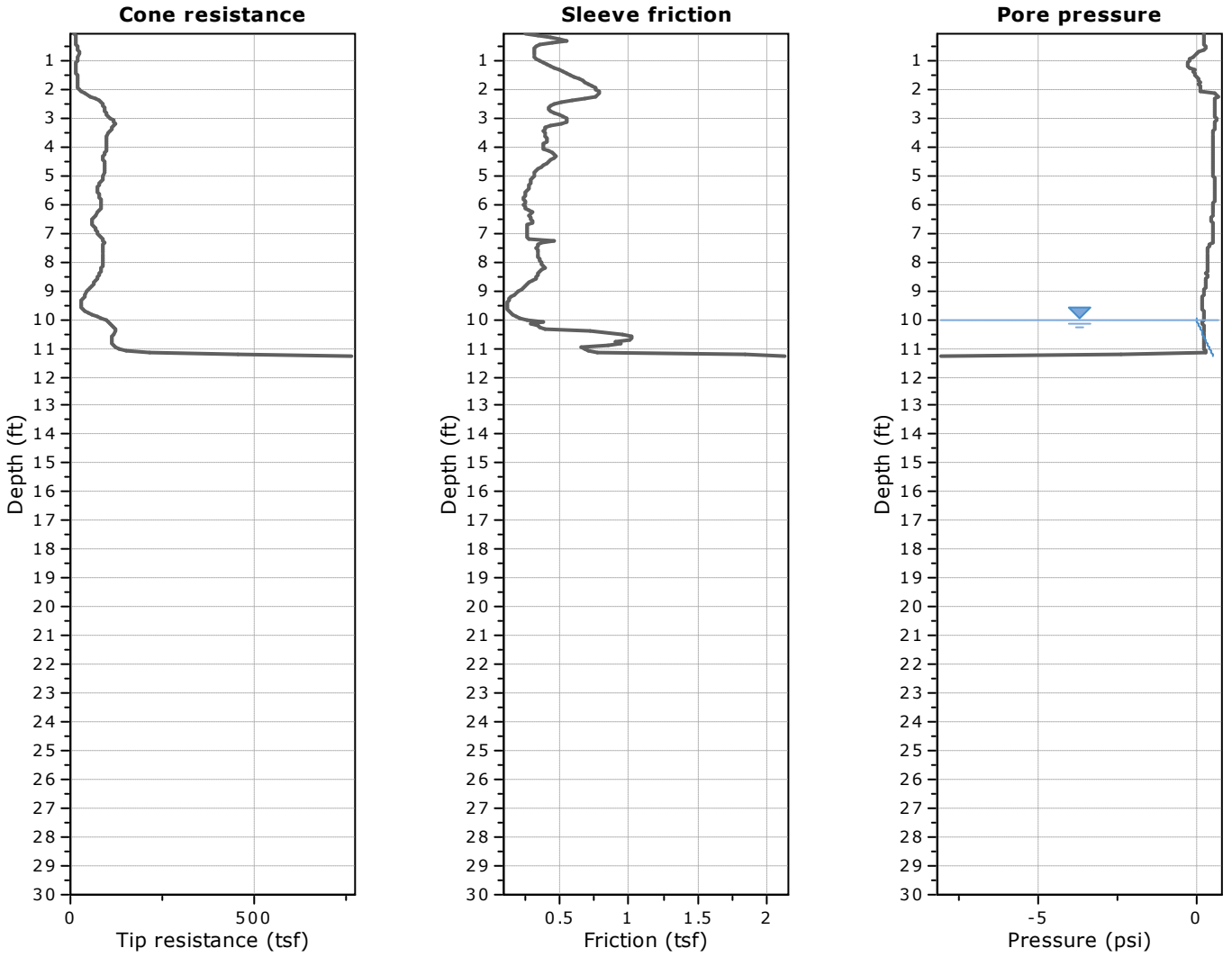
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



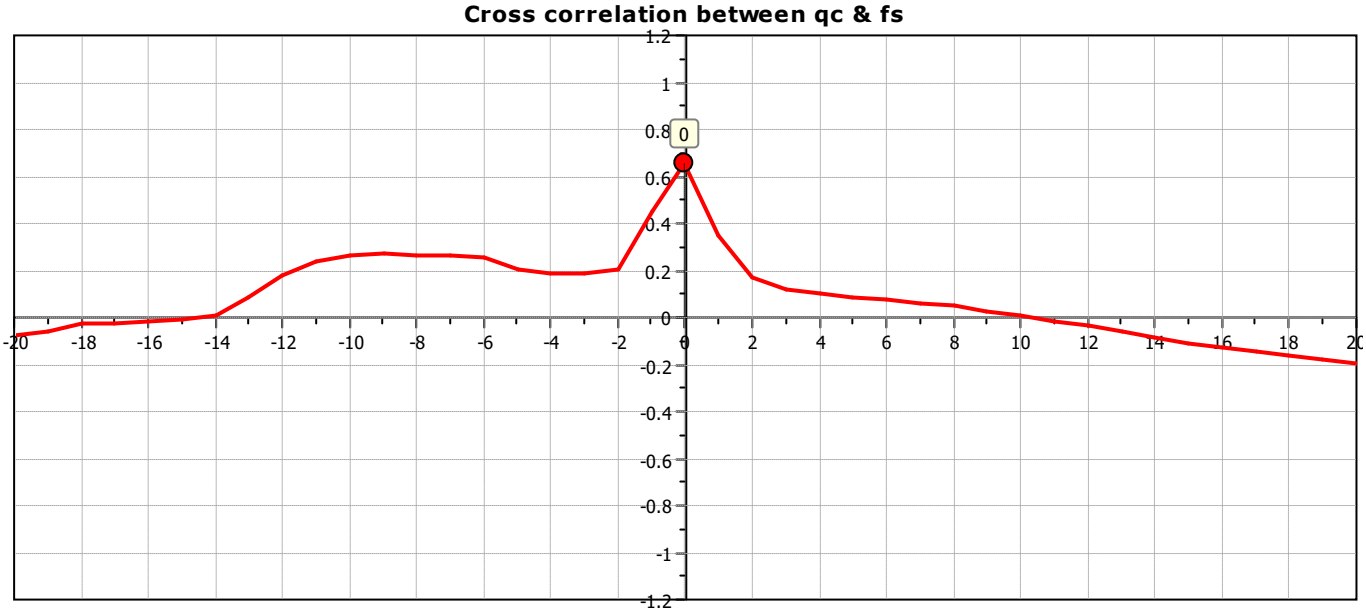
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

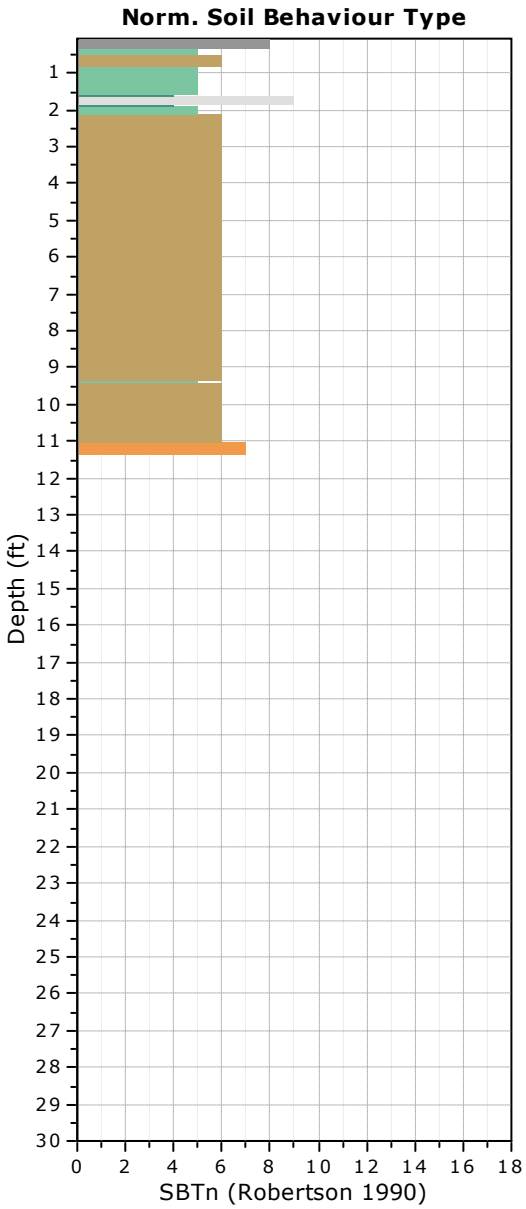
C-14
Total depth: 11.26 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

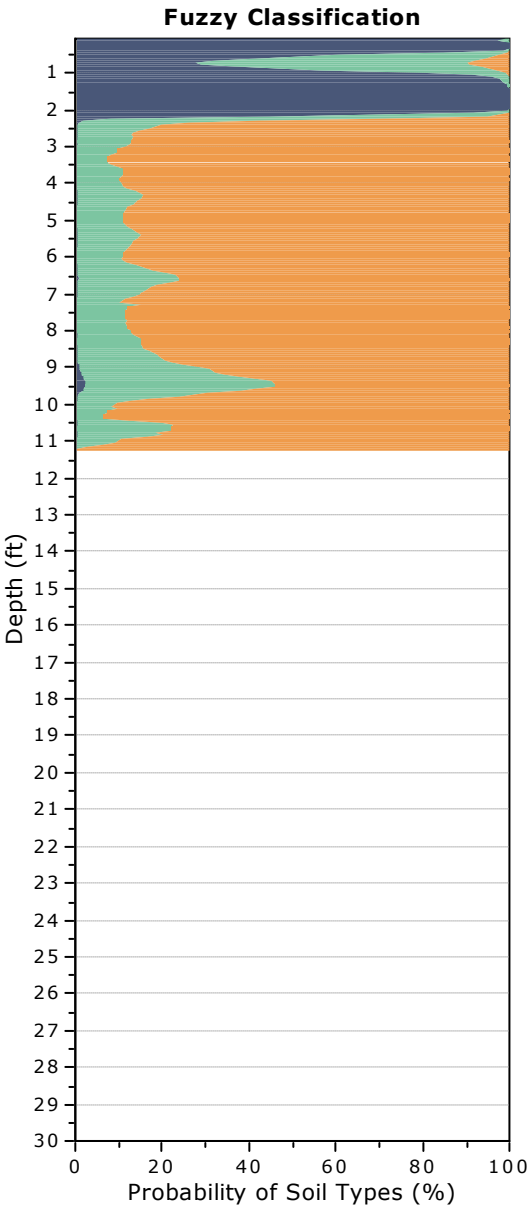
Project: ASD Summit Campus
Location: Middletown, Delaware



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







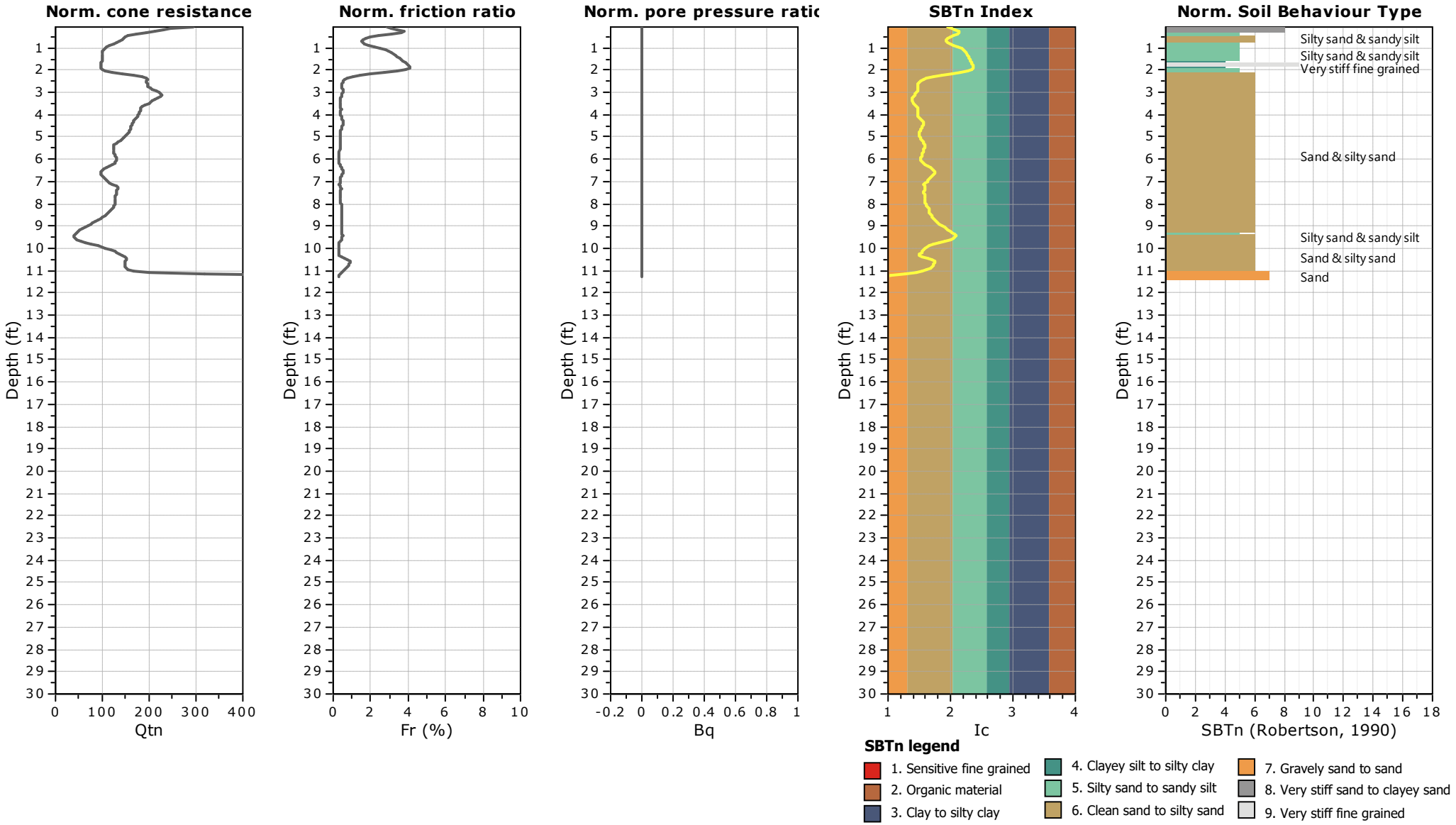
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

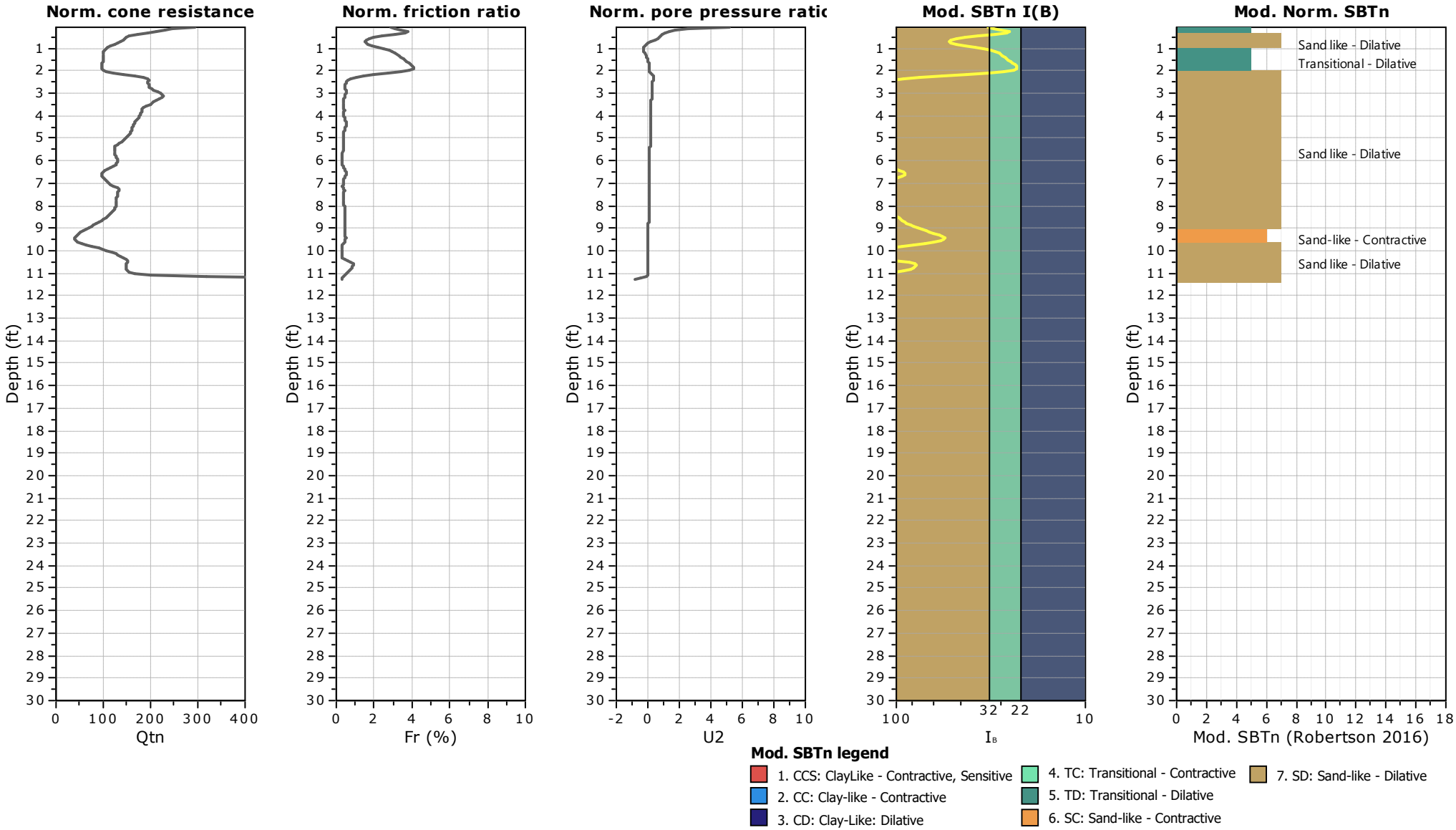
C-14
Total depth: 11.26 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-14
Total depth: 11.26 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

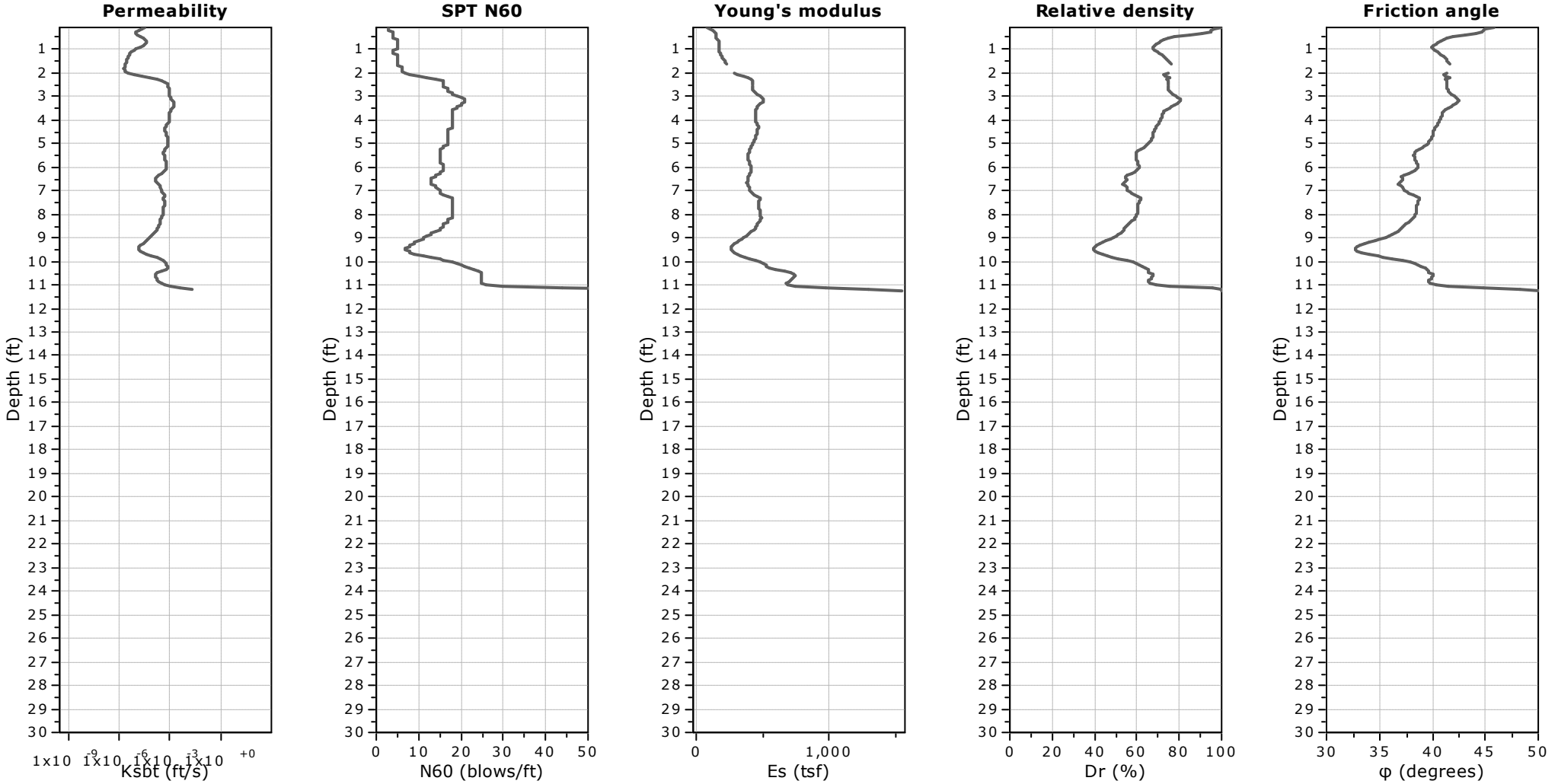
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-14
Total depth: 11.26 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

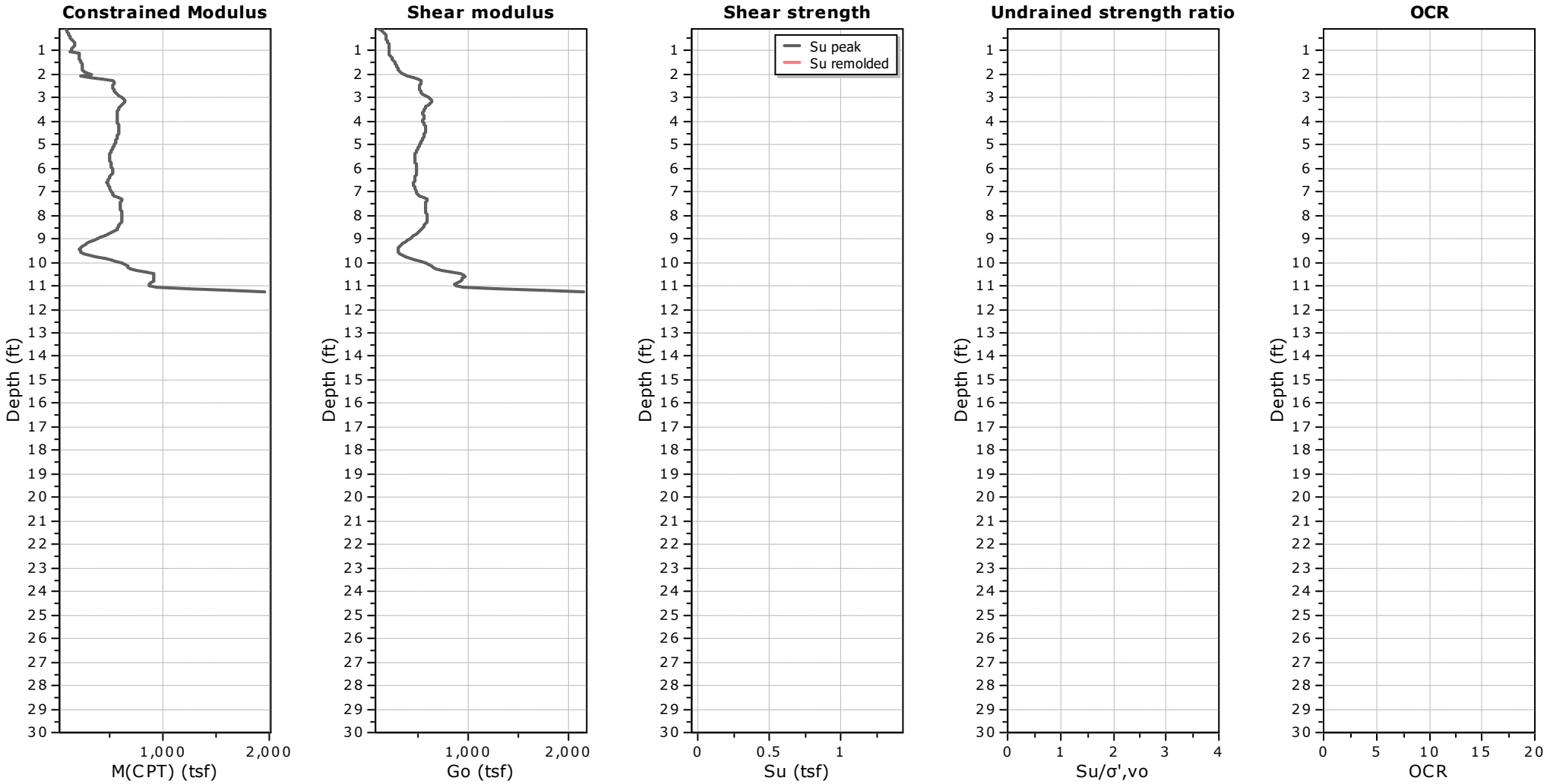


Calculation parameters
Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-14
Total depth: 11.26 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



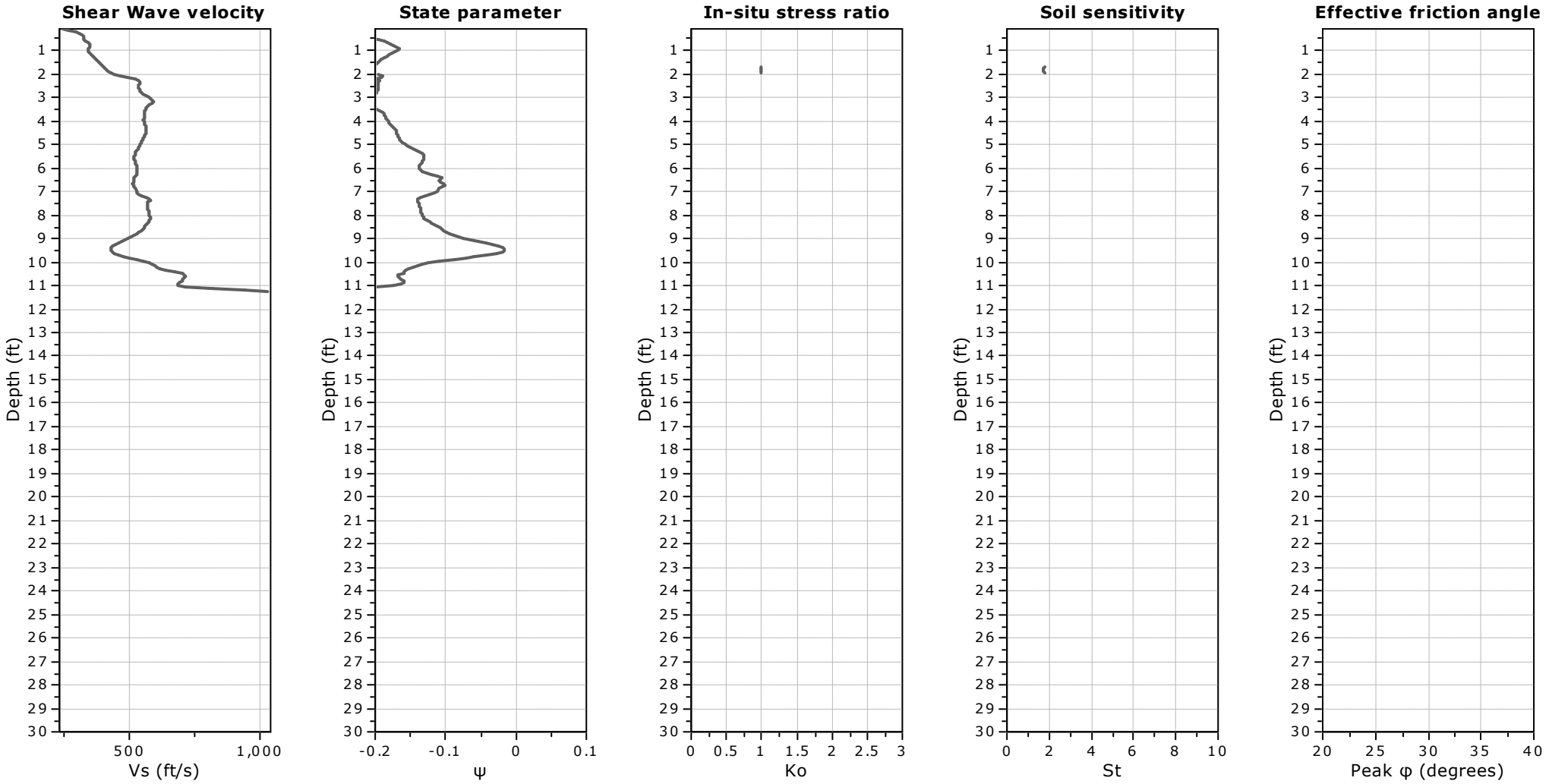
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-14
Total depth: 11.26 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



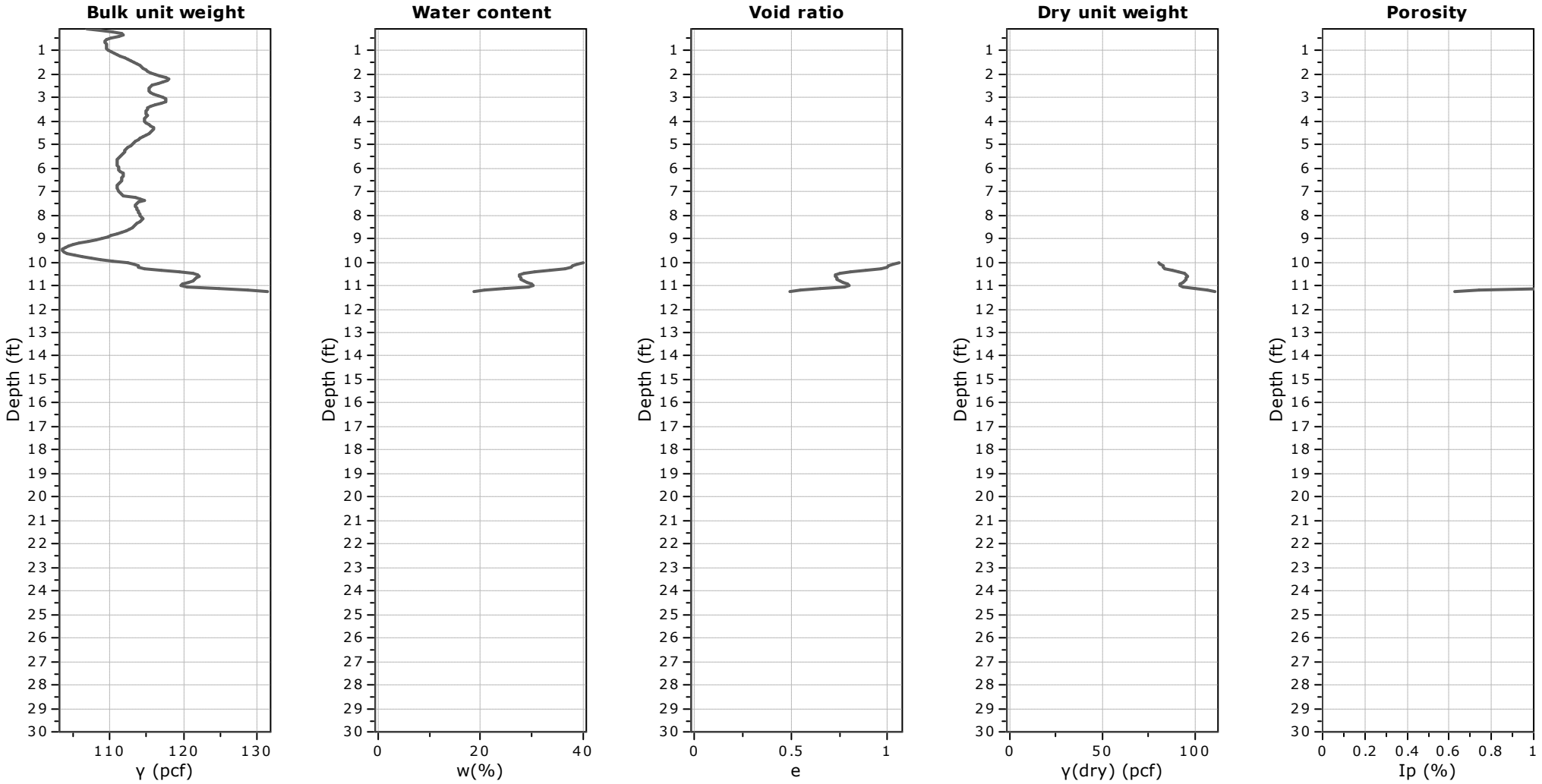
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-14
Total depth: 11.26 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

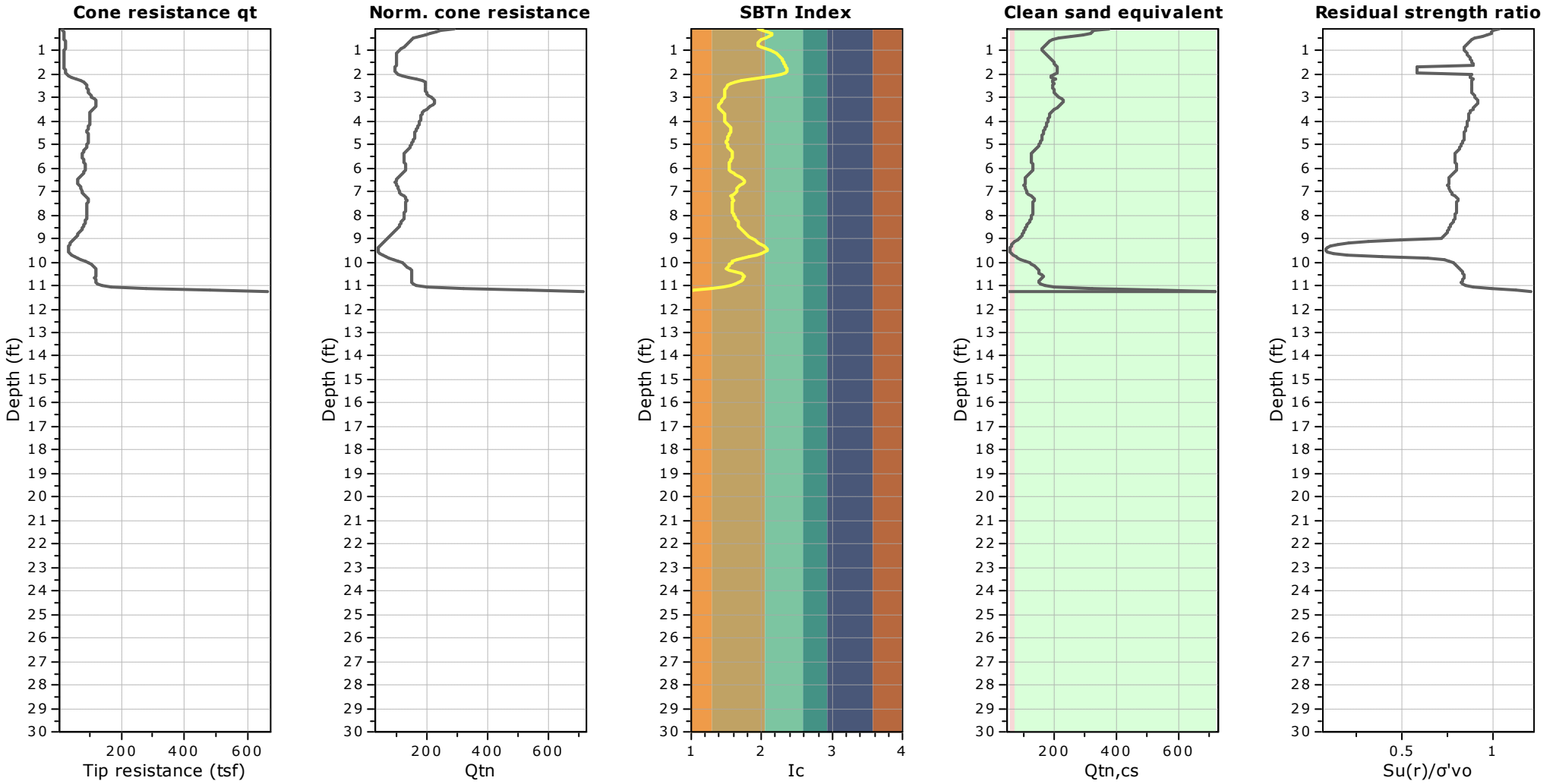
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-14
Total depth: 11.26 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

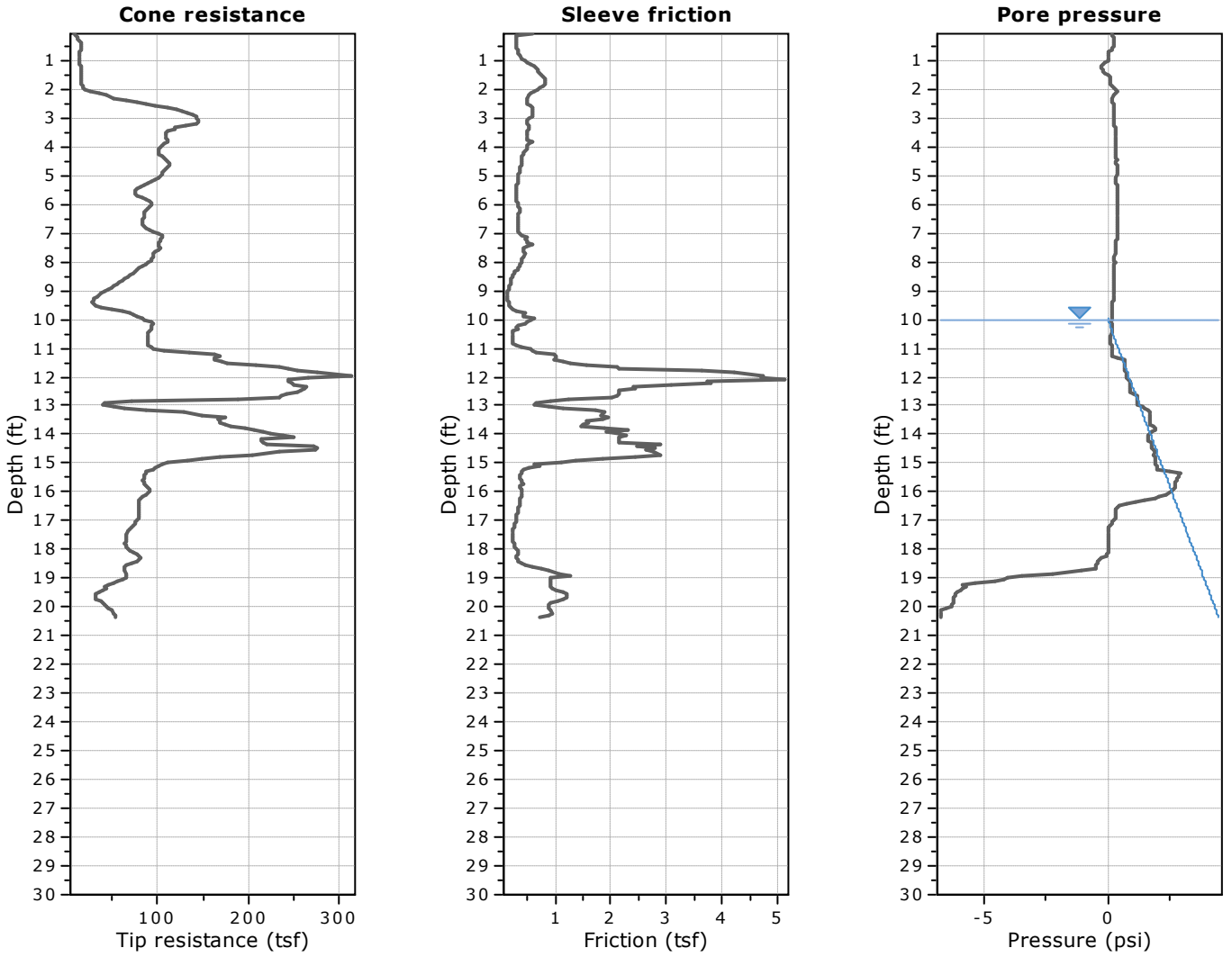
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



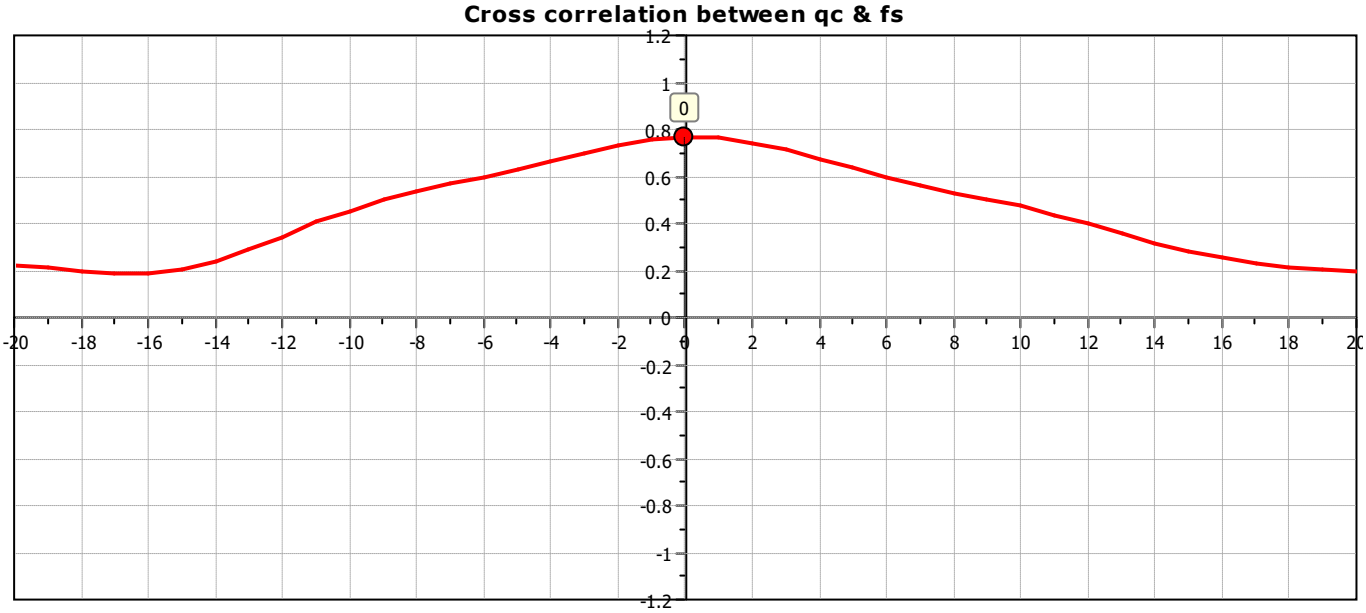
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

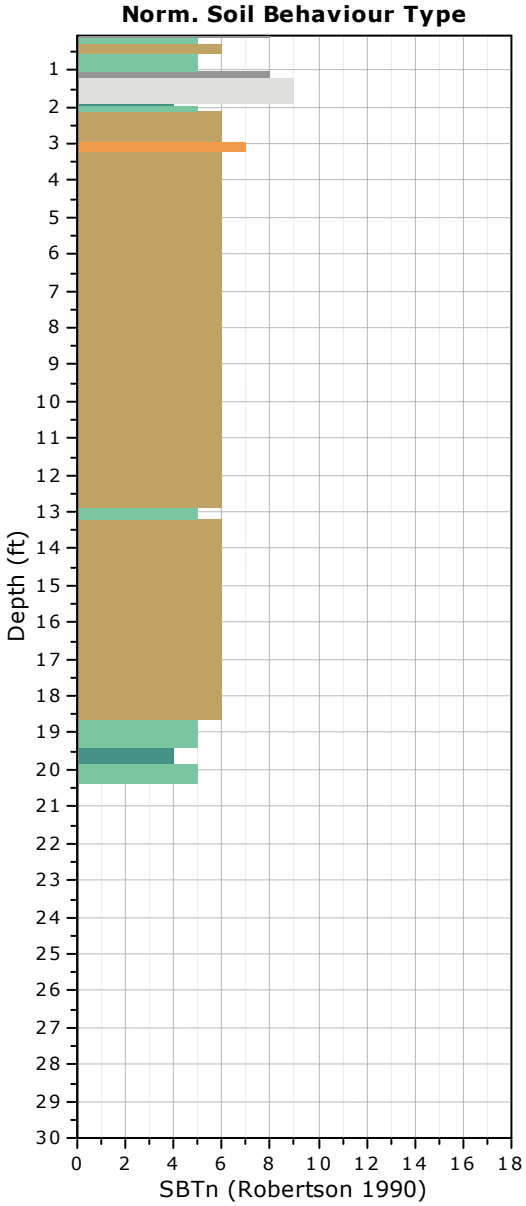
C-14A
Total depth: 20.33 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

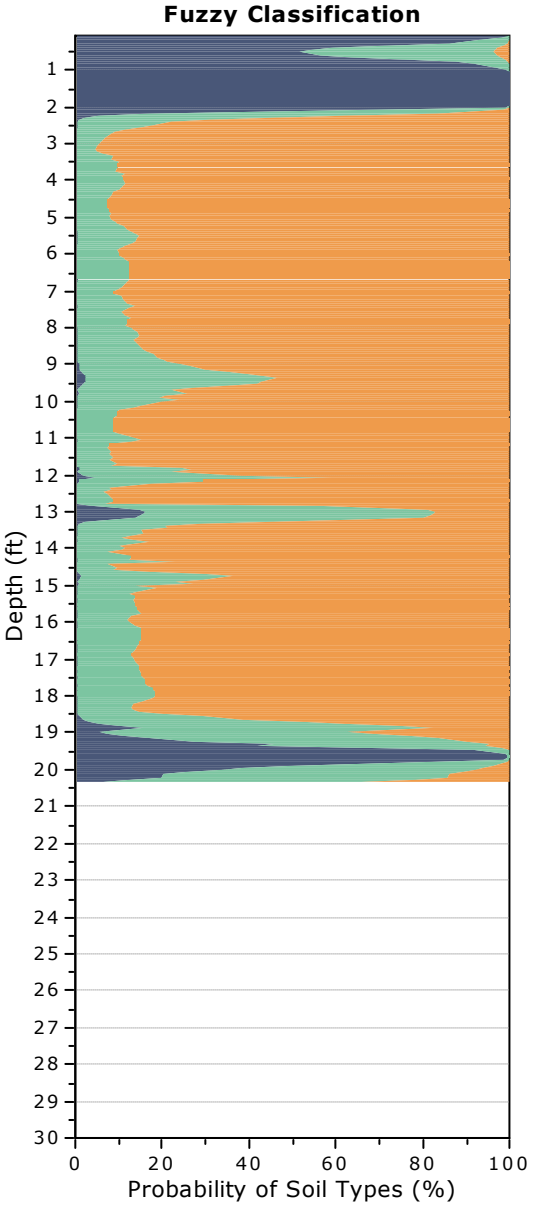
Project: ASD Summit Campus
Location: Middletown, Delaware



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).





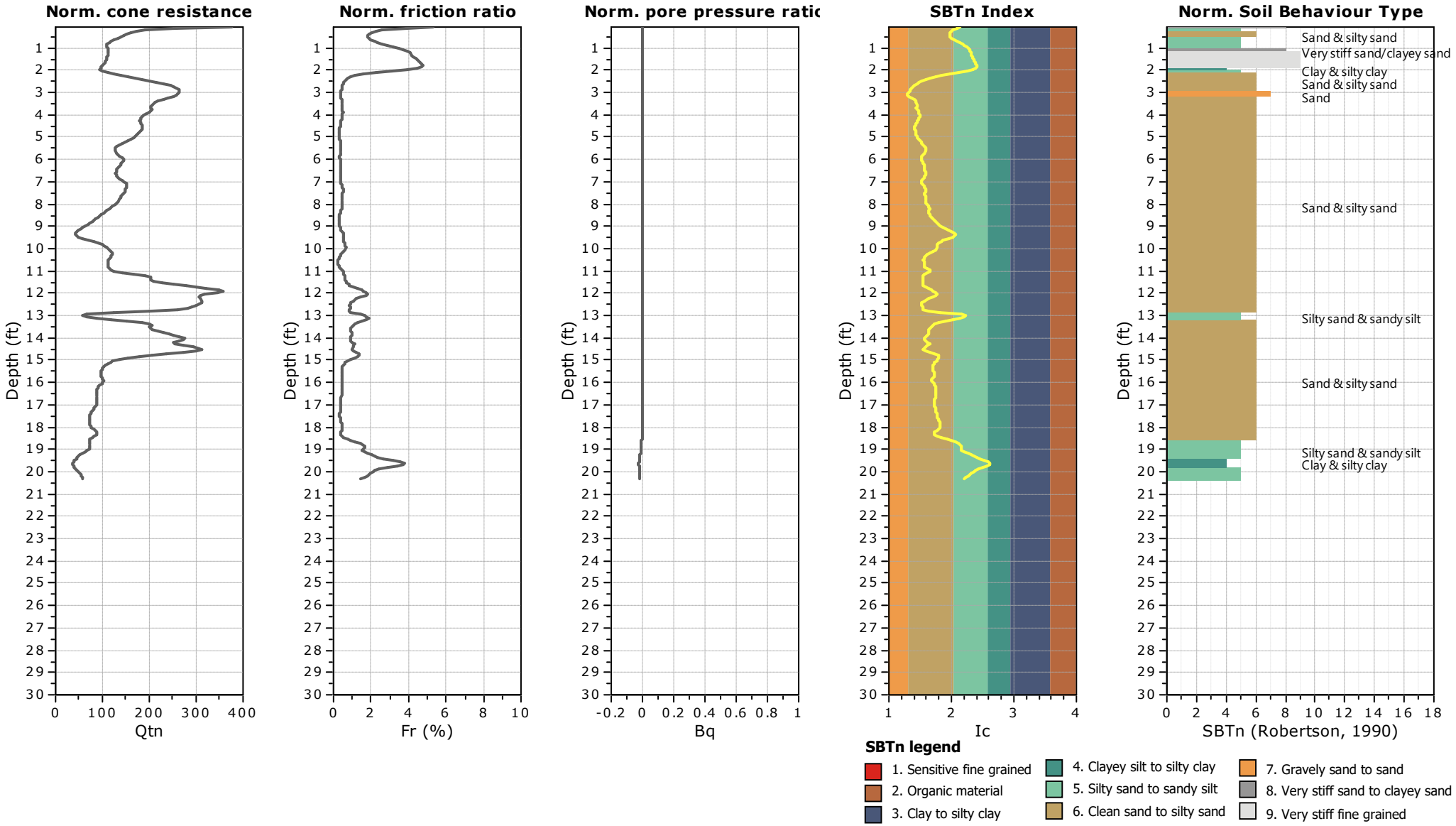


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-14A
Total depth: 20.33 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

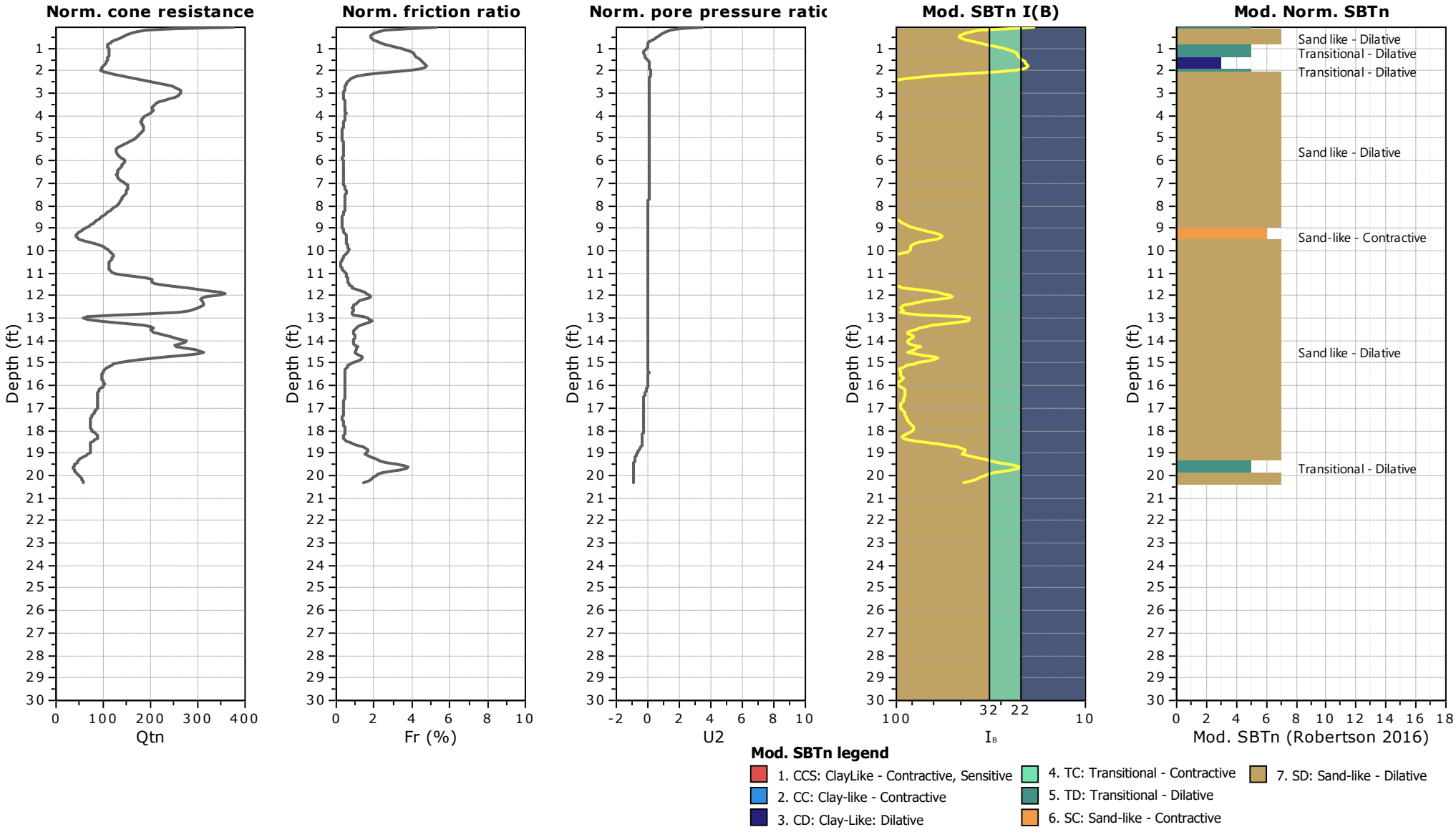
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-14A
Total depth: 20.33 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

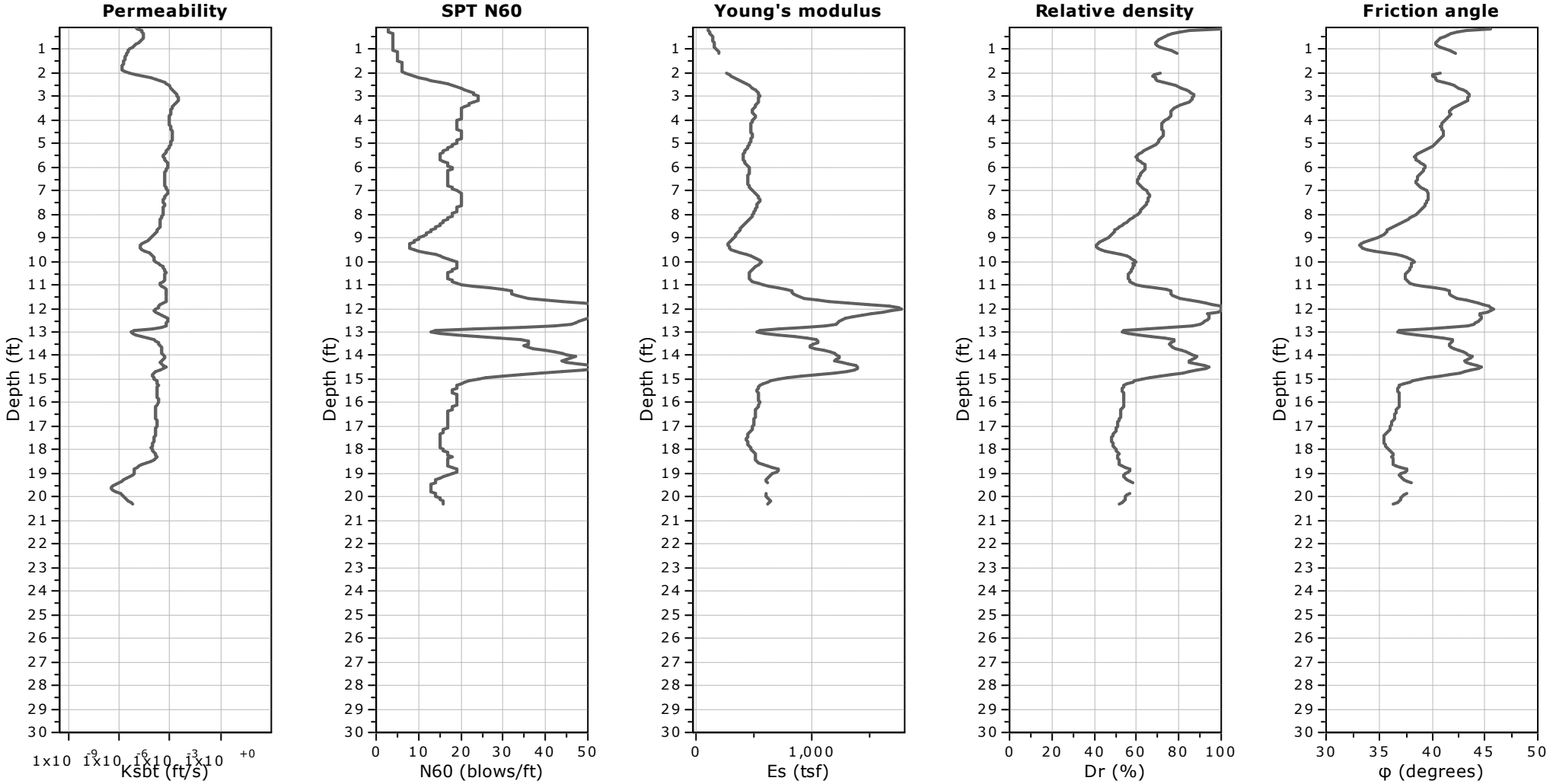
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-14A
Total depth: 20.33 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

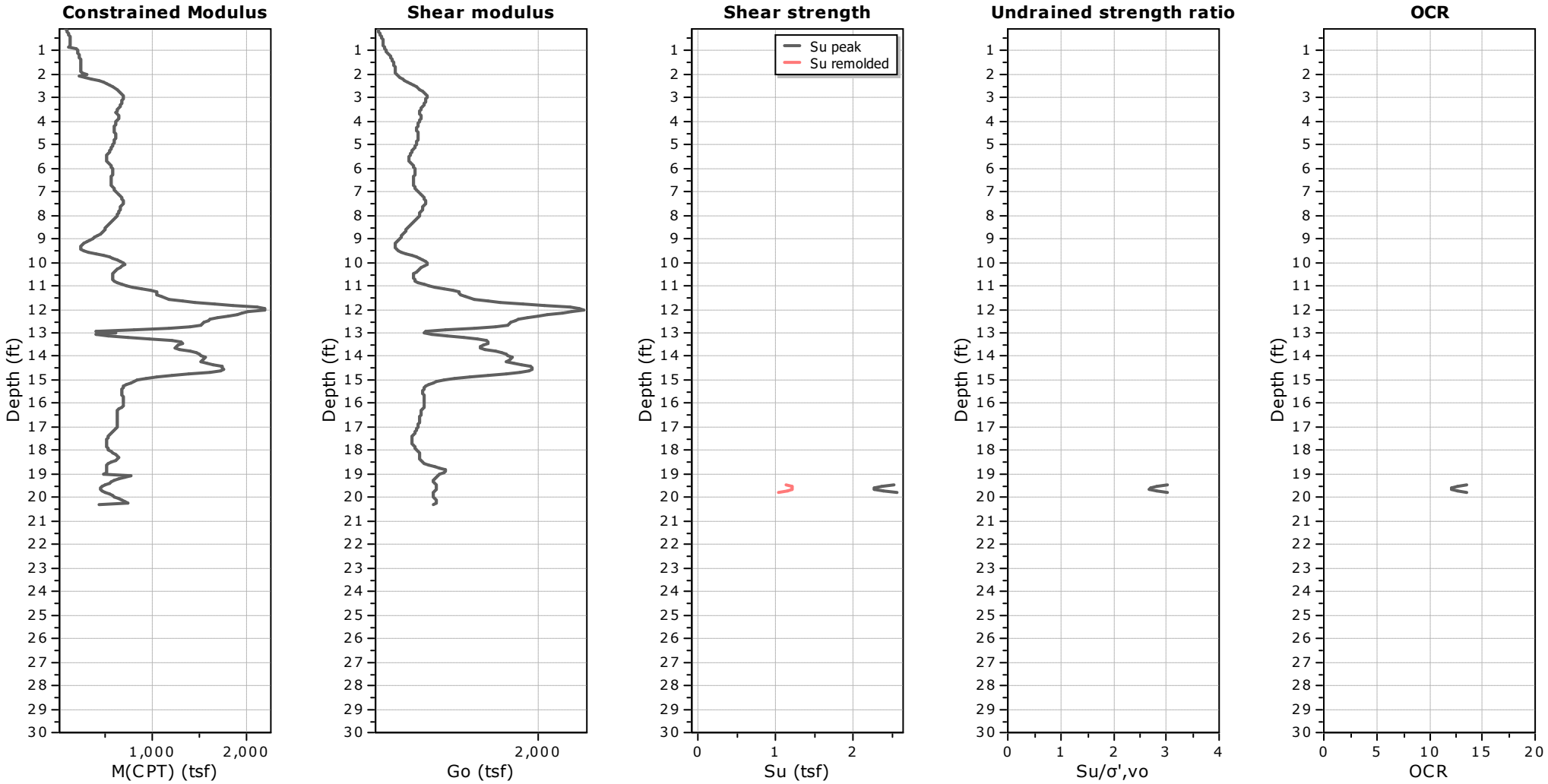


Calculation parameters
Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-14A
Total depth: 20.33 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



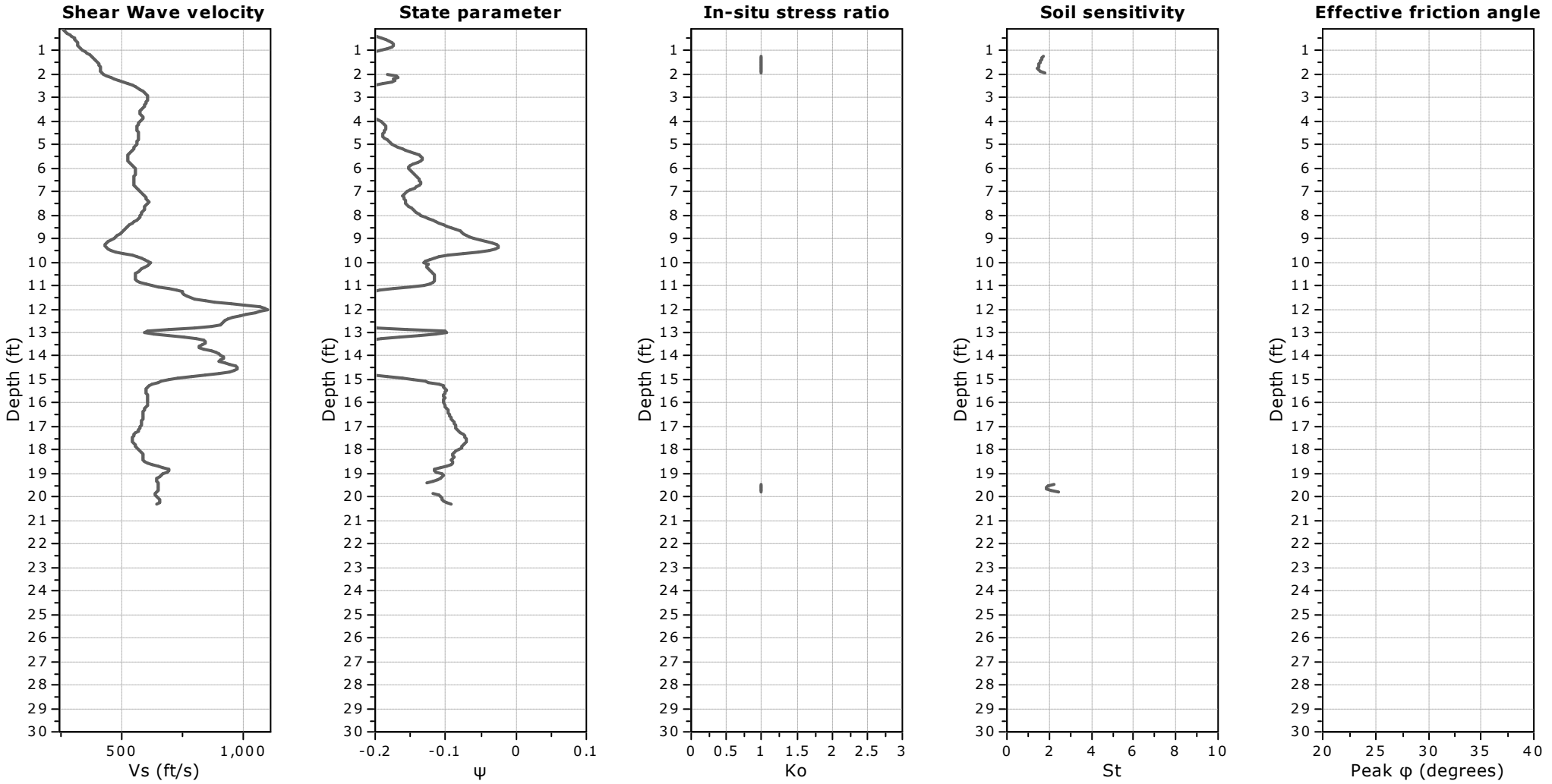
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-14A
Total depth: 20.33 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



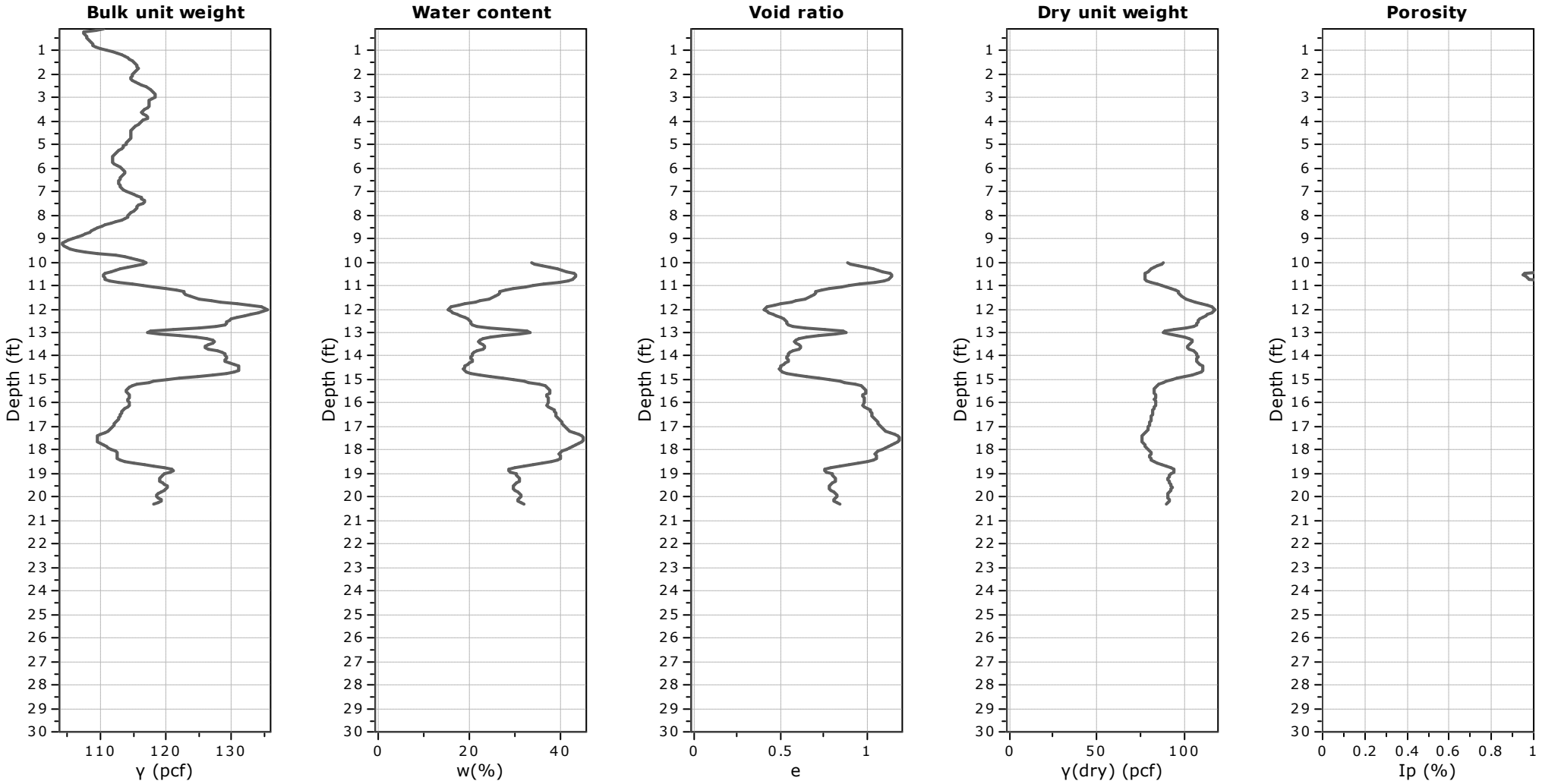
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-14A
Total depth: 20.33 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

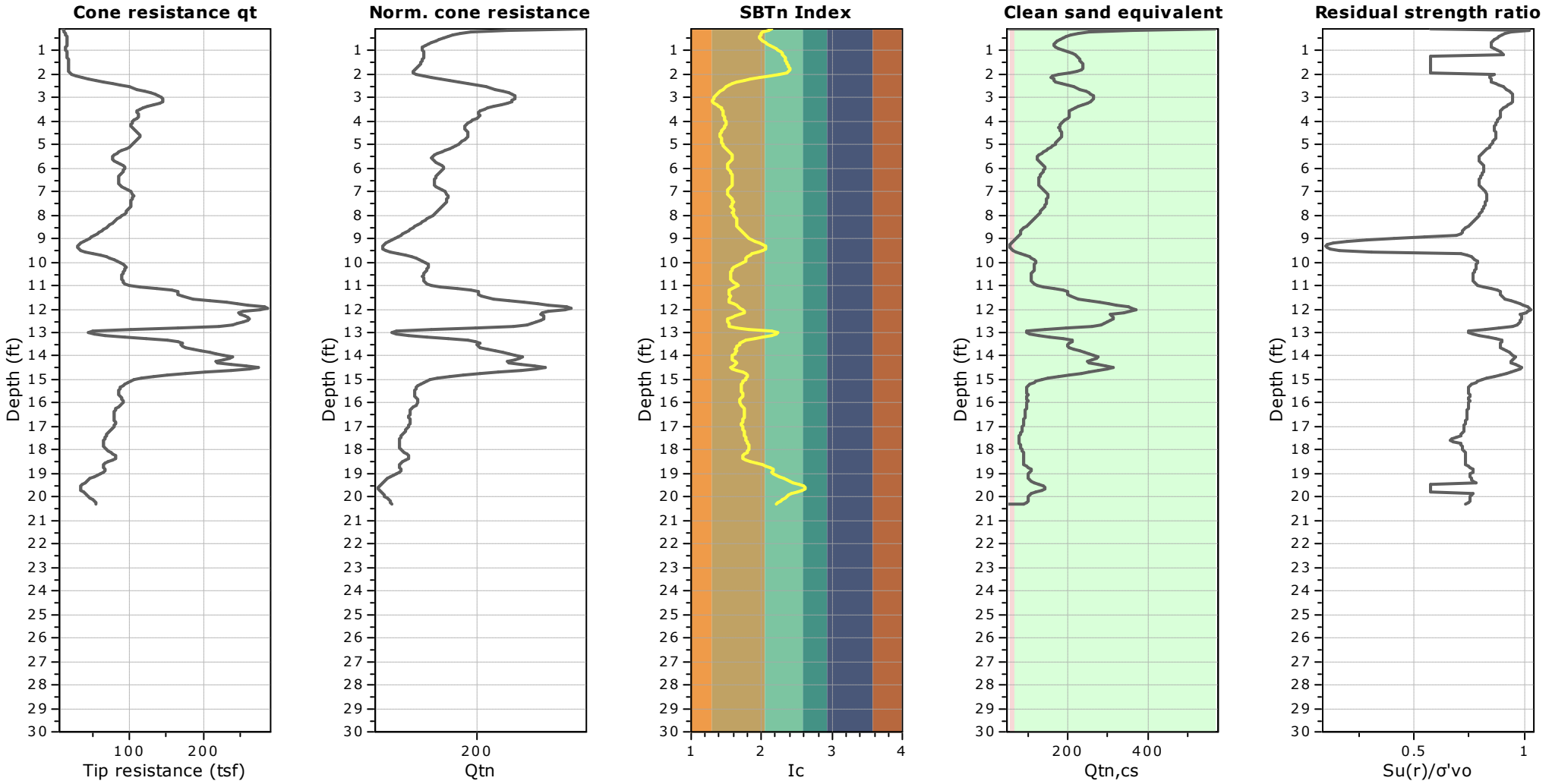
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-14A
Total depth: 20.33 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572239.40, Y:555990.15
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

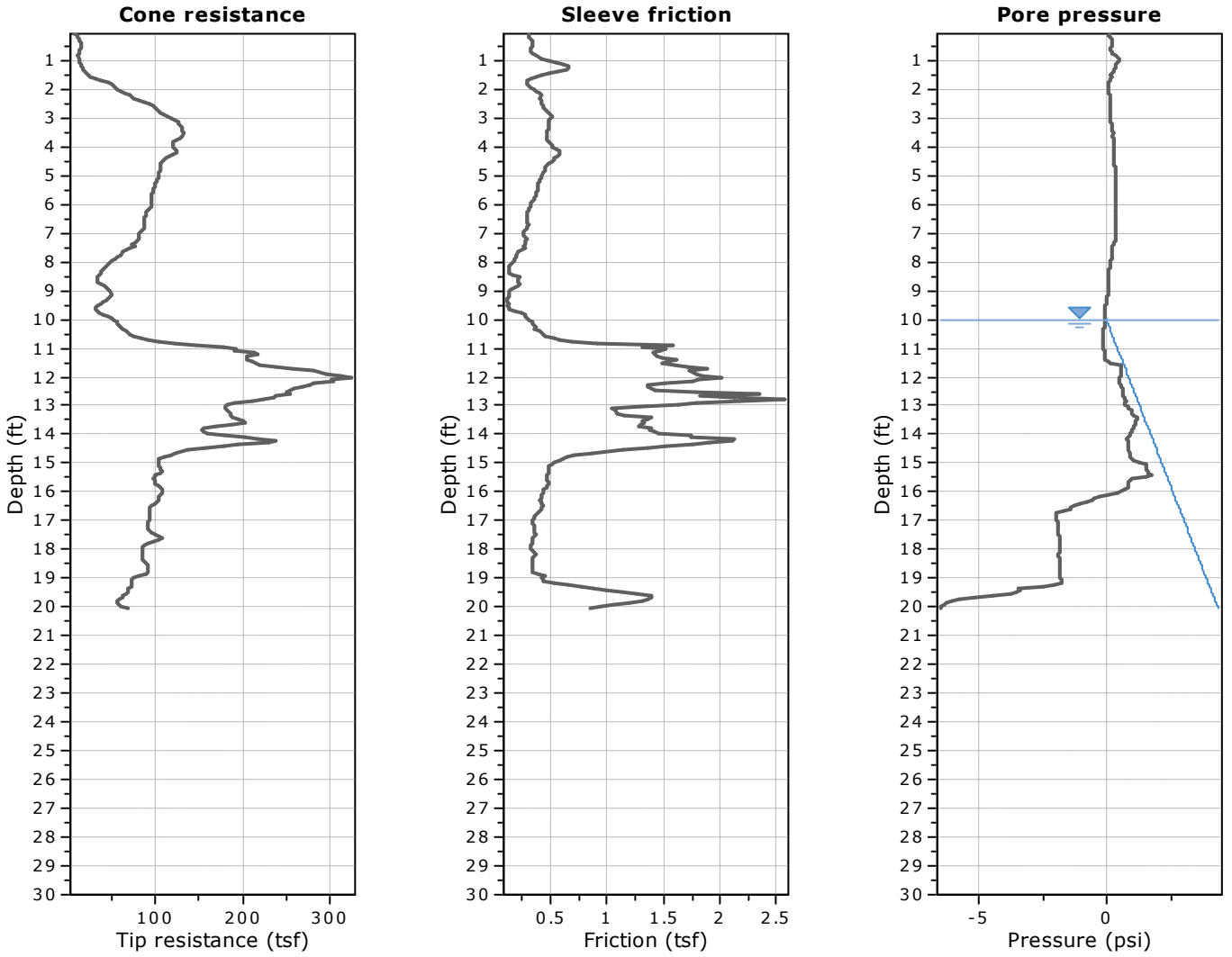
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



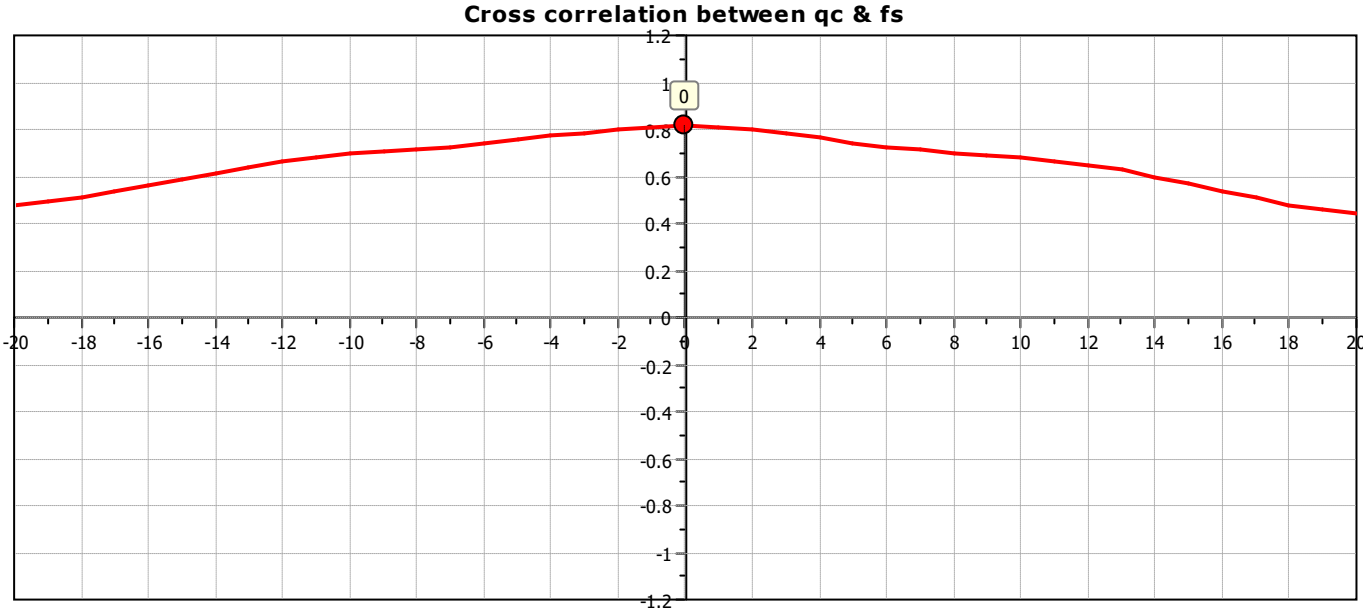
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

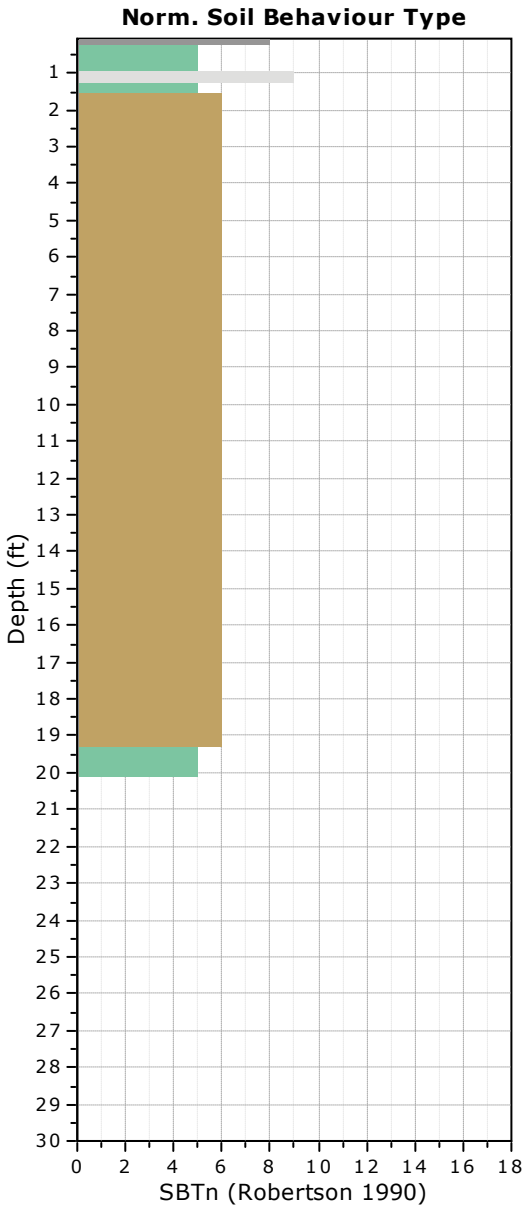
C-15
Total depth: 20.07 ft, Date: 5/14/2024
Surface Elevation: 65.23 ft
Coords: X:572310.83, Y:555945.30
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

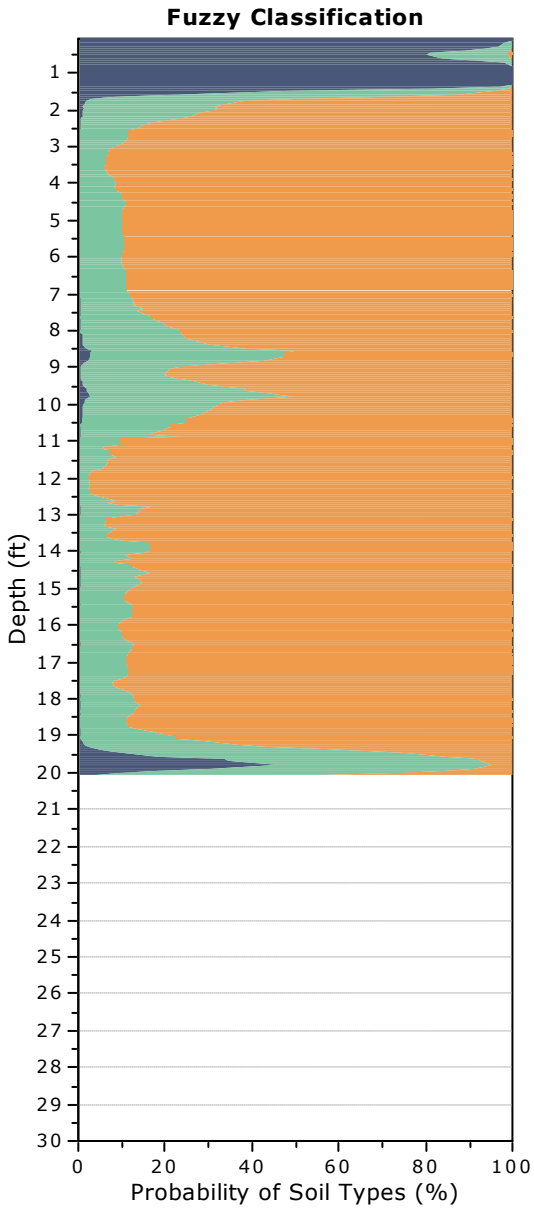
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







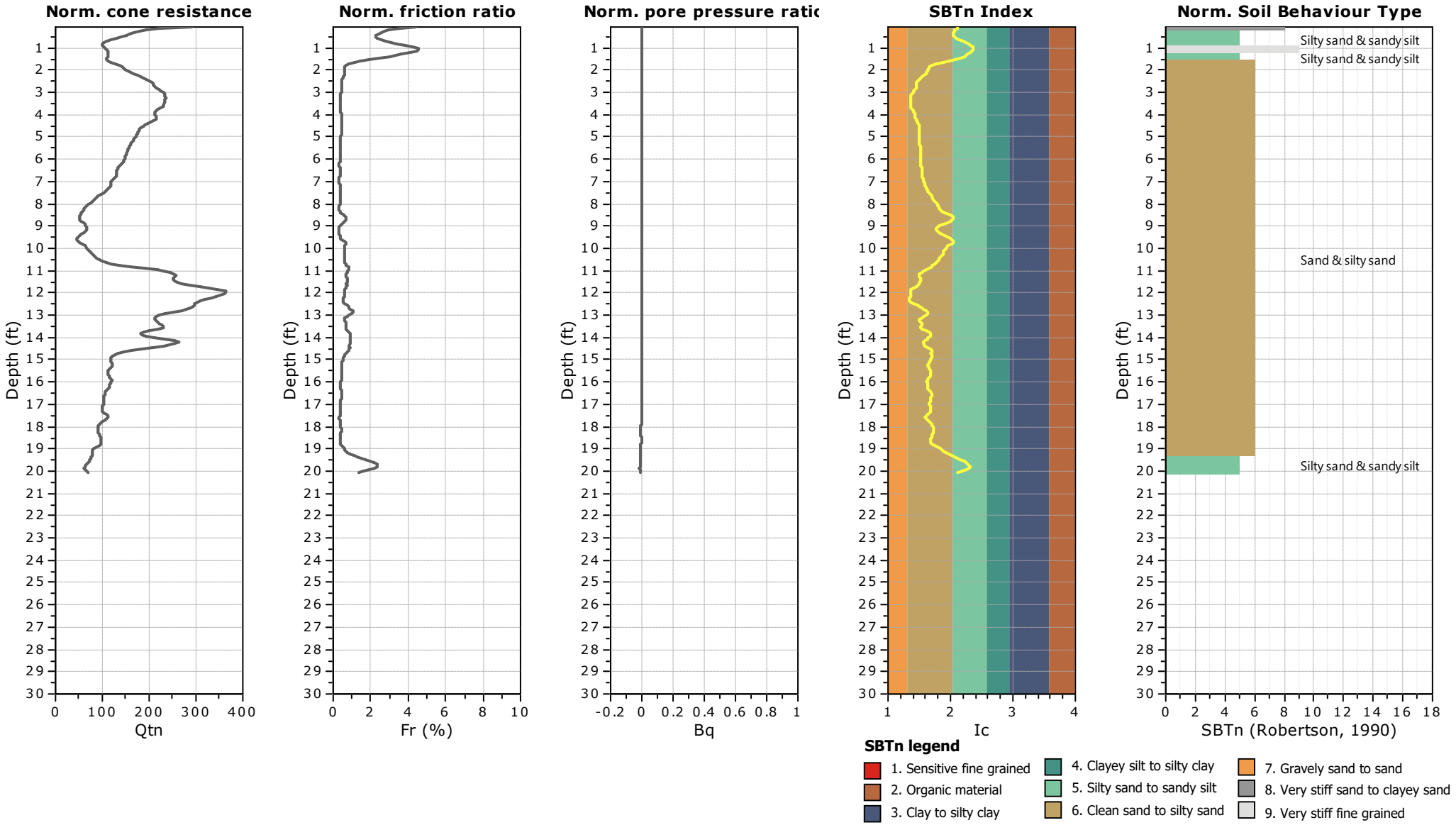
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

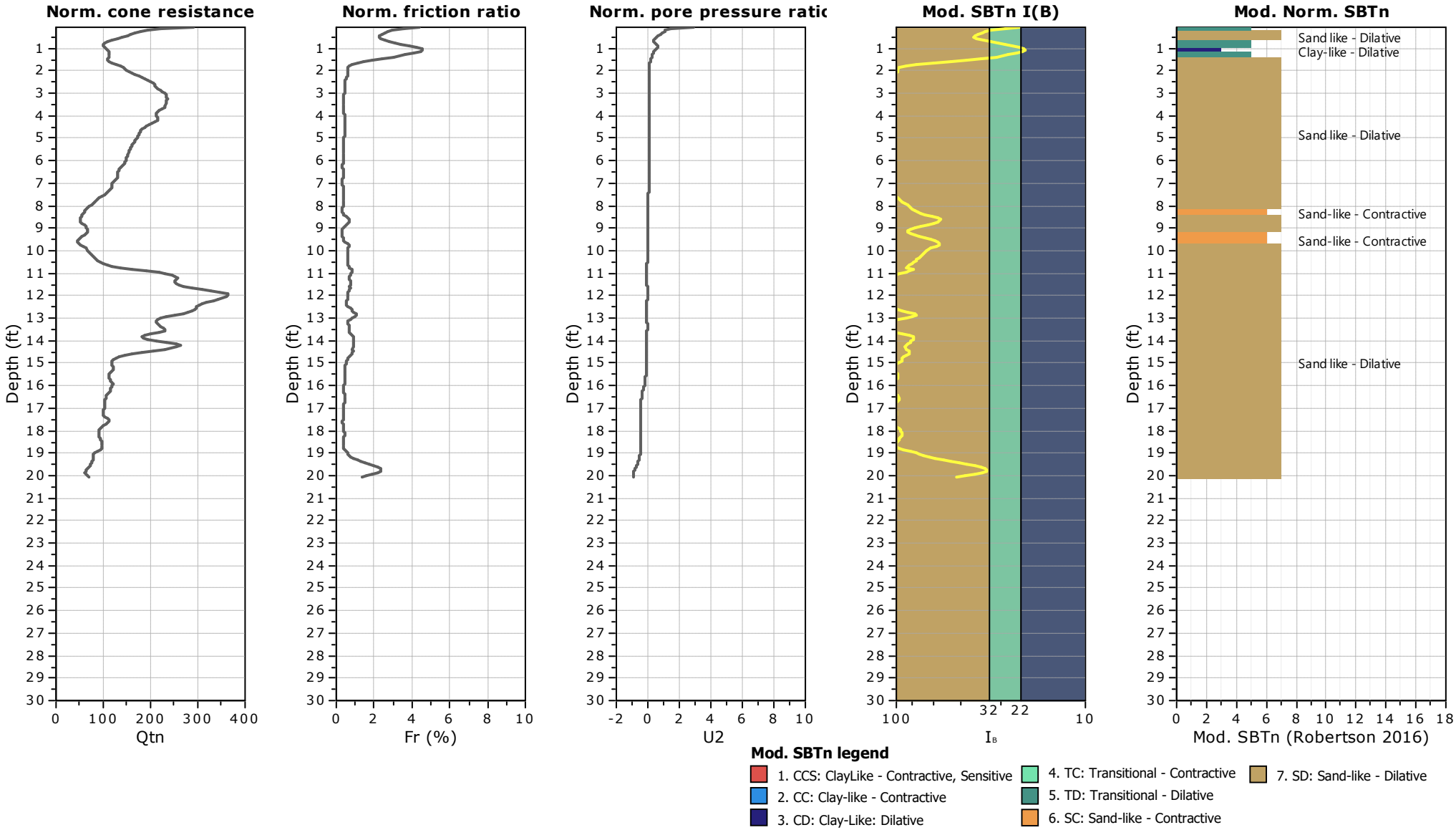
C-15
Total depth: 20.07 ft, Date: 5/14/2024
Surface Elevation: 65.23 ft
Coords: X:572310.83, Y:555945.30
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-15
Total depth: 20.07 ft, Date: 5/14/2024
Surface Elevation: 65.23 ft
Coords: X:572310.83, Y:555945.30
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

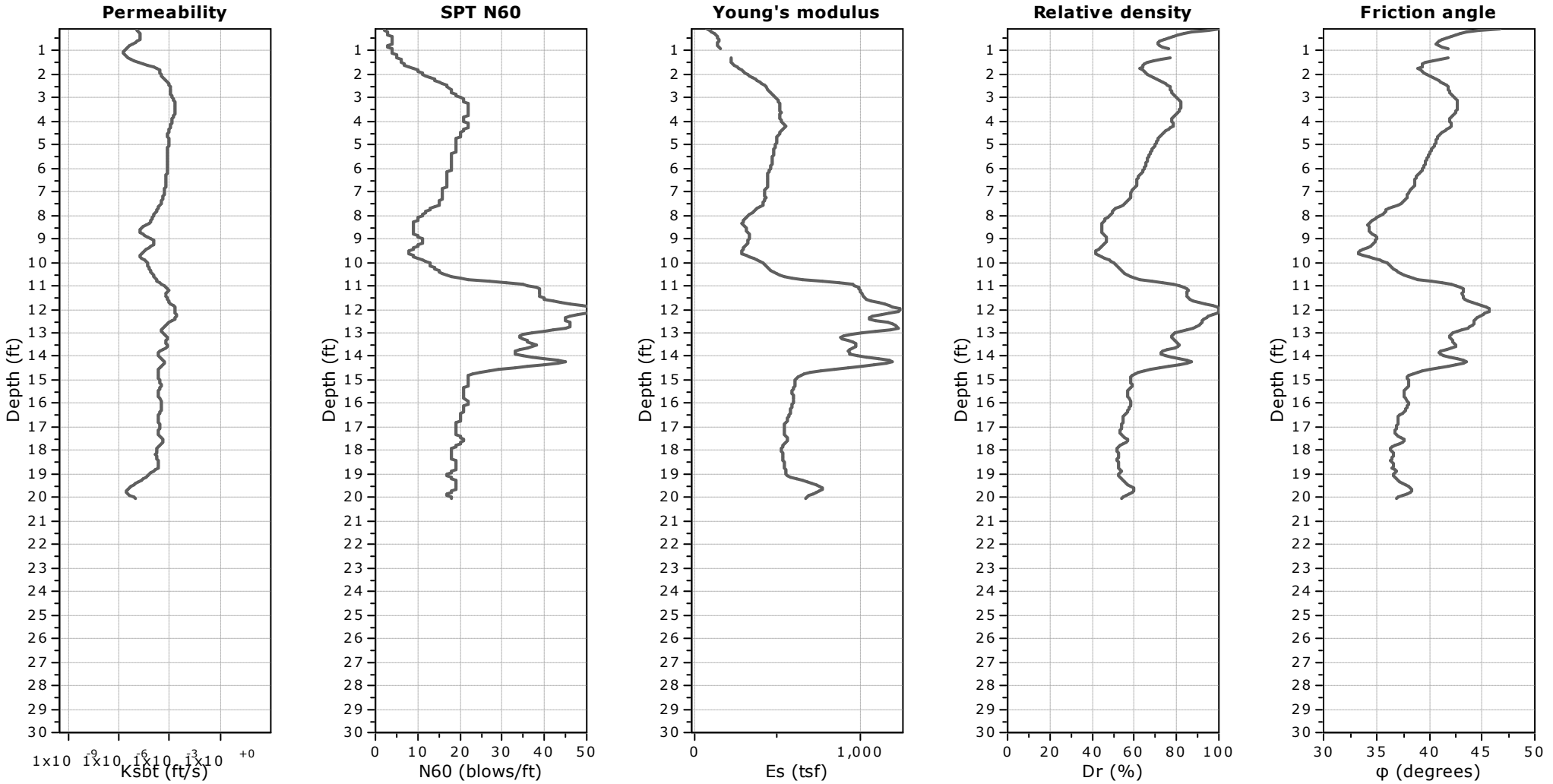
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-15
Total depth: 20.07 ft, Date: 5/14/2024
Surface Elevation: 65.23 ft
Coords: X:572310.83, Y:555945.30
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



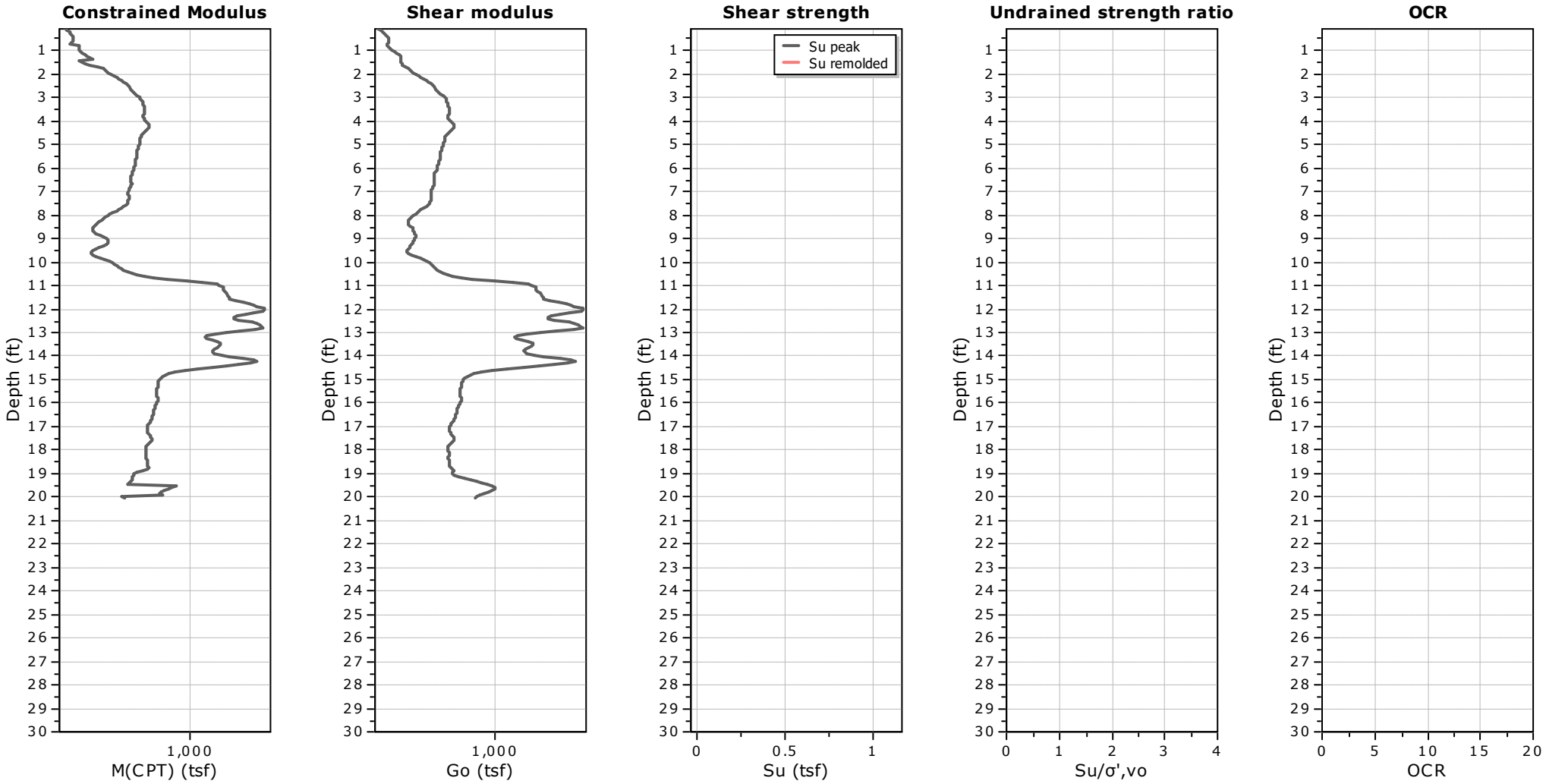
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-15
Total depth: 20.07 ft, Date: 5/14/2024
Surface Elevation: 65.23 ft
Coords: X:572310.83, Y:555945.30
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



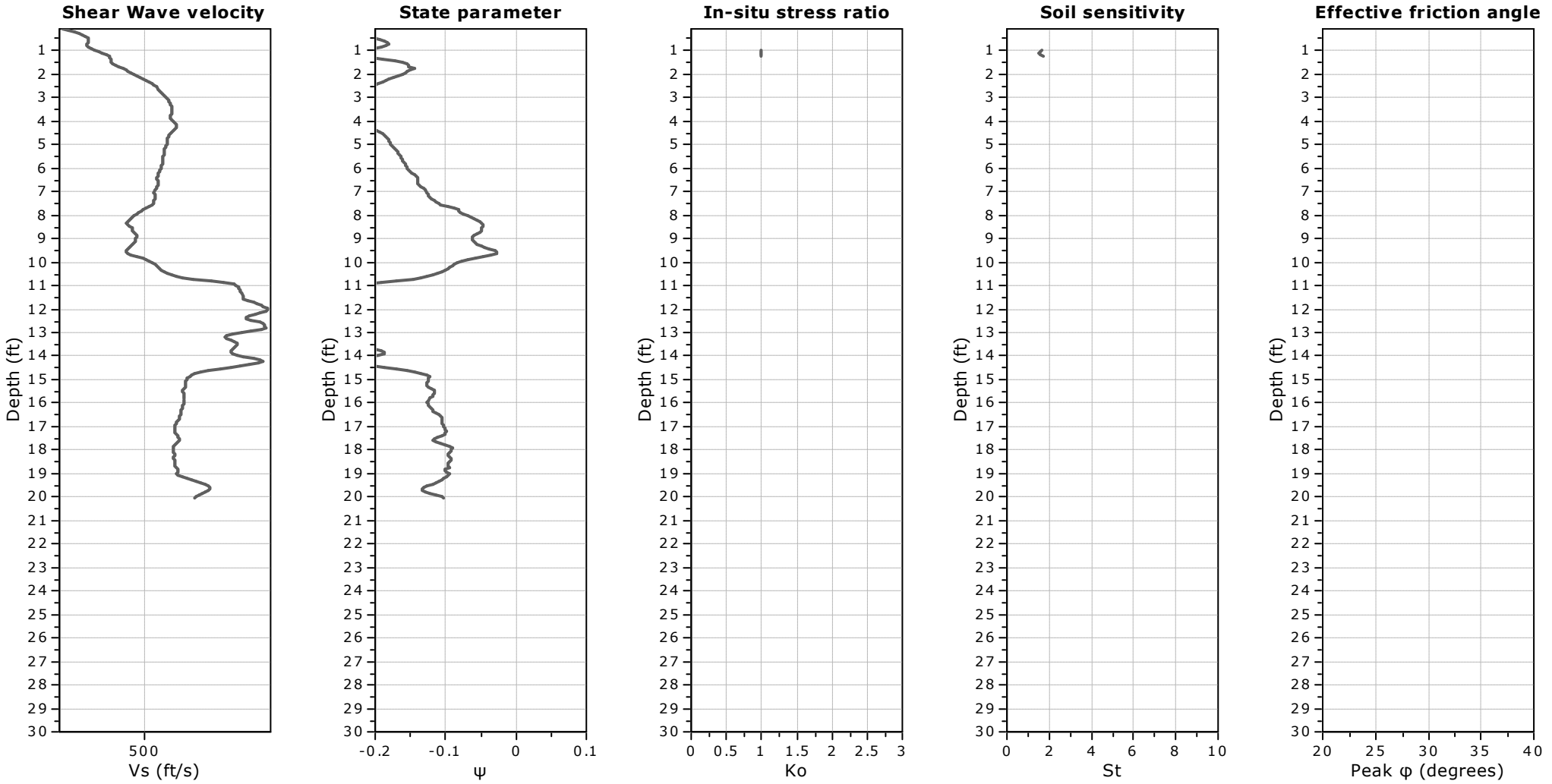
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-15
Total depth: 20.07 ft, Date: 5/14/2024
Surface Elevation: 65.23 ft
Coords: X:572310.83, Y:555945.30
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



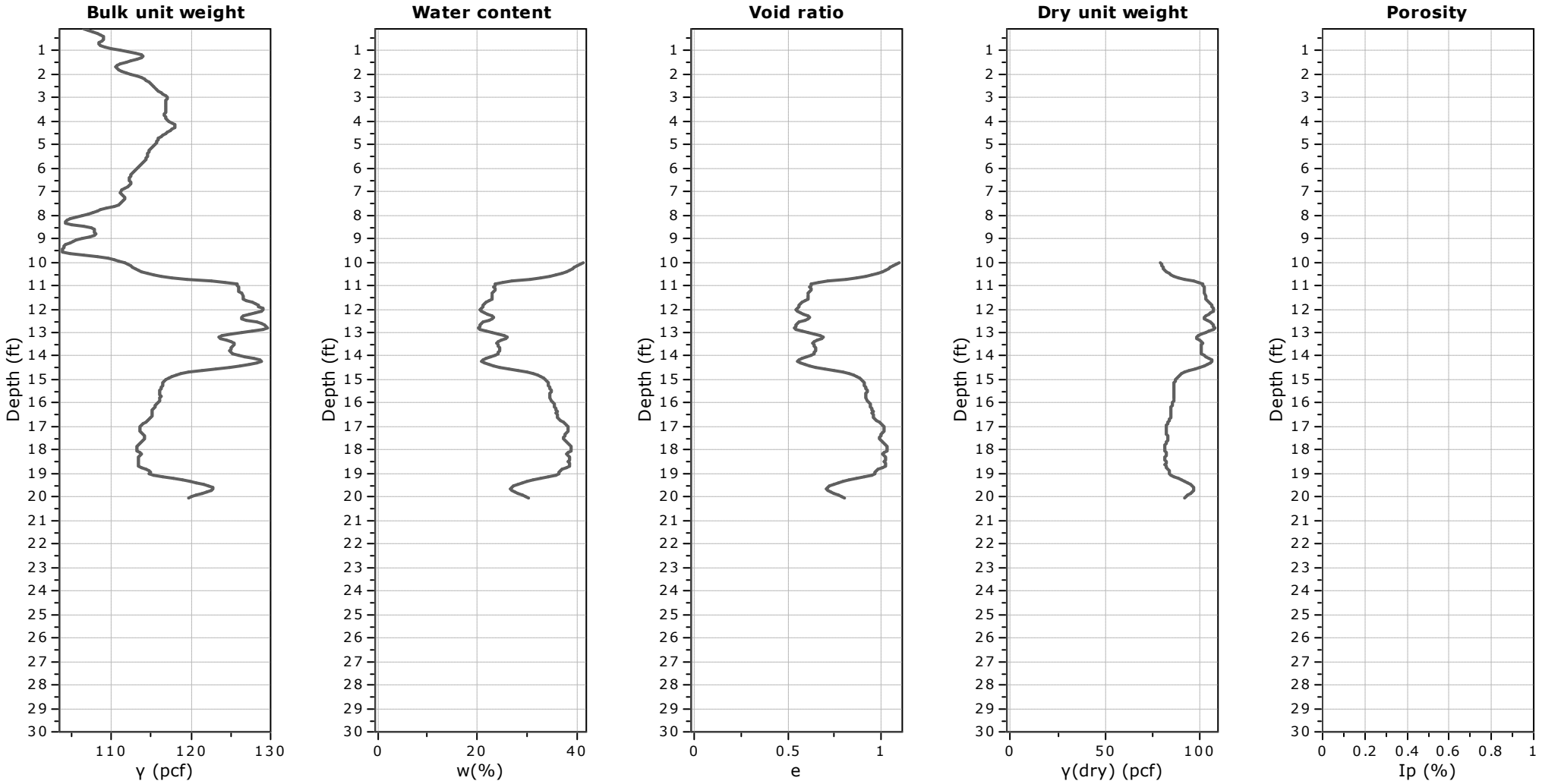
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-15
Total depth: 20.07 ft, Date: 5/14/2024
Surface Elevation: 65.23 ft
Coords: X:572310.83, Y:555945.30
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

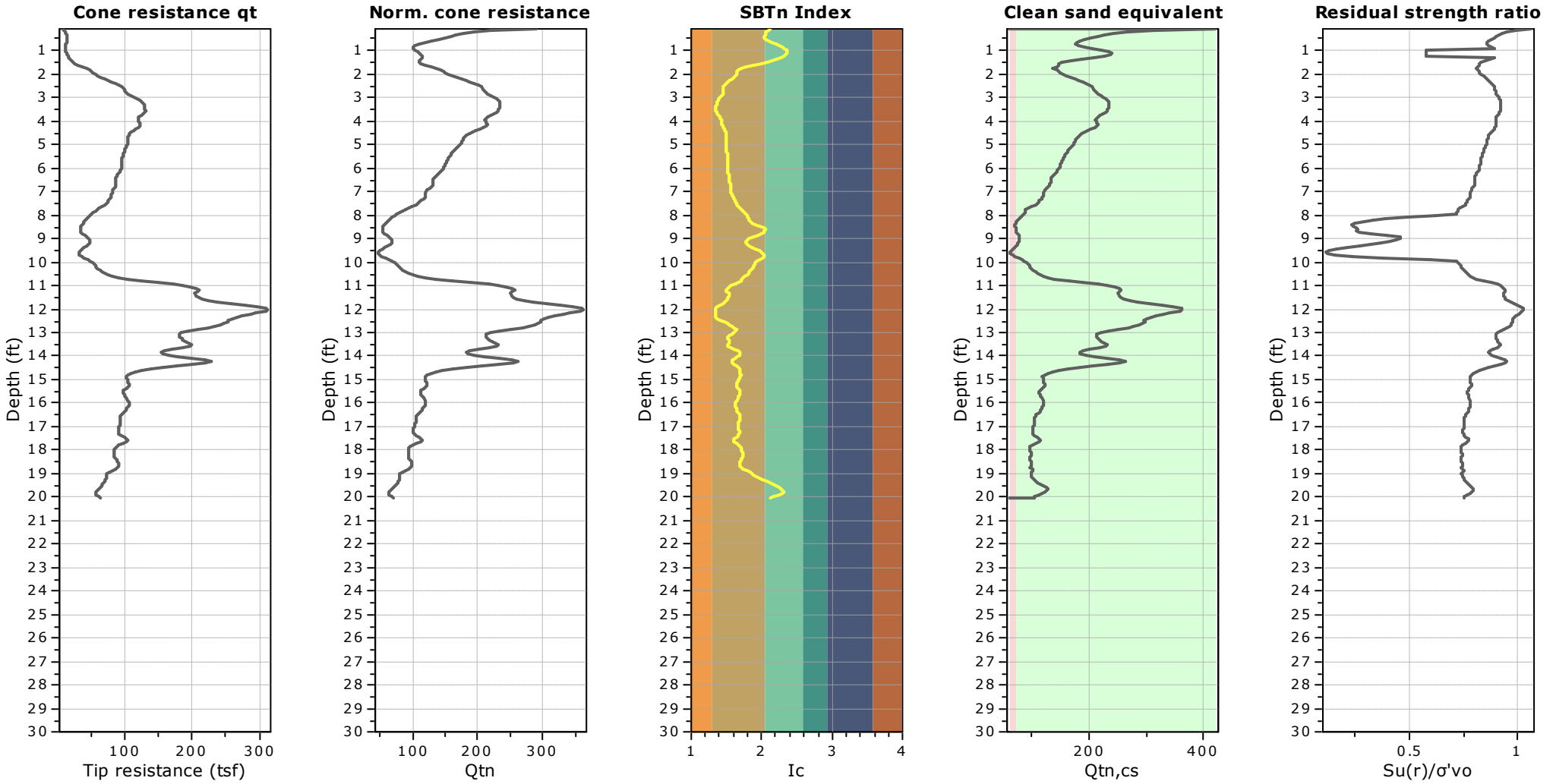
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-15
Total depth: 20.07 ft, Date: 5/14/2024
Surface Elevation: 65.23 ft
Coords: X:572310.83, Y:555945.30
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

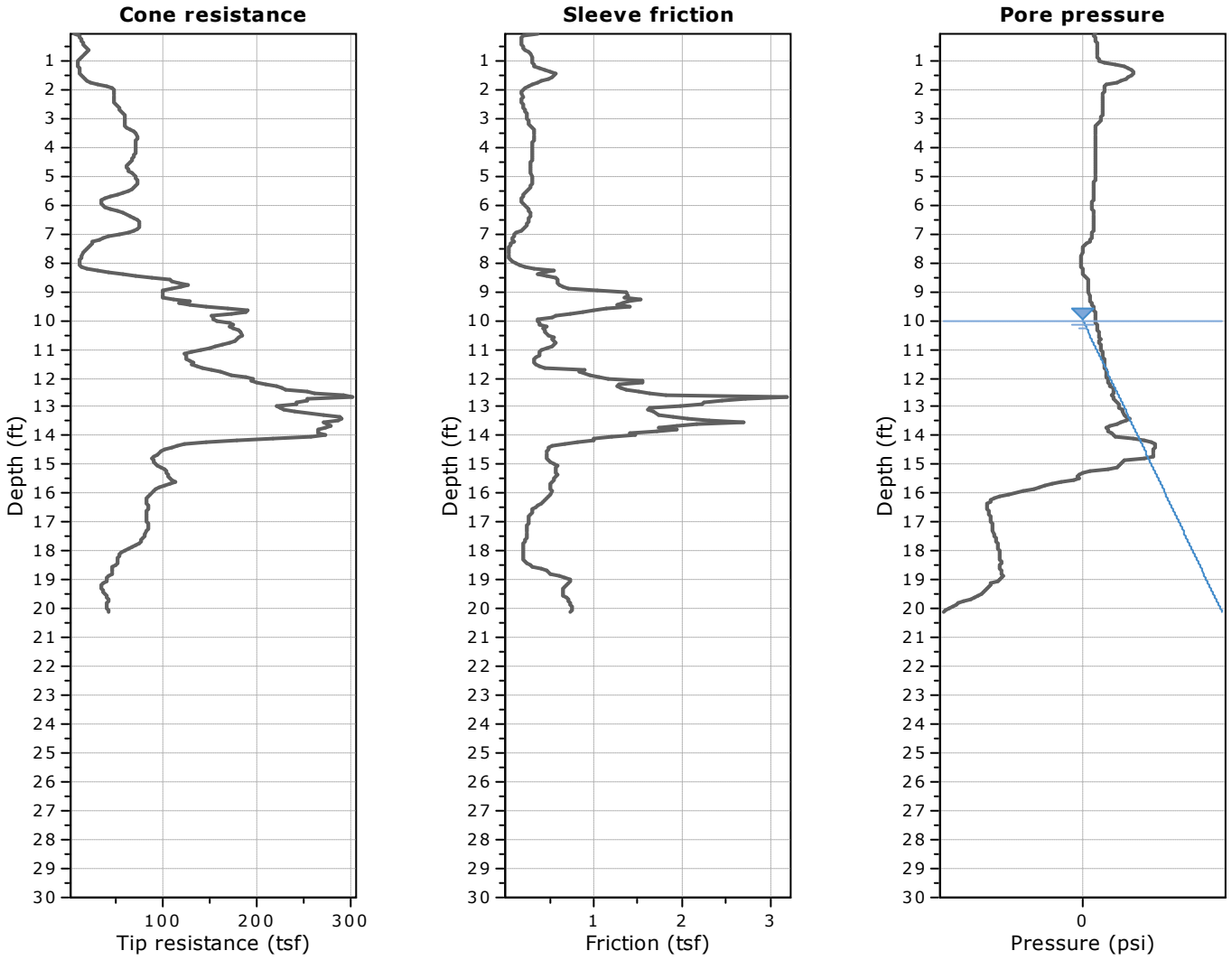
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



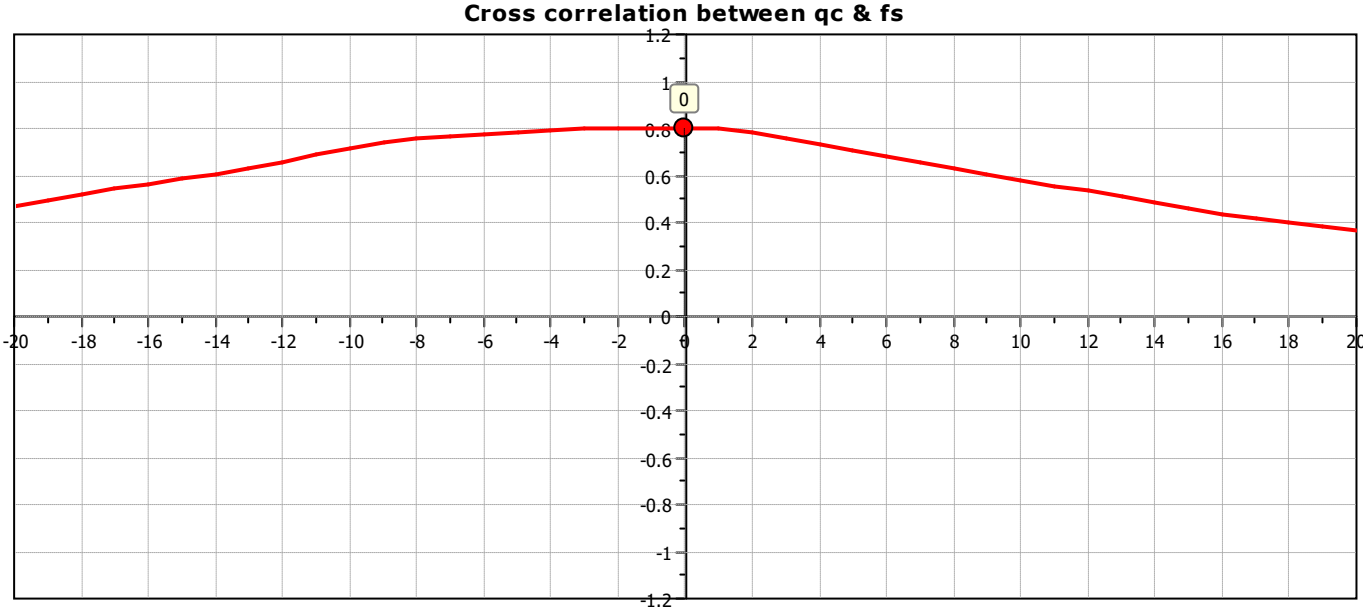
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

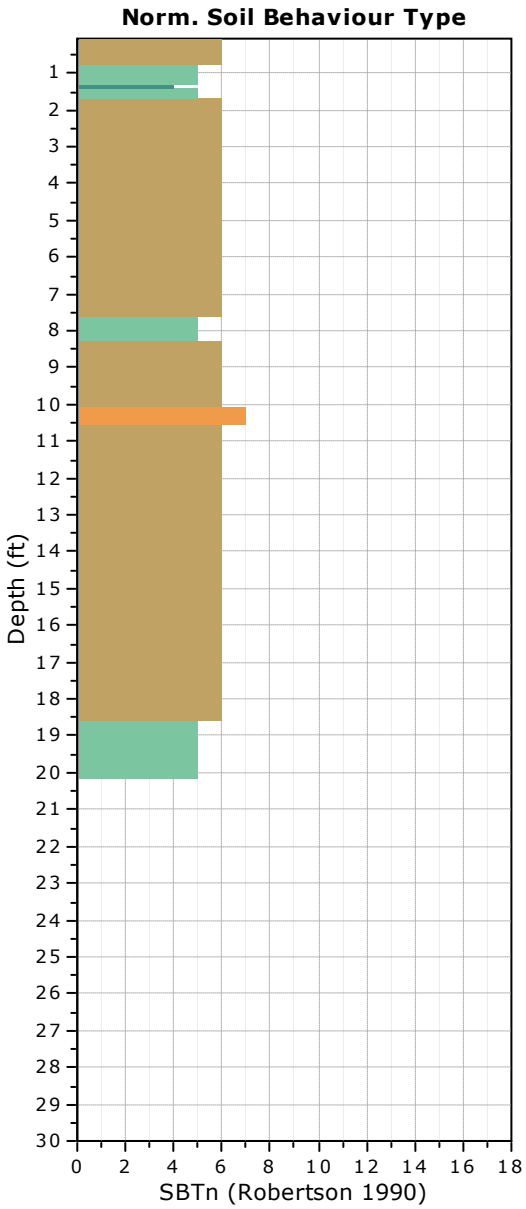
C-16
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 64.60 ft
Coords: X:572395.39, Y:555937.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

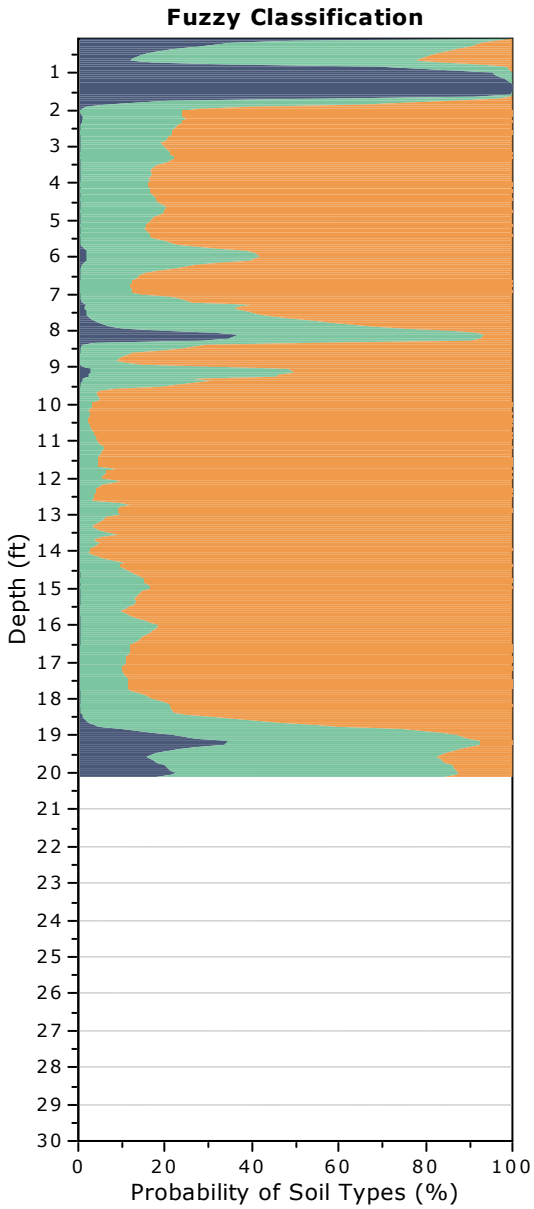
Project: ASD Summit Campus
Location: Middletown, Delaware



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







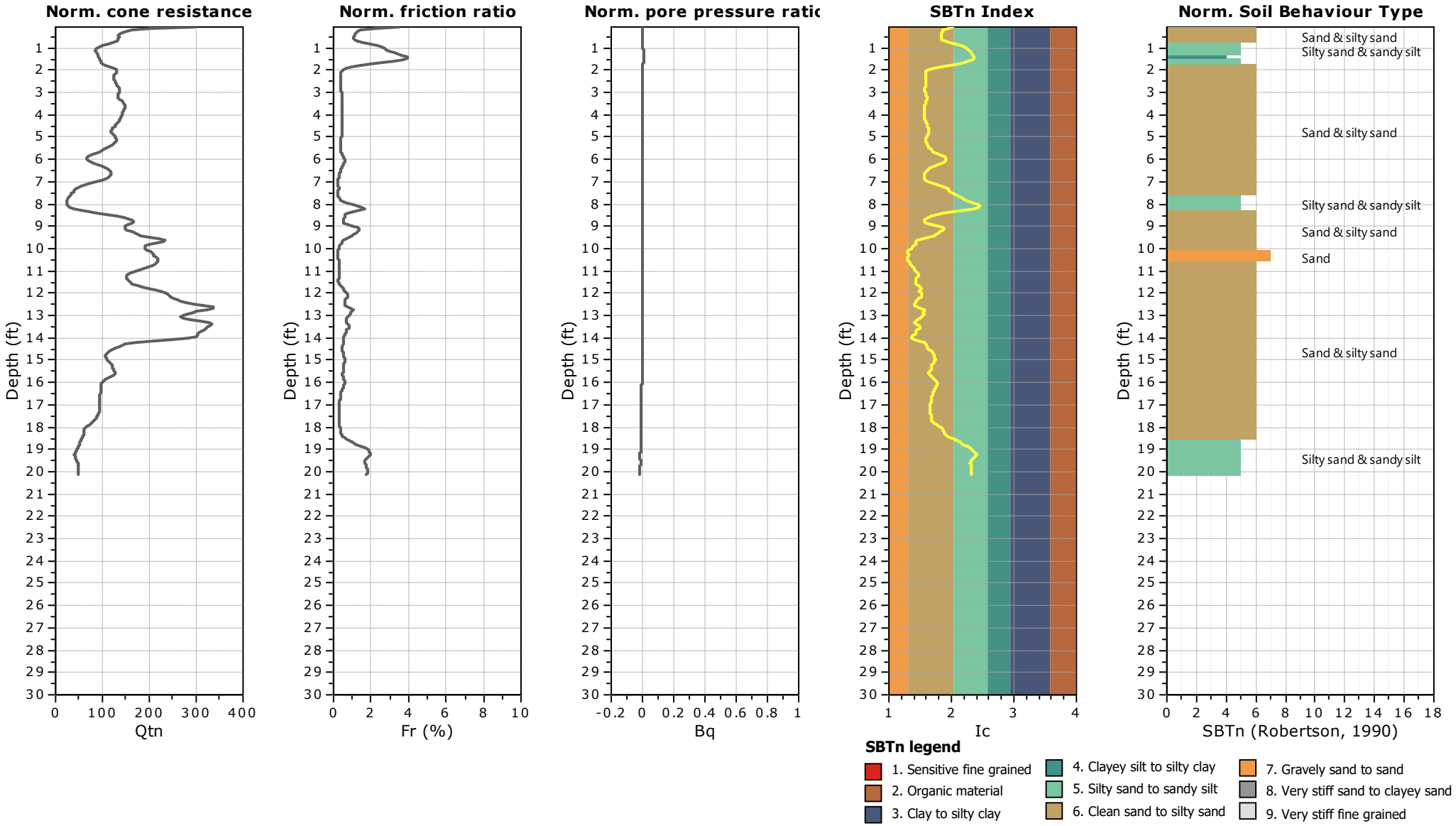
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-16
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 64.60 ft
Coords: X:572395.39, Y:555937.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

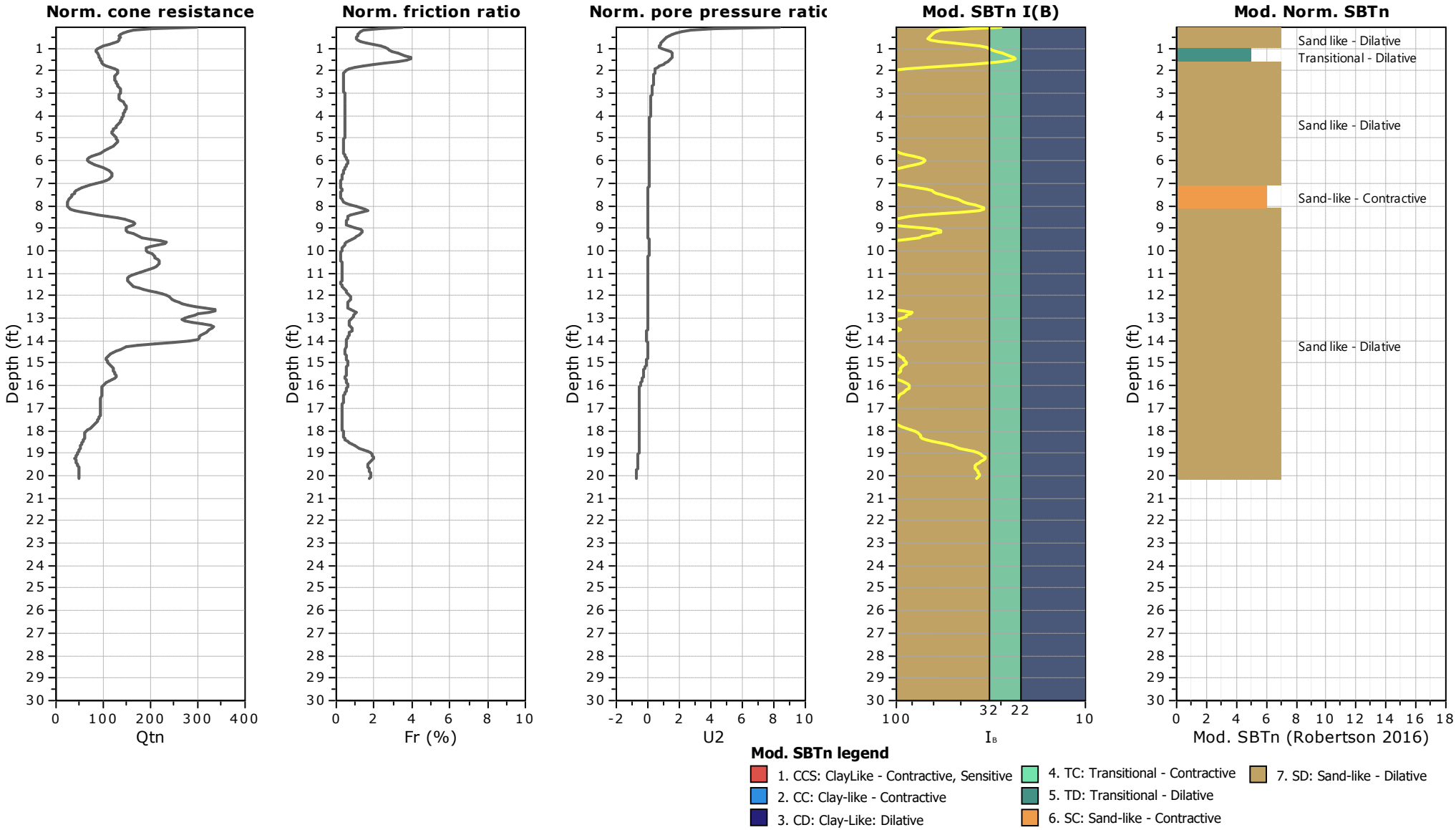
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-16
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 64.60 ft
Coords: X:572395.39, Y:555937.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

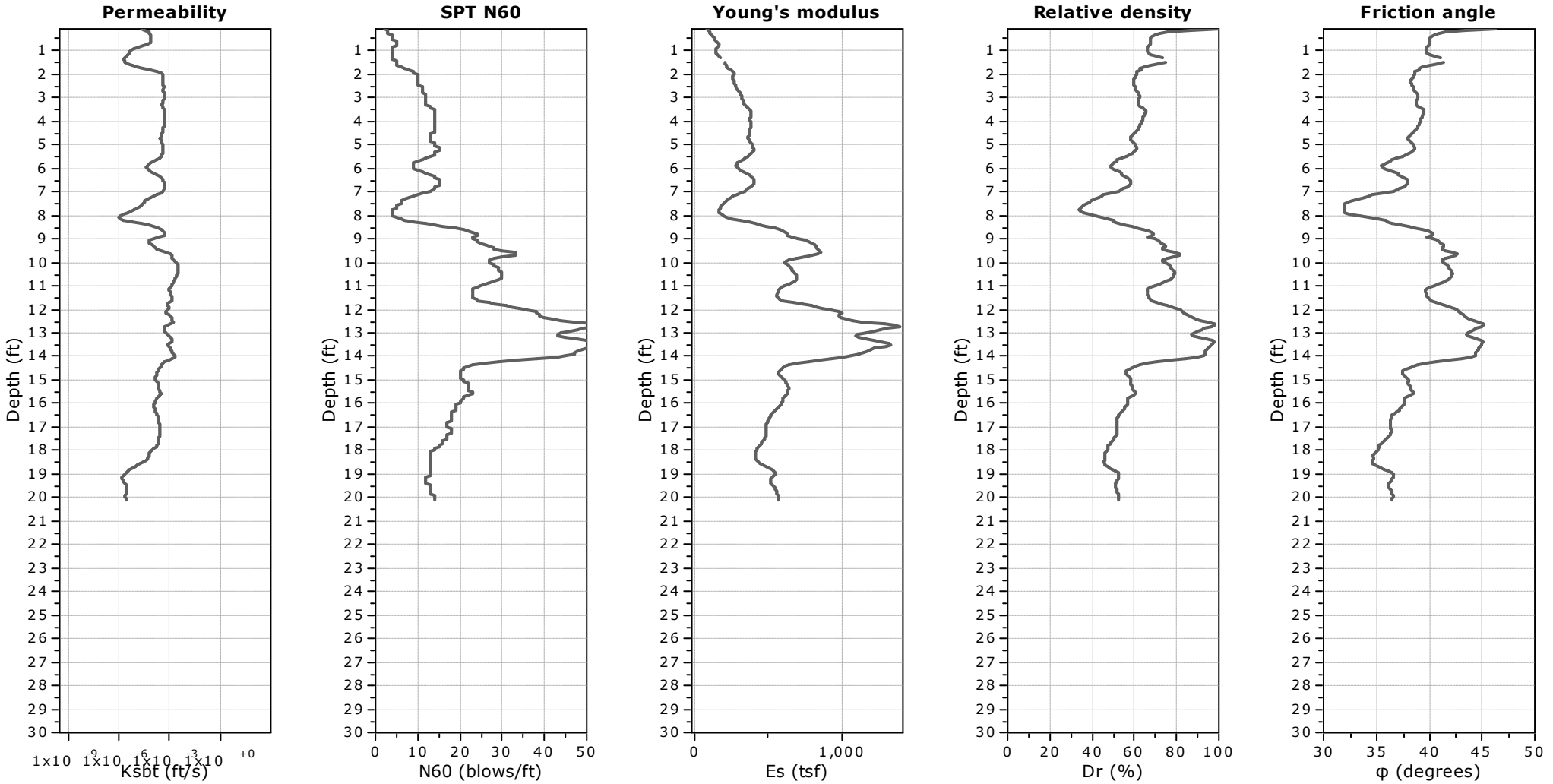
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-16
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 64.60 ft
Coords: X:572395.39, Y:555937.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



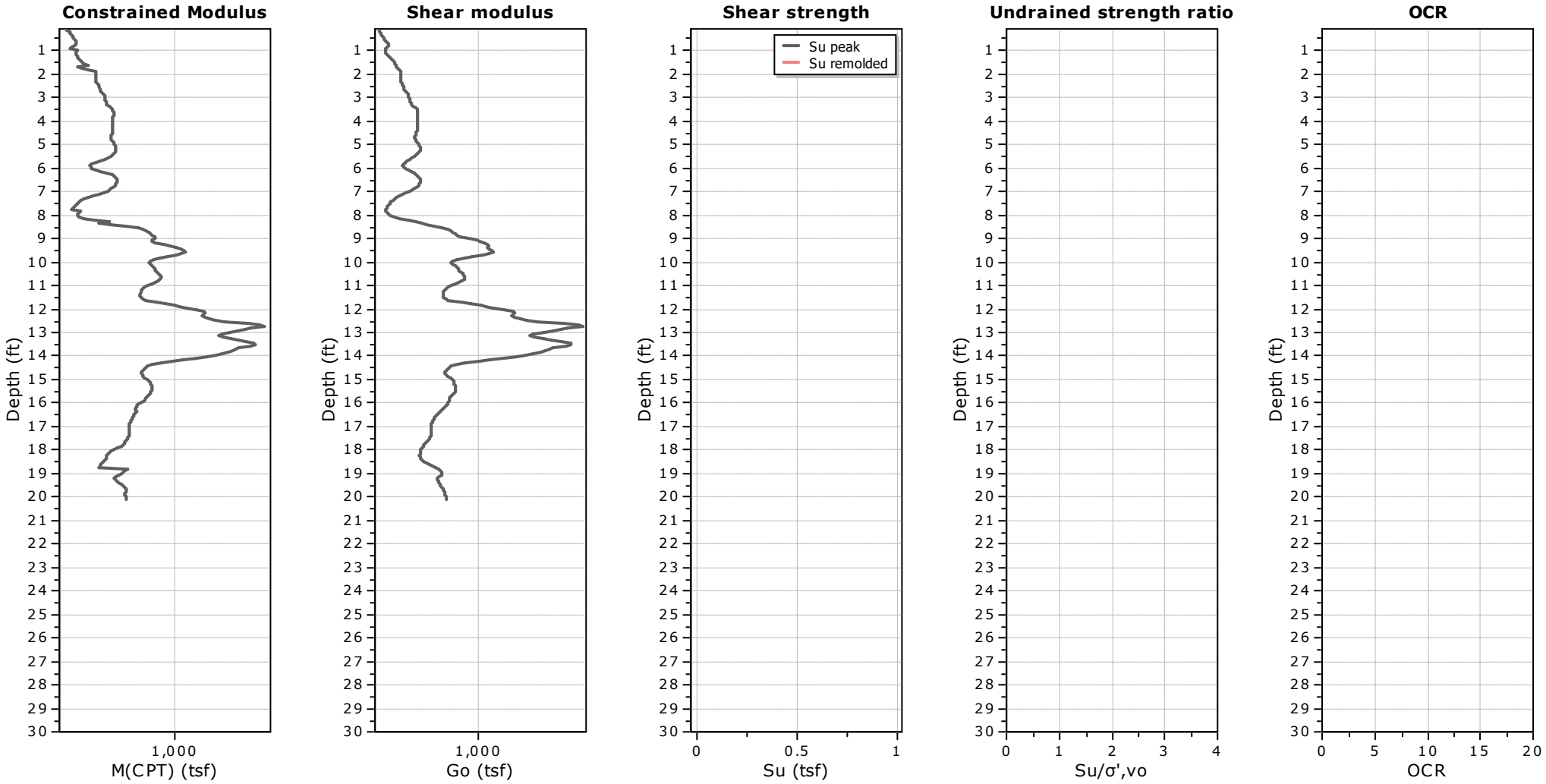
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-16
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 64.60 ft
Coords: X:572395.39, Y:555937.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



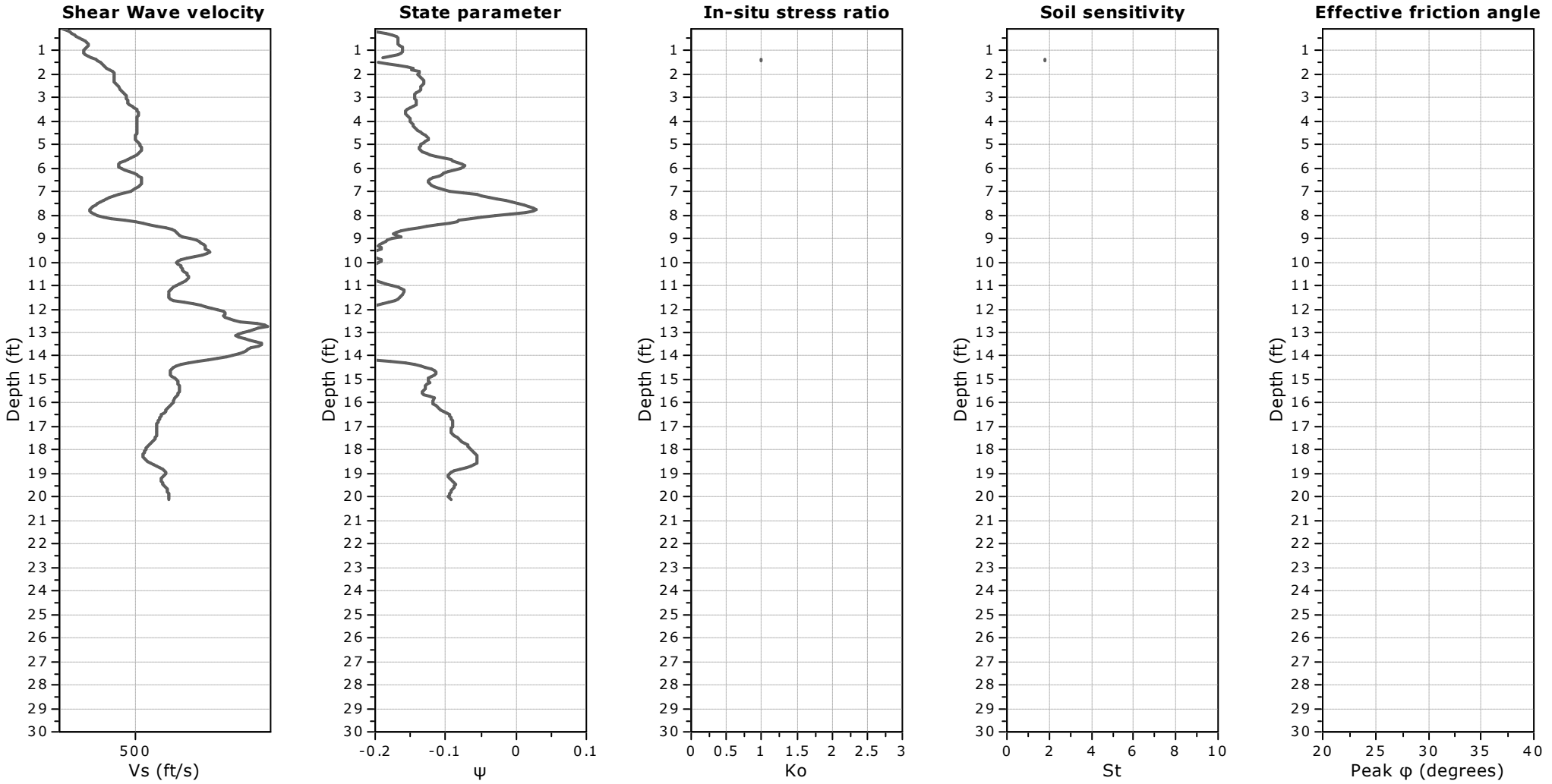
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-16
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 64.60 ft
Coords: X:572395.39, Y:555937.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



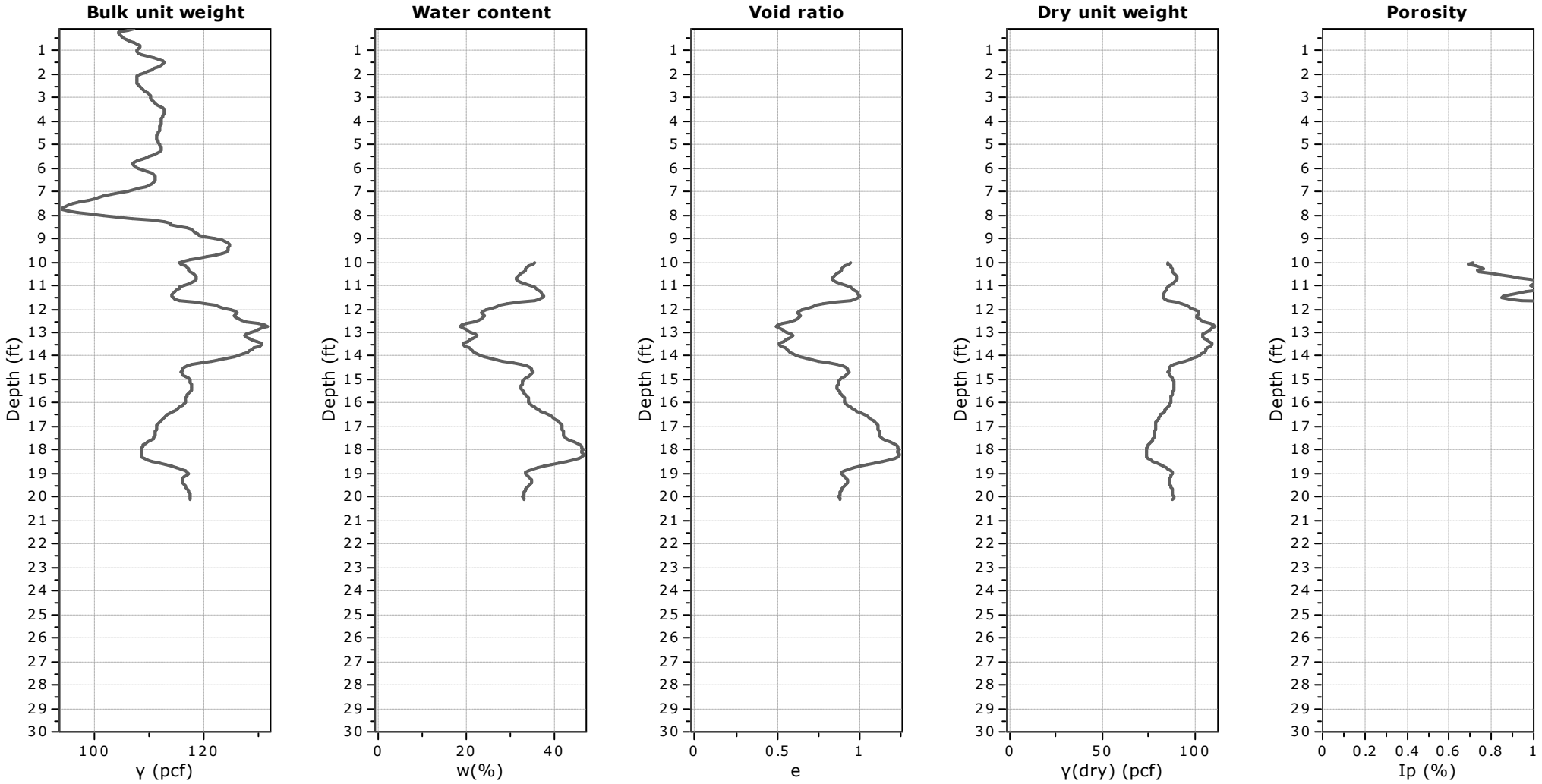
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-16
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 64.60 ft
Coords: X:572395.39, Y:555937.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

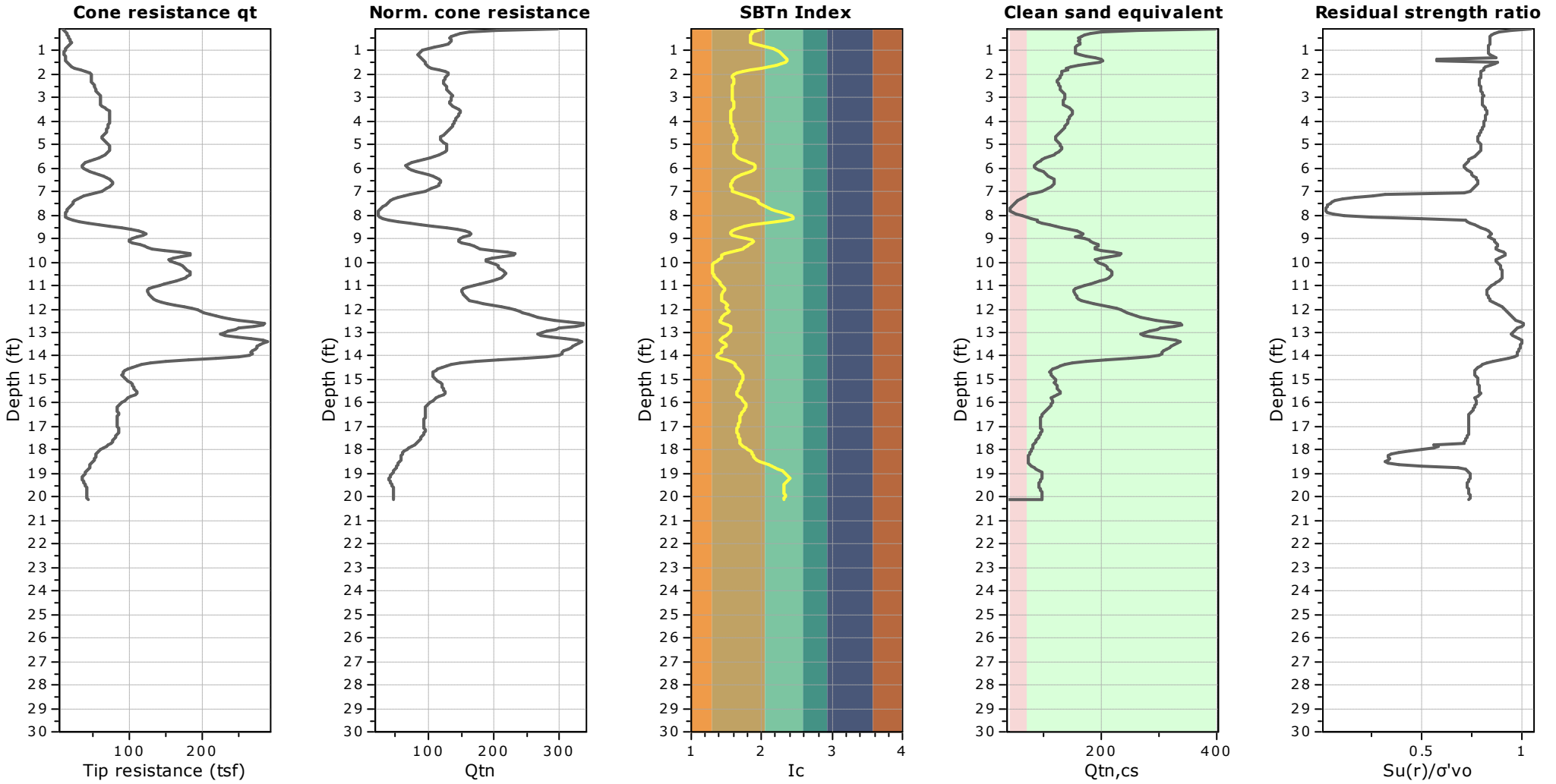
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-16
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 64.60 ft
Coords: X:572395.39, Y:555937.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

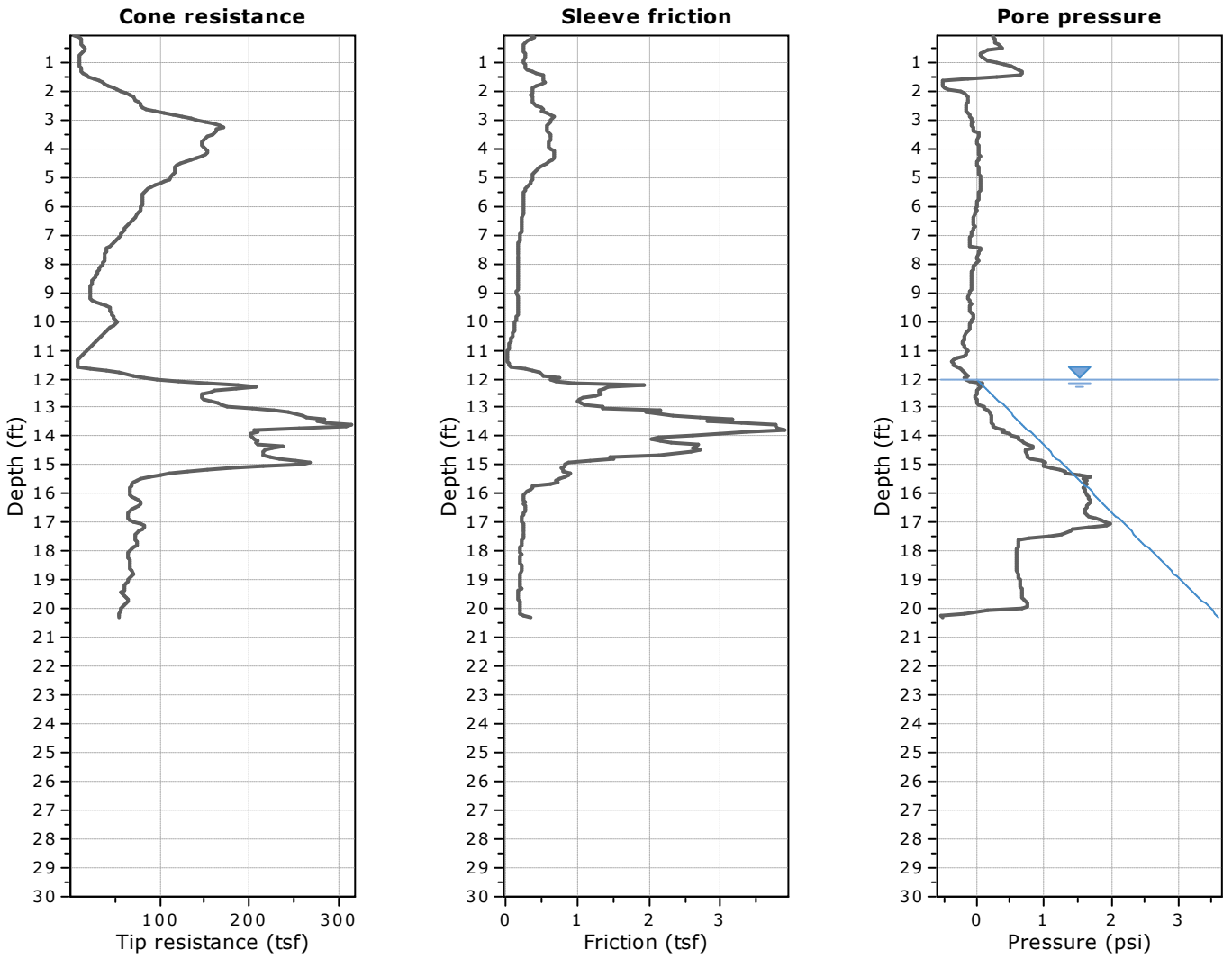
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



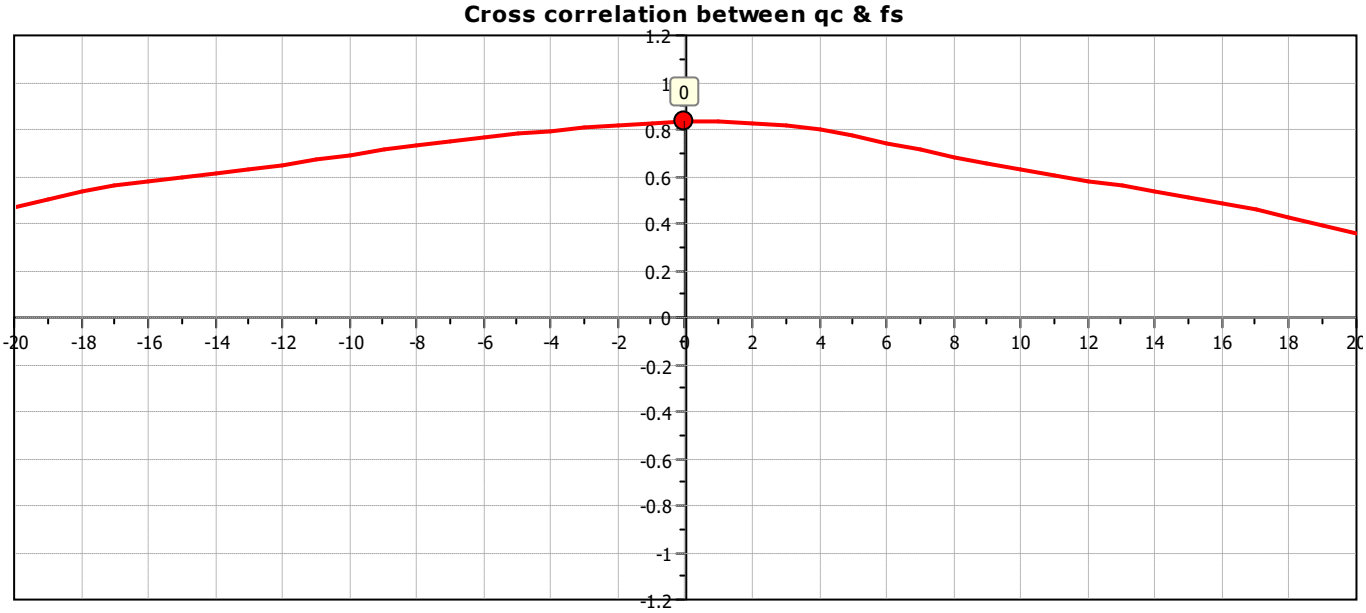
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

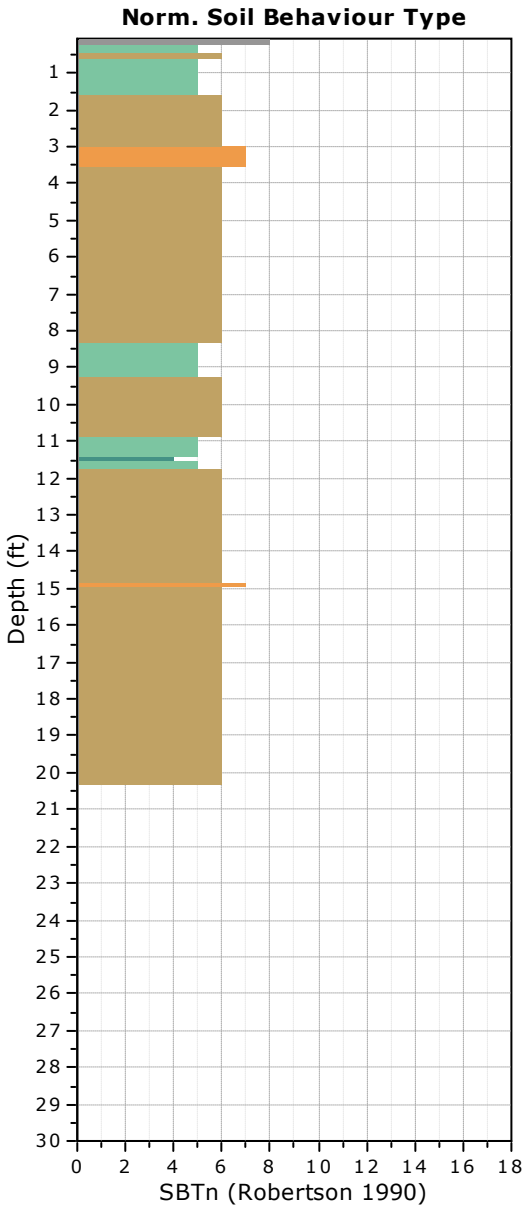
C-17
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 66.39 ft
Coords: X:572377.81, Y:556079.18
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

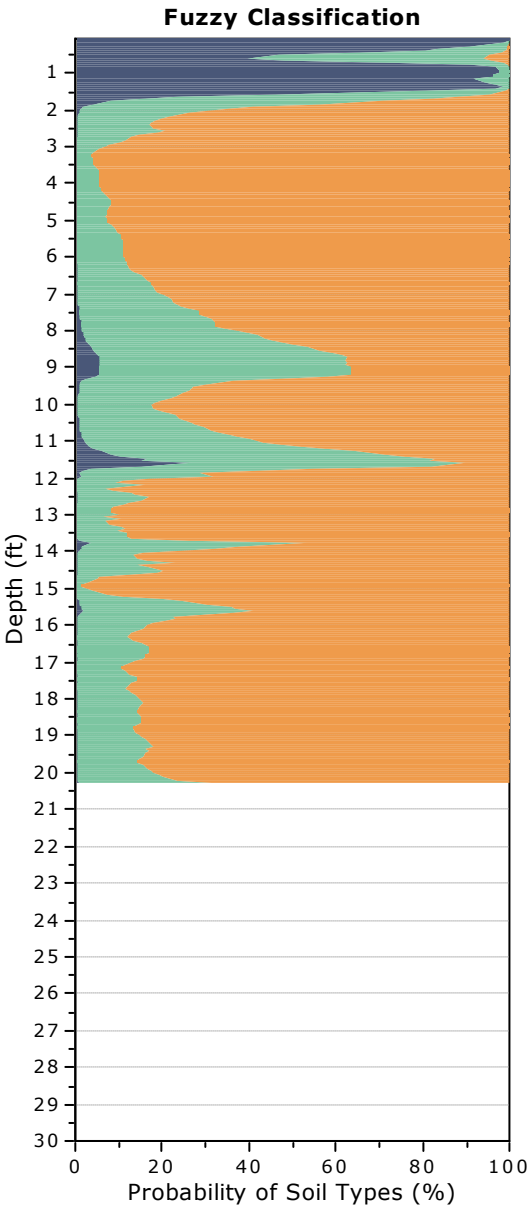
Project: ASD Summit Campus
Location: Middletown, Delaware



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







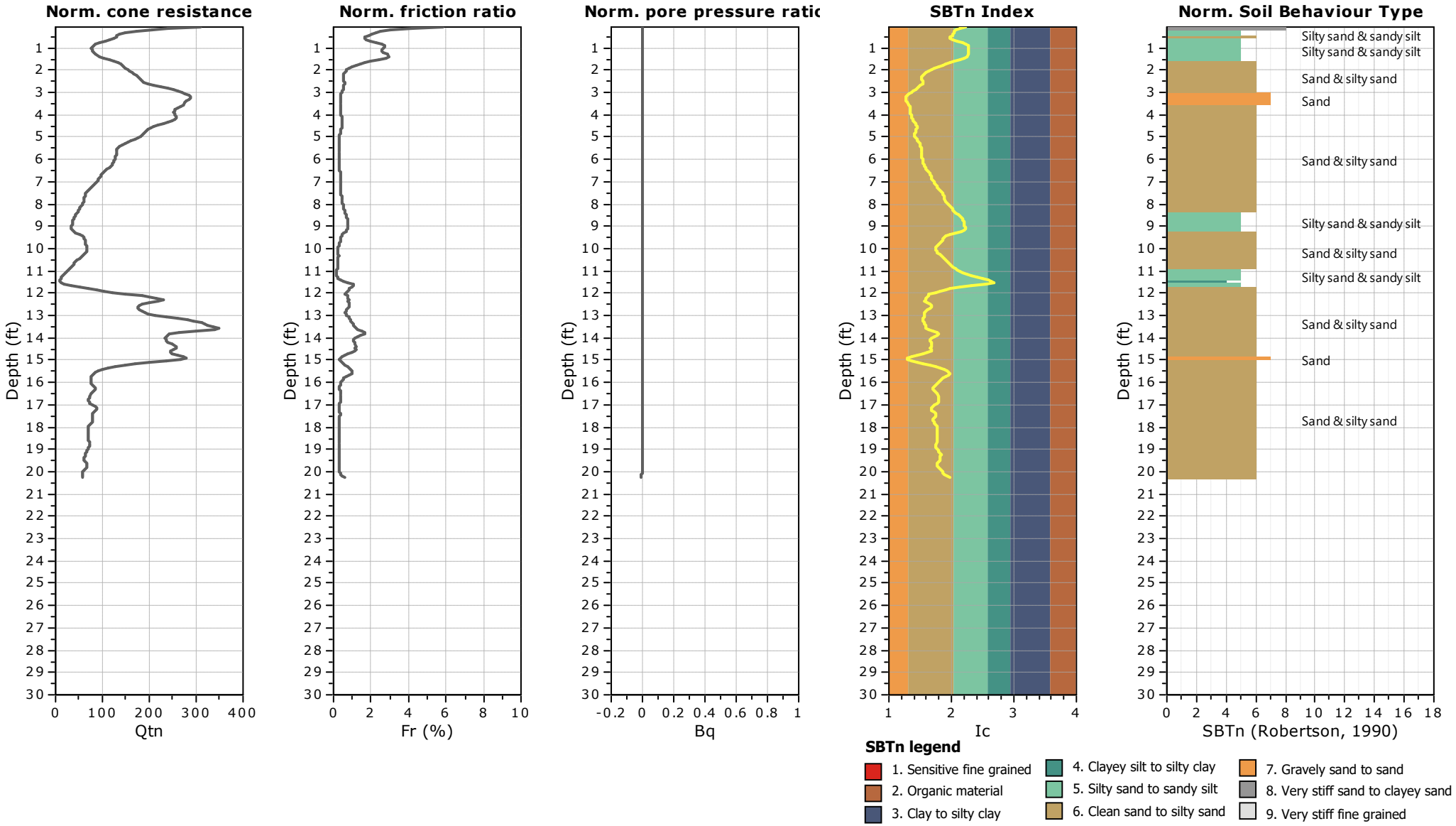
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-17
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 66.39 ft
Coords: X:572377.81, Y:556079.18
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

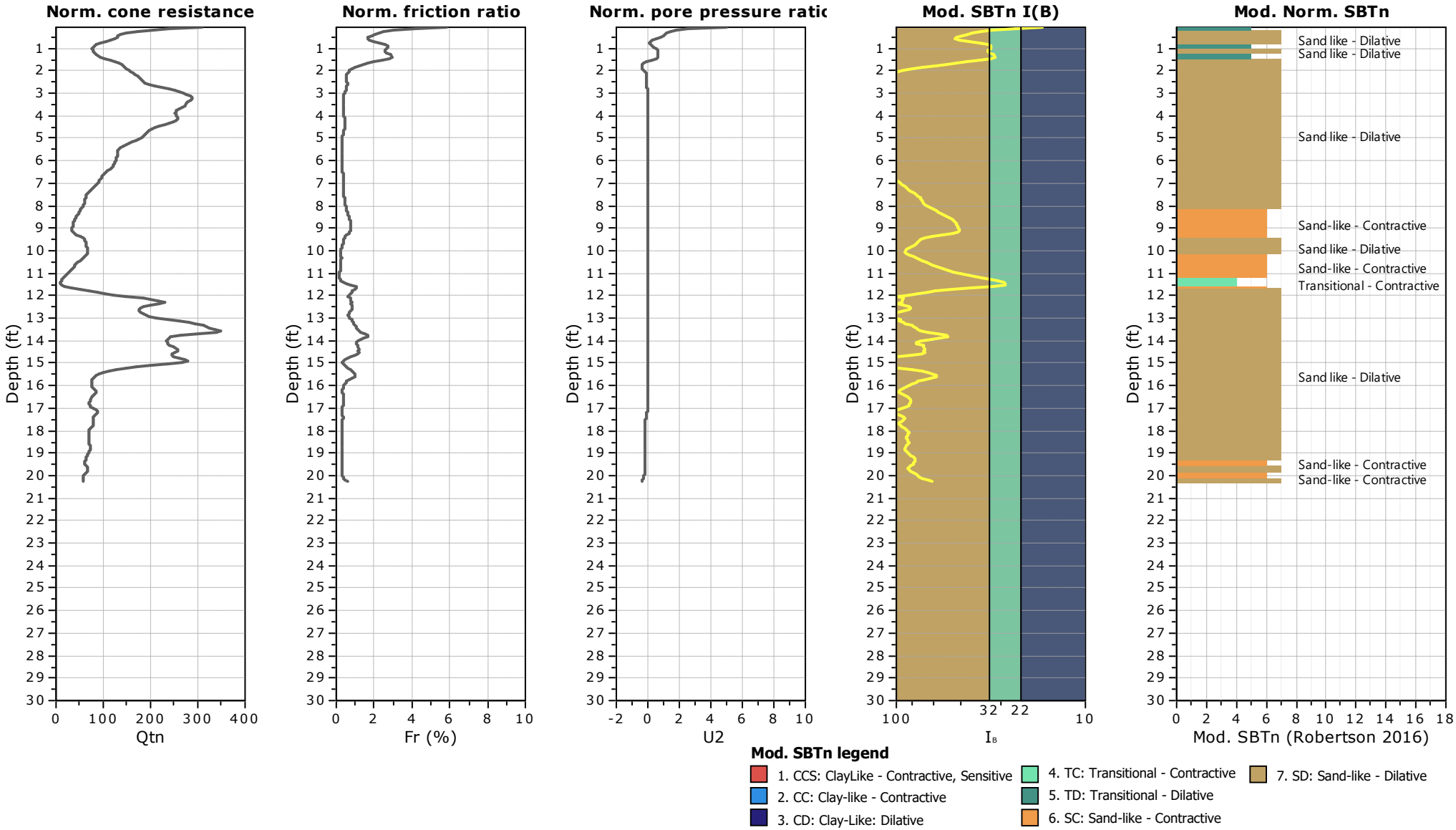
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-17
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 66.39 ft
Coords: X:572377.81, Y:556079.18
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

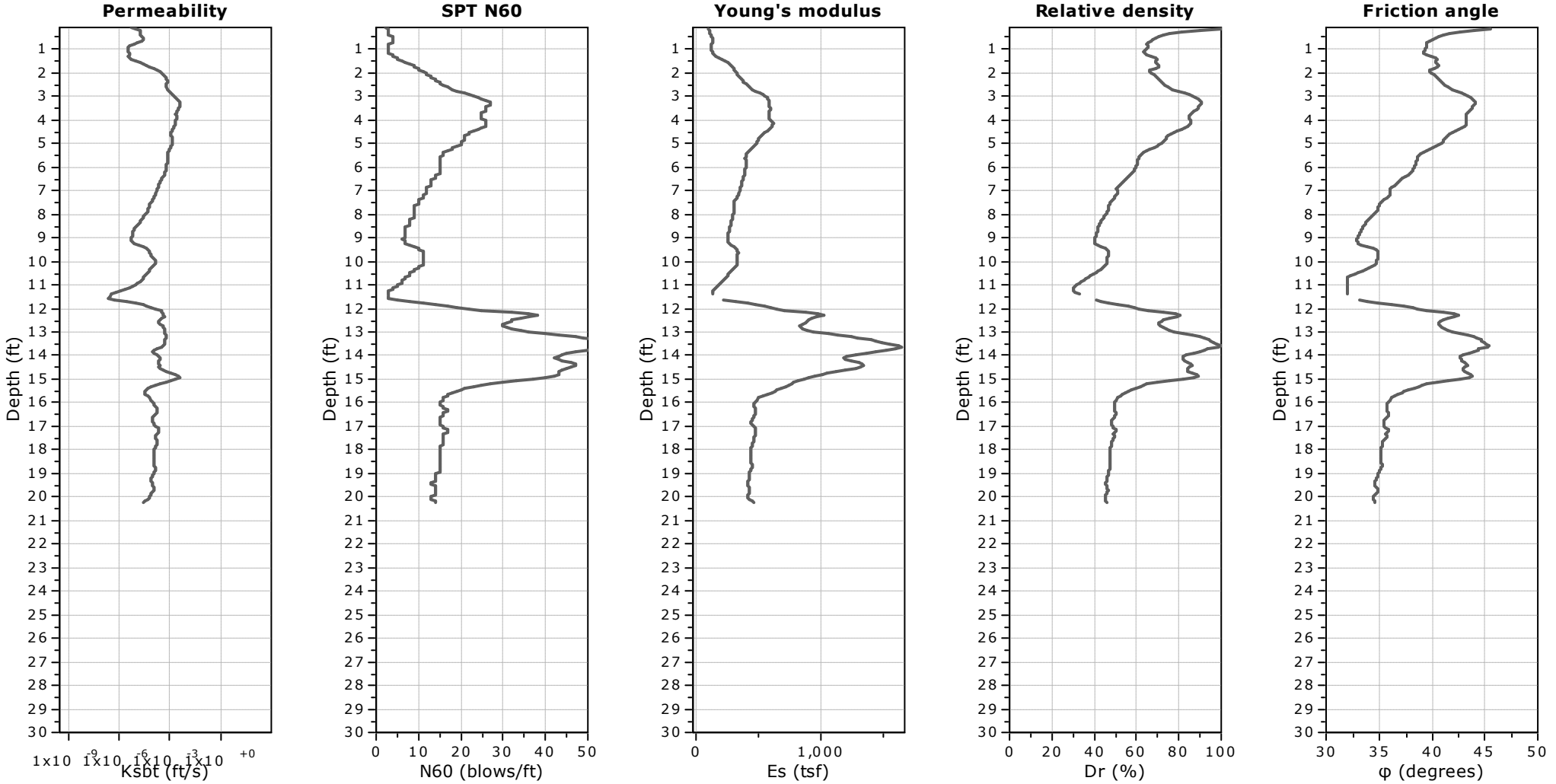
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-17
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 66.39 ft
Coords: X:572377.81, Y:556079.18
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

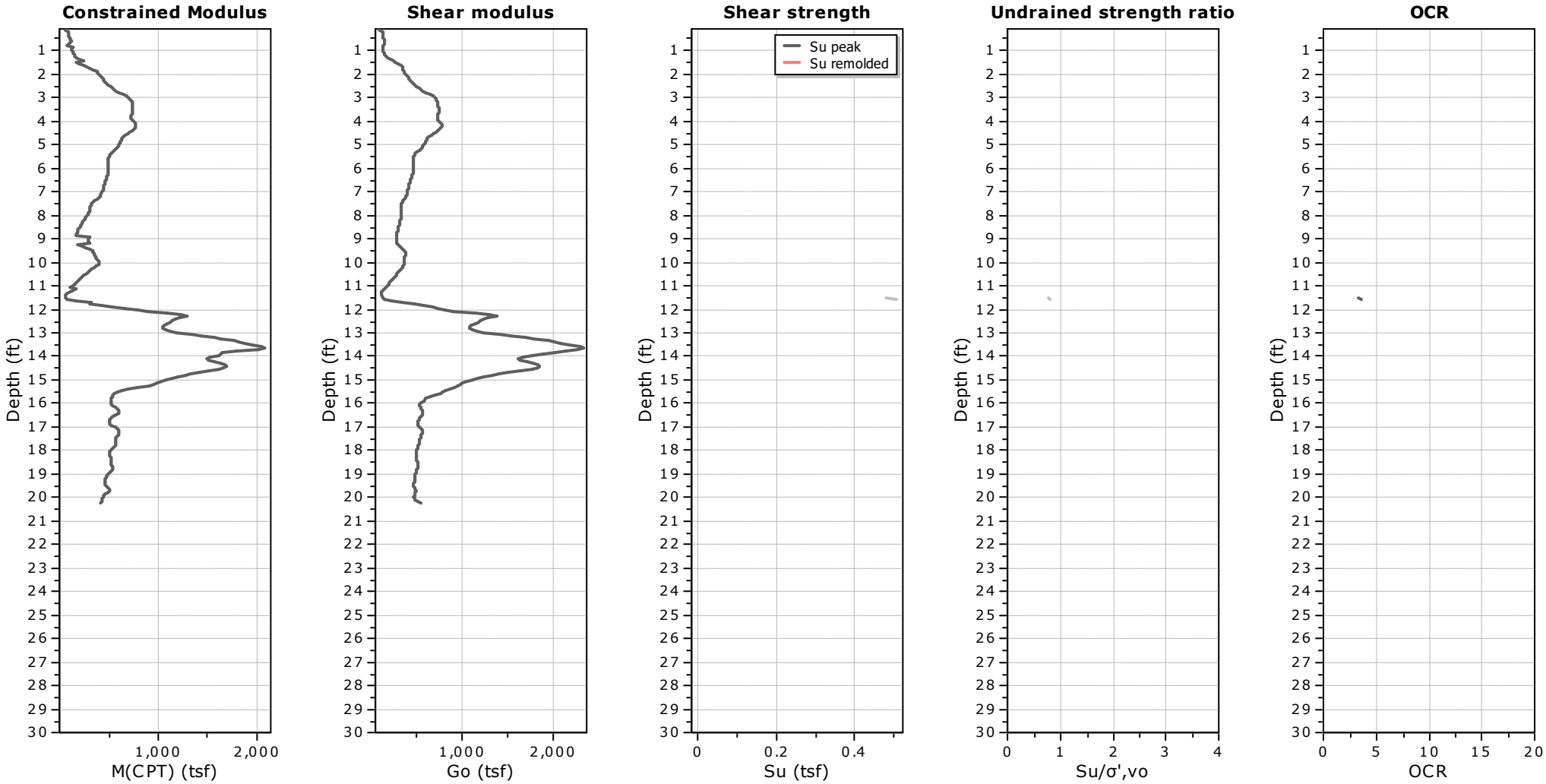


Calculation parameters
Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-17
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 66.39 ft
Coords: X:572377.81, Y:556079.18
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



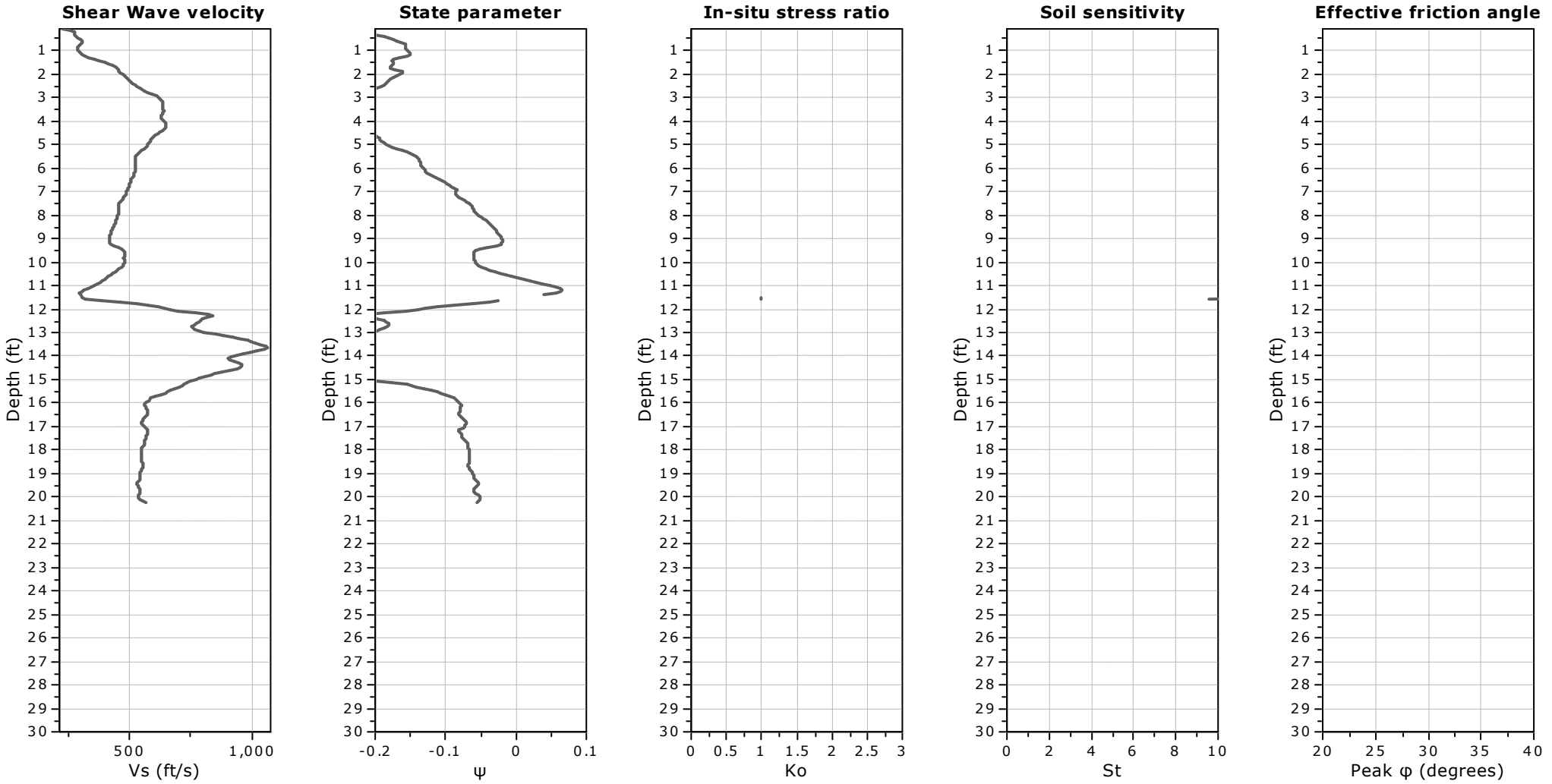
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-17
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 66.39 ft
Coords: X:572377.81, Y:556079.18
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



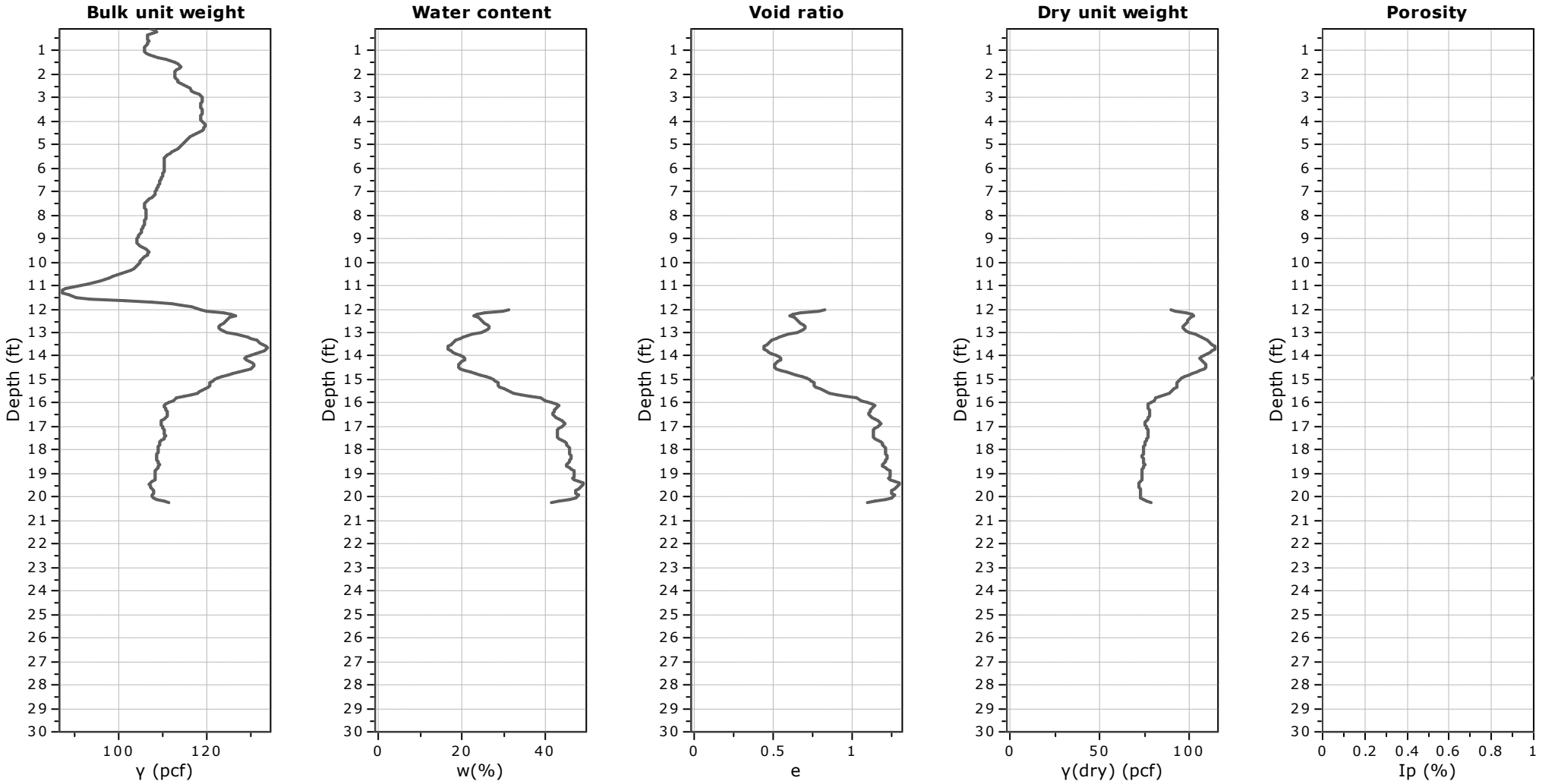
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-17
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 66.39 ft
Coords: X:572377.81, Y:556079.18
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

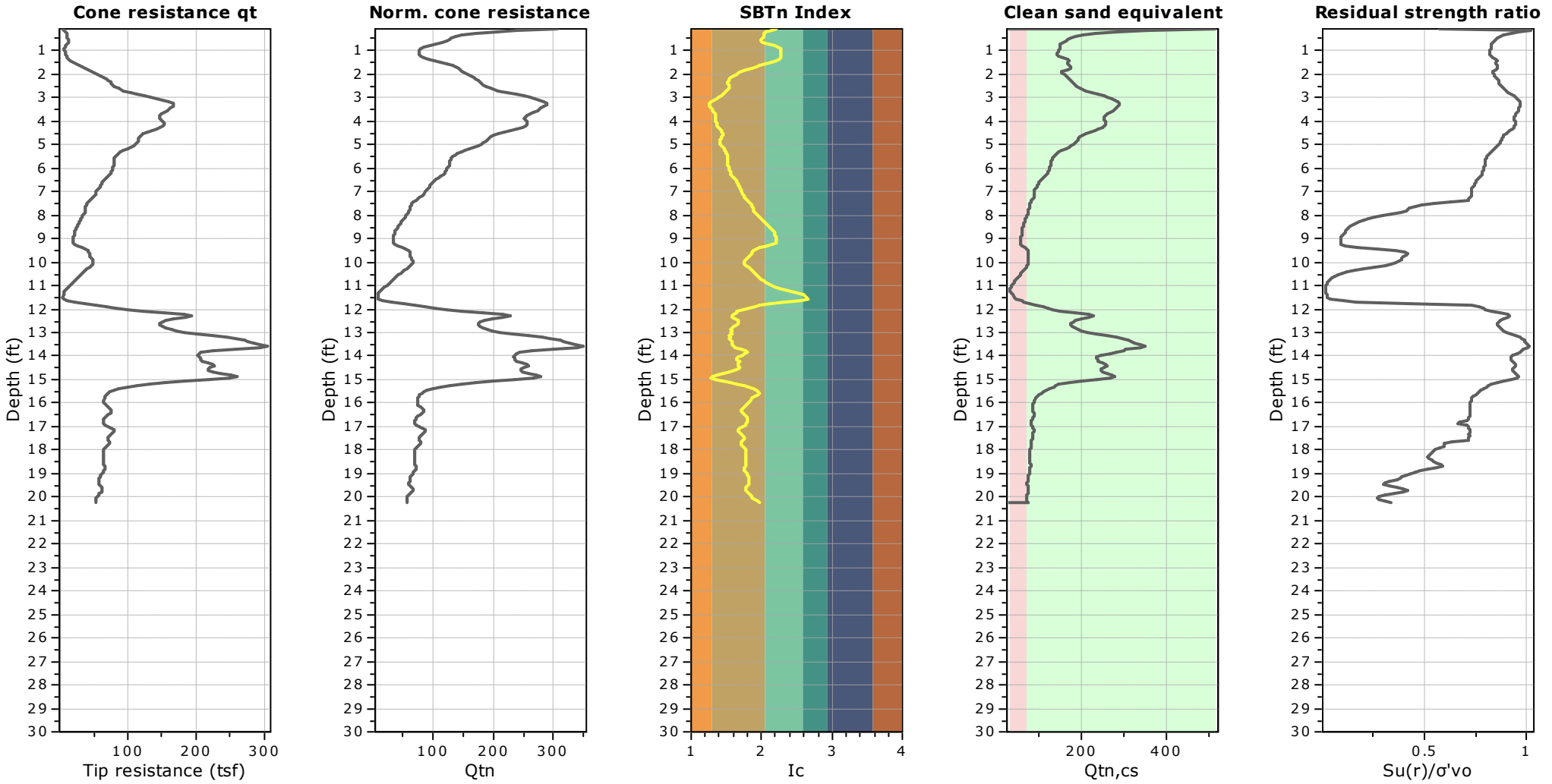
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-17
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 66.39 ft
Coords: X:572377.81, Y:556079.18
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

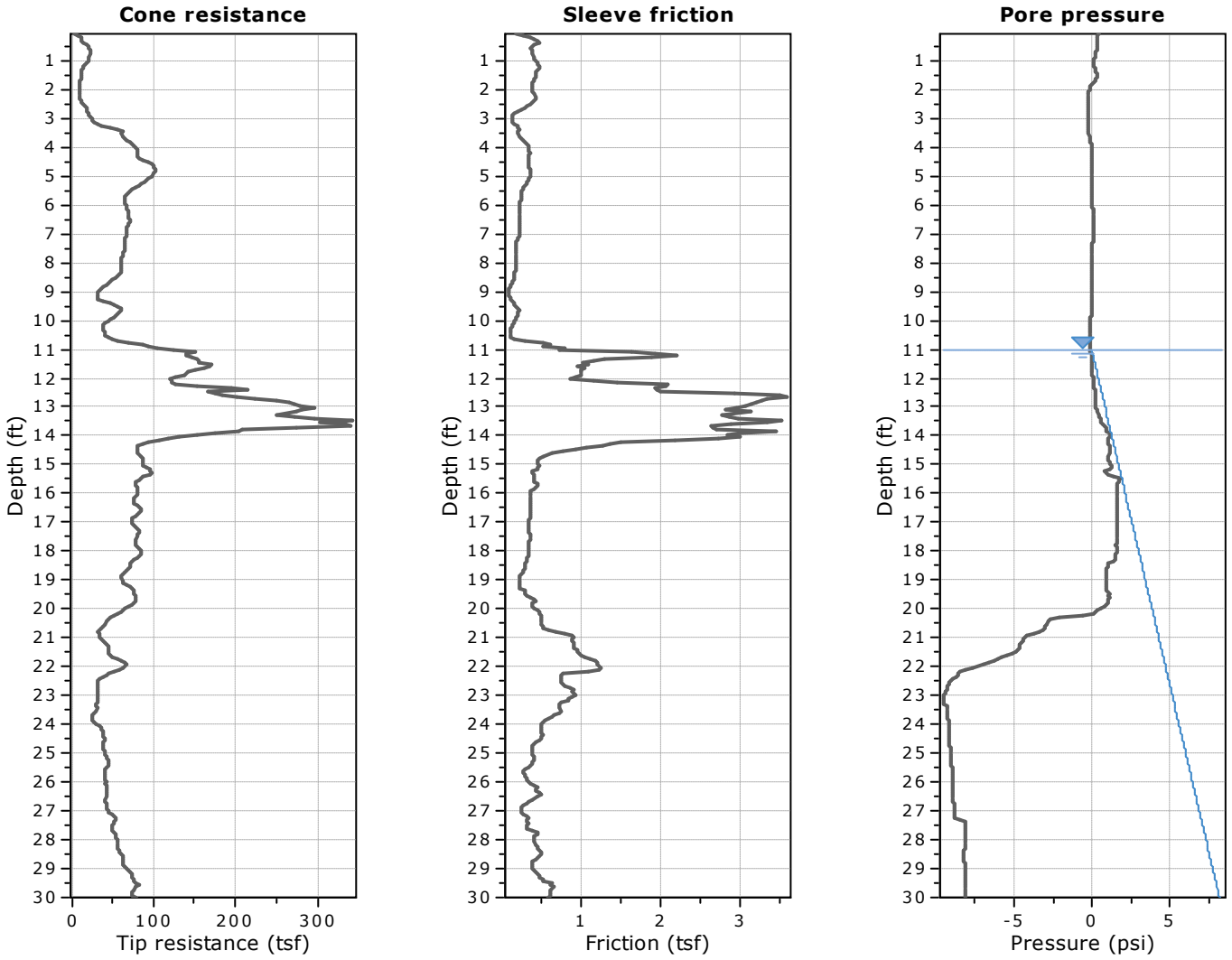
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



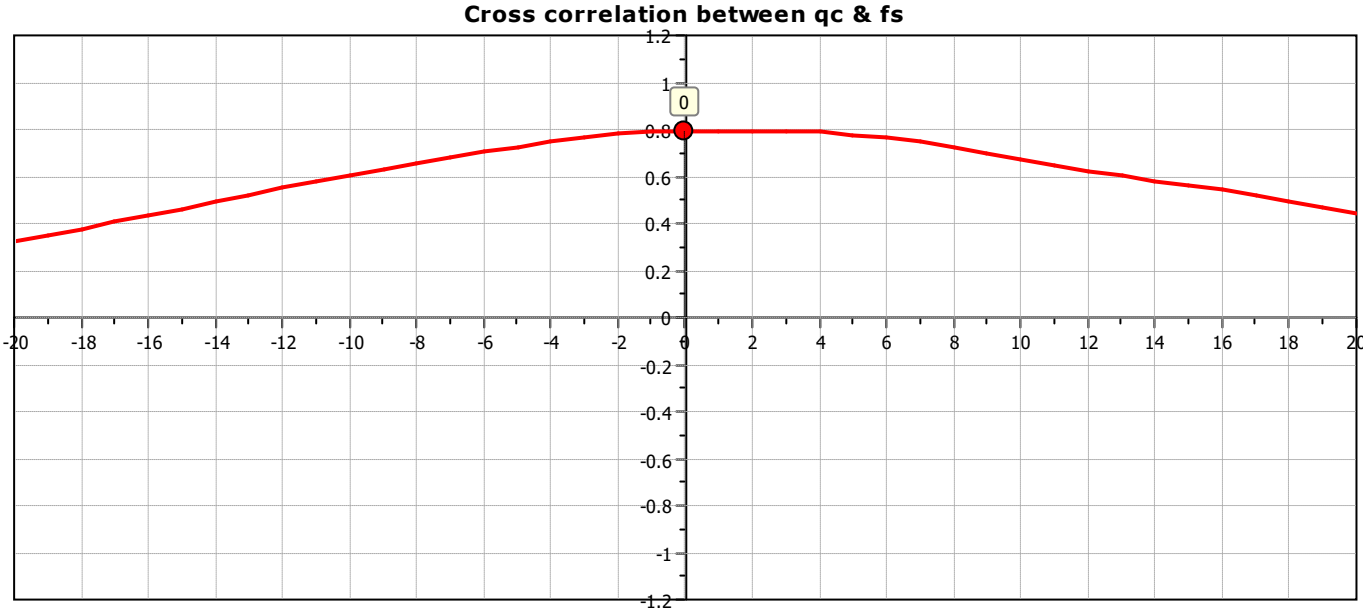
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

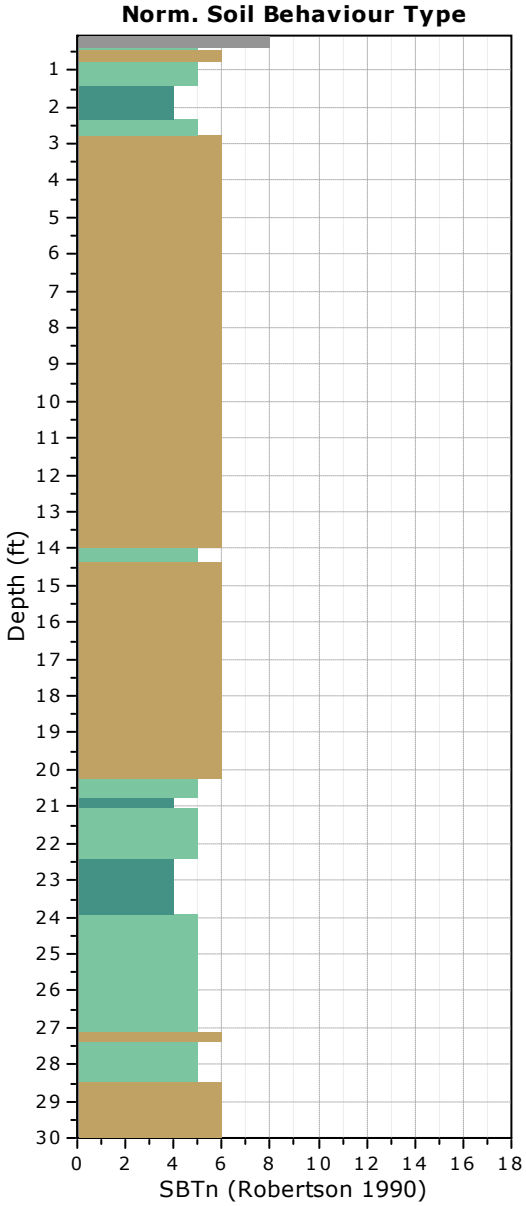
C-18
Total depth: 30.37 ft, Date: 5/14/2024
Surface Elevation: 65.96 ft
Coords: X:572463.67, Y:556105.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

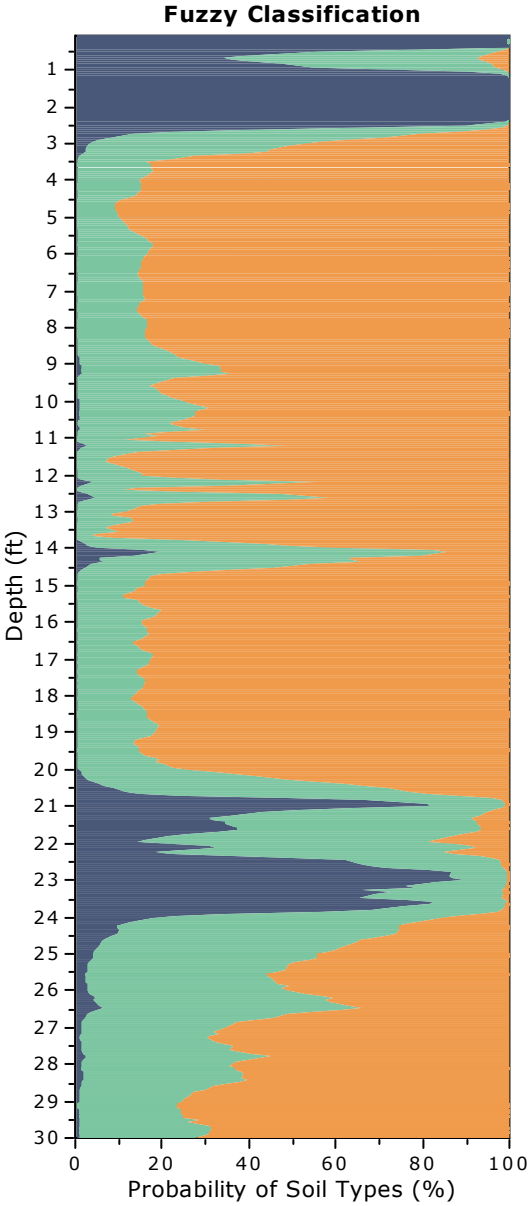
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







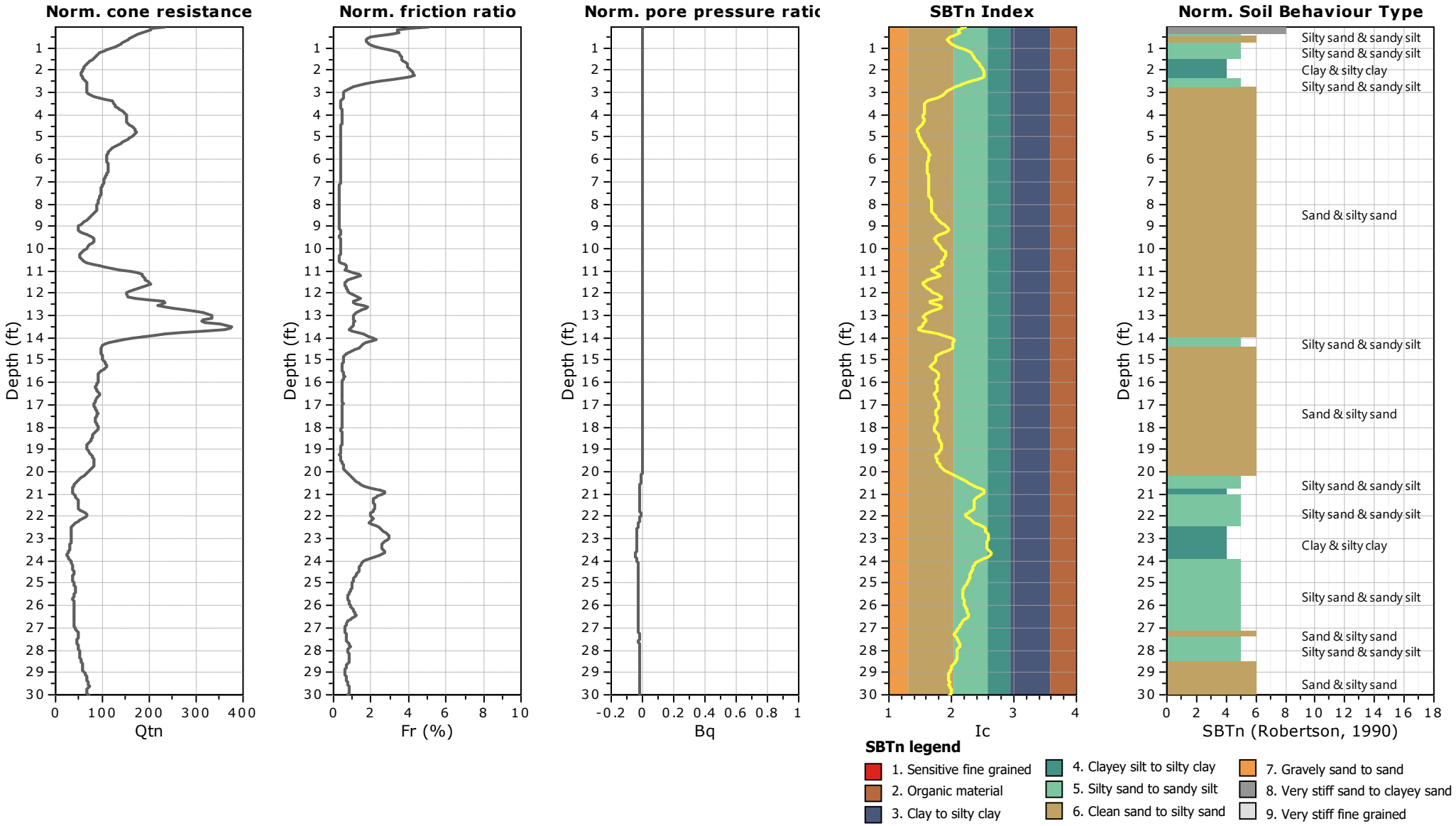
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-18
Total depth: 30.37 ft, Date: 5/14/2024
Surface Elevation: 65.96 ft
Coords: X:572463.67, Y:556105.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

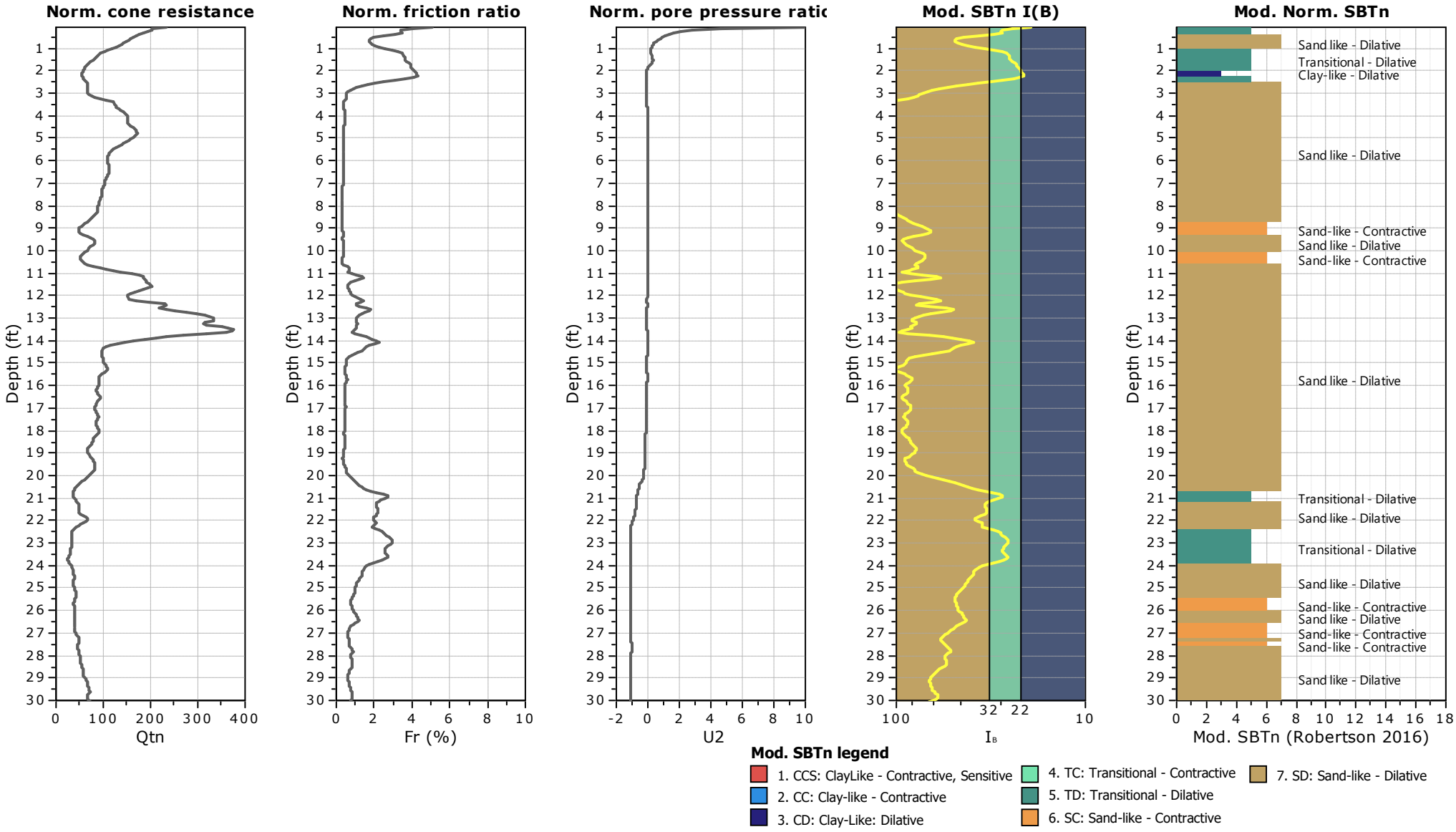
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-18
Total depth: 30.37 ft, Date: 5/14/2024
Surface Elevation: 65.96 ft
Coords: X:572463.67, Y:556105.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

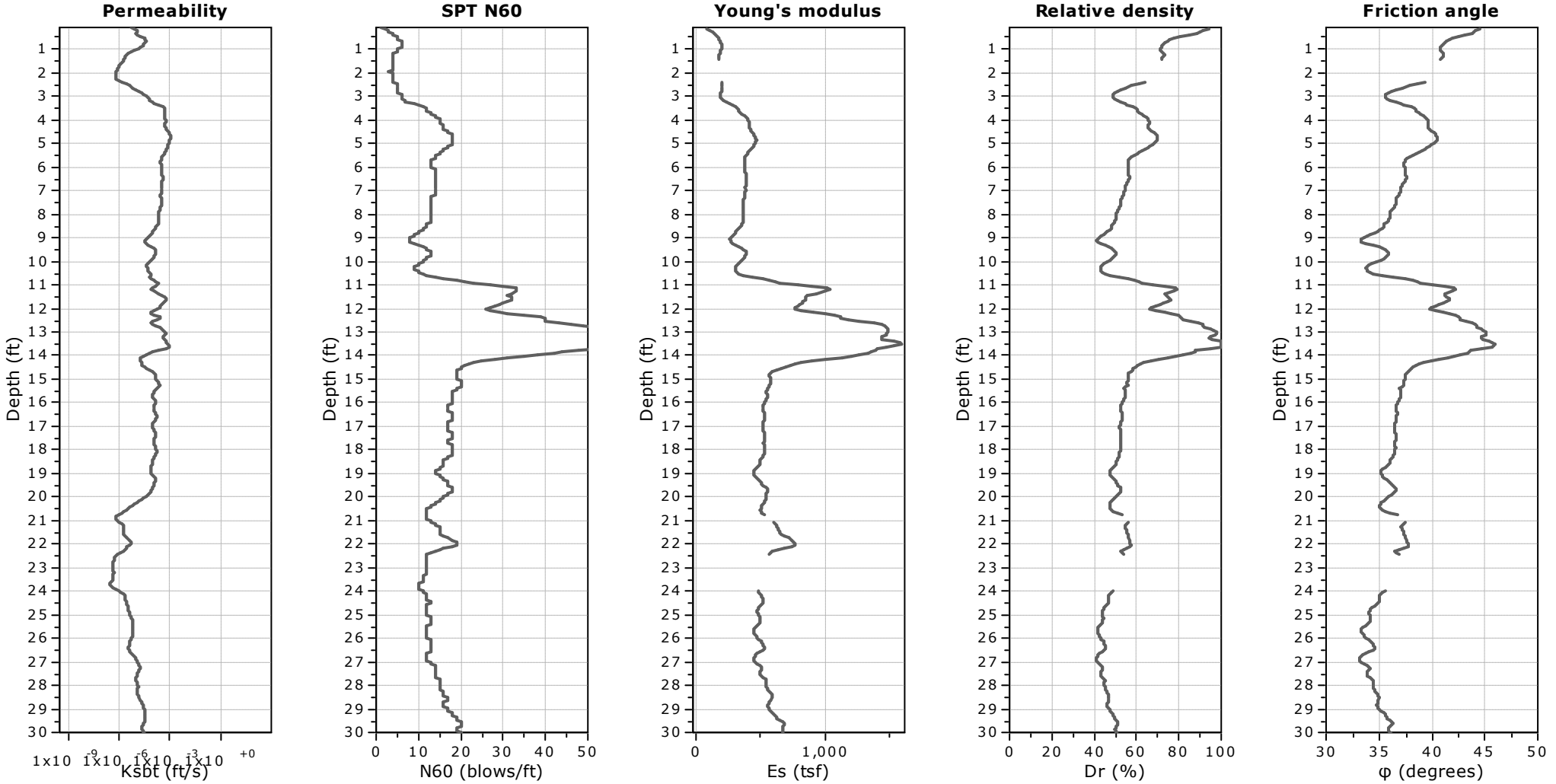
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-18
Total depth: 30.37 ft, Date: 5/14/2024
Surface Elevation: 65.96 ft
Coords: X:572463.67, Y:556105.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



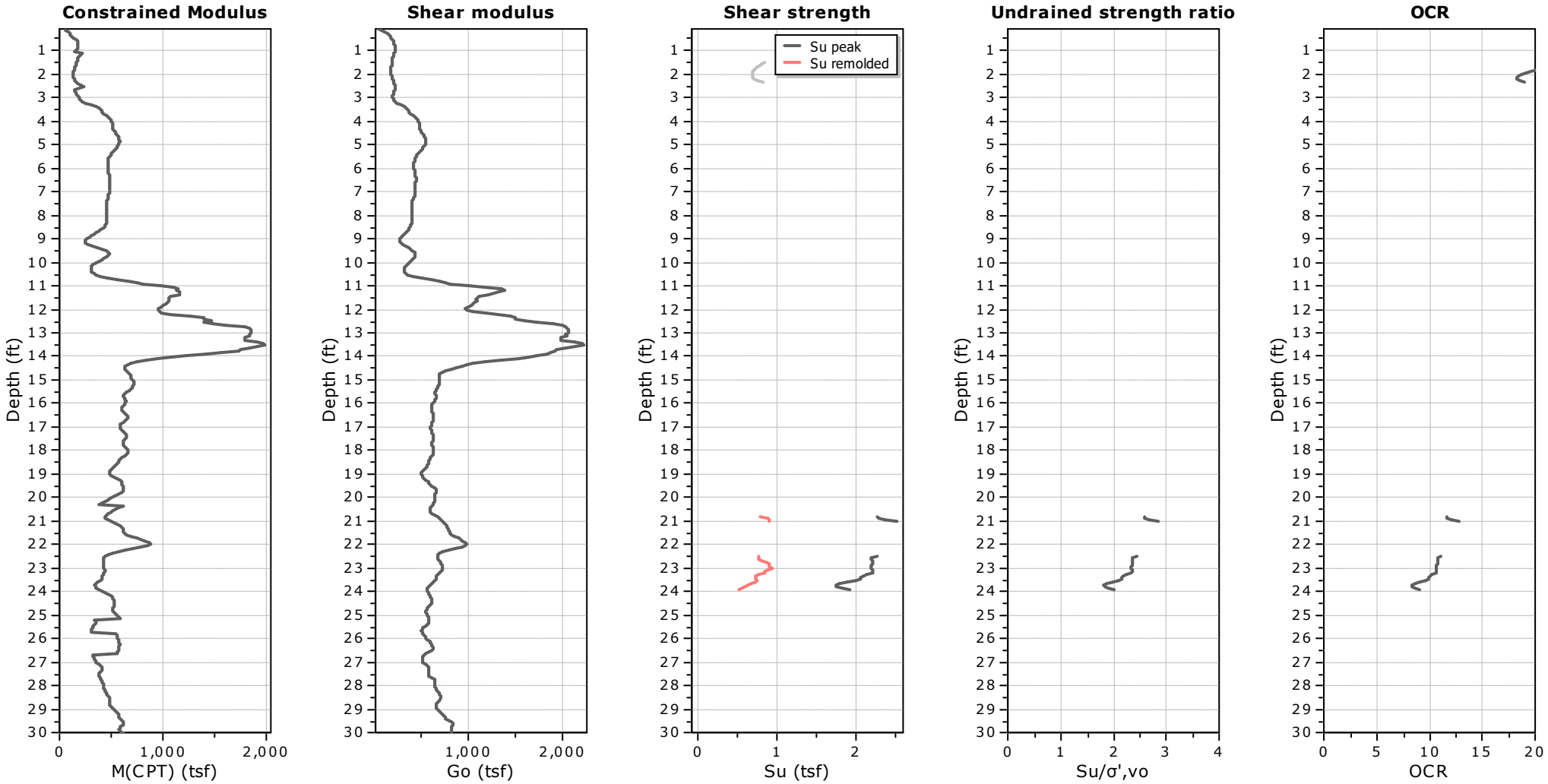
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-18
Total depth: 30.37 ft, Date: 5/14/2024
Surface Elevation: 65.96 ft
Coords: X:572463.67, Y:556105.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



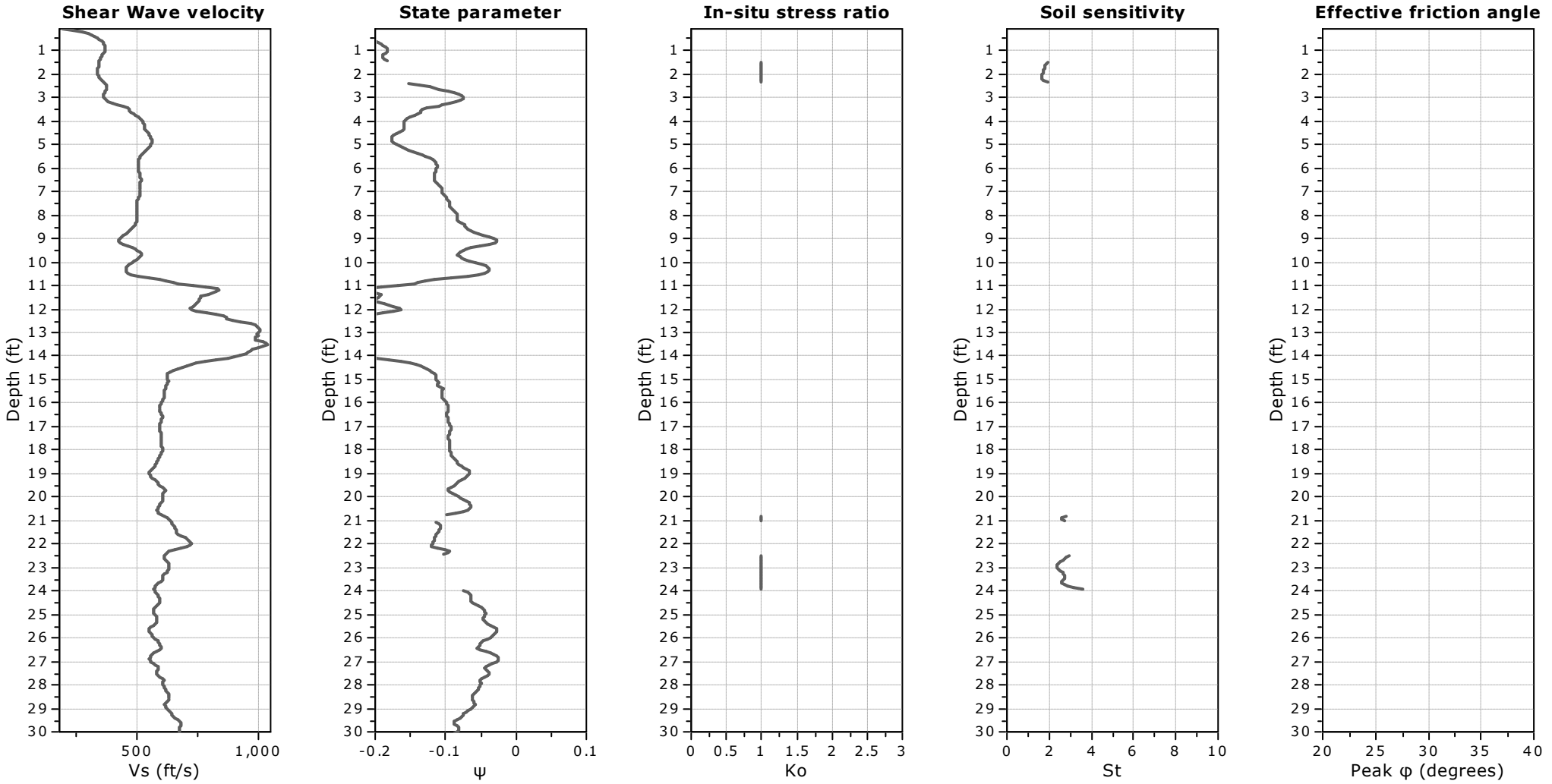
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-18
Total depth: 30.37 ft, Date: 5/14/2024
Surface Elevation: 65.96 ft
Coords: X:572463.67, Y:556105.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



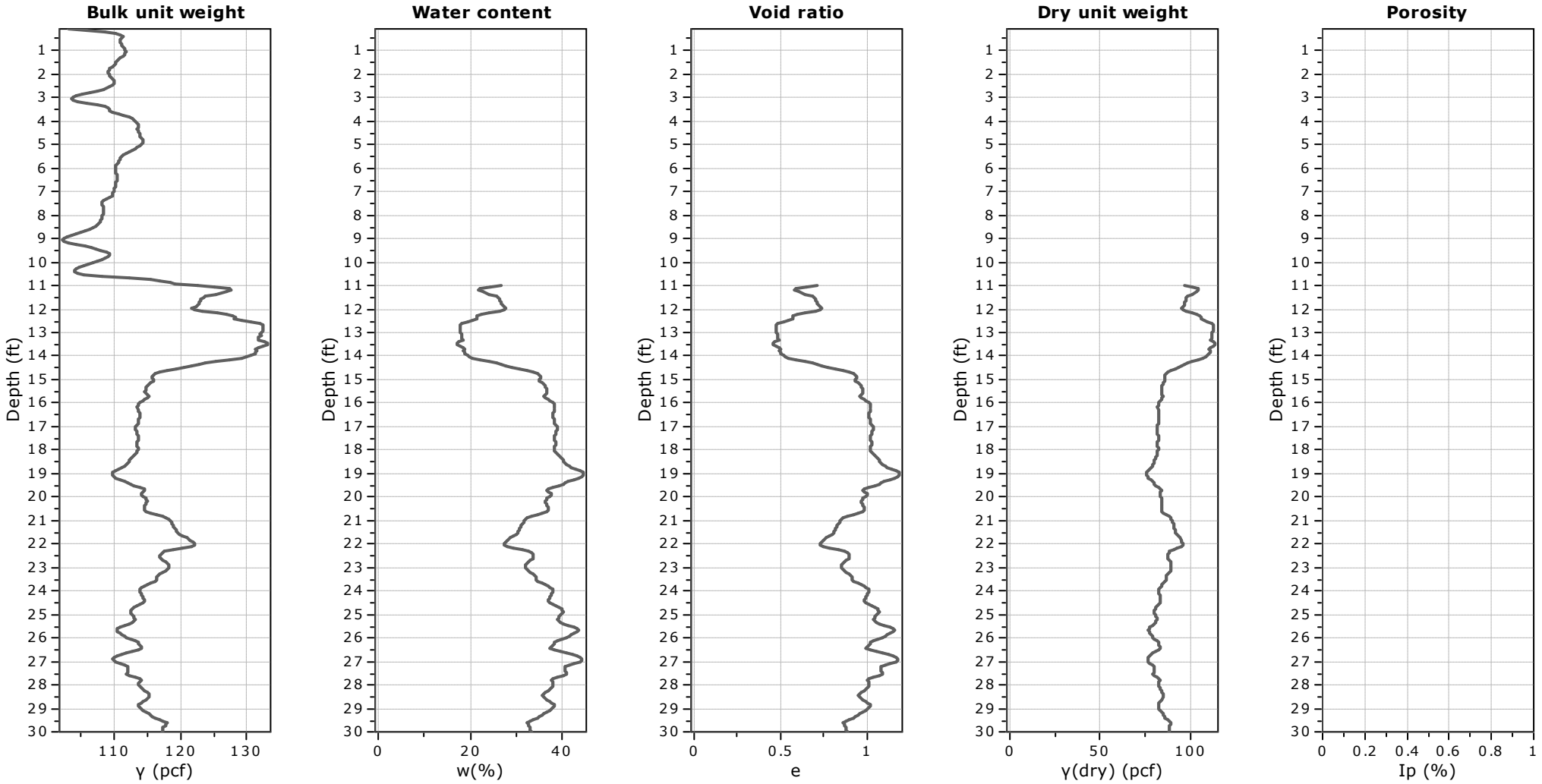
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-18
Total depth: 30.37 ft, Date: 5/14/2024
Surface Elevation: 65.96 ft
Coords: X:572463.67, Y:556105.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

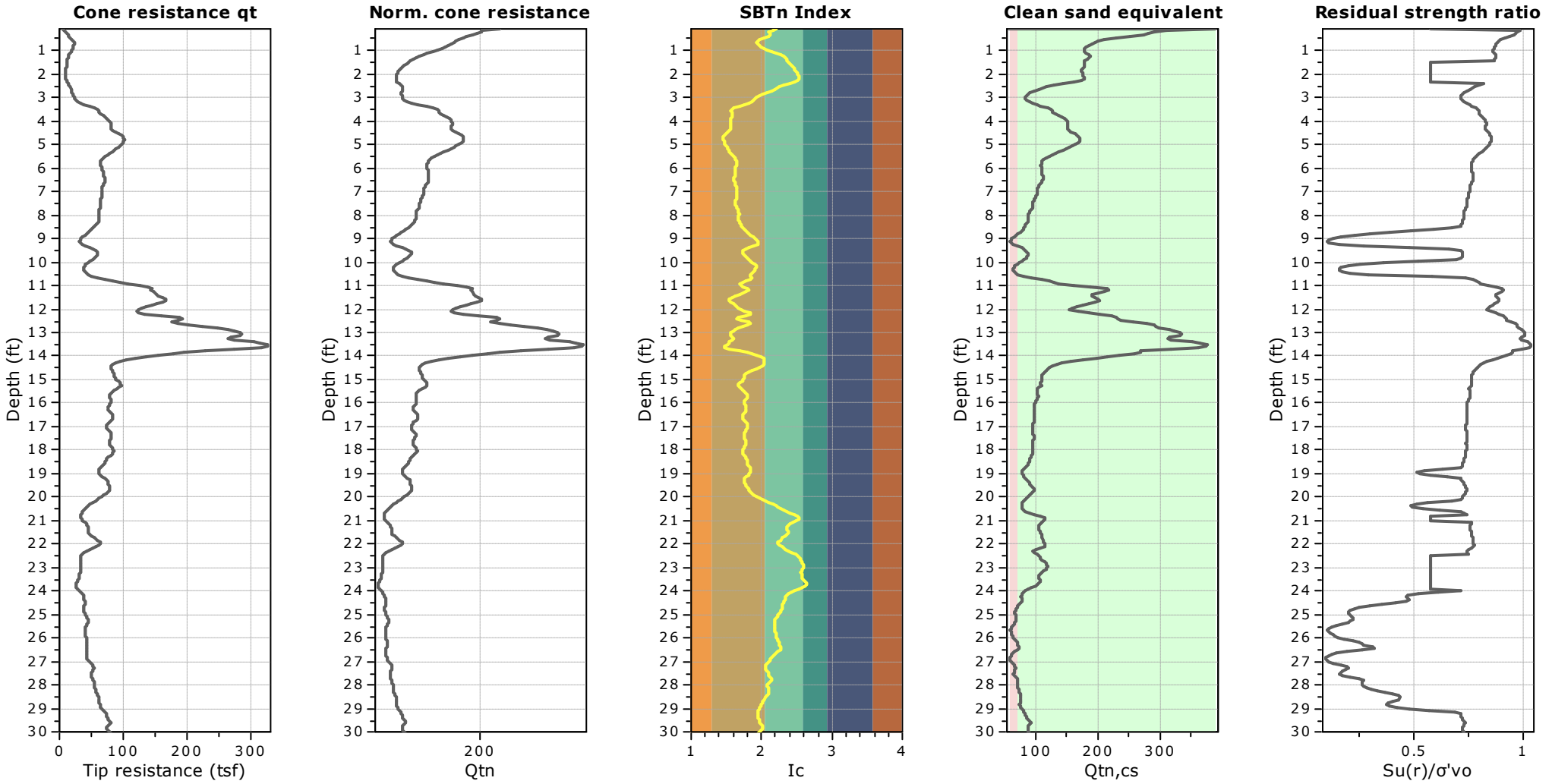
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-18
Total depth: 30.37 ft, Date: 5/14/2024
Surface Elevation: 65.96 ft
Coords: X:572463.67, Y:556105.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

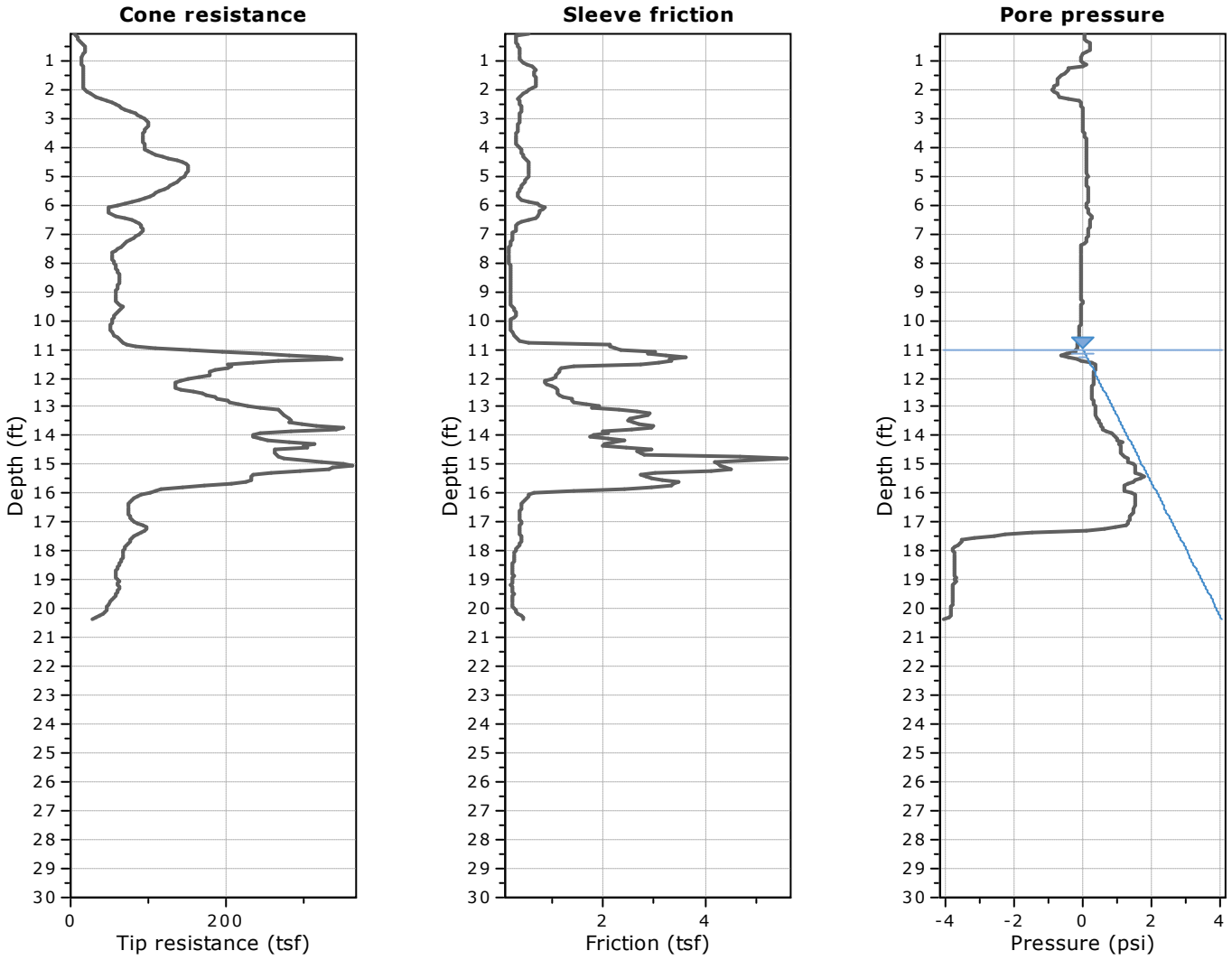
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



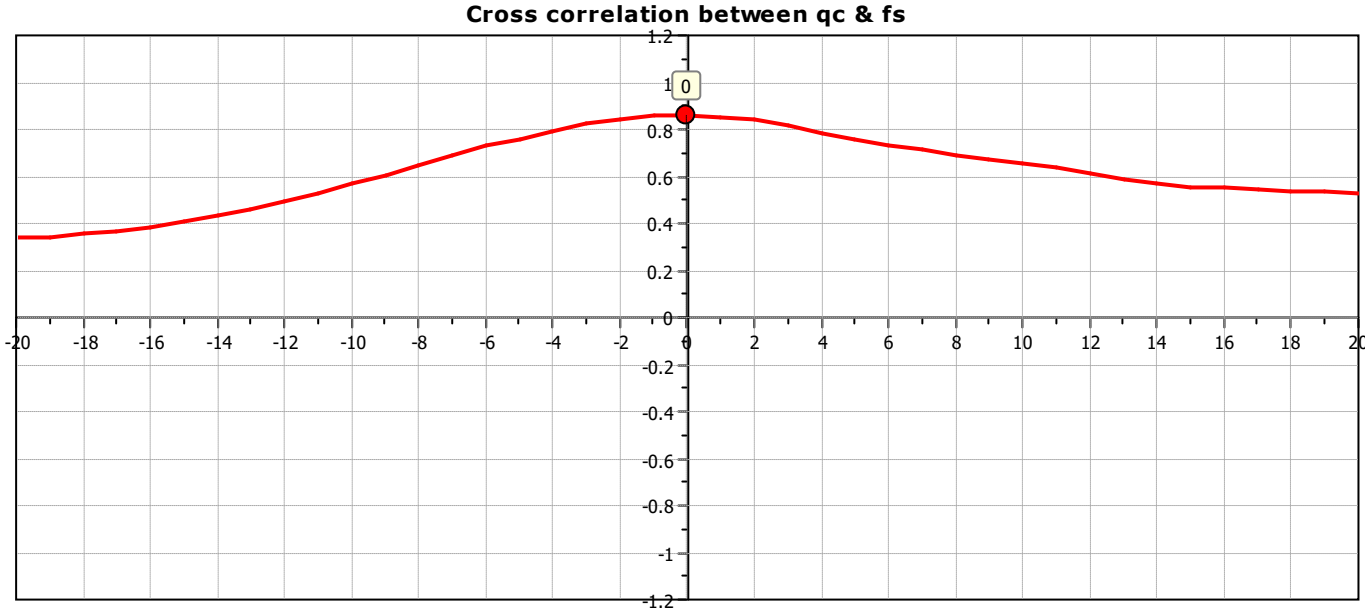
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

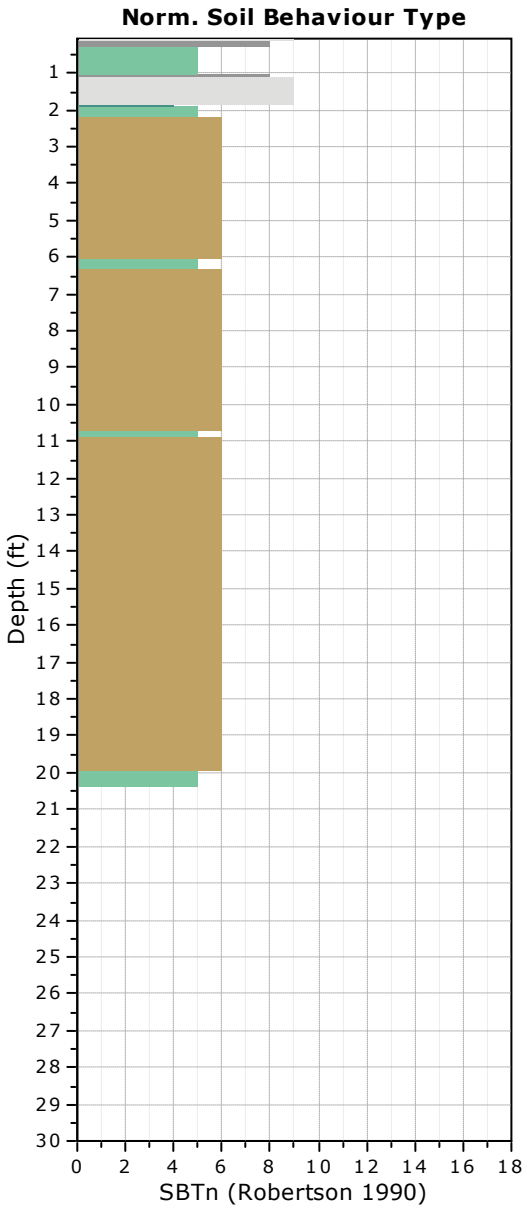
C-19
Total depth: 20.35 ft, Date: 5/14/2024
Surface Elevation: 66.11 ft
Coords: X:572434.04, Y:556037.87
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

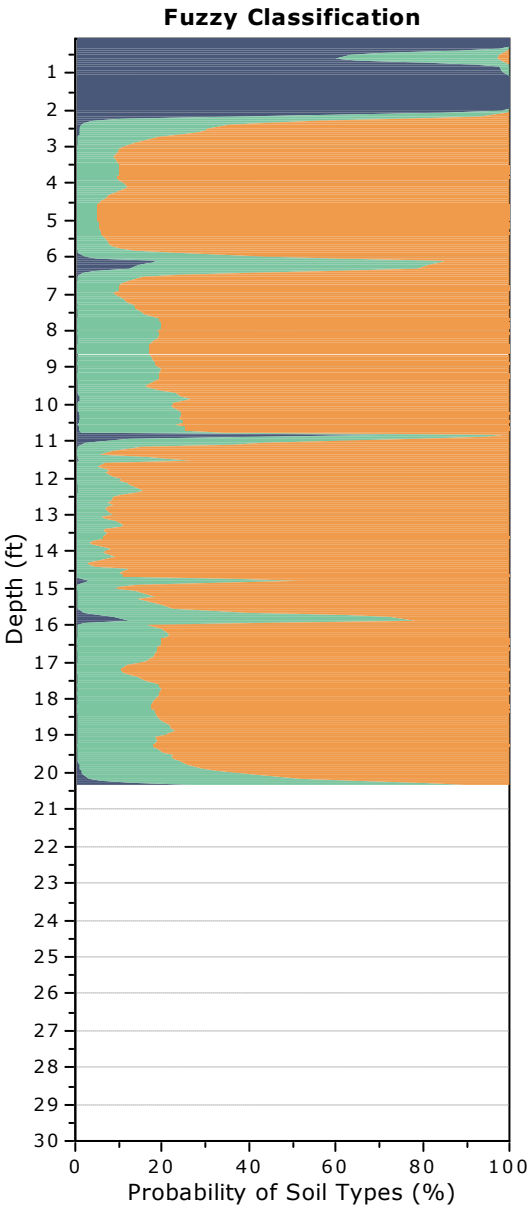
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).





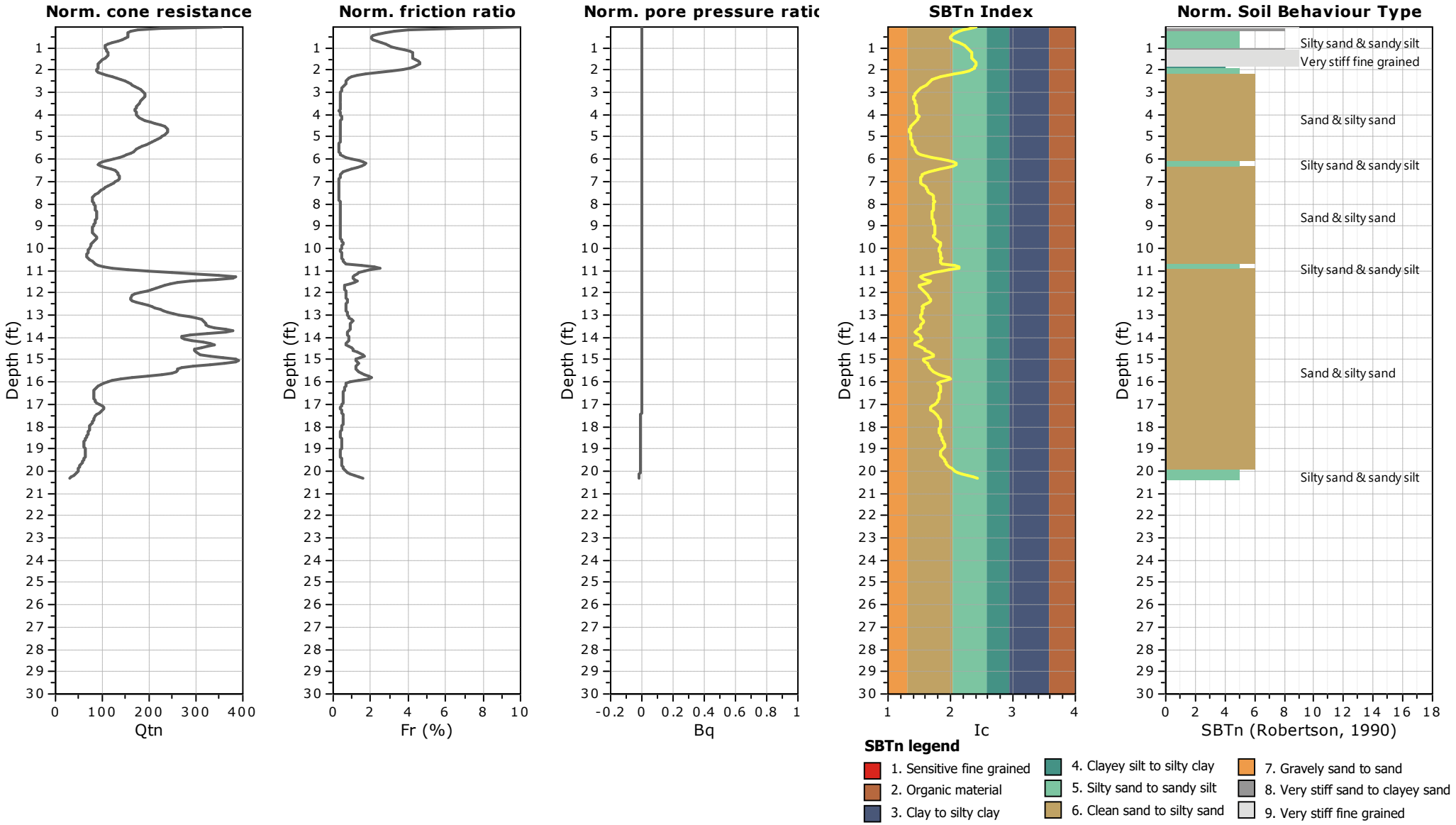


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-19
Total depth: 20.35 ft, Date: 5/14/2024
Surface Elevation: 66.11 ft
Coords: X:572434.04, Y:556037.87
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

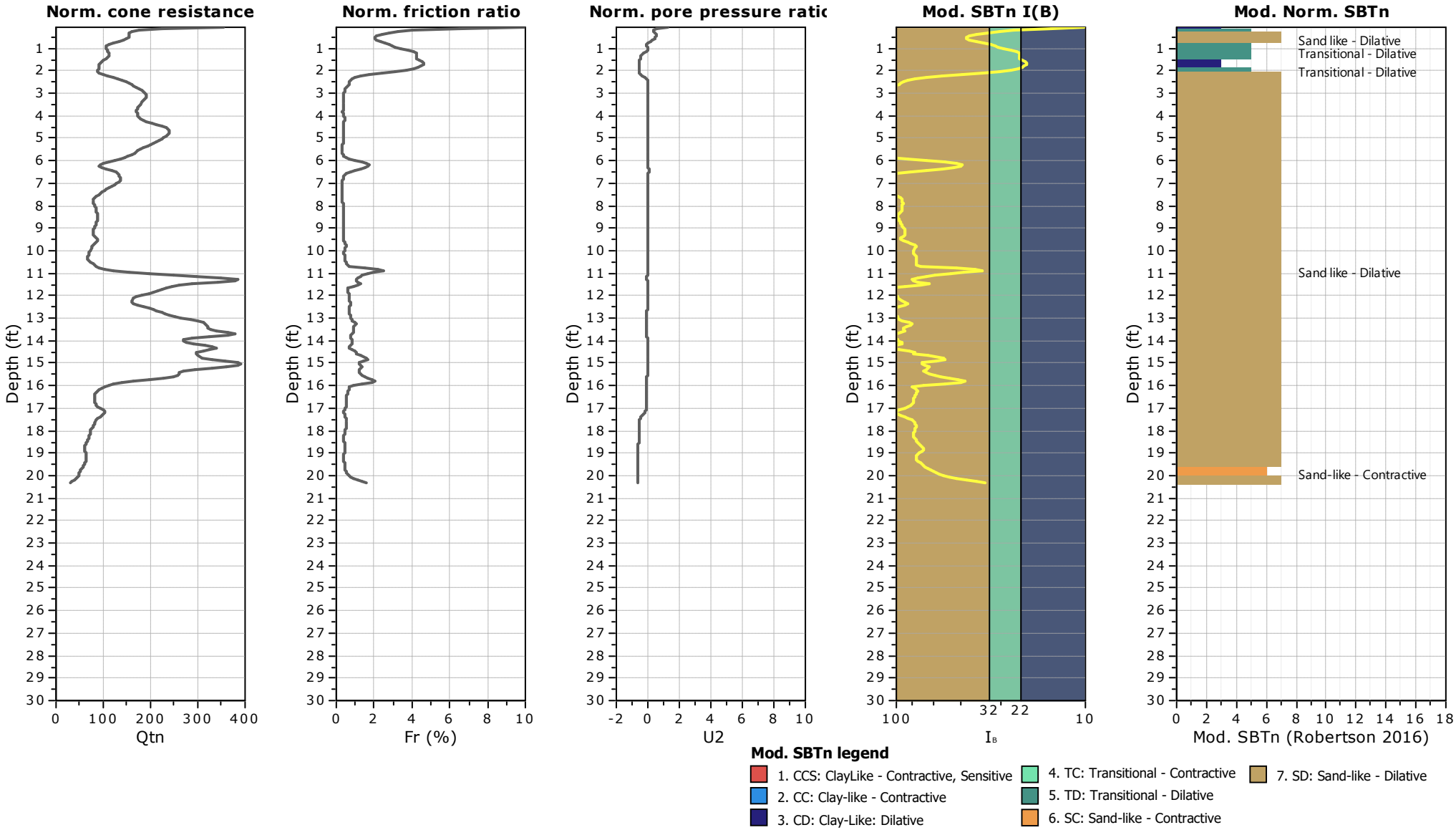
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-19
Total depth: 20.35 ft, Date: 5/14/2024
Surface Elevation: 66.11 ft
Coords: X:572434.04, Y:556037.87
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

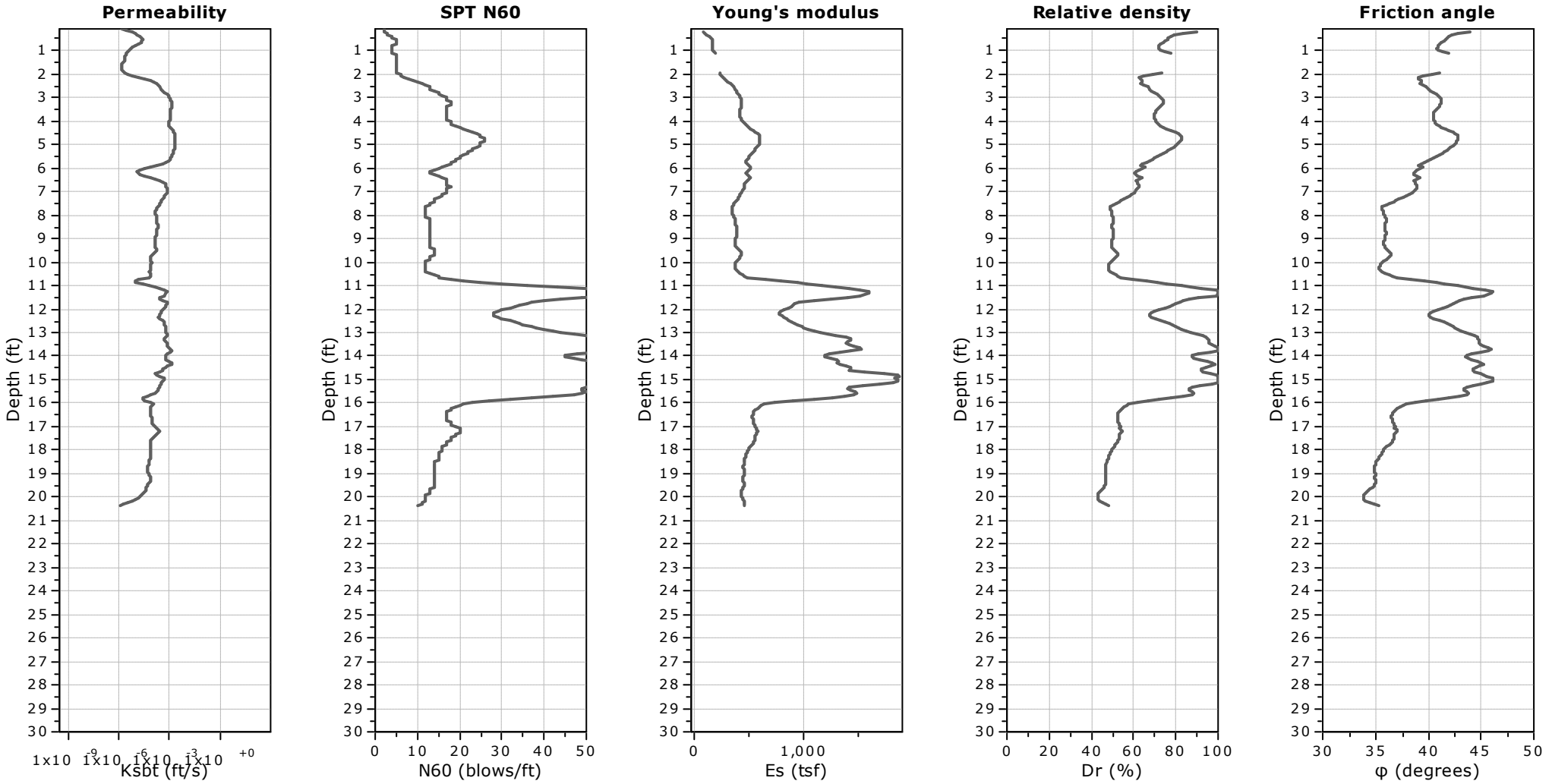
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-19
Total depth: 20.35 ft, Date: 5/14/2024
Surface Elevation: 66.11 ft
Coords: X:572434.04, Y:556037.87
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



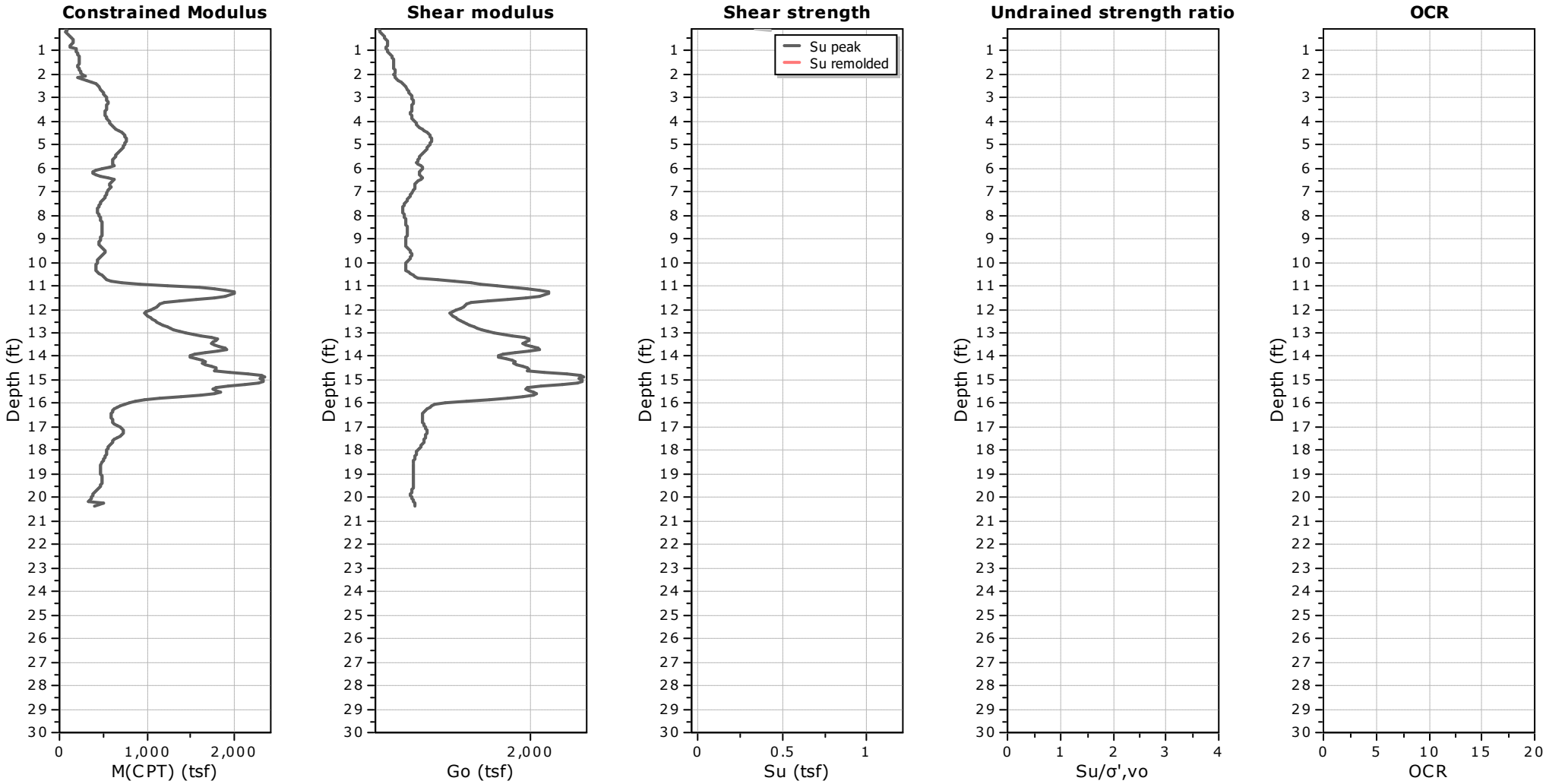
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-19
Total depth: 20.35 ft, Date: 5/14/2024
Surface Elevation: 66.11 ft
Coords: X:572434.04, Y:556037.87
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



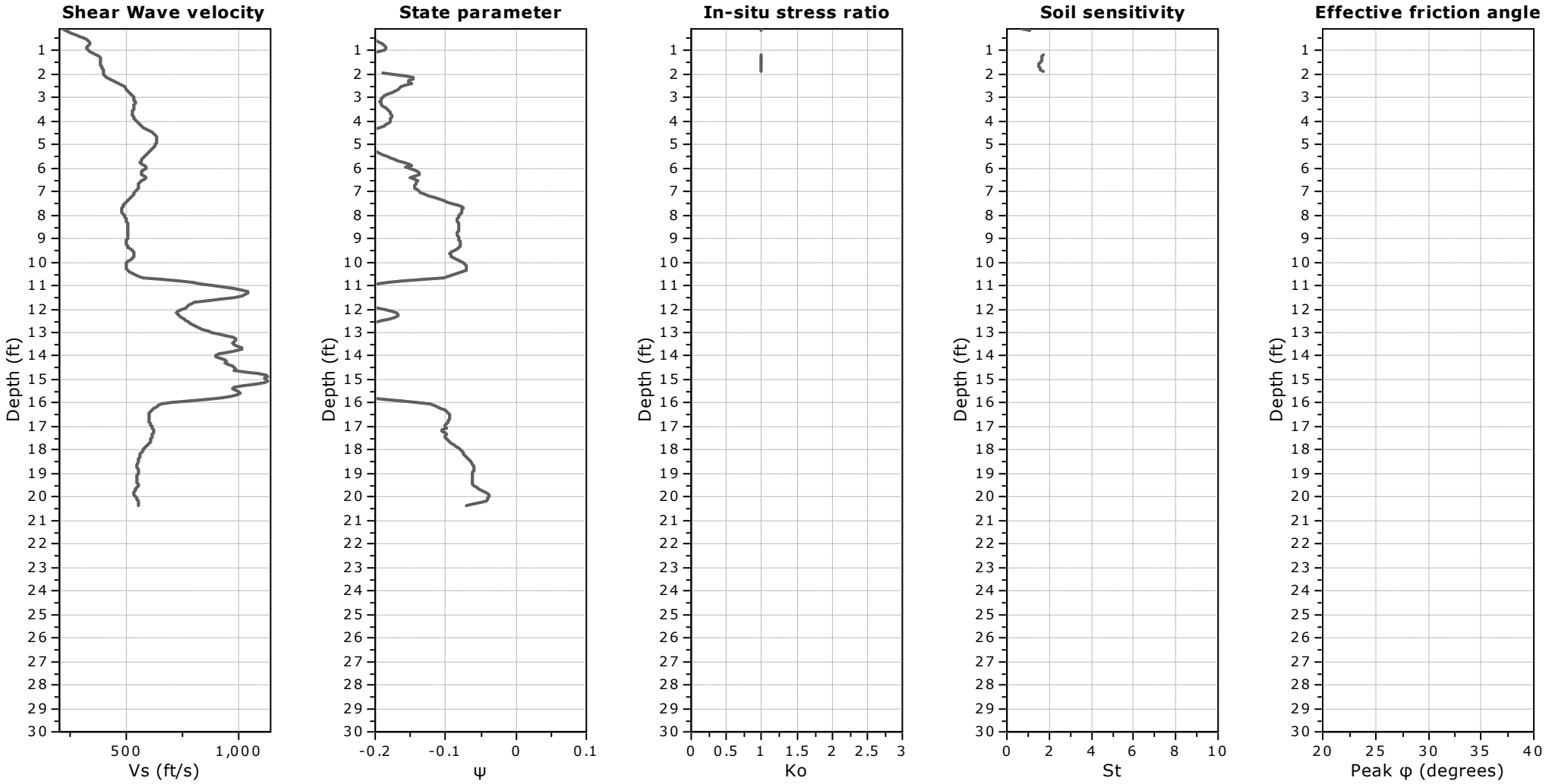
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-19
Total depth: 20.35 ft, Date: 5/14/2024
Surface Elevation: 66.11 ft
Coords: X:572434.04, Y:556037.87
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



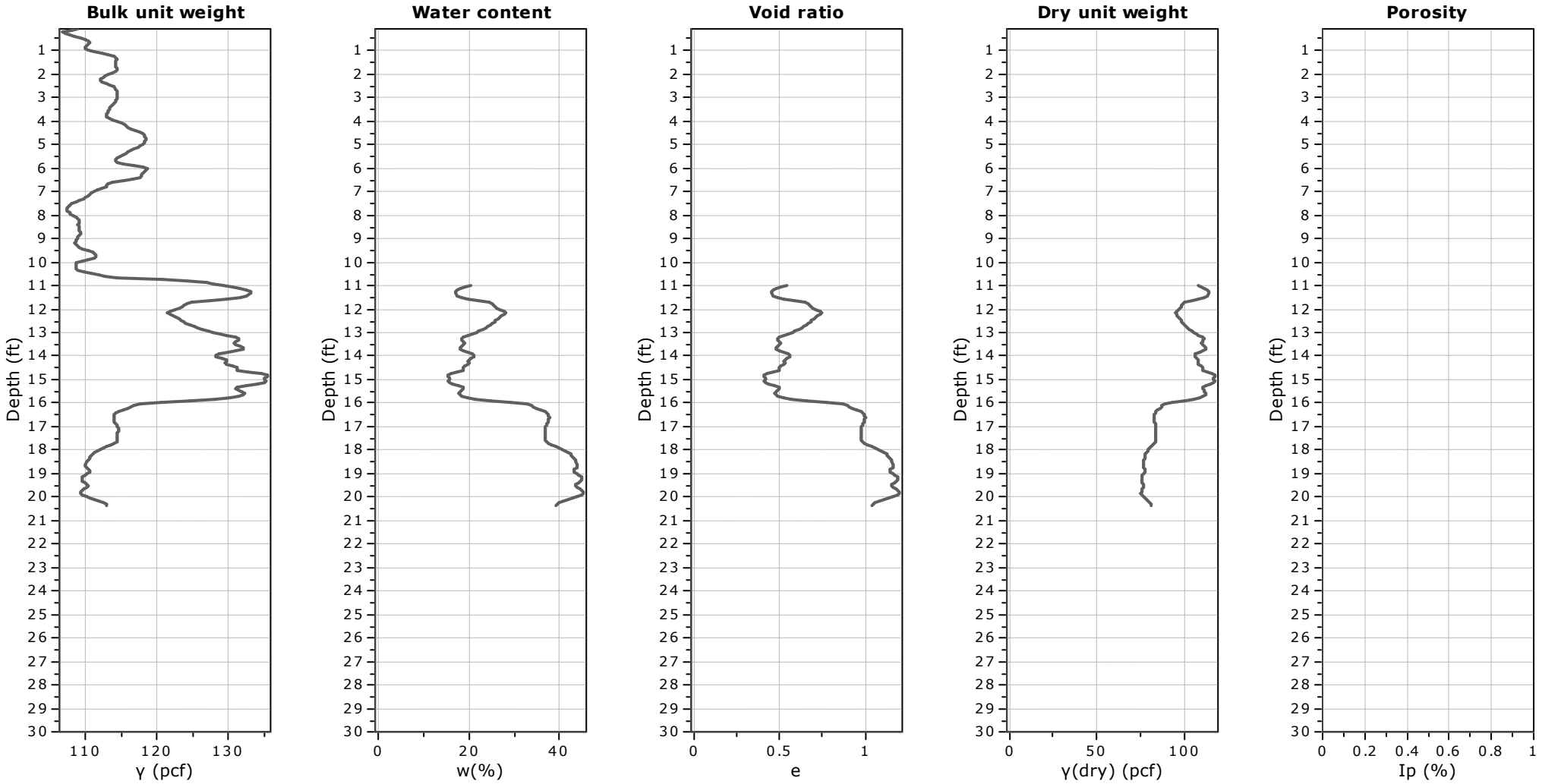
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-19
Total depth: 20.35 ft, Date: 5/14/2024
Surface Elevation: 66.11 ft
Coords: X:572434.04, Y:556037.87
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

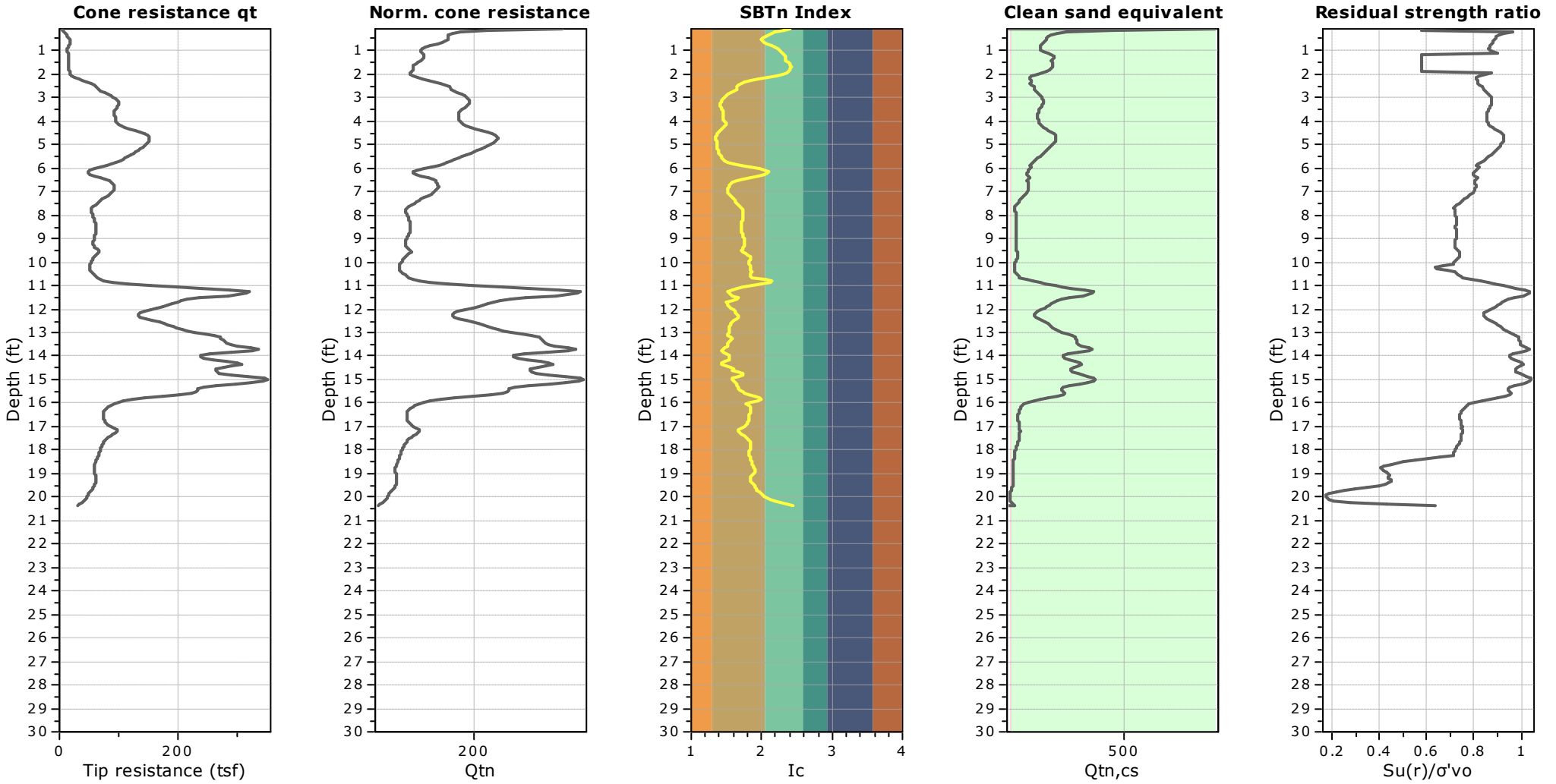
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-19
Total depth: 20.35 ft, Date: 5/14/2024
Surface Elevation: 66.11 ft
Coords: X:572434.04, Y:556037.87
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

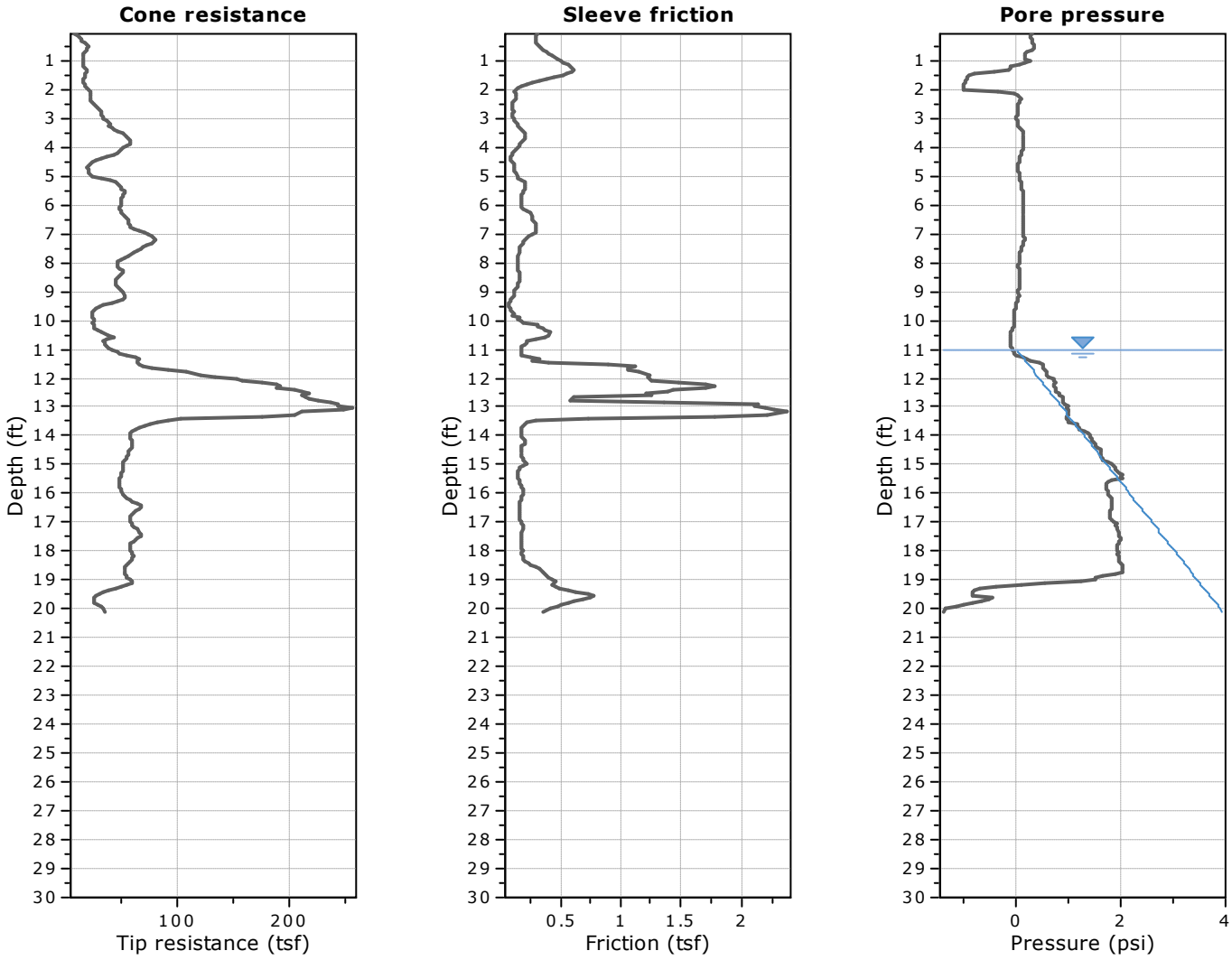
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



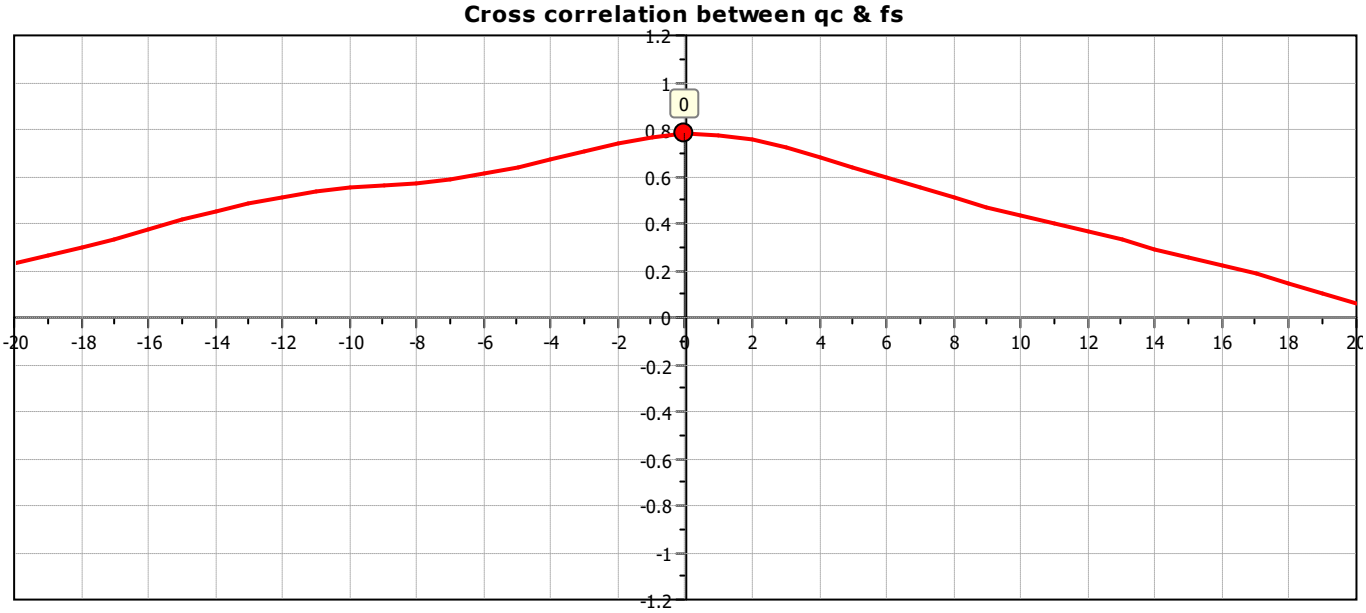
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

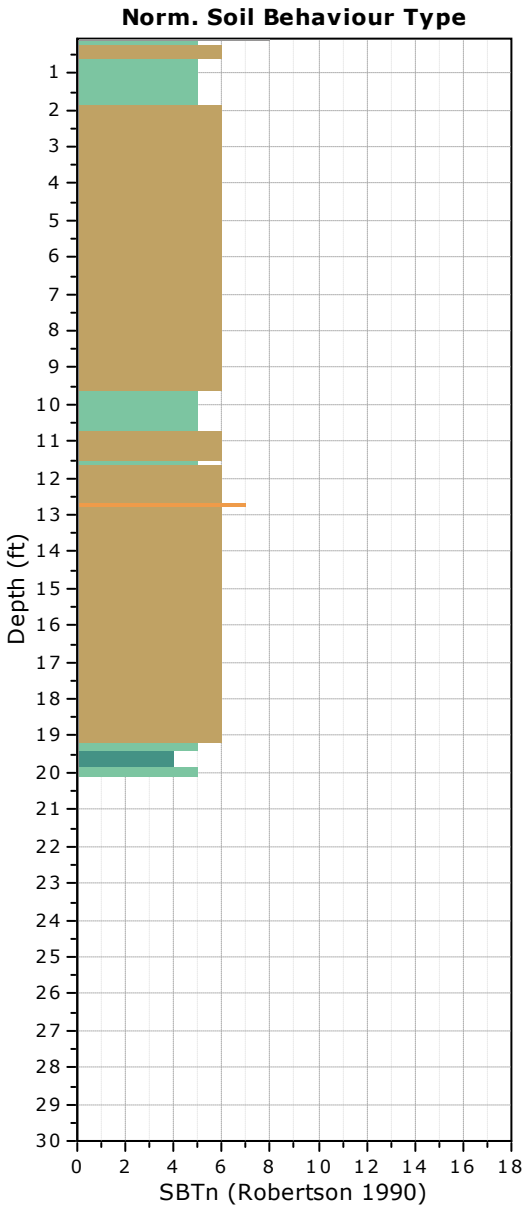
C-20
Total depth: 20.08 ft, Date: 5/14/2024
Surface Elevation: 65.26 ft
Coords: X:572524.84, Y:556012.66
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

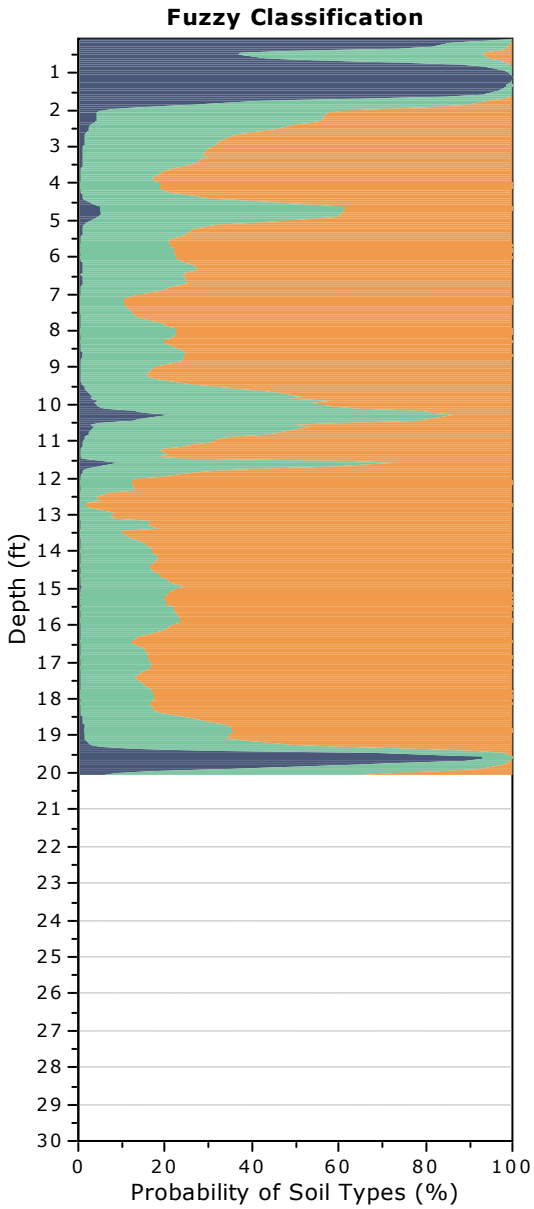
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







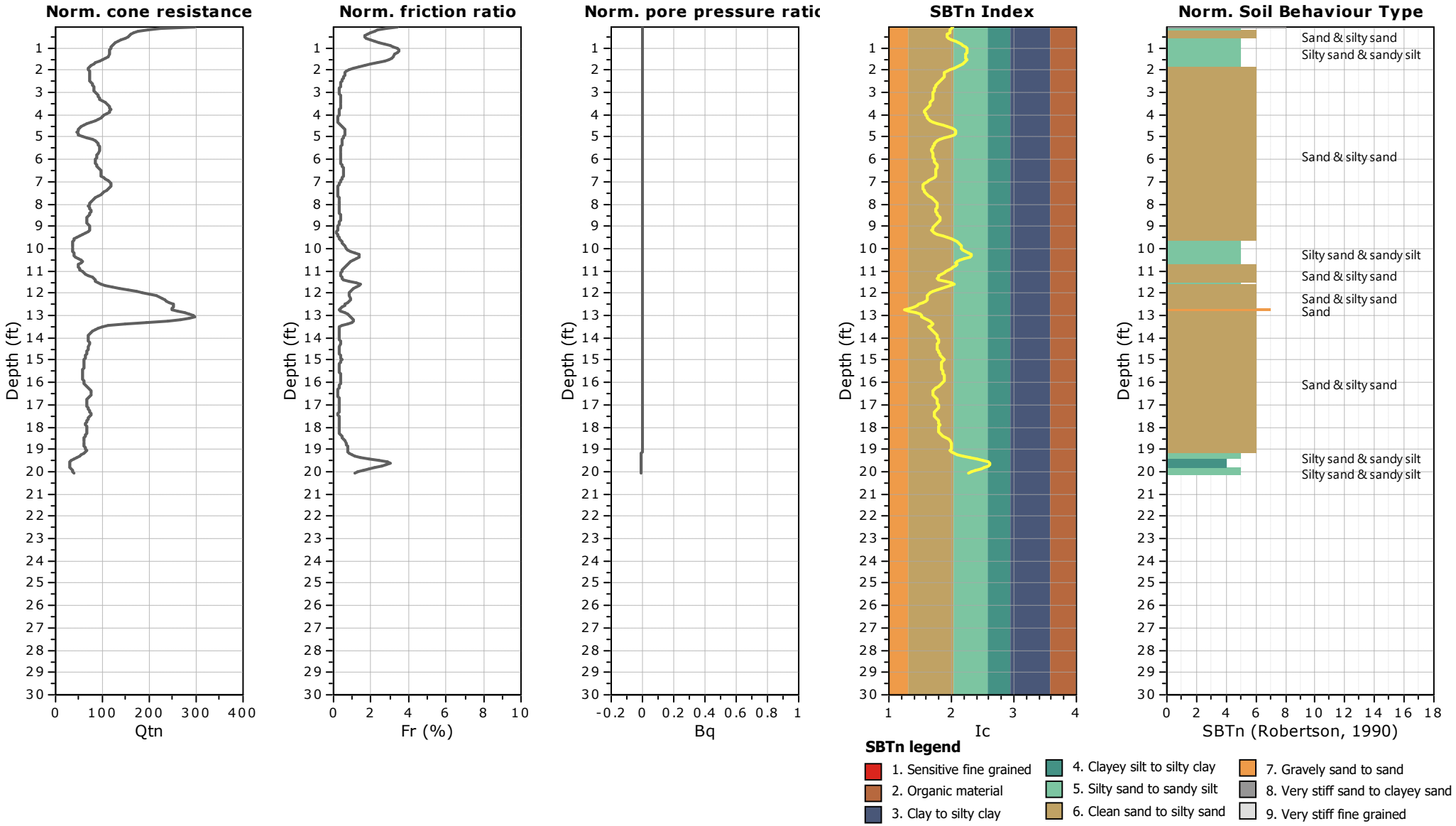
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

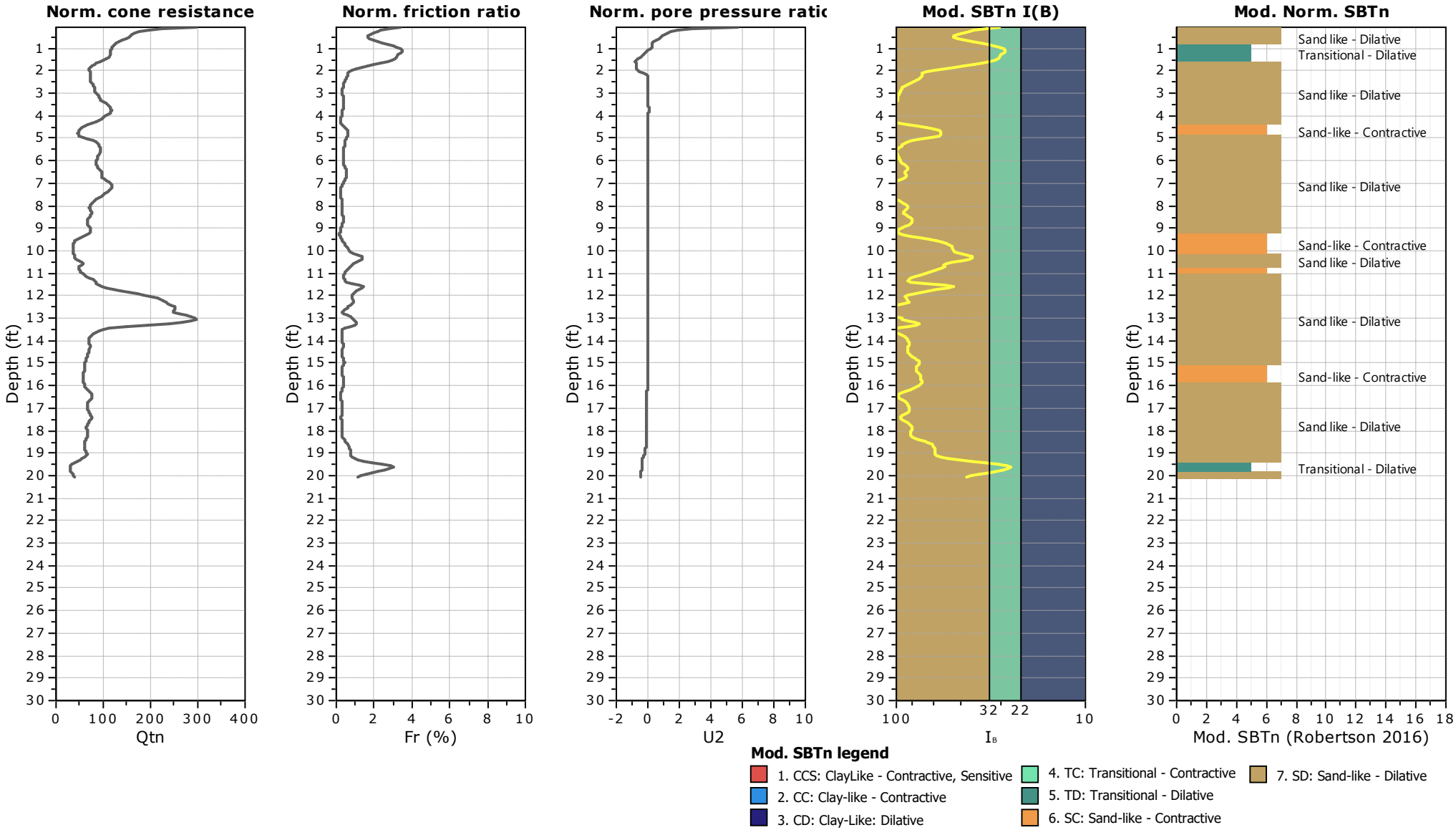
C-20
Total depth: 20.08 ft, Date: 5/14/2024
Surface Elevation: 65.26 ft
Coords: X:572524.84, Y:556012.66
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-20
Total depth: 20.08 ft, Date: 5/14/2024
Surface Elevation: 65.26 ft
Coords: X:572524.84, Y:556012.66
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

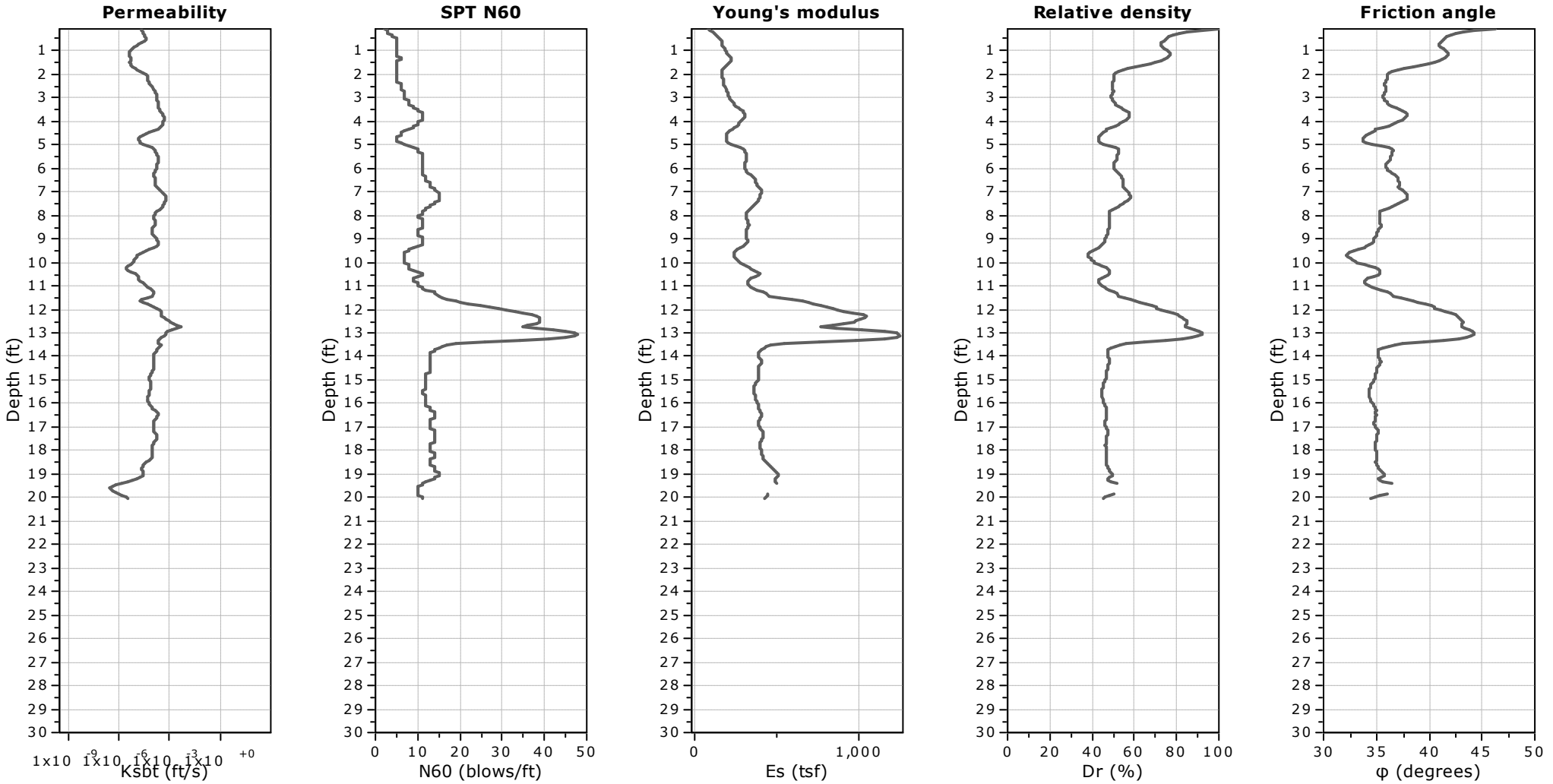
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-20
Total depth: 20.08 ft, Date: 5/14/2024
Surface Elevation: 65.26 ft
Coords: X:572524.84, Y:556012.66
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



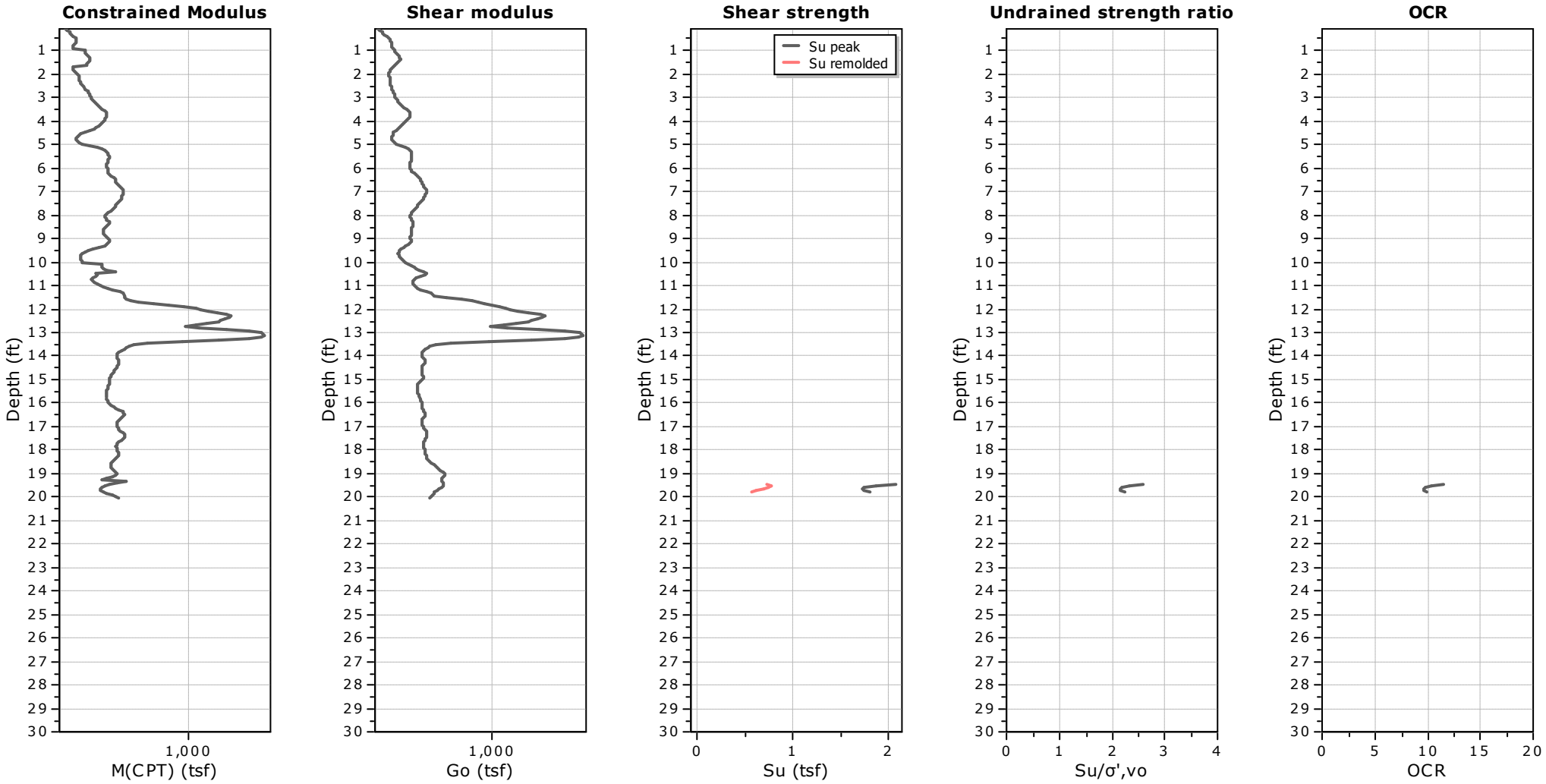
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-20
Total depth: 20.08 ft, Date: 5/14/2024
Surface Elevation: 65.26 ft
Coords: X:572524.84, Y:556012.66
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



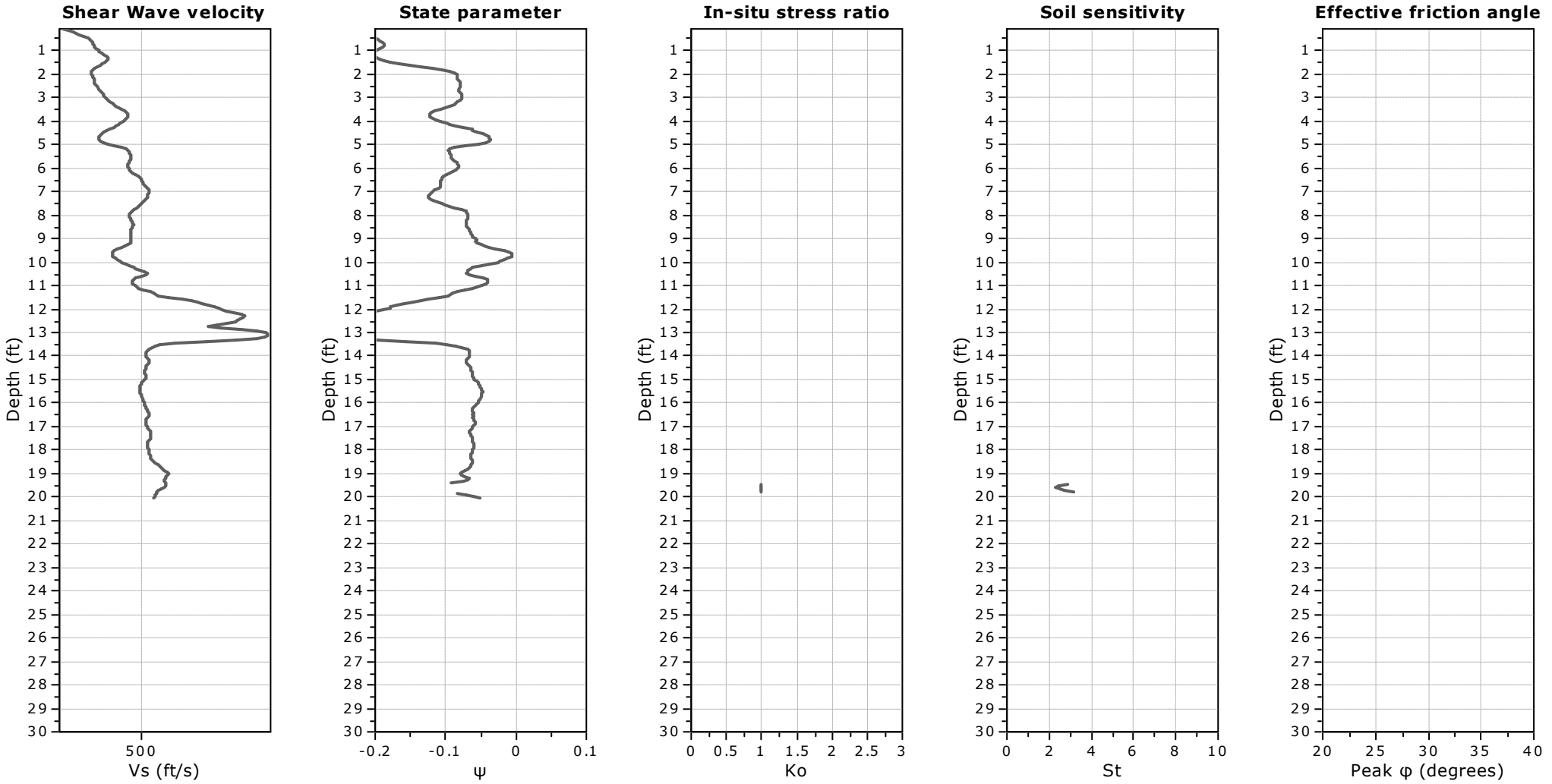
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-20
Total depth: 20.08 ft, Date: 5/14/2024
Surface Elevation: 65.26 ft
Coords: X:572524.84, Y:556012.66
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



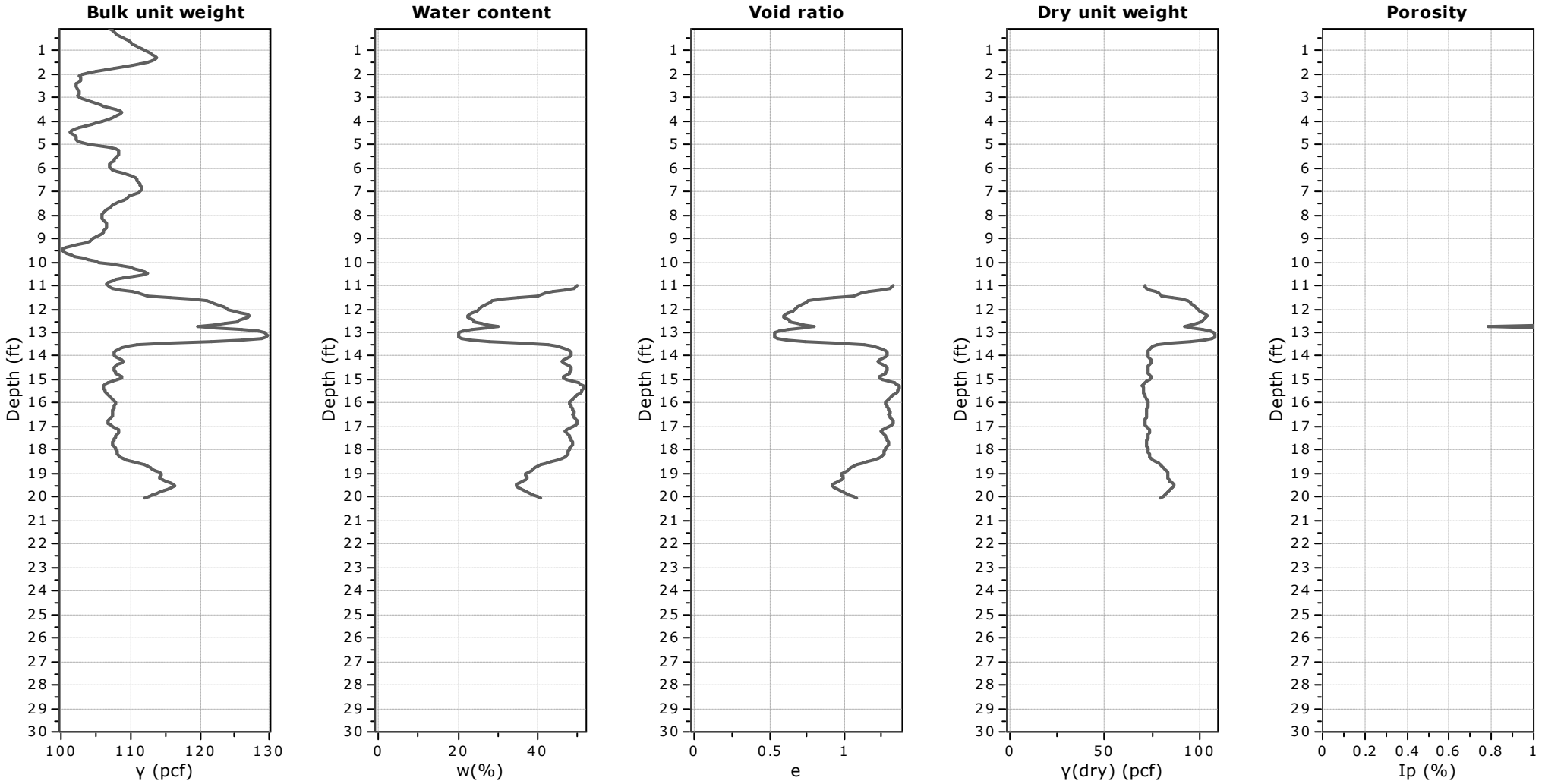
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-20
Total depth: 20.08 ft, Date: 5/14/2024
Surface Elevation: 65.26 ft
Coords: X:572524.84, Y:556012.66
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

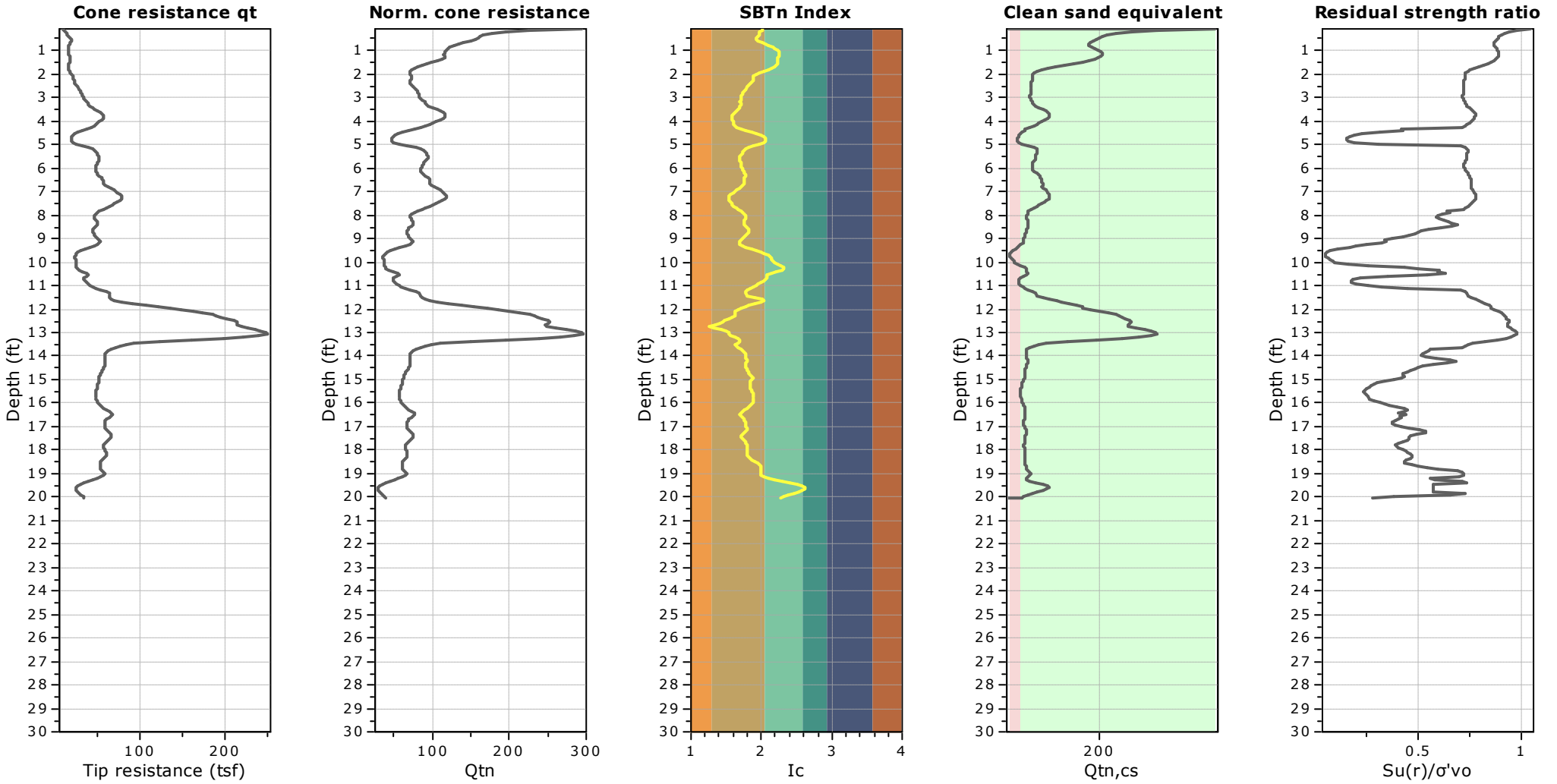
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-20
Total depth: 20.08 ft, Date: 5/14/2024
Surface Elevation: 65.26 ft
Coords: X:572524.84, Y:556012.66
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

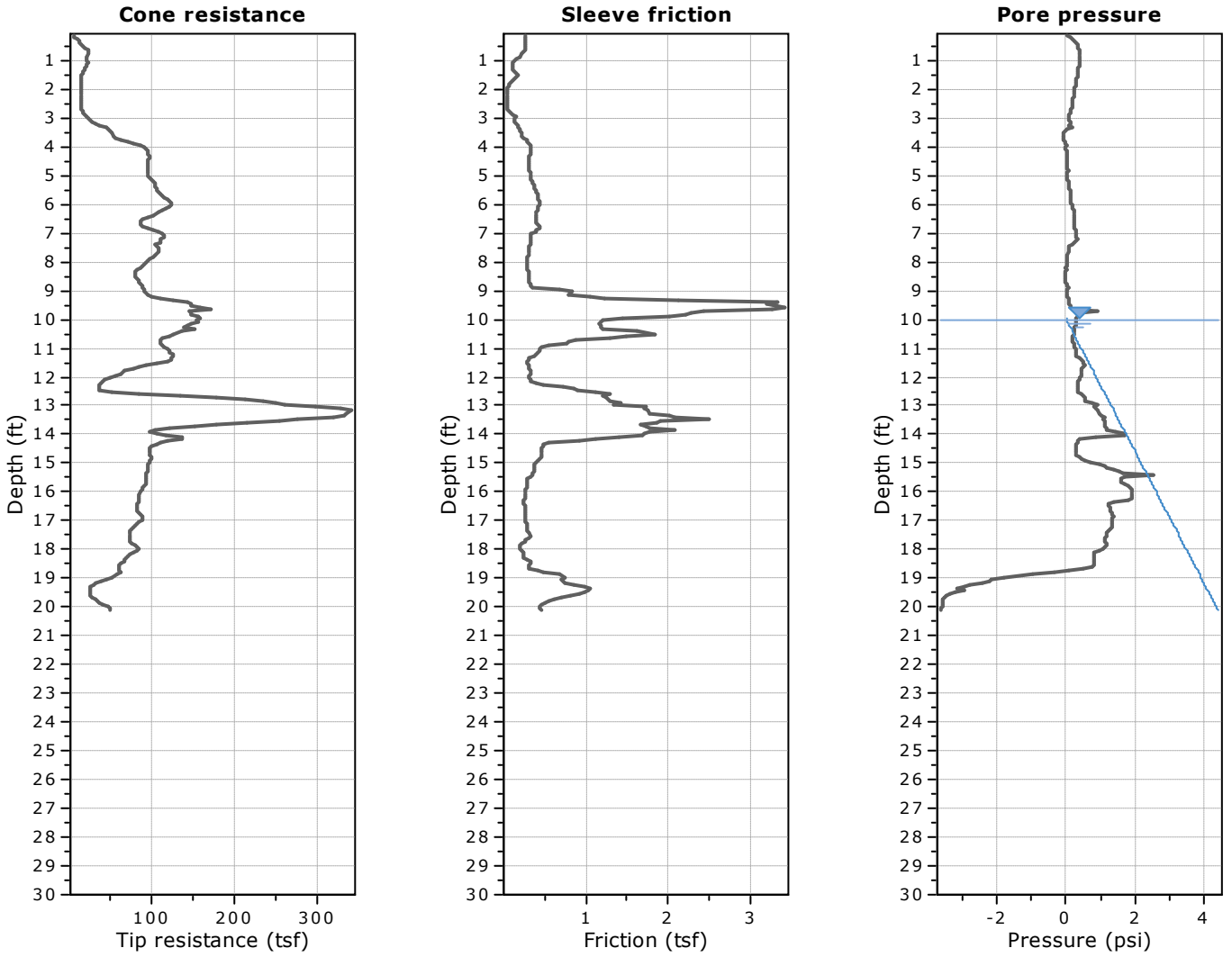
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



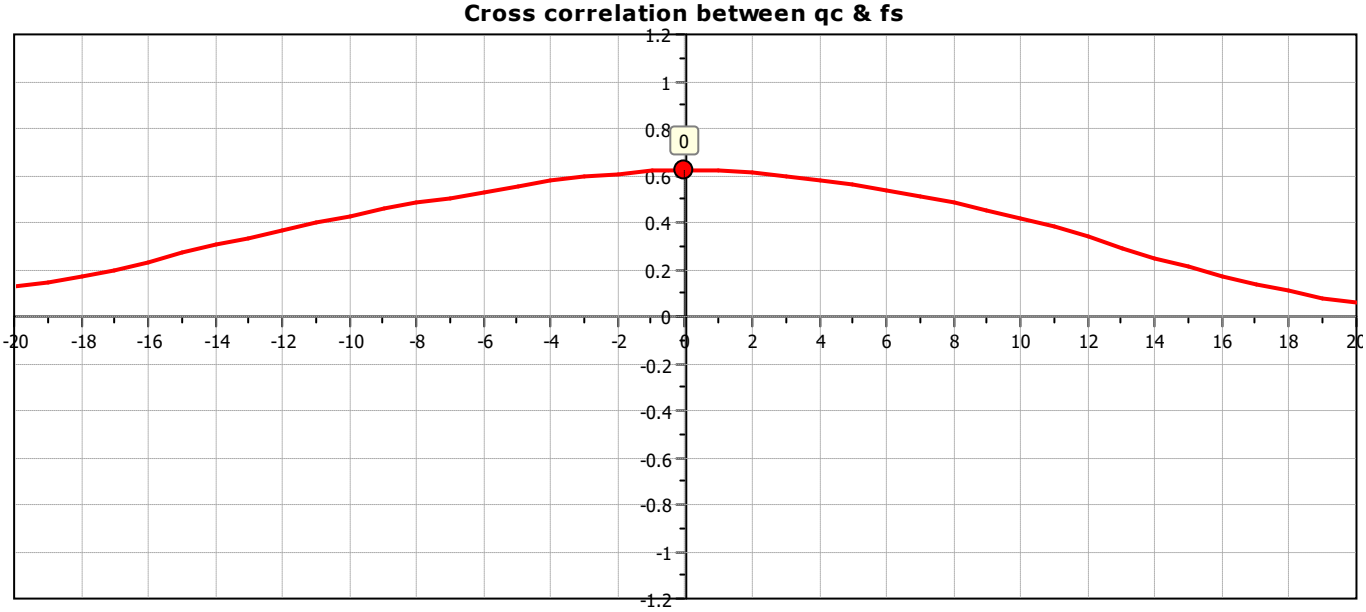
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

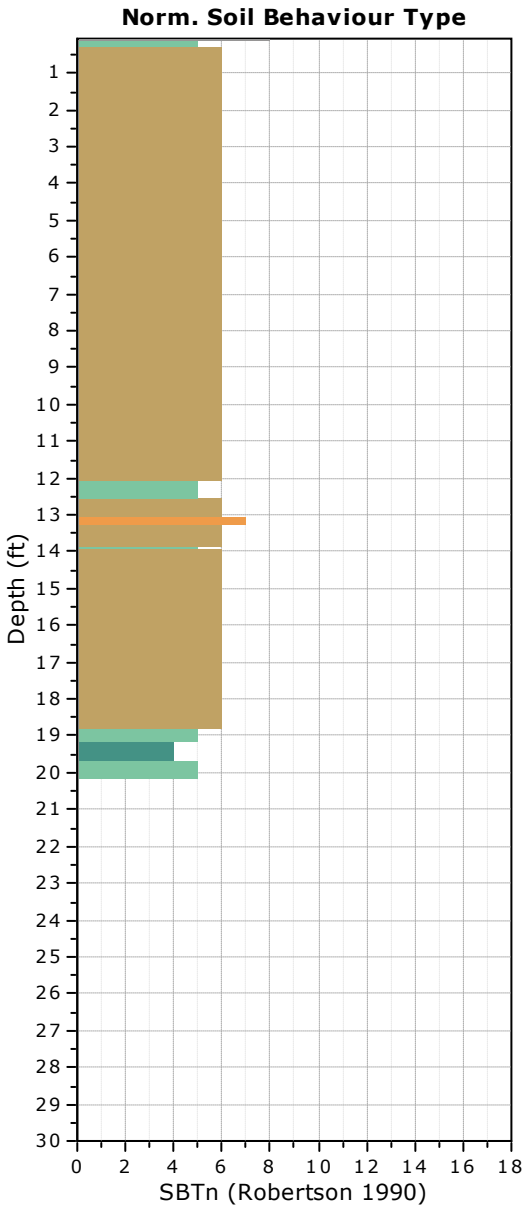
C-21
Total depth: 20.13 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572470.70, Y:555968.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

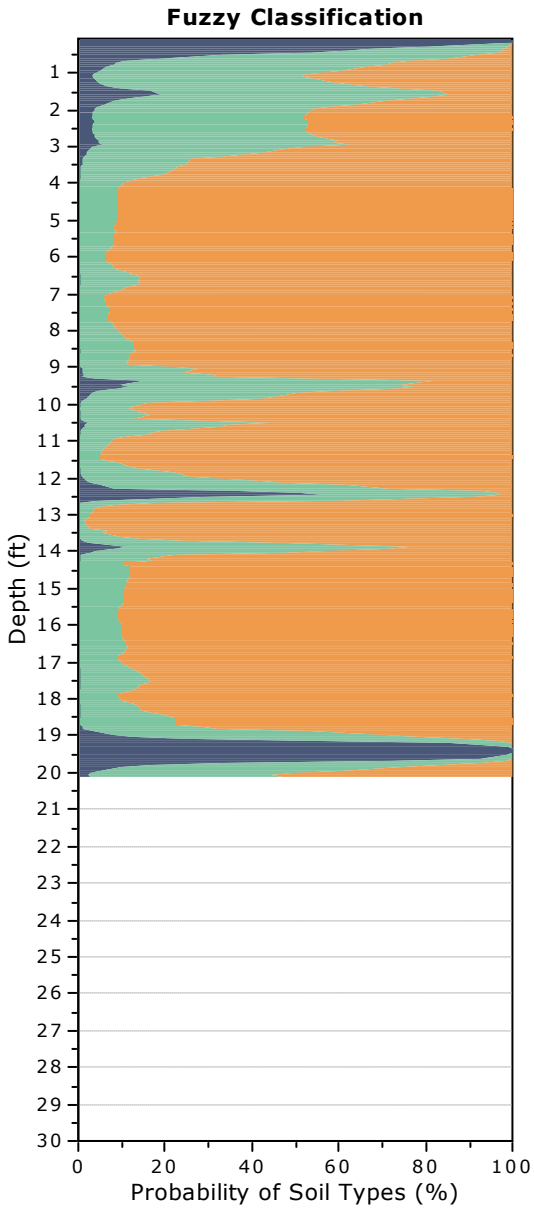
Project: ASD Summit Campus
Location: Middletown, Delaware



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







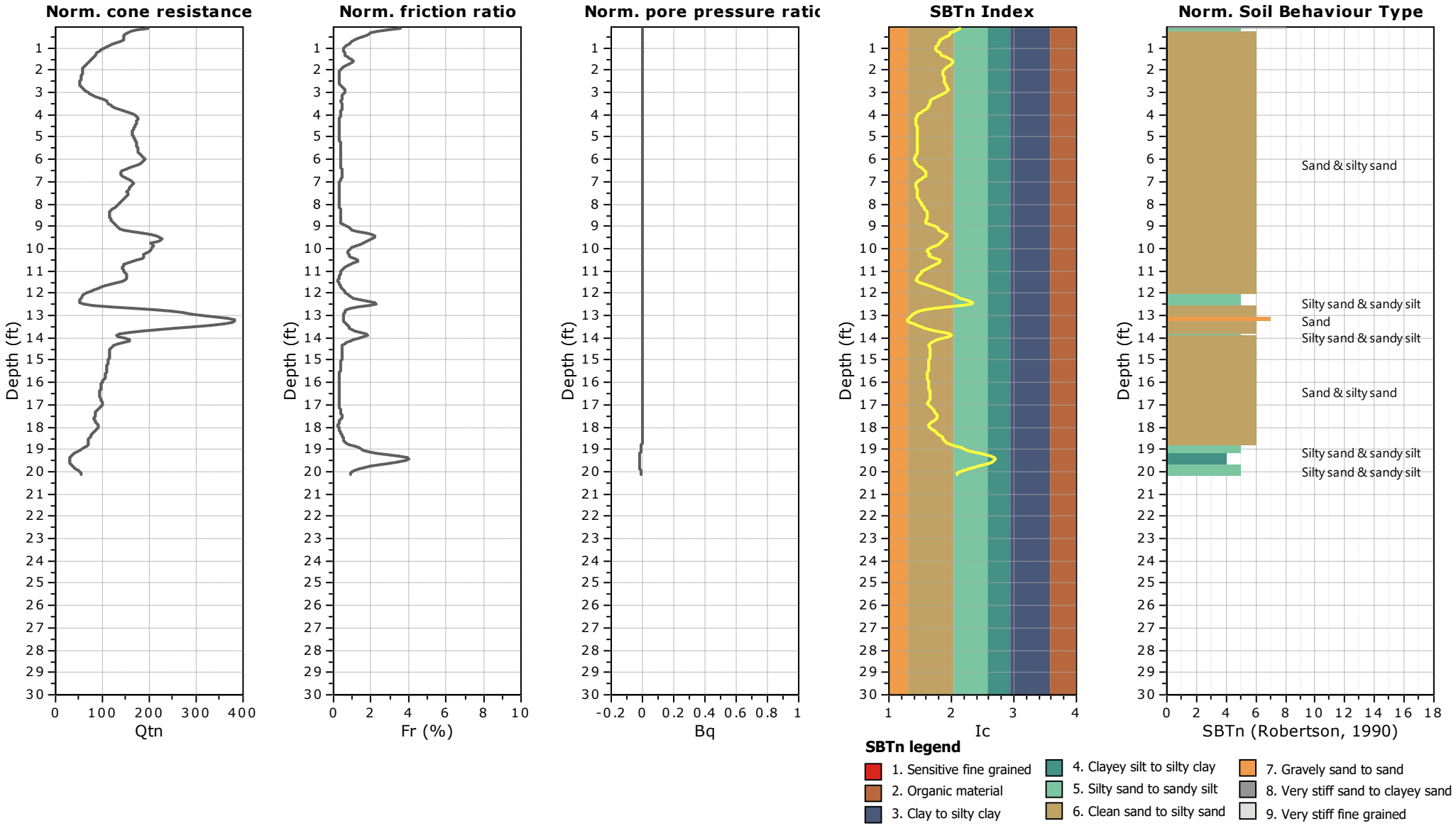
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-21
Total depth: 20.13 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572470.70, Y:555968.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

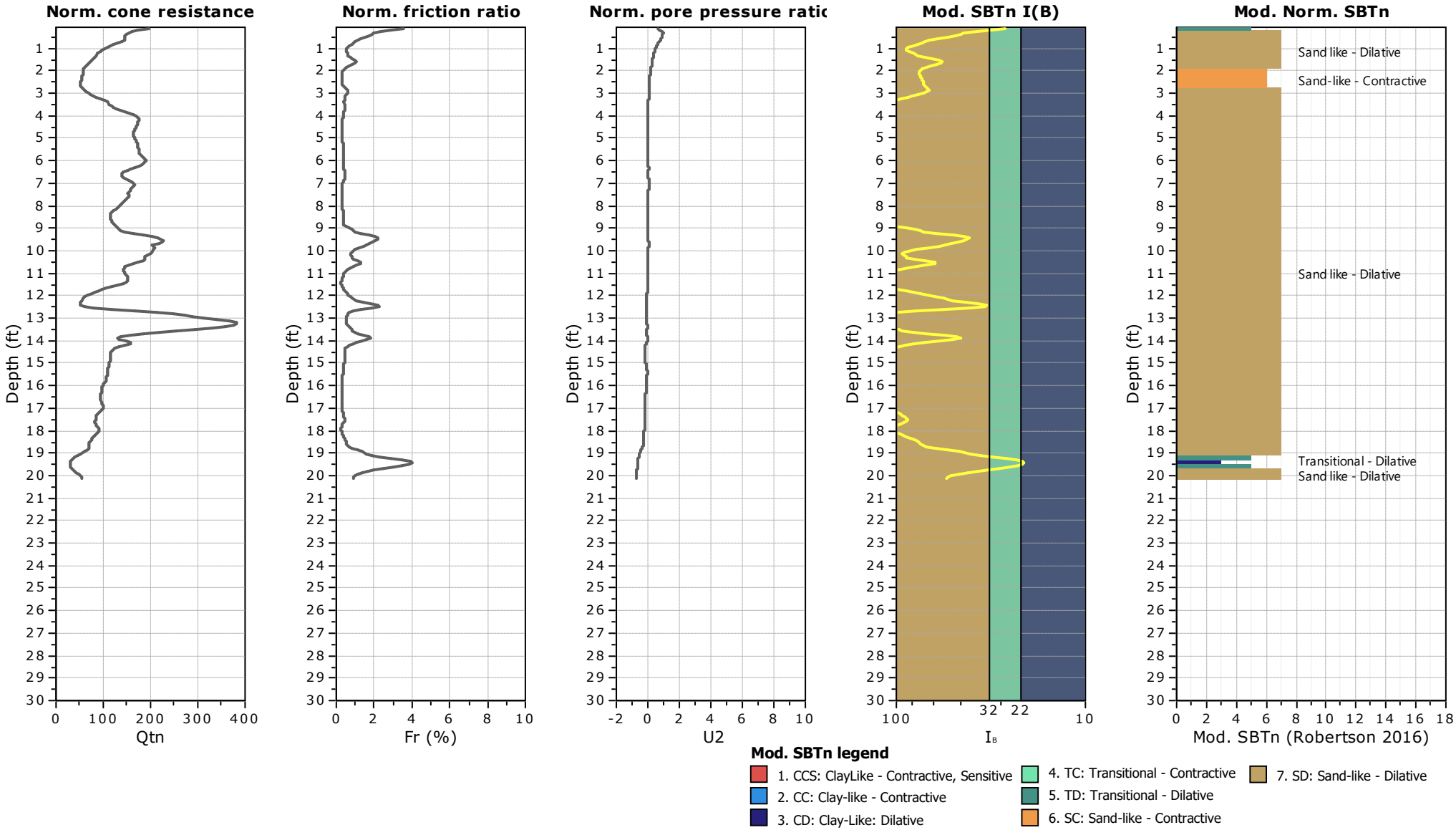
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-21
Total depth: 20.13 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572470.70, Y:555968.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

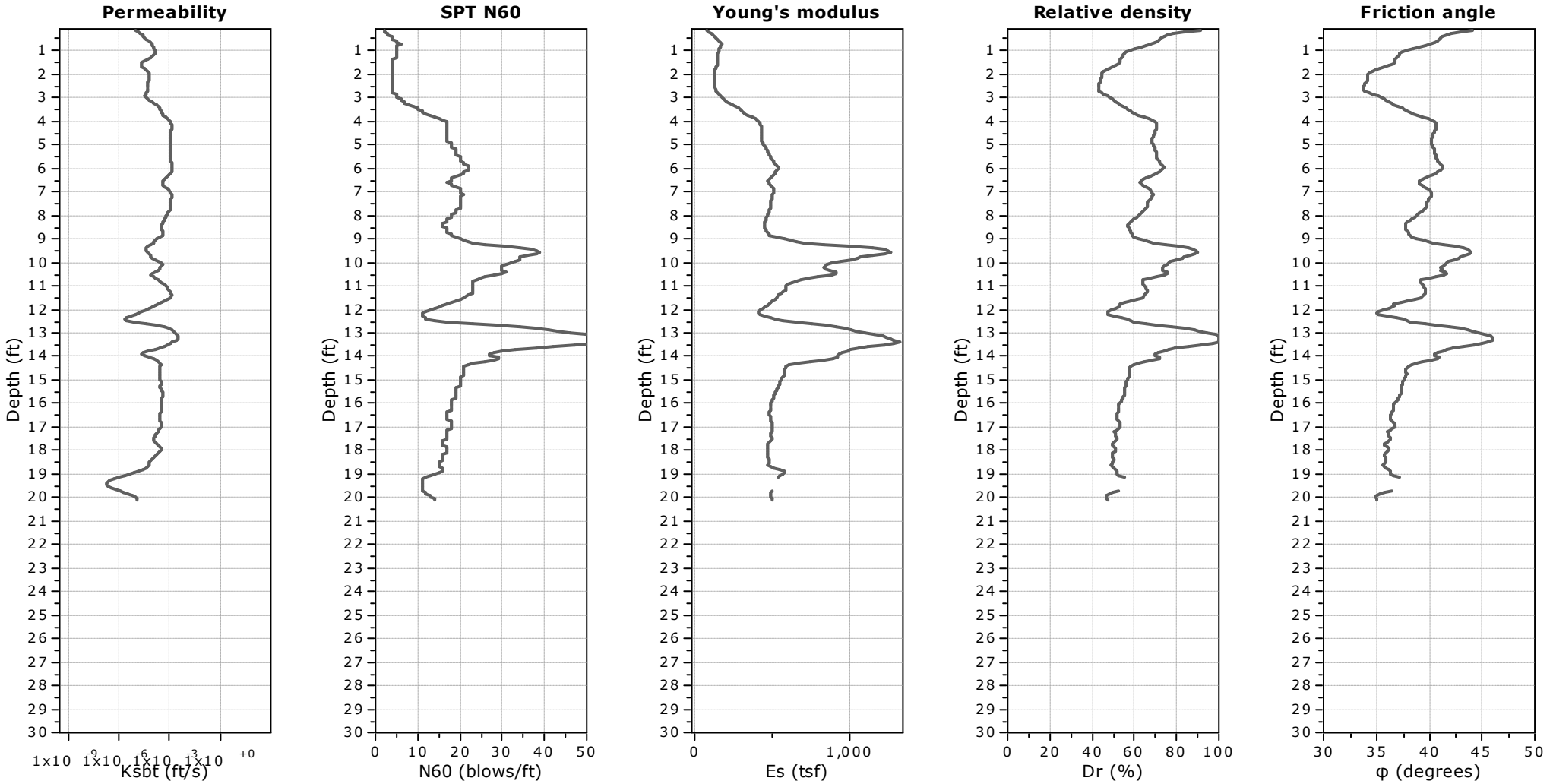
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-21
Total depth: 20.13 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572470.70, Y:555968.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



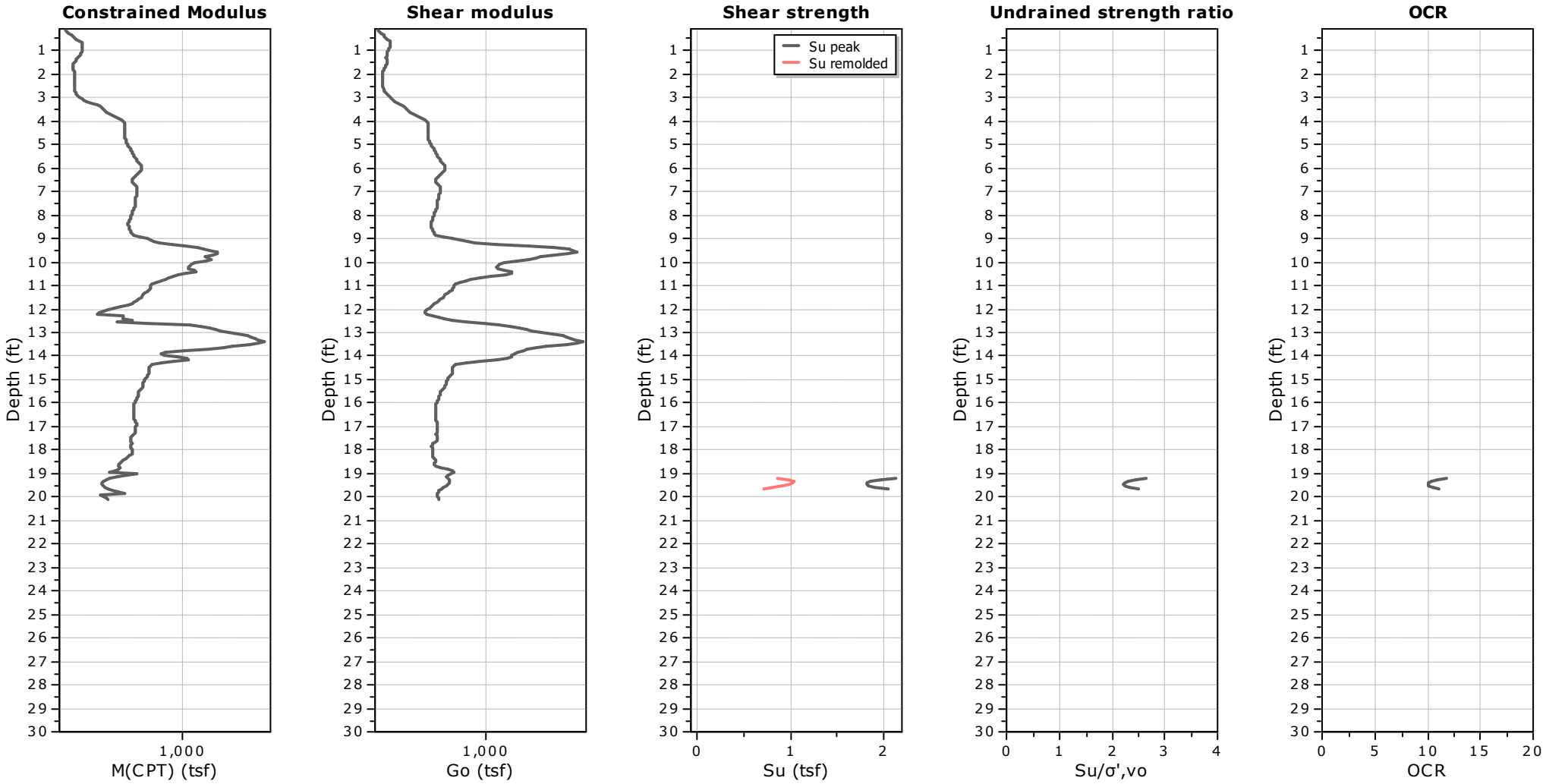
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-21
Total depth: 20.13 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572470.70, Y:555968.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



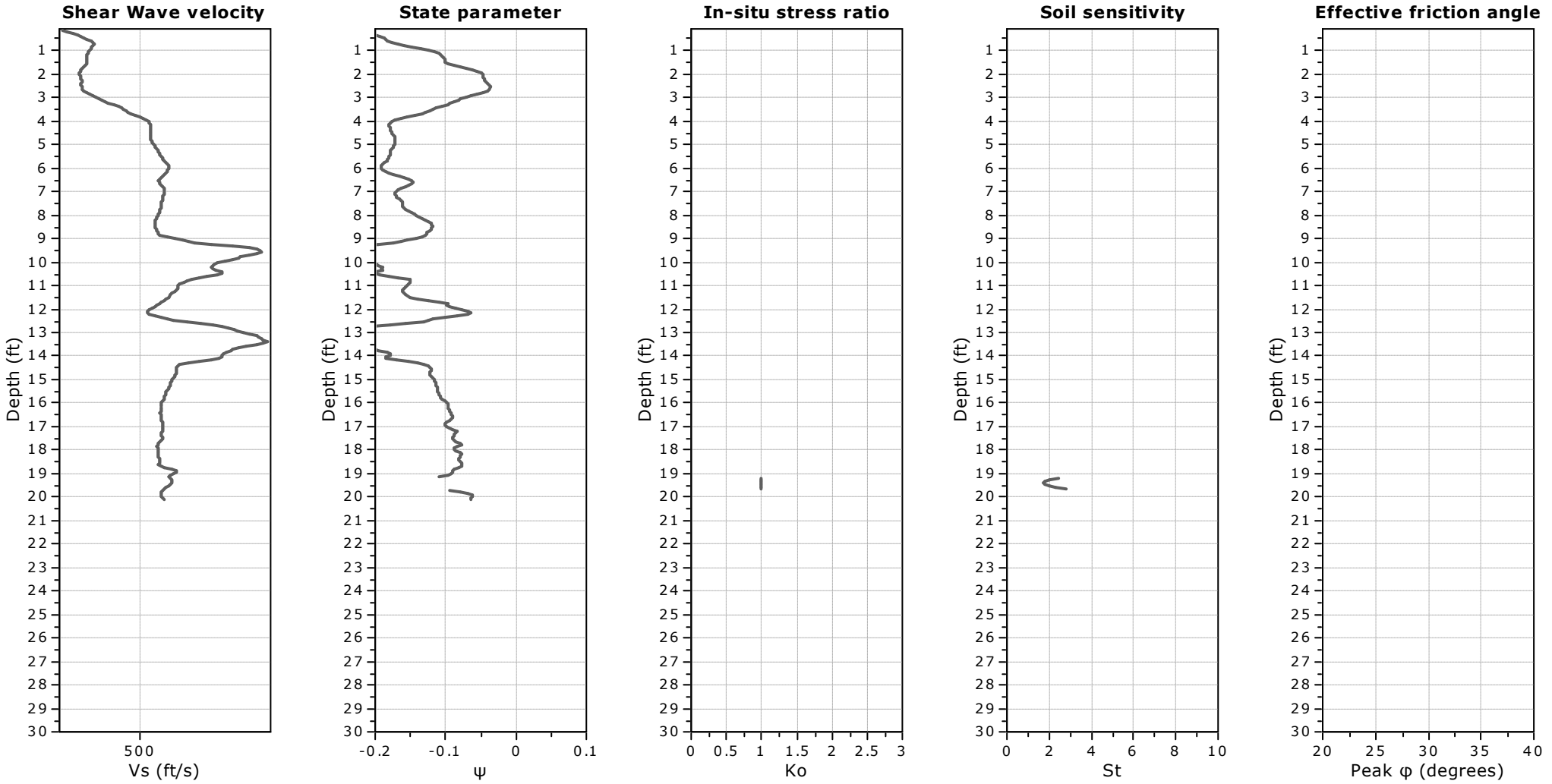
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-21
Total depth: 20.13 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572470.70, Y:555968.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



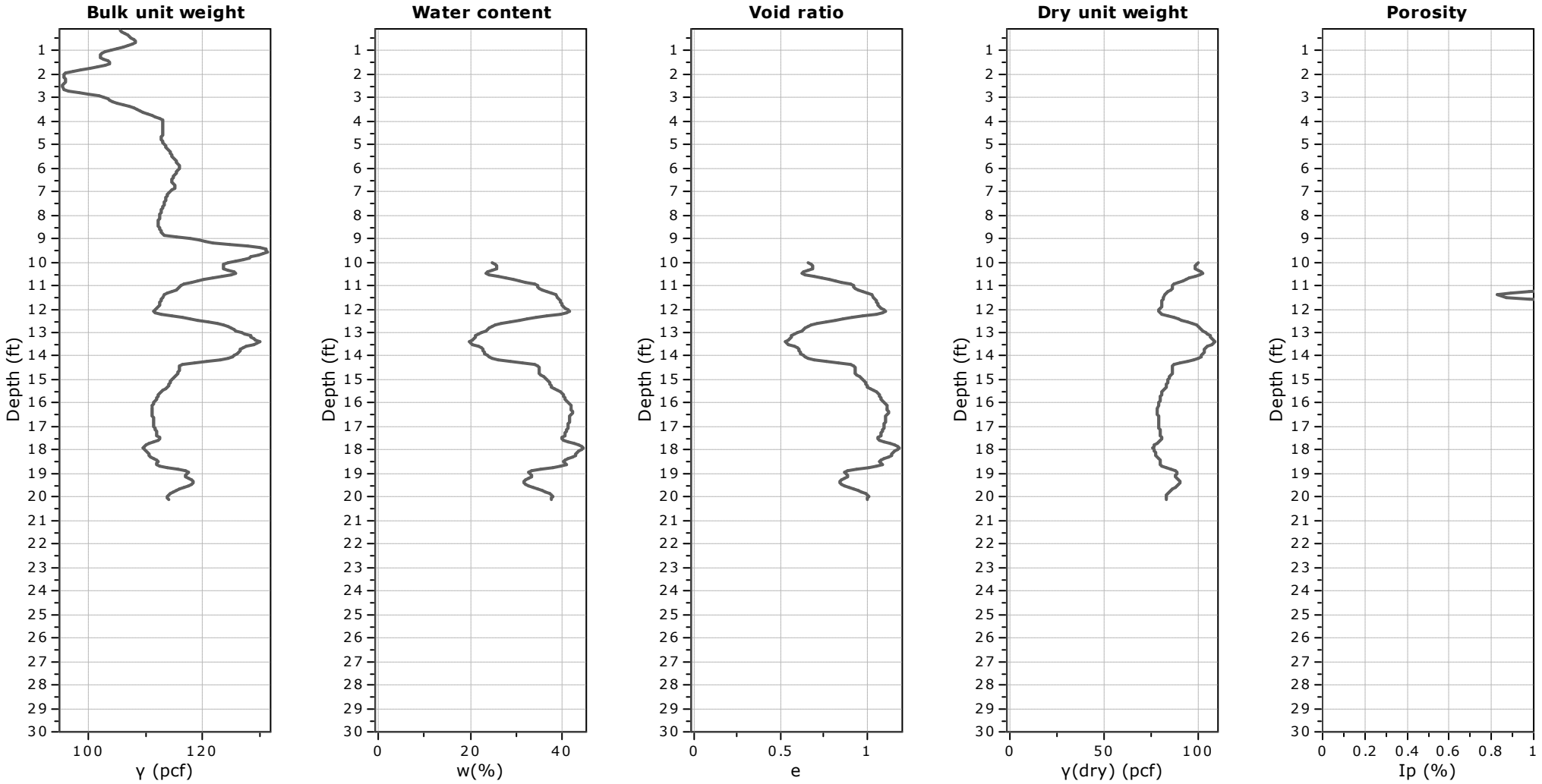
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-21
Total depth: 20.13 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572470.70, Y:555968.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

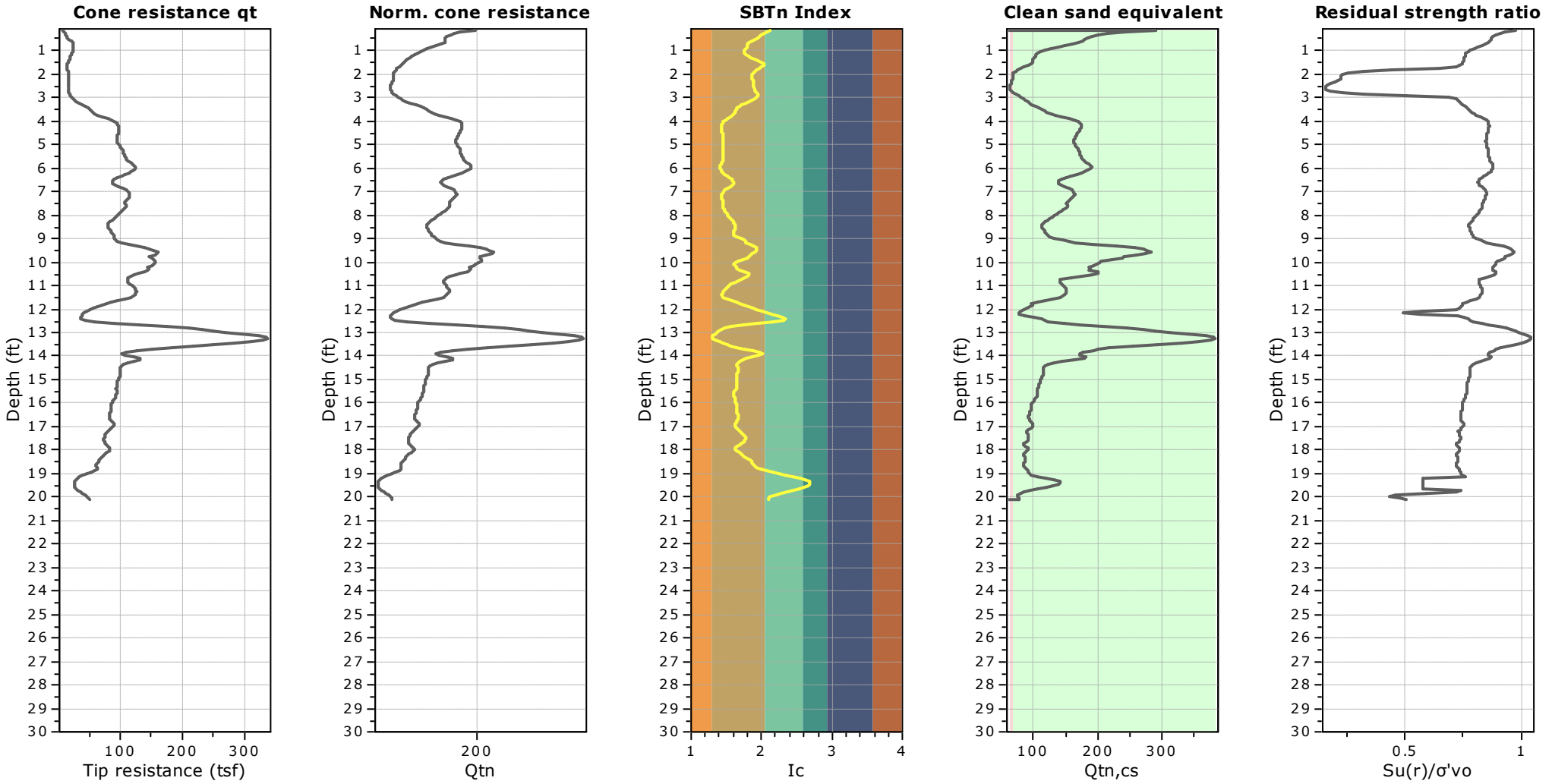
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-21
Total depth: 20.13 ft, Date: 5/14/2024
Surface Elevation: 65.32 ft
Coords: X:572470.70, Y:555968.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

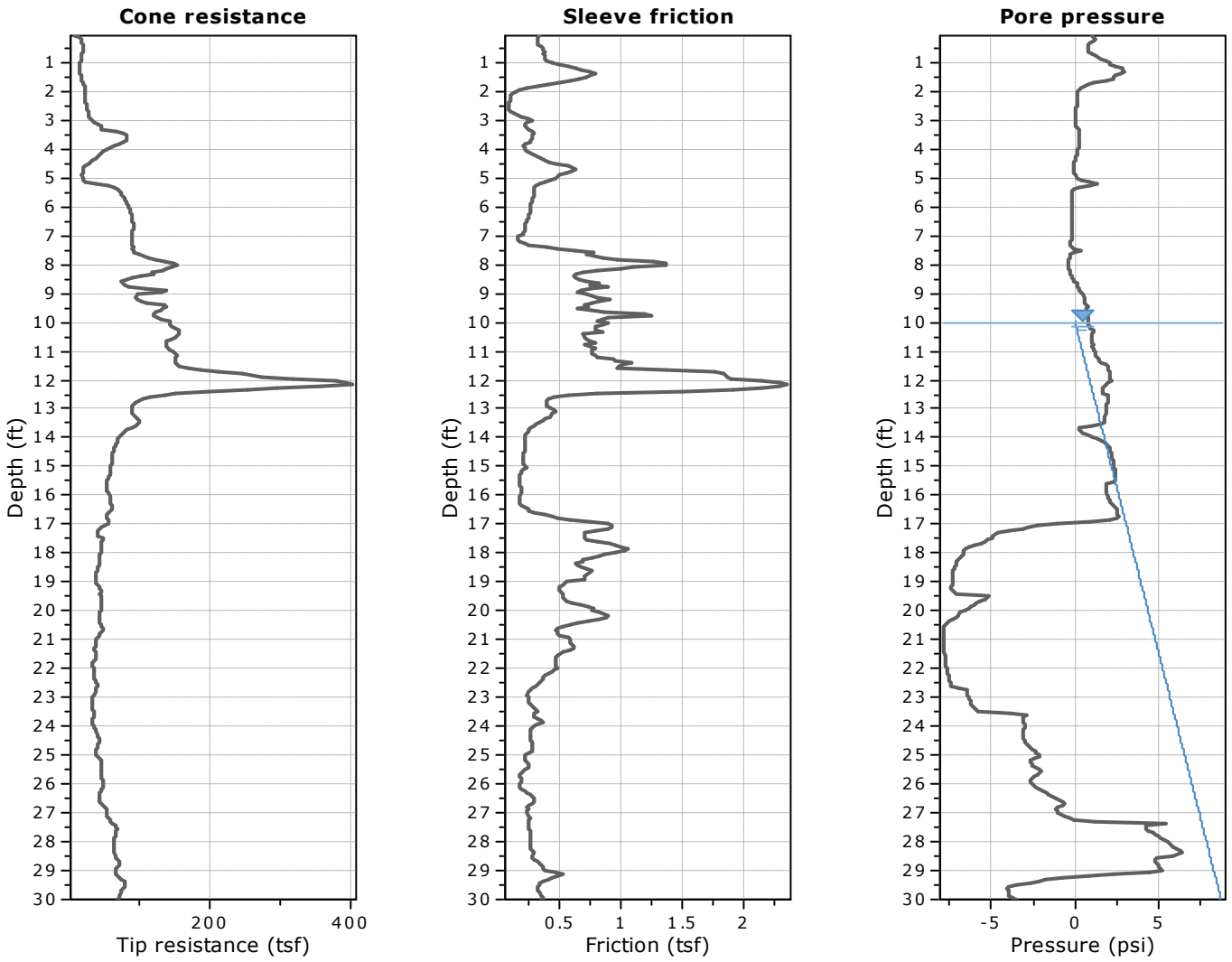
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



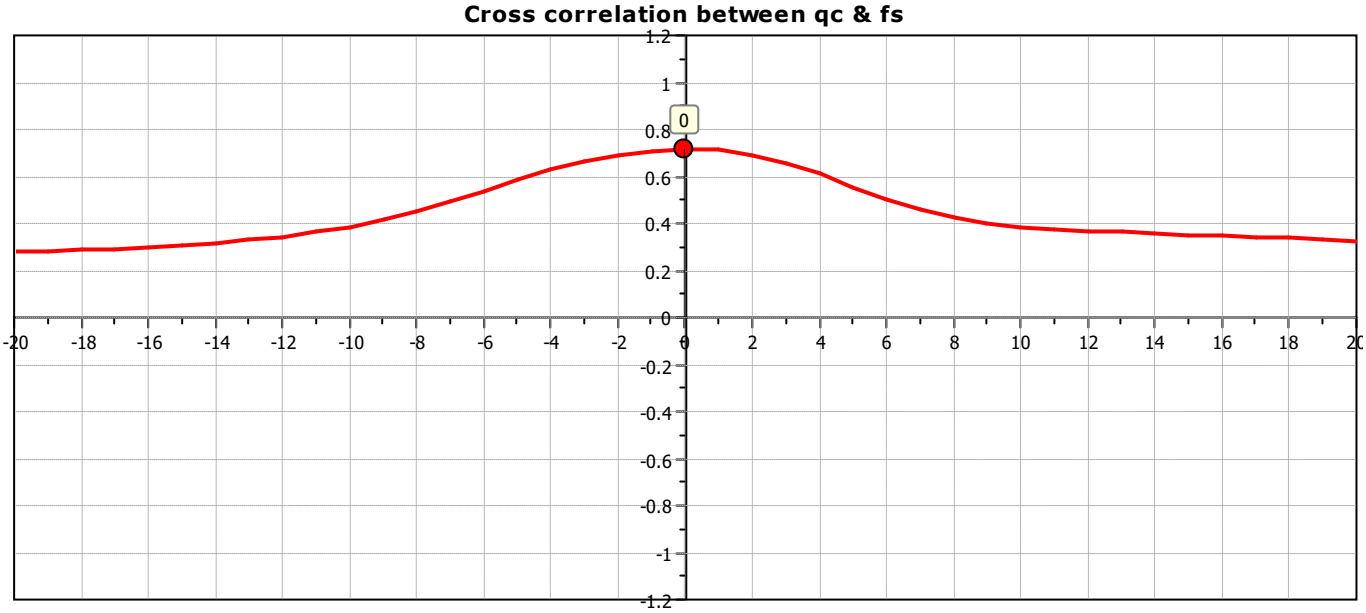
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-22
Total depth: 30.11 ft, Date: 5/13/2024
Surface Elevation: 63.04 ft
Coords: X:572448.29, Y:555866.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



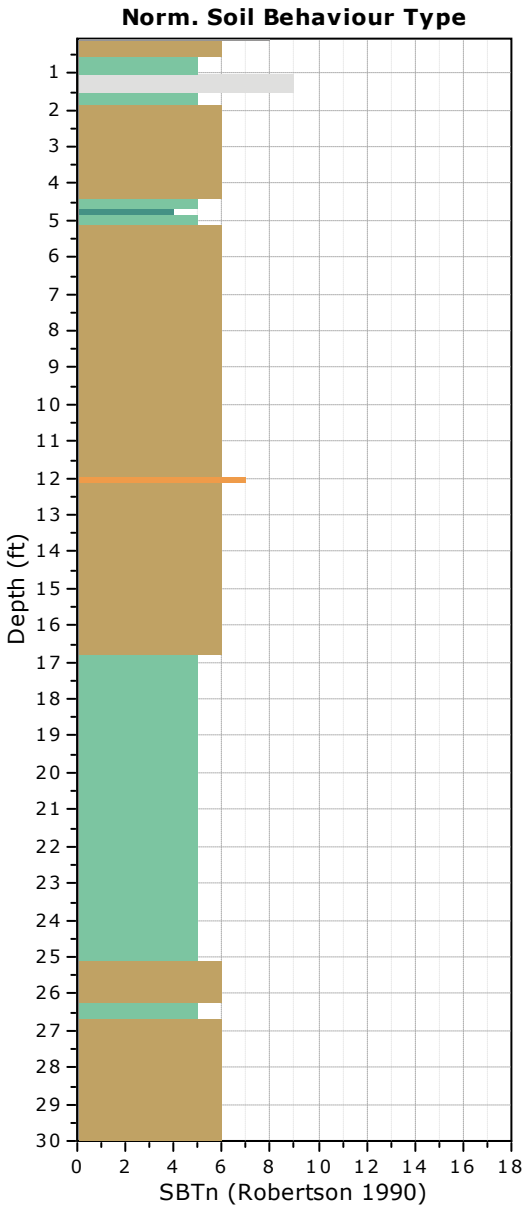
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

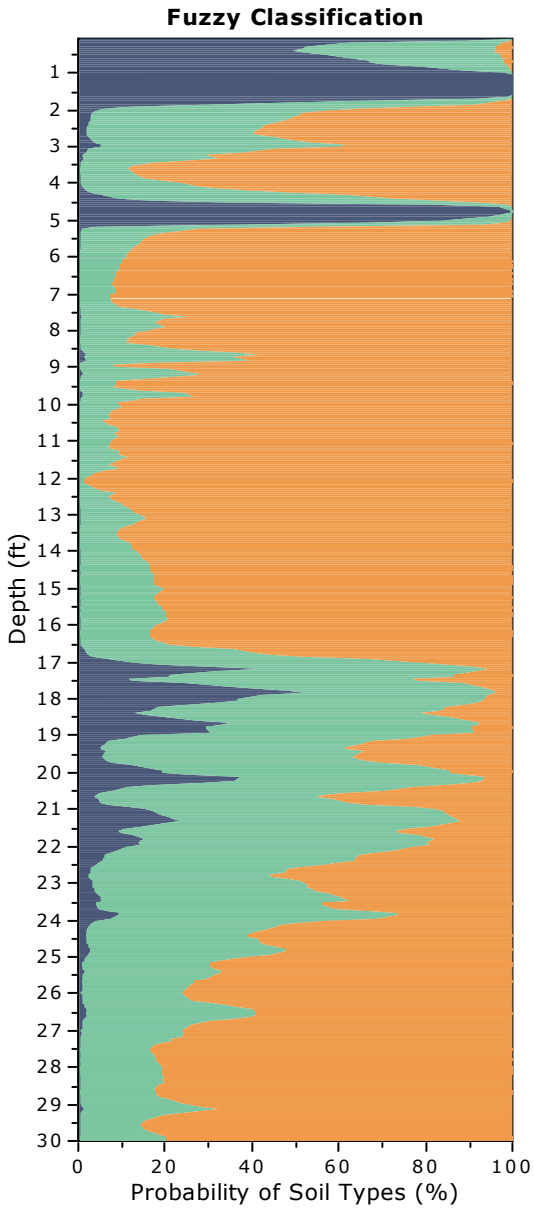


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-22
Total depth: 30.11 ft, Date: 5/13/2024
Surface Elevation: 63.04 ft
Coords: X:572448.29, Y:555866.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



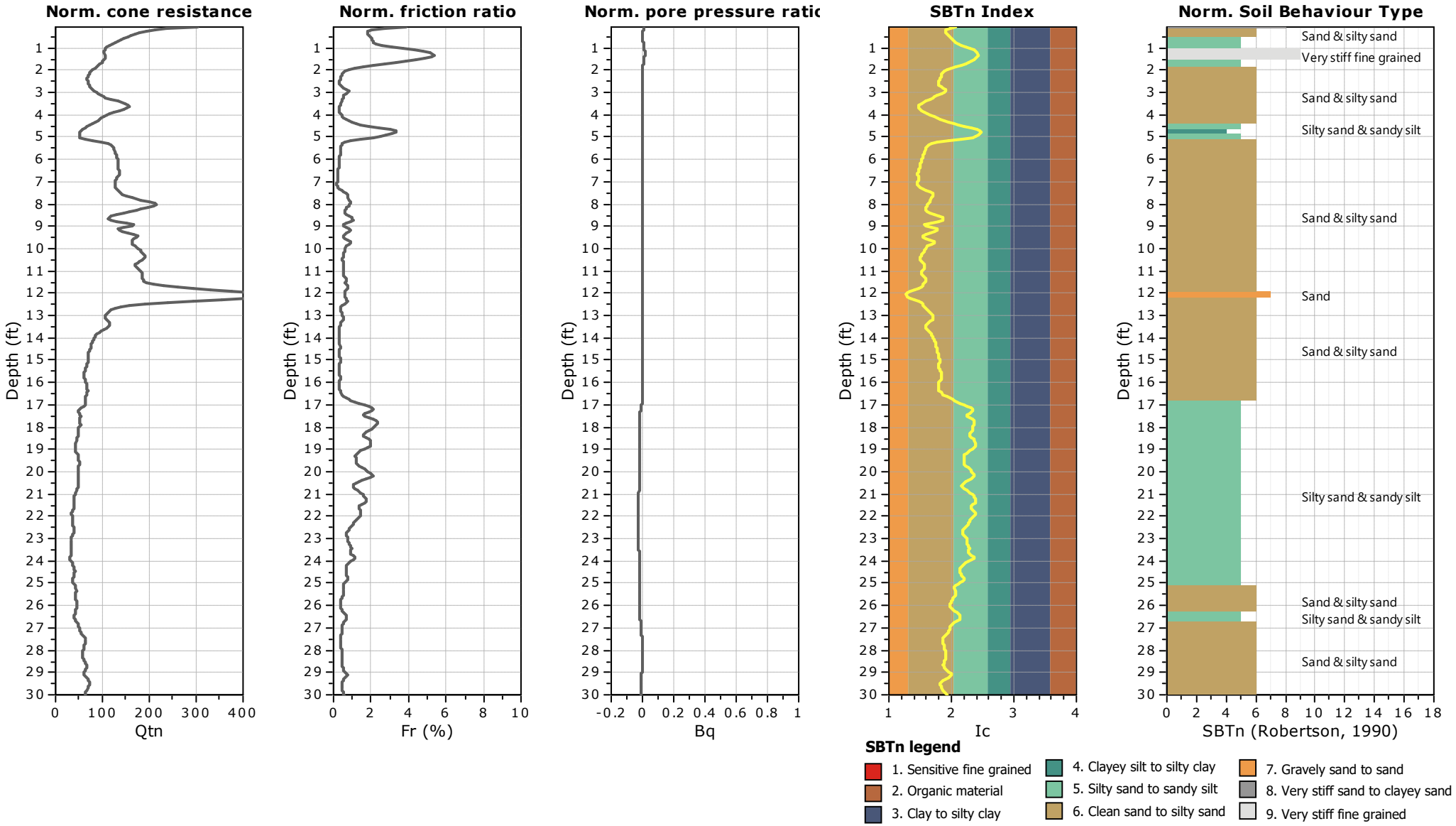


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-22
Total depth: 30.11 ft, Date: 5/13/2024
Surface Elevation: 63.04 ft
Coords: X:572448.29, Y:555866.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

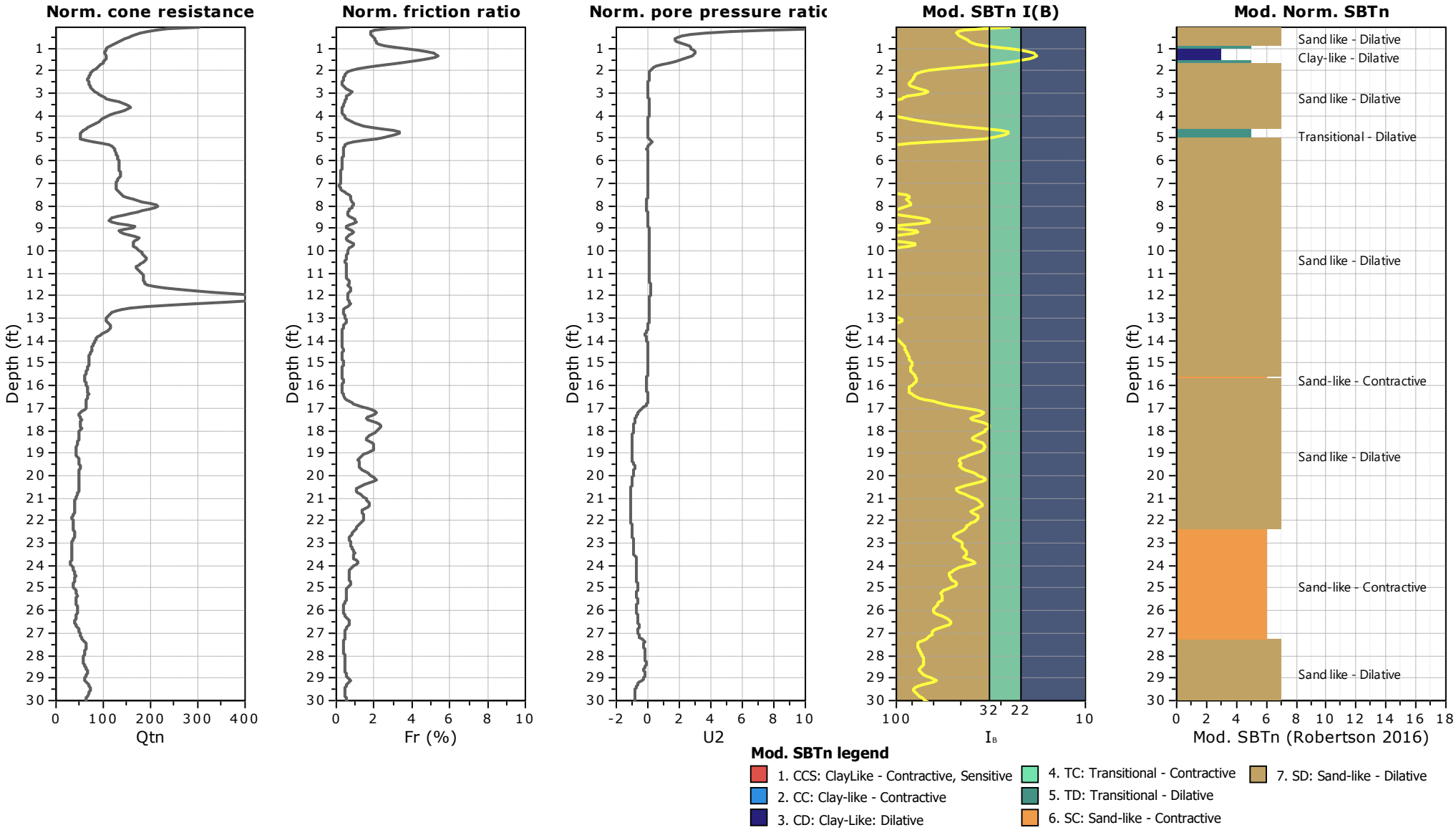
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-22
Total depth: 30.11 ft, Date: 5/13/2024
Surface Elevation: 63.04 ft
Coords: X:572448.29, Y:555866.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

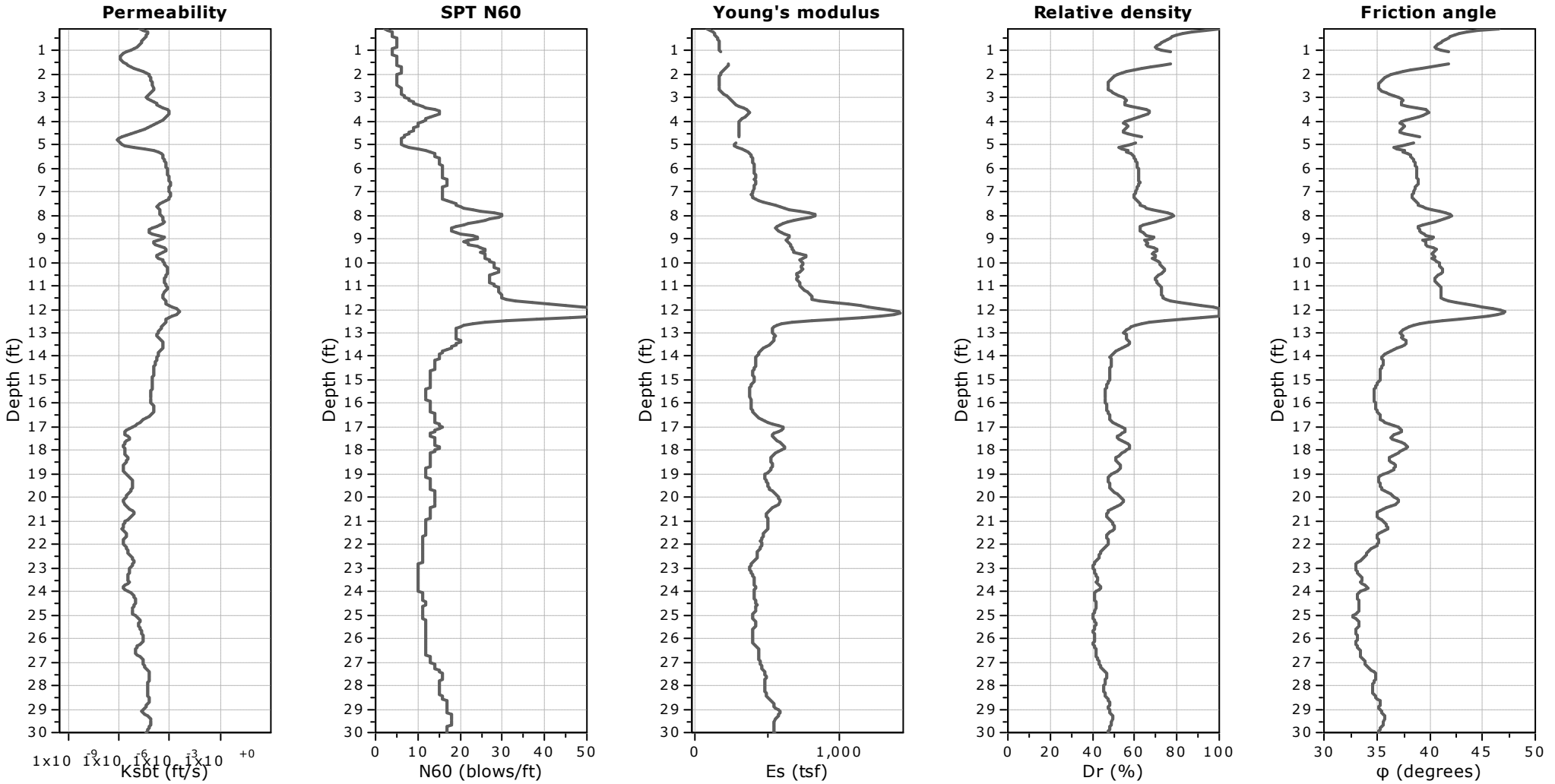
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-22
Total depth: 30.11 ft, Date: 5/13/2024
Surface Elevation: 63.04 ft
Coords: X:572448.29, Y:555866.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



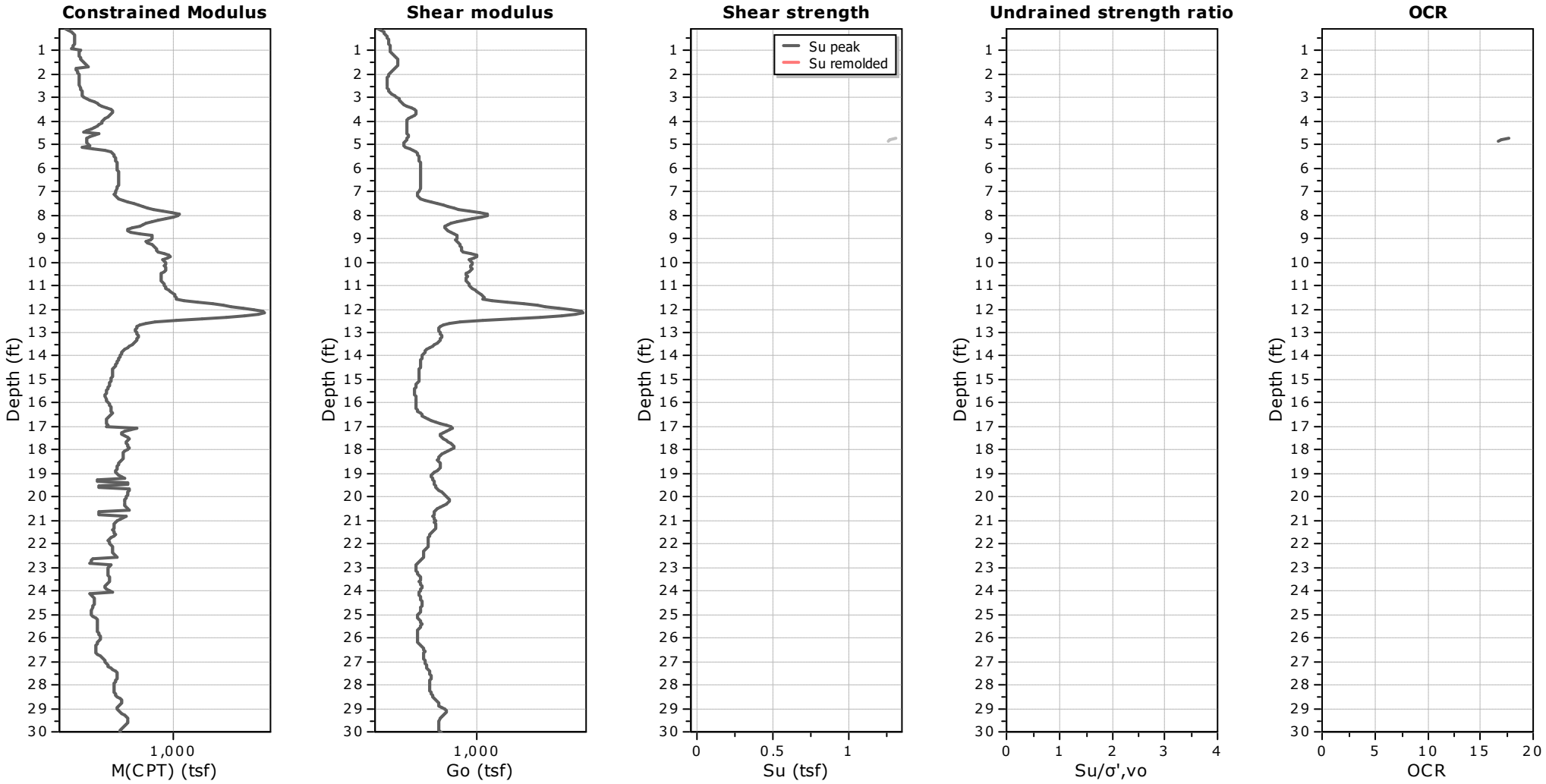
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-22
Total depth: 30.11 ft, Date: 5/13/2024
Surface Elevation: 63.04 ft
Coords: X:572448.29, Y:555866.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



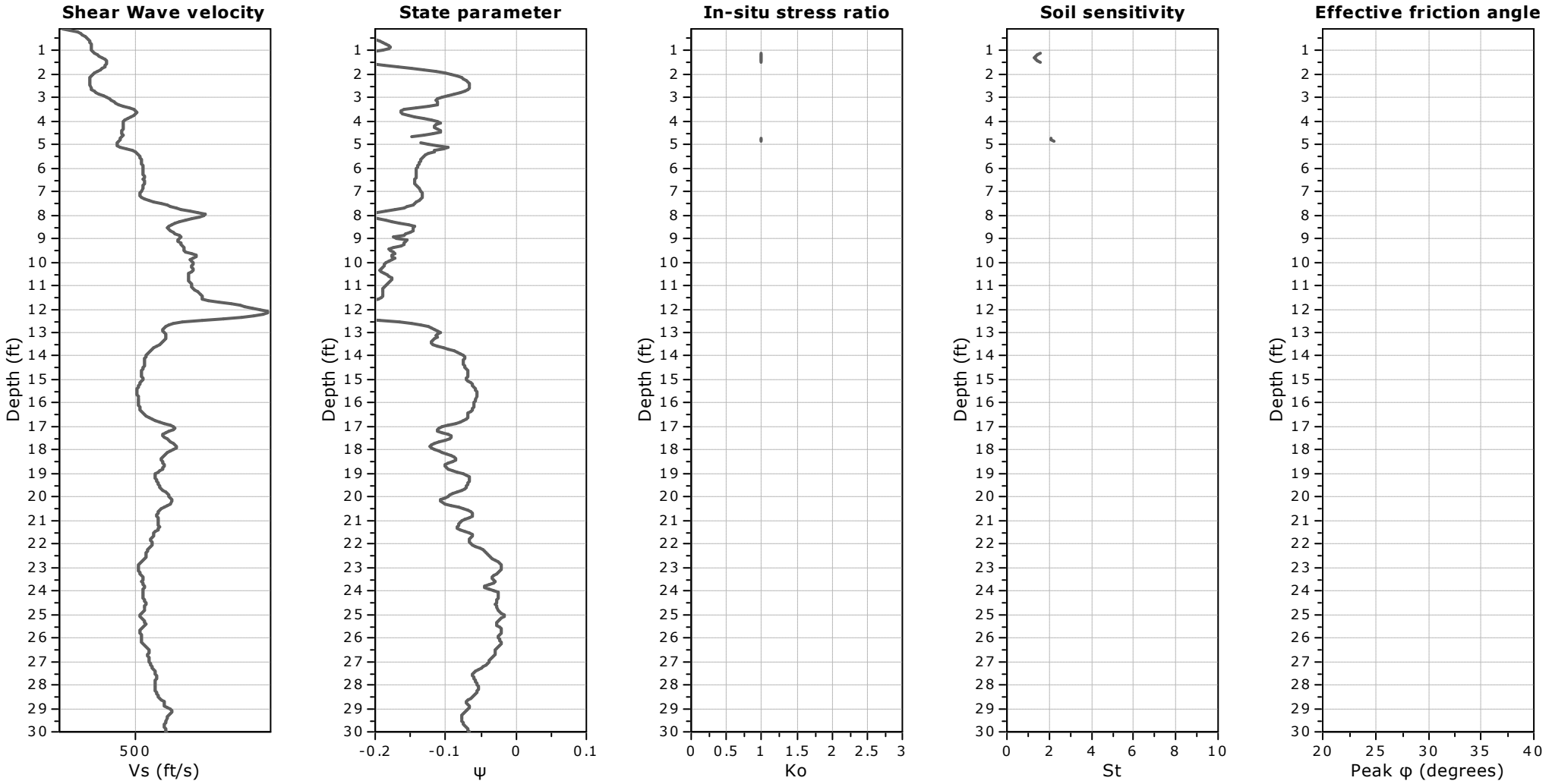
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-22
Total depth: 30.11 ft, Date: 5/13/2024
Surface Elevation: 63.04 ft
Coords: X:572448.29, Y:555866.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



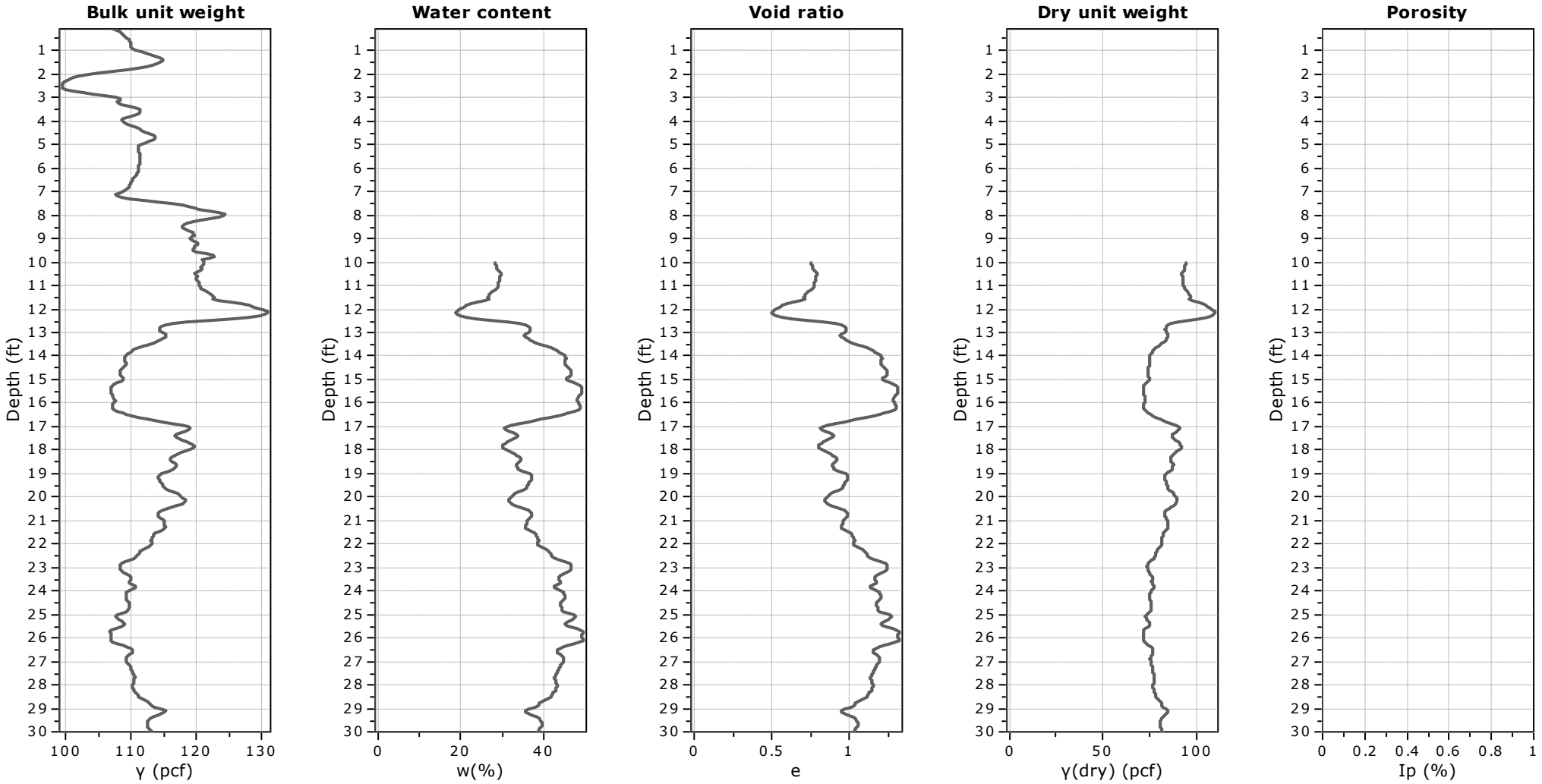
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-22
Total depth: 30.11 ft, Date: 5/13/2024
Surface Elevation: 63.04 ft
Coords: X:572448.29, Y:555866.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

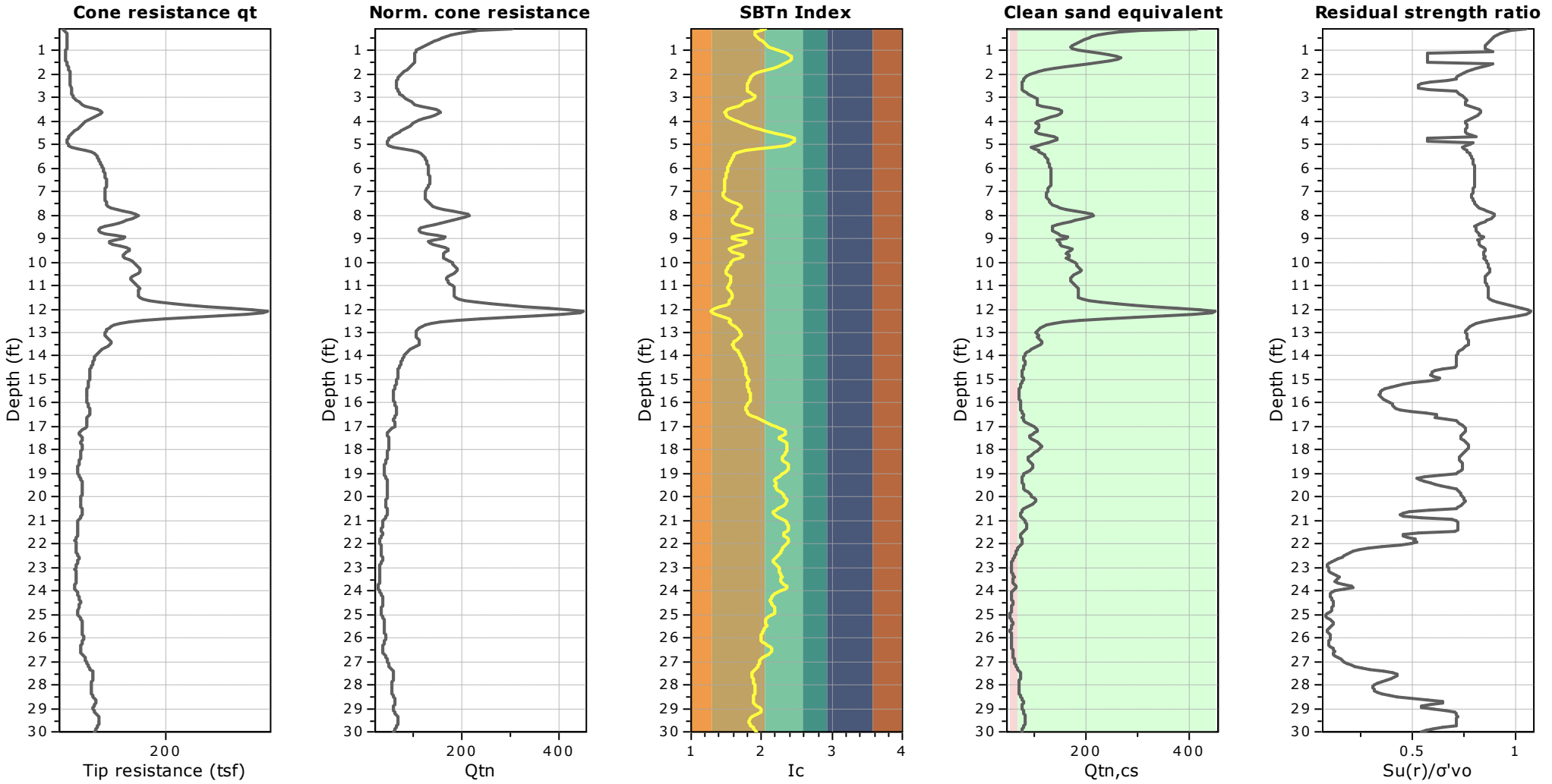
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-22
Total depth: 30.11 ft, Date: 5/13/2024
Surface Elevation: 63.04 ft
Coords: X:572448.29, Y:555866.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

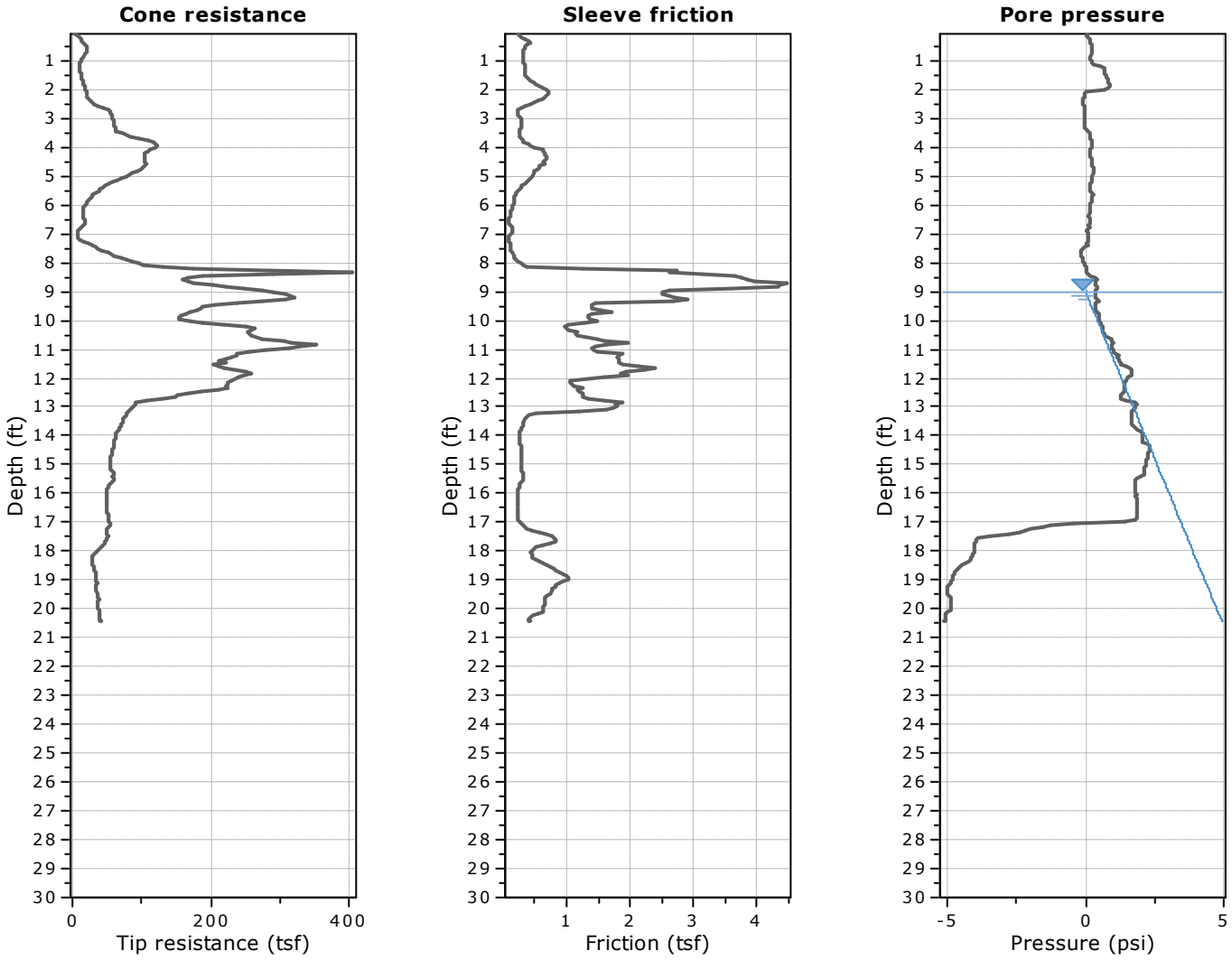
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



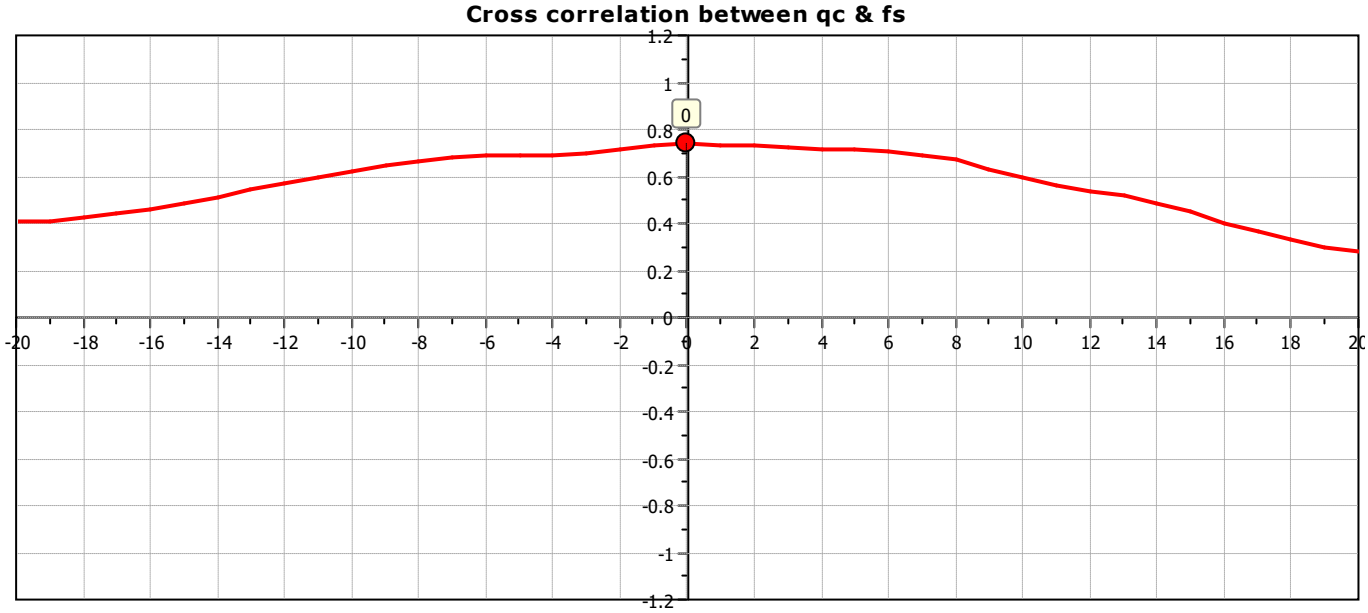
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-23
Total depth: 20.43 ft, Date: 5/14/2024
Surface Elevation: 63.26 ft
Coords: X:572495.24, Y:555878.48
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



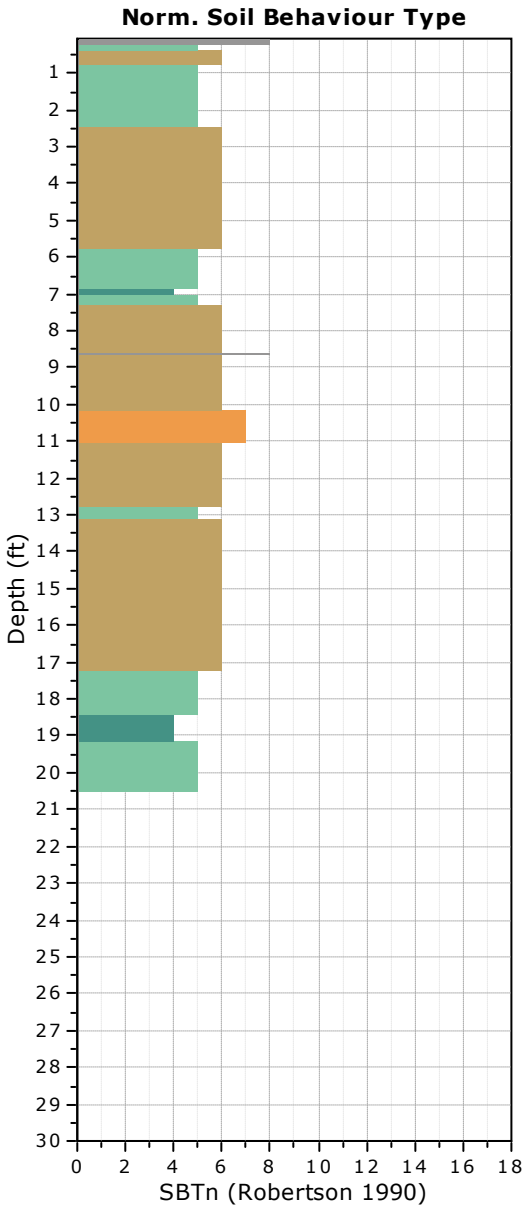
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

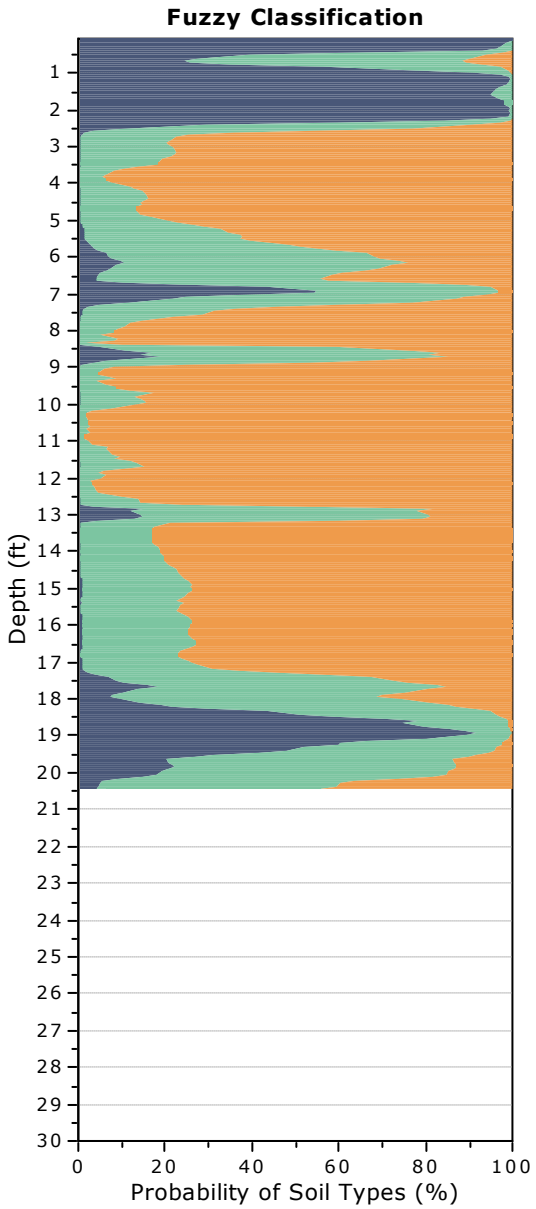


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-23
Total depth: 20.43 ft, Date: 5/14/2024
Surface Elevation: 63.26 ft
Coords: X:572495.24, Y:555878.48
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



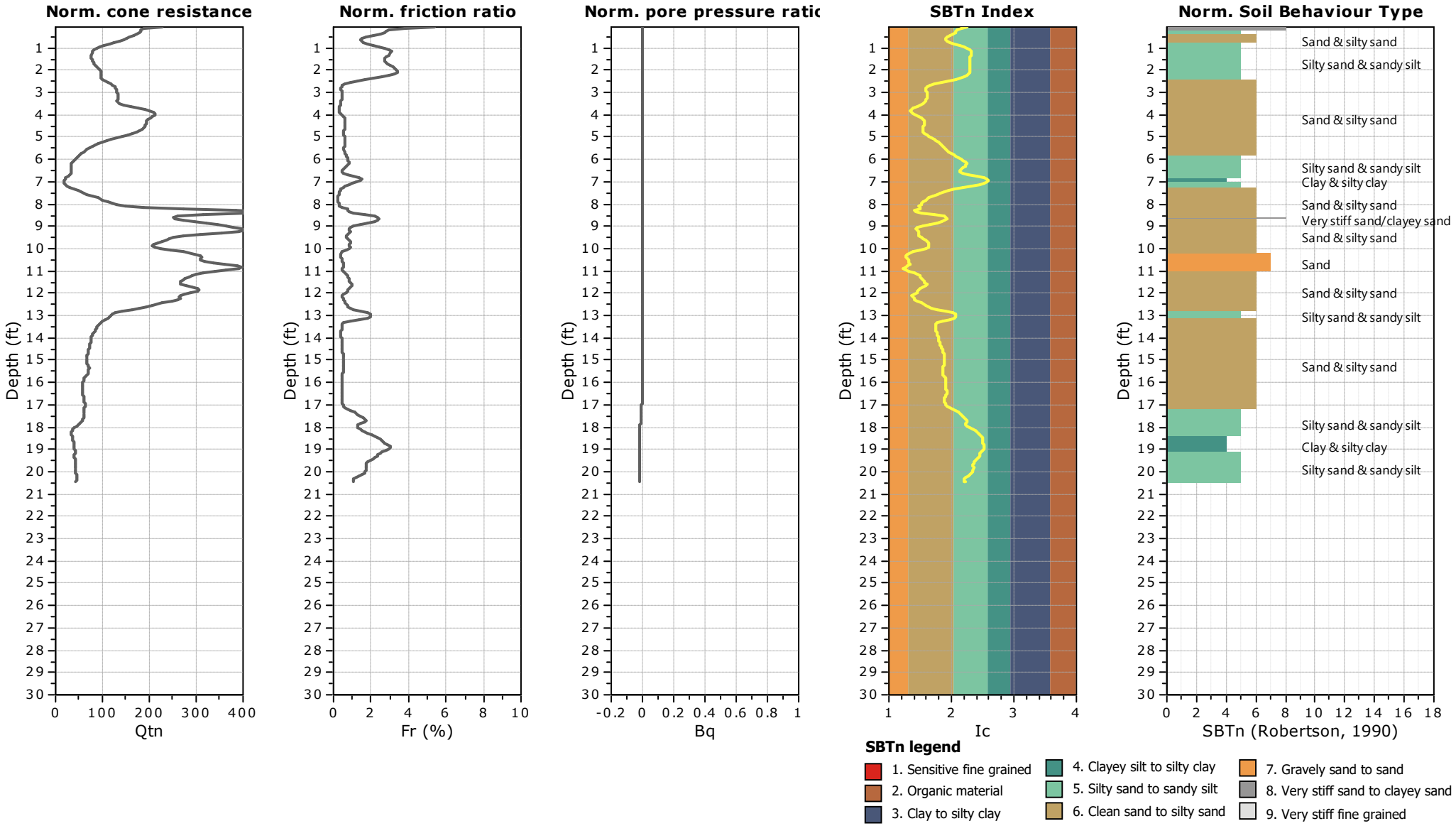


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

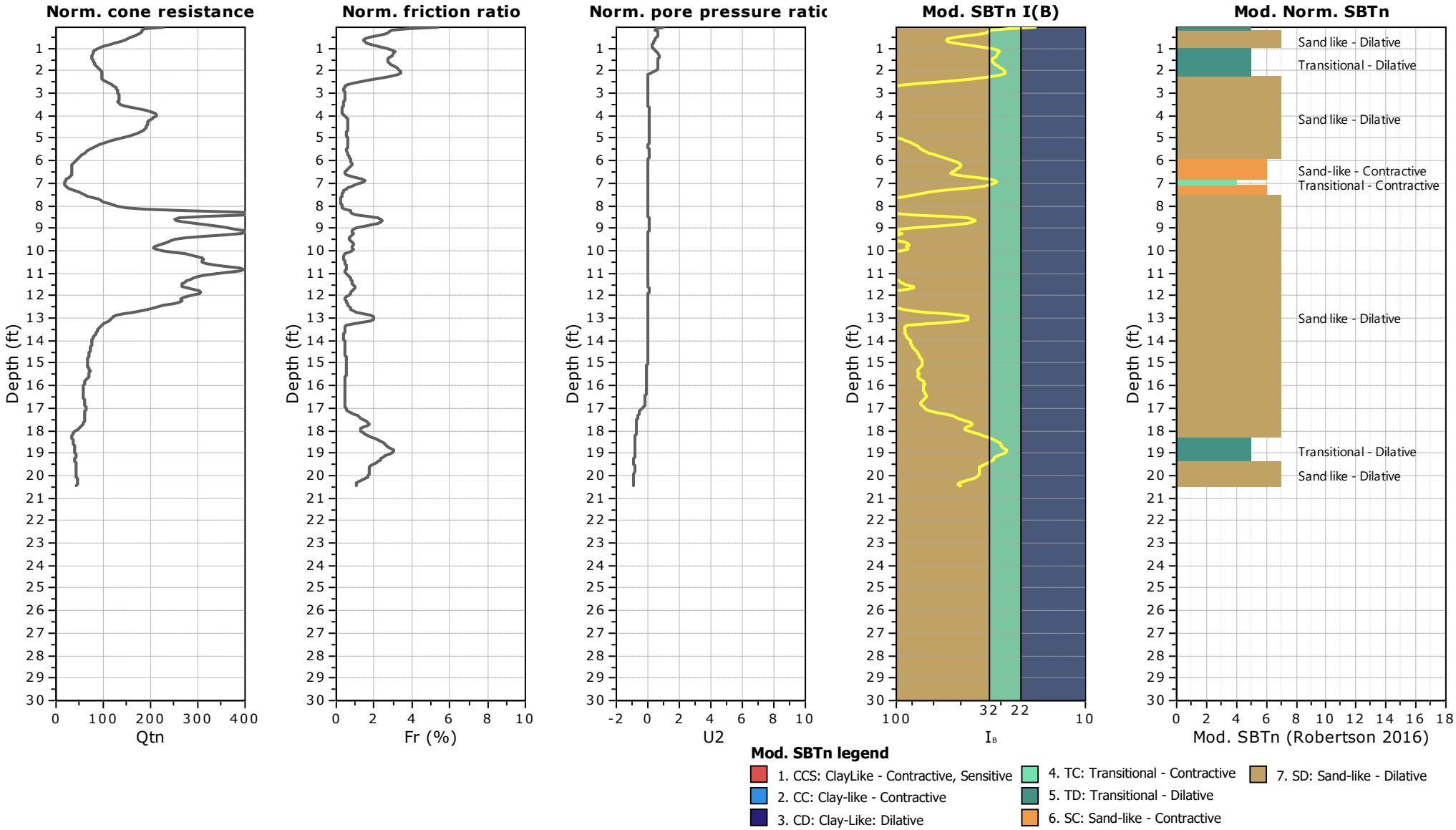
C-23
Total depth: 20.43 ft, Date: 5/14/2024
Surface Elevation: 63.26 ft
Coords: X:572495.24, Y:555878.48
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-23
Total depth: 20.43 ft, Date: 5/14/2024
Surface Elevation: 63.26 ft
Coords: X:572495.24, Y:555878.48
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

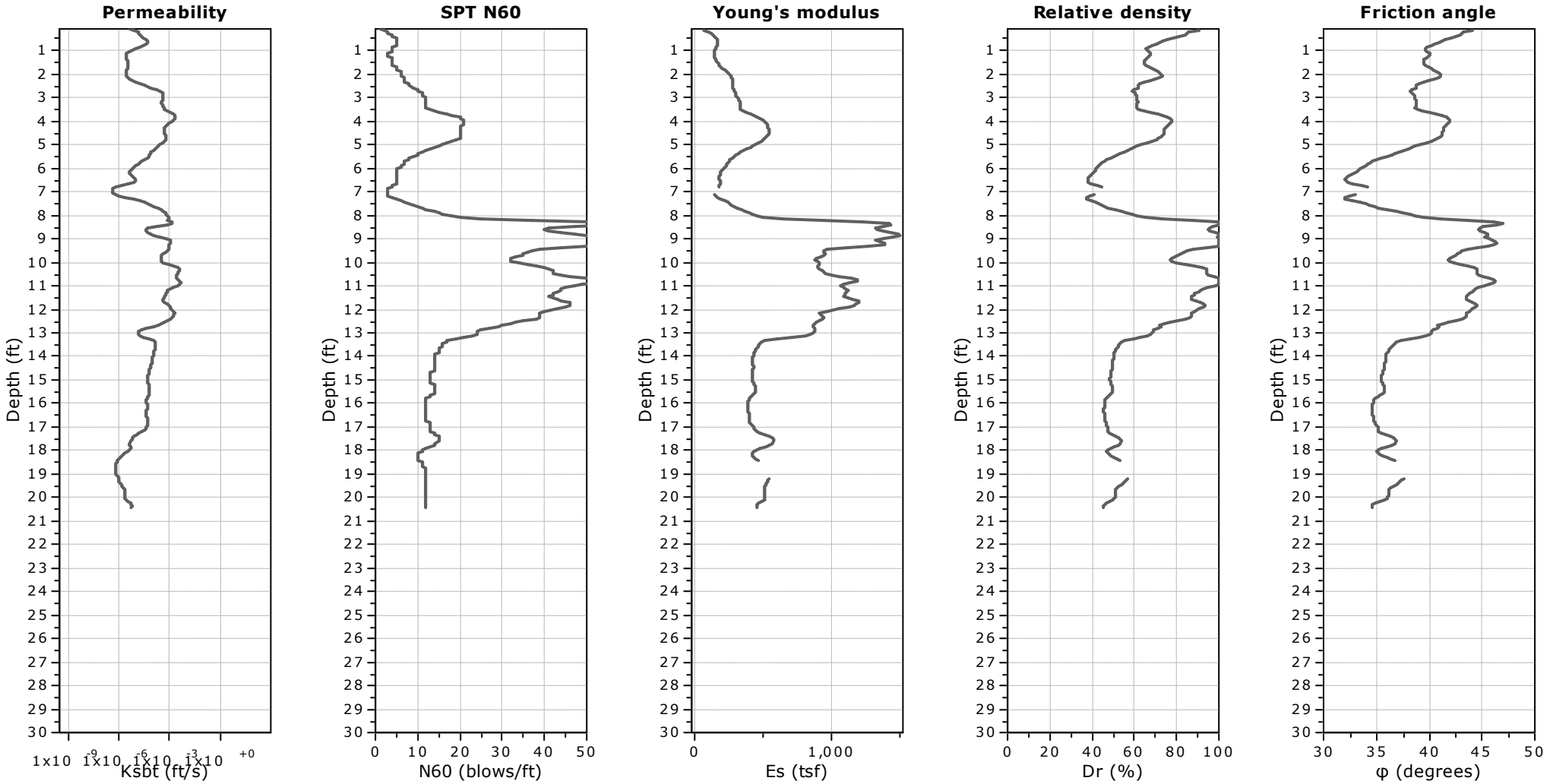
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-23
Total depth: 20.43 ft, Date: 5/14/2024
Surface Elevation: 63.26 ft
Coords: X:572495.24, Y:555878.48
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



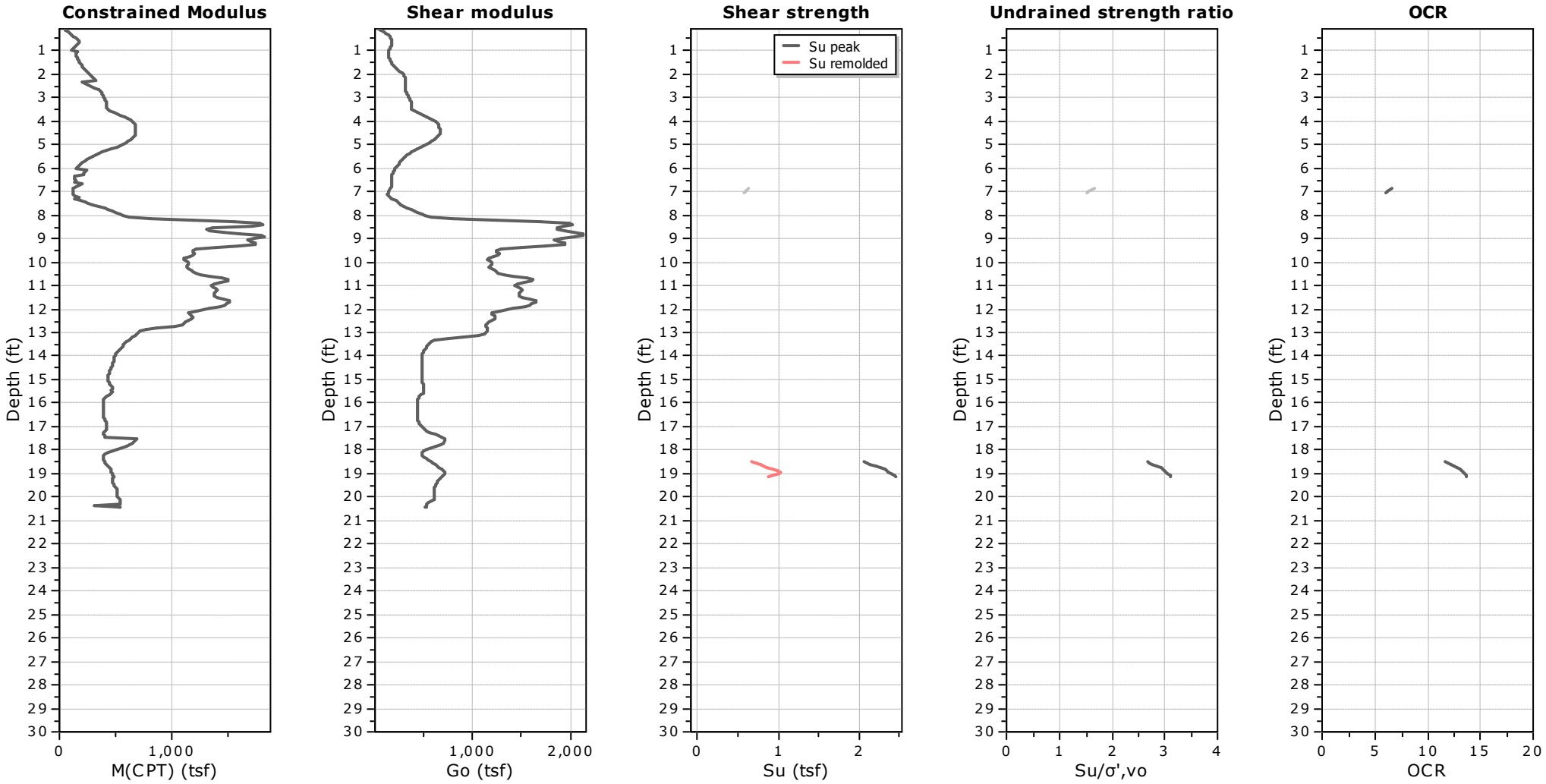
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-23
Total depth: 20.43 ft, Date: 5/14/2024
Surface Elevation: 63.26 ft
Coords: X:572495.24, Y:555878.48
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



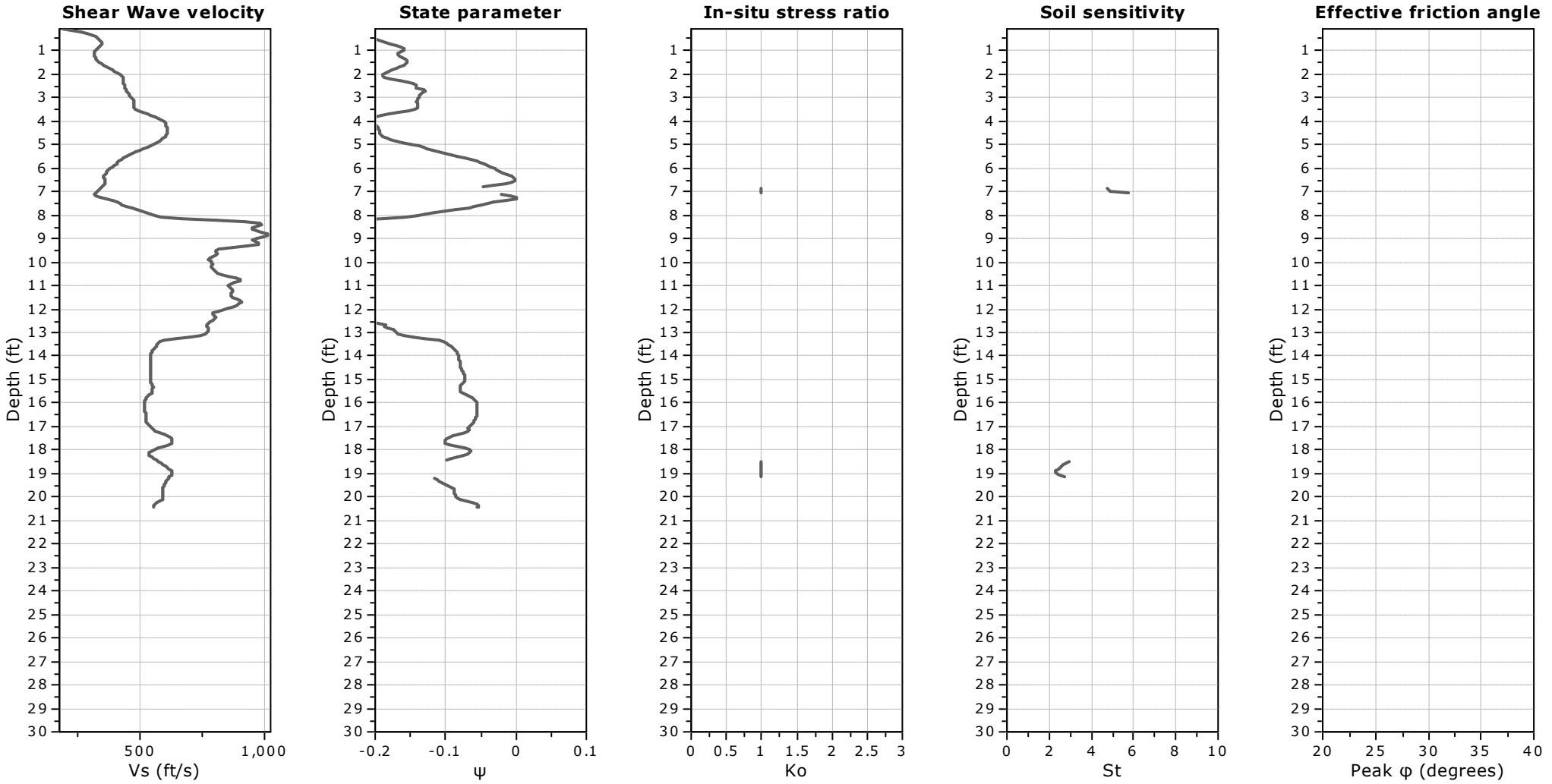
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-23
Total depth: 20.43 ft, Date: 5/14/2024
Surface Elevation: 63.26 ft
Coords: X:572495.24, Y:555878.48
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



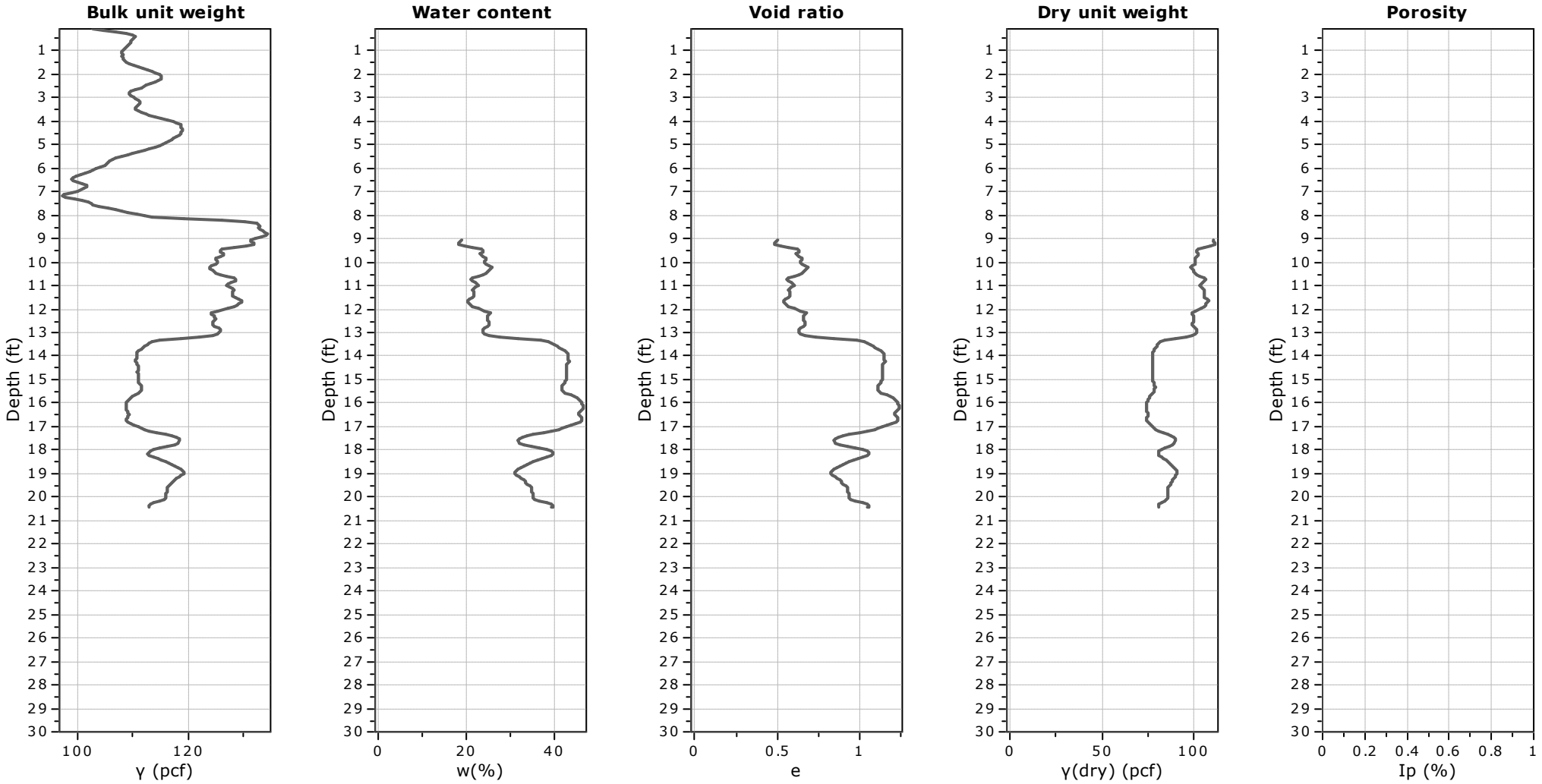
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-23
Total depth: 20.43 ft, Date: 5/14/2024
Surface Elevation: 63.26 ft
Coords: X:572495.24, Y:555878.48
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

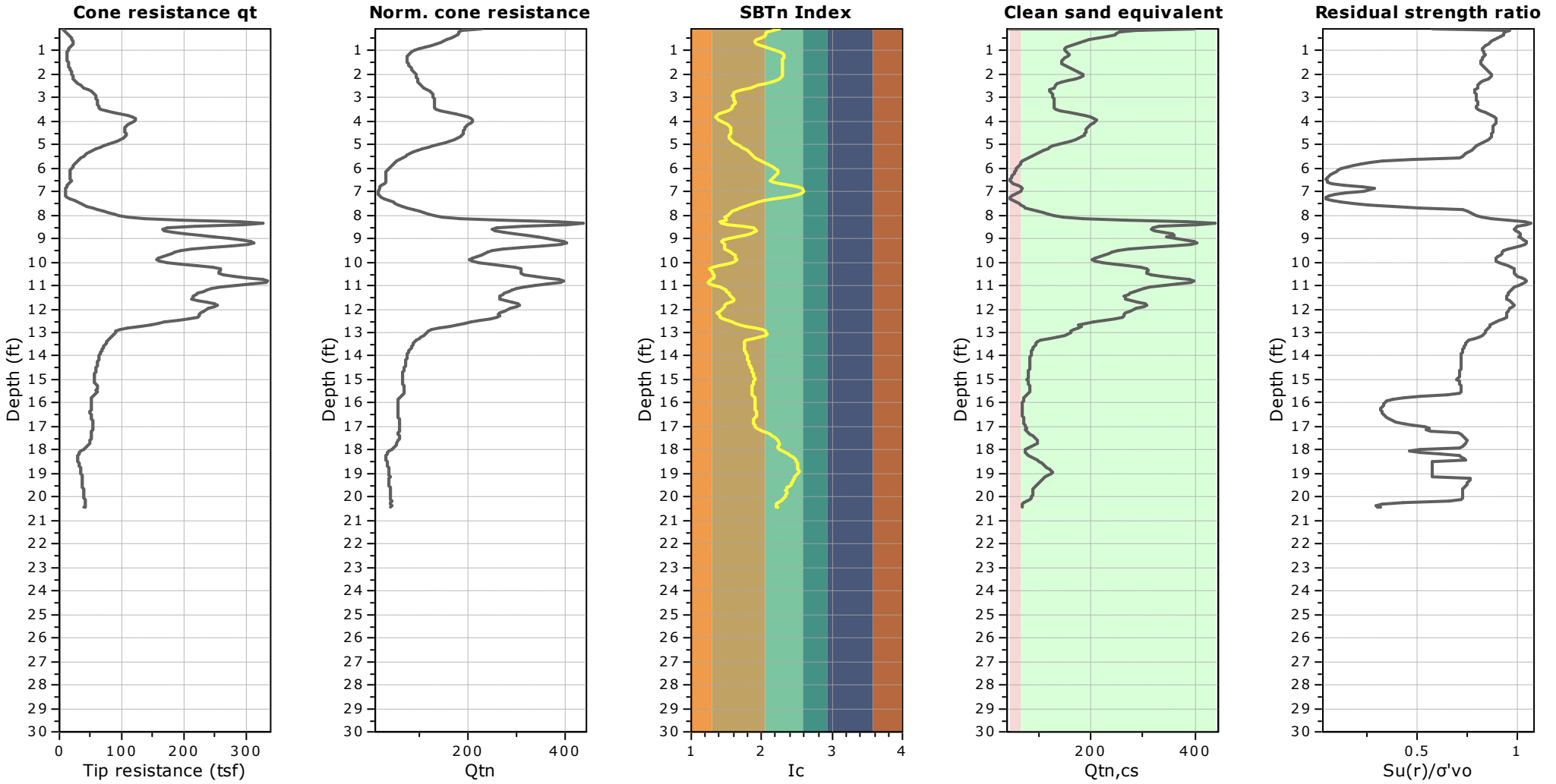
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-23
Total depth: 20.43 ft, Date: 5/14/2024
Surface Elevation: 63.26 ft
Coords: X:572495.24, Y:555878.48
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

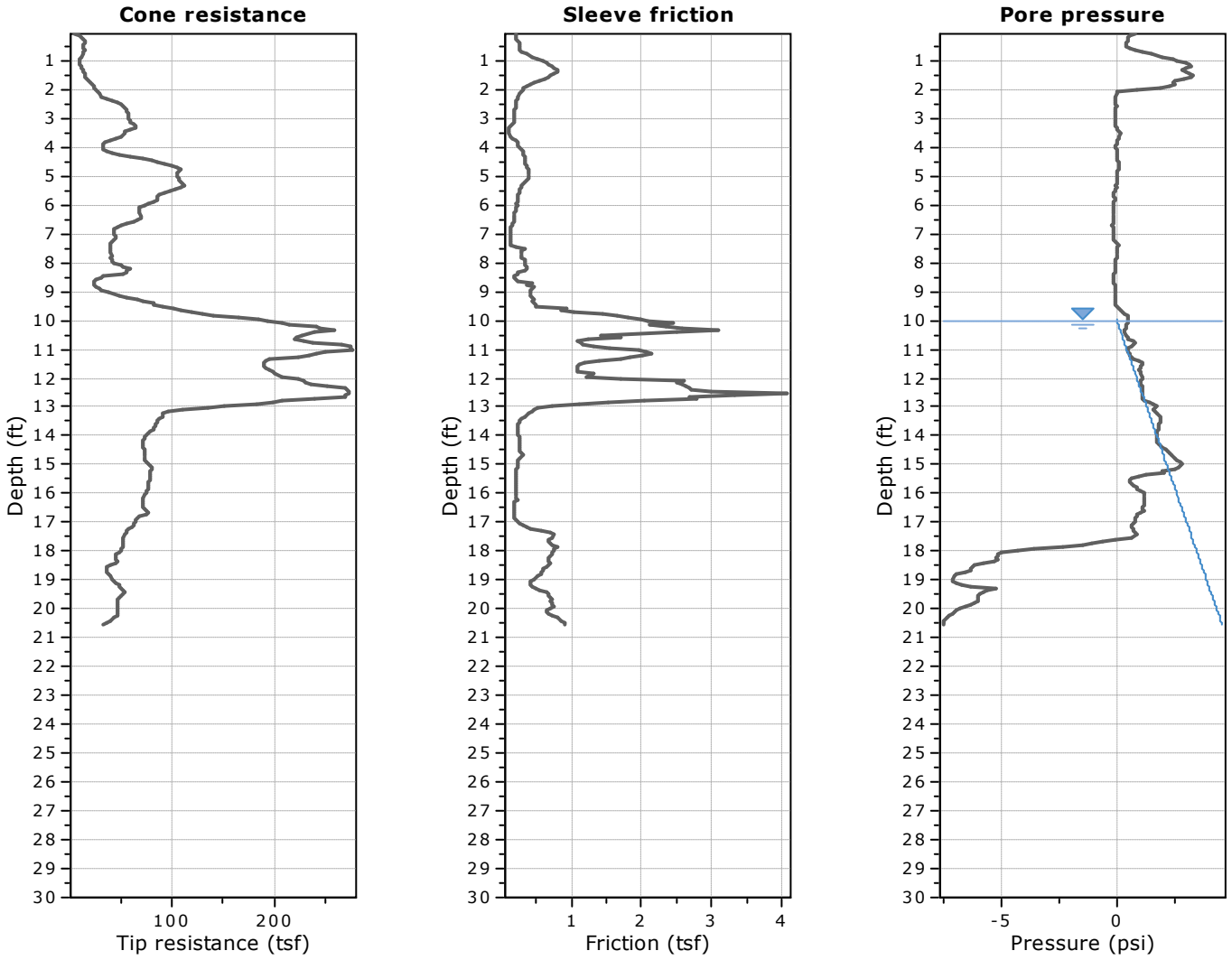
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



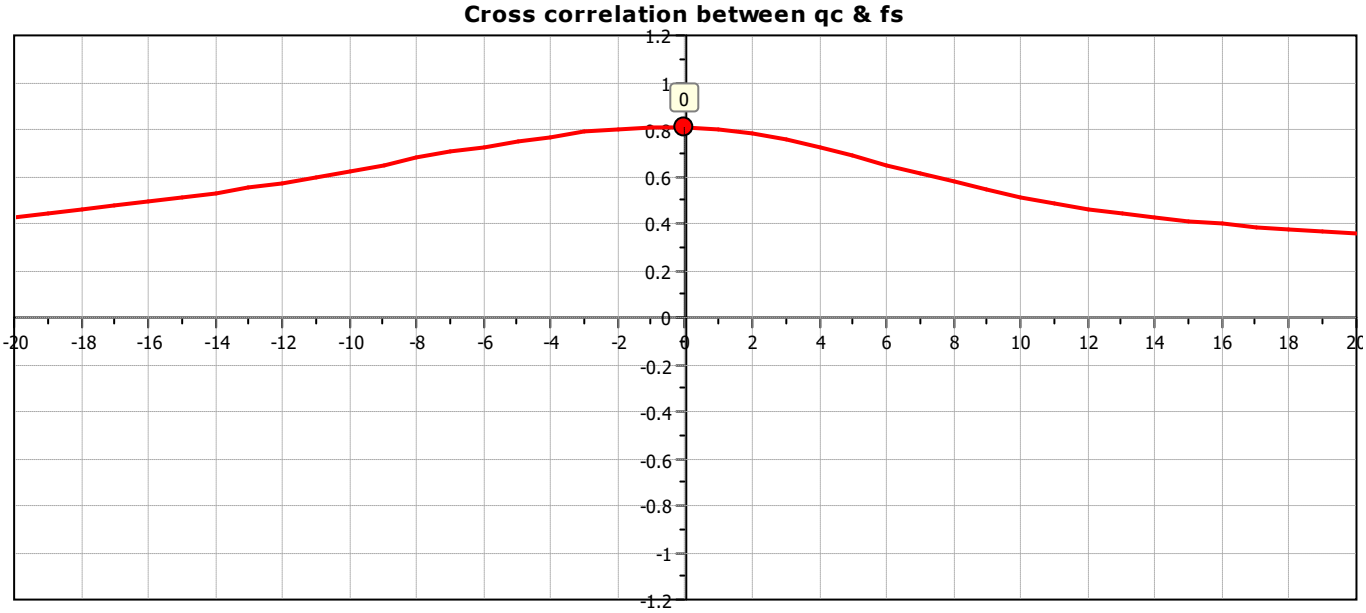
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-24
Total depth: 20.52 ft, Date: 5/13/2024
Surface Elevation: 63.83 ft
Coords: X:572571.88, Y:555949.70
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



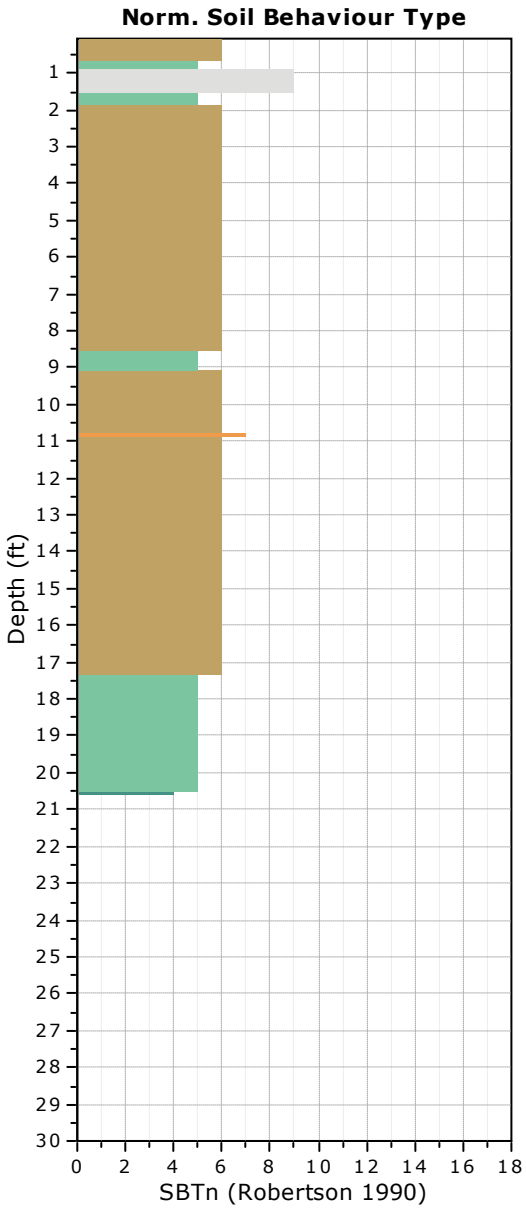
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

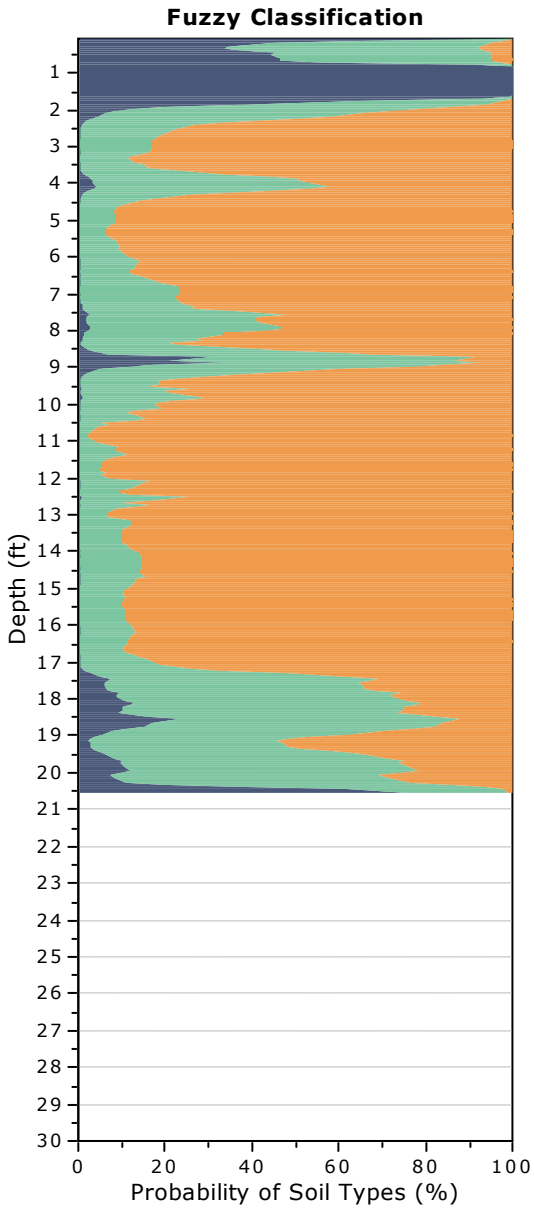


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-24
Total depth: 20.52 ft, Date: 5/13/2024
Surface Elevation: 63.83 ft
Coords: X:572571.88, Y:555949.70
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



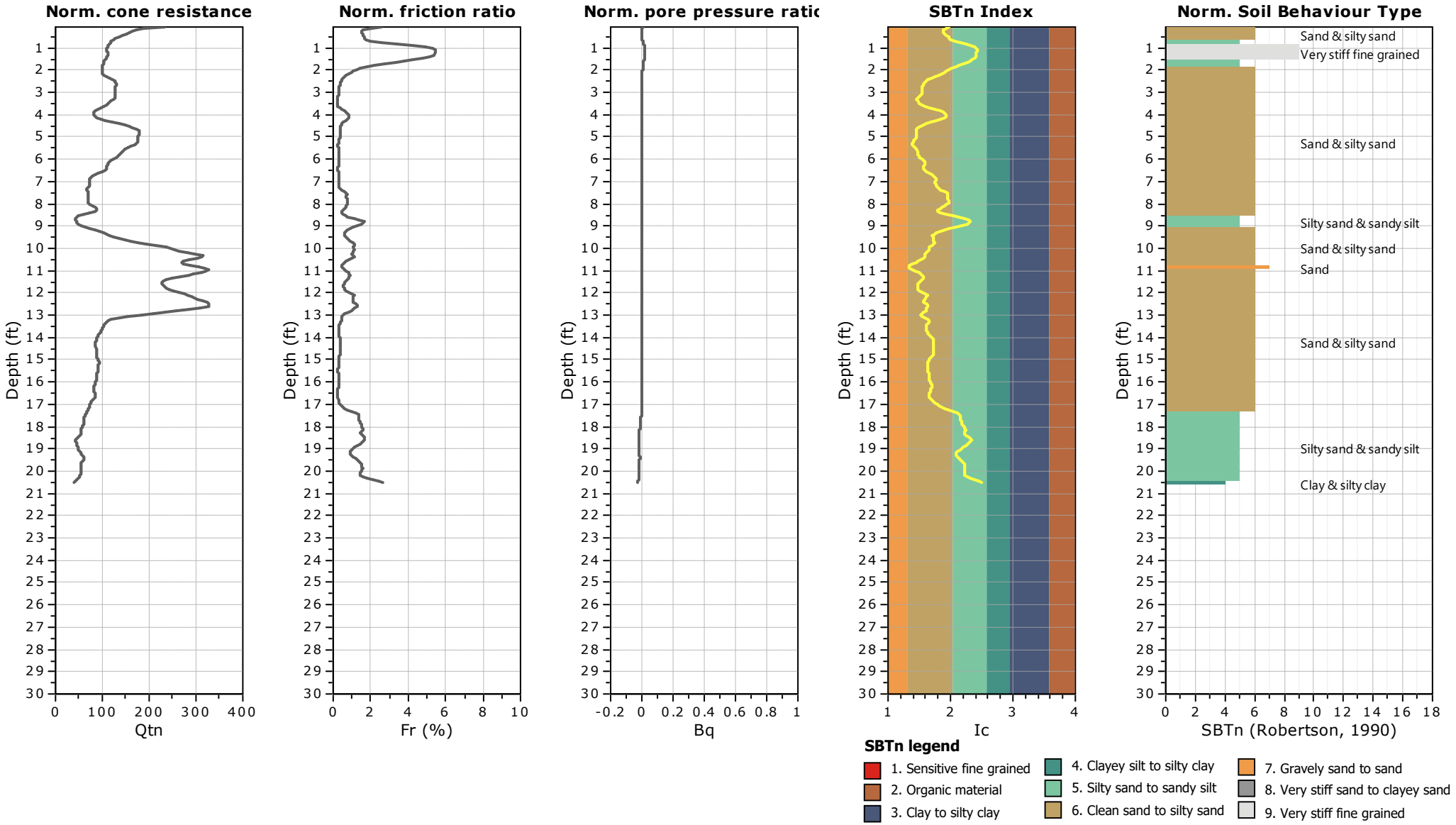


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

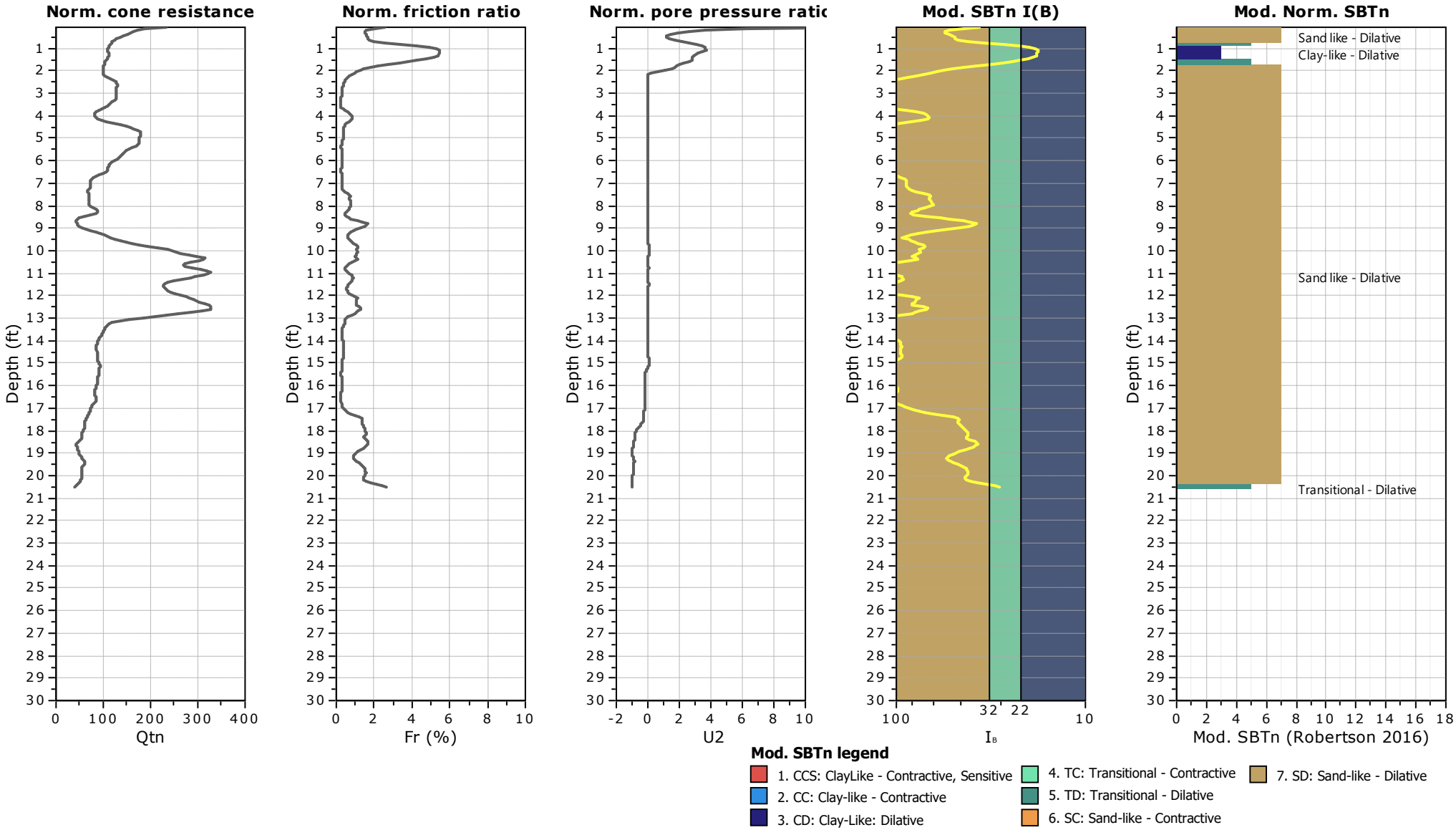
C-24
Total depth: 20.52 ft, Date: 5/13/2024
Surface Elevation: 63.83 ft
Coords: X:572571.88, Y:555949.70
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-24
Total depth: 20.52 ft, Date: 5/13/2024
Surface Elevation: 63.83 ft
Coords: X:572571.88, Y:555949.70
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

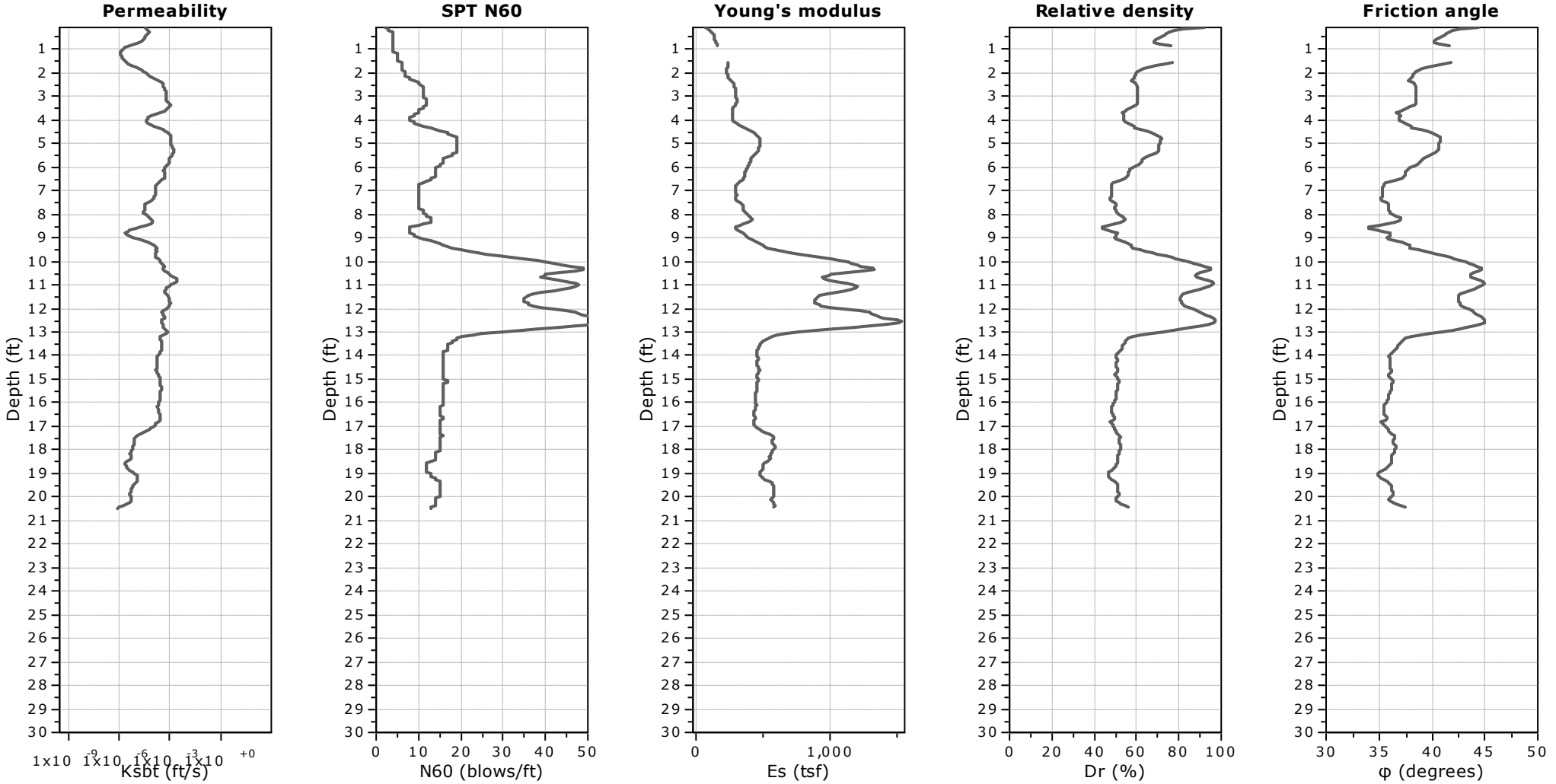
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-24
Total depth: 20.52 ft, Date: 5/13/2024
Surface Elevation: 63.83 ft
Coords: X:572571.88, Y:555949.70
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



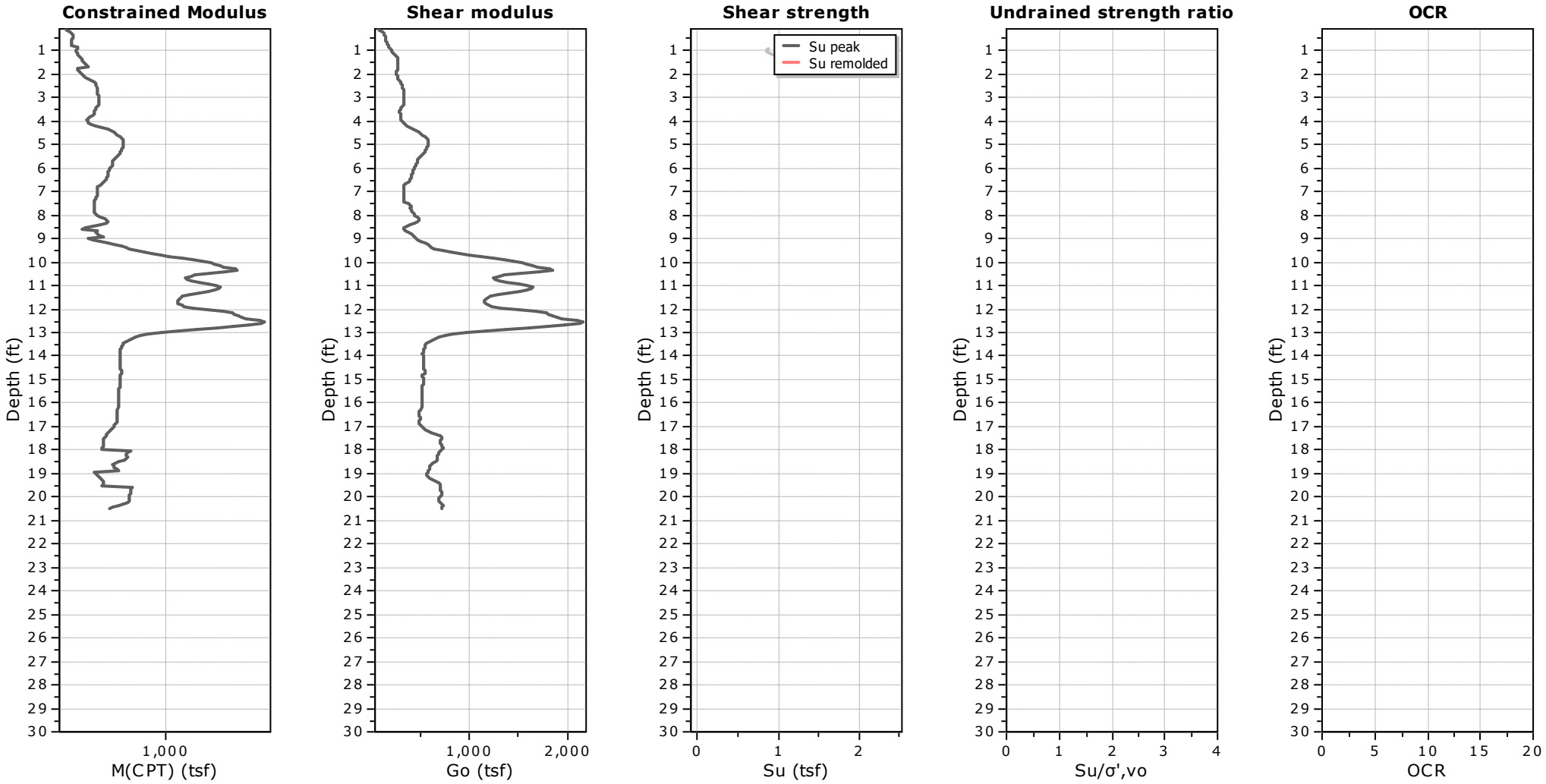
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-24
Total depth: 20.52 ft, Date: 5/13/2024
Surface Elevation: 63.83 ft
Coords: X:572571.88, Y:555949.70
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



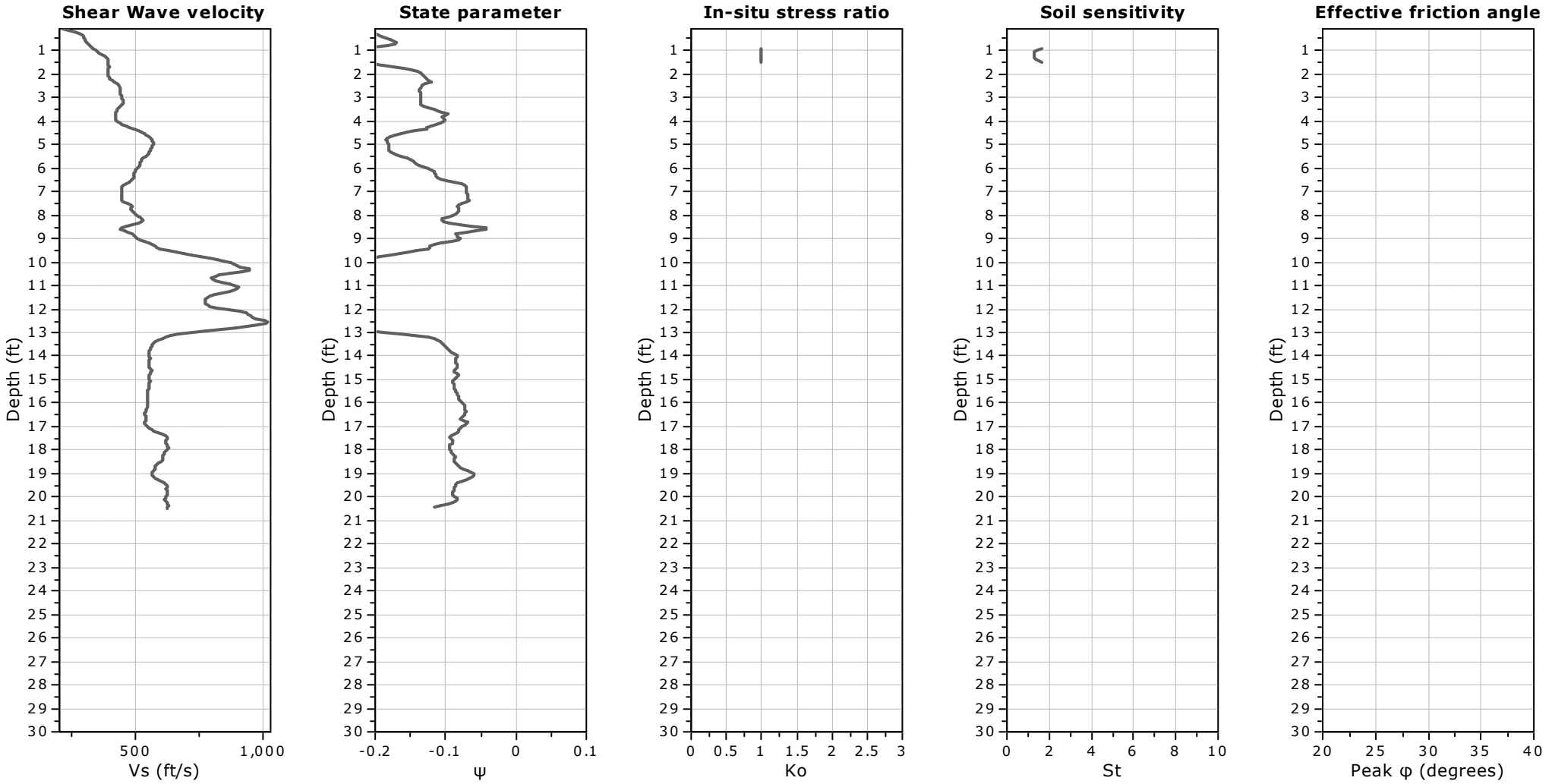
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-24
Total depth: 20.52 ft, Date: 5/13/2024
Surface Elevation: 63.83 ft
Coords: X:572571.88, Y:555949.70
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



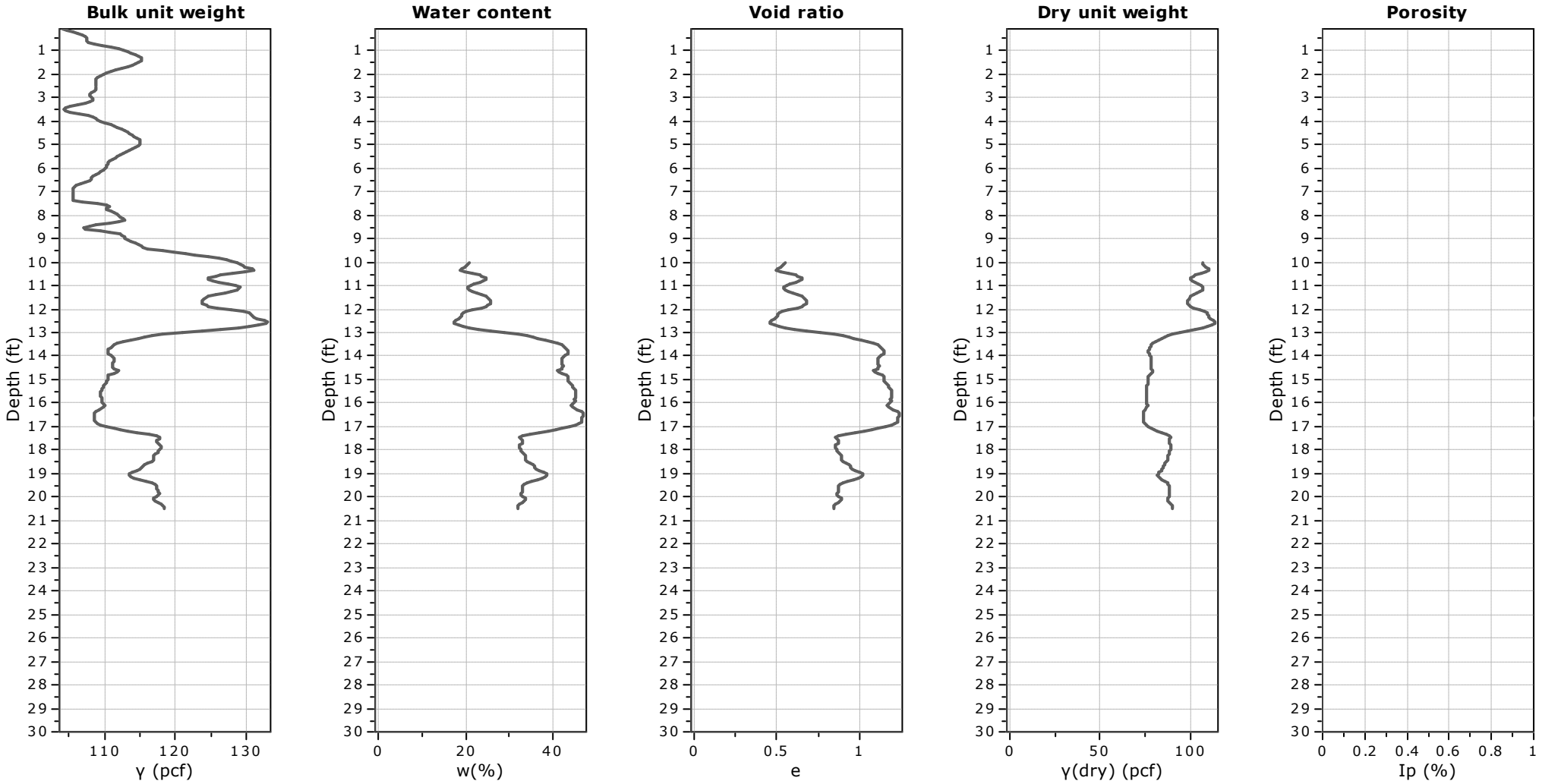
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-24
Total depth: 20.52 ft, Date: 5/13/2024
Surface Elevation: 63.83 ft
Coords: X:572571.88, Y:555949.70
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

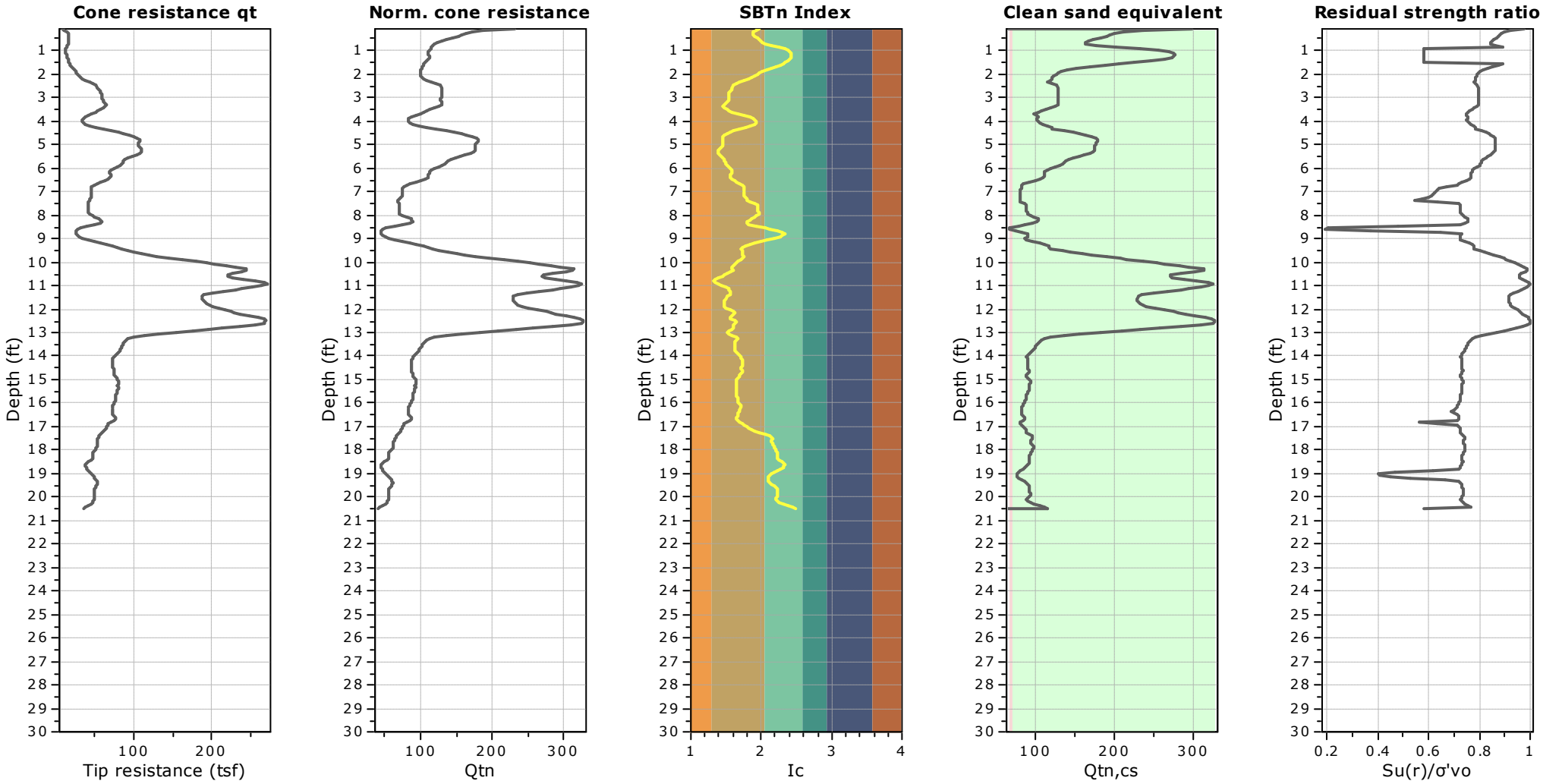
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-24
Total depth: 20.52 ft, Date: 5/13/2024
Surface Elevation: 63.83 ft
Coords: X:572571.88, Y:555949.70
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

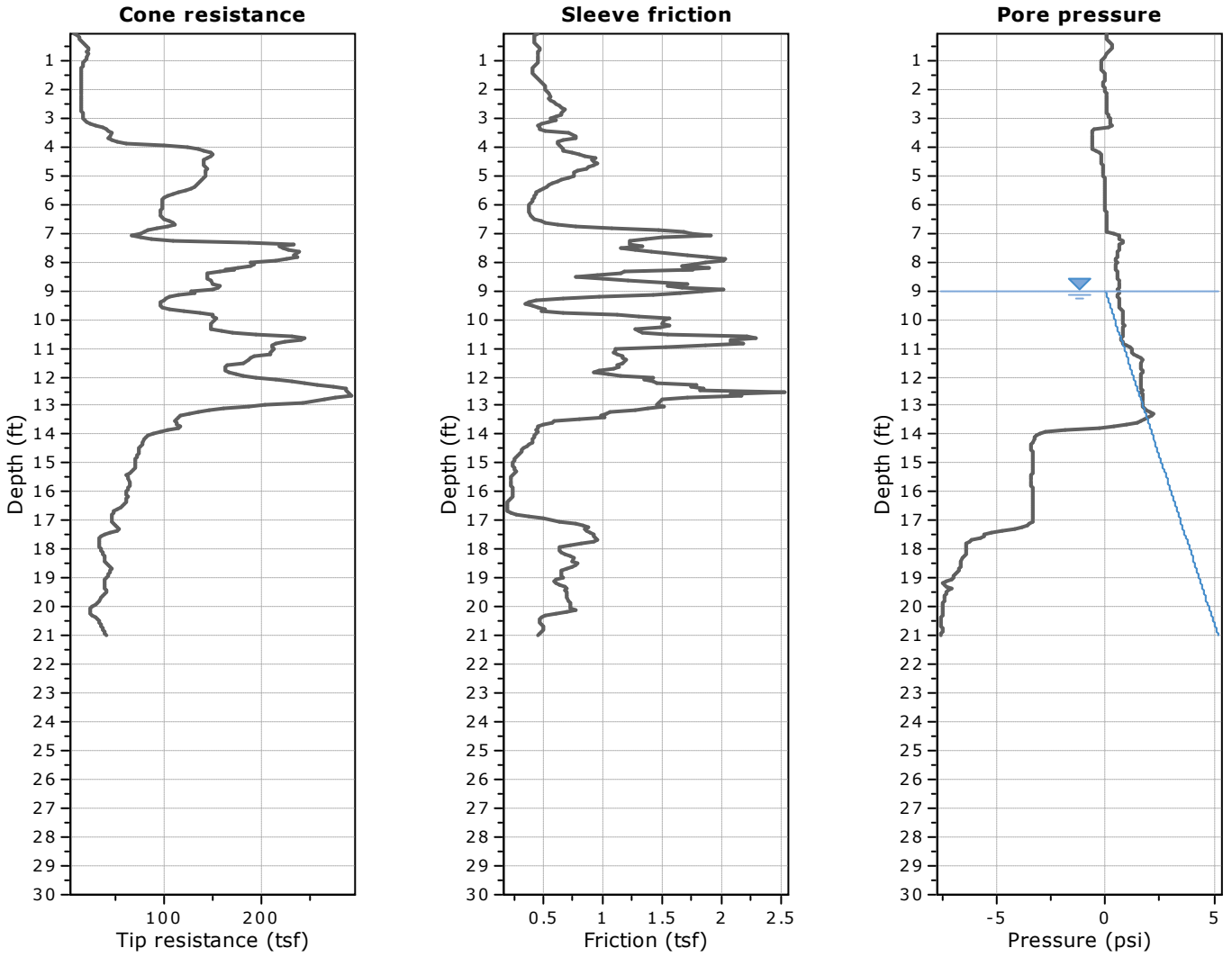
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



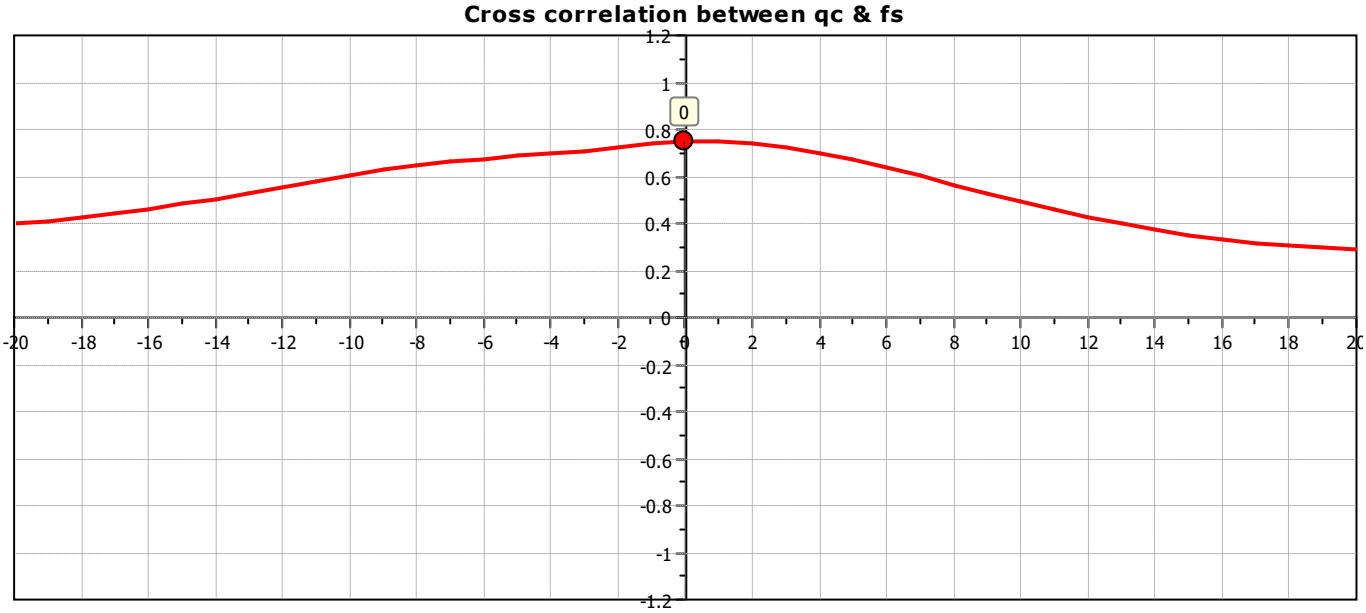
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

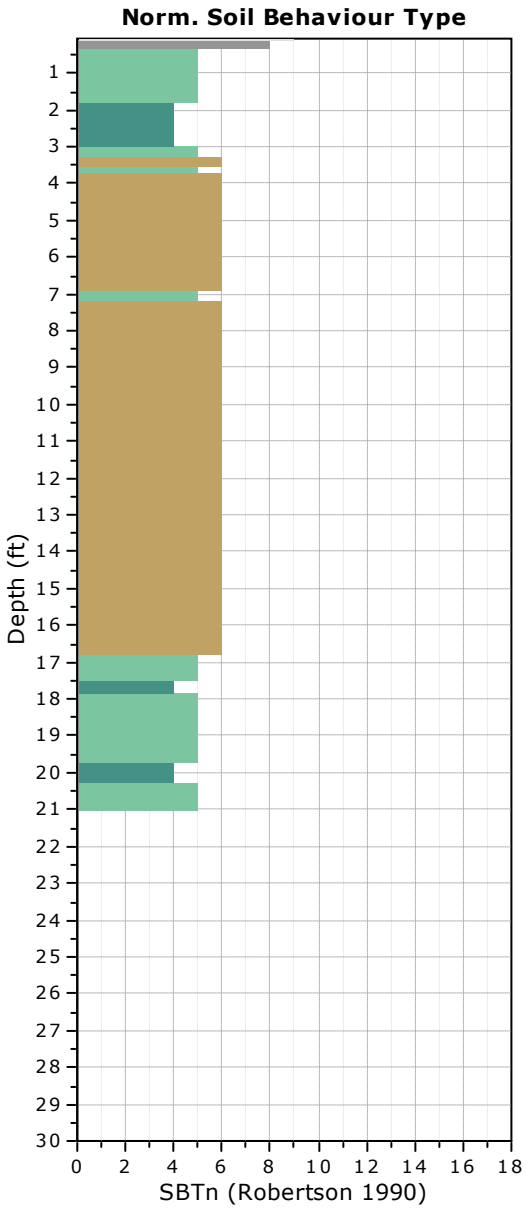
C-25
Total depth: 21.01 ft, Date: 5/14/2024
Surface Elevation: 62.55 ft
Coords: X:572545.04, Y:555821.47
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

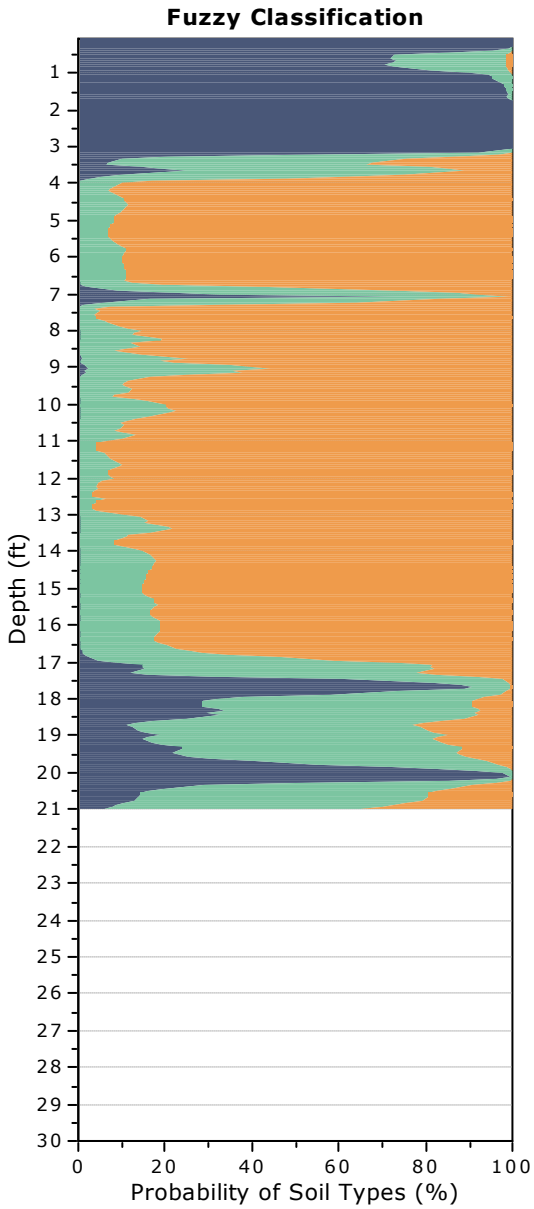
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







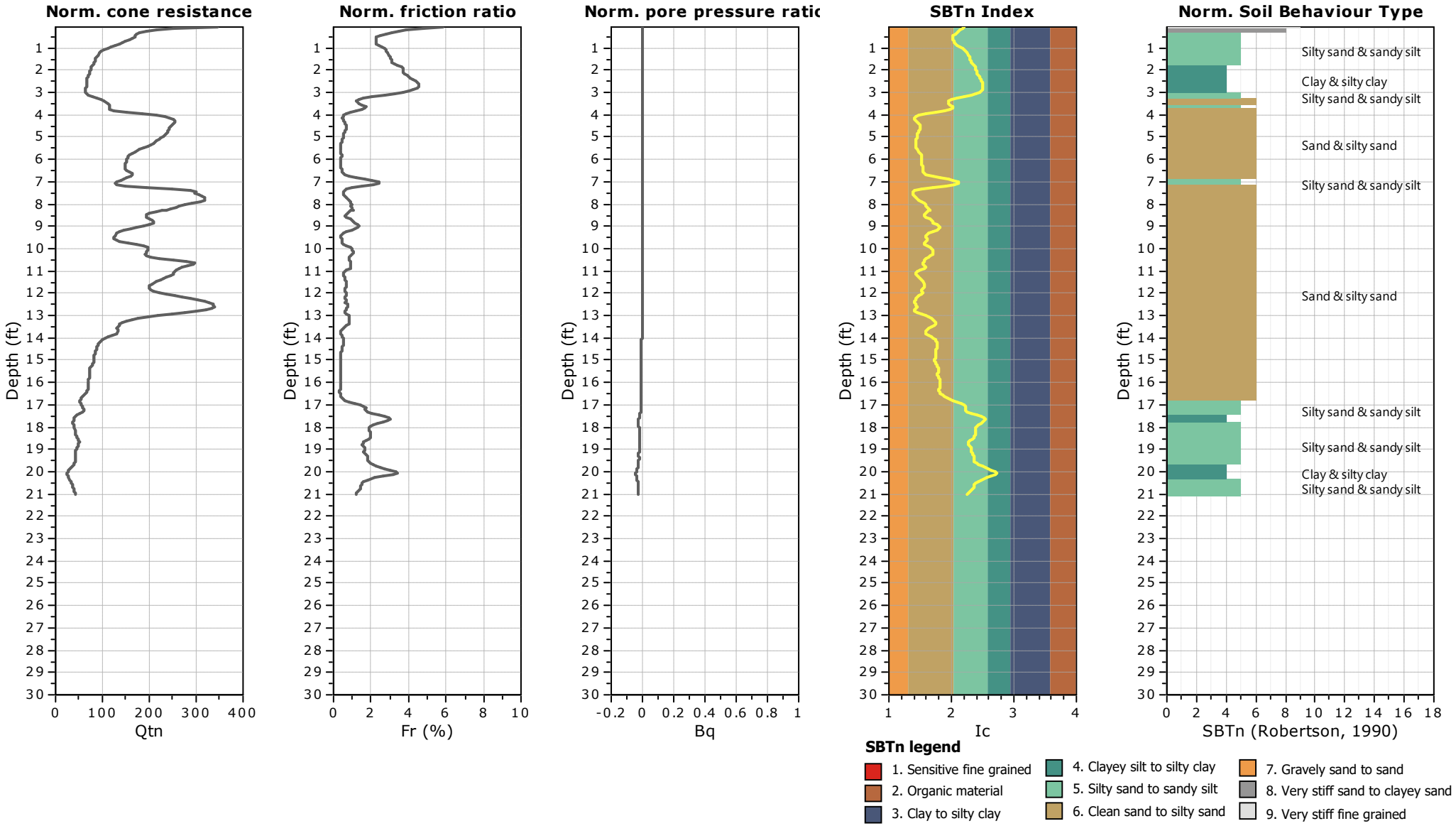
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-25
Total depth: 21.01 ft, Date: 5/14/2024
Surface Elevation: 62.55 ft
Coords: X:572545.04, Y:555821.47
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

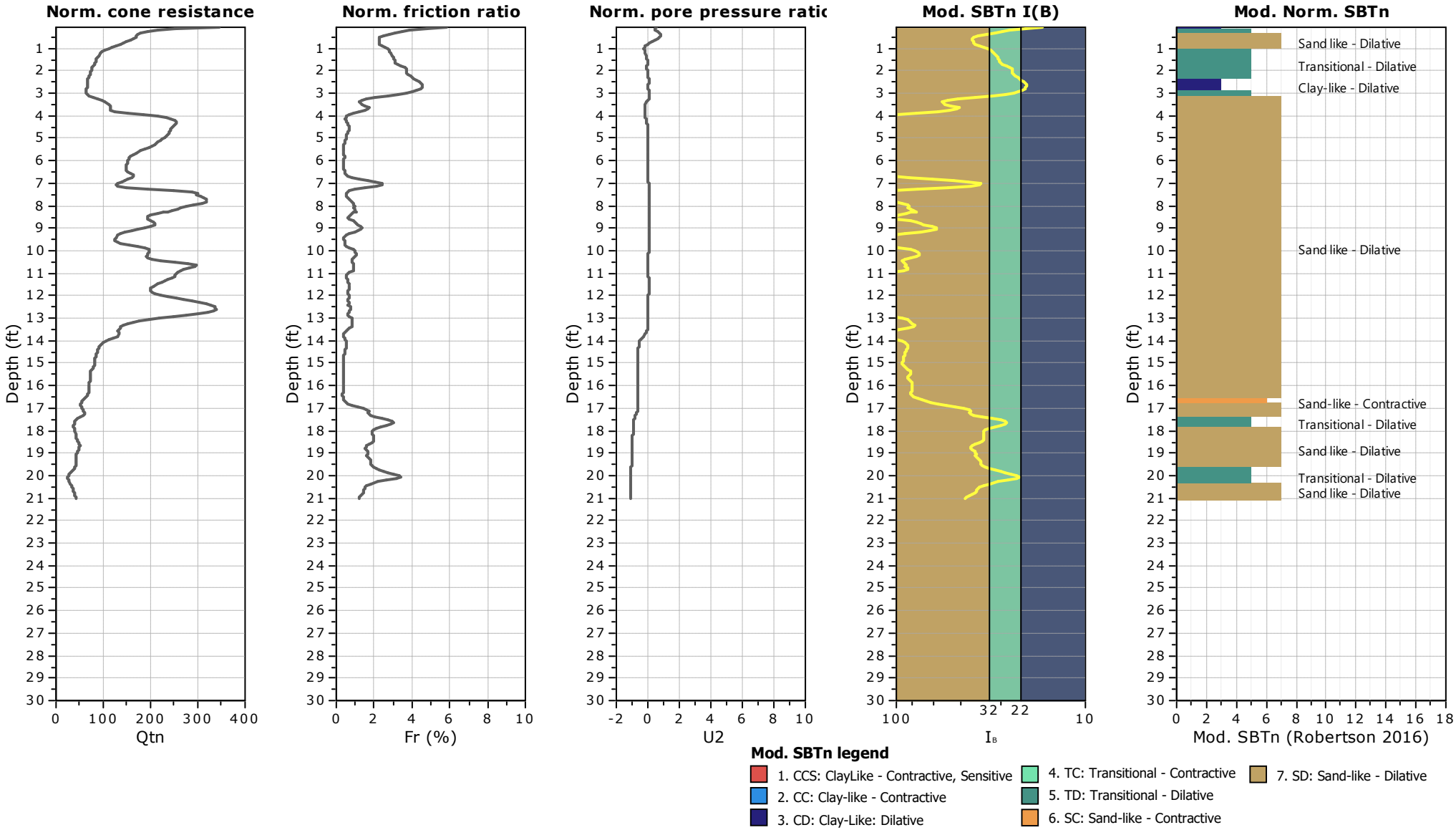
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-25
Total depth: 21.01 ft, Date: 5/14/2024
Surface Elevation: 62.55 ft
Coords: X:572545.04, Y:555821.47
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

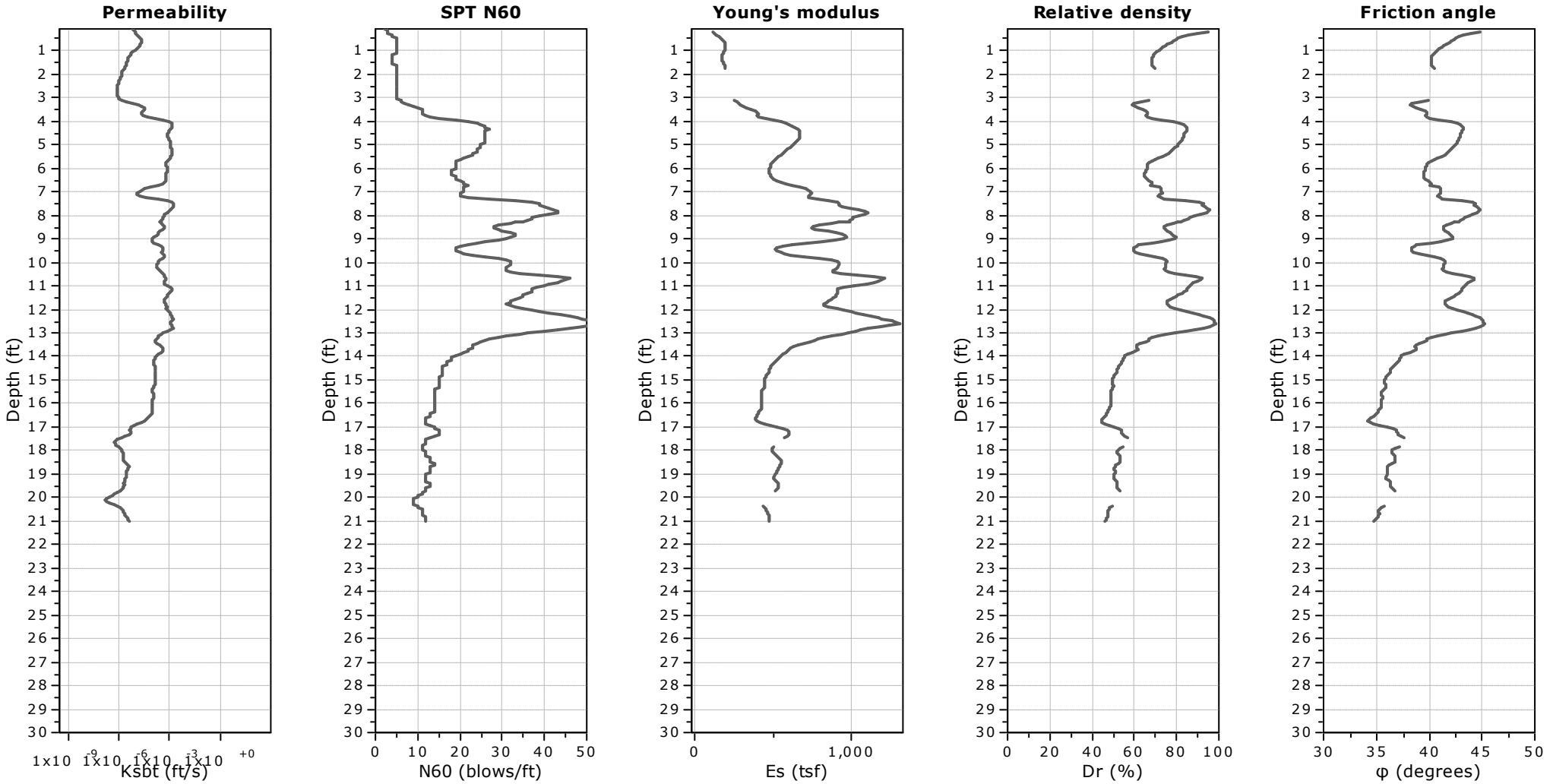
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-25
Total depth: 21.01 ft, Date: 5/14/2024
Surface Elevation: 62.55 ft
Coords: X:572545.04, Y:555821.47
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



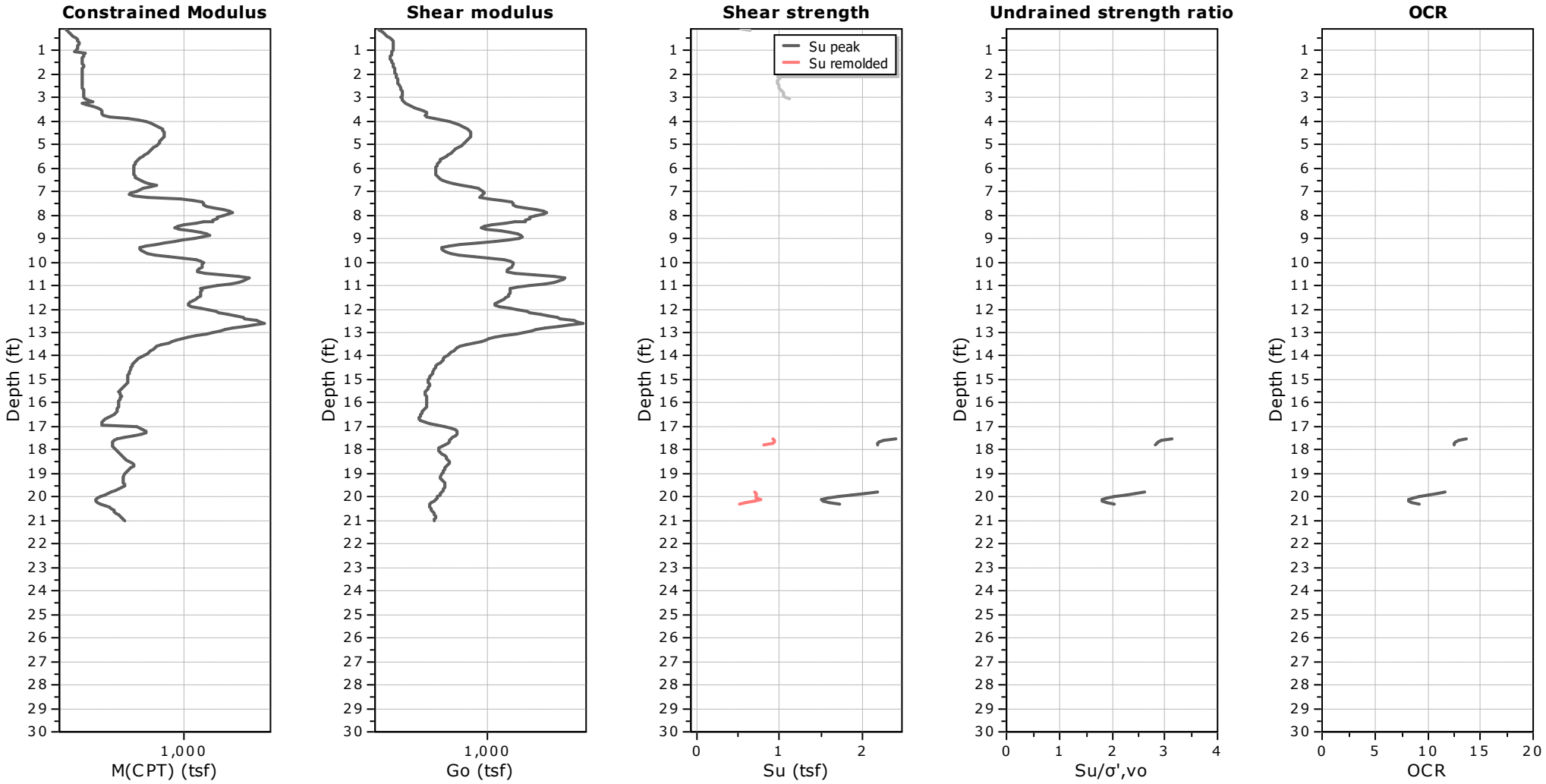
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-25
Total depth: 21.01 ft, Date: 5/14/2024
Surface Elevation: 62.55 ft
Coords: X:572545.04, Y:555821.47
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



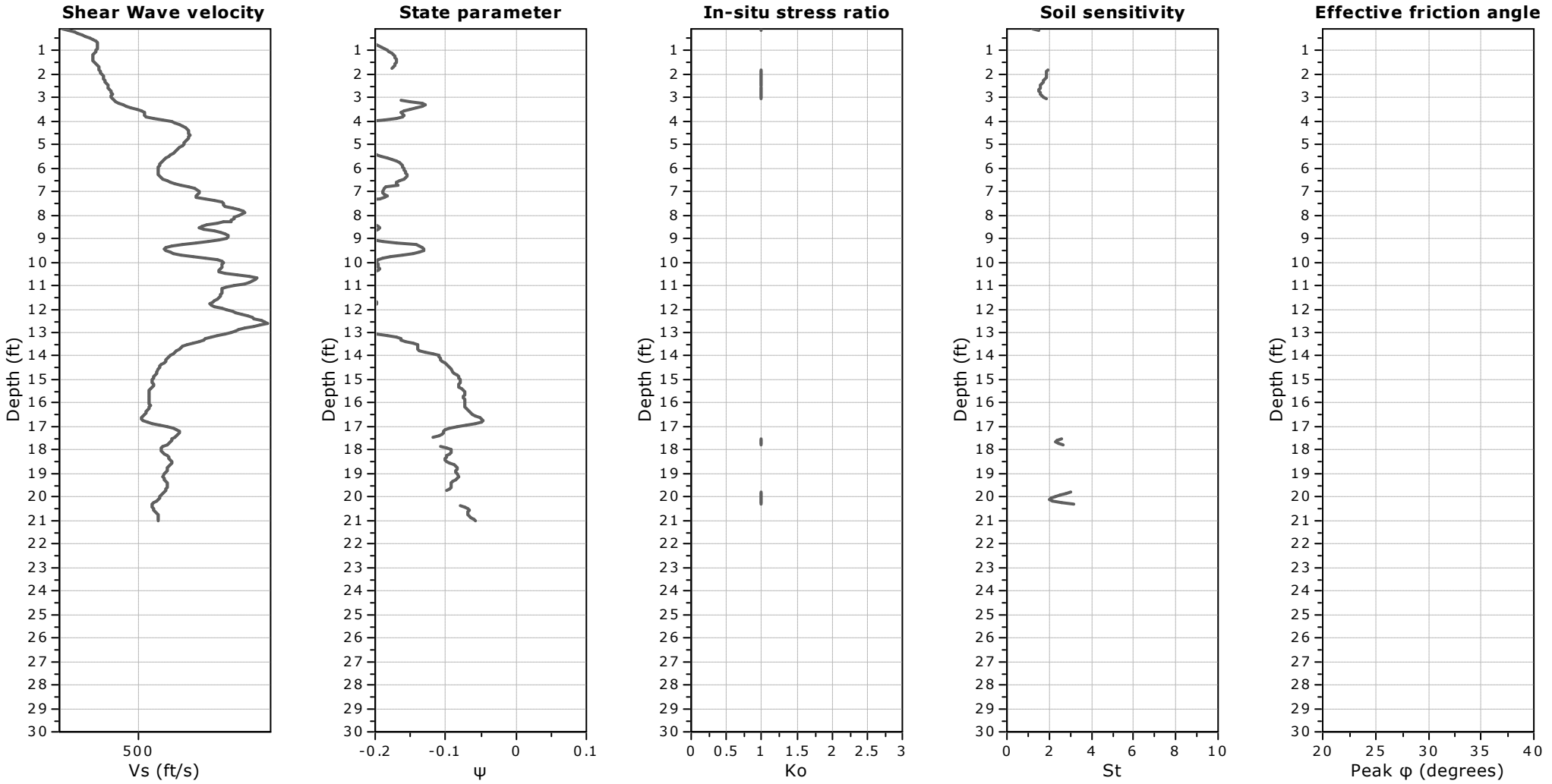
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-25
Total depth: 21.01 ft, Date: 5/14/2024
Surface Elevation: 62.55 ft
Coords: X:572545.04, Y:555821.47
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



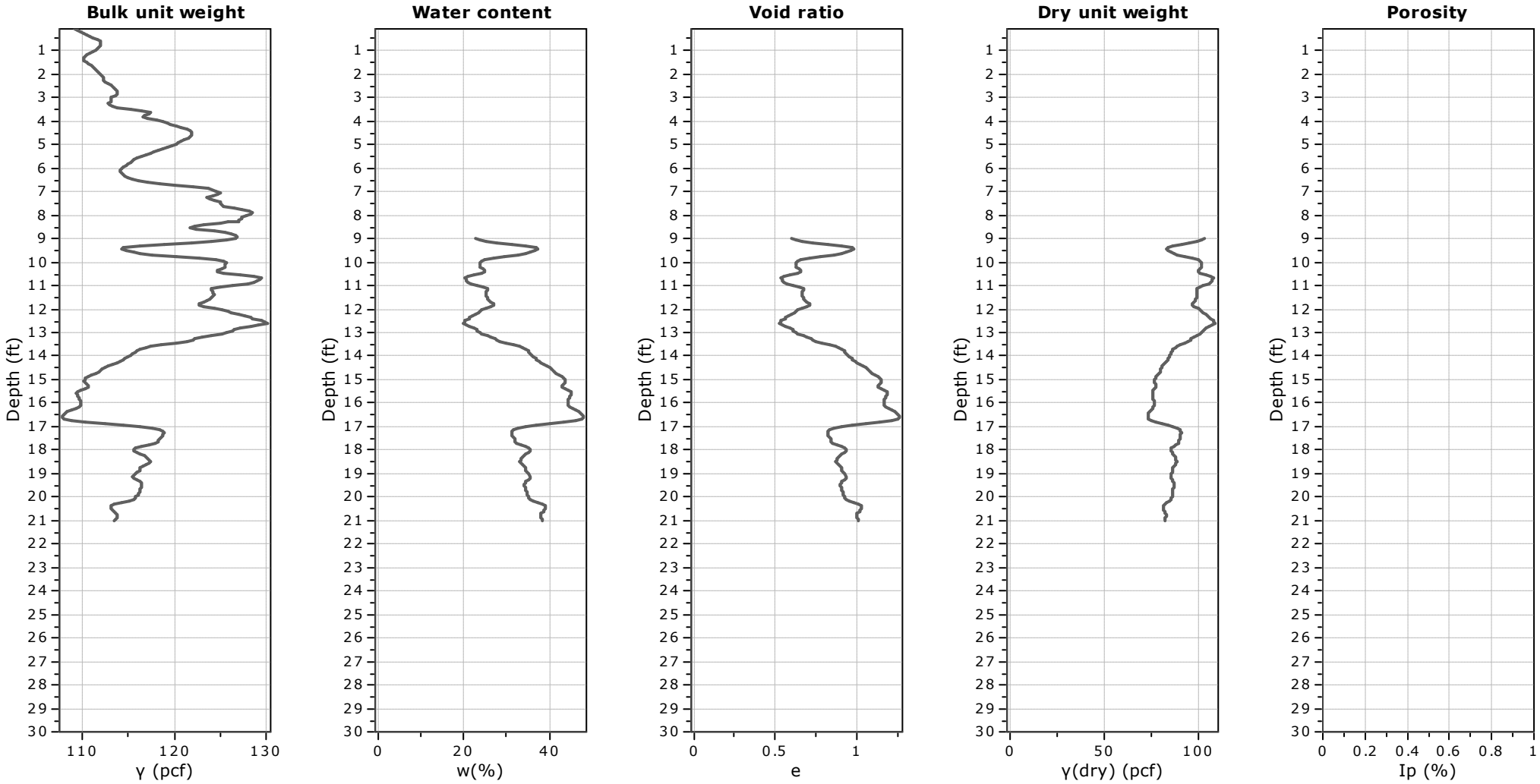
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-25
Total depth: 21.01 ft, Date: 5/14/2024
Surface Elevation: 62.55 ft
Coords: X:572545.04, Y:555821.47
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

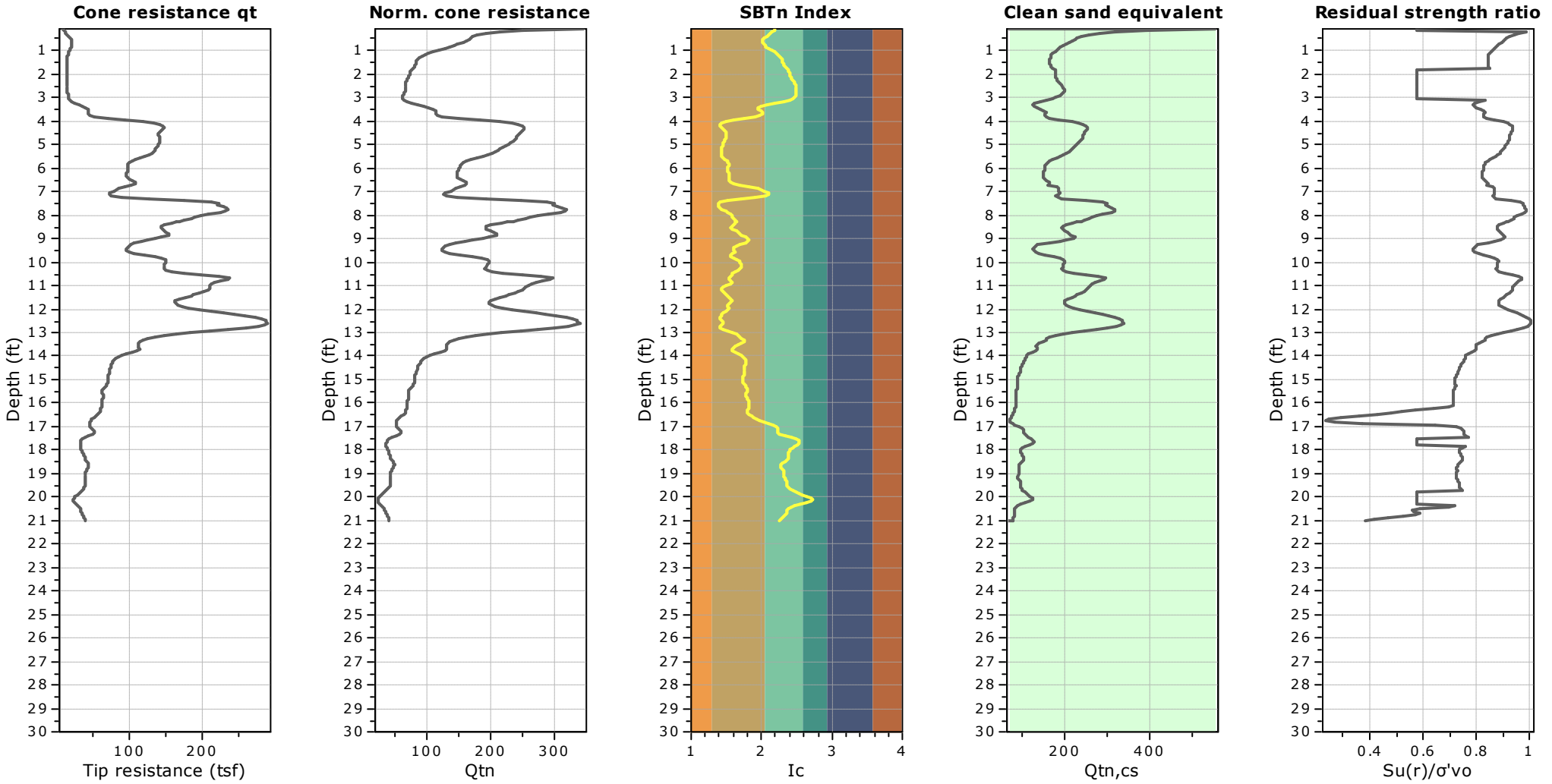
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-25
Total depth: 21.01 ft, Date: 5/14/2024
Surface Elevation: 62.55 ft
Coords: X:572545.04, Y:555821.47
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

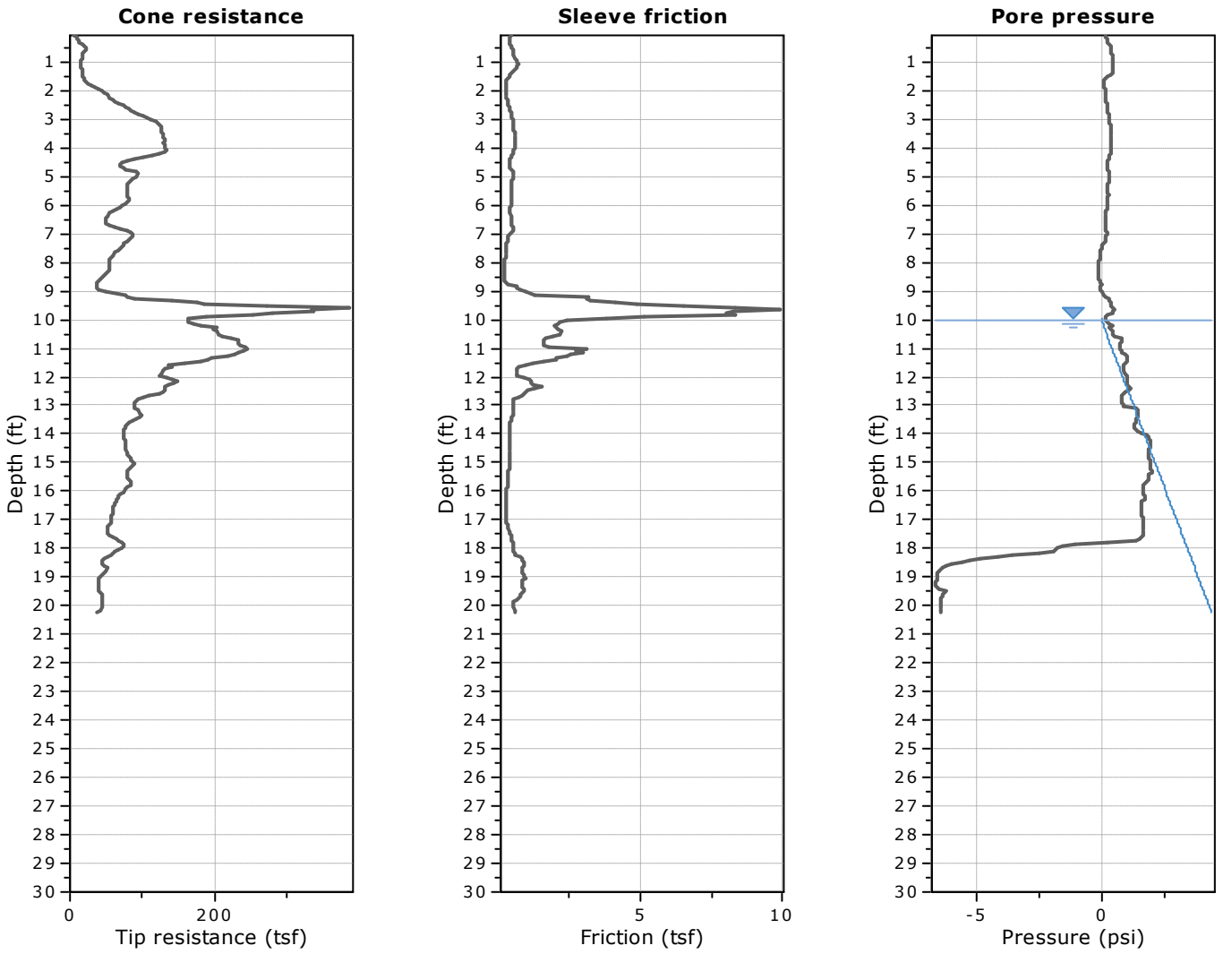
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



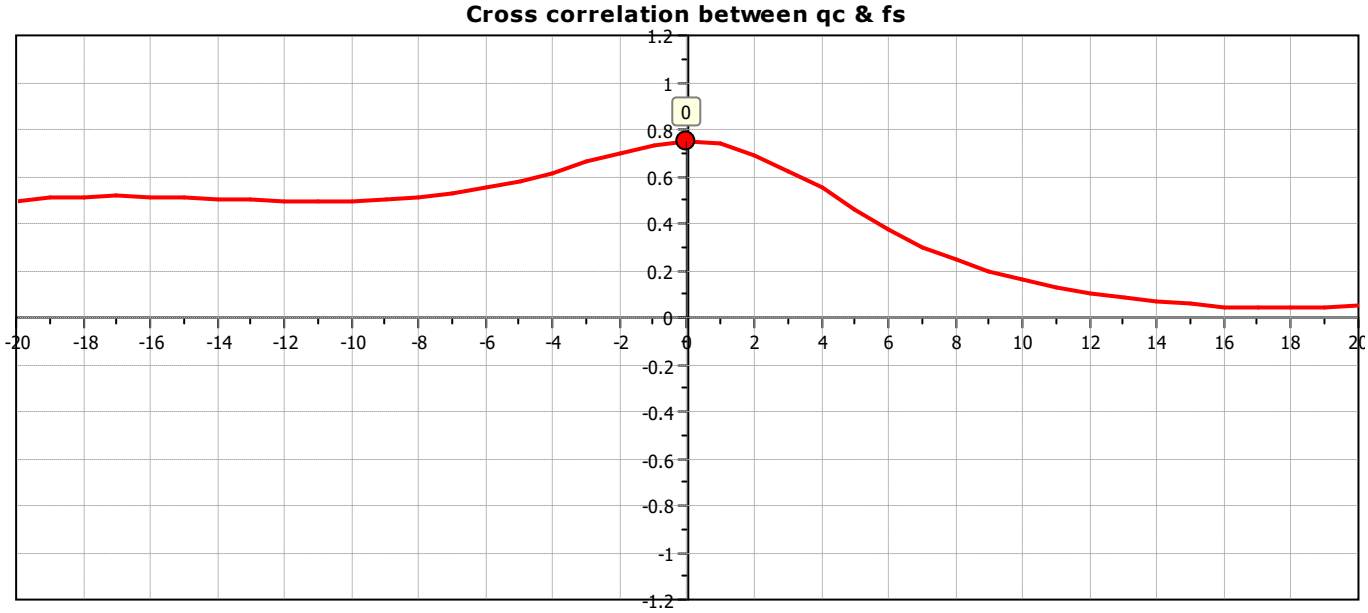
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

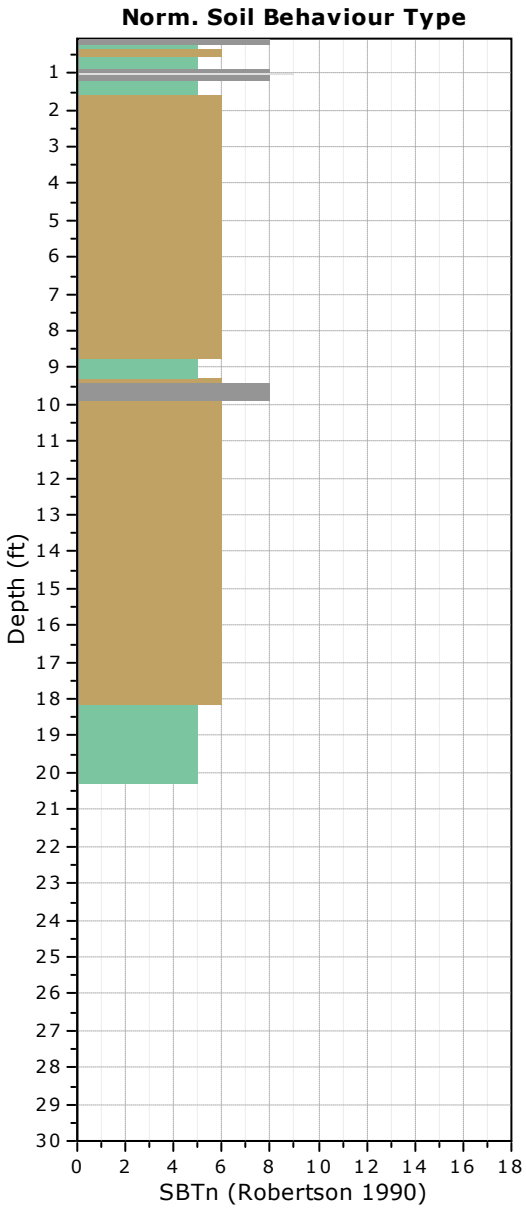
C-26
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 64.27 ft
Coords: X:572573.67, Y:556022.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

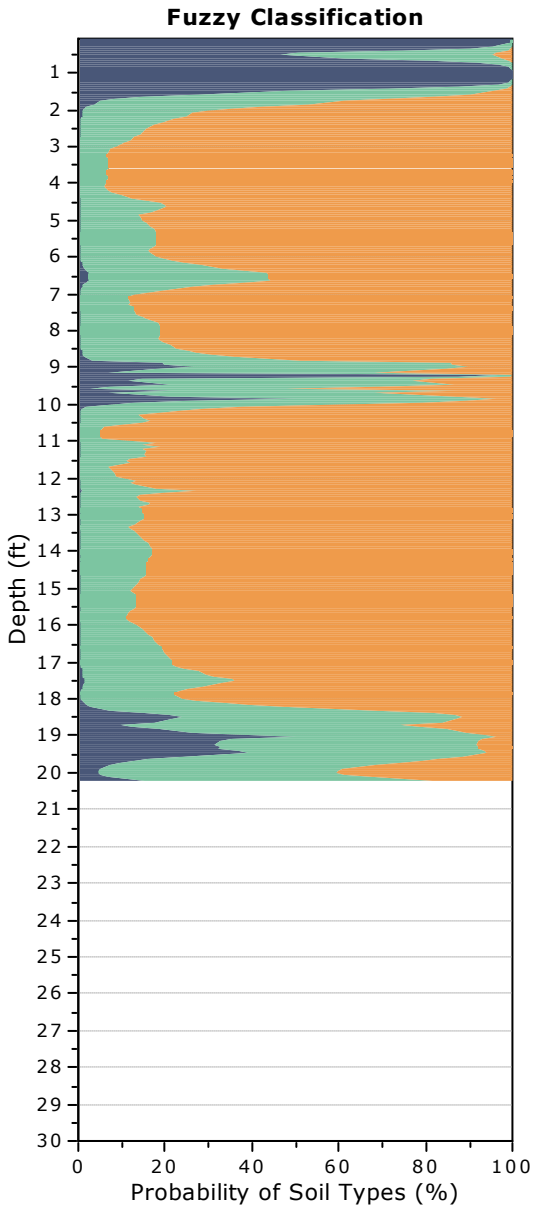
Project: ASD Summit Campus
Location: Middletown, Delaware



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







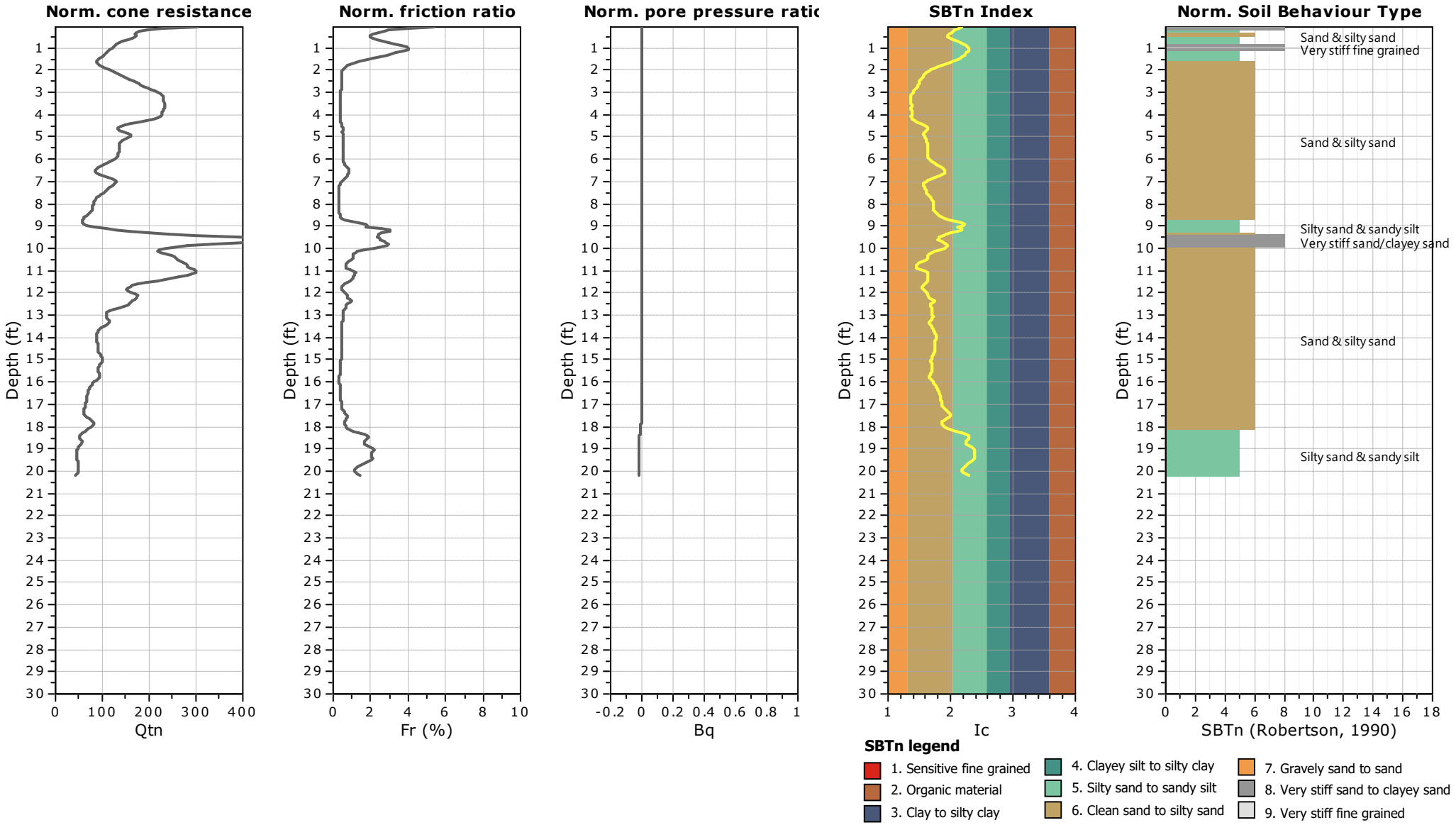
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-26
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 64.27 ft
Coords: X:572573.67, Y:556022.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

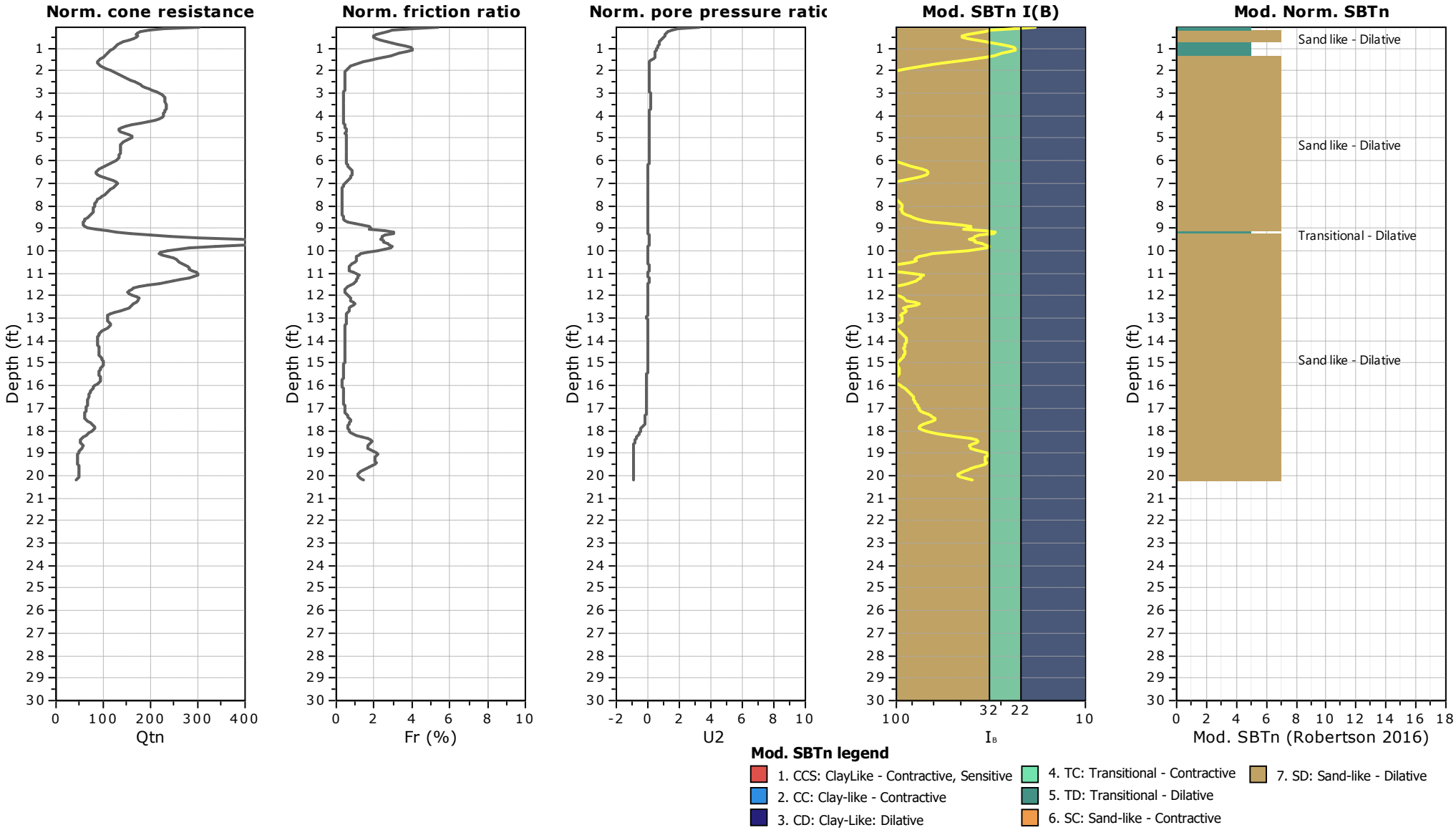
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-26
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 64.27 ft
Coords: X:572573.67, Y:556022.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

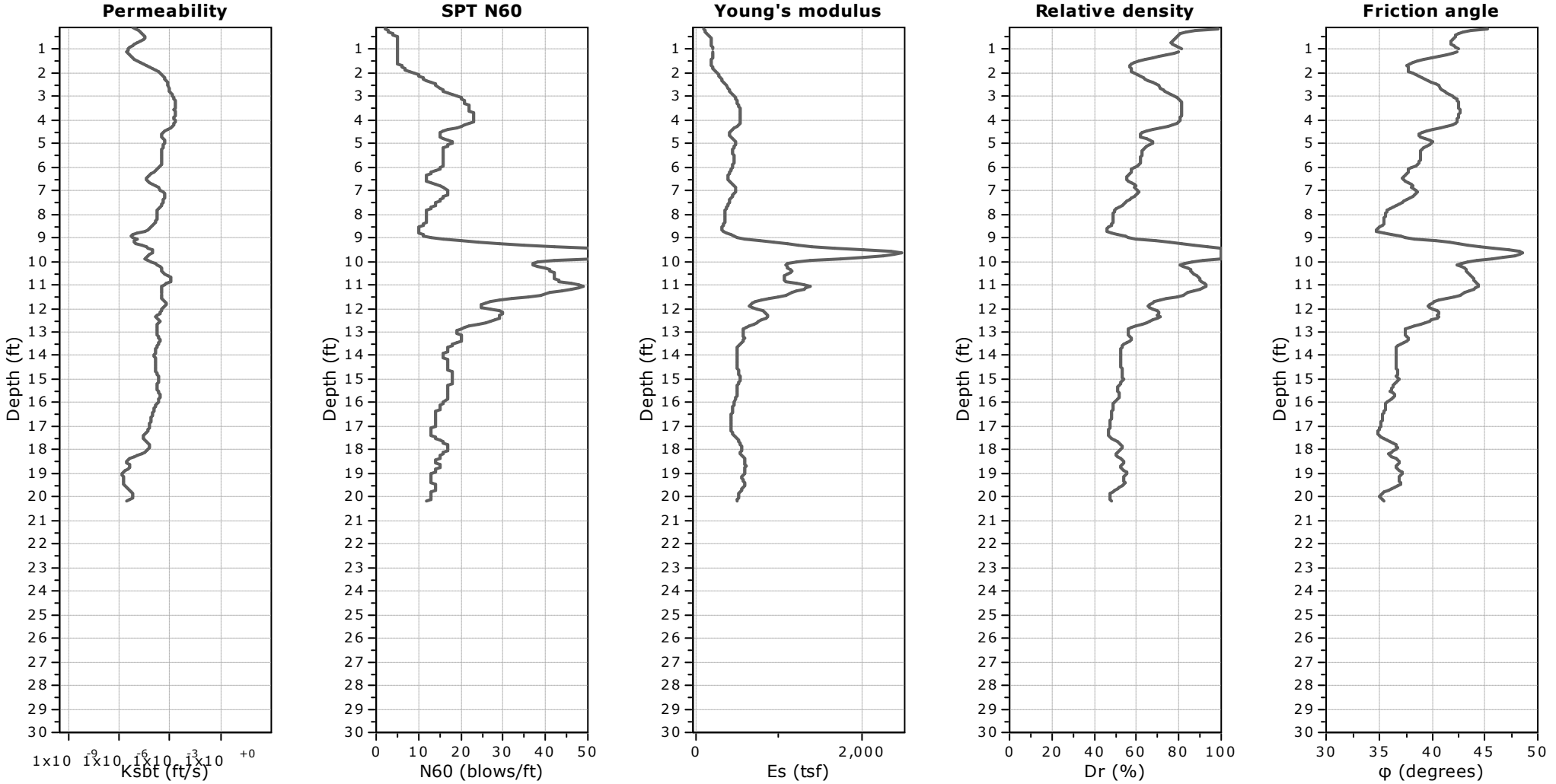
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-26
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 64.27 ft
Coords: X:572573.67, Y:556022.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



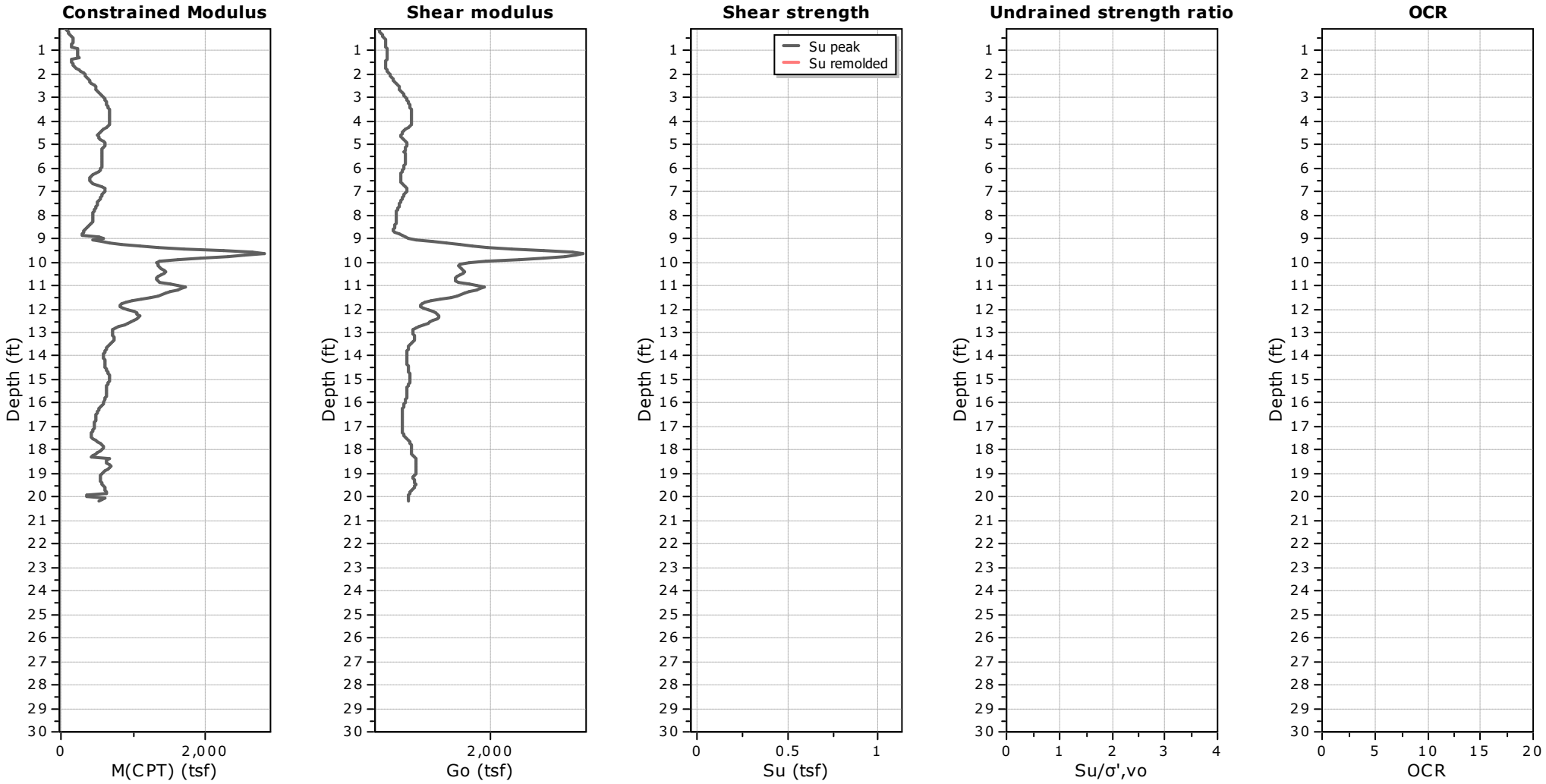
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-26
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 64.27 ft
Coords: X:572573.67, Y:556022.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



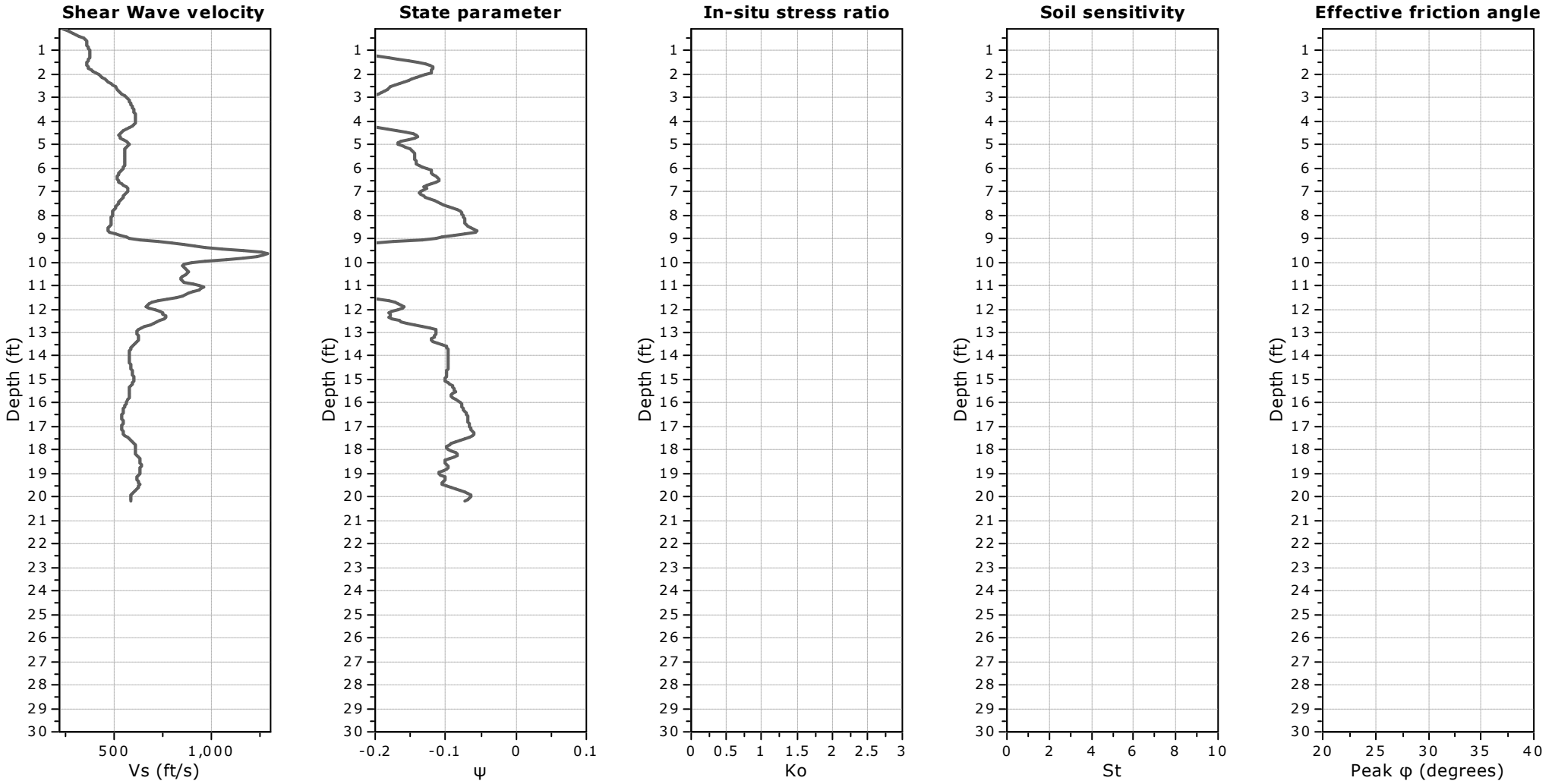
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-26
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 64.27 ft
Coords: X:572573.67, Y:556022.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



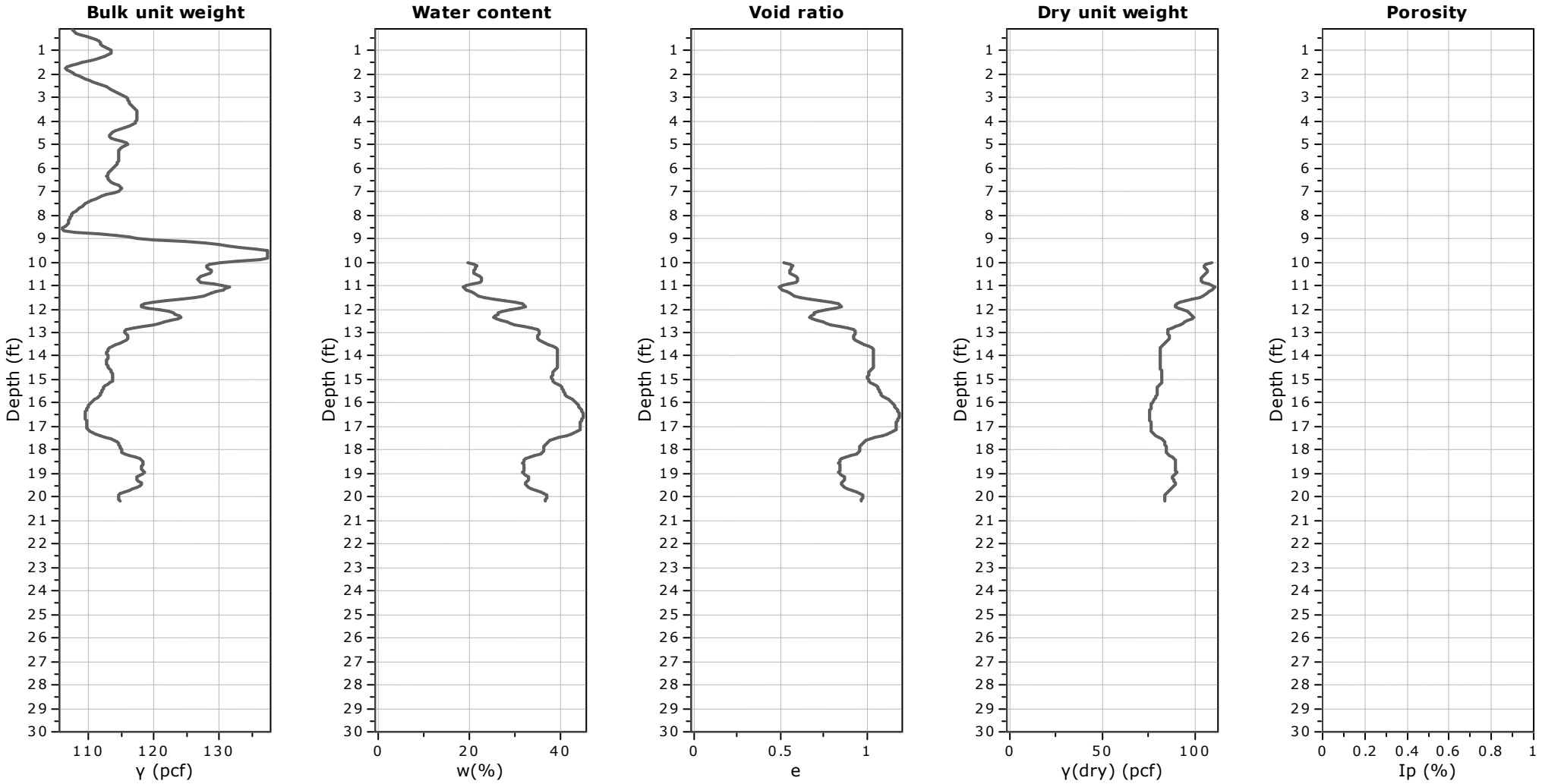
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-26
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 64.27 ft
Coords: X:572573.67, Y:556022.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

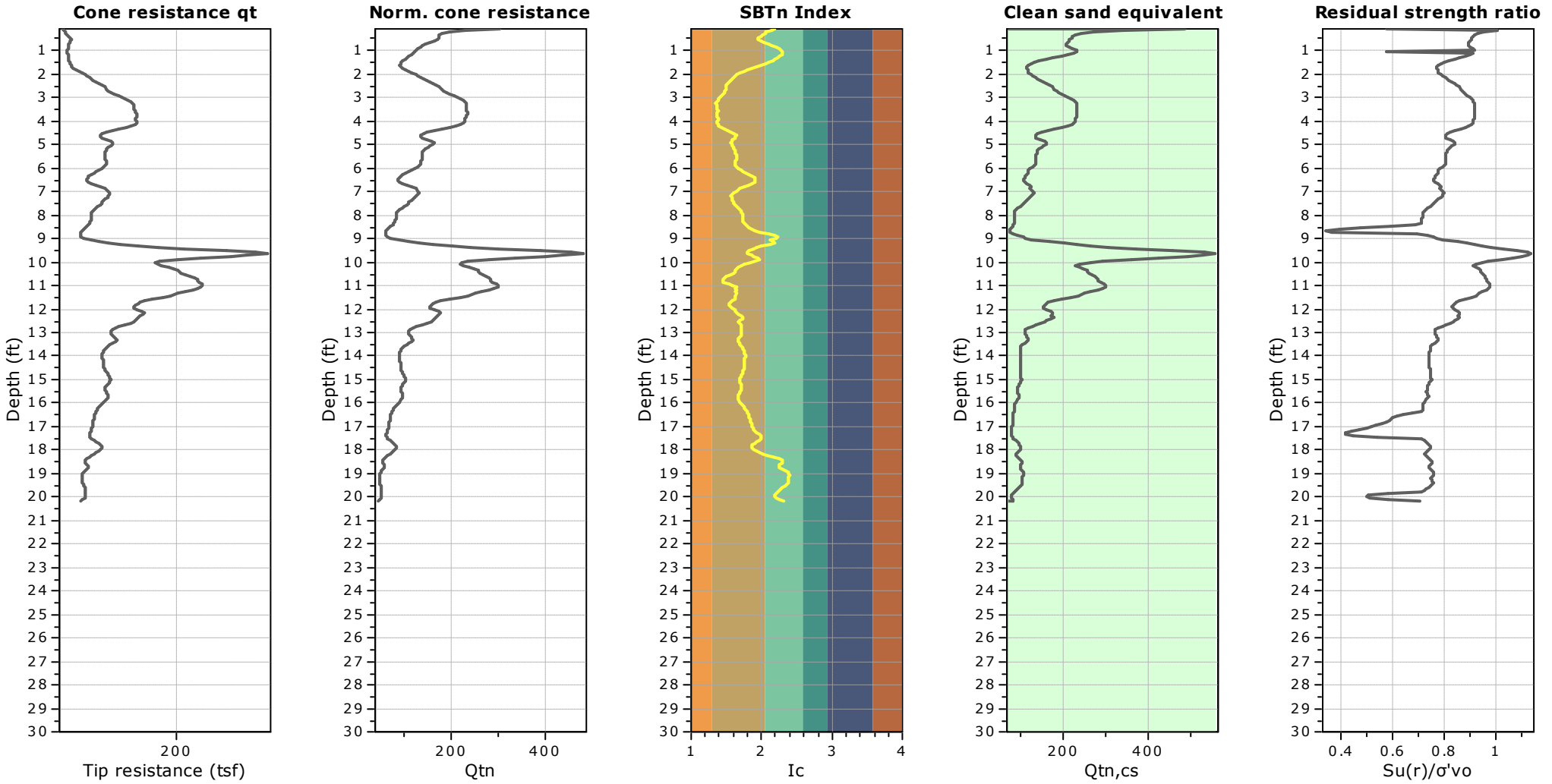
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-26
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 64.27 ft
Coords: X:572573.67, Y:556022.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

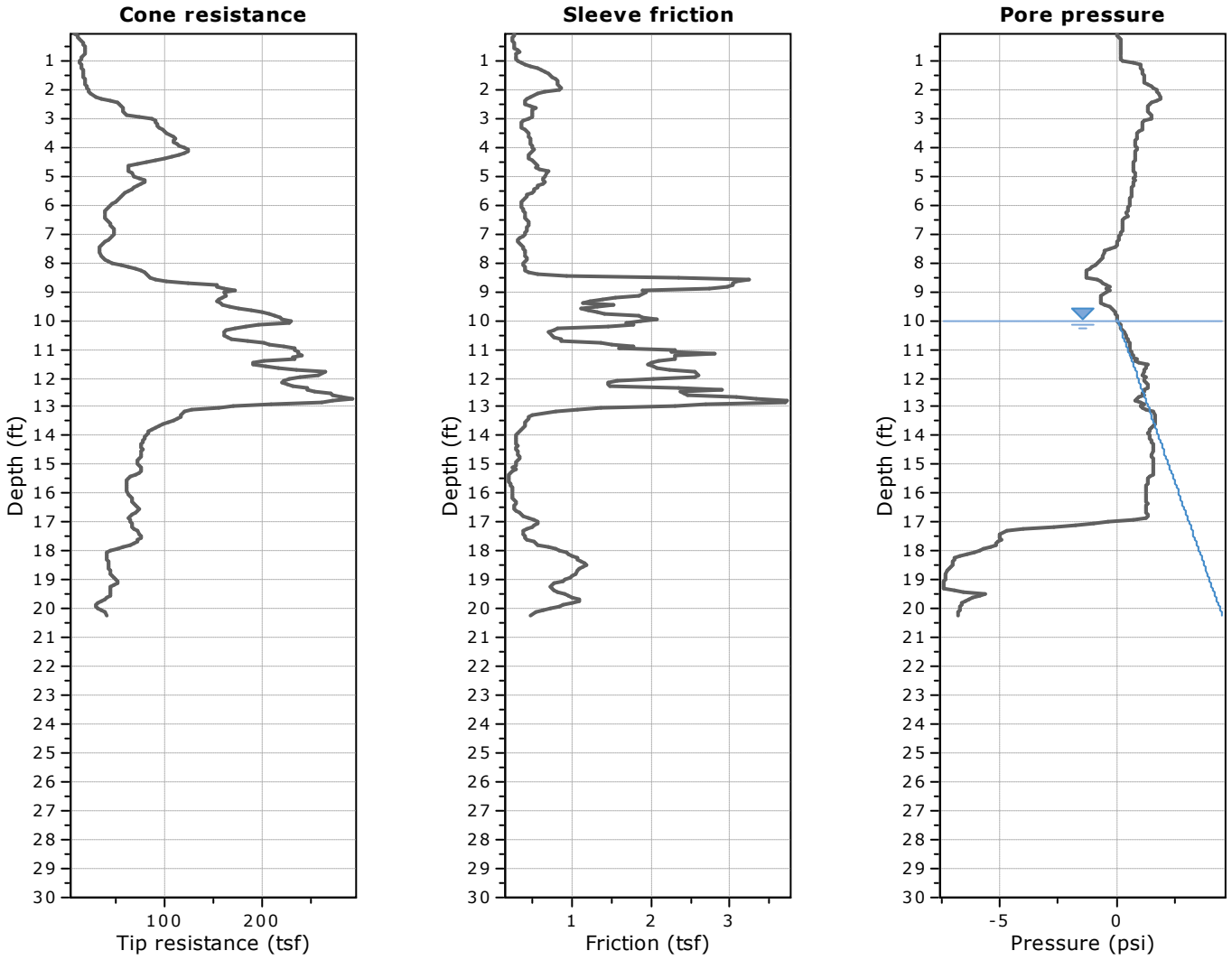
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



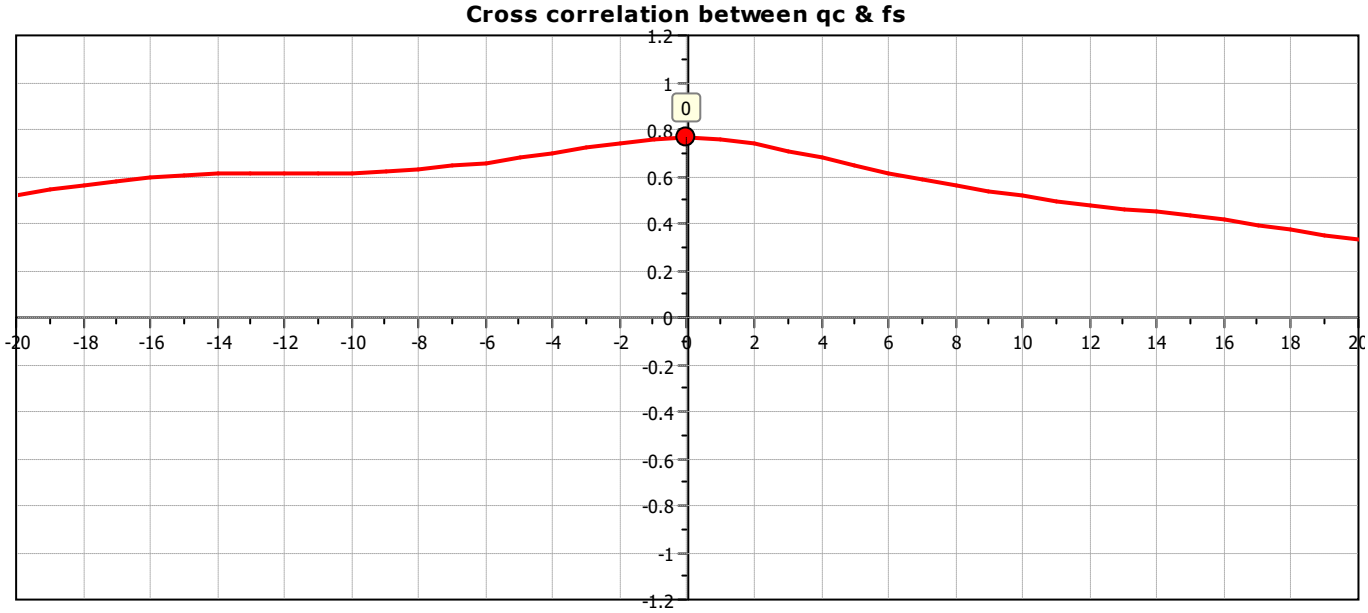
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

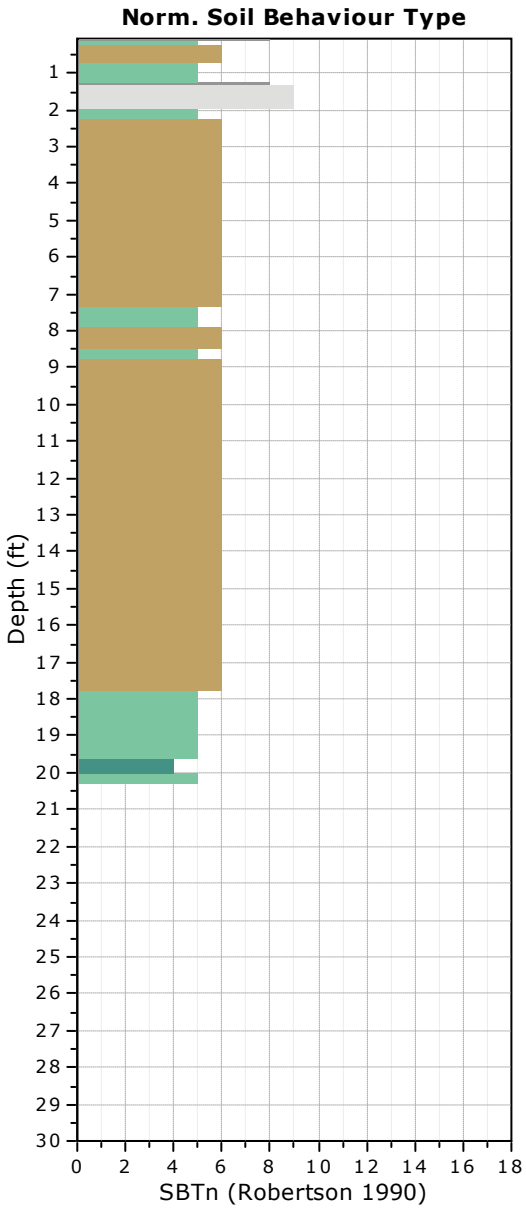
C-27
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 62.44 ft
Coords: X:572660.37, Y:555928.27
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

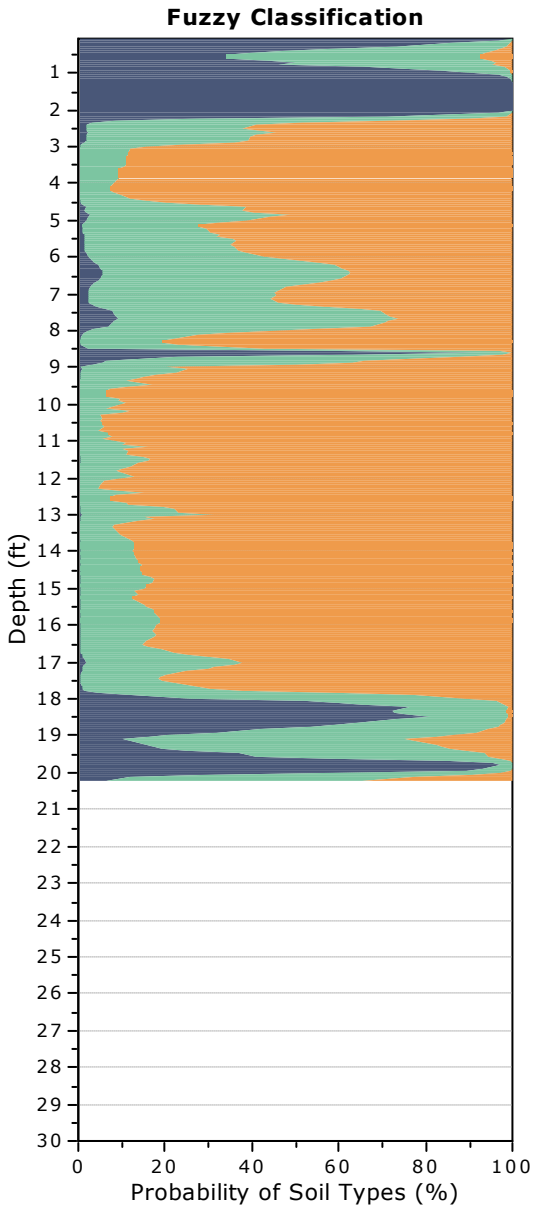
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







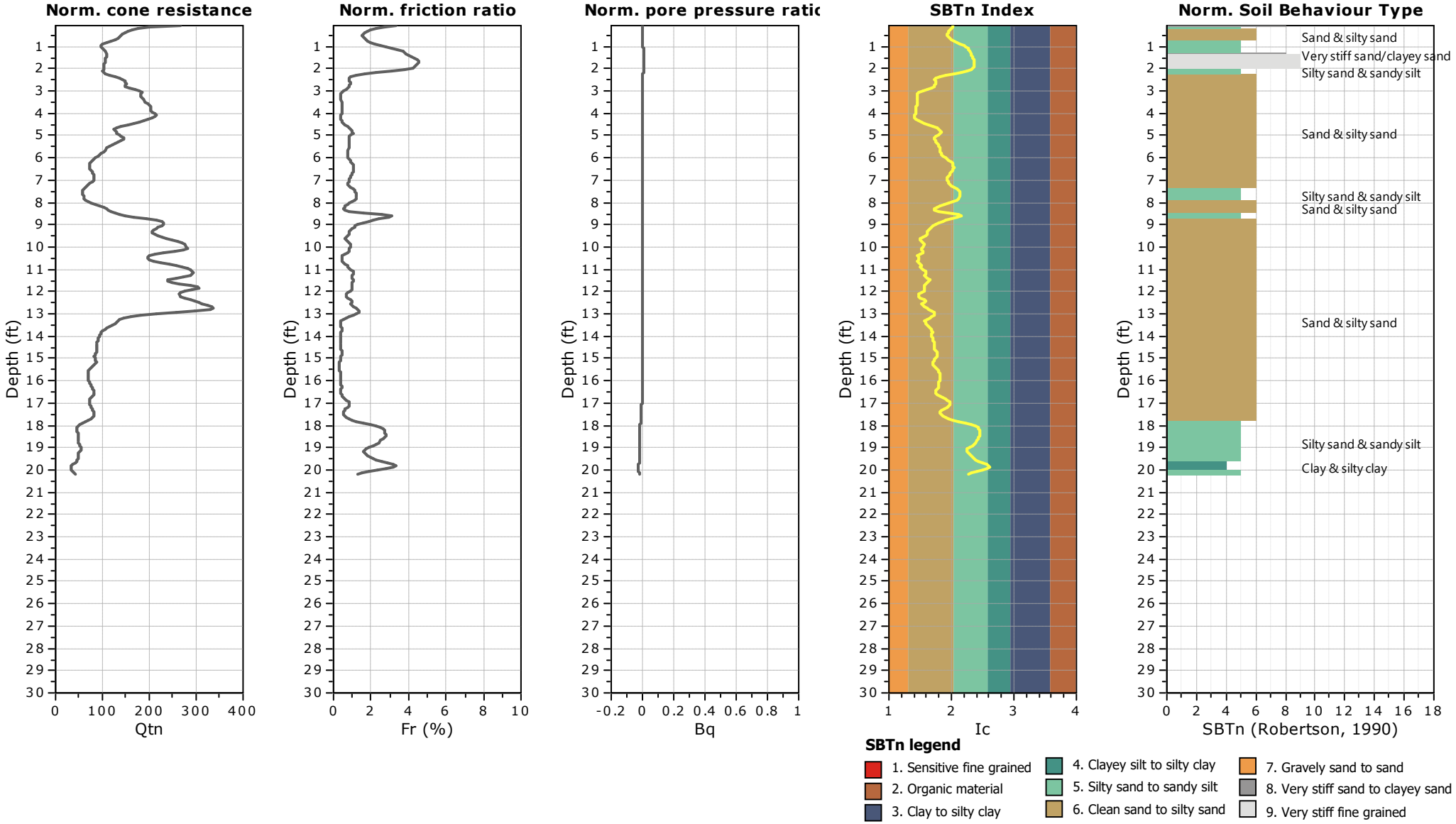
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-27
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 62.44 ft
Coords: X:572660.37, Y:555928.27
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

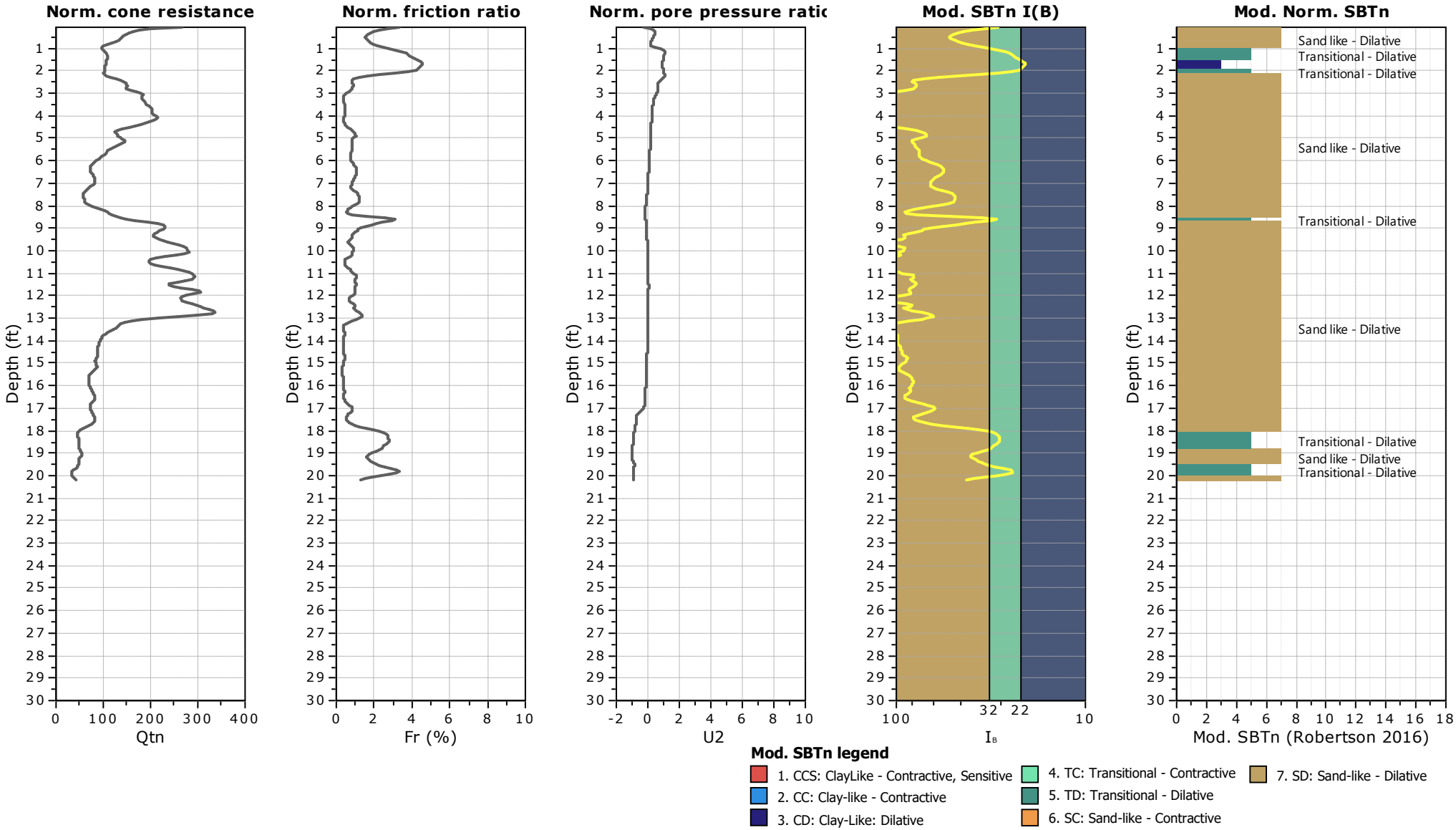
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-27
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 62.44 ft
Coords: X:572660.37, Y:555928.27
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

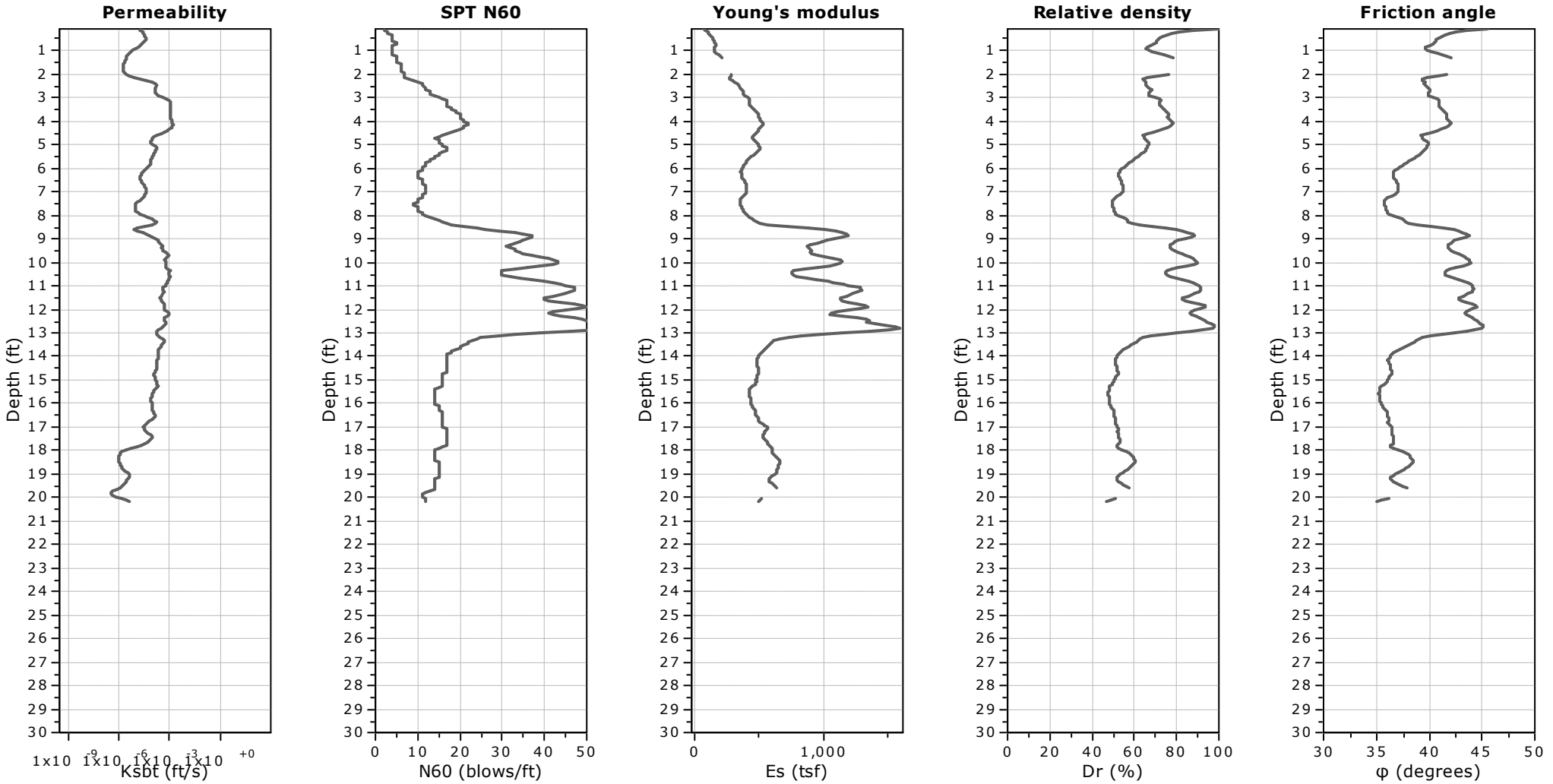
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-27
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 62.44 ft
Coords: X:572660.37, Y:555928.27
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



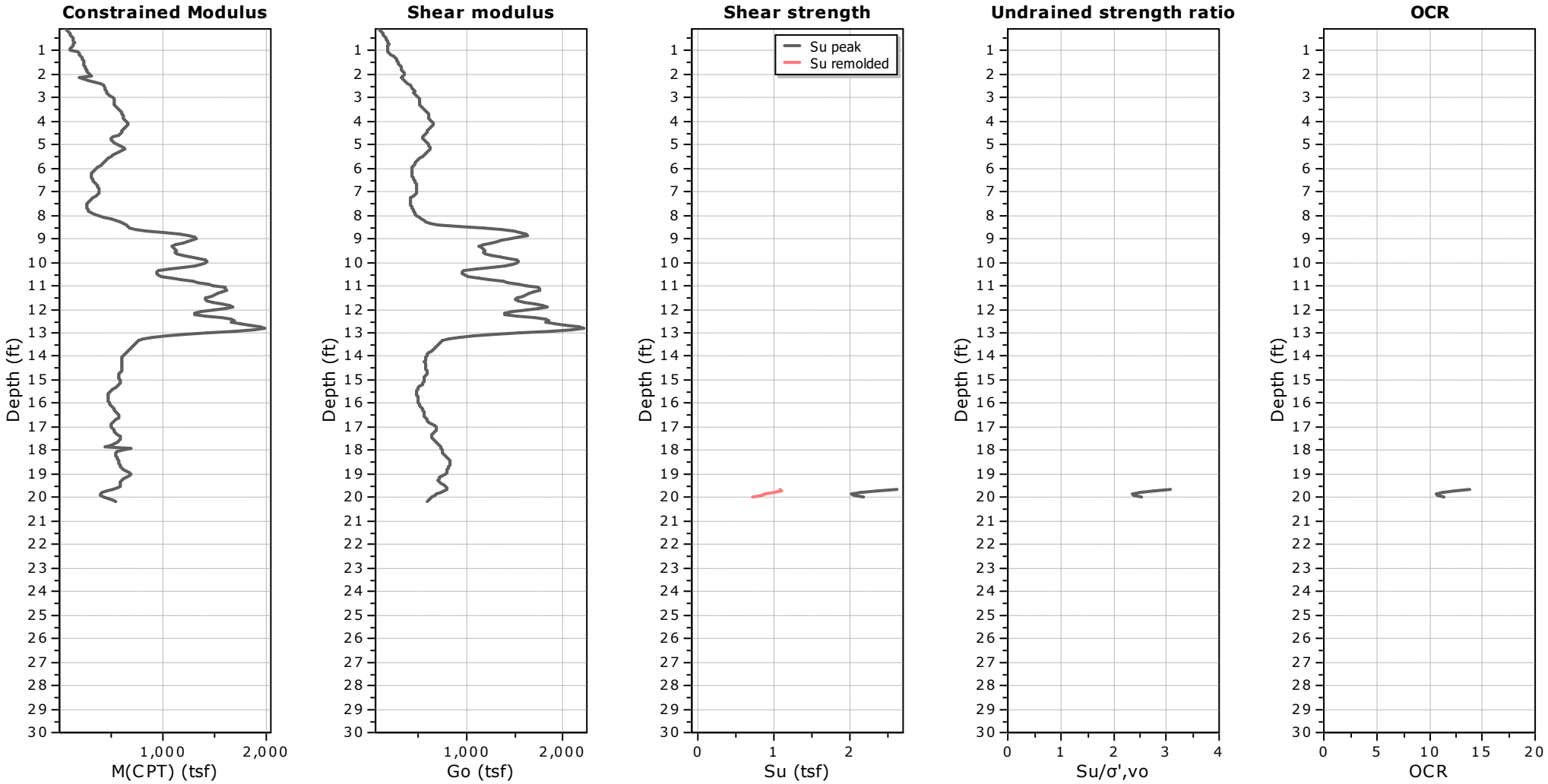
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-27
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 62.44 ft
Coords: X:572660.37, Y:555928.27
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



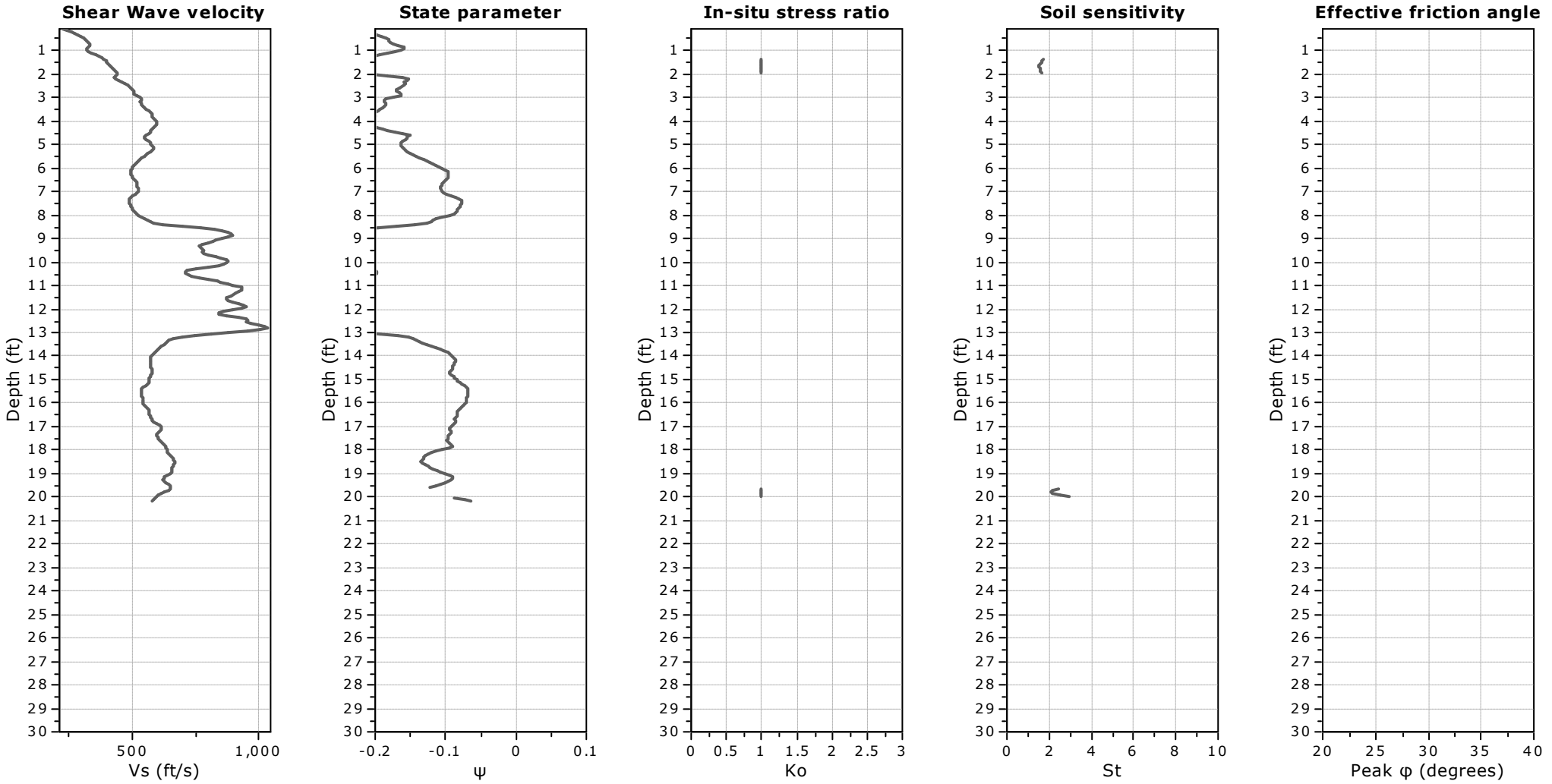
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-27
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 62.44 ft
Coords: X:572660.37, Y:555928.27
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



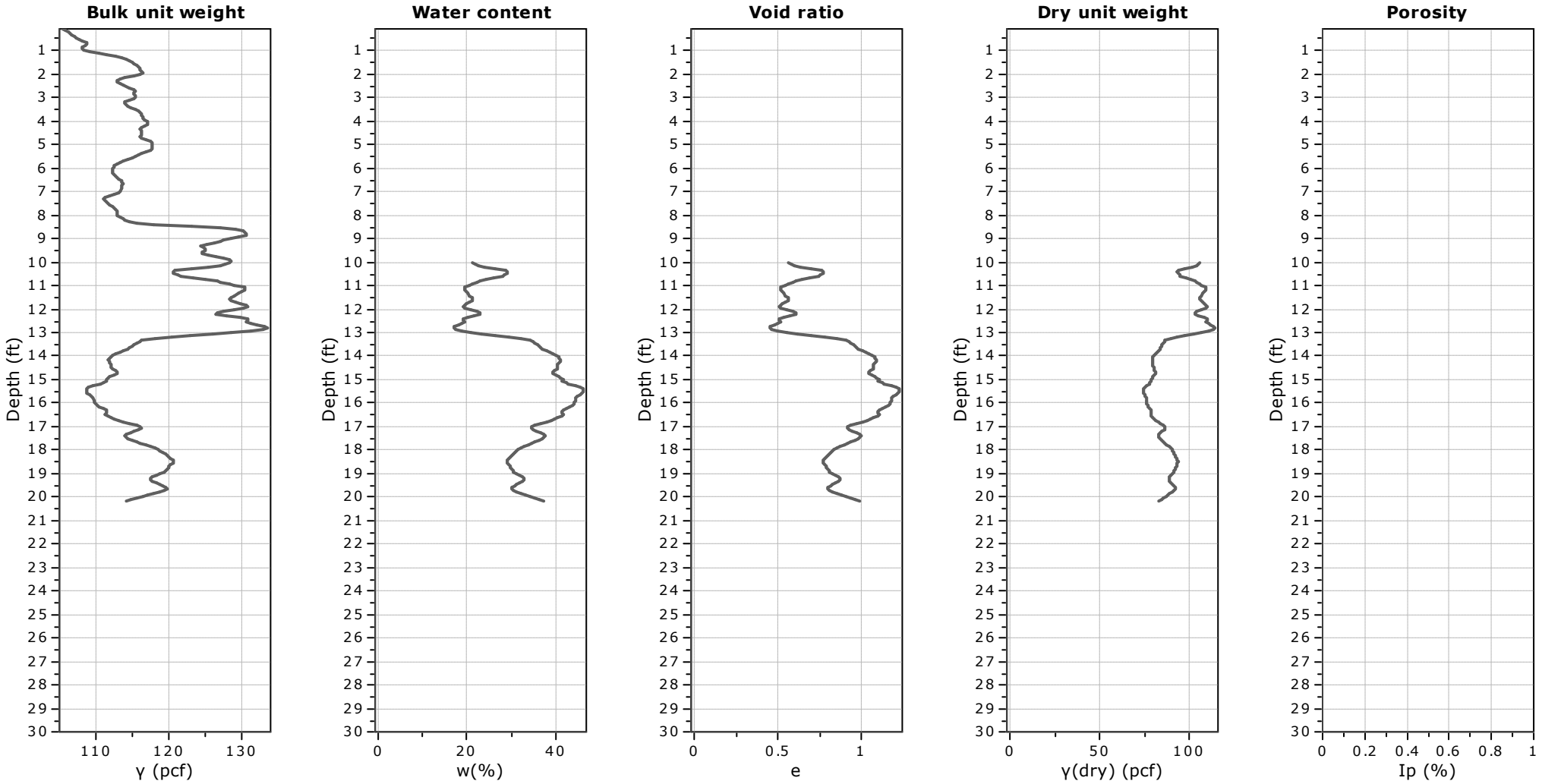
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-27
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 62.44 ft
Coords: X:572660.37, Y:555928.27
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

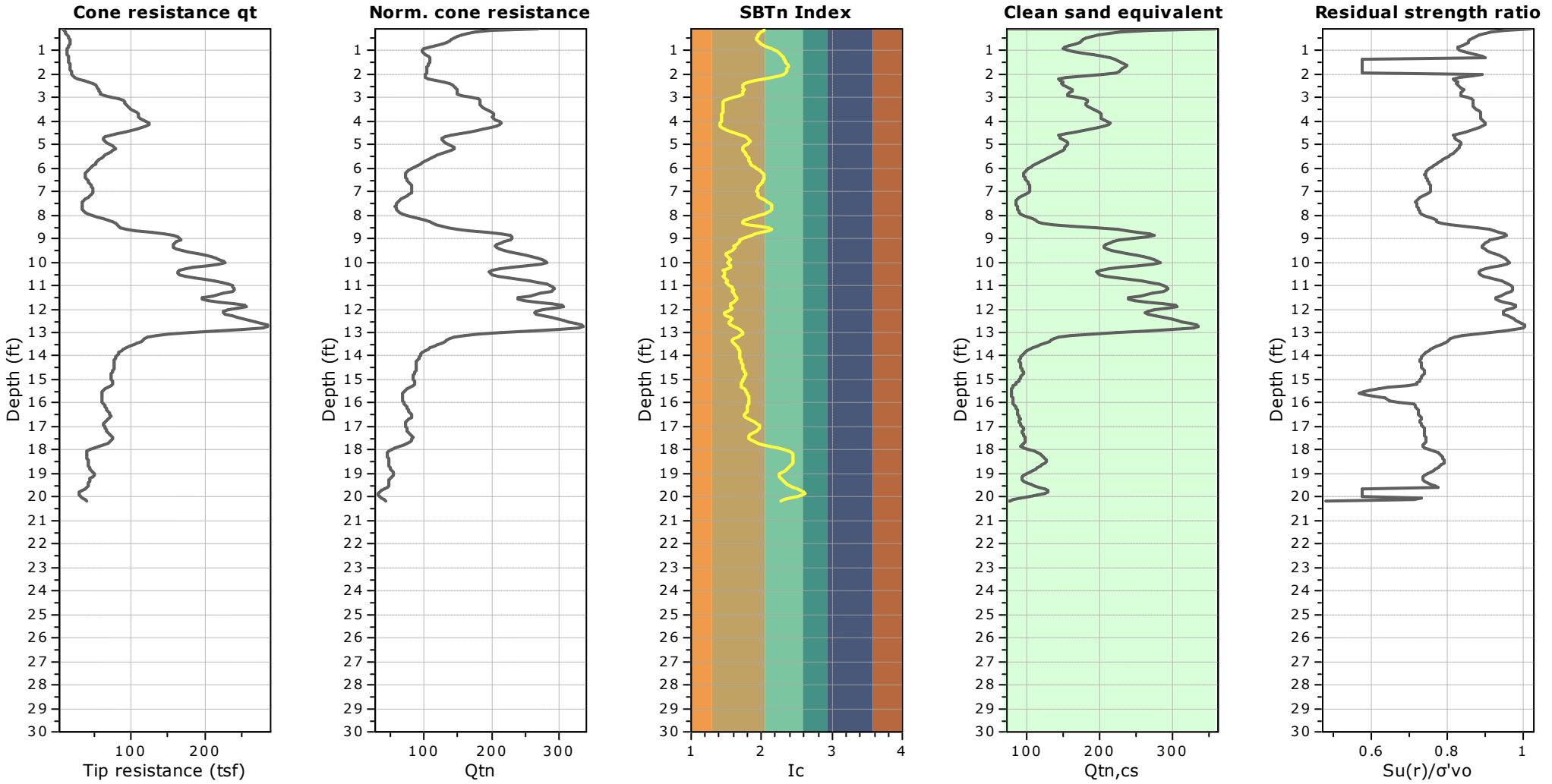
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-27
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 62.44 ft
Coords: X:572660.37, Y:555928.27
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

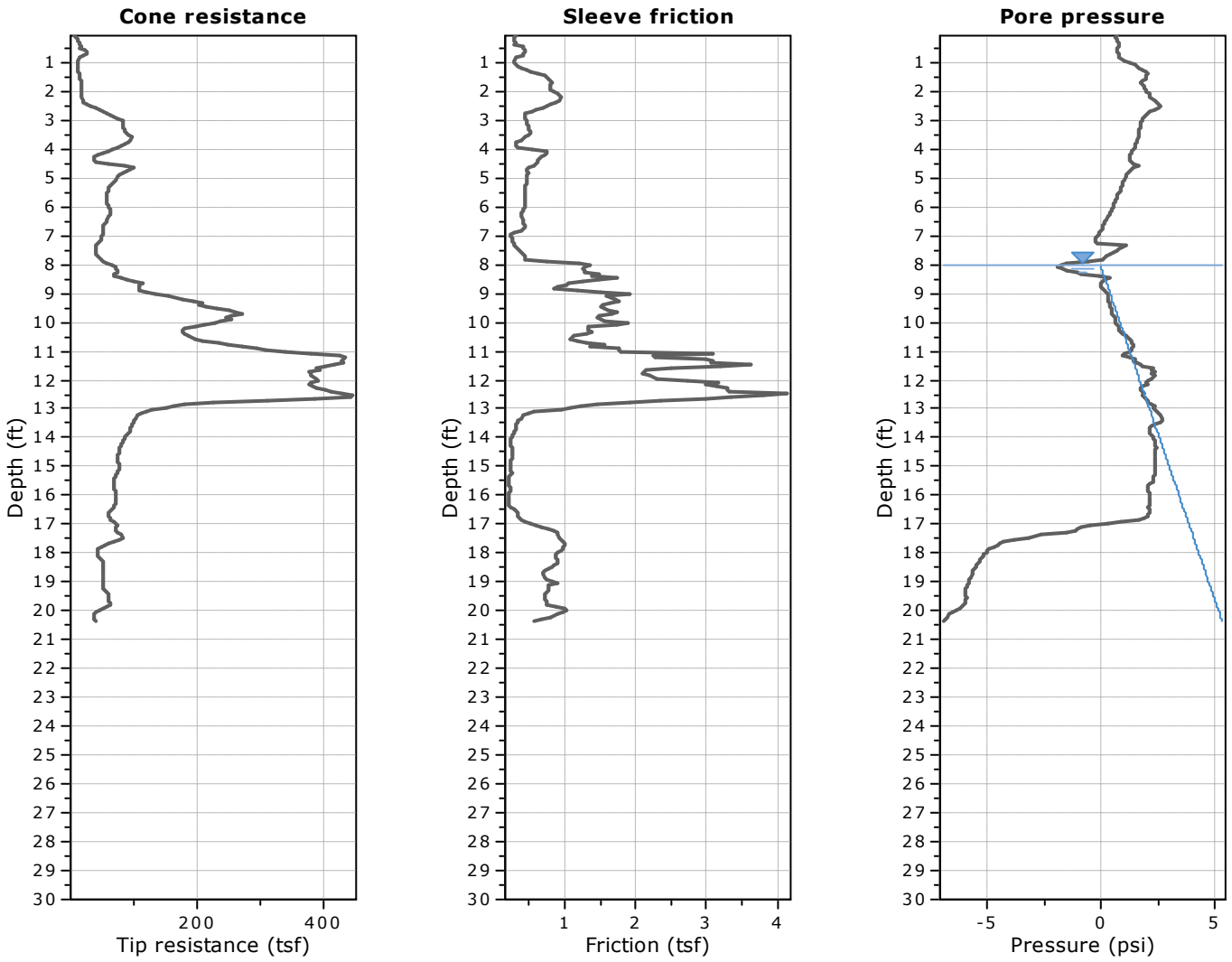
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



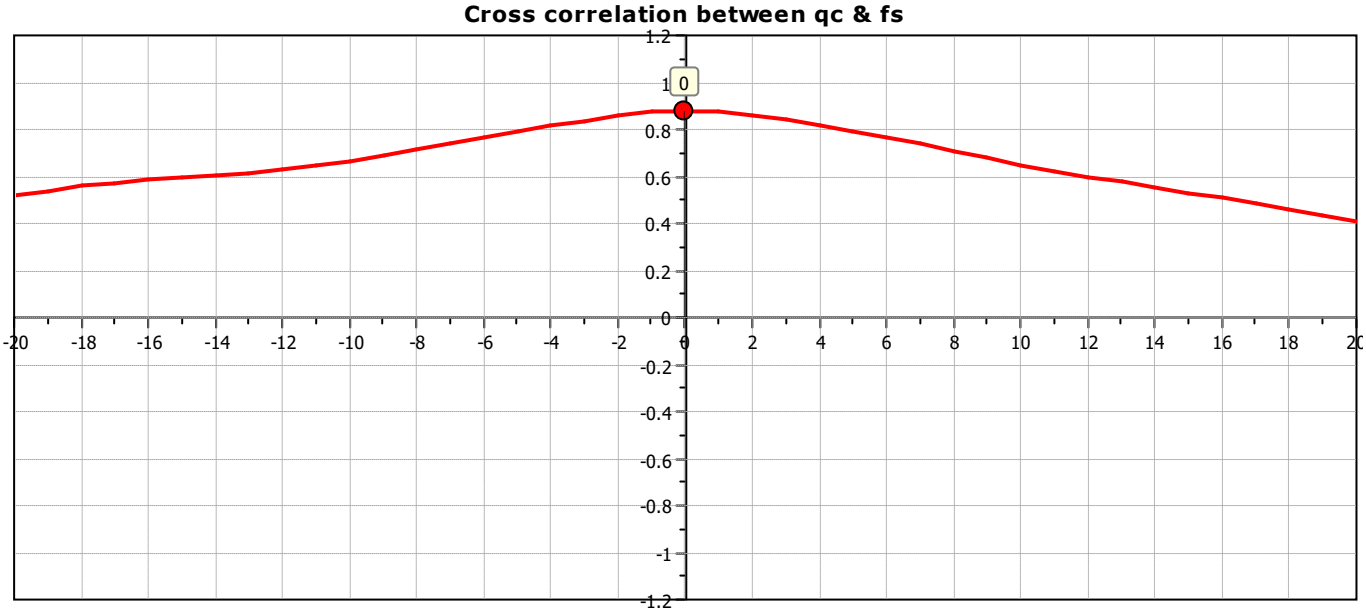
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

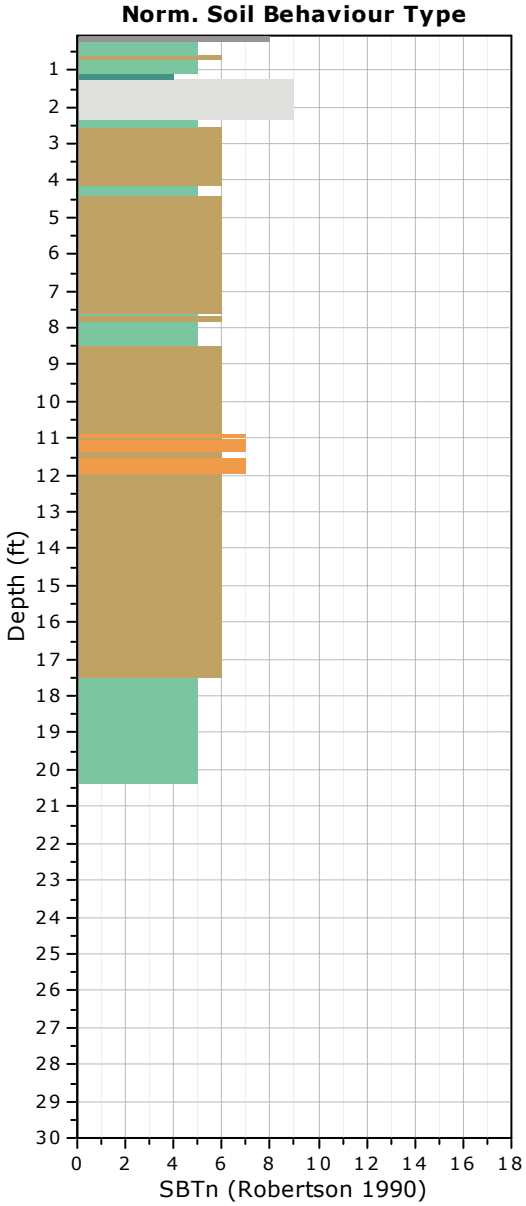
C-28
Total depth: 20.33 ft, Date: 5/13/2024
Surface Elevation: 62.31 ft
Coords: X:572653.14, Y:555871.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

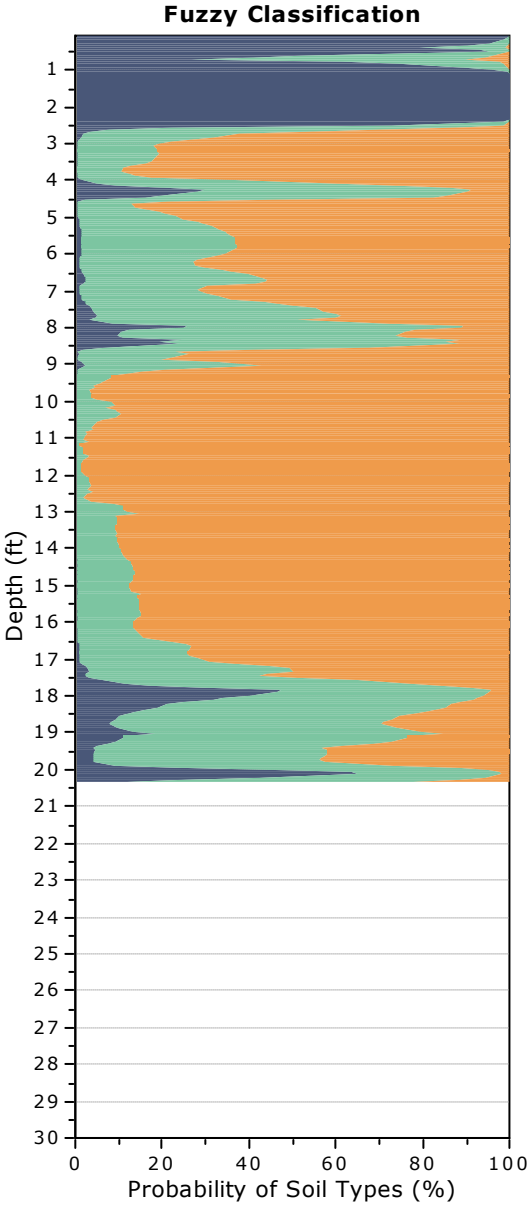
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







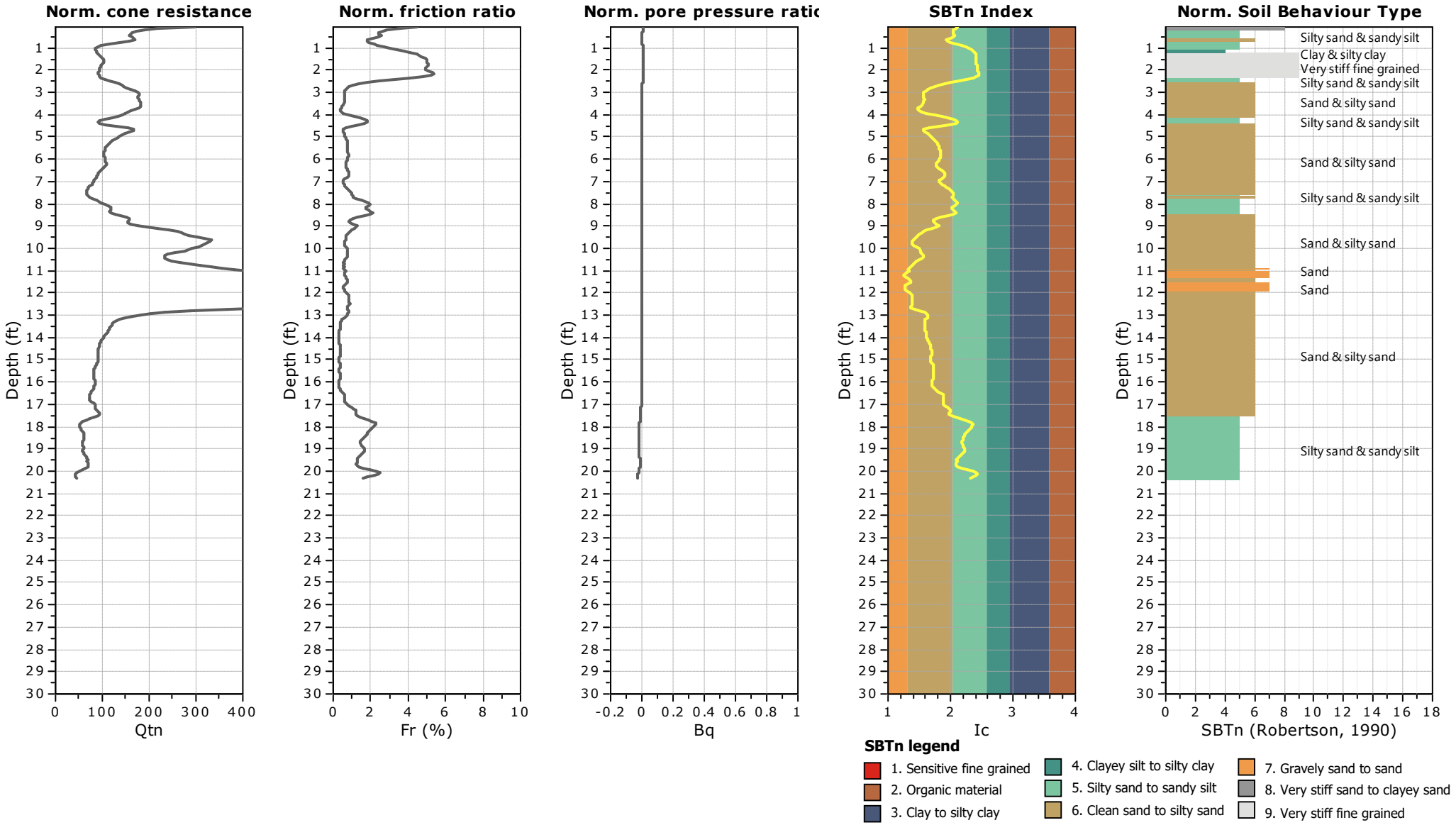
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

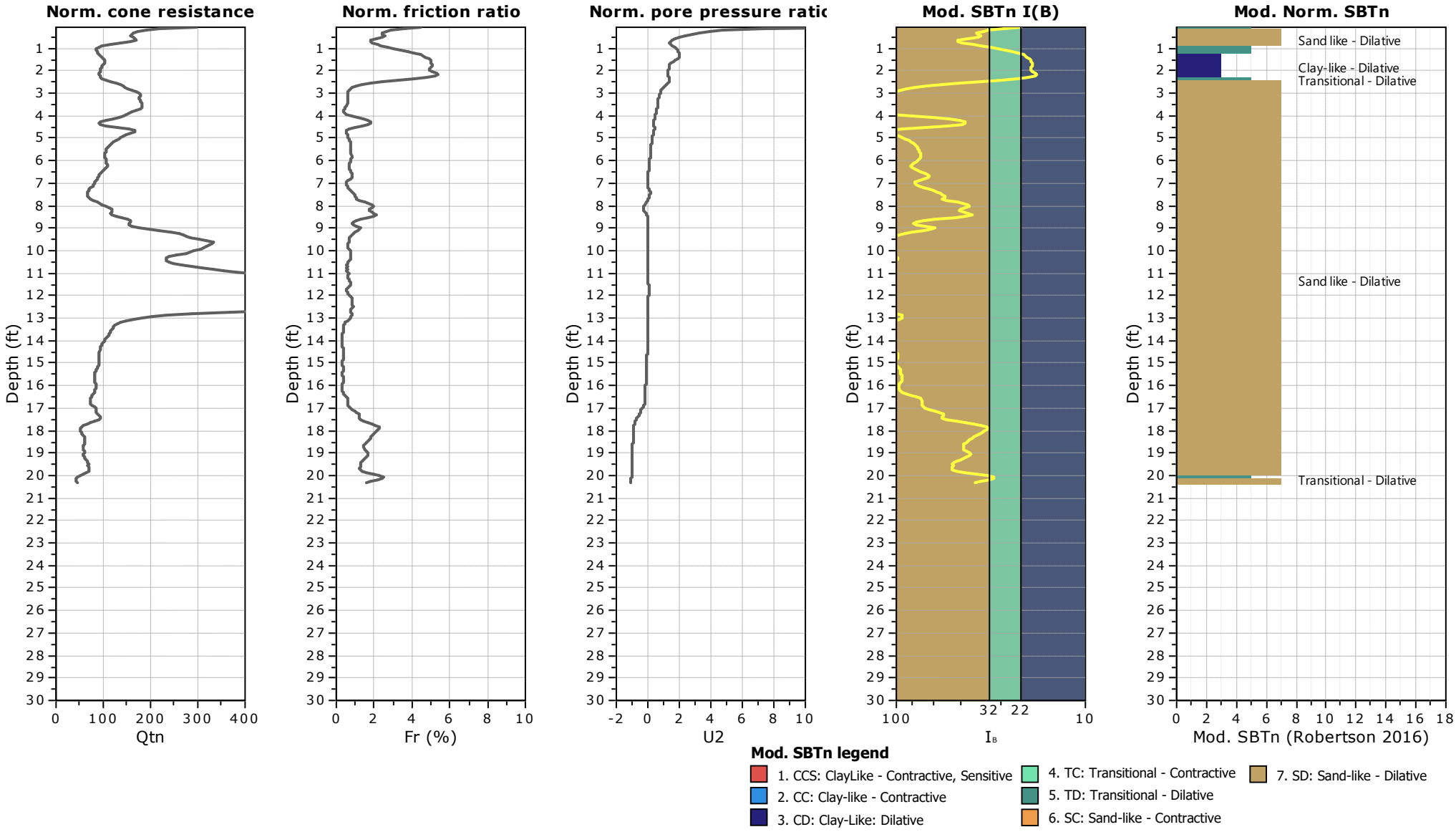
C-28
Total depth: 20.33 ft, Date: 5/13/2024
Surface Elevation: 62.31 ft
Coords: X:572653.14, Y:555871.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

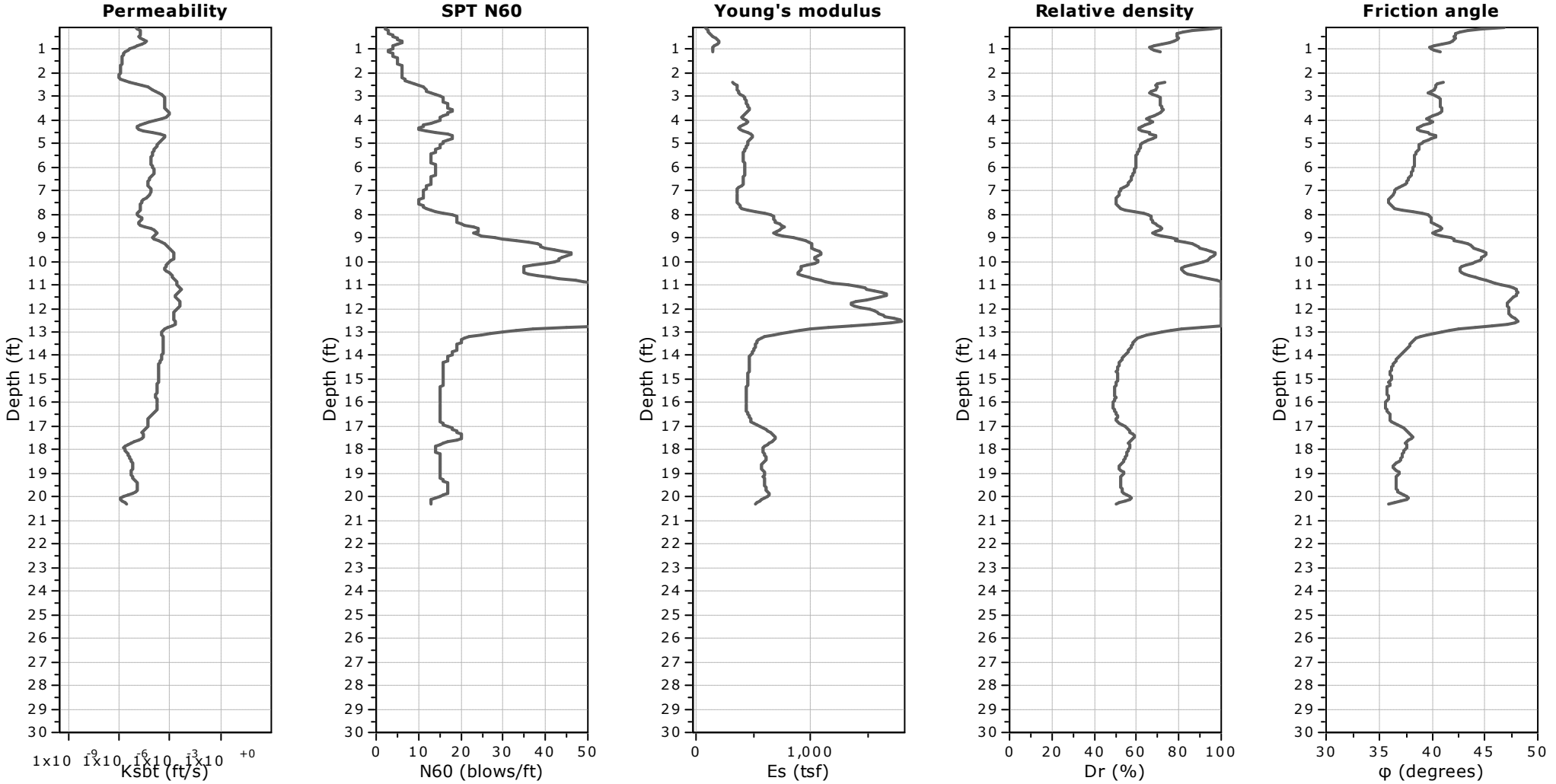
C-28
Total depth: 20.33 ft, Date: 5/13/2024
Surface Elevation: 62.31 ft
Coords: X:572653.14, Y:555871.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-28
Total depth: 20.33 ft, Date: 5/13/2024
Surface Elevation: 62.31 ft
Coords: X:572653.14, Y:555871.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



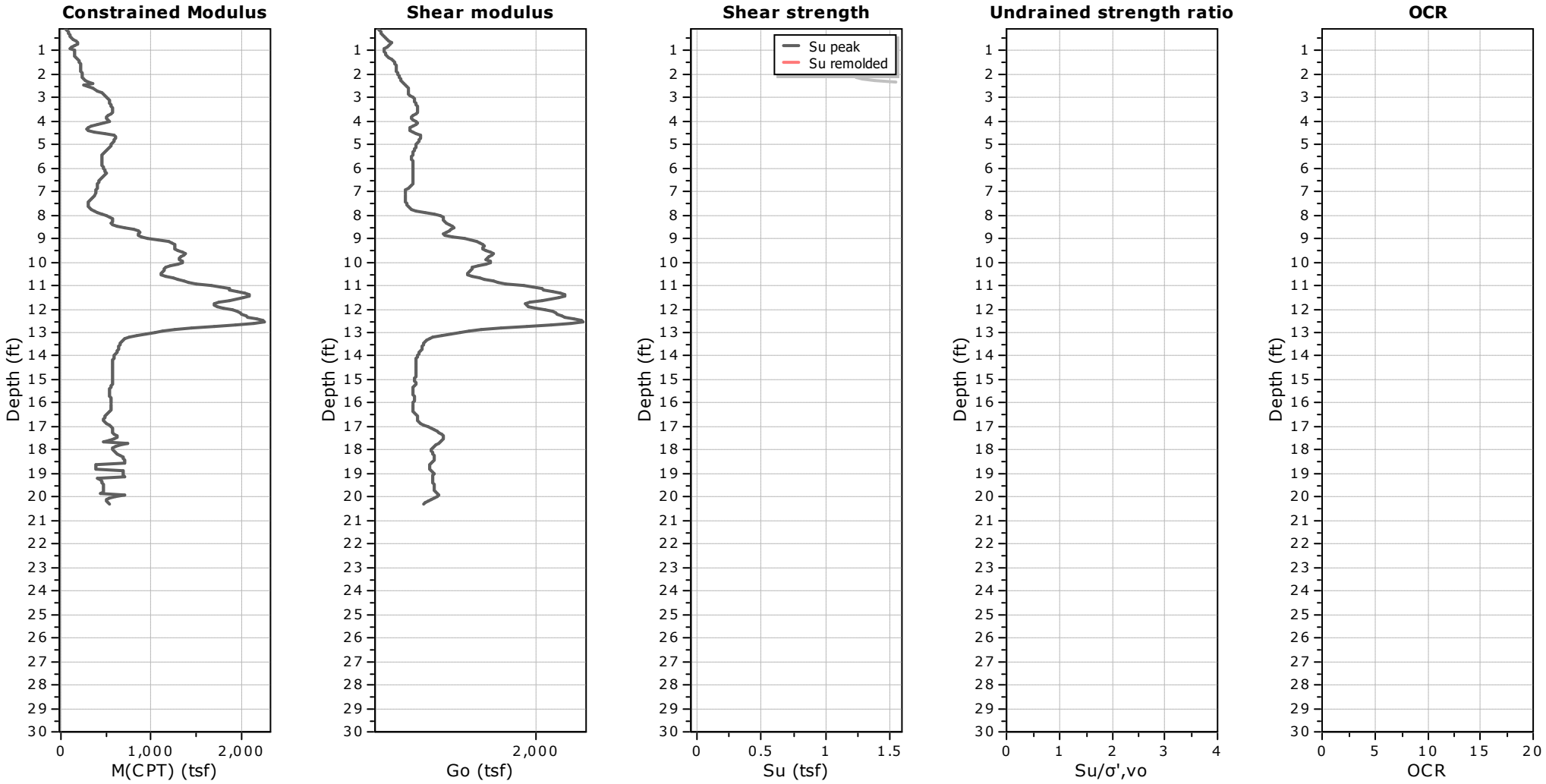
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-28
Total depth: 20.33 ft, Date: 5/13/2024
Surface Elevation: 62.31 ft
Coords: X:572653.14, Y:555871.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



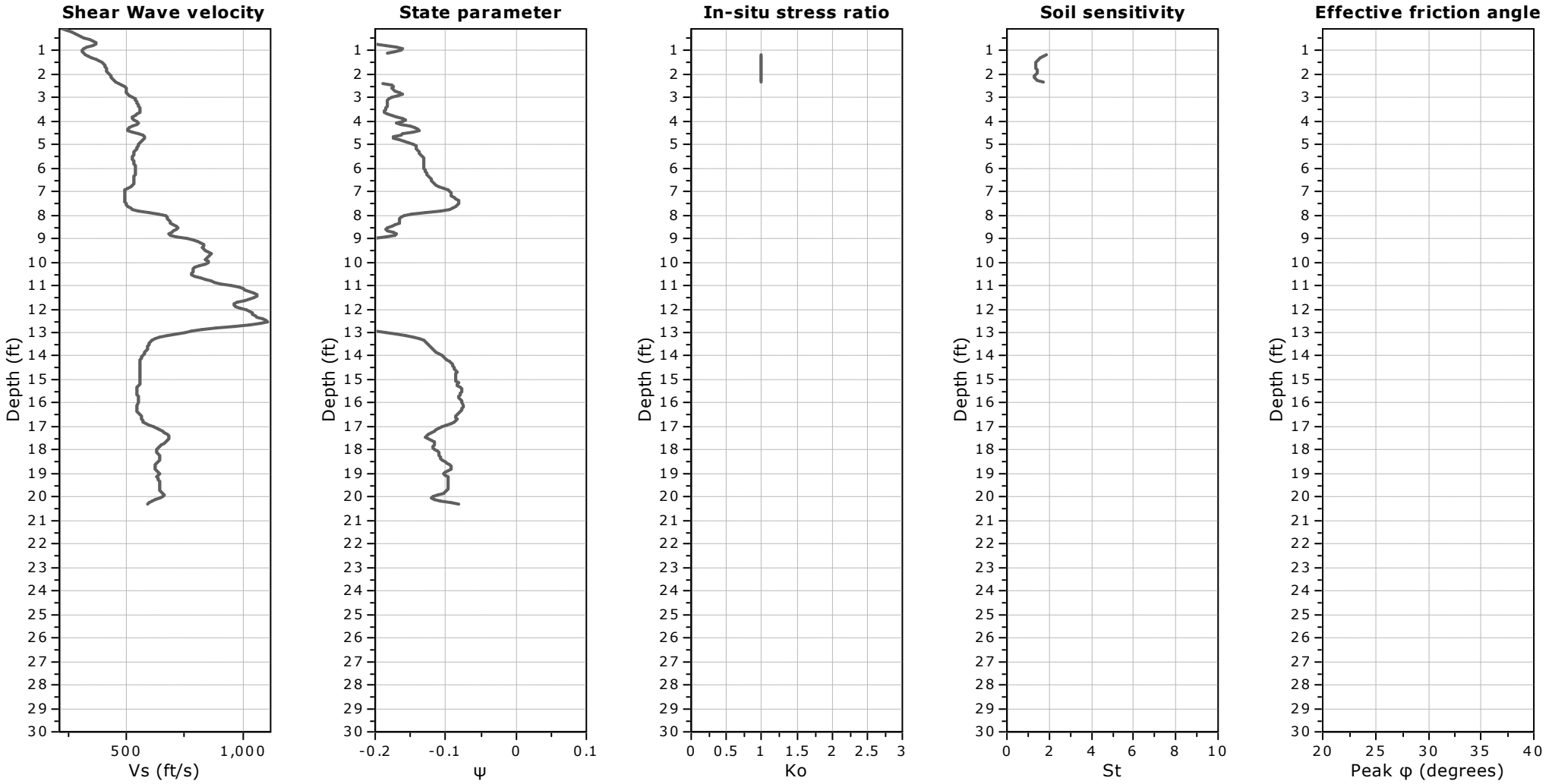
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-28
Total depth: 20.33 ft, Date: 5/13/2024
Surface Elevation: 62.31 ft
Coords: X:572653.14, Y:555871.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



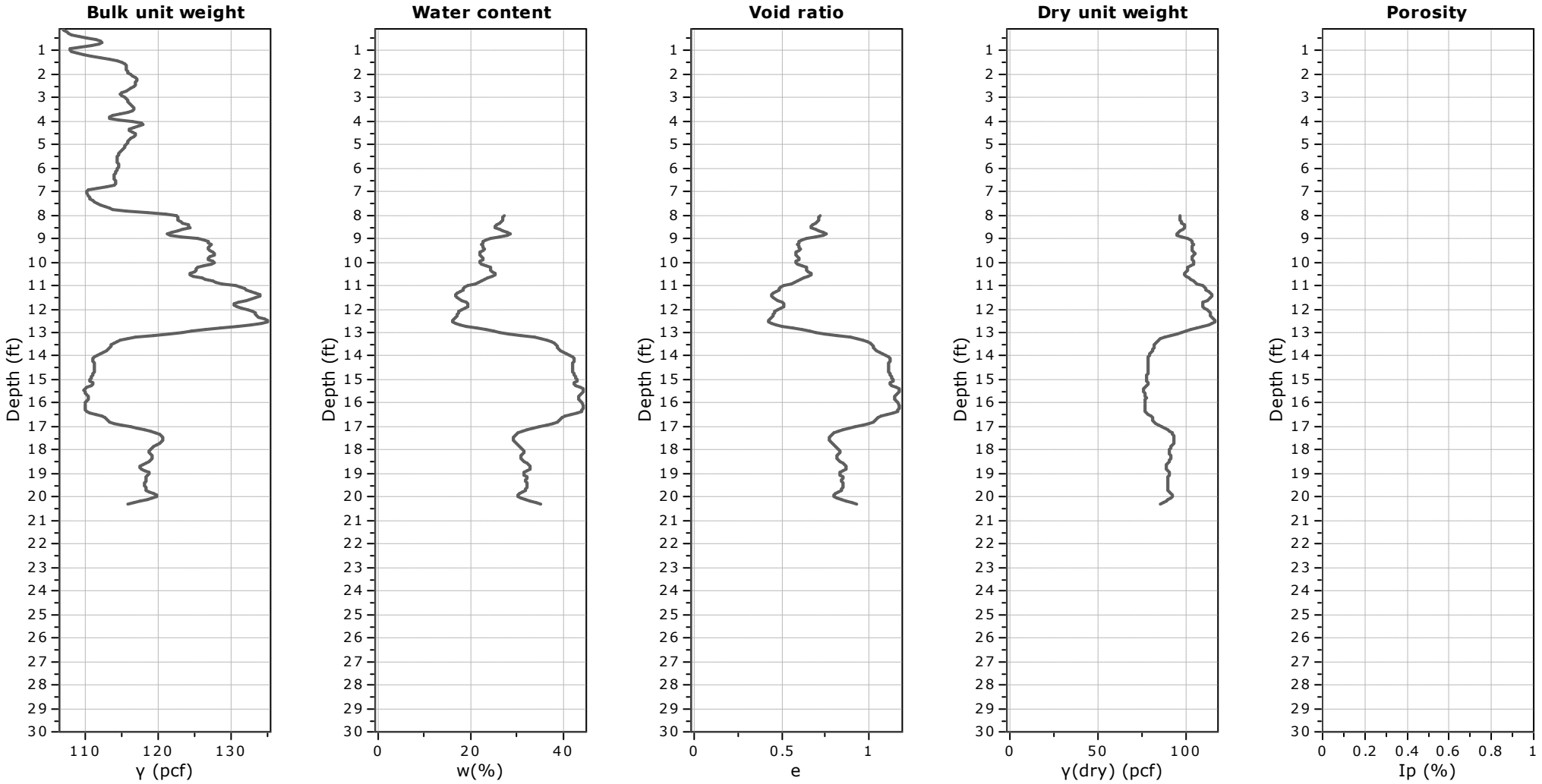
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-28
Total depth: 20.33 ft, Date: 5/13/2024
Surface Elevation: 62.31 ft
Coords: X:572653.14, Y:555871.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

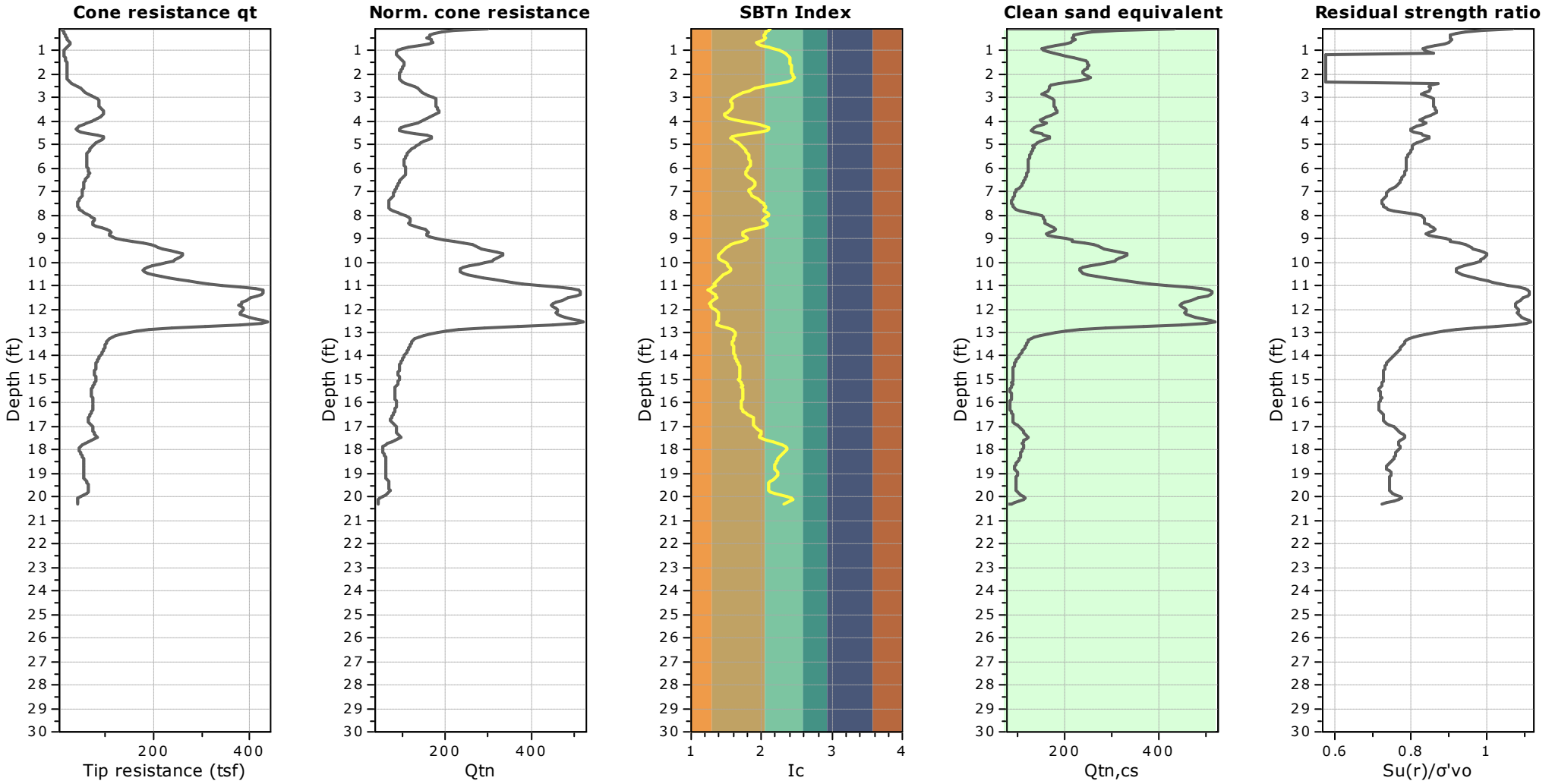
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-28
Total depth: 20.33 ft, Date: 5/13/2024
Surface Elevation: 62.31 ft
Coords: X:572653.14, Y:555871.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

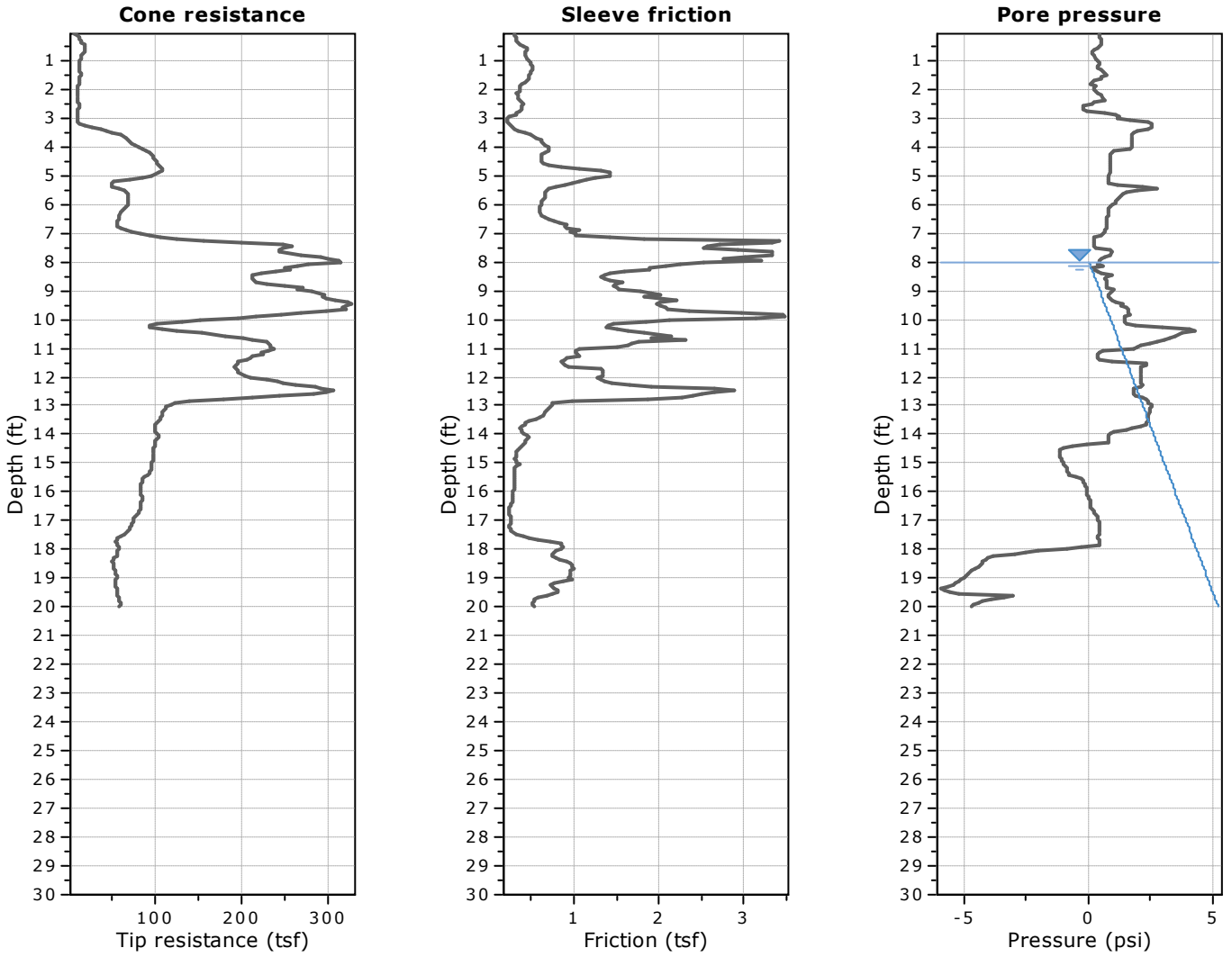
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



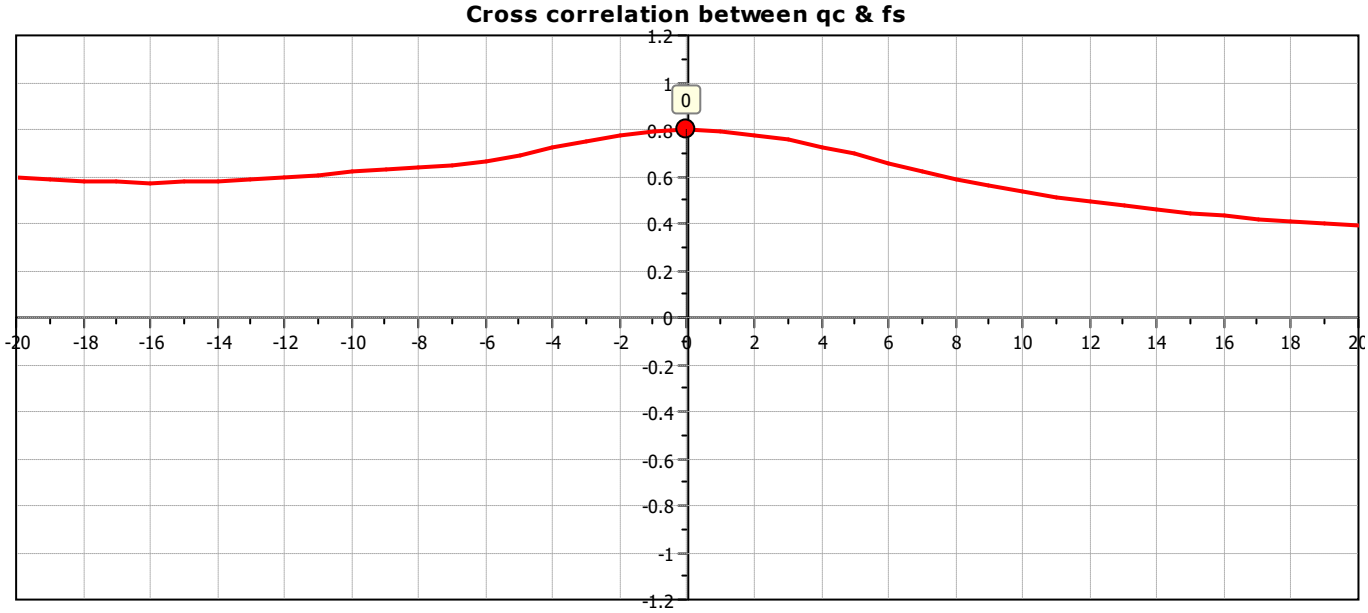
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

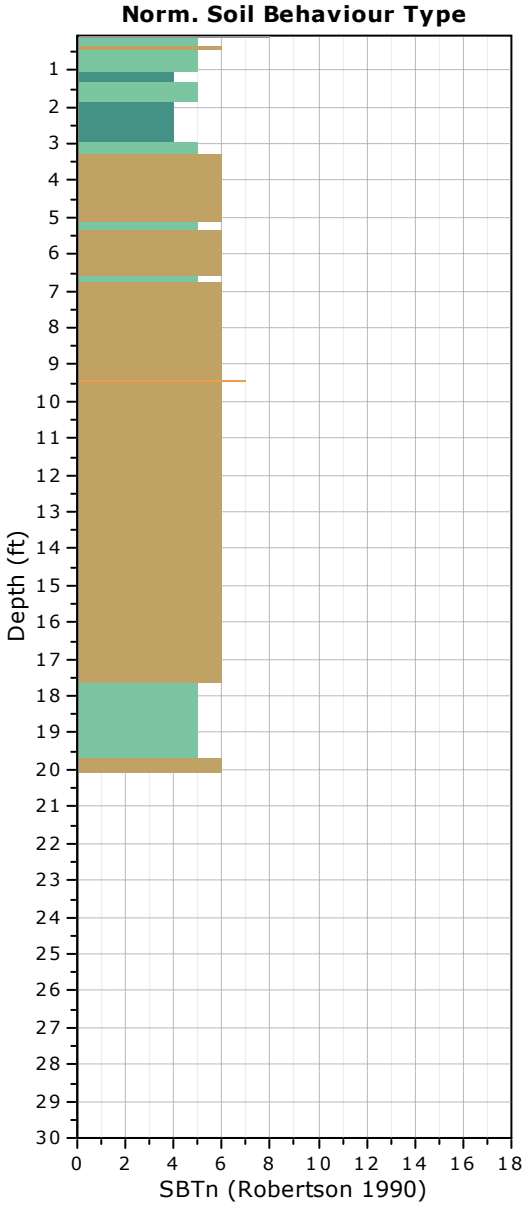
C-29
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 62.07 ft
Coords: X:572639.92, Y:555783.52
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

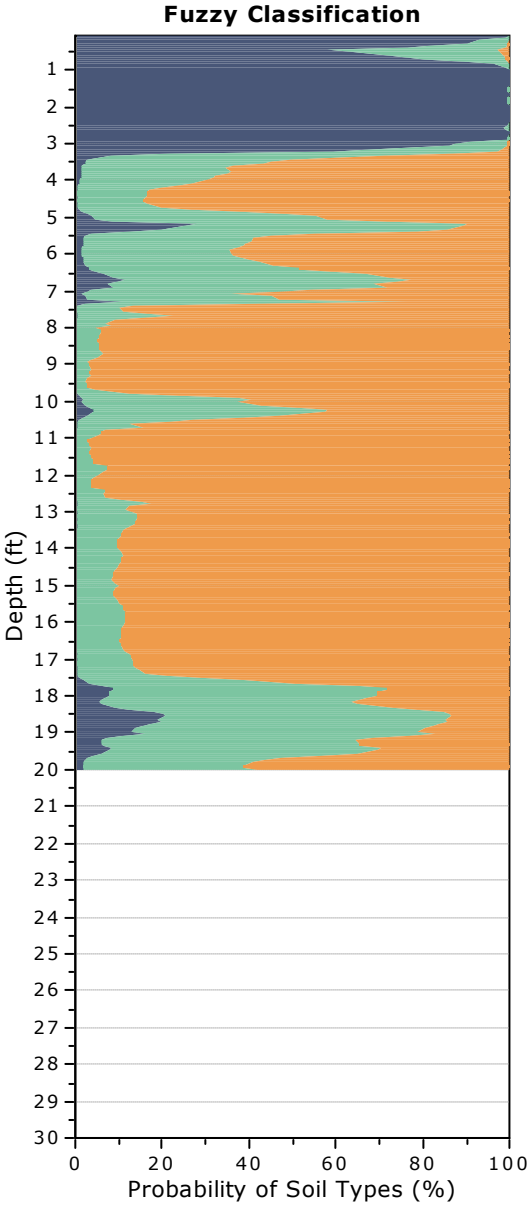
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







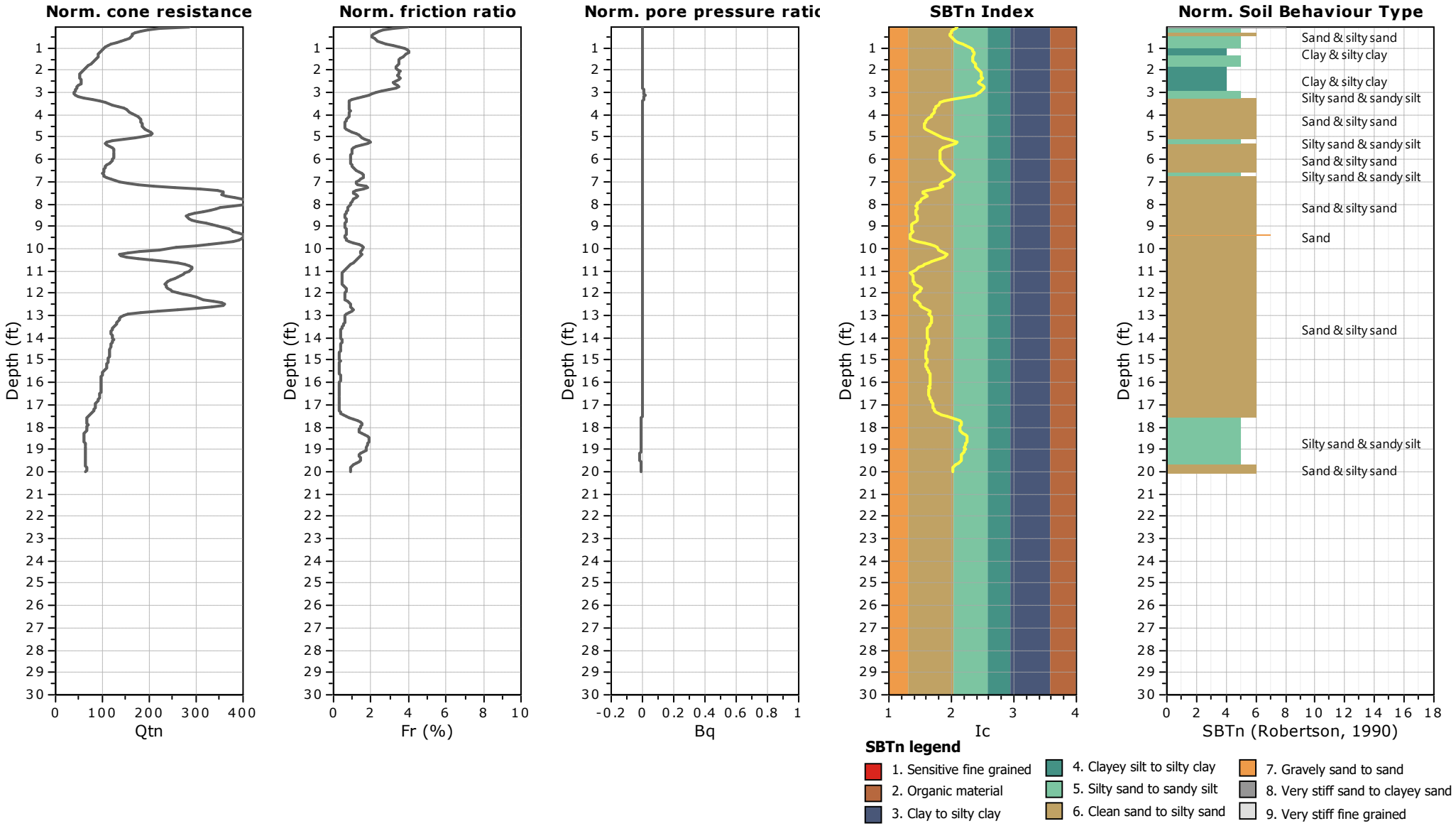
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-29
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 62.07 ft
Coords: X:572639.92, Y:555783.52
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

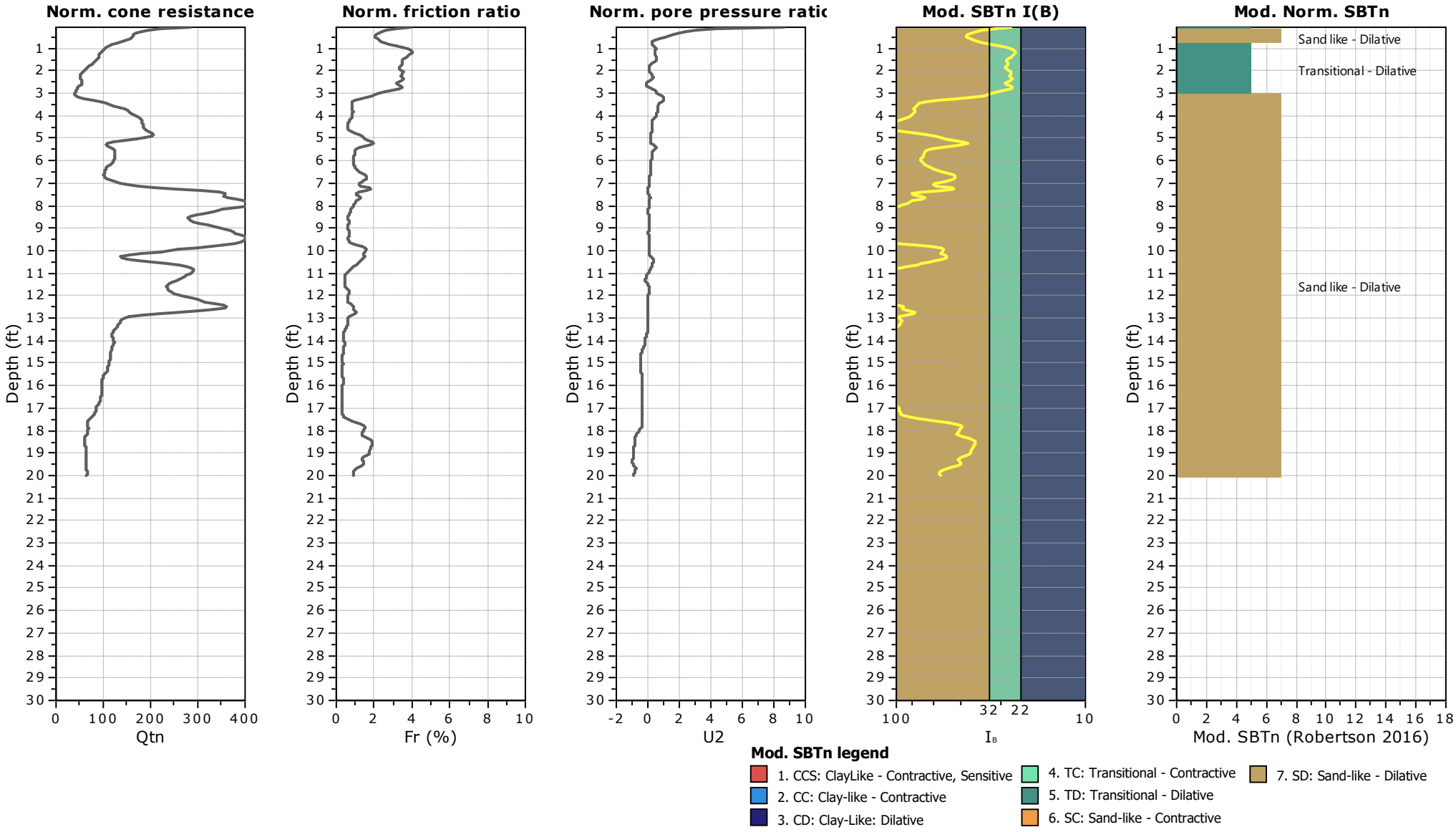
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-29
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 62.07 ft
Coords: X:572639.92, Y:555783.52
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

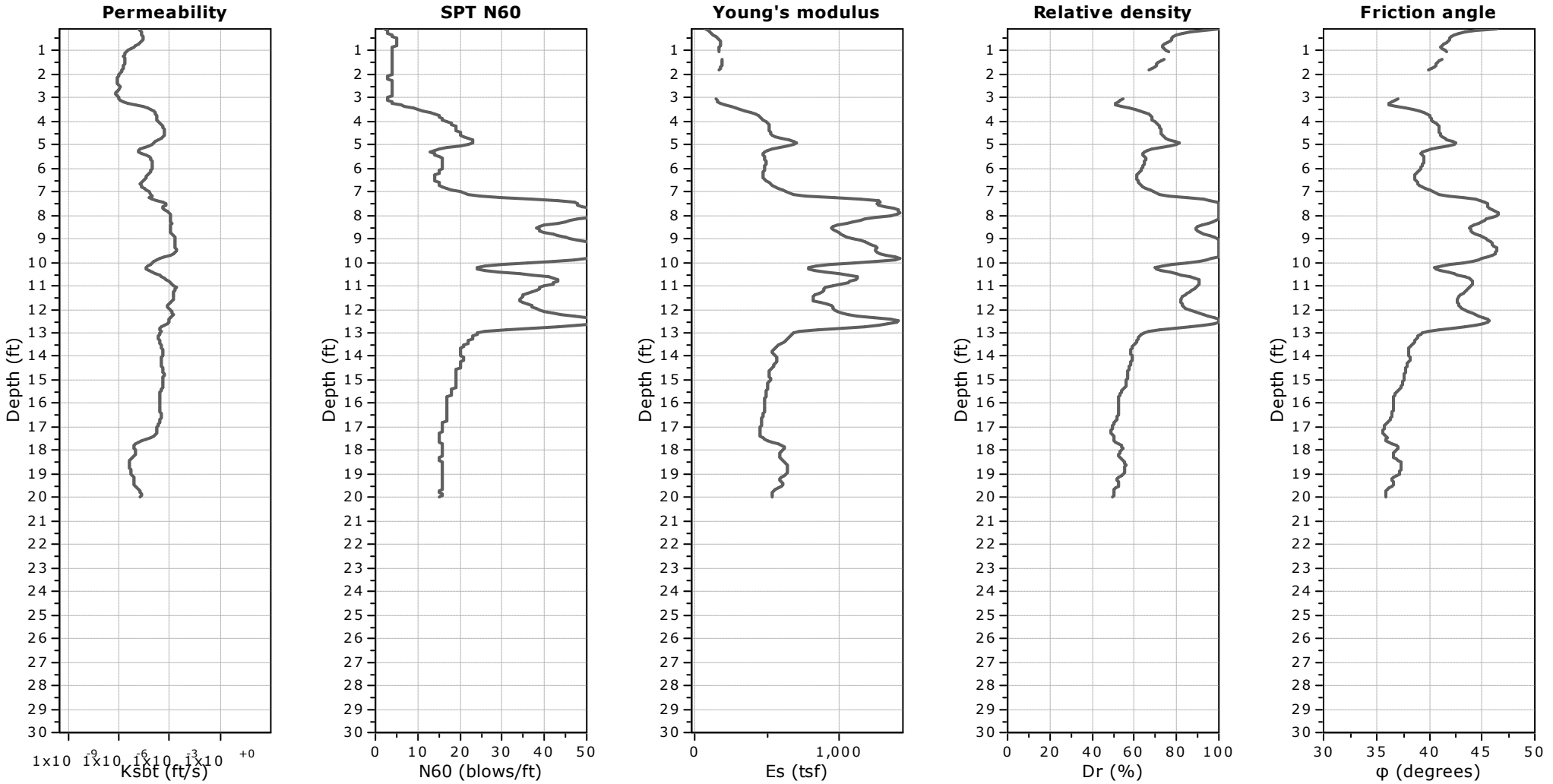
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-29
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 62.07 ft
Coords: X:572639.92, Y:555783.52
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



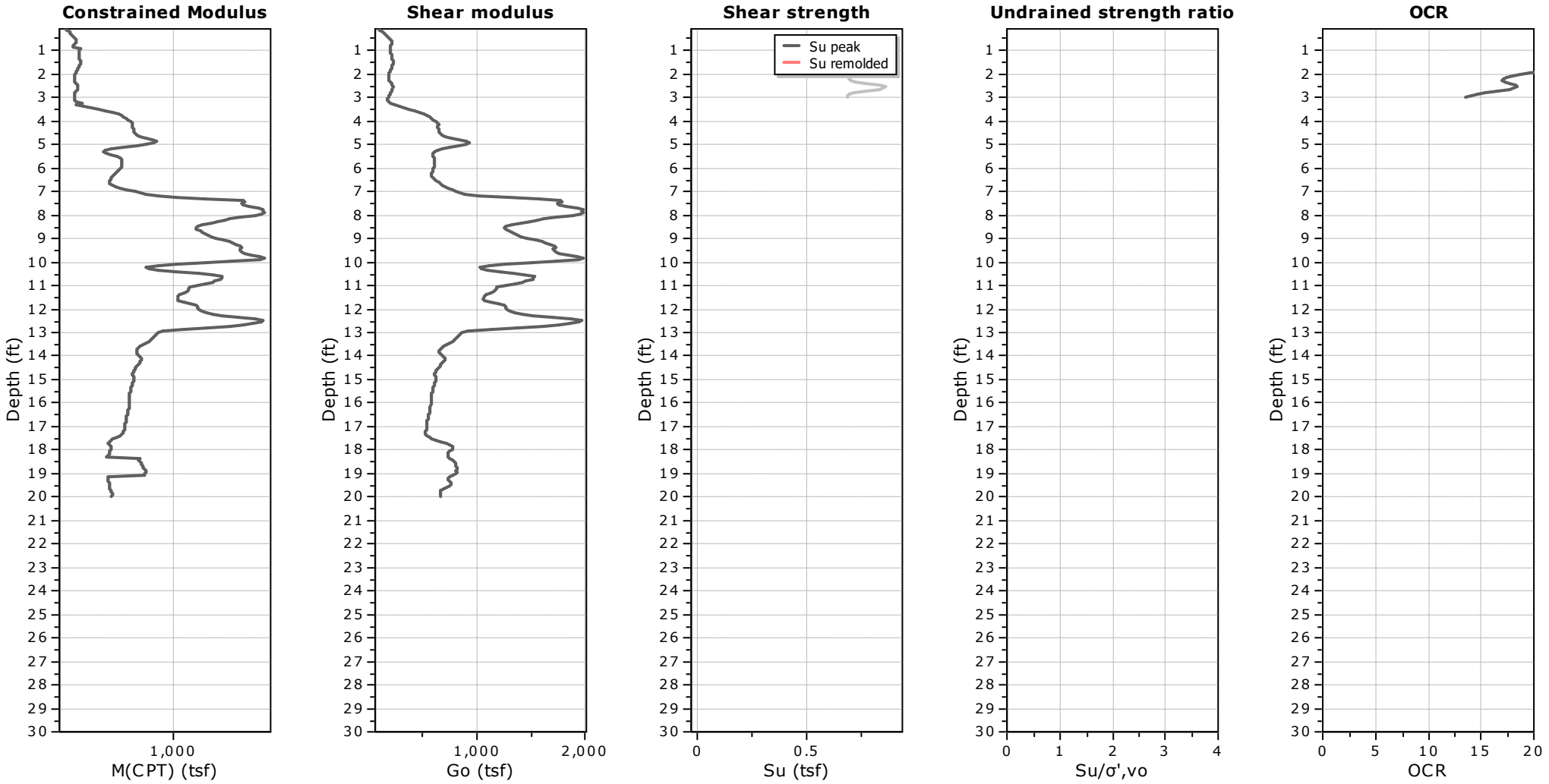
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-29
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 62.07 ft
Coords: X:572639.92, Y:555783.52
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



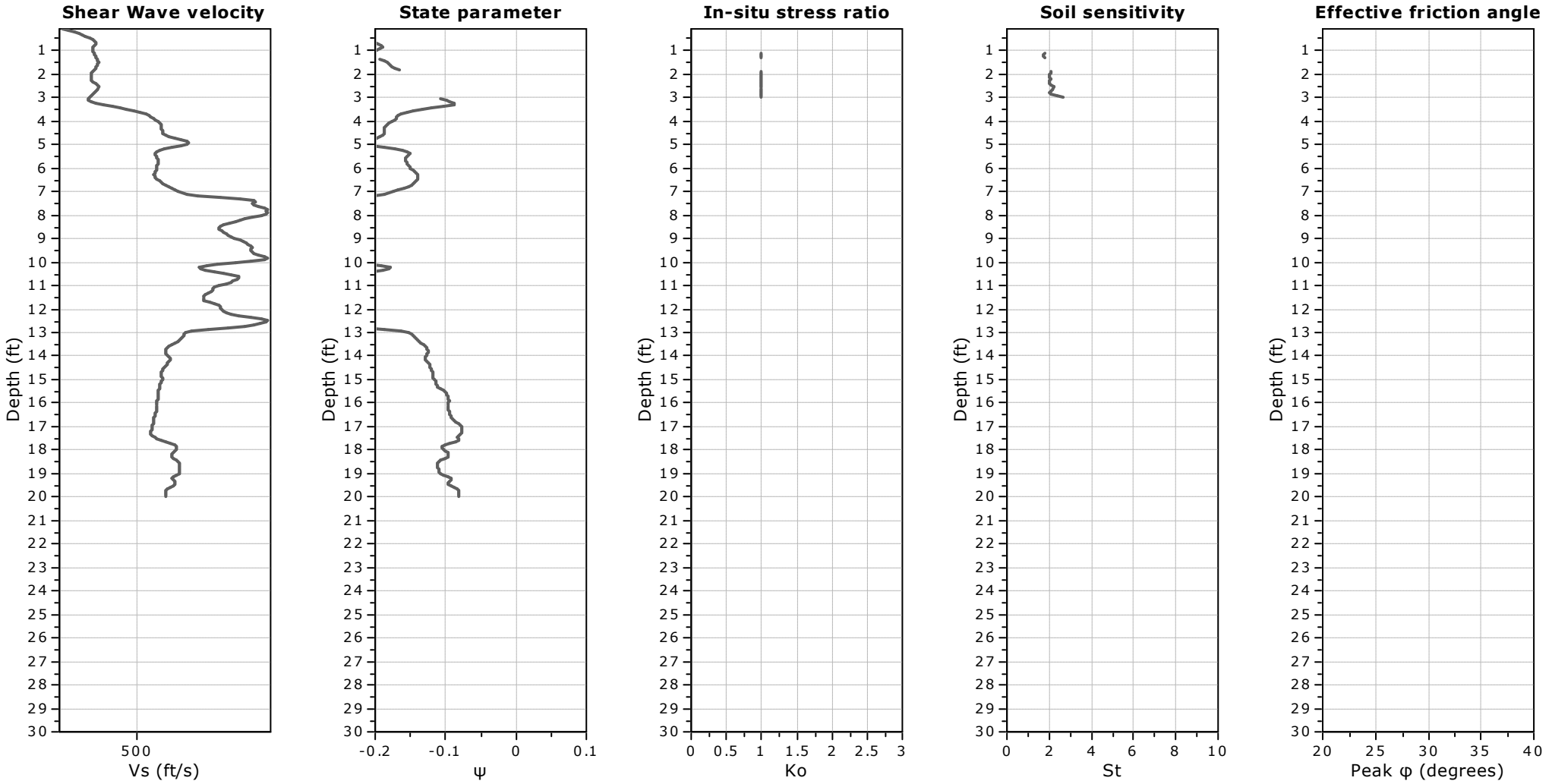
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-29
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 62.07 ft
Coords: X:572639.92, Y:555783.52
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



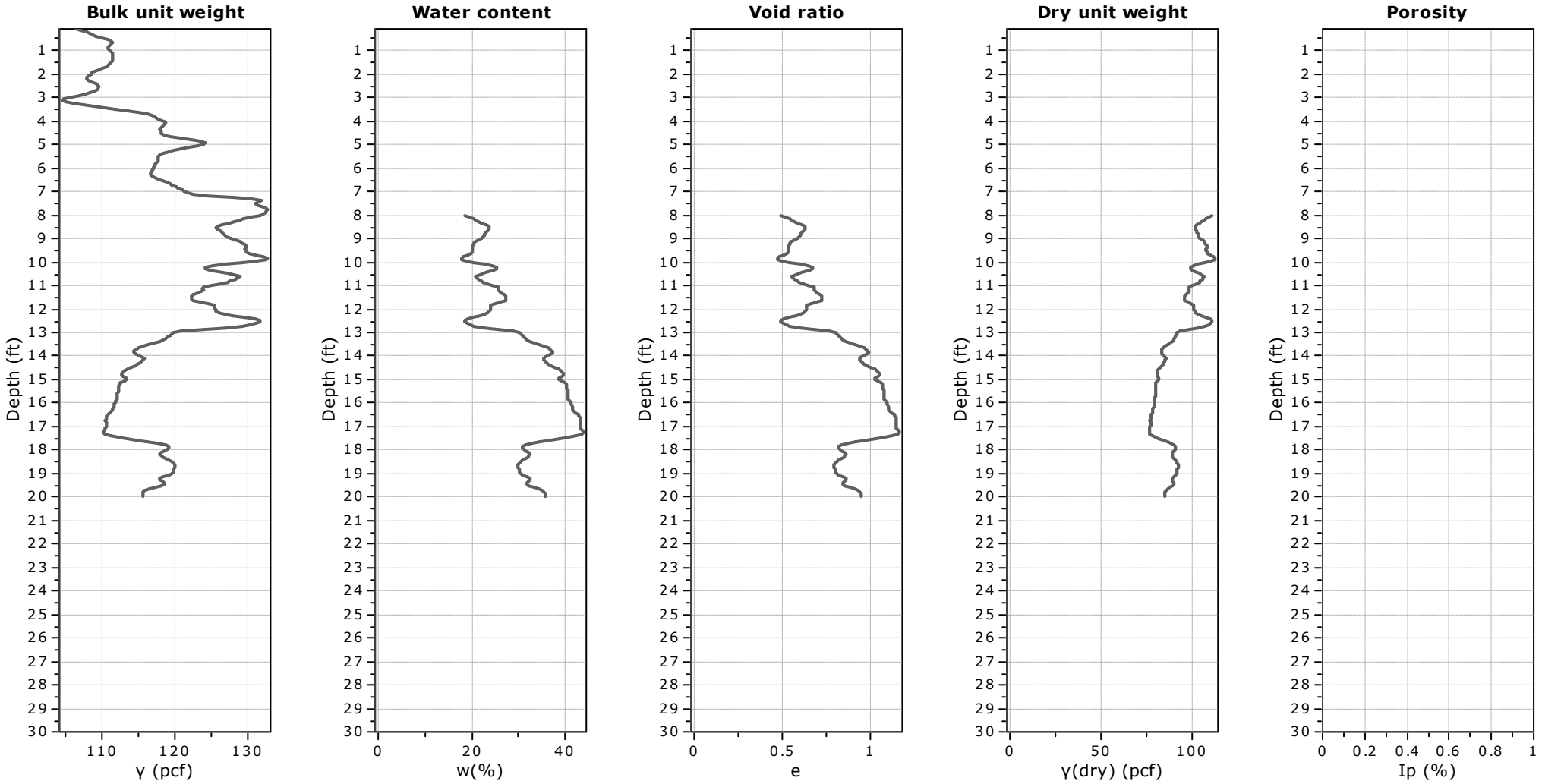
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-29
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 62.07 ft
Coords: X:572639.92, Y:555783.52
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

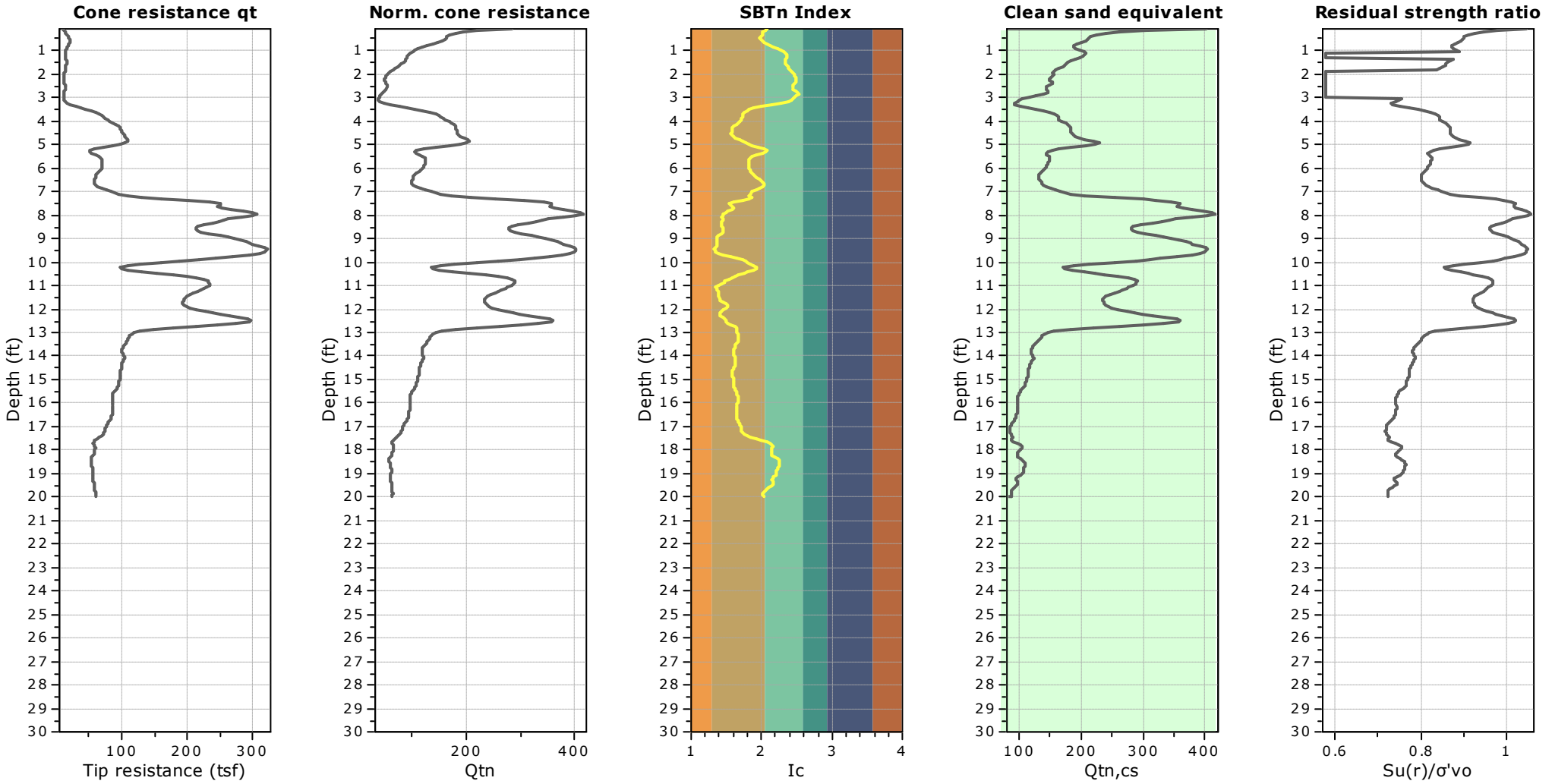
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-29
Total depth: 20.00 ft, Date: 5/14/2024
Surface Elevation: 62.07 ft
Coords: X:572639.92, Y:555783.52
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

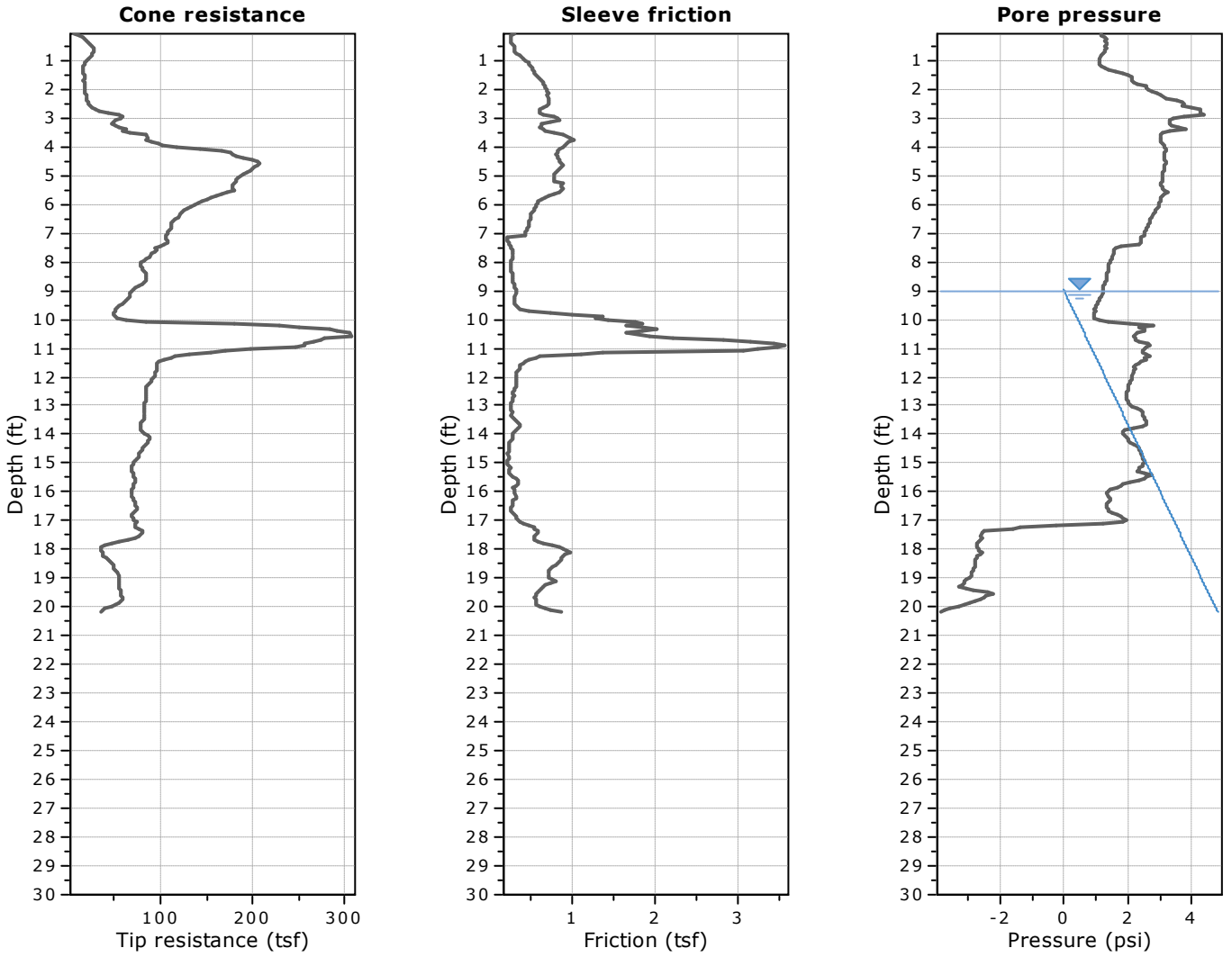
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



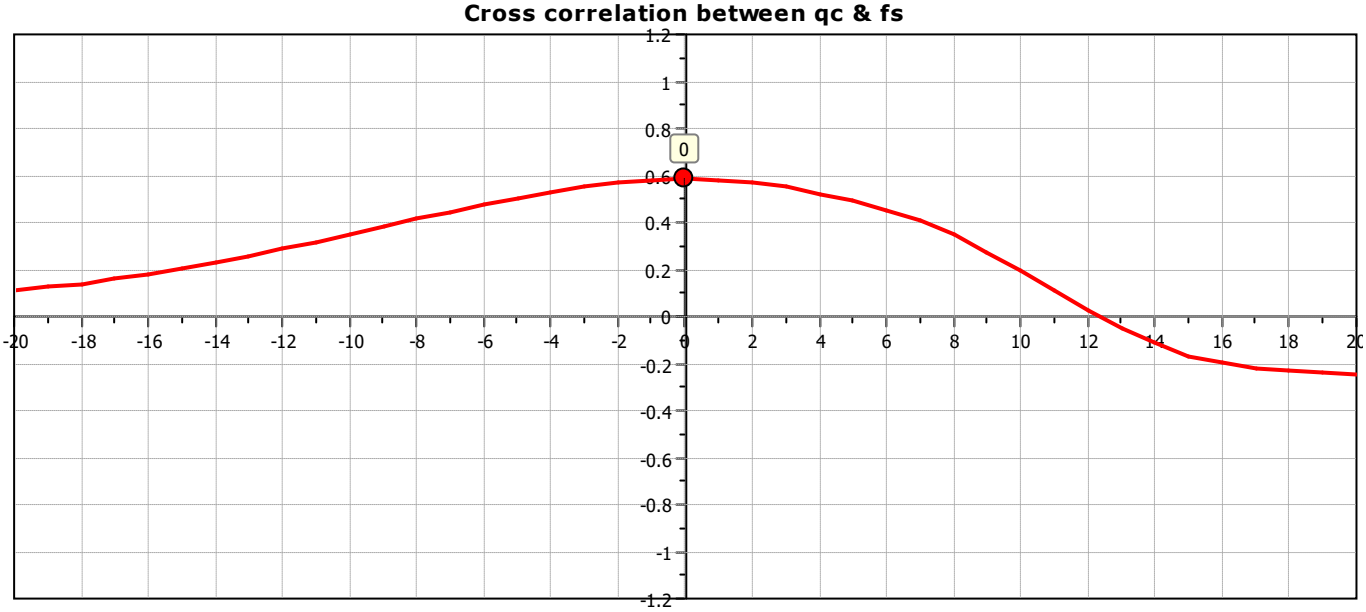
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-30
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 61.66 ft
Coords: X:572763.15, Y:555860.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



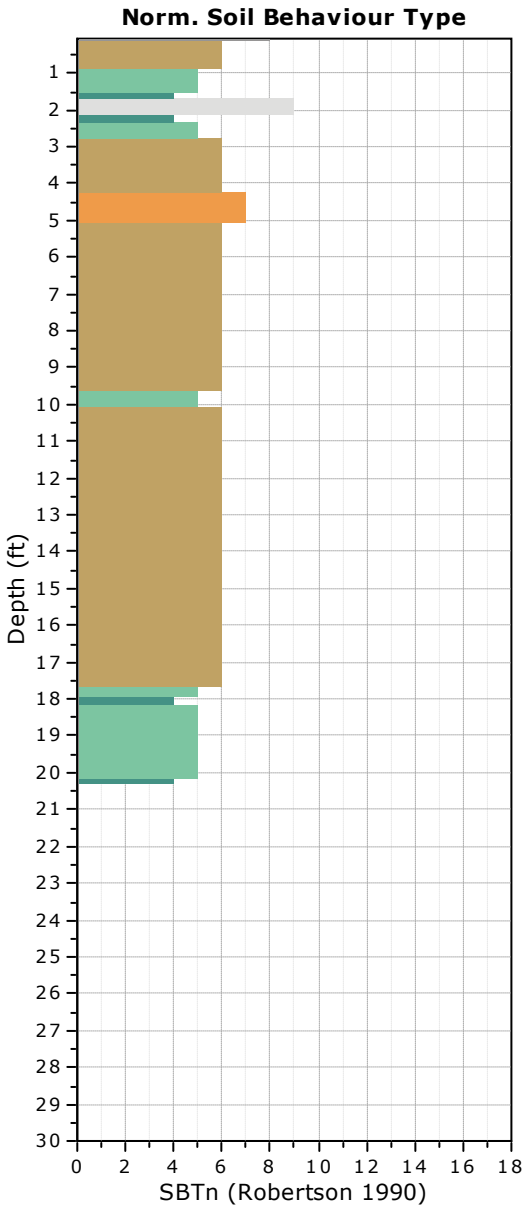
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

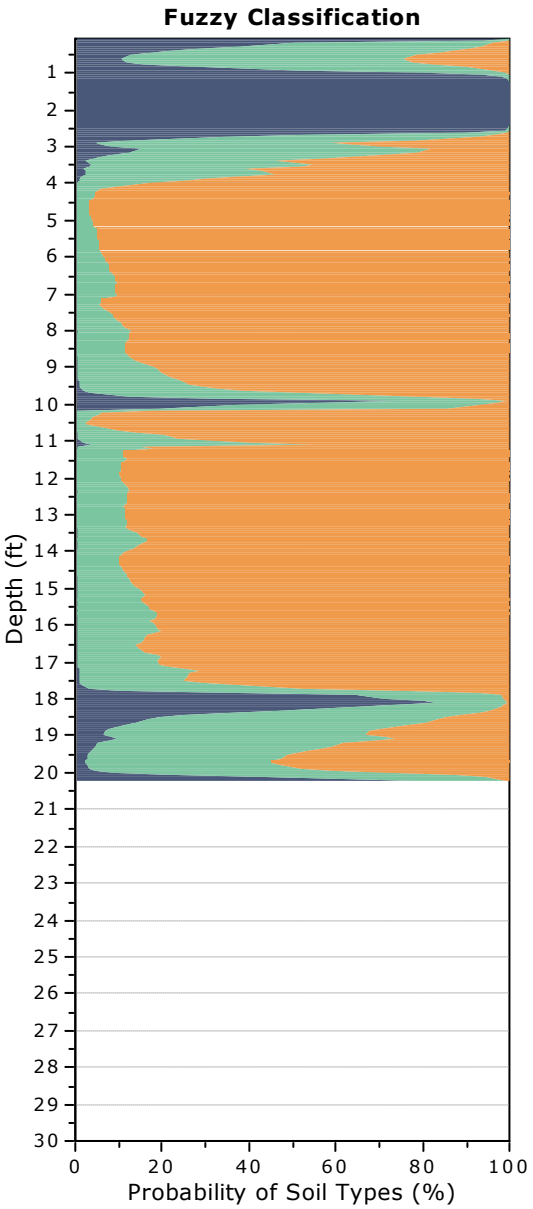


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-30
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 61.66 ft
Coords: X:572763.15, Y:555860.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



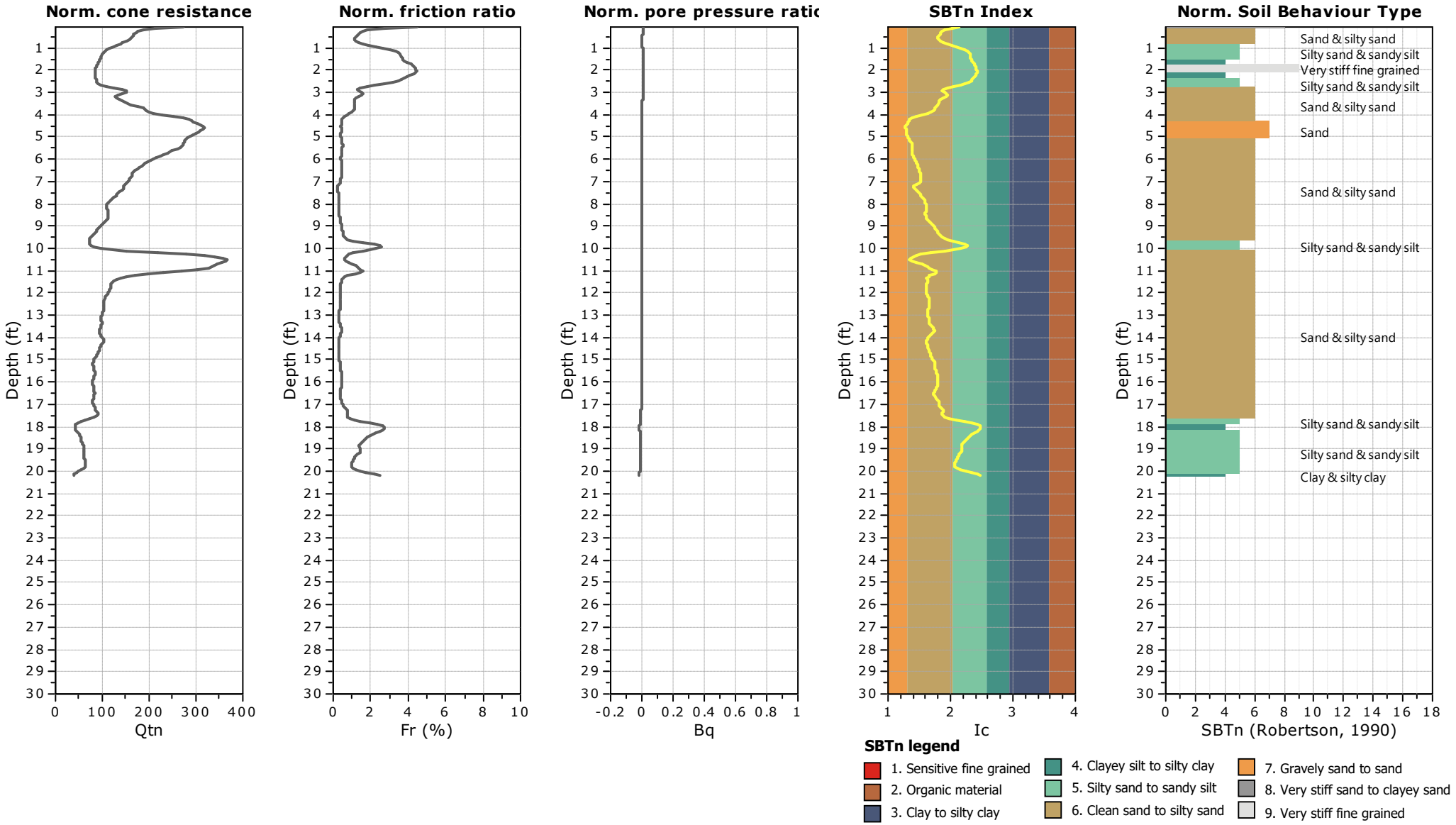


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-30
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 61.66 ft
Coords: X:572763.15, Y:555860.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

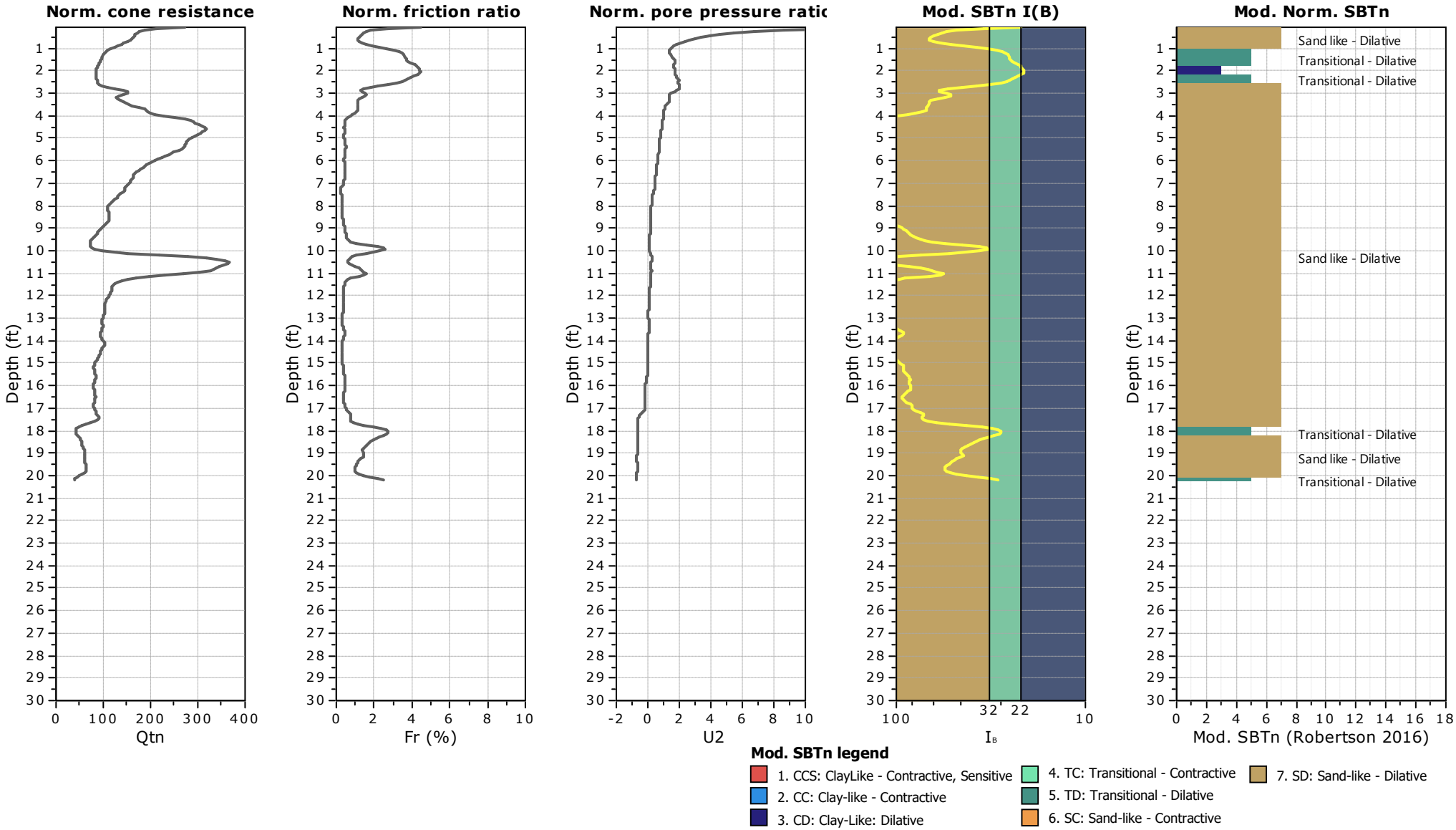
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-30
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 61.66 ft
Coords: X:572763.15, Y:555860.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

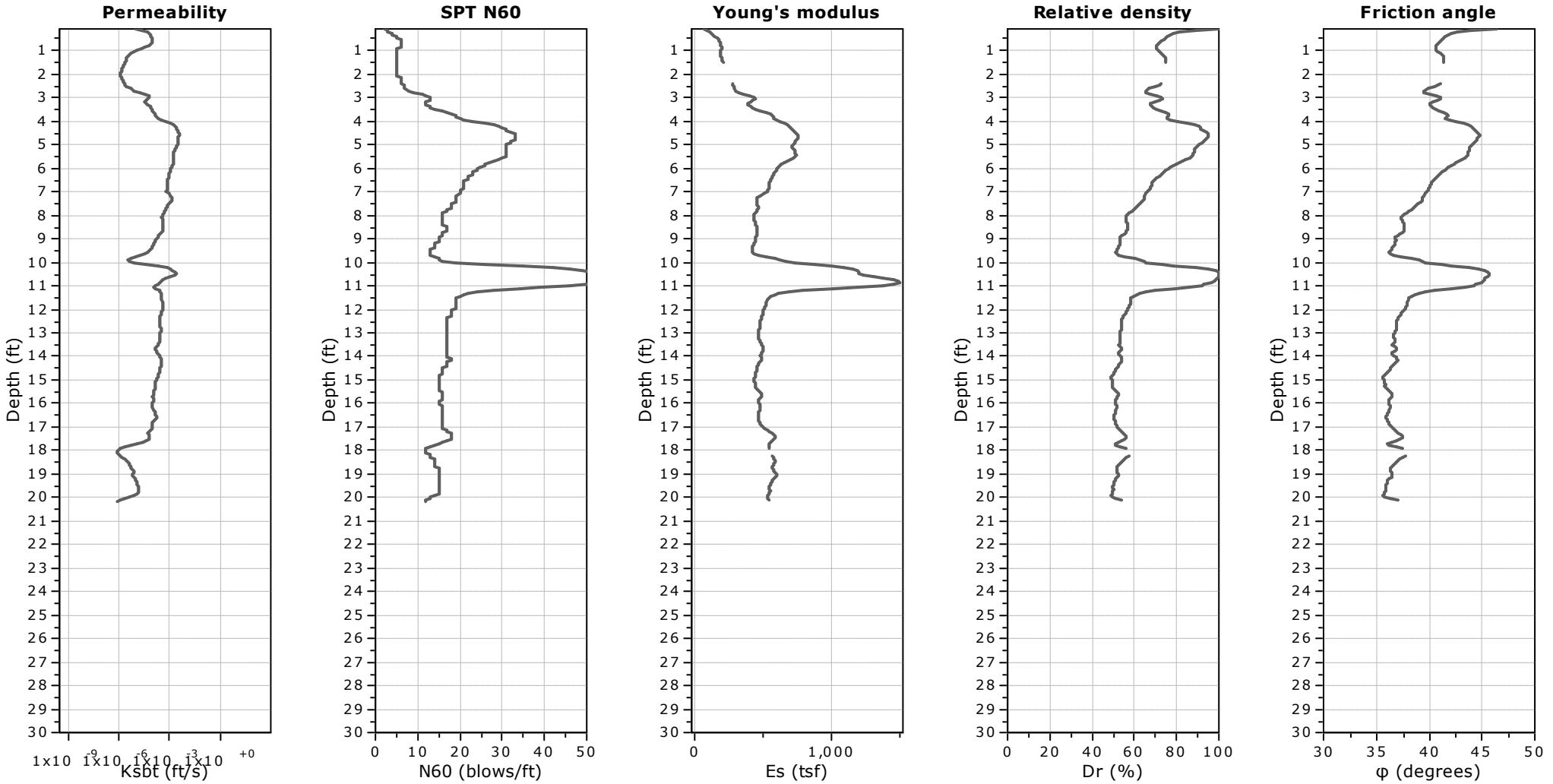
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-30
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 61.66 ft
Coords: X:572763.15, Y:555860.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



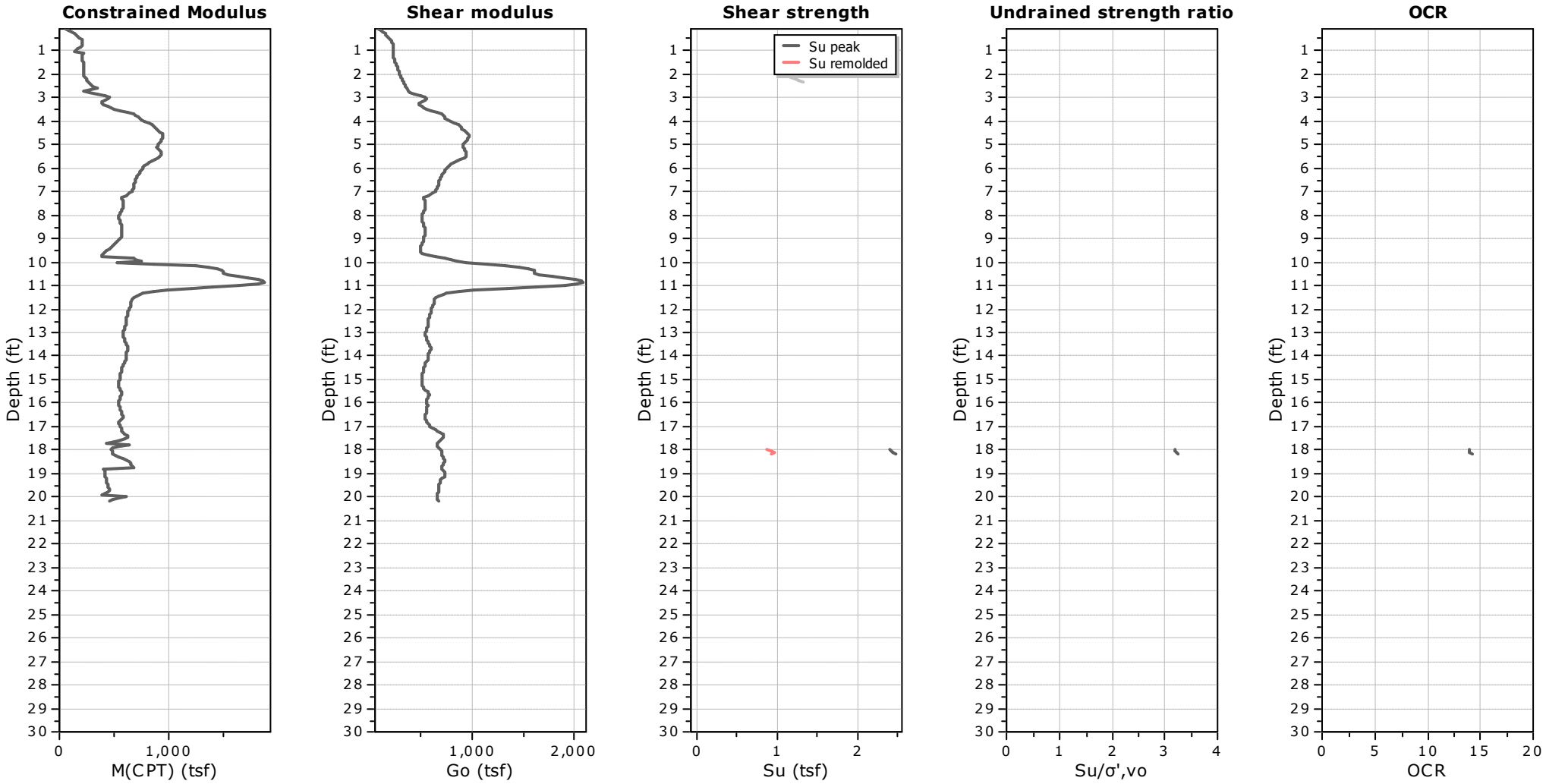
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-30
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 61.66 ft
Coords: X:572763.15, Y:555860.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



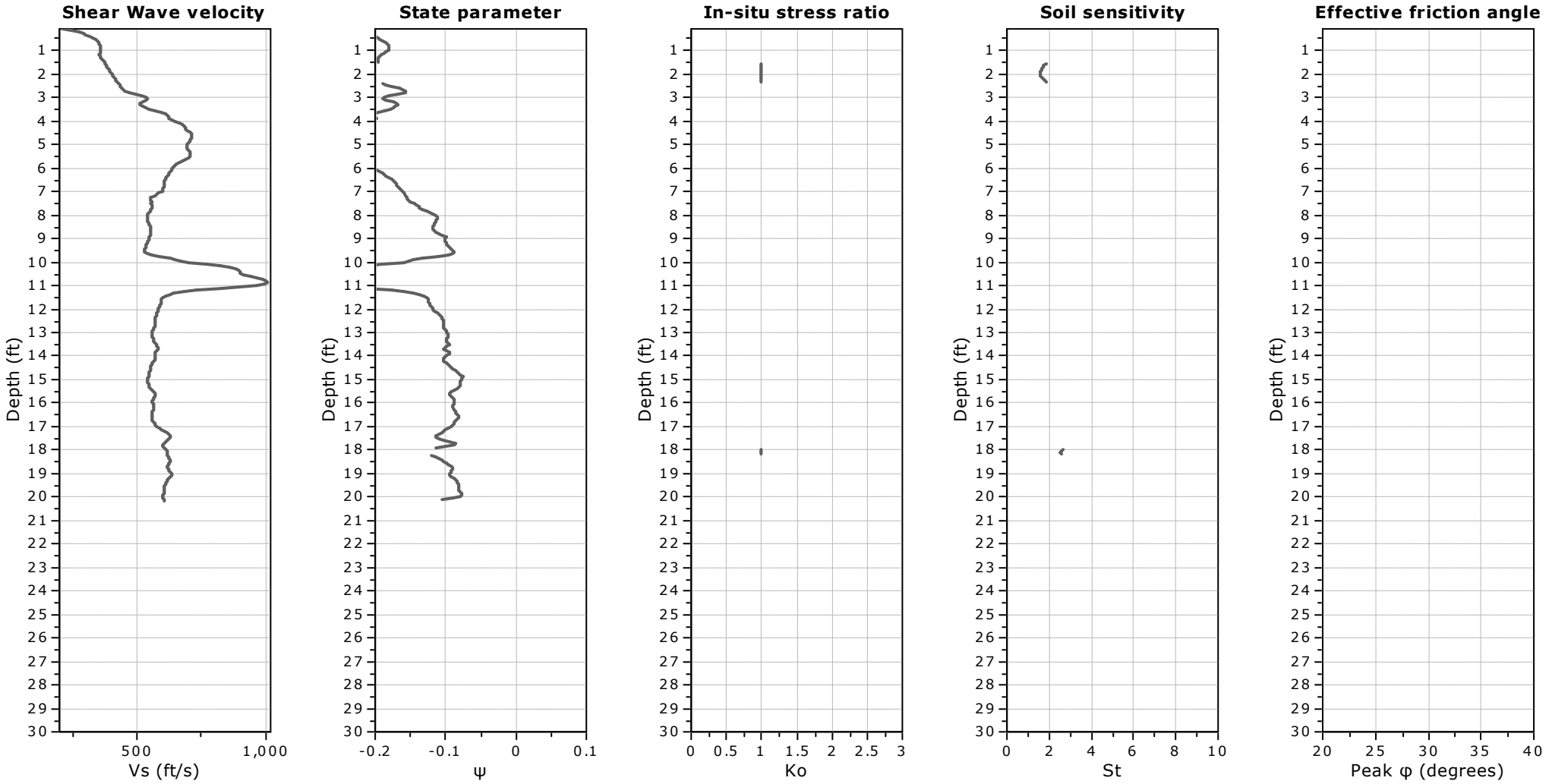
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-30
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 61.66 ft
Coords: X:572763.15, Y:555860.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



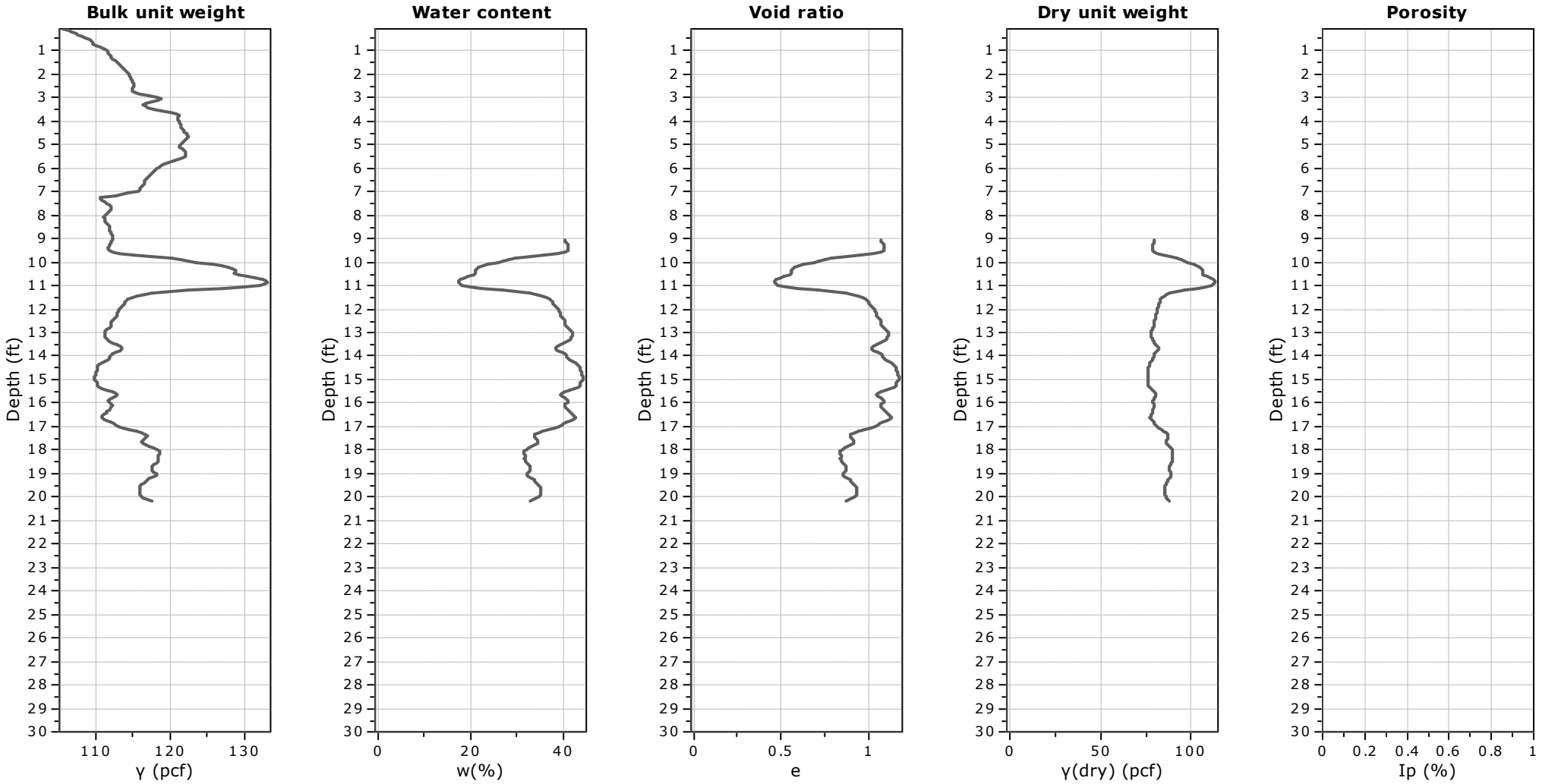
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-30
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 61.66 ft
Coords: X:572763.15, Y:555860.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

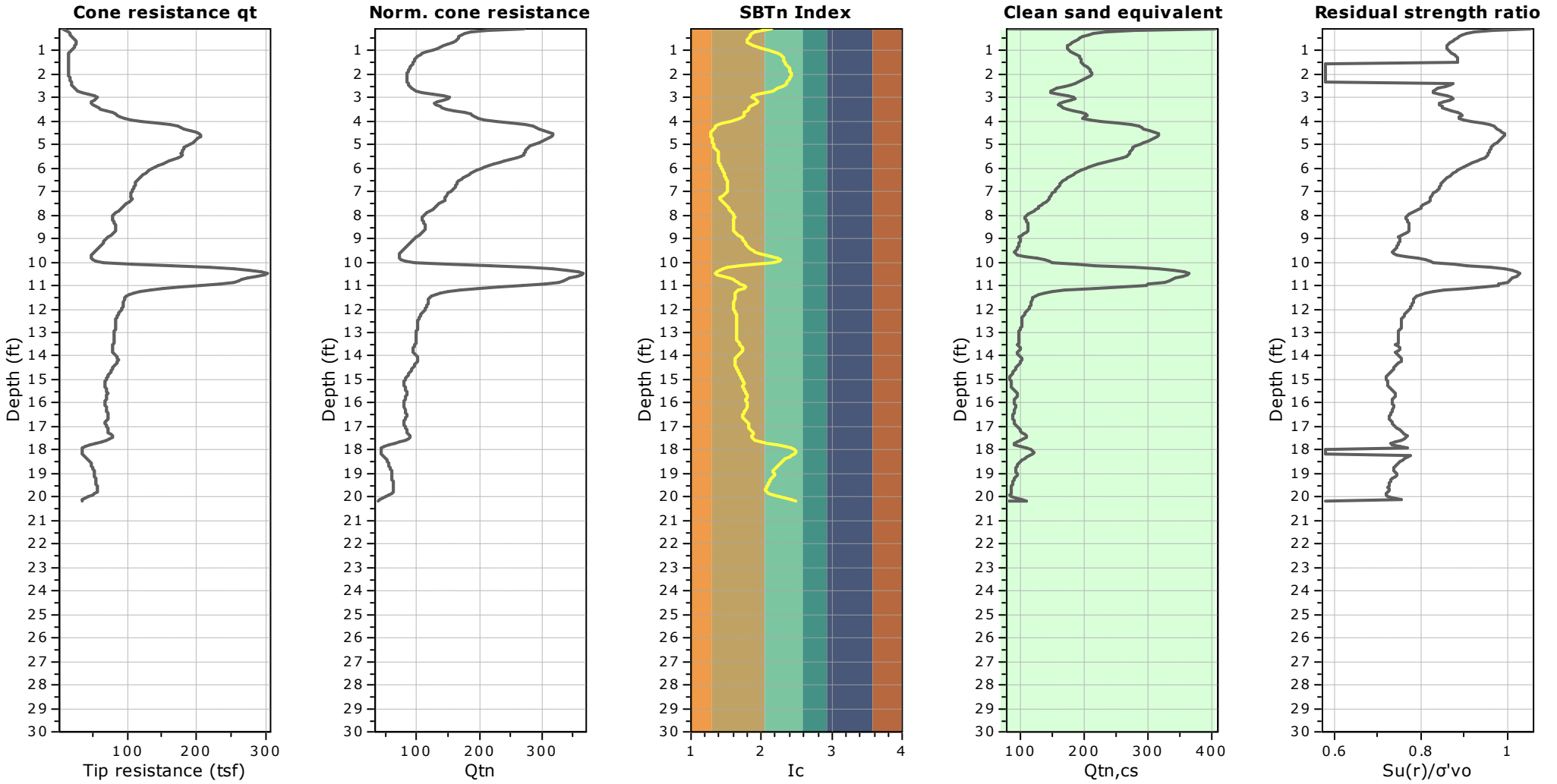
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-30
Total depth: 20.20 ft, Date: 5/14/2024
Surface Elevation: 61.66 ft
Coords: X:572763.15, Y:555860.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

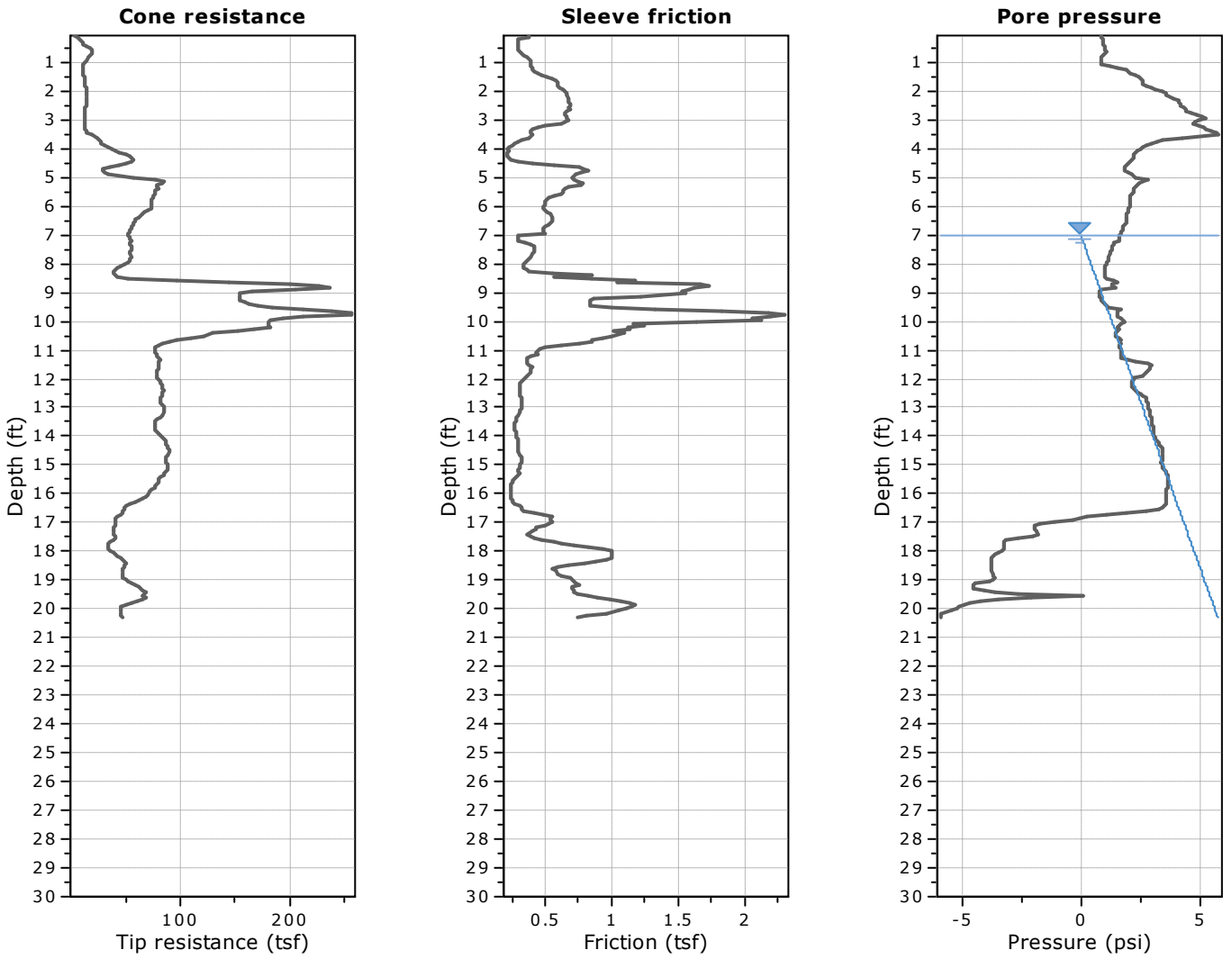
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



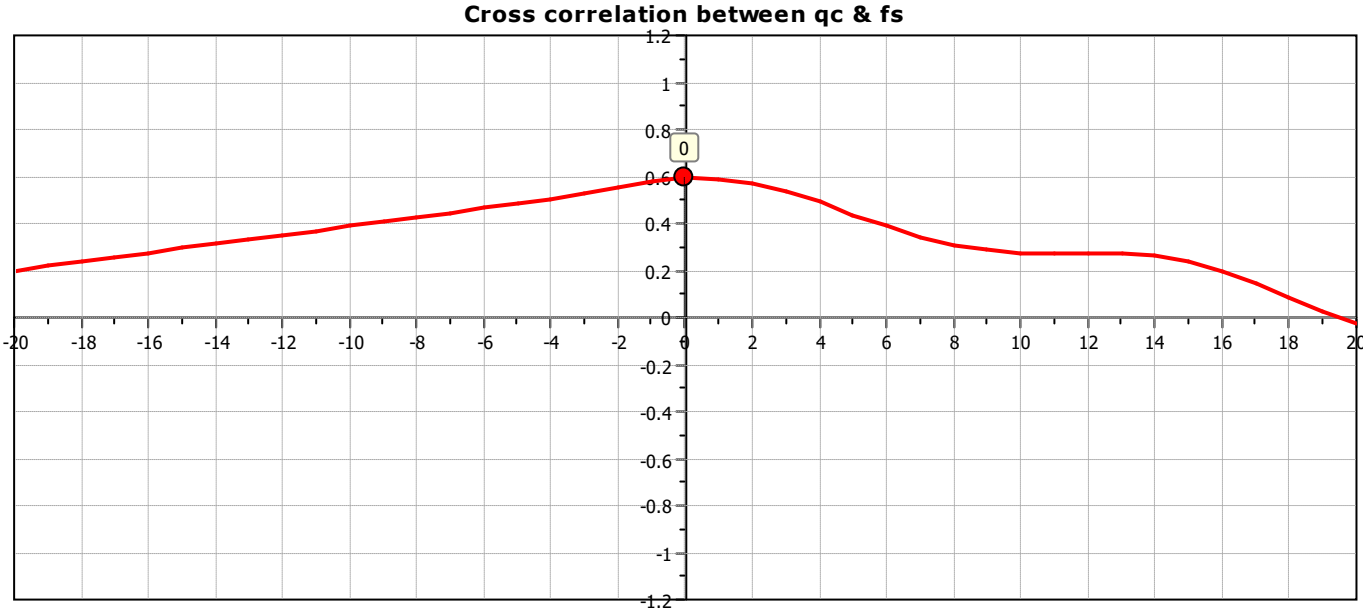
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-31
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572734.99, Y:555836.01
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



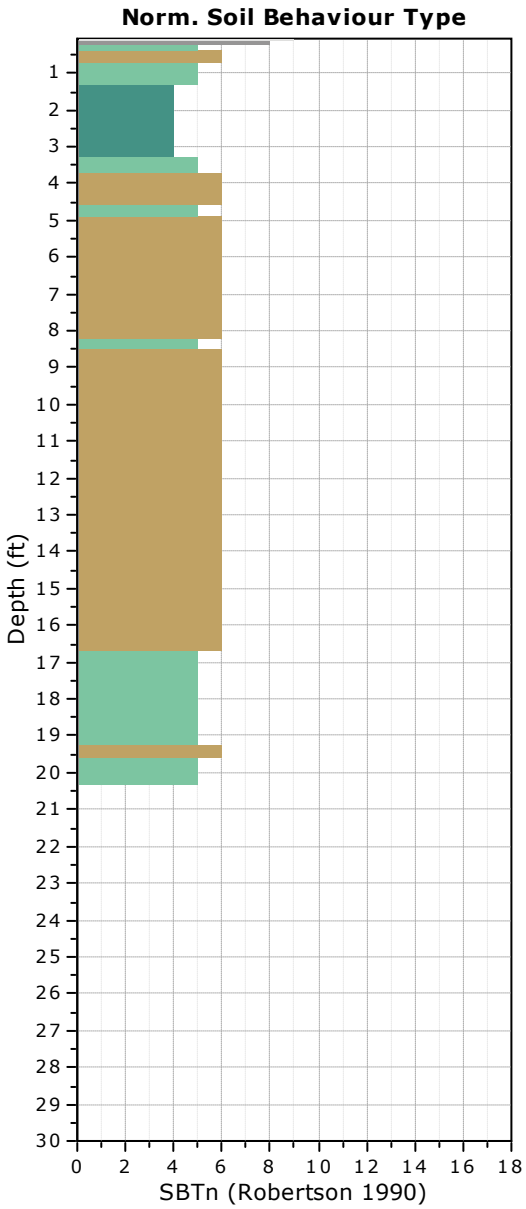
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

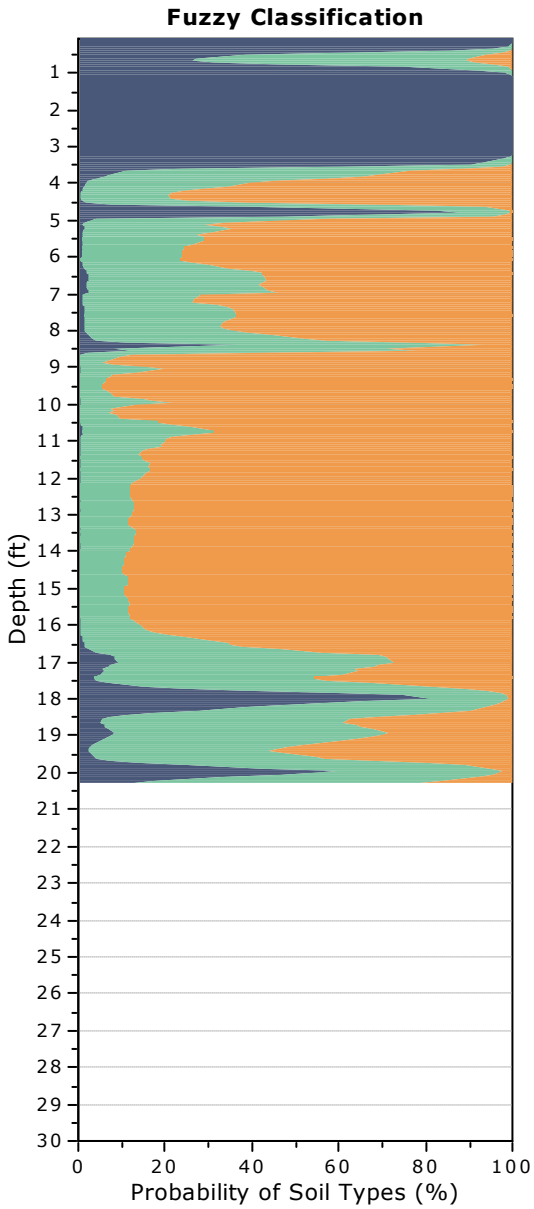


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-31
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572734.99, Y:555836.01
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



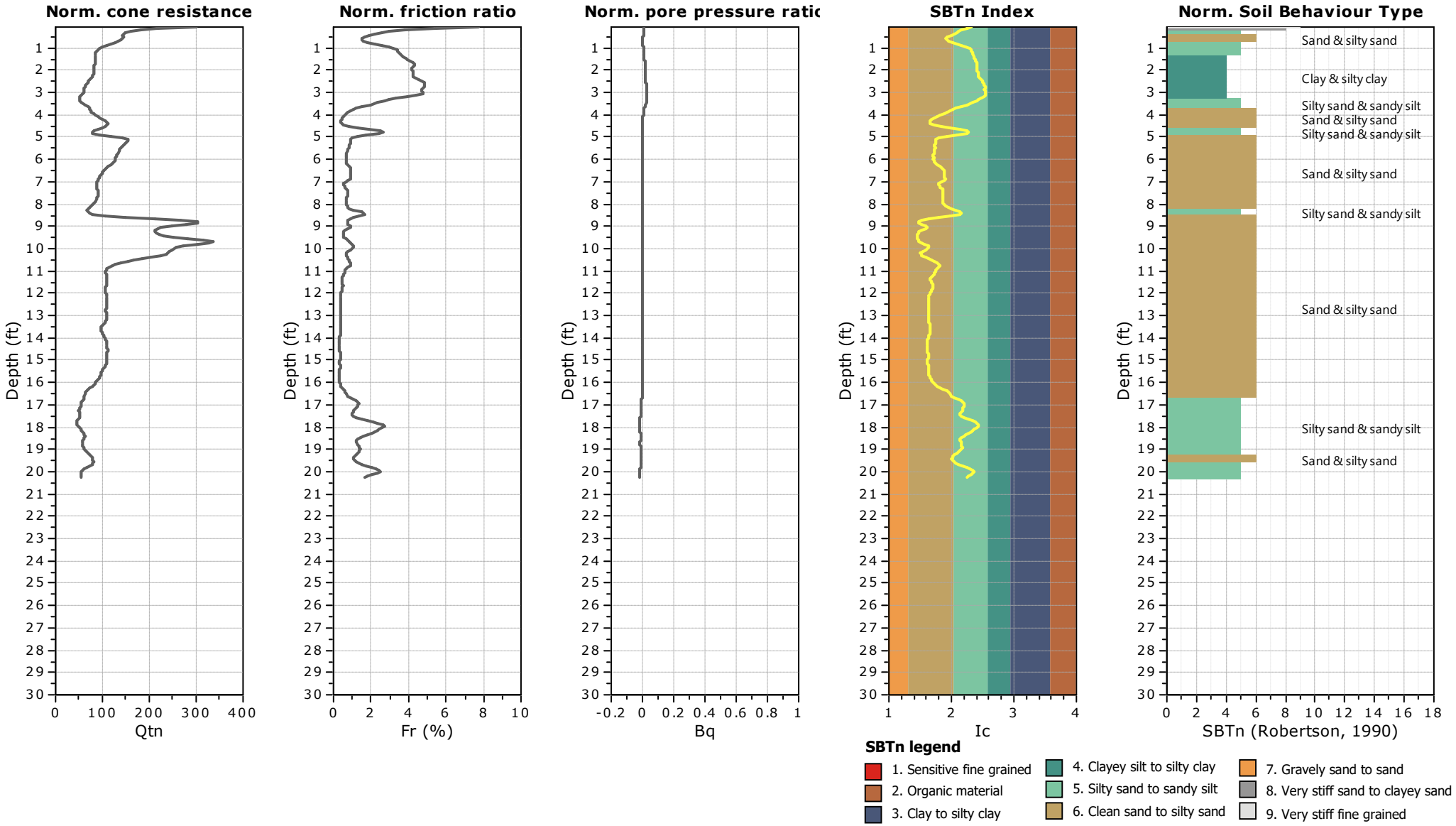


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-31
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572734.99, Y:555836.01
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

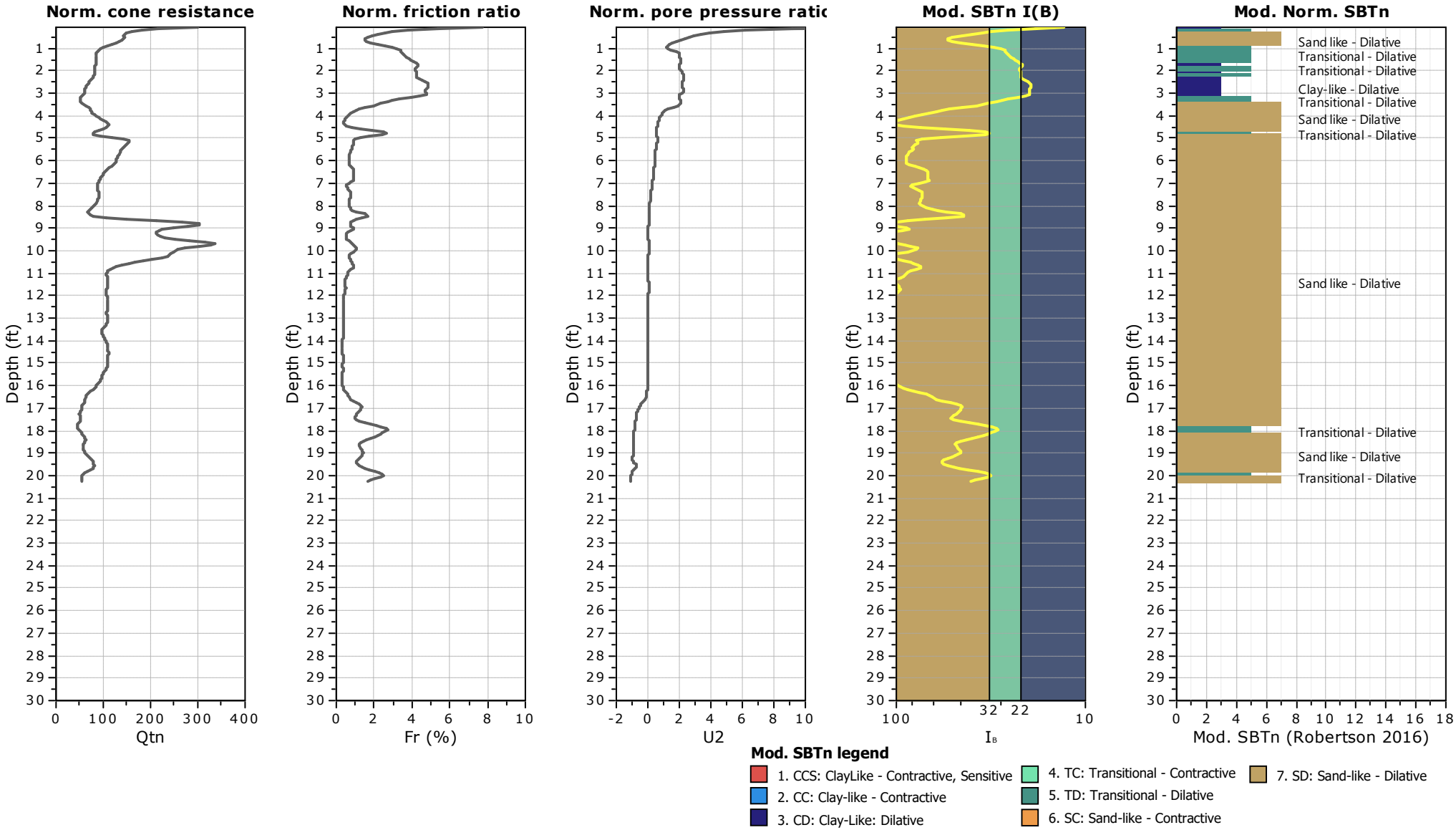
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-31
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572734.99, Y:555836.01
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

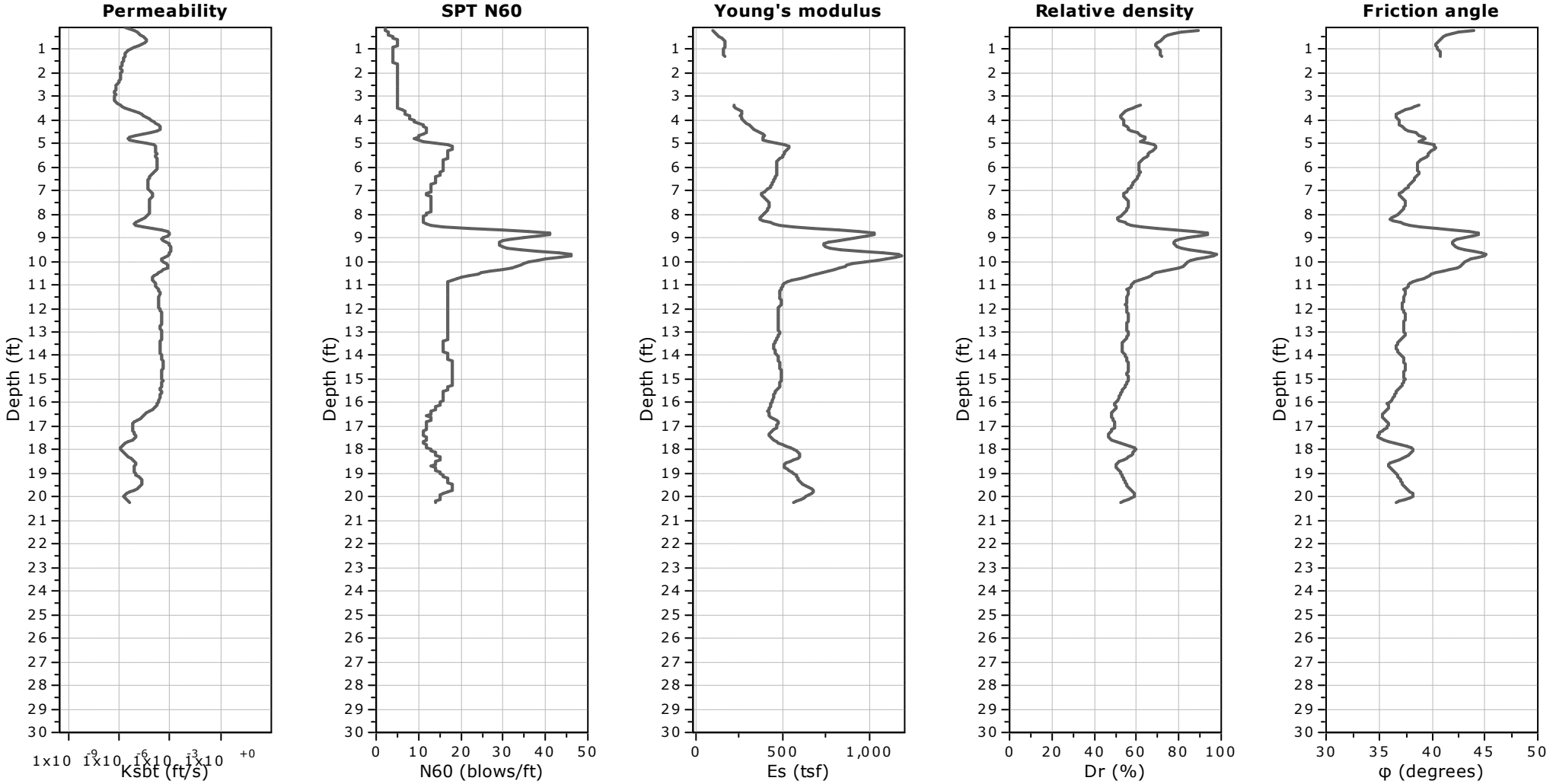
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-31
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572734.99, Y:555836.01
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



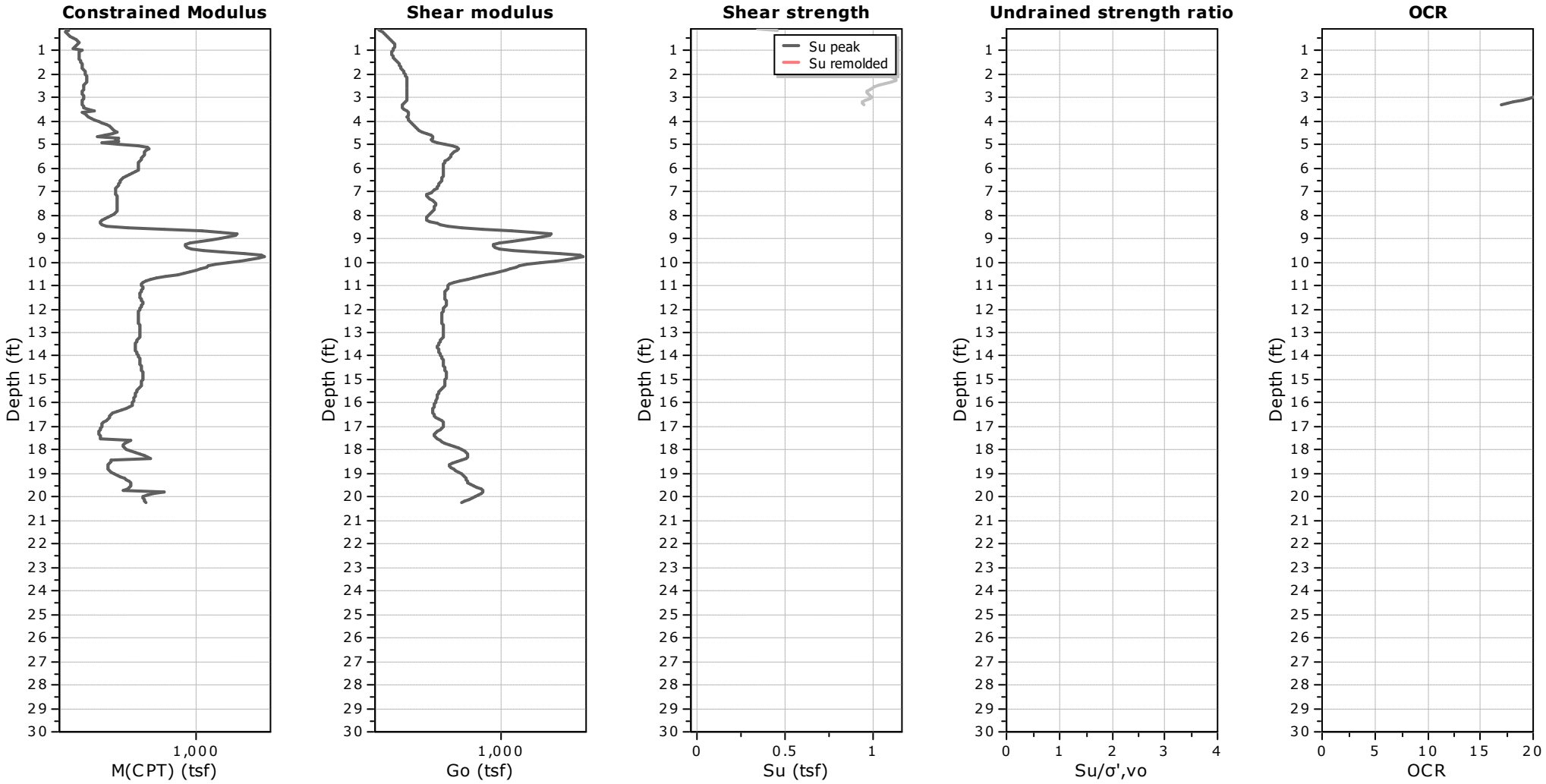
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-31
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572734.99, Y:555836.01
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



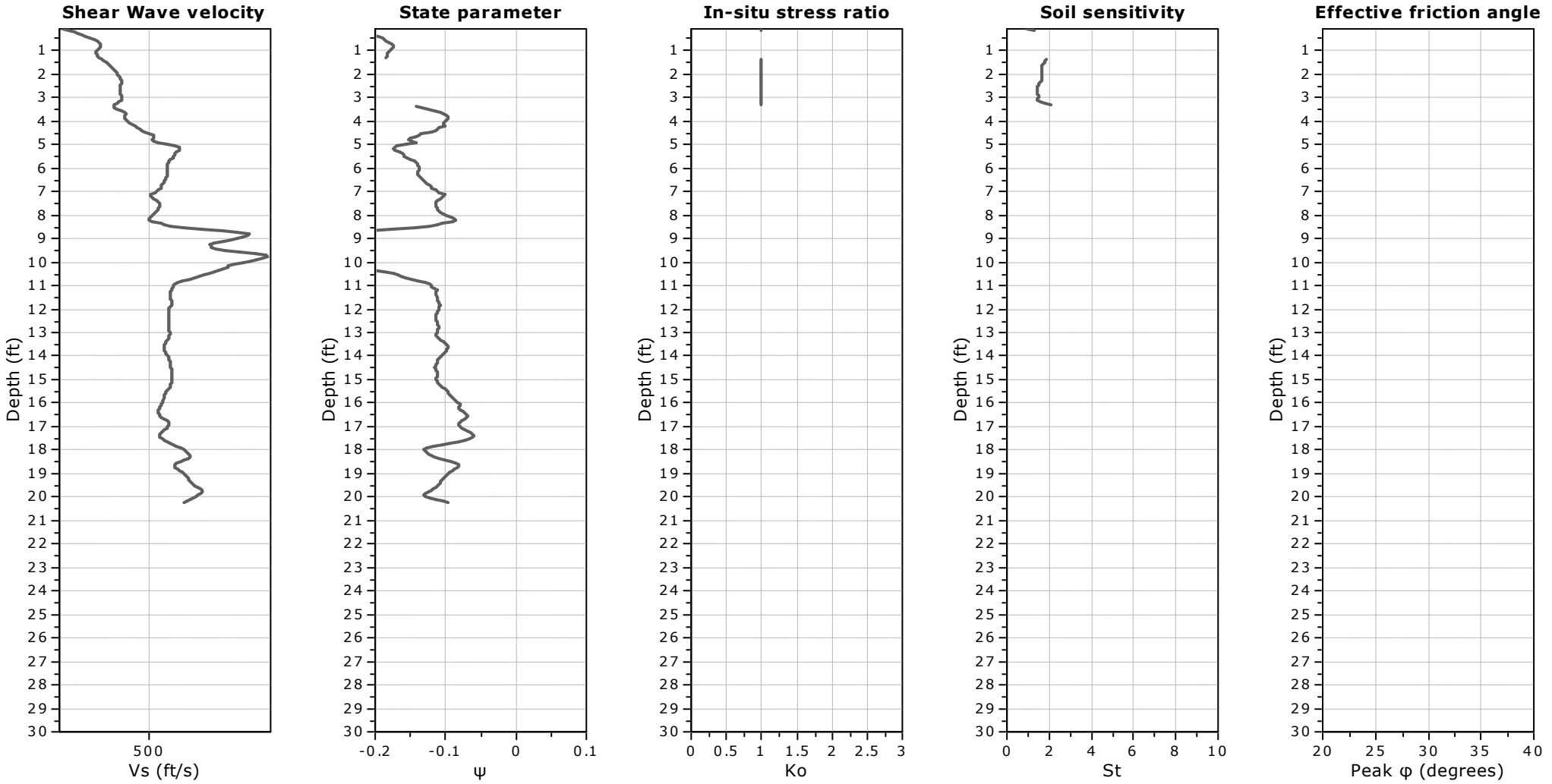
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-31
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572734.99, Y:555836.01
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



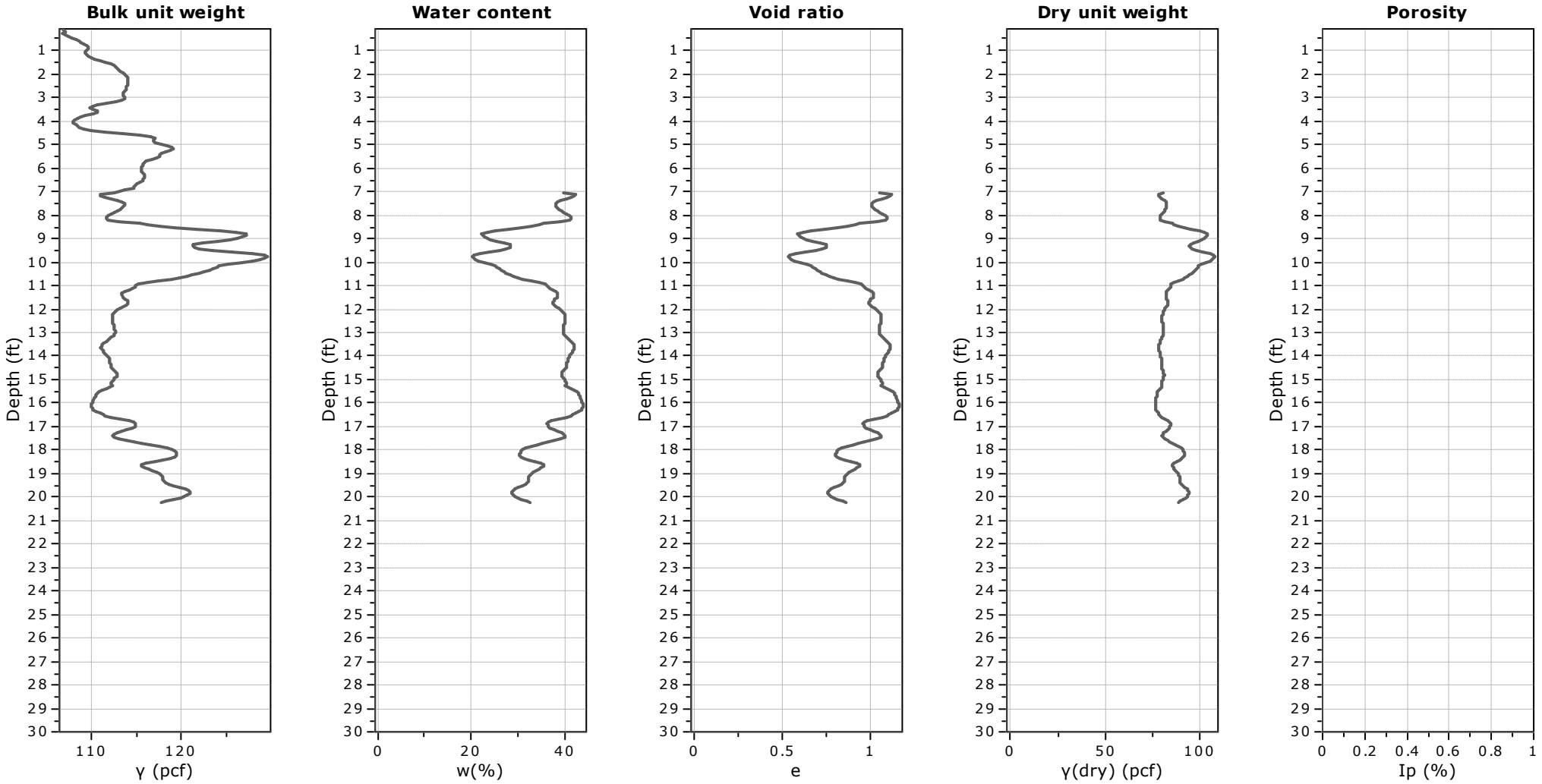
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-31
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572734.99, Y:555836.01
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

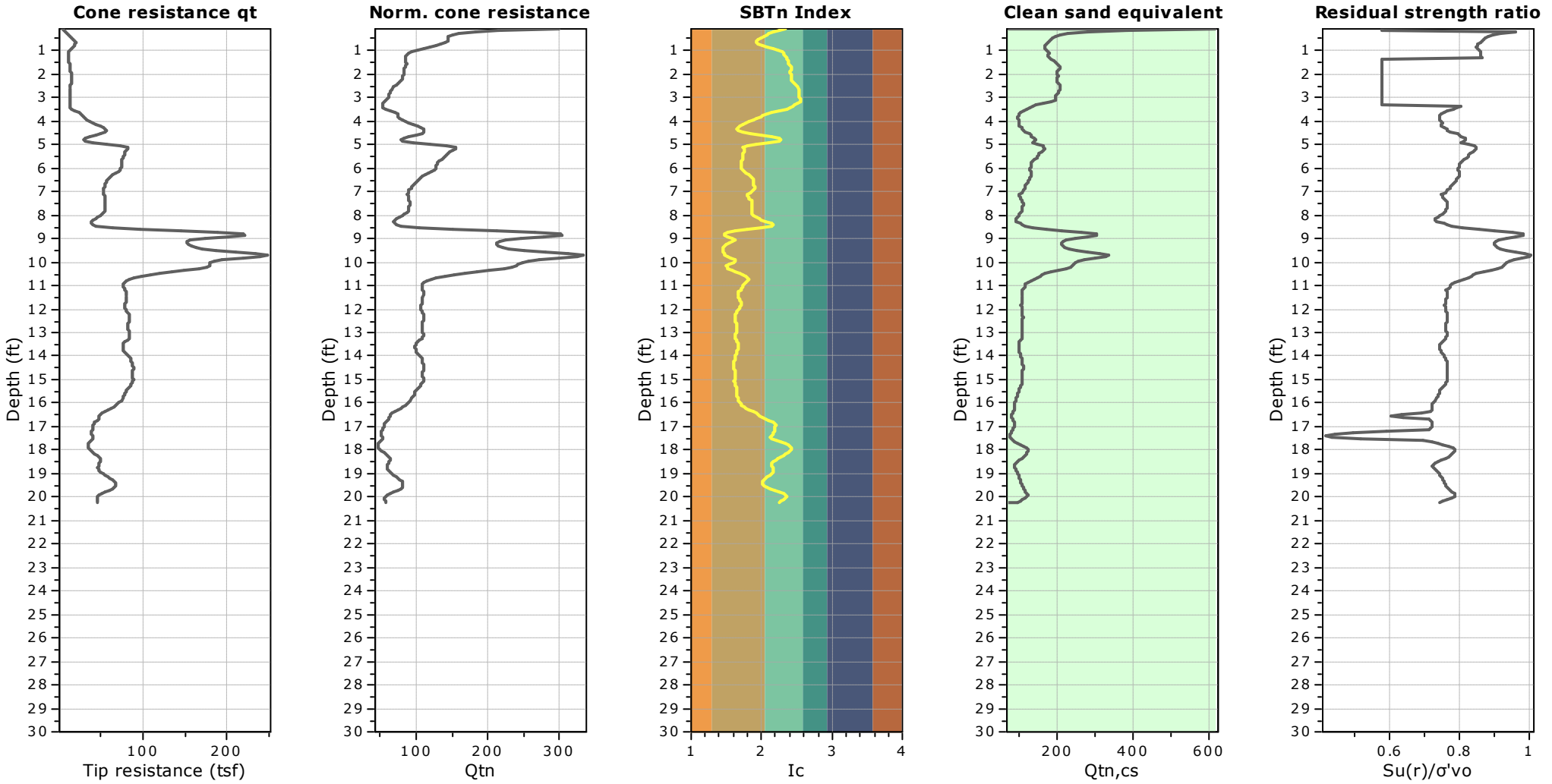
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-31
Total depth: 20.27 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572734.99, Y:555836.01
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

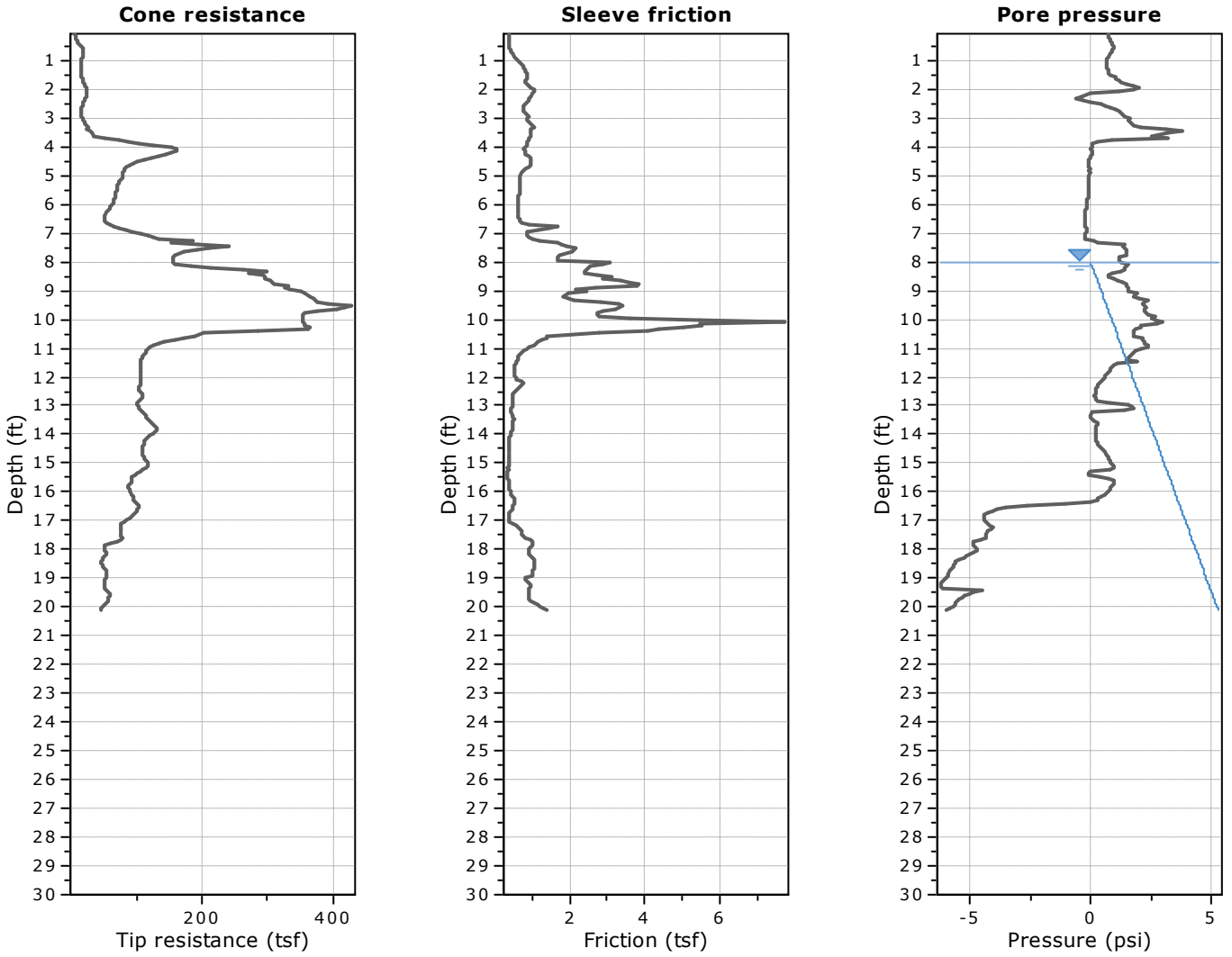
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



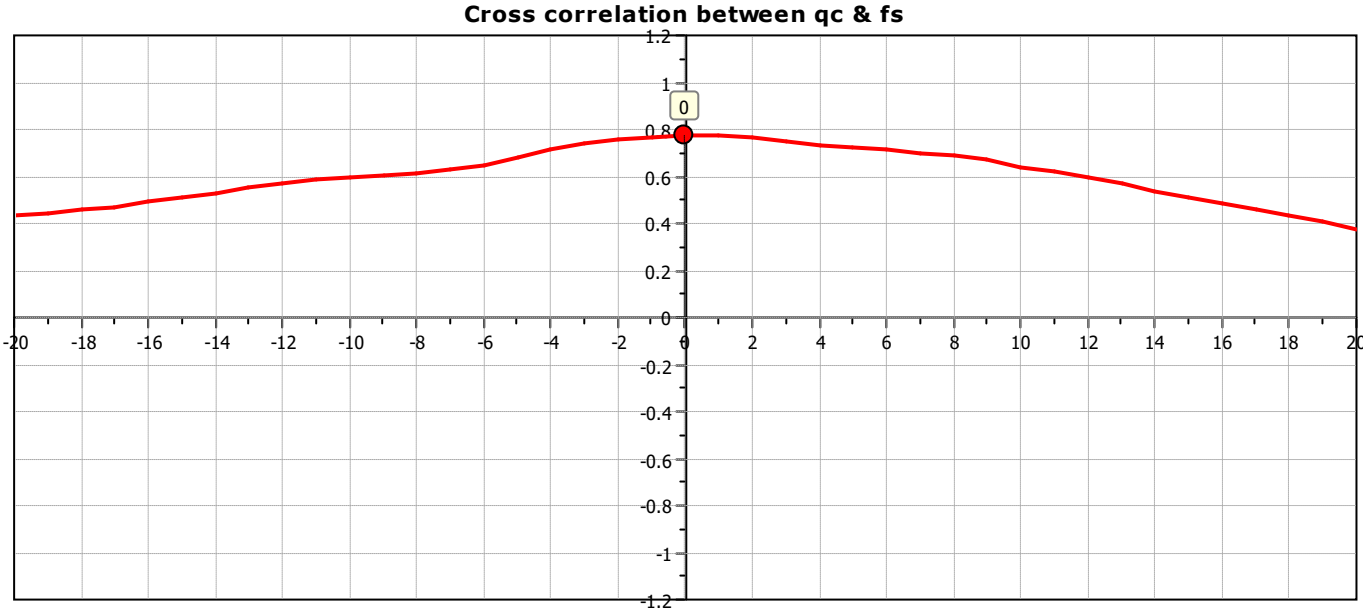
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

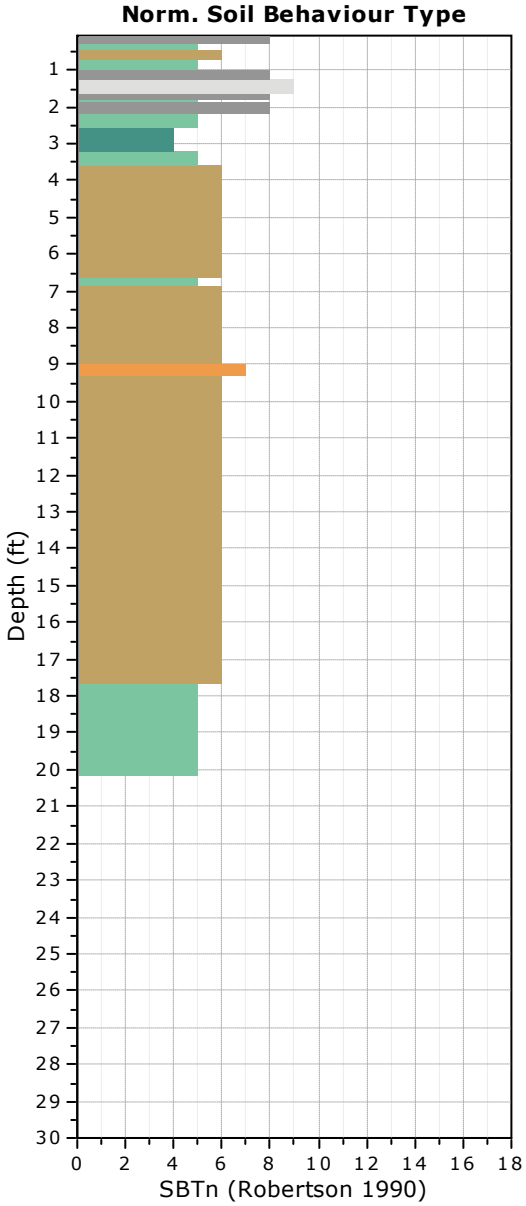
C-32
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 61.82 ft
Coords: X:572688.59, Y:555726.12
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

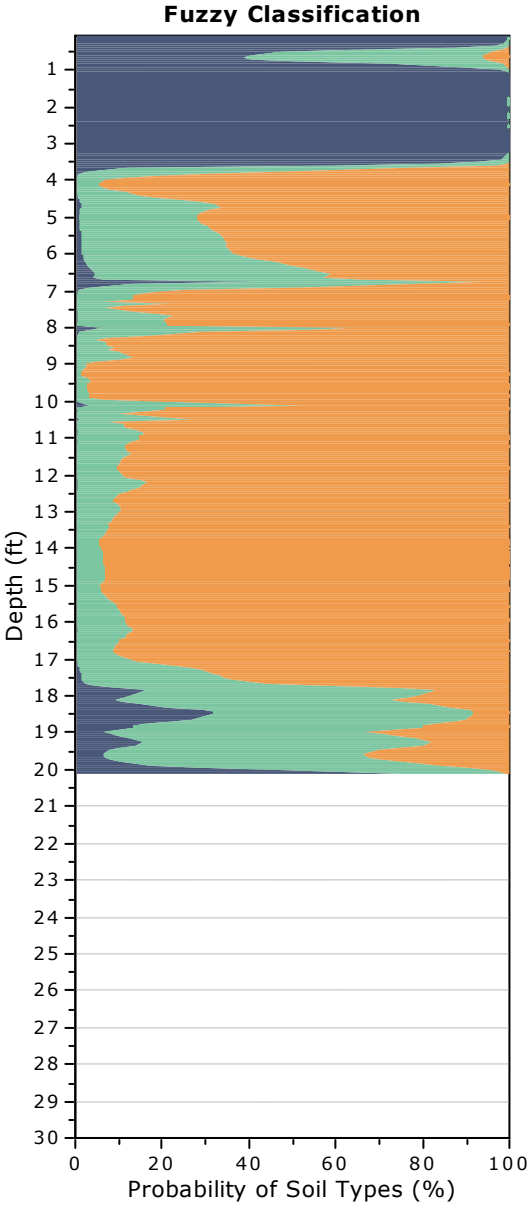
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







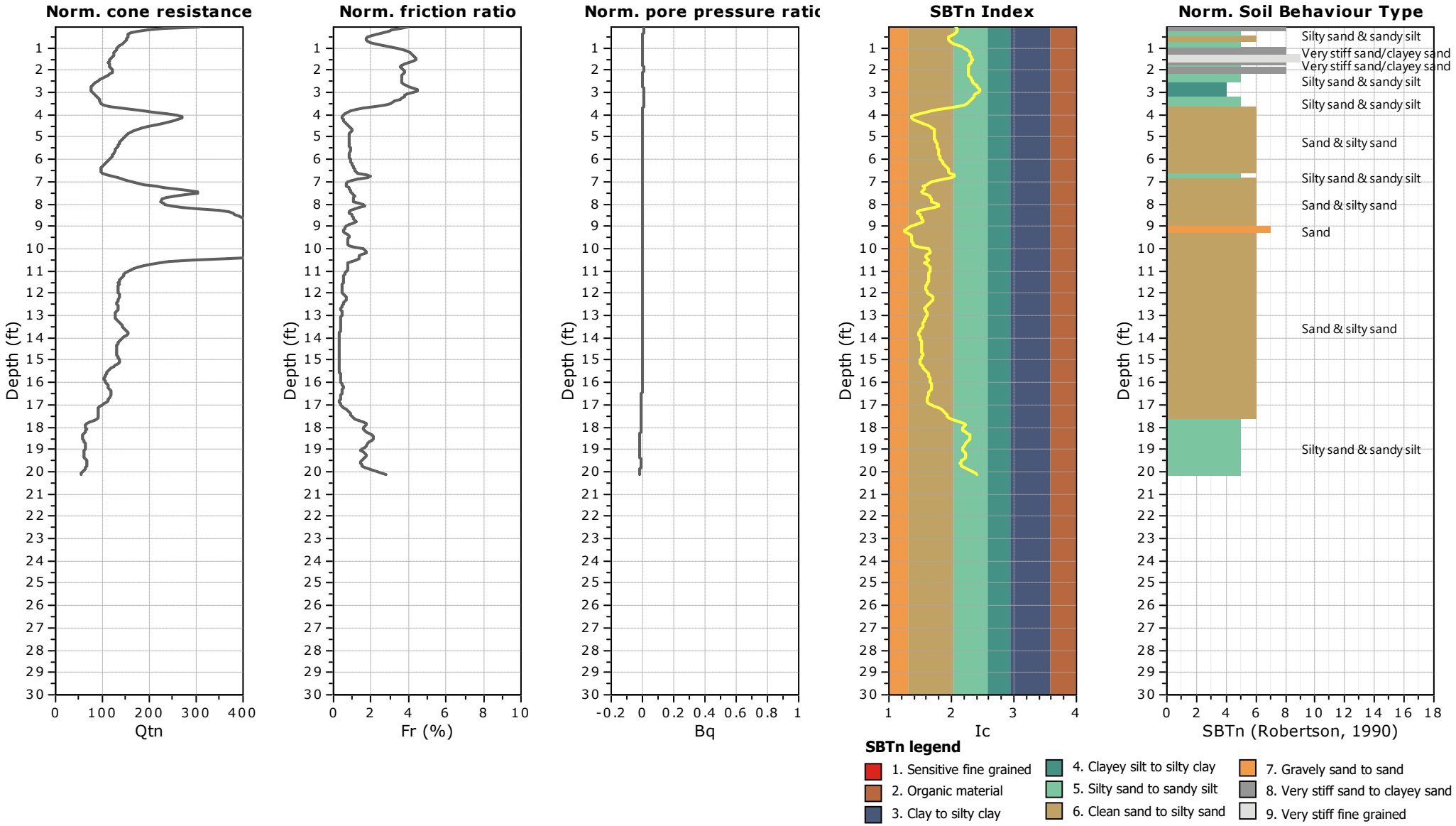
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-32
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 61.82 ft
Coords: X:572688.59, Y:555726.12
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

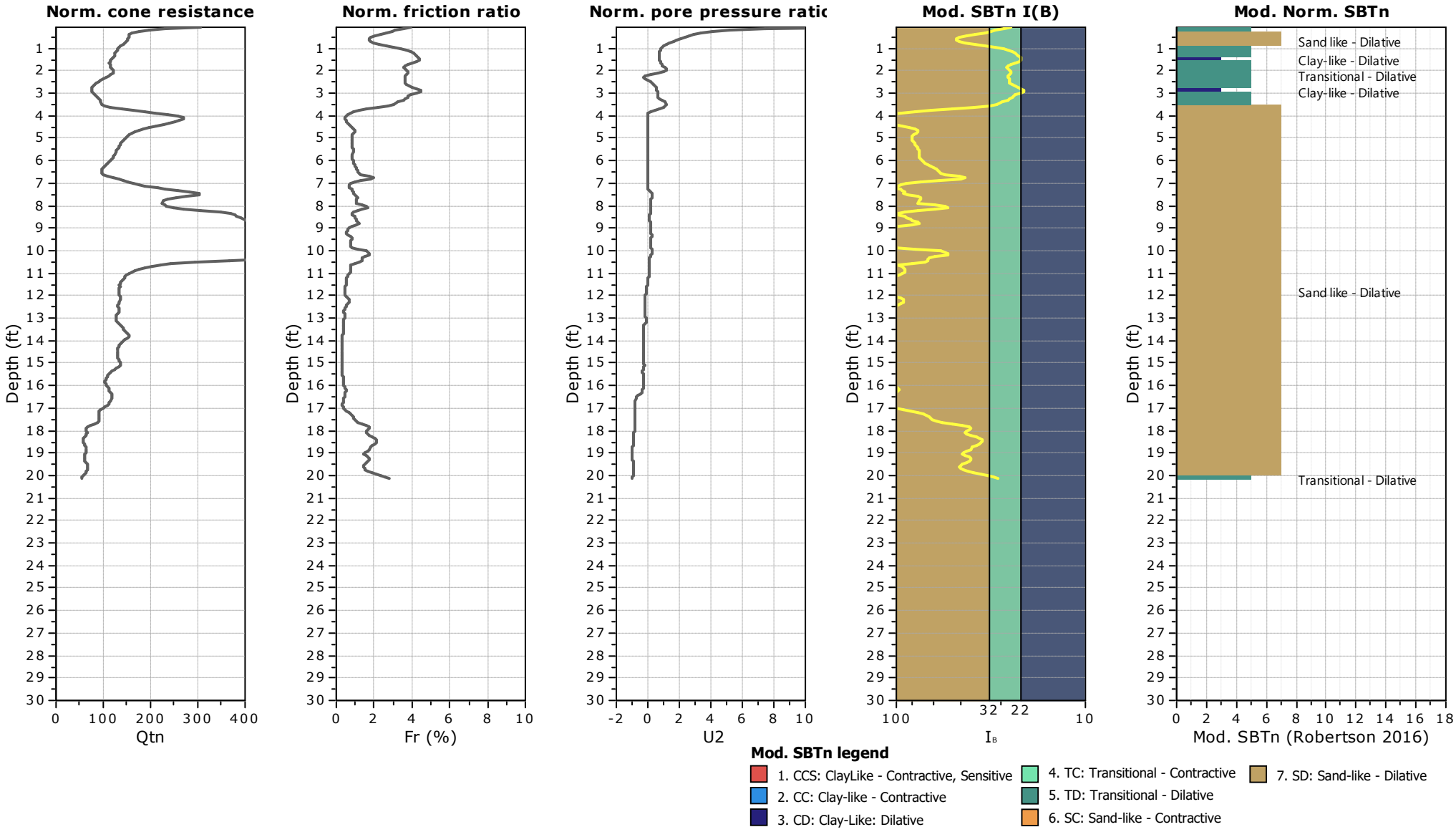
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-32
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 61.82 ft
Coords: X:572688.59, Y:555726.12
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

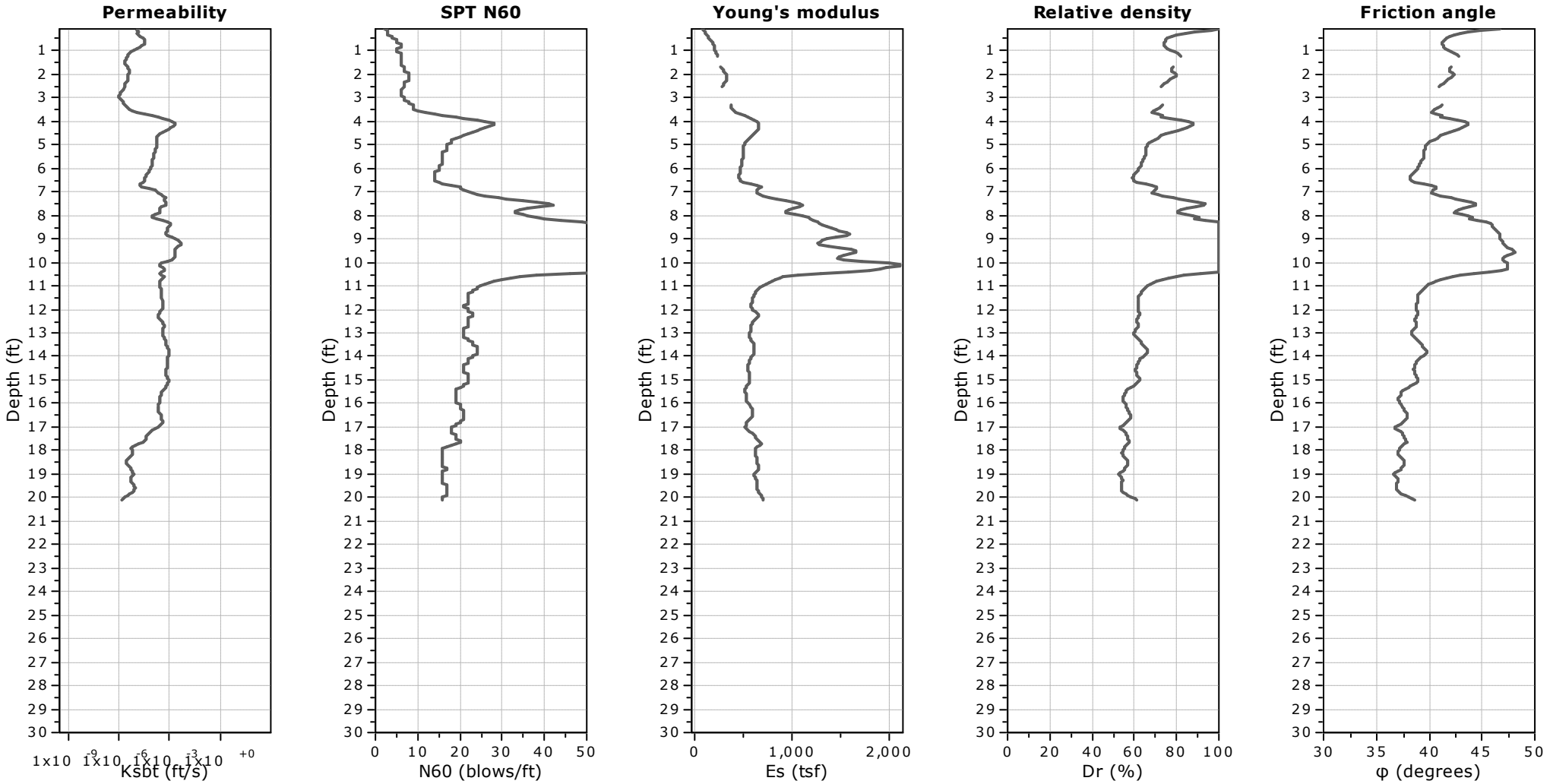
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-32
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 61.82 ft
Coords: X:572688.59, Y:555726.12
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



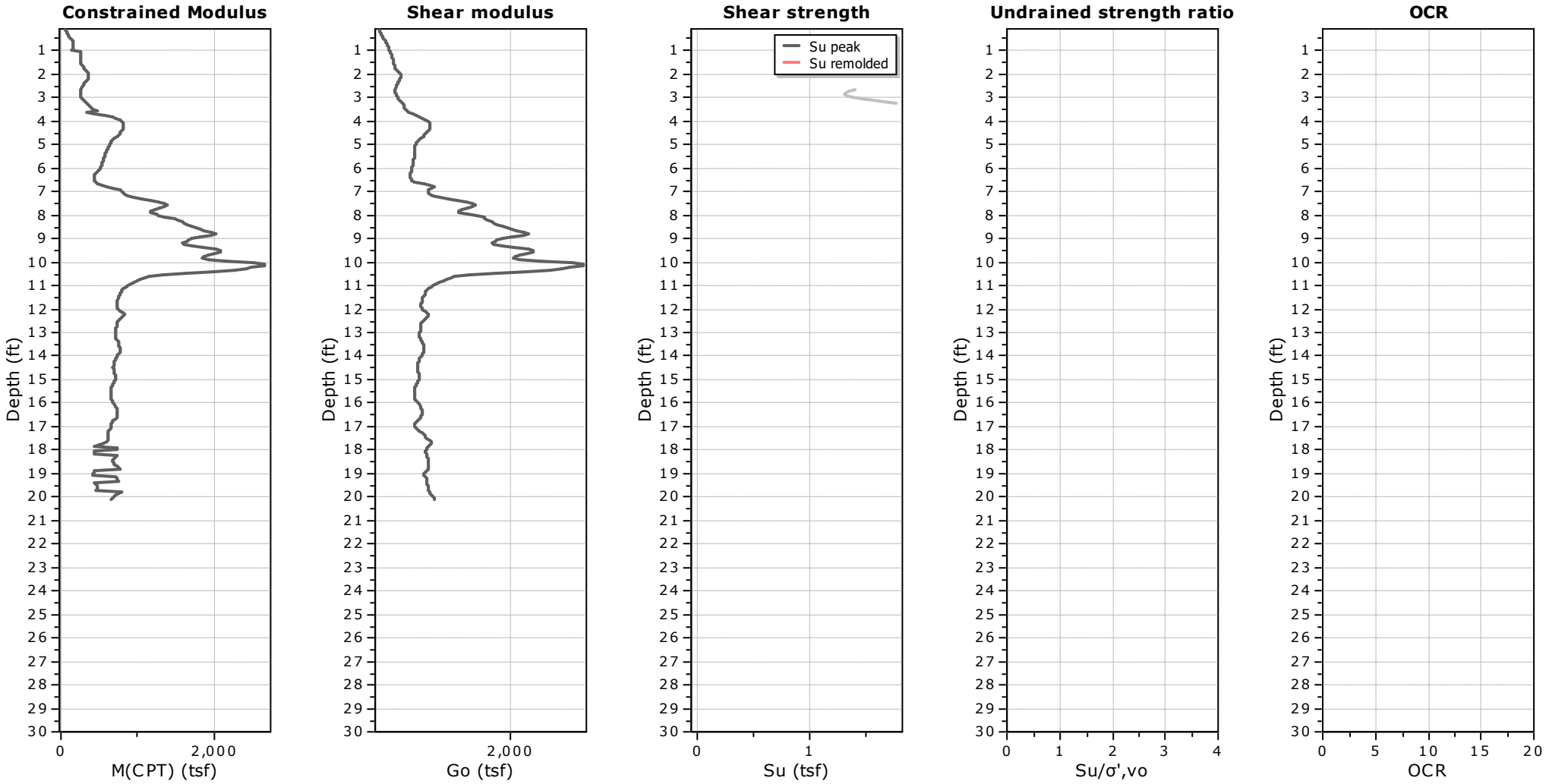
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-32
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 61.82 ft
Coords: X:572688.59, Y:555726.12
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



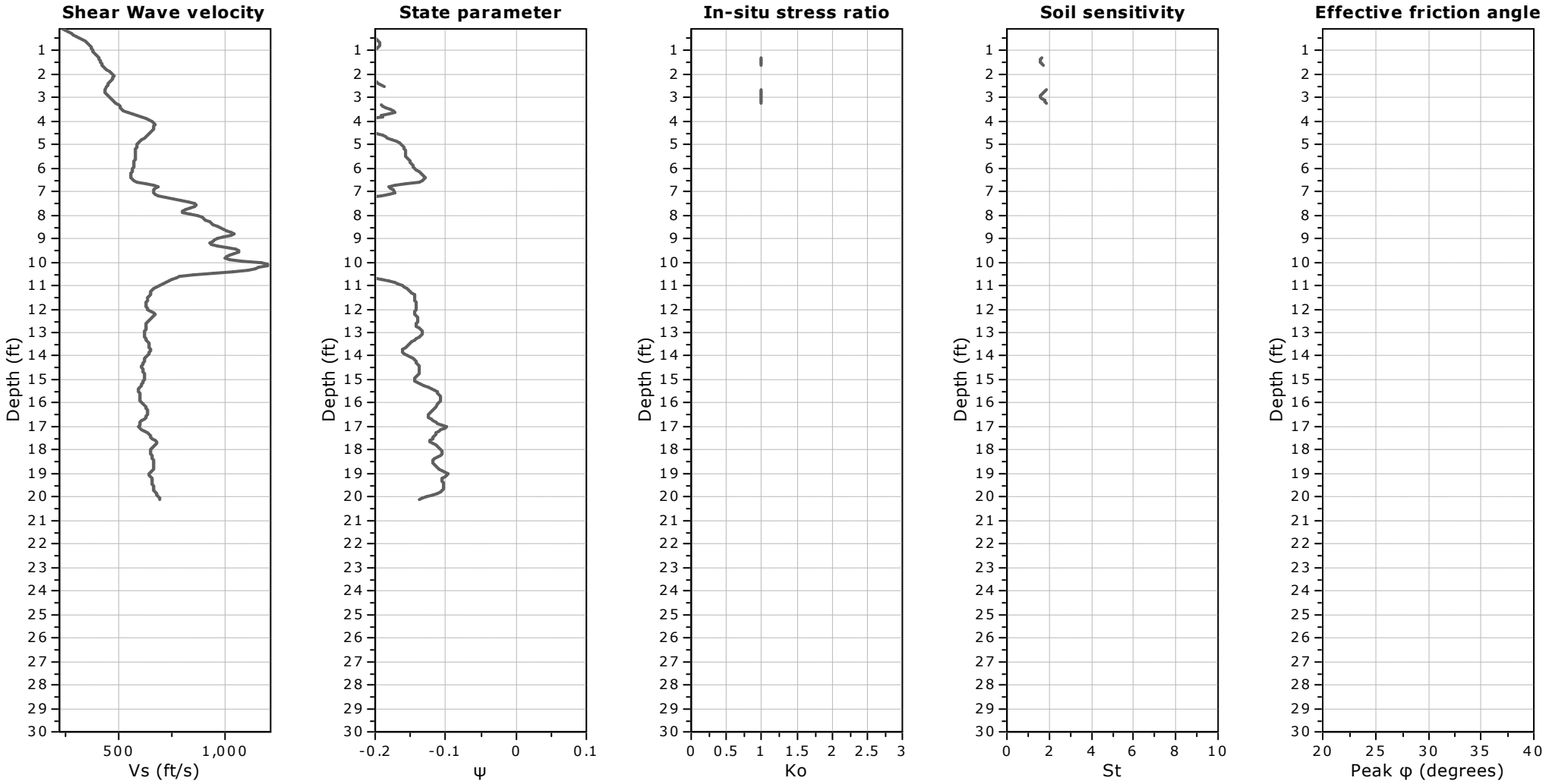
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-32
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 61.82 ft
Coords: X:572688.59, Y:555726.12
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



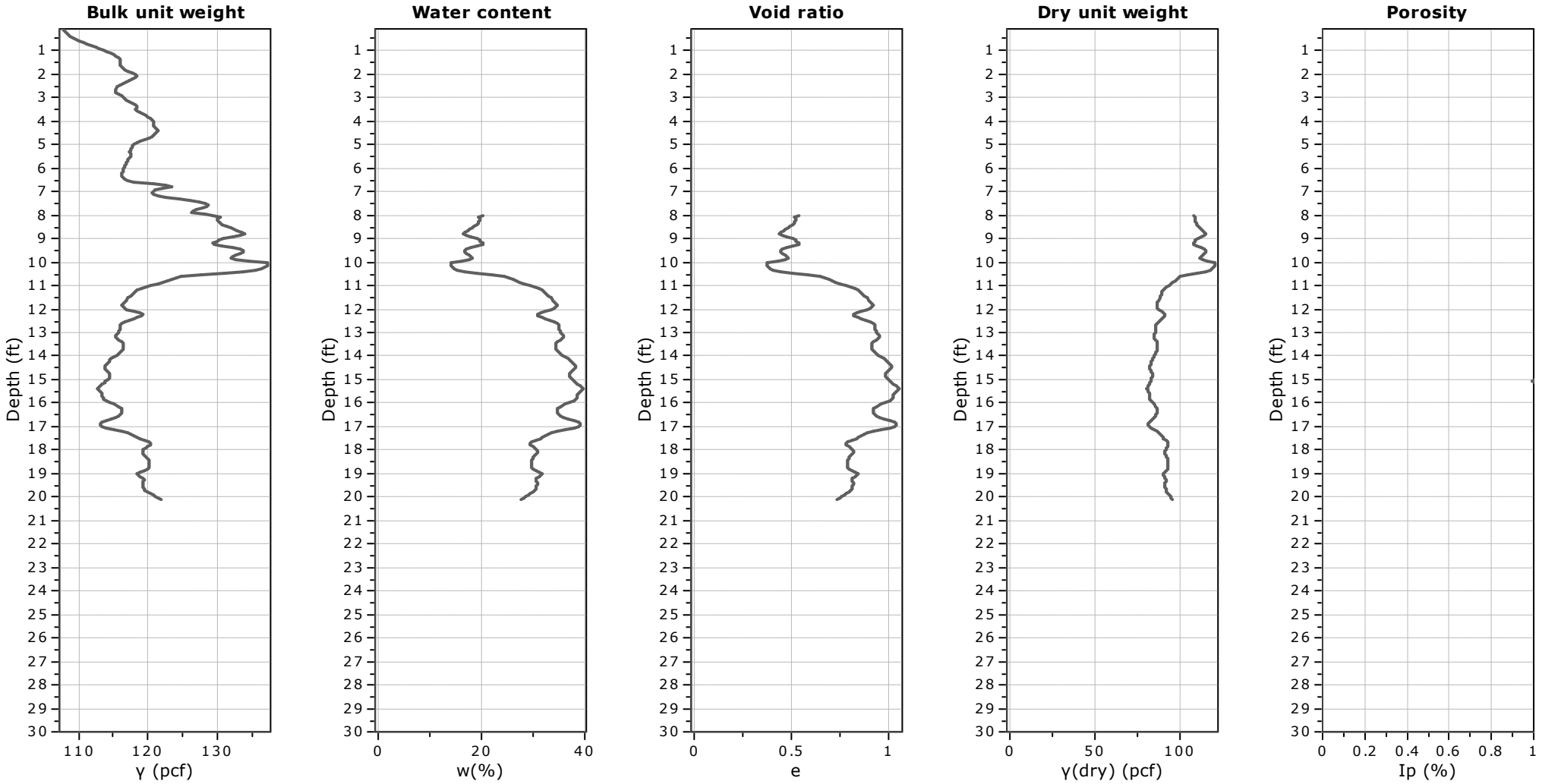
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-32
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 61.82 ft
Coords: X:572688.59, Y:555726.12
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

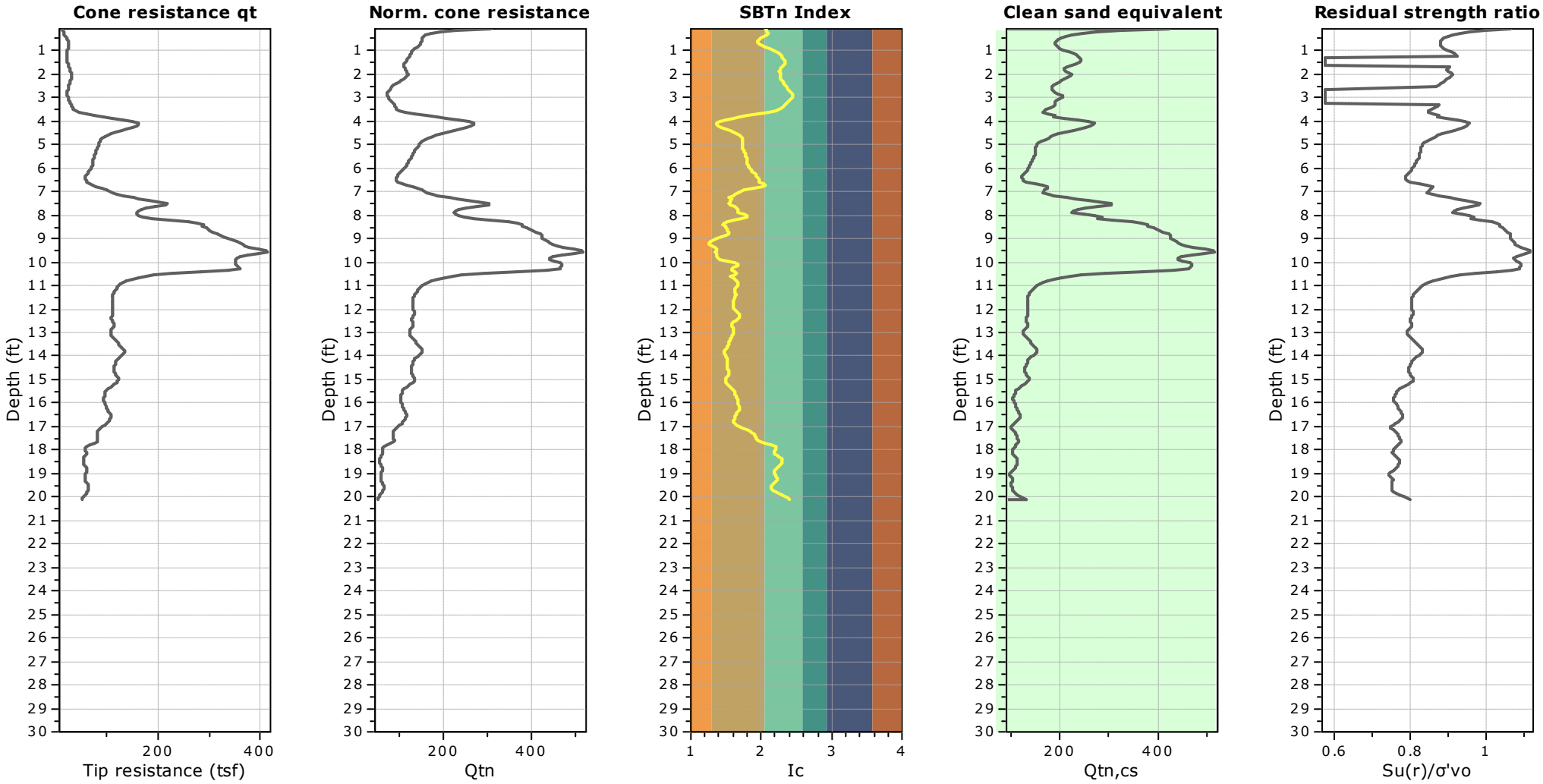
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-32
Total depth: 20.14 ft, Date: 5/14/2024
Surface Elevation: 61.82 ft
Coords: X:572688.59, Y:555726.12
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

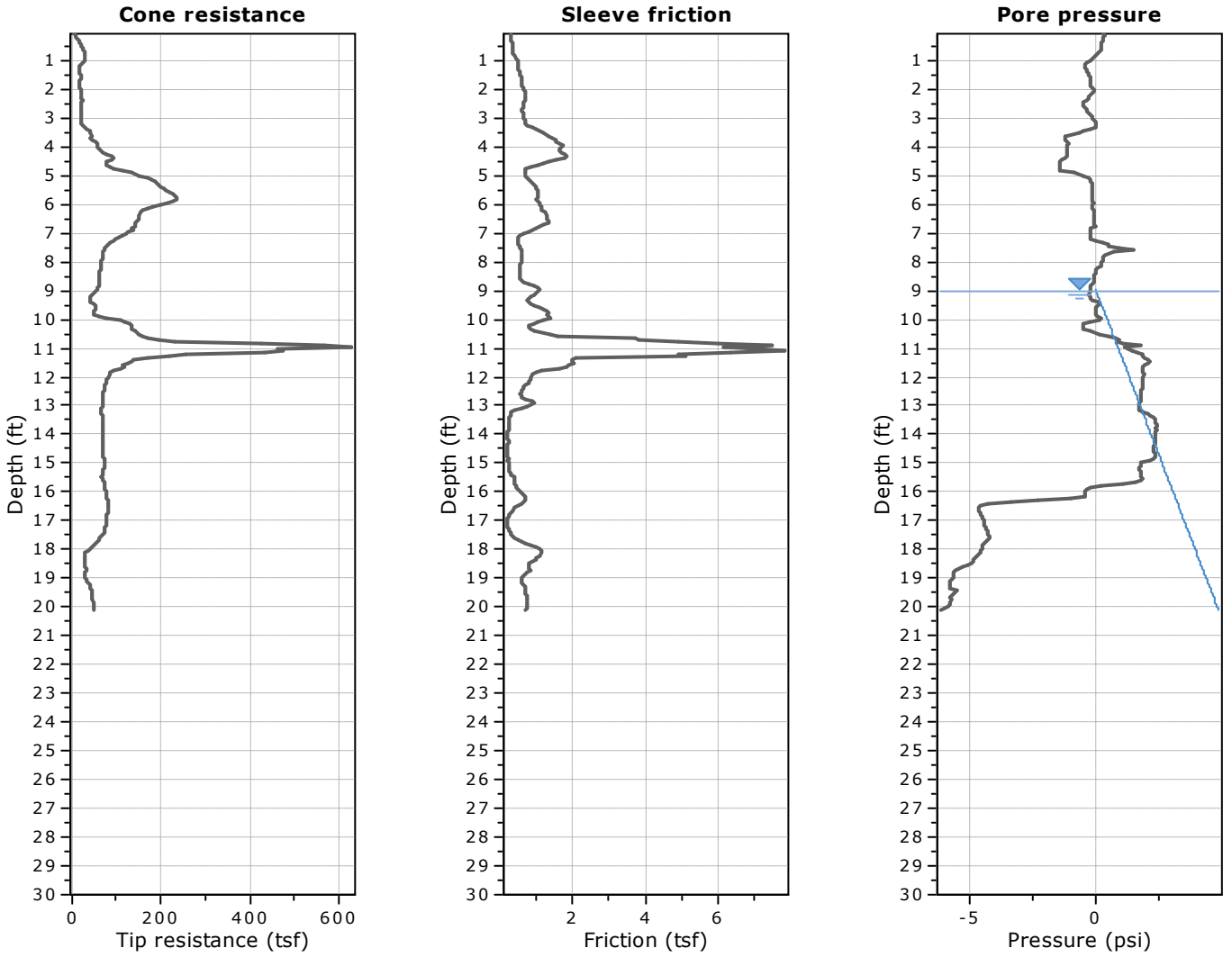
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



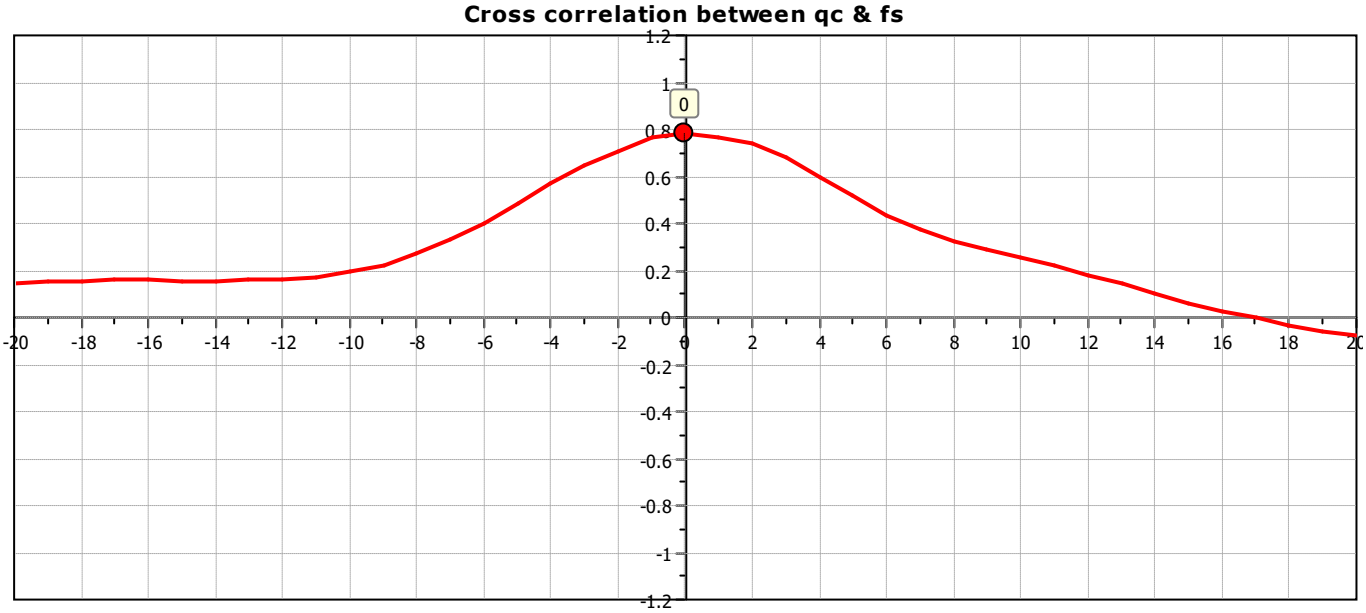
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-33
Total depth: 20.09 ft, Date: 5/13/2024
Surface Elevation: 61.42 ft
Coords: X:572817.41, Y:555819.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: ASD Summit Campus
Location: Middletown, Delaware



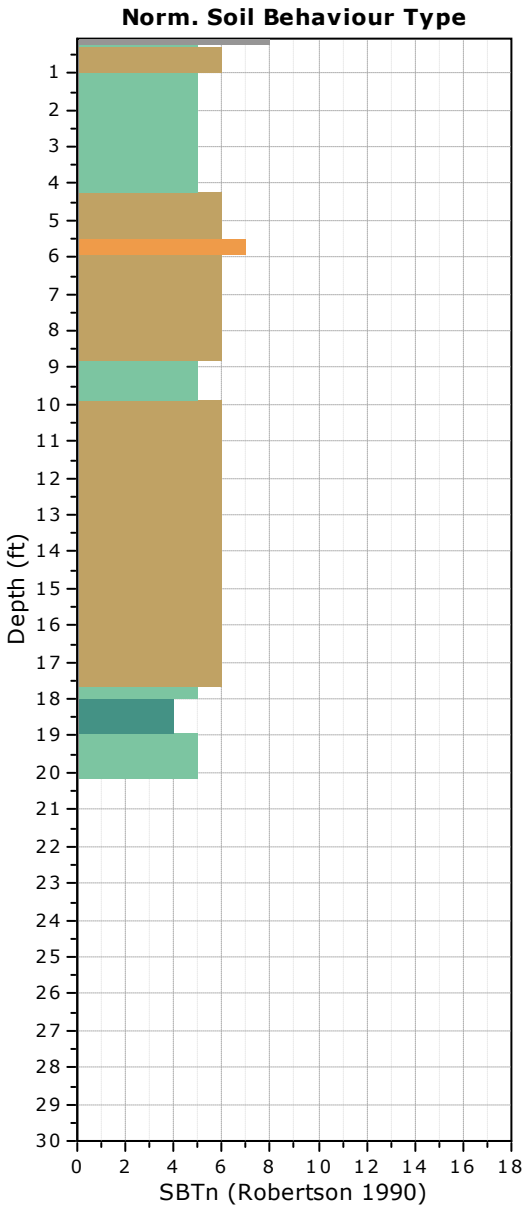
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

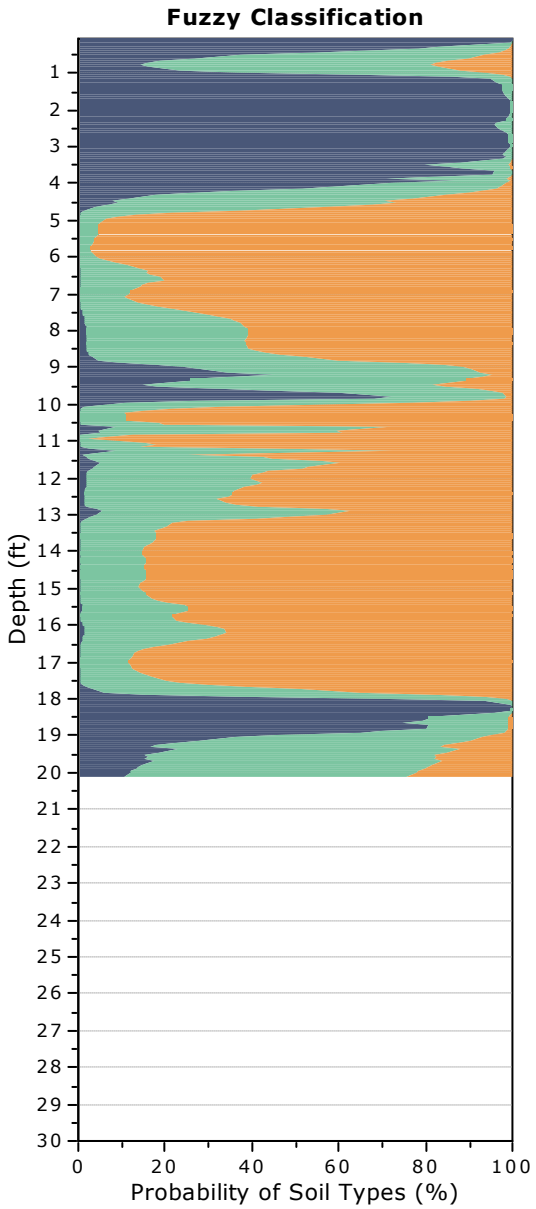


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-33
Total depth: 20.09 ft, Date: 5/13/2024
Surface Elevation: 61.42 ft
Coords: X:572817.41, Y:555819.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



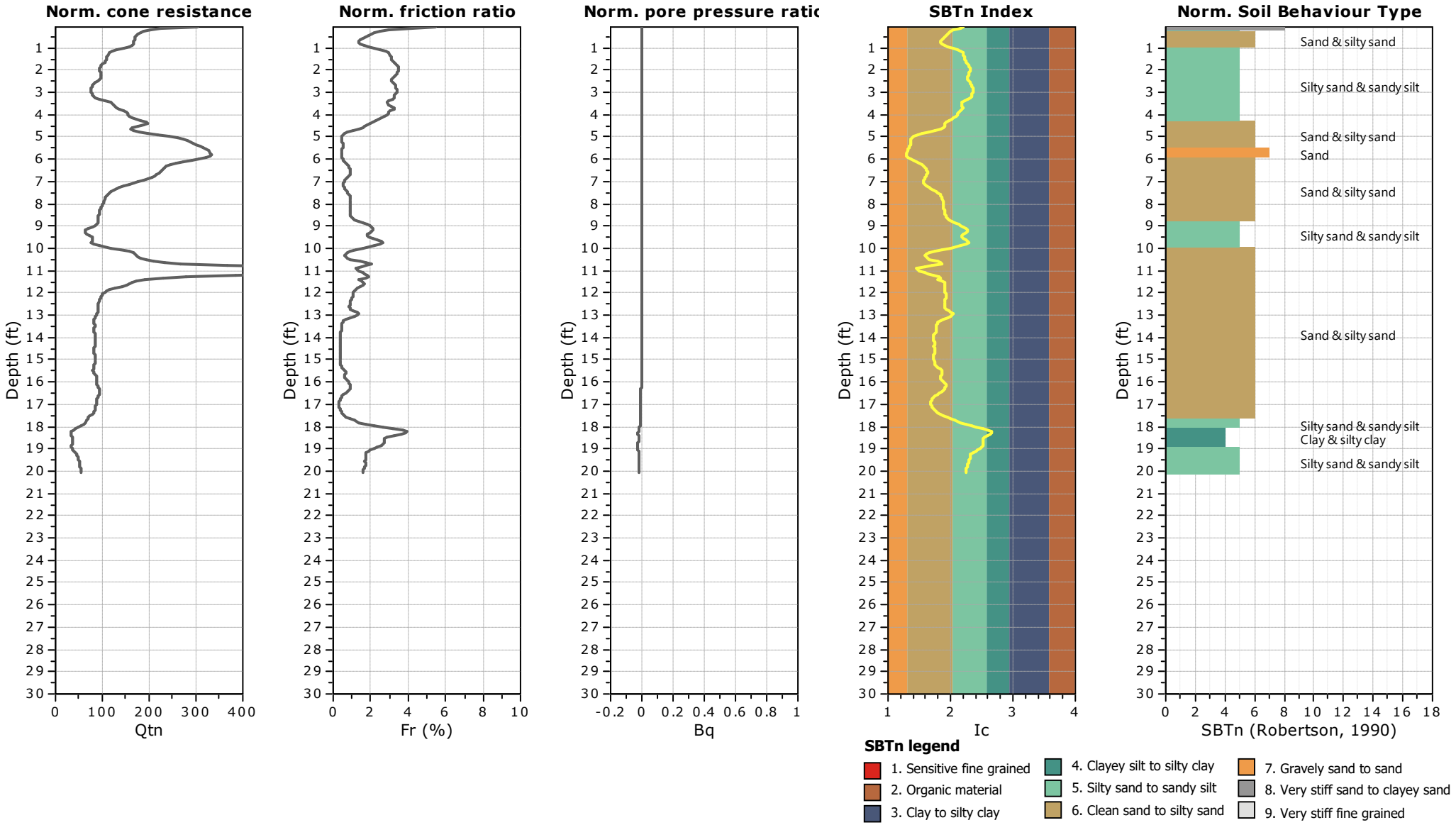


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

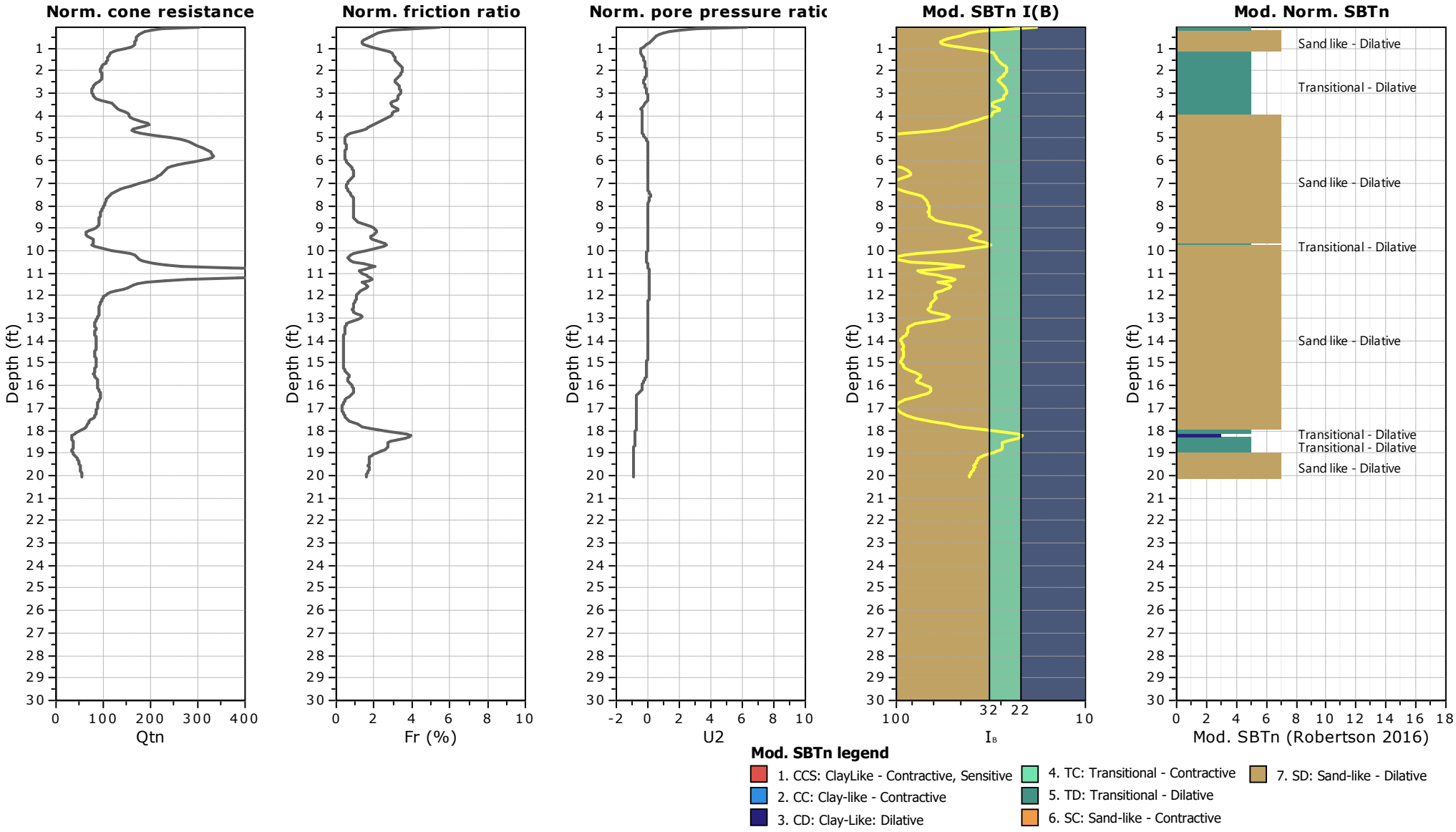
C-33
Total depth: 20.09 ft, Date: 5/13/2024
Surface Elevation: 61.42 ft
Coords: X:572817.41, Y:555819.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

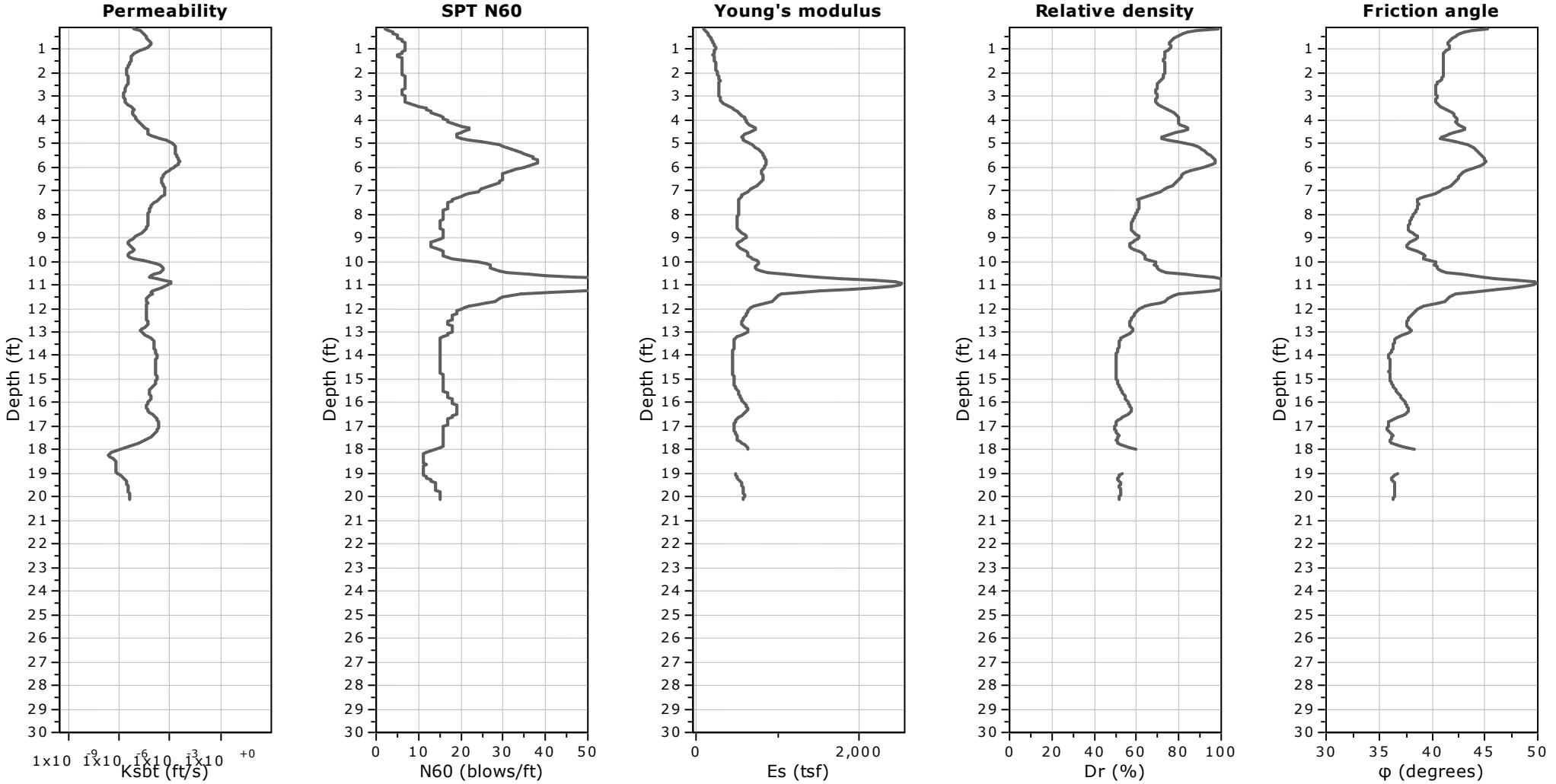
C-33
Total depth: 20.09 ft, Date: 5/13/2024
Surface Elevation: 61.42 ft
Coords: X:572817.41, Y:555819.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-33
Total depth: 20.09 ft, Date: 5/13/2024
Surface Elevation: 61.42 ft
Coords: X:572817.41, Y:555819.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



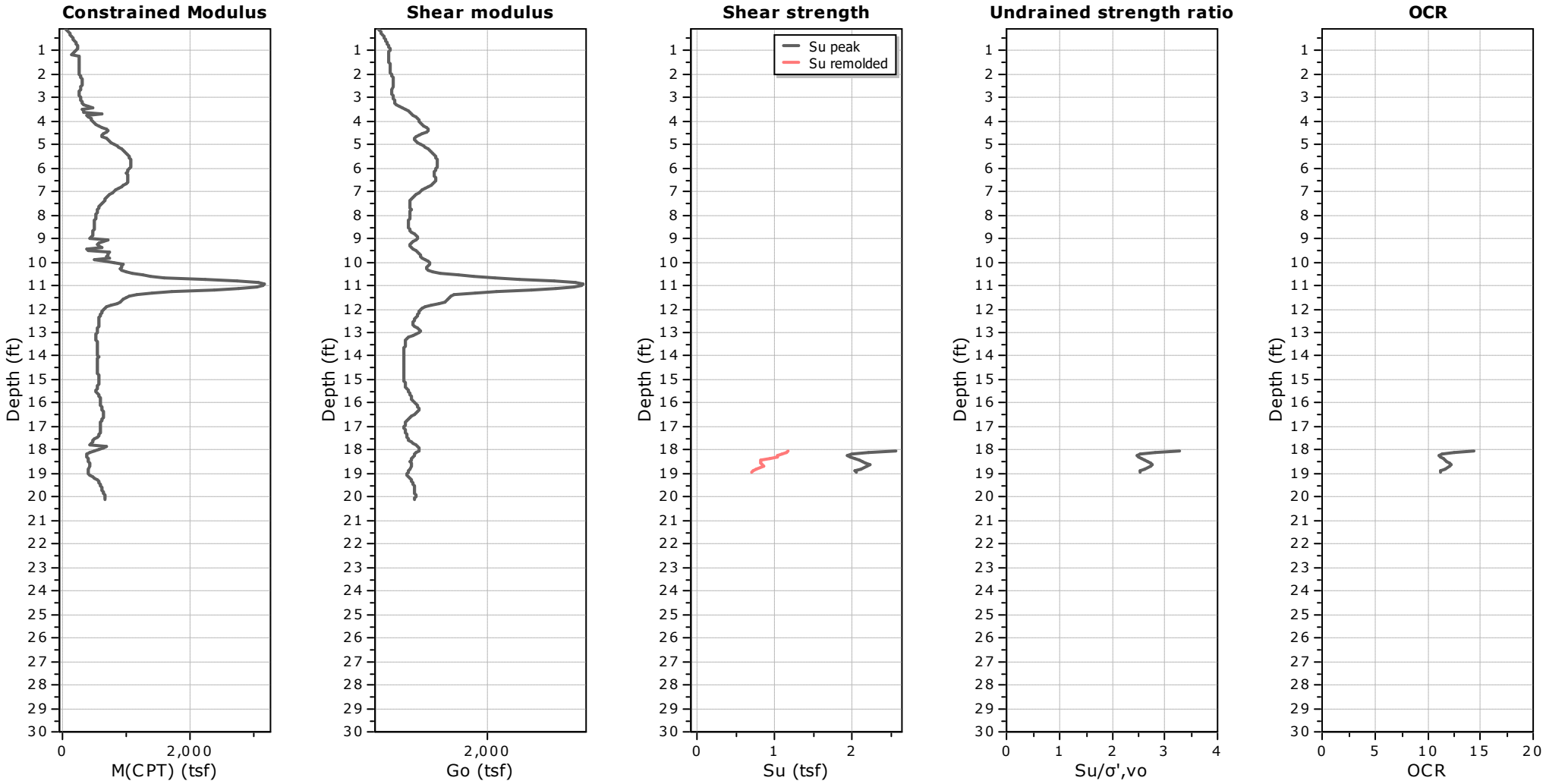
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-33
Total depth: 20.09 ft, Date: 5/13/2024
Surface Elevation: 61.42 ft
Coords: X:572817.41, Y:555819.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



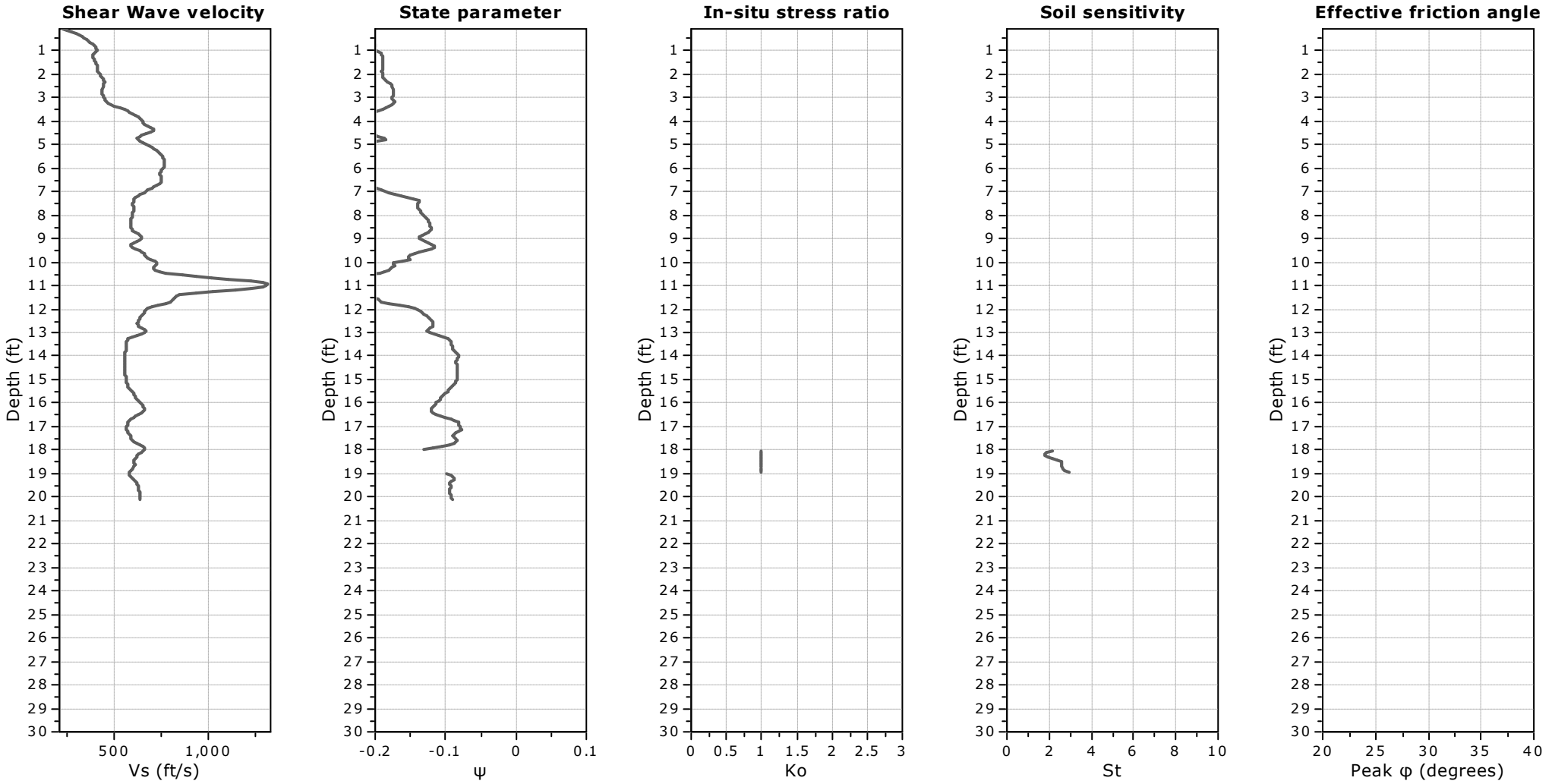
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-33
Total depth: 20.09 ft, Date: 5/13/2024
Surface Elevation: 61.42 ft
Coords: X:572817.41, Y:555819.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



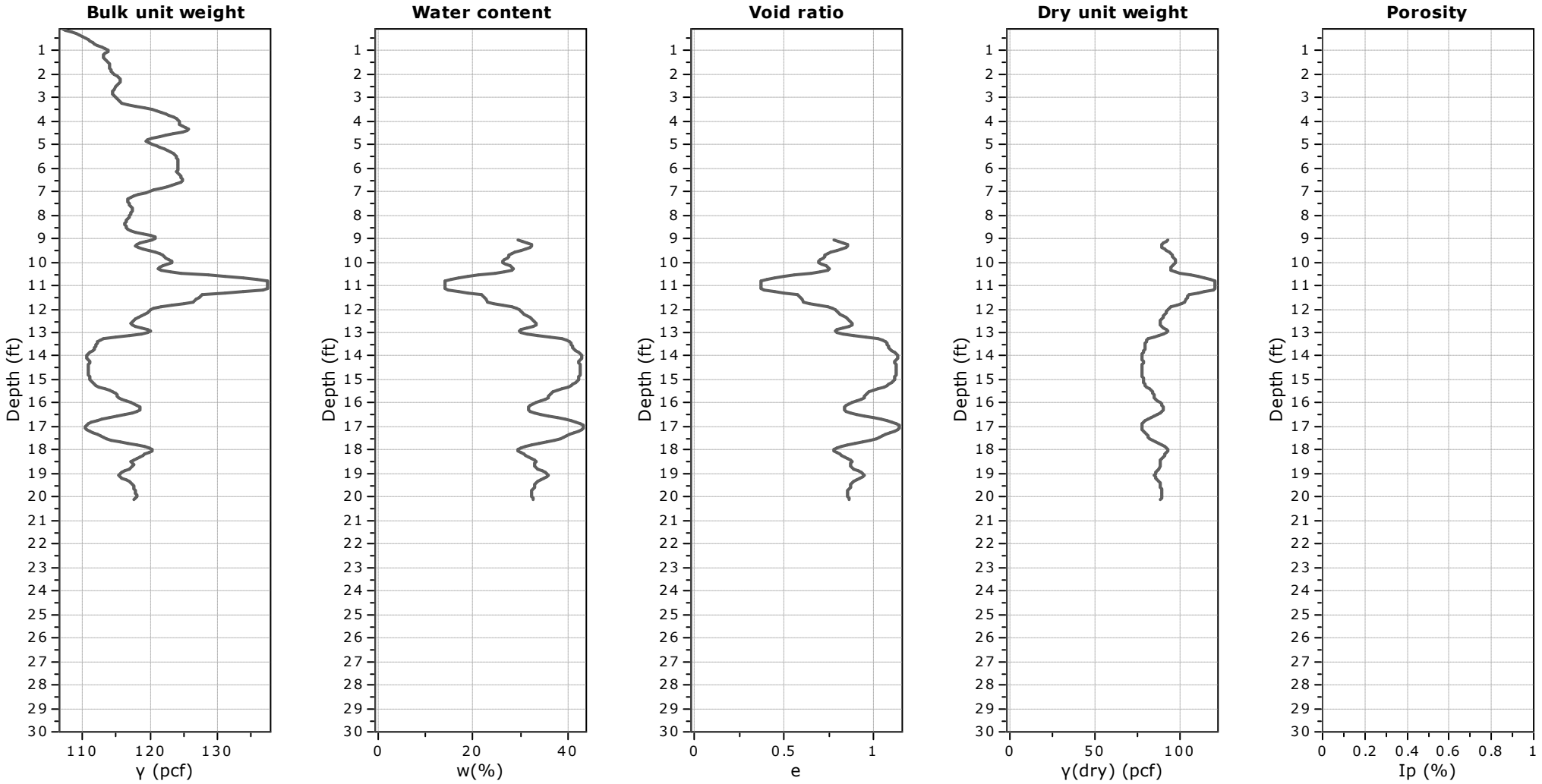
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-33
Total depth: 20.09 ft, Date: 5/13/2024
Surface Elevation: 61.42 ft
Coords: X:572817.41, Y:555819.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

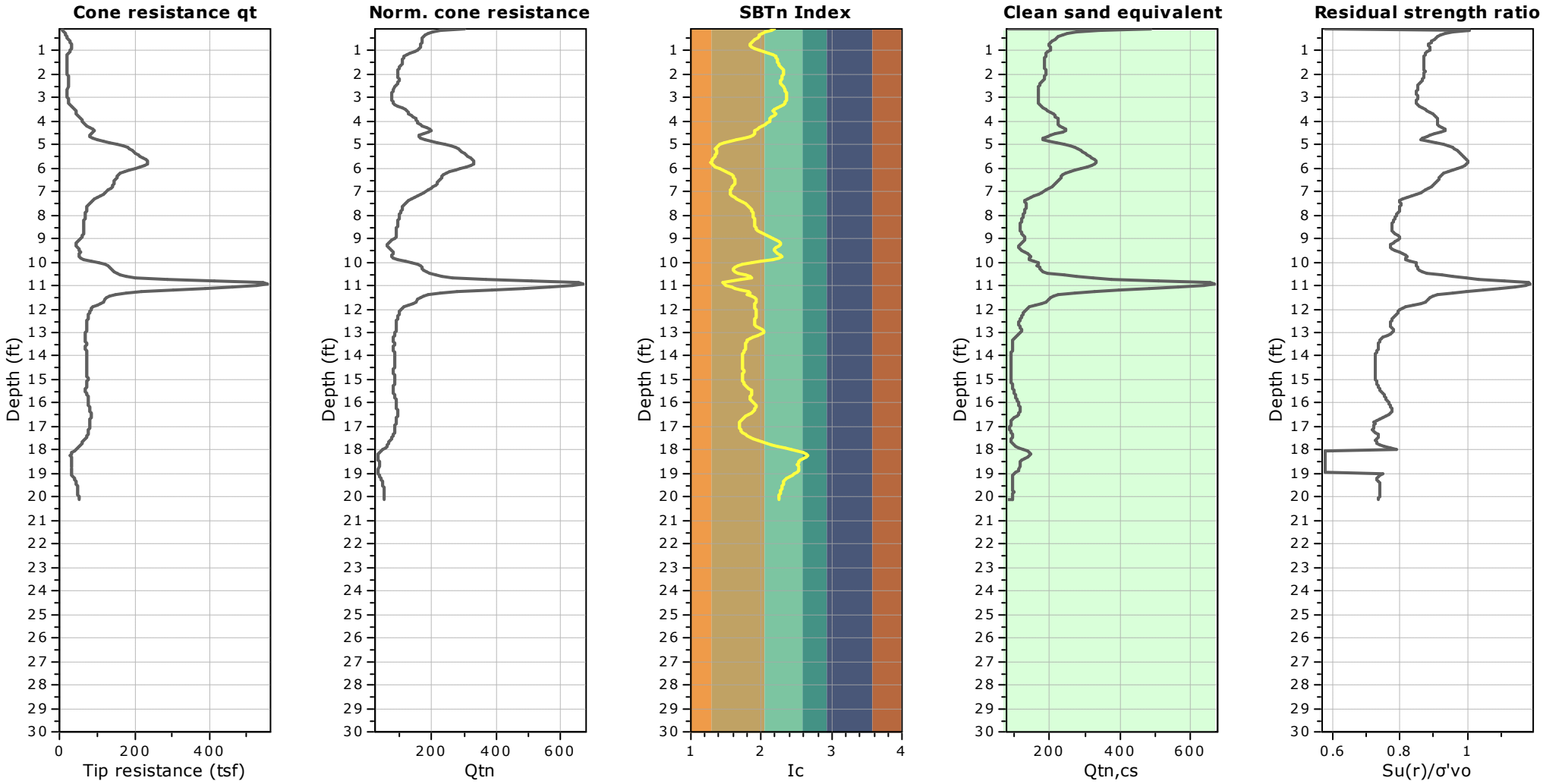
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-33
Total depth: 20.09 ft, Date: 5/13/2024
Surface Elevation: 61.42 ft
Coords: X:572817.41, Y:555819.08
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

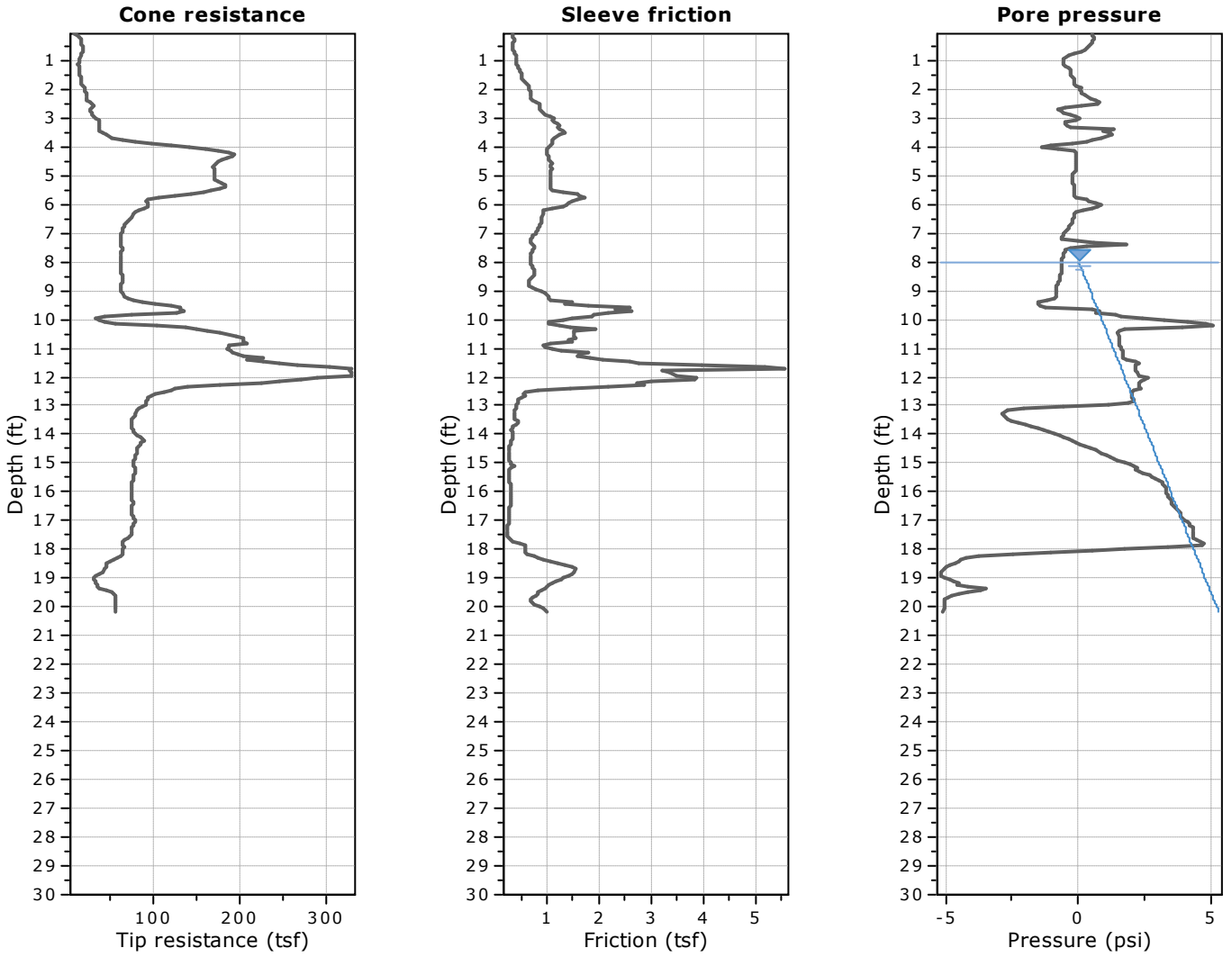
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



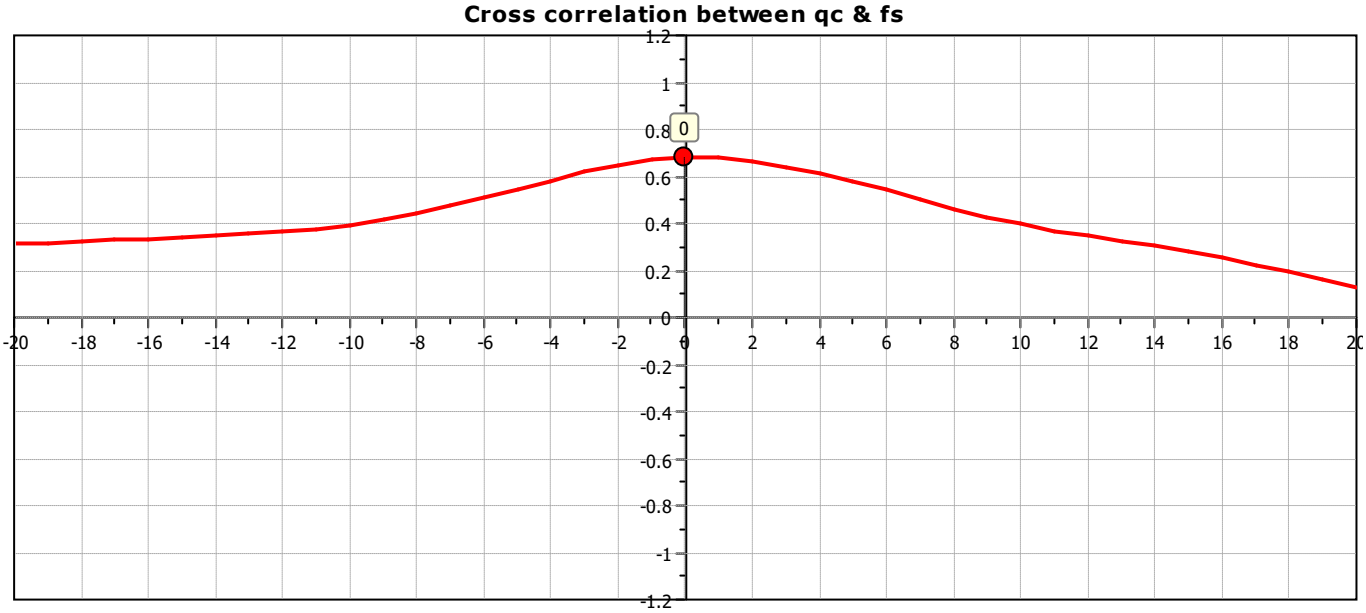
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

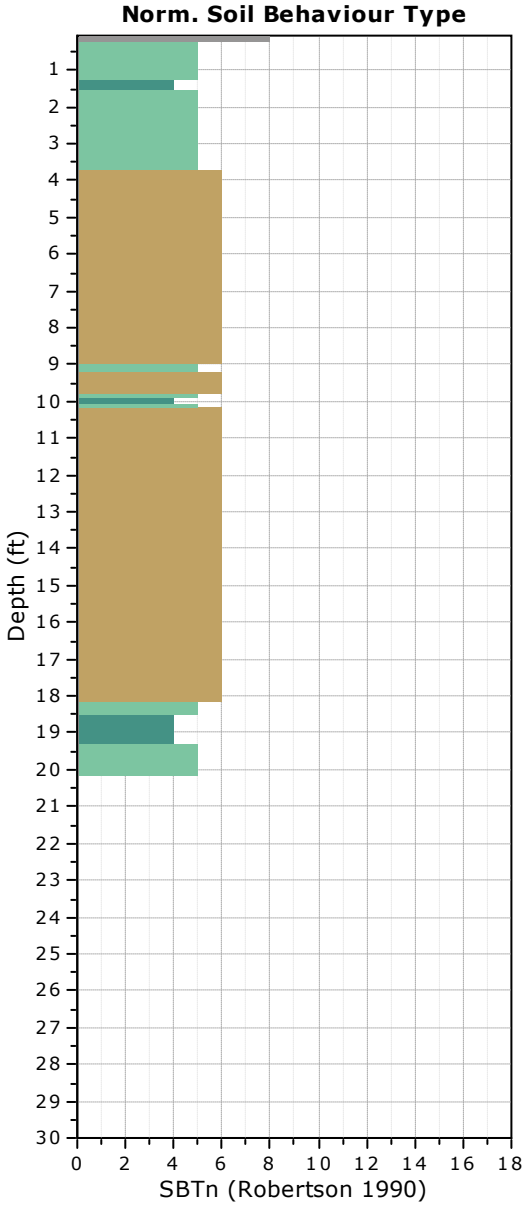
C-34
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 60.98 ft
Coords: X:572875.48, Y:555779.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

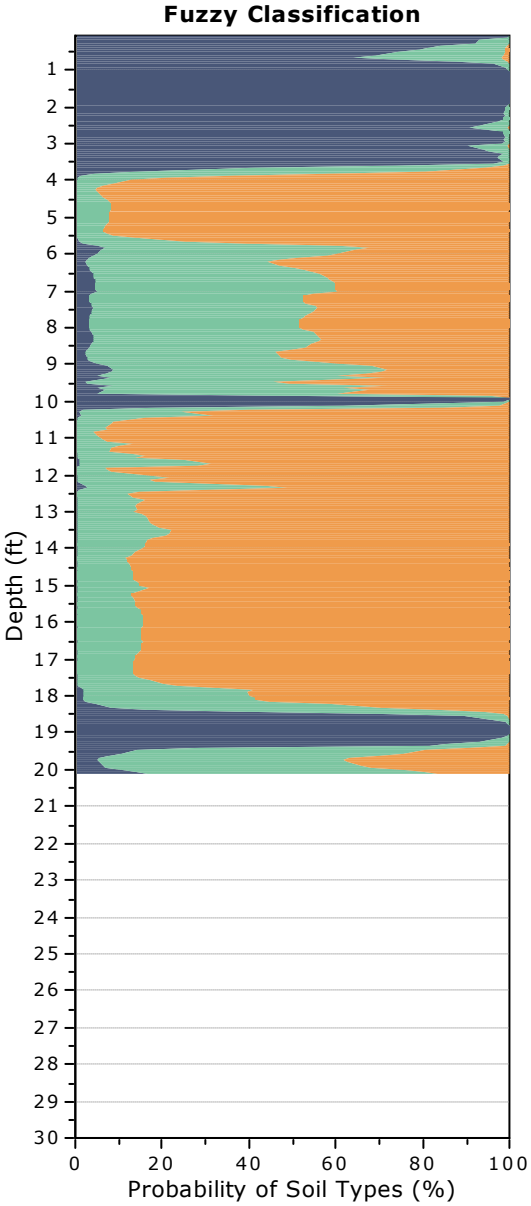
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).





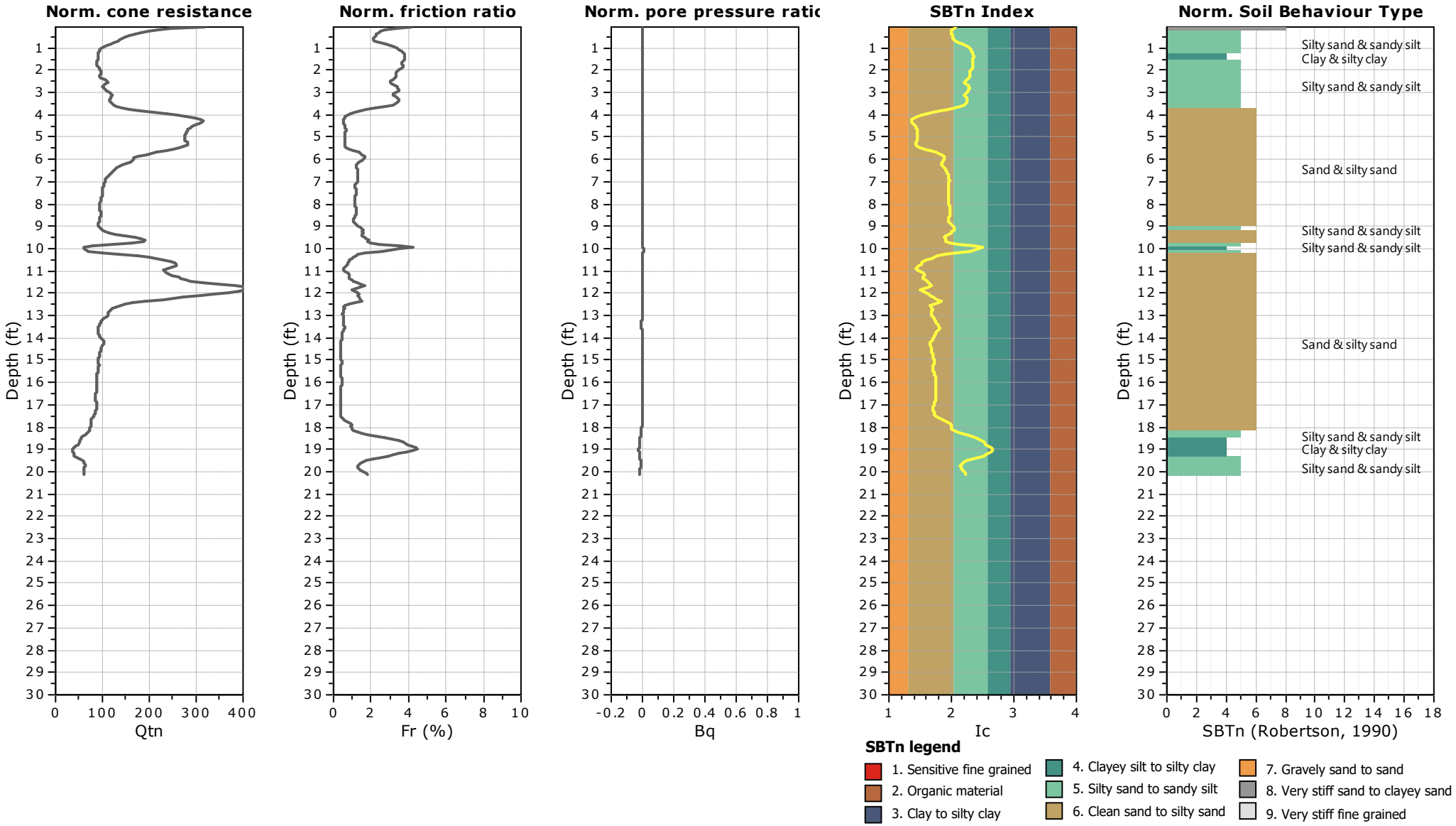


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-34
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 60.98 ft
Coords: X:572875.48, Y:555779.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

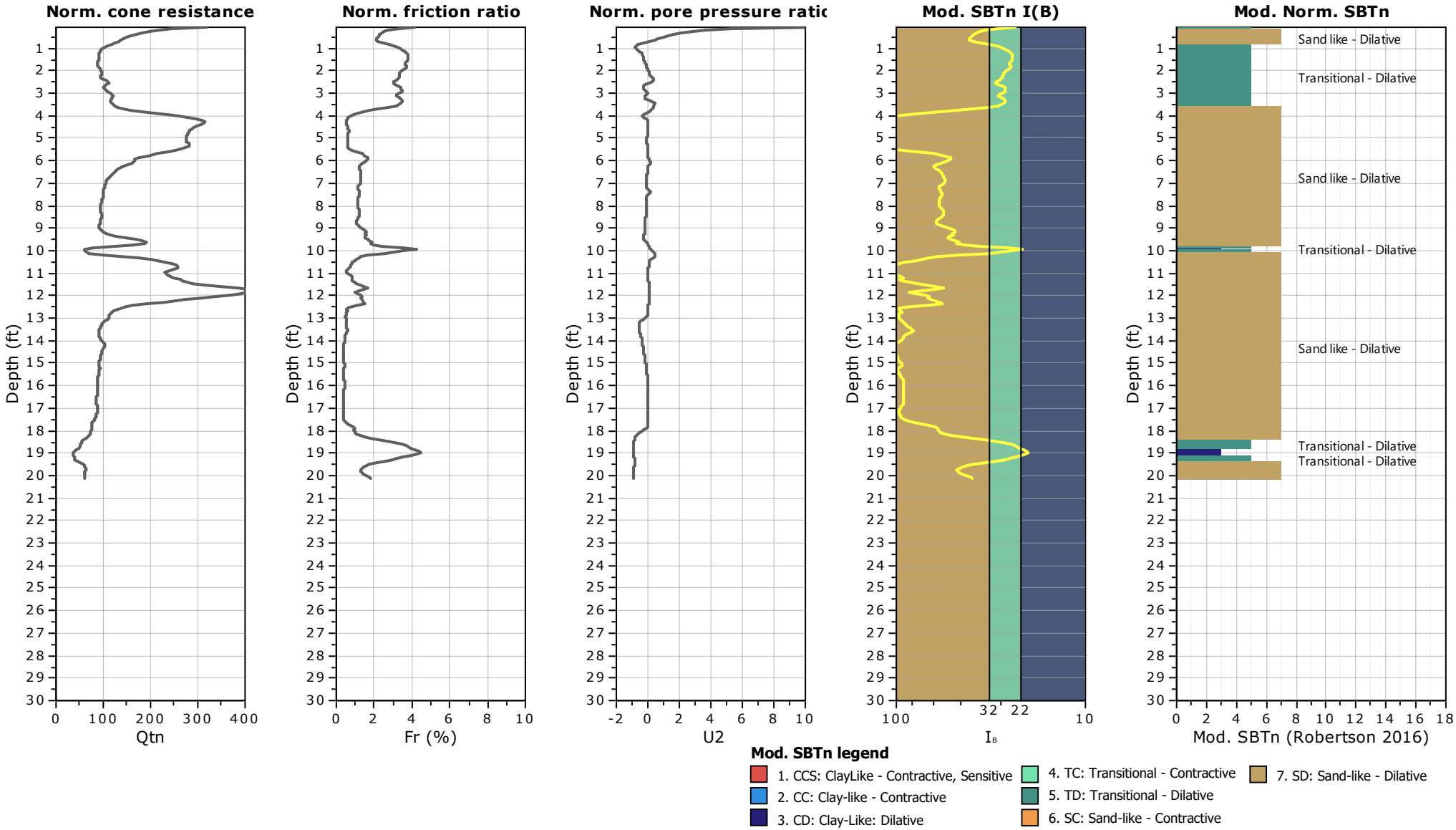
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-34
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 60.98 ft
Coords: X:572875.48, Y:555779.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

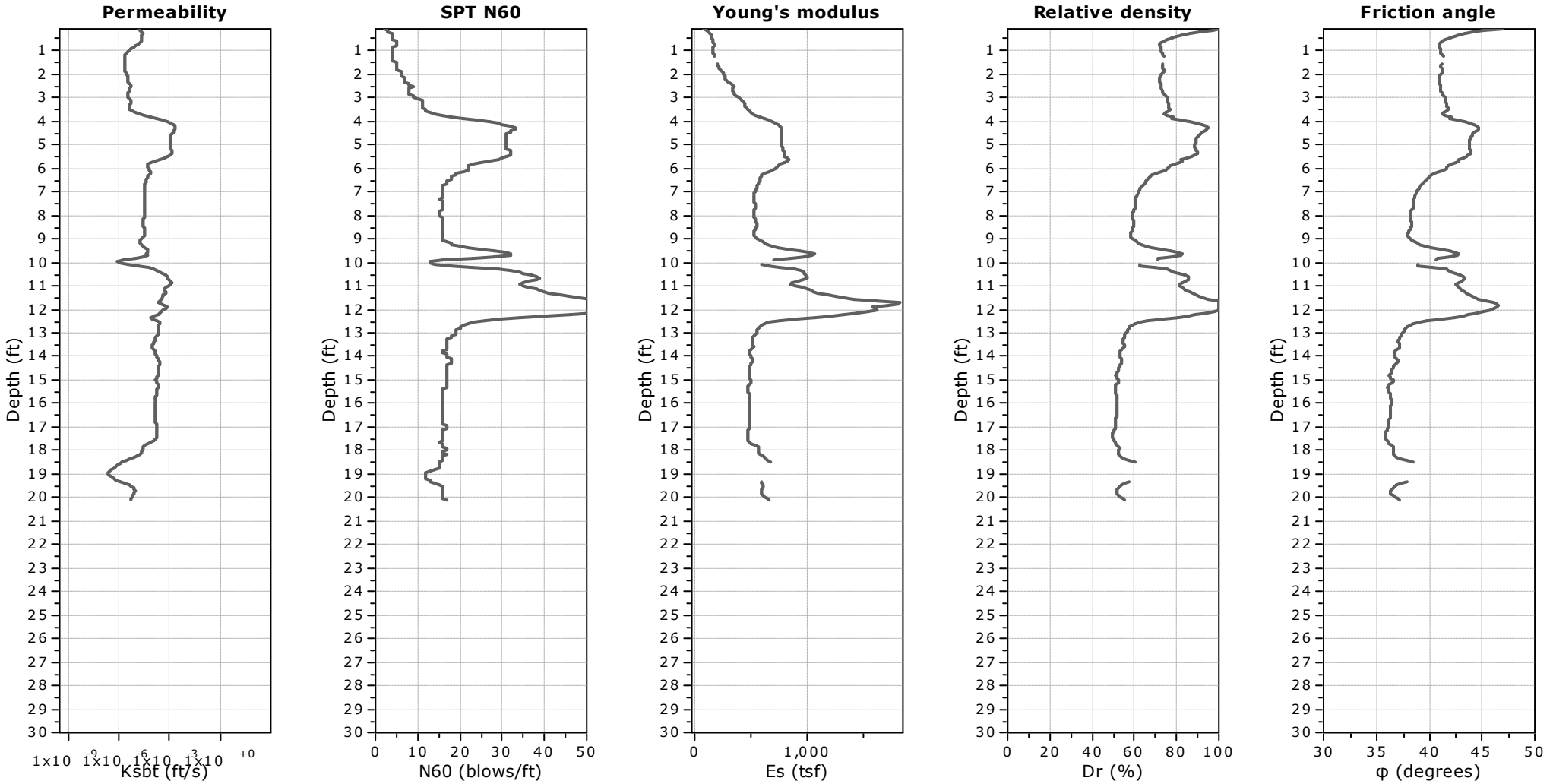
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-34
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 60.98 ft
Coords: X:572875.48, Y:555779.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



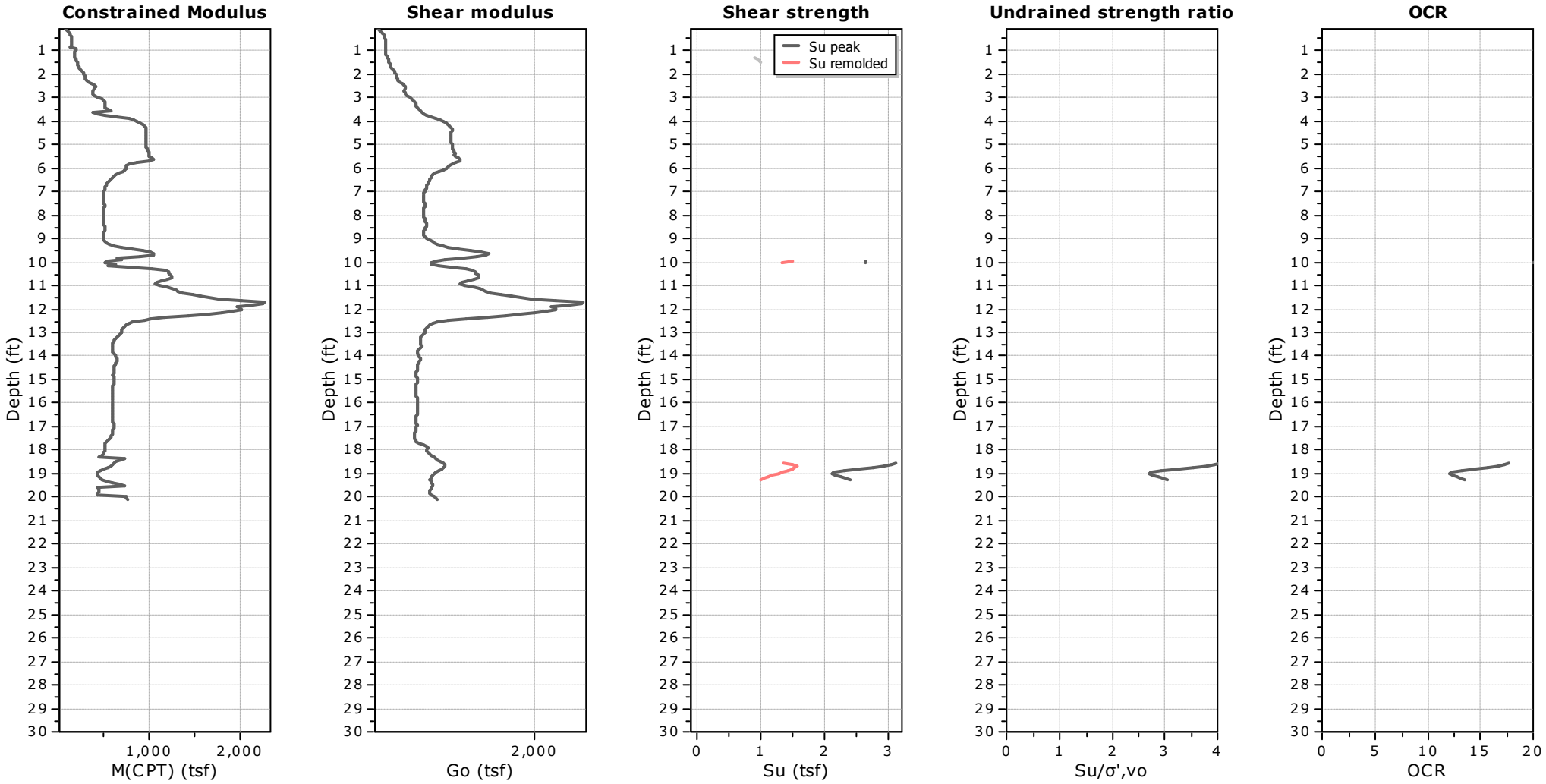
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-34
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 60.98 ft
Coords: X:572875.48, Y:555779.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



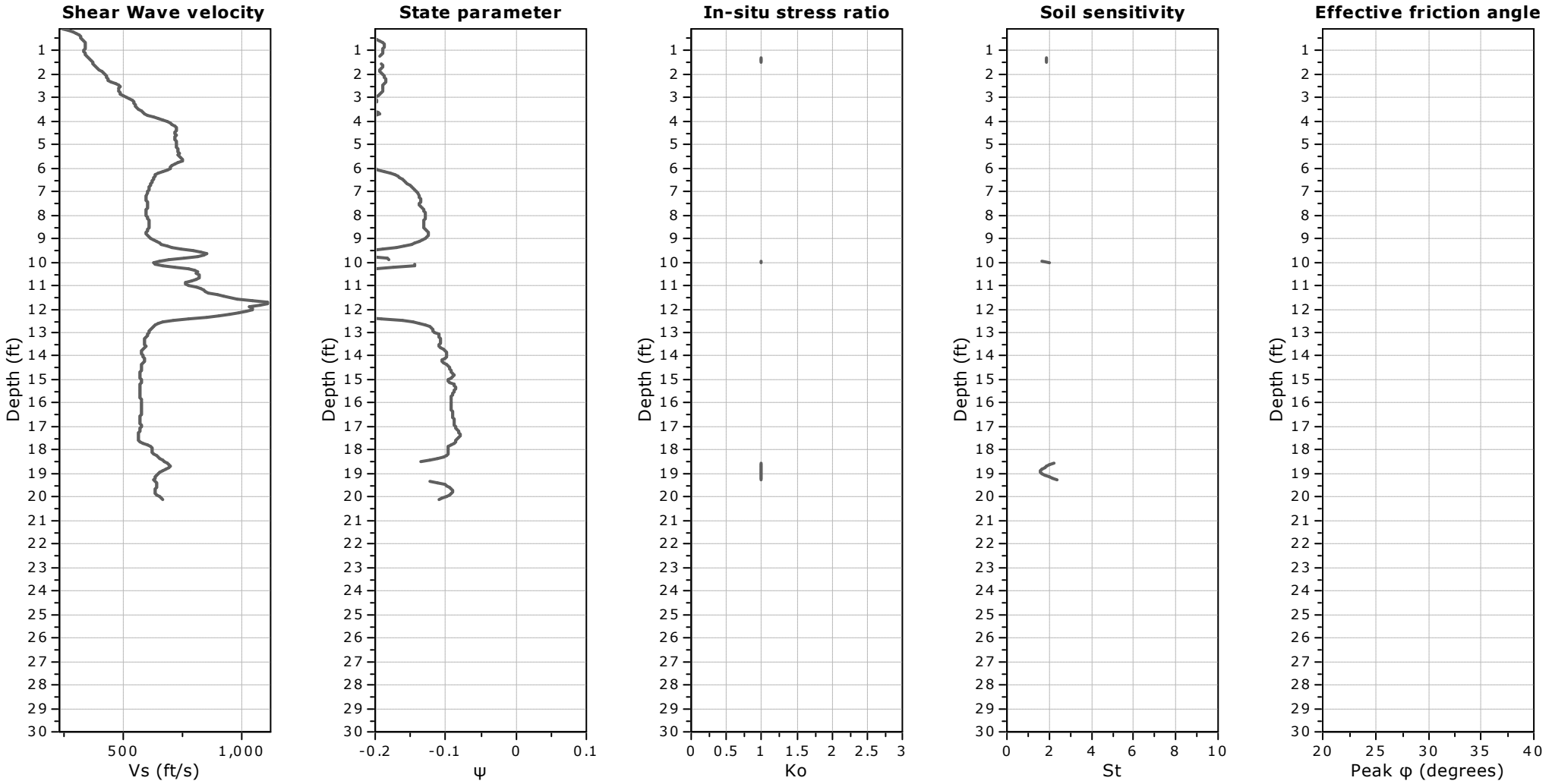
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-34
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 60.98 ft
Coords: X:572875.48, Y:555779.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



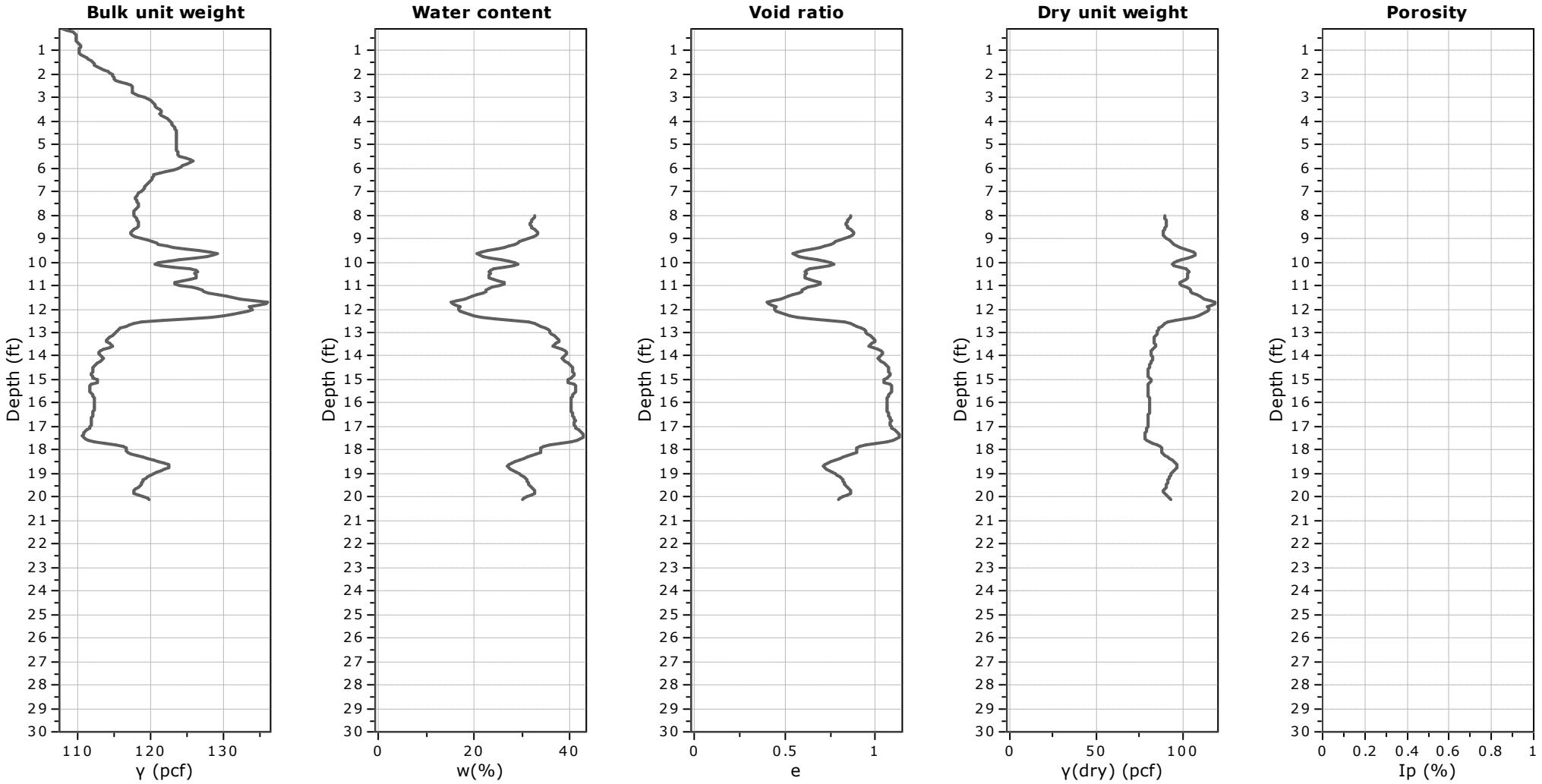
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-34
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 60.98 ft
Coords: X:572875.48, Y:555779.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

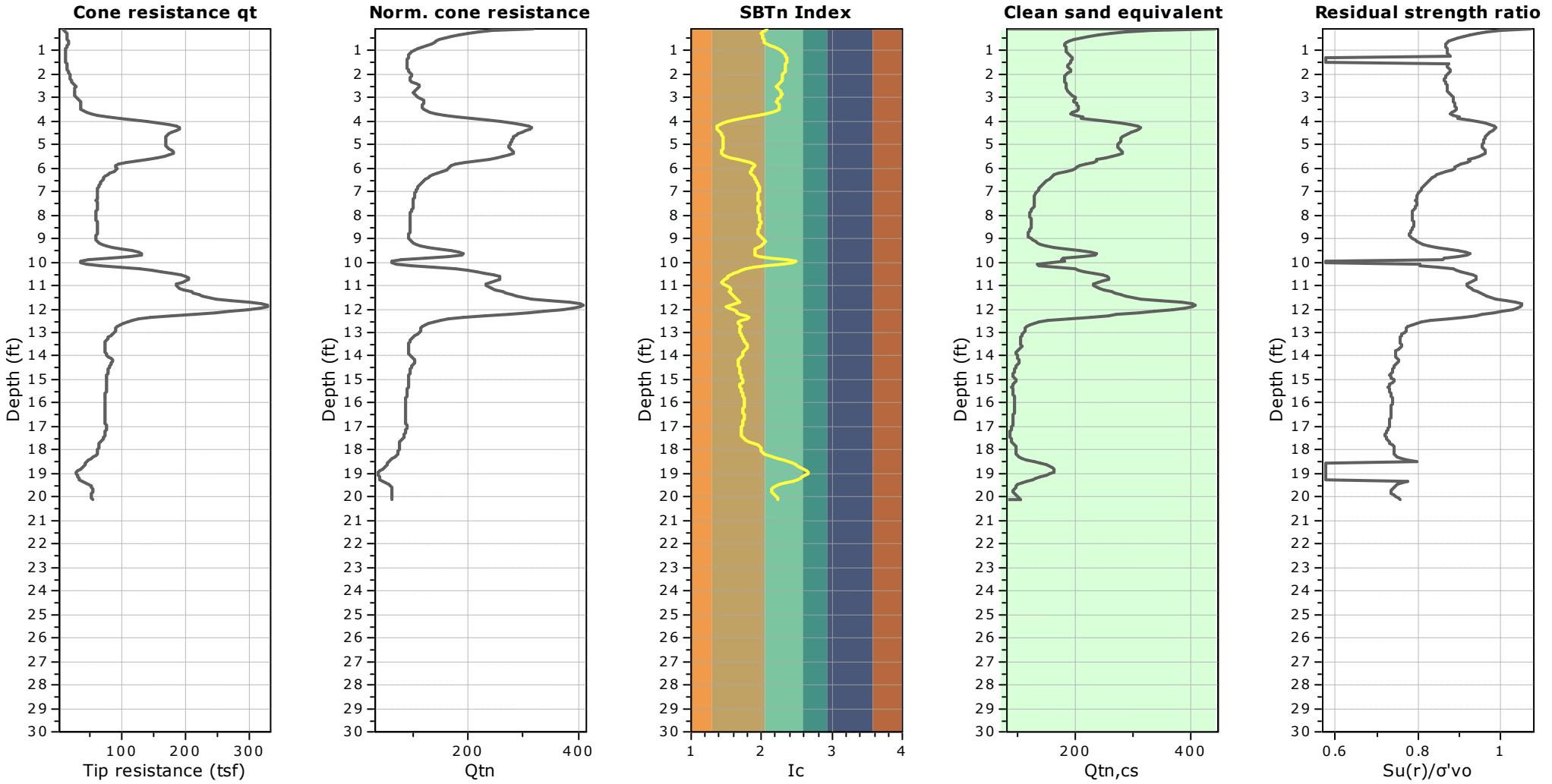
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-34
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 60.98 ft
Coords: X:572875.48, Y:555779.43
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

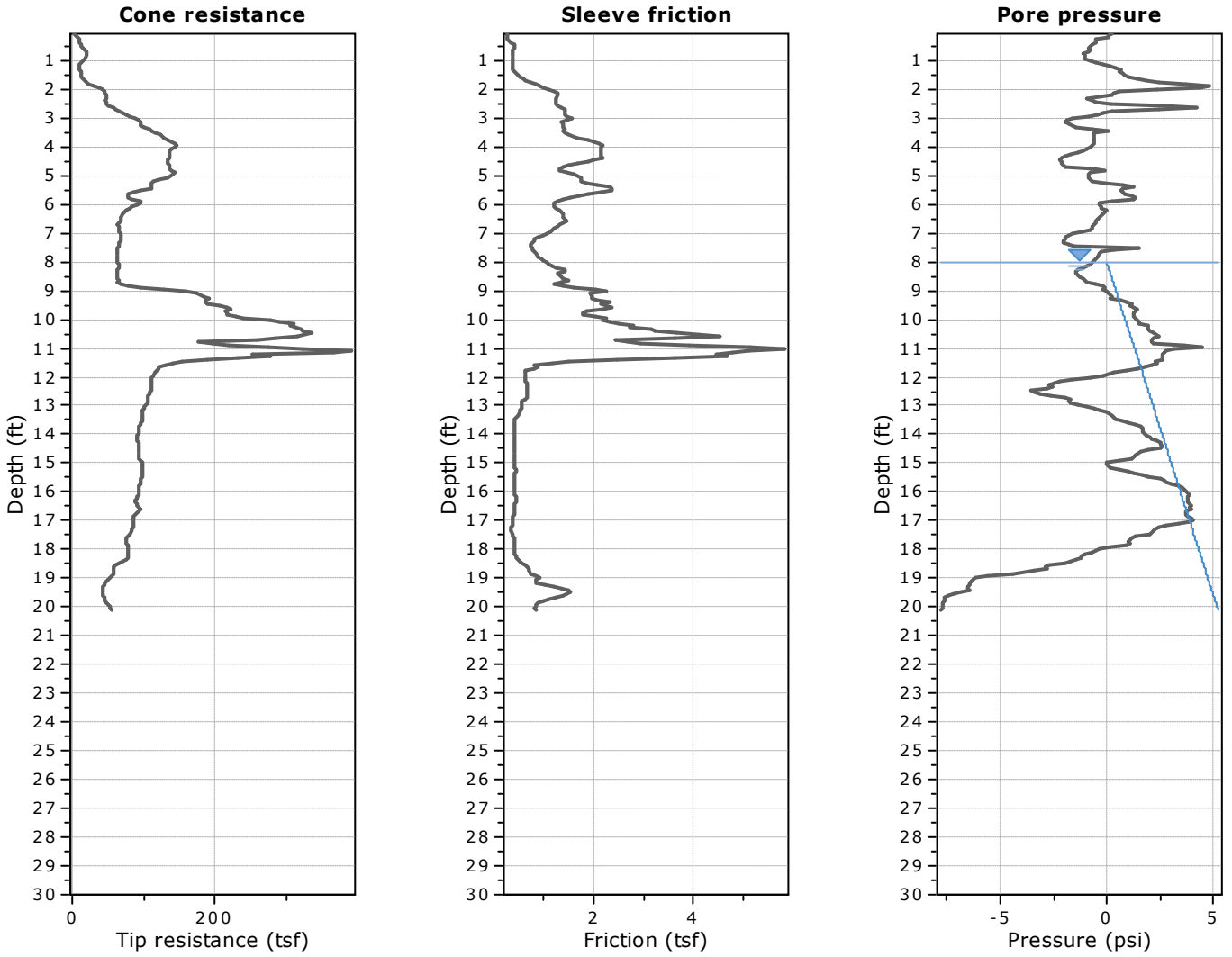
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



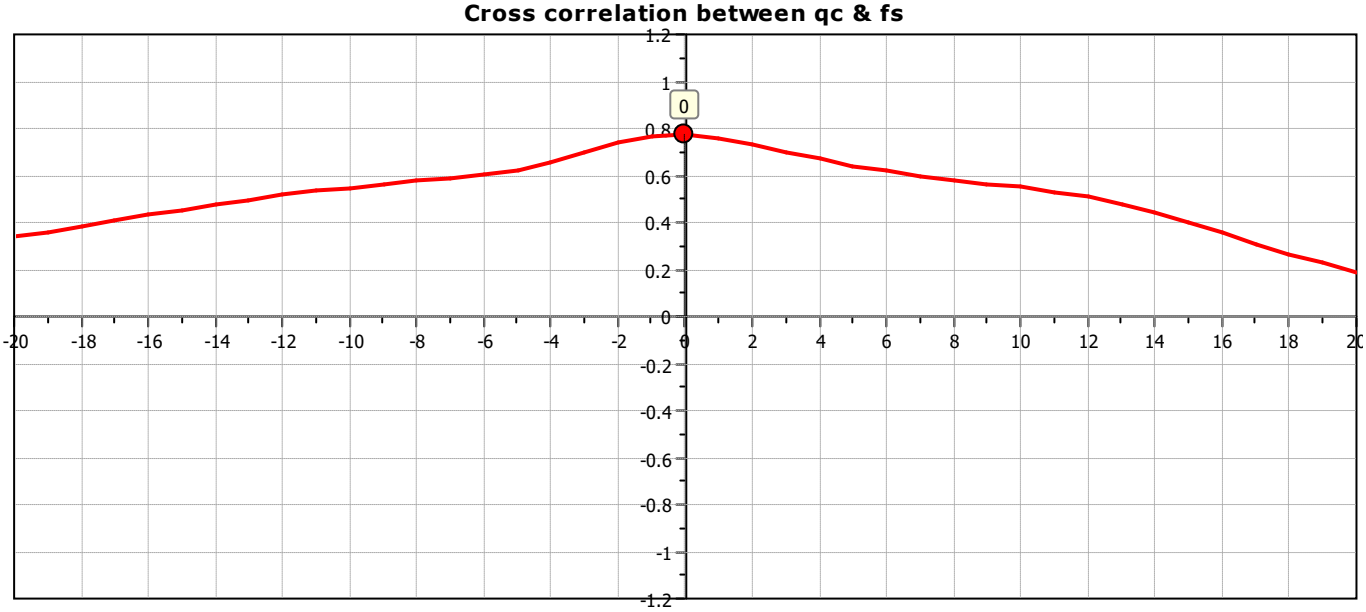
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

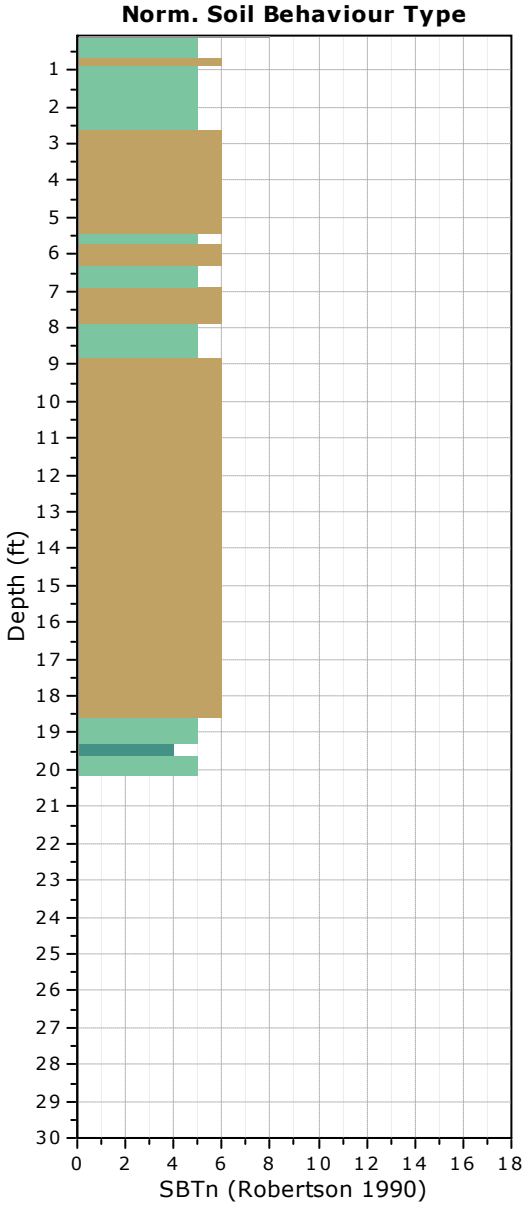
C-35
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 61.02 ft
Coords: X:572835.11, Y:555732.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

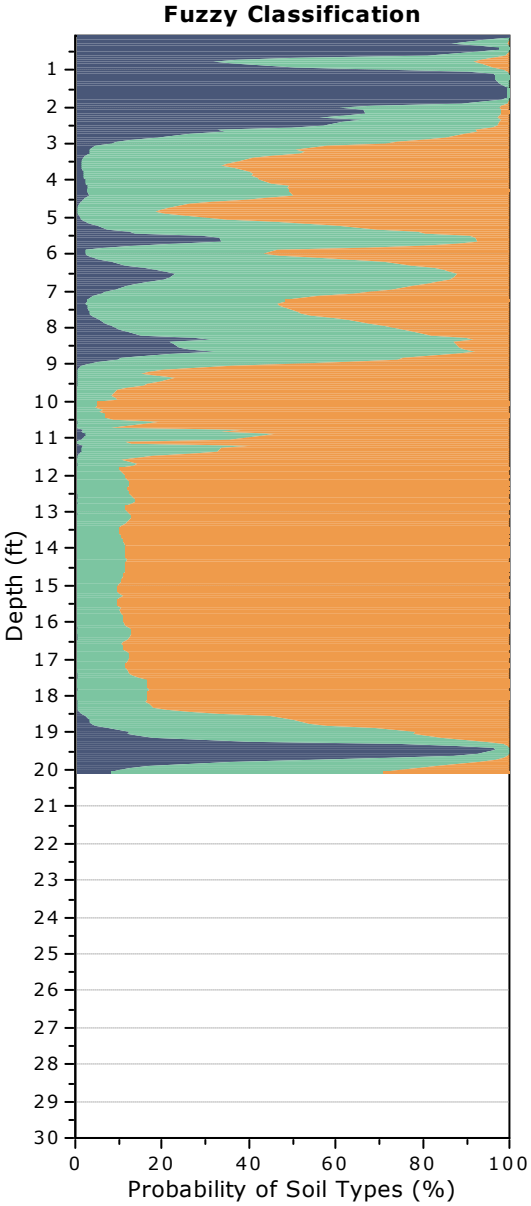
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







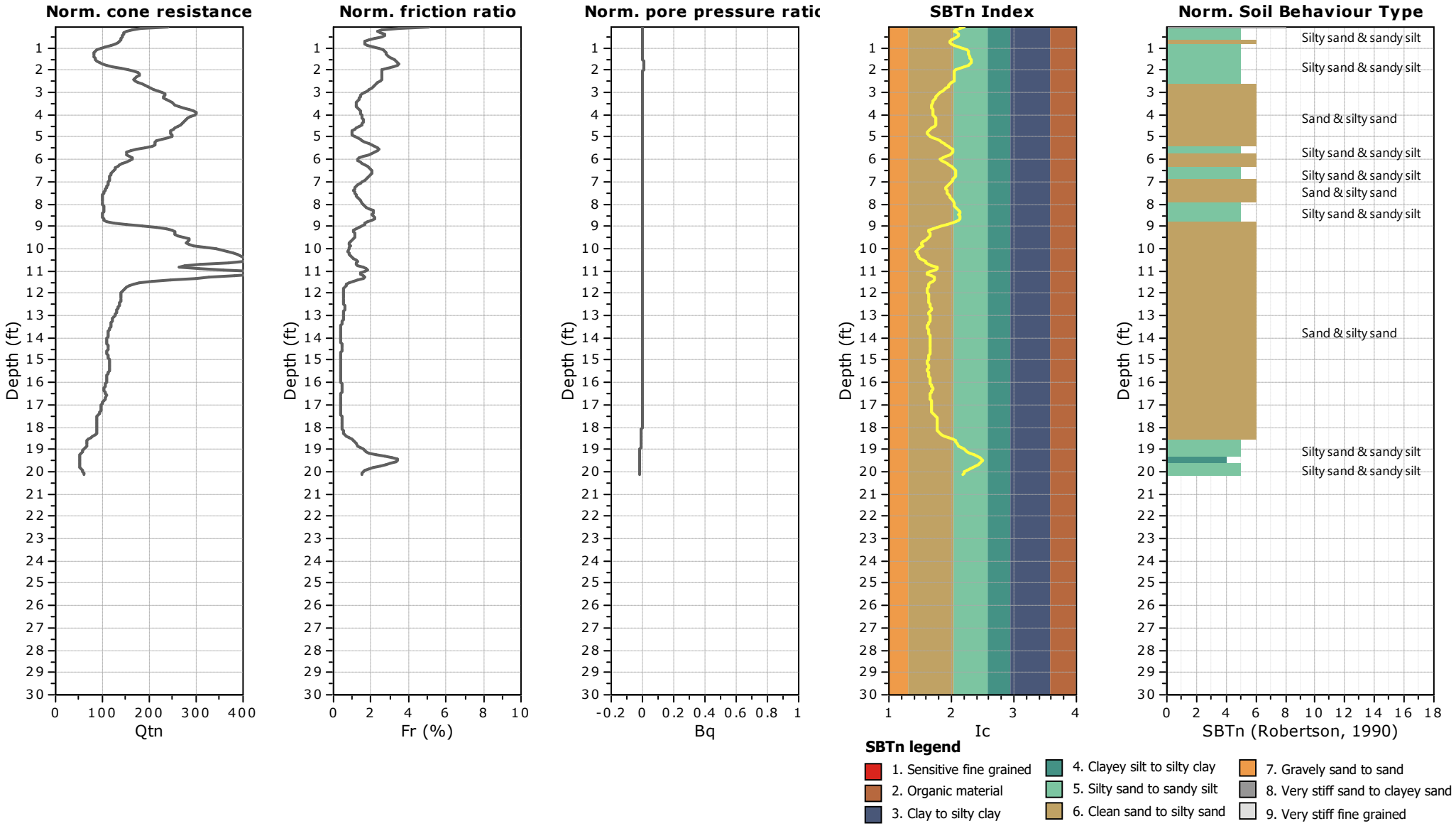
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-35
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 61.02 ft
Coords: X:572835.11, Y:555732.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

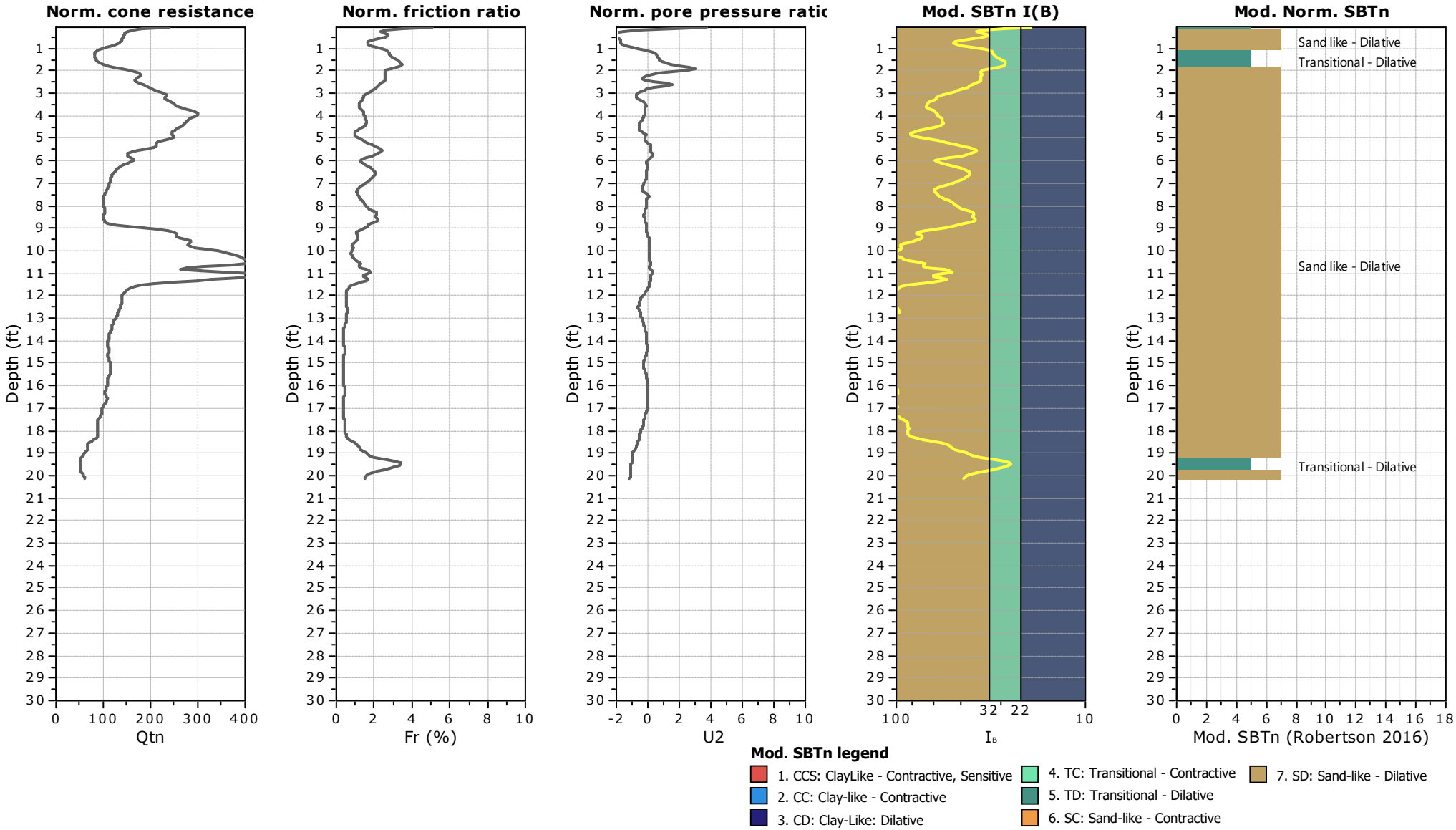
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-35
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 61.02 ft
Coords: X:572835.11, Y:555732.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

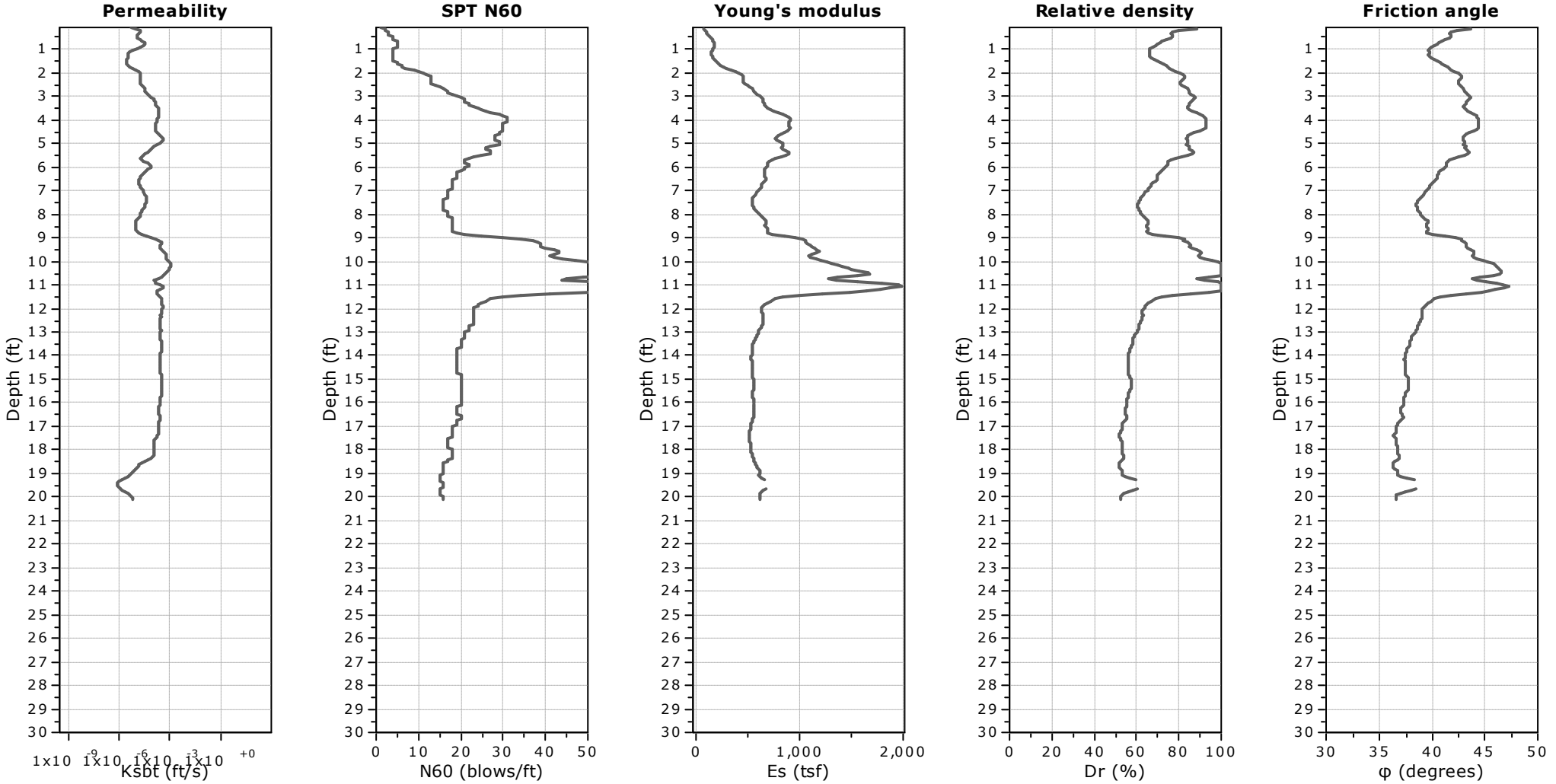
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-35
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 61.02 ft
Coords: X:572835.11, Y:555732.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



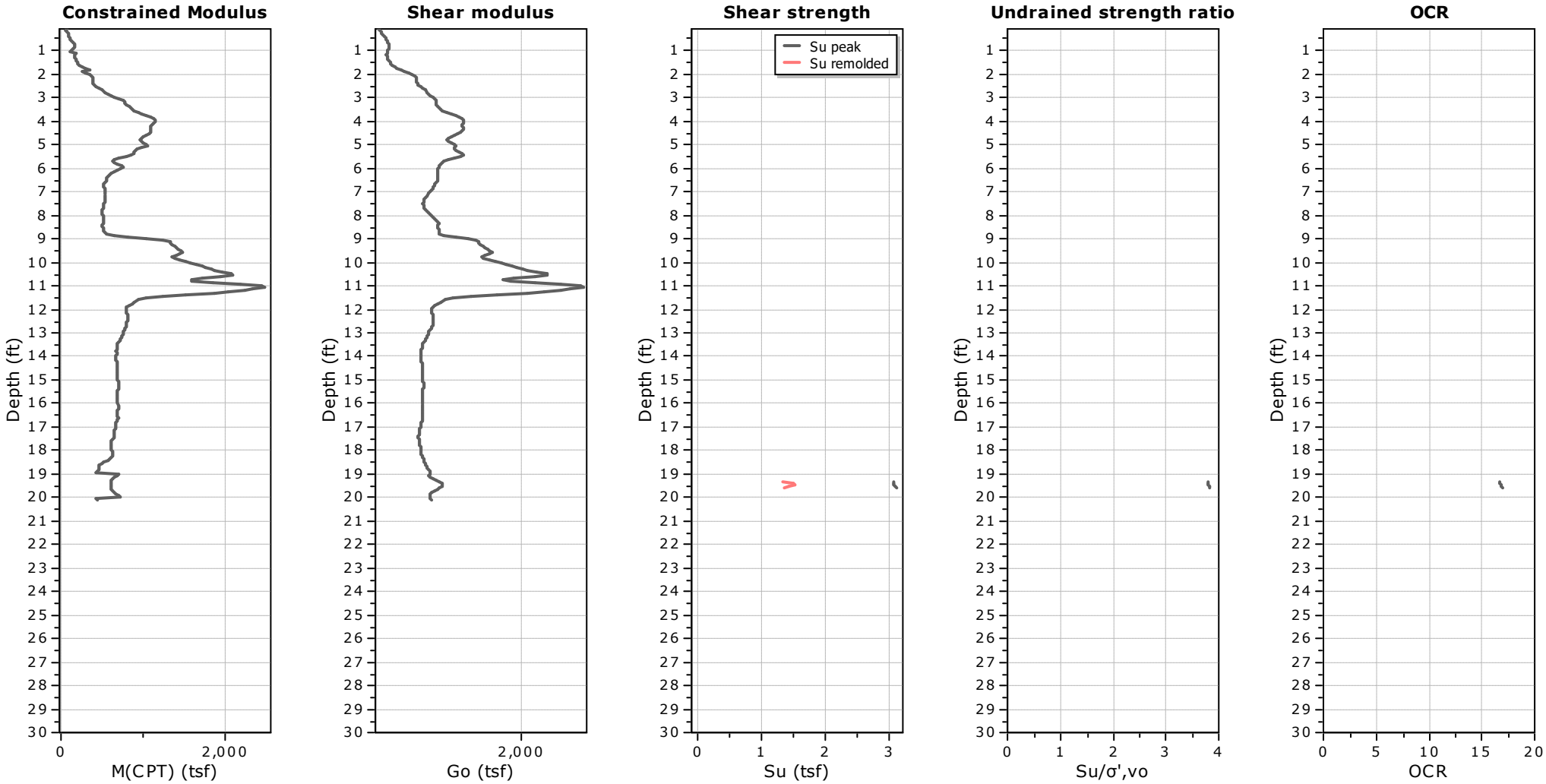
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-35
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 61.02 ft
Coords: X:572835.11, Y:555732.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



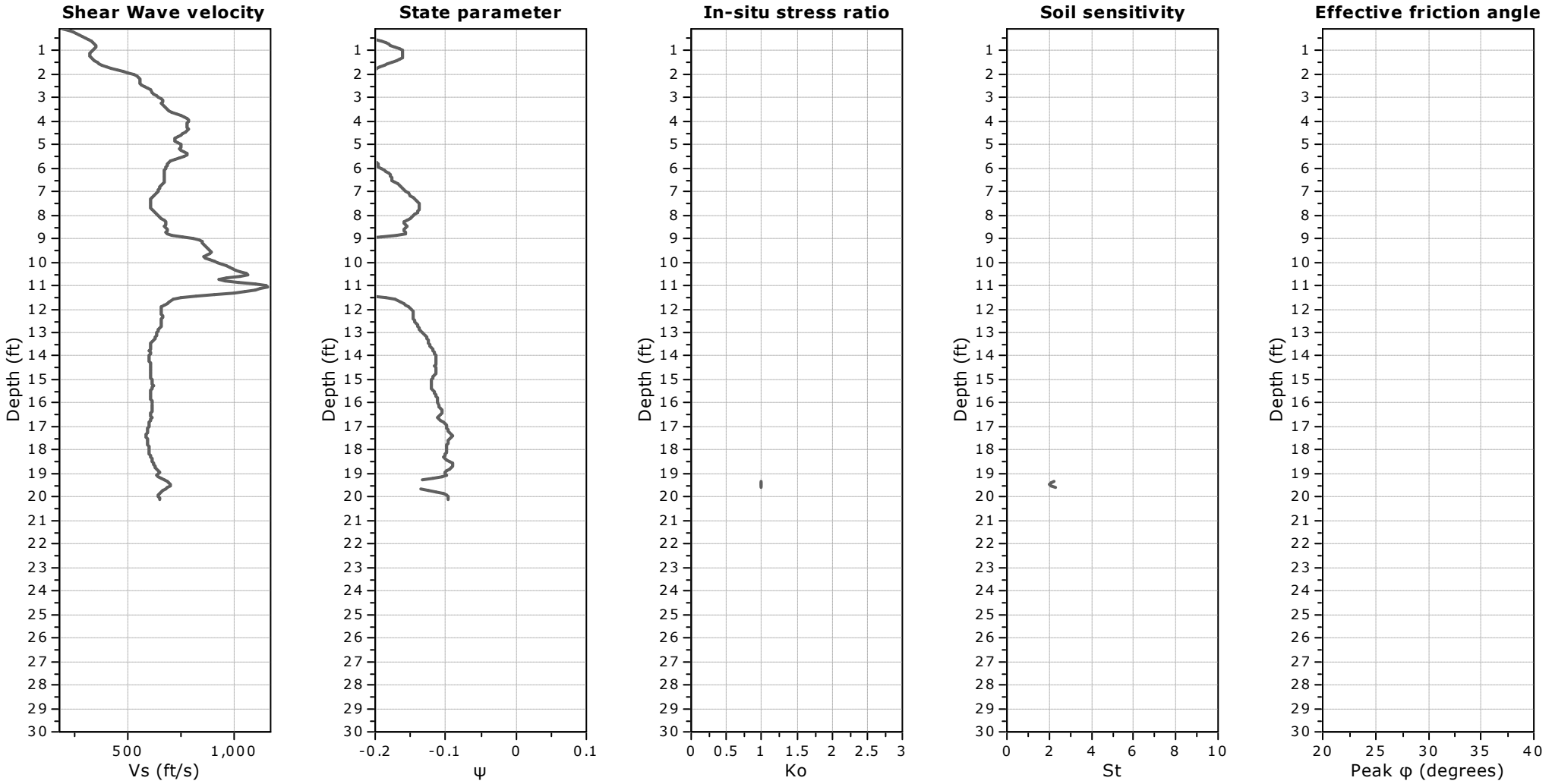
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-35
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 61.02 ft
Coords: X:572835.11, Y:555732.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



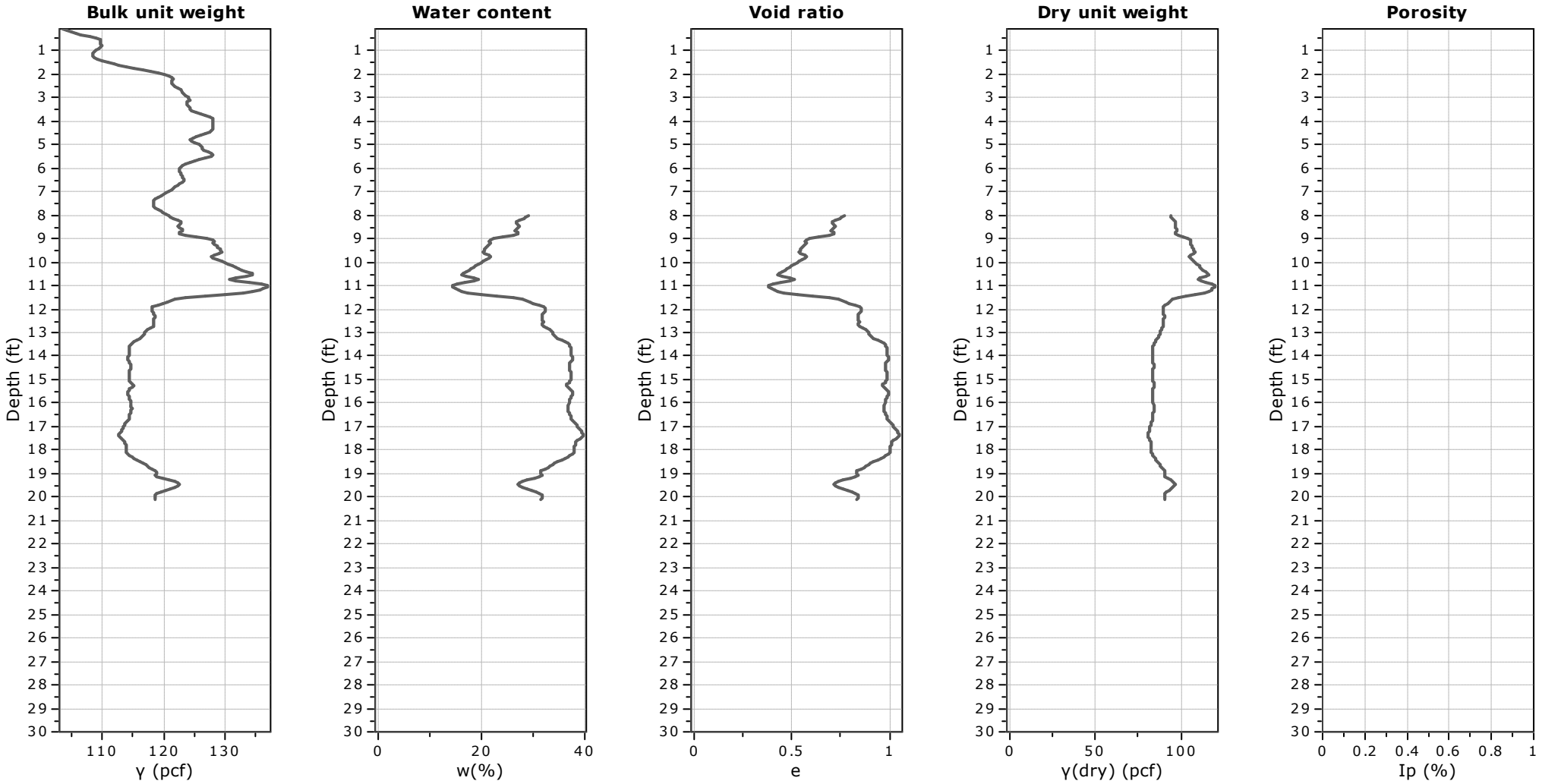
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-35
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 61.02 ft
Coords: X:572835.11, Y:555732.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

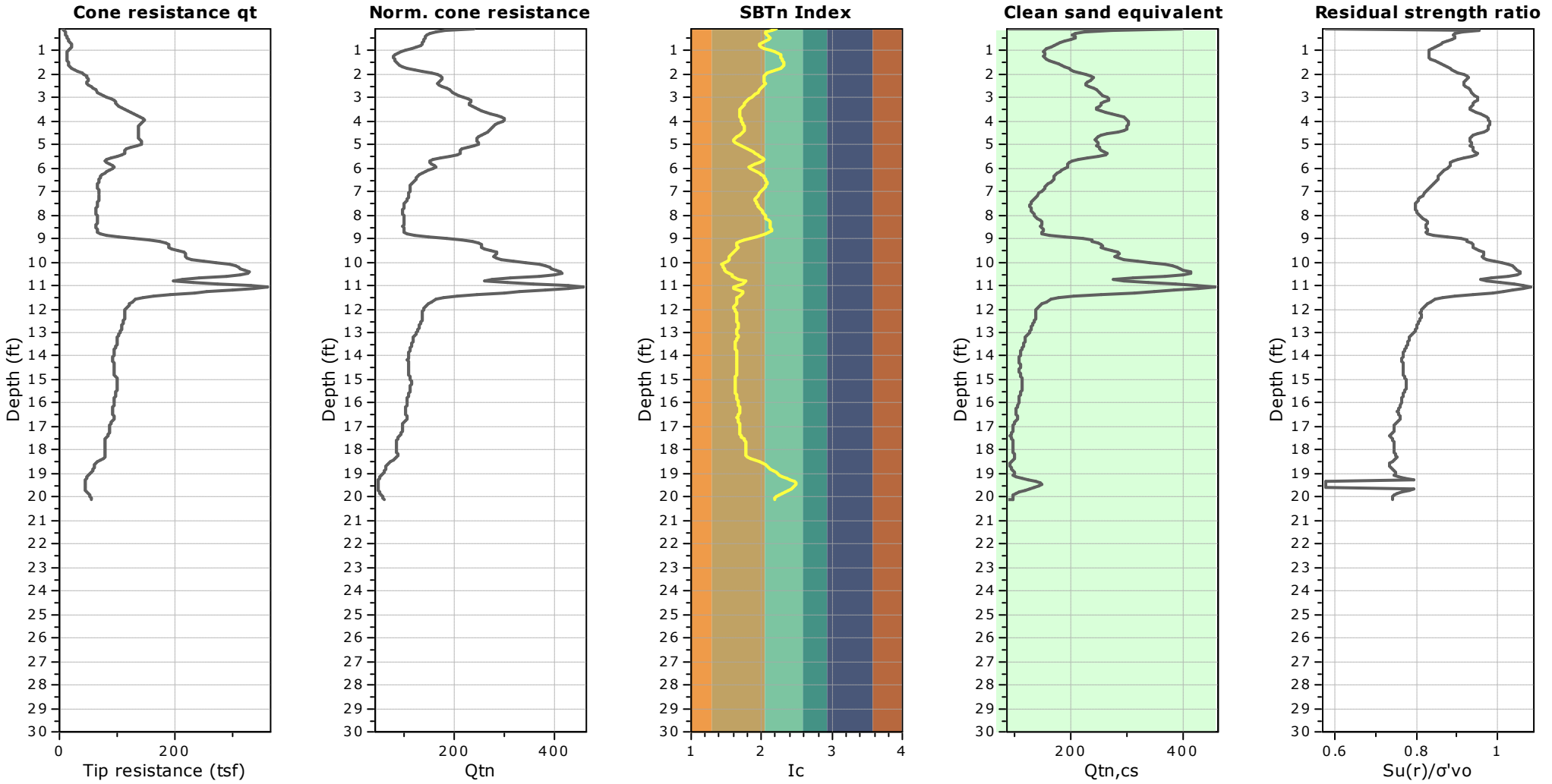
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-35
Total depth: 20.14 ft, Date: 5/16/2024
Surface Elevation: 61.02 ft
Coords: X:572835.11, Y:555732.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

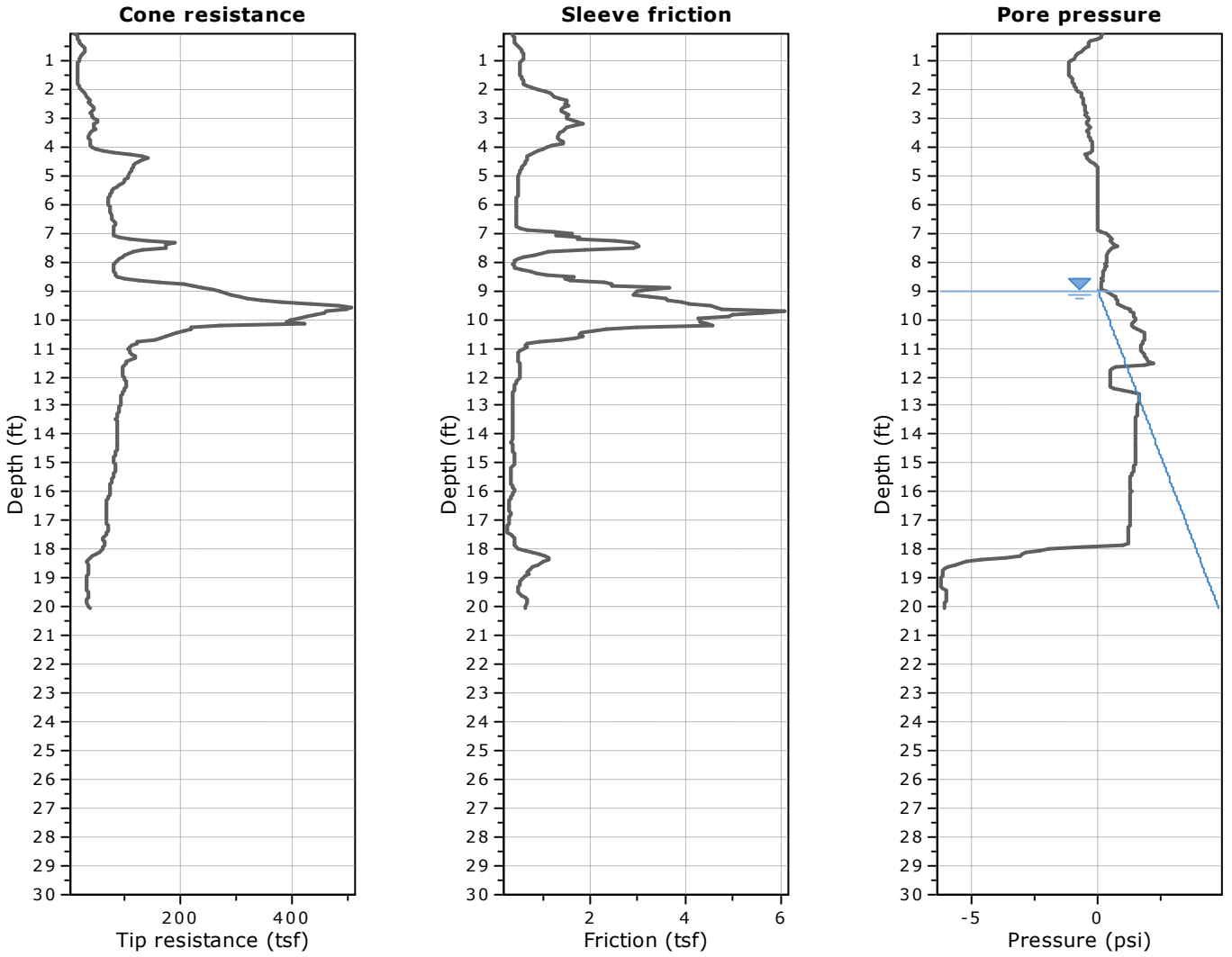
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



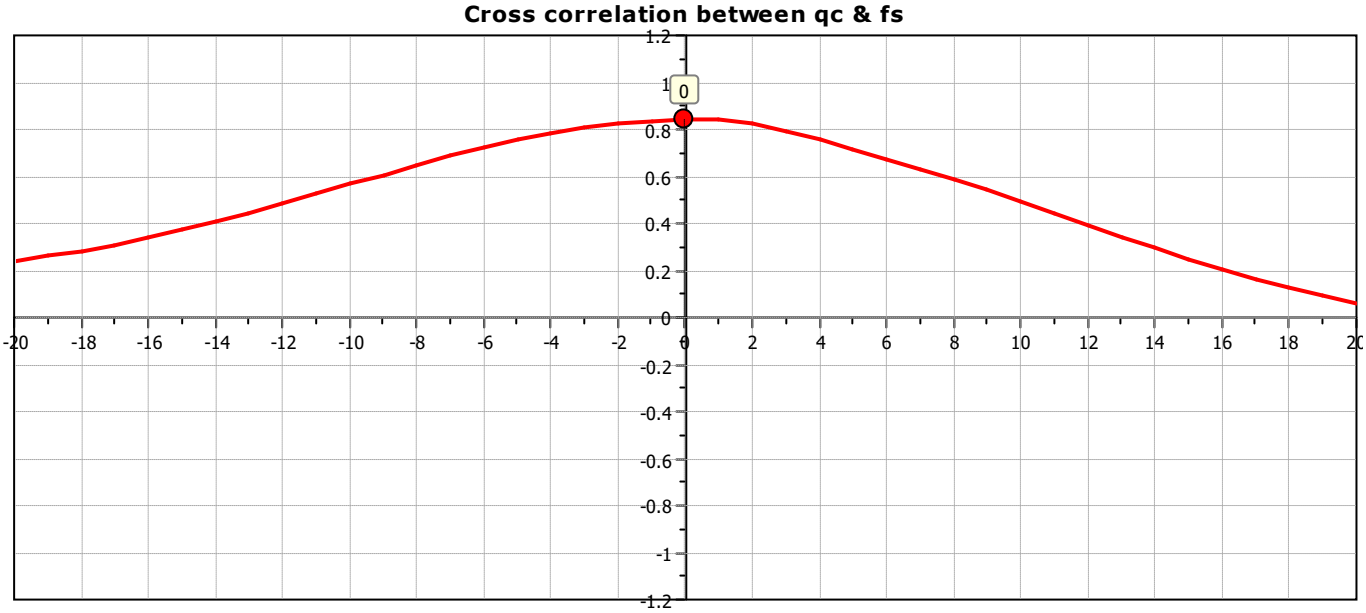
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-36
Total depth: 20.02 ft, Date: 5/14/2024
Surface Elevation: 61.37 ft
Coords: X:572750.10, Y:555691.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: ASD Summit Campus
Location: Middletown, Delaware



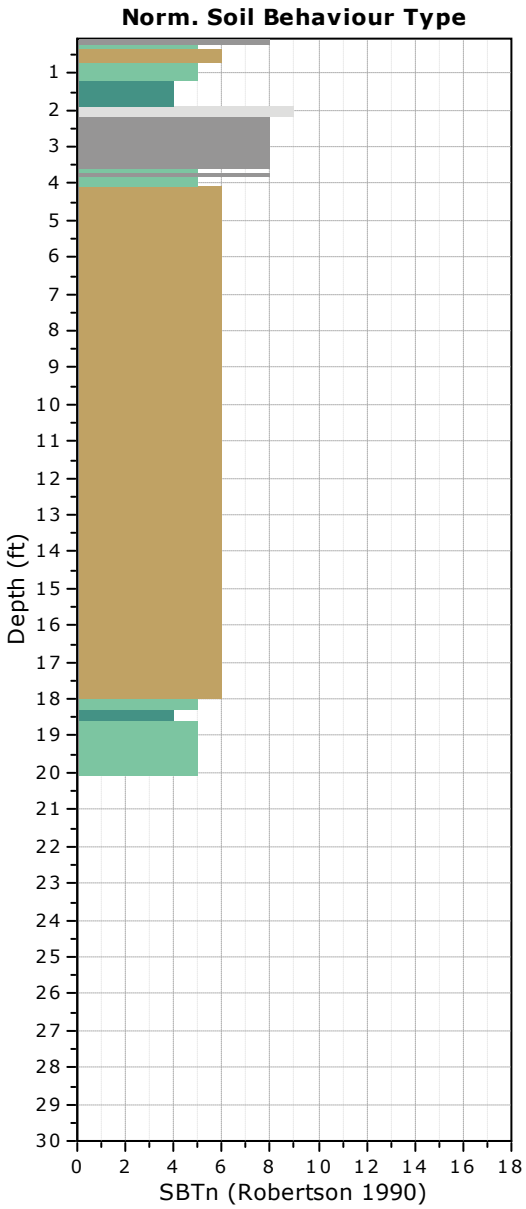
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

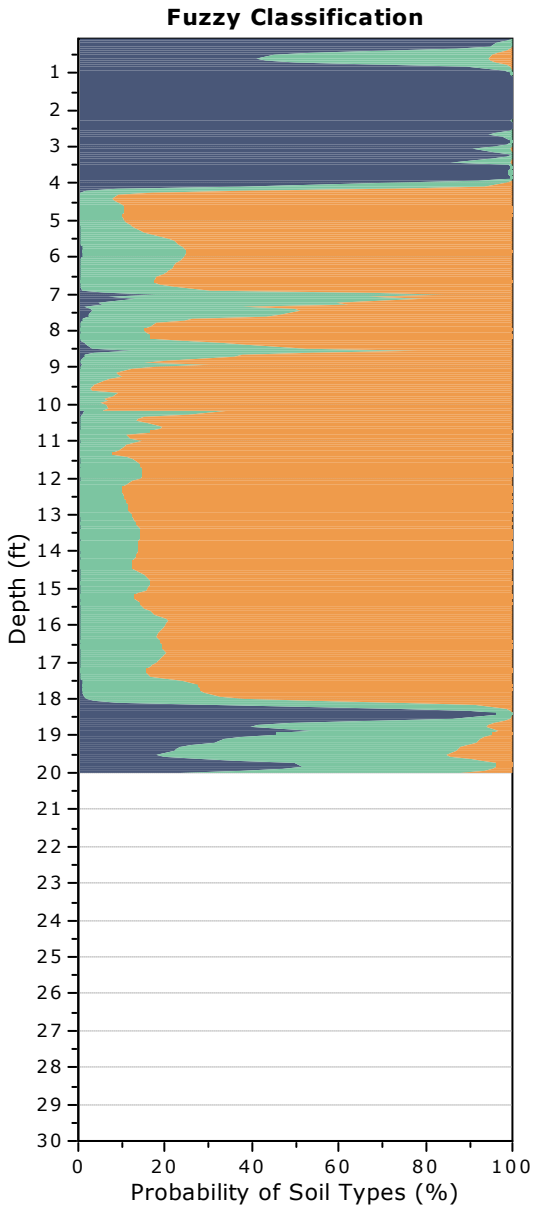


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-36
Total depth: 20.02 ft, Date: 5/14/2024
Surface Elevation: 61.37 ft
Coords: X:572750.10, Y:555691.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



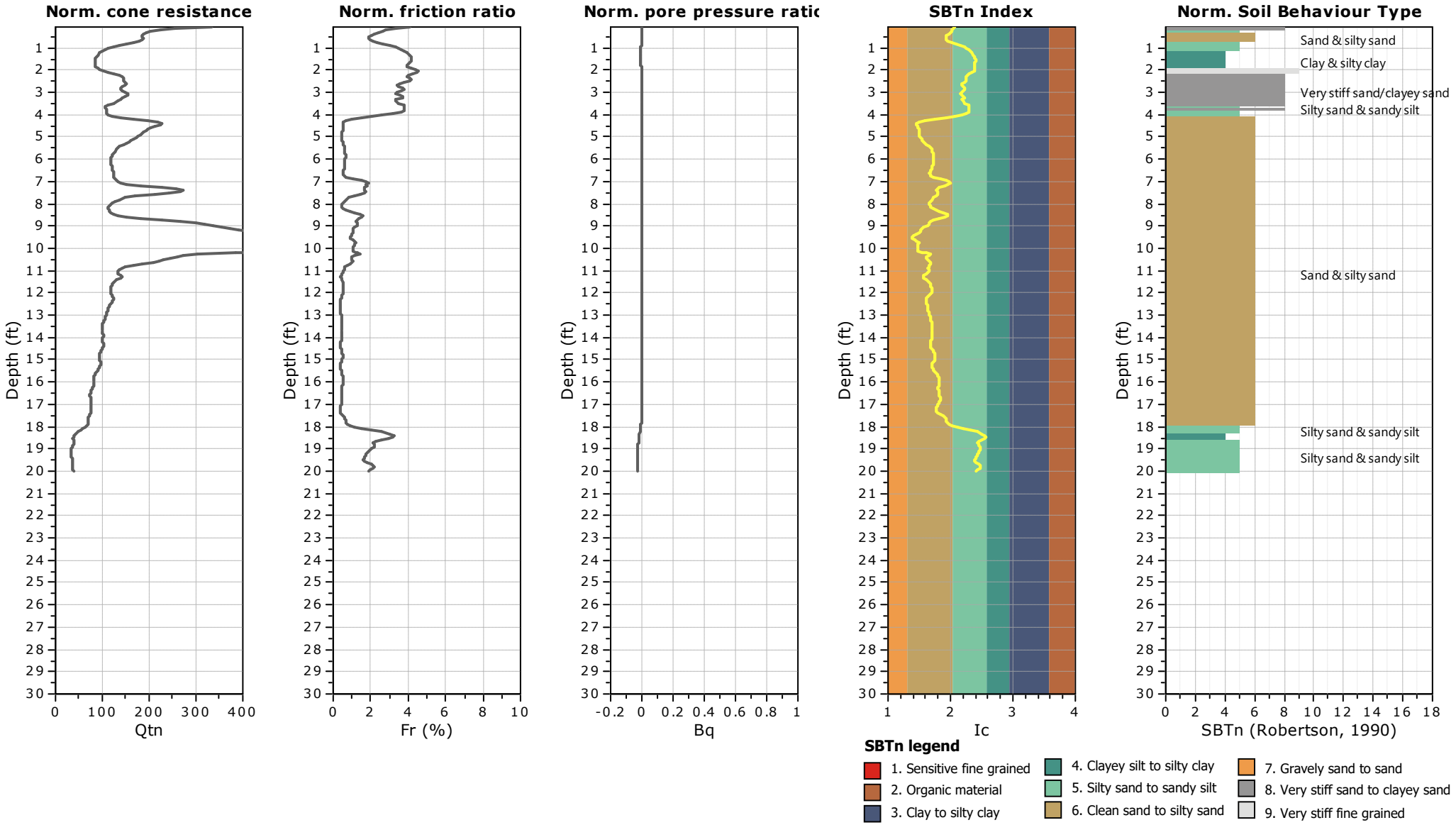


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-36
Total depth: 20.02 ft, Date: 5/14/2024
Surface Elevation: 61.37 ft
Coords: X:572750.10, Y:555691.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

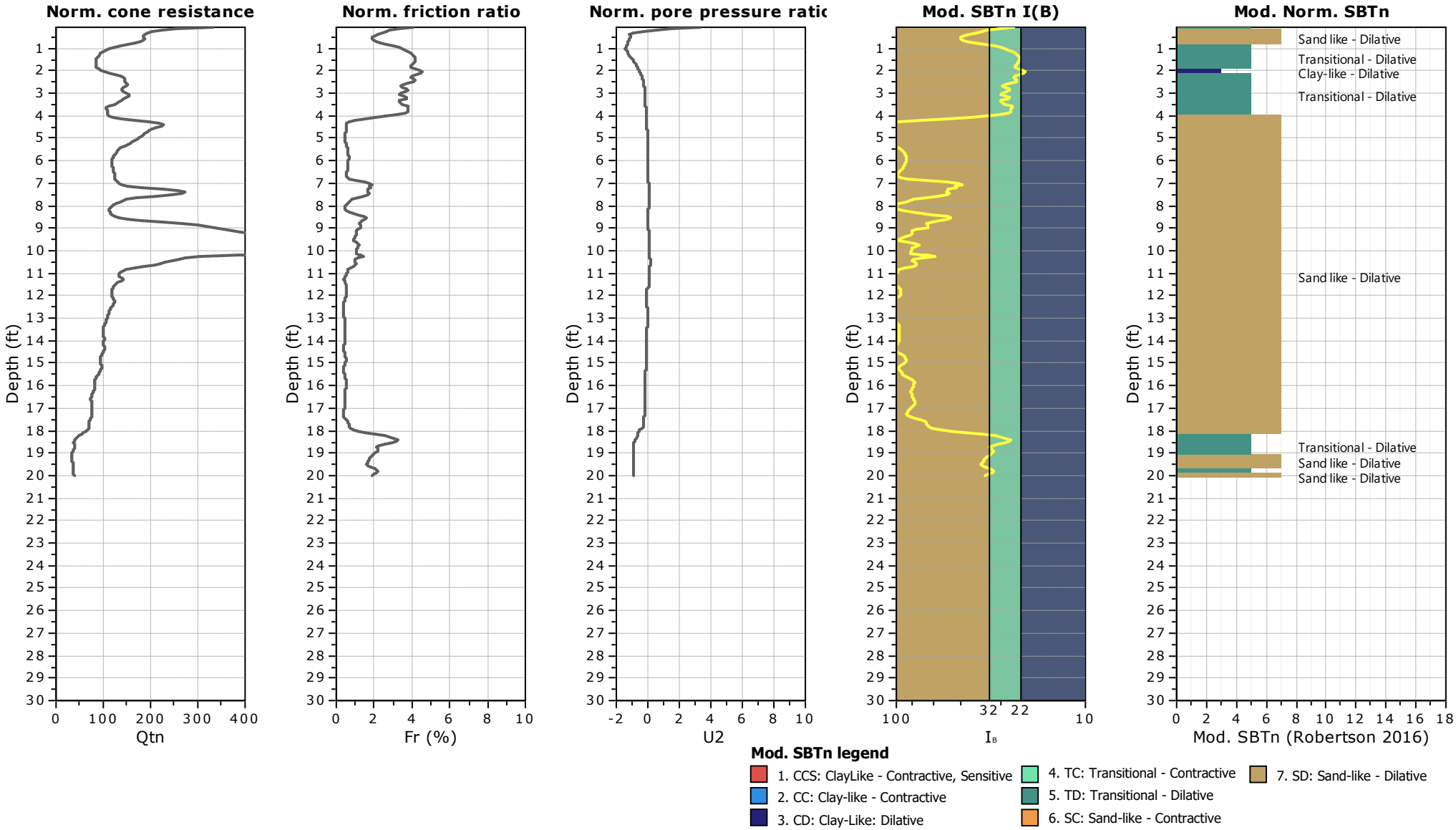
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-36
Total depth: 20.02 ft, Date: 5/14/2024
Surface Elevation: 61.37 ft
Coords: X:572750.10, Y:555691.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

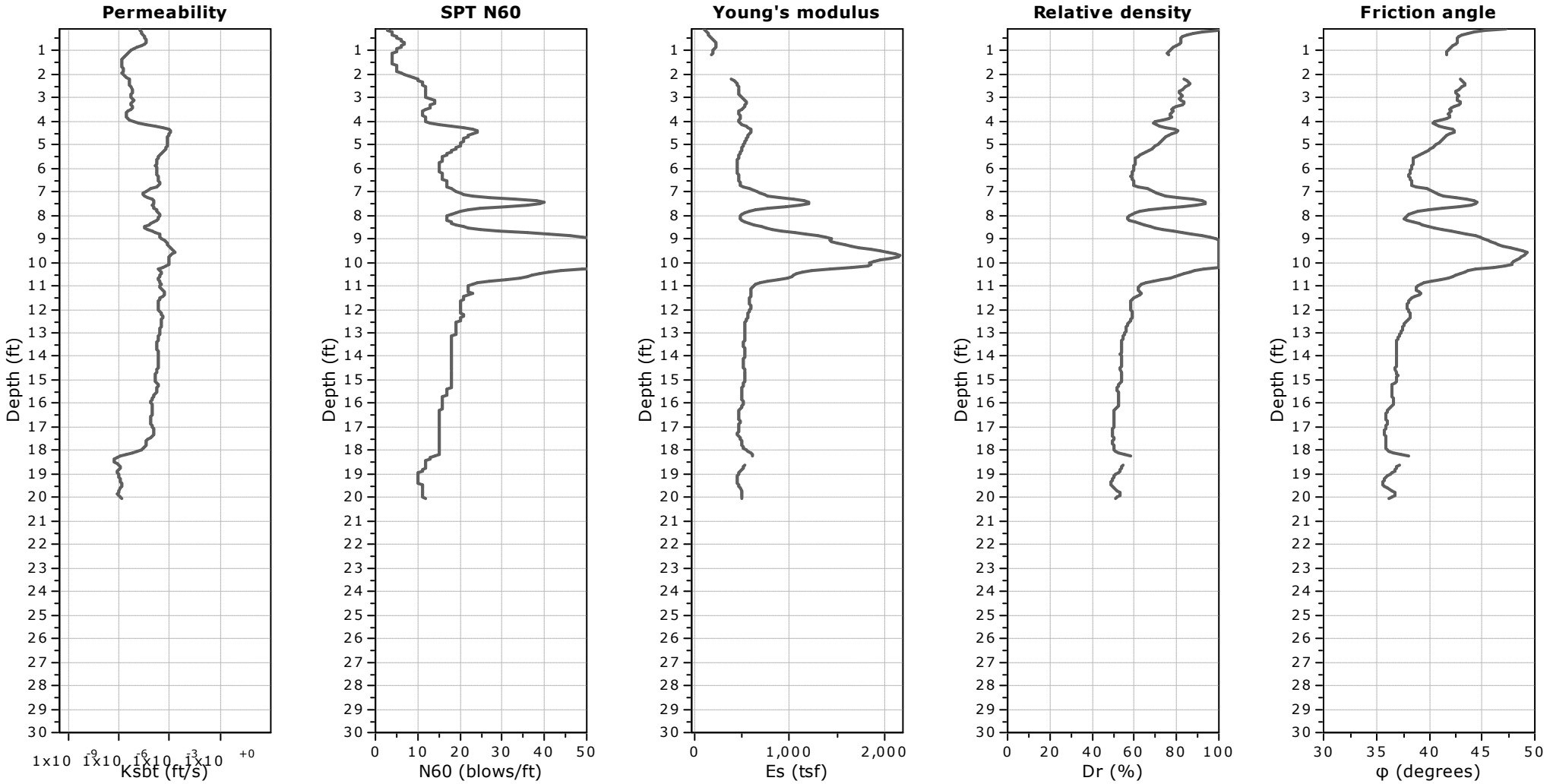
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-36
Total depth: 20.02 ft, Date: 5/14/2024
Surface Elevation: 61.37 ft
Coords: X:572750.10, Y:555691.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

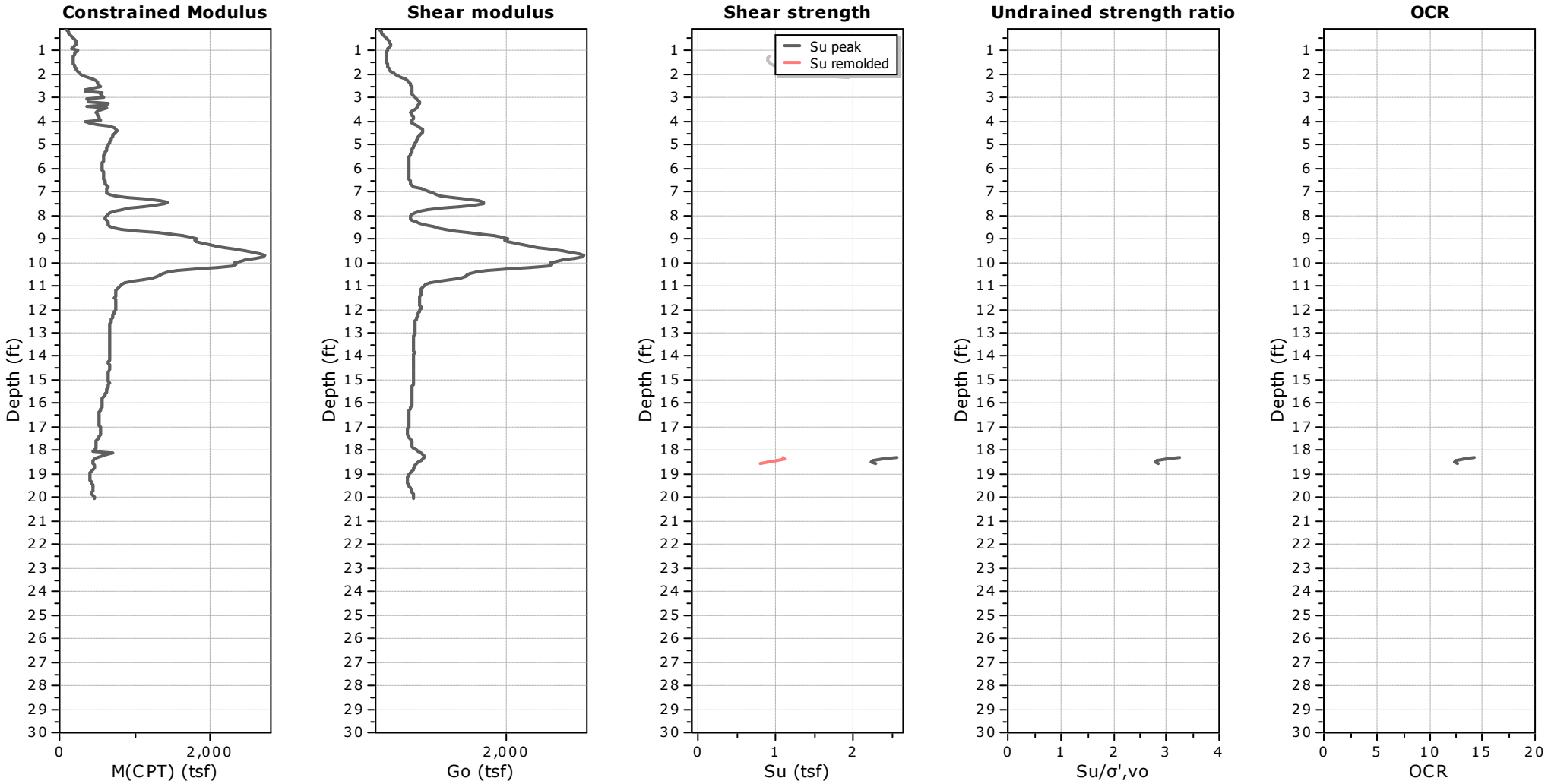


Calculation parameters
Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-36
Total depth: 20.02 ft, Date: 5/14/2024
Surface Elevation: 61.37 ft
Coords: X:572750.10, Y:555691.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



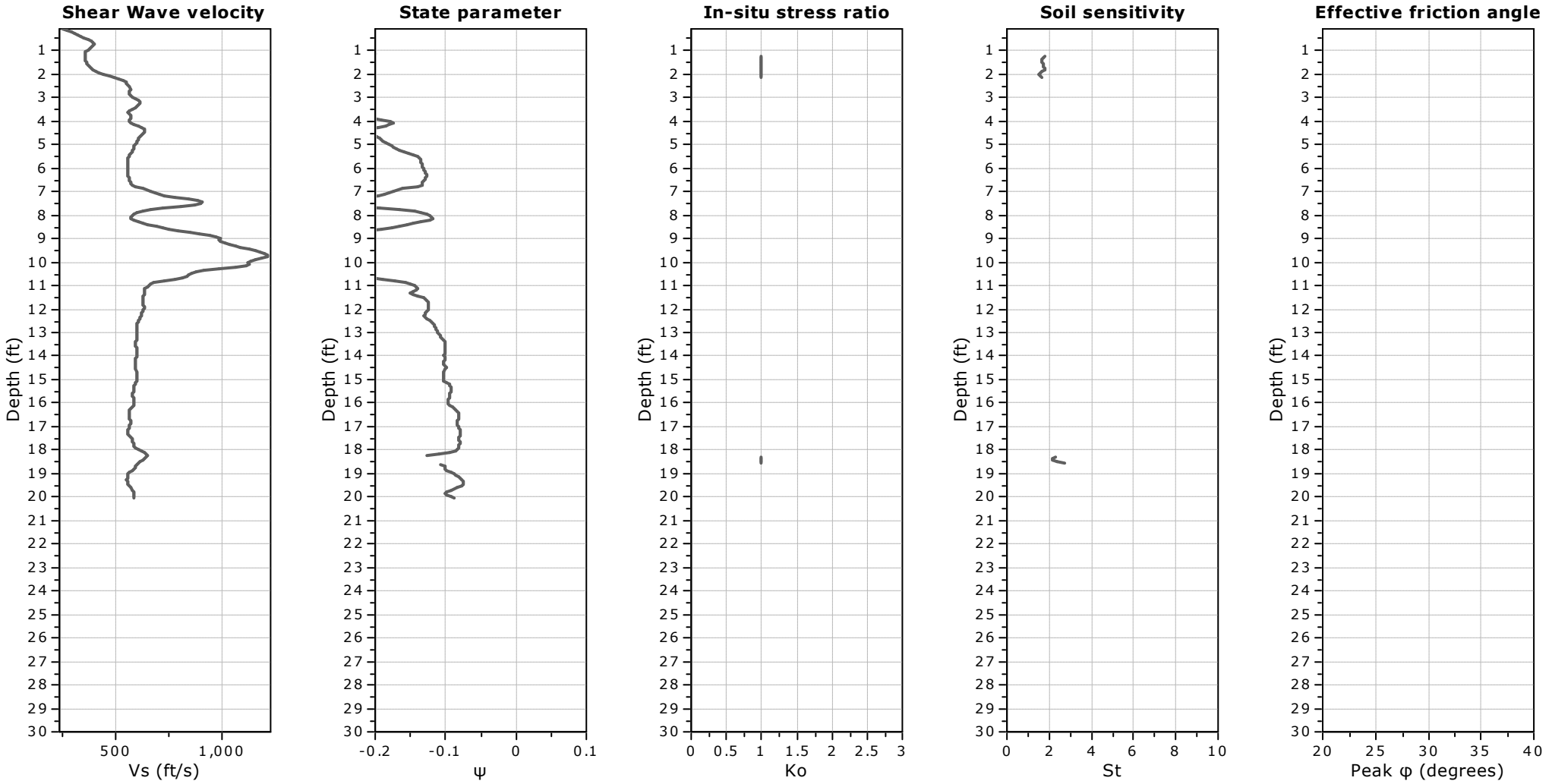
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-36
Total depth: 20.02 ft, Date: 5/14/2024
Surface Elevation: 61.37 ft
Coords: X:572750.10, Y:555691.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



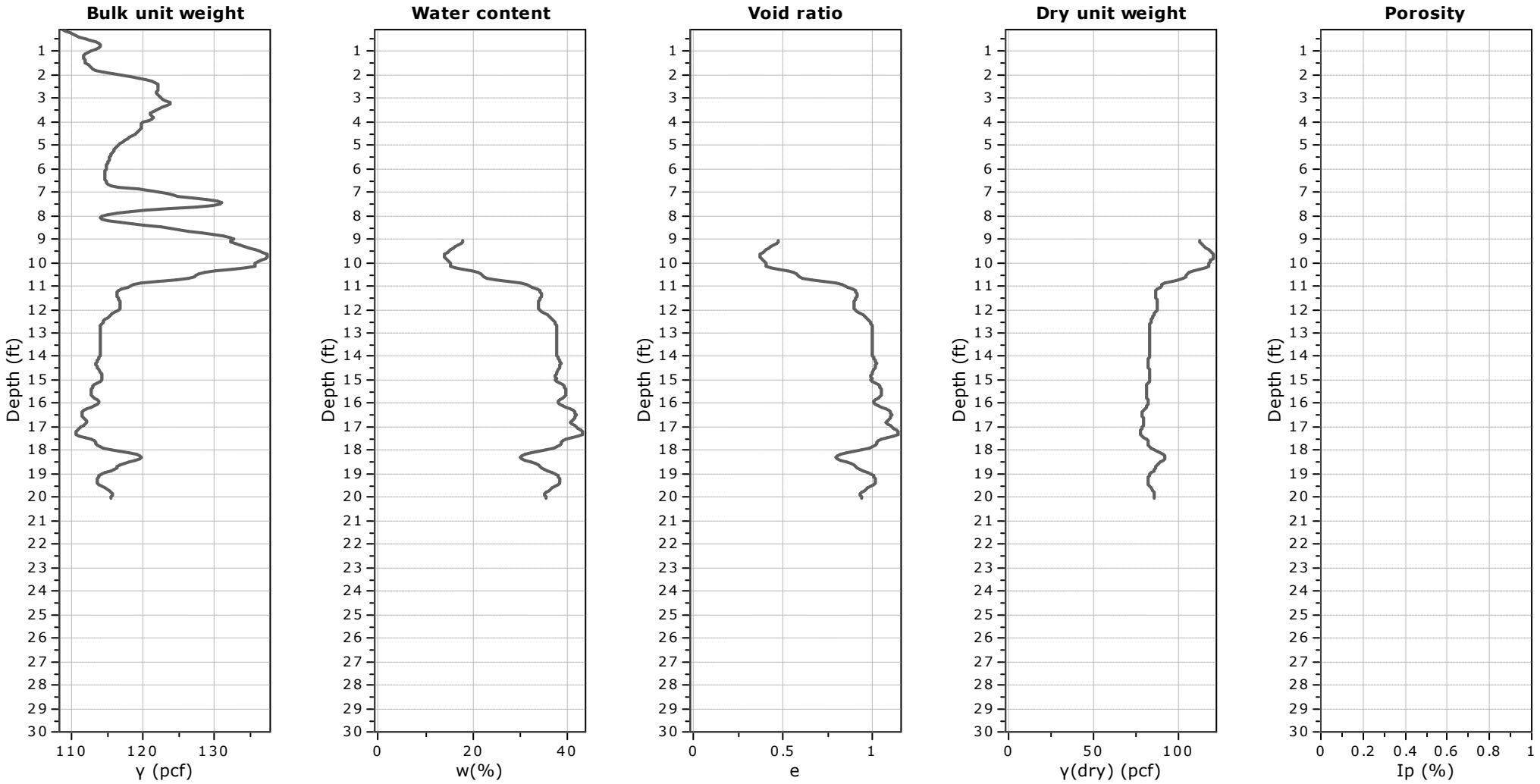
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-36
Total depth: 20.02 ft, Date: 5/14/2024
Surface Elevation: 61.37 ft
Coords: X:572750.10, Y:555691.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

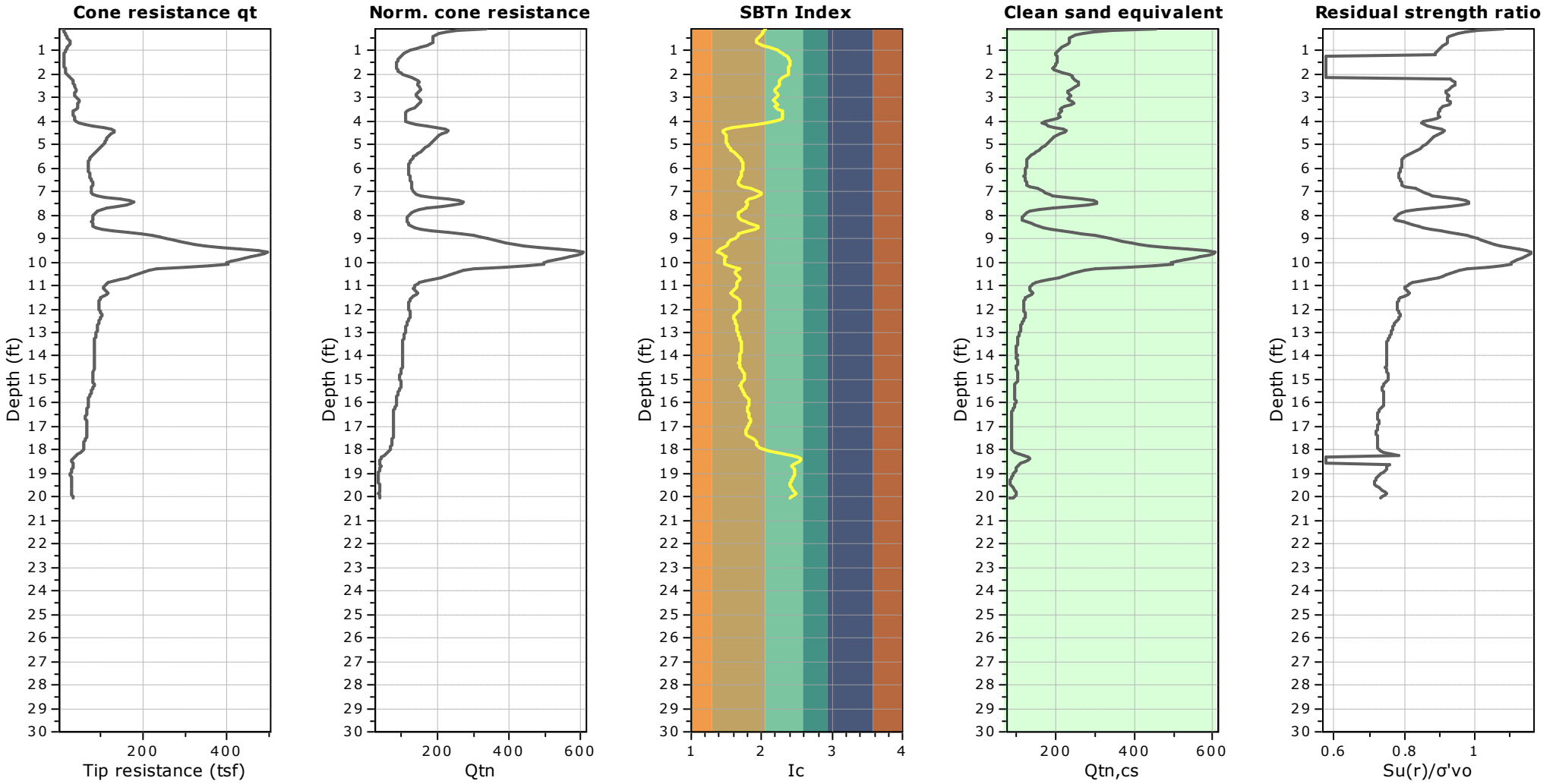
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-36
Total depth: 20.02 ft, Date: 5/14/2024
Surface Elevation: 61.37 ft
Coords: X:572750.10, Y:555691.74
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

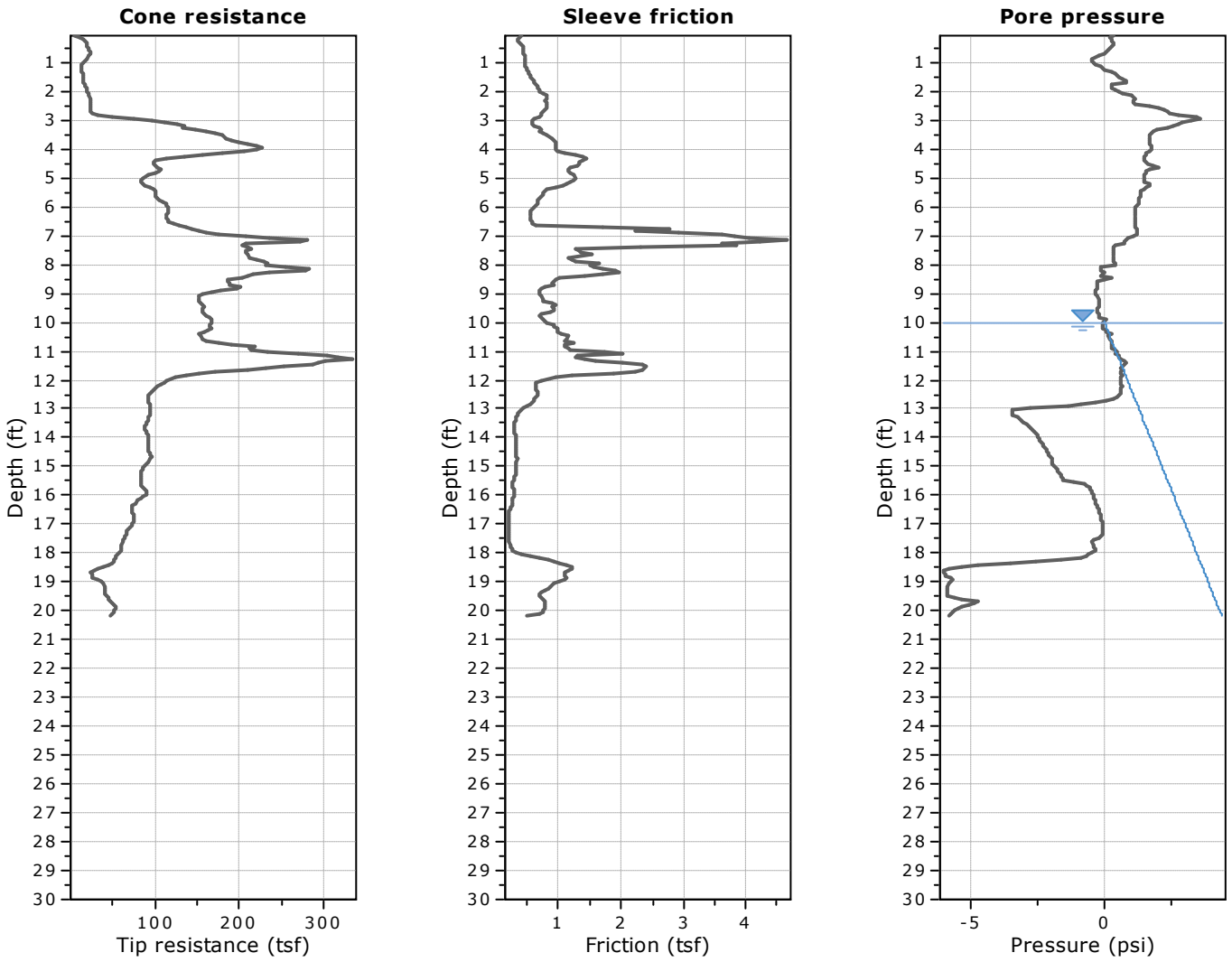
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



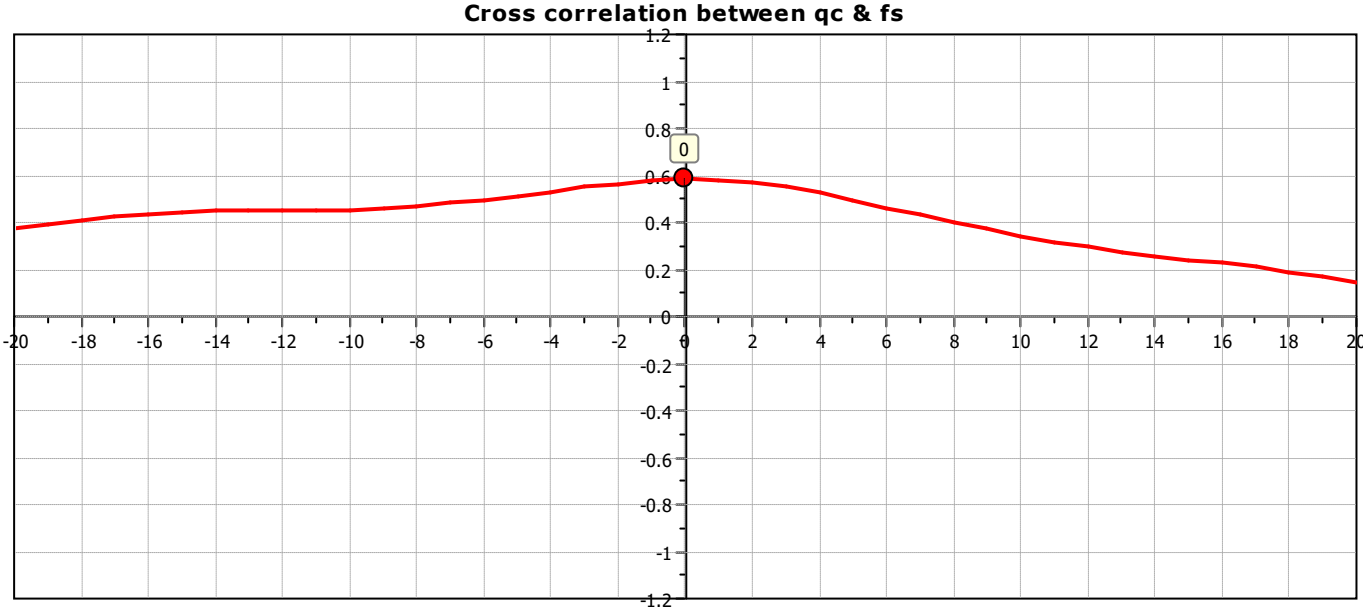
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-37
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 62.13 ft
Coords: X:572636.31, Y:555668.04
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



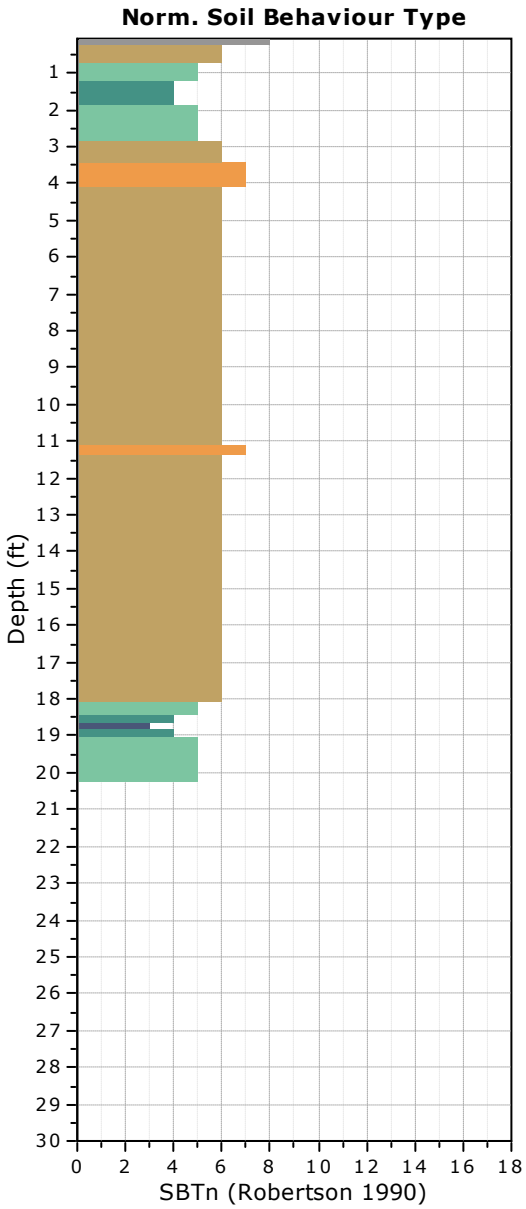
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

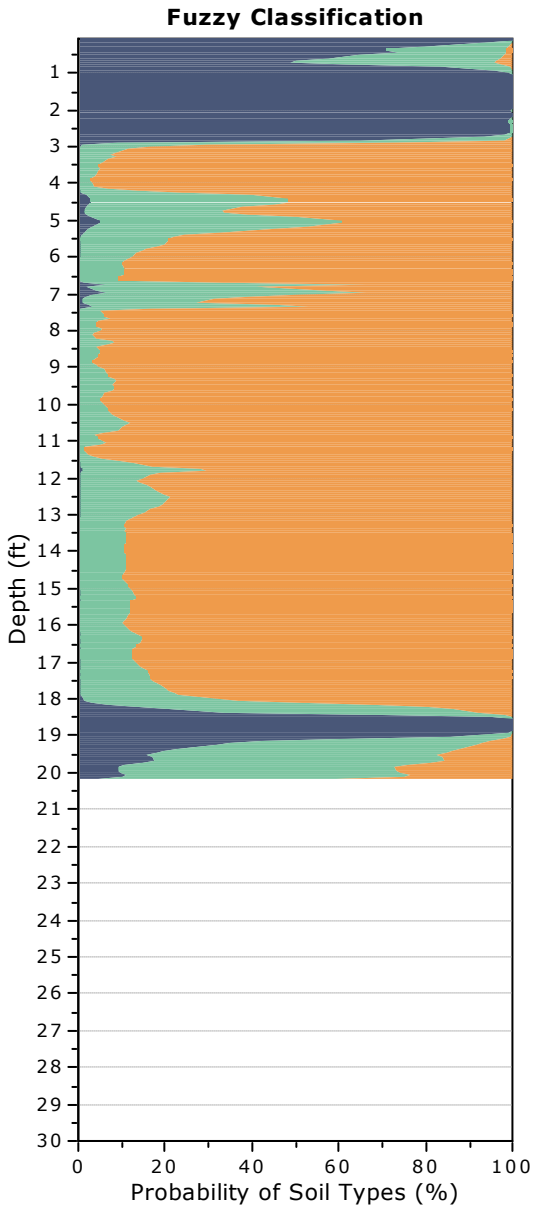


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-37
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 62.13 ft
Coords: X:572636.31, Y:555668.04
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



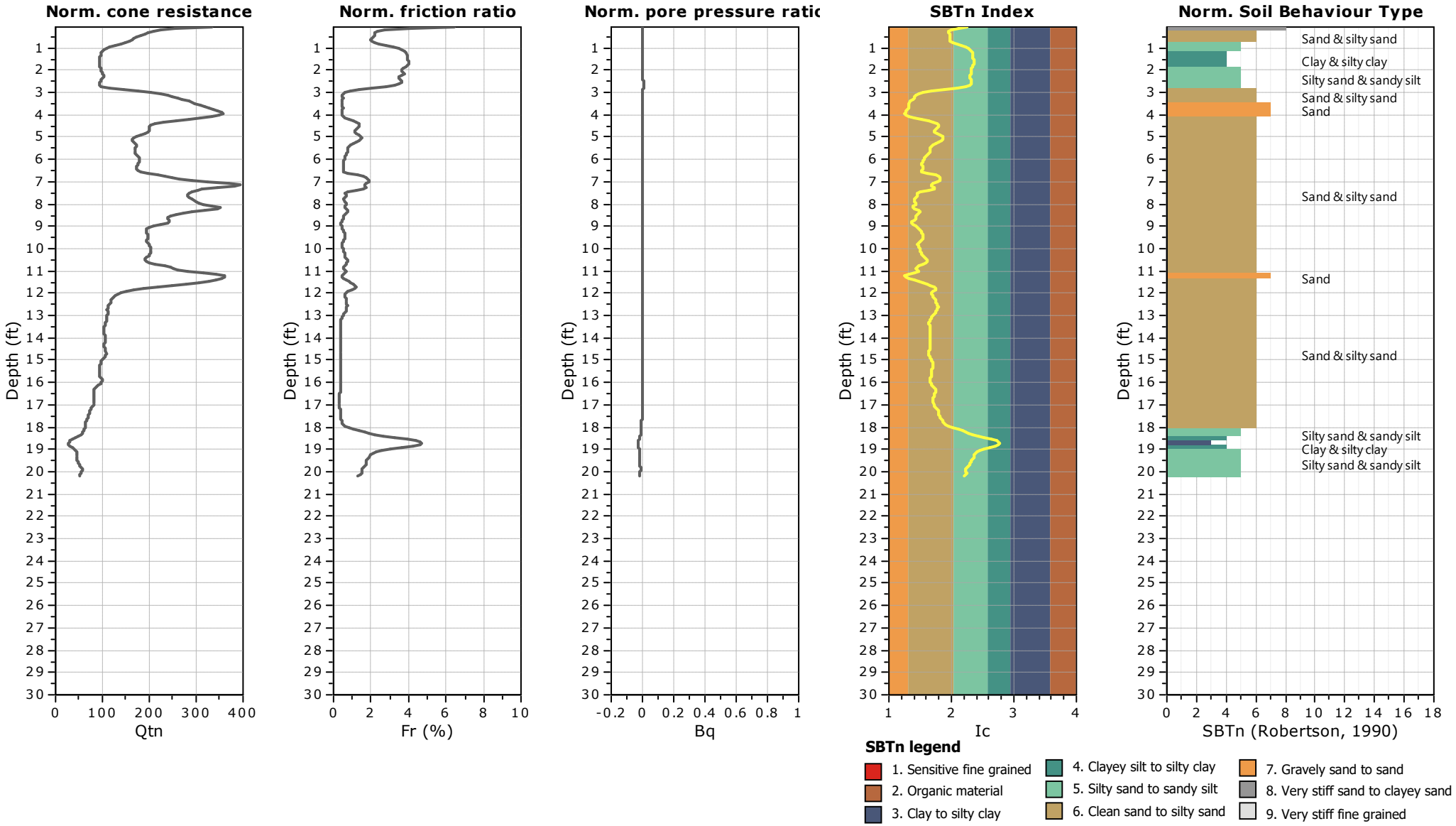


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-37
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 62.13 ft
Coords: X:572636.31, Y:555668.04
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

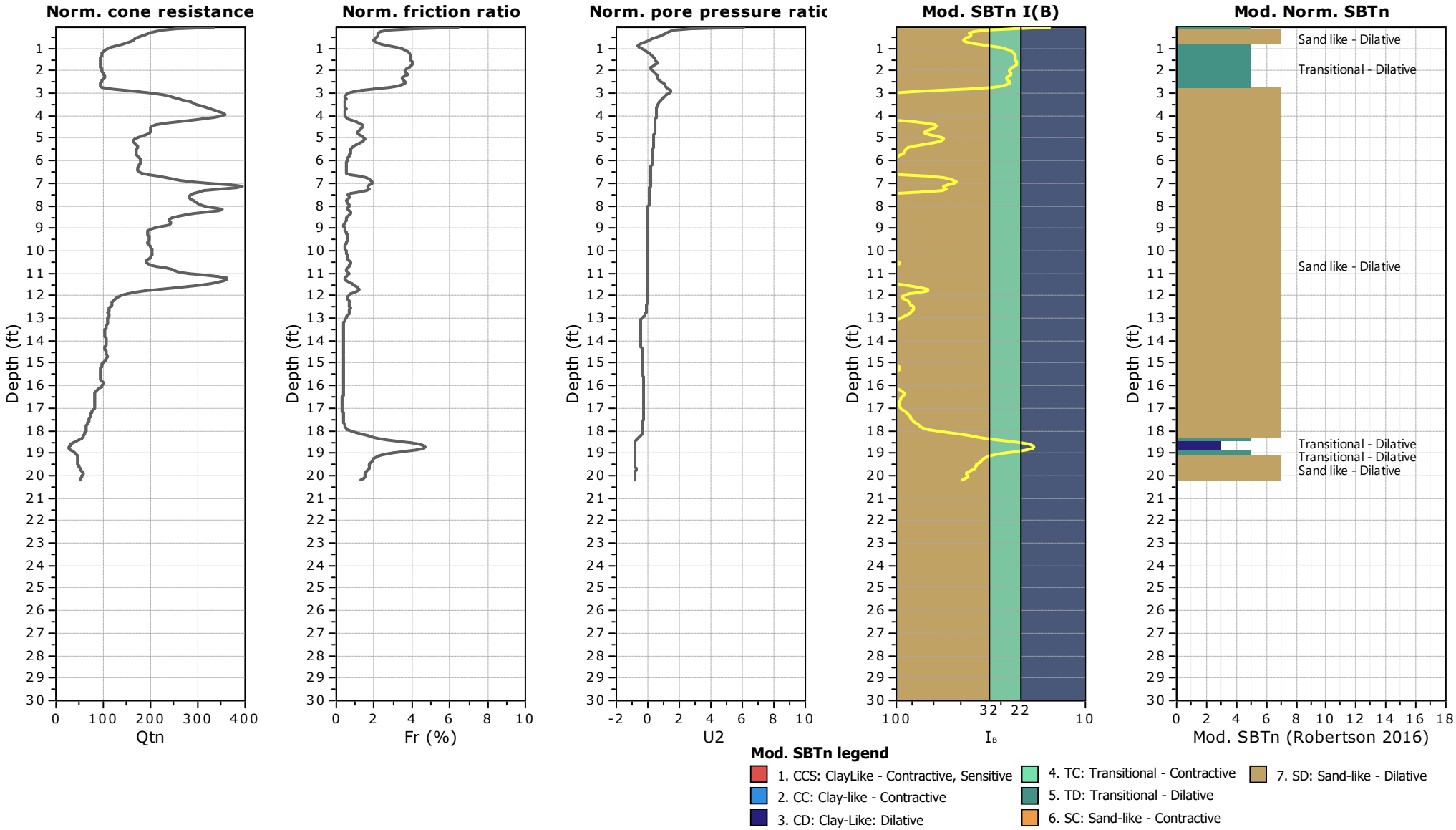
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-37
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 62.13 ft
Coords: X:572636.31, Y:555668.04
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

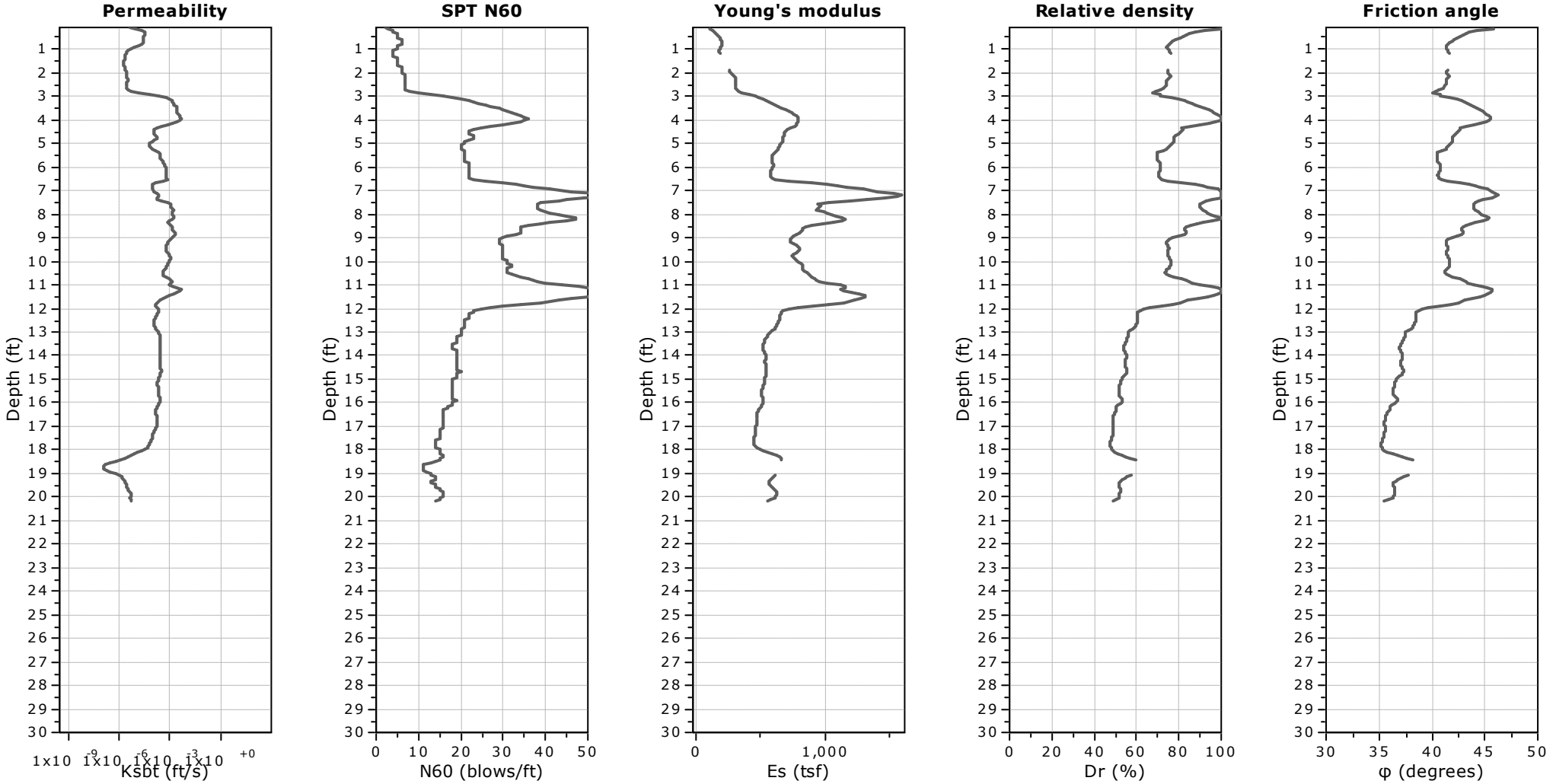
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-37
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 62.13 ft
Coords: X:572636.31, Y:555668.04
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



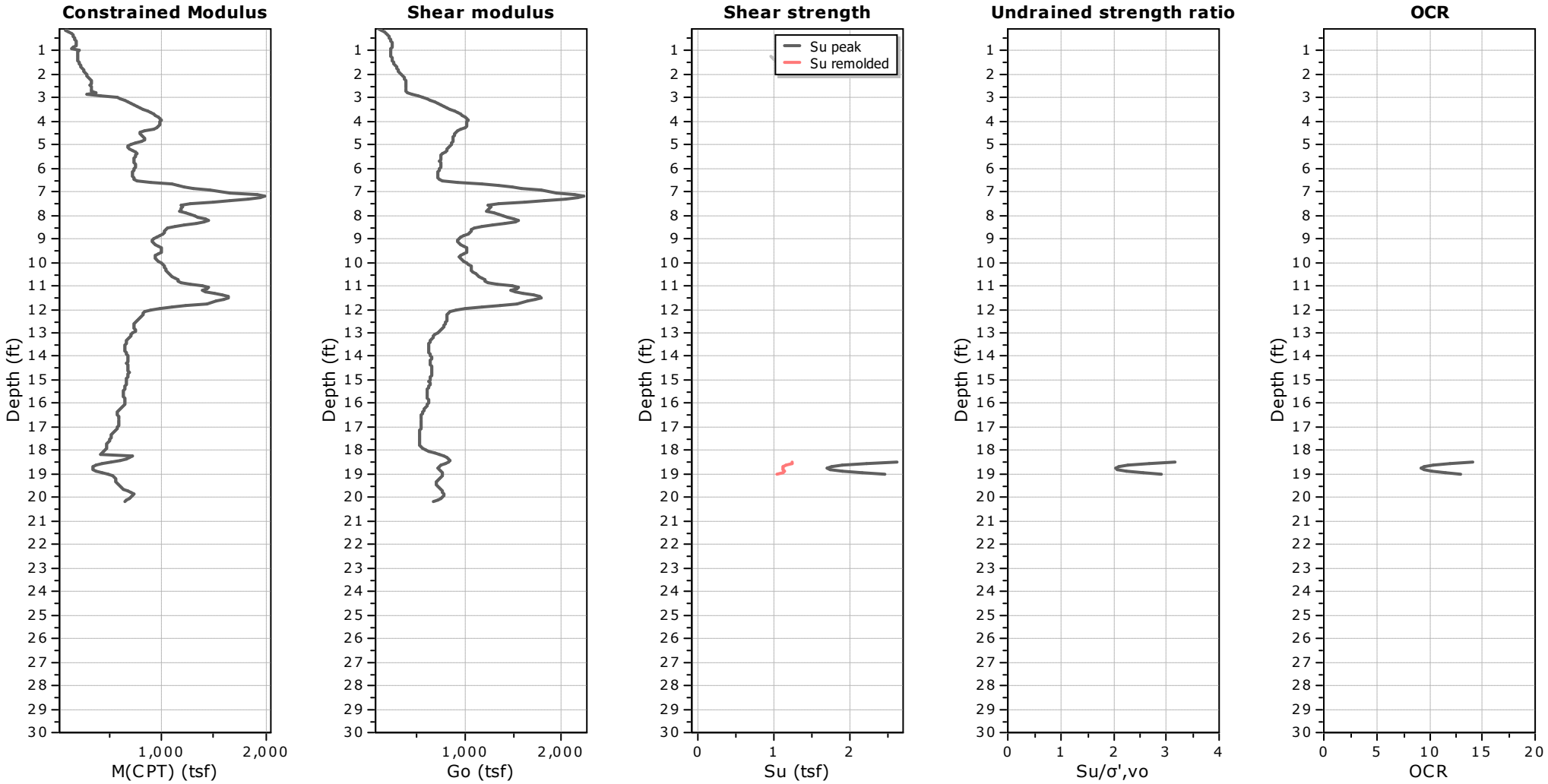
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-37
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 62.13 ft
Coords: X:572636.31, Y:555668.04
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



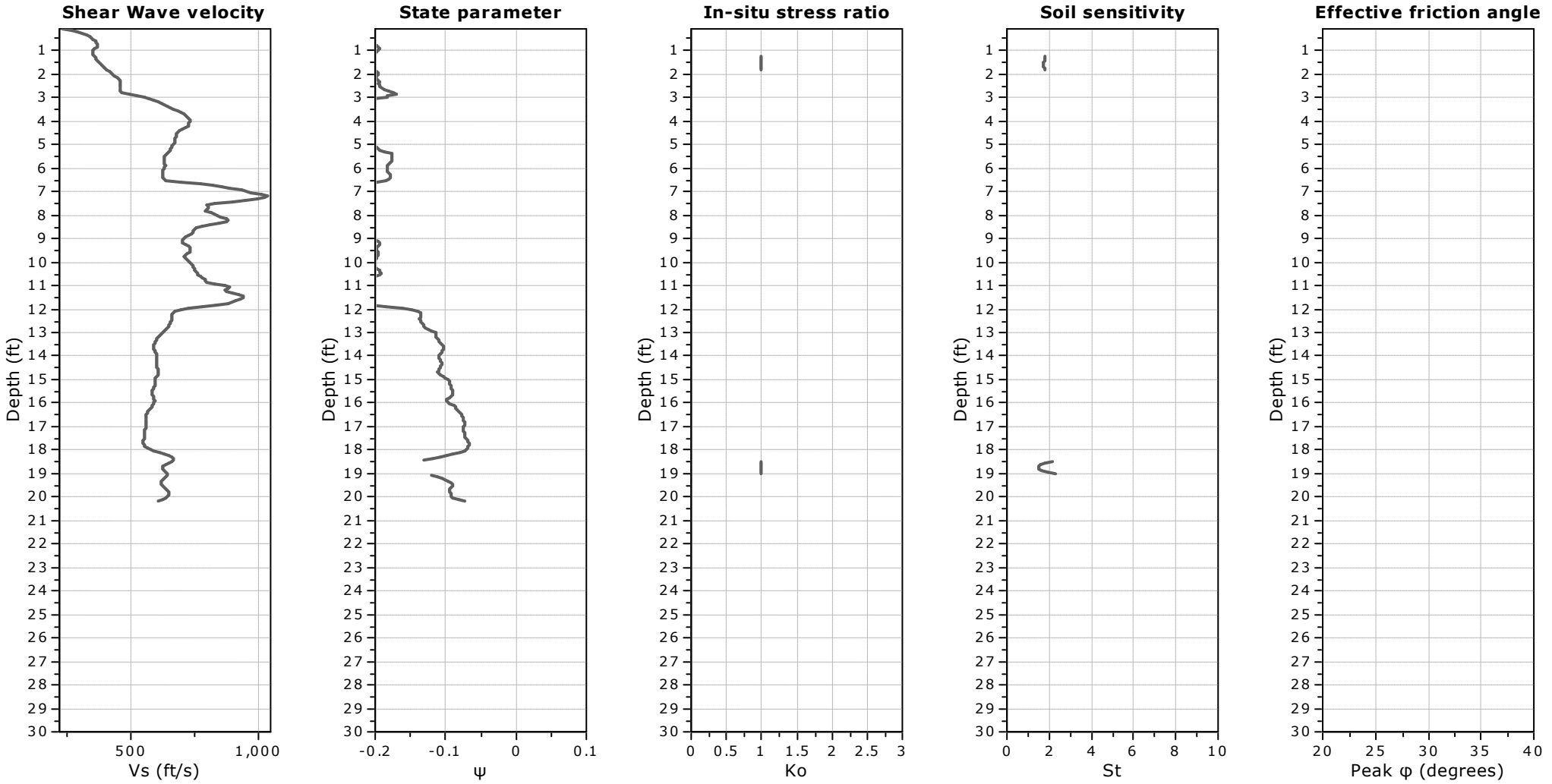
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-37
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 62.13 ft
Coords: X:572636.31, Y:555668.04
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



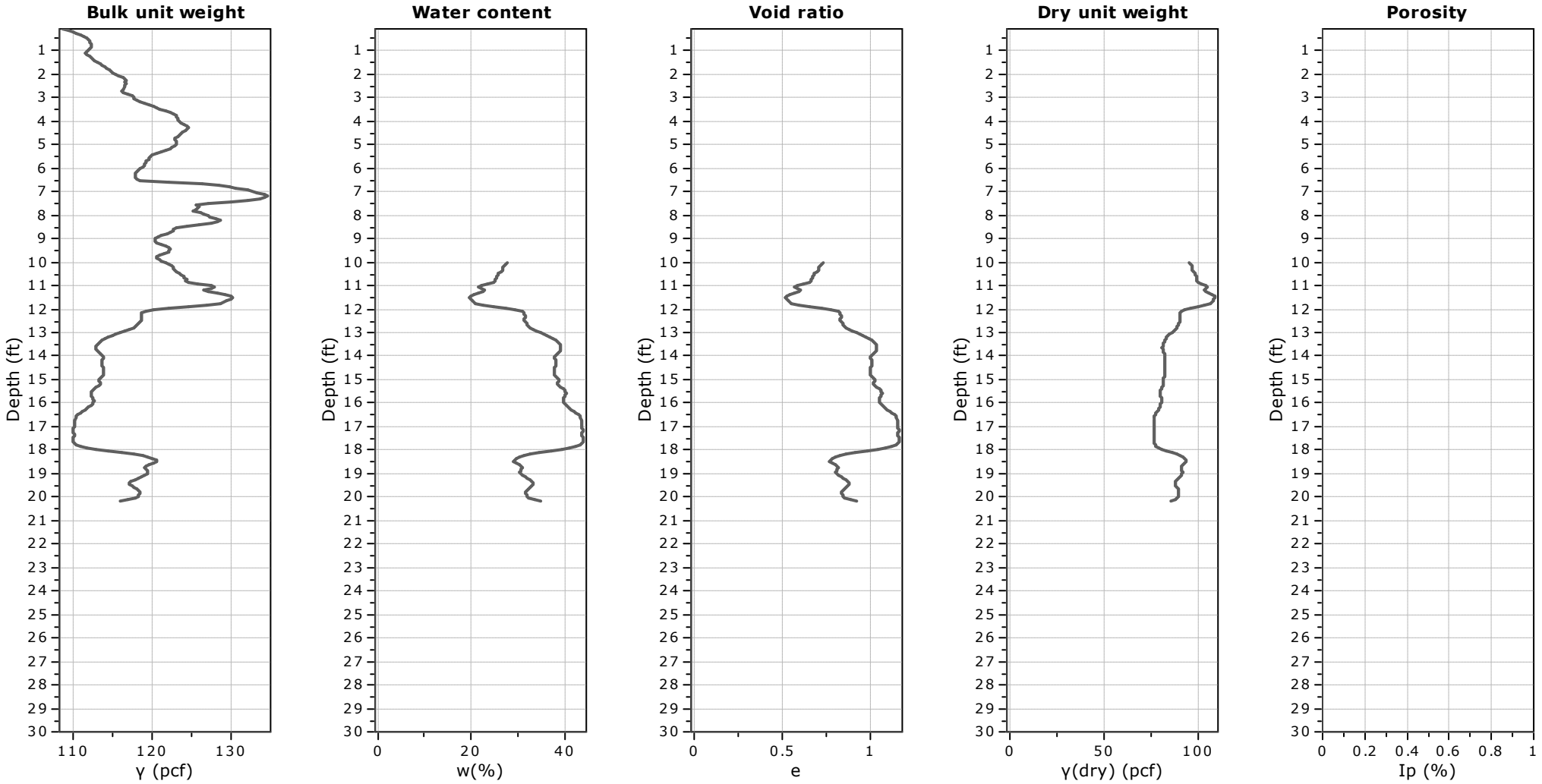
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-37
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 62.13 ft
Coords: X:572636.31, Y:555668.04
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

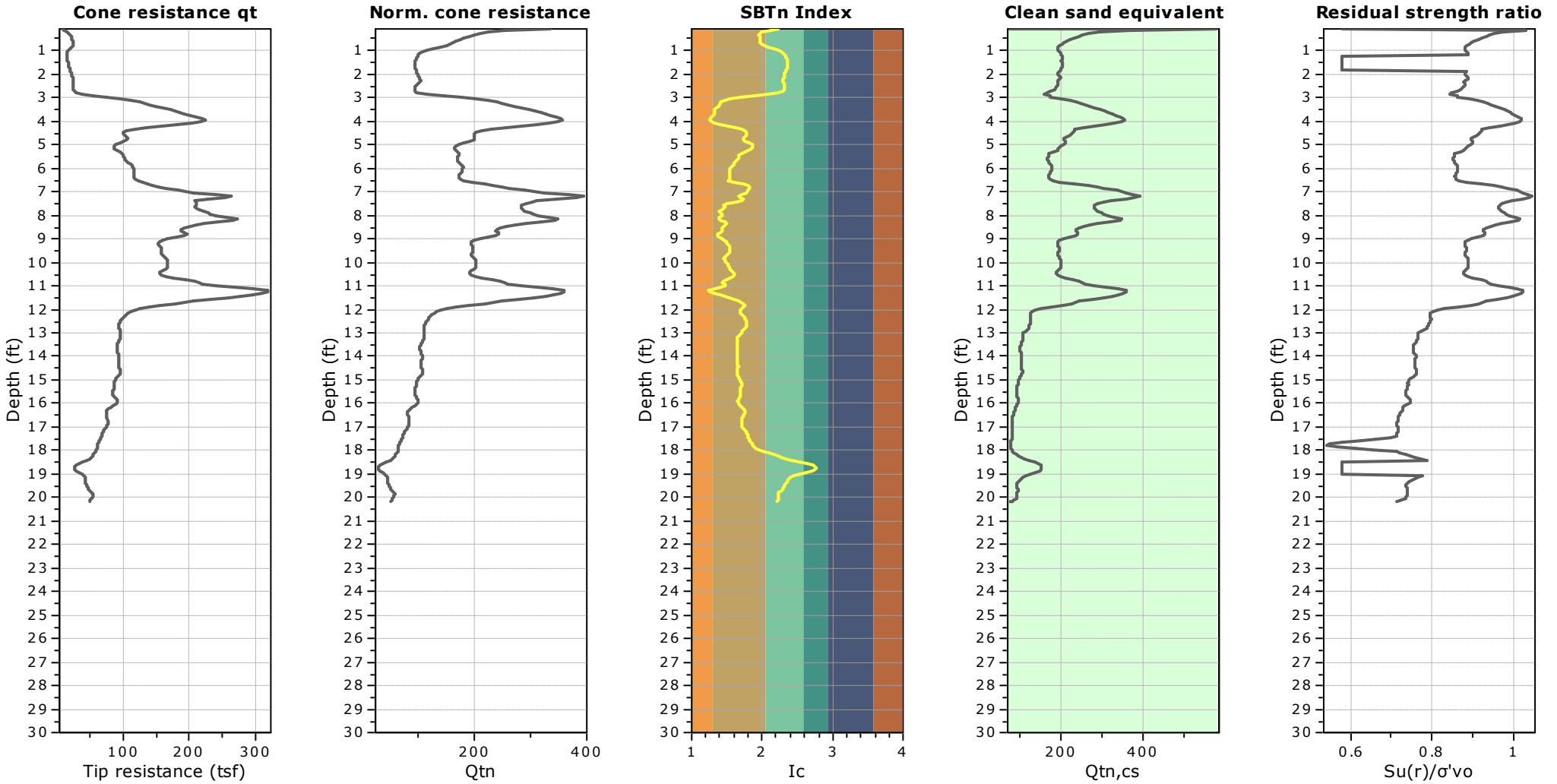
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-37
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 62.13 ft
Coords: X:572636.31, Y:555668.04
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

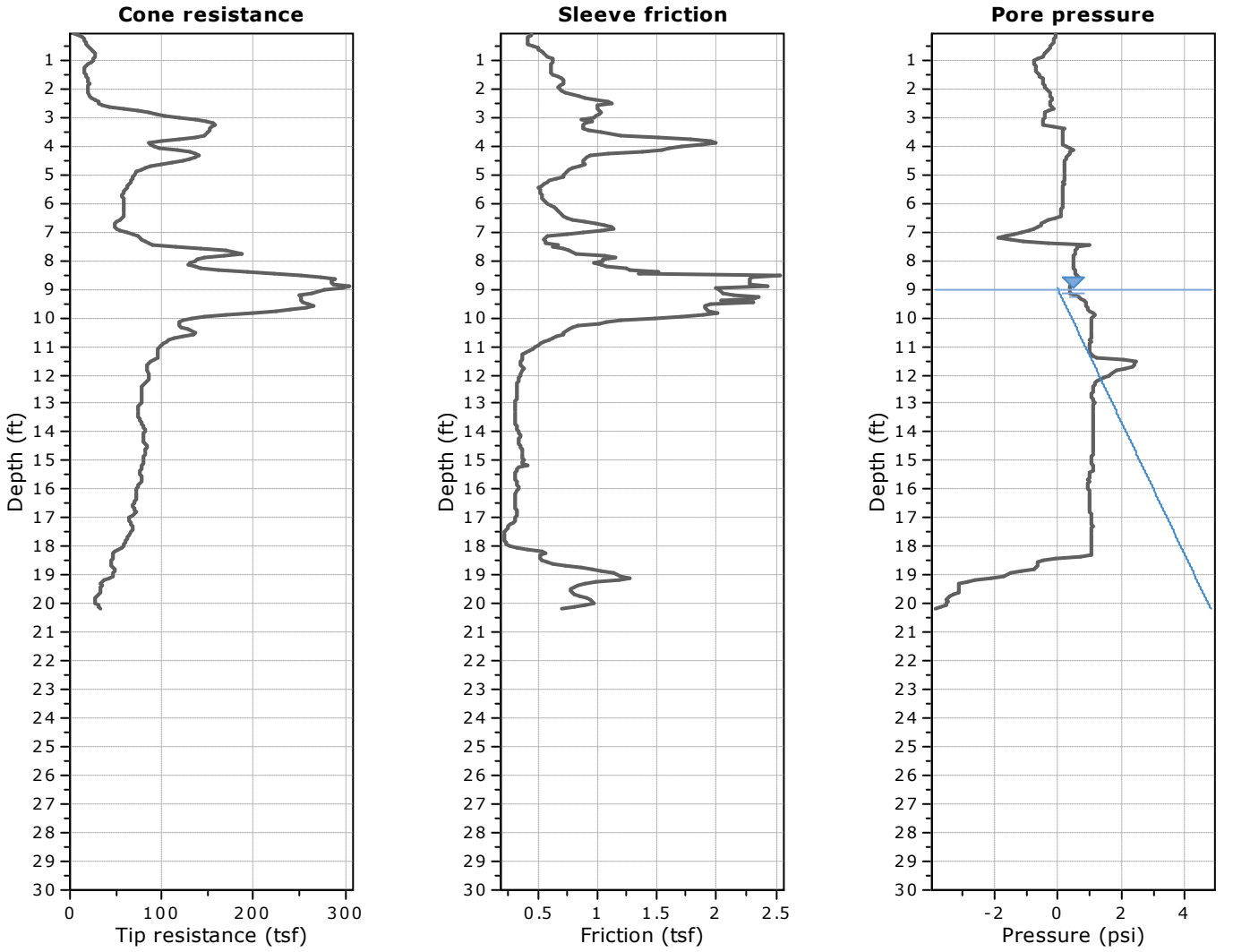
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



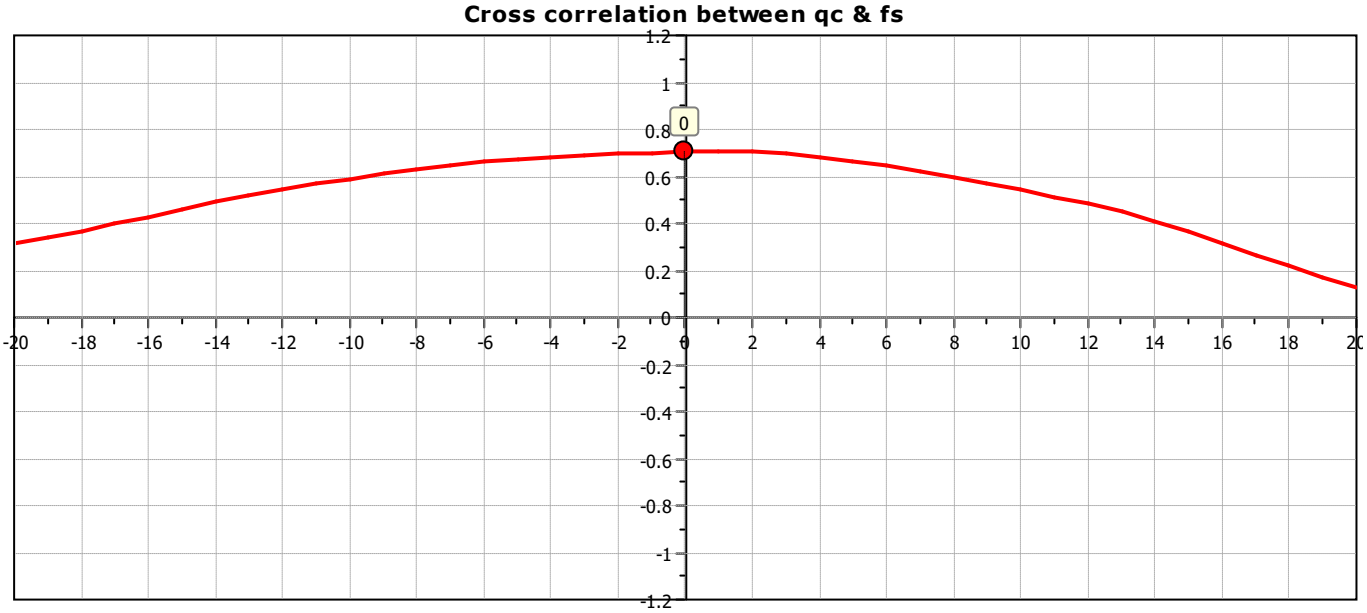
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

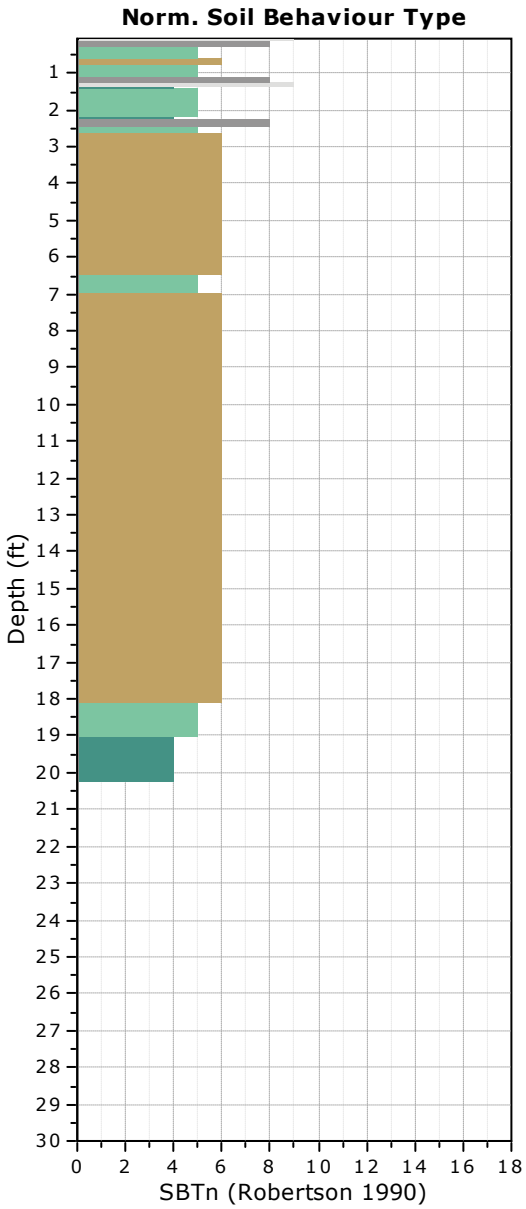
C-38
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572715.55, Y:555638.73
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

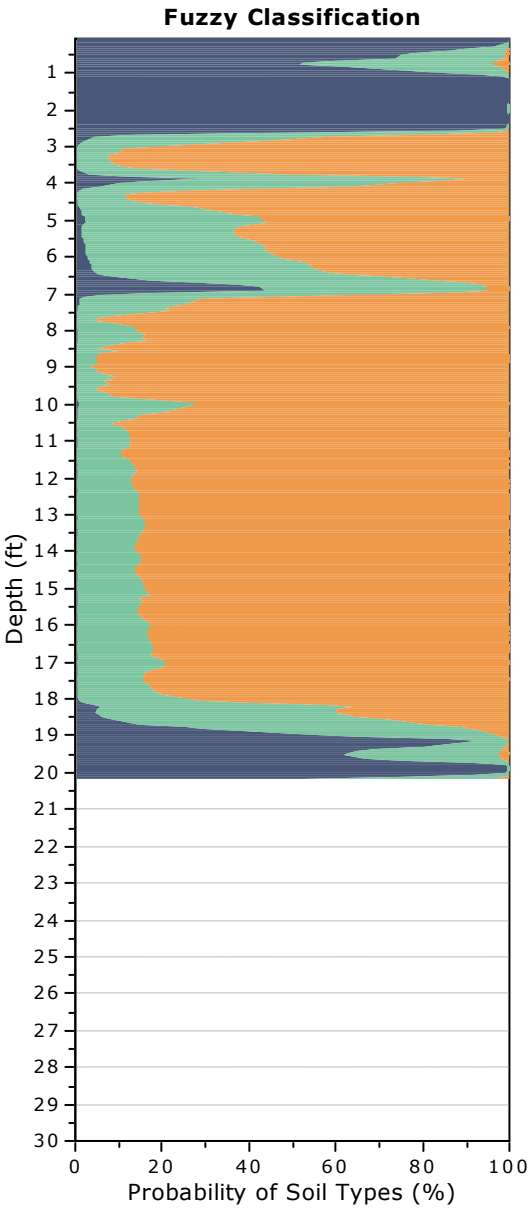
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







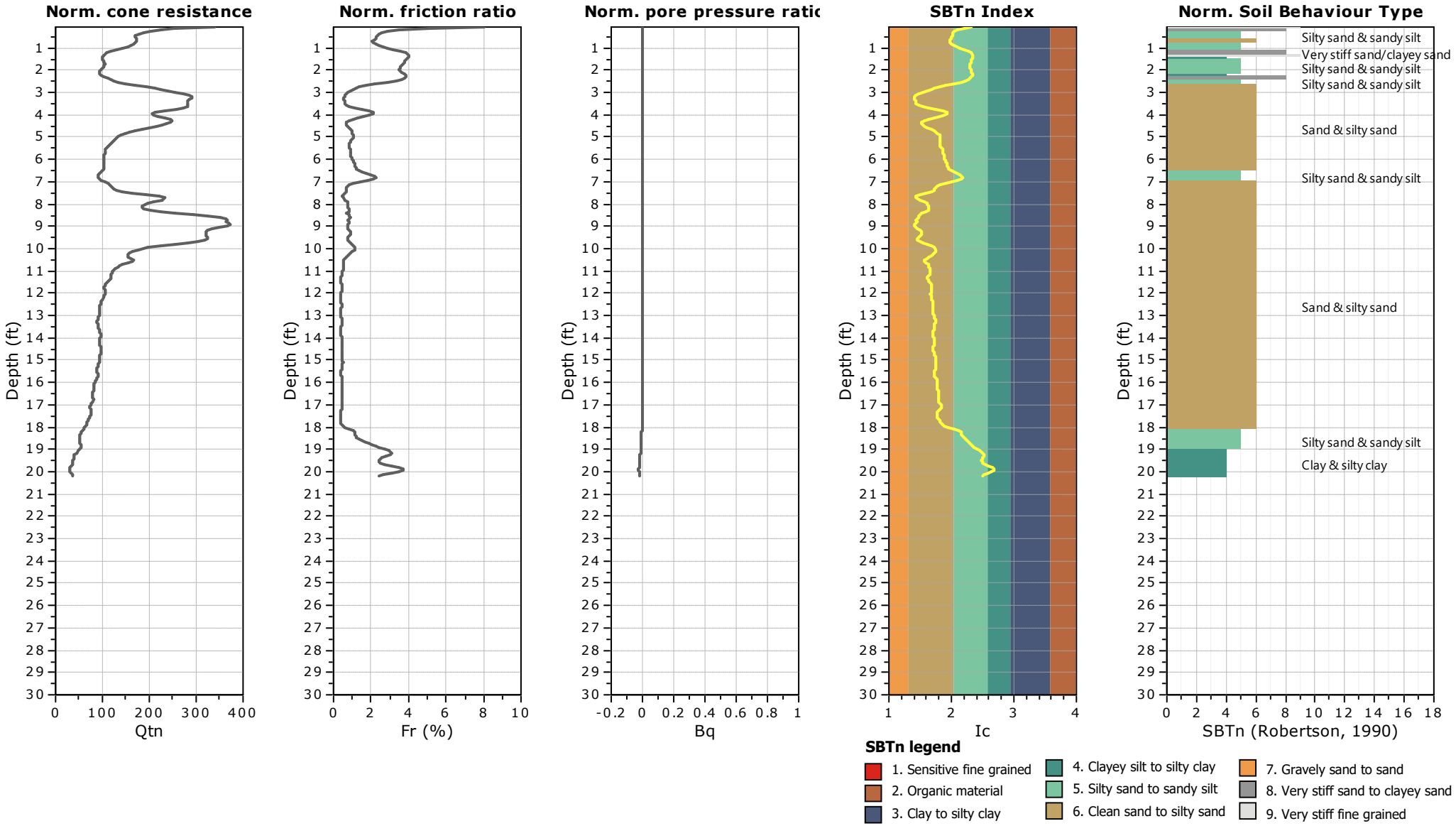
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-38
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572715.55, Y:555638.73
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

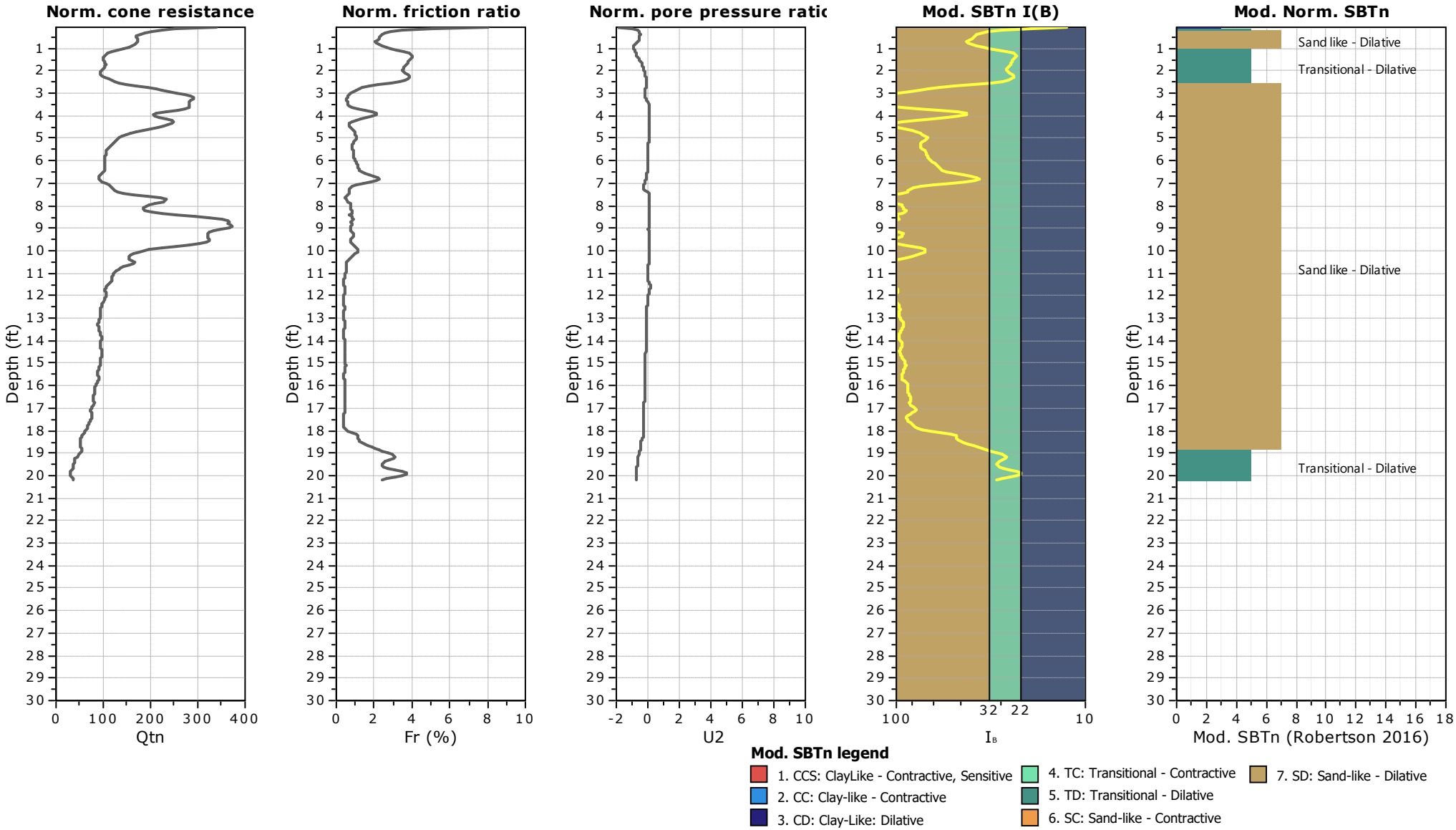
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-38
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572715.55, Y:555638.73
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

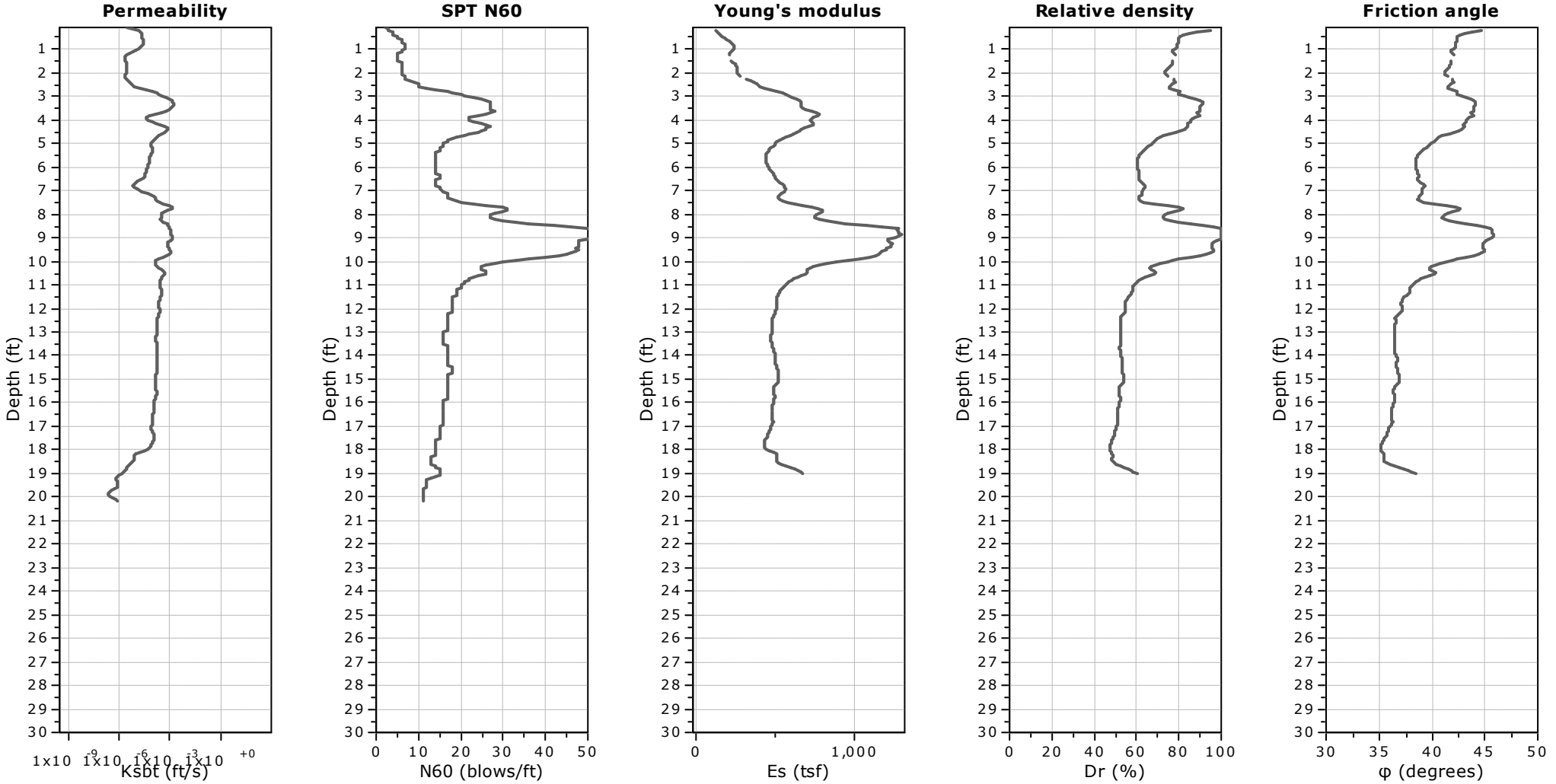
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-38
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572715.55, Y:555638.73
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



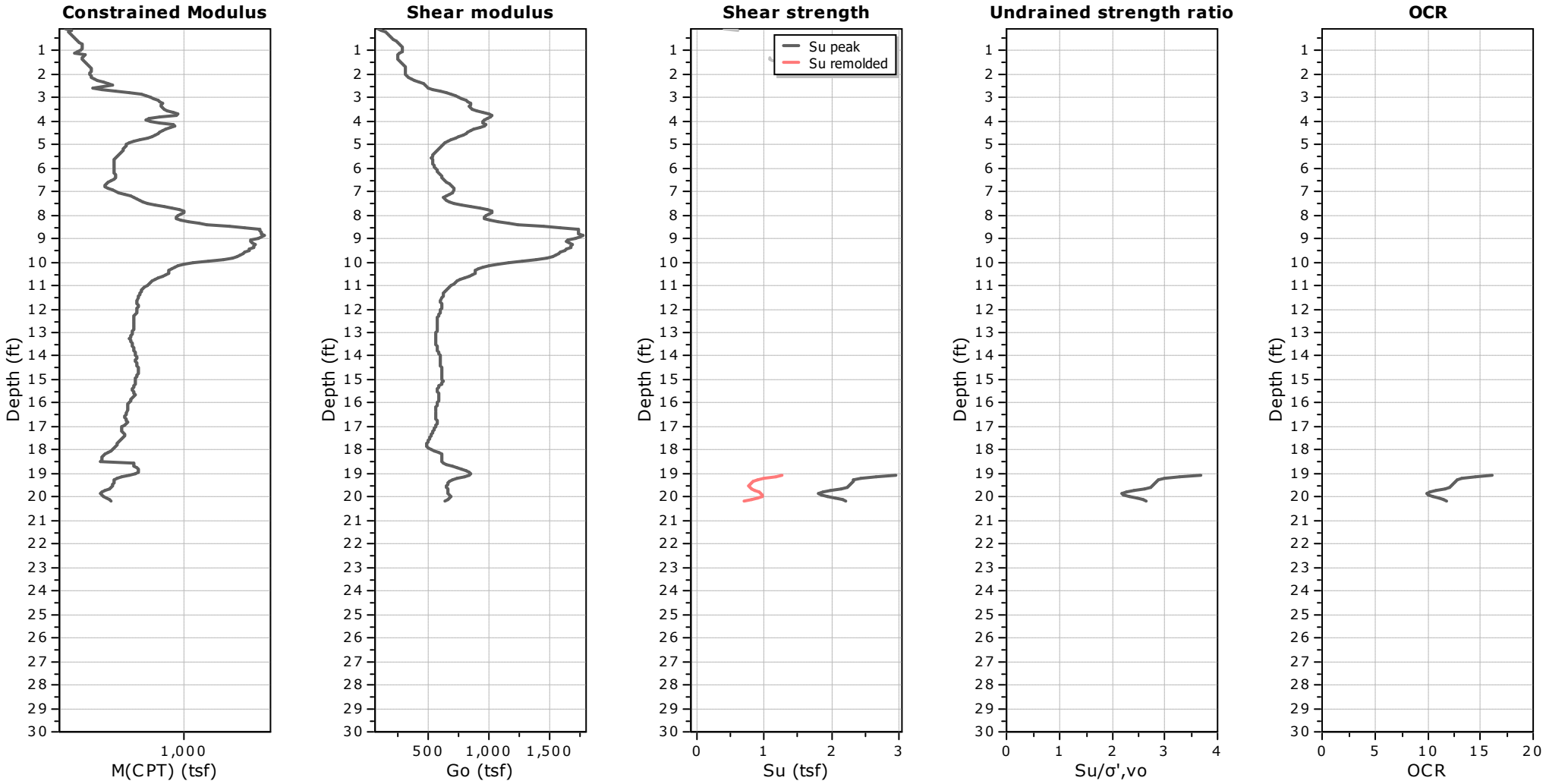
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-38
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572715.55, Y:555638.73
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



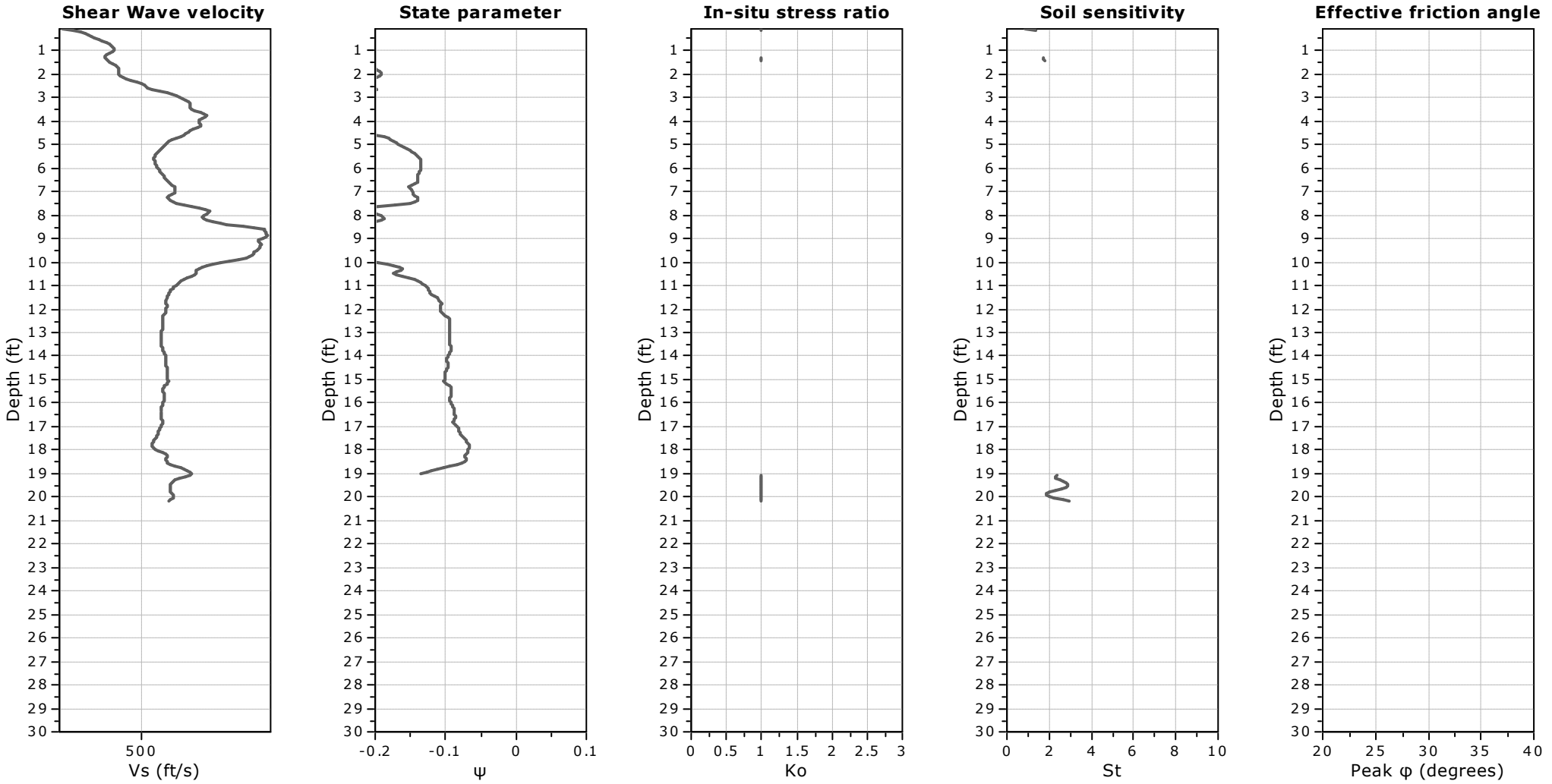
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-38
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572715.55, Y:555638.73
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



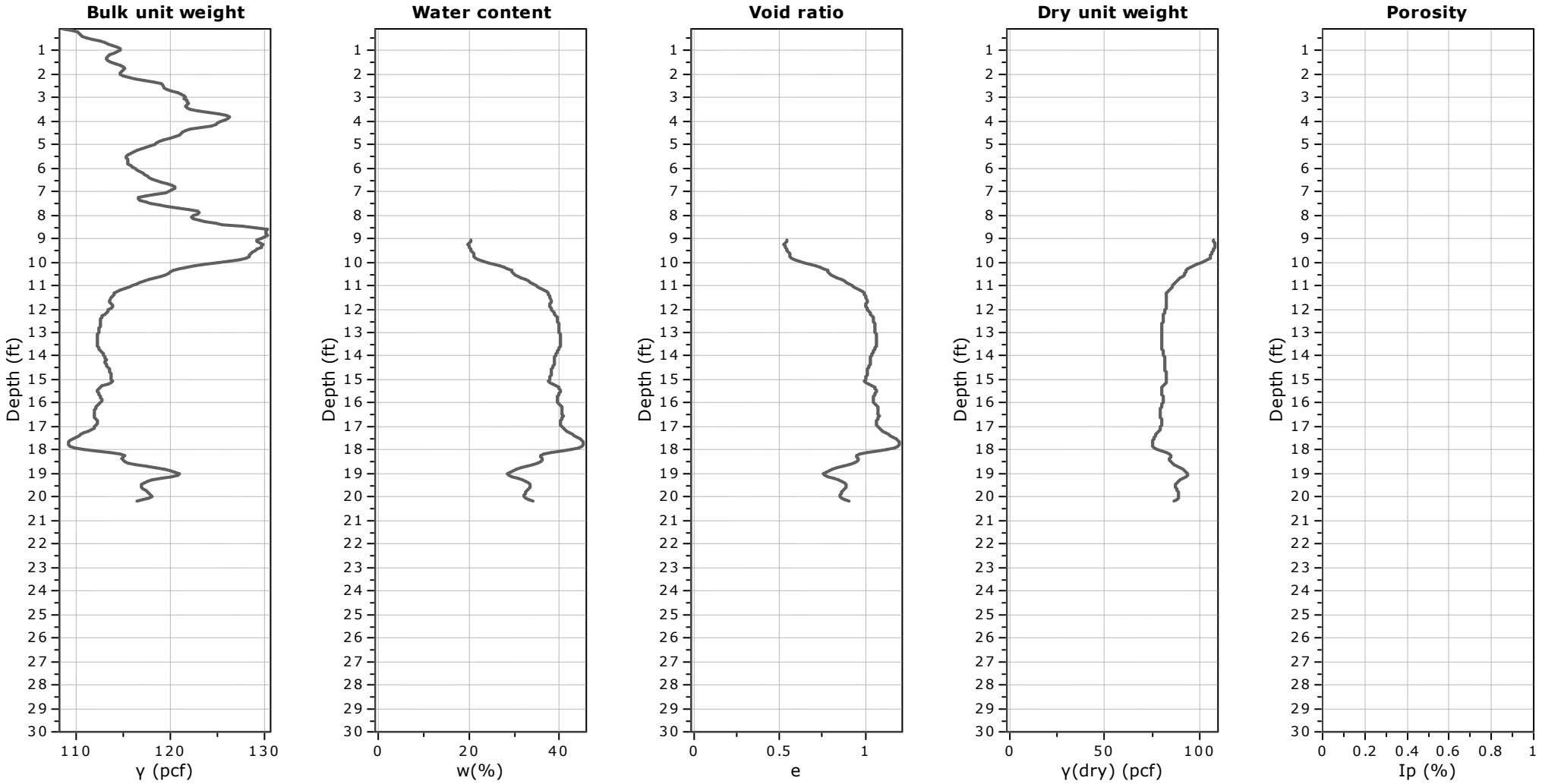
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-38
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572715.55, Y:555638.73
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

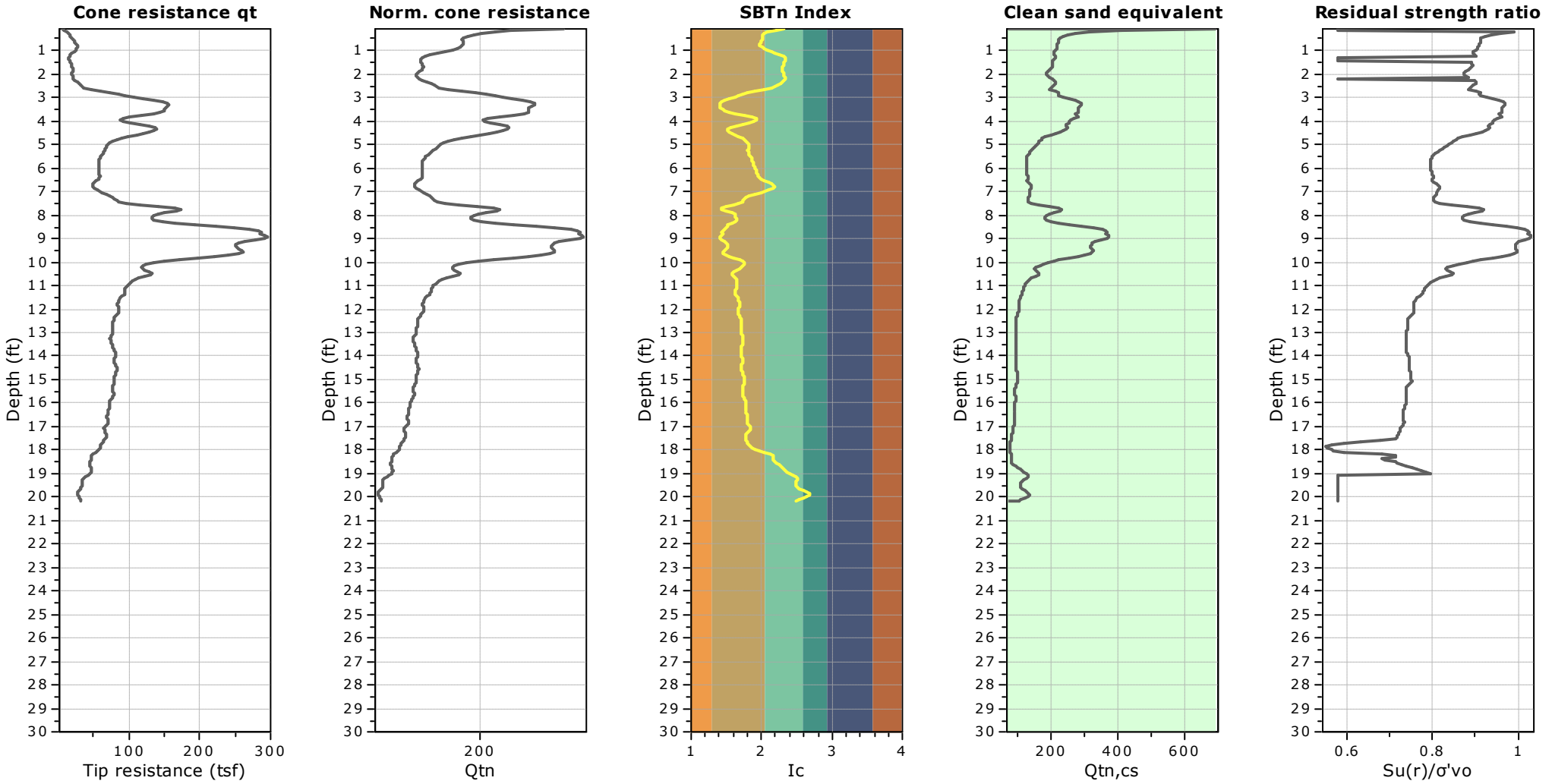
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-38
Total depth: 20.19 ft, Date: 5/14/2024
Surface Elevation: 61.56 ft
Coords: X:572715.55, Y:555638.73
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

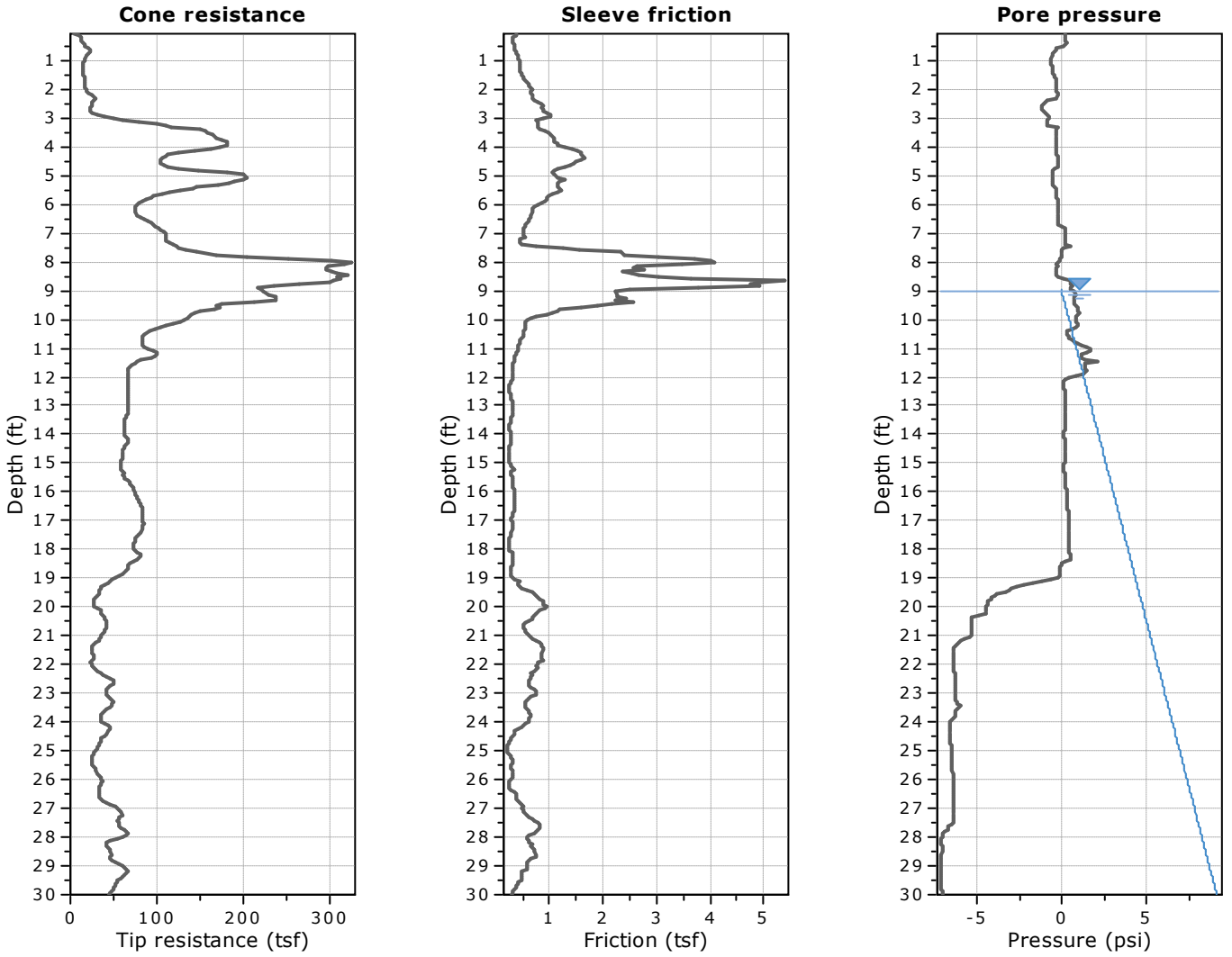
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



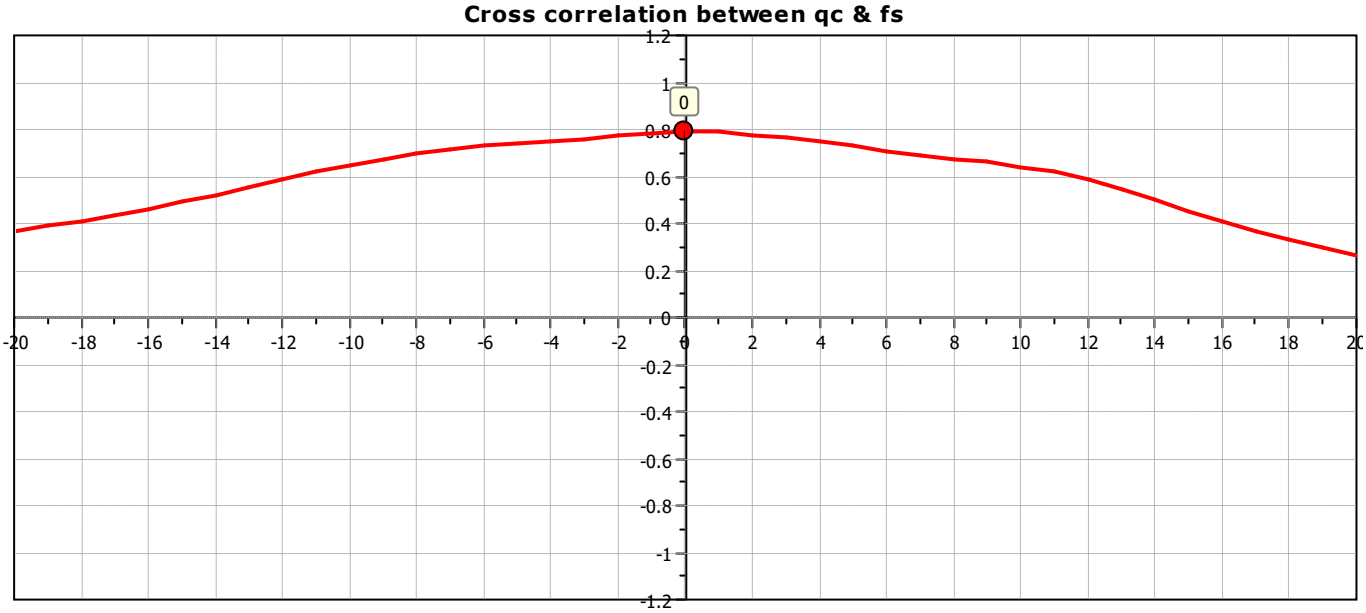
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-39
Total depth: 30.23 ft, Date: 5/14/2024
Surface Elevation: 61.86 ft
Coords: X:572684.18, Y:555600.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



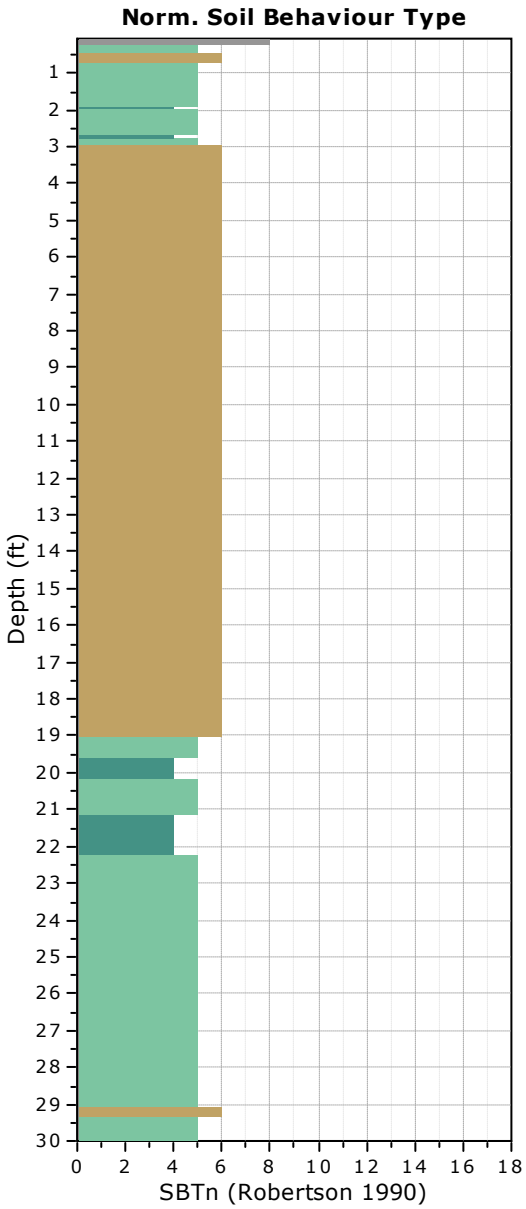
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

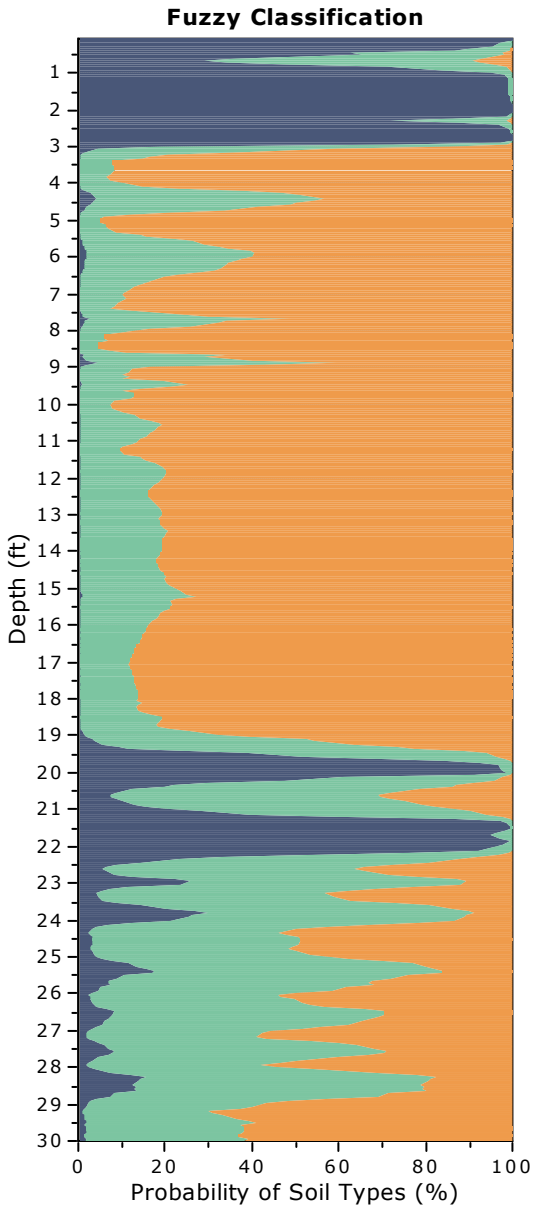


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-39
Total depth: 30.23 ft, Date: 5/14/2024
Surface Elevation: 61.86 ft
Coords: X:572684.18, Y:555600.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



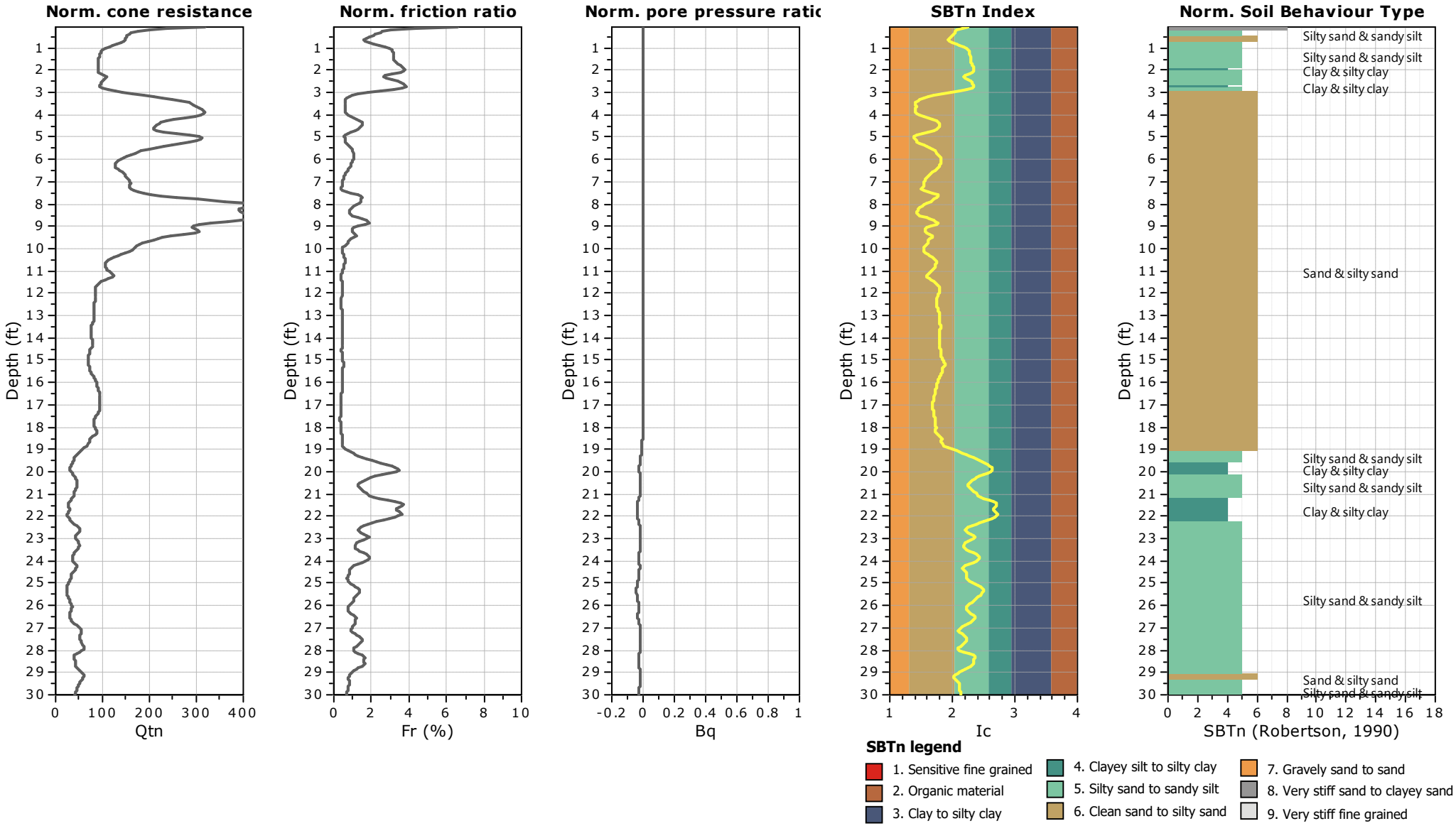


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-39
Total depth: 30.23 ft, Date: 5/14/2024
Surface Elevation: 61.86 ft
Coords: X:572684.18, Y:555600.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

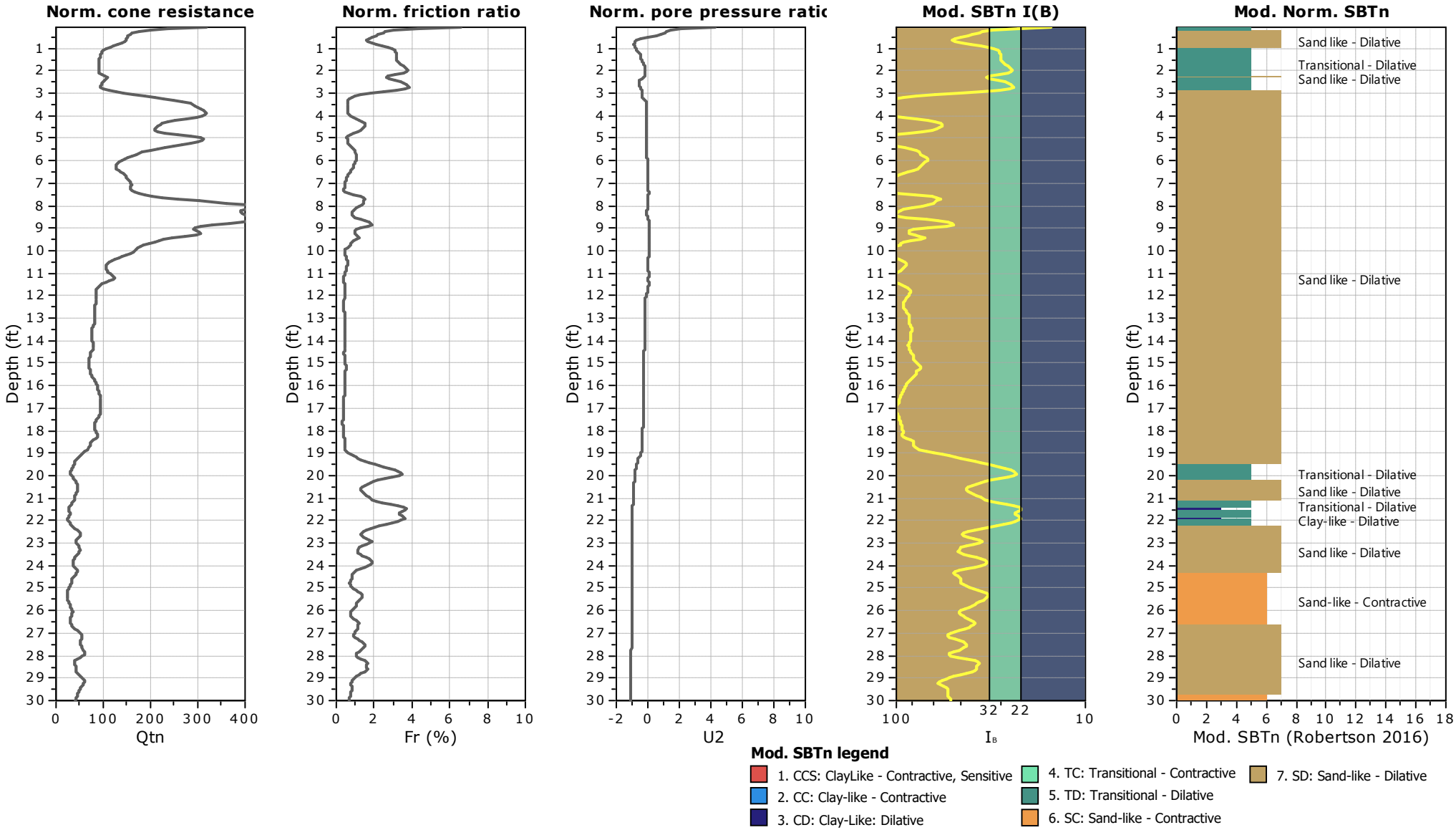
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-39
Total depth: 30.23 ft, Date: 5/14/2024
Surface Elevation: 61.86 ft
Coords: X:572684.18, Y:555600.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

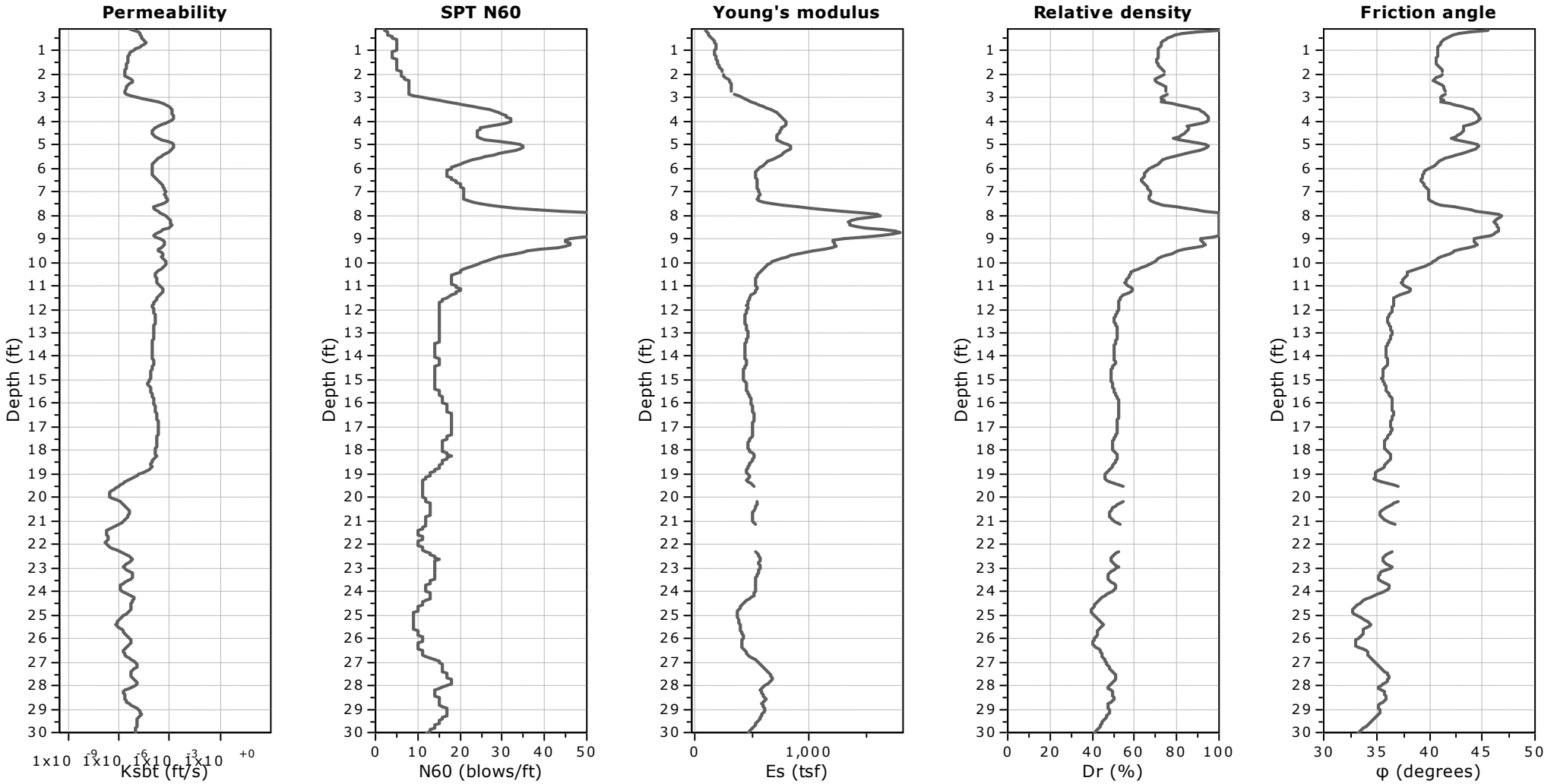
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-39
Total depth: 30.23 ft, Date: 5/14/2024
Surface Elevation: 61.86 ft
Coords: X:572684.18, Y:555600.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

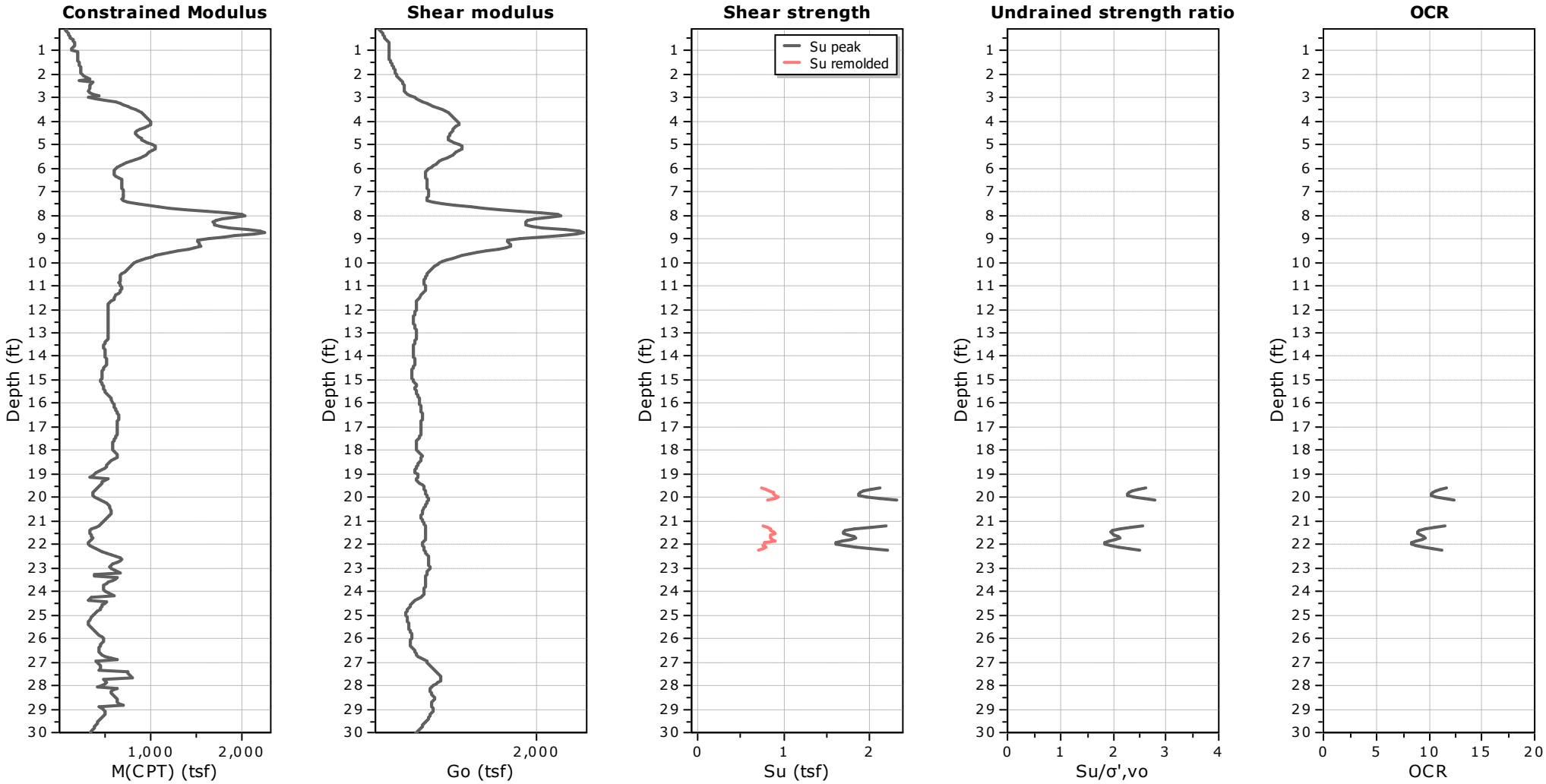


Calculation parameters
Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-39
Total depth: 30.23 ft, Date: 5/14/2024
Surface Elevation: 61.86 ft
Coords: X:572684.18, Y:555600.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



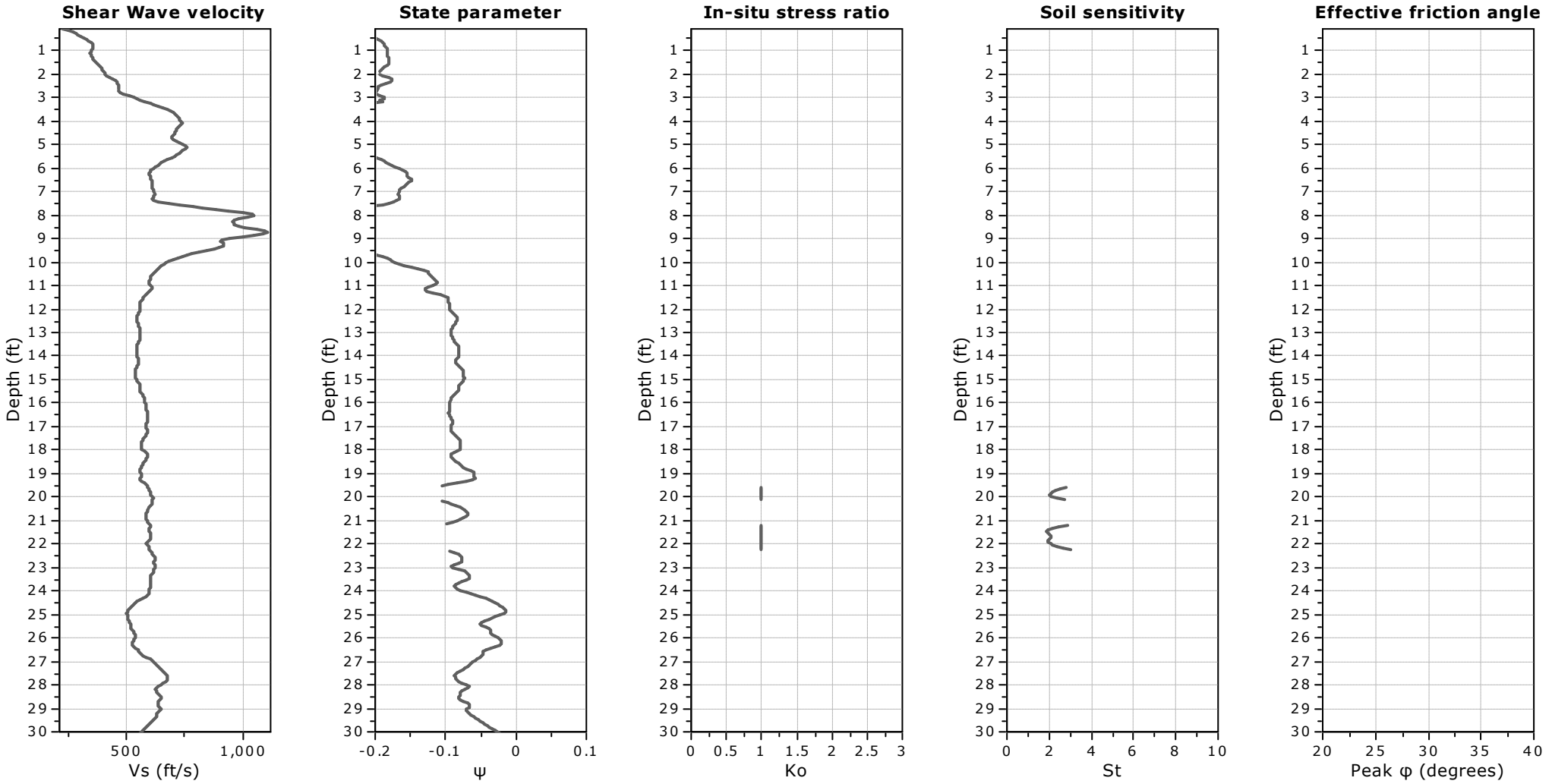
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-39
Total depth: 30.23 ft, Date: 5/14/2024
Surface Elevation: 61.86 ft
Coords: X:572684.18, Y:555600.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



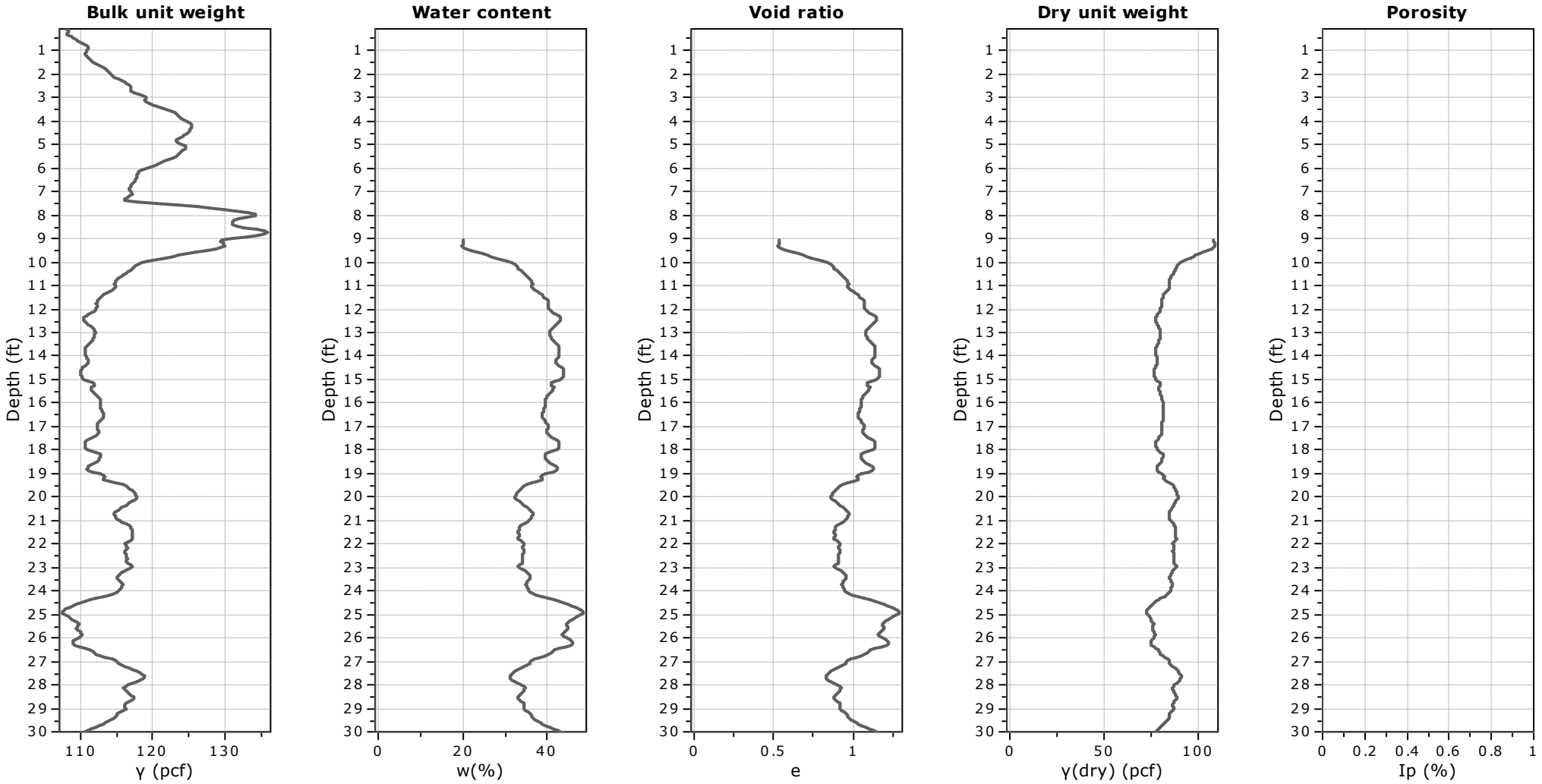
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-39
Total depth: 30.23 ft, Date: 5/14/2024
Surface Elevation: 61.86 ft
Coords: X:572684.18, Y:555600.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

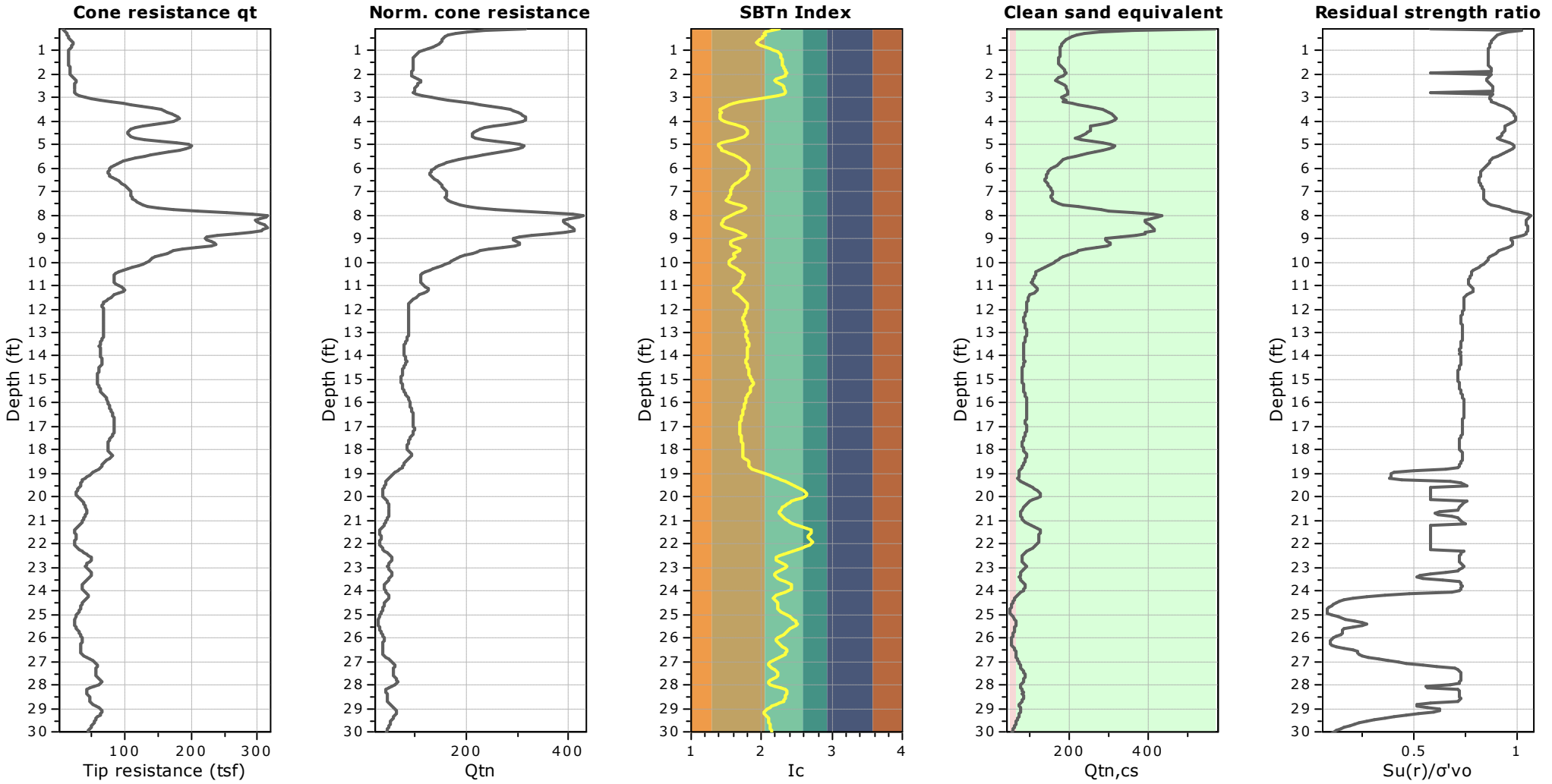
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-39
Total depth: 30.23 ft, Date: 5/14/2024
Surface Elevation: 61.86 ft
Coords: X:572684.18, Y:555600.85
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

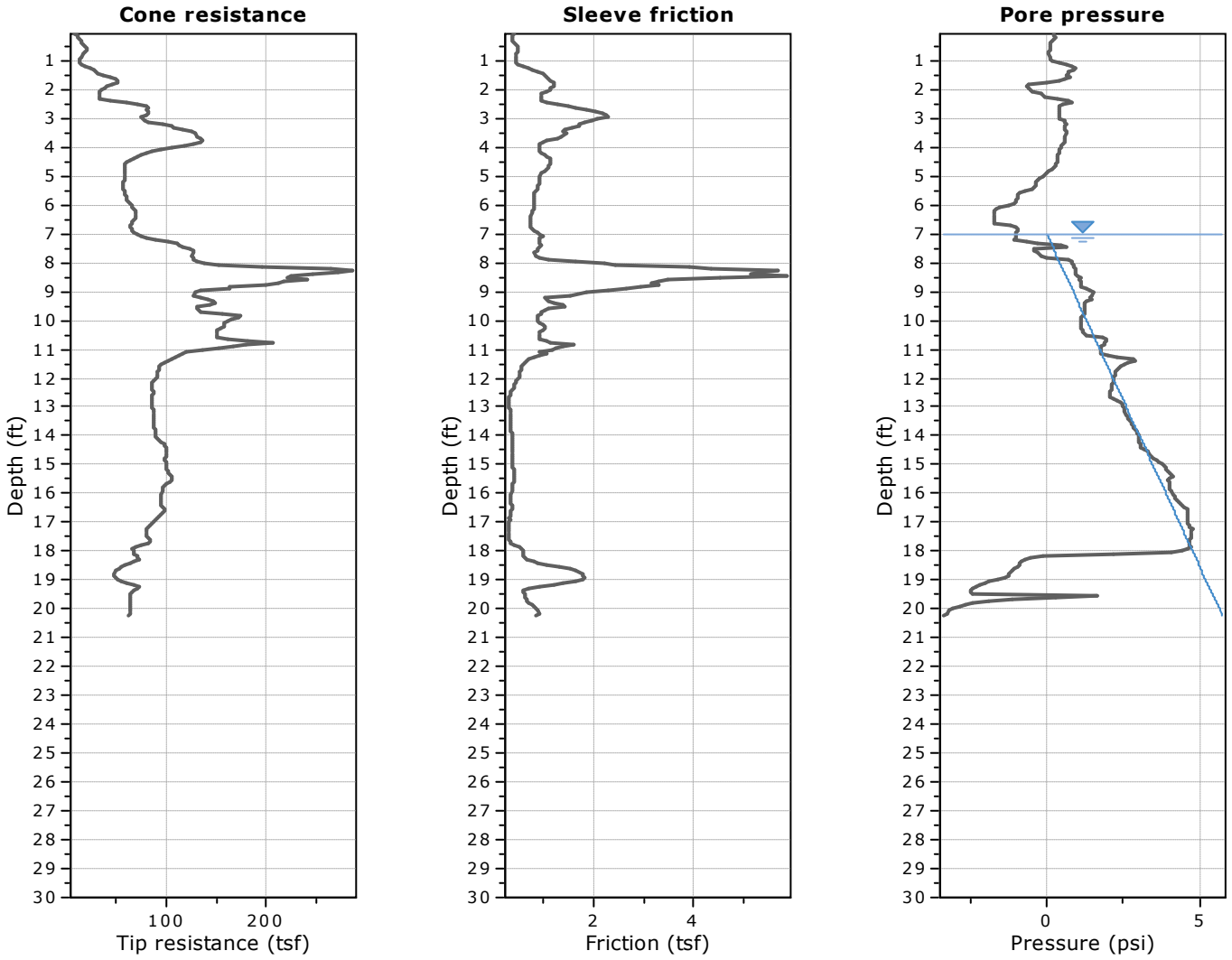
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



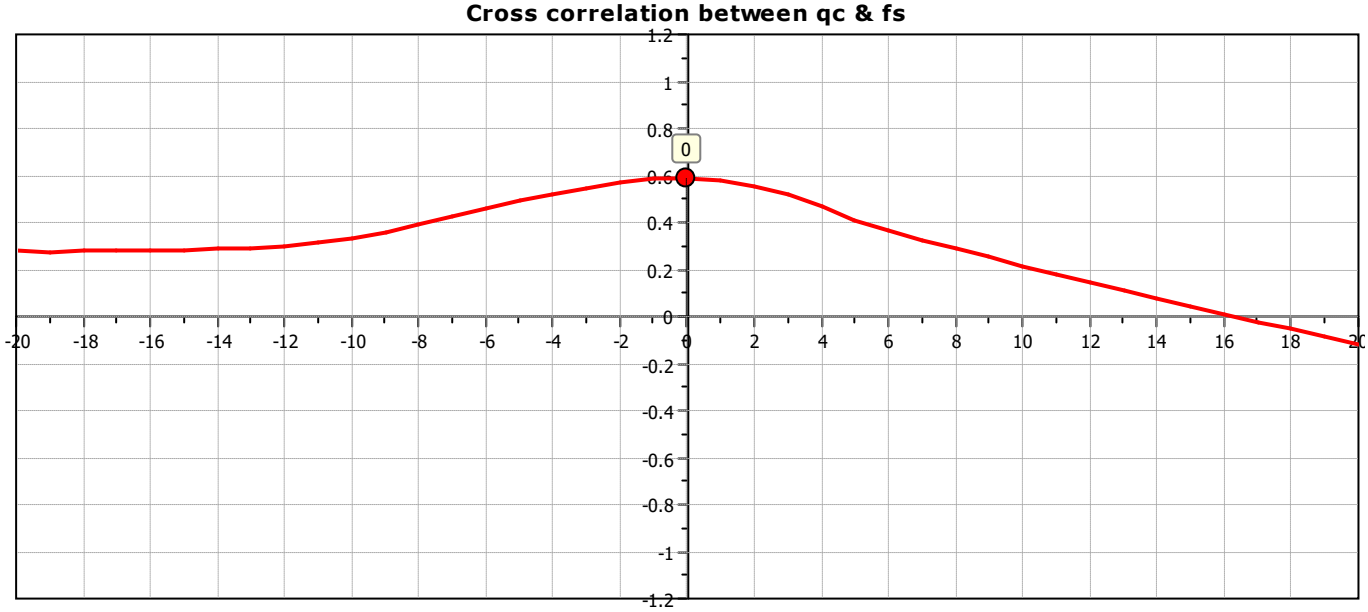
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

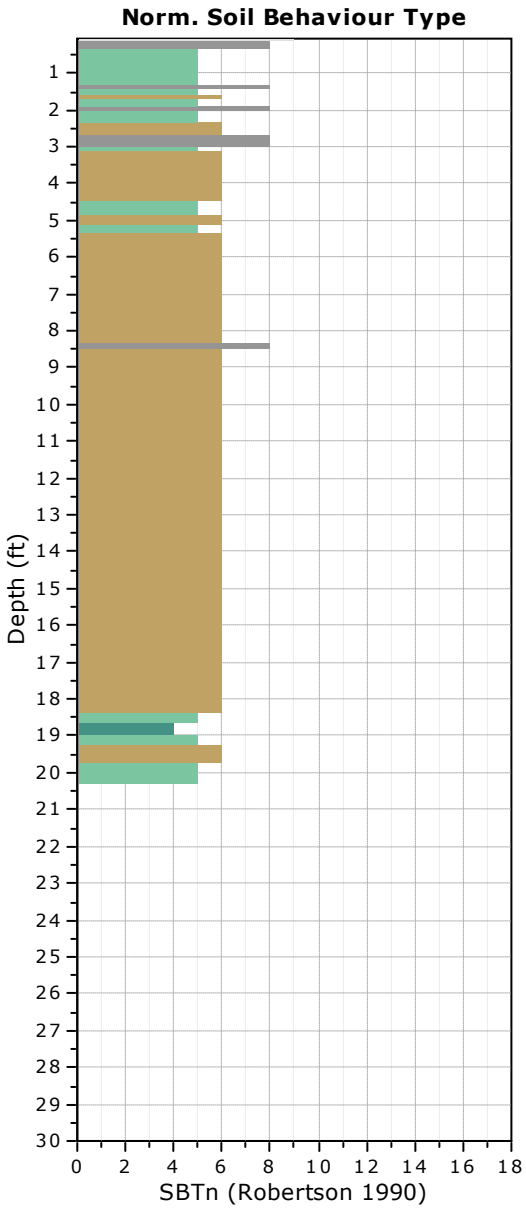
C-40
Total depth: 20.21 ft, Date: 5/16/2024
Surface Elevation: 60.32 ft
Coords: X:572889.77, Y:555695.69
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

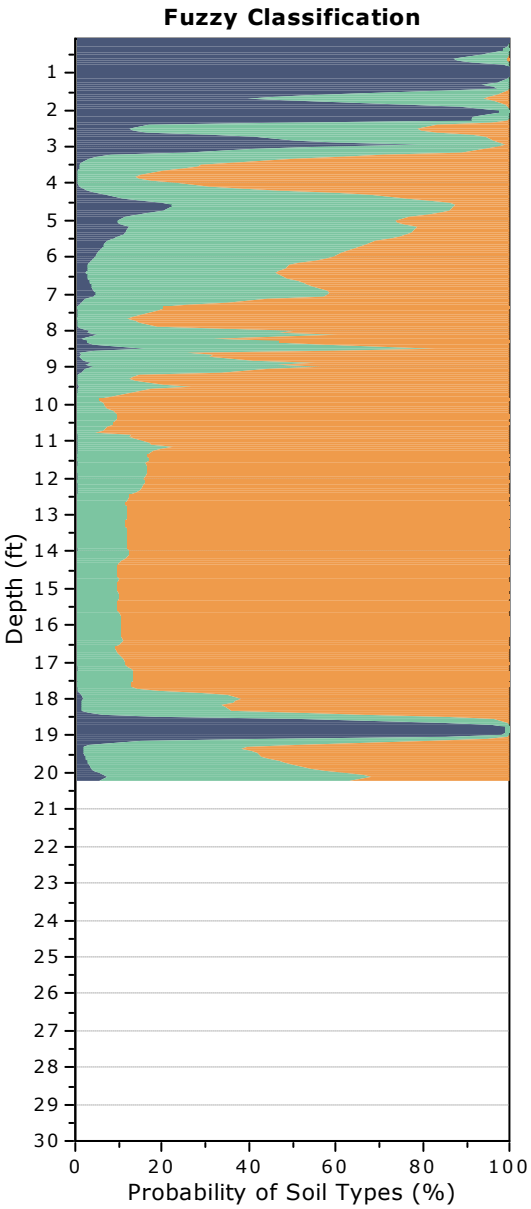
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







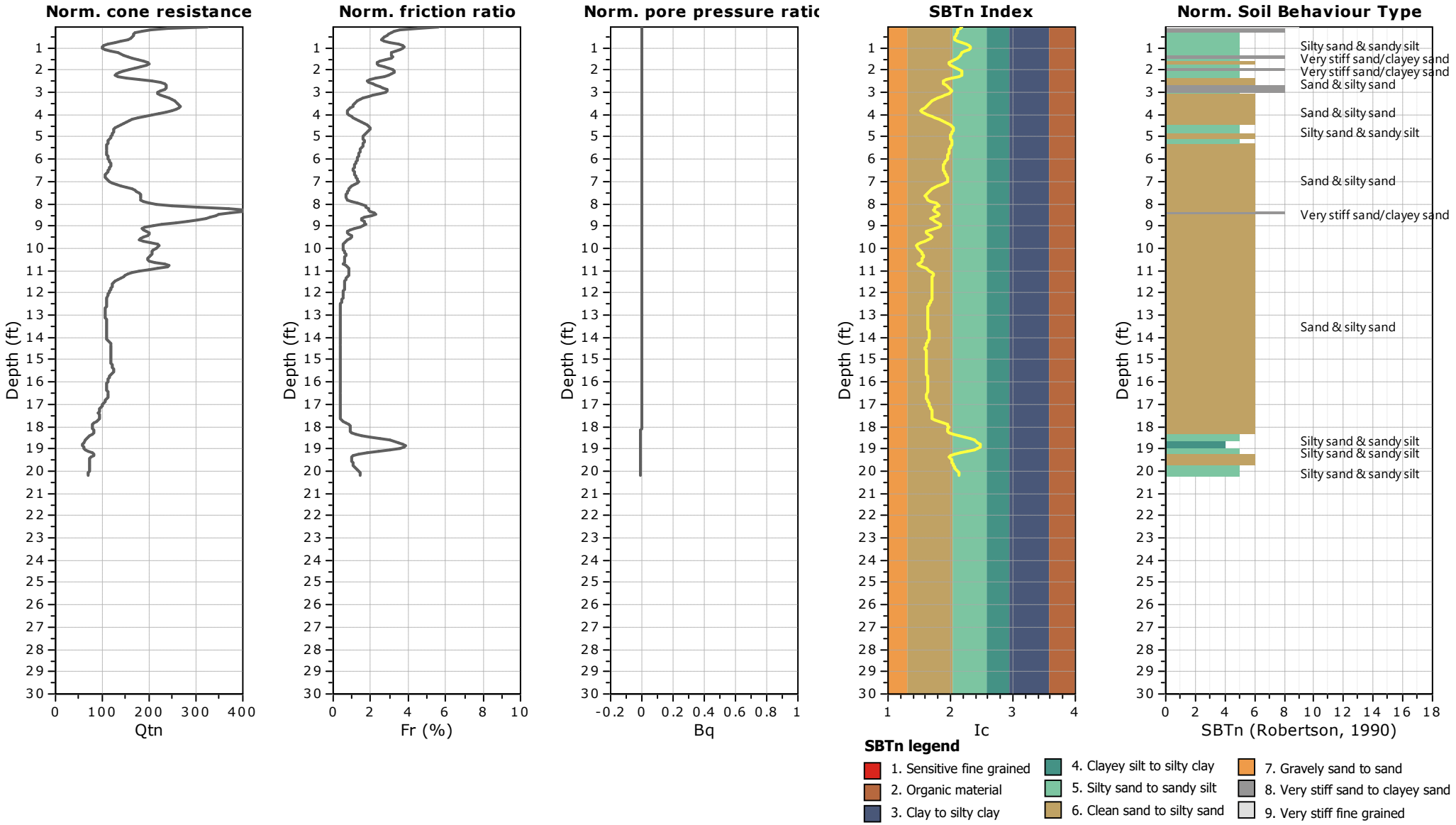
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-40
Total depth: 20.21 ft, Date: 5/16/2024
Surface Elevation: 60.32 ft
Coords: X:572889.77, Y:555695.69
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

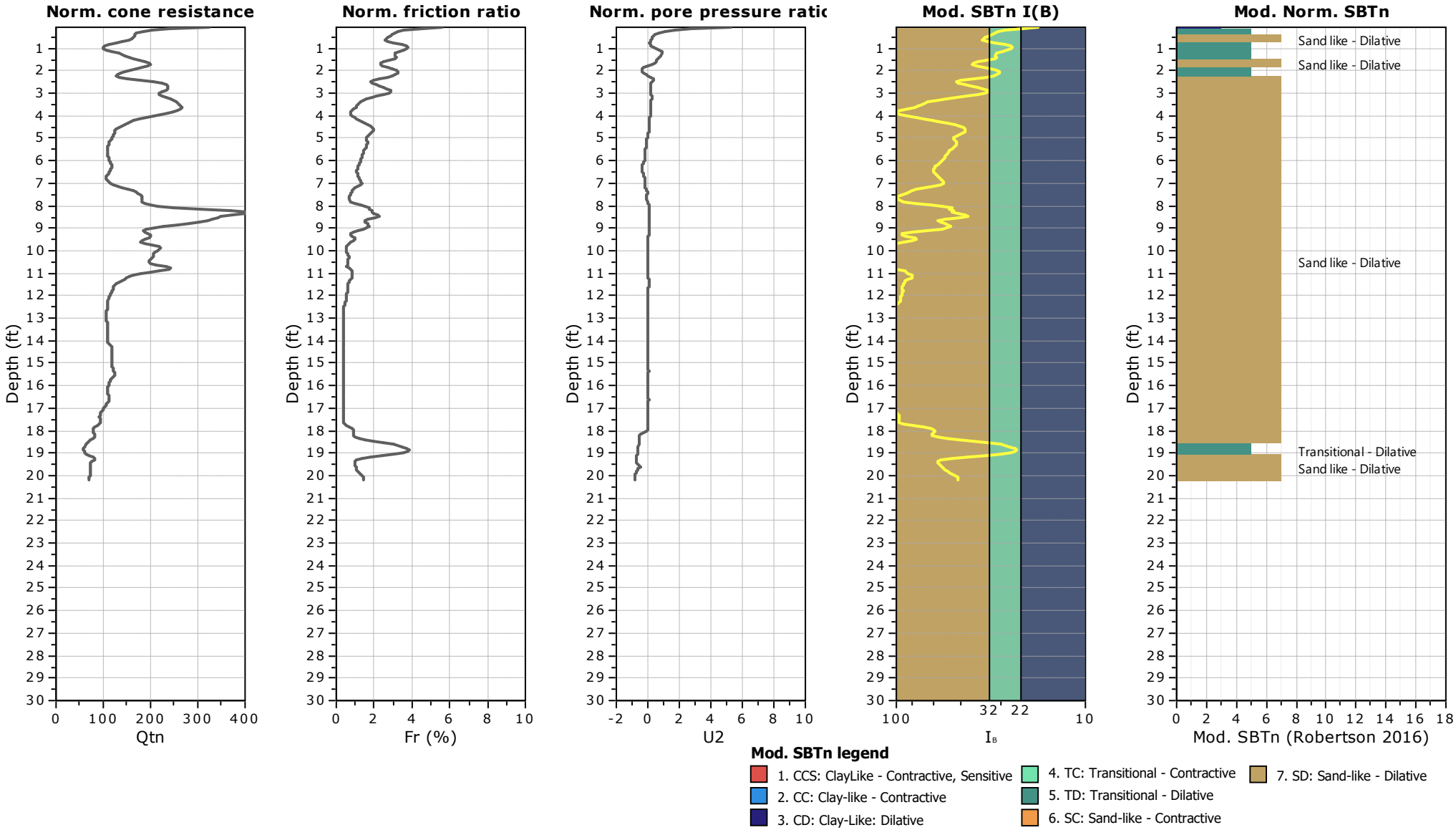
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-40
Total depth: 20.21 ft, Date: 5/16/2024
Surface Elevation: 60.32 ft
Coords: X:572889.77, Y:555695.69
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

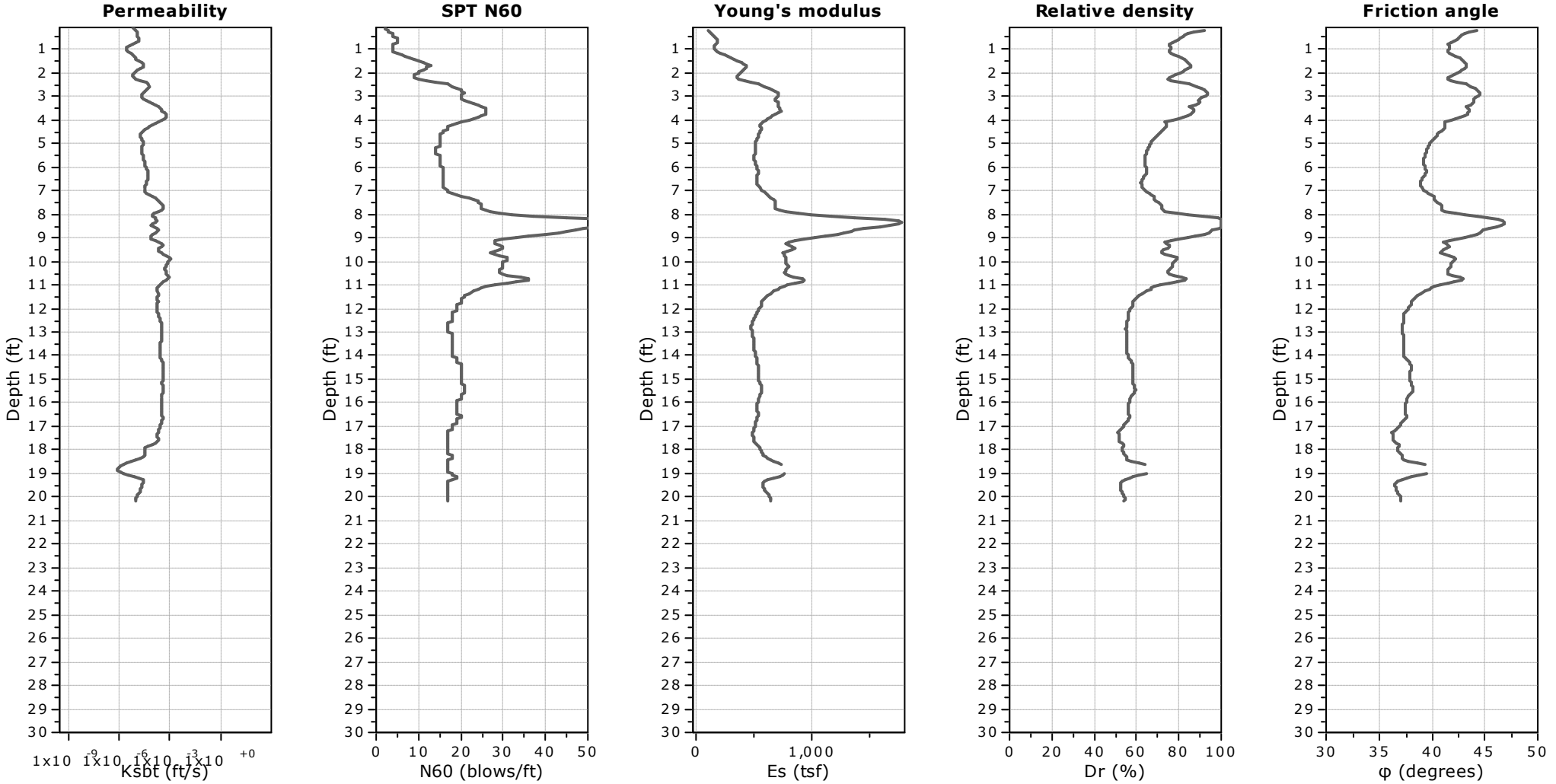
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-40
Total depth: 20.21 ft, Date: 5/16/2024
Surface Elevation: 60.32 ft
Coords: X:572889.77, Y:555695.69
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



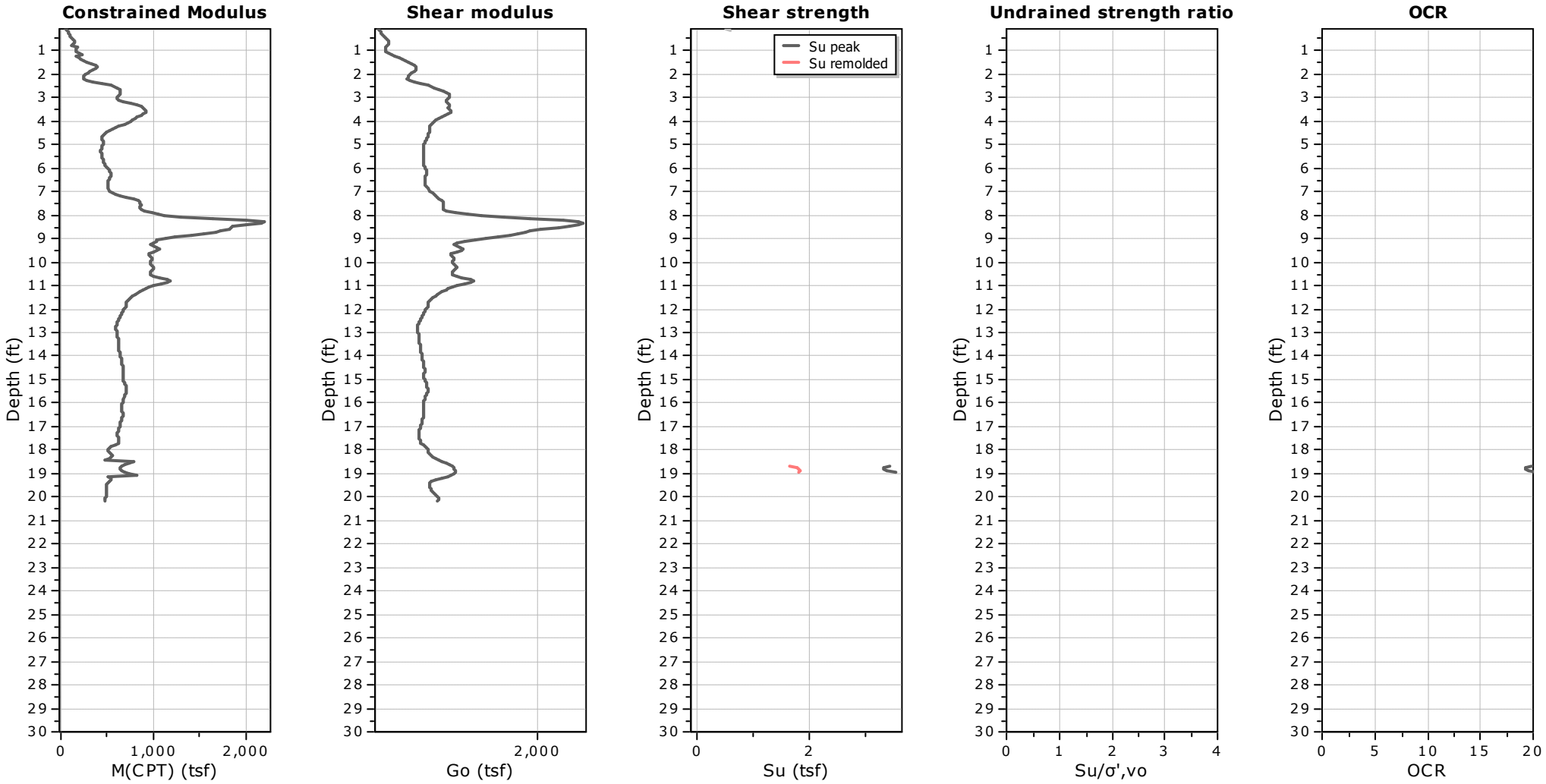
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-40
Total depth: 20.21 ft, Date: 5/16/2024
Surface Elevation: 60.32 ft
Coords: X:572889.77, Y:555695.69
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



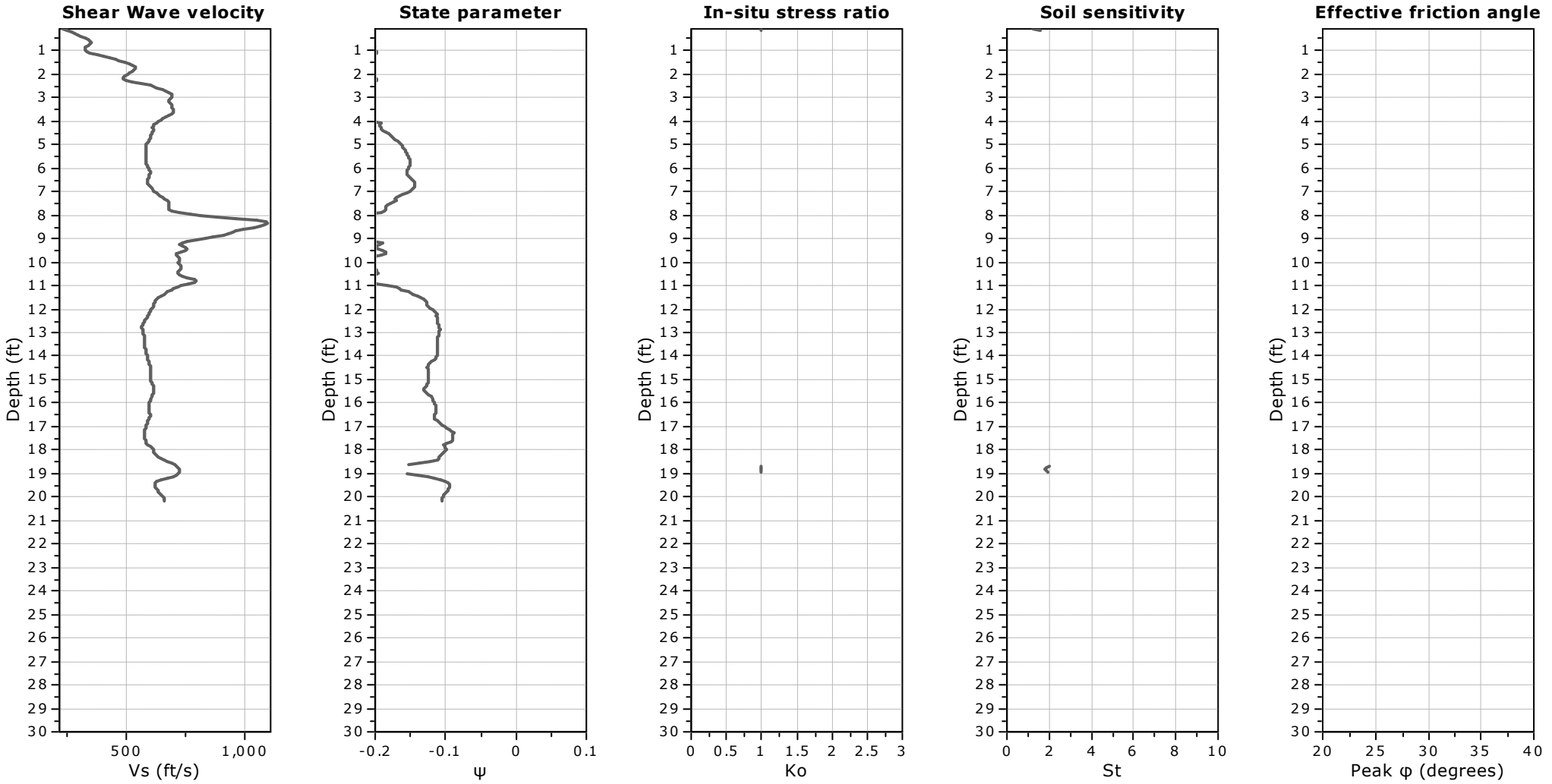
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-40
Total depth: 20.21 ft, Date: 5/16/2024
Surface Elevation: 60.32 ft
Coords: X:572889.77, Y:555695.69
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



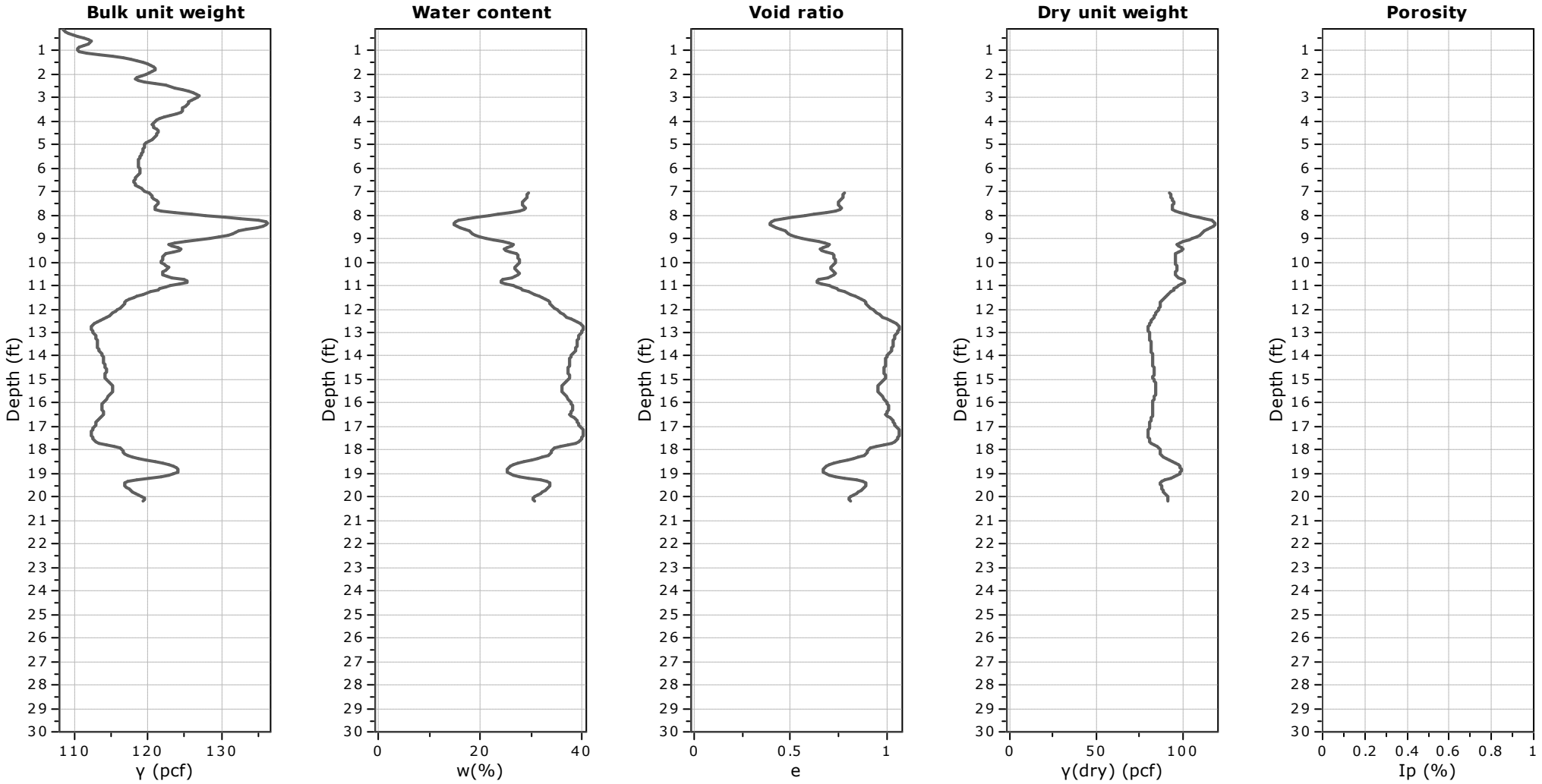
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-40
Total depth: 20.21 ft, Date: 5/16/2024
Surface Elevation: 60.32 ft
Coords: X:572889.77, Y:555695.69
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

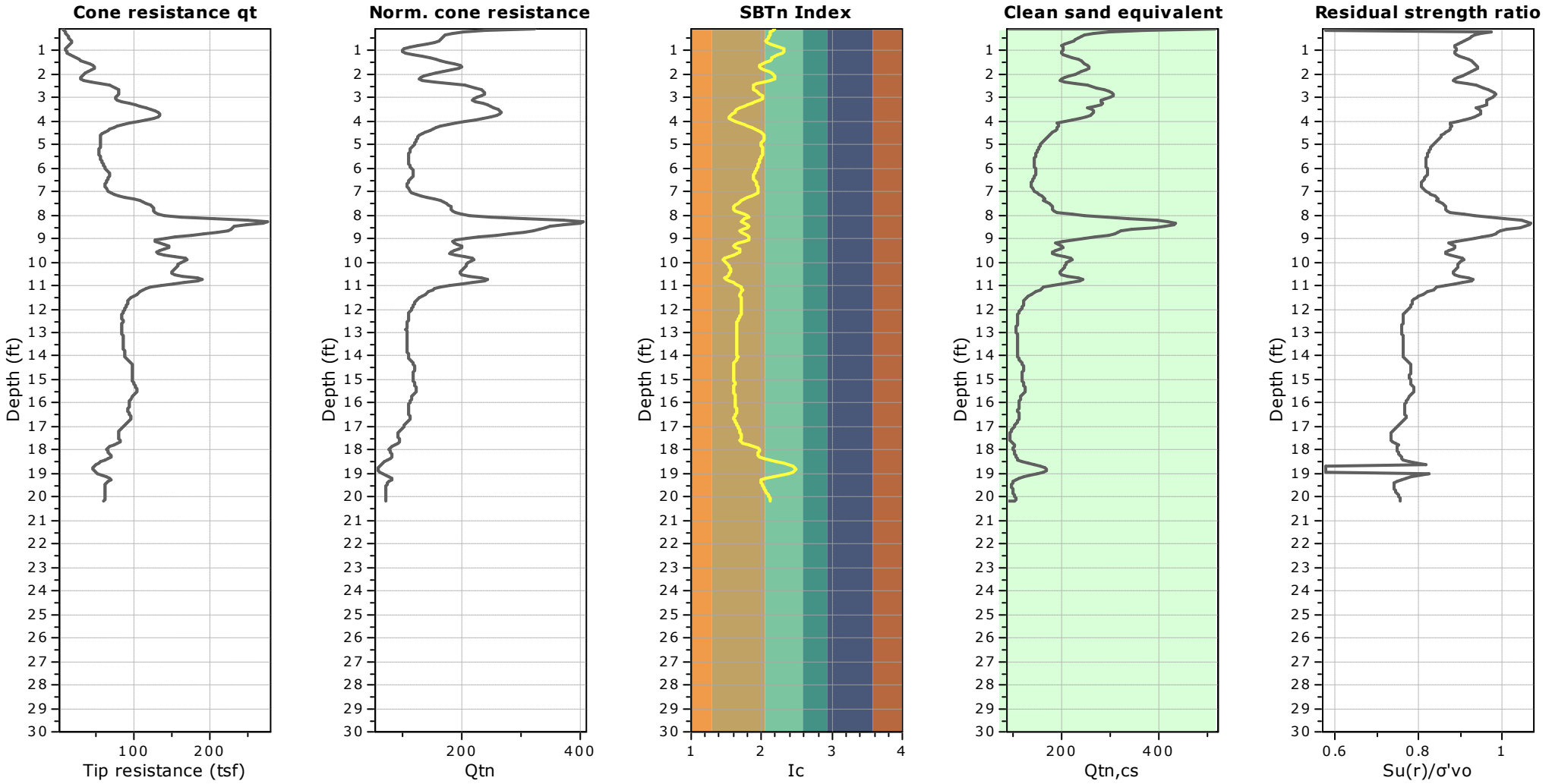
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-40
Total depth: 20.21 ft, Date: 5/16/2024
Surface Elevation: 60.32 ft
Coords: X:572889.77, Y:555695.69
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

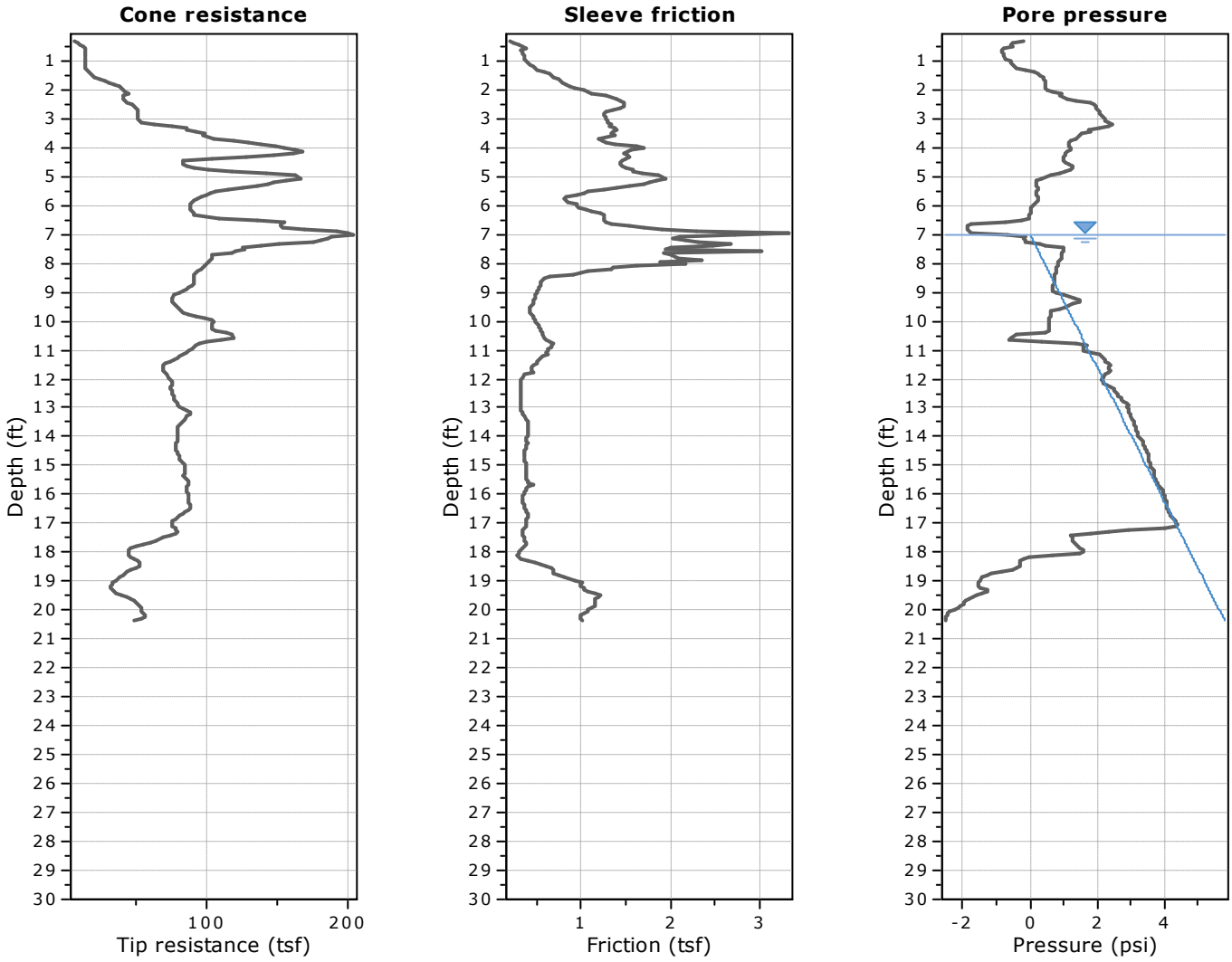
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



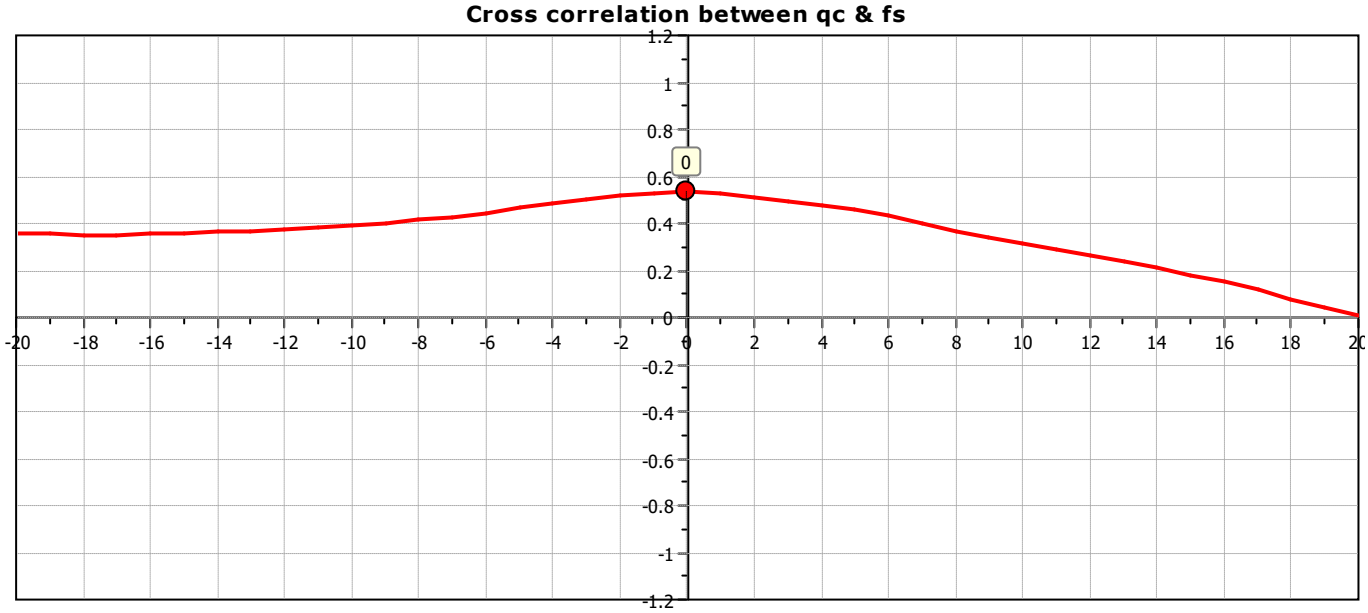
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

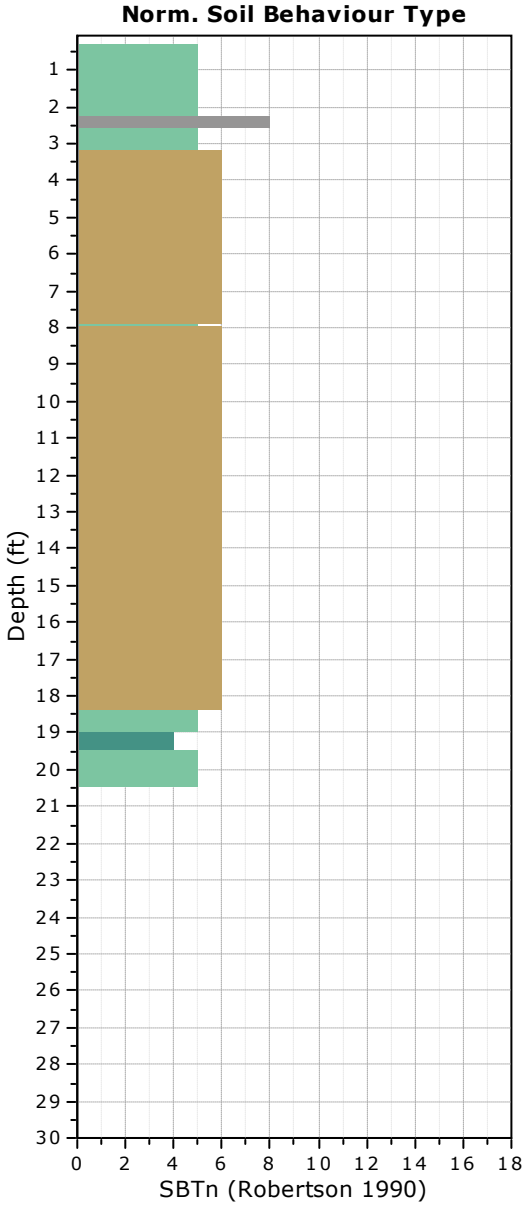
C-41
Total depth: 20.37 ft, Date: 5/16/2024
Surface Elevation: 59.92 ft
Coords: X:572861.31, Y:555611.31
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

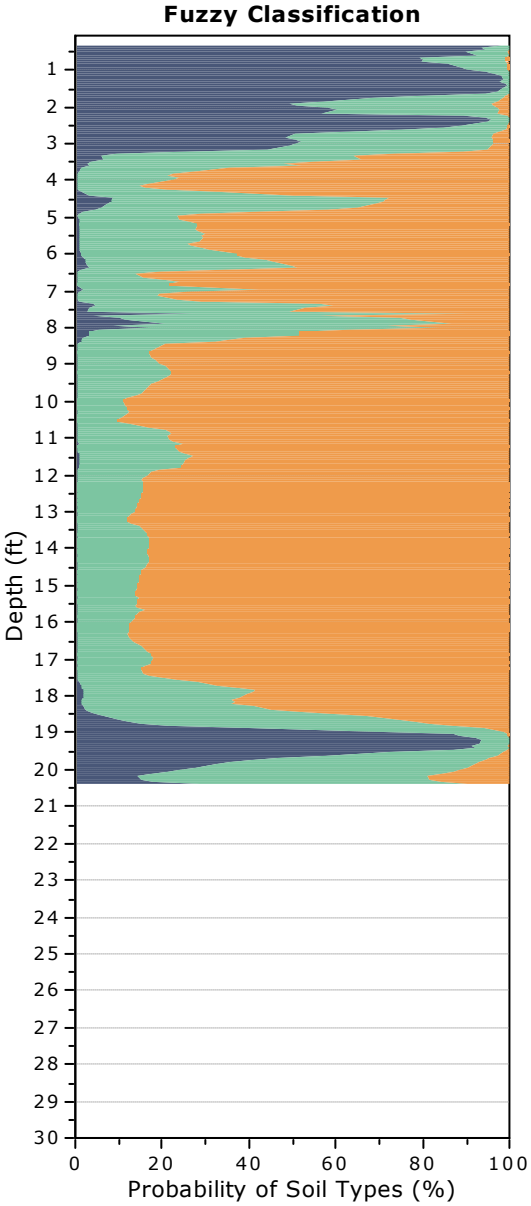
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).





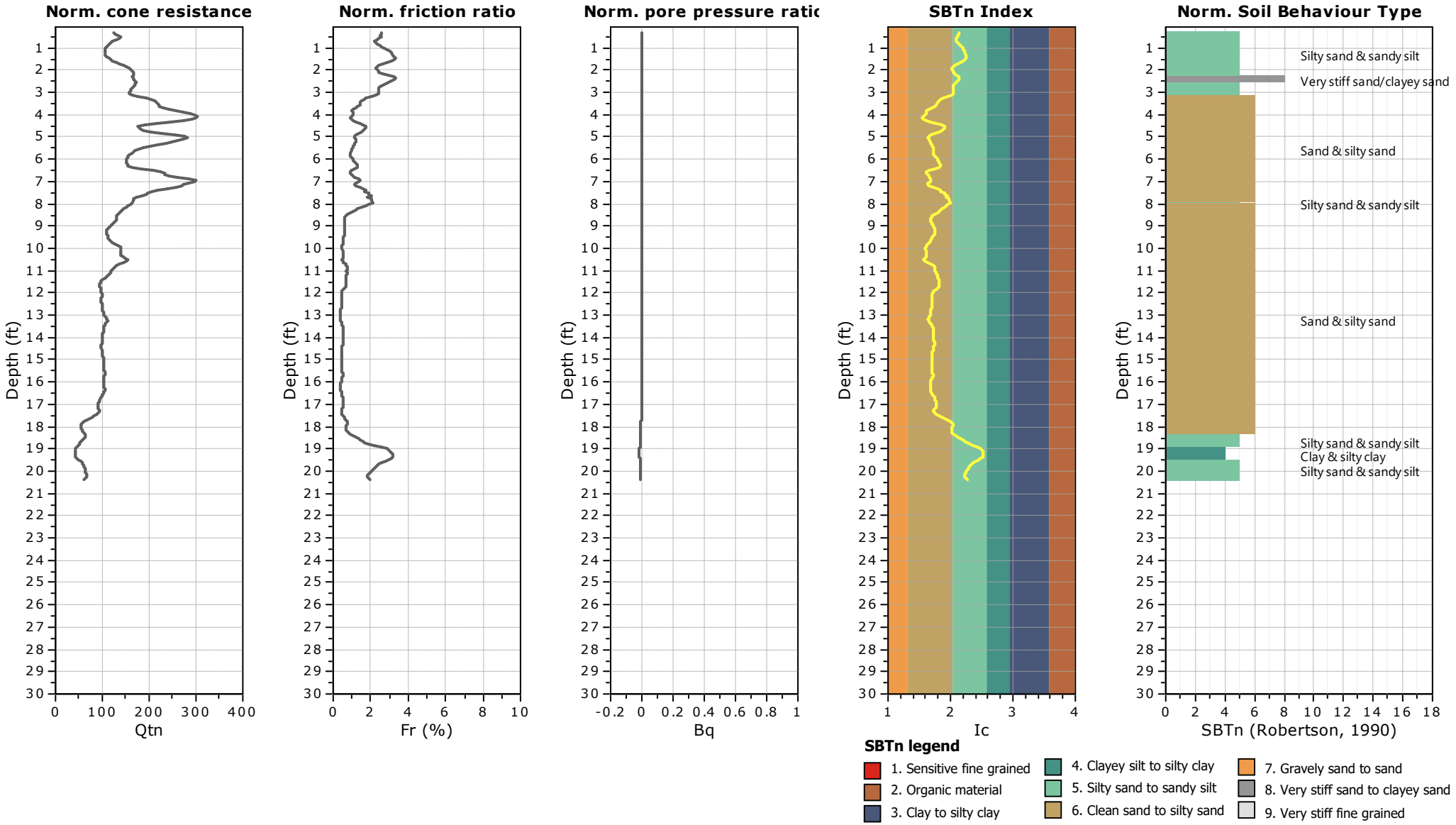


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-41
Total depth: 20.37 ft, Date: 5/16/2024
Surface Elevation: 59.92 ft
Coords: X:572861.31, Y:555611.31
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

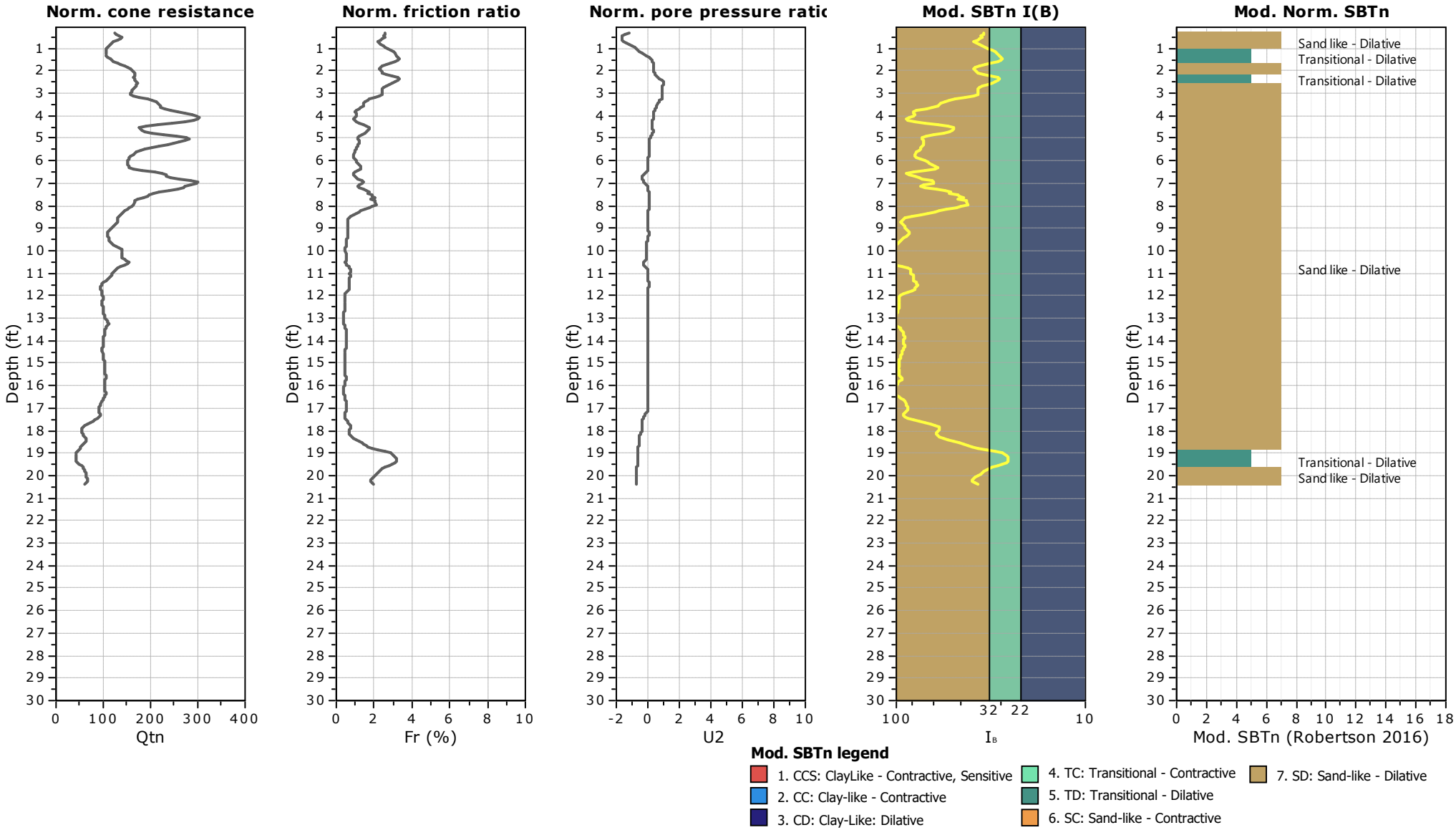
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-41
Total depth: 20.37 ft, Date: 5/16/2024
Surface Elevation: 59.92 ft
Coords: X:572861.31, Y:555611.31
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

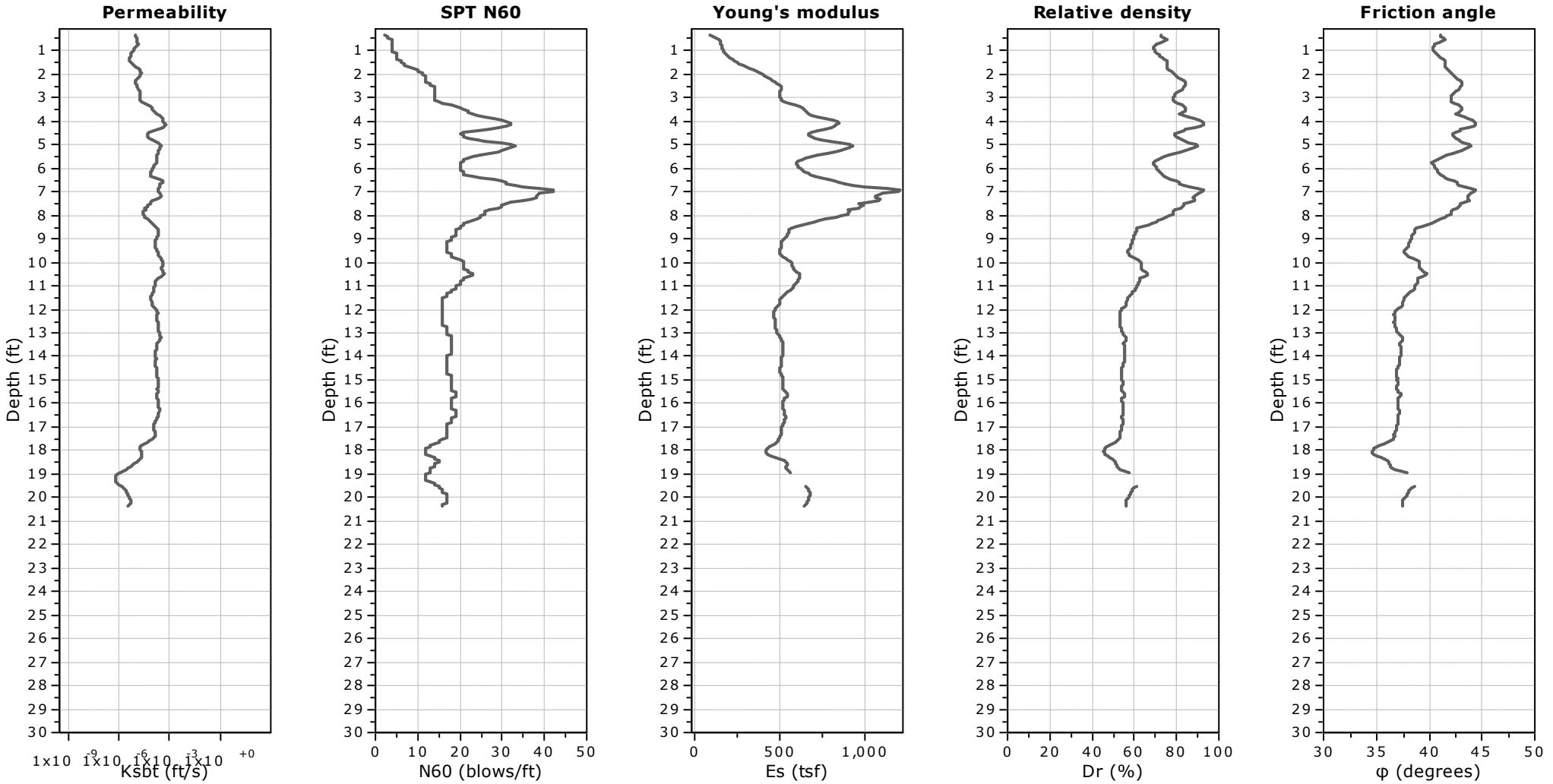
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-41
Total depth: 20.37 ft, Date: 5/16/2024
Surface Elevation: 59.92 ft
Coords: X:572861.31, Y:555611.31
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



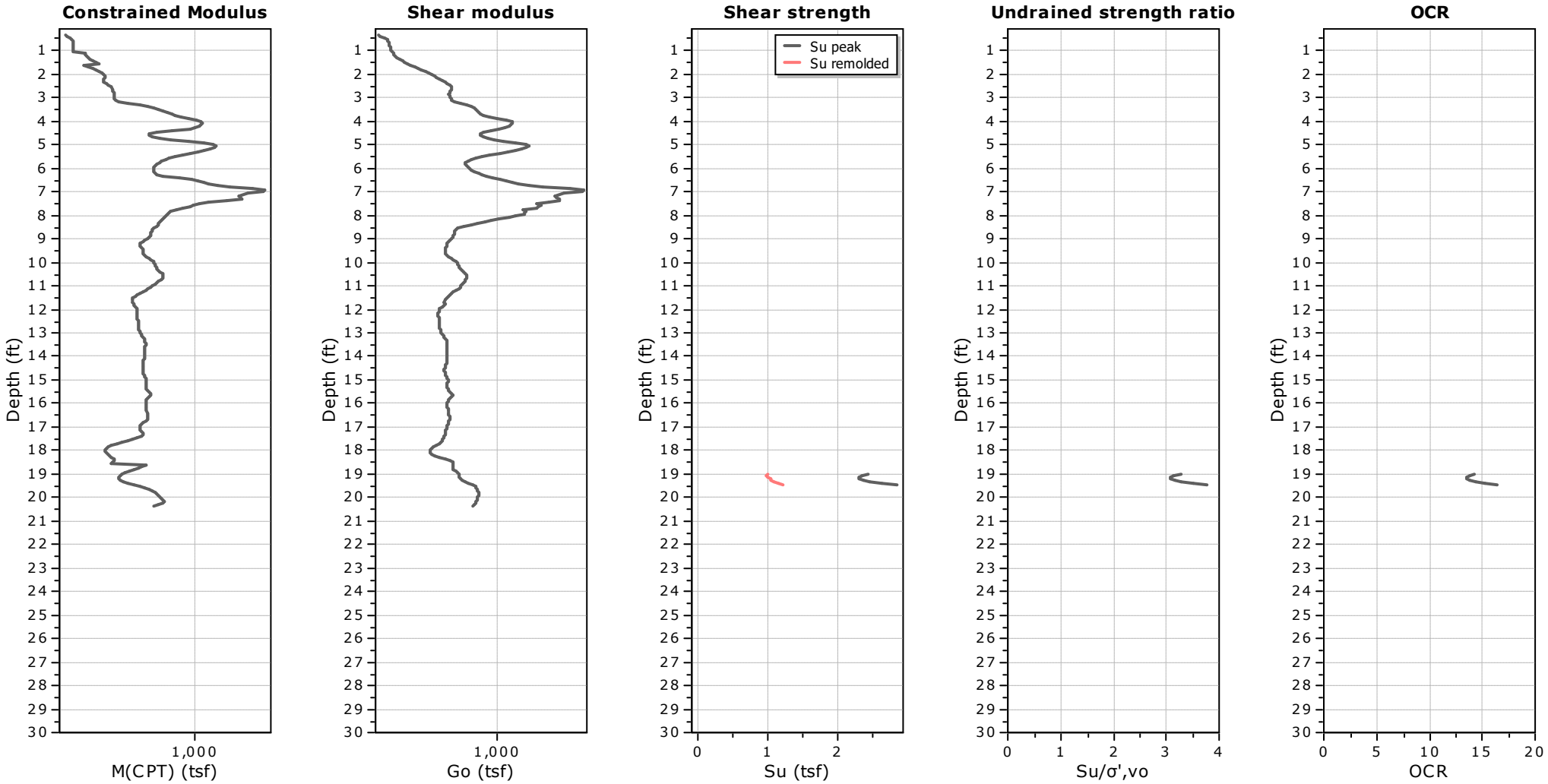
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-41
Total depth: 20.37 ft, Date: 5/16/2024
Surface Elevation: 59.92 ft
Coords: X:572861.31, Y:555611.31
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



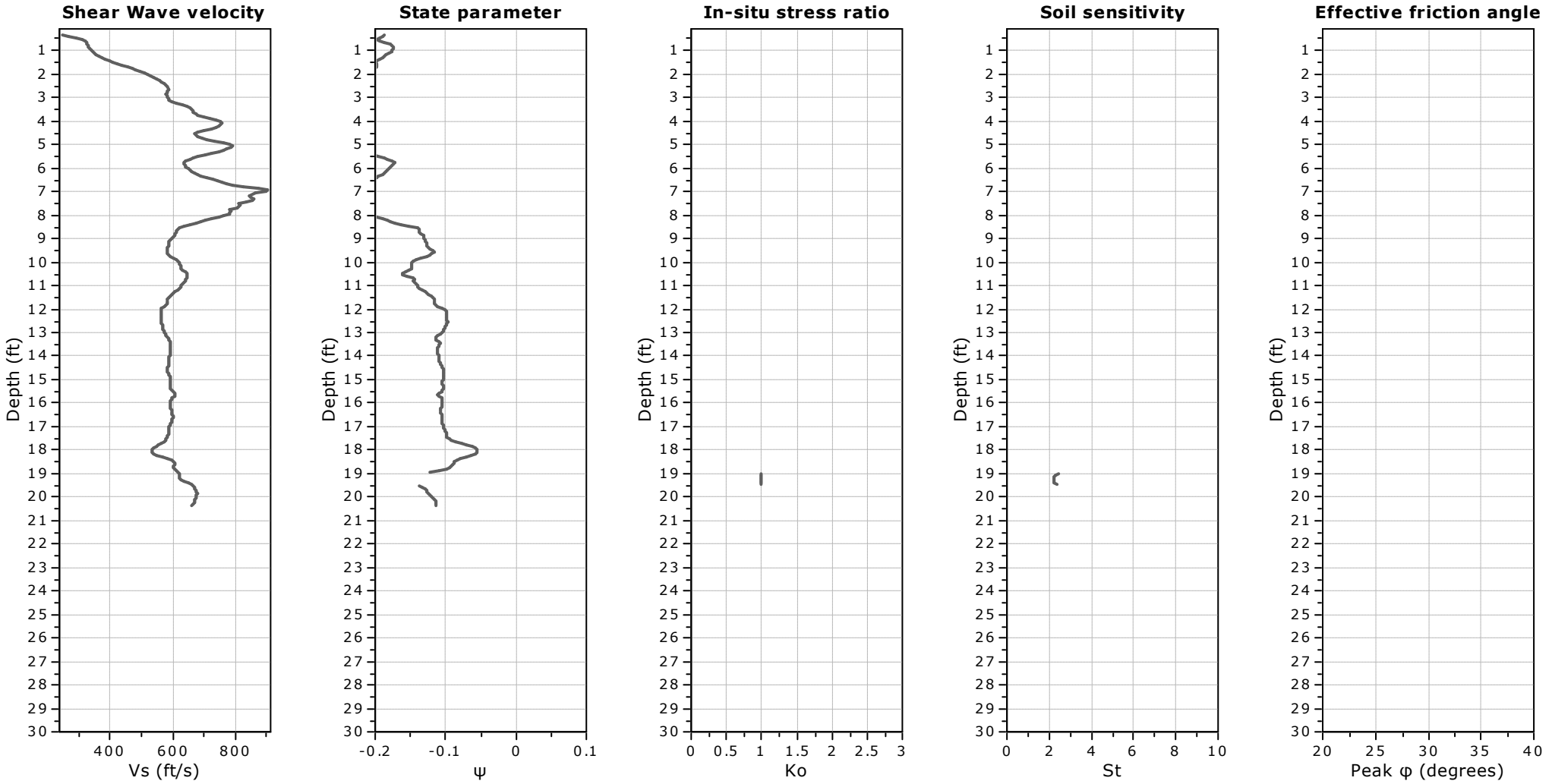
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-41
Total depth: 20.37 ft, Date: 5/16/2024
Surface Elevation: 59.92 ft
Coords: X:572861.31, Y:555611.31
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



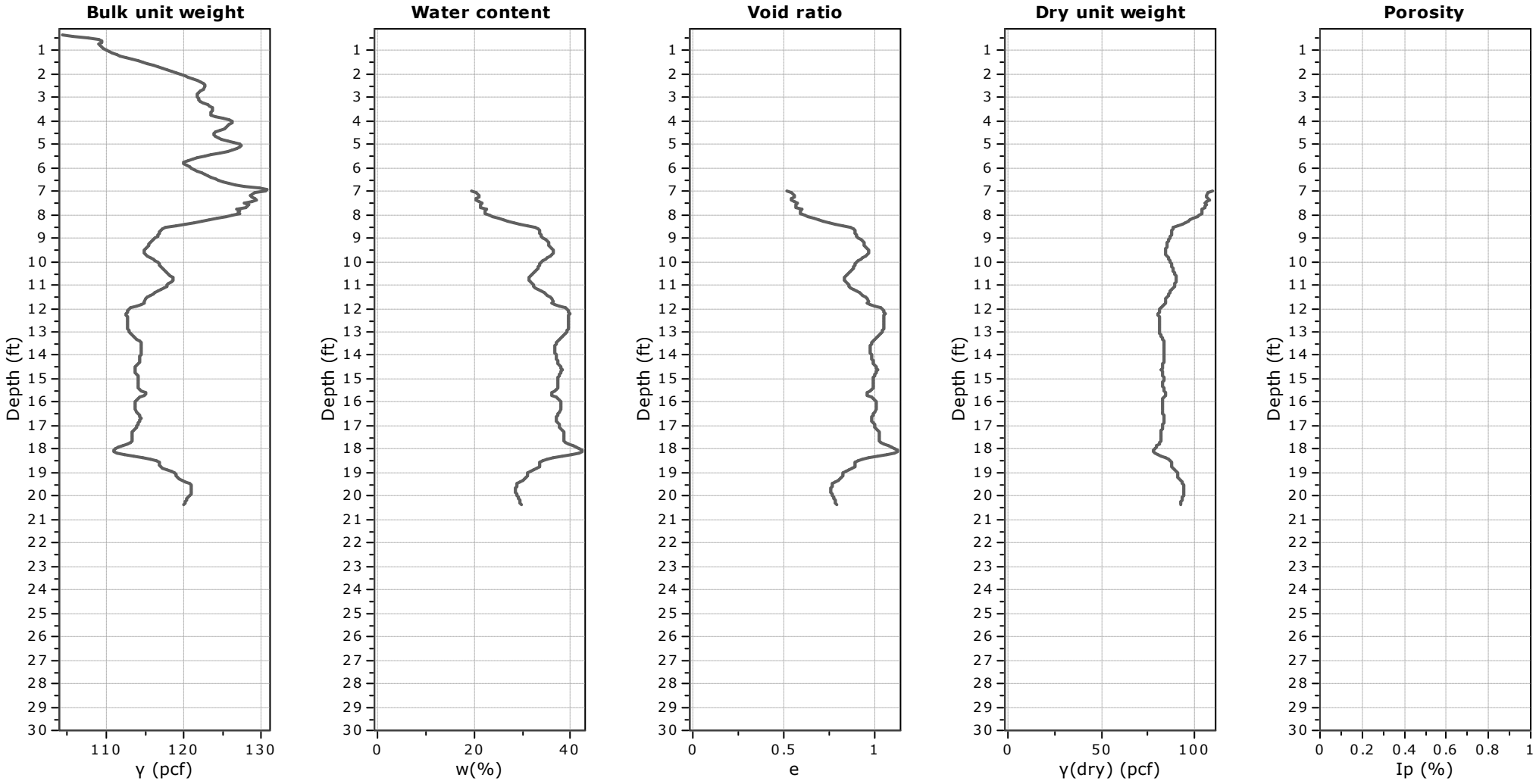
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-41
Total depth: 20.37 ft, Date: 5/16/2024
Surface Elevation: 59.92 ft
Coords: X:572861.31, Y:555611.31
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

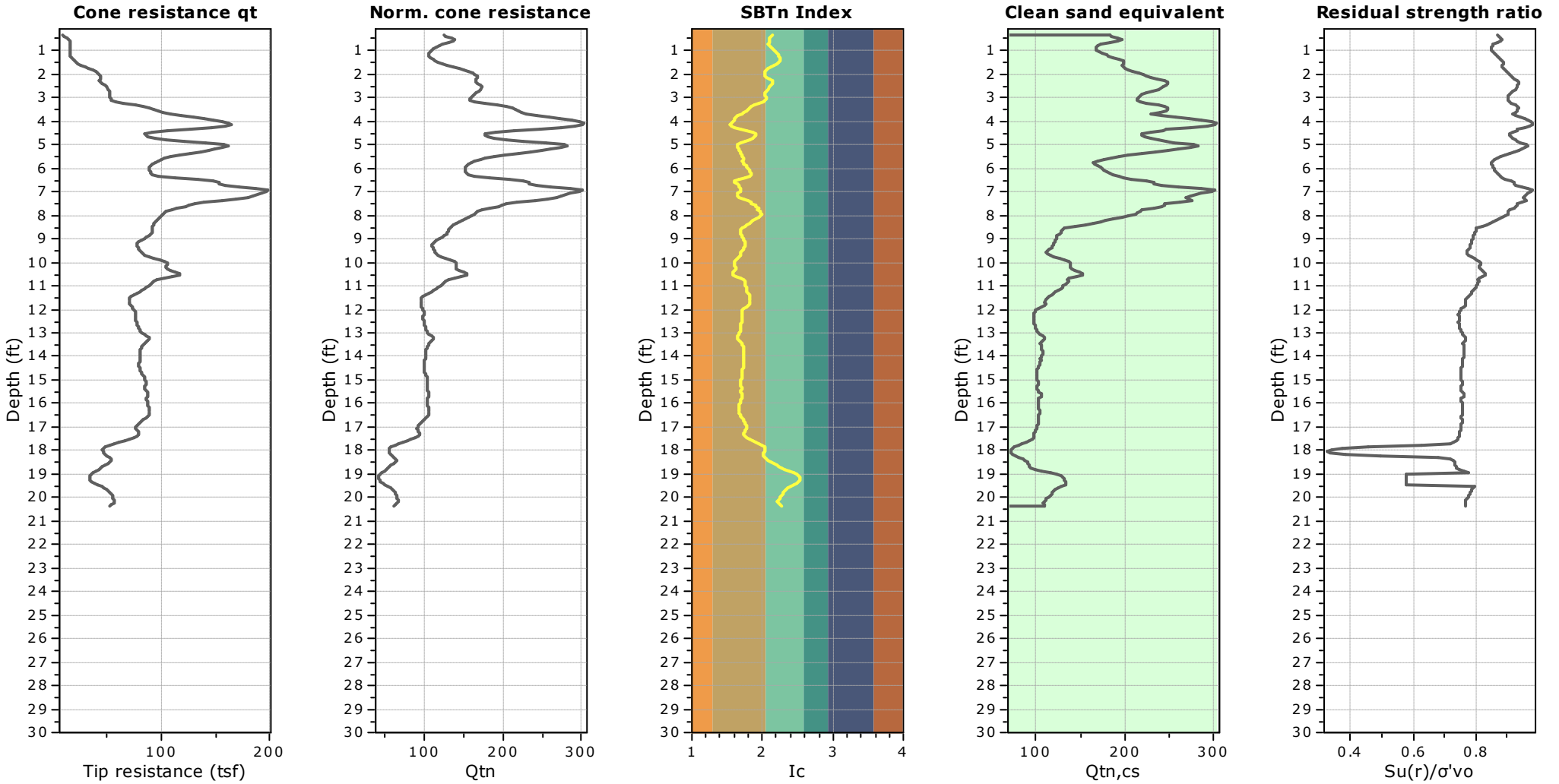
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-41
Total depth: 20.37 ft, Date: 5/16/2024
Surface Elevation: 59.92 ft
Coords: X:572861.31, Y:555611.31
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

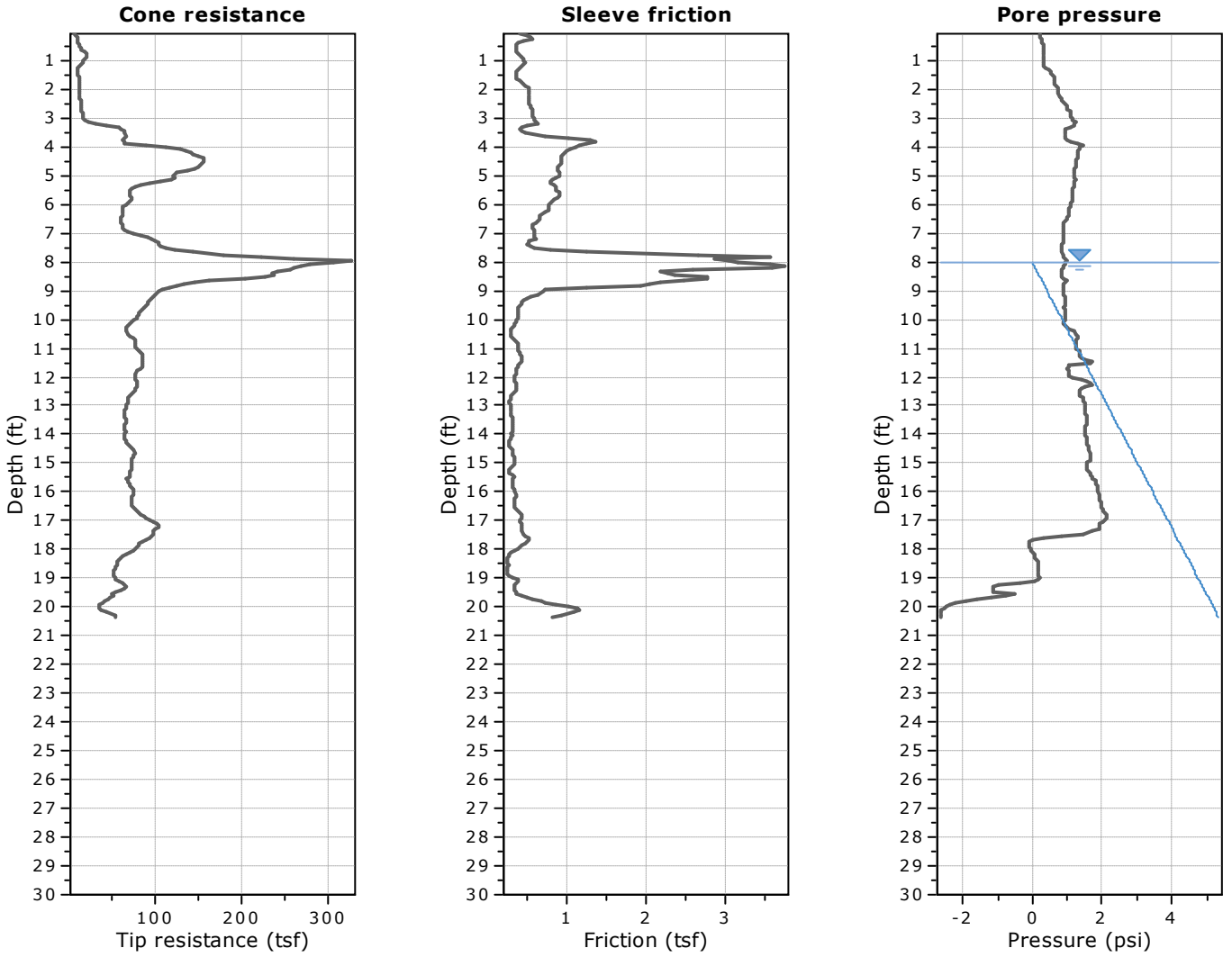
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



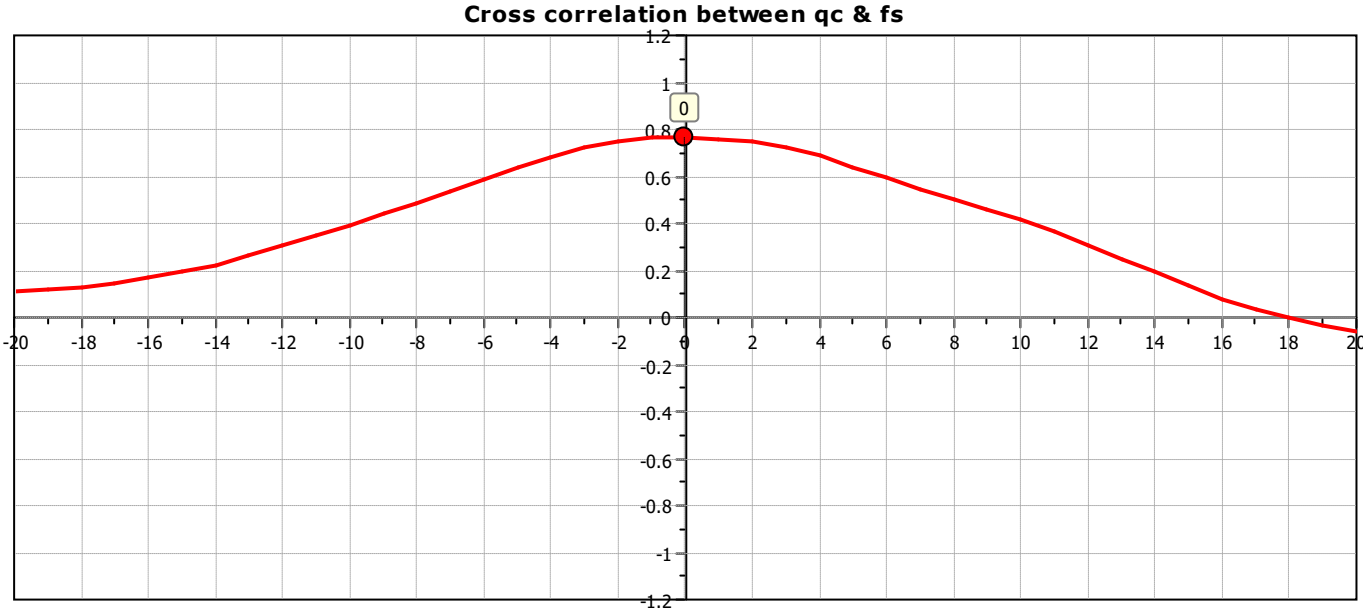
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

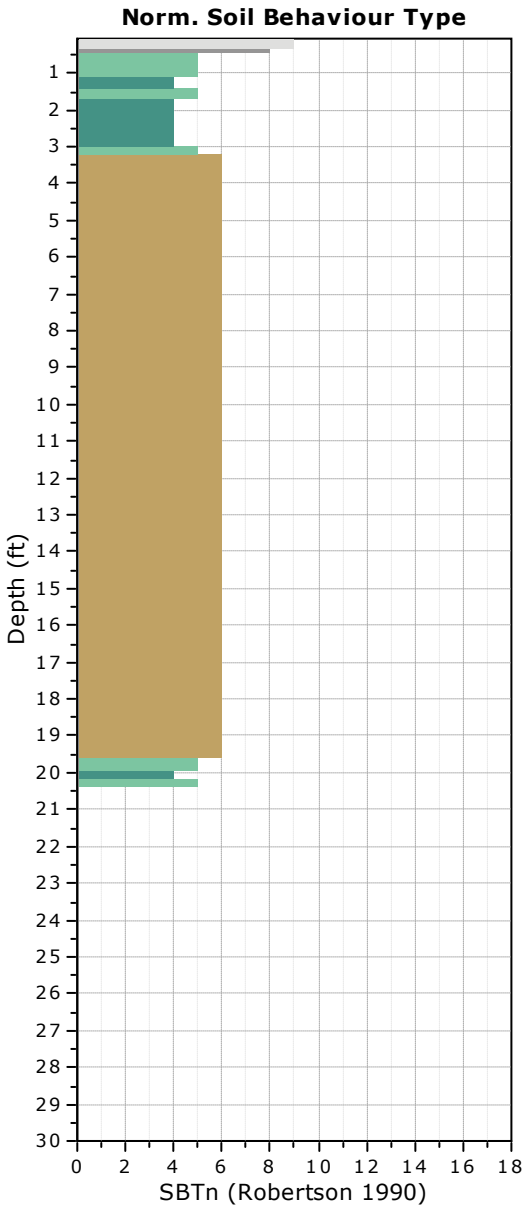
C-42
Total depth: 20.33 ft, Date: 5/16/2024
Surface Elevation: 62.07 ft
Coords: X:572681.78, Y:555540.97
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

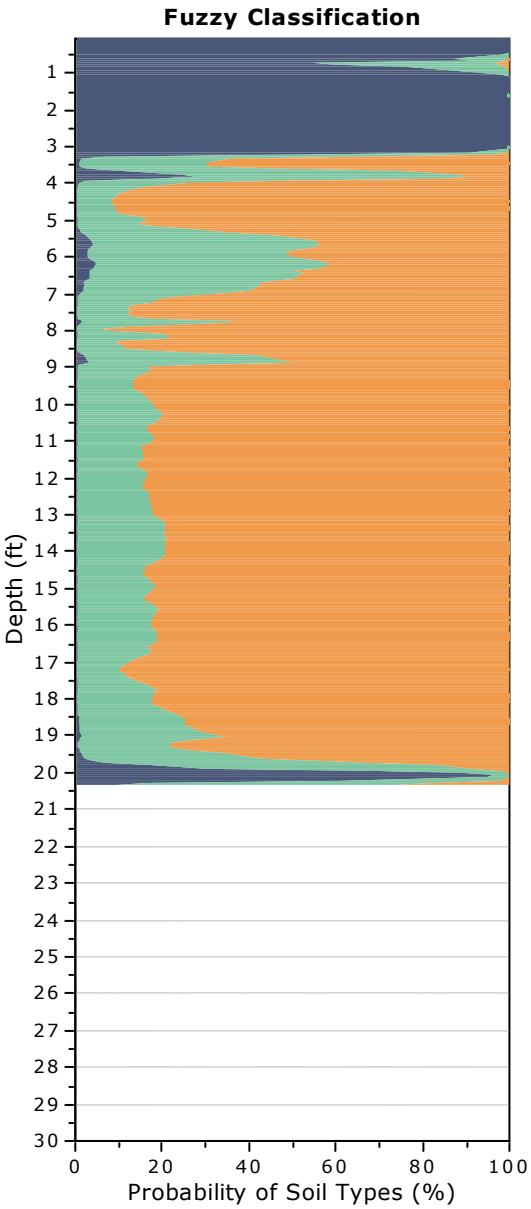
Project: ASD Summit Campus
Location: Middletown, Delaware



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







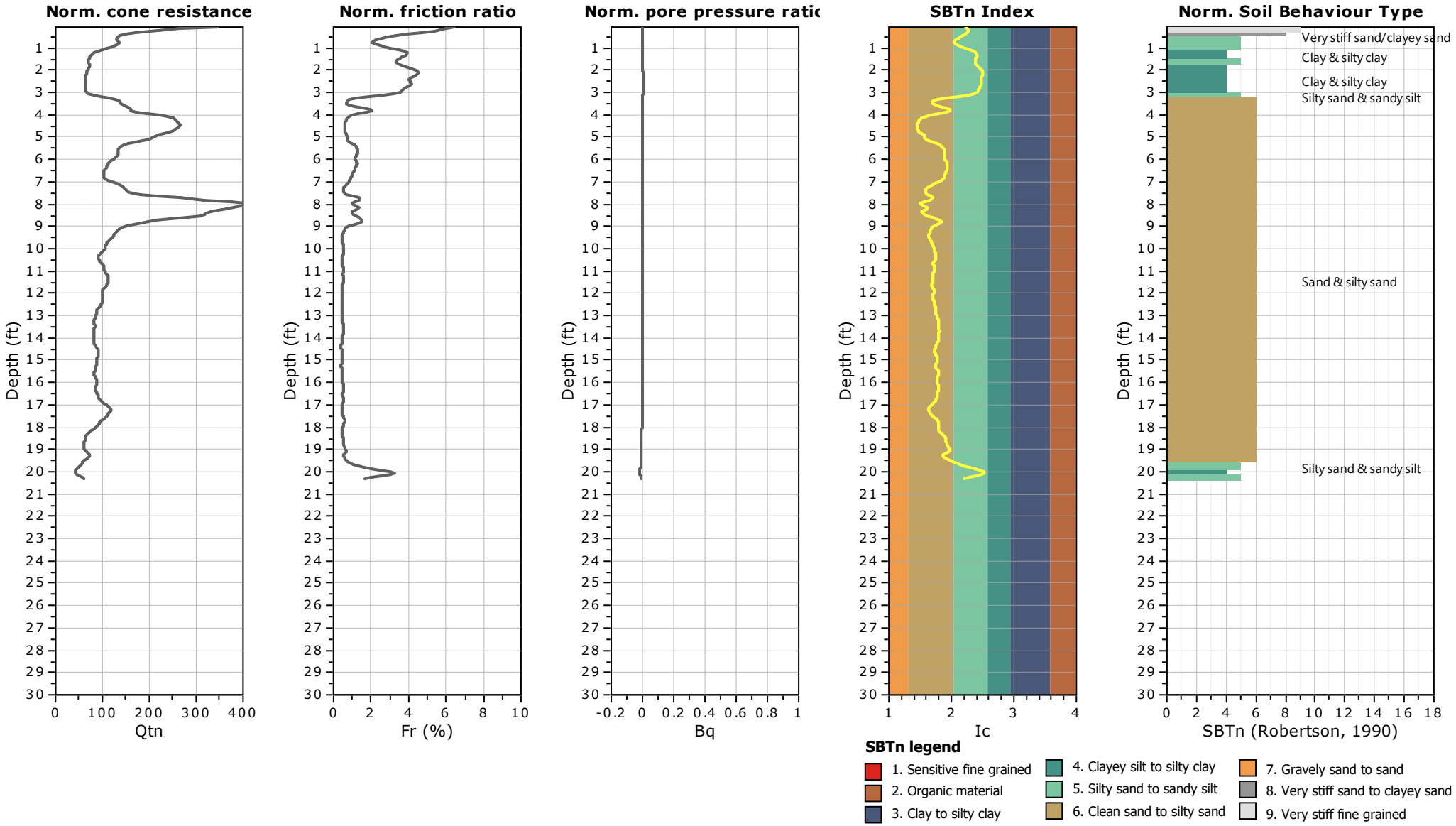
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-42
Total depth: 20.33 ft, Date: 5/16/2024
Surface Elevation: 62.07 ft
Coords: X:572681.78, Y:555540.97
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

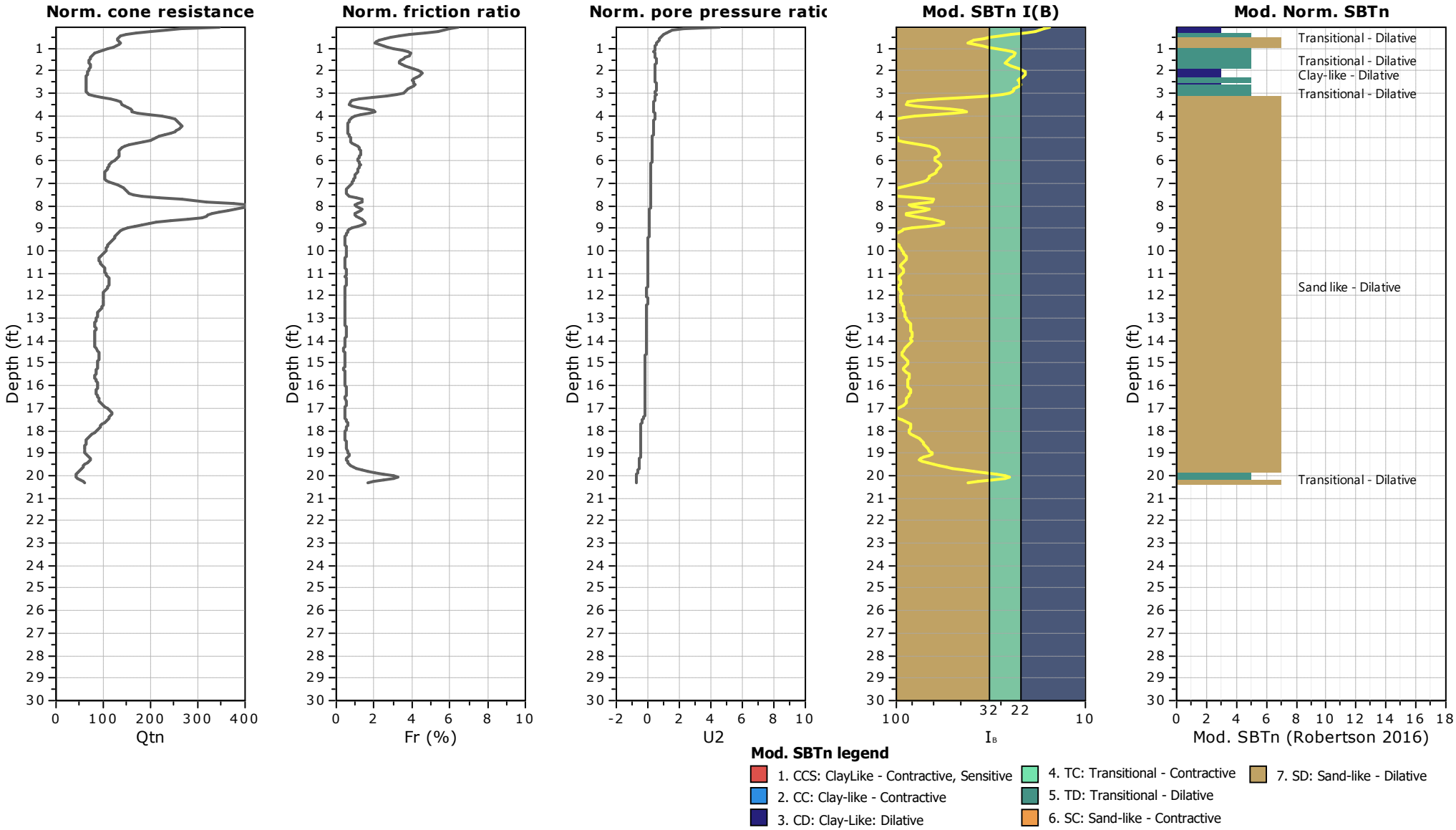
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-42
Total depth: 20.33 ft, Date: 5/16/2024
Surface Elevation: 62.07 ft
Coords: X:572681.78, Y:555540.97
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

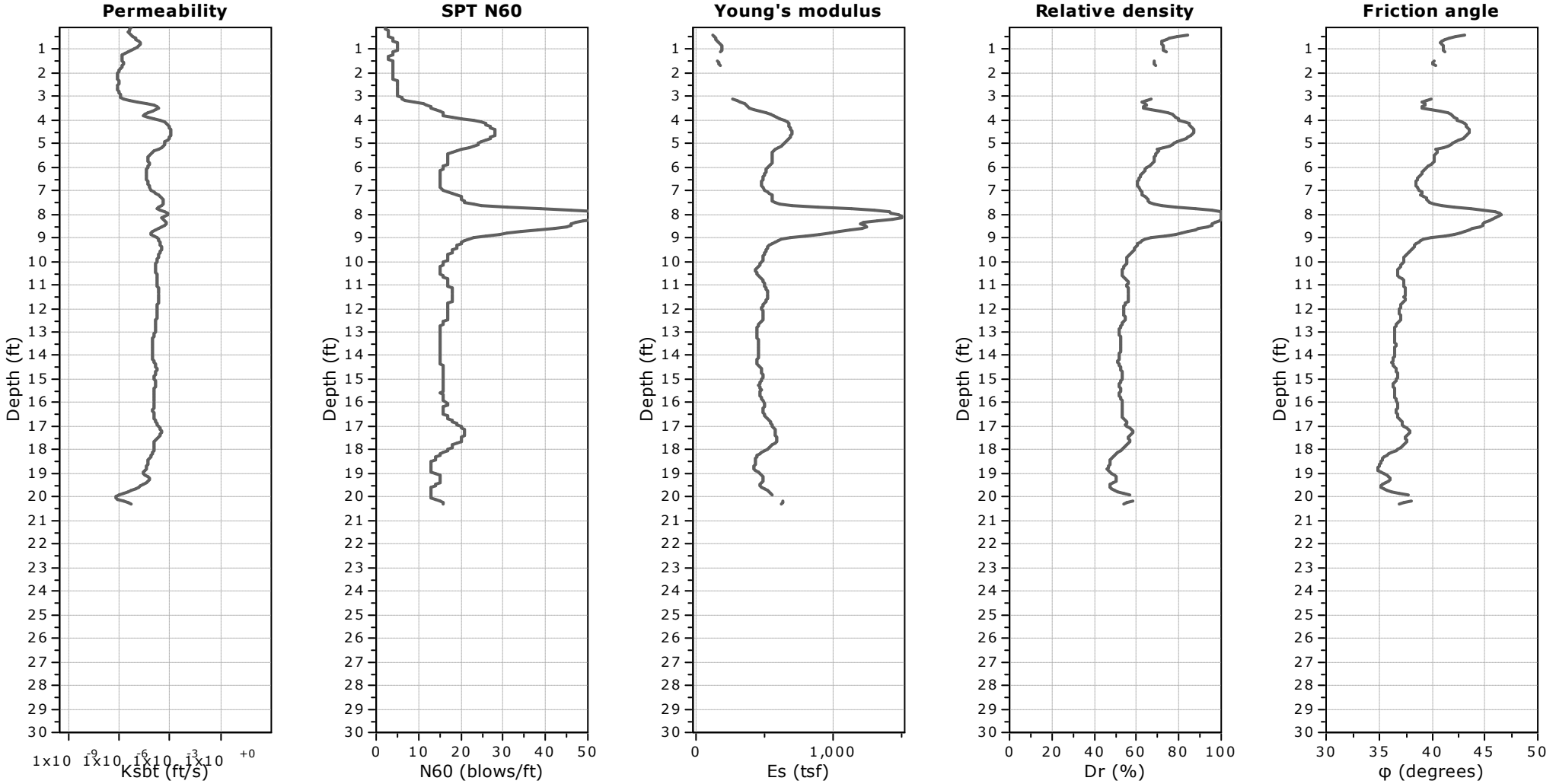
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-42
Total depth: 20.33 ft, Date: 5/16/2024
Surface Elevation: 62.07 ft
Coords: X:572681.78, Y:555540.97
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



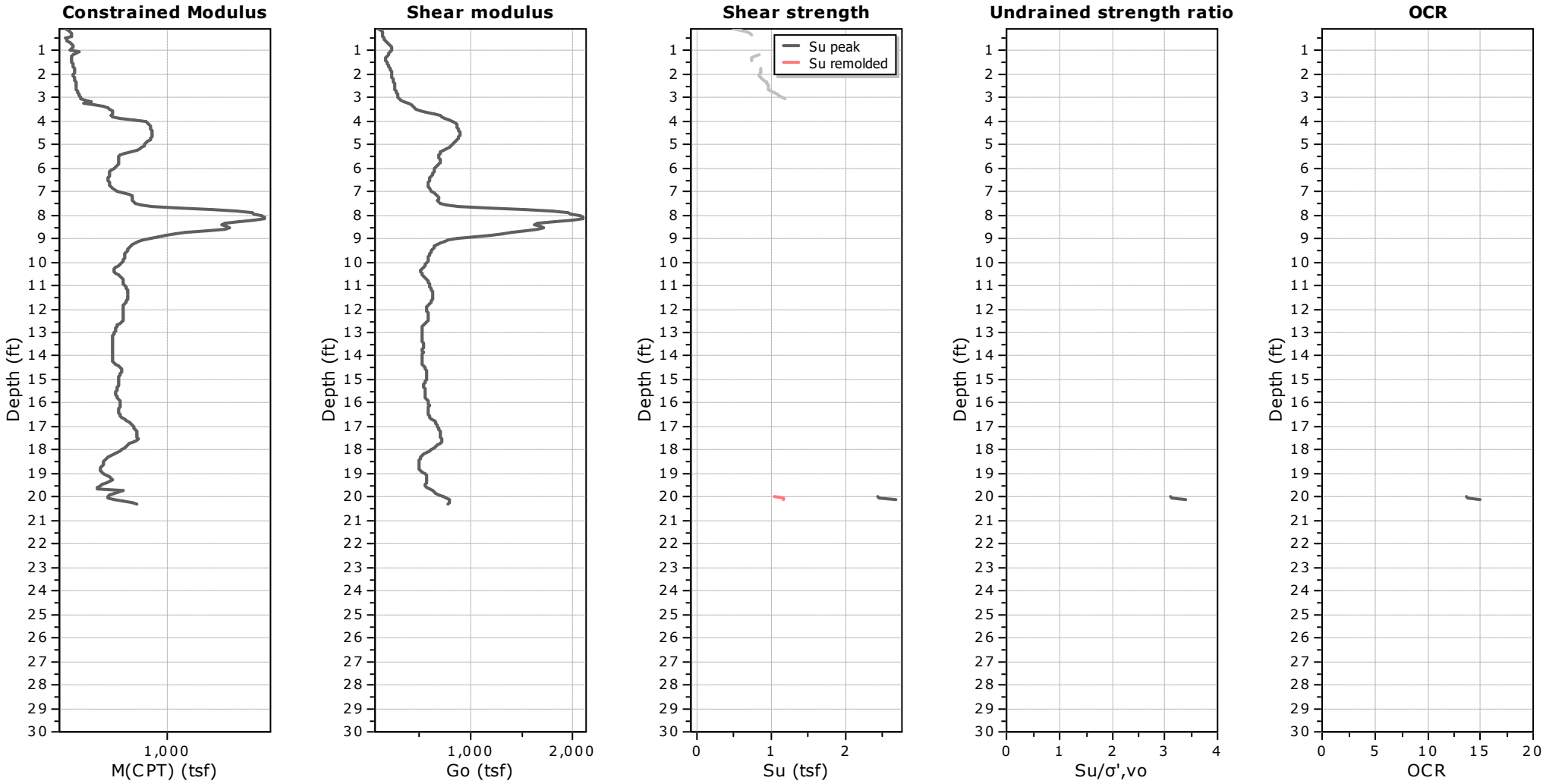
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-42
Total depth: 20.33 ft, Date: 5/16/2024
Surface Elevation: 62.07 ft
Coords: X:572681.78, Y:555540.97
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



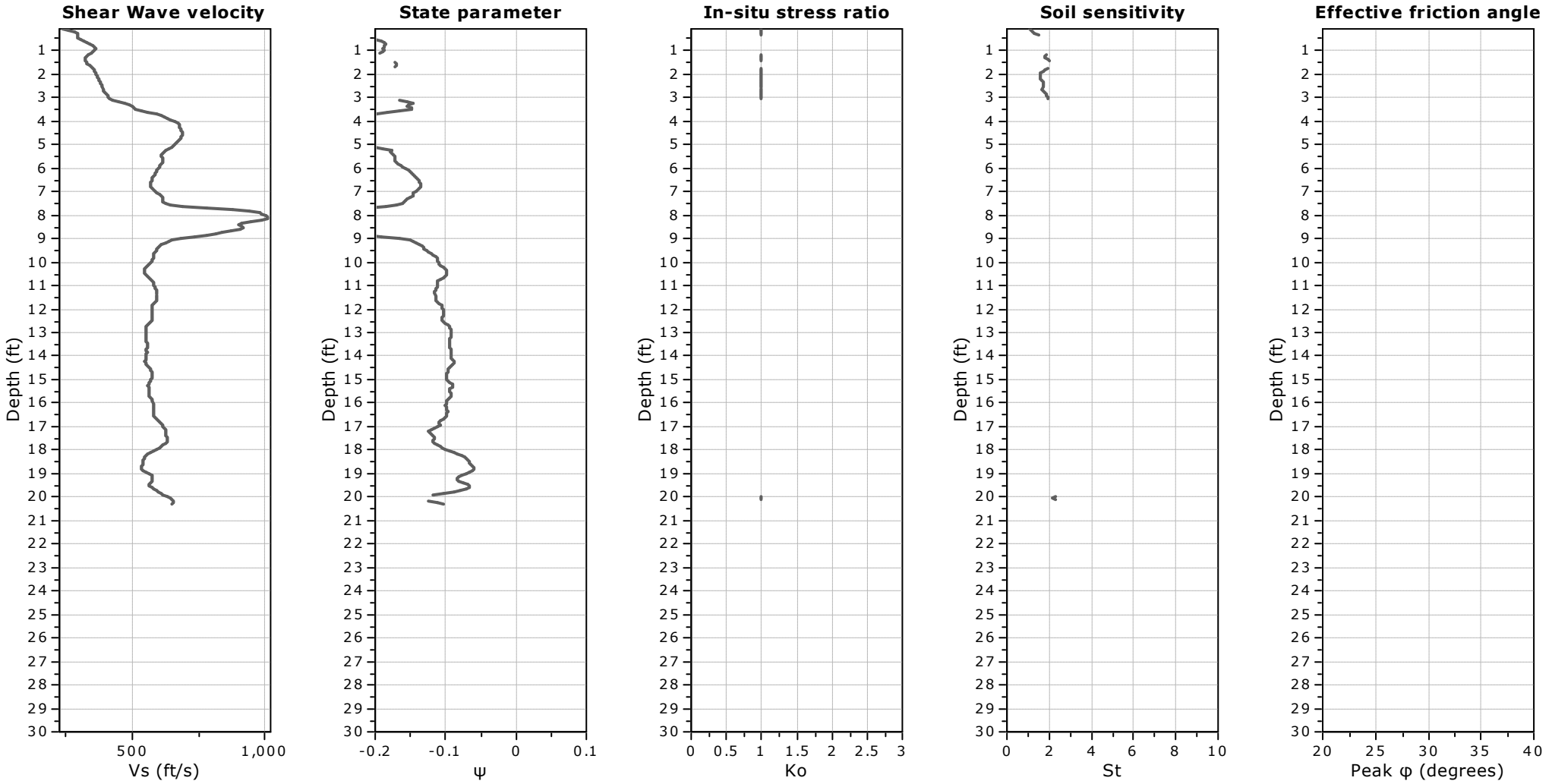
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-42
Total depth: 20.33 ft, Date: 5/16/2024
Surface Elevation: 62.07 ft
Coords: X:572681.78, Y:555540.97
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



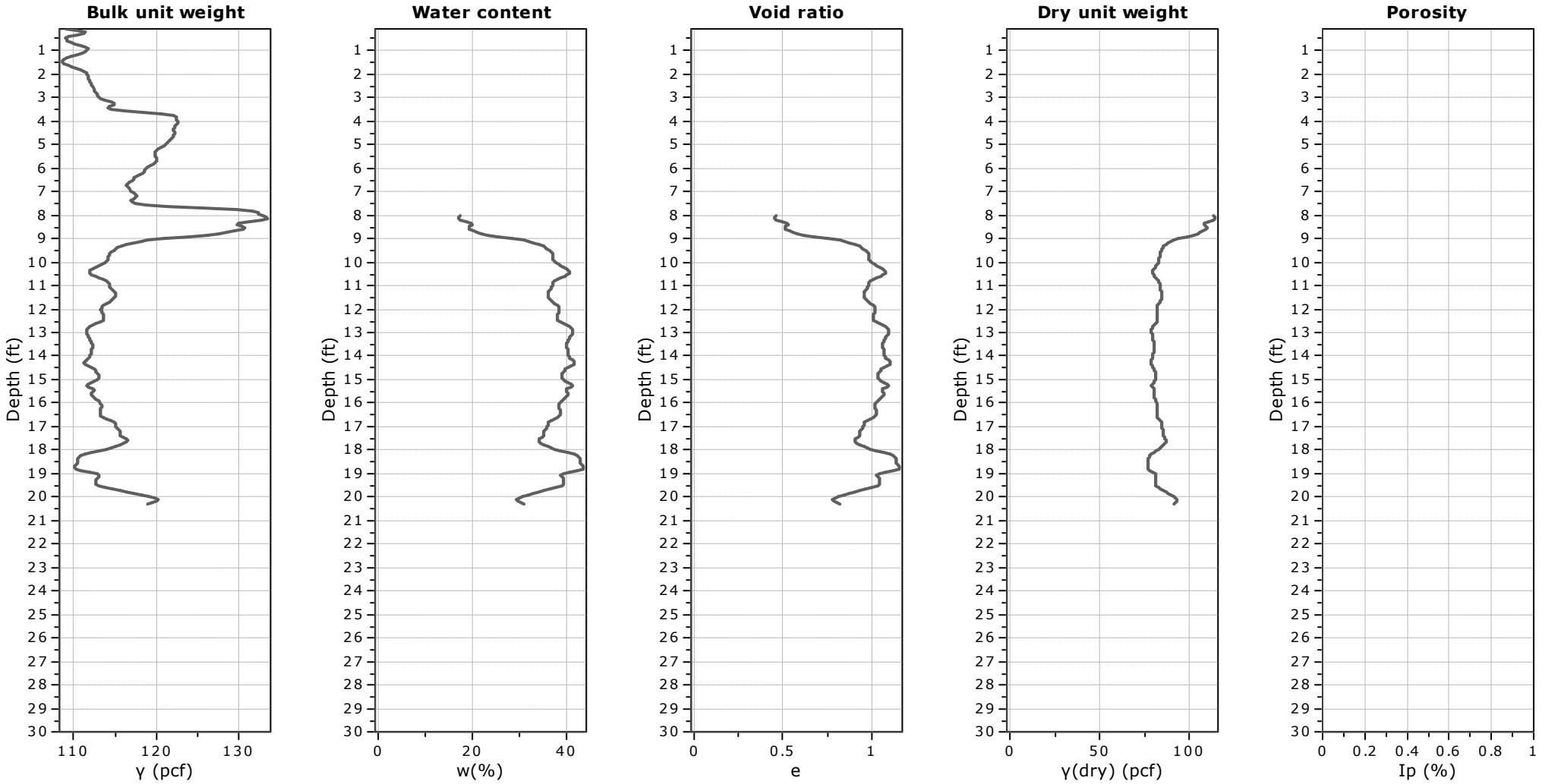
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-42
Total depth: 20.33 ft, Date: 5/16/2024
Surface Elevation: 62.07 ft
Coords: X:572681.78, Y:555540.97
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

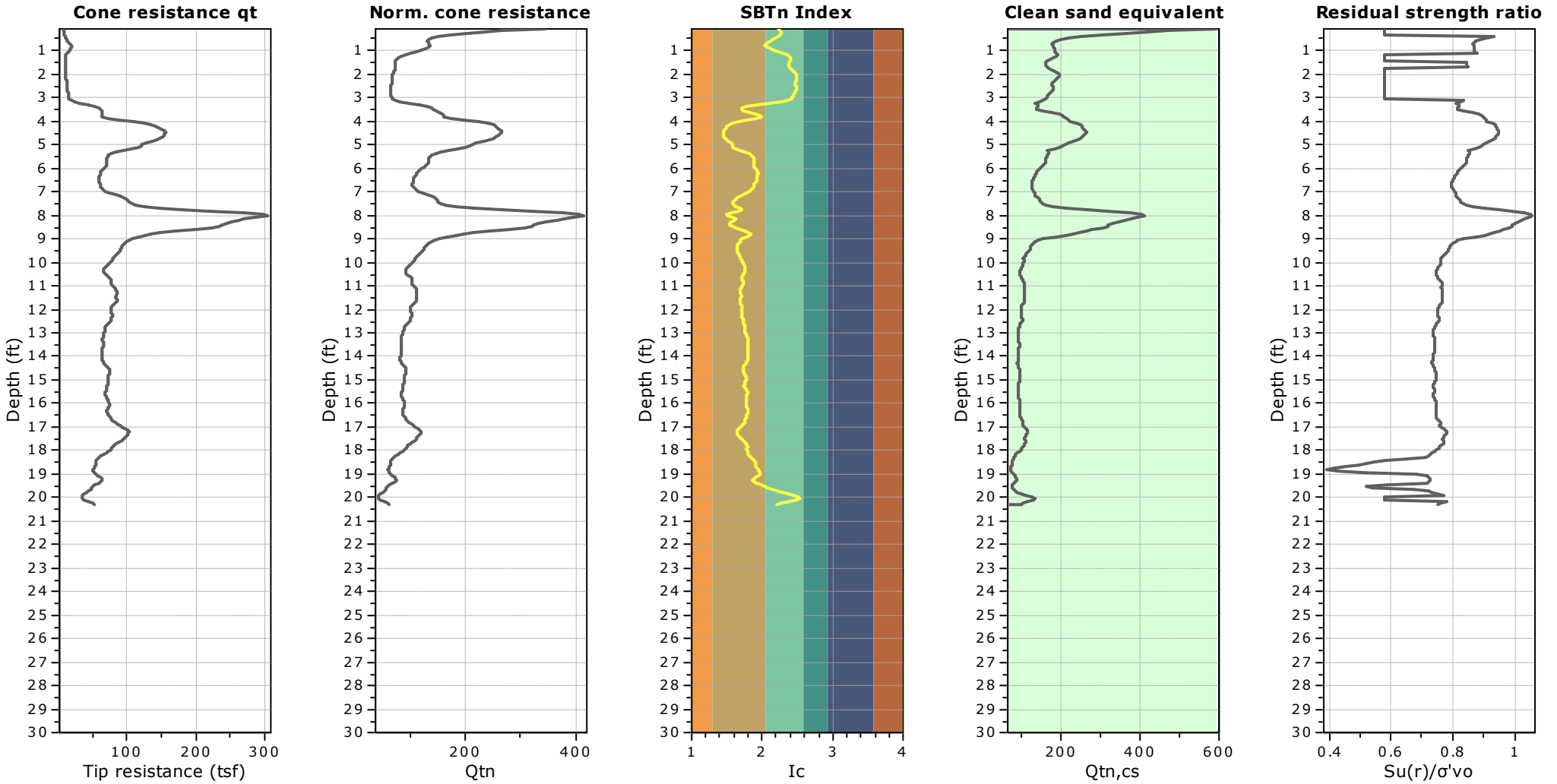
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-42
Total depth: 20.33 ft, Date: 5/16/2024
Surface Elevation: 62.07 ft
Coords: X:572681.78, Y:555540.97
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

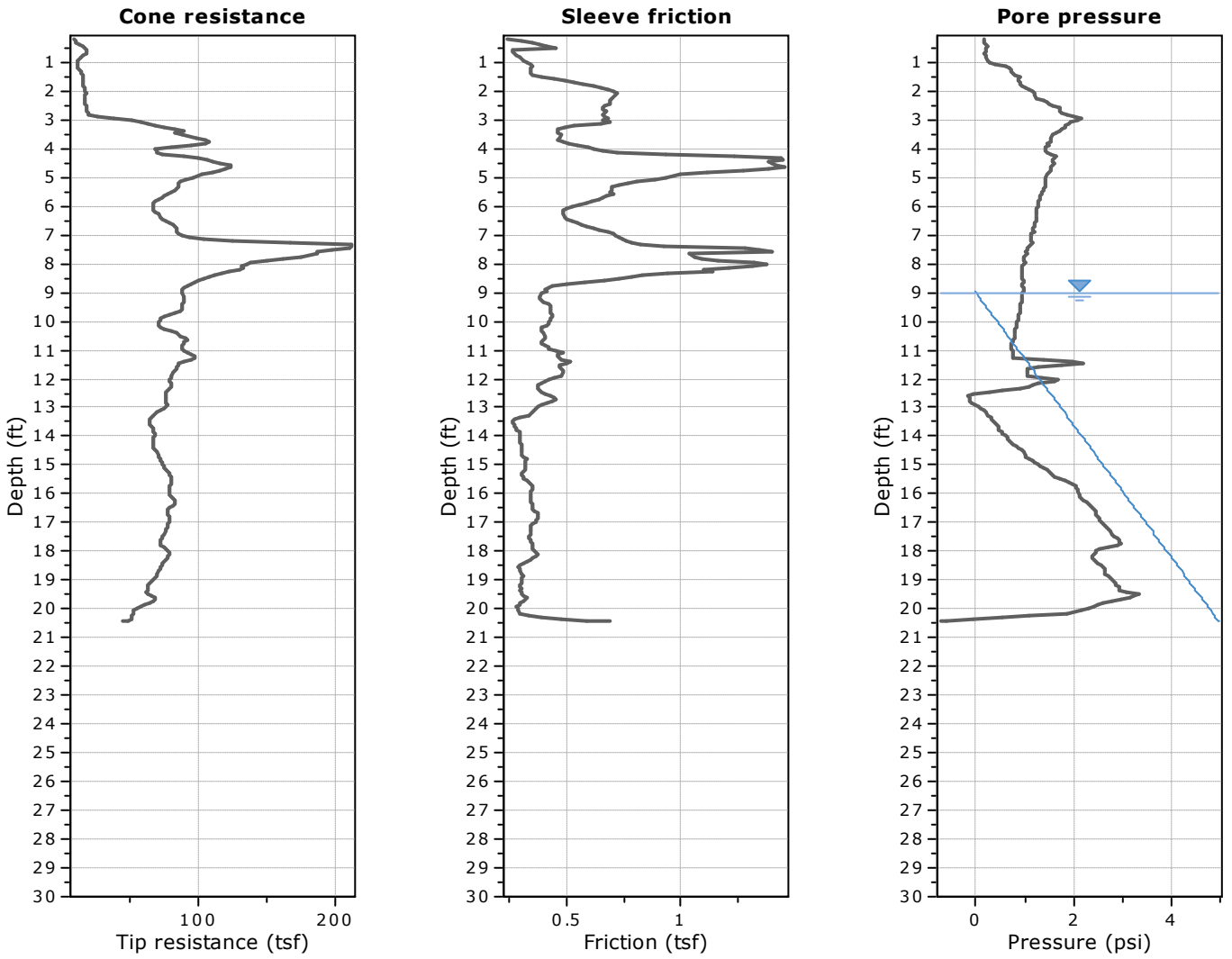
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



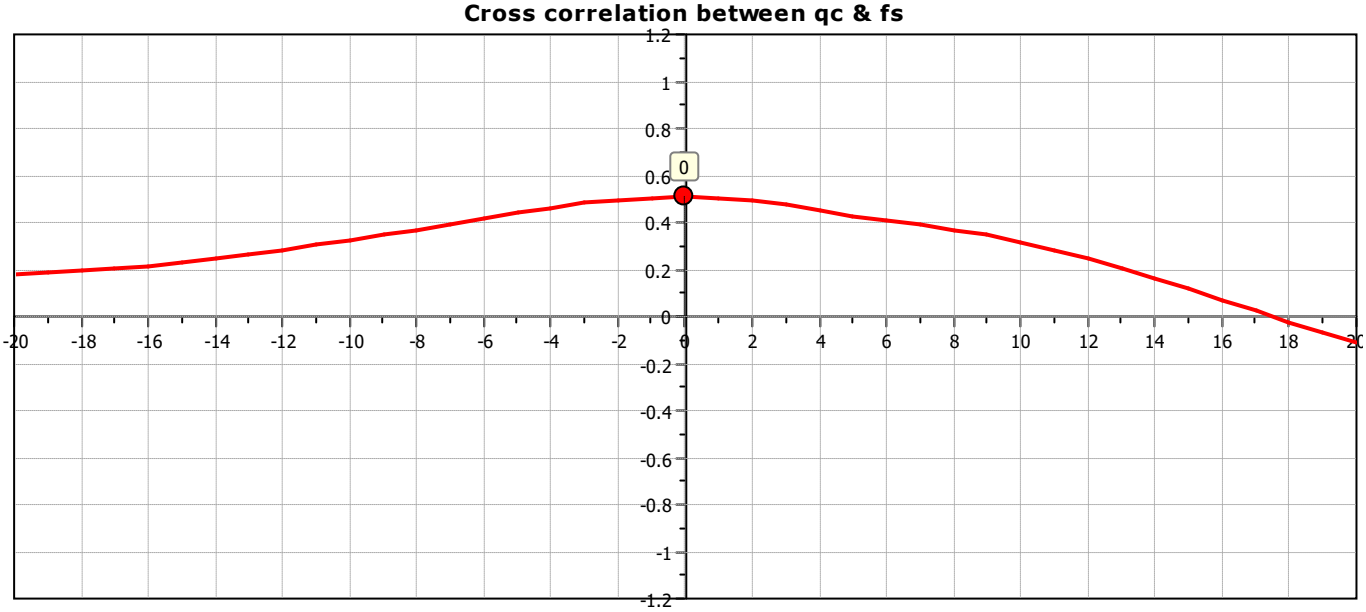
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

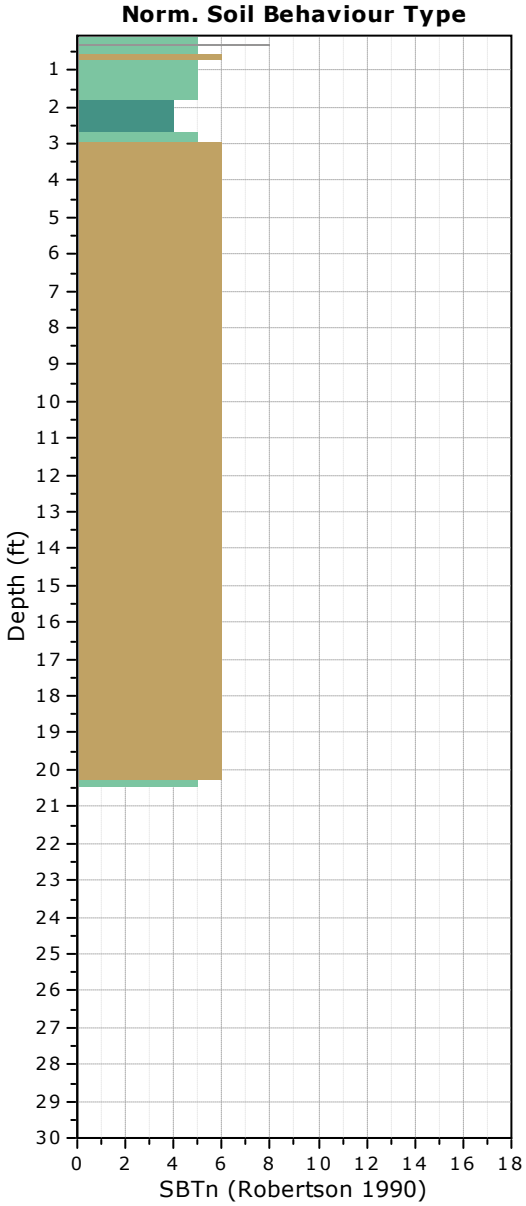
C-43
Total depth: 20.41 ft, Date: 5/16/2024
Surface Elevation: 61.49 ft
Coords: X:572843.89, Y:555527.60
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

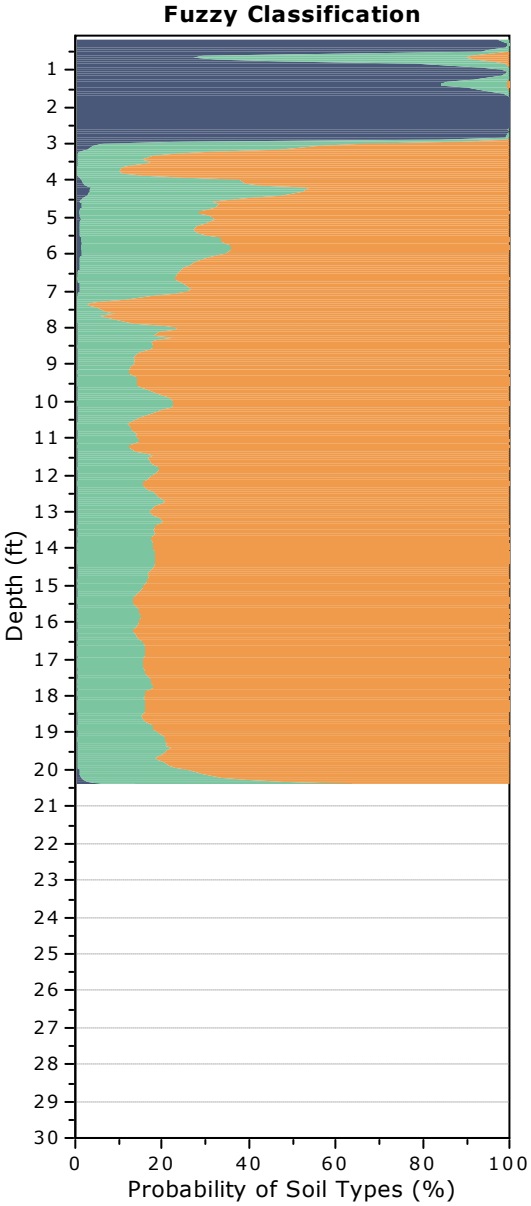
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







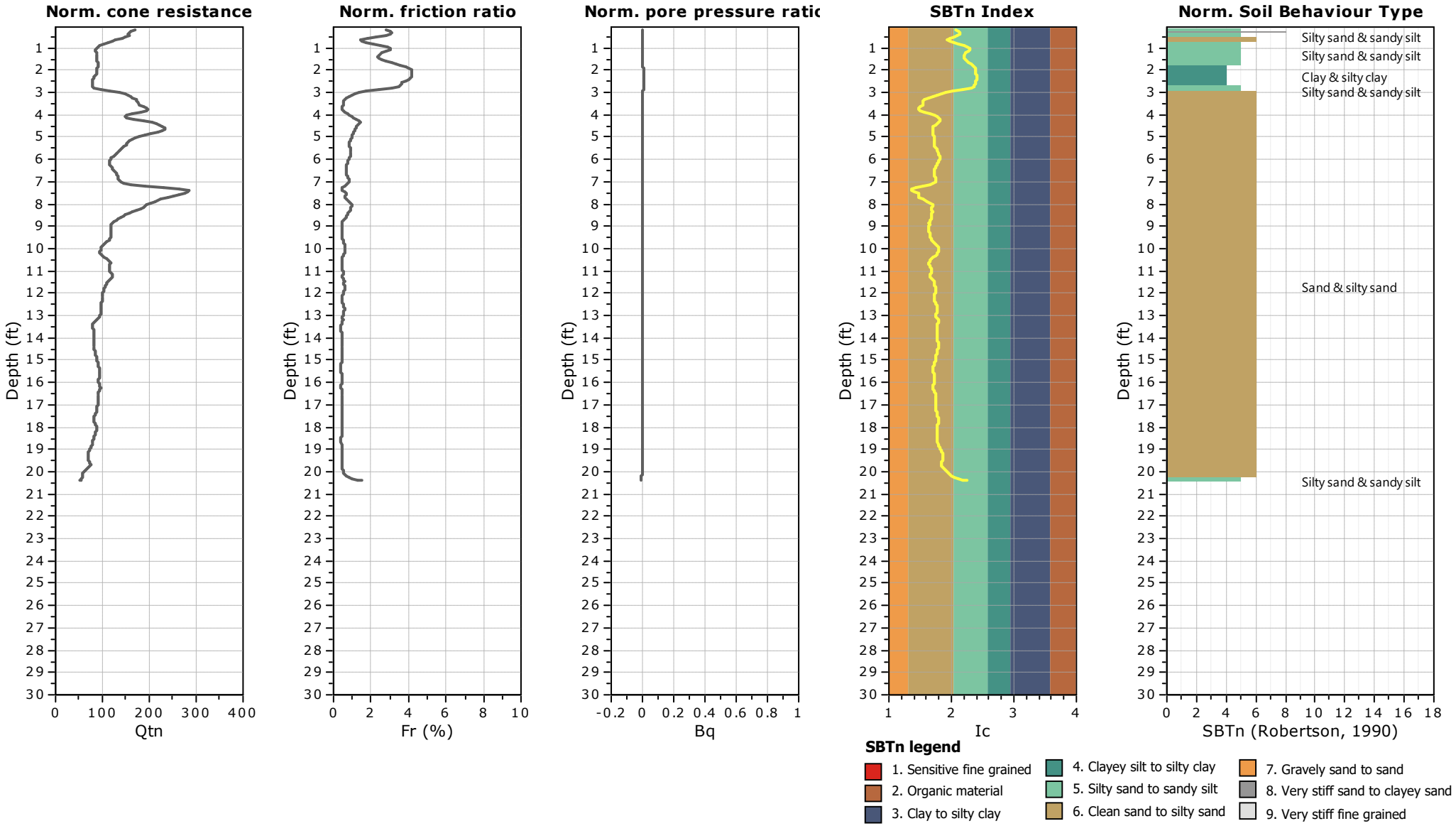
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-43
Total depth: 20.41 ft, Date: 5/16/2024
Surface Elevation: 61.49 ft
Coords: X:572843.89, Y:555527.60
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

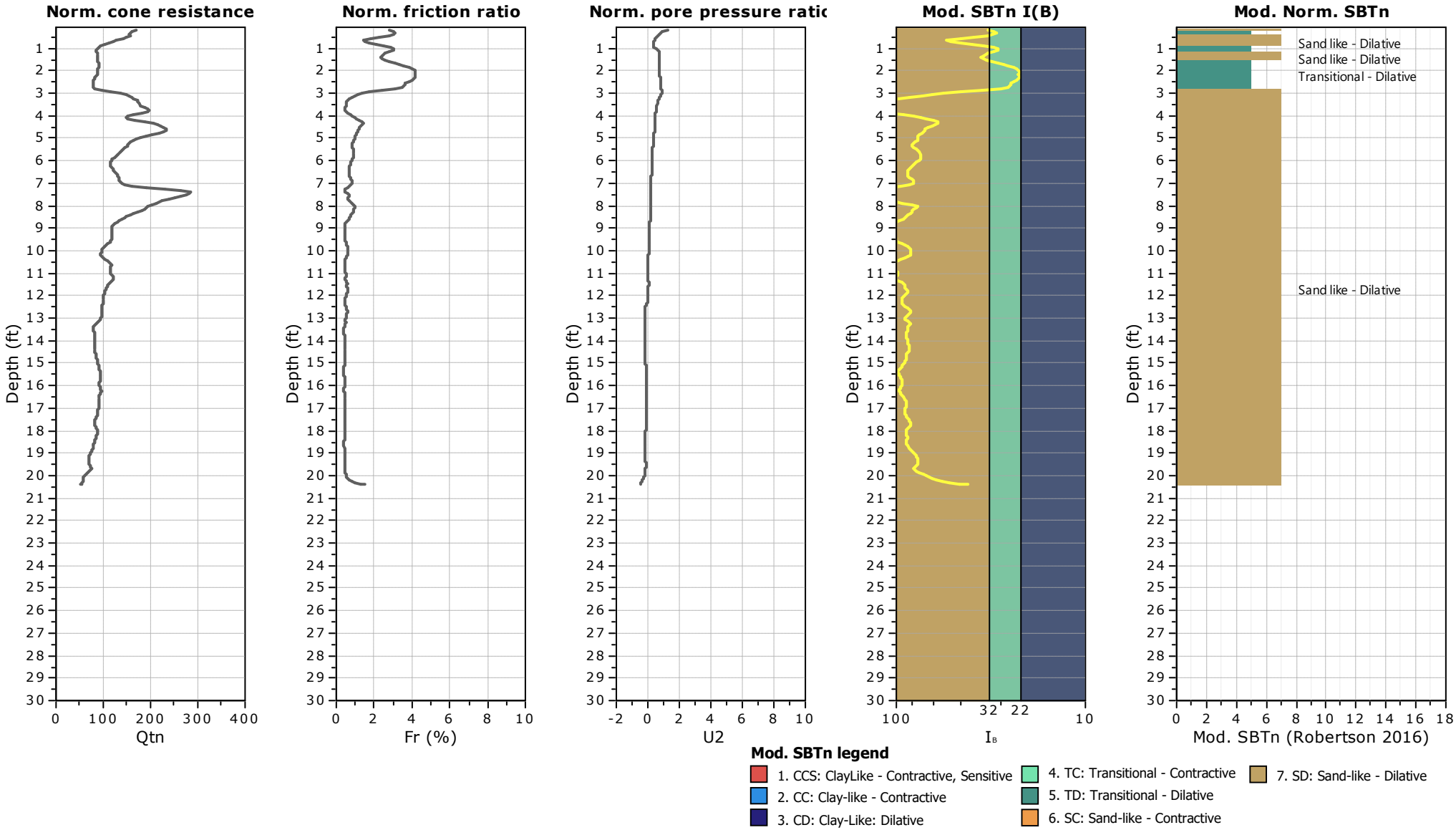
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-43
Total depth: 20.41 ft, Date: 5/16/2024
Surface Elevation: 61.49 ft
Coords: X:572843.89, Y:555527.60
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

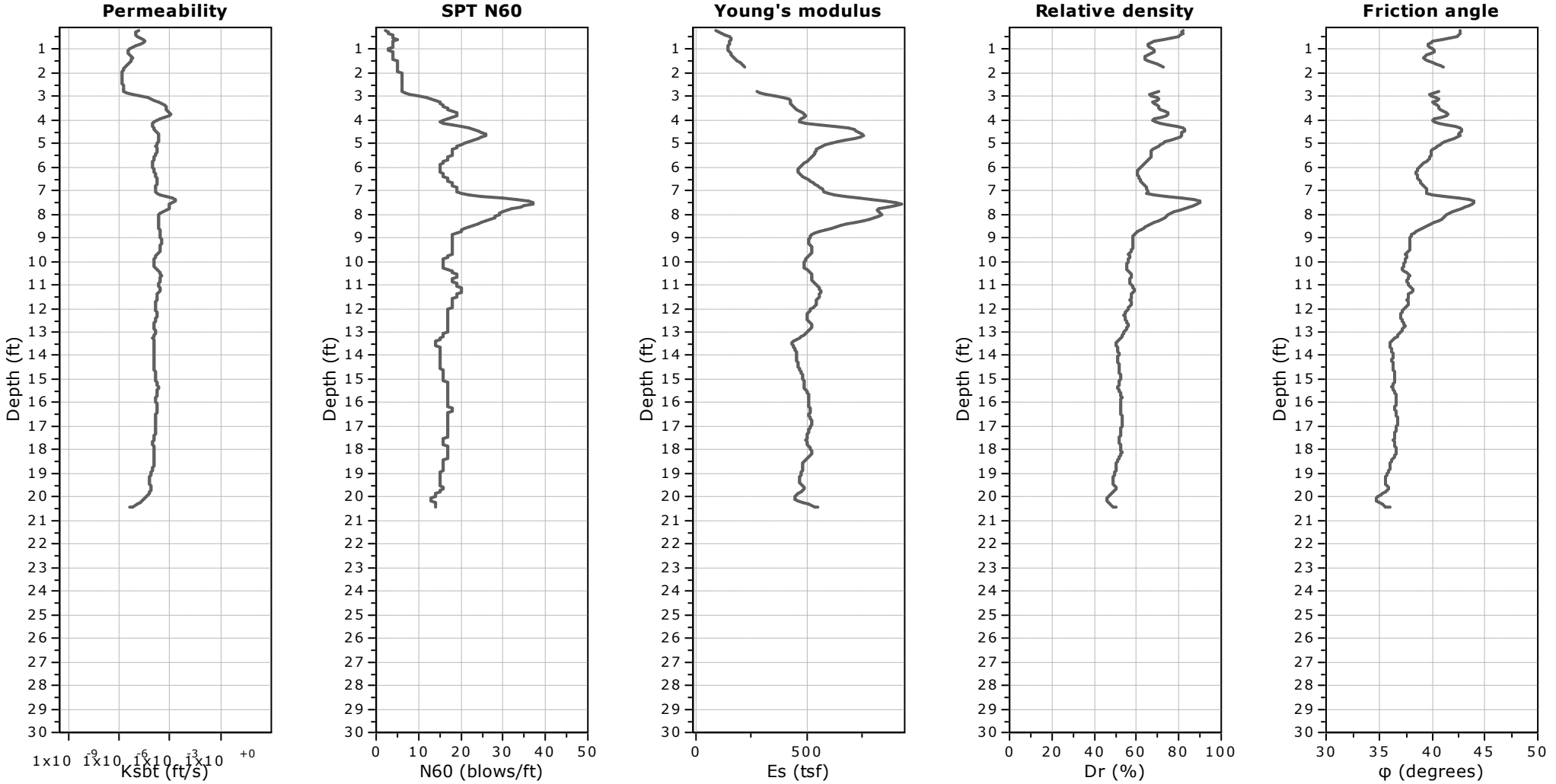
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-43
Total depth: 20.41 ft, Date: 5/16/2024
Surface Elevation: 61.49 ft
Coords: X:572843.89, Y:555527.60
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



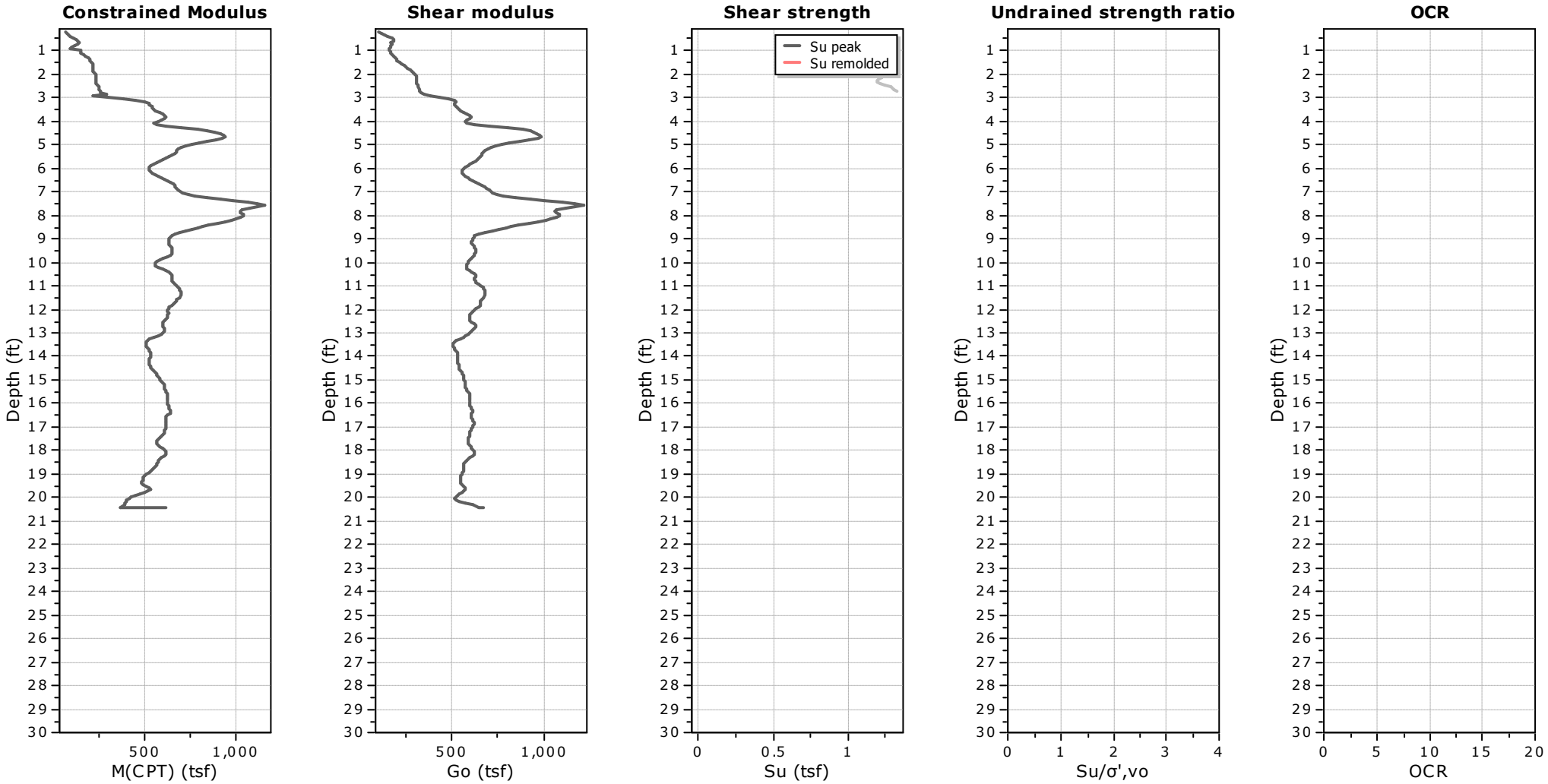
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-43
Total depth: 20.41 ft, Date: 5/16/2024
Surface Elevation: 61.49 ft
Coords: X:572843.89, Y:555527.60
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



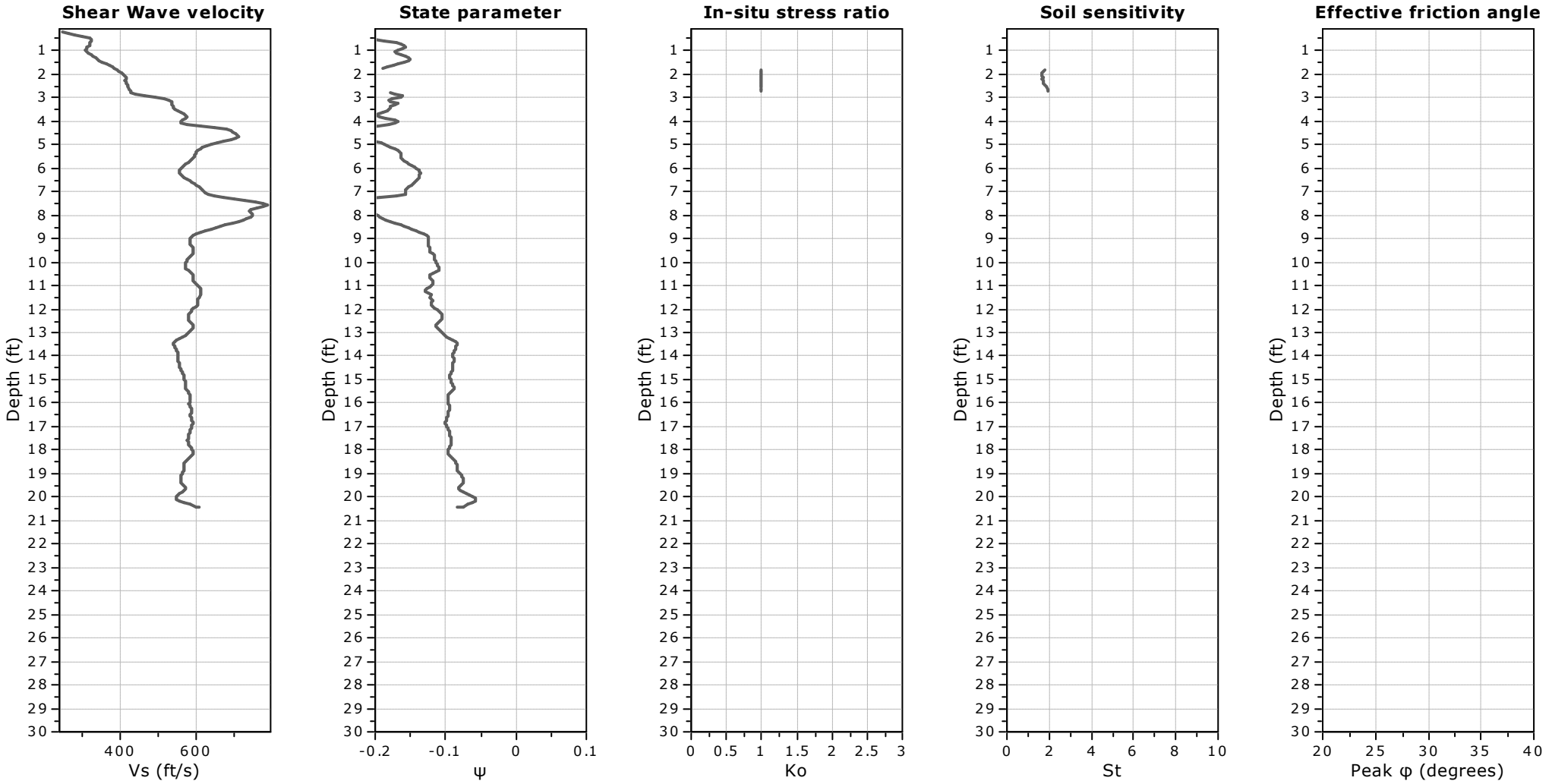
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-43
Total depth: 20.41 ft, Date: 5/16/2024
Surface Elevation: 61.49 ft
Coords: X:572843.89, Y:555527.60
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



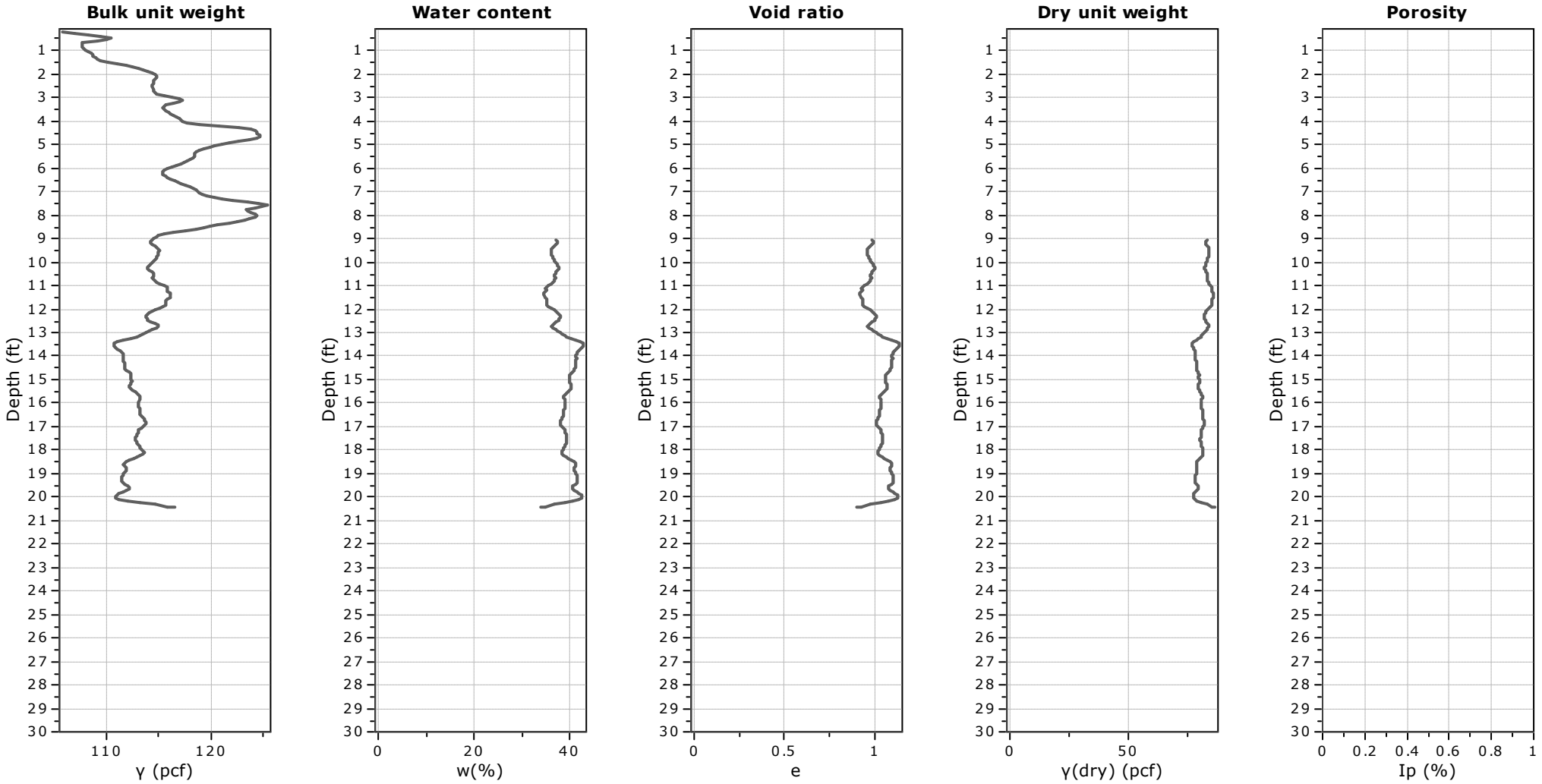
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-43
Total depth: 20.41 ft, Date: 5/16/2024
Surface Elevation: 61.49 ft
Coords: X:572843.89, Y:555527.60
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

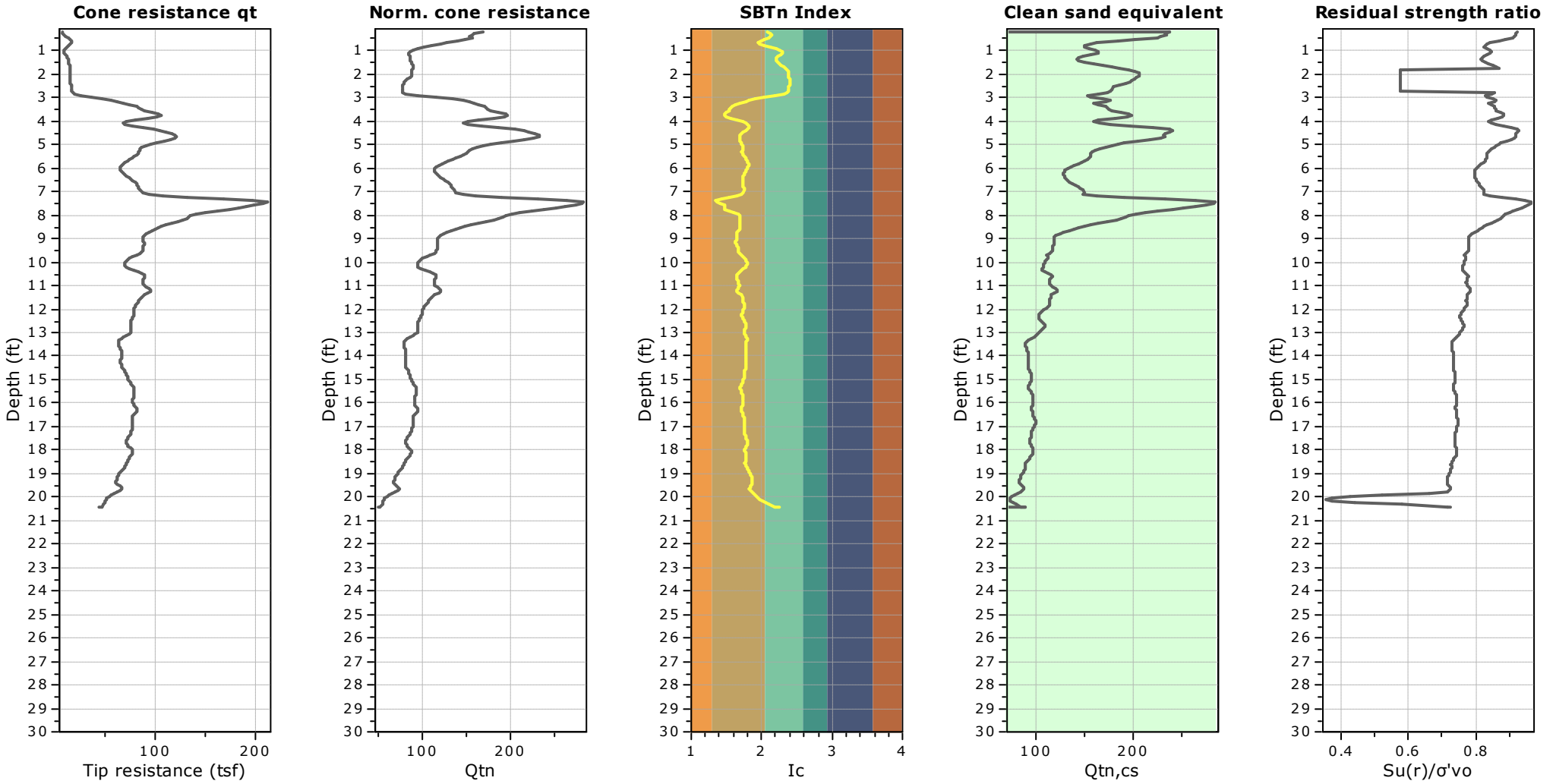
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-43
Total depth: 20.41 ft, Date: 5/16/2024
Surface Elevation: 61.49 ft
Coords: X:572843.89, Y:555527.60
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

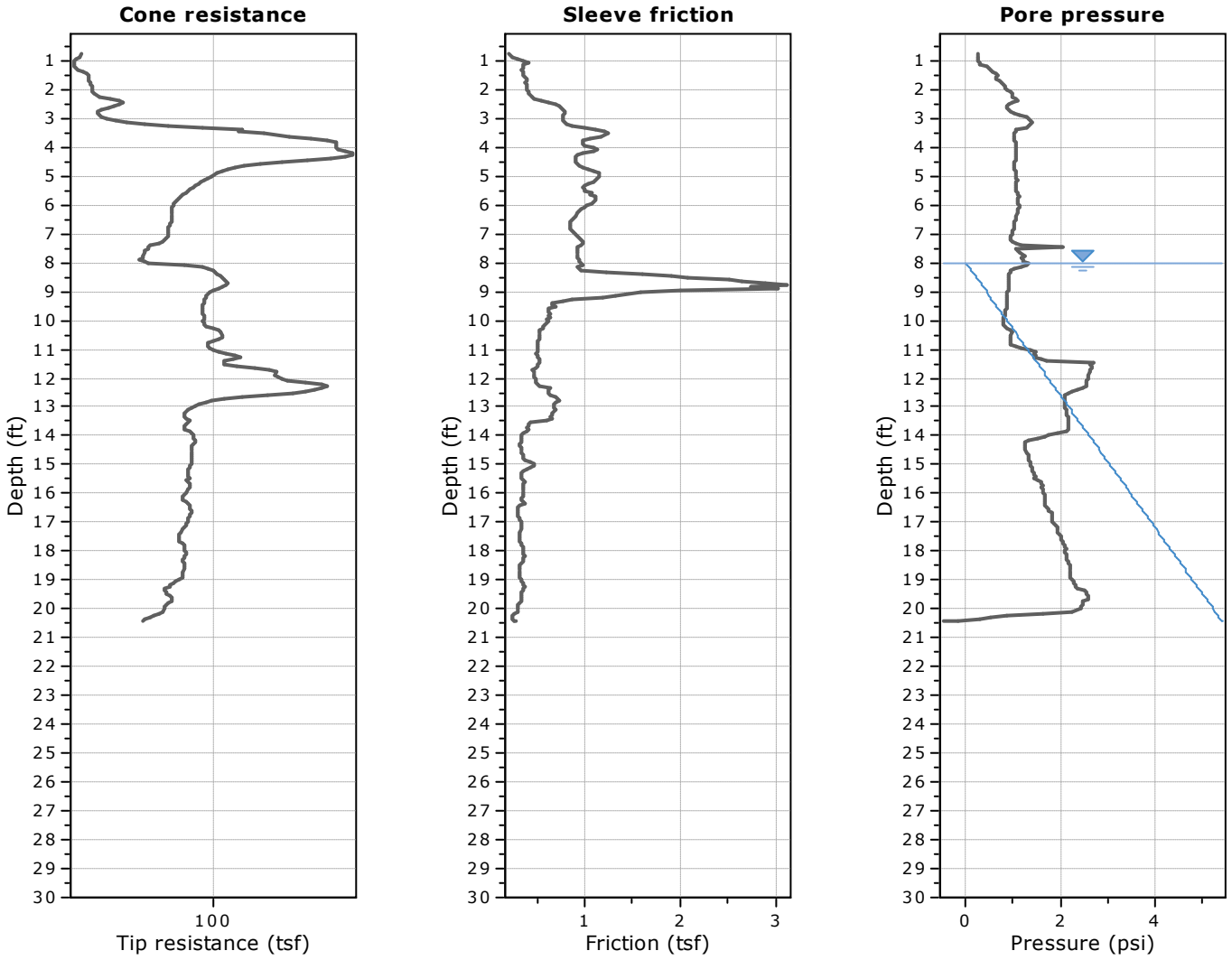
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



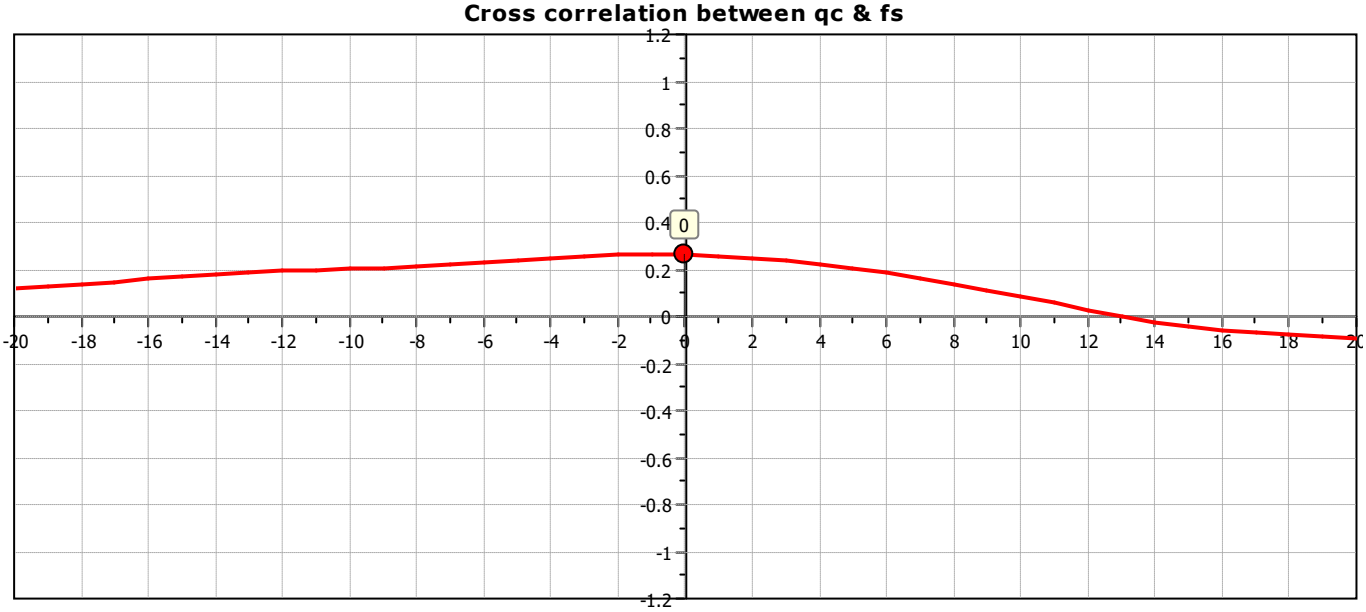
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

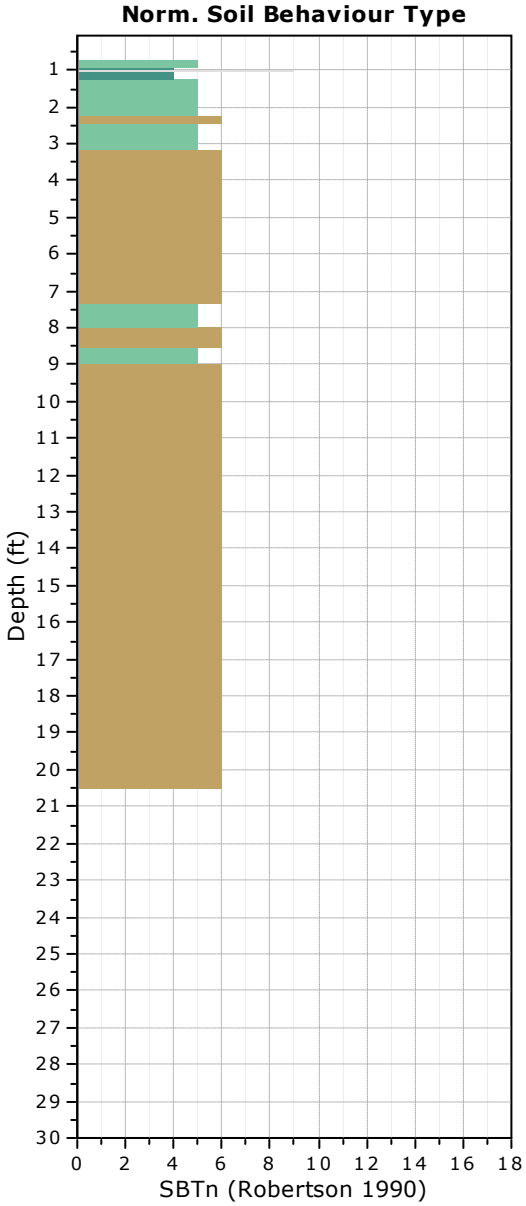
C-44
Total depth: 20.42 ft, Date: 5/16/2024
Surface Elevation: 60.90 ft
Coords: X:572916.54, Y:555550.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

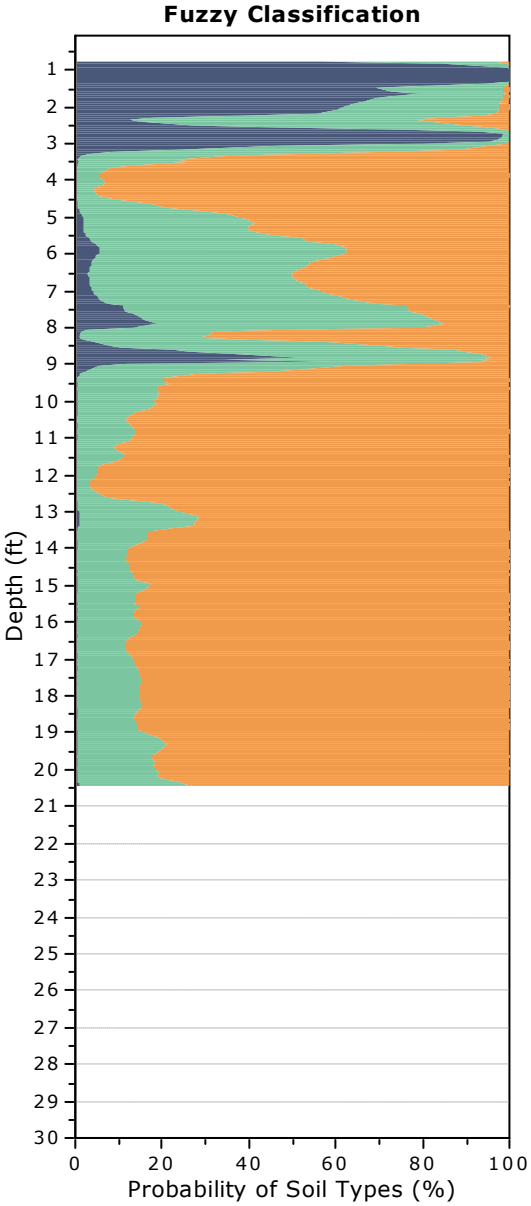
Project: ASD Summit Campus
Location: Middletown, Delaware



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







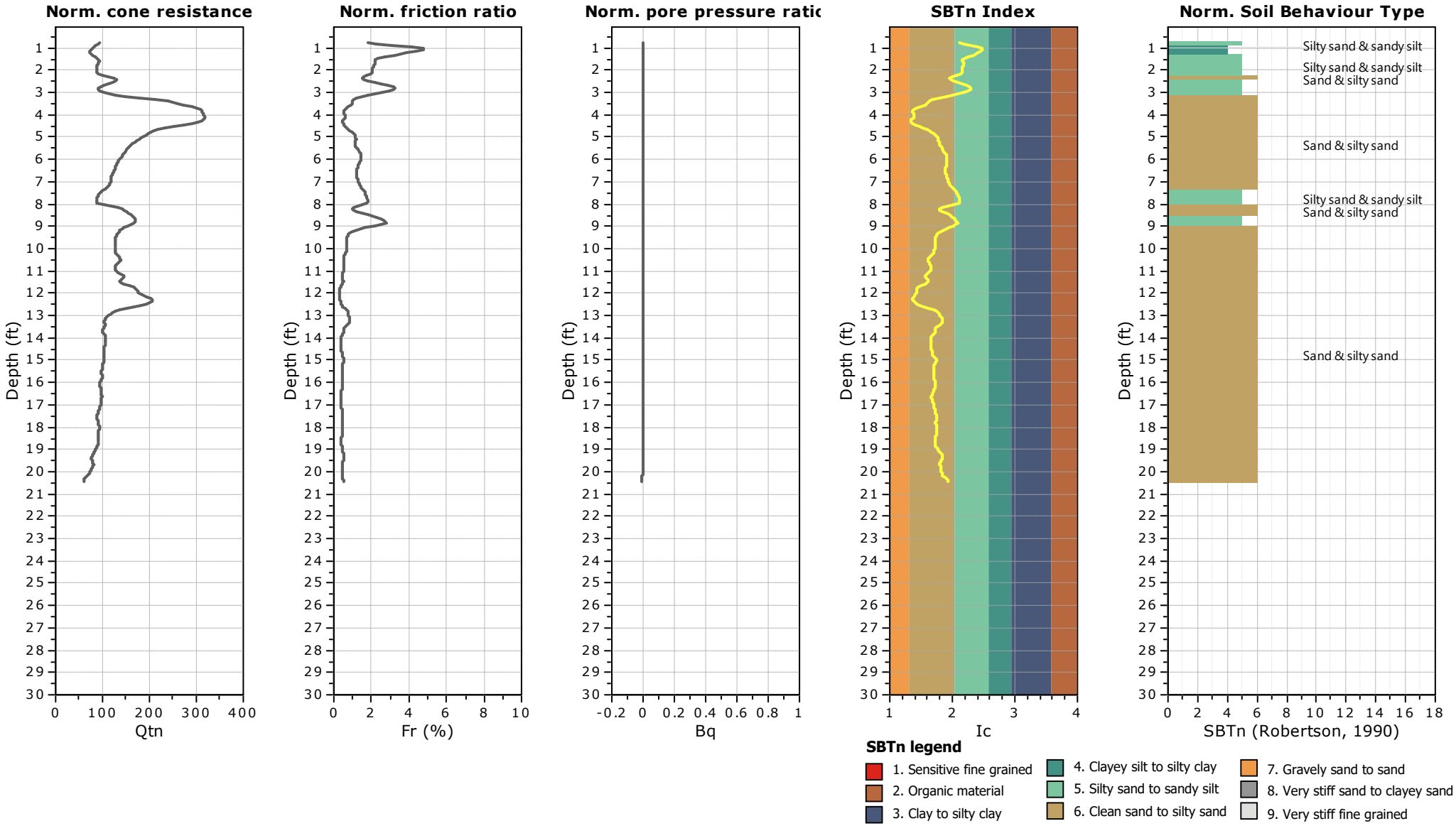
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-44
Total depth: 20.42 ft, Date: 5/16/2024
Surface Elevation: 60.90 ft
Coords: X:572916.54, Y:555550.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

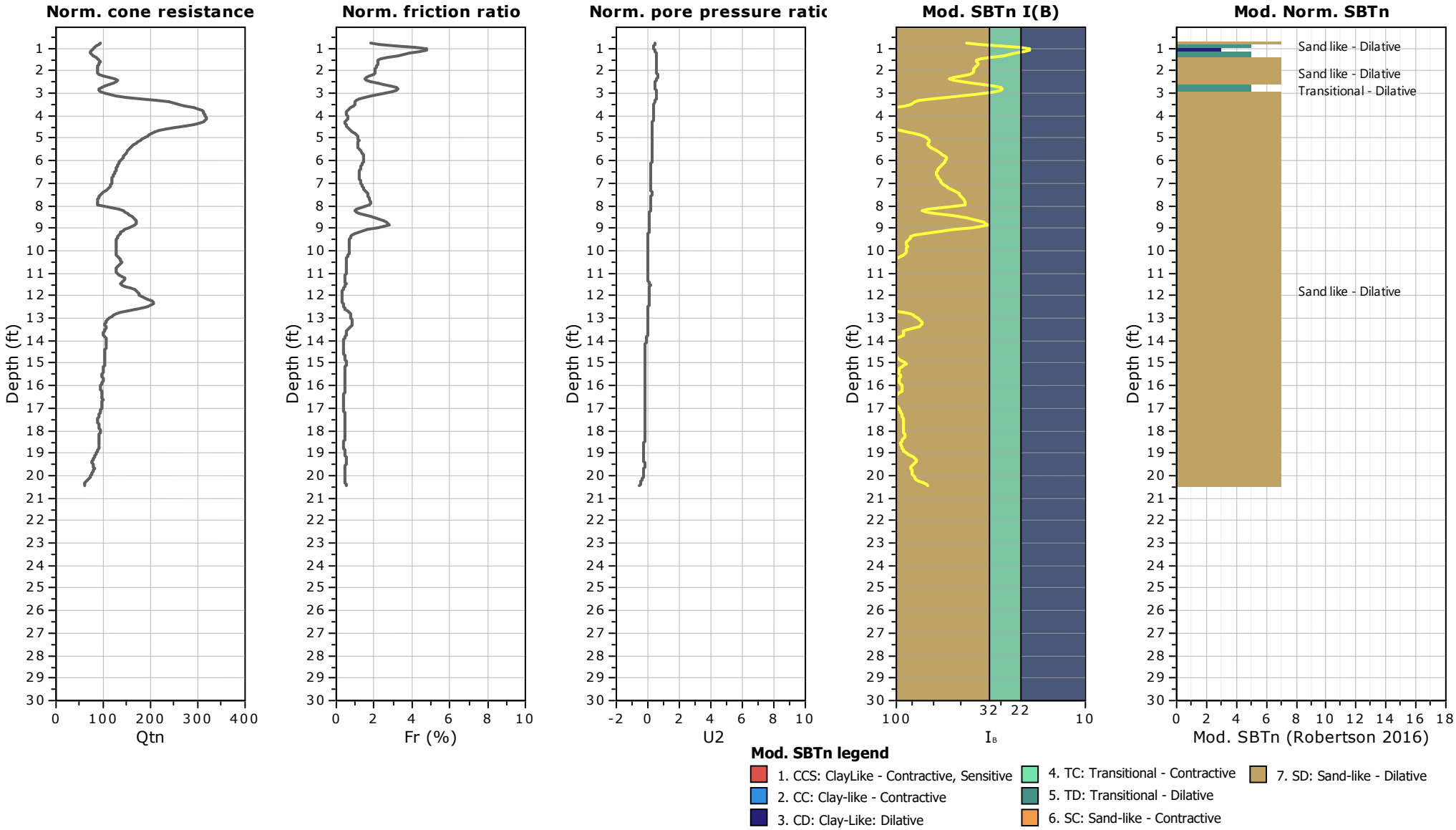
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-44
Total depth: 20.42 ft, Date: 5/16/2024
Surface Elevation: 60.90 ft
Coords: X:572916.54, Y:555550.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

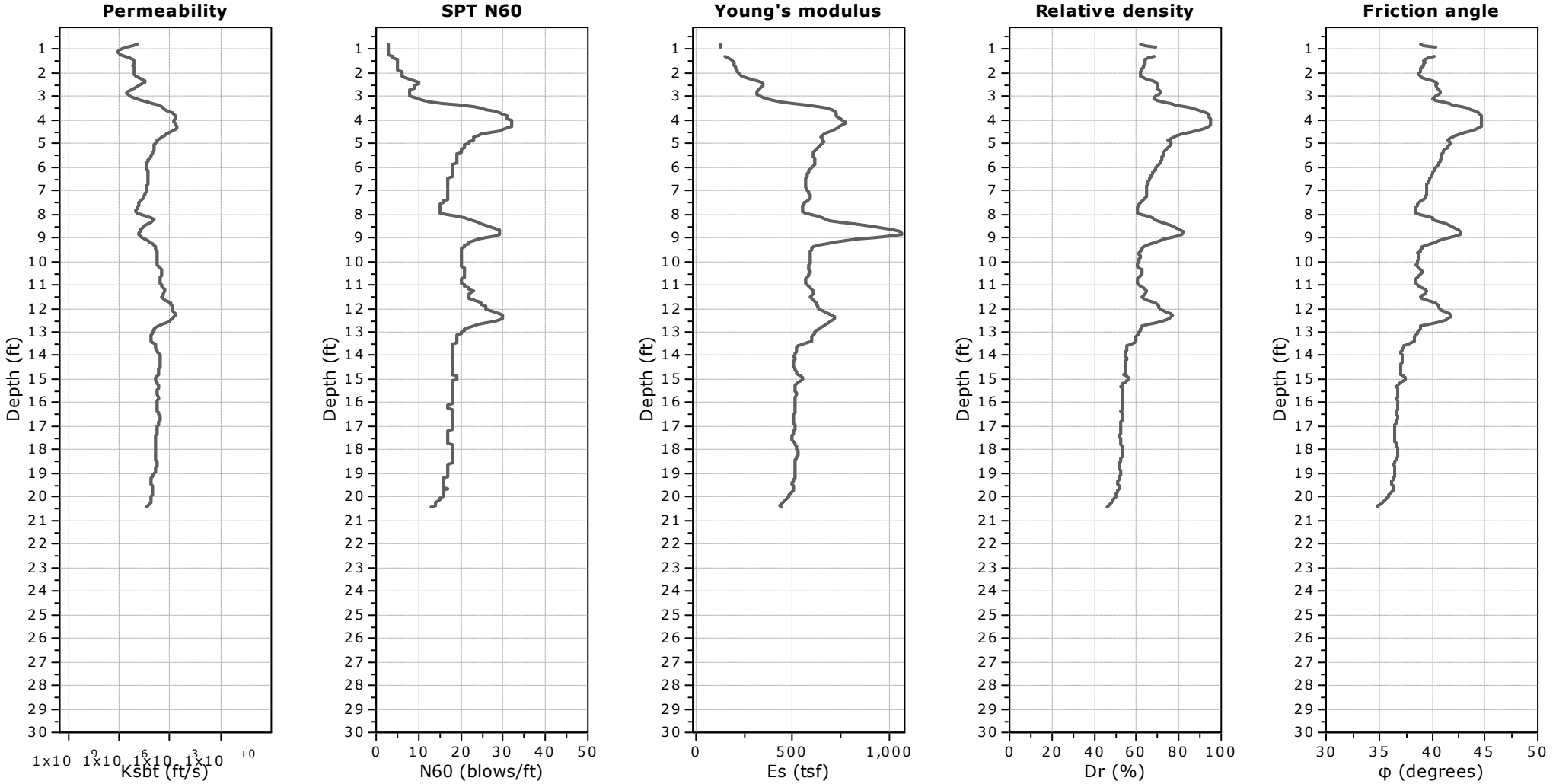
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-44
Total depth: 20.42 ft, Date: 5/16/2024
Surface Elevation: 60.90 ft
Coords: X:572916.54, Y:555550.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



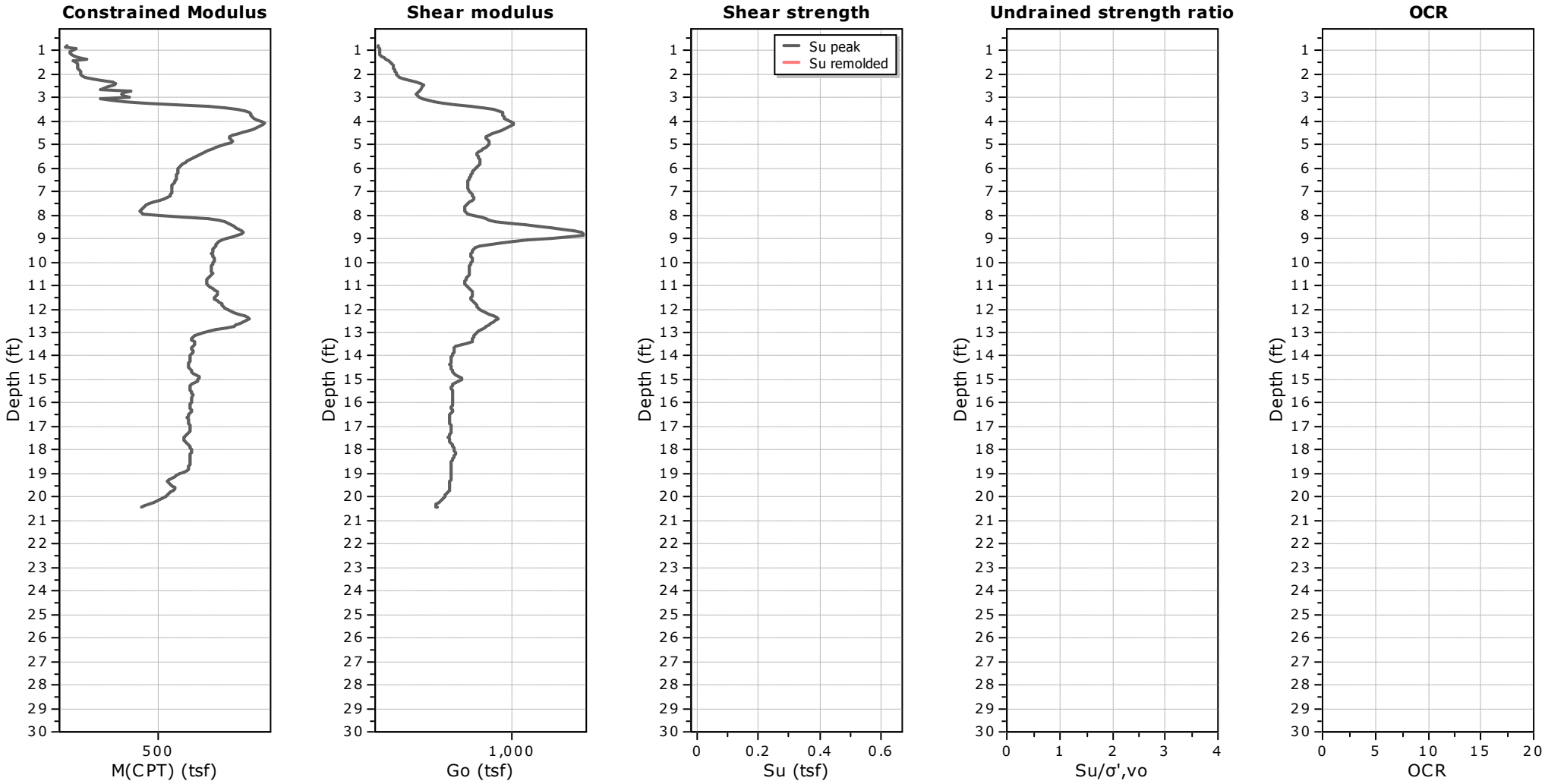
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-44
Total depth: 20.42 ft, Date: 5/16/2024
Surface Elevation: 60.90 ft
Coords: X:572916.54, Y:555550.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



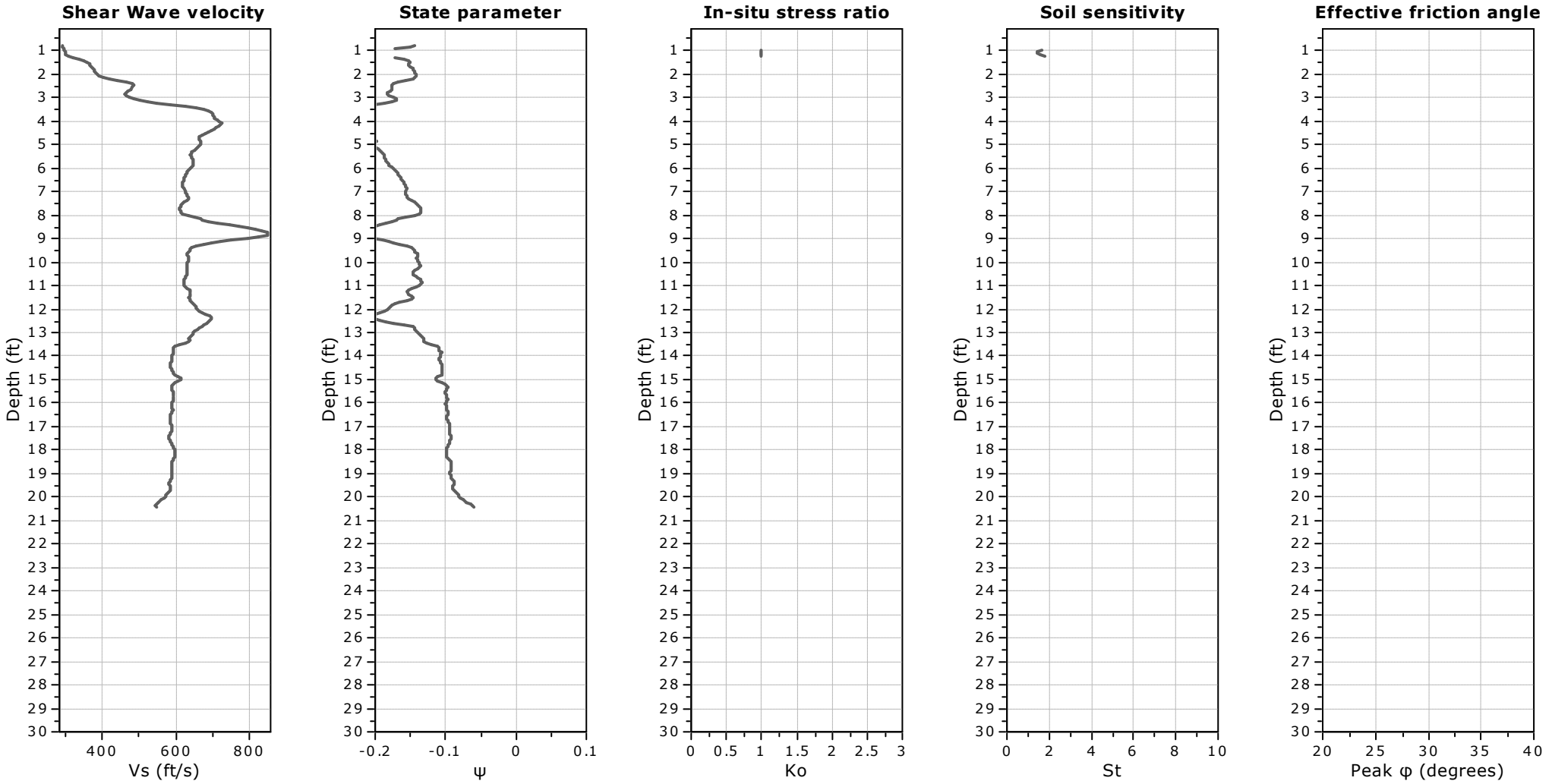
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-44
Total depth: 20.42 ft, Date: 5/16/2024
Surface Elevation: 60.90 ft
Coords: X:572916.54, Y:555550.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



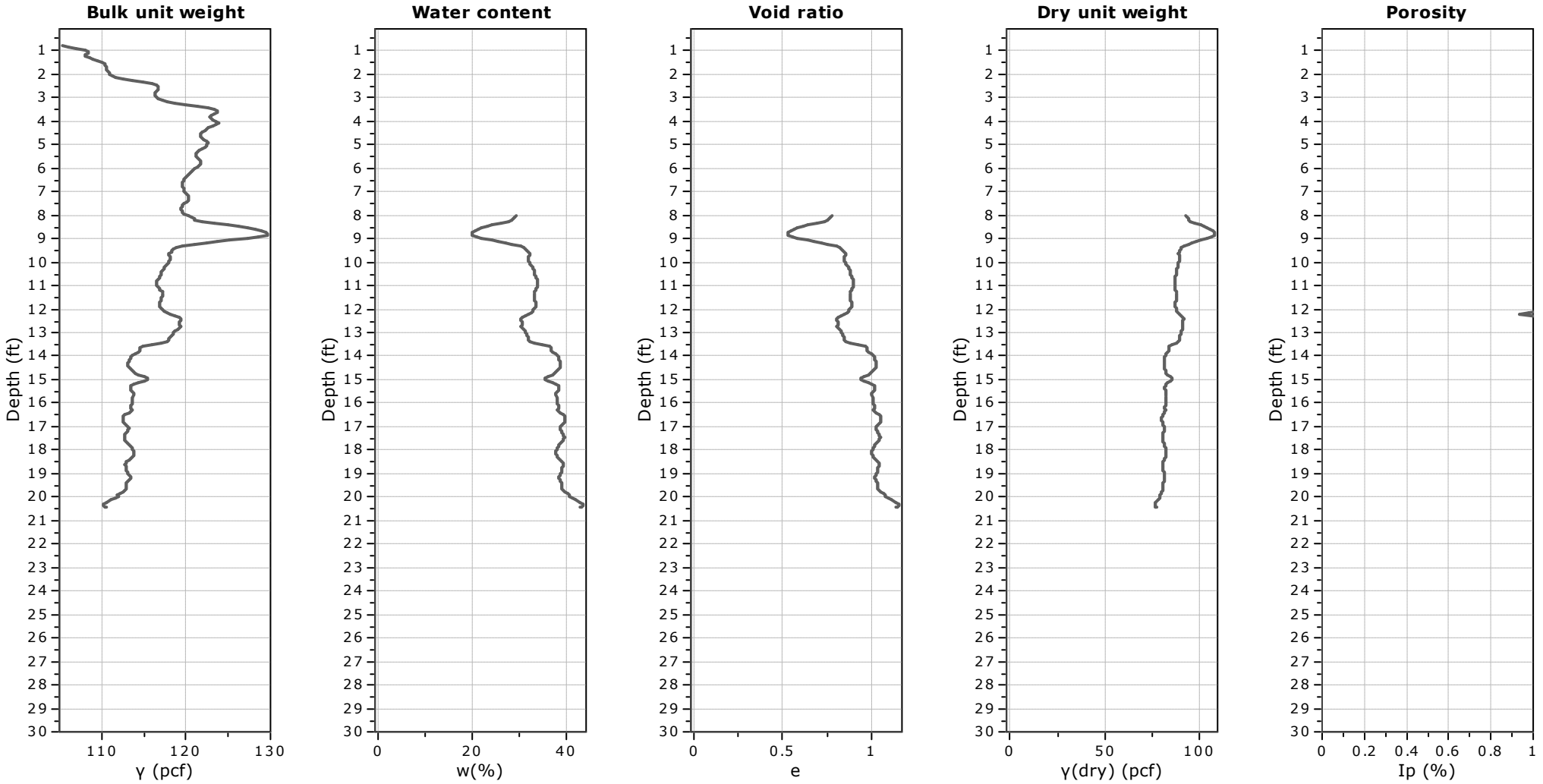
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-44
Total depth: 20.42 ft, Date: 5/16/2024
Surface Elevation: 60.90 ft
Coords: X:572916.54, Y:555550.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

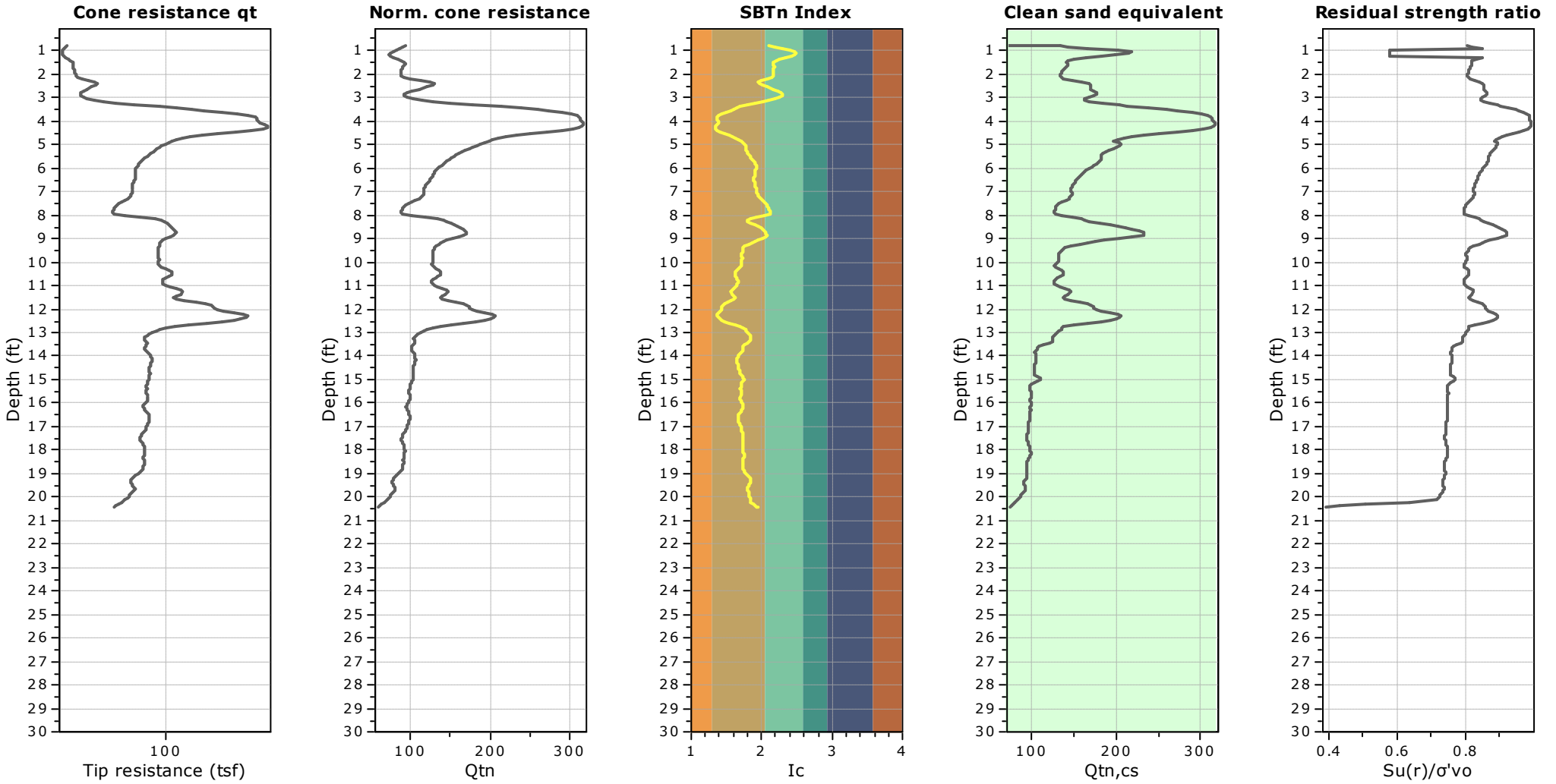
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-44
Total depth: 20.42 ft, Date: 5/16/2024
Surface Elevation: 60.90 ft
Coords: X:572916.54, Y:555550.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

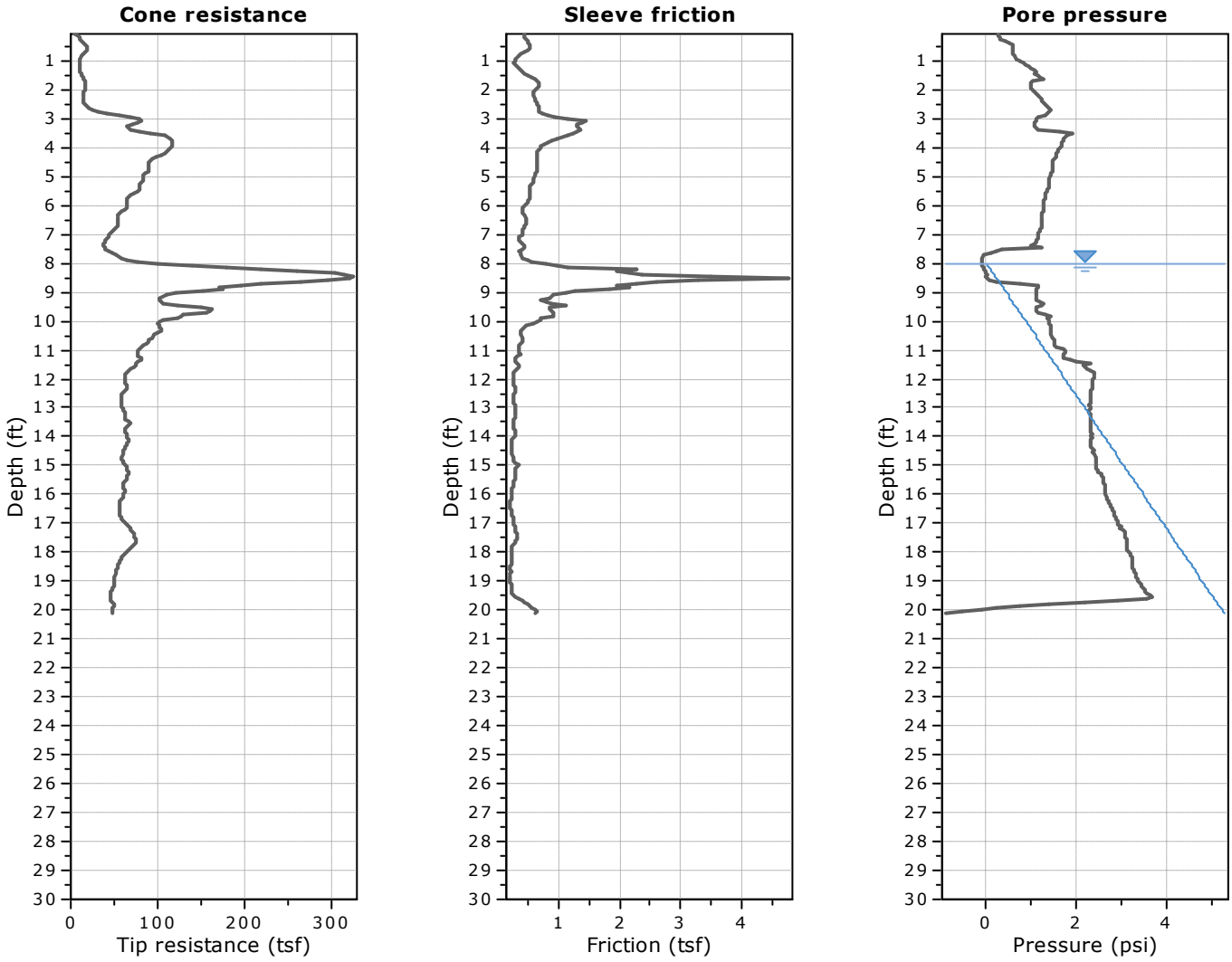
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



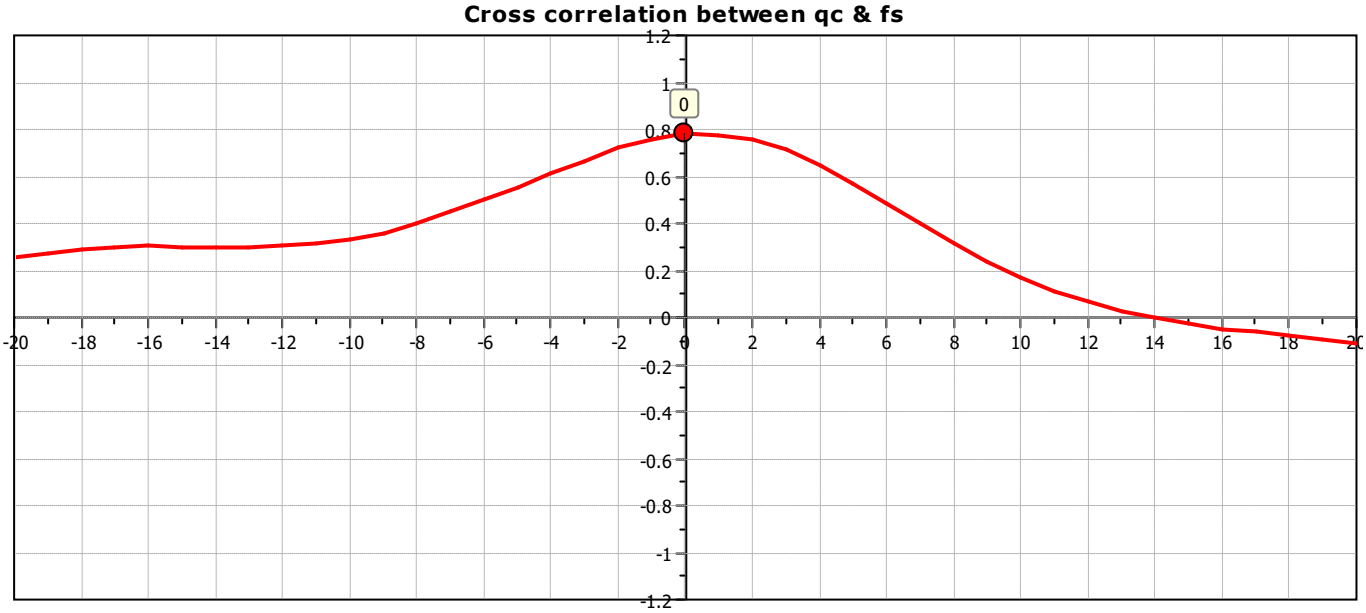
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-45
Total depth: 20.13 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:572692.32, Y:555467.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: ASD Summit Campus
Location: Middletown, Delaware



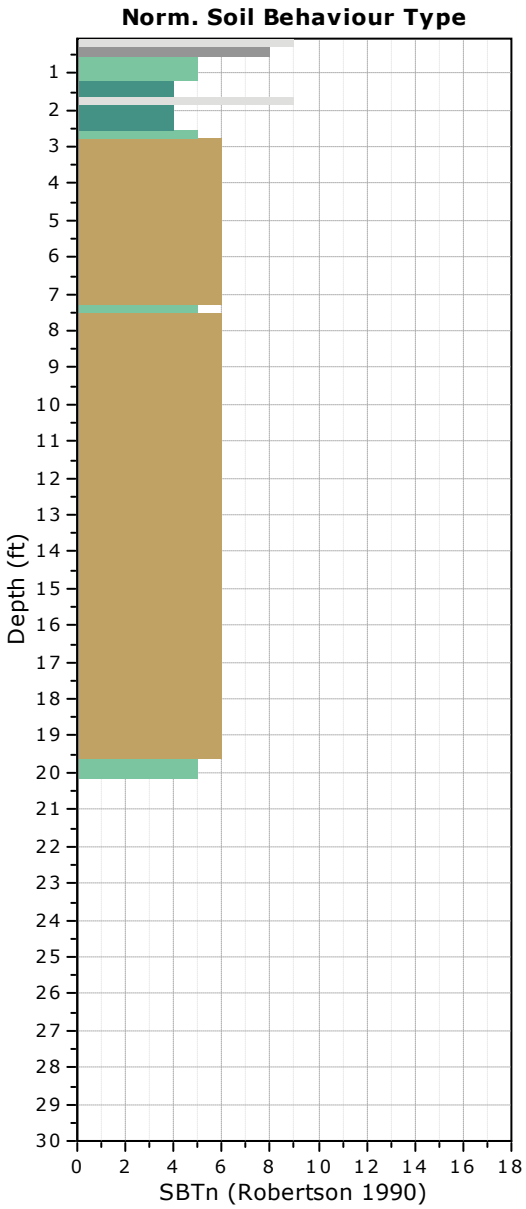
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

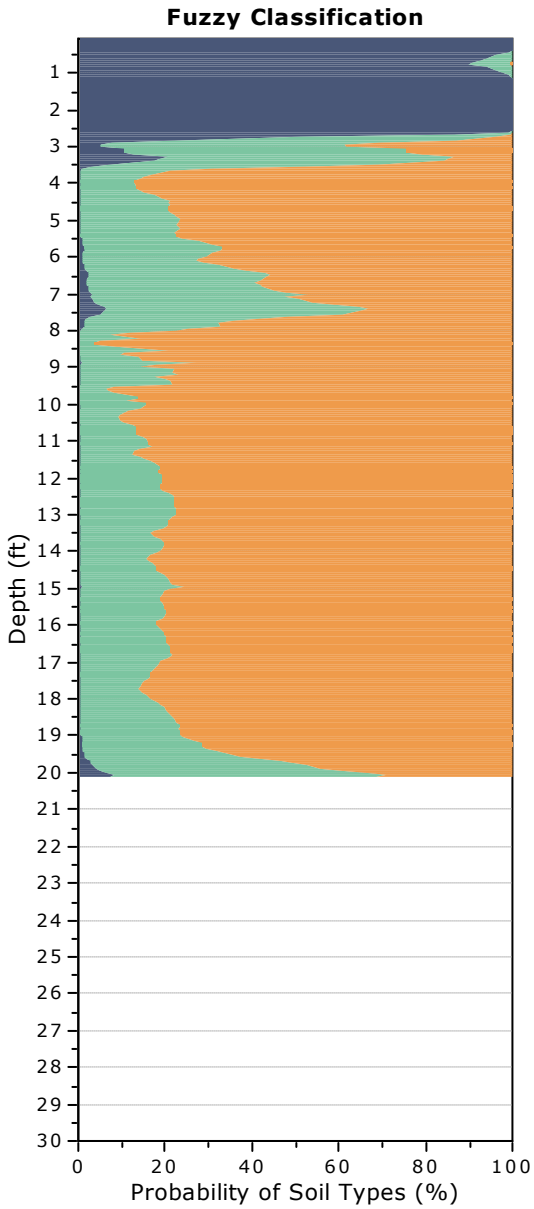


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-45
Total depth: 20.13 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:572692.32, Y:555467.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



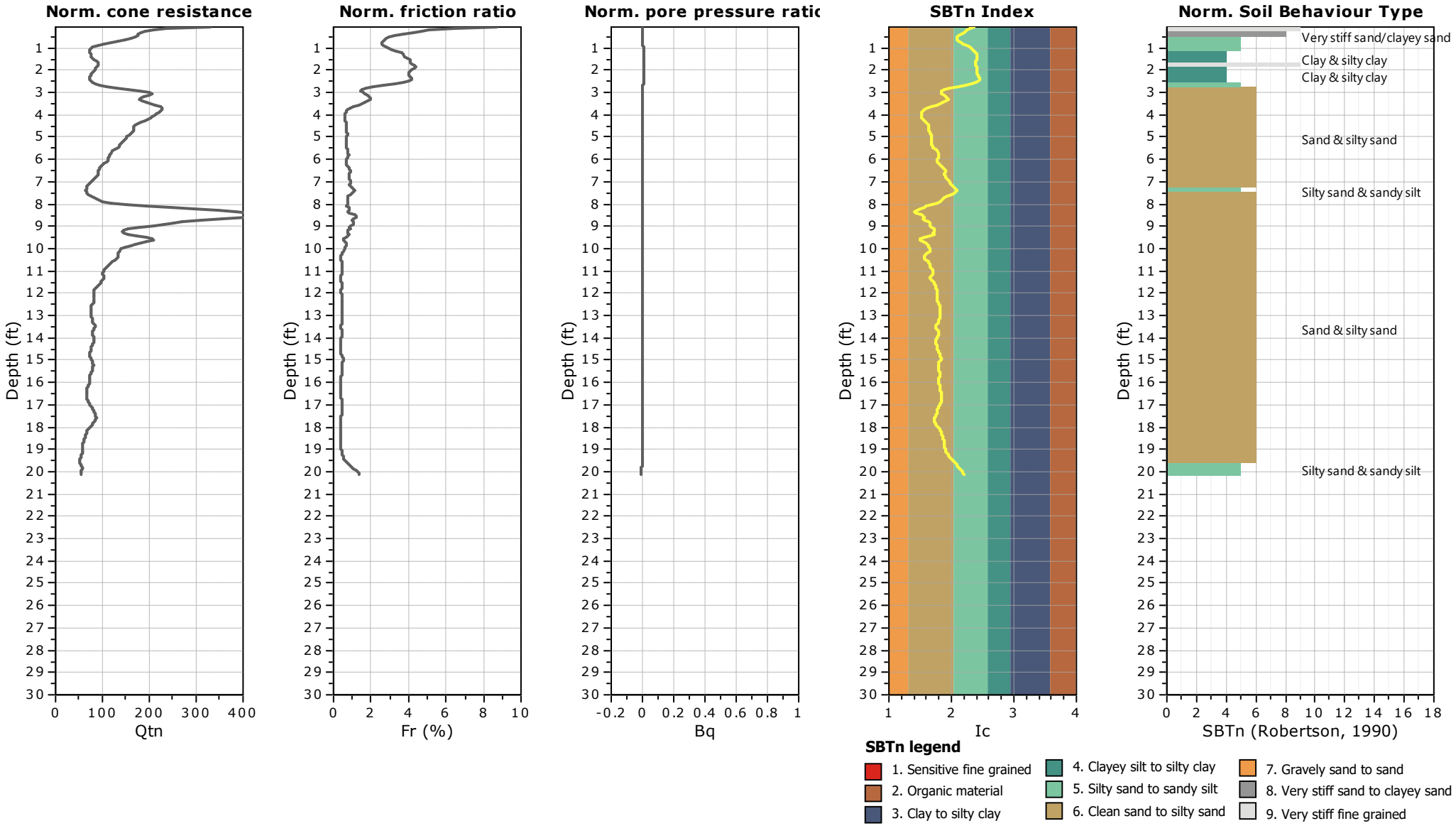


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-45
Total depth: 20.13 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:572692.32, Y:555467.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

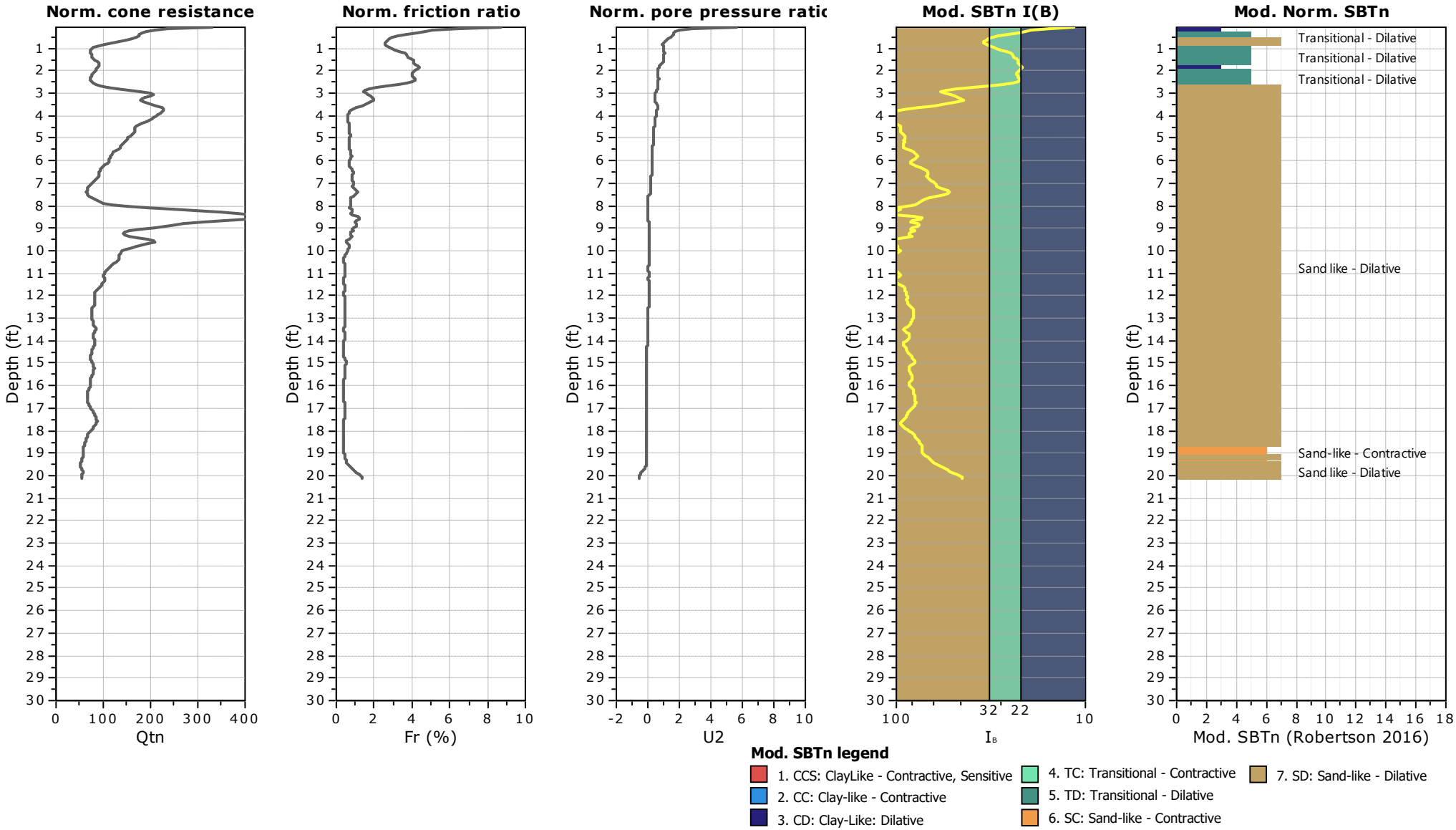
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

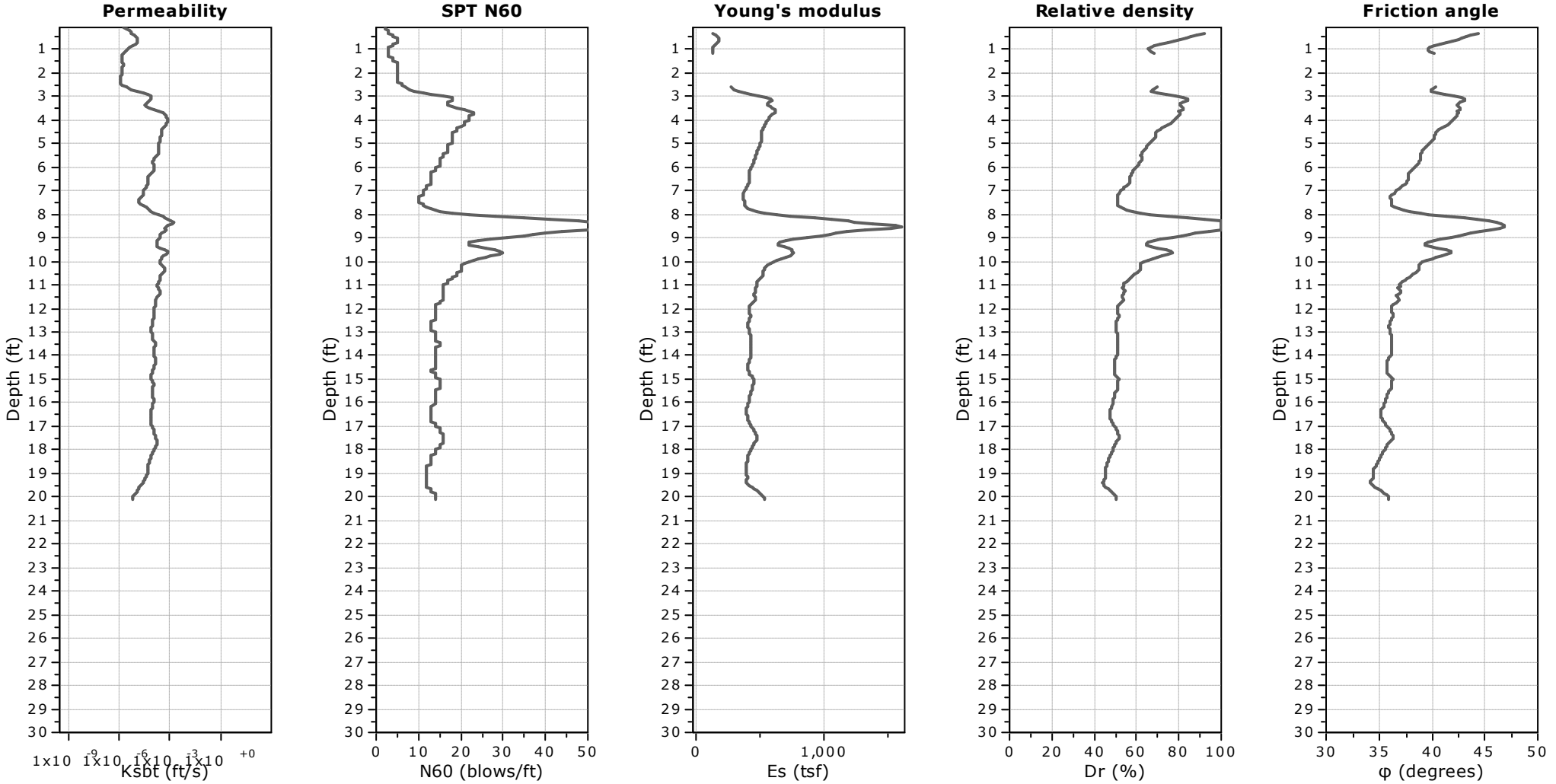
C-45
Total depth: 20.13 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:572692.32, Y:555467.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-45
Total depth: 20.13 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:572692.32, Y:555467.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



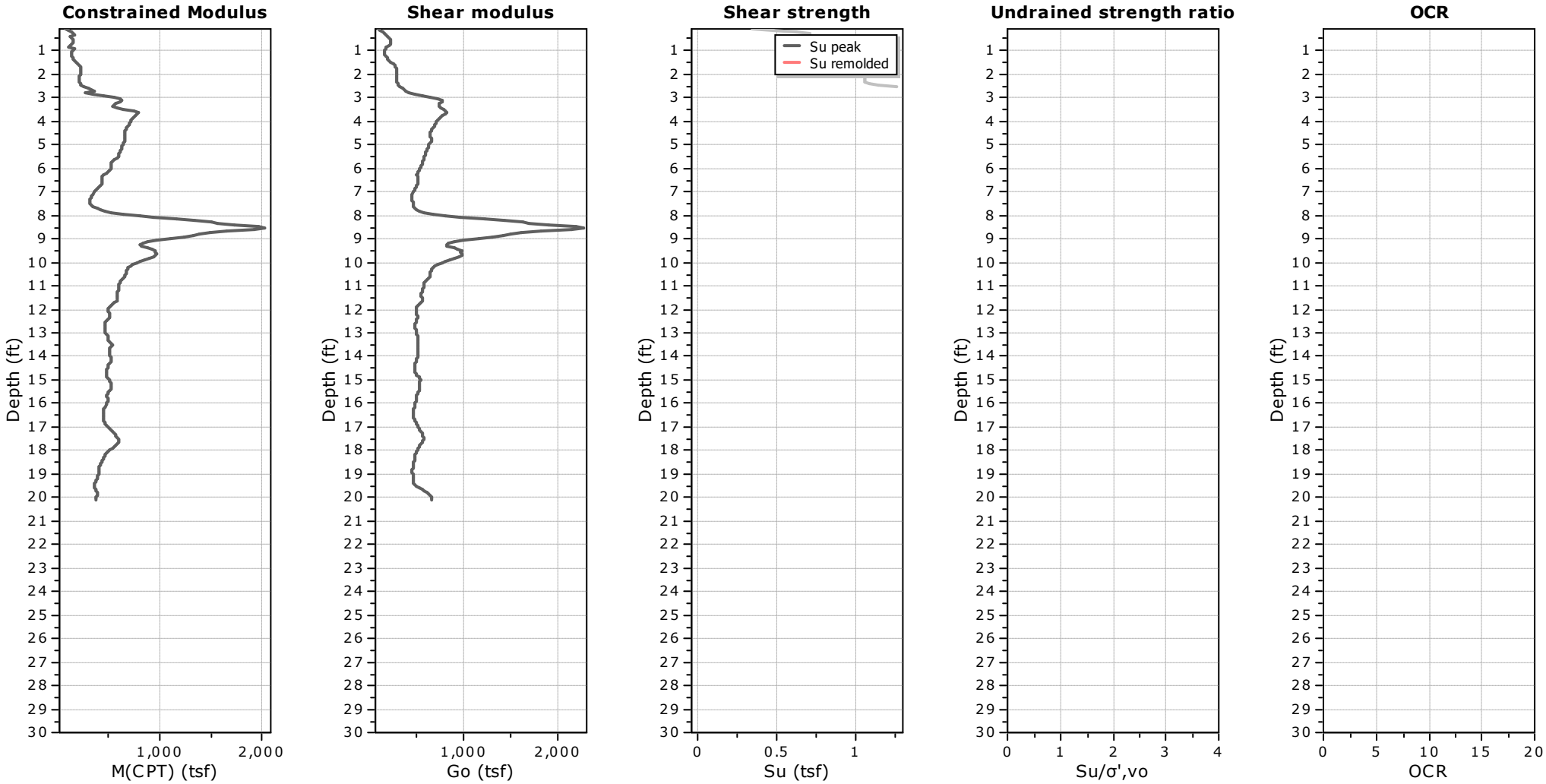
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-45
Total depth: 20.13 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:572692.32, Y:555467.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



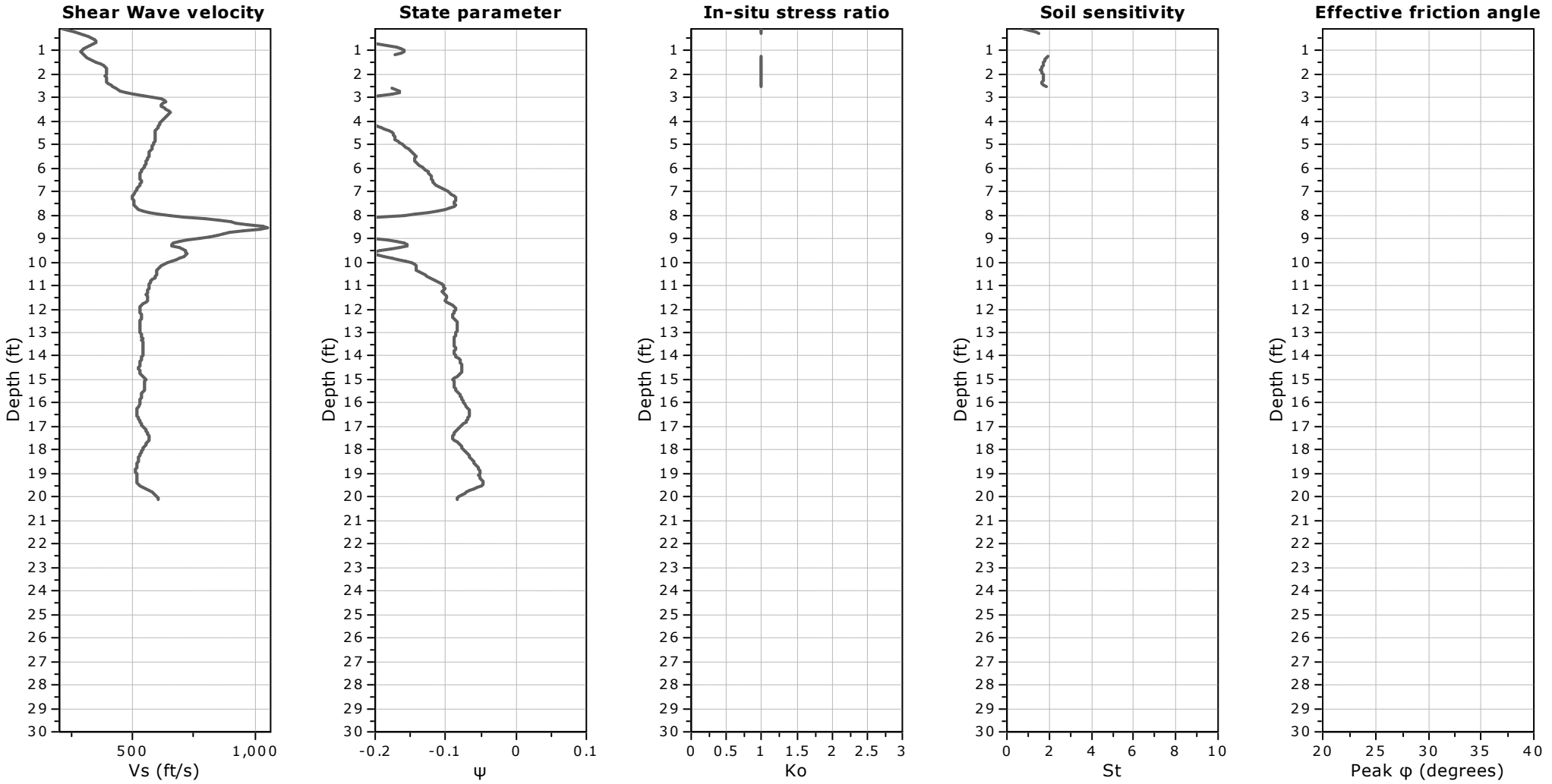
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-45
Total depth: 20.13 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:572692.32, Y:555467.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



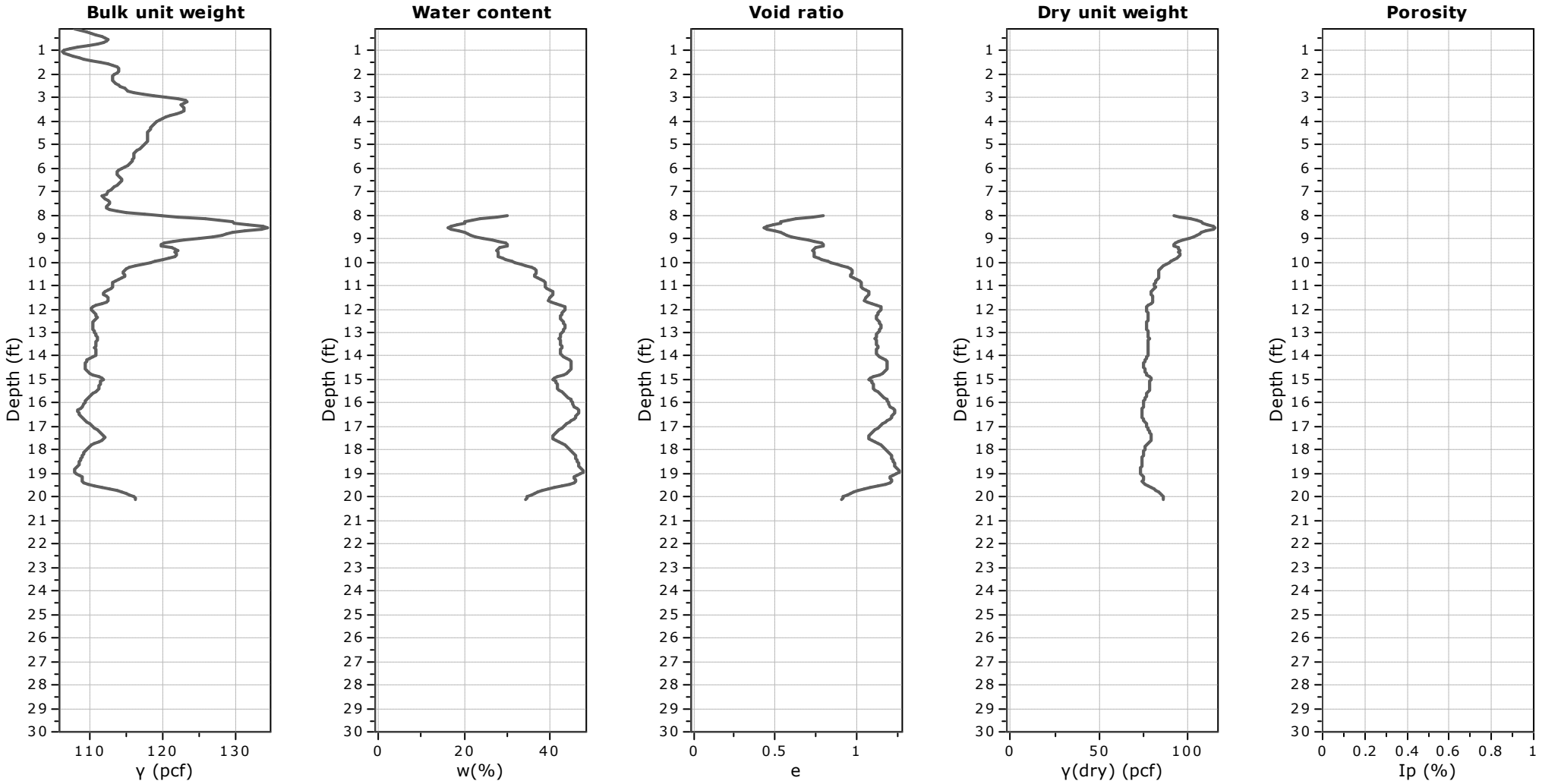
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-45
Total depth: 20.13 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:572692.32, Y:555467.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

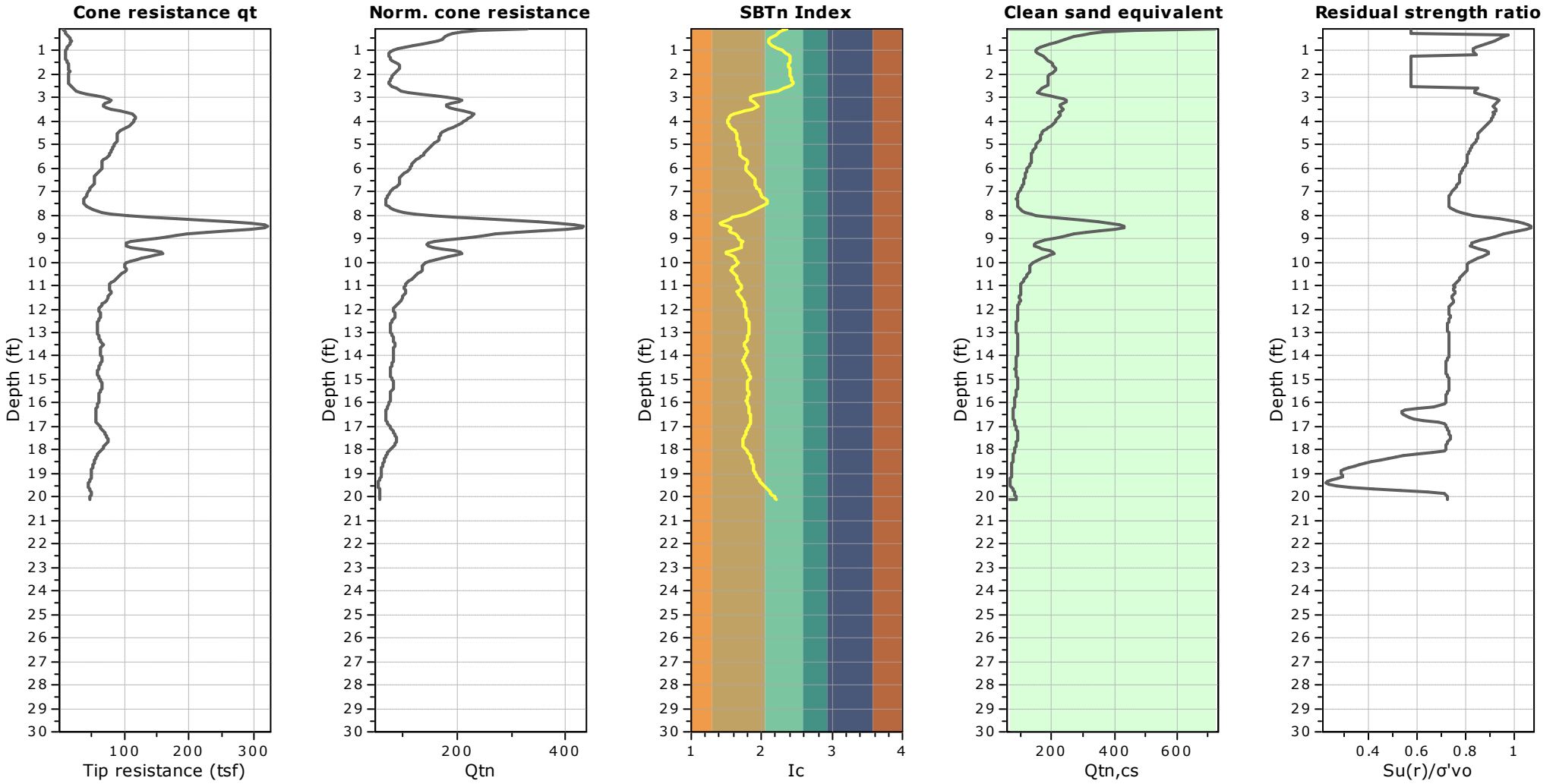
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-45
Total depth: 20.13 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:572692.32, Y:555467.49
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

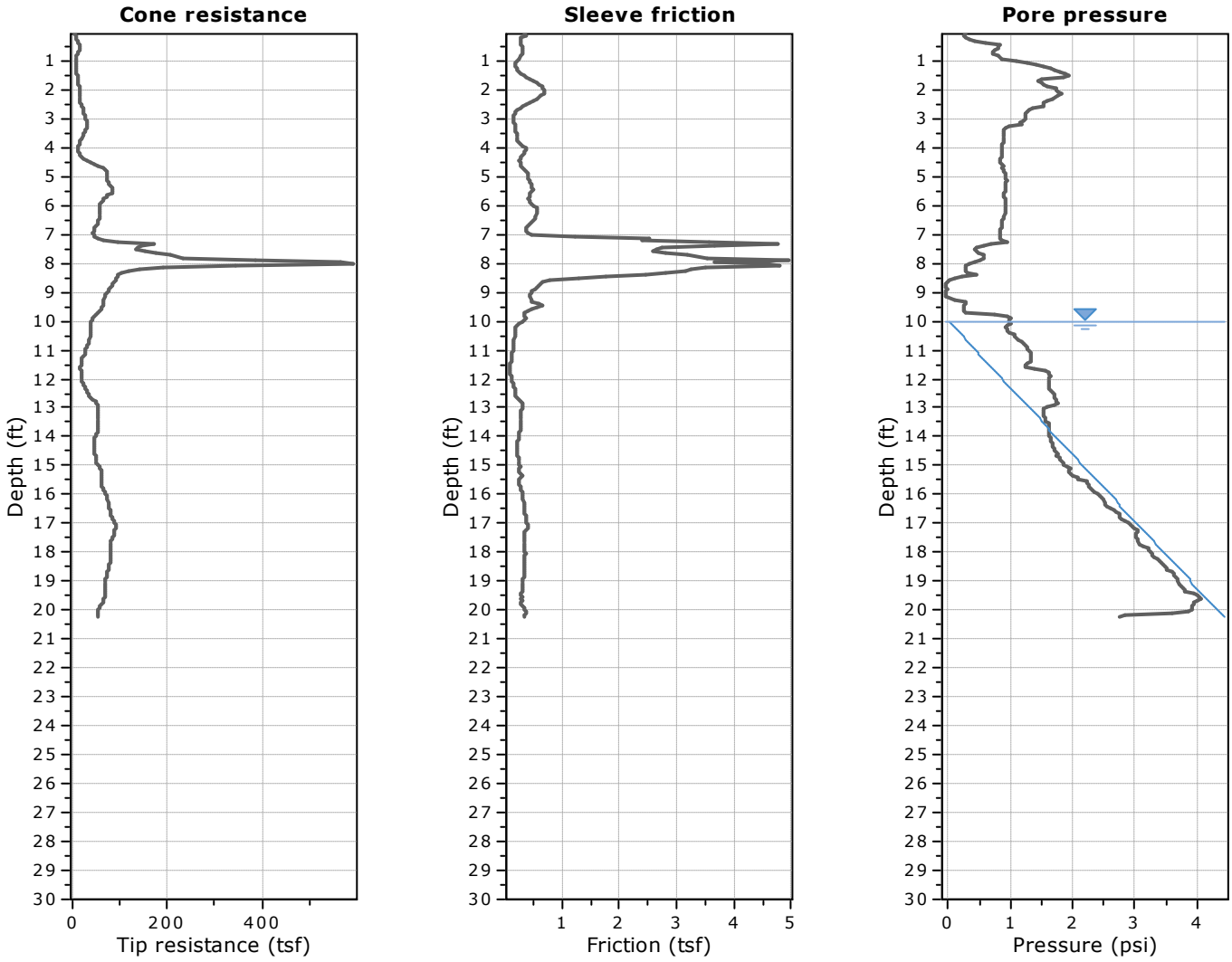
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



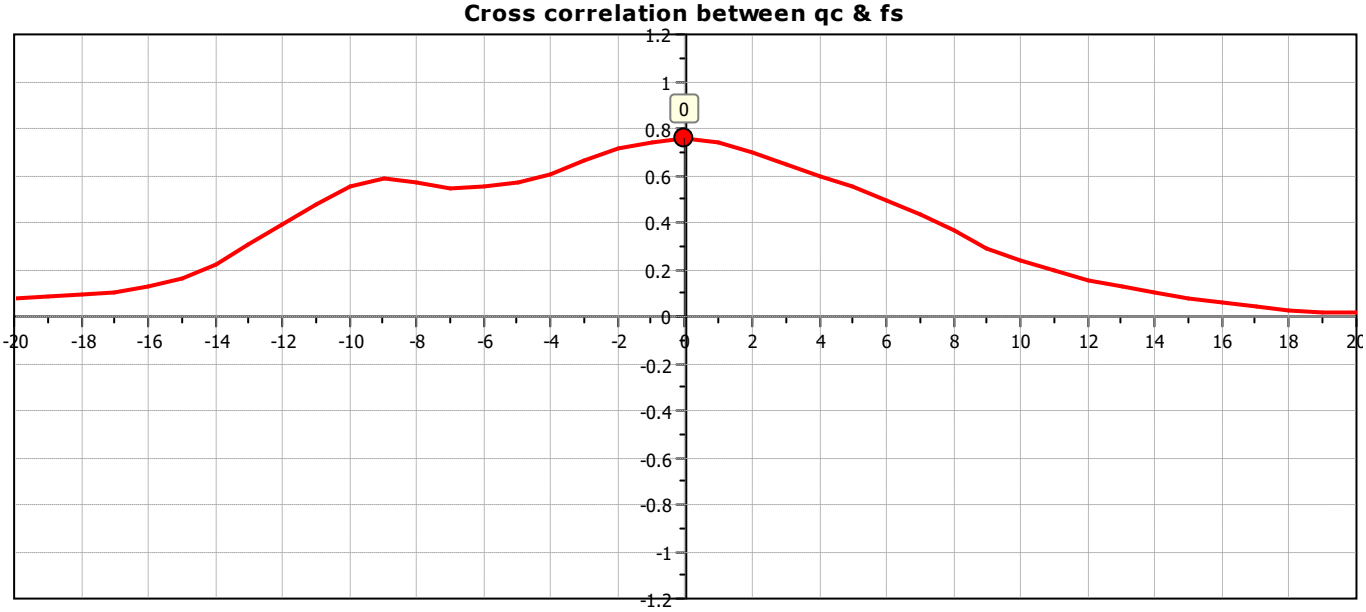
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-46
Total depth: 20.25 ft, Date: 5/16/2024
Surface Elevation: 62.38 ft
Coords: X:572794.07, Y:555431.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



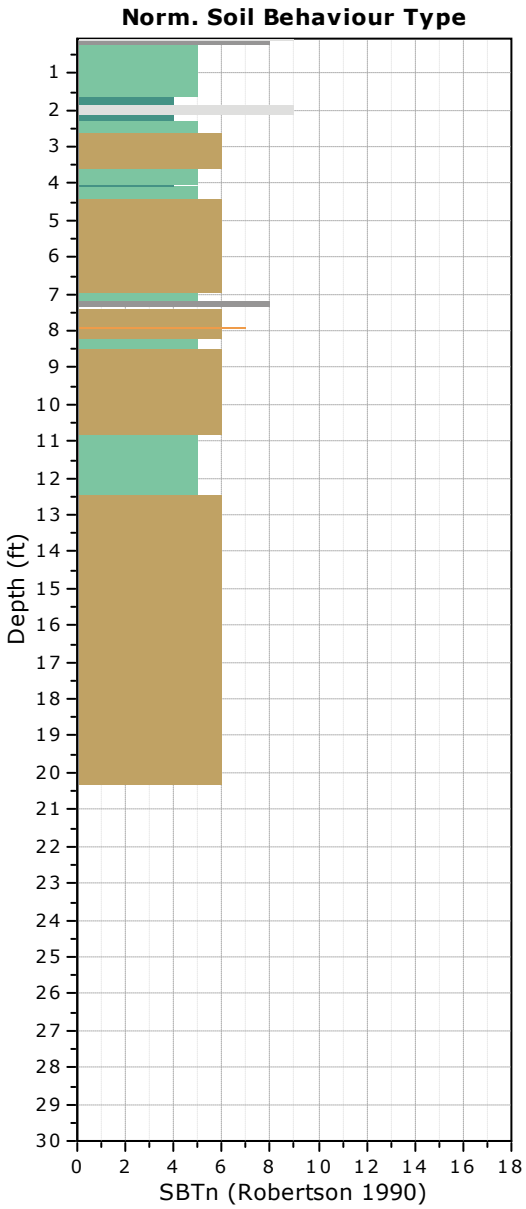
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

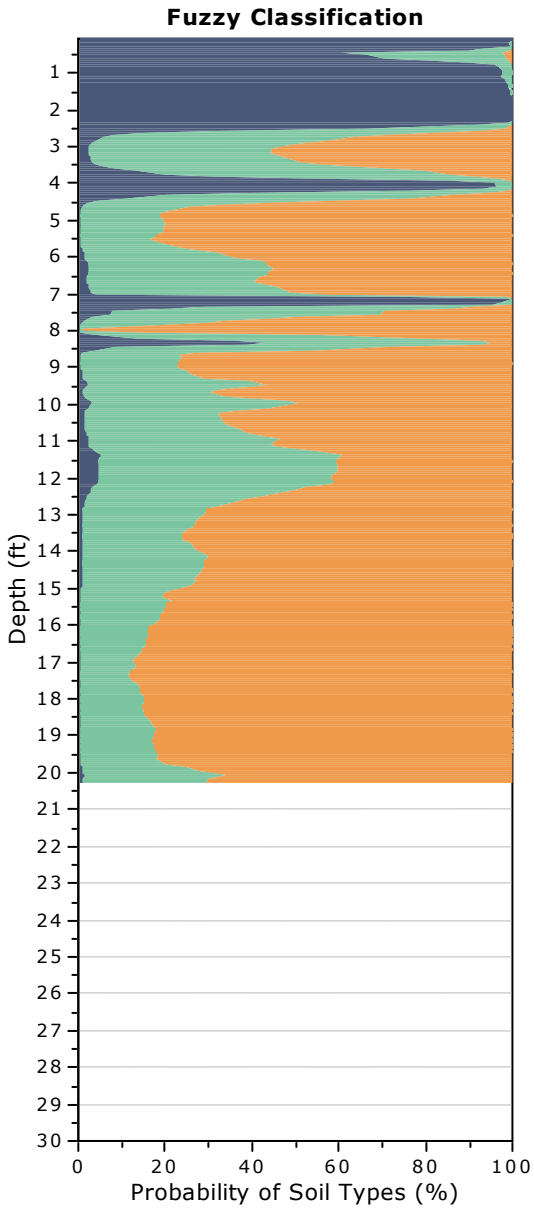


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-46
Total depth: 20.25 ft, Date: 5/16/2024
Surface Elevation: 62.38 ft
Coords: X:572794.07, Y:555431.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



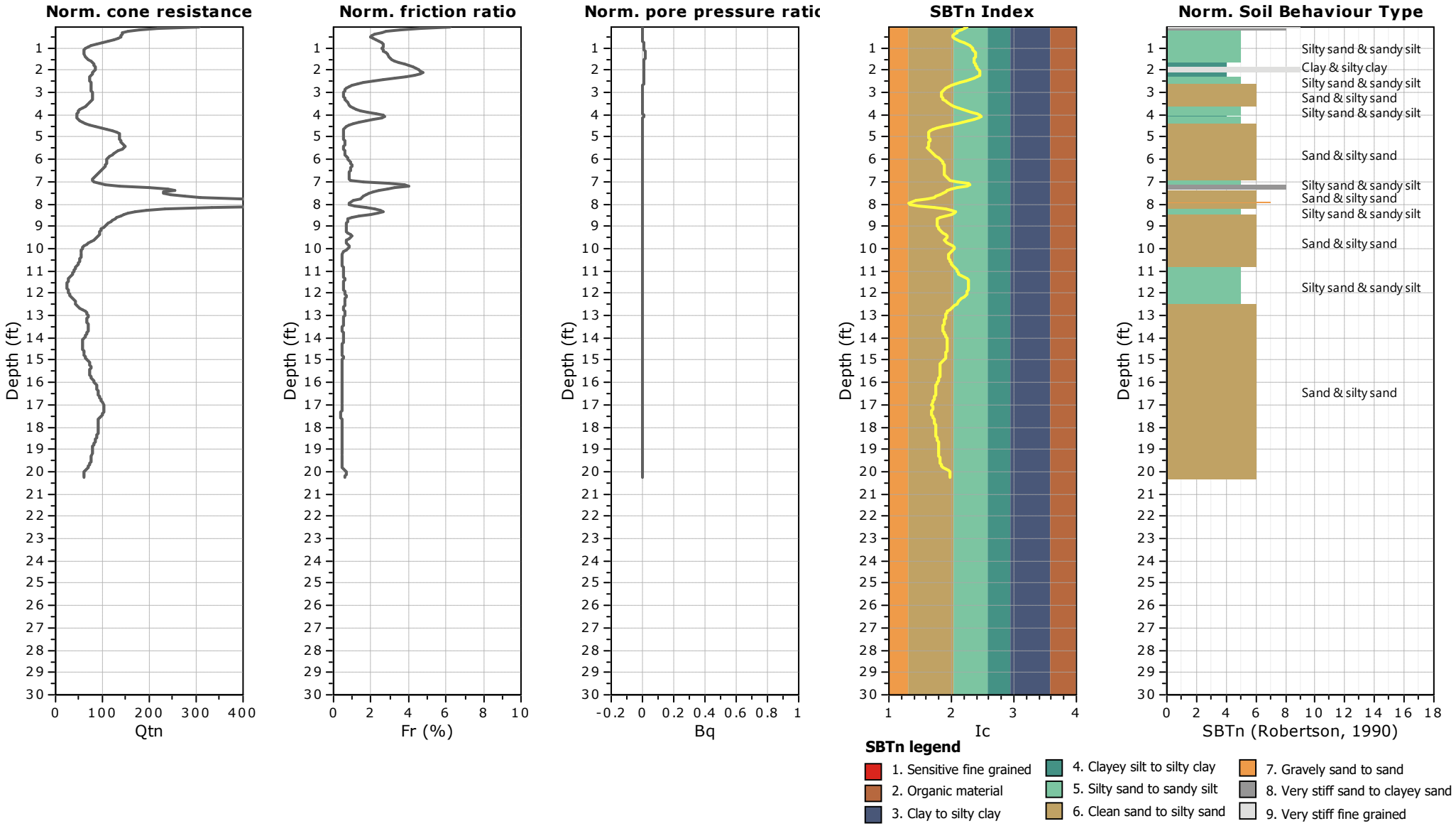


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-46
Total depth: 20.25 ft, Date: 5/16/2024
Surface Elevation: 62.38 ft
Coords: X:572794.07, Y:555431.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

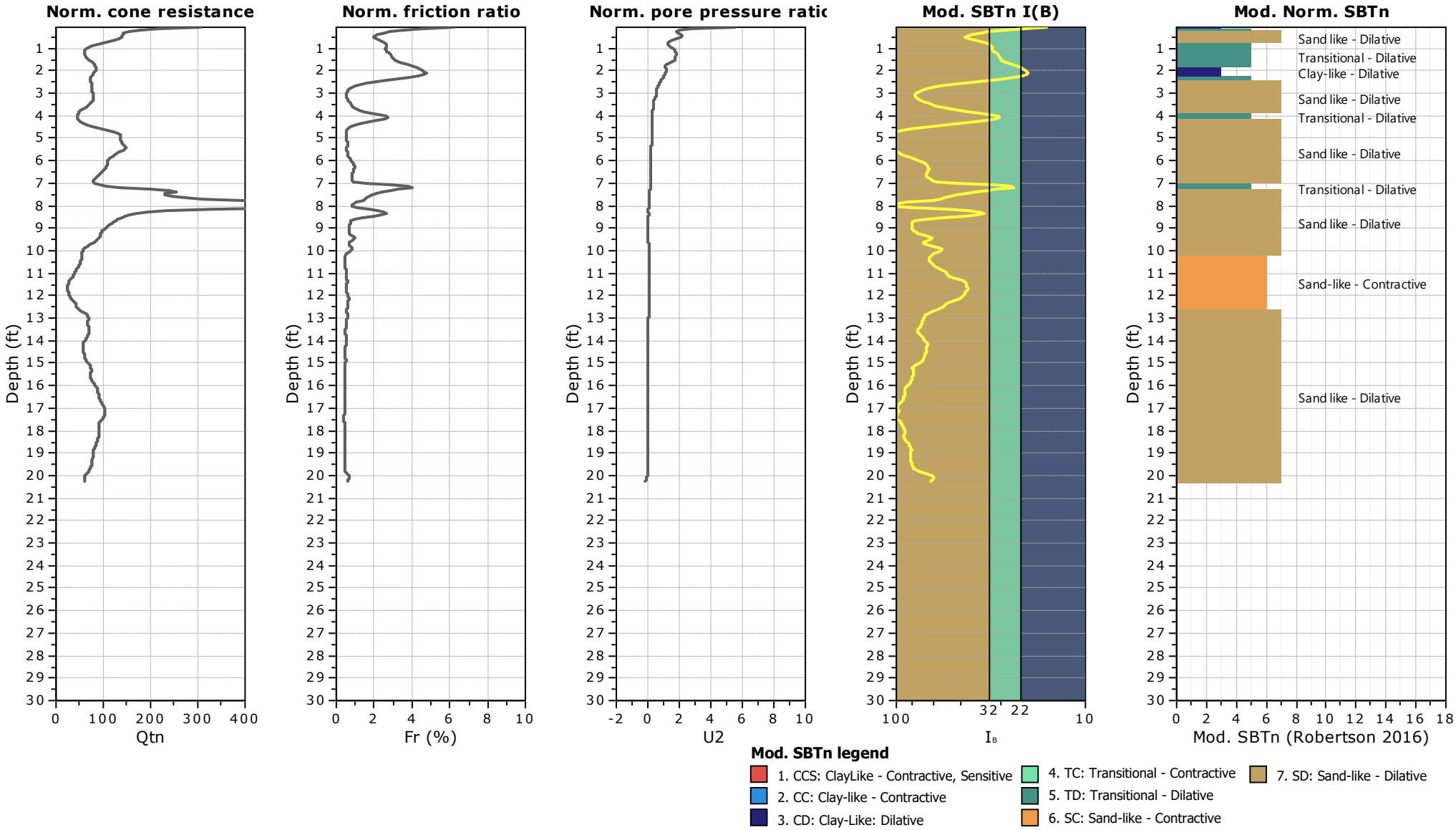
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-46
Total depth: 20.25 ft, Date: 5/16/2024
Surface Elevation: 62.38 ft
Coords: X:572794.07, Y:555431.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

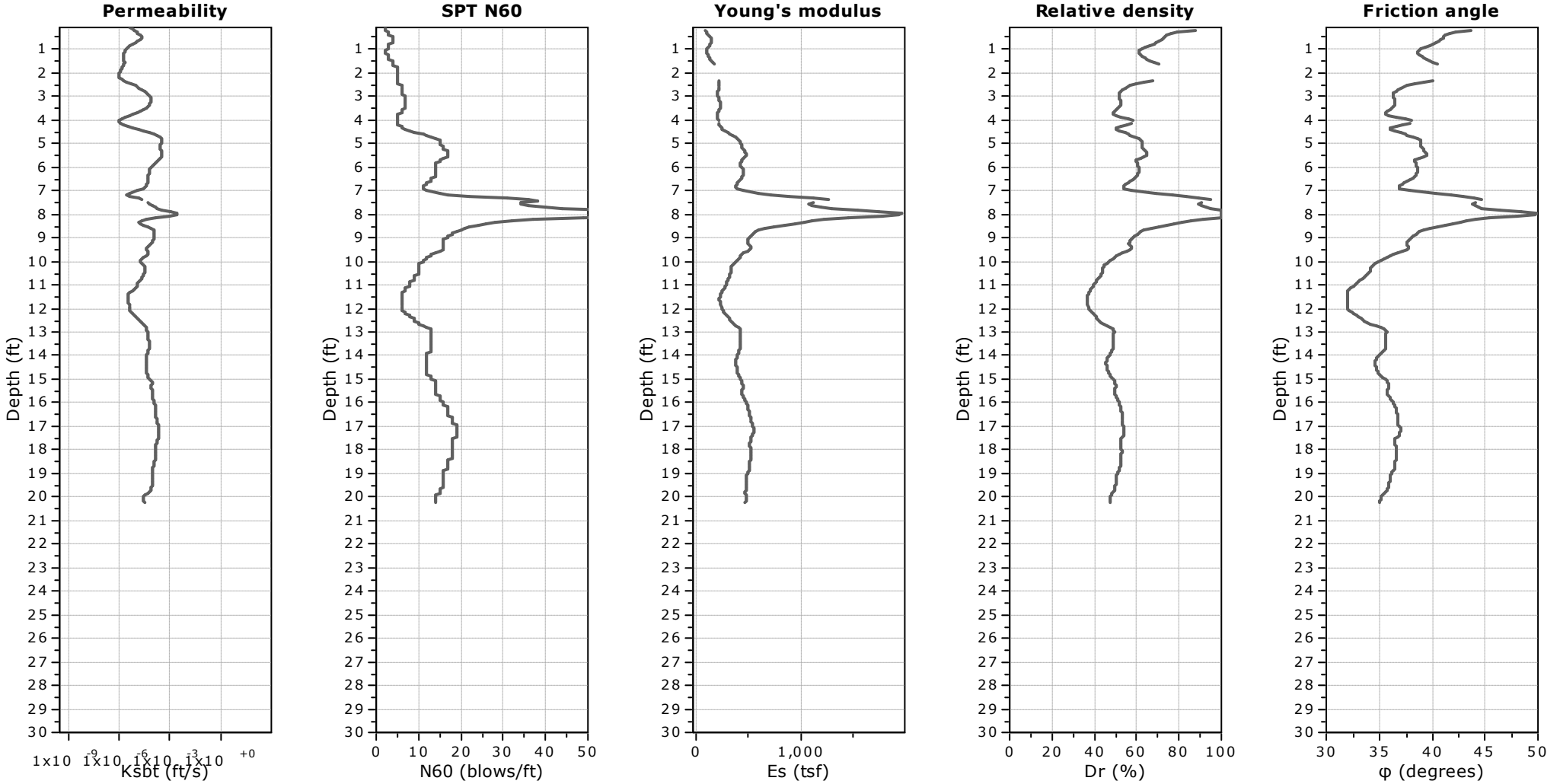
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-46
Total depth: 20.25 ft, Date: 5/16/2024
Surface Elevation: 62.38 ft
Coords: X:572794.07, Y:555431.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



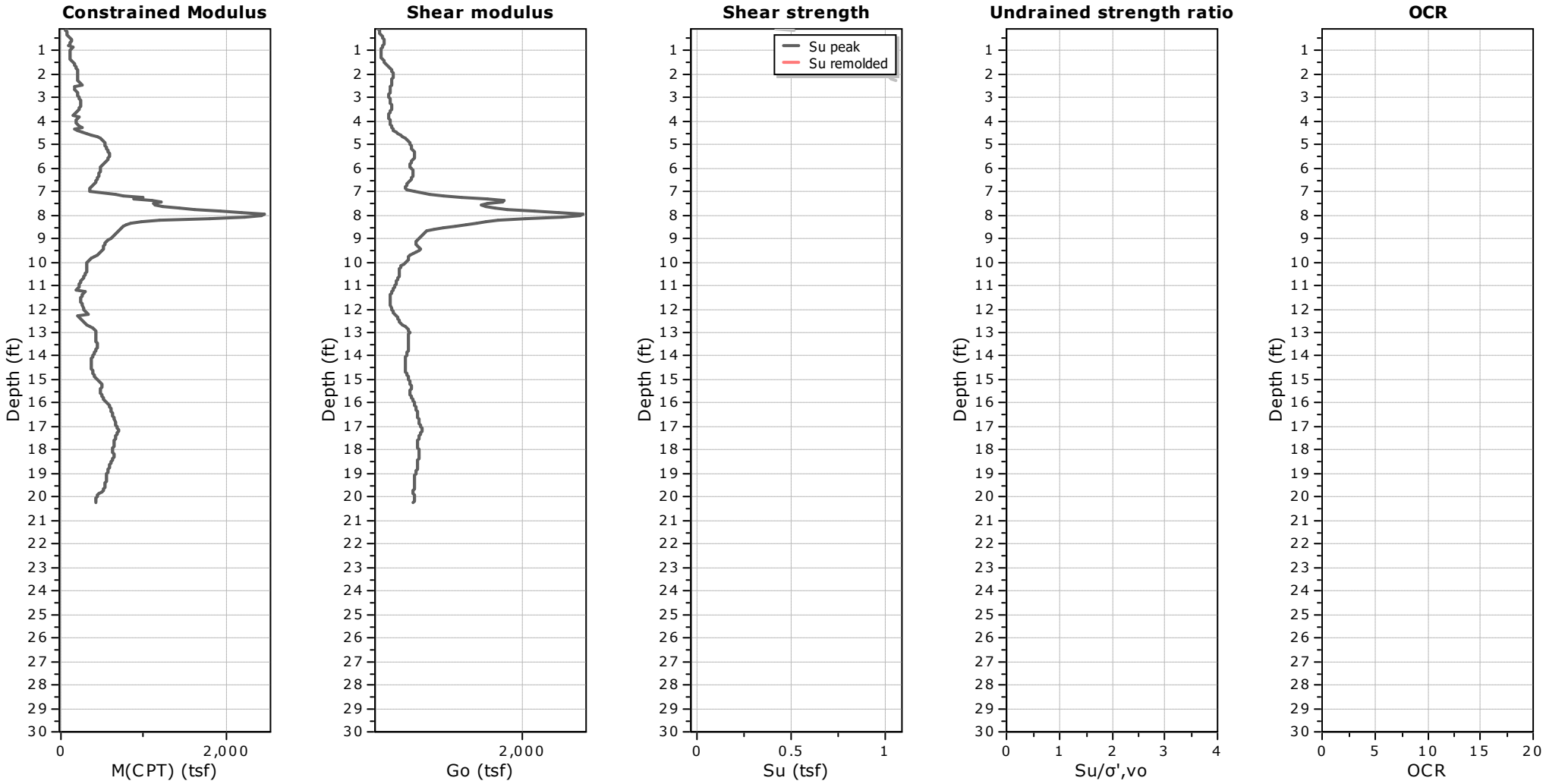
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-46
Total depth: 20.25 ft, Date: 5/16/2024
Surface Elevation: 62.38 ft
Coords: X:572794.07, Y:555431.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



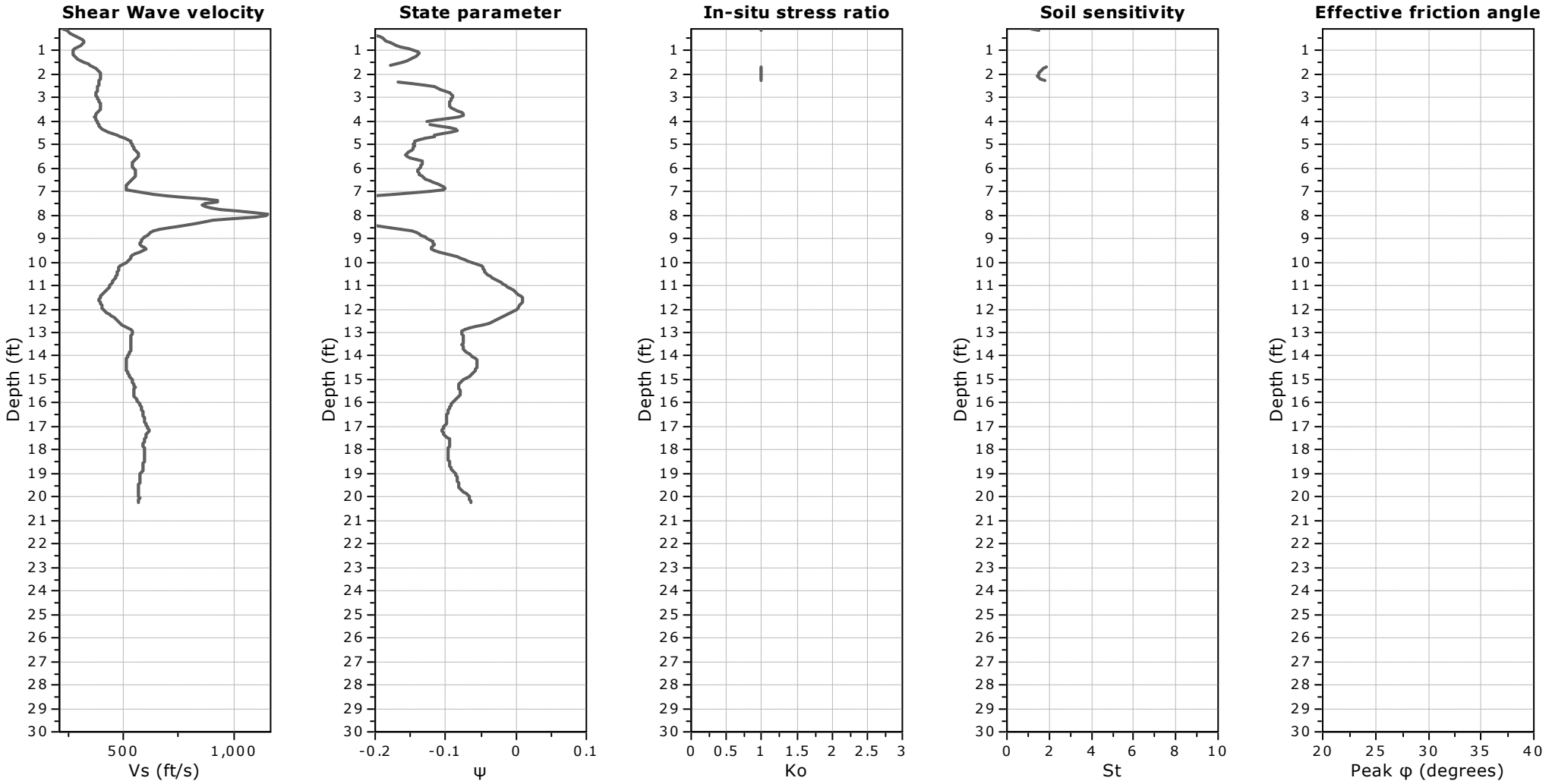
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-46
Total depth: 20.25 ft, Date: 5/16/2024
Surface Elevation: 62.38 ft
Coords: X:572794.07, Y:555431.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



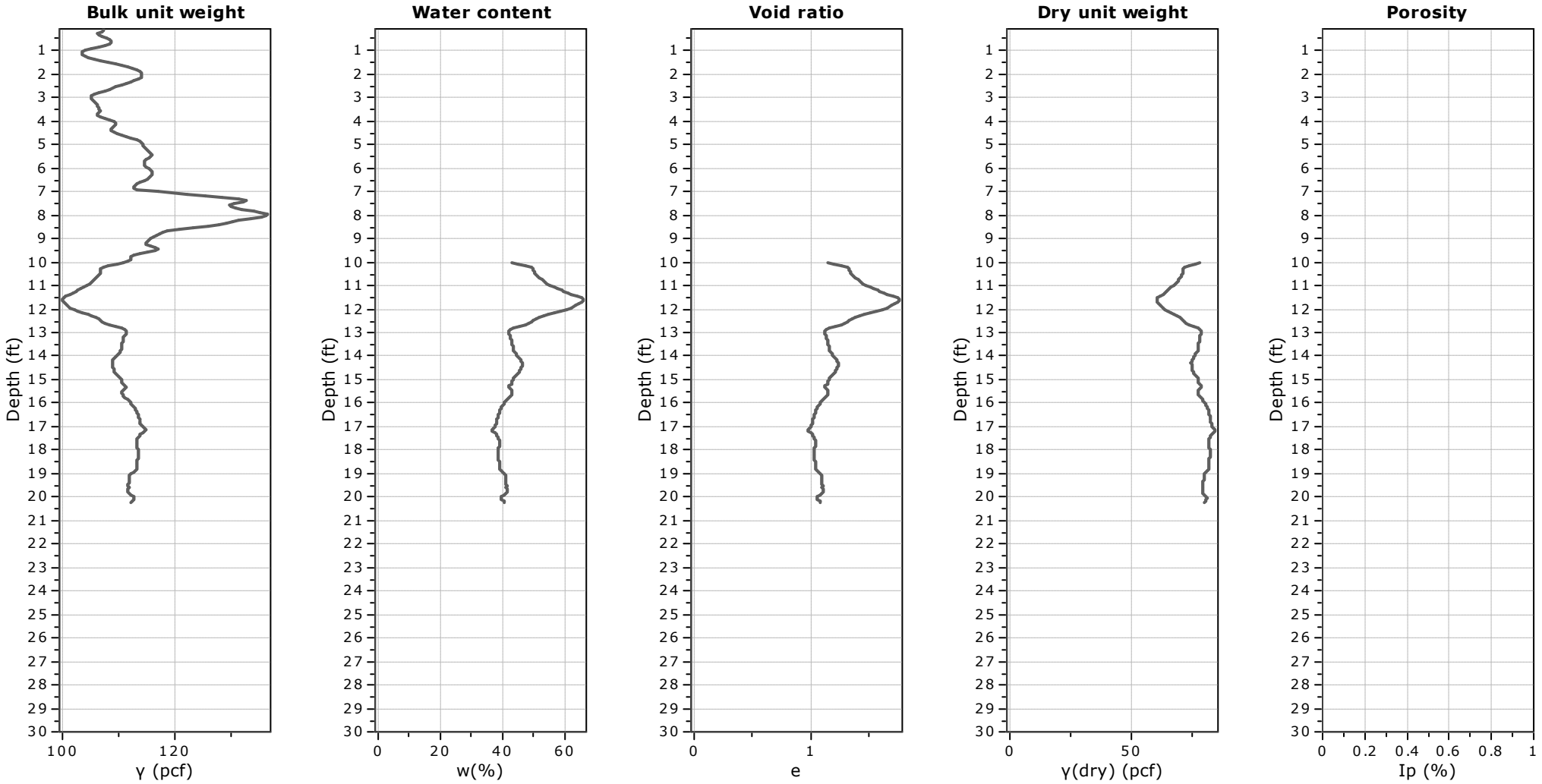
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-46
Total depth: 20.25 ft, Date: 5/16/2024
Surface Elevation: 62.38 ft
Coords: X:572794.07, Y:555431.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

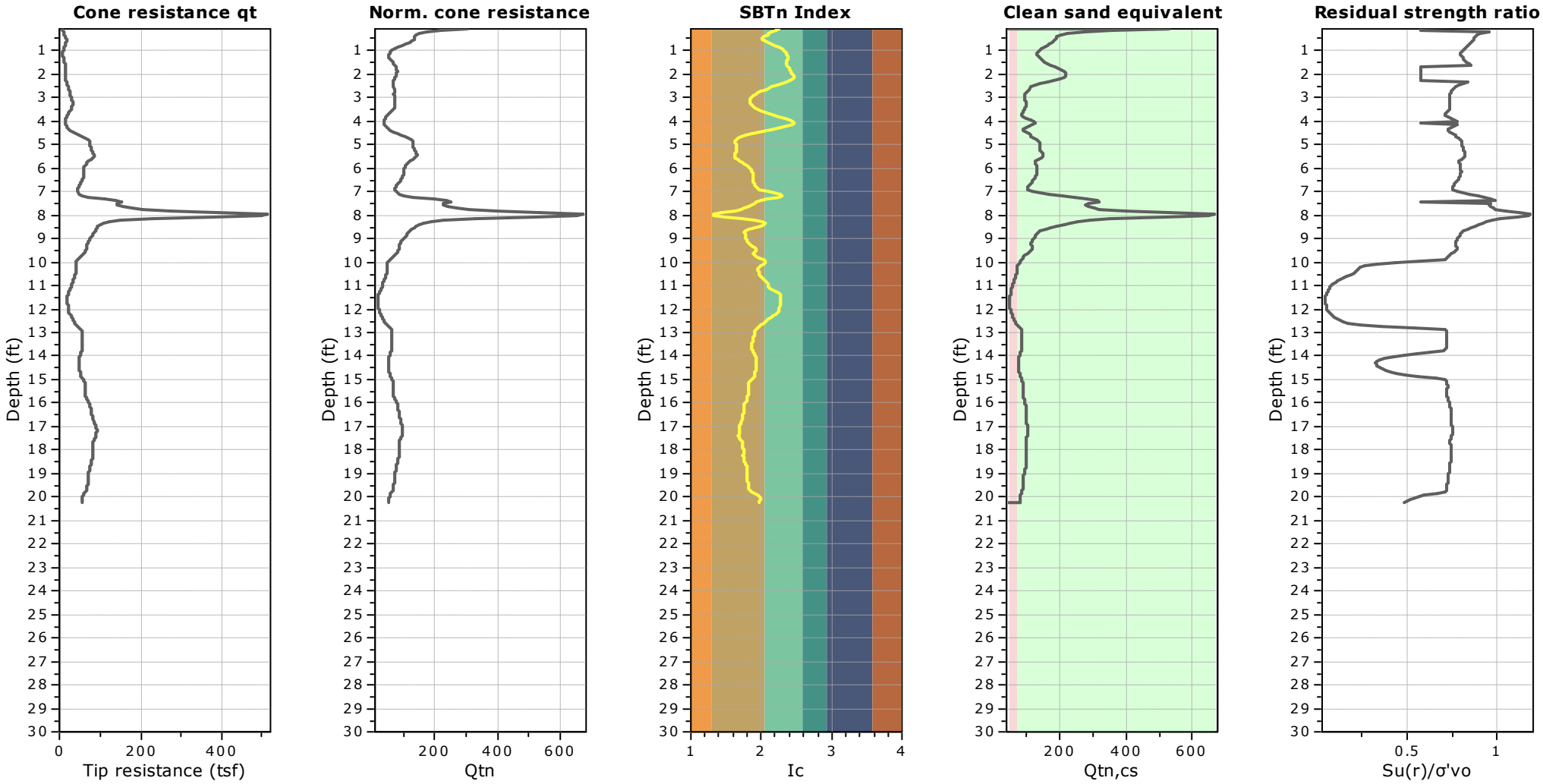
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-46
Total depth: 20.25 ft, Date: 5/16/2024
Surface Elevation: 62.38 ft
Coords: X:572794.07, Y:555431.91
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

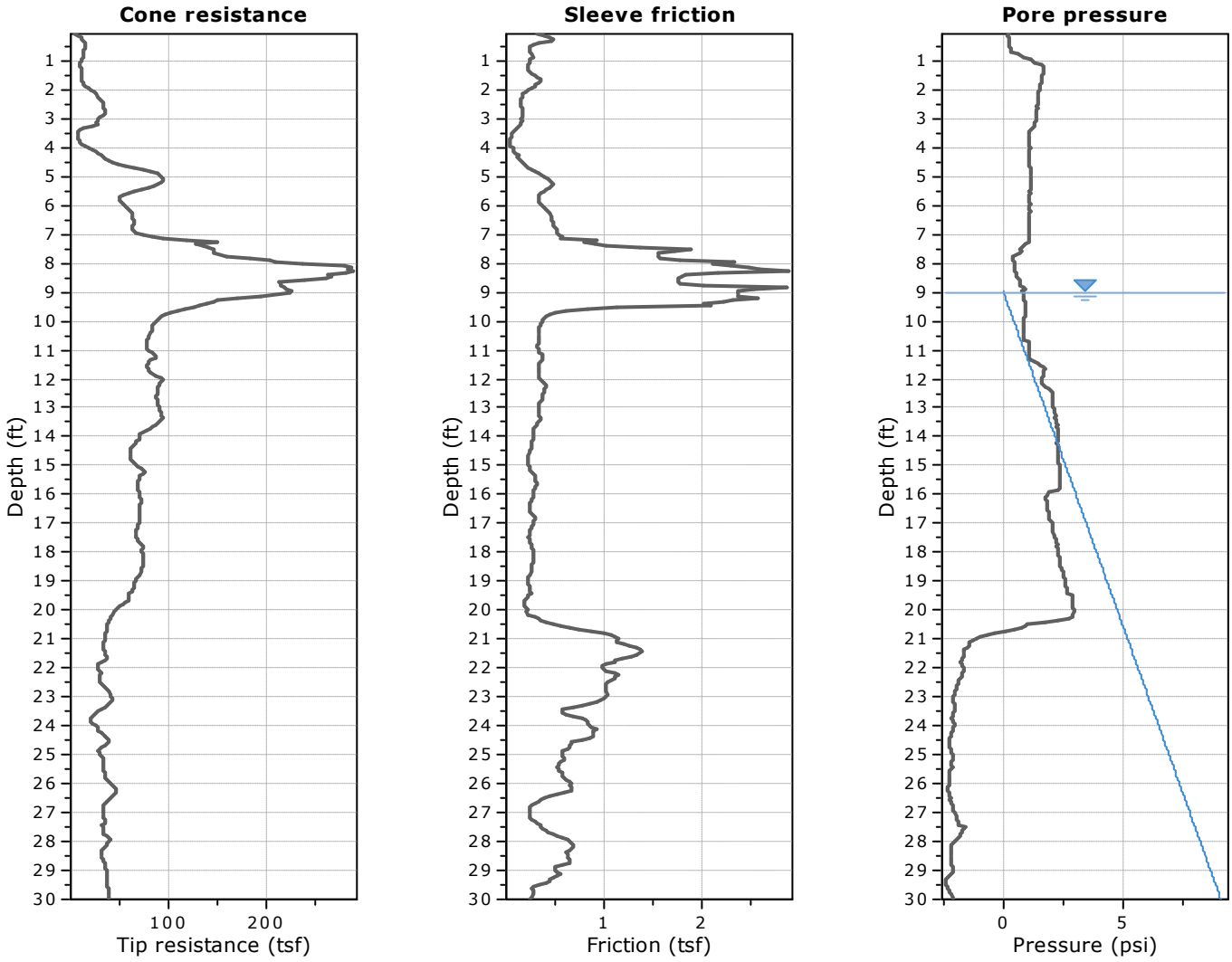
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



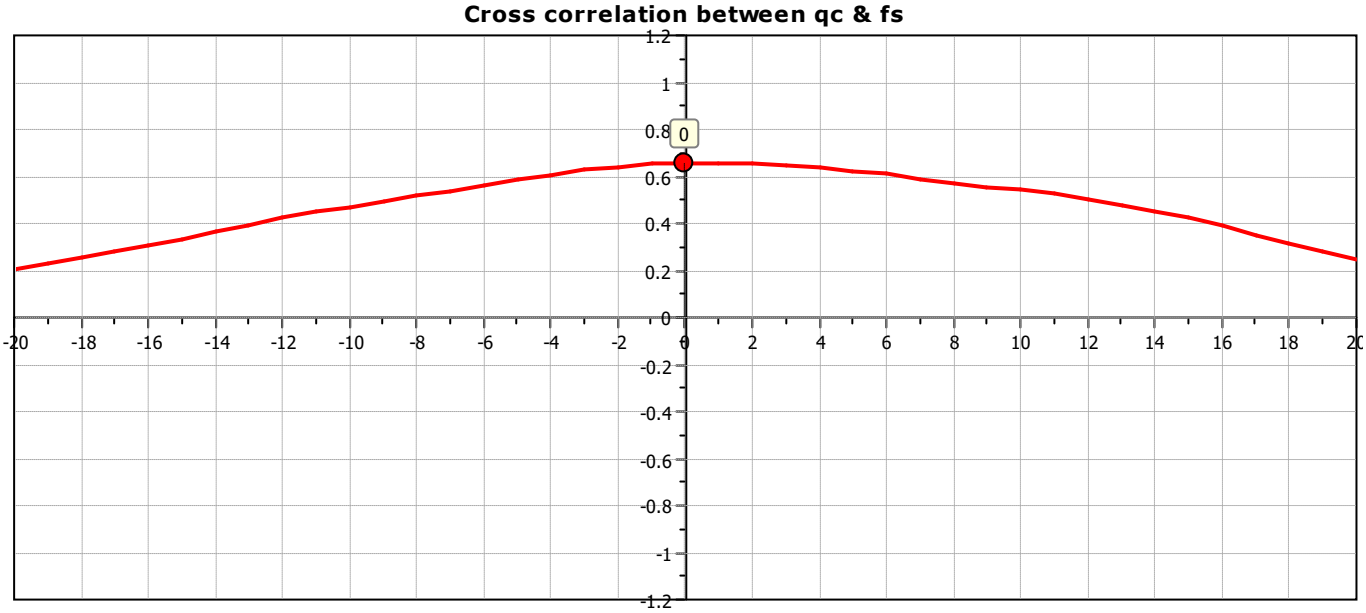
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-47
Total depth: 30.37 ft, Date: 5/16/2024
Surface Elevation: 62.59 ft
Coords: X:572797.46, Y:555393.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



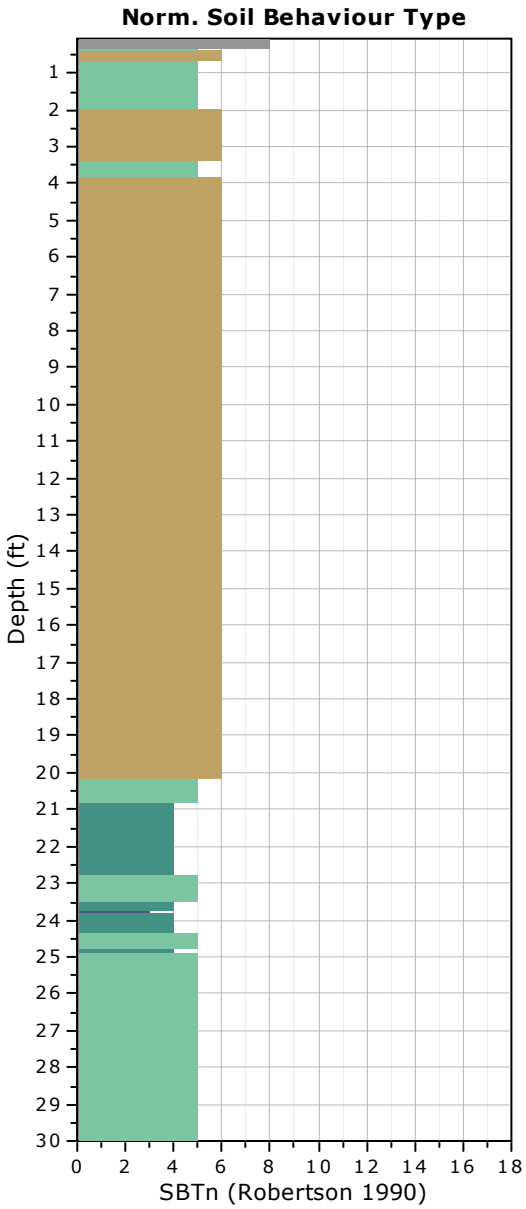
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

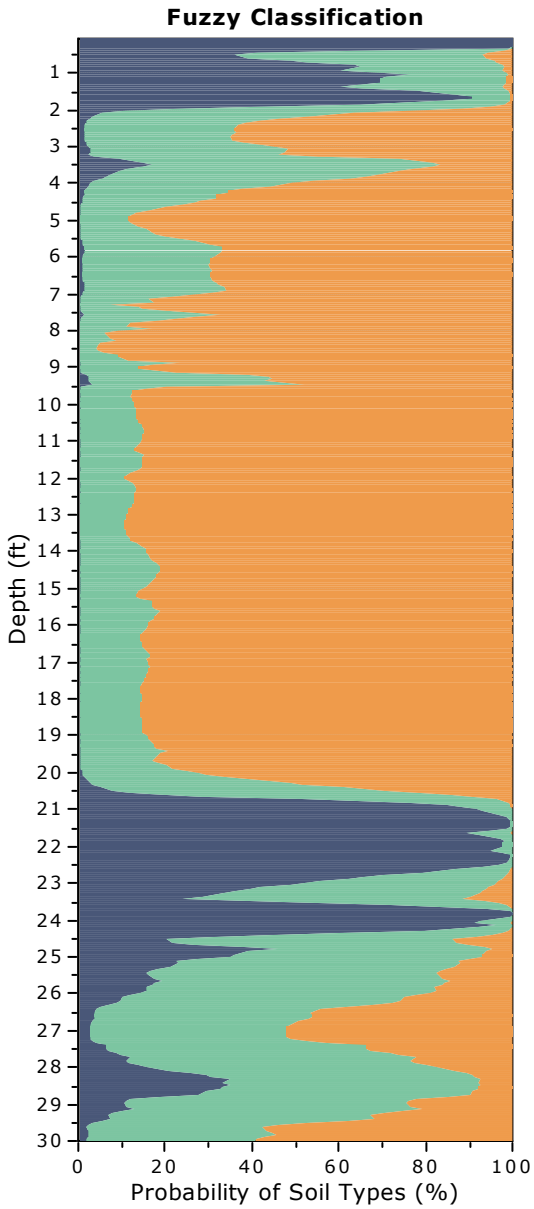


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-47
Total depth: 30.37 ft, Date: 5/16/2024
Surface Elevation: 62.59 ft
Coords: X:572797.46, Y:555393.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



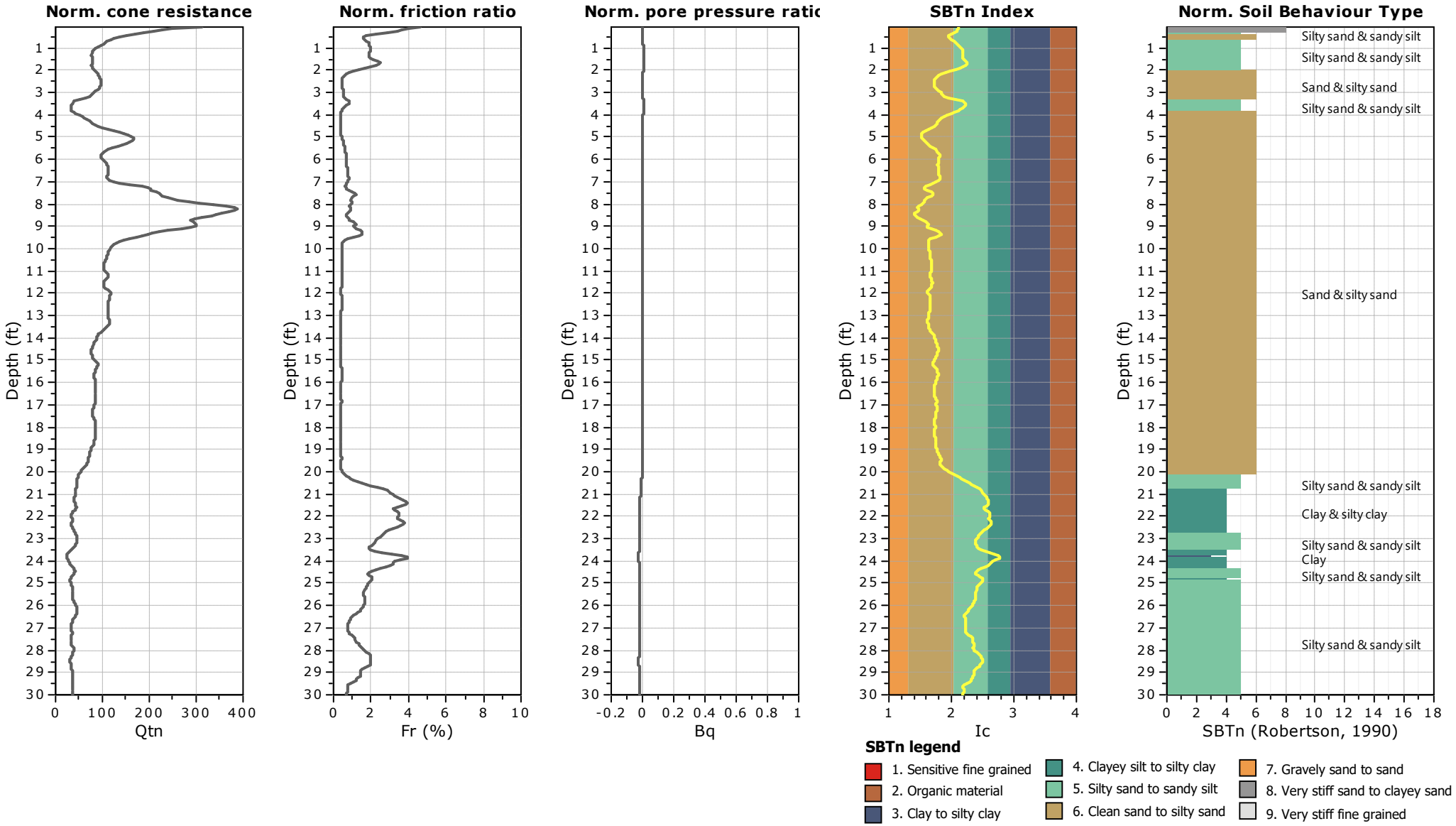


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-47
Total depth: 30.37 ft, Date: 5/16/2024
Surface Elevation: 62.59 ft
Coords: X:572797.46, Y:555393.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

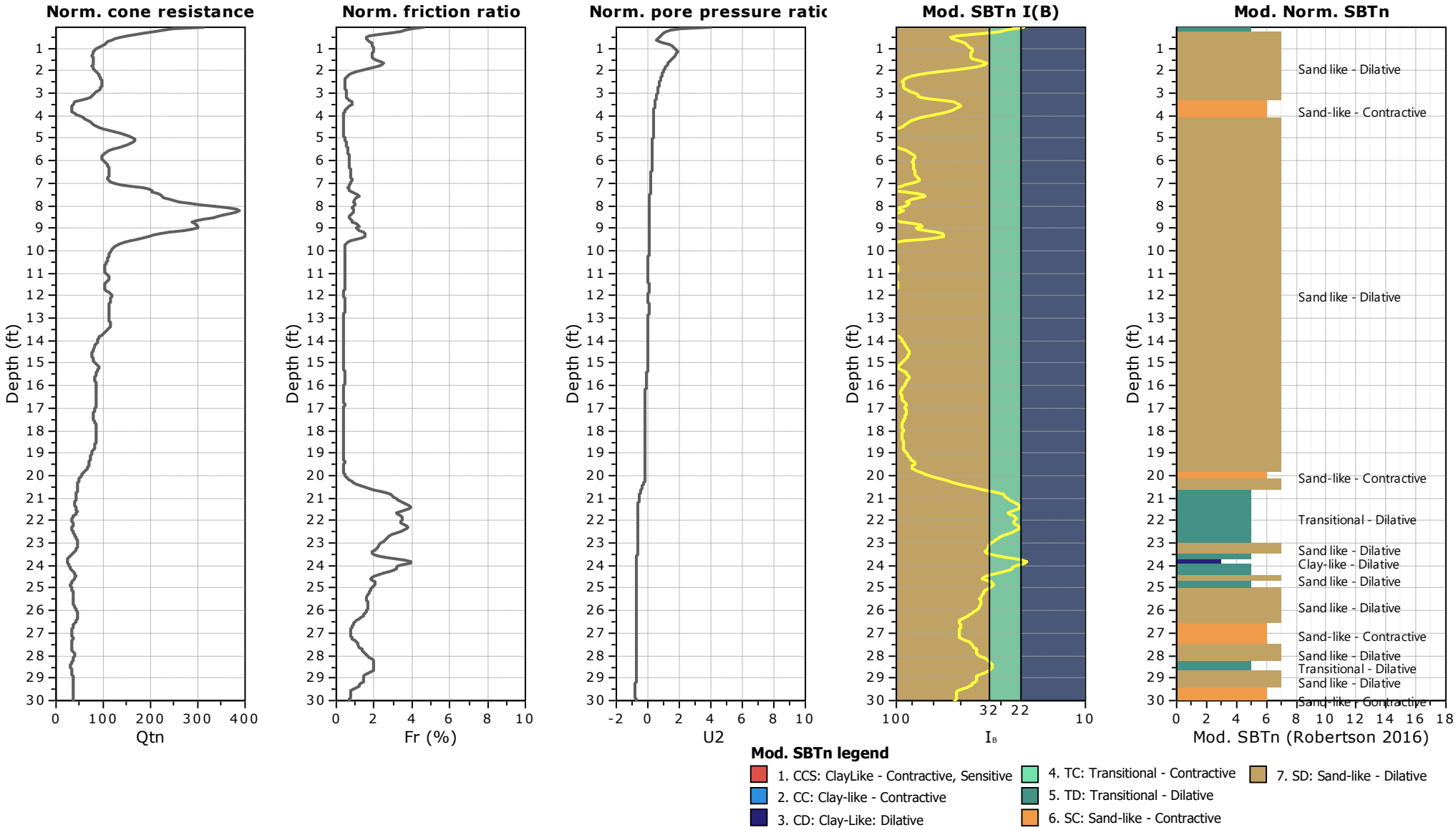
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-47
Total depth: 30.37 ft, Date: 5/16/2024
Surface Elevation: 62.59 ft
Coords: X:572797.46, Y:555393.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

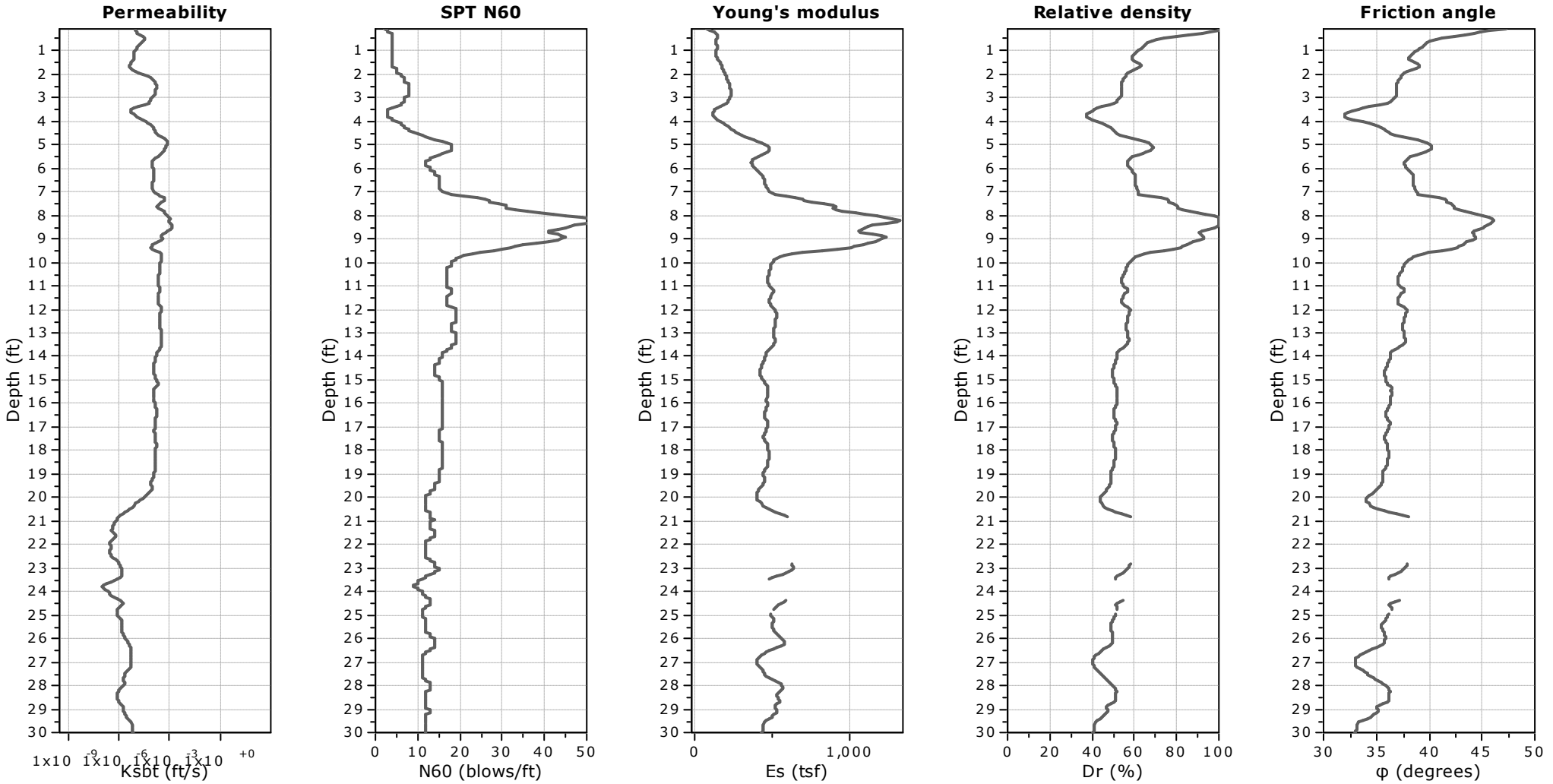
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-47
Total depth: 30.37 ft, Date: 5/16/2024
Surface Elevation: 62.59 ft
Coords: X:572797.46, Y:555393.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



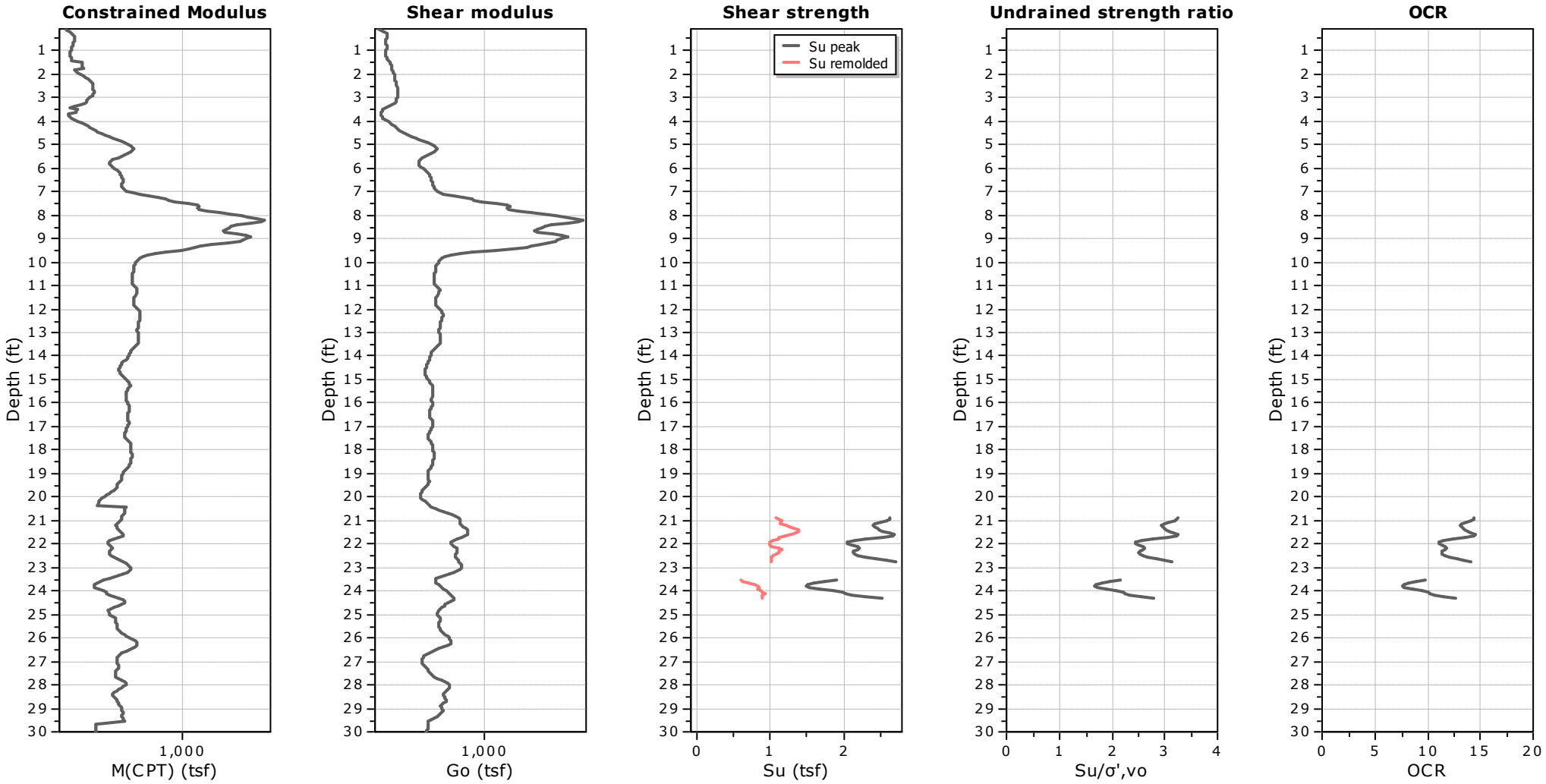
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-47
Total depth: 30.37 ft, Date: 5/16/2024
Surface Elevation: 62.59 ft
Coords: X:572797.46, Y:555393.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



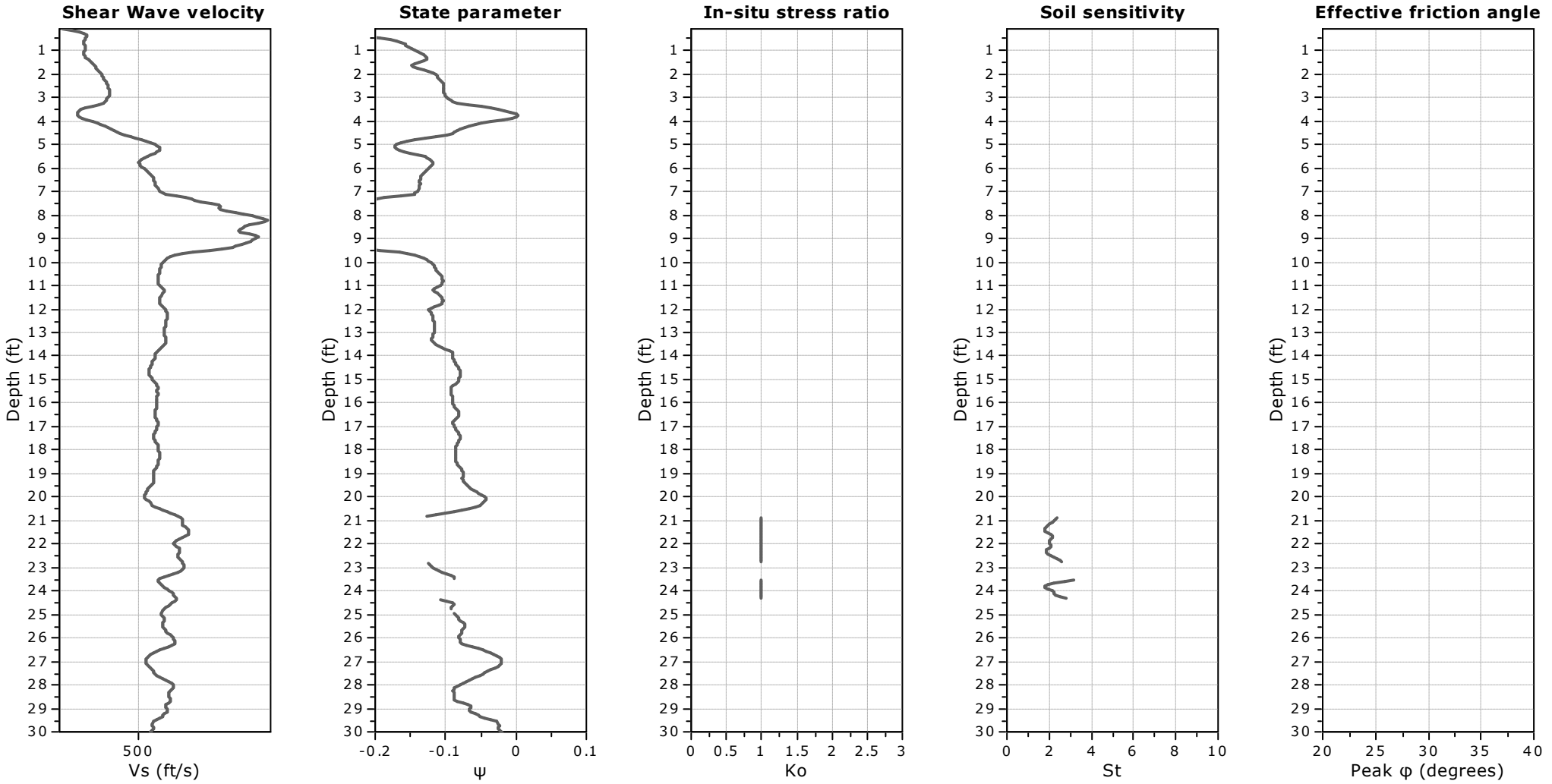
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-47
Total depth: 30.37 ft, Date: 5/16/2024
Surface Elevation: 62.59 ft
Coords: X:572797.46, Y:555393.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



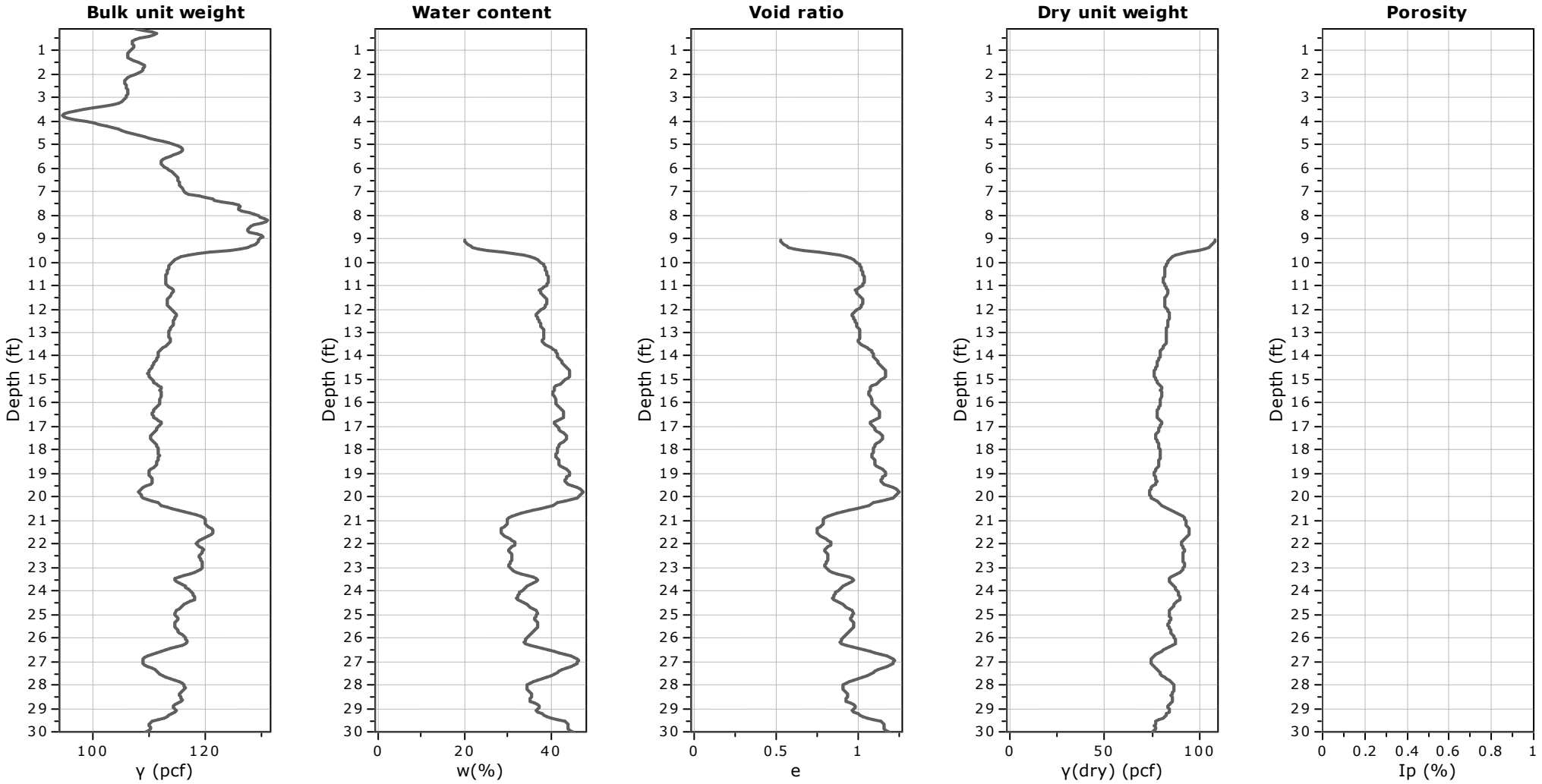
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-47
Total depth: 30.37 ft, Date: 5/16/2024
Surface Elevation: 62.59 ft
Coords: X:572797.46, Y:555393.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

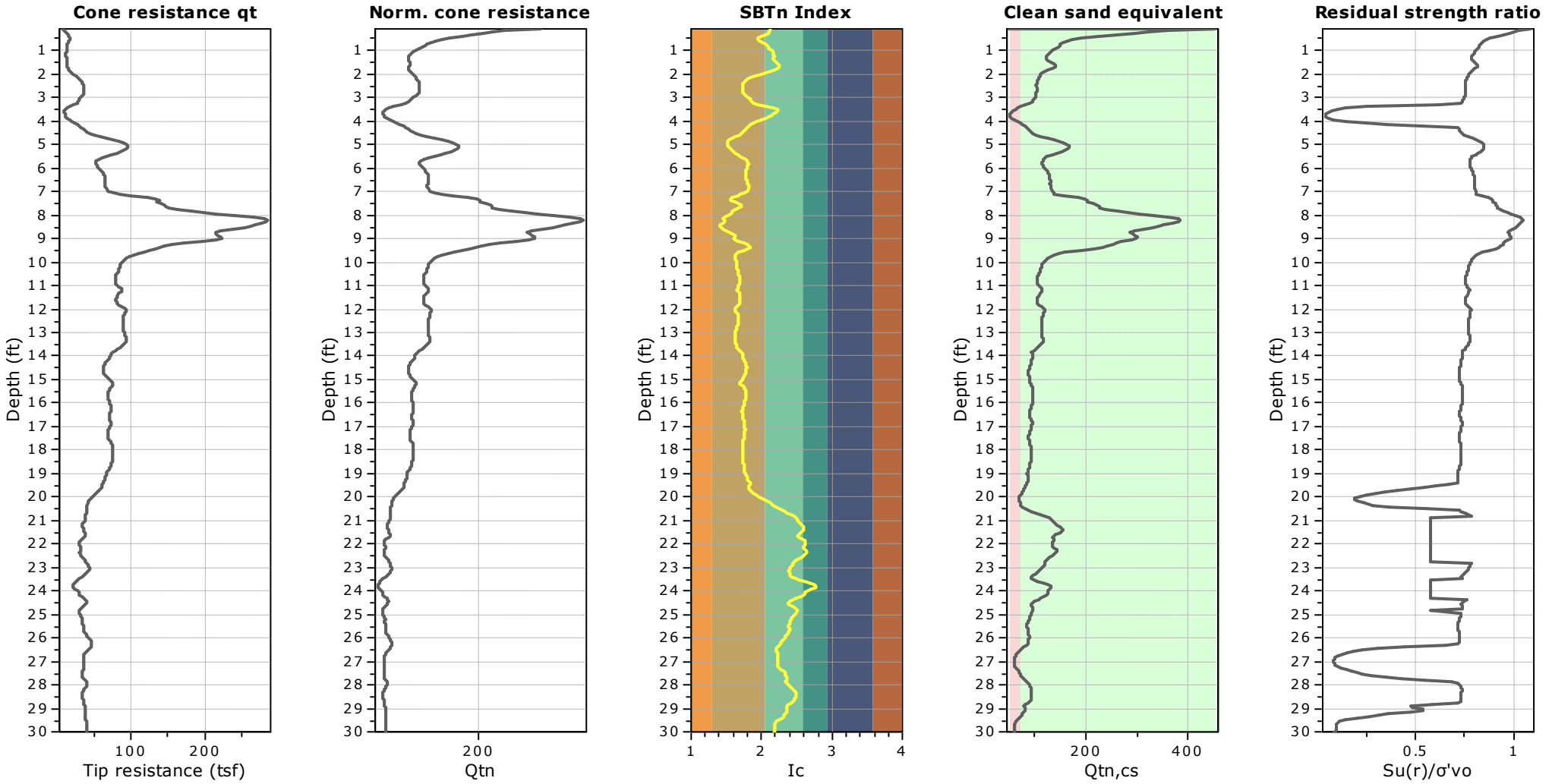
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-47
Total depth: 30.37 ft, Date: 5/16/2024
Surface Elevation: 62.59 ft
Coords: X:572797.46, Y:555393.02
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

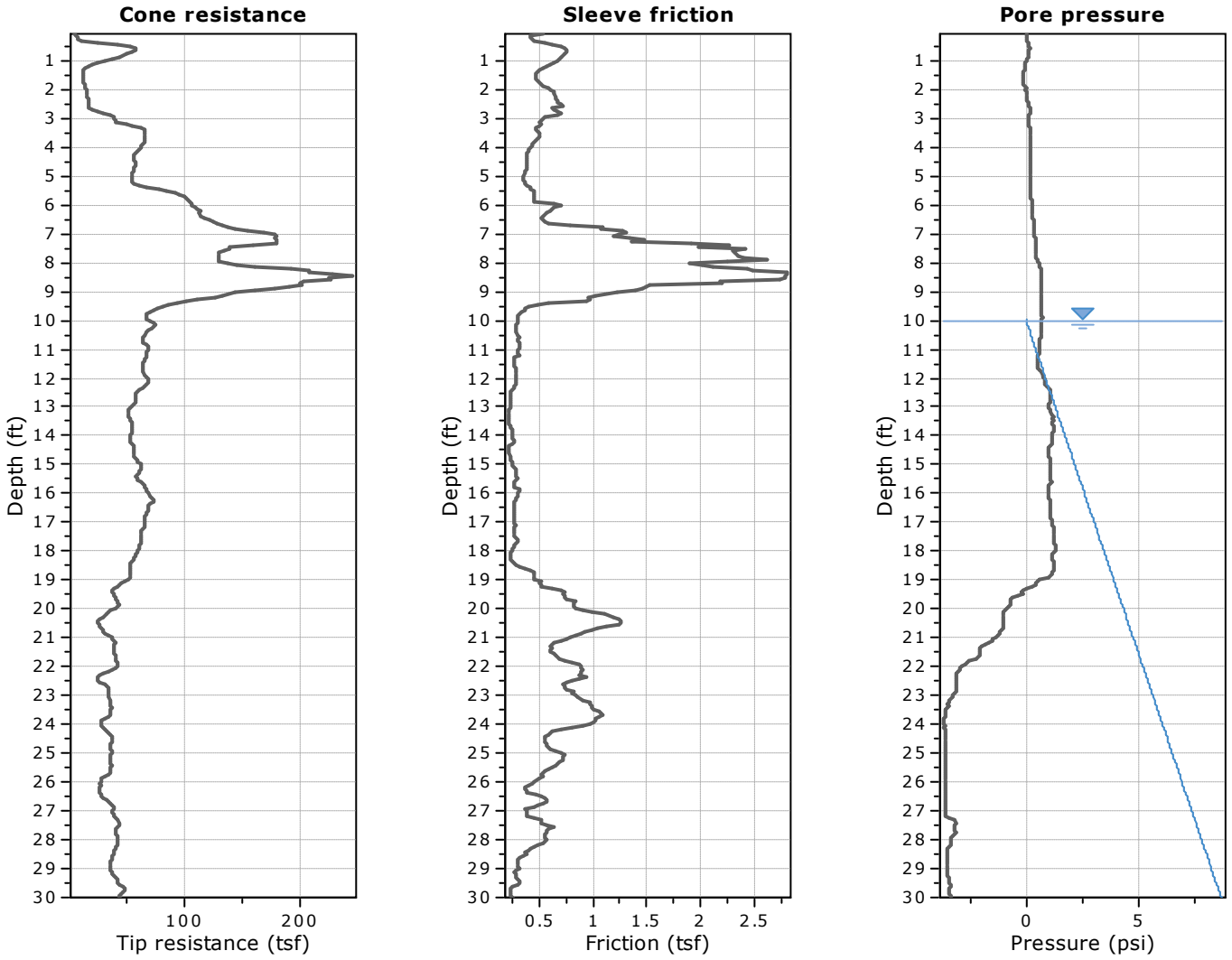
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



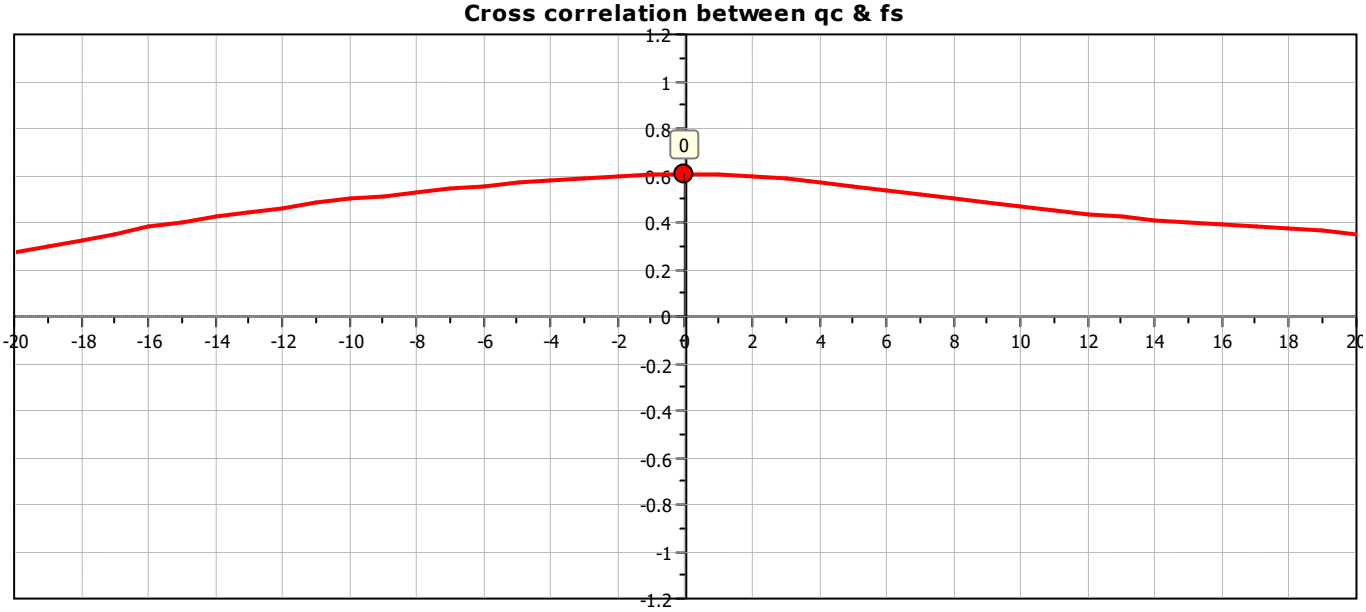
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-48
Total depth: 30.08 ft, Date: 5/16/2024
Surface Elevation: 61.32 ft
Coords: X:573331.73, Y:555749.16
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



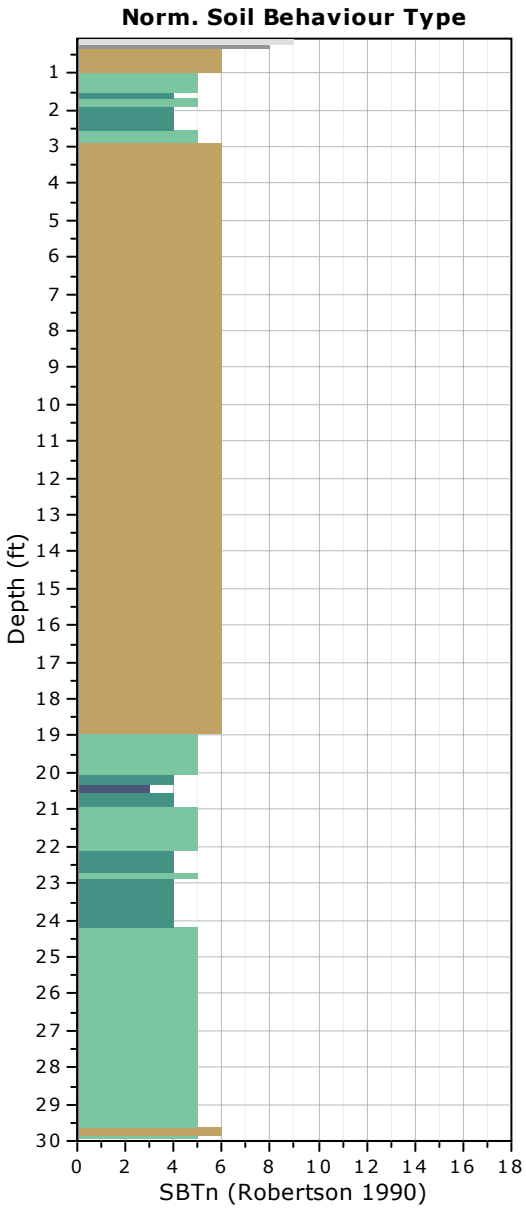
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

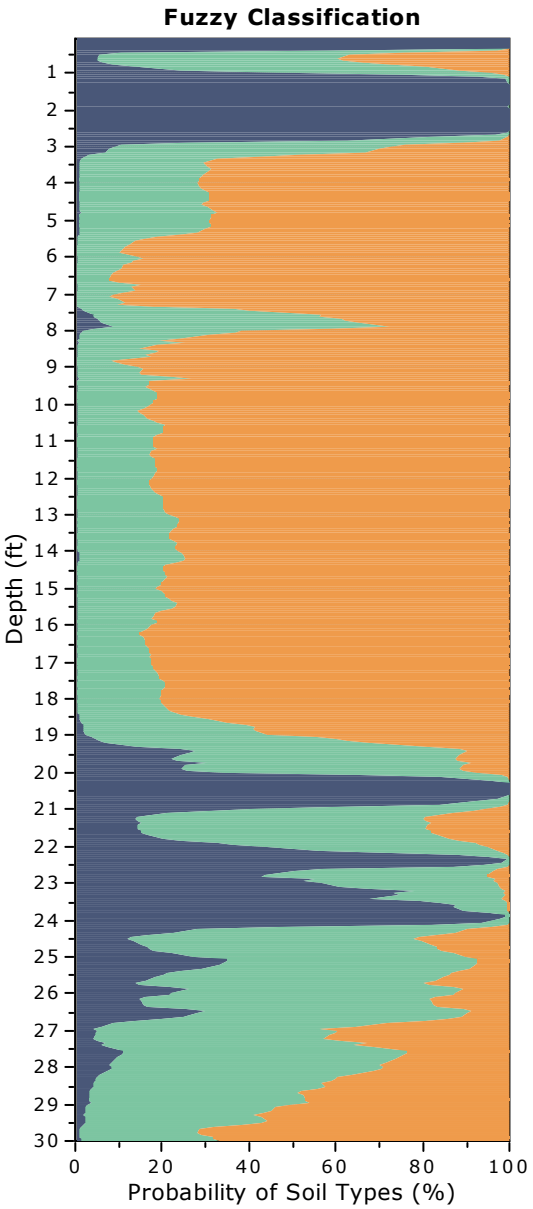


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-48
Total depth: 30.08 ft, Date: 5/16/2024
Surface Elevation: 61.32 ft
Coords: X:573331.73, Y:555749.16
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



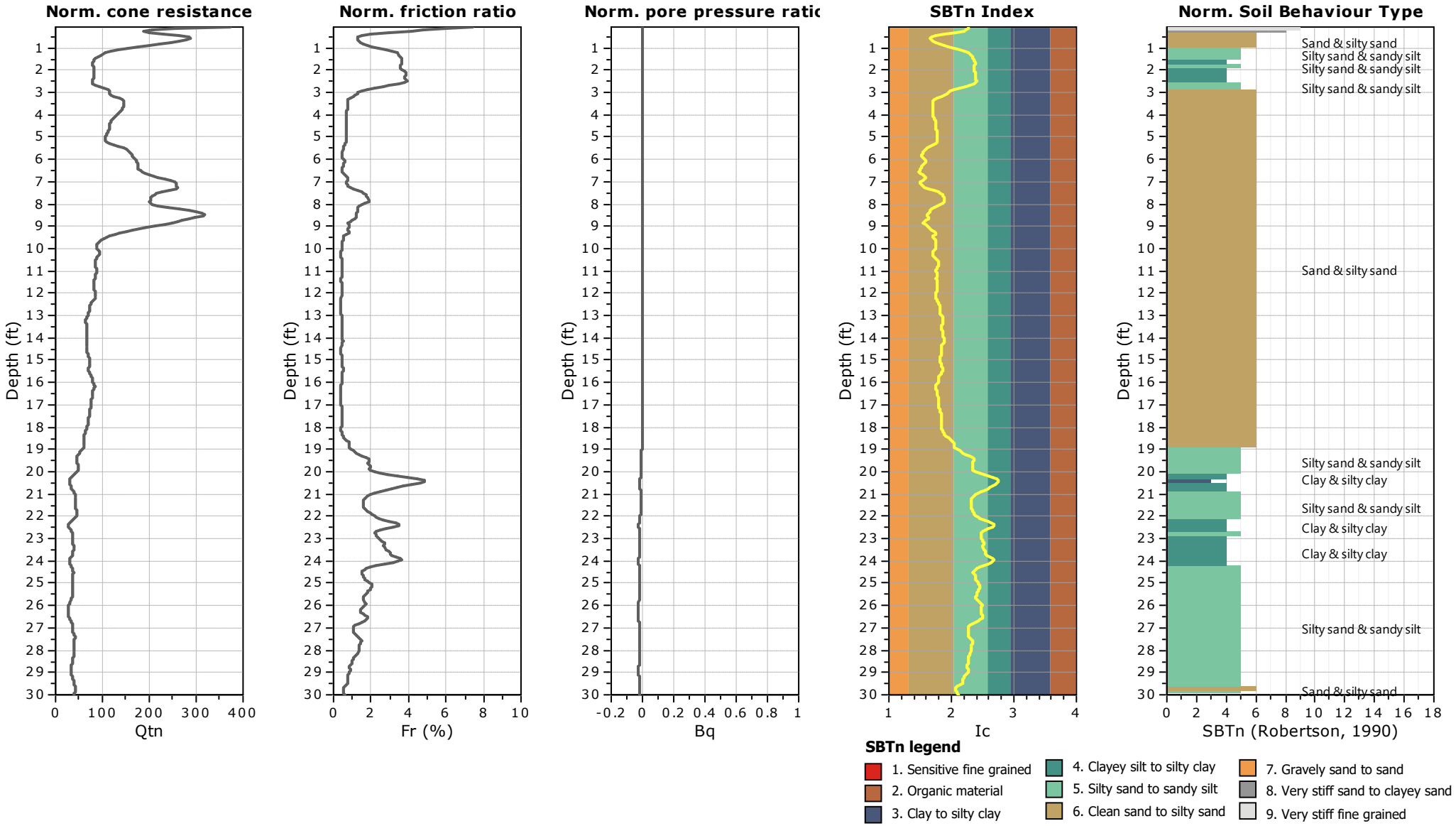


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-48
Total depth: 30.08 ft, Date: 5/16/2024
Surface Elevation: 61.32 ft
Coords: X:573331.73, Y:555749.16
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

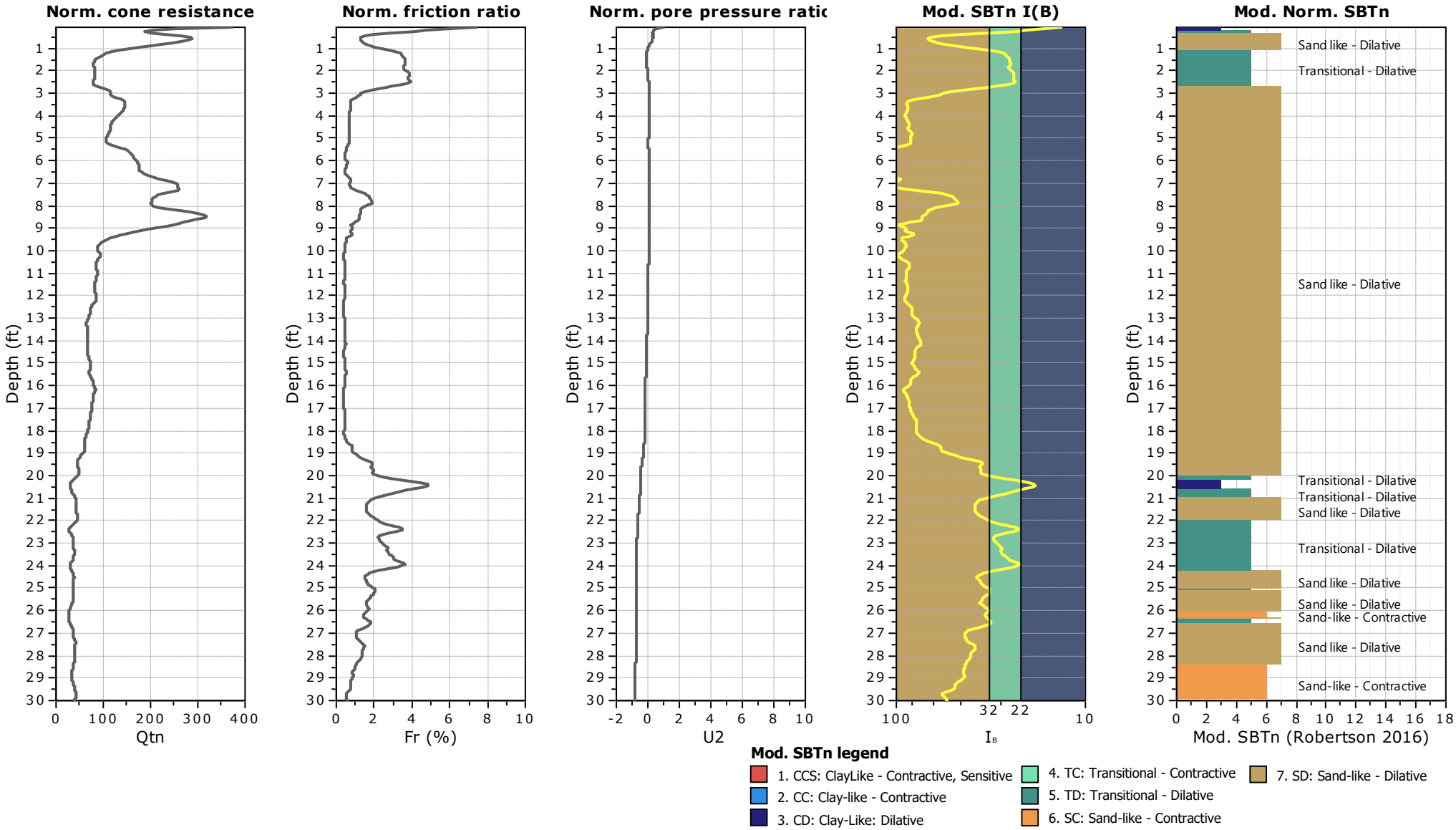
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-48
Total depth: 30.08 ft, Date: 5/16/2024
Surface Elevation: 61.32 ft
Coords: X:573331.73, Y:555749.16
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

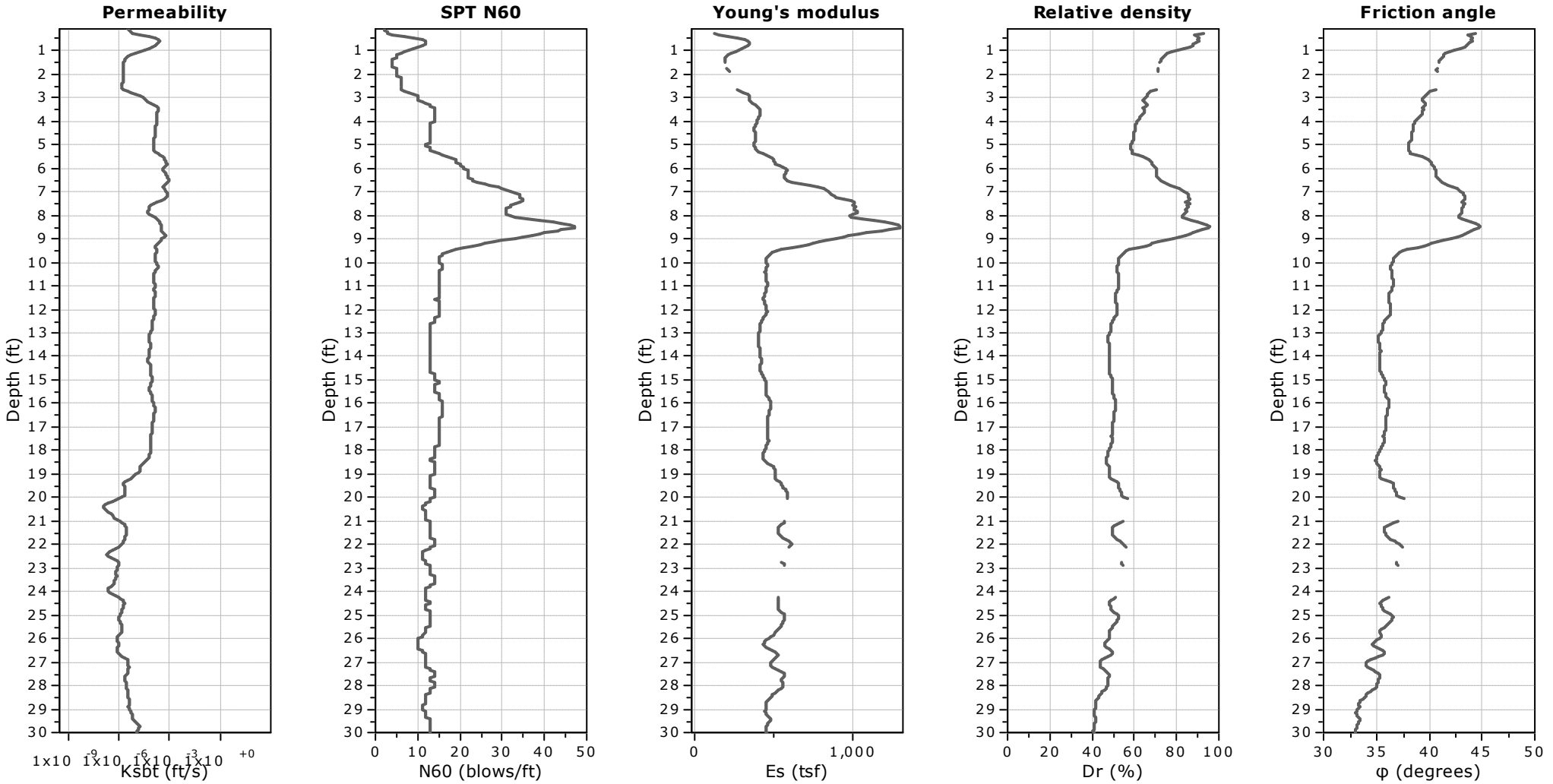
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-48
Total depth: 30.08 ft, Date: 5/16/2024
Surface Elevation: 61.32 ft
Coords: X:573331.73, Y:555749.16
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



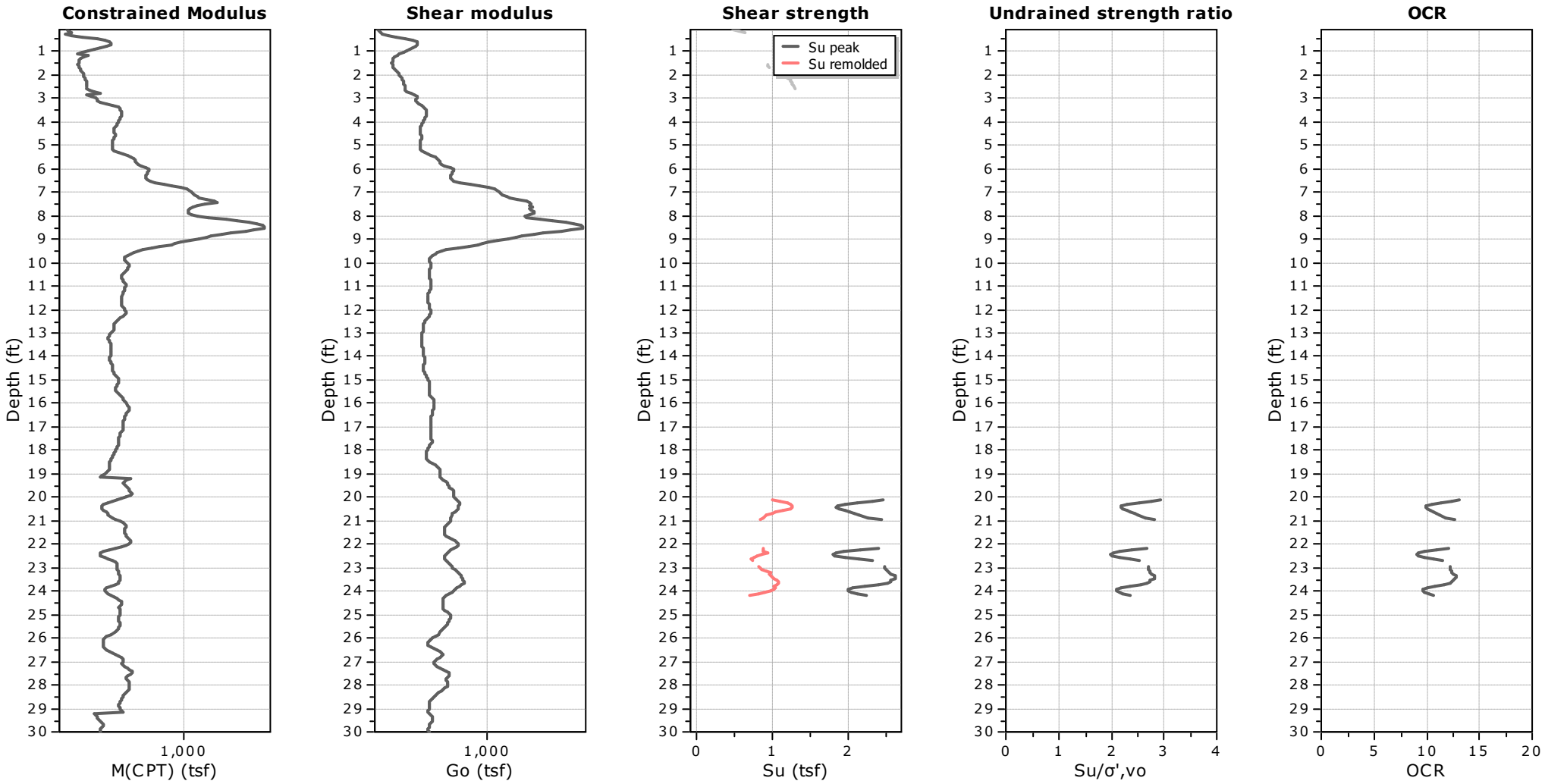
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-48
Total depth: 30.08 ft, Date: 5/16/2024
Surface Elevation: 61.32 ft
Coords: X:573331.73, Y:555749.16
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



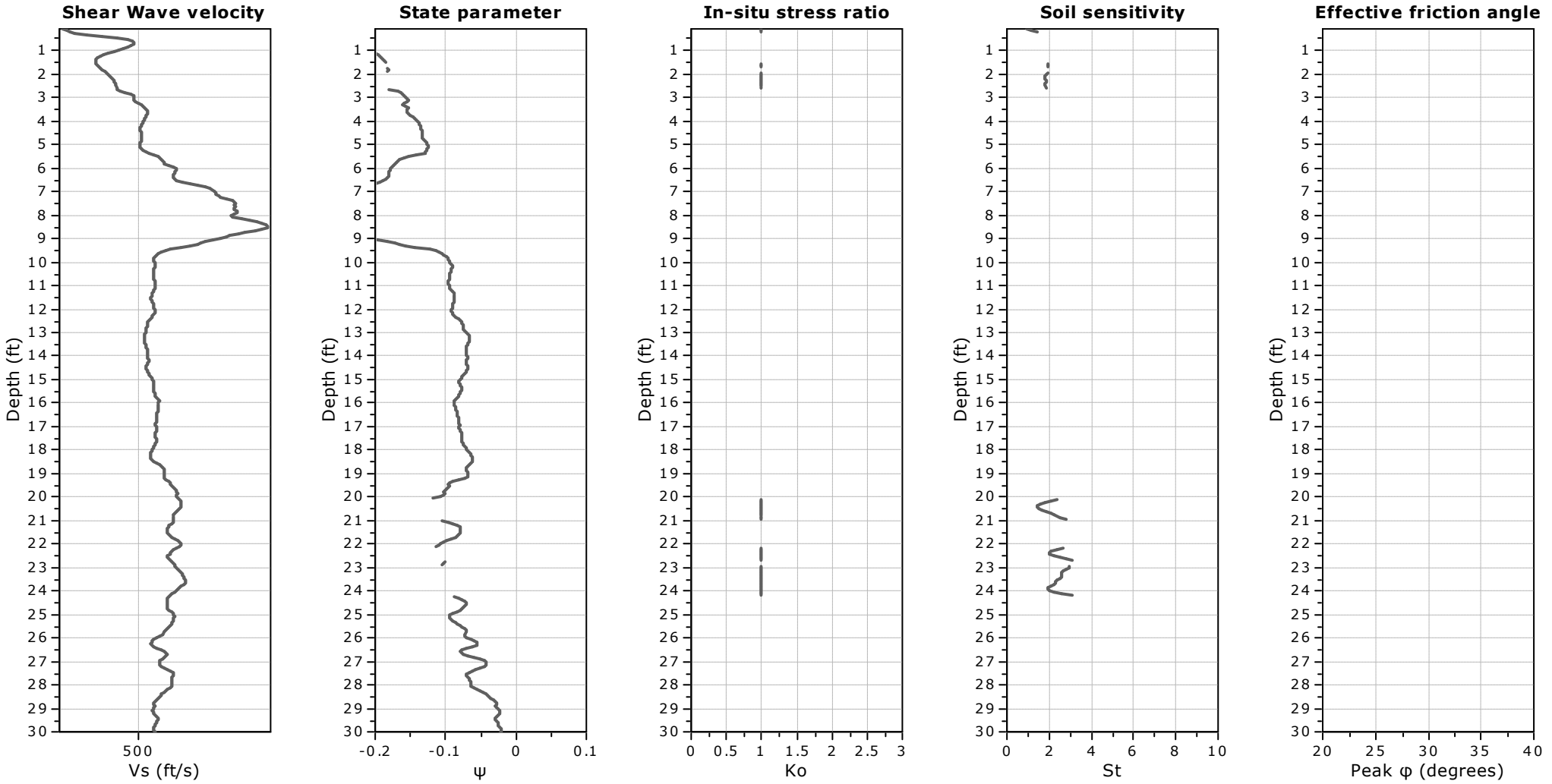
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-48
Total depth: 30.08 ft, Date: 5/16/2024
Surface Elevation: 61.32 ft
Coords: X:573331.73, Y:555749.16
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



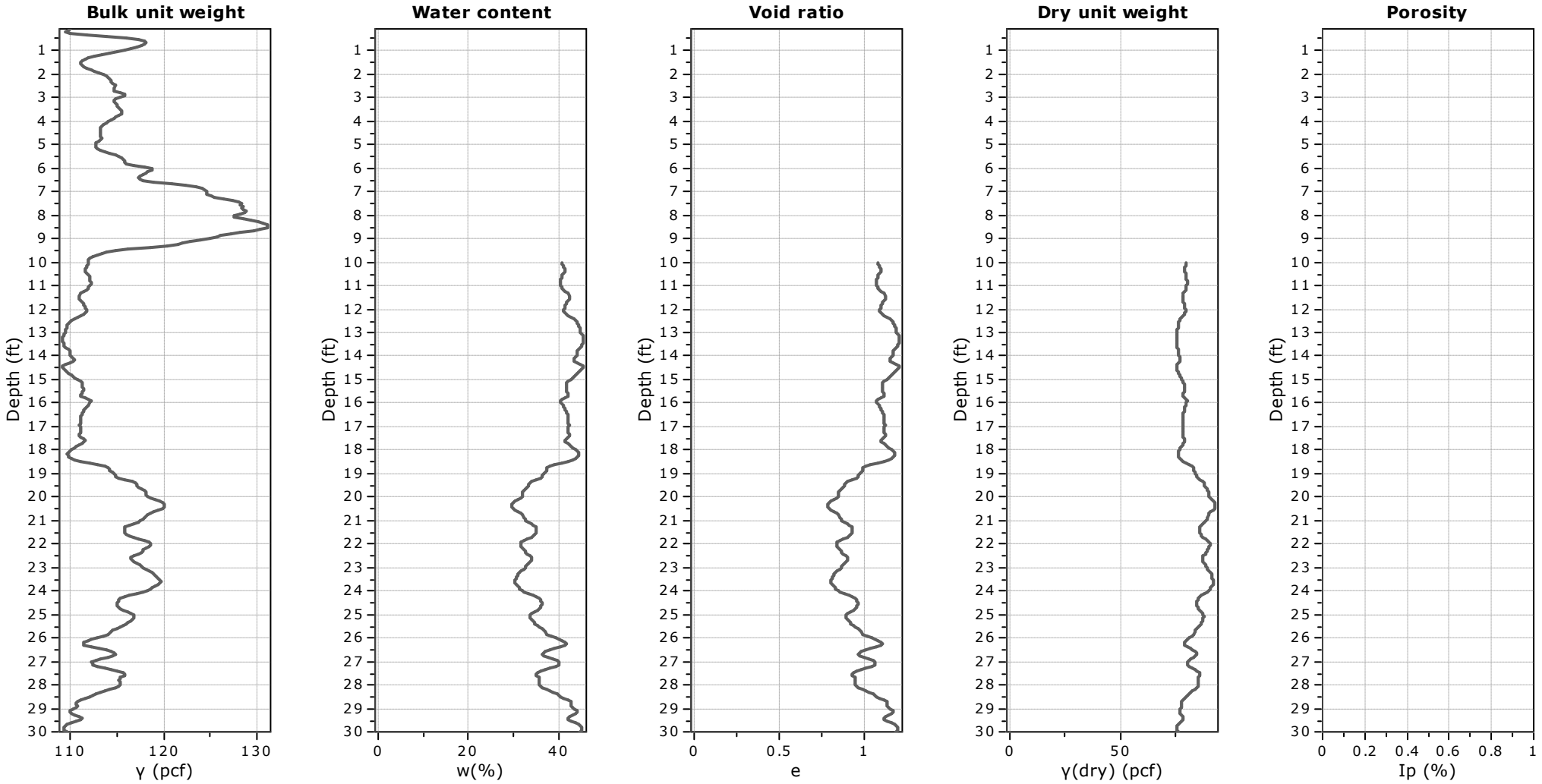
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-48
Total depth: 30.08 ft, Date: 5/16/2024
Surface Elevation: 61.32 ft
Coords: X:573331.73, Y:555749.16
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

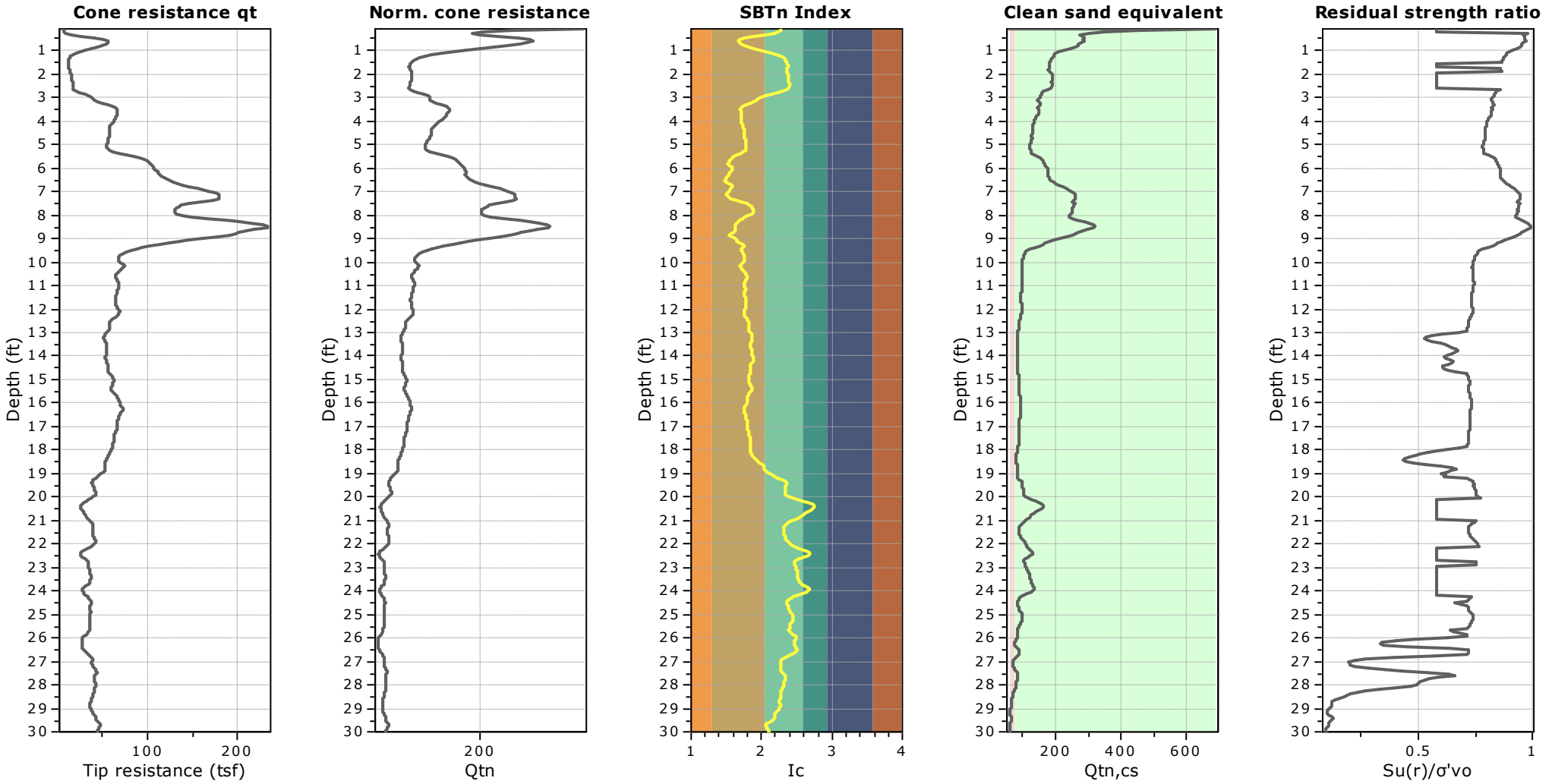
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-48
Total depth: 30.08 ft, Date: 5/16/2024
Surface Elevation: 61.32 ft
Coords: X:573331.73, Y:555749.16
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

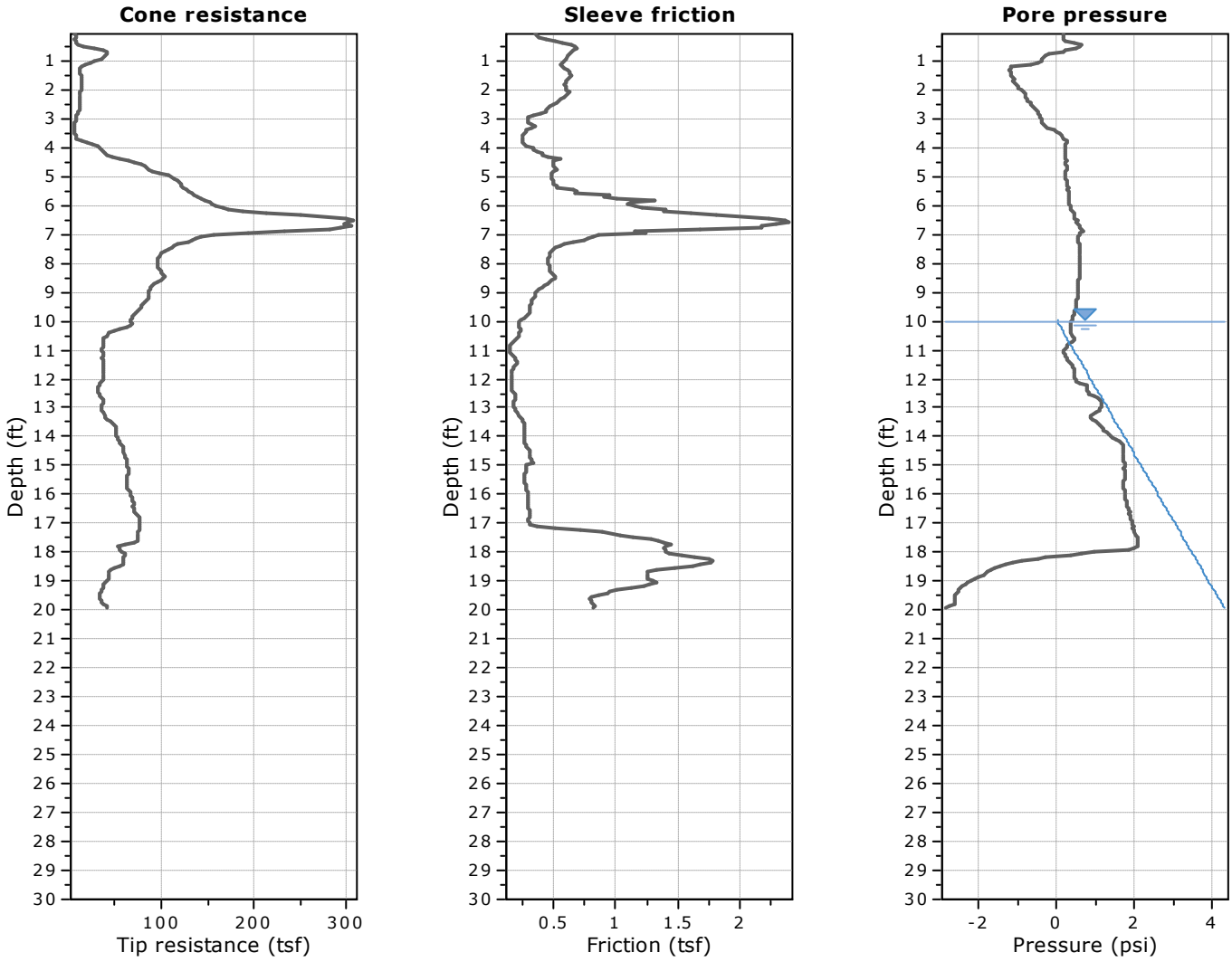
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



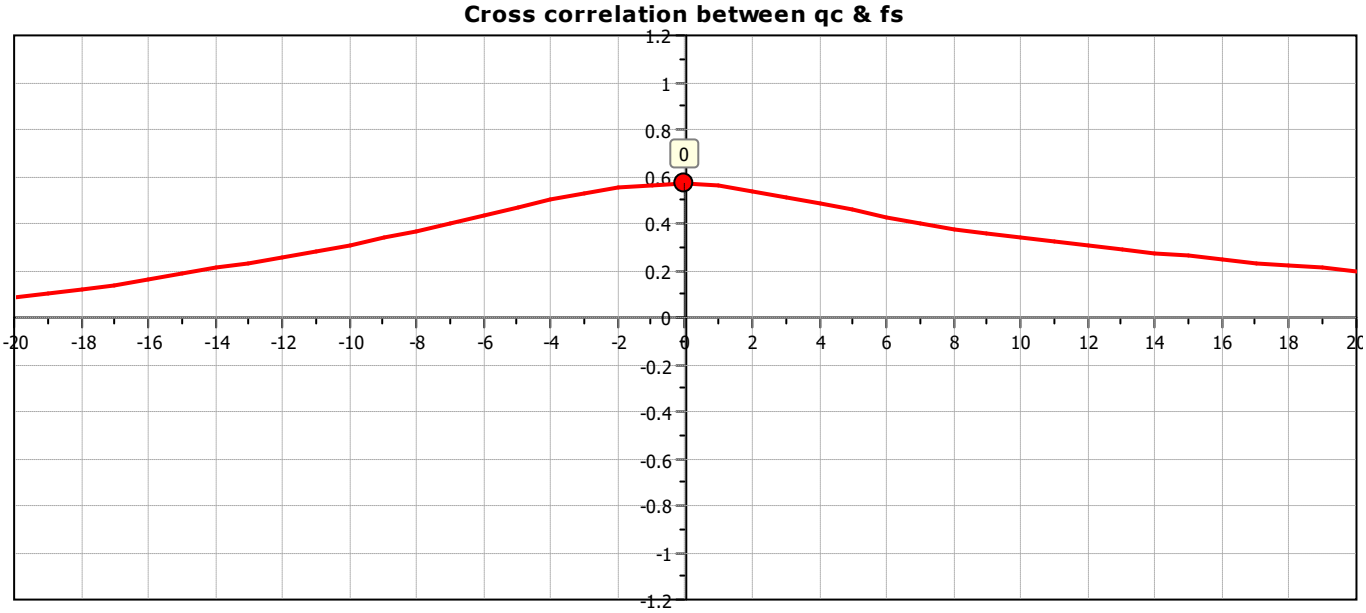
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-49
Total depth: 19.94 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:573314.72, Y:555922.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: ASD Summit Campus
Location: Middletown, Delaware



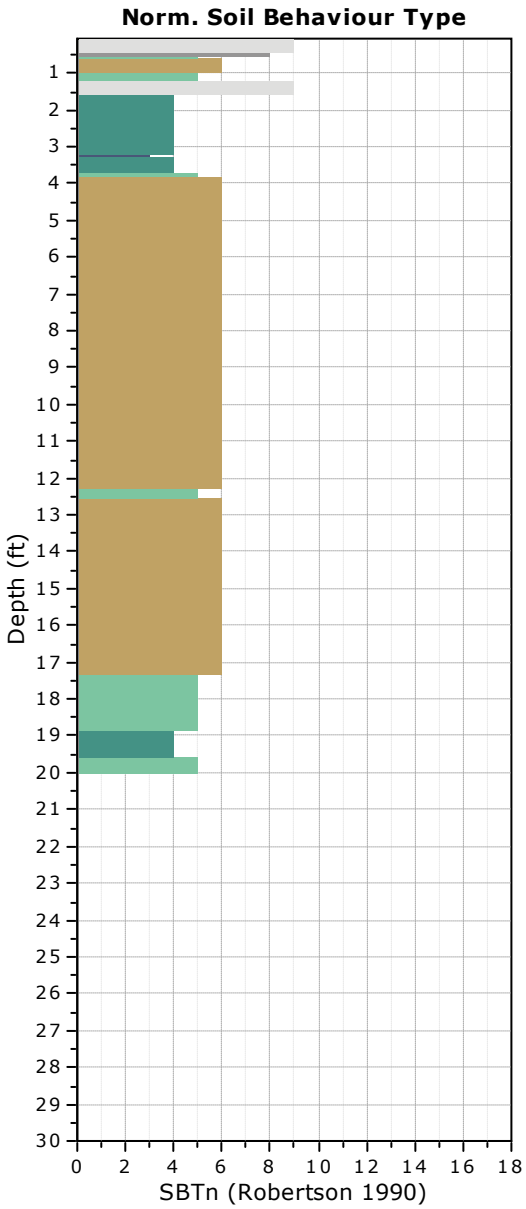
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).

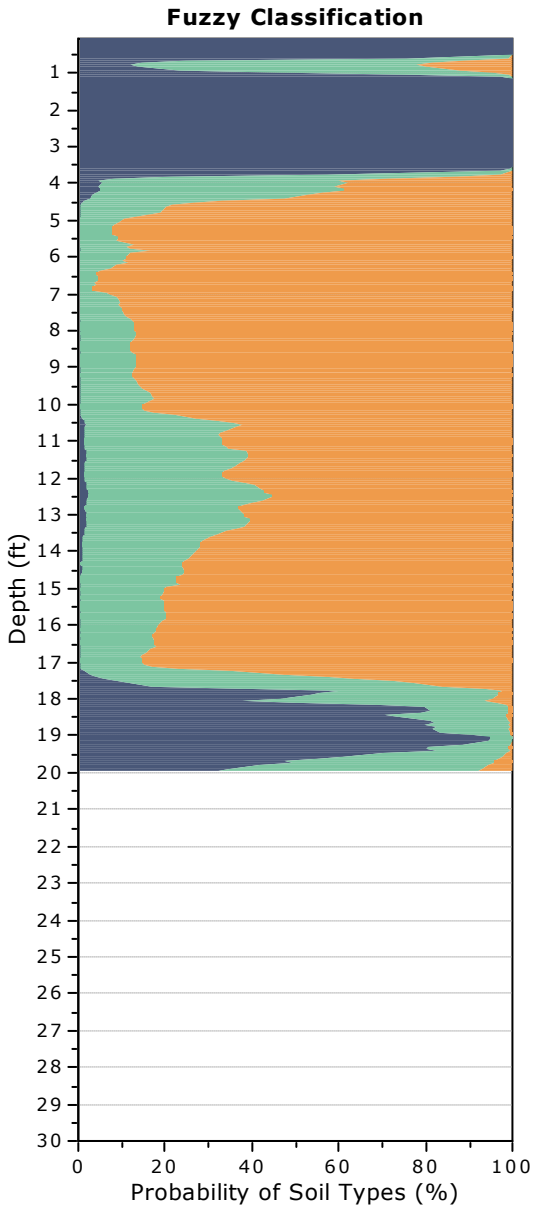


Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-49
Total depth: 19.94 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:573314.72, Y:555922.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



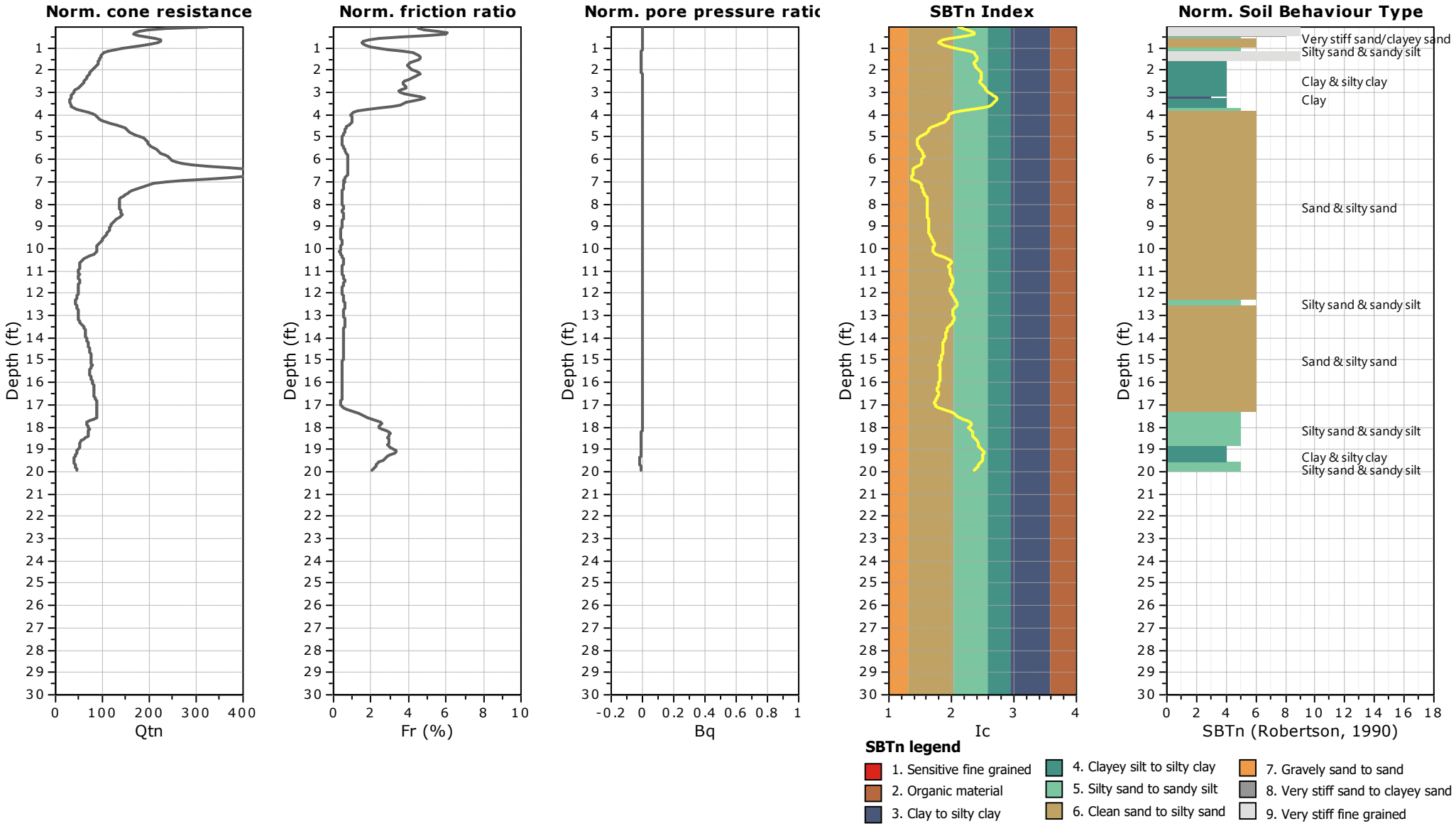


Fuzzy classifiaction legend
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**

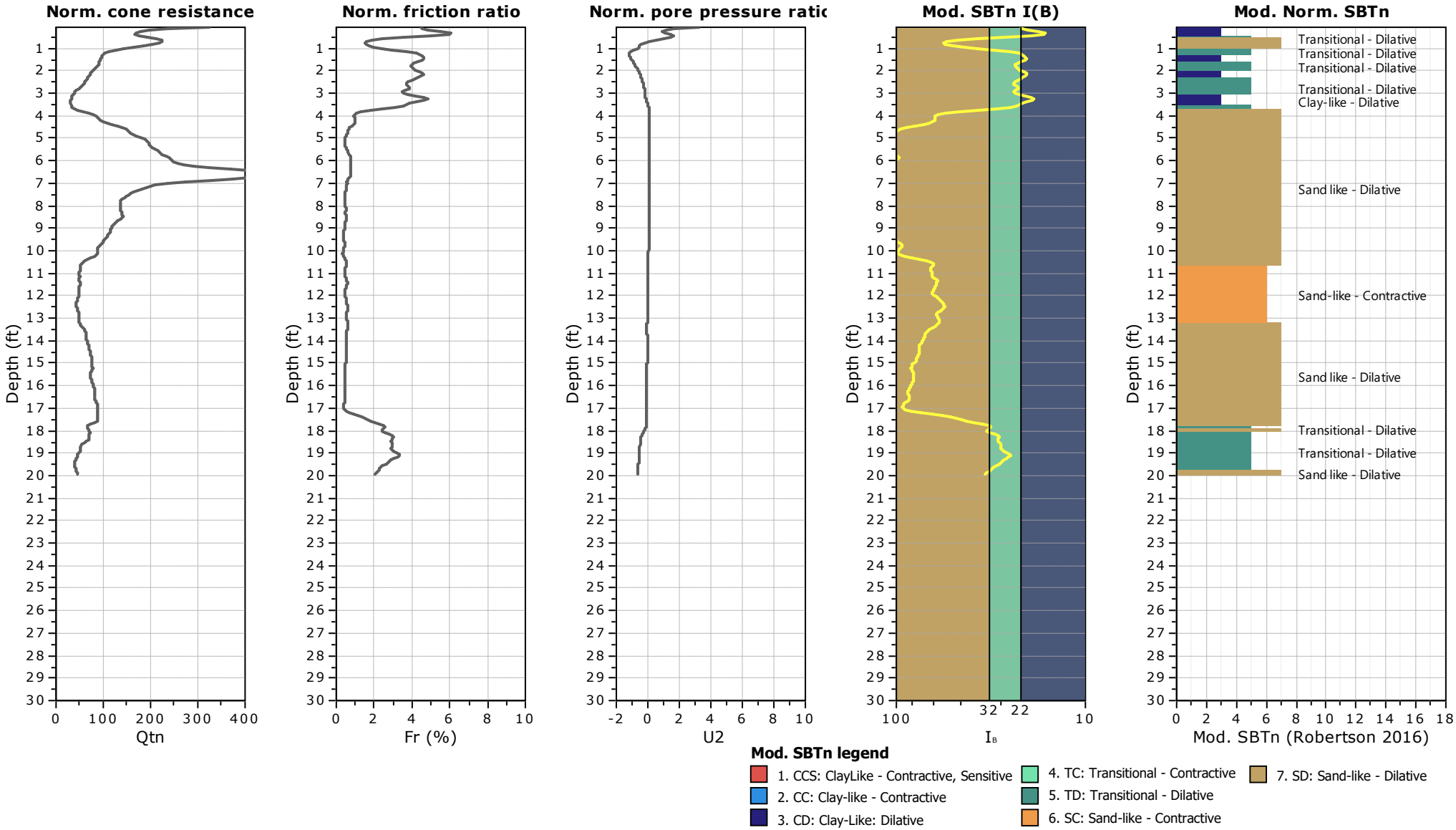
C-49
Total depth: 19.94 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:573314.72, Y:555922.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-49
Total depth: 19.94 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:573314.72, Y:555922.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

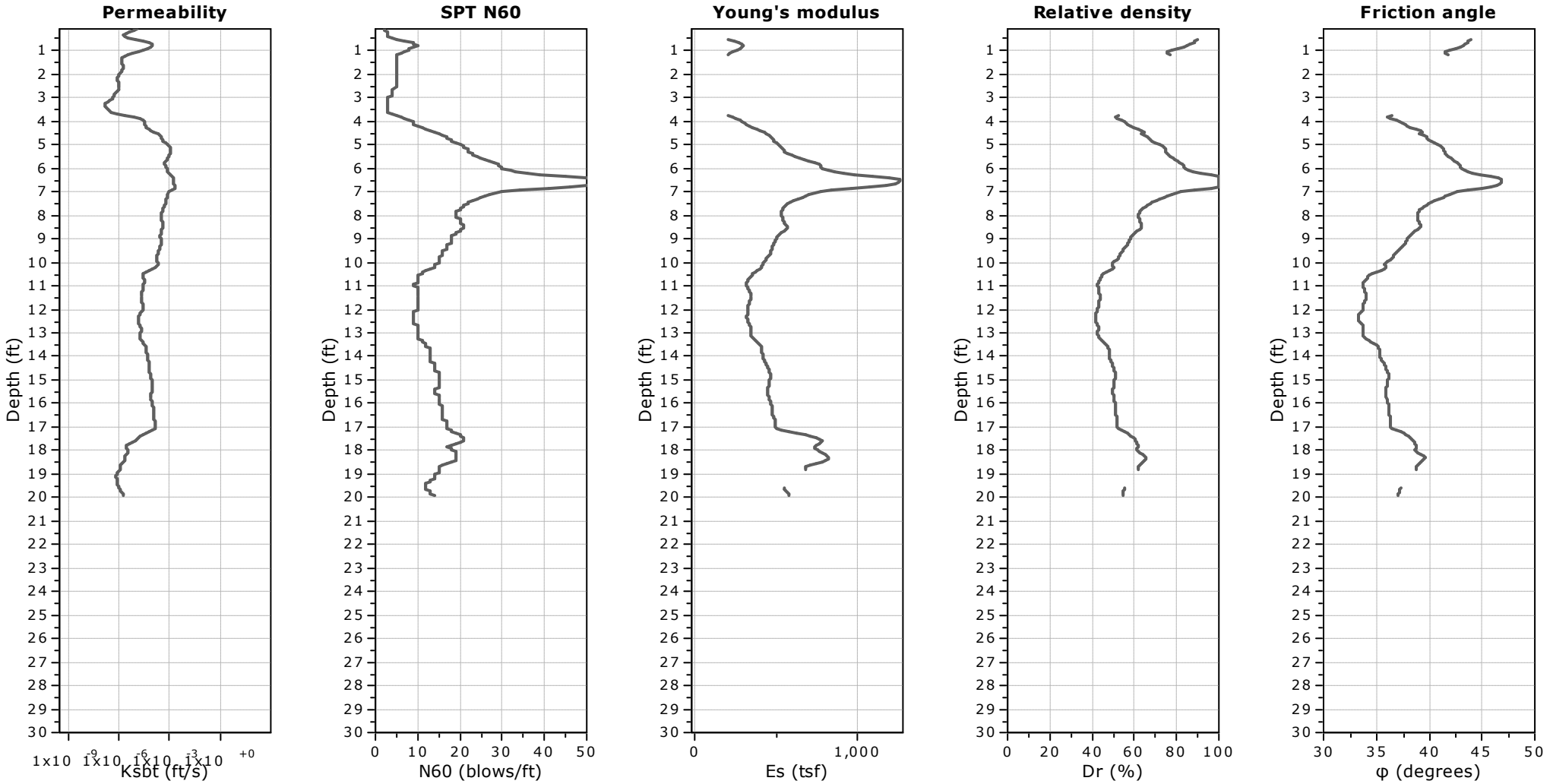
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-49
Total depth: 19.94 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:573314.72, Y:555922.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



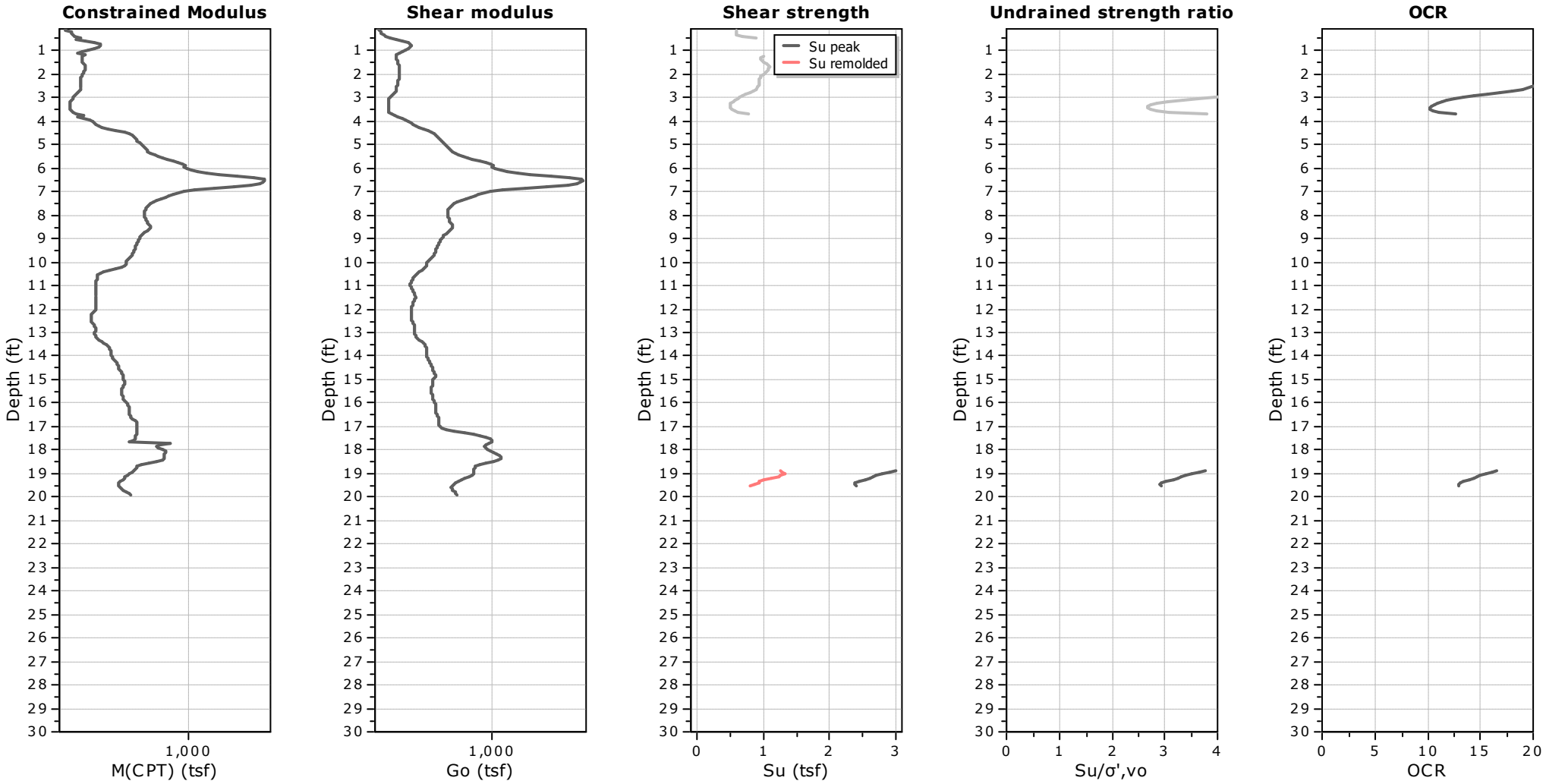
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-49
Total depth: 19.94 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:573314.72, Y:555922.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



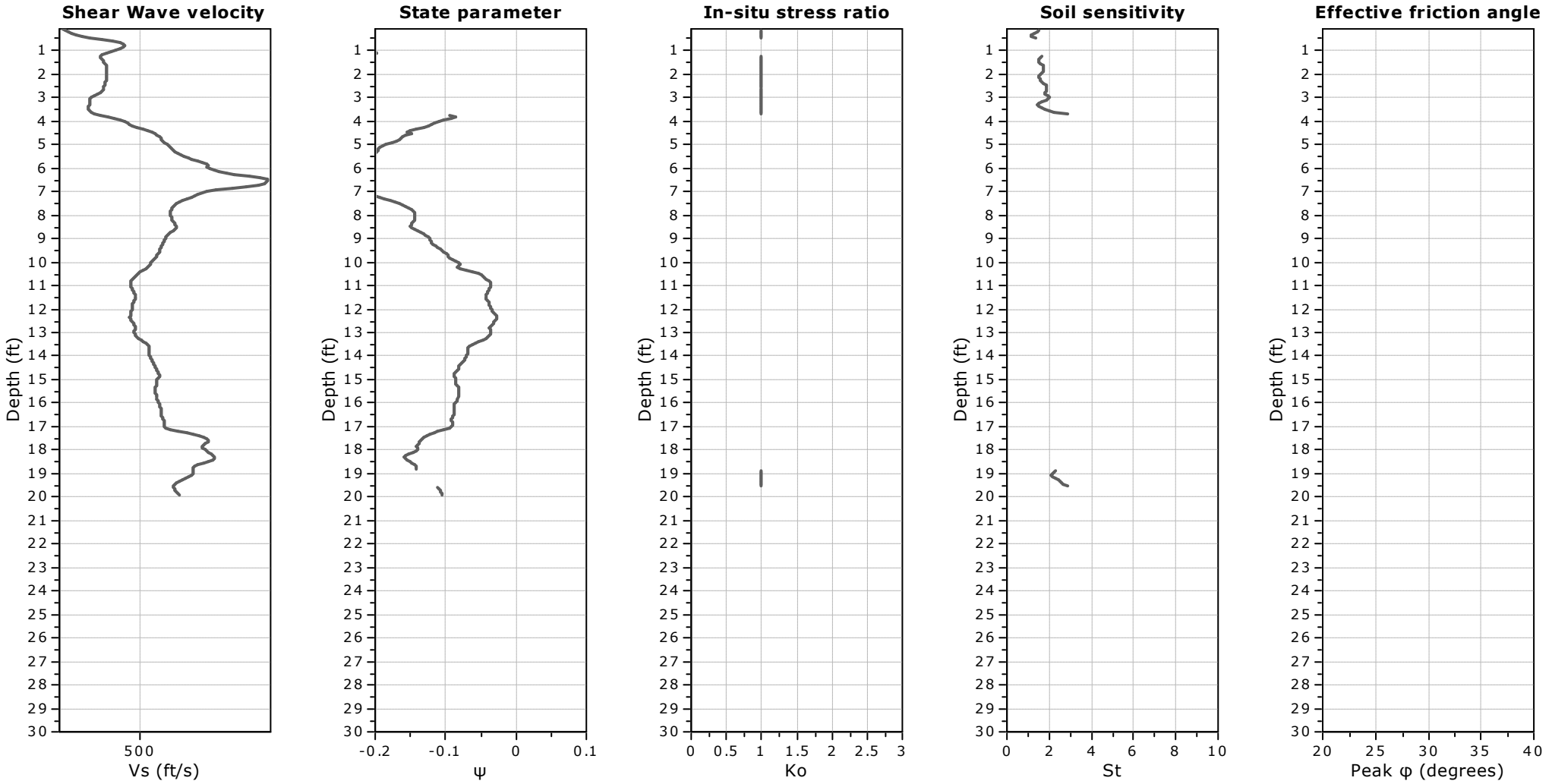
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-49
Total depth: 19.94 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:573314.72, Y:555922.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



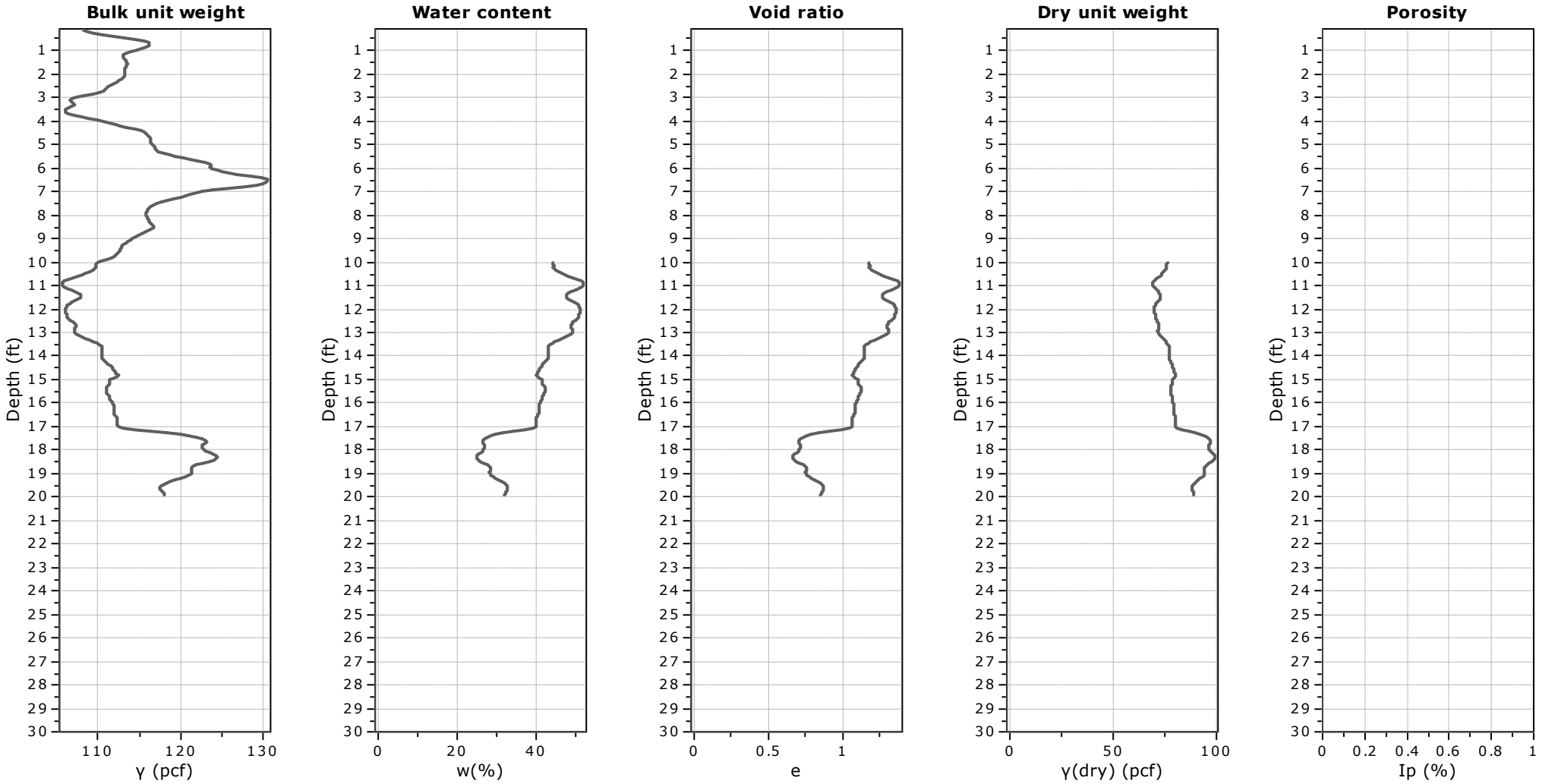
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-49
Total depth: 19.94 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:573314.72, Y:555922.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

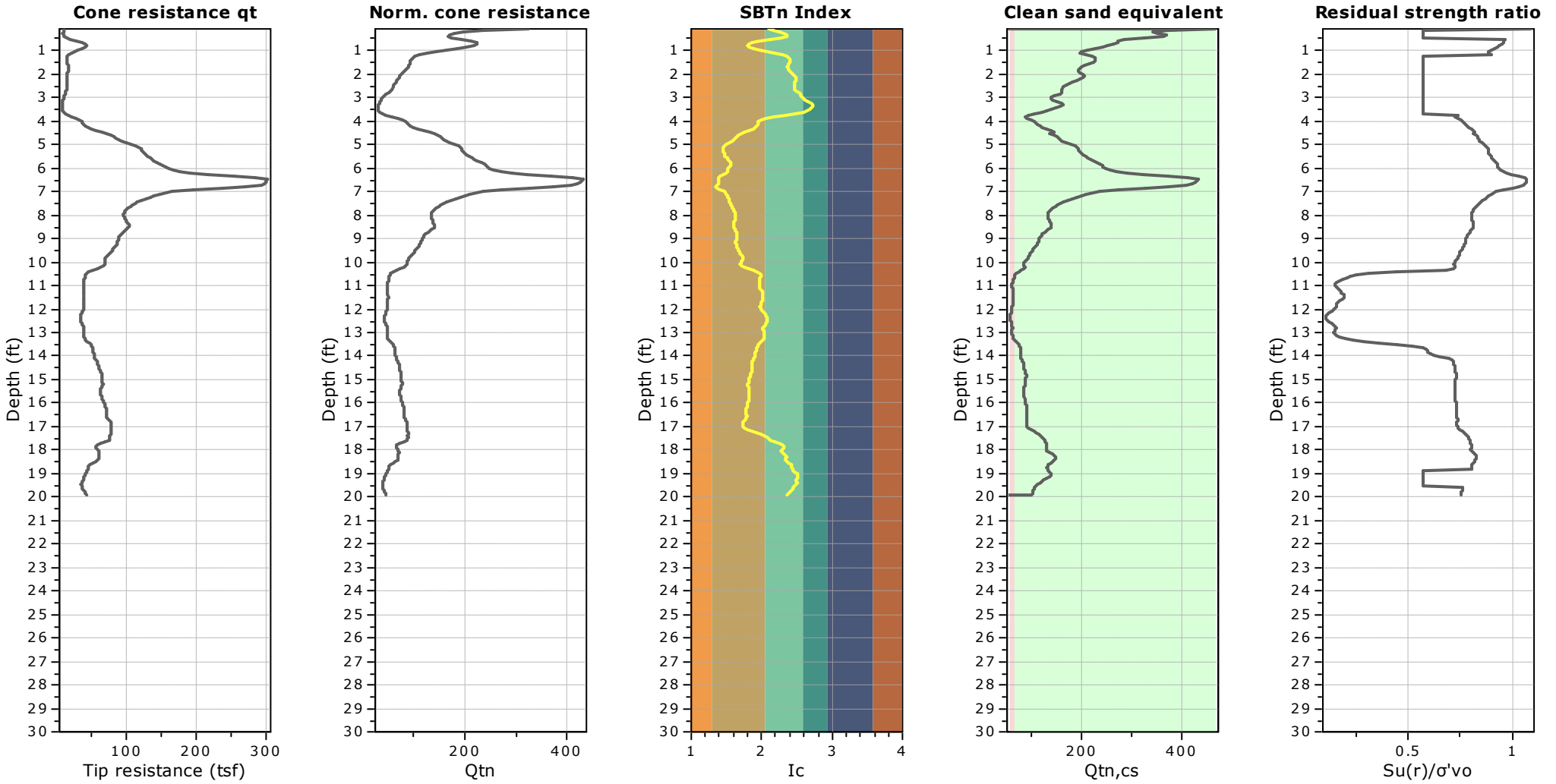
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-49
Total depth: 19.94 ft, Date: 5/16/2024
Surface Elevation: 61.89 ft
Coords: X:573314.72, Y:555922.26
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

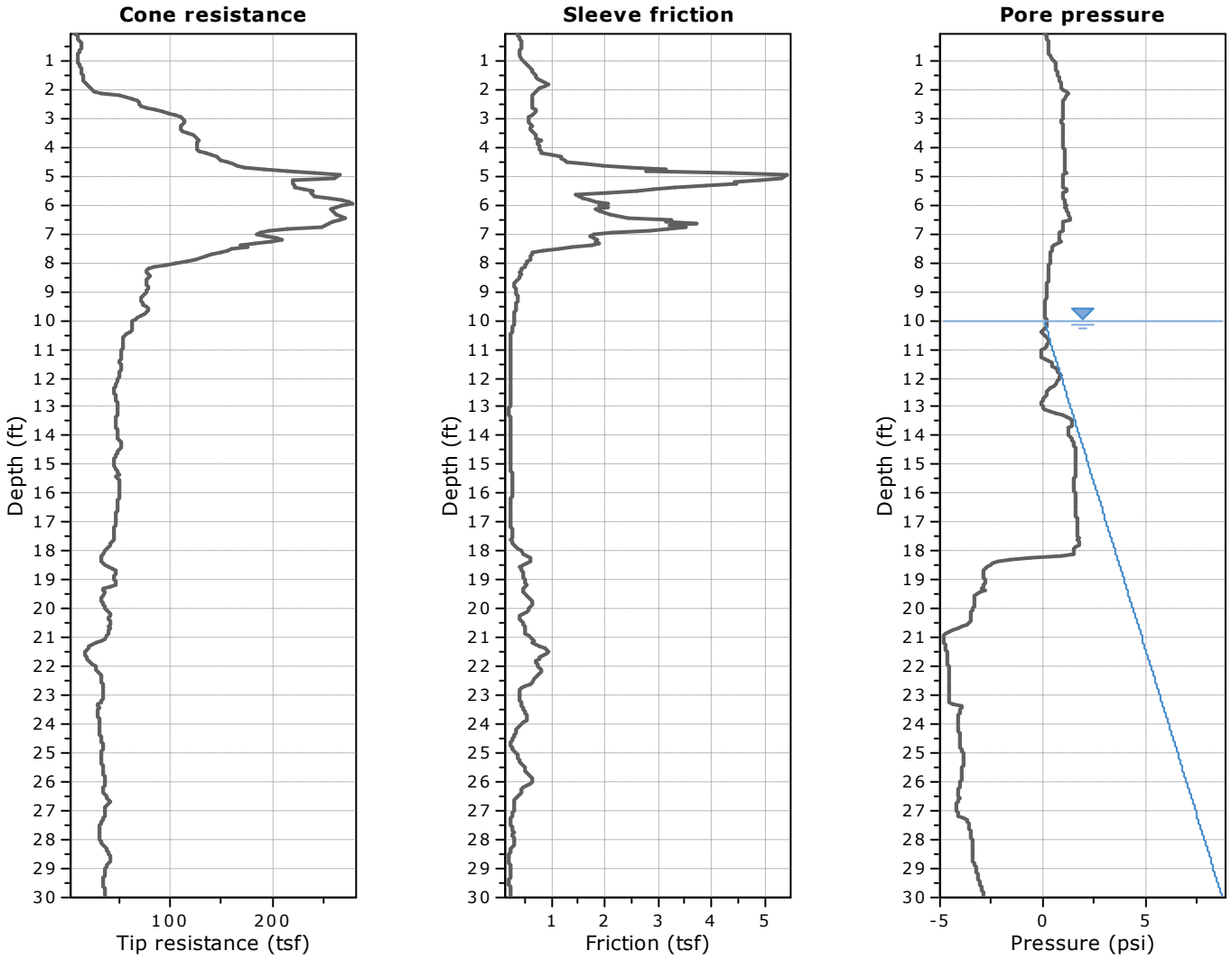
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



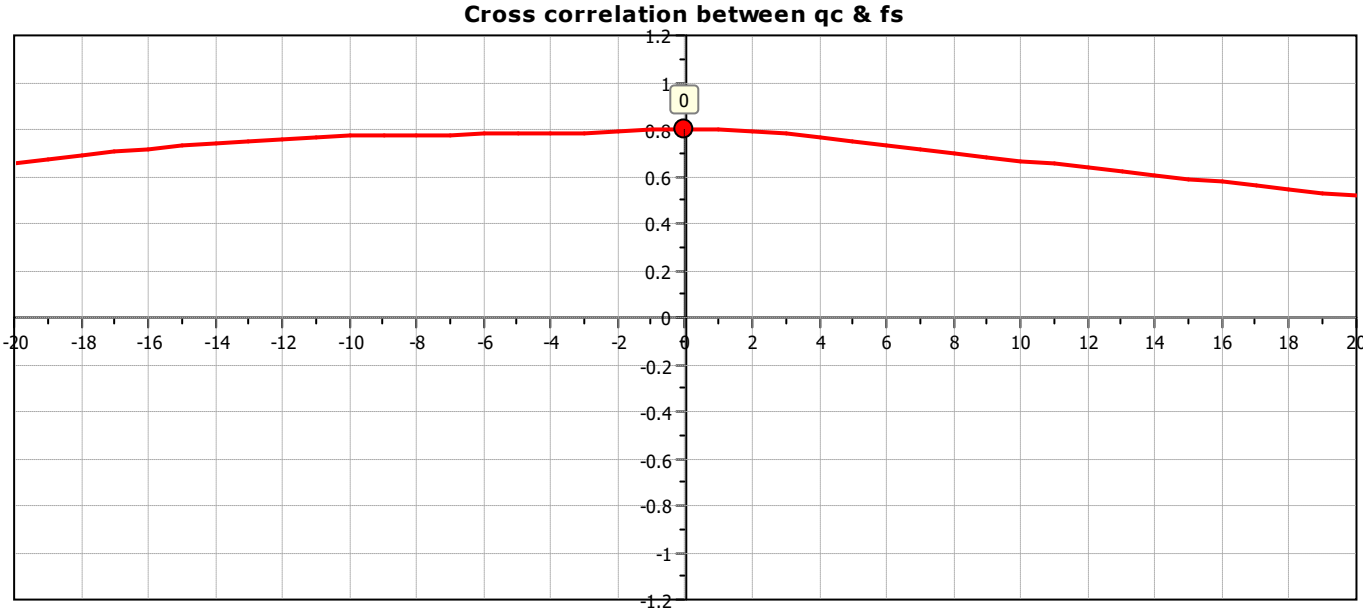
Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

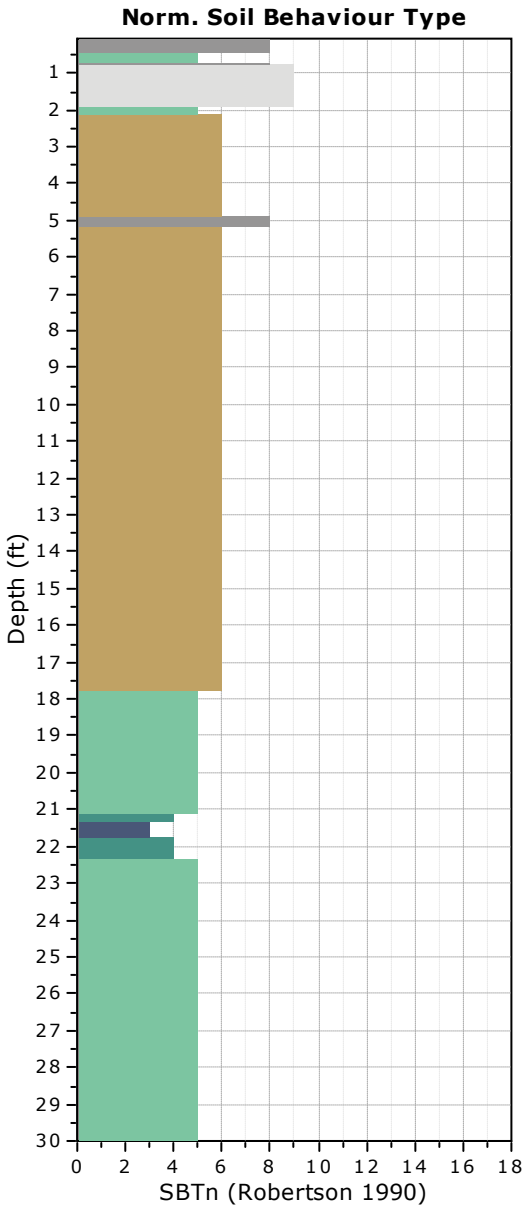
C-50
Total depth: 29.96 ft, Date: 5/16/2024
Surface Elevation: 60.48 ft
Coords: X:573628.48, Y:555930.67
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

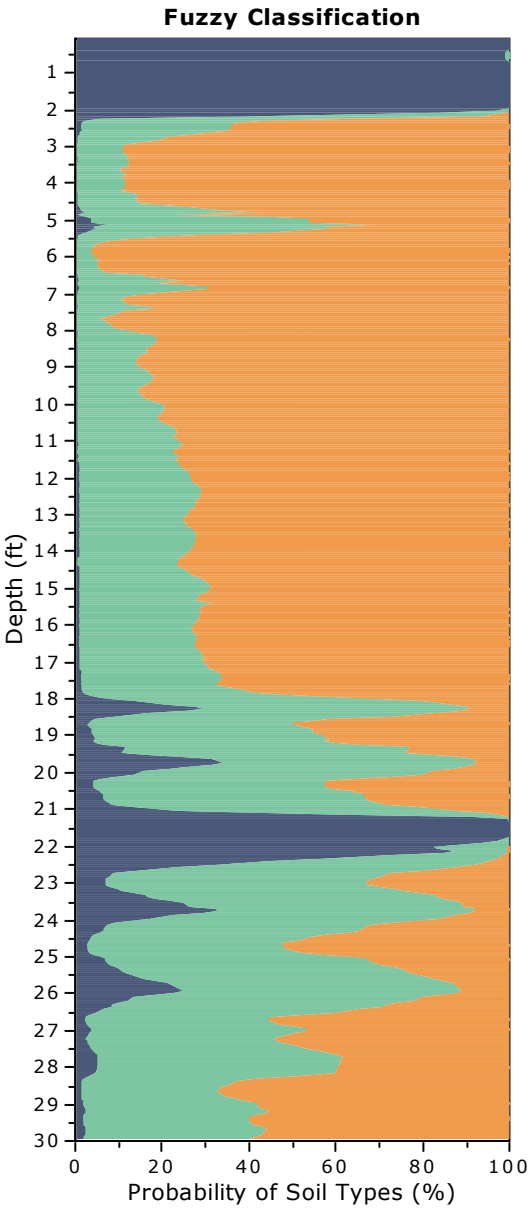
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).







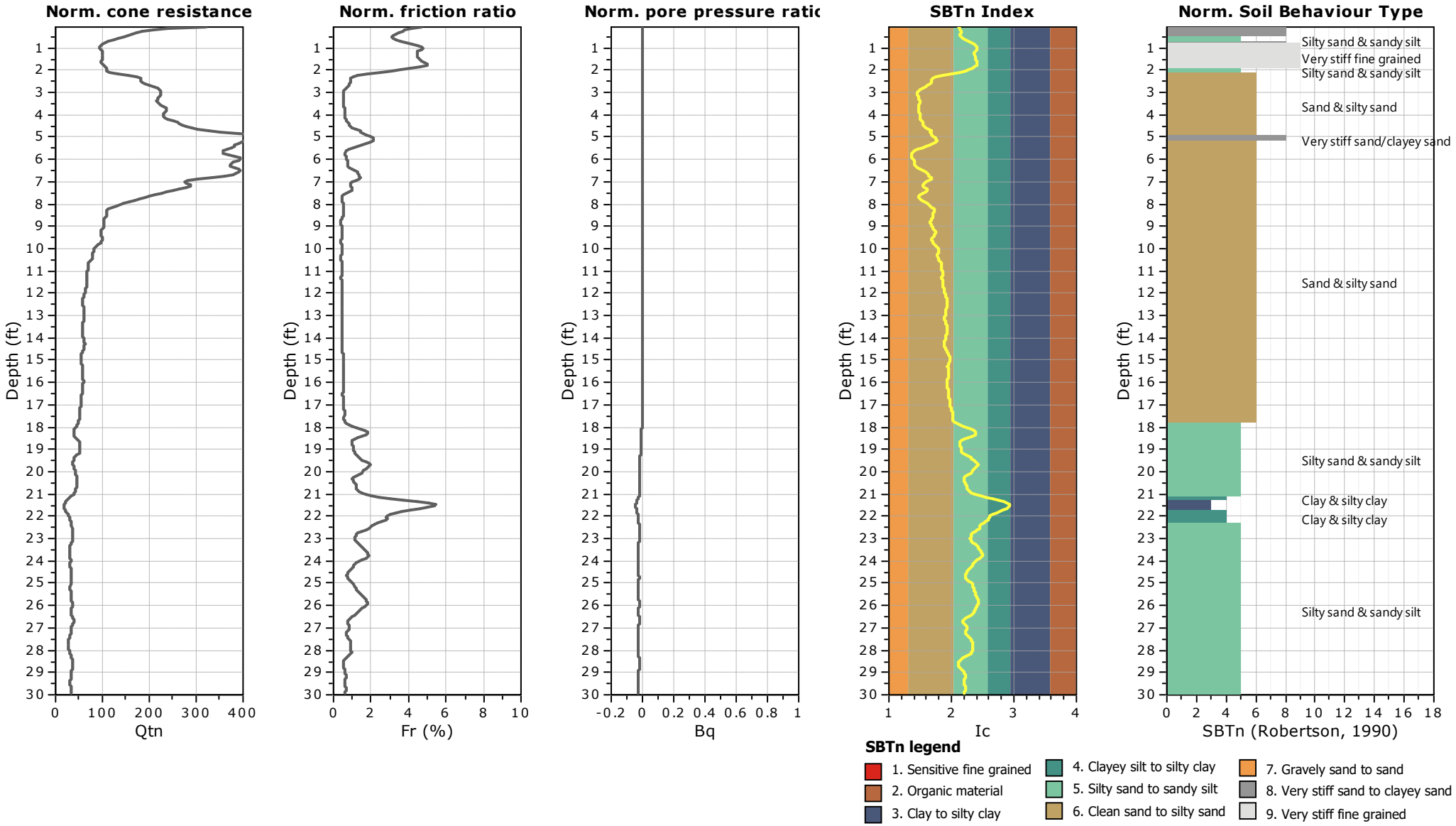
Fuzzy classifiaction legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-50
Total depth: 29.96 ft, Date: 5/16/2024
Surface Elevation: 60.48 ft
Coords: X:573628.48, Y:555930.67
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

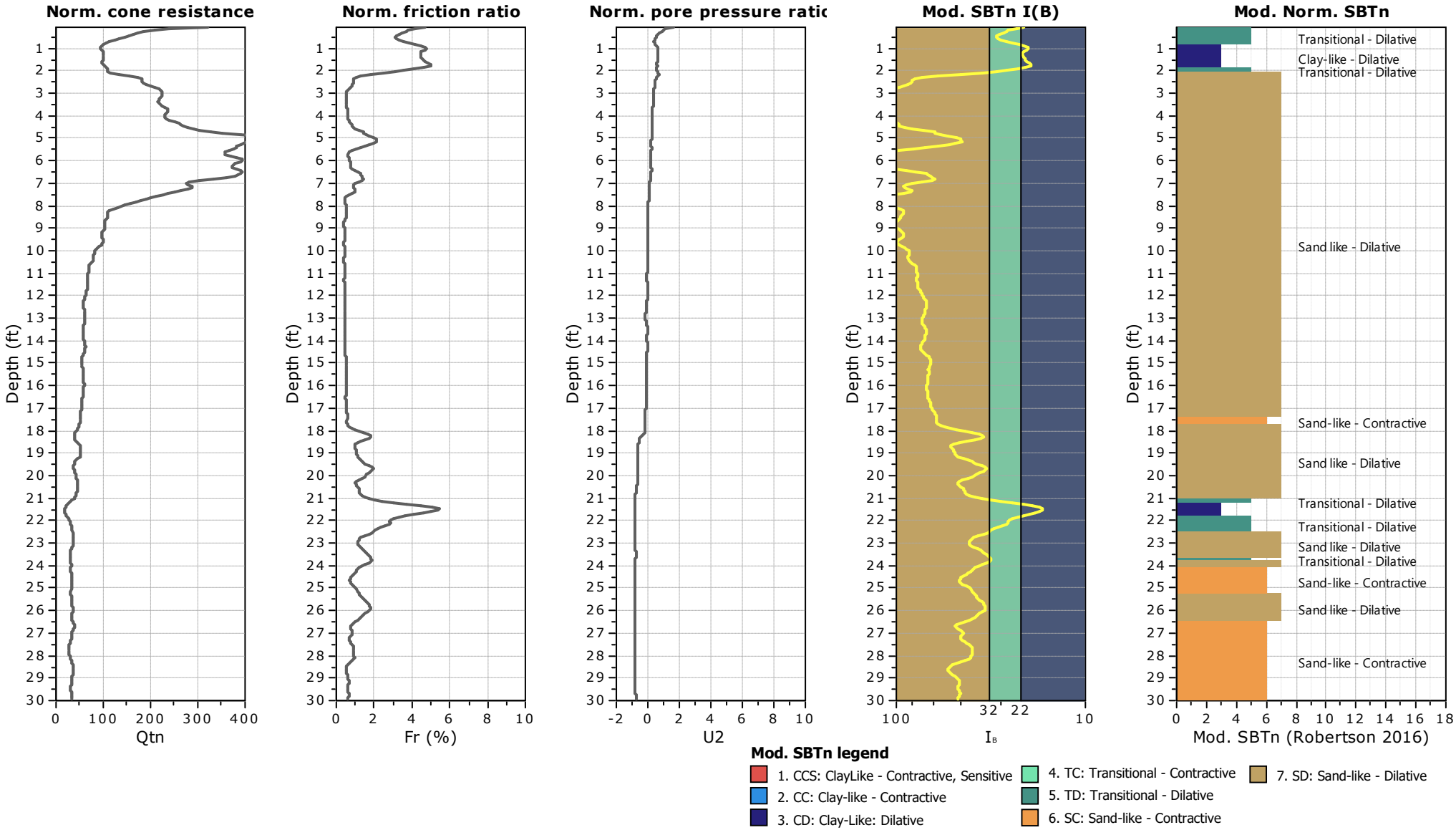
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-50
Total depth: 29.96 ft, Date: 5/16/2024
Surface Elevation: 60.48 ft
Coords: X:573628.48, Y:555930.67
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

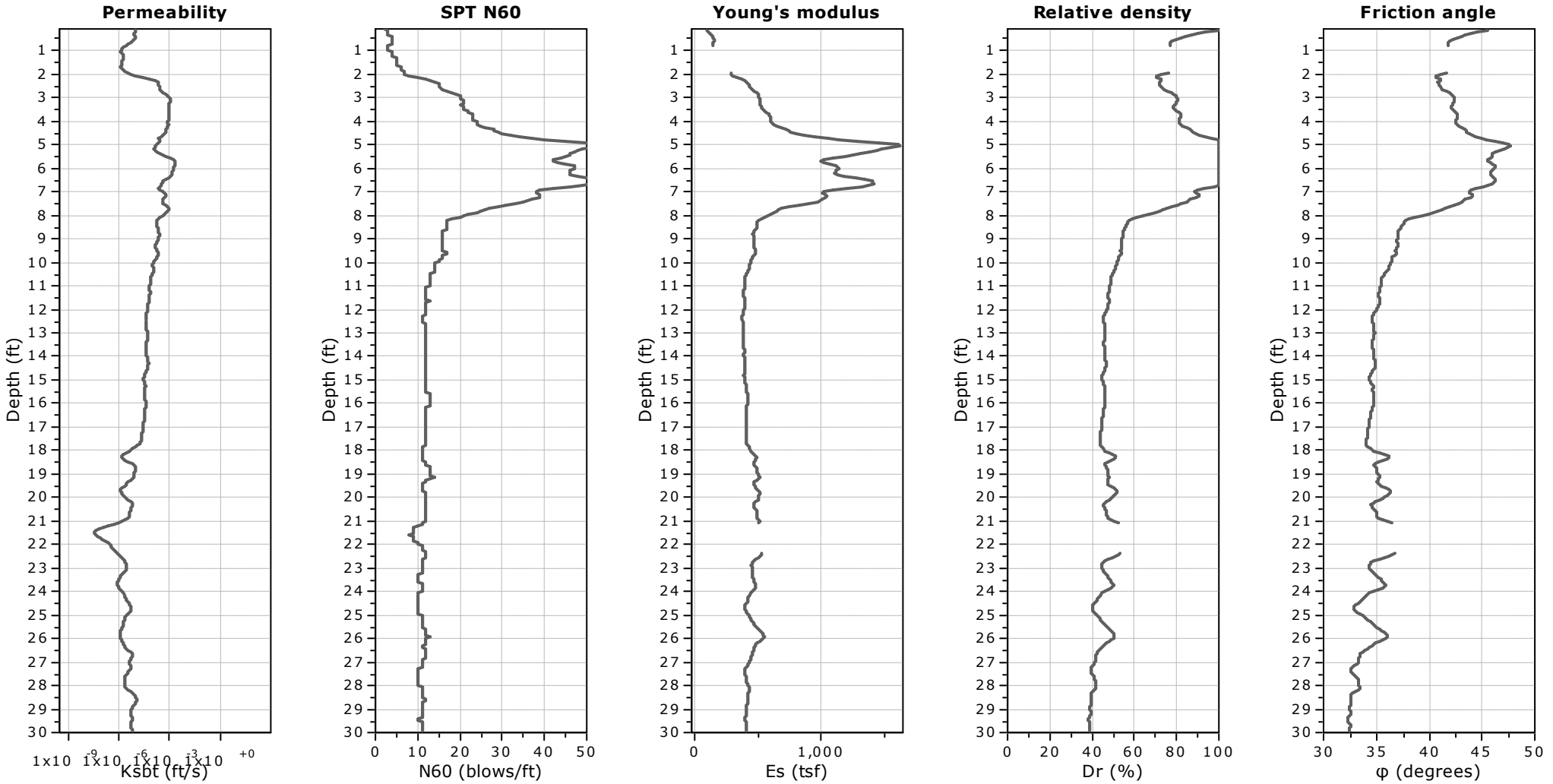
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-50
Total depth: 29.96 ft, Date: 5/16/2024
Surface Elevation: 60.48 ft
Coords: X:573628.48, Y:555930.67
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



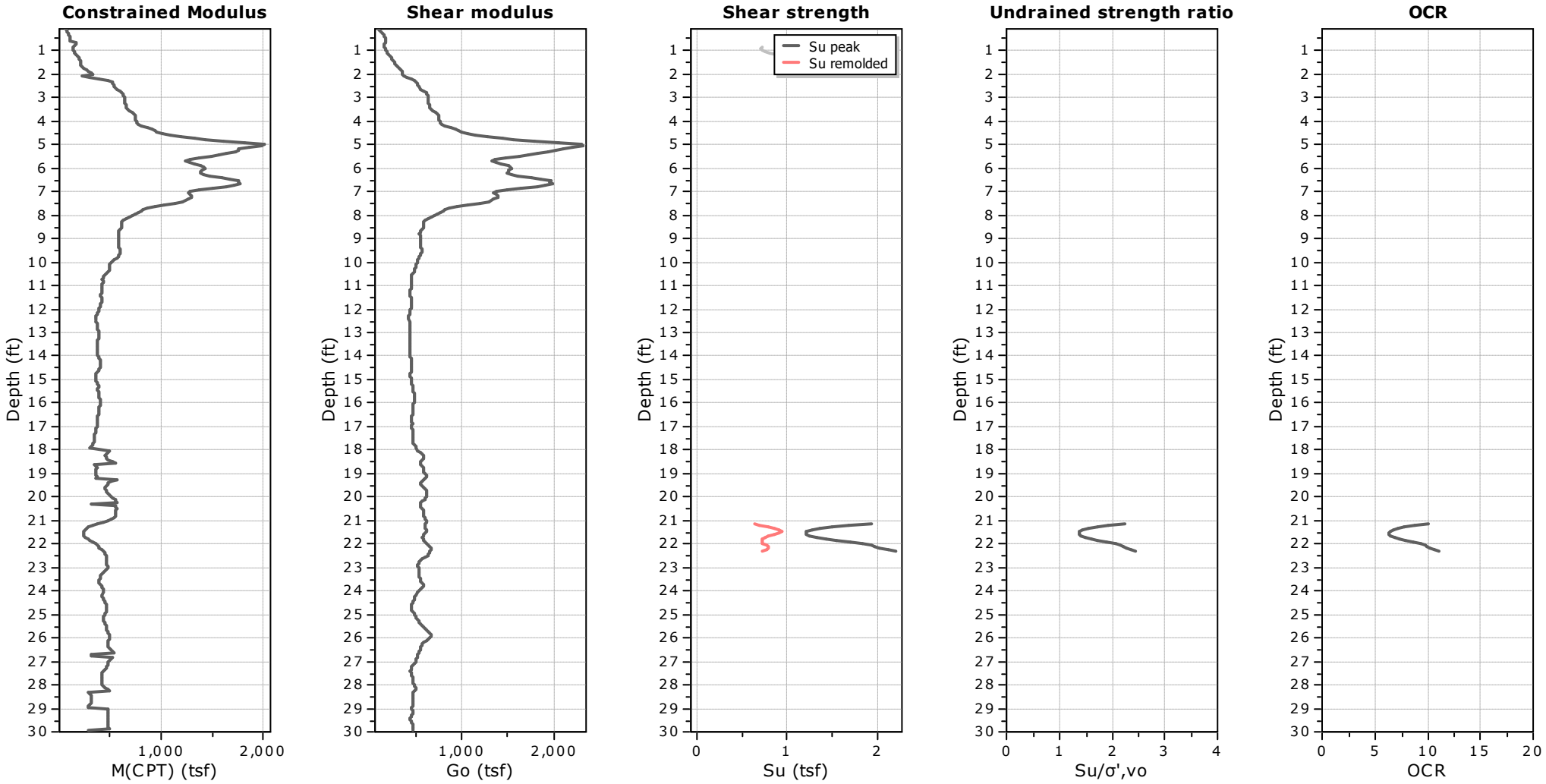
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-50
Total depth: 29.96 ft, Date: 5/16/2024
Surface Elevation: 60.48 ft
Coords: X:573628.48, Y:555930.67
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



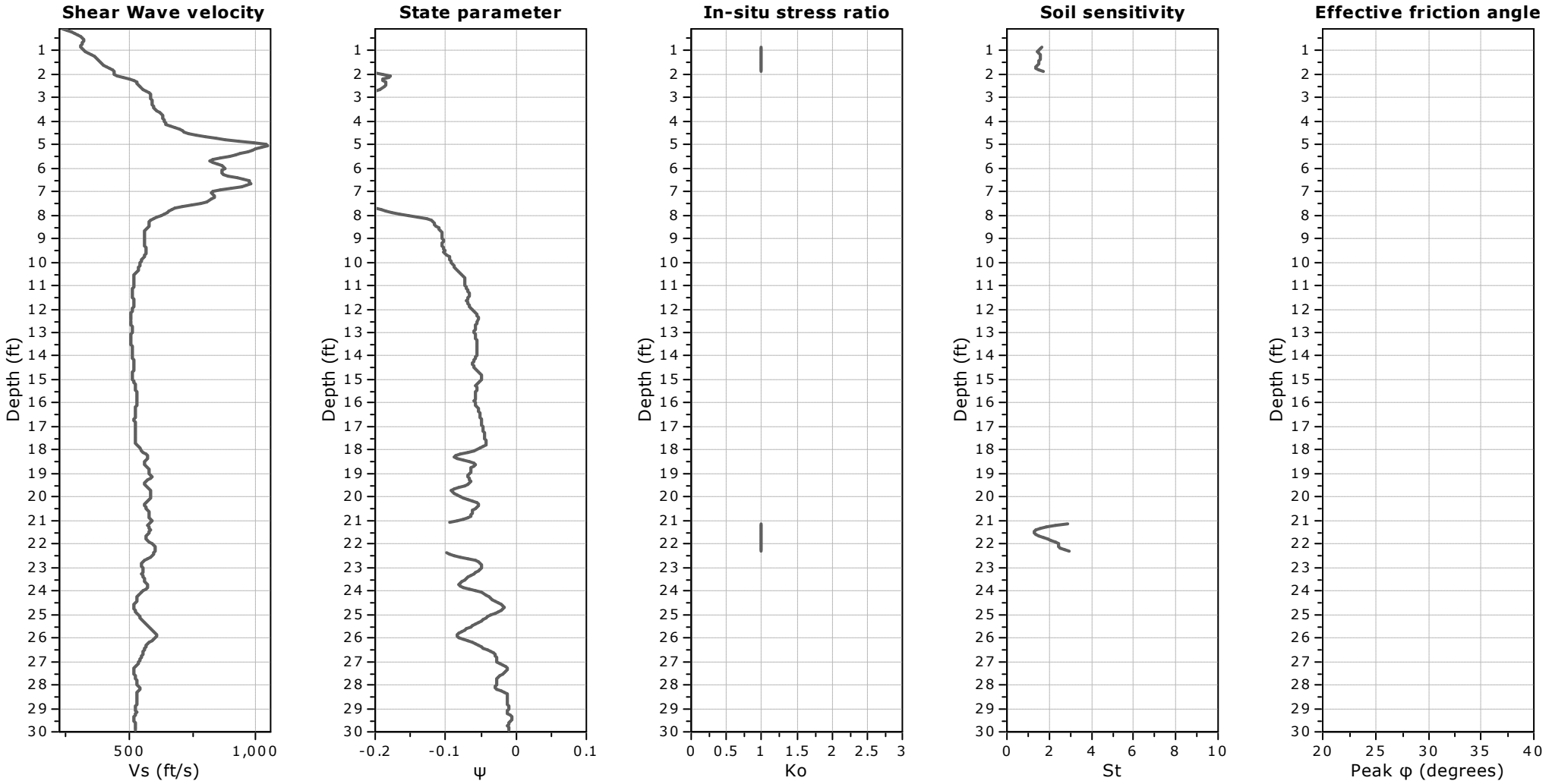
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-50
Total depth: 29.96 ft, Date: 5/16/2024
Surface Elevation: 60.48 ft
Coords: X:573628.48, Y:555930.67
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



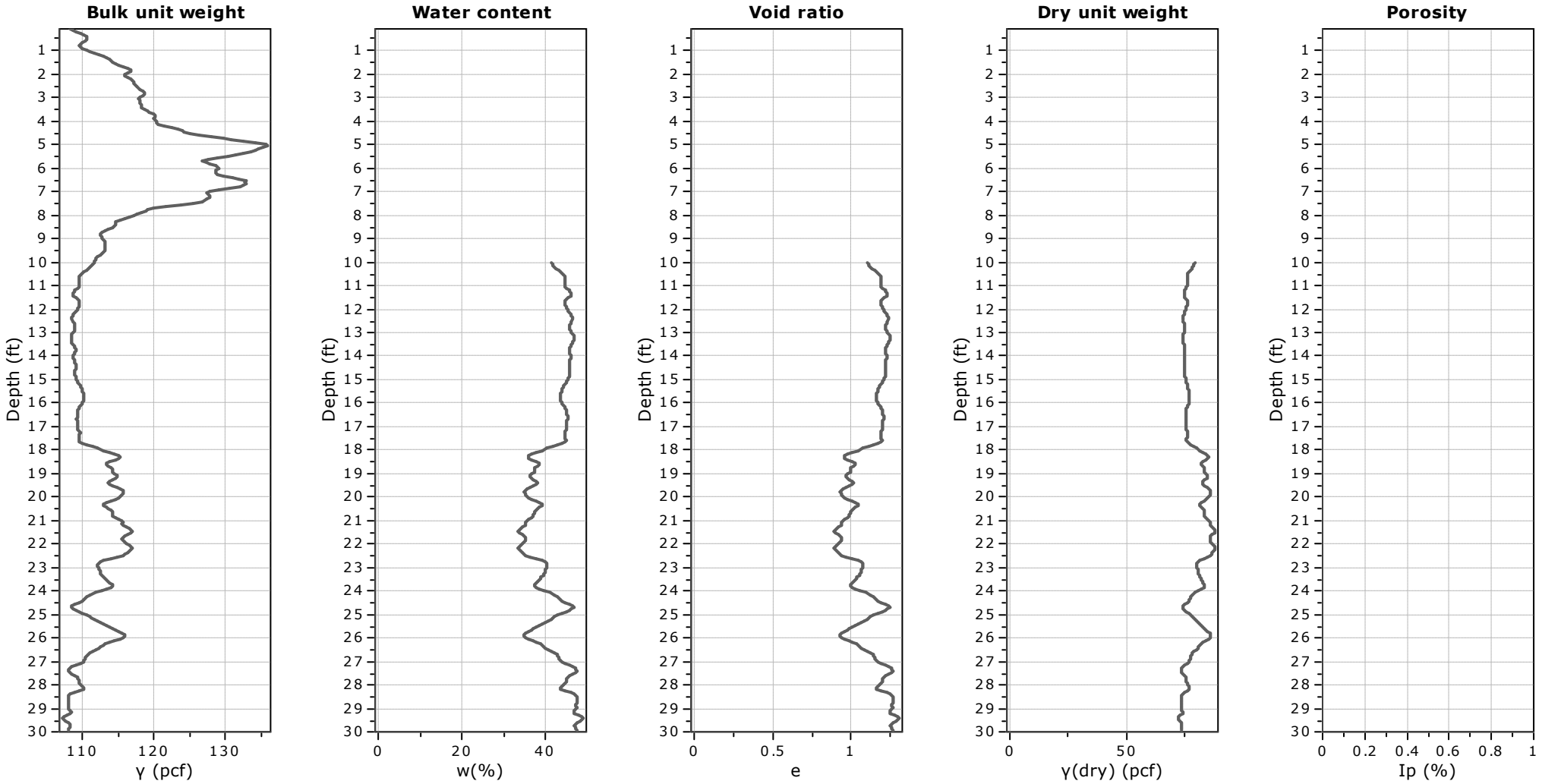
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-50
Total depth: 29.96 ft, Date: 5/16/2024
Surface Elevation: 60.48 ft
Coords: X:573628.48, Y:555930.67
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

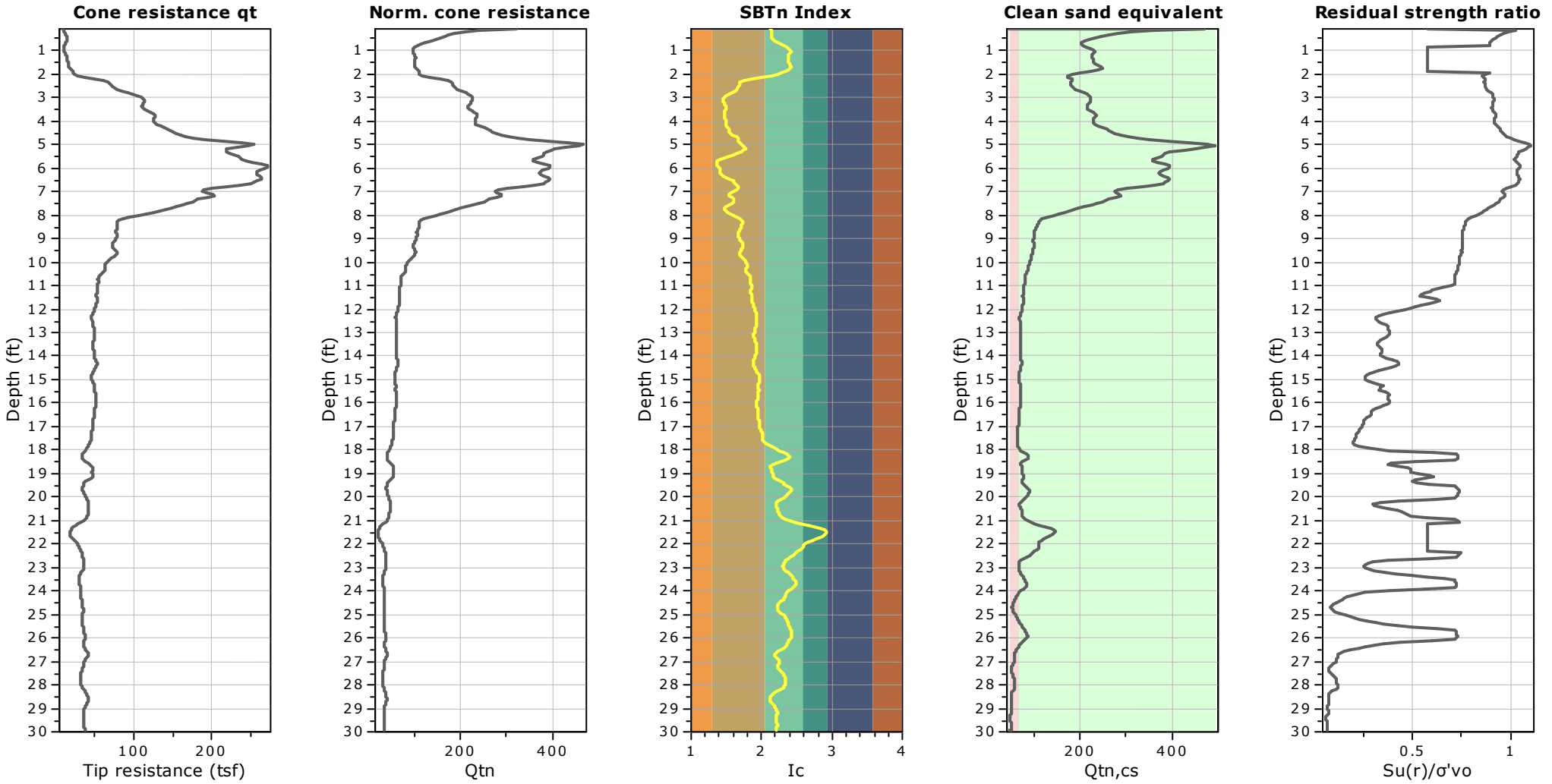
Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Stable Ground In-Situ, LLC
ENGINEERING INVESTIGATIONS AND CONSULTING
BUILD CONFIDENTLY
www.sgi-insitu.com

C-50
Total depth: 29.96 ft, Date: 5/16/2024
Surface Elevation: 60.48 ft
Coords: X:573628.48, Y:555930.67
Cone Type: Geoprobe
Cone Operator: R. Ward, PE, F. Garcia, PE D.GE

Project: **ASD Summit Campus**
Location: **Middletown, Delaware**



Presented below is a list of formulas used for the estimation of various soil properties. The formulas are presented in SI unit system and assume that all components are expressed in the same units.

:: Unit Weight, g (kN/m³) ::

$$g = g_w \cdot \left(0.27 \cdot \log(R_f) + 0.36 \cdot \log(\frac{q_t}{p_a}) + 1.236 \right)$$

where g_w = water unit weight

:: Permeability, k (m/s) ::

$I_c < 3.27$ and $I_c > 1.00$ then $k = 10^{0.952-3.04 \cdot I_c}$

$I_c \leq 4.00$ and $I_c > 3.27$ then $k = 10^{-4.52-1.37 \cdot I_c}$

:: N_{SPT} (blows per 30 cm) ::

$$N_{60} = \left(\frac{q_c}{P_a} \right) \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

$$N_{1(60)} = Q_{tn} \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

:: Young's Modulus, Es (MPa) ::

$$(q_t - \sigma_v) \cdot 0.015 \cdot 10^{0.55 \cdot I_c + 1.68}$$

(applicable only to $I_c < I_{c_cutoff}$)

:: Relative Density, Dr (%) ::

$$100 \cdot \sqrt{\frac{Q_{tn}}{k_{DR}}}$$ (applicable only to SBT_n: 5, 6, 7 and 8 or $I_c < I_{c_cutoff}$)

:: State Parameter, ψ ::

$$\psi = 0.56 - 0.33 \cdot \log(Q_{tn,cs})$$

:: Drained Friction Angle, φ (°) ::

$$\varphi = \varphi'_{cv} + 15.94 \cdot \log(Q_{tn,cs}) - 26.88$$

(applicable only to SBT_n: 5, 6, 7 and 8 or $I_c < I_{c_cutoff}$)

:: 1-D constrained modulus, M (MPa) ::

If $I_c > 2.20$
$\alpha = 14$ for $Q_{tn} > 14$
$\alpha = Q_{tn}$ for $Q_{tn} \leq 14$
$M_{CPT} = \alpha \cdot (q_t - \sigma_v)$

If $I_c \geq 2.20$

$$M_{CPT} = 0.03 \cdot (q_t - \sigma_v) \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Small strain shear Modulus, Go (MPa) ::

$$G_0 = (q_t - \sigma_v) \cdot 0.0188 \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Shear Wave Velocity, Vs (m/s) ::

$$V_s = \left(\frac{G_0}{\rho} \right)^{0.50}$$

:: Undrained peak shear strength, Su (kPa) ::

$N_{kt} = 10.50 + 7 \cdot \log(F_r)$ or user defined

$$S_u = \frac{(q_t - \sigma_v)}{N_{kt}}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Remolded undrained shear strength, Su(rem) (kPa) ::

$S_{u(rem)} = f_s$ (applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Overconsolidation Ratio, OCR ::

$$k_{OCR} = \left[\frac{Q_{tn}^{0.20}}{0.25 \cdot (10.50 \cdot + 7 \cdot \log(F_r))} \right]^{1.25}$$ or user defined

$OCR = k_{OCR} \cdot Q_{tn}$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: In situ Stress Ratio, Ko ::

$$K_O = (1 - \sin\varphi') \cdot OCR^{\sin\varphi'}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Soil Sensitivity, S_t ::

$$S_t = \frac{N_S}{F_r}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Peak Friction Angle, φ' (°) ::

$$\varphi' = 29.5° \cdot B_q^{0.121} \cdot (0.256 + 0.336 \cdot B_q + \log Q_t)$$

(applicable for $0.10 < B_q < 1.00$)

References

• Robertson, P.K., Cabal K.L., Guide to Cone Penetration Testing for Geotechnical Engineering, Gregg Drilling & Testing, Inc., 5th Edition, November 2012

• Robertson, P.K., Interpretation of Cone Penetration Tests - a unified approach., Can. Geotech. J. 46(11): 1337–1355 (2009)

• N Barounis, J Philpot, Estimation of in-situ water content, void ratio, dry unit weight and porosity using CPT for saturated sands, Proc. 20th NZGS Geotechnical Symposium

Terms & Conditions

Visual data, numerical data and any engineering analysis provided by Stable Ground In-Situ, LLC is to be used at the client's discretion. SGI does not warranty, implied or expressed, any additional information other than raw data collected on-site. Raw data (Depth, qc, fs, u2) is provided for separate characteristic and parameter verifications.

NO USCS - STRATIGRAPHY & GW - A SIZE - PENNONI_STANDARD_TEMPLATE_2018.GDT - 7/24/24 08:30 - U:\ACCOUNTS\LDMSE\LDMSE24001 - ASD SUMMIT CAMPUS\ANALYTICAL\FIELD DATA\LDMSE

SUBSURFACE DIAGRAM

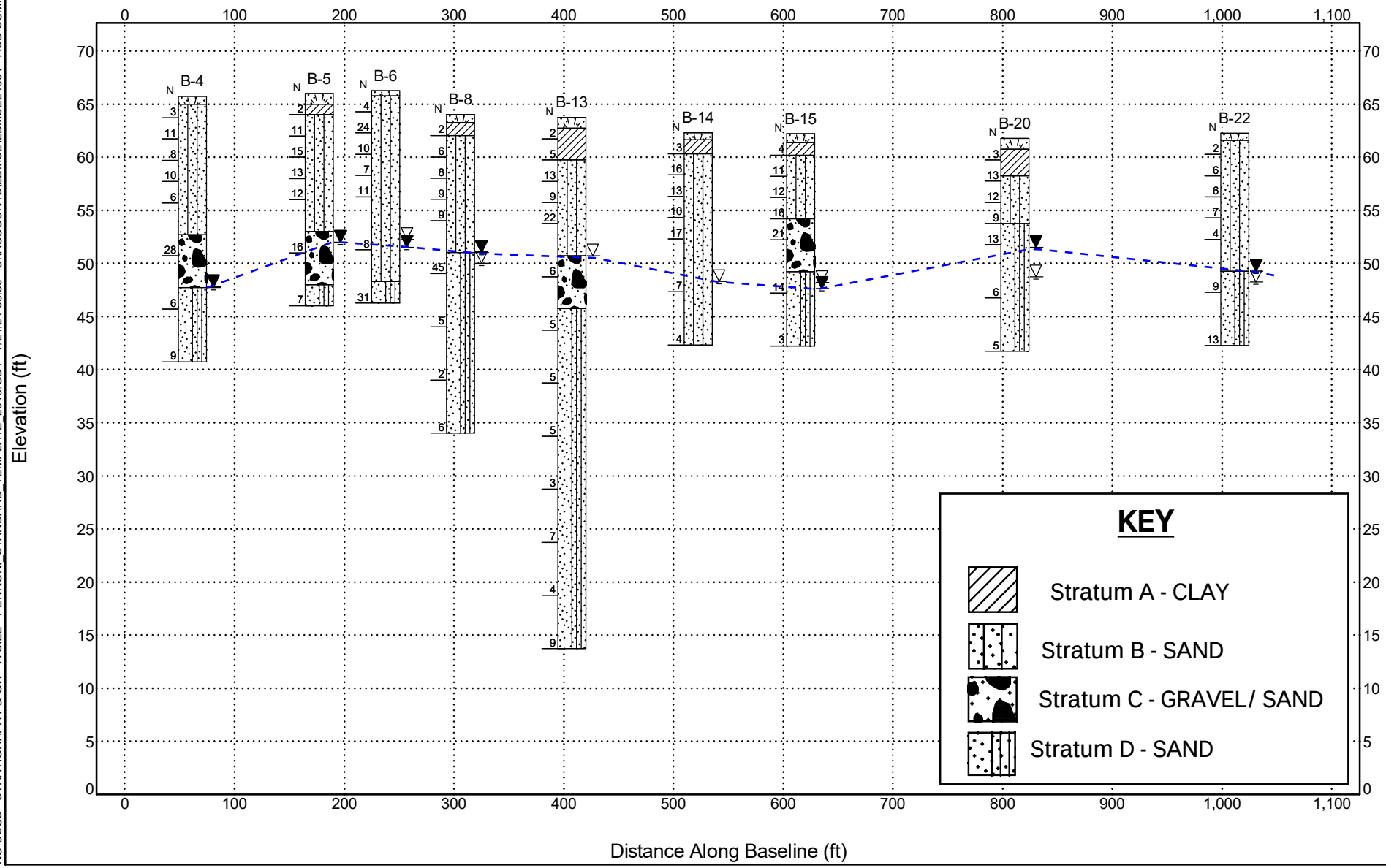
Subsurface Stratigraphy (Cross Section A-A)

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE



NO USCS - STRATIGRAPHY & GW - A SIZE - PENNONI_STANDARD_TEMPLATE_2018.GDT - 7/24/24 08:35 - U:\ACCOUNTS\LDMSE\LDMSE24001 - ASD SUMMIT CAMPUS\ANALYTICAL\FIELD DATA\LDMSE

SUBSURFACE DIAGRAM

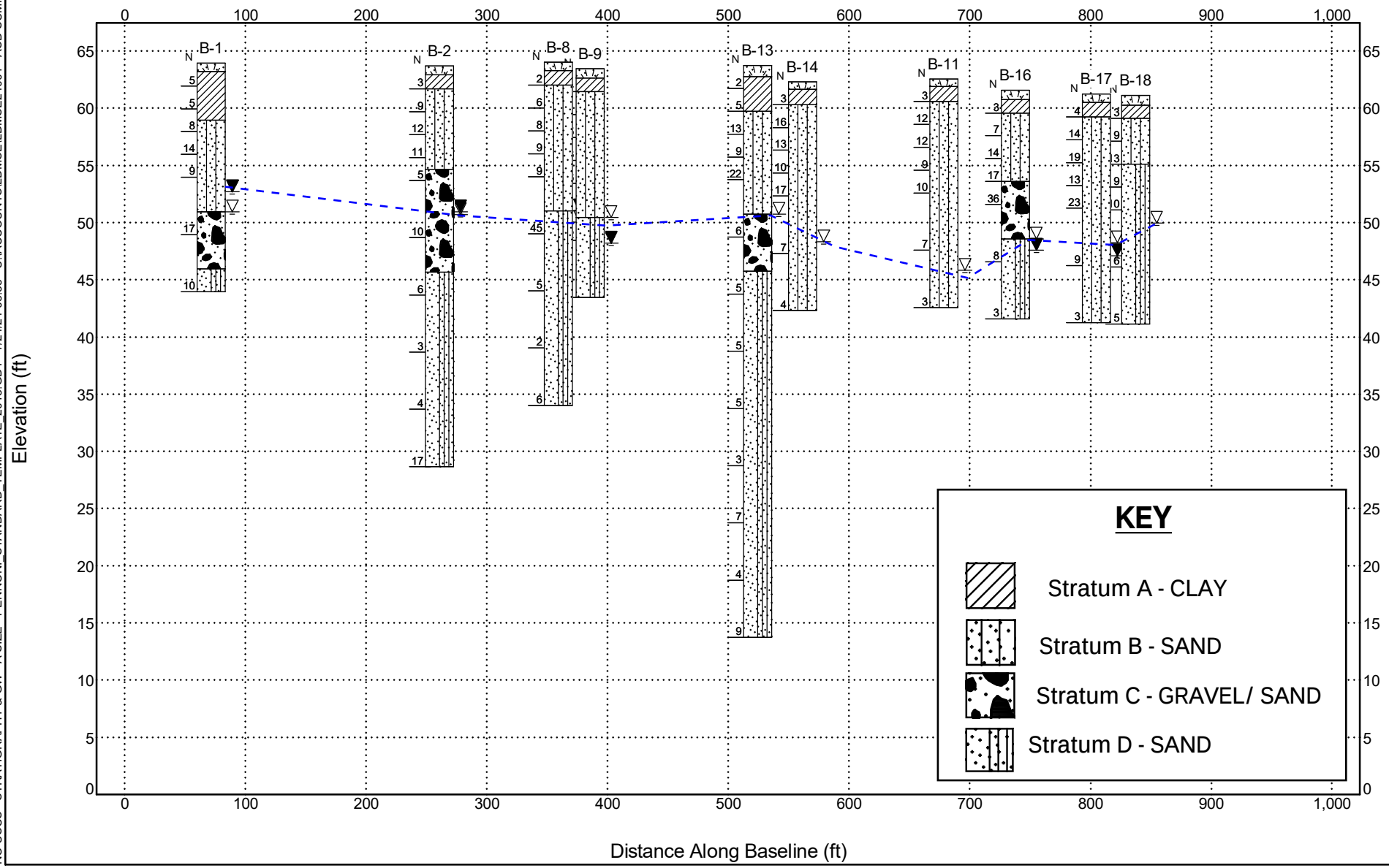
Subsurface Stratigraphy (Cross Section B-B)

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE



APPENDIX C – Geotechnical Laboratory Test Results

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION				PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			Organic Content (%)			SHEAR STRENGTH		
				GRAVEL %	SAND %	SILT %	CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_P	LIQUIDITY INDEX I_L		SPECIFIC GRAVITY (G)	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)
TP-12	CBR-1	2-3'		1	82	17						8.1					127.0	10.1	M						
TP-21	CBR-2	2-3'		1	45	54						13.9					126.1	9.7	M						
TP-32	CBR-3	2-3'		11	63	26						14.4					131.5	8.9	M						
B-1	S-1	0-2'		2	42	56		24	16	8	-0.1	14.8													
	S-6	13-15'		46	45	9						10.5													
B-2	S-3	4-6'		0	84	16						8.6													
	S-9	28-30'		0	93	7						29.6													
B-3	S-2	2-4'		1	74	25						12.3													
	S-6	13-15'		38	46	16						9.9													
B-4	S-2	2-4'		0	77	23						11.8													
	S-8	23-25'		0	91	9						27.7													
B-5	S-4	6-8'		1	84	15						9.8													
	S-6	13-15'		31	58	11						13.1													
B-6	S-3	4-6'		0	83	17						8.3													
	S-6	13-15'		18	72	10						14.4													

PENNONI ASSOCIATES INC.	DRAWN BY: JTR CHECKED BY: ARS	DATE: 7/23/2024 DATE: 7/24/2024	PROJECT: **Appoquinimink School District Summit Campus** LOCATION: **Middletown, DE**	JOB No.: **LDMSE24001** TABLE No.: **L-1**

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION				PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			Organic Content (%)			SHEAR STRENGTH		
				GRAVEL %	SAND %	SILT %	CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_P	LIQUIDITY INDEX I_L		SPECIFIC GRAVITY (G)	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)
B-7	S-3	4-6'		0	81	19						10.2													
	S-7	18-20'		0	87	13						29.2													
B-8	S-3	4-6'		7	83	10						6.7													
	S-8	23-25'		0	91	9						41.3													
B-9	S-2	2-4'		5	80	15						8.8													
	S-7	18-20'		0	88	12						30.2													
B-10	S-3	4-6'		1	79	20						9.7													
	S-6	13-15'		0	91	9						26.7													
B-11	S-4	6-8'		0	80	20						23.4													
	S-7	18-20'		0	90	10						31.1													
B-12	S-1	0-2'		0	61	39		26	16	10	-0.1	15.0													
	S-6	13-15'		0	94	6						27.4													
B-13	S-2	2-4'		0	93	7		NL	NP	-	-	5.3													
	S-12	43-45'		6	89	5						27.7													
B-14	S-5	8-10'		18	71	11						12.9													
	S-7	18-20'		0	87	13						33.6													

PENNONI ASSOCIATES INC.	DRAWN BY: JTR CHECKED BY: ARS	DATE: 7/23/2024 DATE: 7/24/2024
PROJECT: **Appoquinimink School District Summit Campus** LOCATION: **Middletown, DE**	JOB No.: **LDMSE24001** TABLE No.: **L-2**	

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION				PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			Organic Content (%)			SHEAR STRENGTH		
				GRAVEL %	SAND %	SILT %	CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_P	LIQUIDITY INDEX I_L		SPECIFIC GRAVITY (G)	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)
B-15	S-1	0-2'		0	27	73		35	21	14	-0.1	19.7													
	S-5	8-10'		30	58	12						9.1													
B-16	S-2	2-4'		0	58	42						15.6													
	S-6	13-15'		0	93	7						29.5													
B-17	S-2	2-4'		0	67	33						14.6													
	S-5	8-10'		21	64	15						14.3													
B-18	S-3	4-6'		0	83	17						13.4													
	S-7	18-20'		9	80	11						28.2													
B-19	S-1	0-2'		0	6	94		40	21	19	0.2	24.1													
	S-5	8-10'		37	51	12						10													
B-20	S-3	4-6'		1	80	19						17.2													
	S-6	13-15'		0	94	6						30													
B-21	S-1	0-2'		0	37	63		26	16	10	0.1	17.0													
	S-5	8-10'		30	57	13						12.4													
B-22	S-2	2-4'		0	88	12						7.3													
	S-5	8-10'		0	84	16						29.2													

PENNONI ASSOCIATES INC.	DRAWN BY: JTR	DATE: 7/23/2024	PROJECT: **Appoquinimink School District Summit Campus**
	CHECKED BY: ARS	DATE: 7/24/2024	LOCATION: **Middletown, DE**
			JOB No.: **LDMSE24001**
			TABLE No.: **L-3**

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION				PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			Organic Content (%)			SHEAR STRENGTH		
				GRAVEL %	SAND %	SILT %	CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_P	LIQUIDITY INDEX I_L		SPECIFIC GRAVITY (G)	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)
B-23	S-2	2-4'		1	70	29						12.0													
	S-6	13-15'		0	93	7						30.2													
B-24	S-1	0-2'		0	17	83		34	19	15	0.1	20.7													
	S-4	6-8'		38	50	12						5.4													
B-25	S-2	2-4'		7	74	19						9.3													
	S-7	18-20'		0	84	16						35.3													

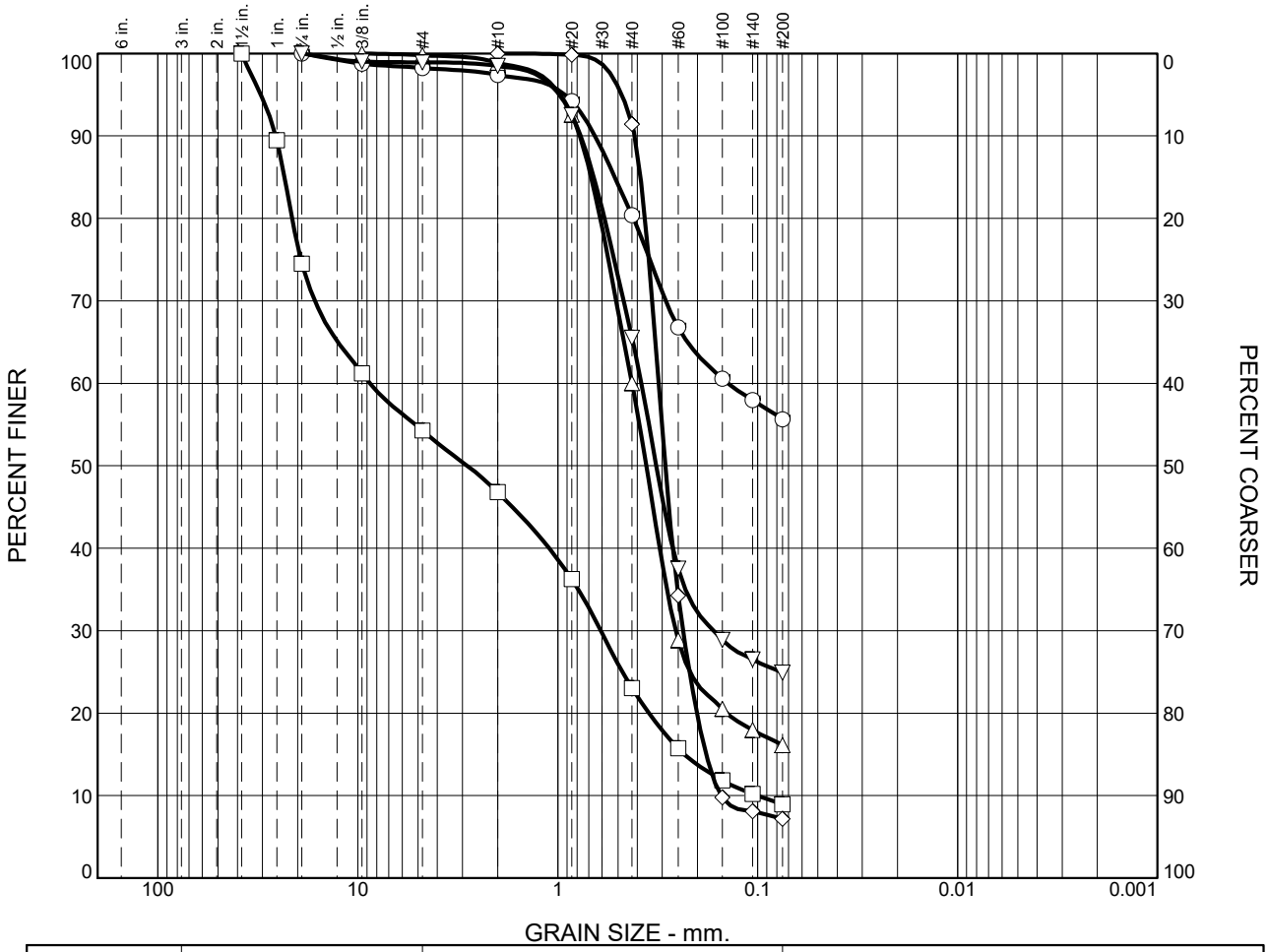
PENNONI ASSOCIATES INC.	DRAWN BY: JTR	DATE: 7/23/2024	PROJECT: **Appoquinimink School District Summit Campus**
	CHECKED BY: ARS	DATE: 7/24/2024	LOCATION: **Middletown, DE**

JOB No.: **LDMSE24001**

TABLE No.: **L-4**

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	2	1	17	24	56	
□	0	26	20	7	24	14	9	
△	0	0	0	1	39	44	16	
◇	0	0	0	0	9	84	7	
▽	0	0	1	1	32	41	25	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-1	S-1	0-2'	Silt/Clay, AND F/M/C Sand, Trace Fine Gravel	CL
□	B-1	S-6	13-15'	C/F Gravel, And M/F/C Sand, Trace Silt/Clay	
△	B-2	S-3	4-6'	F/M/C Sand, Little Silt/Clay	
◇	B-2	S-9	28-30'	F/M Sand, Trace Silt/Clay	
▽	B-3	S-2	2-4'	F/M/C Sand, Some Silt/Clay, Trace Fine Gravel	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

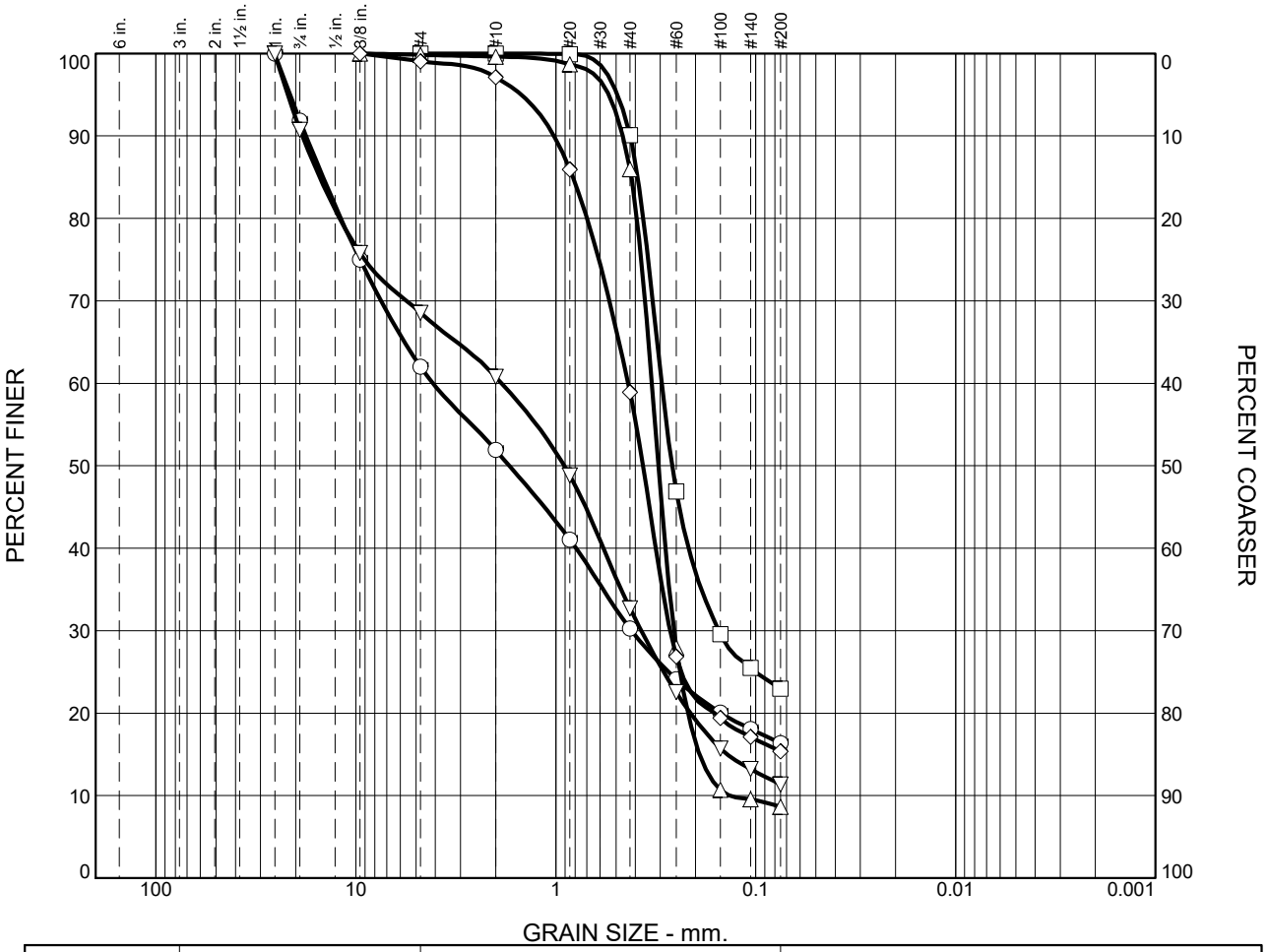
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.01 **Figure** S1

Tested By: BC **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	8	30	10	22	14	16	
□	0	0	0	0	10	67	23	
△	0	0	0	0	14	77	9	
◇	0	0	1	2	38	44	15	
▽	0	9	22	8	28	22	11	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-3	S-6	13-15'	M/F/C Sand, And F/C Gravel, Little Silt/Clay	
□	B-4	S-2	2-4'	F/M Sand, Some Silt/Clay	
△	B-4	S-8	23-25'	F/M Sand, Trace Silt/Clay	
◇	B-5	S-4	6-8'	F/M/C Sand, Little Silt/Clay, Trace Fine Gravel	
▽	B-5	S-6	13-15'	M/F/C Sand, Some F/C Gravel, Little Silt/Clay	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

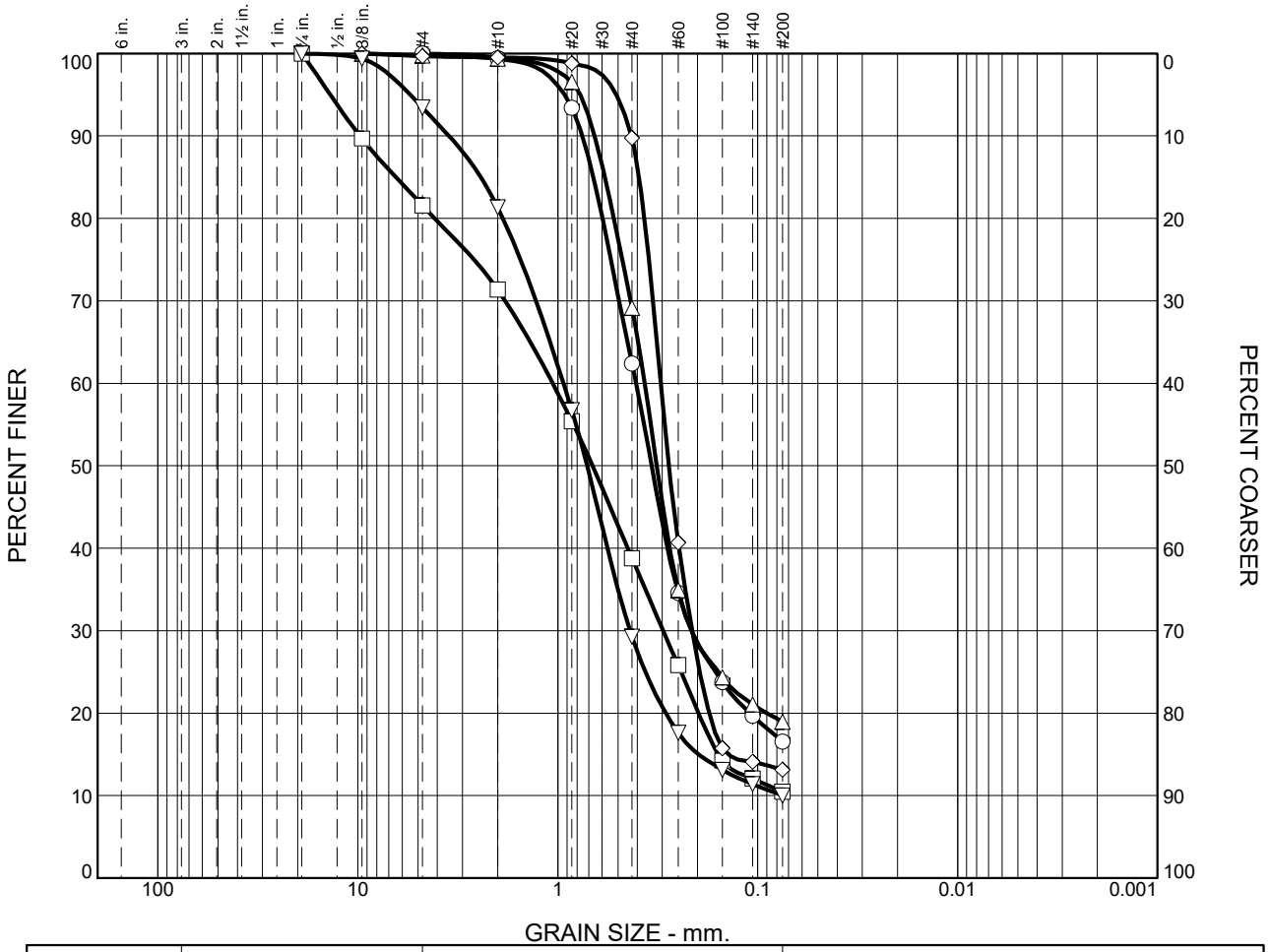
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.01 **Figure** S2

Tested By: BC **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	1	37	45	17	
□	0	0	18	11	32	29	10	
△	0	0	0	1	30	50	19	
◇	0	0	0	0	10	77	13	
▽	0	0	7	12	52	19	10	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-6	S-3	4-6'	M/F/C Sand, Little Silt/Clay, Trace Fine Gravel	
□	B-6	S-6	13-15'	M/F/C Sand, Little Fine Gravel, Trace Silt/Clay	
△	B-7	S-3	4-6'	F/M/C Sand, Little Silt/Clay	
◇	B-7	S-7	18-20'	F/M Sand, Little Silt/Clay	
▽	B-8	S-3	4-6'	M/F/C Sand, Little Silt/Clay, Trace Fine Gravel	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

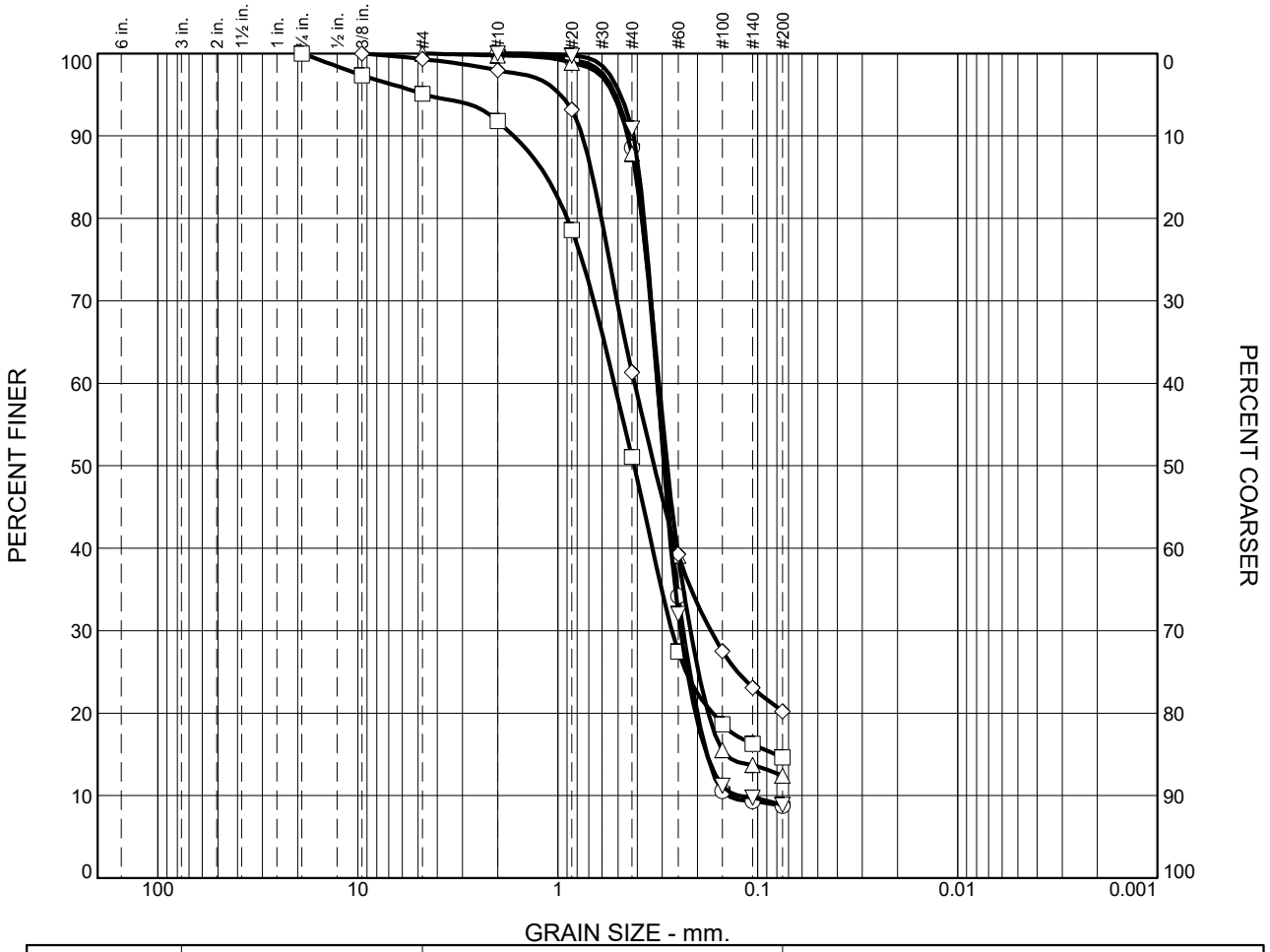
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.01 **Figure** S3

Tested By: BC **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	11	80	9	
□	0	0	5	3	41	36	15	
△	0	0	0	0	12	76	12	
◇	0	0	1	1	37	41	20	
▽	0	0	0	0	9	82	9	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-8	S-8	23-25'	F/M Sand, Trace Silt/Clay	
□	B-9	S-2	2-4'	F/M/C Sand, Little Silt/Clay, Trace Fine Gravel	
△	B-9	S-7	18-20'	F/M Sand, Little Silt/Clay	
◇	B-10	S-3	4-6'	F/M/C Sand, Some Silt/Clay, Trace Fine Gravel	
▽	B-10	S-6	13-15'	F/M Sand, Trace Silt/Clay	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

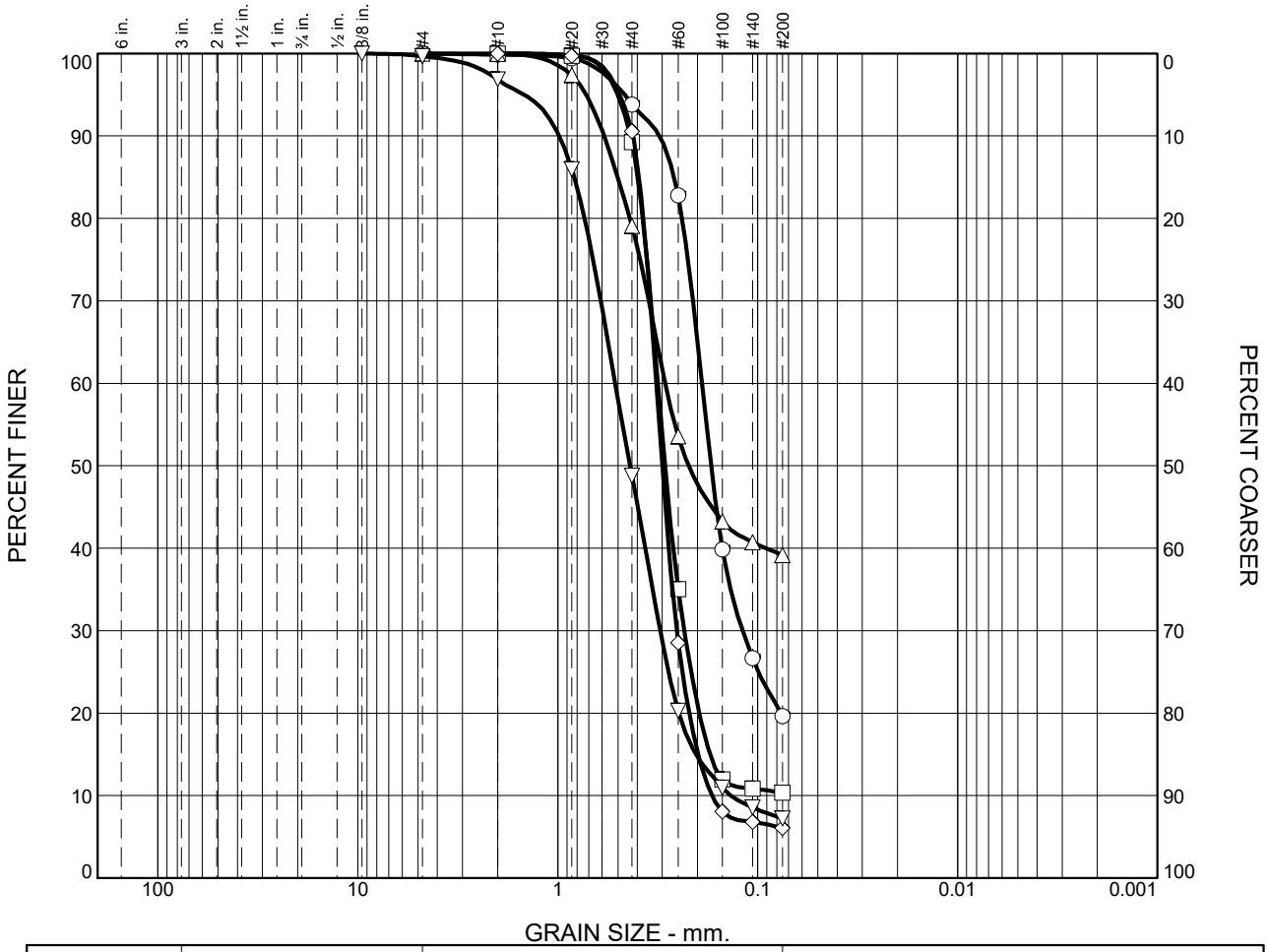
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.01 **Figure** S4

Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	6	74	20	
□	0	0	0	0	11	79	10	
△	0	0	0	0	21	40	39	
◇	0	0	0	0	9	85	6	
▽	0	0	0	3	48	42	7	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-11	S-4	6-8'	F/M Sand, Some Silt/Clay	
□	B-11	S-7	18-20'	F/M Sand, Little Silt/Clay	
△	B-12	S-1	0-2'	F/M Sand, And Silt/Clay	SC
◇	B-12	S-6	13-15'	F/M Sand, Trace Silt/Clay	
▽	B-13	S-2	2-4'	M/F/C Sand, Trace Silt/Clay	SP-SM

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

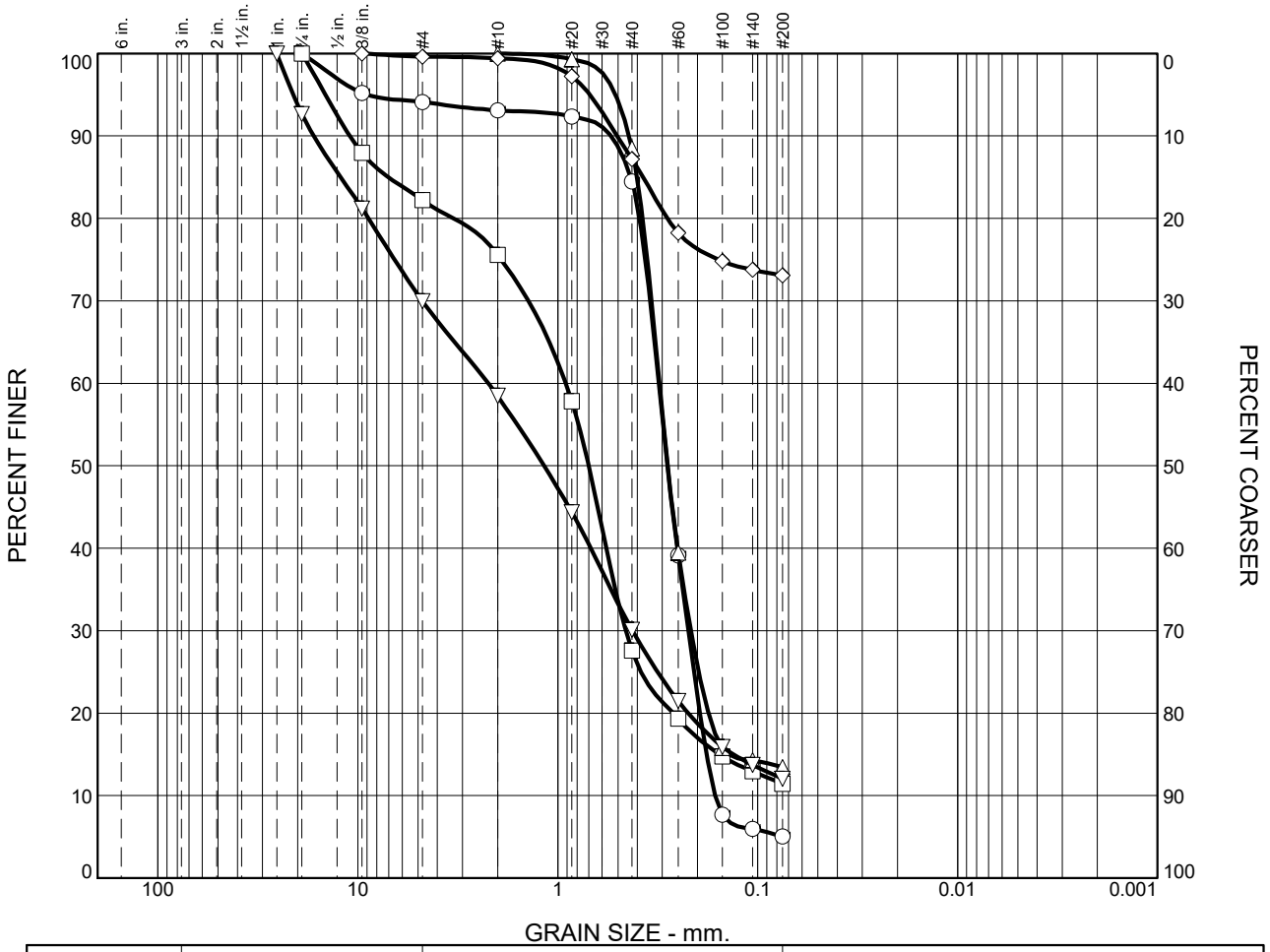
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.01 **Figure** S5

Tested By: BC **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	6	1	9	79	5	
□	0	0	18	6	48	17	11	
△	0	0	0	0	12	75	13	
◇	0	0	0	1	12	14	73	
▽	0	7	23	12	28	18	12	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-13	S-12	43-45'	F/M/C Sand, Trace Fine Gravel, Trace Silt/Clay	
□	B-14	S-5	8-10'	M/F/C Sand, Little Fine Gravel, Little Silt/Clay	
△	B-14	S-7	18-20'	F/M Sand, Little Silt/Clay	
◇	B-15	S-1	0-2'	Silt/Clay, Some F/M/C Sand	CL
▽	B-15	S-5	8-10'	M/F/C Sand, Some F/C Gravel, Little Silt/Clay	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

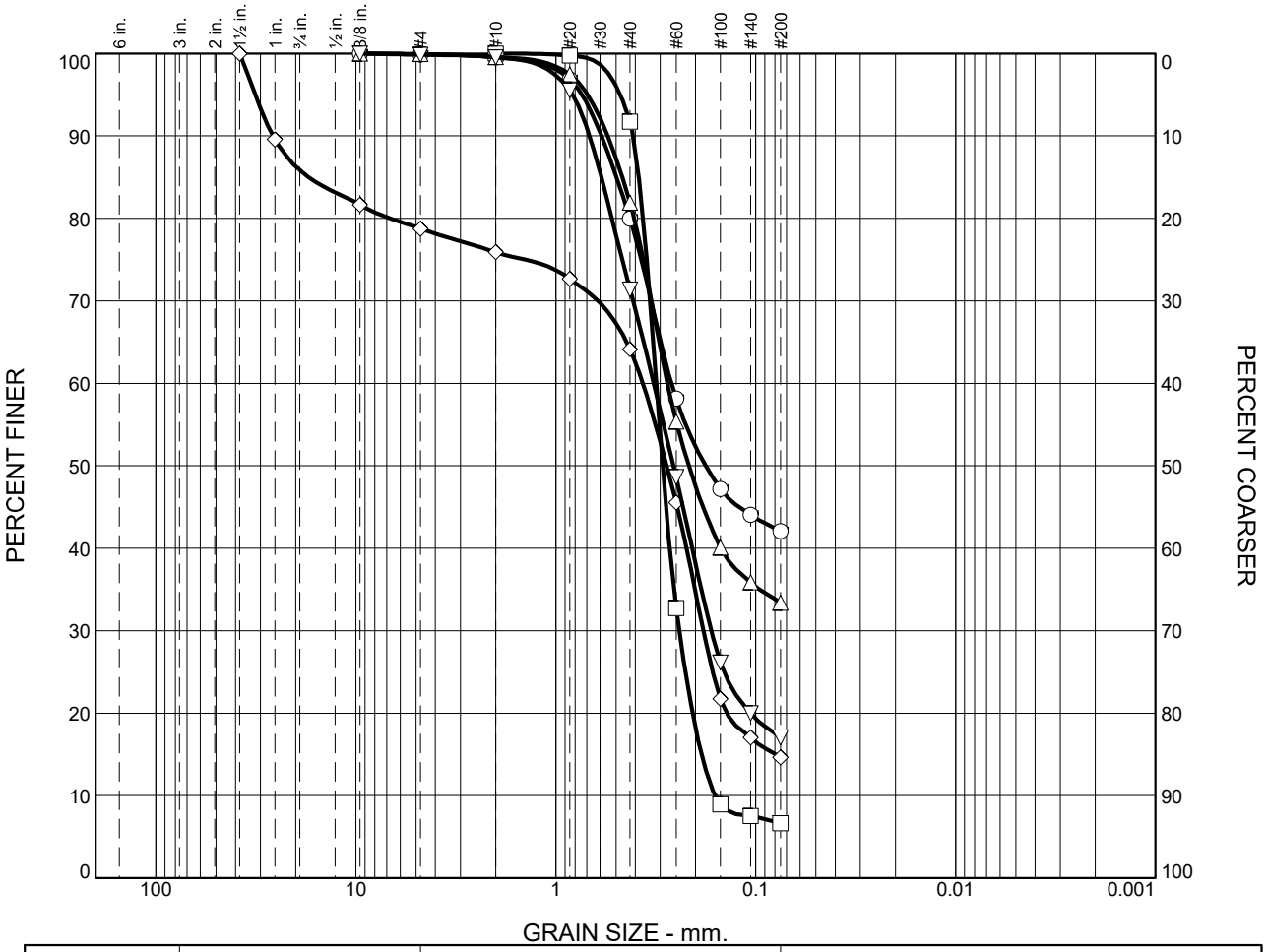
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.01 **Figure** S6

Tested By: BC **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	20	38	42	
□	0	0	0	0	8	85	7	
△	0	0	0	0	18	49	33	
◇	0	14	7	3	12	49	15	
▽	0	0	0	0	29	54	17	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-16	S-2	2-4'	F/M Sand, And Silt/Clay	
□	B-16	S-6	13-15'	F/M Sand, Trace Silt/Clay	
△	B-17	S-2	2-4'	F/M Sand, Some Silt/Clay	
◇	B-17	S-5	8-10'	F/M/C Sand, Some C/F Gravel, Little Silt/Clay	
▽	B-18	S-3	4-6'	F/M Sand, Little Silt/Clay	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

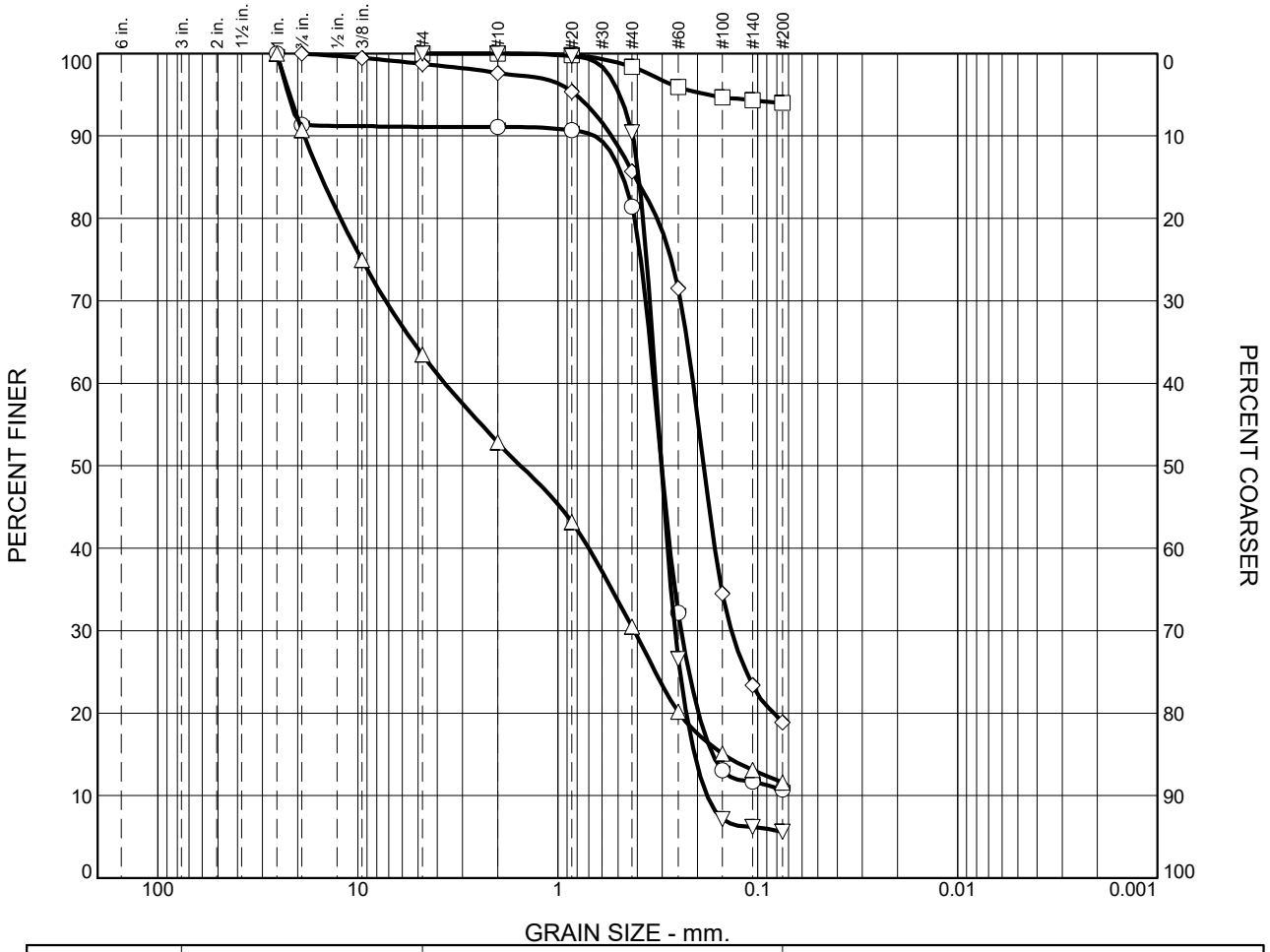
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.01 **Figure** S7

Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	9	0	0	10	70	11	
□	0	0	0	0	2	4	94	
△	0	9	28	10	23	18	12	
◇	0	0	1	1	12	67	19	
▽	0	0	0	0	10	84	6	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-18	S-7	18-20'	F/M Sand, Little Silt/Clay, Trace Coarse Gravel	
□	B-19	S-1	0-2'	Silt/Clay, Trace F/M Sand	CL
△	B-19	S-5	8-10'	M/F/C Sand, And F/C Gravel, Little Silt/Clay	
◇	B-20	S-3	4-6'	F/M/C Sand, Little Silt/Clay, Trace Fine Gravel	
▽	B-20	S-6	13-15'	F/M Sand, Trace Silt/Clay	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

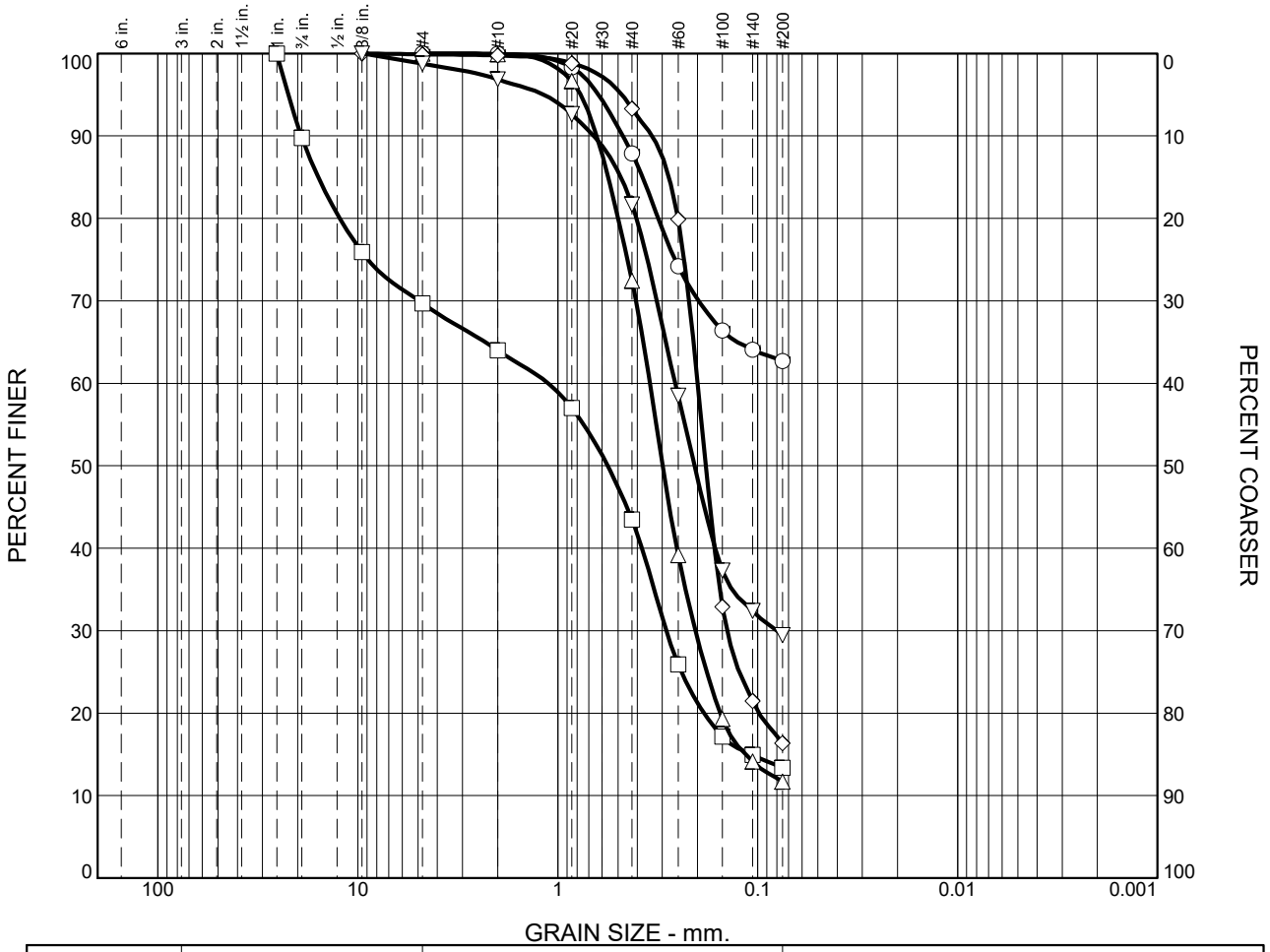
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.01 **Figure** S8

Tested By: BC **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	12	25	63	
□	0	10	20	6	21	30	13	
△	0	0	0	0	28	60	12	
◇	0	0	0	0	7	77	16	
▽	0	0	1	2	15	53	29	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-21	S-1	0-2'	Silt/Clay, And F/M Sand	CL
□	B-21	S-5	8-10'	F/M/C Sand, Some F/C Gravel, Little Silt/Clay	
△	B-22	S-2	2-4'	F/M Sand, Little Silt/Clay	
◇	B-22	S-5	8-10'	F/M Sand, Little Silt/Clay	
▽	B-23	S-2	2-4'	F/M/C Sand,. Some Silt/Clay, Trace Fine Gravel	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

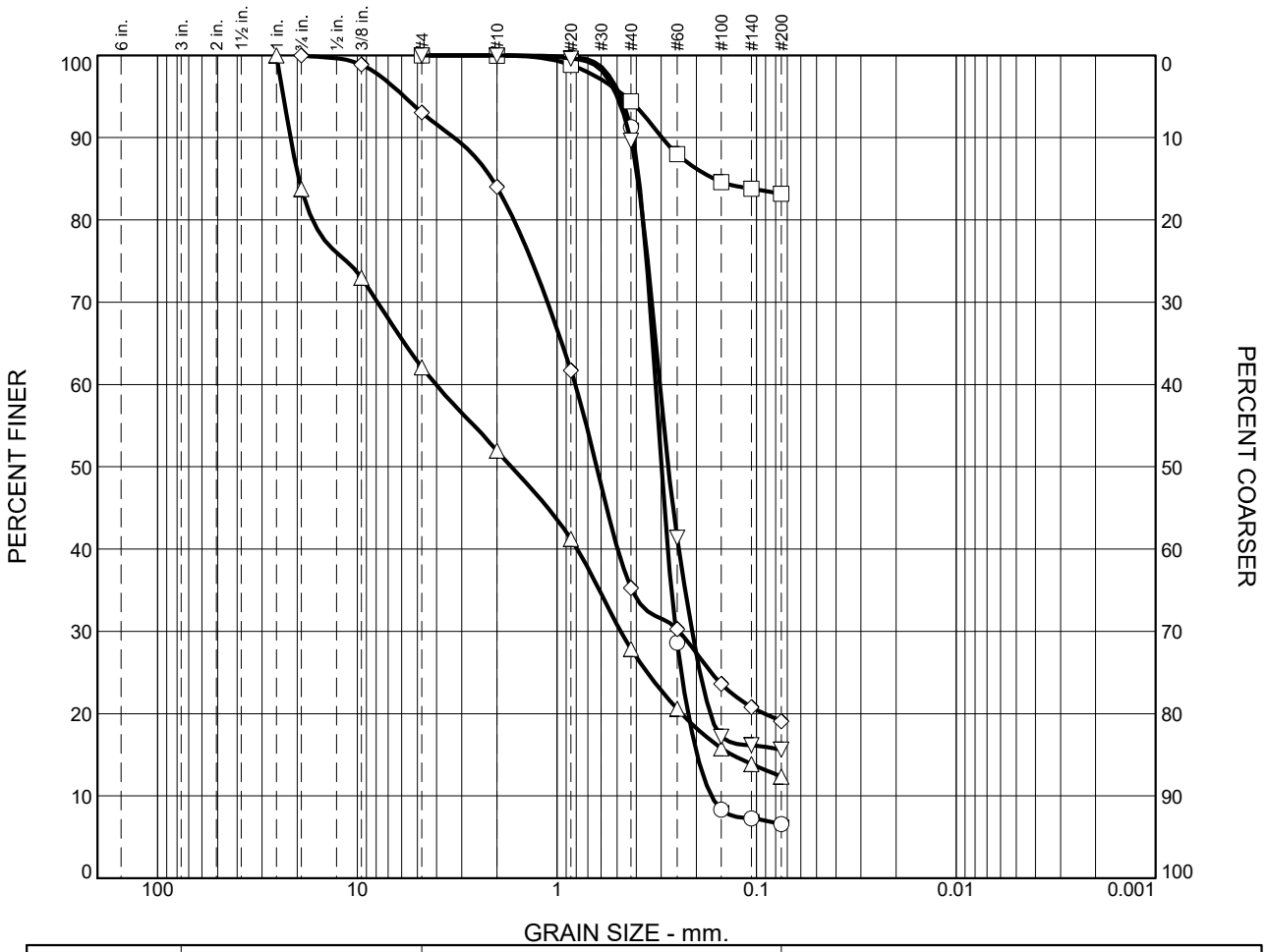
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.01 **Figure** S9

Tested By: BC **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	9	84	7	
□	0	0	0	0	6	11	83	
△	0	16	22	10	24	16	12	
◇	0	0	7	9	49	16	19	
▽	0	0	0	0	10	74	16	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-23	S-6	13-15'	F/M Sand, Trace Silt/Clay	
□	B-24	S-1	0-2'	Silt/Clay, Little F/M Sand	CL
△	B-24	S-4	6-8'	M/F/C Sand, And F/C Gravel, Little Silt/Clay	
◇	B-25	S-2	2-4'	M/F/C Sand, Little Silt/Clay, Trace Fine Gravel	
▽	B-25	S-7	18-20'	F/M Sand, Little Silt/Clay	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

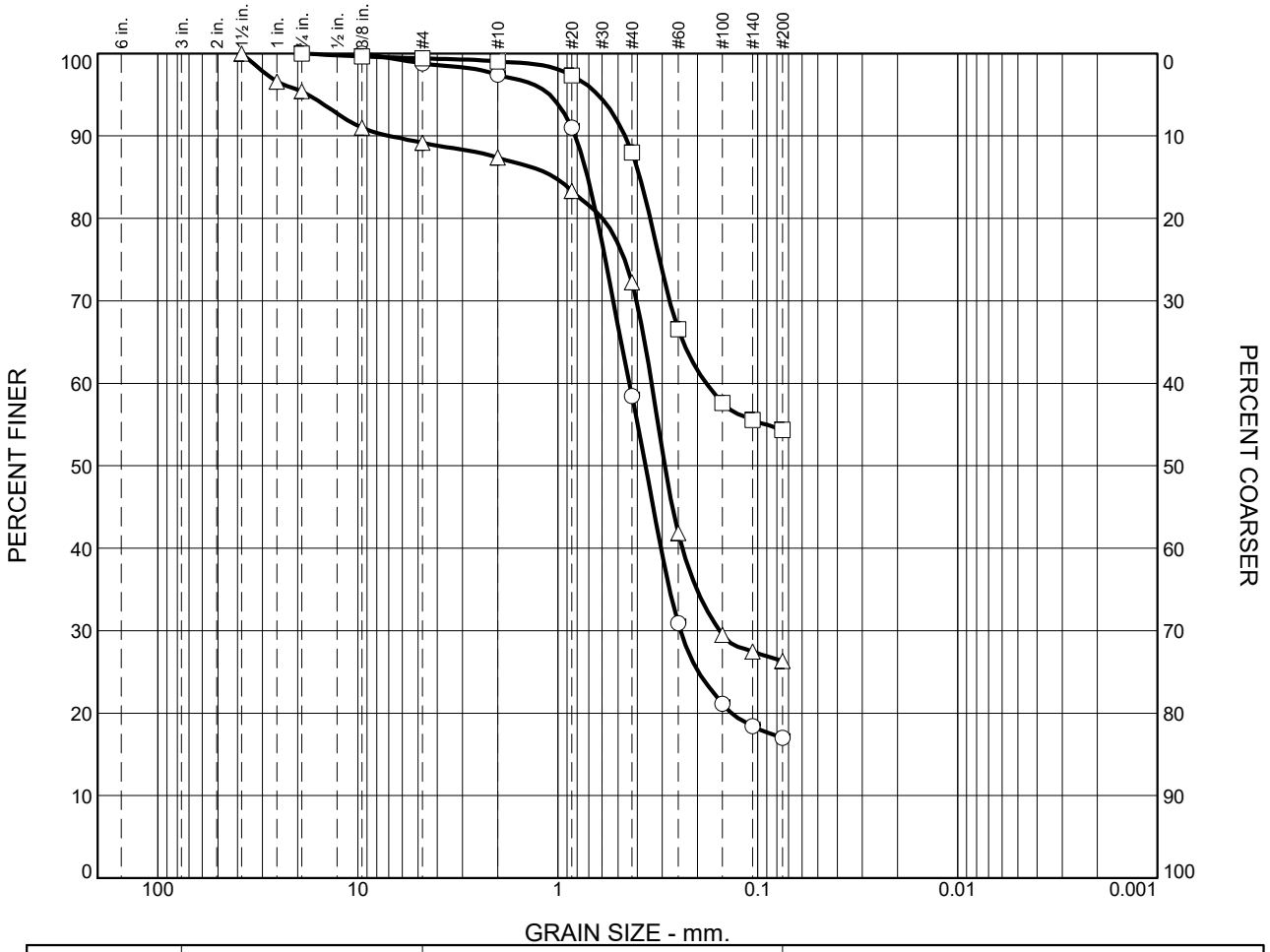
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.01 **Figure** S10

Tested By: BC **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	1	2	39	41	17	
□	0	0	1	0	11	34	54	
△	0	5	6	2	15	46	26	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-12	CBR-1	2-3'	F/M/C Sand, Little Silt/Clay, Trace Fine Gravel	
□	TP-21	CBR-2	2-3'	Silt/Clay, And F/M Sand, Trace Fine Gravel	
△	TP-32	CBR-3	2-3'	F/M/C Sand, Some Silt/Clay, Little F/C Gravel	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

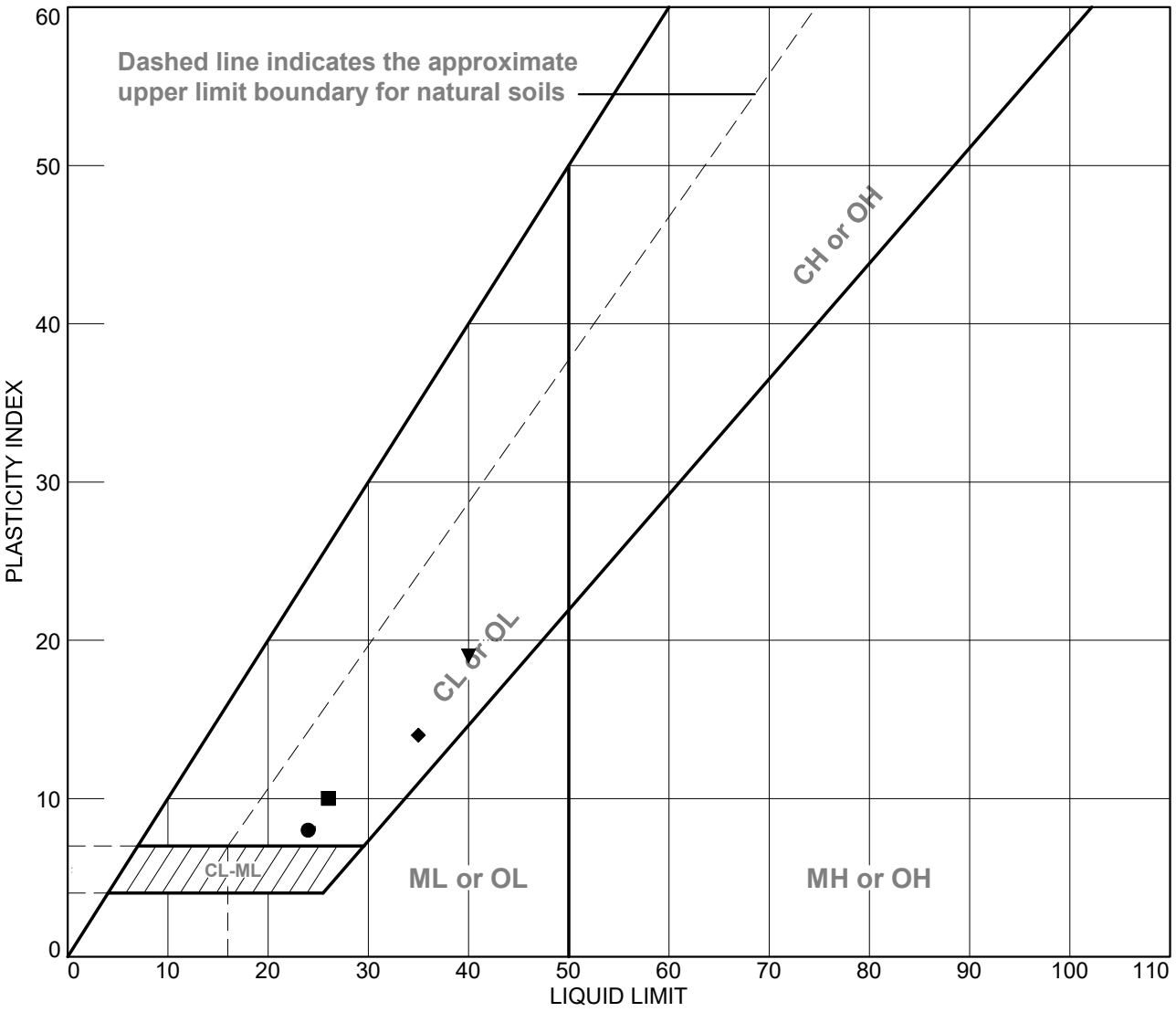
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.01 **Figure** S11

Tested By: ● BC ■ BC ▲ MB **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-1	S-1	0-2'	14.8	16	24	8	CL
■	B-12	S-1	0-2'	15.0	16	26	10	SC
▲	B-13	S-2	2-4'	5.3	NP	NP	NP	SP-SM
◆	B-15	S-1	0-2'	19.7	21	35	14	CL
▼	B-19	S-1	0-2'	24.1	21	40	19	CL

PENNONI ASSOCIATES INC.

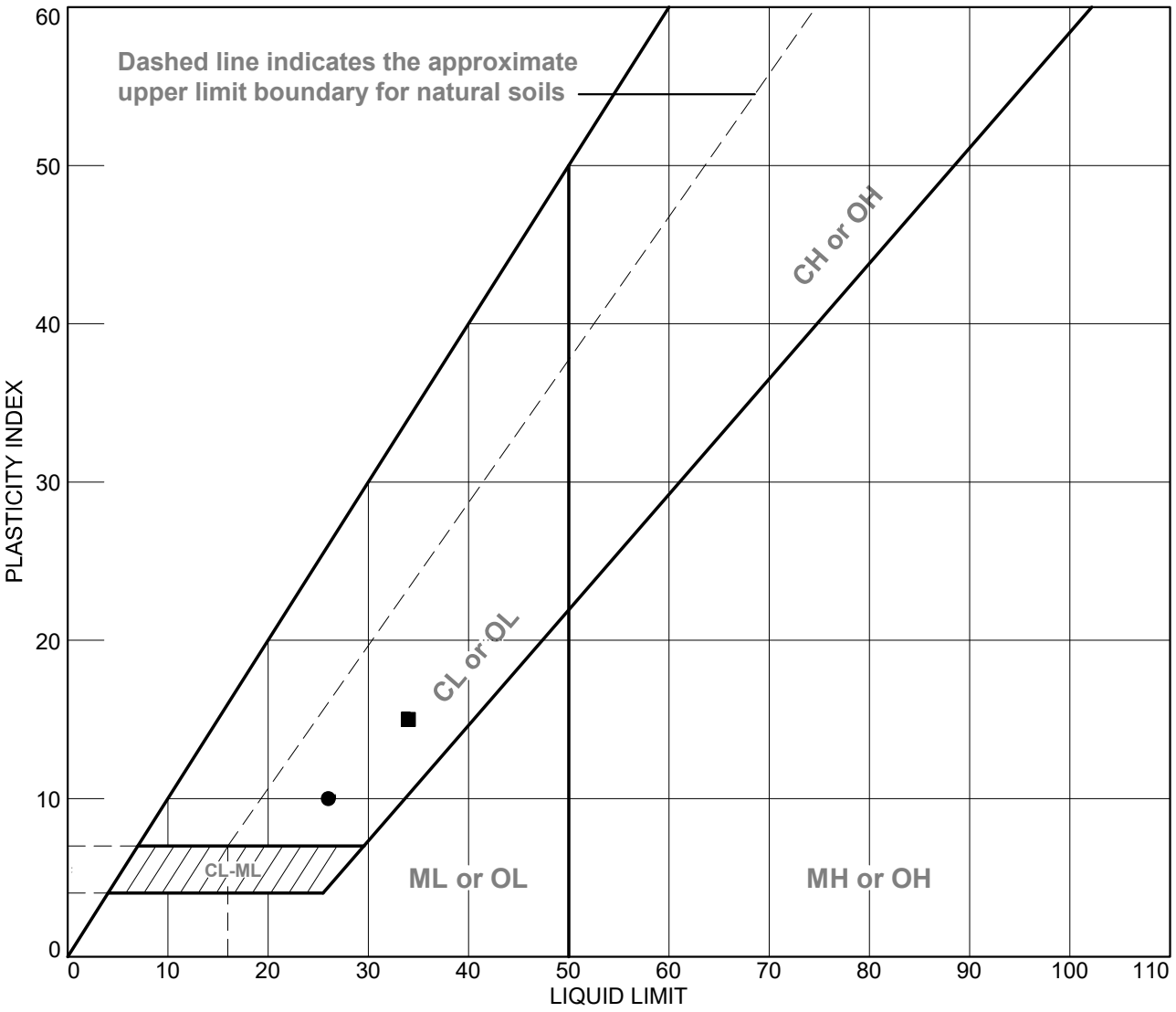
Client: Landmark Science & Engineering

Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.01 **Figure** A1

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-21	S-1	0-2'	17.0	16	26	10	CL
■	B-24	S-1	0-2'	20.7	19	34	15	CL

PENNONI ASSOCIATES INC.

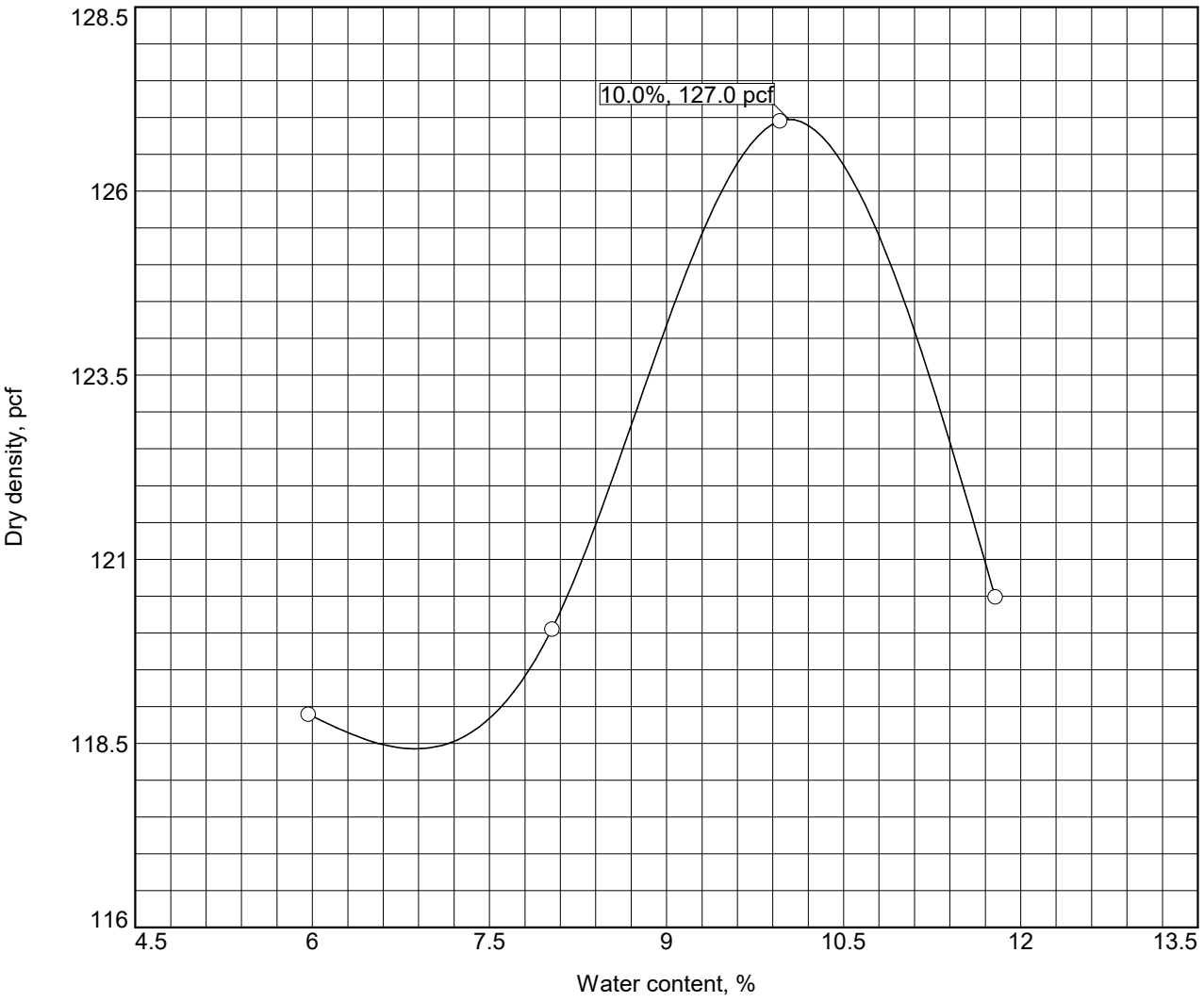
Client: Landmark Science & Engineering

Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.01 **Figure** A2

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples

COMPACTION TEST REPORT for Curve No. C-1



Test specification: ASTM D 1557-12 Method C Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
2-3'			8.1				0	17

TEST RESULTS

Maximum dry density = 127.0 pcf

Optimum moisture = 10.0 %

MATERIAL DESCRIPTION

F/M/C Sand, Little Silt/Clay, Trace Fine Gravel

Project No. LDMSE-24001.01 **Client:** Landmark Science & Engineering

Project: Appoquinimink School District Summit Ca

Date:

○ **Source of Sample:** TP-12 **Sample Number:** CBR-1

Remarks:

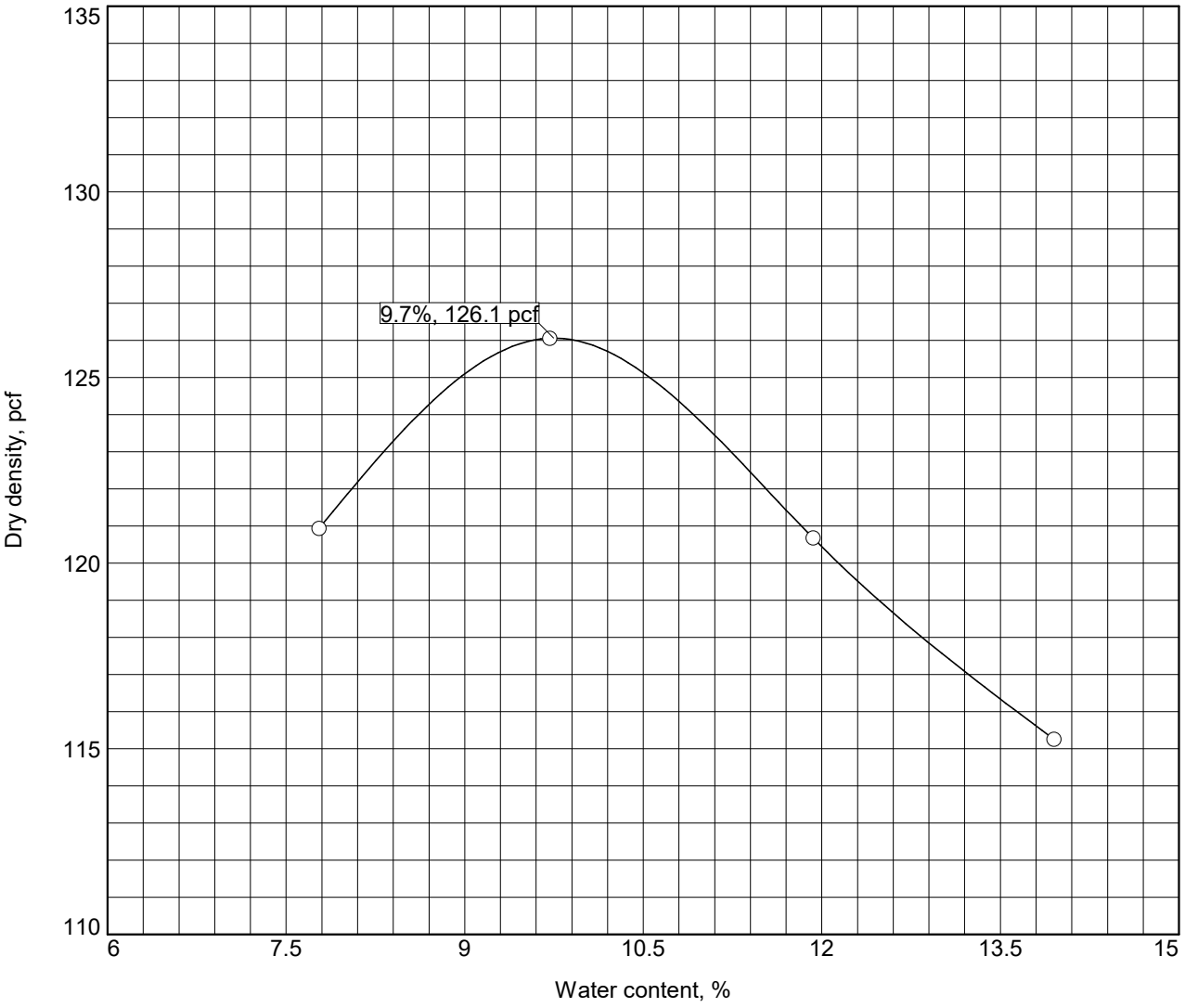
PENNONI ASSOCIATES INC.

Figure C-1

Tested By: NT **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

COMPACTION TEST REPORT for Curve No. C-2



Test specification: ASTM D 1557-12 Method C Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
2-3'			13.9				0	54

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 126.1 pcf Optimum moisture = 9.7 %	Silt/Clay, And F/M Sand, Trace Fine Gravel

Project No. LDMSE-24001.01 **Client:** Landmark Science & Engineering
Project: Appoquinimink School District Summit Ca
Date:
○ **Source of Sample:** TP-21 **Sample Number:** CBR-2

Remarks:

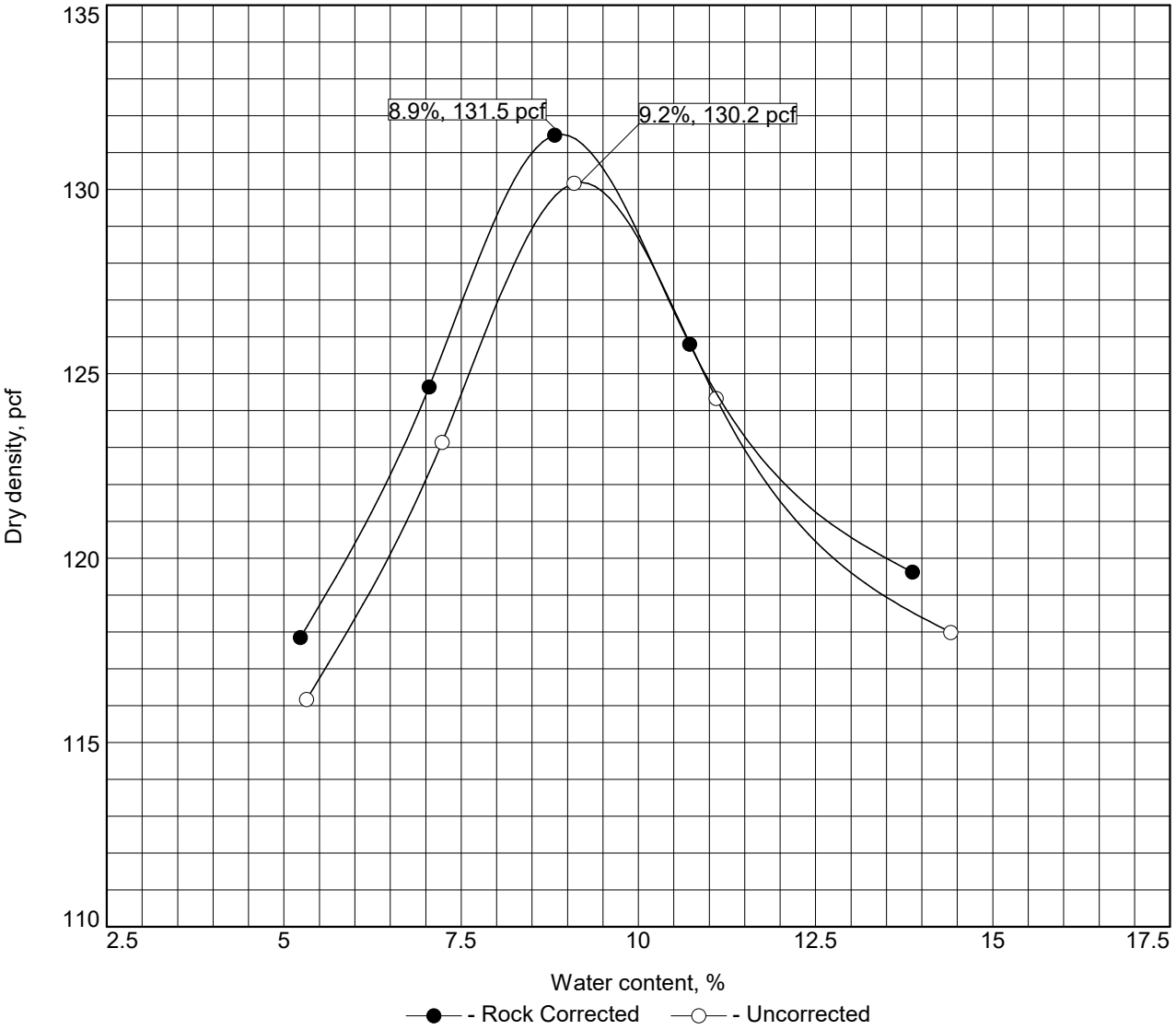
PENNONI ASSOCIATES INC.

Figure C-2

Tested By: NT **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

COMPACTION TEST REPORT for Curve No. C-3



Test specification: ASTM D 1557-12 Method C Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
2-3'			14.4				5	26

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 131.5 pcf	130.2 pcf	F/M/C Sand, Some Silt/Clay, Little F/C Gravel
Optimum moisture = 8.9 %	9.2 %	

Project No. LDMSE-24001.01 **Client:** Landmark Science & Engineering
Project: Appoquinimink School District Summit Ca
Date:
○ **Source of Sample:** TP-32 **Sample Number:** CBR-3

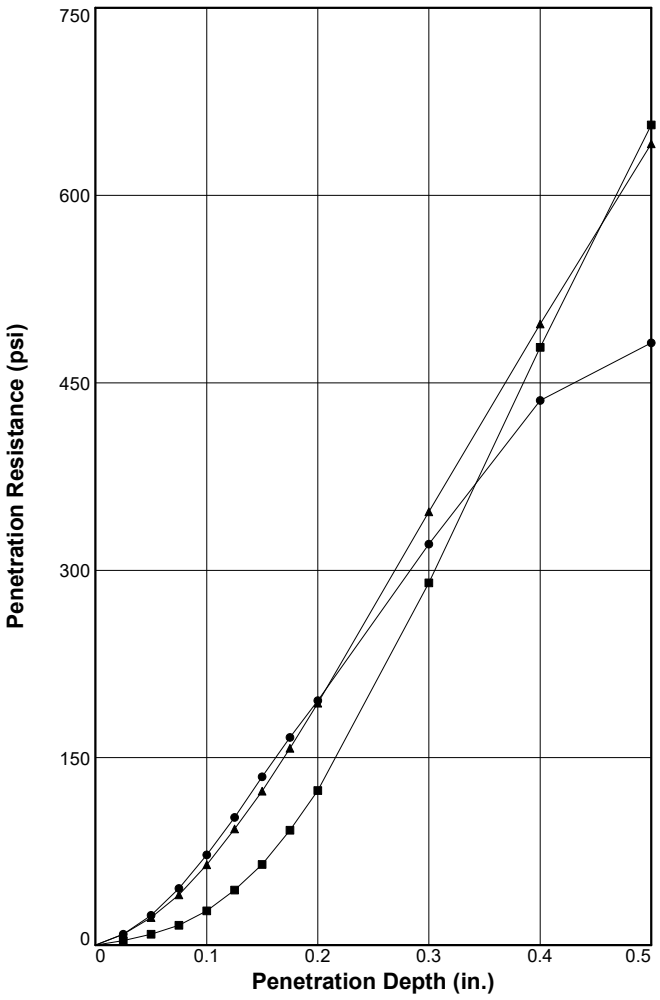
Remarks:

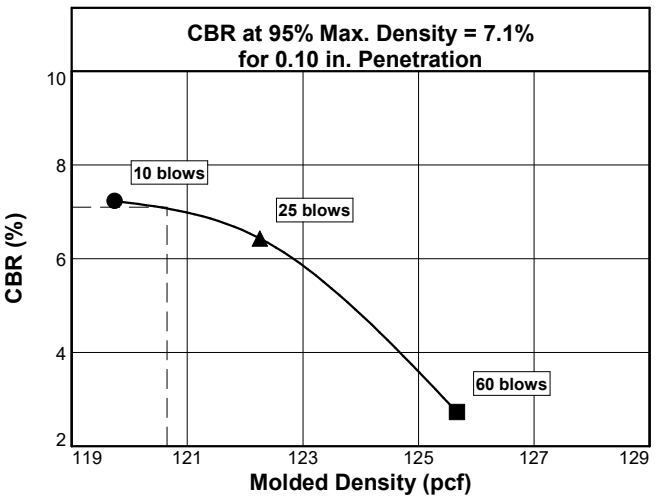
PENNONI ASSOCIATES INC.

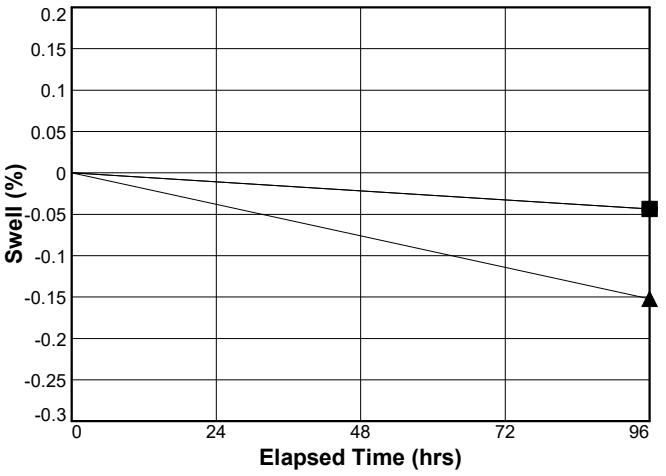
Figure C-3

Tested By: NT **Checked By:** JTR

BEARING RATIO TEST REPORT
ASTM D1883-14







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ●	119.7	94.3	10.1	119.8	94.3	10.9	7.2	13.0	0.000	10	0
2 ▲	122.3	96.3	10.1	122.4	96.4	10.1	6.4	12.9	0.000	10	-0.2
3 ■	125.7	99	10.1	125.7	99	10.0	2.7	8.2	0.000	10	0

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
F/M/C Sand, Little Silt/Clay, Trace Fine Gravel		127.0	10.0		

Project No: LDMSE-24001.01

Project: Appoquinimink School District Summit Ca

Source of Sample: TP-12 **Depth:** 2-3'

Sample Number: CBR-1

Date:

BEARING RATIO TEST REPORT

PENNONI ASSOCIATES INC.

Test Description:

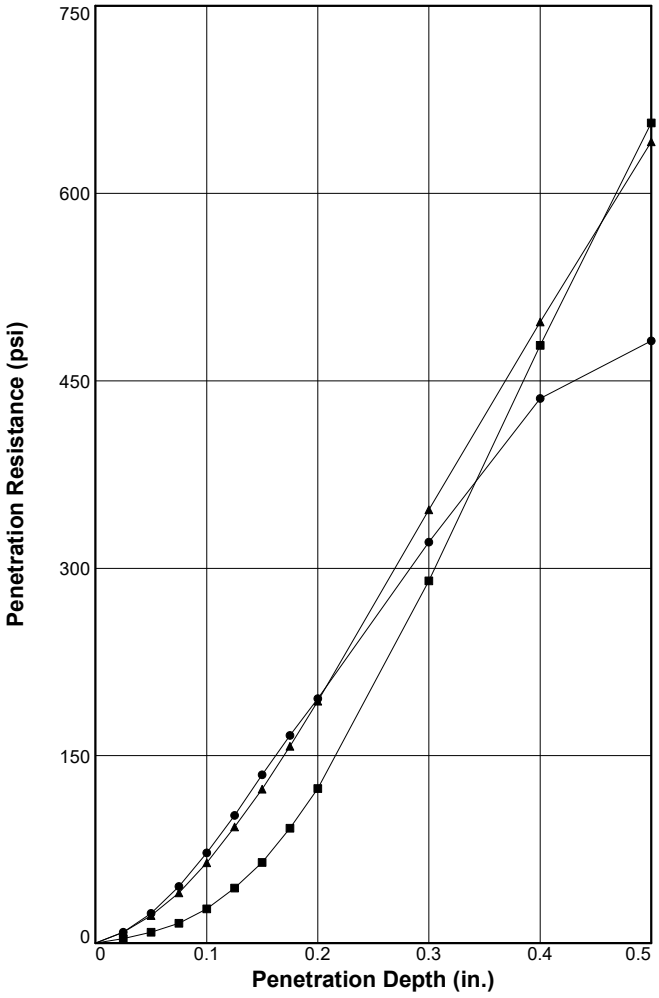
Remolded from Bulk Sample

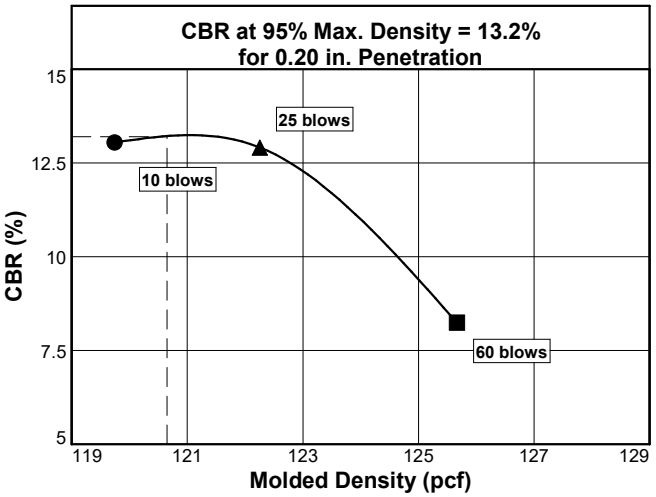
Figure CBR-1

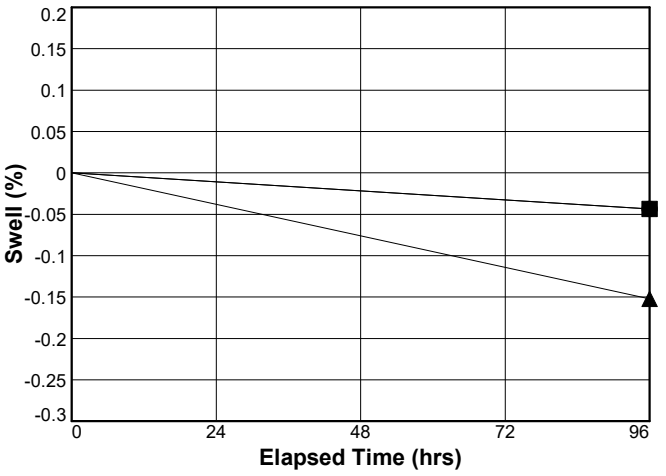
Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

BEARING RATIO TEST REPORT
ASTM D1883-14







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ●	119.7	94.3	10.1	119.8	94.3	10.9	7.2	13.0	0.000	10	0
2 ▲	122.3	96.3	10.1	122.4	96.4	10.1	6.4	12.9	0.000	10	-0.2
3 ■	125.7	99	10.1	125.7	99	10.0	2.7	8.2	0.000	10	0

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
F/M/C Sand, Little Silt/Clay, Trace Fine Gravel		127.0	10.0		

Project No: LDMSE-24001.01

Project: Appoquinimink School District Summit Ca

Source of Sample: TP-12 **Depth:** 2-3'

Sample Number: CBR-1

Date:

BEARING RATIO TEST REPORT

PENNONI ASSOCIATES INC.

Test Description:

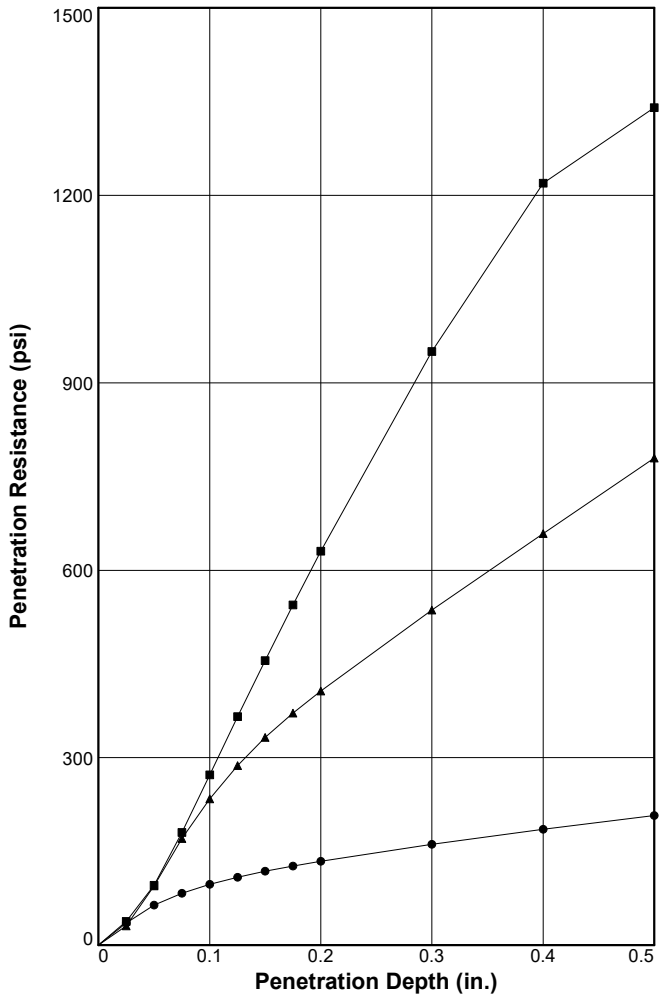
Remolded from Bulk Sample

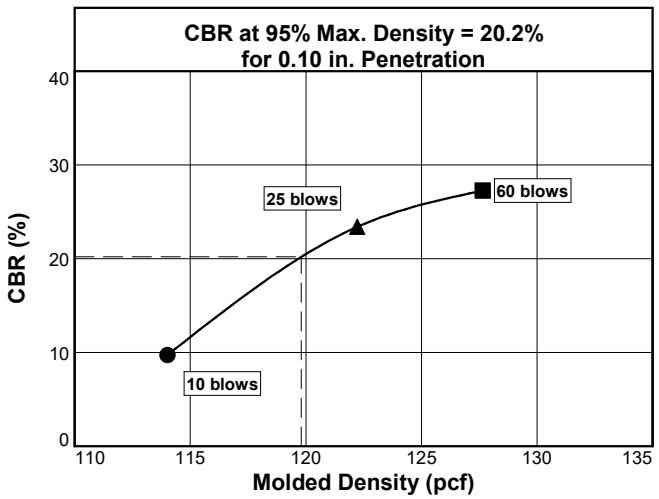
Figure CBR-1A

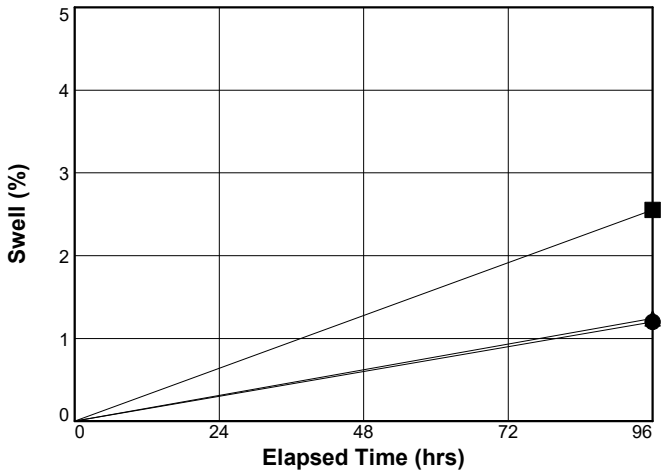
Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

BEARING RATIO TEST REPORT
ASTM D1883-14







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ●	114.0	90.4	9.8	112.7	89.3	15.6	9.7	9.0	0.000	10	1.2
2 ▲	122.2	96.9	9.7	120.7	95.7	13.4	23.4	27.1	0.000	10	1.2
3 ■	127.6	101.2	9.7	124.5	98.7	11.1	27.3	42.0	0.000	10	2.6

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Silt/Clay, And F/M Sand, Trace Fine Gravel		126.1	9.7		

Project No: LDMSE-24001.01

Project: Appoquinimink School District Summit Ca

Source of Sample: TP-21 **Depth:** 2-3'

Sample Number: CBR-2

Date:

BEARING RATIO TEST REPORT

PENNONI ASSOCIATES INC.

Test Description:

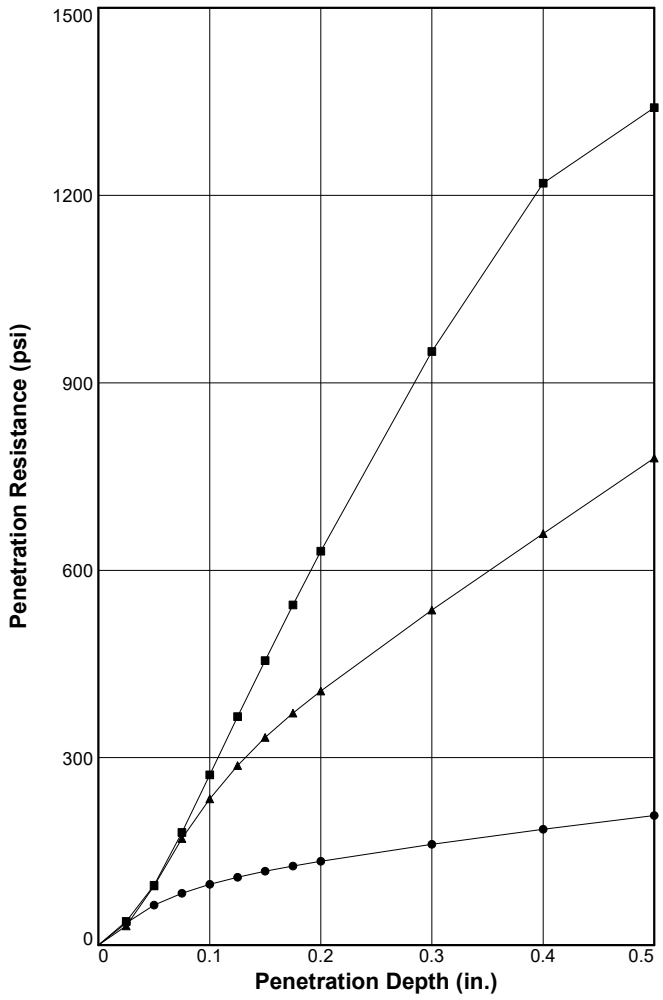
Remolded from Bulk Sample

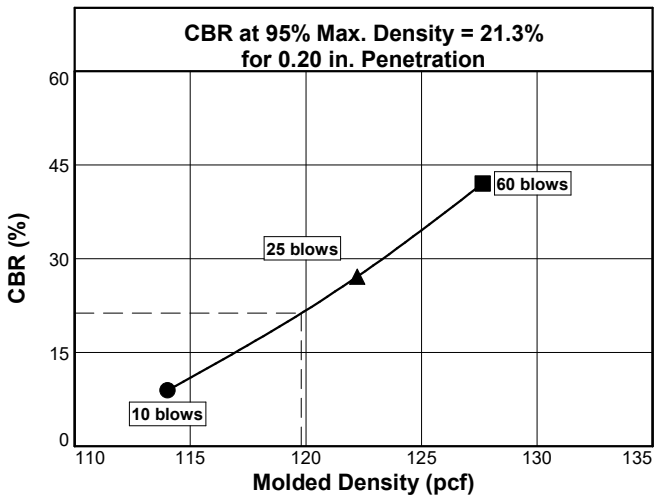
Figure CBR-2

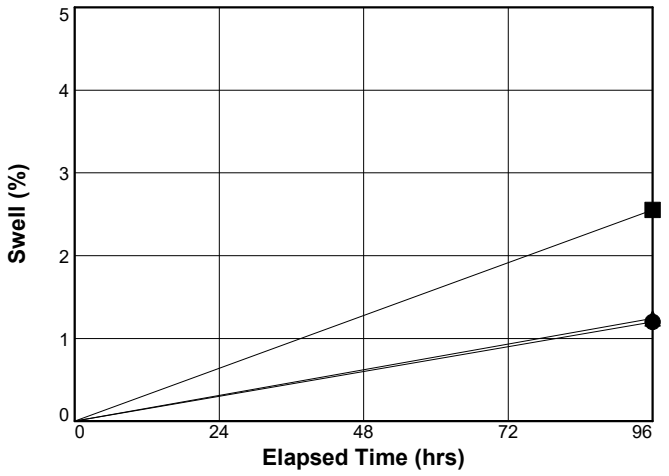
Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

BEARING RATIO TEST REPORT
ASTM D1883-14







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ●	114.0	90.4	9.8	112.7	89.3	15.6	9.7	9.0	0.000	10	1.2
2 ▲	122.2	96.9	9.7	120.7	95.7	13.4	23.4	27.1	0.000	10	1.2
3 ■	127.6	101.2	9.7	124.5	98.7	11.1	27.3	42.0	0.000	10	2.6

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Silt/Clay, And F/M Sand, Trace Fine Gravel		126.1	9.7		

Project No: LDMSE-24001.01

Project: Appoquinimink School District Summit Ca

Source of Sample: TP-21 **Depth:** 2-3'

Sample Number: CBR-2

Date:

BEARING RATIO TEST REPORT

PENNONI ASSOCIATES INC.

Test Description:

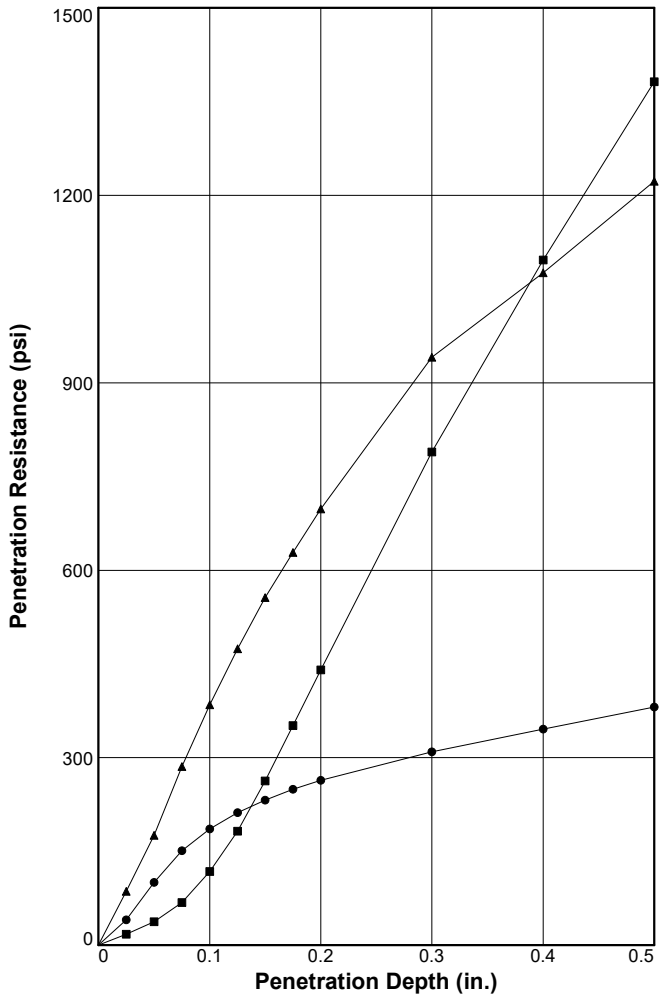
Remolded from Bulk Sample

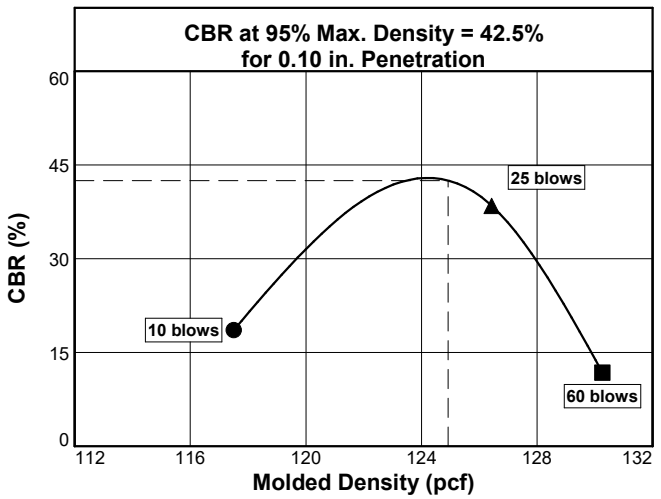
Figure CBR-2

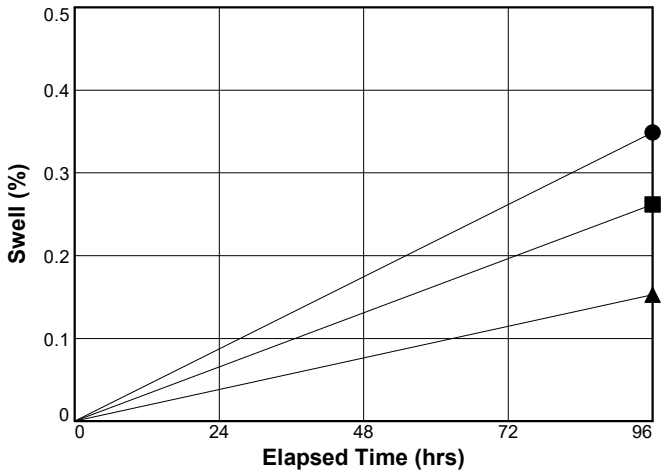
Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

BEARING RATIO TEST REPORT
ASTM D1883-14







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ●	117.5	89.4	8.8	117.1	89	12.2	18.6	17.6	0.000	10	0.3
2 ▲	126.4	96.1	9.2	126.2	96	10.2	38.5	46.5	0.000	10	0.2
3 ■	130.3	99.1	8.8	129.9	98.8	9.6	11.8	29.4	0.000	10	0.3

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
F/M/C Sand, Some Silt/Clay, Little F/C Gravel		131.5	8.9		

Project No: LDMSE-24001.01

Project: Appoquinimink School District Summit Ca

Source of Sample: TP-32 **Depth:** 2-3'

Sample Number: CBR-3

Date:

Test Description:

Remolded from Bulk Sample

BEARING RATIO TEST REPORT

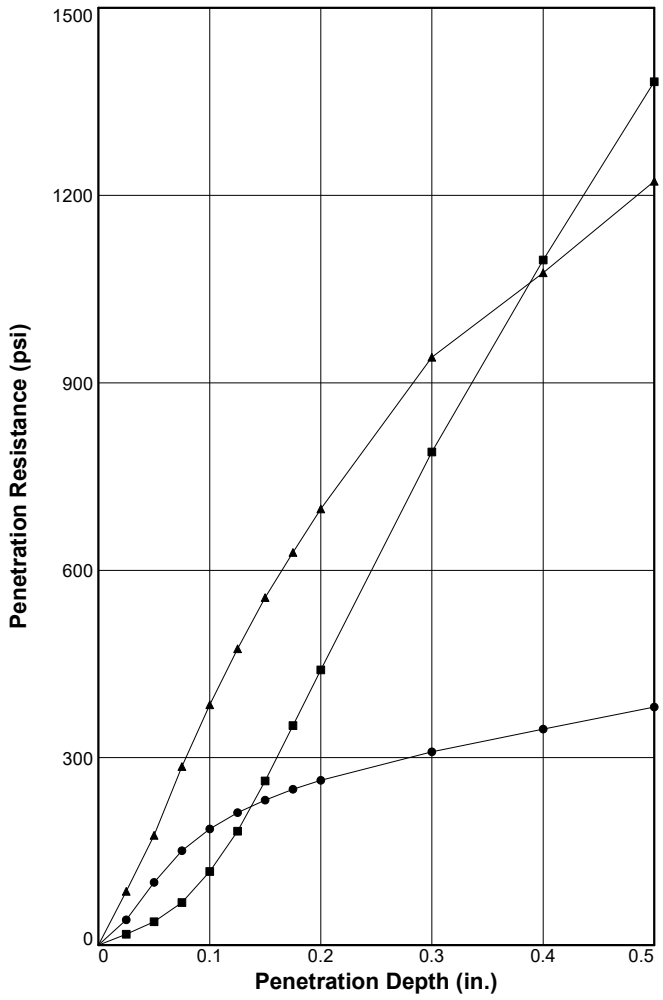
PENNONI ASSOCIATES INC.

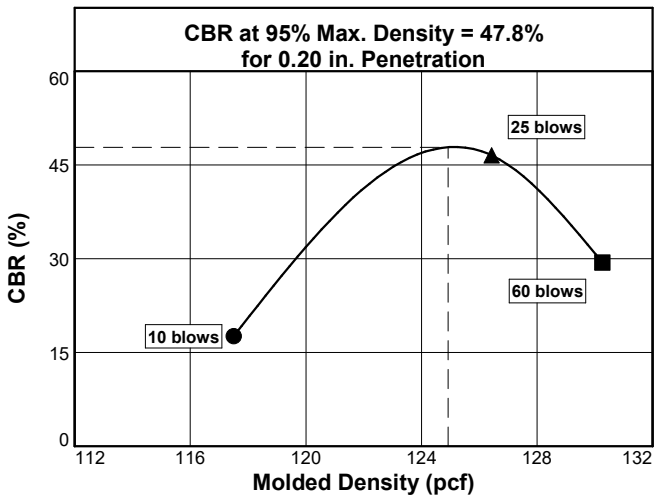
Figure CBR-3

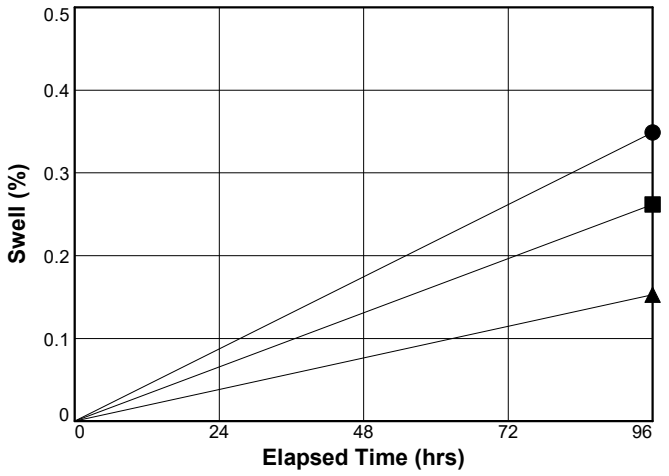
Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

BEARING RATIO TEST REPORT
ASTM D1883-14







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ●	117.5	89.4	8.8	117.1	89	12.2	18.6	17.6	0.000	10	0.3
2 ▲	126.4	96.1	9.2	126.2	96	10.2	38.5	46.5	0.000	10	0.2
3 ■	130.3	99.1	8.8	129.9	98.8	9.6	11.8	29.4	0.000	10	0.3

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
F/M/C Sand, Some Silt/Clay, Little F/C Gravel		131.5	8.9		

Project No: LDMSE-24001.01

Project: Appoquinimink School District Summit Ca

Source of Sample: TP-32 **Depth:** 2-3'

Sample Number: CBR-3

Date:

Test Description:

Remolded from Bulk Sample

BEARING RATIO TEST REPORT

PENNONI ASSOCIATES INC.

Figure CBR-3A

Checked By: JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

APPENDIX D – USDA Web Soil Survey Report

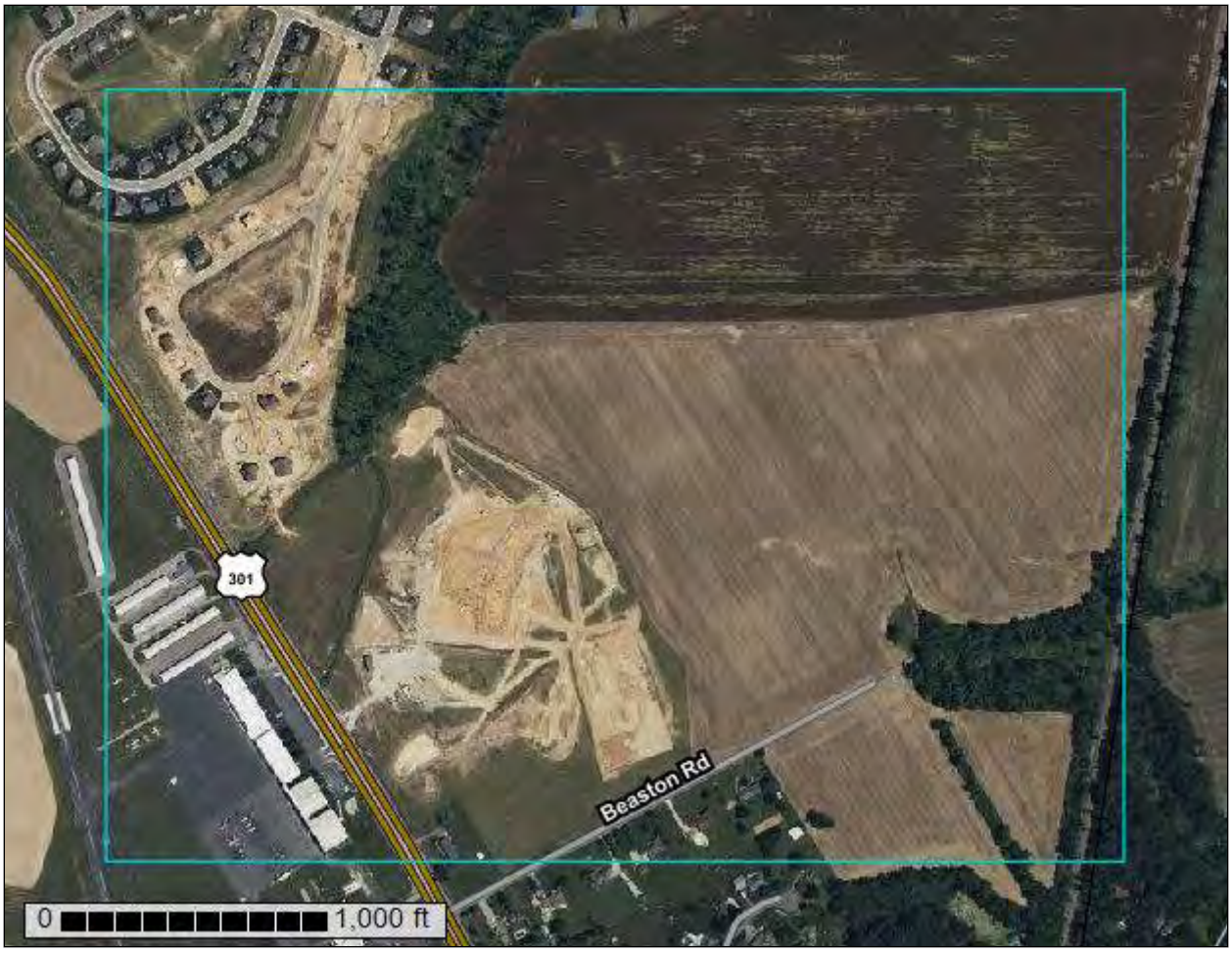
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for New Castle County, Delaware



June 20, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....8
Soil Map.....9
Legend.....10
Map Unit Legend.....11
Map Unit Descriptions.....11
New Castle County, Delaware.....14
LO—Longmarsh and Indiantown soils, frequently flooded.....14
MkA—Matapeake silt loam, 0 to 2 percent slopes.....16
OtcA—Othello silt loams, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain.....17
RdA—Reybold-Queponco complex, 0 to 2 percent slopes.....20
ReB—Reybold silt loam, 2 to 5 percent slopes.....22
ReC—Reybold silt loam, 5 to 10 percent slopes.....23
SacB—Sassafras sandy loam, 2 to 5 percent slopes, Mid-Atlantic Coastal Plain.....25
SacC—Sassafras sandy loam, 5 to 10 percent slopes, Mid-Atlantic Coastal Plain.....26
SaD—Sassafras sandy loam, 10 to 15 percent slopes.....28
WdcA—Woodstown sandy loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain.....29
WocA—Woodstown loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain.....31
References.....34

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:7,470 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: New Castle County, Delaware
Survey Area Data: Version 18, Sep 12, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 5, 2022—Jul 4, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
LO	Longmarsh and Indiantown soils, frequently flooded	3.7	1.4%
MkA	Matapeake silt loam, 0 to 2 percent slopes	2.2	0.8%
OtcA	Othello silt loams, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain	23.6	9.3%
RdA	Reybold-Queponco complex, 0 to 2 percent slopes	46.0	18.0%
ReB	Reybold silt loam, 2 to 5 percent slopes	122.4	48.0%
ReC	Reybold silt loam, 5 to 10 percent slopes	10.5	4.1%
SacB	Sassafras sandy loam, 2 to 5 percent slopes, Mid-Atlantic Coastal Plain	5.7	2.2%
SacC	Sassafras sandy loam, 5 to 10 percent slopes, Mid-Atlantic Coastal Plain	6.8	2.7%
SaD	Sassafras sandy loam, 10 to 15 percent slopes	4.8	1.9%
WdcA	Woodstown sandy loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain	1.9	0.7%
WocA	Woodstown loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain	27.5	10.8%
Totals for Area of Interest		**255.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made

up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

New Castle County, Delaware

LO—Longmarsh and Indiantown soils, frequently flooded

Map Unit Setting

National map unit symbol: 2p7dm
Elevation: 0 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Longmarsh and similar soils: 43 percent
Indiantown and similar soils: 37 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Longmarsh

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 19 inches: mucky loam
Cg1 - 19 to 34 inches: sandy loam
Cg2 - 34 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: R149AY060DE - Wet Alluvial Floodplain
Hydric soil rating: Yes

Description of Indiantown

Setting

Landform: Flood plains

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 25 inches: mucky silt loam
Cg - 25 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: R149AY060DE - Wet Alluvial Floodplain
Hydric soil rating: Yes

Minor Components

Zekiah

Percent of map unit: 10 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R149AY060DE - Wet Alluvial Floodplain
Hydric soil rating: Yes

Manahawkin

Percent of map unit: 5 percent
Landform: Flood plains, swamps
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153DY110NJ - Mucky Swamp
Hydric soil rating: Yes

Klej

Percent of map unit: 5 percent
Landform: Flats
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153DY150NJ - Moist Sandy Upland
Hydric soil rating: No

MkA—Matapeake silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2p7gt
Elevation: 10 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Matapeake and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Matapeake

Setting

Landform: Flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty eolian deposits over fluviomarine sediments

Typical profile

Ap - 0 to 5 inches: silt loam
E - 5 to 11 inches: silt loam
Bt - 11 to 34 inches: silt loam
2BC - 34 to 38 inches: sandy loam
2C - 38 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

Minor Components

Nassawango
Percent of map unit: 10 percent
Landform: Terraces, flats
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

Butlertown
Percent of map unit: 5 percent
Landform: Flats, broad interstream divides, interfluves
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Mattapex
Percent of map unit: 5 percent
Landform: Depressions, swales, flats
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

OtcA—Othello silt loams, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting
National map unit symbol: 2thwn
Elevation: 0 to 100 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 210 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Othello, drained, and similar soils: 48 percent
Othello, undrained, and similar soils: 28 percent
Minor components: 24 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Othello, Drained

Setting
Landform: Swales, depressions, flats

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Silty eolian deposits over fluviomarine deposits

Typical profile

Ap - 0 to 9 inches: silt loam
Btg - 9 to 29 inches: silt loam
2BCg - 29 to 34 inches: sandy loam
2Cg - 34 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 10 to 20 inches
Frequency of flooding: None
Frequency of ponding: Rare
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Description of Othello, Undrained

Setting

Landform: Drainageways, swales, depressions, flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Silty eolian deposits over fluviomarine deposits

Typical profile

Oe - 0 to 2 inches: peat
A - 2 to 4 inches: silt loam
Eg - 4 to 10 inches: silt loam
Btg - 10 to 29 inches: silt loam
2BCg - 29 to 35 inches: sandy loam
2Cg - 35 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: None

Frequency of ponding: Occasional
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Minor Components

Mattapex

Percent of map unit: 7 percent
Landform: Broad interstream divides, swales, depressions, flats
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Crosiadore

Percent of map unit: 7 percent
Landform: Depressions, fluviomarine terraces, flats
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Kentuck, undrained

Percent of map unit: 5 percent
Landform: Swales, depressions, flats
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Fallsington, undrained

Percent of map unit: 5 percent
Landform: Drainageways, swales, depressions, flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

RdA—Reybold-Queponco complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2p7g5
Elevation: 10 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 180 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Reybold and similar soils: 45 percent
Queponco and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reybold

Setting

Landform: Interfluves, flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: High silt loamy eolian deposits over fluviomarine deposits

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 30 inches: silt loam
2BC - 30 to 39 inches: gravelly coarse sandy loam
2C - 39 to 80 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Description of Queponco

Setting

Landform: Swales, flats
Down-slope shape: Concave, linear
Across-slope shape: Linear
Parent material: High silt loamy eolian deposits over fluviomarine deposits

Typical profile

Ap - 0 to 10 inches: silt loam
Bt1 - 10 to 17 inches: silt loam
2Bt2 - 17 to 31 inches: loam
2CB - 31 to 36 inches: sandy loam
2C - 36 to 80 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 40 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Unicorn

Percent of map unit: 10 percent
Landform: Swales, flats
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Matapeake

Percent of map unit: 5 percent
Landform: Rises
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

ReB—Reybold silt loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2p7g7
Elevation: 10 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 180 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Reybold and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reybold

Setting

Landform: Interfluves, flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: High silt loamy eolian deposits over fluviomarine deposits

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 30 inches: silt loam
2BC - 30 to 39 inches: gravelly coarse sandy loam
2C - 39 to 80 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Sassafras
Percent of map unit: 10 percent
Landform: Knolls, flats
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Unicorn
Percent of map unit: 5 percent
Landform: Swales, flats
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Queponco
Percent of map unit: 5 percent
Landform: Swales, flats
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Matapeake
Percent of map unit: 5 percent
Landform: Flats
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

ReC—Reybold silt loam, 5 to 10 percent slopes

Map Unit Setting
National map unit symbol: 2p7g8
Elevation: 10 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Reybold and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reybold

Setting
Landform: Interfluves, flats
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: High silt loamy eolian deposits over fluviomarine deposits

Typical profile
Ap - 0 to 10 inches: silt loam

Bt - 10 to 30 inches: silt loam
2BC - 30 to 39 inches: gravelly coarse sandy loam
2C - 39 to 80 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Sassafras

Percent of map unit: 10 percent
Landform: Knolls, flats
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Unicorn

Percent of map unit: 5 percent
Landform: Swales, flats
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Matapeake

Percent of map unit: 5 percent
Landform: Flats
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

Queponco

Percent of map unit: 5 percent
Landform: Swales, flats
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

SacB—Sassafras sandy loam, 2 to 5 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting

National map unit symbol: 2thxf
Elevation: 0 to 100 feet
Mean annual precipitation: 42 to 46 inches
Mean annual air temperature: 55 to 59 degrees F
Frost-free period: 210 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sassafras and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sassafras

Setting

Landform: Fluviomarine terraces, flats
Landform position (three-dimensional): Riser, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 12 inches: sandy loam
Bt1 - 12 to 18 inches: sandy loam
Bt2 - 18 to 28 inches: sandy clay loam
BC - 28 to 40 inches: loamy sand
C1 - 40 to 58 inches: sand
C2 - 58 to 80 inches: sand

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Ingleside

Percent of map unit: 10 percent
Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Downer

Percent of map unit: 5 percent
Landform: Flats, low hills, knolls
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve, rise
Down-slope shape: Linear, convex
Across-slope shape: Linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Woodstown

Percent of map unit: 5 percent
Landform: Flats, depressions, broad interstream divides, fluviomarine terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

SacC—Sassafras sandy loam, 5 to 10 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting

National map unit symbol: 2thxt
Elevation: 0 to 100 feet
Mean annual precipitation: 42 to 46 inches
Mean annual air temperature: 55 to 59 degrees F
Frost-free period: 210 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sassafras and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sassafras

Setting

Landform: Fluviomarine terraces, flats
Landform position (three-dimensional): Riser, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 9 inches: sandy loam
Bt1 - 9 to 18 inches: sandy loam
Bt2 - 18 to 28 inches: sandy clay loam
BC - 28 to 40 inches: loamy sand
C1 - 40 to 58 inches: sand
C2 - 58 to 80 inches: sand

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Ingleside

Percent of map unit: 10 percent
Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Downer

Percent of map unit: 5 percent
Landform: Flats, low hills, knolls
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve, rise
Down-slope shape: Linear, convex
Across-slope shape: Linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Woodstown

Percent of map unit: 5 percent
Landform: Flats, depressions, broad interstream divides, fluviomarine terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

SaD—Sassafras sandy loam, 10 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2p7fd
Elevation: 0 to 330 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Sassafras and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sassafras

Setting

Landform: Fluviomarine terraces, knolls, low hills, hillslopes
Landform position (three-dimensional): Riser, dip
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex

Typical profile

Ap - 0 to 9 inches: sandy loam
E - 9 to 15 inches: sandy loam
Bt - 15 to 30 inches: loam
BC - 30 to 37 inches: sandy loam
C - 37 to 80 inches: loamy sand

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Downer

Percent of map unit: 10 percent
Landform: Fluviomarine terraces, knolls, flats
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Evesboro

Percent of map unit: 5 percent
Landform: Flats, dunes, fluviomarine terraces, knolls
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Ecological site: F153DY170NJ - Sandy, Excessively Drained Upland
Hydric soil rating: No

Ingleside

Percent of map unit: 5 percent
Landform: Depressions, flats, fluviomarine terraces
Landform position (three-dimensional): Talf
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Zekiah

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R149AY060DE - Wet Alluvial Floodplain
Hydric soil rating: Yes

WdcA—Woodstown sandy loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting

National map unit symbol: 2thvt
Elevation: 0 to 90 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Woodstown and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodstown

Setting

Landform: Flats, broad interstream divides, depressions, fluviomarine terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 7 inches: sandy loam
E - 7 to 11 inches: sandy loam
Bt - 11 to 29 inches: sandy loam
BCg - 29 to 45 inches: fine sandy loam
Cg - 45 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

Minor Components

Hammonton

Percent of map unit: 6 percent
Landform: Broad interstream divides, flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

Fallsington

Percent of map unit: 6 percent

Landform: Flats, swales, depressions, drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Mattapex

Percent of map unit: 4 percent
Landform: Broad interstream divides, swales, depressions, flats
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Hambrook

Percent of map unit: 4 percent
Landform: Flats, fluviomarine terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

WocA—Woodstown loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting

National map unit symbol: 2thx4
Elevation: 0 to 90 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 55 to 59 degrees F
Frost-free period: 210 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodstown and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodstown

Setting

Landform: Flats, broad interstream divides, depressions, fluviomarine terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread, talf, dip

Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 7 inches: loam
E - 7 to 11 inches: sandy loam
Bt - 11 to 29 inches: sandy loam
BCg - 29 to 45 inches: fine sandy loam
Cg - 45 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

Minor Components

Fallsington

Percent of map unit: 6 percent
Landform: Swales, depressions, flats, drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Hammonton

Percent of map unit: 6 percent
Landform: Broad interstream divides, flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

Mattapex

Percent of map unit: 4 percent
Landform: Depressions, flats, broad interstream divides, swales
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Dip, talf

Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Hambrook

Percent of map unit: 4 percent
Landform: Flats, fluviomarine terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

APPENDIX E – Important Information About This Geotechnical Engineering Report

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

Copyright 2015 by Geoprofessional Business Association (GBA). Duplication, reproduction, or copying of this document, or its contents, in whole or in part, by any means whatsoever, is strictly prohibited, except with GBA's specific written permission. Excerpting, quoting, or otherwise extracting wording from this document is permitted only with the express written permission of GBA, and only for purposes of scholarly research or book review. Only members of GBA may use this document as a complement to or as an element of a geotechnical-engineering report. Any other firm, individual, or other entity that so uses this document without being a GBA member could be commiting negligent or intentional (fraudulent) misrepresentation.

February 20, 2025

LDMSE24001

Landmark Science & Engineering
Attn: Ted C. Williams, PE, FACEC, President
200 Continental Drive, Suite 400
Newark, Delaware 19713

RE: Geotechnical Engineering Services – Addendum 1
Appoquinimink School District Summit Campus – Infiltration Testing Summary
Middletown, Delaware

Dear Mr. Williams:

We are pleased to submit our infiltration testing summary addendum for the proposed Appoquinimink School District Summit Campus stormwater management facilities located in Middletown, DE. Work was initiated in general accordance with the scope of work presented in our addendum dated January 10, 2025, and your subsequent notice to proceed on January 13, 2025.

The following information was utilized to develop this addendum:

- A report titled, "Geotechnical Engineering Services – Appoquinimink School District Summit Campus – Phases B to F," prepared by Pennoni Associates, Inc., dated, July 25, 2024;
- A report titled, "Geotechnical Engineering Services – Appoquinimink School District Summit Campus – Infiltration Testing Summary," prepared by Pennoni Associates, Inc., dated July 5, 2024;
- A Drawing No. CR-01 titled "Appoquinimink Summit Campus – St. Georges Hundred – New Castle County – Delaware," prepared by Landmark Science & Engineering, dated April 21, 2021; and
- An undated Drawing titled "Boring Exhibit for Summit Campus – Phase 2," prepared by Landmark Science & Engineering.

BACKGROUND

The project consists of the construction of Phases B through F of the Appoquinimink School Districts (ASD) Summit Campus located in Middletown, Delaware, as shown on the attached Site Location Sketch, SL-1. We understand that construction consists of an approximate two story, 385,473 square feet (SF) middle and high school, 10,800 SF one story field house, athletic fields, stormwater management (SWM) subsurface basins (Storm Tech Chambers) located in the proposed parking areas, and parking areas surrounding the proposed buildings. We understand that the site civil design has advanced since the issuance of the above referenced geotechnical engineering services reports and that additional field exploration was requested for the proposed SWM design.

We understand that the proposed inverts of the above mentioned SWM facilities will be a maximum of 5 feet below existing grade. The site appears to consist of the existing construction site from Phase A of the project as well as an apparent agricultural field. The site is bound by residential properties to the north and south, agricultural field to the east, and Route 896 to the west. Based on the provided topography the project site generally slopes downward from northwest to southeast with elevations ranging from approximately 66 to 55 feet (NAVD88).

ADDITIONAL FIELD EXPLORATION

Standard Penetration Test (SPT) Borings

Pennoni performed 19 additional Standard Penetration Test (SPT, ASTM D1586) borings between January 23 and January 25, 2025, labeled "B-26" through "B-44." The borings were advanced to depths of approximately 20 feet below the ground surface and generally performed throughout the site to identify potential areas for soil mining as well as

document groundwater levels. Continuous sampling was performed to a depth of approximately 10 feet below the existing ground surface and then in 5-foot intervals until the termination depth was reached. Borings "B-1" through "B-25," are summarized in the above referenced Geotechnical Engineering Services Report.

At the conclusion of the drilling, the test borings were backfilled with a mixture of bentonite grout and the excavated soil cuttings. Excess soils were mounded over boreholes located within the grass covered areas. Test borings were performed by CGC Geoservices using track-mounted auger rigs with 3¼ inch hollow stem augers and an automatic hammer. Our T. Thomson, PE directed the field work our A. Spencer, PE and N. Fisher, observed the test drilling. The test boring locations are depicted on the Additional Testing Location Sketch, SK-1 and SK-2, attached below. Test boring logs are also attached below.

Test Pits / Infiltration Testing

Pennoni performed 20 test pits labeled "TP-41" through "TP-60" between January 29 to February 4, 2025. The test pits were performed by CGC Geoservices using a mini excavator at the approximate locations selected by Landmark Engineering and depicted on the attached Additional Testing Location Sketches. Test pits "TP-1" through "TP-40," are summarized in the above referenced Geotechnical Engineering Services Report. The test locations were established in the field by Pennoni personnel. The test pits were performed to a minimum of three feet below the proposed SWM facilities invert elevations to estimate the soil horizons and to determine if restricting layers such as groundwater table (GWT), seasonal high-water table (SHWT), and or/ hardpan were present. Proposed inverts for the SWM facilities were assumed to be a maximum of 5 feet below the existing ground surface; therefore, the test pit excavations were performed to a minimum of 8 feet below the existing ground surface in general accordance with the Delaware Administrative Code Tile 7, Section 5101, Sub-Section 12.0. Test pit logs are attached below.

Concurrently with test pits "TP-41" through "TP-60," an adjacent pit was excavated to the proposed invert elevations for infiltration testing. Locations for the single ring infiltration test were established a maximum of 5 feet away from their corresponding Test Pits "TP-41" through "TP-60." Twenty single ring infiltration tests labeled "INF-41" through "INF-60" were performed by Pennoni personnel. Soil grab samples were collected at the invert elevation of each infiltration test for subsequent laboratory testing. Infiltration operations were directed by our A. Spencer, PE, and observed by our B. Gordon, EIT. Infiltration test locations are depicted on the Additional Testing Location Sketch, SK-1 and SK-2, and are attached below.

The infiltration testing was performed in general accordance with the testing as described in the Delaware Administrative Code Tile 7, Section 5101, Sub-Section 12.0. Following a one-hour pre-soak or a drop of 12 inches, two consistent test periods consisting of 15-minute maximum time intervals and meeting one of the following was performed:

- A minimum of one hour;
- A drop of at least 12 inches in 15 minutes or less for a minimum of two time intervals;
- A difference of 0.25 inches or less of drop between the highest and lowest reading of four (4) consecutive time intervals for infiltration rates greater than two (2.0) inches per hour; or
- A difference of 0.125 inches or less of drop between the highest and lowest reading of four (4) consecutive readings for infiltration rates equal to or less than two (2.0) inches per hour.

Site conditions at the time of the infiltration testing on January 29, 2025, through January 30, 2025, were cloudy to sunny with temperatures ranging from 35 to 50 degrees Fahrenheit. Ground conditions on these days generally observed frozen soil with depths ranging from 4 to 12 inches from the ground surface. Testing summarized above was performed 5 feet below ground surface and testing strata was not frozen with temperatures above freezing. Site conditions at the time of the infiltration testing on February 3, 2025, through February 4, 2025, were overcast to sunny with temperatures ranging from 34 to 50 degrees Fahrenheit. Infiltration testing was not performed on January 31, 2025, due to rainfall. No rainfall greater than one-half inch occurred in the general site area in the 24 hours prior to infiltration testing.

According to ASTM D-3385-18 (Standard Test Method for Infiltration Rate of Soils in Field using Double-Ring Infiltrometer), Section 6.11, Note 5, it states "To obtain maximum infiltration rates, the liquid should be free from suspended solids and the temperature of the liquid should be higher than the soil temperature." Due to cold weather and frozen conditions being present on-site during infiltration testing, ground and water temperatures were taken at each measurement to verify that water temperatures were higher than the soil temperatures. On each measurement taken, the water temperature was generally higher than the ground temperature at all points of testing, which is in general accordance with the ASTM standard to obtain maximum field infiltration rates.

ADDITIONAL LABORATORY TESTING

Following the conclusion of the SPT drilling, test pit excavations, and infiltration testing, the soil samples were delivered to our laboratory for testing. The additional geotechnical laboratory program consisted of the following:

- Moisture Content (ASTM D 2216) 39 tests
- Sieve Analysis (w/out hydrometer, ASTM D 6913) 39 tests
- Atterberg Limits (ASTM D 4318) 6 tests

Samples for testing were selected by Pennoni's geotechnical engineer. Results of the laboratory testing are attached with this report.

GEOLOGY

According to the Physiographic Province of Delaware created by USGS, the project site is located within the Coastal Plain. The Coastal Plain is characterized by gently rolling hills and valleys. It is underlain by a southeastwardly thickening sequence of sediments that consists of sand and gravel aquifers interlayered with silt and clay confining units.

According to the Geologic Map (GM13) of New Castle County (Ramsey, K.W., 2005) the project site is located within the Columbia Formation. The Columbia Formation is described as yellow to red to brown, fine to coarse, feldspathic quartz sand with varying amounts of gravel. Typically, cross-bedded with cross-sets ranging from a few inches to over three feet in thickness. Scattered beds of tan to red to gray clayey silt is common. In places, the upper 5 to 25 feet consists of a gray to red to brown silt to very fine sand overlying medium to coarse sand. Near base of unit, clasts of cobbles to small boulders are found in gravel beds ranging from a few inches to three feet thick. Gravel fraction consists primarily of quartz with lesser amounts of chert. Clasts of sandstone, siltstone, and shale from the Valley and Ridge Province, and pegmatite, micaceous schist, and amphibolite from the Piedmont are present. The Columbia fills an eroded surface and ranges from less than 10 feet thick to over 100 feet thick.

According to USDA Web Soil Survey mapping, the project site consists of mainly Reybold silt loam (ReB), Reybold-Queponco Complex (RdA), Woodstown loam (WocA), and Sassafras sandy loam (SacC). Reybold silt loam is generally described as silt loam underlain by gravelly coarse sandy loam with linear down slope shape. Reybold silt loam is classified as hydrologic soil group B with moderately high to high infiltration rates of approximately 0.20 to 2.00 inches per hour. The depth to water table and restrictive features both exceed 80 inches. Reybold-Queponco Complex is generally described as silt loam underlain by gravelly coarse sandy loam with linear down slope shapes. Reybold-Queponco Complex is classified as hydrologic soil group B with moderately high to high infiltration rates of approximately 0.20 to 2.00 inches per hour. The depth to water table and restrictive features both exceed 80 inches. Woodstown loam is generally described as loam to sandy loam to fine sandy loam underlain by loamy sand with linear to concave down slope shapes. Woodstown sandy loam is classified as hydrologic soil group C with moderately high to high infiltration rates of approximately 0.57 to 1.98 inches per hour. Depth to water table is noted as 20 to 40 inches with depth to restrictive feature exceeding 80 inches. Sassafras sandy loam is generally described as sandy loam to sandy clay loam to loamy sand underlain by sand with linear down slope shape. Sassafras sandy loam is classified as hydrologic soil group B with moderately high to high infiltration rates of approximately 0.20 to 2.00 inches per hour. The depth to water table and restrictive features both exceed 80 inches. Approximate ground surface elevation was not provided in the mapping report prepared by the USDA. The USDA Web Soil Survey Report is attached.

SUBSURFACE STRATIGRAPHY

Subsurface stratigraphy encountered by the supplemental test borings and test pits generally consisted of a surficial layer of topsoil approximately 3 to 12 inches thick. This surficial layer of topsoil is generally underlain by either a silty clay with trace to some fine to medium sand and trace fine to coarse gravel (Stratum A) or a fine to medium sand with trace to and silt/clay and trace fine to coarse gravel (Stratum B). Stratum A was observed in 15 of the test pits beneath the topsoil and consisted of clay/silt with trace to little fine to medium sand, trace fine to coarse gravel. Stratum B was only observed in 5 of the test pits beneath the topsoil and consisted of fine to medium sand with little to some silt/clay. Underlying Strata A and B was a fine to medium to coarse sand with little to and fine to coarse gravel with trace to little silt and trace to little cobbles or a fine to coarse gravel with little to and fine to medium to coarse sand and trace to little silt and trace to little cobbles (Stratum C). Following Stratum C was a fine to medium to coarse sand with trace to little silt, and trace fine to coarse gravel (Stratum D). For descriptive purposes the soil layers can be classified as follows:

Stratum	Approximate Thickness (ft)	Description	USCS Classification
T	0.25 -1.0	Topsoil	--
A [1]	1.0 – 3.0	Orange to gray to tan SILT, trace to little fine sand (firm to stiff, moist) OR Orange to brown to gray CLAY, trace to some fine to medium sand, trace fine to coarse gravel (firm to very stiff, moist)	ML CL CL-ML
B [2]	1.0 – 8.5 +	Gray to orange to tan to brown to black to red fine to medium to coarse SAND, trace to and clay/silt, trace to some fine to coarse gravel (very loose to dense, damp to wet)	SP-SM to SM/ SC
C [3]	0.5 – 2.5 +	Brown to tan to orange fine to coarse GRAVEL, little to and fine to medium to coarse SAND, trace to little silt (medium dense to dense, damp to wet) OR Brown to orange to tan to black to gray fine to medium to coarse SAND, little to and fine to coarse gravel, trace to little silt (medium dense to dense, moist to wet)	GP-GM SP-SM to SM
D [4]	0.5 – 5.5 +	Tan to orange to brown to gray fine to medium to coarse SAND, trace to little silt, trace fine to coarse gravel (very loose to very dense, damp to wet)	SP-SM to SM

Notes:
[1] Stratum A was encountered in every test pit except for test pits “TP-41,” “TP-46,” and “TP-47”;
[2] Stratum B was not fully penetrated in test pits “TP-41” through “TP-45,” and test pits “TP-52” to “TP-55”;
[3] Stratum C was not encountered in test pits “TP-41” though “TP-45” and test pits “TP-52” to “TP-55” and was not fully penetrated in test pits “TP-46,” “TP-47,” and “TP-48”; and
[4] Stratum D was not fully penetrated where encountered. Stratum D was not encountered in “TP-41” through “TP-48” and “TP-52” through “TP-55.”

See attached Subsurface Stratigraphy Cross Sections (CS-1 through CS-4) across the site where the additional infiltration testing was performed. Location of cross sections are shown on the attached Additional Testing Location Sketch, SK-1 and SK-2.

Groundwater Observations

Groundwater observations were made in each boring and test pit during sampling and shortly after completion of drilling/excavation. Groundwater was encountered at the project site in Borings “B-26” through “B-44” at depths ranging from 13.0 to 18.0 feet (Elev. 40.5 to 53.0 feet, NAVD88) below the existing ground surface. Groundwater was not encountered in any of the test pits with depths ranging from 8.0 to 10.0 feet (Elev. 49.3 to 59.9 feet, NAVD88) below the existing ground surface. Groundwater was not encountered in any of the infiltration pits at depths approximately 5.0 feet (Elev. 54.3 to 62.9 feet, NAVD88) below the existing ground surface.

Groundwater depths noted above were measured through the augers shortly after the completion of the test borings and may not be indicative of actual groundwater table elevations. Groundwater observations are for the times indicated and may not be indicative of seasonal or daily variations in the groundwater levels. Seasonal variations on the order of several feet should be anticipated.

Groundwater observations were made in each boring and test pit from the previous site exploration summarized in the above referenced Geotechnical Engineering Services Report. Groundwater was encountered in every test boring performed at depths ranging from 10.2 to 18.0 feet below ground surface (Elev. 45.8 to 52.3 ft, NAVD88). Groundwater was encountered in test pits "TP-1," "TP-2," "TP-6," "TP-15" through "TP-18," and "TP-20" to "TP-36" at depths ranging from approximately 3.0 to 10.0 feet below the ground surface (Elev. 50.4 to 56.9 feet NAVD88).

According to the interactive Delaware Geologic Information Resource map, anticipated groundwater depths are anticipated to range from approximately 10 to 20 feet (elevations 52.96 to 41.94 feet, NAVD88) below the existing ground surface (relative to NAVD88) during dry to wet conditions, respectively.

INFILTRATION TEST RESULTS

The following table represents a summary of the field results for the twenty single-ring infiltration tests conducted at depths approximately 5 feet below the existing ground surface with approximate elevations ranging from 54.34 feet to 62.92 feet (NAVD88). Individual infiltration testing logs and infiltration rate graphs are attached.

Infiltration Test	Corresponding Test Pit	Date Tested	Testing Stratum	Testing Depth /Elevation (NAVD88)	Field Infiltration Rate (in/hr)	Design Infiltration Rate (in/hr)[1]
INF-41	TP-41	1/29/2025	B	5.0 / 60.60	11.0	5.5
INF-42	TP-42	1/29/2025	A	5.0 / 62.40	0.0	0.0
INF-43	TP-43	1/29/2025	B	5.0 / 62.92	12.0	6.0
INF-44	TP-44	1/29/2025	B	5.0 / 60.77	4.0	2.0
INF-45	TP-45	1/29/2025	B	5.0 / 61.79	0.0	0.0
INF-46	TP-46	1/30/2025	B	5.0 / 56.72	2.0	1.0
INF-47	TP-47	1/30/2025	B	5.0 / 55.81	6.0	3.0
INF-48	TP-48	1/30/2025	B	5.0 / 56.29	5.0	2.5
INF-49	TP-49	1/30/2025	C	5.0 / 55.08	20+	10.0
INF-50	TP-50	1/30/2025	C	5.0 / 55.44	20+	10.0
INF-51	TP-51	2/3/2025	B	5.0 / 54.34	8.0	4.0
INF-52	TP-52	2/3/2025	B	5.0 / 54.42	14.0	7.0
INF-53	TP-53	2/3/2025	B	5.0 / 60.00	13.0	6.5
INF-54	TP-54	2/3/2025	B	5.0 / 59.65	11.0	5.5
INF-55	TP-55	2/3/2025	B	5.0 / 60.85	7.0	3.5
INF-56	TP-56	2/4/2025	B	5.0 / 57.68	10.0	5.0
INF-57	TP-57	2/4/2025	B	5.0 / 57.31	19.5	9.75
INF-58	TP-58	2/4/2025	B	5.0 / 58.21	12.5	6.25
INF-59	TP-59	2/4/2025	B	5.0 / 57.60	20+	10.0
INF-60	TP-60	2/4/2025	B	5.0 / 57.19	10.0	5.0

[1] Design infiltration rate includes a factor of safety of 2.0 in accordance with Delaware Administrative Code Title 7, Section 5101, Sub-Section 12.0

Field infiltration rates were observed ranging from approximately 0.0 to 20.0+ inches per hour within the site. Specifically, field infiltration rates of 0.0 inches per hour were observed within Stratum A, or within a transition stage of Stratum A to Stratum B. Field infiltration rates within Stratum B were observed to range from approximately 2.0 to 19.5 inches per hour. Within Stratum C, infiltration rates were observed to be approximately 20.0+ inches per hour. Design infiltration rates for single ring infiltration testing require a minimum factor of safety of 2 applied to the field infiltration rates per the Delaware Administrative Code Title 7, Section 5101, Sub-Section 12.0.

ANALYSIS & RECOMMENDATIONS

A completed DNREC Soil Investigation Report Submittal Checklist is attached. Based on the results of the field exploration, laboratory analysis, and review of published data we offer the following recommendations:

Groundwater Table

Observations for groundwater were performed in all test borings and test pits. Apparent groundwater was encountered in all of the test borings at depths ranging from 13.0 to 18.0 feet (Elev. 40.5 to 53.0 feet, NAVD88). Apparent groundwater was not encountered in any of the test pit excavations to a maximum depth of 10 feet below existing grade.

Observations for groundwater were performed in the previous site exploration programs as summarized in the above referenced Geotechnical Engineering Services Reports. Apparent groundwater was encountered in all of the previous test borings at depths ranging from 10.2 to 18.0 feet (Elev. 45.8 to 52.3 ft, NAVD88) below ground surface. Apparent groundwater was encountered in approximately 24 of the previous test pits at depths ranging from 3.0 to 10.0 feet (Elev. 50.4 to 56.9 feet, NAVD88) below ground surface.

Groundwater, where encountered during this exploration, was generally in agreement with those mapped by the Delaware Geologic Survey. These observations are for the times indicated and may not be indicative of seasonal or daily variations in the ground water levels. Seasonal variations on the order of several feet should be anticipated.

Feasibility of Proposed Facilities

The field infiltration rates observed within Stratum A (Clay) were observed to be 0.0 inches per hour. The field infiltration rates varied across the site due to the varying amounts of fine-grained materials within Stratum B and were observed to range from approximately 2.0 to 20 inches per hour. Within Stratum C (gravel) field infiltration rates were observed to be approximately 20.0+ inches per hour. The field infiltration rates observed within Strata B and C were generally higher than the rates reported for the Reybold Silt loam (0.2 to 2.0 inches per hour), as the material within these areas of testing generally appear more granular than the mapped soils.

According to Subsection 11.1.3.3 of the Delaware Sediment and Stormwater Regulations for native soils to meet infiltration feasibility criteria they must have a minimum field infiltration rate of 1 inch per hour. In general, the observed field infiltration rates indicate that the site is conducive to infiltration within Strata B and C soils. Strata B and C soils were observed between elevations 54.34 to 62.92 feet (NAVD88), and 55.08 to 55.44 feet, (NAVD88), respectively. However, within Stratum B field infiltration rates less than 1 inch per hour were observed in infiltration test “INF-45,” and suggest that this area is not conducive to infiltration. Field infiltration rates observed within stratum A soils indicate that it is not conducive to infiltration.

See attached Subsurface Stratigraphy Cross Sections (CS-1 through CS-4) across the site where the additional infiltration testing was performed depicting the varying elevations of the above-mentioned strata.

Below Grade SWM StormTech Chambers

We understand that the proposed stormwater management (SWM) facilities will consist of subsurface basins (StormTech Chambers) located in the proposed parking areas. We recommend that the StormTech vaults and stone subbase bearing on medium dense, strata B/C/D sand to gravel, or newly placed structural fill can be

designed using a maximum net allowable bearing capacity of 3,000 psf. Based on this maximum net allowable bearing capacity, the subsurface conditions encountered, and the proposed grading, we estimate total settlement on the order of 1 inch with differential settlement estimated on the order of less than 0.5 inch.

Foundation shall be constructed in accordance with the recommendations provided in the Earthwork section below. Refer to the above referenced Geotechnical Engineering Services Report for recommendations regarding foundations.

Earthwork

Prior to placing any new fill, and before the construction of the proposed stormwater management (SWM) facilities, construction debris, vegetation, and associated topsoil must be removed from the proposed construction areas. These materials can remain in proposed landscaped areas provided that future plans do not include building in those areas. SWM facilities shall be designed and constructed in accordance with the Delaware Sediment and Stormwater Regulations.

Our experience indicates that the on-site soils of Strata A, B, C, and D can be reused for the construction, provided all organics and debris larger than 3 inches in its greatest dimension be removed prior to reuse. Strata A and B soils were observed to contain a significant amount of fine-grained material (silts/clays). These types of soils are sensitive to moisture and may therefore require wetting or drying prior to compaction. Drying "wet" soil is difficult during wet periods and during lower temperatures. Therefore, provisions for importing structural fill should be included in the contract documents. If necessary, granular fill should consist of well-graded material with a maximum particle size less than 3 inches, not more than 20 percent passing the No. 200 sieve and have plasticity index (PI) not greater than 8 percent.

Fills should be placed in layers not exceeding 10 to 12 inches loose measure. This criterion might be adjusted by the geotechnical engineer in the field depending on the conditions present at the time of construction, on the compaction equipment used, and on the fill materials selected. Compaction of fill material and subgrade will be highly dependent on whether the area will be utilized for infiltration. Where infiltration is being utilized, excessive compaction of the subgrade and fill is discouraged as this will tend to lower the infiltration rate. Specific guidance can be provided once the final design has been determined. Fills should extend and have side slopes not steeper than 2 horizontal to 1 vertical. Otherwise, settlement of the fill may occur.

Ground and Surface Water Management

The groundwater observations made in the test pits suggest that free standing water is not anticipated in excavations for the proposed SWM facilities. If wet conditions and/or seepage are encountered due to perched water, sumps and pumps should be adequate to maintain stable conditions during construction. During construction, surface runoff should be prevented from entering the basin excavations by creating soil berms or diversion swales along the perimeter if the excavations are expected to be open for a long period of time. Where ponding does occur, the water should be pumped immediately, and grades should then be established to prevent further ponding.

LIMITATIONS

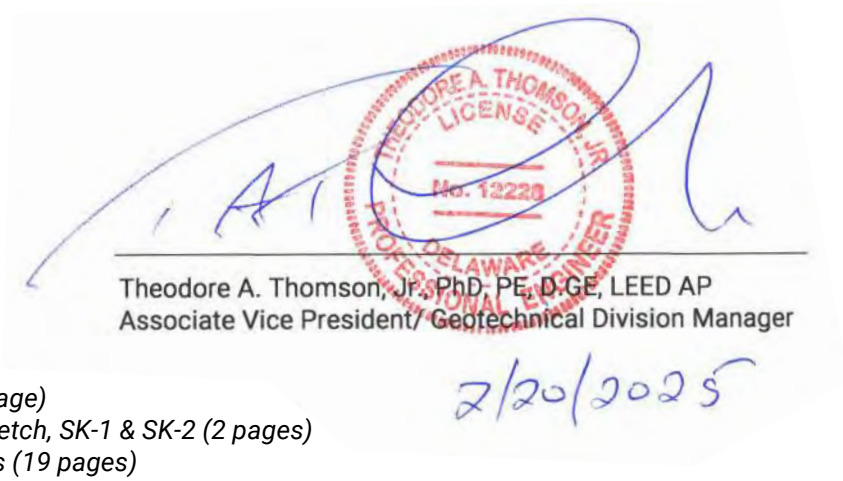
This work has been done in accordance with our authorized scope of work and in accordance with generally accepted professional practice in the fields of geotechnical and foundation engineering **and is considered a supplement to our July 5, 2024, Geotechnical Services Infiltration Summary Report. Conclusions and recommendations presented in that report are valid herein.** This warranty is in lieu of all other warranties either expressed or implied. Our conclusions and recommendations are based on the data revealed by this exploration. We are not responsible for any conclusions or opinions drawn from the data included herein, other than those specifically stated, nor are the recommendations presented in this report intended for direct use as construction specifications. This report is intended for use with regard to the specific project described herein; any changes in loads, structures, or locations should be brought to our attention so that we may determine how they may affect our conclusions. An attempt has been made to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction. If this

should occur, or if additional or contradictory data are revealed in the future, we should be notified so that modifications to this report can be made, if necessary. If we do not review relevant construction documents and witness the relevant construction operations, then we cannot be responsible for any problems that may result from misinterpretation or misunderstanding of this report or failure to comply with our recommendations.

We trust that the information presented in this report is what you require at this time and we thank you for the opportunity to assist you with this project. If you have any questions, or if you need any further assistance with this project, please contact this office at your earliest convenience.

Sincerely,
PENNONI ASSOCIATES INC.

Austin R. Spencer, PE
Staff Geotechnical Engineer II



Theodore A. Thomson, Jr., PhD, PE, D.GE, LEED AP
Associate Vice President/ Geotechnical Division Manager

2/20/2025

Attachments:
Site Location Sketch, SL-1 (1 page)
Additional Testing Location Sketch, SK-1 & SK-2 (2 pages)
Supplemental Test Boring Logs (19 pages)
Supplemental Test Pit Logs (20 pages)
Supplemental Single Ring Infiltration Data Graphs (20 pages)
Subsurface Stratigraphy Cross Sections (4 pages)
Supplemental Laboratory Results (14 pages)
Soil Investigation Report Submittal Checklist (7 pages)
USDA Web Soil Survey Report (35 pages)

Location Sketches

SITE LOCATION SKETCH



Site Location Sketch adapted from a Google Earth Image Dated April 12, 2023

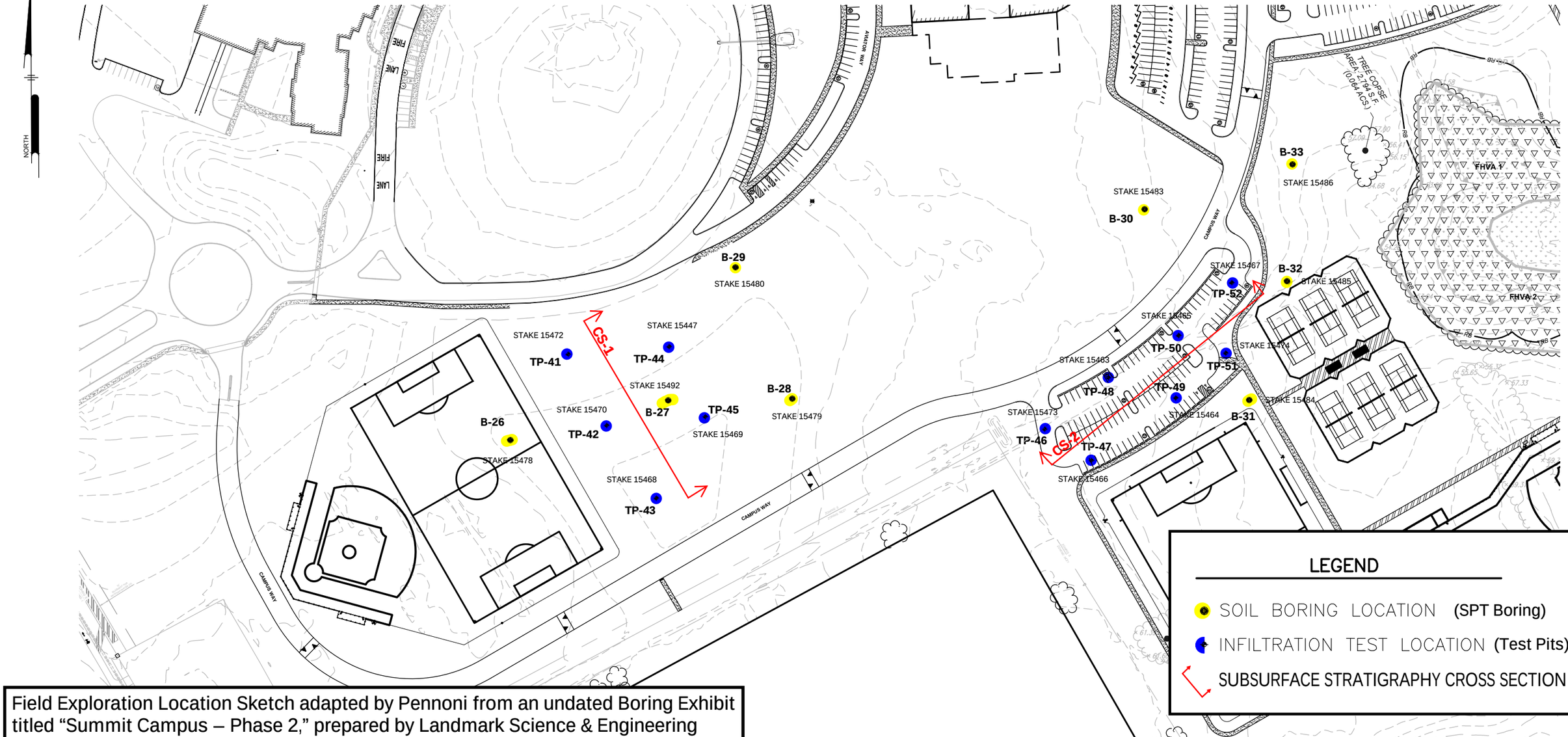
Pennoni Associates, Inc.
121 Continental Drive, Suite 207
Newark, DE 19713

ALL DOCUMENTS PREPARED BY PENNONI ASSOCIATES ARE INSTRUMENTS OF SERVICE IN RESPECT OF THE PROJECT. THEY ARE NOT INTENDED OR REPRESENTED TO BE SUITABLE FOR REUSE BY OWNER OR OTHERS ON EXTENSIONS OF THE PROJECT OR ON ANY OTHER PROJECT. ANY REUSE WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY PENNONI ASSOCIATES FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT OWNERS SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO PENNONI ASSOCIATES; AND OWNER SHALL INDEMNIFY AND HOLD HARMLESS PENNONI ASSOCIATES FROM ALL CLAIMS, DAMAGES, LOSSES, AND EXPENSES ARISING OUT OF OR RESULTING THEREFROM.

DRAWN BY:	SCALE:	DATE:
NPF	AS SHOWN	2/20/2025
CHECKED BY: TAT	FIGURE No. SL-1	
PROJECT No: LDMSE24001		

ASD Summit Campus - Middletown, Delaware

ADDITIONAL TESTING LOCATION SKETCH



Field Exploration Location Sketch adapted by Pennoni from an undated Boring Exhibit titled “Summit Campus – Phase 2,” prepared by Landmark Science & Engineering

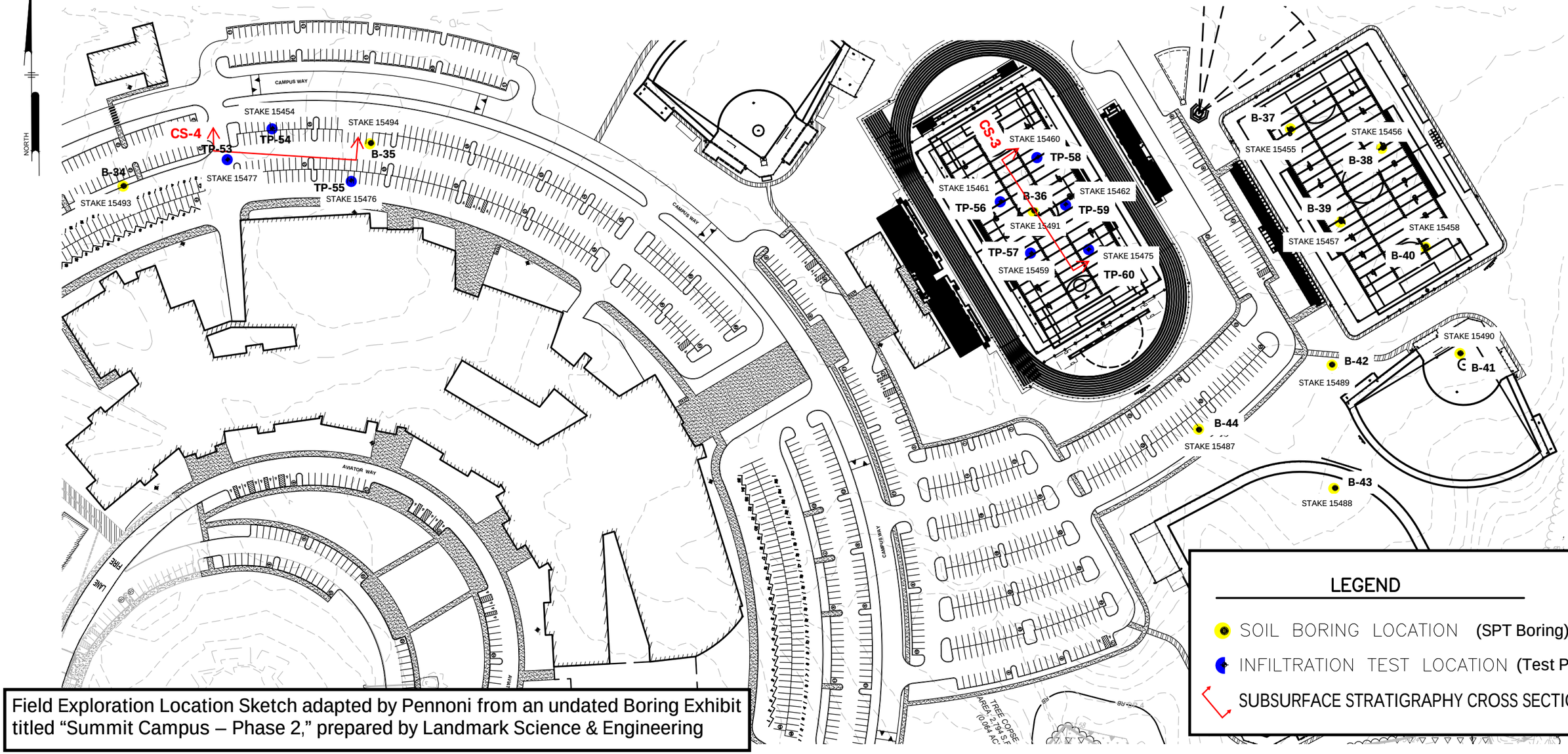
Pennoni Associates, Inc.
121 Continental Drive, Suite 207
Newark, DE 19713

ALL DOCUMENTS PREPARED BY PENNONI ASSOCIATES ARE INSTRUMENTS OF SERVICE IN RESPECT OF THE PROJECT. THEY ARE NOT INTENDED OR REPRESENTED TO BE SUITABLE FOR REUSE BY OWNER OR OTHERS ON EXTENSIONS OF THE PROJECT OR ON ANY OTHER PROJECT. ANY REUSE WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY PENNONI ASSOCIATES FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT OWNERS SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO PENNONI ASSOCIATES; AND OWNER SHALL INDEMNIFY AND HOLD HARMLESS PENNONI ASSOCIATES FROM ALL CLAIMS, DAMAGES, LOSSES, AND EXPENSES ARISING OUT OF OR RESULTING THEREFROM.

DRAWN BY:	SCALE:	DATE:
ARS	NTS	2/20/2025
CHECKED BY:	FIGURE No.	
TAT	SK-1	
PROJECT No:		
LDMSE24001		

Appoquinimink School District Summit Campus - Phases B to F - Addendum 1

ADDITIONAL TESTING LOCATION SKETCH



Field Exploration Location Sketch adapted by Pennoni from an undated Boring Exhibit titled "Summit Campus – Phase 2," prepared by Landmark Science & Engineering

Pennoni

Pennoni Associates, Inc.
121 Continental Drive, Suite 207
Newark, DE 19713

ALL DOCUMENTS PREPARED BY PENNONI ASSOCIATES ARE INSTRUMENTS OF SERVICE IN RESPECT OF THE PROJECT. THEY ARE NOT INTENDED OR REPRESENTED TO BE SUITABLE FOR REUSE BY OWNER OR OTHERS ON EXTENSIONS OF THE PROJECT OR ON ANY OTHER PROJECT. ANY REUSE WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY PENNONI ASSOCIATES FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT OWNERS SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO PENNONI ASSOCIATES; AND OWNER SHALL INDEMNIFY AND HOLD HARMLESS PENNONI ASSOCIATES FROM ALL CLAIMS, DAMAGES, LOSSES, AND EXPENSES ARISING OUT OF OR RESULTING THEREFROM.

DRAWN BY:	SCALE:	DATE:
ARS	NTS	2/20/2025
CHECKED BY: TAT	FIGURE No. SK-2	
PROJECT No: LDMSE24001		

Appoquinimink School District Summit Campus - Phases B to F - Addendum 1

Additional Field Data

Pennoni

TEST BORING LOG

TEST BORING B-26

PAGE 1 OF 1

NORTHING 554862.2463

EASTING 572093

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/23/25 **COMPLETED** 1/23/25

GROUND ELEVATION 67.8' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 14.0' / Elev 53.8'

DRILLER / HELPER Mike / Nelson

▼ **AT END OF DRILLING** 15.2' / Elev 52.6'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	18	21-26-23-19		T	0.3 / 67.6 — 3" TOPSOIL	Frozen subgrade
	S-2	20	15-13-8-8			2.0 — Brown to black fine to medium SAND, some silt 4.0 — Brown to orange fine to medium SAND, little silty clay	
5	S-3	21	12-11-20-19			6.0 — Brown to tan fine SAND, little silt	
	S-4	12	3-4-5-7		B	8.0 — Brown to tan fine to medium to coarse SAND, some silt, trace fine gravel	Moist
10	S-5	21	6-6-7-6			Brown to tan fine to medium SAND, little silt, trace fine gravel	
						14.0 / 53.8	
15 ▼	S-6	19	28-18-18-12		D	16.0 — Brown to black fine to medium SAND, little to some silty clay	Saturated
20	S-7	21	8-13-16-14			20.0 / 47.8 — Brown fine to medium SAND, little silt	Wet on spoon

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-27

PAGE 1 OF 1

NORTHING 554919.4583

EASTING 572322.3632

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/23/25 **COMPLETED** 1/23/25

GROUND ELEVATION 66.4' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 14.0' / Elev 52.4'

DRILLER / HELPER Mike / Nelson

▼ **AT END OF DRILLING** 15.2' / Elev 51.2'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	12	13-10-6-5		T	0.2 — 2" TOPSOIL — 66.2	Frozen subgrade
	S-2	19	6-9-11-14		B	2.0 — Brown fine to medium SAND, little silt 4.0 — Brown fine to medium to coarse SAND, and CLAY, trace fine gravel — 62.4	
5	S-3	18	5-7-7-7		A	6.0 — Brown to gray CLAY, little fine to medium sand — 60.4	
	S-4	18	6-6-8-7		B	8.0 — Tan to orange fine to medium SAND, trace silt	
10	S-5	19	5-5-4-4			Tan to orange fine SAND, trace silt	
						14.0 — 52.4	
15 ▽▼	S-6	19	6-7-7-9		D	16.0 — Brown to orange fine to medium to coarse SAND, little silt	Saturated Fine gravel seam @ 15 ft
20	S-7	16	4-5-8-6			20.0 — Brown to black fine to medium SAND, little silt — 46.4	Wet on spoon
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-28

NORTHING 554922.0602

EASTING 572502.7438

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/25/25 **COMPLETED** 1/25/25

GROUND ELEVATION 66.0' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 53.0'

DRILLER / HELPER Mike / Nelson

▼ **AT END OF DRILLING** 15.2' / Elev 50.8'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	11	2-1-3-4		T	0.7 (65.4) 8" TOPSOIL	
						2.0 Brown fine to medium SAND, some clay	
	S-2	12	6-7-9-6			Brown to black fine to medium SAND, some clay	Moist
						4.0	
5	S-3	24	5-6-6-5			Brown to tan fine to medium to coarse SAND, little silt	
						6.0	
	S-4	16	5-4-5-5		B	Brown to tan to black fine to medium SAND, little silt	Moist
	S-5	0	5-5-5-5				Coarse gravel seam
10							
						14.0 (52.0)	
15 ▼	S-6	19	10-16-8-5		C	Multicolored coarse to fine GRAVEL, and fine to medium to coarse SAND, little silt	Wet on spoon
						18.0 (48.0)	
	S-7	16	6-6-5-6		D	Brown fine to medium SAND, trace to little silt	Saturated
20						20.0 (46.0)	
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-29

NORTHING 555112.6411

EASTING 572420.1583

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/23/25 **COMPLETED** 1/23/25

GROUND ELEVATION 65.5' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 14.0' / Elev 51.5'

DRILLER / HELPER Mike / Nelson

▼ **AT END OF DRILLING** 15.0' / Elev 50.5'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	15	6-3-3-4		T	0.5 — 6" TOPSOIL — 65.0	
					A	2.0 — Brown CLAY, and fine to medium to coarse SAND — 63.5	
	S-2	13	5-6-6-6			Brown to tan fine to medium SAND, little to some clay	
5	S-3	16	4-5-6-4			5.0 — 6.0 — Brown fine to medium SAND, trace silt	
	S-4	16	5-5-6-5			Tan to orange fine to medium SAND, trace silt	Dry
	S-5	14	6-4-6-5		B	8.0 — Tan to orange fine to medium SAND, little silt	
10							
						14.0 — 51.5	
15 ▽▼	S-6	19	3-3-4-4			Brown fine to medium SAND, little silt	Saturated
						16.0	
					D		
	S-7	20	2-4-5-5			Brown to tan fine to medium SAND, little silt	
20						20.0 — 45.5	
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-30

NORTHING 555196.641

EASTING 573014.3084

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/23/25 **COMPLETED** 1/23/25

GROUND ELEVATION 61.4' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 48.4'

DRILLER / HELPER Jason / Cecil / Nelson

▼ **AT END OF DRILLING** 14.9' / Elev 46.5'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER DRILLING Not Measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	6	9-7-5-4		T	0.2 — 2" TOPSOIL — 61.2	
	S-2	20	5-5-5-6			2.0 — Brown fine to medium SAND, some silt	
						Orange fine to medium to coarse SAND, little silt,	
						4.0 — trace fine gravel	
5	S-3	3	3-3-6-7		B	Orange fine to medium SAND, little silt	
						6.0	
	S-4	14	4-8-9-13			Orange fine to medium to coarse SAND, some silt,	
						8.0 — little fine to coarse gravel — 53.4	
10	S-5	20	10-9-8-8			Tan to orange fine to medium SAND, trace silt	
						13.0	
▽							
15 ▼	S-6	18	5-4-4-5		D	Gray to orange fine to medium SAND, trace silt	Saturated
20	S-7	18	3-4-6-6			20.0 — 41.4	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-31

NORTHING 554919.9865

EASTING 573166.8801

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/23/25 **COMPLETED** 1/23/25

GROUND ELEVATION 58.5' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 45.5'

DRILLER / HELPER Jason / Cecil / Nelson

▼ **AT END OF DRILLING** 13.3' / Elev 45.1'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	5	12-8-4-4		T A	0.3 3" TOPSOIL 58.2	
						2.0 Brown fine to medium SAND and CLAY 56.5	
	S-2	16	4-5-9-12			Brown fine to medium SAND, some silt 4.0	
5	S-3	20	3-6-7-6			Orange fine to medium to coarse SAND, little silt	
	S-4	18	5-5-4-4			8.0	
10	S-5	18	3-4-3-4			Orange fine to medium SAND, trace silt	Moist
					B	13.0	
▼ 15	S-6	16	2-3-6-5			Orange to gray fine to medium SAND, trace silt	Wet
						18.0	
20	S-7	10	2-3-5-5			Orange fine to medium SAND, trace silt 20.0 38.5	
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-32

NORTHING 555092.5618

EASTING 573221.265

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/23/25 **COMPLETED** 1/23/25

GROUND ELEVATION 57.3' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 44.3'

DRILLER / HELPER Jason / Cecil / Nelson

▼ **AT END OF DRILLING** 13.3' / Elev 44.1'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	12	3-4-5-6		T A	0.3 — 3" TOPSOIL — 57.1 2.0 — Brown SILT, and fine to medium to coarse SAND, trace fine gravel — 55.3	
	S-2	19	4-5-5-5			4.0 — Orange fine to medium to coarse SAND, trace silt	
5	S-3	18	3-5-4-5			Orange fine to medium to coarse SAND, little silt 6.0	
	S-4	20	4-5-6-4			Orange to red to gray fine to medium SAND, trace silt 8.0	
10	S-5	24	4-5-5-4			Orange fine to medium SAND, trace silt	Moist
					B	13.0	
15	S-6	16	1-3-3-4			Brown to orange fine to medium SAND, trace silt	Wet
						18.0	
20	S-7	24	2-1-3-2			Orange fine to medium SAND, trace silt 20.0 — 37.3	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-33

NORTHING 555262.3719

EASTING 573229.6633

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/23/25 **COMPLETED** 1/23/25

GROUND ELEVATION 57.3' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 44.3'

DRILLER / HELPER Jason / Cecil / Nelson

▼ **AT END OF DRILLING** 13.5' / Elev 43.8'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	5	11-6-5-4		T	0.3 / 57.0 — 3" TOPSOIL	
	S-2	0	7-7-8-7		A	Brown CLAY, little fine to medium SAND	
						4.0 / 53.3	
5	S-3	24	3-4-5-5			Orange to brown fine to medium SAND, little silt	
	S-4	16	5-6-5-6			6.0 — Tan fine to medium SAND, trace silt	
	S-5	3	4-4-4-4			8.0 — Orange fine to medium SAND, trace silt	
10					B		
						13.0	
▼ 15	S-6	6	5-4-3-4			Orange to brown fine to medium to coarse SAND, little silt	Wet
						18.0	
20	S-7	22	1-1-2-2			Orange fine to medium SAND, little silt	
						20.0 / 37.3	
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-34

NORTHING 556183.0531

EASTING 572038.9495

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/23/25 **COMPLETED** 1/23/25

GROUND ELEVATION 62.9' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 18.0' / Elev 44.9'

DRILLER / HELPER Mike

▼ **AT END OF DRILLING** 15.8' / Elev 47.1'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	16	6-4-3-3		T	0.5 — 6" TOPSOIL — 62.4	
					A	2.0 — Brown to orange CLAY, little fine to medium sand — 60.9	
	S-2	19	8-13-15-11		B	4.0 — Brown to tan fine to medium to coarse SAND, little silt	
5	S-3	24	5-6-7-6			6.0 — Brown to tan fine to medium to coarse SAND, trace silt	
	S-4	15	10-10-11-8			8.0 — Tan to brown fine to medium to coarse SAND, trace silt	
10	S-5	20	9-14-15-10			Tan to brown to black fine to medium to coarse SAND, trace fine gravel, trace silt	Auger chatter Coarse gravel seam
						14.0 — 48.9	
15 ▼	S-6	18	7-6-3-4		D	Brown fine to medium SAND, and SILT 16.0	Moist
▽							
20	S-7	24	3-3-6-6			20.0 — Orange to maroon to brown fine to medium SAND, little silt — 42.9	Mottling Wet on spoon
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-35

NORTHING 556246.0186

EASTING 572404.7088

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/23/25 **COMPLETED** 1/23/25

GROUND ELEVATION 66.8' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 18.0' / Elev 48.8'

DRILLER / HELPER Mike

▼ **AT END OF DRILLING** 18.5' / Elev 48.3'

LOGGED BY A. Spencer **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0	S-1	9	8-6-4-6		T	9" TOPSOIL Depth 2.0 — Elev. 64.8	
	S-2	14	4-5-7-11		B	Brown to tan fine to medium SAND, trace silt 4.0	
5	S-3	14	4-8-7-6			Brown to tan fine to medium SAND, little silt 6.0	
	S-4	10	6-9-10-8			Tan to orange fine to medium SAND, little silt 8.0	
10	S-5	18	7-5-6-8			Tan to orange to black fine to medium to coarse SAND, little silt 14.0 — Elev. 52.8	Moist
15	S-6	16	35-17-17-13		C	Multicolored medium to fine to coarse SAND, some fine to coarse gravel, little silt 18.0 — Elev. 48.8	
▼ 20	S-7	24	32-30-33-37		D	Maroon to brown fine to medium SAND, little to some silt 20.0 — Elev. 46.8	Saturated
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-36

NORTHING 556145.2886

EASTING 573389.3638

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/24/25 **COMPLETED** 1/24/25

GROUND ELEVATION 62.9' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 18.0' / Elev 44.9'

DRILLER / HELPER Jason / Cecil / Nelson

▼ **AT END OF DRILLING** 16.8' / Elev 46.2'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	6	8-8-3-3		T A	0.2 — 2" TOPSOIL — 62.8	
						2.0 — Brown Silty CLAY, some fine to medium sand — 60.9	
	S-2	20	4-4-6-7			4.0 — Brown to orange medium to fine to coarse SAND, some clay, trace fine gravel	
5	S-3	12	5-10-10-6			6.0 — Orange to gray fine to medium to coarse SAND, little to some silt	
	S-4	14	4-7-17-20			8.0 — Orange to tan fine to medium SAND, little silt, trace fine gravel	
10	S-5	15	12-9-9-9			10.0 — Orange to brown to tan fine to medium to coarse SAND, trace silt, trace fine gravel	
					B		
15	S-6	14	9-7-7-4			15.0 — Orange fine to medium to coarse SAND, little silt	Auger chatter
20	S-7	20	2-1-1-1			20.0 — Orange fine to medium SAND, little silt — 42.9	Wet
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-37

NORTHING 556266.3552

EASTING 573770.3345

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/24/25 **COMPLETED** 1/24/25

GROUND ELEVATION 62.2' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 19.5' / Elev 42.7'

DRILLER / HELPER Jason / Cecil / Nelson

AT END OF DRILLING Not encountered

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	8	6-8-5-5		T A	0.3 — 3" TOPSOIL — 61.9	
						2.0 — Orange to gray CLAY, some fine to medium sand — 60.2	
	S-2	18	4-4-9-8			Orange fine to medium SAND, little clay	
						4.0	
5	S-3	20	4-6-6-6		B	Orange fine to medium SAND, trace silt	
						6.0	
	S-4	20	5-5-5-8			Orange fine to medium to coarse SAND, trace silt, trace fine gravel	
						8.0 — 54.2	
	S-5	18	9-8-7-9			Orange to red fine to medium SAND, trace silt	
10							
						13.0	
	S-6	18	5-5-5-5		D	Orange fine to medium to coarse SAND, little silt	Moist
15							
						18.0	
	S-7	20	1-2-1-1			Brown fine to medium SAND, some silt	
20 ▽						20.0 — 42.2	Wet
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-38

PAGE 1 OF 1

NORTHING 556238.7668

EASTING 573907.4629

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/24/25 **COMPLETED** 1/24/25

GROUND ELEVATION 61.6' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 18.0' / Elev 43.6'

DRILLER / HELPER Jason / Cecil / Nelson

▼ **AT END OF DRILLING** 17.3' / Elev 44.3'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	6	7-11-3-3		T A	0.2 — 2" TOPSOIL — 61.4	
						2.0 — Brown fine to medium SAND and CLAY — 59.6	
	S-2	16	4-3-4-4			Orange fine to medium SAND, little silt	
						4.0	
5	S-3	18	2-3-3-3			Orange to tan fine to medium SAND, trace silt	
	S-4	14	3-4-5-6			8.0	
	S-5	16	7-6-5-5			Orange to tan fine to medium SAND, little silt	
10					B		
						13.0	
	S-6	24	3-3-2-1			Orange to tan fine to medium SAND, little silt	Moist
15							
						18.0	
	S-7	22	1-1-2-1			Brown fine to medium to coarse SAND, some silt	Wet
20						20.0 — 41.6	
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-39

NORTHING 556130.0167

EASTING 573845.2505

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/24/25 **COMPLETED** 1/24/25

GROUND ELEVATION 62.9' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 18.0' / Elev 44.9'

DRILLER / HELPER Jason / Cecil / Nelson

▼ **AT END OF DRILLING** 17.5' / Elev 45.4'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	14	6-15-5-6		T / A	0.5 (62.4) 6" TOPSOIL 2.0 (60.9) Orange CLAY, some fine to medium to coarse sand	
	S-2	18	6-6-8-7			4.0 Orange fine to medium to coarse SAND, little silty clay	
5	S-3	20	4-5-5-6		B	6.0 Orange fine to medium SAND, trace silt	
	S-4	14	5-5-5-4			Orange fine to medium to coarse SAND, trace silt 8.0 (54.9)	
10	S-5	20	4-4-5-6			Orange to tan fine to medium SAND, trace silt, trace fine gravel	
						13.0	
15	S-6	5	5-6-6-6		D	Orange to tan to red fine to medium to coarse SAND, little silt, trace coarse gravel	
						18.0	
20	S-7	20	2-2-2-2			Orange fine to medium to coarse SAND, some silt 20.0 (42.9)	Wet
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-40

NORTHING 556092.4214

EASTING 573970.7983

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/24/25 **COMPLETED** 1/24/25

GROUND ELEVATION 59.2' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 46.2'

DRILLER / HELPER Jason / Cecil / Nelson

▼ **AT END OF DRILLING** 17.0' / Elev 42.2'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	3	7-4-4-3		T	0.2 — 2" TOPSOIL — 59.1	
	S-2	16	5-6-8-10		A	2.0 — Gray SILT, little fine to medium sand Gray SILT, and fine to medium sand 4.0 — 55.2	
5	S-3	16	3-7-8-9		B	Orange fine to medium to coarse SAND, little silt 6.0	
	S-4	24	9-10-9-9			Orange fine to medium SAND, trace silt 8.0 — 51.2	
10	S-5	18	8-13-12-8		D	Orange fine to medium to coarse SAND, some clay, little fine to coarse gravel	
						13.0	
▽ 15	S-6	10	6-8-5-4			Brown fine to medium to coarse SAND, little silt, trace fine gravel	Wet
▼						18.0	
20	S-7	18	2-1-2-2			Brown fine to medium to coarse SAND, some silt 20.0 — 39.2	
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-41

NORTHING 555934.059

EASTING 574021.9336

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/24/25 **COMPLETED** 1/24/25

GROUND ELEVATION 58.5' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 18.0' / Elev 40.5'

DRILLER / HELPER Jason / Cecil / Nelson

▼ **AT END OF DRILLING** 15.3' / Elev 43.2'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	14	11-14-8-8		T A	0.3 / 58.1: 4" TOPSOIL	
	S-2	16	10-7-17-14			2.0 / 56.5: Orange to brown Silty CLAY, little fine to medium sand	
						4.0: Orange fine to medium to coarse SAND, little clay	
5	S-3	6	3-5-7-7			Orange fine to medium SAND, little silt	
						6.0	
	S-4	20	8-8-8-8			Orange fine to medium SAND, trace silt	
	S-5	16	5-7-6-6				
10					B		
						13.0	
	S-6	16	5-4-3-4			Orange fine to medium SAND, trace silt	Moist
15 ▼							
▽						18.0 / 40.5	
	S-7	20	3-3-3-2		D	Brown fine to medium SAND, some silt	Wet
20						20.0 / 38.5	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-42

NORTHING 555917.2598

EASTING 573831.2752

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/23/25 **COMPLETED** 1/23/25

GROUND ELEVATION 60.0' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 18.0' / Elev 42.0'

DRILLER / HELPER Jason / Cecil / Nelson

▼ **AT END OF DRILLING** 16.7' / Elev 43.3'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	8	7-5-4-3		T	0.2 — 2" TOPSOIL — 59.8	
	S-2	14	5-7-8-13		A	2.0 — Brown CLAY, trace fine to medium sand Orange CLAY	
						4.0 — 56.0	
5	S-3	18	2-9-8-7			Orange fine to medium SAND, little clay	
						6.0	
	S-4	16	8-18-18-15			Orange fine to medium to coarse SAND, little silt, little fine to coarse gravel	
						8.0	
	S-5	20	8-7-8-8			Orange to tan fine to medium SAND, trace silt	
10						10.0	
					B		
15	S-6	0	9-7-5-6				Coarse gravel stuck in spoon tip
	S-7	20	3-2-3-4			Orange fine to medium SAND, trace silt	Wet
20						20.0 — 40.0	

Borehole terminated at 20.0 feet.

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-43

NORTHING 555733.7253

EASTING 573835.9703

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/23/25 **COMPLETED** 1/23/25

GROUND ELEVATION 58.7' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 14.5' / Elev 44.2'

DRILLER / HELPER Jason / Cecil / Nelson

▼ **AT END OF DRILLING** 15.3' / Elev 43.4'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	6	7-6-4-4		T	0.2 / 58.5 — 2" TOPSOIL	
	S-2	24	5-8-10-11			2.0 — Brown CLAY, and fine to medium SAND	
						Orange to tan fine to medium SAND, trace silt,	
						4.0 — trace fine gravel	
5	S-3	12	3-7-9-10			Orange fine to medium to coarse SAND, trace silt,	
						6.0 — trace fine gravel	
	S-4	18	9-9-8-7		B	Orange to tan fine to medium SAND, trace silt	
	S-5	18	5-6-5-5				
10							
						13.0 / 45.7	
	S-6	12	3-2-2-2			Brown fine to medium SAND, trace silt	Wet
15 ▽▼					D		
						18.0	
	S-7	24	1-1-1-2			Orange fine to medium SAND and SILT	
20						20.0 / 38.7	
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST BORING LOG

TEST BORING B-44

NORTHING 555820.6654

EASTING 573634.1358

CLIENT Landmark Science & Engineering

PROJECT NAME Appoquinimink School District Summit Campus

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, DE

DATE STARTED 1/23/25 **COMPLETED** 1/23/25

GROUND ELEVATION 59.7' NAVD88 +/-

DRILLING CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

DRILLING METHOD 3.25 Hollow Stem Auger

▽ **DURING DRILLING** 13.0' / Elev 46.7'

DRILLER / HELPER Jason / Cecil / Nelson

▼ **AT END OF DRILLING** 16.3' / Elev 43.4'

LOGGED BY N. Fisher **CHECKED BY** T. Thomson

AFTER DRILLING Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0						Depth / Elev.	
	S-1	10	7-5-5-6		T	0.5 — 6" TOPSOIL — 59.2	
					A	2.0 — Orange CLAY, trace fine to medium sand — 57.7	
	S-2	24	8-9-9-7			Orange fine to medium SAND, trace silt	
5	S-3	6	3-4-6-7				
	S-4	24	7-8-8-8			6.0 — Orange fine to medium SAND, little silt	
10	S-5	12	6-5-4-3				
					B		
▽						13.0 — Orange fine to medium SAND, little silt	Wet
15	S-6	14	3-4-4-3				
▼							
						18.0 — Orange fine to medium SAND, little to some silt	
20	S-7	16	3-2-2-2			20.0 — 39.7	
						Borehole terminated at 20.0 feet.	

NOTES:

Northing, easting, and surface elevation provided by Landmark Science & Engineering

TEST PIT LOG

Test Pit TP-41

NORTHING 554986.3348

EASTING 572177.1863

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 1/29/25 **COMPLETED** 1/29/25

GROUND ELEVATION 65.6' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	0.3 — 3" TOPSOIL — 65.4	
				Gray to brown fine to medium SAND, little to some silty clay	
				2.0 — Orange to brown fine to medium SAND, some silt	
				4.5 — Tan to orange fine to medium to coarse SAND, little silt	
5	S-1		B		Moist
10				10.0 — 55.6	

Test Pit terminated at 10.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-42

NORTHING 554882.9737

EASTING 572233.4817

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 1/29/25 **COMPLETED** 1/29/25

GROUND ELEVATION 67.4' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.3	3" TOPSOIL	67.2	
			B		Brown to orange fine to medium SAND, little to some silty clay		
				1.5		65.9	
			A		Gray to brown Silty CLAY, and fine to medium to coarse SAND, trace fine gravel		
5	S-1			5.5		61.9	Moist
			B	6.5	Orange to tan fine to medium SAND, little silt, trace coarse to fine gravel Tan to orange fine to medium SAND, trace to little silt		
				8.5		58.9	

Test Pit terminated at 8.5 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.
Test pit offset 5 feet Northeast due to encountered utility.

TEST PIT LOG

Test Pit TP-43

NORTHING 554777.2284

EASTING 572305.7296

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 1/29/25 **COMPLETED** 1/29/25

GROUND ELEVATION 67.9' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.3	3" TOPSOIL	67.7	
			A		Brown to gray CLAY, little fine to medium sand		
				3.0		64.9	
					Orange to tan to brown medium to fine to coarse SAND, little silt, trace fine gravel		
5	S-1		B				
				6.5	Tan to orange fine to medium SAND, trace silt		Moist
				8.3		59.6	

Test Pit terminated at 8.3 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-44

NORTHING 554997.6272

EASTING 572323.9337

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 1/29/25 **COMPLETED** 1/29/25

GROUND ELEVATION 65.8' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0				Depth / Elev.	
			T	0.3 — 3" TOPSOIL — 65.5	
			B	Brown to tan fine to medium SAND, little to some clay	
				2.0 — 63.8	
			A	Dark brown to gray CLAY, little fine to medium sand	
				4.5	
5				5.0 — Brown to orange fine to medium to coarse SAND, some clay — 60.8	
	S-1		B	Tan to orange to brown fine to medium SAND, trace silt	
				9.5 — 56.3	
				Test Pit terminated at 9.5 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-45

NORTHING 554896.0971

EASTING 572376.1596

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 1/29/25 **COMPLETED** 1/29/25

GROUND ELEVATION 66.8' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.3	3" TOPSOIL	66.5	
			A	0.8	Dark gray CLAY, trace to little fine to medium sand	66.0	
			B	1.5	Brown to orange fine to medium SAND, some clay	65.3	
			A	4.5	Gray to brown Silty CLAY, little fine to medium sand	62.3	Moist
5	S-1		B	5.0	Orange to tan fine to medium to coarse SAND, and SILT, trace fine gravel Orange to tan fine to medium SAND, trace silt		
				8.3		58.5	

Test Pit terminated at 8.3 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-46

NORTHING 554875.5421

EASTING 572869.8593

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 1/30/25 **COMPLETED** 1/30/25

GROUND ELEVATION 61.7' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.3	3" TOPSOIL	61.5	
					Brown fine SAND, some silt		
				2.5	Brown to orange fine to medium SAND, little silty clay		
			B	4.0	Brown to orange fine to medium to coarse SAND, little silt		Damp
5	S-1						
				7.0		54.7	Moist
			C		Orange to brown fine to medium SAND, little cobbles, little coarse to fine gravel, trace silt		
				8.0		53.7	

Test Pit terminated at 8.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering. Test pit location offset 15' from roadway.

TEST PIT LOG

Test Pit TP-47

NORTHING 554832.1615

EASTING 572937.5182

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 1/30/25 **COMPLETED** 1/30/25

GROUND ELEVATION 60.8' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.5	6" TOPSOIL	60.3	
					Brown to gray fine SAND, some clayey silt		
				2.0	Brown to gray fine to medium SAND, little clay		
			B	4.0	Orange fine to medium to coarse SAND, little silt		Damp
5	S-1						
				7.0		53.8	Moist
			C		Orange fine to medium to coarse SAND, little coarse to fine gravel, little cobbles		
				8.0		52.8	
					Test Pit terminated at 8.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-48

PAGE 1 OF 1

NORTHING 554952.4625

EASTING 572962.5107

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 1/30/25 **COMPLETED** 1/30/25

GROUND ELEVATION 61.3' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.5	6" TOPSOIL	60.8	Frozen
			A		Gray to brown Silty CLAY, little fine to medium sand		
				2.5		58.8	
			B		Orange to brown fine to medium SAND, little silt		
				4.0	Orange fine to medium to coarse SAND, little silt		
5	S-1						
				7.0		54.3	Damp
			C		Orange to tan to light gray fine to medium to coarse SAND, little coarse to fine gravel, trace to little cobbles, trace silt		
				8.0		53.3	

Test Pit terminated at 8.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-49

NORTHING 554923.0372

EASTING 573060.1754

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 1/30/25 **COMPLETED** 1/30/25

GROUND ELEVATION 60.1' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.3	4" TOPSOIL	59.7	
			A	2.0	Brown Silty CLAY, little fine to medium sand	58.1	
			B	4.0	Orange to brown fine to medium SAND, little silt		
5				5.0	Orange to brown fine to medium to coarse SAND, little silt, trace fine gravel	55.1	
	S-1		C	6.5	Orange to brown fine to medium to coarse SAND, some coarse to fine gravel, little cobbles, trace silt	53.6	Damp, cemented sand
			D	8.0	Orange to tan fine to medium to coarse SAND, trace fine to coarse gravel, trace silt	52.1	

Test Pit terminated at 8.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-50

NORTHING 555013.772

EASTING 573064.1006

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 1/30/25 **COMPLETED** 1/30/25

GROUND ELEVATION 60.4' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	1.0	12" TOPSOIL	59.4	
			A	3.0	Orange to brown Silty CLAY, little fine sand	57.4	
5			B	5.0	Brown to orange fine to medium SAND, little silt	55.4	
	S-1		C	6.0	Orange to brown fine to coarse GRAVEL, some medium to fine to coarse sand, little silt		
				7.0	Orange to brown fine to medium to coarse SAND, little fine to coarse gravel, trace cobbles, trace silt	53.4	Damp
			D	8.0	Orange to tan fine to medium to coarse SAND, little fine gravel, trace silt	52.4	
					Test Pit terminated at 8.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-51

PAGE 1 OF 1

NORTHING 554987.8322

EASTING 573132.8947

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 2/3/25 **COMPLETED** 2/3/25

GROUND ELEVATION 59.3' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.5	6" TOPSOIL	58.8	
			A	3.0	Brown Silty CLAY, little fine to medium sand	56.3	
			B	4.0	Brown to orange fine to medium SAND, little silty clay		
5	S-1			5.5	Orange to tan fine to medium SAND, little silt, trace fine gravel	53.8	
			C	6.5	Orange to tan to brown fine to medium to coarse SAND, some coarse to fine gravel, little cobbles, trace silt	52.8	
			D	8.3	Orange to tan fine to medium SAND, trace silt	51.0	Damp

Test Pit terminated at 8.3 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-52

NORTHING 555090.0508

EASTING 573141.6218

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 2/3/25 **COMPLETED** 2/3/25

GROUND ELEVATION 59.4' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	DESCRIPTION	REMARKS
0			T	Depth 0.5 — 6" TOPSOIL — Elev. 58.9	
			A	Brown Silty CLAY, little to trace fine to medium sand	
				Depth 4.0 — Elev. 55.4	
5	S-1		B	Orange to tan fine to medium SAND, trace silt	Trace cobbles @ 4'6"
				Depth 8.5 — Elev. 50.9	Damp
				Test Pit terminated at 8.5 feet.	

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-53

NORTHING 556222.5153

EASTING 572192.8706

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 2/3/25 **COMPLETED** 2/3/25

GROUND ELEVATION 65.0' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.5	6" TOPSOIL	64.5	
			A		Brown CLAY, trace to little fine to medium sand		
				2.5		62.5	
					Orange to brown to gray fine to medium SAND, little silty clay		
				3.5			
					Orange fine to medium to coarse SAND, little silt		
5							
	S-1		B	6.0			
					Tan to orange fine to medium SAND, trace silt		Moist Compacted sand segments
				8.7		56.3	

Test Pit terminated at 8.7 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-54

NORTHING 556267.9148

EASTING 572259.2525

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 2/3/25 **COMPLETED** 2/3/25

GROUND ELEVATION 64.7' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.5	6" TOPSOIL	64.2	
			A		Brown CLAY, little fine to medium sand		
				3.5		61.2	
					Orange to tan medium to fine to coarse SAND, little silt		
5	S-1		B	6.0	Tan to orange fine to medium SAND, trace silt		Damp
				8.5		56.2	Moist
					Test Pit terminated at 8.5 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-55

PAGE 1 OF 1

NORTHING 556190.6089

EASTING 572375.6661

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 2/3/25 **COMPLETED** 2/3/25

GROUND ELEVATION 65.8' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.5	6" TOPSOIL	65.3	
			A		Brown CLAY, little to some fine to medium sand		
				3.5		62.3	
					Tan medium to fine to coarse SAND, some silt		
5	S-1						Dry
			B	6.0	Tan to orange fine to medium SAND, trace silt		Moist
				9.0		56.8	

Test Pit terminated at 9.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-56

NORTHING 556159.5067

EASTING 573340.5751

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 2/4/25 **COMPLETED** 2/4/25

GROUND ELEVATION 62.7' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.5	6" TOPSOIL	62.2	
			A		Brown CLAY, trace fine to medium sand		
				2.5	Tan SILT, little fine sand		
				3.5		59.2	
5	S-1		B		Orange to tan medium to fine to coarse SAND, little silt, trace fine gravel		
				7.0		55.7	
			C		Orange to maroon to tan fine to medium to coarse SAND, little coarse to fine gravel, trace cobbles, trace silt		Iron conglomerate chunks
				8.5		54.2	
			D	9.0	Tan to orange fine to medium SAND, trace silt	53.7	
					Test Pit terminated at 9.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-57

NORTHING 556082.5826

EASTING 573385.6171

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 2/4/25 **COMPLETED** 2/4/25

GROUND ELEVATION 62.3' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.5	6" TOPSOIL	61.8	
			A		Brown CLAY, little fine to medium sand		
				2.5		59.8	
			B		Brown fine to medium SAND, little silty clay		
				4.5			
5					Tan medium to fine to coarse SAND, little silt, little fine gravel		
	S-1			5.5		56.8	
			C	6.5	Tan to orange to red fine to medium to coarse SAND, little coarse to fine gravel, trace cobbles, trace silt	55.8	
			D		Orange to tan fine to medium SAND, trace silt		Damp
				8.5		53.8	

Test Pit terminated at 8.5 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-58

NORTHING 556225.4448

EASTING 573394.982

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 2/4/25 **COMPLETED** 2/4/25

GROUND ELEVATION 63.2' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.7	8" TOPSOIL	62.5	
			A	3.0	Brown Clayey SILT, trace fine to medium sand	60.2	
5	S-1		B	5.5	Orange to brown fine to medium SAND, little silty clay Tan to orange medium to fine to coarse SAND, little silt, trace fine gravel	55.7	
			C	8.5	Tan to orange medium to fine to coarse SAND, some coarse to fine gravel, little cobbles, trace silt	54.7	Damp
			D	9.0	Tan to orange fine to medium SAND, trace silt	54.2	
					Test Pit terminated at 9.0 feet.		

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-59

NORTHING 556154.9063

EASTING 573436.3281

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 2/4/25 **COMPLETED** 2/4/25

GROUND ELEVATION 62.6' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.5	6" TOPSOIL	62.1	
			A	2.0	Brown CLAY, little to trace fine to medium sand	60.6	
			B	4.0	Brown fine to medium SAND, little silty clay		
5	S-1			6.0	Orange medium to fine to coarse SAND, little silt, trace fine gravel	56.6	
			C	7.0	Orange to gray to tan medium to fine to coarse SAND, some coarse to fine gravel, little cobbles, trace silt	55.6	
			D	9.0	Tan to orange fine to medium SAND, trace silt	53.6	Slightly damp

Test Pit terminated at 9.0 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

TEST PIT LOG

Test Pit TP-60

NORTHING 556087.9864

EASTING 573470.766

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware

DATE STARTED 2/4/25 **COMPLETED** 2/4/25

GROUND ELEVATION 62.2' NAVD88 +/-

EXCAVATION CONTRACTOR CGC Geoservices, LLC

WATER ENCOUNTERED:

EXCAVATION METHOD Mini-Excavator

DURING EXCAVATION Not encountered

OPERATOR / HELPER Jim F.

AT END OF EXCAVATION Not encountered

LOGGED BY B. Gordon **CHECKED BY** T. Thomson

AFTER EXCAVATION Not measured

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	STRATA	Depth	DESCRIPTION	Elev.	REMARKS
0			T	0.5	6" TOPSOIL	61.7	
			A		Brown CLAY, little fine to medium sand		
				2.5		59.7	
			B		Orange to tan fine to medium SAND, trace silt		
5				5.0			
	S-1			5.5	Orange to tan medium to fine to coarse SAND, trace silt, trace fine gravel	56.7	
			C	6.5	Orange to tan fine to medium to coarse SAND, some coarse to fine gravel, little cobbles, trace silt	55.7	
			D		Tan to orange to brown fine to medium SAND, trace silt		Damp
				8.8		53.4	

Test Pit terminated at 8.8 feet.

NOTES:

Northing, easting, and surface elevations provided by Landmark Science & Engineering.

Single Ring Infiltration Log

INF - 41

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	1/29/2025 Completed 1/29/2025	Testing Depth / Elev.	5 ft / 60.60 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	1:59	2:13	14	4.50	0.0000	4.5000	--
P2	2:13	2:29	16	4.50	0.0000	4.5000	--
P3	2:29	2:59	30	4.50	0.0000	4.5000	--
1	2:59	3:14	15	4.50	1.000	3.500	14.00
2	3:14	3:29	15	4.50	1.750	2.750	11.00
3	3:29	3:44	15	4.50	1.750	2.750	11.00
4	3:44	3:59	15	4.50	1.750	2.750	11.00
5	3:59	4:14	15	4.50	1.750	2.750	11.00
6	4:14	4:29	15	4.50	1.750	2.750	11.00
7	4:29	4:44	15	4.50	1.750	2.750	11.00
8	4:44	4:59	15	4.50	1.750	2.750	11.00
					Field Infiltration Rate:		**11.00**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

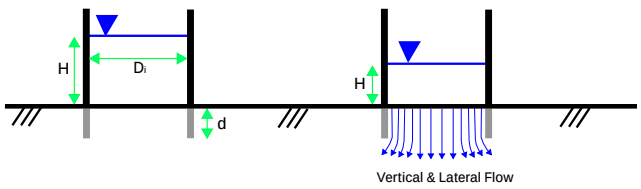
Notes:

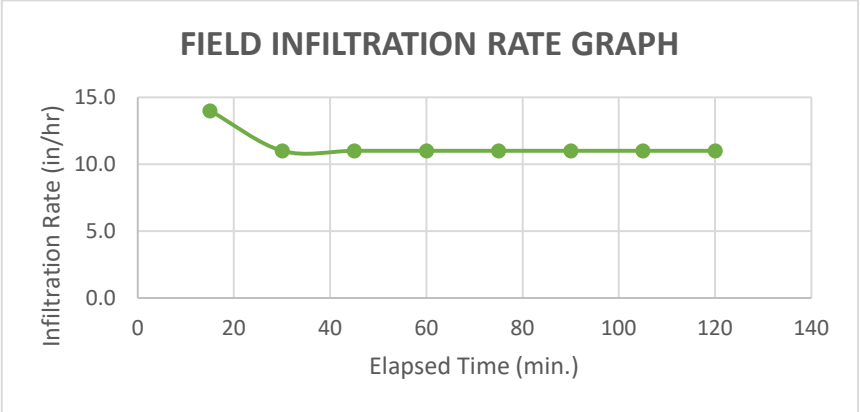
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3.5 in

Corresponds to Test Pit Log 41

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 42

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	1/29/2025 Completed 1/29/2025	Testing Depth / Elev.	5 ft / 62.40 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	9:29	9:59	30	6.00	5.5000	0.5000	--
P2	9:59	20:29	30	6.00	5.6250	0.3750	--
1	10:29	10:44	15	6.00	5.750	0.250	1.00
2	10:44	10:59	15	6.00	6.000	0.000	0.00
3	10:59	11:14	15	6.00	6.000	0.000	0.00
4	11:14	11:29	15	6.00	5.875	0.125	0.50
5	11:29	11:44	15	6.00	6.000	0.000	0.00
6	11:44	11:59	15	6.00	6.000	0.000	0.00
7	11:59	12:14	15	6.00	6.000	0.000	0.00
8	12:14	12:29	15	6.00	6.000	0.000	0.00
					Field Infiltration Rate:		**0.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

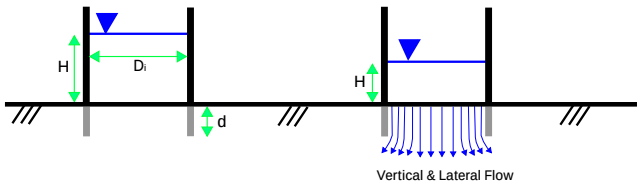
Notes:

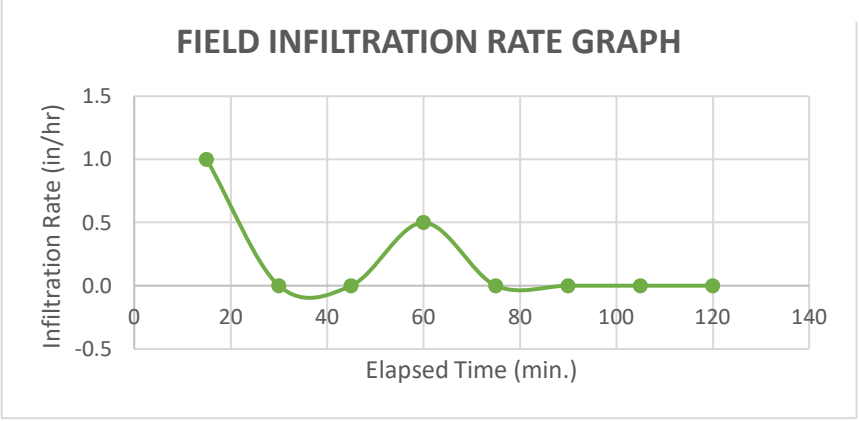
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 2 in

Corresponds to Test Pit Log 42

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 43

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	1/29/2025 Completed 1/29/2025	Testing Depth / Elev.	5 ft / 62.92 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	10:52	11:12	20	5.00	0.0000	5.0000	--
P2	11:12	11:37	25	5.00	0.0000	5.0000	--
P3	11:37	11:52	15	5.00	1.0000	4.0000	--
1	11:52	12:07	15	5.00	1.125	3.875	15.50
2	12:07	12:22	15	5.00	1.125	3.875	15.50
3	12:22	12:37	15	5.00	1.500	3.500	14.00
4	12:37	12:52	15	5.00	2.000	3.000	12.00
5	12:52	1:07	15	5.00	2.000	3.000	12.00
6	1:07	1:22	15	5.00	2.000	3.000	12.00
7	1:22	1:37	15	5.00	2.000	3.000	12.00
8	1:37	1:52	15	5.00	2.000	3.000	12.00
						Field Infiltration Rate:	**12.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

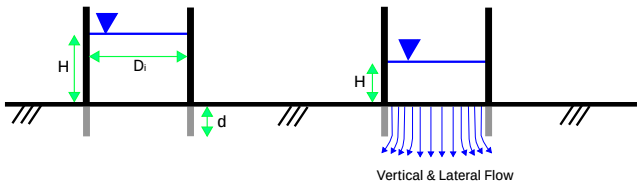
Notes:

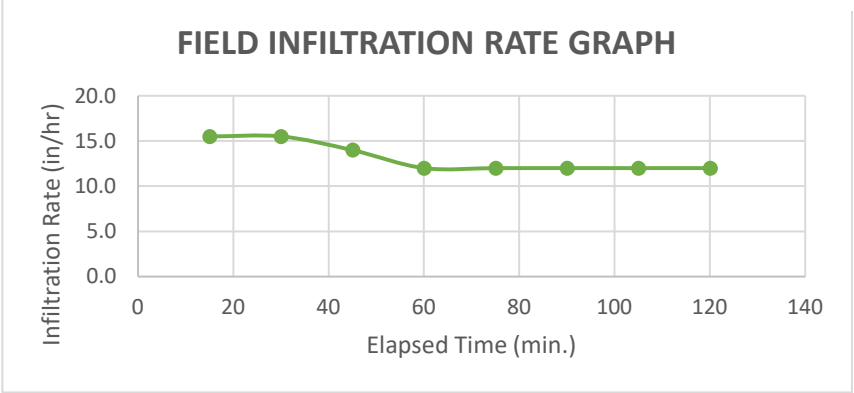
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 43

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 44

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	1/29/2025 Completed 1/29/2025	Testing Depth / Elev.	5 ft / 60.77 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	1:04	1:23	19	4.00	0.0000	4.0000	--
P2	1:23	1:53	30	4.00	1.3750	2.6250	--
P3	1:53	2:04	11	4.00	2.8750	1.1250	--
1	2:04	2:19	15	4.00	2.875	1.125	4.50
2	2:19	2:34	15	4.00	2.875	1.125	4.50
3	2:34	2:49	15	4.00	2.875	1.125	4.50
4	2:49	3:04	15	4.00	2.875	1.125	4.50
5	3:04	3:19	15	4.00	3.000	1.000	4.00
6	3:19	3:34	15	4.00	3.000	1.000	4.00
7	3:34	3:49	15	4.00	3.000	1.000	4.00
8	3:49	4:04	15	4.00	3.000	1.000	4.00
					Field Infiltration Rate:		**4.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

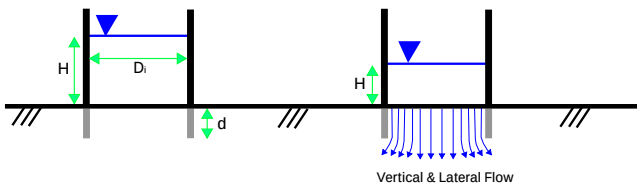
Notes:

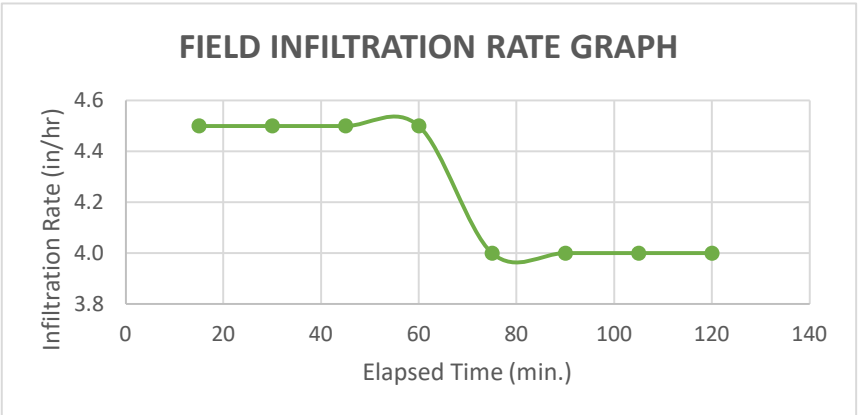
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 4 in

Corresponds to Test Pit Log 44

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 45

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	1/29/2025 Completed 1/29/2025	Testing Depth / Elev.	5 ft / 61.79
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	11:55	12:25	30	5.00	4.8750	0.1250	--
P2	12:25	12:55	30	5.00	5.0000	0.0000	--
1	12:55	1:10	15	5.00	5.000	0.000	0.00
2	1:10	1:25	15	5.00	5.000	0.000	0.00
3	1:25	1:40	15	5.00	5.000	0.000	0.00
4	1:40	1:55	15	5.00	5.000	0.000	0.00
5	1:55	2:10	15	5.00	5.000	0.000	0.00
6	2:10	2:25	15	5.00	5.000	0.000	0.00
7	2:25	2:40	15	5.00	5.000	0.000	0.00
8	2:40	2:55	15	5.00	5.000	0.000	0.00
					Field Infiltration Rate:		**0.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

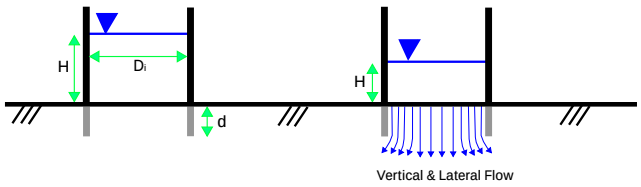
Notes:

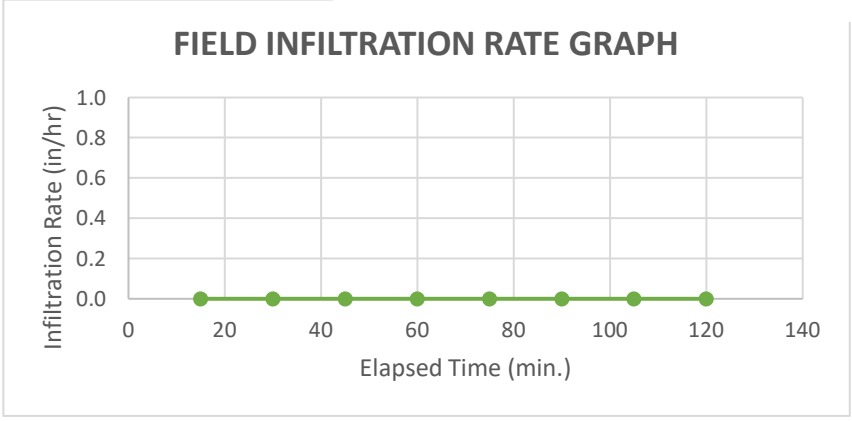
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 45

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 46

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	1/30/2025 Completed 1/30/2025	Testing Depth / Elev.	5 ft / 56.72 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	9:21	9:51	30	5.00	2.8750	2.1250	--
P2	9:51	10:21	30	5.00	3.1250	1.8750	
1	10:21	10:36	15	5.00	4.125	0.875	3.50
2	10:36	10:51	15	5.00	4.125	0.875	3.50
3	10:51	11:06	15	5.00	4.125	0.875	3.50
4	11:06	11:21	15	5.00	4.250	0.750	3.00
5	11:21	11:36	15	5.00	4.500	0.500	2.00
6	11:36	11:51	15	5.00	4.500	0.500	2.00
7	11:51	12:06	15	5.00	4.500	0.500	2.00
8	12:06	12:21	15	5.00	4.500	0.500	2.00
						Field Infiltration Rate:	**2.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

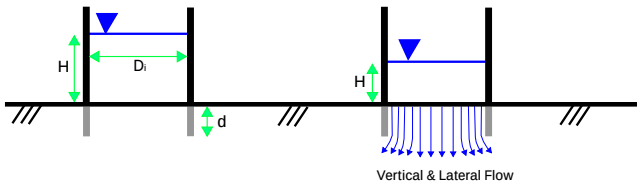
Notes:

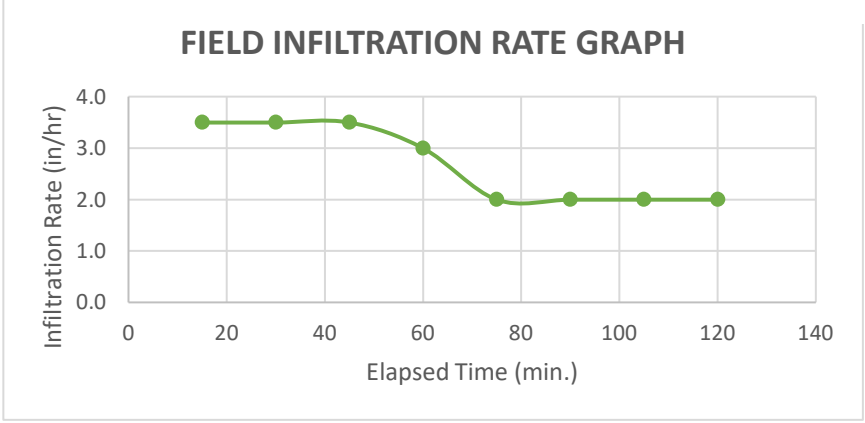
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 46

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 47

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	1/30/2025 Completed 1/30/2025	Testing Depth / Elev.	5 ft / 55.81
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	9:59	10:29	30	5.00	1.3750	3.6250	--
P2	10:29	10:59	30	5.00	1.7500	3.2500	--
1	10:59	11:14	15	5.00	3.500	1.500	6.00
2	11:14	11:29	15	5.00	3.500	1.500	6.00
3	11:29	11:44	15	5.00	3.500	1.500	6.00
4	11:44	11:59	15	5.00	3.500	1.500	6.00
5	11:59	12:14	15	5.00	3.500	1.500	6.00
6	12:14	12:29	15	5.00	3.500	1.500	6.00
7	12:29	12:44	15	5.00	3.500	1.500	6.00
8	12:44	12:59	15	5.00	3.500	1.500	6.00
					Field Infiltration Rate:		**6.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

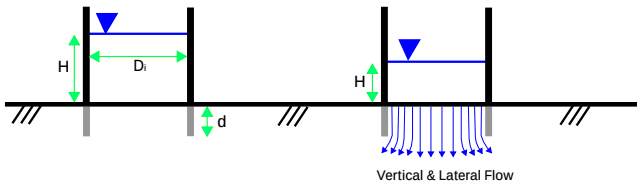
Notes:

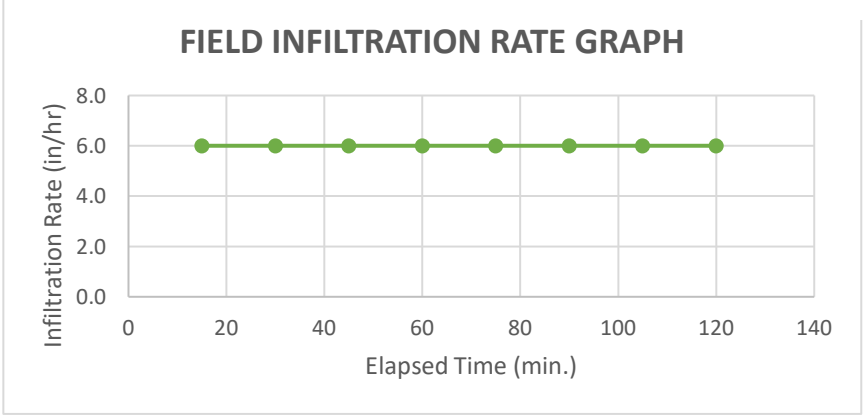
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 47

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 48

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	1/30/2025 Completed 1/30/2025	Testing Depth / Elev.	5 ft / 56.29 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	12:26	12:56	30	4.50	1.6250	2.8750	--
P2	12:56	1:26	30	4.50	2.0000	2.5000	--
1	1:26	1:41	15	4.50	3.000	1.500	6.00
2	1:41	1:56	15	4.50	3.250	1.250	5.00
3	1:56	2:11	15	4.50	3.250	1.250	5.00
4	2:11	2:26	15	4.50	3.250	1.250	5.00
5	2:26	2:41	15	4.50	3.250	1.250	5.00
6	2:41	2:56	15	4.50	3.250	1.250	5.00
7	2:56	3:11	15	4.50	3.250	1.250	5.00
8	3:11	3:26	15	4.50	3.250	1.250	5.00
						Field Infiltration Rate:	**5.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

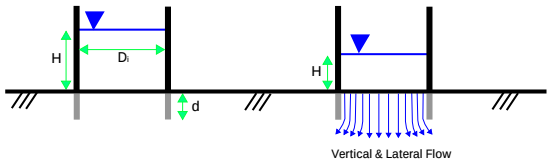
Notes:

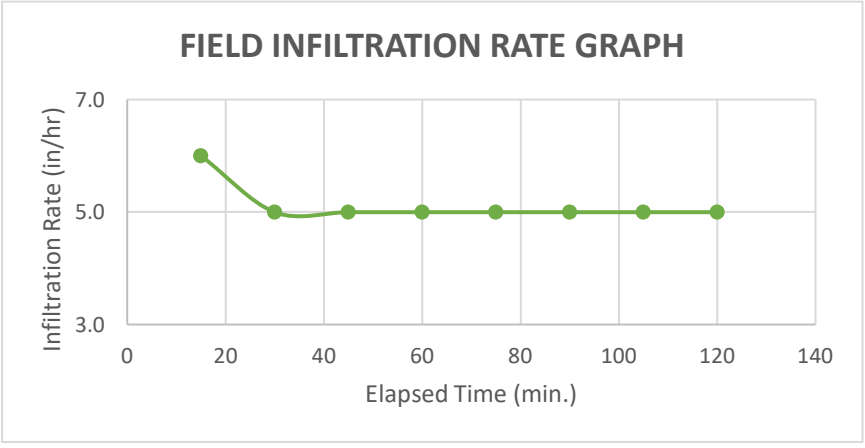
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3.5 in

Corresponds to Test Pit Log 48

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 49

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	1/30/2025 Completed 1/30/2025	Testing Depth / Elev.	5 ft / 55.08
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	10:47	11:01	14	4.00	0.0000	4.0000	--
P2	11:01	11:17	16	4.00	0.0000	4.0000	--
P3	11:17	11:25	8	4.00	0.0000	4.0000	--
1	11:25	11:38	13	4.00	0.000	4.000	16.00
2	11:38	11:53	15	4.00	0.000	4.000	16.00
3	11:53	12:08	15	4.00	0.000	4.000	16.00
4	12:08	12:23	15	4.00	0.000	4.000	16.00
5	12:23	12:34	11	4.00	0.000	4.000	16.00
6	12:34	12:41	13	4.00	0.000	4.000	16.00
7	12:41	1:00	13	4.00	0.000	4.000	16.00
8	1:00	1:13	13	4.00	0.000	4.000	16.00
9	1:13	1:28	15	4.00	0.000	4.000	16.00
10	1:28	1:43	15	4.00	0.000	4.000	16.00
11	1:44	1:54	10	4.00	0.500	3.500	21.00
12	1:54	2:04	10	4.00	0.500	3.500	21.00
13	2:04	2:14	10	4.00	0.750	3.250	19.50
14	2:14	2:24	10	4.00	0.750	3.250	19.50
15	2:24	2:34	10	4.00	0.750	3.250	19.50
16	2:34	2:44	10	4.00	0.750	3.250	19.50
17	2:44	2:54	10	4.00	0.750	3.250	19.50
18	2:54	3:04	10	4.00	0.750	3.250	19.50
					Field Infiltration Rate:		**19.5**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

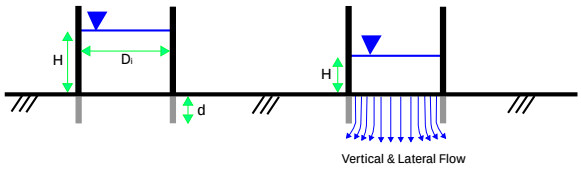
Notes:

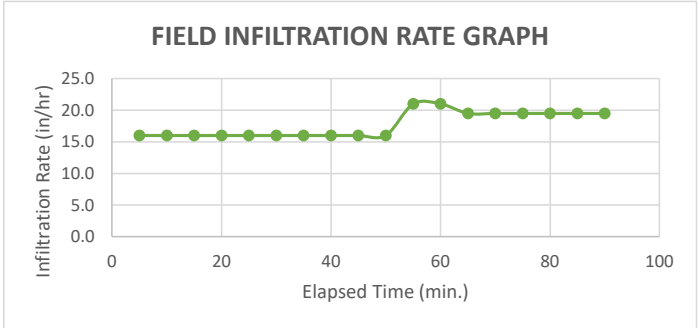
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 4 in

Corresponds to Test Pit Log 49

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 50

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	1/30/2025 Completed 1/30/2025	Testing Depth / Elev.	5 ft / 55.44
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	1:18	1:22	4	6.00	0.0000	6.0000	--
P2	1:22	1:29	7	6.00	0.0000	6.0000	
1	1:29	1:36	7	6.00	0.000	6.000	45.00
2	1:36	1:42	7	6.00	0.000	6.000	45.00
3	1:43	1:50	7	6.00	0.000	6.000	45.00
4	1:50	1:58	8	6.00	0.000	6.000	45.00
					Field Infiltration Rate:		**45.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

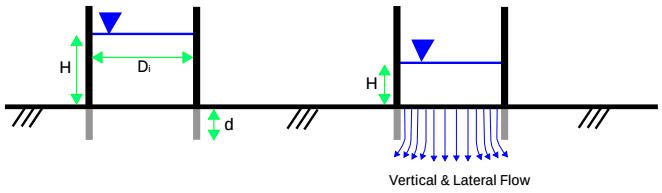
Notes:

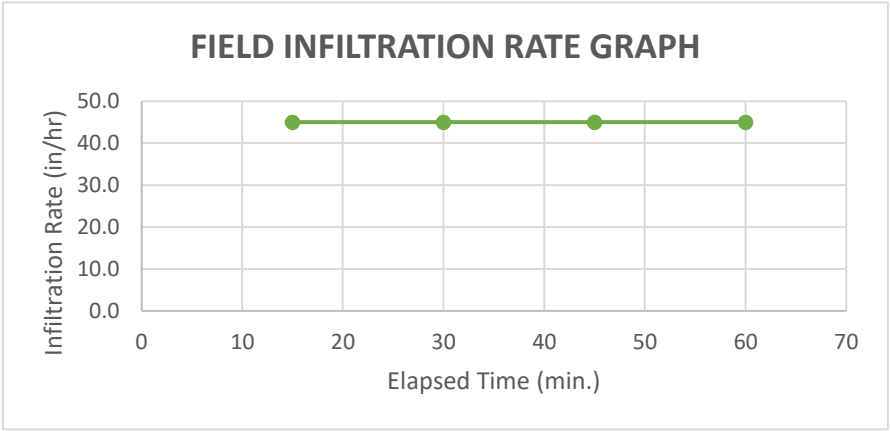
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 2 in

Corresponds to Test Pit Log 50

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 51

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	2/3/2025 Completed 2/3/2025	Testing Depth / Elev.	5 ft / 54.34 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	8:55	9:25	30	5.50	0.7500	4.7500	--
P2	9:25	9:55	30	5.50	1.5000	4.0000	--
1	9:55	10:10	15	5.50	3.375	2.125	8.50
2	10:10	10:25	15	5.50	3.375	2.125	8.50
3	10:25	10:40	15	5.50	3.500	2.000	8.00
4	10:40	10:55	15	5.50	3.500	2.000	8.00
5	10:55	11:10	15	5.50	3.500	2.000	8.00
6	11:10	11:25	15	5.50	3.500	2.000	8.00
7	11:25	11:40	15	5.50	3.500	2.000	8.00
8	11:40	11:55	15	5.50	3.500	2.000	8.00
					Field Infiltration Rate:		**8.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

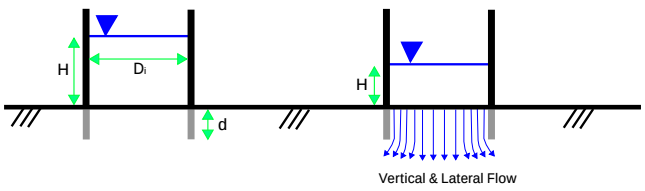
Notes:

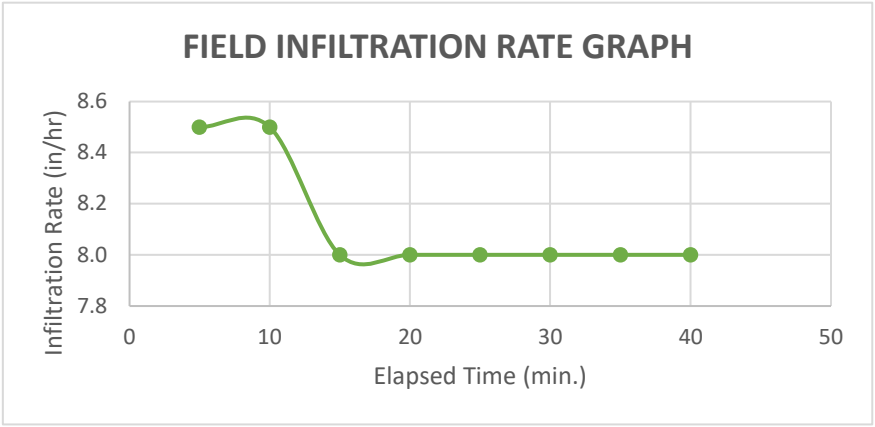
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 2.5 in

Corresponds to Test Pit Log 51

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 52

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	2/3/2025 Completed 2/3/2025	Testing Depth / Elev.	5 ft / 54.42 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	9:34	9:48	14	5.00	0.0000	5.0000	--
P2	9:48	10:12	24	5.00	0.0000	5.0000	--
P3	10:12	10:28	16	5.00	0.0000	5.0000	--
1	10:28	10:43	15	5.00	0.500	4.500	18.00
2	10:43	10:58	15	5.00	0.500	4.500	18.00
3	10:58	11:13	15	5.00	1.000	4.000	16.00
4	11:13	11:28	15	5.00	1.000	4.000	16.00
5	11:28	11:43	15	5.00	1.500	3.500	14.00
6	11:43	11:58	15	5.00	1.500	3.500	14.00
7	11:58	12:13	15	5.00	1.500	3.500	14.00
8	12:13	12:28	15	5.00	1.500	3.500	14.00
					Field Infiltration Rate:		**14.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

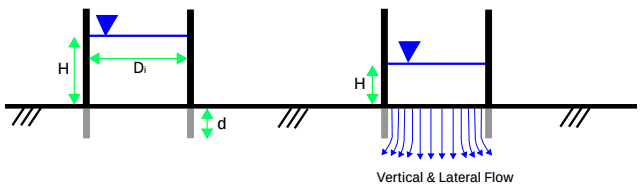
Notes:

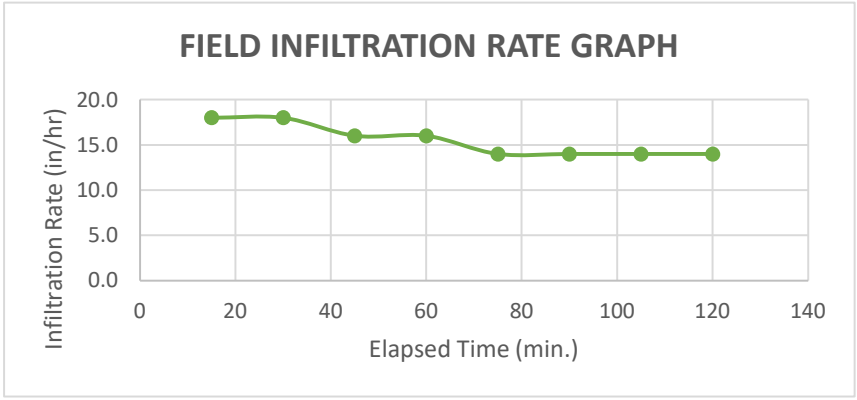
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 52

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 53

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	2/3/2025 Completed 2/3/2025	Testing Depth / Elev.	5 ft / 60.00 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	12:39	12:57	18	4.50	0.0000	4.5000	--
P2	12:57	1:17	20	4.50	0.0000	4.5000	--
P3	1:17	1:39	22	4.50	0.0000	4.5000	--
1	1:40	1:55	15	4.50	0.750	3.750	15.00
2	1:55	2:10	15	4.50	1.000	3.500	14.00
3	2:10	2:25	15	4.50	1.250	3.250	13.00
4	2:25	2:40	15	4.50	1.250	3.250	13.00
5	2:40	2:55	15	4.50	1.250	3.250	13.00
6	2:55	3:10	15	4.50	1.250	3.250	13.00
7	3:10	3:25	15	4.50	1.250	3.250	13.00
8	3:25	3:40	15	4.50	1.250	3.250	13.00
					Field Infiltration Rate:		**13.00**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

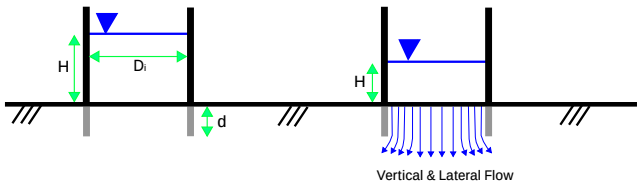
Notes:

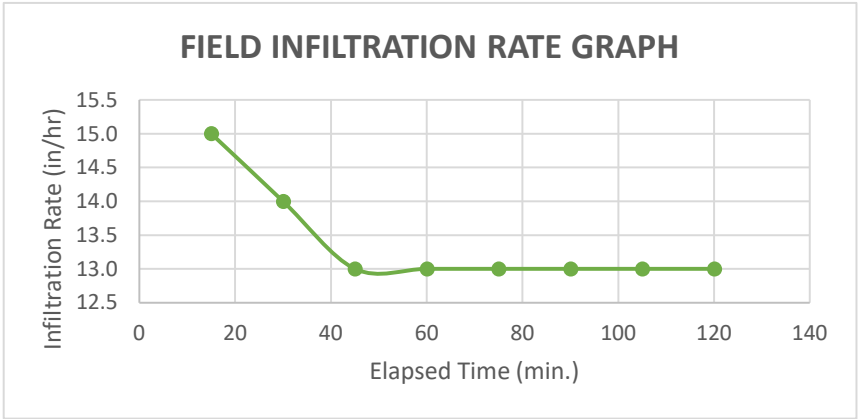
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3.5 in

Corresponds to Test Pit Log 53

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 54

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	2/3/2025 Completed 2/3/2025	Testing Depth / Elev.	5 ft / 59.65 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	12:49	1:09	20	5.00	0.0000	5.0000	--
P2	1:09	1:29	20	5.00	1.0000	4.0000	--
P3	1:29	1:49	20	5.00	1.0000	4.0000	--
1	1:50	2:05	15	5.00	2.000	3.000	12.00
2	2:05	2:20	15	5.00	2.000	3.000	12.00
3	2:20	2:35	15	5.00	2.000	3.000	12.00
4	2:35	2:50	15	5.00	2.000	3.000	12.00
5	2:50	3:05	15	5.00	2.250	2.750	11.00
6	3:05	3:20	15	5.00	2.250	2.750	11.00
7	3:20	3:35	15	5.00	2.250	2.750	11.00
8	3:35	3:50	15	5.00	2.250	2.750	11.00
					Field Infiltration Rate:		**11.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

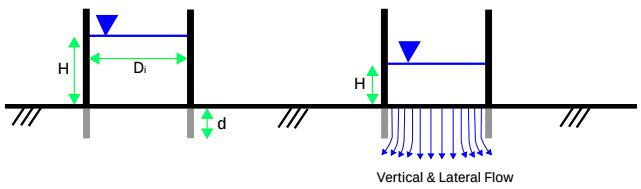
Notes:

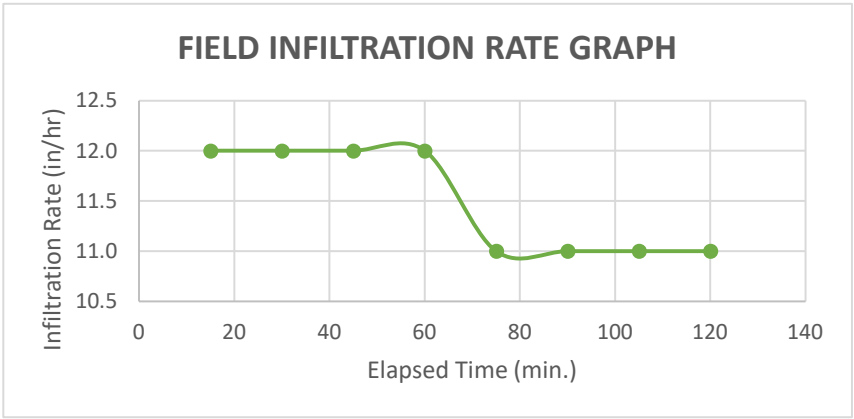
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 54

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 55

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	2/3/2025 Completed 2/3/2025	Testing Depth / Elev.	5 ft / 60.85 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	12:07	12:33	26	5.00	0.0000	5.0000	--
P2	12:33	1:07	34	5.00	1.0000	4.0000	--
1	1:07	1:22	15	5.00	2.875	2.125	8.50
2	1:22	1:37	15	5.00	3.000	2.000	8.00
3	1:37	1:52	15	5.00	3.000	2.000	8.00
4	1:52	2:07	15	5.00	3.000	2.000	8.00
5	2:07	2:22	15	5.00	3.250	1.750	7.00
6	2:22	2:37	15	5.00	3.250	1.750	7.00
7	2:37	2:52	15	5.00	3.250	1.750	7.00
8	2:52	3:07	15	5.00	3.250	1.750	7.00
					Field Infiltration Rate:		**7.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

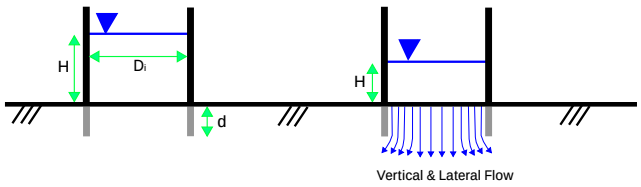
Notes:

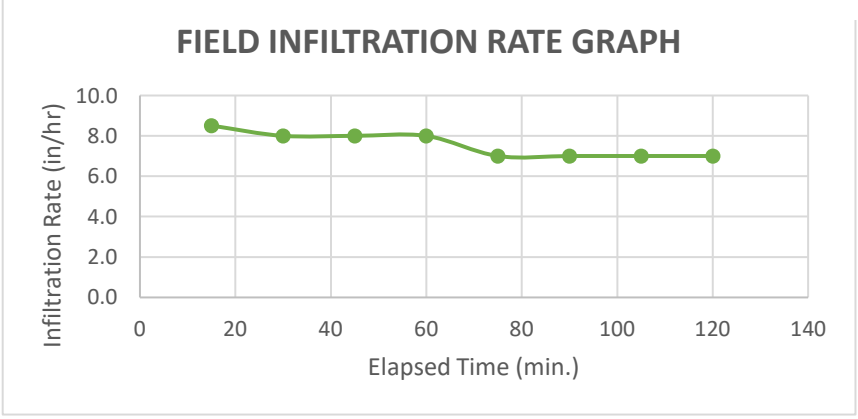
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 55

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 56

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	2/4/2025 Completed 2/4/2025	Testing Depth / Elev.	5 ft / 57.68 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	12:17	12:33	16	5.00	0.0000	5.0000	--
P2	12:33	12:55	22	5.00	0.0000	5.0000	
P3	12:55	1:17	22	5.00	0.5000	4.5000	
1	1:17	1:32	15	5.00	2.250	2.750	11.00
2	1:32	1:47	15	5.00	2.250	2.750	11.00
3	1:47	2:02	15	5.00	2.500	2.500	10.00
4	2:02	2:17	15	5.00	2.500	2.500	10.00
5	2:17	2:32	15	5.00	2.500	2.500	10.00
6	2:32	2:47	15	5.00	2.500	2.500	10.00
7	2:47	3:02	15	5.00	2.500	2.500	10.00
8	3:02	3:17	15	5.00	2.500	2.500	10.00
					Field Infiltration Rate:		**10.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

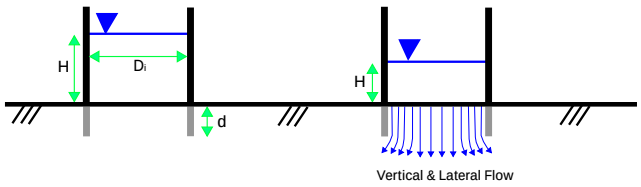
Notes:

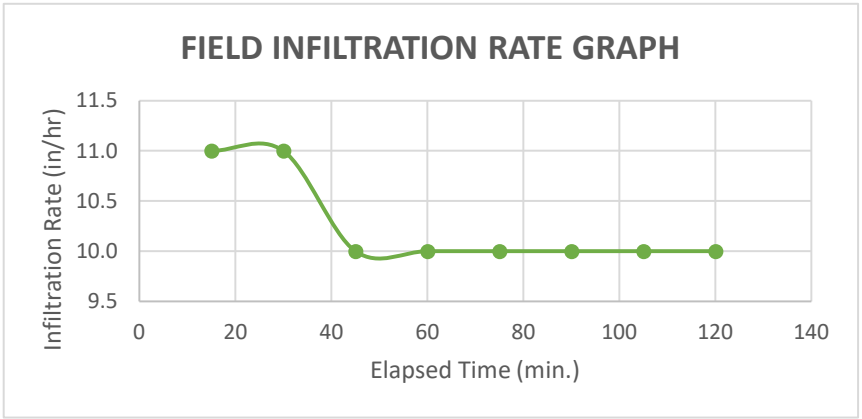
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 56

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 57

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	2/4/2025 Completed 2/4/2025	Testing Depth / Elev.	5 ft / 57.31 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

Trial #	Start time	End Time	DT (min)	H1 (in.)	H2 (in.)	DH (in.)	Rate (in/hr)
P1	9:48	9:53	5	5.00	0.0000	5.0000	--
P2	9:53	10:02	9	5.00	0.0000	5.0000	--
P3	10:02	10:16	14	5.00	0.0000	5.0000	--
1	10:16	10:26	10	5.00	0.750	4.250	25.50
2	10:26	10:36	10	5.00	1.250	3.750	22.50
3	10:36	10:46	10	5.00	1.250	3.750	22.50
4	10:46	10:56	10	5.00	1.500	3.500	21.00
5	10:56	11:06	10	5.00	1.500	3.500	21.00
6	11:06	11:16	10	5.00	1.500	3.500	21.00
7	11:16	11:26	10	5.00	1.500	3.500	21.00
8	11:26	11:36	10	5.00	1.750	3.250	19.50
9	11:36	11:46	10	5.00	1.750	3.250	19.50
10	11:46	11:56	10	5.00	1.750	3.250	19.50
11	11:56	12:06	10	5.00	1.750	3.250	19.50
12	12:06	12:16	10	5.00	1.750	3.250	19.50
					Field Infiltration Rate:		**19.5**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

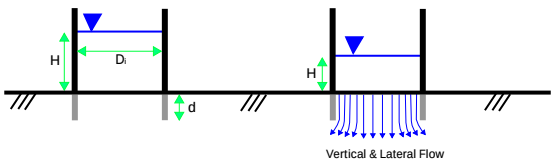
Notes:

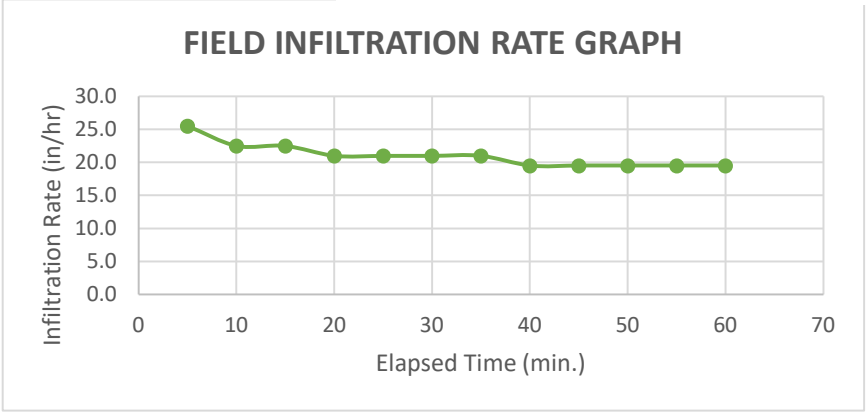
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 57

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 58

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	2/4/2025 Completed 2/4/2025	Testing Depth / Elev.	5 ft / 58.21 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	12:40	1:00	20	5.00	0.0000	5.0000	--
P2	1:00	1:20	20	5.00	0.1250	4.8750	--
P3	1:20	1:40	20	5.00	0.2500	4.7500	--
1	1:40	1:55	15	5.00	1.750	3.250	13.00
2	1:55	2:10	15	5.00	1.750	3.250	13.00
3	2:10	2:25	15	5.00	1.750	3.250	13.00
4	2:25	2:40	15	5.00	1.750	3.250	13.00
5	2:40	2:55	15	5.00	1.875	3.125	12.50
6	2:55	3:10	15	5.00	1.875	3.125	12.50
7	3:10	3:25	15	5.00	1.875	3.125	12.50
8	3:25	3:40	15	5.00	1.875	3.125	12.50
					Field Infiltration Rate:		**12.5**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

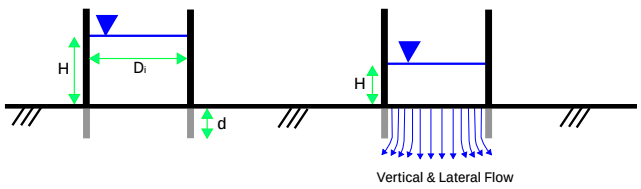
Notes:

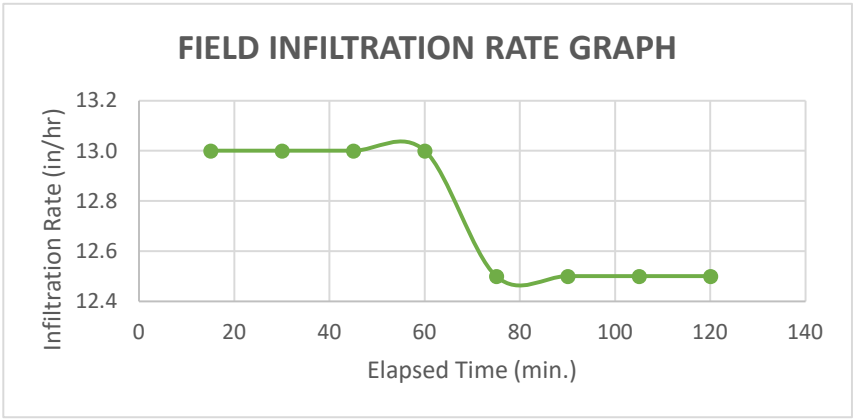
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 58

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 59

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	2/4/2025 Completed 2/4/2025	Testing Depth / Elev.	5 ft / 57.60 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	10:40	10:50	10	5.00	0.0000	5.0000	--
P2	10:50	11:01	11	5.00	0.0000	5.0000	--
P3	11:01	11:11	10	5.00	0.7500	4.2500	--
1	11:11	11:21	10	5.00	1.250	3.750	22.50
2	11:21	11:31	10	5.00	1.000	4.000	24.00
3	11:31	11:41	10	5.00	1.000	4.000	24.00
4	11:41	11:51	10	5.00	1.250	3.750	22.50
5	11:51	12:01	10	5.00	1.250	3.750	22.50
6	12:01	12:11	10	5.00	1.250	3.750	22.50
7	12:11	12:21	10	5.00	1.250	3.750	22.50
8	12:21	12:31	10	5.00	1.250	3.750	22.50
					Field Infiltration Rate:		**22.5**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

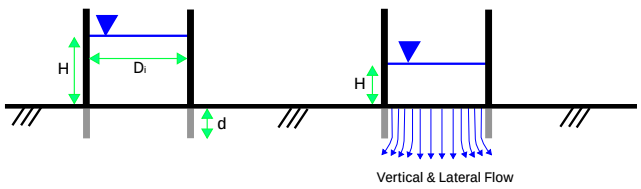
Notes:

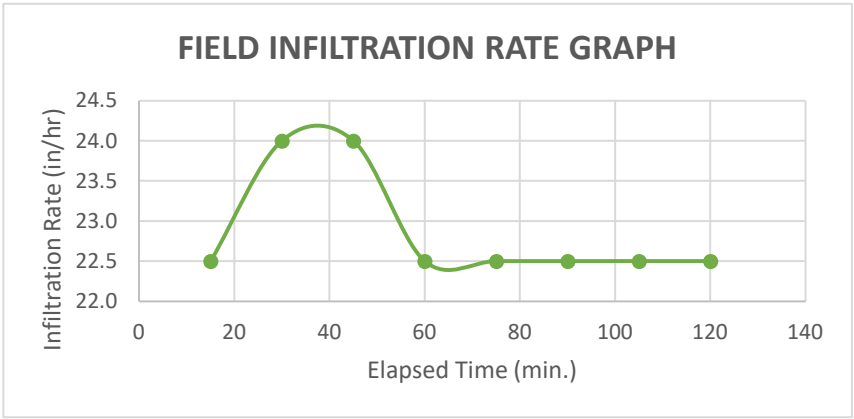
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 59

SINGLE RING INFILTRATION TESTING





Single Ring Infiltration Log

INF - 60

Client	Landmark Science & Engineering	Project Name	ASD Summit Campus
Project Number	LDMSE24001	Project Location	Middletown, DE
Date Started	2/4/2025 Completed 2/4/2025	Testing Depth / Elev.	5 ft / 57.19 ft
Test Performed By	B. Gordon	Water Depth /Elev.	Not encountered
Excavator / Operator	Jim Feldmann	Equipment	New Holland EH 50.B

							Rate (in/hr)
Trial #	**Start time**	**End Time**	**DT (min)**	**H1 (in.)**	**H2 (in.)**	**DH (in.)**	
P1	9:17	9:32	15	5.00	0.0000	5.0000	--
P2	9:32	9:50	18	5.00	0.0000	5.0000	--
P3	9:50	10:13	23	5.00	0.0000	5.0000	--
1	10:14	10:29	15	5.00	1.875	3.125	12.50
2	10:29	10:44	15	5.00	2.000	3.000	12.00
3	10:44	10:59	15	5.00	2.000	3.000	12.00
4	10:59	11:14	15	5.00	2.500	2.500	10.00
5	11:14	11:29	15	5.00	2.500	2.500	10.00
6	11:29	11:44	15	5.00	2.500	2.500	10.00
7	11:44	11:59	15	5.00	2.500	2.500	10.00
8	11:59	12:14	15	5.00	2.500	2.500	10.00
					Field Infiltration Rate:		**10.0**

* Pre soak rates are not included in the calculated average. The field verified infiltration rate shall be the final steady state reading of the test performed

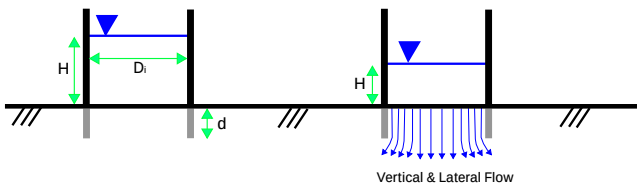
Notes:

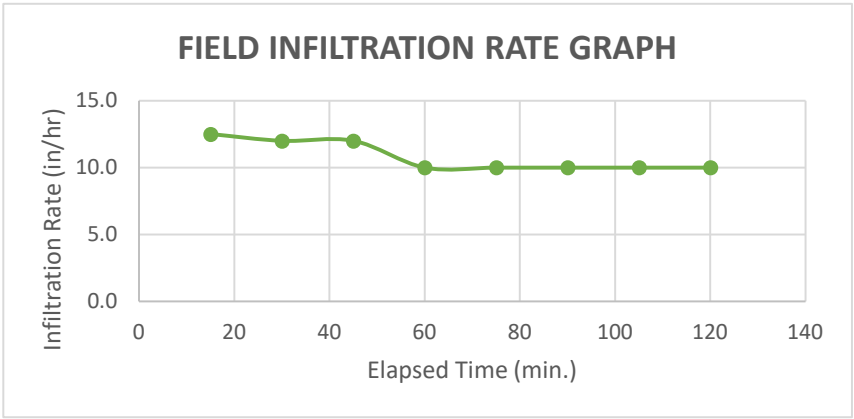
Diameter Inner Ring, Di: 5.5 in

Seating Depth of Rings, d: 3 in

Corresponds to Test Pit Log 60

SINGLE RING INFILTRATION TESTING





Subsurface Stratigraphy Cross Sections

NO USCS - STRATIGRAPHY & GW - A SIZE - PENNONI_STANDARD_TEMPLATE_2018.GDT - 2/18/25 08:47 - U:\ACCOUNTS\LDMSE\LDMSE24001 - ASD SUMMIT CAMPUS\ANALYTICAL\FIELD DATA\ADDIT

SUBSURFACE DIAGRAM

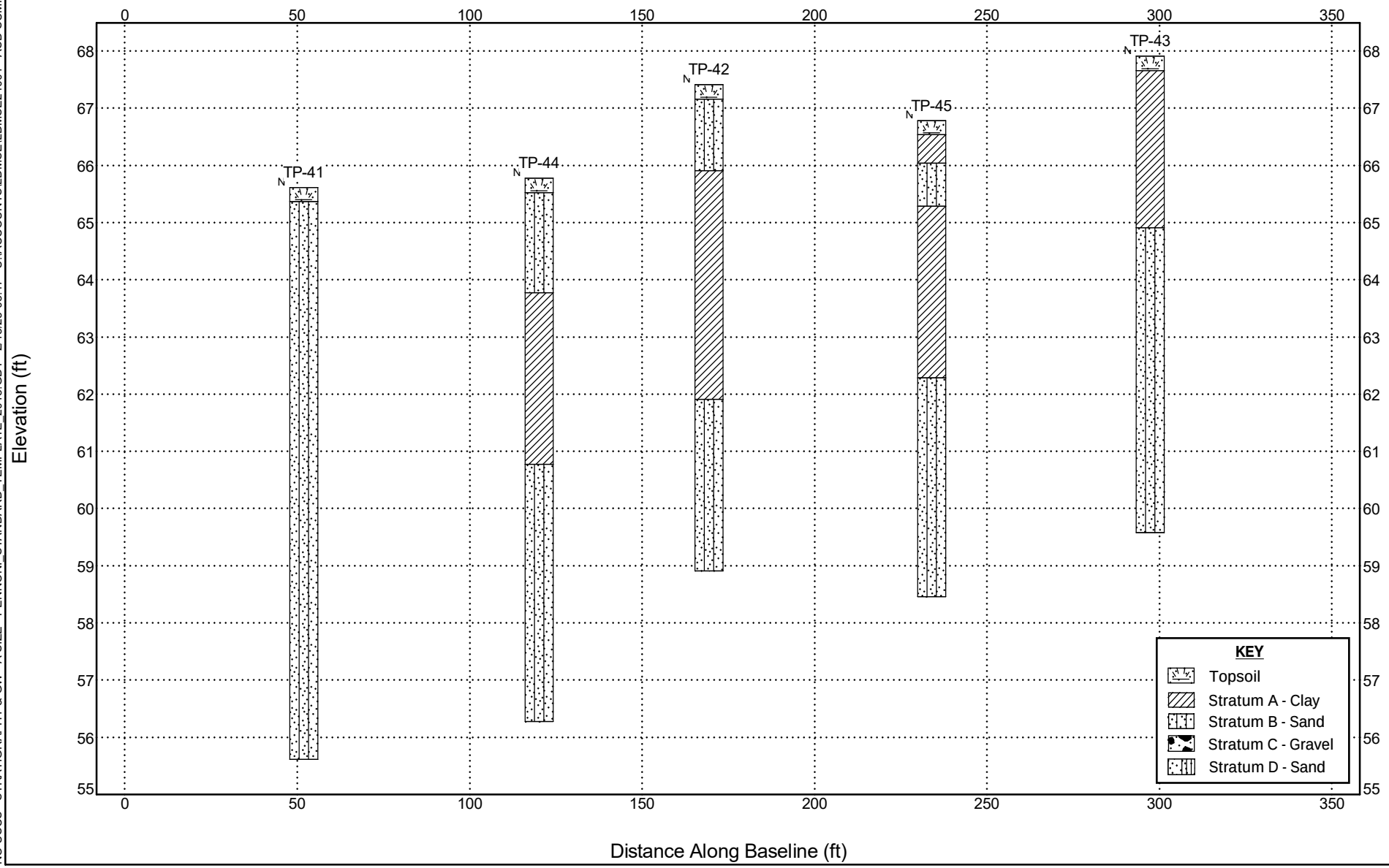
Subsurface Stratigraphy (CS-1)

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware



NO USCS - STRATIGRAPHY & GW - A SIZE - PENNONI_STANDARD_TEMPLATE_2018.GDT - 2/18/25 08:49 - U:\ACCOUNTS\LDMSE\LDMSE24001 - ASD SUMMIT CAMPUS\ANALYTICAL\FIELD DATA\ADDIT

SUBSURFACE DIAGRAM

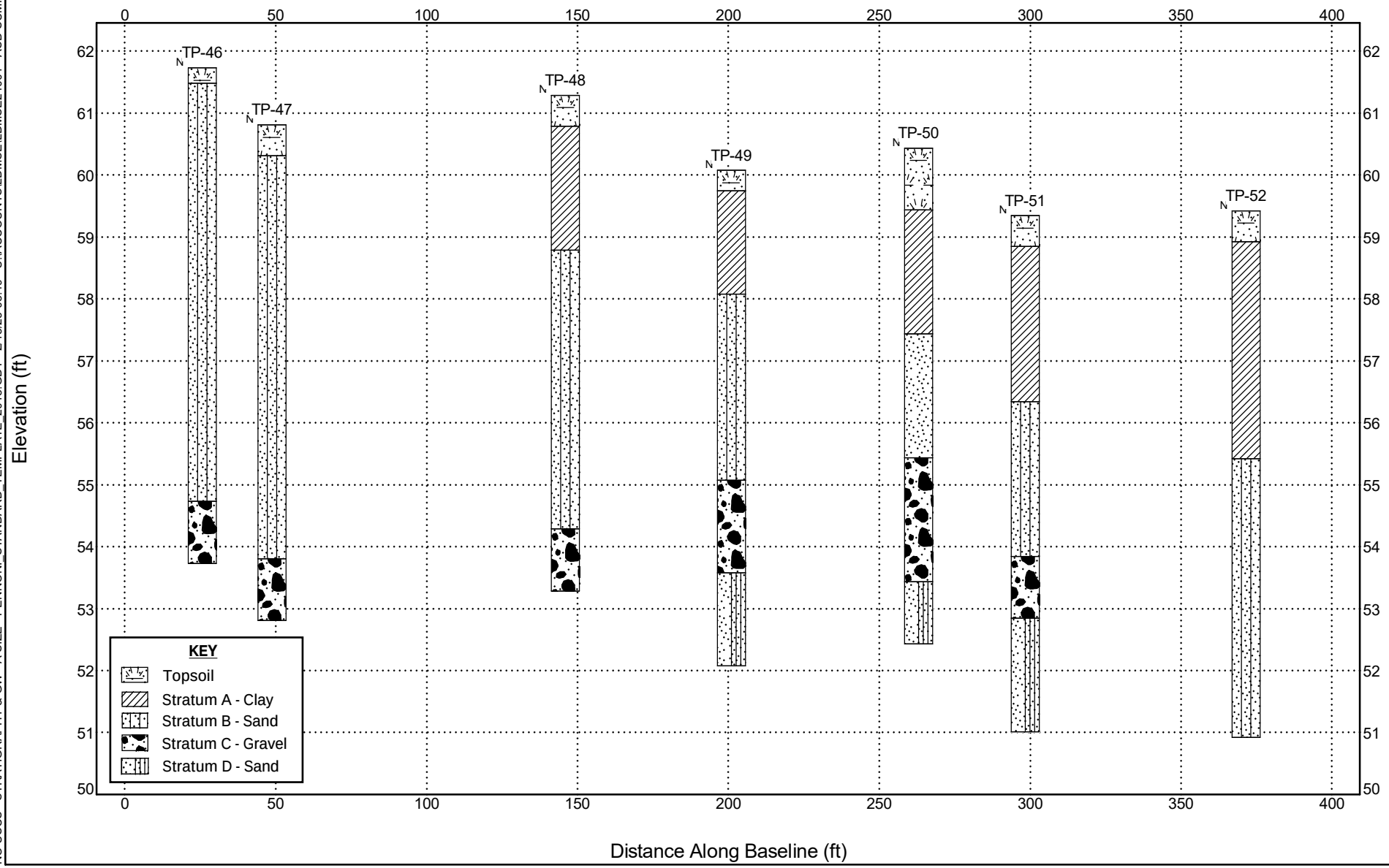
Subsurface Stratigraphy (CS-2)

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware



NO USCS - STRATIGRAPHY & GW - A SIZE - PENNONI_STANDARD_TEMPLATE_2018.GDT - 2/18/25 08:51 - U:\ACCOUNTS\LDMSE\LDMSE24001 - ASD SUMMIT CAMPUS\ANALYTICAL\FIELD DATA\ADDIT

SUBSURFACE DIAGRAM

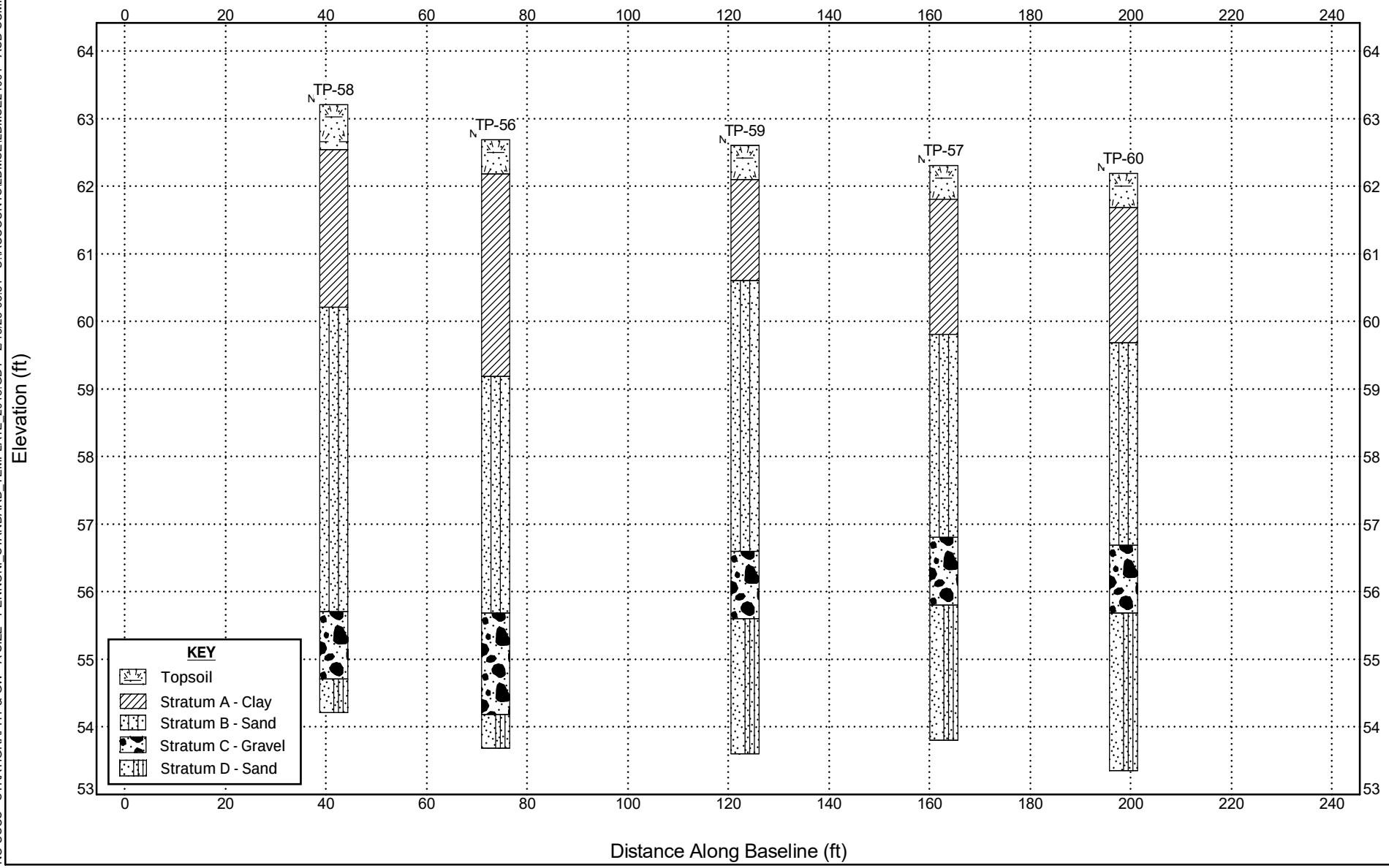
Subsurface Stratigraphy (CS-3)

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware



NO USCS - STRATIGRAPHY & GW - A SIZE - PENNONI_STANDARD_TEMPLATE_2018.GDT - 2/18/25 08:52 - U:\ACCOUNTS\LDMSE\LDMSE24001 - ASD SUMMIT CAMPUS\ANALYTICAL\FIELD DATA\ADDIT

SUBSURFACE DIAGRAM

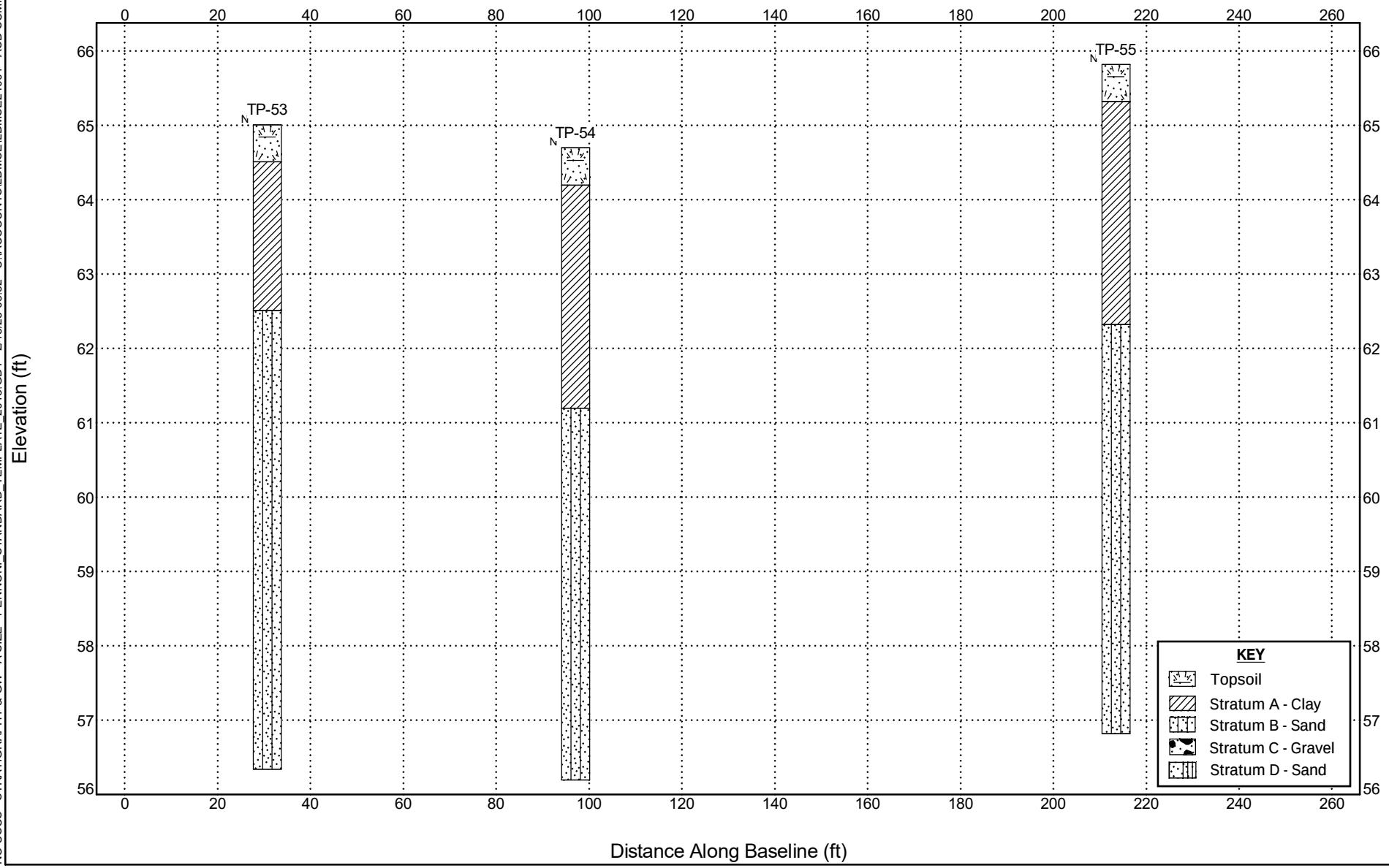
Subsurface Stratigraphy (CS-4)

CLIENT Landmark Science & Engineering

PROJECT NAME ASD Summit Campus - Addendum 1

PROJECT NUMBER LDMSE24001

PROJECT LOCATION Middletown, Delaware



Laboratory Results

Pennoni

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION				PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			Organic Content (%)			SHEAR STRENGTH		
				GRAVEL %	SAND %	SILT %	CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_p	LIQUIDITY INDEX I_L		SPECIFIC GRAVITY (G)	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)
B-26	S-4	6-8		2	76	22						12.2													
B-27	S-2	2-4	SC	3	52	45		25	17	8	-0.8	10.9													
B-28	S-6	14-16		51	39	10						8.7													
B-29	S-1	0-2	CL-ML	0	39	61		25	18	7	-0.4	14.9													
B-30	S-6	13-15		0	92	8						27.8													
B-31	S-3	4-6		0	83	17						9.0													
B-32	S-1	4-6	SC-SM	9	42	49		23	16	7	-0.5	12.3													
B-33	S-3	4-6		0	88	12						8.1													
B-34	S-7	18-20		0	85	15						30.7													
B-35	S-6	14-16		31	54	15						5.9													
B-36	S-2	2-4		4	76	20						7.7													
B-37	S-1	0-2	CL	0	25	75		27	18	9	-0.1	17.1													

PENNONI ASSOCIATES INC.	DRAWN BY: MB	DATE: 2/11/2025	PROJECT: **Appoquinimink School District Summit Campus**
	CHECKED BY: JTR	DATE: 2/12/2025	LOCATION: **Middletown, DE**

JOB No.: **LDMSE24001.02**

TABLE No.: **L-1**

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION				PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			Organic Content (%)			SHEAR STRENGTH		
				GRAVEL %	SAND %	SILT %	CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_p	LIQUIDITY INDEX I_L		SPECIFIC GRAVITY (G)	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)
B-38	S-5	8-10		0	85	15						10.3													
B-39	S-1	0-2		0	27	73						17.6													
B-40	S-2	2-4		0	47	53						14.7													
B-41	S-1	0-2	CL	0	16	84		35	19	16	-0.1	18.2													
B-42	S-3	4-6		0	81	19						7.3													
B-43	S-1	0-2		0	46	54						20.1													
B-44	S-4	6-8		0	92	8						5.6													

PENNONI ASSOCIATES INC.	DRAWN BY: MB CHECKED BY: JTR	DATE: 2/11/2025 DATE: 2/12/2025
PROJECT: **Appoquinimink School District Summit Campus** LOCATION: **Middletown, DE**	JOB No.: **LDMSE24001.02** TABLE No.: **L-2**	

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION				PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			Organic Content (%)			SHEAR STRENGTH		
				GRAVEL %	SAND %	SILT %	CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_P	LIQUIDITY INDEX I_L		SPECIFIC GRAVITY (G)	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)
INF-41	S-1	5		0	88	12						8.0													
INF-42	S-1	5	CL	1	49	50		25	16	9	-0.6	11.0													
INF-43	S-1	5		1	87	12						8.6													
INF-44	S-1	5		0	76	24						14.9													
INF-45	S-1	5		3	59	38						14.2													
INF-46	S-1	5		0	84	16						8.1													
INF-47	S-1	5		0	86	14						6.0													
INF-48	S-1	5		0	85	15						8.9													
INF-49	S-1	5		2	88	10						7.5													
INF-50	S-1	5		56	34	10						6.1													
INF-51	S-1	5		1	88	11						8.8													
INF-52	S-1	5		0	92	8						7.1													

PENNONI ASSOCIATES INC.

DRAWN BY: JTR DATE: 2/17/2025

CHECKED BY: DATE:

PROJECT: **Appoquinimink School District Summit Campus**

LOCATION: **Middletown, DE**

JOB No.: **LDMSE24001.02**

TABLE No.: **L-3**

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION				PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			Organic Content (%)			SHEAR STRENGTH		
				GRAVEL %	SAND %	SILT %	CLAY %	LIQUID LIMIT w_l	PLASTIC LIMIT wp	PLASTICITY INDEX I_P	LIQUIDITY INDEX I_L		SPECIFIC GRAVITY (G)	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)
INF-53	S-1	5		0	85	15						7.2													
INF-54	S-1	5		0	89	11						5.8													
INF-55	S-1	5		0	78	22						7.7													
INF-56	S-1	5		1	88	11						5.4													
INF-57	S-1	5		10	78	12						7.2													
INF-58	S-1	5		2	88	10						5.8													
INF-59	S-1	5		2	87	11						6.0													
INF-60	S-1	5		1	92	7						4.2													

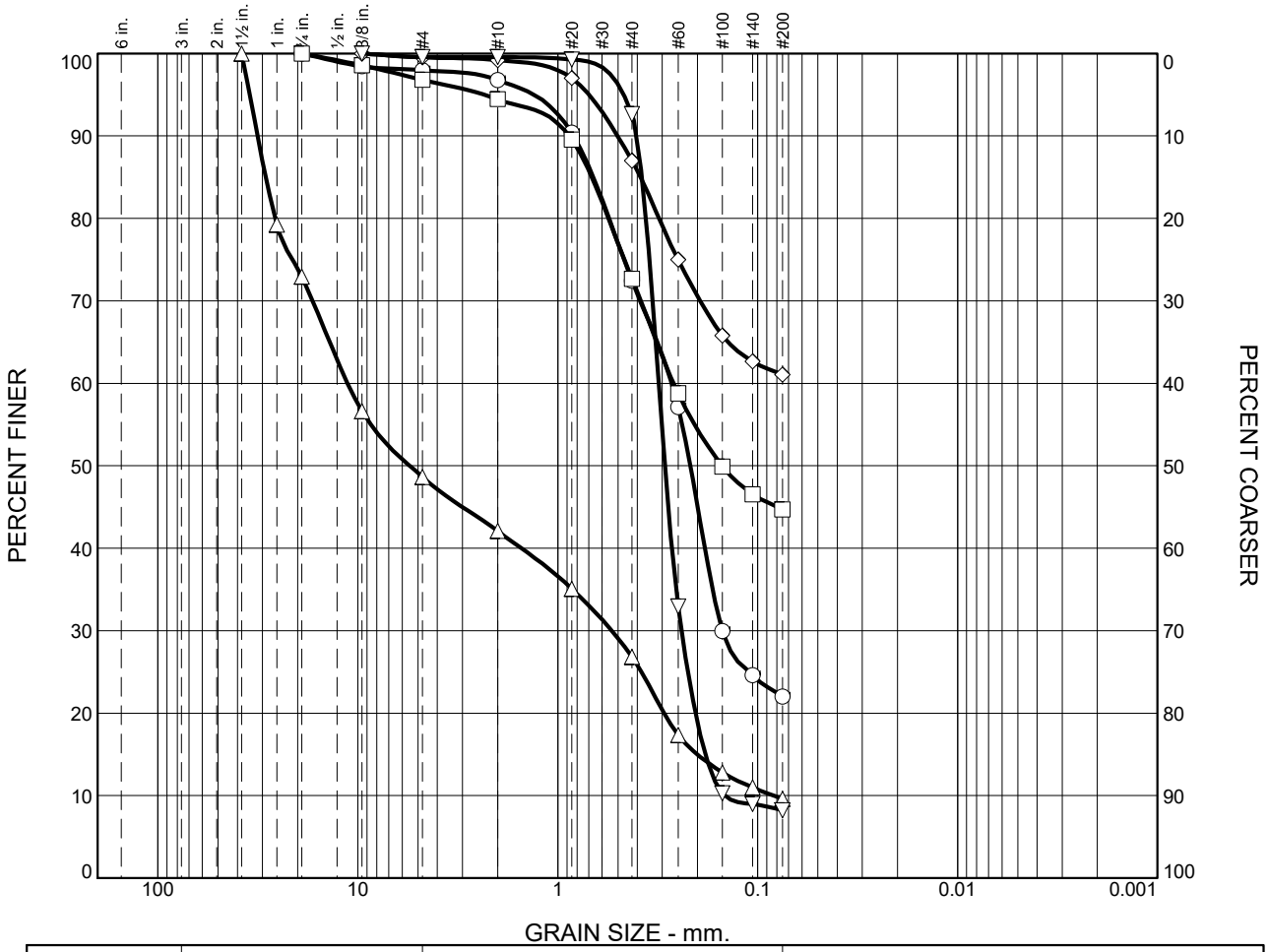
PENNONI ASSOCIATES INC.	DRAWN BY: JTR	DATE: 2/17/2025	PROJECT: **Appoquinimink School District Summit Campus**
	CHECKED BY:	DATE:	LOCATION: **Middletown, DE**

JOB No.: **LDMSE24001.02**

TABLE No.: **L-4**

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	2	1	25	50	22	
□	0	0	3	3	21	28	45	
△	0	27	24	7	15	17	10	
◇	0	0	0	1	12	26	61	
▽	0	0	0	0	7	85	8	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-26	S-4	6-8	F/M/C Sand, Some Silt/Clay, Trace Fine Gravel	
□	B-27	S-2	2-4	F/M/C Sand, And Silt/Clay, Trace Fine Gravel	SC
△	B-28	S-6	14-16	C/F Gravel, And F/M/C Sand, Little Silt/Clay	
◇	B-29	S-1	0-2	Silt/Clay, And F/M/C Sand	CL-ML
▽	B-30	S-6	13-15	F/M Sand, Trace Silt/Clay	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

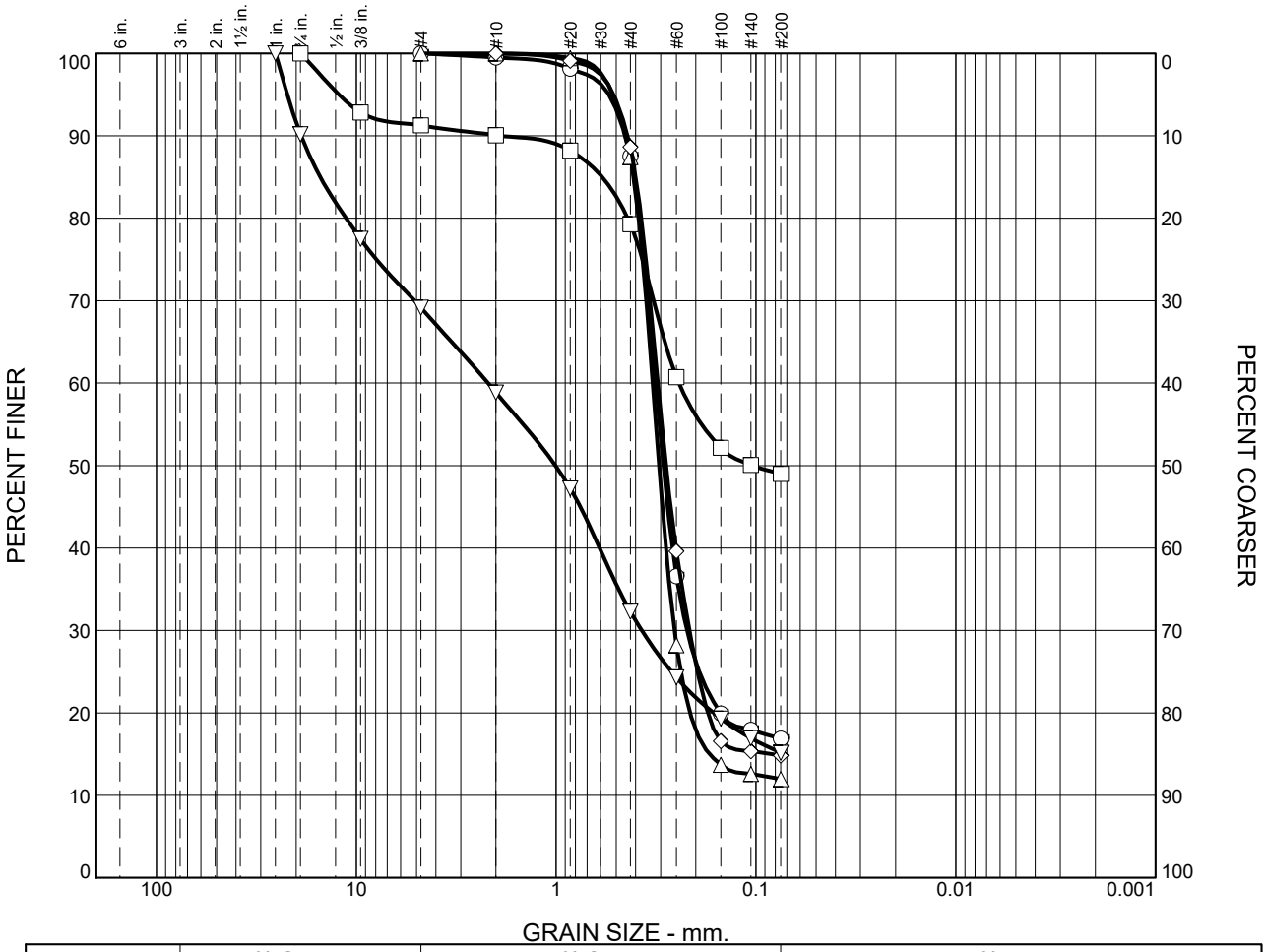
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.02 **Figure** S-1

Tested By: ○ MB □ BG △ MB ◇ BG ▽ MB **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	1	11	71	17	
□	0	0	9	1	11	30	49	
△	0	0	0	0	13	75	12	
◇	0	0	0	0	11	74	15	
▽	0	10	21	10	27	17	15	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-31	S-3	4-6	F/M/C Sand, Little Silt/Clay	
□	B-32	S-1	4-6	Silt/Clay, And F/M/C Sand, Trace Fine Gravel	SC-SM
△	B-33	S-3	4-6	F/M Sand, Little Silt/Clay	
◇	B-34	S-7	18-20	F/M Sand, Little Silt/Clay	
▽	B-35	S-6	14-16	M/F/C Sand, Some F/C Gravel, Little Silt/Clay	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

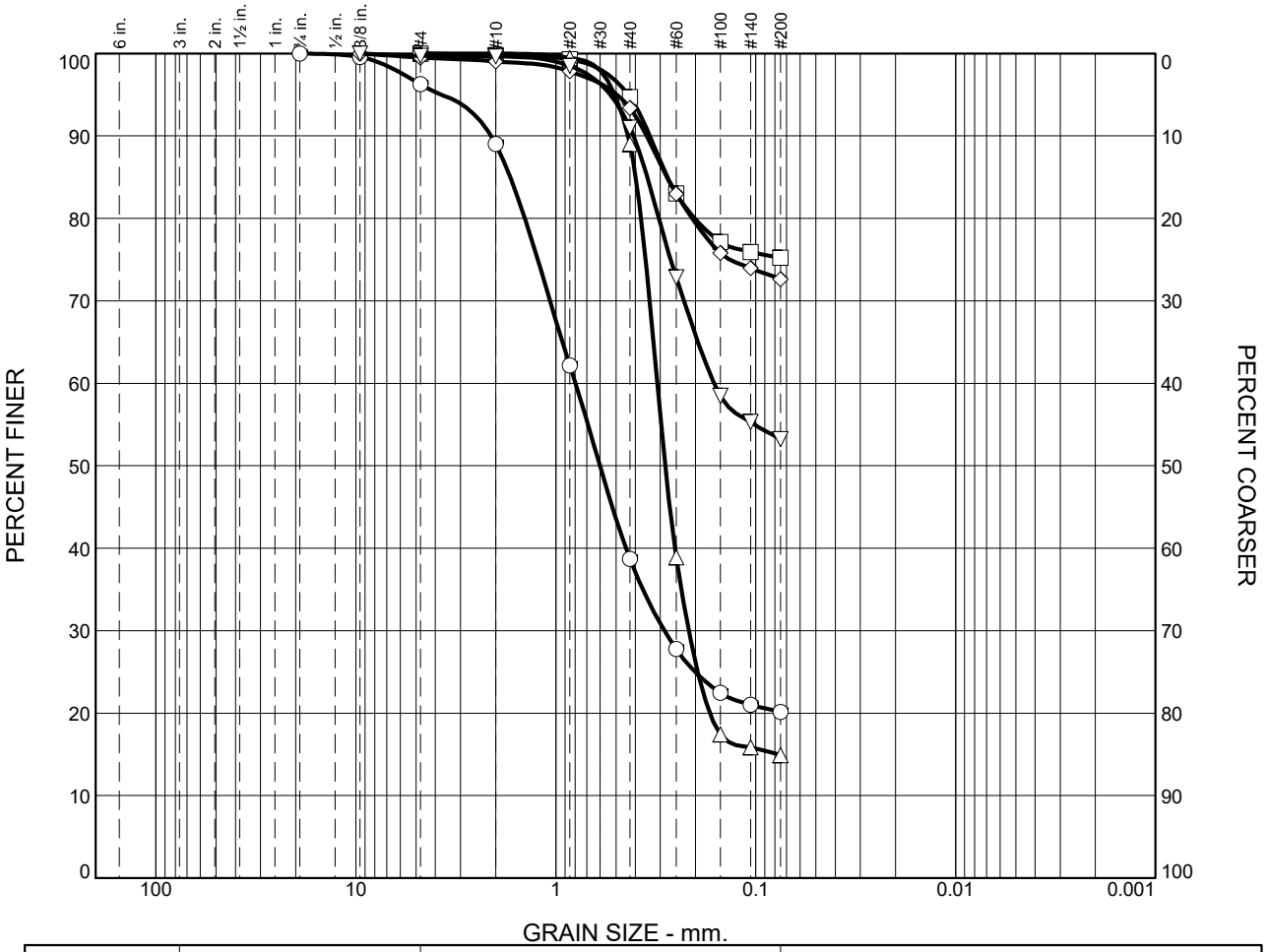
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.02 **Figure** S-2

Tested By: BG **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	4	7	50	19	20	
□	0	0	0	0	5	20	75	
△	0	0	0	0	11	74	15	
◇	0	0	0	1	6	20	73	
▽	0	0	0	0	9	38	53	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-36	S-2	2-4	M/F/C Sand, Some Silt/Clay, Trace Fine Gravel	
□	B-37	S-1	0-2	Silt/Clay, Some F/M Sand	CL
△	B-38	S-5	8-10	F/M Sand, Little Silt/Clay	
◇	B-39	S-1	0-2	Silt/Clay, Some F/M/C Sand	
▽	B-40	S-2	2-4	Silt/Clay, And F/M Sand	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

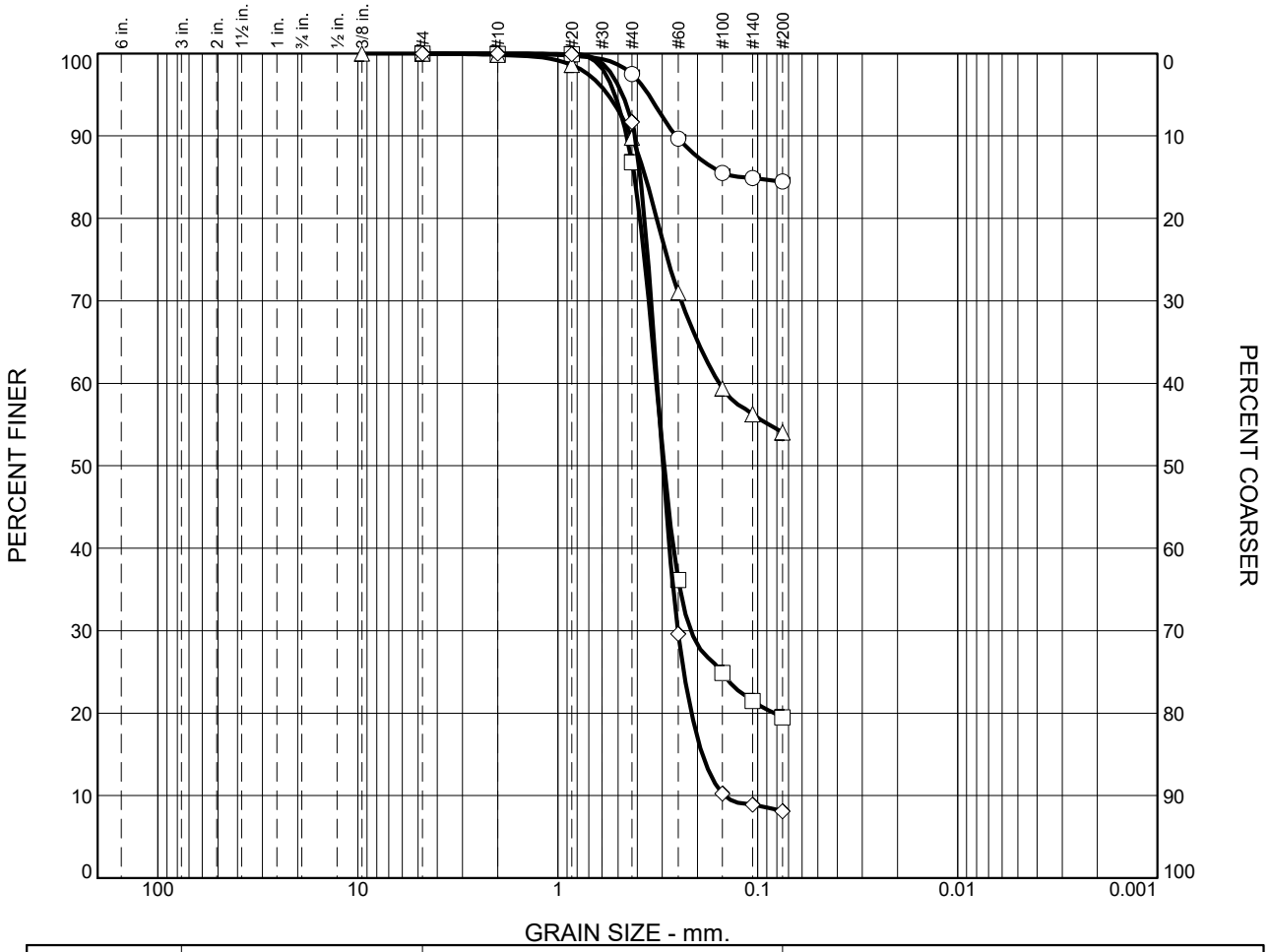
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.02 **Figure** S-3

Tested By: BG **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	2	14	84	
□	0	0	0	0	13	68	19	
△	0	0	0	0	10	36	54	
◇	0	0	0	0	8	84	8	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-41	S-1	0-2	Silt/Clay, Little F/M Sand	CL
□	B-42	S-3	4-6	F/M Sand, Little Silt/Clay	
△	B-43	S-1	0-2	Silt/Clay, And F/M Sand	
◇	B-44	S-4	6-8	F/M Sand, Little Silt/Clay	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

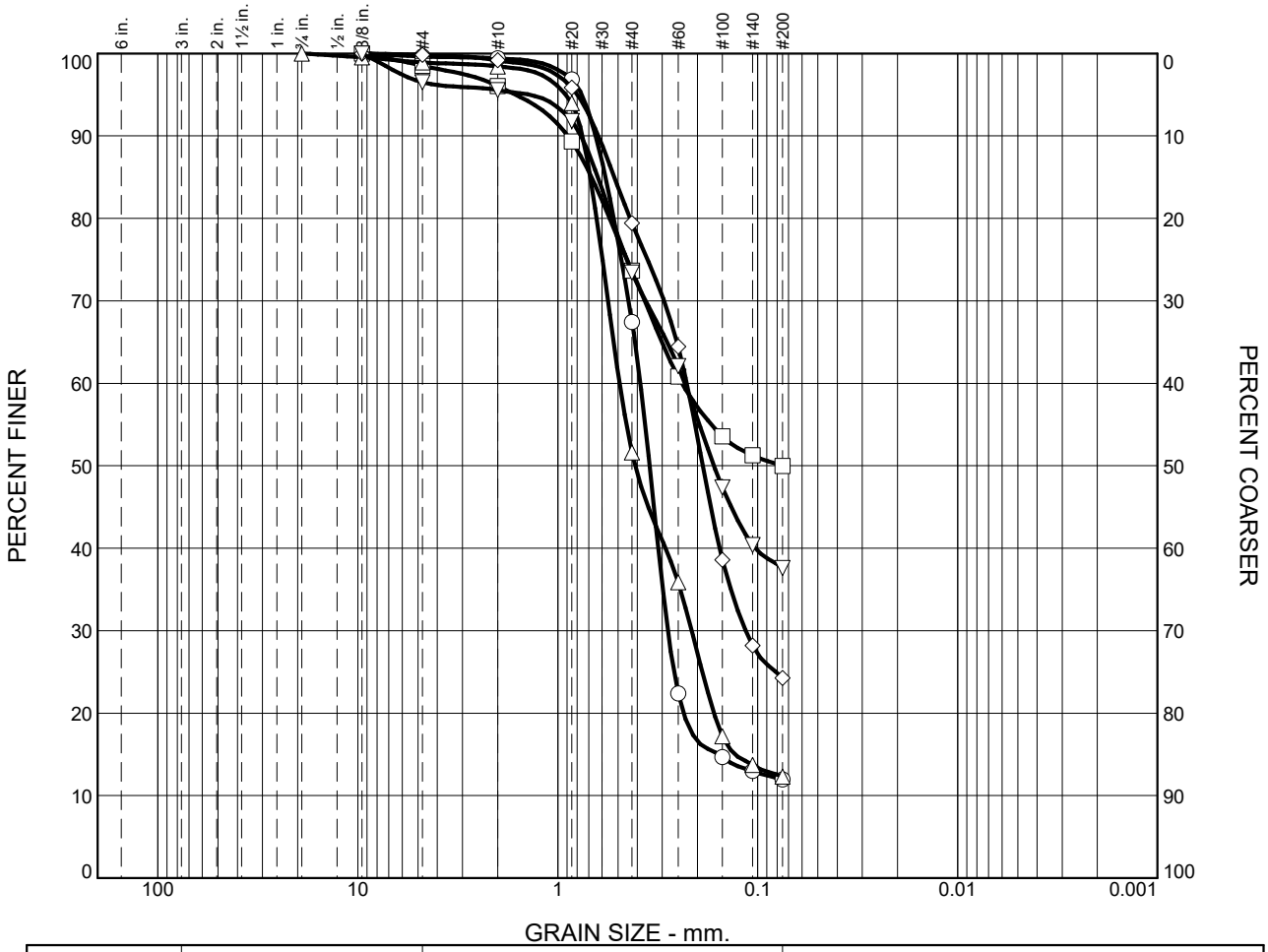
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.02 **Figure** S-4

Tested By: BG **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	1	32	55	12	
□	0	0	1	3	22	24	50	
△	0	0	1	1	46	40	12	
◇	0	0	0	1	20	55	24	
▽	0	0	3	1	23	35	38	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	INF-41	S-1	5	F/M/C Sand, Little Silt/Clay	
□	INF-42	S-1	5	Silt/Clay, And F/M/C Sand, Trace Fine Gravel	CL
△	INF-43	S-1	5	M/F/C Sand, Little Silt/Clay, Trace Fine Gravel	
◇	INF-44	S-1	5	F/M/C Sand, Some Silt/Clay	
▽	INF-45	S-1	5	F/M/C Sand, And Silt/Clay, Trace Fine Gravel	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

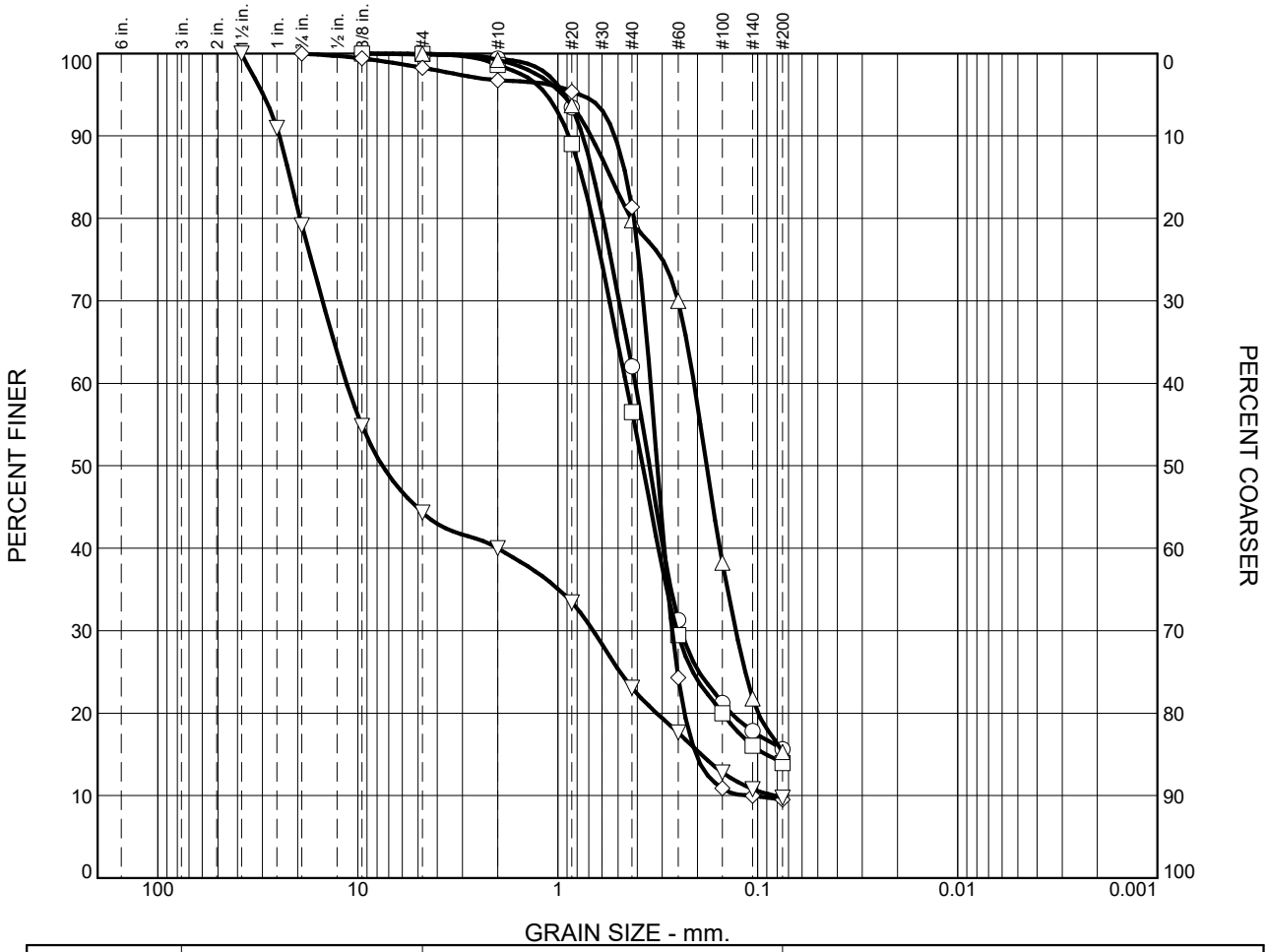
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.02 **Figure** S-5

Tested By: BG **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	1	37	46	16	
□	0	0	0	1	42	43	14	
△	0	0	0	1	19	65	15	
◇	0	0	2	1	16	71	10	
▽	0	21	35	4	17	13	10	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	INF-46	S-1	5	F/M/C Sand, Little Silt/Clay	
□	INF-47	S-1	5	F/M/C Sand, Little Silt/Clay	
△	INF-48	S-1	5	F/M/C Sand, Little Silt/Clay	
◇	INF-49	S-1	5	F/M/C Sand, Little Silt/Clay, Trace Fine Gravel	
▽	INF-50	S-1	5	F/C Gravel, Some M/F/C Sand, Little Silt/Clay	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

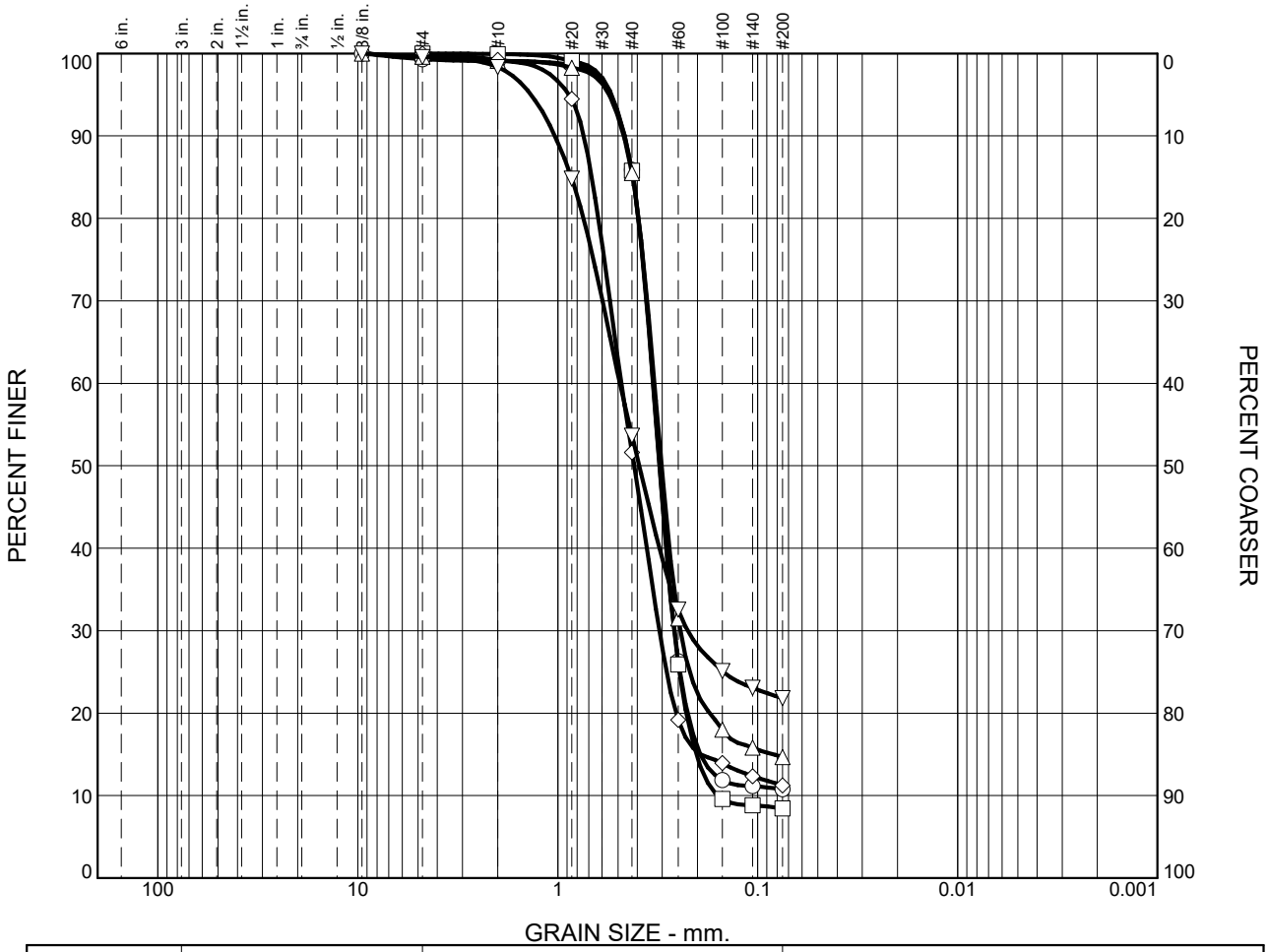
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.02 **Figure** S-6

Tested By: BG **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	1	0	13	75	11	
□	0	0	0	0	14	78	8	
△	0	0	0	1	13	71	15	
◇	0	0	0	1	47	41	11	
▽	0	0	0	2	44	32	22	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	INF-51	S-1	5	F/M Sand, Little Silt/Clay, Trace Fine Gravel	
□	INF-52	S-1	5	F/M Sand, Trace Silt/Clay	
△	INF-53	S-1	5	F/M/C Sand, Little Silt/Clay	
◇	INF-54	S-1	5	M/F/C Sand, Little Silt/Clay	
▽	INF-55	S-1	5	M/F/C Sand, Some Silt/Clay	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

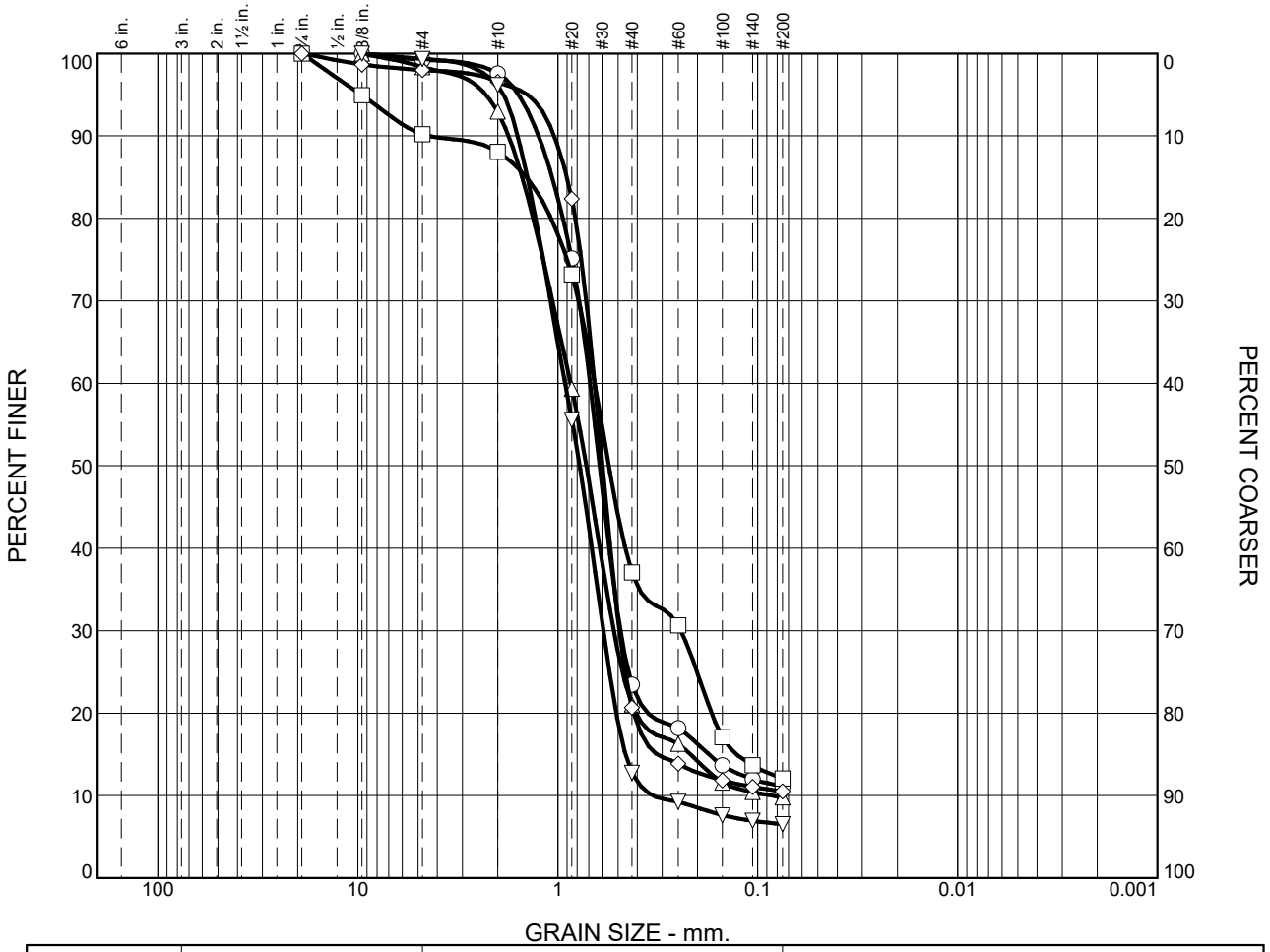
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.02 **Figure** S-7

Tested By: BG **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical s

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	1	1	75	12	11	
□	0	0	10	2	51	25	12	
△	0	0	2	5	72	11	10	
◇	0	0	2	1	76	10	11	
▽	0	0	1	3	83	6	7	

SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	INF-56	S-1	5	M/F/C Sand, Little Silt/Clay, Trace Fine Gravel	
□	INF-57	S-1	5	M/F/C Sand, Little Silt/CLay, Little Fine Gravel	
△	INF-58	S-1	5	M/F/C Sand, Little Silt/Clay, Trace Fine Gravel	
◇	INF-59	S-1	5	M/F/C Sand, Little Silt/Clay, Trace Fine Gravel	
▽	INF-60	S-1	5	M/F/C Sand, Trace Silt/Clay, Trace Fine Gravel	

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

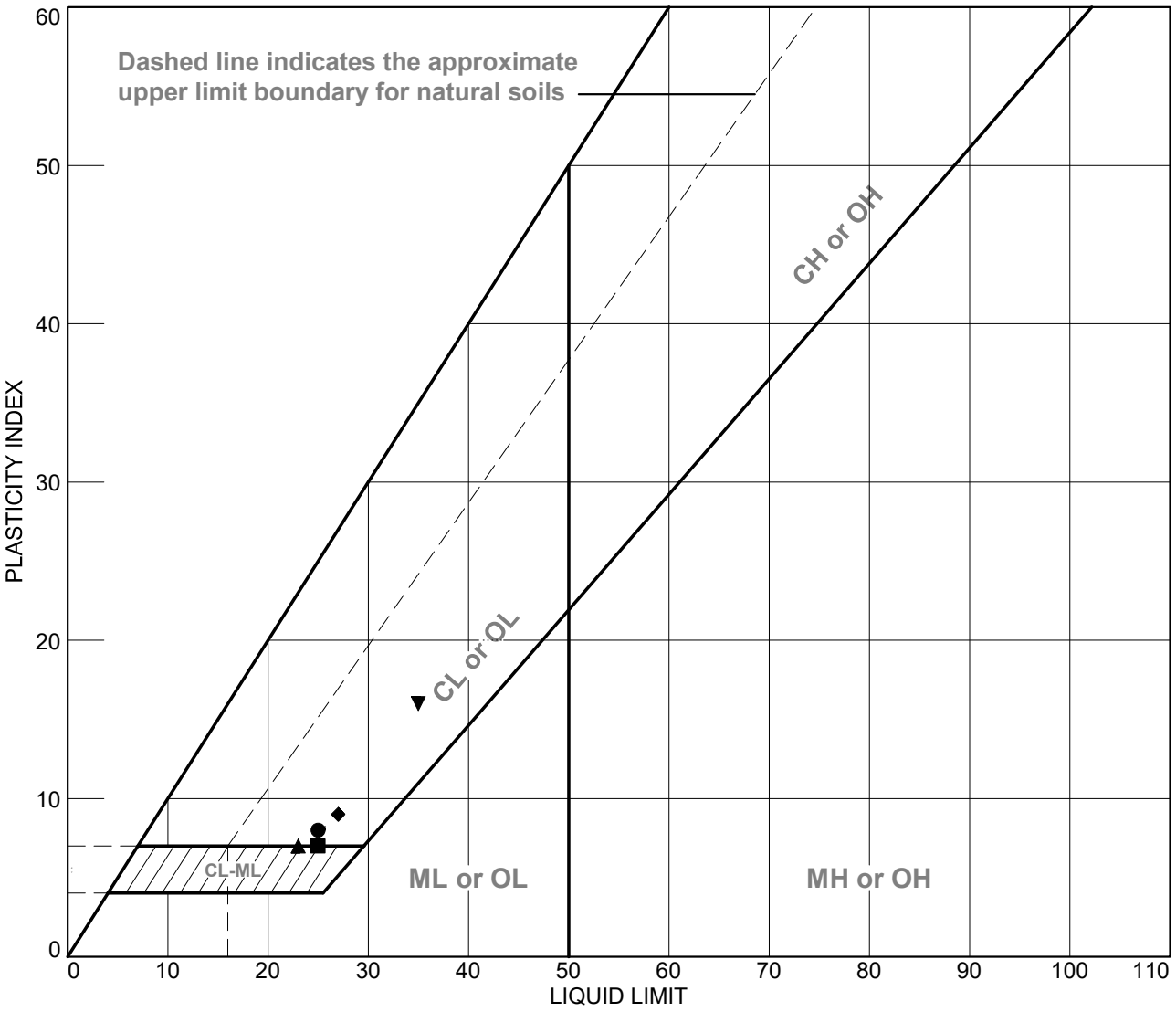
Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.02 **Figure** S-8

Tested By: BG **Checked By:** JTR

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-27	S-2	2-4	10.9	17	25	8	SC
■	B-29	S-1	0-2	14.9	18	25	7	CL-ML
▲	B-32	S-1	4-6	12.3	16	23	7	SC-SM
◆	B-37	S-1	0-2	17.1	18	27	9	CL
▼	B-41	S-1	0-2	18.2	19	35	16	CL

PENNONI ASSOCIATES INC.

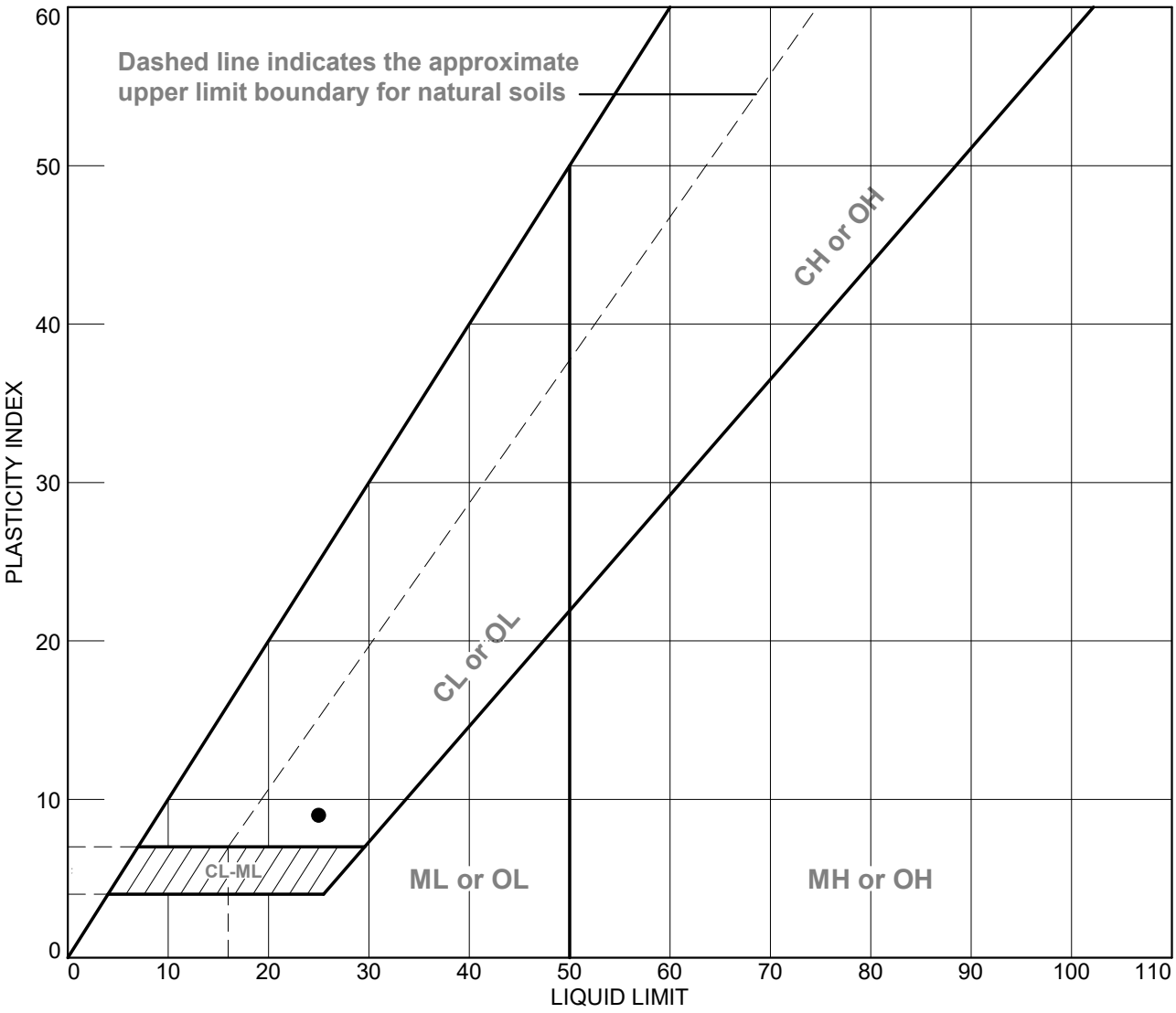
Client: Landmark Science & Engineering

Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.02 **Figure** A-1

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	INF-42	S-1	5	11.0	16	25	9	CL

PENNONI ASSOCIATES INC.

Client: Landmark Science & Engineering

Project: Appoquinimink School District Summit Ca

Project No.: LDMSE-24001.02 **Figure** A-2

DNREC Soil Investigation Report Submittal Checklist

DNREC Division of Watershed Stewardship
89 Kings Highway
Dover, DE 19901
(302) 739-9921

Soil Investigation Report Submittal Checklist

DATE RECEIVED: _____ **PROJECT NUMBER:** LDMSE24001.02

PROJECT NAME: Appoquinimink School District Summit Campus – Infiltration Testing

The items contained on this checklist are necessary to properly evaluate and determine the completeness of any Soil Investigation Report submitted under subsection 12.1 of the Delaware Sediment and Stormwater Regulations. Complete all items. It is understood not all items will be applicable to all projects and as such marking an item "N/A" is acceptable.

I. ✓ **General Soil Investigation Reports.** The following information, as applicable, should be submitted for all projects.

1) ✓ The signature, seal and date of a professional engineer or professional geologist experienced in soils licensed in the State of Delaware.

2) ✓ General description of the project, project elements, and project background.

3) ✓ Project site surface conditions and current use.

4) ✓ Regional and site geology. An initial screening of readily available data to determine feasibility of infiltration practices, if applicable, including:

a) ✓ Site topography

b) ✓ Soil characteristics as defined in the USDA NRCS Web Soil Survey

c) ✓ Depth to groundwater and seasonal high water table

d) ✓ Historical groundwater level data from the nearest Delaware Geological Survey (DGS) monitoring well or wells

5) ✓ Minimum number of borings or test pits conducted in accordance with the following:

a) ____ Surface area BMPs:

i)____ Two (2) borings or pits for the first 8,000 square feet

ii) ___ Three (3) borings or pits for up to 16,000 square feet

iii)____ Four (4) borings or pits for up to 25,000 square feet

iv) ___ One (1) additional boring or pit for each additional 25,000 square feet beyond the first 25,000 square feet

v)____ Boring or pit locations distributed within the facility and sufficient to determine soil variability

b) ____ Linear BMPS:

i)____ Two (2) borings or pits up to 500 linear feet, and

ii) ___ One (1) additional boring or pit per additional 500 linear feet of trench

iii)____ Boring or pit locations distributed and sufficient to determine soil variability

Soil Investigation Report Submittal Checklist

6) ✓ Borings or test pits advanced to the depth of the limiting layer or a minimum of three (3) feet below bottom of the proposed facility, whichever is encountered first.

7) ✓ Borehole or test pit logs including the following information:

a) ✓ Project name

b) ✓ Name of individual collecting the field data

c) ✓ Date field data was collected

d) ✓ Type of boring or test pit excavation method and equipment used

e) ✓ Air temperature and precipitation, including significant precipitation prior to investigation

f) ✓ Elevation of ground at boring location based on site benchmark

g) ✓ Visual description of soil profile layers, and depths below grade encountered

h) ✓ Sample numbers

i) ✓ Depths to any indications of instability such as cave in, sloughing, flowing sands, or obstructions

j) ✓ Blow counts if Standard Penetration Test (SPT) borings are performed

k) ✓ Depth of seasonal high water table indicators such as mottling

l) ✓ Depth of encountered free water during and after excavation

m) N/A Depth to bedrock if encountered

n) ✓ General observations

o) ✓ Testing standards

8) ✓ Depth and type of field testing performed. A summary of the laboratory testing conducted, if applicable.

9) ✓ Project soil and rock conditions including a description of the soil and rock units encountered, and how the units tie into the site geology.

10) ✓ Description of groundwater conditions, including the identification of any of the following:

a) N/A Confined aquifers

b) N/A Artesian pressures

c) ✓ Perched water tables

d) ✓ Potential seasonal variations, if known

e) ✓ Any influences on the ground water levels observed

f) ✓ Direction and gradient of groundwater, if known

11) N/A Discussion of rock structure, if applicable, including but not limited to:

a) ____ The results of any field structure mapping using photographs as needed,

b) ____ Joint condition

c) ____ Rock strength

d) ____ Potential for seepage.

12) N/A Summary of geological hazards identified and their impact on the project design, if any. Description of the location and extent of the geological hazard.

13) N/A For analysis of unstable slopes including existing settlement areas, cuts, and fills, include background regarding the analysis approach, assessment of failure mechanisms, and determination of design parameters. Include a description of any back-analyses conducted, the results of those analyses, comparison of those results to any laboratory test data obtained, and the conclusions made regarding the parameters to be used for final design.

14) ✓ Geotechnical recommendations for structural earthwork including:

a) N/A Embankment design recommendations, as applicable, including but not limited to the following:

i)____ Slope required for stability

ii) ___ Need and extent of removal of any unsuitable materials beneath the proposed fills

iii)____ Any other measures that need to be taken to provide a stable embankment

iv) ___ Embankment settlement magnitude and rate

b) N/A Cut design recommendations, as applicable, including but not limited to the following:

i)____ Slope required for stability

ii) ___ Seepage and piping control

iii)____ Erosion control measures

iv) ___ Any special measures required to provide a stable slope

c) ✓ Determination of adequacy of excavated material for use as structural fill or spoil

d) N/A Data for structural designs of BMP outlet works

15) N/A Long-term or construction monitoring needs, if applicable.

a) ____ Recommendation for types of instrumentation needed to evaluate long-term performance or to control construction

b) ____ Specify the reading schedule required

c) ____ Specify how the data should be used to control construction or to evaluate long-term performance

d) ____ Specify the zone of influence for each instrument.

16) ✓ Address issues of construction staging, shoring needs and potential installation difficulties, temporary slopes, potential foundation installation problems, earthwork constructability issues, and dewatering, as applicable.

17) ✓ Appendices to support geotechnical recommendations.

Soil Investigation Report Submittal Checklist

II.__✓__ **Infiltration Test Reports.** The following information, as applicable, should be submitted for all stormwater management BMPs that rely upon infiltration.

18)__✓__ Description of approved infiltration testing method.

a) __✓__ Field Permeability Testing conducted in accordance with ASTM-D5126 "Comparison of Field Methods for Determining Hydraulic Conductivity in the Vadose Zone".

b) __✓__ Single Ring or Double Ring Infiltrometer test method

c) ____ Cased Borehole Permeameter test method

i)____ Department or Delegated Agency approval granted prior to conducting the test

ii) ___ Minimum four (4) inch diameter casing used

d) ____ Any deviation from infiltration testing procedures approved by the Department or Delegated Agency noted in the report.

19)__✓__ Summary table of location of test, depth of test, elevation of test if available and field verified infiltration rate.

20)__✓__ The minimum number of field measured infiltration tests are based on the proposed facility's dimensions as follows:

a) ____ For an infiltration trench with less than 10,000 square feet of impervious drainage area:

i)____ One (1) test up to 500 linear feet, and

ii) ___ One (1) additional test per 250 linear feet of trench, and

iii)____ Sufficient to determine variability.

b) ____ For an infiltration trench with greater than 10,000 square feet of impervious drainage area:

i)____ One (1) test up to 250 linear feet, and

ii) ___ One (1) additional test per 250 linear feet of trench, and

iii)____ Sufficient to determine variability.

c) ____ For an infiltration trench used with roadway perforated pipe layouts:

i)____ One (1) test up to 500 linear feet, and

ii) ___ One (1) additional test per 500 linear feet of trench, and

iii)____ Sufficient to determine variability.

d) ____ For an infiltrating bioretention system:

i)____ One (1) test for the first 8,000 square feet

ii) ___ Two (2) tests for up to 16,000 square feet

iii)____ Three (3) tests for up to 25,000 square feet

iv) ___ One (1) additional test for each additional 25,000 square feet beyond the first 25,000 square feet

v)____ Test locations distributed within the facility and sufficient to determine variability.

e) ____ For a surface infiltration basin:

i)____ One (1) test for the first 8,000 square feet

ii) ___ Two (2) tests for up to 16,000 square feet

iii)____ Three (3) tests for up to 25,000 square feet

iv) ___ One (1) additional test for each additional 25,000 square feet beyond the first 25,000 square feet.

v)____ Test locations distributed within the facility and sufficient to determine variability.

f) ✓ For a subsurface infiltrating practice:

i)____ One (1) test per infiltration area

ii) ___ One (1) additional test for every 8,000 square feet of infiltration area

iii) ✓ Test locations distributed within the facility and Sufficient to determine variability

21) ✓ Infiltration test log, including:

a) ✓ Name and license number of individual performing test. Individuals in responsible charge of infiltration testing possesses a Class D On-Site License issued by DNREC Division of Water Groundwater Discharges Section or be licensed in the State of Delaware as a Professional Engineer or Professional Geologist.

b) ✓ Date test was performed

c) ✓ Type of test method

d) ✓ Air temperature and precipitation

e) ✓ Depth of test below ground surface and elevation. Separation to a limiting layer such as bedrock or groundwater of at least two (2) feet maintained.

f) ✓ Diameters of boring and casing

g) ✓ Depth of casing penetration

h) ✓ Time and depth from reference point for each time increment.

i) ✓ A saturation period of one hour or a drop of 12 inches or 30.5 centimeters achieved. Saturation period not used in determining field verified infiltration rate.

ii) ✓ After the saturation period, a minimum of two (2) test periods completed or until at least two (2) consecutive test periods are consistent and achieve a stabilized infiltration rate. Each test period has a maximum reading interval of 15 minutes and meets one (1) of the following criteria:

(1) ✓ A minimum of one hour as determined by the sum of the interval times

(2) ✓ A drop of at least 12 inches in 15 minutes or less for a minimum of 30 minutes as determined by the sum of the interval times

iii)_✓_ Stabilized infiltration rate met as defined as one of the following:

(1)_✓_ A difference of 0.25 inches or less of drop between the highest and lowest reading of four (4) consecutive readings for infiltration rates greater than two (2.0) inches per hour

(2)_✓_ A difference of 0.125 inches or less of drop between the highest and lowest reading of four (4) consecutive readings for infiltration rates equal to or less than two (2.0) inches per hour.

iv)_✓_ When using the constant head test method, water level inside the casing maintained at a constant level or refilled to the starting level after each reading throughout the test period at no more than 15 minute intervals.

v)____ When using the falling head test method each test period starts with the same initial head.

22)_✓_ Infiltration rate graph for each test charting the field verified infiltration rate versus elapsed time of test. Append to each graph a table of the testing results. The field verified infiltration rate is the final steady state reading of the test performed.

23)_✓_ Geotechnical recommendations for each stormwater management facility, including the following:

a) _✓_ Recommended design infiltration rate based on the following:

i)_✓_ Apply a minimum factor of safety of 2.0 to field results from Single Ring or Double Ring Infiltrometer testing

ii)____ Apply a minimum factor of safety of 2.5 to field results from Cased Borehole Permeameter testing.

iii)_✓_ Provide an elevation range over which the recommended design rates are applicable.

iv)_✓_ The maximum design infiltration rate is less than or equal to 15 inches per hour.

b) N/A Impact of infiltration on adjacent facilities

c) N/A Effect of infiltration on slope stability

d) N/A If the facility is located on a slope, stability of slopes within the facility

e) _✓_ Foundation bearing resistance

f) N/A If steady state conditions for a given test are not achieved, provide an explanation as to why steady state could not be achieved and the professional's opinion regarding the use of the results for design purposes. If steady state is not achieved for a given test and a reasonable professional opinion is not provided, the Department or Delegated Agency may require additional testing.

Soil Investigation Report Submittal Checklist

III. N/A **Geotechnical Reports for Embankments.** The following information, as applicable, should be submitted for all stormwater management BMPs containing an embankment.

24)____ The signature, seal and date of a professional engineer licensed in the State of Delaware.

25)____ Subsurface Exploration

a) ____ Explorations every 200 feet on center along the length of the embankment.

b) ____ Unless bedrock is encountered at a shallower depth, explorations at a depth twice the proposed height from bottom of pond to top of embankment.

c) ____ If bedrock is encountered, a minimum five (5) foot rock core performed. If organic, plastic, or soils with an actual or estimated N-value less than four (4) are encountered, extended exploration to a depth of four (4) times the proposed embankment height.

d) ____ If there is a potential for a significant groundwater gradient beneath an embankment or surface water levels are significantly higher on one side of the embankment than the other, the effect of reduced soil strength caused by water seepage has been evaluated.

e) ____ Seepage effects considered when an embankment is placed on or near the top of a slope that has known or potential seepage through it.

26)____ Summary of design analyses, which provide the project description and basis of the design recommendations.

27)____ Summary of stability analyses, which provide the results of the stability analyses performed for the given embankment dimensions.

28)____ Summary of settlement analyses, including design assumptions and settlement results for above-grade embankments.

29)____ Design recommendations for embankment construction identifying the following actions:

a) ____ Construction procedures for placement of material in embankment widening areas

b) ____ Embankment cut-off and core trench materials for above-grade embankments

c) ____ Special notes for excavation of unsuitable material, with specific backfill requirements

d) ____ Specific measures required prior to placing embankment material

e) ____ Installation of appropriate erosion control and vegetative cover

USDA Web Soil Survey Report

Pennoni

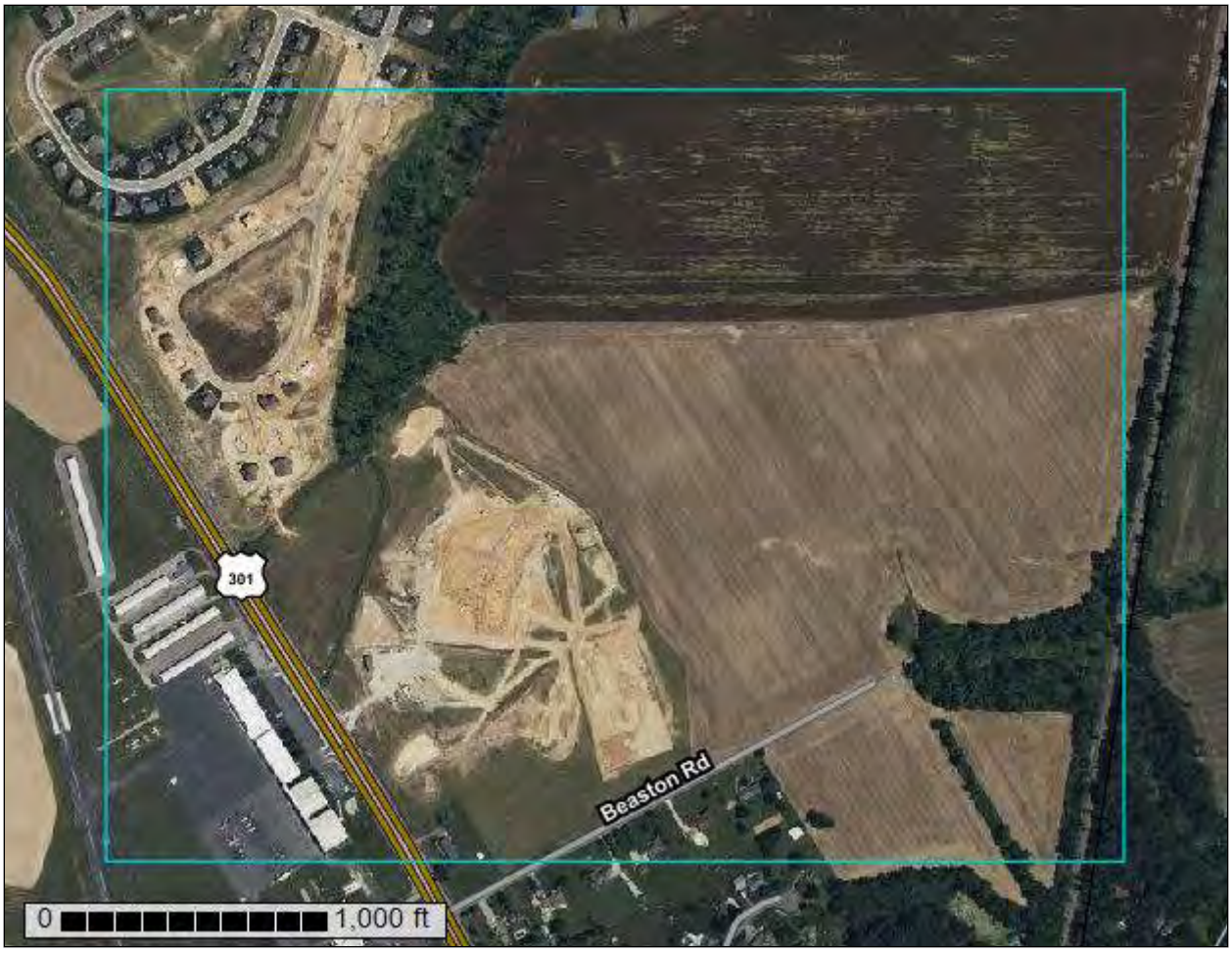
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for New Castle County, Delaware



June 20, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....8
Soil Map.....9
Legend.....10
Map Unit Legend.....11
Map Unit Descriptions.....11
New Castle County, Delaware.....14
LO—Longmarsh and Indiantown soils, frequently flooded.....14
MkA—Matapeake silt loam, 0 to 2 percent slopes.....16
OtcA—Othello silt loams, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain.....17
RdA—Reybold-Queponco complex, 0 to 2 percent slopes.....20
ReB—Reybold silt loam, 2 to 5 percent slopes.....22
ReC—Reybold silt loam, 5 to 10 percent slopes.....23
SacB—Sassafras sandy loam, 2 to 5 percent slopes, Mid-Atlantic Coastal Plain.....25
SacC—Sassafras sandy loam, 5 to 10 percent slopes, Mid-Atlantic Coastal Plain.....26
SaD—Sassafras sandy loam, 10 to 15 percent slopes.....28
WdcA—Woodstown sandy loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain.....29
WocA—Woodstown loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain.....31
References.....34

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:7,470 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: New Castle County, Delaware
Survey Area Data: Version 18, Sep 12, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 5, 2022—Jul 4, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
LO	Longmarsh and Indiantown soils, frequently flooded	3.7	1.4%
MkA	Matapeake silt loam, 0 to 2 percent slopes	2.2	0.8%
OtcA	Othello silt loams, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain	23.6	9.3%
RdA	Reybold-Queponco complex, 0 to 2 percent slopes	46.0	18.0%
ReB	Reybold silt loam, 2 to 5 percent slopes	122.4	48.0%
ReC	Reybold silt loam, 5 to 10 percent slopes	10.5	4.1%
SacB	Sassafras sandy loam, 2 to 5 percent slopes, Mid-Atlantic Coastal Plain	5.7	2.2%
SacC	Sassafras sandy loam, 5 to 10 percent slopes, Mid-Atlantic Coastal Plain	6.8	2.7%
SaD	Sassafras sandy loam, 10 to 15 percent slopes	4.8	1.9%
WdcA	Woodstown sandy loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain	1.9	0.7%
WocA	Woodstown loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain	27.5	10.8%
Totals for Area of Interest		**255.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made

up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

New Castle County, Delaware

LO—Longmarsh and Indiantown soils, frequently flooded

Map Unit Setting

National map unit symbol: 2p7dm
Elevation: 0 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Longmarsh and similar soils: 43 percent
Indiantown and similar soils: 37 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Longmarsh

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 19 inches: mucky loam
Cg1 - 19 to 34 inches: sandy loam
Cg2 - 34 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: R149AY060DE - Wet Alluvial Floodplain
Hydric soil rating: Yes

Description of Indiantown

Setting

Landform: Flood plains

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 25 inches: mucky silt loam
Cg - 25 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: R149AY060DE - Wet Alluvial Floodplain
Hydric soil rating: Yes

Minor Components

Zekiah

Percent of map unit: 10 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R149AY060DE - Wet Alluvial Floodplain
Hydric soil rating: Yes

Manahawkin

Percent of map unit: 5 percent
Landform: Flood plains, swamps
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153DY110NJ - Mucky Swamp
Hydric soil rating: Yes

Klej

Percent of map unit: 5 percent
Landform: Flats
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153DY150NJ - Moist Sandy Upland
Hydric soil rating: No

MkA—Matapeake silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2p7gt
Elevation: 10 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Matapeake and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Matapeake

Setting

Landform: Flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty eolian deposits over fluviomarine sediments

Typical profile

Ap - 0 to 5 inches: silt loam
E - 5 to 11 inches: silt loam
Bt - 11 to 34 inches: silt loam
2BC - 34 to 38 inches: sandy loam
2C - 38 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

Minor Components

Nassawango
Percent of map unit: 10 percent
Landform: Terraces, flats
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

Butlertown
Percent of map unit: 5 percent
Landform: Flats, broad interstream divides, interfluves
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Mattapex
Percent of map unit: 5 percent
Landform: Depressions, swales, flats
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

OtcA—Othello silt loams, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting
National map unit symbol: 2thwn
Elevation: 0 to 100 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 210 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Othello, drained, and similar soils: 48 percent
Othello, undrained, and similar soils: 28 percent
Minor components: 24 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Othello, Drained

Setting
Landform: Swales, depressions, flats

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Silty eolian deposits over fluviomarine deposits

Typical profile

Ap - 0 to 9 inches: silt loam
Btg - 9 to 29 inches: silt loam
2BCg - 29 to 34 inches: sandy loam
2Cg - 34 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 10 to 20 inches
Frequency of flooding: None
Frequency of ponding: Rare
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Description of Othello, Undrained

Setting

Landform: Drainageways, swales, depressions, flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Silty eolian deposits over fluviomarine deposits

Typical profile

Oe - 0 to 2 inches: peat
A - 2 to 4 inches: silt loam
Eg - 4 to 10 inches: silt loam
Btg - 10 to 29 inches: silt loam
2BCg - 29 to 35 inches: sandy loam
2Cg - 35 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: None

Frequency of ponding: Occasional
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Minor Components

Mattapex

Percent of map unit: 7 percent
Landform: Broad interstream divides, swales, depressions, flats
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Crosiadore

Percent of map unit: 7 percent
Landform: Depressions, fluviomarine terraces, flats
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Kentuck, undrained

Percent of map unit: 5 percent
Landform: Swales, depressions, flats
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Fallsington, undrained

Percent of map unit: 5 percent
Landform: Drainageways, swales, depressions, flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

RdA—Reybold-Queponco complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2p7g5
Elevation: 10 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 180 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Reybold and similar soils: 45 percent
Queponco and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reybold

Setting

Landform: Interfluves, flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: High silt loamy eolian deposits over fluviomarine deposits

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 30 inches: silt loam
2BC - 30 to 39 inches: gravelly coarse sandy loam
2C - 39 to 80 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Description of Queponco

Setting

Landform: Swales, flats
Down-slope shape: Concave, linear
Across-slope shape: Linear
Parent material: High silt loamy eolian deposits over fluviomarine deposits

Typical profile

Ap - 0 to 10 inches: silt loam
Bt1 - 10 to 17 inches: silt loam
2Bt2 - 17 to 31 inches: loam
2CB - 31 to 36 inches: sandy loam
2C - 36 to 80 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 40 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Unicorn

Percent of map unit: 10 percent
Landform: Swales, flats
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Matapeake

Percent of map unit: 5 percent
Landform: Rises
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

ReB—Reybold silt loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2p7g7
Elevation: 10 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 180 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Reybold and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reybold

Setting

Landform: Interfluves, flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: High silt loamy eolian deposits over fluviomarine deposits

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 30 inches: silt loam
2BC - 30 to 39 inches: gravelly coarse sandy loam
2C - 39 to 80 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Sassafras
Percent of map unit: 10 percent
Landform: Knolls, flats
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Unicorn
Percent of map unit: 5 percent
Landform: Swales, flats
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Queponco
Percent of map unit: 5 percent
Landform: Swales, flats
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Matapeake
Percent of map unit: 5 percent
Landform: Flats
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

ReC—Reybold silt loam, 5 to 10 percent slopes

Map Unit Setting
National map unit symbol: 2p7g8
Elevation: 10 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Reybold and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reybold

Setting
Landform: Interfluves, flats
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: High silt loamy eolian deposits over fluviomarine deposits

Typical profile
Ap - 0 to 10 inches: silt loam

Bt - 10 to 30 inches: silt loam
2BC - 30 to 39 inches: gravelly coarse sandy loam
2C - 39 to 80 inches: gravelly coarse sandy loam

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Sassafras

Percent of map unit: 10 percent
Landform: Knolls, flats
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Unicorn

Percent of map unit: 5 percent
Landform: Swales, flats
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Matapeake

Percent of map unit: 5 percent
Landform: Flats
Ecological site: F153CY030MD - Well Drained Loess Upland
Hydric soil rating: No

Queponco

Percent of map unit: 5 percent
Landform: Swales, flats
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

SacB—Sassafras sandy loam, 2 to 5 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting

National map unit symbol: 2thxf
Elevation: 0 to 100 feet
Mean annual precipitation: 42 to 46 inches
Mean annual air temperature: 55 to 59 degrees F
Frost-free period: 210 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sassafras and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sassafras

Setting

Landform: Fluviomarine terraces, flats
Landform position (three-dimensional): Riser, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 12 inches: sandy loam
Bt1 - 12 to 18 inches: sandy loam
Bt2 - 18 to 28 inches: sandy clay loam
BC - 28 to 40 inches: loamy sand
C1 - 40 to 58 inches: sand
C2 - 58 to 80 inches: sand

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Ingleside

Percent of map unit: 10 percent
Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Downer

Percent of map unit: 5 percent
Landform: Flats, low hills, knolls
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve, rise
Down-slope shape: Linear, convex
Across-slope shape: Linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Woodstown

Percent of map unit: 5 percent
Landform: Flats, depressions, broad interstream divides, fluviomarine terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

SacC—Sassafras sandy loam, 5 to 10 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting

National map unit symbol: 2thxt
Elevation: 0 to 100 feet
Mean annual precipitation: 42 to 46 inches
Mean annual air temperature: 55 to 59 degrees F
Frost-free period: 210 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sassafras and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sassafras

Setting

Landform: Fluviomarine terraces, flats
Landform position (three-dimensional): Riser, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 9 inches: sandy loam
Bt1 - 9 to 18 inches: sandy loam
Bt2 - 18 to 28 inches: sandy clay loam
BC - 28 to 40 inches: loamy sand
C1 - 40 to 58 inches: sand
C2 - 58 to 80 inches: sand

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Ingleside

Percent of map unit: 10 percent
Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Downer

Percent of map unit: 5 percent
Landform: Flats, low hills, knolls
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve, rise
Down-slope shape: Linear, convex
Across-slope shape: Linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Woodstown

Percent of map unit: 5 percent
Landform: Flats, depressions, broad interstream divides, fluviomarine terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

SaD—Sassafras sandy loam, 10 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2p7fd
Elevation: 0 to 330 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Sassafras and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sassafras

Setting

Landform: Fluviomarine terraces, knolls, low hills, hillslopes
Landform position (three-dimensional): Riser, dip
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex

Typical profile

Ap - 0 to 9 inches: sandy loam
E - 9 to 15 inches: sandy loam
Bt - 15 to 30 inches: loam
BC - 30 to 37 inches: sandy loam
C - 37 to 80 inches: loamy sand

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

Minor Components

Downer

Percent of map unit: 10 percent
Landform: Fluviomarine terraces, knolls, flats
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Evesboro

Percent of map unit: 5 percent
Landform: Flats, dunes, fluviomarine terraces, knolls
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Ecological site: F153DY170NJ - Sandy, Excessively Drained Upland
Hydric soil rating: No

Ingleside

Percent of map unit: 5 percent
Landform: Depressions, flats, fluviomarine terraces
Landform position (three-dimensional): Talf
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F153DY160NJ - Well Drained Coarse-Loamy Upland
Hydric soil rating: No

Zekiah

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R149AY060DE - Wet Alluvial Floodplain
Hydric soil rating: Yes

WdcA—Woodstown sandy loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting

National map unit symbol: 2thvt
Elevation: 0 to 90 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Woodstown and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodstown

Setting

Landform: Flats, broad interstream divides, depressions, fluviomarine terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 7 inches: sandy loam
E - 7 to 11 inches: sandy loam
Bt - 11 to 29 inches: sandy loam
BCg - 29 to 45 inches: fine sandy loam
Cg - 45 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

Minor Components

Hammonton

Percent of map unit: 6 percent
Landform: Broad interstream divides, flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

Fallsington

Percent of map unit: 6 percent

Landform: Flats, swales, depressions, drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Mattapex

Percent of map unit: 4 percent
Landform: Broad interstream divides, swales, depressions, flats
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Hambrook

Percent of map unit: 4 percent
Landform: Flats, fluviomarine terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

WocA—Woodstown loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain

Map Unit Setting

National map unit symbol: 2thx4
Elevation: 0 to 90 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 55 to 59 degrees F
Frost-free period: 210 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodstown and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodstown

Setting

Landform: Flats, broad interstream divides, depressions, fluviomarine terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Tread, talf, dip

Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 7 inches: loam
E - 7 to 11 inches: sandy loam
Bt - 11 to 29 inches: sandy loam
BCg - 29 to 45 inches: fine sandy loam
Cg - 45 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

Minor Components

Fallsington

Percent of map unit: 6 percent
Landform: Swales, depressions, flats, drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Hammonton

Percent of map unit: 6 percent
Landform: Broad interstream divides, flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F149AY130NJ - Moist Loamy Upland
Hydric soil rating: No

Mattapex

Percent of map unit: 4 percent
Landform: Depressions, flats, broad interstream divides, swales
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Dip, talf

Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F153CY020MD - Moist Loess Upland
Hydric soil rating: No

Hambrook

Percent of map unit: 4 percent
Landform: Flats, fluviomarine terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F149AY170MD - Well Drained Fine-Loamy Upland
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf