New York City Economic Development Corporation

New Stapleton Waterfront: Phase 2 & 3

Preliminary Geotechnical Report

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1 Introduction

Ove Arup & Partners P.C. (Arup) has been retained by the New York City Economic Development Corporation (NYCEDC) to provide lead the Phase 2 and 3 redevelopment of the New Stapleton Waterfront (NSW) in Staten Island, New York, shown on Figure 1, Site Location Map.

The purpose of this report is to provide the results of a geotechnical site investigation, an assessment of the subsurface conditions, the results of our analyses, and foundation recommendations for the redevelopment.

2 Background

NYCEDC has undertaken a series of projects involving new development and infrastructural improvements along the North Shore of Staten Island. The NSW project is one such redevelopment project and is structured in 3 phases. Phase 1 is substantially completed and is the central area of the redevelopment, with Phase 2 directly to the south and Phase 2 directly to the north. Phases 2 and 3 therefore become the critical links to the greater Staten Island waterfront. It is located directly adjacent to the Staten Island Railway station at Stapleton and near the Staten Island Ferry, St. George's Terminal. The proposed multi-use commercial, residential and recreation area will be located along on the northeast shore of Staten Island. The project area is bounded by Hannah Street to the north, the Clifton rail yard to the south, the Upper New York Bay to the east and Front Street to the west, as Figure 2, Site Layout Plan.

In October 2015, the NYCEDC retained Arup to develop plans and specifications for the New Stapleton Waterfront redevelopment project.

2.1 Historic Site Use

The Stapleton waterfront has a long and interesting history that includes, breweries, ferry landings and later, rail yards, heavy portage, piers, and the US Navy's Homeport Pier. Prior to the mid-nineteenth century, the Stapleton Waterfront area was all located within the New York Harbor and was utilized as a ferry terminal and port for trade in the late 18th century. In 1836 the village of Stapleton was founded and grew rooted in the economic success of the waterfront and additional commercial establishments began to spring up such as hotels, lumber dealers, breweries, and rubber manufacturing. Some of these original structures still stand along the historic waterfront area. In the early 20th century to accommodate the growth of the waterfront area the shoreline was reclaimed and extended into the harbor. By 1928, landfill and construction had brought the waterfront to its current configuration. In the late 1980's the Naval Station New York was to be constructed under the Reagan administration's Strategic

Homeport program. Part of this was the construction of a new pier to accommodate warships. The homeport site housed several naval enterprises however due to high cost of maintenance the facility was closed in 1994.

2.2 Description of Existing Structures

The site is currently occupied by various terrain, coastal structures and utilities including but not limited to several independent buildings of varying use, a 1,400ft long by 90ft wide pier which extends in a southeast direction into the Upper New York Bay, 1,600ft of steel sheet pile bulkhead and a 60" wide sewer easement. Included in nthe 36-acre Staten Island Homeport site is a historic U.S. Navy yard developed in the 1980's.

Phase 2, which has an area of nearly 8 acres, contains two buildings with an address 144 and 150 Front Street; both are two story warehouses which used to serve as a bagel production facility, now decommissioned. The remainder of the Phase 2 area is 776 Edge Water Drive which is an open parking lot which serviced 144 and 150 Front Street.

Phase 3, which has an area of nearly 16.5 acres, contains several multiuse developed plots, some of which are currently no longer in operation. The tract of land addressed as 21-27 Murray Hulbert Drive was previously the U.S. Navy facility and yard. The property contains a 3 story warehouse, a power generation station, a storage tank and several other smaller structures which are currently unoccupied. Also on this property is the New York State Department of Transportation (NYSDOT) Dock builder's headquarters, which is operational. The plot of land addressed 14-16 Murray Hulbert Drive is the location of the Water Main Siphon project which is being undertaken by the NYCEDC and New York City Department of Environmental Protection (NYCDEP). The property houses 2 one-story warehouses and several administrative trailers. The area of land with an address 6-10 Hannah Street operates as an active NYCDEP pump station and contains a one-story and two-story masonry structure. There are several NYCDEP sewer and outfall easements through the site. The largest of these is a 60' wide sewer easement that runs through Pier Place.

2.3 Proposed Construction

Several structures are proposed in this project. These include a Maintenance & Operations building and a pedestrian bridge and path in Phase 2 area; and a comfort station, and two pedestrian bridges located in the Phase 3 area. An electrical substation is proposed for the future. These structures are described briefly below:

- ***Maintenance and Operations (M&O) Facility:*** This will be two-story structure built on grade having a footprint area of 1,920 square feet. Landscaping for the overlook area will cover part of this structure.

Additionally, there is to be an observation deck constructed onto the top grade of the overlook area. This structure will house maintenance equipment and vehicles as well as offices for groundskeepers.

- ***Phase 2 Area Bridge Path:*** This bridge structure is proposed to be 350 ft long and 12 ft wide with pier locations every 20 ft.
- ***Comfort Station:*** One story building to be constructed on raised piers having footprint 650 square feet. Additionally, there is to be an attached viewing platform also supported on raised piers having footprint 1150 square feet. To access the facility a ramp is to be constructed also supported on piers which will be 6 ft wide and 55 ft long.
- ***Phase 3 Area South Bridge Path:*** This bridge structure is proposed to be 360 ft long and 12 ft wide with pier locations every 20 feet.
- ***Phase 3 Area North Bridge Path:*** This bridge structure is proposed to be 340 ft long and 12 ft wide with pier locations every 20 feet.
- In addition to the above, a new sheetpile bulkhead structures are to be constructed along the waterfront and repairs to the existing bulkhead to be made in the Phase 3 area, approximate locations are shown on Figure 4. The design and stability analysis and repair schemes of the bulkhead structure and shorelines are to be completed by the McLaren Engineering Group of West Nyack, New York and therefore not in scope of this report.

There will be significant re-grading of the site in both areas, Phase 2 and 3. At the south end of the Phase 2 area the grade will be raised by 11 ft.

At the south end of the Phase 3 area the grade is to be raised by about 5 ft in the west corner to create a level pad for parcel B1. In the eastern portion, known as Pier Place, the grade is to be raised by about 13 ft to create a landscaped hill.

Construction for the proposed NSW will require demolition of existing pavements and utilities, re-grading of the ground surface through earth work, and placement of rip-rap for coastal protection, foundation construction for buildings and pedestrian bridges sheetpile installation for the bulkhead.

3 Scope of Work

Based on an understanding of the project requirements, the following scope of work was established:

- Research and review available geologic and geotechnical literature pertinent to the site.
- Based on an understanding of the proposed development, develop a geotechnical investigation program to be implemented by a subconsultant.

- Similarly, develop a suitable lab testing program to be implemented laboratory.
- Coordinate with the subconsultant the drilling of 22 geotechnical boreholes to depths of 40 ft -75 ft; 24 boreholes drilled to depths of 10 ft - 17 ft, logged and sampled for environmental testing purposes, and 6 boreholes drilled to depth of 6 ft for the purposes of insitu falling head permeability testing.
- Using borehole information provided by subconsultant to prepare subsurface profiles across selected locations at the site.
- Interpret subsurface conditions and laboratory results to develop design parameters for the site soils.
- Recommend the appropriate seismic site class using New York City Building Code (NYCBC, 2014).
- Perform liquefaction analysis for the site.
- Assess seismic settlement of the site soils.
- Assess settlement resulting from mass grading and earthwork proposed at the site.
- Develop recommendation for preloading and surcharging, where necessary, to mitigate future settlement.
- Meet with the structural engineers to understand their requirements and assist with foundation selection.
- Assess foundation requirements for proposed structures and select appropriate foundation type.
- Make recommendation for shallow and deep foundations where needed, including driven piles, and bored piles.
- Prepare a geotechnical report.
- Provide QA/QC to work by subconsultant.

4 Previous Investigations

The NSW site is in a former industrial area that experienced significant growth and development in the past century. As a result, a number of commercial and infrastructure projects have been built in the past within the project limits which are no longer in service.

Numerous prior investigations at or near the site were reviewed to provide an understanding of the ground conditions. The geotechnical studies for these projects provide ample, relevant geotechnical data relevant to the current NSW project.

Of these the most relevant were:

- CDM/HMM (2009) – The Replacement of Existing Water Siphons between Brooklyn and Staten Island: Geotechnical Data Report, Stapleton, Staten Island, NY. Camp Dresser & McKee and Hatch Mott McDonald New York, Inc. a Joint Venture, December 2009
- Matrix (2007) – Geotechnical Engineering Study, Front Street, Stapleton, Staten Island, NY. Matrix Engineering Services P.C., July 11, 2007
- PRC Engineering (1985) – Naval Station, Staten Island, N.Y. Site Improvements, Stapleton, Staten Island NY. Department of the Navy, Naval Facilities Engineering Command, Northern Division, Naval Base, Philadelphia, Pa., 1989

A number of geotechnical boreholes relevant to the NSW site were collected from projects in the vicinity to provide a better understanding of the ground condition prior to the investigation. However, most of them were related to Phase 1 of the project or are located along the project areas limits with the exception of an investigation completed by Hatch Mott MacDonald on behalf of the NYEDC for the installation of a new 60" diameter siphon tunnel and select borings completed by the United States Department of the Navy in 2009.

Subsurface data from these projects were used to develop subsurface stratigraphic sections across the site. The location of the relevant boreholes used to assess subsurface conditions, are identified in Figures 3 and 4. A summary of the available historic borehole data is listed in Table 1. Copies of the logs of these boreholes are included in Appendix A.

5 Current Investigation and Testing Program

The implemented geotechnical investigation and laboratory testing program, in the current phase of work is described below:

5.1 Initial Site Visit

In September 2015, Arup reconnoitered the site to determine accessibility for suitable drilling rigs. From our observations is was noted that accessibility is generally good and will allow for a full truck mounted drill rig to complete borehole explorations on land.

5.2 Planning the Investigation

In general, boreholes were planned to adequately cover the aerial extent of the site, while accommodating the planned structures, whose locations were still undecided. It was understood that the geotechnical investigation program was preliminary and additional boreholes would need to be drilled to meet New City Building Code requirements.

Ten geotechnical soil borings with planned depth 40 ft were spaced within the limits of Phase 2 area. Likewise nine soil borings with planned depths 40 ft to 75 ft were located within the limits of Phase 3 area.

An additional five soil borings of depth 75 ft were proposed along the proposed bulkhead line within Phase 3 area on the inboard side. Of these five locations, two were deemed unnecessary by the design marine engineers, McLaren Engineering Group, who are designing the bulkhead. Additionally, six boreholes or cone penetration soundings to depths of 75 ft were proposed along the outboard side of the bulkhead; however these were also deemed unnecessary by the marine design engineers and therefore not conducted.

Apart from the boreholes, an obstruction survey using side-scan sonar was recommended, for NYCEDC's consideration. The obstruction survey would help delineate buried obstructions such as timber piles, rip-rap, shipwrecks, etc., that may hinder sheetpile or pile installation along the waterfront.

5.3 Current Geotechnical Investigation

Distinct Engineering Solutions Inc. (DESI) of North Brunswick, NJ was retained by Arup to conduct the field investigations and provide full time observation of the drilling operations including soil logging and sampling of all subsurface explorations. DESI, in turn, retained, Craig Geotechnical Drilling Company Inc. of Mays Landing, NJ to perform the drilling operations; and TerraSense, L.L.C. of Totowa, NJ to perform soils laboratory testing on samples from the field investigation.

The first phase of investigation started on January 3, 2016 and was completed on January 15, 2016. For the second phase, the investigation began on May 5, 2016 and was completed on May 10, 2016.

In the current exploration, all boreholes were completed using a truck mounted drill rig equipped with a safety hammer with an automatic release mechanism. Drilling was progressed first using a hollow-stem auger in the upper 15ft and then continued using a 2-7/8in rotary bit for the remainder of the borehole. Disturbed split spoon samples were recovered using a 2-inch O.D., 1-3/8in I.D., unlined standard split-barrel sampler. The sampler was driven 24 inches into the soil under the impact of a 140lb hammer falling from a height of 20in as per ASTM D1586 procedure. The number of blows required to drive the sampler were recorded for each 6in increment of penetration into the ground. Samples were collected at 2ft increments in the upper 15ft and the 5ft increments for the remainder of the exploration. At depths where cohesive materials were encountered a 3in thin walled (Shelby) tube was pushed to collect undisturbed samples in accordance with ASTM D1587.

All proposed boring locations for Phase 2 and 3 geotechnical investigation are summarized in Table 2, Current Borehole Data and presented in Figures 3 and 4. Borehole logs of the current exploration program have been included in Appendix B.

5.4 Terrestrial Survey

Prior to the start of the subsurface investigation a site survey was completed by Naik Consulting Group, PC (Naik). The datum used in this survey was the North American Vertical Datum of 1988 (NAVD 88). The survey indicates that elevations range from 0ft at the water's edge to about 8 ft to 10.5 ft across the project area. This information along with the borehole locations provided by DESI was used to determine the borehole elevations.

5.5 Bathymetric Survey

A hydrographic survey was completed by Marine Infrastructure Engineering Solutions, PC using multibeam hydrography in order to provide high-resolution full bottom coverage of the subaqueous area adjacent to the Phase 2 and 3 areas. Results of the hydrographic survey indicate that in the Phase 2 area mudline elevations vary from +0.00ft to14.00ft at a distance of 40ft from the water's edge. In the Phase 3 area the elevations vary from +0.00ft to -16.00ft, 25ft into the water. Contours developed by Marine Engineering were overlain onto an aerial photograph of the project area. These bathymetric survey is included in Appendix D.

5.6 Laboratory Testing

A laboratory testing program was undertaken to determine the engineering properties of the soils that were encountered during the site investigation. The type and number of tests performed for this scope of work are listed in Table 3.

Index tests were performed on selected soil samples, generally consisted of moisture content determinations in accordance with ASTM D2216. Sieve analyses in accordance with ASTM D422, Hydrometer tests, Atterberg Limits performed on cohesive samples in accordance with ASTM D4318.

Table 3: Type and Quantity of Laboratory Tests

Test Type	Number of Tests
Sieve Analysis	8
Hydrometer	3
Fines Content (Passing #200)	12
Atterberg Limit	9
Water Content	13
Consolidation Testing	3
UU-Triaxial	3
Corrosivity Suite	6

One-Dimensional Consolidation testing on selected undisturbed samples was performed in accordance with ASTM D2435.

Unconsolidated-Undrained Triaxial Compression tests were also performed representative selected undisturbed samples in accordance with ASTM D2850.

Corrosivity tests consisting of ph, minimum resistivity, chloride, sulfate and redox potential were performed on samples of soil cuttings.

The results of all tests performed in the laboratory testing program are included in Appendix C.

6 Geologic and Subsurface Conditions

6.1 Bedrock Geology

The site is located between the boundaries of the four major New York City physiographic provinces, the Manhattan Prong, Newark Basin, the Atlantic Coastal Plain, and the terminal moraine from one or more of the regional Pleistocene glaciers.

The existing rock formations in this area, from the oldest to the most recent, are Staten Island Serpentine, Manhattan Schist, Newark Supergroup, Palisade Diabase and Raritan Formation. The Serpentine formed as the continents of Laurentia (ancient North America) and Gondwanaland converged towards each other closing the proto-Atlantic ocean. As these two masses collided they formed the Appalachian Mountain range. During the early stages of the mountain building event a piece of Serpentine ocean crust broke off and became embedded in the collision zone was to become Staten Island.

Manhattan Schist originated after major plate collisions – Grenvillian collisions – which deformed and buried the rocks deeply, and underwent high-grade metamorphism. The continent that was formed by the Grenville collisions started to split up, leading to the opening of the Iapetus Ocean. Sediments deposited in the bottom of the Iapetus Ocean underwent metamorphosis and formed the Manhattan Schist as well as other regional formations.

The Newark Supergroup follows the Appalachian Mountains along the east coast and consists of nine different subgroup formations as follows from oldest to youngest: Stockton Formation; Lockatong Formation; Passaic Formation; Orange Mountain Basalt; Feltville Formation; Preakness Basalt; Towaco Formation; Hook Mountain Basalt and Boonton Formation. This set of formations was made possible by crustal extension forces causing the breakup of Pangaea. The uplift and faulting that was part of this rifting brought with it new sources of sediment and basalt flows which would fill the exposed rift basins to form the subgroups.

Also a result of the rifting of Pangaea, the Palisades Diabase was formed as magma was generated through decompression melting and intruded into the Stockton Formation of the Newark Supergroup. The magma took with it sandstones and arkoses eventually cooling and solidifying.

The Raritan formation of Staten Island consists of stratified white, light to dark gray, and red beds and lenses of clay, silt and sand. This geologic unit is broken into five subdivisions, from youngest to oldest they are the Raritan Fire Clay, Farrington Sand Member, Woodbridge Clay, Sayreville Sand and South Amboy Fire clay. The deposition of these materials are indicative of a series of major transgression of the seas during the Cretaceous era.

Overburden Units: The bedrock of this region is usually covered by glacial, inter-glacial and post-glacial deposits. The terminal moraine of the last Wisconsin ice advance is a main morphological feature of the region. The lake that was formed behind the terminal moraine led to the deposition of sediments that usually overlay till carried by the glaciers. A geologic map of the project location is shown on Figure 5.

6.2 Subsurface Conditions

Borehole locations have not yet been surveyed prior to the completion of the subsurface program. As the as-drilled location were not surveyed, borehole location elevations have been interpolated based on available topographic survey data (Naik, 2016).

The subsurface soil profiles were delineated using the borehole data from the site investigation program. Two design profiles were drawn across the north-south direction, as shown on Figures 6 and 7 (Cross-sections A-A' and B-B'). Additionally two more cross sections were drawn along the inboard and outboard sides, Figures 8 and 9 (Cross-sections C-C' and D-D') respectively, of the proposed costal structures. To delineate the profile on the inboard side boreholes from the current exploration were used and for the outboard side boreholes from the PRC (1985) exploration were used. Both areas of the site are underlain by four principal soil strata. Boundaries between strata were developed by linearly interpolating between boreholes. Actual boundaries may be different from those shown in the cross-section and there may be gradual transitions between strata. The soil layers presented in the cross-sections for each Phase area are described below:

6.2.1 Phase 2 Area

The following sections describe the expected subsurface conditions in Phase 2 of the project.

Stratum I, Miscellaneous Fill: A layer of undocumented and un-engineered fill underlies the ground surface and extends to a depth of about 25ft. The thickness of the fill layer varies across the Phase 2 area and has been recorded at depths as shallow as 10ft and as deep as 25ft. Historic data indicates this fill was placed as the land was reclaimed for the construction of the Homeport facility.

Stratum I, Miscellaneous Fill consisted primarily of dark grey brown sands and gravel with trace silt and clay with significant amounts of debris such as brick fragments and wood pieces. These soils were predominantly classified as SP according to the Unified Soil Classification System (USCS). The fill had standard penetration test resistance (N_{60}) ranging between 2 and 100 blows per foot (bpf), with an average of 19bpf. Figure 10, Engineering Properties of Miscellaneous Fill shows the N_{60} blowcounts versus elevation for the miscellaneous fill layer, where N_{60} is the field blowcount corrected to a hammer energy efficiency of 60 percent. These values are indicative of a moderately to well compacted material however the presence of gravel and debris within the matrix may have led to higher blowcounts. Five samples in the Miscellaneous Fill were tested to determine the percent passing the #200 sieve in the soil matrix. The fill had fines ranging from 2.9% to 36% with an average fines content of 15.8%. No moisture content test were completed in this strata in Phase 2. In addition, Chemical (Chloride and Sulfate) content and minimum resistivity tests were performed on two samples in this area. Results indicate the Fill in this area has pH ranging between 6.6 and 7.5, minimum resistivity ranging between 700 and 2,000 Ω-cm. Sulfate content ranges between 124 and 1,810 ppm and Chloride content ranges between 190 and 404 ppm. The results are also presented versus sample elevation on Figure 10.

Stratum II, Upper Outwash Deposit: At all borehole locations, Stratum I, Miscellaneous Fill was underlain by an outwash deposit of typical thickness 15ft. The upper outwash deposit consisted predominantly of dark grey brown sands and gravels. These soils were typically classified as SM, SP, or GP according to the Unified Soil Classification System (USCS). The Upper Outwash Deposit N_{60}-values ranging between 0 bpf and 48 bpf with average of 14 bpf. The upper outwash deposit has density ranging from loose (5 bpf<N_{60}<10 bpf) to dense (30 bpf<N_{60}<50 bpf). Figure 11, Engineering Properties of Stratum II: Upper Outwash Deposit shows the N_{60} blowcounts versus elevation for the upper outwash deposit layer. Fines content testing was completed on two samples in the Upper Outwash Deposit for this area (see Figure 11) with results ranging from 7.4% to 34% having an average of 20.7%. No moisture content tests were completed on this strata in Phase 2. No corrosion testing was completed on this strata in this area. The results are presented versus sample elevation on Figure 11.

Stratum III, Clay and Silt: Deposits of Clay and Silt were encountered in 4 of the Phase 2 boreholes at a typical depth of 30ft below the ground surface. In this Phase area this stratum does not appear to be continuous from the current borehole information. However, based on other borehole information this stratum is likely continuous across Phase 2 with a minimum thickness of 5ft. The clay and silt deposit had N_{60}-values ranging from 0bpf to 26bpf with an average of 16 bpf. Samples ranged from very soft (N_{60}<5 bpf) to very stiff (15 bpf <N_{60}<30 bpf). Figure 12, Properties of Stratum III: Clay and Silts shows the N_{60} blowcounts versus elevation for the clay and silt layer. The moisture content of the clay and silt was tested ranged from 20.8% to 47.2% with an average of 34.0% for the 2 samples that were tested. The Liquid Limit of the soils tested in this strata ranged from 26 to 53 and averaging at 39 based on 2 tests. The Plastic Limit of the soils tested in this strata ranged from 21 to 52 and averaging at 36 based on 2 tests. The plasticity Index of the soils ranged from 1 to 5 having average value 3 based on 2 tests. In one borehole, P2-B2 an additional sample of clay and silt was collected near the termination depth, therefore the nature of this sample could not be determined definitively. No undisturbed samples were taken in the Phase 2 area. The results are presented versus sample elevation on Figure 12.

Stratum IV, Lower Outwash Deposit: The boundaries of the previous cohesive strata were interpolated between to delineate a lower outwash deposit strata. These lower outwash deposits typically occur at a depth of 35ft below the ground surface. The lower outwash deposit consisted of dark brown sands and gravels. These soils were typically classified as SM, SP, or GP according to the Unified Soil Classification System (USCS). The lower outwash deposit had N_{60}-values ranging between 5 bpf and 45 bpf with an average of 22 bpf. The lower outwash deposit is typically medium dense (10 bpf<N_{60}<30 bpf). Figure 13, Engineering Properties of Stratum IV: Lower Outwash Deposits shows the N_{60} blowcounts versus elevation for the lower outwash deposit strata. One fines content test was completed on the Lower Outwash Deposit samples in this area (see Figure 13) yielding a result of 15%. No moisture contents were completed on this strata in the Phase 2 area. Chemical content (Chloride and Sulfate) and minimum resistivity tests were not performed on any samples on this strata in this area. The results are presented versus sample elevation on Figure 13.

6.2.2 Phase 3 Area

The subsurface conditions anticipated in Phase 3 area of the project are described below:

Stratum I, Miscellaneous Fill: Similar to Phase 2 a layer of undocumented and un-engineered fill is located below the ground surface extending to a depth of about 15ft below the ground surface. The material consists of dark grey brown sands and gravels with trace silt and clay, with a USCS classification SP. The thickness of the fill layer varies across the Phase 2 area and has been recorded at depths as shallow as 5ft and as deep as 30ft.

The Phase 3 fill had N_{60}-values ranging between 1bpf and 78bpf and averaging at 18bpf. Similarly to Phase 2 these values are indicative of a moderately to well compacted material however the presence of gravel and debris within the matrix may have led to higher blowcounts. Samples in Stratum I, Miscellaneous Fill were tested for percent passing the #200 sieve. The percent fines in the soil matrix ranged from 5% to 8.3% with and average value of 6.65% on two tests. No moisture contents were reported for this strata in this location. Chemical content (Chloride and Sulfate) and minimum resistivity tests were performed on one sample on this strata in this area. Results indicate the soil in this strata has pH 7.1, minimum resistivity 500 Ω-cm. Sulfate and chloride content has been determined to be 99 and 160 ppm respectively. All results are also summarized on Figure 10, Engineering Properties of Miscellaneous Fill.

Stratum II, Upper Outwash Deposit: At 9 of the 11 boreholes completed in the Phase 3 exploration program a strata of upper outwash deposits was encountered underlying the miscellaneous fill having typical thickness 15ft. The material sampled was similar in description and classification to what was received in the Phase 2 portion of the exploration, consisting of dark grey classified as SM, SP, or GP according to the Unified Soil Classification System (USCS). The upper outwash deposit had N_{60}-values ranging from 0bpf to 27bpf with an average of 8bpf. The upper outwash deposit can ranges in density from very loose (0bpf$<N_{60}<$4bpf) to medium dense (10bpf$<N_{60}<$30bpf). Some N_{60}-values are seen to be greater near the limits of the fill, the interactions between these two matrixes likely yielded higher blows. The moisture content of the Upper Outwash Deposit ranges from 17.6% to 25.2% and averages to 20.8% based on three tests. The fines content of the Outwash Deposit samples ranged from 1% to 33% with an average value of 18.7%, based on 7 tests. Chemical content (Chloride and Sulfate) and minimum resistivity tests were performed on two samples on this strata in this area. Results indicate the soils in this area have pH ranging between 6.7 and 6.8, minimum resistivity of 300 Ω-cm. Sulfate content ranges between 565 and 3,168 ppm and Chloride content ranges between 240 and 1,751 ppm. All results for this strata are summarized on Figure 11, Properties of Upper Outwash Deposit.

Stratum III, Clay and Silt: Underlying Stratum II, Upper Outwash Deposit, where encountered or Stratum I, Miscellaneous Fill elsewhere a continuous deposit of clay and silt was encountered during the Phase 3 investigation. This cohesive deposit may be encountered as shallow as 15ft and as deep as 30ft below the ground surface. Strata thicknesses range from 5ft to 30ft. The cohesive deposit had an N_{60}-values ranging from 0 bpf to 36 bpf with an average of 7 bpf. Soil density in this strata can be described as being predominantly very soft (N_{60}<2bpf) to soft (2bpf<N_{60}<4bpf). Some N_{60} values ranged as high as (15<N_{60}<30) indicating very stiff zones. With the exception of two moisture content tests which yielded results greater than 100% were excluded from the average, in general the moisture content of the clay and silt ranged from 22.5% to 83.3% and averaging at 35% for the 8 samples that were tested. Soils having these results are likely to contain organics. The Liquid Limit of the soils tested in this strata ranged from 24 to 139 and averaging at 70 based on 6 tests. The Plastic Limit of the soils tested in this strata ranged from 23 to 105 and averaging at 54 based on 6 tests. The Plasticity Index of the soils tested in this strata ranged from 0 to 44 and averaging at 16 based on 6 tests. The fines content of clay and silt was 83% based on a single test. Three undisturbed samples were taken in the Phase 3 area which were used to determine values for undrained shear strength through UU triaxial testing. All results for this strata are summarized on Figure 12, Properties of Clay and Silt Deposit.

Stratum IV, Lower Outwash Deposit: Immediately below Stratum III, Clay and Silt samples indicate the presence of a lower outwash deposit. Similar to the materials encountered in Phase 2 the lower outwash deposit consists of dark brown sands and gravel having USCS classifications either SP SM, or GP. The lower outwash deposit had N_{60}-values ranging from 0bpf to 100bpf and averaging at 41bpf. As seen in Figure 13 the N_{60} values increased with depth. The lower outwash deposit increases from medium dense (10bpf<N_{60}<30bpf) from immediately beneath the clay and silt to very dense (N_{60}>50bpf) at a depth of about 55ft. One moisture content test on the Upper Outwash Deposit sample indicated a value of 25.6%. The fines content of four of the Lower Outwash Deposit samples (see Figure 13) ranged from 3.9% to 28% with an average value of 15%. Chemical content (Chloride and Sulfate) and minimum resistivity tests were performed on one of the samples taken in this strata within this area. Results indicate the soil in this area has pH 7.6, minimum resistivity 2,700 Ω-cm. Sulfate and chloride content has been reported at 46 and 11 ppm respectively. All results for this strata are summarized on Figure 13, Properties of Lower Outwash Deposit.

6.3 Groundwater

Groundwater was encountered in all boreholes. During the current investigation depths to groundwater were recorded at a depth of 8ft below ground surface consistently across both Phases. Using the topographic survey (Naik, 2016) the groundwater table can be identified at about elevation +0.00ft.

6.4 Geotechnical Parameters for Design

This section presents the design parameters selected for the four soil strata for use in the geotechnical engineering analyses (See Table 4). The results from the laboratory program and field standard penetration tests resistances were used to select these parameters (See Figures 10, 11, 12 and 13).

Of the four strata, the three primary soil strata encountered across both Phases were found to be similar. For the purpose of design and engineering analyses, the following parameters are recommended:

Stratum I, Miscellaneous Fill: Estimates of effective friction angle in the miscellaneous fill were obtained from empirical correlations based on the standard penetration test based on correlations presented in Peck, Hanson, and Thornburn (1974).

The following parameters are recommended for the fill:

- Total unit weight, γ_t: 106 pcf
- Effective friction angle, ϕ': 31°

Stratum II, Upper Outwash Deposit: Estimates of effective friction angle in the Upper Outwash Deposits were obtained from empirical correlations based on the standard penetration test based on correlations presented in Peck, Hanson, and Thornburn (1974).

For the purpose of design and engineering analyses, the following parameters are recommended for the Outwash Deposits:

Medium Dense Sands:

- Total unit weight, γ_t: 112 pcf
- Effective friction angle, ϕ': 32

Stratum III, Clay and Silt: Values for undrained shear strength were obtained from UU triaxial tests completed on 3 undisturbed samples collected from the Phase 3 area. The results from these tests range from 330psf to 550psf and have an average value of 450psf, as shown on Figure 12.

The compressibility characteristics of the cohesive strata were evaluated from the results of three consolidation tests completed on the available undisturbed samples. The procedures outlined by Casagrande (1936), Pacheco Silva (1970), and Becker (1987) were used to estimate the pre-consolidation stress for each sample, and the design values were determined by comparing the values from these three methods. Figure 14, Compressibility Parameters for Stratum III shows the over-consolidation ratio (OCR) ranges from 0.8 to 1.2, indicating the cohesive soils are most closely normally consolidated. OCR should be taken as 1.0 for design purposes. Results of testing also indicated a Coefficient of secondary compression, $C_{\alpha\varepsilon}$, ranging

Time rates of consolidation were also measured under various stress levels. Values of C_v were interpreted using the square root of time or log of time method. The average value of coefficient of consolidation, C_v, for the organic deposit was estimated at 0.516 ft^2/day and 0.140 ft^2/day, for the range of virgin compression and recompression, respectively. The initial void ratio of these samples generally ranged from 1.62 to 2.1 and averaging at 1.92. The compressibility characteristics for the silt and clay deposits as evaluated from the consolidation tests are presented in Figure 14.

The following parameters are recommended for the Stratum III, Silt and Clay deposits:

- Total unit weight, γ_t: 97 pcf
- Undrained shear strength, S_u: 450 psf
- Over-consolidation ratio, OCR: 1.0
- Compression ratio, $C'_{c\varepsilon}$: 0.28
- Recompression ratio, $R'_{r\varepsilon}$: 0.02
- Coefficient of consolidation in the range of virgin compression, $C_{v,vc}$: 0.52ft^2/day
- Coefficient of consolidation in the range of recompression, $C_{v,rc}$: 0.14 ft^2/day
- Coefficient of secondary compression, $C_{\alpha\varepsilon}$: 0.01

Stratum IV, Lower Outwash Deposit: Estimates of effective friction angle in the Lower Outwash Deposits were obtained from empirical correlations based on the standard penetration test based on correlations presented in Peck, Hanson, and Thornburn (1974). As seen on Figure 13, the density of the Outwash Deposits increases with depth from medium dense immediately beneath the cohesive strata to very dense at a depth of 55ft.

For the purpose of design and engineering analyses, the following parameters are recommended for the Outwash Deposits:

Medium Dense Sands:

- Total unit weight, γ_t: 120 pcf
- Effective friction angle, ϕ': 33^o

Very Dense Sands:

- Total unit weight, γ_t: 125 pcf

Effective friction angle, ϕ': 36^o to 38^o

Table 4: Recommended Design Soil Parameters for Phase 2 and 3

Stratum	Moist Unit Weight (pcf)	Total Stress Parameters	
		Angle of Internal Friction (deg.)	Undrained Shear Strength (psf)
Miscellaneous Fill	106	31	--
Upper Outwash Deposits	112	32	--
Clay and Silt	97	--	450-500
Lower Outwash Deposits	120-125	33-36	--

7 Seismic Engineering Analyses

7.1 Seismic Setting

In the New York City area, seismic activity is infrequent and is usually of low magnitude, see Figure 15, Regional Seismicity. The three greatest earthquakes reported in the New York City area date 1884, 1783 and 1737, reaching estimated magnitudes between 5.0 and 5.5 and intensities V2 in the Mercalli scale.

The 1884 earthquake had its epicenter in the New York bight basin, approximately 14 miles southeast of the site.

The 1783 earthquake epicenter was located near the Ramapo fault, roughly 30 miles northwest of the site. Though it does not appear in Figure 15, the Ramapo fault is the most important fault in the region, striking northeast – southwest with its shortest distance to the site being approximately 30 miles. The Ramapo fault is responsible for a significant number of low magnitude earthquakes.

The epicenter of the 1737 earthquake occurred very close to the Cameron's Line. The Cameron's Line is a major regional fault that strikes northeast – southwest, crossing downtown and uptown Manhattan, very near to the project site, and the East river, near the Queens shore. Earthquakes along the Cameron's Line are less frequent, but may reach higher magnitudes than those occurring along the Ramapo Fault.

7.2 Seismic Design

The simplified procedure presented in the 2014 NYCBC for earthquake loads (Section BC 1615) was used to obtain code design response spectrum for the project site.

The 2014 NYCBC procedures use site amplification coefficients to estimate design response spectra for different site classes starting from mapped acceleration parameters that correspond to spectral acceleration values for a Maximum Considered Earthquake (MCE). The MCE is equivalent to an earthquake event with a 2% probability of exceedance in 50 years (return period of 2,475 years). The mapped spectral values are for the 0.2 and 1.0 sec periods (S_S and S_1), and for a Site Class A that corresponds to a "Hard Rock" site. The MCE spectral values are modified by site coefficients (F_a and F_v) to account for soil conditions other than Site Class B conditions. The modified spectra values are referred to as S_{MS} and S_{M1}. The design spectral acceleration values, S_{DS} and S_{D1}, are then obtained by reducing the modified values by 33%, as recommended by the code.

The development of the design response spectrum presented in the 2014 NYCBC follows the procedure presented in Section 3.3.4 of the NEHRP (National Earthquake Hazards Reduction Program): Recommended Provisions for Seismic Regulations for New Buildings and Other Structures (FEMA 450).

The site classification for Phase 2 and 3 area was determined using the results of the standard penetration resistance tests performed during the field exploration work, and following the guidelines presented in the 2014 NYCBC for site class determination using the average standard penetration resistance test values, N_{avg}.

Based on the criteria set forth in the 2014 NYCBC the soils below the depth of the Phase 2 area indicate that the Site Class is predominantly Site Class E (Soft Soil Profile). The determination of site class is based on a weighted average of the N-values for the depth of sampling. The soils below the depth of the Phase 3 area indicate that the Site Class is also predominantly Site Class E (Soft Soil Profile).

Figure 16, 2014 NYCBC Design Spectrum, presents the recommended design response spectra for a Site Class E. The 2014 NYCBC mapped acceleration parameters, and site coefficients used to generate the response spectra in Figure 16 are:

- Mapped acceleration parameters, S_S = 0.281 and S_1 =0.073
- Site Class E site coefficients, F_a = 2.37 and F_v = 3.50
- Site Class E design peak ground acceleration per NYCBC = 0.33g

7.3 Liquefaction Assessment

Soil liquefaction, or a significant reduction in soil strength and stiffness as a result of increase in pore pressure, is a major cause of damage during earthquakes. Usually, for soil liquefaction to occur, three conditions must exist, including: 1) the presence of loose, sandy soils or silty soils of low plasticity; 2) the presence of shallow groundwater, within the upper 40-50ft; and 3) a source of sudden or rapid loading, typically associated with earthquakes.

Across the site the groundwater table is present relatively close to the ground surface, because of its proximity to the shoreline, and the cohesionless soils at site loose to medium dense with some deposits which appear denser at depth.

As shown on Figure 17 the results of the grain-size distribution tests were plotted in conjunction with the limits for liquefiable soils (Tsuchida, 1971) based on a coefficient of uniformity either greater or less than 3.5. The results of this analysis indicate all of the samples tested fall in the range of potentially liquefiable soils. Consequently, the conclusion is drawn that these soils are susceptible to liquefaction in a suitable seismic event. Therefore a liquefaction susceptibility analyses were performed.

The New York City Building Code (NYCBC) requires an evaluation of the liquefaction potential of soils below the groundwater table and up to 50ft below the ground surface. The results of these analyses are shown on Figure 18, Liquefaction Evaluation.

Further to the analysis required by the NYCBC, the procedure presented in Idriss and Boulanger (2008) was also used to evaluate the liquefaction potential of these layers using standard penetration resistance (SPT N values).

Liquefaction potential analyses were performed for a PGA value of 0.33g and a Moment Magnitude 5.7 which corresponds to the spectral peak ground acceleration for a Site Class E as well as a PGA value of 0.24g and a Moment Magnitude 5.7 which corresponds to the spectral peak ground acceleration for a Site Class D as determined by the 2014 New York City Building Code and the 2,475 year return period Moment Magnitude determined from the United States Geological Survey (USGS) (USGS, 2016).

The field SPT N values were converted to equivalent $(N_1)_{60}$ values which were corrected for overburden stress of 1 ton per square foot (tsf), and converted to a 60% hammer energy efficiency. The $(N_1)_{60}$ values were used to perform a liquefaction analysis based on the method presented by Idriss and Boulanger (2008) where triggering of liquefaction is related to the blow count and Cyclic Stress Ratio (CSR).

The results of the liquefaction analysis are also shown on Figure 18, as a function of CSR and corrected N-values. The factor of safety against liquefaction was also computed and is also shown on Figure 18. The factor of safety is defined as the Cyclic Resistance Ratio (CRR) divided by the CSR. It can be seen from Figure 18 that the factor of safety against liquefaction is frequently less than one with maximum values greater than 4.0 at some depths within the Outwash Deposits.

Therefore potential for liquefaction in the foundation soils must be considered, in foundation design. Based on the results of these analyses the implications of liquefaction are; 1) Seismic settlement, 2) Downdrag loads on piling, 3) potential for instability of coastline by lateral spread, 4) Instability of and impact on retaining structures. These must be assessed and incorporated in foundation design.

7.4 Seismic Settlement

Additional analyses were to evaluate the magnitude of settlement which will be undergone due to post- liquefaction densification at each proposed structure location. These settlements are determined using recommended relationships to volumetric strain, ε_{v}, as presented by Seed et al. (2003), which are likely to occur in the event of liquefaction. To determine the volumetric strains in each strata these relationships are used in conjunction with the cyclic shear stress ratio likely to develop at the depth of each of the standard penetration test with corrections for fines content to represent equivalent values for a clean sand $(N1)_{60,CS}$. Post-liquefaction settlements from each strata are then totaled to estimate the overall magnitude. Post-liquefaction settlements have been summarized for each structure in Table 5. These will result in downdrag loads on deep foundations.

Table 5: Post liquefaction Seismic Settlement

Post-liquefaction Settlement		
Phase Area	**Structure**	**Settlement, in**
2	M&O Facility	9.0
	Bridge Path, North Abutment	9.4
	Bridge Path, South Abutment	6.4
3	Comfort Station	11.8
	North Bridge Path, North Abutment	10.0
	North Bridge Path, South Abutment	11.1
	South Bridge Path, North Abutment	5.7
	South Bridge Path, South Abutment	11.8

7.5 Lateral Spread

Lateral spreading occurs primarily by horizontal displacement of surficial soil layer due to liquefaction of underlying granular deposits. The degradation in the undrained shear resistance arising from liquefaction may lead to limited lateral spreads induced by earthquake inertial loading. Such spreads can occur on gently sloping ground or where nearby drainage or stream channels can lead to static shear biases on essentially horizontal ground. The determination of lateral spread potential and an assessment of its likely magnitude were conducted for the project site. The area of the proposed development is relatively level. However, an open face exists.

Therefore, the Youd et. al. (2002) equation was used to gain an order of magnitude estimate of the lateral spread that could occur in the event of the MCE_G earthquake.

Using regression analyses and a large database of lateral spread case histories from past earthquakes, Bartlett and Youd (1992) developed empirical equations relating lateral spread displacements to a number of site and source parameters. They analyzed 43 detailed factors from eight different earthquakes to account of seismological, geological, topographical and geotechnical effects on lateral ground displacements due to liquefaction. Applications of these equations to the case history database indicated that 90 percent of the observed displacements were within a factor of 2 of the predicted values. Unfortunately, this prediction approach is least reliable in the small displacement range. The empirical procedure developed by Youd et. al (1999) to assess lateral spreading is summarized below:

1) If $(N_1)_{60}$ values are equal to or more than 15, the potential for lateral displacements would be small for earthquakes with magnitudes less than 8, and no additional analyses are warranted.
2) If $(N_1)_{60}$ values are less than 15, then the evaluation of ground displacements are continued using the prescribed equations.

Youd et. al. (2002) later corrected and updated the original analysis, and gave two equations for lateral ground displacement, D_H, one for movement down a gentle slope and another towards a free face. The equation for the free face is as follows:

$$\log D_H = -16.713 + 1.532M - 1.406\log R^* - 0.012R + 0.592\log W + 0.540\log T_{15} + 3.413\log(100 - F_{15}) - 0.795\log(D50_{15} + 0.1)$$

The various site parameters include the cumulative thickness (T_{15}) of saturated granular layers with corrected SPT N- values $(N_1)_{60}$ less than or equal to 15, in meters. The average mean grain size $(D_{50})_{15}$ in the granular layer; the average fines content for the granular materials included in T_{15} in percent. The various source parameters include the design earthquake magnitude, horizontal distance from the site to the seismic energy source and the ground slope in percent.

M = earthquake moment magnitude,
R = horizontal distance from the site in question to the nearest bound of seismic energy source (km),
R* = modified source distance (R* = R + 10(0.89M- 5.64)),
W = ratio of free face height to distance to free face (%),
T_{15} = cumulative thickness (m) of saturated sandy layers with normalized SPT N-value $(N_1)_{60}$ <15,

F_{15} = average fines content of saturated granular layers within T_{15} (%) and,
$D50_{15}$ = average mean grain size (in mm) of layers included in T_{15}.

At the project site, the average cumulative thickness of layers with corrected N-values $(N_1)_{60}$ less than 15 is about 25 to 30 ft. The average mean grain size $(D_{50})_{15}$ in the granular layer was found to be 0.23 mm to 2.54 mm while the average fines content for the granular materials included in T_{15} was 15-20 percent. For a ratio of the free face height (24 ft) to distance from free face of 200 ft, of about 12 percent, a minimal lateral displacement (<0.1 ft) should be expected in the event of the MCE_G.

8 Geotechnical Engineering Analyses

8.1 Settlement from Areal Fill

During the construction of both the Phase 2 and 3 areas the project areas will graded to meet landscape architecture and site drainage requirements. To achieve this compacted fill will be placed across specific locations at the site.

Few selected locations in both the Phase 2 and 3 areas will receive significant heights of fill. The first, referred to as “Location 1”, is at the southernmost point of the Phase 2 area and will serve as a raised overlook and will receive 11 ft of fill. The second, referred to as “Location 2”, is at the southeast corner of Phase 3 and will also serve as a raised overlook and will receive 13 ft of fill. The third, referred to as “Location 3”, is located at the south west corner of Parcel B1 and is to serve as an approach to the proposed new structure located at Parcel B1 will receive 5ft of fill.

For each location, settlement analyses were completed for the maximum areal fill heights using subsurface data from adjacent borehole sites. The compressibility parameters presented in Section 7.5 were used in these analyses as well as an OCR value of 1.0. Primary consolidation settlements are estimated to be 4.0in in 2 months, 15.7in in 24months, and 8.5in 18 months respectively. In addition secondary compression may results may results in continued long-term settlement on the order of 0.8in, 1.7in and 2.1in respectively over the course of 50 years. Computed total settlements for each areal fill are presented in Table 6.

At Location 1 in the Phase 2 area cohesive materials were not encountered. Underlying Locations 2 and 3 were deposits of compressible clays and silts encountered in boreholes adjacent to the site. These soils will undergo long term consolidation under stresses from additional fill placed at the site. Any settlement that may occur in the cohesionless soils under the imposed fill load would likely be immediate.

Borehole P2-B1 was used to compute settlements at location 1. Due to the lack of cohesive material at this location the typical profile for Phase 2 was used. The typical profile includes 15 of Miscellaneous Fill underlain by 15 ft of sands and gravel, underlain by 5 ft of clay and silt, underlain by an additional strata of sand and gravel of which the thickness is unknown as the borehole was terminated within the strata.

At location 2 both boreholes P3-B1 and P3-B11 were considered as they were both adjacent but indicated varying subsurface conditions. Borehole P3-B1 includes 15 ft of Miscellaneous fill underlain by 10 ft of sand and gravel, underlain by 5 ft of clay and silt, underlain by 5 ft of sand and gravel underlain by an additional stratum of clay and silt of which the thickness is unknown as the borehole was terminated within the strata. A thickness of 15 ft was assumed for this strata. Borehole P3-B11 exhibits 30 ft of Miscellaneous Fill underlain by 5 ft of clay and silt, see Figure 7. Subsurface conditions at P3-B1 were considered to be more critical and used for the primary analyses at location 2.

At Location 3 borehole P3-B2 was used for settlement analysis. The soil profile at P3-B2 includes 15 ft of Miscellaneous Fill underlain by 5 ft of sands and gravel, underlain by a strata of clay and silt. The thickness of this strata is unknown as the boring was terminated within this strata. For the purposes of these analyses, a thickness of 20 ft was assumed.

Table 6: Settlement Analyses under Areal Fill

	Location 1	***Location 2***	***Location 3***
Soil Profile from Borehole	P2-B1	P3-B1 and P3-B11	P3-B2
Proposed Fill Height (ft)	11 ft	13 ft	5 ft
Primary Consolidation (in)	4.0in	15.7in	8.5in
Secondary Consolidation (in)	0.8	1.7	2.1
Total Settlement (in)	4.8	16.8	10.6
Time to Complete Primary Settlement	10 days	3 months	5 months

Settlements of this magnitude would be problematic to the various structures proposed in both phase areas.

Due to the magnitudes of the calculated settlements it would not be favorable to allow the soils to consolidate naturally under the increased surcharge. Long term settlements could cause varying levels of damage to the surrounding structures such as cracking of walls and flatwork. To mitigate these issues it is recommended that ground improvement measures be implemented at each of the previously discussed locations to allow the compressible underlying soils to consolidate prior to beginning construction.

Preloading and Surcharging: The most economical solution to mitigate settlements is to install preload the surface with additional surcharge equivalent to or greater than the proposed grade increase for a period of time equivalent to those previously discussed. By surcharging the area with loads greater than those imposed by the proposed fill primary settlement would be accelerated and secondary compression would be reduced.

Preloading and Surcharging with Prefabricated Vertical Drains: If the rate of settlement is not fast enough to complete settlement within the desired construction schedule then it is recommended that vertical drains be installed down to the cohesive deposits. The vertical drains will allow the pore pressures within the soils to alleviate faster accelerating the process. It should be noted that actual settlement rates in the field are generally difficult to predict using laboratory data. Differences between settlements in the field and lab are attested to the presence of internal drainage paths within the soil matrix as well as the intrinsic variability of the soils. Therefore, it is recommended that settlements be monitored during each of the previously stated settlement times respectively.

Stresses from the preloading will not only cause consolidation settlement of the cohesive deposits, but will also initiate some lateral squeezing and displacement of underlying deposits. Lateral displacements will produce downdrag and possible lateral loads on deep foundations. Therefore foundation installation should not begin prior to the previously stated periods of settlement are completed.

8.2 Foundation Selection

A foundation type selection assessment was made for the various structures planned in light of the expected structural loading, site subsurface conditions, constructability, and economic considerations. Both shallow foundations, slabs on grade and deep foundations were assessed.

8.2.1 Shallow Foundations

Shallow foundations will be adequate for structures with relatively small loads in both the Phase 2 and 3 areas. Examples of structures which qualify for support on shallow foundations include benches, playground equipment and bus stop shelters.

8.2.2 Deep Foundations

The presence of a compressible strata of clay and silt and potentially liquefiable hydraulic fill across both Phases will require that the structures or utilities whose operation is dependent on their elevation inverts be supported on deep foundations. As part of the foundation type selection study, various types of piles were qualitatively assessed with respect to: 1) lateral and vertical load carrying capacity, 2) available space for the pile cap, 3) overhead constraints, 4) construction considerations, and 5) economic considerations.

Options evaluated included square concrete piles, closed and open-ended steel pipe piles, drilled shafts, drilled minipiles and timber piles.

Pre-stressed concrete piles: offer the advantage of relatively high load carrying capacity. Perhaps their biggest advantage is that these piles are most commonly used in the area for the redevelopment of the Hudson River Park along the Manhattan waterfront. Installing full displacement piles such as a prestressed concrete pile has some potential for causing vibration-induced permanent ground settlement. These issues can be somewhat mitigated by predrilling an undersized hole prior to driving the pile. The anticipated pile design lengths would likely be about 70 ft, the typical length that can be transported. However, if needed this problem can be resolved by driving the concrete piles in two sections connected by a factory installed mechanical splice. Where, hard driving is expected, a hardened steel H-section can be cast into the pile.

Closed-End Pipe Piles: These piles are attractive due to their ability to achieve high axial and moment capacity. An advantage of close-end pile over their open-end counterparts is that it allows a more detailed post installation damage and verticality inspection. Driving full displacement piles may cause excessive vibrations. Moreover, if obstructions are encountered during installation, there is no recourse available but to extract and redrive the piles at an adjacent location. Obstructions may cause damage to the pile itself. Given the relatively high likelihood of encountering potential obstructions at the site, this closed end piles were not selected.

Open-End Pipe Piles: Open end pipe piles is a low displacement pile which can be advanced relatively easily and offers several advantages over closed end piles. If obstructions are encountered, one can potentially auger or through inside the pile to remove them. The soil infill can also be removed partially to make room for the reinforcement cage and concrete plug. If hard driving is expected, then a high strength steel driving shoe can be used. In view of the above driven open ended pipe piles were selected for further analyses.

Bored Piles do offer excellent vertical load and moment carrying capacity. However, these are most suitable for ground conditions where the drilled holes will retain their shape and not cave in during drilling and concrete placement. Constructing bored piles in loose to medium dense sands below the ground water table without a casing is typically not recommended for a number of reasons. The drilling procedure is likely to cause disturbance to the surrounding soils and if the sands are only medium dense, caving is quite likely. While the slurry displacement method can be used for constructing bored piles below the water table, it creates a different set of problems. Loss of slurry through the rip-rap on site is also a factor to consider. All these factors result in poor quality of the constructed shaft. Also, while a steel casing can be installed to prevent cave-ins, for subsurface conditions which involve mostly loose to medium dense sands, the length of casing will result in increased costs. Moreover, the process of removing the casing from the drilled hole with the reinforcement cage in place and while the concrete is poured is cumbersome and has potential for the steel casing to get stuck in the hole. In view of the reasons mentioned above, bored piles may not be the preferred option for final design of the proposed facility. Nevertheless, pile diameters of 16 in, 24 in and 36 in were evaluated for the subject project site, purposes of comparison.

Drilled Minipiles can be installed in areas of particularly difficult, variable, or unpredictable geologic conditions such as ground with cobbles, boulders, fill with buried miscellaneous debris, and irregular lenses of competent and weak materials. Soft clays, running sands, and high ground water not conducive to conventional drilled shaft or bored pile construction cause minimal impact to drilled minipile installation. The method of installation of drilled minipiles causes less noise and vibration than conventional pile driving techniques. They are being frequently used for underpinning existing structures and can be installed in environments with space constraints. Moreover, they can be installed very close to any adjacent structure without causing damage. In addition, drilled minipiles can be installed in hazardous and contaminated soils; their small diameters result in less spoil than created by conventional drilled shafts and the flush effluent can be controlled easily at the ground surface through containerization. These factors greatly reduce the potential for surface contamination and handling costs. Besides, grout mixes can be designed to withstand chemically corrosive groundwater and soils. Special admixtures can be included in the grout mix design to reduce and avoid deterioration from acidic and corrosive environment. Minipiles are capable of sustaining ultimate loads as high as 300 tons. Drilled minipiles have not been selected for the current phase of the project, as the loads are not significant to warrant the additional costs.

Timber Piles: It is common Practice in New York City to support sewers and drains on timber piles. In dealing with the installation of private sewers and drains the New York Department of Environmental Protection (NYDEP) requires the use of timber piles to support these structures if subgrade soils have standard penetration resistance equal or less than 15 bpf. Timber piles will be analyzed further as design is progressed.

In view of the ground conditions and the proposed structures deep foundations such as open-ended pipe, pre-stressed concrete piles, or bored piles may be selected for structures and driven timber piles be used for storm drains, sewers or other utilities.

8.3 Foundation Analyses

8.3.1 Bearing Capacity of Shallow Foundations

Analyses for allowable bearing pressures were completed for both square and strip footing options placed on the present fill materials. A maximum allowable bearing pressure of 1500psf with a minimum footing width of 3 ft and an embedment of 4 ft is recommended. For these analyses a limiting settlement of 1in was used. The resultant of any applied loads on a shallow foundation must lie within the middle third of the footing.

Remedial removals of the existing unsuitable, loose materials from the foundation location will likely be required. It is expected that depending on actual conditions, the upper 2-3 ft of soils below the foundation level may be excavated and replaced with aggregate base or crushed rock compacted to 90% of relative compaction (ASTM D1557).

8.3.2 Deep Foundations Analyses

Preliminary analyses being completed by the structural engineer have indicated that piles installed on site will be required to resist axially a structural load 50 tons per column.

8.3.2.1 Pile Sizing

For preliminary purposes a 24 inch diameter open ended steel pipe pile as well as a 24 inch diameter bored pile were selected for analyses. The allowable design load per pile was taken as 100 kip (50 tons). The selected pile sizes were checked for their structural capacities which were then compared with the structural design load of 50 tons plus the design downdrag load ranging from about 40 ton to 90 ton, depending on the location (See 8.3.2.2).

Wall thicknesses for various diameters steel pipe pile were initially selected based on general commercial availability. Then, the selected pile sizes and wall thicknesses (16 in diameters with 0.50 in wall; 24 in diameter with 0.625 in wall) were assessed for their allowable structural capacity in compression per applicable NYBC Subsection 1810.6 requirements using the following allowable axial stresses:

$$f_a = 0.35 f_y$$

Where f_y is no greater than 36 ksi; therefore, f_a = 12.6 ksi

The NYBC allows the allowable stress to be increased to 18 ksi, provided load tests and geotechnical investigations are carried out under the direct supervision of a qualified engineer.

At the NSW site, there is some potential for pile damage from boulders, during driving and hard driving is to be expected. It was assumed that the steel pipe piles that meet ASTM A252 steel with a yield stress (f_y) of 36 ksi will be used. For piles in the inland areas, to account for corrosion of the steel pile cross-section, a reduction of 0.075 inch in the outer pile wall was selected for the design life of 75 years. However, for piles in the marine zone exposed to saline water would require a greater corrosion allowance of 0.3 in for a design life of 75 years (See Section 8.7).

Concrete infill, when used, would limit corrosion inside the pile and would also further enhance the allowable axial compressive stress in the pile leading to an allowable axial load:

$$P_a = A_s * (0.25 f_y) + A_c * (0.33 f'_c)$$

where,

fy = 36 ksi, yield stress of steel, As = area of steel cross-section after corrosion allowance, and f'c = 5000 psi, 28-day compressive strength of concrete infill and Ac = area of concrete cross-section.

Following these analyses an allowable axial load of 220 ton and 485 ton have been determined for 16 in and 24 in open-ended concrete filled steel pipe piles.

8.3.2.2 Pile Downdrag Loads

In accordance with FHWA (1998), a relative movement of 0.25 inch to 0.5 inch between the soil and pile surface is considered necessary to develop full negative skin friction (downdrag). As additional fill is being placed in the area of the new piles, the underlying clay will likely undergo consolidation. The thickness of the compressible soils varies across the site. Therefore estimates of expected settlements and related downdrag for different pile sizes were made. Downdrag loads for different pile types were assessed using beta-parameters by Fellenius et al and published by FHWA. For sandy fill material, a beta of 0.3 and for clays beta of 0.20 was selected for use. Several approaches to incorporate downdrag loads in pile design are available, including:

- Reducing downdrag by friction reducers- bitumen coating or other coatings.
- Increasing pile structural resistance to carry the downdrag loads; an approach which works well in areas where ample geotechnical capacity is available, such as for piles in sound rock.
- Isolating the piles from the frictional fill and compressible clay layer; but this would impact lateral resistance.

Of these, we selected the second approach as the pile loads are not high. Typical downdrag loads estimated for the 24 in piles at select locations ranged between approximately 36 tons and 62 tons. Downdrag loads estimated for the 36 in diameter piles at selected locations ranged between approximately 54 tons and 92 tons.

8.3.3 Pile Axial Capacity

Driven Piles: Static axial pile analyses were performed for 16 and 24-inch open-ended steel pipe piles to determine the estimated pile tip elevations for the design capacity identified above. The static pile calculations were performed using the API-RP2A method (API, 2000), which incorporates limiting values of skin friction and end resistance. In this axial compressive pile capacity analysis, no side resistance was assumed in the clay layer or layers above it due to the high compressibility of these soils and the related potential for downdrag.

Pile tip elevations were determined using a minimum factor of safety of 2.0, assuming that pile testing in this report will be performed. For computing the axial tensile pile capacity, side resistance from the clay layer and the layers above was also included. A factor of safety of 2.0 was applied to the side shear capacity to obtain the allowable tensile capacity.

Based on these analyses and the preliminary loads provided by the structural engineer, it is determined that the 24-inch diameter pipe piles must penetrate about 20-30 ft into the lower outwash deposits to develop the required design resistance. Table 7 presents a summary of estimated tip elevations for open-ended steel pipe piles for various structures.

Bored Piles: Static axial pile analyses were performed for 24 and 36-inch bored concrete piles to determine the estimated pile tip elevations for the design capacity identified above. Static pile calculations were performed using conventional procedures such as listed in Section 10.8 of AASHTO-LRFD Bridge Design Specifications, 2007.

Results of these analyses are provided for the relevant soil profiles at each structure location on Figures 19 and 20 Pile Axial Capacity for Soil Profiles A, B, C, D, E and in Table 7.

Table 7: Axial Pile Analyses for the Proposed Structures

Structure	Pile Type	Required Ultimate Pile[2] Capacity in Compression (ton)	Downdrag Loads (ton)	Allowable Pile Capacity in Compression (ton)	Allowable Pile Capacity in Tension (ton)	Estimated Pile Tip Elevation (ft)
Maintenance and Operations (M&O) Facility	24" Steel Pipe	76	40	50	78	-45
	24" Bored Concrete	112	95	50	78	-57
Phase 2 Area Bridge Path North and South Abutments:	24" Steel Pipe	76	40	50	78	-45
	24" Bored Concrete	112	95	50	78	-57
Comfort Station:	24" Steel Pipe	88	58	50	27	-47
	24" Bored Concrete	93	65	50	33.6	-53
Phase 3 Area South Bridge Path:	24" Steel Pipe	96	70	50	67	-56
	24" Bored Concrete	128	120	50	67	-60
Phase 3 Area North Bridge Path:	24" Steel Pipe	96	70	50	68	-55
	24" Bored Concrete	128	120	50	67	-58

Notes:

Steel pipe piles are 24-inch diameter, 0.5 inch wall thickness.

Required Ultimate Pile Capacity includes 36 to 62 tons of downdrag load.

8.3.4 Pile Lateral Capacity

For preliminary design, to analyze the behavior of the piles supporting various structures, lateral load analyses of the selected pile types were performed for various locations using the computer program Lpile (Ensoft 2016). Program Lpile Version uses a beam-column, soil-structure interaction approach in which the soil response is modeled by non-linear load-deflection relationships referred to as "p-y curves". Pile group effects are considered in the analyses through p-y multipliers. As the structural design is being developed and nature of the pile to pile-cap connection is unknown, both pinned and fixed head conditions were used in these analyses.

To model service level conditions, in general the lateral deflection at the pile head was limited to 0.25 inch. The lateral force at pile head that would result in a 0.25 inch deflection was ascertained. The resulting distribution along the pile length of bending moment, shear force and deflection are presented in Figure 21, through Figure 25, for the selected sites and structure locations. These estimates are preliminary and shall be revised after final pile type selection and as structural loads are refined. In addition, further analyses would be required to model submerged conditions, such as during extreme hurricanes and episodes of flooding.

The results of lateral load analyses are summarized in Table 8.

Table 8: Lateral pile analyses for the proposed structures

Structure	***Pile Type***	***Pinned Head***			***Fixed Head***		
		Pile Head Shear (kips)	***Maximum Moment (ft-kip)***	***Depth to Maximum Moment (ft)***	***Pile Head Shear (kips)***	***Maximum Moment (ft-kip)***	***Depth to Maximum Moment (ft)***
Maintenance and Operations (M&O) Facility	24" Steel Pipe	28	135	8	65	385	0
	24" Bored Concrete	27	140	8	62	360	0
Phase 2 Area Bridge Path North and South Abutments:	24" Steel Pipe	28	135	8	65	385	0
	24" Bored Concrete	27	140	8	62	360	0
Comfort Station:	24" Steel Pipe	28	140	7.5	65	385	0
	24" Bored Concrete	28	140	7.5	65	385	0
Phase 3 Area South Bridge Path:	24" Steel Pipe	27	125	8	60	335	0
	24" Bored Concrete	26	130	8	62	365	0
Phase 3 Area North Bridge Path:	24" Steel Pipe	27	135	8	63	370	0
	24" Bored Concrete	28	135	8	62	370	0

1. Shear and Moments for Service Level Conditions; Pile Head deflections limited to 0.25 inch for service level conditions.

8.4 Lateral Earth Pressures

Static: Procedures outlined in the NAVFAC, DM7.2 were used to compute Rankine's earth pressure coefficients. Flexible retaining walls should be designed for an active earth pressure of 38 pcf. Basement walls that are restrained from lateral displacement should be designed to resist an at-rest earth pressure of 60 pcf in terms of an equivalent fluid density. Surcharge loads, such as traffic should be added to the above recommended lateral earth pressures. Unless a higher relative compaction is required, such as below the roadway pavement, the backfill should be compacted to 90 percent (ASTM D1557), be freely draining structural backfill and in conformance with the NYCBC standard specifications. A geo-composite subdrain system in conjunction with weep holes should be included behind the wall to prevent the build-up of hydrostatic pressure on the wall (if any).

Seismic: Mononobe-Okabe analyses were performed to determine seismic lateral earth pressures on abutment walls for a level backfill condition. In our analyses, a coefficient of horizontal acceleration of 0.33 g was used, along with an angle of friction of 32 degrees and a total unit weight of 125 pcf, for backfill compacted to 90 percent (ASTM D1557). The dynamic component of the total dynamic earth pressure was taken to act at 0.6H from the bottom of the wall, where H is the wall height. For an 8 ft high wall, a dynamic resultant force of 1.6 kip was obtained.

8.5 Anchored Sheetpile Bulkhead and Tieback

Design and analysis of the sheetpile bulkhead including tieback design and global stability analyses is to be completed by McLaren Engineering. Global stability analyses must incorporate any surcharge loading from maintenance traffic and earthen landscaping or buildings, if any. Global stability may drive the overall depth of sheeting.

8.6 Slope Stability Analyses

Static Case: Overall stability analyses were conducted for the critical cross-sections at the existing shoreline at selected locations using the computer program Slope/W (Geosoft). In the analyses the design strength parameters listed in Table 2 were used for the foundation soils. The Morgenstern Price Method was used for circular slip-surfaces. The results of the stability analyses are summarized in Table 10. The results indicate that in the long-term, the shoreline slopes will have a factor of safety greater than 1.5.

Seismic Case: Post-earthquake stability analyses were also conducted for the proposed embankment assuming that liquefaction in the sand strata has occurred. For the liquefied strata, a post-liquefaction residual strength (c = 450 psf) was used based on available correlations with SPT N-values (Seed and Harder, 1990). The results of the analyses are presented in Table 10.

Seismic stability analyses to account for the inertial effect due to shaking were performed by using a pseudo-static earthquake coefficient of 0.33g for the MCE_G. The factor of safety for the pseudo-static case is reported in Table 10 and will be lower than 1.0. Therefore, permanent deformations must be calculated for assessing the impact on the embankment, as discussed below.

Table 9: Long Term Global Stability Analyses

	Factor of Safety Criterion	**Type of Analysis**	**Phase 2 Minimum Factor of Safety**	**Phase 3 Minimum Factor of Safety**
Static Analyses (Long term Effective Strength)				
Static, with no Liquefaction	1.5	Morgenstern Price Method Circular Surface	1.7	2.6
Static Analyses with Liquefaction (Post Liquefaction Residual Strength for Stratum 1 and 2)				
Static, Liquefaction	1.1	Morgenstern Price Method Circular Surface	>1.1	>1.1
Seismic Pseudostatic Analyses (Long term Effective Strength)				
Pseudo-static MCE_{Ga} acceleration coefficient	1.1	Morgenstern Price Method Circular Surface, without Liquefaction	<1	<1

Note: Assumes a 2 horizontal to 1 vertical side slope gradient.

Permanent Displacement of Slopes: Newmark analyses were conducted to compute permanent ground displacements. Yield accelerations for the embankments were computed by trial and error using pseudostatic slope stability analyses. The yield acceleration is the horizontal ground acceleration at which the factor of safety of slope stability is 1.0. The yield acceleration was found to be 0.11g and 0.21 g for Phase 2 and 3 locations, respectively and was then used to estimate permanent ground displacements during the MCE_G using procedures by Makdisi and Seed (1978). These yield accelerations of translate into a negligible permanent deformation (<2 in).

8.7 Corrosion Protection

The presence of sulfates and chlorides in the soil indicate a potential for sulfate attack and corrosion. Typically, per Caltrans a site should be considered corrosive if the chloride concentration is 500ppm or greater, sulfate is 2000ppm or greater or ph is 5.5 or less. These guidelines are widely accepted across the US. Steel piling located in the soil embedded zone will corrode at a rate of 0.001in per year. Therefore, for a 75 year lifespan the steel may undergo 0.075 in of corrosion. For steel in the marine zone, corrosion saline water would occur at a higher rate, on the order of 0.004 in per year, and must be accounted for in design. Therefore, for a 75 year lifespan the steel may undergo 0.3 in of corrosion.

Effects of corrosion were considered during pile capacity calculations for steel pipe piles. If bored concrete piles are selected with no permanent casing it is recommended that type 2 Portland Cement be used in the mix.

8.8 Miscellaneous

Pile Splices: Due to variability in subsurface conditions at the site, actual pile penetration may vary somewhat from those estimated. This does not present a problem for steel piles, which can be spliced in the field to accommodate additional penetration.

Predrilling: In order to mitigate a potential of damage to piles during pile driving, it recommended that an undersized hole be predrilled through rip-rap. No loss of lateral pile capacity is expected with a predrilled undersized hole.

Corrosion Protection of piling: It is recommended that corrosion protection measures consisting of coating the exposed steel surface and field coating the pile splices be provided for the steel piles. Corrosion allowance of 0.075 in should be implemented in steel pile design for piles embedded in soil away from the waterfront. A high corrosion allowance of 0.3 in would be required for piles in the saline water.

Corrosion Protection of Ground Anchors: It is recommended that corrosion protection measures consisting of coating the exposed steel surface and field coating the pile splices be provided for the steel piles.

Obstructions: Obstructions from rip-rap and old timber piles should be expected along the waterfront during sheetpile and pile installation and tieback installation. An obstruction survey should be performed along with sub-bottom profiling to document and capture any potential obstructions. Measures shall be taken to identify these obstructions, where feasible, and make allowances in the contract for such occurrences.

9 Construction Considerations

9.1 Earthwork

Where excavation is required all exposed soils should be level and clear of standing or frozen water, debris, or other deleterious materials. All undesirable material should be removed and disposed of offsite. All loose zones should be excavated and properly re-compacted. All exposed soils which are to receive additional loading on the surface should be proof-rolled using heavy compaction equipment. Proof-rolling should show minimum pumping of the soils.

If fill placement is to be continued in the same area in consecutive days prior to placing additional fill the previously placed fill should be proof-rolled. Upon completion of proof-rolling, the exposed surface soils should be uniformly compacted to 95 percent of the maximum dry density. The New York City Department of Buildings (NYCDOB) requires that a Professional Engineer and certified DOB Special Inspector inspect and approve foundation subgrades before placement of concrete, to verify that the subgrade material is adequate to provide the recommended allowable bearing pressure.

Excavation for deep foundation will likely require temporary shoring for installation of concrete. Due to the vicinity to water and the shallow groundwater table infiltration of water could be a concern during construction. The contractor responsible with the construction of the pile caps will need to implement local dewatering through pumping.

9.2 Pile Driving

Pile Driveability Analyses: To assess whether the piles are adequately sized to withstand compressive stresses during driving and to assess a range of hammer energy required to obtain the required pile tip elevations and capacities, wave equation analyses would be necessary and should be performed. After the contractors equipment has been determined analyses to determine minimum driving resistance and hammer energy should be determined as per NYCBC 1809.3.1.

Obstructions: One of the concerns in the design of the foundations at the site is the possible interference with buried obstructions, such as old piles, abandoned or active utilities, and rip-rap. When interference is anticipated, the obstructing pile should be removed, or the Engineer contacted to assess relocation of the new pile and redesign of the pile cap. Voids caused by pile extraction should be filled with relatively clean sand. All pile locations should be pre-drilled to a depth of 15 ft to clear utilities and other obstructions. If a utility is encountered at shallow depth, it should be uncovered by hand excavation.

During construction, pile inspection personnel should be alert to unanticipated interference from existing piles that may have been driven out of plan location. The inspector should immediately bring to the attention of the Engineer any pile which meets refusal more than about 5 ft above the estimated tip elevation listed in the drawings, or which exhibits unusual rebounding during driving, or which encounters any other unusual conditions during driving. If closed end pile are used visual inspection with a down-hole camera, should be performed on any piles suspected of being damaged during installation. Obstructions may occur randomly throughout the site and should be anticipated during construction. To advance the piles through these obstructions, it may be necessary to spud or excavate and remove the rubble when encountered at shallow depth. No pile driving should be performed within 5 feet of a known utility.

9.3 Drilled Shaft Considerations

In general, procedures outlined in the FHWA guidelines for design and construction of drilled shafts (FHWA, 2008) should be followed. The performance of drilled shafts largely depends on construction methods used and the care taken during drilling. Proper care in drilling, placement of steel and the pouring of concrete will be essential to avoid excessive erosion of walls of the drilled hole. It will be necessary to clean all loose soils from the bottom of the drilled hole. If an auger type drill rig is utilized, it will be necessary to use a clean-out bucket to adequately remove loose soils from the bottom of the drilled hole. Alternative procedures for clean-out can be considered but must be accepted by the geotechnical engineer. After verifying that the shaft bottom is clean (less 12 mm of loose sediment on average) and the shaft meets the required dimensions the reinforcement cage should be installed and the concrete placed. It is preferred that no drilled shafts is left open overnight. Moreover, no shaft should be drilled immediately adjacent to a freshly poured drilled shaft until the concrete has attained an initial set. Concrete placement by pumping or tremie-pipe to the bottom of the shaft will be necessary to prevent segregation or bleeding of concrete. Since the drilled shafts will be constructed through medium dense cohesionless deposits below the water table some potential for ravelling to moderate caving should be expected. The degree of potential caving will depend on the relative density of the materials encountered. In addition, the presence of a relatively thick gravel deposit overlying bedrock will pose some difficult in advancing the casing and preventing sloughing. The contractor should be prepared to use slurry or employ a temporary casing or other methods of advancing the drilled shaft in the case of excessive caving. The casing should have an outer diameter equal to or exceeding the planned shaft diameter. The casing should be advanced as the boring proceeds by drilling with a drilling bucket or auger drill smaller in diameter than the inside of the casing. The casing may be hammered or vibrated to advance it or alternately, a rotator casing system may be used. Casing should be pulled as the concrete is being poured while always maintaining at least 10 ft head of concrete inside the casing.

9.4 Pile Load Testing

It is recommended that a pile testing program be performed during construction a) to confirm pile capacity and embedment requirements, b) to assess the performance of the pile driving equipment to be used by the construction contractor, and c) for quality control during production pile driving operations. Specifically, the recommended construction test pile program includes the following:

Wave Equation Analyses (WEA): WEA should be performed prior to pile driving operations. As previously discussed, the results of the WEA can be used to develop driving resistance criteria, to assess the suitability of the contractor's proposed pile driving equipment, to predict driving stresses developed in the pile, and to predict the energy transferred to the pile.

Index Piles: Index or test piles should be driven prior to production pile driving operations to assess the driving characteristics, capacity and embedment requirements of the foundation piles at the various locations along the project alignment. At least 5-6 index piles should be driven at across the currently planned structures. These test piles should be located near existing borings to facilitate development of correlations between driving resistance and the subsoil conditions. All index piles should be driven vertical.

Dynamic Testing: Dynamic pile testing using the Pile Driving Analyzer (PDA) should be performed on all the index piles for the full length of driving and periodically during production pile driving operations, particularly if the contractor changes any pile driving equipment. Dynamic testing can be used to estimate pile capacity, measure driving stresses in the piles and determine the actual energy transferred to the pile for assessing hammer performance. In addition to PDA, Case Pile Wave Equation Analyses Program (CAPWAP) analyses should be performed for each of the index piles and tested production piles. CAPWAP analyses provide an estimate of ultimate pile capacity, the distribution of soil resistance along the length of the pile, and the various soil parameters assumed in the Wave Equation Analyses.

Static Load Tests: A program of pile load testing is recommended to verify pile geotechnical resistance and to warrant the use of a factor of safety of 2.0. Details of the load test program will be provided during final design.

9.5 New York City Building Code (NYCBC) Requirements

NYCBC specifies as a minimum, two exploratory boreholes for built-over areas up to 5000 square feet and at least one borehole for each additional 2,500 square feet of built-over areas up to 20,000 square feet. For built-over areas in excess of 20,000 square feet, there shall be at least one borehole for each additional 5000 square feet. Borings shall be taken to bed rock or to an adequate depth below the top of load bearing strata. For structures to be supported on pile foundations, the required number of borings shall be increased by 30 percent. In addition, the code requires that at least one-half of the borings must be drilled within the building footprint. In addition, the NYCBC allows for available borehole logs from prior investigations, to be used, provided these extend to depths required by the code. Therefore, as the building footprints are finalized, an additional geotechnical investigation would be required to meet code requirements.

9.6 Observation During Construction

Geotechnical Observation and monitoring should be provided during construction for all relevant geotechnical-related activities, including the following:

- All excavations, including over-excavations, and excavations for footings and utilities,
- Processing of soils;
- Placement of fills;
- Backfilling of utility trenches;
- Installation of piling, whether driven or drilled;
- Slab and subgrade preparation;
- When any unusual or unexpected geotechnical conditions are encountered.

In-grading tests should be carried out, prior to any significant work on ground, to establish the following soil properties:

- Maximum dry density/optimum moisture content
- In-situ dry density/moisture content
- Expansion Potential
- California Bearing ratio
- Sulfate Content

Other tests may be required as per usual practice and as conditions dictate.

Excavations for foundations should be observed before placing reinforcing steel. Such observations are considered essential to identify field conditions that may differ from those anticipated in the preliminary investigations, to adjust designs to actual field conditions and to determine that the earthwork are performed in substantial accordance with the recommendations of this report.

All recommendations presented herein are subject to review when excavations are made and subsurface conditions become more fully exposed.

10 Limitations

The information provided in this Geotechnical Report is based on the project requirements and data described in this report and is intended only for the purpose, site, and project described herein. The information is subject to possible modifications when further information on subsurface conditions become available.

This work was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional opinions included in this report.

As in many, projects conditions revealed in excavations may be at variance with findings from individual exploration points. If this occurs, then changed conditions must be evaluated by the geotechnical consultant and additional recommendations be obtained as warranted.

This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the information and recommendations contained herein are brought to the attention of the necessary design consultants for the project and incorporated into the plans; and that the necessary steps are taken to see that the contractors carry out such recommendations in the field.

The findings presented in this report are considered valid as of the present date. However, changes in the condition of site can occur with the passage of time, whether due to natural processes or the work of man on the subject or adjacent properties. In addition, changes in standards of practice may occur from legislation or the broadening of knowledge. Accordingly, the findings of this report may at some future time be invalidated wholly or partially by changes outside Arup's control.

The identification and testing of hazardous, toxic or contaminated materials were outside the Geotechnical scope of work. Should such materials be encountered at any time, or their existence be suspected, all measures stipulated in the Local, County, State and Federal regulations, as applicable, should be implemented.

This geotechnical report is intended only for the use of New York City Economic Development Council and only as related expressly to the Stapleton Waterfront Site, Phase 2 and 3.

11 References

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Tables

Table 1: Summary of Boreholes (Current Investigation)

	Boring Number	Type of Boring	Date Completed	Northing	Easting	Ground Surface Elevation	Depth of Termination	Ground Water Depth bgs	Ground Water Elevation	Date of Measurement
				(ft)	**(ft)**	**(ft)**	**(ft)**	**(ft)**	**(ft)**	**(ft)**
Matrix Engineering (2007)[1]										
1	M-50	Hollow Stem Auger	4/1/2007	N/A	N/A	0.0	52.0	5.4	-5.4	4/2007 - 6/2007
2	M-51	Hollow Stem Auger	4/1/2007	N/A	N/A	0.0	52.0			
3	M-52	Hollow Stem Auger	4/1/2007	N/A	N/A	0.0	52.0			
CDM/ HMM (2006-2007)[2]										
1	C/H-201	Hollow Stem Auger	1/4/2007	656446	610568	8.6	185.0	3.8	4.8	1/4/2007
2	C/H-203	Hollow Stem Auger	10/19/2006	656477	610488	10.6	115.0	5.6	5.0	10/19/2006
3	C/H-204	Hollow Stem Auger	12/21/2006	656497	610471	10.2	185.0	5.0	5.2	12/21/2006
4	C/H-205	Hollow Stem Auger	9/16/2006	656518	610444	10.6	115.0	4.4	6.2	9/16/2006
5	C/H-206	Hollow Stem Auger	10/16/2006	656496	610283	11.5	61.0			
6	C/H-211	Hollow Stem Auger	10/12/2016	656517	610348	11.3	57.0	5.8	5.5	10/12/2016
7	C/H-212	Hollow Stem Auger	10/16/2016	656546	610476	10.0	47.0			
8	C/H-213	Hollow Stem Auger	8/15/2006	656583	610556	8.4	42.0			
9	C/H-214	Hollow Stem Auger	8/16/2006	656704	610541	8.1	42.0			
10	C/H-215	Hollow Stem Auger	8/21/2006	656817	610530	7.6	42.0			
11	C/H-216	Hollow Stem Auger	8/21/2006	656905	610486	12.1	42.0			
12	C/H-229	Hollow Stem Auger	10/19/2007	656522	610405	10.9	55.0	6.4	4.6	10/19/2007
13	C/H-230	Hollow Stem Auger	7/10/2007	656470	610332	10.5	77.0			
14	C/H-231	Hollow Stem Auger	7/11/2007	656433	610360	10.5	67.0			
PRC Engineering (1985)[3]										
1	P-A5	Hollow Stem Auger	9/1985	N/A	N/A	N/A	95.0		N/A	9/1985
2	P-B16	Hollow Stem Auger	9/1985	N/A	N/A	N/A	117.0	9.6	N/A	9/1985
3	P-B17	Hollow Stem Auger	9/1985	N/A	N/A	N/A	82.0		N/A	9/1985
4	P-B18	Hollow Stem Auger	9/1985	N/A	N/A	N/A	97.0	9.9	N/A	9/1985
5	P-S5	Hollow Stem Auger	9/1985	N/A	N/A	N/A	32.0	11.3	N/A	9/1985
6	P-S6	Hollow Stem Auger	9/1985	N/A	N/A	N/A	37.0	12.4	N/A	9/1985
7	P-U2	Hollow Stem Auger	9/1985	N/A	N/A	N/A	47.0	11.5	N/A	9/1985
8	P-U3	Hollow Stem Auger	9/1985	N/A	N/A	N/A	72.0	10.6	N/A	9/1985
9	P-U4	Hollow Stem Auger	9/1985	N/A	N/A	N/A	52.0	11.9	N/A	9/1985
10	P-US1	Hollow Stem Auger	9/1985	N/A	N/A	N/A	72.0	9.5	N/A	9/1985
11	P-US2	Hollow Stem Auger	9/1985	N/A	N/A	N/A	67.0	9.5	N/A	9/1985
12	P-US3	Hollow Stem Auger	9/1985	N/A	N/A	N/A	77.0	9.5	N/A	9/1985
13	P-US4	Hollow Stem Auger	9/1985	N/A	N/A	N/A	72.0	9.5	N/A	9/1985
14	P-US5	Hollow Stem Auger	9/1985	N/A	N/A	N/A	97.0	9.5	N/A	9/1985

1. Investigation performed by Matrix Engineering Services P.C., 2007
2. Investigation performed by Camp Dresser & McKee and Hatch Mott McDonald New York, Inc. a Joint Venture, 2006-2007
3. Investigation performed by PRC Engineering, 1885

Table 2: Summary of Boreholes (Previous Investigation)[1]

	Boring Number	Type of Boring	Date Completed	Northing	Easting	Ground Surface Elevation[2]	Depth of Termination	Ground Water Depth bgs	Ground Water Elevation	Date of Measurement
				(ft)	**(ft)**	**(ft)**	**(ft)**	**(ft)**	**(ft)**	**(ft)**
Boreholes (2016)										
1	P2-B1	Hollow Stem Auger/Mud Rotary	1/5/2016	N/A	N/A	8.0	40.0	8.0	0.0	1/5/2016
2	P2-B2	Hollow Stem Auger/Mud Rotary	1/5/2016	N/A	N/A	8.0	40.0	8.0	0.0	1/5/2016
3	P2-B3	Hollow Stem Auger/Mud Rotary	1/6/2016	N/A	N/A	8.5	40.0	8.0	0.5	1/6/2016
4	P2-B4	Hollow Stem Auger/Mud Rotary	1/4/2016	N/A	N/A	8.5	40.0	8.0	0.5	1/4/2016
5	P2-B5	Hollow Stem Auger/Mud Rotary	1/7/2016	N/A	N/A	8.5	40.0	8.0	0.5	1/7/2016
6	P2-B6	Hollow Stem Auger/Mud Rotary	1/4/2016	N/A	N/A	8.5	40.0	8.0	0.5	1/4/2016
7	P2-B7	Hollow Stem Auger/Mud Rotary	1/4/2016	N/A	N/A	10.0	40.0	8.0	2.0	1/4/2016
8	P2-B8	Hollow Stem Auger/Mud Rotary	1/7/2016	N/A	N/A	9.5	40.0	8.0	1.5	1/7/2016
9	P2-B9	Hollow Stem Auger/Mud Rotary	1/8/2016	N/A	N/A	9.0	40.0	8.0	1.0	1/8/2016
10	P2-B10	Hollow Stem Auger/Mud Rotary	1/8/2016	N/A	N/A	7.0	40.0	8.0	-1.0	1/8/2016
11	P3-B1	Hollow Stem Auger/Mud Rotary	1/11/2016	N/A	N/A	9.0	40.0	8.0	1.0	1/11/2016
12	P3-B2	Hollow Stem Auger/Mud Rotary	1/12/2016	N/A	N/A	10.0	40.0	8.0	2.0	1/12/2016
13	P3-B3	Hollow Stem Auger/Mud Rotary	1/12/2016	N/A	N/A	9.0	40.0	8.0	1.0	1/12/2016
14	P3-B4	Hollow Stem Auger/Mud Rotary	1/12/2016	N/A	N/A	9.0	40.0	8.0	1.0	1/12/2016
15	P3-B5	Hollow Stem Auger/Mud Rotary	1/11/2016	N/A	N/A	9.5	40.0	8.0	1.5	1/11/2016
16	P3-B6	Hollow Stem Auger/Mud Rotary	1/13/2016	N/A	N/A	9.0	70.0	8.0	1.0	1/13/2016
17	P3-B7	Hollow Stem Auger/Mud Rotary	1/15/2016	N/A	N/A	9.0	40.0	8.0	1.0	1/15/2016
18	P3-B8	Hollow Stem Auger/Mud Rotary	1/14/2016	N/A	N/A	8.5	70.0	8.0	0.5	1/14/2016
19	P3-B9	Hollow Stem Auger/Mud Rotary	1/15/2016	N/A	N/A	8.5	70.0	8.0	0.5	1/15/2016
20	P3-B11	Hollow Stem Auger/Mud Rotary	5/5/2016	N/A	N/A	8.5	77.0	8.0	0.5	5/5/2016
21	B3-B13	Hollow Stem Auger/Mud Rotary	5/10/2016	N/A	N/A	8.5	77.0	8.0	0.5	5/10/2016
22	P3-B14	Hollow Stem Auger/Mud Rotary	5/11/2015	N/A	N/A	8.5	77.0	8.0	0.5	5/11/2015

Figures

(Google Maps, 2016)

SITE LOCATION MAP

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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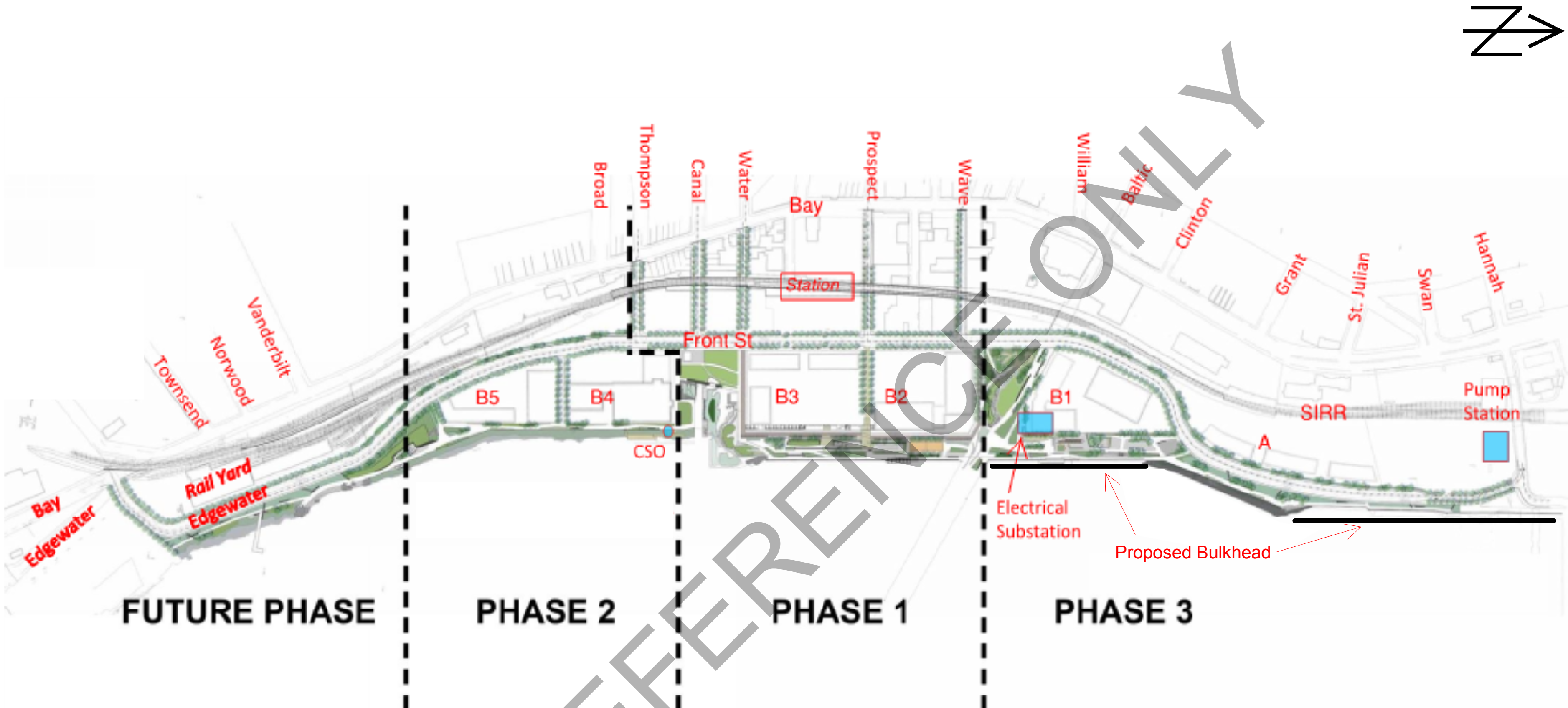
FIGURE 1



SITE LAYOUT PLAN

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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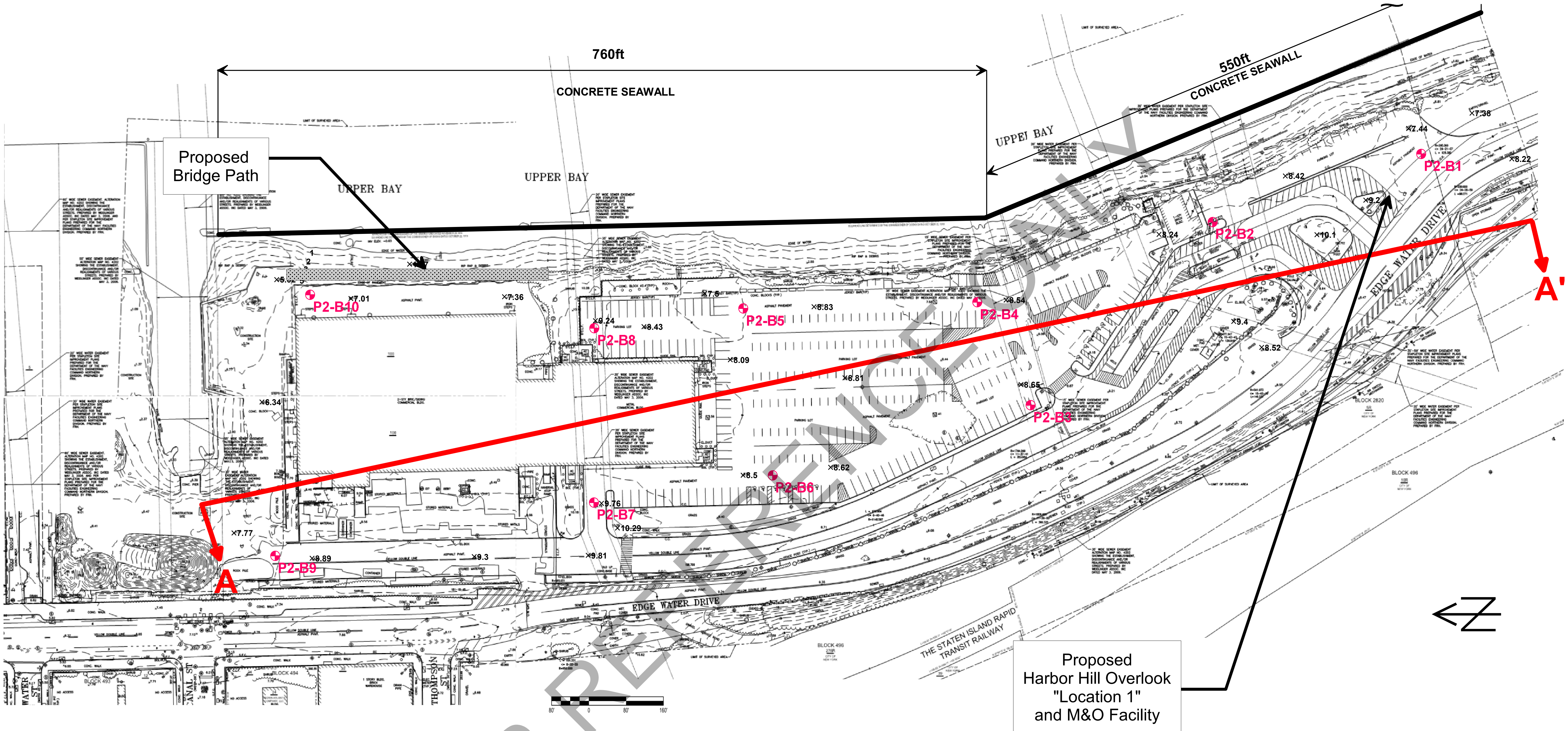
FIGURE 2

\\global.arup.com\americas\Jobs\N-Y\240000\245326-00\4 Internal Project Data\4-05 Reports & Narratives\Geotech\Investigation Report\Figures\Site Location\Site layout plan.grf



LEGEND:

Current Phase II Area Boreholes (2016)

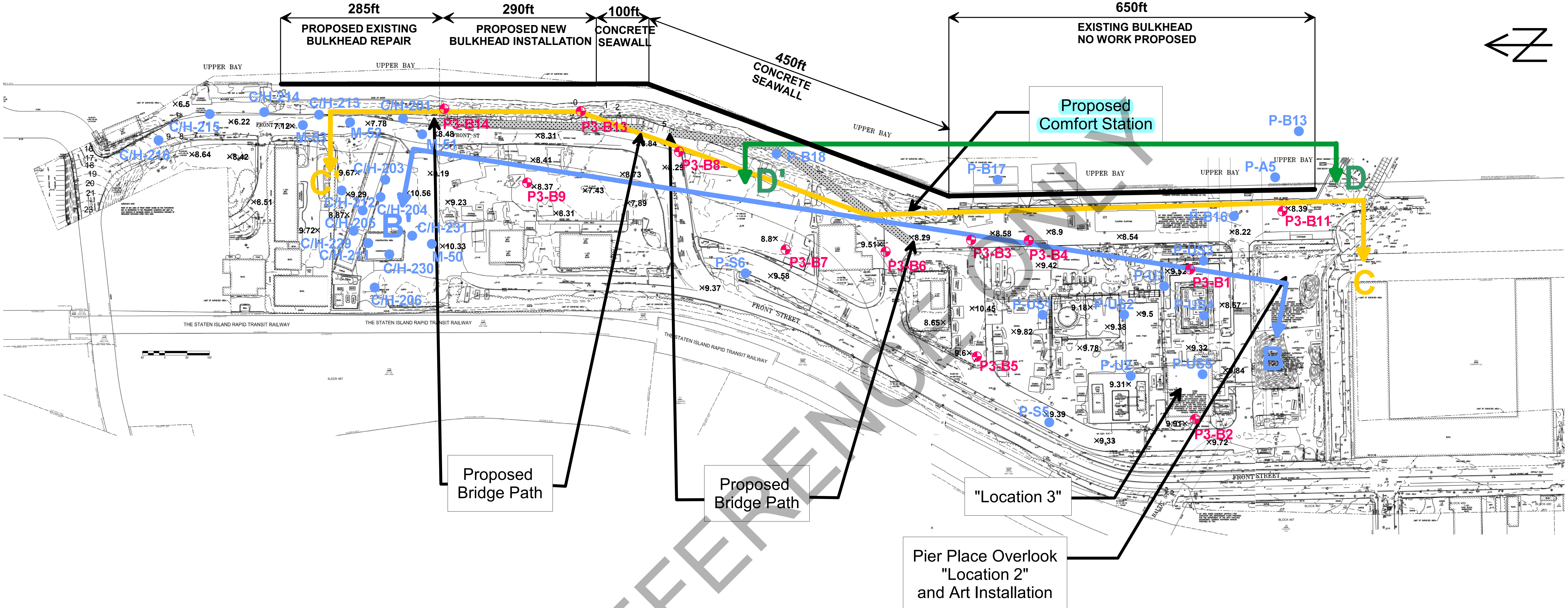
Notes:

1. Boreholes were not surveyed; Boreholes were located by measuring distances from fixed objects.
2. Survey points provided by Naik Consulting Engineers, PC (2015)

BOREHOLE LOCATION PLAN - PHASE 2 AREA

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

FIGURE 3



LEGEND:

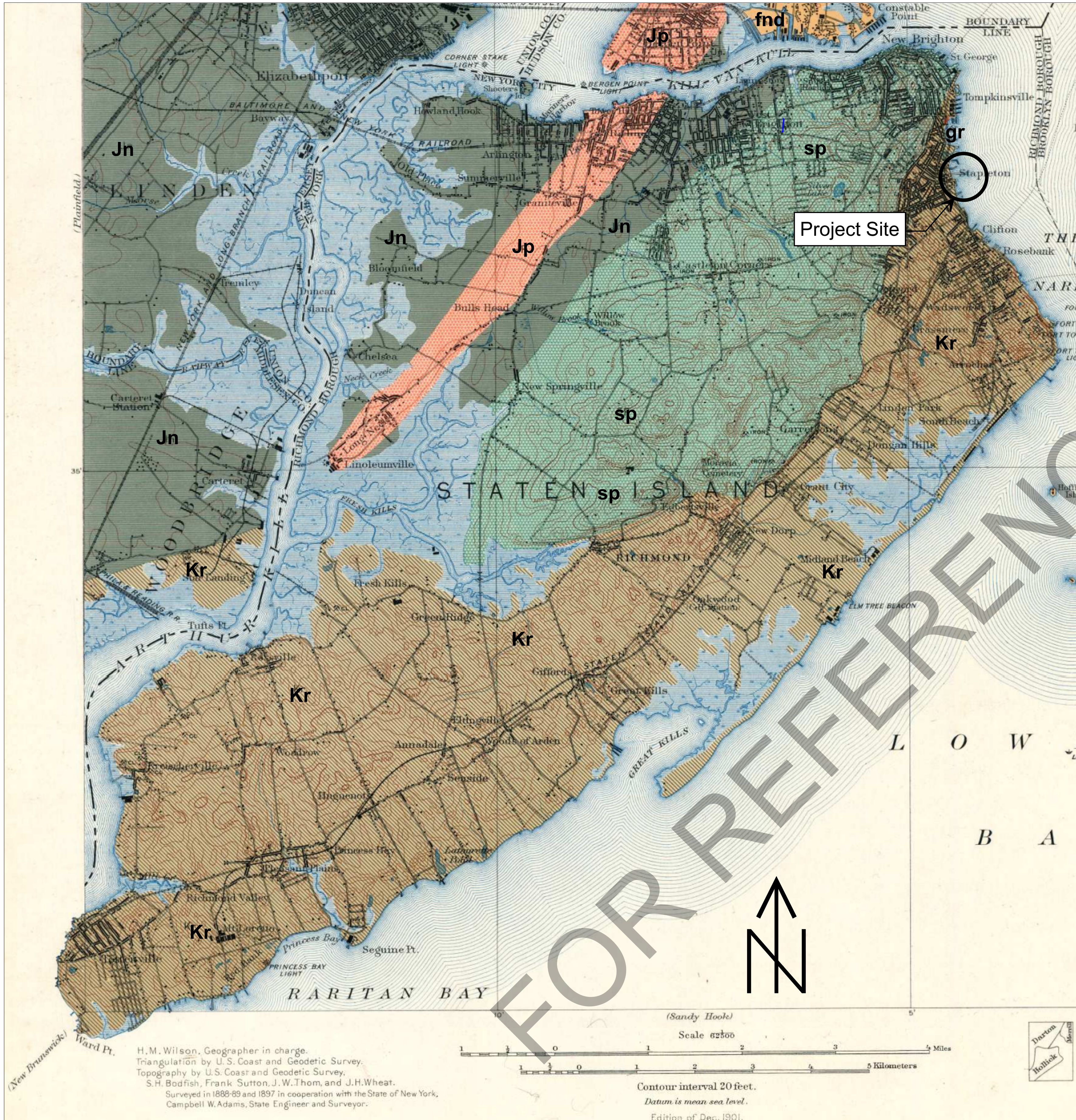
Current Phase III Area Boreholes	P3-B14	(2016)
Historic Phase III Area Boreholes	M-53	(2007)
	C/H-231	(2006)
	P-B18	(1985)
Limits of Proposed Bulkhead Installation		

Notes:
1. Boreholes were not surveyed; Boreholes were located by measuring distances from fixed objects.
2. Survey points provided by Naik Consulting Engineers, PC (2015)

BOREHOLE LOCATION PLAN - PHASE 3 AREA

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

FIGURE 4



Source: Washington Distric of Columbia, New York City dolio, Paterson, Harlem, Statem Island and Brooklyn quadrangles, New York-NewJersey.
USGS Geologic Atlas of the United States Folio GF-83, 1:62,500, 1902.

Legend:

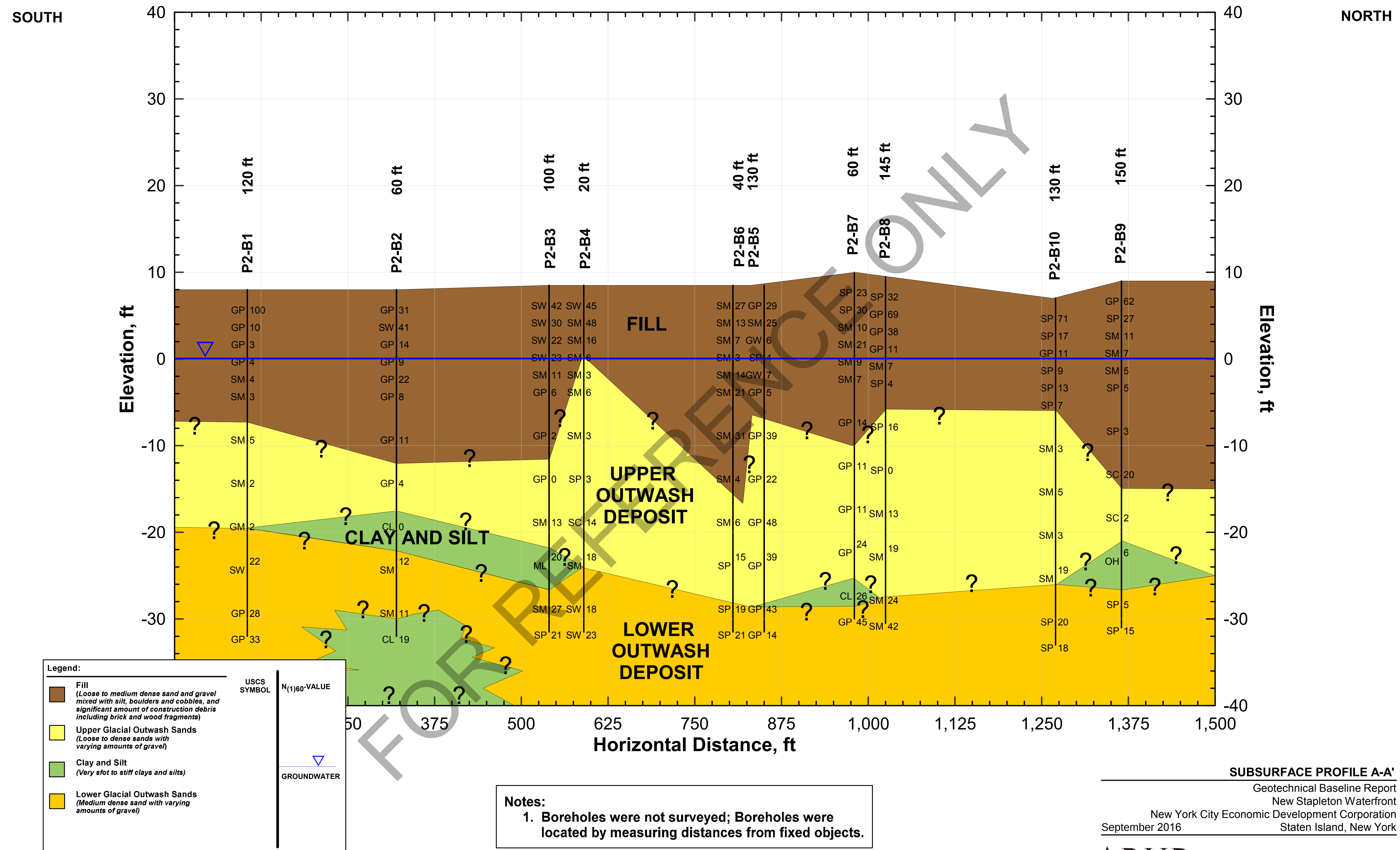
- Kr — **Raritan Formation (Cretaceous)** - Plastic clay and gravel possibly including clay marl of the Matawan formation in eastern portion.
- Jn — **Newark Formation (Juratrias)** - Red sandstone and shales.
- Sh — **Hudson Schist (Silurian)** - Mica-schist, consisting of biotite and quartz, with garnet, staurolite fibrolite, and cyanite.
- Jp — **Palisade Diabase (Juratrias)** - Intrusive sheet forming the Palisades and small dikes.
- sp — **Serpentine (Silurian of Later)** - Resulting from local alternation of hornblende, bronzite and allied minerals in basic dikes and masses.
- gr — **Granite Dike (Silurian or Later)** - White to reddish granite and pegmatite.
- fnd — **Formation not Determined** - Areas deeply covered by drift and artifically made land.

GEOLOGIC MAP

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

ARUP

FIGURE 5



Notes:

1. Boreholes were not surveyed; Boreholes were located by measuring distances from fixed objects.

SUBSURFACE PROFILE A-A'

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 — Staten Island, New York

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FIGURE 6

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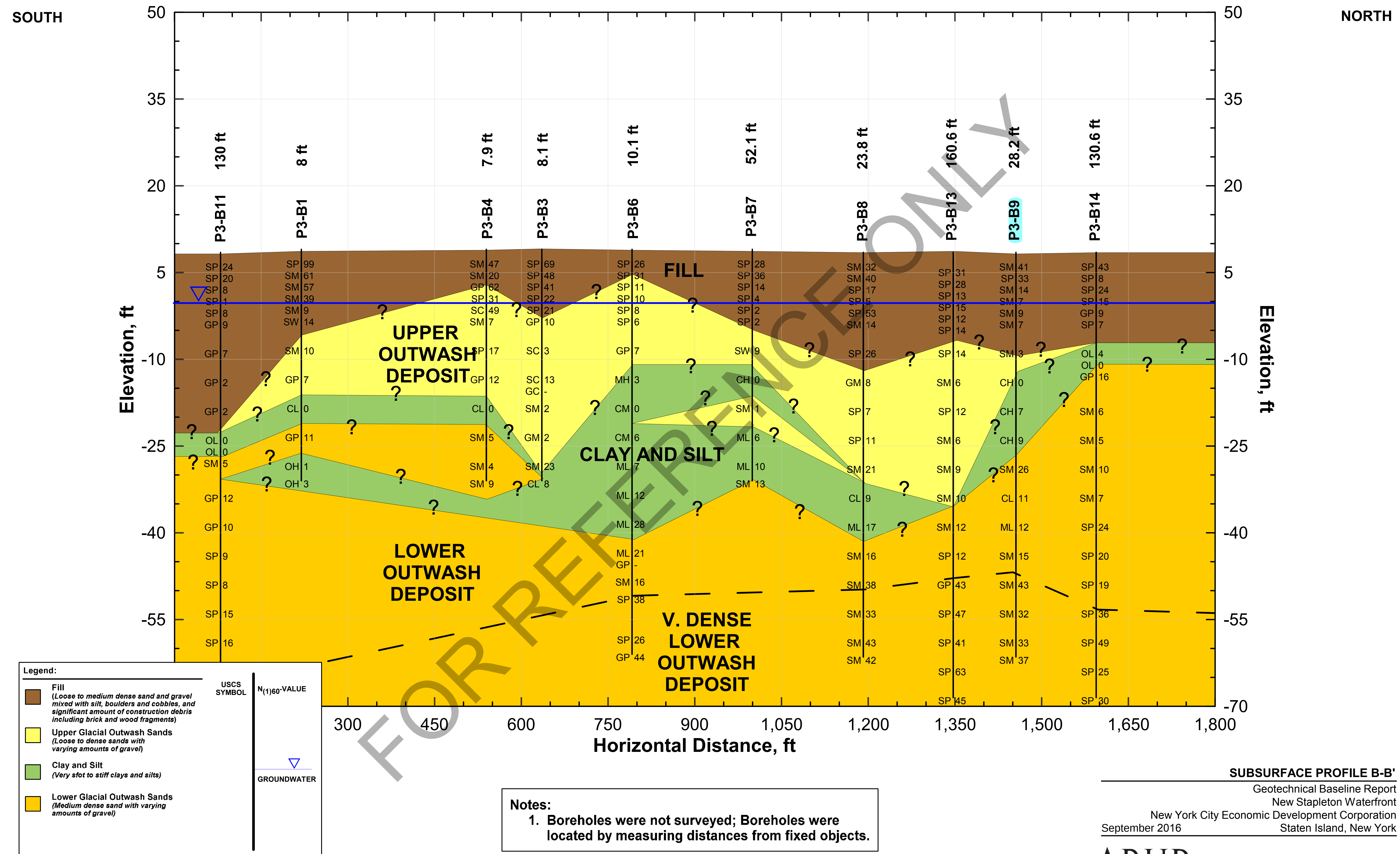

Notes:
1. Boreholes were not surveyed; Boreholes were located by measuring distances from fixed objects.

SUBSURFACE PROFILE B-B'
Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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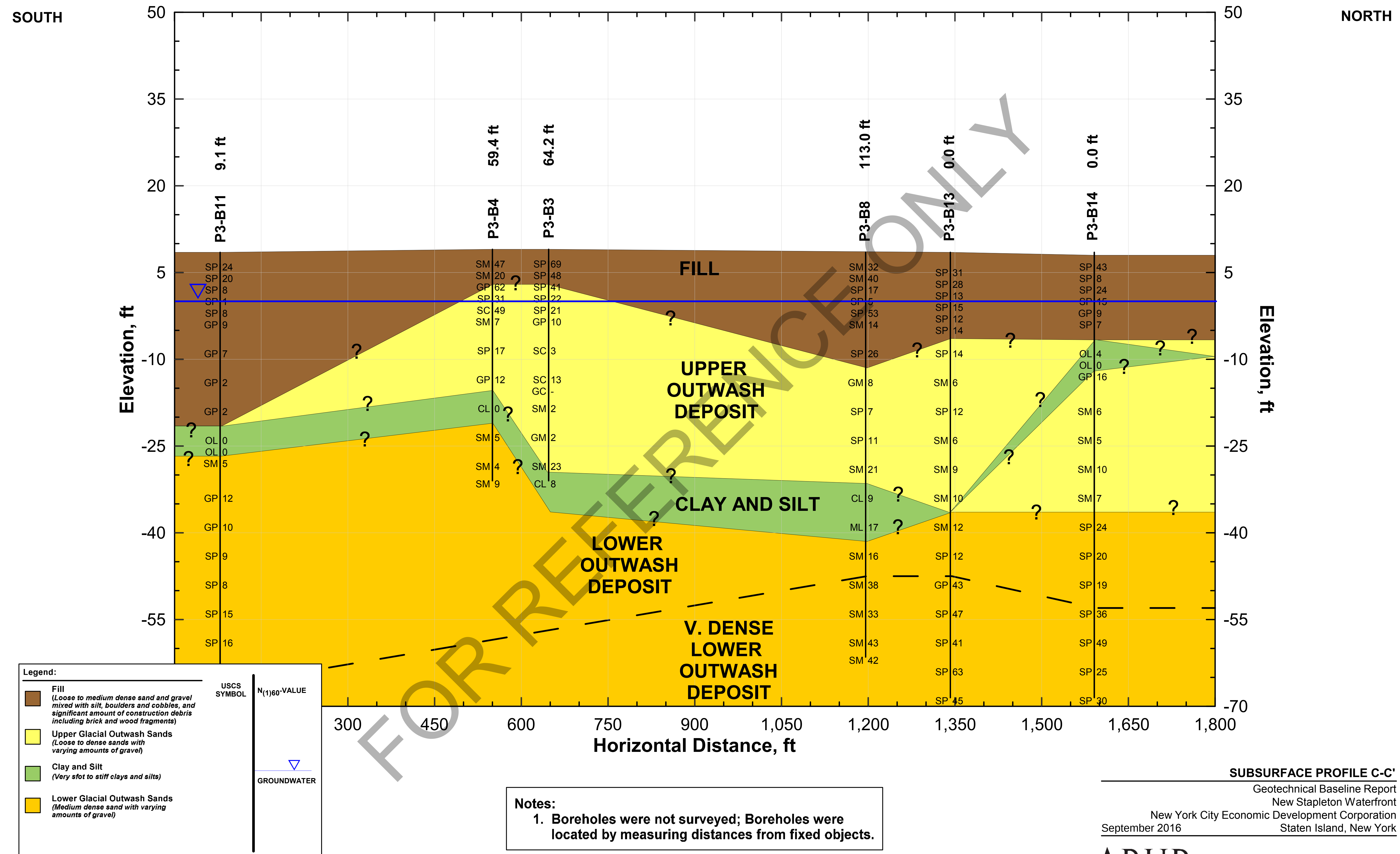
FIGURE 7

\\global.arup.com\americas\Jobs\N-Y\240000\245326-00\4 Internal Project Data\4-04 Calculations\4-04-05 Geotech\Cross Sections\Phase 3\B-B'\Cross Section B-B'_v2.grf



Notes:

1. Boreholes were not surveyed; Boreholes were located by measuring distances from fixed objects.

SUBSURFACE PROFILE C-C'

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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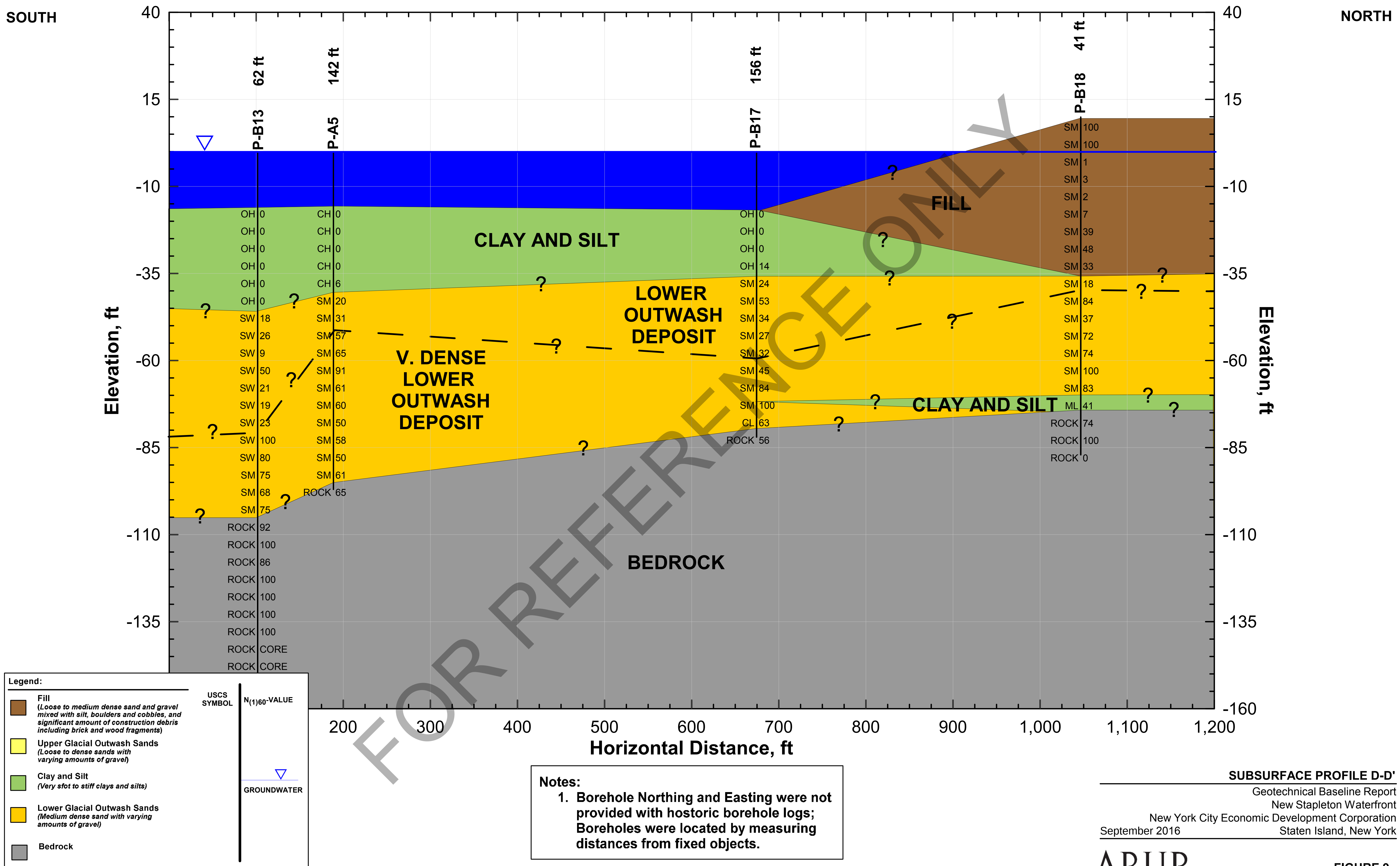
FIGURE 8

\\global.arup.com\americas\Jobs\N-Y\240000\245326-00\4 Internal Project Data\4-04 Calculations\4-04-05 Geotech\Cross Sections\Phase 3\Bulkhead\Cross Section C-C'.grf



Notes:
1. Borehole Northing and Easting were not provided with historic borehole logs; Boreholes were located by measuring distances from fixed objects.

SUBSURFACE PROFILE D-D'

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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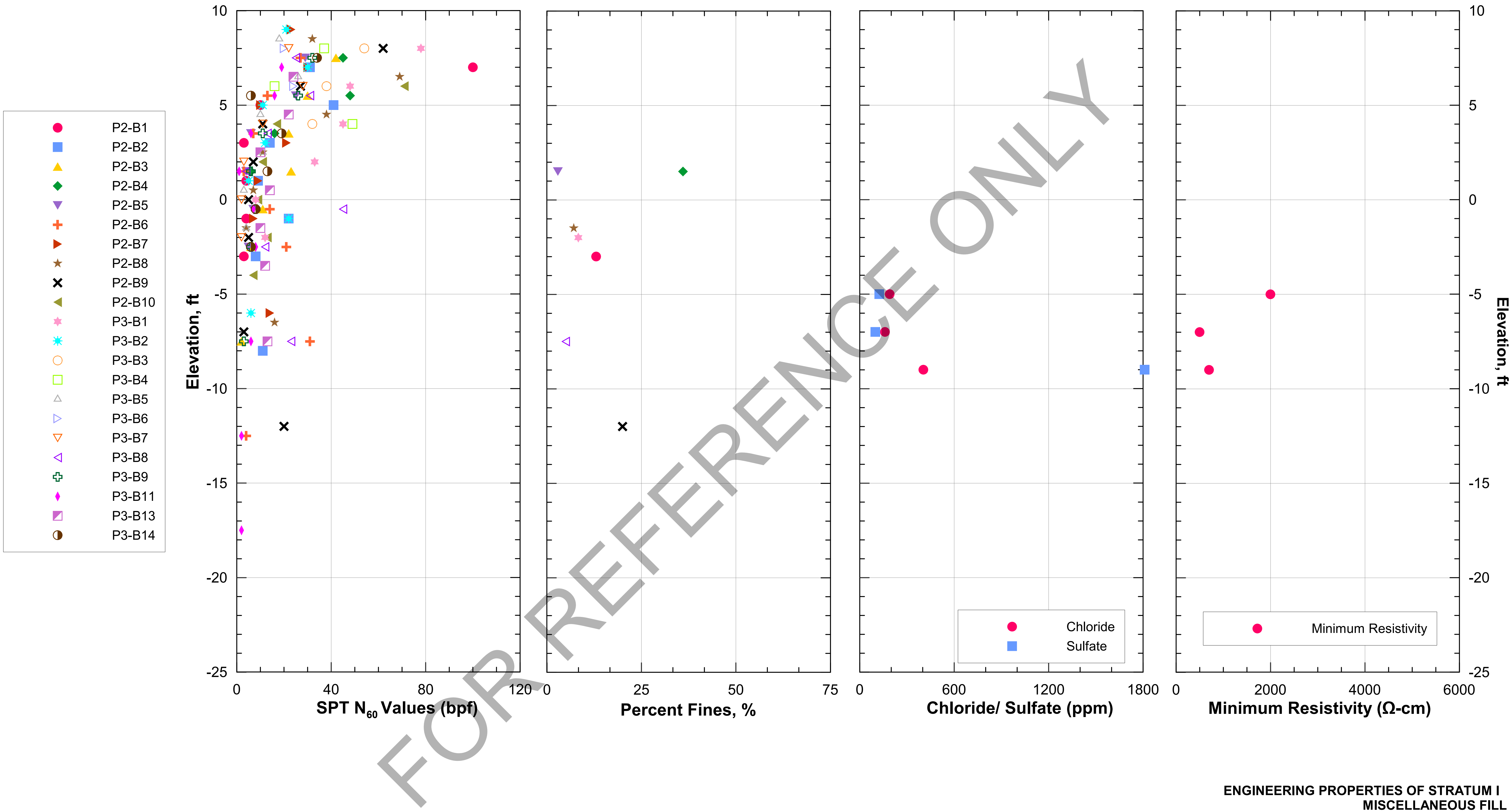
FIGURE 9

\\global.arup.com\americas\Jobs\N-Y\240000\245326-00\4 Internal Project Data\4-04 Calculations\4-04-05 Geotech\Cross Sections\Phase 3\D-D'\Cross Section D-D'.grf



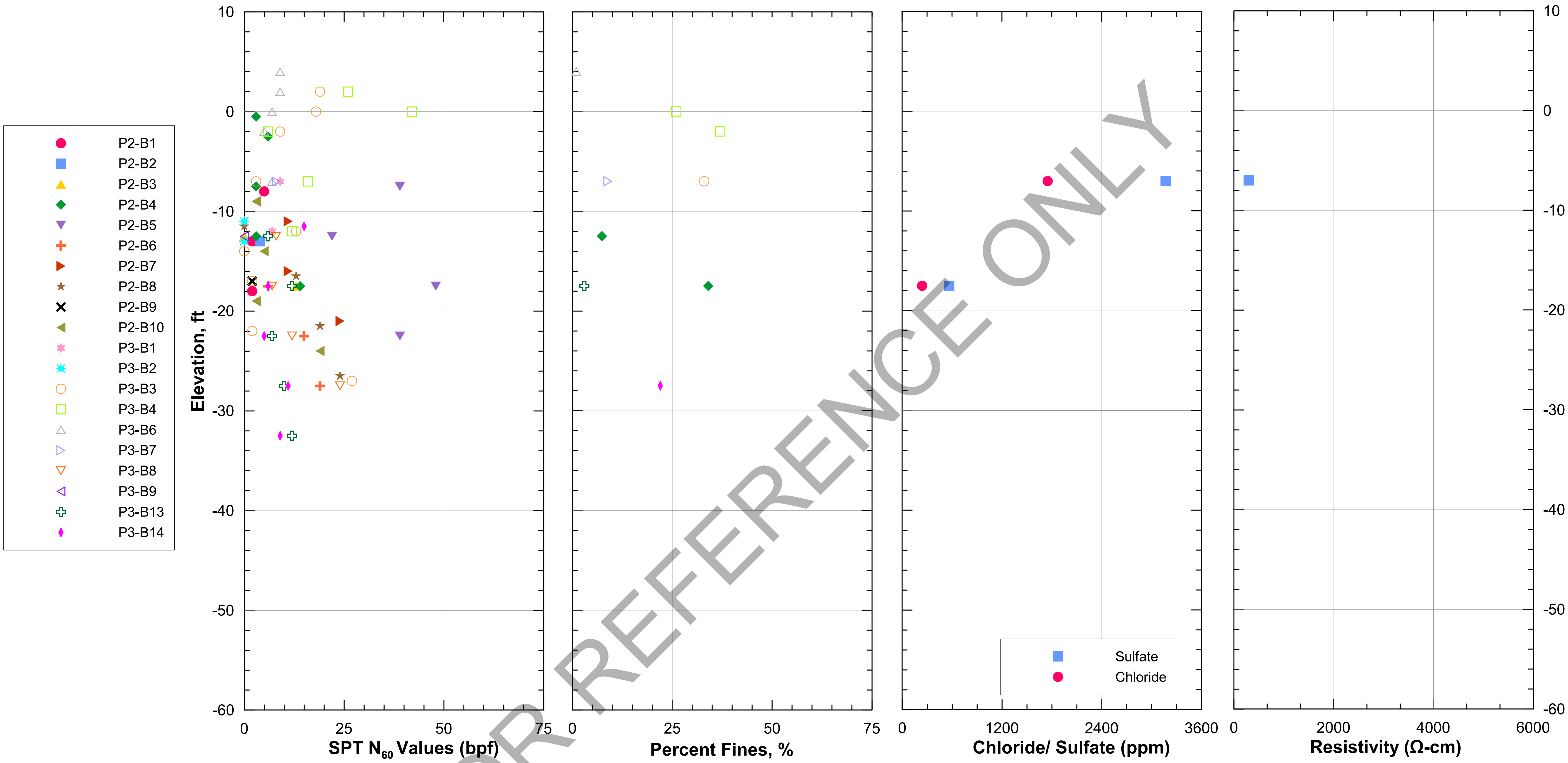
Notes:
1. **Elevations are not accurately depicted, as boreholes were not surveyed.**

ENGINEERING PROPERTIES OF STRATUM I MISCELLANEOUS FILL

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

ARUP

FIGURE 10



Notes:

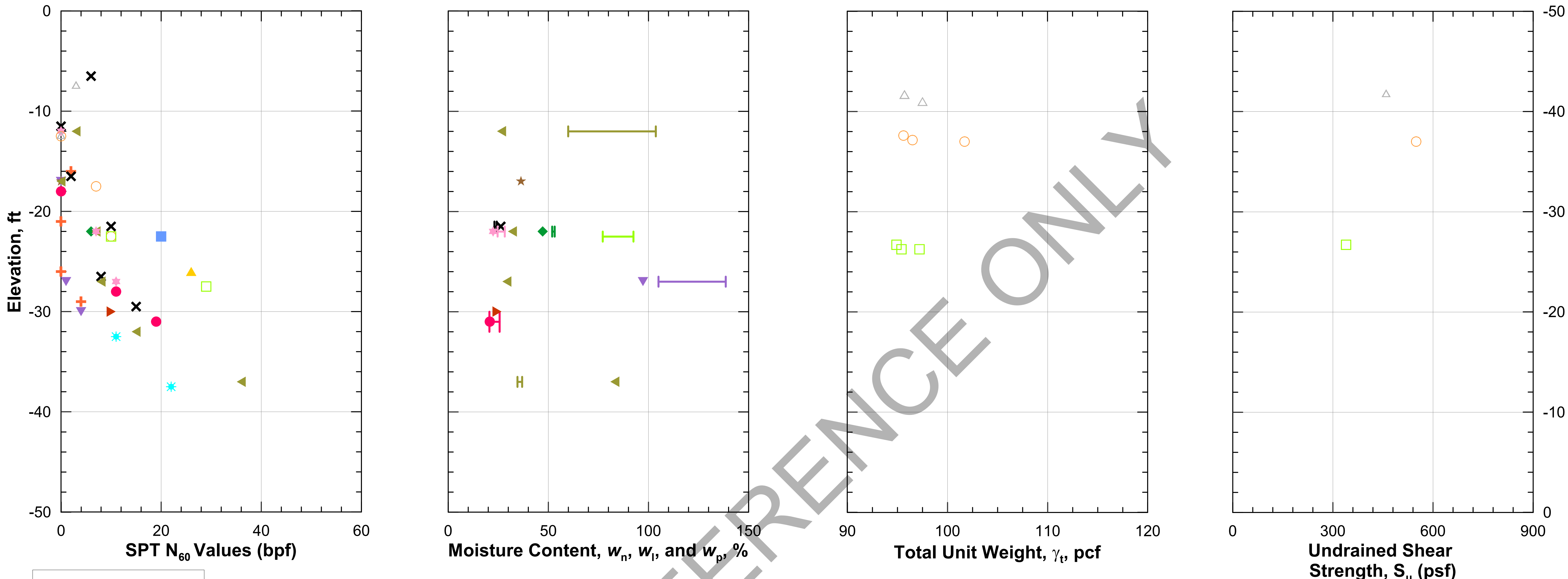
1. **Elevations are not accurately depicted, as boreholes were not surveyed.**

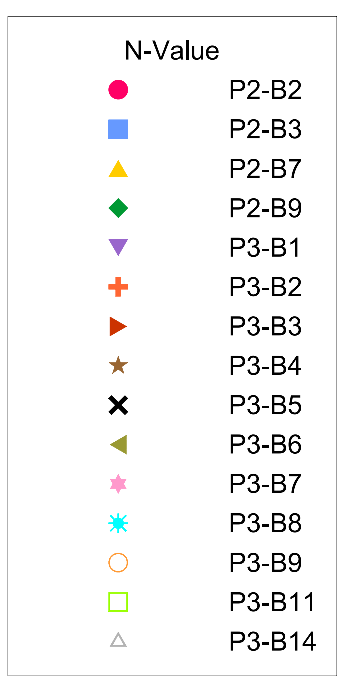
ENGINEERING PROPERTIES OF STRATUM II
UPPER OUTWASH DEPOSIT

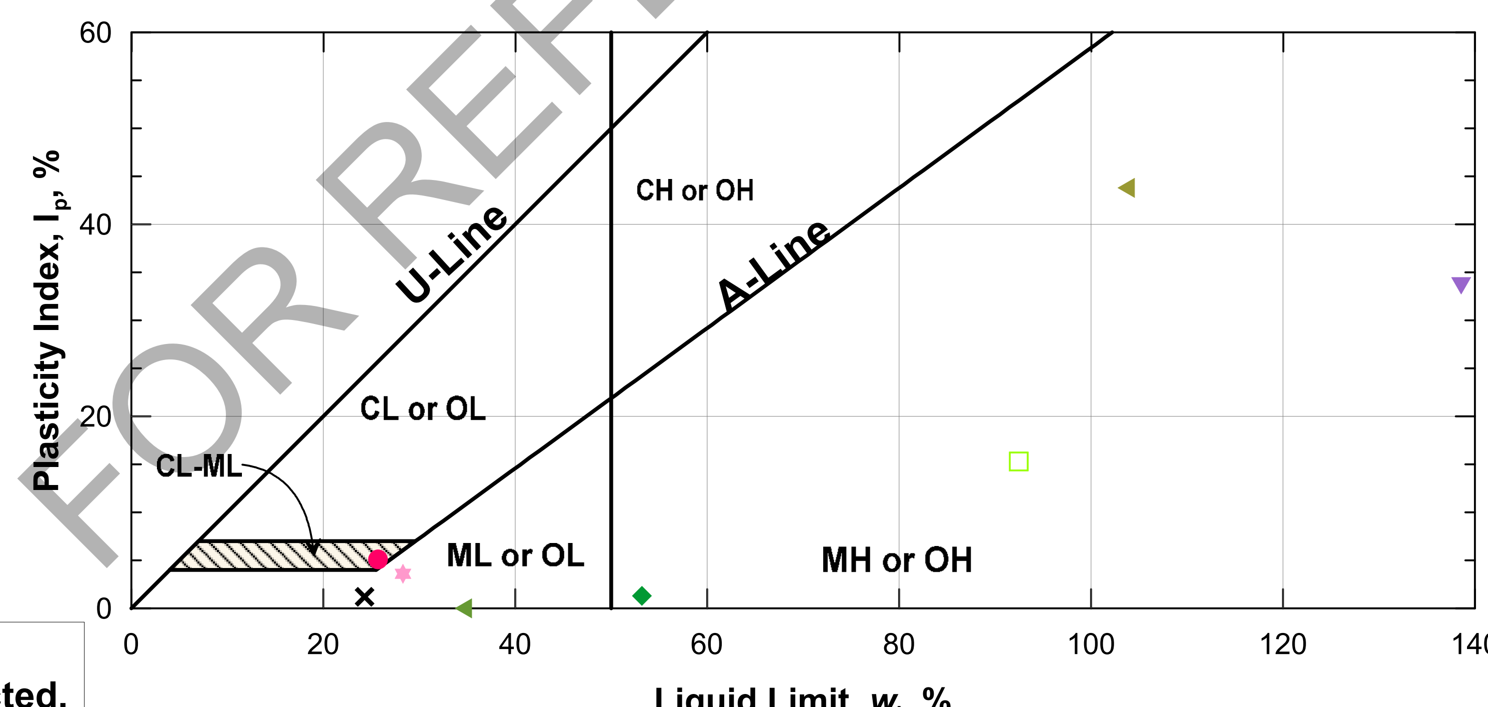
Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

ARUP

FIGURE 11







Notes:

1. **Elevations are not accurately depicted, as boreholes were not surveyed.**

ENGINEERING PROPERTIES OF STRATUM III
CLAY AND SILT

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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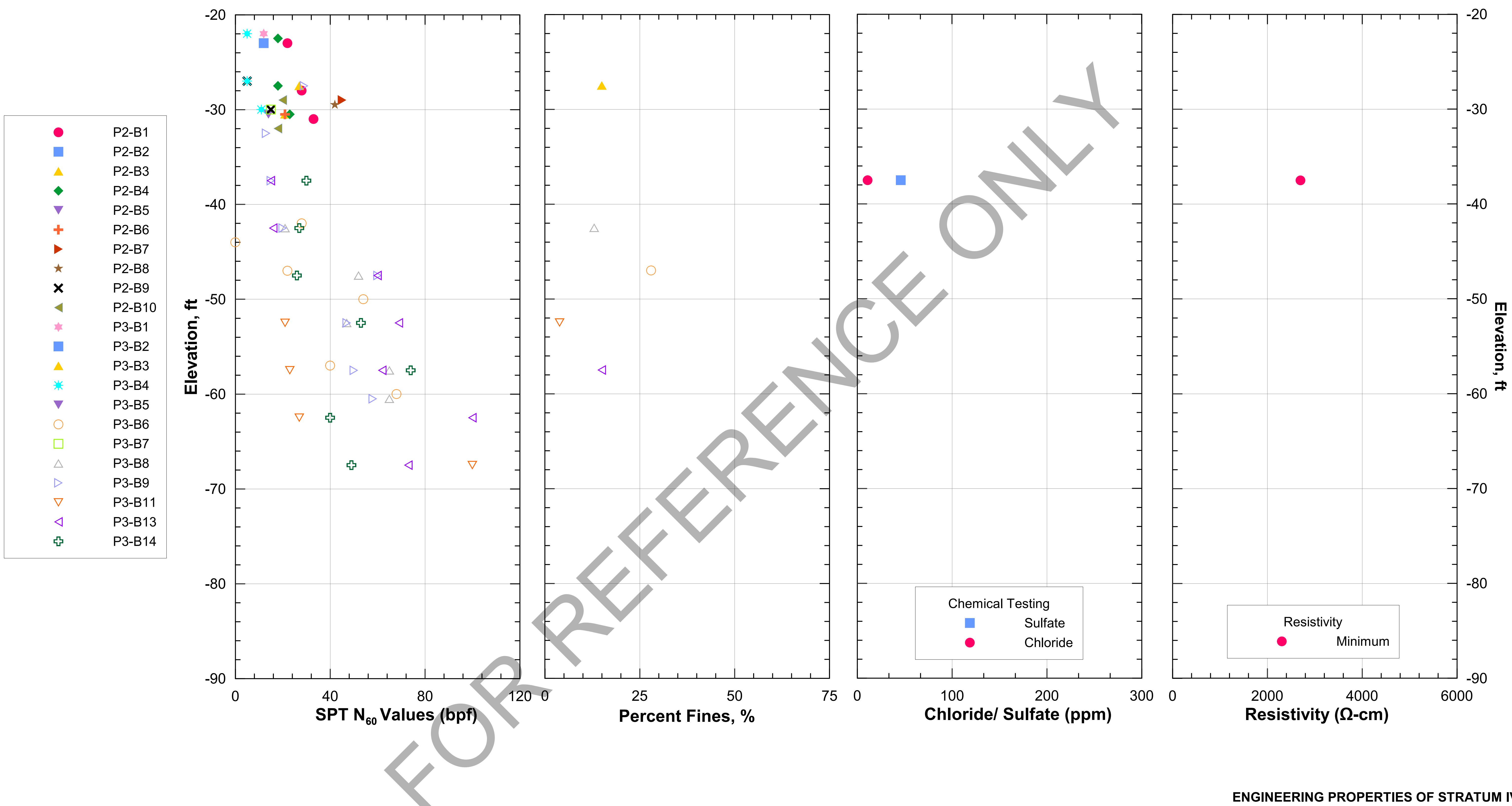
FIGURE 12



Notes:

1. **Elevations are not accurately depicted, as boreholes were not surveyed.**

ENGINEERING PROPERTIES OF STRATUM IV
LOWER OUTWASH DEPOSIT

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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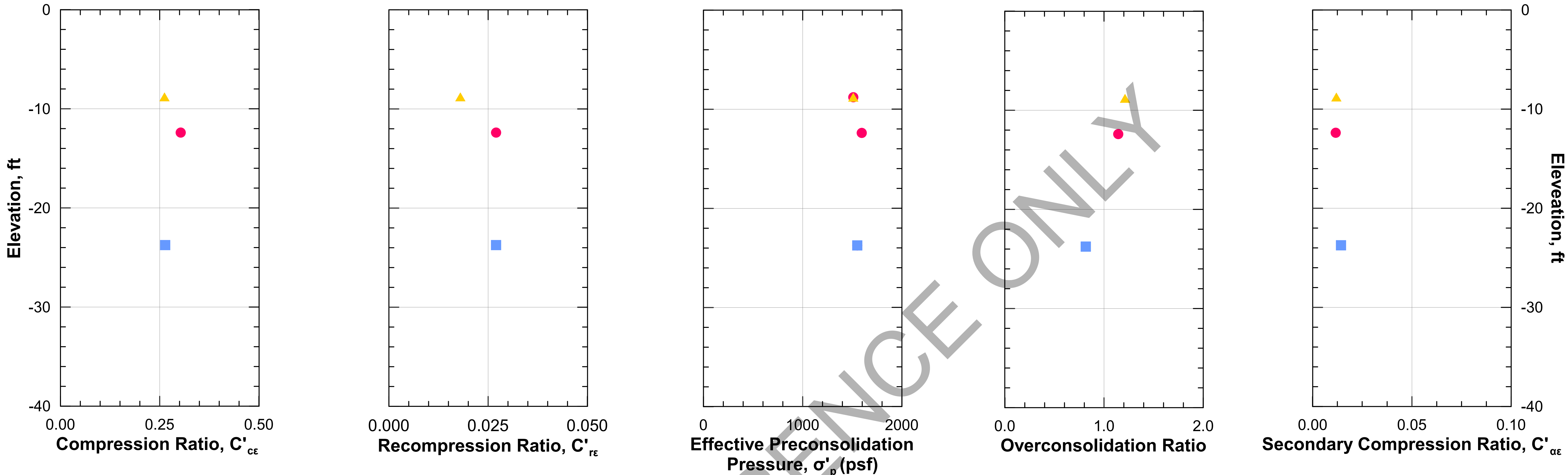
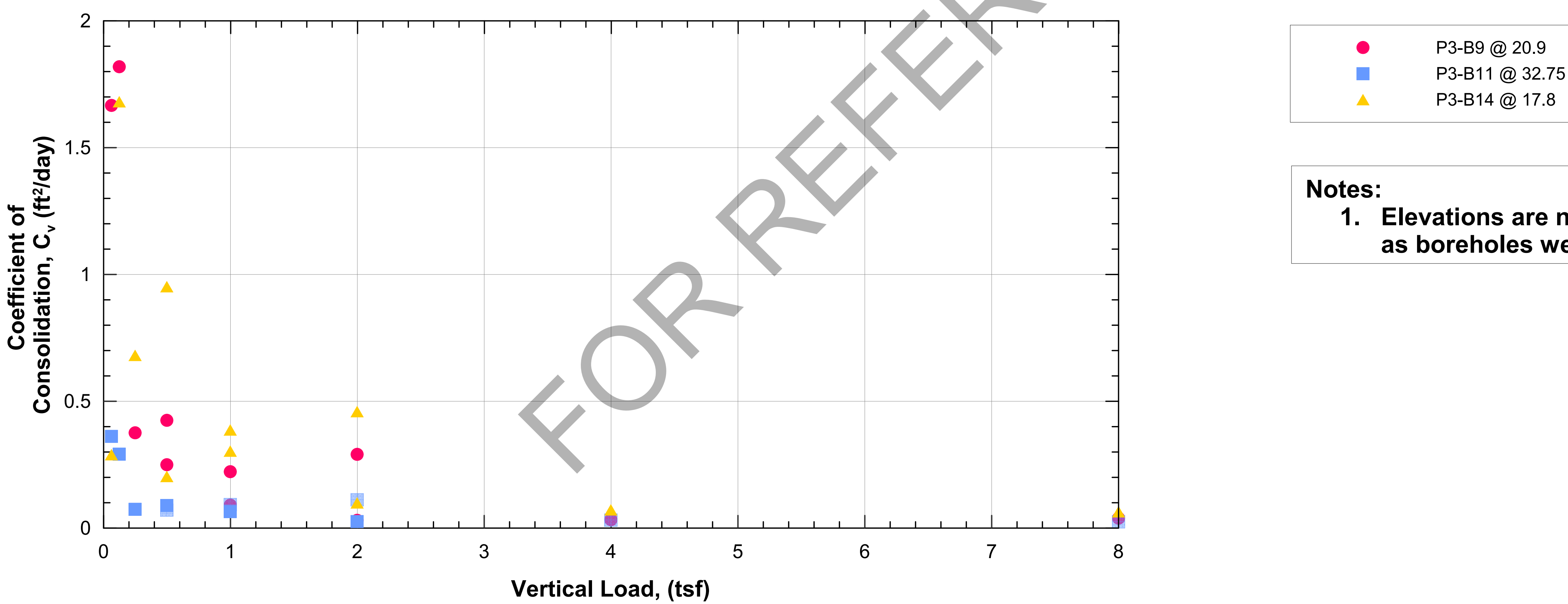
FIGURE 13





Notes:

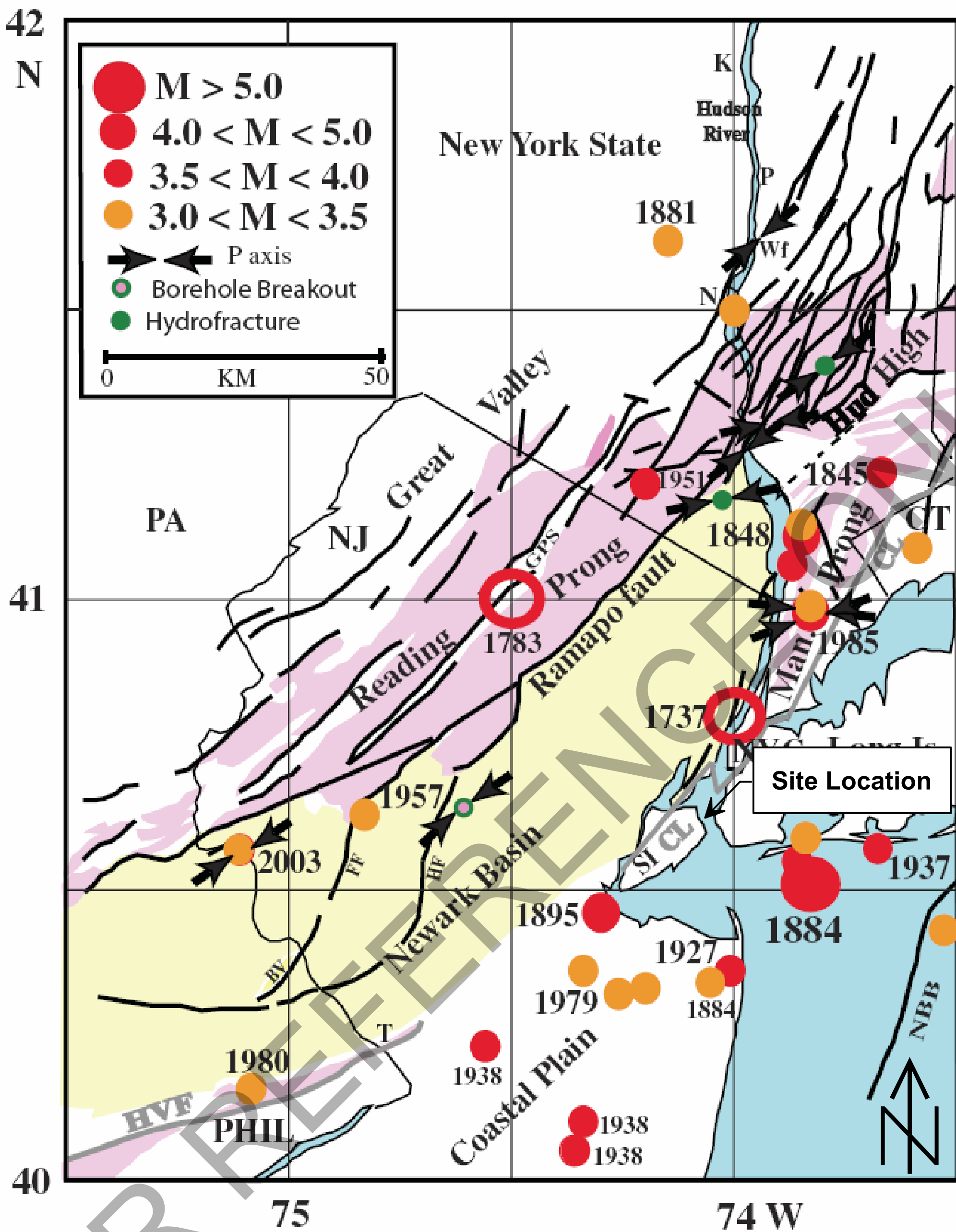
1. **Elevations are not accurately depicted, as boreholes were not surveyed.**

COMPRESSIBILITY PARAMETERS FOR STRATUM III

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

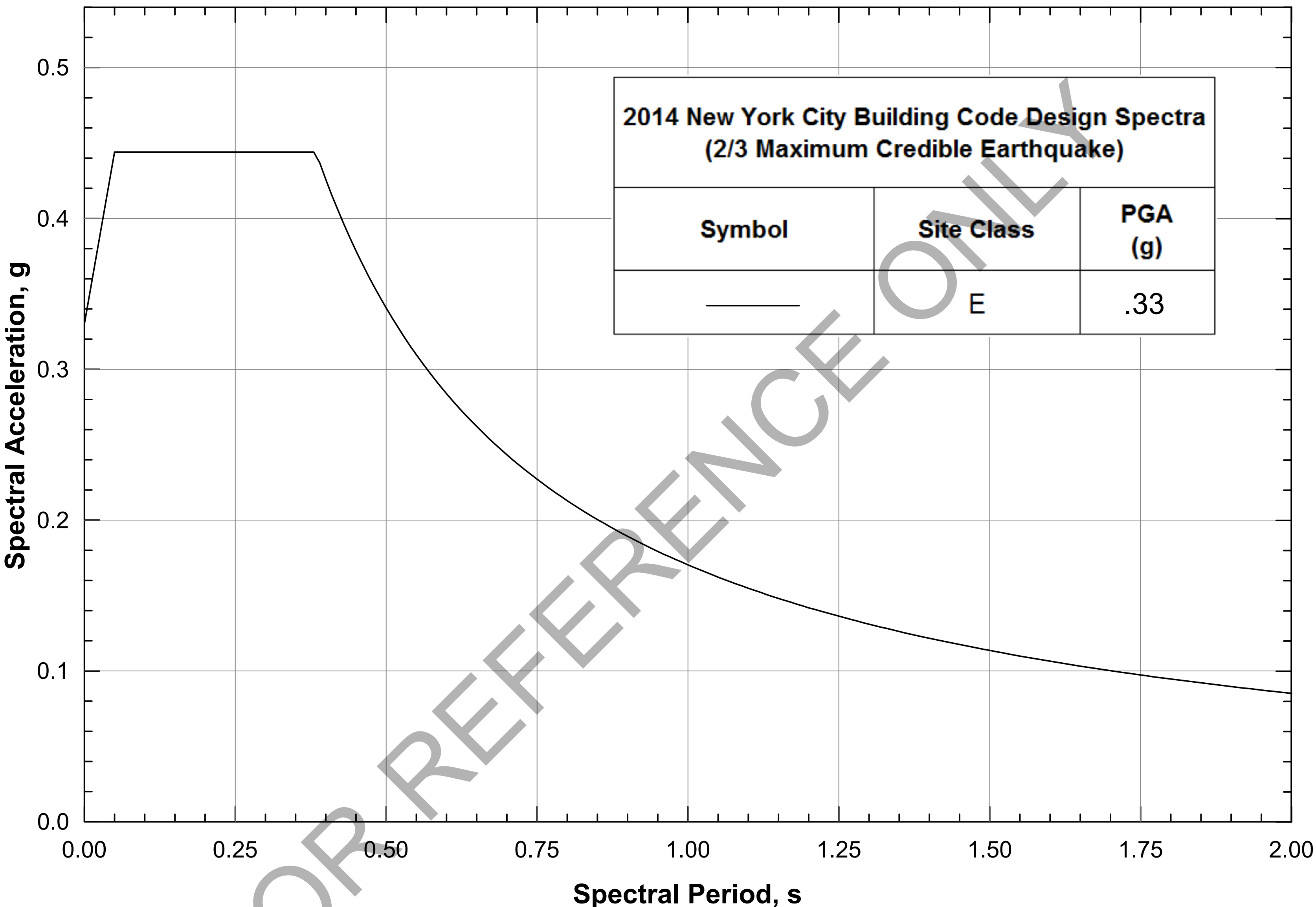
ARUP

FIGURE 14



Earthquakes of Magnitude > 3.0 (Richter Scale)
in the New York City Region
Main Geologic Features of the New York City Region

Reference: Sykes, L. et al. *Observations and Tectonic Setting of Historic and Instrumentally Located Earthquakes in the Greater New York City - Philadelphia Area,* Bulletin of the Seismological Society of America, Vol. 98, No. 4, pp. 1696 - 1719, August 2008



NYCBC DESIGN SPECTRA

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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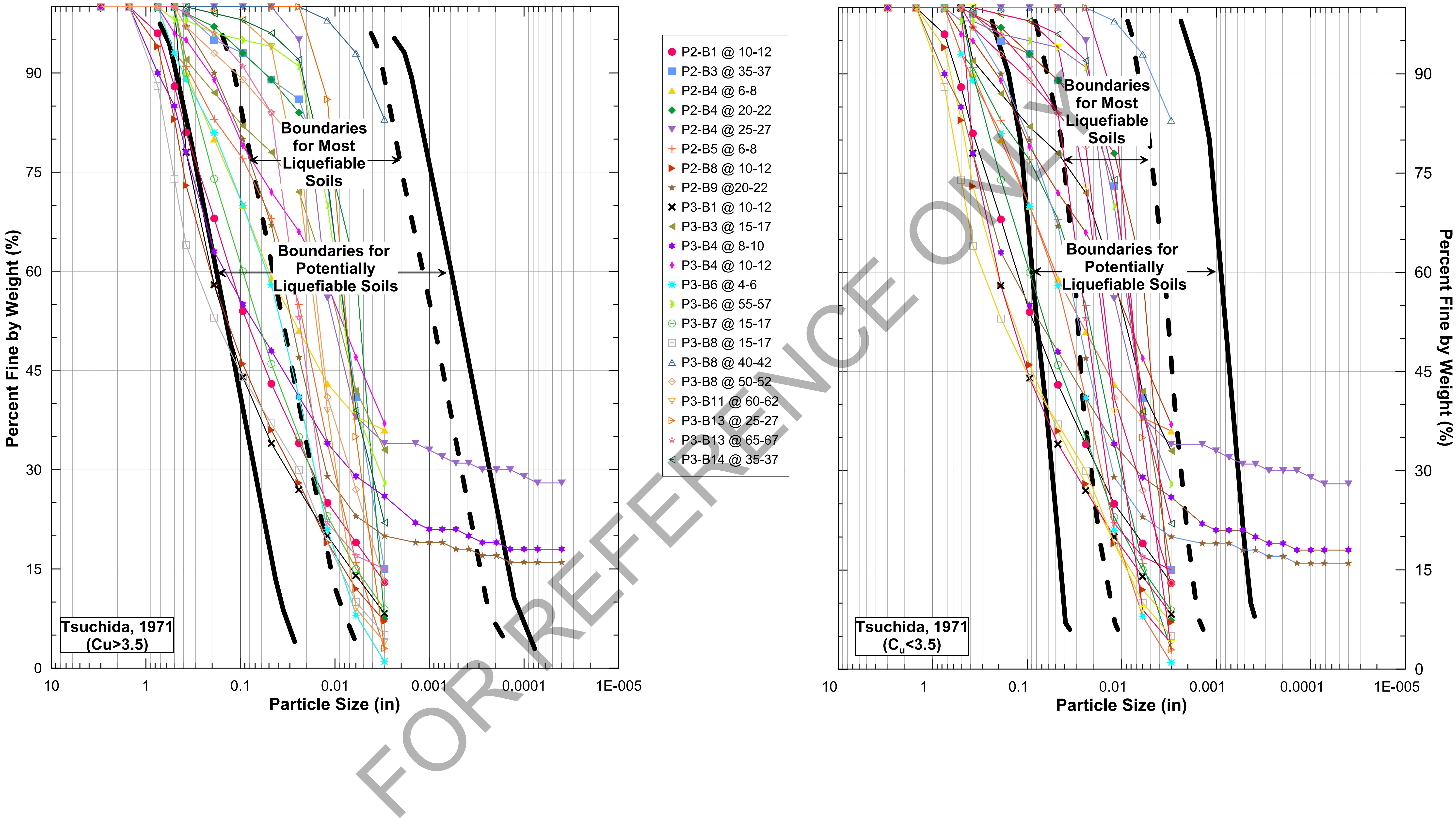
FIGURE 16



LIQUEFACTION SUSCEPTIBILITY

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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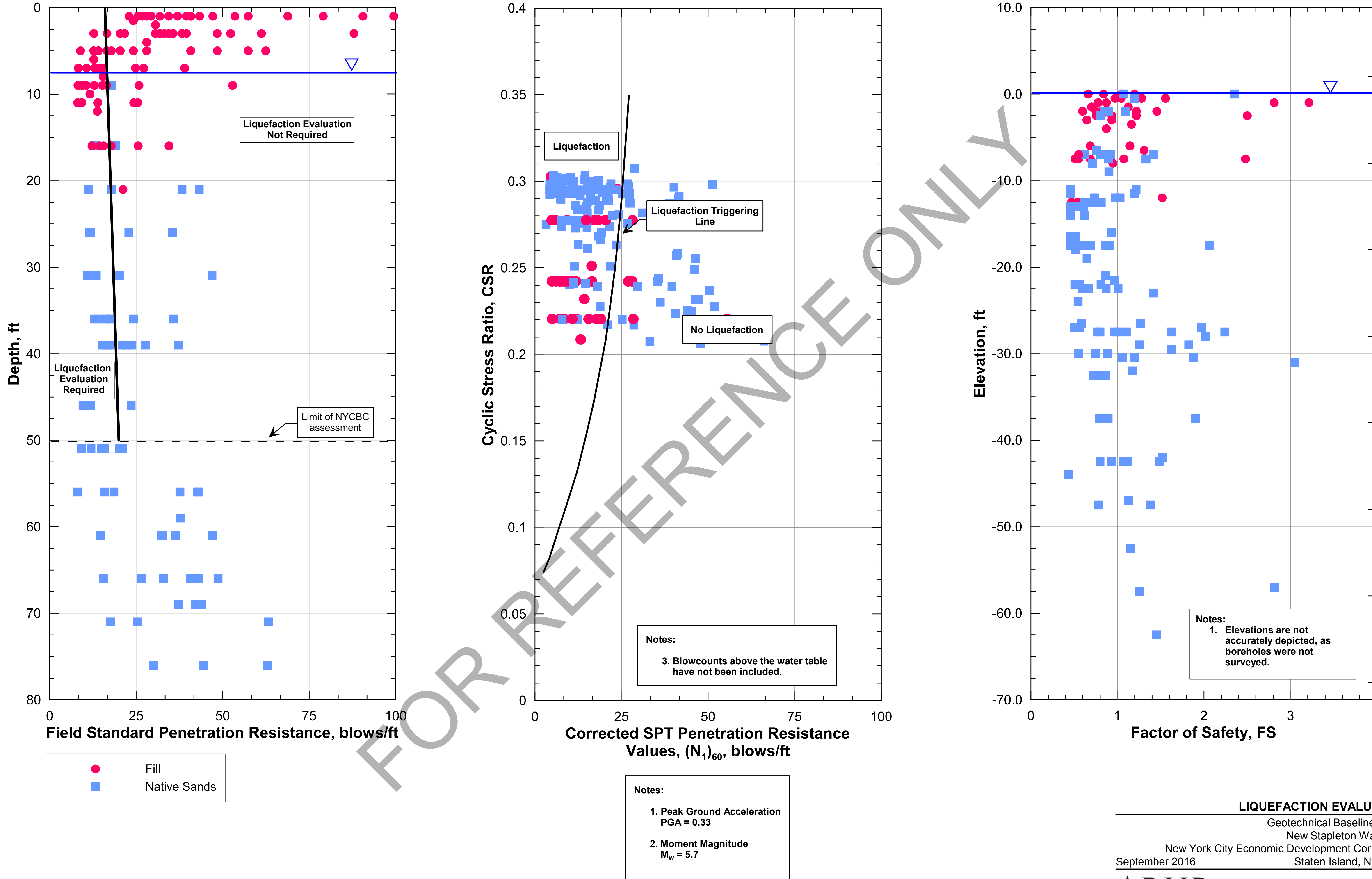
FIGURE 17

\\global.arup.com\americas\Jobs\N-Y\240000\245326-00\4 Internal Project Data\4-05 Reports & Narratives\Geotech\Investigation Report\Figures\Liquefaction\Liquefaction Particle Size Envelope.grf



LIQUEFACTION EVALUATION

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New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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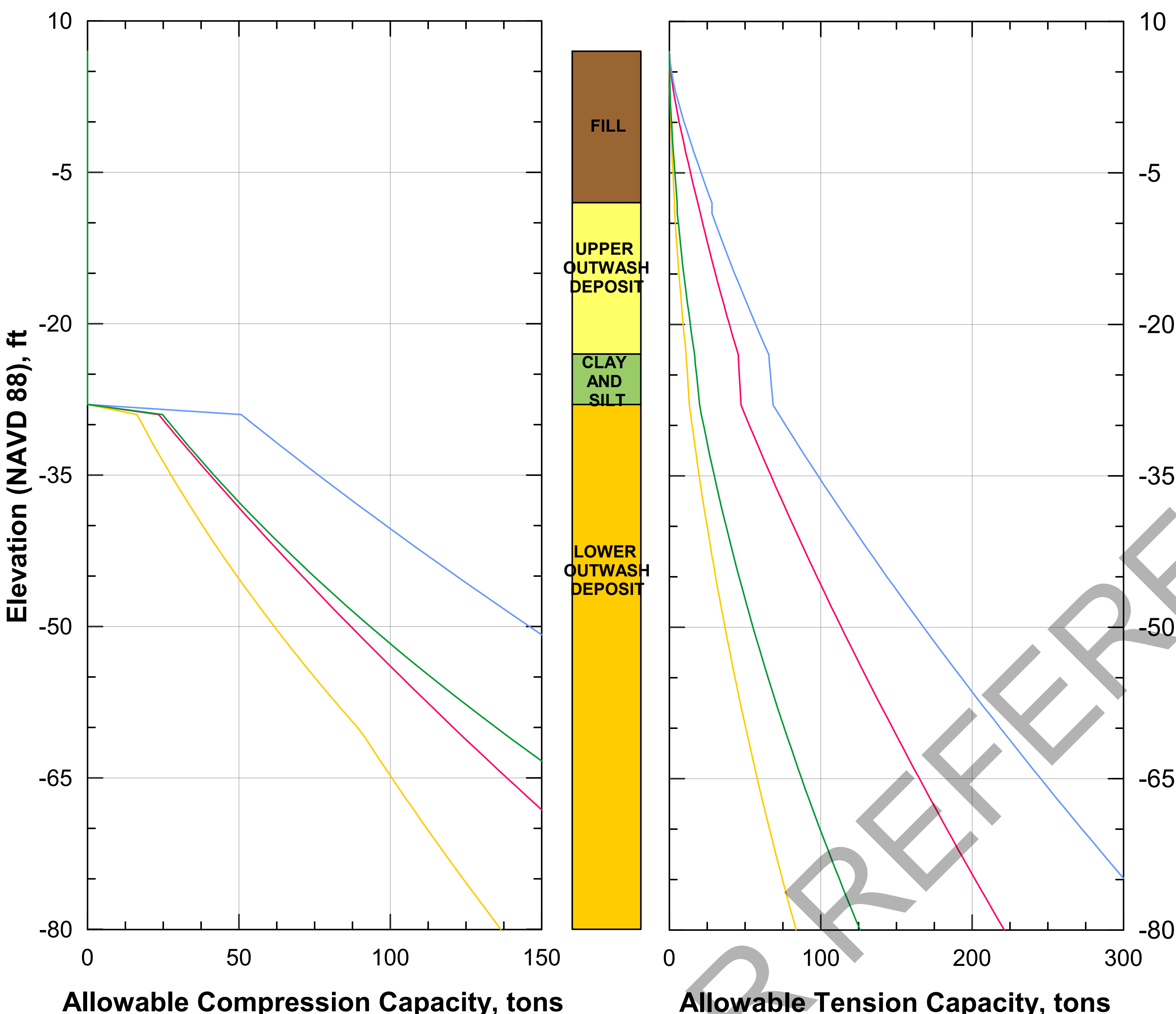
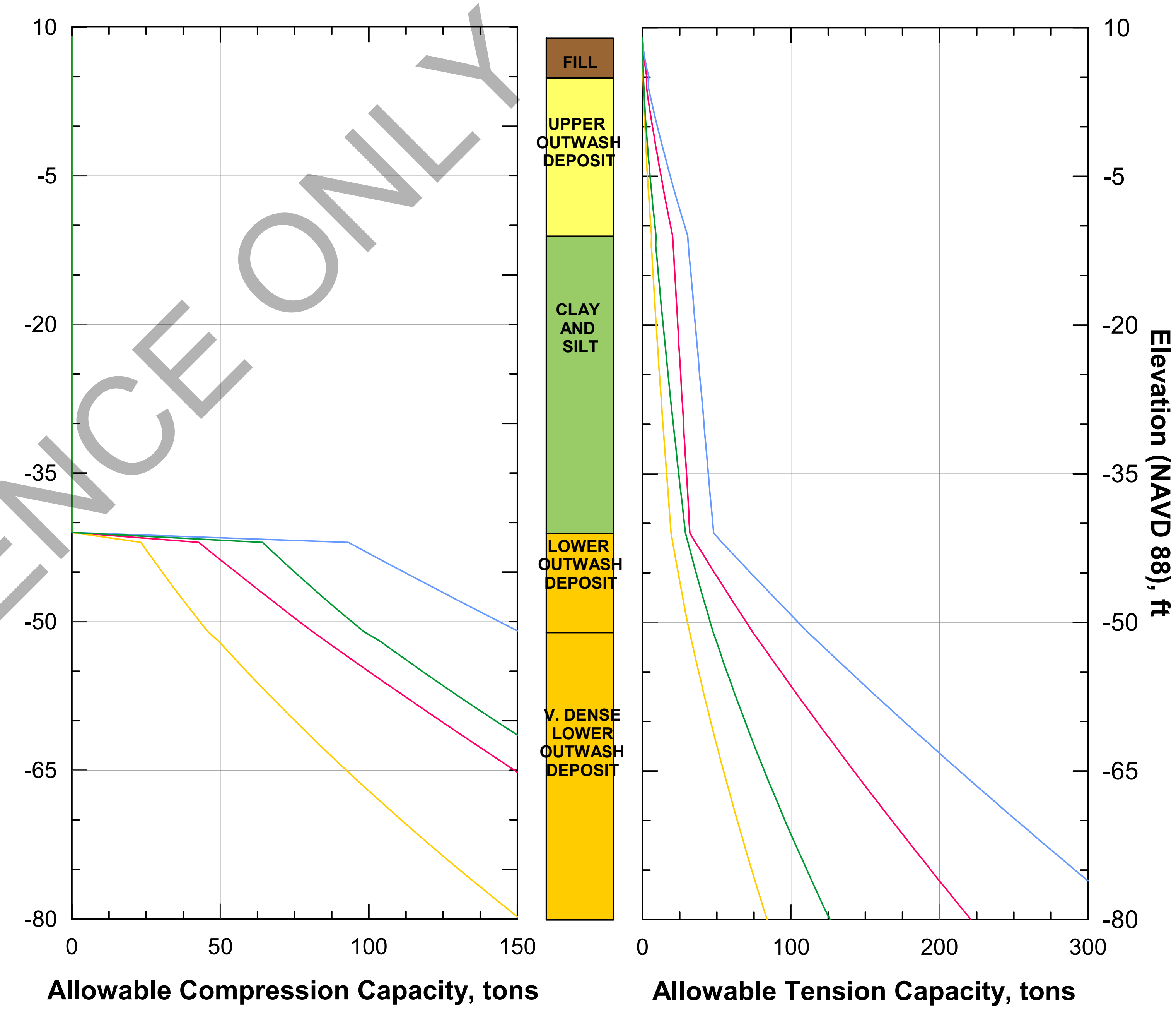
FIGURE 18

\\global.arup.com\americas\Jobs\N-Y\240000\245326-00\4 Internal Project Data\4-05 Reports & Narratives\Geotech\Investigation Report\Figures\Liquefaction\Liquefaction Evaluation.grf

M&O FACILITY/ PHASE 2 AREA BRIDGE PATH, NORTH & SOUTH



COMFORT STATION/ PHASE 3 AREA SOUTH BRIDGE PATH, SOUTH



Notes:
1) Factor of Safety against side capacity = 2
2) Factor of Safety against side capacity = 2
3) Factor of Safety against tension capacity = 2
4) Pile loads to be confirmed through load testing.

Legend
24in Drilled Shaft
36in Drilled Shaft
16in Pipe Pile
24in Pipe Pile

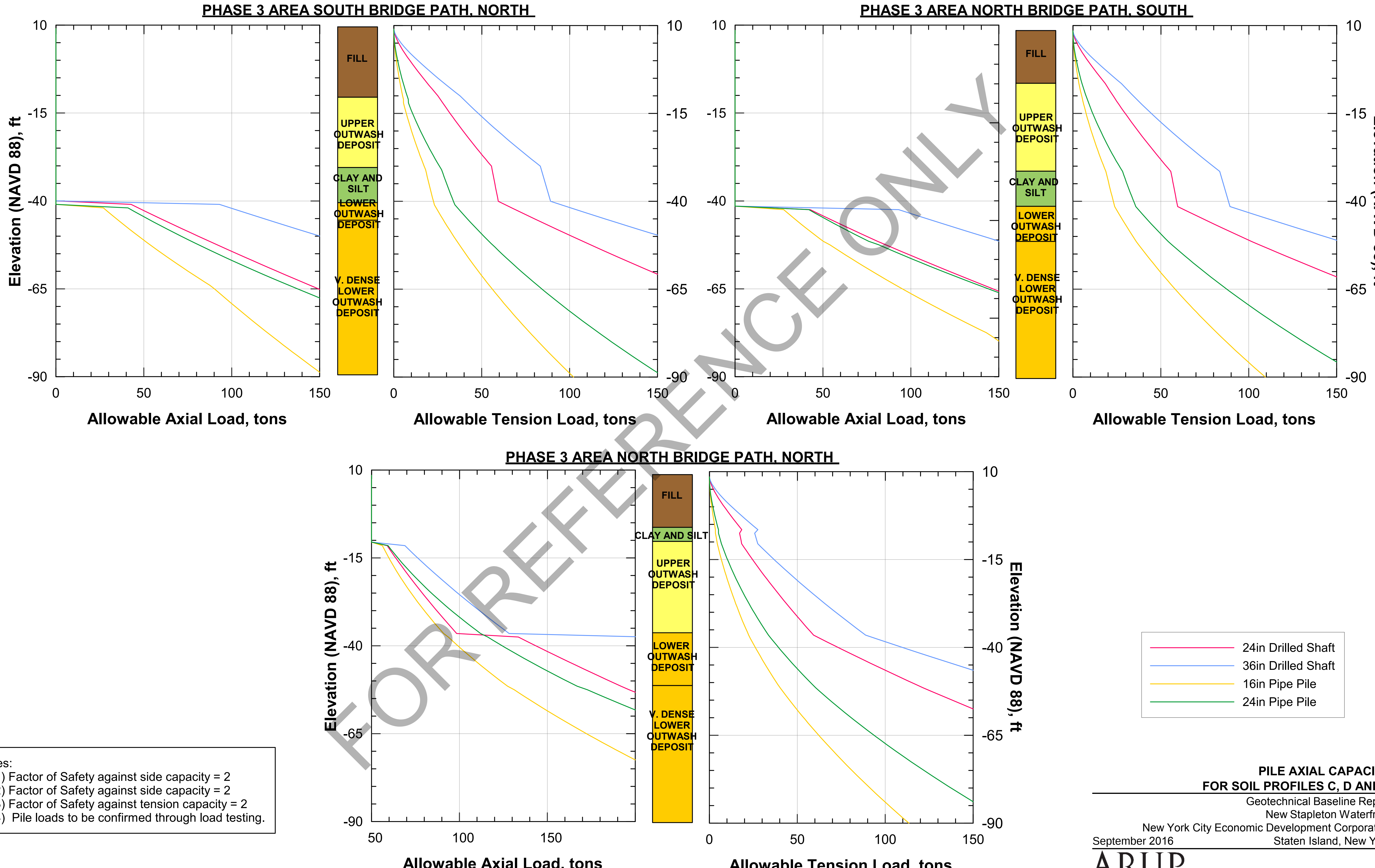
PILE AXIAL CAPACITY
FOR SOIL PROFILES A AND B

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

ARUP

Figure 19

\\global.arup.com\americas\Jobs\N-Y\240000\245326-00\4 Internal Project Data\4-04 Calculations\4-04-05 Geotech\Pile Capacities\Axial Pile Capacity - Profiles A, B, C.grf



Notes:
1) Factor of Safety against side capacity = 2
2) Factor of Safety against side capacity = 2
3) Factor of Safety against tension capacity = 2
4) Pile loads to be confirmed through load testing.

PILE AXIAL CAPACITY FOR SOIL PROFILES C, D AND E

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New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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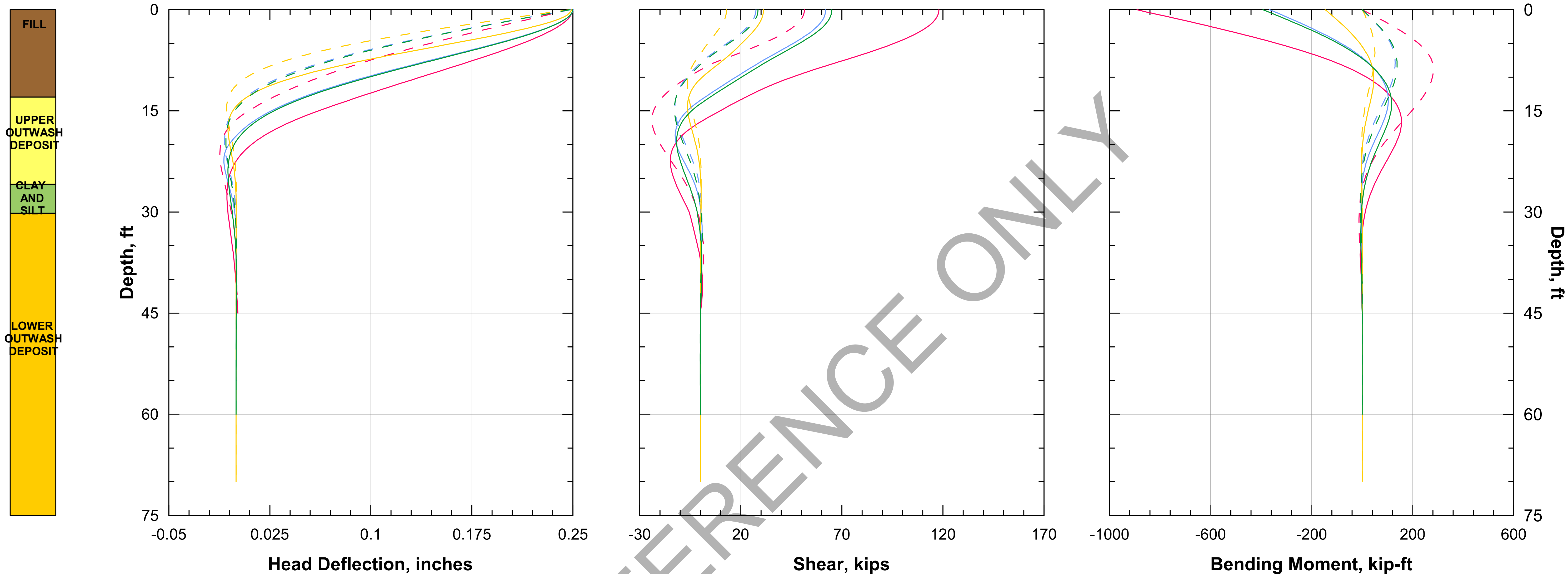
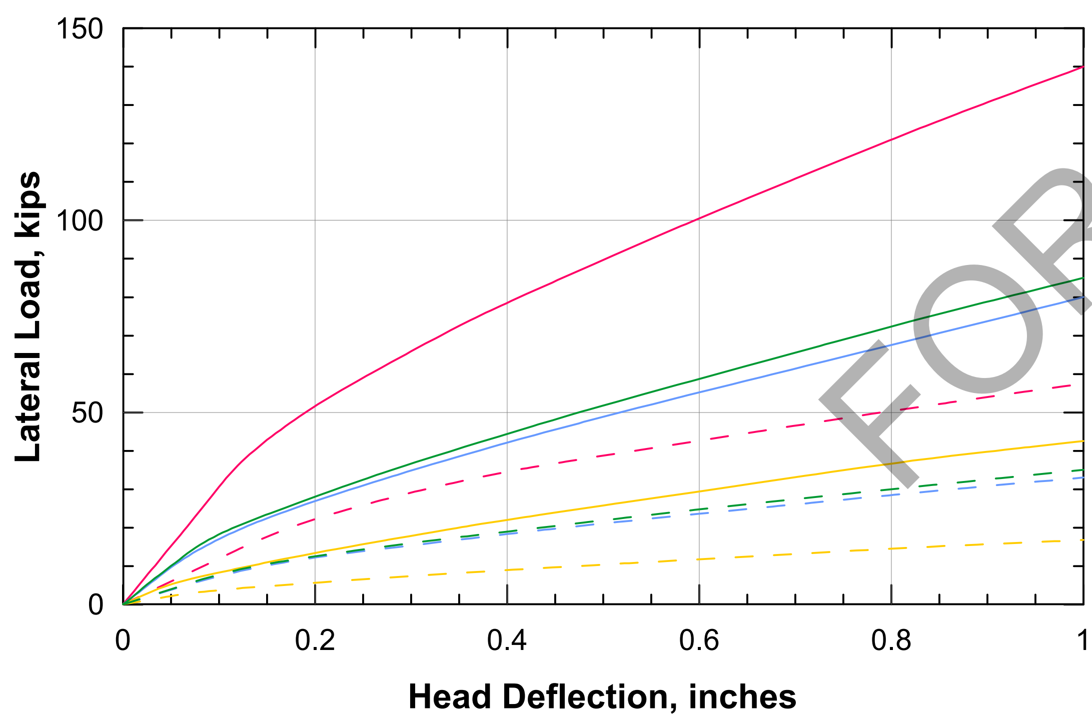
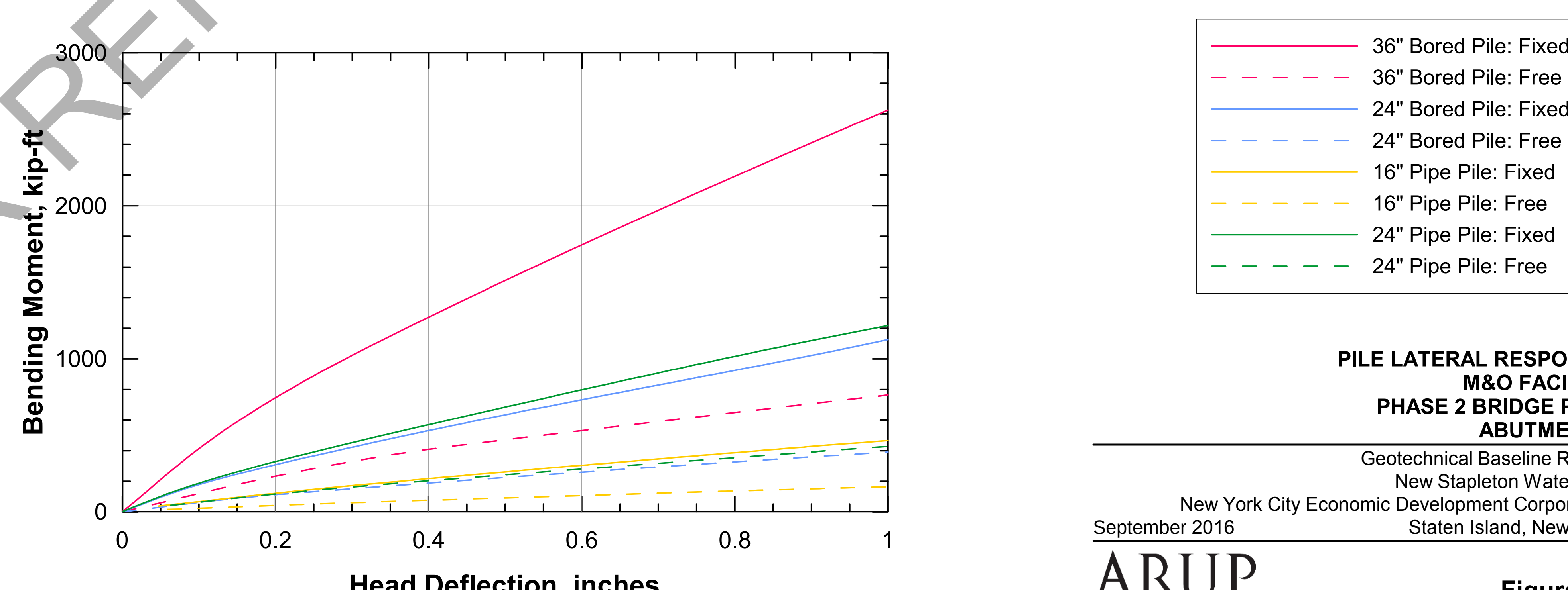
Figure 20

\\global.arup.com\americas\Jobs\N-Y\240000\245326-00\4 Internal Project Data\4-04 Calculations\4-04-05 Geotech\Pile Capacities\Axial Pile Capacity - Profiles D, E, F.grf







PILE LATERAL RESPONSE
M&O FACILITY
PHASE 2 BRIDGE PATH
ABUTMENTS

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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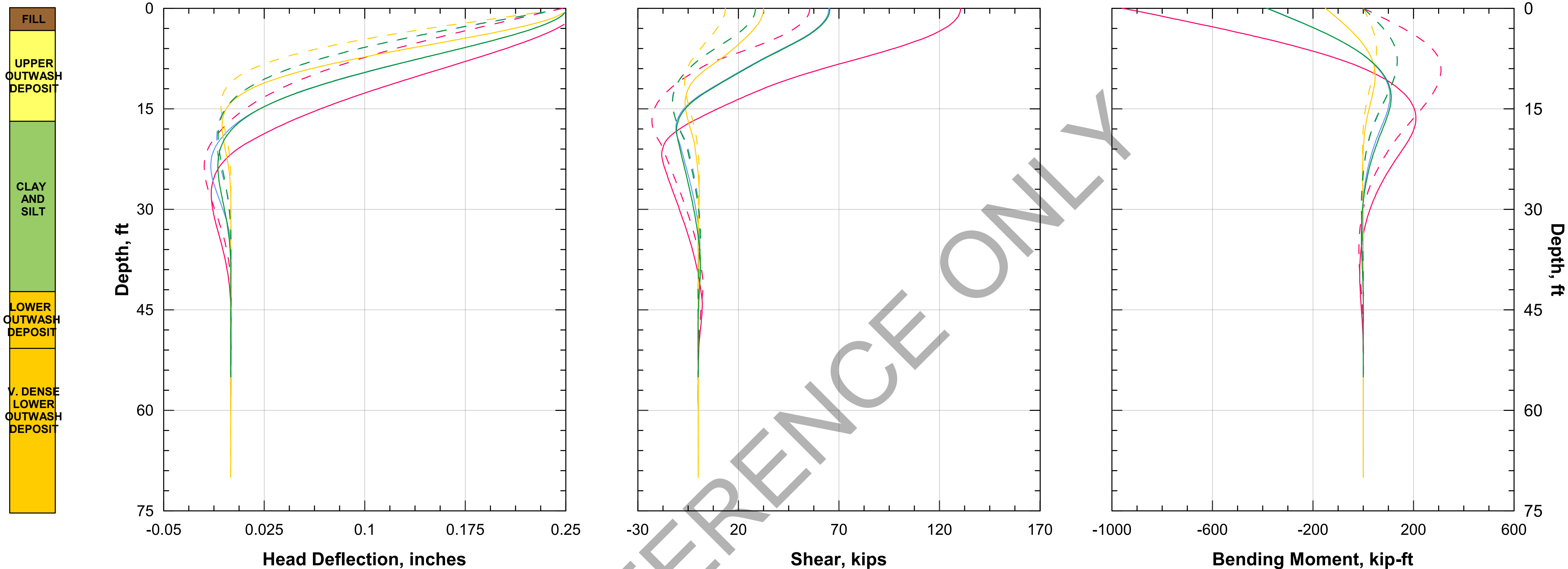
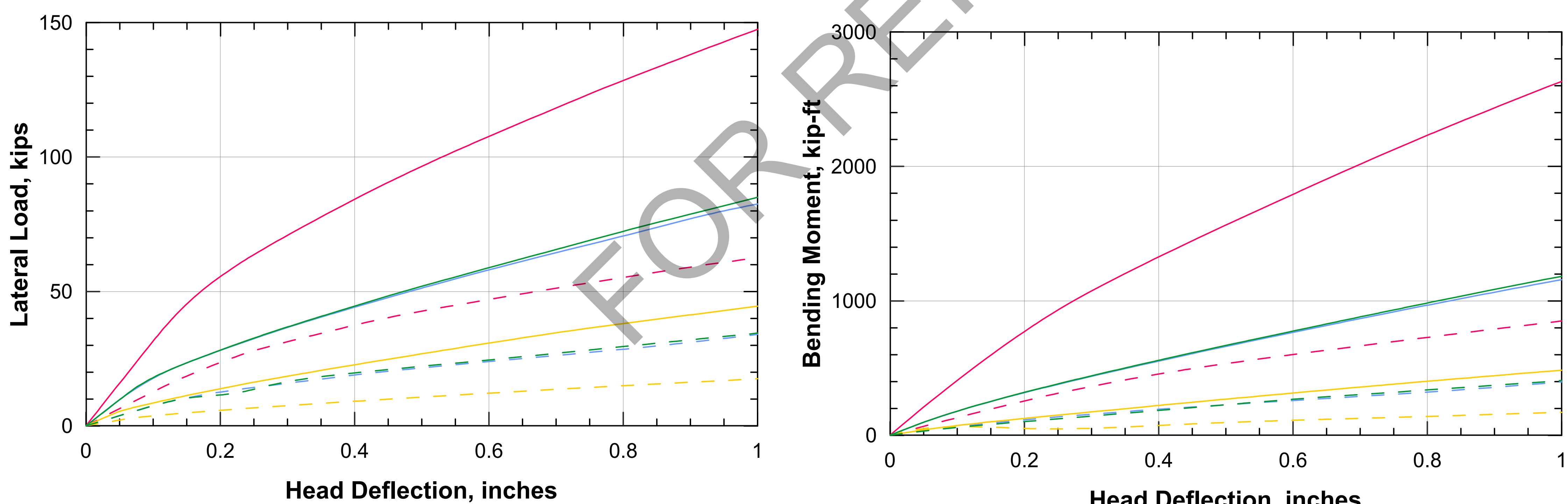
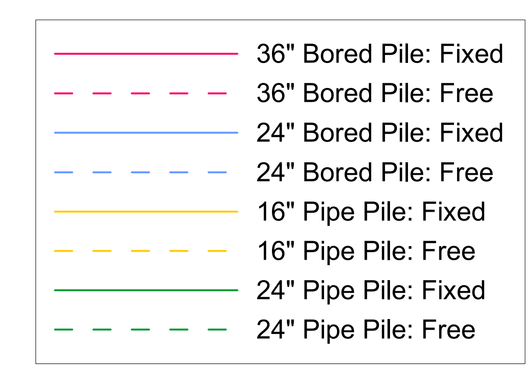
Figure 21

\\global.arup.com\americas\Jobs\N-Y\240000\245326-00\4 Internal Project Data\4-04 Calculations\4-04-05 Geotech\Pile Capacities\Lpile\Phase II\Bridge Path\--North Abutment--\Lateral Capacity wo reveal.grf







PILE LATERAL RESPONSE
COMFORT STATION AND PHASE 3
SOUTH BRIDGE, SOUTH ABUTMENT

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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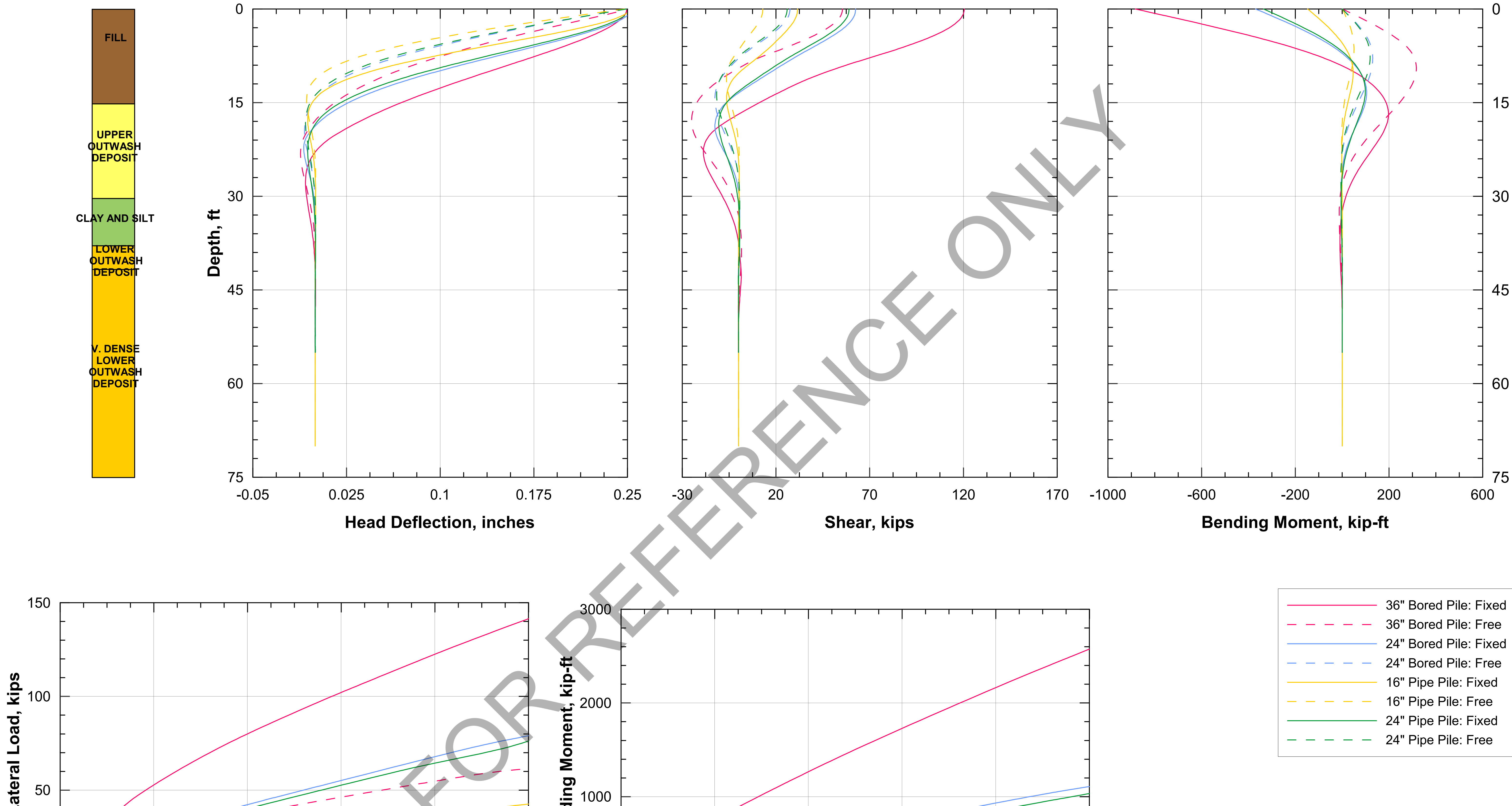
Figure 22

\\global.arup.com\americas\Jobs\N-Y\240000\245326-00\4 Internal Project Data\4-04 Calculations\4-04-05 Geotech\Pile Capacities\Lpile\Phase III\Comfort Station\Lateral Capacity wo reveal.grf



PILE LATERAL RESPONSE
PHASE 3 SOUTH BRIDGE, NORTH ABUTMENT

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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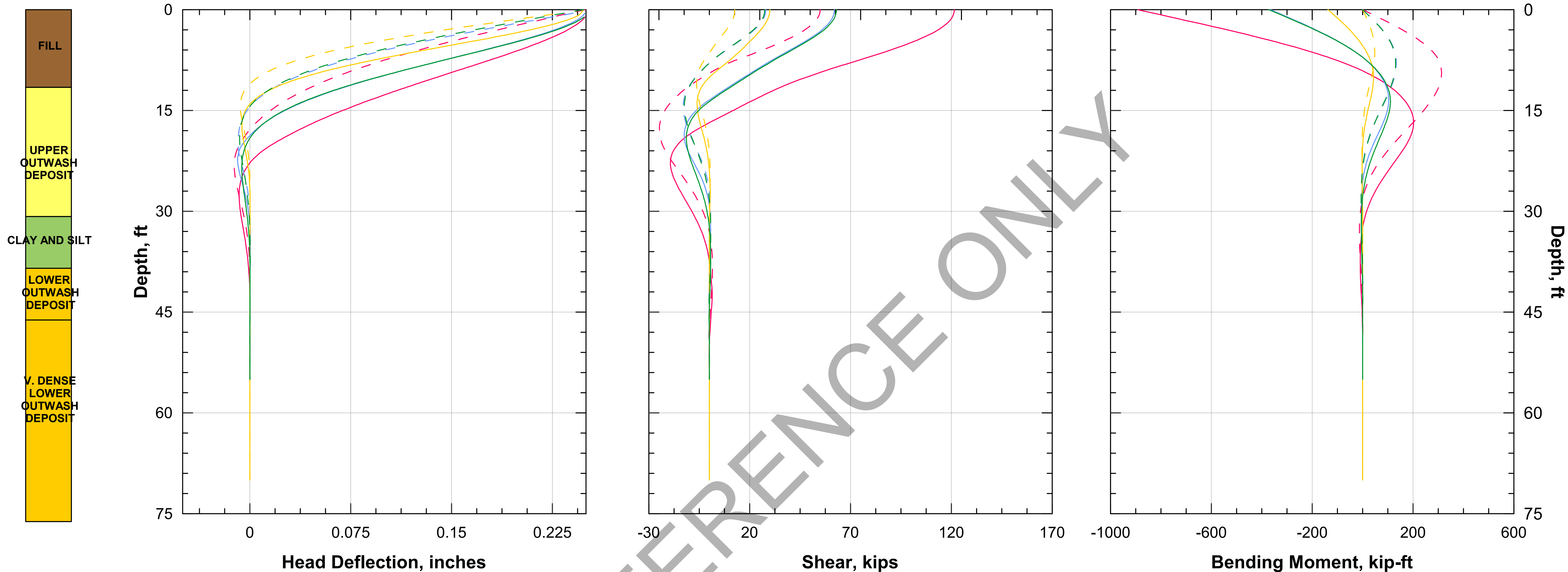
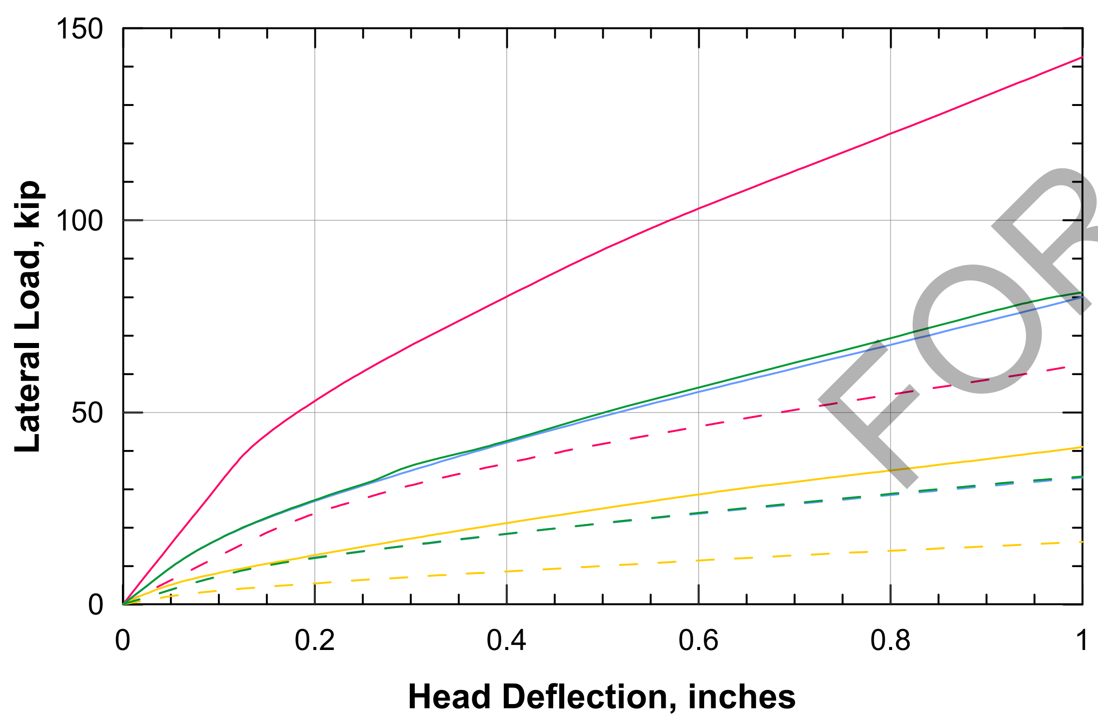
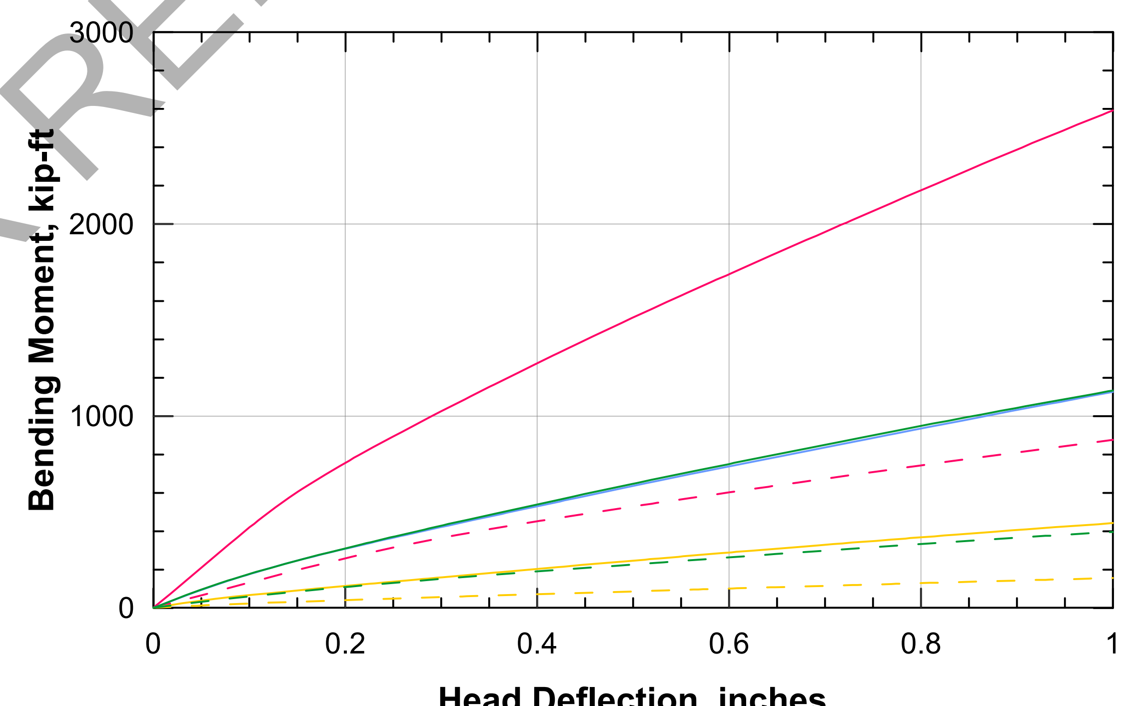
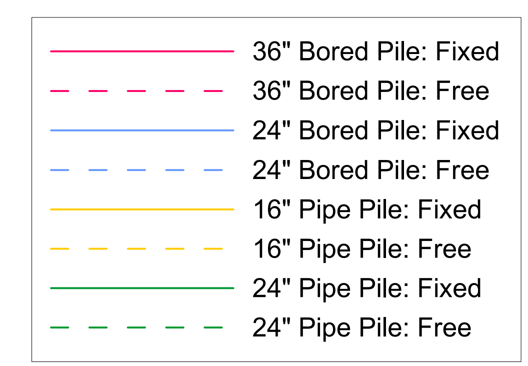
Figure 23

\\global.arup.com\americas\Jobs\N-Y\240000\245326-00\4 Internal Project Data\4-04 Calculations\4-04-05 Geotech\Pile Capacities\Lpile\Phase III\South Bridge Path\North Abutment\Lateral Capacity wo reveal.grf









PILE LATERAL RESPONSE
PHASE 3 NORTH BRIDGE, SOUTH ABUTMENT

Geotechnical Baseline Report
New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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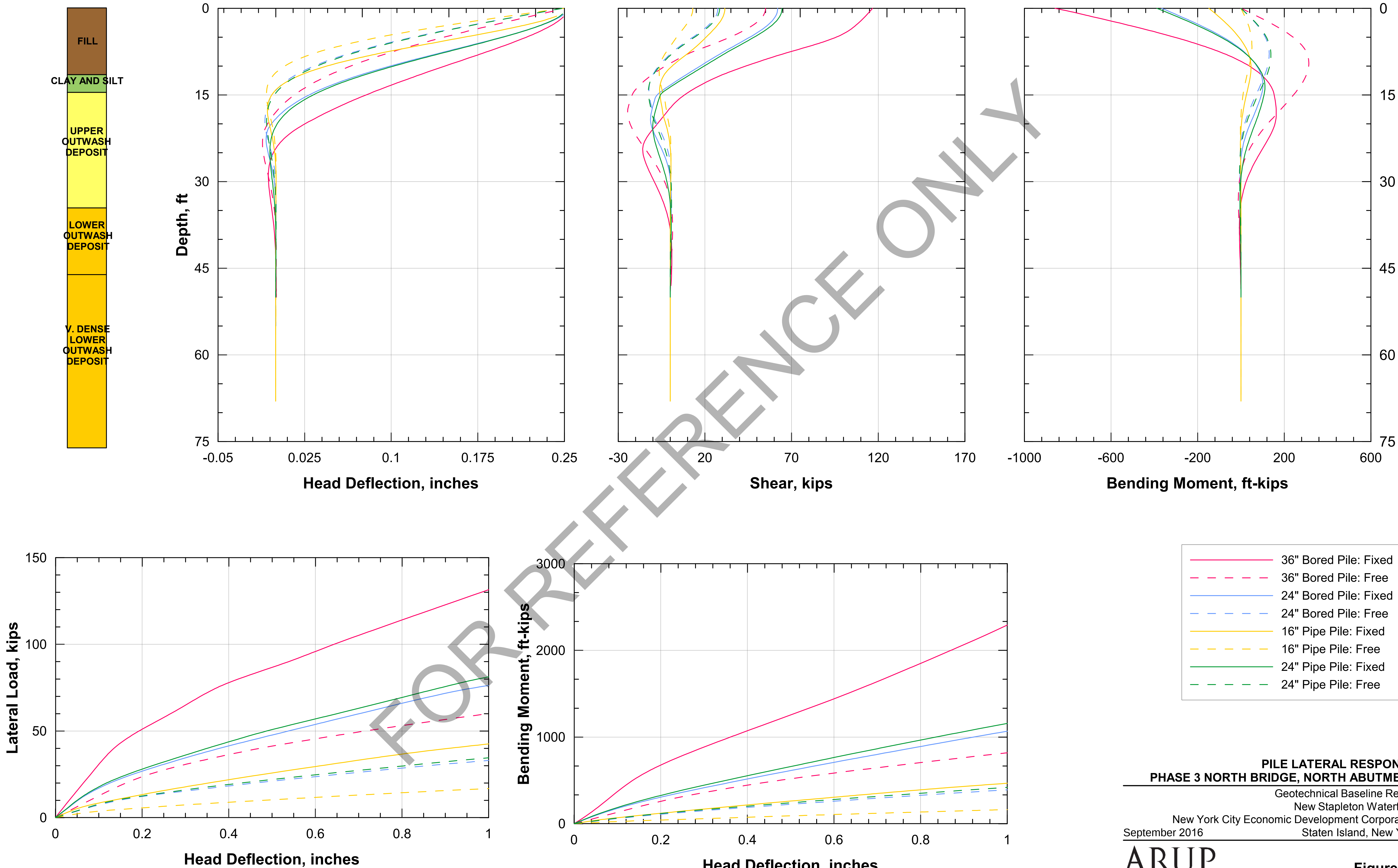
Figure 24



PILE LATERAL RESPONSE
PHASE 3 NORTH BRIDGE, NORTH ABUTMENT

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New Stapleton Waterfront
New York City Economic Development Corporation
September 2016 Staten Island, New York

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Figure 25

\\global.arup.com\americas\Jobs\N-Y\240000\245326-00\4 Internal Project Data\4-04 Calculations\4-04-05 Geotech\Pile Capacities\Lpile\Phase III\North Bridge Path\North Abutment\Lateral Capacity wo reveal.grf

Appendix A

Relevant Historic Borehole Logs

CDM | Hatch Mott MacDonald | A JOINT VENTURE

Test Boring B-201

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Drilling Contractor/ Driller: Aquifer Drilling and Testing, Inc/J. Philbin/E. Felliciano

Ground Surface or Mudline Elevation: 8.6 (NVGD 29)

Drilling Method/Diameter: Drive and Wash/4"

Boring Depth: 185

Hammer Type/Weight/Drop Height: Automatic/140 lb/30 in

Abandonment Method: Grouted to ground surface

Logged by: M. Cronin/E. Ekingen

Boring Location: N 656446 E 610568

Date: Started 8/25/2006 Completed 1/4/2007

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
							-Vacuum excavated 0 to 5 feet -7 inches asphalt over 9 inches concrete over miscellaneous granular fill, 0 to 5 feet -Boring drilled from 0 to 115 feet by J. Philbin from 8/25/06 to 9/1/06. Boring was extended to 185 feet by E. Felliciano from 12/29/2006 to 1/4/2007.			
3.6 5.0		S-1 5-7'	24/6	12 15 9 6		Fill	Wet, medium dense, dark brown, fine to coarse SAND, some fine to coarse gravel, trace silt, trace brick, trace shells	SW-SM		
-1.4 10.0		S-2 10-12'	24/8	1 1 2 2			Wet, very loose, gray, fine to coarse SAND, trace silt, trace fine gravel	SW-SM		
-6.4 15.0		S-3 15-17'	24/1	2 1 1 1				SW-SM		MC=19 -200=10
-11.4 20.0										

General Remarks:

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Test Boring B-201

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
	X	S-4 20-22'	24/16	WOH 1 2 3		Recent Marine Sediment	Wet, very loose, black, fine to medium SAND and SILT	SM		
-16.4 / 25.0	X	S-5 25-27'	24/18	5 5 5 10		Silty Sand and Gravel	Wet, loose, reddish brown, fine SAND, some silt	SM		MC=23 -200=21
-21.4 / 30.0	X	S-6 30-32'	24/20	3 3 2 3		Silty Sand and Gravel	Wet, loose, reddish brown, SILT and fine to medium SAND	ML		MC=22 -200=53
-26.4 / 35.0	X	S-7 35-37'	24/19	4 4 4 3		Silty Sand and Gravel				
-31.4 / 40.0	X	S-8 40-42'	24/17	5 8 11 15		Silty Sand and Gravel	Wet, medium dense, dark brown to reddish brown, fine to medium SAND, little fine gravel, trace silt	SW-SM		MC=13 -200=9

General Remarks:

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Test Boring B-201

Client: NYC EDC/DEP | **Project Location: New York City, New York**

Project Name: Harbor Siphon Replacement | **Project Number: 36856-46971**

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
						Silty Sand and Gravel	Wet, medium dense, dark brown to reddish brown, fine to medium SAND, little fine gravel, trace silt			
-36.4 / 45.0		S-9 45-47'	24/nr	5 5 15 13			Wet, medium dense, dark brown to reddish brown, fine to coarse SAND, some fine to coarse gravel, little silt	SM		
-41.4 / 50.0										
-46.4 / 55.0		S-10 55-56'	7/3	13 50/1"			-very dense, 55 to 57 feet	SW-SM		
		S-11 57-59'	24/20	12 9 12 24			-trace silt, trace gravel, 57 to 59 feet	SW-SM		
-51.4 / 60.0		S-12 59-61'	24/14	20 15 13 16			-some silt, some fine gravel, 59 to 61 feet	SM		MC=13 -200=26
		S-13 61-63'	24/17	8 13 9 21			Wet, dense to very dense, dark brown to reddish brown, fine to medium SAND, little silt -medium dense, 61 to 63 feet	SM		
-56.4 / 65.0		S-14 63-65'	24/15	13 25 46 57				SM		

General Remarks:

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Test Boring B-201

Client: NYC EDC/DEP

Project Name: Harbor Siphon Replacement

Project Location: New York City, New York

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		S-15 65-67'	24/18	22 25 35 65		Silty Sand and Gravel	Wet, dense to very dense, dark brown to reddish brown, fine to medium SAND, little silt	SM		
		S-16 67-69'	24/18	32 60 80 72			-trace fine gravel, 67 to 69 feet	SM		MC=14 -200=17
-61.4 / 70.0		S-17 69-70.5'	15/12	36 61 50/3"				SM		
		S-18 71-73'	24/10	33 54 74 70				SM		
		S-19 73-75'	24/14	30 47 56 70			-trace silt, 73 feet	SM		
-66.4 / 75.0						Decomposed Rock	Wet, very dense, dark green and gray, fine to coarse SAND, some gravel, trace silt, trace mica (completely weathered, PEGMATITE to SCHISTOSE GNEISS)	SP-SM		
		S-20 75-77'	24/12	46 65 70 82			-some silt, little fine gravel, 75 to 77 feet	SM		MC=12 -200=21
		S-21 77-79'	24/14	19 40 70 65			-little fine gravel, trace silt, 77 to 79 feet	SP-SM		
-71.4 / 80.0		S-22 79-81'	24/12	46 65 23 27			Wet, very dense, dark green and gray, fine to coarse SAND, some silt, little fine gravel (completely weathered, PEGMATITE to SCHISTOSE GNEISS)	SM		
		S-23 81-83'	24/14	16 26 38 47			-light green, trace fine gravel, 81 to 92 feet	SM		MC=15 -200=34
-76.4 / 85.0		S-24 83-85'	24/9	62 80 55 81				SM		
		S-25 85-87'	24/12	35 60 67 72				SM		MC=15 -200=25
		S-25A	6/4	100/6"			(Boring resampled from 85 to 91 feet on 1/2/2007)			

General Remarks:

Test Boring B-201

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Client: NYC EDC/DEP | **Project Location: New York City, New York**

Project Name: Harbor Siphon Replacement | **Project Number: 36856-46971**

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		87-87.5'					Wet, very dense, dark green and gray, fine to coarse SAND, some silt, little fine gravel (completely weathered, PEGMATITE to SCHISTOSE GNEISS)			
	X	S-25B 89-89.5'	4/3	100/4"						
-81.4 / 90.0	X	S-26 90-90.5'	5/3	100/5"						MC=9 -200=22
	X	S-27 92-92.5'	1/0	50/1"			-No recovery			
	X	S-28 94-94.5'	1/0	50/1"			-No recovery			
-86.4 / 95.0		C-1 95-100'	60/48	[0] (0)		Decomposed Rock	Very soft, completely weathered, extremely fractured, white to dark gray, coarse to very coarse-grained, PEGMATITE (Q Rating: Exceptionally Poor)			
-91.4 / 100.0		C-2 100-105'	60/57	[0] (0)			Very soft, highly to completely weathered, moderately to extremely fractured, white to dark gray, coarse to very coarse-grained, PEGMATITE (Q Rating: Exceptionally Poor) PJS: horizontal to low angle, very close to close spacing, rough and irregular surface, open to wide aperture		PM=8640	
-96.4 / 105.0		C-3 105-110'	60/57	[0] (0)					PM=6480 PM=5760	
-101.4 / 110.0										

General Remarks:

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Test Boring B-201

Client: NYC EDC/DEP | **Project Location: New York City, New York**

Project Name: Harbor Siphon Replacement | **Project Number: 36856-46971**

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
						Weathered Rock	C-4A: Very soft, highly to completely weathered, white to dark gray, coarse to very coarse-grained, PEGMATITE (sample from 9/1/2006, recovery =27/60 RQD=0) (Q Rating: Exceptionally Poor)		PM=7200	
-106.4 115.0		C-4B 110-115'	60/46.5	[33] (<0.1)			C-4B: Moderately hard to hard, moderately weathered, slightly to moderately fractured, white and black, coarse to very coarse-grained, SCHISTOSE GNEISS (Q Rating: Extremely Poor) PJS: horizontal to low angle, rough and irregular surfaces, very close to close spacing, wide to very wide aperture, sand and silt on surfaces SJS: high angle to vertical joint, rough and planar surfaces, moderately wide spacing, wide aperture, silt and sand on surfaces			
-111.4 120.0		C-5 115-120'	60/51	[21] (0.1)			(Boring sampled/cored 110 to 185 feet, from 1/3/2007 to 1/4/2007) Moderately hard, moderately weathered, moderately fractured, white, black and gray, coarse to very coarse-grained PEGMATITE intermixed with Schistose GNEISS (Q Rating: Very Poor) PJS: horizontal to low angle, rough and irregular surfaces, very close to close spacing, open to very wide aperture, silt and sand on surfaces 118' 3"-120': extremely fractured, completely weathered zone		PM=8640	
-116.4 125.0		C-6 120-125'	60/60	[93] (6.4)			Hard, slightly to moderately weathered, sound, white, black, gray and pink, coarse to very coarse-grained SCHISTOSE GNEISS intermixed with white and gray PEGMATITE veins (Q Rating: Fair) PJS: low angle to horizontal, rough and irregular surfaces, close to moderately wide spacing, open to very wide aperture, trace sand and silt on surfaces 122' 7": moderate angle joint, somooth and undulating surface, open aperture 123' 9", 124' 4": high angle joint, rough and planar surface, wide aperture, silt on surface		PM=11520	
-121.4 130.0		C-7 125-130'	60/39	[37] (0.1)			Moderately hard to hard, slightly weathered, slightly fractured, white, black, pink and gray, coarse to very coarse-grained SCHISTOSE GNEISS intermixed with PEGMATITE veins and layers (Q Rating: Very Poor) PJS: horizontal to low angle, rough and irregular surfaces, very close to moderately wide spacing, open aperture, silt and sand on surfaces 127'1"- 127' 4": completely weathered rock zone 127' 4": verical healed hoint			
		C-8 130-135'	60/58	[80] (22.6)			Hard, slightly weathered, slightly fractured to sound, white and gray, speckled black, coarse to very coarse-grained , PEGMATITE (Q Rating: Good) PJS: horizontal to low angle, rough and planar surfaces, tight to wide aperture, trace silt on some surface 130' 6"-130' 8": highly factured zone 133' 5": high angle joint, rough and planar surface, open			

General Remarks:

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Test Boring B-201

Client: NYC EDC/DEP | **Project Location: New York City, New York**

Project Name: Harbor Siphon Replacement | **Project Number: 36856-46971**

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		C-8 30-135'	60/58	[80] (22.6)			aperture, trace silt on surface			
-126.4 135.0		C-9 35-140'	60/60	[82] (27.1)			Hard, slightly weathered, slightly fractured to sound, white and gray, black speckled, coarse to very coarse-grained PEGMATITE (Q Rating: Good) PJS: moderate angle, rough and planar surfaces, very close to moderately wide spacing, open to wide aperture SJS: horizontal to low angle, rough and planar to irregular surface, very close to moderately close spacing, open to wide aperture		PM=8640	
-131.4 140.0		C-10 40-145'	60/60	[53] (19.5)		Slightly Weathered Rock	Hard, slightly weathered, slightly fractured to sound, white and gray and speckled black, coarse to very coarse-grained PEGMATITE (Q Rating: Good) PJS: horizontal to low angle, rough and planar to irregular surfaces, very close to moderately wide spacing, open to wide aperture, silt on surface SJS: moderate angle, rough and planar surfaces, very close to wide spacing, wide aperture, silt on surface 140' 3"-140' 9": highly fractured zone		PM=7200	
-136.4 145.0		C-11 45-150'	60/60	[52] (4.2)			Hard, slightly weathered, slightly fractured to sound, white and gray, speckled black, coarse to very coarse-grained PEGMATITE (Q Rating: Fair) PJS: horizontal to low angle, rough and planar to irregular surfaces, very close to moderately wide spacing, open to wide aperture, silt on surface SJS: moderate angle, rough and planar surfaces, very close to wide spacing, wide aperture, silt on surface			
-141.4 150.0		C-12 50-155'	60/60	[25] (1.6)			Moderately hard to hard, slightly weathered, moderately fractured, white and gray, black speckled, coarse to very coarse-grained PEGMATITE (Q Rating: Poor) PJS: horizontal to low angle, rough and planar to irregular surfaces, very close to close spacing, open to wide aperture, trace silt on some surfaces 152' 7"-152' 11": vertical joint, rough and planar surface, open aperture		PM=10080	
-146.4 155.0										

General Remarks:

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Test Boring B-201

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		C-13 155-160'	60/60	[55] (2.6)		Slightly Weathered Rock	Moderately hard to hard, slightly weathered, slightly fractured, white, black and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Poor) PJS: horizontal to low angle, rough and planar surfaces, very close to close spacing, tight to wide aperture, trace silt on some surfaces, few healed joints 157' 9" -158' 4": highly angled healed joint 159' 4"-160': highly fractured zone		PM=9360	
-151.4 / 160.0		C-14 160-165'	60/60	[48] (7.9)		Slightly Weathered Rock	Moderately hard to hard, slightly weathered, slightly fractured, white, black, pink and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Fair) PJS: horizontal to low angle, rough and planar surfaces, very close to close spacing, tight to wide aperture, trace silt on some surfaces, few healed joints SJS: moderate to high angle joint, rough and planar surface, close to moderately wide spacing, close aperture, trace silt on surfaces		PM=10080	
-156.4 / 165.0		C-15 165-170'	60/60	[10] (0.7)		Weathered Rock	Moderately hard to hard, slightly to moderately weathered, moderately fractured, white, pink, gray and speckled black, coarse to very coarse-grained PEGMATITE (Q Rating: Very Poor) PJS: horizontal to low angle, rough and planar surfaces, very close to close spacing, tight to wide aperture, trace silt on some surfaces, few healed joints 167' 5"-168' 7": vertical joint, rough and planar surface, open aperture			
-161.4 / 170.0		C-16 170-175'	60/60	[100] (54.3)		Slightly Weathered Rock	Hard, fresh, sound, pink and speckled black, coarse to very coarse-grained PEGMATITE (Q Rating: Very Good) PJS: horizontal to low angle, rough and planar surfaces, close to moderately wide spacing, open aperture, thin coating of silt on some surface		PM=7200	
-166.4 / 175.0		C-17 175-180'	60/60	[33] (0.2)		Slightly Weathered Rock	Hard, slightly weathered, moderately to slightly factured, pink and black speckled, coarse to very coarse-grained PEGMATITE (Q Rating: Very Poor) PJS: horizontal to low angle, rough and irregular surfaces, very close to close joint spacing, open to wide aperture, trace silt on surfaces, few healed joints 175' 10": moderate angle joint, rough and planar surface, tight			

General Remarks:

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Test Boring B-201

Client: NYC EDC/DEP | **Project Location: New York City, New York**

Project Name: Harbor Siphon Replacement | **Project Number: 36856-46971**

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
-171.4 / 180.0		C-17 175-180'	60/60	[33] (0.2)			aperture 177' 8"-177' 10": vertical joint, rough and planar surface, open aperture, silt on surface 177' 9" -178' 3": highly fractured zone 178' 8"-179' 3": highly fractured zone			
-176.4 / 185.0		C-18 180-185'	60/48	[12] (<0.1)		Weathered Rock	Very soft to hard, moderately weathered, moderately to extremely fractured, white, black and gray, coarse to very coarse-grained PEGMATITE intermixed with black and dark gray SCHISTOSE GNEISS veins and layers (Q Rating: Extremely Poor) PJS: low to moderate angle, very close to close spacing, planar and irregular surfaces, open to very wide aperture, silt on surfaces 180'- 181' 8": completely weathered zone 182' 5": high angled joint, rough and planar 183' -183' 4": highly fractured zone			
-181.4 / 190.0							BOE at 185 feet			
-186.4 / 195.0										
-191.4 / 200.0										

General Remarks:

CDM | Hatch Mott MacDonald — A JOINT VENTURE

Test Boring B-203

Client: NYC EDC/DEP

Project Name: Harbor Siphon Replacement

Project Location: New York City, New York

Project Number: 36856-46971

Drilling Contractor/ Driller: Aquifer Drilling and Testing, Inc/T. Hebert

Drilling Method/Diameter: Drive and Wash/4"

Hammer Type/Weight/Drop Height: Automatic/140 lb/30 in

Boring Location: N 656477 E 610488

Ground Surface or Mudline Elevation: 10.6 (NVGD 29)

Boring Depth: 115

Abandonment Method: Grouted to ground surface

Logged by: M. Vajirkar/L. Gionet

Date: Started 10/11/2006 Completed 10/19/2006

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description / Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
						Fill	-Vacuum excavated from 0 to 4 feet -Miscellaneous granular fill, 0 to 4 feet			
5.6 / 5.0		S-1 4-6'	24/0	4 2 2 3		Fill	-No recovery			
		S-2 6-8'	24/6	3 3 5 2		Fill	Wet, loose, black to gray, brown, fine to coarse SAND and GRAVEL, trace brick	SW		
		S-3 8-10'	24/6	3 1 1 2		Fill	Wet, very loose, black to gray, fine to medium SAND, trace fine to coarse gravel, trace silt	SP-SM		
0.6 / 10.0		S-4 10-12'	24/6	5 6 5 6		Fill	Wet, medium dense, black, fine to medium SAND, little fine to coarse gravel, trace silt, trace brick, organic odor	SP-SM		
		S-5 12-14'	24/6	1 1 1 WOH		Fill	Wet, very loose to loose, black, gray, brown, fine to coarse SAND, trace fine gravel, trace silt, organic odor	SP-SM		
-4.4 / 15.0		S-6 14-16'	24/3	7 3 5 8		Fill		SP-SM		
		S-7 16-18'	24/3	2 2 2 2		Fill	-trace brick, 16 to 18 feet	SP-SM		
		S-8 18-20'	24/6	4 3 3 6		Recent Marine Sediment	Wet, medium stiff, blackish gray, slightly organic CLAY and SILT, piece of leather, organic odor	ML		MC=50 OC=3.8 LL=46 PL=31 PI=15
-9.4 / 20.0										

General Remarks:

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Test Boring B-203

Client: NYC EDC/DEP | **Project Location: New York City, New York**

Project Name: Harbor Siphon Replacement | **Project Number: 36856-46971**

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		S-9 20-22'	24/8	1 3 3 4			Wet, loose, black to gray, fine to coarse SAND, trace fine gravel, trace silt, organic odor	SP-SM		
		S-10 22-24'	24/12	8 10 10 10			Wet, medium dense, reddish brown, SILT, some fine sand	ML		MC=24 -200=71
-14.4 / 25.0		S-11 24-25.5'	14/9	11 13 100/2"			Wet, very dense, reddish brown, fine to coarse SAND, little fine to coarse gravel, trace silt (From sample S-11 down, used safety hammer. Hard material to wash from 25 to 27.5 feet) -No sample, boulder encountered, 25 to 27.5 feet	SW-SM		
		S-13 28-30'	24/6	13 11 9 10		Silty Sand and Gravel	Wet, medium dense, reddish brown, fine to coarse SAND, some fine gravel, little silt	SM		
-19.4 / 30.0		S-14 30-32'	24/6	8 7 8 12				SM		MC=10 -200=16
		S-15 32-34'	24/1	10 7 7 12			Wet, medium dense, brown to yellow, fine to coarse GRAVEL, little fine to coarse sand, little silt (siltstone)	GP-GM		
-24.4 / 35.0		S-16 34-36'	24/3	8 13 10 11			-black stone at tip of spoon at 34 feet	GP-GM		
		S-17 36-38'	24/0	8 14 15 14			-No recovery			
		S-18 38-40'	24/1	14 21 18 13			Wet, dense, brown, yellow, gray, fine to coarse SAND, little fine to medium gravel, trace silt (possible wash)	SW-SM		
-29.4 / 40.0		S-19 40-42'	24/6	23 9 8 7			Wet, medium dense, reddish brown, gray, fine GRAVEL and fine to coarse SAND, little silt	GM		MC=17 -200=16
			24/9	17				GM		

General Remarks:

CDM | Hatch Mott MacDonald | A JOINT VENTURE

Test Boring B-203

Client: NYC EDC/DEP
Project Location: New York City, New York
Project Name: Harbor Siphon Replacement
Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		S-20 42-44'	24/9	12 9 6		Silty Sand and Gravel	Wet, medium dense, reddish brown, greenish, fine to coarse GRAVEL, some fine to coarse sand, trace silt			
-34.4 45.0		S-21 44-46'	24/0	9 11 9 9			-No recovery (one piece of gravel at mouth of spoon)			
		S-22 46-48'	24/9	16 6 6 7			Wet, medium dense, reddish brown, fine to coarse SAND, some fine to coarse gravel, trace silt	SW-SM		
		S-23 48-48.5'	3/1	100/3"			Wet, very dense, reddish brown, grayish black, medium to coarse GRAVEL, little fine to medium sand, trace silt	GM		
-39.4 50.0		C-1 49-52'	36/22	[56] ()			Hard, slightly weathered, black to gray, SANDSTONE. Primary Joing Set: Low angle, rough and planar and angular surfaces, close to moderate joint spacing, open to moderately wide aperature (boulder, 49 to 52 feet)			
-44.4 55.0		S-24 54-56'	24/9	17 35 33 43			Wet, very dense, reddish brown, blackish gray, fine GRAVEL and fine to coarse SAND, little silt	GP-GM		MC=11 -200=12
		S-25 56-58'	24/2	17 39 49 38				GP-GM		
		S-26 58-60'	24/14	52 44 81 64			-blackish gray to green, 58 to 60 feet (sandstone fragments)	GP-GM		
-49.4 60.0		S-27 60-61.5'	15/4	40 75 100/3"			Wet, very dense, reddish brown, green, fine to coarse SAND, little fine to coarse gravel, trace silt (sandstone fragments)	SM		
		S-28 62-64'	24/18	30 39 59 70			Wet, very dense, reddish brown, fine SAND, some silt, trace fine gravel	SM		
-54.4 65.0		S-29 64-66'	23/18	55 56				SM		

General Remarks:

CDM | Hatch Mott MacDonald | A JOINT VENTURE

Test Boring B-203

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev / Depth (ft)	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Strata	Material Description / Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
	S-29 64-66'	23/18	95 100/5"	Silty Sand and Gravel	Wet, very dense, reddish brown, fine SAND, some silt, trace fine gravel			
	S-30 66-67.5'	18/12	43 55 56	Silty Sand and Gravel		SM		MC=18 -200=27
	S-31 68-69.5'	17/12	45 57 60/5"	Silty Sand and Gravel	Wet, very dense, brown to reddish brown, fine SAND, trace silt	SM		
-59.4 / 70.0	S-32 70-72'	24/18	30 45 46 52	Silty Sand and Gravel	Wet, very dense, dark gray, SILT, trace fine sand, trace organics (seams)	ML		
	S-33 72-74'	24/24	17 30 32 35	Silty Sand and Gravel	Wet, very dense, dark reddish brown, slightly organic clayey SILT, trace fine to medium sand	ML		MC=25 OC=2.7 -200=91 LL=30 PL=26 PI=4
-64.4 / 75.0	S-34 74-75.5'	18/18	21 37 70	Silty Sand and Gravel	-trace mica, 74 to 75.5 feet	ML		
	S-35 76-77'	9/9	44 100/3"	Decomposed Rock	Wet, very dense, dark gray, fine to coarse SAND, some silt, little fine gravel, trace mica (completely weathered rock)	SM		
	S-36 78-79'	12/10	80 110	Decomposed Rock		SM		MC=12 -200=22.3
-69.4 / 80.0	C-2 80-85'	60/0	[0] ()	Decomposed Rock	-Rock cored, very soft with no recovery, 80 to 85 feet			
-74.4 / 85.0				Decomposed Rock	-Boring drilled/washed without sampling to surface of more competent rock at 90 feet			

General Remarks:

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Test Boring B-203

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
-79.4						Decomposed Rock				
90.0 -84.4		C-3 90-95'	60/48	[27] (<0.1)		Weathered Rock	Very soft, highly to completely weathered, white and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Extremely poor) PJS: horizontal to low angle, rough and planar surfaces, very close to close joint spacing, open to very wide aperature, decomposed rock on surfaces. 90'2": 2" zone completely weathered rock 92'10": 2" zone completely weathered rock 93'8": 2" zone completely weathered rock			
95.0 -89.4		C-4 95-100'	60/0	[0] (0)		Decomposed Rock	-(No recovery)			
100.0 -94.4		C-5 100-105'	60/60	[83] (1.1)		Weathered Rock	Moderately hard, moderately to slightly weathered, gray and white, coarse to very coarse-grained PEGMATITE (Q Rating: Poor) PJS: low angle, rough and planar surface, close to moderate joint spacing, close to wide aperature, completely weathered on some surface (thin coating). Top 2": completely weathered Bottom 4": completely weathered			
105.0 -99.4		C-6 105-110'	60/60	[95] (1.3)		Weathered Rock	Moderately hard, moderately to slightly weathered, gray and white, coarse to very coarse-grained PEGMATITE (Q Rating: Poor) PJS: low angle, rough and planar surface, close to moderately close spacing, close to wide aperture SJS: moderate angle, close to wide spacing, rough and planar, open aperature, sanded surfaces			
110.0										

General Remarks:

Test Boring B-203

Client: NYC EDC/DEP

Project Name: Harbor Siphon Replacement

Project Location: New York City, New York

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		C-7 110-115'	60/60	[20] (0.2)		Weathered Rock	Soft, moderately to slightly weathered, gray, coarse to very coarse-grained PEGMATITE (Q Rating: Very Poor) PJS: horizontal to low angle, rough and planar surface, very close to close spacing, open to wide aperture, sand and decomposed rock on seams			
-104.4 / 115.0							BOE at 115 feet			
-109.4 / 120.0										
-114.4 / 125.0										
-119.4 / 130.0										

General Remarks:

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Test Boring B-204

Client: NYC EDC/DEP

Project Name: Harbor Siphon Replacement

Project Location: New York City, New York

Project Number: 36856-46971

Drilling Contractor/ Driller: Aquifer Drilling and Testing, Inc/J. Philbin

Drilling Method/Diameter: Drive and Wash/4"

Hammer Type/Weight/Drop Height: Automatic/140 lb/30 in

Boring Location: N 656497 E 610471

Ground Surface or Mudline Elevation: 10.2 (NVGD 29)

Boring Depth: 185

Abandonment Method: Backfilled with cuttings

Logged by: M. Cronin

Date: Started 9/14/2006 Completed 12/21/2006

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
							-Vacuum excavated from 0 to 5 feet -Boring drilled from 0 to 135 feet by J. Philbin from 9/14/2006 to 9/15/2006. Boring was extended to 185 feet by E. Felliciano from 12/20/2006 to 12/21/2006.			
5.2 / 5.0		S-1 5-7'	24/6	7 10 9 6		Fill	Dry, medium dense, dark brown, fine to coarse SAND, little fine to coarse gravel, trace silt	SP-SM		
		S-2 7-9'	24/0	16 10 6 2			-No recovery			
0.2 / 10.0		S-3 9-11'	24/1	3 4 4 5			Wet, loose, dark gray, fine to medium SAND, trace silt	SP-SM		
		S-4 11-13'	24/6	2 5 2 1			Wet, loose, dark gray, fine to coarse GRAVEL and fine to coarse SAND, trace silt	GP		MC=16 -200=4
		S-5 13-15'	24/3	9 8 5 5				GP		
-4.8 / 15.0		S-6 15-17'	24/5	2 1 2 6			Wet, very loose, dark gray, fine to medium SAND, trace silt	SP-SM		
		S-7 17-19'	24/6	4 3 2 3			Wet, loose, dark gray, fine to coarse SAND, some silt, little fine gravel	SM		MC=14 -200=23
		S-8 19-21'	24/7	2 2			Wet, medium dense, reddish brown, fine to medium SAND, trace silt, trace shells	SP-SM		
-9.8 / 20.0										

General Remarks:

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Test Boring B-204

Client: NYC EDC/DEP | **Project Location: New York City, New York**

Project Name: Harbor Siphon Replacement | **Project Number: 36856-46971**

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
	X	S-8 19-21'	24/7	9 10						
	X	S-9 21-23'	24/6	6 6 4 8			Wet, medium dense, reddish brown, SILT, some fine to medium sand, trace fine gravel	ML		MC=23 -200=61
	X	S-10 23-25'	24/14	3 5 9 11			Wet, medium dense, reddish brown, fine to medium SAND, little silt	SM		
-14.8 / 25.0	X	S-11 25-27'	24/16	7 7 8 11				SM		
	X	S-12 27-29'	24/12	5 9 8 9			-fine to coarse sand, some fine gravel, 27 to 29 feet	SM		MC=13 -200=17
-19.8 / 30.0	X	S-13 29-31'	24/6	8 12 21 15			Wet, dense, dark brown, fine to coarse SAND, trace fine gravel, trace silt	SP-SM		
	X	S-14 31-33'	24/18	22 8 15 16		Silty Sand and Gravel		SP-SM		
	X	S-15 33-35'	24/14	12 25 21 22				SP-SM		MC=16 -200=4
-24.8 / 35.0	X	S-16 35-37'	24/0	7 8 5 7			-No recovery			
	X	S-17 37-39'	24/12	4 5 5 6			-some fine gravel, 37 to 39 feet	SP-SM		
-29.8 / 40.0	X	S-18 39-41'	24/6	5 7 6 6			Wet, medium dense, dark brown, fine GRAVEL and fine to coarse SAND, trace silt	GW		MC=10 -200=4
	X	S-19 41-43'	24/7	10 14 16				GW		

General Remarks:

CDM | Hatch Mott MacDonald — A JOINT VENTURE

Test Boring B-204

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
			24/7	16						
		S-20 43-45'	24/11	6 5 5 4			Wet, medium dense, dark brown, fine to coarse SAND, some silt, little fine gravel	SM		MC=16 -200=30
-34.8 45.0		S-21 45-47'	24/2	6 12 13 10				SM		
		S-22 47-49'	24/8	9 3 11 15			-trace silt, 47 to 51 feet -little fine to coarse gravel, 47 to 49 feet	SW-SM		
-39.8 50.0		S-23 49-51'	24/8	14 15 16			-some fine to coarse gravel, 49 to 51 feet	SW-SM		
		S-24 51-53'	24/4	7 13 8 9			-medium dense, some fine gravel, little silt, 51 to 53 feet	SM		MC=13 -200=16
		S-25 53-55'	24/4	43 35 42 65		Silty Sand and Gravel	-very dense, some fine to coarse gravel, trace silt, 53 to 55 feet	SP-SM		
-44.8 55.0		S-26 55-57'	24/12	23 40 44 57			-very dense, little fine to coarse gravel, trace silt, 55 to 57 feet	SP-SM		
		S-27 57-59'	24/16	26 35 47 50			Wet, very dense, dark brown, fine to medium SAND, little silt, trace fine gravel	SM		
-49.8 60.0		S-28 59-61'	24/16	19 34 42 44				SM		MC=19 -200=15
		S-28a 61-63'	21/9	14 45 50 50/3"				SM		
-54.8 65.0		S-29 63-65'	24/20	16 37 52 45				SM		

General Remarks:

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Test Boring B-204

Client: NYC EDC/DEP

Project Name: Harbor Siphon Replacement

Project Location: New York City, New York

Project Number: 36856-46971

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		S-30 65-67'	24/16	16 32 47 57		Silty Sand and Gravel	Wet, dense to very dense, dark brown, fine to medium SAND, some silt	SM		MC=17 -200=22 LL=NP PL=NP PI=NP
		S-31 67-69'	24/8	25 32 33 48		Silty Sand and Gravel	Wet, dense to very dense, gray, SILT, trace fine sand	ML		
-59.8 / 70.0		S-32 69-71'	24/6	9 11 30 32		Silty Sand and Gravel		ML		MC=10 -200=91
		S-33 71-73'	24/14	13 20 32 35		Silty Sand and Gravel		ML		MC=18 -200=93
		S-34 73-74'	9/0	36 50/3"		Silty Sand and Gravel	-No recovery			
-64.8 / 75.0		S-35 75-77'	22/16	13 25 29 50/4"		Silty Sand and Gravel		ML		
-69.8 / 80.0		C-1 80-85'	60/60	[52] (3.7)		Weathered Rock	Moderately hard, moderately weathered, slightly to moderately fractured, gray and white, coarse to very coarse-grained PEGMATITE (Q Rating: Poor) PJS: horizontal to low angle, rough and iregular surfaces, close to very close spacing, tight to wide aperture, silt and sand on surfaces, oxidation staining on some surfaces 84'-85': completely weathered zone			
-74.8 / 85.0		C-2 85-90'	60/60	[38] (1.4)		Weathered Rock	Moderately hard, moderately weathered, slightly to moderately fractured, gray and white, coarse to very coarse-grained PEGMATITE (Q rating: Poor to Very Poor) PJS: horizontal to low angle, rough and iregular surfaces, close to very close spacing, tight to wide aperture, silt and sand on Surfaces, oxidation staining on some surfaces 85' 6"-85' 10": highly fractured zone			

General Remarks:

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Test Boring B-204

Client: NYC EDC/DEP

Project Name: Harbor Siphon Replacement

Project Location: New York City, New York

Project Number: 36856-46971

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		C-2 85-90'	60/60	[38] (1.4)		Weathered Rock	86'-86'6": vertical joint Moderately hard, moderately weathered, slightly to moderately fractured, gray and white, coarse to very coarse-grained PEGMATITE (Q Rating: Poor to Very Poor) PJS: horizontal to low angle, rough and iregular surfaces, close to very close spacing, tight to wide aperture, silt and sand on surfaces, oxidation staining on some surfaces			
-79.8 / 90.0		C-3 90-95'	60/60	[0] (<0.1)			Moderately hard, moderately weathered, moderately to extremely fractured, gray and white, coarse to very coarse-grained PEGMATITE (Q Rating: Extremely Poor) PJS: horizontal to low angle, rough and iregular surfaces, close to very close spacing, tight to wide aperture, silt and sand on surfaces, oxidation staining on some surfaces			
-84.8 / 95.0		C-4 95-100'	60/36	[0] (<0.1)			Moderately hard, highly weathered, moderately to extremely fractured, gray and white, coarse to very coarse-grained PEGMATITE (Q Rating: Extremely Poor) PJS: horizontal to low angle, rough and iregular surfaces, close to very close spacing, tight to wide aperture, silt and sand on surfaces, oxidation staining on some surfaces			
-89.8 / 100.0		C-5 100-105'	60/32	[48] (<0.1)			Hard, moderately to slightly weathered, slightly to moderately fractured, white and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Extremely Poor) PJS: horizontal to low angle, rough and planar surfaces, close to moderate joint spacing, partially open aperture, sand and silt on some surfaces			
-94.8 / 105.0		C-6 105-110'	60/29	[45] (<0.1)			Hard, moderately to slightly weathered, slightly to moderately fractured, white and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Extremely Poor) PJS: low angle, planar surfaces, very close to moderately close joint spacing, partly open to open aperture, trace sand on some surfaces 7" down the run: 1" high angled healed joint 24": two low angled healed joints			
-99.8 / 110.0										

General Remarks:

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Test Boring B-204

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		C-7 110-115'	60/35	[13] (<0.1)		Weathered Rock	Very soft, highly weathered, moderately to extremely fractured, white and gray, coarse to very coarse-grained PEGMATITE intermixed with black AMPHIBOLE GNEISS veins (Q Rating: Extemely to Exceptionally Poor) PJS: horizontal to low angle, rough and irregular surfaces, close joint spacing, open to wide aperture, sand and silt on surfaces Top 9": completely weathered zone 25-32" down the run: completely weathered zone			
-104.8 115.0		C-8 115-120'	60/46	[50] (<0.1)		Weathered Rock	Hard, moderately to slightly weathered, slightly fractured to sound, black, coarse to very coarse-graind AMPHIBOLE GNEISS (Q Rating: Very Poor) PJS: horizontal to low angle, rough and planar to irregular surfaces, very close to moderately wide spacing, open to very wide aperture 116'2": calcite infilled horizontal joint			
-109.8 120.0		C-9 120-125'	60/14	[0] (0)		Decomposed Rock	Very soft, completely weathered, extremely fractured, white and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Exceptionally Poor)			
-114.8 125.0		C-10 125-130'	60/22	[0] (0)		Decomposed Rock	Very soft, completely weathered, extremely fractured, white and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Exceptionally Poor)			
-119.8 130.0		C-11 & C-12 130-135'	60/48	[0] (0.02)		Decomposed Rock	Very soft, completely weathered, white and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Extremely Poor)(sample C-11 from 9/15/2006) Very soft, completely to moderately weathered, moderately to extremely fractured, coarse to very coarse-grained PEGMATITE (Q Rating: Extremely Poor)			

General Remarks:

Test Boring B-204

Client: NYC EDC/DEP

Project Name: Harbor Siphon Replacement

Project Location: New York City, New York

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
-124.8 135.0		C-11 & C-12 130-135'	60/48	[0] (0.02)		Weathered Rock	PJS: low angle, closely spaced, rough and planar surfaces, silty sand coating, open aperture (1 - 2 mm) (sample C-12 from 12/20/2006) (Boring sampled/cored 130 to 185 feet, from 12/20/2006 to 12/21/2006) Very soft, moderately weathered, moderately to extremely fractured, white and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Extremely Poor)			
-129.8 140.0		C-13 135-140'	60/44	[0] (<0.1)		Weathered Rock				
-134.8 145.0		C-14 140-145'	60/0	[0] (0)		Decomposed Rock	-No recovery			
-139.8 150.0		C-15 145-150'	60/42	[0] (<0.1)		Weathered Rock	Very soft to soft, moderately weathered, moderately to extremely fractured, white and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Extremely Poor) PJS: horizontal, rough and planar surfaces, very close to close spacing, tight to wide aperture 145' -146': completely weathered zone			
-144.8 155.0		C-16 150-155'	60/52	[0] (<0.1)		Weathered Rock	Very soft to soft, moderately weathered, moderately to extremely fractured, white and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Extremely Poor) PJS: horizontal, rough and irregular to planar surfaces, very close to close spacing, open to wide aperture Top 8": completely weathered zone 153' 6" - 154' 3": completely weathered zone			

General Remarks:

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Test Boring B-204

Client: NYC EDC/DEP

Project Name: Harbor Siphon Replacement

Project Location: New York City, New York

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
-149.8		C-17 155-160'	60/50	[0] (<0.1)		Weathered Rock	Very soft to soft, moderately weathered, moderately to extremely fractured, white and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Extremely Poor) PJS: horizontal, rough and irregular to planar surfaces, very close to close spacing, open to wide aperture Top 10": completely weathered zone			
160.0		C-18 160-165'	60/0	[0] (0)		Decomposed Rock	-No recovery, sand, mica flakes (attempted spoon sample at 165 feet, spoon refusal)			
-154.8 165.0		C-19 165-170'	60/0	[0] (0)		Decomposed Rock	-No recovery			
-159.8 170.0		C-20 170-175'	60/57	[63] (6.2)		Weathered Rock	Moderately hard, moderately to slightly weathered, slightly fractured to sound, white, gray and black, coarse to very coarse-grained PEGMATITE (Q Rating: Fair) PJS: horizontal to low angle, rough and planar to irregular surfaces, very close to close spacing, open to very wide aperture, silt and sand on surfaces 174' 6"-175': completely weathered zone			
-164.8 175.0		C-21 175-180'	60/60	[63] (12.1)		Weathered Rock	Soft to hard, moderately weathered, slightly fractured to sound, white, black, gray and pink, coarse to very coarse-grained PEGMATITE (Q Rating: Good) PJS: low angle to horizontal, very close to moderately wide spacing, rough and planar to irregular surfaces, open to very wide aperture, silt on surfaces 175' -176': completely weathered zone			

General Remarks:

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Test Boring B-204

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		C-21 175-180'	60/60	[63] (12.1)		Weathered Rock	178' 6": high angle joint, rough and planar surface, silt on surfaces 179' 8" -180': completely weathered zone			
-169.8 180.0		C-22 180-185'	60/48	[25] (0.2)			Soft to hard, moderately weathered, slightly to moderately fractured, white, gray and black, coarse to very coarse-grained PEGMATITE (Q Rating: Very Poor to Poor) PJS: horizontal to low angle, very close to close spacing, rough and planar to irregular surfaces, open to very wide aperture, silt on surfaces, few healed joints 180' -181' 6": completely weathered zone 182' -183': completely weathered zone 183' 7"- 184': extremely fractured zone			
-174.8 185.0							BOE at 185 feet			
-179.8 190.0										
-184.8 195.0										
-189.8 200.0										

General Remarks:

CDM | Hatch Mott MacDonald — A JOINT VENTURE

Test Boring B-205

Client: NYC EDC/DEP | **Project Location: New York City, New York**

Project Name: Harbor Siphon Replacement | **Project Number: 36856-46971**

Drilling Contractor/ Driller: Aquifer Drilling and Testing, Inc/E. Felliciano

Drilling Method/Diameter: Drive and Wash/4"

Hammer Type/Weight/Drop Height: Safety/140 lb/30 in

Boring Location: N 656518 E 610444

Ground Surface or Mudline Elevation: 10.6 (NVGD 29)

Boring Depth: 115

Abandonment Method: Backfilled with cuttings

Logged by: R. Howard/M. Cronin

Date: Started 9/14/2006 Completed 9/16/2006

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
						Fill	-Vacuum excavated 0 to 5 feet -Miscellaneous granular fill, 0 to 5 feet			
5.6 / 5.0		S-1 5-7'	24/5	18 11 11 7			Moist, medium dense, brown, fine to coarse SAND, little clay, little gravel, trace silt	SW-SM		
		S-2 7-9'	24/6	6 7 17 14			Moist, medium dense, brown, fine to coarse SAND, some gravel, little silt	SM		
0.6 / 10.0		S-3 9-11'	24/0	13 4 8 6			-No recovery			
		S-4 11-13'	24/4	8 8 10 2			Moist, medium dense, gray, fine to medium SAND, little gravel, trace silt, trace brick	SW-SM		
		S-5 13-15'	24/2	3 9 8 8			Wet, medium dense, gray and brown, fine to coarse GRAVEL with concrete, brick and wood	GW-GM		
-4.4 / 15.0		S-6 15-17'	24/6	10 10 49 12			Wet, very dense, gray and black, fine to coarse SAND and fine GRAVEL, little silt, trace mica	SM		MC=14 -200=19
		S-7 17-19'	24/2	7 7 7 8			-some silt, trace brick, wood and mica, 17 to 19 feet	SM		
-9.4 / 20.0		S-8 19-21'	24/7	10 14			Wet, medium dense, gray and black, slightly organic SILT, some fine to coarse sand	ML		OC=0.9 LL=NP

General Remarks:

CDM | Hatch Mott MacDonald — A JOINT VENTURE

Test Boring
B-205

Client: NYC EDC/DEP

Project Name: Harbor Siphon Replacement

Project Location: New York City, New York

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		S-8 19-21'	24/7	15 14			Wet, medium dense, reddish brown, slightly organic SILT, some fine sand			PL=NP PI=NP
		S-9 21-23'	24/13	10 14 15 14				ML		MC=22 -200=77
-14.4 25.0		S-10 23-25'	24/18	15 16 15 15			Wet, medium dense to dense, reddish brown, fine SAND and SILT	SM		
		S-11 25-27'	24/16	5 7 6 5				SM		
		S-12 27-29'	24/18	9 6 14 11				SM		MC=27 -200=38
-19.4 30.0		S-13 29-31'	24/16	5 17 28 17		Silty Sand and Gravel	Wet, dense to very dense, reddish brown, fine to coarse SAND, little silt, little fine to coarse gravel	SM		
		S-14 31-33'	24/6	26 18 27 30			-trace fine gravel, trace silt, 31 to 33 feet	SP-SM		
-24.4 35.0		S-15 33-35'	24/12	39 49 33 25			-trace fine to coarse gravel, trace silt, 33 to 37 feet	SP-SM		
		S-16 35-37'	24/6	28 29 31 42				SP-SM		
		S-17 37-39'	24/6	25 21 22 17			Wet, dense to very dense, reddish brown, fine GRAVEL and fine to coarse SAND, trace silt (siltstone fragments)	GP-GM		MC=13 -200=10
-29.4 40.0		S-18 39-41'	24/12	27 21 31 30			Wet, dense to very dense, reddish brown, fine to coarse SAND, little fine to coarse gravel, trace silt	SP-SM		
		S-19 41-43'	24/10	49 44 62			Wet, dense to very dense, reddish brown, grayish green, fine to coarse GRAVEL, little fine to coarse SAND, trace silt, serpentine fragments	GP-GM		

General Remarks:

CDM | Hatch Mott MacDonald — A JOINT VENTURE

Test Boring B-205

Client: NYC EDC/DEP | **Project Location: New York City, New York**

Project Name: Harbor Siphon Replacement | **Project Number: 36856-46971**

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
			24/10	50						
		S-20 43-43.5'	6/2	100/6"			-siltstone fragments, 43 to 45 feet	GP-GM		
-34.4 / 45.0		S-21 45-47'	24/10	44 34 39 50			Wet, dense to very dense, fine to coarse SAND, some fine gravel, little silt	SM		MC=10 -200=17
		S-22 47-47.5'	6/2	100/6"			-No recovery			
		S-23 49-49.5'	4/1	50/4"			Wet, dense to very dense, dark brown, fine to coarse SAND and coarse GRAVEL, trace silt	SW-SM		
-39.4 / 50.0										
		S-24 51-51.5'	2/0	50/2"			-No recovery			
		S-25 53-55'	24/20	35 35 60 59		Silty Sand and Gravel	Wet, dense to very dense, dark brown, fine to coarse SAND, some fine gravel, trace silt	SW-SM		MC=10 -200=9
-44.4 / 55.0		S-26 55-57'	24/18	49 60 87 84			Wet, very dense, dark brown, fine to medium SAND, trace fine gravel, trace silt	SP-SM		
		S-27 57-59'	24/12	64 62 67 71				SP-SM		
-49.4 / 60.0		S-28 59-61'	24/16	47 53 57 54			Wet, dense to very dense, dark brown, SILT and fine to medium SAND, trace fine gravel	ML		
		S-29 61-63'	24/nr	46 57 54 57				ML		
		S-30 63-65'	24/12	37 44 61 100				ML		MC=17 -200=59
-54.4 / 65.0										

General Remarks:

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Test Boring B-205

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		S-31 65-67'	24/10	30 54 50 51		Silty Sand and Gravel	Wet, dense to very dense, dark brown, SILT, some fine to medium sand, trace fine gravel	ML		
		S-32 67-69'	24/12	34 41 53 54				ML		
-59.4 / 70.0		S-33 69-71'	24/8	40 30 50 55			-wood fragments, 69 to 71 feet.	ML		
		S-34 71-73'	24/6	25 34 20 18				ML		MC=24 -200=74
		S-35 73-74'	7/6	37 67/1"				ML		
-64.4 / 75.0										
		S-36 75-77'	24/9	34 60 61 64				ML		
		S-37 77-78'	8/6	60 66/2"						
		S-38 78-79'	7/5	50 70/1"		Decomposed Rock	Wet, very dense, gray, fine to coarse SAND, some silt, trace fine gravel, trace mica (completely weathered, mica Schist to Gneiss)	SM		MC=14 -200=23
-69.4 / 80.0		S-39 80-80.5'	6/2	100/6"				SM		
		S-40 83-83.5'	4/2	100/4"				SM		
-74.4 / 85.0		C-1 85-90'	60/60	[0] (0.01)			Very soft to soft, completely weathered, moderately to extremely fractured, white and gray, coarse to very coarse-grained, PEGMATITE (Q Rating: Expectionally to Extremely Poor) PJS: horizontal to low angle, rough and irregular joints, very close to close spacing, open aperture	SM		

General Remarks:

Test Boring B-205

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
-79.4 90.0		C-1 85-90'	60/60	[0] (0.01)		Decomposed Rock	Very soft to soft, completely weathered, moderately to extremely fractured, white and gray, coarse to very coarse-grained , PEGMATITE (Q Rating: Exceptionally Poor to Extremely Poor)			
-84.4 95.0		C-2 90-95'	60/6	[0] (0)		Decomposed Rock	Very soft to soft, completely weathered, extremely fractured, white and gray, coarse to very coarse-grained, PEGMATITE (Q Rating: Exceptionally Poor)			
-89.4 100.0		C-3 95-100'	60/24	[0] (0)		Decomposed Rock	Very soft to soft, completely weathered, extremely fractured, white and gray, coarse to very coarse-grained, PEGMATITE (Q Rating: Exceptionally Poor)			
-94.4 105.0		C-4 100-105'	60/60	[0] (0.01)		Weathered Rock	Moderately hard, moderately to highly weathered, moderately to slightly fractured, white and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Exceptionally Poor to Extremely Poor) PJS: horizontal to low angle, rough and irregular surfaces, very close to close spacing, open to wide aperture 102'2": two vertical joints, rough and planar surfaces			
-99.4 110.0		C-5 105-110'	60/0	[0] (0)		Decomposed Rock	(No Recovery)			

General Remarks:

Test Boring B-205

Client: NYC EDC/DEP
Project Location: New York City, New York
Project Name: Harbor Siphon Replacement
Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
-104.4 / 115.0		C-6 110-115'	60/36	[0] (0.01)		Weathered Rock	Moderately hard, moderately to highly weathered, moderately to extremely fractured, white and gray, coarse to very coarse-grained PEGMATITE (Q Rating: Exceptionally Poor to Extremely Poor) PJS: horizontal to low angle, rough and planar to irregular surfaces, very close to close spacing, open to moderately wide aperture Top 3": extremely fractured zone 30" down run: 6" extremely fractured zone			
							BOE at 115 feet			
-109.4 / 120.0										
-114.4 / 125.0										
-119.4 / 130.0										

General Remarks:

Test Boring B-206

Client: NYC EDC/DEP

Project Name: Harbor Siphon Replacement

Project Location: New York City, New York

Project Number: 36856-46971

Drilling Contractor/ Driller: Aquifer Drilling and Testing, Inc/E. Felliciano

Drilling Method/Diameter: Drive and Wash/4"

Hammer Type/Weight/Drop Height: Safety/140 lb/30 in

Boring Location: N 656496 E 610283

Ground Surface or Mudline Elevation: 11.5 (NVGD 29)

Boring Depth: 61

Abandonment Method: Backfilled with cuttings

Logged by: M. Vajirkar/L. Gionet

Date: Started 10/11/2006 Completed 10/16/2006

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
							-Vacuum/hand excavated 0 to 5 feet -Miscellaneous granular fill, 0 to 5 feet			
6.5 5.0	X	S-1 5-7'	24/4	4 3 3 3			Wet, loose, black, fine to coarse SAND, some fine gravel, little silt	SM		MC=19 -200=19
1.5 10.0	X	S-2 10-12'	24/1	15 12 9 19		Fill	Wet, medium dense, blackish gray, coarse GRAVEL, little fine to coarse sand, trace silt	GP-GM		
-3.5 15.0	X	S-3 15-17'	24/4	2 3 6 8			Wet, loose, blackish gray, fine to coarse SAND and fine to coarse GRAVEL, little silt (organic odor) -(Obstruction, possibly a metal pipe, encountered at 16 feet. Boring offset 10 feet east and redrilled to 16 feet)	SM		
	X	S-4 17-19'	21/10	3 7 10 100/3"				SM		MC=15 -200=17
-8.5 20.0	X	S-5 19-21'	24/6	16 12				SM		

General Remarks:

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Test Boring
B-206

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		S-5 19-21'	24/6	12 11		Fill	Wet, loose, blackish gray, fine to coarse SAND and fine to coarse GRAVEL, little silt (organic odor)			
		S-6 21-23'	24/7	16 17 20 16		Silty Sand and Gravel	Wet, dense, reddish brown and greenish brown, fine to coarse GRAVEL, some fine to coarse sand, little silt	GM		
		S-7 23-25'	24/0	8 2 3 4			-No recovery			
-13.5 25.0										
		S-8 25-27'	24/6	7 8 10 10			Wet, medium dense, reddish brown and gray, fine to coarse SAND, little silt, trace fine gravel	SM		MC=23 -200=16
		S-9 27-29'	24/0	9 3 2 1			-No recovery			
		S-10 29-31'	24/8	3 7 10 8			-trace gravel, 29 to 31 feet	SM		
-18.5 30.0										
		S-11 31-33'	24/0	5 8 8 5			-No recovery			
		S-12 33-35'	24/10	8 9 8 7			-some silt/clay, 33 to 35 feet	SM		MC=34 -200=21
-23.5 35.0										
		S-13 35-37'	24/10	2 1 1 4			-some angular gravel, little silt/clay with clay pockets, 35 to 37 feet	SM		
		S-14 37-39'	24/7	13 13 23 31			-dense, 37 to 39 feet	SM		
		S-15 39-39.5'	6/3	100/6"			Wet, very dense, reddish brown and grayish brown, fine GRAVEL and fine to coarse SAND, little silt	GM		
-28.5 40.0										
		S-16 41-43'	24/7	24 33 40			-silt pocket, 41 to 43 feet	GM		MC=10 -200=13

General Remarks:

Test Boring B-206

CDM / Hatch Mott MacDonald — A JOINT VENTURE

Client: NYC EDC/DEP
Project Location: New York City, New York
Project Name: Harbor Siphon Replacement
Project Number: 36856-46971

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
	X		24/7	39		Silty Sand and Gravel				
-33.5 / 45.0	X	S-17 45-46.5'	17/4	16 53 100/5"			Wet, very dense, brown, fine to coarse SAND, some gravel, trace silt	SW-SM		
							-Boulder, 49 to 50 feet			
-38.5 / 50.0	X	S-18 50-51'	11/11	46 100/5"			Wet, very dense, brown, fine to coarse SAND, some gravel, little silt	SM		
						Decomposed Rock	Wet, very dense, white and green, fine to coarse SAND, some silt, trace fine gravel (completely weathered mica Schist to Gneiss)			
-43.5 / 55.0	X	S-19 55-57'	24/nr	14 26 27 40				SM		MC=14 -200=31
-48.5 / 60.0	X	S-20 60-61'	10/9	47 100/4"				SM		
							BOE at 61 feet			
-53.5 / 65.0										

General Remarks:

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Test Boring B-211

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Drilling Contractor/ Driller: Aquifer Drilling and Testing, Inc/E. Felliciano

Drilling Method/Diameter: Drive and Wash/4"

Hammer Type/Weight/Drop Height: Safety/140 lb/30 in

Boring Location: N 656517 E 610348

Ground Surface or Mudline Elevation: 11.3 (NVGD 29)

Boring Depth: 57

Abandonment Method: Backfilled with cuttings

Logged by: M. Vajirkar

Date: Started 10/11/2006 Completed 10/12/2006

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
						Fill	-Vacuum excavated 0 to 5 feet -Miscellaneous granular fill, 0 to 5 feet			
6.3 / 5.0		S-1 5-7'	24/4	3 4 4 4			Wet, loose, grayish black, reddish brown, fine to coarse SAND, little fine to coarse gravel, little silt	SM		
		S-2 7-9'	24/9	8 8 7 12			Wet, medium dense, reddish brown, SILT, some fine to medium sand, trace fine gravel, trace mica	ML		MC=24 -200=63
1.3 / 10.0		S-3 9-11'	24/2	2 2 4 2			Wet, loose, grayish black, reddish brown, fine to coarse SAND, some silt, some fine gravel	SM		MC=18 -200=29
		S-4 11-13'	24/3	2 3 4 4			-trace brick, 11 to 13 feet	SM		
		S-5 13-15'	24/4	9 7 7 6			Wet, medium dense, blackish gray, red, fine to coarse GRAVEL and SAND, trace silt, metal pieces, brick pieces (organic odor)	SM		
-3.7 / 15.0		S-6 15-17'	24/9	4 5 7 9			Wet, medium dense, blackish gray, fine to medium SAND, trace fine to medium gravel, trace silt	SM		
		S-7 17-19'	24/4	4 3 2 4			Wet, loose, blackish gray, red, fine to coarse SAND, little fine gravel, trace brick (organic odor)	SM		
-8.7 / 20.0		S-8 19-21'	24/22	12 8			Wet, medium dense, dark gray, fine to coarse SAND, some silt, trace fine gravel (organic odor)	SM		MC=21 OC=0.3 -200=30

General Remarks:

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Test Boring
B-211

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		S-8 19-21'	24/22	9 15		Fill	Wet, medium dense, dark gray, fine to coarse SAND, some silt, trace fine gravel (organic odor)			
-13.7 25.0		S-9 25-26'	12/8	8 100/6"		Silty Sand and Gravel	Wet, very dense, brownish black, fine to coarse SAND, little fine gravel, little silt -Hard material (probably boulder) at 26-27 feet	SM		MC=14 -200=14
-18.7 30.0		S-10 30-32'	24/12	11 9 11 12			Wet, medium dense to dense, reddish brown, greenish-yellow, fine to coarse SAND, some fine gravel, little silt	SM		
-23.7 35.0		S-11 35-37'	24/14	30 19 20 19				SM		MC=15 -200=16
-28.7 40.0		S-12 40-42'	24/9	28 15 24 25				SM		

General Remarks:

CDM | Hatch Mott MacDonald | A JOINT VENTURE

Test Boring B-211

Client: NYC EDC/DEP
Project Location: New York City, New York
Project Name: Harbor Siphon Replacement
Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
-33.7 / 45.0	X	S-13 45-47'	24/14	17 17 40 36		Silty Sand and Gravel	Wet, dense, reddish brown, fine to coarse SAND, some fine gravel, little silt	SM		
-38.7 / 50.0	X	S-14 50-51.5'	13/12	50 80 100/1"			Wet, very dense, reddish brown, green, fine to coarse SAND and GRAVEL, trace silt	SP-SM		
-43.7 / 55.0	X	S-15 55-57'	24/14	33 40 55 40			Wet, very dense, reddish brown, fine to coarse SAND, little fine to coarse gravel, trace silt Bottom 2": decomposed to weathered mica SCHIST	SP-SM		
							BOE at 57 feet			
-48.7 / 60.0										
-53.7 / 65.0										

General Remarks:

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Test Boring B-212

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Drilling Contractor/ Driller: Aquifer Drilling and Testing, Inc/E. Felliciano

Drilling Method/Diameter: Drive and Wash/4"

Hammer Type/Weight/Drop Height: Safety/140 lb/30 in

Boring Location: N 656546 E 610476

Ground Surface or Mudline Elevation: 10 (NVGD 29)

Boring Depth: 47

Abandonment Method: Backfilled with cuttings

Logged by: M. Vajirkar

Date: Started 10/12/2006 Completed 10/16/2006

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
						Fill	-Vacuum excavated 0 to 5 feet -Miscellaneous granular fill, 0 to 5 feet			
5.0 5.0		S-1 5-7'	24/11	16 12 8 9			Wet, medium dense, grayish black, red, fine to coarse SAND, some fine to coarse gravel, some silt, trace brick	SM		MC=11 -200=26
		S-2 7-9'	24/2	25 12 12 10				SM		
0.0 10.0		S-3 9-11'	24/4	9 7 7 4			-no brick	SM		
		S-4 11-13'	24/3	3 4 5 7			Wet, loose, brown, fine SAND, trace silt, trace mica	SM		
-5.0 15.0		S-5 13-15'	24/2	5 3 3 3			Wet, loose, gray to black, red, fine to coarse SAND, little fine to coarse gravel, trace silt, red brick pieces	SP-SM		
		S-6 15-17'	24/6	5 11 13 8			Wet, loose to medium dense, gray to black, fine to coarse slightly organic SAND and fine GRAVEL, little silt	SP-SM		MC=24 OC=9.5 -200=12
		S-7 17-19'	24/2	4 2 2 4				SP-SM		
-10.0 20.0		S-8 19-21'	24/12	7 4				SP-SM		MC=41 OC=3.3

General Remarks:

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Test Boring B-212

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
	X	S-8 19-21'	24/12	4 6		Fill	Wet, loose, gray to black, slightly organic fine to coarse SAND and fine GRAVEL, little silt, trace shells, trace brick			
						Silty Sand and Gravel	Wet, medium dense, reddish brown, fine SAND, trace silt -reddish brown gravel at 21 feet	SP		
-15.0 25.0	X	S-9 25-27'	24/16	11 8 9 10						
-20.0 30.0	X	S-10 30-32'	24/16	4 5 6 6			Wet, medium dense, reddish brown, SILT, some fine sand, trace clay	ML		MC=25 -200=78
-25.0 35.0	X	S-11 35-37'	24/0	6 6 9 14			-No recovery	ML		
-30.0 40.0	X	S-12 40-42'	24/8	14 11 15 21			Wet, medium dense, reddish brown, fine to medium SAND, some gravel, trace silt	SM		

General Remarks:

Test Boring B-212

Client: NYC EDC/DEP
Project Location: New York City, New York
Project Name: Harbor Siphon Replacement
Project Number: 36856-46971

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
-35.0 / 45.0		S-13 45-47'	24/6	9 11 26 23		Silty Sand and Gravel	Wet, dense, reddish brown, brown, fine to coarse SAND and GRAVEL, trace silt	SP-SM		
							BOE at 47 feet			
-40.0 / 50.0										
-45.0 / 55.0										
-50.0 / 60.0										
-55.0 / 65.0										

General Remarks:

CDM | Hatch Mott MacDonald — A JOINT VENTURE

Test Boring B-213

Client: NYC EDC/DEP

Project Name: Harbor Siphon Replacement

Project Location: New York City, New York

Project Number: 36856-46971

Drilling Contractor/ Driller: Aquifer Drilling and Testing, Inc/J. Philbin
Drilling Method/Diameter: Drive and Wash/4"
Hammer Type/Weight/Drop Height: Automatic/140 lb/30 in
Boring Location: N 656583 E 610556

Ground Surface or Mudline Elevation: 8.4 (NVGD 29)
Boring Depth: 42
Abandonment Method: Backfilled with cuttings
Logged by: M. Cronin
Date: Started 8/15/2006 Completed 8/15/2006

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
						Fill	-Vacuum excavated 0 to 3.5 feet -7 inches asphalt over 7 inches concrete over miscellaneous granular fill, 0 to 3.5 feet			
3.4 / 5.0		S-1 5-7'	24/6	2 2 2 2			Wet, loose, dark brown, fine to coarse SAND, some gravel, trace silt, trace shells, trace brick, trace glass	SW		
		S-2 7-9'	24/1	1 1 2 1				SW		
-1.6 / 10.0		S-3 9-11'	24/4	2 1 45 7			Wet, dense, dark brown, fine to coarse SAND, some gravel, some wood, little brick	SW		
		S-4 11-13'	24/7	3 3 3 5			Top 4": wet, loose, dark brown, fine to coarse SAND and GRAVEL, trace brick Bottom 3": wet, reddish brown, fine to coarse SAND, trace silt, trace gravel	SW		
		S-5 13-15'	24/7	10 4 3 4			Top 3": wet, gray, fine to coarse SAND, some silty clay Bottom 4": wet, reddish brown, trace gravel, trace brick	SM		
-6.6 / 15.0		S-6 15-17'	24/8	3 3 2 2			Wet, loose, reddish brown and gray, fine to coarse SAND, trace silt, trace fine gravel, trace brick	SP-SM		MC=29 -200=9
		S-7 17-19'	24/5	1 2 3 2				SP-SM		
-11.6 / 20.0		S-8 19-21'	24/8	6 2			Wet, medium dense, gray, fine to coarse SAND, little fine gravel, little silt, trace brick	SM		MC=22 -200=14

General Remarks:

Test Boring B-213

Client: NYC EDC/DEP
Project Location: New York City, New York
Project Name: Harbor Siphon Replacement
Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
	X	S-8 19-21'	24/8	10 15		Fill	Wet, medium dense, gray, fine to coarse SAND, little fine gravel, little silt, trace brick			
-16.6 25.0	X	S-9 25-27'	24/12	5 4 7 32		Silty Sand and Gravel	Wet, medium dense, brown, fine to coarse SAND, trace silt	SW-SM		
-21.6 30.0	X	S-10 30-32'	24/10	5 5 7 7			Wet, medium dense, reddish brown, fine SAND, little silt	SP-SM		
-26.6 35.0	X	S-11 35-37'	24/14	3 5 3 7				SP-SM		
-31.6 40.0	X	S-12 40-42'	24/14	4 7 8 9				SP-SM		
							BOE at 42 feet			

General Remarks:

Test Boring B-214

Client: NYC EDC/DEP

Project Name: Harbor Siphon Replacement

Project Location: New York City, New York

Project Number: 36856-46971

Drilling Contractor/ Driller: Aquifer Drilling and Testing, Inc/J. Philbin
Drilling Method/Diameter: Drive and Wash/4"
Hammer Type/Weight/Drop Height: Automatic/140 lb/30 in
Boring Location: N 656704 E 610541

Ground Surface or Mudline Elevation: 8.1 (NVGD 29)
Boring Depth: 42
Abandonment Method: Backfilled with cuttings
Logged by: M. Cronin
Date: Started 8/16/2006 Completed 8/16/2006

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
						Fill	-Vacuum excavated 0 to 5 feet -7 inches asphalt over 14 inches concrete over miscellaneous granular fill, 0 to 5 feet			
3.1 5.0		S-1 5-7'	24/6	4 5 2 2			Wet, loose, dark brown, fine to coarse SAND, some gravel, trace silt	SW-SM		
		S-2 7-9'	24/5	1 1 1 2			Wet, very loose, dark brown, fine to coarse GRAVEL, some fine to coarse sand, trace silt	GW-GM		
-1.9 10.0		S-3 9-11'	24/7	2 3 2 2			Wet, loose, dark brown, fine to coarse SAND, some fine to coarse gravel, trace silt	SW-SM		
		S-4 11-13'	24/5	1 2 1 2			Wet, very loose, dark brown, fine to coarse SAND and fine GRAVEL, little silt	SP-SM		-200=10
		S-5 13-15'	24/4	5 2 1 1			Wet, very loose, dark brown, fine to coarse GRAVEL, little coarse sand, trace shells	GP		
-6.9 15.0		S-6 15-17'	24/4	WOH WOH 6 14			- loose, some coarse sand, 15 to 17 feet	GP		
		S-7 17-19'	24/1	WOH WOH WOH WOH			-trace organics, 17 to 19 feet	GP		
-11.9 20.0		S-8 19-21'	24/12	3 6			Top 9": wet, medium dense, black and reddish brown, fine to coarse GRAVEL and fine to coarse SAND, some organic clayey silt	GW-SW		

General Remarks:

Test Boring B-214

CDM | Hatch Mott MacDonald — A JOINT VENTURE

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		S-8 19-21'	24/12	5 4		Fill				
		S-9 21-23'	24/13	4 6 5 8			Wet, medium dense/stiff, reddish brown, clayey SILT	ML		MC=28 LL=36 PL=34 PI=2
-16.9 25.0		S-10 25-27'	24/12	7 7 9 9		Silty Sand and Gravel	Wet, medium dense, reddish brown, fine to coarse SAND, little silt, trace fine gravel	SM		MC=14 -200=12
-21.9 30.0		S-11 30-32'	24/14	7 8 10 10			Top 12": wet, reddish brown, fine SAND, trace silt Bottom 2": wet, reddish brown, SILT, little fine sand, trace gravel	SP-SM		
-26.9 35.0		S-12 35-37'	24/15	6 8 8 11			Wet, medium dense, reddish brown, fine SAND, trace silt -3" layer of fine to medium SAND, trace silt at 35 feet	SP-SM		
-31.9 40.0		S-13 40-42'	24/15	10 10 8 6			Wet, medium dense, reddish brown, fine to coarse SAND, trace gravel, trace silt -clayey silt with trace sand layer at 41.5 feet	SP-SM		
							BOE at 42 feet			

General Remarks:

CDM | Hatch Mott MacDonald — A JOINT VENTURE

Test Boring B-215

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Drilling Contractor/ Driller: Aquifer Drilling and Testing, Inc/J. Philbin
Drilling Method/Diameter: Drive and Wash/4"
Hammer Type/Weight/Drop Height: Automatic/140 lb/30 in
Boring Location: N 656817 E 610530

Ground Surface or Mudline Elevation: 7.6 (NVGD 29)
Boring Depth: 42
Abandonment Method: Backfilled with cuttings
Logged by: M. Cronin
Date: Started 8/21/2006 Completed 8/21/2006

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
							-Vacuum excavated 0 to 5 feet -7 inches asphalt over 14 inches concrete over miscellaneous granular fill, 0 to 5 feet			
2.6 / 5.0		S-1 5-7'	24/4	3 2 2 2		Fill	Wet, loose, dark brown, fine to coarse SAND and fine to coarse GRAVEL, track silt, trace brick, trace shells	SP-SM		
		S-2 7-9'	24/5	1 3 5 8			Wet, loose, dark brown, fine to coarse SAND, some fine to coarse gravel, trace silt, trace brick, trace wood	SP-SM		
-2.4 / 10.0		S-3 9-11'	24/5	3 3 2 4			Wet, loose, black, fine to coarse SAND, some fine gravel, little silt, trace wood	SM		MC=18 -200=16
		S-4 11-13'	24/7	3 3 4 4			Wet, loose, black, fine to coarse SAND, some fine to coarse gravel, trace silt, trace brick	SP-SM		
		S-5 13-15'	24/5	5 2 2 3			-trace wood, 13 to 15 feet	SP-SM		
-7.4 / 15.0		S-6 15-17'	24/4	3 WOH WOH WOH			Wet, very loose, dark brown, fine to coarse SAND, trace fine gravel, trace silt, trace brick	SW		
		S-7 17-19'	24/9	WOH 3 3 4			-loose, some fine gravel, little silt, 17 to 19 feet	SP-SM		MC=23 -200=13
-12.4 / 20.0		S-8 19-21'	24/24	2 6			Wet, medium dense to dense, dark brown to reddish brown, fine to medium SAND, little silt	SM		

General Remarks:

CDM | Hatch Mott MacDonald — A JOINT VENTURE

Test Boring B-215

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		S-8 19-21'	24/24	41 20		Silty Sand and Gravel	Wet, medium dense to dense, dark brown to reddish brown, fine to medium SAND, little silt			
		S-9 21-23'	24/12	7 7 6 11			-trace silt, 21 to 23 feet -trace fine gravel, 22.5 to 23 feet	SM		
-17.4 25.0		S-10 25-27'	24/11	5 1 3 4			-loose, 25 to 27 feet -1" fine sand and silt layer, 25.3 feet	SM		
-22.4 30.0		S-11 30-32'	24/18	6 9 12 13			Wet, medium dense, reddish brown, fine to coarse SAND, trace fine gravel, trace silt	SP-SM		
-27.4 35.0		S-12 35-37'	24/8	8 7 7 4			-little fine gravel, 35 to 37 feet	SP-SM		
-32.4 40.0		S-13 40-42'	24/18	5 5 7 8			-little silt, trace fine to coarse gravel, 40 to 42 feet	SM		
							BOE at 42 feet			

General Remarks:

CDM | Hatch Mott MacDonald | A JOINT VENTURE

Test Boring B-216

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Drilling Contractor/ Driller: Aquifer Drilling and Testing, Inc/J. Philbin
Drilling Method/Diameter: Drive and Wash/4"
Hammer Type/Weight/Drop Height: Automatic/140 lb/30 in
Boring Location: N 656905 E 610486

Ground Surface or Mudline Elevation: 12.1 (NVGD 29)
Boring Depth: 42
Abandonment Method: Backfilled with cuttings
Logged by: M. Cronin
Date: Started 8/21/2006 Completed 8/21/2006

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
						Fill	-Vacuum excavated 0 to 5 feet -7 inches asphalt over 9 inches concrete over miscellaneous granular fill, 0 to 5 feet			
7.1 / 5.0		S-1 5-7'	24/14	12 10 8 9			Wet, medium dense, dark brown, fine to coarse SAND, little silt, trace fine gravel, trace brick	SP-SM		
		S-2 7-9'	24/12	6 5 3 6			Wet, loose, dark brown, fine to coarse SAND, some silt	SM		
2.1 / 10.0		S-3 9-11'	24/2	WOH 1 2 2			Wet, very loose, dark brown, coarse SAND and GRAVEL	SW/GW		
		S-4 11-13'	24/6	1 1 3 2			Wet, very loose, dark brown, fine to medium SAND, trace silt	SP		
		S-5 13-15'	24/5	2 1 1 2			Wet, very loose, dark brown, SILT and fine to coarse SAND, some fine gravel	SM		MC=18 -200=41
-2.9 / 15.0		S-6 15-17'	24/6	1 2 4 2			-loose, little silt, trace roots, 15 to 17 feet	SM		
		S-7 17-19'	24/6	8 10 5 4			Wet, medium dense, dark brown, fine to medium SAND, trace silt, trace fine gravel, trace roots	SW-SM		
-7.9 / 20.0		S-8 19-21'	24/1	5 3			Wet, very loose, dark brown, coarse GRAVEL, little coarse sand, trace silt, trace roots	GW		

General Remarks:

Test Boring B-216

Client: NYC EDC/DEP
Project Location: New York City, New York
Project Name: Harbor Siphon Replacement
Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
	X	S-8 19-21'	24/1	WOH 1		Fill				
	X	S-9 21-23'	24/7	1 1 1 2			Wet, soft, reddish brown, clayey SILT	ML		MC=24 LL=33 PL=28 PI=5
-12.9 25.0	X	S-10 25-27'	24/20	4 7 9 11			-very stiff, trace fine sand, 25 to 27 feet	ML		MC=23 -200=98
-17.9 30.0	X	S-11 30-32'	24/8	6 7 8 8		Silty Sand and Gravel	Wet, medium dense, dark brown, fine to coarse SAND, little fine to coarse gravel, trace silt	SP-SM		
-22.9 35.0	X	S-12 35-37'	24/20	4 10 10 9				SP-SM		
-27.9 40.0	X	S-13 40-42'	24/12	19 23 26 31			Wet, dense, reddish brown, fine to coarse SAND, some fine to coarse gravel, trace silt	SP-SM		
							BOE at 42 feet			

General Remarks:

CDM | Hatch Mott MacDonald | A JOINT VENTURE

Test Boring B-230

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Drilling Contractor/ Driller: Aquifer Drilling and Testing, Inc/T. Hebert

Drilling Method/Diameter: Drive and Wash/4"

Hammer Type/Weight/Drop Height: Automatic/140 lb/30 in

Boring Location: N 656470 E 610332

Ground Surface or Mudline Elevation: 10.5 (NVGD 29)

Boring Depth: 77

Abandonment Method: Backfilled with cuttings

Logged by: L. Gionet

Date: Started 7/9/2007 Completed 7/10/2007

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
	X	S-1 0-2'	24/24	27 15 11 15			Moist, medium dense, black, fine to coarse SAND, some gravel, little silt, trace brick, trace asphalt, trace glass (oily odor) (sampled with 3" split spoon)	SM		
	X	S-2 2-4'	24/18	22 15 12 9			Wet, medium dense, black, GRAVEL, some sand, some silty clay, trace brick (sampled with 3" split spoon)	GM		
5.5 / 5.0	X	S-3 4-6'	24/10	1 2 3 5			Moist to wet, loose, reddish brown, SILT, some fine sand, trace fine gravel	ML		
	X	S-4 6-8'	24/13	2 3 2 3				ML		MC=27 -200=75
	X	S-5 8-10'	24/6	2 2 2 WOH			Wet, very loose to loose, reddish brown, fine SAND, little silt, little gravel (possible blow-in) (sampled with 3" split spoon)	SM		
0.5 / 10.0	X	S-6 10-12'	24/24	2 1 2 2		Fill	- some silt, trace asphalt (sampled with 3" split spoon)	SM		
	X	S-7 12-14'	24/8	2 1 WOH WOH			Wet, very loose to loose, reddish brown, fine SAND and SILT, trace gravel	SM		
-4.5 / 15.0	X	S-8 14-16'	24/24	3 2 2 2				SM		
	X	S-9 16-18'	24/0	2 2 1 1			No Recovery			
-9.5 / 20.0	X	S-10 18-20'	24/24	7 10 12 24			Wet, medium dense, gray and reddish brown, fine to coarse SAND and GRAVEL, little silt, trace brick, trace asphalt (Sampled with 3" split spoon)	SM		MC=13 -200=17

General Remarks:

CDM | Hatch Mott MacDonald — A JOINT VENTURE

Test Boring B-230

Client: NYC EDC/DEP

Project Name: Harbor Siphon Replacement

Project Location: New York City, New York

Project Number: 36856-46971

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		S-11 20-22'	24/20	2 5 5 15			Wet, medium dense to dense, light brown, fine to coarse SAND, some silt, some fine gravel	SM		MC=12 -200=31
		S-12 22-24'	24/11	18 19 17 19			Wet, dense, tan, SILT and GRAVEL, little fine to coarse sand	SM		
-14.5 / 25.0		S-13 24-26'	24/15	8 10 10 15				SM		
		S-14 26-28'	24/11	5 6 6 7			Wet, medium dense, reddish brown to tan, fine to medium SAND, trace fine gravel, trace silt	SW-SM		MC=15 -200=8 LL=17 PL=26 PI=9
		S-15 28-30'	24/7	11 14 14 11			- some silt, trace gravel, 28 to 30 feet	SM		
-19.5 / 30.0		S-16 30-32'	24/2	7 7 7 7			- (2-inch piece of gravel caught in tip of spoon)			
-24.5 / 35.0		S-17 35-37'	24/0	6 6 7 6			No recovery			
-29.5 / 40.0		S-18 40-42'	24/14	5 6 6 6			Wet, medium dense, light brown, fine to medium SAND, little silt, trace fine gravel	SP-SM		MC=18 -200=11

General Remarks:

CDM | Hatch Mott MacDonald — A JOINT VENTURE

Test Boring B-230

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
						Silty Sand and Gravel	Wet, medium dense, reddish brown, fine to medium SAND, little silt			
-34.5 / 45.0		S-19 45-47'	24/10	5 6 6 7				SM		
-39.5 / 50.0		S-20 50-52'	24/15	7 11 13 15			Wet, medium dense, reddish brown and light brown, interbedded layers of fine to medium SAND, little silt and SILT and fine to medium SAND, little gravel	SP-SM		MC=18 -200=12
							Wet, medium dense, reddish brown, fine to coarse SAND, little gravel, trace silt			
-44.5 / 55.0		S-21 55-57'	24/9	18 16 11 14				SW-SM		
						Decomposed Rock	Wet, very dense, blue gray and silver, fine to medium SAND, some clay, trace fine gravel (completely weathered mica Schist to Gneiss)	SC		
-49.5 / 60.0		S-22 60-62'	24/12	16 26 34 49				SC		MC=10 -200=26 LL=NP PL=NP PI=NP
-54.5 / 65.0										

General Remarks:

Test Boring B-230

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
	X	S-23 65-67'	24/8	16 19 55 43		Decomposed Rock	Wet, very dense, blue gray and silver, fine to medium SAND and SILTY CLAY, trace fine gravel (completely weathered mica Schist to Gneiss)	SC		
-59.5 / 70.0	X	S-24 70-72'	24/10	17 34 40 55				SC		
-64.5 / 75.0	X	S-25 75-77'	24/24	20 31 42 47				SC		
							End of exploration at 77'. Grout to surface			
-69.5 / 80.0										
-74.5 / 85.0										

General Remarks:

Test Boring B-231

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Drilling Contractor/ Driller: Aquifer Drilling and Testing, Inc/T. Hebert
Drilling Method/Diameter: Drive and Wash/4"
Hammer Type/Weight/Drop Height: Automatic/140 lb/30 in
Boring Location: N 656433 E 610360

Ground Surface or Mudline Elevation: 10.5 (NVGD 29)
Boring Depth: 67
Abandonment Method: Backfilled with cuttings
Logged by: L. Gionet
Date: Started 7/10/2007 Completed 7/11/2007

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		S-1 0-1'	9/9	26 50/3"		Fill	Dry, very dense, black, GRAVEL, little sand, trace silt, trace asphalt, trace brick, trace wood, trace glass (sampled with a 3" split spoon)	GP		
		S-2 2-4'	24/12	7 7 5 5		Fill	Moist, medium dense, black and brown, fine to coarse SAND and GRAVEL, trace silt, trace asphalt (sampled with 3" split spoon)	SW		
5.5 / 5.0		S-3 4-6'	24/18	2 1 2 2		Fill	Moist, very loose, reddish brown, SILT and fine SAND, little gravel - trace asphalt, 4 to 6 feet	SM/ML		
		S-4 6-8'	24/9	WOH WOH WOH 1		Fill	- trace gravel, 6 to 8 feet	SM/ML		
		S-5 8-10'	24/24	3 2 2 2		Fill	Wet, loose, black, slightly organic SILT and fine to medium SAND, trace fine gravel, trace asphalt, trace wood (organic odor) - (sampled with 3" split spoon)	ML		
0.5 / 10.0		S-6 10-12'	24/8	1 1 3 3		Fill		ML		MC=31 OC=1.0 -200=51
		S-7 12-14'	24/10	1 2 1 WOH		Fill	Wet, very loose to loose, reddish brown and black, fine SAND and SILT, trace gravel	SM		
-4.5 / 15.0		S-8 14-16'	24/15	1 1 3 4		Fill	- little gravel, little silt, little brick, trace asphalt, 14 to 16 feet	SM		
		S-9 16-18'	24/11	2 1 4 2		Fill	- trace brick (oily sheen), 16-18 feet	SM		
-9.5 / 20.0		S-10 18-20'	24/24	8 9 7 7		Fill	Wet, medium dense, gray to brown, fine to coarse SAND, little fine gravel, trace silt, trace brick - (sampled with 3" split spoon)	SW-SM		MC=20 -200=9.8

General Remarks:

Test Boring B-231

Client: NYC EDC/DEP

Project Location: New York City, New York

Project Name: Harbor Siphon Replacement

Project Number: 36856-46971

Elev / Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
	X	S-11 20-22'	24/12	2 4 5 7			Wet, loose to medium dense, reddish brown, fine to coarse SAND, trace fine gravel, trace silt	SW-SM		
	X	S-12 22-24'	24/8	3 2 3 4				SW-SM		MC=16 -200=9
-14.5 / 25.0	X	S-13 24-26'	24/4	6 7 6 9			Wet, medium dense, reddish brown, fine to coarse SAND and fine GRAVEL, trace silt	SW-SM		
	X	S-14 26-28'	24/12	5 4 5 6			Wet, medium dense, reddish brown, fine to coarse SAND, little fine gravel, little silt	SM		
	X	S-15 28-30'	24/15	5 7 6 6				SM		MC=15 -200=16
-19.5 / 30.0										
-24.5 / 35.0	X	S-16 35-37'	24/24	5 7 6 9			-trace fine gravel, 35 to 37 feet	SM		MC=16 -200=12
-29.5 / 40.0	X	S-17 40-42'	24/18	12 13 10 13			Wet, medium dense, interbedded layers of reddish brown, fine to coarse SAND and GRAVEL, and brown-yellow, fine to coarse SAND, trace silt, trace gravel	SW-SM		

General Remarks:

Test Boring B-231

Client: NYC EDC/DEP
Project Location: New York City, New York
Project Name: Harbor Siphon Replacement
Project Number: 36856-46971

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
						Silty Sand and Gravel	Wet, dense, reddish brown, fine to coarse SAND, little silt, trace fine gravel			
-34.5 45.0	X	S-18 45-47'	24/24	12 17 15 6				SM		MC=14 -200=12
-39.5 50.0	X	S-19 50-52'	24/24	13 13 17 18				SM		
-44.5 55.0	X	S-20 55-57'	24/24	16 23 20 18				SM		
-49.5 60.0	X	S-21 60-62'	24/6	29 24 24 22			Wet, dense, reddish brown, fine to coarse SAND and GRAVEL, trace silt	SP-SM		MC=12 -200=9
							Wet, very dense, white and gray, fine to coarse SAND and GRAVEL, trace silty clay			
-54.5 65.0										

General Remarks:

Test Boring
B-231

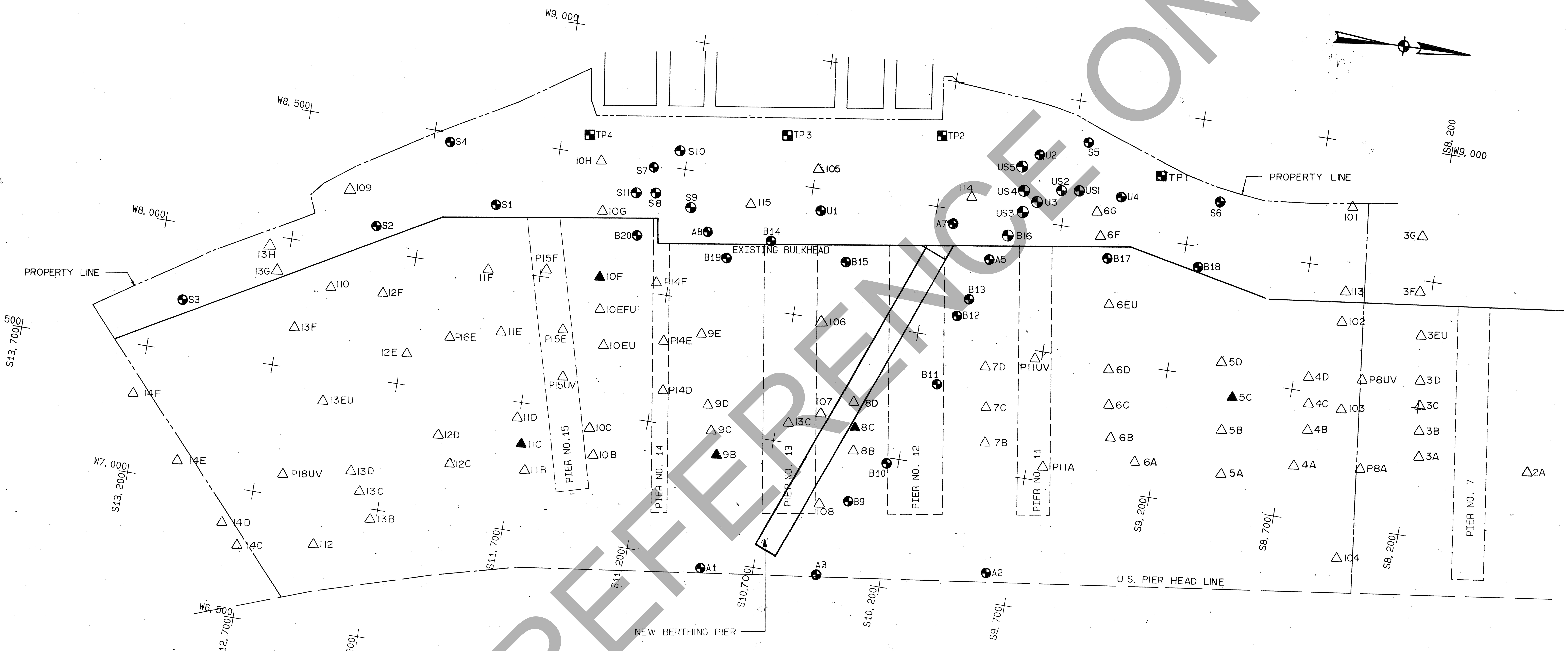
Client: NYC EDC/DEP | **Project Location: New York City, New York**

Project Name: Harbor Siphon Replacement | **Project Number: 36856-46971**

Elev Depth (ft)	Sample Type	Sample Number and Depth	Sample Length/ Recovery	Blows/6" [RQD (%)] (Q-Index)	Graphic Log	Strata	Material Description Remarks	USCS	Undrained Shear Strength (psf)	Index Testing (%)
		S-22 65-67'	24/24	8 26 37 50		Decomposed Rock	Wet, very dense, white and gray, fine to coarse SAND and GRAVEL, trace silty clay (completely weathered Pegmatite and/or Schistose Gneiss)	SM		
							End of exploration at 67'. Observation monitoring well installed see well schematic for details			
-59.5 70.0										
-64.5 75.0										
-69.5 80.0										
-74.5 85.0										

General Remarks:

LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED



LEGEND

- ⊕ PIER, BULKHEAD AND SITE BORINGS COMPLETED IN 1984 AND 1985 PRESENTED ON DRAWING B-102, 103, 104, 105, 107 AND 108.
- ◪ TEST PITS COMPLETED IN 1984 AND PRESENTED IN REFERENCE NO. 1.
- ▲ PREVIOUSLY DRILLED BORINGS COMPLETED IN 1967 BY OTHERS - PRESENTED ON DRAWING B-106.
- △ PREVIOUSLY DRILLED BORINGS COMPLETED IN 1967 BY OTHERS AND PRESENTED IN REFERENCE NO. 2.

NOTES

1. THE FOLLOWING SUBSURFACE INFORMATION IS AVAILABLE FOR REVIEW:
   REFERENCE NO. 1 - SAG STRATEGIC HOMEPORTING VOLUME 5 SOILS REPORT, BY PRC ENGINEERING DATED DECEMBER 1984 PLUS ADDENDA DATED SEPTEMBER 1985.
   REFERENCE NO. 2 - AMBROSE MARINE TERMINAL REPORT, VOLUME 2, BY MUESER RUTLEDGE ETAL DATED 1967.

GRAPHIC SCALES

CHECK GRAPHIC SCALES BEFORE USING

200' 100' 0 200' 400'

SATISFACTORY TO DATE

PRC Engineering
New York N.Y.

DSGN FP DR FC CHK SP
SUPV FW CH ENGR
SUBMITTED BY DATE
FIRM MEMBER
NORTHDIV HD
DM HD
FPE DIR
APPROVED DATE
OFFICER IN CHARGE
APPROVED DATE
NORTHDIV FOR COMMANDER NAVFAC

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
NAVAL BASE PHILADELPHIA, PA.

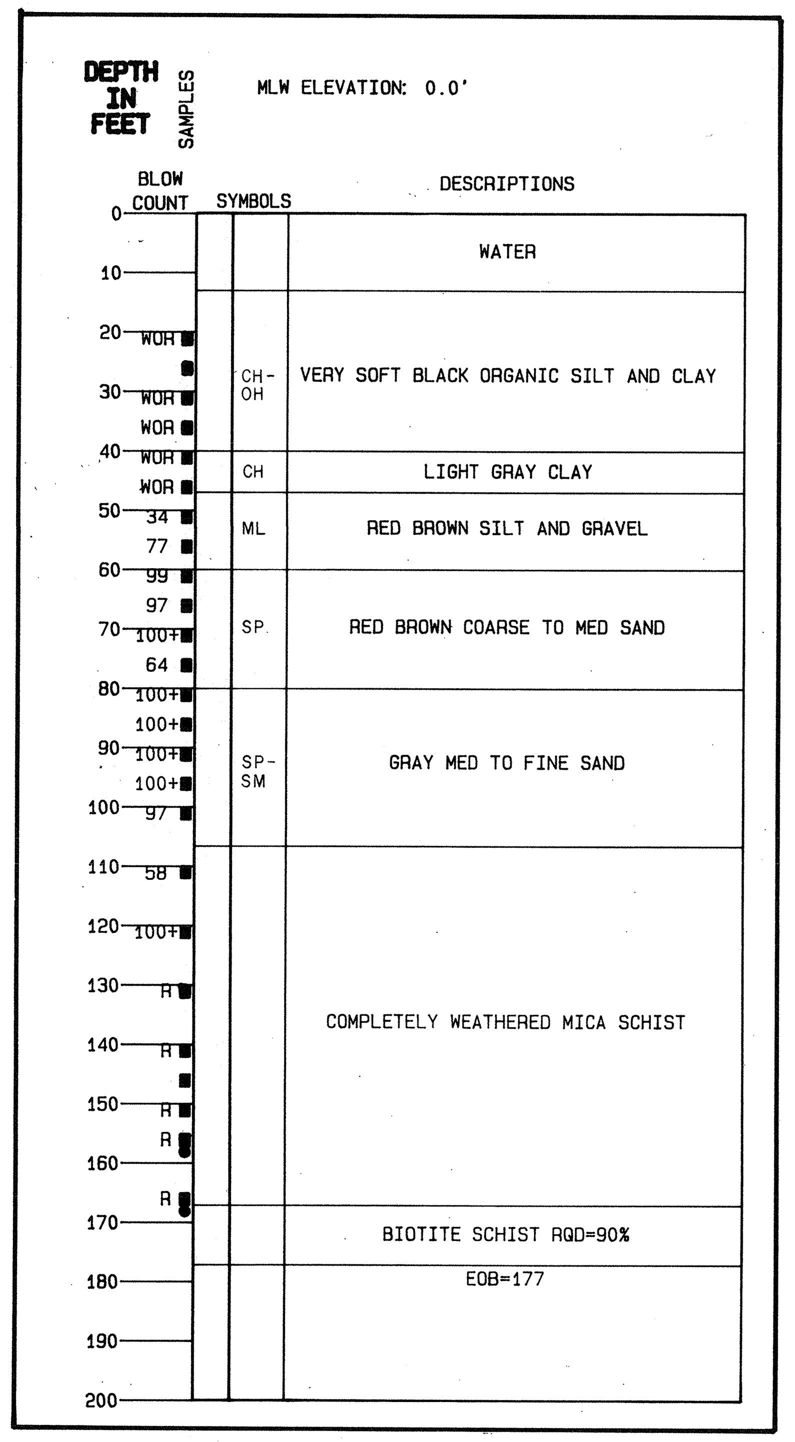
NAVAL STATION STATEN ISLAND, N.Y.

BERTHING PIER, SITE WORK & DREDGING

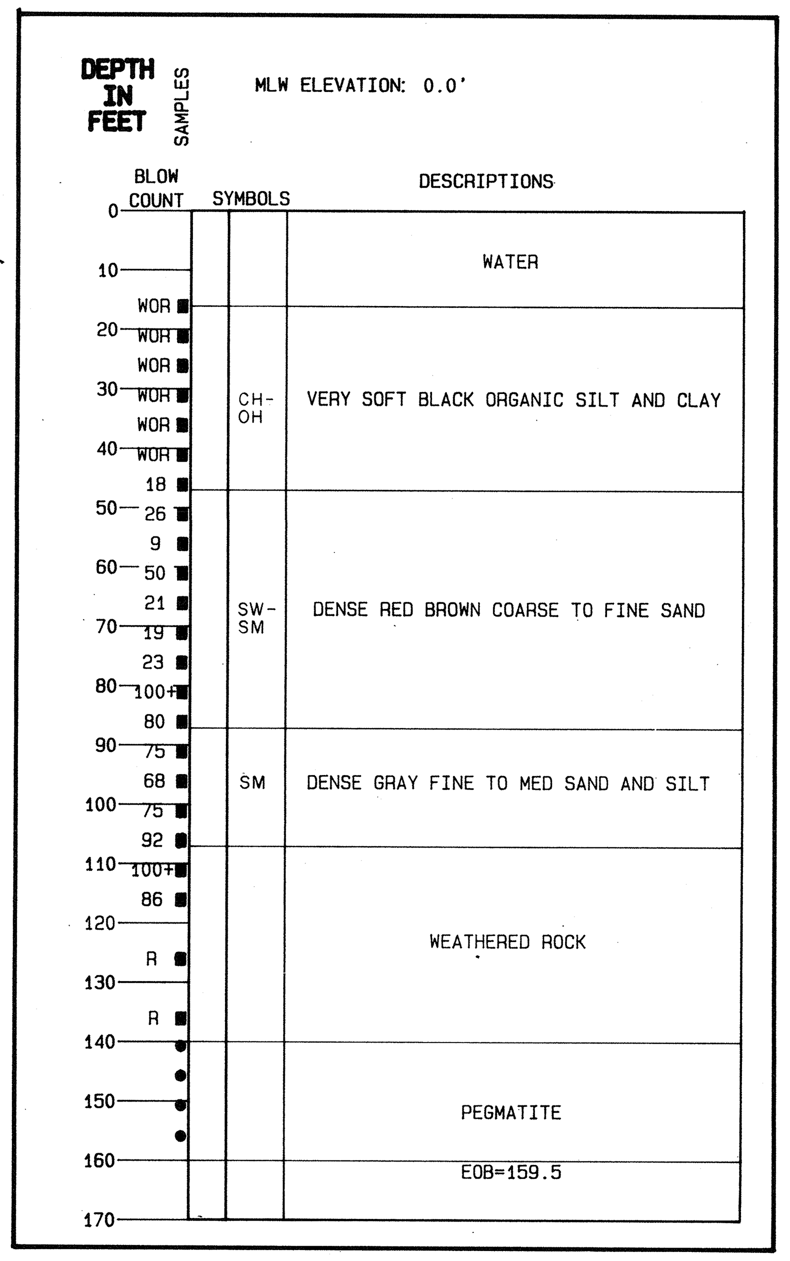
BORING LOCATION PLAN

SIZE	CODE IDENT. NO.	NAVFAC DRAWING NO.	DIS. SH. NO.
F	80091	2095051	B-101
		CONSTR. CONTR. NO. N62472-84-C-0266	
SCALE AS NOTED		SPEC. 04-84-0266	SHEET 5 OF 156

REVISIONS				
LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED



NO. B12



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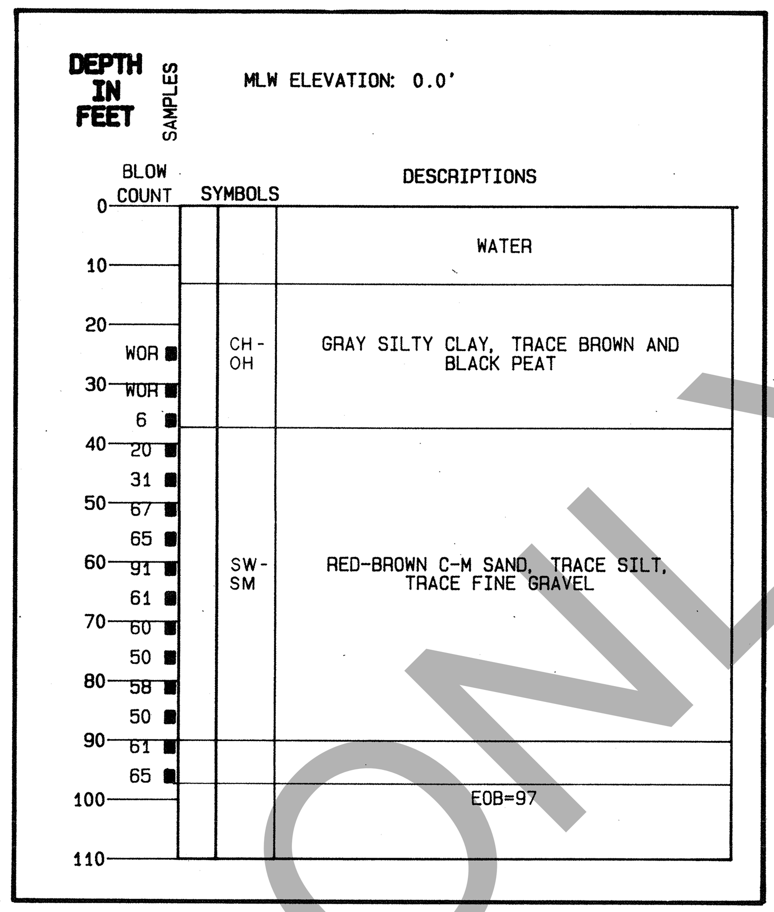
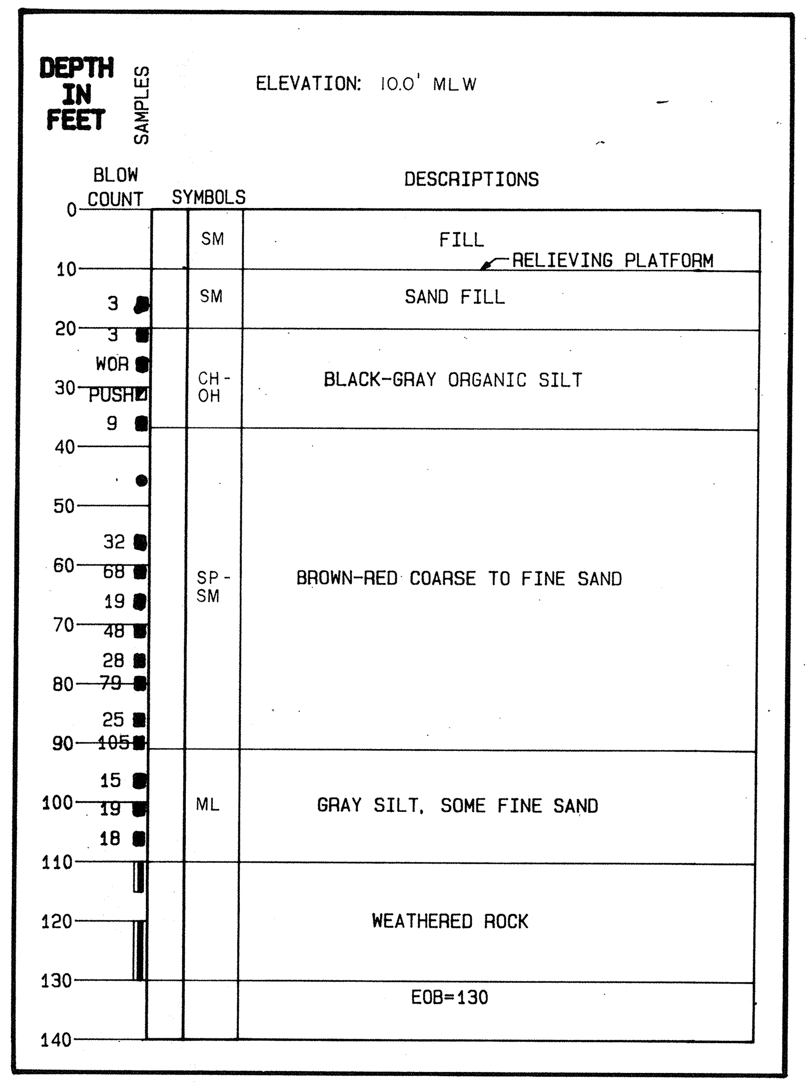


NO. A5

LEGEND:

- ■ — SPLIT SPOON SAMPLE
- ◪ — UNDISTURBED SAMPLE
- ● — ROCK CORE
- ⌽ — FIELD VANE
- WOR — WEIGHT OF RODS
- R — REFUSAL
- (SM) — UNIFIED SOIL CLASSIFICATION FOLLOWS ASTM D2487-83



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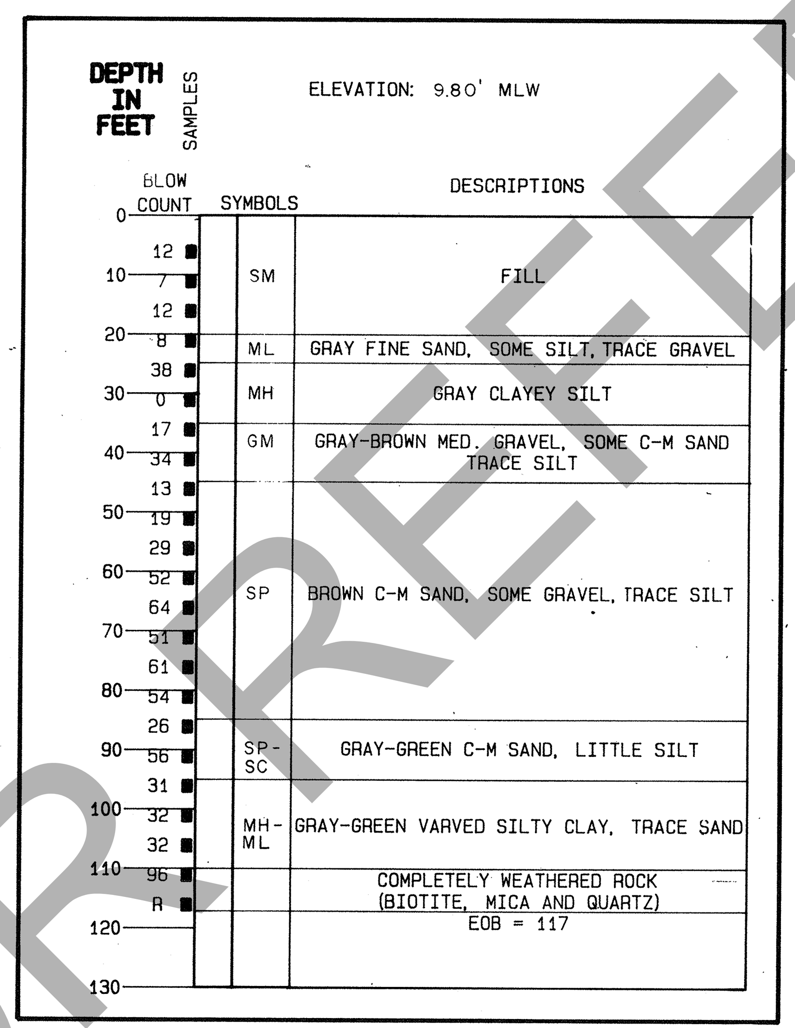
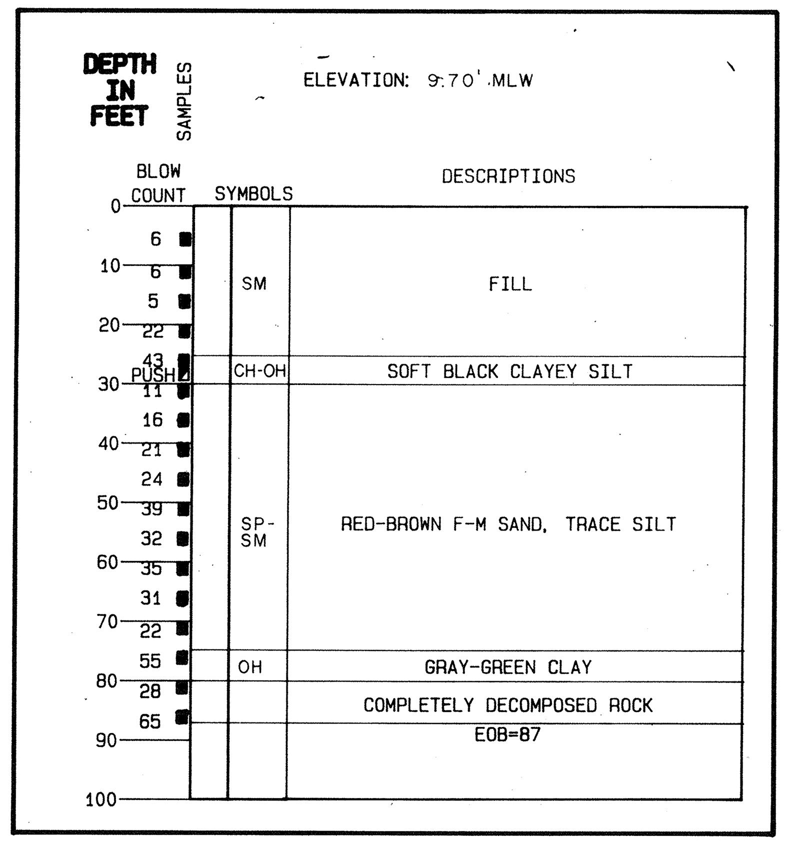


NO. B14



NO. A7

NOTES:

1. FOR BORING NOTES, SEE DRAWING B-102.

GRAPHIC SCALES

CHECK GRAPHIC SCALES BEFORE USING

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PRC Engineering
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DSGN DR FC CHK
SUPV CH ENGR
SUBMITTED BY DATE
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NORTHDIV
DM
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OFFICER IN CHARGE
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NAVAL STATION STATEN ISLAND, N.Y.
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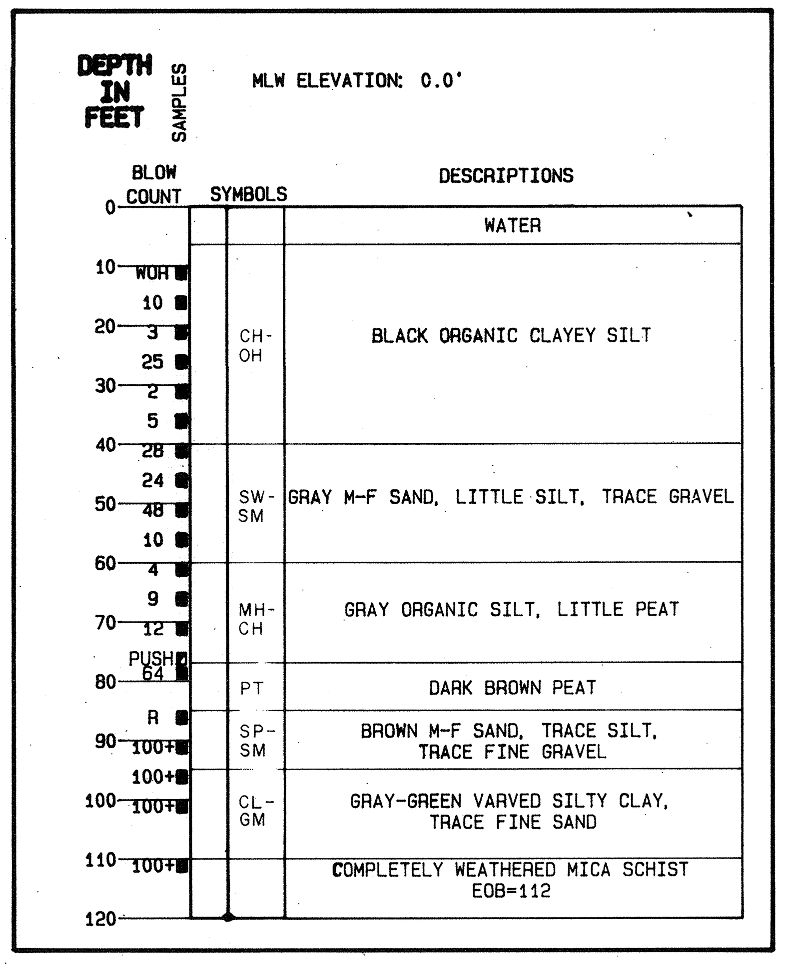
BORING LOG II

SIZE	CODE IDENT. NO.	NAVFAC DRAWING NO.	DIS. SH. NO.
F	80091	2095053	B-103
		CONSTR. CONTR. NO. N62472-84-C-0256	
SCALE AS NOTED		SPEC. 04-84 0256	SHEET 7 OF 156

A-57

REVISIONS				
LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED



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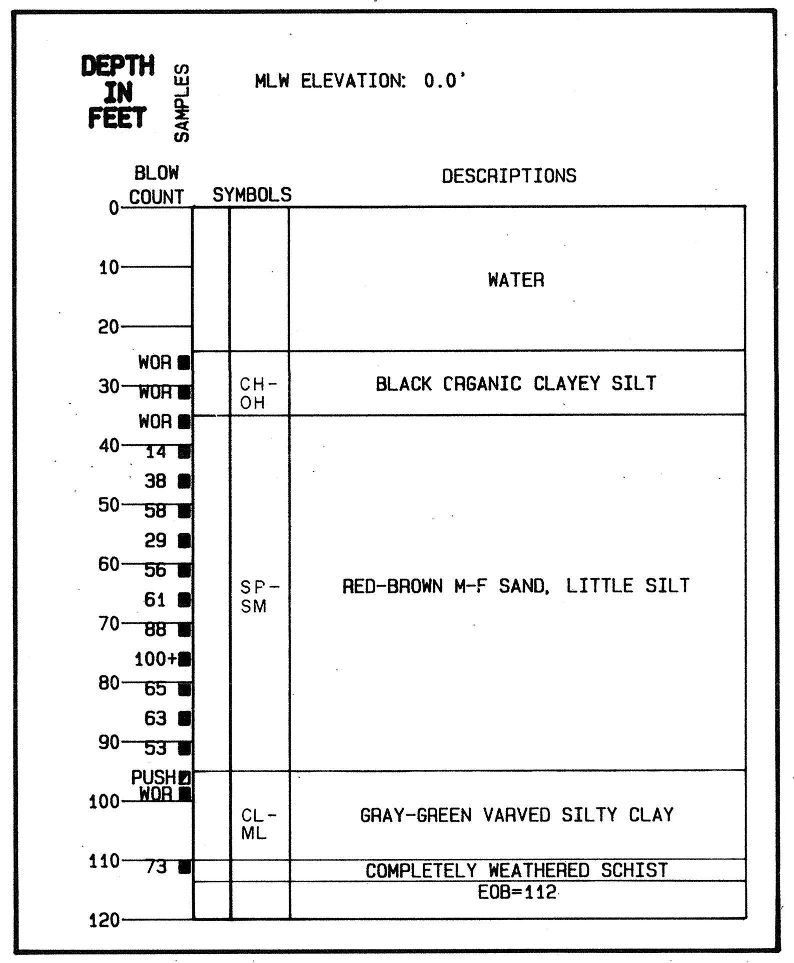

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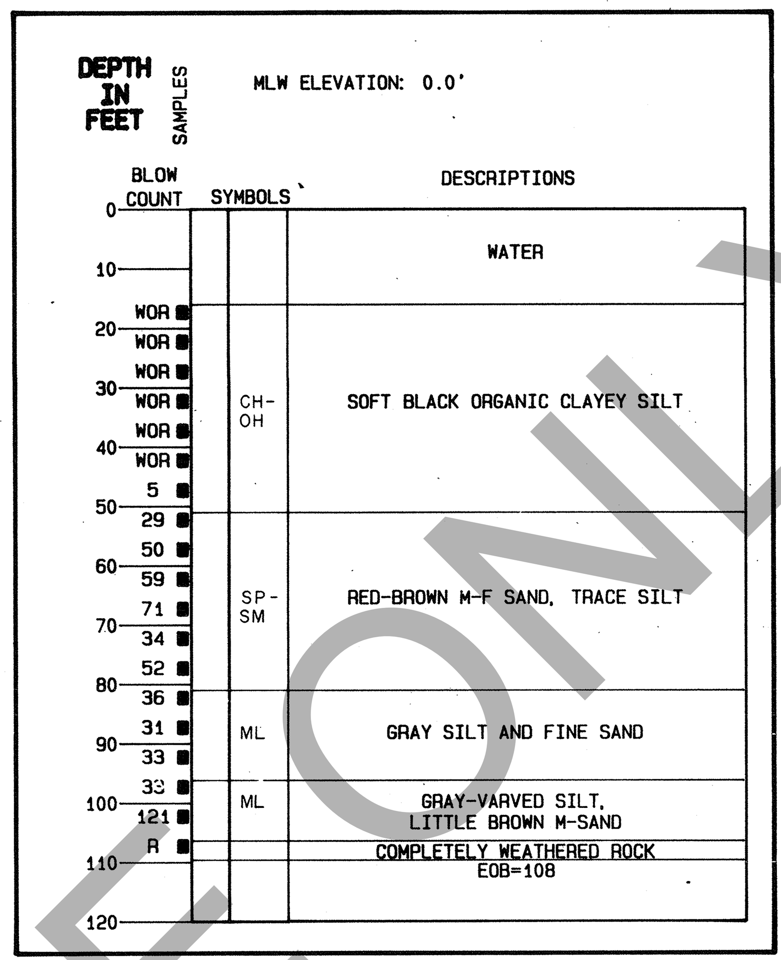
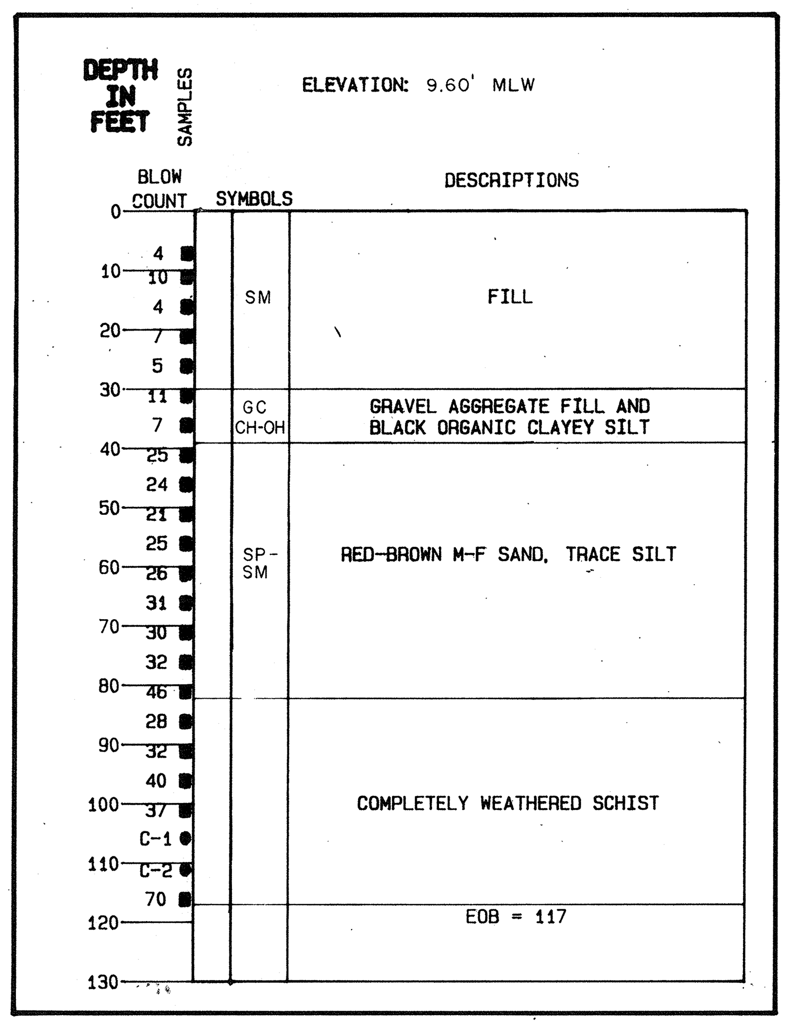


NO. B15

LEGEND:

- ■ — SPLIT SPOON SAMPLE
- ◩ — UNDISTURBED SAMPLE
- ● — ROCK CORE
- ⊕ — FIELD VANE
- WOR — WEIGHT OF RODS
- R — REFUSAL
- (SM) — UNIFIED SOIL CLASSIFICATION FOLLOWS ASTM D2487-83



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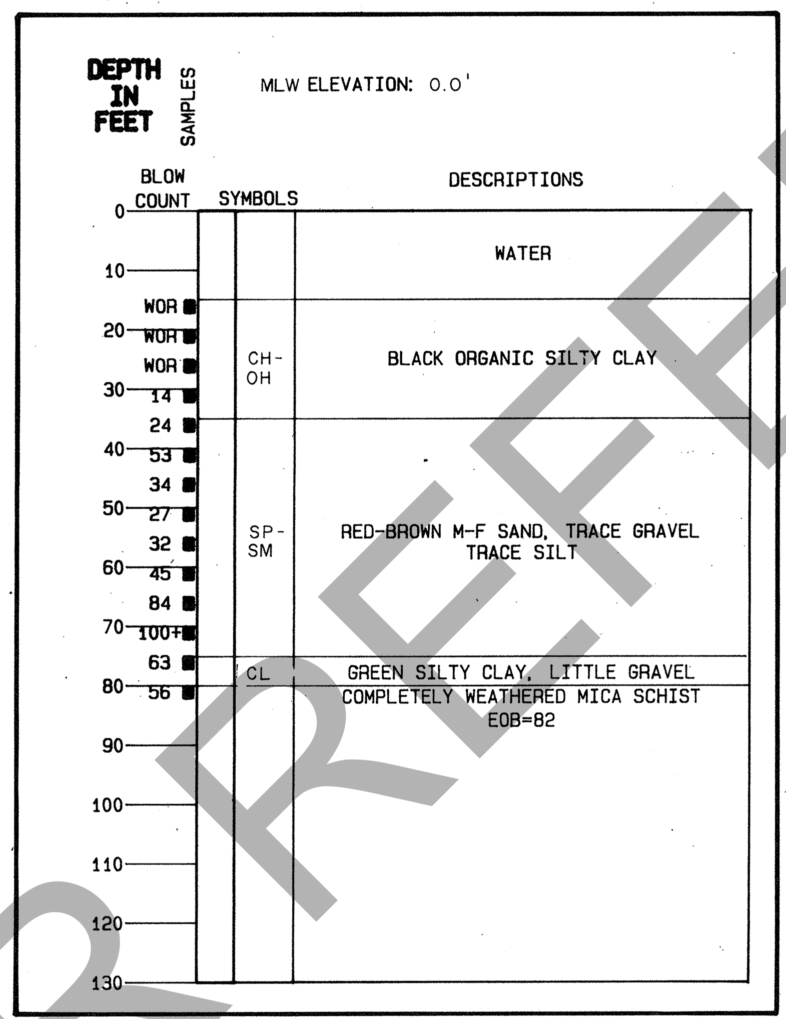

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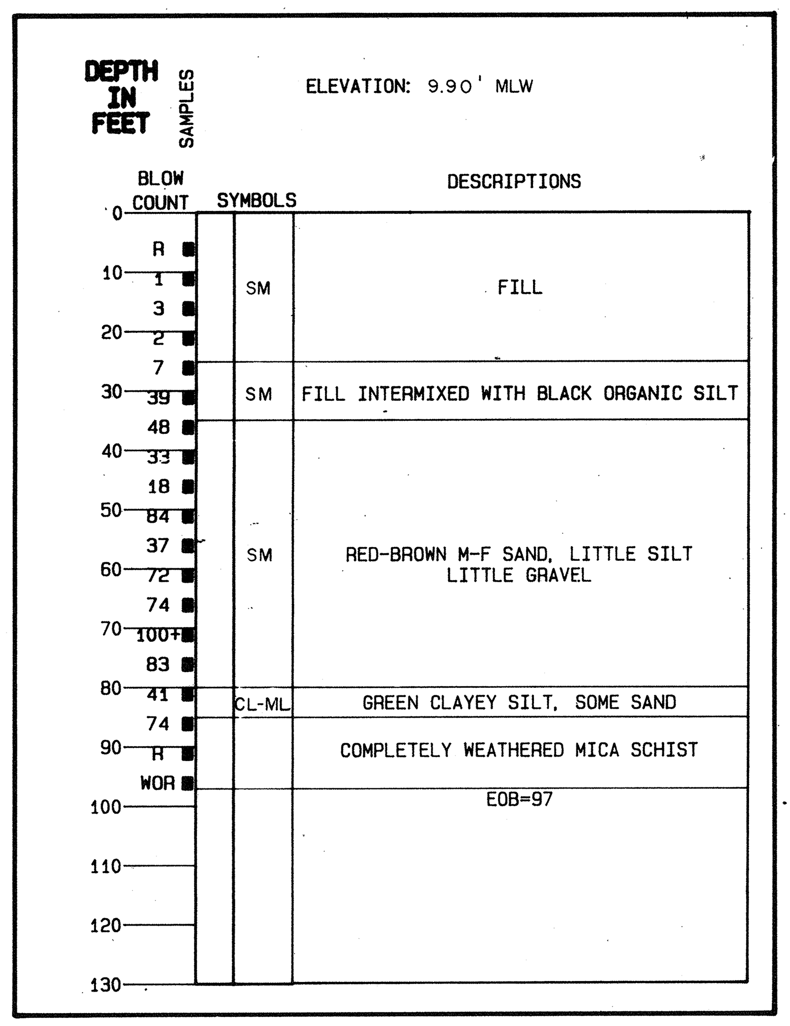

NO. B18

NOTES:

1. FOR BORING NOTES, SEE DRAWING B-102

GRAPHIC SCALES

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PRC Engineering
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DSGN WF DR FC CHK SP
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FIRM MEMBER
NORTHDIV | CIVIL
DM | MD
FPE | DIR
APPROVED | DATE
OFFICER IN CHARGE
APPROVED | DATE
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NORTHERN DIVISION
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BERTHING PIER, SITE WORK & DREDGING

BORING LOG III

SIZE	CODE IDENT. NO.	NAVFAC DRAWING NO.	DIS. SH. NO.
F	80091	2095054	B-104
		CONSTR.CONTR. NO. N62472-84-C-0256	
SCALE AS NOTED		SPEC.04-84 0256	SHEET 3 OF 12

NO. S1

DEPTH IN FEET — ELEVATION: 9.70' MLW

Blow count (samples): 5, 25, 25, 6, 10, 21, 21

Symbols	Descriptions
SM	FILL
SM	GRAY C-M SAND, SOME M-F GRAVEL LITTLE SILT
SP	RED-BROWN F-M SAND, TRACE FINE GRAVEL EOB=37

NO. S2

DEPTH IN FEET — ELEVATION: 9.80' MLW

Blow count (samples): 4, 2, 28, R, 10, 18, PUSH, 26, 41

Symbols	Descriptions
SM	FILL
CH-ML	RED BROWN SILT AND FINE SAND
SW	BROWN-RED C-M SAND

NO. S3

DEPTH IN FEET — ELEVATION: 10.3' MLW

Blow count (samples): 16, 18, 12, 30, 1, 8, 18, 21, 53, R

Symbols	Descriptions
SM	FILL
ML	RED- BROWN SILT LITTLE FINE SAND
SM	RED-BROWN FINE SAND, SOME SILT
	EOB=42

NO. S4

DEPTH IN FEET — ELEVATION: 12.0' MLW

Blow count (samples): 8, 9, 3, 6, 23, 27

Symbols	Descriptions
SM-SC	FILL
	GRAY M-F SAND, SOME SILT, TRACE F-GRAVEL
SM-SC	RED-BROWN C-F SAND AND GRAVEL TRACE SILT
	EOB=34

NO. S5

DEPTH IN FEET — ELEVATION: 11.30' MLW

Blow count (samples): 4, 14, 5, PUSH, 3, 2, 39

Symbols	Descriptions
SP	FILL
MH-OH	BLACK AND GRAY ORGANIC CLAYEY SILT
SM	BROWN M-F SAND AND SILT, LITTLE GRAVEL EOB=32

NO. S6

DEPTH IN FEET — ELEVATION: 12.40' MLW

Blow count (samples): 5, 0, 0, 21, 24, 42

Symbols	Descriptions
SM	FILL
CH	GRAY SILTY CLAY, TRACE SHELL, TRACE ORGANICS
ML	RED BROWN CLAYEY SILT, LITTLE FINE SAND
SW-SM	BROWN C-F SAND, SOME M-F GRAVEL, LITTLE SILT EOB=37

NO. S7

DEPTH IN FEET — ELEVATION: 10.60' MLW

Blow count (samples): 19, 3, 23, 4, 83, 13, 53, 87

Symbols	Descriptions
	VOID — DECK ON PILES
SW-SM	FILL
SW-SM	BROWN AND GRAY C-M SAND AND FINE GRAVEL
GW-GM	RED-BROWN C-F SAND AND GRAVEL, LITTLE CLAY EOB=42

NO. U1

DEPTH IN FEET — ELEVATION: 9.70' MLW

Blow count (samples): 16, 4, 1, 2, 1, 27, 18, 41

Symbols	Descriptions
SM	FILL
ML	GRAY SILT, LITTLE FINE SAND, TRACE SHELLS
SW-SM	TAN C-F SAND AND GRAVEL, TRACE SILT
SP-SM	BROWNISH RED C-M SAND, TRACE GRAVEL, TRACE SILT EOB=42

NO. U2

DEPTH IN FEET — ELEVATION: 11.50' MLW

Blow count (samples): 13, 2, 3, 2, 16, 4, 13, 84, 70

Symbols	Descriptions
SM	FILL
ML	GRAY-BROWN ORGANIC SILT, SOME FINE SAND
SM	RED-BROWN C-F SAND SOME FINE GRAVEL LITTLE SILT
	EOB=47

NO. U3

DEPTH IN FEET — ELEVATION: 10.60' MLW

Blow count (samples): 10, 4, 14, 14, 4, 5, WOR, 13, 35, 64, 39, 48, 100+, 100+

Symbols	Descriptions
SM	FILL
OL-PT	BLACK ORGANIC SILT, LITTLE PEAT
SM	RED-BROWN C-F SAND, SOME FINE GRAVEL SOME SILT
	BLACK AND TAN COMPLETELY WEATHERED MICACEOUS SCHIST
	EOB=72

NO. U4

DEPTH IN FEET — ELEVATION: 11.90' MLW

Blow count (samples): 56, 7, 5, 13, 5, 18, 17, 31, 26, 53

Symbols	Descriptions
SM	FILL
	GREEN-YELLOW WEATHERED SERPENTINE
ML	RED -BROWN CLAYEY SILT AND FINE SAND
SM	RED BROWN C-F SAND, LITTLE SILT TRACE F-GRAVEL EOB=52

REVISIONS

LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED

LEGEND:

- ■ — SPLIT SPOON SAMPLE
- ◩ — UNDISTURBED SAMPLE
- ● — ROCK CORE
- ⊕ — FIELD VANE
- WOR — WEIGHT OF RODS
- R — REFUSAL
- (SM) — UNIFIED SOIL CLASSIFICATION FOLLOWS ASTM D2487-83

NOTES:

1. FOR BORING NOTES, SEE DRAWING B-102.

GRAPHIC SCALES

CHECK GRAPHIC SCALES BEFORE USING

SATISFACTORY TO DATE

PRC Engineering New York N.Y.

DSGN WF DR FC CHK SP
SUPV FW CH ENGR
SUBMITTED BY DATE 12/4/86
FIRM MEMBER
NORTHDIV HD
DM HD
FPE DIR
APPROVED DATE
OFFICER IN CHARGE
APPROVED DATE
NORTHDIV FOR COMMANDER NAVFAC

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
NAVAL BASE PHILADELPHIA, PA.

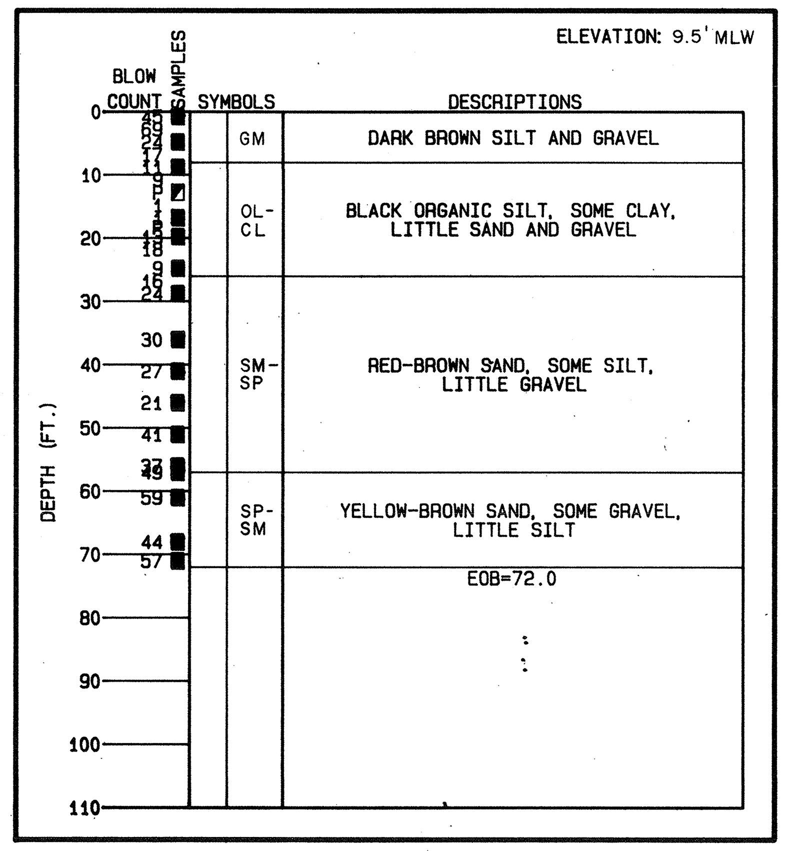
NAVAL STATION STATEN ISLAND, N.Y.

BERTHING PIER, SITE WORK & DREDGING

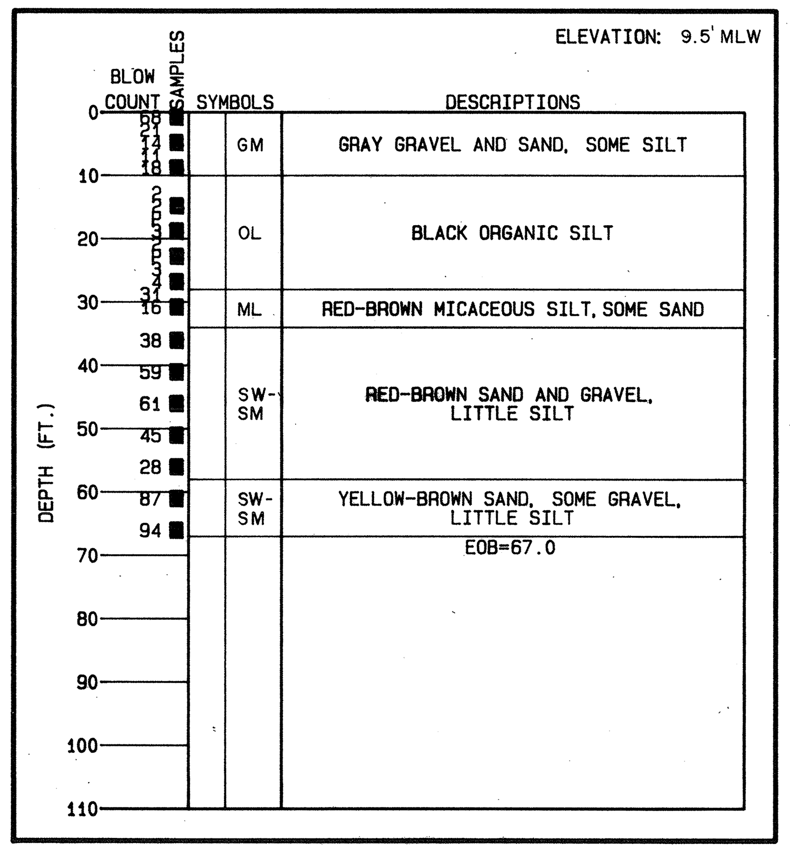
BORING LOG IV

SIZE	CODE IDENT. NO.	NAVFAC DRAWING NO.	DIS. SH. NO.
F	80091	2095055	B-105
SCALE AS NOTED		CONSTR.CONTR. NO. N62472-84-C-0266	
		SPEC.04-84-0266	SHEET OF 156

REVISIONS				
LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED



NO. US-1



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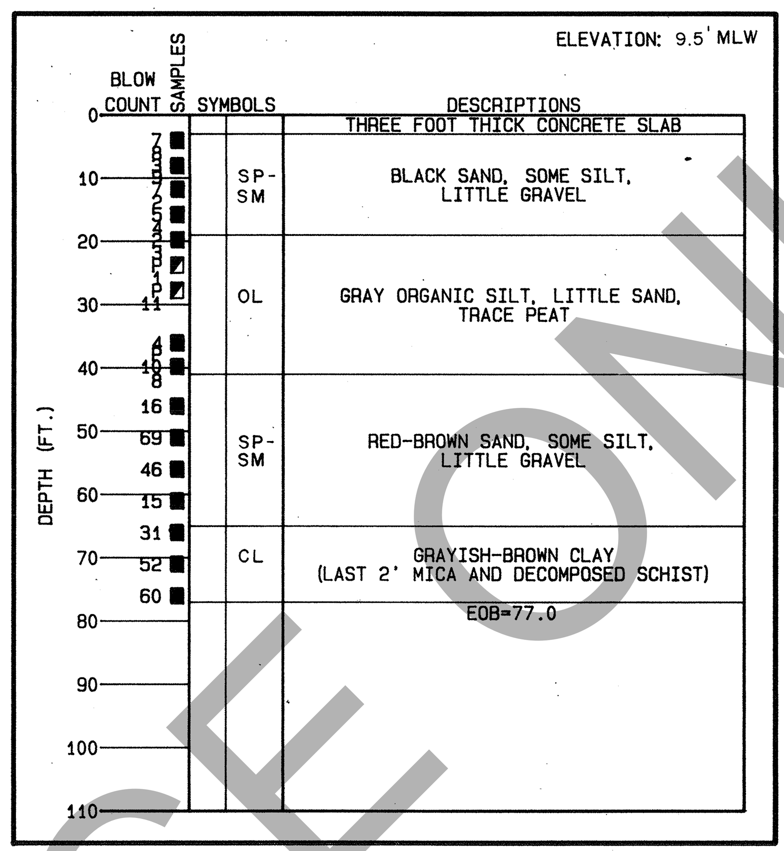
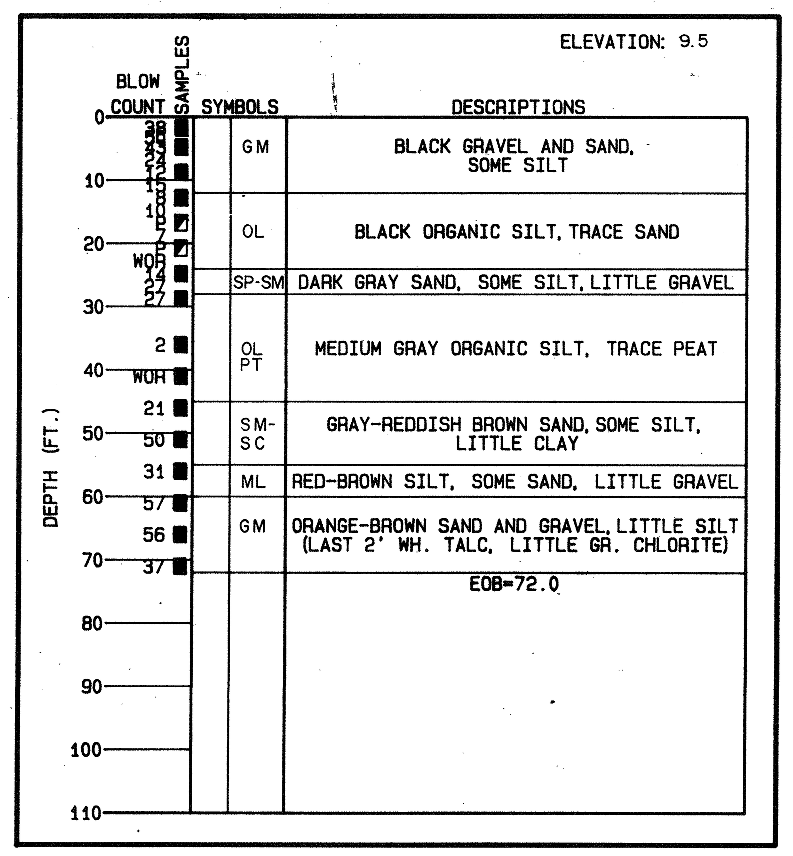


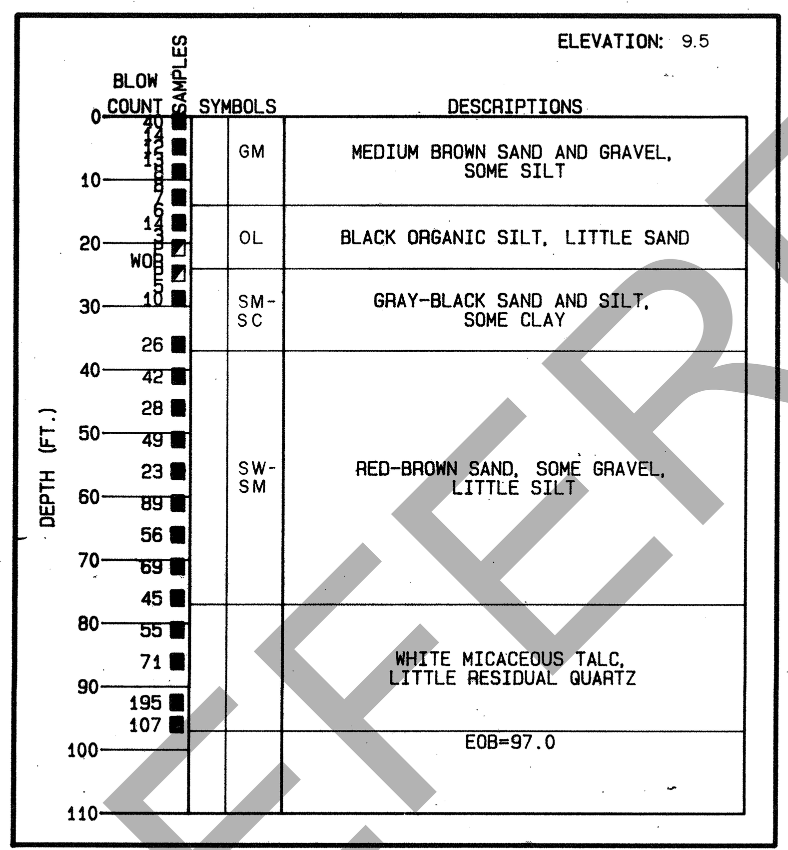
NO. US-3

LEGEND:

- ■ — SPLIT SPOON SAMPLE
- ◩ — UNDISTURBED SAMPLE
- ● — ROCK CORE
- ⊕ — FIELD VANE
- WOR — WEIGHT OF RODS
- R — REFUSAL
- (SM) — UNIFIED SOIL CLASSIFICATION FOLLOWS ASTM D2487-83



NO. US-4



NO. US-5

NOTES:

1. FOR BORING NOTES, SEE DRAWING B-102.

GRAPHIC SCALES
CHECK GRAPHIC SCALES BEFORE USING

SATISFACTORY TO DATE

PRC Engineering New York N.Y.

DSGN WF DR FC CHK SP
SUPV CH ENGR
SUBMITTED BY DATE 12/4/86
FIRM MEMBER
NORTHDIV DM FPE HD CIVIL HD DIR
APPROVED DATE
OFFICER IN CHARGE
APPROVED DATE
NORTHDIV FOR COMMANDER NAVFAC

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BERTHING PIER, SITE WORK & DREDGING

BORING LOG VI

SIZE	CODE IDENT. NO.	NAVFAC DRAWING NO.	DIS. SH. NO.
F	80091	2095057	B-107
		CONSTR. CONTR. NO. N62472-84-C-0266	
SCALE AS NOTED		SPEC. 04-84 0266	SHEET 11 OF 156

IMPORTANT NOTE

The Boring Logs shown on this sheet are the result of inferences drawn by the engineers or scientific personnel during boring operations at the site, and from certain evidence, viz. (1) samples of subsurface materials recovered during boring operations; (2) the logs kept by the drill operator and the inspector, which contain, among other things, expression of their opinions as to the nature of subsurface materials encountered during boring operations; and (3) other records concerning the site deemed pertinent by the engineers. The driller's log, the inspector's log, the samples and the records , together with the engineer's reports, are made available for inspection and study by the bidders so that they may draw their own inferences from all of the available evidence.

Bidders are warned that in the subsurface, other than that actually penetrated by the borings, obstructions, both natural and man-made, and which are not indicated on the Boring Logs, may be encountered, and that the Boring Logs make no representations or warranties either as to the presence or absence of such obstructions, or as to their nature and extent. Where possible, borings are located to avoid all obstructions and previous construction which can be found by inspection of the surface, and the bidder is required to estimate the influence of such features from his own inspection of the site.

In addition, bidders are warned that in the subsurface other than that actually penetrated by the borings, soil or rock may vary widely, with regard to elevation, composition, texture, structure, perviousness, soundness, and other characteristics, from the descriptions given on the Boring Logs and all reports.

The "water reading", shows the elevation of water in the boring holes at the times indicated. They may or may not indicate the elevations of perched water or true ground water table during boring operations or subsequently.

EXPLANATION OF TERMS

SOIL SIZES

Description Term	Pass Sieve No.	Retained Sieve No.	Size Range
Clay	200	Atterberg Limits, Hydrometer Analysis	< .005 mm.
Silt	200		.005 to .074 mm.
Fine Sand (Note 1)	40 (60)	200	.074 to .420 mm.
Medium Sand	10	40	.420 to 2.00 mm.
Coarse Sand	4	10	2.00 to 4.76 mm.
Gravel (fine) (Note 2)	-----	-----	4.76 mm. to 3/4"
Gravel (coarse) (Note 2)	-----	-----	3/4" to 3"
Cobble	-----	-----	3" to 6"
Boulder	-----	-----	> 6"

Note 1: Special Fine Sand (60) designated in the NYC Building Code;
Note 2: For Visual Identification NYC Building Code does not distinguish Fine and Coarse Gravel.

UNIFIED SYSTEMS

GROUP SYMBOLS	Typical Names
GW	Well-graded gravels, gravel - sand mixtures, less than 5% fines.
GP	Poorly-graded gravels, gravels - sand mixtures, less than 5% fines.
GM	Silty gravels, gravel - sand - silt mixtures, more than 12% fines.
GC	Clayey gravels, gravel-sand-clay mixtures, more than 12% fines.
SW	Well-graded sands, gravelly sands, less than 5% fines.
SP	Poorly-graded sands, gravelly sands, less than 5% fines.
SM	Silty sands, sand - silt mixtures, more than 12% fines.
SC	Clayey sands, sand - clay mixtures, more than 12% fines.
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silt, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
CH	Inorganic clays of high plasticity. Fat clays.
OH	Organic clays of medium to high plasticity, organic silts.
Pt	Peat and other highly organic soils.

QUANTITATIVE ESTIMATE

Secondary Components	Percentage Range
AND	35 - 50
SOME	20 - 35
LITTLE	10 - 20
TRACE	< 10

GRAIN SIZE ABBREVIATIONS

F = FINE, M = MEDIUM, C = COARSE
= PREDOMINANT FRACTION (e.g. F -M)

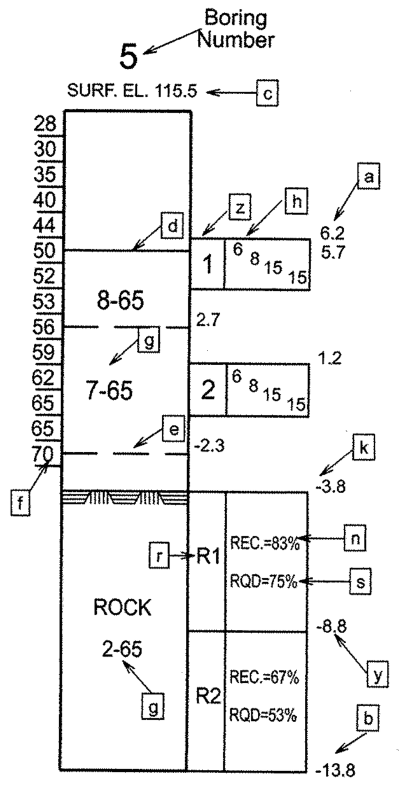
The descriptive size terms in the Boring Logs were arrived at by estimate only, using standard samples for visual comparison.

These tables have been used as an approximate guide, with latitude for interpretation and selective judgement.

EQUIPMENT

Unless otherwise noted:
Type of spoon hammer SAFETY
Weight of casing hammer 300 lbs.
Weight of spoon hammer 140 lbs.
Size of Casing 4.0 inches.
Size of Sample spoon 2 inches.
Size of Core Bit -
Type of Core Barrel -

BORING LEGEND



a = Elevation, top of sample.
b = Elevation, bottom of boring.
c = Surface elevation.
d = Primary strata boundary and elevation.
e = Approximate or secondary strata boundary and elevation.
f = Number of blows required to drive casing through one foot of strata with casing hammer falling 18".
g = Numerical Classification. Refers to the N.Y. City Building Code, Sect. C 26-1103.4, Table 11-2.

SPOON SAMPLES

Unless otherwise specified, sample spoon was driven 24 inches.
h = Number of Blows required to drive sample spoon for each 6" increment of penetration, with spoon hammer falling 30".
P = Pushed by weight of hammer.
z = Sample Number
or : M = Missed sample.
U = Undisturbed sample.
W = Wash sample.
I = Insufficient recovery of undisturbed sample,

CORE DRILLING

r = Run number.
k = Elevation, at start of core drilling.
y = Elevation, at completion of Run.
n = Percentage of rock core recovered.
s = Percentage of RQD.

LABORATORY ANALYSIS OF SOILS *

SAND AND GRAVEL

BORING NO.	SAMPLE NO.	DEPTH (ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	% GRAVEL (> #4 SIEVE)	% SAND	% SILT OR CLAY (< #200 SIEVE)	WC%	Cc	Cu
1	5	25-27	19.00	1.29	0.09	-	16.5	54.9	28.6	23.9	-	-
6	8	45-47	2.00	-	-	-	-	23.4	76.6	21.9	-	-
10	8	45-47	37.50	2.65	0.38	0.07	32.9	56.6	10.5	10.9	0.8	39.8
11	4	20-22	37.50	0.13	-	-	14.8	48.9	36.3	20.6	-	-
12B	1	30-32	19.00	0.77	0.44	0.20	7.8	86.8	5.4	18.7	1.2	3.8
13	6	30-32	37.50	2.88	0.30	0.09	34.5	56.9	8.6	13.4	0.4	33.2
14	4	20-22	9.50	0.38	0.13	-	2.7	73.0	24.3	21.9	-	-
16	8	40-42	19.00	4.18	0.47	0.05	37.4	51.0	11.6	10.6	1.1	90.8
18A	6	30-32	9.50	0.36	0.17	-	0.8	79.1	20.1	28.7	-	-
19	4	25-27	19.00	0.83	0.31	0.06	19.5	69.8	10.7	17.1	1.9	13.2
22	9	45-47	37.50	1.17	0.26	0.07	19.1	70.5	10.4	13.9	0.8	16.2
23	6	30-32	37.50	0.78	0.31	0.15	23.0	71.9	5.1	18.3	0.8	5.2
25	5	25-27	19.00	0.43	-	-	10.4	48.6	41.0	19.5	-	-
27A	2	30-32	9.50	0.40	0.26	0.14	2.0	91.8	6.2	22.8	1.3	2.9
28	4	25-27	9.50	1.02	0.15	-	19.0	57.3	23.7	17.9	-	-
33	9	45-47	9.50	0.15	-	-	2.4	44.4	53.2	24.0	-	-
35A	6	30-32	19.00	0.79	-	-	20.7	47.5	31.8	14.6	-	-
38	9	50-52	19.00	2.71	0.82	0.19	23.1	70.5	6.4	13.4	1.3	14.6
41A	2	25-27	2.00	0.11	-	-	-	57.6	42.4	21.1	-	-
43	7	35-37	19.00	-	-	-	12.5	16.0	71.5	21.9	-	-
44	5	25-27	2.00	-	-	-	-	27.3	72.7	25.7	-	-
50	4	20-22	9.50	0.40	-	-	5.5	64.2	30.3	20.9	-	-
51	5	35-37	4.75	-	-	-	-	33.0	67.0	22.4	-	-
53	3	25-27	2.00	0.14	0.08	-	-	74.8	25.2	22.8	-	-

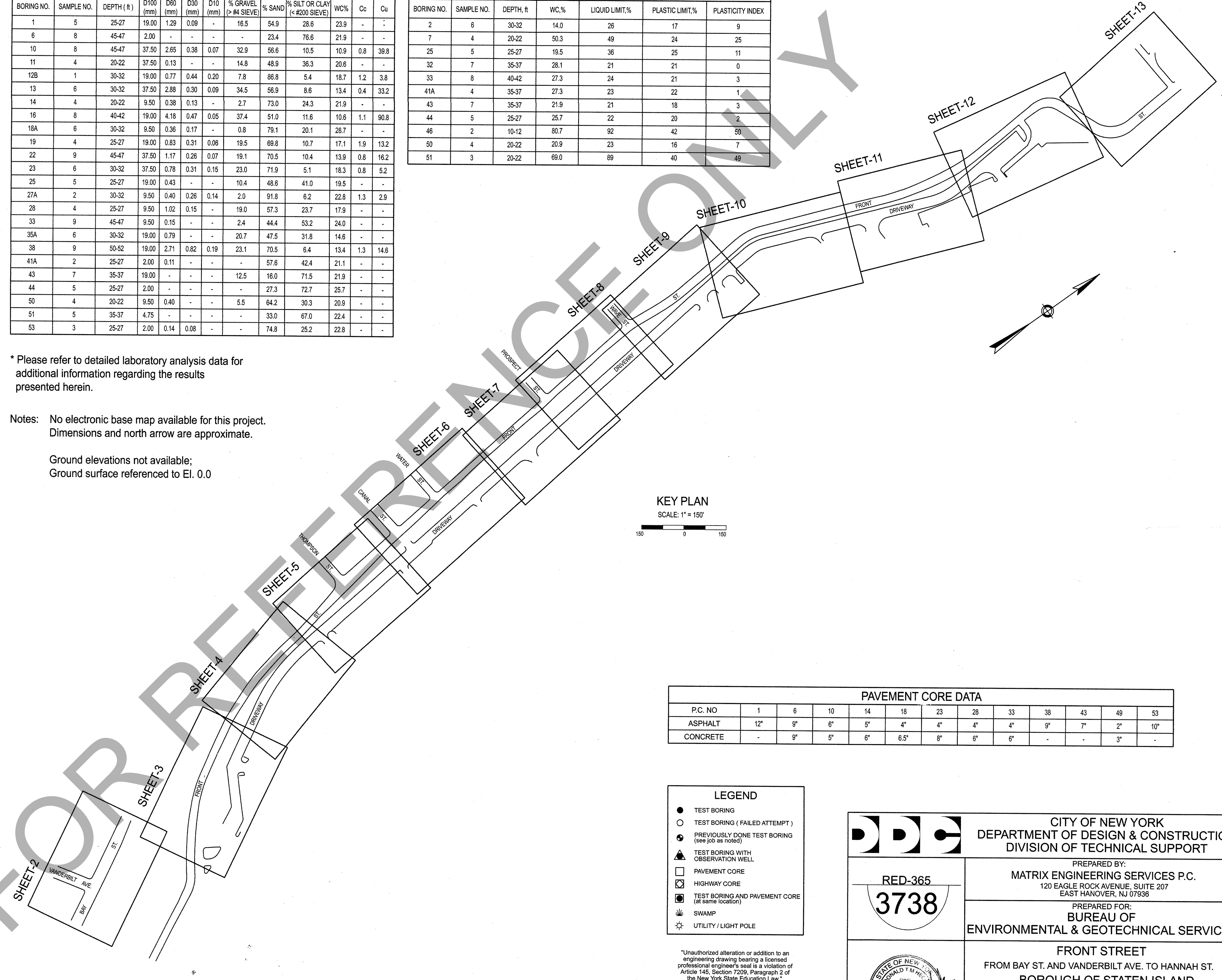
SILT AND CLAY

BORING NO.	SAMPLE NO.	DEPTH, ft	WC,%	LIQUID LIMIT,%	PLASTIC LIMIT,%	PLASTICITY INDEX
2	6	30-32	14.0	26	17	9
7	4	20-22	50.3	49	24	25
25	5	25-27	19.5	36	25	11
32	7	35-37	28.1	21	21	0
33	8	40-42	27.3	24	21	3
41A	4	35-37	27.3	23	22	1
43	7	35-37	21.9	21	18	3
44	5	25-27	25.7	22	20	2
46	2	10-12	80.7	92	42	50
50	4	20-22	20.9	23	16	7
51	3	20-22	69.0	89	40	49

* Please refer to detailed laboratory analysis data for additional information regarding the results presented herein.

Notes: No electronic base map available for this project.
Dimensions and north arrow are approximate.

Ground elevations not available;
Ground surface referenced to El. 0.0



KEY PLAN
SCALE: 1" = 150'
150 0 150

PAVEMENT CORE DATA

P.C. NO	1	6	10	14	18	23	28	33	38	43	49	53
ASPHALT	12"	9"	6"	5"	4"	4"	4"	4"	9"	7"	2"	10"
CONCRETE	-	9"	5"	6"	6.5"	8"	6"	6"	-	-	3"	-

LEGEND

- TEST BORING
- TEST BORING (FAILED ATTEMPT)
- PREVIOUSLY DONE TEST BORING (see job as noted)
- TEST BORING WITH OBSERVATION WELL
- PAVEMENT CORE
- HIGHWAY CORE
- TEST BORING AND PAVEMENT CORE (at same location)
- SWAMP
- UTILITY / LIGHT POLE

CITY OF NEW YORK
DEPARTMENT OF DESIGN & CONSTRUCTION
DIVISION OF TECHNICAL SUPPORT

RED-365
3738

PREPARED BY:
MATRIX ENGINEERING SERVICES P.C.
120 EAGLE ROCK AVENUE, SUITE 207
EAST HANOVER, NJ 07936

PREPARED FOR:
BUREAU OF ENVIRONMENTAL & GEOTECHNICAL SERVICES

STATE OF NEW YORK · DONALD T M HECK · LICENSED PROFESSIONAL ENGINEER · 083855

FRONT STREET
FROM BAY ST. AND VANDERBILT AVE. TO HANNAH ST.
BOROUGH OF STATEN ISLAND

RECORD OF BORINGS

DATE	SCALE	SHEET
JULY 11, 2007	AS SHOWN	1 OF 13

NO.	DATE	DESCRIPTIONS	APPR'D
		REVISIONS	

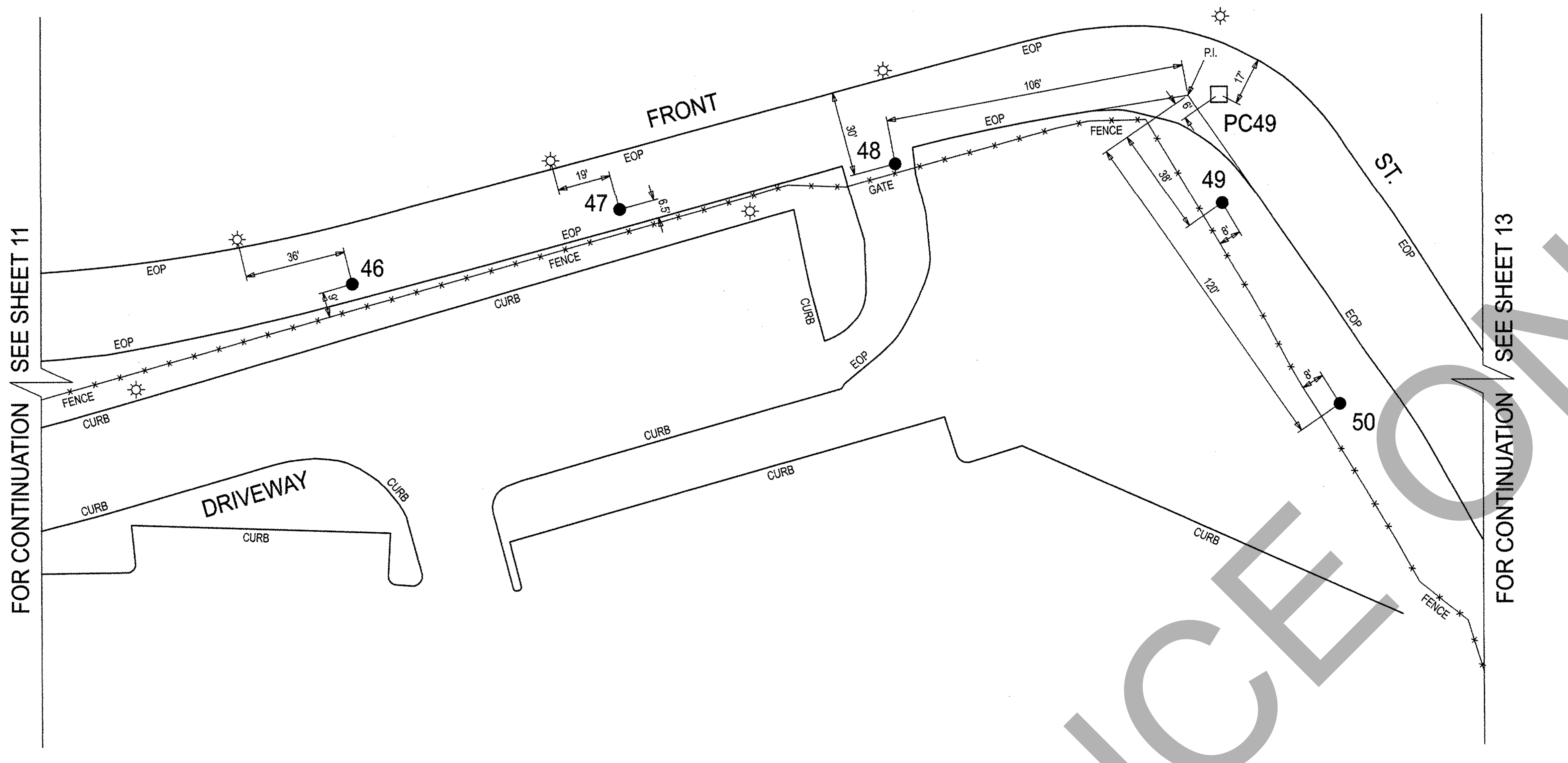
DRAFTPERSON SCOTT HALM
CHECKER DONALD T. M. HECK
P. BUSTAMANTE / B. STABILE / J. THAKKAR
SOIL ANALYSIS BY

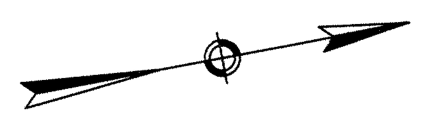
DONALD T. M. HECK
GEOTECHNICAL ENGINEER
MATRIX ENGINEERING SERVICES P.C.

JEFFREY F. KATZ, C.P.G.
SECTION CHIEF
B.E.G.S.

JEAN M. JEAN-LOUIS
DIRECTOR
B.E.G.S.

MARK A. CANU
ASSOCIATE COMMISSIONER
DIVISION OF TECHNICAL SUPPORT

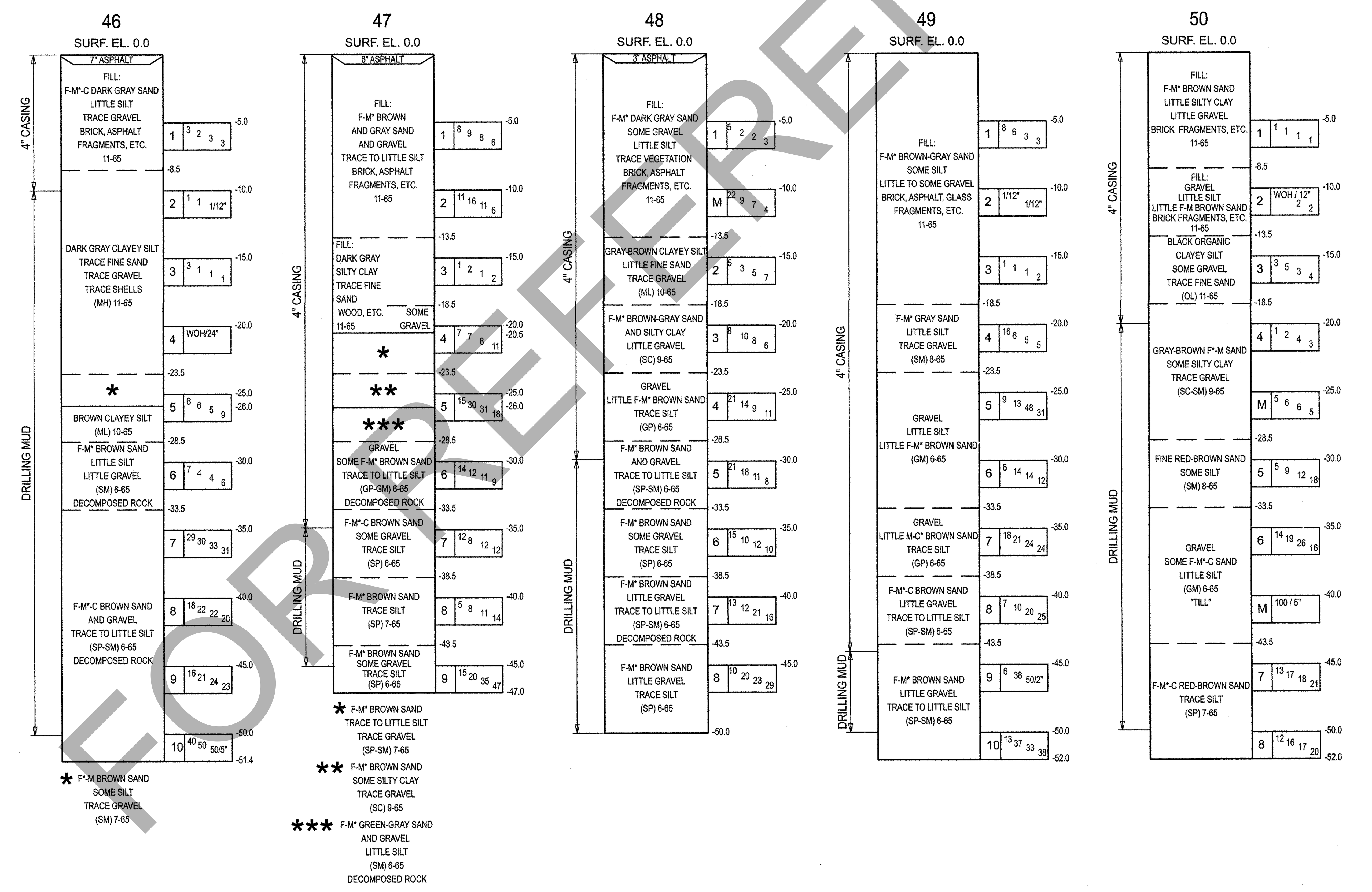




LOCATION PLAN

SCALE: 1" = 30'

30 0 30



Notes: Boring 48 terminated at 50' due to running sands and inability to advance boring further.

"Unauthorized alteration or addition to an engineering drawing bearing a licensed professional engineer's seal is a violation of Article 145, Section 7209, Paragraph 2 of the New York State Education Law."

LEGEND

- TEST BORING
- TEST BORING (FAILED ATTEMPT)
- PREVIOUSLY DONE TEST BORING (see job as noted)
- TEST BORING WITH OBSERVATION WELL
- PAVEMENT CORE
- HIGHWAY CORE
- TEST BORING AND PAVEMENT CORE (at same location)
- SWAMP
- UTILITY / LIGHT POLE

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BOROUGH OF STATEN ISLAND

STATE OF NEW YORK · DONALD T M HECK · 083855 · LICENSED PROFESSIONAL ENGINEER

RECORD OF BORINGS

DATE	SCALE	SHEET
JULY 11, 2007	AS SHOWN	12 OF 13

NO.	DATE	DESCRIPTIONS	APPR'D
		REVISIONS	

DRAFTPERSON SCOTT HALM
CHECKER DONALD T. M. HECK
STABILE / THAKKAR / HECK / GUTSHTEYN
SOIL ANALYSIS BY

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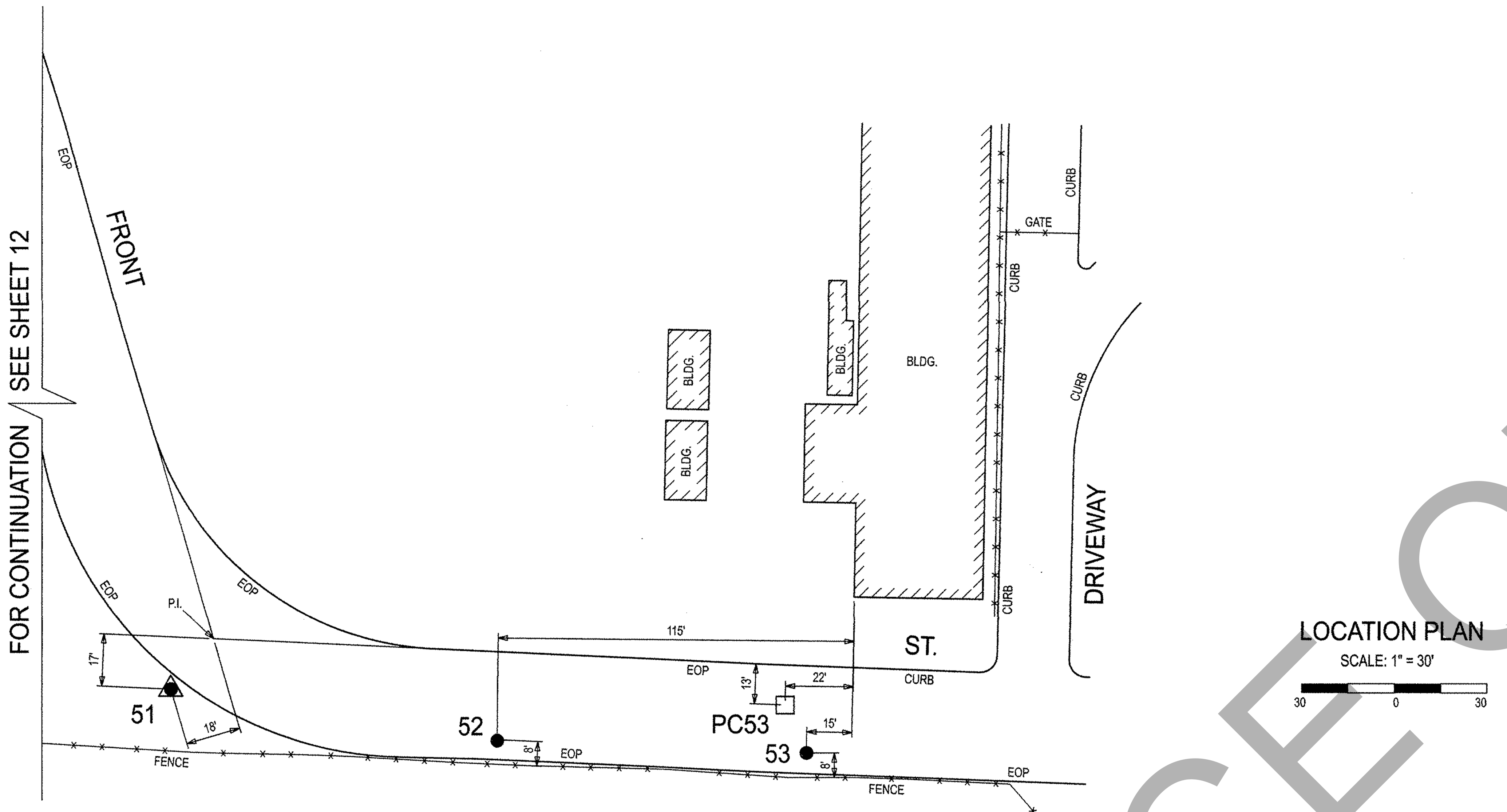
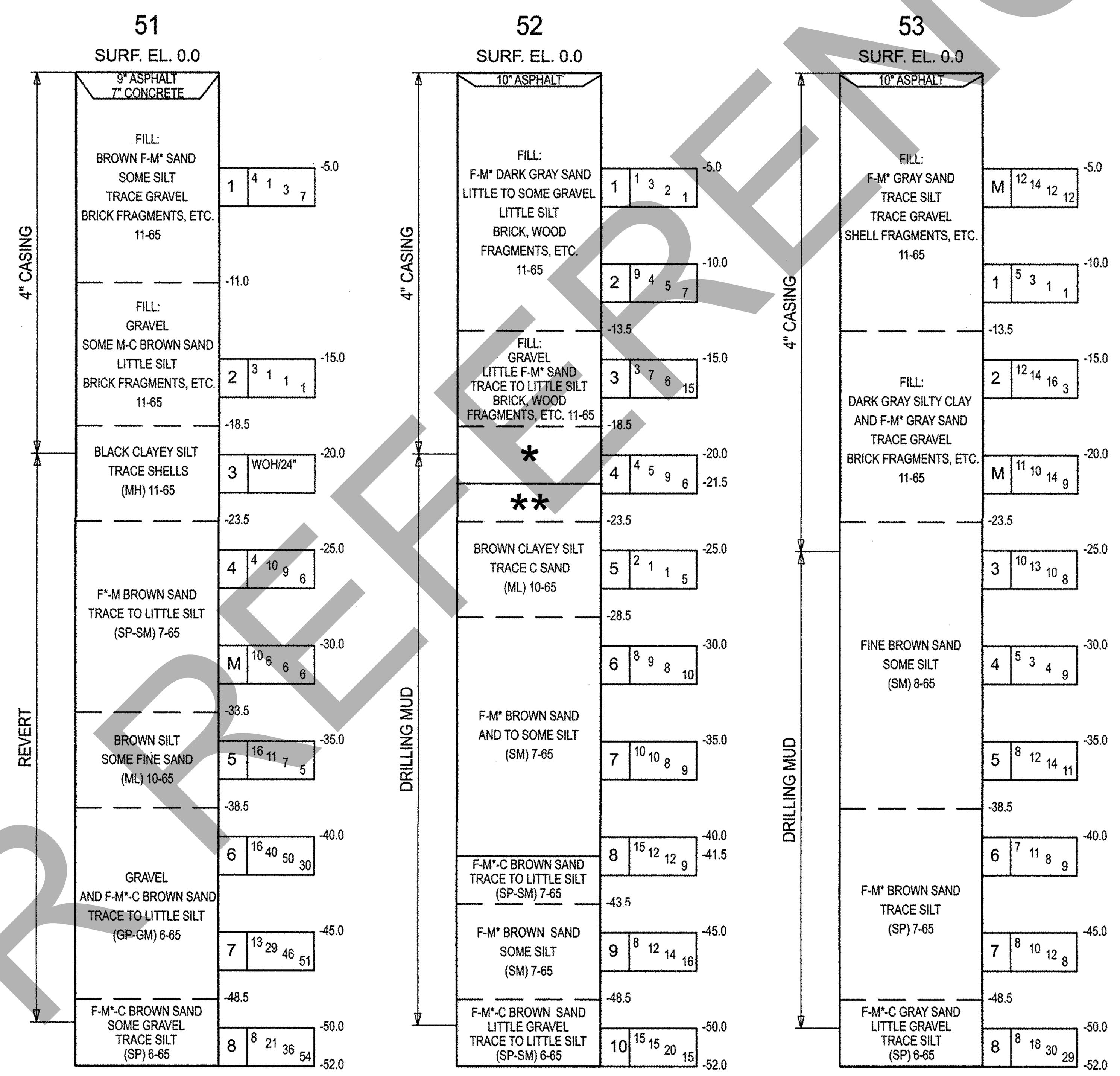


LOCATION PLAN
SCALE: 1" = 30'



WELLPOINT INSTALLED TO A DEPTH OF 20 FEET
GROUND WATER OBSERVATIONS FOR WELLPOINT

DATE	TIME	DEPTH, FT
04/10/07	12:20 PM	6.2
04/11/07	12:30 PM	6.2
04/13/07	8:05 AM	5.7
04/17/07	10:05 AM	4.0
04/20/07	7:20 AM	4.7
05/17/07	1:37 PM	5.3
05/22/07	2:30 PM	5.6
06/04/07	9:05 AM	5.5

* F-M*-C DARK BROWN SAND LITTLE GRAVEL TRACE TO LITTLE SILT (SP-SM) 11-65 POSSIBLE FILL

** FINE BROWN SAND TRACE TO LITTLE SILT (SP-SM) 8-65

Note: Variations of groundwater readings are likely due to tidal fluctuations from the adjacent bay.

"Unauthorized alteration or addition to an engineering drawing bearing a licensed professional engineer's seal is a violation of Article 145, Section 7209, Paragraph 2 of the New York State Education Law."

LEGEND

- ● TEST BORING
- ○ TEST BORING (FAILED ATTEMPT)
- PREVIOUSLY DONE TEST BORING (see job as noted)
- ▲ TEST BORING WITH OBSERVATION WELL
- □ PAVEMENT CORE
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FRONT STREET
FROM BAY ST. AND VANDERBILT AVE. TO HANNAH ST.
BOROUGH OF STATEN ISLAND

RECORD OF BORINGS

DATE	SCALE	SHEET
JULY 11, 2007	AS SHOWN	13 OF 13

DRAFTPERSON SCOTT HALM
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DIVISION OF TECHNICAL SUPPORT

NO.	DATE	DESCRIPTIONS	APPR'D

REVISIONS

Appendix B

Borehole Logs

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. **P2-B1 (1)** PROJECT NO. **15040**
PROJECT: NYCEDC - Stapleton
BORING STATION: OFFSET:

CLIENT: ARUP
G. SURF EL. (ft) 8.00 COORDINATES:

SAMPLER: 2" Split Spoon SAMPLER HAMMER: 140 lb DATUM: NORTHING: EASTING:
CASING SIZE: 4 inch CASING HAMMER: 140 lb

ROCK CORE: RIG TYPE: CME 850-XR
FINAL BORING DEPTH: 1 ft BORING CO.: Craig Geotechnical Drilling Co., Inc.
DATE START: 1/5/2016 FORMAN: Eric Delmeier
DATE END: 1/5/2016 ENGINEER: Scott Mermelstein

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
			4 IN	

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 1**	15	50/4"		**5/12**			Moist, Very dense dark grey, fine GRAVEL, some f-c Sand, trace Silt (GP)	FILL	Concrete obstruction at 1 ft - Refusal

1) Water level reading have been made at times and under condtions stated. Fluctuation of groundwater levels may occur due to other factors than those present at the time measurements were made.
2) Stratification lines represent approximate boundaries between soil and rock types, transitions may be gradual.
Inspector: Scott Mermelstein

BORING NO. **P2-B1 (1)**

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. P2-B1 (2)		PROJECT NO. 15040	
PROJECT: NYCEDC - Stapleton			
BORING STATION:		OFFSET:	
CLIENT: ARUP		G. SURF EL. (ft) 8.00	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb	GROUND WATER READINGS	
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/5/2016	FORMAN: Eric Delmeier		
DATE END: 1/6/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/5/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0		0				/					Drilled through to 2 ft depth
2	S-1	2 - 4	4	5		1/24		0.0	Moist, loose grey, fine GRAVEL, trace f-c Sand, trace		Sample not collected
			5	6	10				Clayey Silt (GP)		
4	S-2	4 - 6	3	2		4/24		0.1	Moist, very loose dark grey, fine GRAVEL, some f-c		
			1	2	3				Sand, trace Silt (GP)		
6	S-3	6 - 8	3	2		8/24		0.3	Same as above	FILL	Groundwater encountered~8'
			2	2	4						
8	S-4	8 - 10	2	2		4/24		0.0	Wet, very loose dark grey, f-c SAND, some fine	8 ft	
			2	2	4				Gravel, little Silt (SM)		
10	S-5	10 - 12	2	2		9/24		1.0	Wet, very loose dark grey, f-c SAND, some f-c Gravel,		
			1	1	3				little Silt (SM)		
15	S-6	15 - 17	3	3		0/24		N/A	No recovery		Depth of strata change unidentifiable due to no sample recovery at depths of 15 ft to 22 ft
			2	1	5					NR	
20	S-7	20 - 22	2	1		0/24		N/A	No recovery		
			1	2	2						
25	S-8	25 - 27	2	1		5/24		2.0	Wet, very loose dark grey, fine GRAVEL, some f-c	GM	
			1	1	2				SAND, little Clayey Silt (GM)		
30	S-9	30 - 32	7	5		6/24		1.1	Wet, medium dense brown, f-c SAND, some Gravel,	SW	
			17	14	22				trace Silty Clay (SW)		
35	S-10	35 - 37	7	14		3/24		1.1	Wet, medium dense brown, fine GRAVEL, little f-c		
			14	16	28				Sand, trace Silty Clay (GP)	GP	
38	S-11	38 - 40	19	17		10/24		0.4	Wet, dense brown, fine GRAVEL and f-c SAND, trace		
			16	23	33				Silty Clay (GP)		

1) Water level reading have been made at times and under condtions stated. Fluctuation of groundwater levels may occur due to other factors than those present at the time measurements were made.
2) Stratification lines represent approximate boundaries between soil and rock types, transitions may be gradual.
Inspector: Scott Mermelstein

BORING NO. P2-B1 (2)

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. **P2-B2** PROJECT NO. **15040**

PROJECT: NYCEDC - Stapleton

BORING STATION: OFFSET:

CLIENT: ARUP

G. SURF EL. (ft) 8.00 COORDINATES:

SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb		
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/5/2016	FORMAN: Eric Delmeier		
DATE END: 1/5/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/5/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	30	17		**17/24**			Moist, Dense dark grey, fine GRAVEL, some f-c Sand,		
			14	18	**31**				trace Silt (GP-GM Fill)		
2	**S-2**	**2 - 4**	21	24		**14/24**			Moist, Dense dark grey, f-c SAND, some fine Gravel,		
			17	15	**41**				trace Clayey Silt (SW Fill)		
4	**S-3**	**4 - 6**	9	7		**5/24**			Moist, Dense dark grey, fine GRAVEL, trace f-c Sand,		Brick fragments
			7	6	**14**				trace Clayey Silt (GP fill)		
6	**S-4**	**6 - 8**	7	5		**9/24**			Same as above		
			4	4	**9**						
8	**S-5**	**8 - 10**	3	7		**9/24**			Same as above	8 ft	Groundwater encountered~8'
			15	13	**22**					FILL	
10	**S-6**	**10 - 12**	6	4		**0/24**			No recovery		
			4	4	**8**						
15	**S-7**	**15 - 17**	2	3		**5/24**			Wet, Medium dense grey, fine GRAVEL, some f-c		Fragments of Brick, wood and
			8	4	**11**				Sand, trace Clayey Silt (GP fill)		charcoal
20	**S-8**	**20 - 22**	2	2		**0/24**			No recovery	NR	Depth of strata change unidentifiable due to no sample recovery at depths of 20 ft to 22 ft
			2	2	**4**						
25	**S-9**	**25 - 27**	WOH	1		**3/24**			Wet, Very loose grey, Silty CLAY and fine GRAVEL,	CL	
			WOH	4	**0**				trace f-c Sand (CL)		
30	**S-10**	**30 - 32**	4	5		**6/24**			Wet, Medium dense brown, f-c SAND, some Clayey		
			7	6	**12**				Silt, trace Gravel (SM)	SM	
35	**S-11**	**35 - 37**	6	6		**0/24**			No recovery		Depth of strata change unidentifiable due to no sample recovery at depths of 35 ft to 37 ft
			5	6	**11**					CL-ML	
38	**S-12**	**38 - 40**	7	9		**11/24**			Wet, Very stiff brown, Clayey SILT, trace f-c Sand		
			10	8	**19**				(CL-ML)		

1) Water level reading have been made at times and under condtions stated. Fluctuation of groundwater levels may occur due to other factors than those present at the time measurements were made.
2) Stratification lines represent approximate boundaries between soil and rock types, transitions may be gradual.
Inspector: Scott Mermelstein

BORING NO. **P2-B2**

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. P2-B3			PROJECT NO. 15040		
PROJECT: NYCEDC - Stapleton					
BORING STATION:			OFFSET:		
CLIENT: ARUP		G. SURF EL. (ft) 8.50	COORDINATES:		
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING:	EASTING:	
CASING SIZE: 4 inch	CASING HAMMER: 140 lb	GROUND WATER READINGS			
ROCK CORE:	RIG TYPE: CME 850-XR	DATE	TIME	DEPTH (FT)	CASING / STABILIZATION TIME
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.	1/3/2016		8	4 IN / 0
DATE START: 1/6/2016	FORMAN: Eric Delmeier				
DATE END: 1/6/2016	ENGINEER: Scott Mermelstein				

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	30		**42**	**18/24**	35	0.1	Moist, Very dense dark grey-brown, f-c SAND, some fine Gravel, trace Clayey Silt (SW Fill)		
2	**S-2**	**2 - 4**	16 / 15	15 / 21	**30**	**8/24**		0.1	Moist, Dense dark grey, f-c SAND, some fine Gravel, trace Clayey Silt (SW Fill)		
4	**S-3**	**4 - 6**	16 / 10	12 / 8	**22**	**4/24**		0.1	Same as above		
6	**S-4**	**6 - 8**	5 / 13	10 / 12	**23**	**8/24**		0.1	Same as above		
8	**S-5**	**8 - 10**	7 / 6	5 / 5	**11**	**9/24**		0.2	Wet, Medium dense grey, f-c SAND, some fine Gravel, little Clayey Silt (SM Fill)	8 ft	Groundwater encountered~8'
10	**S-6**	**10 - 12**	2 / 5	1 / 5	**6**	**14/24**		0.6	Wet, Loose dark grey, fine GRAVEL, little f-c SAND, trace Clayey Silt (GP, Fill)	FILL	Brick fragments
15		**15 - 17**	1 / 1	1 / 1	**2**	**2/24**		1.4	Wet, Very loose dark grey, fine GRAVEL, trace f-c Sand, trace Silt (GP Fill)		Sample not collected
20	**S-7**	**20 - 22**	1 / WOH	WOH / WOH	**0**	**0/24**		0.1	No recovery		Depth of strata change unidentifiable due to no sample recovery at depths of 20 ft to 22 ft
25	**S-8**	**25 - 27**	4 / 7	6 / 7	**13**	**17/24**		0.3	Wet, Medium dense red-brown, f-c Sand, some Clayey Silt, trace fine Gravel (SM)	SM	
30	**S-9**	**30 - 32**	6 / 10	10 / 14	**20**	**19/24**		0.0	Wet, Very stiff red-brown, Clayey SILT, some f-c Sand, trace fine Gravel (ML)	ML	
35	**S-10**	**35 - 37**	10 / 16	11 / 12	**27**	**15/24**		0.7	Wet, Medium dense brown, f-c SAND, little Clayey Silt, trace fine Gravel (SM)	SM	
38	**S-11**	**38 - 40**	10 / 12	9 / 12	**21**	**11/24**		0.2	Wet, Medium dense red-brown, f-c SAND, little fine Gravel, trace Clayey Silt (SP)	SP	

1) Water level reading have been made at times and under condtions stated. Fluctuation of groundwater levels may occur due to other factors than those present at the time measurements were made.
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Inspector: Scott Mermelstein

BORING NO. **P2-B3**

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. **P2-B4**		PROJECT NO. **15040**	
PROJECT: NYCEDC - Stapleton			
BORING STATION:		OFFSET:	
CLIENT: ARUP		G. SURF EL. (ft) 8.50	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb	**GROUND WATER READINGS**	
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/4/2016	FORMAN: Eric Delmeier		
DATE END: 1/4/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/4/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	24	20		**18/24**			Moist, Dense dark brown, f-c SAND, some fine Gravel, trace Silt (SW Fill)		
			25	32	**45**						
2	**S-2**	**2 - 4**	20	23		**15/24**			Moist, Dense dark grey, f-c SAND, some Silt, trace fine Gravel (SM Fill)		Brick fragments
			25	20	**48**						
4	**S-3**	**4 - 6**	10	10		**15/24**			Moist, Medium dense dark grey, f-c SAND, little fine Gravel and Silt (SM Fill)	FILL	
			6	3	**16**						
6	**S-4**	**6 - 8**	3	3		**5/24**			Moist, Loose dark grey, f-c SAND, some fine Gravel, some Clayey Silt (SM Fill)		Wood fragments
			3	1	**6**						
8	**S-5**	**8 - 10**	2	2		**5/24**			Wet, Very loose dark grey, f-c SAND, little fine Gravel and Silt (SM)	8 ft	Groundwater encountered~8'
			1	1	**3**						
10	**S-6**	**10 - 12**	2	2		**6/24**			Wet, Loose dark grey, f-c SAND, some fine Gravel, little Silt (SM)		
			4	3	**6**						
										SM	
15	**S-7**	**15 - 17**	1	2		**3/24**			Wet, Very loose dark grey, f-c SAND, some Silt, trace fine Gravel (SM)		
			1	1	**3**						
20	**S-8**	**20 - 22**	1	1		**5/24**			Wet, Very loose brown, f-c SAND, trace Silt, trace fine Gravel (SP-SM)	SP-SM	Organic odor
			2	1	**3**						
25	**S-9**	**25 - 27**	1	7		**10/24**			Wet, Medium dense grey brown, f-m SAND, some Silty Clay (SC)	SC	
			7	7	**14**						
30	**S-10**	**30 - 32**	7	8		**15/24**			Wet, Medium dense brown, f-c SAND, little fine Gravel, little Silt (SM)	SM	
			10	11	**18**						
35	**S-11**	**35 - 37**	6	9		**11/24**			Wet, Medium dense brown, f-c SAND, little fine Gravel, trace Clayey Silt (SW)		
			9	16	**18**					SW	
38	**S-12**	**38 - 40**	10	11		**7/24**			Wet, Medium dense brown, f-c SAND, some fine Gravel, trace Clayey Silt (SW)		
			12	14	**23**						

1) Water level reading have been made at times and under condtions stated. Fluctuation of groundwater levels may occur due to other factors than those present at the time measurements were made.
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Inspector: Scott Mermelstein

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. **P2-B5** PROJECT NO. **15040**
PROJECT: NYCEDC - Stapleton
BORING STATION: OFFSET:

CLIENT: ARUP
G. SURF EL. (ft) 8.50 COORDINATES:
SAMPLER: 2" Split Spoon SAMPLER HAMMER: 140 lb DATUM: NORTHING: EASTING:
CASING SIZE: 4 inch CASING HAMMER: 140 lb
ROCK CORE: RIG TYPE: CME 850-XR
FINAL BORING DEPTH: 40 ft BORING CO.: Craig Geotechnical Drilling Co., Inc.
DATE START: 1/7/2016 FORMAN: Eric Delmeier
DATE END: 1/7/2016 ENGINEER: Scott Mermelstein

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/7/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	11	9		**19/24**		0.7	Moist, Medium dense dark brown, fine GRAVEL and		
			20	23	**29**				f-c SAND, trace Silt (GP-SW)		
2	**S-2**	**2 - 4**	15	15		**9/24**		0.2	Moist, Medium dense yellow brown, f-c SAND, some		
			10	8	**25**				fine Gravel, little Clayey Silt (SM Fill)		
4	**S-3**	**4 - 6**	5	4		**9/24**		0.2	Moist, Loose dark grey, fine GRAVEL, some f-c Sand,		
			2	3	**6**				trace Silt (GW Fill)		
6	**S-4**	**6 - 8**	2	3		**7/24**		0.1	Wet, Loose dark brown, f-c SAND, little fine Gravel,	FILL	
			1	4	**4**				trace Silt (SP Fill)		
8	**S-5**	**8 - 10**	2	2		**5/24**		0.3	Wet, Loose dark grey, fine GRAVEL, some f-c Sand,	8 ft	Groundwater encountered~8'
			5	2	**7**				trace Clayey Silt (GW Fill)		
10	**S-6**	**10 - 12**	2	3		**5/24**		0.2	Wet, Loose dark grey, fine GRAVEL, little f-c Sand,		Wood fragments
			2	7	**5**				trace Clayey Silt (GP Fill)		
15	**S-7**	**15 - 17**	23	20		**6/24**		0.1	Wet, Dense dark grey, fine Gravel, little f-c Sand,		
			19	12	**39**				trace Silt (GP)	GP	
20	**S-8**	**20 - 22**	14	12		**4/24**		0.1	Wet, Medium dense dark grey, fine GRAVEL, trace f-c		
			10	7	**22**				SAND, tracce Clayey Silt (GP)		
25	**S-9**	**25 - 27**	18	21		**0/24**		0.0	No recovery	NR	Depth of strata change unidentifiable due to no sample recovery at depths of 25 ft to 27 ft
			27	32	**48**						
30	**S-10**	**30 - 32**	13	18		**2/24**		0.0	Wet, Dense brown, fine GRAVEL, trace f-c Sand,		
			21	12	**39**				trace Clayey Silt (GP)	GP	
35	**S-11**	**35 - 37**	6	17		**4/24**		0.0	Wet, Dense brown,fine GRAVEL, little f-c Sand, trace		
			26	15	**43**				Clayey Silt (GP)		
38	**S-12**	**38 - 40**	4	4		**3/24**		0.0	Wet, Medium dense brown, fine GRAVEL, trace f-c		
			10	47	**14**				Sand, trace Clayey Silt (GP)		

1) Water level reading have been made at times and under condtions stated. Fluctuation of groundwater levels may occur due to other factors than those present at the time measurements were made.
2) Stratification lines represent approximate boundaries between soil and rock types, transitions may be gradual.
Inspector: Scott Mermelstein

BORING NO. **P2-B5**

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. **P2-B6 (1)** PROJECT NO. **15040**
PROJECT: NYCEDC - Stapleton
BORING STATION: OFFSET:

CLIENT: ARUP		G. SURF EL. (ft) 8.50	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb		
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/4/2016	FORMAN: Eric Delmeier		
DATE END: 1/4/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/4/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	9	12		**8/24**			Moist, Medium dense dark-grey, f-c SAND, little fine		
			15	12	**27**				Gravel, little Silt (SM Fill)		
2	**S-2**	**2 - 4**	6	7		**15/24**			Same as above		
			6	5	**13**						
4	**S-3**	**4 - 6**	5	4		**5/24**			Moist, Loose dark-grey, f-c SAND, little fine Gravel,		
			3	2	**7**				little Silt (SM Fill)		
6	**S-4**	**6 - 8**	1	1		**4/24**			Moist, Very loose dark-grey, f-c SAND, little fine		
			2	1	**3**				Gravel, little Silt (SM Fill)	FILL	
8	**S-5**	**8 - 10**	7	4		**6/24**			Wet, Medium dense dark-grey, f-c SAND, some	8 ft	Groundwater encountered~8',
			10	12	**14**				Clayey Silt, little fine Gravel (SM Fill)		organic odor
10	**S-6**	**10 - 12**	9	8		**12/24**			Wet, Medium dense dark-grey, f-c SAND, some		
			13	17	**21**				Clayey Silt, little fine Gravel (SM Fill)		
15		15				/					Obstruction at 15ft

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Inspector: Scott Mermelstein

BORING NO. **P2-B6 (1)**

BORING LOG

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425 Old Georges Road, North Brunswick, NJ 08902
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BORING NO. P2-B6 (2)		PROJECT NO. 15040	
PROJECT: NYCEDC - Stapleton			
BORING STATION:		OFFSET:	
CLIENT: ARUP		G. SURF EL. (ft) 8.50	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb		
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/4/2016	FORMAN: Eric Delmeier		
DATE END: 1/4/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/4/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0		0				/					Drill down to 15'
										8 ft	
15	S-7	15 - 17	15	16		6/24			Wet, Dense dark-grey, f-c SAND, some Clayey Silt, little fine Gravel (SM Fill)	FILL	Fragments of brick, wood, charcoal
			15	12	31						
20	S-8	20 - 22	1	2		8/24			Wet, Dense dark-grey, f-c SAND, some Clayey Silt, trace fine Gravel (SM Fill)		
			2	4	4						
25	S-9	25 - 27	1	3		0/24			No recovery	NR	Depth of strata change unidentifiable due to no sample recovery at depths of 25 ft to 27 ft
			3	4	6						
30	S-10	30 - 32	10	8		2/24			Wet, Medium dense brown, f-c SAND, some fine Gravel, trace Clayey Silt (SP)	SP	
			7	6	15						
35	S-11	35 - 37	9	9		7/24			Wet, Medium dense red-brown, f-c SAND, little fine Gravel, trace Clayey Silt (SP)		
			10	10	19						
38	S-12	38 - 40	6	7		8/24			Wet, Medium dense brown, f-c SAND, little fine Gravel, trace Clayey Silt (SP)		
			14	11	21						

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Inspector: Scott Mermelstein

BORING NO. P2-B6 (2)

BORING LOG

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425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. **P2-B7**	PROJECT NO. **15040**
PROJECT: NYCEDC - Stapleton	
BORING STATION:	OFFSET:

CLIENT: ARUP		G. SURF EL. (ft) 10.0	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb	**GROUND WATER READINGS**	
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/4/2016	FORMAN: Eric Delmeier		
DATE END: 1/5/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/4/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	15	10		**16/24**			Moist, Medium dense dark grey, f-c SAND, some fine		Brick fragments
			13	7	**23**				Gravel, trace Silt (SP Fill)		
2	**S-2**	**2 - 4**	7	18		**12/24**			Same as above		
			12	10	**30**						
4	**S-3**	**4 - 6**	7	6		**11/24**			Moist, Loose yellow-brown, f-c SAND, little fine		
			4	4	**10**				Gravel, little Clayey Silt (SM Fill)		
6	**S-4**	**6 - 8**	6	10		**7/24**			Same as above		
			11	4	**21**						
8	**S-5**	**8 - 10**	6	5		**7/24**			Wet, Loose dark grey, f-c SAND, some fine Gravel,	8 ft	Groundwater encountered~8'
			4	4	**9**				little Clayey Silt (SM Fill)	FILL	
10	**S-6**	**10 - 12**	6	3		**9/24**			Wet, Loose dark grey, f-c SAND, some Clayey Silt,		
			4	4	**7**				little fine Gravel (SM Fill)		
15	**S-7**	**15 - 17**	7	8		**10/24**			Wet, Medium dense dark grey, fine GRAVEL, some		Fragments of brick, wood, charcoal
			6	9	**14**				f-c Sand, trace Clayey Silt (GP Fill)		
20	**S-8**	**20 - 22**	4	5		**0/24**			No recovery	NR	Depth of strata change unidentifiable
			6	8	**11**						due to no sample recovery at depths
											of 20 ft to 22 ft
25	**S-9**	**25 - 27**	8	6		**4/24**			Wet, Medium dense dark grey, fine GRAVEL, trace f-c		
			5	7	**11**				Sand, trace Clayey Silt (GP)	GP	
30	**S-10**	**30 - 32**	10	12		**5/24**			Wet, Medium dense brown, fine GRAVEL, trace f-c		
			12	13	**24**				Sand, trace Clayey Silt (GP)		
35	**S-11**	**35 - 37**	17	15		**14/24**			Wet, Very stiff brown,Silty CLAY, little fine Gravel,	CL-CH	
			11	24	**26**				trace f-c Sand (CL/CH)		
38	**S-12**	**38 - 40**	5	11		**7/24**			Wet, Dense brown, fine GRAVEL, little f-c Sand, trace	GP	
			34	43	**45**				Clayey Silt (GP)		

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Inspector: Scott Mermelstein

BORING NO. **P2-B7**

BORING LOG

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425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. P2-B8 PROJECT NO. 15040
PROJECT: NYCEDC - Stapleton
BORING STATION: OFFSET:

CLIENT: ARUP
G. SURF EL. (ft) 9.50 COORDINATES:

SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb		
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/7/2016	FORMAN: Eric Delmeier		
DATE END: 1/7/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/7/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVERY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	9	18		**14/24**			Moist, Medium dense brown-dark grey, f-c SAND,		Brick fragments
			14	28	**32**				some fine Gravel, trace Silt (SP Fill)		
2	**S-2**	**2 - 4**	27	44		**17/24**			Moist, Very dense grey-brown, fine GRAVEL, some f-c		
			25	22	**69**				Sand, trace Silt (GP Fill)		
4	**S-3**	**4 - 6**	21	21		**17/24**			Same as above		
			17	11	**38**						
6	**S-4**	**6 - 8**	9	7		**8/24**			Top 7": Moist, Medium dense brown, fine GRAVEL,		
			4	6	**11**				some f-c Sand, trace Silt (GP Fill); Bot. 1": Wet,		
8	**S-5**	**8 - 10**	3	2		**6/24**			Medium dense red-brown, f-c SAND, little Clayey Silt,	8 ft	Groundwater encountered~8'
			5	1	**7**				trace fine Gravel (SM Fill)	FILL	
10	**S-6**	**10 - 12**	1	2		**8/24**			Wet, Loose dark grey, f-c SAND and GRAVEL, trace		
			2	2	**4**				Clayey Silt (SW-SM Fill)		
									Wet, Loose dark brown, f-c SAND, and f-c Gravel,		
									trace Clayey Silt (SP-SM Fill)		
15	**S-7**	**15 - 17**	16	10		**5/24**			Wet, Medium dense dark grey, f-c SAND and fine		
			6	4	**16**				GRAVEL, trace Clayey Silt (SP Fill)		
20	**ST-1**	**20 - 22**	1	WOH		**0/24**			Shelby tube - No recovery	NR	Attempt to take a shelby tube
			WOH	WOH	**0**						resulted in no recovery
25	**S-8**	**25 - 27**	4	7		**21/24**			Wet, Medium dense dark grey, f-c SAND, little fine	SM	
			6	6	**13**				Gravel, little Clayey Silt (SM)		
30	**S-9**	**30 - 32**	9	8		**0/24**			No recovery	NR	Gravel stuck in tip of the sampler;
			11	15	**19**						Depth of strata change unidentifiable due to no sample recovery at depths of 30 ft to 32 ft
35	**S-10**	**35 - 37**	11	13		**4/24**			Wet, Medium dense brown-dark grey, f-c SAND and	SM	
			11	15	**24**				fine GRAVEL, little Clayey Silt (SM)		
38	**S-11**	**38 - 40**	25	25		**8/24**			Wet, Dense yellow-brown, f-c SAND, little fine Gravel,		
			17	20	**42**				little Clayey Silt (SM)		

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Inspector: Scott Mermelstein

BORING NO. P2-B8

BORING LOG

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425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. **P2-B9** PROJECT NO. **15040**

PROJECT: NYCEDC - Stapleton

BORING STATION: OFFSET:

CLIENT: ARUP

G. SURF EL. (ft) 9.00 COORDINATES:

SAMPLER: 2" Split Spoon | SAMPLER HAMMER: 140 lb | DATUM: | NORTHING: EASTING:

CASING SIZE: 4 inch | CASING HAMMER: 140 lb

ROCK CORE: | RIG TYPE: CME 850-XR

FINAL BORING DEPTH: 40 ft | BORING CO.: Craig Geotechnical Drilling Co., Inc.

DATE START: 1/8/2016 | FORMAN: Eric Delmeier

DATE END: 1/8/2016 | ENGINEER: Scott Mermelstein

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/8/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	35	39		**20/24**			Moist, Very dense brown-dark grey, fine GRAVEL and		Brick, coal fragments
			23	28	**62**				f-c SAND , trace Silt (GP Fill)		
2	**S-2**	**2 - 4**	21	15		**13/24**			Moist, Medium dense dark brown, f-c SAND, some		
			12	11	**27**				fine Gravel, trace Silt (SP Fill)		
4	**S-3**	**4 - 6**	4	7		**7/24**			Moist, Medium dense brown, f-c SAND, little Clayey		Fibrous
			4	2	**11**				Silt, trace fine Gravel (SM Fill)		
6	**S-4**	**6 - 8**	5	4		**10/24**			Moist, Loose brown, f-c SAND, some Silty Clay, little		Groundwater encountered ~8', wood
			3	1	**7**				fine Gravel (SM Fill)		in pieces
8	**S-5**	**8 - 10**	2	2		**10/24**			Wet, Loose dark grey-grey, f-c SAND, little Clayey Silt,	8 ft	
			3	6	**5**				trace fine Gravel (SM Fill)		
10	**S-6**	**10 - 12**	4	2		**18/24**			Wet, Loose dark grey, f-c SAND, little fine Gravel,		
			3	4	**5**				trace Clayey Silt (SP Fill)	FILL	
15	**S-7**	**15 - 17**	5	2		**0/24**			No recovery		
			1	2	**3**						
20	**S-8**	**20 - 22**	10	11		**16/24**			Wet, Medium dense grey, m-c SAND, little Silty Clay,		
			9	10	**20**				trace fine Gravel (SC Fill)		
25	**S-9**	**25 - 27**	1	1		**0/24**			No recovery	NR	Depth of strata change unidentifiable
			1	1	**2**						due to no sample recovery at depths
											of 25 ft to 27 ft
30	**S-10**	**30 - 32**	4	2		**7/24**			Wet, Medium stiff dark grey, Silty Organic CLAY (OH)	OH	Fragments of wood and organics
			4	7	**6**						
35	**S-11**	**35 - 37**	1	2		**9/24**			Wet, Loose dark grey, f-c SAND, trace fine Gravel,		
			3	5	**5**				trace Clayey Silt (SP)	SP	
38	**S-12**	**38 - 40**	3	6		**11/24**			Wet, Medium dense dark grey, f-c SAND, little fine		
			9	8	**15**				Gravel, trace Clayey Silt (SP)		

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Inspector: Scott Mermelstein

BORING NO. **P2-B9**

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. **P2-B10**	PROJECT NO. **15040**
PROJECT: NYCEDC - Stapleton	
BORING STATION:	OFFSET:
CLIENT: ARUP	
G. SURF EL. (ft) 7.00	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb
DATUM:	NORTHING: / EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb
ROCK CORE:	RIG TYPE: CME 850-XR
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.
DATE START: 1/8/2016	FORMAN: Eric Delmeier
DATE END: 1/8/2016	ENGINEER: Scott Mermelstein

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/8/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	24 21	50 6	**71**	**19/24**		0	Moist, Very dense brown-dark grey, f-c SAND, some fine Gravel, trace Clayey Silt (SP Fill)	FILL	Brick fragment, coal
2	**S-2**	**2 - 4**	9 9	8 10	**17**	**9/24**		0.1	Moist, Medium dense dark brown, f-c SAND, little fine Gravel, trace Clayey Silt (SP Fill)		Brick fragment
4	**S-3**	**4 - 6**	7 7	4 7	**11**	**11/24**		1.5	Moist, Medium dense dark brown, fine GRAVEL and f-c SAND, trace Clayey Silt (GP/SP Fill)		Brick fragment
6	**S-4**	**6 - 8**	4 4	5 8	**9**	**10/24**		0.1	Moist, Loose dark grey, f-c SAND, some fine Gravel, trace ClayeySilt (SP Fill)		
8	**S-5**	**8 - 10**	17 8	5 5	**13**	**6/24**		0.0	Wet, Medium dense dark grey, f-c SAND, some fine Gravel, trace Clayey Silt (SP Fill)	8 ft	Groundwater encountered~8', organic odor
10	**S-6**	**10 - 12**	3 3	4 3	**7**	**11/24**		0.0	Wet, Loose dark grey, f-c SAND, some fine Gravel, trace Clayey Silt (SP Fill)		
15	**S-7**	**15 - 17**	WOH 2	1 2	**3**	**9/24**		0.0	Wet, Very loose dark grey, f-c SAND, some Clayey Silt, little fine Gravel (SM)	SM	
20	**S-8**	**20 - 22**	3 2	3 3	**5**	**6/24**		0.0	Wet, Loose dark grey, f-c SAND, little fine Gravel, little Clayey Silt (SM)		
25	**S-9**	**25 - 27**	1 2	1 1	**3**	**13/24**		0.0	Wet, Loose dark grey, f-c SAND, little fine Gravel, little Silty Clay (SM)		
30	**S-10**	**30 - 32**	11 9	10 11	**19**	**0/24**		0.0	No recovery	NR	Gravel in tip; Depth of strata change unidentifiable due to no sample recovery at depths of 30 ft to 32 ft
35	**S-11**	**35 - 37**	6 11	9 12	**20**	**7/24**		0.0	Wet, Medium dense brown, fine GRAVEL and f-c SAND, trace Clayey Silt (SP/GP)	GP	
38	**S-12**	**38 - 40**	7 10	8 14	**18**	**5/24**		0.0	Wet, Medium dense brown, fine GRAVEL and f-c SAND, trace Clayey Silt (SP/GP)		

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2) Stratification lines represent approximate boundaries between soil and rock types, transitions may be gradual.
Inspector: Scott Mermelstein

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. P3-B1		PROJECT NO. 15040	
PROJECT: NYCEDC - Stapleton			
BORING STATION:		OFFSET:	
CLIENT: ARUP		G. SURF EL. (ft) 9.00	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb	GROUND WATER READINGS	
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/11/2016	FORMAN: Eric Delmeier		
DATE END: 1/11/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/11/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	9	28		**8/24**		0.0	Moist, Very dense dark grey, f-c SAND, some fine Gravel, trace Silt (SP Fill)		Obstruction at 1ft and drilled through
			50/4"								
2	**S-2**	**2 - 4**	29	26		**24/24**		0.1	Moist, Dense dark brown, f-c SAND, some fine Gravel, little Clayey Silt (SM Fill)		
			22	18	**48**						
4	**S-3**	**4 - 6**	32	20		**21/24**		0.0	Same as above		
			25	20	**45**						
6	**S-4**	**6 - 8**	20	17		**15/24**		0.1	Same as above	FILL	
			16	20	**33**						
8	**S-5**	**8 - 10**	8	4		**8/24**		0.0	Wet, Loose dark brown, f-c SAND, some fine Gravel, little Clayey Silt (SM Fill)	8 ft	Groundwater encountered~8'
			4	4	**8**						
10	**S-6**	**10 - 12**	3	5		**11/24**		0.0	Wet, Medium dense dark grey, f-c SAND, and fine Gravel, trace Silt (SW-SM, Fill)		
			7	8	**12**						
15	**S-7**	**15 - 17**	6	4		**5/24**		0.0	Wet, Loose dark grey, f-c SAND, little fine Gravel, little Silty Clay (SM)	SM	
			5	6	**9**						
20	**S-8**	**20 - 22**	3	3		**3/24**		0.0	Wet, Loose dark grey, fine GRAVEL, some f-c Sand, trace Clayey Silt (GP)	GP	
			4	3	**7**						
25	**S-9**	**25 - 27**	WH	WR		**24/24**		0.0	Wet, Very soft brown, Silty CLAY, some f-c Sand, trace fine Gravel (CL)	CL	
			WR	WR	**0**						
30	**S-10**	**30 - 32**	4	5		**4/24**		0.0	Wet, Meidum dense dark grey, fine GRAVEL, little f-c Sand, trace Clayey Silt (GP)	GP	
			7	3	**12**						
35	**S-11**	**35 - 37**	WH	WH		**24/24**		0.2	Wet, Very soft, dark grey-brown, Organic Silty CLAY (OH)	OH	Roots
			1	4	**0**						
38	**S-12**	**38 - 40**	1	2		**4/24**		0.5	Same as above.		
			2	2	**4**						

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Inspector: Scott Mermelstein

Page 1 of 1

BORING NO. P3-B1

BORING LOG

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BORING NO. P3-B2 PROJECT NO. 15040
PROJECT: NYCEDC - Stapleton
BORING STATION: OFFSET:

CLIENT: ARUP		G. SURF EL. (ft) 10.0	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb	GROUND WATER READINGS	
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/12/2016	FORMAN: Eric Delmeier		
DATE END: 1/12/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/12/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	7	12		**16/24**		0.0	Moist, Medium dense brown, f-c SAND, some fine		
			9	8	**21**				Gravel, trace Clayey Silt (SP Fill)		
2	**S-2**	**2 - 4**	13	15		**20/24**		0.0	Moist, Medium dense dark grey, f-c SAND, some fine		
			15	14	**30**				Gravel, little Clayey Silt (SM Fill)		
4	**S-3**	**4 - 6**	7	6		**17/24**		0.0	Same as above		
			5	4	**11**						
6	**S-4**	**6 - 8**	5	6		**12/24**		0.0	Same as above		
			6	5	**12**						
8	**S-5**	**8 - 10**	2	3		**14/24**		0.0	Wet, Loose dark brown, f-c SAND, some fine Gravel,	8 ft	Groundwater encountered~8'
			2	2	**5**				little Clayey Silt (SM Fill)	FILL	
10	**S-6**	**10 - 12**	2	9		**24/24**		0.0	Wet, Medium dense dark grey, fine GRAVEL, some		
			13	4	**22**				f-c Sand, trace Clayey Silt (GP Fill)		
15	**S-7**	**15 - 17**	2	3		**6/24**		0.0	Wet, Loose dark grey, fine GRAVEL, some f-c Sand,		Brick fragnments
			3	2	**6**				trace Clayey Silt (GP Fill)		
20	**S-8**	**20 - 22**	1	1		**0/24**		0.0	No recovery	NR	Depth of strata change unidentifiable
			WOH	WOH	**0**						due to no sample recovery at depths
22	**S-9**	**22 - 24**	N/A	N/A		**7/24**		0.0	Wet, Very loose dark grey, fine GRAVEL, some Silty		of 20 ft to 22 ft
			N/A	N/A	**0**				Clay, trace f-c Sand (GC)	GC	3" sampler
25	**S-10**	**25 - 27**	2	1		**12/24**		0.0	Wet, Soft dark grey, Silty CLAY, some f-c Sand, trace		12" wood in the spoon
			1	1	**2**				fine Gravel (CL)		
30	**S-11**	**30 - 32**	WOH	WOH		**24/24**		0.0	Wet, Very soft dark grey, Silty CLAY, little f-c Sand,		Organic odor
			1	2	**0**				trace fine Gravel (CL)	CL	
35	**S-12**	**35 - 37**	WOH	WOH		**24/24**		0.0	Wet, Very soft dark grey, Silty CLAY, little f-c Sand,		Roots
			1	4	**0**				trace fine Gravel (CL)		
38	**S-13**	**38 - 40**	1	2		**4/24**		0.0	Wet, Stiff dark grey, Silty CLAY, little f-c Sand, trace		
			2	2	**4**				fine Gravel (CL)		

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2) Stratification lines represent approximate boundaries between soil and rock types, transitions may be gradual.
Inspector: Scott Mermelstein

BORING NO. **P3-B2**

BORING LOG

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BORING NO. **P3-B3**		PROJECT NO. **15040**	
PROJECT: NYCEDC - Stapleton			
BORING STATION:		OFFSET:	
CLIENT: ARUP		G. SURF EL. (ft) 9.00	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb		
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/12/2016	FORMAN: Eric Delmeier		
DATE END: 1/12/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/12/2016		10	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	24	29		**17/24**		0.1	Moist, Very dense brown-grey, f-c SAND and fine GRAVEL, trace Clayey Silt (SP/GP Fill)		
			25	21	**54**						
2	**S-2**	**2 - 4**	18	20		**22/24**		0.1	Moist, Dense brown-grey, f-c SAND and fine GRAVEL, trace Clayey Silt (SP/GP Fill)	FILL	
			18	19	**38**						
4	**S-3**	**4 - 6**	16	17		**21/24**		0.1	Same as above		
			15	14	**32**						
6	**S-4**	**6 - 8**	15	9		**21/24**		0.1	Moist, Medium dense brown-grey, f-c SAND and fine GRAVEL, trace Clayey Silt (SP/GP)		
			10	8	**19**					SP	
8	**S-5**	**8 - 10**	8	8		**19/24**		0.0	Same as above		Bottom of the sample is wet, ground water encountered~10"
			10	7	**18**						
10	**S-6**	**10 - 12**	5	5		**10/24**		0.0	Wet, Loose dark grey, fine GRAVEL, some f-c Sand, trace Clayey Silt (GP)	10 ft	
			4	7	**9**					GP	
15	**S-7**	**15 - 17**	1	2		**16/24**		0.1	Wet, Very loose dark grey, f-c SAND, some Silty Clay, little fine Gravel (SC)		
			1	2	**3**					SC	
20	**S-8**	**20 - 22**	10	6		**0/24**		0.0	No recovery		Depth of strata change unidentifiable due to no sample recovery at depths of 20 ft to 22 ft
			7	7	**13**						
22	**S-9**	**22 - 24**	-	-		**8/24**		0.0	Wet, Very loose dark grey, fine GRAVEL, some Silty Clay, trace f-c Sand (GC)	GC	3" sampler
			-	-							
25	**S-10**	**25 - 27**	2	1		**12/24**		0.0	Top 6": Wet, Very loose dark grey, fine GRAVEL, little Sand, trace Clayey Silt (GP); Bot. 6": Wet, Very loose dark brown, f-c SAND, some Silty Clay, trace fine Gravel (SM)	GP	Wood pieces
			1	1	**2**					SM	
30	**S-11**	**30 - 32**	2	1		**1/24**		0.0	Wet, Very loose dark grey,fine GRAVEL, some Silty Clay, little f-c Sand (GM)	GM	
			1	3	**2**						
35	**S-12**	**35 - 37**	9	16		**12/24**		0.0	Wet, Medium dense red-brown, f-c SAND, some Clayey Silt, trace fine Gravel (SM)	SM	
			11	17	**27**						
38	**S-13**	**38 - 40**	6	6		**19/24**		0.0	Wet, Stiff red-brown, Silty CLAY, little f-c Sand, trace fine Gravel (CL)	CL	
			4	8	**10**						

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Inspector: Scott Mermelstein

BORING LOG

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BORING NO. P3-B4		PROJECT NO. 15040	
PROJECT: NYCEDC - Stapleton			
BORING STATION:		OFFSET:	
CLIENT: ARUP		G. SURF EL. (ft) 9.00	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb	GROUND WATER READINGS	
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/12/2016	FORMAN: Eric Delmeier		
DATE END: 1/12/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/13/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	S-1	0 - 2	14	25		14/24		0.1	Moist, Dense grey, f-c SAND, some fine GRAVEL,		
			12	7	37				little Clayey Silt (SM Fill)		
2	S-2	2 - 4	10	8		18/24		0.1	Moist, Medium dense grey, f-c SAND, some fine	FILL	
			8	17	16				GRAVEL, little Clayey Silt (SM Fill)		
4	S-3	4 - 6	20	25		24/24		0.2	Moist, Dense dark grey, fine GRAVEL, some f-c Sand,		
			24	25	49				trace Clayey Silt (GP Fill)		
6	S-4	6 - 8	20	16		13/24		0.1	Moist, Medium dense dark-grey, f-c SAND and fine	SP	Groundwater encountered~8'
			10	6	26				GRAVEL, trace Clayey Silt (SP)		
8	S-5	8 - 10	17	33		12/24		0.0	Wet, Dense grey, f-c GRAVEL and f-c SAND, some	8 ft SC	
			9	5	42				Silty Clay (SC)		
10	S-6	10 - 12	4	3		11/24		0.1	Wet, Loose dark grey, f-c SAND and Clayey SILT,	SM	
			3	6	6				little fine Gravel (SM)		
15	S-7	15 - 17	3	7		8/24		0.8	Wet, Medium dense dark grey, f-c SAND and fine	SP	PID value is the same as the
			9	4	16				GRAVEL, trace Clayey Silt (SP/GP)		background
20	S-8	20 - 22	11	8		4/24		0.0	Wet, Medium dense dark grey, fine GRAVEL, trace f-c	GP	
			4	2	12				Sand, trace Clayey Silt (GP)		
25	S-9	25 - 27	1	WH		10/24		0.0	Wet, Very loose dark grey,Silty CLAY, little fine	CL	
			WH	1	0				Gravel, little f-c Sand (CL)		
30	S-10	30 - 32	1	3		7/24		0.0	Wet, Loose red-brown, f-c SAND, some Silty Clay,		
			2	1	5				trace fine Gravel (SM)	SM	
35	S-11	35 - 37	2	2		18/24		0.0	Wet, Loose red-brown, f-c SAND, some Silty Clay,		
			3	6	5				trace fine Gravel (SM)		
38	S-12	38 - 40	5	5		18/24		0.0	Wet, Medium dense red-brown, f-c SAND, some Silty		
			6	7	11				Clay, trace fine Gravel (SM)		

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Inspector: Scott Mermelstein

BORING NO. P3-B4

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
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BORING NO. **P3-B5**		PROJECT NO. **15040**	
PROJECT: NYCEDC - Stapleton			
BORING STATION:		OFFSET:	
CLIENT: ARUP		G. SURF EL. (ft) 9.50	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb		
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/11/2016	FORMAN: Eric Delmeier		
DATE END: 1/11/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/11/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	2 / 12	6 / 17	**18**	**10/24**		0.0	Moist, Medium dense dark grey, fine GRAVEL and f-c SAND, little Clayey Silt (GM Fill)	FILL	
2	**S-2**	**2 - 4**	20 / 11	15 / 10	**26**	**18/24**		0.1	Moist, Medium dense dark grey, fine GRAVEL and f-c SAND, little Clayey Silt (GM Fill)	FILL	
4	**S-3**	**4 - 6**	8 / 4	6 / 4	**10**	**13/24**		0.0	Moist, Loose dark brown, fine GRAVEL, little f-c Sand, trace Clayey Silt (GP Fill)	FILL	Charcoal fragments
6	**S-4**	**6 - 8**	9 / 4	7 / 6	**11**	**8/24**			Moist, Medium dense brown, fine GRAVEL, some f-c Sand, trace Silt (GP Fill) Grading to wet	FILL	Groundwater encountered ~8'
8	**S-5**	**8 - 10**	1 / 1	2 / 2	**3**	**6/24**		0.0	Wet, Loose dark-brown, f-c SAND, little fine Gravel, trace Clayey Silt (SP Fill)	FILL (8 ft)	
10	**S-6**	**10 - 12**	2 / 2	2 / 3	**4**	**9/24**		0.0	Wet, Very loose dark grey, f-c SAND, some fine Gravel, trace Clayey Silt (SP Fill)	FILL	Brick fragments
15	**S-7**	**15 - 17**	2 / 5	1 / 5	**6**	**12/24**		0.0	Top 6": Wet, Medium stiff dark grey, Silty CLAY, little f-c Sand (CL/CH); Bot. 6": Wet, Loose dark grey, f-c SAND, little fine Gravel, tace Silty Clay (SP)	CL-CH / SP	
20	**S-8**	**20 - 22**	WH / 2	WH / 2	**0**	**7/24**		0.0	Wet, Soft dark grey, Silty CLAY, some f-c Sand, trace fine Gravel (CL)	CL	
25	**S-9**	**25 - 27**	WH / 1	1 / 2	**2**	**10/24**		0.0	Wet, Soft brown,Silty CLAY, little f-c Sand, trace fine Gravel (CL)	CL	
30	**S-10**	**30 - 32**	3 / 5	5 / 8	**10**	**15/24**		0.0	Wet, Stiff, Clayey SILT, trace f-c Sand (ML)	ML	
35	**S-11**	**35 - 37**	3 / 5	3 / 6	**8**	**18/24**		0.0	Wet,Stiff brown, Clayey SILT, trace f-c Sand (ML)	ML	
38	**S-12**	**38 - 40**	6 / 6	9 / 8	**15**	**16/24**		0.0	Same as above	ML	

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Inspector: Scott Mermelstein

BORING NO. **P3-B5**

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. **P3-B6**		PROJECT NO. **15040**	
PROJECT: NYCEDC - Stapleton			
BORING STATION:		OFFSET:	
CLIENT: ARUP		G. SURF EL. (ft) 9.00	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb	**GROUND WATER READINGS**	
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 70 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/13/2016	FORMAN: Eric Delmeier		
DATE END: 1/13/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/13/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	9	7		**16/24**		0.0	Moist, Medium dense dark grey, f-c SAND, some fine Gravel, trace Clayey Silt (SP Fill)	FILL	
			13	15	**20**						
2	**S-2**	**2 - 4**	22	13		**17/24**		0.0	Same as above		
			11	10	**24**						
4	**S-3**	**4 - 6**	7	5		**14/24**		0.0	Moist, Loose dark brown, f-c SAND, little fine Gravel, trace Clayey Silt (SP)		
			4	4	**9**						
6	**S-4**	**6 - 8**	4	3		**4/24**		0.0	Moist, Loose dark-brown, f-c SAND, little fine Gravel, trace Clayey Silt (SP)	SP	
			6	5	**9**						
8	**S-5**	**8 - 10**	7	4		**4/24**		0.0	Wet, Loose dark-brown, f-c SAND, little fine Gravel, trace Clayey Silt (SP)	8 ft	Groundwater encountered~8'
			3	2	**7**						
10	**S-6**	**10 - 12**	2	2		**0/24**		0.0	No recovery		Depth of strata change unidentifiable due to no sample recovery at depths of 10 ft to 12 ft
			3	2	**5**						
15	**S-7**	**15 - 17**	2	3		**2/24**		0.0	Wet, Loose dark grey, fine GRAVEL, trace f-c Sand and Clayey Silt (GP)	GP	
			4	3	**7**						
20	**S-8**	**20 - 22**	WOH	1		**24/24**		0.0	Wet, Soft dark grey, Clayey SILT (MH)	MH	Wood in cuttings
			2	2	**3**						
25	**S-9**	**25 - 27**	WOH	WOH		**4/24**		0.0	Wet, Stiff dark grey, Silty CLAY, little f-c Sand, trace fine Gravel (CH)	CH	
			WH	1	**0**						
30	**S-10**	**30 - 32**	1	1		**12/24**		0.0	Wet,Medium stiff red-brown, Silty CLAY, little fine Gravel, trace f-c Sand (CH)		
			6	8	**7**						
35	**S-11**	**35 - 37**	6	4		**19/24**		0.0	Wet,Medium stiff red-brown, Clayey SILT, little f-c Sand (ML)	ML	
			4	5	**8**						

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Inspector: Scott Mermelstein

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. **P3-B6** PROJECT NO. **15040**

PROJECT: NYCEDC - Stapleton

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
40	**S-12**	**40 - 42**	7	7		**18/24**		0.0	Wet, Stiff red-brown, Clayey SILT, some f-c Sand. trace fine Gravel (ML)	ML	
			8	11	**15**						
45	**S-13**	**45 - 47**	9	12		**11/24**		0.0	Wet, Hard red-brown, Clayey SILT, some f-c Sand. trace fine Gravel (ML)		
			24	16	**36**						
50	**S-14**	**50 - 52**	9			**0/24**		0.0	No recovery	NR	Gravel in tip of spoon; Depth of strata change unidentifiable due to no sample recovery at depths of 50 ft to 52 ft
					28						
52	**S-15**	**52 - 54**	N/A	N/A		**6/24**		0.0	Wet, Medium dense brown, fine GRAVEL, little f-c Sand, trace Calyey Silt (GP)	GP	3" spoon.
			N/A	N/A	**0**						
55	**S-16**	**55 - 57**	12	12		**7/24**		0.0	Wet, Medium dense brown, f-c SAND, some Clayey Silt, trace fine Gravel (SM)	SM	
			10	10	**22**						
58	**S-17**	**58 - 60**	22	25		**14/24**		0.0	Wet, Very dense yellow-brown, f-c SAND and fine GRAVEL, trace Clayey Silt (SP)	SP	
			29	27	**54**						
65	**S-18**	**65 - 67**	13	22		**9/24**		0.0	Wet, Dense yellow-brown, f-c SAND and fine GRAVEL, trace Clayey Silt (SP)		
			18	20	**40**						
68	**S-19**	**68 - 70**	9	28		**13/24**		0.0	Wet, Very dense yellow-brown, fine GRAVEL, some f-c Sand, trace Clayey Silt (GP)	GP	
			40	50/5"	**68**						

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Inspector: Scott Mermelstein

BORING NO. **P3-B6**

BORING LOG

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BORING NO. P3-B7	PROJECT NO. 15040
PROJECT: NYCEDC - Stapleton	
BORING STATION:	OFFSET:

CLIENT: ARUP		G. SURF EL. (ft) 9.00	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb	GROUND WATER READINGS	
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 40 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/15/2016	FORMAN: Eric Delmeier		
DATE END: 1/15/2016	ENGINEER: Scott Mermelstein		

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/15/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	6	11		**12/24**		0.0	Moist, Medium dense brown-grey, f-c SAND, some	FILL	Brick fragments
			11	10	**22**				fine Gravel, trace Clayey Silt (SP Fill)		
2	**S-2**	**2 - 4**	8	14		**16/24**		0.0	Moist, Dense dark grey, fine GRAVEL and f-c		Brick fragments
			14	10	**28**				SAND,trace Clayey Silt (SP Fill)		
4	**S-3**	**4 - 6**	10	6		**15/24**		0.0	Moist, Medium dense grey,f-c SAND, some fine		
			5	7	**11**				Gravel, trace Clayey Silt (SP Fill)		
6	**S-4**	**6 - 8**	4	2		**8/24**		0.0	Moist, Very loose grey,f-c SAND, some fine Gravel,		
			1	1	**3**				trace Clayey Silt (SP Fill)		
8	**S-5**	**8 - 10**	1	2		**3/24**		0.0	Same as above	8 ft	Groundwater encountered~8'
			WH	WH	**0**						
10	**S-6**	**10 - 12**	1	1		**4/24**		0.0	Same as above		
			1	1	**2**						
15	**S-7**	**15 - 17**	8	5		**8/24**		0.0	Wet, Loose dark grey, f-c SAND, some fine GRAVEL,	SW-SM	Wood pieces
			3	2	**8**				trace Clayey Silt (SW-SM)		
20	**S-8**	**20 - 22**	WH	WH		**19/24**		0.0	Wet, Very soft dark grey, Silty CLAY, trace f-c Sand,	CH	
			WH	WH	**0**				trace fine Gravel (CH)		
25	**S-9**	**25 - 27**	1	WH		**2/24**		0.0	Wet, Very loose grey, f-c SAND, some Clayey Silt,	SM	
			1	4	**0**				trace fine Gravel (SM)		
30	**S-10**	**30 - 32**	2	5		**23/24**		0.0	Wet, Medium stiff grey, Clayey SILT, trace f-c Sand	ML	
			2	6	**7**				(ML)		
35	**S-11**	**35 - 37**	8	6		**10/24**		0.0	Wet, Medium stiff red-brown, Clayey SILT, little f-c		
			5	7	**11**				Sand, trace fine Gravel (ML)		
38	**S-12**	**38 - 40**	5	7		**18/24**		0.0	Wet, Medium dense red-brown, f-c SAND, some Silty	SM	
			8	7	**15**				Clay, trace fine Gravel (SM)		

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2) Stratification lines represent approximate boundaries between soil and rock types, transitions may be gradual.
Inspector: Scott Mermelstein

BORING NO. **P3-B7**

BORING LOG

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BORING NO. **P3-B8**	PROJECT NO. **15040**
PROJECT: NYCEDC - Stapleton	
BORING STATION:	OFFSET:

CLIENT: ARUP		G. SURF EL. (ft) 8.50	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb		

GROUND WATER READINGS

		DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
ROCK CORE:	RIG TYPE: CME 850-XR					
FINAL BORING DEPTH: 70 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.	1/14/2016		8	4 IN	0
DATE START: 1/14/2016	FORMAN: Eric Delmeier					
DATE END: 1/14/2016	ENGINEER: Scott Mermelstein					

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	8	14		**16/24**		0.0	Moist, Medium dense dark grey, f-c SAND, some fine		
			11	15	**25**				Gravel, little Clayey Silt (SM Fill)		
2	**S-2**	**2 - 4**	14	17		**12/24**		0.0	Moist, Dense dark grey, f-c SAND, some fine Gravel,		Brick fragments
			14	15	**31**				little Clayey Silt (SM Fill)		
4	**S-3**	**4 - 6**	13	8		**10/24**		0.0	Moist, Medium dense grey, fine GRAVEL and f-c		Brick fragments
			5	3	**13**				SAND, trace Clayey Silt (SP Fill)		
6	**S-4**	**6 - 8**	2	1		**0/24**			No recovery		
			3	2	**4**						
8	**S-5**	**8 - 10**	9	35		**5/24**		0.0	Wood only	8 ft	Groundwater encountered ~8'
			10	3	**45**					FILL	
10	**S-6**	**10 - 12**	25	7		**4/24**		0.0	Wet, Dark grey, f-c SAND, some fine Gravel, little		Wood pieces
			5	4	**12**				Clayey Silt (SM Fill)		
15	**S-7**	**15 - 17**	10	2		**7/24**		0.0	Wet, Medium dense dark gray, f-c SAND and f-c		Decomposing serpentinite cobbles
			21	17	**23**				GRAVEL, trace Clayey Silt (SP-SM Fill)		and boulders
19		**19 - 20**				**/12**					Fill materials in soil cuttings while
20	**S-8**	**20 - 22**	2	5		**10/24**		0.0	Wet, Loose dark grey, fine GRAVEL, some f-c Sand,		drilling
			3	7	**8**				little Clayey Silt (GM)	GM	
25	**S-9**	**25 - 27**	55	5		**4/24**		0.0	Wet, Loose dark grey,f-c SAND, some fine Gravel,		
			2	3	**7**				trace Clayey Silt (SP)		
										SP	
29		**29 - 30**				**/12**					Wood pieces during drilling
30	**S-10**	**30 - 32**	5	5		**13/24**		0.0	Wet, Medium dense red-brown, f-c SAND, trace fine		
			7	9	**12**				Gravel, trace Clayey Silt (SP)		
35	**S-11**	**35 - 37**	5	12		**12/24**		0.0	Wet, Medium dense brown, f-c SAND, little Clayey		
			12	13	**24**				Silt, trace fine Gravel (SM)	SM	
										CL	

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Inspector: Scott Mermelstein

BORING NO. **P3-B8**

BORING LOG

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BORING NO. **P3-B8** PROJECT NO. **15040**

PROJECT: NYCEDC - Stapleton

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
40	**S-12**	**40 - 42**	4	7		**17/24**		0.0	Wet, Medium dense red-brown, Silty CLAY, little f-m Sand (CL)	CL	
			4	9	**11**						
45	**S-13**	**45 - 47**	9	9		**10/24**		0.0	Wet, Very stiff brown, Clayey SILT, little f-c Sand, trace fine Gravel (ML)	ML	
			13	10	**22**						
50	**S-14**	**50 - 52**	6	9		**16/24**		0.0	Wet, Medium dense red-brown,f-c SAND, little Clayey Silt, trace fine Gravel (SM)	SM	
			12	20	**21**						
55	**S-15**	**55 - 57**	14	20		**16/24**		0.0	Wet, Medium dense brown, f-c SAND, little Clayey Silt, trace fine Gravel (SM)		
			32	25	**52**						
60	**S-16**	**60 - 62**	16	22		**15/24**		0.0	Wet, Dense red-brown, f-c SAND, some Clayey Silt, trace fine Gravel (SM)		
			25	23	**47**						
65	**S-17**	**65 - 67**	21	30		**17/24**		0.0	Wet, Very dense brown, f-c SAND, little Clayey Silt, trace fine Gravel (SM)		
			35	41	**65**						
68	**S-18**	**68 - 70**	18	30		**18/24**		0.0	Wet, Very dense brown, f-c SAND, little Clayey Silt, trace fine Gravel (SM)		
			35	35	**65**						

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Inspector: Scott Mermelstein

BORING NO. **P3-B8**

BORING LOG

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BORING NO. P3-B9		PROJECT NO. 15040	
PROJECT: NYCEDC - Stapleton			
BORING STATION:		OFFSET:	
CLIENT: ARUP		G. SURF EL. (ft) 8.50	COORDINATES:
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: EASTING:
CASING SIZE: 4 inch	CASING HAMMER: 140 lb	GROUND WATER READINGS	
ROCK CORE:	RIG TYPE: CME 850-XR		
FINAL BORING DEPTH: 70 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 1/15/2016	FORMAN: Eric Delmeier		
DATE END: 1/15/2016	ENGINEER: Scott Mermelstein		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/15/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	8	17		**16/24**		0.0	Moist, Dense dark grey, f-c SAND, some fine Gravel,		Brick fragments
			15	26	**32**				little Clayey Silt (SM Fill)		
2	**S-2**	**2 - 4**	15	14		**12/24**		0.0	Top 9": brick only; Bot. 6": Moist, Medium dense dark		Brick fragments
			12	12	**26**				brown, f-c SAND, some fine Gravel, little Clayey Silt		
4	**S-3**	**4 - 6**	9	6		**10/24**		0.0	(SP Fill)		
			5	4	**11**				Moist, Medium dense grey-brown, f-c SAND, some		
6	**S-4**	**6 - 8**	4	2		**0/24**		0.0	Clayey Silt, trace fine Gravel (SM)		Bottom of the sample is Wet,
			4	3	**6**				Wet, Medium dense grey-brown, f-c SAND, some		groundwater encountered~8'
8	**S-5**	**8 - 10**	3	5		**5/24**		0.0	Clayey Silt, trace fine Gravel (SM Fill)	8 ft FILL	Brick fragments
			3	4	**8**				Same as above		
10	**S-6**	**10 - 12**	10	3		**4/24**		0.0	Same as above		Brick fragments
			3	3	**6**						
15	**S-7**	**15 - 17**	4	2		**7/24**		0.0	Wet, Loose dark grey, f-c SAND, some fine Gravel,		
			1	2	**3**				little Clayey Silt (SM Fill)		
19		**19 - 20**				**/12**					Silt during drilling
20	**S-8**	**20 - 22**	N/A	N/A		**10/24**			Put a shelby tube.		
			N/A	N/A	**0**						
25	**S-9**	**25 - 27**	WH	3		**4/24**		0.0	Wet, Medium stiff red-brown, Silty CLAY, little f-c	CL-CH	
			4	5	**7**				SAND, trace fine Gravel (CH/CL)		
30	**S-10**	**30 - 32**	3	5		**13/24**		0.0	Wet, Stiff red-brown, Silty CLAY, little f-c SAND, trace		
			5	6	**10**				fine Gravel (CH/CL)		
35	**S-11**	**35 - 37**	9	15		**12/24**		0.0	Wet, Medium dense red-brown, f-c SAND, little fine	SM	
			14	11	**29**				Gravel and Clayey Silt (SM)		

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Inspector: Scott Mermelstein

BORING NO. P3-B9

BORING LOG

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BORING NO. **P3-B9** PROJECT NO. **15040**

PROJECT: NYCEDC - Stapleton

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY/RUN	RQD (%)	PID	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
40	**S-12**	**40 - 42**	6	6		**17/24**		0.0	Wet, Medium dense red-brown, f-c SAND, some Clayey Silt, trace fine Gravel (SM)	SM	
			7	11	**13**						
45	**S-13**	**45 - 47**	5	9		**10/24**		0.0	Wet, Medium dense red-brown, f-c SAND and CLAYEY SILT, trace fine Gravel (SM)		
			6	9	**15**						
50	**S-14**	**50 - 52**	3	8		**16/24**		0.0	Wet, Medium dense red-brown, f-c SAND, some Clayey Silt, trace fine Gravel (SM)		
			12	15	**20**						
55	**S-15**	**55 - 57**	10	23		**16/24**		0.0	Wet, Very dense red-brown, f-c SAND, some fine Gravel, trace Clayey Silt (SP)	SP	
			37	30	**60**						
60	**S-16**	**60 - 62**	12	20		**15/24**		0.0	Wet, Dense yellow-brown, f-c SAND, some fine Gravel, trace Clayey Silt (SP)		
			27	33	**47**						
65	**S-17**	**65 - 67**	21	25		**17/24**		0.0	Wet, Dense brown, f-c SAND, trace fine Gravel, trace Clayey Silt (SP)		
			25	31	**50**						
68	**S-18**	**68 - 70**	16	25		**18/24**		0.0	Wet, Very dense yellow-brown, f-c SAND, trace fine Gravel, trace Clayey Silt (SP)		
			33	34	**58**						

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Inspector: Scott Mermelstein

BORING LOG

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BORING NO. **P3-B11**		PROJECT NO. **15040**	
PROJECT: NYCEDC - Stapleton			
BORING STATION:		OFFSET:	
CLIENT: ARUP		G. SURF EL. (ft) 8.50	COORDINATES: 40.6304740, -74.0731280
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: 168983.529 EASTING: 963951.864
CASING SIZE: 4 inch	CASING HAMMER: 140 lb	**GROUND WATER READINGS**	
ROCK CORE:	RIG TYPE: CME-75 Truck Mount		
FINAL BORING DEPTH: 77 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 5/5/2016	FORMAN: Dave Cooke		
DATE END: 5/5/2016	ENGINEER: Peijun Shentu		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
5/5/2016	8:30:00 AM	8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY (IN)	RQD (%)	PID (PPM)	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0		**0 - 1**							1' asphalt.	ASPHALT	Bricks fragments and debris.
	S-1	**1 - 2**	9	19		**10**		0.0	Dark gray f-c SAND, and fine Gravel, trace Clayey Silt, dry. Medium dense (SP, Fill).		
2	**S-2**	**2 - 4**	11	10		**17**		0.0	Dark gray f-c SAND, and fine Gravel, trace Clayey Silt, dry. Loose (SP, Fill).		Bricks fragments and debris.
			6	4	**16**						
4	**S-3**	**4 - 6**	5	3		**5**		0.0	Dark gray f-c SAND, and fine Gravel, trace Clayey Silt, moist. Loose (SP, Fill).		Bricks fragments and debris.
			3	2	**6**						
6	**S-4**	**6 - 8**	3	1		**21**		0.0	Dark gray f-c SAND, and fine Gravel, trace Clayey Silt, moist to wet. Loose (SP, Fill).		Bricks fragments and debris. Groundwater encountered ~8'
			WOH	WOH	1						
8	**S-5**	**8 - 10**	1	3		**21**		0.0	Brown f-c SAND, little fine Gravel, trace Clayey Silt, wet. Loose (SP, Fill).	8 ft	
			4	4	**7**						
10	**S-6**	**10 - 12**	5	4		**3**		0.0	Dark gray fine GRAVEL, little f-c Sand, trace Clayey Silt, wet. Loose (GP, Fill).		Fill material washed out from 12 to
			4	3	**8**						
15	**S-7**	**15 - 17**	3	3		**11**		0.0	Same as above.	FILL	
			3	2	**6**						
20	**S-8**	**20 - 22**	1	1		**3**		0.0	Dark gray fine GRAVEL, trace f-c Sand, trace Clayey Silt, wet. Very loose (GP, Fill).		Bricks and mica washed out from 17' to 20'. 2" SPT no recovery, used 3" spoon.
			1	1	**2**						
25	**S-9**	**25 - 27**	1	1		**9**		0.0	Same as above.		
			1	WOH	**2**						
30	**S-10**	**30 - 32**	WOH	WOH		**21**		0.0	Black Clayey SILT, organic, little f-c Sand, wet. Very soft. (OH).	OH	Organic odor
			WOH	WOH	**0**						
32	**PS-1**	**32 - 34**						0.0	Sample collected in piston sampler.		
34	**S-11**	**34 - 36**	2	3		**4**		0.0	Dark gray f-c SAND, little Clayey Silt, some fine Gravel, wet. Loose (SM).	SM	Silty sand washed out from 36' to 40'.
			3	2	**6**						
										GP	

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2) Stratification lines represent approximate boundaries between soil and rock types, transitions may be gradual.
Inspector: Peijun Shentu

BORING NO. **P3-B11**

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. P3-B11 PROJECT NO. 15040

PROJECT: NYCEDC - Stapleton

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY (IN)	RQD (%)	PID (PPM)	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
40	**S-12**	**40 - 42**	4	5		**11**		0.0	Brown fine GRAVEL, little f-c Sand, trace Clayey Silt, wet.	GP	
			9	6	**14**				Medium dense (GP).		
45	**S-13**	**45 - 47**	5	6		**3**		0.0	Brown fine GRAVEL, and f-c Sand, trace Clayey Silt, wet.		
			6	6	**12**				Medium dense (GP).		
50	**S-14**	**50 - 52**	6	6		**12**		0.0	Brown f-c SAND, little fine Gravel, trace Clayey Silt, wet.	SP	
			6	6	**12**				Medium dense (SP).		
55	**S-15**	**55 - 57**	5	6		**11**		0.0	Same as above.		
			5	6	**11**						
60	**S-16**	**60 - 62**	8	9		**12**		0.0	Brown f-c SAND, trace fine Gravel, trace Silt, wet. Medium		
			12	10	**21**				dense (SP).		
65	**S-17**	**65 - 67**	9	10		**16**		0.0	Same as above.		
			13	15	**23**						
70	**S-18**	**70 - 72**	8	13		**14**		0.0	Same as above.		
			14	13	**27**						
75		**75 - 77**	10	40		**1**		0.0	Same as above.		Gravel in the tip cause little recovery, sample not collected. Final depth 77'.
			60/1"								

1) Water level reading have been made at times and under condtions stated. Fluctuation of groundwater levels may occur due to other factors than those present at the time measurements were made.
2) Stratification lines represent approximate boundaries between soil and rock types, transitions may be gradual.
Inspector: Peijun Shentu

BORING LOG

DISINCT ENGINEERING SOLUTIONS, INC.
425 Old Georges Road, North Brunswick, NJ 08902
Ph. (732) 658-1052 Fax (732) 398-1699 www.distinct-esi.com

BORING NO. **E-22/B-13**		PROJECT NO. **15040**	
PROJECT: NYCEDC - Stapleton			
BORING STATION:		OFFSET:	
CLIENT: ARUP		G. SURF EL. (ft) 8.50	COORDINATES: 40.6340340 , -74.0732830
SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb	DATUM:	NORTHING: 170280.568 EASTING: 963909.925
CASING SIZE: 4 inch	CASING HAMMER: 140 lb	**GROUND WATER READINGS**	
ROCK CORE:	RIG TYPE: CME-75 Truck Mount		
FINAL BORING DEPTH: 77 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.		
DATE START: 5/10/2016	FORMAN: Dave Cooke		
DATE END: 5/10/2016	ENGINEER: Peijun Shentu		

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
5/10/2016	8:30:00 AM	8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY (IN)	RQD (%)	PID (PPM)	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0		**0 - 1**							1' asphalt	ASPHALT	
1	**S-1**	**1 - 3**	10	13		**17**		0.0	Dark gray f-c SAND, some fine Gravel, trace Clayey Silt, moist. Medium dense (SP, Fill).		Brick in the tip
			11	12	**24**						
3	**S-2**	**3 - 5**	10	12		**10**		0.0	Same as above.		Brick fragments
			10	8	**22**						
5	**NR-1**	**5 - 7**	9	6		**0**		0.0	No recovery.		Gravel in the tip.
			4	7	**10**						
7	**S-3**	**7 - 9**	4	3		**10**		0.0	Brown f-c SAND, and fine Gravel, trace Clayey Silt, moist to wet. Medium dense (SP-GP Fill).		Groundwater encountered
			11	4	**14**						8 ft ~8', brick fragments and debris
9	**S-4**	**9 - 11**	4	5		**14**		0.0	Dark gray fine GRAVEL, some f-c Sand, trace Clayey Silt, wet. Loose (SP, Fill).	FILL	
			5	7	**10**						Debris
11	**S-5**	**11 - 13**	4	5		**9**		0.0	Dark gray f-c SAND, some fine Gravel, trace Clayey Silt, wet. Medium dense (SP, Fill).		2" brick in the tip, wood pieces
			7	4	**12**						
15	**S-6**	**15 - 17**	24	7		**9**		0.0	Same as above.		Brick fragments
			6	5	**13**						
20	**S-7**	**20 - 22**	7	4		**13**		0.0	Dark gray f-c SAND, some Clayey Silt, trace fine Gravel, wet. Loose (SM).	SM	Organic odor
			2	11	**6**						
25	**S-8**	**25 - 27**	8	6		**15**		0.0	Brown f-m SAND, trace Clayey Silt, wet. Medium dense (SP).	SP	Gravel in the tip, iron pieces washed out from 27' to 30'
			6	10	**12**						
30	**S-9**	**30 - 32**	3	3		**15**		0.0	Brown f-c SAND, some Clayey Silt, trace fine Gravel, wet. Loose (SM).		
			4	2	**7**					SM	
35	**S-10**	**35 - 37**	4	4		**18**		0.0	Same as above.		
			6	7	**10**						

1) Water level reading have been made at times and under condtions stated. Fluctuation of groundwater levels may occur due to other factors than those present at the time measurements were made.
2) Stratification lines represent approximate boundaries between soil and rock types, transitions may be gradual.
Inspector: Peijun Shentu

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BORING NO. **E-22/B-13** PROJECT NO. **15040**

PROJECT: NYCEDC - Stapleton

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY (IN)	RQD (%)	PID (PPM)	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
40	**S-11**	**40 - 42**	4	7		**14**		0.0	Brown f-c SAND, little Clayey Silt, trace fine Gravel. Medium dense (SM).		
			5	6	**12**						
										SM	
45	**S-12**	**45 - 47**	7	8		**20**		0.0	Same as above.		
			7	10	**15**						
50	**S-13**	**50 - 52**	5	7		**18**		0.0	Brown f-c SAND, little fine Gravel, trace Clayey Silt, wet. Medium dense (SP).	SP	
			9	10	**16**						
55	**S-14**	**55 - 57**	9	20		**7**		0.0	Brown fine GRAVEL, little f-c Sand, trace Clayey Silt, wet. Very dense (GP).	GP	
			40	24	**60**						
60	**S-15**	**60 - 62**	13	37		**18**		0.0	Brown f-c SAND, and fine Gravel, trace Clayey Silt, wet. Very dense (SP-GP).		
			32	20	**69**						
65	**S-16**	**65 - 67**	20	27		**18**		0.0	Brown f-c SAND, little Clayey Silt, trace fine Gravel, wet. Very dense (SP).		
			35	39	**62**					SP	
70	**S-17**	**70 - 72**	84	60/4"		**4**		0.0	Same as above.		
75	**S-18**	**75 - 77**	25	40		**16**		0.0	Same as above.		Final depth 77'
			33	27	**73**						

1) Water level reading have been made at times and under condtions stated. Fluctuation of groundwater levels may occur due to other factors than those present at the time measurements were made.
2) Stratification lines represent approximate boundaries between soil and rock types, transitions may be gradual.
Inspector: Peijun Shentu

BORING NO. **E-22/B-13**

BORING LOG

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BORING NO. **E-23/B-14** PROJECT NO. **15040**

PROJECT: NYCEDC - Stapleton

BORING STATION: OFFSET:

CLIENT: ARUP

G. SURF EL. (ft) 8.50 COORDINATES: 40.6354360, -74.0733220

SAMPLER: 2" Split Spoon	SAMPLER HAMMER: 140 lb
CASING SIZE: 4 inch	CASING HAMMER: 140 lb
ROCK CORE:	RIG TYPE: CME-75 Truck Mount
FINAL BORING DEPTH: 77 ft	BORING CO.: Craig Geotechnical Drilling Co., Inc.
DATE START: 5/11/2016	FORMAN: Dave Cooke
DATE END: 5/11/2016	ENGINEER: Peijun Shentu

DATUM:

NORTHING: 170791.363 EASTING: 963899.528

GROUND WATER READINGS

DATE	TIME	DEPTH (FT)	CASING	STABILIZATION TIME
1/8/2016		8	4 IN	0

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY (IN)	RQD (%)	PID (PPM)	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
0	**S-1**	**0 - 2**	21	28		**7**		0.0	Brown f-c SAND, some fine Gravel, trace Clayey Silt, dry.	FILL	Brick fragments and
			6	7	**34**				Dense (SP, Fill).		concrete
2	**S-2**	**2 - 4**	6	3		**14**		0.0	Brown f-c SAND, some fine Gravel, trace Clayey Silt, dry.		Brick fragments and
			3	7	**6**				Loose (SP, Fill).		debris
4	**S-3**	**4 - 6**	8	8		**12**		0.0	Dark gray f-C SAND, little fine Gravel, trace Clayey Silt,		Brick fragments, wood
			11	7	**19**				moist. Medium dense (SP, Fill).		pieces
6	**S-4**	**6 - 8**	6	5		**8**		0.0	Brown f-c SAND, some fine Gravel, trace Clayey Silt, moist		Bricks debris,
			8	6	**13**				to wet. Medium dense (SP, Fill).		groundwater
8	**S-5**	**8 - 10**	6	5		**2**		0.0	Brown fine GRAVEL, little f-c Sand, trace Clayey Silt, wet.	8 ft	encountered~8'
			3	3	**8**				Loose (GP, Fill).		Brick fragments and
10	**S-6**	**10 - 12**	4	3		**16**		0.0	Brown f-c SAND, little fine Gravel, trace Clayey Silt, wet.		debris
			3	2	**6**				Medium dense (SP, Fill).		
15	**S-7**	**15 - 17**	2	3		**12**		0.0	Top 8": same as above.		Organic odor
			1	WOH	**4**				4": Dark gray Clayey SILT, little f-c Sand, trace fine Gravel, wet. Soft (OL).	OL	
17	**PS-1**	**17 - 19**							Sample collected in piston sampler.		
19	**S-8**	**19 - 21**	3	8		**6**		0.0	Dark gray fine GRAVEL, little f-c Sand, trace Clayey Silt, wet.	GP	
			7	4	**15**				Medium dense (GP).		
25	**S-9**	**25 - 27**	5	4		**16**		0.0	Brown f-c SAND, some Clayey Silt, trace fine Gravel, wet.	SM	
			2	3	**6**				Loose (SM).		
30	**S-10**	**30 - 32**	2	3		**20**		0.0	Same as above.		
			2	4	**5**						
35	**S-11**	**35 - 37**	4	5		**17**		0.0	Brown f-c SAND, some Clayey Silt, trace fine Gravel, wet.		
			6	5	**11**				Medium dense (SM).		

1) Water level reading have been made at times and under condtions stated. Fluctuation of groundwater levels may occur due to other factors than those present at the time measurements were made.
2) Stratification lines represent approximate boundaries between soil and rock types, transitions may be gradual.
Inspector: Peijun Shentu

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BORING NO. **E-23/B-14** PROJECT NO. **15040**

PROJECT: NYCEDC - Stapleton

DEPTH(FT)	SAMPLE NO.	SAMPLE DEPTH	BLOWS PER 6 INCH		N VALUE	RECOVEY (IN)	RQD (%)	PID (PPM)	SAMPLE DESCRIPTION (BURMISTER or USCS)	STRATIGRAPHY	NOTES
40	**S-12**	**40 - 42**	4	4		**21**		0.0	Same as above.	SM	
			5	5	**9**						
45	**S-13**	**45 - 47**	3	15		**7**		0.0	Brown f-c SAND, little fine Gravel, trace Clayey Silt, wet.		
			15	18	**30**				Medium dense (SP).		
50	**S-14**	**50 - 52**	11	10		**8**		0.0	Same as above.		
			17	11	**27**						
55	**S-15**	**55 - 57**	12	12		**14**		0.0	Same as above.		
			14	21	**26**						
60	**S-16**	**60 - 62**	14	23		**18**		0.0	Brown f-c SAND, trace fine Gravel, trace Clayey Silt, wet.	SP	
			30	40	**53**				Medium dense (SP).		
65	**S-17**	**65 - 67**	19	33		**15**		0.0	Same as above.		
			41	44	**74**						
70	**S-18**	**70 - 72**	19	23		**16**		0.0	Same as above.		
			17	23	**40**						
75	**S-19**	**75 - 77**	30	25		**14**		0.0	Gray f-c SAND, some fine Gravel, trace Clayey Silt, wet.		Final depth 77'
			24	28	**49**				Dense (SP).		

1) Water level reading have been made at times and under condtions stated. Fluctuation of groundwater levels may occur due to other factors than those present at the time measurements were made.
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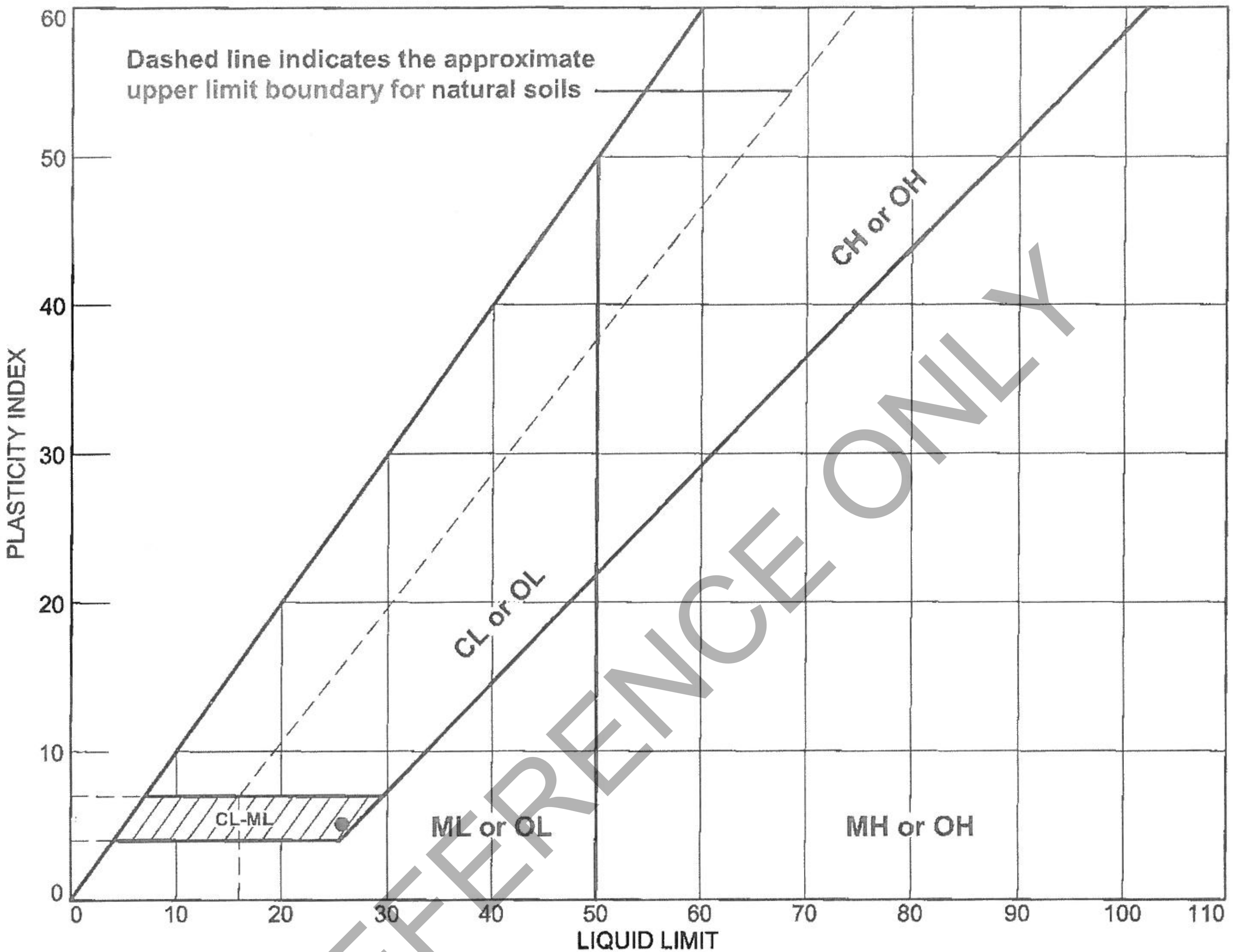
Inspector: Peijun Shentu

BORING NO. **E-23/B-14**

Appendix C

Laboratory Test Results

LIQUID AND PLASTIC LIMITS TEST REPORT



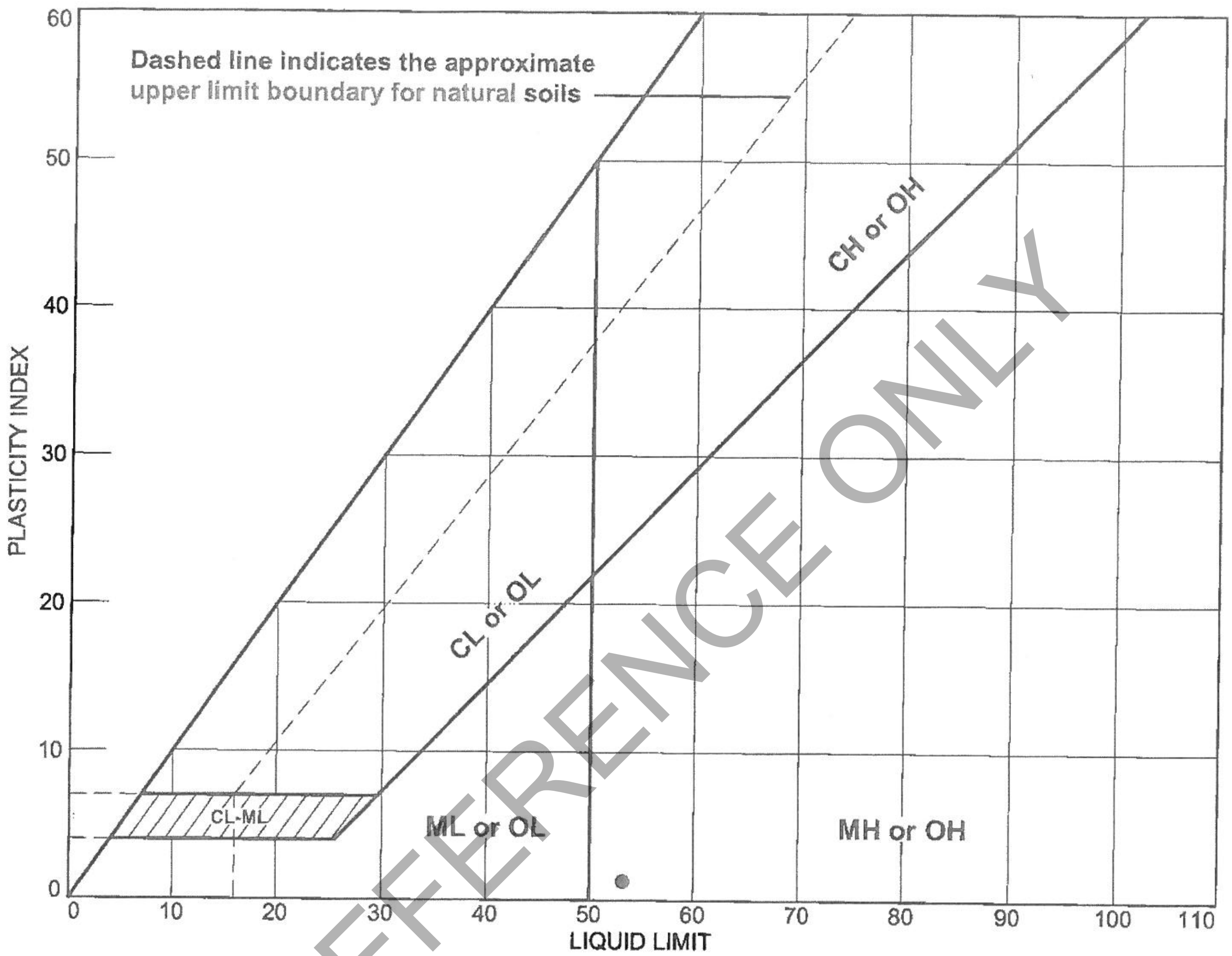
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	P2-B2	12	38-40	20.8	20.6	25.7	5.1	CL-ML

Distinct Engineering Solutions, Inc. **North Brunswick, NJ**	**Client:** ARUP **Project:** STAPLETON **Project No.:** 15040 **Figure**

Tested By: VA,SS **Checked By:** RT

LIQUID AND PLASTIC LIMITS TEST REPORT



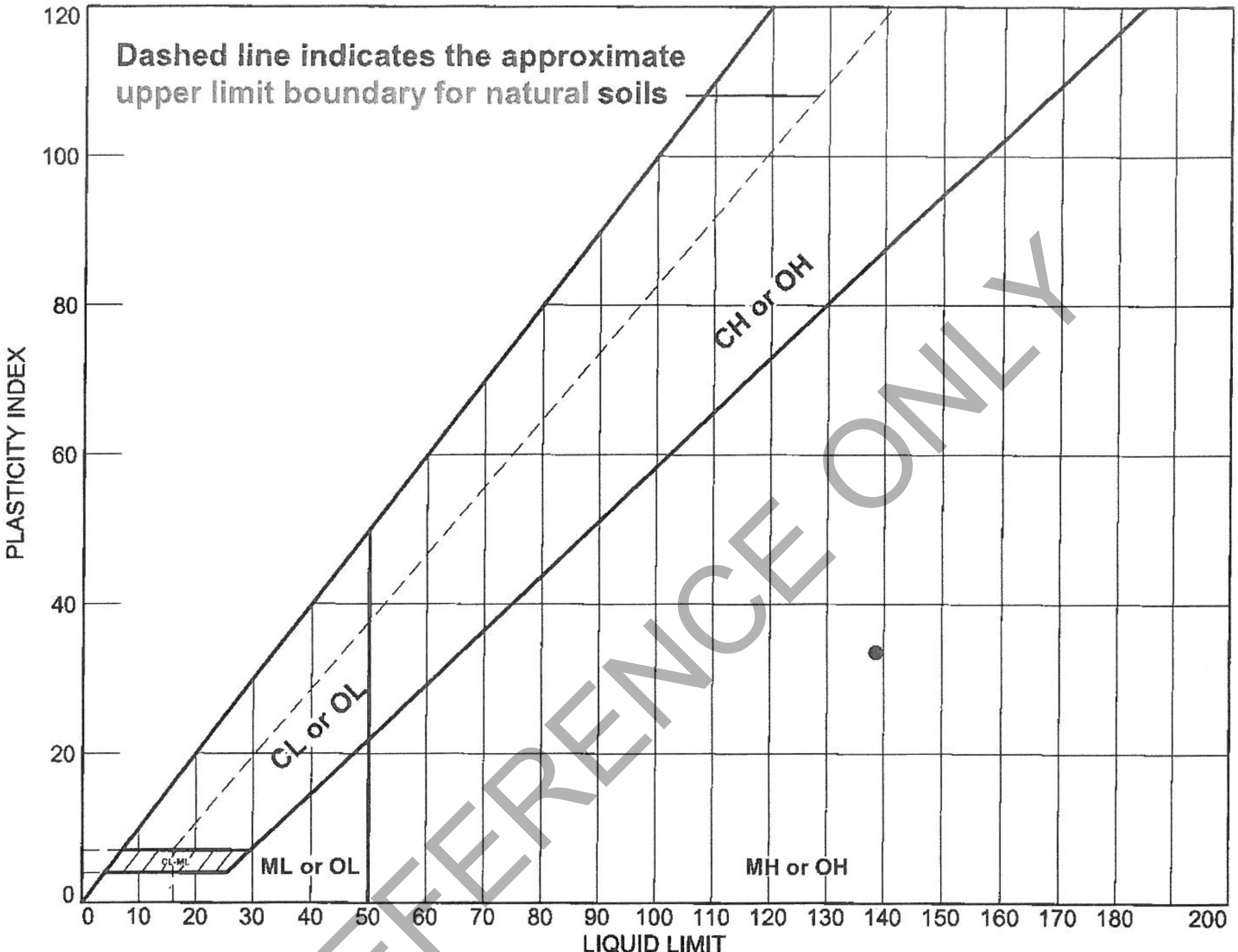
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	P2-B9	10	30-32	47.2	51.9	53.2	1.3	OH

Distinct Engineering Solutions, Inc. North Brunswick, NJ	**Client:** ARUP **Project:** STAPLETON **Project No.:** 15040 **Figure**

Tested By: VA,SS **Checked By:** RT

LIQUID AND PLASTIC LIMITS TEST REPORT



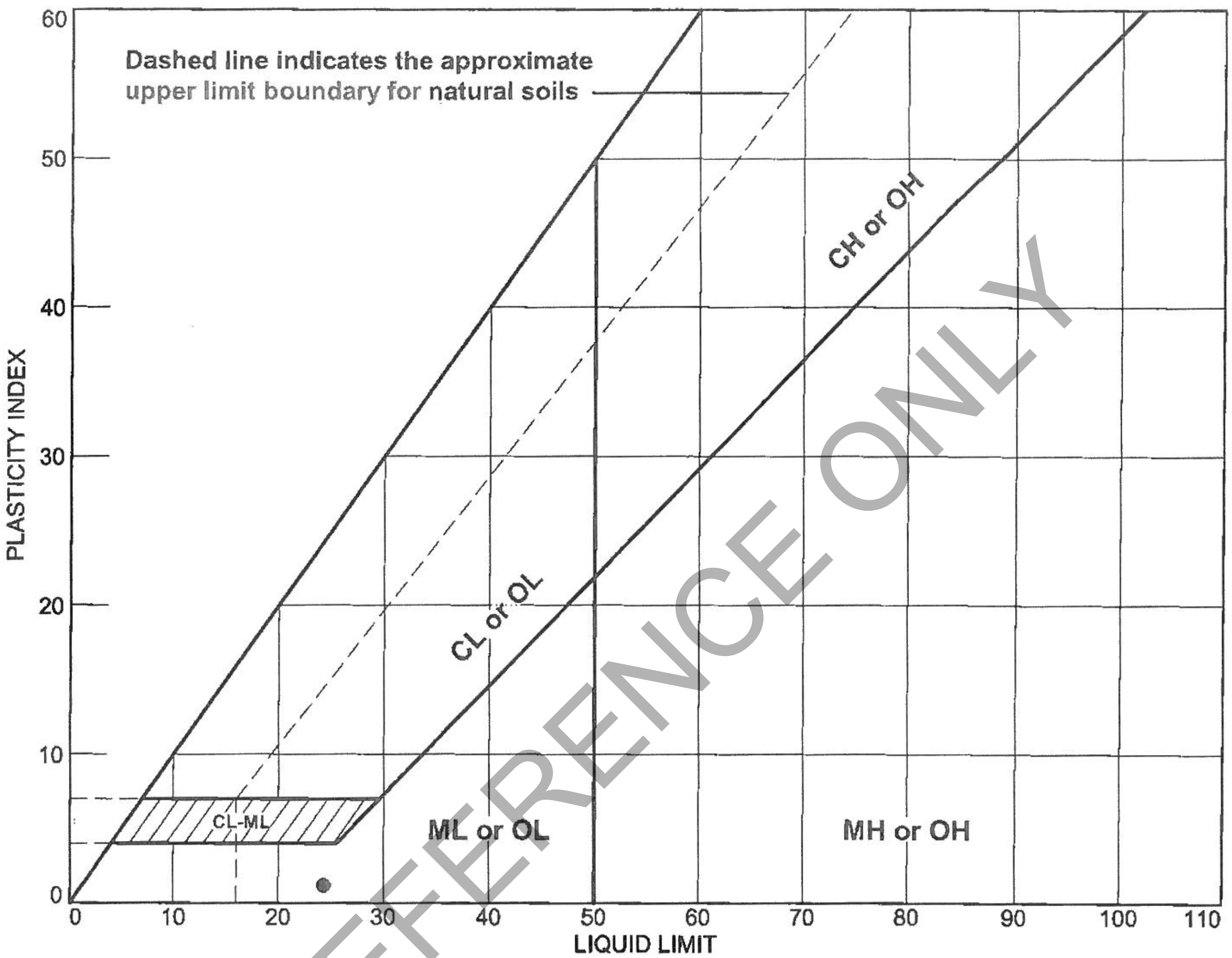
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	P3-B1	11	35-37	97.3	105.0	138.6	33.6	OH

Distinct Engineering Solutions, Inc. North Brunswick, NJ	**Client:** ARUP **Project:** STAPLETON **Project No.:** 15040 **Figure**

Tested By: VA,SS **Checked By:** RT

LIQUID AND PLASTIC LIMITS TEST REPORT

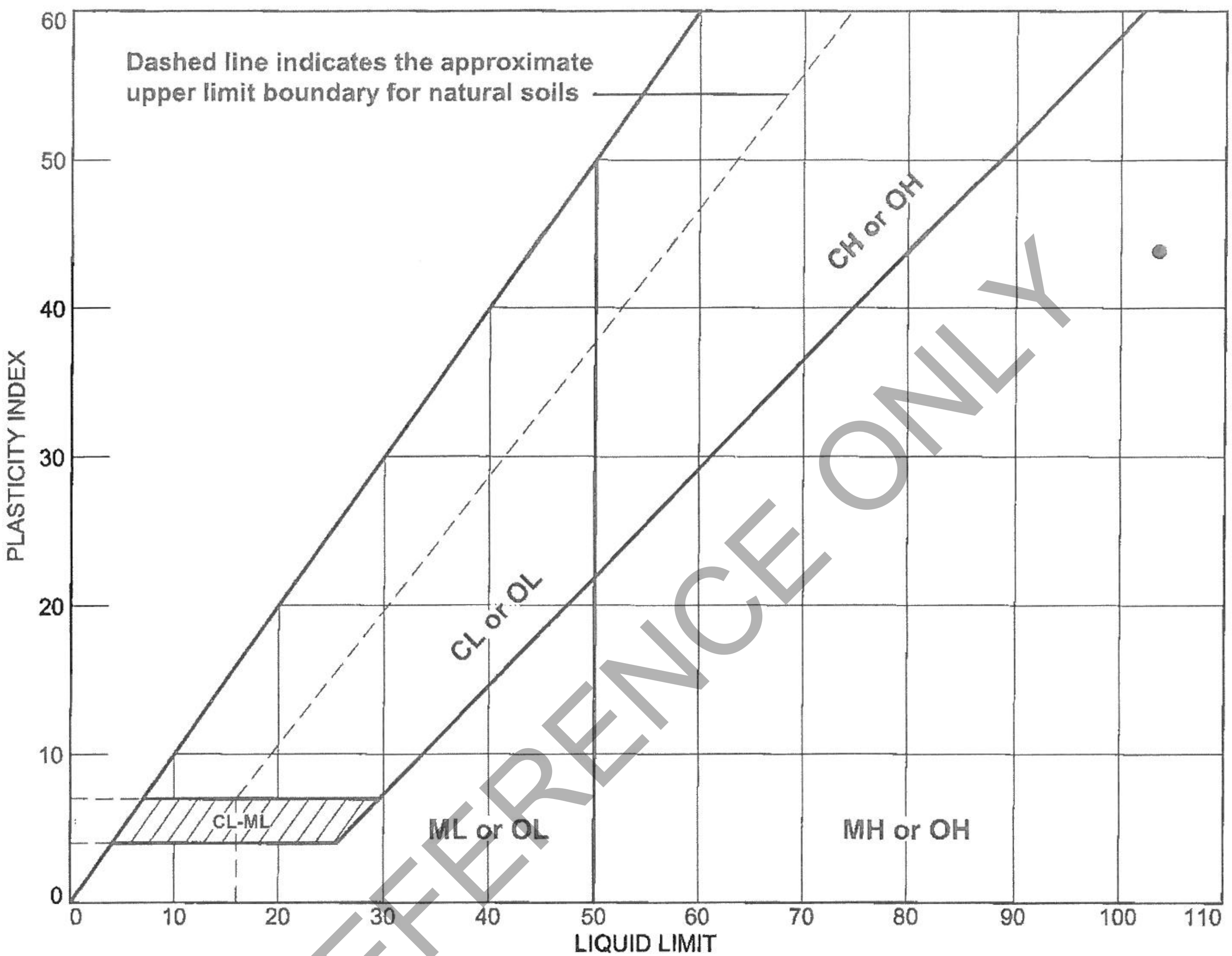


SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	P3-B5	10	30-32	26.3	23.1	24.3	1.2	ML

Distinct Engineering Solutions, Inc. **North Brunswick, NJ**	**Client:** ARUP **Project:** STAPLETON **Project No.:** 15040 **Figure**

Tested By: VA,SS **Checked By:** RT

LIQUID AND PLASTIC LIMITS TEST REPORT

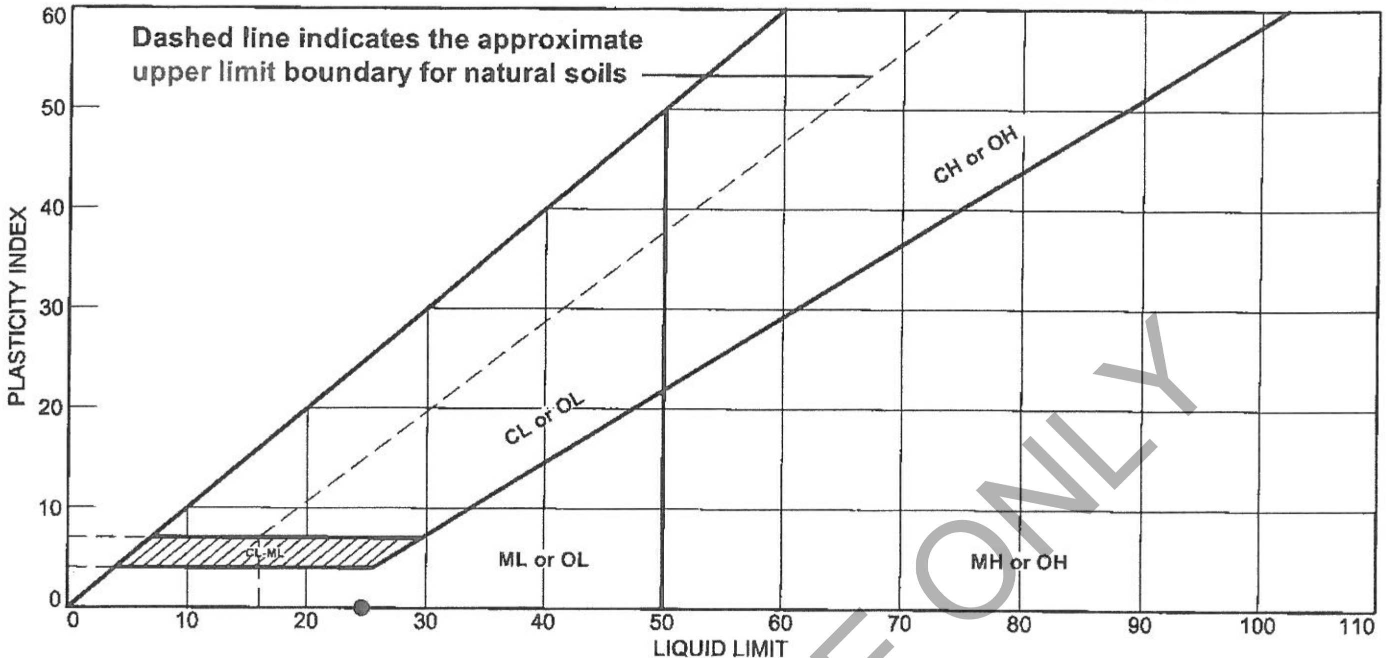


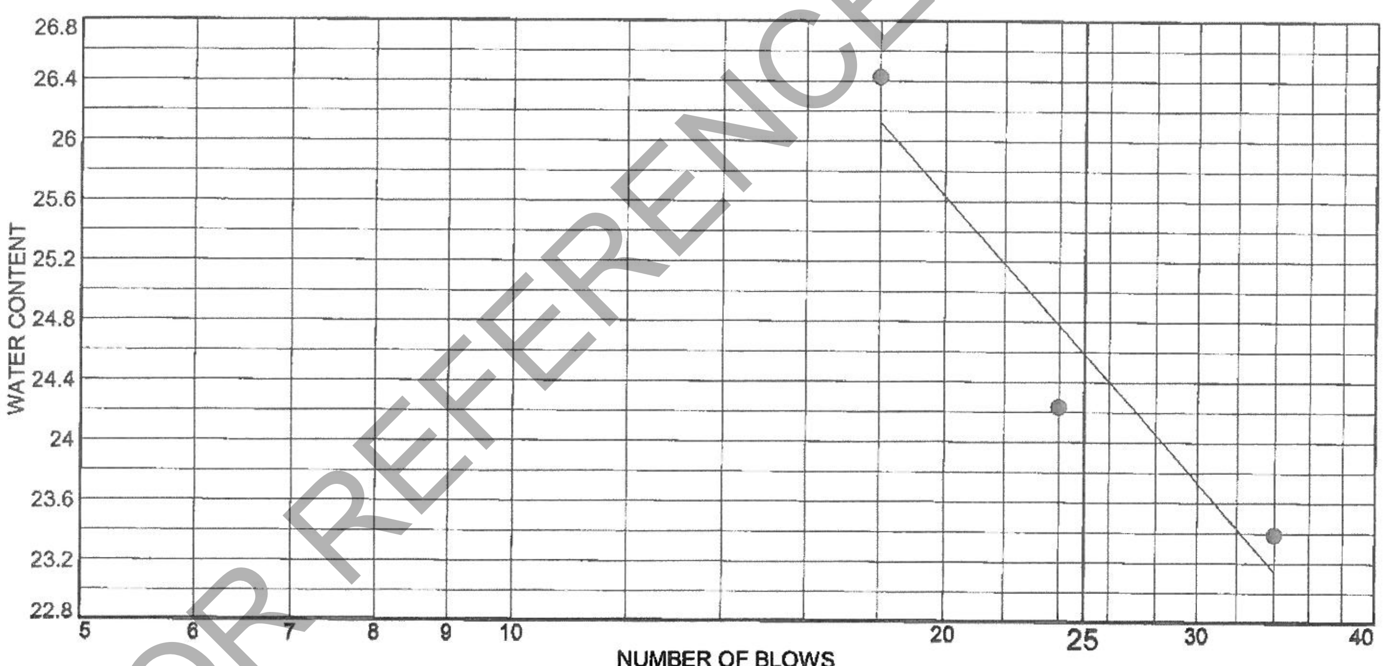
SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
•	P3-B6	8	20-22	26.7	59.9	103.7	43.8	MH

Distinct Engineering Solutions, Inc. North Brunswick, NJ	Client: ARUP Project: STAPLETON Project No.: 15040 Figure

Tested By: VA,SS Checked By: RT

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Clayey SILT, and c-f Sand	24.6	26.9	0.0			ML

Project No. 15040 **Client:** Arup

Project: Stapleton Phase 2 and 3

Location: P3-B6
Sample Number: S12 **Depth:** 45-47

Remarks:
● soil passing sieve #10 used

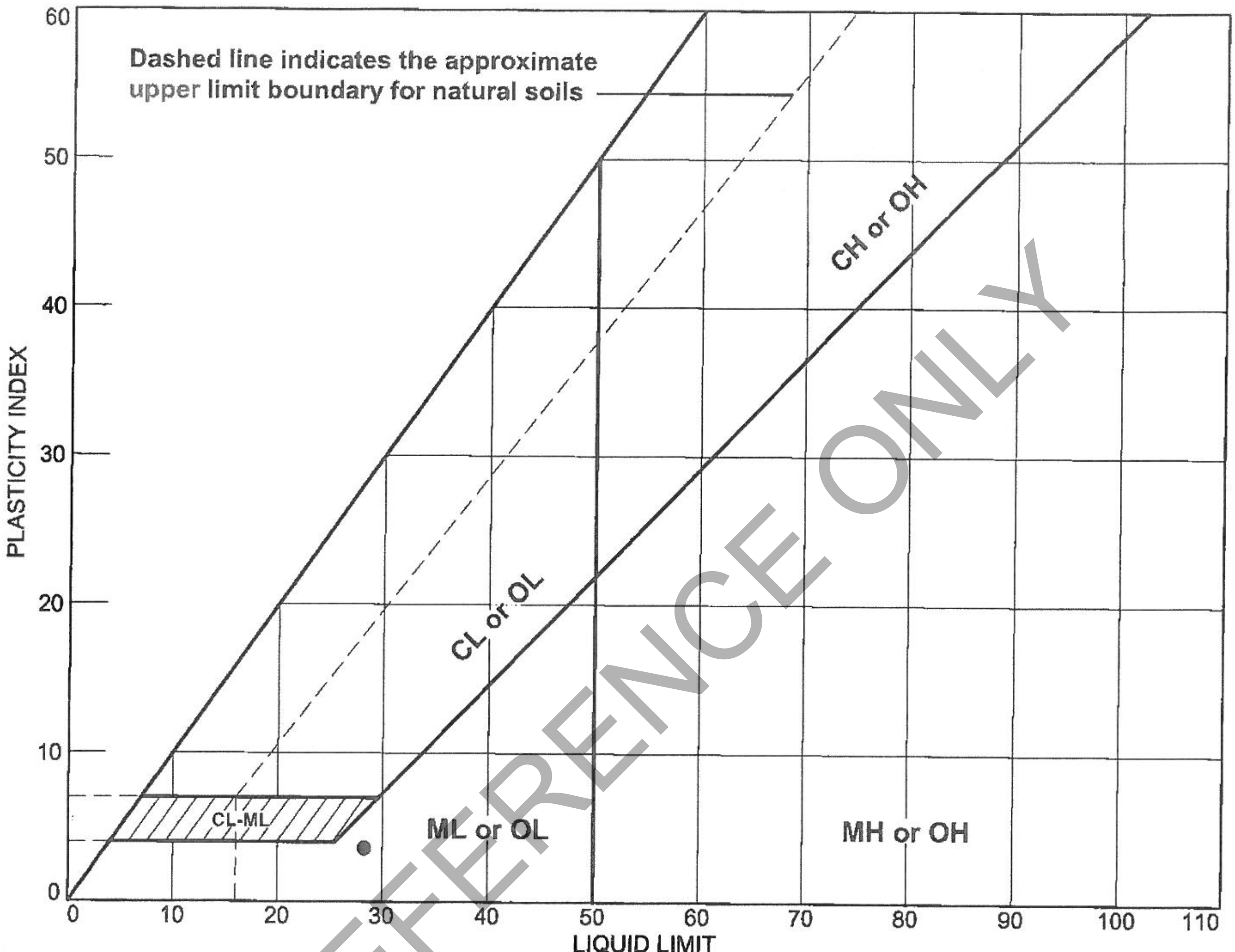
Distinct Engineering Solutions, Inc.
North Brunswick, NJ

RST

Figure

Tested By: EM **Checked By:** RT

LIQUID AND PLASTIC LIMITS TEST REPORT

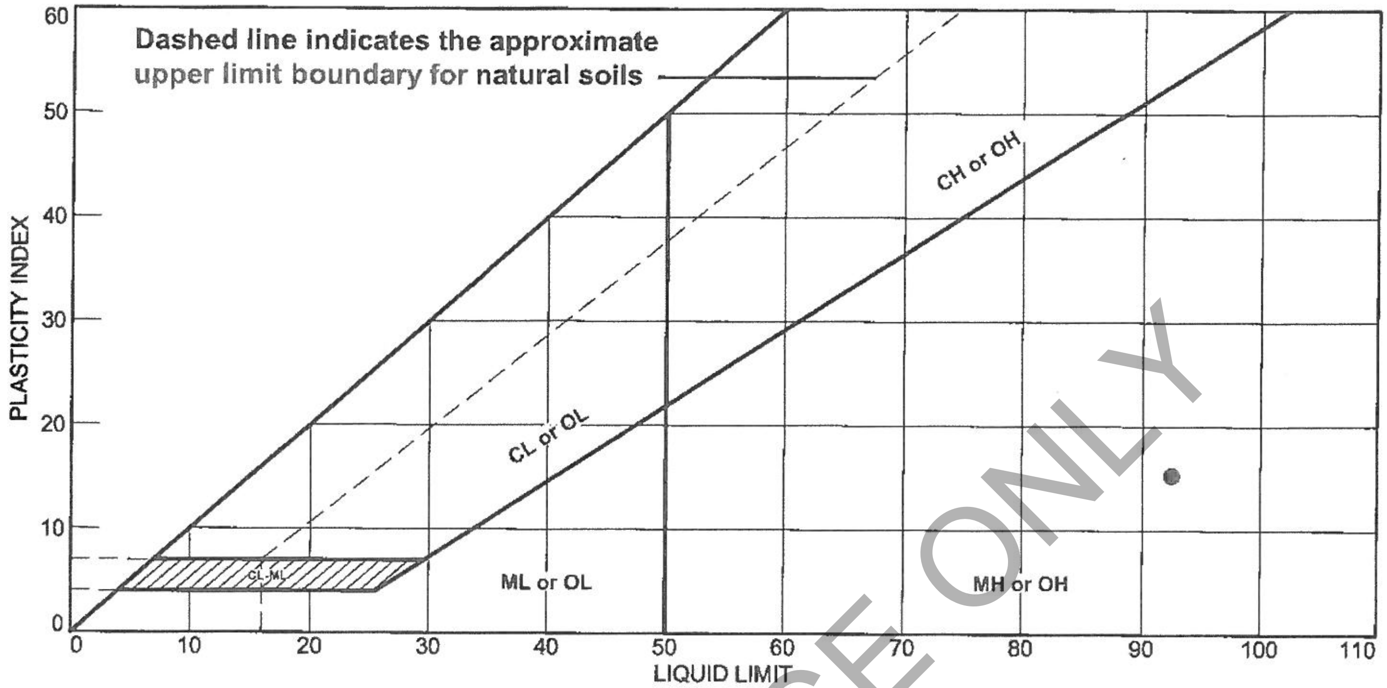


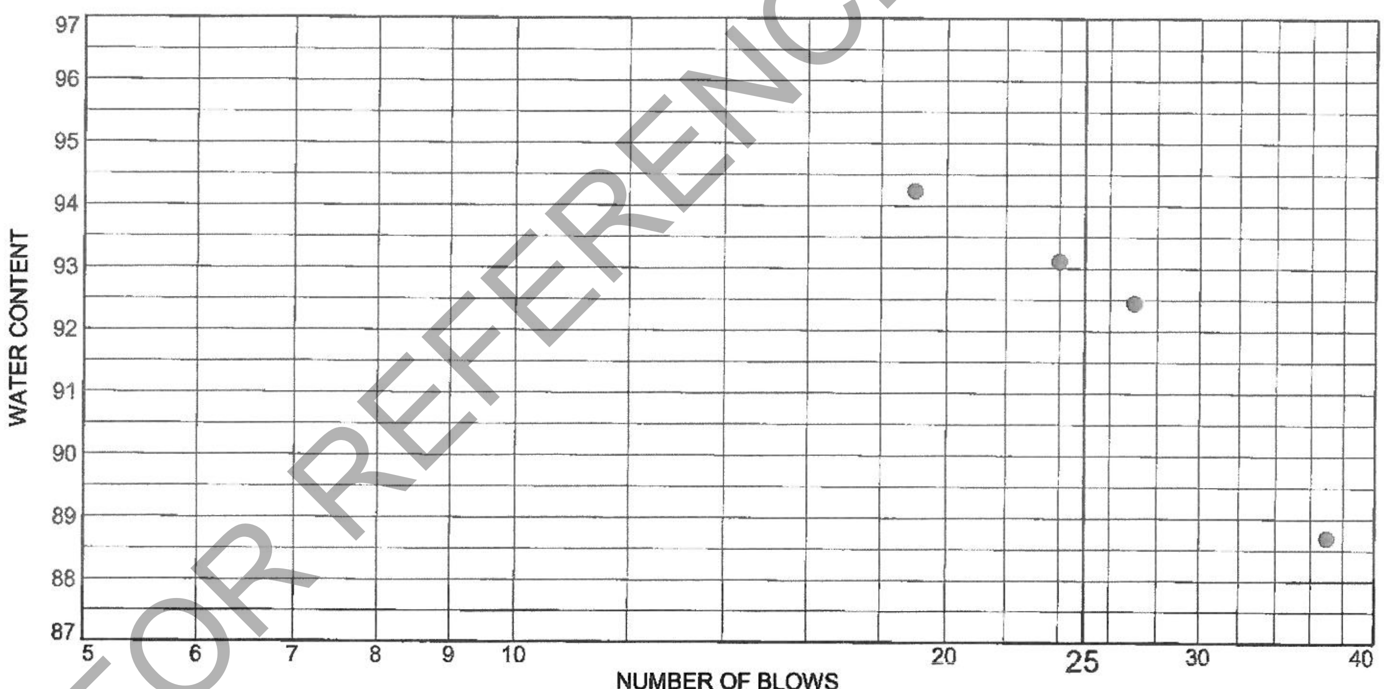
SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	P3-B7	10	30-32	22.5	24.7	28.3	3.6	ML

Distinct Engineering Solutions, Inc. **North Brunswick, NJ**	**Client:** ARUP **Project:** STAPLETON **Project No.:** 15040 **Figure**

Tested By: VA,SS **Checked By:** RT

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Black Clayey Silt, Organic	92.5	77.2	15.3			

Project No. 15040 **Client:** Arup

Project: Stapleton Phase 2 and 3

Location: P3-B11

Sample Number: S10 **Depth:** 30-32

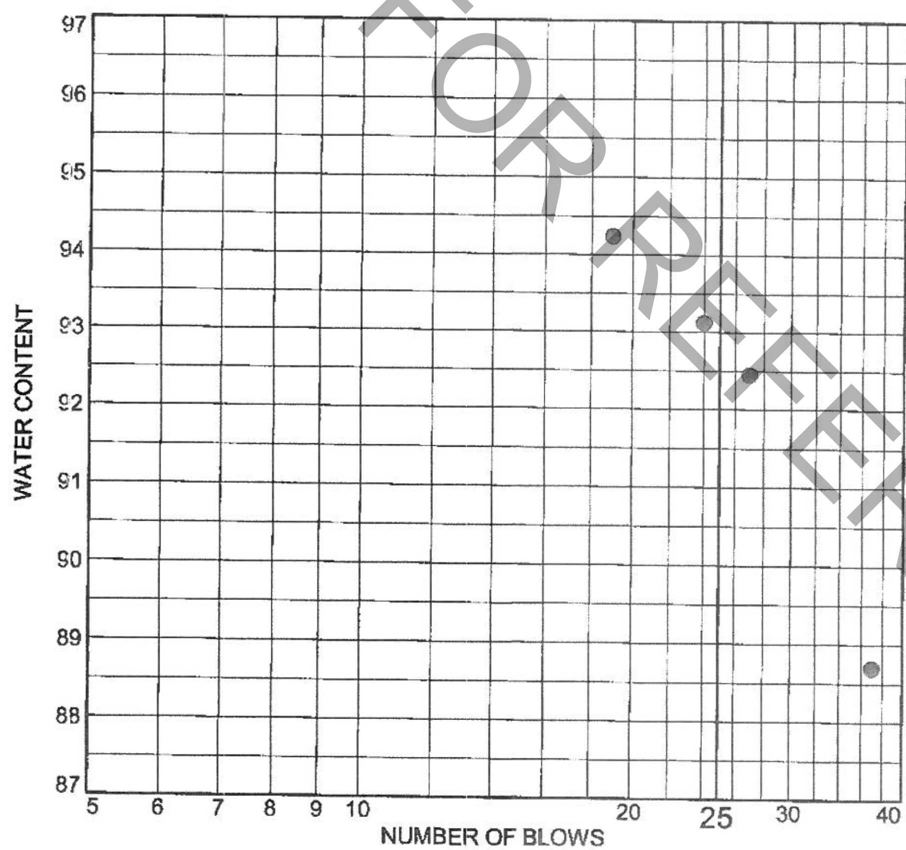
Remarks:

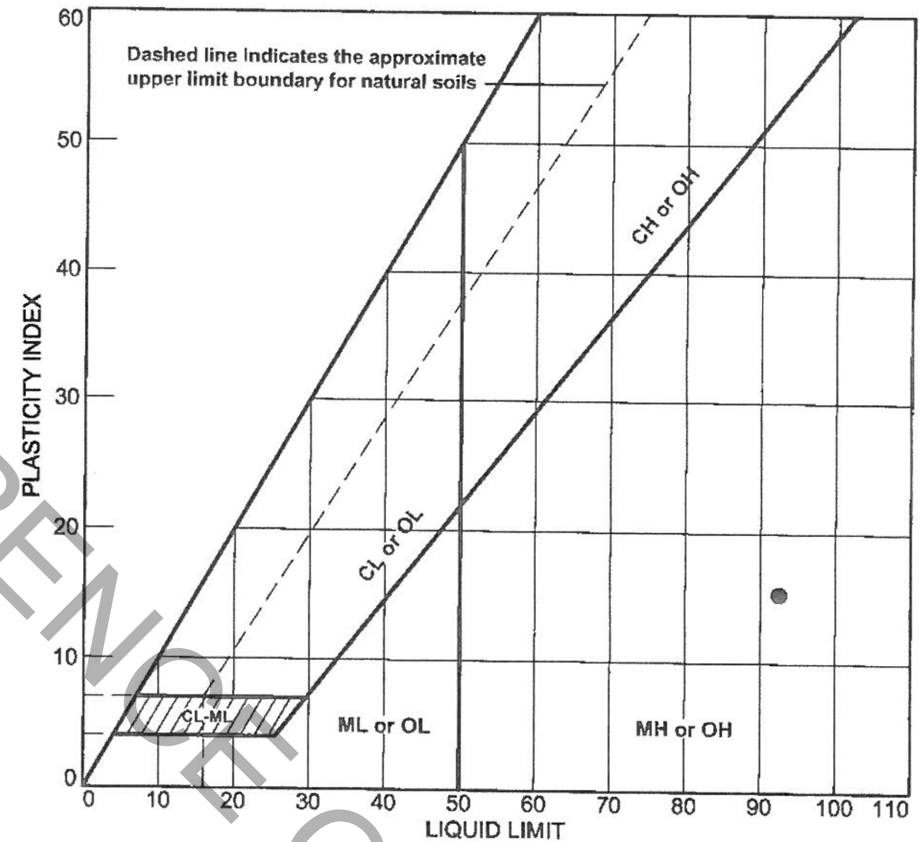
Distinct Engineering Solutions, Inc.

North Brunswick, NJ

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



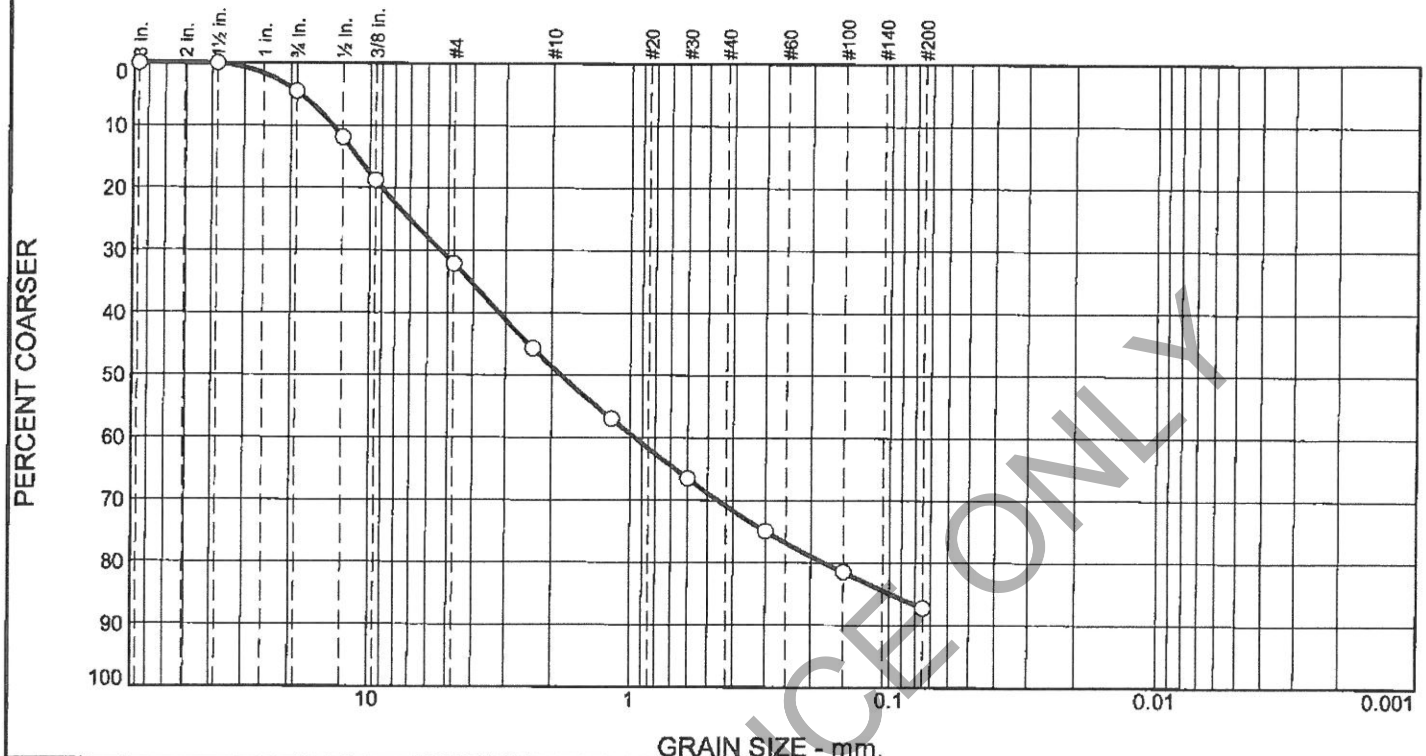


	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●		S10	30-32			P3-B11 S10 - Black Clayey Silt, Organic	59.2	92.5	15.3
■		S11	34-36			P3-B11 S11 - Dark Gray Black Clayey Silt	52.9		

Client Arup	Distinct Engineering Solutions, Inc.	
Project Stapleton Phase 2 and 3		
Project No. 15040	Figure	North Brunswick, NJ

Tested By: EM **Checked By:** RT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	4	28	17	22	16	13	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3	100		
1.5	100		
.75	96		
0.5	88		
.375	81		
#4	68		
#8	54		
#16	43		
#30	34		
#50	25		
#100	19		
#200	13		

* (no specification provided)

Material Description

Dark Gray C-F SAND, some C-F Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-1-b

Coefficients

D_{90}= 13.8421 D_{85}= 11.1413 D_{60}= 3.1674
D_{50}= 1.8417 D_{30}= 0.4558 D_{15}= 0.0983
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 2/19/16

Tested By: VA,SS

Checked By: RT

Title: PM

Source of Sample: P2-B1 **Depth:** 10-12 **Date Sampled:**

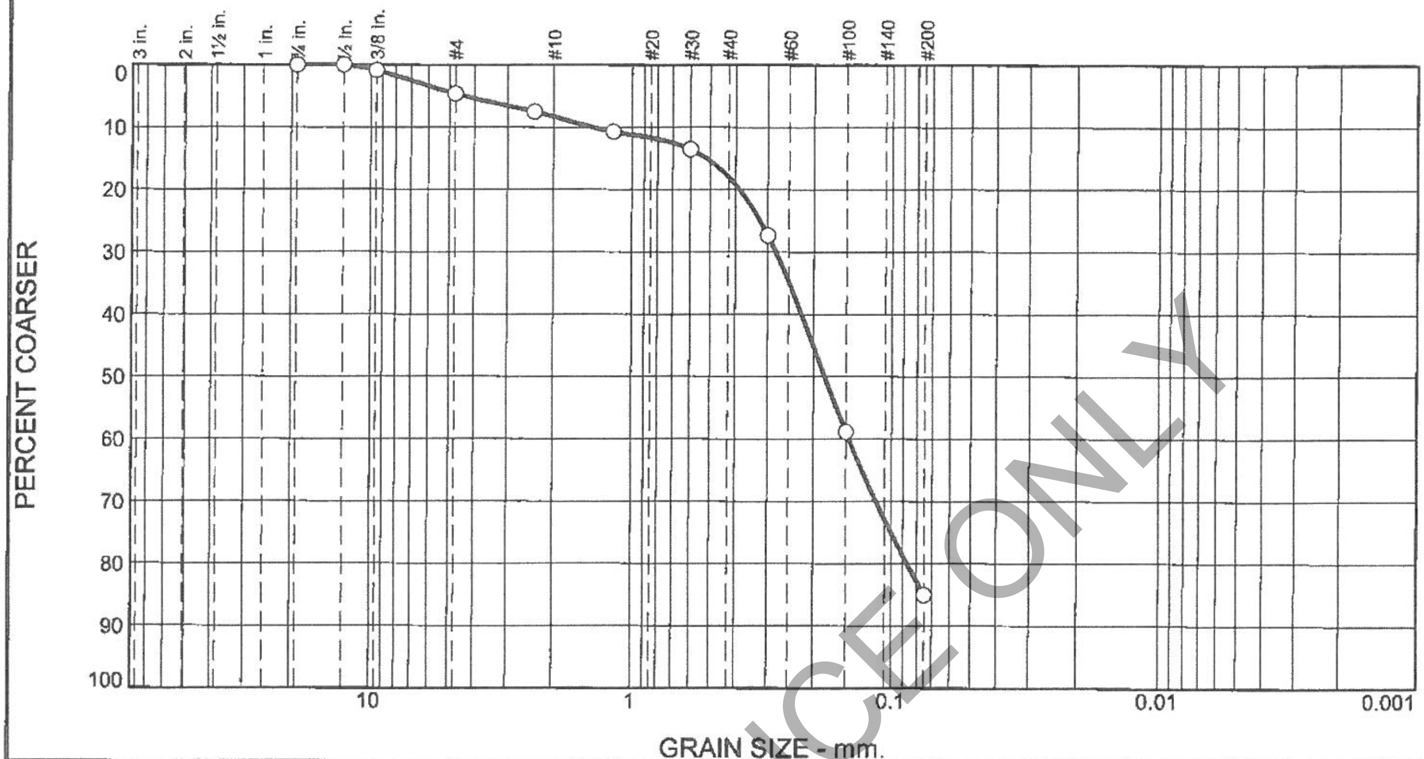
Sample Number: 5

Distinct Engineering Solutions, Inc.

North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	5	3	10	67	15	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.75	100		
0.5	100		
.375	99		
#4	95		
#8	93		
#16	89		
#30	86		
#50	73		
#100	41		
#200	15		

* (no specification provided)

Material Description

Brown C-F SAND, little Silt, trace F Gravel

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 1.4095 D_{85}= 0.5167 D_{60}= 0.2225
D_{50}= 0.1809 D_{30}= 0.1144 D_{15}=
D_{10}= C_u= C_c=

Remarks

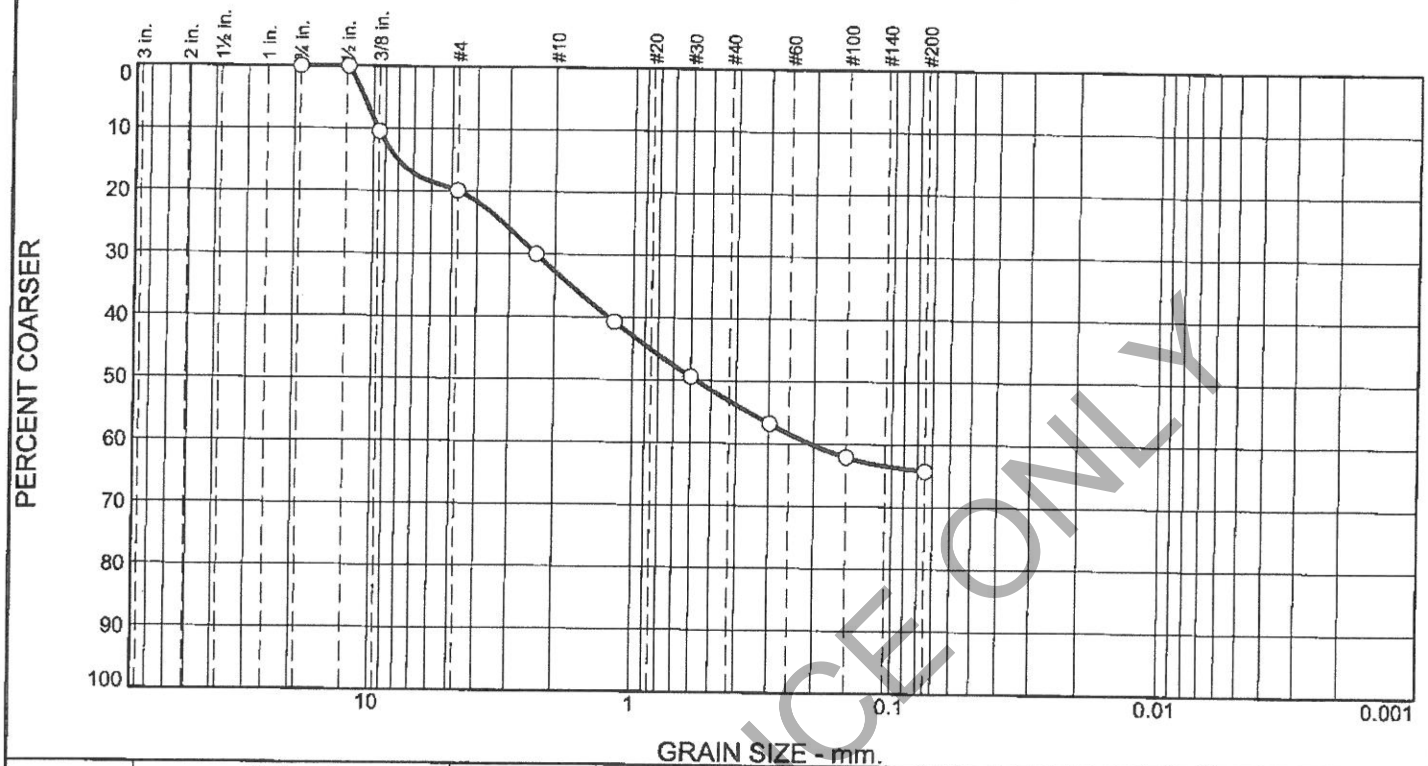
Date Received: **Date Tested:** 2/19/16
Tested By: VA,SS
Checked By: RT
Title: PM

Source of Sample: P2-B3 **Depth:** 35-37 **Date Sampled:**
Sample Number: 10

Distinct Engineering Solutions, Inc.
North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	20	13	20	11	36	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.75	100		
0.5	100		
.375	90		
#4	80		
#8	70		
#16	59		
#30	51		
#50	43		
#100	38		
#200	36		

* (no specification provided)

Material Description

Black Gray C-F SAND, some Gravel and Silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-4(0)

Coefficients

D_{90}= 9.6058 D_{85}= 8.0519 D_{60}= 1.2392
D_{50}= 0.5680 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 2/17/16

Tested By: VA,SS

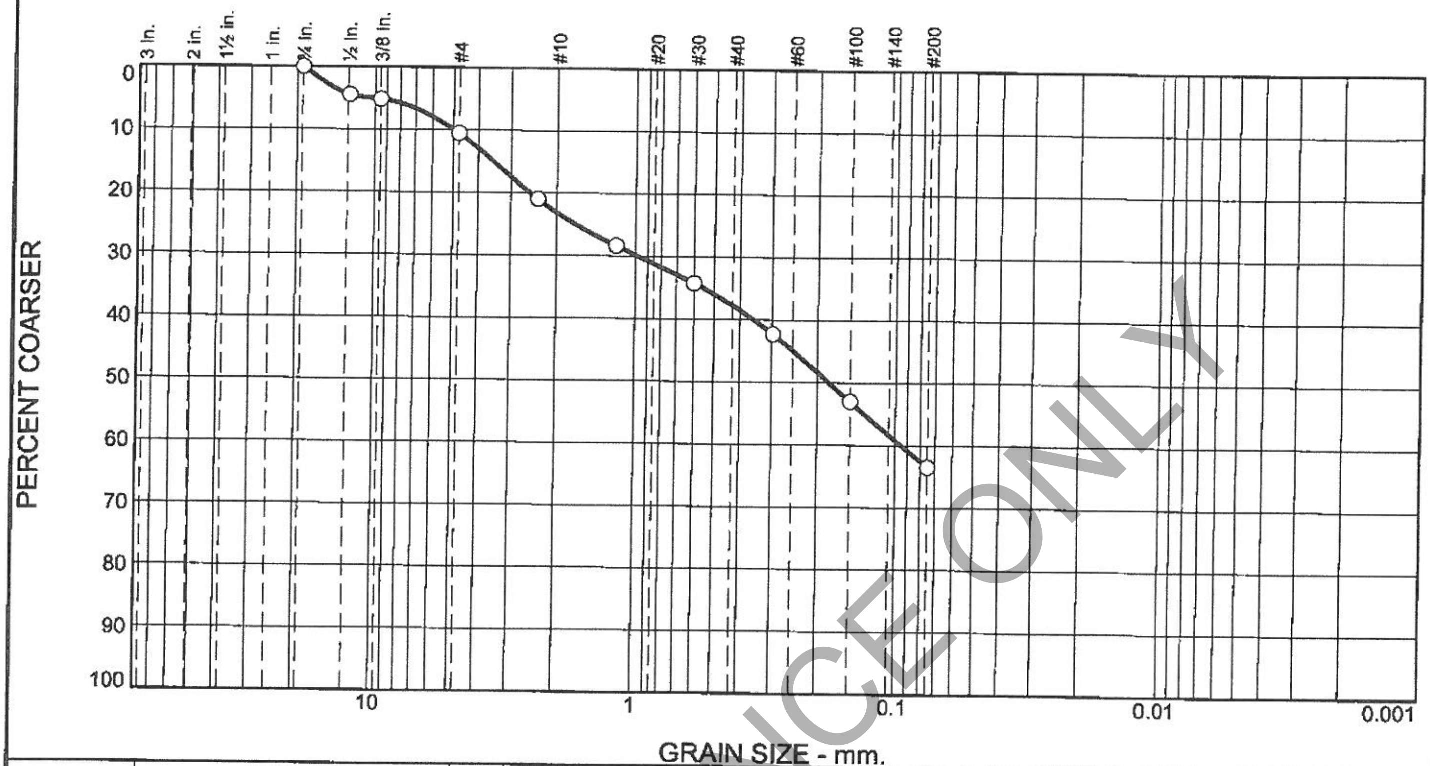
Checked By: RT

Title: PM

Source of Sample: P2-B4 **Depth:** 6-8
Sample Number: 4 **Date Sampled:**

Distinct Engineering Solutions, Inc. **North Brunswick, NJ**	**Client:** ARUP **Project:** STAPLETON **Project No:** 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	11	12	15	25	37	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.75	100		
0.5	96		
.375	95		
#4	89		
#8	79		
#16	72		
#30	66		
#50	58		
#100	47		
#200	37		

* (no specification provided)

Material Description

Dark Gray C-F SAND and SILT, little F Gravel (SM)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 4.9580 D_{85}= 3.5004 D_{60}= 0.3521
D_{50}= 0.1805 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 2/17/16

Tested By: VA,SS

Checked By: RT

Title: PM

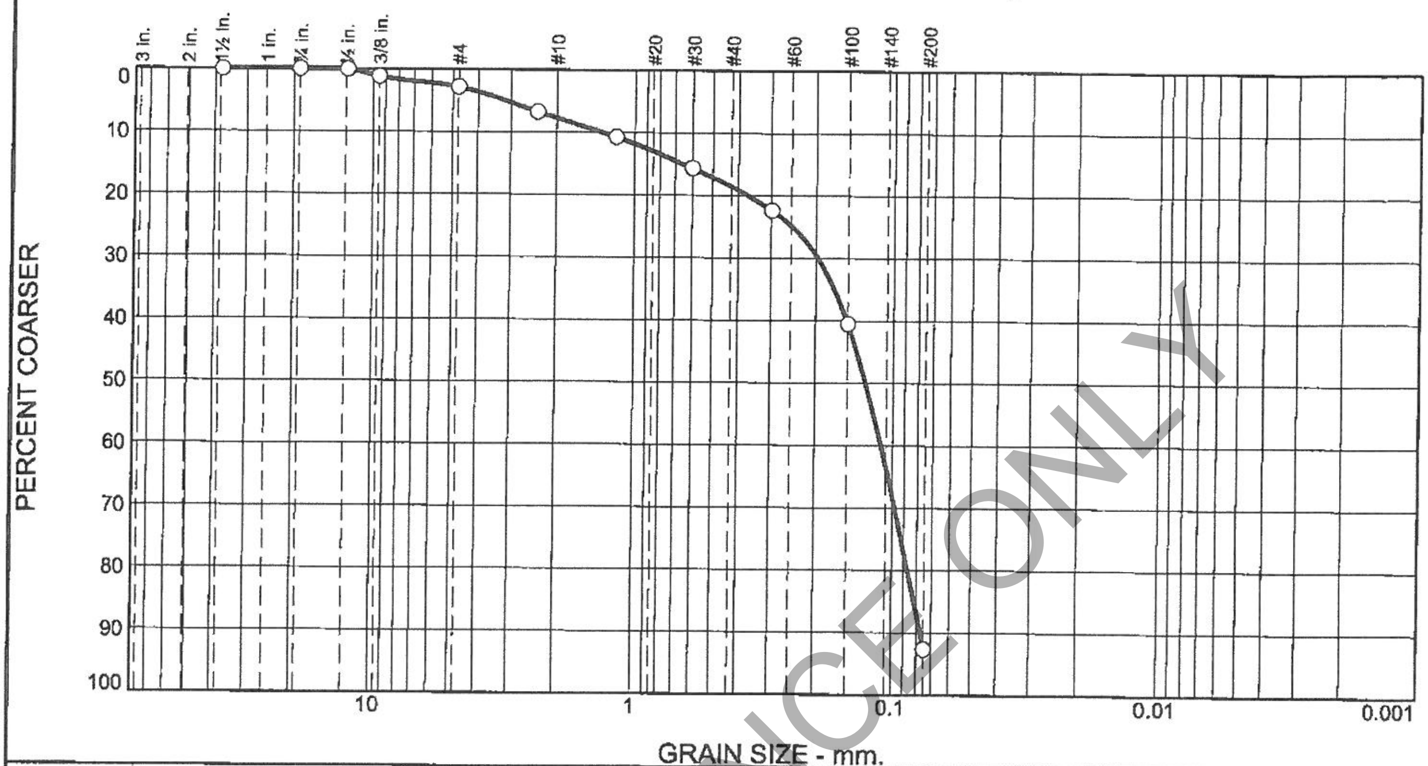
Source of Sample: P3-B4 **Depth:** 10-12 **Date Sampled:**
Sample Number: 6

Distinct Engineering Solutions, Inc.

North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	3	5	11	74	7	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100		
.75	100		
0.5	100		
.375	99		
#4	97		
#8	93		
#16	89		
#30	84		
#50	78		
#100	60		
#200	7.4		

* (no specification provided)

Material Description

Brorn C-F SAND, trace Gravel and Silt.

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-3

Coefficients

D_{90}= 1.3238 D_{85}= 0.6488 D_{60}= 0.1514
D_{50}= 0.1276 D_{30}= 0.0977 D_{15}= 0.0818
D_{10}= 0.0773 C_u= 1.96 C_c= 0.82

Remarks

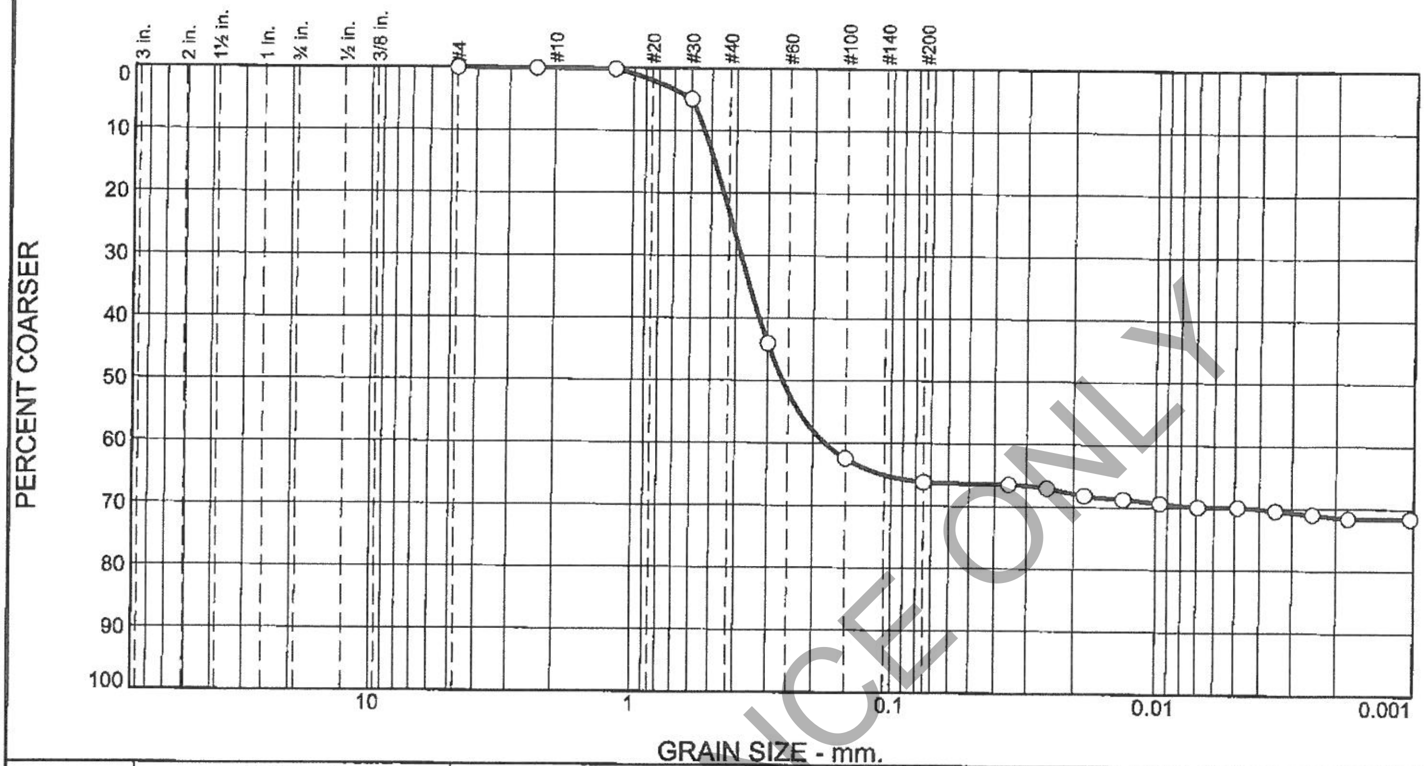
Date Received: **Date Tested:** 2/19/16
Tested By: VA,SS
Checked By: RT
Title: PM

Source of Sample: P2-B4 **Depth:** 20-22
Sample Number: 8 **Date Sampled:**

Distinct Engineering Solutions, Inc.
North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	23	43	4	30

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100		
#8	100		
#16	100		
#30	95		
#50	56		
#100	38		
#200	34		
0.0352 mm.	34		
0.0252 mm.	33		
0.0183 mm.	32		
0.0131 mm.	31		
0.0096 mm.	31		
0.0069 mm.	30		
0.0049 mm.	30		
0.0035 mm.	30		
0.0025 mm.	29		
0.0018 mm.	28		
0.0010 mm.	28		

* (no specification provided)

Material Description

Gray Brown M-F SAND, some Siltyclay

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SC AASHTO (M 145)=

Coefficients

D_{90}= 0.5331 D_{85}= 0.4856 D_{60}= 0.3234
D_{50}= 0.2625 D_{30}= 0.0043 D_{15}=
D_{10}= C_u= C_c=

Remarks

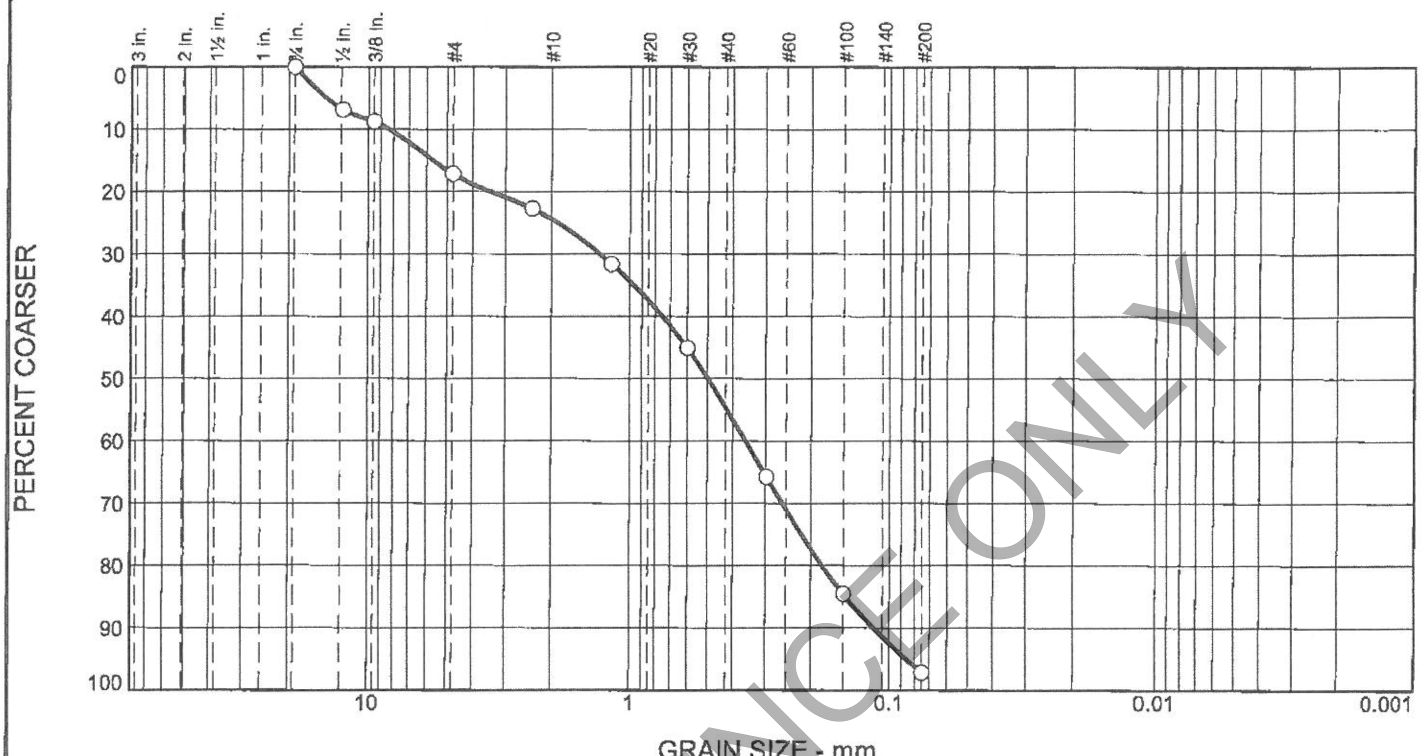
Date Received: **Date Tested:** 2/24/16
Tested By: VA
Checked By: RT
Title: PM

Source of Sample: P2-B4 **Depth:** 25-27 **Date Sampled:**
Sample Number: 9

Distinct Engineering Solutions, Inc.
North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	17	7	31	42	3	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.75	100		
0.5	93		
.375	91		
#4	83		
#8	77		
#16	68		
#30	55		
#50	34		
#100	16		
#200	2.9		

* (no specification provided)

Material Description

Dark Brown C-F SAND, little Gravel, Tr. Silt.

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SP AASHTO (M 145)= A-1-b

Coefficients

D_{90}= 8.2940 D_{85}= 5.6451 D_{60}= 0.7463
D_{50}= 0.4995 D_{30}= 0.2579 D_{15}= 0.1466
D_{10}= 0.1145 C_u= 6.52 C_c= 0.78

Remarks

Date Received: **Date Tested:** 2-17-16

Tested By: VA,SS

Checked By: RT

Title: PM

Source of Sample: P2-B5 **Depth:** 6-8 **Date Sampled:** 2/17/16

Sample Number: 4

Distinct Engineering Solutions, Inc.

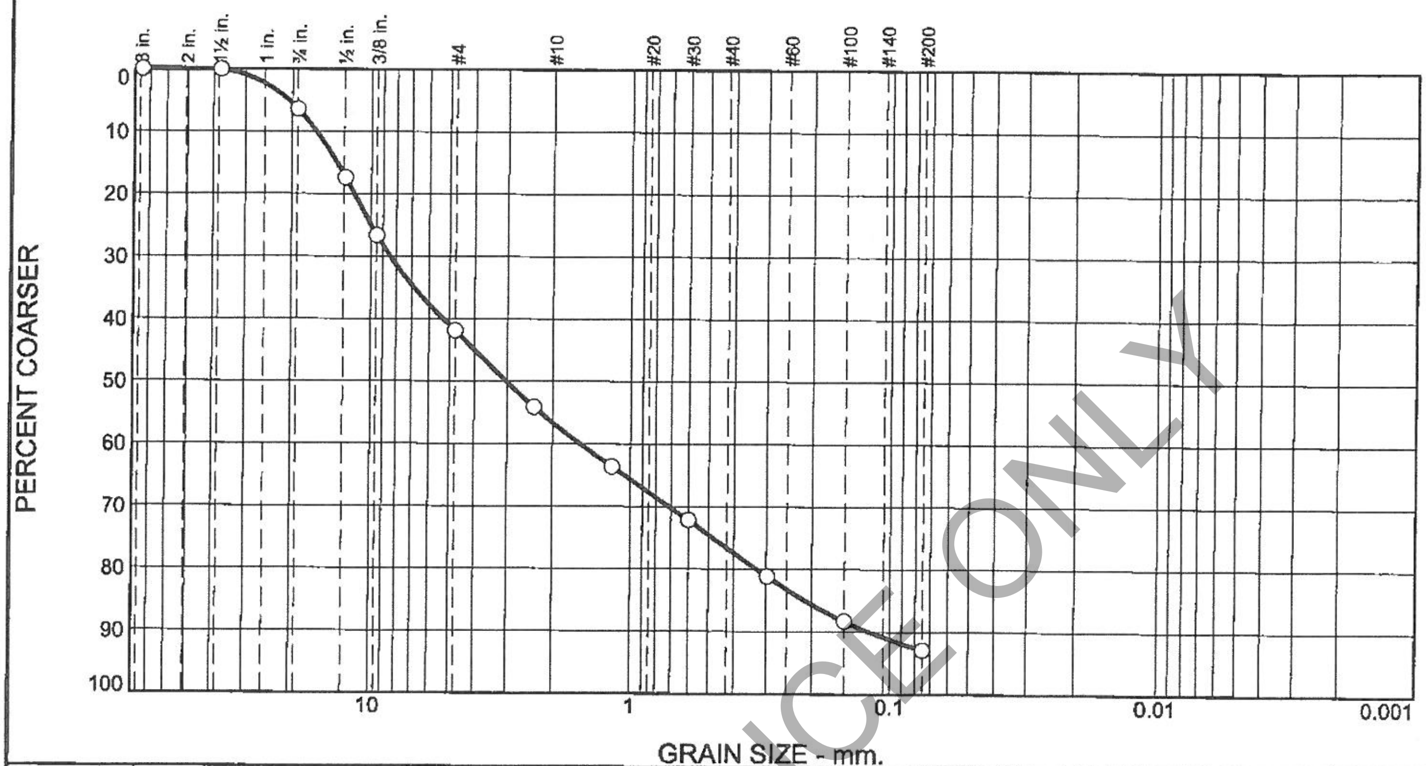
North Brunswick, NJ

Client: ARUP

Project: STAPLETON

Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	6	36	15	20	16	7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3	100		
1.5	100		
.75	94		
0.5	83		
.375	73		
#4	58		
#8	46		
#16	36		
#30	28		
#50	19		
#100	12		
#200	7.1		

* (no specification provided)

Material Description

Dark Brown C-F SAND, C-F Gravel, Trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-1-a

Coefficients

D_{90}= 16.1290 D_{85}= 13.4744 D_{60}= 5.2765
D_{50}= 3.0185 D_{30}= 0.7094 D_{15}= 0.2108
D_{10}= 0.1194 C_u= 44.20 C_c= 0.80

Remarks

Date Received: **Date Tested:** 2/17/16
Tested By: VA,SS
Checked By: RT
Title: PM

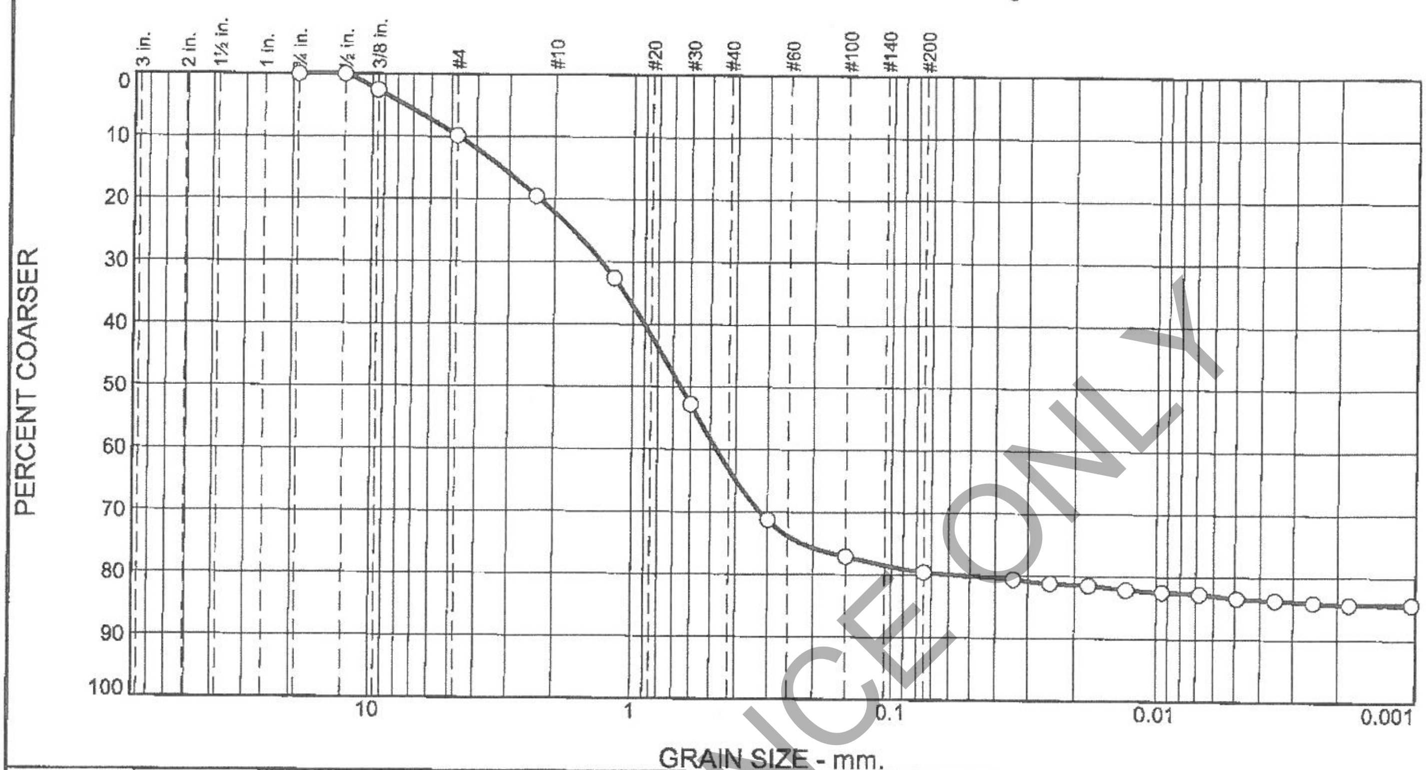
Source of Sample: P2-B8 **Depth:** 10-12
Sample Number: 6
Date Sampled:

Distinct Engineering Solutions, Inc.

North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	10	12	41	17	3	17

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.75	100		
0.5	100		
.375	97		
#4	90		
#8	80		
#16	67		
#30	47		
#50	29		
#100	23		
#200	20		
0.0341 mm.	19		
0.0248 mm.	19		
0.0177 mm.	19		
0.0128 mm.	18		
0.0095 mm.	18		
0.0068 mm.	17		
0.0049 mm.	17		
0.0035 mm.	16		
0.0025 mm.	16		
0.0018 mm.	16		
0.0010 mm.	16		

* (no specification provided)

Material Description

Gray C-M SAND, Little Silty Clay, Trace F Gravel

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SC AASHTO (M 145)=

Coefficients

D_{90}= 4.6672 D_{85}= 3.1918 D_{60}= 0.9021
D_{50}= 0.6540 D_{30}= 0.3211 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 2-24-16

Tested By: VA

Checked By: RT

Title: PM

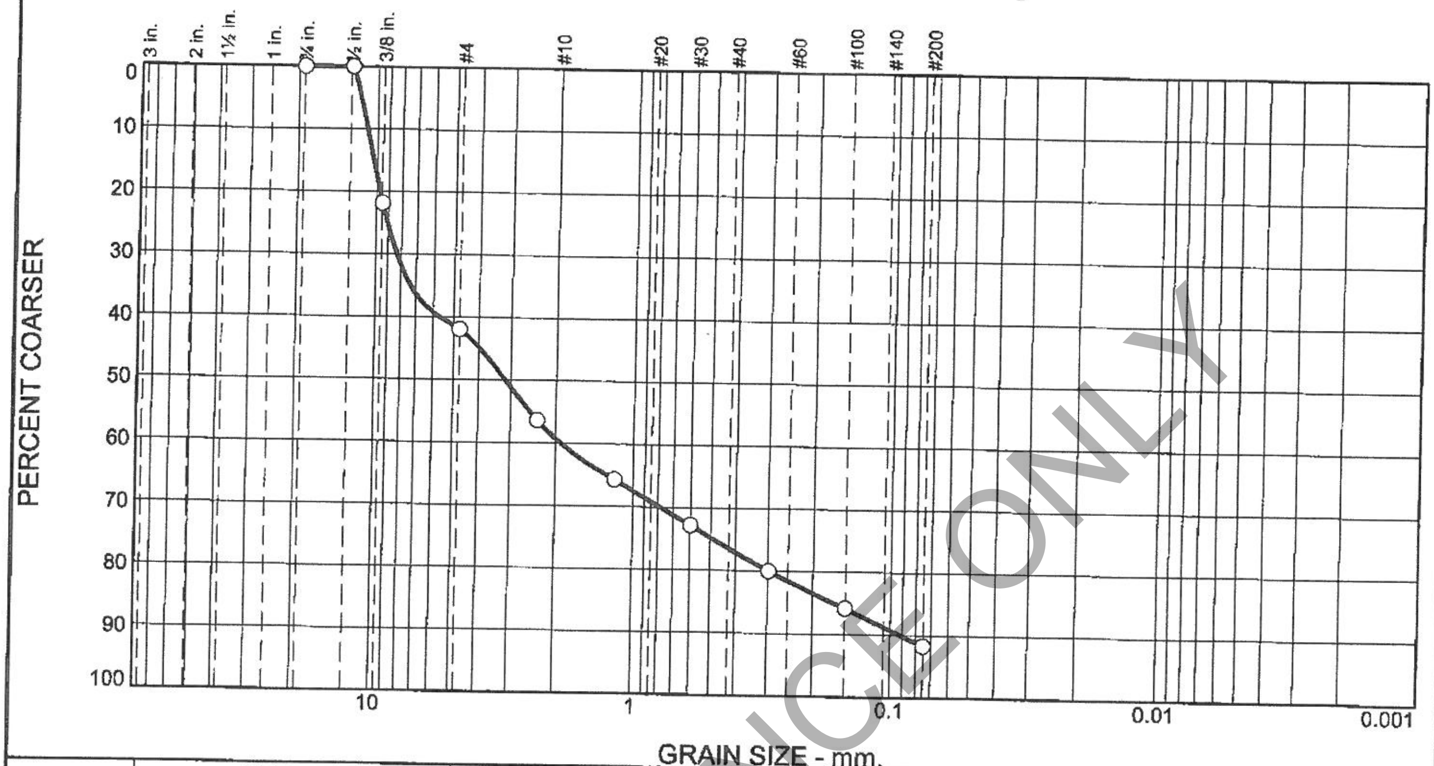
Source of Sample: P2-B9 **Depth:** 20-22
Sample Number: 8
Date Sampled: 2-24-2016

Distinct Engineering Solutions, Inc.

North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	42	17	17	16	8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.75	100		
0.5	100		
.375	78		
#4	58		
#8	44		
#16	34		
#30	27		
#50	20		
#100	14		
#200	8.3		

* (no specification provided)

Material Description

Dark Gray C-F SAND, F Gravel, Tr. Silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SW-SM AASHTO (M 145)= A-1-a

Coefficients

D_{90}= 10.9159 D_{85}= 10.3102 D_{60}= 5.6409
D_{50}= 3.1462 D_{30}= 0.7817 D_{15}= 0.1649
D_{10}= 0.0914 C_u= 61.73 C_c= 1.19

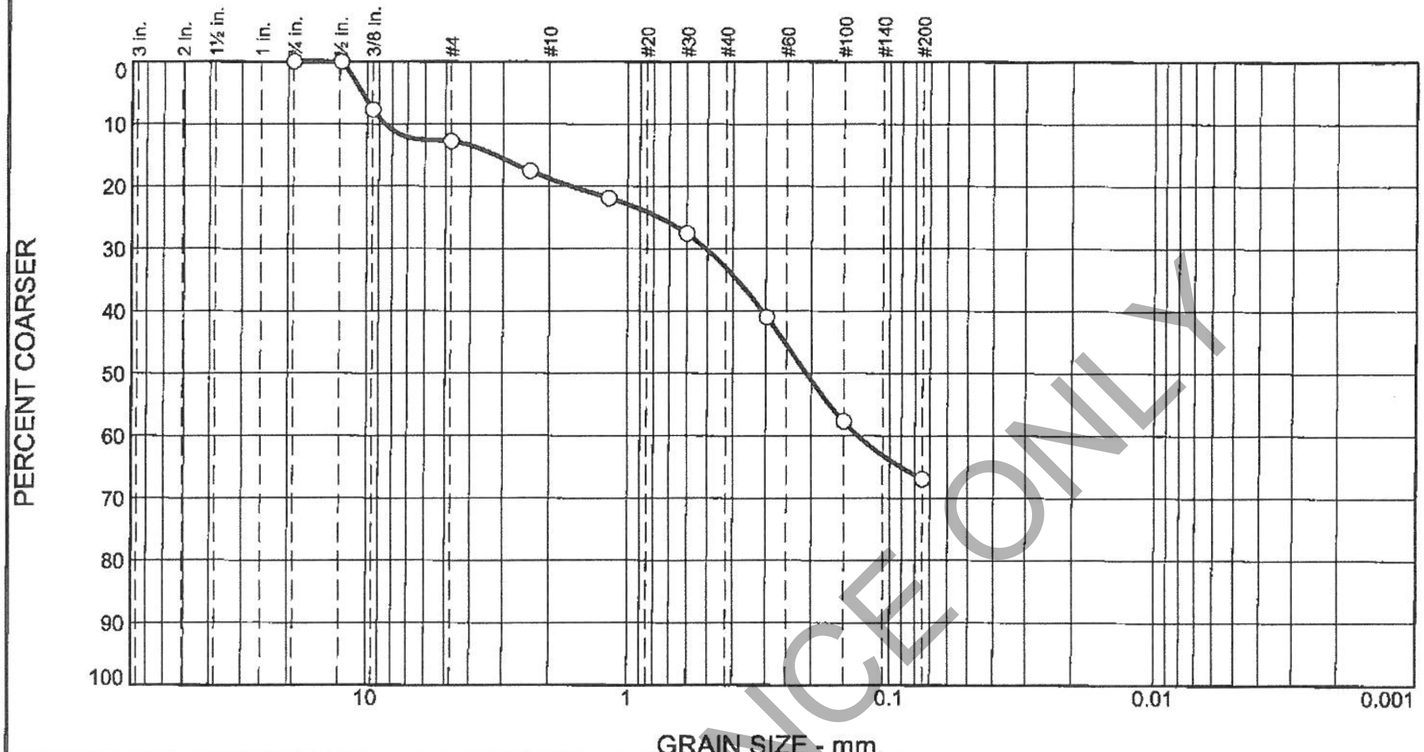
Remarks

Date Received: **Date Tested:** 2-17-16
Tested By: VA,SS
Checked By: RT
Title: PM

Source of Sample: P3-B1 **Depth:** 10-12
Sample Number: S#6 **Date Sampled:**

Distinct Engineering Solutions, Inc. North Brunswick, NJ	Client: ARUP Project: STAPLETON Project No: 15040 Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	13	6	14	34	33	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.75	100		
0.5	100		
.375	92		
#4	87		
#8	82		
#16	78		
#30	72		
#50	59		
#100	42		
#200	33		

* (no specification provided)

Material Description

Dark Gray C-F SAND, some Clay (SC),Little Gravel

Atterberg Limits (ASTM D 4318)

PL= NP LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 8.5320 D_{85}= 3.1911 D_{60}= 0.3085
D_{50}= 0.2086 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

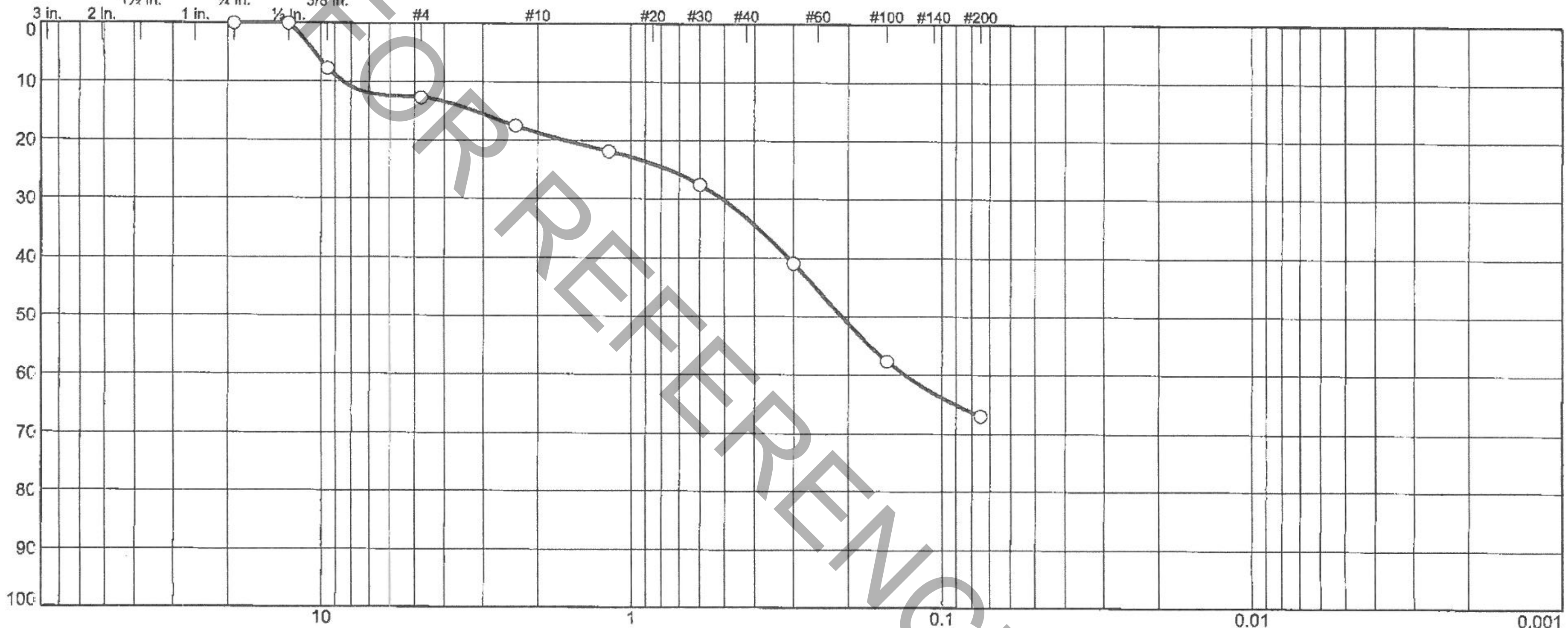
Date Received: **Date Tested:** 2-17-16
Tested By: VA,SS
Checked By: VA
Title: PM

Source of Sample: P3-B3 **Depth:** 15-17 **Date Sampled:**
Sample Number: S#7

Distinct Engineering Solutions, Inc.
North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 **Figure**

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	13	6	14	34	33	

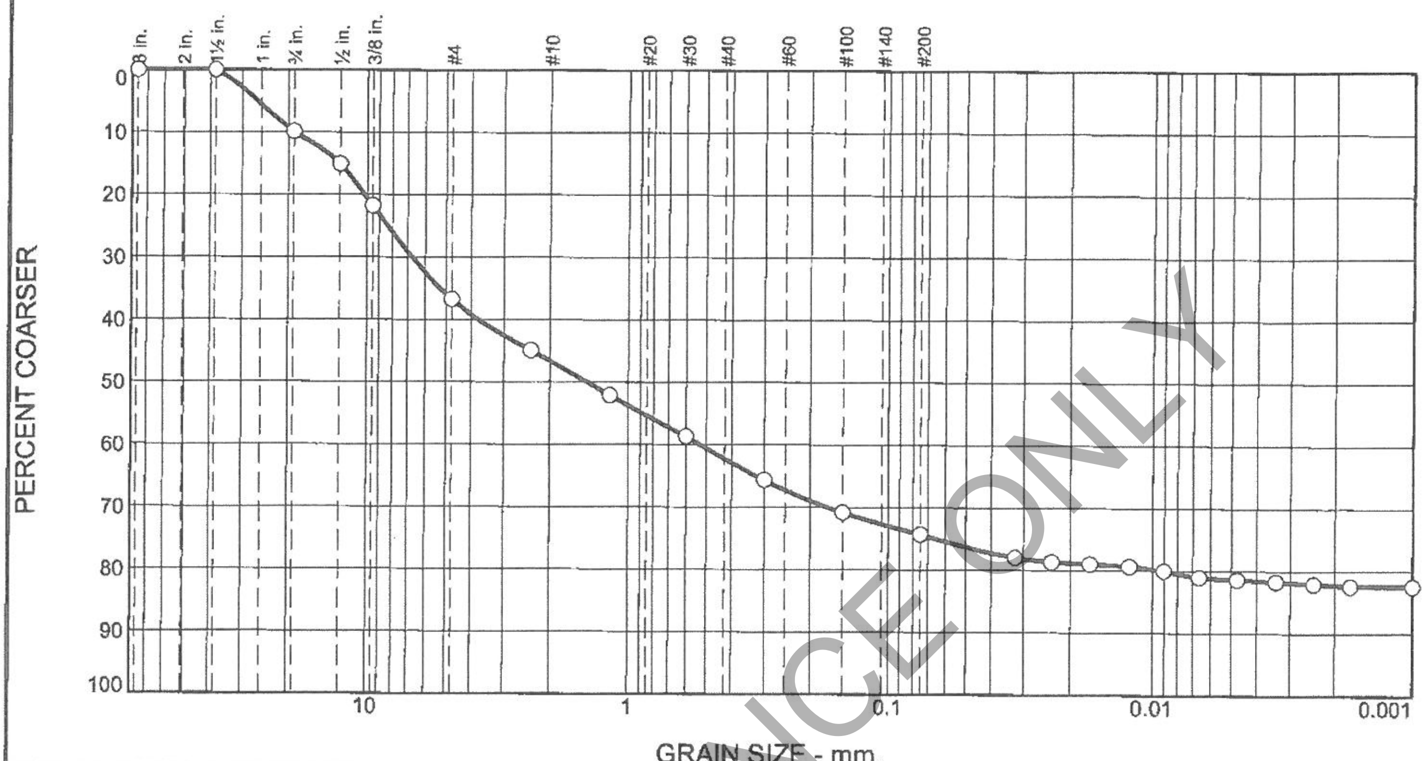
	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	P3-B3	S#7	15-17		SC	Dark Gray C-F SAND, some Silty Clay, little F Gravel	19.6		

Client ARUP
Project STAPLETON
Project No. 15040 Figure

Distinct Engineering Solutions, Inc.
North Brunswick, NJ

Tested By: VA,SS Checked By: RT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	10	27	10	15	12	7	19

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3	100		
1.5	100		
.75	90		
0.5	85		
.375	78		
#4	63		
#8	55		
#16	48		
#30	41		
#50	34		
#100	29		
#200	26		
0.0324 mm.	22		
0.0235 mm.	21		
0.0169 mm.	21		
0.0121 mm.	21		
0.0091 mm.	20		
0.0066 mm.	19		
0.0047 mm.	19		
0.0034 mm.	18		
0.0024 mm.	18		
0.0017 mm.	18		
0.0010 mm.	18		

* (no specification provided)

Material Description

Gray C-F GRAVEL and C-F Sand, some Siltyclay

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SC AASHTO (M 145)=

Coefficients

D_{90}= 18.8400 D_{85}= 12.7373 D_{60}= 3.7593
D_{50}= 1.4444 D_{30}= 0.1704 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 2/24/16

Tested By: VA

Checked By: RT

Title: PM

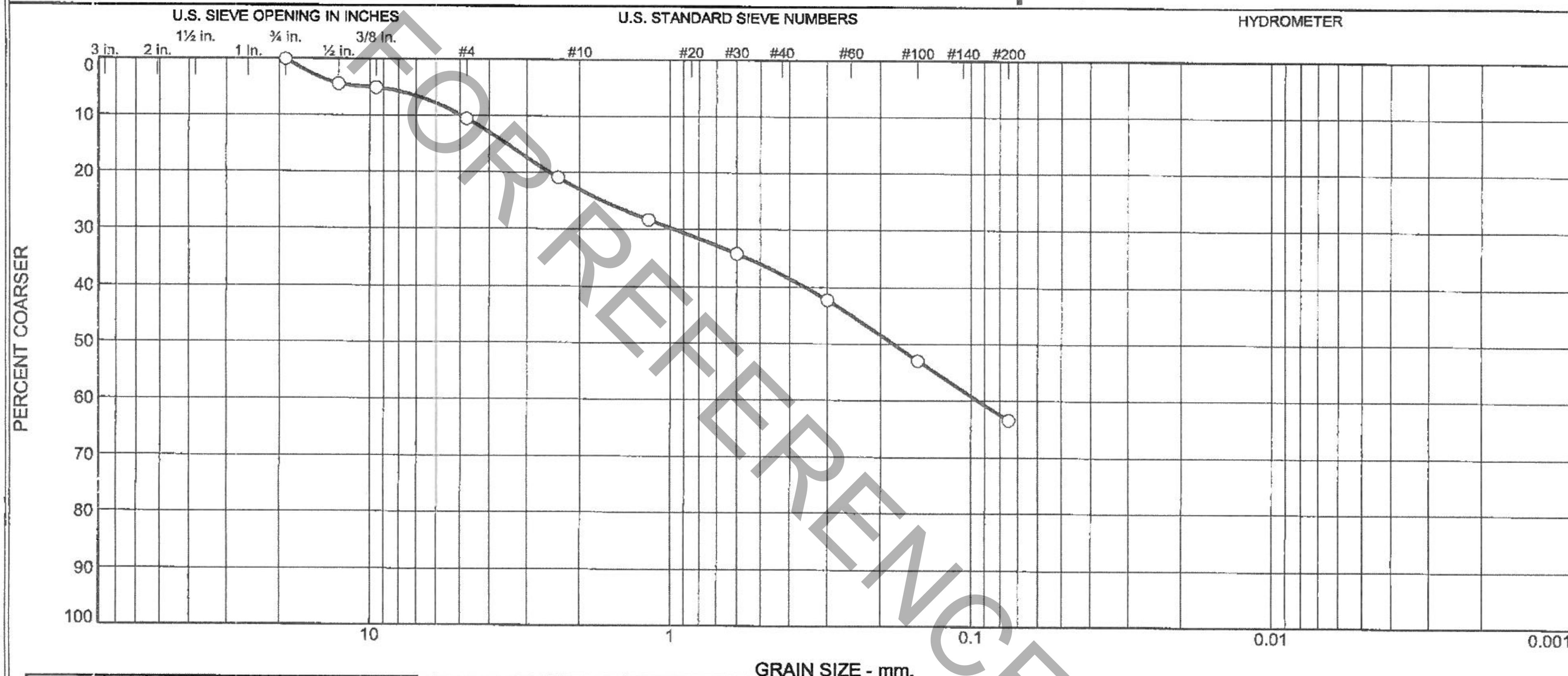
Source of Sample: P3-B4 **Depth:** 8-10 **Date Sampled:**
Sample Number: 5

Distinct Engineering Solutions, Inc.

North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 **Figure**

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	11	12	15	25	37	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	P3-B4	6	10-12		SM	Dark Gray C-F SAND and SILT, little F Gravel (SM)	17.6		

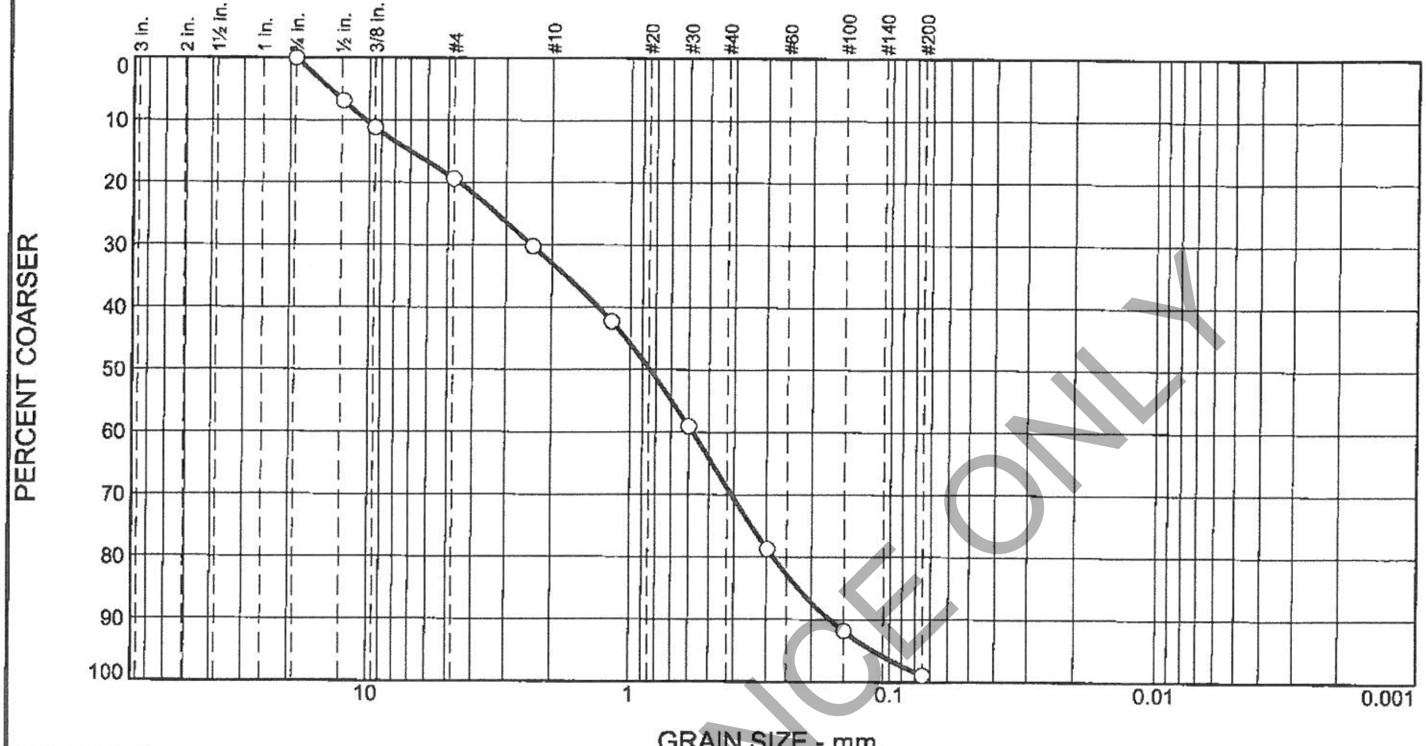
Client ARUP
Project STAPLETON
Project No. 15040 Figure

Distinct Engineering Solutions, Inc.

North Brunswick, NJ

Tested By: VA,SS **Checked By:** RT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	19	14	36	30	1	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.75	100		
0.5	93		
.375	89		
#4	81		
#8	70		
#16	58		
#30	41		
#50	21		
#100	8		
#200	1.0		

* (no specification provided)

Material Description

Dark Brown C-F SAND, little F Gravel, trace Silt (SP)

Atterberg Limits (ASTM D 4318)

PL= NP LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 10.2882 D_{85}= 6.9460 D_{60}= 1.3226
D_{50}= 0.8404 D_{30}= 0.4098 D_{15}= 0.2245
D_{10}= 0.1697 C_u= 7.79 C_c= 0.75

Remarks

Date Received: **Date Tested:** 2/18/16

Tested By: VA,SS

Checked By: RT

Title: PM

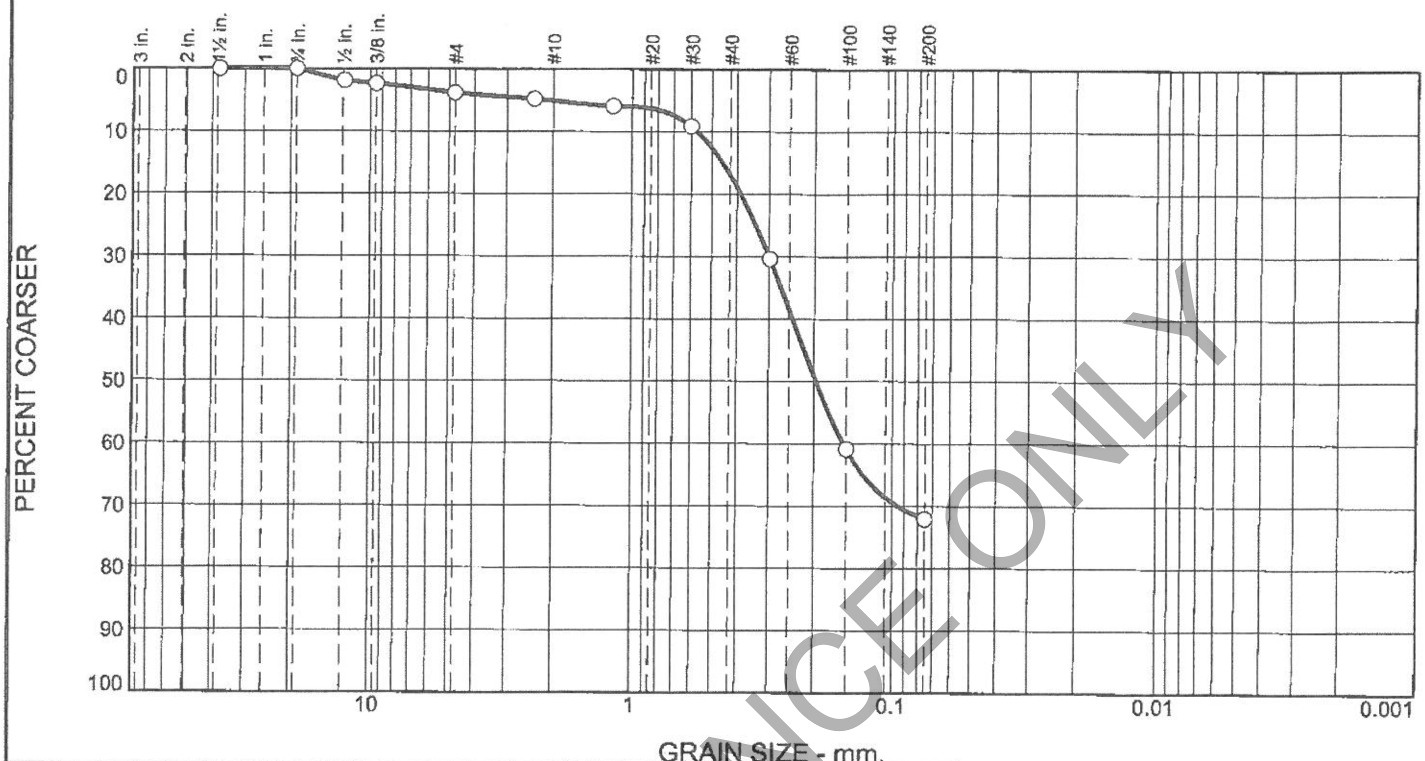
Source of Sample: P3-B6 **Depth:** 4-6 **Date Sampled:**
Sample Number: 3

Distinct Engineering Solutions, Inc.

North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	4	1	12	55	28	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100		
.75	100		
0.5	98		
.375	98		
#4	96		
#8	95		
#16	94		
#30	91		
#50	70		
#100	39		
#200	28		

* (no specification provided)

Material Description

Brown C-F SAND, Some Silt, Tr. Gravel

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 0.5676 D_{85}= 0.4545 D_{60}= 0.2419
D_{50}= 0.1963 D_{30}= 0.0944 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: Date Tested: 2/17/16

Tested By: VA,SS

Checked By: RT

Title: PM

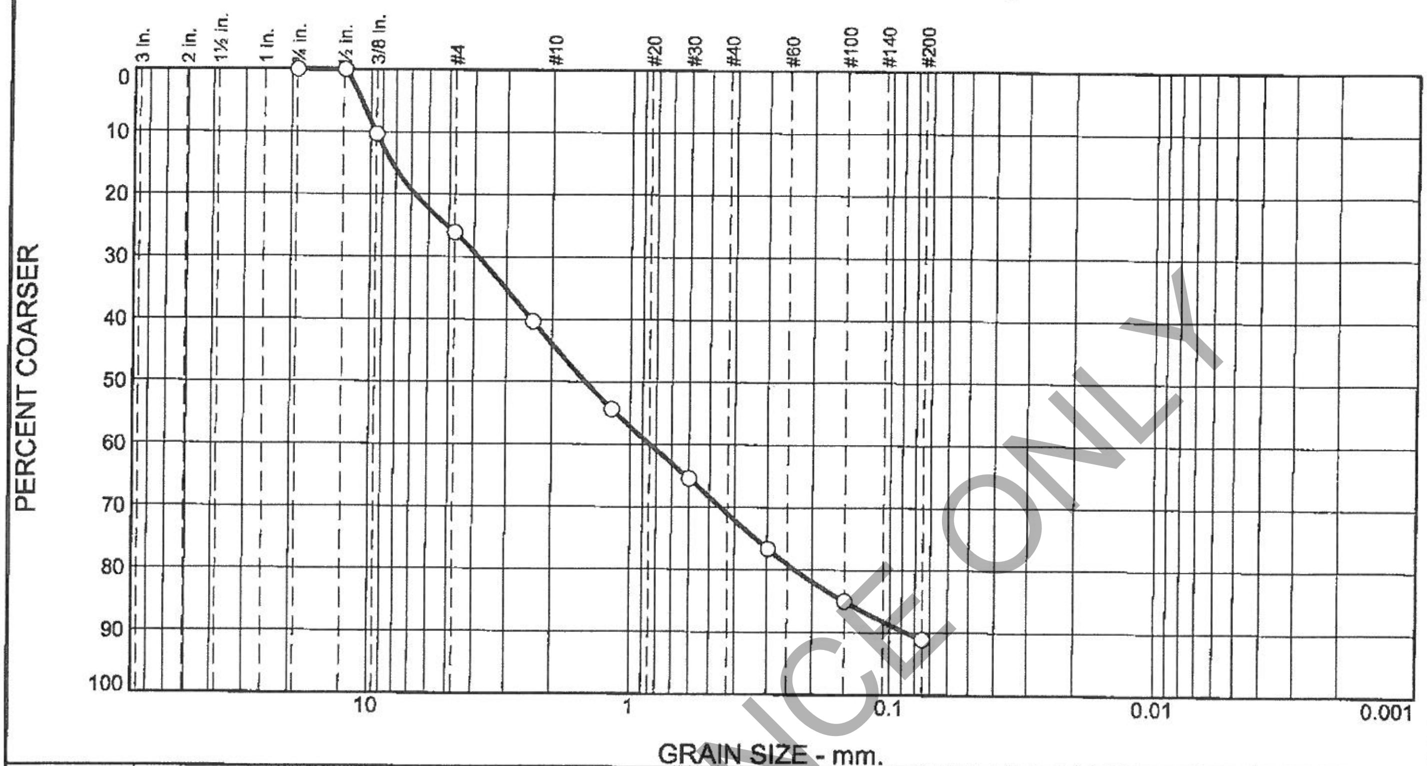
Source of Sample: P3-B6 Depth: 55-57 Date Sampled:
Sample Number: 16

Distinct Engineering Solutions, Inc.

North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	26	18	27	20	9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.75	100		
0.5	100		
.375	90		
#4	74		
#8	60		
#16	46		
#30	35		
#50	23		
#100	15		
#200	8.9		

* (no specification provided)

Material Description

GRAY C-F SAND, Some Gravel, Tr. Silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SW-SM AASHTO (M 145)= A-1-b

Coefficients

D_{90}= 9.5837 D_{85}= 8.2837 D_{60}= 2.3987
D_{50}= 1.4846 D_{30}= 0.4535 D_{15}= 0.1493
D_{10}= 0.0856 C_u= 28.04 C_c= 1.00

Remarks

Date Received: **Date Tested:** 2/18/2016

Tested By: SS, VA

Checked By: RT

Title: PM

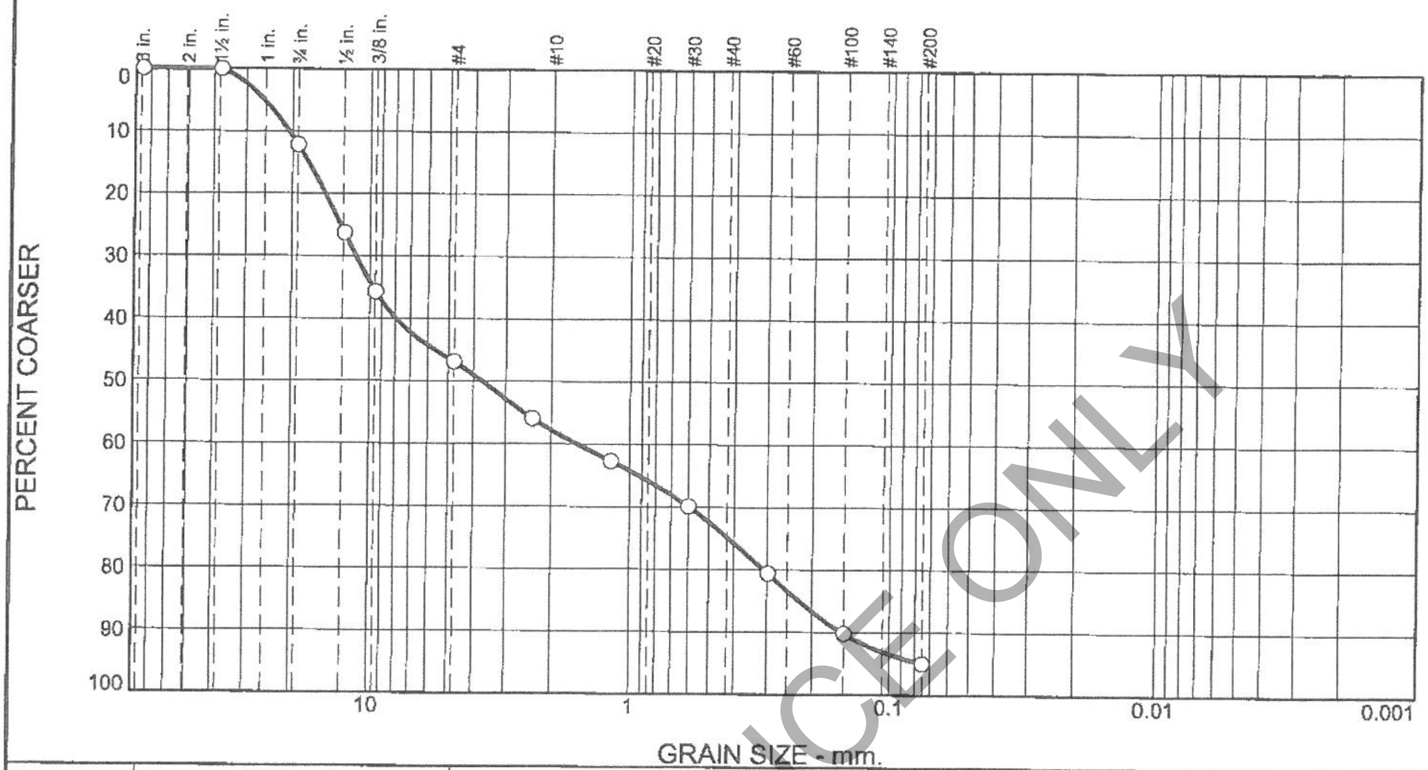
Source of Sample: P3-B7 **Depth:** 15-17
Sample Number: 7 **Date Sampled:** 2/18/16

Distinct Engineering Solutions, Inc.

North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	12	35	11	17	20	5	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3	100		
1.5	100		
.75	88		
0.5	74		
.375	64		
#4	53		
#8	44		
#16	37		
#30	30		
#50	19		
#100	10		
#200	5.0		

* (no specification provided)

Material Description

Dark Gray C-F SANDand C-F GRAVE, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-1-a

Coefficients

D_{90}= 20.5783 D_{85}= 17.3100 D_{60}= 7.9475
D_{50}= 3.6960 D_{30}= 0.5947 D_{15}= 0.2234
D_{10}= 0.1524 C_u= 52.16 C_c= 0.29

Remarks

Date Received: Date Tested: 2/18/2016

Tested By: VA,SS

Checked By: RT

Title: PM

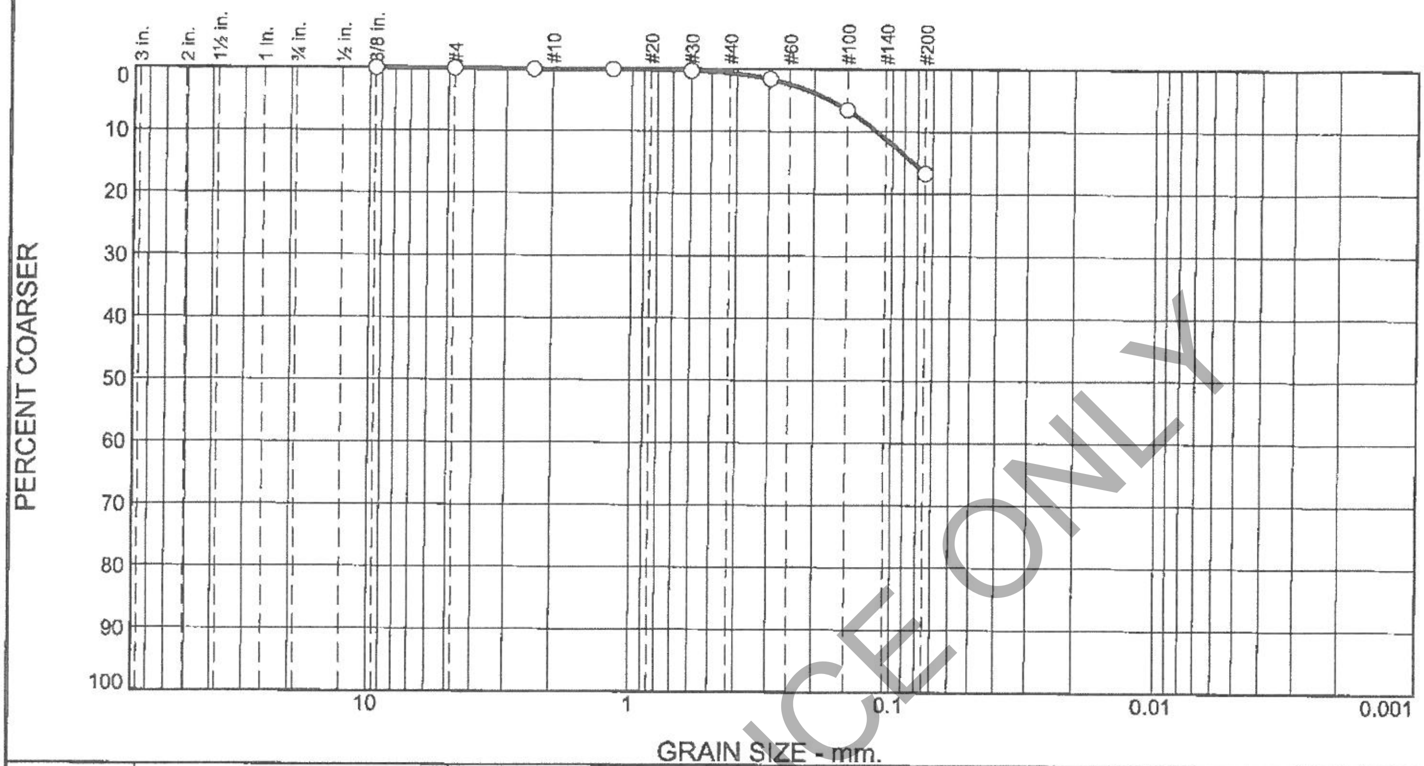
Source of Sample: P3-B8 **Depth:** 15-17 **Date Sampled:**
Sample Number: 7

Distinct Engineering Solutions, Inc.

North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	1	16	83	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.375	100		
#4	100		
#8	100		
#16	100		
#30	100		
#50	98		
#100	93		
#200	83		

* (no specification provided)

Material Description

Red Brown SILTY CLAY, Little Sand.

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= CL AASHTO (M 145)=

Coefficients

D_{90}= 0.1147 D_{85}= 0.0832 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 2-17-16

Tested By: VA,SS

Checked By: RT

Title: PM

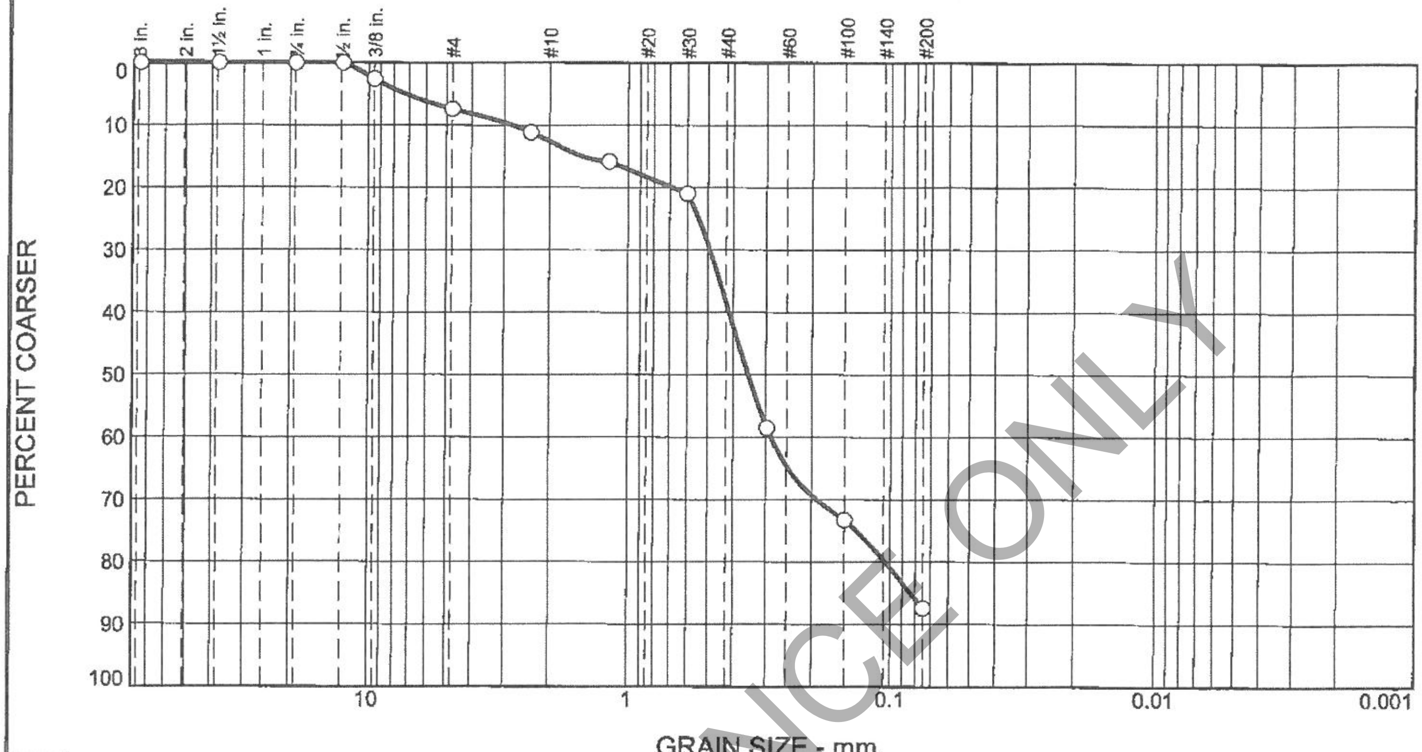
Source of Sample: P3-B8 **Depth:** 40-42 **Date Sampled:** 2-15-16
Sample Number: 12

Distinct Engineering Solutions, Inc.

North Brunswick, NJ

Client: ARUP
Project: STAPLETON
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	7	6	26	48	13	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3	100		
1.5	100		
.75	100		
0.5	100		
.375	97		
#4	93		
#8	89		
#16	84		
#30	79		
#50	41		
#100	27		
#200	13		

* (no specification provided)

Material Description

Red Brown F-C SAND, Little Silt, trace F Gravel

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 2.7729 D_{85}= 1.4907 D_{60}= 0.4147
D_{50}= 0.3508 D_{30}= 0.1906 D_{15}= 0.0832
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 2/18/2016

Tested By: SS, VH

Checked By: RT

Title: PM

Source of Sample: P3-B8 **Depth:** 50-52 **Date Sampled:**

Sample Number: 14

Distinct Engineering Solutions, Inc.

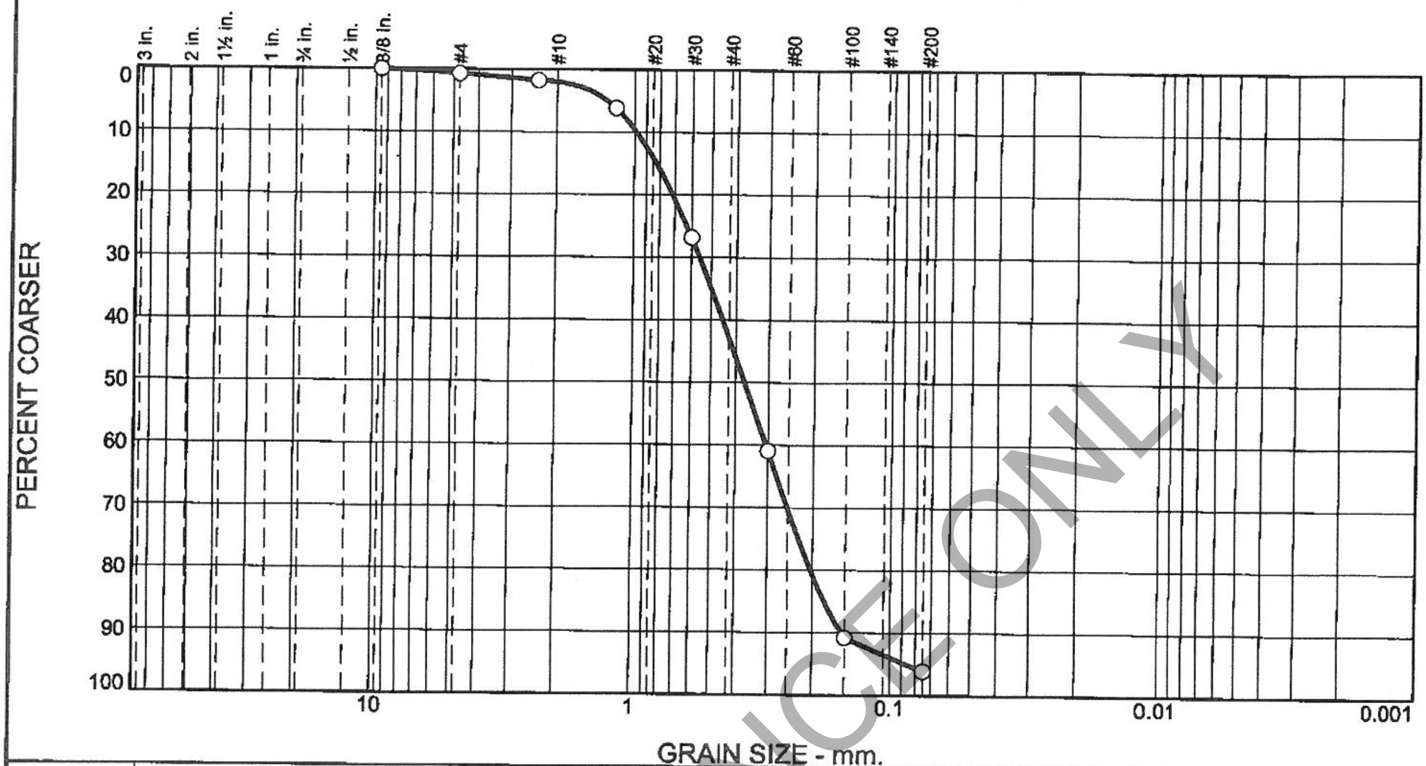
North Brunswick, NJ

Client: ARUP

Project: STAPLETON

Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	1	41	53	4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375	100		
#4	99		
#8	98		
#16	94		
#30	73		
#50	39		
#100	9		
#200	3.9		

* (no specification provided)

Material Description

Brown CF SAND, trace Silt,trace F Gravel

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.9822 D_{85}= 0.8234 D_{60}= 0.4508
D_{50}= 0.3699 D_{30}= 0.2515 D_{15}= 0.1799
D_{10}= 0.1543 C_u= 2.92 C_c= 0.91

Remarks

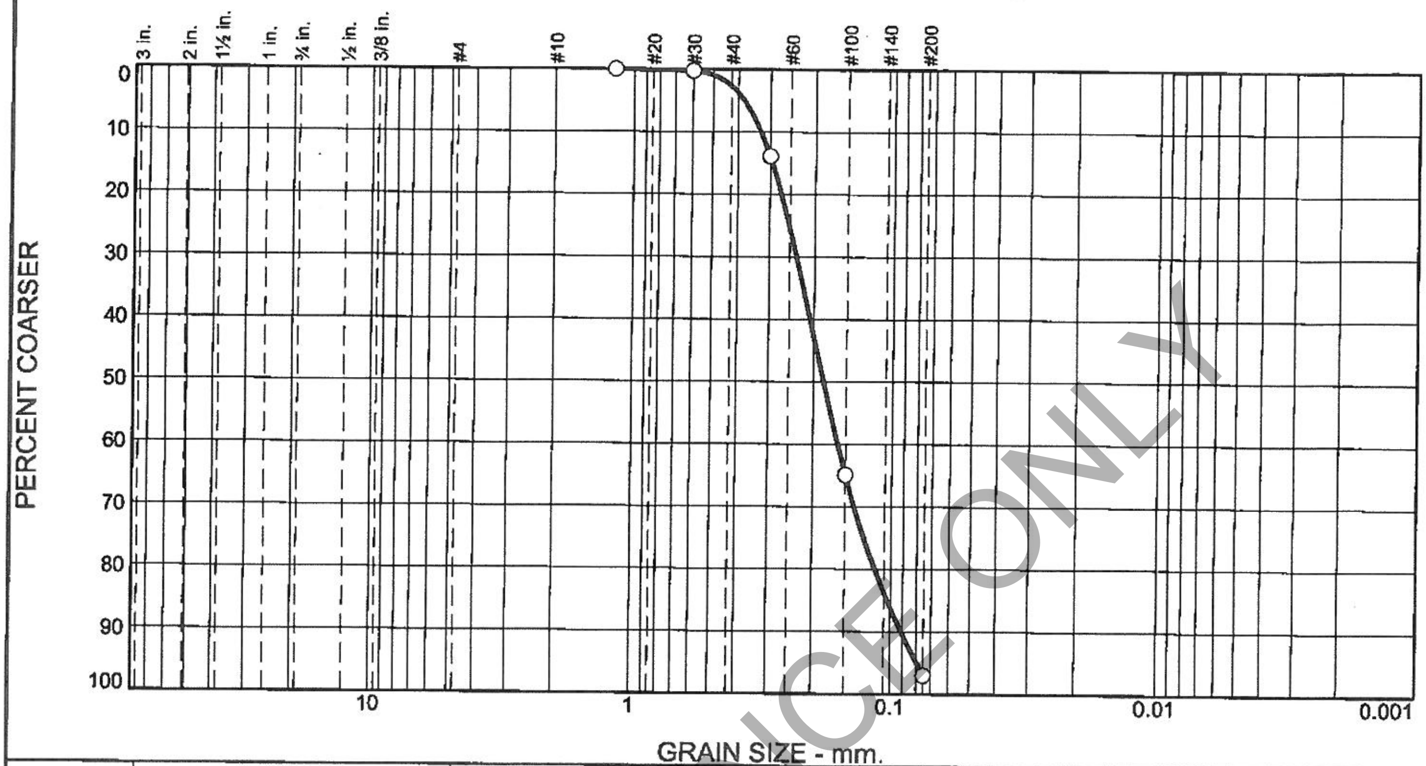
Date Received: **Date Tested:** 5/28/16
Tested By: EM
Checked By: RT
Title:

Location: P3-B11
Sample Number: S16 **Depth:** 60-62 **Date Sampled:**

Distinct Engineering Solutions, Inc.
North Brunswick, NJ

Client: Arup
Project: Stapleton Phase 2 and 3
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	3	94	3	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#16	100		
#30	100		
#50	86		
#100	35		
#200	3.0		

* (no specification provided)

Material Description

Brown MF SAND, trace Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.3257 D_{85}= 0.2938 D_{60}= 0.2070
D_{50}= 0.1829 D_{30}= 0.1386 D_{15}= 0.1031
D_{10}= 0.0910 C_u= 2.28 C_c= 1.02

Remarks

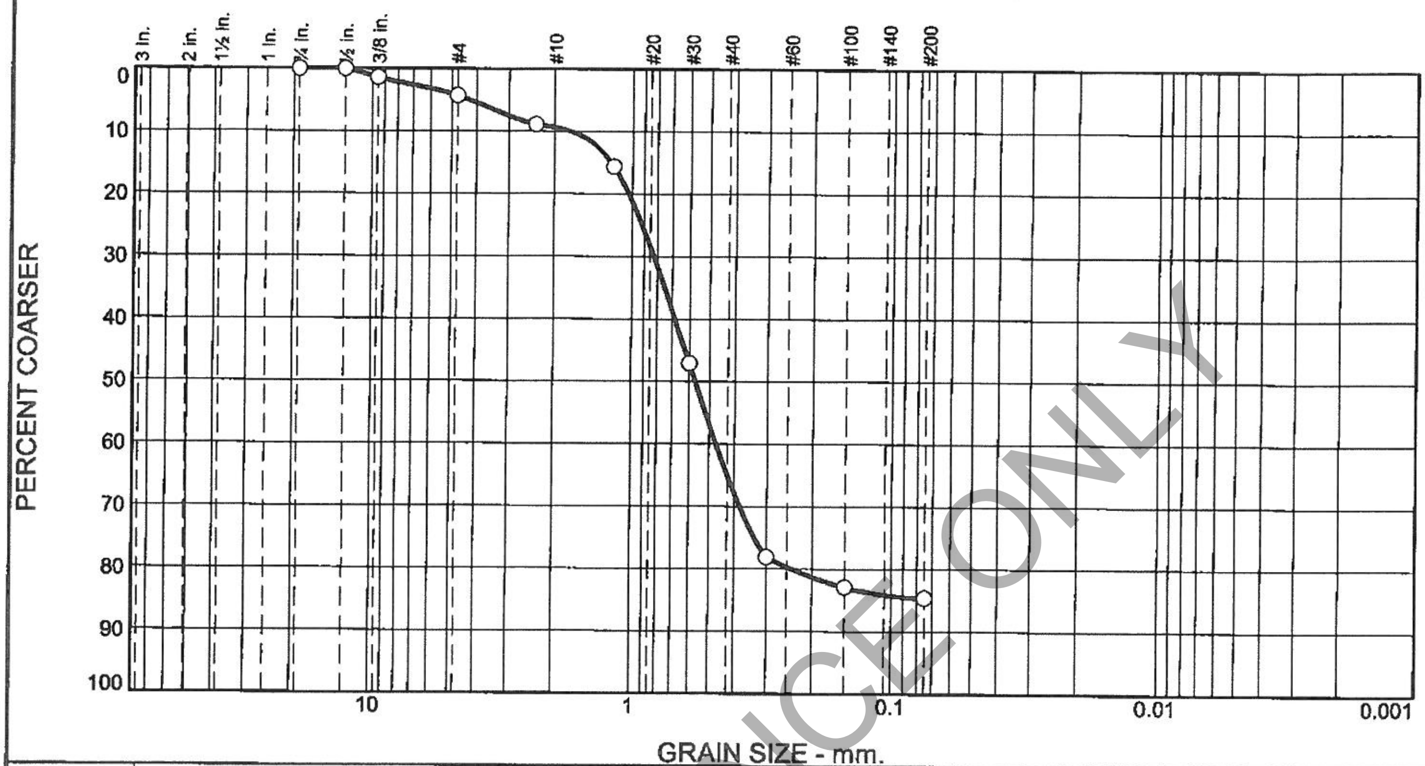
Date Received: **Date Tested:** 5/31/2016
Tested By: EM
Checked By: RT
Title:

Location: P3-B13
Sample Number: S8 **Depth:** 25-27 **Date Sampled:**

Distinct Engineering Solutions, Inc.
North Brunswick, NJ

Client: Arup
Project: Stapleton Phase 2 and 3
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	4	5	56	20	15	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75	100		
0.5	100		
0.375	99		
#4	96		
#8	91		
#16	84		
#30	53		
#50	22		
#100	17		
#200	15		

* (no specification provided)

Material Description

Brown CF SAND, little Silt, trace F Gravel

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 1.7215 D_{85}= 1.2081 D_{60}= 0.6821
D_{50}= 0.5691 D_{30}= 0.3809 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 5/31/16

Tested By: EM

Checked By: RT

Title:

Location: P3-B13
Sample Number: S16 **Depth:** 65-67

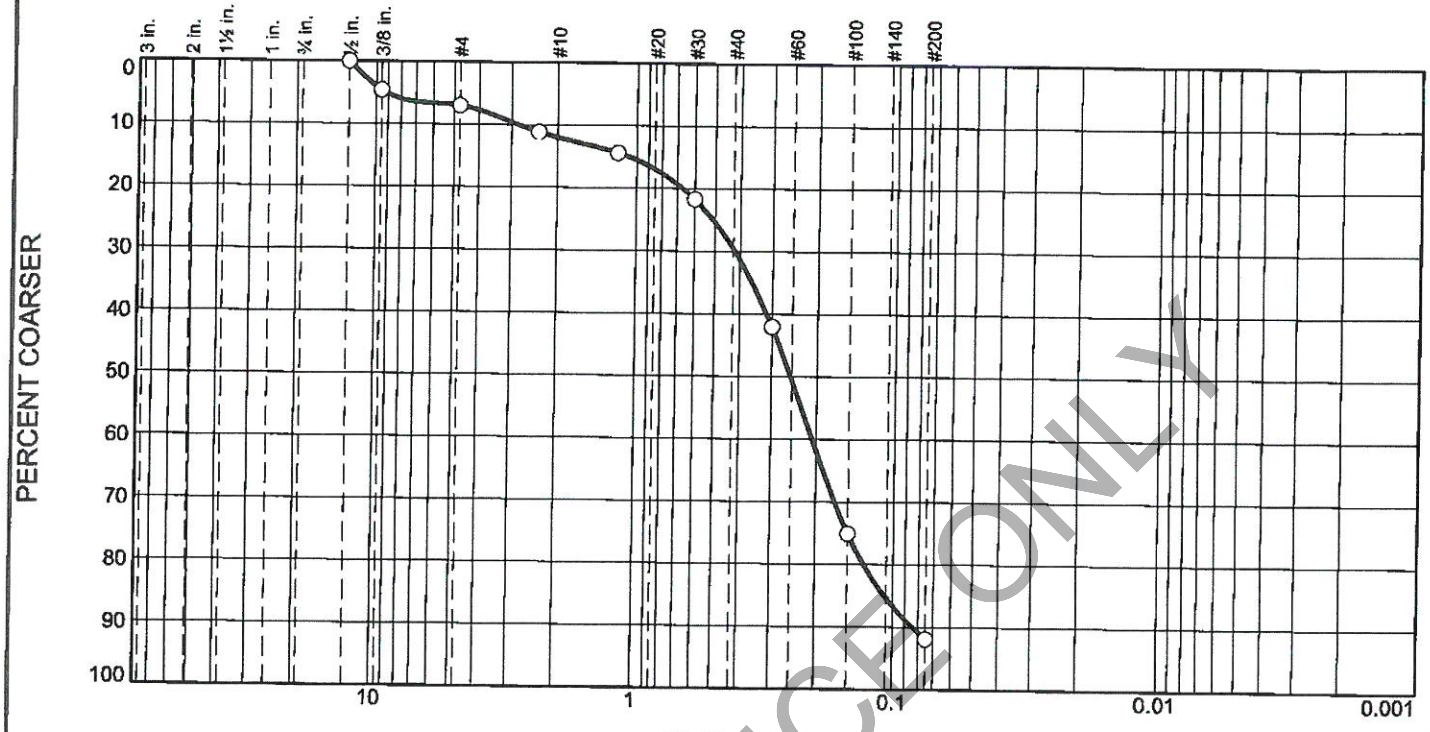
Date Sampled:

Distinct Engineering Solutions, Inc.

North Brunswick, NJ

Client: Arup
Project: Stapleton Phase 2 and 3
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	7	5	18	62	8	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.5	100		
.375	95		
#4	93		
#8	89		
#16	86		
#30	78		
#50	58		
#100	25		
#200	8.1		

* (no specification provided)

Material Description

Dark Brown CF Sand, trace F Gravel, trace Silt, brick fragments

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 2.8079 D_{85}= 1.0665 D_{60}= 0.3145
D_{50}= 0.2530 D_{30}= 0.1690 D_{15}= 0.1077
D_{10}= 0.0838 C_u= 3.75 C_c= 1.08

Remarks

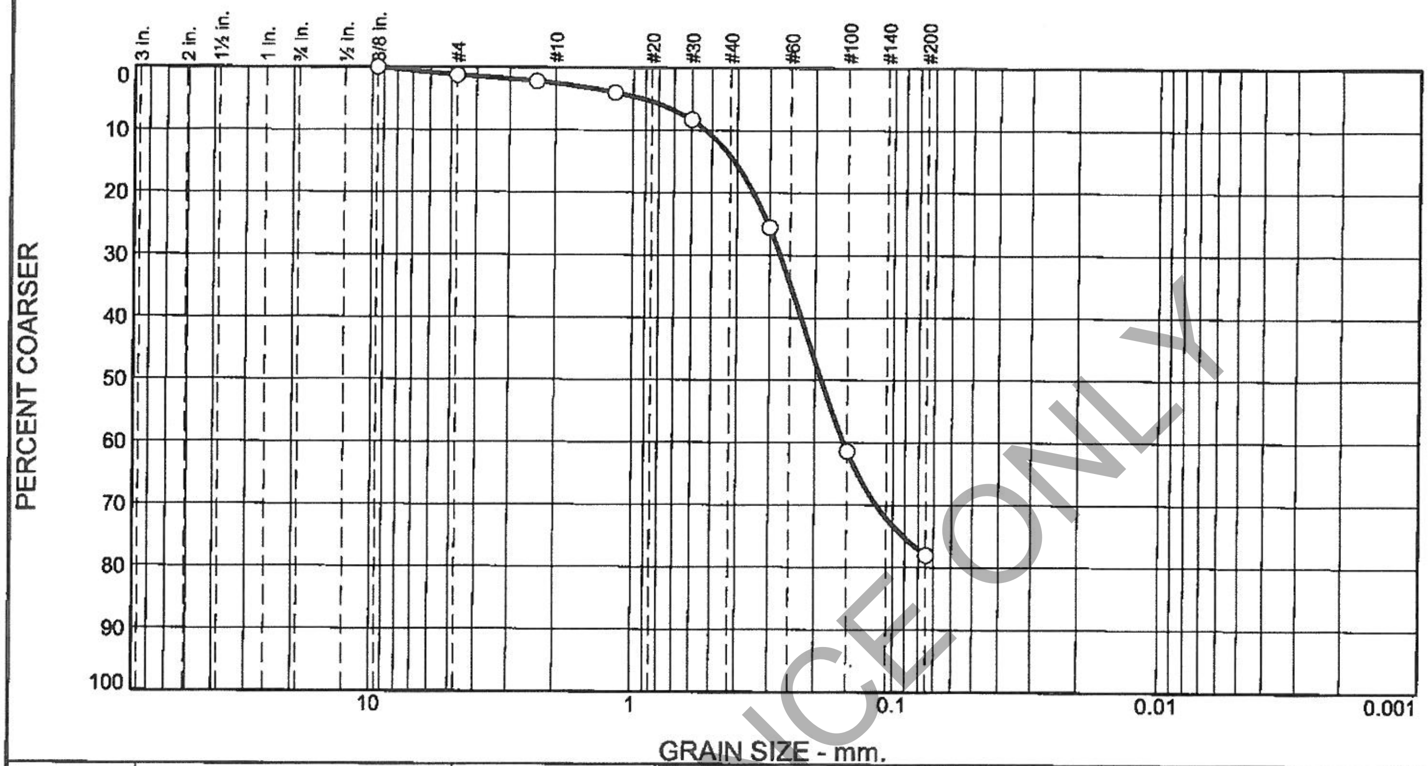
Date Received: **Date Tested:** 7/6/2016
Tested By: EM
Checked By: RT
Title:

Source of Sample: E-23/B-14 **Depth:** 15-17
Sample Number: S7 **Date Sampled:**

Distinct Engineering Solutions, Inc.
North Brunswick, NJ

Client: Arup
Project: Stapleton Phase 2 and 3
Project No: 15040 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	2	11	64	22	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375	100		
#4	99		
#8	98		
#16	96		
#30	92		
#50	74		
#100	39		
#200	22		

* (no specification provided)

Material Description

Brown CF SAND, some Clayey Silt, trace F Gravel

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 0.5272 D_{85}= 0.4091 D_{60}= 0.2264
D_{50}= 0.1891 D_{30}= 0.1157 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 5/31/16

Tested By: EM

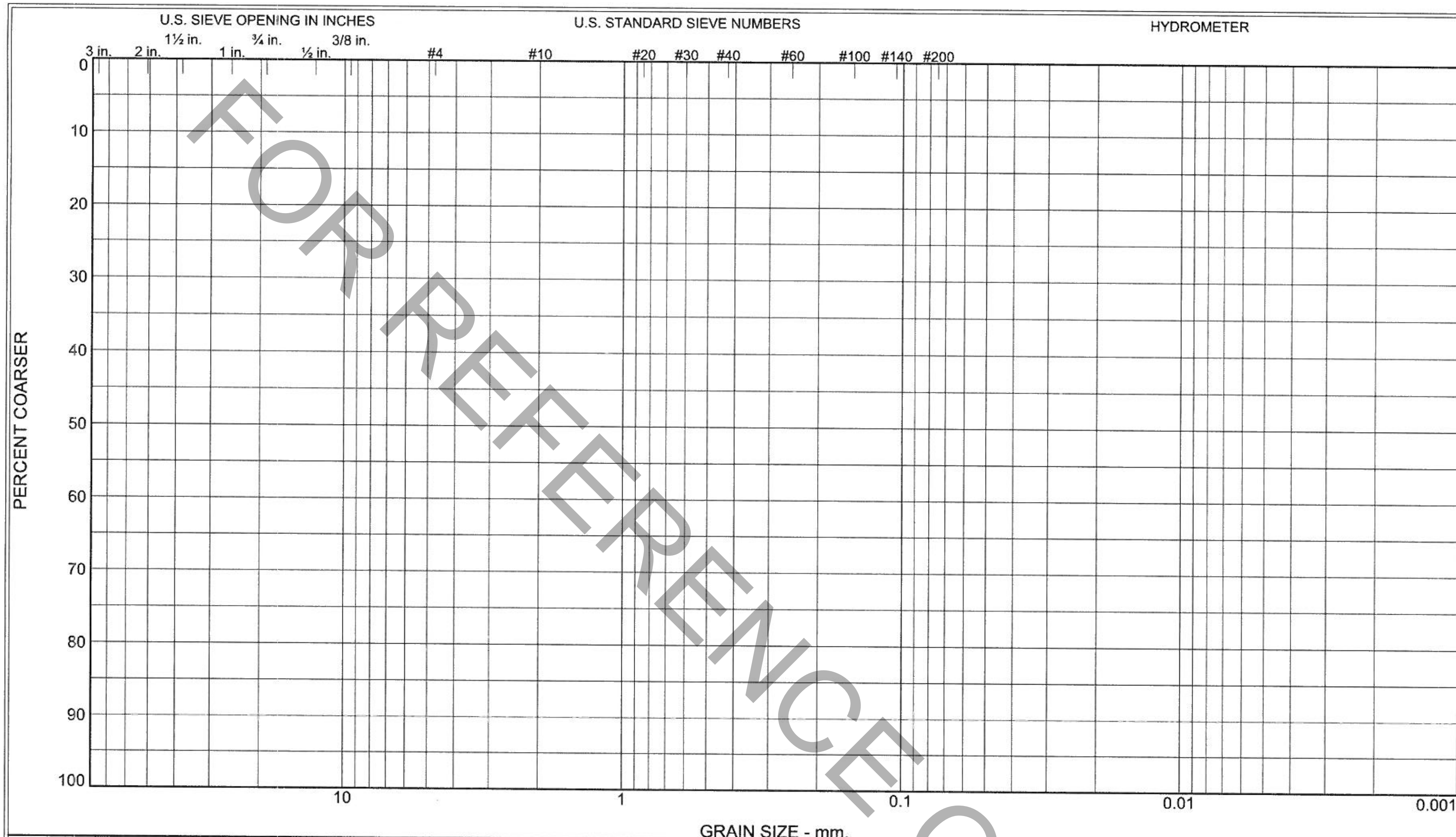
Checked By: RT

Title:

Location: P3-B14
Sample Number: S11 **Depth:** 35-37 **Date Sampled:**

Distinct Engineering Solutions, Inc.
North Brunswick, NJ

Client: Arup
Project: Stapleton Phase 2 and 3
Project No: 15040 **Figure**



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
12	38-40	Dark Gray Clay SILT	194.2	NV	NP	NP

Project STAPLETON

Area

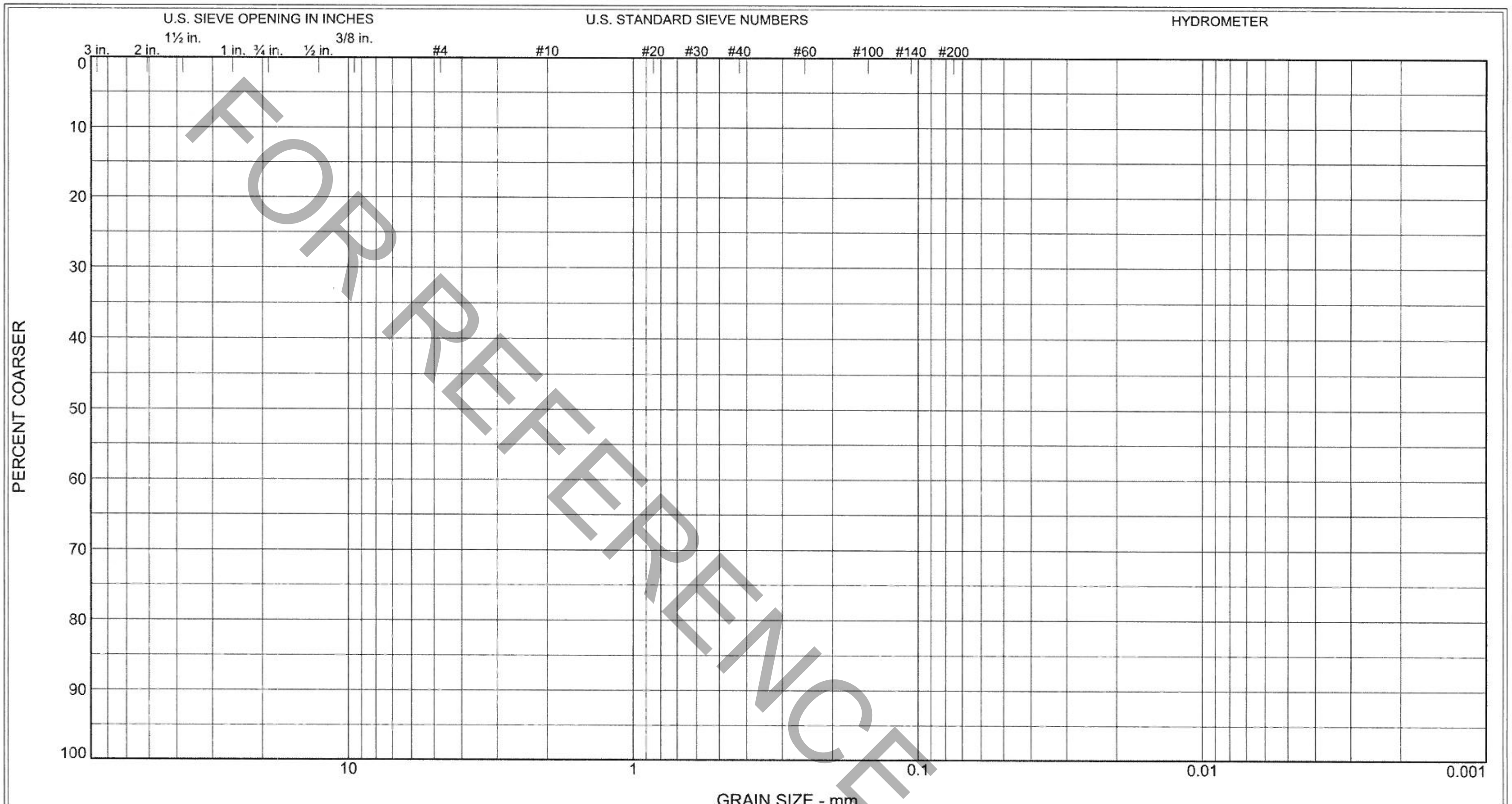
Boring No. P3-B1

Date: 3/7/2016

Distinct Engineering Solutions, Inc.

Particle Size Distribution Report

ENG FORM 1 MAY 63 **2087**



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
13	38-40	Brown CLAY	24.4	NV	NP	NP

Project STAPLETON

Area

Boring No. P3-B3

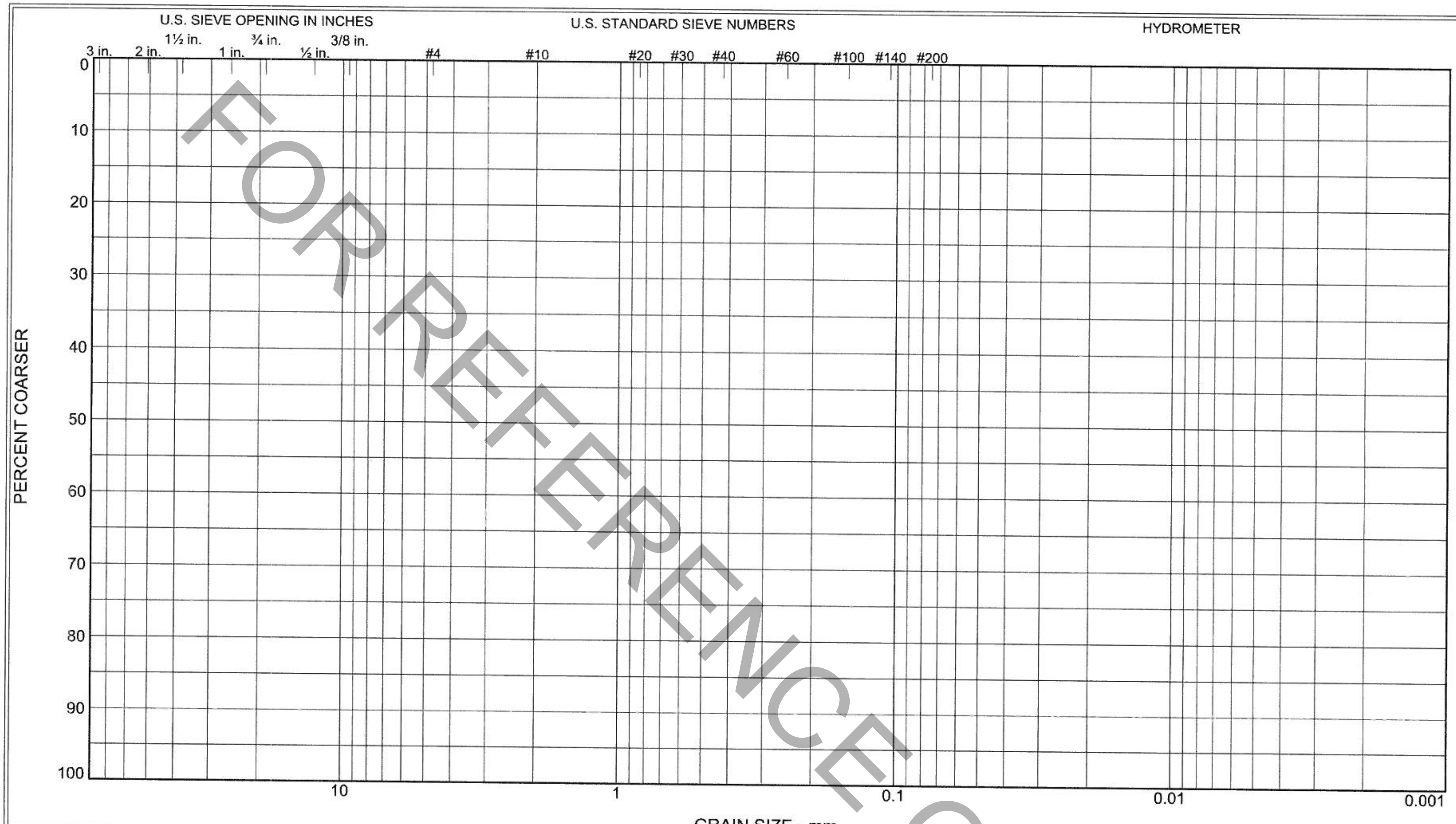
Date: 3/7/2016

Distinct Engineering Solutions, Inc.

Particle Size Distribution Report

ENG FORM 1 MAY 63 **2087**

Tested By: VA,SS



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

	Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
○	9	25-27	Dark Gray Silty CLAY	36.4	NV	NP	NP

Project STAPLETON

Area

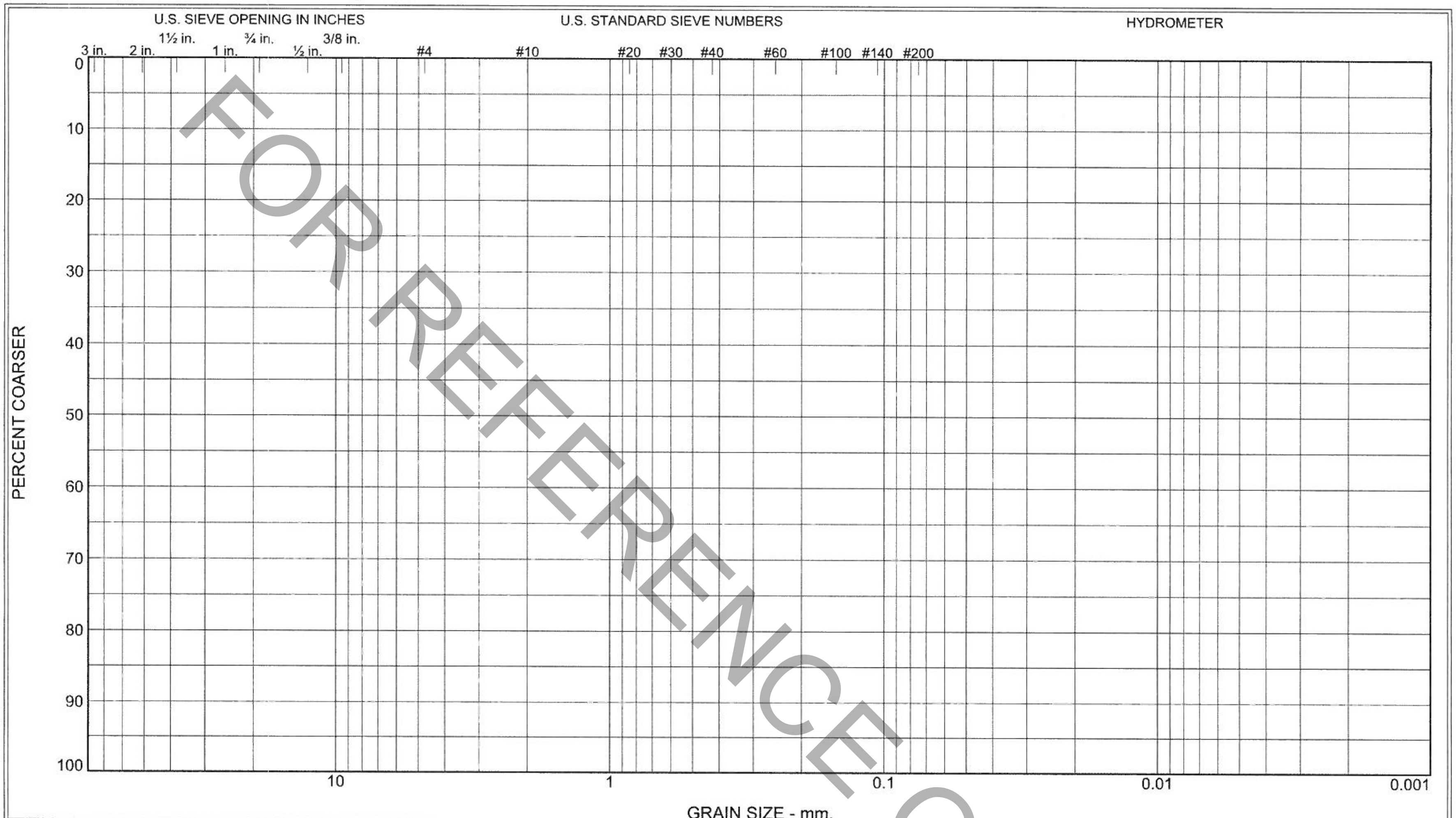
Boring No. P3-B4

Date: 3/7/2016

Distinct Engineering Solutions, Inc.

Particle Size Distribution Report

ENG FORM 1 MAY 63 **2087**



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
10	30-32	Brown Silty CLAY	32.1	NV	NP	NP

Project STAPLETON

Area

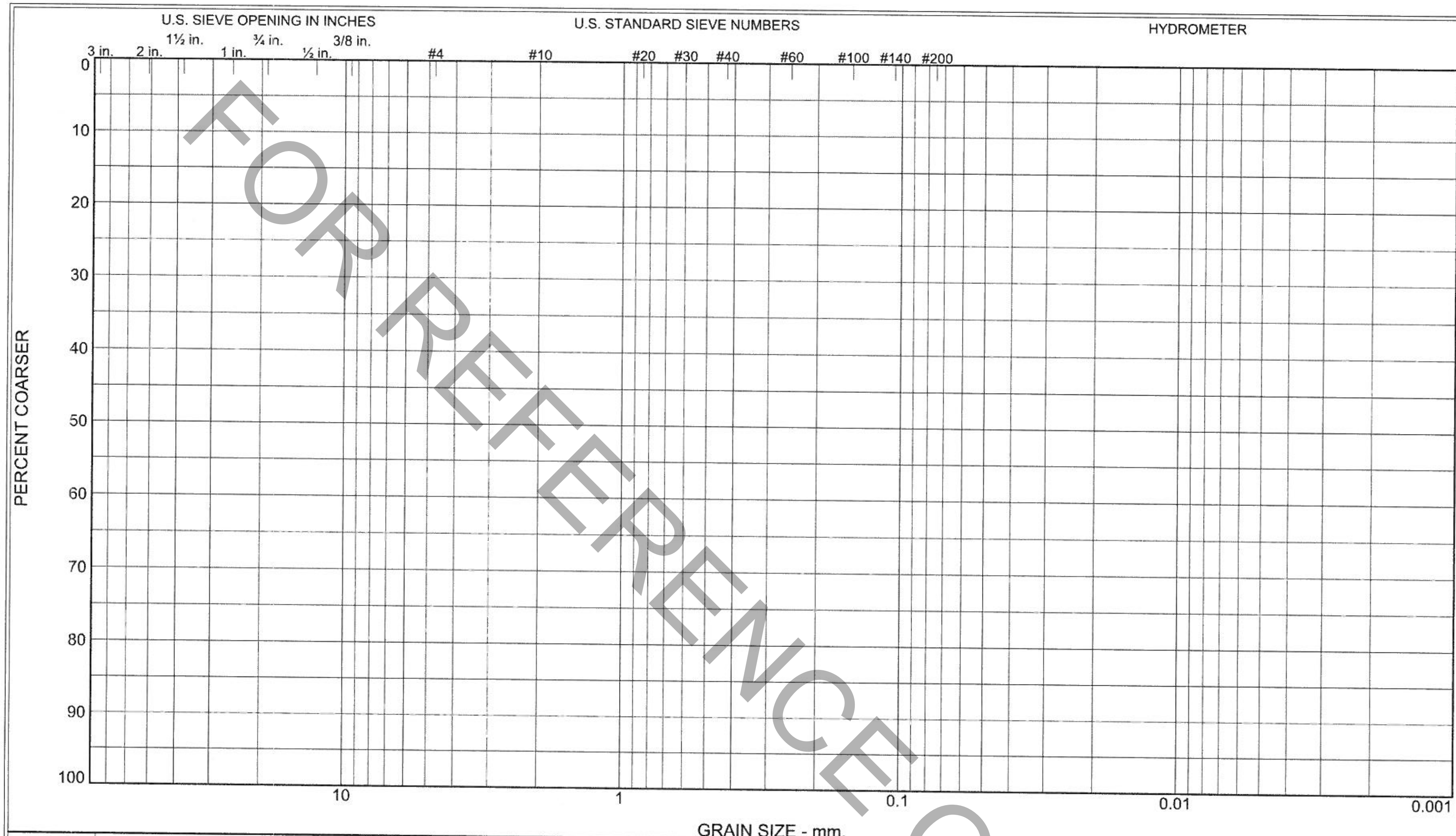
Boring No. P3-B6

Date: 3/7/2016

Distinct Engineering Solutions, Inc.

Particle Size Distribution Report

ENG FORM 1 MAY 63 **2087**



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

	Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
○	11	35-37	Black Gray CLAYEY SILT, little F Sand,	29.4	NV	NP	NP

Project STAPLETON

Area

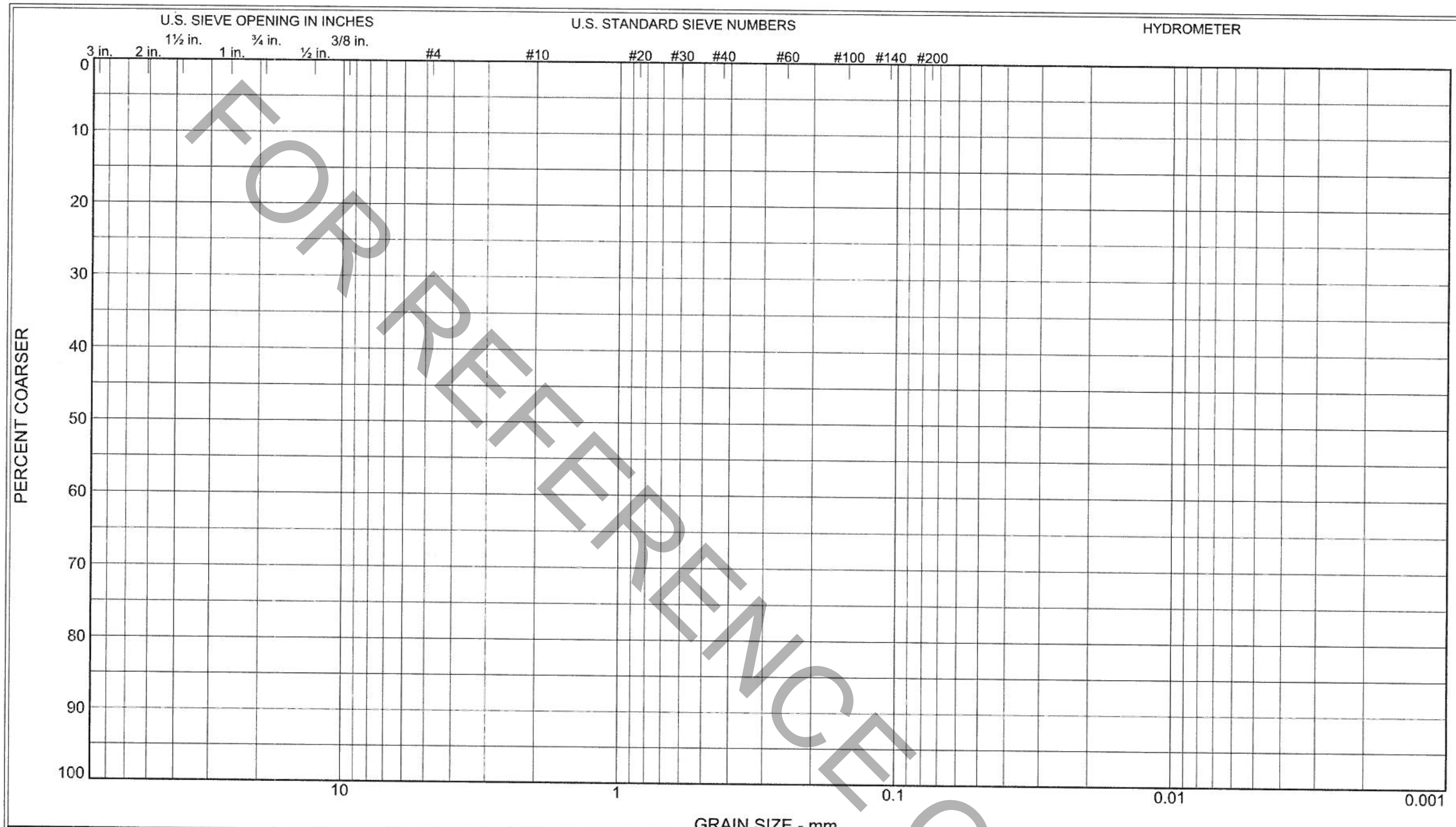
Boring No. P3-B6

Date: 3/7/2016

Distinct Engineering Solutions, Inc.

Particle Size Distribution Report

ENG FORM 1 MAY 63 2087



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
13	45-47	Red Brown CLAYEY SILT, some F Sand	83.3			

Project STAPLETON

Area

Boring No. P3-B6

Date: 3/7/2016

Distinct Engineering Solutions, Inc.

Particle Size Distribution Report

ENG FORM 1 MAY 63 **2087**

Distinct Engineering #15040
Stapleton, Staten Island
LABORATORY TESTING DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS				STRENGTH			CONSOLIDATION			REMARKS
NO.	NO.	(ft)	WATER CONTENT (%)	USCS SYMB. (1)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	Type Test @ STRESS (tsf)	PEAK DEVIATOR STRESS (tsf)	AXIAL STRAIN @ PEAK STRESS (%)	Method	INITIAL CONDITIONS VOID RATIO (-)	INITIAL CONDITIONS SATUR-ATION (%)	
P3-B9	S-7	20-22		resealed							returned top section		
P3-B9	S-7	20.75-22			101.7							bottom section	
P3-B9	S-7	20.8	67.5										
P3-B9	S-7	20.9	77.9	OH	95.6	53.7				D2435	2.102	99	C16008
P3-B9	S-7	21.1	68.4										
P3-B9	S-7	21.35	73.7	OH	96.5	55.6	UU@0.5	0.55	4.5				UU056a

Note: (1) USCS symbol based on visual observation.

Prepared by: NG
Reviewed by: GET
Date: 3/17/2016

TerraSense, LLC
45H Commerce Way
Totowa, NJ 07512

Project No.: 7984-16001
File: Indx1.xls

Distinct Engineering #15040
Stapleton, Staten Island
LABORATORY TESTING DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS				STRENGTH			CONSOLIDATION			REMARKS
											INITIAL CONDITIONS		
NO.	NO.	(ft)	WATER CONTENT (%)	USCS SYMB. (1)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	Type Test	PEAK DEVIATOR STRESS (tsf)	AXIAL STRAIN @ PEAK STRESS (%)	Method	VOID RATIO (-)	SATUR-ATION (%)	/ TEST ID
P3-B11	PS-1	32-34			97.2								
P3-B11	PS-1A	32.3	77.4	OH	94.9	53.5	UU@.5	0.34	15.0				UU158d
P3-B11	PS-1B	32.75	76.8	OH	95.4	53.9				D2435	2.044	99	C16129
P3-B14	PS-1	17-19			97.5								
P3-B14	PS-1A	17.3	76.6	OH	95.7	54.2	UU@.5	0.46	9.6				UU158e
P3-B14	PS-1	17.55	69.1										
P3-B14	PS-1B	17.8	63.2	OH	99.3	60.9				D2435	1.615	100	C16128

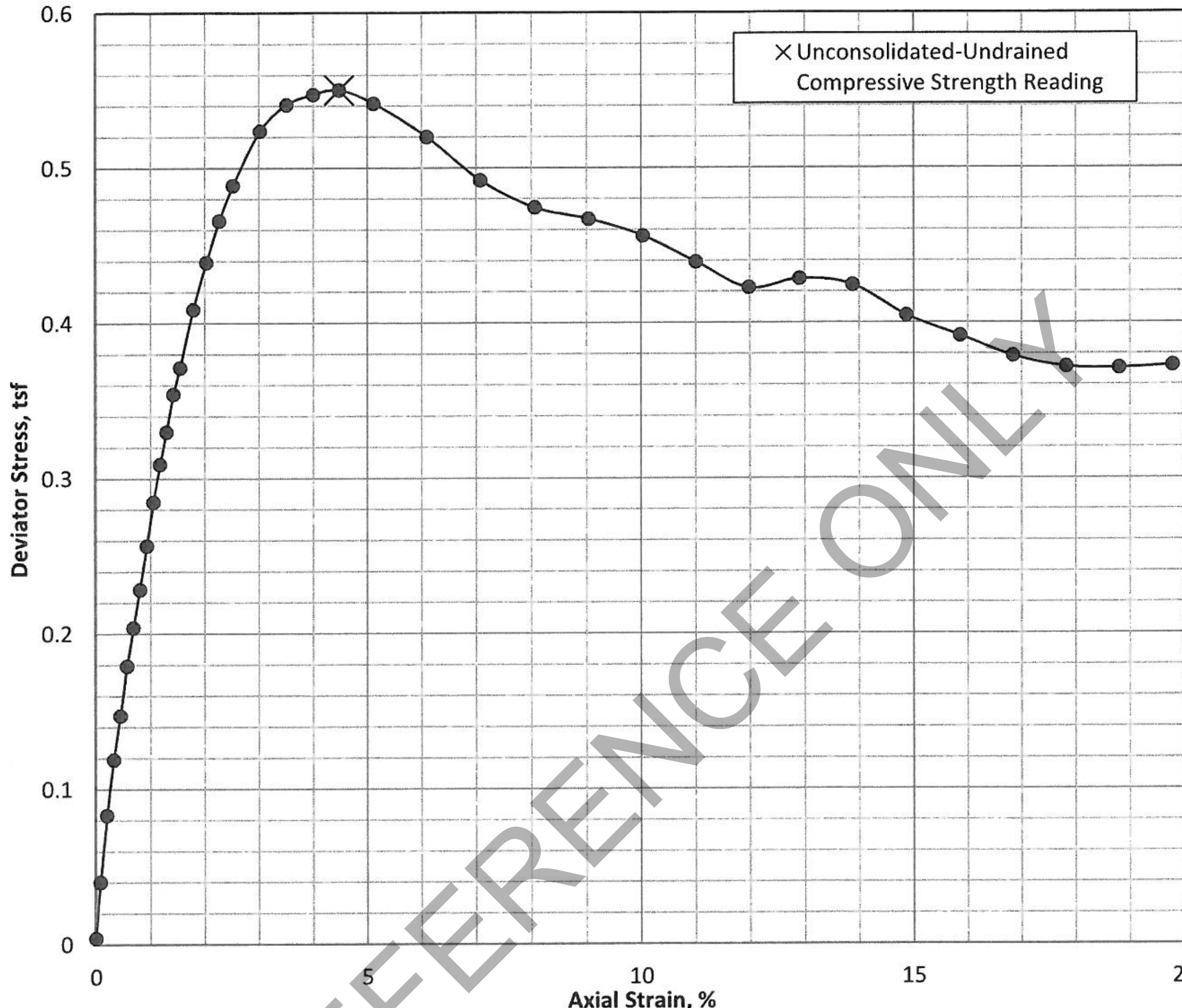
Note: (1) USCS symbol based on visual observation.

Prepared by: NG
Reviewed by: GET
Date: 6/20/2016

TerraSense, LLC
45H Commerce Way
Totowa, NJ 07512

Project No.: 7984-16003
File: Indx3.xls

UNCONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2850



Specimen and Material Property Information

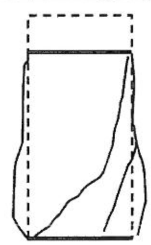
Sample Type: Intact tube sample

Description and/or Classification: OH, gray organic clay

Cell Pressure (tsf)	Water Content (%) [1]	Wet Unit Weight (pcf)	Dry Unit Weight (pcf) [1]	Void Ratio (-)	Saturation (%) [2]	Length (inch)	Diameter (inch)	L/D (-)	LL/PL (-)	PI (-)	Specific Gravity (-) [2]
0 (Initial)	73.7	96.5	55.6	2.00	98.3	6.008	2.857	2.1			2.67
0.5	73.7	96.6	55.6	2.00	98.5	6.006	2.856	2.1			

Failure Summary

U-U Compressive Strength (tsf)	U-U Shear Strength, s_u (tsf)	Strain to to Peak (%)	Strain Rate (%/min)
0.55	0.275	4.5	0.73



FAILURE SKETCH

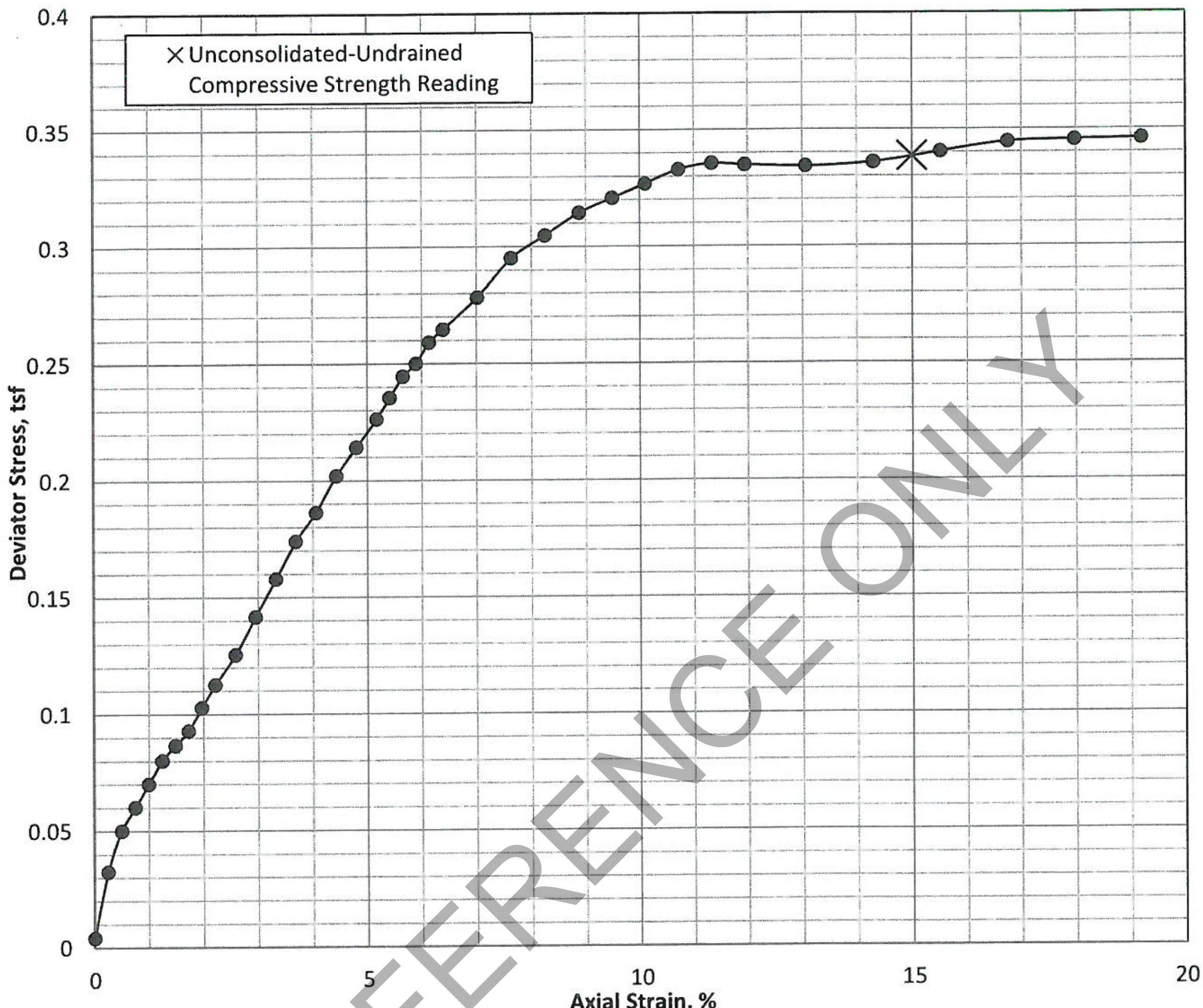
Remarks and Notes:
(1) Water Content determined after shear from partial specimen.
(2) Assumed specific gravity

Tested by: BB
Test Date: 2/25/2016
Reviewed by: GET
Review Date: 3/17/2016

Distinct Engineering **Project # 15040**	**Stapleton, Staten Island**	**UNCONSOLIDATED-UNDRAINED COMPRESSION TEST**
TerraSense, LLC **Project # 7984-16001**		**Boring: P3-B9 Sample: S-7** **Section: C Depth: 21.75 ft.**

 TS Analysis File: UUv4 (9/09) UU056a.xlsx 3/17/2016

UNCONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2850



Specimen and Material Property Information

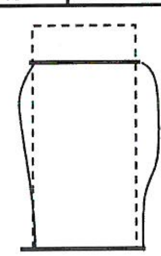
Sample Type: Intact tube sample

Description and/or Classification: OH, black organic clay

Cell Pressure (tsf)	Water Content (1) (%)	Wet Unit Weight (pcf)	Dry Unit (1) Weight (pcf)	Void Ratio (-)	Saturation (2) (%)	Length (inch)	Diameter (inch)	L/D (-)	LL/PL (-)	PI (-)	Specific Gravity (2) (-)
0 (Initial)	77.4	94.9	53.5	2.04	98.9	6.037	2.855	2.1			2.60
0.5	77.4	95.5	53.8	2.02	99.8	6.024	2.849	2.1			

Failure Summary

U-U Compressive Strength (tsf)	U-U Shear Strength, s_u (tsf)	Strain to Peak (%)	Strain Rate (%/min)
0.34	0.17	15.0	0.74



FAILURE SKETCH

Remarks and Notes:

(1) Water Content determined after shear from partial specimen.

(2) Assumed specific gravity

Tested by: BB
Test Date: 6/6/2016

Reviewed by: GET
Review Date: 6/20/216

Distinct Engineering
Project # 15040

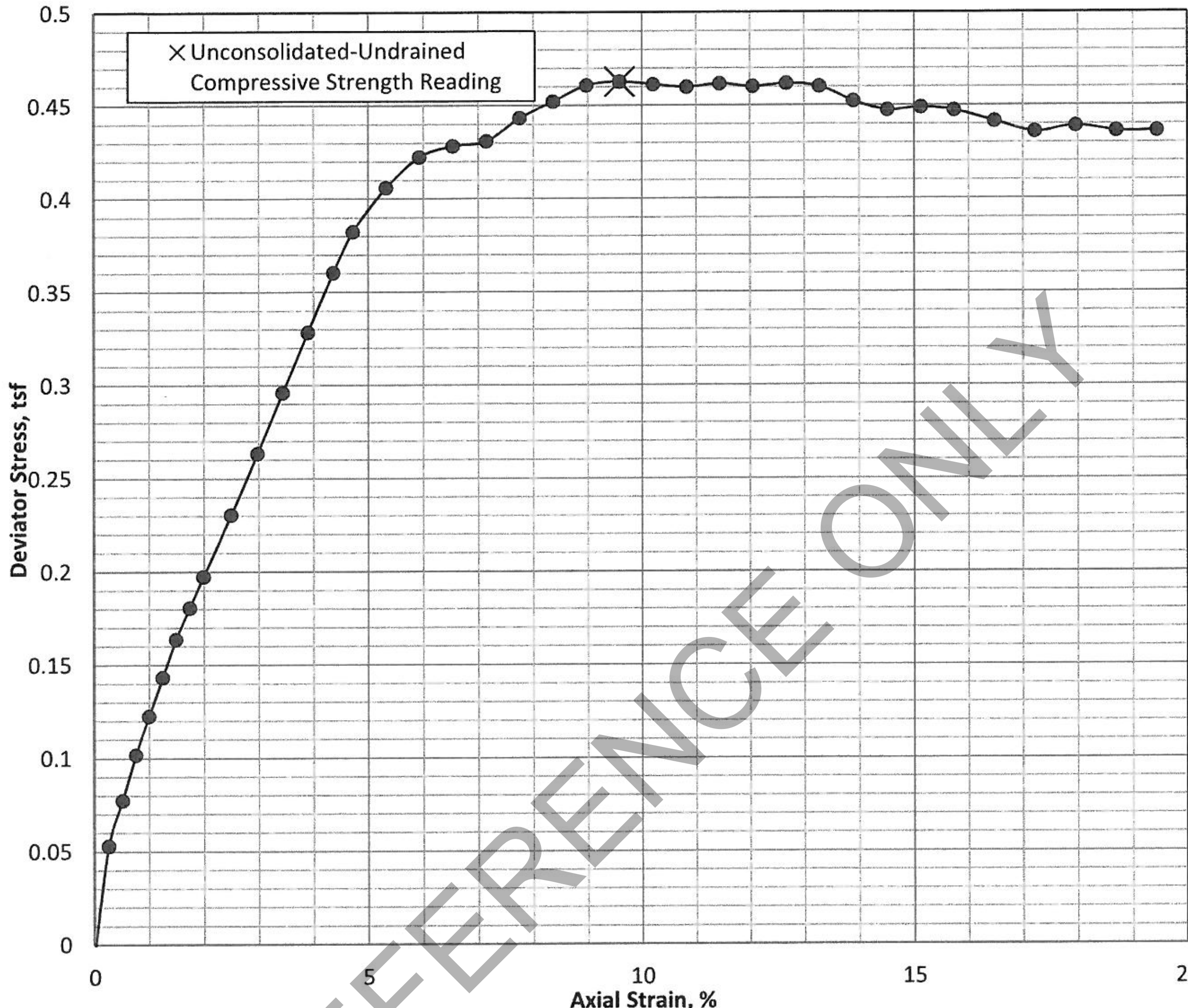
TerraSense, LLC
Project # 7984-16003

Stapleton, Staten Island

UNCONSOLIDATED-UNDRAINED COMPRESSION TEST

Boring: P3-B11 Sample: PS-1
Section: A Depth: 32.3 ft.

UNCONSOLIDATED-UNDRAINED COMPRESSIVE STRENGTH TEST, ASTM METHOD D2850



Specimen and Material Property Information

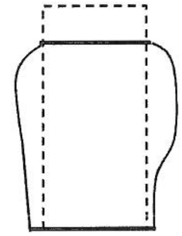
Sample Type: Intact tube sample

Description and/or Classification: OH, Dark gray organic clay with fine sand seams

Cell Pressure (tsf)	Water Content [1] (%)	Wet Unit Weight (pcf)	Dry Unit Weight [1] (pcf)	Void Ratio (-)	Saturation [2] (%)	Length (inch)	Diameter (inch)	L/D (-)	LL/PL (-)	PI (-)	Specific Gravity [2] (-)
0 (Initial)	76.6	95.7	54.2	1.99	99.8	6.009	2.853	2.1			2.60
0.5	76.6	95.8	54.3	1.99	100.0	6.007	2.852	2.1			

Failure Summary

U-U Compressive Strength (tsf)	U-U Shear Strength, s_u (tsf)	Strain to Peak (%)	Strain Rate (%/min)
0.46	0.23	9.6	0.73



FAILURE SKETCH

Remarks and Notes:

(1) Water Content determined after shear from partial specimen.

(2) Assumed specific gravity

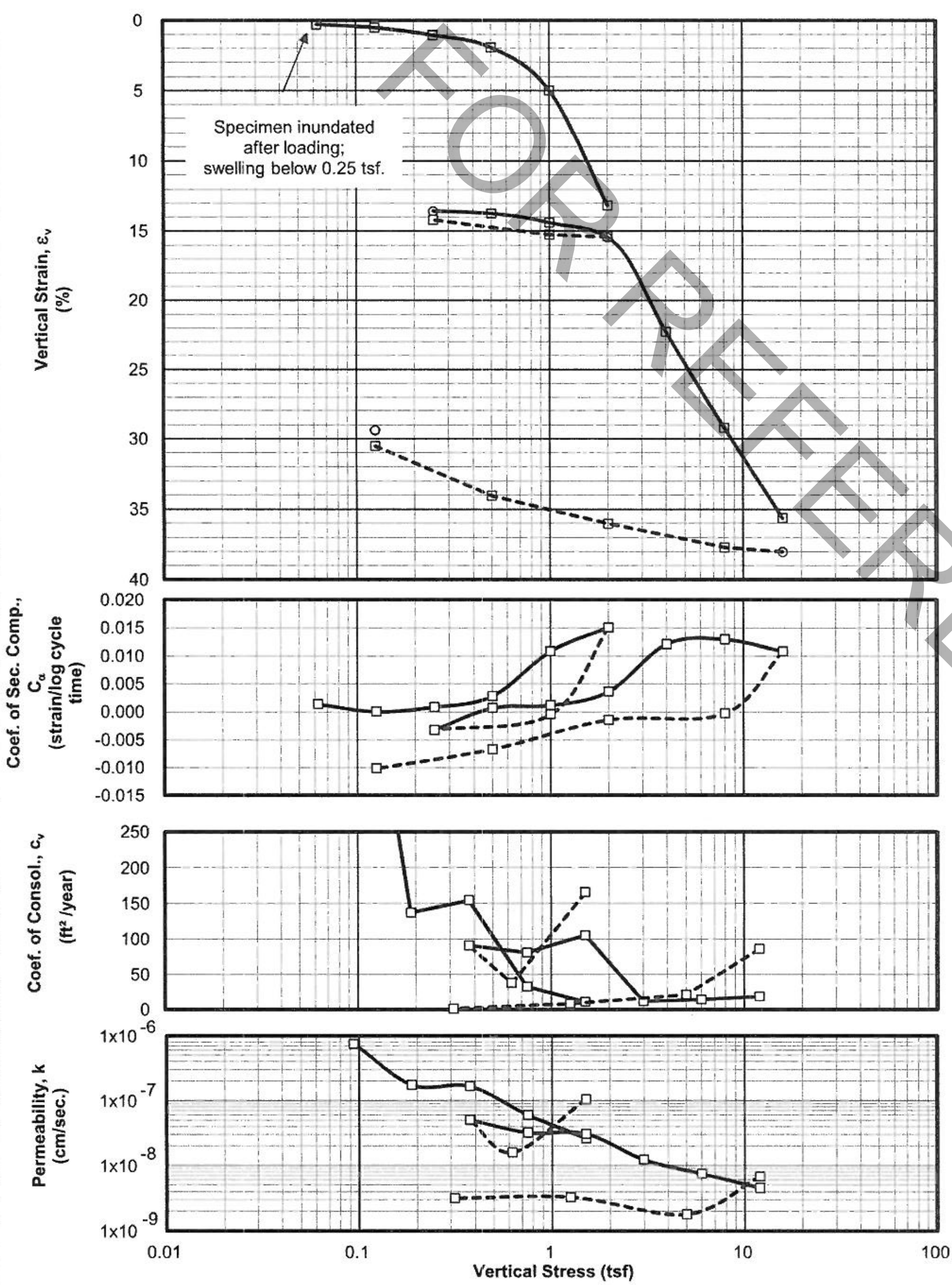
Tested by: BB

Test Date: 6/6/2016

Reviewed by: GET

Review Date: 6/20/2016

Distinct Engineering Project # 15040	**Stapleton, Staten Island**	**UNCONSOLIDATED-UNDRAINED COMPRESSION TEST**
TerraSense, LLC Project # 7984-16003		**Boring: P3-B14 Sample: PS-1 Section: A Depth: 17.3 ft.**



SAMPLE INFORMATION

Boring:	P3-B9
Sample:	S-7
Depth:	20.90 feet
Elevation:	
Type:	3-inch thin wall tube
Description:	OH, black organic clay; shells noted

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height:	0.61	inch
Diameter:	2.50	inch
Initial water content:	77.9	%
Initial total unit weight:	95.6	pcf
Initial dry unit weight:	53.7	pcf
Initial void ratio:	2.102	
Initial degree of saturation:	99	%
Final water content:	49.5	%
Final total unit weight:	107.3	pcf
Final dry unit weight:	71.8	pcf
Final void ratio:	1.323	
Final degree of saturation:	100	% (assumed specific gravity = 2.67)

TEST SUMMARY

Construction Method:	Casagrande (Log)
Estimated preconsolidation stress (tsf):	1.0 (Range: 0.9 to 1.0)
Estimated in situ effective overburden stress (tsf):	
Compression Ratio (strain per log cycle stress):	0.303
Compression Index (void ratio per log cycle stress):	0.940
Swell Ratio (strain per log cycle stress):	0.017
Swell Index (void ratio per log cycle stress):	0.053
Recompression Ratio (strain per log cycle stress):	0.027
Recompression Index (void ratio per log cycle stress):	0.084
Remarks:	

LEGEND: □ End of primary ○ End of Stage ——— Loading - - - - - - - Unloading

Test Date: 2/25/16 Tested By: CMJ/MHC Checked By: GET

Distinct Engineering Project No. 15040	Stapleton, Staten Island	ONE DIMENSIONAL CONSOLIDATION TEST Boring: P3-B9 Depth: 20.90 feet
TerraSense, LLC	Project No. 7984-16001	March 2016

PROJECT:	Stapleton, Staten Island				
PROJECT NO.:	7984-16001	Initial height:	0.611 inch	Final height:	0.458 inch
BORING:	P3-B9	Initial water content:	77.9 %	Final water content:	49.5 %
SAMPLE:	S-7	Initial dry density:	53.7 pcf	Final dry density:	71.8 pcf
TEST:	C16008	Initial total density:	95.6 pcf	Final total density:	107.3 pcf
DEPTH, feet:	20.9	Initial saturation:	99 %	Final saturation:	100 %
BY:	CMJ/MHC	Initial void ratio:	2.102	Final void ratio:	1.323
TEST DATE:	2/25/2016			Final strain:	25.1 %

EQUIPMENT:
Load Frame No.: 3
Ring Diameter: 2.5 inch

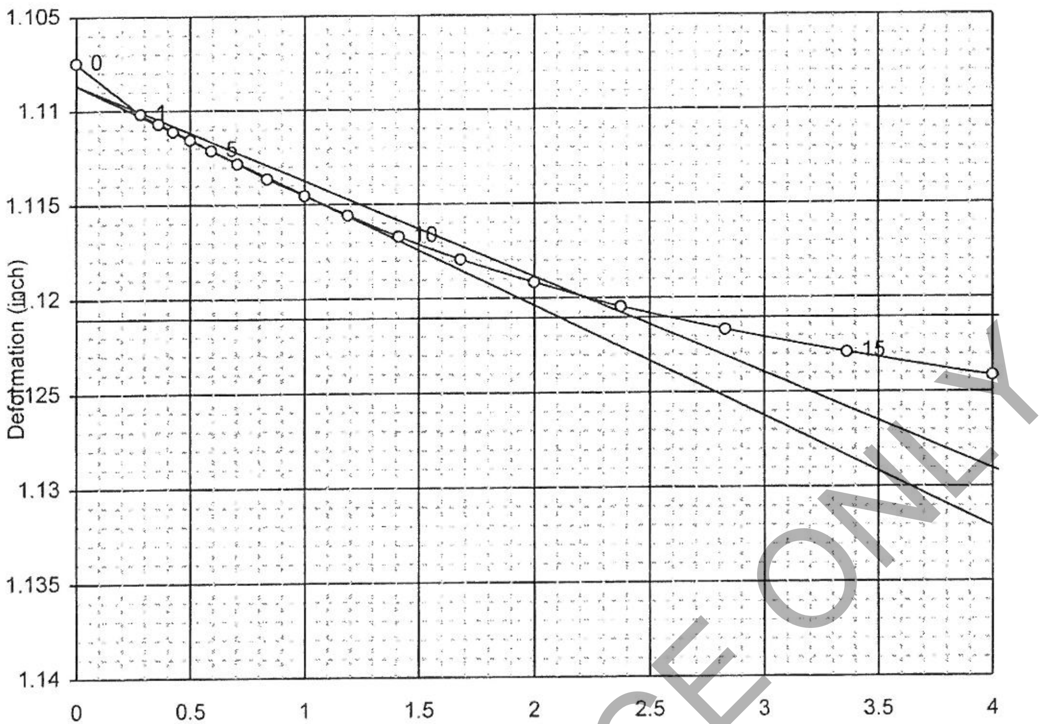
SPECIMEN DESCRIPTION: OH, black organic clay; shells noted

G	LL	PL	PI
2.67			

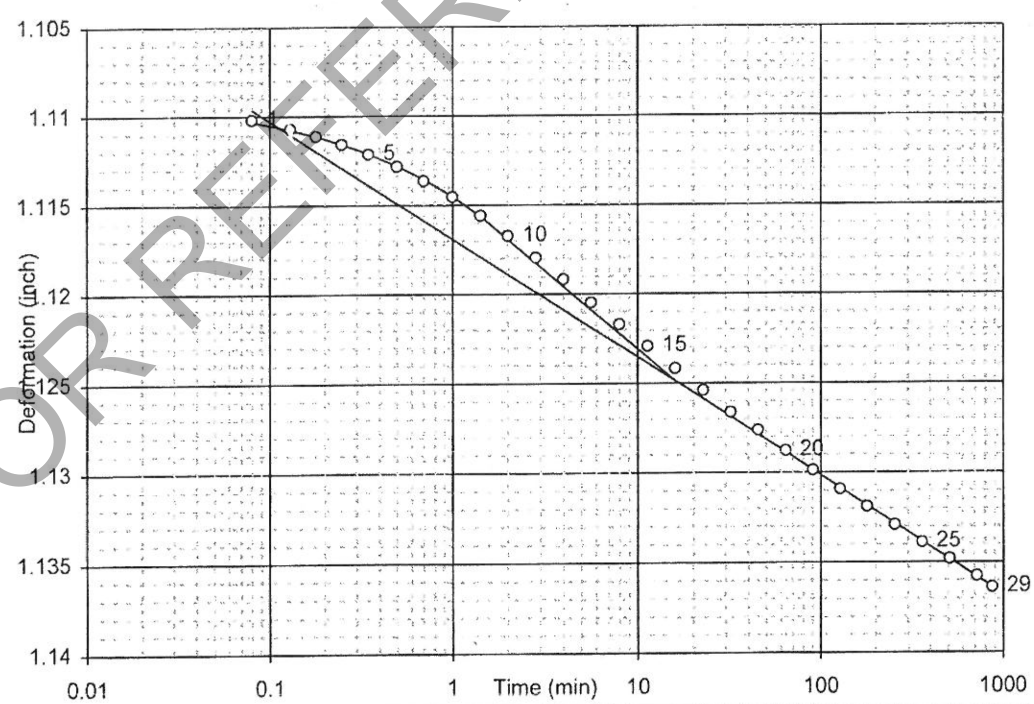
Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft²/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.063	0.0018	0.295	2.092	0.393	2.089	608	0.0013	21	8.7E-07
2	0.125	0.0032	0.529	2.085	0.513	2.086	664	0.0000	27	7.5E-07
3	0.250	0.0064	1.053	2.069	1.184	2.065	137	0.0008	24	1.7E-07
4	0.500	0.0119	1.942	2.041	2.384	2.028	155	0.0028	28	1.7E-07
5	1.00	0.0305	4.984	1.947	6.867	1.889	33	0.0108	16	6.0E-08
6	2.00	0.0804	13.166	1.693	15.457	1.622	11	0.0151	12	2.6E-08
7	1.00	0.0932	15.259	1.628	15.128	1.632	166	-0.0005	48	1.0E-07
8	0.250	0.0868	14.209	1.661	13.570	1.681	38	-0.0033	71	1.6E-08
9	0.500	0.0840	13.750	1.675	13.832	1.673	91	0.0007	55	5.0E-08
10	1.00	0.0880	14.405	1.655	14.552	1.650	81	0.0011	76	3.2E-08
11	2.00	0.0939	15.370	1.625	15.927	1.608	106	0.0036	104	3.1E-08
12	4.00	0.1361	22.280	1.411	23.966	1.358	12	0.0121	29	1.2E-08
13	8.00	0.1783	29.185	1.196	30.641	1.151	14	0.0129	58	7.4E-09
14	16.0	0.2177	35.631	0.996	38.021	0.922	19	0.0108	124	4.5E-09
15	8.00	0.2304	37.708	0.932	37.643	0.934	86	-0.0003	385	6.8E-09
16	2.00	0.2201	36.020	0.984	35.840	0.990	21	-0.0015	355	1.8E-09
17	0.500	0.2081	34.053	1.045	32.727	1.086	8	-0.0067	76	3.3E-09
18	0.125	0.1865	30.531	1.155	29.385	1.190	1	-0.0101	11	3.2E-09

Unit: 3
Project No.: 7984-16001
Test No: C16008
Load No.: 5
Load: 1 tsf

No.	Time	Deformation
0	0.00	1.1075
1	0.08	1.1102
2	0.13	1.1107
3	0.18	1.1111
4	0.25	1.1116
5	0.35	1.1121
6	0.50	1.1128
7	0.70	1.1136
8	1.00	1.1145
9	1.42	1.1156
10	2.00	1.1167
11	2.83	1.1179
12	4.00	1.1192
13	5.65	1.1205
14	8.00	1.1217
15	11.32	1.1229
16	16.00	1.1242
17	22.63	1.1254
18	32.00	1.1266
19	45.25	1.1276
20	64.0	1.1288
21	90.5	1.1299
22	128.0	1.1309
23	181.0	1.1319
24	256.0	1.1329
25	362.0	1.1339
26	512.0	1.1348
27	724.1	1.1358
28	876.1	1.1364
29	876.7	1.1364
30	0.0	0.0000
31	0.0	0.0000
32	0.0	0.0000
33	0.0	0.0000
34	0.0	0.0000
35	0.0	0.0000
36	0.0	0.0000
37	0.0	0.0000
38	0.0	0.0000
39	0.0	0.0000
40	0.0	0.0000
41	0.0	0.0000
42	0.0	0.0000
43	0.0	0.0000
44	0.0	0.0000
45	0.0	0.0000
46	0.0	0.0000
47	0.0	0.0000
48	0.0	0.0000
49	0.0	0.0000



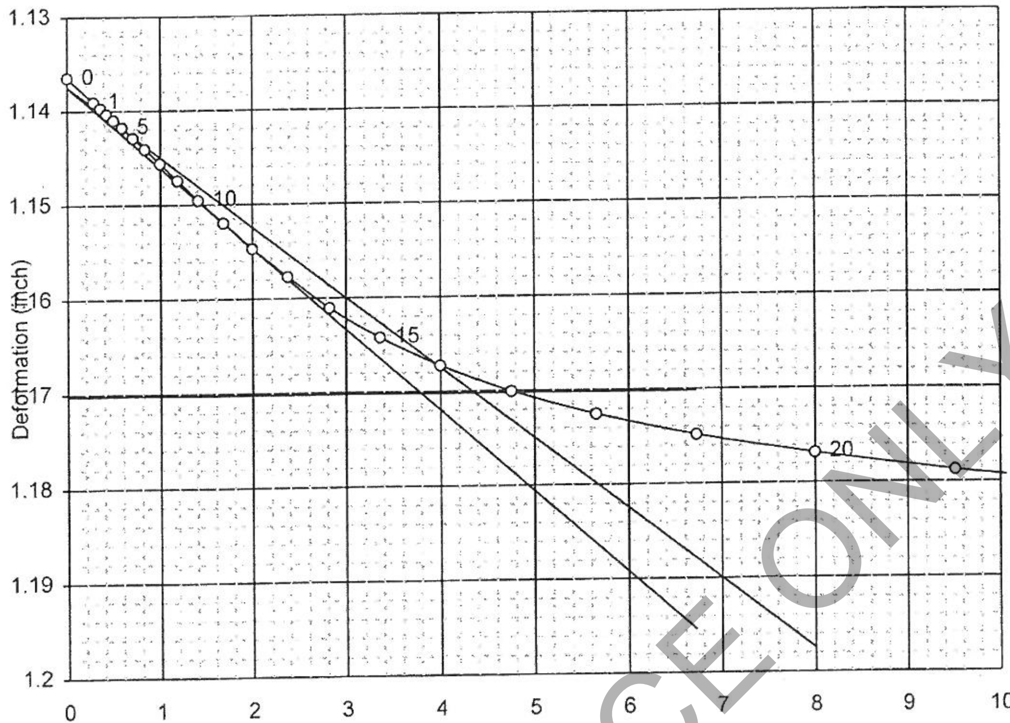
			Primary Line	t90 Line	Secondary Line
Load Unit	3				
Load No.	5	First Pt.	3	12	20
Points Beyond 2nd Point	7	Second Pt.	9	13	28



GENERAL			SQUARE ROOT ANALYSIS				LOG ANALYSIS				
Dinitial	Dfinal	D0	D50	D90	T90	D100	T50	D50	T100	D100	Secondary Slope
1.1075	1.1364	1.1086	1.1148	1.1198	4.79	1.1210	1.91	1.1168	16.03	1.1249	0.00662

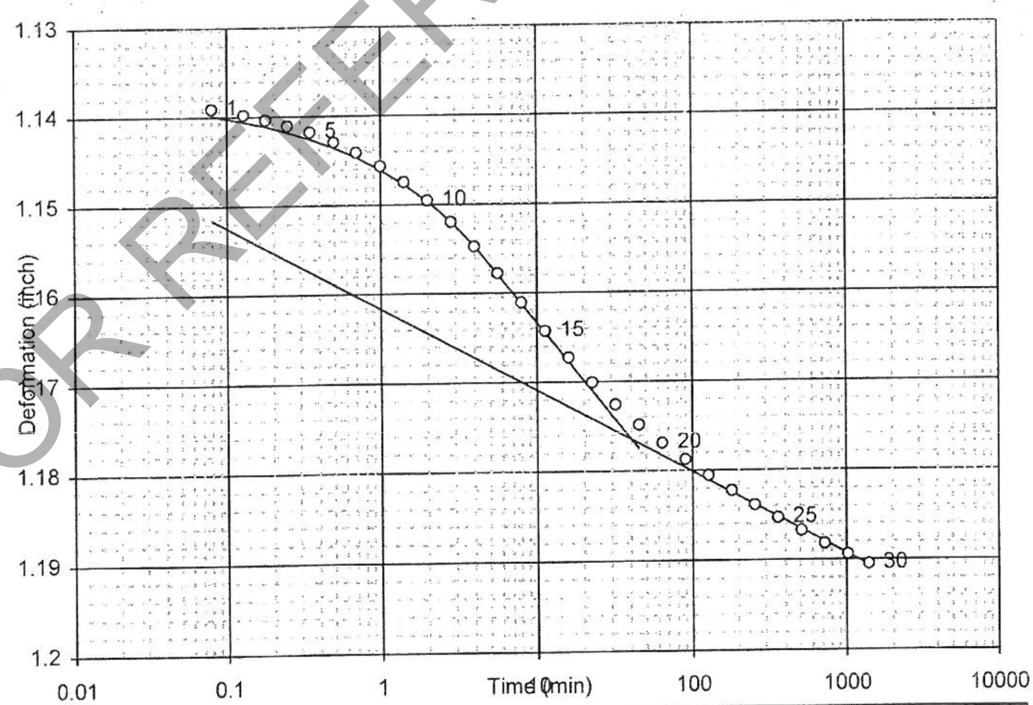
Unit: 3
Project No.: 7984-16001
Test No: C16008
Load No.: 6
Load: 2 tsf

No.	Time	Deformation
0	0.00	1.1365
1	0.08	1.1391
2	0.13	1.1397
3	0.18	1.1403
4	0.25	1.1410
5	0.35	1.1418
6	0.50	1.1429
7	0.70	1.1441
8	1.00	1.1456
9	1.42	1.1474
10	2.00	1.1495
11	2.83	1.1520
12	4.00	1.1547
13	5.65	1.1577
14	8.00	1.1610
15	11.32	1.1643
16	16.00	1.1673
17	22.63	1.1700
18	32.00	1.1726
19	45.25	1.1748
20	64.0	1.1769
21	90.5	1.1787
22	128.0	1.1805
23	181.0	1.1822
24	256.0	1.1839
25	362.0	1.1853
26	512.0	1.1867
27	724.1	1.1882
28	1024.0	1.1894
29	1400.9	1.1905
30	1406.2	1.1905
31	0.0	0.0000
32	0.0	0.0000
33	0.0	0.0000
34	0.0	0.0000
35	0.0	0.0000
36	0.0	0.0000
37	0.0	0.0000
38	0.0	0.0000
39	0.0	0.0000
40	0.0	0.0000
41	0.0	0.0000
42	0.0	0.0000
43	0.0	0.0000
44	0.0	0.0000
45	0.0	0.0000
46	0.0	0.0000
47	0.0	0.0000
48	0.0	0.0000
49	0.0	0.0000



Load Unit 3
Load No. 6
Points Beyond 2nd Point 7

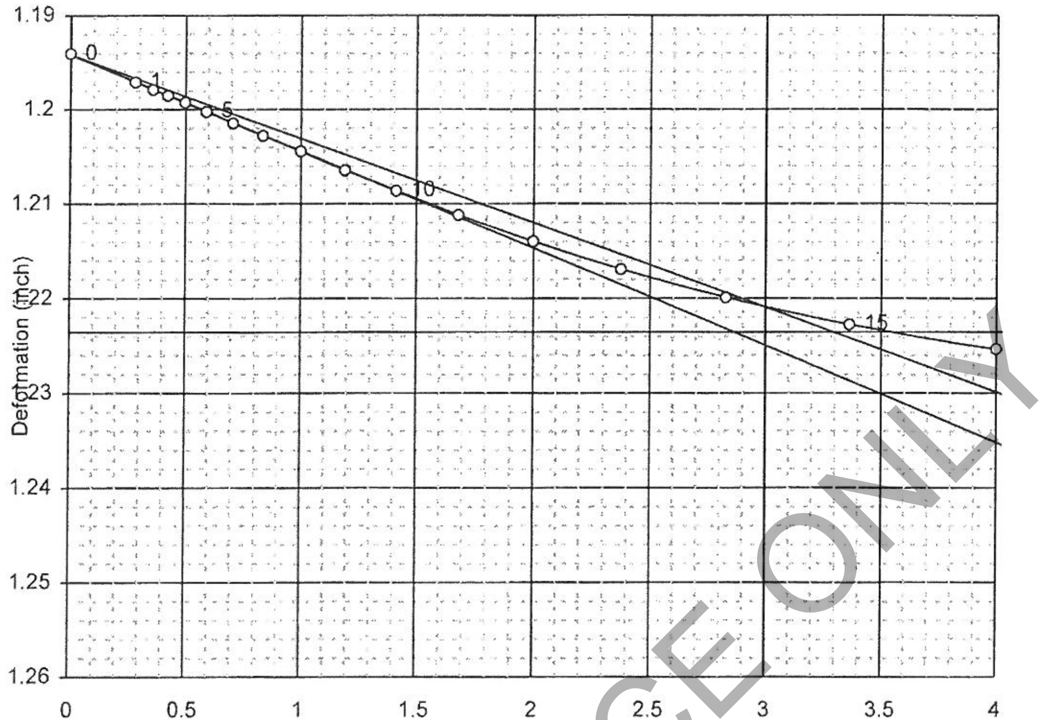
	Primary Line	t90 Line	Secondary Line
First Pt.	11	15	23
Second Pt.	12	16	30



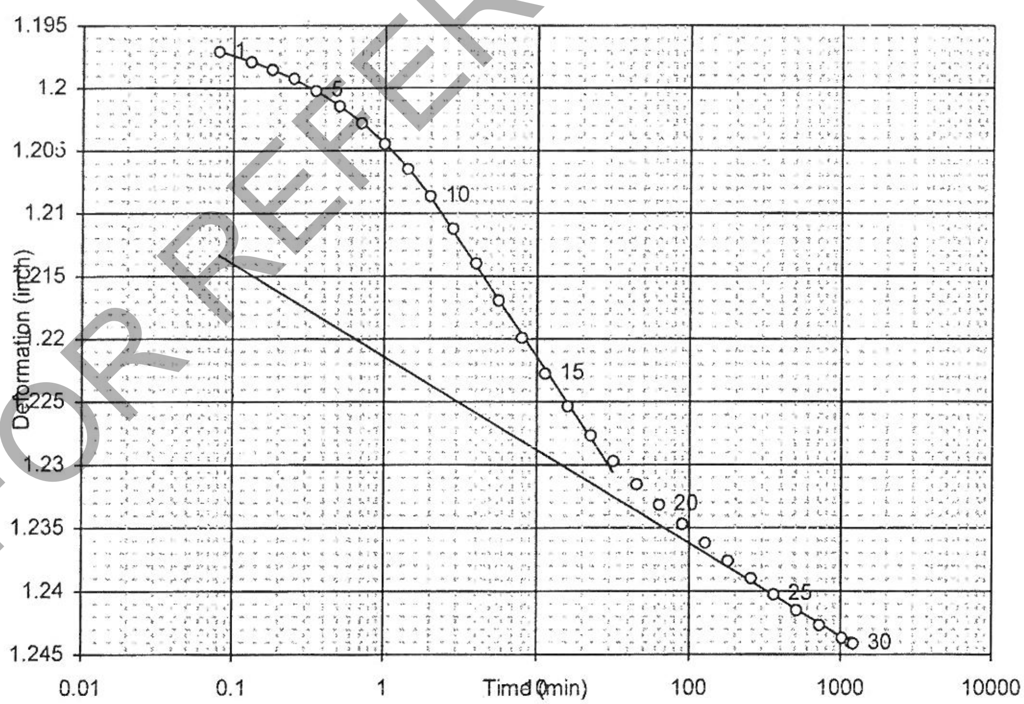
GENERAL			SQUARE ROOT ANALYSIS				LOG ANALYSIS				
Dinitial	Dfinal	D0	D50	D90	T90	D100	T50	D50	T100	D100	Secondary Slope
1.1365	1.1905	1.1375	1.1538	1.1669	15.46	1.1702	5.11	1.1570	40.34	1.1765	0.00920

Unit: 3
Project No.: 7984-16001
Test No: C16008
Load No.: 12
Load: 4 tsf

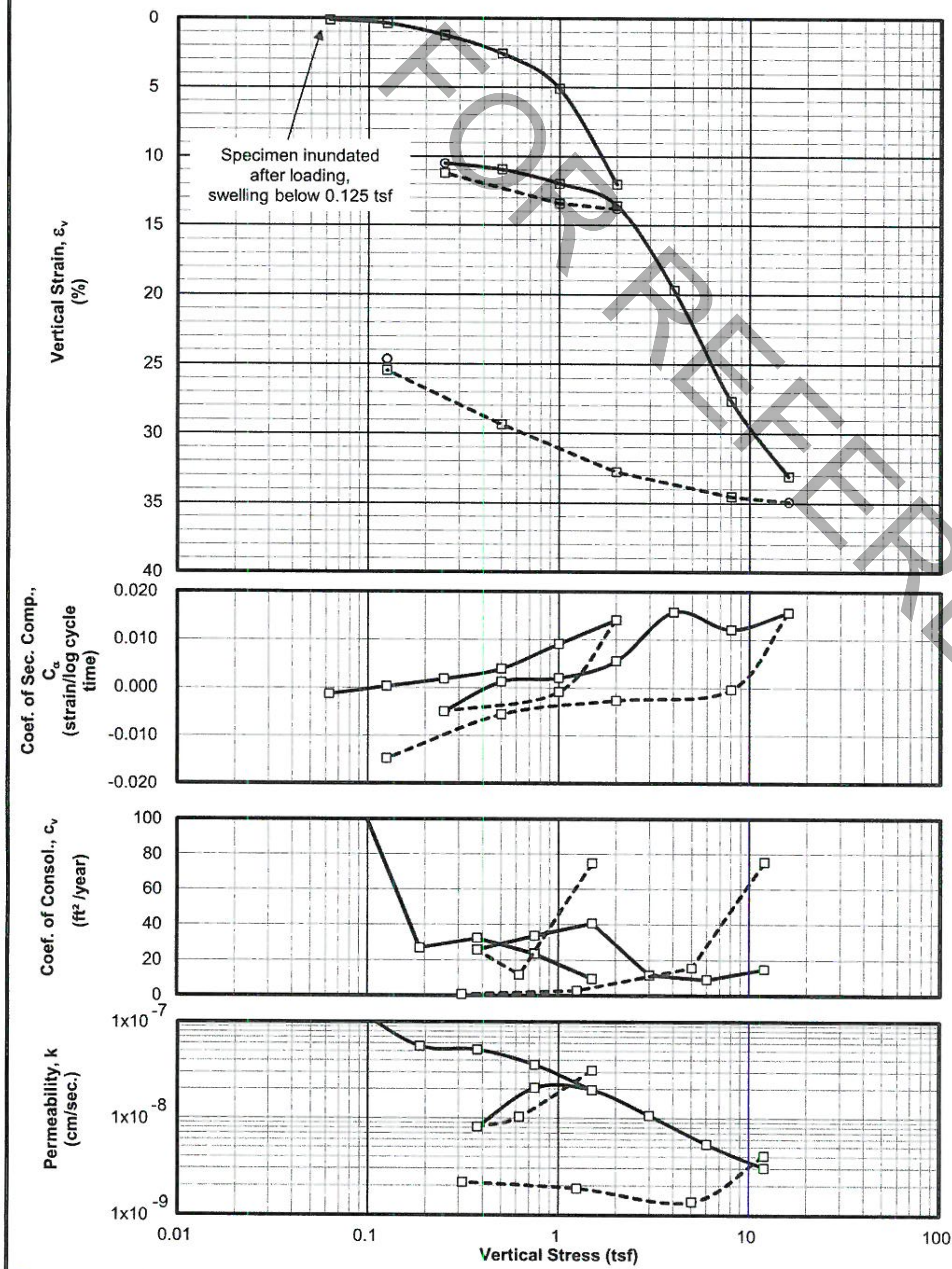
No.	Time	Deformation
0	0.00	1.1941
1	0.08	1.1971
2	0.13	1.1979
3	0.18	1.1985
4	0.25	1.1992
5	0.35	1.2002
6	0.50	1.2014
7	0.70	1.2028
8	1.00	1.2044
9	1.42	1.2064
10	2.00	1.2086
11	2.83	1.2112
12	4.00	1.2140
13	5.65	1.2169
14	8.00	1.2199
15	11.32	1.2227
16	16.00	1.2253
17	22.63	1.2277
18	32.00	1.2297
19	45.25	1.2315
20	64.0	1.2332
21	90.5	1.2347
22	128.0	1.2362
23	181.0	1.2376
24	256.0	1.2390
25	362.0	1.2402
26	512.0	1.2415
27	724.1	1.2427
28	1024.0	1.2437
29	1170.0	1.2441
30	1218.1	1.2441
31	0.0	0.0000
32	0.0	0.0000
33	0.0	0.0000
34	0.0	0.0000
35	0.0	0.0000
36	0.0	0.0000
37	0.0	0.0000
38	0.0	0.0000
39	0.0	0.0000
40	0.0	0.0000
41	0.0	0.0000
42	0.0	0.0000
43	0.0	0.0000
44	0.0	0.0000
45	0.0	0.0000
46	0.0	0.0000
47	0.0	0.0000
48	0.0	0.0000
49	0.0	0.0000



			Primary Line	t90 Line	Secondary Line
Load Unit	3				
Load No.	12	First Pt.	1	14	25
Points Beyond 2nd Point	8	Second Pt.	10	15	30



GENERAL			SQUARE ROOT ANALYSIS				LOG ANALYSIS				
Dinitial	Dfinal	D0	D50	D90	T90	D100	T50	D50	T100	D100	Secondary Slope
1.1941	1.2441	1.1942	1.2089	1.2206	8.80	1.2236	3.74	1.2140	47.86	1.2338	0.00739



SAMPLE INFORMATION

Boring:	P3-B11
Sample:	PS-1
Depth:	32.75 feet
Elevation:	
Type:	3-inch thin wall tube
Description:	OH, black organic clay

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height:	0.61	inch
Diameter:	2.50	inch

Initial water content:	76.8	%
Initial total unit weight:	95.4	pcf
Initial dry unit weight:	53.9	pcf
Initial void ratio:	2.044	
Initial degree of saturation:	99	%
Final water content:	56.5	%
Final total unit weight:	103.4	pcf
Final dry unit weight:	66.1	pcf
Final void ratio:	1.484	
Final degree of saturation:	100	% (assumed specific gravity = 2.63)

TEST SUMMARY

Construction Method:	Casagrande (Log)
Estimated preconsolidation stress (tsf):	1.1 (Range: 0.9 to 1.3)
Estimated in situ effective overburden stress (tsf):	
Compression Ratio (strain per log cycle stress):	0.264
Compression Index (void ratio per log cycle stress):	0.804
Swell Ratio (strain per log cycle stress):	0.036
Swell Index (void ratio per log cycle stress):	0.110
Recompression Ratio (strain per log cycle stress):	0.027
Recompression Index (void ratio per log cycle stress):	0.082
Remarks:	

LEGEND: □ End of primary ○ End of Stage ——— Loading - - - - - - - Unloading

Test Date: 6/6/16 Tested By: CMJ/MHC Checked By: GET

Distinct Engineering Project No. 15040	Stapleton, Staten Island	ONE DIMENSIONAL CONSOLIDATION TEST Boring: P3-B11 Depth: 32.75 feet
TerraSense, LLC	Project No. 7984-16003	June 2016

PROJECT:	Stapleton, Staten Island				
PROJECT NO.:	7984-16003	Initial height:	0.612 inch	Final height:	0.500 inch
BORING:	P3-B11	Initial water content:	76.8 %	Final water content:	56.5 %
SAMPLE:	PS-1	Initial dry density:	53.9 pcf	Final dry density:	66.1 pcf
TEST:	C16129	Initial total density:	95.4 pcf	Final total density:	103.4 pcf
DEPTH, feet:	32.75	Initial saturation:	99 %	Final saturation:	100 %
BY:	CMJ/MHC	Initial void ratio:	2.044	Final void ratio:	1.484
TEST DATE:	6/6/2016			Final strain:	18.4 %

EQUIPMENT:
Load Frame No.: 2
Ring Diameter: 2.5 inch

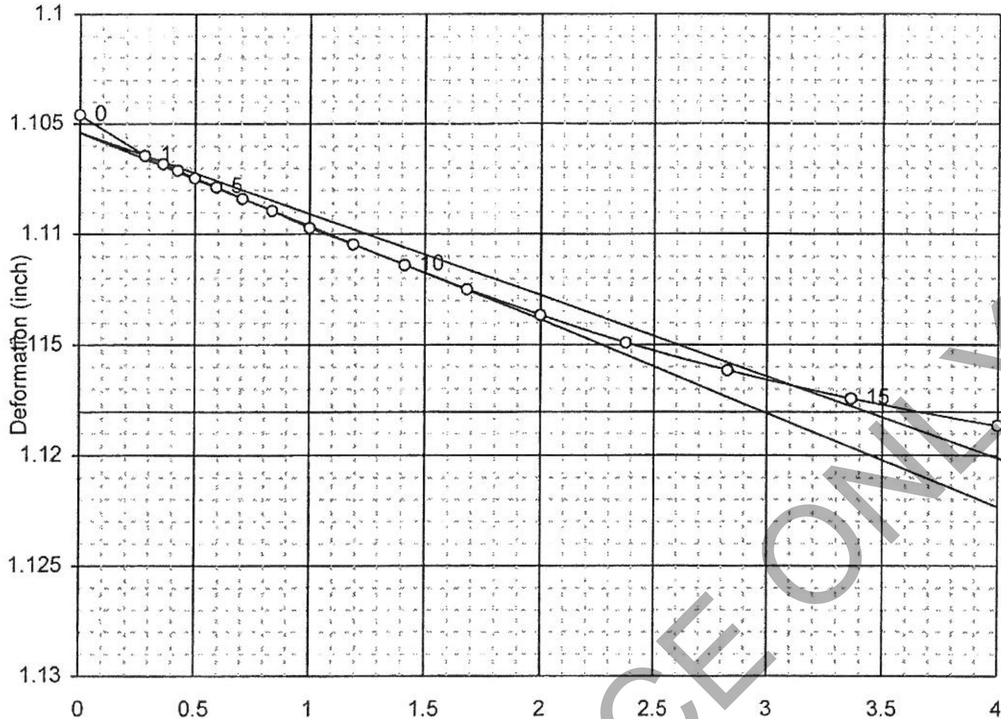
SPECIMEN DESCRIPTION: OH, black organic clay

G	LL	PL	PI
2.63			

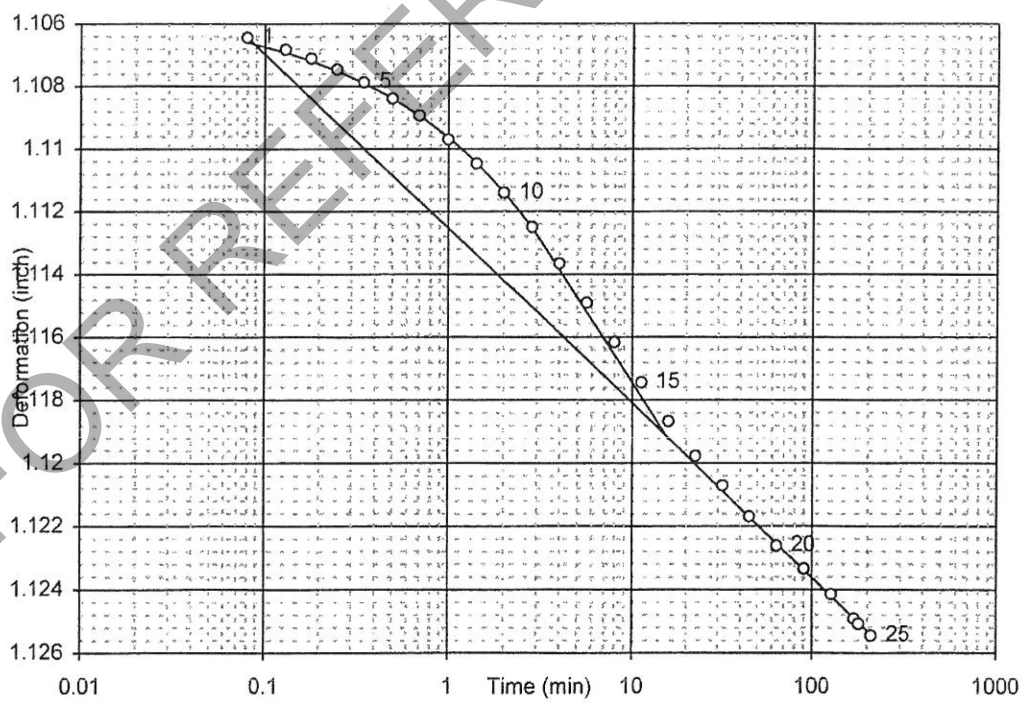
Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft²/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.063	0.0009	0.147	2.040	0.065	2.042	131.97	-0.0014	42.53	9.36E-08
2	0.125	0.0023	0.381	2.033	0.397	2.032	106.41	0.0002	26.70	1.20E-07
3	0.250	0.0076	1.246	2.006	1.540	1.997	26.83	0.0018	14.44	5.60E-08
4	0.500	0.0158	2.575	1.966	2.999	1.953	32.34	0.0039	18.82	5.18E-08
5	1.00	0.0313	5.104	1.889	6.149	1.857	23.63	0.0091	19.77	3.61E-08
6	2.00	0.0736	12.025	1.678	13.805	1.624	9.38	0.0141	14.45	1.96E-08
7	1.00	0.0821	13.412	1.636	13.314	1.639	75.02	-0.0009	72.12	3.14E-08
8	0.250	0.0687	11.221	1.703	10.502	1.724	11.75	-0.0051	34.23	1.04E-08
9	0.500	0.0671	10.959	1.711	11.155	1.705	25.74	0.0012	95.62	8.12E-09
10	1.00	0.0733	11.971	1.680	12.200	1.673	33.61	0.0019	49.40	2.05E-08
11	2.00	0.0831	13.572	1.631	14.225	1.611	40.64	0.0055	62.50	1.96E-08
12	4.00	0.1206	19.698	1.444	21.347	1.394	11.55	0.0157	32.64	1.07E-08
13	8.00	0.1693	27.648	1.202	29.085	1.159	8.97	0.0121	50.31	5.38E-09
14	16.0	0.2026	33.084	1.037	34.913	0.981	14.85	0.0156	147.18	3.04E-09
15	8.00	0.2114	34.520	0.993	34.422	0.996	75.54	-0.0004	557.30	4.09E-09
16	2.00	0.2007	32.769	1.047	32.475	1.056	15.63	-0.0027	342.82	1.38E-09
17	0.500	0.1798	29.354	1.151	28.782	1.168	2.73	-0.0056	43.91	1.87E-09
18	0.125	0.1559	25.464	1.269	24.648	1.294	0.69447	-0.0148	9.64	2.17E-09

Unit: 2
Project No.: 7984-16003
Test No: C16129
Load No.: 5
Load: 1 tsf

No.	Time	Deformation
0	0.00	1.1046
1	0.08	1.1064
2	0.13	1.1068
3	0.18	1.1071
4	0.25	1.1075
5	0.35	1.1079
6	0.50	1.1084
7	0.70	1.1089
8	1.00	1.1097
9	1.42	1.1105
10	2.00	1.1114
11	2.83	1.1125
12	4.00	1.1137
13	5.65	1.1149
14	8.00	1.1162
15	11.32	1.1174
16	16.00	1.1187
17	22.63	1.1198
18	32.00	1.1207
19	45.25	1.1217
20	64.0	1.1226
21	90.5	1.1233
22	128.0	1.1241
23	170.2	1.1249
24	181.0	1.1251
25	210.6	1.1255
26	0.0	0.0000
27	0.0	0.0000
28	0.0	0.0000
29	0.0	0.0000
30	0.0	0.0000
31	0.0	0.0000
32	0.0	0.0000
33	0.0	0.0000
34	0.0	0.0000
35	0.0	0.0000
36	0.0	0.0000
37	0.0	0.0000
38	0.0	0.0000
39	0.0	0.0000
40	0.0	0.0000
41	0.0	0.0000
42	0.0	0.0000
43	0.0	0.0000
44	0.0	0.0000
45	0.0	0.0000
46	0.0	0.0000
47	0.0	0.0000
48	0.0	0.0000
49	0.0	0.0000



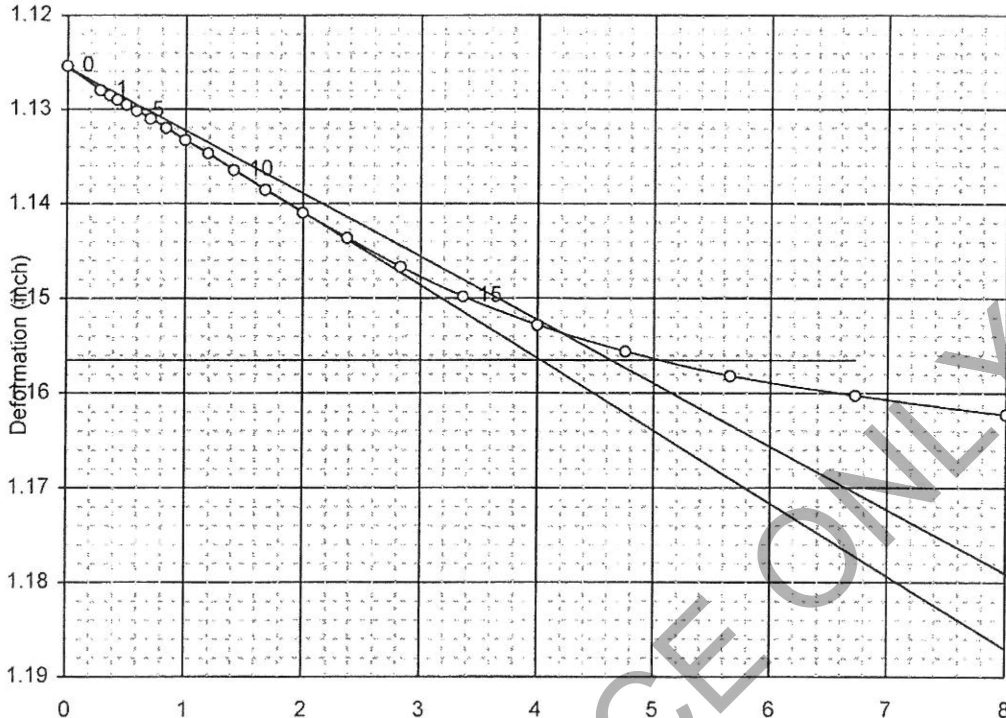
			Primary Line	t90 Line	Secondary Line
Load Unit	2				
Load No.	5	First Pt.	5	14	20
Points Beyond 2nd Point	5	Second Pt.	11	15	25



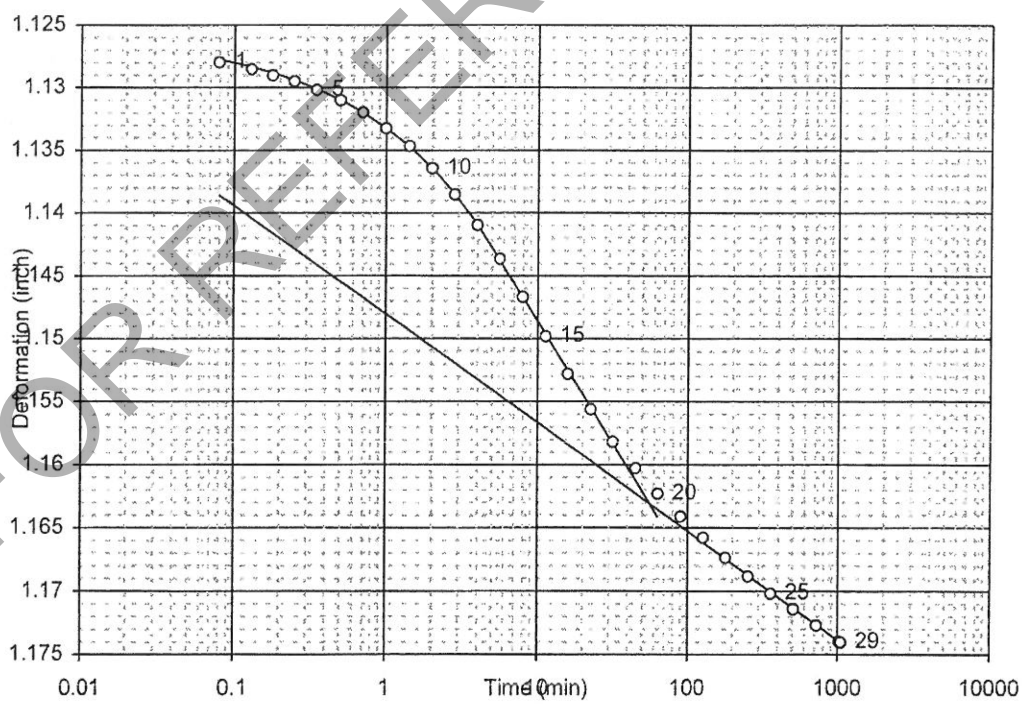
GENERAL			SQUARE ROOT ANALYSIS				LOG ANALYSIS				
Dinitial	Dfinal	D0	D50	D90	T90	D100	T50	D50	T100	D100	Secondary Slope
1.1046	1.1255	1.1054	1.1117	1.1168	9.55	1.1180	2.63	1.1123	15.49	1.1191	0.00555

Unit: 2
Project No.: 7984-16003
Test No: C16129
Load No.: 6
Load: 2 tsf

No.	Time	Deformation
0	0.00	1.1254
1	0.08	1.1280
2	0.13	1.1285
3	0.18	1.1290
4	0.25	1.1295
5	0.35	1.1302
6	0.50	1.1310
7	0.70	1.1320
8	1.00	1.1332
9	1.42	1.1347
10	2.00	1.1364
11	2.83	1.1385
12	4.00	1.1410
13	5.65	1.1436
14	8.00	1.1467
15	11.32	1.1498
16	16.00	1.1528
17	22.63	1.1556
18	32.00	1.1582
19	45.25	1.1603
20	64.0	1.1623
21	90.5	1.1641
22	128.0	1.1658
23	181.0	1.1674
24	256.0	1.1688
25	362.0	1.1702
26	512.0	1.1714
27	724.1	1.1727
28	1024.0	1.1739
29	1055.5	1.1740
30	0.0	0.0000
31	0.0	0.0000
32	0.0	0.0000
33	0.0	0.0000
34	0.0	0.0000
35	0.0	0.0000
36	0.0	0.0000
37	0.0	0.0000
38	0.0	0.0000
39	0.0	0.0000
40	0.0	0.0000
41	0.0	0.0000
42	0.0	0.0000
43	0.0	0.0000
44	0.0	0.0000
45	0.0	0.0000
46	0.0	0.0000
47	0.0	0.0000
48	0.0	0.0000
49	0.0	0.0000



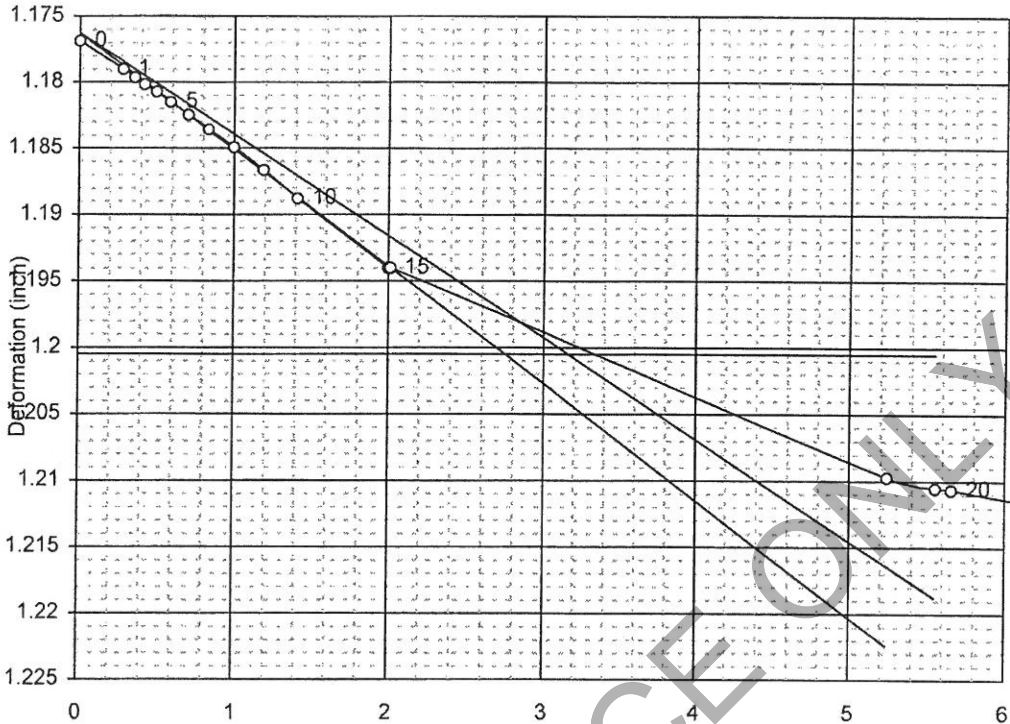
			Primary Line	t90 Line	Secondary Line
Load Unit	2				
Load No.	6	First Pt.	5	16	23
Points Beyond 2nd Point	8	Second Pt.	12	17	29



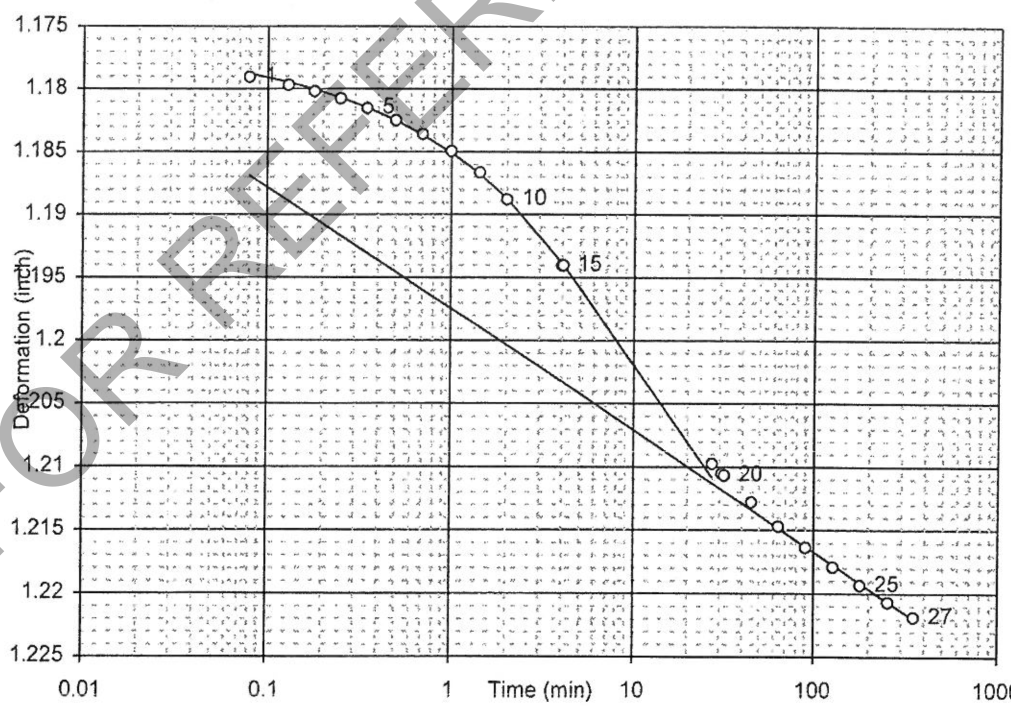
GENERAL			SQUARE ROOT ANALYSIS				LOG ANALYSIS				
Dinitial	Dfinal	D0	D50	D90	T90	D100	T50	D50	T100	D100	Secondary Slope
1.1254	1.1740	1.1256	1.1411	1.1534	17.43	1.1565	5.96	1.1443	56.19	1.1631	0.00862

Unit: 2
Project No.: 7984-16003
Test No: C16129
Load No.: 12
Load: 4 tsf

No.	Time	Deformation
0	0.00	1.1769
1	0.08	1.1790
2	0.13	1.1797
3	0.18	1.1802
4	0.25	1.1807
5	0.35	1.1815
6	0.50	1.1825
7	0.70	1.1836
8	1.00	1.1849
9	1.42	1.1866
10	2.00	1.1888
11	4.00	1.1940
12	4.01	1.1940
13	4.02	1.1940
14	4.03	1.1940
15	4.04	1.1940
16	4.05	1.1940
17	4.06	1.1940
18	27.47	1.2097
19	30.85	1.2105
20	32.0	1.2106
21	45.3	1.2128
22	64.0	1.2147
23	90.5	1.2163
24	128.0	1.2179
25	181.0	1.2193
26	256.0	1.2206
27	352.0	1.2218
28	0.0	0.0000
29	0.0	0.0000
30	0.0	0.0000
31	0.0	0.0000
32	0.0	0.0000
33	0.0	0.0000
34	0.0	0.0000
35	0.0	0.0000
36	0.0	0.0000
37	0.0	0.0000
38	0.0	0.0000
39	0.0	0.0000
40	0.0	0.0000
41	0.0	0.0000
42	0.0	0.0000
43	0.0	0.0000
44	0.0	0.0000
45	0.0	0.0000
46	0.0	0.0000
47	0.0	0.0000
48	0.0	0.0000
49	0.0	0.0000



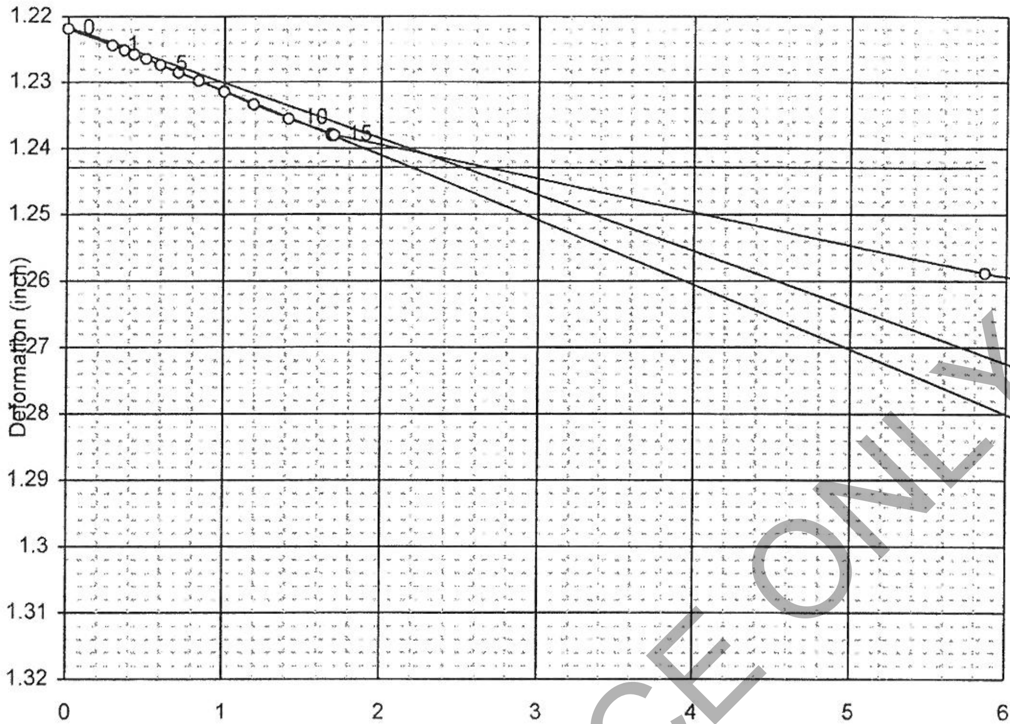
			Primary Line	t90 Line	Secondary Line
Load Unit	2				
Load No.	12	First Pt.	3	15	22
Points Beyond 2nd Point	7	Second Pt.	11	18	27



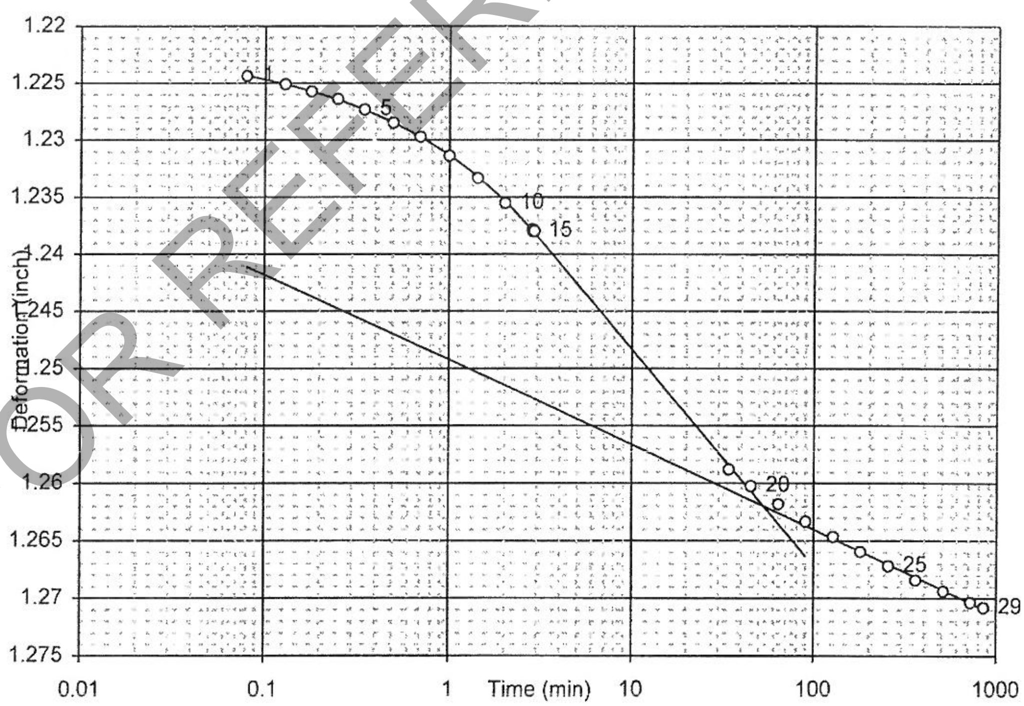
GENERAL			SQUARE ROOT ANALYSIS				LOG ANALYSIS				
Dinitial	Dfinal	D0	D50	D90	T90	D100	T50	D50	T100	D100	Secondary Slope
1.1769	1.2218	1.1763	1.1884	1.1981	8.10	1.2005	4.04	1.1940	30.17	1.2117	0.00963

Unit: 2
Project No.: 7984-16003
Test No: C16129
Load No.: 13
Load: 8 tsf

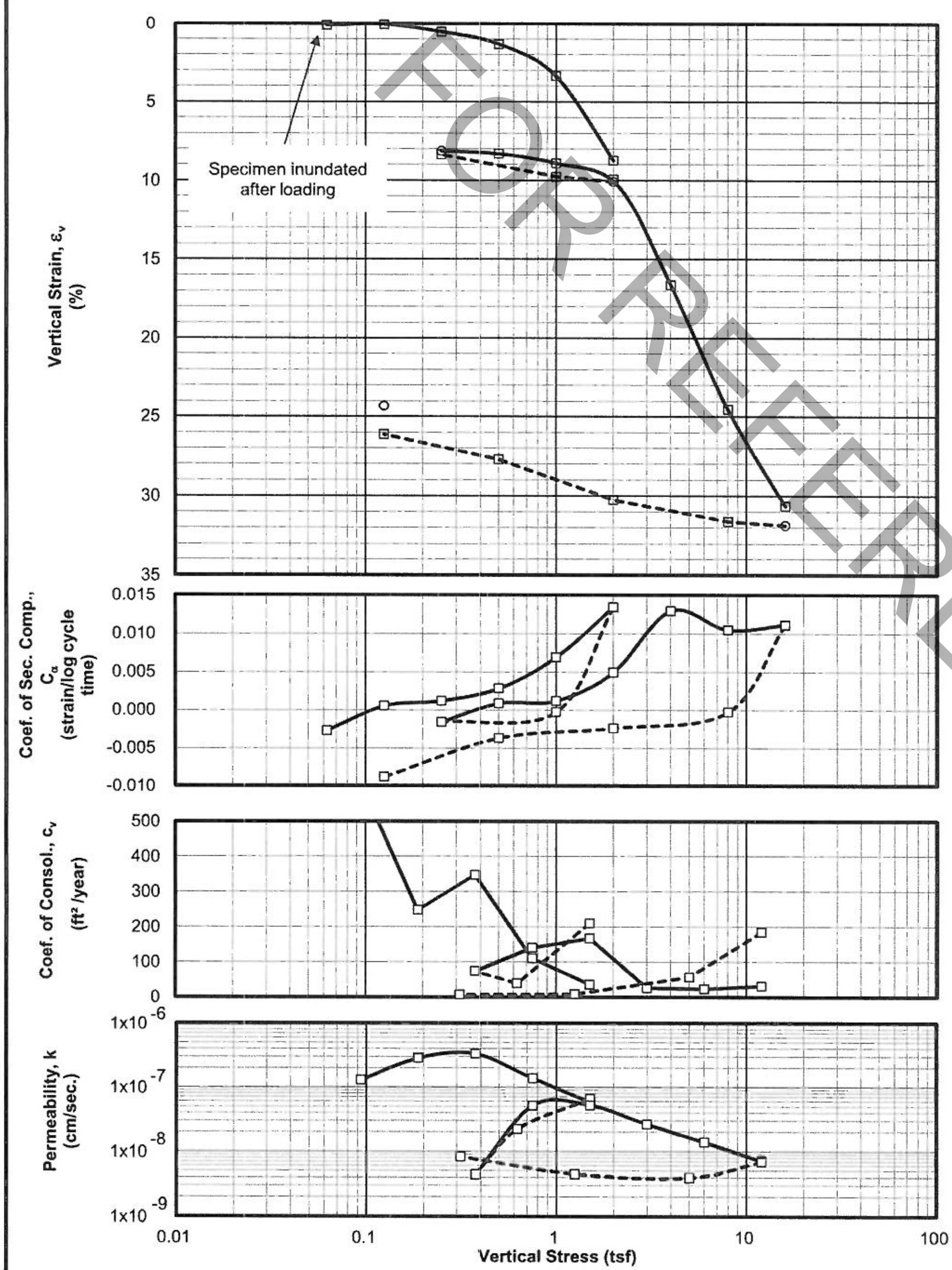
No.	Time	Deformation
0	0.00	1.2219
1	0.08	1.2244
2	0.13	1.2251
3	0.18	1.2257
4	0.25	1.2264
5	0.35	1.2273
6	0.50	1.2285
7	0.70	1.2297
8	1.00	1.2314
9	1.42	1.2333
10	2.00	1.2355
11	2.83	1.2378
12	2.84	1.2380
13	2.85	1.2380
14	2.86	1.2380
15	2.87	1.2380
16	2.88	1.2380
17	2.89	1.2380
18	2.90	1.2380
19	34.37	1.2588
20	45.3	1.2602
21	64.0	1.2618
22	90.5	1.2633
23	128.0	1.2646
24	181.0	1.2659
25	256.0	1.2672
26	362.0	1.2684
27	512.0	1.2694
28	724.1	1.2703
29	854.9	1.2708
30	0.0	0.0000
31	0.0	0.0000
32	0.0	0.0000
33	0.0	0.0000
34	0.0	0.0000
35	0.0	0.0000
36	0.0	0.0000
37	0.0	0.0000
38	0.0	0.0000
39	0.0	0.0000
40	0.0	0.0000
41	0.0	0.0000
42	0.0	0.0000
43	0.0	0.0000
44	0.0	0.0000
45	0.0	0.0000
46	0.0	0.0000
47	0.0	0.0000
48	0.0	0.0000
49	0.0	0.0000



			Primary Line	t90 Line	Secondary Line
Load Unit	2				
Load No.	13	First Pt.	3	18	23
Points Beyond 2nd Point	11	Second Pt.	11	19	29



GENERAL			SQUARE ROOT ANALYSIS				LOG ANALYSIS				
Dinitial	Dfinal	D0	D50	D90	T90	D100	T50	D50	T100	D100	Secondary Slope
1.2219	1.2708	1.2216	1.2322	1.2408	5.13	1.2429	4.30	1.2418	52.88	1.2620	0.00741



SAMPLE INFORMATION

Boring:	P3-B14
Sample:	PS-1
Depth:	17.80 feet
Elevation:	
Type:	3-inch thin wall tube
Description:	OH, gray and black organic clay; shells and sand seams noted

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height:	0.61	inch
Diameter:	2.50	inch
Initial water content:	63.2	%
Initial total unit weight:	99.3	pcf
Initial dry unit weight:	60.9	pcf
Initial void ratio:	1.615	
Initial degree of saturation:	100	%
Final water content:	42.3	%
Final total unit weight:	109.1	pcf
Final dry unit weight:	76.7	pcf
Final void ratio:	1.076	
Final degree of saturation:	100	% (assumed specific gravity = 2.55)

TEST SUMMARY

Construction Method:	Casagrande (Log)
Estimated preconsolidation stress (tsf):	1.3 (Range: 1.2 to 1.5)
Estimated in situ effective overburden stress (tsf):	
Compression Ratio (strain per log cycle stress):	0.262
Compression Index (void ratio per log cycle stress):	0.685
Swell Ratio (strain per log cycle stress):	0.023
Swell Index (void ratio per log cycle stress):	0.060
Recompression Ratio (strain per log cycle stress):	0.018
Recompression Index (void ratio per log cycle stress):	0.047
Remarks:	

LEGEND: □ End of primary ○ End of Stage ——— Loading - - - - - - - Unloading

Test Date: 6/6/16 Tested By: CMJ/MHC Checked By: GET

Distinct Engineering Project No. 15040	Stapleton, Staten Island	ONE DIMENSIONAL CONSOLIDATION TEST Boring: P3-B14 Depth: 17.80 feet
TerraSense, LLC	Project No. 7984-16003	June 2016

Analysis File: Conv41.xls (4/12) C16128.xlsx 6/20/2016

PROJECT:	Stapleton, Staten Island				
PROJECT NO.:	7984-16003	Initial height:	0.613 inch	Final height:	0.486 inch
BORING:	P3-B14	Initial water content:	63.2 %	Final water content:	42.3 %
SAMPLE:	PS-1	Initial dry density:	60.9 pcf	Final dry density:	76.7 pcf
TEST:	C16128	Initial total density:	99.3 pcf	Final total density:	109.1 pcf
DEPTH, feet:	17.8	Initial saturation:	100 %	Final saturation:	100 %
BY:	CMJ/MHC	Initial void ratio:	1.615	Final void ratio:	1.076
TEST DATE:	6/6/2016			Final strain:	20.6 %

EQUIPMENT:
Load Frame No.: 3
Ring Diameter: 2.5 inch

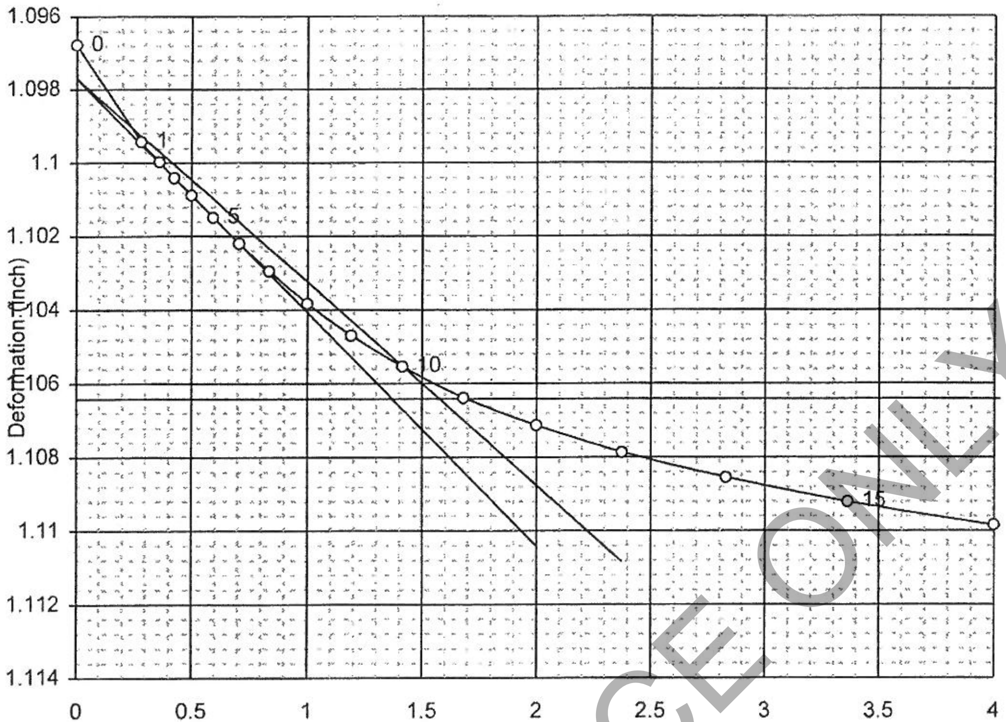
SPECIMEN DESCRIPTION: OH, gray and black organic clay; shells and sand seams noted

G	LL	PL	PI
2.55			

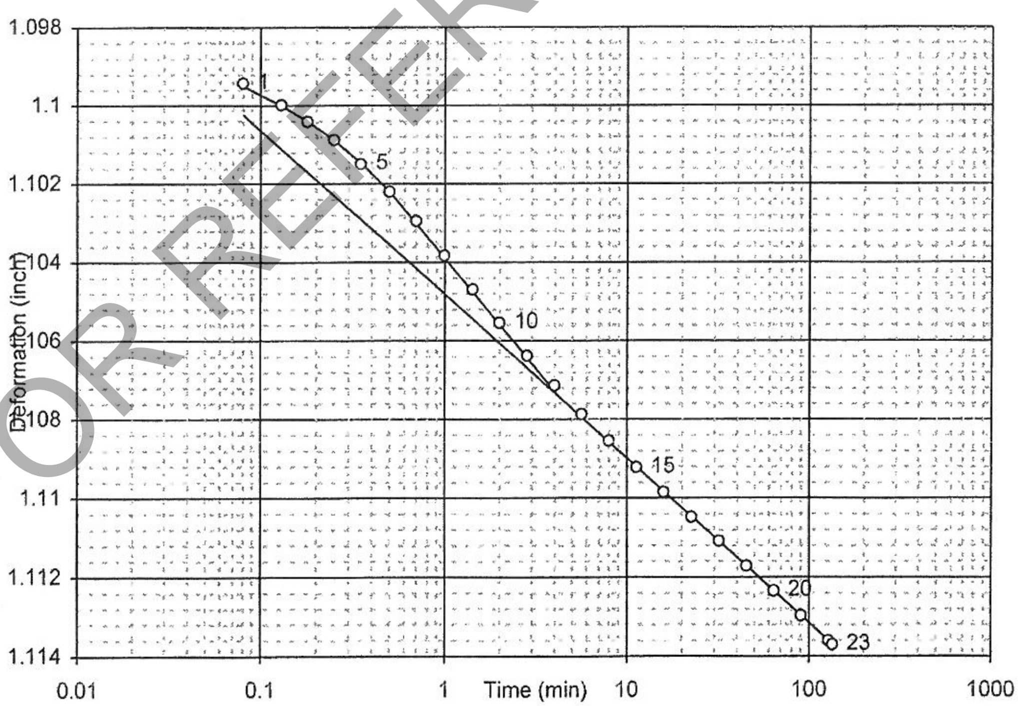
Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft²/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.063	0.0006	0.098	1.613	0.000	1.615	105.30	-0.0028	63.81	4.98E-08
2	0.125	0.0003	0.054	1.614	0.169	1.611	613.22	0.0005	143.58	1.29E-07
3	0.250	0.0032	0.528	1.601	0.903	1.592	248.12	0.0011	26.41	2.83E-07
4	0.500	0.0081	1.317	1.581	1.888	1.566	347.37	0.0028	31.69	3.31E-07
5	1.00	0.0207	3.372	1.527	4.400	1.500	110.37	0.0069	24.33	1.37E-07
6	2.00	0.0535	8.740	1.387	10.079	1.352	35.95	0.0134	18.63	5.82E-08
7	1.00	0.0598	9.767	1.360	9.718	1.361	210.34	-0.0003	97.38	6.52E-08
8	0.250	0.0512	8.360	1.397	8.132	1.403	39.23	-0.0016	53.31	2.22E-08
9	0.500	0.0509	8.311	1.398	8.344	1.397	73.89	0.0008	508.52	4.38E-09
10	1.00	0.0546	8.915	1.382	9.078	1.378	140.98	0.0011	82.81	5.14E-08
11	2.00	0.0609	9.943	1.355	10.776	1.333	167.60	0.0049	97.26	5.20E-08
12	4.00	0.1019	16.639	1.180	18.304	1.137	26.11	0.0129	29.87	2.64E-08
13	8.00	0.1503	24.538	0.974	26.219	0.930	23.35	0.0104	50.64	1.39E-08
14	16.0	0.1877	30.641	0.814	31.865	0.782	30.92	0.0111	131.08	7.12E-09
15	8.00	0.1937	31.619	0.788	31.537	0.790	185.11	-0.0003	818.04	6.83E-09
16	2.00	0.1853	30.245	0.824	29.984	0.831	56.62	-0.0024	436.62	3.91E-09
17	0.500	0.1698	27.712	0.891	27.206	0.904	8.73	-0.0038	59.21	4.45E-09
18	0.125	0.1601	26.142	0.932	24.330	0.979	6.59	-0.0088	23.88	8.33E-09

Unit: 3
Project No.: 7984-16003
Test No: C16128
Load No.: 5
Load: 1 tsf

No.	Time	Deformation
0	0.00	1.0968
1	0.08	1.0994
2	0.13	1.1000
3	0.18	1.1004
4	0.25	1.1009
5	0.35	1.1015
6	0.50	1.1022
7	0.70	1.1029
8	1.00	1.1038
9	1.42	1.1047
10	2.00	1.1055
11	2.83	1.1064
12	4.00	1.1071
13	5.65	1.1079
14	8.00	1.1085
15	11.32	1.1092
16	16.00	1.1098
17	22.63	1.1105
18	32.00	1.1111
19	45.25	1.1117
20	64.0	1.1123
21	90.5	1.1130
22	128.0	1.1136
23	134.9	1.1137
24	0.0	0.0000
25	0.0	0.0000
26	0.0	0.0000
27	0.0	0.0000
28	0.0	0.0000
29	0.0	0.0000
30	0.0	0.0000
31	0.0	0.0000
32	0.0	0.0000
33	0.0	0.0000
34	0.0	0.0000
35	0.0	0.0000
36	0.0	0.0000
37	0.0	0.0000
38	0.0	0.0000
39	0.0	0.0000
40	0.0	0.0000
41	0.0	0.0000
42	0.0	0.0000
43	0.0	0.0000
44	0.0	0.0000
45	0.0	0.0000
46	0.0	0.0000
47	0.0	0.0000
48	0.0	0.0000
49	0.0	0.0000



			Primary Line	t90 Line	Secondary Line
Load Unit	3				
Load No.	5	First Pt.	3	10	17
Points Beyond 2nd Point	6	Second Pt.	6	11	23

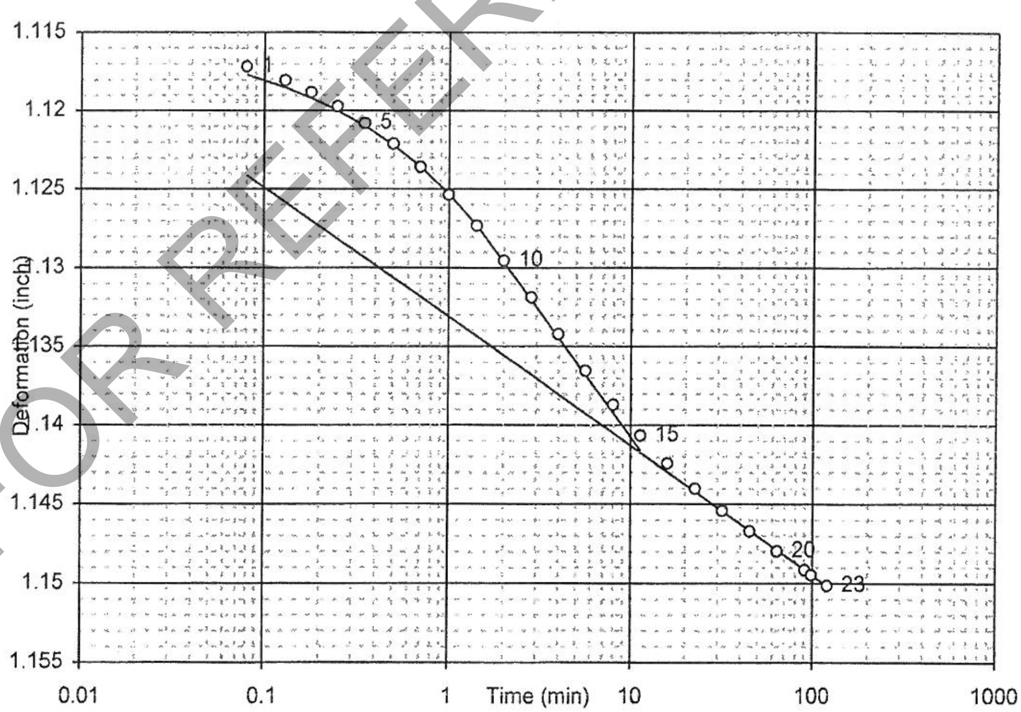


GENERAL			SQUARE ROOT ANALYSIS				LOG ANALYSIS				
Dinitial	Dfinal	D0	D50	D90	T90	D100	T50	D50	T100	D100	Secondary Slope
1.0968	1.1137	1.0977	1.1021	1.1055	2.01	1.1064	0.58	1.1026	4.21	1.1074	0.00417

Unit: 3
Project No.: 7984-16003
Test No: C16128
Load No.: 6
Load: 2 tsf

No.	Time	Deformation
0	0.00	1.1138
1	0.08	1.1172
2	0.13	1.1181
3	0.18	1.1188
4	0.25	1.1197
5	0.35	1.1208
6	0.50	1.1221
7	0.70	1.1236
8	1.00	1.1253
9	1.42	1.1273
10	2.00	1.1295
11	2.83	1.1319
12	4.00	1.1342
13	5.65	1.1365
14	8.00	1.1387
15	11.32	1.1406
16	16.00	1.1424
17	22.63	1.1440
18	32.00	1.1454
19	45.25	1.1467
20	64.0	1.1480
21	90.5	1.1492
22	98.7	1.1495
23	121.0	1.1501
24	0.0	0.0000
25	0.0	0.0000
26	0.0	0.0000
27	0.0	0.0000
28	0.0	0.0000
29	0.0	0.0000
30	0.0	0.0000
31	0.0	0.0000
32	0.0	0.0000
33	0.0	0.0000
34	0.0	0.0000
35	0.0	0.0000
36	0.0	0.0000
37	0.0	0.0000
38	0.0	0.0000
39	0.0	0.0000
40	0.0	0.0000
41	0.0	0.0000
42	0.0	0.0000
43	0.0	0.0000
44	0.0	0.0000
45	0.0	0.0000
46	0.0	0.0000
47	0.0	0.0000
48	0.0	0.0000
49	0.0	0.0000

			Primary Line	t90 Line	Secondary Line
Load Unit	3				
Load No.	6	First Pt.	7	12	18
Points Beyond 2nd Point	6	Second Pt.	9	13	23

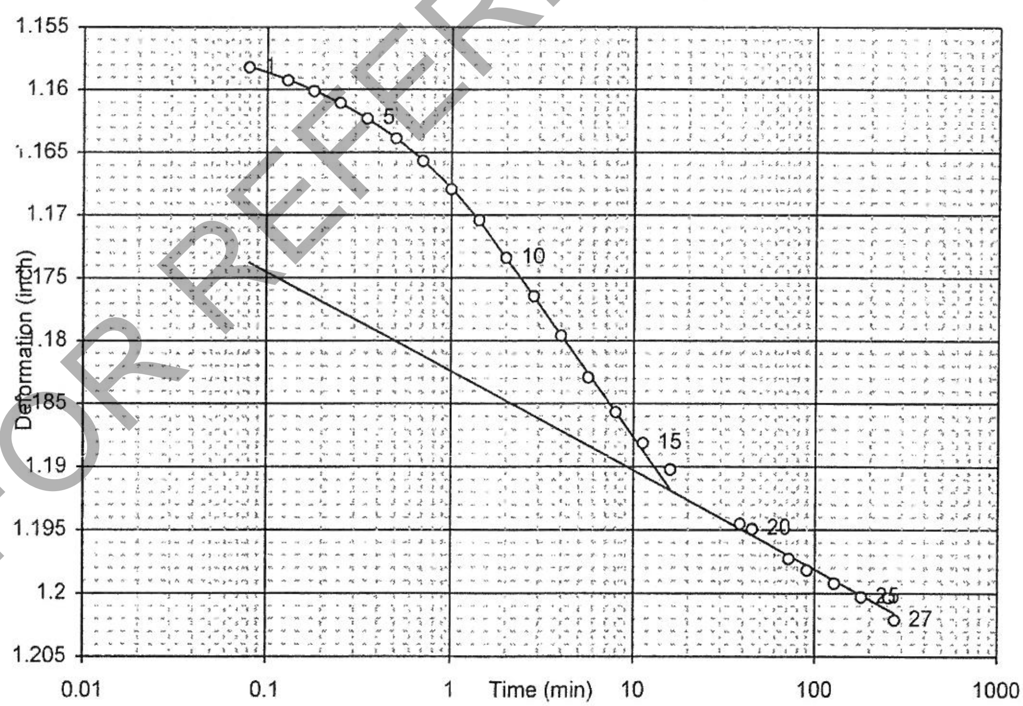


GENERAL			SQUARE ROOT ANALYSIS				LOG ANALYSIS				
Dinitial	Dfinal	D0	D50	D90	T90	D100	T50	D50	T100	D100	Secondary Slope
1.1138	1.1501	1.1147	1.1267	1.1364	5.53	1.1388	1.64	1.1283	11.75	1.1419	0.00820

Unit: 3
Project No.: 7984-16003
Test No: C16128
Load No.: 12
Load: 4 tsf

No.	Time	Deformation
0	0.00	1.1549
1	0.08	1.1582
2	0.13	1.1593
3	0.18	1.1601
4	0.25	1.1611
5	0.35	1.1623
6	0.50	1.1639
7	0.70	1.1657
8	1.00	1.1679
9	1.42	1.1704
10	2.00	1.1734
11	2.83	1.1765
12	4.00	1.1796
13	5.65	1.1829
14	8.00	1.1857
15	11.32	1.1881
16	16.00	1.1902
17	16.01	1.1902
18	16.02	1.1902
19	38.85	1.1945
20	45.3	1.1949
21	45.3	1.1949
22	72.0	1.1973
23	90.5	1.1982
24	128.0	1.1992
25	181.0	1.2003
26	256.0	1.2004
27	274.7	1.2021
28	0.0	0.0000
29	0.0	0.0000
30	0.0	0.0000
31	0.0	0.0000
32	0.0	0.0000
33	0.0	0.0000
34	0.0	0.0000
35	0.0	0.0000
36	0.0	0.0000
37	0.0	0.0000
38	0.0	0.0000
39	0.0	0.0000
40	0.0	0.0000
41	0.0	0.0000
42	0.0	0.0000
43	0.0	0.0000
44	0.0	0.0000
45	0.0	0.0000
46	0.0	0.0000
47	0.0	0.0000
48	0.0	0.0000
49	0.0	0.0000

			Primary Line	t90 Line	Secondary Line
Load Unit	3				
Load No.	12	First Pt.	3	13	21
Points Beyond 2nd Point	7	Second Pt.	9	14	27



GENERAL			SQUARE ROOT ANALYSIS				LOG ANALYSIS				
Dinitial	Dfinal	D0	D50	D90	T90	D100	T50	D50	T100	D100	Secondary Slope
1.1549	1.2021	1.1543	1.1705	1.1835	6.14	1.1867	1.93	1.1731	16.24	1.1919	0.00787

Unit: 3
Project No.: 7984-16003
Test No: C16128
Load No.: 13
Load: 8 tsf

No.	Time	Deformation
0	0.00	1.2024
1	0.08	1.2066
2	0.13	1.2077
3	0.18	1.2085
4	0.25	1.2096
5	0.35	1.2109
6	0.50	1.2127
7	0.70	1.2146
8	1.00	1.2170
9	1.42	1.2197
10	2.00	1.2226
11	2.83	1.2257
12	4.00	1.2287
13	5.65	1.2316
14	8.00	1.2322
15	11.32	1.2322
16	16.00	1.2322
17	22.63	1.2322
18	32.00	1.2322
19	45.25	1.2322
20	55.5	1.2432
21	64.0	1.2437
22	72.4	1.2448
23	90.5	1.2455
24	128.0	1.2466
25	181.0	1.2477
26	256.0	1.2488
27	362.0	1.2498
28	512.0	1.2507
29	724.1	1.2517
30	906.3	1.2522
31	0.0	0.0000
32	0.0	0.0000
33	0.0	0.0000
34	0.0	0.0000
35	0.0	0.0000
36	0.0	0.0000
37	0.0	0.0000
38	0.0	0.0000
39	0.0	0.0000
40	0.0	0.0000
41	0.0	0.0000
42	0.0	0.0000
43	0.0	0.0000
44	0.0	0.0000
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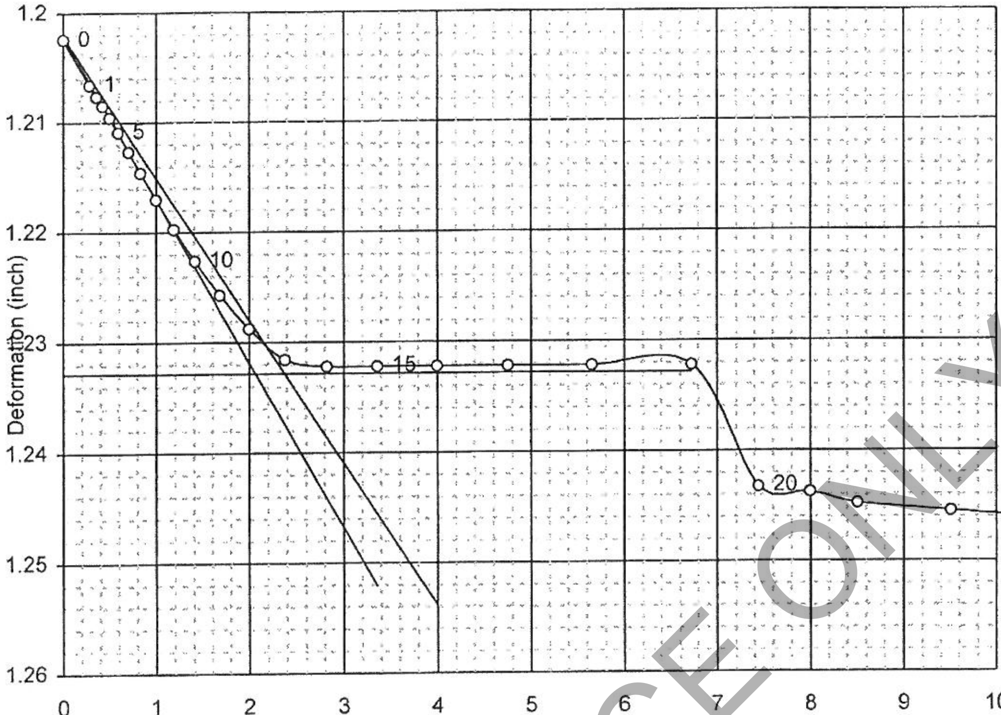
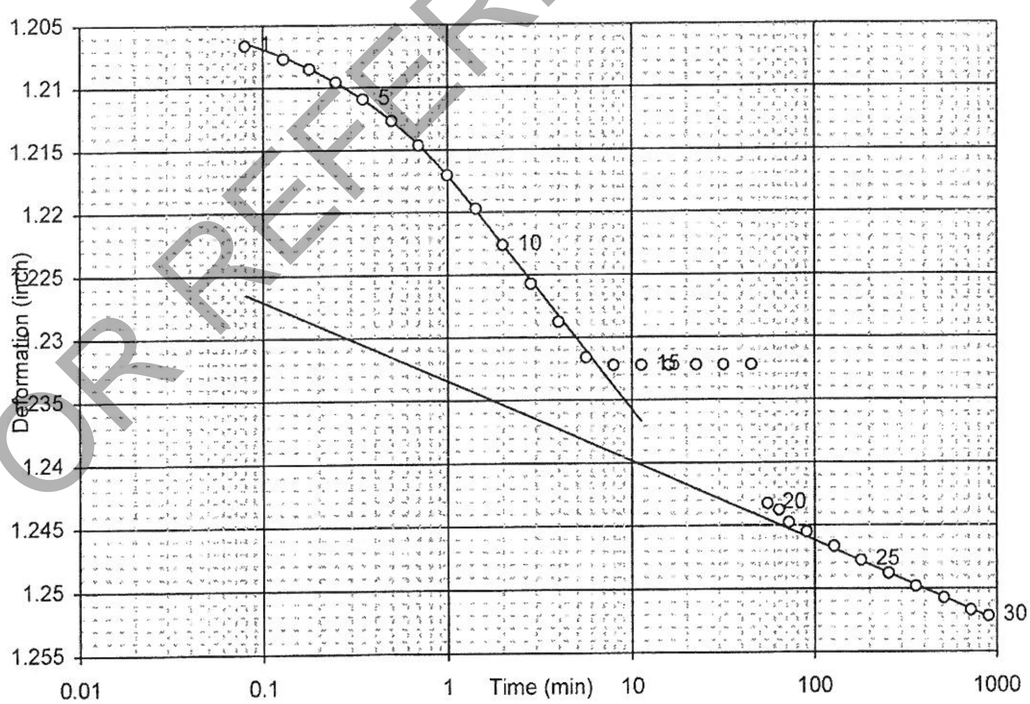


			Primary Line	t90 Line	Secondary Line
Load Unit	3				
Load No.	13	First Pt.	3	12	25
Points Beyond 2nd Point	7	Second Pt.	8	13	30



GENERAL			SQUARE ROOT ANALYSIS				LOG ANALYSIS				
Dinitial	Dfinal	D0	D50	D90	T90	D100	T50	D50	T100	D100	Secondary Slope
1.2024	1.2522	1.2022	1.2175	1.2298	4.58	1.2328	1.79	1.2220	21.58	1.2419	0.00637

Distinct Engineering Solutions, Inc. #15040
Stapleton, Staten Island
Summary of Corrosion Testing

SAMPLE ID			RESISTIVITY TESTS					CHEMICAL TESTS				REMARKS
				As-Received		@ Minimum Resistivity		pH ASTM G51		Leachable Chloride (1) ASTM D4327	Leachable Sulfate (1) ASTM D4327	
Boring No.	Sample No.	Depth (ft)	Test Method (2)	Water Content (%)	Resistivity (kΩ - cm)	Water Content (%)	Resistivity (kΩ - cm)	pH (pH units)	Temperature (°C)	(ppm)	(ppm)	
P-3 B-4	S-7	15-17	ASTM G57*	25.2	0.3	25.2	0.3	6.7	22.5	1751	3168	

KEY: (1) Test results provided by Luvak.
(2) ASTM G57*: Multi point test using G187 equipment to identify minimum resistivity

Prepared by: BB

TerraSense, LLC
45H Commerce Way

Project No. 7984-16004

Distinct Engineering Solutions, Inc. #15040
Stapleton Staten Island
Summary of Corrosion Testing

SAMPLE ID			RESISTIVITY TESTS					CHEMICAL TESTS				REMARKS
Boring No.	Sample No.	Depth	Test Method (2)	As-Received		@ Minimum Resistivity		pH ASTM G51		Leachable Chloride (1) ASTM D4327	Leachable Sulfate (1) ASTM D4327	
		(ft)		Water Content (%)	Resistivity (kΩ - cm)	Water Content (%)	Resistivity (kΩ - cm)	pH (pH units)	Temperature (°C)	(ppm)	(ppm)	
P2-B4	S-3	4-6	ASTM G57	19.1	4.3	37.5	2.0	7.5	24.5	190	124	
P2-B9	S-5	8-10	ASTM G57*	22.6	0.7	29.7	0.7	6.6	24.0	404	1810	
P3-B7	S-4	6-8	ASTM G57*	22.8	0.7	30.3	0.5	7.1	25.0	160	99	
P3-B8	S-9	25-27		insufficient material				6.8	25.5	240	565	

KEY: (1) Test results provided by Luvak.
(2) ASTM G57*: Multi point test using G187 equipment to identify minimum resistivity

Prepared by: NB
Reviewed by: RT
Date: 3/23/2016

TerraSense, LLC
45H Commerce Way
Totowa, NJ 07512
(973) 812-1818

Project No. 7984-16001
File: Corrosion1.2.xlsx
Page 1 of 1

Distinct Engineering Solutions, Inc. #15040
Stapleton, Staten Island
Summary of Corrosion Testing

SAMPLE ID				RESISTIVITY TESTS				CHEMICAL TESTS				REMARKS
Boring No.	Sample No.	Depth (ft)	Test Method (2)	As-Received Water Content (%)	As-Received Resistivity (kΩ - cm)	@ Minimum Resistivity Water Content (%)	@ Minimum Resistivity Resistivity (kΩ - cm)	pH ASTM G51 pH (pH units)	pH ASTM G51 Temperature (°C)	Leachable Chloride (1) ASTM D4327 (ppm)	Leachable Sulfate (1) ASTM D4327 (ppm)	
P-3 B-11	S-13	45-47	ASTM G57*	25.6	2.9	33.2	2.7	7.6	24.7	11	46	

KEY: (1) Test results provided by Luvak.
(2) ASTM G57*: Multi point test using G187 equipment to identify minimum resistivity

Prepared by: BB
Reviewed by: RT
Date: 7/13/2016

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(973) 812-1818

Project No. 7984-16004
File: Corrosion7984-16004.xlsx

Appendix D

Hydrographic Survey Marine, 2016

OVERALL PLAN - HYDROGRAPHIC SURVEY
SCALE: 1" = 200'

GENERAL NOTES

1. THE INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE MEASUREMENTS AND SOUNDINGS TAKEN BY MARINE INFRASTRUCTURE ENGINEERING SOLUTIONS P.C. ON JUNE 7 & 8, 2016 .
2. ECHOSOUNDER - R2SONIC 2022 MULTIBEAM WITH AVAILABLE SWATH WIDTHS 10 DEG. TO 160 DEG., 256 BEAMS OPERATING AT 400KHZ.
3. POSITIONING AND MOTION - R2SONIC I2NS WHICH IS BASED ON APPLANIX POS MV WAVEMASTER WITH IARTK POSITIONING.
4. SOUND VELOCITY SENSORS - AML MICRO SOUND VELOCITY PROBE ATTACHED TO THE SONAR BRACKET AND AN AML SOUND VELOCITY PROFILER.
5. VERTICAL COMPENSATION FOR CHANGING WATER LEVELS IS PROVIDED USING PPK SOLUTION PROVIDED BY CORRECTIONS FROM THE CORS NETWORK.
6. HORIZONTAL DATUM: STATE PLANE NEW YORK LONG ISLAND NAD83 HARN U.S. SURVEY FEET.
7. VERTICAL DATUM: NAVD88 U.S. SURVEY FEET.
8. SURVEY PERFORMED IN ACCORDANCE WITH INTERNATIONAL HYDROGRAPHIC ORGANIZATION (IHO) ORDER 1A.
9. AERIAL PROVIDED BY ARUP.

0 100 0 200 FT
SCALE: 1"= 200'

OWNER:
New York City Economic Development Corporation
110 William Street
Sixth Floor
New York, New York 10038
tele. 212. 619. 5000

KEY PLAN:

PRIME / SITE ENGINEER:
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F: (845) 353 6509

MARINE SURVEYOR:
Marine Infrastructure Engineering Solutions PC
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New York, NY 10017
917.426.0975

NAME

REVISIONS

NO.	DATE	DESCRIPTION

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DRAWN BY JKB
DESIGNED BY
CHECKED BY MJD
DATE

New Stapleton Waterfront
PHASE II & III

SHEET TITLE
OVERALLL PLAN
HYDROGRAPHIC SURVEY

CONTRACT NO. 59530001
PROJECT NO. 245326-00
DRAWING NO. **1 of 8**
CADD FILE NO. **MSI03-16-006**

DWG NAME: T:\Projects\03 - MES NY\2016\03-16-006 - McLaren Bathymetry Survey At Stapleton\5 - Drafting\Sheets\MSI03-16-006.dwg
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MOD. TIME: 7/6/2016 2:49 PM
PLOT BY: Jacqueline Bliss
PLOT TIME: 7/6/2016 2:50 PM

PARTIAL PLAN - HYDROGRAPHIC SURVEY
SCALE: 1" = 20'

0 10 0 20 FT
SCALE: 1"= 20'

OWNER:
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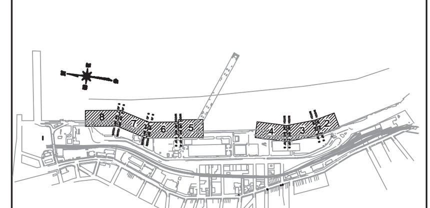
New York, New York 10038
tele. 212. 619. 5000

KEY PLAN:



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REVISIONS		
NO.	DATE	DESCRIPTION

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DESIGNED BY
CHECKED BY MJD
DATE

New Stapleton Waterfront
PHASE II & III

SHEET TITLE
PARTIAL PLAN - PHASE II HYDROGRAPHIC SURVEY

CONTRACT NO. 59530001
PROJECT NO. 245326-00
DRAWING NO. **2 of 8**
CADD FILE NO. **MSI03-16-006**

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PLOT BY: Jacqueline Bliss
PLOT TIME: 7/6/2016 2:51 PM

PARTIAL PLAN - HYDROGRAPHIC SURVEY
SCALE: 1" = 20'

0 10 0 20 FT
SCALE: 1"= 20'

OWNER:

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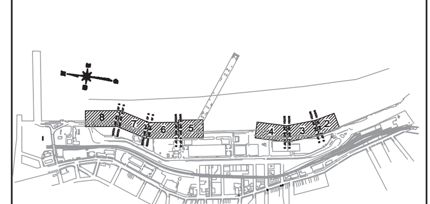
New York, New York 10038
tele. 212. 619. 5000

KEY PLAN:



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REVISIONS

NO.	DATE	DESCRIPTION

APPROVED BY

DRAWN BY JKB

DESIGNED BY

CHECKED BY MJD

DATE

New Stapleton Waterfront
PHASE II & III

SHEET TITLE

PARTIAL PLAN - PHASE II
HYDROGRAPHIC SURVEY

CONTRACT NO. 59530001

PROJECT NO. 245326–00

DRAWING NO. **3 of 8**

CADD FILE NO. **MSI03-16-006**

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PARTIAL PLAN - HYDROGRAPHIC SURVEY
SCALE: 1" = 20'

0 10 0 20 FT
SCALE: 1"= 20'

OWNER:	KEY PLAN:	PRIME / SITE ENGINEER:	SITE SURVEYOR:	LANDSCAPE ARCHITECT:	MARINE ENGINEER:	MARINE SURVEYOR:
New York City Economic Development Corporation 110 William Street Sixth Floor New York, New York 10038 tele. 212. 619. 5000		ARUP 77 Water Street New York, NY 10005 Tel (212) 896 3000 www.arup.com	NAIK CONSULTING GROUP, PC 253 W 35th Street, Floor 12A New York, NY 10001 T: (212) 575 2701 www.naikgroup.com	SCAPE / LANDSCAPE ARCHITECTURE PLLC 277 Broadway Suite 1606 New York, NY 10007 212.462.2628	McLaren Engineering Group 100 Snake Hill Road West Nyack, NY 10994 T: (845) 353 6400 F: (845) 353 6509	Marine Infrastructure Engineering Solutions PC 708 3rd Avenue, 5th Floor New York, NY 10017 917.426.0975

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DESIGNED BY
CHECKED BY MJD
DATE

New Stapleton Waterfront
PHASE II & III

SHEET TITLE
PARTIAL PLAN - PHASE II HYDROGRAPHIC SURVEY

CONTRACT NO. 59530001
PROJECT NO. 245326-00
DRAWING NO. **4 of 8**
CADD FILE NO. **MSI03-16-006**

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PLOT TIME: 7/6/2016 3:22 PM

MATCH LINE (SEE SHEET 6)

PARTIAL PLAN - HYDROGRAPHIC SURVEY

SCALE: 1" = 20'

0 10 0 20 FT
SCALE: 1"= 20'

OWNER:

New York City Economic Development Corporation
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Sixth Floor
New York, New York 10038
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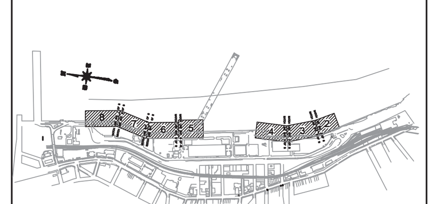
KEY PLAN:



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New Stapleton Waterfront
PHASE II & III

SHEET TITLE

PARTIAL PLAN - PHASE III HYDROGRAPHIC SURVEY

CONTRACT NO. 59530001
PROJECT NO. 245326-00
DRAWING NO. 5 of 8
CADD FILE NO. **MSI03-16-006**

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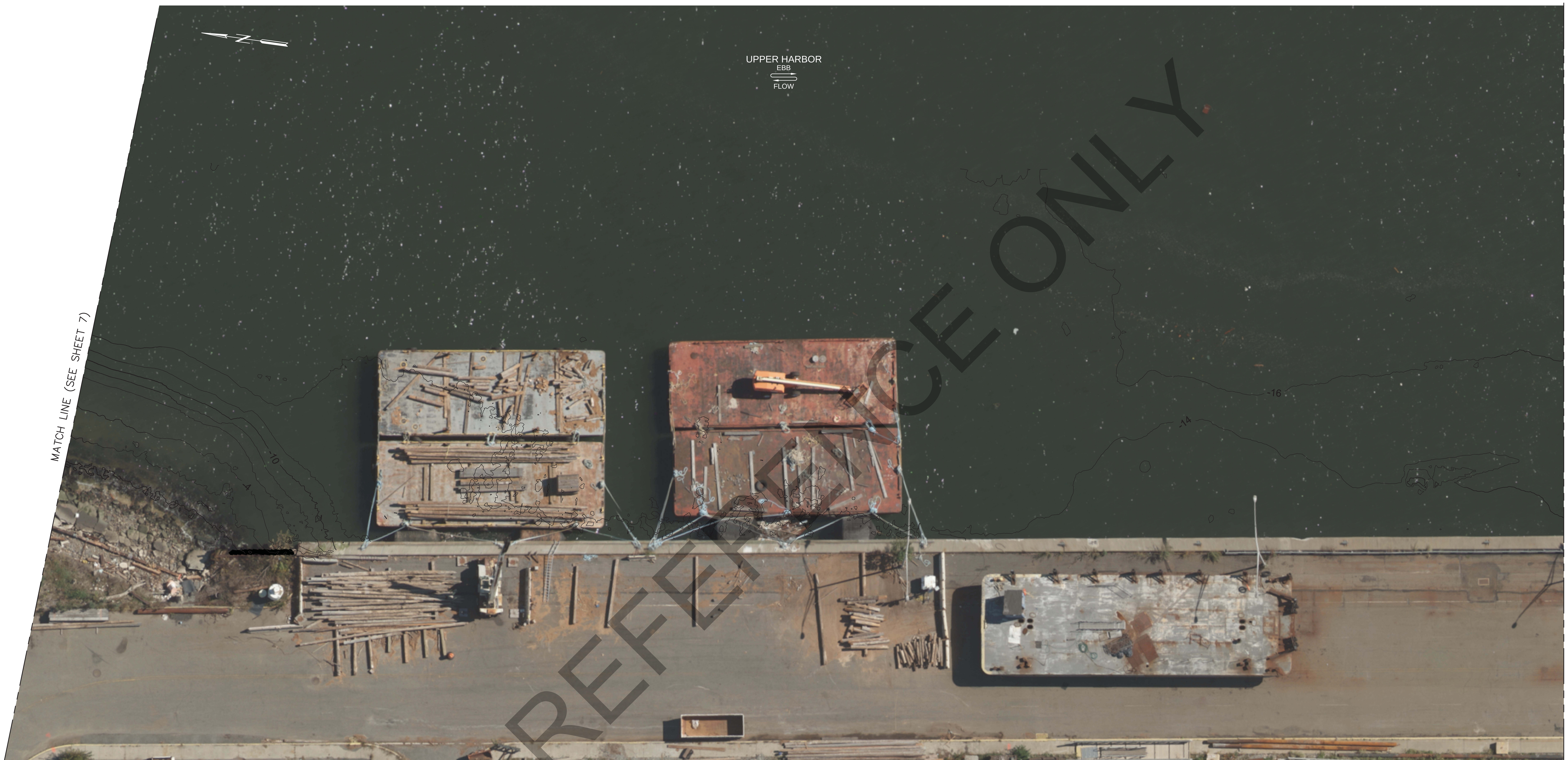

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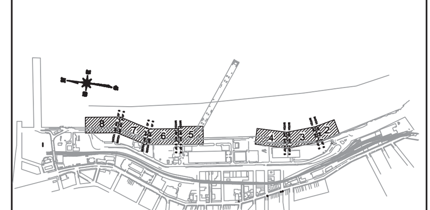

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DRAWN BY JKB
DESIGNED BY
CHECKED BY MJD
DATE

New Stapleton Waterfront
PHASE II & III

SHEET TITLE
PARTIAL PLAN - PHASE III
HYDROGRAPHIC SURVEY

CONTRACT NO. 59530001
PROJECT NO. 245326–00
DRAWING NO. **6 of 8**
CADD FILE NO. **MSI03-16-006**

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PLOT TIME: 7/6/2016 3:01 PM

PARTIAL PLAN - HYDROGRAPHIC SURVEY
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SCALE: 1"= 20'

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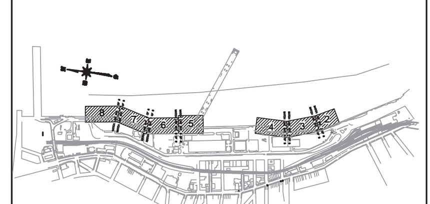
KEY PLAN:



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MARINE SOLUTIONS
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917.426.0975

NAME

REVISIONS		
NO.	DATE	DESCRIPTION

APPROVED BY

DRAWN BY JKB

DESIGNED BY

CHECKED BY MJD

DATE

New Stapleton Waterfront
PHASE II & III

SHEET TITLE

PARTIAL PLAN - PHASE III
HYDROGRAPHIC SURVEY

CONTRACT NO. 59530001

PROJECT NO. 245326-00

DRAWING NO. 7 of 8

CADD FILE NO. MSI03-16-006

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PLOT BY: Jacqueline Bliss
PLOT TIME: 7/6/2016 3:05 PM

PARTIAL PLAN - HYDROGRAPHIC SURVEY
SCALE: 1" = 20'

0 10 0 20 FT
SCALE: 1"= 20'

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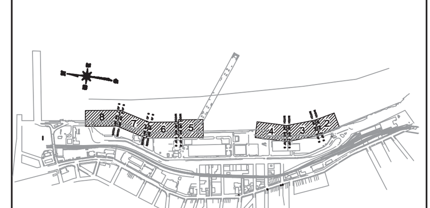
KEY PLAN:



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NAME

REVISIONS

NO.	DATE	DESCRIPTION

APPROVED BY

DRAWN BY: JKB

DESIGNED BY

CHECKED BY: MJD

DATE

New Stapleton Waterfront
PHASE II & III

SHEET TITLE

PARTIAL PLAN - PHASE III HYDROGRAPHIC SURVEY

CONTRACT NO.: 59530001

PROJECT NO.: 245326-00

DRAWING NO.: **8 of 8**

CADD FILE NO.: **MSI03-16-006**

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