118 Hope Street

BROOKLYN, NEW YORK

Preliminary Geotechnical Engineering Report

AKRF Project Number: 180075

Prepared for:

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1.0 INTRODUCTION

AKRF, Inc. (AKRF) has prepared this preliminary geotechnical engineering report (the “report”) to summarize the results of our recent preliminary geotechnical subsurface exploration for the proposed residential development (the “Project”), located at 118 Hope Street in Brooklyn, New York, also known as Brooklyn Block 2386, Lots 7, 12, and 14 (the “site”). This report includes the findings of an initial field exploration performed at the site.

The geotechnical evaluations and recommendations presented herein are in general accordance with the 2014 New York City Building Code (NYCBC). The exploration work described in this report was performed by AKRF in accordance with the subcontract between Hope Keap LLC (the “Client”) and AKRF, dated January 29, 2018.

In preparation of this report, AKRF reviewed the following information:

- A Schematic Design Set of drawings for the Project, developed by Hill | West Architects (the “Project Architect”) and dated December 20, 2017.
- An architectural survey of the site, performed by GeoLand Land Surveying, dated January 19, 2017 and revised on January 13, 2018.[1]

2.0 SITE DESCRIPTION & PROPOSED DEVELOPMENT

The site is located on a rectangular block, which is bounded on the north by Hope Street, on the east by Keap Street, on the south by Grand Street, and on the west by Rodney Street on the west (See Figure 1). The site is comprised of three contiguous lots which occupy the northeastern quadrant of the block near the intersection of Hope and Keap Streets and have a combined area of about 20,000 square feet. Previous buildings at the site have been demolished, and the site is currently vacant and graded level to the adjacent sidewalk elevations. The site has a gentle slope from about el. +16.5 in the southwestern corner of the site to about el. +13.5 near the northeastern corner of the site.

The site is bordered on the northwest by a 2-story brick building at 428 Rodney Street (Block 2386, Lot 4); on the southwest by the rear yards of 424 Rodney Street (Block 2386, Lot 2) and 426 Rodney Street (Block 2386, Lot 3); on the south and southwest by 3- to 4-story brick buildings at 417 Grand Street (Block 2386, Lot 26), 419 Grand Street (Block 2386, Lot 25), and 432 Grand Street (Block 2386, Lots 23 and 24); and on the southeast by a 7-story building at 431 Grand Street (Block 2386, Lot 21) and a 6-story building at 425 Keap Street (Block 2386, Lot 18). The presence, depth, and extent of any below-grade levels of the buildings adjacent to the site were not explored as part of the scope of this report.

The proposed development involves the construction of an “L-shaped” seven-story building rising about 75 feet above existing site grades. The building structure will consist of residential apartments and amenity spaces, including a partial below-grade cellar near the northeastern section of the building. The below-grade level will extend about 12 feet below the first floor (at grade).

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[1] All elevations (el.) cited in this report are based on this survey, measured in feet, and referenced to the North American Vertical Datum of 1988 (NAVD 88).

3.0 REVIEW OF AVAILABLE INFORMATION

3.1 Historical Land Use

We reviewed available historical aerial photographs from the New York City Department of Information Technology (NYC DOITT) to determine historical land use at the site. The site appears to have been developed since at least 1924 (see Figure 2) with buildings occupying most of the site on Lots 7, 12, and 14. Buildings continued to occupy the site from 1951 through 2012 (see Figures 3 through 5), until their recent demolition for the proposed development.

3.2 Geological Setting

A review of the historic map titled “Map Showing the Original High and Low Grounds, Salt Marsh, and Shore Lines in the City of Brooklyn from original Government Surveys made in 1776-1777,” dated 1875-1876, prepared by the Board of Health, shows that the site appears to be located to the south of one of the tributary creeks in the vicinity of the historic Bushwick Inlet.

Bedrock in this area of Brooklyn is expected to be between about 150 and 200 feet below the existing ground surface (Figure 6). Review of subsurface explorations published by the U.S. Works Progress Administration dated November 1937 corroborates this information, indicating that the bedrock depth near the project site is about 175 feet below ground surface.

The Lower Hudson Sheet of the Surficial Geologic Map of New York shows that surficial soils at the site are comprised of till (shown in pink with the abbreviation "t" on Figure 7). These soils typically consist of varying amounts of cobbles, gravels, sands, silts, and clays.

4.0 PRELIMINARY SUBSURFACE EXPLORATION

This section discusses the results of our preliminary subsurface investigation at the site. When we originally developed the scope of work for this Project, we assumed the proposed building would have a shallow foundation system and that eight borings would be needed to satisfy the requirements of the NYCBC. Based on our preliminary findings, a deep foundation system is expected; therefore, a minimum of ten borings will be needed to satisfy the requirements of the NYCBC.

Our preliminary subsurface exploration consisted of four borings and two temporary groundwater observation wells.

4.1 Test Boring Program

Four test borings, designated B-1, B-4, B-5, and B-8, were drilled at the site between February 28, 2018 and March 6, 2018 as part of our preliminary subsurface exploration. All borings were inspected on a full-time basis by an AKRF geotechnical engineer. The test boring locations are shown in Figure 8.

Drilling was performed by Craig Geotechnical Drilling Company, Inc. of Mays Landing, NJ using a CME-75 truck-mounted drill rig fitted with an automatic hammer. The borings were advanced using the mud rotary technique with a 3⅞-inch diameter tri-cone roller bit. Soil samples were obtained in all borings in accordance with the American Society for Testing and Materials (ASTM) Standard Specification D1586: Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils. SPT consists of driving a 2-inch outside diameter (OD) split spoon sampler for a depth of 24 inches with repeated blows of 140-pound hammer free-falling 30 inches. The standard penetration, or N-value, is defined as the number of hammer blows required to drive the sampler for a 12-inch interval after an initial 6 inches of penetration, and is measured in blows per foot (bpf). The soil samples obtained from the borings were visually classified using the Unified Soil Classification System (USCS; ASTM Standard D2488) and the NYCBC designations.

The test boring logs are included in Appendix A.

4.2 Temporary Groundwater Observation Well

Two groundwater observation wells were installed to a depth of 40 feet in completed test borings B-4 (OW) and B-5 (OW) on February 28, 2018. The wells were constructed of 2-inch nominal diameter Schedule 40 PVC pipe with 20 feet of slotted screen at the bottom and 20 feet of riser pipe. The annuli between the pipes and the walls of the boreholes were backfilled with sand to a minimum of 2 feet above the screened sections. The remainders of the annuli were backfilled with at least 2 feet of bentonite and then sand. A flush-mount cap was installed at the top of each borehole.

Sketches of the groundwater observation wells are included in Appendix B.

4.3 Geotechnical Laboratory Testing

Geotechnical laboratory testing was performed on selected samples collected during the exploration. The purpose of the geotechnical laboratory testing was to confirm field soil classifications and to define the mechanical and physical soil properties for use in the foundation design and construction recommendations. The geotechnical laboratory testing consisted of ten sieve analyses performed in accordance with ASTM Standard D422 and eight Atterberg limits test (for silty/clayey soils) performed in accordance with ASTM Standard D4318.

The geotechnical laboratory results are included in Appendix C.

5.0 GENERALIZED SUBSURFACE CONDITIONS

Based on our review of the logs, we present our interpretation of the generalized subsurface conditions with the following strata and groundwater descriptions. Subsurface conditions may be summarized by the following brief descriptions of the major strata, listed in their order of occurrence with depth:

5.1 Fill (Class 7) [2]

A layer of uncontrolled fill material was encountered in all borings. The fill generally consists of brown sand with varying amounts of gravel, silt, clay, and other miscellaneous fill including brick, concrete, and cinders.

The fill ranged in thickness from about 8 feet to about 15 feet. Uncorrected SPT N-values ranged from 1 bpf to 26 bpf. The variation in SPT N-values indicates that the fill was likely placed in an uncontrolled manner. The fill is characterized as very loose to medium dense in terms of relative density and is classified as NYCBC Material Class 7—Uncontrolled Fill.

5.2 Organic Silts and Clays (Class 6)

A layer of brown and gray organic silts and clays was encountered beneath the fill soils in all borings except boring B-8. The organic soils ranged in thickness from 3.5 feet to about 10 feet in thickness. Uncorrected SPT N-values ranged from 1 bpf to 16 bpf, with most uncorrected SPT N-values ranging

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[2] Class numbers indicate material class in accordance with the NYCBC.

between 1 bpf and 2 bpf (very loose and soft). These organic soils are generally compressible, and will result in consolidation-based settlements if loaded above their existing overburden and preconsolidation pressures. These organic soils can be classified as NYCBC Material Class 6—Nominally Unsatisfactory Bearing Material.

5.3 Glacial Till (Classes 3 through 6)

Beneath the fill and organic soils, glacial till soils were encountered. These soils vary in texture and composition, and sub-strata of different materials can be identified within the larger stratum of glacial till.

5.3.1 Sand (Classes 3 and 6)

Brown to gray, fine- to coarse-grained sand with varying amount of silt and gravel was encountered at a depth of between 10 feet and 18 feet below existing ground surface, and extended to a depth of between 60 feet to 65 feet below existing ground surface. A discrete layer of sand was also encountered at the location of boring B-8, between about 77 feet and 90 feet below the existing ground surface.

Uncorrected SPT N-values ranged from 1 bpf to 30 bpf, with an average value of 19 bpf, and can be classified as medium dense in terms of relative density. The loose sands (uncorrected SPT N-values less than 10 bpf) were found within the top of the sand sub-stratum, and can be attributed to the transition between the fill and/or organic soils and the underlying sands. The loose sands near the top of this sub-stratum can be classified as NYCBC Material Class 6—Nominally Unsatisfactory Bearing Material, with the remaining sand soils being classified as NYCBC Material Class 3b—Granular Soils.

5.3.2 Silts and Clays (Classes 4, 5, and 6)

A layer of gray clay and silt with varying amounts of sand and gravel was encountered in borings B-1, B-4, and B-8.[3] The clay and silt layer extended to boring termination depths of 77 feet and 102 feet.

Uncorrected SPT N-values ranged from 4 bpf to 18 bpf and can be classified as loose to medium dense (for silty soils) and as soft to stiff (for clayey soils). The looser and softer silts and clays were encountered near the top of this sub-stratum where the soils changed from coarse-grained (primarily sand) to fine-grained (silts and clays); these soils can be classified as NYCBC Material Class 6— Nominally Unsatisfactory Bearing Material. The underlying clayey soils can be classified as NYCBC Material Class 4—Clays, and the underlying silty soils can be classified as NYCBC Material Class 5—Silts.

5.4 Groundwater Level

Groundwater depth was measured periodically in the observation wells installed within completed borings B-4 (OW) and B-5 (OW) during the preliminary subsurface exploration program. The measurements indicate that groundwater is at about 10 to 11 feet below existing grade, corresponding to between about el. +4.0 and el. +4.5.

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[3] Boring B-5 was terminated at a depth of 52 feet, and didn't encounter the top of this sub-stratum.

6.0 FOUNDATION DESIGN RECOMMENDATIONS

This section presents preliminary engineering evaluations and recommendations for the design of the foundations. The evaluations and recommendations are based on the results of the subsurface investigation, our experience on other projects, and the information we have been provided to date on the design requirements for the proposed buildings.

6.1 Preliminary Seismic Evaluation

The seismic design recommendations presented in this section are in accordance with NYCBC Section 1613. The subsurface exploration revealed a profile consisting of loose to medium dense soil based on an evaluation of SPT N-values.

The termination depths of the borings ranged from 52 feet to 102 feet below the existing ground surface. The measured SPT N-values were used to determine the weighted averages. The weighted average N-value ($\bar{N}$) over the top 100 feet was determined to be 10.6 bpf; since the value of $\bar{N}$ is less than 15 bpf, we recommend a "stiff soil profile" is assigned with a corresponding Site Class E. We assume that the building will be assigned to Structural Occupancy/Risk Category (SO/RC) II. The appropriate SO/RC should be confirmed by the Architect or Structural Engineer. Based on the recommended Site Class and SO/RC, the recommended Seismic Design Category is C.

6.2 Preliminary Assessment of Liquefaction Potential

Liquefaction is the full or partial loss of shear strength of granular or cohesionless soils during an earthquake. The potential consequences of liquefaction could include loss of bearing capacity causing collapse or excessive settlement of ground. The NYCBC requires that liquefaction potential be considered for non-cohesive soils located below the groundwater and to a depth of 50 feet. The most recent groundwater measurements indicated the depth to groundwater is about 10 feet below the existing ground surface.

The N_{60}-values[4] were plotted on the basic NYCBC liquefaction screening chart criteria from NYCBC Section 1813 which compares N_{60}-values versus depth. The plotted data indicates that less than 10 percent of the N_{60}-values plot in the "Liquefaction Evaluation Required" area as shown in Figure 9. As a result, our preliminary assessment is that liquefaction should not be a concern for this site.

6.3 Preliminary Foundation Recommendations

The uncontrolled fill and potentially compressible organic silt and clay soils are unsatisfactory bearing materials and are not suitable to support the foundation loads. Therefore, shallow foundations are not a viable option, and a deep foundation system is needed.

Deep foundations are long pile elements, which either transfer the building loads to the underlying soils by friction or end bearing. For this project, it is expected that all deep foundation elements will develop their resistance from friction.

Deep foundations can consist of either impact hammer-driven piles (such as timber piles, H-Piles, steel pipe, or tapered piles) or drilled-in piles (such as micropiles, auger-cast piles, caissons piles). Typical capacities of driven elements in the New York City area range from about 60 tons to 250 tons for steel piles and about 30 tons to 40 tons for timber piles. In addition, the length of driven piles is limited to

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[4] Field SPT N-values have been corrected for depth and hammer efficiency.

sections that range between 50 feet and 60 feet long for easier storage and transportation. Piles that need to be installed with longer lengths require splicing in the field during the time of construction. Based on similar experience in the area and anticipated foundation loads, we would recommend the use of driven timber piles as a feasible and economic foundation option.

Drilled piles can achieve larger capacities and can penetrate obstructions relatively easier; however, their installation is more time consuming and costlier than driven piles. Since the installation of driven piles near existing buildings may cause damage to the buildings and their foundations, as well as have a densifying effect on the soils at subgrade bearing levels below these buildings, we have also considered use of drilled micropiles bearing into the natural silty sand layer.

Our recommendations for various pile foundation options are discussed below. The foundation contractor should submit the final selected pile type, size, cross-section and reinforcement arrangement for the selected pile foundation, and a wave equation analysis with pile driving criteria for the proposed assembly of pile driving hammer prior to the start of construction for driven piles to be installed.

We recommend all piles with a circular cross-section are installed with a minimum center-to-center spacing of three times the diameter of the pile head.

6.3.1 Timber Driven Piles

A timber pile (Douglas Fir) with a minimum tip diameter of 8 inches may be driven into satisfactory bearing material. The basic maximum allowable capacity is 30 tons per pile with an estimated total length of about 50 feet to 60 feet. The timber piles should be treated with a preservative in accordance with American Wood Protection Association (AWPA) C3. The preservative-treated piles shall be subject to quality control program administered by an approved agency. Pile cuts shall be treated in accordance with AWPA M4.

We recommend that driven piles are not installed within at least 25 feet of the existing buildings tot eh south and west of the site. We recommend drilled foundation elements be installed within at least 25 feet of these structures as discussed below.

6.3.2 Drilled Micropile

Drilled micropiles should be installed in sensitive areas near to adjacent structures where driven piles would cause excessive vibrations and result in ground settlement.

Micropiles consist of an open-ended steel pipe (casing) drilled to the proposed pile toe elevation. Duplex drilling techniques are used whereby a drilling bit is mounted inside the casing. The bit and casing are advanced simultaneously so there is never an uncased shaft section in the soil. After drilling, the micropile is constructed by installing the required reinforcement and placing cement grout from the bottom of the hole to replace the drilling fluid. Additional grout is injected under a constant pressure through the casing while the casing is withdrawn. A grout socket or bond zone is formed in the soil below the base of the casing that allows the pile to develop its frictional resistance with the surrounding soil.

Given the presence of uncontrolled fill and organics, we recommend the bottom of the permanent casing is about 18 feet below existing grade. During the installation of micropiles, air drilling shall be prohibited where existing structures may be affected by subsurface disturbances.

The estimated capacity and corresponding bond lengths of drilled micropiles are presented in Table 1.

Table 1 Estimated Micropile Capacities

Maximum Allowable Compressive Capacity (tons)	Steel Casing Outside Diameter (inches)	Steel Casing Thickness (inches)	Number and Size of Reinforcing Bars	Minimum Estimated Bond Length (feet)
50	9.625	0.545	1 - #11	30
60	10.750	0.500	1 - #11	30
70	11.875	0.500	1 - #11	30

Notes:

1. The steel casing and reinforcing bar should have minimum yield strengths of 50 kips per square inch (ksi) and 75 ksi, respectively.
2. The grout should have minimum compression strength of 5,000 psi.
3. The minimum bond length diameter is estimated to equal the outside diameter of the steel casing.
4. The bond length is estimated and should be adjusted based on the results of pile load tests performed prior to the installation of production piles.
5. Piles were considered to have a 30-foot bond length so that all piles developed their friction within the glacial till – sand sub-stratum.

6.3.3 Lateral Loads

NYCBC allows a maximum basic lateral load of 1 ton per pile. Should lateral resistance in excess of 1 ton per pile be required, lateral load tests must be performed, along with analysis to demonstrate capacity and group effects.

6.3.4 Ground Floor Slab Support

The uncontrolled fill and loose sand materials may settle and consolidate; therefore, these materials are not suitable for support of the ground floor slab. We recommend the ground floor slab is designed as a structural slab supported by grade beams and the pile caps of the deep foundation system. Utilities constructed below ground level floor slabs may also be subjected to settlement. Therefore, we recommend utilities be constructed in chases cast into the structural slab. Utilities entering the building, and utility structures, should be fitted with flexible connections. Hanging utilities from the slab is not recommended.

6.3.5 Foundation Settlement

Preliminary estimates for the maximum total and differential settlement of the pile-supported columns will depend on the type and length of the pile type selected. We estimate the total settlements will be about 0.5 inches to 1.0 inch.

6.4 Permanent Groundwater Control

The static groundwater level was measured at about 10 feet to 11 feet below the existing ground surface, corresponding to between about el. +4.0 and el. +4.5. We recommend the design groundwater elevation is taken as el. +8.5 to account for the possible rise in the groundwater elevation due to heavy precipitation or utility leaks.

The below-grade space for the new building is proposed to be 12 feet below the first floor. We expect that this partial below-grade cellar level will need to be designed for hydrostatic pressures acting laterally on foundation walls and upwards on the underside of the cellar level slab. We recommend that the cellar slab be constructed as a structural pressure slab to resist hydrostatic uplift pressures resulting from the groundwater level at the design groundwater elevation.

We recommend that the proposed cellar slab, below grade walls, and any proposed elevator pits be fully waterproofed to at least 1 foot above the design groundwater elevation. We recommend a membrane type waterproofing product be used, such as Preprufe and Bituthene by GCP Applied Technologies[5] For horizontal applications, we recommend that the membrane be installed on a two-inch-thick concrete substrate (mudslab). Waterproofing installation should be performed by a certified installer and be inspected on a full-time basis to confirm that the waterproofing is being installed per the manufacturer's recommendations.

6.5 Additional Design Recommendations

Additional borings will be required to satisfy the requirements of the NYCBC. For buildings with developed footprint areas of about 20,000 square feet, a minimum of ten borings are required to be made. Since the preliminary subsurface exploration at the site consisted of four borings, six additional borings need to be made at the site.

Based on the existing borings made to date, the site currently falls under Seismic Site Class E, resulting in Seismic Design Category C. In order to explore the site to determine if a higher Seismic Site Class is possible, we would recommend that seismic cone penetrometer testing is performed at the site. The seismic cone penetrometer data records the shear wave velocity of the soils present, which has a higher accuracy than the SPT data from the soil borings.

7.0 FOUNDATION CONSTRUCTION RECOMMENDATIONS

This section presents a discussion of our recommendations regarding foundation construction aspects of the proposed development that should be addressed in the project specifications and contract documents.

7.1 Excavation

The bottom of pile caps should be at least 4 feet below proposed finished grade, and grade beams should be embedded at least 18 inches for frost protection. Minor excavation and regrading may be required to achieve design elevations. The general excavation will primarily involve the removal of miscellaneous uncontrolled fill, and can be performed with conventional earth moving equipment such as backhoes, excavators, and dozers. All excavation should be performed in accordance with OSHA requirements including, but not limited to, temporary shoring, use of trench boxes, and proper benching, where necessary. The existing uncontrolled fill material is likely unsuitable for re-use as discussed in a subsequent section.

7.2 Temporary Excavation Support

Excavation for the proposed partial basement is expected to extend to depths of at least 13 feet below existing grade to bottom of slab (assumed to be at least 12 inches thick). The contractor must take appropriate measures to stabilize the work area and prevent lateral movements of the adjacent areas

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[5] Formerly W.R. Grace & Co.

during the excavation. The adjacent streets, sidewalks, and utilities must not be undermined by the proposed excavation and measures should be taken to prevent raveling of soil from around and beneath these structures. Therefore, temporary support of excavation will be required along portions of Hope Street on the northern property line and Keap Street on the eastern property line. Excavation support system may likely include steel sheetpiles with lateral restraints (e.g., tiebacks, rakers and walers, etc.) or soldier pile and lagging, as necessary. Excavation support on the southern and western sides of the excavation can likely be provided by sloping and benching the excavation.

The design and construction of any temporary support of excavation system and/or slopes should be performed by a licensed New York Professional Engineer. All excavations and temporary support systems should conform to relevant OSHA and local safety regulations.

7.3 Construction Dewatering

The need for temporary groundwater control will depend on the groundwater level at the time of construction and the proposed cellar depth. While we don't expect dewatering will be needed for the excavation of pile caps and grade beams for the majority of the building, the excavation of the cellar, as well as localized pits for the elevator pits and pile caps in the cellar level, will most likely require dewatering.

The groundwater table should be maintained at a depth of at least 2 feet below the bottom of the excavations to preserve the excavation bottom to allow construction activities. Based on the measured groundwater elevation of about 10 feet to 11 feet below the existing ground surface, the contractor will need to install well points or deep wells to draw down or lower the groundwater level. The contractor is responsible for the design and operation of the dewatering system. In considering the design of the dewatering system, the temporary effects of drawdown should be determined, as well as any effects the dewatering may have on existing utilities beneath the roadway and nearby adjacent buildings.

Collected groundwater must be discharged in accordance with New York City Department of Environmental Protection (DEP) and New York State Department of Environmental Conservation (DEC) regulations.

7.4 Deep Foundation Installation and Testing

We recommend installing index piles that are the same in every aspect to production piles at the start of the pile driving operations. The recommended number of index piles is about 5 percent to 10 percent of the total number of piles required. Index piles allow for estimating pile lengths, and identifying unusual driving conditions and the need for spudding and pre-drilling. The index piles should be installed using a pile driving analyzer (PDA) to collect data on pile integrity, driving stresses and hammer energy in accordance with ASTM Standard Specification D4945. A PDA provides real-time information regarding pile capacity and stresses during pile driving and will assist in deciding which piles to select for static axial compressive load tests and will assist in developing the final pile driving criteria.

In accordance with the NYCBC, static axial compressive load tests are required for any driven pile with an allowable design load greater than 40 tons (30 tons for timber piles), or for drilled piles with an allowable design load greater than 20 tons that meet the requirements of NYCBC Section 1808.3.1 (3)(4).

NYCBC requires that a minimum of two load tests be conducted for a building footprint of between 5,000 and 30,000 square feet, with one additional load test for each additional 20,000 square feet of footprint area. Therefore, a minimum of two axial compressive load tests should be performed for the drilled micropiles with allowable capacities greater than 20 tons. No static axial compressive load tests are required for the driven timber piles, provided that the timber piles are not installed to capacities in excess of 30 tons. We do recommend the index piles are installed using PDA to determine ultimate driving resistances and developing final blow counts. The load tests should be performed in accordance with ASTM Standard D1143. The maximum test load for the piles should be maintained for a minimum of 12 hours for the drilled micropiles with a basic maximum allowable capacity of less than or equal to 75 tons. Production piles should be installed in the manner as the successfully load-tested piles.

If the required lateral load per pile exceeds the basic lateral load capacity of one ton, a minimum of two lateral load tests shall be performed in accordance with ASTM Standard D3966. For free-headed piles, the maximum allowable lateral load shall not be more than one-half the test load producing a gross lateral movement of one inch at the ground surface. For fixed-headed piles, the results of the load test shall be used to verify the input parameters used in the lateral load analysis.

7.5 Subgrade Preparation

To minimize soil disturbance at bearing elevation within excavations for pile caps and utilities, excavation within the last foot above final subgrade elevation should be performed by hand, or by using an excavator fitted with a straightedge bucket or a bucket with a flat plate welded across the teeth.

The exposed subgrade surface should be level. Foundation concrete should be placed as soon as possible on the prepared subgrade to prevent disturbance. While subgrade soils do not require approval prior to construction of the pile-supported foundation, it is recommended to protect construction subgrade from precipitation, freezing weather, and construction traffic until the concrete is placed. Methods of protection could include sealing with lean concrete (mud slab) or placement of a gravel layer. The contractor shall not place any concrete for foundations on frozen ground, or where snow or standing water is present.

Where very soft and unstable soils, large construction and demolition debris, or deleterious materials (organic material) are present at the subgrade elevation, localized over-excavation may be required. The extent of over-excavation will be determined during site excavation. Where required, the excavated unsuitable fill should be replaced with compacted controlled fill. Recommendations for fill materials placement and compaction are presented in a subsequent section.

7.6 Fill Material and Compaction Criteria

The use of imported controlled fill is expected after the construction of pile caps and grade beams, and for supporting the structural slab. Imported fill should meet the minimum requirements for controlled fill per the NYCBC. The fill material should be well graded, have less than 10 percent by dry weight passing the No. 200 sieve, and should be free of organics, clay, and other deleterious or compressible materials and should have a maximum particle size of 3 inches. We note that the existing uncontrolled fill material at the site is unlikely to be suitable for re-use as controlled fill material.

Any fill material placed in restricted areas where only hand-operated compactors can be used should be placed in lifts having a maximum thickness of 8-inches. We recommend using a 0.5-ton-maximum walk-behind roller or other equipment capable of effecting the necessary compaction. The appropriate water content at the time of compaction should be plus or minus 2 percentage points of optimum as determined by the laboratory compaction tests of proposed fill material, performed in accordance with ASTM Standard Specification D1557. No backfill material should be placed in areas where free water is standing or on frozen subsoil areas. Compaction of all fill should be verified by the on-site geotechnical engineer using visual inspection and the performance of in-place nuclear density tests.

7.7 Construction Documents and Quality Assurance

Design specifications and drawings should incorporate our recommendations to ensure that subsurface conditions and other geotechnical issues at the site are adequately addressed in construction documents. AKRF should assist the design team in preparing specification sections related to geotechnical issues such as subgrade preparation. AKRF should also review foundation design drawings and details, and all contractor submittals and construction procedures related to geotechnical work.

A geotechnical engineer familiar with the site subsurface conditions and design intent should perform the quality assurance observations and testing of geotechnical-related work during construction. Per the requirements of NYCBC, the installation of any support of excavation system and the construction of foundations (foundation subgrade preparation, earthwork, pile driving, etc.) requires Special Inspection by a Professional Engineer currently registered in the State of New York and retained by the Owner. We recommend that AKRF provide the required Special Inspections to provide continuity from design through construction and to verify that the foundation design is implemented during construction for providing appropriate responses to field questions and changes.

7.8 Preconstruction Conditions Documentation and Monitoring Program of Adjacent Structures

The Owner is required by NYCBC to protect the adjacent property during demolition and construction work. NYCBC Section 1814 requires, at a minimum, that preconstruction conditions documentation (pre-con) of all neighboring buildings, sidewalks, and utilities in nearby areas should be performed. The pre-con would provide the Owner and the foundation contractor with documentation of existing conditions in the event of a future damage claim. The limits and extent of the pre-con should be determined by a qualified Professional Engineer experienced in such documentation work. The pre-con should include detailed photographs and videos referenced to an accurate floor plan.

Crack reference lines and settlement reference points should be established for monitoring during construction. The pre-con would serve as a pictorial and quantitative reference document to assess conditions prior to, during, and after construction. On the basis of this documentation, a construction monitoring program should be designed for monitoring the responses of adjacent structures and evaluating construction procedures. This program should consist of monitoring horizontal and vertical movements by optical surveying and vibration monitoring using threshold-type seismographs to measure construction-induced vibrations.

We recommend that a monitoring plan and specifications be completed for the project, which should provide details of the methods and equipment for monitoring vibration and movement, as well as movement criteria and requirements for frequency of readings and reporting. The monitoring plan should describe the procedures to be implemented if the threshold levels are exceeded during construction.

8.0 LIMITATIONS

The conclusions and recommendations provided by AKRF in this report have been prepared based on professional judgment of the subsurface conditions inferred from borings made at the site, as well as plans and/or drawings provided to AKRF. The recommendations provided are solely for the conditions encountered at the site, and should not be used independently at other sites where other subsurface conditions are presumed to exist.

In the event that the proposed building is changed, modified, or its location moved, AKRF should be informed to determine whether such modification would change AKRF's recommendations as presented herein. Geological and groundwater conditions presented herein represent conditions encountered at the time and specific locations where exploration work was performed. In the event that conditions during construction differ from those presented in this report, they should be brought to AKRF's immediate attention for evaluation, as recommendations in this report may be affected.

AKRF has prepared this geotechnical engineering report for the site at 118 Hope Street in Brooklyn, NY for use by the Owner, the project architect and structural engineer in the design process and is only applicable for this specific site and the planned design work. The information in this report should not be relied upon by engineers or contractors involved in other unrelated aspects of design or construction work at the site without first verifying from AKRF whether the information contained herein is applicable for such use.

Environmental issues (such as potentially contaminated soil and groundwater) are outside the scope of this study and should be addressed in a separate study.

9.0 REFERENCES

- American Society for Testing and Materials (ASTM). ASTM Standard D422. “Standard Test Method for Particle-Size Analysis of Soils.” West Conshohocken, PA: ASTM International, 2007.
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FIGURES

Source: NYC Department of Information Technology

Note: Location plan not to scale.

LEGEND

🟥 APPROXIMATE LOCATION OF PROJECT SITE

PROJECT LOCATION

118 HOPE STREET
BROOKLYN, NY 11211

GEOTECHNICAL EXPLORATION
118 HOPE STREET
BROOKLYN, NY

SITE LOCATION MAP

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DATE
3/20/2018

PROJECT No.
180075

FIGURE
1

Source: NYC Department of Information Technology

Note: Location plan not to scale.

LEGEND

▨ APPROXIMATE LOCATION
OF PROJECT SITE

PROJECT LOCATION

118 HOPE STREET
BROOKLYN, NY 11211

GEOTECHNICAL EXPLORATION
118 HOPE STREET
BROOKLYN, NY

1924 AERIAL PHOTOGRAPH

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DATE	3/20/2018
PROJECT No.	180075
FIGURE	2

Source: NYC Department of Information Technology
Note: Location plan not to scale.

LEGEND

🟥 APPROXIMATE LOCATION OF PROJECT SITE

PROJECT LOCATION

118 HOPE STREET
BROOKLYN, NY 11211

GEOTECHNICAL EXPLORATION
118 HOPE STREET
BROOKLYN, NY

1951 AERIAL PHOTOGRAPH

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DATE	3/20/2018
PROJECT No.	180075
FIGURE	3

Source: NYC Department of Information Technology

Note: Location plan not to scale.

LEGEND

🟥 APPROXIMATE LOCATION
OF PROJECT SITE

PROJECT LOCATION

118 HOPE STREET
BROOKLYN, NY 11211

GEOTECHNICAL EXPLORATION
118 HOPE STREET
BROOKLYN, NY

1996 AERIAL PHOTOGRAPH

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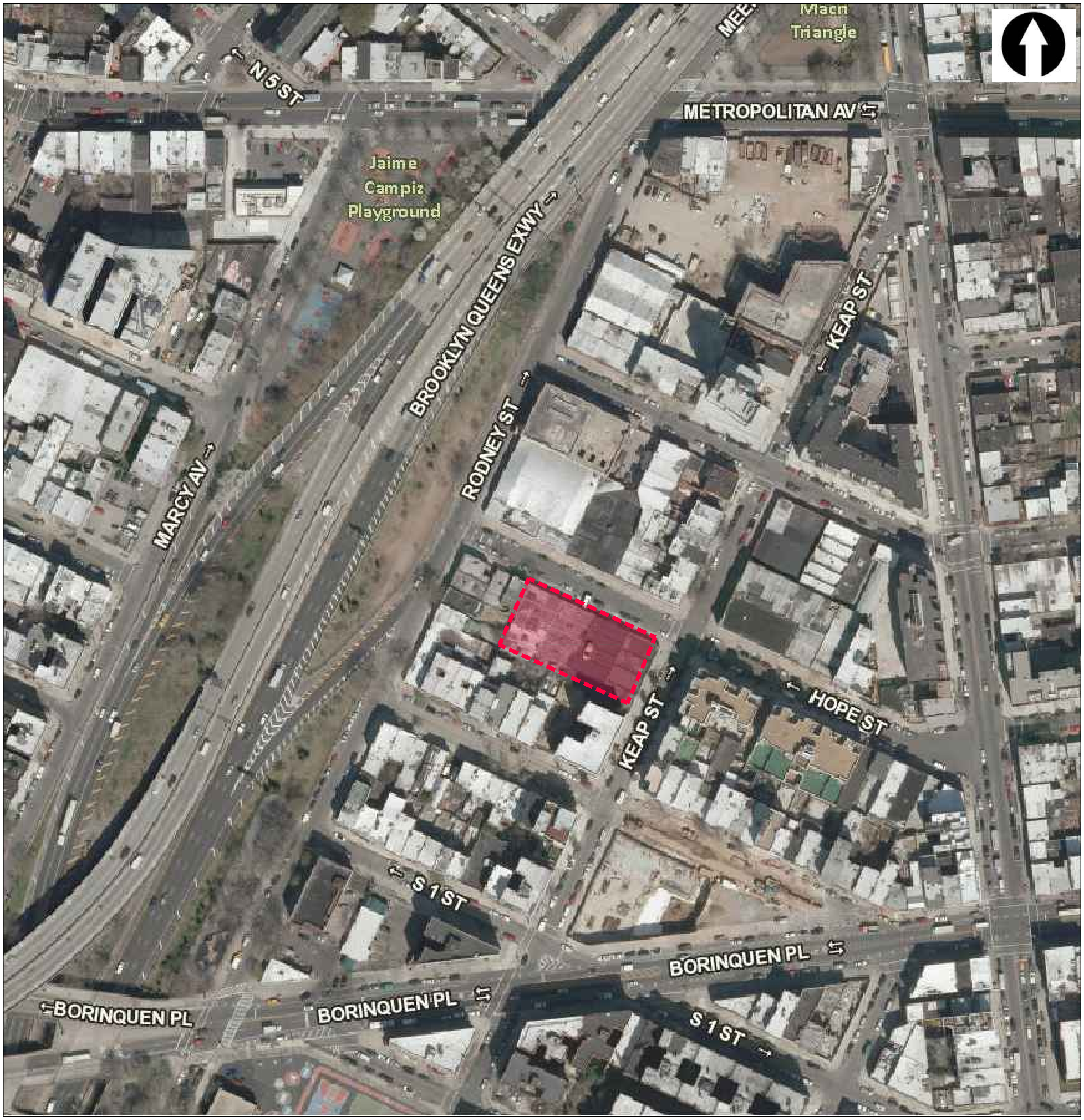
DATE	3/20/2018
PROJECT No.	180075
FIGURE	4



Source: NYC Department of Information Technology

Note: Location plan not to scale.

LEGEND

▨ APPROXIMATE LOCATION OF PROJECT SITE

PROJECT LOCATION

118 HOPE STREET
BROOKLYN, NY 11211

GEOTECHNICAL EXPLORATION
118 HOPE STREET
BROOKLYN, NY

2012 AERIAL PHOTOGRAPH

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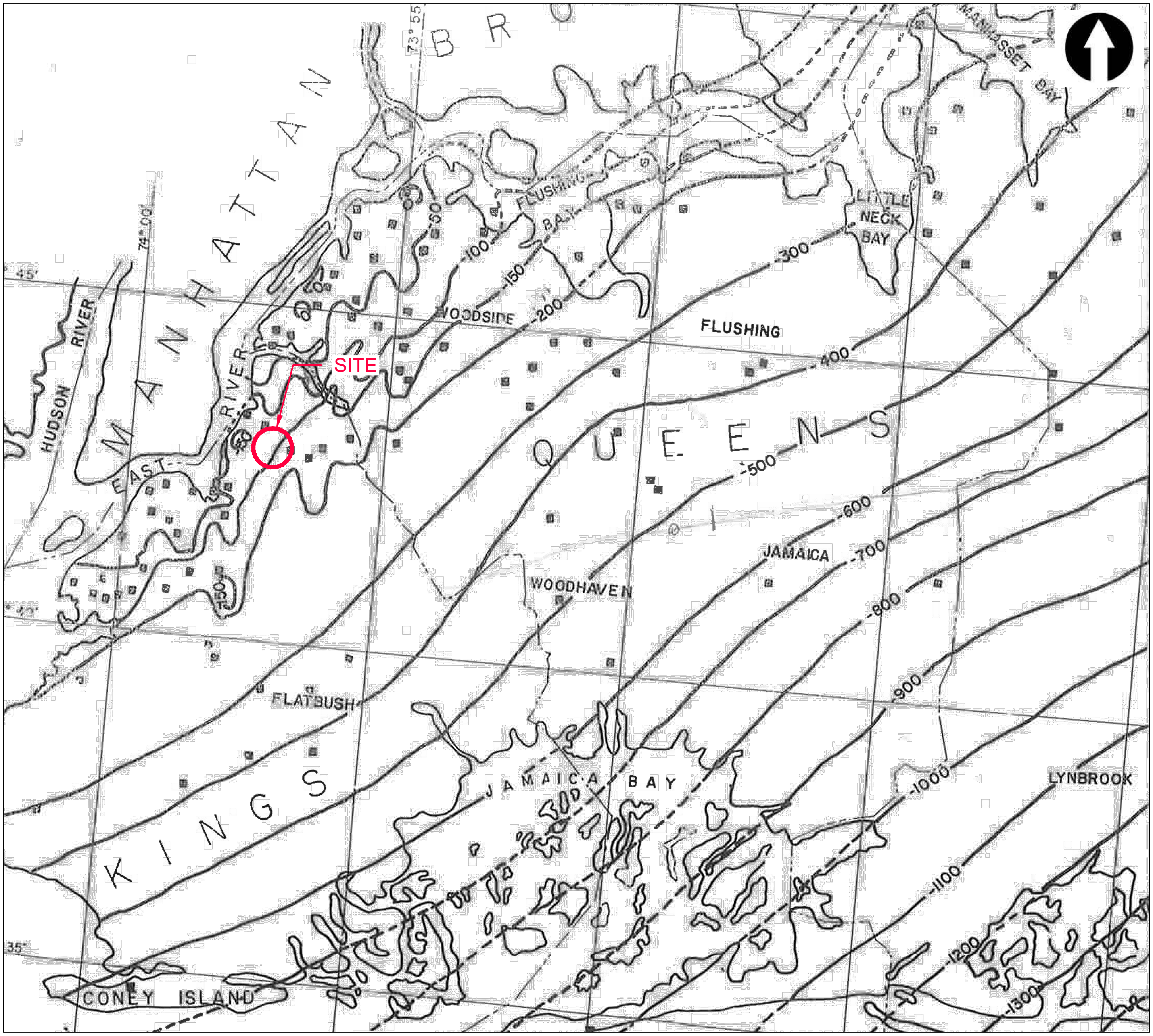
DATE	3/20/2018
PROJECT No.	180075
FIGURE	5



Source: State of New York Department of Conservation Bulletin GW-18 © 1949 by Russell Suter.

Note: Not to scale.

LEGEND

○ APPROXIMATE LOCATION
OF PROJECT SITE

PROJECT LOCATION

118 HOPE STREET
BROOKLYN, NY 11211

GEOTECHNICAL EXPLORATION
118 HOPE STREET
BROOKLYN, NY

BEDROCK MAP

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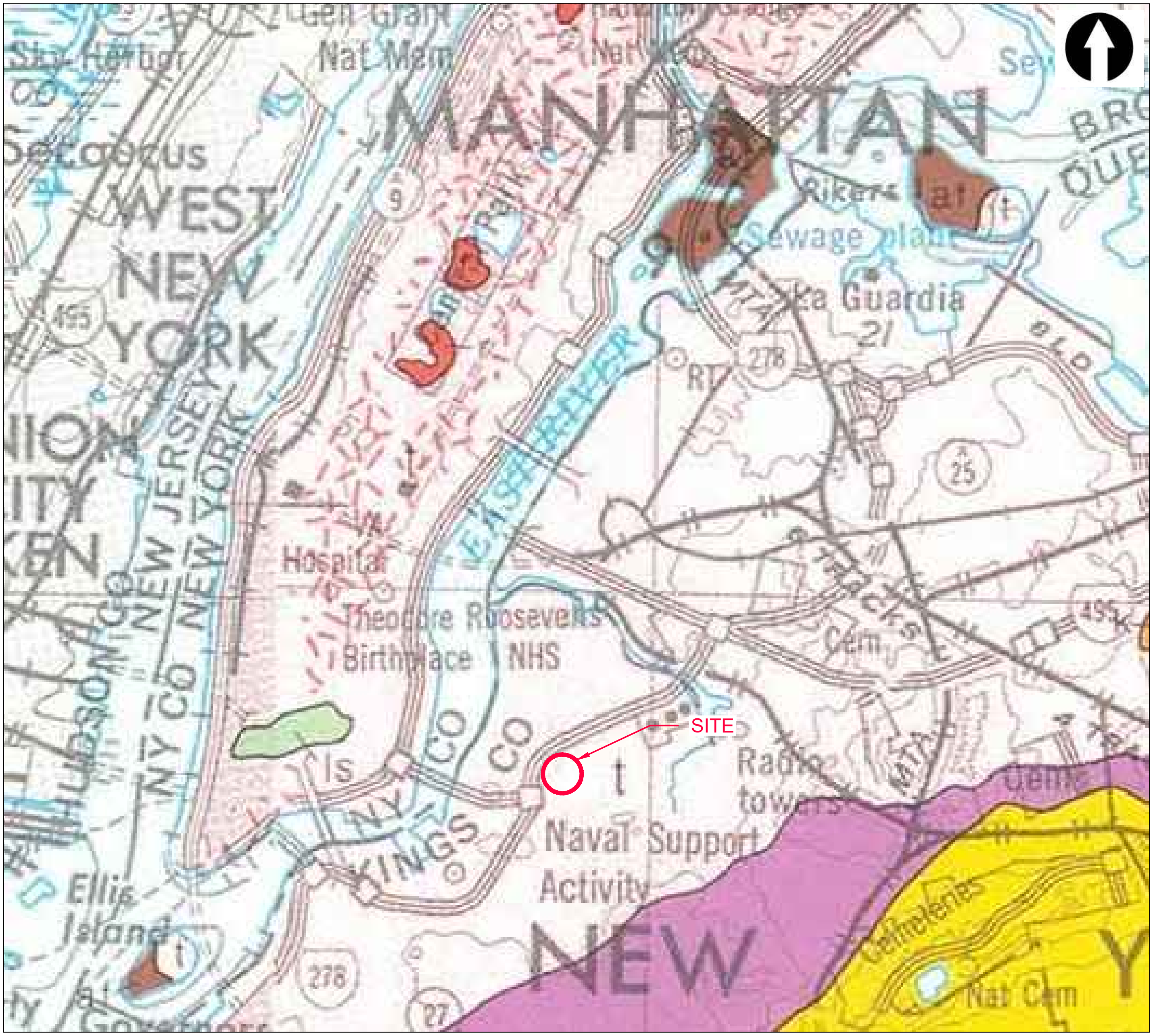
PROJECT No.
180075

FIGURE
6



Source: Surficial Geologic Map of New York - Lower Hudson Sheet. © 1989 by NYSGS.
Note: Not to scale.

LEGEND

○	APPROXIMATE LOCATION OF PROJECT SITE
▨	BEDROCK WITHIN ABOUT 3 TO 10 FEET OF THE SURFACE
☐	TILL OF THICKNESS OF ABOUT 3 TO 150 FEET

PROJECT LOCATION

118 HOPE STREET
BROOKLYN, NY 11211

GEOTECHNICAL EXPLORATION
118 HOPE STREET
BROOKLYN, NY

SURFICIAL GEOLOGIC MAP

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DATE
3/20/2018

PROJECT No.
180075

FIGURE
7

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440 PARK AVENUE SOUTH
NEW YORK, NY 10016
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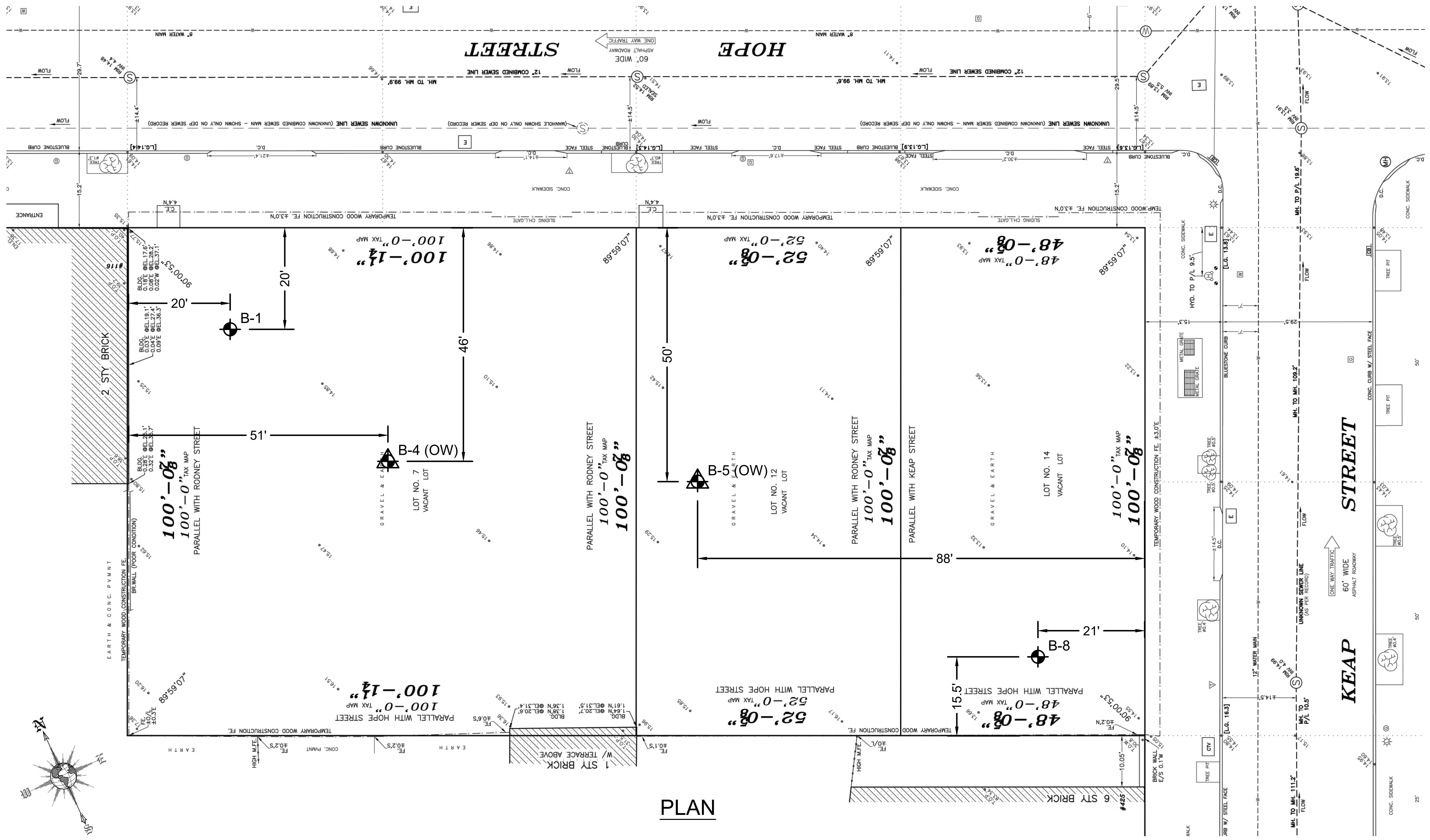
(212) 726-0942 (FAX)



PLAN

0	10	20	40

SCALE: 1" = 20'

LEGEND:

⊕ B-1	BORING LOCATION
▲ B-1 (OW)	OBSERVATION WELL INTALLED WITHIN SOIL BORING

NOTES:

1. SURVEY COMPLETED BY GEOLAND LAND SURVEYING, P.C. ON JANUARY 13, 2018.
2. DRILLING WAS PERFORMED BY CRAIG DRILLING COMPANIES, INC. OF MAYS LANDING, NJ BETWEEN FEBRUARY 28, 2018 AND MARCH 6, 2018.
3. ALL BORINGS WERE INSPECTED FULL TIME BY AN AKRF GEOTECHNICAL ENGINEER.
4. BORING LOCATIONS WERE MEASURED IN THE FIELD AND ARE APPROXIMATE.

PROJECT
118 HOPE STREET
BROOKLYN, NY

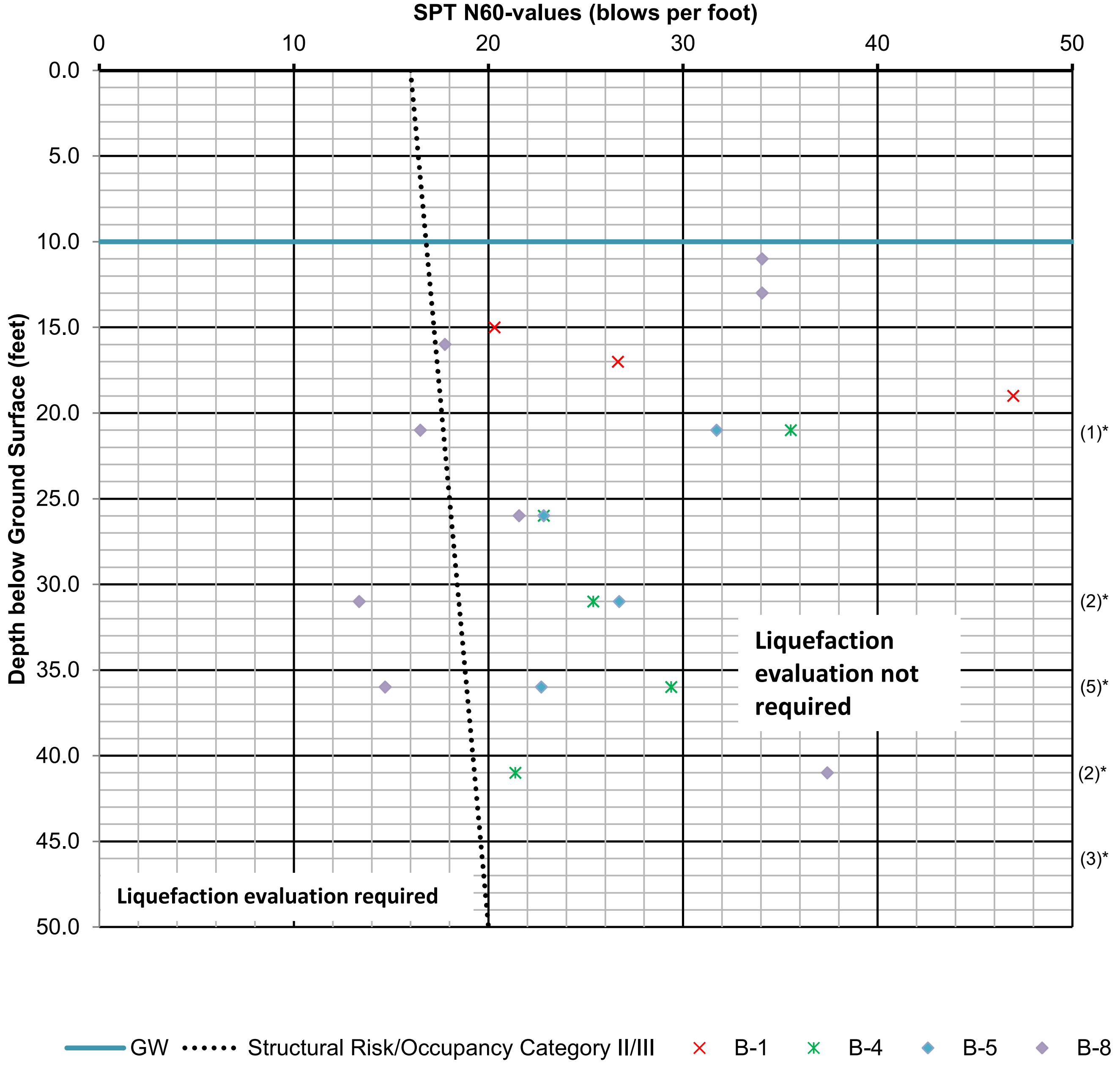
DRAWN BY	CHECKED BY
GH	GM
SCALE	**DATE**
1" = 20'	3/20/2018

SHEET TITLE
BORING LOCATION PLAN

SHEET NO.
FIGURE 8

SHEET 1 OF 1

SPT N-values vs. Depth



Note: This figure is based on Section 1813 of the 2014 NYC Building Code for Structural Risk/Occupancy Category II/III structures.

*Indicates the number of samples observed at this depth having an N_{60} value greater than 50 blows per foot.

Project Location

118 HOPE STREET
BROOKLYN, NY 11211

Geotechnical Exploration
118 HOPE STREET
Brooklyn, NY

Liquefaction Potential

AKRF

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DATE
3/20/2018

PROJECT No.
180075

FIGURE
9

APPENDIX A

SOIL BORING LOGS

Table A-1: Unified Soil Classification System

COARSE -GRAINED SOILS (50% > #200 Sieve)	Gravels and Gravelly Soils (50% > #4 Sieve)	Clean Gravels (No more than 5% < #200 Sieve)	●	GW	Well-graded gravels, or gravel-sand mixtures. Little to no fines.
			○	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
		Dirty Gravels (more than 12% > #200 Sieve)	○	GM	Silty gravels, or gravel-sand-silt mixtures
			▨	GC	Clayey gravels, or gravel-sand-silt mixtures
	Sands and Sandy Soils (50% < #4 Sieve)	Clean Sands (No more than 5% < #200 Sieve)	∘	SW	Well-graded sands, or gravelly sands. Little to no fines
			░	SP	Poorly graded sands, or gravelly sands. Little to no fines
		Dirty Sands (more than 12% > #200 Sieve)	░	SM	Silty sands, or sand-silt mixtures
			▨	SC	Clayey sands, or sand-clay mixtures
FINE-GRAINED SOILS (50% < #200 Sieve)	Silts and Clays (LL < 50%)		‖	ML	Inorganic silt, rock flour, or clayey silts with slight plasticity
			▨	CL	Inorganic, lean clays of low to medium plasticity; gravelly, sandy or silty clays.
			┆	OL	Organic silty or organic silty clays of low plasticity.
	Silts and Clays (LL >= 50%)		▮	MH	Inorganic silt, spongy, talcy, micaceous, diatomaceous, or fine sandy silt
			▨	CH	Inorganic, fat clays of high plasticity
			▨	OH	Organic fat clay of high plasticity
	Peat		≈	PT	Peats or other highly organic soils
Fill Material			F	FILL	Brick, concrete, wood, etc.
Rock			▦	R	Weathered Rock
			^	R	Competent Rock

Table A-2: Particle Sizes of Geologic Material

Material Size	Size Range	Passing Sieve Size	Retained Sieve Size
Boulder	Greater than 12 in.	---	---
Cobble	3 in. to 12 in.	---	---
Coarse Gravel	$\frac{3}{4}$ in. to 3 in.	3 inch	$\frac{3}{4}$ inch
Fine Gravel	19.1 mm ($\frac{3}{4}$ in.) to 4.76 mm	$\frac{3}{4}$ inch	No. 4
Coarse Sand	4.75 mm to 2.00 mm	No. 4	No. 10
Medium Sand	2.00 mm to 0.425 mm	No. 10	No. 40
Fine Sand	0.425 mm to 0.074 mm	No. 40	No. 200
Silt	0.074 mm to 0.005 mm	Requires Hydrometer Analysis	
Clay	Less than 0.005 mm		

Table A-3: Quantity Descriptors

Descriptor	Percentage of Sample (by weight)	Examples
CAPITALIZED	> 50%	Brown *SAND*
and	35 to 50%	*and* silt
some	20 to 35%	*some* gravel
little	10 to 20%	*little* clay
trace	< 10%	*trace* silt

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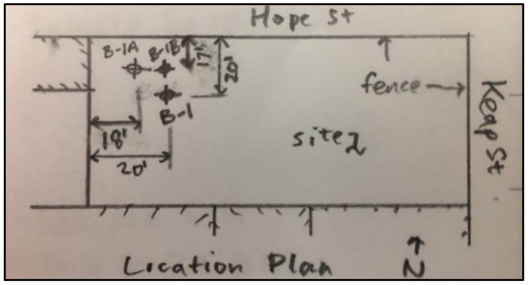
LOG OF BORING B-1

PAGE 1 OF 6

PROJECT NAME: 118 Hope Street
PROJECT NO.: 180075
PROJECT LOCATION: Brooklyn, NY
BOREHOLE COORD. (N/E): 198753.602, 997168.921
ELEVATION/DATUM: 15.1 / NAVD 88
BORING START: 3/1/2018 7:15:00 AM
BORING END: 3/5/2018 12:10:00 PM
LOGGED BY: Greg Highley, EIT
CONTRACTOR: Craig Geotechnical Drilling Co., Inc.
RIG TYPE & FOREMAN: CME-75 / Mark Aeir
SAMPLER TYPE(S): 2 in. O.D. Split Spoon
HAMMER TYPE(S): Automatic
DRILL BIT TYPE/DIA.: Tricone Roller Bit 3 7/8 in.
CASING TYPE/DIA.: Steel Flush Mount 4 in.
WATER LEVEL: 1ST -- END -- 24H --
NO. OF SAMPLES: SS 27 U 0 C 0
DRILLING METHOD: Mud Rotary

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE				OBSERVATIONS & NOTES
				NO.	REC. (INCH)	TYPE	BLOWS PER 6-INCH PEN.	
	FILL (Class 7)	1 2	S-1: 1" gravel bed. Dry brown to black fine to medium SAND, some fine gravel, plastic fragments, cinders, concrete fragments (Class 7) (FILL)	S-1	12	SS	8 6 5 3	
		3 4	S-2: Dry tan and black fine to medium SAND, some fine to coarse gravel, cinders, concrete fragments (Class 7) (FILL)	S-2	17	SS	6 12 14 7	
		5 6	S-3: Dry brown to black fine to coarse SAND and fine gravel, brick and concrete fragments (Class 7) (FILL)	S-3	2	SS	14 7 5 2	-Sample S-1 -Sample S-2 -Sample S-3
		7 8	S-4: Wet miscellaneous FILL, including brick and concrete fragments, black fine sand, fine to coarse gravel (Class 7) (FILL)	S-4	6	SS	3 7 11 4	-Sample S-4 -Drill to 4' BGS -Easy, Light chatter 3'-4' -Casing driven to 4' -Casing deflecting, moving hole 2' East -New hole start at 8 am -Drilled to 8' BGS -Heavy chatter
	ORGANICS (Class 6, 5b)	9 10	S-5: Wet gray fine to medium SAND and silt, little clay (Class 6) (SM)	S-5	13	SS	8 7 2 2	-Casing driven - heavy deflection at 5', hole moved 3' south (to location shown on plan) -New hole start at 9:30 am -Drilled to 8' BGS -hard, slow -Casing driven to 8' BGS -Drilled to 8' BGS -Easy, Light brown wash
		11 12	S-6: Wet gray SILT, little fine sand (Class 6) (ML)	S-6	18	SS	0 0 2 1	-Sample S-5 -Sample S-6 -Weight of hammer for first 12 inches -Casing pushed to 12' BGS -Drilled to 12' BGS -Easy -Gray wash
		13 14	S-7: Wet gray SILT and clay (Class 6) (ML)	S-7	1	SS	0 0 2 4	-Sample S-7 -Weight of hammer for first 12 inches

LOG OF BORING B-1

PAGE 2 OF 6

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
		15 16	S-8: Wet gray SILT, little clay, trace fine sand, trace coarse gravel (Class 5b) (ML)	S-8	8	SS	4 5 11 10	-Sample S-8 -Drill to 16' BGS -Easy -Gray wash -Casing driven to 16' BGS
	SILTY SAND (Class 3a, 3b)	17 18	S-9: Wet gray fine to medium SAND and silt, trace fine gravel (Class 3b) (SM)	S-9	19	SS	1 6 15 14	-Sample S-9
		19 20	S-10: Wet gray fine SAND, some silt, little fine to coarse gravel (Class 3a) (SM)	S-10	8	SS	18 25 12 15	-Sample S-10
		21 22	S-11: Wet gray fine to coarse SAND, little silt, trace fine to coarse gravel (Class 3b) (SM)	S-11	20	SS	12 13 13 10	-Sample S-11 -Drilled to 25' BGS -Easy, Light chatter 23'-24' -Gray wash, turned to brown at 24' -Quick gel added
		23 24						
	SAND AND GRAVEL (Class 2b, 3b)	25						
		26 27	S-12: Wet brown fine to medium SAND, little fine gravel, trace silt (Class 3b) (SP)	S-12	16	SS	5 6 8 9	-Sample S-12 -Drilled to 30' -Easy, Light chatter -Brown wash
		28 29 30						
		31 32	S-13: Wet brown fine to coarse GRAVEL, some fine to coarse sand, trace silt (Class 2b) (GW)	S-13	5	SS	3 5 12 12	-Sample S-13 -Drilled to 35' BGS -Easy -Brown wash

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LOG OF BORING B-1

PAGE 3 OF 6

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
	SAND (Class 3b)	33						
		34						
		35	S-14: Wet brown fine to medium SAND, some fine to coarse gravel, trace silt (Class 3b) (SP-SM)	S-14	7	SS	5 10 10 9	-Sample S-14 -Drilled to 40' BGS -Easy brown wash
		36						
		37						
		38						
		39						
		40	S-15: Wet brown fine to medium SAND, little fine gravel, trace silt (Class 6) (SP-SM)	S-15	8	SS	1 4 5 5	-Sample S-15 -Drilled to 45' BGS -Easy -brown wash
		41						
		42						
		43						
		44						
		45	S-16: Wet reddish brown fine SAND, trace fine gravel, trace silt (Class 3b) (SP-SM)	S-16	6	SS	0 5 10 8	-Sample S-16 -Weight of rods for first 6 inches -Drilled to 50' BGS -Easy -Brown wash
		46						
		47						
		48						
		49						
		50						

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	REC. (INCH)	TYPE	BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
	SAND (Class 3b)	51 52	S-17: Wet reddish brown fine to medium SAND, trace fine gravel, trace silt (Class 3b) (SP-SM)	S-17	7	SS	0 6 6 8	-Sample S-17 -Work paused 3/1/18 at 2 pm for rig maintenance -Work resumed 3/4/18 at 8 am -Drilled to 55' BGS -Easy -quick gel added -brown wash
		53 54 55						
		56 57	S-18: Wet gray and brown fine SAND, trace fine gravel, trace silt (Class 3b) (SP-SM)	S-18	6	SS	6 9 8 10	-Sample S-18 -Drilled to 60' BGS -easy -gray and brown wash
		58 59 60						
	SILT AND CLAY (Class 4b, 4c, 5b, 6)	61 62	S-19: Wet gray SILT, some clay, some fine sand (Class 6) (ML)	S-19	13	SS	4 4 4 5	-Sample S-19 -Drill to 65' BGS -Easy -Gray wash
		63 64 65						
		66 67	S-20: Wet gray CLAY, some silt, trace fine sand (Class 4c) (CL)	S-20	19	SS	1 4 7 6	-Sample S-20 -Drilled to 70' BGS -quick gel added -Easy -Gray wash
		68						

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
▨	SILT AND CLAY (Class 4b, 4c, 5b, 6)	69						
		70 71 72	S-21: Wet gray CLAY, little silt (Class 4c) (CL)	S-21	20	SS	3 3 5 7	-Sample S-21 -Drilled to 75' BGS -Easy -Gray wash
		73 74						
		75 76 77	S-22: Wet gray CLAY, little silt (Class 4b) (CL)	S-22	0	SS	6 5 9 9	-Sample S-22 -No recovery -Sample S-22 (3" O.D. SS) -Sample description from this sample -17" recovery -Drilled to 80' BGS -Easy -Gray wash
		78 79						
		80 81 82	S-23: Wet gray CLAY, little silt, trace fine sand (Class 6) (CL)	S-23	18	SS	0 1 3 6	-Sample S-23 -Weight of rods for first 6 inches -Drilled to 85' BGS -Easy -Gray wash
		83 84						
		85 86	S-24: Wet gray CLAY, some silt (Class 4b) (CL)				3 7	-Sample S-24 -Drilled to 90' BGS -Easy

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
▨	SILT AND CLAY (Class 4b, 4c, 5b, 6)	87		S-24	18	SS	8 8	-Gray wash
▨		88 89 90						
▨		91 92	S-25: Wet gray CLAY and silt, trace fine sand (Class 4b) (ML)	S-25	18	SS	4 8 10 11	-Sample S-25 -Drilled to 95' BGS -Gray wash -Steady, easy
▨		93 94 95						
▨		96 97	S-26: Wet gray SILT and fine sand, little clay (Class 5b) (ML)	S-26	19	SS	0 4 12 14	-Sample S-26 -Weight of rods for first 6 inches -Drilled to 100' BGS -Easy -Gray wash
▨		98 99 100						
▨		101 102	S-27: Wet gray and brown mottled SILT and fine sand (Class 5b) (ML)	S-27	15	SS	5 6 9 7	-Sample S-27
		103 104	Bottom of Exploration at 102 feet.					

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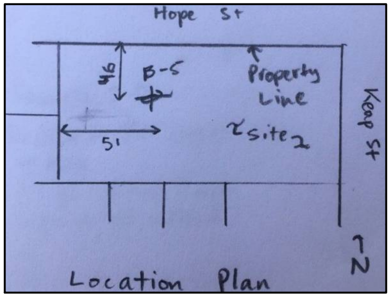
New York, NY 10016

LOG OF BORING B-4

PAGE 1 OF 5

PROJECT NAME:	118 Hope Street	**CONTRACTOR:**	Craig Geotechnical Drilling Co., Inc.
PROJECT NO.:	180075	**RIG TYPE & FOREMAN:**	CME-75 / Dave Dolan
PROJECT LOCATION:	Brooklyn, NY	**SAMPLER TYPE(S):**	2 in. O.D. Split Spoon
BOREHOLE COORD. (N/E):	198717.168, 997168.941	**HAMMER TYPE(S):**	Automatic
ELEVATION/DATUM:	15.2 / NAVD 88	**DRILL BIT TYPE/DIA.:**	Tricone Roller Bit 3 7/8 in.
BORING START:	2/28/2018 7:30:00 AM	**CASING TYPE/DIA.:**	Steel Flush Mount 4 in.
BORING END:	2/28/2018 11:00:00 AM	**WATER LEVEL:**	1ST -- END -- 24H --
LOGGED BY:	Greg Highley, EIT	**NO. OF SAMPLES:**	SS 19 U 0 C 0
		DRILLING METHOD:	Mud Rotary

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE				OBSERVATIONS & NOTES
				NO.	REC. (INCH)	TYPE	BLOWS PER 6-INCH PEN.	
	FILL (Class 7)	1 2	S-1: 1" gravel bed. Dry brown-black fine to medium SAND, some fine gravel, concrete fragments, cinders (Class 7) (FILL)	S-1	9	SS	10 11 6 6	
		3 4	S-2: Moist light to dark brown fine to medium SAND and silt, clay pipe fragment, cinders (Class 7) (FILL)	S-2	11	SS	5 4 4 3	
		5 6	S-3: Moist light to dark brown fine SAND, some clay, little silt, trace fine gravel, cinders (Class 7) (FILL)	S-3	20	SS	8 9 8 8	-Sample S-1 -Sample S-2 -Sample S-3
		7 8	S-4: Moist brown fine SAND and clay, brick fragments (Class 7) (FILL)	S-4	8	SS	3 2 2 2	-Sample S-4
	ORGANICS (Class 6)	9 10	S-5: Wet brown to gray CLAY, little silt (Class 6) (CL)	S-5	7	SS	1 1 0 1	-Sample S-5 -Weight of hammer for third 6 inches
		11 12	S-6: Wet brown CLAY, little silt, trace fine gravel (Class 6) (CL)	S-6	8	SS	1 1 1 1	-Sample S-6 -Casing pushed to 15' BGS -Drilled to 15' BGS -Easy -Light brown wash
		13 14						

LOG OF BORING B-4

MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
ORGANICS (Class 6)	15	S-7: Moist gray to black CLAY and silt, organics (Class 6) (OL)	S-7	18	SS	1 1 0 1	-Sample S-7 -weight of hammer for third 6 inches -Drilled to 20' BGS -Easy -Light brown wash -quick gel added
	16						
	17						
	18						
SAND (Class 3b)	19						
	20	S-8: Wet gray fine to coarse SAND, little silt, little fine to coarse gravel (Class 3b) (SM)	S-8	13	SS	8 14 14 13	-Sample S-8 -Drilled to 25' BGS -Easy -Light gray wash
	21						
	22						
SAND (Class 3b)	23						
	24						
	25	S-9: Wet brown fine to medium SAND and fine to coarse gravel, trace silt (Class 3b) (SP)	S-9	12	SS	4 9 9 11	-Sample S-9 -Drilled to 30' BGS -Light chatter 25'-26' -Light brown wash
	26						
	27						
	28						
	29						
	30	S-10: Wet brown fine to medium SAND, little fine to coarse gravel, trace silt (Class 3b) (SP)	S-10	6	SS	3 10 9 9	-Sample S-10 -Drilled to 35' BGS -Easy -brown wash
	31						
	32						

LOG OF BORING B-4

PAGE 3 OF 5

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
		33						
		34						
		35						
	SAND (Class 3b)	36	S-11: Wet brown fine to medium SAND, little fine to coarse gravel, trace silt (Class 3b) (SP)	S-11	10	SS	7 12 10 9	-Sample S-11 -Drill to 40' BGS -Light chatter -brown wash
		37						
		38						
		39						
		40						
		41	S-12: Wet reddish brown to dark gray fine to medium SAND and silt, trace fine gravel (Class 3b) (SM)	S-12	7	SS	4 5 11 11	-Sample S-12 -Drilled to 45' BGS -Light chatter -brown wash
		42						
		43						
	SAND (Class 3b)	44						
		45						
		46	S-13: Wet reddish brown fine to medium SAND, some silt, trace fine gravel (Class 3b) (SM)	S-13	12	SS	5 10 9 8	-Sample S-13 -Drilled to 50' BGS -Easy -brown wash
		47						
		48						
	SAND (Class 3b)	49						
		50						

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
░	SAND (Class 3b)	51 52	S-14: Wet reddish brown fine to medium SAND, trace silt, trace fine gravel (Class 3b) (SP)	S-14	9	SS	6 12 8 6	-Sample S-14 -Drill to 55' BGS -Light chatter at 51' and 55' -brown wash
░		53 54 55						
░		56 57	S-15: No recovery	S-15	0	SS	4 12 11 10	-Sample S-15 -Drill to 60' BGS -Light chatter 58'-60' -brown wash
░		58 59 60						
░		61 62	S-16: No recovery	S-16	0	SS	2 10 10 10	-Sample S-16 -Drill to 65' BGS -Light chatter throughout -brown wash -quick gel added
░		63 64 65						
▨		66 67	S-17: Wet gray CLAY, little fine to coarse gravel (Class 4b) (CL)	S-17	5	SS	0 5 5 6	-Sample S-17 -Weight of rods for first 6 inches -Drilled to 70' BGS -Easy -brown wash
▨		68						

LOG OF BORING B-4

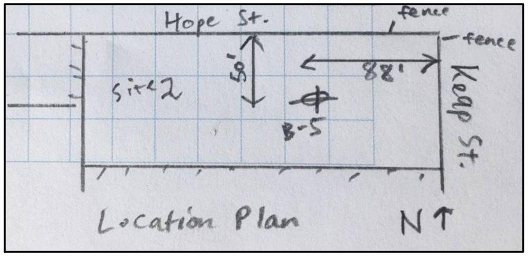
PAGE 5 OF 5

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE				OBSERVATIONS & NOTES
				NO.	REC. (INCH)	TYPE	BLOWS PER 6-INCH PEN.	
▨	CLAY AND SILT (Class 4b, 4c)	69 70						
▨		71 72	S-18: Wet brown and gray CLAY and silt, some fine sand (Class 4b) (CL)	S-18	13	SS	0 6 11 8	-Sample S-18 -weight of rods for first 6 inches
▨		73 74 75						
▨		76 77	S-19: Wet brown and gray CLAY (Class 4c) (CL)	S-19	17	SS	0 3 3 11	-Sample S-19 -weight of rods for first 6 inches
		78 79 80 81 82 83 84 85 86	Bottom of Exploration at 77 feet.					

AKRF
AKRF, Inc.
440 Park Avenue South
New York, NY 10016

LOG OF BORING B-5

PROJECT NAME:	118 Hope Street	**CONTRACTOR:**	Craig Geotechnical Drilling Co., Inc.
PROJECT NO.:	180075	**RIG TYPE & FOREMAN:**	CME-75 / Dave Dolan
PROJECT LOCATION:	Brooklyn, NY	**SAMPLER TYPE(S):**	2 in. O.D. Split Spoon
BOREHOLE COORD. (N/E):	198680.751, 997196.683	**HAMMER TYPE(S):**	Automatic
ELEVATION/DATUM:	15.1 / NAVD 88	**DRILL BIT TYPE/DIA.:**	Tricone Roller Bit 3 7/8 in.
BORING START:	2/28/2018 11:35:00 AM	**CASING TYPE/DIA.:**	Steel Flush Mount 4 in.
BORING END:	2/28/2018 1:10:00 PM	**WATER LEVEL:**	1ST -- END -- 24H --
LOGGED BY:	Greg Highley, EIT	**NO. OF SAMPLES:**	SS 14 U 0 C 0
		DRILLING METHOD:	Mud Rotary

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE				OBSERVATIONS & NOTES
				NO.	REC. (INCH)	TYPE	BLOWS PER 6-INCH PEN.	
	FILL (Class 7)	1 2	S-1: 1" gravel bed. Dry brown, black, and red fine SAND, some clay, little fine gravel, cinders, concrete fragments (Class 7) (FILL)	S-1	17	SS	5 6 3 2	
		3 4	S-2: Dry brown and black fine SAND, trace clay, cinders, concrete fragments	S-2	9	SS	2 1 1 1	
		5 6	S-3: No recovery (Class 7) (FILL)	S-3	0	SS	1 1 1 1	-Sample S-1 -Sample S-2 -Sample S-3
		7 8	S-4: Moist brown and gray fine SAND and clay, little silt (Class 7) (FILL)	S-4	9	SS	0 0 1 2	-Sample S-4 -weight of hammer for first 12 inches
		9 10	S-5: Moist brown and gray CLAY and fine sand (Class 7) (FILL)	S-5	24	SS	1 2 5 3	-Sample S-5
		11 12	S-6: Wet brown and gray fine SAND and clay, little silt (Class 7) (FILL)	S-6	24	SS	3 4 2 1	-Sample S-6 -Casing pushed to 15' BGS -Drilled to 15' BGS -Easy -Gray and brown wash -Quick gel added
		13 14						

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE				OBSERVATIONS & NOTES
				NO.	REC. (INCH)	TYPE	BLOWS PER 6-INCH PEN.	
	ORGANICS (Class 6)	15						
		16	S-7: Moist gray SILT, organics (Class 6) (OL)	S-7	8	SS	0 1 2 2	-Sample S-7 -weight of hammer for first 6 inches -Drilled to 20’ BGS -Light chatter at 19’ BGS -gray wash turned brown around 18’-19’
		17 18						
	SAND (Class 3b)	19 20						
		21	S-8: Wet brown fine to medium SAND, trace silt, trace fine gravel (Class 3b) (SP-SM)	S-8	10	SS	12 12 13 14	-Sample S-8 -Drilled to 25’ BGS -Easy -brown wash
		22 23 24 25						
		26	S-9: Wet brown fine to medium SAND, trace silt (Class 3b) (SP-SM)	S-9	10	SS	5 8 10 9	-Sample S-9 -Drill to 30’ BGS -Easy -brown wash
		27 28 29 30						
		31 32	S-10: Wet brown fine to coarse SAND, little fine gravel, trace silt (Class 3b) (SP-SM)	S-10	11	SS	5 10 10 11	-Sample S-10 -Drilled to 35’ BGS -Easy, Light chatter at 35’ -brown wash

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LOG OF BORING B-5

PAGE 3 OF 4

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
	SAND (Class 3b)	33 34 35						
		36 37	S-11: Wet brown fine SAND, trace fine gravel, trace silt (Class 3b) (SP-SM)	S-11	13	SS	5 8 9 8	-Sample S-11 -Drilled to 40' BGS -Easy -brown wash
		38 39 40						
		41 42	S-12: Wet red to brown fine to coarse SAND, little fine gravel, little silt (Class 3b) (SP-SM)	S-12	9	SS	5 9 6 6	-Sample S-12 -Drill to 45' BGS -Easy -Brown wash
		43 44 45						
	SAND (Class 3b)	46 47	S-13: Wet reddish brown fine SAND, little silt, trace coarse gravel (Class 3b) (SM)	S-13	7	SS	5 14 13 10	-Sample S-13 -Drilled to 50' BGS -Easy -brown wash
		48 49 50						

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LOG OF BORING B-5

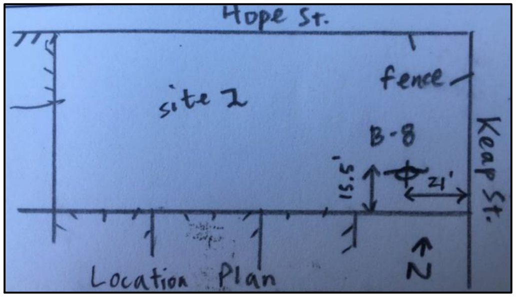
GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	REC. (INCH)	TYPE	BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
▨	SAND (Class 3b)	51 52	S-14: Wet brown fine SAND, trace silt (Class 3b) (SP-SM)	S-14	11	SS	9 11 12 14	-Sample S-14
		53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68	Bottom of Exploration at 52 feet.					

AKRF, Inc.
440 Park Avenue South
New York, NY 10016

LOG OF BORING B-8

PROJECT NAME: 118 Hope Street
PROJECT NO.: 180075
PROJECT LOCATION: Brooklyn, NY
BOREHOLE COORD. (N/E): 198607.913, 997252.169
ELEVATION/DATUM: 13.9 / NAVD 88
BORING START: 3/6/2018 7:45:00 AM
BORING END: 3/6/2018 12:15:00 PM
LOGGED BY: Greg Highley, EIT

CONTRACTOR: Craig Geotechnical Drilling Co., Inc.
RIG TYPE & FOREMAN: CME-75 / Dave Dolan
SAMPLER TYPE(S): 2 in. O.D. Split Spoon
HAMMER TYPE(S): Automatic
DRILL BIT TYPE/DIA.: Tricone Roller Bit 3 7/8 in.
CASING TYPE/DIA.: Steel Flush Mount 4 in.
WATER LEVEL: 1ST -- END -- 24H --
NO. OF SAMPLES: SS 25 U 0 C 0
DRILLING METHOD: Mud Rotary

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE				OBSERVATIONS & NOTES
				NO.	REC. (INCH)	TYPE	BLOWS PER 6-INCH PEN.	
	FILL (Class 7)	1 2	S-1: 1” gravel bed. Dry brown fine SAND, little clay, brick fragments, cinders, concrete fragments (Class 7) (FILL)	S-1	7	SS	4 5 2 1	
		3 4	S-2: Moist brown fine SAND, trace clay, cinders, brick fragments, clay pipe fragment (Class 7) (FILL)	S-2	6	SS	2 3 1 1	
		5 6	S-3: Dry brown to gray fine SAND, some silt, trace fine gravel, brick fragments (Class 7) (FILL)	S-3	15	SS	3 2 4 3	-Sample S-1 -Sample S-2 -Sample S-3
		7 8	S-4: Moist brown to gray SILT and fine sand, little fine gravel (Class 7) (FILL)	S-4	14	SS	2 2 1 1	-Sample S-4
		9 10	S-5: Moist brown fine SAND and silt, trace fine gravel (Class 7) (FILL)	S-5	14	SS	0 2 2 1	-Sample S-5 -Weight of hammer for 6 inches -Casing driven to 10’ BGS -Drilled to 10’ BGS -Steady, slight chatter
	SAND (Class 3a)	11 12	S-6: Wet brown fine to coarse SAND, little silt, trace fine gravel (Class 3a) (SM)	S-6	13	SS	10 13 17 17	-Sample S-6
		13 14	S-7: Wet brown fine SAND, trace fine gravel, trace silt (Class 3a) (SP-SM)	S-7	12	SS	8 14 16 21	-Sample S-7 -Drilled to 15’ BGS -Easy -Light brown wash -Quick gel added

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
	SAND (Class 3b)	15						
		16 17	S-8: Wet brown fine SAND, trace silt (Class 3b) (SP-SM)	S-8	9	SS	3 6 8 8	-Sample S-8 -Casing pushed to 15' BGS -Drilled to 20' BGS -Easy -Light brown wash
		18 19 20						
		21 22	S-9: Wet brown fine to coarse SAND, trace fine gravel, trace silt (Class 3b) (SP-SM)	S-9	7	SS	4 6 7 6	-Sample S-9 -Casing driven to 20' BGS -Drilled to 25' BGS -Easy -Brown wash
		23 24 25						
		26 27	S-10: Wet brown fine SAND, trace fine to coarse gravel, trace silt (Class 3b) (SP-SM)	S-10	0	SS	5 8 9 6	-Sample S-10 -No recovery -Sample S-10 (3" O.D. SS pushed) -Material description from this -Drilled to 30' BGS -Easy -Brown wash
		28 29 30						
		31 32	S-11: Wet reddish brown fine to medium SAND, trace fine gravel, trace silt (Class 3b) (SP-SM)	S-11	10	SS	4 4 6 6	-Sample S-11 -Casing pushed to 25' BGS -Drilled to 35' BGS -Quick gel added -Easy -Brown wash

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LOG OF BORING B-8

PAGE 3 OF 6

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE				OBSERVATIONS & NOTES
				NO.	REC. (INCH)	TYPE	BLOWS PER 6-INCH PEN.	
	SAND (Class 3b)	33 34 35						
	SILTY SAND (Class 3b)	36 37	S-12: Wet brown fine SAND and silt, trace fine gravel (Class 3b) (SM)	S-12	14	SS	5 5 6 6	-Sample S-12 -Drilled to 40’ BGS -Easy -Brown wash
		38 39 40						
		41 42	S-13: Wet brown fine SAND, little silt (Class 3b) (SM)	S-13	8	SS	10 13 15 14	-Sample S-13 -Drilled to 45’ BGS -Easy -Brown wash
		43 44 45						
	SAND (Class 3b)	46 47	S-14: Wet brown fine SAND, trace silt (Class 3b) (SP-SM)	S-14	15	SS	7 7 12 9	-Sample S-14 -Drilled to 50’ BGS -Easy -Brown wash
		48 49 50						

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LOG OF BORING B-8

PAGE 4 OF 6

MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
SAND (Class 3b)	51 52	S-15: Wet reddish brown to tan fine SAND, trace silt (Class 3b) (SP-SM)	S-15	14	SS	7 8 11 13	-Sample S-15 -Drilled to 55' BGS -Easy -Brown wash
	53 54 55						
	56 57	S-16: Wet brown fine SAND, little silt (Class 3b) (SM)	S-16	16	SS	7 9 13 12	-Sample S-16 -Drilled to 60' BGS -Easy -Brown wash
	58 59 60						
CLAY AND SILT (Class 4c, 5b, 6)	61 62	S-17: Wet gray CLAY, some silt (Class 4c) (CL)	S-17	21	SS	1 3 5 6	-Sample S-17 -Drilled to 65' BGS -Easy -Brown wash
	63 64 65						
	66 67	S-18: Wet gray SILT and clay, trace fine sand (Class 6) (ML)	S-18	22	SS	0 2 3 5	-Sample S-18 -Weight of hammer for first 6 inches -Drilled to 70' BGS -Quick gel added -Easy -Brown wash
	68						

LOG OF BORING B-8

PAGE 5 OF 6

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
▨	CLAY AND SILT (Class 4c, 5b, 6)	69						
▨		70 71	S-19: Wet gray SILT, some clay, trace fine sand (Class 5b) (ML)	S-19	0	SS	4 8 10 12	-Sample S-19 -No recovery -Sample S-19 (3" O.D. SS pushed) -Material description from this -Drilled to 75' BGS -Easy -Brown wash
▨		72 73 74						
▨		75 76	S-20: Wet gray SILT and clay, little fine sand, trace coarse gravel (Class 5b) (CL-ML)	S-20	19	SS	4 6 11 13	-Sample S-20 -Drilled to 80' BGS -Easy -Brown wash
░	SAND (Class 3b)	77 78 79						
░		80 81	S-21: Wet gray fine SAND, trace fine gravel, trace silt (Class 3b) (SP-SM)	S-21	14	SS	8 11 15 13	-Sample S-21 -Drilled to 85' BGS -Easy, Light chatter 80'-81' -Brown wash
░		82 83 84						
░		85 86	S-22: Wet greenish gray fine SAND, trace fine gravel, trace silt (Class 3b)				6 6	-Sample S-22 -Drilled to 90' BGS -Easy, Light chatter at 88'

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LOG OF BORING B-8

PAGE 6 OF 6

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
	SAND (Class 3b)	87	(SP-SM)	S-22	10	SS	9 11	-Brown wash
		88 89 90						
	CLAY AND SILT (Class 4b, 5b)	91 92	S-23: Wet greenish gray SILT and fine sand, little clay (Class 5b) (ML)	S-23	5	SS	10 5 5 5	-Sample S-23 -Drilled to 95' BGS -Easy -Gray to brown wash
		93 94 95						
		96 97	S-24: Wet greenish gray SILT and clay, trace coarse gravel (Class 5b) (ML)	S-24	5	SS	4 6 13 15	-Sample S-24 -Drilled to 100' BGS -Easy -Gray to brown wash
		98 99 100						
		101 102	S-25: Wet light gray, brown, and black CLAY and silt, little fine sand (Class 4b) (CL)	S-25	16	SS	3 4 8 14	-Sample S-25
		103 104	Bottom of Exploration at 102 feet.					

APPENDIX B

TEMPORARY GROUNDWATER OBSERVATION WELL LOGS

AKRF, Inc.
440 Park Avenue South
New York, NY 10016

WELL CONSTRUCTION LOG

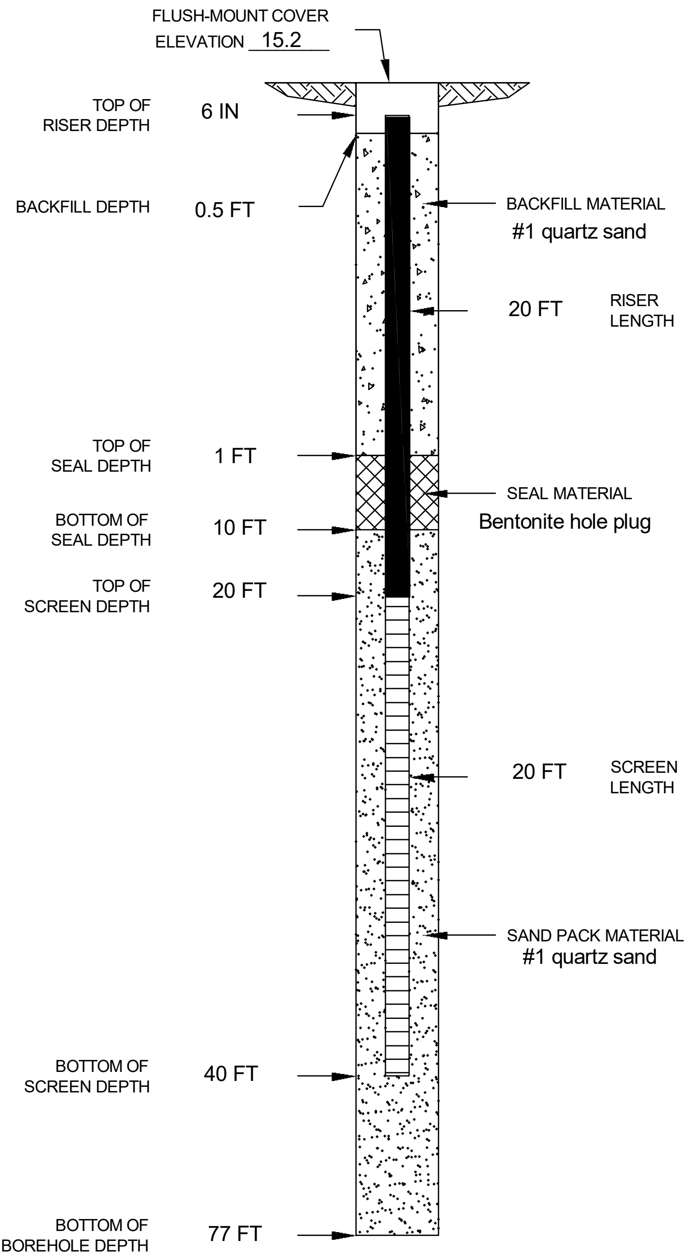
OW -4

PROJECT NAME:	118 Hope Street	**CONTRACTOR:**	Craig Geotechnical Drilling Co., Inc.
PROJECT NO.:	180075	**RIG TYPE & FOREMAN:**	CME-75, Dave Dolan
PROJECT LOCATION:	Brooklyn, NY	**WELL DEVELOPMENT METHOD:**	Flushed until clear return Bailed
BOREHOLE COORD. (N/E):	198717.168, 997168.941		
ELEVATION/DATUM:	15.2 / NAVD 88	**CASING TYPE/DIA.:**	Steel Flush Mount 4 in.
BORING START:	2/28/2018 7:30:00 AM	**WELL MATERIAL/DIA.:**	PVC, 2 Nominal O.D.
BORING END:	2/28/2018 11:00:00 AM	**LOGGED BY:**	Greg Highley, EIT

*ALL DEPTHS REFERENCED FROM EXISTING GROUND SURFACE

BASIC SOIL TYPE

WELL CONSTRUCTION SKETCH



FLUSH-MOUNT COVER ELEVATION 15.2

TOP OF RISER DEPTH 6 IN

BACKFILL DEPTH 0.5 FT

BACKFILL MATERIAL #1 quartz sand

20 FT RISER LENGTH

TOP OF SEAL DEPTH 1 FT

SEAL MATERIAL Bentonite hole plug

BOTTOM OF SEAL DEPTH 10 FT

TOP OF SCREEN DEPTH 20 FT

20 FT SCREEN LENGTH

SAND PACK MATERIAL #1 quartz sand

BOTTOM OF SCREEN DEPTH 40 FT

BOTTOM OF BOREHOLE DEPTH 77 FT

OBSERVATIONS & NOTES

Well bailed three times after the reading on 2/28 at 1:25 pm and again after the reading on 3/1 at 7:12 am.

GROUNDWATER MEASUREMENTS

DATE/TIME	DEPTH TO GROUNDWATER*	GROUNDWATER ELEVATION
2/28/18 1:25 pm	8.4	6.8
1:31 pm	9.6	5.6
2:00 pm	9.6	5.6
3/1/18 7:12 am	11.1	4.1
7:15 am	11.1	4.1
8:02 am	11.1	4.1
12:14 pm	11	4.2
1:55 pm	11.1	4.1
3/5/18 7:55 am	10.6	4.6
3/6/18 7:08 am	10.8	4.4
12:26 pm	10.8	4.4

AKRF, Inc.
440 Park Avenue South
New York, NY 10016

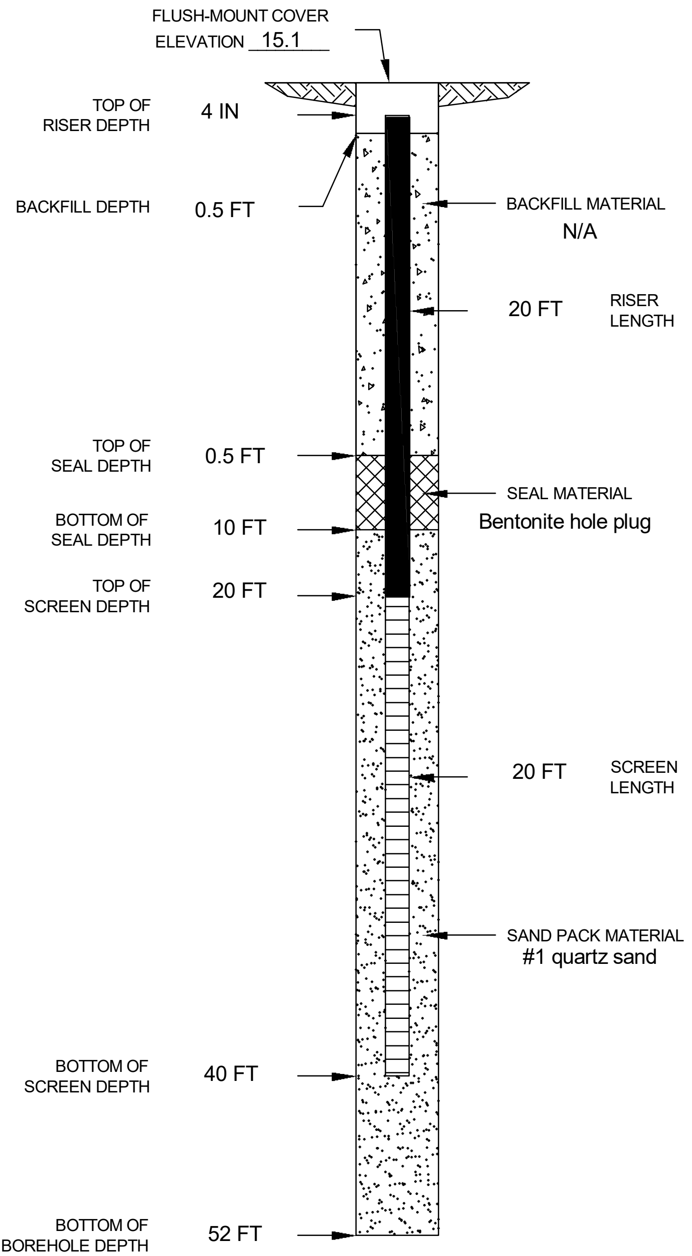
WELL CONSTRUCTION LOG
OW -5

PROJECT NAME:	118 Hope Street	**CONTRACTOR:**	Craig Geotechnical Drilling Co., Inc.
PROJECT NO.:	180075	**RIG TYPE & FOREMAN:**	CME-75, Dave Dolan
PROJECT LOCATION:	Brooklyn, NY	**WELL DEVELOPMENT METHOD:**	Flushed until clear return Bailed
BOREHOLE COORD. (N/E):	198680.751, 997196.683		
ELEVATION/DATUM:	15.1 / NAVD 88	**CASING TYPE/DIA.:**	Steel Flush Mount 4 in.
BORING START:	2/28/2018 11:35:00 AM	**WELL MATERIAL/DIA.:**	PVC, 2 Nominal O.D.
BORING END:	2/28/2018 1:10:00 PM	**LOGGED BY:**	Greg Highley, EIT

*ALL DEPTHS REFERENCED FROM EXISTING GROUND SURFACE

BASIC SOIL TYPE

WELL CONSTRUCTION SKETCH



OBSERVATIONS & NOTES

Well bailed four times after the reading on 2/28 at 2:05 pm and three times after the reading on 3/1 at 7:05 am

GROUNDWATER MEASUREMENTS

DATE/TIME	DEPTH TO GROUNDWATER*	GROUNDWATER ELEVATION
2/28 2:05 pm	5.5	9.6
2:10 pm	9.5	5.6
3/1/18 7:05 am	10.9	4.2
7:08 am	11.5	3.6
7:17 am	11.2	3.9
8:05 am	11.1	4
12:17 pm	11.1	4
1:53	11.1	4
3/5/18 7:57 am	10.8	4.3
3/6/18 7:10 am	11	4.1
12:24 pm	11	4.1

APPENDIX C

LABORATORY TEST RESULTS

TEST SUMMARY

Project AKRF – 118 Hope Street

Job No. 18-010

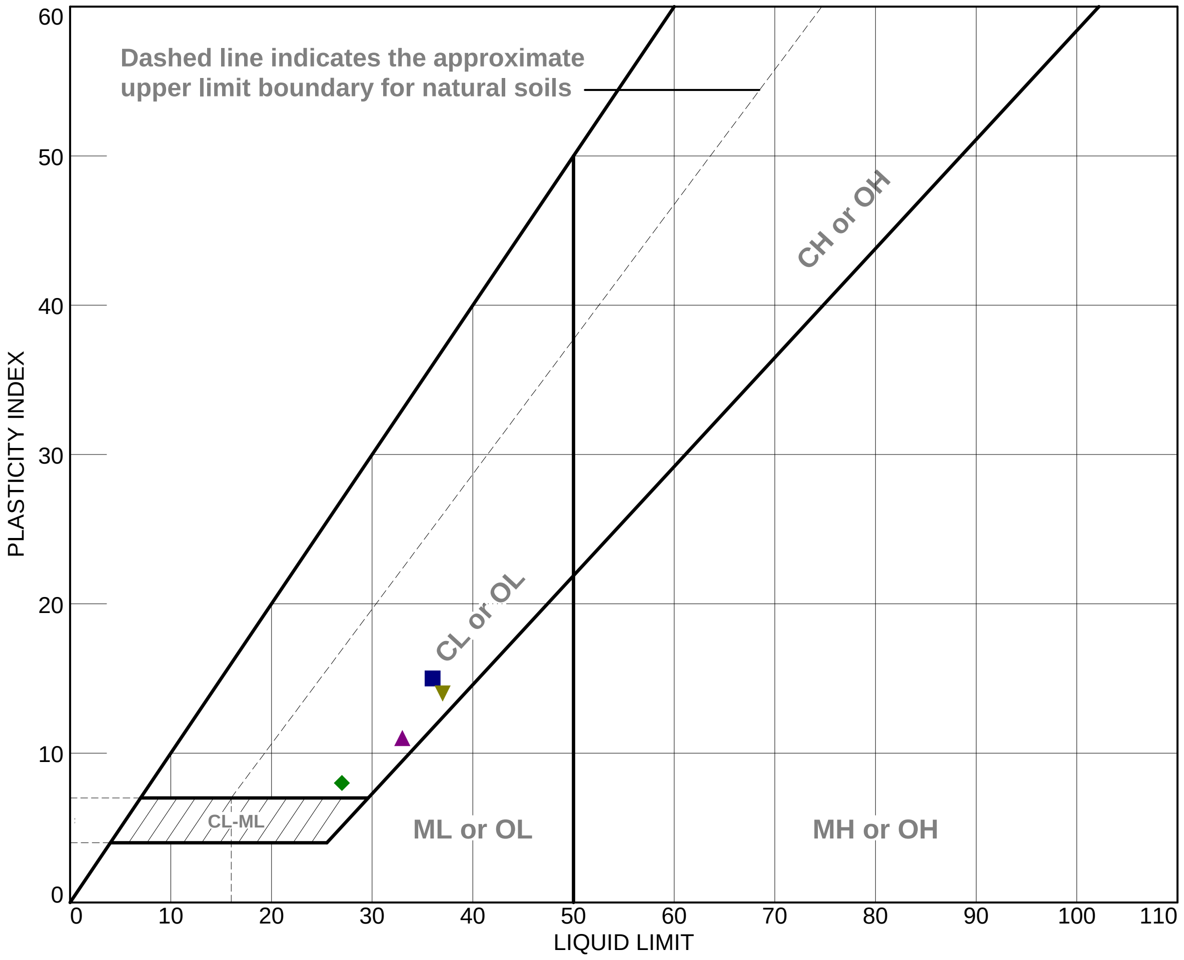
Location Brooklyn, New York

Date March 19, 2018

Boring	Sample	Depth (ft.)	M.C.(1)	Organic Content(2)	LL	PL	PI	LI	Notes
B-1	S-6	10-12	25.5%			NP			sample washed on #40, could not roll PL
B-1	S-23	80-82	29.3		36	21	15	0.6	
B-1	S-25	90-92	28.5		33	22	11	0.6	
B-4	S-7	15-17	47.0	7.3%					
B-4	S-18	70-72	27.2		27	19	8	1.0	sample washed on #40
B-4	S-19	75-77	30.0		37	23	14	0.5	
B-5	S-7	15-17	18.7			NP			could not roll PL
B-8	S-20	75-77	24.5		29	22	7	0.4	
B-8	S-25	100-102	19.3		26	18	8	0.2	

Notes:
1 ASTM D2216
2 ASTM D2974 Method C

ATTERBERG LIMITS REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-1	S-6[1]	10-12 ft.	25.5	NP			
■	B-1	S-23	80-82 ft.	29.3	21	36	15	
▲	B-1	S-25	90-92 ft.	28.5	22	33	11	
◆	B-4	S-18[1]	70-72 ft.	27.2	19	27	8	
▼	B-4	S-19	75-77 ft.	30.0	23	37	14	

Notes:

1 sample washed on #40 sieve

SKYLANDS TESTING, LLC

Sparta, NJ

Client: AKRF

Date: 3-19-2018

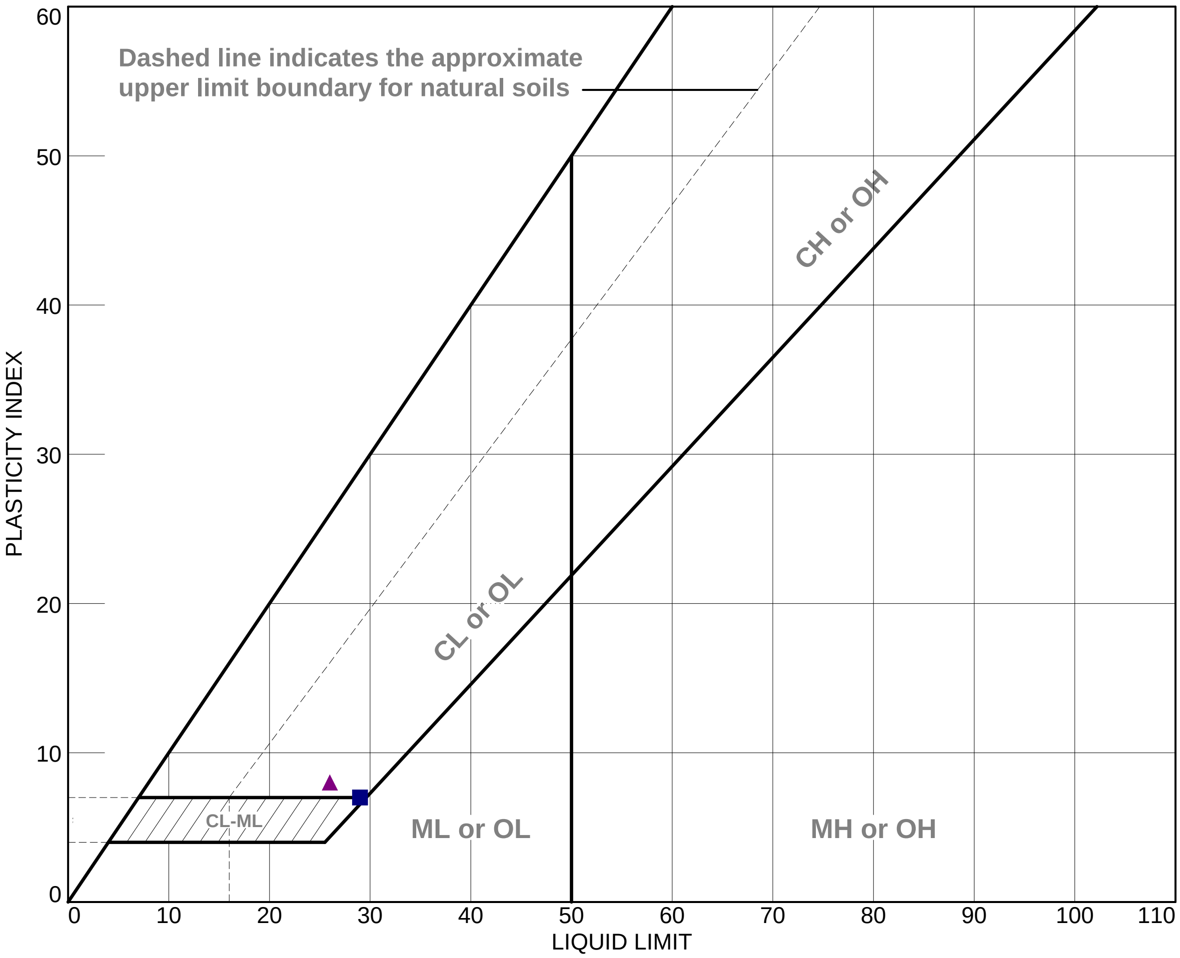
Project: 118 Hope Street
Brooklyn, NY

Project No.: 18-010

Figure

Tested By: ○ EFS, EJS □ EFS △ EFS ◇ EFS ▽ EFS **Checked By:** EJS

ATTERBERG LIMITS REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-5	S-7	15-17 ft.	18.7	NP			
■	B-8	S-20	75-77 ft.	24.5	22	29	7	
▲	B-8	S-25	100-102 ft.	19.3	18	26	8	

SKYLANDS TESTING, LLC

Sparta, NJ

Client: AKRF

Date: 3-19-2018

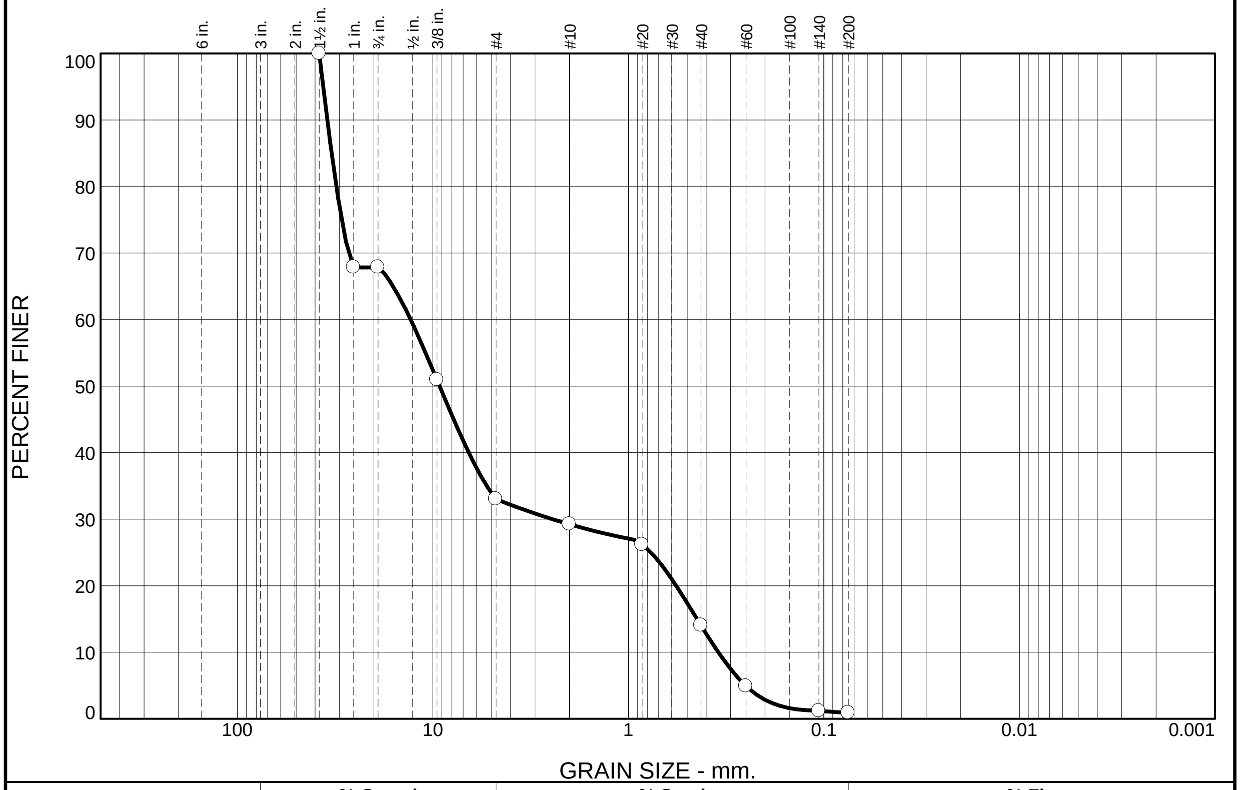
Project: 118 Hope Street
Brooklyn, NY

Project No.: 18-010

Figure

Tested By: ○ EFS, EJS □ EFS △ EFS **Checked By:** EJS

GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	32.2	34.8	3.8	15.2	13.1	0.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	67.8		
.75	67.8		
.375	50.9		
#4	33.0		
#10	29.2		
#20	26.2		
#40	14.0		
#60	4.9		
#140	1.2		
#200	0.9		

* (no specification provided)

Material Description

Light brown and gray well-graded gravel with sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 34.6253	D_{85}= 32.9167	D_{60}= 12.9858
D_{50}= 9.2370	D_{30}= 2.4466	D_{15}= 0.4456
D_{10}= 0.3465	C_u= 37.48	C_c= 1.33

Classification

USCS= GW AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: B-1 **Depth:** 30-32 ft.
Sample Number: S-13

Date: 3-16-2018

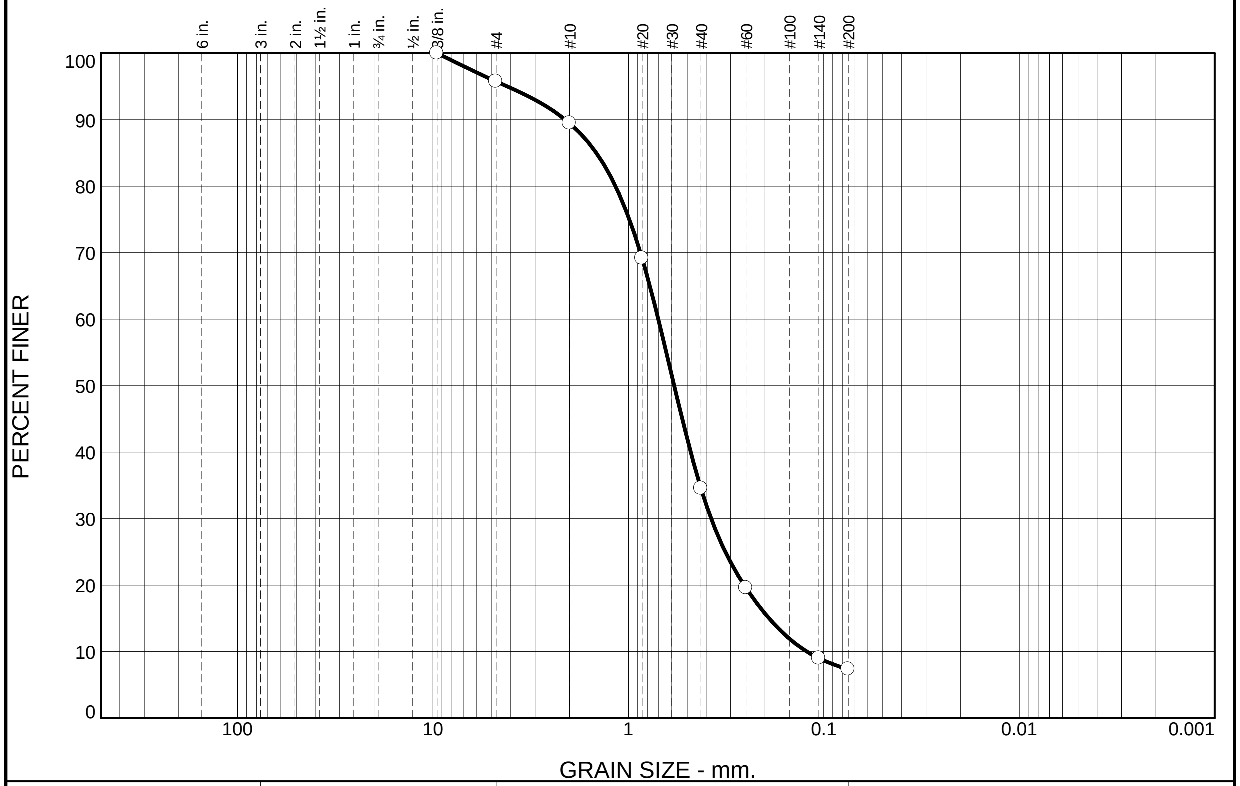
SKYLANDS TESTING, LLC

Sparta, NJ

Client: AKRF
Project: 118 Hope Street
Brooklyn, NY
Project No: 18-010 **Figure**

Tested By: AB, ND **Checked By:** EJS

GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.2	6.3	55.0	27.2	7.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	95.8		
#10	89.5		
#20	69.1		
#40	34.5		
#60	19.6		
#140	9.0		
#200	7.3		

* (no specification provided)

Material Description

Orange-brown poorly graded sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.1042 D_{85}= 1.4577 D_{60}= 0.7030
D_{50}= 0.5826 D_{30}= 0.3772 D_{15}= 0.1906
D_{10}= 0.1221 C_u= 5.76 C_c= 1.66

Classification

USCS= SP-SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: B-1 **Depth:** 50-52 ft.
Sample Number: S-17

Date: 3-16-2018

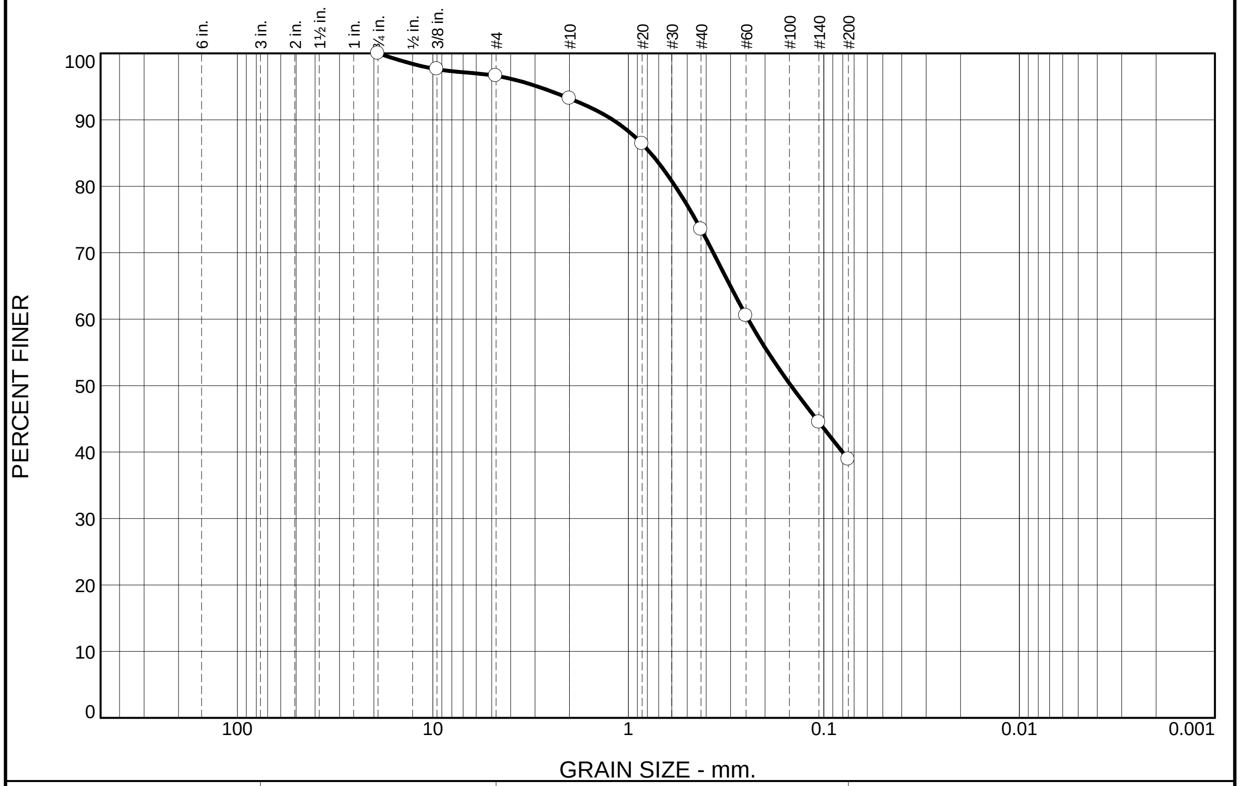
SKYLANDS TESTING, LLC

Sparta, NJ

Client: AKRF
Project: 118 Hope Street
Brooklyn, NY
Project No: 18-010 **Figure**

Tested By: AB, ND **Checked By:** EJS

GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.4	3.4	19.7	34.6	38.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	97.6		
#4	96.6		
#10	93.2		
#20	86.4		
#40	73.5		
#60	60.5		
#140	44.5		
#200	38.9		

* (no specification provided)

Material Description

Gray and light brown silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.1991	D_{85}= 0.7699	D_{60}= 0.2442
D_{50}= 0.1472	D_{30}=	D_{15}=
D_{10}=	C_u=	C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: B-1 **Depth:** 16-18 ft.
Sample Number: S-9 **Date:** 3-16-2018

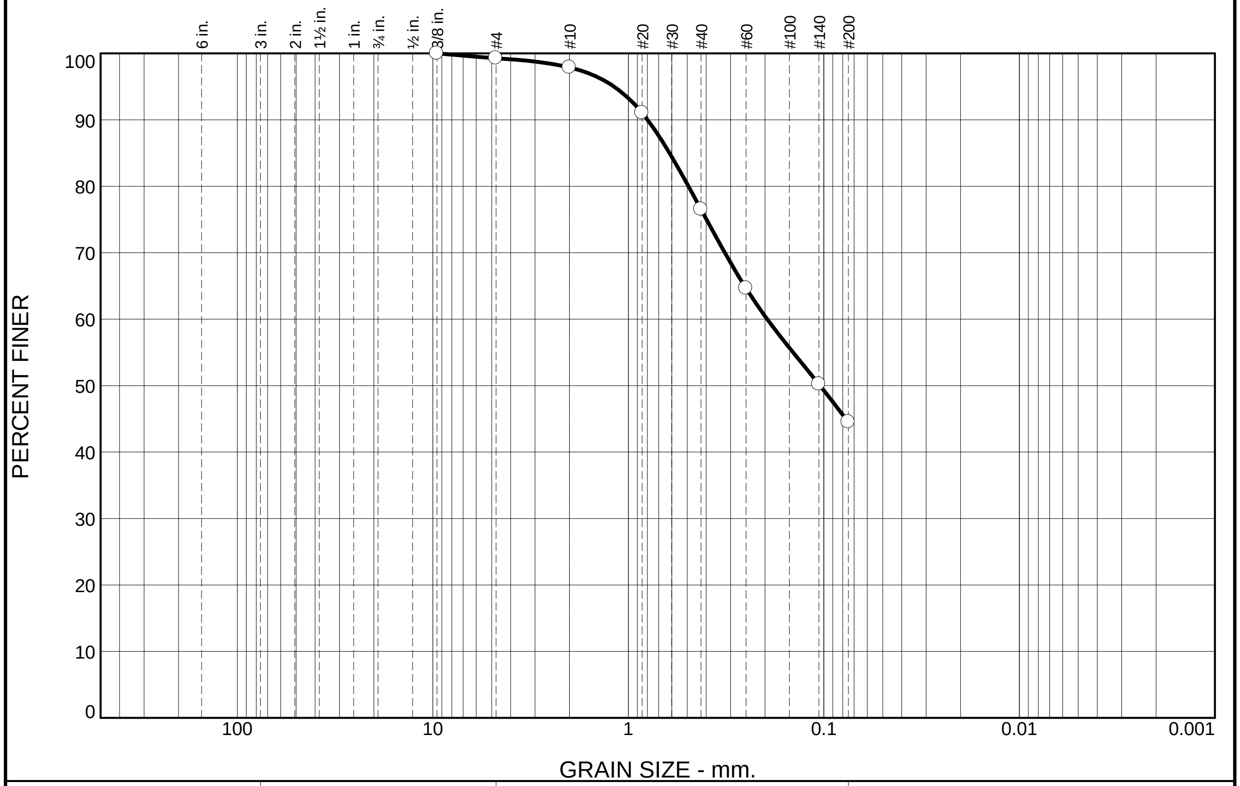
SKYLANDS TESTING, LLC

Sparta, NJ

Client: AKRF
Project: 118 Hope Street
Brooklyn, NY
Project No: 18-010 **Figure**

Tested By: AB, ND **Checked By:** EJS

GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.7	1.4	21.4	32.0	44.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.3		
#10	97.9		
#20	91.0		
#40	76.5		
#60	64.6		
#140	50.2		
#200	44.5		

* (no specification provided)

Material Description

Gray and orange-brown silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.7971 D_{85}= 0.6155 D_{60}= 0.1948
D_{50}= 0.1046 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: B-4 **Depth:** 40-43 ft.
Sample Number: S-12

Date: 3-16-2018

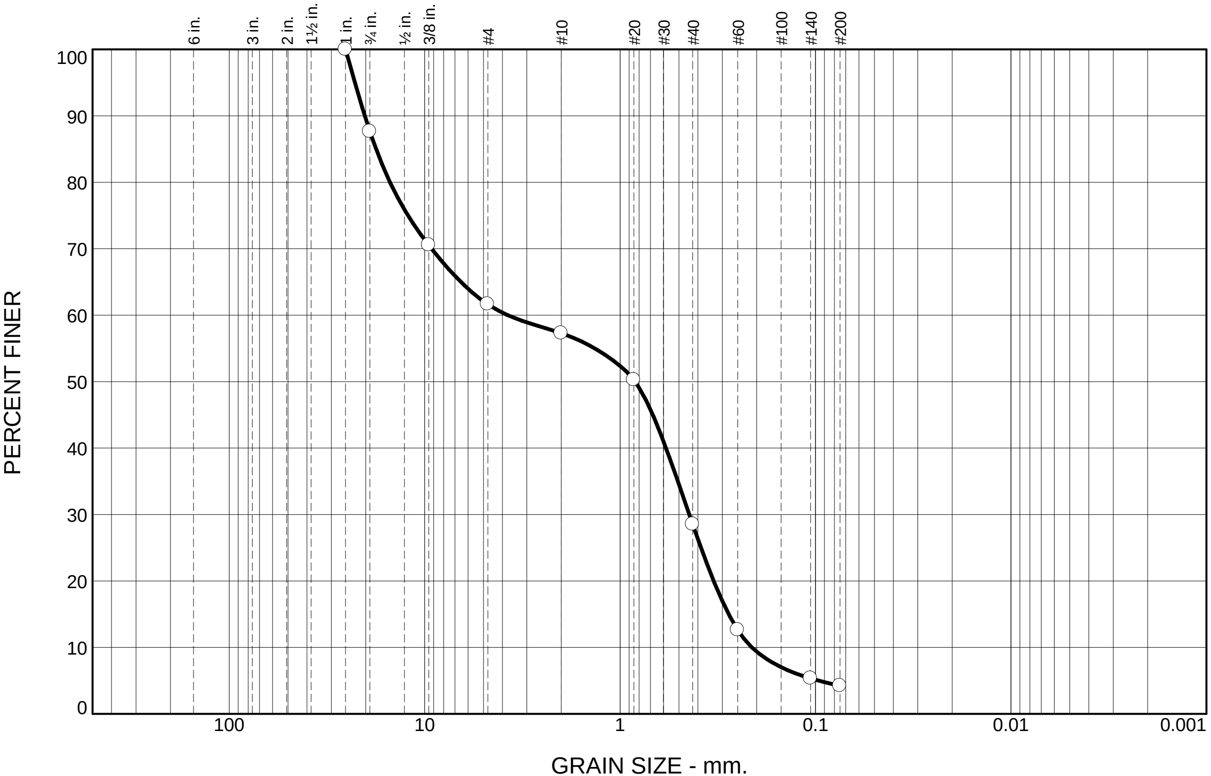
SKYLANDS TESTING, LLC

Sparta, NJ

Client: AKRF
Project: 118 Hope Street
Brooklyn, NY
Project No: 18-010 **Figure**

Tested By: AB, ND **Checked By:** EJS

GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	12.4	26.0	4.3	28.8	24.3	4.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	87.6		
.375	70.5		
#4	61.6		
#10	57.3		
#20	50.3		
#40	28.5		
#60	12.6		
#140	5.3		
#200	4.2		

* (no specification provided)

Material Description

Light brown-gray, white, gray and red-brown poorly graded sand with gravel

Atterberg Limits

PL=	LL=	PI=

Coefficients

D_{90}= 20.2351	D_{85}= 17.7146	D_{60}= 3.7494
D_{50}= 0.8378	D_{30}= 0.4426	D_{15}= 0.2783
D_{10}= 0.2117	C_u= 17.71	C_c= 0.25

Classification

USCS= SP AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: B-4 **Depth:** 25-27 ft.
Sample Number: S-9

Date: 3-16-2018

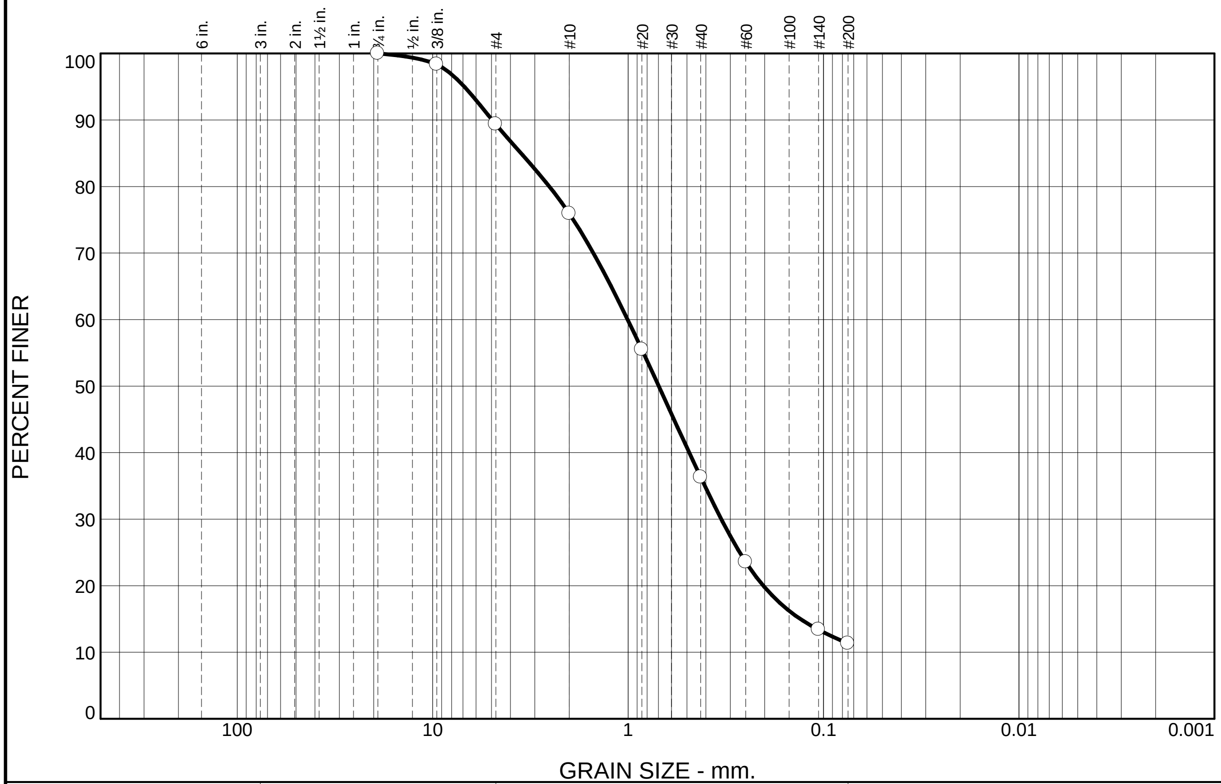
SKYLANDS TESTING, LLC

Sparta, NJ

Client: AKRF
Project: 118 Hope Street
Brooklyn, NY
Project No: 18-010 **Figure**

Tested By: AB, ND **Checked By:** EJS

GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.7	13.4	39.6	25.0	11.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	98.4		
#4	89.3		
#10	75.9		
#20	55.5		
#40	36.3		
#60	23.5		
#140	13.4		
#200	11.3		

* (no specification provided)

Material Description

Orange-brown poorly graded sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 4.9559 D_{85}= 3.5305 D_{60}= 1.0054
D_{50}= 0.6968 D_{30}= 0.3336 D_{15}= 0.1314
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: B-5 **Depth:** 40-42 ft.
Sample Number: S-12

Date: 3-16-2018

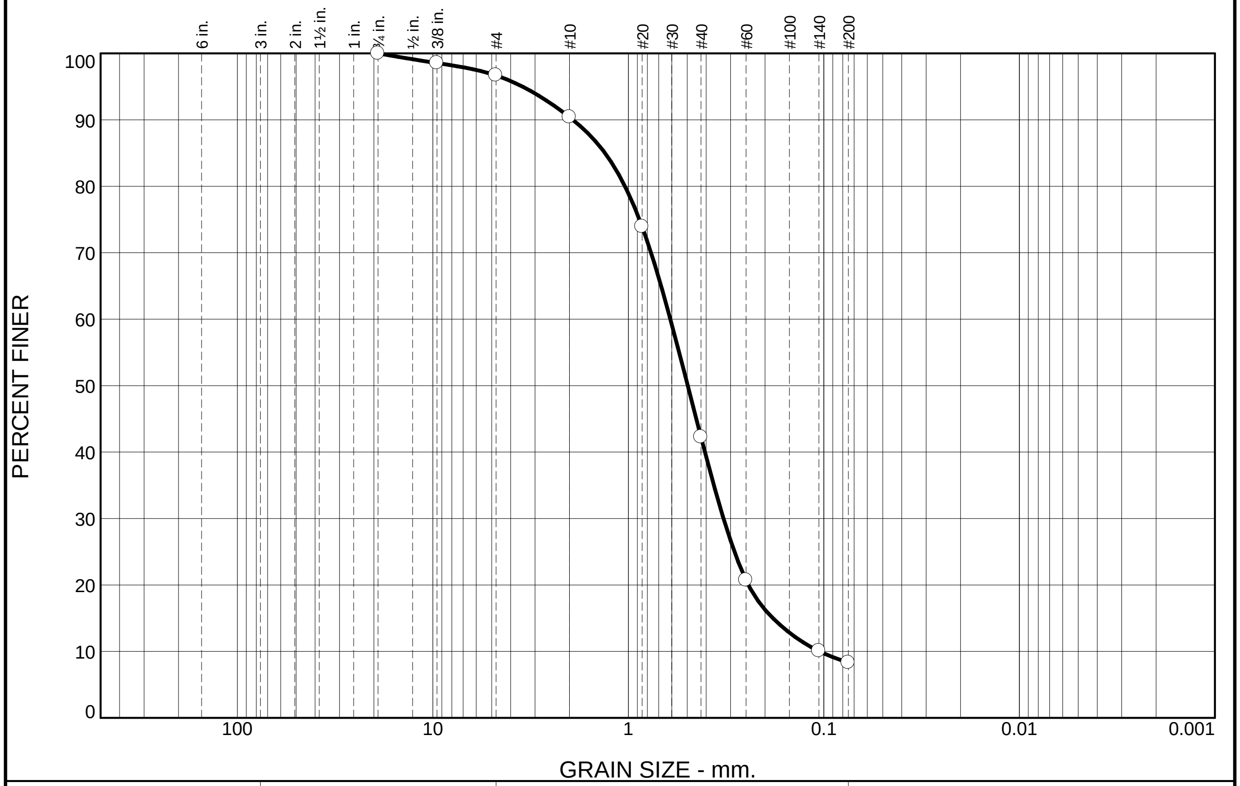
SKYLANDS TESTING, LLC

Sparta, NJ

Client: AKRF
Project: 118 Hope Street
Brooklyn, NY
Project No: 18-010 **Figure**

Tested By: AB, ND **Checked By:** EJS

GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.3	6.3	48.1	34.0	8.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	98.5		
#4	96.7		
#10	90.4		
#20	73.9		
#40	42.3		
#60	20.7		
#140	10.0		
#200	8.3		

* (no specification provided)

Material Description

Light orange-brown poorly graded sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.9220 D_{85}= 1.3167 D_{60}= 0.6098
D_{50}= 0.4968 D_{30}= 0.3260 D_{15}= 0.1821
D_{10}= 0.1051 C_u= 5.80 C_c= 1.66

Classification

USCS= SP-SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: B-5 **Depth:** 20-22 ft.
Sample Number: S-8
Date: 3-16-2018

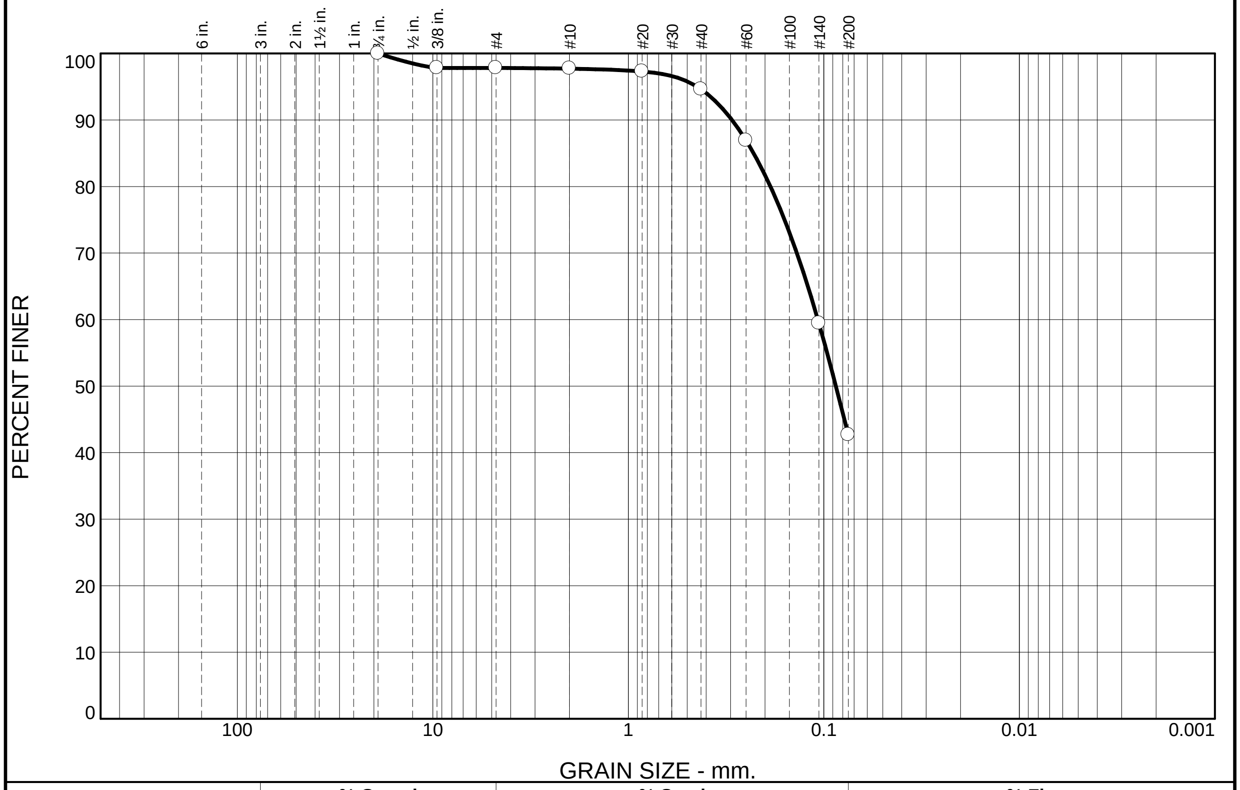
SKYLANDS TESTING, LLC

Sparta, NJ

Client: AKRF
Project: 118 Hope Street
Brooklyn, NY
Project No: 18-010 **Figure**

Tested By: AB, ND **Checked By:** EJS

GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.2	0.1	3.1	51.9	42.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	97.8		
#4	97.8		
#10	97.7		
#20	97.3		
#40	94.6		
#60	86.9		
#140	59.4		
#200	42.7		

* (no specification provided)

Material Description

Orange-brown silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2951 D_{85}= 0.2288 D_{60}= 0.1073
D_{50}= 0.0868 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: B-8 **Depth:** 35-37 ft.
Sample Number: S-12

Date: 3-16-2018

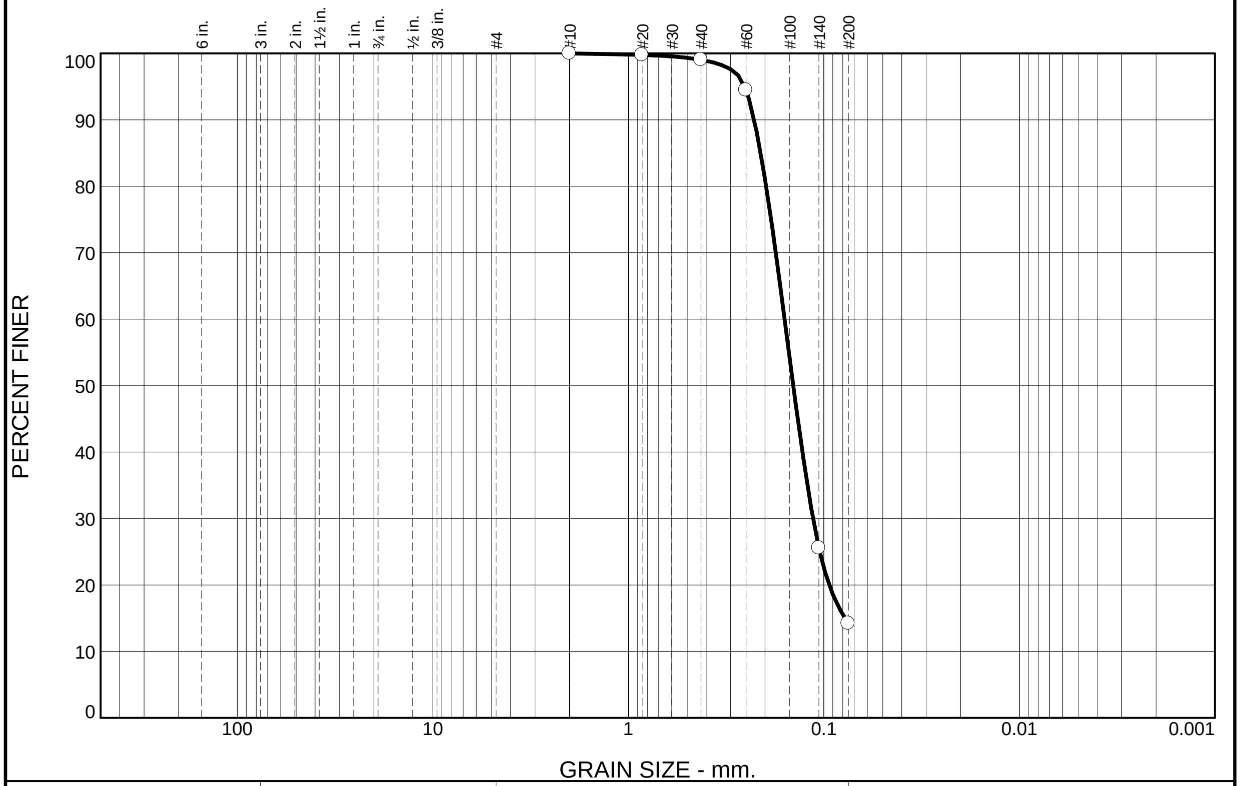
SKYLANDS TESTING, LLC

Sparta, NJ

Client: AKRF
Project: 118 Hope Street
Brooklyn, NY
Project No: 18-010 **Figure**

Tested By: AB, ND **Checked By:** EJS

GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.0	84.8	14.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.8		
#40	99.0		
#60	94.4		
#140	25.5		
#200	14.2		

* (no specification provided)

Material Description

Orange-brown silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2272 D_{85}= 0.2105 D_{60}= 0.1588
D_{50}= 0.1433 D_{30}= 0.1136 D_{15}= 0.0779
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: B-8 **Depth:** 55-57 ft
Sample Number: S-16

Date: 3-16-2018

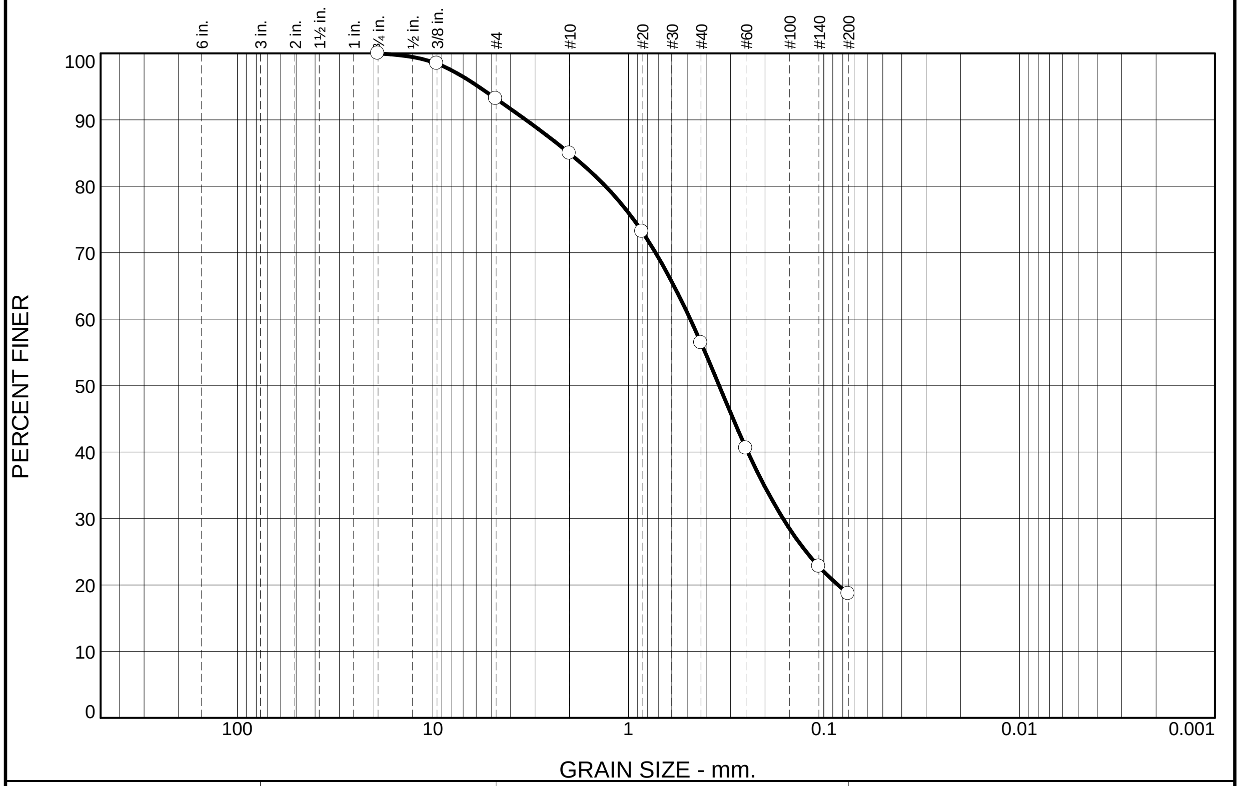
SKYLANDS TESTING, LLC

Sparta, NJ

Client: AKRF
Project: 118 Hope Street
Brooklyn, NY
Project No: 18-010 **Figure**

Tested By: AB, ND **Checked By:** EJS

GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.8	8.2	28.6	37.7	18.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	98.5		
#4	93.2		
#10	85.0		
#20	73.2		
#40	56.4		
#60	40.6		
#140	22.8		
#200	18.7		

* (no specification provided)

Material Description

Orange-brown silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 3.3457 D_{85}= 2.0079 D_{60}= 0.4821
D_{50}= 0.3431 D_{30}= 0.1618 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: B-8 **Depth:** 10-12 ft.
Sample Number: S-6

Date: 3-16-2018

SKYLANDS TESTING, LLC

Sparta, NJ

Client: AKRF
Project: 118 Hope Street
Brooklyn, NY
Project No: 18-010 **Figure**

Tested By: AB, ND **Checked By:** EJS