E4 – AmeriGEO Preliminary Geotechnical Investigation Report, Dated April 2, 2019

REPORT

Preliminary Geotechnical Investigation Report

1660 Boone Avenue
Bronx, New York

Prepared for:

JJS BOONE LLC
511 Canal Street, Suite 500
New York, NY 10013

Date: April 2, 2019

Prepared by:

AmeriGEO, Inc.
Advanced Engineering Design and Construction Inspection

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April 2, 2019

Mr. John Silviano
JJS BOONE LLC
511 Canal Street, Suite #500
New York, NY

Subject: **Preliminary Geotechnical Evaluation Report**
1660 Boone Avenue
Bronx, NY
(19-NY005-01)

Dear Mr. John Silviano:

This report covers the preliminary geotechnical evaluation and recommendations based on the site investigation performed in between March 7 to 12, 2019 for the proposed construction at the referenced site in the Borough of Bronx, New York. The investigation consisted of the performance of three (3) test borings. Two (2) additional borings shall be performed inside the lot after the demolition of the existing building.

Thank you for the opportunity of assisting you on this project. If you have any questions concerning the information or recommendations presented in this report, or if we can be of further assistance, please call.

Sincerely,

AmeriGEO Inc.

Kang Beongjoon

Beongjoon Kang, Ph.D., EIT
Project Engineer

Jean Hwang, Ph.D., P.E.
Project Manager

JH: jh

Submitted: 3 copies

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PROJECT DESCRIPTION

GENERAL

This report presents the results of the geotechnical evaluation and analysis performed by AmeriGEO, Inc. (AGI) for the proposed construction. The project site is located at 1660 Bone Avenue (Block 3015, Lot 1) in the Borough of Bronx, New York (see Figure No.1: Site Location Map). The purpose of the study is to evaluate the subsurface conditions at the site and to develop recommendations for foundation support. The geotechnical evaluations and recommendations presented herein are in general accordance with the New York City Building Code 2014.

Our understanding of the requirements of the project is primarily based on the architectural drawing dated August 25, 2018 provided by JLS Designs, Architect of Bayside, New York.

Our understanding of the project, the results of our field exploration program, and the summary of our recommendations are presented herein.

PROJECT LOCATION AND DESCRIPTION

The project site is located at 1660 Boone Avenue in the Borough of Bronx, New York. The project consists of the constructions of a 4-story community building (school) without a cellar. Currently, there is a 3-story warehouse building without cellar occupying the site. The existing warehouse is planned to be demolished. The proposed building occupies approximately 10,900 square feet space.

OBJECTIVES AND SCOPE OF SERVICES

The objectives of this study are to evaluate the subsurface conditions beneath the project site and to provide geotechnical recommendations for the foundations of the proposed construction. In order to achieve these objectives, the following scope of services was performed:

1. Collected and reviewed available surficial geology information.
2. Provided resident observation of the drilling operation retained by others and logged the subsurface conditions as encountered.
3. Performed geotechnical laboratory testing on representative soil samples obtained from the field investigation.
4. Preparation of a geotechnical report that includes:
   a) A description of the field investigation and geotechnical laboratory testing;
   b) A boring location plan and generalized subsurface profiles;
   c) Overview of the general site and geologic conditions;
   d) Results of engineering evaluations and recommendations regarding the proposed construction including:
      - Soil type, bearing capacity, and estimated bearing elevation.
      - Method to prepare the subgrade to provide adequate support to the structures.
      - Geotechnical earthquake engineering considerations including soil profile type and liquefaction potential based on the New York City Building Code 2014 and other pertinent code.
      - Permanent groundwater control measures, if necessary.
      - Discussion of construction related issues such as excavation, dewatering, and underpinning of foundations of adjacent buildings.
      - Construction monitoring considerations including vibration control and compaction control.
      - Appendices that include test boring and laboratory test results.

SUBSURFACE INVESTIGATION

GENERAL

The subsurface investigation consisted of a field investigation and a geotechnical laboratory testing program. The field investigation consisted of performing three (3) test borings for determining soil conditions under the site. The laboratory testing program included performing three (3) physical index tests and two (2) unconfined compression tests on rock core specimens to characterize the subsurface conditions.

Details of the subsurface investigation are described in the following sections.

SITE GEOLOGY

We have reviewed a geologic data from our files. The project site belongs to the geologic formation named "Hartland formation" which is from the Cambrian-Ordovician Period. "*The Hardland Formation is a deep-water oceanic deposit underlying most of central Manhattan, and easter Bronx. It is interbedded with marble and consists of units of schist, white/pinkish granite with monor greenish amphibolite and granitic intrusions."* (Local Geology of New York City And Its Effect on Seismic Ground Motions, Sissy Nikolaou 2004) The surficial geology of this area of the Bronx is glacial till. Till has variable texture of clay, silt, sand, gravel, and boulders which is, usually, poorly sorted and relatively impermeable. A map showing area's bedrock geology and surficial geology is presented in Figure No.2-A: Bedrock Geology Map and No.2-B: Surficial Geology Map, respectively.

FIELD INVESTIGATION PROGRAM

The subsurface investigation consisted of the performance three (3) test borings. The logs of the test borings performed under AGI are presented in Appendix A. The locations of the test borings are shown in Figure No.3: Boring Location Plan.

The test borings were performed by PG Environmental Services, Inc. of Hauppauge, NY. The test borings were advanced using a tracked drill rig, Geoprobe 7822DT. The borings were advanced using the mud rotary drilling technique with a 3⅛-in diameter tri-cone roller bit.

Soil samples were obtained using techniques and equipment in general accordance with the American Society for Testing and Materials (ASTM) Standard Specification D1586-Standard Penetration Test (SPT). The SPT consists of driving a 2-inches O.D. Split Spoon sampler for a distance of 24-inches, with repeated blows of a 140-lb hammer free falling a distance of 30-inches. The standard penetration, or N-value, is determined as the number of blows required to advance the sampler 12-inches after the initial 6-inches penetration. The recovered split-spoon samples were labeled with the project name and number, boring number, sample depth, SPT blow counts and the amount of recovery.

Rock core specimens were obtained using techniques and equipment in general accordance with the ASTM D2113-Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration. 10ft rock core specimens were retrieved from Boring B-3, labeled with the project name and number, boring number, depth, recovery, and Rock Quality Designmation (RQD).

All soil samples and rock core specimens were transported to our geotechnical laboratory for classification, testing, and storage.

LABORATORY TESTING PROGRAM

Laboratory testing of soil samples selected from the test borings was performed at a Geotechnical Laboratory in Totowa, New Jersey. The laboratory testing program consisted of physical index tests performed on the selected soil samples and strength tests on the selected rock core specimens to verify the field classifications and assist in engineering evaluations. *Grain-Size Distribution Analyses* were performed on selected soil samples of coarse-grained soils in general accordance with ASTM Standard D422-63. *Unconfined Compressive Tests* were performed on selected rock core specimens in general accordance with ASTM Standard D2938.

A summary of the laboratory tests performed for this evaluation, and the results including plots of grain-size distribution curves and compressive strengths are contained in Appendix B.

SUBSURFACE CONDITIONS

Generalized subsurface profile was developed. (See Figure No.4: Generalized Subsurface Profile) Utilizing the information from the test borings, subsurface conditions can be generally described by the following major strata (listed in order of being encountered from the ground surface):

Stratum 1 : FILL (NYCBC Class 7)

This stratum was encountered in all the test borings. This stratum generally consists of loose to dense, light brown to brown, gray, coarse to fine SAND with varying amounts of silt and miscellaneous fill materials such as concrete and rock fragment. The thickness of this stratum is estimated to be approximately 3ft to 8ft. SPT N-values ranged from approximately 3 blows per foot (bpf) to 30 bpf.

Stratum 2 : SAND (SP or SM, NYCBC Class 6 to Class 3a)

This stratum was encountered in all the test boring below Stratum 1. This stratum consists of loose to dense, light brown to brown, coarse to fine SAND with varying amount of silt, weathered rock, and gravel. This stratum was encountered at the depth of approximately 3ft to 8ft. SPT N-values ranged from approximately 5 bpf to 38 bpf, indicative of loose to dense compaction level. The thickness varies from approximately 5ft to 13ft.

Stratum 3 : BEDROCK (SCHIST, NYCBC Class 1b)

This stratum was encountered in all the test borings below Stratum 2. This stratum was encountered at the depths ranging from approximately 8ft to 21ft below the existing ground surfaces. Based on the rock core specimen from B-3, this stratum consists of light gray, medium-grained, angular, thinly laminated, unearthed, medium hard to hard Schist bedrock. The recovery was 100%. The RQD ranges from 52% to 53%.

GROUNDWATER CONDITIONS

Groundwater was not encountered in the deepest depth of borings. Therefore, the groundwater level is below the lowest excavation. However, fluctuations in groundwater level may occur because of seasonal variations in the amount of rainfall, runoff and other factors. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

ENGINEERING EVALUATIONS AND RECOMMENDATIONS

GENERAL

This section of the report presents our geotechnical analyses and recommendations for the proposed construction. Our evaluations and recommendations are based on the results of the preliminary field investigation performed for this project and our current understanding of the proposed project requirements.

DESIGN SPECTRAL RESPONSE ACCELERATION

Based on the NYC Building Code 2014, Section 1613.5.1, the mapped maximum considered earthquake response spectra for the short period (S_S) and 1-second period (S_1) are 0.281g and 0.073g, respectively.

Based on the results of the subsurface investigation, bedrock was encountered at the depth of 8ft to 21ft below the existing grades. The standard penetration resistances at the test borings has average N-values between 15 bpf to 21 bpf. The arithmetical average of the N-values indicates medium dense compactness. The depth of bedrock is 8ft to 21ft from ground surface.

In accordance with the New York City Building Code 2014, based on the arithmetical average of the standard resistance and considering the depth of bedrock and the rock class, the site soil profile corresponds to a Site Class of "C".

Base on the information provided by the structural engineer, the seismic use group of the proposed building is III in accordance with the Building Code. Therefore, the seismic design category is "B".

As per Table 1613.5.3 (1) and 1613.5.3 (2) of the Building Code, the site coefficients for the short period (F_a) and 1-second period (F_v) are each given 1.20 and 1.70, respectively. The design spectral response accelerations at short periods (S_{DS}) and 1-second periods (S_{D1}) are 0.225g and 0.083g, respectively.

The peak ground acceleration at zero second period is 0.090g at the project site. Figure No.5 depicts the design response spectrum recommended for 2% in 50 year probability of exceedance. The design spectral response accelerations are tabulated in the following Table 1;

Table 1. Design Spectral Acceleration

Period, T (sec)	Acceleration, (g)	Period, T (sec)	Acceleration, (g)
0.01	0.1082	0.6	0.1379
0.03	0.1449	0.7	0.1182
0.04	0.1632	0.8	0.1034
0.05	0.1815	0.9	0.0919
0.06	0.1999	1	0.0827
0.079	0.2248	2	0.0414
0.397	0.2084	3	0.0276
0.4	0.2068	4	0.0207
0.5	0.1655	6	0.0138

SOIL LIQUEFACTION POTENTIAL

The ground water level is lower than the depth of bedrock. Therefore, the site need not be considered for liquefaction.

COLUMNS AND WALLS

Based on the architectural drawing prepared by JLS Designs and Architect, the proposed building has no cellar. Considering the results of the subsurface investigation, fill materials (i.e. Stratum 1) and loose to dense sand layer (i.e. Stratum 2) were encountered to the depths of approximately 3ft to 8ft below the existing slabs and bedrock (i.e. Stratum 3) was encountered approximately 8ft to 21ft below existing slabs. We recommend two (2) foundation options for this site.

Option 1: Shallow Foundation

The proposed building can be supported on a spread or mat foundation bearing on Stratum 2 (SP/SM). The spread foundation will require excavation in timber sheeted pits. The spread footings can be constructed in the prepared subgrade compacted using the portable compactor in the pits and in accordance with the subgrade preparation section. Based on the soil conditions and the building code requirements, the recommended allowable soil bearing pressure is 3tsf.

Option 2: Piled Foundation

If the recommended bearing pressure is not sufficient or soil excavations are not planned, the building can be supported on mini-caissons with rock socket or driven piles. The top of the rock varies from 8ft to 21ft below the existing grades. Based on the results of the test borings, it is recommended that the building be supported on Class 1c, Intermediate rock, or better. The installation of a caisson consists of drilling a steel casing to the bedrock, removing the material from inside the casing, drilling rock socket, installing the necessary reinforcing steel, and grouting the entire length. Various casing diameter sizes and reinforcing steel sizes can be used to achieve a range of axial compression and uplift capacities.

- 100ton design load:

  7-⅝"x 0.43"-80ksi drilled pile with #20-75ksi rebar and 6,500 psi grout with 10"x10"x1" 75ksi bearing plate with nuts; the estimated pile consists of 10 to 20ft casing and 10ft rock socket constructed in Stratum 3 (Intermediate rock or better).

  HP12x63 driven piles; HP piles can be driven to the refusal to the bedrock. The estimated pile length varies from 10ft to 25ft. Considering the detrimental effect of vibrations, the driven pile can be used outside 20ft of the adjacent buildings or more based on the vibration monitoring.

It is recommended that the foundation contractor performing the drilled/driven pile installation provide a submission, signed and sealed by a New York State Professional Engineer, that includes design details of the piles, calculations providing the axial compression and uplift capacity of the piles and complete installation procedure. The construction of piles shall be in accordance with the NYC Building Code (2014). Axial and lateral load tests are needed as per the building code.

Base slab

Based on the subsurface investigation results and the information available, it is recommended that the first floor slab be constructed as a slab-on-grade or structural slab bearing on compacted subgrade prepared in the Stratum 1. See "Subgrade Preparation" for recommendations regarding the preparation of the subgrade.

LATERAL EARTH PRESSURE CONSIDERATIONS

The design lateral pressures for permanent below-grade walls consist of static, hydrostatic and dynamic pressures that are affected by the thickness and type of overburden materials and presence of water above the base slab of the structure. The static lateral pressure against the wall is due to at-rest earth pressure, which is based on the assumption of non-yielding basement walls.

The static lateral pressures should be based on the use of an equivalent fluid weight of 50 pcf, assuming that full drainage conditions exist (i.e., hydrostatic pressures do not develop against the walls).

In order to estimate the dynamic soil lateral earth pressures on a non-yielding wall, the active earth pressure coefficient using Mononobe-Okabe analysis can be determined using 1.5 × peak ground acceleration (1.5 × 0.159g = 0.239g). Based on this procedure, it is recommended to use a seismic lateral soil force of $7.5 \times H^2$ lb (per one foot of wall along the longitudinal direction of the wall), where H is the total vertical height of the wall, in feet. This force is in addition to the static force and should be applied at a distance of H/3 from the top of the wall (wall pressure is an inverted triangle).

The recommended lateral pressure does not consider any surcharge loads adjacent to the walls or at the ground surface. We recommend adding a uniform (i.e., rectangular) lateral pressure distribution of 0.40 times the surcharge to the lateral soil pressure distribution. The structural engineer should determine the magnitude of the surcharge loads (i.e., live loads).

GROUNDWATER CONTROL

During the investigation, the groundwater was not observed to the deepest depth of borings which is approximately 21ft below grade. Based on this and the proposed floor plan, groundwater appears to be below the bottom of the proposed base slab. Based on this, permanent groundwater control is not required.

It is recommended that the foundation walls and the lowest cellar floor be damp-proofed. Because there is a potential for trapped rain waters to be present against the foundation walls, the following can be considered for groundwater control:

- Place a free draining zone behind the foundation walls. A toe drain consisting of 6-inch diameter porous pipe enclosed in gravel should be placed at the base of the exterior wall to collect the water from the free draining zone. The water in the toe drain could then be discharged by gravity into a sump pit. The drainage medium should be separated from the natural or backfill materials by a non-woven geotextile.
- Consider installing a porous drainage layer below new slabs on grade to provide additional protection against these possible events. This should consist of a 6-inch-thick layer of natural crushed stone or gravel having a maximum particle size of 1-inch and zero passing the No. 200 sieve placed over a non-woven geotextile on the subgrade. Perforated 6-inch diameter PVC drainage pipes should be installed in the drainage medium with approximately 20ft spacing. The pipes should be surrounded by at least 6-inch of the drainage medium. The pipes should be connected to sumps with a self-activating pump.
- Install a vapor barrier directly beneath the lowest slab for a humidity control by installing a membrane such as Grace Construction Products Florprufe, Stego Wrap Vapor Barrier (20 mil), or approved equal.

CONSTRUCTION RECOMMENDATIONS

GENERAL

The following sections provide recommendations regarding preparation of the subgrade, backfill and compaction control, temporary groundwater control, temporary support of excavation controls, excavation considerations, vibration controls, and the need for construction monitoring.

VIBRATION MONITORING

It is recommended that the vibration levels inside the adjacent buildings be monitored during shoring pile installation and excavation. It is our understanding that the vibrations on the exterior walls of the adjacent buildings will be monitored during the installation of shoring or foundation piles if driven piles are used.

If the vibration levels exceed 2 in./sec, or if noticeable damage to adjacent facilities is observed at lower vibration levels, then pile installation should be stopped and appropriate remedial measures should be undertaken.

EXCAVATION CONSIDERATIONS

Temporary soil excavations above the natural groundwater level can have cut slopes as steep as 1H:1V. All vertical soil faces will require temporary support until the new basement walls and foundations are constructed and the area is properly backfilled. A feasible support of excavation system may consists of soldier piles and wood lagging on support of anchors, rakers, or bracing, as required.

The design and construction of any slopes and/or temporary excavation support systems should be the responsibility of a licensed New York State Professional Engineer retained by the foundation contractor. All excavations and temporary support systems should conform to pertinent OSHA and local safety regulations. The soil parameters used in the design of the temporary excavation support systems should be reviewed by the owner’s geotechnical engineer prior to the construction of the temporary support structures. Excavations and bracing will be subject to special inspection in accordance with the Building Code.

TEMPORARY GROUNDWATER CONTROL

Assuming that the groundwater remains below the maximum excavation depth, it is not anticipated that dewatering operations for the installation of the foundation footings will be required. However, we assume dewatering by sump pumping will be needed to handle any inflow from surface runoff. Discharge of groundwater to the sewer will require a discharge permit from the New York City Department of Environmental Protection (DEP).

SUBGRADE PREPARATIONS

Upon excavating to the proposed bottom of the lowest slab, a minimum of 4-inches of compacted coarse aggregate, commonly known as ¾" crushed stone or gravel, will be placed beneath the lowest concrete slab. The subgrade for the foundations and sub-cellar slab should be level and cleaned of any loose soil, mud, and other miscellaneous fill materials (such as concrete, brick, wood, debris, etc.) that can have a negative impact on the performance of the foundation or slab.

In order to limit any differential settlement, the subgrade for the lowest slabs should be compacted using with a minimum of 4 passes of a smooth drum roller with a minimum 10 ton static weight, or other approved equipment having similar energy. The compaction should not be performed when the subgrade is wet, muddy, or frozen.

If the concrete slab is constructed in the winter, the subgrade should be protected from frost action to limit possible subgrade deterioration resulting from freezing and thawing cycles

BACKFILL AND COMPACTION REQUIREMENT

Backfill materials should be granular soils free of debris such as organic material, cinder, brick, asphalt, ash, and other unsuitable materials. Some of the existing fill materials encountered in Stratum 1 are generally free of debris. Considering this, some sandy soils of the site can be used as backfill material provided that the unsuitable materials are removed prior to placement.

The structural backfill for foundations should be placed in horizontal layers not exceeding 12 inches in loose thickness and each layer should be compacted to a minimum of 95% of maximum Modified Proctor density (ASTM D1557-78). Backfill placed beneath slabs-on-grade, behind below-grade walls, and underneath sidewalks should be compacted to a minimum of 90% of the maximum dry density.

A suitable gradation for imported granular fill is as follows:

- Maximum particle size – 4 inches
- At least 15% and not more than 75% by weight retained on the #10 sieve
- Not more than 15% by weight of non-plastic fines (material passing the #200 sieve)
- The fill must be free of organic or other deleterious matter.

UNDERPINNING

Underpinning will be required at locations where the foundations of the existing adjacent structures are above the proposed excavation levels and can be impacted negatively by the excavation.

Underpinning of the adjacent structures should transfer the foundation loads from their present bearing level to below the proposed excavation. Underpinning or rigid support of excavation system will be required if the proposed subgrade extends below an influence line drawn at a slope of 1V:1½H from the bottom of existing foundation to the bottom of the new foundation.

The underpinning should be designed to resist lateral earth pressure as well as the vertical foundation loads. Therefore, lateral bracing should be required. No uncontrolled open excavation should be allowed within the influence zone.

The underpinning system should be designed and reviewed by a qualified geotechnical engineer, and then inspected by a qualified engineer during construction.

Considering the proposed plan without a cellar, underpinning appears not needed.

CONSTRUCTION INSPECTION

It is recommended that a geotechnical engineer familiar with the soil conditions and foundation design criteria review and approve the foundation contractors procedures and provide inspection services during excavation and foundation construction. The qualified engineer's role should include the following:

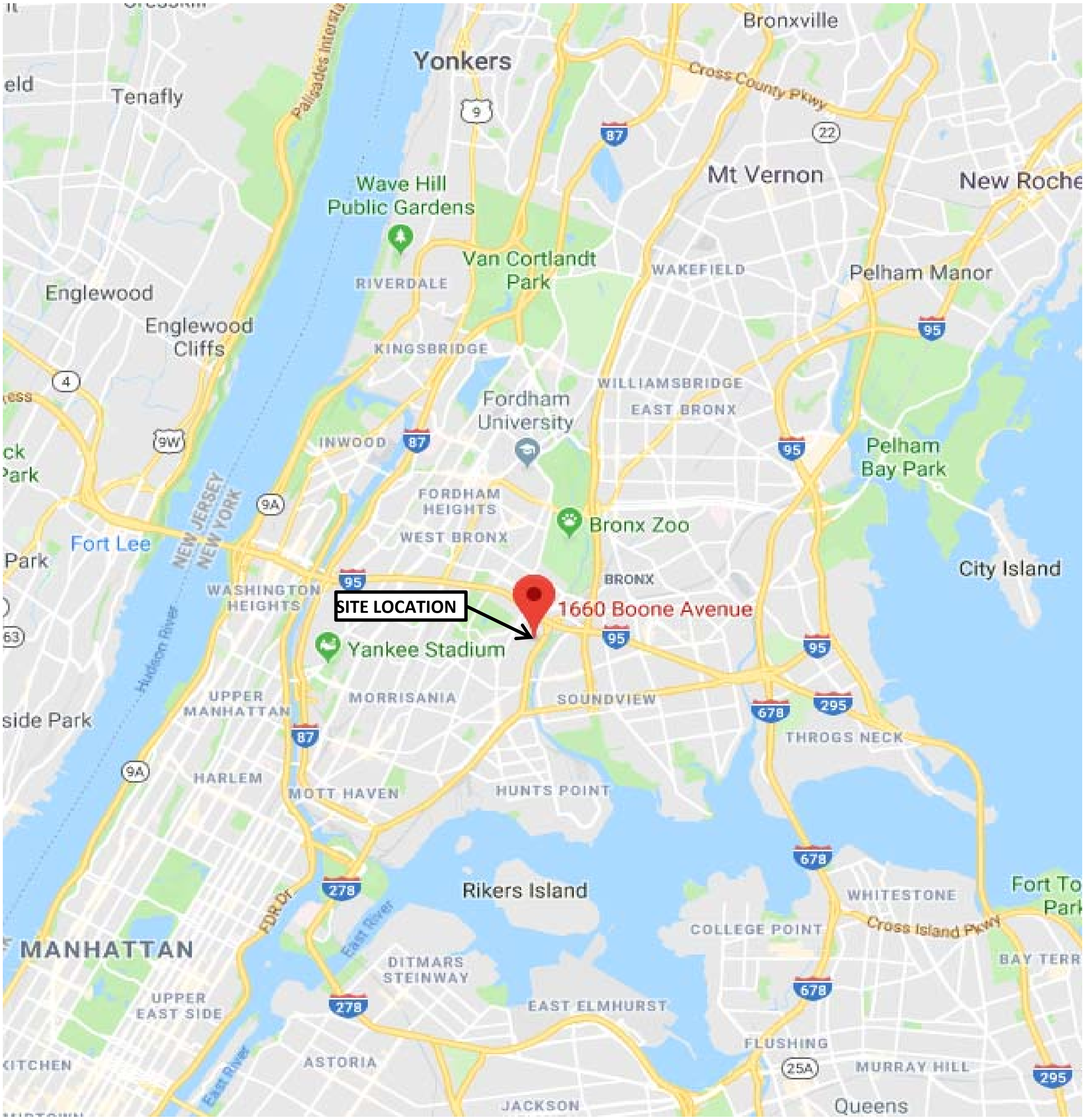
- Review and approval of the contractors submittals related to foundation construction;
- Observation and documentation of all phases of excavation and foundation construction;
- Special inspection of underpinning and support of excavation if needed;
- Pile Installation, field test inspection, and report preparation;
- Monitoring of vibrations;
- Monitoring of subgrade preparation, backfill placement and compaction.

LIMITATIONS

The recommendations contained in this report are our best professional judgment as to the procedures to be followed in the construction of the proposed project in accordance with the plans and criteria referred to in this report. Since the borings are widely spaced, there may be subsurface conditions not disclosed by the explorations. However, in our opinion the explorations are adequate to characterize the subsurface conditions for the purpose of this study. If changes in location or character of this project are subsequently planned, or if during construction any differences are found between the report of the explorations and the actual subsurface conditions, they should be brought to our attention immediately so that the effect on our recommendations can be evaluated.

The results presented in this report are applicable only to the present study, and should not be used for any other purpose without our review and consent. This study has been conducted in accordance with the standard of care commonly used as state-of-the-practice in the profession for the specification to the proposed construction in Queens, New York. No other warranties are either expressed or implied.

FIGURES



SITE LOCATION MAP
1660 BOONE AVENUE
BRONX, NEW YORK

AmeriGEO
MOUNTAINSIDE, NEW JERSEY

CHK'D BY: JH	DATE: 03/19/2019	FIG. NO: 1

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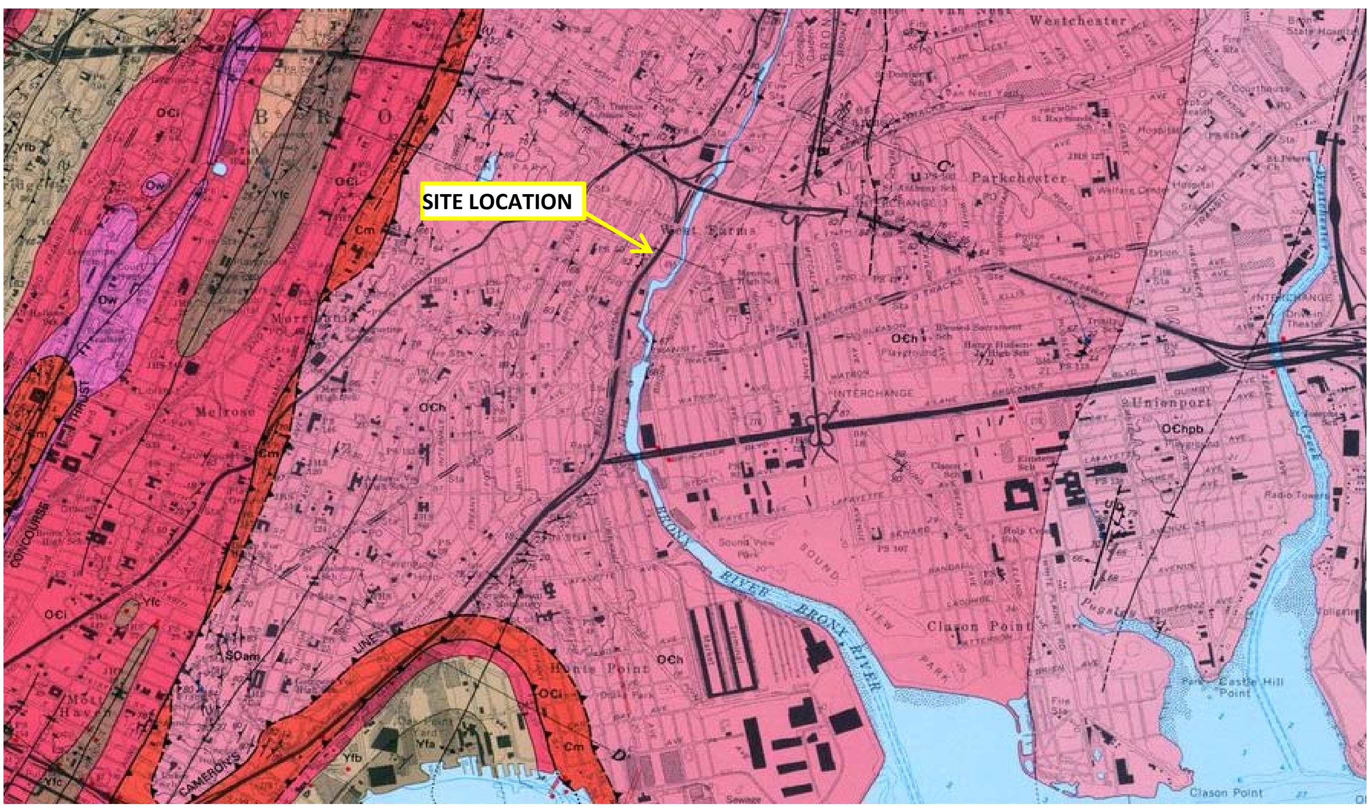
O€h **Hartland Formation (Middle Ordovician to Lower Cambrian)**—Consists of the following:

1. Gray and gray-weathering, thinly laminated muscovite-biotite-quartz schist with minor garnet;
2. Medium-gray, black-weathering, fine-grained biotite-muscovite-quartz schist; the muscovite flakes are commonly large and may give outcrops a "spangled" or shiny metallic appearance;
3. White to pinkish-white, light-green-weathering, fine- to medium-grained gneissic quartz-microcline-muscovite-biotite-plagioclase granite with minor garnet; occurs in layers as much as several feet thick, and locally has large feldspar crystals 2 in. or more across. Some of the granite shows gneissic banding; the bands are about 0.8 in. thick separated by discontinuous stripes of biotite 0.04–0.08 in. thick;
4. Dark greenish-black quartz-biotite-hornblende amphibolite, with some white and (or) pink granite pegmatite; occurs in belts 30–60 ft wide; weathers black and rusty along fractures;
5. Gray, rusty-weathering, unevenly foliated sillimanite-plagioclase-muscovite-biotite-microcline-quartz gneissic schist with minor garnet, and mica-feldsper-quartz boudins.

These rocks are interlayered with coarse quartz-plagioclase-muscovite pegmatite, hornblende amphibolite, and coarse granoblastic-textured amphibolite gneiss; the gneiss is similar in composition to an igneous diorite



BEDROCK GEOLOGY MAP OF BRONX

Reference: Bedrock and engineering geologic maps of Bronx County and parts of New York and Queens Counties, New York (Charles A. Baskerville, 1992)

BEDROCK GEOLOGY
1660 BOONE AVENUE
BRONX, NEW YORK

AmeriGEO
MOUNTAINSIDE, NEW JERSEY

CHK'D BY: JH	DATE: 03/19/2019	FIG. NO: 2-A

C:\Users\Administrator\Desktop\AMERIGEO\ongoing\BRNG@1660booneAvBX\GeotechReport\material\liquefaction_geology-NYC.xls t

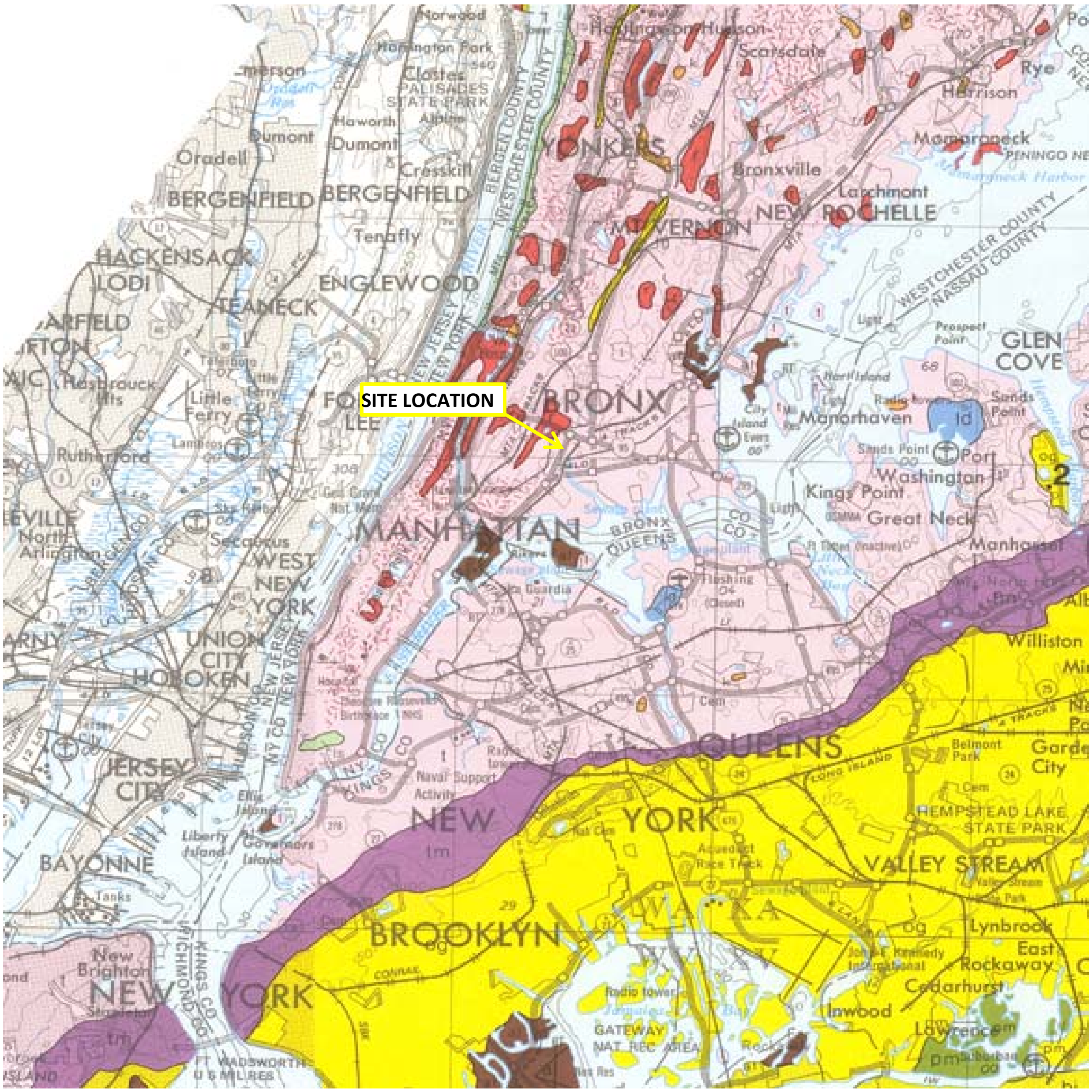
t — Till
Variable texture (e.g. clay, silt-clay, boulder clay),
usually poorly sorted diamict,
deposition beneath glacier ice,
relatively impermeable (loamy matrix),
variable clast content — ranging from abundant well-rounded
diverse lithologies in valley tills to relatively
angular, more limited lithologies in upland tills,
tends to be sandy in areas underlain by gneiss or sandstone,
potential land instability on steep slopes,
thickness variable (1-50 meters).

af

af — Artificial fill

r

r — Bedrock
Exposed or generally within 1 meter of surface.



SURFICIAL GEOLOGY MAP OF BRONX

Reference: Bedrock and engineering geologic maps of Bronx County and parts of New York and Queens Counties, New York (Charles A. Baskerville, 1992)

SURFICIAL GEOLOGY
1660 BOONE AVENUE
BRONX, NEW YORK

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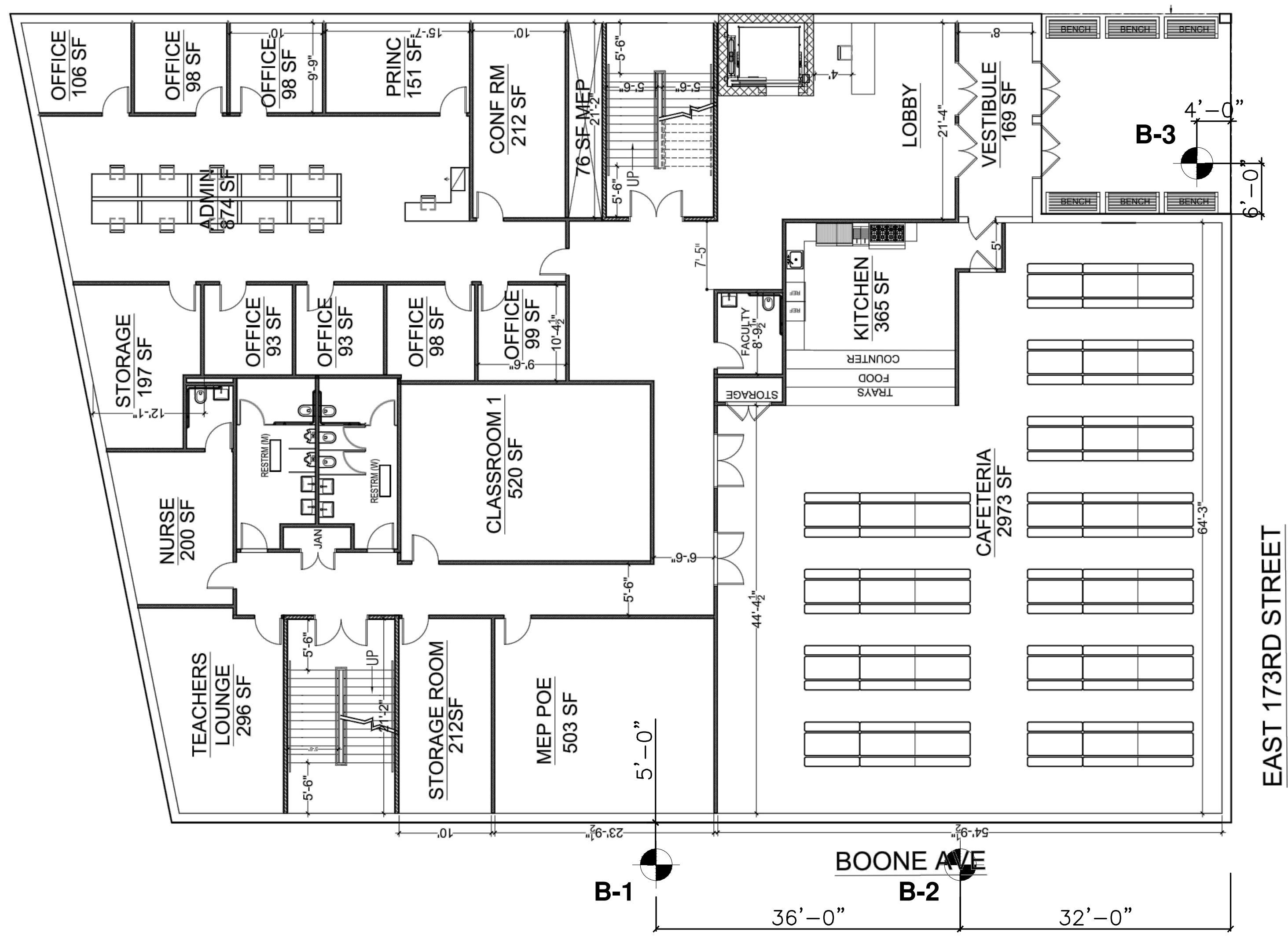
CHK'D BY: JH	DATE: 03/19/2019	FIG. NO: 2-B

LEGEND

B-1 BORING LOCATION PERFORMED IN MARCH, 2019



BORING LOCATION PLAN

SCALE 1/20" = 1'–0"

NOTE :

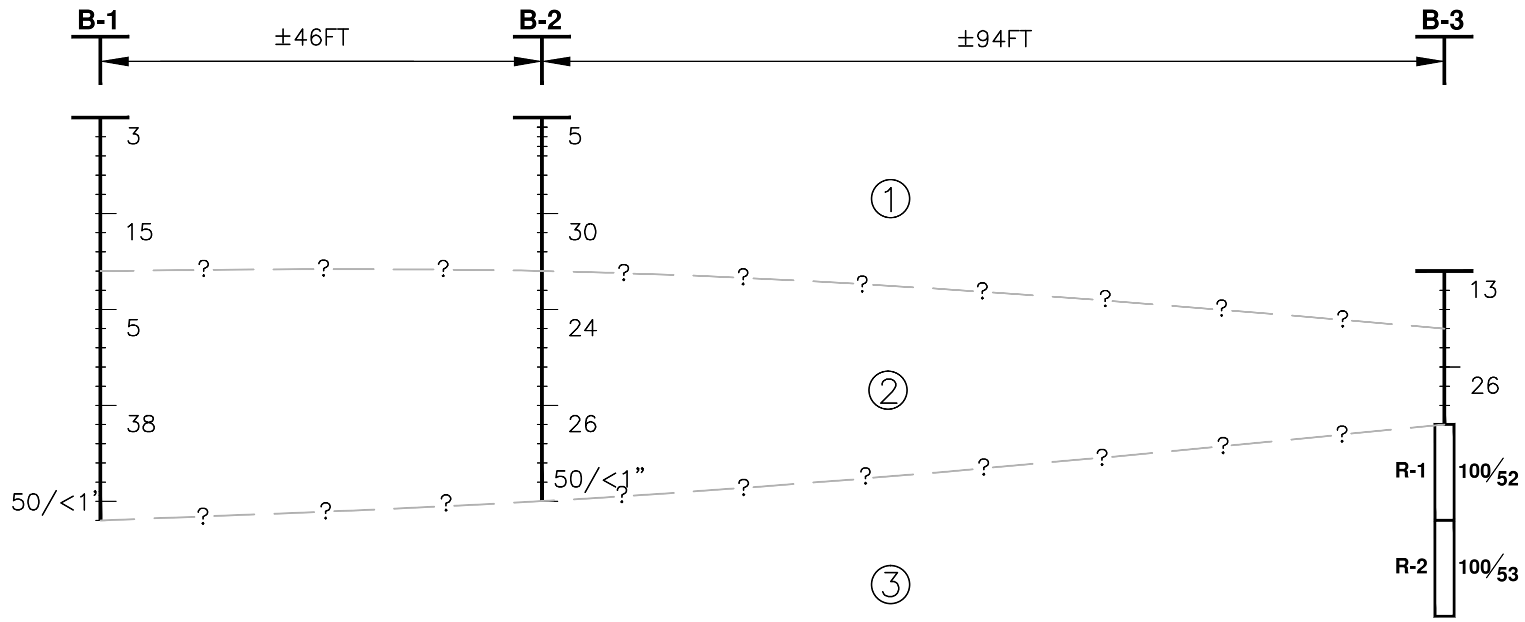
1. BORING LOCATIONS AND ELEVATIONS WERE NOT SURVEYED AND THEREFORE SHOULD BE CONSIDERED APPROXIMATE.

2. THE BORINGS B–1 TO B–3 WERE DRILLED WITH SOIL SAMPLES BY PG ENVIRONMENTAL SERVICES. INC. OF HAUPPAUGE, NY UNDER THE FULL TIME INSPECTION OF AMERIGEO. INC. OF MOUNTAINSIDE, NJ.

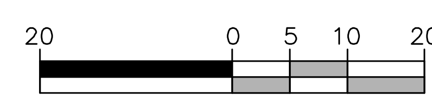
BORING LOCATION PLAN
1660 BOONE AVENUE
BRONX, NEW YORK

AmeriGEO

DR. BY	SP.	SCALE	AS SHOWN	DWG. NO.	PROJ. NO. 19-NY005-01
CK'D. BY	JH	DATE	MAR. 18, 2019	FIG. NO.	3



GENERALIZED SUBSURFACE PROFILE A-A



GENERALIZED SOIL DESCRIPTIONS :

1. MISC. FILL: LOOSE TO DENSE, LIGHT BROWN TO BROWN, GRAY, COARSE TO FINE SAND WITH VARYING AMOUNTS OF SILT, CONCRETE, AND ROCK FRAGMENT (CLASS–7)
2. SAND: LOOSE TO DENSE, LIGHT BROWN TO BROWN, COARSE TO FINE SAND WITH VARYING AMOUNT OF SILT, WEATHERED ROCK, AND GRAVEL (CLASS–3B TO CLASS–3A)
3. BEDROCK: SCHIST, LIGHT GRAY, MEDIUM–GRAINED, ANGULAR, THINLY LAMINATED, UNWEATHERED, MEDIUM STRONG TO STRONG (CLASS–1B)

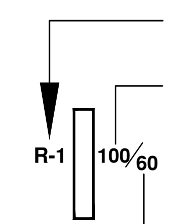
LEGEND:

B-1 — GEOTECHNICAL BORING DRILLED BY PG ENVIRONMENTAL SERVICES, INC., UNDER AGI'S SUPERVISION.

10 — N–VALUE, DEFINED AS NUMBER OF BLOWS OF A 140–LB HAMMER FREE FALLING FOR 30 INCHES REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES AFTER INITIAL 6 INCH PENETRATION.

? — APPROXIMATE INTERFACE BETWEEN SOIL STRATA.

WATER LEVEL IN GROUNDWATER OBSERVATION WELL AND DATE MEASURED BY LANGAN.



ROCK CORE NUMBER

ROCK CORE RECOVERY, EXPRESSED AS A RATIO OF TOTAL LENGTH OF RECOVERED CORE TO THE LENGTH CORED, IN PERCENT/

ROCK QUALITY DESIGNATION DEFINED AS THE TOTAL LENGTH OF ALL THE PIECES OF CORE 4–INCHES OR LONGER DIVIDED BY THE TOTAL LENGTH OF CORE RUN, IN PERCENT.

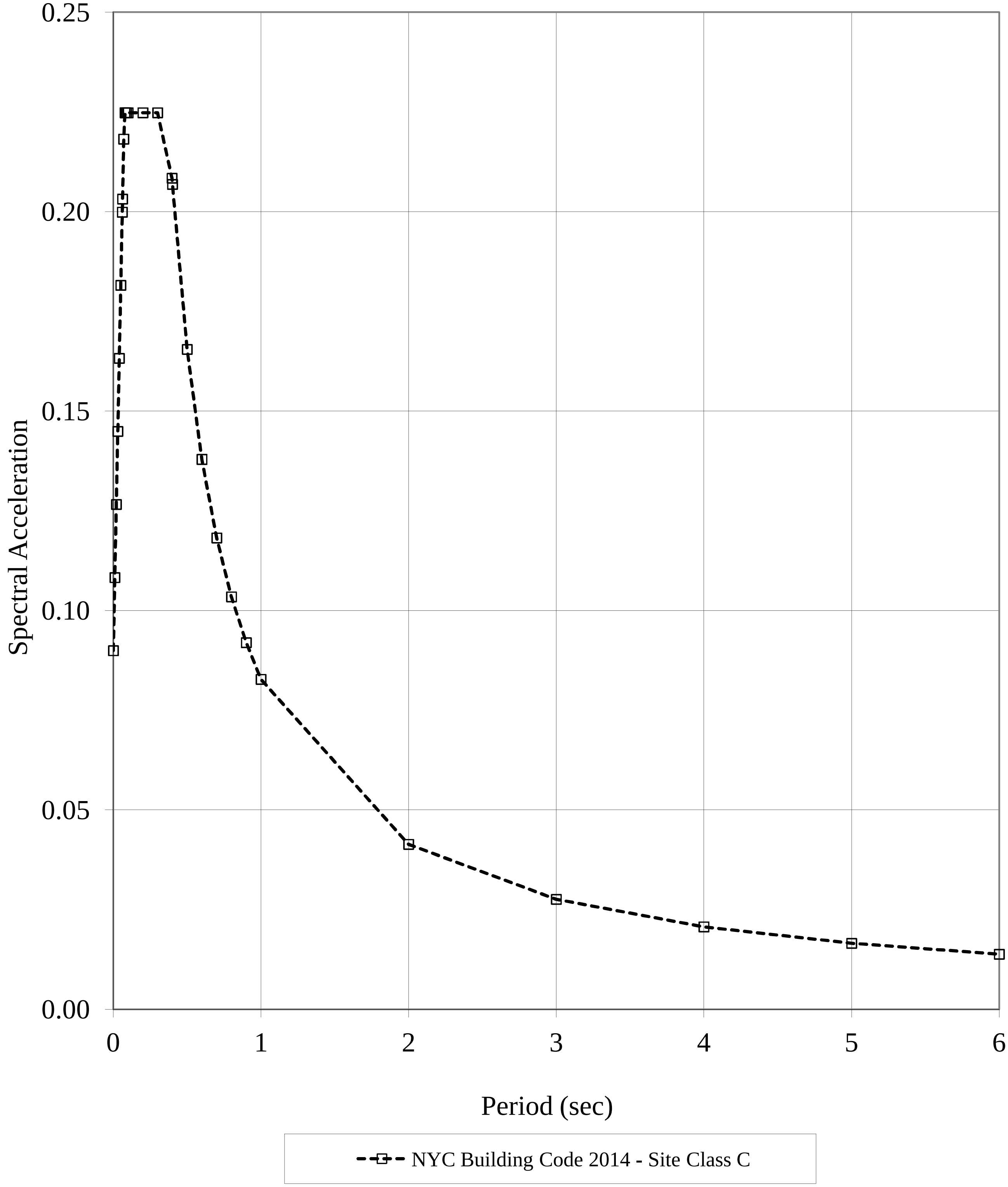
GENERAL NOTES:

1. BORING LOCATIONS AND ELEVATIONS WERE NOT SURVEYED AND THEREFORE SHOULD BE CONSIDERED APPROXIMATE.
2. MATERIAL DESCRIPTIONS ARE GENERALIZED AND INCLUDE SAMPLES WITH A NATURAL DEGREE OF VARIATION. SEE BORING LOGS FOR A MORE DETAILED DESCRIPTION OF THE INDIVIDUAL SAMPLES.
3. THICKNESS OF SOIL STRATA BETWEEN BORING IS ESTIMATED. STRATA BOUNDARIES ARE BASED ON INTERPRETATION OF BORING AND LABORATORY TESTS. RESULTS ARE SHOWN ONLY TO AID IN VISUALIZING GENERALIZED SUBSURFACE CONDITIONS. ACTUAL STRATA BOUNDARIES BETWEEN BORINGS MAY DIFFER FROM THE CONDITIONS SHOWN HEREIN.

GENERALIZED SUBSURFACE PROFILE A-A
1660 BOONE AVENUE
BRONX, NEW YORK

AmeriGeo, Inc

DR. BY	SP.	SCALE	AS SHOWN	PROJ. NO.	19-NY005-01
CK'D. BY	JH	DATE	APRIL 2, 2019	FIG. NO.	4



DESIGN RESPONSE SPECTRUM
1660 BOONE AVENUE
BRONX, NEW YORK

AmeriGEO
MOUNTAINSIDE, NEW JERSEY

CHK'D BY: JH	DATE: 3/21/2019	FIG. NO: 5

APPENDIX A- BORING LOGS

Project: Site Investigation
Project Location: 1660 Boone Avenue, Bronx
Project Number: 19-NY005-01

Log of Boring. B-1

Sheet 1 of 1

Date(s) Drilled	3/11/2019	Logged By	B. Kang	Approximate Surface Elevation (feet)	Top of Street
Drilling Method	Mud Rotary	Drilling Contractor	PG Environmental Services, Inc.	Coordinates	**North:** - **East:** -
Casing Size/Type	4-1/2" Steel	Drill Rig Operator	Oscar Peralta	Totel Depth Drilled (feet)	21.5
Drill Rig Type	Geoprobe 7822DT	Drill Bit Size/Type	3-1/8" Tricone	Sampler Type(s)	2" OD Split Spoon
Groundwater Level and Date Measured	-	Hammer Wt/Drop	140lb/30in Automatic; Casing Hammer Wt/Drop 140lb/30in	Core Barrel Size/Type	-
Boring Location and Comments	Street along Boone Ave, 5ft from property line, 68ft from E 173rd St			No. of Samples	**Dist.: 5** **Undist.: -** **Core (ft): -**

Depth, feet	Soil Samples: Type, Number	Soil Samples: Recov. (in)	Soil Samples: Pen. Resist. (blows/6in)	Rock Coring: Run Number	Rock Coring: Recov. (%)	Rock Coring: RQD (%)	Graphic Log	MATERIAL DESCRIPTION	REMARKS
0									6" concrete pavement
	S-1	11	4 2 1 2					Loose, Dry, light Brown m-f SAND some Silt [FILL, Class 7]	
5	S-2	9	6 10 5 4					med Dense, Dry, Gray m-f SAND trace Silt, Rock fragment [FILL, Class 7]	
10	S-3	24	1 1 4 4					Loose, Moist, light Brown to Brown, m-f SAND some Silt [FILL, Class 7]	
15	S-4	17	18 14 24 20					Dense, Moist, light Brown, m-f SAND some Silt, Rock fragment [SM, Class 3a]	
20	S-5	16	5 7 >50					very Dense, Wet, Brown, m-f SAND some Silt, weathered Rock [SM, Class 3a]	**End of Boring@21.5' (Top of Rock)**

Project: Site Investigation	**Log of Boring. B-2**
Project Location: 1660 Boone Avenue, Bronx	**Sheet 1 of 1**
Project Number: 19-NY005-01	

Date(s) Drilled	3/7/2019	Logged By	B. Kang	Approximate Surface Elevation (feet)	Top of Street
Drilling Method	Mud Rotary	Drilling Contractor	PG Environmental Services, Inc.	Coordinates	**North:** - **East:** -
Casing Size/Type	4-1/2" Steel	Drill Rig Operator	Oscar Peralta	Totel Depth Drilled (feet)	20
Drill Rig Type	Geoprobe 7822DT	Drill Bit Size/Type	3-1/8" Tricone	Sampler Type(s)	2" OD Split Spoon
Groundwater Level and Date Measured	-	Hammer Wt/Drop	140lb/30in Automatic; Casing Hammer Wt/Drop 140lb/30in	Core Barrel Size/Type	-
Boring Location and Comments	Along Boone Av, 5ft from property line, 32ft from E 173rd St			No. of Samples	**Dist.: 4** **Undist.: -** **Core (ft): -**

Depth, feet	Soil Samples: Type, Number	Soil Samples: Recov. (in)	Soil Samples: Pen. Resist. (blows/6in)	Rock Coring: Run Number	Rock Coring: Recov. (%)	Rock Coring: RQD (%)	Graphic Log	MATERIAL DESCRIPTION	REMARKS
0									4" concrete pavement
	S-1	11	5 3 2 34					Loose, Dry, light Brown to Green m-f SAND trace Silt [FILL, Class 7]	
5	S-2	13	5 22 8 12					Dense, Dry, Gray m-f SAND trace Silt, weathered Rock [SP, Class 3a]	
10	S-3	20	4 9 15 17					med Dense, Moist, Light Brown c-f SAND trace Silt [SM, Class 3b]	
15	S-4	20	17 13 13 16					med Dense, Moist, light Brown, c-f SAND some Silt, Gravel [SM, Class 3b]	
20	S-5	-	50/< 1"					no sample retreived	**End of Boring@20' (Top of Rock)**

AmeriGEO

Project: Site Investigation	Log of Boring. B-3
Project Location: 1660 Boone Avenue, Bronx	Sheet 1 of 1
Project Number: 19-NY005-01	

Date(s) Drilled	3/11/2019	Logged By	B. Kang	Approximate Surface Elevation (feet)	Top of Slab
Drilling Method	Mud Rotary	Drilling Contractor	PG Environmental Services, Inc.	Coordinates	North: - East: -
Casing Size/Type	4-1/2" Steel	Drill Rig Operator	Oscar Peralta	Totel Depth Drilled (feet)	18
Drill Rig Type	Geoprobe 7822DT	Drill Bit Size/Type	3-7/8 to 2-7/8" Tricone	Sampler Type(s)	2" OD Split Spoon
Groundwater Level and Date Measured	-	Hammer Wt/Drop	140lb/30in Automatic; Casing Hammer Wt/Drop 140lb/30in	Core Barrel Size/Type	-
Boring Location and Comments	Driveway (8ft lower than Boone Avenue)			No. of Samples	Dist.: 2 Undist.: - Core (ft): 10

Depth, feet	Soil Samples: Type, Number	Recov. (in)	Pen. Resist. (blows/6in)	Rock Coring: Run Number	Recov. (%)	RQD (%)	Graphic Log	MATERIAL DESCRIPTION	REMARKS
0									6" concrete Slab
	S-1	13	6 11 2 2					med Dense, Dry, light Brown m-f SAND some Silt, conc' fragment [FILL, Class 7]	
5	S-2	24	14 13 16 15					med Dense, moist, Brown c-f SAND trace Silt, Gravel, Rock fragment [SP, Class 3b]	
10				R-1	100	52		Schist, light gray, medium-grained, angular, thinly laminated, unweathered, strong to medium strong [SCHIST, Class 1c]	
15				R-2	100	53		Schist, light gray, medium-grained, angular, thinly laminated, unweathered, strong to medium strong [SCHIST, Class 1c]	End of Boring@18'
20									

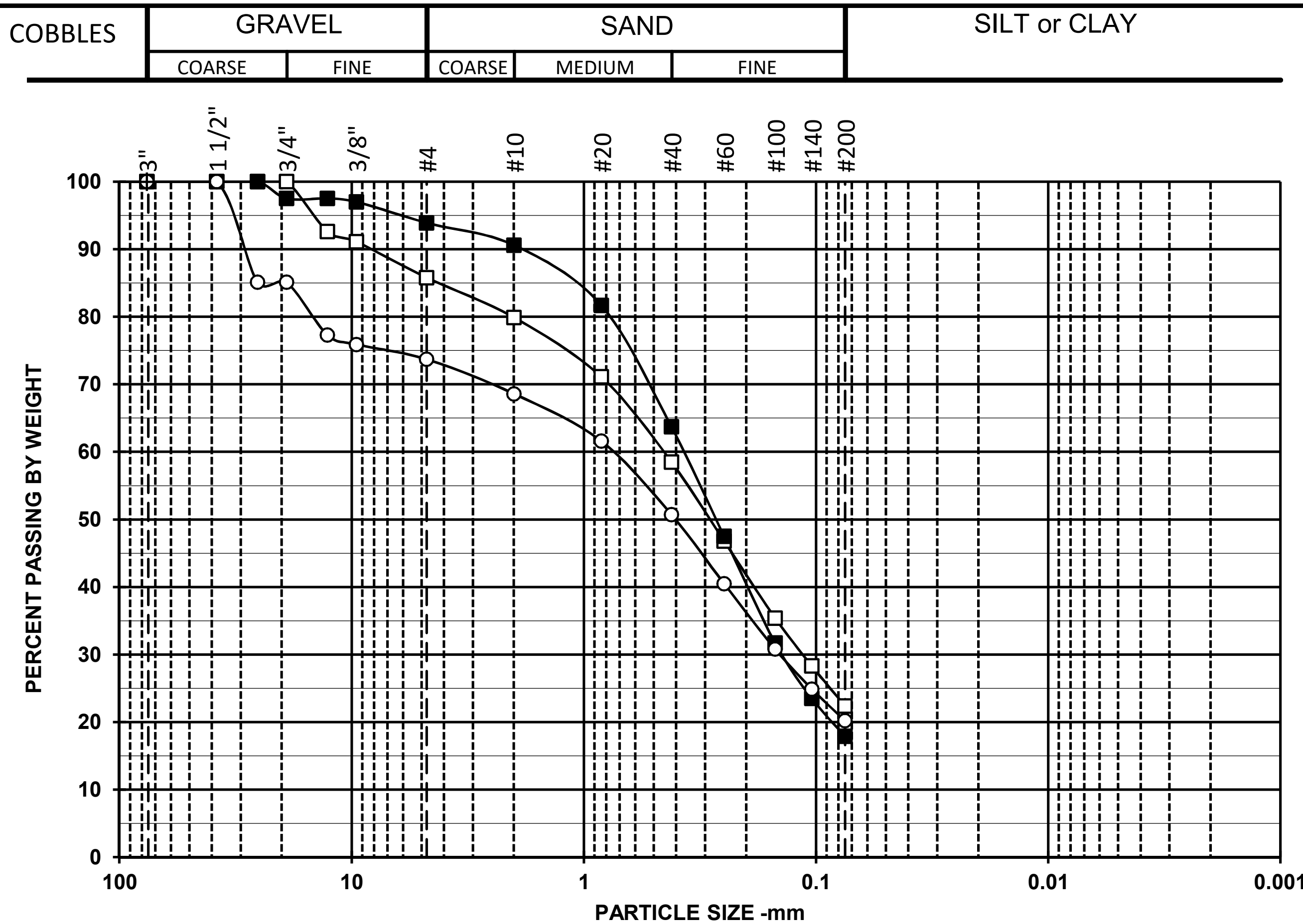
AmeriGEO

APPENDIX B- LABORATORY TEST RESULTS

AmeriGeo #19-NY005-01
1660 Boone Ave. - Bronx, NY
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS			REMARKS
			WATER CONTENT (%)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	
B-1	S-4	15-17	12.5	SM	22.4	
B-1	S-5	20-22	17.6	SM	17.9	
B-2	S-4	15-17	9.5	SM	20.2	

Note: (1) USCS symbol based on visual observation and Sieve reported.



Symbol	□	■	○
Boring	B-1	B-1	B-2
Sample	S-4	S-5	S-4
Depth	15-17	20-22	15-17
% +3"	0.0	0.0	0.0
% Gravel	14.2	6.1	26.3
% SAND	63.4	76.0	53.5
%C SAND	5.9	3.3	5.1
%M SAND	21.4	26.9	17.9
%F SAND	36.1	45.8	30.5
% FINES	22.4	17.9	20.2
D_{100} (mm)	19.050	25.400	38.100
D_{60} (mm)	0.455	0.372	0.759
D_{30} (mm)	0.114	0.139	0.143
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	100.0
4"	100.0	100.0	100.0
3"	100.0	100.0	100.0
1 1/2"	100.0	100.0	100.0
1"	100.0	100.0	85.1
3/4"	100.0	97.5	85.1
1/2"	92.6	97.5	77.3
3/8"	91.1	97.0	75.9
#4	85.8	93.9	73.7
#10	79.9	90.6	68.6
#20	71.1	81.7	61.6
#40	58.5	63.7	50.7
#60	46.8	47.5	40.5
#100	35.4	31.7	30.8
#140	28.3	23.5	24.9
#200	22.4	17.9	20.2
5μ m			
2μ m			
1μ m			

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	12.5				SM		Brown, Silty sand	03/25/19
■	17.6				SM		Brown, Silty sand	03/25/19
○	9.5				SM		Brown, Silty sand with gravel	03/25/19

AmeriGeo #19-NY005-01

TerraSense, LLC #7994-19003

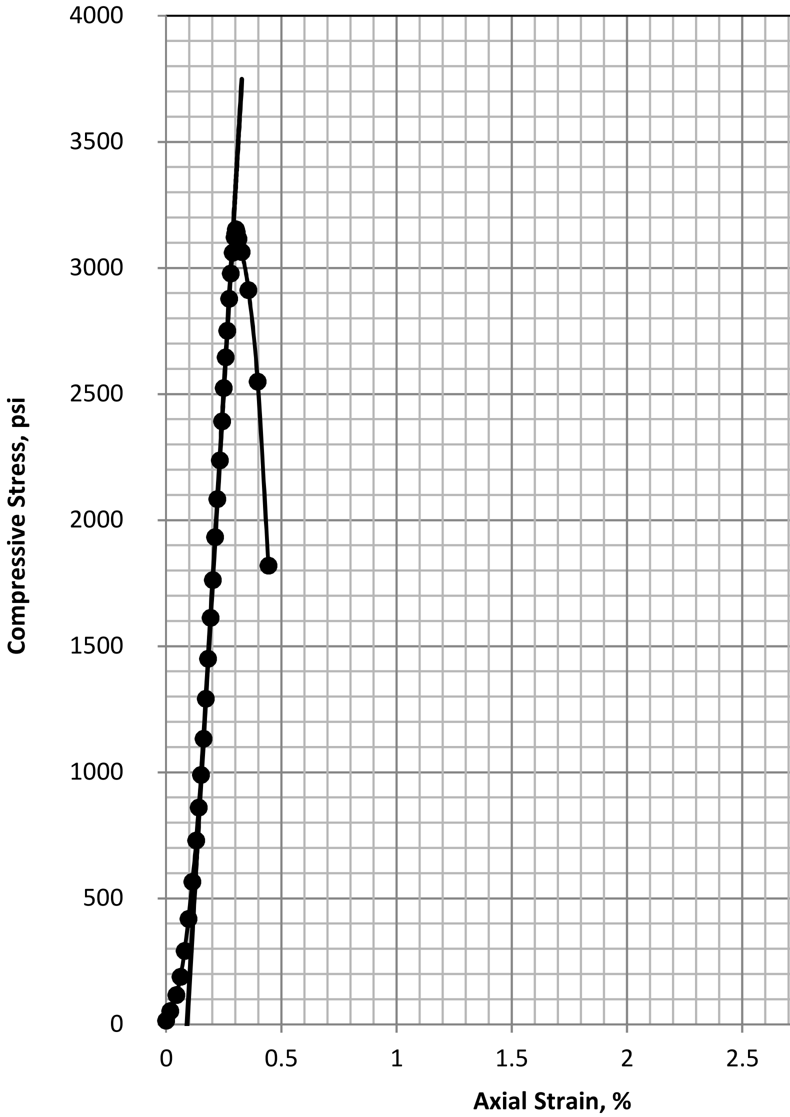
1660 Boone Ave.
Bronx, NY

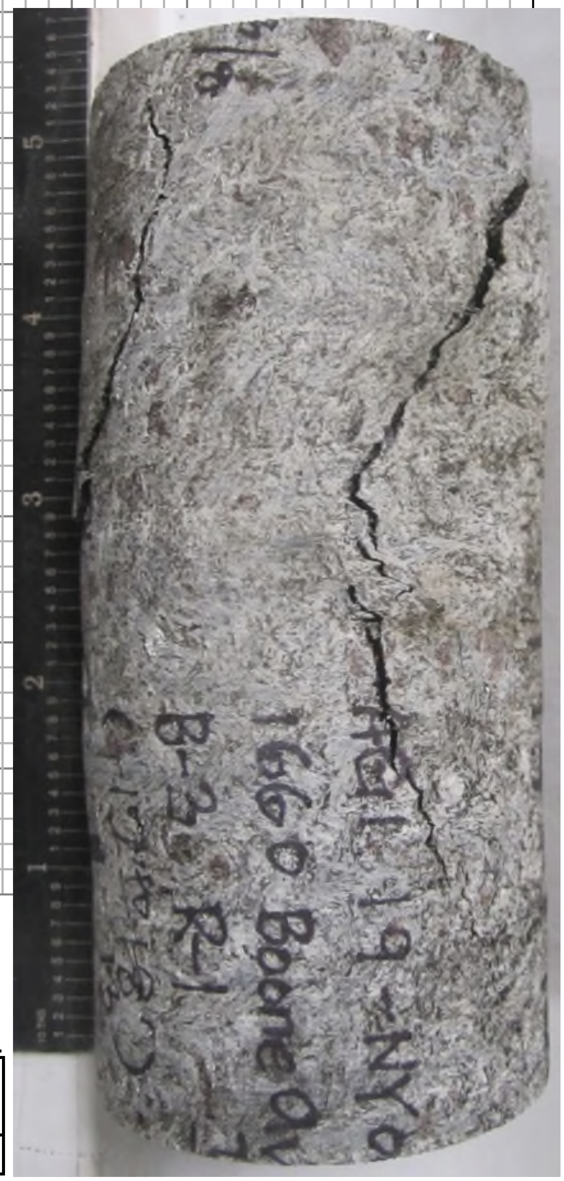
PARTICLE SIZE DISTRIBUTION

AmeriGeo
1660 Boone Ave. Bronx, NY
SUMMARY OF ROCK TESTING

SAMPLE IDENTIFICATION			STATE PROPERTIES			ENGINEERING PROPERTY TESTS				REMARKS
Boring	Run	Depth	WATER CONTENT (1) (%)	TOTAL UNIT WGT. (pcf)	DRY UNIT WGT. (pcf)	TEST TYPE (2)	UNCONFINED COMPRESSION TESTS (ASTM D7012) COMPRESSIVE STRENGTH (psi)	AXIAL STRAIN @ FAILURE (%)	ESTIMATED (5) ELASTIC MODULUS (psi)	
B-3	R-1	12.1-12.5	0.1	177	177	UC	3150	0.21	2E+06	
B-3	R-2	17.1-17.5	0.1	174	174	UC	3510	0.23	2E+06	

Notes: (1) Water contents determined after trimming and shearing.
(2) Test Type Abbreviations: UC: UC Compression test with estimated elastic moduli
(5) Modulus estimated based on corrected gross deformations.





Specimen Information

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (inch)	Diameter (inch)
0.09	177	177	5.086	2.128

Specimen does not meet ASTM D4543 shape tolerances for side straightness

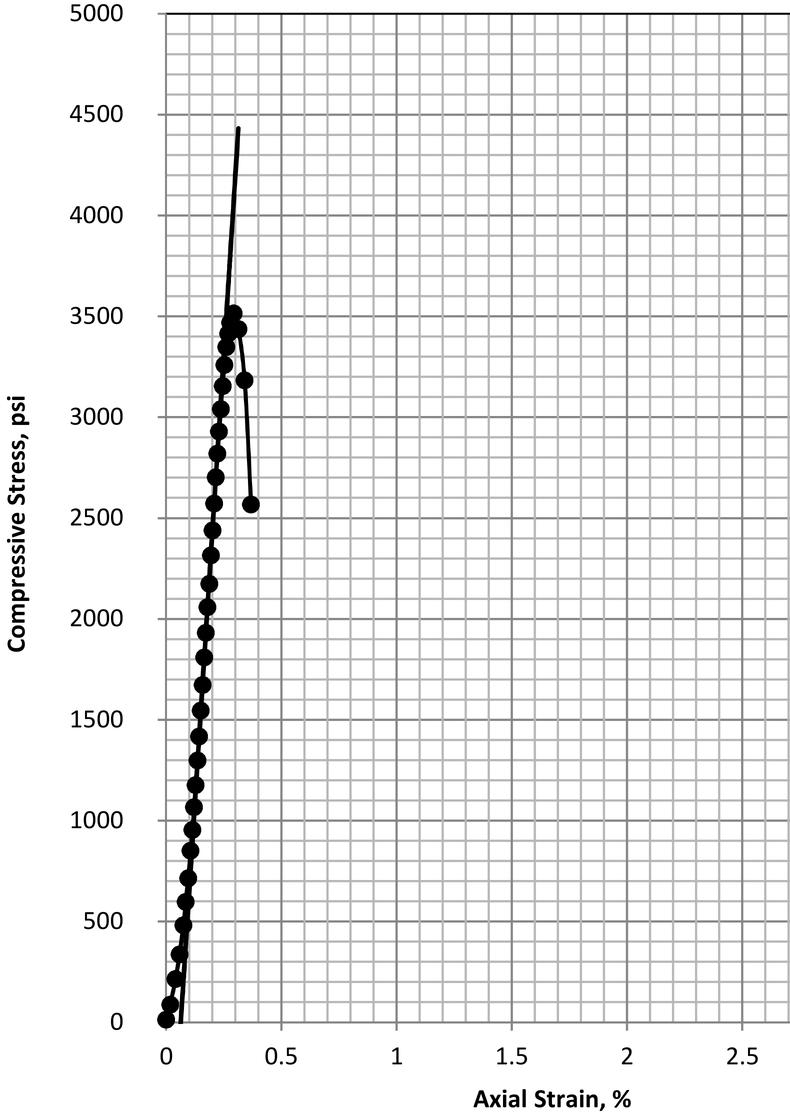
FAILURE PHOTO

Test Summary

Strain Rate (%/min)	Corrected Strain Strain to Peak (%)	q_u (psi)	Estimated (shown) Elastic Modulus (psi)
0.15	0.21	3150	2E+06

Test by: DM
Test Date: Mar-19-19
Reviewed by: GET

AmeriGeo **Project # 19-NY005-01** **TerraSense, LLC** **Project # 7994-19003**	**1660 Boone Ave.** **Bronx, NY**	**COMPRESSIVE STRESS VS STRAIN** **UNCONFINED COMPRESSIVE STRENGTH TEST** **Boring: B-3 Run: R-1** **Depth 12.1-12.5 ft.**



Specimen Information

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (inch)	Diameter (inch)
0.14	174	174	5.200	2.130

Specimen meets ASTM D4543 shape tolerances

FAILURE PHOTO

Test Summary

Strain Rate (%/min)	Corrected Strain Strain to Peak (%)	q_u (psi)	Estimated (shown) Elastic Modulus (psi)
0.14	0.23	3510	2E+06

Test by: DM
Test Date: Mar-19-19
Reviewed by: GET

AmeriGeo Project # 19-NY005-01	**1660 Boone Ave. Bronx, NY**	**COMPRESSIVE STRESS VS STRAIN UNCONFINED COMPRESSIVE STRENGTH TEST**
TerraSense, LLC Project # 7994-19003		**Boring: B-3 Run: R-2 Depth 17.1-17.5 ft.**