

**REPORT
PRELIMINARY GEOTECHNICAL
INVESTIGATION**

**111 Willow Avenue
Bronx, New York**

Prepared for:

**JCAL Development Group LLC,
55 Bruckner Boulevard
Bronx, New York 10454**

Prepared By:

**Pillori Associates
333 Meadowlands Pkwy, Suite 102
Secaucus, New Jersey 07094**

November 2017



PILLORI ASSOCIATES, P.A.
Geotechnical Engineering

November 17, 2017
Via Email: josh@jcaldevelopment.com

JCAL Development Group LLC
55 Bruckner Boulevard
Bronx, New York 10454

Attn: Mr. Joshua Weissman

Re: Preliminary Geotechnical Engineering Investigation Report
111 Willow Avenue
Bronx, New York

Gentlemen:

Presented herein is the preliminary geotechnical engineering report for the referenced project. We are confident that the subsurface information and engineering recommendations contained herein will meet the needs of the project. Thank you for the opportunity to be of service. Please call if you have any questions or if we can be of further assistance.

Sincerely,

Pillori Associates, PA



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Introduction

Presented herein are the results of the preliminary geotechnical investigation conducted for the proposed development at 111 Willow Avenue in Bronx, New York. The investigation was performed in accordance with our proposal dated March 20, 2017. The purpose of the investigation was to identify the subsurface soil conditions in order to determine the relative soil parameters for the design and construction of new foundations for the proposed 8-story building.

Project Description

The project site is located on west side of Willow Avenue and extends from East 133rd Street to East 134th Street as shown in Figure 1. The project site measures approximately 20,660 square feet (0.474 acres) in plan dimensions. Currently, the southern half of the site supports two brick buildings (3-story and 1-story) while the northern half supports an asphalt parking lot. A 2-story brick building (#759 East 133rd Street) and 1-story building (#740 East 134th Street) border the site to the west.



Figure 1 Site Vicinity Map

The proposed development entails demolition of the existing buildings on the site and construction of a new 8-story building. The footprint area of the proposed building and the depth of the cellar(s) were not defined at the time of this investigation.

Geotechnical Investigation

The preliminary geotechnical investigation consisted of drilling six exploratory soil borings (B-1 through B-6). Warren George, Inc. drilled the borings between the dates of October 30 and November 7, 2017, using a truck mounted drill rig within the vacant space. Two borings B-2 and B-6 were terminated within the decomposed rock, and the remaining borings, B-1, B-3, B-4W and B-5 were advanced 5 feet into competent bedrock, at completion depths ranging from 28'-6" to 85'-2" beneath the existing grade. In the borings, Standard Penetration Tests (SPTs) were performed within the overburden soil at regular 5-foot intervals in accordance with procedures specified in ASTM D1586. The underlying

bedrock was core drilled using a double tube core barrel in accordance with ASTM D2113. A groundwater observation well consisting of 1-1/4" PVC pipe and well screen was installed in completed boring B-4W.

Full-time special inspection was provided by Pillori Associates to locate the explorations in the field, direct drilling, sampling, and maintain continuous logs of the explorations. Soil/rock types observed in the borings were visually classified according to the Unified Soil Classification System (USCS) and the New York City Building Code (NYCBC). The special inspection was performed in accordance with Sections 1704.7, 1704.8 and 1704.9 of the NYCBC.

At the conclusion of the exploration program, the soil and rock samples were delivered to our soil laboratory for re-examination and further classification. The individual sample classifications were combined according to soil group and geologic origin, and their descriptions were recorded on finalized logs of the borings. The finalized logs of the borings are attached to this report along with a Boring Location Plan (Drawing No. 1), Subsurface Soil Sections A-A and B-B (Drawing Nos. 2 and 3), and a Unified Soils Classification System chart.

Stratigraphy

In general, the subsoil conditions consisted of a surface layer of miscellaneous fill material overlying soft estuarine deposits, followed by glacial soils. Beneath the glacial soils, decomposed bedrock was found overlying competent bedrock. Detailed descriptions of the subsurface stratigraphy encountered in the borings are presented on the individual boring logs attached to this report, and generalized descriptions are presented below in order of increasing depth.

Fill (F): A surface layer of miscellaneous fill was encountered in all the explorations immediately beneath the ground surface. The fill was a heterogeneous mixture of sand, silt and gravel with miscellaneous debris, brick and asphalt fragments. The fill layer was approximately 8 to 13 feet deep, and was loose to medium compact in terms of relative density. The fill was classified as nominally unsatisfactory bearing material, Class 7, in accordance with the NYCBC.

Estuarine River Deposit (Es): A discontinuous tidal marsh deposit (silt, clay and peat) approximately 6 to 15 feet thick, extending in depth from 16 to 23 feet below the existing grade was encountered in the borings B-1, B-3, B-4W and B-5. The marsh deposit once formed the ground surface, flanking a small stream that fed into the East River. Prior to the existing development, fill was placed to reclaim the land, forming the current ground surface. The marsh deposit was nominally unsatisfactory bearing material MH, Class 6 material, in accordance with USCS and NYCBC, respectively.

Glacial Alluvium (GA): A stratified deposit of glacial alluvium was encountered beneath the estuarine river deposits and glacial lake deposits in all the borings. The deposit consisted of both well-graded and poorly graded sand, and contained varying percentages of silt and gravel. The thickness of the deposit ranged from 3.5 to 25 feet, varying in depth

from 20.5 to 43 feet below the existing grade. The sand deposits were loose to medium compact to compact in terms of relative density and was classified as SM and SW, Classes 3a, 3b and 6 material, in accordance with the USCS and NYCBC, respectively.

Decomposed Rock/Residual Soil (DR/R_s): Decomposed bedrock and/or residual soil derived from the complete weathering of the underlying parent bedrock were encountered beneath the glacial soils. The residual soil material consisted of sand, silt and decomposed rock fragments and was found overlying the decomposed bedrock. The decomposed rock maintained the fabric and structure of the parent bedrock but was typically weak and could be broken with moderate hand pressure. The residual soil was classified as GP and GW, Class 2a material, and the decomposed rock was classified as Class 1d material, in accordance with the USCS and NYCBC, respectively.

Inwood Marble/Gneiss Bedrock (R): Inwood Marble and Gneiss bedrock was encountered beneath the decomposed rock at depths ranging from 30 to 45 feet in borings B-1, B-3, B-4W and B-5, but was not encountered in borings B-2 and B-6. Boring B-6 was advanced to a depth of 85 feet, but was unable to penetrate the decomposed rock layer. Deep zones of decomposed rock are typical for inter-bedded rock formations with steep folds as was encountered on the site. The core samples of the competent rock possessed recovery values (REC) ranging from 40% to 100% and rock quality designation values (RQD) ranging from 15% to 83% as well. The core samples were classified as Medium Hard Rock, Intermediate Hard Rock, and Soft Rock, Classes 1b, 1c and 1d material, in accordance with the NYCBC.

Groundwater: Groundwater was measured at 8'-5" below the existing grade in the groundwater observation well installed in boring B-4W. The groundwater levels are expected to fluctuate with tidal action in the East River, as well as seasonal wet and dry periods.

Geotechnical Engineering Evaluation

The presence of relatively deep unsuitable fill and soft estuarine deposits preclude the use of shallow foundations for the support of the new building. Conventional shallow foundations bearing in these materials would experience excessive settlement; therefore, excavations to reach suitable bearing soil (glacial soil) would generally be between 16 to 23 feet deep across the site, and as much as 7'-7" to 14'-7" below the measured ground water level. Given the depth of suitable bearing soil on the site, pile foundations will be most economical foundation solution for the proposed building. Two piling options are recommended for the project: 1) driven H piles or open-end pipe piles, 2) drilled caisson piles. Specific recommendations for both piling options are discussed below. Load testing will be required for the driven piles with capacities greater than 40 tons, and for caisson piles that do not reach Class 1b rock or better. Special inspection during installation will be required, regardless of the pile type. The inspection records should be signed and sealed by a professional engineer licensed in the State of New York and submitted to the NYCBD for approval.

Because some of the neighboring buildings may be supported at shallow foundations bearing within the soft surface soils, it would be inadvisable to drive piles within 25 feet of

the neighboring buildings. Ground vibrations generated by pile driving could consolidate the loose fill and soften the estuarine deposits, causing ground loss and/or settlement of surrounding areas. Buildings located within the influence of the ground disturbances could experience significant settlement, resulting in cracking and damage to structural elements, such as walls, floors, beams and columns. As a consequence, we recommend that drilled caisson piles be used in lieu of driven piles within 25 feet of the neighboring structures.

If no cellar level is included in the building design, we recommend constructing a crawl space below the ground floor to allow future access to under-slab utility lines. If no crawl space is included, the ground floor should be pile supported and galvanized steel hangers, suspended from the underside of ground floor slab, should be used to support any underground utility lines.

Engineering Recommendations

Driven Piles

Driven Piles (open-end pipe piles or H piles) can be successfully driven to capacities ranging from 40 to 90 tons capacity within the decomposed rock/bedrock. Typical steel pile sections for 40 and 90-ton pile capacities are presented in the following table. Pile lengths are anticipated to vary from 25 to 50 feet, generally mimicking the depth to compact residual soil or bedrock across the site. Hard driving through the fill should be anticipated, requiring spudding and pre-augering to reach appropriate pile depths. Pile locations intersecting the location of the previous building foundations should be pre-excavated to remove any remnant foundations in order to minimize the number of misaligned piles.

Table 1 – Driven Piles

Pile Capacity	Open-End Pipe Pile	H Pile
40 tons	8 inch O.D. pipe with a 0.322 inch wall, A36 steel	HP 8 X 36
90 tons	10-3/4 inch O.D. pipe with 0.5 inch wall, A36 steel	HP 10 X 57

Piles can be driven using compressed air, single or double acting hammers, with minimum energy of 15,000 or 35,000 ft-lbs for 40 ton and 90 ton capacities. For 90 ton pile capacities, the piles can be driven to refusal (5 blows per ¼ inch) within the residual soil/decomposed rock/bedrock, or to a final driving resistance determined by Pile Dynamic Analyzer (PDA) testing. We recommend that a minimum of 6 index piles should be driven using PDA instrumentation to collect the necessary resistance data to establish the final pile driving criteria. At least two pile load tests must be performed in accordance with NYCBC to verify the driving criteria determined by the PDA test pile program. For 40-ton pile capacities, the final driving resistance can be determined by the following formula.

$$P = 2E / (S+0.1)$$

Where P = allowable load in pounds; E = rated energy in foot-pounds; and S = average penetration in inches per hammer blow over the final foot driving. The driving resistance

due to the non-bearing material must be added to the driving resistance as determined by the driving formula.

The test pile program and installation of production piles should be inspected by a professional engineer licensed in the State of New York.

Drilled Caissons

As discussed, drilled caisson piles bearing within the decomposed rock or underlying bedrock can be used in areas where neighboring buildings are located within 25 feet. Drilled caisson piles bearing in decomposed rock must be treated like driven piles, wherein; load tests will be required to verify the compressive capacity of the piles. Caisson piles bearing within the underlying competent rock do not require load testing to verify compressive capacity. In either case, drilled caisson piles are capable of a wide range of capacities and can be installed with minimal disturbance to adjacent structures. Caisson piles typically consist of N-80 (80 ksi) steel casing with a center-reinforcing rod (75-ksi steel) inserted for full length of the caisson. Typically, the casing will be seated a minimum of 12 inches into the top of bedrock (Class 1b or better) and then the rock socket will be drilled using a slightly smaller bit. Centralizers, spaced 8 to 12 feet on center, should be used to keep the reinforcing rod in the center of the caisson. After the reinforcing rod is installed, the caisson can be tremie grouted, using grout tubes extending to the bottom of the caisson. Grouting will be accomplished in a single step, as the caisson capacity will be developed through sidewall friction in the rock socket. The table below presents typical designs 100-ton, 150-ton and 200-ton capacity mini-caissons.

Table 2 – Mini-Caisson Design Sections

Caisson Capacity	Casing Size (in)	Reinforcing Steel (75 ksi)	Grout (psi)	Rock Socket Diameter, Length
100-ton	7.625 O.D. X 0.43 wall	#14 thread bar	5,000	6.5 in, 9 ft
150-ton	9.625 O.D. X 0.5 wall	#14 thread bar	5,000	7.5 in, 11 ft
200-ton	9.625 O.D. X 0.5 wall	#18 thread bar	5,000	7.5 in, 15 ft

The caisson designs presented above are for estimating purposes only. A final design can be provided once the compression and uplift loads are determined. The caissons must be inspected to verify the construction of the shaft and the depth and quality of the rock socket. The inspection records should be signed and sealed by a professional engineer licensed in the State of New York and submitted to the NYCBD for approval.

Uplift and Lateral Load Capacity

The uplift capacity of the drilled caisson piles will be limited by the tension capacity of the internal threadbar, whereas the uplift capacity of driven piles will be achieved through soil friction and will be a function of the actual pile lengths. For design purposes we recommend using an allowable uplift capacity of 25 tons. Static uplift tests may be required

if the allowable uplift capacity possesses a factor of safety less than 3.0 against the ultimate uplift capacity. If required, the static uplift tests should be performed in accordance with ASTM D3689.

The NYCBC allows for a minimum lateral load capacity of 1 ton per pile. Higher capacities must be verified by lateral load tests performed in accordance with ASTM D3966.

Ground Floor Slabs

The existing fill in its current condition is unsuitable for the support of a new ground floor slab. Therefore, the ground floor slab should be designed as structural slab, supported on grade beams spanning between pile caps or individual piles evenly spaced throughout the floor area. The floor piles should be the same type and quality as column piles and should be the same capacity.

If a crawl space is utilized, the crawl space floor can be designed as a conventional slab-on-grade bearing within the existing fill, after the fill has been prepared in accordance with the following recommendations. The existing fill should be excavated to a nominal depth of 12 inches below the planned crawl space slab. The resulting subgrade should be compacted to 95% of the maximum dry density as determined by ASTM D1557. Areas that cannot be suitably compacted should be over excavated to firm ground and the resulting subgrade re-compacted. Once approved, over-excavated areas should then be filled using select fill material (see Table-3) placed in 1-foot loose lifts and compacted to the same 95% of the maximum dry density as determined by ASTM D1557. The fill should be tested and approved prior to placing the crawl space slab. A continuous vapor retarder should be placed between the select fill and the crawl space slab to reduce moisture within the crawl space.

Table 3 - Select Fill

Sieve Size	Percent Passing
1.0 in	100
3/4 in	100 – 80
No. 4	80 – 60
No. 40	60 – 30
No. 200	< 15

Seismic Evaluation and Criteria

The proposed structure must be designed in accordance with all applicable New York City Building Code seismic design criteria. The site classes are based on the average soil properties in the upper 100 feet. The soil and rock encountered in the borings most closely resemble a “Very Dense Soil Profile”, Site Class C. The profile is based on Table 1613.5.2

of the NYCBC. Peak accelerations may be estimated using Table 1813.2.1 and values for the site coefficients F_a and F_v may be estimated using Tables 1613.5.3(1) and 1613.5.3(2), respectively. The building code requires an evaluation of the liquefaction potential of non-cohesive soils below the groundwater table and to a depth of 50 feet below the ground surface. The potential for liquefaction was evaluated using methods recommended by the National Center for Earthquake Engineering Research 2001 committee workshop report chaired by Youd, which is considered the state of the practice by the National Earthquake Hazard Reduction Program. The results of the analyses showed that the site has an adequate margin of safety against liquefaction.

Excavation

Temporary, shallow excavations with vertical sides less than 4 feet high will generally be stable, although there is a potential for sloughing. Temporary excavations sides greater than 4 feet in depth may be sloped back at an inclination of 1.5:1 (horizontal to vertical). Some sloughing or erosion of surface soils should be anticipated. All applicable safety requirements and regulations, including OSHA requirements should be met.

Underpinning

Underpinning of neighboring buildings will be required where new foundations extend below neighboring foundations. If required, the underpinning should be supported on drilled piles or titan piles. The piles should be installed at each underpinning pit location before the pits are excavated. The pits should be lagged to prevent sloughing or loss bearing capacity during excavation. Once the piles are installed, the underpinning pits can be excavated in sequence, in which every fourth pit is excavated and concreted. The final 3 inches should be performed using steel wedges and plates, and dry pack concrete. The sequence is repeated until the entire walls are completely supported on the new pile supported concrete underpinning. The individual underpinning pits should be 4 feet wide and should extend 1-foot below the planned depth of the excavation on the site.

Exterior Fill and Backfill

All compact fill and backfill placed outside the building footprint, beneath floor slabs, pavements and used for backfilling foundation walls and utility trenches should be performed in a controlled manner using onsite or off-site material free of organic matter and debris. The fill material should be placed in 8-inch thick loose lifts and compacted to 95% of the maximum dry density as determined ASTM D1557. Compaction can be performed using walk-behind vibratory plate or roller type compactors. Lift thickness may be increased to 12 inches for larger compaction equipment. Imported fill material, if required, should be approved prior to its use.

Demolition of Remnant Foundations

The cellar depths of the neighboring buildings to the west should be determined prior to finalizing plans for demolition. Removal of remnant walls during demolition should be performed carefully to ensure the neighboring footings are not undermined. If required, soil

berms and/or additional steel bracing can be constructed against the neighboring foundation walls to resist lateral earth, groundwater and foundation pressures.

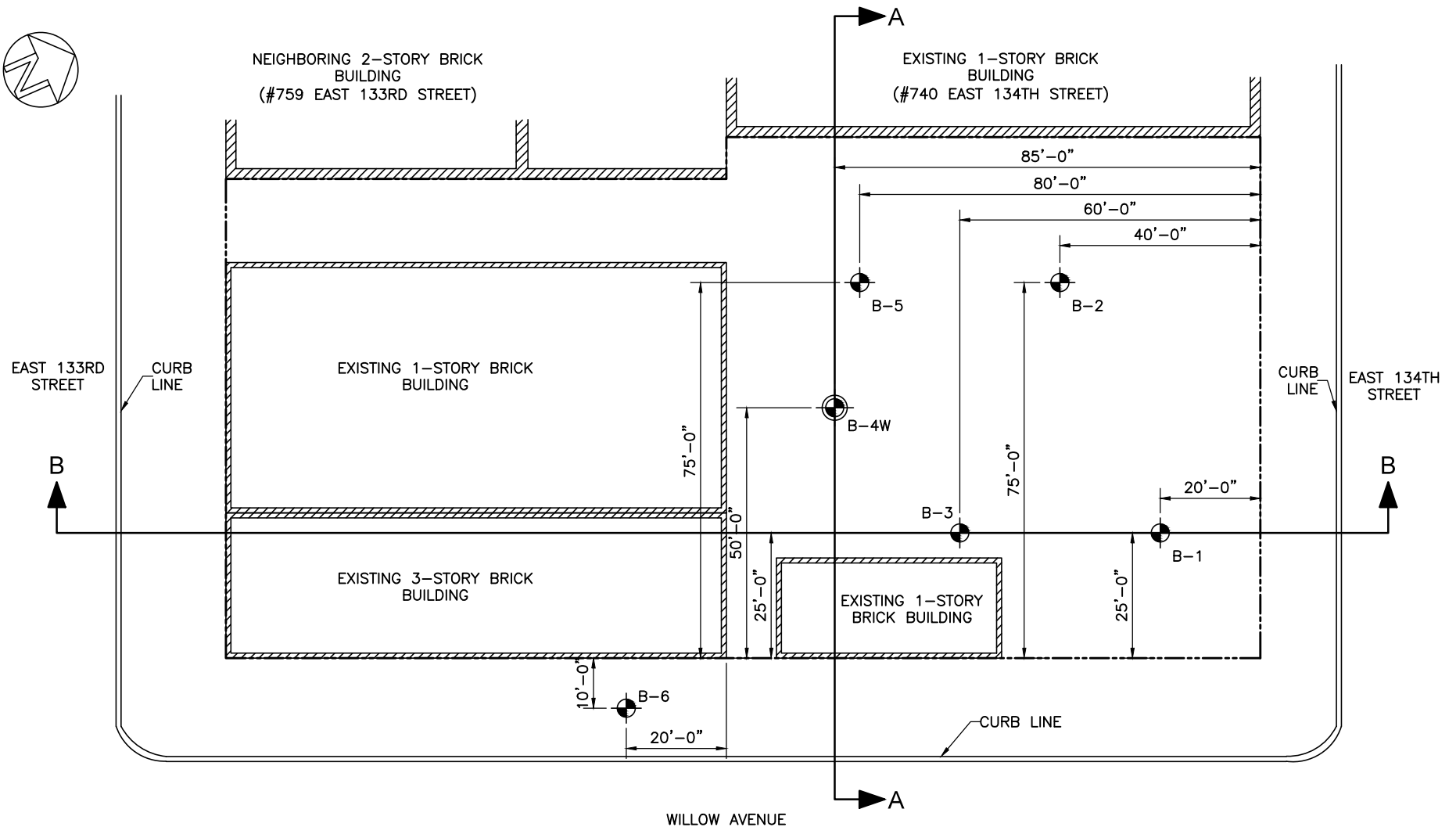
Protection of Adjacent Structure

We strongly recommend that a pre-construction survey be conducted for the neighboring buildings adjacent to the site. The survey should be completed prior to construction. Each building should be inspected and photographed, inside and out, to record existing conditions. In addition, crack monitors should be installed on all visible cracks greater than 1/16 inches.

Vibration and optical survey monitoring programs should be implemented to record potential movements of the neighboring buildings. The monitoring program should be initiated prior to the start of construction, and periodic readings should be taken during construction. Any landmark buildings located within 90 feet of the site must be monitored in accordance with TPPN 10/88.

Closure

This report presents the results of the preliminary geotechnical investigation performed at 111 Willow Avenue in Bronx, New York. This report is not a bid document, and any contractor reviewing this report must draw his own conclusions regarding specific construction techniques to be used on this project.



LEGEND

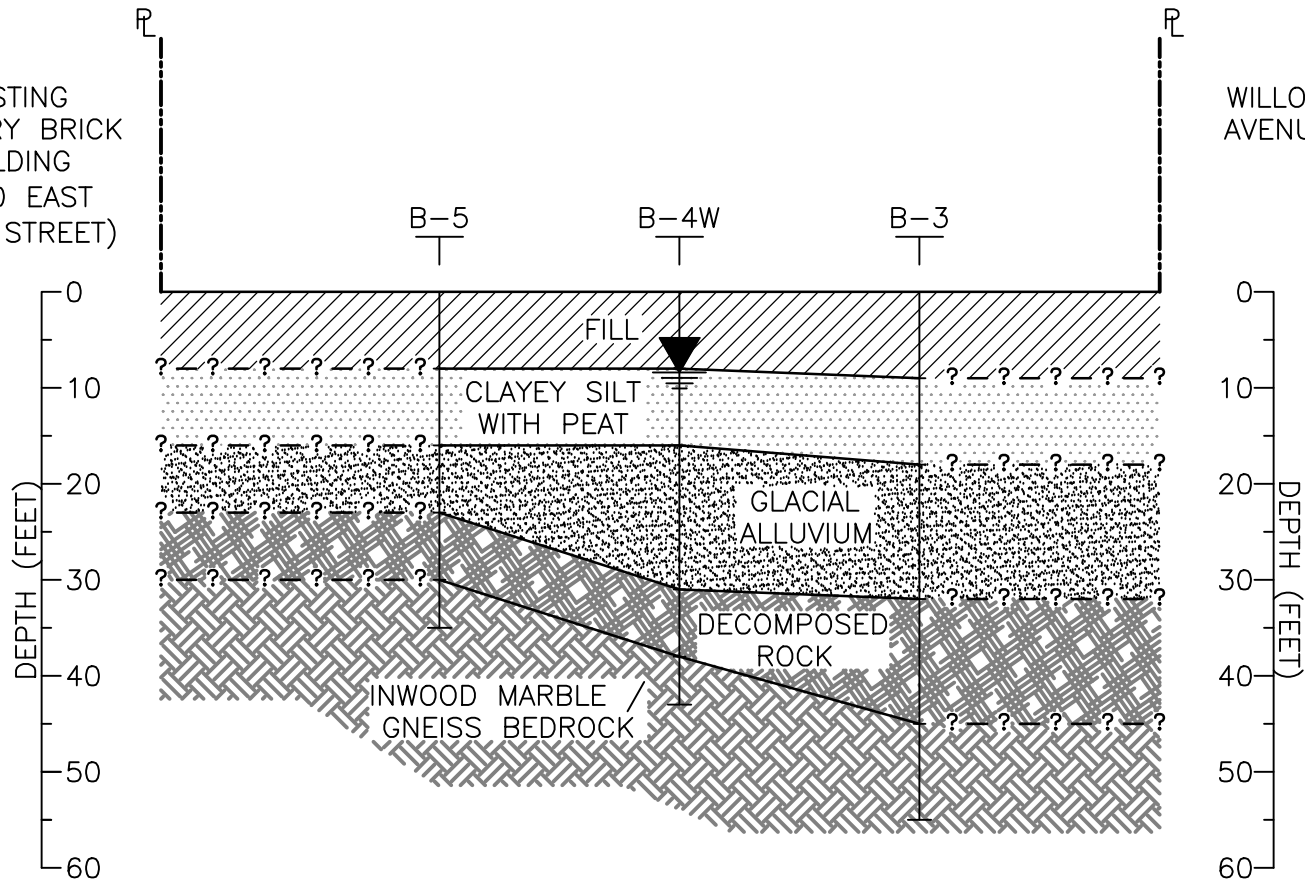
- B-1 BORING LOCATION
- B-4W BORING LOCATION WITH WELL

SCALE: 1" = 30'

Title: BORING LOCATION PLAN		
Project: 111 WILLOW AVENUE BRONX, NEW YORK		
PILLORI ASSOCIATES, P.A. Geotechnical Engineering 71 Route 35, Laurence Harbor, NJ 08879 333 Meadowlands Parkway, Suite 102 Secaucus, NJ 07094	Date: 11-09-2017	Dwg No. 1
	Job No.: 170309	

EXISTING
1-STORY BRICK
BUILDING
(#740 EAST
134TH STREET)

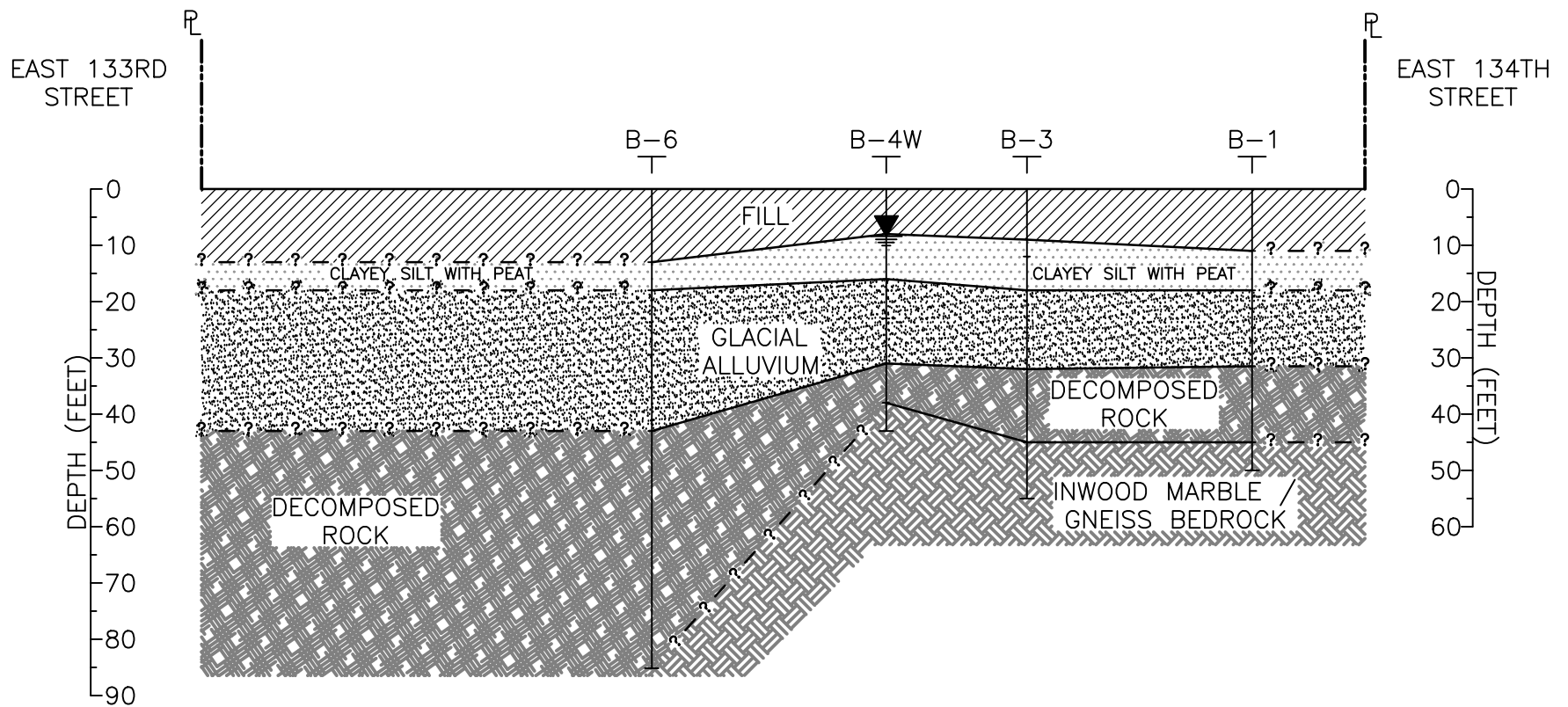
WILLOW
AVENUE



SUBSURFACE SECTION A-A

SCALE: 1" = 20'

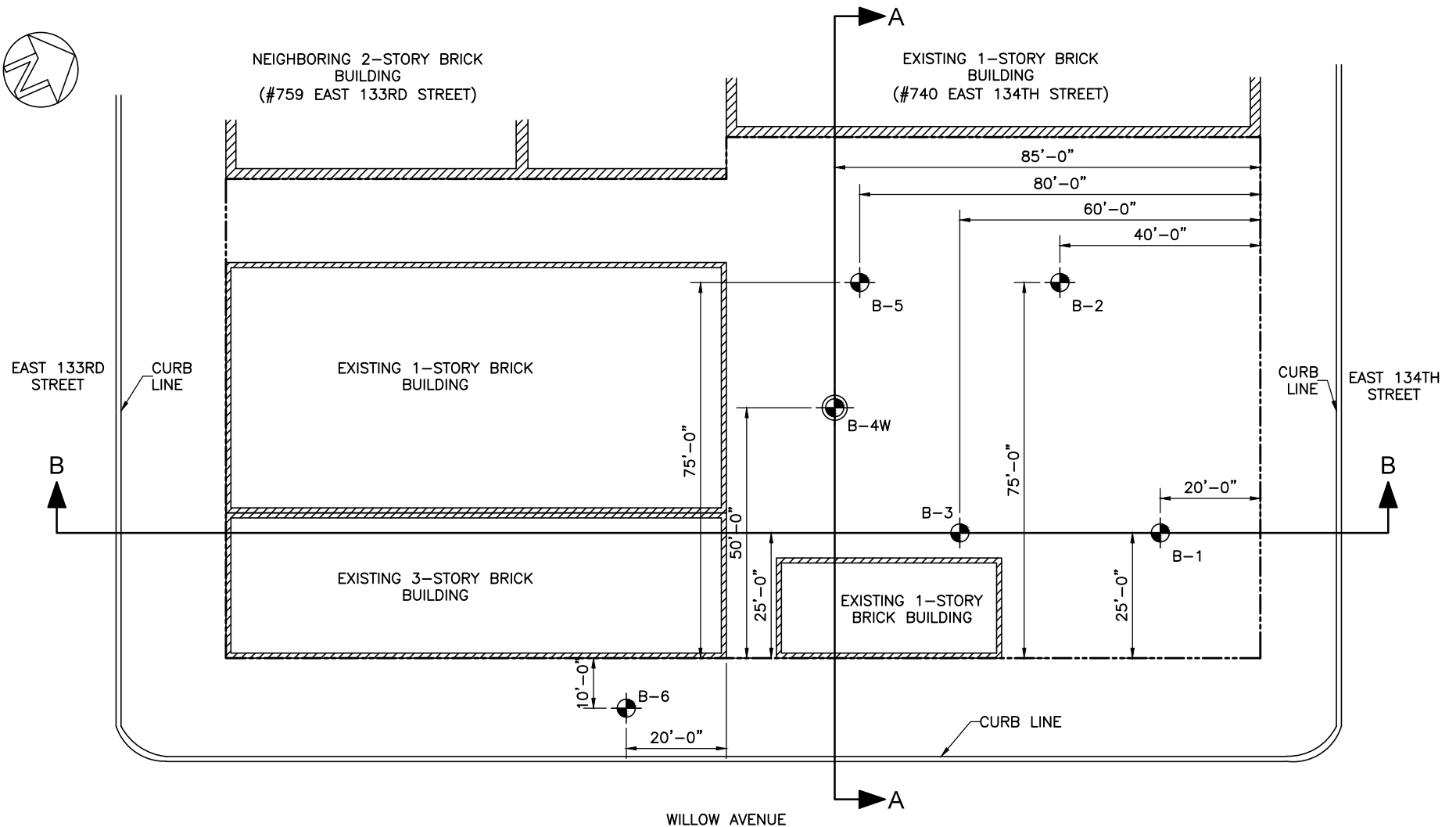
Title: SOIL/ROCK PROFILE - 1		
Project: 111 WILLOW AVENUE BRONX, NEW YORK		
PILLORI ASSOCIATES, P.A. <i>Geotechnical Engineering</i> 71 Route 35, Laurence Harbor, NJ 08879 333 Meadowlands Parkway, Suite 102 Secaucus, NJ 07094	Date: 11-15-2017	Dwg No. 2
	Job No.: 170309	



SUBSURFACE SECTION B-B

SCALE: 1" = 30'

Title: SOIL/ROCK PROFILE - 2		
Project: 111 WILLOW AVENUE BRONX, NEW YORK		
PILLORI ASSOCIATES, P.A. <i>Geotechnical Engineering</i> 71 Route 35, Laurence Harbor, NJ 08879 333 Meadowlands Parkway, Suite 102 Secaucus, NJ 07094	Date: 11-15-2017	Dwg No. 3
	Job No.: 170309	



LEGEND

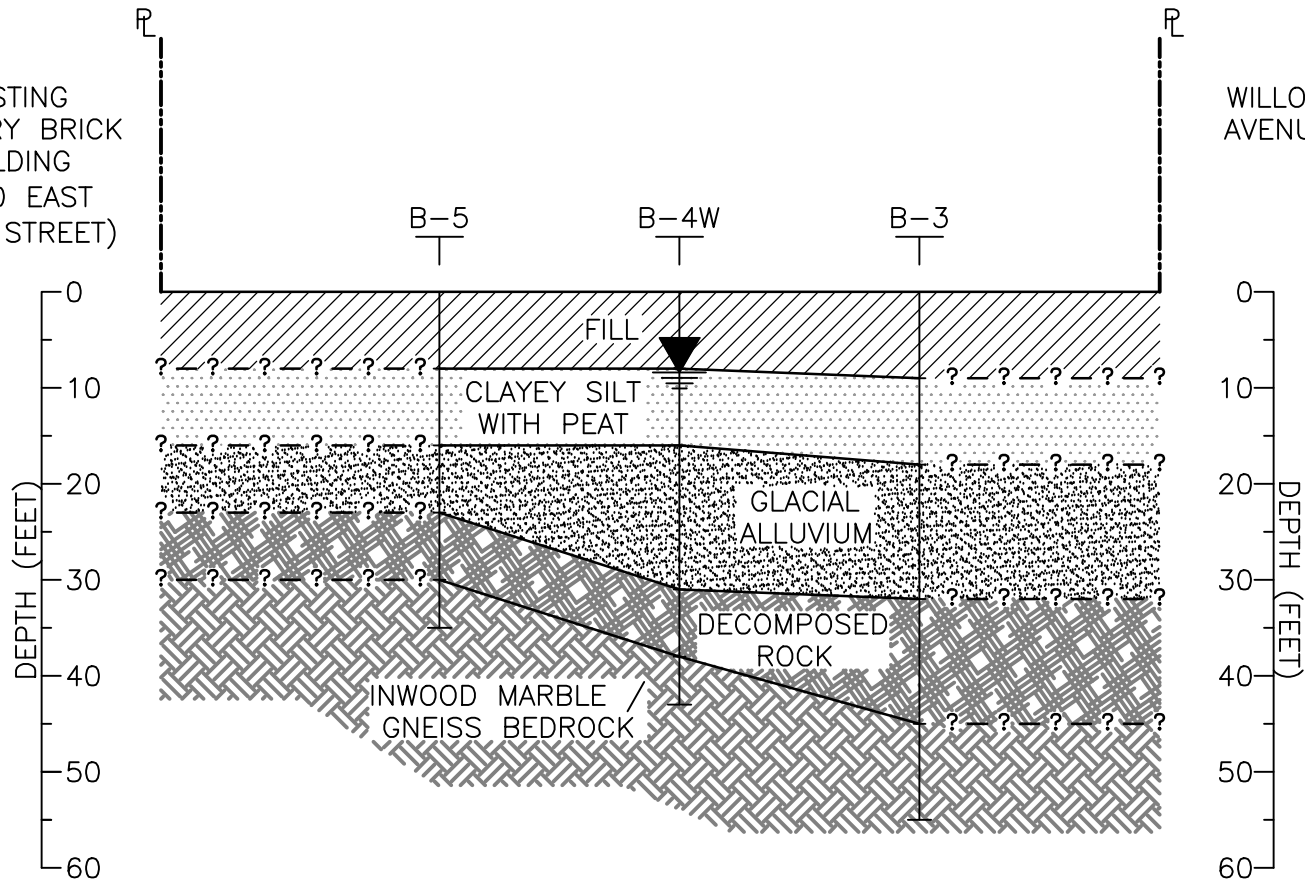
- B-1 BORING LOCATION
- B-4W BORING LOCATION WITH WELL

SCALE: 1" = 30'

Title: BORING LOCATION PLAN		
Project: 111 WILLOW AVENUE BRONX, NEW YORK		
PILLORI ASSOCIATES, P.A. Geotechnical Engineering 71 Route 35, Laurence Harbor, NJ 08879 333 Meadowlands Parkway, Suite 102 Secaucus, NJ 07094	Date: 11-09-2017	Dwg No. 1
	Job No.: 170309	

EXISTING
1-STORY BRICK
BUILDING
(#740 EAST
134TH STREET)

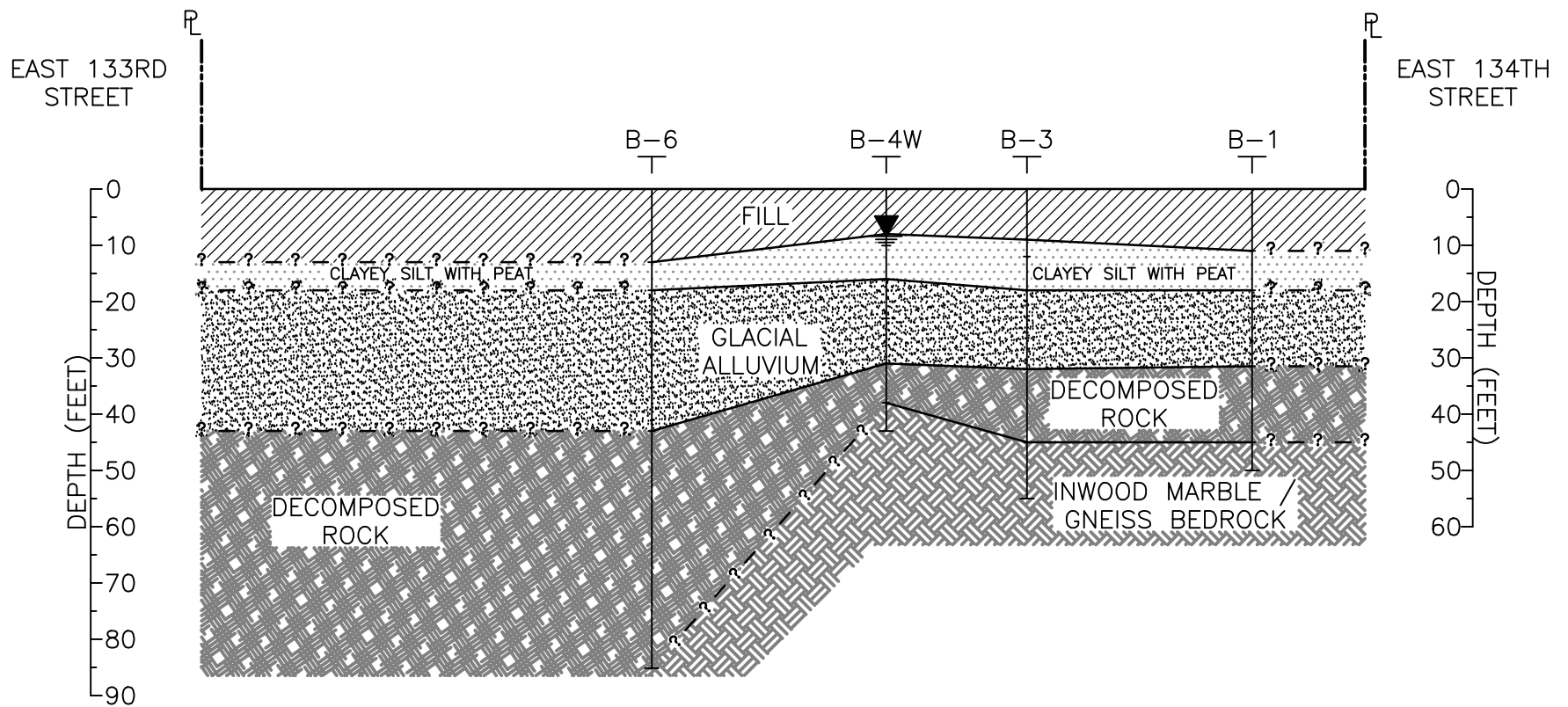
WILLOW
AVENUE



SUBSURFACE SECTION A-A

SCALE: 1" = 20'

Title: SOIL/ROCK PROFILE - 1		
Project: 111 WILLOW AVENUE BRONX, NEW YORK		
PILLORI ASSOCIATES, P.A. <i>Geotechnical Engineering</i> 71 Route 35, Laurence Harbor, NJ 08879 333 Meadowlands Parkway, Suite 102 Secaucus, NJ 07094	Date: 11-15-2017	Dwg No. 2
	Job No.: 170309	



SUBSURFACE SECTION B-B

SCALE: 1" = 30'

Title: SOIL/ROCK PROFILE - 2		
Project: 111 WILLOW AVENUE BRONX, NEW YORK		
PILLORI ASSOCIATES, P.A. <i>Geotechnical Engineering</i> 71 Route 35, Laurence Harbor, NJ 08879 333 Meadowlands Parkway, Suite 102 Secaucus, NJ 07094	Date: 11-15-2017	Dwg No. 3
	Job No.: 170309	

Project: **111 Willow Avenue**
Bronx, New York
Date: 10-30-2017 to 10-31-2017
Contractor: Warren George, Inc.

Boring No.: B-1
Sheet: 1 of 1
Ground El: NA
Groundwater Depth: NA

Depth Feet	SAMPLES			SOIL DESCRIPTION	Classification Depth Elevation
	Number	Blows / 6"	Strata		
5	S-1	1-2-1-1	F	Brown coarse to fine Sand w/brick, concrete fragments, & miscellaneous debris	FILL (7)
	S-2	3-1-1-1			
10	S-3	16-13-8-3	Es	Gray clayey Silt, little fine Sand, with black Peat	11'-0"
15	S-4	WOR-2-3-6		Gray clayey Silt, trace fine Sand, with black Peat	MH (6) 18'-0"
20	S-5	10-13-14-50/4"	GA	Brown fine Sand, some Silt	SM (3b) 23'-0"
25	S-6	(8-2-2-2)* Disturbed		Boulder from 23.0' to 24.0' Brown coarse to fine Sand, some Silt, little medium to fine Gravel	SM 28'-0"
30	S-7	5-3-8-100/5"		Brown coarse to fine Sand, some Silt, some coarse to fine Gravel	SM (3b) 31'-6"
35	R-1	RUN = 60" 35.0' - 40.0' REC = 50% RQD = 0%	DR	Decomposed Rock	(1d) 45'-0"
40	S-8	53-89-50/1"			
45	R-2	RUN = 60" 45.0' - 50.0' REC = 50% RQD = 15%	R	Inwood Marble Bedrock: Soft, weathered	(1d) 50'-0"
50				End of Boring	

Project: **111 Willow Avenue**
Bronx, New York
Date: 10/31/2017 to 11/01/2017
Contractor: Warren George, Inc.

Boring No.: B-2
Sheet: 1 of 1
Ground El: NA
Groundwater Depth: NA

Depth Feet	SAMPLES			SOIL DESCRIPTION	Classification Depth Elevation
	Number	Blows / 6"	Strata		
5	S-1	7-5-8-5	F	Brown coarse to fine Sand, little Silt, trace fine Gravel with brick fragments	FILL (7) 8'-0"
	S-2	4-7-11-9			
10	S-3	26-10-7-8	Es	Gray-brown clayey Silt, little fine Sand	ML (5b) 17'-0"
15	UT-1	PUSH = 24"			
	S-4	9-22-10-12	GA	Brown coarse to fine Sand, trace Silt	SW (3a) 20'-6"
20	S-5	80-50/0"			
25	S-6	80-100/2"	Rs/ DR	Brown medium to fine Sand, trace Silt with decomposed rock fragments	GP (2a) 28'-6"
30					
35				End of Boring	
40					
45					
50					

Project: **111 Willow Avenue**
Bronx, New York
Date: 11-01-2017 to 11-02-2017
Contractor: Warren George, Inc.

Boring No.: B-3
Sheet: 1 of 2
Ground El: NA
Groundwater Depth: NA

Depth Feet	SAMPLES			SOIL DESCRIPTION	Classification	
	Number	Blows / 6"	Strata		Depth	Elevation
	S-1	7-7-5-4	F	Gray coarse to fine Sand, trace Silt, trace fine Gravel, with asphalt fragments	FILL (7)	9'-0"
5	S-2	6-2-5-11				
	S-3	1-2-2-1				
10	S-4	2-3-4-4	Es	Gray clayey Silt, little fine Sand, with black Peat	MH (6)	18'-0"
15	UT-1	PUSH = 24"				
	S-5	5-8-13-15				
20	S-6	(7-3-3-4)* Disturbed	GA	Brown coarse to fine Sand, little Silt	SM (3b)	23'-0"
25	S-7	(4-5-6-8)* Disturbed		Brown coarse to fine Sand, trace Silt, trace fine Gravel	SW (3b)	28'-0"
30	S-8	5-16-51-100/4"		Brown coarse to fine Sand, trace Silt, trace fine Gravel	SW (3a)	32'-0"
35	R-1	RUN = 60" 35.0' - 40.0' REC = 100% RQD = 0%	DR	Decomposed Rock	(1d)	45'-0"
40	S-8	13-33-63-88				
45	R-2	RUN = 60" 45.0' - 50.0' REC = 40% RQD = 15%	R	Inwood Marble Bedrock: Soft, weathered	(1d)	50'-0"
50						
					(1c)	

Project: **111 Willow Avenue**
Bronx, New York
 Date: 11-01-2017 to 11-02-2017
 Contractor: Warren George, Inc.

Boring No.: B-3
 Sheet: 2 of 2
 Ground El: NA
 Groundwater Depth: NA

[illegible]

Project: **111 Willow Avenue**
Bronx, New York
 Date: 11-02-2017 to 11-03-2017
 Contractor: Warren George, Inc.

Boring No.: B-4W
 Sheet: 1 of 1
 Ground El: NA
 Groundwater Depth: 8'-5"

Depth Feet	SAMPLES			SOIL DESCRIPTION	Classification Depth Elevation
	Number	Blows / 6"	Strata		
5	S-1	11-12-15-10	F	Gray coarse to fine Sand, trace Silt, trace fine Gravel, with brick fragments	FILL (7) 8'-0"
	S-2	8-6-4-3			
10	S-3	7-4-5-8	Es	Gray clayey Silt, and fine Sand, with black Peat	MH (6) 16'-0"
15	S-4	4-4-7-8			
20	S-5	WOH-WOH-2-3* Disturbed	GA	Brown medium to fine Silt, some fine Sand	SM 23'-0"
25	S-6	(4-2-3-4)* Disturbed		Brown coarse to fine Sand, little Silt, trace fine Gravel	SM 28'-0"
30	S-7	7-11-78-50/0"		Brown coarse to fine Sand, trace Silt, little fine Gravel	SW (3b) 31'-0"
35	S-8	28-100/3"	DR	Decomposed Rock	(1d) 38'-0"
40	R-2	RUN = 60" 38.0' - 43.0' REC = 73% RQD = 50%	R	Gneiss Bedrock: intermediate Hard, slightly weathered, mediumly jointed	(1c) 43'-0"
45				End of Boring	
50					

Project: **111 Willow Avenue**
Bronx, New York
 Date: 11-03-2017
 Contractor: Warren George, Inc.

Boring No.: B-5
 Sheet: 1 of 1
 Ground El: NA
 Groundwater Depth: NA

Depth Feet	SAMPLES			SOIL DESCRIPTION	Classification	
	Number	Blows / 6"	Strata		Depth	Elevation
5	S-1	6-9-16-13	F	Gray coarse to fine Sand, trace Silt, trace fine Gravel, with asphalt fragments	FILL (7)	8'-0"
	S-2	4-3-3-2				
10	S-3	3-1-1-2	Es	Gray clayey Silt, little fine Sand, with black Peat	MH (6)	16'-0"
15	S-4	(7-10-5-3)* Disturbed				
20	S-5	13-8-13-58	GA	Brown coarse to fine Sand, trace Silt, trace fine Gravel	SW (3b)	23'-0"
25	S-6	100/4"				
30	R-1	RUN = 60" 30.0' - 25.0' REC = 100% RQD = 83%	Rs/ DR	Brown coarse to fine Sand, trace Silt, trace fine Gravel with decomposed rock fragments	GW (2a)	30'-0"
35			R	Gneiss Bedrock: medium Hard, unweathered, closely jointed	(1b)	35'-0"
				End of Boring		
40						
45						
50						

Project: **111 Willow Avenue**
Bronx, New York
 Date: 11-06-2017 to 11-07-2017
 Contractor: Warren George, Inc.

Boring No.: B-6
 Sheet: 1 of 2
 Ground El: NA
 Groundwater Depth: NA

Depth Feet	SAMPLES			SOIL DESCRIPTION	Classification	
	Number	Blows / 6"	Strata		Depth	Elevation
5	S-1	13-14-8-7	F	Gray coarse to fine Sand, trace Silt, trace fine Gravel, with asphalt fragments	FILL (7)	13'-0"
	S-2	3-2-90-27				
10	S-3					
15	S-4	2-2-7-11	Es	Gray clayey Silt, little fine Sand	ML (6)	18'-0"
20	S-5	17-28-28-17	GA	Brown coarse to fine Sand, little Silt, little coarse to fine Gravel	SM (3a)	43'-0"
25	S-6	15-16-22-21				
30	S-7	15-29-44-26				
35	S-8	13-15-19-22				
40	S-9	20-31-24-36				
45	S-10	38-37-30-38	DR	Decomposed Rock	(1d)	
50	S-11	39-100/4"				

Project: **111 Willow Avenue**
Bronx, New York
 Date: 11-06-2017 to 11-07-2017
 Contractor: Warren George, Inc.

Boring No.: B-6
 Sheet: 2 of 2
 Ground El: NA
 Groundwater Depth: NA

Depth Feet	SAMPLES			SOIL DESCRIPTION	Classification Depth Elevation
	Number	Blows / 6"	Strata		
	S-11	39-100/4"	 DR	Decomposed Rock	(1d)
55	S-12	100/2"			
60					
65	S-13	100/2"			
70					
75	S-14	100/1"		Decomposed Rock	(1d)
80	R-1	RUN = 60" 80.0' - 85.0' REC = 0% RQD = 0%			
85	S-15	100/2"			
				End of Boring	85'-2"
90					
95					
100					

SOIL CLASSIFICATION CHART					
MAJOR DIVISIONS			GROUP SYMBOLS (ASTM D2487)	TYPICAL DESCRIPTIONS	
COARSE-GRAINED SOIL MORE THAN 50% RETAINED ON NO.200 SIEVE*	GRAVEL 50% OR MORE OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL- GRADED GRAVEL & GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
			GP	POORLY GRADED GRAVEL & GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
		GRAVEL WITH FINES	GM	SILTY GRAVEL, GRAVEL SAND CLAY MIXTURES	
			GC	CLAYEY GRAVEL, GRAVEL SAND CLAY MIXTURES	
	SANDS MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND & GRAVELLY SAND, LITTLE OR NO FINES	
			SP	POORLY GRADED SAND & GRAVELLY SAND, LITTLE OR NO FINES	
		SAND WITH FINES	SM	SILTY SAND, SAND-SILT MIXTURES	
			SC	CLAYEY SAND, SAND-CLAY MIXTURES	
FINE-GRAINED SOIL 50% OR MORE PASSING NO.200 SIEVE*	SILT & CLAY LIQUID LIMIT LESS THAN 50%	ML	INORGANIC SILT, VERY FINE SAND, ROCK FLOUR, SILTY OR CLAYEY FINE SAND		
		CL	INORGANIC CLAY OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAY, SANDY CLAY, SILTY CLAY, LEAN CLAY		
		OL	ORGANIC SILT & ORGANIC SILTY CLAY OF LOW PLASTICITY		
	SILT & CLAY LIQUID LIMIT GREATER THAN 50%	MH	INORGANIC SILT, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT, ELASTIC		
		CH	INORGANIC CLAY OF HIGH PLASTICITY, FAT CLAY		
		OH	ORGANIC CLAY OF MEDIUM TO HIGH PLASTICITY		
HIGHLY ORGANIC SOIL			PT	PEAT, MUCK & OTHER HIGHLY ORGANIC SOIL	

* BASED ON MATERIAL PASSING THE 3" (75MM) SIEVE

GRADATION**

COMPACTNESS**
(SAND AND/OR GRAVEL)

CONSISTENCY**
(CLAY AND/OR SILT)

GRADATION**				COMPACTNESS**				CONSISTENCY**			
TERM	% BY WEIGHT			TERM	% RELATIVE DENSITY			SHEAR STRENGTH TERM	TONS/SQ.FT.		
TRACE	1	TO	10	LOOSE	0	TO	40	SOFT	LESS THAN 0.25		
LITTLE	10	TO	20	MEDIUM DENSE	41	TO	70	FIRM	0.25	TO	0.5
SOME	20	TO	35	DENSE	71	TO	90	STIFF	0.5	TO	1.0
AND	35	TO	50	VERY DENSE	91	TO	100	VERY STIFF	1.0	TO	2.0
								HARD	OVER 2.0		

** VALUES ARE FROM LABORATORY OR FIELD TEST DATA, WHERE APPLICABLE, WHEN NO TESTING WAS PERFORMED VALUES ARE ESTIMATED.