LANGAN

Memorandum

Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
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To: Ms. Rose Tilley (RXR Development Services)

From: Jared Green, Sukh Gurung, Karmen Chong, Terrence Cheung

Info: Chris Vitolano

Date: 28 March 2018 **(revised 18 April 2018)**

Re: Preliminary Geotechnical Engineering Memorandum
42-11 9th Street
Queens, NY
Langan Project No.: 170514701

This memorandum summarizes the results of our preliminary subsurface investigation and presents our conceptual schemes for foundations and other geotechnical aspects of design and construction. We performed our services in accordance with our authorized proposal (12 February 2018) to RXR Development Services.

Our understanding of the project was based on our site investigation and the zoning study (11 October 2018) by Perkins Eastman. Topographic information was taken from the Boundary & Topographic survey (14 March 2018) prepared by Control Point Associates, Inc. All elevations in this report are referenced to the North American Vertical Datum of 1988 (NAVD88).

Analyses and recommendations presented here are in accordance with the 2014 New York City Building Code.

SITE DESCRIPTION

The site (Block 461, Lot 16) is at the northern part of the city block, bounded by Queens Plaza South on the north, 10th Street on the east, 43rd Avenue on the south, and 9th Street on the west. The footprint of the site is about 49,400 square feet. The site is occupied by a 1- to 2-story commercial building (built around 1939) without below-grade levels with a footprint of about 39,000 square feet at the north, a 1.5-story metal commercial building (built around 1939) without below-grade levels with a footprint of about 4,900 square feet at the southeast, and an enclosed 4,000-square-foot at-grade concrete parking area at the southwest. The top of the existing ground-floor slab of the main building is at about el 15.

The sidewalk grade fronting the site along Queens Plaza South slopes down from the east (el 18) to the west (el 13), along 10th Street slopes down from the north (el 18) to the south (el 14), and along 9th Street slopes down from the south (el 15) to north (el 13). A site location map is presented as Figure No. 1.

Adjacent Building

One lot borders the site on the south:

- 42-25 9th Street (Block 461, Lot 13): A three-story building with two below-grade levels, built in about 1919, abuts the site at the south. The building occupies the western half of the lot, and an at-grade asphalt parking area covers the other half of the lot.

No existing foundation drawings for this building were available to Langan at the time of writing this memorandum. The number of stories and the number of cellars in this adjacent building were obtained from city Department of Building records[1].

Adjacent DOT and NYCT Structures

A New York City Department of Transportation (DOT) bridge abutment is about 80 feet from the site's north property line. The Queensboro Bridge runs directly above Queens Plaza South. Interaction with the DOT should be expected during the project permitting phase, and possibly during foundation construction.

A New York City Transit (NYCT) building is about 80 feet to the northwest of the site. Additionally, an NYCT manhole was observed about 200 feet to the north of the site on the opposite side of the Queensboro Bridge. The exact locations and extents of the NYCT tunnel (N, Q, and R subway lines) and other below-grade structures will require additional research.

Design and construction of the proposed building must conform to NYCT requirements and restrictions due to the proximity to the NYCT structures. The Department of Buildings (DOB) protocol will require a Letter of No Impact from NYCT before issuing building permits.

[1] New York City Department of Buildings website property profile and certificate of occupancy (www.nyc.gov)

FEMA Flood Insurance Rate Map

We have reviewed the Preliminary Flood Insurance Rate Maps (FIRM) for the City of New York published by the Federal Emergency Management Agency (FEMA). The site is within Community Panel No. 3604970089G (5 December 2013). The Preliminary FIRM shows the majority of the site within the unshaded area of Flood Hazard Zone X: "areas determined to be outside the 0.2 percent annual chance floodplain." A hatched portion of Flood Hazard Zone X, "areas of 0.2 % annual chance of flood," directly borders the site at the southeast. The relevant portion of the FEMA FIRM is provided as Figure No. 2.

PROPOSED DEVELOPMENT

The proposed development options presented by Perkins Eastman include the construction of a new 12- or 13-story building with a full cellar level. The top of the proposed cellar slab is assumed to extend to about 15 feet (el 0) below sidewalk grade. From our discussion, we understand that partial- or no-cellar options are being considered. The structural information was not available at the time of this memorandum.

PRELIMINARY SUBSURFACE INVESTIGATION

Our preliminary subsurface investigation consisted of drilling two borings, B-1(OW) and B-2(OW) and installing two monitoring wells within the completed borings. A boring location plan is provided as Figure No. 3. Copies of the installation logs are included in Appendix A. To comply with Building Code requirements, ten additional borings that will be needed can be performed after the demolition of the existing buildings. If needed, interior borings can be performed before to the building demolition by a portable limited-access drill rig.

Laboratory Testing

Geotechnical laboratory tests were conducted on representative soil samples to confirm visual field classifications and to define index properties (physical and mechanical) for use in evaluating and designing the foundation system. The laboratory tests consisted of:

- Five mechanical grain-size determinations (sieve analysis; ASTM D422); and
- Five natural water content determinations (ASTM D2216)

The laboratory test results are included in Appendix B.

SUBSURFACE CONDITIONS

The subsurface conditions generally consist of uncontrolled fill underlain by a layer of medium-dense to dense sand, and finally bedrock at 15 to 19 feet below sidewalk grade. Groundwater was encountered at about 9 to 10 feet below sidewalk grade. The subsurface profile is included as Figure No. 4.

SEISMIC EVALUATION

This section presents the results of our seismic evaluation for the site relative to the provisions outlined in the 2014 NYC Building Code. The following subsections provide recommended parameters for use in the seismic design of the proposed structure. Our seismic evaluation is based on the two sidewalk borings performed at the site. This evaluation will need to be performed again after the balance of the borings is performed.

NYC Building Code Seismic Design Parameters

The recommended Building Code seismic parameters are based on the average N-value in the soil. The soil profile below the foundation level is consistent with Site Class C "Soft Rock Profile," and we assumed that the structure is Structural Occupancy/Risk Category II (to be confirmed by the structural engineer). For Structural Occupancy II and Site Class C, the design spectral accelerations result in Seismic Design Category (SDC) B. The seismic design parameters are presented in Table 1. If the additional subsurface investigation reveals different subsurface conditions or elevation of bedrock, these parameters will be updated accordingly.

Table 1 – Seismic Design Parameters

Description	Parameter	Recommended Value	Building Code Reference
Mapped Spectral Acceleration for short periods:	S_s	0.281 g	Section 1613.5.1
Mapped Spectral Acceleration for 1-sec period:	S_1	0.073 g	
Site Class	Soft Rock Profile	**C**	Table 1613.5.2
Site Coefficient:	F_a	1.20	Table 1613.5.3(1)
Site Coefficient:	F_v	1.70	Table 1613.5.3(2)
5 percent damped design spectral response acceleration at short periods:	**S_{DS}**	**0.225 g**	Section 1613.5.4
5 percent damped design spectral response acceleration at 1-sec period:	**S_{D1}**	**0.083 g**	
SDC for Structural Occupancy II		**B**	Table 1613.5.6
Peak Ground Acceleration	**PGA**	**0.20**	Table 1813.2.1

Liquefaction Evaluation

Soil liquefaction is a phenomenon primarily associated with saturated, loose, cohesionless soils near the ground surface at depths less than 50 feet. The liquefaction potential was evaluated using both the 2014 Building Code.

In accordance with the Building Code screening process, N-values versus depth are plotted on the Building Code Liquefaction Assessment Chart in Figure No. 5. The majority of N-values fall within "Liquefaction Evaluation Not Required." Based on these results, our opinion is that liquefaction need not be considered for foundation design.

FOUNDATION RECOMMENDATIONS

Shallow Foundations

We recommend shallow foundations consisting of conventional spread footings bearing on Class 1b bedrock to be used for the cellar-level option. The recommended allowable bearing pressure is 40 tons per square foot (tsf). The minimum side dimension should not be less than

3 feet for spread footings and not less than 2 feet for continuous footings. All footings should be protected from frost by extending to a minimum of 4 feet below the lowest adjacent permanent exposed grade.

Settlement Evaluation

Total settlements are not expected to exceed 1/2 inch for footings bearing on bedrock. The majority of the settlement will occur as the dead load of the building superstructure is applied to the foundation system.

Lateral Resistance

Lateral loads can be resisted by friction along the bottom of the footings. The recommended sliding friction coefficient, with a factor of safety of 1.5, is 0.2 for waterproofed surfaces and 0.6 for concrete cast on the rock subgrade. Passive pressure may be used in combination with friction to resist lateral loading on the footings.

Deep Foundations

For any portions of the building with no cellar – we recommend a deep foundation system consisting of caisson piles socketed into the Class 1b bedrock for foundation support.

Caisson Piles

A caisson pile consists of an open-ended steel pipe drilled into the top of the rock and an uncased rock socket. The steel pipe should be advanced using duplex-drilling techniques with internal water flushing through the overburden material with a soil plug above the tip of casings. The rock socket is often drilled into the bedrock using a down-the-hole hammer. After drilling, both the steel pipe and the rock socket are installed with steel reinforcement and filled with grout.

The allowable capacity of the caisson pile is derived from the peripheral shear between the concrete fill and the side of the rock socket. The recommended peripheral shear resistance for is 200 pounds per square inch (psi) in Class 1b or better rock.

Casing lengths to the top of the rock will be about 15 feet to 20 feet bgs. The balance of the caisson-pile design is presented below:

Caisson Pile – Design Parameters

Design Compressive Capacity (tons)	Design Tensile Capacity (tons)	Casing Outside Diameter (inch)	Casing Wall Thickness (inch)	Rock Socket Length (feet)	Cement Grout 28-day Strength (psi)	Reinforcing (Grade 75)
175	75	9.625	0.5	10	6,000	1 #24

Load tests are not required to substantiate the caisson pile capacity; however, video inspection is required by the Building Code for each of the rock sockets.

Pile Spacing

We recommend that the center-to-center spacing of caisson sockets shall be at least two and one-half times the outside diameter of the steel casing, but not less than 4 feet.

Lateral Pile Capacity

Lateral load tests will be required by the Building Code to substantiate a lateral pile capacity of more than 1 ton. The lateral load tests shall be performed in accordance with ASTM D3966. The maximum allowable lateral capacity shall not be more than one-half the test load producing a gross lateral movement of 1 inch at the ground surface.

Piles located near a lot line shall be designed on the assumption that the adjacent lot will be excavated to a depth of about 10 feet below the nearest legally established curb level. The portion of the pile exposed shall be deemed to provide no lateral support. This should be considered when finalizing the design of the sub-structure and choosing pile locations.

Permanent Groundwater Control

The measured static groundwater level was about 9 feet below grade, corresponding to el 7. We recommend a design groundwater level of about 3 feet above the measured groundwater level to account for periods of prolonged precipitation events, utility breaks, etc. Therefore, the recommended design groundwater level is at el 10.

Pressure Slab

Walls and slabs that extend below the groundwater level will be subject to lateral and uplift hydrostatic pressures, as well as the potential for water seepage into the occupied spaces. The

proposed cellar level extends to about el 0, about 10 feet below the design groundwater level. We recommend that the cellar slab extending below the design groundwater level be constructed as a structural pressure slab designed to resist a hydrostatic uplift pressure from the design groundwater level. The foundation walls must also be proportioned to resist the hydrostatic pressures. Foundation walls should be keyed into the slab and poured integrally with a water stop.

Uplift Forces

The uplift forces from wind or earthquake loading can be resisted by using tie-down rock anchors. We recommend that the rock anchors consist of double corrosion-protected threaded bars, each having a yield strength of 150 kips per square inch. The bars should be secured into 5-inch-nominal-diameter drill holes using neat cement grout having a 28-day compressive strength of at least 6,000 psi.

Waterproofing

We recommend installing exterior waterproofing below the pressure slab and behind the cellar walls up to the ground surface. We recommend a membrane type waterproofing, such as Preprufe™ and Bituthene™ products, and post-injectable water stop (i.e., TRIOject) by Grace Applied Technologies. The use of bentonite waterproofing or negative side crystalline waterproofing as the primary barrier is not recommended.

Permanent Below-Grade Walls

Permanent below-grade foundation walls should be designed to resist static lateral earth pressures, hydrostatic pressures (if not drained), and surcharge loads. Backfill should not be placed against below-grade walls until the wall concrete attains its 28-day compressive design strength, and temporary lateral bracing has been provided to prevent rotation of the wall. Additional recommendations on the support of below-grade walls may be required by the structural engineer.

The lateral pressure diagram is presented as Figure No. 6.

GENERAL CONSTRUCTION RECOMMENDATIONS

The following sections present recommendations that are relative to below-grade construction within the site.

Support of Excavation

The contractor must take appropriate measures to stabilize the work area and prevent lateral movement of the adjacent areas during the excavation. Temporary below-grade walls should be designed to resist static earth pressures, pavement, and construction surcharges. All adjacent utilities must also be protected and supported as needed.

Underpinning

The Department of Buildings (DOB) records for the adjacent building to the south indicate two below-grade levels. This building is likely bearing on bedrock. However, test pits will be required to confirm the existing foundations of this neighboring building. If the test pits reveal that the building rests on the native sand, then underpinning piers to the bedrock will be required along the foundation wall.

Temporary Construction Dewatering

We expect the general excavation will be at about el -2, which is about 8 feet below the measured groundwater level. Controlling the groundwater will be critical for foundation construction. Lowering of the groundwater table a minimum of 2 feet below the bottom of excavation will be necessary to provide a dry working surface.

Fill Material, Placement, and Compaction Criteria

Structural fill placed to establish the finished subgrade beneath floor slabs or as backfill behind walls should consist of a well-graded durable granular material having no more than 10% fines passing the No. 200 sieve and a maximum particle size less than 4 inches. All fill materials should be free of trash, debris, roots, vegetation, peat, or other deleterious materials and should be approved by the geotechnical engineer before placement. Natural soil materials excavated from within the site conforming to the above gradation criteria can be re-used as structural fill.

Department of Transportation and New York City Transit Approvals

Approval will be required from the Department of Transportation (DOT) for the development, because of the proximity to the Queensboro Bridge. The DOT may request monitoring of their structures during the foundation construction. Interacting with the DOT and satisfying the requirements for project insurance must be considered during the planning, permitting, and

construction phases of the project. The review process may take up to six months or more and should be considered in the project schedule.

The design and construction of the building are also subject to NYCT review and approval. The Department of Buildings will require a letter of no impact from NYCT before issuing building permits.

ADDITIONAL INVESTIGATION

Ten additional borings will be required to comply with Building Code requirements. We also recommend installing at least one additional groundwater observation well within the building footprint after building demolition. If needed, interior borings can be performed by a portable limited-access drill rig before building demolition.

To better determine the underpinning and support of excavation scope, we also recommend excavating two test pits along the adjacent building to the south. These test pits will help to determine the type, condition, and configuration of the foundations of the adjacent building.

LIMITATIONS

The conclusions and recommendations provided in this memorandum result from our interpretation of the geotechnical conditions existing at the site inferred from a limited number of borings, and from the architectural information prepared by Perkins Eastman. Actual subsurface conditions may vary. Recommendations provided are dependent upon one another, and no recommendation should be followed independently of the others.

Any proposed changes in structures or their locations should be brought to Langan's attention as soon as possible so we can determine whether such changes affect our recommendations. Information on subsurface strata and groundwater levels shown on the logs represent conditions encountered only at the locations indicated and at the time of the investigation. If different conditions are encountered during construction, they should immediately be brought to Langan's attention for evaluation because they may affect our recommendations.

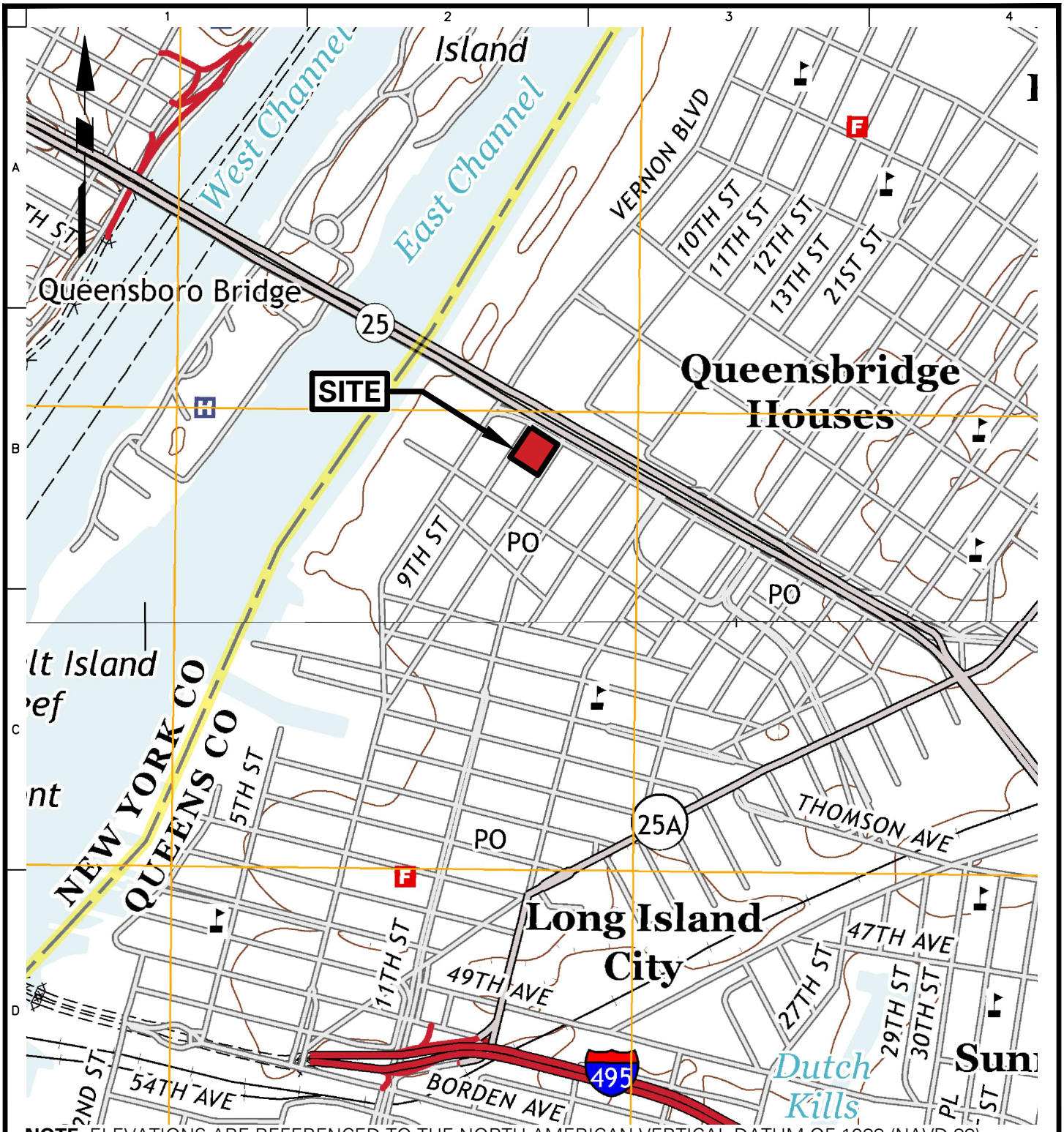
This report has been prepared to assist the owner, architect, and structural engineer in the design process and is only applicable to the design of the specific project identified. The information in this report cannot be used or depended on by engineers or contractors involved in evaluations or designs of facilities (including underpinning, grouting, stabilization, etc.) on adjacent properties beyond the limits of that which is the specific subject of this report.

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

LIST OF FIGURES

APPENDICIES

FIGURES



NOTE: ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

SOURCE: "CENTRAL PARK AND BROOKLYN SECTIONS NEW YORK 7.5-MINUTE SERIES", U.S. GEOLOGICAL SURVEY, 2013

1000 0 500 1000

SCALE IN FEET

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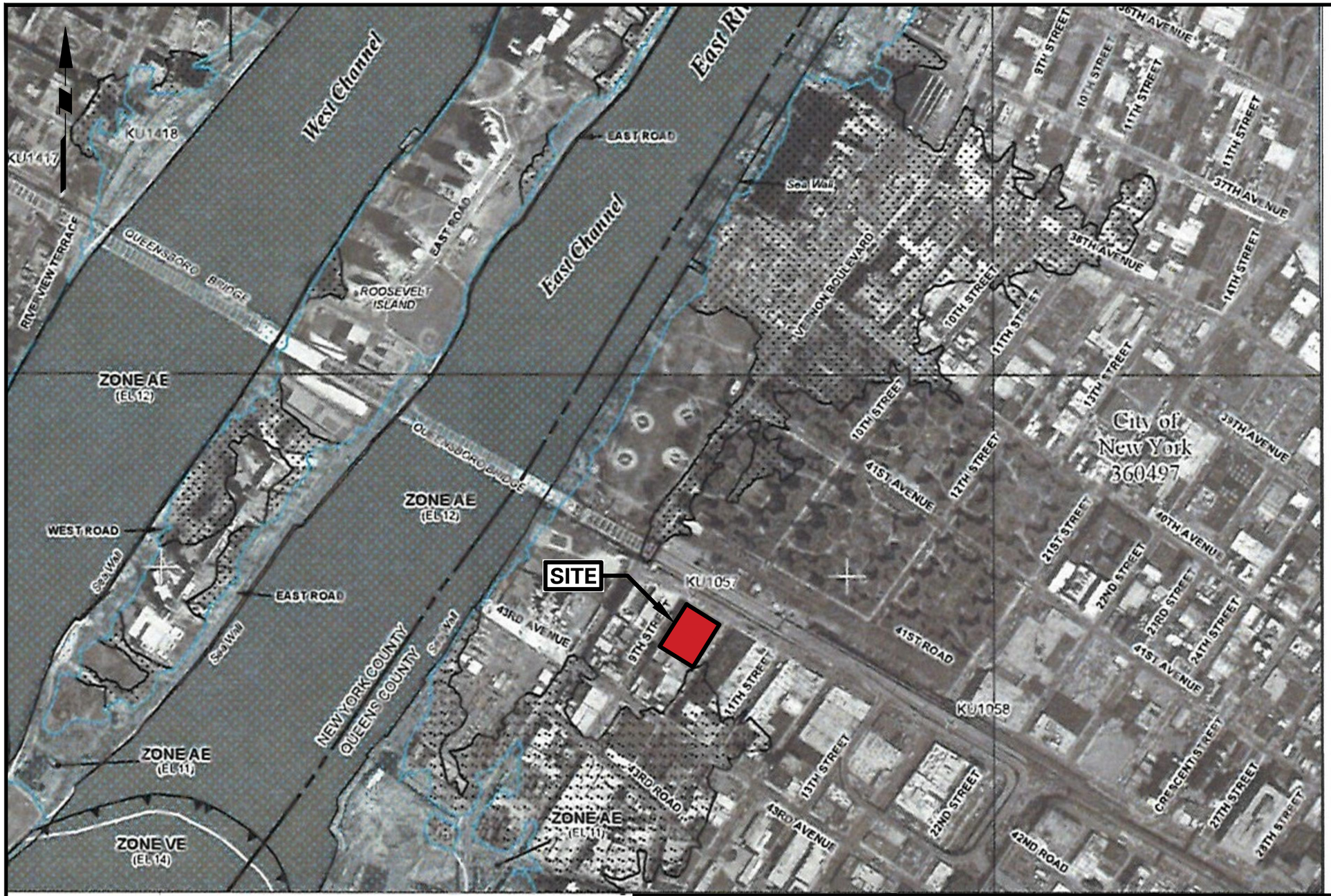
Project	42-11 9TH STREET BLOCK No. 461, LOT No. 16 LONG ISLAND CITY NEW YORK
Figure Title	SITE LOCATION MAP
Project No.	170514701
Date	4/18/2018
Scale	1" = 1000'
Drawn By	KC
Checked By	SG
Figure No.	1

Filename: \\langan.com\data\NY\data7\170514701\Project Data\CAD\01\SheetFiles\Geotechnical\FIGURE 1 - Site Location Map.dwg Date: 4/18/2018 Time: 15:04 User: kchong Style Table: Langan.stb Layout: ANSIA-BP



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- Limit of Moderate Wave Action
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- Cross section line
- Transect line
- Culvert, Flume, Penstock or Aqueduct
- Road or Railroad Bridge
- Footbridge
- 87°07'45", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4276000mN — 1000-meter Universal Transverse Mercator grid values, zone 18
- 600000 FT — 5000-foot grid values: New York State Plane coordinate system, Long Island zone (FIPSZONE 3104), Lambert Conformal Conic projection
- DX5510 x — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

INITIAL NFIP MAP DATE
June 28, 1974

SOURCE: FIRM FLOOD RATE INSURANCE MAP FOR THE CITY OF NEW YORK, NEW YORK PANEL 89 OF 457 [3604970089G] MAP REVISED PRELIMINARY DECEMBER 5, 2013.

500 0 250 500
SCALE IN FEET

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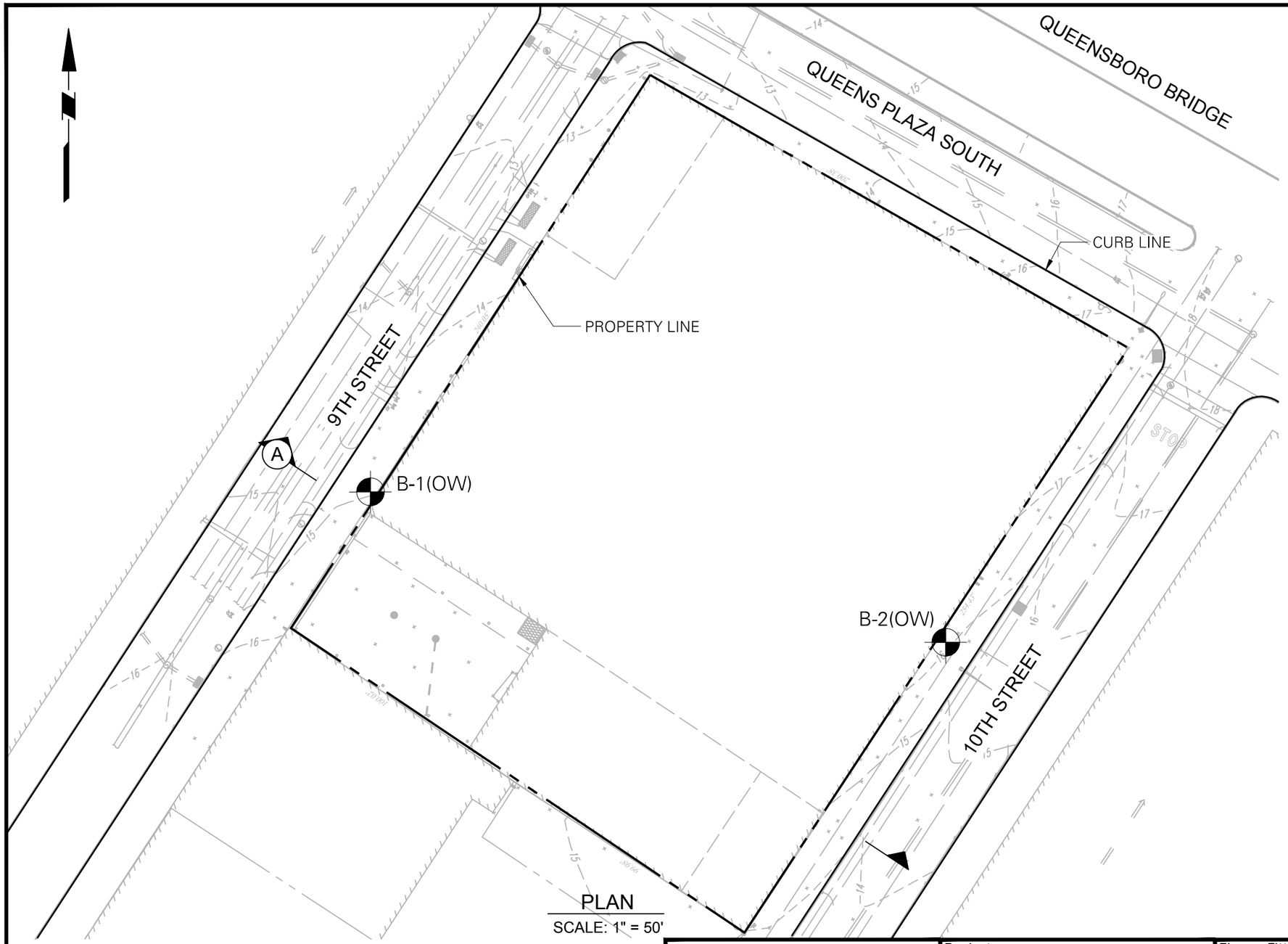
Project
42-11 9TH STREET
BLOCK No. 461, LOT No. 16
LONG ISLAND CITY
QUEENS **NEW YORK**

Figure Title
PRELIMINARY FLOOD INSURANCE RATE MAP

Project No. 170514701	Figure No. 2
Date 4/18/2018	
Scale 1" = 500'	
Drawn By KC / Checked By SG	

Filename: \\langan.com\data\NY\data7\170514701\Project Data\CAD\01\SheetFiles\Geotechnical\FIGURE 2 - FEMA MAP.dwg Date: 4/18/2018 Time: 15:05 User: kchong Style Table: Langan.stb Layout: ANSIB-BL



PLAN
SCALE: 1" = 50'

GENERAL NOTES

1. THE BASE PLAN WAS TAKEN FROM THE BOUNDARY AND TOPOGRAPHICAL SURVEY FOR 4211 9TH STREET PREPARED BY CONTROL POINTS ASSOCIATES, INC. DATED 14 MARCH 2018.
2. ELEVATIONS ARE WITH RESPECT TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. THE TOP 6 FEET OF THE BORINGS WERE EXCAVATED USING A HAND-OPERATED AUGUR. SUBSEQUENTLY, THE BORINGS WERE DRILLED TO THE TERMINATION DEPTH USING A CME-55 TRACK-MOUNTED DRILL RIG WITH MUD-ROTARY DRILLING TECHNIQUES, CASING, AND DRILLING FLUID BY CRAIG GEOTECHNICAL DRILLING, INC. THE BORINGS WERE PERFORMED BETWEEN 9 AND 12 MARCH 2018 UNDER THE FULL-TIME SPECIAL INSPECTION OF A LANGAN ENGINEER.
4. OBSERVATION WELLS WERE INSTALLED IN BOTH COMPLETED BORINGS TO THE FULL DEPTH OF THE BOREHOLES. THE WELLS CONSIST OF 2-INCH-DIAMETER SCHEDULE 40 PVC PIPING WITH WELL SCREEN AND RISER PIPE. THE WELLS WERE COMPLETED WITH A FLUSH-MOUNTED STEEL WELL CAP AT SIDEWALK GRADE.
5. BORINGS LOCATIONS SHOWN ARE APPROXIMATE AND MEASURED IN THE FIELD.

LEGEND:

B-1 (OW) — COMPLETED GEOTECHNICAL BORING

(OW) — OBSERVATION WELL LOCATION

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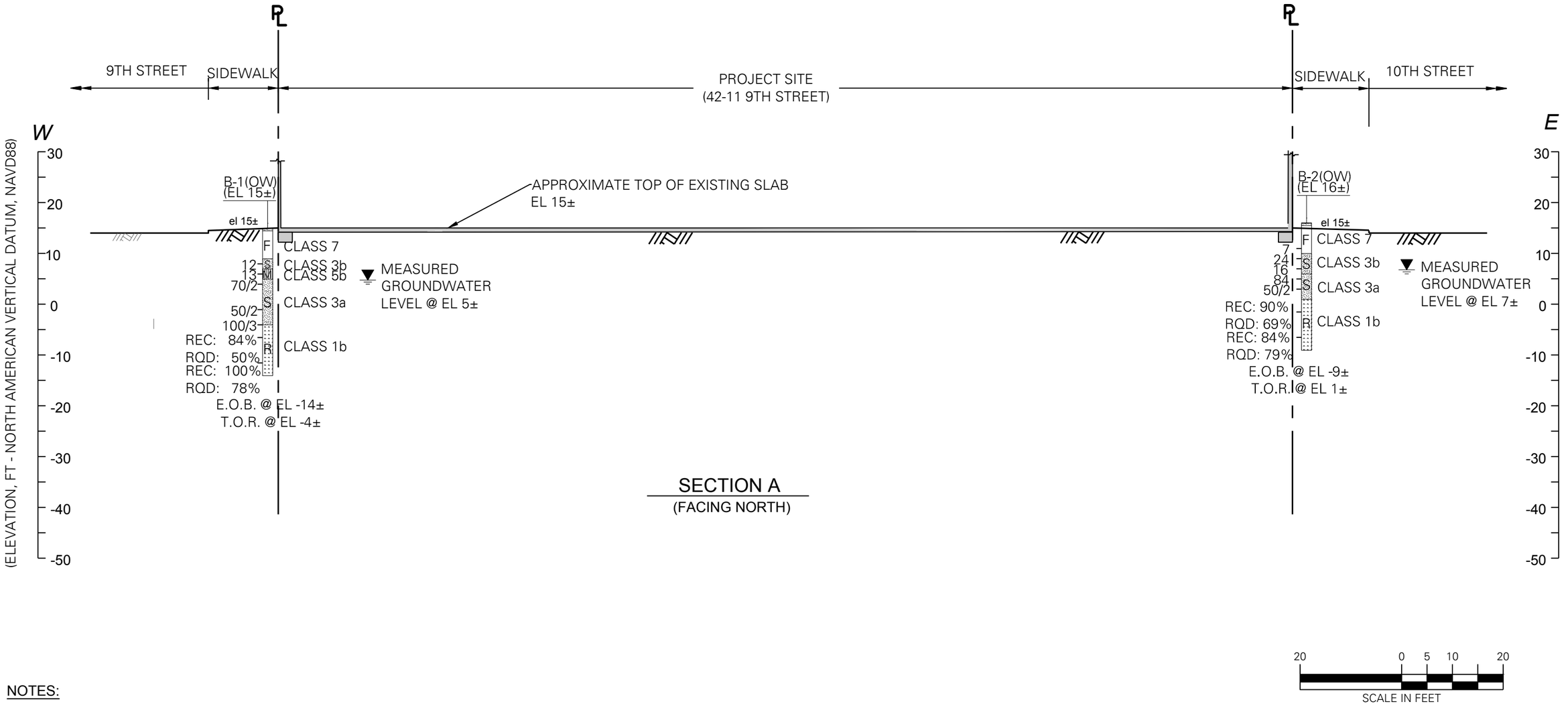
Figure Title
BORING LOCATION PLAN

Project No.	Figure No.
170514701	3
Date: 4/18/2018	
Scale: 1" = 50'	
Drawn By: KC	Checked By: SG

Filename: \\langan.com\data\NY\data7\170514701\Project Data\CAD\01\SheetFiles\Geotechnical\FIGURE 3- BLP.dwg Date: 4/18/2018 Time: 15:05 User: kchong Style Table: Langan.stb Layout: ANSIB-BL



SECTION A
(FACING NORTH)

20 0 5 10 20
SCALE IN FEET

NOTES:

1. REFER TO FIGURE NO. 5 FOR GENERAL NOTES.
2. THE EXISTING BUILDING EXTENTS DEPICTED HEREIN SHOULD BE CONSIDERED APPROXIMATE, AND ARE BASED ON REVIEW OF AVAILABLE DESIGN PLANS PREPARED BY OTHERS.
3. THIS PROFILE REPRESENTS A GENERALIZED SOIL CROSS SECTION INTERPRETED FROM MULTIPLE BORINGS. SOIL, ROCK, AND GROUNDWATER MAY VARY IN TYPE, LOCATION, ELEVATION, AND ENVIRONMENTAL AND ENGINEERING PROPERTIES.
4. REFER TO LS-1 FOR BORING KEY.

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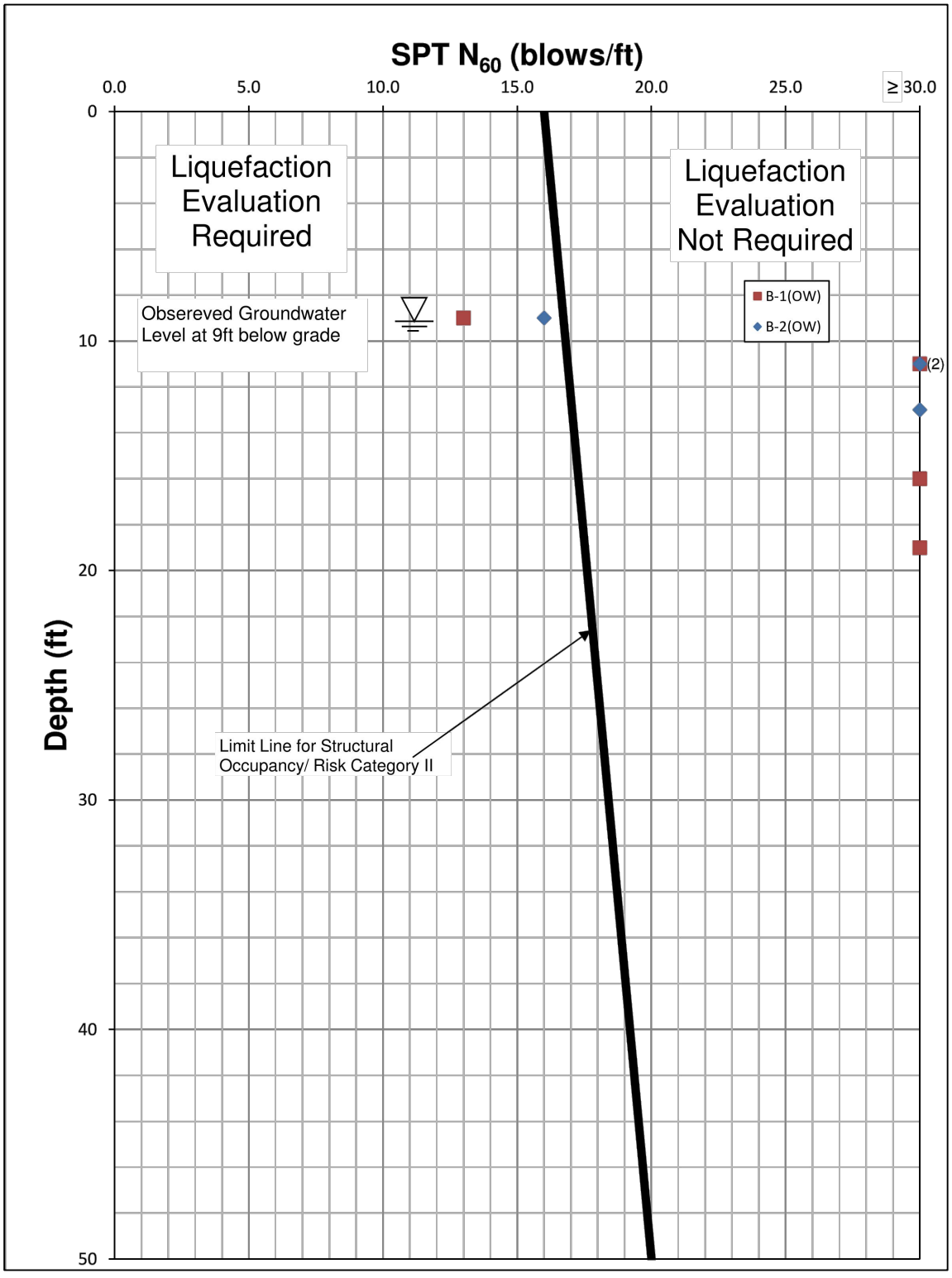
Figure Title
BORING LOCATION PLAN

Project No.	Figure No.
170514701	4
Date: 4/18/2018	
Scale: 1" = 20'	
Drawn By: KC	Checked By: SG

Filename: \\langan.com\data\NY\data7\170514701\Project Data\CAD\01\SheetFiles\Geotechnical\FIGURE 4- Section A.dwg Date: 4/18/2018 Time: 15:06 User: kchong Style Table: Langan.stb Layout: ANSIB-BL



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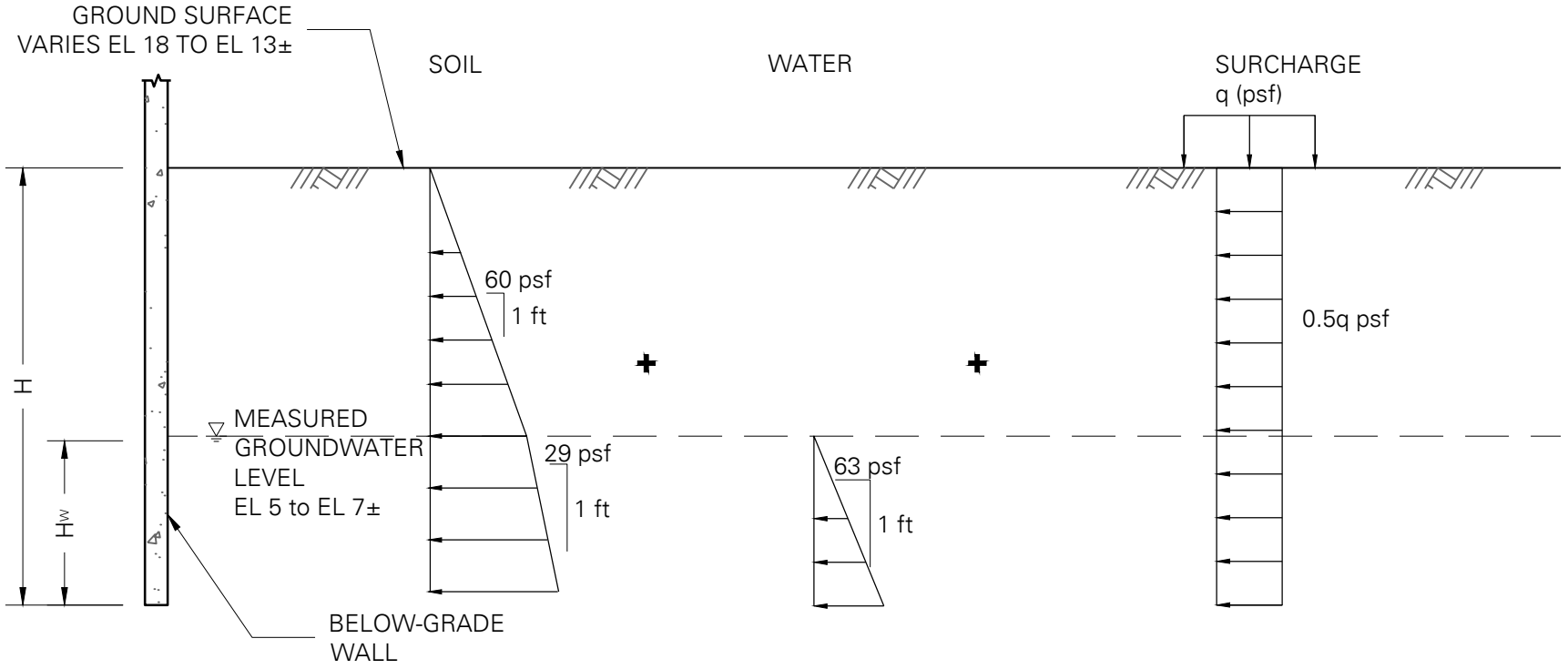
Project	42-11 9TH STREET
	BLOCK No. 461, LOT No. 16
	LONG ISLAND CITY NEW YORK
Figure Title	NYCBC LIQUEFACTION ASSESSMENT CHART
Project No.	170514701
Date	4/18/2018
Scale	N.T.S.
Drawn By	KC
Checked By	SG
Figure No.	5

Filename: \\langan.com\data\NY\data7\170514701\Project Data\CAD\01\SheetFiles\Geotechnical\FIGURE 5 - Liquefaction.dwg Date: 4/18/2018 Time: 15:06 User: kchong Style Table: Langan.stb Layout: ANSIA-BP



LEGEND:

H = HEIGHT OF BELOW GRADE WALL (FT)
H_W = DEPTH TO MEASURED GROUNDWATER TABLE (FT)

LANGAN
21 Penn Plaza, 360 West 31st Street, 8th Floor
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Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C. S.A.
Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
Langan Engineering and Environmental Services, Inc.
Langan CT, Inc.
Langan International LLC
Collectively known as Langan

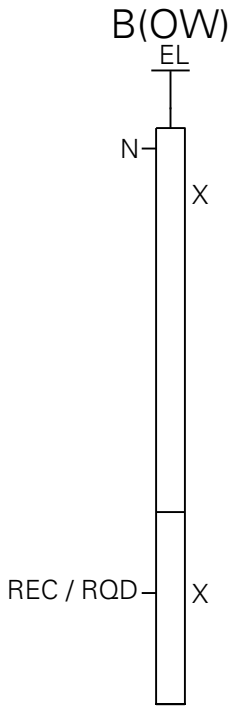
Project
42-11 9TH STREET
BLOCK No. 461, LOT No. 16
LONG ISLAND CITY
QUEENS NEW YORK

Drawing Title
LATERAL EARTH PRESSURE DIAGRAM

Project No.	Figure
170514701	6
Date: 4/18/2018	
Scale: N.T.S.	
Drawn By: KC	Checked By: SG

Filename: \\langan.com\data\NY\data7\170514701\Project Data\CAD\01\SheetFiles\Geotechnical\Figure 6 LEP.dwg Date: 4/18/2018 Time: 15:07 User: kchong Style Table: Langan.stb Layout: ANSIA-BL (2)

BORING KEY



B	BORING IDENTIFICATION
EL	GROUND SURFACE ELEVATION AT TIME OF BORING
N	STANDARD PENETRATION RESISTANCE; NUMBER OF BLOWS OF A 140 LB. HAMMER FREE FALLING 30 IN. TO DRIVE A 2 IN O.D. SPLIT SPOON SAMPLER 12 IN. AFTER 6 INCHES OF INITIAL PENETRATION
REC	(LENGTH OF ROCK RETRIEVED)/(LENGTH OF ROCK CORED)*100%
RQD	ROCK QUALITY DESIGNATION (LENGTH OF ROCK PIECES 4 INCHES OR LONGER)/ (LENGTH OF ROCK CORED)*100%
X	NEW YORK CITY BUILDING CODE CLASSIFICATION
(OW)	GROUNDWATER OBSERVATION WELL
▼	MEASURED GROUNDWATER LEVEL

MATERIAL SYMBOLS

R	BEDROCK
WR	WEATHERED ROCK
G	GRAVEL
S	SAND
C	CLAY
M	SILT
O	ORGANIC SILT/CLAY
F	UNCONTROLLED FILL

NEW YORK CITY BUILDING CODE CLASSIFICATION NUMBER

1A	HARD SOUND ROCK
1B	MEDIUM ROCK
1C	INTERMEDIATE ROCK
1D	SOFT ROCK
2A	DENSE SANDY GRAVEL & GRAVEL
2B	MEDIUM SANDY GRAVEL & GRAVEL
3A	DENSE GRANULAR SOILS
3B	MEDIUM GRANULAR SOILS
4A	HARD CLAYS
4B	STIFF CLAYS
4C	MEDIUM CLAYS
5A	DENSE SILTS & SILTY SOILS
5B	MEDIUM SILTS & SILTY SOILS
6	ORGANIC SILTS & CLAYS, PEATS, SOFT CLAYS, LOOSE GRANULAR SOILS, AND VARVED SILTS
7	CONTROLLED & UNCONTROLLED FILLS

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Collectively known as Langan

Project: 42-11 9TH STREET
BLOCK No. 461, LOT No. 16
LONG ISLAND CITY NEW YORK

Figure Title: BORING KEY AND LANGAN STANDARDS

Project No. 170514701	Figure No. LS-1
Date 4/18/2018	
Scale N.T.S.	
Drawn By SP / Checked By TKC	

Filename: \\langan.com\data\NY\data7\170514701\Project Data\CAD\01\Sheet Files\Geotechnical\LS-1 Boring Key and Legend.dwg

APPENDIX A

BORING LOGS
AND OBSERVATION WELL CONSTRUCTION LOGS

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Log of Boring **B-1(OW)** Sheet 1 of 2

Project: 42-11 9th Street	Project No.: 170514701
Location: 42-11 9th Street, Long Island City, New York	Elevation and Datum: El. 15 +/- NAVD88
Drilling Company: Craig Geotechnical Drilling	Date Started: 3/9/18 — Date Finished: 3/12/18
Drilling Equipment: CME 55 Track Rig	Completion Depth: 29 ft — Rock Depth: 19 ft
Size and Type of Bit: 3-7/8in Tricone Roller Bit	Number of Samples: Disturbed 5 — Undisturbed - — Core 3
Casing Diameter (in): 4-in Flush Joint Steel Casing — Casing Depth (ft): 15	Water Level (ft.): First ▽ 14.5 — Completion ▼ 10.2 — 24 HR. ▼
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Mike Tartar
Sampler: 2-Inch Split Spoon	Field Engineer: Veronica Zuluaga
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	NYCBC	Sample Description	Depth Scale	Sample Number	Sample Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+15.0			0						
	+14.7		6" CONCRETE Slab	0						Begin Coring through Sidewalk at 03/09/2018 8:20 AM
		CLASS 7	Brown, medium to fine SAND, trace fine gravel, trace brick, trace coal (dry) [SM/FILL]	1	S-1	HAND AUGER				
				2						
				3						
				4						
				5						
	+9.0			6						S-2 at 6ft.
		CLASS 3B	Brown, medium dense, fine SAND, some silt (moist)[SM]	7	S-2	SS	20	5 6 6 13	12	
	+7.0			8						S-3 at 8ft.
		CLASS 5B	Reddish-brown, medium dense, SILT, some fine sand (moist)[ML]	9	S-3	SS	20	5 6 7 7	13	
	+5.0			10						S-4 at 10ft, Drive Casing 9:40 AM
		CLASS 3A	Gray, dense, coarse to fine SAND, some silt, some fine gravel, trace glass (moist) [SM]	11	S-4	SS	6	4 20 70/2"	70/2"	Refusal, probable boulder. Drive casing to 15ft. Cleanout hole
				12						
				13						
				14						
	0.0			15	C-1	NX		50/2"	50/2"	C-1 at 15ft. Rig Chatter, refusal. No recovery
		CLASS 3A	Dark gray, very dense, medium to fine SAND, some medium to fine gravel (Wet) [SP]	16						
				17						
				18						S-5 at 18.2ft.
	-4.0			19	S-5	SS	10	59 100/3"	100/3"	
		CLASS 1B		19	C-2	NX				Refusal, losing water. Return to on Monday 03/12/2018.
				20						

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Log of Boring **B-1(OW)** Sheet 2 of 2

Project	Project No.
42-11 9th Street	170514701
Location	**Elevation and Datum**
42-11 9th Street, Long Island City, New York	El. 15 +/- NAVD88

MATERIAL SYMBOL	Elev. (ft)	NYCBC	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	-5.0		Gray GNEISS, medium grained, interlayed with quartz, slightly weathered to moderately weathered rock, medium hard rock [BEDROCK]	20–24	C-2	NX	REC=50.5"/60" =84%	RQD=30"/60" =50%		C-2 at 19ft. Core drill through 4-inch casing, losing a lot of water
		CLASS 1B	Gray GNEISS, medium grained gneiss, interlayed with quartz, slightly weather to fresh, medium hard rock. [BEDROCK]	24–29	C-3	NX	REC=60"/60" =100%	RQD=46.5"/60" =78%		C-3 at 24ft.
	-14.0		Bottom of boring at 29ft - 03/12/2018	29						End of Boring at 29ft. Install observation well, screened from 19ft to 29ft and 19ft of solid PVC riser. Install flush-mounted 4inch well cap.

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Log of Boring **B-2(OW)** Sheet 1 of 2

Project: 42-11 9th Street	Project No.: 170514701
Location: 42-11 9th Street, Long Island City, New York	Elevation and Datum: El. 16 +/- NAVD88
Drilling Company: Craig Geotechnical Drilling	Date Started: 3/9/18 — Date Finished: 3/12/18
Drilling Equipment: CME 55 Track Rig	Completion Depth: 25 ft — Rock Depth: 15 ft
Size and Type of Bit: 3-7/8in Tricone Roller Bit	Number of Samples: Disturbed 5 — Undisturbed - — Core 2
Casing Diameter (in): 4-in Flush Joint Steel Casing — Casing Depth (ft): 15	Water Level (ft.): First ▽ 15 — Completion ▼ 9.2 — 24 HR. ▼
Casing Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	Drilling Foreman: Mike Tartar
Sampler: 2-Inch Split Spoon	Field Engineer: Veronica Zuluaga
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	NYCBC	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+16.0			0						Started Drilling at 03/09/2018 2:25 PM
	+15.7		6" CONCRETE Slab	1						S-1 at 0.3ft
		CLASS 7	Dark gray, loose, fine SAND, trace fine gravel, brick, coal [dry][SP/FILL]	2	S-1	HA				
				3						
			Dark gray, medium dense, coarse to fine SAND, some silt, some medium to fine gravel, trace brick, trace coal, trace coal ash, trace glass [dry][SM/FILL]	4	S-2	SS	7	11 4 3 6	7	S-2 at 4ft.
	+10.0			5						
				6	S-3	SS	2	68 17 7 7	24	S-3 at 6ft.
		CLASS 3B	Brown, very dense, fine SAND, trace fine gravel [dry][SP]	7						
				8	S-4	SS	9	5 8 8 8	16	S-4 at 8ft. Install Casing
			Brown, medium dense, coarse to fine SAND, some silt, trace fine gravel [dry][SP-SM]	9						
				10	S-5	SS	20	26 40 44 50/2"	84	S-5 at 10ft.
	+5.0			11						
		CLASS 3A	Mottled gray over white, very dense, coarse to fine SAND, trace fine gravel [dry][SP]	12	S-6	SS	0	50/2"	50/2"	S-6 at 12ft. Refusal at 12ft 4:20 PM - No return drive casing to 12ft Resume Monday 03/12/2018 Monday 03/12/2018 8:12 AM Begin Cleaning out hole 8:30 AM Begin SPT- Refusal at 12ft, no recovery, Drive casing to 15ft and begin coring
				13						
				14						
	+1.0			15						
		CLASS 1B	Gray GNEISS, medium grained, interlayed with quartz; slightly weathered to fresh; medium hard rock [BEDROCK]	16	C-1	NX	REC=54"/60" =90%	RQD=41.5"/60" =69%		C-1 at 15ft. Cleanout borehole to begin coring 8:50 AM begin coring Losing water, pause to get more water 9:10 AM Finishing coring first 5ft of bedrock
				17						
				18						
				19						
				20						

\\LANGAN.COM\DATA\NY\DATA\170514701\PROJECT DATA_DISCIPLINE\GEOTECHNICAL\GINTLOGS\170514701.GPJ ... 3/23/2018 12:32:35 PM ... Report: Log - LANGAN

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Log of Boring **B-2(OW)** Sheet 2 of 2

Project	Project No.
42-11 9th Street	170514701
Location	**Elevation and Datum**
42-11 9th Street, Long Island City, New York	El. 16 +/- NAVD88

MATERIAL SYMBOL	Elev. (ft)	NYCBC	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	-4.0			20						C-2 at 20ft. 9:26 AM Begin coring
		CLASS 1B	Gray GNIESS, medium grained, interlayed with quartz; slightly weathered to fresh; medium hard rock [BEDROCK]	21	C-2	NX	REC=50.5"/60" =84%	RQD=47.5"/60" =79%		Losing water, pause to get more water
	-9.0		End of Boring @ 25ft - 03/12/2018	22						End of Boring at 25ft. Install observation well, screened from 15ft to 25ft and 15ft of solid PVC riser. Install flush-mounted 4inch well cap.
				23						
				24						
				25						
				26						
				27						
				28						
				29						
				30						
				31						
				32						
				33						
				34						
				35						
				36						
				37						
				38						
				39						
				40						
				41						
				42						
				43						
				44						
				45						

WELL CONSTRUCTION LOG

Well No. B-1(OW)

PROJECT 42-11 9TH STREET	**PROJECT NO.** 170514701
LOCATION LONG ISLAND CITY, QUEENS, NY	**ELEVATION AND DATUM** 15 ± NAVD88
DRILLING AGENCY CRAIG GEOTECHNICAL BORING, INC.	**DATE STARTED** 3/9/2018 **DATE FINISHED** 3/12/2018
DRILLING EQUIPMENT CME 55 Track Rig	**DRILLER** Mike Tartar
SIZE AND TYPE OF BIT 3-7/8" Roller Bit	**INSPECTOR** Veronica Zuluaga

METHOD OF INSTALLATION

The boring was drilled by a 3 7/8" tri-cone roller bit to approximately 29 ft below existing sidewalk grade.
A 2-inch diameter slotted PVC screen 10 ft long and a 19 ft long riser was installed.
The annulus between the borehole and the pipes was backfilled with No. 2 filter sand.
Approximately 2 feet of bentonite pellets were placed above the filter sand
The remainder of the annulus was backfilled and a cap was used to cover the well.

METHOD OF WELL DEVELOPMENT

The observation well was flushed by pumping clean water into the borehole until the return water was clear. The well was not bailed at the time of the initial well reading.

TYPE OF CASING PVC	**DIAMETER** 2"	**TYPE OF BACKFILL MATERIAL** #2 Filter Clean Sand/Soil Cuttings
TYPE OF SCREEN PVC	**DIAMETER** 2"	**TYPE OF SEAL MATERIAL** Bentonite Pellets
BOREHOLE DIAMETER 4"		**TYPE OF FILTER MATERIAL** #2 Filter Clean Sand

	ELEVATION	DEPTH (ft)
TOP OF CASING	15.0	0
TOP OF SEAL	7.0	8
TOP OF FILTER	6.0	9
TOP OF SCREEN	-4.0	19
BOTTOM OF BORING	-14.0	29

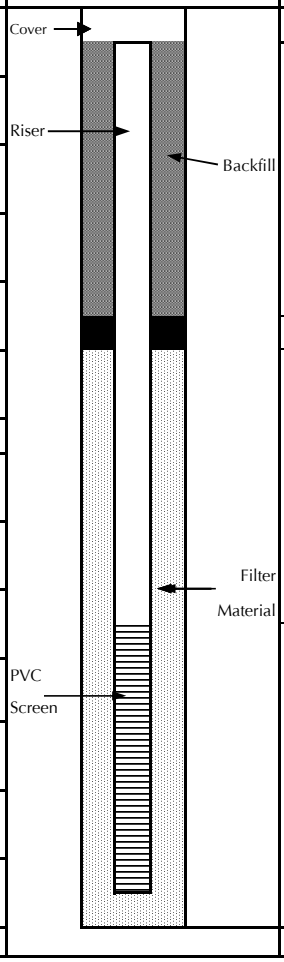
SCREEN LENGTH
10 ft

SLOT SIZE
.02 inches

GROUNDWATER ELEVATIONS

ELEVATION	DATE	DEPTH TO WATER
0.5	3/12/2018	14.5
4.8	3/23/2018	10.2
4.7	3/28/2018	10.3

WELL DETAILS



SUMMARY SOIL CLASSIFICATION	DEPTH (FT)
	0.0
0-6ft: FILL 6-8ft: SAND 8-10ft: SILT 10-12ft: SAND 19-29ft: ROCK	
	8.0
	9.0
	19.0
	29.0

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WELL CONSTRUCTION LOG

Well No. B-2(OW)

PROJECT 42-11 9TH STREET	**PROJECT NO.** 170514701
LOCATION LONG ISLAND CITY, QUEENS, NY	**ELEVATION AND DATUM** 16 ± NAVD88
DRILLING AGENCY CRAIG GEOTECHNICAL BORING, INC.	**DATE STARTED** 3/9/2018 **DATE FINISHED** 3/12/2018
DRILLING EQUIPMENT CME 55 Track Rig	**DRILLER** Mike Tartar
SIZE AND TYPE OF BIT 3-7/8" Roller Bit	**INSPECTOR** Veronica Zuluaga

METHOD OF INSTALLATION

The boring was drilled by a 3 7/8" tri-cone roller bit to approximately 25 ft below existing sidewalk grade.
A 2-inch diameter slotted PVC screen 10 ft long and a 15 ft long riser was installed.
Clean filter sand was backfilled into the hole around the screen. A bentonite seal was placed above the clean sand.

METHOD OF WELL DEVELOPMENT

The observation well was flushed by pumping clean water into the borehole until the return water was clear. The well was not bailed at the time of the initial well reading.

TYPE OF CASING PVC **DIAMETER** 2"	**TYPE OF BACKFILL MATERIAL** #2 Filter Clean Sand/Soil Cuttings
TYPE OF SCREEN PVC **DIAMETER** 2"	**TYPE OF SEAL MATERIAL** Bentonite Pellets
BOREHOLE DIAMETER 4"	**TYPE OF FILTER MATERIAL** #2 Filter Clean Sand

	ELEVATION	DEPTH (ft)
TOP OF CASING	15.0	0
TOP OF SEAL	11.0	4
TOP OF FILTER	10.0	5
TOP OF SCREEN	0.0	15
BOTTOM OF BORING	-10.0	25

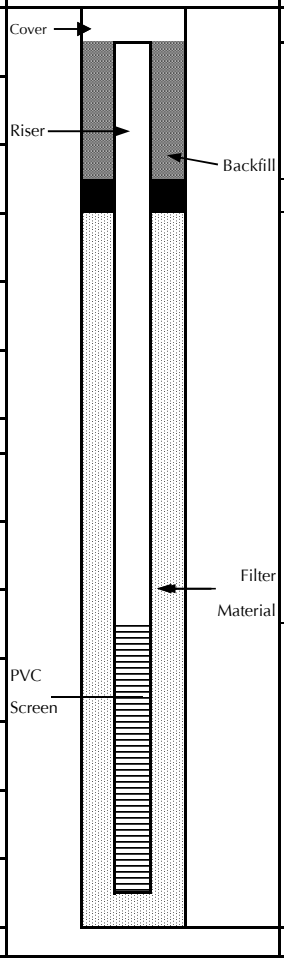
SCREEN LENGTH
10 ft

SLOT SIZE
.02 inches

GROUNDWATER ELEVATIONS

ELEVATION	DATE	DEPTH TO WATER
1.0	3/12/2018	15.0
6.8	3/23/2018	9.2
6.8	3/28/2018	9.2

WELL DETAILS



SUMMARY SOIL CLASSIFICATION

0-6ft: FILL
6-15ft: SAND
15-25ft: ROCK

DEPTH (FT)
0.0
4.0
5.0
15.0
25.0

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APPENDIX B
LABORATORY DATA RESULTS

Client:	Langan Engineering				
Project:	42-11 9th Street				
Location:	---			Project No:	GTX-307810
Boring ID:	---	Sample Type:	---	Tested By:	jbr
Sample ID:	---	Test Date:	03/16/18	Checked By:	emm
Depth :	---	Test Id:	446102		

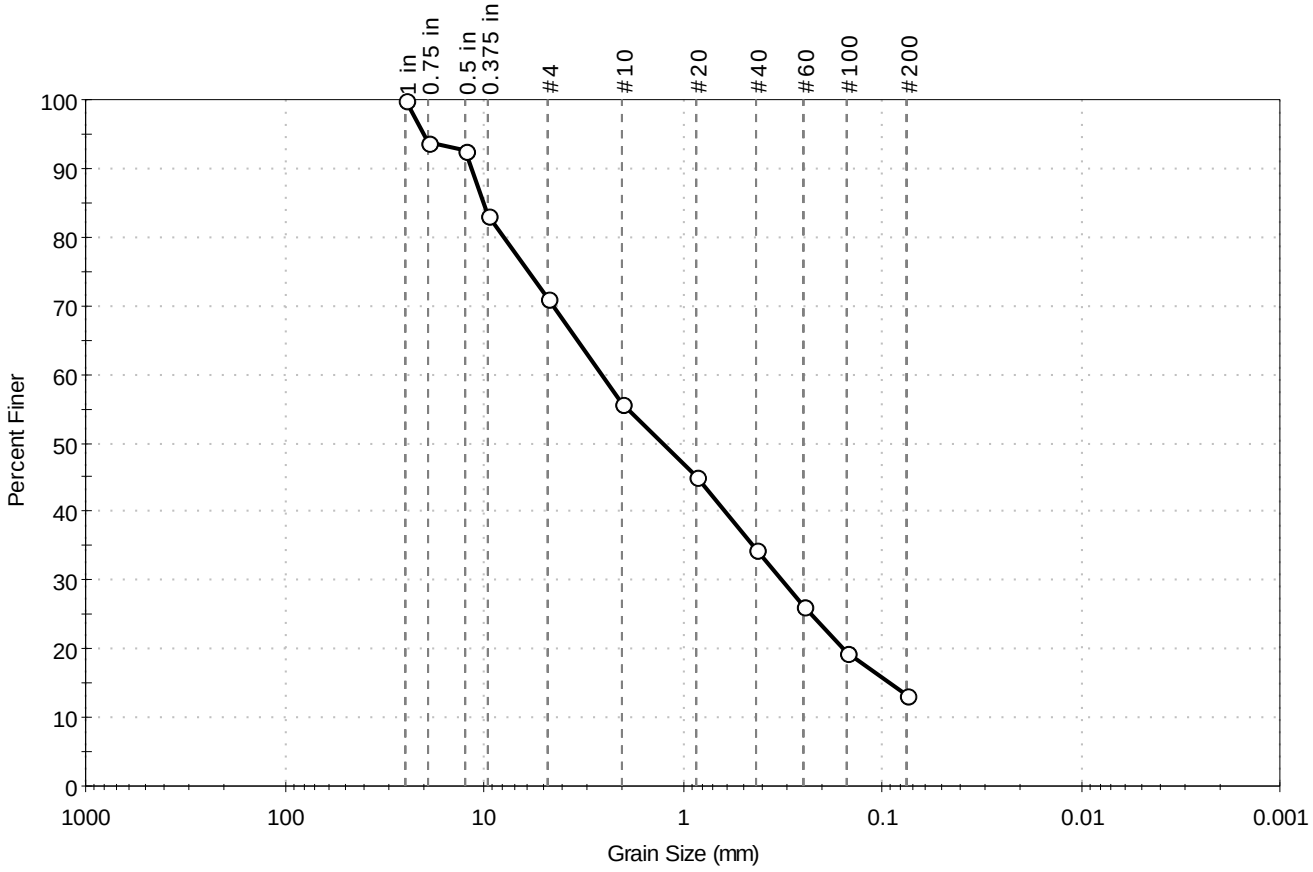
Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content, %
B-2	S2	4-6 ft	Moist, dark brown silty sand with gravel	12.9
B-1	S3	8-10 ft	Moist, yellowish brown clay with sand	18.2
B-2	S4	8-10 ft	Moist, brown silty sand	10.3
B-1	S4	10-12 ft	Moist, brown silty sand with gravel	16.7
B-2	S5	10-12	Moist, brown sand with silt and gravel	6.0

Notes: Temperature of Drying : 110º Celsius

Client:	Langan Engineering				
Project:	42-11 9th Street				
Location:	---			Project No:	GTX-307810
Boring ID:	B-2	Sample Type:	jar	Tested By:	jbr
Sample ID:	S2	Test Date:	03/19/18	Checked By:	emm
Depth :	4-6 ft	Test Id:	446095		
Test Comment:	---				
Visual Description:	Moist, dark brown silty sand with gravel				
Sample Comment:	Sample contains glass				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	28.8	57.8	13.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	94		
0.5 in	12.50	93		
0.375 in	9.50	83		
#4	4.75	71		
#10	2.00	56		
#20	0.85	45		
#40	0.42	35		
#60	0.25	26		
#100	0.15	19		
#200	0.075	13		

Coefficients

D_{85} = 9.9932 mm	D_{30} = 0.3173 mm
D_{60} = 2.5303 mm	D_{15} = 0.0906 mm
D_{50} = 1.2563 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

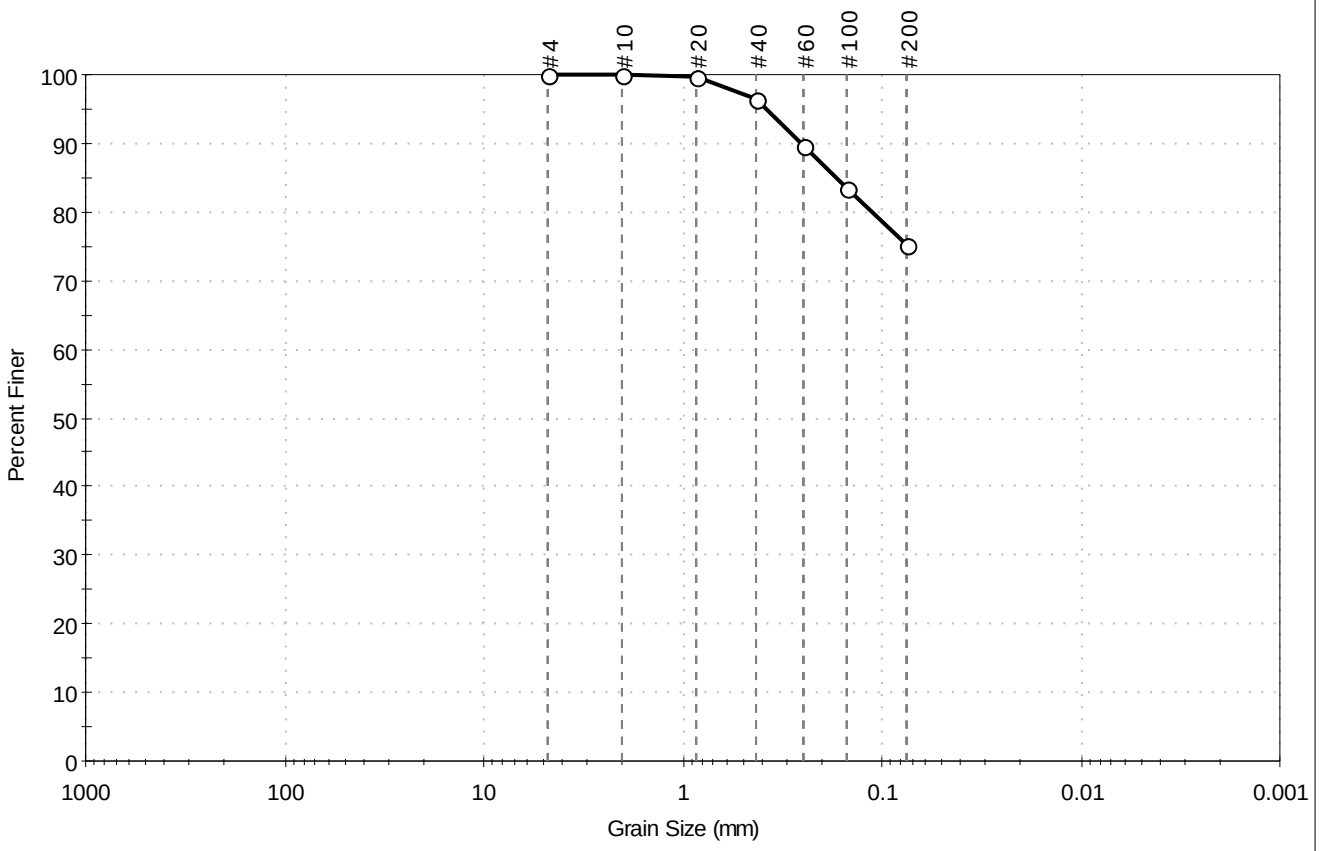
Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Langan Engineering				
Project:	42-11 9th Street				
Location:	---			Project No:	GTX-307810
Boring ID:	B-1	Sample Type:	jar	Tested By:	jbr
Sample ID:	S3	Test Date:	03/19/18	Checked By:	emm
Depth :	8-10 ft	Test Id:	446093		
Test Comment:	---				
Visual Description:	Moist, yellowish brown clay with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	24.7	75.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	96		
#60	0.25	90		
#100	0.15	84		
#200	0.075	75		

Coefficients

D_{85} = 0.1702 mm	D_{30} = N/A
D_{60} = N/A	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

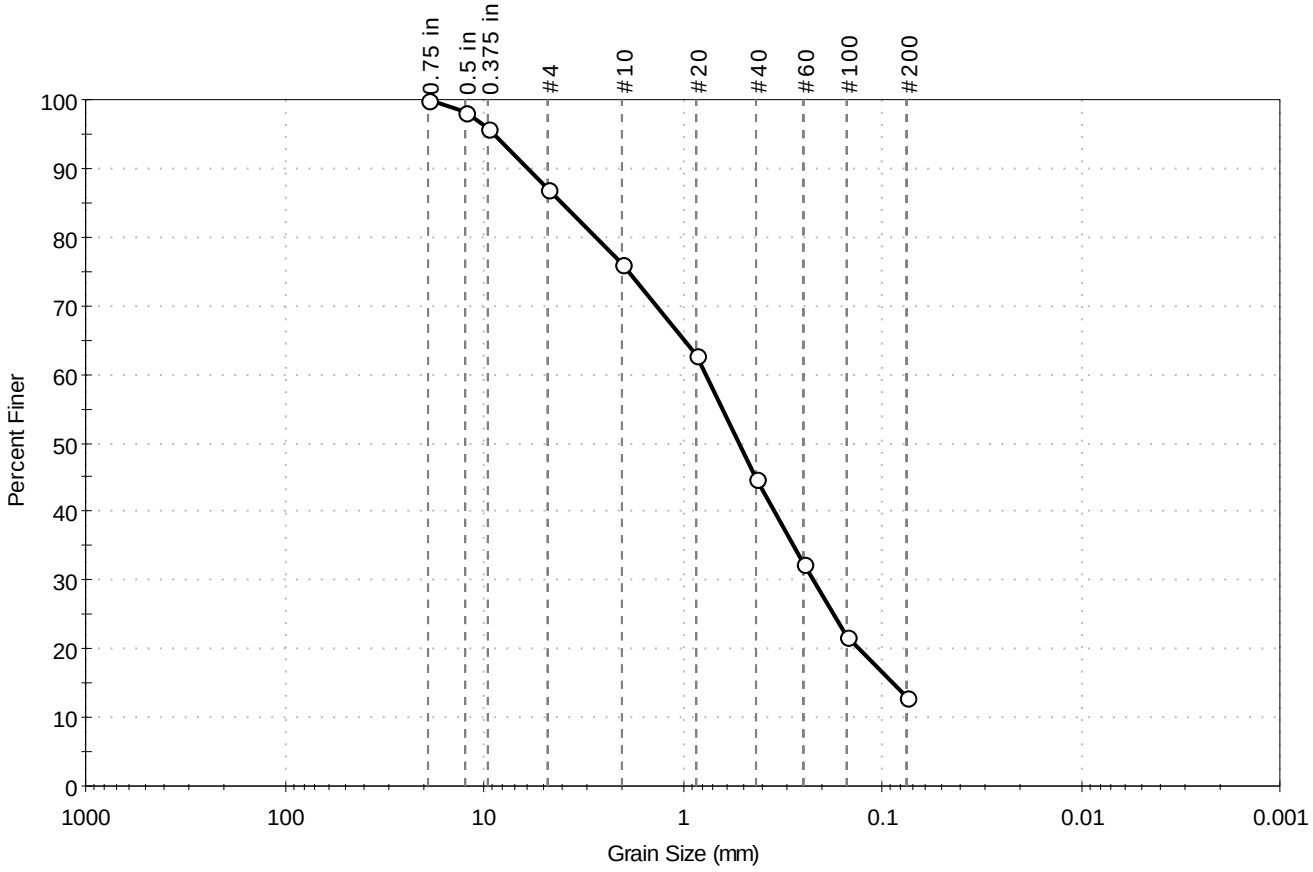
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	Langan Engineering				
Project:	42-11 9th Street				
Location:	---			Project No:	GTX-307810
Boring ID:	B-2	Sample Type:	jar	Tested By:	jbr
Sample ID:	S4	Test Date:	03/19/18	Checked By:	emm
Depth :	8-10 ft	Test Id:	446096		
Test Comment:	---				
Visual Description:	Moist, brown silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	13.0	74.1	12.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	98		
0.375 in	9.50	96		
#4	4.75	87		
#10	2.00	76		
#20	0.85	63		
#40	0.42	45		
#60	0.25	32		
#100	0.15	22		
#200	0.075	13		

Coefficients

D_{85} = 4.0546 mm	D_{30} = 0.2225 mm
D_{60} = 0.7639 mm	D_{15} = 0.0884 mm
D_{50} = 0.5170 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

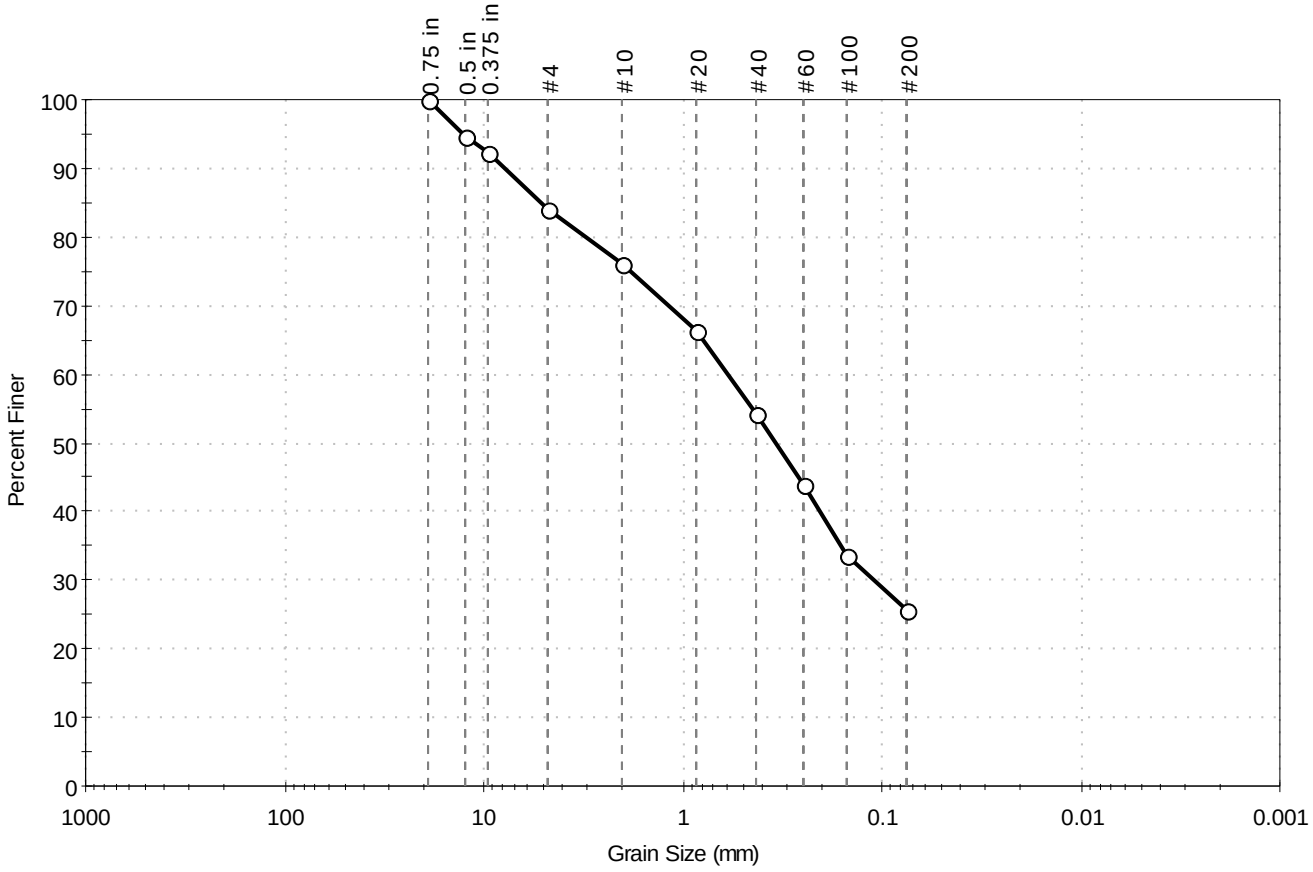
Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Langan Engineering				
Project:	42-11 9th Street				
Location:	---			Project No:	GTX-307810
Boring ID:	B-1	Sample Type:	jar	Tested By:	jbr
Sample ID:	S4	Test Date:	03/19/18	Checked By:	emm
Depth :	10-12 ft	Test Id:	446094		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	Sample contains glass				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	15.8	58.7	25.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	95		
0.375 in	9.50	92		
#4	4.75	84		
#10	2.00	76		
#20	0.85	66		
#40	0.42	54		
#60	0.25	44		
#100	0.15	34		
#200	0.075	26		

Coefficients

D_{85} = 5.0846 mm	D_{30} = 0.1104 mm
D_{60} = 0.5868 mm	D_{15} = N/A
D_{50} = 0.3408 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

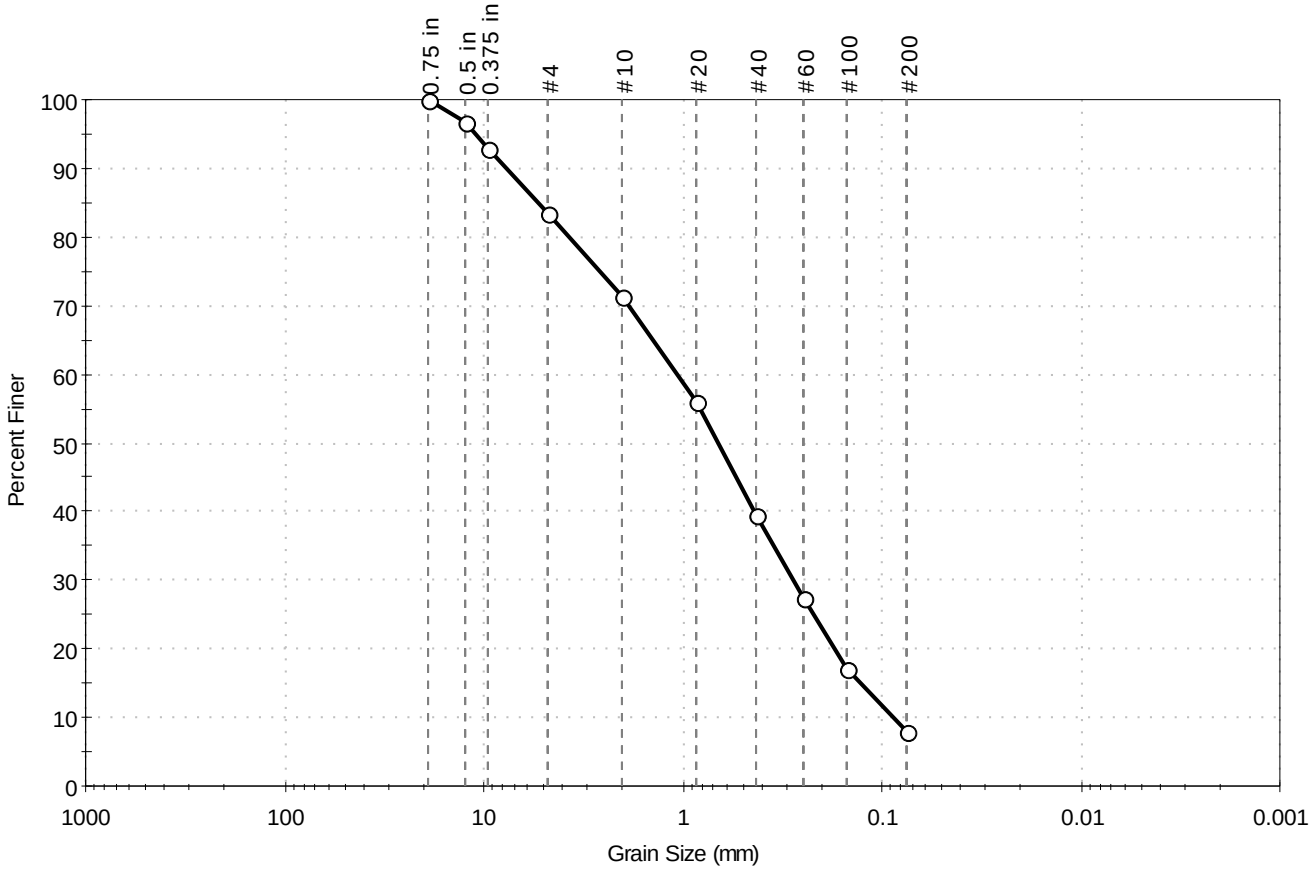
Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Langan Engineering				
Project:	42-11 9th Street				
Location:	---			Project No:	GTX-307810
Boring ID:	B-2	Sample Type:	jar	Tested By:	jbr
Sample ID:	S5	Test Date:	03/19/18	Checked By:	emm
Depth :	10-12	Test Id:	446097		

Test Comment: ---
Visual Description: Moist, brown sand with silt and gravel
Sample Comment: Sample contains glass

Particle Size Analysis - ASTM D422



%Cobble	%Gravel	%Sand	%Silt & Clay Size
---	16.5	75.5	8.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	97		
0.375 in	9.50	93		
#4	4.75	83		
#10	2.00	71		
#20	0.85	56		
#40	0.42	40		
#60	0.25	28		
#100	0.15	17		
#200	0.075	8.0		

Coefficients

D_{85} = 5.3149 mm
D_{30} = 0.2791 mm
D_{60} = 1.0616 mm
D_{15} = 0.1275 mm
D_{50} = 0.6600 mm
D_{10} = 0.0872 mm
C_u = 12.174
C_c = 0.841

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD