Preliminary Geotechnical Engineering Report

for

25-01 Queens Plaza North
Queens, New York

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INTRODUCTION

Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C (Langan). has prepared this preliminary geotechnical report in support of the due diligence effort by Grubb Properties and BRP Companies (Client). Our report presents the results of our review of available information and a very limited subsurface exploration, as well as our preliminary foundation-related recommendations for the development at 25-01 Queens Plaza North in the Long Island City neighborhood of Queens, New York.

Our understanding of the project is based on the Schematic Design prepared by Handel Architects, dated 26 August 2020. All elevations reported herein are with respect to the North American Vertical Datum (NAVD 88)[1]. All recommendations in this study are in accordance with our interpretations of the 2014 New York City Building Code (Building Code).

SITE DESCRIPTION

The approximate 30,540 square-foot site in the Long Island City neighborhood of Queens is identified as Block 415, Lots 4 and 10 on the New York City tax assessment map. The block is bordered by 41st Avenue to the north, 27th Street to the east, Queens Plaza North to the south, and Crescent Street to the west. The site occupies the southern part of the block. The site is occupied by a two-story commercial building with a partial cellar level fronting Queens Plaza North (Lot 4) and an associated rear at-grade parking area (Lot 10). A pedestrian bridge connects the second-story of the existing building to the New York City Transit (NYCT) elevated subway station located between Queens Plaza North and Queens Plaza South. The subway station is serves the NYCT N, W, and 7 trains.

Existing sidewalk grades around the site vary between about el 24 and el 27 along Crescent Street, about el 22 and el 24 along Queens Plaza North, and about el 22 and el 27 along 27th Street. A site location map is presented as Figure 1.

Adjacent Structures

The following structures border the site:

- NYCT Elevated Line Pedestrian Bridge: The elevated subway line services the N, W, and No. 7 lines. An about 125-foot-long pedestrian bridge connects the second story of the existing structure to the elevated Queensboro Plaza subway station. The NYCT structure condition is not addressed in this report.
- 41-23 Crescent Street (Block 415 - Lot 7502): An 18-story building along the north property line of Lot 10. The building was constructed circa 2007 and has multiple below-

[1] North American Vertical Datum of 1988 (NAVD88) is 1.1 feet below the mean sea level at Sandy Hook, New Jersey, 1929 (NGVD 1929).

grade levels listed on its certificate of occupancy. Records show the sub-cellar is used as a parking garage with an entrance on 41st Avenue. It is unknown if the cellar levels extend to the Lot 10 property line.

- 41-32 27th Street (Block 415 - Lot 36): A 16-story building along the east property line of Lot 10 and north property line of Lot 4. The building was constructed circa 2015 and has one below-grade level listed on its certificate of occupancy. It is unknown if the cellar level extends to the Lot 4 or Lot 10 property lines.
- The Ed Koch Queensboro Bridge spans the East River connecting Long Island and Manhattan Island. The ramp onto the bridge begins at Crescent Street west of the site. Coordination with the DOT may be required due to the proximity of the bridge to the site.

Access into the adjacent buildings and as-built drawings of the adjacent buildings were not available to Langan at the time of this report. The project expediter should obtain available records from the NYC Department of Buildings. At a minimum, the top of lowest cellar slab elevations must be obtained during the design phase of the project.

PROPOSED DEVELOPMENT

The proposed re-development includes demolishing the existing two-story building on Lot 4 and constructing a new mid-rise residential building with retail space and a single cellar occupying the majority of Lots 4 and 10. The final height of the building will depend of the additional FAR that will be pursued during the building permitting process. Preliminary foundation plans and building loads were not available at the time of this report. Current discussion with NYCT includes preserving the existing pedestrian bridge, possibly modifying the staircase, and possibly installing an elevator.

REVIEW OF PUBLISHED INFORMATION

We reviewed FEMA maps, historical maps, historical photographs, and regional geological maps of containing the re-development area.

Flood Elevations

The site is located outside the mapped flood hazard zones shown on the FEMA Preliminary Flood Insurance Rate Map (PFIRM) dated 5 December 2013.

Historical Uses

Historical maps (see Figure 2a through 2c), show development of the site was limited to a single frame building in the southeast corner of the site until the beginning of the 20th century.

- By 1907, a multi-story office building occupied the middle of the site fronting Queens Plaza North (previously Queens Bridge North).

- In photographs dating between about 1910 and 1912, the office building is visible as a 2-story structure west of the Brewster Building.
- By 1913, the building has a pediment constructed in the middle of the front façade; it appears that the pediment was added to the existing building.
- By 1936, the Queensboro Corporation, a real estate development company, occupied the office building which was connected to the then larger Queensboro Plaza NYCT station. Lot 10 contains small buildings in the northwest and southwest corners.
- In 1940, as seen in the NYC Department of Finance photographs, the central building at Lot 4 is much as it is today connected to the then larger NYCT station, a detached single-story frame structure is on the west end of Lot 4. There is a 2-story frame building, probably a home, at Lot 10.
- In 1947, additional detached structures are present at the western end of Lot 4.
- In 1950 the entire footprint of Lot 4 is developed. The configuration is likely identical to the present construction though as built plans and photos could not be obtained for verification.
- In the 1950's the NYCT station was reduced in size to its present configuration.
- By 1970, the structures at the northwest and southwest corners of Lot 10 were demolished.

Additional information regarding historical uses at the site are included in the Phase I Assessment issued by Langan separately.

Local Geology

The Baskerville Bedrock Geology Maps printed in 1994[2] indicates that the site is located over Ravenswood Granodiorite, which is generally comprised of gray sillimanite-garnet-microcline gneiss. The relevant part of the Bedrock Geology Map is presented in Figure 3.

SUBSURFACE EXPLORATION

Our subsurface exploration consisted of one test boring in which one groundwater monitoring well was installed. The proposed building will require an additional 10 borings to meet the Building Code geotechnical exploration requirements. The following sections provide details of our due diligence exploration program.

Test Boring

Warren George Inc. (WGI) drilled one test boring, LB-01(OW), between 15 and 21 December 2020, within Lot 10 under the full time inspection of Langan. WGI advanced the borehole with a

[2] "Bedrock and Engineering Geology Maps of New York City and parts of Kings and Queens Counties, New York" by Charles A. Baskerville, dated 1994, and published by the U.S. Geological Survey.

truck-mounted drill rig, using mud-rotary drilling techniques with drilling fluid and temporary steel casing to provide soil support. The boring was approximately 65 feet deep, with the bottom of the boring terminating 10 feet below the top of the bedrock. The bedrock was identified by roller bit and split-barrel sampler refusal and confirmed by rock coring. The boring location is shown on the Subsurface Exploration Plan, Figure 4.

Standard Penetration Test (SPT)[3] samples were collected and N-values recorded continuously in the upper 12 feet of the boring and at 5-foot intervals thereafter. The Langan inspector visually examined and classified soil and rock samples recovered in the field and assigned preliminary Building Code classifications.

Rock cores were drilled with an NX core barrel equipped with a diamond cutting bit in general accordance with ASTM D2113. Rock type, percent recovery (REC)[4], and Rock Quality Designation (RQD)[5], were determined for each core run. Rock core samples were visually examined and classified in the field in general accordance with the Building Code.

A copy of the boring log is included in Appendix A.

One 20-foot-deep groundwater observation well was installed in the completed boring LB-1(OW). A copy of the well construction log is provided in Appendix A.

SUBSURFACE CONDITIONS

The subsurface conditions below the pavement consist of a layer surficial of fill underlain by an upper sand, underlain by sandy silt, underlain by lower sand, underlain by bedrock. A representative subsurface profile is presented as Figure 5.

Fill [Class 7][6]

The layer directly below the asphalt pavement surface is uncontrolled fill consisting of fine to medium sand with varying amounts of silt and fine gravel. The bottom of the fill layer is at about 6 feet depth corresponding to about el 21 Field SPT N-values within the fill layer varied from 36 blows per foot (bpf) to 77 bpf. The higher SPT N-values are likely indicative of obstructions (demolition debris, etc.) rather than a dense material. The material in the fill layer is generally classified as Building Code Class 7, Controlled and Uncontrolled Fills.

[3] The Standard Penetration Test is a measure of the soil density and consistency. The Standard Penetration Resistance N-value is the number of blows required to drive a 2-inch-outer-diameter split-barrel sampler 12 inches, after an initial 6-inches of penetration, using a 140-pound hammer falling freely for 30 inches.
[4] The percent recovery is the ratio of the length of rock recovered over the total rock-core length, expressed as a percentage.
[5] The RQD is defined as the ratio of the summation of each rock piece greater than 4 inches (for NX core size) over the total core length, expressed as a percentage.
[6] Numbers in brackets indicate classification of soil and rock materials in accordance with the New York City Building Code.

Upper Sand [Class 3b]

A dry brown fine to medium sand with varying amounts of silt underlies the fill layer. The about 6.5-foot-thick upper sand layer extended from about 6 to 13.5 feet depth (about el 21 to el 13.5). Field SPT N-values in the upper sand layer varied between 24 bpf and refusal, averaging about 23 bpf; the highest SPT N-values are likely indicative of obstructions rather than a dense material. The material in the upper sand layer is generally classified as Building Code Class 3b material, Medium Granular Soils.

Silt [Class 5b and 5a]

A gray-brown sandy silt with a pocket of silty fine sand underlies the upper sand layer. The about 20-foot-thick silt layer extended from about 13.5 feet to 33.5 feet depth (about el 13.5 to el -6.5). Field SPT N-values in the silt layer varied between 10 and 85 bpf averaging about 35 bpf. Large SPT N-values are from a pocket of silty sand. The material in the silt layer is generally classified as Building Code Class 5b and 5a, Medium and Dense Sandy Silts. The pocket of silty sand material is generally classified as Building Code Class 3a, Dense Granular Soils.

Lower Sand [Class 3a]

Below the upper sand layer is a layer of brown and gray, fine to medium sand with varying amounts of silt. The 21-foot thick lower sand layer extended from about 33.5 to 54.5 feet depth (about el -6.5 to el -27.5). Field SPT N-values in the lower sand layer varied from 30 bpf to refusal, averaging to about 65 bpf. The material in the lower sand layer is generally classified as Building Code Class 3a, Dense Granular Soils.

An obstruction, a possible boulder, was encountered within this layer at about 47 feet deep.

Bedrock [Class 1a]

The top-of-bedrock was encountered about 54.5 feet below existing grade, corresponding to about el -28. Bedrock is slightly weathered gray gneissic schist. Rock core recovery was 100% and rock quality designation (RQD) was 100%. The bedrock is designated as Building Code Class 1a, Hard Sound Rock.

Groundwater

The groundwater level at LB-01(OW) was measured after drilling on 21 December 2020 at about 15 feet below the top of pavement, corresponding to about el 12. The groundwater level at LB-01(OW) was measured on 11 January 2021 at approximately 15.5 feet below the top of the pavement, corresponding to about el 11.5. The groundwater level was also measured at temporary environmental monitoring wells: MW-02, MW-03, MW-06, and MW-09 during environmental drilling and sampling. The groundwater elevation measured at the environmental monitoring wells was also at about el 12. Groundwater levels may vary seasonally and may be sensitive to heavy precipitation.

PRELIMINARY SEISMIC EVALUATION

Our preliminary seismic evaluation is in accordance with our interpretation of the 2014 New York City Building Code. We assume the development will be assigned Structural Occupancy/Risk Category II; the structural engineer should assign the Occupancy/Risk category.

The Building Code requires assignment of a Site Class in accordance with the procedures outlined in Section 1613.5.5. The determination is based on the type, thickness, and average soil and rock properties in the top 100 feet of bearing stratum. Based on the SPT N-values at LB-01(OW), the site is preliminarily classified Site Class D. The site class can be finalized upon completion of the Building Code required borings.

Preliminary recommendations are given in Table 1. Based on the preliminary design spectral accelerations and the assumed Structural Occupancy/Risk Category the Seismic Design Category (SDC) is B in accordance with NYCBC Section 1613.5.6.

Table 1 – Preliminary Seismic Design Parameters

Description	Parameter	Recommended Value	NYCBC 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	Stiff Soil Profile	**D**	Table 1613.5.2
Site Coefficient:	F_a	1.57	Table 1613.5.3
Site Coefficient:	F_v	2.40	
5 percent damped design spectral response acceleration at short periods:	$\mathbf{S_{DS}}$	**0.294 g**	Section 1613.5.4
5 percent damped design spectral response acceleration at 1-sec period:	$\mathbf{S_{D1}}$	**0.117 g**	
Structural Occupancy/Risk Category	-	**II**	Table 1604.5
Seismic Design Category	-	**B**	Tables 1613.5.6(1) 1613.5.6(2)

Soil Liquefaction Potential

The Building Code requires assessment of certain non-cohesive granular soils below the water table and less than 50 feet deep for potential soil liquefaction. In accordance with the Building Code, we plotted the SPT N_{60}-values with respect to depth, Figure 6. A total of 2 points out of 7 points plotted require liquefaction evaluation. We analyzed these 2 points using the procedure outlined by Idriss and Boulanger (2008) found neither was susceptible to liquefaction. The potential for liquefaction must be further analyzed after additional borings are performed.

Peats and loose sand are present at some sites in Long Island City and may underlie parts of this site. These soils have the potential to liquefy or collapse during seismic loading. If these soils are at the site and are not removed then the Building Code may require a site-specific ground motion determination for design. We can provide a site-specific ground motion as part of a site-specific seismic study (SSSS).

ADDITIONAL SUBSURFACE EXPLORATION

The Building Code requires 10 additional geotechnical borings for the proposed building footprint. Our recommendations are preliminary and must be revised or confirmed after the required boring investigation is complete. We recommend installing 2 to 3 additional monitoring in the remaining borings, in order to collect additional groundwater level information, which will be critical for the building design.

The presence of buried obstructions in the fill layer, including pile foundations from the current building can significantly impact the viability of driven pile foundations. We recommend excavating test pits within Lot 4 to identify obstructions in the fill and to determine if the building is supported on piles.

The current schematic design will likely require limited interaction with the neighbors throughout construction. In order to better evaluate construction methods and accommodate changes to the design it will be useful to understand how the neighboring buildings are supported. In the absence, of historical foundation drawings, we recommend excavating test pits to identify the type, condition, and locations of foundations at 41-23 Crescent Street and 41-32 27th Street.

FOUNDATION DESIGN RECOMMENDATIONS

Interaction with NYCT

Due to the proximity of the redevelopment to NYCT structure, the Building Department will require approvals from NYCT prior to issuing construction permits. NYCT will consider, among other things, the distance of proposed foundations and excavations horizontally and vertically to the NYCT structures, foundation loads, foundation types, and construction methods. Interaction with NYCT will most concern the pedestrian bridge and construction related vibrations.

If the pedestrian bridge bears on the current building or has independent foundations within the building footprint, the bridge may require underpinning or new foundations and temporary shoring following demolition. Our foundation recommendations only consider the new building and do not apply the pedestrian bridge or new NYCT structures, which we understand another consultant is evaluating. A structural engineer should design shoring for support of the pedestrian bridge during construction.

Foundation Evaluation and Discussion

The proposed redevelopment will include a cellar level; current zoning plans show the top of the cellar slab 15 feet below existing grade corresponding to about el 12, which is at the measured groundwater elevation. We recommend that during the design phase, the cellar level depth is kept as short as possible in order to limit the general excavation into the water to limit or possibly avoid dewatering.

The material at about 15-feet depth, medium silt, is not adequate to support the proposed development on shallow foundations, such as a mat or spread footings, without experiencing settlements beyond typical structural tolerances. To use shallow foundations would require a deeper excavation and construction of a 3 to 4-foot-thick mat. This deeper excavation will require extensive dewatering and installing a watertight support-of-excavation (SOE) system such as steel sheet piles, a secant pile wall, or a soil mix wall.

Based on the above preliminary assessment, we recommend using deep foundations to support the proposed development.

Deep Foundations

We recommend deep foundations such as driven piles, drilled micropiles bearing within the lower sand, or drilled caissons bearing on or within the bedrock. Our experience in the area shows that top of rock may vary across the site but is generally shallow enough and of sufficient quality for drilled caissons or driven end-bearing piles. Drilled caissons are preferable to micropiles where rock is shallow, as rock depth increases micropiles become a more viable option.

To limits effects from pile driving-induce vibrations, driven elements should not be used within 25 feet of adjacent buildings and the NYCT structures. The depth of bedrock, possible buried obstructions, and the anticipated response of neighboring buildings to construction vibrations will significantly influence the viability of driven pile foundations at the site.

The Building Code requires full-scale load testing to confirm the axial of driven piles and micropiles. The Code does not require axial load tests for caissons; however, each caisson must be inspected using a down-the-hole video camera. Lateral capacities greater than 1 ton must be confirmed with load tests regardless of what type of foundation is used.

Drilled Caissons

A drilled caisson is a shaft comprised of steel casing drilled to the top of rock and an uncased rock socket drilled into the rock. After drilling, reinforcement, either a steel cage or steel section, is installed in the shaft and the shaft is filled with grout or concrete. Caissons develop axial load capacity through peripheral shear resistance between the concrete/grout and bedrock within the rock socket. Caissons can accommodate relatively large loads in compression and tension. Caissons can be installed in close proximity to existing structures. Many foundation contractors can install caissons through common obstructions without specialized equipment or procedures.

For preliminary design, we recommend a 13-5/8-inch-diameter caisson with an allowable capacity of 450 tons in compression and 150 tons in tension developed via a 12-foot long rock socket.

Micropiles

Micropiles are constructed with an uncased socket into soil overburden. Micropiles develop capacity through peripheral shear along the uncased soil socket and develop less capacity than caissons. Micropile construction can be more economical than caisson construction where rock is deep or loads are small; therefore, we recommend considering micropiles where the top of rock is encountered more than 70 to 80 feet below existing grades. For preliminary design, we recommend using a 13-5/8-inch-diameter micropile with a preliminary allowable capacity of about 120 tons compression and 60 tons tension developed via a 50-feet long soil socket constructed in lower sand.

Open-Ended Driven Piles

Open-ended driven piles are steel pipes driven to bedrock. Driven piles develop capacity through end bearing at the tip of the pile on bedrock.

Driven piles have a faster rate and lower cost of installation than drilled caissons but produce greater noise and vibration. For preliminary design, we recommend an allowable axial capacity in compression between 200 and 225 tons.

Pile Installation Issues

Obstructions can slow, damage, and/or prevent the installation of deep foundations. Obstructions common in the fill include timbers, brick, boulders, and historical buried structures. In addition, a boulder was encountered at LB-01(OW) at about 47 feet depth.

The impact of shallow obstructions can be mitigated by pre-drilling and spudding before pile driving. Information from the remaining subsurface exploration will help further identify the likelihood of encountering obstructions. In addition, prior to production pile driving, the contractor must implement an index pile program consisting of driving 10 to 15 index piles to identify potential drivability issues. Select index piles will also be tested to meet the Building Code load testing requirements.

Cellar Slab

Considering the depth of excavation, the proximity to the groundwater, and the presence of softer, moisture sensitive silt at the excavation elevation, our preliminary recommendation is that the cellar slab is designed as structural slab spanning between pile caps. The cellar floor slab must also be designed to resist hydrostatic uplift pressures resulting from the groundwater rising at the preliminary design flood elevation of el 15 (see subsequent section).

Lateral Earth Pressures

Permanent below-grade walls will be subjected to lateral pressures from soil, surcharge, and groundwater (hydrostatic) loads. Our recommended lateral-pressure diagram is presented in Figure 7. We recommend that the below-grade wall next to the sidewalk be designed to resist a 300 psf vertical surcharge. Higher surcharge loads could be applied during construction from crane pads and outriggers; these loads (if applicable) will be provided by the crane designers.

Permanent Groundwater Control

Preliminary Design Flood Elevation

The cellar slab should be designed for hydrostatic pressures produced between the bottom of slab and design flood elevation. Waterproofing should be installed on slabs and walls located below the design flood elevation. The groundwater surface at LB-01(OW) was at about el 12. To account for utility breaks and heavy precipitation we recommend using a preliminary design flood elevation of el 15.

Foundation Waterproofing

To limit seepage and water vapor infiltration (through the concrete, cold joints, shrinkage cracks, and/or utility penetrations), we recommend that below grade spaces, including slabs, foundation walls, and pile caps be fully waterproofed to the design groundwater elevation. The foundation waterproofing should connect to any above-grade waterproofing. We recommend using membrane type of waterproofing; the use of bentonite waterproofing or negative side crystalline waterproofing is not recommended. For horizontal applications, we recommend that the waterproofing membrane be installed on a 3-inch-thick concrete working surface (mud slab).

Agency Approvals

Due to the proximity of the redevelopment to NYCT structures, the Building Department will require approvals from NYCT prior to issuing construction permits. We anticipate significant involvement with NYCT will be required during the planning, permitting, and the construction phases of the project. The review process may take several months or more and should be considered in the project schedule. Before performing any work, NYCT may require an initial photographic documentation supplemented with optical surveying and vibration monitoring of the bridge and possibly the elevated structure until the foundation construction is complete.

The ramp approaching the Ed Koch Queensboro Bridge begins at about Crescent Street and Queens Plaza at the west side of the Site. NYSDOT may require monitoring of the bridge during construction. Additional interaction with the NYSDOT may be required.

KEY FOUNDATION CONSTRUCTION CONSIDERATIONS

Support of Excavation

The foundation contractor must take appropriate measures to stabilize the work area and prevent lateral movements of the adjacent buildings and structures during the foundation excavation. A temporary support of excavation (SOE) system consisting of drilled soldier piles and timber lagging appears feasible to support overburden soil. SOE's deeper than 10-12 feet typically require horizontal bracing (i.e. tiebacks, rakers, struts, etc.). The extents of adjacent cellars may reduce earth pressures on SOE and allow for reduced bracing. The cellar extents should be identified with surveys, as-built drawings, and test pits. Deep pile caps and isolated elevator and ejector pits may require localized deeper SOE with local dewatering during excavation (see following section).

If the excavation at or near the property line extends deeper than adjacent foundations (footings and mats), permission must be acquired from the owners of the adjacent buildings before installing underpinning, tiebacks, or any other SOE elements extending beyond the property lines.

Temporary Groundwater Control

Excavation extending below the observed groundwater elevation (el 12) will require temporary dewatering. The extent of dewatering should be determined based on the finalized foundation design. The dewatering should be designed by the contractor's dewatering engineer.

Dewatering within the site may require permits issued by the New York City Department of Environmental Protection (DEP) and should be coordinated with the project environmental. The dewatering permitting and installation must be considered in the foundation cost and schedule.

Preconstruction Condition Documentation and Monitoring

Preconstruction documentation of the adjacent buildings and NYCT structures must be completed prior to the commencement of the demolition and construction activities. In addition, a monitoring program should be implemented to observe the performance of adjacent structures and evaluate construction procedures. This program should consist of monitoring horizontal and vertical movements by optical surveying and monitoring vibrations using threshold-type seismographs to measure construction-induced vibrations during and, until the foundation construction is complete. In addition, NYCT will require a force account to be in place prior to allowing the foundation construction to start.

LIMITATIONS

This is a limited scope study to assist Grubb Properties and BRP Companies (Client) during their due diligence for this site. The conclusions and recommendations provided in this report are initial and preliminary and result from our interpretation of the geotechnical conditions existing at the site inferred from a single-boring subsurface-exploration and other available information. Recommendations provided are dependent upon one another and no recommendation should be followed independent of the others.

Information on subsurface strata and groundwater levels shown on the logs represent conditions encountered only at the locations indicated and at the time of investigation. If different conditions are encountered during construction, they should immediately be brought to Langan's attention for evaluation, as they may affect our recommendations.

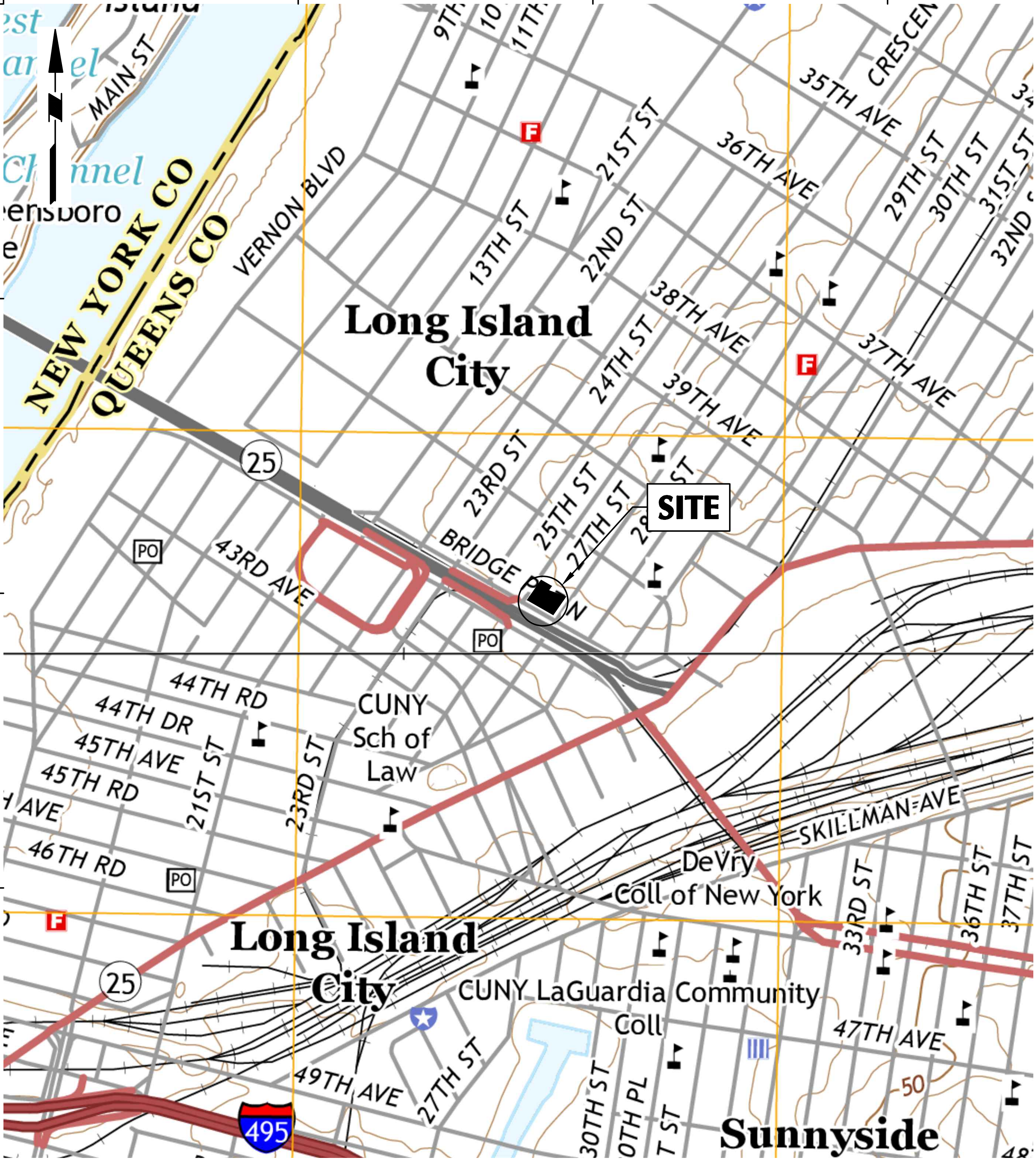
The information in this study cannot be utilized or depended on by engineers or contractors who are involved in evaluations or designs of facilities (including underpinning, grouting, stabilization, etc.) on adjacent properties which are beyond the limits of that which is the specific subject of this study.

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.

FIGURES

1 2 3 4

A B C D



SOURCE: BROOKLYN QUADRANGLE NEW YORK AND CENTRAL PARK QUADRANGLE NEW YORK-NEW JERSEY, 7.5-MINUTE SERIES, TOPOGRAPHIC QUADRANGLE MAPS, DATED 2016.

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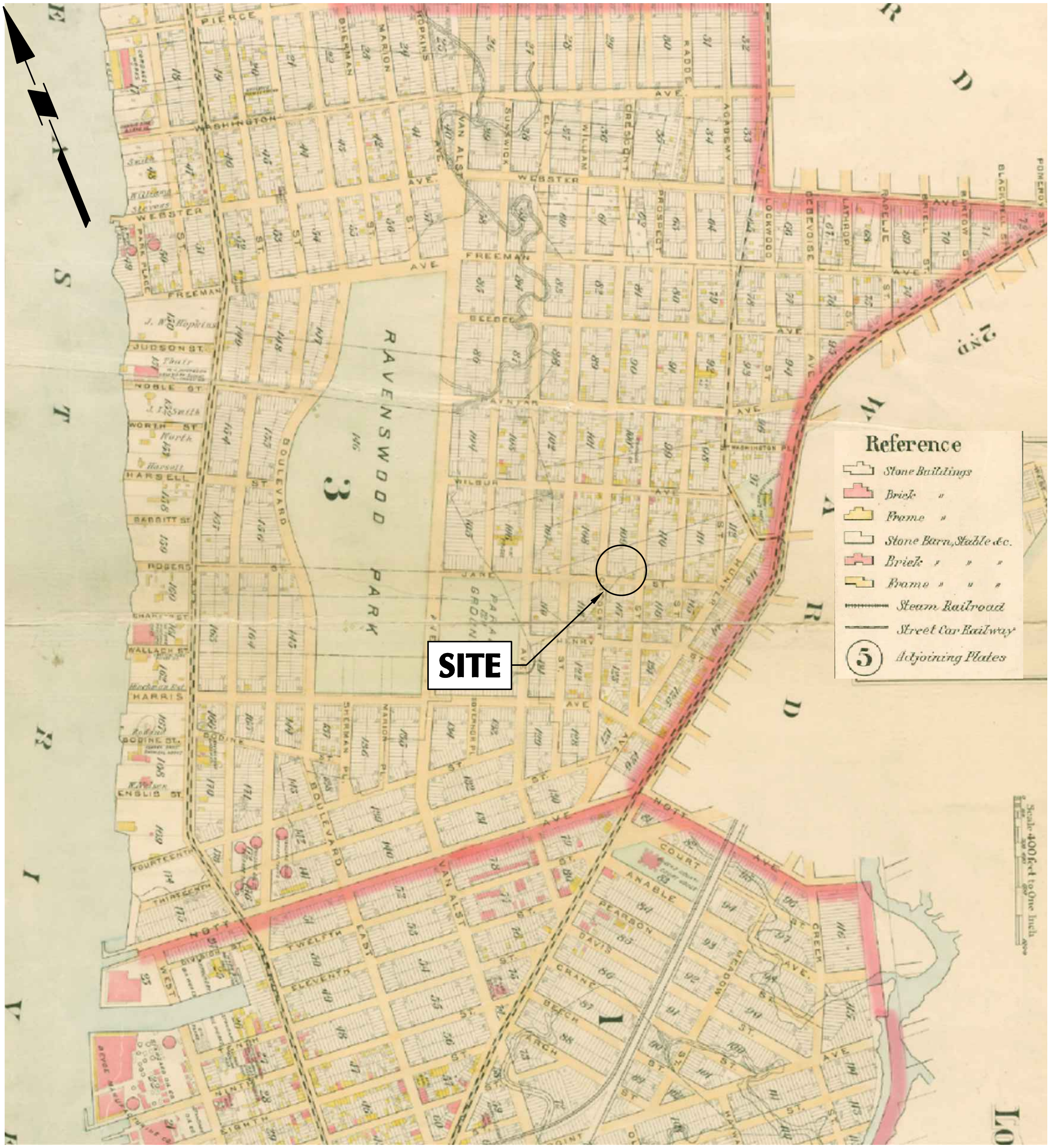
LANGAN	Project	Figure Title	Project No. 170652801	Figure No.
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.	25-01 QUEENS PLAZA NORTH	SITE LOCATION MAP	Date 01/13/2021	1
21 Penn Plaza, 360 West 31st Street, 8th Floor New York, NY 10001	BLOCK No. 415, LOT No. 4 & 10		Drawn By EK	
T: 212.479.5400 F: 212.479.5444 www.langan.com	QUEENS NEW YORK		Checked By DBS	Sheet 1 of 10

1 2 3 4

A B C D



SOURCE: "ATLAS OF QUEENS COUNTY, LONG ISLAND, NEW YORK; PLATE 4: PART OF LONG ISLAND CITY WARD NO. 1 & 3" (1891) BY CHESTER WOLVERTON

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Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. 21 Penn Plaza, 360 West 31st Street, 8th Floor New York, NY 10001 T: 212.479.5400 F: 212.479.5444 www.langan.com	25-01 QUEENS PLAZA NORTH BLOCK No. 415, LOT No. 4 & 10 QUEENS NEW YORK	HISTORICAL MAP (1891)	170652801 Date 01/13/2021 Drawn By EK Checked By DBS	2A Sheet 2 of 10

Filename: \\langan.com\data\NYC\data8\170652801\Project Data\CAD\01\SheetFiles\Geotechnical\Geotechnical Due Diligence Figures\Figure 2 - Historic Maps.dwg Date: 1/22/2021 Time: 15:33 User: dspitzer Style Table: Langan.stb Layout: 1891 WOLVERTON MAP

1 2 3 4

A B C D

SOURCE: "ATLAS OF THE BOROUGH OF QUEENS CITY OF NEW YORK: VOLUME 2 PLATE 2; LONG ISLAND CITY WARD NO. 1" (1903) BY E. BELCHER HYDE

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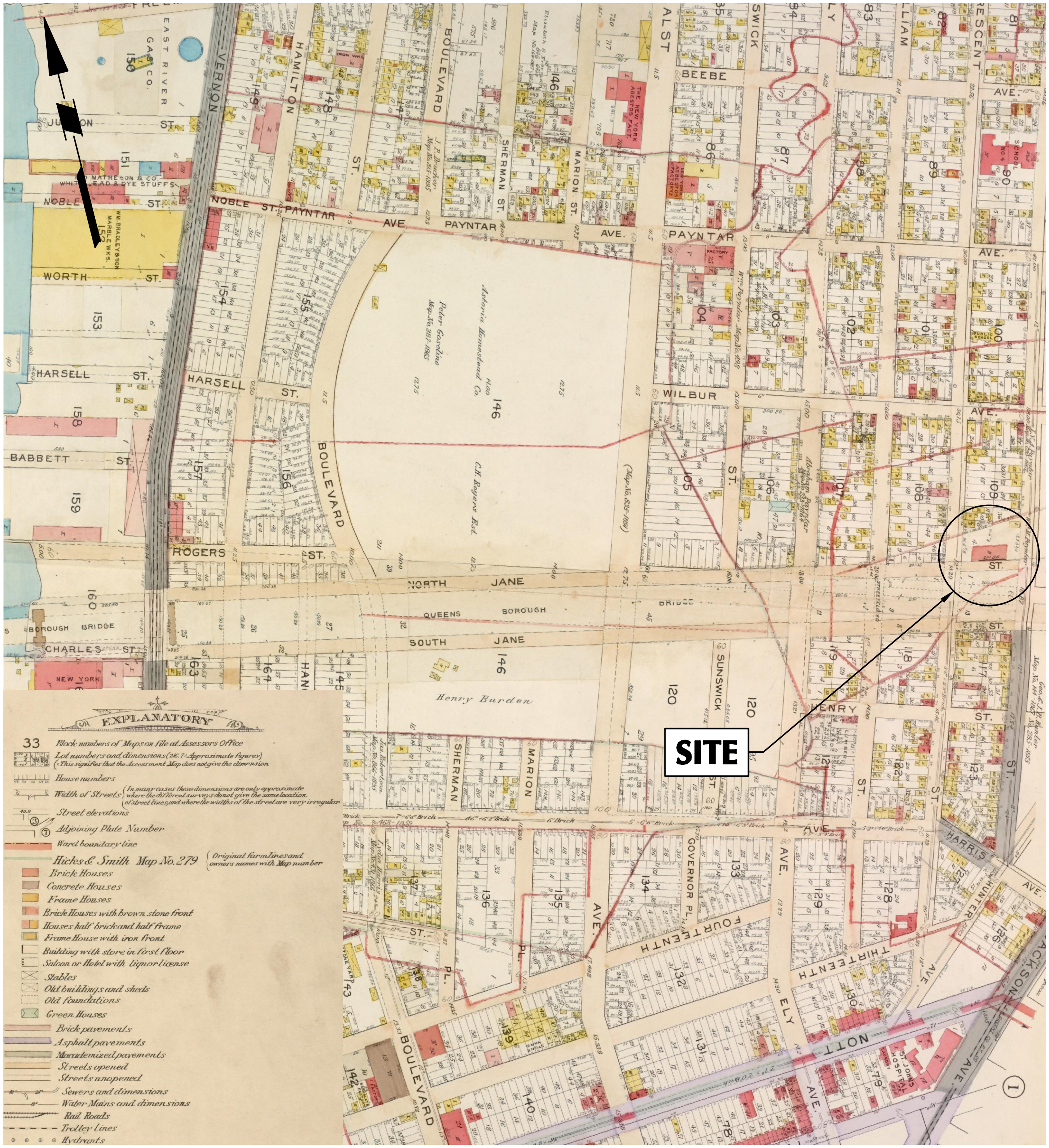
LANGAN	Project	Figure Title	Project No.	Figure No.
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. 21 Penn Plaza, 360 West 31st Street, 8th Floor New York, NY 10001 T: 212.479.5400 F: 212.479.5444 www.langan.com	25-01 QUEENS PLAZA NORTH BLOCK No. 415, LOT No. 4 & 10 QUEENS NEW YORK	HISTORICAL MAP (1903)	170652801 Date 01/13/2021 Drawn By EK Checked By DBS	2B Sheet 3 of 10



SOURCE: "ATLAS OF THE BOROUGH OF QUEENS CITY OF NEW YORK: VOLUME 2 PLATE 2; LONG ISLAND CITY WARD NO. 1" (1907) BY E. BELCHER HYDE

500 0 250 500

SCALE IN FEET

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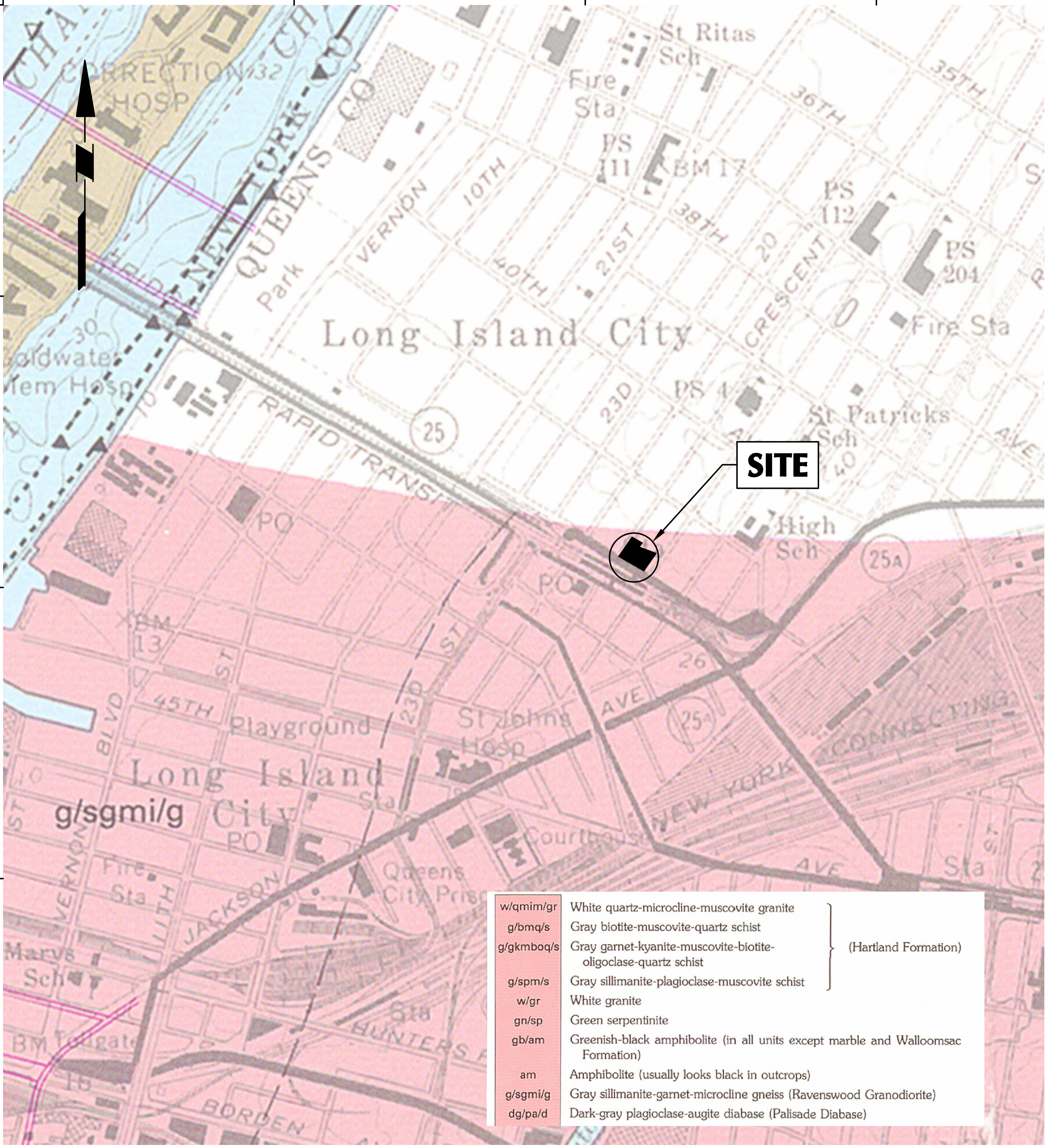

w/qmim/gr	White quartz-microcline-muscovite granite	(Hartland Formation)
g/bmq/s	Gray biotite-muscovite-quartz schist	(Hartland Formation)
g/gkmboq/s	Gray garnet-kyanite-muscovite-biotite-oligoclase-quartz schist	(Hartland Formation)
g/spm/s	Gray sillimanite-plagioclase-muscovite schist	(Hartland Formation)
w/gr	White granite	
gn/sp	Green serpentinite	
gb/am	Greenish-black amphibolite (in all units except marble and Walloomsac Formation)	
am	Amphibolite (usually looks black in outcrops)	
g/sgmi/g	Gray sillimanite-garnet-microcline gneiss (Ravenswood Granodiorite)	
dg/pa/d	Dark-gray plagioclase-augite diabase (Palisade Diabase)	

SOURCE: "BEDROCK AND ENGINEERING GEOLOGIC MAPS OF NEW YORK CITY AND PARTS OF KINGS AND QUEENS COUNTIES, NEW YORK" PROVIDED BY CHARLES A. BASKERVILLE, DATED 1994.

1000 0 500 1000
SCALE IN FEET

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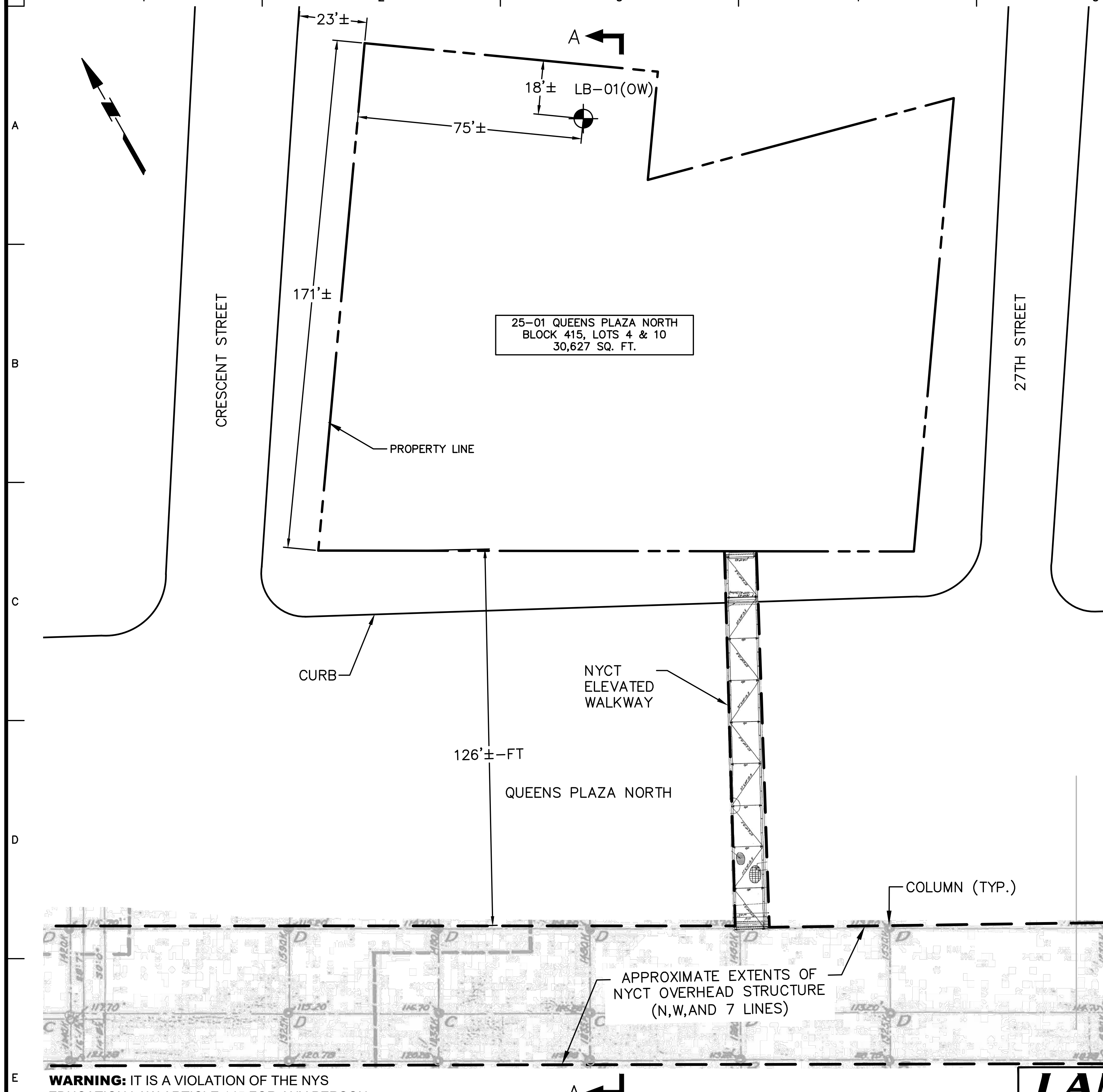
Project
25-01 QUEENS PLAZA NORTH
BLOCK No. 415, LOT No. 4 & 10
QUEENS NEW YORK

Figure Title
BEDROCK GEOLOGY MAP

Project No. 170652801
Date 01/13/2021
Drawn By EK
Checked By DBS

Figure No. **3**

Filename: \\langan.com\data\NYC\data8\170652801\Project Data\CAD\01\SheetFiles\Geotechnical\Geotechnical Due Diligence Figures\FIGURE 3-Bedrock Geology Map.dwg Date: 1/22/2021 Time: 15:34 User: dspitzer Style Table: Langan.stb Layout: Bedrock Geology Map



GENERAL NOTES:

1. NYCT PLAN BACKGROUNDS FROM NYCT RECORD DRAWINGS:
   - 1.1. FILE NO. 3201 DWG. NO. 30, "ROUTE NO. 36 & 37 – SECTION NO. 1, STRUCTURAL PLANS, QUEENSBORO BRIDGE PLAZA APPROACH, STA. 72+95 TO STA. 77+75" DATED 3 DEC 1913.
   - 1.2. FILE NO. 3201 DWG. NO C-147-C-4, "DEMOLITION OF AND ALTERATION TO PORTIONS OF ELEVATED RAILROAD STRUCTURE QUEENSBORO PLAZA STATION ROUTES NO. 36&37 SECTION NO. 1 BOROUGH OF QUEENS" DATED 28 FEB 1961.
2. TEST BORING WAS DRILLED BETWEEN 15 AND 21 DECEMBER 2020 BY WARREN GEORGE, INC. UNDER THE FULL TIME SPECIAL INSPECTION OF A LANGAN ENGINEER..
3. BORING LOCATION WAS MEASURED IN THE FIELD AND IS APPROXIMATE.

LEGEND:

LB-01 (OW) — LANGAN GEOTECHNICAL BORING LOCATION / OBSERVATION WELL

PROPERTY LINE

40 0 10 25 40

SCALE IN FEET

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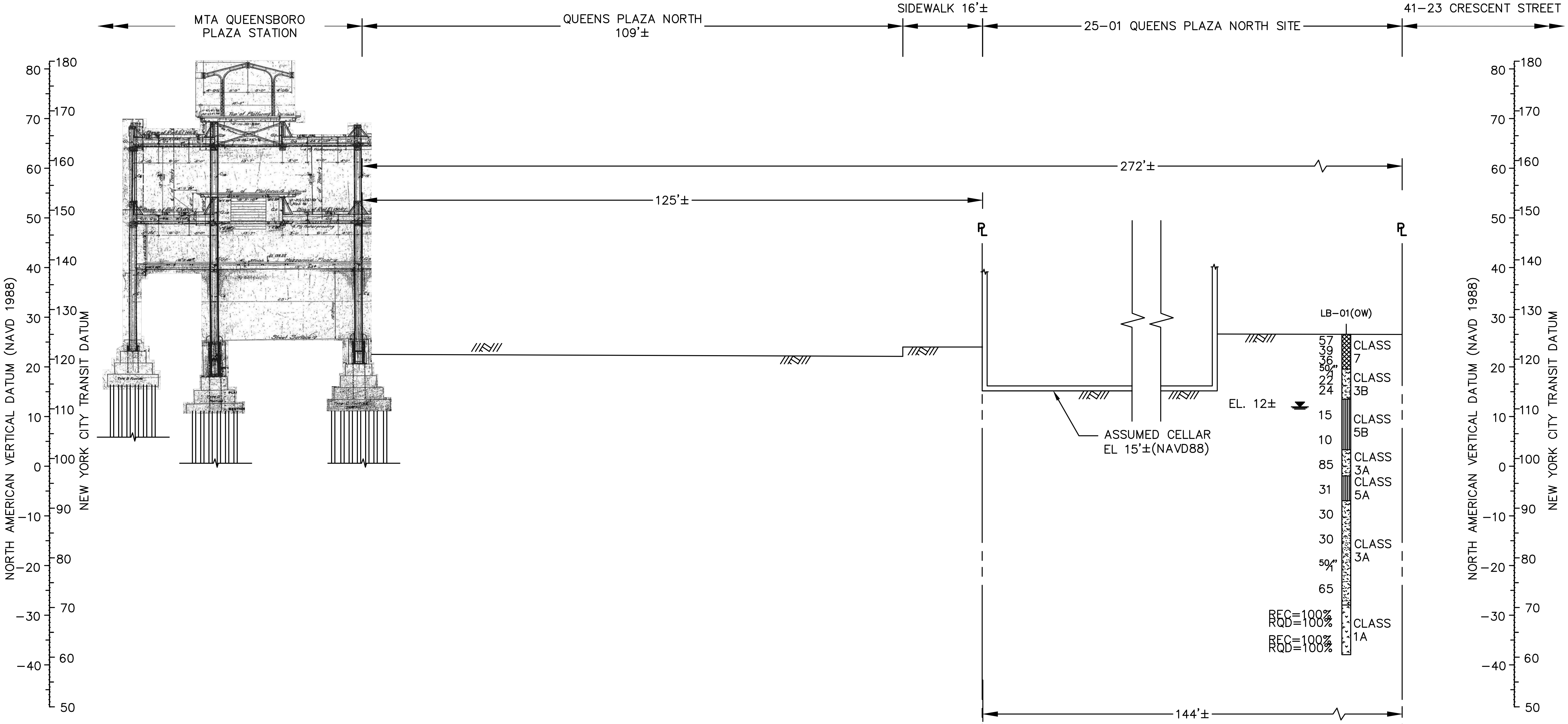
Project	Figure Title	Project No. 170652801	Figure No.
25-01 QUEENS PLAZA NORTH BLOCK No. 415, LOT Nos. 4 & 10 QUEENS NEW YORK	BORING LOCATION PLAN	Date 01/13/2021 Drawn By EK Checked By DBS	4 Sheet 6 of 10

Filename: \\langan.com\data\NYC\data8\170652801\Project Data\CAD\01\SheetFiles\Geotechnical\Geotechnical Due Diligence Figures\Figure 4 - Boring Location Plan.dwg Date: 1/22/2021 Time: 15:34 User: dspitzer Style Table: Langan.stb Layout: BLP



GENERAL NOTES:

1. ALL ELEVATIONS ARE APPROXIMATE AND WITH RESPECT TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), WHICH IS 1.1 FEET BELOW THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
2. THE BUILDING EXTENTS DEPICTED HEREIN ARE ASSUMED AND SHOULD BE CONSIDERED APPROXIMATE.
3. GROUND WATER ELEVATIONS REFERENCED HEREIN REPRESENT WATER LEVELS TAKEN AT MONITORING WELL LB-1(OW). SEE FIGURE NO. 4 FOR LOCATION OF THE MONITORING WELLS.
4. SUBSURFACE LITHOLOGY INTERPRETED FROM RECOVERED SOIL AND ROCK CORE SAMPLES.
5. REFER TO FIGURE NO. 4 FOR LOCATION OF SECTION.
6. ALL BORING LOCATIONS ARE APPROXIMATE AND PROJECTED.
7. SEE FIGURE LS-1 FOR LANGAN STANDARDS.

SUBSURFACE PROFILE A

FACING WEST

SCALE: 1" = 20'

20 0 5 10 20

SCALE: 1 INCH = 20 FEET

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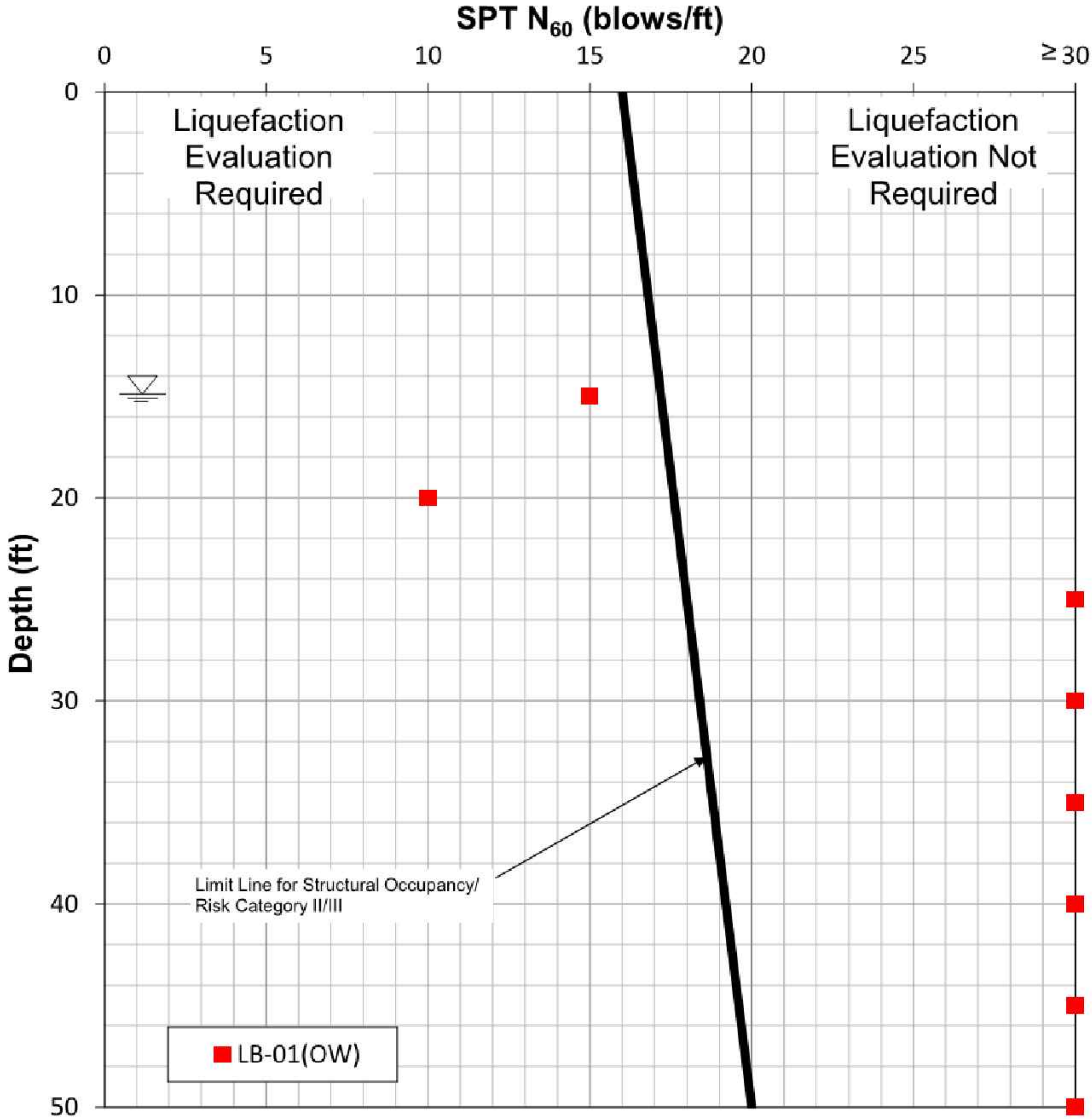
Project	Figure Title	Project No. 170652801	Figure No.
25-01 QUEENS PLAZA NORTH BLOCK No. 415, LOT Nos. 4 & 10 QUEENS NEW YORK	SUBSURFACE PROFILE	Date 01/13/2021 Drawn By EK Checked By DBS	5 Sheet 7 of 10



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Project

25-01 QUEENS PLAZA NORTH

BLOCK No. 415, LOT No. 4 & 10

QUEENS NEW YORK

Figure Title

LIQUEFACTION ASSESSMENT DIAGRAM

Project No. 170652801

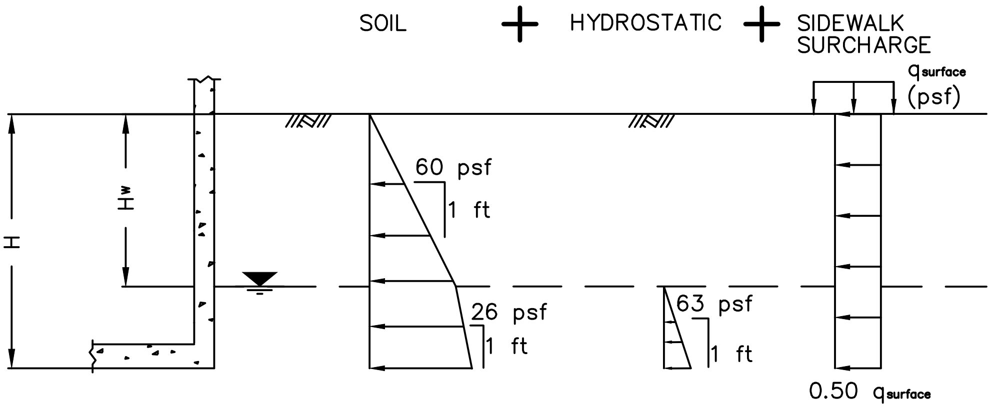
Date 01/13/2021

Drawn By EK

Checked By DBS

Figure No. 6

Filename: \\langan.com\data\NYC\data8\170652801\Project Data\CAD\01\SheetFiles\Geotechnical\Geotechnical Due Diligence Figures\Figure 6 -NYCBC Liquefaction.dwg Date: 1/22/2021 Time: 15:35 User: dspitzer Style Table: Langan.stb Layout: ANSIA-BP



LEGEND:

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

LATERAL-EARTH PRESSURES

LANGAN	Project	Figure Title	Project No.	Figure No.
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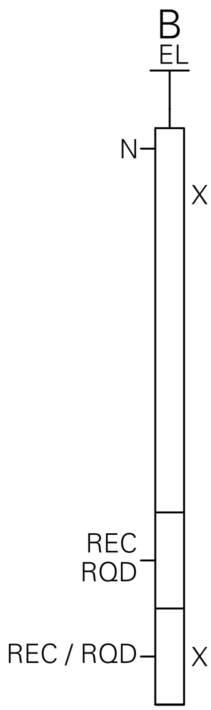
BORING KEY



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 RETRIEEVED)/(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
Pt	PEAT
F	UNCONTROLLED FILL

NEW YORK CITY BUILDING CODE CLASSIFICATION NUMBER

1A	HARD SOUND ROCK
1B	MEDIUM SOUND ROCK
1C	INTERMEDIATE ROCK
1D	SOFT ROCK-WEATHER 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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Project	Figure Title	Project No.	Figure No.
665 FIFTH AVENUE BLOCK No. 1288, LOT No.69 MANHATTAN NEW YORK	LANGAN STANDARDS	Date 01/13/2021 Drawn By EK Checked By DBS	LS-1 Sheet 10 of 10

APPENDIX A
BORING AND WELL CONSTRUCTION LOG

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Project: 25-01 Queens Plaza North	Project No.: 170652801
Location: Long Island City, NY	Elevation and Datum: Approx. el 27 ± NAVD88
Drilling Company: Warren George Inc	Date Started: 12/15/20 / Date Finished: 12/22/20
Drilling Equipment: CME-75	Completion Depth: 65 ft / Rock Depth: 54.5 ft
Size and Type of Bit: 3-7/8in Tricone Roller Bit	Number of Samples: Disturbed 14 / Undisturbed / Core 2
Casing Diameter (in): 4in / Casing Depth (ft): 54	Water Level (ft.): First 15 ft / Completion / 24 HR.
Casing Hammer: Donut Hammer / Weight (lbs): 300 lb / Drop (in): 30 inches	Drilling Foreman: Caeser Moreira
Sampler: 2-inch-diameter split spoon; NX Core Barrel	Field Engineer: Anshuman Kowtha & Conrad Kieras
Sampler Hammer: Safety Hammer / Weight (lbs): 140 lbs / Drop (in): 30 inch	

Elev. (ft)	NYCBC	Sample Description
+27.0 to +26.5	Class 7	6" Asphalt pavement
+26.5 to +21.0	CLASS 7	Dark grey poorly graded GRAVEL, some sand (dry) [FILL]
		Dark grey poorly graded fine GRAVEL, some sand (moist) [FILL]
		Light grey poorly graded fine GRAVEL, some sand (moist) [FILL]
+21.0 to +13.5	Class 3b	Brown silty fine SAND (dry) [SM]
		Brown silty fine SAND (dry) [SM]
		Brown fine SAND (dry) [SP]
+13.5	Class 5b	— ? — ? — ? — ? —
		Brown sandy SILT (wet) [ML]

Depth (ft)	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
0–1.5	S-1	SS	6	30, 27, 50/1"	50/1"	Started Drilling 12:00 PM; Asphalt for about 0.5'; S-1 at 0.5'
2–4	S-2	SS	9	30, 27, 12, 3	39	S-2 at 2'
4–6	S-3	SS	6	25, 20, 16, 20	36	S-3 at 4'
6–7	S-4	SS	12	8, 9, 50/1"	50/1"	S-4 at 6'; Drill to 8'
8–10	S-5	SS	13	9, 10, 12, 10	22	S-5 at 8'
10–12	S-6	SS	17	10, 12, 12, 14	24	S-6 at 10'
15–17	S-7	SS	14	7, 7, 8, 9	15	Drilling Start 7:25 AM; Drive Casiing to 15'; Drill to 15'; S-7 at 15'

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Log of Boring **LB-01(OW)** Sheet 2 of 3

Project	Project No.
25-01 Queens Plaza North	170652801
Location	**Elevation and Datum**
Long Island City, NY	Approx. el 27 ± NAVD88

Elev. (ft)	NYCBC	Sample Description	Coring (min)	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+7.0	Class 5b	Gray-brown sandy SILT [wet] [ML]		20	S-8	SS	15	4 / 7 / 3 / 4	10	Drill to 20' S-8 at 20'
+3.5	Class 3a	Gray-brown silty SAND with fine gravel (moist) [SM]		25	S-9	SS	12	7 / 35 / 50 / 35	85	Drill to 25' S-9 at 25'
-1.5	Class 5a	Gray-brown sandy SILT with trace fine gravel (moist) [ML]		30	S-10	SS	20	23 / 17 / 14 / 10	31	Drill to 30' S-10 at 30'
-6.5	Class 3a	Brown-gray fine SAND with silt (moist) [SP]		35	S-11	SS	12	10 / 17 / 13 / 11	30	Dill to 35' S-11 at 35'
		Gray fine SAND with silt (moist) [SP]		40	S-12	SS	14	14 / 15 / 15 / 14	30	Drill to 40' S-12 at 40'
				45						

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Log of Boring **LB-01(OW)** Sheet 3 of 3

Project	Project No.
25-01 Queens Plaza North	170652801
Location	**Elevation and Datum**
Long Island City, NY	Approx. el 27 ± NAVD88

Material Symbol	Elev. (ft)	NYCBC	Sample Description	Coring (min)	Depth Scale	Sample Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	-18.0	Class 3a	Dark gray silty SAND (moist) [SM]		45	S-13	SS	17	10, 13, 50/1"	50/1"	Drill to 45' S-13 at 45' Refusal encountered during last 7" Switch to core barrel
			Gray and brown fine to coarse SAND, some silt, some fine gravel (moist) [SM]		50	S-14	SS	23	10, 30, 35, 32	65	Coring stopped, no recovery S-14 at 50'
	-27.5	Class 1a	Gray GNEISS; medium grained quartz; slightly weathered; wide fracture spacing; fractures shallow dipping; intact; [BEDROCK]	2:29, 3:21, 4:35, 3:00, 4:39	54.5	C-1	NX CORE	REC=60"/60" =100%	RQD=60"/60" =100%		Split barrel Sampler refusal at 54.5' C-1 at 54.5'
			Gray GNEISS; medium grained quartz; slightly weathered; wide fracture spacing; fractures shallow dipping; intact; [BEDROCK]	3:26, 2:57, 4:06, 6:31, 2:41	59.5	C-2	NX CORE	REC=60"/60" =100%	RQD=60"/60" =100%		C-2 at 59.5'
	-37.5				64.5						Bottom of boring at 12/21/2020 11:45 am Well Installed to 20 ft bgs

Depth scale: 45 – 70 ft

WELL CONSTRUCTION SUMMARY
Well No. LB-01(OW)

PROJECT	PROJECT NO.
25-01 Queens Plaza North	170652801
LOCATION 25-01 Queens Plaza North, NYC, NY	**ELEVATION AND DATUM** 27 NAVD
DRILLING AGENCY Warren George Inc.	**DATE STARTED** 12/15/2020 **DATE FINISHED** 12/21/2020
DRILLING EQUIPMENT Truck Mounted Rig	**DRILLER** Caeser Moreira
SIZE AND TYPE OF BIT 3-7/8" O.D. Tri-Cone Roller Bit	**INSPECTOR** Conrad Kieras

METHOD OF INSTALLATION

This boring was advanced through soil and rock to about 64.5 feet from the surface level using a 3 7/8" tri-cone roller bit. Using soil cutings, the hole was backfilled to 24 below the ground surface (bgs). A 2-inch-diameter, 10-foot-long slotted PVC screen was installed to a depth of approximately 20 feet bgs. 10 feet of pvc riser was then used to bring the well to surface level. Filter sand was then used to fill annulus around the screen and riser from 24 ft bgs to 2 ft bgs. The final 2 feet of the hole were then capped off with hole plug (bentonite). Once level, a flush plastic cap was used to protect the well from external disturbances.

METHOD OF WELL DEVELOPMENT

This observation well was flushed until the water return was clean. The observation well was bailed approximately 3 times the well volume.

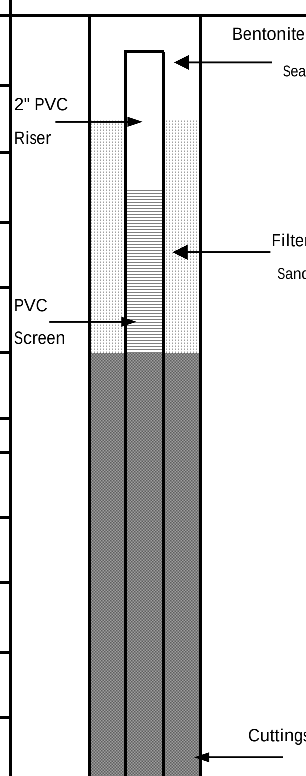
TYPE OF RISER	DIAMETER	TYPE OF BACKFILL MATERIAL
PVC	2"	Clean Sand & Hole Cuttings
TYPE OF SCREEN Slotted PVC	**DIAMETER** 2"	**TYPE OF SEAL MATERIAL** Bentonite
BOREHOLE DIAMETER 4"		**TYPE OF FILTER MATERIAL** Clean Sand

	ELEVATION	DEPTH (ft)
TOP OF RISER	27	0
TOP OF SEAL	26	1
TOP OF FILTER	25.0	2.0
TOP OF SCREEN	17	10
BOTTOM OF BORING	-37.5	64.5
SCREEN LENGTH	10 ft	
SLOT SIZE	0.01 in	

GROUNDWATER ELEVATIONS

ELEVATION	DATE	DEPTH TO WATER
12.0	12/21/2020	15.0 ft
11.5	1/11/2021	15.5 ft
		ft
		ft
		ft
		ft

WELL DETAILS



SUMMARY SOIL CLASSIFICATION	DEPTH (FT)
FILL	0.0 – 6.0
SAND AND SILT	6.0 – 54.5
GNESIS	54.5 – 64.5

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