REVISED FINAL REPORT

REVISED GEOTECHNICAL INVESTIGATION AND FOUNDATION RECOMMENDATIONS

61 BUENA VISTA AVENUE
YONKERS, NEW YORK

Prepared for:

Mr. Brian Tierney
AMS Acquisitions, Development & Construction
595 Madison Avenue, Suite 1101
New York, NY 10022

April 19, 2019 *(Revised May 3, 2019)*

Prepared By:

Geotechnical Engineering Services, P.C.
6 Bayberry Road
Elmsford, New York 10523

TABLE OF CONTENTS

TABLE OF CONTENTS

List of Figures

List of Appendices

1.1 GENERAL

As described by our revised proposal, dated January 22, 2019, this revised geotechnical report presents the results of a subsurface investigation and geotechnical recommendations for the proposed construction at 61 Buena Vista Avenue in Yonkers, New York. This report supersedes our previously issued geotechnical report, dated April 19, 2019, and incorporates the comments made by the project structural engineer, as well as subsequent project meetings. The objectives for this investigation were to determine the in-situ subsurface conditions at the site, as well as provide foundation design and construction-related recommendations for the proposed new building.

1.2 PROJECT LOCATION, DESCRIPTION, HISTORY, AND GEOLOGY

Based on recent discussions between the Owner and Mr. Ziad H. Maad, P.E., D. GE. of Geotechnical Engineering Services, P.C. (GES), we understand the project site is located within the City of Yonkers, in Westchester County, New York at 61 Buena Vista Avenue. The property is currently an open lot, and bounded to the east by Buena Vista Avenue, to the north by a high two-story brick building at 92 Main Street, to the west by the New York City Transit Authority Metro-North Rail Road (TA) and Amtrak north and southbound tracks, and to the south by an alley and a two-story brick building (with cellar level) at 73 Buena Vista Avenue.

The recent progress drawings provided to us show you plan to construct an about 19,000-square-foot, multi-story residential tower, which will rise at least 300 feet above Buena Vista Avenue, and have three basement levels in the northern portion of the site. We understand this tower will be connected to a six-story podium, also with three basement levels, and used for residential housing and parking, which will cover about 27,000-square-feet in footprint area within the southern portion of the site. The new structure will cover nearly the entirety of the currently open, about 49,960-square-foot lot. We understand the depth of excavation will extend to approximately 30 feet below sidewalk level (at the south end of the site), i.e., to about el. +20, and locally deeper for elevator and sump pits.

As the project site is within 200 feet of the west adjacent TA tracks, filing of the boring program and methodology with the TA was required. Prior to mobilization, GES produced a set of drawings for the TA, showing the proximity of the project site to the tracks, and obtained a TA Letter of No Impact for the geotechnical borings.

We understand SOR Testing Laboratories, Inc. (SOR) previously conducted a geotechnical investigation at the site, consisting of nine (9) hollow-stem-auger geotechnical borings, summarized in their May 10, 2010 “Geotechnical Investigation Report” for the proposed development. Some of the data collected from this investigation was referenced in this report.

GES did not perform any surveying and solely relied on our information as measured in the field, as well as a March 5, 2019 Architectural Survey by Empire State Layout, Inc., provided by the Owner. The survey contains elevations which show the site grades vary greatly across the site, ranging from about el. +50 in the southeastern corner of the lot, to about el. +22 along the western edge of the lot, though could be lower in an inaccessible area (to the survey crew) in the southwestern corner of the lot. All elevations in this report and the survey reference the North American Vertical Datum of 1988.

Site History

Based on our review of historic photographs and maps of the area, it appears that the lot was covered by various structures as recently as 2013, but all had been demolished and the site left in its current condition by 2015. These structures were present during the 2010 SOR investigation, referenced above, and as noted on our attached Geologic Cross-Sections. It appears the south adjacent building was constructed between 1966 and 1974, and pre-dated by another building of unknown height, dating back to at least 1889. The north adjacent high two-story building was constructed at some point between 1911 and 1954, and was predated by another structure of unknown height, built between 1889 and 1911.

Site Geology

Geologic maps indicate that the site is located well north of the terminal moraine, and was likely subject to several periods of glaciation, as was evidenced by our investigation encountering a thick layer of sand and gravel (likely Glacial Till), further discussed below. The bedrock in this area maps as Fordham Gneiss, though is adjacent to several other rock types. However, as further discussed below, white and gray marble was encountered at this site.

1.3 OBJECTIVES AND SCOPE OF SERVICES

The objectives of this investigation were to evaluate the subsurface conditions beneath the proposed construction and to provide geotechnical recommendations for the design and construction of the foundation and support of excavation for the proposed development. The following scope of services was performed:

1. Filed boring program with the TA and obtained a TA Letter of No Impact.
2. Performed three (3) geotechnical borings within the vacant lot and within the proposed footprint of the new development.
3. Provided full-time controlled inspection of the drilling operations.
4. Prepared this report that includes the following:
   a) Description of the methodology of drilling and sampling of the geotechnical borings;
   b) A Boring Location Plan showing the as-drilled locations of all borings (including approximate locations of SOR borings);
   c) Geologic Cross-Sections (3) showing the stratigraphy in the northern and southern portions of the site, as well as a section along the length of the site;
   d) Results of engineering evaluations and recommendations regarding the foundation design including:
      - Design and construction recommendations for the proposed foundation systems;
      - Geotechnical earthquake engineering considerations, including liquefaction evaluation, Site Class, and select seismic design parameters;
      - Permanent and temporary groundwater control measures;
      - Support of excavation, underpinning, and lateral earth pressure considerations;

- Protection of adjacent and nearby structures and utilities, including the TA and Amtrak rail lines running north-south along the western edge of the site;
- Third basement level slab subgrade preparation;
- Construction monitoring considerations including vibration monitoring and compaction control.

e) List of Figures, which includes the Boring Location Plan, Geologic Cross-Sections, a plot of Groundwater Levels, and a Lateral Earth Pressure Diagram.

f) Appendices which include geotechnical boring logs and rock core photo logs.

2.1 GENERAL

Our geotechnical investigation consisted of field locating and drilling three (3) geotechnical borings, performed within the proposed footprint of the new development. Typed boring logs, as well as rock core photo logs are attached to this geotechnical report as Appendix A and B, respectively. Details of the subsurface investigation program and the generalized subsurface conditions are described in the following sections.

2.2 GEOTECHNICAL BORINGS

Three (3) geotechnical borings, denoted as B-1, B-2, and B-3 were performed by Municipal Testing Laboratory, Inc. (MTL) of Hauppauge, New York, using a GeoProbe Track-Mounted Drill Rig from March 18 to 26, 2019, at the locations shown on the Boring Location Plan on Figure 1. The borings were continuously inspected by Messrs. Aflaaz Saleem, Haykel Melaouhia, Ph. D., and Youssouf Boubaa of GES. The 2010 SOR borings are also shown for reference. The Geologic Cross-Sections attached to this report show the stratigraphy through the site.

The GES borings were typically drilled utilizing the mud-rotary drilling technique with a 2-7/8-inch and 3-7/8-inch diameter tri-cone roller bit and 3-inch and 4-inch diameter steel casing to stabilize each boring, respectively. The use of 3-inch diameter steel casing became necessary due to the presence of boulders and cobbles within the glacial till, as discussed below. Soil samples were obtained using techniques and equipment in general accordance with the American Society for Testing and Materials (ASTM) Standard Specification D1586-Standard Penetration Test (SPT). The SPT consists of driving a 2-inch O.D. split-spoon sampler typically to 24-inches of penetration, using repeated blows of a 140-lb hammer, free-falling a height of 30-inches. The standard penetration value, or N-value, is determined as the number of blows required to advance the sampler the sum of the second and third 6-inch intervals of a typical 24-inch penetration. MTL used an automatic trip hammer. This hammer operates with a 90% efficiency whereas the manual (cathead and rope) hammer operates at a 60% efficiency. This means that the blow counts are reported on the boring logs, where the automatic hammer was used, are about 2/3 of the values that would be reported if a conventional donut-type hammer was used. A correction factor of 1.3 is generally used to convert N-values from the automatic hammer to the normalized N-value (N_{60}).

Where the split-spoon sampler could not be advanced through a rock or an obstruction, the sampler was driven for 50 blows, and distance of actual penetration less than 6 inches was recorded. Soil samples were placed in jars following completion of sampler advance. Boring logs showing N-Values and stratigraphy are attached as Appendix A.

When the borings encountered top of rock, core drilling was performed using an NX-size core barrel with a diamond bit. Approximately 5 to 7.5 feet of rock was cored in each boring. The length of recovery and Rock Quality Designation (RQD) was measured and calculated for each rock core run, and denoted as a percent recovery and percent RQD, respectively. RQD refers to the sum of the lengths of rock core pieces four inches or longer, neglecting mechanical breaks, expressed as a percentage of the total length of the core run. Percentage recovery and RQD, and rock sample descriptions are included on the boring logs, attached as Appendix A.

Similarly, wherever the split-spoon sampler could not penetrate a boulder or cobble within the overburden material, core drilling was performed, also using an NX-Size or H-Size core barrel with a diamond bit. Recovery length was measured for the depths cored and is reported on each

boring log in terms of percent recovery. RQD is not applicable to boulders and is reported as 0 percent on the boring logs.

The recovered split-spoon soil samples were labeled with the project name, boring number, sample number, depth of sample, SPT blow counts and length of recovery. Cores through boulders and rock core samples were arranged and organized in wooden five-foot-long core boxes, labeled with project name and number, boring number, sample number, depth of sample, and core recovery and RQD percentages. All samples were transported to MTL's shop for storage.

The borings were drilled from the existing ground surface level, which varies greatly across the site, as mentioned above. However, the ground surface for the three (3) borings ranged from about el. +25 to +28. The sidewalk along Buena Vista Avenue ranges from about el. +42 to +50, from north to south. All borings were performed within or just outside the tower portion of the proposed new development. Further description of each GES boring is presented below:

- Boring B-1 was drilled near the north-central edge of the site (from about el. +28), to a depth of about 62.5 feet (about el. -34.5), encountering competent bedrock at a depth of about 57.5 feet (about el. -29.5).
- Boring B-2 was drilled in the north-central portion of the site (from about el. +25), to a depth of about 58 feet (about el. -33), encountering competent bedrock at a depth of about 53 feet (about el. -28).
- Boring B-3 was drilled in the west-central portion of the site (from about el. +25), to a depth of about 59 feet (about el. -34), encountering competent bedrock at a depth of about 54 feet (about el. -29).

2.3 GENERALIZED SUBSURFACE CONDITIONS

The following general descriptions of the subsurface strata are based on our interpretations of the results of the field investigation. All depths are relative to top of ground level, which ranges from about el. +25 to +28 between boring locations. Elevations are noted in parentheses after depths and rounded to the nearest one-half foot:

Stratum 1 – Fill: – The Fill generally consists of loose to medium dense brown silty coarse to fine Sand, with varying amounts of gravel, clay, and vegetation. Fill was encountered at grade in all borings, and extended to between about 3.5 and 8.5 feet below grade (about el. +16 to +24.5). N-Values within Stratum 1 ranged from 3 to 28 blows per foot (bpf), with an average of 10 bpf, indicative of the heterogeneous nature of uncontrolled fill.

Stratum 2 – Medium Dense Sand: Stratum 2 was encountered directly below the Fill in all borings, and generally consists of brown and gray-brown coarse to fine Sand, with varying amounts of gravel, clay and silt. The natural medium dense Sand layer extends to about 18 to 19 feet below grade (about el. +6 to +10), and is generally between 10 and 15 feet thick. The SPT N-Values within the natural medium dense Sand range from 6 to 33 bpf, with an average of 16 bpf.

Stratum 3 – Very Dense Gravelly Sand: Underlying Stratum 2, the very dense gravelly sand layer generally consists of brown and gray gravelly coarse to fine Sand, with varying amounts of silt. All but one split spoon sample taken within Stratum 3 reached refusal prior to extending two feet. Stratum 3 was measured to extend to between about 51.5 and 55 feet below grade (about el. -26 to -28), and is approximately 33 to 37 feet thick. Stratum 3 is characterized by very low sample recovery, hard drilling and rig chatter through boulders and cobbles throughout the layer, which

were cored where possible. Due to the density of the stratum, assessing the top of decomposed or competent rock (Stratum 4 and Stratum 5, respectively) was very difficult. Stratum 3 is likely glacial till, deposited by several periods of glaciation of this area.

Stratum 4 – Decomposed Rock: – An about 2.5-foot-thick layer of decomposed rock was encountered just above more competent rock in Borings B-1 and B-3 at depths of 57.5 and 54 feet (about el. -27 and -26, respectively). One split spoon sample was taken within Stratum 4 in Boring B-1, reaching refusal, and consisting of gray decomposed rock fragments. As stated above, it is possible this stratum is also present at Boring B-2 and is much thicker than noted, due to the difficulty drilling through the boulders and cobbles at the bottom of Stratum 3.

Stratum 5 – Competent Rock: – Competent Rock was encountered in all three borings, at depths ranging from 51.5 to 57.5 feet (about el. -26.5 to -30). All three borings extended at least five (5) feet into competent rock and were terminated in Stratum 5. The rock encountered can be described as hard to intermediate, slightly weathered gray and white Marble, jointed to closely-jointed, with weathered joints and mica intrusions. Rock core recoveries ranged from 95 to 100 percent, with an average of 97 percent, while RQD ranged from 80 to 88 percent, with an average of 86 percent.

2.4 GROUNDWATER CONDITIONS

A 30-foot-deep groundwater observation well was installed during this investigation in GES Boring B-3. An electronic piezometer was installed to take hourly readings of the water level from April 7 to April 17, 2019 in Boring B-3, as shown in Figure 5. Based on the readings obtained from the electronic piezometer, the groundwater level stabilized at a depth of about 18.2 feet below grade at Boring B-3 (about el. +7). Therefore, based on these results, and the data recorded from the piezometer, a design groundwater level for foundation design of about el. +9 is recommended.

It should also be noted that changes in groundwater levels will occur due to variations in seasonal influences, tidal fluctuations, precipitation amounts, local pumping, utility leakage, and other factors different from those existing at the time the observations were made. According to the FEMA flood hazard data for this area, the site is not located within a potential flood zone.

3.1 GENERAL

This section of the report presents seismic considerations, our recommendations for feasible foundation and floor slab systems, lateral earth pressures, and permanent control of groundwater. Our evaluation and recommendations are based on the subsurface conditions encountered at the boring locations, our understanding of the site geology, foundation loading information, and construction considerations.

3.2 SEISMIC CONSIDERATIONS

The subsurface conditions at this site generally consist of a thin layer of fill (Stratum 1) over medium dense sand (Stratum 2), over a thick layer of very dense gravelly sand (Stratum 3) overlying a thin layer of decomposed white and gray marble (Stratum 4), over competent bedrock (Stratum 5). Based on the results of our geotechnical investigation, the stratigraphy consists of very dense soil over hard bedrock. Therefore, liquefaction is not a concern at this site.

Considering that the depth to bedrock is approximately 50 feet below ground, the recommended seismic site classification is Site Class "C" from the International Building Code (IBC). The Mapped Spectral Accelerations from the IBC were determined to be $S_1 = 0.3$, $S_s = 0.06$ with corresponding site coefficients of $F_a = 1.2$ and $F_v = 1.5$.

3.3 FOUNDATION RECOMMENDATIONS

Based on our most recent discussions, we understand the proposed construction at the site will include the construction of an about 19,000-square-foot, multi-story residential tower, with three basement levels (Tower), connected to a six-story, 27,000-square-foot podium, also with three basement levels (Podium), to be used for residential housing and parking. The architectural renderings provided to us show multiple options being considered, and the new structure will cover nearly the entirety of the currently open, about 49,960-square-foot lot. As such, our recommendations are separated into two sections.

Multi-Story Tower with Three Basement Levels

Considering the high anticipated loads, we recommend the proposed Tower can be founded on drilled caissons, founded in Stratum 5 – Competent Rock. Caissons are drilled piles that obtain their resistance through friction and end-bearing in rock. The caissons will also provide the required uplift capacity. The installation of a caisson consists of drilling a steel casing a minimum of one foot into competent rock, removing the material from inside the casing, drilling a rock socket, installing the necessary reinforcing steel and grouting the entire length. The compression and uplift capacity of caissons can vary significantly, depending on the diameter of the caisson and the steel reinforcement. The length and quality of rock required for the rock socket depends on the design side friction between the rock and grout.

The following are possible design options for the drilled caissons with design loads:

Casing Diameter (in)	Wall (in)	Core Reinforcement		Grout Strength (psi)	Rock Socket Length (ft)	Design Compression Capacity (tons)	Design Uplift Capacity (tons)
		Bars and Size	Yield Strength (ksi)				
13.375	0.514	2 #24	75	6000	10	375	90
11.875	0.582	2 #20	75	6000	10	275	75
9.625	0.472	1 #24	75	7000	8	200	65
7.625	0.430	1 #20	75	6000	8	125	55

Notes:

1. The estimated capacities are based on steel casing and reinforcing bar minimum yield strengths of 50 ksi and 75 ksi, respectively, and minimum grout compression strength of 6,000 psi.
2. The rock socket should be installed entirely within Stratum 5 – Competent Rock, and verified by video inspection by a NYS-licensed Professional Engineer.
3. The center-to-center spacing of the caissons should be at least 2.5 times the outside diameter of the casing, but not less than 3 feet.
4. The maximum diameter of the rock socket shall be approximately equal to the inside diameter of the casing.
5. Spring coefficients for the drilled caissons can be addressed in separate discussions with the structural engineer, once the foundation design is complete, and method for foundation support is selected, i.e., mat foundation, driven steel piles with a mat foundation, or drilled caissons.

We recommend that the maximum allowable lateral capacity of caissons is limited to 1 ton, without the performance of a load test. Based on our experience with similar projects, if a load test were performed, it may be possible to provide allowable lateral capacities up to 10 tons for caissons having diameters of 13.375 inches.

The settlement under the building loads is expected to be less than 1/2 inch and this settlement is expected to occur during construction. The recommendation of using drilled caissons founded in rock to support the proposed building is contingent upon GES being retained to provide inspection of caisson installation. All caisson rock sockets should be inspected using a down-the-hole HD video camera by a NYS-licensed Professional Engineer. We recommend against the use of air within 50 feet of a nearby building or TA structure when advancing the casing within the soil overburden, unless an obstruction is encountered, or otherwise approved by the geotechnical engineer. The contractor's means and methods, equipment, and caisson identification plan must be submitted for approval by the geotechnical and structural engineer prior to mobilization on-site.

Based on a proposed excavation level of about el. +20, we understand the proposed construction will not extend lower than the adjacent foundation at 92 Main Street, and may bear above the

adjacent foundation. We recommend installing drilled caissons as described above, or setting back a shallow foundation away from the property line, to avoid imposing loads on the north adjacent building. We also recently completed a test pit investigation program at the site, which will be further discussed in a separate letter report. Please see Section 4.3 below regarding support of excavation recommendations.

Another possible option for foundation support of the Tower is the use of driven steel H-piles, or as a method of foundation support in conjunction with a mat foundation. Due to the very dense nature of Stratum 3, which contained many cobbles and boulders, driving of piles to bedrock will be extremely difficult, with many piles reaching refusal on cobbles and boulders. The TA may also not allow driven piles within 50 feet (or potentially a greater linear distance) of the tracks, due to vibrations, and settlement induced by driving piles. Furthermore, the north adjacent building at 92 Main Street has the potential to settle or crack, also due to vibrations.

Therefore, we do not recommend driven piles be used for foundation support. However, should the Owner be interested in exploring the use of driven piles, we recommend a program of indicator piles be performed, with scattered evenly throughout the proposed footprint. We would recommend the contractor submit a WEAP analysis for review by the geotechnical engineer, along with submittals for driven pile equipment/hammer, pile material, and a pile splice detail, should splicing be required. Performance of an indicator pile program would also be contingent upon approval of the program by the TA prior to mobilization. All adjacent structures/utilities/TA structures would have to be monitored in accordance with Section 4.7 below and as required by the TA.

Shallow Foundation Option

In lieu of installing drilled caissons, founded in rock, another possible option for foundation support would be the use of a mat foundation, bearing on Stratum 2 – Medium Dense Sand, with a maximum allowable bearing capacity of 3 tsf. Use of a mat foundation will likely induce settlement on the order of 3 inches, with most of the settlement occurring during construction. We recommend the structural engineer consider this potential for settlement during final foundation design when evaluating use of a mat foundation or drilled caissons. Our professional opinion and recommendation would be to use drilled caissons, founded in rock, as described above, for the Tower portion. It cannot be reliably stated that the subgrade at about el. +20 can support greater than 3 tsf, based on the information currently available to us. Furthermore, a mat foundation must not impose load on any adjacent structures, i.e., the 92 Main Street building, as discussed in Section 4.3 below. Subsequent recommendations given below in the next two paragraphs would apply if a mat foundation is used for the Tower portion.

The subgrade for the mat foundation should be proof-rolled using a minimum of six (6) passes with a dual-drum vibratory roller, under continuous inspection by a licensed NYS Professional Engineer. A minimum of 6 inches of ¾" crushed stone should be placed under the mat foundation and compacted. The recommended bearing pressure is also dependent on GES being retained to provide controlled inspection of the subgrade. Should the soil at the design subgrade elevation be found to be unsuitable for further construction, softer and wetter areas may need to be removed and replaced by ¾" clean crushed stone and compacted in maximum 12-inch-thick lifts. Should this be insufficient, new footing requirements should be reviewed with the structural engineer to confirm the subgrade can support the design bearing pressures.

If the structural engineer determines that some portions of the Tower will be subjected to uplift loading, we recommend the installation of soil or rock anchors for the purpose of resisting uplift loads on the mat foundation. We recommend the anchors be spaced at a minimum of four (4) feet, and composed of threaded Double-Corrosion Protected (DCP) bars, with centralizers spaced at 10 feet. All anchors must be proof-tested, and at least 10 percent of all anchors must be performance-tested. The anchors must be grouted and designed in accordance with PTI and NYSBC requirements, should be installed without the use of air, and installed under continuous inspection. Recommendations for soil/rock anchors are contingent upon GES being retained to perform the inspection.

Six-Story Podium with Three Basement Levels

The six-story Podium borders a five-foot-wide alley at sidewalk level, separating the site from a two-story building. It is not known how deep the cellar foundation extends for this building. The final depth of the proposed foundation has also not yet been confirmed. Therefore, we recommend that two options be considered for foundation support along the southern property line.

We recommend that the foundation along the south adjacent building can be comprised of a secant pile wall, installed deep enough into Stratum 3 or to Stratum 4 or 5, to resist expected lateral loading from the adjacent two-story building, and support axial loads from the new building. The secant pile wall would comprise the foundation wall along the southern border. The wall would also function as support of excavation and must be designed by a NYS-licensed Professional Engineer, with extensive experience in designing secant walls in similar applications. We highly recommend that secant piles are continuously inspected by a geotechnical engineer. Means and methods for wall installation shall be reviewed and approved by the Geotechnical Engineer of Record, and carefully inspected to prevent damage or loss of ground to nearby or adjacent structures or utilities. The secant piles will require lateral support until the floors are constructed. This support can be provided by anchors (if the adjacent property owner approves the installation of anchors under the building) or by rakers and heel blocks.

We also strongly recommend the foundation level of the south adjacent building foundation at 73 Buena Vista Avenue be determined to refine the lateral support requirements of the proposed new building foundation with the secant pile wall. At a minimum, the interior of the building should be inspected to determine the approximate elevation of top of cellar slab.

We recommend the rest of the Podium can be founded on either a mat foundation or shallow footings, bearing in Stratum 2 (Medium Dense Sand) or Stratum 3 (Very Dense Gravelly Sand), with a maximum allowable bearing capacity of 3 tsf to design the foundation. We recommend a coefficient of friction for sliding for shallow footings or a mat foundation of 0.45 for Stratum 2 and 0.5 for Stratum 3. Any fill encountered at subgrade level must be removed, as it is not suitable for foundation support. Groundwater is not expected to be encountered. Please see Section 3.5 regarding permanent control of groundwater. It is anticipated that settlement under the building loads is expected to be on the order of ½ to 1 inch, though most of the settlement is expected to occur during construction. A minimum of 12 inches of ¾" crushed stone should be placed under the mat or footings and compacted. The recommended bearing pressure is also dependent on GES being retained to provide controlled inspection.

If the Podium is subjected to uplift, then soil or rock anchors can be installed to provide the necessary uplift resistance, similar to the Tower building.

The mat foundation subgrade shall be inspected by a geotechnical engineer, familiar with the soil conditions and is licensed in New York State, prior to mat foundation construction. Should the soil at the design subgrade elevation be found to be unsuitable for further construction, softer and wetter areas may need to be removed and replaced by ¾" clean crushed stone and compacted in maximum 12-inch-thick lifts. Should this be insufficient, new foundation requirements, such as extending areas of the mat deeper, should be reviewed with the structural engineer to confirm the subgrade can support the design bearing pressures.

If the cost of construction of the secant pile wall is too high, additional engineering evaluations should be performed to investigate the possibility of using drilled soldier piles with timber lagging. Using this system, the mat and the perimeter wall should be constructed in smaller sections to reduce movement of the adjacent building.

A coefficient of subgrade reaction of 150 pci (pounds per cubic inch) may be used for designing the mat foundation for either Stratum 2 (Medium Dense Sand) or Stratum 3 (Very Dense Gravelly Sand). Further discussion of subgrade preparation may be found in Section 4.4.

We also recommend that the connections between the two buildings be designed to account for up to 3 inches of differential settlement, if the Tower is founded by a mat foundation. While settlement is expected to occur during construction, the structural engineer should account for this possibility in their final design.

3.4 LATERAL EARTH PRESSURES

The design lateral pressures for permanent below grade walls consist of static pressures that are influenced by the thickness and type of overburden material. For design purposes, we recommend that the below grade walls be designed for a static lateral soil pressure of 45 pcf. Please see the attached lateral earth pressure diagram in Figure 6.

Below grade walls must be designed to resist seismic loads. We recommend using a seismic lateral soil force of $6H^2$ (lb/ft of wall), where H is the total vertical height of the wall, in feet. This force is in addition to the static force and should be applied at a distance of H/3 from the top of the wall (wall pressure is an inverted triangle).

The recommended lateral pressure does not include any surcharge loads adjacent to the walls (such as from adjacent buildings, or loading from nearby TA rails due to the weight of trains, or at the ground surface. We recommend adding a uniform (i.e., rectangular) lateral pressure distribution of 0.40 times the surcharge to the lateral soil pressure distribution. The structural engineer should determine the magnitude of the surcharge loads (i.e., live loads), considering these factors at a minimum.

3.5 PERMANENT GROUNDWATER CONTROL

Groundwater was observed at about el. +7, or about 18 feet below grade at Boring B-3. It is expected that the new Tower foundation will not extend more than a few feet lower than current grade at Boring B-3. Therefore, we do not expect groundwater to be encountered during construction. As such, we recommend that a vapor barrier be placed below any subsurface foundation element to prevent intrusion of moisture into the concrete. The material used for the vapor barrier should be submitted to the geotechnical engineer for review and approval. We

recommend that the vapor barrier also be inspected, or installed by a certified installer. Please see Section 4.2 below regarding temporary groundwater control.

It should be noted that groundwater was observed at about el. +25 to +29 in SOR Borings B-1, B-2, and B-7. However, these borings show a thin layer of silt at this elevation. These borings were not inspected by GES, and it is possible that the observed water is perched water on the silt layer.

4.1 GENERAL

The following sections provide recommendations regarding temporary groundwater control during foundation construction, support of excavation, preparation of the subgrade for the Podium mat foundation / shallow footings and Tower slab-on-grade / mat foundation, excavation considerations, backfill and compaction control, pre-construction surveys of adjacent buildings/utilities/TA rail lines, construction monitoring requirements (in accordance with the TA), and geotechnical engineer inspection items, for which we are able to provide additional proposals.

4.2 TEMPORARY GROUNDWATER CONTROL

The design and construction of a secant wall along the southern edge of the site will not require a groundwater cut-off, as groundwater is not expected to be encountered. Therefore, we do not expect that a site dewatering system will be required. However, we recommend the contractor be prepared to control any runoff water by the use of sump pumps or other suitable means. The subgrade for all new foundations must also be protected from rainwater or runoff, to prevent undermining or scouring of the approved subgrade.

4.3 SUPPORT OF EXCAVATION

The design of any temporary excavation support system is the responsibility of a licensed New York State Professional Engineer. All excavations and temporary support systems should conform to pertinent OSHA and local safety regulations. The soil parameters used in the design of the temporary excavation support systems should be reviewed by the Geotechnical and Support of Excavation Engineers of Record prior to construction of any excavation support structures. All excavations and bracing should be inspected. We recommend any interior shallow excavations for pile caps or elevator pits/sumps be designed using timber-sheeted pits, designed by a Professional Engineer.

East Property Line – Buena Vista Avenue

Based on our geotechnical investigation, and proposed footprint of the new building we recommend the installation of a temporary support of excavation system consisting of driven or drilled soldier piles (such as 9 5/8-inch O.D. casing) with timber lagging be installed within the sidewalk along Buena Vista Avenue. We recommend against driving soldier piles or the use of air as a flushing medium for drilled soldier pile installation within 50 feet of any adjacent building. We recommend the utilities below Buena Vista Avenue be identified, and means and methods for soldier pile installation be adjusted to protect these nearby or adjacent utilities. We also recommend that lateral bracing, such as walers, with either drilled tie-backs, installed under Buena Vista Avenue, or braces connected to heel blocks be constructed to support Buena Vista Avenue. Installation and testing of tiebacks should follow the same recommendations given above in Section 3.3. These recommendations are contingent upon GES being retained to perform the controlled inspection of support of excavation. We also recommend the street itself and any underlying utilities be routinely monitored for settlement during construction.

We understand the Owner also owns the north adjacent building. Therefore, an access agreement for soldier pile installation at the northeast corner of the site will not be necessary. However, it may be required at the southeast corner of the site with the Owner of 73 Buena Vista Avenue.

Southern Property Line – 73 Buena Vista Avenue

As stated above, we recommend the south adjacent property be supported by the use of either a secant pile wall (which would double as the foundation wall), constructed along the property line within the site, or a system of drilled soldier piles with timber lagging, just outside of the property line, within the adjacent alley. If the adjacent property owner at 73 Buena Vista Avenue does not consent to installing drilled soldier piles within the alley, the system can be constructed just inside the property line. The proposed Podium would likely lose a small portion of square footage in this case.

As discussed in Section 3.3, we recommend the foundation level be determined for 73 Buena Vista Avenue for support of excavation and foundation design. We also recommend construction of the support of excavation system and foundation follow construction monitoring recommendations given in Section 4.7 below.

Western Property Line – TA Rail Lines

As the construction of a third basement level is only expected to extend a few feet lower than current site grades along the western property line, it is unlikely that a support of excavation system will be required. However, if the third basement level extends deeper, and a support of excavation system is required, we recommend a drilled soldier pile with timber lagging system be used along the western property line. We strongly recommend against the use of air as a flushing medium to install piles within 50 feet of the TA rail lines. The adjacent TA rail lines and any ancillary structures must be monitored for movement and vibrations, in accordance with TA requirements.

We also recommend the Record Drawings for the existing TA tracks be obtained through an information search with the TA, in order to understand the exact plan location of the tracks, as well as the elevation. The monitoring protocols recommended by the TA must be strictly adhered to, as further discussed in Section 4.7 below.

Northern Property Line – 92 Main Street

We recently completed a test pit investigation at 92 Main Street, along the north and south edges of the southern foundation wall for the building. For the results of this investigation, please refer to our separate Test Pit Letter Report.

We understand the proposed depth of construction is not expected to extend lower than the north adjacent building at 92 Main Street. Therefore, we recommend the proposed foundation for the Tower be designed such that no lateral load is imposed on the foundation for 92 Main Street. This would include either matching the bottom of new foundation with the bearing level of the adjacent building, or installing drilled caissons (as discussed in Section 3.3 above), designed such that no load is imposed on the adjacent building. It is unlikely that a support of excavation system will be required along 92 Main Street, but we recommend additional test pits should be performed to confirm the bearing level of the north adjacent building.

4.4 SUBGRADE PREPARATION

We recommend that the Podium and Tower foundation subgrades be proof-rolled with a dual-drum roller, or other compaction equipment approved by the Geotechnical Engineer, with six (6) overlapping passes. Any unstable areas encountered which cannot be stabilized by additional compaction should be excavated to competent material and the area backfilled with compacted

select or structural backfill. The proof-rolling should not be performed when the subgrade is wet, muddy, or frozen. If the new slabs are constructed in the winter, the subgrade should be protected from frost action to limit possible subgrade deterioration resulting from freezing and thawing cycles. Any areas of frozen soil must be removed prior to concrete placement.

All subgrade preparation should be performed under the continuous inspection of the Geotechnical Engineer. The subgrade for any mat foundations or footings must be inspected by a NYS-licensed Professional Engineer. Also, as stated above, Stratum 1 (Fill) is not considered acceptable for foundation support below a mat foundation or shallow footings and must be completely removed prior to construction of the new Podium mat foundation or shallow footings.

4.5 EXCAVATION CONSIDERATIONS

All excavation must be performed using equipment sized such that removal of existing soil and remnant foundations does not produce unacceptable vibration levels to nearby/adjacent buildings/utilities/TA structures. The possibility exists that remnant foundations from the buildings that formerly occupied the site may still exist below grade. We highly recommend that all adjacent building and TA structure vibration and optical prism point monitoring be in place prior to commencement of excavation or construction.

We recommend that all excavation within two feet of the design subgrade elevation for the Podium mat foundation be performed with a flat-plated excavator bucket, as to not disturb the virgin subgrade beneath.

At no point shall excavation create a loss of ground and potentially undermine any adjacent building foundations, sidewalks or TA structure. Additionally, any excavation that extends deeper than four feet must be supported using a temporary support of excavation system, designed by a NYS-licensed Professional Engineer. The design of such system is the responsibility of the contractor and must adhere to all relevant codes and acceptable industry standards and practices, as described in Section 4.3. Excavation shall not penetrate a 1V:1.5H envelope below the bottom of any neighboring/bordering foundation element, as to not undermine the bearing material below adjacent foundations.

4.6 BACKFILL AND COMPACTION REQUIREMENTS

Where needed, select backfill or structural backfill should be granular material only, free of cinders, brick, asphalt, ash, silt/clay, and other unsuitable materials. We recommend that structural backfill or select backfill beneath/around the proposed foundations be compacted to a minimum of 95% of the maximum dry density, as determined by ASTM D1557, Method C. All backfill should be placed in lifts not exceeding 8 inches in loose thickness. All crushed stone should be placed in lifts not exceeding 6 inches in loose thickness. The subgrade underneath the backfill should be satisfactorily proof-rolled prior to placement of backfill and should also meet the same density requirements as the backfill to be placed above the subgrade. All fill placement shall be subject to inspection as well.

4.7 PRE-CONSTRUCTION SURVEY AND MONITORING

Throughout the excavation and foundation construction phases of the project, measurements of movement and vibration levels should be made in the north and south adjacent buildings, west

adjacent TA rail tracks and any ancillary structures, and the street/nearby utilities running beneath Buena Vista Avenue to the east. The maximum vibration level that a structure can tolerate is dependent on many factors, including the age and condition of the building, and should be established as part of the monitoring plan. Additionally, the TA also has strict monitoring protocols that must be adhered to throughout construction. Therefore, we recommend as a preliminary limit, that the monitoring plan follow all movement criteria as stipulated and required by the TA for vibrations and settlement. We recommend that an experienced geotechnical engineer generate the monitoring plan, based on the type and condition of surrounding structures, and perform continuous vibration and optical survey monitoring throughout excavation, demolition and foundation construction. The plan must also include stop work limits and protocol for exceedances.

We also recommend a pre-construction survey be performed for any adjacent structure/TA structure, rail line, or utility that is within 25 feet of the property. We recommend a significant pre-construction documentation and observational monitoring program be developed and utilized. On the basis of the pre-construction survey, an observational program should be designed for checking performance and monitoring construction procedures. This observational program could include the establishment of survey points to monitor vertical and horizontal movements and / or the monitoring of vibrations during construction.

4.8 CONSTRUCTION INSPECTION

Our recommendations are contingent upon the proper review and observation during excavation and foundation construction operations by a geotechnical engineer familiar with the subsurface conditions and foundation design criteria. The geotechnical engineer's role should include the following:

- Review and approval of contractor submittals related to foundation construction;
- Observation and documentation of all phases of excavation and foundation construction, including drilled caissons, and soil/rock anchors if necessary;
- Controlled inspection of secant wall/soldier pile with lagging installation/tiebacks/heel blocks and subgrade preparation;
- Monitoring of subgrade preparation and structural fill placement and compaction.

Our conclusions and summary of recommendations are as follows:

1. Based on the results of our geotechnical investigation, the stratigraphy consists of very dense soil over rock. Therefore, liquefaction is not a concern at this site. We recommend a Site Class of "C" from the IBC for this site. Please see Section 3.2 for additional seismic considerations for foundation design.
2. We recommend the proposed Tower be founded on drilled caissons, with rock sockets in Stratum 5 – Competent Rock. The caissons will also provide any required uplift resistance. We recommend that the maximum allowable lateral capacity of caissons is limited to 1 ton, without the performance of a load test. Another possible option for foundation support is to support the Tower on a mat foundation. However, it cannot be reliably stated that a maximum allowable bearing pressure of greater than 3 tsf can be used for foundation design. Anticipated settlement for a mat foundation would be on the order of 3 inches, and less than ½ inch if drilled caissons are used. In addition, any uplift on the mat should be resisted by anchors. Continuous inspection of subgrade preparation must be performed.
3. The depth of foundation for the south adjacent building and on-site new Podium foundation are both unknown at this time. One possible option for foundation support for the Podium along the south side of the site is a secant pile wall, installed deep enough into Stratum 3 or to Stratum 4 or 5, to resist expected lateral loading from the adjacent building, and support axial loads from the new building. Soldier piles with lagging could be alternatively used in lieu of a secant wall, especially if a secant wall is cost-prohibitive. Using this system, the mat and the perimeter wall should be constructed in smaller sections to reduce movement of the adjacent building.
4. We recommend the rest of the Podium can be founded on a mat foundation or shallow footings, bearing in Stratum 2 (Medium Dense Sand) or Stratum 3 (Very Dense Gravelly Sand), with a maximum allowable bearing capacity of 3 tons per square foot (tsf) to design the foundation. If the podium is subjected to uplift, then soil/rock anchors can be installed to provide the necessary uplift resistance, similar to the Tower foundation.
5. Groundwater was observed at about el. +7, or about 18 feet below grade at Boring B-3. We recommend that a vapor barrier be placed below any subsurface foundation element to prevent intrusion of moisture into the concrete. For temporary dewatering needs, we recommend the contractor be prepared to control any runoff water by the use of sump pumps or other suitable means.
6. We recommend the use of driven or drilled soldier pile with timber lagging support system be used along Buena Vista Avenue (no driven piles or drilled soldier piles with air within at least 50 feet of TA structures, adjacent buildings, or sensitive utilities), and as necessary along the TA property line. A secant wall would double as the support of excavation wall along 73 Buena Vista Avenue, if soldier piles with lagging are not used for excavation support. We recommend designing a drilled caisson system, designed to not induce lateral loading on the north adjacent building at 92 Main Street, or setting back the proposed Tower footprint, if shallow foundations are preferred. Please refer to our separate Test Pit Letter Report for the recent test pit work conducted at 92 Main Street.
7. We recommend that the Podium and Tower foundation subgrades be proof-rolled with a dual-drum vibratory roller, or other compaction equipment approved by the Geotechnical

Engineer, with six (6) overlapping passes. All subgrade preparation should be performed under the continuous inspection of the Geotechnical Engineer.

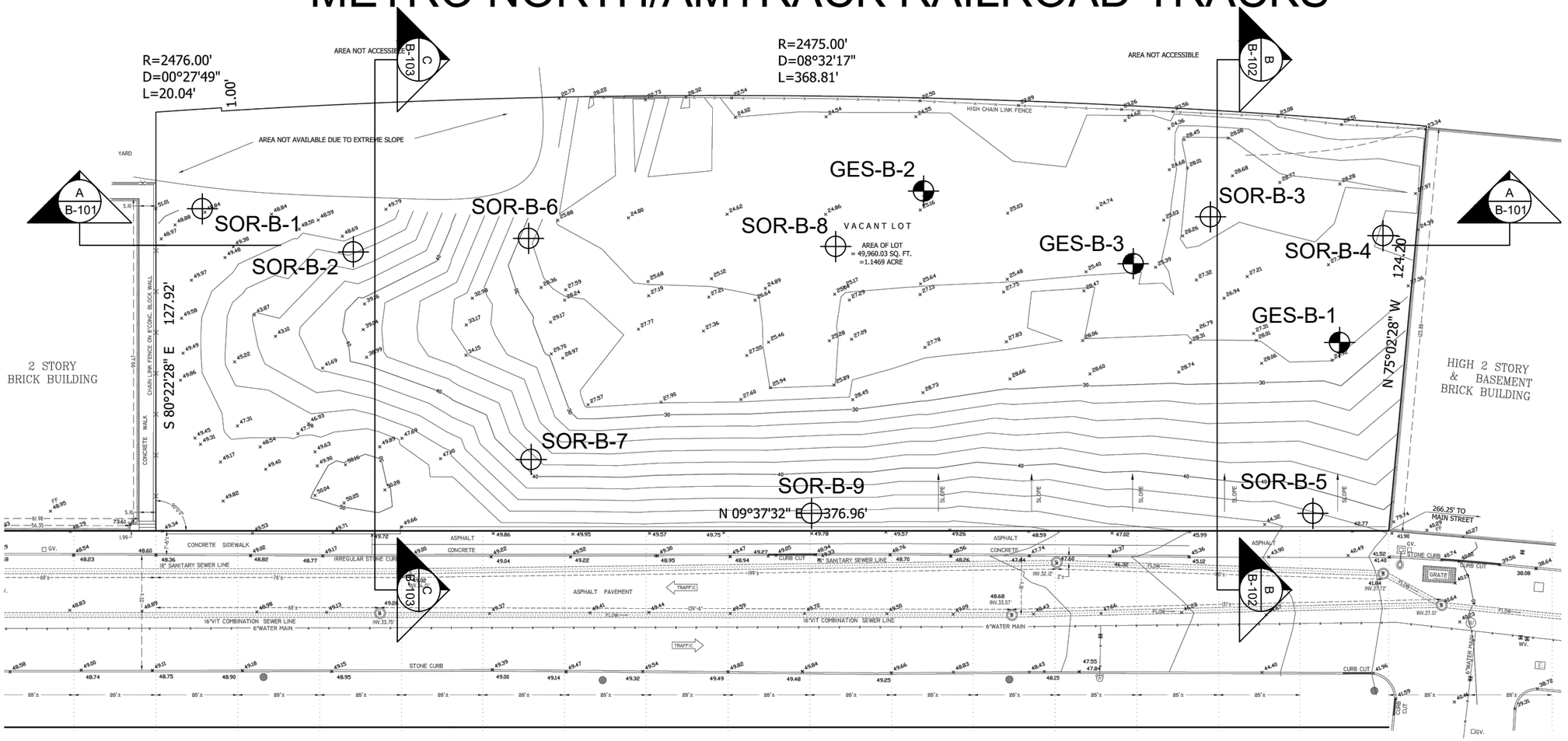
8. All excavation must be performed using equipment sized such that removal of existing soil and remnant foundations does not produce unacceptable vibration levels to nearby/adjacent buildings/utilities/TA structures. We recommend that all excavation within two feet of the design subgrade elevation for any mat foundation or shallow footings be performed with a flat-plated excavator bucket, as to not disturb the virgin subgrade beneath.
9. Throughout the excavation and foundation construction phases of the project, measurements of movement and vibration levels should be made in the north and south adjacent buildings, west adjacent TA rail lines and any ancillary structures, and the street/nearby utilities running beneath Buena Vista Avenue to the east. We recommend the monitoring plan follow movement criteria required by the TA for vibrations and settlement.
10. Our recommendations are contingent upon GES being retained for controlled inspections.

Professional judgments were necessary in relation to determining stratigraphy and soil properties from the subsurface investigations. Such judgments were based partly on the evaluation of the technical information gathered, and partly on our experience with similar projects. If further investigation reveals differences in the subsurface conditions and/or groundwater level, or if the proposed building design is different from indicated herein, or is changed, it is recommended that we be given the opportunity to review the new information and modify our recommendations, if deemed appropriate.

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

FIGURES

METRO NORTH/AMTRACK RAILROAD TRACKS



BUENA VISTA AVENUE

(50' WIDE)

LEGEND

SOR-B-1 — 2010 SOR Boring

GES-B-1 — 2019 GES Boring

No.	DESCRIPTION	DATE	BY

GES

GEOTECHNICAL ENGINEERING SERVICES, P.C.

6 BAYBERRY ROAD
ELMSFORD, NEW YORK 10523
PHONE 914-592-4616 FAX 914-592-0416

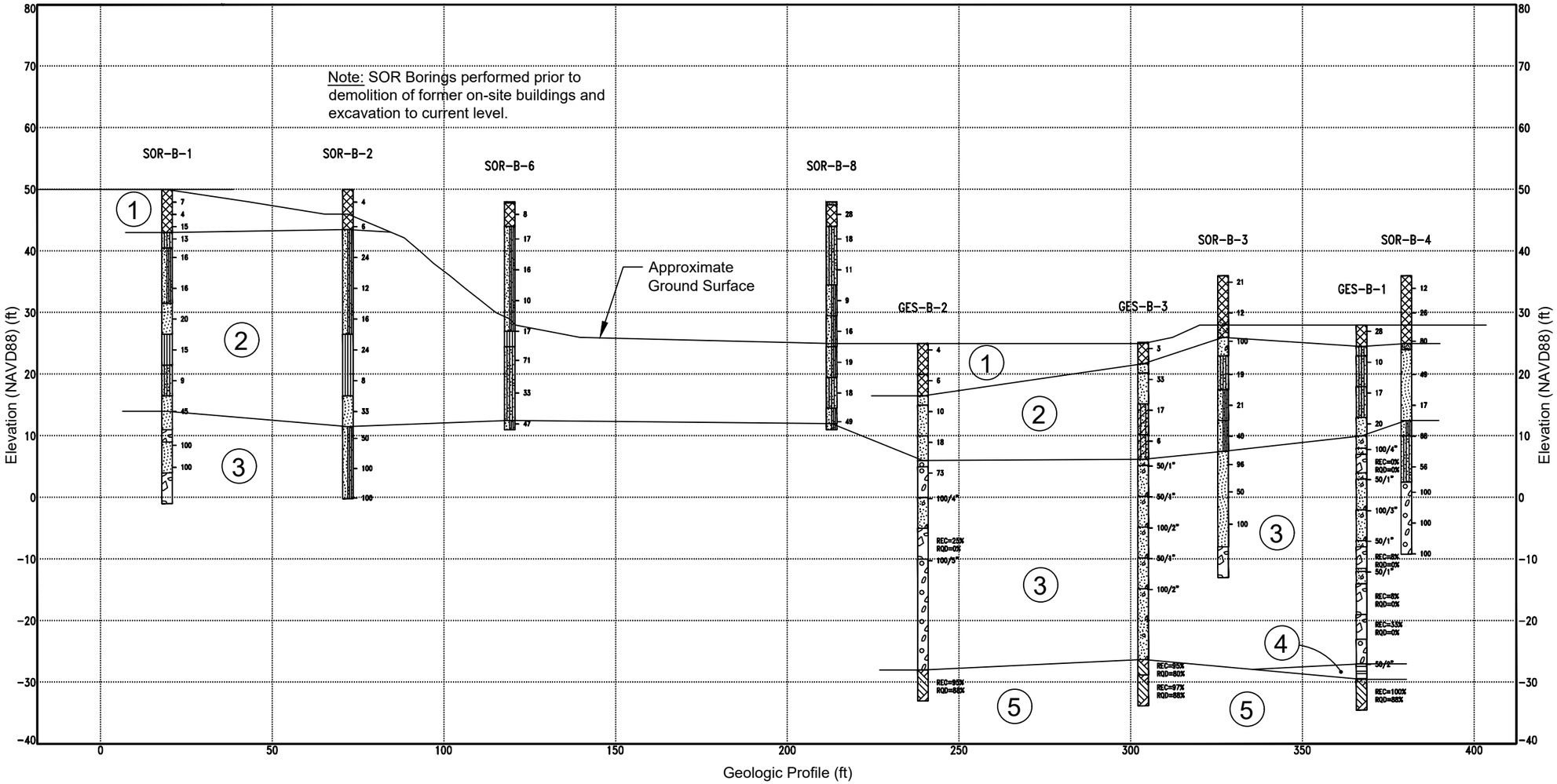
61 BUENA VISTA AVENUE
YONKERS, NY

BLOCK: LOT: ZONE: MAP:

BORING
LOCATION PLAN

PROFESSIONAL ENGINEER

PROJECT #:	2018113
SCALE:	NTS
DATE:	4/1/2019
DRAWING NO:	B-100.00
FIGURE NO:	1



Note: Stratifications represent interpretations between borings by GES and may not represent actual subsurface conditions.

STRATUM LEGEND:

STRATUM 1 - FILL: Loose to medium dense brown silty coarse to fine Sand, with varying amounts of gravel, clay and vegetation.

STRATUM 2 - MEDIUM DENSE SAND: Loose to dense brown and gray-brown coarse to fine Sand, with varying amounts of gravel, clay and silt.

STRATUM 3 - VERY DENSE GRAVELLY SAND: Very dense brown and gray gravelly coarse to fine Sand, with varying amounts of silt.

STRATUM 4 - DECOMPOSED ROCK: Intermediate, weathered gray and white decomposed Marble, closely jointed to broken with weathered joints.

STRATUM 5 - ROCK: Hard, slightly weathered gray and white Marble, jointed to closely jointed, with slightly weathered joints and mica intrusion.

LEGEND

- Fill
- Silty Sand
- Poorly-graded Sand
- Poorly-graded Gravelly Sand
- Boulders and Cobbles
- Poorly-graded Gravel
- Shale
- Bedrock
- Poorly-graded Sand with Silt
- Well-graded Sand
- Silt
- Well-graded Sand with Silt
- Clayey Sand with Silt
- Concrete
- Well-graded Sand with Silt and Gravel

No.	DESCRIPTION	DATE	BY

GES
GEOTECHNICAL ENGINEERING SERVICES, P.C.
6 BAYBERRY ROAD
ELMSFORD, NEW YORK 10523
PHONE 914-592-4616 FAX 914-592-0416

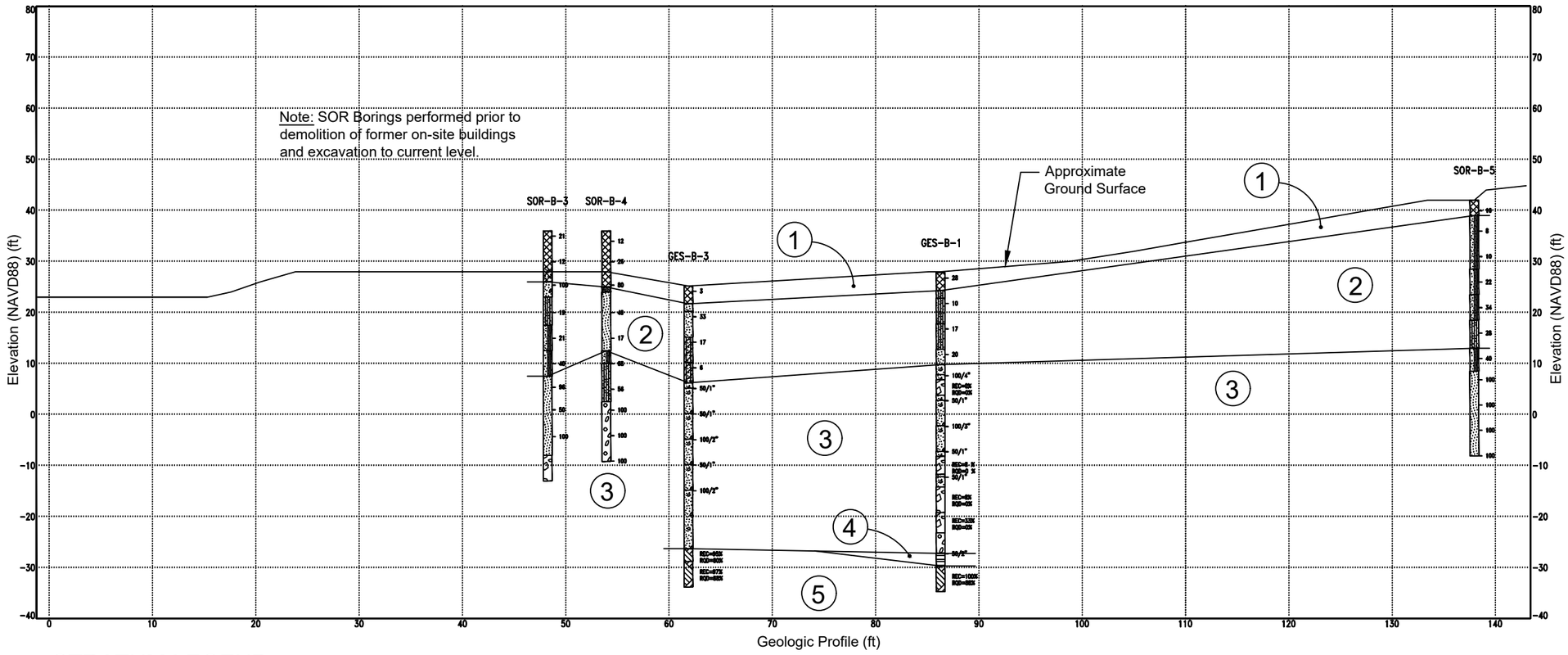
61 BUENA VISTA AVENUE
YONKERS, NY

BLOCK: LOT: ZONE: MAP:

GEOLOGIC
CROSS SECTION A-A'

PROFESSIONAL ENGINEER

PROJECT #:	2018113
SCALE:	NTS
DATE:	04/16/2019
DRAWING NO:	B-101.00
FIGURE NO:	2



Note: Stratifications by GES represent interpretations between borings and may not represent actual subsurface conditions.

STRATUM LEGEND:

STRATUM 1 - FILL: Loose to medium dense brown silty coarse to fine Sand, with varying amounts of gravel, clay and vegetation.

STRATUM 2 - MEDIUM DENSE SAND: Loose to dense brown and gray-brown coarse to fine Sand, with varying amounts of gravel, clay and silt.

STRATUM 3 - VERY DENSE GRAVELLY SAND: Very dense brown and gray gravelly coarse to fine Sand, with varying amounts of silt.

STRATUM 4 - DECOMPOSED ROCK: Intermediate, weathered gray and white decomposed Marble, closely jointed to broken with weathered joints.

STRATUM 5 - ROCK: Hard, slightly weathered gray and white Marble, jointed to closely jointed, with slightly weathered joints and mica intrusion.

LEGEND

- Fill
- Silty Sand
- Poorly-graded Sand
- Poorly-graded Gravelly Sand
- Boulders and Cobbles
- Poorly-graded Gravel
- Shale
- Bedrock
- Clayey Sand with Silt
- Poorly-graded Sand with Silt
- Well-graded Sand with Silt
- Well-graded Sand
- Concrete

No.	DESCRIPTION	DATE	BY

GES
GEOTECHNICAL ENGINEERING SERVICES, P.C.
6 BAYBERRY ROAD
ELMSFORD, NEW YORK 10523
PHONE 914-592-4616 FAX 914-592-0416

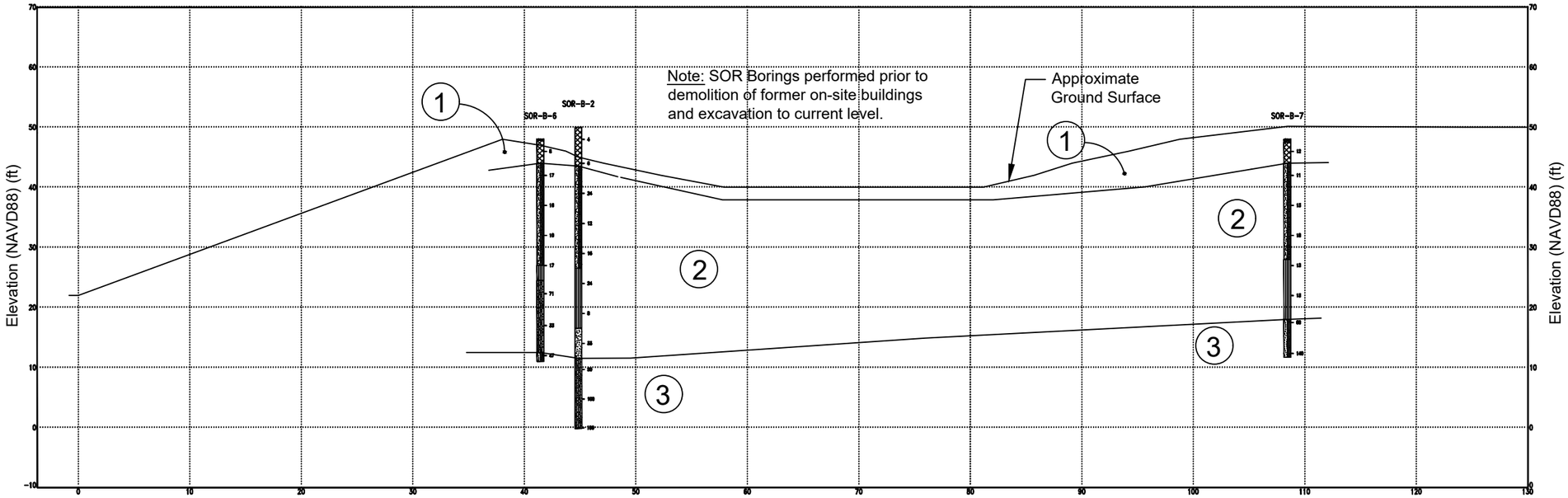
61 BUENA VISTA AVENUE
YONKERS, NY

BLOCK: LOT: ZONE: MAP:

GEOLOGIC
CROSS SECTION B-B'

PROFESSIONAL ENGINEER

PROJECT #:	2018113
SCALE:	NTS
DATE:	04/16/2019
DRAWING NO:	B-102.00
FIGURE NO:	3



Geologic Profile (ft)

LEGEND

- Concrete
- Fill
- Poorly-graded Sand with Silt
- Silt
- Silty Sand
- Well-graded Sand with Silt

Note: Stratifications by GES represent interpretations between borings and may not represent actual subsurface conditions.

STRATUM LEGEND:

STRATUM 1 - FILL: Loose to medium dense brown silty coarse to fine Sand, with varying amounts of gravel, clay and vegetation.

STRATUM 2 - MEDIUM DENSE SAND: Loose to dense brown and gray-brown coarse to fine Sand, with varying amounts of gravel, clay and silt.

STRATUM 3 - VERY DENSE GRAVELLY SAND: Very dense brown and gray gravelly coarse to fine Sand, with varying amounts of silt.

No.	DESCRIPTION	DATE	BY

GES
GEOTECHNICAL ENGINEERING SERVICES, P.C.
6 BAYBERRY ROAD
ELMSFORD, NEW YORK 10523
PHONE 914-592-4616 FAX 914-592-0416

61 BUENA VISTA AVENUE
YONKERS, NY

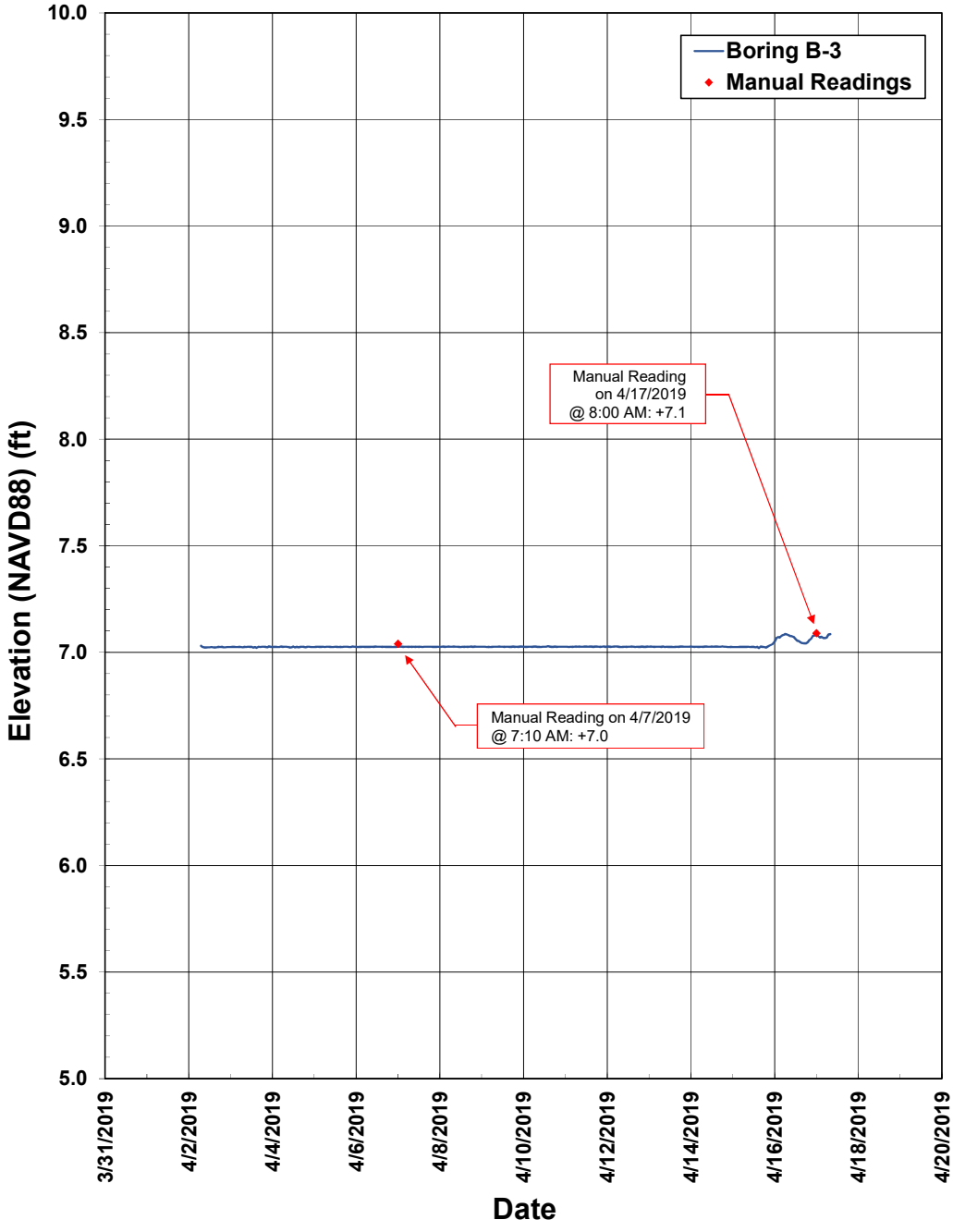
BLOCK: LOT: ZONE: MAP:

GEOLOGIC
CROSS SECTION C-C'

PROFESSIONAL ENGINEER

PROJECT #:	2018113
SCALE:	NTS
DATE:	04/16/2019
DRAWING NO:	B-103.00
FIGURE NO:	4

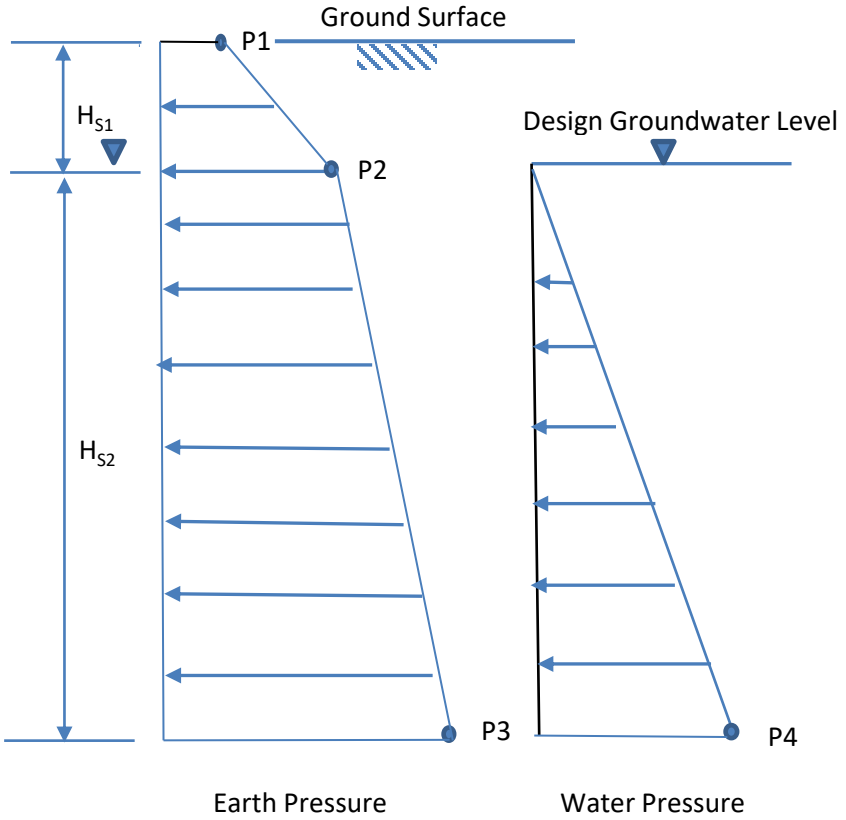
61 Buena Vista Avenue - Groundwater Level

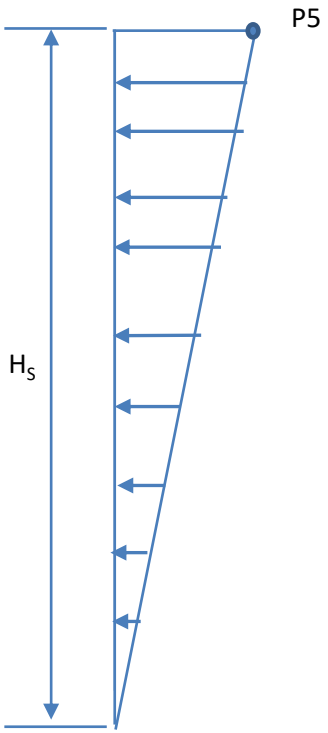


Water Level Readings
Boring B-3
61 Buena Vista Avenue
Yonkers, New York

GES, P.C.
Elmsford, New York

DRAWN BY:	AS	**SCALE:** AS SHOWN		**PROJ NO:**	2018113
CHECKED BY:	DJG	**DATE:** 4/17/2019		**FIGURE NO:**	5





SEISMIC CONDITIONS

P5 (psf) = 12 H_S

P1 (psf) = 0.4*SURCHARGE PRESSURE (SP)
P2 (psf) = 0.4*SP + 45*H_{S1}
P3 (psf) = P2 + 22 H_{S2}
P4 (psf) = 62*H_{S2}

Units are in feet and psf
H_{s2} = 0 when there is no groundwater

BELOW GRADE LATERAL WALL PRESSURES
61 BUENA VISTA AVENUE
YONKERS, NEW YORK

ALLENDALE, NEW JERSEY

DR. BY: PH	SCALE: As Shown	PROJ NO:
CHK'D BY: ZM	DATE: 4/29/2019	FIG NO.

APPENDIX A

Log of Boring B-1

Project: 61 Buena Vista Avenue			**Project Number: 2018113**
Location: Between Hudson and Prospect Streets, Yonkers, NY			
Date(s) Drilled: **3/18/19 - 3/20/19**	Inspector: **H. Melaouhia, Ph.D.**		Coordinates: **North: East:**
Drilling Agency: **Municipal Testing Laboratory**	Foreman: **Prem Gopaul**		Approximate Surface Elevation (feet): **+27.8 (NAVD 88)**
Drilling Equipment: **Geoprobe Track rig**	Drilling Method: **Mud Rotary**		Completion Depth (feet): **62.5** Rock Depth (feet): **57.5**
Casing Size/Type: **3" & 4" Steel**	Size/Type of Bit: **2-7/8" & 3-7/8" Roller Bit**		Sampler Type(s): **2" Split Spoon**
Groundwater Level and Date Measured: **NA / NA**	Hammer Wt/Drop: **140/30" (Auto)**	Casing Hammer Wt/Drop: **140/30" (Auto)**	Size/Type of Core Barrel: **NX**
Boring Location: **See Boring Location Plan (Figure 1)**			No. of Samples: **Dist.: 10 Undist.: 0 Core (ft): 22**

Depth, feet	Soil Samples: Type, Number	Recov. (ft)	Pen. Resist. (blows/6 in)	Rock Coring: Run Number	Recov. (%)	RQD (%)	Graphic Log	DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont.(%)	% Fines	REMARKS
0	S-1	0.2	14 15 13 15					FILL: Brown medium to fine Sand, some Silt, Gravel, trace Roots					S-1: Dry. Cased to 5 ft. with 4" casing
5	S-2	1.1	3 5 5 5					NATURAL: Red brown Silty medium to fine Sand, some Gravel, trace Mica (SM)					S-2: Moist. Cased to 10 ft. with 4" casing
													Rig chatter from 7 to 10 ft. Red brown wash return
10	S-3	0.0	9 10 7 7					No recovery. Presumed same as above. (SM)					
													Rig chatter from 12 to 13 ft.
15	S-4	0.8	4 9 11 11					Brown and gray coarse to fine Sand, some coarse to fine Gravel, trace Silt (SP)					S-4: Wet
													Rig chatter from 18 to 20 ft.
20													

Template: GENERAL GES LOGO Proj ID: 61 BUENA VISTA YONKERS.GPJ

GES P.C.

Printed: 4/9/19

Log of Boring B-1

Project: 61 Buena Vista Avenue | **Project Number: 2018113**

Location: Between Hudson and Prospect Streets, Yonkers, NY

Depth, feet	Soil Samples: Type, Number	Recov. (ft)	Pen. Resist. (blows/6 in)	Rock Coring: Run Number	Recov. (%)	RQD (%)	Graphic Log	DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont.(%)	% Fines	REMARKS
20	S-5	0.3	100/4"					Brown and gray gravelly coarse to fine Sand (SP-GP)					S-5: Wet. Spoon refusal at 20.3 ft. Gravel wedged in tip of spoon.
								Cored through Boulders					
				C-1	0	0							
													Barrel teeth broken. Cased to 25 ft. with 3" casing
25	S-6	0.0	50/1"					No recovery. Presumed same as above. (SP-GP)					S-6: Spoon refusal at 25.1 ft. Rig chatter from 25 to 30 ft.
30	S-7	0.3	100/3"					Red brown gravelly coarse to fine Sand (SP-GP)					S-7: Wet. Cased to 30 ft. with 3" casing. Spoon refusal at 30.3 ft. Rig chatter from 30 to 35 ft.
35	S-8	0.1	50/1"					Brown and gray gravelly coarse to fine Sand (SP-GP)					S-8: Wet. Spoon refusal at 35.1 ft. Cased to 35 ft. with 3" casing
								Cored through Boulders					
				C-2	8	0							
													Rig chatter from 39.5 to 42 ft. Hard at 42 ft. S-9: Wet. Spoon refusal at 40.1 ft.
40	S-9	0.1	50/1"					Same as above. (SP-GP)					
								Cored through Boulders					
													Core barrel blocked up

Template: GENERAL GES LOGO Proj ID: 61 BUENA VISTA YONKERS.GPJ

GES P.C.

Printed: 4/9/19

Log of Boring B-1

Project: 61 Buena Vista Avenue | **Project Number: 2018113**

Location: Between Hudson and Prospect Streets, Yonkers, NY

Depth, feet	Soil Samples: Type, Number	Soil Samples: Recov. (ft)	Soil Samples: Pen. Resist. (blows/6 in)	Rock Coring: Run Number	Rock Coring: Recov. (%)	Rock Coring: RQD (%)	Graphic Log	DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont.(%)	% Fines	REMARKS
													at 43 ft.
45				C-3	8	0							
								Cored through Boulders					
				C-4	33	0							
50													
													Core barrel blocked up at 51 ft. Rig chatter from 51 to 55 ft.
55	S-10	0.1	50/2"					Gray Decomposed Rock fragments. (GP)					S-10: Wet. Spoon refusal at 55.2 ft. White wash return and hard drilling from 55 to 57.5 ft.
								Hard gray and white Marble, Slightly weathered at joints, Mica intrusion, jointed.					Core barrel blocked up at 58 ft.
60				C-5	100	88							
								Boring Completed at 62.5 ft. Backfilled with soil cuttings and patched upon completion.					
65													

Template: GENERAL GES LOGO Proj ID: 61 BUENA VISTA YONKERS.GPJ

GES P.C.

Printed: 4/9/19

Log of Boring B-2

Project: 61 Buena Vista Avenue			**Project Number: 2018113**
Location: Between Hudson and Prospect Streets, Yonkers, NY			
Date(s) Drilled: **3/20/19 - 3/22/19**	Inspector: **H. Melaouhia, Ph.D./ Saleem A.**		Coordinates: **North: East:**
Drilling Agency: **Municipal Testing Laboratory**	Foreman: **Prem Gopaul**		Approximate Surface Elevation (feet): **+24.8 (NAVD 88)**
Drilling Equipment: **Geoprobe Track rig**	Drilling Method: **Mud Rotary**		Completion Depth (feet): **58.0** Rock Depth (feet): **53.0**
Casing Size/Type: **3" & 4" Steel**	Size/Type of Bit: **2-7/8" & 3-7/8" Roller Bit**		Sampler Type(s): **2" Split Spoon**
Groundwater Level and Date Measured: **NA NA**	Hammer Wt/Drop: **140/30" (Auto)**	Casing Hammer Wt/Drop: **140/30" (Auto)**	Size/Type of Core Barrel: **NX & H**
Boring Location: **See Boring Location Plan (Figure 1)**			No. of Samples **Dist.: 7 Undist.: 0 Core (ft): 10**

Depth, feet	Soil Samples: Type, Number	Soil Samples: Recov. (ft)	Soil Samples: Pen. Resist. (blows/6 in)	Rock Coring: Run Number	Rock Coring: Recov. (%)	Rock Coring: RQD (%)	Graphic Log	DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont.(%)	% Fines	REMARKS
0	S-1	1.1	1 1 3 2					FILL: Brown coarse to fine silty Sand, trace Roots					S-1: Dry.
5	S-2	1.8	2 3 3 5					FILL: Red brown Silty medium to fine Sand, trace Gravel					S-2: Dry. Cased to 10 ft. with 4" casing
10	S-3	1.0	4 5 5 6					NATURAL: Gray and brown medium to fine Sand, trace Silt (SP)					S-3: Moist.
15	S-4	1.2	5 9 9 9					Brown coarse to fine Sand, trace Silt, Gravel (SP)					S-4: Wet. Cased to 20 ft. with 4" casing.
20													Rig chatter from 19 to 20 ft.

Template: GENERAL GES LOGO Proj ID: 61 BUENA VISTA YONKERS.GPJ

GES P.C.

Printed: 4/9/19

Log of Boring B-2

Project: 61 Buena Vista Avenue | **Project Number: 2018113**

Location: Between Hudson and Prospect Streets, Yonkers, NY

Depth, feet	Soil Samples: Type, Number	Recov. (ft)	Pen. Resist. (blows/6 in)	Rock Coring: Run Number	Recov. (%)	RQD (%)	Graphic Log	DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont.(%)	% Fines	REMARKS
20	S-5	1.0	12 22 51 32					Red brown gravelly coarse to fine Sand, trace Silt (GP)					S-5: Moist.
25	S-6	0.2	100/4"					Brown gravelly coarse to fine Sand (SP-GP)					S-6: Moist. Spoon refusal at 25.3 ft. Rig chatter from 27 to 30 ft. Cased to 30 ft. with 4" casing.
30				C-1	25	0		Cored through Boulders					Cored with H barrel
35	S-7	0.2	100/5"					Brown and gray gravelly coarse to fine Sand (SP-GP)					S-7: Wet. Spoon refusal at 35.4 ft. Rig chatter from 36 to 40 ft.
40													Hard drilling and no sampling from 40 to 45 ft.

Template: GENERAL GES LOGO Proj ID: 61 BUENA VISTA YONKERS.GPJ

GES P.C.

Printed: 4/9/19

Log of Boring B-2

Project: 61 Buena Vista Avenue | **Project Number: 2018113**

Location: Between Hudson and Prospect Streets, Yonkers, NY

Depth, feet	Soil Samples: Type, Number	Soil Samples: Recov. (ft)	Soil Samples: Pen. Resist. (blows/6 in)	Rock Coring: Run Number	Rock Coring: Recov. (%)	Rock Coring: RQD (%)	Graphic Log	DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont.(%)	% Fines	REMARKS
45													Cased to 45 ft. with 3" casing. Hard drilling and no sampling from 45 to 50 ft.
50													Hard drilling and no sampling from 50 to 53 ft.
				C-2	95	88		Hard, white Marble, slightly weathered at joints, jointed.					
55													
								Boring Completed at 58 ft. Backfilled with soil cuttings and patched upon completion.					
60													
65													

Template: GENERAL GES LOGO Proj ID: 61 BUENA VISTA YONKERS.GPJ

GES P.C.

Printed: 4/9/19

Log of Boring B-3

Project: 61 Buena Vista Avenue			**Project Number: 2018113**
Location: Between Hudson and Prospect Streets, Yonkers, NY			
Date(s) Drilled: **3/22/19 - 3/26/19**	Inspector: **H. Melaouhia, Ph.D.**		Coordinates: **North: East:**
Drilling Agency: **Municipal Testing Laboratory**	Foreman: **Prem Gopaul**		Approximate Surface Elevation (feet): **+25.2 (NAVD 88)**
Drilling Equipment: **Geoprobe Track rig**	Drilling Method: **Mud Rotary**		Completion Depth (feet): **59.0** Rock Depth (feet): **54.0**
Casing Size/Type: **3" & 4" Steel**	Size/Type of Bit: **2-7/8" & 3-7/8" Roller Bit**		Sampler Type(s): **2" Split Spoon**
Groundwater Level and Date Measured: **NA NA**	Hammer Wt/Drop: **140/30" (Auto)**	Casing Hammer Wt/Drop: **140/30" (Auto)**	Size/Type of Core Barrel: **NX**
Boring Location: **See Boring Location Plan (Figure 1)**			No. of Samples: **Dist.: 10 Undist.: 0 Core (ft): 18**

Depth, feet	Soil Samples: Type, Number	Recov. (ft)	Pen. Resist. (blows/6 in)	Rock Coring: Run Number	Recov. (%)	RQD (%)	Graphic Log	DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont.(%)	% Fines	REMARKS
0	S-1	1.3	1 1 2 4					FILL: Brown Silty Clay, some fine to coarse Sand, trace Gravel, Vegetation					S-1: Moist. Cased to 5 ft. with 4" casing
5	S-2	0.5	20 19 14 10					NATURAL: Brown fine to coarse Sand, some fine to coarse Gravel (SP)					S-2: Moist. Cased to 10 ft. with 4" casing
10	S-3	0.3	11 9 8 8					Brown clayey fine to coarse Sand, some Silt (SC-SM)					S-3: Moist
15	S-4	1.0	2 4 2 5					Brown clayey fine to coarse Sand, some Silt, Gravel (SC-SM)					S-4: Moist
20													Rig chatter from 19 to 20 ft.

Template: GENERAL GES LOGO Proj ID: 61 BUENA VISTA YONKERS.GPJ

GES P.C.

Printed: 4/9/19

Log of Boring B-3

Project: 61 Buena Vista Avenue | **Project Number: 2018113**

Location: Between Hudson and Prospect Streets, Yonkers, NY

Depth, feet	Soil Samples: Type, Number	Recov. (ft)	Pen. Resist. (blows/6 in)	Rock Coring: Run Number	Recov. (%)	RQD (%)	Graphic Log	DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont.(%)	% Fines	REMARKS
20	S-5	0.0	50/1"					No recovery. Presumed Same as below. (SP-GP)					S-5: Spoon sampler bouncing at 20.1 ft.
													Rig chatter from 20 to 25 ft.
													Cased to 25 ft. with 3" casing.
25	S-6	0.0	50/1"					No recovery. Presumed same as below. (SP-GP)					S-6: Spoon refusal at 25.1 ft.
													Cased to 30 ft. with 3" casing. Brown wash return observed.
30	S-7	0.2	100/2"					Brown and gray gravelly medium to fine Sand (SP-GP)					S-7: Moist.Spoon refusal at 30.2 ft.
													Cased to 35 ft. with 3" casing. Rig chatter from 30 to 35 ft.
35	S-8	0.0	50/1"					No recovery. Presumed same as below. (SP-GP)					S-8: Spoon refusal at 35.1 ft.
													Cased to 40 ft. with 3" casing. Rig chatter from 35 to 40 ft. Brown wash return observed.
40	S-9	0.1	100/2"					Brown gravelly medium to fine Sand (SP-GP)					S-9: Moist. Spoon refusal at 40.2 ft.
													Rig chatter from 40 to 45 ft.

Template: GENERAL GES LOGO Proj ID: 61 BUENA VISTA YONKERS.GPJ

GES P.C.

Printed: 4/9/19

Log of Boring B-3

Project: 61 Buena Vista Avenue | **Project Number: 2018113**

Location: Between Hudson and Prospect Streets, Yonkers, NY

Depth, feet	Soil Samples: Type, Number	Soil Samples: Recov. (ft)	Soil Samples: Pen. Resist. (blows/6 in)	Rock Coring: Run Number	Rock Coring: Recov. (%)	Rock Coring: RQD (%)	Graphic Log	DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont.(%)	% Fines	REMARKS
45													Hard drilling and boulders from 40.2 to 51.5 ft. No sampling performed.
50				C-1	95	80		Intermediate, weathered white Marble, closely jointed to broken with weathered joints					
55				C-2	97	88		Hard, slightly weathered white Marble, moderately to closely jointed with slightly weathered joints					
60								Boring Completed at 59 ft. 30 ft. Piezometer installed (10 ft. screen plus 20 ft. riser)					
65													

Template: GENERAL GES LOGO Proj ID: 61 BUENA VISTA YONKERS.GPJ

GES P.C.

Printed: 4/9/19

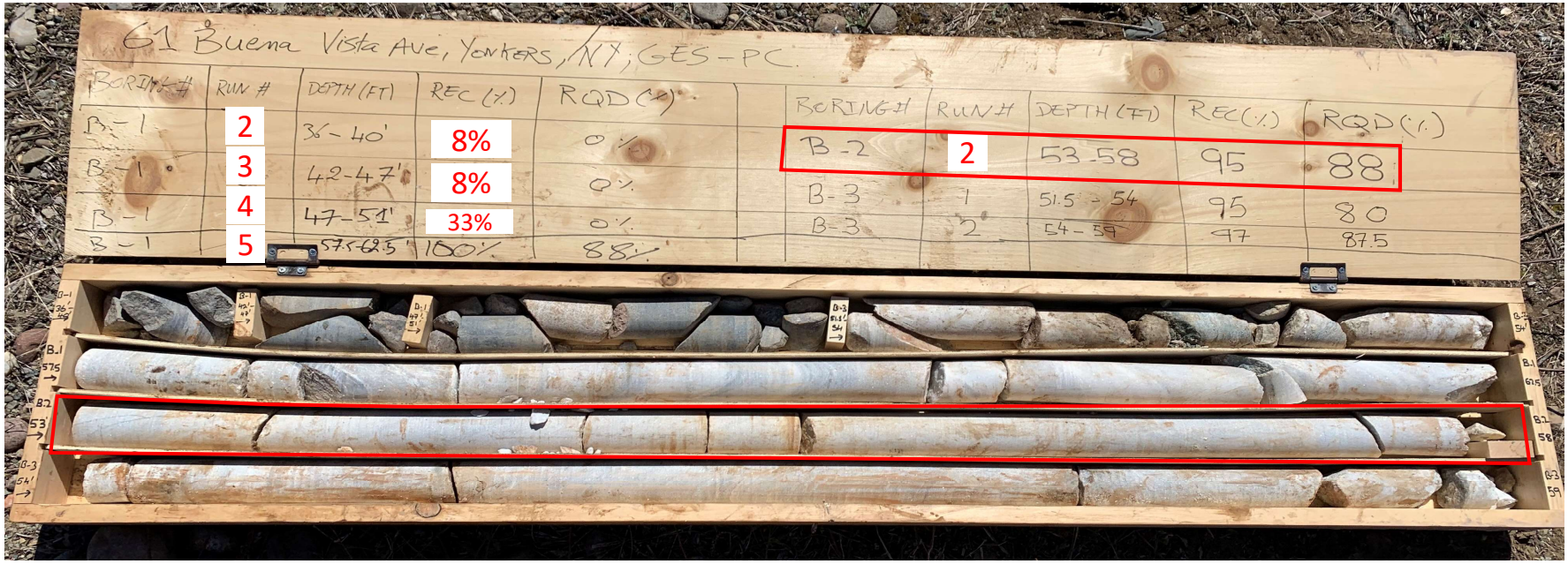
APPENDIX B

GEOTECHNICAL ENGINEERING SERVICES, P.C.
6 Bayberry Road
Elmsford, NY 10523

ROCK CORE PHOTOGRAPHIC PLATE

Boring No.	Core No.	Depth (ft)	Rec %	RQD %
B-1	C-2	36-40	8	0
	C-3	42-47	8	0
	C-4	47-51	33	0
	C-5	57.5-62.5	100	88

Project Name:	**61 Buena Vista Avenue**
Project Location:	Buena Vista Avenue, between Hudson and Prospect Streets
Dwg No.	Appendix B, Plate 1
Drawn By: DJG	**Project No:** 2018113
Ch'ked By: ZM	**Date:** 4/1/2019



GES

GEOTECHNICAL ENGINEERING SERVICES, P.C.
6 Bayberry Road
Elmsford, NY 10523

ROCK CORE PHOTOGRAPHIC PLATE

Boring No.	Core No.	Depth (ft)	Rec %	RQD %
B-2	C-2	53-58	95	88

Project Name:	**61 Buena Vista Avenue**		
Project Location:	Buena Vista Avenue, between Hudson and Prospect Streets		
Dwg No.	Appendix B, Plate 2		
Drawn By:	DJG	**Project No:**	2018113
Ch'ked By:	ZM	**Date:**	4/1/2019

GES

GEOTECHNICAL ENGINEERING SERVICES, P.C.
6 Bayberry Road
Elmsford, NY 10523

ROCK CORE PHOTOGRAPHIC PLATE

Boring No.	Core No.	Depth (ft)	Rec %	RQD %
B-3	C-1	51.5-54	95	80
B-3	C-2	54-59	97	87.5

Project Name:	**61 Buena Vista Avenue**		
Project Location:	Buena Vista Avenue, between Hudson and Prospect Streets		
Dwg No.	Appendix B, Plate 3		
Drawn By:	DJG	**Project No:**	2018113
Ch'ked By:	ZM	**Date:**	4/1/2019