Geotechnical Engineering Report

3 Story Senior Housing
Buffalo, New York
February 8, 2021
Terracon Project No. J5205291

Prepared for:
Silvestri Architects, PC
Buffalo, New York

Prepared by:
Terracon Consultants-NY, Inc.
Buffalo, New York

February 8, 2021

Silvestri Architects, PC
1321 Millersport Highway, Suite 101
Buffalo, New York 14221

Attn: Ms. Dawn Blickenstaff-Schwanz
P: (716) 691-0900
E: dawns@silvestriarchetects.com

Re: Geotechnical Engineering Report
3 Story Senior Housing
701 East Delevan Avenue
Buffalo, New York
Terracon Project No. J5205291

Dear Ms. Blickenstaff-Schwanz:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PJ5205291 dated December 2, 2020. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants-NY, Inc.

Blake J. Pilarski, E.I.T.
Staff Engineer

Michele A. Fiorillo, P.E.
Geotechnical Department Manager

C/C: Charles B. Guzzetta, Office Manager

REPORT TOPICS

Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report

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701 East Delevan Avenue
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INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Senior Housing Project to be located at 701 East Delevan Avenue in Buffalo, New York. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Dewatering considerations
- Excavation considerations
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per IBC
- Frost consideration

The geotechnical engineering Scope of Services for this project included the advancement of seventeen test borings to depths ranging from approximately 1.6 to 6 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The boring logs are included in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 701 East Delevan Avenue in Buffalo, New York. The site is bordered on the north by the Mount Olive Baptist Church, on the east and south by manufacturing facilities, and on the west by Sheridan Avenue. The western side of Sheridan Avenue includes mixed residential and commercial/industrial land use. The approximate borders of the site are shown with the orange line in the aerial image below (from Bing). 
Current Ground Cover	The site is developed with a grass-covered athletic field with associated paved areas on the North of the site.
Existing Topography (Google Earth™)	The site appears relatively level, with ground surface elevations (El.) of approximately 654 to 656 feet.
Geology[1]	The project is located within the Erie-Ontario Lowlands physiographic province. Geologic Maps indicate surficial deposits at the project site as lacustrine silt and clay deposits. The underlying bedrock is identified as Onondaga Limestone (Middle Devonian).

1. References: Fisher, D.W., Isachsen, Y.W., and Rickard, L.V., 1970, Geologic Map of New York State, consisting of 5 sheets: Niagara, Finger Lakes, Hudson-Mohawk, Adirondack, and Lower Hudson, New York State Museum and Science Service, Map and Chart Series No. 15, scale 1: 250,000.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	The following information were provided by Silvestri Architects (Silvestri): ■ RFP emailed to Terracon on November 30, 2020. ■ Concept Plan prepared by Silvestri Architects, dated November 17, 2020
Project Description	The project includes two three-story, senior housing buildings including associated landscaping, sidewalks and a stormwater detention area to the East of the buildings.
Proposed Structure	The concept plan prepared by Silvestri indicates that the new buildings will have slab-on-grade (non-basement).
Building Construction	■ Wood frame ■ Slab-on-grade ■ Concrete spread foundations
Finished Floor Elevation	Grading information was not provided. It is anticipated that minor (i.e. less than 4 feet) earthwork cut and fill may be required across the site to balance earthwork operations.
Maximum Loads[1]	Structural loads were not provided. We have assumed the following: ■ Columns: 200 kips ■ Walls: 6 kips per linear foot (klf) ■ Slabs: 100 pounds per square foot (psf)

1. Please contact our office if structural loads information is significant higher, since revision to our recommendations may be required.

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	**Surface**	Topsoil
2	**Fill**[1]	Silty sand; gray, red-brown or black; trace brick fragments; trace concrete fragments; trace cinders
3	**Native Soil**	Mixtures of Silt, Sand, and Gravel (SM); trace weathered limestone fragments; loose to medium dense
4	**Bedrock**	Limestone; weathered to slightly weathered; medium strong; gray or brown-gray

1. Fill was encountered in most borings starting at the surface in some cases and up to 4 feet below grade surface.

Bedrock

Bedrock was encountered in the borings at depths ranging from 2 to 4 feet below existing ground surface. The drillers were able to sample and/or auger within the bedrock 1 to 2.5 feet before encountering "practical" auger refusal. Practical auger refusal indicates a material that cannot be penetrated any further, over a reasonable amount of time, by power augering. At the location of B-8 and B-17 the borings were extended deeper by means of coring methods in order to investigate the nature and quality of the underlying bedrock. The recovered rock cores consist of limestone bedrock of poor quality. A summary of rock core recoveries and RQD values is presented in the table below:

Boring Number	Rock Core Depth (Feet Below grade)	Recovery (%)	Rock Quality Designation (RQD) (%)
B-8	2.0 – 7.0	80	47
B-16	2.5 – 6.0	86	35

Please note that ground surface elevations at each boring location are approximate and based upon a survey plan prepared by others and provided to our office. If elevations and a more precise boring layout are desired, we recommend borings be surveyed following completion of fieldwork. It should be noted that some variations in the depths/elevations and the quality of the bedrock were noted. This could result in encountering bedrock in localized areas which may be slightly shallower or deeper, or sounder, than the trend.

Groundwater Conditions

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Groundwater was generally not observed in the borings for the short duration the borings could remain open.

Sedimentary bedrock was encountered in the borings at shallow depths and would be considered to be a relatively impermeable layer. Therefore, perched groundwater conditions could be encountered in excavations, particularly after rainfall events.

Groundwater level fluctuations may occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project. The predominant source of water to the site soils is likely from rainfall/snow melt.

GEOTECHNICAL OVERVIEW

The subsurface conditions encountered in the test borings performed at the project site generally consist of 2 to 4 feet of fill material overlying limestone bedrock. As discussed in **Geotechnical Characterization**, some variations in the depths/elevations and the quality of the bedrock were noted, which could result in encountering bedrock in localized areas which may be slightly shallower or deeper, or sounder, than the trend.

The key geotechnical consideration impacting the proposed construction is the presence of shallow bedrock. Within the building footprint we anticipate that bedrock may be encountered at depths ranging from about 2 to 4 feet below site grades. Excavations advanced into the bedrock will likely require very high capacity excavating equipment, in conjunction with use of pneumatic breakers to shatter the bedrock prior to removal.

In general, the site is suitable for the proposed construction based upon geotechnical conditions encountered during the exploration program. The proposed building may be supported on a shallow foundation system bearing upon compacted Structural Fill placed upon bedrock or directly upon bedrock. Existing fill (where encountered) is not suitable to support foundations and (if encountered) should be replaced with compacted Structural Fill within the foundation bearing zone, as discussed in the **Shallow Foundations** section of this report.

Support of floor slabs and pavement areas on or above existing fill is discussed in this report. However, even with the recommended construction testing services, there is an inherent risk for the owner that unsuitable material within or buried during re-grading will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill from beneath floor slabs and pavement areas but can be reduced by following the recommendations contained in this report. To take advantage of the cost benefit of not removing the entire amount of undocumented fill from beneath floor slabs areas, the owner must be willing to accept the risk associated with building over the undocumented fills following the recommended reworking of the material. We recommend that before of any fill placement, exposed grades (beneath the building footprint and pavement areas) be proofrolled with proper compaction equipment. The compactive effort will help to improve the relative density of the bearing grades, and therefore, will help to better distribute the foundation loads. Unstable subgrades, as identified by the Geotechnical Engineer, should be over-excavated from the building footprint, footing bearing zones, and pavement areas to competent material and replaced with compacted Structural Fill.

The **Floor Slabs** and **Pavements** section addresses support of slab-on-grades and pavements, respectively.

Monitoring of the construction operations discussed herein will be critical in achieving the design subgrade support. We recommend Terracon be retained to evaluate soil bearing subgrades exposed after excavation to confirm they are suitable for footing, or slab support. Subsurface conditions in the explorations have been reviewed and evaluated with respect to the proposed construction plans known to us now.

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Earthwork will include removal of topsoil, removal of any unsuitable soft soil and fill (if encountered), excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria as necessary to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavement.

Site Preparation

Complete stripping of the topsoil should be performed in the proposed building and parking/driveway areas. Subgrades should be proof-rolled with a minimum 10-ton (static weight) smooth drum roller compactor. We recommend a minimum of two overlapping passes in one direction, followed by two overlapping passes in a direction perpendicular to the first passes. The intent is to compact areas with relatively loose surficial soil, to re-compact areas loosened by stripping operations, and to identify unacceptable subgrade areas. As an alternative, proof-rolling can also be performed with an adequately loaded vehicle such as a fully loaded tandem axle dump truck or other heavy, rubber-tired construction equipment weighing at least 20 tons.

Areas which excessively deflect under the proof-roll should be delineated and subsequently addressed by the Geotechnical Engineer. Unstable subgrades, as identified by the Geotechnical Engineer, should be over-excavated from the building footprint, footing bearing zones, and pavement areas to competent material and replaced with compacted Structural Fill.

Fill Material Types

Structural Fill should be used as fill/backfill within the proposed building and pavement areas. The fill should consist of imported sand and gravel which meets the limits of gradation given below. Any imported materials should be free of recycled concrete, asphalt, bricks, glass, and pyritic shale rock.

IMPORTED STRUCTURAL FILL

Sieve Size	Percent Finer
3"	100
¼"	30 to 75
No. 40	5 to 40
No. 200	0 to 10

The reuse of excavated native soils and/or existing fill materials may be considered for reuse outside the building area (excluding within three feet of finished grade in proposed pavement areas) if approved by the Geotechnical Engineer and pending the conditions encountered at the time of construction. Any reuse of the existing fill would require that all organics, oversize particles and unsuitable foreign matter found therein be separated and wasted off-site.

If construction is performed during the wet season, it is possible the moisture content of the excavated soils is in excess of the optimum moisture content required to achieve proper compaction, and that proper compaction of the on-site soils may be very difficult to achieve. Saturated soils which cannot achieve compaction should be removed or used in non-structural areas where significant post construction settlement is acceptable. The contractor is ultimately responsible for moisture conditioning of fill/backfill materials to achieve proper compaction.

Fill Compaction Requirements

New fills beneath the building pad and pavements should be placed in uniform loose layers no more than about one-foot thick where heavy vibratory compaction equipment is used. Smaller lifts should be used where hand operated equipment is required for compaction. Each lift should be compacted to no less than 95 percent of its maximum dry density as determined by the Modified Proctor Compaction Test, ASTM D1557. In landscape areas, the compaction requirement may be relaxed to 90 percent of maximum dry density.

Onsite soil used for subgrade fill should have a moisture content within +/-2 percent of its optimum moisture content when it is placed and compacted.

Utility Trench Backfill

Trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. Trenches should be backfilled with material that approximately matches the permeability characteristics of the surrounding soil to reduce the infiltration and preferential conveyance of surface water through the trench backfill. Fill placed as backfill for utilities located below the slab should consist of compacted Structural Fill or suitable bedding material.

Utility trenches are a common source of water infiltration and migration. All utility trenches that penetrate beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the building. The trench should provide an effective trench plug that extends at least 5 feet out from the face of the building exterior. The plug material should consist of cementitious flowable fill or low permeability clay. The trench plug material should be placed to surround the utility line. If used, the clay trench plug material should be placed and compacted to comply with the water content and compaction recommendations for Structural Fill stated previously in this report.

Grading and Drainage

Grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts discharging onto splash blocks at a distance of at least 10 feet from the buildings.

Exposed ground should be sloped and maintained at a minimum 5 percent away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After buildings construction and landscaping, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted as necessary as part of the structure's maintenance program. Where paving or flatwork abuts the structure a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations, for the proposed structure, are anticipated to be accomplished with conventional construction equipment. Based upon the subsurface conditions encountered in the boring logs, we anticipate top of bedrock to be encountered at approximately 2 to 4 feet below existing site grades.

The contractor shall assure himself by site investigation or other necessary means that he is familiar with the type, quantity, quality, and character of excavation to be performed. We strongly recommend that the contractor be provided the opportunity to review the boring logs and data presented in our geotechnical report to determine the most efficient means and methods for excavation at the project site.

A grading plan was not available at the time of the preparation of the report. We anticipate that excavations for the building foundations and utilities extending within the bedrock will be difficult, and will likely require very high capacity excavating equipment, in conjunction with use of pneumatic breakers to shatter the bedrock prior to removal. Rock excavation (if required) should be advanced to form level bearing grades at the bottom of the utilities and foundation (if any extending down to bedrock) excavation. Loose or shattered rock layers should be removed to provide a sound and unshattered base for utilities and foundations. Where the top of bedrock is uneven, it would be acceptable to use a minus ¾-inch crushed stone or lean concrete to create a level working surface for the new utilities and foundation.

Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of foundations and floor slabs. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over, or adjacent to, construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted, prior to floor slab construction.

Although groundwater was generally not encountered in the borings at the time of our investigation, groundwater level fluctuations due to seasonal variations in the amount of rainfall, runoff and other factors should be anticipated. Sedimentary rock was encountered in the borings and would be considered to be relatively impermeable layers. Therefore, perched groundwater conditions could be encountered in excavations particularly after rainfall events. If perched water is encountered during construction, it is expected to be limited in volume and standard sump and pump methods should be sufficient for its removal. Dewatering is a means and methods consideration for the contractor.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, “Excavations” and its appendices, and in accordance with any applicable local, and/or state regulations. The contractor should be aware that slope height, slope inclination, and excavation depth should in no instance exceed OSHA guidelines. OSHA guidelines are strictly enforced and if they are not followed, the owner, contractor, and/or earthwork and utility subcontractor could be liable and subject to substantial penalties.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and topsoil, proofrolling and mitigation of areas delineated by the proof-roll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked as necessary until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. One density and water content test for every 50 linear feet of compacted utility trench backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. If unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer’s evaluation of subsurface conditions, including assessing variations and associated design changes.

SHALLOW FOUNDATIONS

Based upon the subsurface conditions encountered in the boring logs, we anticipate top of bedrock to be encountered at about 2 to 4 feet below existing site grades. A grading plan was not available at the time of the preparation of the report. We anticipate that excavations for the building foundations and utilities extending within the bedrock will be difficult, and will likely require very high capacity excavating equipment, in conjunction with use of pneumatic breakers to shatter the bedrock prior to removal.

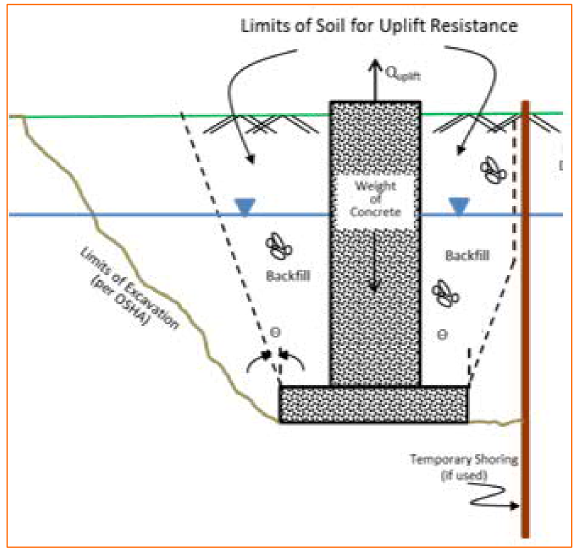
If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing Pressure [1, 2]	5,000 psf
Required Bearing Stratum [3]	Bedrock or compacted Structural Fill placed over bedrock.
Minimum Foundation Dimensions	Columns: 30 inches Continuous: 18 inches
Ultimate Passive Resistance [4] **(equivalent fluid pressures)**	390 pcf (compacted Structural Fill)
Ultimate Coefficient of Sliding Friction [5]	0.70 (Footing on bedrock) 0.50 (Footing on compacted Structural Fill)
Minimum Embedment below Finished Grade [6]	Exterior footings in unheated areas: 48 inches Exterior footings in heated areas: 48 inches Interior footings in heated areas: 18 inches
Estimated Total Settlement from Structural Loads [2]	Less than about 1 inch
Estimated Differential Settlement [2, 7]	About 2/3 of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. These bearing pressures can be increased by 1/3 for transient loads unless those loads have been factored to account for transient conditions. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2. Values provided are for maximum loads noted in **Project Description**.
3. Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in the **Earthwork**. If wet soils are present at the planned foundation bearing elevation, a nominal 6-inch thick base of clean Crushed Stone should be installed to establish a more stable surface for construction and to assist in dewatering if required. The Crushed Stone should be an ASTM C33 Blend 57 aggregate and it should be placed over a geotextile stabilization fabric meeting the requirements of NYSDOT Table 737-01E.
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted Structural Fill be placed against the vertical footing face. The Structural Fill must extend out and up from the base of the foundation at an angle of at least 60 degrees from vertical for the passive case.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
6. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7. Differential settlements are as measured over a span of 50 feet.

Design Parameters - Uplift Loads



Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils. As illustrated on the figure to the right, the effective weight of the soil prism defined by diagonal planes extending up from the top of the perimeter of the foundation to the ground surface at an angle, θ, of 20 degrees from the vertical can be included in uplift resistance. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation, divided by an appropriate factor of safety. A maximum total unit weight of 125 pcf should be used for the backfill. provided the fill is placed and compacted following the recommendations contained in **Fill Material Types** and **Fill Compaction Requirements**. This unit weight should be reduced to 62 pcf for portions of the backfill or natural soils below the groundwater elevation.

Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Rock excavation should be advanced to form level bearing grades at the bottom of the foundation excavation. Loose or shattered rock layers should be removed to provide a sound and unshattered base for foundations. Where the top of bedrock is uneven, it would be acceptable to use a minus ¾-inch crushed stone or lean concrete to create a level working surface for the foundation.

SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Seismic site class is required to determine the Seismic Design Category for a structure, in accordance with Section 1613 Earthquake Loads of the 2020 Building Code of New York State, which refer to Chapter 20 of ASCE 7.

Based on the properties of subsurface materials encountered at the site, it is our opinion that the Seismic Site Classification for the site is **C**. Subsurface explorations at the site were extended to a maximum depth of 7 feet. The properties of materials below the bottom of the deepest boring at the site to a depth of 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. If a more precise seismic site classification is desired, additional deeper borings or geophysical testing may be performed to confirm the conditions below the deepest current boring depth.

FLOOR SLABS

If the owner elects to leave existing fills in place beneath new building floor slabs, proof-rolling and stabilization of the subgrades as described herein will lessen but cannot eliminate the risk of settlement. If this risk cannot be accepted, the existing fills should be removed and replaced in their entirety as part of the site preparation. Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor Slab Support [1]	Minimum 9 inches of Aggregate Base material which conforms to the requirements for NYSDOT Type 2 Subbase compacted to at least 95% of Modified Proctor (ASTM D 1557). The Aggregate Base should be placed upon proofrolled stable on-site subgrade soils. Consideration should be given to using a thicker subbase course in areas subject to heavier loads and/or use, or those exposed to freezing temperatures.
Estimated Modulus of Subgrade Reaction [2]	150 pounds per square inch per inch (psi/in) for point loads for slab placed upon 9 inches of compacted Aggregate Base material.

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Floor Slab Construction Considerations

Finished subgrade within and for at least 10 feet beyond the floor slab should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and Structural Fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

FROST CONSIDERATIONS

Frost may penetrate beneath sidewalks and pavements and cause them to heave, and resulting displacements may be differential, particularly where sidewalks and pavements meet building doorways and along curbs. To limit heave and the creation of such uneven joints to generally tolerable magnitudes for most winters, a 16-inch thick base of ASTM C33 Blend 57 crushed stone should be placed beneath sensitive sidewalk or pavement areas, along with an underdrain to relieve any collected waters.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

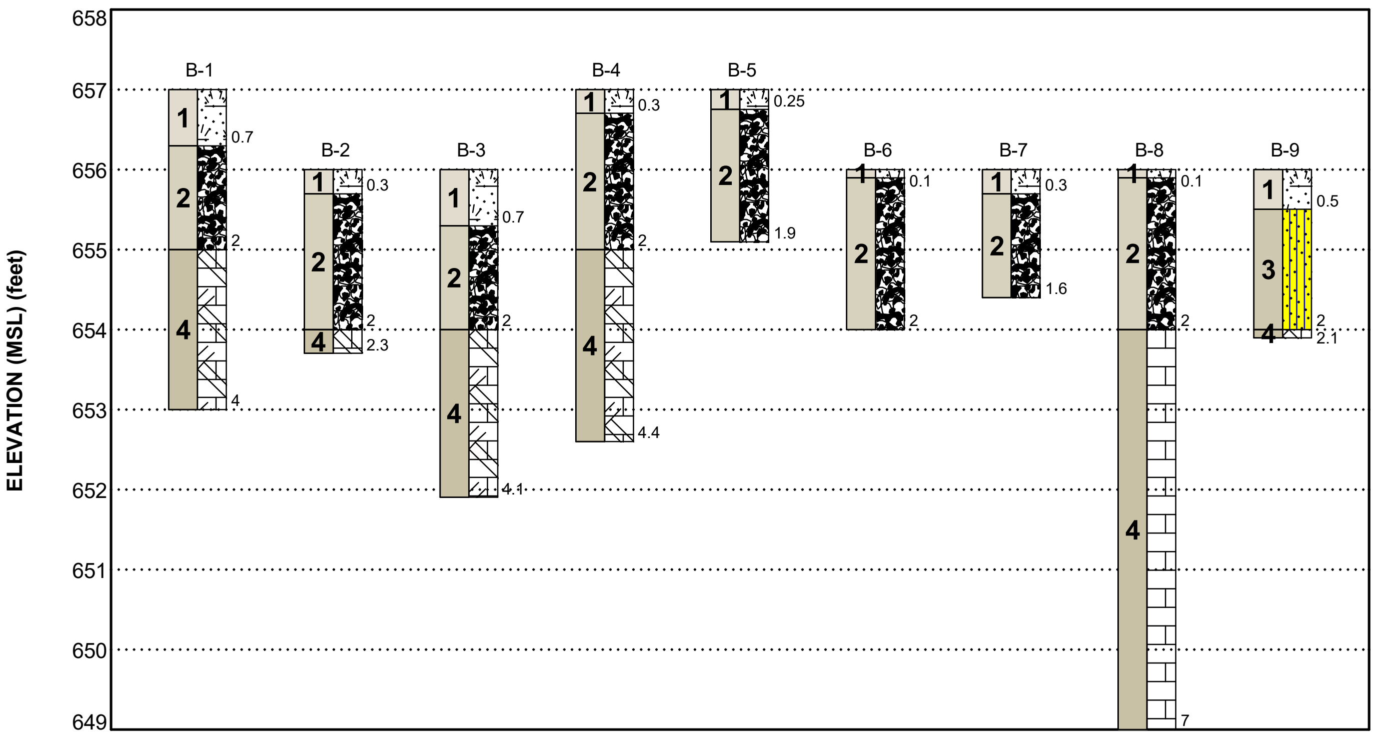
FIGURES

Contents:

GEOMODEL

Senior Housing ■ Buffalo, New York
Terracon Project No. J5205291

Terracon GeoReport



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Surface	Topsoil
2	FILL	Mixtures of Silt and Sand with rock/brick/concrete fragments, and cinders; red-brown and black
3	NATIVE SOIL	Silty Sand (SM) with rock fragments; brown; loose to medium dense
4	BEDROCK	Limestone; slightly to moderately weathered; gray, brown-gray

LEGEND

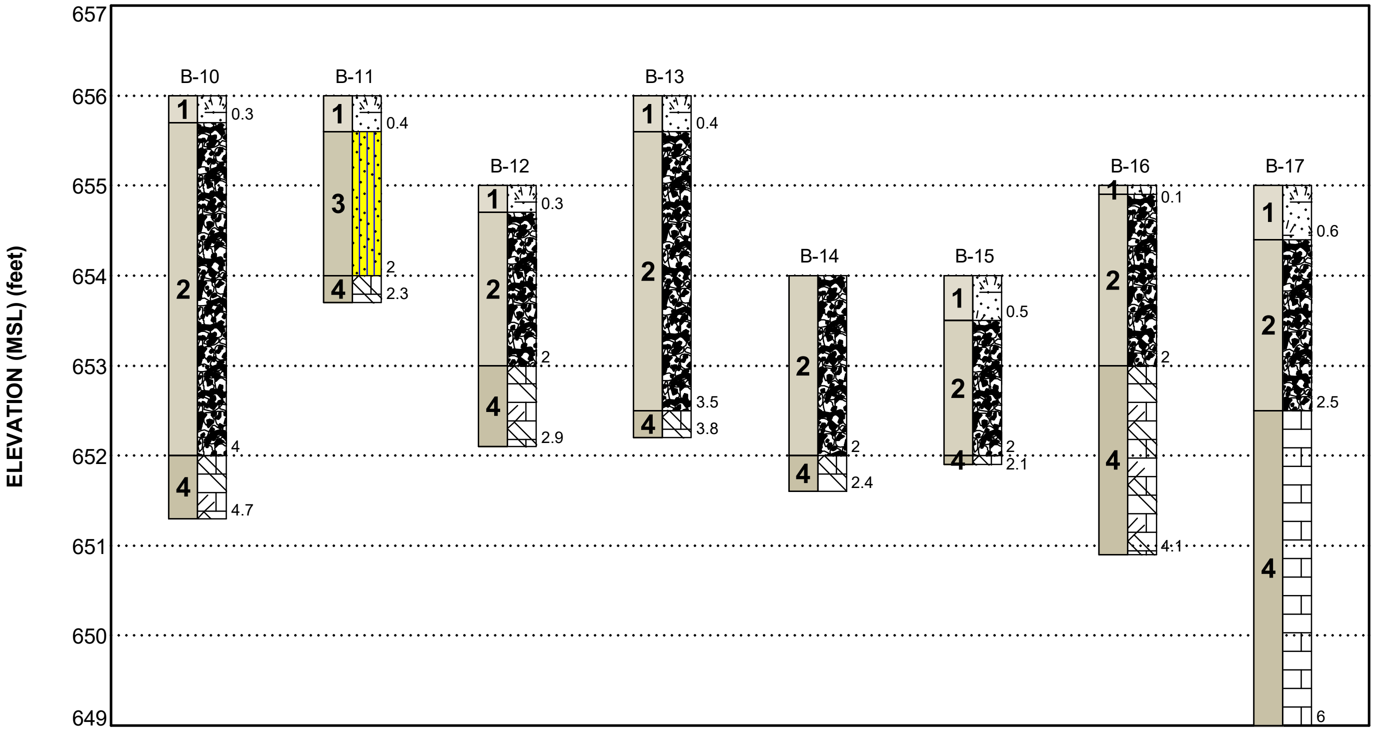
- Topsoil
- Fill
- Weathered Limestone
- Limestone
- Silty Sand

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

GEOMODEL

Senior Housing ■ Buffalo, New York
Terracon Project No. J5205291

Terracon GeoReport



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Surface	Topsoil
2	FILL	Mixtures of Silt and Sand with rock/brick/concrete fragments, and cinders; red-brown and black
3	NATIVE SOIL	Silty Sand (SM) with rock fragments; brown; loose to medium dense
4	BEDROCK	Limestone; slightly to moderately weathered; gray, brown-gray

LEGEND

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)[1]	Location
16 (B-1, B-2 and B-4 to B-17)	1.6 to 7	Proposed building
1 (B-3)	4	Proposed entrance sidewalk

1. Borings B-1 through B-7 and B-9 through B-16 were completed with auger refusal upon apparent bedrock. At the location of B-8 and B-17 the borings were extended deeper by means of coring methods in order to investigate the nature and quality of the underlying bedrock.

Boring Layout and Elevations: Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±20 feet) and approximate elevations were obtained by interpolation from Google Earth. If elevations and a more precise boring layout are desired, we recommend borings be surveyed following completion of fieldwork.

Subsurface Exploration Procedures: We advanced the borings with a track-mounted CME-550X rotary drill rig using continuous hollow stem flight augers. Soil samples were obtained using a split-spoon sampler. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the middle 12 inches of a normal 24-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion.

Bedrock core samples were obtained at boring locations B-8 and B-17 to investigate the nature and quality of the underlying bedrock. Standard diamond rock coring methods were utilized to obtain NQ-2 size (2-inch nominal diameter) samples of the underlying bedrock strata. The percent recovery and the Rock Quality Designation (RQD) for the recovered sample were recorded. The percent recovery is the ratio of the length of rock recovered over the length of coring. The RQD is the ratio of the sum of the length of recovered rock core 4 inches or greater in length, over the length of rock core recovered. The RQD is useful is providing a qualitative and quantitative evaluation of the engineering quality of bedrock.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Rock classification was conducted using locally accepted practices for engineering purposes; petrographic analysis may reveal other rock types. Rock core samples typically provide an improved specimen for this classification. Boring log rock classification was determined using the Description of Rock Properties.

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location
Exploration Plan with Aerial Image
Exploration Plan with Project Overlay

Note: All attachments are one page unless noted above.

SITE LOCATION

3 Story Senior Housing ■ Buffalo, New York

February 8, 2021 ■ Terracon Project No. J5205291

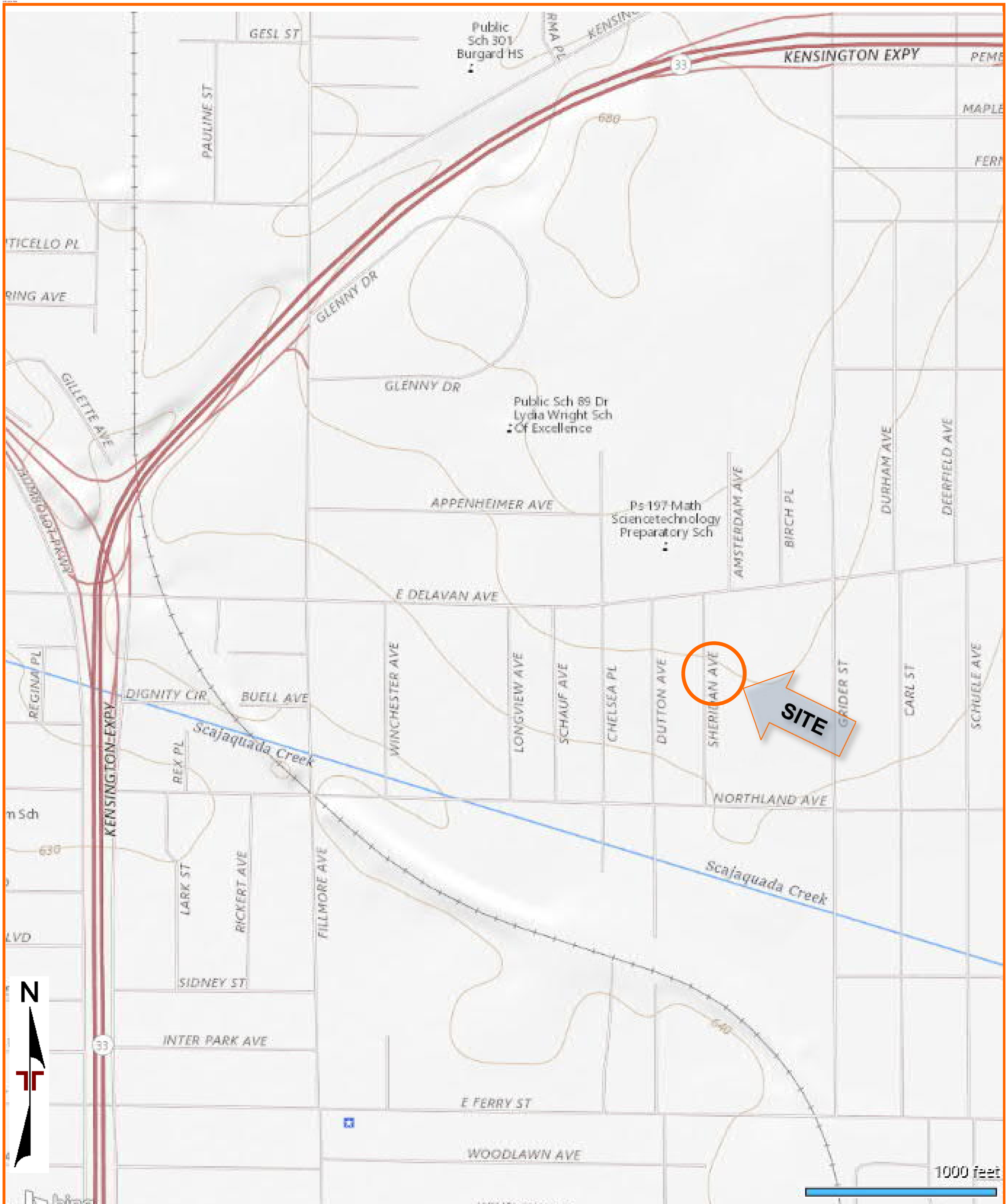


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN WITH AERIAL IMAGE

3 Story Senior Housing ■ Buffalo, New York

February 8, 2021 ■ Terracon Project No. J5205291

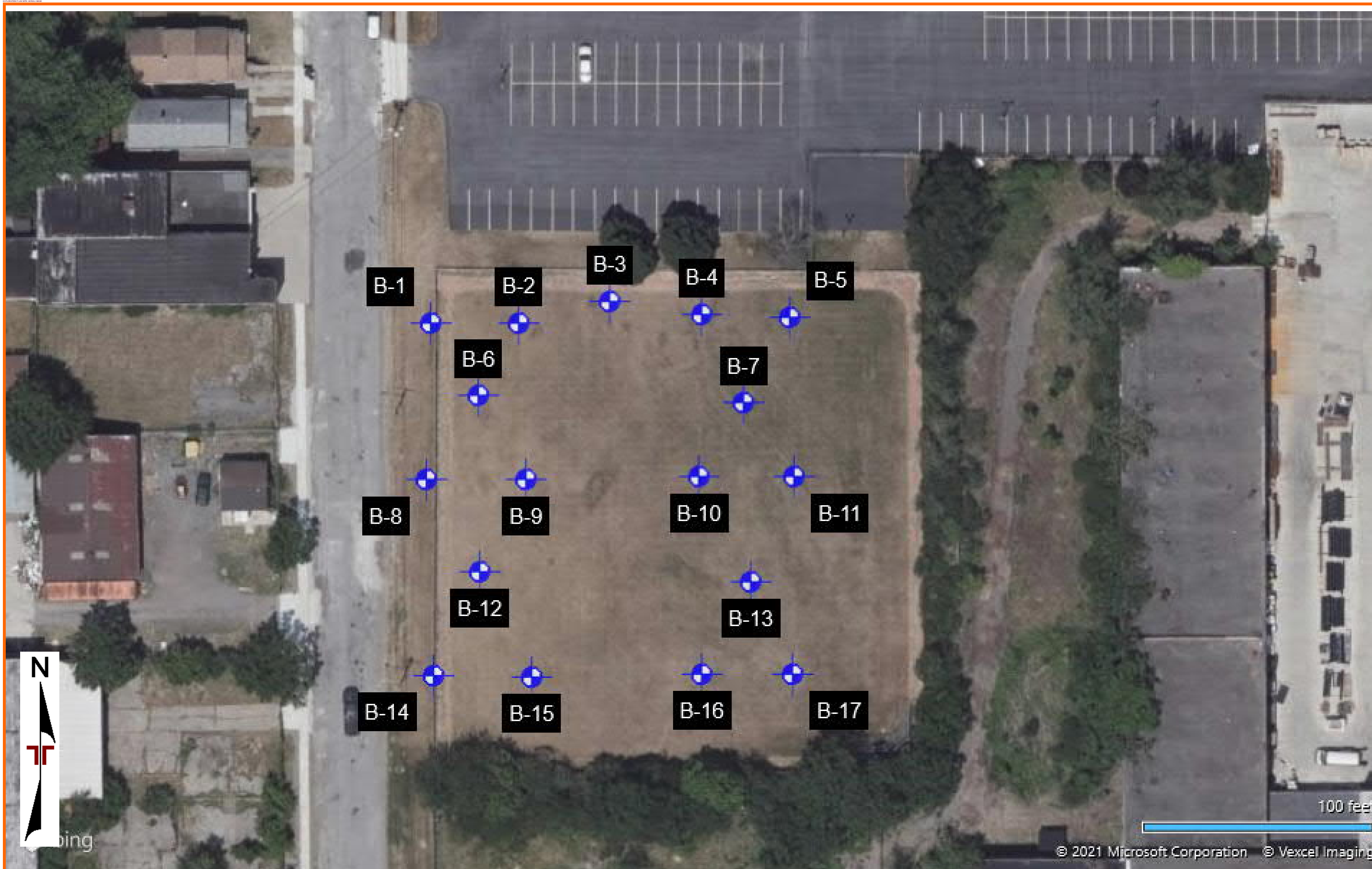


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN WITH PROJECT OVERLAY

3 Story Senior Housing ■ Buffalo, New York

February 8, 2021 ■ Terracon Project No. J5205291

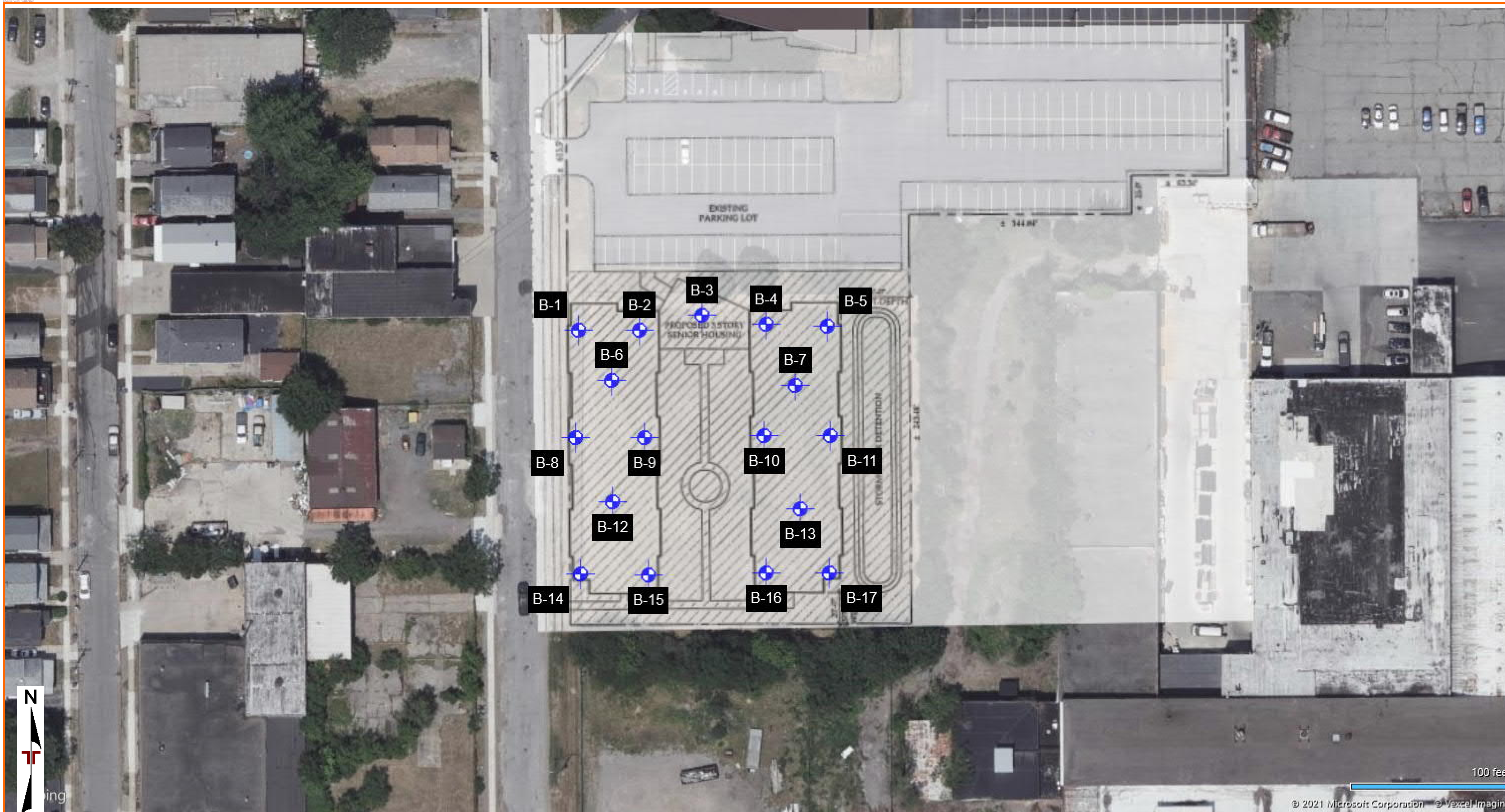


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

BASE MAP PROVIDED BY SILVESTRI ARCHITECTS

EXPLORATION RESULTS

Contents:

Boring Logs (17 pages; B-1 to B-17)
Rock Core Photo Log

Note: All attachments are one page unless noted above.

BORING LOG NO. B-1

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC
Amherst, NY

SITE: 701 East Delavan Avenue
Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9207° Longitude: -78.8315°

Approximate Surface Elev.: 657 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1		**TOPSOIL**								
		0.7	656.5+/-							
2		**FILL - SILTY SAND WITH BRICK FRAGMENTS**, red-brown and black		1			9	4-5-7-9 N=12		BKG
		2.0	655+/-	2						
4		**WEATHERED LIMESTONE**, gray		3			10	40-45-30-50/5" N=75		BKG
		4.0	653+/-	4			0	50/0"		BKG
		Sample Spoon and Auger Penetration Refusal Encountered Upon Apparent Bedrock at 4 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-12-2021	Boring Completed: 01-12-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J5205291 701 EAST DELAVAN.GPJ TERRACON_DATATEMPLATE.GDT 2/8/21

BORING LOG NO. B-2

PROJECT: Senior Housing

**CLIENT: Silvestri Architects PC
Amherst, NY**

**SITE: 701 East Delavan Avenue
Buffalo, New York**

LOCATION See Exploration Plan

Latitude: 42.9207° Longitude: -78.8314°

Approximate Surface Elev.: 656 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	MATERIAL DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1		0.3	**TOPSOIL**	655.5+/-							
2		2.0	**FILL - SILTY SAND**, trace cinders, trace concrete fragments, brown-black	654+/-	1		X	4	1-5-8-10 N=13		BKG
4		2.3	**WEATHERED LIMESTONE**, brown-gray	653.5+/-	2		X	1	50/4"		BKG
			Sample Spoon Penetration Refusal Encountered Upn Apparent Bedrock at 2.3 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-12-2021	Boring Completed: 01-12-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J5205291 701 EAST DELAVAN.GPJ TERRACON_DATATEMPLATE.GDT 2/8/21

BORING LOG NO. B-3

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC, Amherst, NY

SITE: 701 East Delavan Avenue, Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9207° Longitude: -78.8312°

Approximate Surface Elev.: 656 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1		0.7	**TOPSOIL**	655.5+/-							
2		2.0	**FILL - SILTY SAND**, trace gravel, trace weathered limestone fragments, brown-black	654+/-	1		X	4	1-5-14-9 N=19		BKG
4		4.1	**WEATHERED LIMESTONE**, brown-gray	652+/-	2, 3		X	4	4-6-4-4 N=10		BKG
					4		X	1	50/1"		BKG

Sample Spoon Penetration Refusal Encountered Upn Apparent Bedrock at 4.1 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-12-2021	Boring Completed: 01-12-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J5205291 701 EAST DELAVAN.GPJ TERRACON_DATATEMPLATE.GDT 2/8/21

BORING LOG NO. B-4

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC
Amherst, NY

SITE: 701 East Delavan Avenue
Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9207° Longitude: -78.8311°

Approximate Surface Elev.: 657 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	MATERIAL DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1		0.3	**TOPSOIL**	656.5+/-							
2		2.0	**FILL - SILTY SAND**, brown-black	655+/-	1			6	1-2-3-9 N=5		BKG
4		4.4	**WEATHERED LIMESTONE**, brown-gray	652.5+/-	2 3			12	6-10-3-7 N=13		BKG
					4			2	50-2/-1"		BKG

Sample Spoon Penetration Refusal Encountered Upn Apparent Bedrock at 4.4 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-12-2021	Boring Completed: 01-12-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J5205291 701 EAST DELAVAN.GPJ TERRACON_DATATEMPLATE.GDT 2/8/21

BORING LOG NO. B-5

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC
Amherst, NY

SITE: 701 East Delavan Avenue
Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9207° Longitude: -78.8309°

Approximate Surface Elev.: 657 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1		0.3	**TOPSOIL**	657+/-							
2		1.9	**FILL - SILTY SAND**, brown-black	655+/-	1		X	6	1-2-4-50/5" N=6		BKG
			Sample Spoon Penetration Refusal Encountered Upn Apparent Bedrock at 1.9 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-12-2021	Boring Completed: 01-12-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J5205291 701 EAST DELAVAN.GPJ TERRACON_DATATEMPLATE.GDT 2/8/21

BORING LOG NO. B-6

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC
Amherst, NY

SITE: 701 East Delavan Avenue
Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9206° Longitude: -78.8314°

Approximate Surface Elev.: 656 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH / DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1		0.1 **TOPSOIL**	656+/-							
2		**FILL - SILTY SAND**, trace gravel, trace cinders, brown-black		1		X	6	2-5-9-50 N=14		BKG
		2.0	654+/-	2			0	50/0"		
		Sample Spoon and Auger Penetration Refusal Encountered Upon Apparent Bedrock at 2 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-12-2021	Boring Completed: 01-12-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J5205291 701 EAST DELAVAN.GPJ TERRACON_DATATEMPLATE.GDT 2/8/21

BORING LOG NO. B-7

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC
Amherst, NY

SITE: 701 East Delavan Avenue
Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9206° Longitude: -78.8310°

Approximate Surface Elev.: 656 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1		0.3	**TOPSOIL**	655.5+/-							
2		1.6	**FILL - SILTY SAND**, trace gravel, trace brick fragments, brown-black	654.5+/-	1		X	8	1-2-7-50/1" N=9		BKG
			Sample Spoon Penetration Refusal Encountered Upn Apparent Bedrock at 1.6 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-13-2021	Boring Completed: 01-13-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J5205291 701 EAST DELAVAN.GPJ TERRACON_DATATEMPLATE.GDT 2/8/21

BORING LOG NO. B-8

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC
Amherst, NY

SITE: 701 East Delavan Avenue
Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9205° Longitude: -78.8315°

Approximate Surface Elev.: 656 (Ft.) +/-

MODEL LAYER	DEPTH	MATERIAL DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1	0.1	**TOPSOIL**	656+/-							
2	2.0	**FILL - SILTY SAND WITH BRICK FRAGMENTS**, red-brown and black	654+/-	1		Split barrel	10	6-6-6-50/5" N=12		BKG
4	7.0	**LIMESTONE**, gray to dark gray, fine-grained, upper 2' moderately fractured, grades to slightly fractured, very close fracture spacing, thin bedding, slightly to moderately weathered, medium strong, occasional chert nodules	649+/-	2–7		Rock core	48	RUN # 1 2.0' - 7.0'	47	

Boring Terminated at 7 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler to 2' BGS.
NQ '2' size rock core barrel 2.0' - 7.0'

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered prior to coring

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-12-2021	Boring Completed: 01-12-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J5205291 701 EAST DELAVAN.GPJ TERRACON_DATATEMPLATE.GDT 2/8/21

BORING LOG NO. B-9

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC
Amherst, NY

SITE: 701 East Delavan Avenue
Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9205° Longitude: -78.8314°

Approximate Surface Elev.: 656 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	MATERIAL DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1		0.5	**TOPSOIL**	655.5+/-							
3		2.0	**SILTY SAND (SM)**, with highly weathered limestone fragments, brown, medium dense	654+/-	1			5	1-5-9-6 N=14		BKG
4		2.1	**WEATHERED LIMESTONE**, brown-gray	654+/-	2			2	50/1"		BKG

Sample Spoon Penetration Refusal Encountered Upn Apparent Bedrock at 2.1 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-12-2021	Boring Completed: 01-12-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J5205291 701 EAST DELAVAN.GPJ TERRACON_DATATEMPLATE.GDT 2/8/21

BORING LOG NO. B-10

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC Amherst, NY

SITE: 701 East Delavan Avenue Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9205° Longitude: -78.8311°

Approximate Surface Elev.: 656 (Ft.) +/-

MODEL LAYER	DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1	0.3	655.5+/-	**TOPSOIL**							
2	4.0	652+/-	**FILL - SILTY SAND**, trace salg, trace cinders, brown-black	1			5	1-2-5-6 N=7		BKG
				2						
				3			4	5-3-3-2 N=6		BKG
4	4.7	651.5+/-	**WEATHERED LIMESTONE**, brown-gray	4			3	2-50/2"		BKG

Sample Spoon Penetration Refusal Encountered Upn Apparent Bedrock at 4.7 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-13-2021	Boring Completed: 01-13-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J5205291 701 EAST DELAVAN.GPJ TERRACON_DATATEMPLATE.GDT 2/8/21

BORING LOG NO. B-11

PROJECT: Senior Housing

**CLIENT: Silvestri Architects PC
Amherst, NY**

**SITE: 701 East Delavan Avenue
Buffalo, New York**

LOCATION See Exploration Plan

Latitude: 42.9205° Longitude: -78.8309°

Approximate Surface Elev.: 656 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	Description	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1		0.4	**TOPSOIL**	655.5+/-							
3		2.0	**SILTY SAND (SM)**, trace gravel, trace weathered limestone fragments, brown, loose	654+/-	1		X	5	1-2-7-13 N=9		BKG
4		2.3	**WEATHERED LIMESTONE**, brown-gray	653.5+/-	2		X	2	50/4"		BKG

Sample Spoon Penetration Refusal Encountered Upn Apparent Bedrock at 2.3 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-13-2021	Boring Completed: 01-13-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J5205291 701 EAST DELAVAN.GPJ TERRACON_DATATEMPLATE.GDT 2/8/21

BORING LOG NO. B-12

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC
Amherst, NY

SITE: 701 East Delavan Avenue
Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9204° Longitude: -78.8314°

Approximate Surface Elev.: 655 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1		0.3	**TOPSOIL**	654.5+/-							
2		2.0	**FILL - SILTY SAND**, trace limestone fragments, brown-black	653+/-	1		X	6	2-3-5-8 N=8		BKG
4		2.9	**WEATHERED LIMESTONE**, brown-gray	652+/-	2		X	3	8-50/5"		BKG
			Sample Spoon Penetration Refusal Encountered Upn Apparent Bedrock at 2.9 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-12-2021	Boring Completed: 01-12-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

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BORING LOG NO. B-13

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC
Amherst, NY

SITE: 701 East Delavan Avenue
Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9204° Longitude: -78.8310°

Approximate Surface Elev.: 656 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH / DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1		**TOPSOIL**								
		0.4	655.5+/-							
2		**FILL - SILTY SAND**, trace cinders, trace concrete fragments, brown-black								
				1			4	1-6-9-8		BKG
				2						
				3			3	2-4-4-50/4"		BKG
		3.5	652.5+/-							
4		**WEATHERED LIMESTONE**, brown-gray								
		3.8	652+/-							
		Sample Spoon Penetration Refusal Encountered Upn Apparent Bedrock at 3.8 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-13-2021	Boring Completed: 01-13-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

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BORING LOG NO. B-14

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC
Amherst, NY

SITE: 701 East Delavan Avenue
Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9203° Longitude: -78.8315°

Approximate Surface Elev.: 654 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
2		**FILL - SILTY SAND**, with brick fragments, red brown and black		1			6	5-5-7-11 N=12		BKG
		2.0	652+/-	2						
4		**WEATHERED LIMESTONE**, gray					2	50/5"		BKG
		2.4	651.5+/-							
		Sample Spoon Penetration Refusal Encountered Upn Apparent Bedrock at 2.4 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-12-2021	Boring Completed: 01-12-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

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BORING LOG NO. B-15

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC
Amherst, NY

SITE: 701 East Delavan Avenue
Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9203° Longitude: -78.8314°

Approximate Surface Elev.: 654 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	Description	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1		0.5	**TOPSOIL**	653.5+/-							
2		2.0	**FILL - SILTY SAND**, trace gravel, trace weathered limestone fragments, brown-black	652+/-	1			5	1-3-5-7		BKG
4		2.1	**WEATHERED LIMESTONE**, brown-gray	652+/-	2			1	50/1"		BKG

Sample Spoon Penetration Refusal Encountered Upn Apparent Bedrock at 2.1 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-13-2021	Boring Completed: 01-13-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J5205291 701 EAST DELAVAN.GPJ TERRACON_DATATEMPLATE.GDT 2/8/21

BORING LOG NO. B-16

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC
Amherst, NY

SITE: 701 East Delavan Avenue
Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9203° Longitude: -78.8311°

Approximate Surface Elev.: 655 (Ft.) +/-

MODEL LAYER	DEPTH	Description	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1	0.1	**TOPSOIL**	655+/-							
2		**FILL - SILTY SAND**, trace cinders, trace concrete fragments, brown-black		1		X	5	1-7-7-50 N=14		BKG
	2.0		653+/-	2						
4		**WEATHERED LIMESTONE**, gray-black				X	2	50/4"		BKG
				3						
	4.1		651+/-	4		X	1	50/1"		BKG

Sample Spoon Penetration Refusal Encountered Upn Apparent Bedrock at 4.1 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered at completion of sampling

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-13-2021	Boring Completed: 01-13-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J5205291 701 EAST DELAVAN.GPJ TERRACON_DATATEMPLATE.GDT 2/8/21

BORING LOG NO. B-17

PROJECT: Senior Housing

CLIENT: Silvestri Architects PC
Amherst, NY

SITE: 701 East Delavan Avenue
Buffalo, New York

LOCATION See Exploration Plan

Latitude: 42.9203° Longitude: -78.8309°

Approximate Surface Elev.: 655 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH / MATERIAL DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	PID (PPM)
1		**TOPSOIL** (0.6)	654.5+/-							
2		**FILL - SILTY SAND**, trace cinders, trace weathered limestone fragments, brown-black (2.5)	652.5+/-	1		Split spoon	5	1-4-7-50/5" N=11		BKG
4		**LIMESTONE**, gray, fine-grained, moderately fractured, very close fracture spacing, thin bedding, slightly weathered, medium strong (6.0)	649+/-	3–6		Core	36	RUN # 1 2.5' - 6.0'	35	

Boring Terminated at 6 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25 inch ID Hollow Stem Augers and 2 inch OD Split Barrel Sampler

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were estimated from Google Earth.

Notes:

PID readings obtained utilizing a MiniRAE 3000 Photoionization Detector. Results are expressed in parts-per-million (PPM)
BKG = Background levels (0 - 1 PPM)

WATER LEVEL OBSERVATIONS

None encountered prior to coring

Terracon
15 Marway Cir, Ste 2B
Rochester, NY

Boring Started: 01-13-2021	Boring Completed: 01-13-2021
Drill Rig: CME-550X	Driller: B. Duffey
Project No.: J5205291	

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Rock cores extracted at borings: B-8 and B-17

Boring:	Depth (ft)	Recovery (%)	RQD (%)
B-8	2 to 7	80	47
B-17	2.5 to 6	86	35

Notes:
The ruler presented in the photographs is intended to provide a reference scale only. Therefore, the dimensions of the cores may not be accurately reflected in the photographs. Please refer to the boring logs for accurate core measurements.

SUPPORTING INFORMATION

Contents:

Note: All attachments are one page unless noted above.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Senior Housing ■ Buffalo, New York

Terracon Project No. J5205291

SAMPLING	WATER LEVEL	FIELD TESTS
Rock Core Standard Penetration Test	**Water Initially Encountered** **Water Level After a Specified Period of Time** **Water Level After a Specified Period of Time** **Cave In Encountered** Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	**N** — **Standard Penetration Test Resistance (Blows/Ft.)** **(HP)** — **Hand Penetrometer** **(T)** — **Torvane** **(DCP)** — **Dynamic Cone Penetrometer** **UC** — **Unconfined Compressive Strength** **(PID)** — **Photo-Ionization Detector** **(OVA)** — **Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Terracon GeoReport

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E]	GW	Well-graded gravel [F]
			Cu < 4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E]	SW	Well-graded sand [I]
			Cu < 6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above “A” line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below “A” line [J]	ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above “A” line	CH	Fat clay [K, L, M]
			PI plots below “A” line	MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add “with sand” to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add “with organic fines” to group name.

[I] If soil contains ≥ 15% gravel, add “with gravel” to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add “with sand” or “with gravel,” whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add “sandy” to group name.

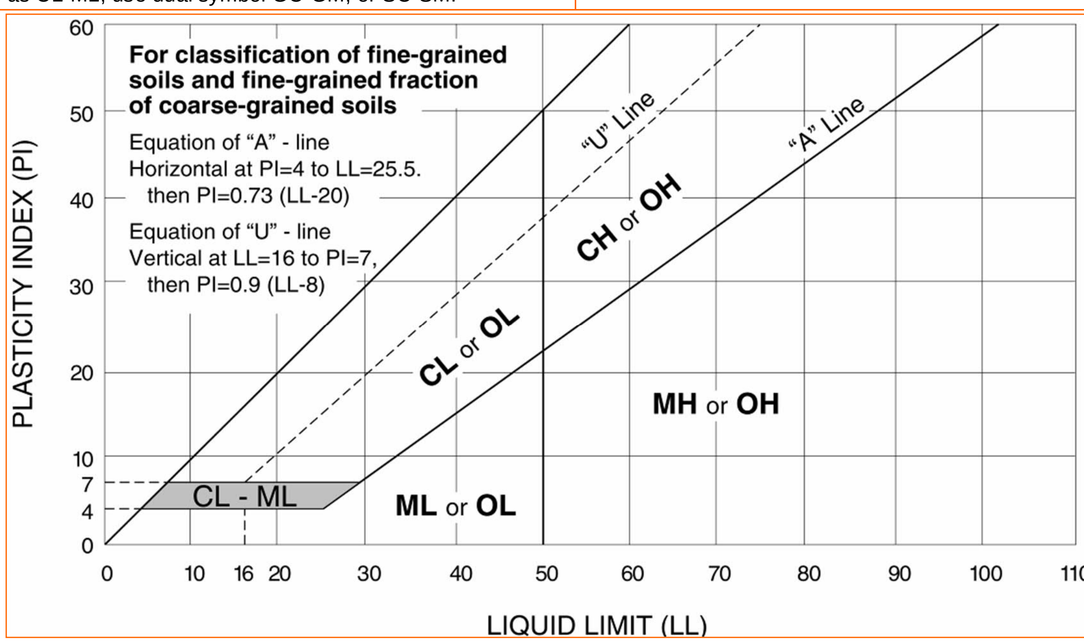
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] PI ≥ 4 and plots on or above “A” line.

[O] PI < 4 or plots below “A” line.

[P] PI plots on or above “A” line.

[Q] PI plots below “A” line.



DESCRIPTION OF ROCK PROPERTIES

WEATHERING	
Term	**Description**
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
Moderately weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

STRENGTH OR HARDNESS		
Description	**Field Identification**	**Uniaxial Compressive Strength, psi (MPa)**
Extremely weak	Indented by thumbnail	40-150 (0.3-1)
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	150-700 (1-5)
Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	700-4,000 (5-30)
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	4,000-7,000 (30-50)
Strong rock	Specimen requires more than one blow of geological hammer to fracture it	7,000-15,000 (50-100)
Very strong	Specimen requires many blows of geological hammer to fracture it	15,000-36,000 (100-250)
Extremely strong	Specimen can only be chipped with geological hammer	>36,000 (>250)

DISCONTINUITY DESCRIPTION			
Fracture Spacing (Joints, Faults, Other Fractures)		**Bedding Spacing (May Include Foliation or Banding)**	
Description	**Spacing**	**Description**	**Spacing**
Extremely close	< ¾ in (<19 mm)	**Laminated**	< ½ in (<12 mm)
Very close	¾ in – 2-1/2 in (19 - 60 mm)	**Very thin**	½ in – 2 in (12 – 50 mm)
Close	2-1/2 in – 8 in (60 – 200 mm)	**Thin**	2 in – 1 ft. (50 – 300 mm)
Moderate	8 in – 2 ft. (200 – 600 mm)	**Medium**	1 ft. – 3 ft. (300 – 900 mm)
Wide	2 ft. – 6 ft. (600 mm – 2.0 m)	**Thick**	3 ft. – 10 ft. (900 mm – 3 m)
Very Wide	6 ft. – 20 ft. (2.0 – 6 m)	**Massive**	> 10 ft. (3 m)

Discontinuity Orientation (Angle): Measure the angle of discontinuity relative to a plane perpendicular to the longitudinal axis of the core. (For most cases, the core axis is vertical; therefore, the plane perpendicular to the core axis is horizontal.) For example, a horizontal bedding plane would have a 0-degree angle.

ROCK QUALITY DESIGNATION (RQD) [1]	
Description	**RQD Value (%)**
Very Poor	0 - 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 - 100

1. The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.

Reference: U.S. Department of Transportation, Federal Highway Administration, Publication No FHWA-NHI-10-034, December 2009 Technical Manual for Design and Construction of Road Tunnels – Civil Elements