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Geotechnical Investigation

Proposed Multi-Storey Buildings
3370 Greenbank Road
Ottawa, Ontario

Prepared For

Claridge Homes

August 12, 2021

Report: PG5705-2

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Claridge Homes to complete a geotechnical investigation for the proposed multi-storey buildings to be located at 3370 Greenbank Road in the City of Ottawa (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objectives of the geotechnical investigation were to:

- ☐ Determine the subsoil and groundwater conditions at this site by means of test holes.

- ☐ Provide geotechnical recommendations pertaining to design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

2.0 Proposed Development

Based on the available drawings, it is understood that the proposed development will consist of several high-rise and mid-rise buildings. Although not currently shown on the drawings, it is anticipated that the high-rise buildings will have 2 or more levels of underground parking, while the mid-rise buildings are anticipated to have 1 or more levels of underground parking.

Asphalt-paved access lanes and parking areas with landscaped margins are also anticipated at finished grades surrounding the proposed buildings. It is also expected that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

The field program for the geotechnical investigation was carried out from June 28 to July 9, 2021. At that time, 13 boreholes were advanced to a maximum depth of 17.8 m. The borehole locations were distributed in a manner to provide general coverage of the subject site. Previous geotechnical investigations were also conducted at the subject site by others in 2015 and 2016 consisting of a total of 7 boreholes which were advanced to a maximum depth of 9.3 m below existing ground surface. The test hole locations are shown on Drawing PG5705-4 - Test Hole Location Plan included in Appendix 2.

The boreholes were advanced using a track-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of our personnel under the direction of a senior engineer. The drilling procedure consisted of augering and bedrock coring to the required depths at the selected locations and sampling the overburden.

Sampling and In Situ Testing

Soil samples were recovered from the boreholes using two different techniques, namely, sampled directly from the auger flights (AU) or collected using a 50 mm diameter split-spoon (SS) sampler. Rock cores (RC) were obtained using a 47.6 mm inside diameter coring equipment. All samples were visually inspected and initially classified on site. The auger and split-spoon samples were placed in sealed plastic bags, and rock cores were placed in cardboard boxes. All samples were transported to our laboratory for further examination and classification. The depths at which the auger, split spoon and rock core samples were recovered from the boreholes are shown as AU, SS and RC, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

A Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Bedrock samples were recovered at boreholes BH 1-21, BH 2-21, BH 8-21, BH 10-21, BH 11-21, BH 12-21 and BH 13-21 using a core barrel and diamond drilling techniques. The depths at which rock core samples were recovered from the boreholes are shown as RC on the Soil Profile and Test Data sheets in Appendix 1.

A recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section (core run) of bedrock and are shown on the borehole logs. The recovery value is the ratio, in percentage, of the length of the bedrock sample recovered over the length of the drilled section (core run). The RQD value is the ratio, in percentage, of the total length of intact rock pieces longer than 100 mm in one core run over the length of the core run. These values are indicative of the quality of the bedrock.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are logged on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

Monitoring wells were installed in select boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program. Flexible standpipes were installed in the boreholes which did not receive a monitoring well.

All monitoring wells should be decommissioned in accordance with Ontario Regulations O.Reg 902 by a qualified licensed well technician and prior to construction.

Sample Storage

All samples from the current investigation will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The borehole locations were selected by Paterson to provide general coverage of the proposed development, taking into consideration the existing site features and underground utilities. The borehole locations and ground surface elevations at each borehole location were surveyed by Paterson using a GPS unit with respect to a geodetic datum. The location of the boreholes and ground surface elevation at each borehole location are presented on Drawing PG5705-4 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil and bedrock samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. Gradation testing was completed by others on 1 soil sample obtained from the previous geotechnical investigation. The results of the gradation testing are presented in Appendix 1.

3.4 Analytical Testing

One soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Section 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is located within the eastern portion of 3370 Greenbank Road. The majority of the subject site is undeveloped and consists of former agricultural lands, although temporary structures and fill piles were observed within the southern portion of the subject site.

The subject site is bordered to the north by agricultural lands, to the east by Greenbank Road, to the south by the Jock River and to the west by undeveloped, former agricultural lands. The existing ground surface across the site slopes downward gradually from east to west, from approximate geodetic elevation 93.5 m to 92.5 m.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile encountered at the test hole locations consists of topsoil underlain by a silty clay deposit and glacial till deposit. An approximate 0.9 to 1.1 m thick fill layer was observed at surface at boreholes BH 6-21 and BH 7-21. The fill material was generally observed to consist of brown silty clay with sand and trace amounts of gravel and topsoil.

A hard to very stiff, brown silty clay was generally observed underlying the topsoil in all boreholes with the exception of borehole BH 1-21, BH 6-21, BH 7-21, BH 15-7, and BH 15-17 within the southeast corner of the site. The thickness of the silty clay deposit generally increases from east to west across the site, extending to approximate depths ranging from 0.6 m at borehole BH 5-21 within the eastern half of the site, to 3.0 m at borehole BH 12-21 at the western half of the site.

The glacial till deposit was encountered in all boreholes and was generally observed to consist of a brown to grey, silty sand to silty clay with gravel, cobbles, and boulders.

Bedrock

Bedrock was cored at boreholes BH 1-21, BH 2-21, BH 8-21, and BH 10-21 through BH 13-21, and was encountered at approximate depths ranging from 5.6 m at borehole BH 1-21 within the southeast corner of the site, to 9.7 m at borehole BH 10-21 at the northwestern corner of the site.

The bedrock was observed to consist of grey dolostone interbedded with grey limestone and sandstone and was generally of fair to excellent quality based on the RQDs of the bedrock core. The bedrock was cored to approximate depths ranging from 9.3 to 17.8 m below the existing ground surface.

Based on available geological mapping, the bedrock in this area consists of limestone and dolomite of the Gull River Formation with an overburden drift thickness of 5 to 15 m depth.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location.

4.3 Groundwater

Groundwater level readings were measured in the monitoring wells and piezometers installed at the borehole locations on July 27, 2021. The observed groundwater levels are summarized in Table 1 below.

Table 1 - Summary of Groundwater Levels

Test Hole Number	Ground Surface Elevation (m)	Groundwater Levels (m)	Groundwater Elevation (m)	Dated Recorded
BH 1-21*	93.38	3.93	89.45	July 27, 2021
BH 2-21*	92.73	2.45	90.28	July 27, 2021
BH 3-21	92.81	2.09	90.72	July 27, 2021
BH 4-21	92.89	1.89	91.00	July 27, 2021
BH 5-21	93.23	3.11	90.12	July 27, 2021
BH 7-21	93.08	3.15	89.93	July 27, 2021
BH 8-21	93.19	0.83	92.36	July 27, 2021
BH 9-21	92.69	Blocked and Dry	-	July 27, 2021
BH 10-21*	92.66	2.41	90.25	July 27, 2021
BH 11-21*	92.73	2.41	90.32	July 27, 2021
BH 12-21	93.23	Blocked and Dry	-	July 27, 2021
BH 16-103	93.51	0.91	92.60	March 7, 2016
BH 15-7	92.84	2.17	90.67	August 24, 2016

Note: Ground surface elevations at test hole locations are referenced to a geodetic datum.
*Denotes a monitoring well location

It should be noted that groundwater levels could be influenced by surface water infiltrating the backfilled boreholes. The long-term groundwater level can also be estimated based on the recovered soil samples' moisture levels, colouring and consistency. Based on these observations, the long-term groundwater level is anticipated at a depth of approximately 2.5 to 3.5 m below ground surface.

However, it should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could be different at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed multi-storey buildings. It is recommended that foundation support for the proposed high-rise buildings consist of conventional spread footings bearing on clean, surface sounded bedrock, while foundation support for the proposed mid-rise buildings should consist of conventional spread footings bearing on the undisturbed, compact to dense silty sand or glacial till, or clean, surface sounded bedrock.

Where the footings are designed to be supported on bedrock which is encountered below the underside of footing elevation, the overburden should be excavated to the surface of the clean, surface sounded bedrock and replaced with lean concrete to the proposed founding elevation.

Dependent on the finalized founding depths of the proposed buildings, bedrock removal may be required. The blasting operations should be planned and completed under the guidance of a professional engineer with experience in blasting operations.

Due to the presence of a silty clay layer across much of the site, the proposed development will be subjected to grade raise restrictions. Our permissible grade raise recommendations are discussed in Section 5.3.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures.

Bedrock Removal

Bedrock removal can be accomplished by hoe ramming where the bedrock is weathered and/or where only small quantities of the bedrock need to be removed. Sound bedrock may be removed by line drilling in conjunction with controlled blasting and/or hoe ramming.

Prior to considering blasting operations, the blasting effects on the existing services, buildings and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in proximity of the blasting operations should be completed prior to commencing site activities. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries/claims related to the blasting operations.

As a general guideline, peak particle velocity (measured at the structures) should not exceed 25 mm/s during the blasting program to reduce the risks of damage to the existing structures.

The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is an experienced blasting consultant.

Vibration Considerations

Construction operations are the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels should be incorporated in the construction operations to maintain, as much as possible, a cooperative environment with the residents.

The following construction equipment could be the source of vibrations: hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations, whether caused by blasting operations or by construction operations, could be the source of detrimental vibrations on the nearby buildings and structures. Therefore, all vibrations are recommended to be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). The guidelines are for current construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a pre-construction survey is recommended be completed to minimize the risks of claims during or following the construction of the proposed building.

Fill Placement

Fill used for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. Granular material should be tested and approved prior to delivery to the site. The fill should be placed in lifts of 300 mm thick or less and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building areas should be compacted to at least 98% of the Standard Proctor Maximum Dry Density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 98% of their respective SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

Lean Concrete Filled Trenches

Where footings are designed to be supported on bedrock which is encountered below the underside of footing elevation, zero-entry vertical trenches should be excavated to the clean, surface sounded bedrock, and backfilled with lean concrete to the founding elevation (minimum **17 MPa** 28-day compressive strength). Typically, the excavation side walls will be used as the form to support the concrete. The trench excavation should be at least 150 mm wider than all sides of the footing (strip and pad footings) at the base of the excavation. The additional width of the concrete poured against an undisturbed trench sidewall will suffice in providing a direct transfer of the footing load to the underlying bedrock. Once the trench excavation is approved by the geotechnical engineer, lean concrete can be poured up to the proposed founding elevation.

5.3 Foundation Design

Conventional spread footings placed on an undisturbed, compact to dense silty sand or glacial till bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **250 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **375 kPa**. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS.

Footings designed using the bearing resistance value at SLS given above will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively.

An undisturbed soil bearing surface consists of a surface from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

Footings placed on clean, surface sounded bedrock can be designed using a factored bearing resistance value at ultimate limit states (ULS) of **5,000 kPa**, incorporating a geotechnical resistance factor of 0.5.

A clean, surface-sounded bedrock bearing surface should be free of loose materials, and have no near surface seams, voids, fissures or open joints which can be detected from surface sounding with a rock hammer.

Footings placed on clean, surface-sounded bedrock will be subjected to negligible post-construction total and differential settlements.

Footings placed on a sound bedrock bearing surface at depth can also be designed using a higher factored bearing resistance value at ultimate limit states (ULS) of **6,000 kPa**, incorporating a geotechnical resistance factor of 0.5, if founded on limestone bedrock and the bedrock is free of seams, fractures and voids within 1.5 m below the founding level. This could be verified by completing and probing 50 mm diameter drill holes to a depth of 1.5 m below the founding level within the footprint of the footings. At least one drill hole should be completed per major footing. The drill hole inspection should be carried out by the geotechnical consultant. Also, the above probing program can be omitted if the bedrock side profile in the excavation demonstrates and confirms that the limestone bedrock is sound.

Footings supported either on an acceptable bedrock bearing surface or on lean concrete trenches which are placed directly on an acceptable bedrock bearing surface and designed for the bearing resistance values provided herein will be subjected to negligible post-construction total and differential settlements.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to the undisturbed, glacial till above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil. Adequate lateral support is provided to a sound bedrock bearing medium when a plane extending horizontally and vertically from the footing perimeter at a minimum of 1H:6V (or shallower) passes through sound bedrock or a material of the same or higher capacity as the bedrock, such as concrete.

Permissible Grade Raise

Due to the presence of the silty clay deposit across most of the site, a permissible grade raise restriction of **3.0 m** is recommended for grading at the subject site.

If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

5.4 Design for Earthquakes

Seismic shear wave velocity testing was completed for the subject site to accurately determine the applicable seismic site classification for the proposed building in accordance with Table 4.1.8.4.A of the Ontario Building Code 2012. The shear wave velocity testing was completed by Paterson personnel. The results of the shear wave velocity test are provided in Figures 2 and 3 in Appendix 2 of the present report.

Field Program

The seismic array testing location was placed as presented in Drawing PG5705-4 - Test Hole Location Plan, attached to the present report. Paterson field personnel placed 24 horizontal 2.4 Hz. geophones mounted to the surface by means of two 75 mm ground spikes attached to the geophone land case. The geophones were spaced at 2 m intervals and connected by a geophone spread cable to a Geode 24 Channel seismograph.

The seismograph was also connected to a computer laptop and a hammer trigger switch attached to a 12-pound dead blow hammer. The hammer trigger switch sends a start signal to the seismograph. The hammer is used to strike an I-Beam seated into the ground surface, which creates a polarized shear wave. The hammer shots are repeated between four (4) to eight (8) times at each shot location to improve signal to noise ratio. The shot locations were 2, 3 and 15 m away from the last geophone and at the centre of the seismic array.

Data Processing and Interpretation

Interpretation for the shear wave velocity results were completed by Paterson personnel. Shear wave velocity measurement was made using reflection/refraction methods. The interpretation is performed by recovering arrival times from direct and refracted waves.

The interpretation is repeated at each shot location to provide an average shear wave velocity, V_{s30}, of the upper 30 m profile, immediately below the foundation of the building. The layer intercept times, velocities from different layers and critical distances are interpreted from the shear wave records to compute the bedrock depth at each location.

The bedrock velocity was interpreted using the main refractor wave velocity, which is considered a conservative estimate of the bedrock velocity due to the increasing quality of the bedrock with depth. It should be noted that as bedrock quality increases, the bedrock shear wave velocity also increases.

Site Class for Footings supported on directly on Bedrock

For conventional spread footings bearing directly on bedrock, or on lean concrete which extends to the bedrock surface, the V_{s30} was calculated as follows. Specifically, the V_{s30} was calculated using the standard equation for average shear wave velocity provided in the OBC 2012 and as presented below:

$$V_{s30} = \frac{Depth_{of\ interest}(m)}{\left(\frac{Depth_{Layer1}(m)}{V_{s_{Layer1}}(m/s)} + \frac{Depth_{Layer2}(m)}{V_{s_{Layer2}}(m/s)}\right)}$$

$$V_{s30=} \frac{30\ m}{\left(\frac{30\ m}{2{,}205\ m/s}\right)}$$

$$V_{s30=}\ 2{,}205\ m/s$$

Based on the results of the shear wave velocity testing, the average shear wave velocity V_{s30}, for footings supported on bedrock,, or on lean concrete trenches which extend to the bedrock surface, is 2,205 m/s. Therefore, a **Site Class A** is applicable for design of proposed buildings in this case, as per Table 4.1.8.4.A of the OBC 2012. The soils underlying the subject site are not susceptible to liquefaction.

Site Class for Footings within 3 m of Bedrock Surface

Based on our testing results, the average overburden shear wave velocity is **307 m/s**, while the bedrock shear wave velocity is **2,205 m/s**.

Based on this, the V_{s30} was calculated using the standard equation for average shear wave velocity provided in the OBC 2012 and as presented below:

$$V_{s30} = \frac{Depth_{of\ interest}(m)}{\left(\frac{Depth_{Layer1}(m)}{V_{s_{Layer1}}(m/s)} + \frac{Depth_{Layer2}(m)}{V_{S_{Layer2}}(m/s)}\right)}$$

$$V_{s30=} \frac{30\ m}{\left(\frac{3\ m}{307\ \ m/s} + \frac{27\ m}{2{,}205\, m/s}\right)}$$

$$V_{s30=}\ 1{,}363\ \ m/s$$

Based on the results of the shear wave velocity testing, the average shear wave velocity V_{s30} is **1363 m/s** for conventional spread footings founded within 3 m of the bedrock surface. Therefore, a **Site Class B** is applicable for design of proposed buildings in this case, as per Table 4.1.8.4.A of the OBC 2012. The soils underlying the subject site are not susceptible to liquefaction.

Site Class for Footings greater than 3 m above the Bedrock

For this scenario, the V_{s30} was calculated as follows:

$$V_{s30} = \frac{Depth_{of\ interest}(m)}{\left(\frac{Depth_{Layer1}(m)}{V_{s_{Layer1}}(m/s)} + \frac{Depth_{Layer2}(m)}{V_{S_{Layer2}}(m/s)}\right)}$$

$$V_{s30=} \frac{30\ m}{\left(\frac{6\ m}{307\ \ m/s} + \frac{24\ m}{2{,}205\, m/s}\right)}$$

$$V_{s30=}\ 986\ \ m/s$$

Based on the results of the shear wave velocity testing, the average shear wave velocity Vs30 is **986 m/s** for conventional shallow footings which are founded at a depth greater than 3 m above the bedrock surface. Therefore, a **Site Class C** is applicable for design of proposed buildings in this case, as per Table 4.1.8.4.A of the OBC 2012. The soils underlying the subject site are not susceptible to liquefaction.

5.5 Basement Slab

With the removal of all topsoil and deleterious fill from within the footprint of the proposed buildings, the native soil or bedrock will be considered an acceptable subgrade on which to commence backfilling for floor slab construction. It is anticipated that the underground levels for the proposed buildings will be mostly parking and the recommended pavement structures noted in Subsection 5.7 will be applicable. However, if storage or other uses of the lower level will involve the construction of a concrete floor slab, the upper 200 mm of sub-slab fill is recommended to consist of 19 mm clear crushed stone.

Any soft areas in the basement slab subgrade should be removed and backfilled with appropriate backfill material prior to placing fill. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD.

In consideration of the groundwater conditions encountered during the field investigation, a sub-slab drainage system, consisting of lines of perforated drainage pipe subdrains connected to a sump pit, should be provided in the subfloor fill under the lower basement floor (discussed further in Subsection 6.1).

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the proposed building. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a drained unit weight of 20 kN/m^3 (effective unit weight 13 kN/m^3).

However, where the basement walls are to be poured against a composite drainage blanket which will be placed against the exposed bedrock face, a nominal coefficient of at-rest earth pressure of 0.05 is recommended in conjunction with a bulk unit weight of 23.5 kN/m^3 (effective 15.5 kN/m^3). Further, a seismic earth pressure component will not be applicable for the foundation wall which is poured against the bedrock face. It is expected that the seismic earth pressure will be transferred to the underground floor slabs, which should be designed to accommodate these pressures. A hydrostatic groundwater pressure should be added for the portion below the groundwater level.

Lateral Earth Pressures

The static horizontal earth pressure (P_o) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained soil (0.5)
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the "at-rest" case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Earth Pressures

The total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}).

The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

a_c = $(1.45-a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)
g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32 g according to OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5\ K_o\ \gamma\ H^2$, where $K_o = 0.5$ for the soil conditions noted above.

The total earth force (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:

$h = \{P_o \cdot (H/3) + \Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per OBC 2012.

5.7 Pavement Design

For design purposes, it is recommended that the rigid pavement structure for the lower underground parking level of each building consist of Category C2, 32 MPa concrete at 28 days with air entrainment of 5 to 8%. The recommended rigid pavement structure is further presented in Table 2 below. The flexible pavement structure presented in Table 3 should be used for at grade access lanes and heavy loading parking areas.

Table 2 - Recommended Rigid Pavement Structure - Lower Parking Level

Thickness (mm)	Material Description
125	**Exposure Class C2 - 32 MPa Concrete** (5 to 8% Air Entrainment)
300	**BASE** - OPSS Granular A Crushed Stone
SUBGRADE - Existing imported fill, or OPSS Granular B Type I or II material placed over in situ soil.	

To control cracking due to shrinking of the concrete floor slab, it is recommended that strategically located saw cuts be used to create control joints within the concrete floor slab of the lower underground parking level. The control joints are generally recommended to be located at the center of the column lines and spaced at approximately 24 to 36 times the slab thickness (for example; a 0.15 m thick slab should have control joints spaced between 3.6 and 5.4 m). The joints should be cut between 25 and 30% of the thickness of the concrete floor slab and completed as early as 4 hour after the concrete has been poured during warm temperatures and up to 12 hours during cooler temperatures.

Table 3 - Recommended Asphalt Pavement Structure - Access Lanes and Heavy Loading Parking Areas

Thickness (mm)	Material Description
40	**Wear Course** - Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - OPSS Granular B Type II overlying the Concrete Podium Deck.	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material.

The pavement granular (base and subbase) should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the material's SPMDD using suitable compaction equipment.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage – 1 Level of Underground Parking

For buildings with 1 level of underground parking, it is recommended that a perimeter foundation drainage system be provided for each proposed structure. The system should consist of a 150 mm diameter perforated and corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, which is placed at the footing level around the exterior perimeter of the proposed structure. The clear stone should be wrapped in a non-woven geotextile. The pipe should have a positive outlet, such as a gravity connection to the storm sewer or sump pump pit.

Where insufficient room is available for exterior backfill, it is suggested that the composite drainage system (such as Delta Drain 6000 or equivalent) be secured against the temporary shoring system, extending to a series of drainage sleeve inlets through the building foundation wall at the footing/foundation wall interface. The drainage sleeves should be at least 150 mm diameter and be spaced 3 m along the perimeter foundation walls. An interior perimeter drainage pipe should be placed along the building perimeter along with the sub-slab drainage system. The perimeter drainage pipe and sub-slab drainage system should direct water to sump pit(s) within the underground level.

Foundation Drainage and Waterproofing – 2 or More Levels of Underground Parking

Waterproofing of the foundation walls is recommended for buildings with 2 or more levels of underground parking. The waterproofing membrane is to be installed from 3 m below finished grade down the foundation walls to the bottom of foundation.

It is also recommended that a composite drainage system, such as Delta Drain 6000 or equivalent, be installed between the waterproofing membrane and the foundation wall, and extend from the exterior finished grade to the founding elevation. The purpose of the composite drainage system is to direct any water infiltration resulting from a breach of the waterproofing membrane to the building sump pit. It is recommended that 150 mm diameter sleeves at 3 m centres be cast in the foundation wall at the perimeter footing interface to allow the infiltration of water to flow to an interior perimeter underfloor drainage pipe. The perimeter drainage pipe should direct water to sump pit(s) within the lower basement area.

A waterproofing system should also be provided for any elevator pits (pit bottom and walls). Detailed designs can be provided for the overall recommended waterproofing system, if required.

Sub-slab Drainage

Sub-slab drainage will be required to control water infiltration below the underground parking level slab. For preliminary design purposes, we recommend that 150 mm perforated pipes be placed at approximate 6 m centres underlying the basement floor slab. The spacing of the sub-slab drainage system should be confirmed by the geotechnical consultant at the time of completing the excavation when water infiltration can be better assessed.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are recommended to be insulated against the deleterious effects of frost action. A minimum 1.5 m thick soil cover, or an equivalent combination of soil cover and foundation insulation, should be provided in this regard.

Exterior unheated footings, such as isolated piers, are more prone to deleterious movement associated with frost action than the exterior walls of the structure proper and require additional protection, such as soil cover of 2.1 m, or an equivalent combination of soil cover and foundation insulation.

However, the footings are generally not expected to require protection against frost action due to the founding depth. Unheated structures such as the access ramp may require insulation for protection against the deleterious effects of frost action.

6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials should either be cut back at acceptable slopes or should be retained by temporary shoring systems from the start of the excavation until the structure is backfilled.

Unsupported Excavations

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be excavated at 1H:1V or shallower. The shallower slope is required for excavation below groundwater level. The subsurface soils are considered to be a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides. Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

A trench box is recommended to protect personnel working in trenches with steep or vertical sides. Services are expected to be installed by “cut and cover” methods and excavations should not remain open for extended periods of time.

Temporary Shoring

Due to the anticipated depth of excavation of the buildings and the proximity of the proposed buildings to the north and east property boundaries, temporary shoring may be required to support the overburden soils. The design and approval of the shoring system will be the responsibility of the shoring contractor and the shoring designer who is a licensed professional engineer and is hired by the shoring contractor. It is the responsibility of the shoring contractor to ensure that the temporary shoring is in compliance with safety requirements, designed to avoid any damage to adjacent structures and include dewatering control measures.

In the event that subsurface conditions differ from the approved design during the actual installation, it is the responsibility of the shoring contractor to commission the required experts to re-assess the design and implement the required changes.

The designer should also take into account the impact of a significant precipitation event and designate design measures to ensure that a precipitation will not negatively impact the shoring system or soils supported by the system. Any changes to the approved shoring design system should be reported immediately to the owner’s representative prior to implementation.

The temporary shoring system may consist of a soldier pile and lagging system or steel sheet piles which could be cantilevered, anchored or braced. Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be added to the earth pressures described below.

The earth pressures acting on the temporary shoring system may be calculated using the parameters outlined in Table 4 on the following page.

Table 4 - Soil Parameters for Calculating Earth Pressures Acting on Shoring System

Parameter	Value
Active Earth Pressure Coefficient (K_a)	0.33
Passive Earth Pressure Coefficient (K_p)	3
At-Rest Earth Pressure Coefficient (K_o)	0.5
Unit Weight (γ), kN/m^3	21
Submerged Unit Weight(γ'), kN/m^3	13

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible.

The dry unit weight should be used above the groundwater level while the effective unit weight should be used below the groundwater level.

The hydrostatic groundwater pressure should be added to the earth pressure distribution wherever the effective unit weights are used for earth pressure calculations. If the groundwater level is lowered, the dry unit weight for the soil should be used full weight, with no hydrostatic groundwater pressure component. For design purposes, the minimum factor of safety of 1.5 should be calculated.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications and Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

A minimum of 150 mm of OPSS Granular A should be placed for bedding for sewer or water pipes when placed on a soil subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to a minimum of 300 mm above the obvert of the pipe, should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts and compacted to 98% of the SPMDD.

It should generally be possible to re-use the site materials above the cover material if the operations are carried out in dry weather conditions.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) and above the cover material should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

To reduce long-term lowering of the groundwater at this site, clay seals should be provided within the service trenches excavated through the silty clay deposit. The seals should be at least 1.5 m long (in the trench direction) and should extend from trench wall to trench wall. The seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches excavated through the silty clay deposit.

6.5 Groundwater Control

Based on our observations, it is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

A temporary Ministry of the Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

One (1) soil sample was submitted for analytical testing. The analytical test results of the soil sample indicate that the sulphate content is less than 0.01%. These results along with the chloride and pH value are indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of an aggressive to very aggressive corrosive environment.

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that the following material testing and observation program be performed by the geotechnical consultant.

☐ Review final grading plan, from a geotechnical perspective.

☐ Review of the geotechnical aspects of the excavation contractor’s shoring design, if required, prior to construction.

☐ Observation of all bearing surfaces prior to the placement of concrete.

☐ Sampling and testing of the concrete and fill materials.

☐ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.

☐ Observation of all subgrades prior to backfilling.

☐ Field density tests to determine the level of compaction achieved.

☐ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations provided are in accordance with the present understanding of the project. Paterson requests permission to review the final grading plan, once available, and to review our recommendations when the drawings and specifications are completed.

A geotechnical investigation of this nature is a limited sampling of a site. The recommendations are based on information gathered at the specific test locations by others and can only be extrapolated to an undefined limited area around the test locations. The extent of the limited area depends on the soil, bedrock and groundwater conditions, as well the history of the site reflecting natural, construction, and other activities. Should any conditions at the site be encountered which differ from those at the test locations, we request notification immediately in order to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine the suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Claridge Homes or their agents is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.

Scott Dennis

Scott S. Dennis, P.Eng.

LICENSED PROFESSIONAL ENGINEER
Aug. 12, 2021
S. S. DENNIS
100519516
Scott Dennis
PROVINCE OF ONTARIO

David J. Gilbert, P.Eng.

Report Distribution:

- ❑ Claridge Homes. (e-mail copy)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

RECORD OF BOREHOLE SHEETS BY OTHERS

GRAIN SIZE DISTRIBUTION TEST RESULTS BY OTHERS

ANALYTICAL TESTING RESULTS

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE June 28, 2021

FILE NO. PG5705

HOLE NO. BH 1-21

SOIL DESCRIPTION

GROUND SURFACE

TOPSOIL 0.05

GLACIAL TILL: Compact to very dense, brown silty sand with gravel, cobbles and boulders, trace clay

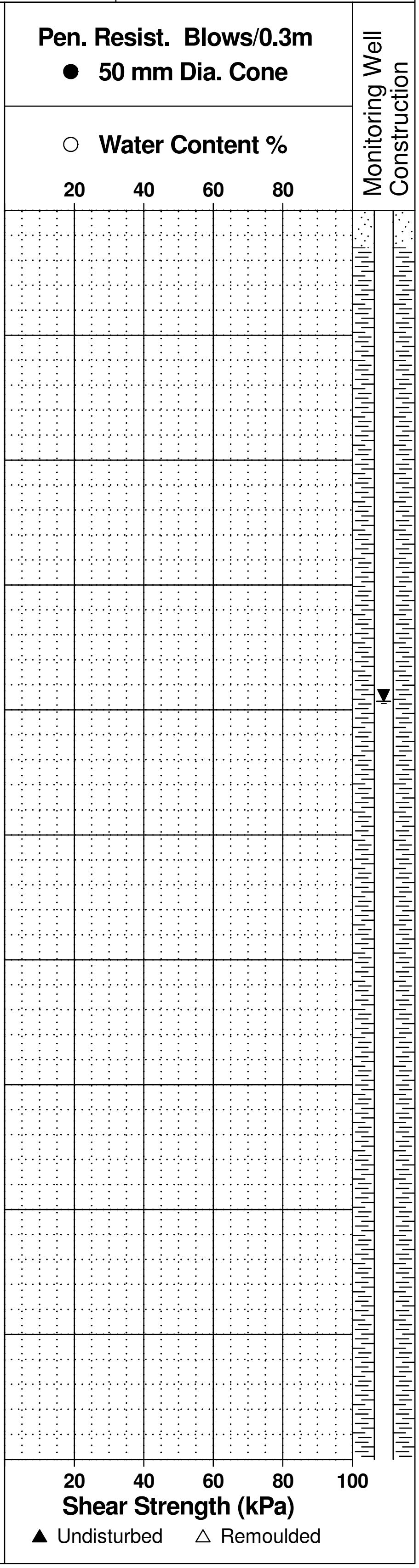
- grey by 3.2m depth

5.56

BEDROCK: Fair to excellent quality, grey silty dolostone interbedded with grey limestone and sandstone

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	50	12
SS	3	42	84
SS	4	17	60
SS	5	67	35
SS	6	25	18
SS	7	53	87
SS	8	50	50+
RC	1	100	72
RC	2	100	97
RC	3	100	100

DEPTH (m)	ELEV. (m)
0	93.38
1	92.38
2	91.38
3	90.38
4	89.38
5	88.38
6	87.38
7	86.38
8	85.38
9	84.38
10	83.38



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

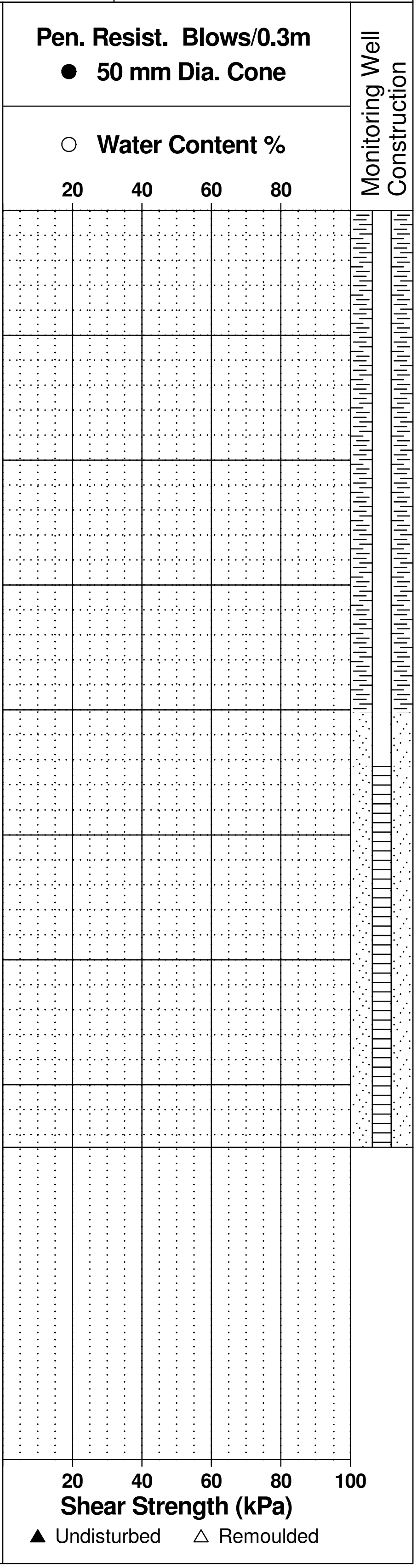
BORINGS BY Track-Mount Power Auger

DATE June 28, 2021

FILE NO. PG5705

HOLE NO. BH 1-21

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					10	83.38
	RC	4	100	88		
					11	82.38
					12	81.38
	RC	5	100	67		
					13	80.38
BEDROCK: Fair to excellent quality, grey silty dolostone interbedded with grey limestone and sandstone						
	RC	6	100	90	14	79.38
					15	78.38
	RC	7	100	71		
					16	77.38
	RC	8	100	92		
					17	76.38
17.50						
End of Borehole (GWL @ 3.93m - July 27, 2021)						



SOIL PROFILE AND TEST DATA

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Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE June 29, 2021

FILE NO. PG5705

HOLE NO. BH 2-21

SOIL DESCRIPTION	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	92.73
Brown **SILTY CLAY,** trace sand and organics	AU	1				
0.76						
	SS	2	83	11	1	91.73
Hard to very stiff, brown **SILTY CLAY**	SS	3		3		
					2	90.73
2.90						
	SS	4	0	50+	3	89.73
Cored boulder from 3.4 to 4.1m depth	RC	1	62			
					4	88.73
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders, trace clay					5	87.73
	SS	5	42	8		
	SS	6	42	42	6	86.73
					7	85.73
					8	84.73
8.73						
					9	83.73
BEDROCK: Fair to good quality, grey silty dolostone interbedded with grey limestone and sandstone	RC	2	100	72		
					10	82.73

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

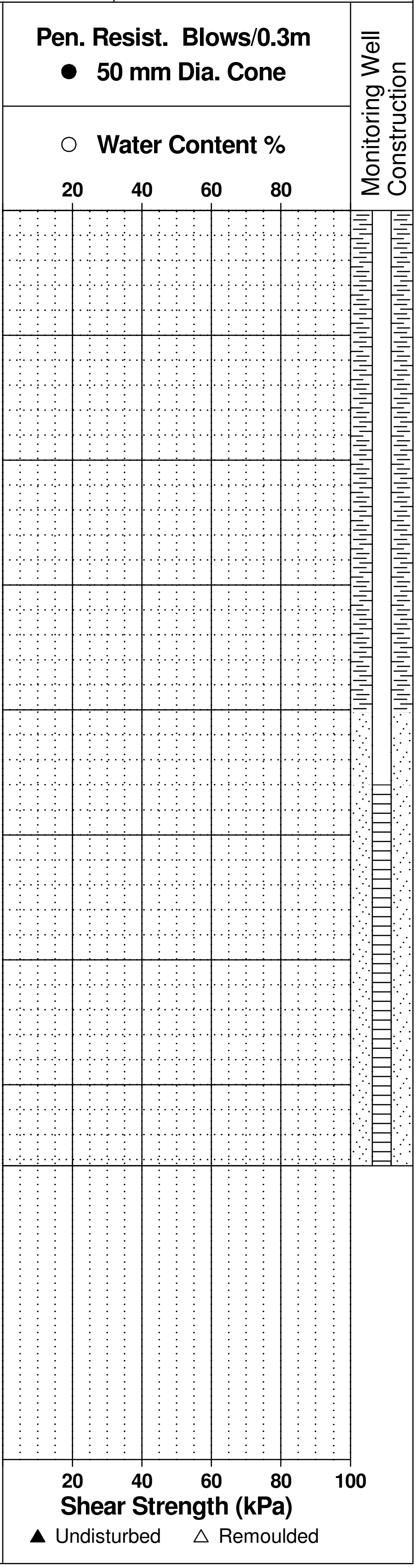
DATE June 29, 2021

FILE NO. PG5705

HOLE NO. BH 2-21

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD
GROUND SURFACE				
BEDROCK: Fair to good quality, grey silty dolostone interbedded with grey limestone and sandstone	RC	3	100	57
	RC	4	100	90
	RC	5	98	83
	RC	6	100	77
	RC	7	100	83
17.65				
End of Borehole (GWL @ 2.45m - July 27, 2021)				

DEPTH (m)	ELEV. (m)
10	82.73
11	81.73
12	80.73
13	79.73
14	78.73
15	77.73
16	76.73
17	75.73



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE June 29, 2021

FILE NO. PG5705

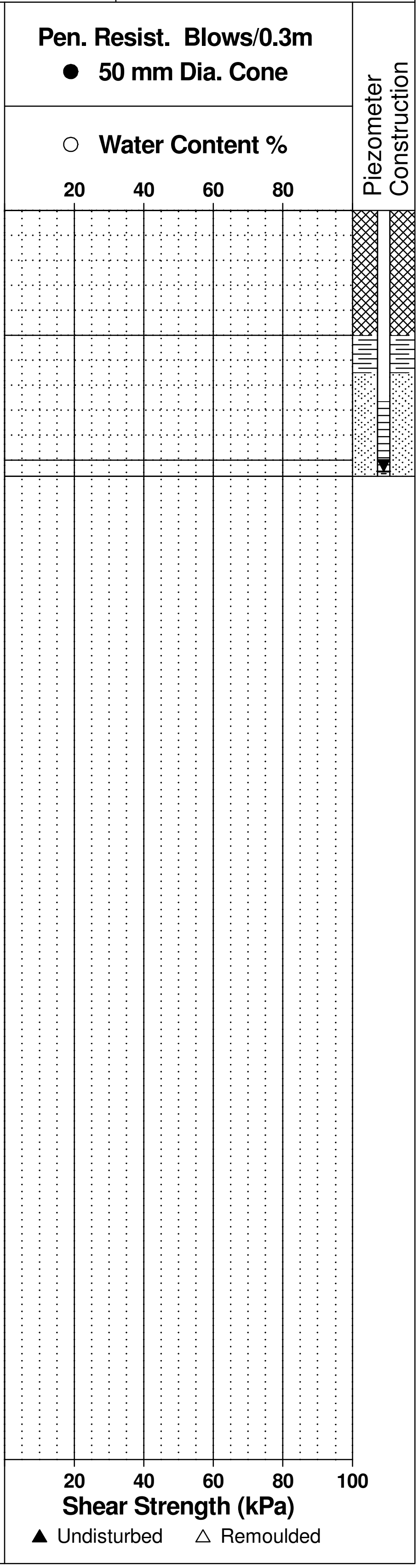
HOLE NO. BH 3-21

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	92.81
Brown **SILTY CLAY,** trace sand	AU	1				
0.91	SS	2	75	50+	1	91.81
GLACIAL TILL: Dense, brown silty sand, some clay, gravel, cobbles and boulders	SS	3	58	30	2	90.81
2.13						

End of Borehole

Practical refusal to augering at 2.13m depth

(GWL @ 2.09m - July 27, 2021)



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Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

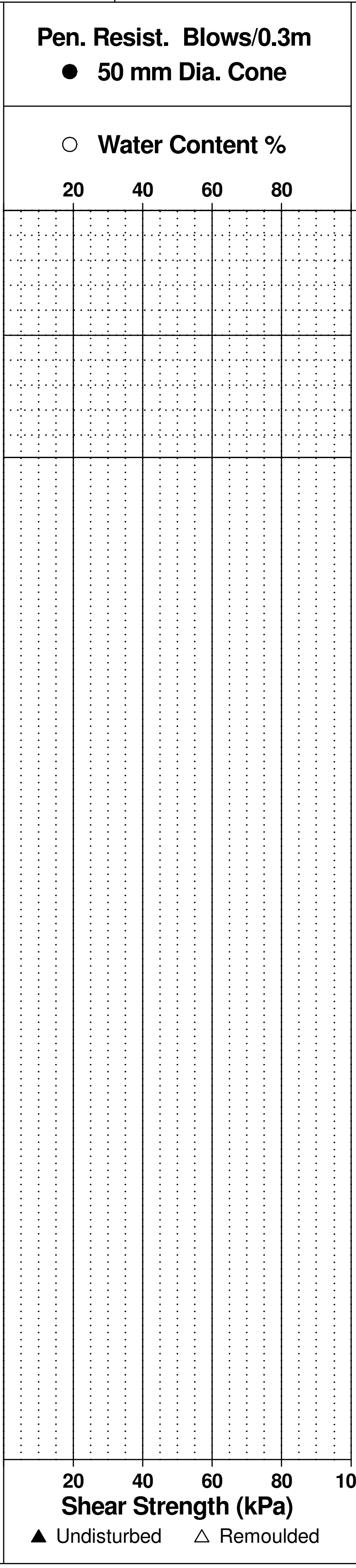
BORINGS BY Track-Mount Power Auger

DATE June 29, 2021

FILE NO. PG5705

HOLE NO. BH 3A-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE						0	92.81	
Inferred **SILTY CLAY**	▨							
0.91						1	91.81	
Inferred **GLACIAL TILL**	^^^							
1.98								
End of Borehole Practical refusal to augering at 1.98m depth (BH dry upon completion)								



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SOIL PROFILE AND TEST DATA

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Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE July 2, 2021

FILE NO. PG5705

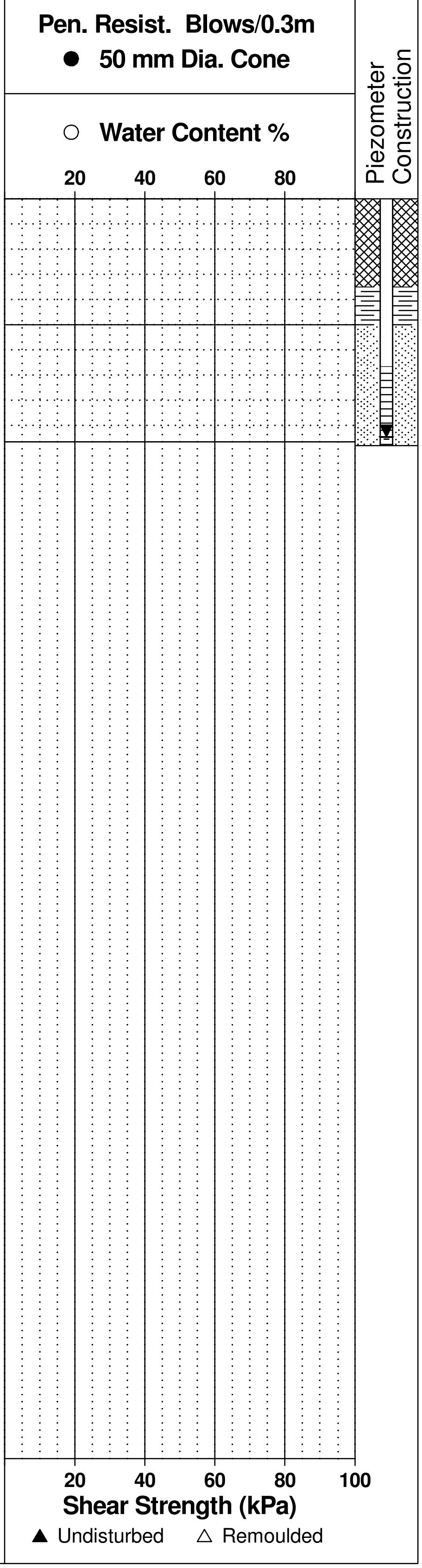
HOLE NO. BH 4-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
GROUND SURFACE						0	92.89
Brown **SILTY CLAY,** trace sand		AU	1				
0.76							
GLACIAL TILL: Brown silty clay, some sand, gravel, cobbles and boulders		SS	2	83	7	1	91.89
		SS	3	92	50+		
1.93							

End of Borehole

Practical refusal to augering at 1.93m depth

(GWL @ 1.89m - July 27, 2021)



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REMARKS

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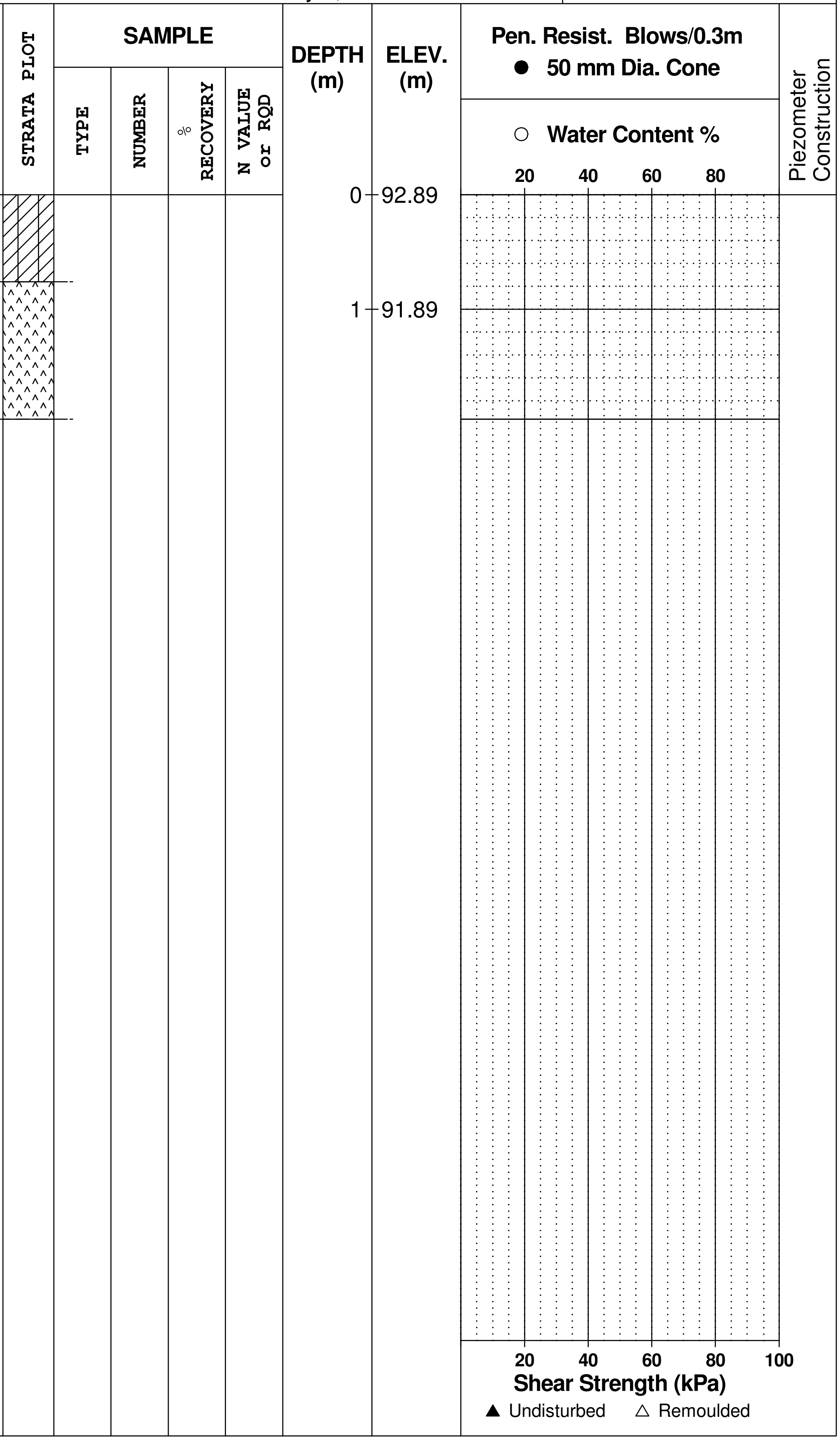
DATE July 2, 2021

FILE NO. PG5705

HOLE NO. BH 4A-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.89
Inferred **SILTY CLAY** 0.76							
Inferred **GLACIAL TILL** 1.96						1	91.89
End of Borehole Practical refusal to augering at 1.96m depth (BH dry upon completion)							



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SOIL PROFILE AND TEST DATA

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Prop. Multi-Storey Buildings - 3370 Greenbank Road
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DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE July 2, 2021

FILE NO. PG5705

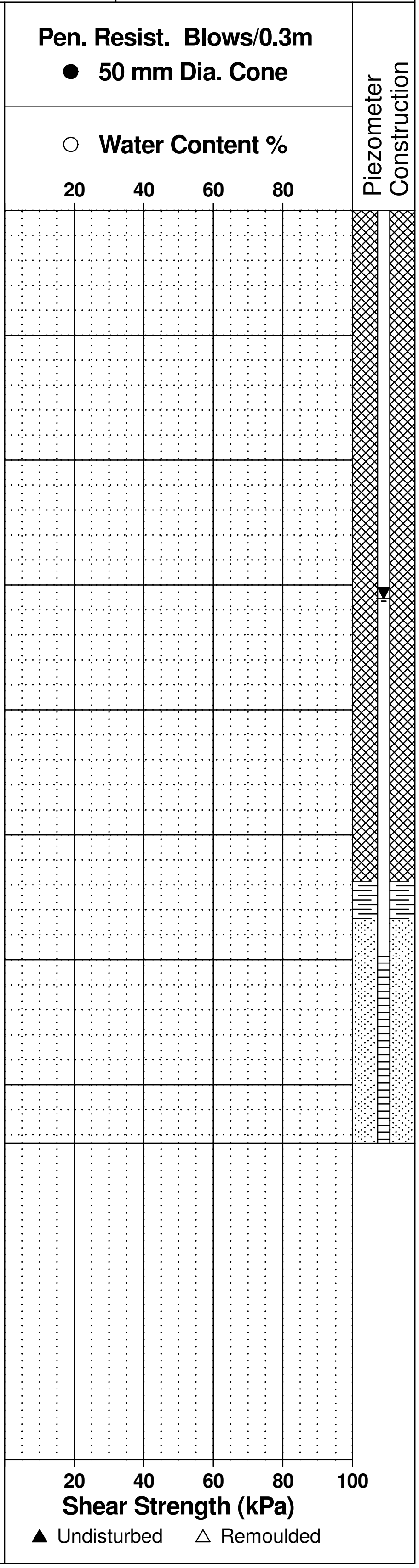
HOLE NO. BH 5-21

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	93.23
Brown **SILTY CLAY,** trace sand	AU	1				
0.60						
GLACIAL TILL: Brown silty clay, some sand, gravel, cobbles and boulders	SS	2	100	50+	1	92.23
	SS	3	100	5	2	91.23
	SS	4	83	21		
- grey by 3.0m depth					3	90.23
	SS	5	50	14		
4.10					4	89.23
GLACIAL TILL: Compact, grey silty sand with clay, trace gravel, cobbles and boulders	SS	6	50	3	5	88.23
					6	87.23
	SS	7	58	15		
					7	86.23
7.47						

End of Borehole

Practical refusal to augering at 7.47m depth.

(GWL @ 3.11m - July 27, 2021)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5705

REMARKS

HOLE NO. BH 6-21

BORINGS BY Track-Mount Power Auger **DATE** July 2, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	93.40		
FILL: Brown silty clay with sand, trace gravel and topsoil		AU	1						
1.07		SS	2	75	9	1	92.40		
GLACIAL TILL: Loose to compact, brown silty sand, some clay, gravel, cobbles and boulders		SS	3	50	28	2	91.40		
2.82		SS	4	48	29				
End of Borehole Practical refusal to augering at 2.82m depth. (BH dry upon completion)									

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE July 2, 2021

FILE NO. PG5705

HOLE NO. BH 6A-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	93.40		
Inferred **FILL**	▨								
0.91									
End of Borehole Practical refusal to augering at 0.91m depth. (BH dry upon completion)									

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE July 2, 2021

FILE NO. PG5705

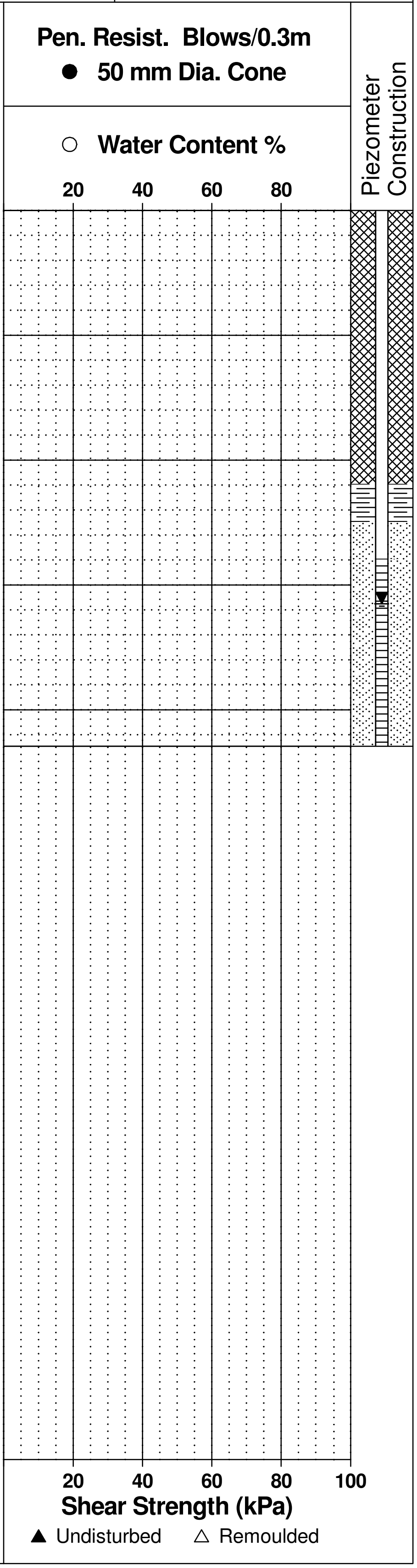
HOLE NO. BH 7-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.08
FILL: Crushed stone with clay 0.15							
FILL: Brown silty clay with sand, trace gravel and topsoil 0.91		AU	1				
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders, trace clay - brown clayey silt layer from 2.7 to 3.0m depth 4.29		SS	2	25	43	1	92.08
		SS	3	83	47	2	91.08
		SS	4	100	38	3	90.08
		SS	5	100	42	4	89.08

End of Borehole

Practical refusal to augering at 4.29m depth

(GWL @ 3.15m - July 27, 2021)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE July 5, 2021

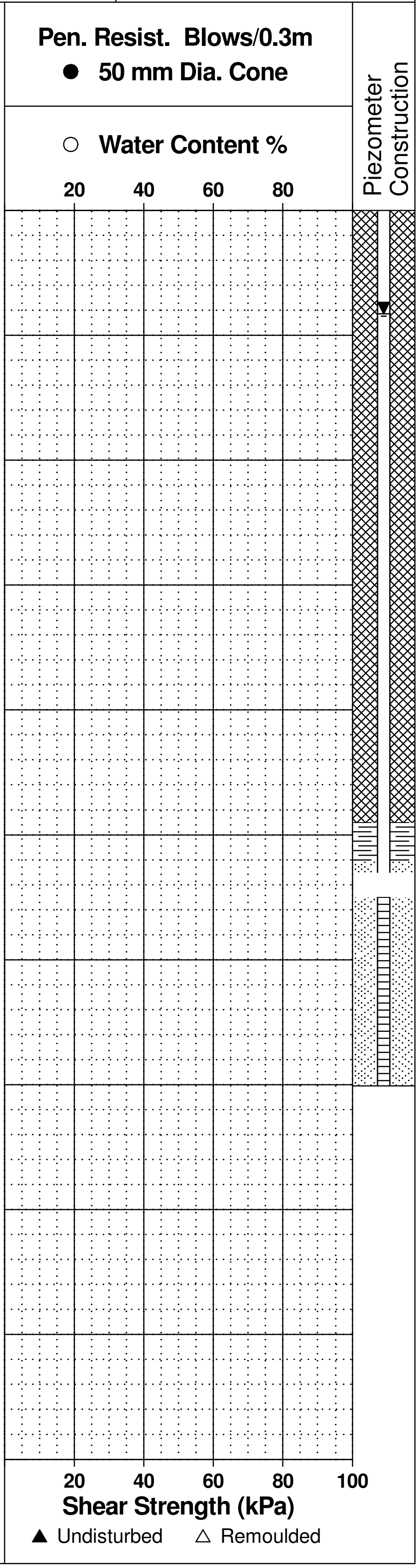
FILE NO. PG5705

HOLE NO. BH 8-21

SOIL DESCRIPTION	Depth (m)
GROUND SURFACE	
TOPSOIL	0.08
Very stiff to stiff, brown **SILTY CLAY,** trace sand	1.37
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders, trace clay	7.60
BEDROCK: Fair to good quality, grey silty dolostone interbedded with grey limestone and sandstone	

TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	25	11
SS	3	42	47
SS	4	42	64
SS	5	50	17
SS	6	8	8
SS	7	0	35
SS	8	100	50+
RC	1	100	54
RC	2	100	77

DEPTH (m)	ELEV. (m)
0	93.19
1	92.19
2	91.19
3	90.19
4	89.19
5	88.19
6	87.19
7	86.19
8	85.19
9	84.19
10	83.19



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE July 5, 2021

FILE NO. PG5705

HOLE NO. BH 8-21

SOIL DESCRIPTION GROUND SURFACE	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
						10	83.19		
		RC	3	100	90				
						11	82.19		
						12	81.19		
		RC	4	100	90				
BEDROCK: Fair to good quality, grey silty dolostone interbedded with grey limestone and sandstone - poor to good quality by 13.1m depth						13	80.19		
		RC	5	100	40				
						14	79.19		
						15	78.19		
		RC	6	100	48				
						16	77.19		
		RC	7	100	77				
						17	76.19		
17.65									
End of Borehole (GWL @ 0.83m - July 27, 2021)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE July 5, 2021

FILE NO. PG5705

HOLE NO. BH 9-21

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	92.69
TOPSOIL 0.15	AU	1				
Hard to very stiff, brown **SILTY CLAY**	AU	2				
	SS	2	25	19	1	91.69
2.00	SS	3	42	8		
GLACIAL TILL: Loose to compact, brown silty sand with clay, gravel, cobbles and boulders - grey by 3.7m depth					2	90.69
	SS	4	50	12		
	SS	5	17	9	3	89.69
					4	88.69
4.42	SS	6	58	2		
End of Borehole (Piezometer blocked and dry at 3.11m depth - July 27, 2021)						

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE July 7, 2021

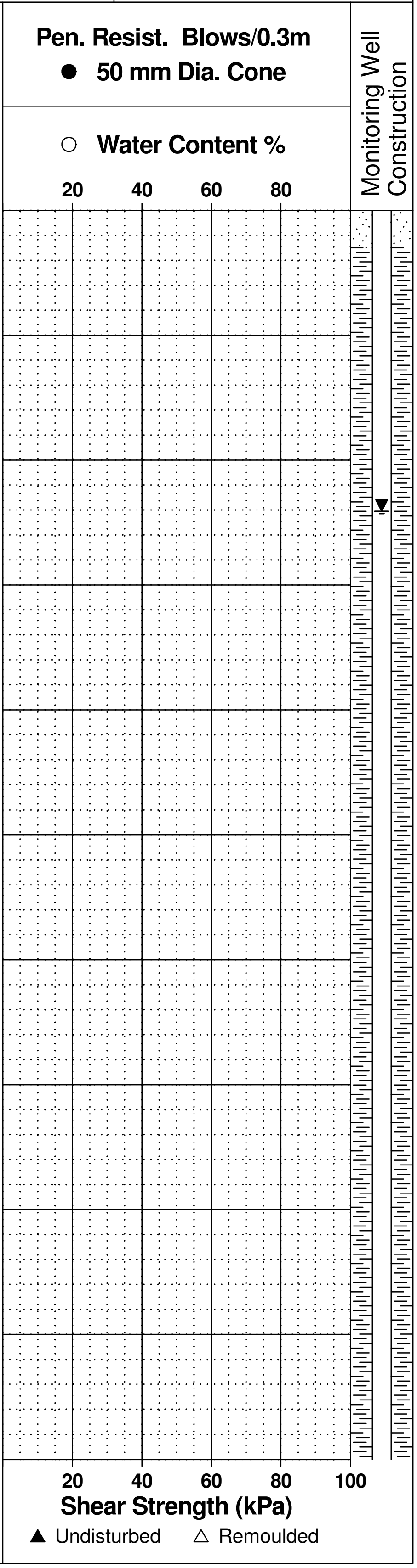
FILE NO. PG5705

HOLE NO. BH10-21

SOIL DESCRIPTION	Depth to base (m)
GROUND SURFACE	
TOPSOIL	0.20
Hard to very stiff, brown **SILTY CLAY,** trace sand	2.59
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders	4.90
GLACIAL TILL: Compact to very dense, grey silty sand with gravel, cobbles and boulders Cored boulders from 7.5 to 9.7m depth	9.73

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	50	9
SS	3	100	3
SS	4	42	7
SS	5	29	4
SS	6	80	50+
SS	7	50	20
RC	1	100	
RC	2	100	83

DEPTH (m)	ELEV. (m)
0	92.66
1	91.66
2	90.66
3	89.66
4	88.66
5	87.66
6	86.66
7	85.66
8	84.66
9	83.66
10	82.66



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE July 7, 2021

FILE NO. PG5705

HOLE NO. BH10-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Monitoring Well Construction
GROUND SURFACE						10	82.66		
		RC	3	100	68				
						11	81.66		
						12	80.66		
		RC	4	100	88				
						13	79.66		
BEDROCK: Good to excellent quality, grey silty dolostone interbedded with grey limestone, sandstone and black shale									
		RC	5	100	63	14	78.66		
						15	77.66		
		RC	6	100	100				
						16	76.66		
		RC	7	100	98	17	75.66		
17.73									
End of Borehole (GWL @ 2.41m - July 27, 2021)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE July 7, 2021

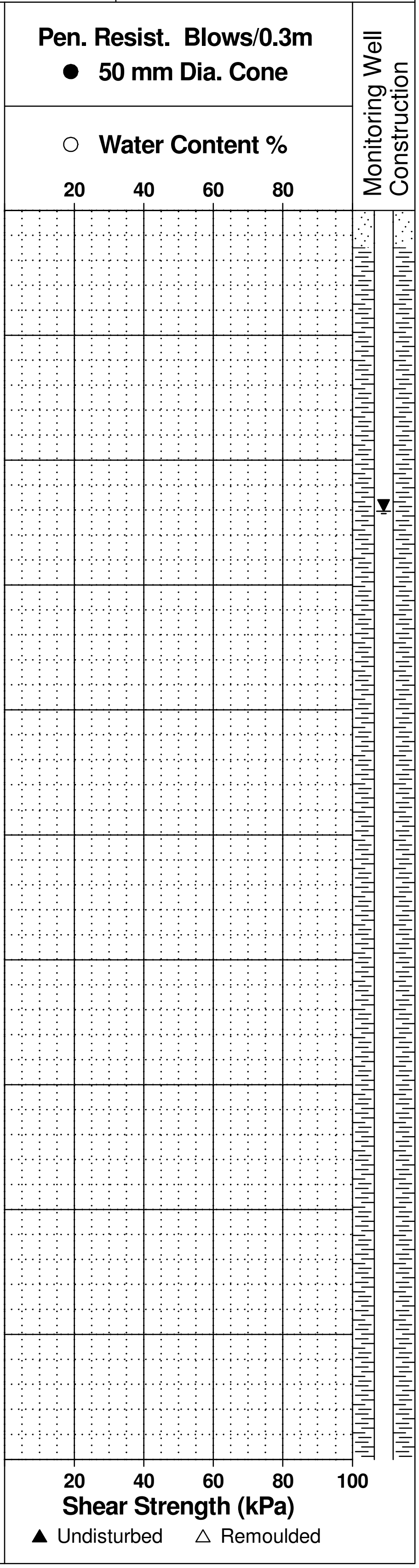
FILE NO. PG5705

HOLE NO. BH11-21

SOIL DESCRIPTION	Depth to base (m)
GROUND SURFACE	
TOPSOIL	0.20
Hard to very stiff, brown **SILTY CLAY**	2.54
GLACIAL TILL: Compact to very dense, grey silty sand with gravel, cobbles and boulders, some clay - clay content decreasing with depth	8.59
BEDROCK: Fair to good quality, grey silty dolostone interbedded with grey limestone, sandstone and black shale	

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	50	10
SS	3	75	4
SS	4	83	3
SS	5	0	7
SS	6	50	50+
SS	7	25	31
RC	1	100	50

DEPTH (m)	ELEV. (m)
0	92.73
1	91.73
2	90.73
3	89.73
4	88.73
5	87.73
6	86.73
7	85.73
8	84.73
9	83.73
10	82.73



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

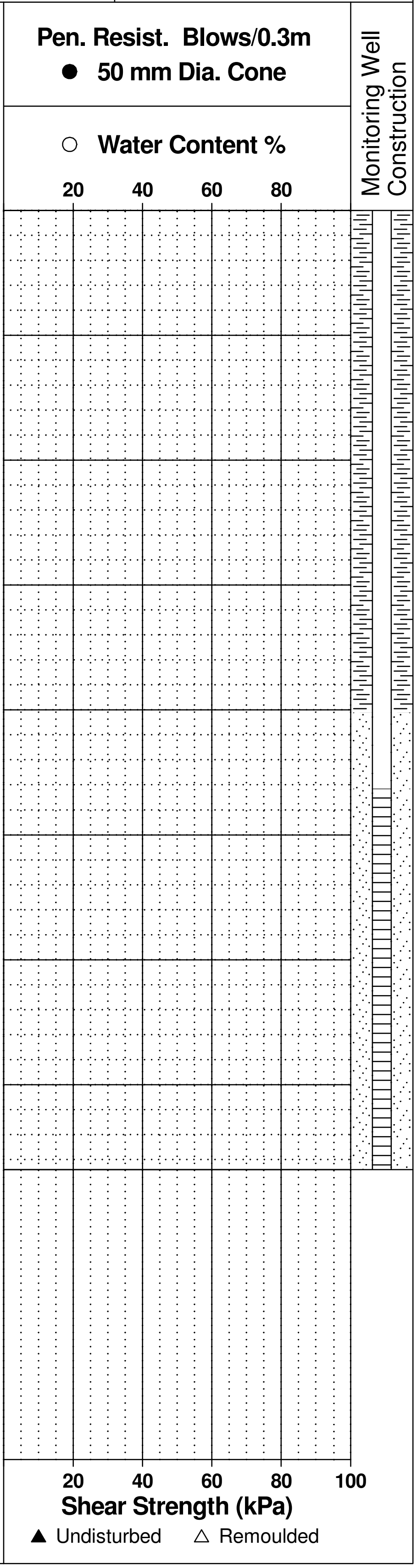
BORINGS BY Track-Mount Power Auger

DATE July 7, 2021

FILE NO. PG5705

HOLE NO. BH11-21

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						
BEDROCK: Fair to good quality, grey silty dolostone interbedded with grey limestone, sandstone and black shale					10	82.73
	RC	2	100	100	11	81.73
	RC	3	100	73	12	80.73
					13	79.73
	RC	4	100	100	14	78.73
					15	77.73
	RC	5	100	68	16	76.73
	RC	6	100	85	17	75.73
17.68						
End of Borehole (GWL @ 2.41m - July 27, 2021)						



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

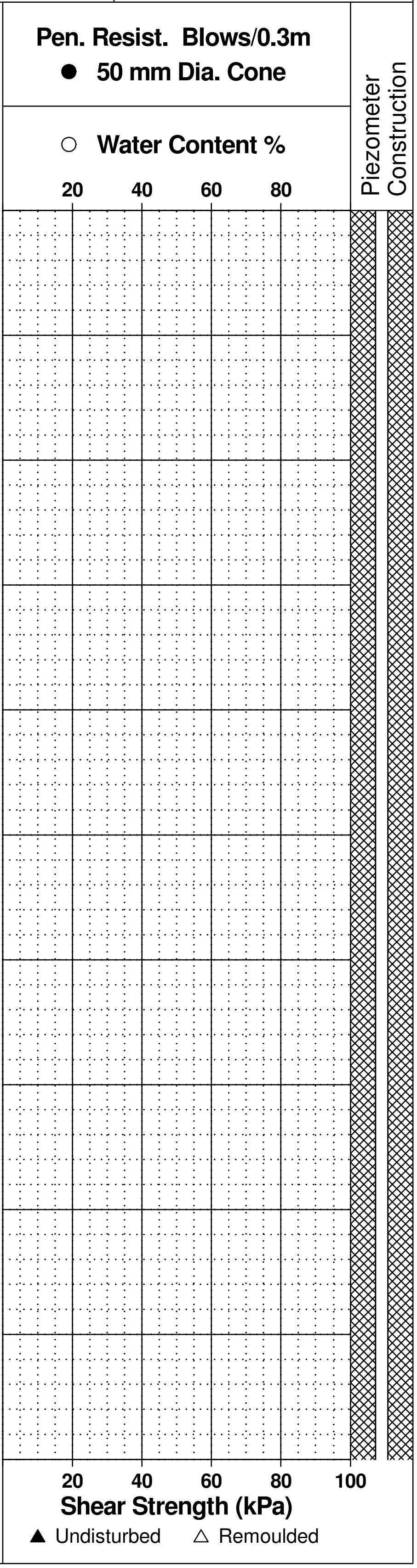
FILE NO. **PG5705**

REMARKS

HOLE NO. **BH12-21**

BORINGS BY Track-Mount Power Auger **DATE** July 8, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
GROUND SURFACE		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
TOPSOIL 0.25	■					0	93.23
	▨	AU	1				
	▨	SS	2	83	12	1	92.23
Hard to very stiff, brown **SILTY CLAY**	▨						
	▨	SS	3	100	8	2	91.23
- trace sand and gravel by 2.4m depth	▨						
3.00	▨	SS	4	83	3	3	90.23
	⁞	SS		12	12		
Compact, brown **SILTY SAND** - running sand encountered from 3.0 to 5.8m depth	⁞					4	89.23
	⁞	SS	6	75	19	5	88.23
5.80	⁞					6	87.23
	^	SS	7	58	52		
GLACIAL TILL: Very dense, grey silty sand with gravel, cobbles and boudlers, trace clay	^					7	86.23
	^					8	85.23
9.60	^					9	84.23
	☰	RC	1	100	67	10	83.23



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE July 8, 2021

FILE NO. PG5705

HOLE NO. BH12-21

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						
					10	83.23
	RC	2	100	82		
					11	82.23
					12	81.23
	RC	3	100	100		
BEDROCK: Fair to excellent quality, grey silty dolostone interbedded with grey limestone and sandstone					13	80.23
	RC	4	100	100	14	79.23
- vertical seam from 15.0 to 15.4m depth						
					15	78.23
	RC	5	100	66		
					16	77.23
					17	76.23
	RC	6	100	92		
17.81						
End of Borehole (Piezometer blocked and dry at 2.40m depth - July 27, 2021)						

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic
REMARKS
BORINGS BY Track-Mount Power Auger
DATE July 9, 2021
FILE NO. **PG5705**
HOLE NO. **BH13-21**

SOIL DESCRIPTION		SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.25
TOPSOIL	0.30	AU	1				
Very stiff to stiff, brown **SILTY CLAY,** trace sand		SS	2	67	6	1	92.25
		SS	3	58	3		
	2.29					2	91.25
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders - grey by 3.0m depth Cored boulder from 3.2 to 4.2m depth		SS	4	0	50+		
		SS	5	67	50+	3	90.25
		RC	1	62			
						4	89.25
		SS	6	83	9		
						5	88.25
	6.32					6	87.25
BEDROCK: Excellent quality, grey dolostone interbedded with grey limestone and sandstone		RC	2	100	94		
						7	86.25
		RC	3	100	66		
						8	85.25
						9	84.25
		RC	4	100	100		
						10	83.25

STRATA PLOT

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Buildings - 3370 Greenbank Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE July 9, 2021

FILE NO. PG5705

HOLE NO. BH13-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
GROUND SURFACE						10	83.25		
BEDROCK: Excellent quality, grey dolostone interbedded with grey limestone and sandstone		RC	5	100	100	11	82.25		
11.66									
End of Borehole									

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) ‘N’ value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of “P” denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	‘N’ Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

Consistency	Undrained Shear Strength (kPa)	‘N’ Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity: $S_t < 2$
Medium Sensitivity: $2 < S_t < 4$
Sensitive: $4 < S_t < 8$
Extra Sensitive: $8 < S_t < 16$
Quick Clay: $S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	**ROCK QUALITY**
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS - Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW - Thin wall tube or Shelby tube, generally recovered using a piston sampler
G - "Grab" sample from test pit or surface materials
AU - Auger sample or bulk sample
WS - Wash sample
RC - Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC% - Natural water content or water content of sample, %
LL - Liquid Limit, % (water content above which soil behaves as a liquid)
PL - Plastic Limit, % (water content above which soil behaves plastically)
PI - Plasticity Index, % (difference between LL and PL)

Dxx - Grain size at which xx% of the soil, by weight, is of finer grain sizes
These grain size descriptions are not used below 0.075 mm grain size
D10 - Grain size at which 10% of the soil is finer (effective grain size)
D60 - Grain size at which 60% of the soil is finer

Cc - Concavity coefficient = $(D30)^2 / (D10 \times D60)$
Cu - Uniformity coefficient = $D60 / D10$

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

p'_o - Present effective overburden pressure at sample depth
p'_c - Preconsolidation pressure of (maximum past pressure on) sample
Ccr - Recompression index (in effect at pressures below p'_c)
Cc - Compression index (in effect at pressures above p'_c)

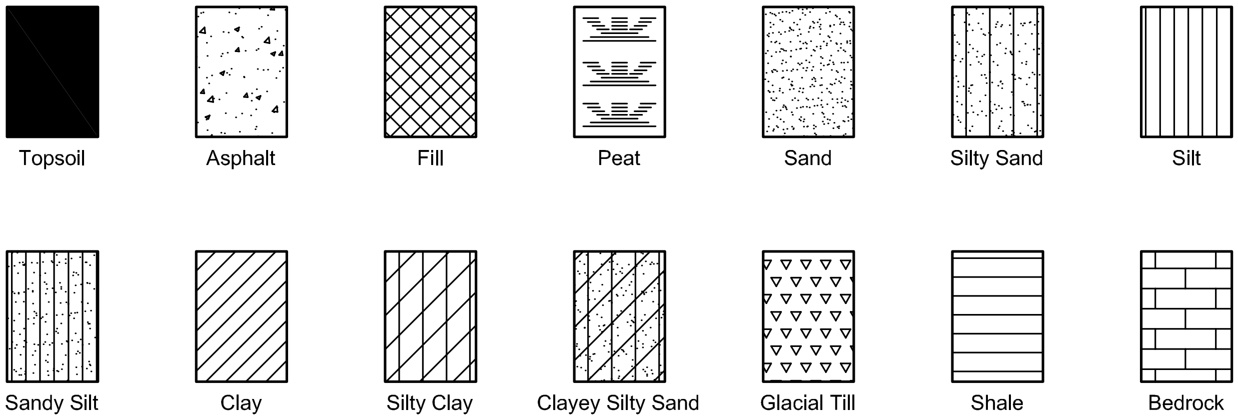
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

PERMEABILITY TEST

k - Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

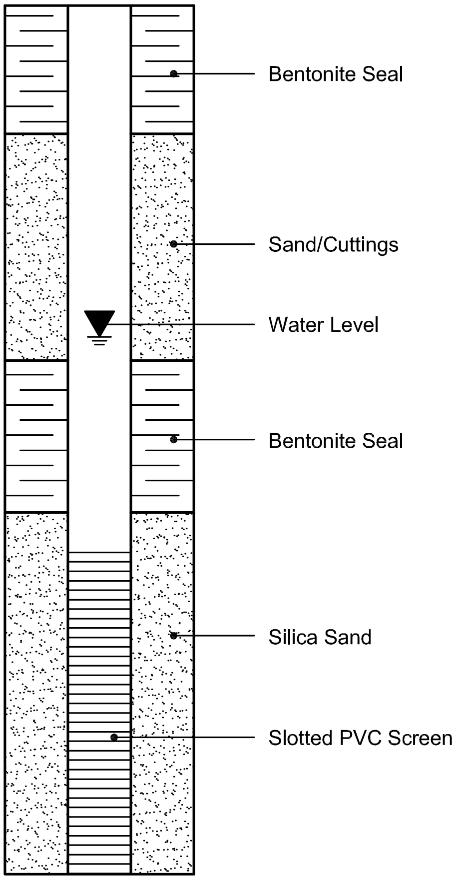
SYMBOLS AND TERMS (continued)

STRATA PLOT

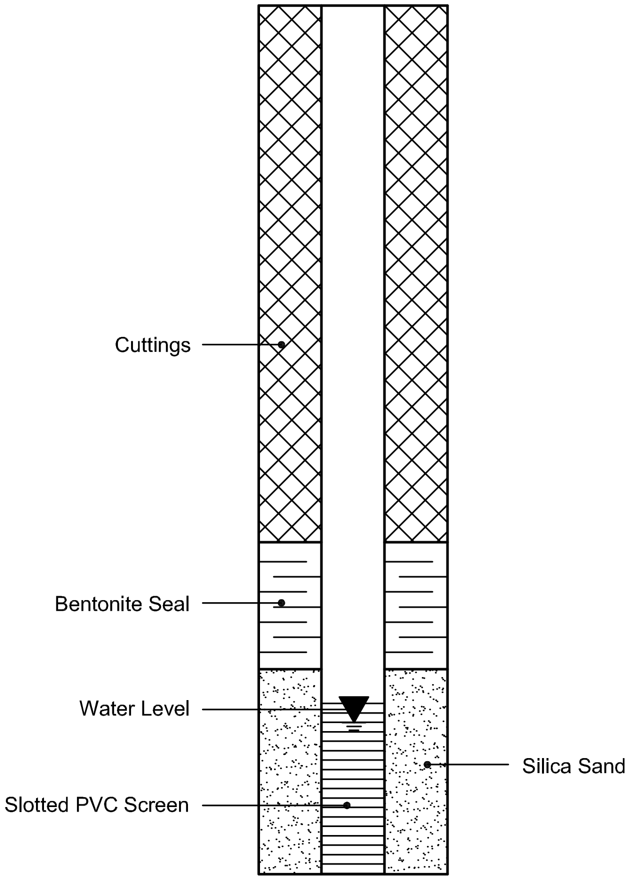


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



PROJECT: 1523044-1000

RECORD OF BOREHOLE: 16-103

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: February 19, 2016

DATUM: Geodetic

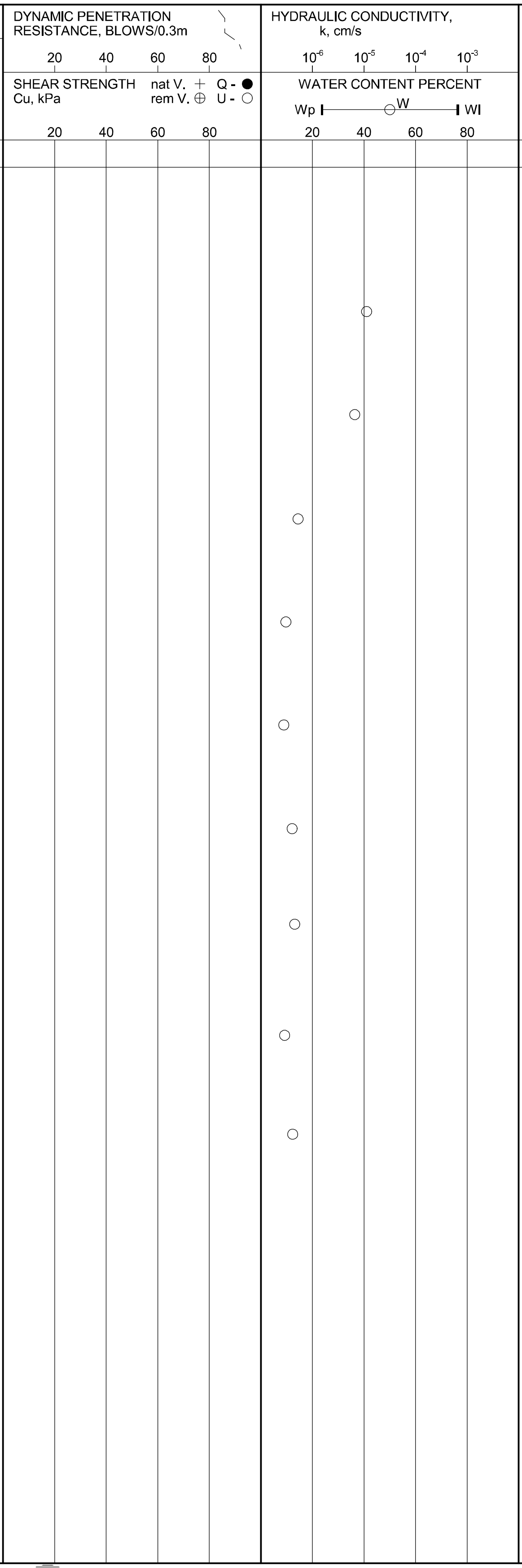
SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Power Auger, 200 mm Diam. (Hollow Stem)

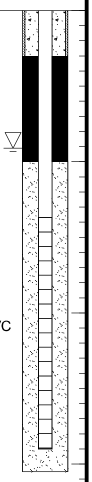
DESCRIPTION	ELEV. DEPTH (m)
GROUND SURFACE	93.51
TOPSOIL - (ML) CLAYEY SILT; dark brown	0.00
(CI/CH) SILTY CLAY to CLAY; grey brown (Weathered Crust); cohesive, w>PL, very stiff	0.15
(SM) SILTY SAND, some gravel; brown; non-cohesive, wet, loose	91.69 1.82
(SM) SILTY SAND, some gravel; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, loose to very dense	91.38 2.13
End of Borehole Auger Refusal	86.25 7.26

NUMBER	TYPE	BLOWS/0.30m
1	GRAB	-
2	GRAB	-
3	SS	10
4	SS	4
5	SS	11
6	SS	4
7	SS	25
8	SS	33
9	SS	40
10	SS	58
11	SS	>50



ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



Bentonite Seal

Silica Sand

51 mm Diam. PVC
#10 Slot Screen

Silica Sand

W.L. in Screen at
Elev. 92.60 m on
March 7, 2016

DEPTH SCALE
1 : 50

LOGGED: DG

CHECKED: CK

PROJECT: 1523044-1000

RECORD OF BOREHOLE: 16-106

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: February 18, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80 / SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-6} 10^{-5} 10^{-4} 10^{-3} / WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl 20 40 60 80	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	92.78							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) CLAYEY SILT; dark brown	0.00	1	GRAB	-				
		(CL/CI) SILTY CLAY; grey brown (Weathered Crust); cohesive, w>PL, stiff to very stiff	0.15	2	GRAB	-				
1				3	SS	6				
2				4	SS	4				
		(SM) SILTY SAND, some gravel; grey brown to grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, very loose	90.49 2.29	5	SS	2				
3				6	SS	1				
4		(ML) SANDY SILT, some gravel; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, compact	88.97 3.81	7	SS	15				
5		(SM) SILTY SAND, fine; grey; non-cohesive, wet, compact	88.21 4.57	8	SS	15			MH	
				9	SS	19				
6		(SM) SILTY SAND, some gravel; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet	86.84 5.94							
		End of Borehole Auger Refusal	6.10							
7										
8										
9										
10										

DEPTH SCALE

1 : 50

LOGGED: CG

CHECKED: CK

PROJECT: 1523044-1000

RECORD OF BOREHOLE: 16-107

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: February 18, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ — 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl — 20 40 60 80

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.30m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	93.14					
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) CLAYEY SILT; dark brown	0.00	1	GRAB	-		
		(CL/CI) SILTY CLAY; grey brown (Weathered Crust); cohesive, w>PL, stiff to very stiff	0.15	2	GRAB	-		
1				3	SS	4		
		(SM) SILTY SAND; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, very dense	91.77 1.37	5	SS	>50		
2		End of Borehole Auger Refusal	91.16 1.98					
3								
4								
5								
6								
7								
8								
9								
10								

DEPTH SCALE

1 : 50

LOGGED: CG

CHECKED: CK

PROJECT: 1523044-1000

RECORD OF BOREHOLE: 16-107A

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: February 18, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80 SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-6} 10^{-5} 10^{-4} 10^{-3} WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl 20 40 60 80	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		93.14							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) CLAYEY SILT; dark brown		0.00							
		(CL/CI) SILTY CLAY; grey brown (Weathered Crust); cohesive, w>PL, stiff to very stiff		0.15							
1											
		(SM) SILTY SAND; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, very dense		91.77 1.37							
		End of Borehole Auger Refusal Note: Soil stratigraphy inferred from BH 16-107		91.46 1.68							
2											
3											
4											
5											
6											
7											
8											
9											
10											

MIS-BHS 001 1523044.GPJ GAL-MIS.GDT 05/24/16 JEM

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: CG
CHECKED: CK

PROJECT: 1523645

RECORD OF BOREHOLE: 16-301

SHEET 1 OF 2

LOCATION: N 5013712.6 ;E 364379.1

BORING DATE: March 4-7, 2016

DATUM: CGVD28

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80 SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-8} 10^{-6} 10^{-4} 10^{-2} WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl 20 40 60 80	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		93.16							
0	Wash Boring NW Casing	Probable Sand		0.00							∇
1		Probable Glacial Till		92.25 0.91							
2											
3											
4											
5											
6											
7											
8											
9											WL in open borehole at 0.78 m depth below ground surface upon completion of drilling
10		Borehole continued on RECORD OF DRILLHOLE 16-301		83.36 9.8							
11											
12											
13											
14											
15											

DEPTH SCALE

1 : 75

Golder Associates

LOGGED: DWM

CHECKED:

PROJECT: 1523645

RECORD OF DRILLHOLE: 16-301

SHEET 2 OF 2

LOCATION: N 5013712.6 ;E 364379.1

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: March 4-7, 2016

DRILL RIG: CME 850

DRILLING CONTRACTOR: CCC

DATUM: CGVD28

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate

BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage

PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular

PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break

BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	COLOUR % RETURN FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA B Angle	DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	
		BEDROCK SURFACE		83.36																
10	Rotary Drill NQ Core	Fresh, thickly bedded, light brownish grey DOLOMITE		9.80	1	100														
11					2	100														
12					3	100														
13		End of Drillhole		80.16 13.00																WL in open borehole at 0.78 m depth below ground surface upon completion of drilling
14																				
15																				
16																				
17																				
18																				
19																				
20																				
21																				
22																				
23																				
24																				

DEPTH SCALE

1 : 75

Golder Associates

LOGGED: DWM

CHECKED:

PROJECT: 1523645

RECORD OF BOREHOLE: 16-302

SHEET 1 OF 2

LOCATION: N 5013746.6 ;E 364217.4

BORING DATE: March 4, 2016

DATUM: CGVD28

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80 SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-8} 10^{-6} 10^{-4} 10^{-2} WATER CONTENT PERCENT Wp ⊢ ○W ⊣ Wl 20 40 60 80	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		93.06							
0	Wash Boring NW Casing	Probable Sand		0.00							
1		Probable Glacial Till		92.15 0.91							
2											
3											
4											
5											
6											
7											
8		Borehole continued on RECORD OF DRILLHOLE 16-302		85.04 8.02							
9											
10											
11											
12											
13											
14											
15											

DEPTH SCALE

1 : 75

Golder Associates

LOGGED: DWM

CHECKED:

PROJECT: 1523645

RECORD OF DRILLHOLE: 16-302

SHEET 2 OF 2

LOCATION: N 5013746.6 ;E 364217.4

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: March 4, 2016

DRILL RIG: CME 850

DRILLING CONTRACTOR: CCC

DATUM: CGVD28

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate

BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage

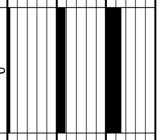
PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular

PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break

BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH COLOUR % RETURN	RECOVERY TOTAL CORE % 80 60 40 20	RECOVERY SOLID CORE % 80 60 40 20	R.Q.D. % 80 60 40 20	FRACT. INDEX PER 0.25 m 5 10 15 20	DISCONTINUITY DATA B Angle 0 90 180 270	DIP w.r.t. CORE AXIS 0 30 60 90	TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec 10^{-8} 10^{-6} 10^{-4} 10^{-2}	Diametral Point Load Index (MPa) 2 4 6	RMC -Q' AVG.
		BEDROCK SURFACE		85.04															
	Rotary Drill NQ Core	Fresh, medium to thickly bedded, light brownish grey DOLOMITE, with a medium thick, black shale interbed		8.02	1	100													
9					2	0													
10					3	0													
11				81.86 11.20															
		End of Drillhole																	
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			
21																			
22																			
23																			



DEPTH SCALE

1 : 75

Golder Associates

LOGGED: DWM

CHECKED:

PROJECT: 1523645

RECORD OF BOREHOLE: 15-7

SHEET 1 OF 2

LOCATION: N 5013739.7 ;E 364291.3

BORING DATE: August 12, 2015

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Power Auger, 200 mm Diam. (Hollow Stem)

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-8} 10^{-6} 10^{-4} 10^{-2}

WATER CONTENT PERCENT: Wp ├──○W──┤ Wl 20 40 60 80

SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.30m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
GROUND SURFACE	92.84					
TOPSOIL - (ML/SM) sandy SILT to SILTY SAND; dark brown; moist	0.00 92.56	1	AS	-		Native Backfill
(SM) gravelly SILTY SAND; grey brown, with oxidation staining, presence of cobbles and boulders inferred from auger resistance (GLACIAL TILL); non-cohesive, moist to wet, compact to very dense	0.28					Bentonite Seal
		2	SS	>50		
		3	SS	17		∇
		4	SS	46		
(SM) SILTY SAND, fine, trace gravel; brown; non-cohesive, wet, compact	89.64 3.20	5	SS	12		Native Backfill
(SM) gravelly SILTY SAND; grey (GLACIAL TILL); non-cohesive, wet, compact	88.72 4.12	6	SS	22	M	
		7	SS	21		
(ML) gravelly sandy SILT; grey (GLACIAL TILL); non-cohesive, wet, compact	87.81 5.03	8	SS	11		
		9	SS	>50		
Borehole continued on RECORD OF DRILLHOLE 15-7	86.64 6.2					

DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

MIS-BHS 001 1523645.GPJ GAL-MIS.GDT 09/23/15 JM

DEPTH SCALE

1 : 75

Golder Associates

LOGGED: PAH

CHECKED: SD

PROJECT: 1523645

RECORD OF DRILLHOLE: 15-7

SHEET 2 OF 2

LOCATION: N 5013739.7 ;E 364291.3

DRILLING DATE: August 12, 2015

DATUM: CGVD28

DRILL RIG: CME 850

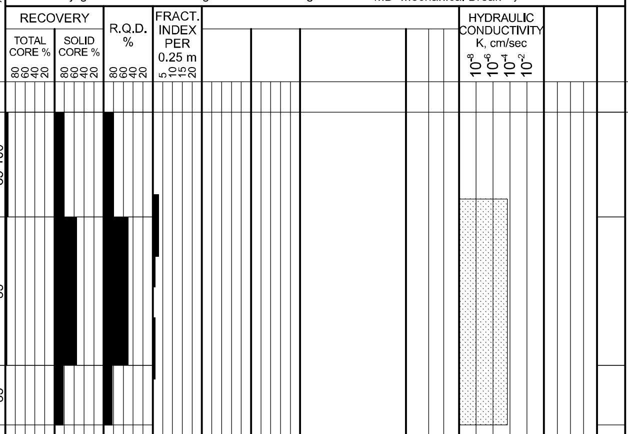
INCLINATION: -90° AZIMUTH: ---

DRILLING CONTRACTOR: Marathon Drilling

JN - Joint
FLT - Fault
SHR- Shear
VN - Vein
CJ - Conjugate
BD- Bedding
FO- Foliation
CO- Contact
OR- Orthogonal
CL - Cleavage
PL - Planar
CU- Curved
UN- Undulating
ST - Stepped
IR - Irregular
PO- Polished
K - Slickensided
SM- Smooth
Ro - Rough
MB- Mechanical Break
BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH COLOUR / % RETURN
		BEDROCK SURFACE		86.64		
7	Rotary Drill NQ Core	Fresh, thinly to medium bedded, grey LIMESTONE		6.20	1	85-100
8					2	85
9				83.54 9.30	3	85
10		End of Drillhole				
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

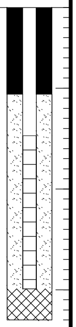


Peltonite Seal

Granitic Sand

32 mm Diam. PVC
#10 Slot Screen

Cave



WL in Screen at
Elev. 90.67 m on
Aug. 24, 2015

DEPTH SCALE
1 : 75

Golder Associates

LOGGED: PAH
CHECKED: SD

PROJECT: 1523645

RECORD OF BOREHOLE: 15-17

SHEET 1 OF 1

LOCATION: N 5013731.1 ;E 364221.7

BORING DATE: August 11, 2015

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}); WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		93.79							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (ML) gravelly sandy SILT; dark brown and red brown, contains organic matter; non-cohesive, moist, compact	▨	0.00	1	SS	15				
1					2	SS	15				
		FILL - (ML) CLAYEY SILT, some gravel; dark grey; cohesive, w>PL	▨	92.57 1.22	3	SS	7				
2		TOPSOIL - (OL) ORGANIC SILT; black; moist	≡	91.75 2.04	4	SS	11				
3		(ML) gravelly sandy SILT; grey brown, presence of cobbles and boulders inferred from auger resistance (GLACIAL TILL); non-cohesive, wet, compact	▨	2.23	5	SS	24				
					6	SS	29				
4		(SM) gravelly SILTY SAND; grey, presence of cobbles and boulders inferred from auger resistance (GLACIAL TILL); non-cohesive, wet, compact	▨	90.13 3.66	7	SS	20				
					8	SS	13				
5		End of Borehole		88.91 4.88							
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											

DEPTH SCALE

1 : 75

Golder Associates

LOGGED: PAH

CHECKED: SD

MIS-BHS 001 1523645.GPJ GAL-MIS.GDT 09/23/15 JM

PROJECT: 1523645

RECORD OF PROBEHOLE: 15-17A

SHEET 1 OF 1

LOCATION: N 5013728.8 ;E 364221.0

BORING DATE: August 12, 2015

DATUM: CGVD28

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80 SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-8} 10^{-6} 10^{-4} 10^{-2} WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl 20 40 60 80	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m				
		GROUND SURFACE		93.62							
0 1 2 3 4	Power Auger 200 mm Diam. (Hollow Stem)	Refer to Record of Borehole 15-17 for stratigraphy		0.00							
5		Probable Glacial Till	▨	88.74 4.88							
6 7 8 9 10 11 12 13 14 15		End of Probehole Auger Refusal		88.08 5.54							

DEPTH SCALE

1 : 75

Golder Associates

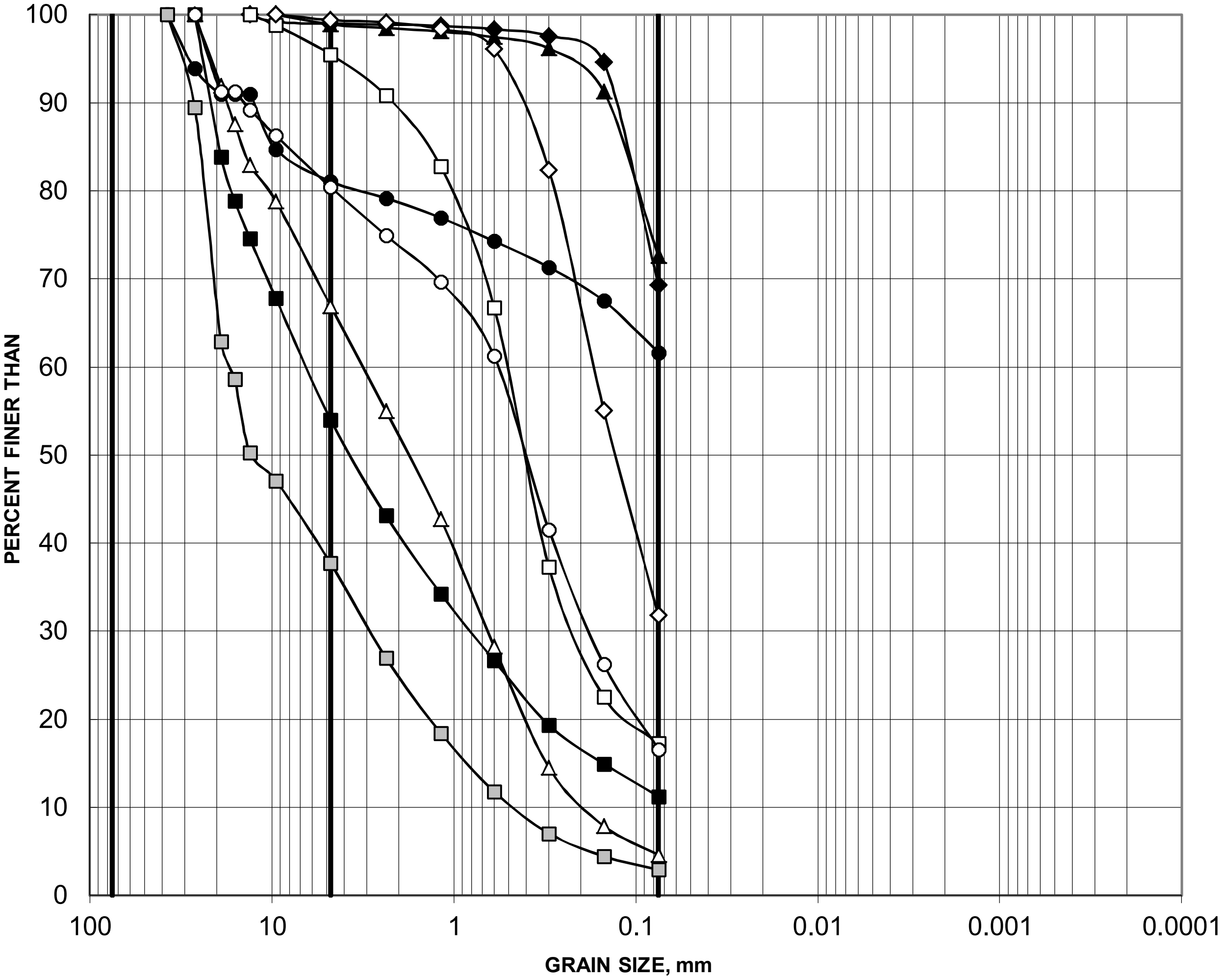
LOGGED: PAH

CHECKED: SD

GRAIN SIZE DISTRIBUTION

FIGURE B-3

Interbedded SAND/SILT within Glacial Till



Cobble	coarse	fine	coarse	medium	fine	SILT AND CLAY
Size	GRAVEL SIZE		SAND SIZE			

Borehole	Sample	Depth (m)
—■— 15-2	9	5.34-5.79
—◆— 15-4	10	5.98-6.59
—▲— 15-5	10	7.62-8.23
—●— 15-6A	9	7.62-8.23
—□— 15-6B	7	4.57-5.18
—◇— 15-7	6	3.81-4.12
—△— 15-9A	5	7.62-8.23
—○— 15-10	9	8.54-9.15
—▨— 15-11	9	8.54-9.15

Created by: MI
Checked by: CNM

Project: 1523645

Golder Associates

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 32282

Report Date: 09-Jul-2021

Order Date: 6-Jul-2021

Project Description: PG5705

	Client ID:	BH2-21 SS3	-	-	-
	Sample Date:	29-Jun-21 09:00	-	-	-
	Sample ID:	2128232-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	71.3	-	-	-
General Inorganics					
pH	0.05 pH Units	7.53	-	-	-
Resistivity	0.10 Ohm.m	17.6	-	-	-
Anions					
Chloride	5 ug/g dry	262	-	-	-
Sulphate	5 ug/g dry	36	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

FIGURES 2 & 3 – SEISMIC SHEAR WAVE VELOCITY PROFILES

DRAWING PG5705-4 – TEST HOLE LOCATION PLAN

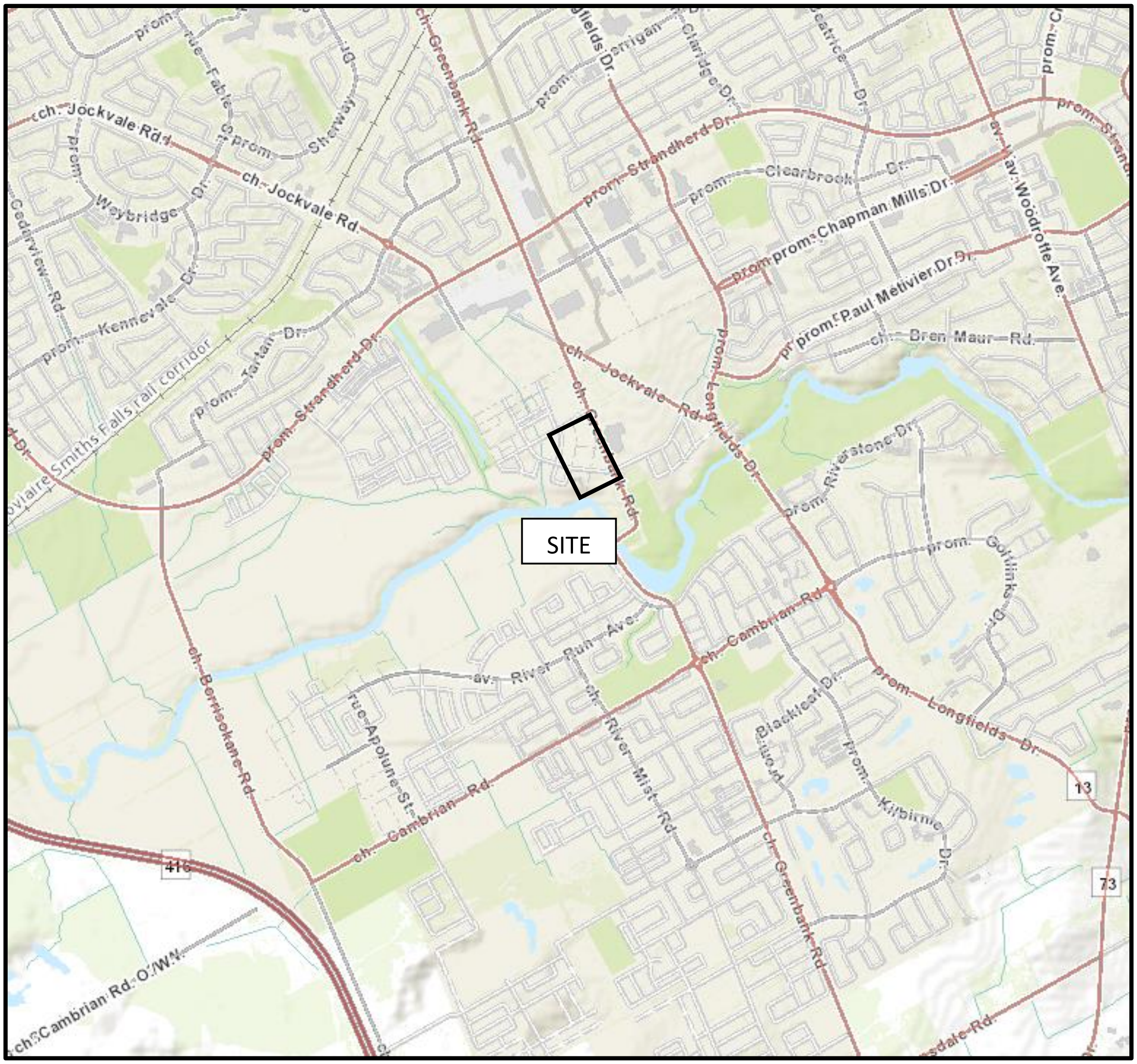


FIGURE 1

KEY PLAN

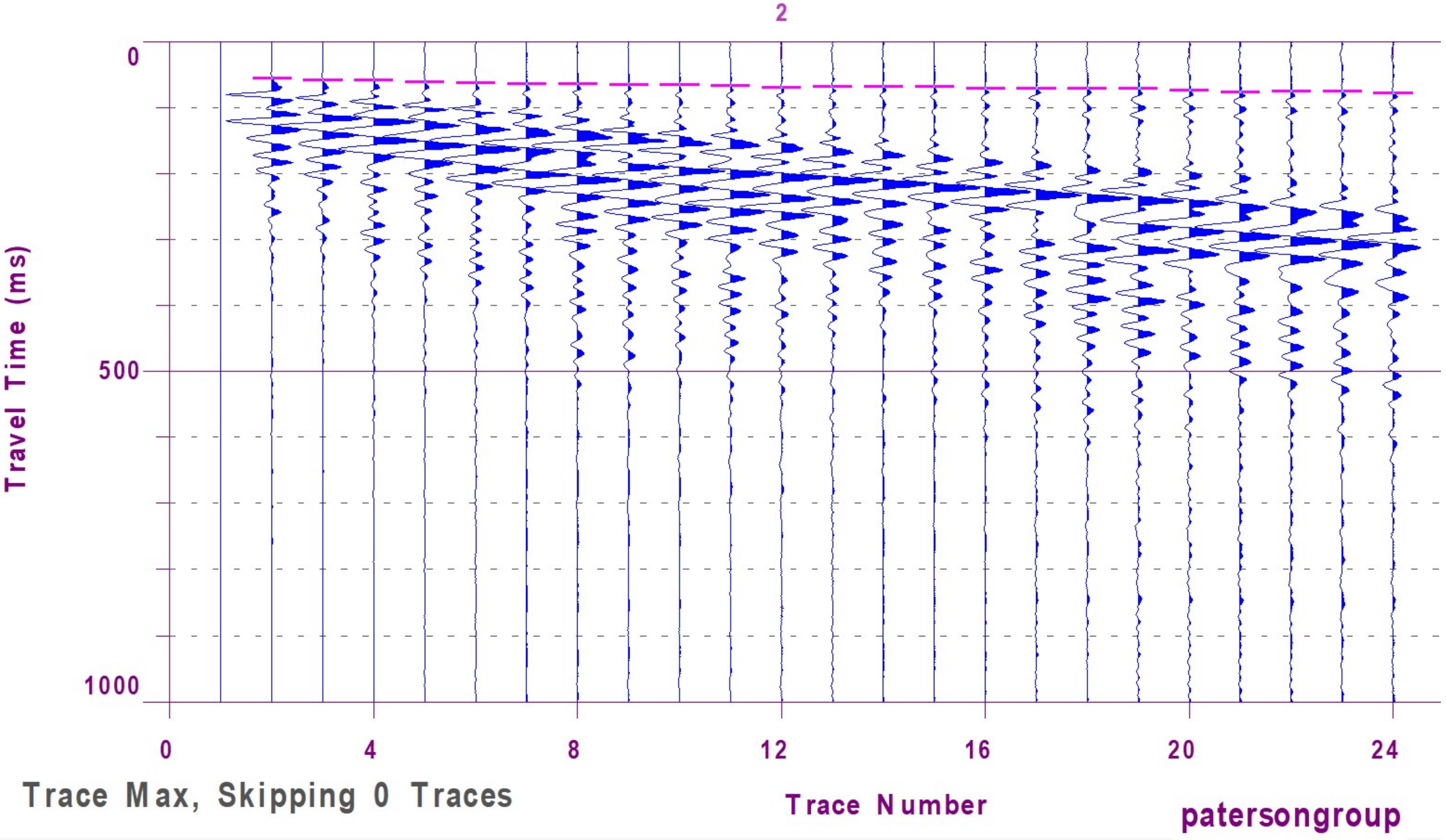


Figure 2 – Shear Wave Velocity Profile at Shot Location -15 m

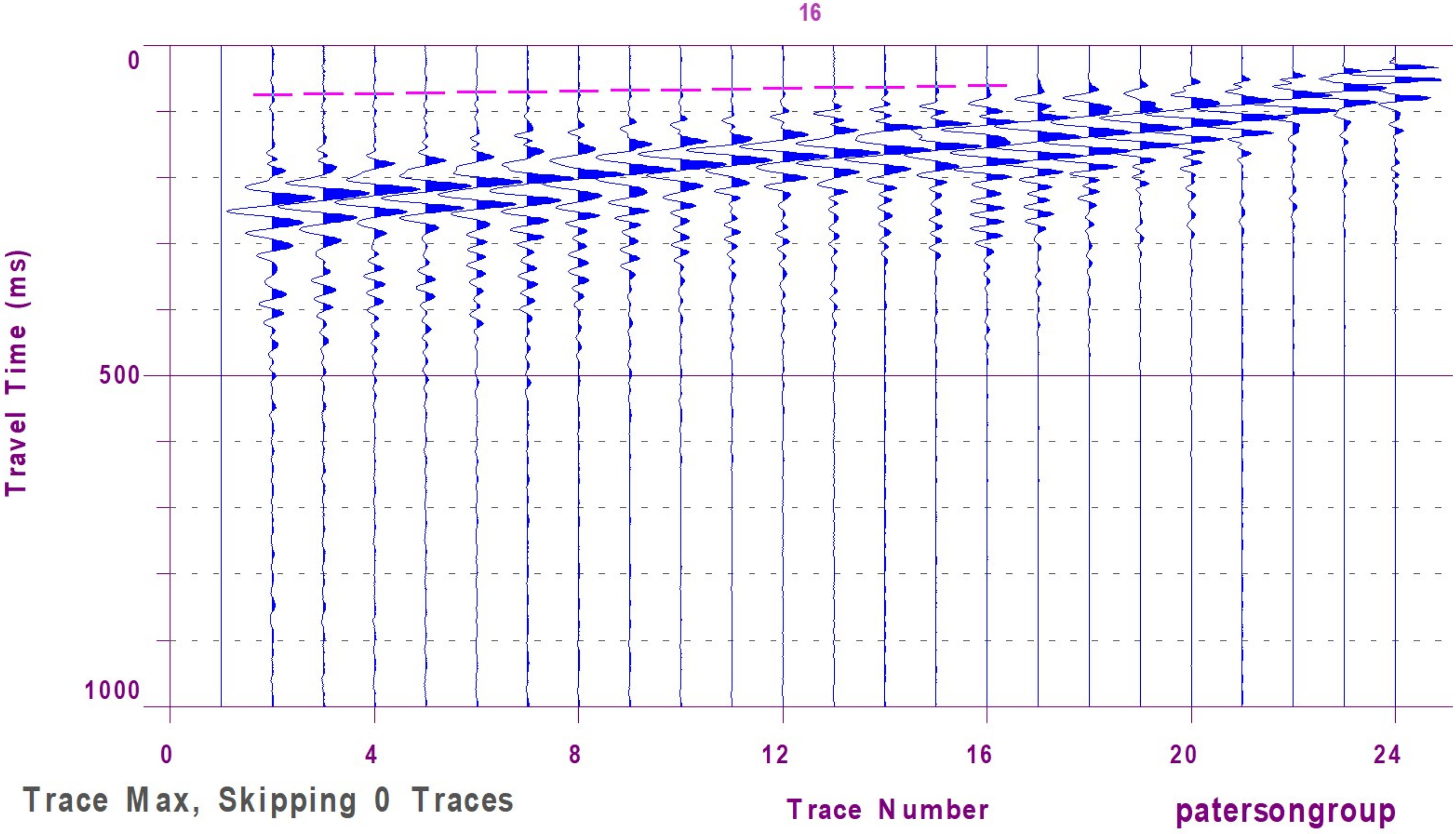
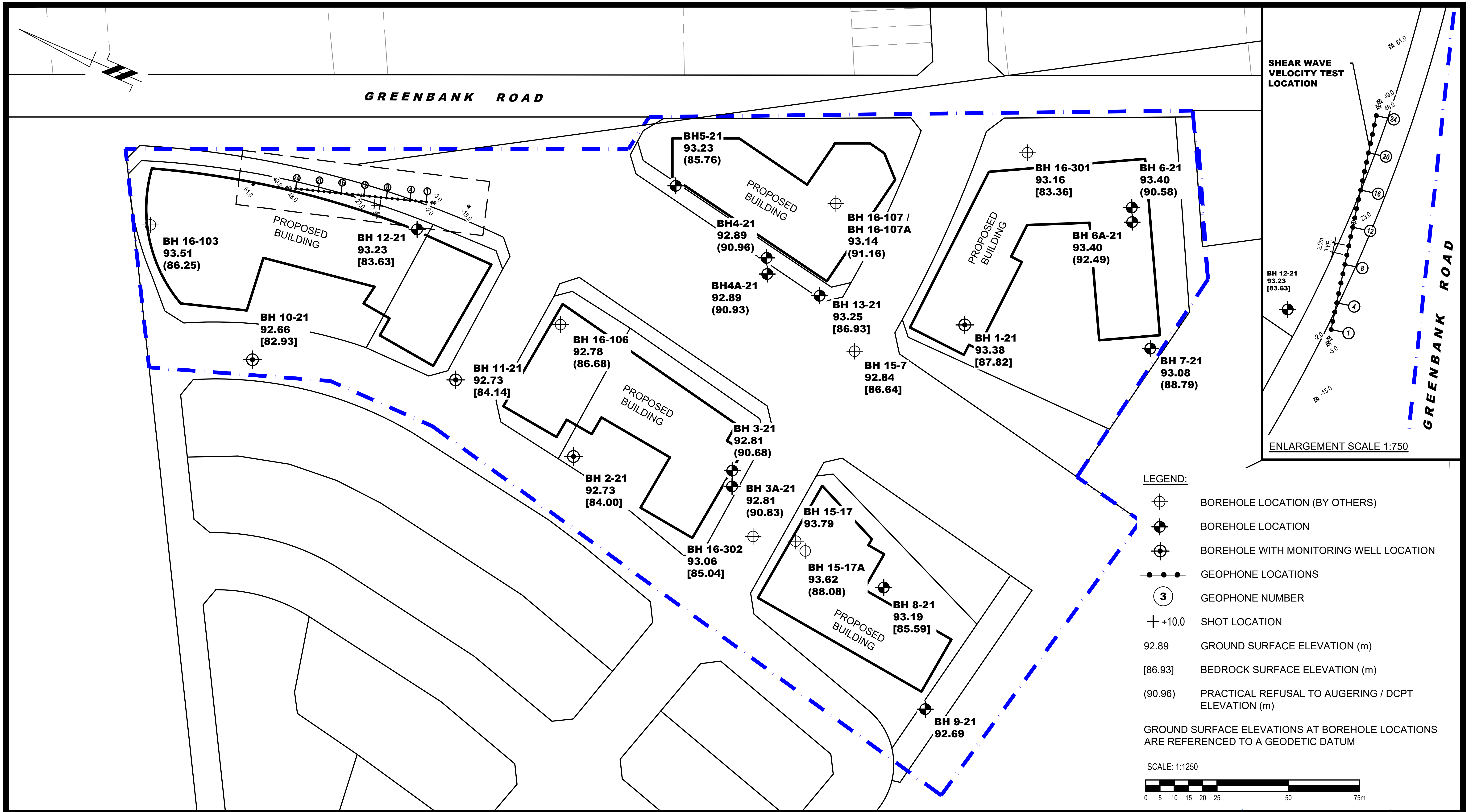


Figure 3 – Shear Wave Velocity Profile at Shot Location 49 m



LEGEND:

⌖	BOREHOLE LOCATION (BY OTHERS)
◕	BOREHOLE LOCATION
⊕	BOREHOLE WITH MONITORING WELL LOCATION
●—●—●	GEOPHONE LOCATIONS
③	GEOPHONE NUMBER
+10.0	SHOT LOCATION
92.89	GROUND SURFACE ELEVATION (m)
[86.93]	BEDROCK SURFACE ELEVATION (m)
(90.96)	PRACTICAL REFUSAL TO AUGERING / DCPT ELEVATION (m)

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

CLARIDGE HOMES

GEOTECHNICAL INVESTIGATION
PROPOSED MULTI-STOREY DEVELOPMENT
3370 GREENBANK ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1250
Date: 02/2021
Drawn by: NFRV
Report No.: PG5705-2
Checked by: KP
Dwg. No.: PG5705-4
Approved by: SD
Revision No.:

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