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Geotechnical Investigation

Proposed High-Rise Complex
3-33 Selkirk Street and 2 Montreal Road
Ottawa, Ontario

Prepared For

Main and Main Developments Inc.

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Report PG4915-1 Revision 3

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Main and Main Developments Inc. to conduct a geotechnical investigation for the subject site located at 3-33 Selkirk Street and 2 Montreal Road in the City of Ottawa (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objectives of the current investigation were to:

- ❏ determine the subsurface soil and groundwater conditions based on borehole information.
- ❏ provide geotechnical recommendations for the 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.

Investigating the presence or potential presence of contamination on the subject property was not part of the scope of work of this present investigation. Environmental information is provided under a separate cover.

2.0 Proposed Development

Based on the current conceptual drawings, it is our understanding that several multi-storey high-rise buildings will be constructed over an underground parking structure with one basement level which will occupy the majority of the subject site.

It is further expected that the proposed high-rise complex will be municipally serviced with water and sewer services Further, it is also expected the existing structures will be demolished as part of construction of the proposed development.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current investigation was undertaken between December 20, 2021 and February 18, 2022. During that time, a total of 14 boreholes (BH 1-21 to BH 6-21 and BH 1-22 to BH 8-22) and 18 test pits were advanced to a maximum depth of 11.3 m below the existing ground surface. The field program for the preliminary geotechnical investigation was conducted on April 3, 4 and 5, 2019. During that time, a total of 10 boreholes (BH 1 to BH 10) were drilled to a maximum depth of 8.3 m below existing ground surface.

Historical investigations by others were undertaken throughout the area of 2 Montreal Road between September and October of 2014 and May of 2019. Boreholes undertaken at that time were advanced to a maximum depth of 11.5 m below ground surface. The soil profiles encountered by others are presented on the Soil Profile and Test Data sheets in Appendix 1.

The test holes undertaken by Paterson were located in the field by Paterson personnel in a manner to provide general coverage of the subject site taking into consideration of site features and underground utilities. The approximate locations of the test holes are shown in Drawing PG4915-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were drilled using a truck-mounted auger drill rig and portable drilling equipment operated by a two-person crew. The test pits were advanced using a hydraulic shovel. All fieldwork was conducted under the full-time supervision of our personnel under the direction of a senior engineer from our geotechnical department. The drilling and test pitting procedure consisted of advancing to the required depths at select locations, sampling and testing the overburden.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using a 50 mm diameter split-spoon (SS) sampler, or from the auger flights. Grab samples were collected from the test pit sidewalls at selected intervals. The samples were classified on site and placed in sealed plastic bags. All samples were transported to our laboratory. The depths at which the split-spoon, auger and grab samples were recovered from the test holes are shown as SS, AU and G, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

Standard Penetration Tests (SPT) were 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.

Diamond drilling was carried out at several borehole locations to assess the bedrock quality. A recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section of bedrock and are shown on the Soil Profile and Test Data sheets in Appendix 1.

The recovery value is the ratio, in percentage, of the length of the bedrock sample recovered over the length of the drilled section. The RQD value is the ratio, in percentage, of the total length of intact rock pieces longer than 100 mm in one drilled section over the length of the drilled section. These values are indicative of the quality of the bedrock.

The subsurface conditions observed in the boreholes were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets in Appendix 1.

Groundwater

A 32 or 51 mm diameter PVC groundwater monitoring well was installed in all boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

Monitoring Well Installation

Typical monitoring well construction details are described below:

- ❏ Slotted 32 or 51 mm diameter PVC screen at the base of the aforementioned boreholes.
- ❏ 32 or 51 mm diameter PVC riser pipe from the top of the screen to the ground surface.
- ❏ No.3 silica sand backfill within annular space around screen.
- ❏ A minimum of 300 mm thick bentonite hole plug directly above PVC slotted screen.
- ❏ Clean backfill from top of bentonite plug to the ground surface.

The groundwater observations are noted on the Soil Profile and Test Data sheets presented in Appendix 1.

3.2 Field Survey

The test hole locations carried out by Paterson were determined by Paterson personnel taking into consideration of site features and underground utilities. The location and ground surface elevation at each test hole location was surveyed by Paterson personnel.

The boreholes were surveyed with respect to a geodetic datum using a temporary benchmark (TBM), consisting of the top of spindle of the fire hydrant located to the east of the subject site in front of 307 Montgomery Street. A geodetic elevation of 57.63 m was assigned to the TBM by Annis O'Sullivan Vollebek Ltd.

The test hole locations and ground surface elevation at each test hole location are presented on Drawing PG4915-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Review

Soil samples recovered from the subject site were visually examined in our laboratory to review the field logs.

4.0 Observations

4.1 Surface Conditions

The subject site is currently occupied by a one storey commercial retail building with a slab-on-grade construction surrounded by asphalt covered parking areas and access lanes. The site is bordered by Montreal Road to the north, Montgomery Street to the east and Selkirk Street to the south followed by a mixture of residential, commercial and institutional structures. It should be further noted that the site is bordered to the west by North River Road followed by a municipal park and the Rideau River.

The site was observed to be relatively flat and approximately at grade with adjacent roadways and neighbouring properties.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile at the test hole locations consists of an asphaltic pavement structure or topsoil overlying a fill layer of variable thickness. The fill layer was observed to extend to depths between 1.2 to 5.6 m below existing ground surface. The fill consisted of a mixture of silty sand//sandy silt with gravel, shale fragments, trace clay, topsoil and brick. Glacial till, consisting of sandy silt to silty sand with gravel, trace clay was identified at all test hole locations where the fill layer did not extend to the bedrock surface. Fill was observed to extend to the bedrock surface at BH 2-21, BH 4-21, BH 5-21, BH 6-21, TP 4-21, TP 5-21, BH 8-22, BH 1, BH 2, BH 3, BH 4, BH 6, BH 7 and BH 8.

A heavily fractured to fractured weathered shale bedrock was encountered below the glacial till deposit.

Specific details of the subsurface profile at each test hole location are presented on the Soil Profile and Test Data sheets in Appendix 1.

Bedrock

Based on available geological mapping, the subject site is located in an area where the bedrock consists of a dark brown to black shale with laminations of calcareous silt stone of the Billings Formation and expected to be encountered at depths varying between 3 and 10 m. Reference can be made to Drawing PG4915-2 - Bedrock Contour Plan for the approximate test hole locations and depth which bedrock had been encountered.

4.3 Groundwater

Groundwater levels were measured in monitoring wells on April 12, 2019. The measured groundwater level (GWL) readings are presented in Table 1 below and further presented in the Soil Profile and Test Data sheets in Appendix 1. Long-term groundwater level can also be estimated based on the observed moisture levels, colour and consistency of the recovered soil samples. Based on these observations, it is estimated that the long-term groundwater table can be expected between 6 to 7 m depth. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

Table 1A - Summary of Groundwater Level Readings - 2022 Boreholes

Test Hole Number	Ground Elevation, m	Groundwater Levels (m)		Recording Date
		Depth	Elevation	
BH 1-22	57.06	7.00	50.06	March 2, 2022
BH 2-22	57.05	7.01	50.04	March 2, 2022
BH 3-22	56.02	6.02	50.00	March 2, 2022
BH 4-22	56.21	6.21	50.00	March 2, 2022
BH 5-22	56.33	6.28	50.05	March 2, 2022
BH 6-22	55.99	6.04	49.95	March 2, 2022
BH 7-22	56.18	6.19	49.99	March 2, 2022
BH 8-22	56.04	6.06	49.98	March 2, 2022

Notes: The boreholes were surveyed with respect to a temporary benchmark (TBM), consisting of the top of spindle of the fire hydrant located to the east of the subject site in front of 307 Montgomery Street. A geodetic elevation of 57.63 m was assigned to the TBM.

Table 1B - Summary of Groundwater Level Readings - 2021 Boreholes

Test Hole Number	Ground Elevation, m	Groundwater Levels (m)		Recording Date
		Depth	Elevation	
BH 1-21	57.49	7.45	50.04	January 6, 2022
BH 2-21	57.30	7.24	50.06	January 6, 2022
BH 3-21	57.19	7.15	50.04	January 6, 2022
BH 4-21	57.02	7.00	50.02	January 6, 2022
BH 5-21	56.94	6.97	49.97	January 6, 2022
BH 6-21	56.82	6.84	49.98	January 6, 2022

Notes: The boreholes were surveyed with respect to a temporary benchmark (TBM), consisting of the top of spindle of the fire hydrant located to the east of the subject site in front of 307 Montgomery Street. A geodetic elevation of 57.63 m was assigned to the TBM.

Table 1C - Summary of Groundwater Level Readings - 2019 Boreholes				
Test Hole Number	Ground Elevation, m	Groundwater Levels (m)		Recording Date
		Depth	Elevation	
BH 1	56.08	6.02	50.06	April 12, 2019
BH 2	56.09	5.56	50.53	April 12, 2019
BH 3	56.47	5.94	50.53	April 12, 2019
BH 4	56.50	5.95	50.55	April 12, 2019
BH 5	56.55	5.98	50.57	April 12, 2019
BH 6	56.69	5.56	51.13	April 12, 2019
BH 7	56.75	6.22	50.53	April 12, 2019
BH 8	56.70	6.16	50.54	April 12, 2019
BH 9	56.66	4.04	52.62	April 12, 2019
BH 10	57.07	6.43	50.64	April 12, 2019
Notes: The boreholes were surveyed with respect to a temporary benchmark (TBM), consisting of the top of spindle of the fire hydrant located to the east of the subject site in front of 307 Montgomery Street. A geodetic elevation of 57.63 m was assigned to the TBM.				

All test pits were dry upon completion at the time of the 2021 test pit investigation.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed development. It is recommended that the proposed high-rise buildings be founded on conventional spread footing foundations placed directly upon a clean, surface sounded unweathered/sound shale bedrock and/or indirectly extended to a sound bedrock bearing surface by lean concrete in-filled trenches.

Foundation supporting the underground parking structure and overlying podium level may be supported by conventional spread footings placed on the aforementioned bedrock bearing mediums and/or a weathered bedrock bearing surface, an undisturbed, compact glacial till bearing medium or suitable and site-approved existing fill.

Footings located below the proposed two to three-storey podium levels may be founded upon a sound/unweathered surface-sounded bedrock bearing surface, weathered bedrock bearing surface, undisturbed glacial till bearing surface and/or site-approved existing fill.

Where foundation loads exceed the bearing pressures provided herein for the existing fill layer, recommendations have been provided for the reinstatement of the bearing medium to attain a suitable bearing surface.

Due to the presence of potentially expansive shales, it is recommended protection measures be undertaken at the time of the excavation to mitigate excessive exposure of the shale to ambient air and dewatering.

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

5.2 Site Grading and Preparation

Stripping Depth

For the subject development, it is expected that all the overburden will be removed to accommodate one level of underground parking. Furthermore, all buildings and structures will be demolished and removed.

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

Existing foundation walls and other construction debris should be entirely removed from within the building perimeters. Under paved areas, existing construction remnants such as foundation walls should be excavated to a minimum of 1 m below finished grade.

Bedrock Removal

It is expected that line-drilling in conjunction with hoe-ramming and/or controlled blasting will be required to remove sound bedrock. In areas of weathered bedrock and where only a small quantity of bedrock is to be removed, bedrock removal may be possible by hoe-ramming in conjunction with conventional excavation techniques, such as the use of a hydraulic excavator.

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 the proximity of the blasting operations should be carried out prior to commencing site activities.

A CCTV inspection of all the surrounding watermain pipes should also be completed prior to bedrock removal and shoring installation. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries or claims related to the blasting operations.

As a general guideline, peak particle velocities (measured at the structures) should not exceed 25 mm/s during the blasting program to reduce the risks of damage to the existing surrounding structures. In addition, vibration monitoring is recommended to be undertaken for watermains located throughout the adjacent City of Ottawa right-of-ways.

Excavation side slopes in sound bedrock can be carried out using near vertical sidewalls. A minimum 1 m horizontal ledge should be left between the bottom of the overburden excavation and the top of the bedrock surface to provide an area to allow for potential sloughing. The 1 m horizontal ledge set back can be eliminated with a shoring program which has drilled piles extending below the proposed founding elevation.

It is anticipated that the specialized contractor/blasting consultant will limit peak particle velocities experienced by the nearest alignments service to standard peak particle velocity tolerances.

Based on this, provided the nearest adjacent service infrastructure throughout Montreal Road, Selkirk Street, Montgomery Street and North River Road remains intact throughout the blasting program, existing services at greater distance may be considered similarly unaffected by the blasting program. However, the blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

Vibration Considerations

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

Two parameters determine the recommended vibration limit, 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). These guidelines are for current construction standards.

It is suggested that the underground service alignments within the adjacent City of Ottawa right-of-ways be inspected prior and post construction of the subject buildings. This can be accomplished by running a CCTV camera through the adjacent pipes and be reviewed and approved by a professional engineer specialized in these works.

These guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a pre-construction survey is recommended to minimize the risks of claims during or following the construction of the proposed building.

Protection of Potential Expansive Bedrock

It is anticipated that expansive shale will be encountered at the subject site. Although the effects of expansive shale will not affect the proposed building structure, it is possible that it will affect the proposed basement floor slabs founded close to the shale bedrock.

A potential for heaving and rapid deterioration of the shale bedrock exists at this site. To reduce the long term deterioration of the shale, exposure of the bedrock surface to oxygen should be kept as low as possible. The bedrock surface within the proposed development footprint should be protected from excessive dewatering and exposure to ambient air. These requirements should be evaluated by Paterson during the excavation operations and should be discussed with Paterson during the design stage.

To accomplish this, a 50 mm thick concrete mud slab should be placed on the exposed bedrock surface within a 48 hour period of being exposed. A 17 MPa sulphate resistant lean concrete is recommended for this purpose. As an alternative to the mud slab, keeping the shale surface covered with granular backfill is also acceptable.

Selected excavated vertical sides of the exposed bedrock can be protected using a sprayed elastomeric coating or shotcrete to seal the bedrock from exposure to air and dewatering.

Fill Placement

Fill placed 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. The imported fill material should be tested and approved prior to delivery to the site. The fill should be placed in maximum 300 mm thick loose lifts and compacted using suitable compaction equipment. Fill placed beneath the building should be compacted to a minimum of 98% of the standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in maximum 300 mm thick lifts and compacted by the tracks of the spreading equipment to minimize voids.

Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls, unless used in conjunction with a geocomposite drainage membrane, such as Miradrain G100N or Delta Drain 6000.

Excavated shale deteriorates upon exposure to air and is not generally suitable for re-use as an engineered fill. The use of imported granular fill is recommended for this purpose.

5.3 Foundation Design

Bearing Resistance Values - High Rise Buildings

Footings placed over clean, surface sounded **sound shale and/or limestone bedrock** can be designed using a factored bearing resistance value at Ultimate Limit States (ULS) of **3,000 kPa**, incorporating a geotechnical resistance factor of 0.5. The elevation of the relatively unweathered and sound shale bedrock surface is depicted on Drawing PG4915 - Sound Bedrock Contours in Appendix 2 of this report.

Consideration may be given to placing footings supporting the high-rise buildings directly upon the sound shale bedrock bearing surface or placing the footings upon a near-vertical lean concrete trench extending from USF to the sound shale bedrock surface, from a geotechnical perspective.

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.

Bearing Resistance Values - Basement and Podium Level Structures

Based on our review, footings supporting the remainder of the structures may be founded upon a combination of the existing fill, in-situ glacial till and/or weathered bedrock bearing mediums. Consideration may be required to be given to replacing the existing fill layer with a suitably prepared pad of engineered fill where the footing loads exceed the bearing pressure provided herein for the existing fill layer. Further, footings founded upon glacial till and bedrock bearing mediums should be provided a bedrock-to-soil bearing medium transition treatment as described herein.

Upper levels of the weathered and fractured shale bedrock can be designed using a factored bearing resistance value at Ultimate Limit States (ULS) of **1,500 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 an undisturbed, dense glacial till bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **300 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **500 kPa**, incorporating a geotechnical resistance factor of 0.5.

Footings placed on the existing and site-approved fill bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **80 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **120 kPa**, incorporating a geotechnical resistance factor of 0.5. All existing fill bearing surfaces should be proof-rolled at the time of construction. Proof-rolling of the existing fill should be reviewed at the time of construction by Paterson personnel.

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

Lean Concrete Filled Trenches

Where sound bedrock is encountered below the design underside of footing elevation for the high-rise buildings, consideration may be given to excavating vertical trenches to expose the underlying bedrock surface and backfilling with lean concrete (**17 MPa** 28-day compressive strength). Typically, the excavation sidewalls will be used as the form to support the concrete. 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 sound bedrock.

The effectiveness of this operation will depend on the ability of maintaining vertical trenches until the lean concrete can be poured. It is suggested that once the bottom of the excavation is exposed, an assessment should be completed to determine the water infiltration and stability of the excavation sidewalls extending to the bedrock surface.

The trench excavation should be at least 300 mm wider than all sides of the footing at the base of the excavation. The excavation should be relatively clean using the hydraulic shovel only (workers will not be permitted in the excavation below a 1.5 m depth). Once approved by the geotechnical engineer, lean concrete can be poured up to the proposed founding elevation.

Soil/Bedrock Transition

It is anticipated the majority of the footings supporting the low to mid-rise structures will be founded on glacial till or approved fill. However, where footings may be founded partly on bedrock and partly on soil, it is recommended to decrease the soil bearing resistance value by 25% for the footings placed on a soil bearing medium to reduce the potential for long-term total and differential settlements.

At the soil/bedrock transitions, it is recommended that a minimum depth of 300 mm of bedrock be removed from below the founding elevation for a minimum length of 2.0 m on the bedrock side. This area should be subsequently reinstated with an engineered fill, such as OPSS Granular A or OPSS Granular B Type II crushed stone and compacted to a minimum of 98% of the materials SPMDD.

Proof Rolling and Subgrade Improvement for Unsuitable Existing Fill

Where the existing fill is considered unsuitable due to high amounts of inorganic debris and/or provides an insufficient bearing pressure, the existing fill should removed and reinstated with a suitable engineered fill pad. Where required, it is recommended to sub-excavate the existing fill a minimum of 750 mm below USF as described herein.

The sub-excavation should extend a minimum of 500 mm beyond all faces of the affected footings, where required. The surface of the sub-excavation should be reviewed and approved by Paterson personnel and covered with a woven geotextile liner, such as Terrafix 200W, and further by a bi-axial geogrid layer, such as Terrafix TBX2500, once approved.

The geotextile and geogrid layers should be overlapped over the subgrade surface as specified by the manufacturer and reviewed and approved by Paterson prior to being covered with stone fill. The contractor should provide sufficient extensions of these layers to wrap the geotextile and geogrid layers around the stone layer.

The sub-excavated area should be backfilled to USF with granular fill, consisting of a Granular B Type II or Granular A crushed stone placed in maximum 300 mm loose lifts and compacted to 98% of its SPMDD. The geogrid and geotextile liners should be wrapped around the compacted granular fill with a minimum overlap of 500 mm along the top of stone layer as per manufacturer's recommendations.

Footings placed on the prepared subgrade improvement pads bearing upon an approved in-situ, compact glacial till or existing and approved fill bearing medium can be designed using bearing resistance value at SLS of **150 kPa** and ULS (factored) of **225 kPa**. Footings designed using the bearing resistance values provided herein will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

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 a sound bedrock bearing medium when a plane extending down and out from the bottom edge of the footing at a minimum of 1H:6V (or flatter) passes only through sound bedrock or a material of the same or higher capacity as the bedrock, such as concrete. A heavily fractured, weathered bedrock or soil bearing medium will require a lateral support zone of 1H:1V (or flatter).

Settlement

Footings placed on the glacial till deposit using the above-noted values at SLS will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively. Footings bearing on an acceptable bedrock bearing surface and designed using the bearing resistance values provided herein will be subjected to negligible potential post-construction total and differential settlements.

5.4 Design for Earthquakes

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 (OBC) 2012. The results of the shear wave velocity testing are attached to the present report.

Field Program

The seismic array location is presented on Drawing PG4915-1 - Test Hole Location Plan presented in Appendix 2. Paterson field personnel placed 18 horizontal geophones in a straight line in a roughly east-west orientation. The 4.5 Hz. horizontal geophones were mounted to the surface by means of a 75 mm ground spike attached to the geophone land case. The geophones were spaced at 2 m intervals and were 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 are also completed in forward and reverse directions (i.e.- striking both sides of the I-Beam seated parallel to the geophone array). The shot locations are located at the centre of the geophone array and 3, 4.5 and 15 m away from the first geophone and last geophones.

Data Processing and Interpretation

Interpretation of the shear wave velocity results was completed by Paterson personnel. Shear wave velocity measurement was made using reflection/refraction methods. The interpretation is repeated at each shot location to provide an average shear wave velocity, Vs_{30}, of the upper 30 m profile immediately below the proposed building foundations. 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 shear wave velocity due to the increasing quality of bedrock with depth. It should be noted that as bedrock quality increases, the bedrock shear wave velocity also increases.

Based on our testing results, the average overburden shear wave velocity is **240 m/s**, while the bedrock shear wave velocity is **2,782 m/s**. Provided the building will be founded partly directly and partly indirectly on the bedrock surface, the overburden shear wave velocity does not need to be considered for the calculation of Vs_{30}.

Foundations on Weathered and Sound Bedrock

The Vs_{30} was calculated using the standard equation for average shear wave velocity provided in the OBC 2012 and as presented below:

$$V_{s30} = \frac{Depth_{OfInterest}(m)}{\left(\frac{(Depth_{Layer1}(m)}{Vs_{Layer1}(m/s)} + \frac{Depth_{Layer2}(m)}{Vs_{Layer2}(m/s)}\right)}$$

$$V_{s30} = \frac{30m}{\left(\frac{30m}{2{,}782m/s}\right)}$$

$$V_{s30} = 2{,}782m/s$$

Based on the results of the shear wave velocity testing, the average shear wave velocity, Vs_{30}, for the proposed high-rise buildings is **2,782 m/s** provided the footings are placed directly on bedrock surface and/or extended to an approved sound bedrock bearing surface by means of near vertical, zero entry lean concrete in-filled trenches. Therefore, a **Site Class A** is applicable for the proposed high-rise buildings, as per Table 4.1.8.4.A of the OBC 2012. The soils underlying the subject site are not susceptible to liquefaction.

Foundations on Overburden

Based on our review, it is understood the finished floor elevation throughout the basement level is approximately 53.74 m. Further ,the lowest elevation the bedrock surface was encountered throughout the proposed building footprints was at a geodetic elevation of 49.96 m. It is anticipated footings will be generally founded at geodetic elevations ranging between 53.00 and 52.5, depending on their individual sizes. Given this, it is expected up to 3.0 m of overburden may be present between USF and the bedrock surface. The Vs_{30} was calculated considering the above-noted methodology and using the standard equation for average shear wave velocity provided in the OBC 2012 and as presented below:

$$V_{s30} = \frac{Depth_{OfInterest}(m)}{\left(\frac{(Depth_{Layer1}(m)}{Vs_{Layer1}(m/s)} + \frac{Depth_{Layer2}(m)}{Vs_{Layer2}(m/s)}\right)}$$

$$V_{s30} = \frac{30m}{\left(\frac{3m}{240m/s} + \frac{27m}{2{,}782\,m/s}\right)}$$

$$V_{s30} = 1{,}351 m/s$$

Based on the results of the shear wave velocity testing, the average shear wave velocity, Vs_{30}, for the proposed buildings beyond the high-rise buildings is **1,351 m/s**. Therefore, a **Site Class B** is applicable for the proposed podium buildings and parking structures, 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 within the footprint of the proposed building, the in-situ soil and/or bedrock surfaces will be considered an acceptable subgrade upon which to commence backfilling for basement slab construction.

The recommended pavement structures noted in Subsection 5.7 will be applicable for the founding level of the proposed parking garage structure. 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 consists of 19 mm clear crushed stone.

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

A sub-slab drainage system consisting of lines of perforated drainage pipes should be connected to a sump pump located within the lowest basement level. The spacing and layout of the sub-slab drainage system should be provided by the geotechnical consultant once the foundation layout has been finalized.

The spacing may be subject to change based on groundwater conditions encountered at the time of construction and as reviewed by the geotechnical consultant.

5.6 Basement Wall

It is expected that the basement walls are to be poured against a waterproofing and/or drainage system, which will be placed against the shoring face and exposed bedrock face, where encountered. Below the bedrock surface, a nominal coefficient for at-rest earth pressure of 0.05 is recommended in conjunction with a bulk unit weight of 24.5 kN/m^3 (effective 15.5 kN/m^3). A seismic earth pressure component will not be applicable for the foundation wall, which is to be 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.

Where soil is to be retained, 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 bulk (drained) unit weight of 20 kN/m^3. Undrained conditions are anticipated (i.e. below the groundwater level). Therefore, the applicable effective (undrained) unit weight of the retained soil can be taken as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight.

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 0.32g 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.

Design Parameters

According to the latest version of the Canadian Foundation Manual, a load resistance factored design (LRFD) should be implemented. As such, the coefficient of friction factor for concrete on bedrock bearing surface can be taken as 0.7. A sliding resistance factor of 0.8 should be utilized as per the Canadian Foundation Manual.

5.7 Rock Anchor Design

The geotechnical design of grouted rock anchors in sedimentary bedrock is based upon two possible failure modes. The anchor can fail either by shear failure along the grout/rock interface or by pullout from a 60 to 90 degree cone with the apex near the middle of the anchor bonded length. Interaction may develop between the failure cones of adjacent anchors resulting in a total group capacity less than the sum of the individual anchor load capacity.

A third failure mode of shear failure along the grout/steel interface should also be reviewed by a qualified structural engineer to ensure all typical failure modes have been reviewed. Typical rock anchor suppliers, such as Dywidag Systems International (DSI Canada), have qualified personnel on staff to recommend appropriate rock anchor size and materials.

Centre-to-centre spacing between anchors should be at least four times the anchor hole diameter and greater than 1/5 of the total anchor length (minimum of 1.2 m) to lower the group influence effects. Anchors in close proximity to each other are recommended to be grouted at the same time to ensure any fractures or voids are completely in-filled and grout does not flow from one hole to an adjacent empty one.

Regardless of whether an anchor is of the passive or post tensioned type, the anchor is recommended to be provided with a fixed length at the anchor base, which will provide the anchor capacity, and a free length between the rock surface and the bonded length. As the depth at which the apex of the shear failure cone develops midway along the bonded length, a fully bonded anchor has a much shallower cone, and therefore less geotechnical resistance, than one where the bonded length is at the bottom portion of the anchor.

Permanent anchors should be provided with corrosion protection. As a minimum, this requires that the entire drill hole be filled with cementitious grout. The free anchor length is provided by installing a sleeve to act as a bond break, with the sleeve filled with grout. Double corrosion protection can be provided with factory assembled systems, such as those available from Dywidag Systems International or Williams Form Engineering Corp. Recognizing the importance of the anchors for the long term performance of the foundation of the proposed buildings, the rock anchors for this project are recommended to be provided with double corrosion protection.

Grout to Rock Bond

The unconfined compressive strength of shale bedrock ranges between 40 and 90 MPa, which is stronger than most routine grouts. A factored tensile grout to rock bond resistance value at ULS of **1.0 MPa**, incorporating a resistance factor of 0.3, can be used. A minimum grout strength of 40 MPa is recommended.

Rock Cone Uplift

As discussed previously, the geotechnical capacity of the rock anchors depends on the dimensions of the rock anchors and the configuration of the anchorage system. A **Rock Mass Rating (RMR) of 44** was assigned to the bedrock, and Hoek and Brown parameters (**m and s**) were taken as **0.183 and 0.00009**, respectively. For design purposes, all rock anchors were assumed to be placed at least 1.2 m apart to reduce group anchor effects.

Recommended Rock Anchor Lengths

Rock anchor lengths can be designed based on the required loads. Rock anchor lengths for some typical loads have been calculated and are presented on the following page. Load specified rock anchor lengths can be provided, if required.

For our calculations the following parameters were used.

Table 2 - Parameters Used in Rock Anchor Review

Grout to Rock Bond Strength - Factored at ULS	1.0 MPa
Compressive Strength - Grout	40 MPa
Rock Mass Rating (RMR) - Fair Quality Shale Hoek and Brown parameters	44 m=0.183 and s=0.00009
Unconfined compressive strength - Shale bedrock	40 MPa
Unit weight - Submerged Bedrock	15 kN/m^3
Apex angle of failure cone	60^o
Apex of failure cone	mid-point of fixed anchor length

From a geotechnical perspective, the fixed anchor length will depend on the diameter of the drill holes. Recommended anchor lengths for a 75 and 125 mm diameter hole are provided in Table 3.

Table 3 - Recommended Rock Anchor Lengths - Grouted Rock Anchor				
Diameter of Drill Hole (mm)	Anchor Lengths (m)			Factored Tensile Resistance (kN)
	Bonded Length	Unbonded Length	Total Length	
75	3.0	1.5	4.5	250
	4.2	2.2	6.4	500
	6.5	2.6	9.1	1000
	10	3.5	13.5	2000
125	2.8	1.5	4.3	250
	3.5	2.4	5.9	500
	5.5	2.8	8.3	1000
	8	3.8	11.8	2000

The anchor drill holes should be within 1.5 to 2 times the rock anchor tendon diameter, inspected by geotechnical personnel and flushed clean with water prior to grouting. A tremie tube is recommended to place grout from the bottom of the anchor holes. Compressive strength testing is recommended to be completed for the rock anchor grout. A set of grout cubes should be tested for each day that grout is prepared.

The geotechnical capacity of each rock anchor should be proof tested at the time of construction. More information on testing can be provided upon request. Compressive strength testing is recommended to be completed for the rock anchor grout. A set of grout cubes should be tested for each day grout is prepared.

5.8 Pavement Structure

The recommended pavement structures for the subject site are shown in Tables 4, 5 and 6.

Table 4 - Recommended Pavement Structure - Car Only Parking Areas	
Thickness (mm)	**Material Description**
50	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - In situ soil, or OPSS Granular B Type I or II material placed over in situ soil or bedrock.	

Table 5 - Recommended Pavement Structure Access Lanes and Heavy Truck Parking Areas	
Thickness (mm)	**Material Description**
40	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course -** HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - In situ soil, or OPSS Granular B Type I or II material placed over in situ soil or bedrock.	

Table 6 - Recommended Rigid Pavement Structure - Lower Parking Level	
Thickness (mm)	**Material Description**
125	**32 MPa Concrete**
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 or bedrock.	

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be sub-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 100% of the SPMDD with suitable vibratory equipment.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It's recommended that a perimeter foundation drainage system be provided for the proposed structure. It's expected that insufficient room will available for exterior backfill and the foundation wall will bast as a blind-sided pour against a shoring system. It is recommended that the drainage system consist of the following:

- A composite drainage membrane (DeltaDrain 6000, MiraDrain G100N or equivalent) should be placed against the shoring system and bedrock excavation face from the finished ground surface to the top of the footing.

- It is recommended that 150 mm diameter sleeves at 3 m centres be cast in the footing or at the foundation wall/footing interface to allow the infiltration of water to flow to the interior perimeter drainage pipe. The sleeves should be connected to openings in the HDPE face of the drainage board layer. The perimeter drainage pipe and underfloor drainage system should direct water to sump pit(s) within the lower basement area.

Water Infiltration Volumes

Based on the above-noted methodology, water carried by the foundation and underfloor drainage system will generally consist of surface water and will not consist of groundwater/long-term dewatering of the groundwater table. Water managed by this system will be directed to the appropriate building sump pit.

It is expected that the successful implementation of this system throughout the subject site will result in a long-term infiltration rate of less than 30,000 L/day of surface water. Peak periods of infiltration (i.e.- short-term conditions) should be anticipated during heavy rainfall and snow-melt events.

Underfloor Drainage

For design purposes, it is recommended the underfloor drainage system consist of 150 mm diameter perforate pipes surrounded by a geosock and a 150 mm thick layer of 19 mm clear crushed stone on all of its sides. Several north-south and east-west lines of pipes will be placed throughout the basement level, and as directed by the geotechnical consultant, to direct water from the foundation drainage and perimeter subdrain systems to the sump pump system. The final spacing of the underfloor drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Foundation Backfill

For areas where sufficient space is available for backfill against the exterior sides of the foundation walls, the backfill material should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, such as Miradrain G100N or Delta Drain 6000, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum of 1.5 m thick soil cover (or equivalent) should be provided in this regard.

Exterior unheated footings, such as those for isolated exterior 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 a combination of soil cover and foundation insulation.

The underground parking area should not require protection against frost action due to the founding depth. Unheated structures, such as the access ramp wall footings, may be required to be insulated against the deleterious effect of frost action. A minimum of 2.1 m of soil cover alone, or a minimum of 0.6 m of soil cover, in conjunction with foundation insulation, should be provided.

6.3 Excavation Side Slopes

Unsupported Excavations

The side slopes of excavations in the soil and fill overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that insufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsurface soil is considered to be mainly 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.

Excavation side slopes around the building excavation should be protected from erosion by surface water and rainfall events by the use of secured tarpaulins or other approved erosion protection spanning the length of the side slopes. Efforts should also be made to maintain dry surfaces at the bottom of excavation side slopes within the overburden. Additional measures may be recommended at the time of construction by the geotechnical consultant.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

In sound bedrock, almost vertical side slopes can be constructed, provided all weathered and loose rock is removed or stabilized with rock anchors. A minimum 1 m horizontal ledge should remain between the unsupported excavation and sound bedrock surface. Where sufficient space for the horizontal ledge is not available, it is recommended that a temporary concrete block retaining wall be used to retain the overburden soils.

Where the vertical sides are constructed within sound bedrock, bedrock stabilization may be required. Specifically, horizontal anchors maybe required at specific location to prevent pop-outs of the bedrock, especially in areas where bedrock fractures and weak bedding planes are conductive to the failure of the bedrock surface.

The requirement for horizontal rock anchors should be evaluated by Paterson during the excavation operations and should be discussed with the structural engineer during the design stage.

Temporary Shoring

Temporary shoring will be required to support the overburden soils. The design and implementation of these temporary systems will be the responsibility of the excavation contractor or the shoring contractor and their design team. Inspections and approval of the temporary system will also be the responsibility of the designer. Geotechnical information provided below is to assist the designer in completing a suitable and safe shoring system. The designer should take into account the potential for a fully saturated condition following a significant precipitation event. Any changes to the approved shoring design system should be reported immediately to the owner's representative prior to implementation.

Temporary shoring may be required to complete the required excavations where insufficient room is available for open cut methods. The shoring requirements will depend on the depth of the excavation, the proximity of the adjacent buildings and underground structures and the elevation of the adjacent building foundations and underground services. Additional information can be provided when the above details are known.

For design purposes, the temporary system may consist of soldier pile and lagging system or interlocking steel sheet piling. Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be added to the earth pressures described below. These systems can be cantilevered, anchored or braced. The earth pressures acting on the shoring system may be calculated using the following parameters.

Table 7 - Soil Parameters for Shoring System Design	
Parameters	**Values**
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	20
Submerged Unit Weight (γ), kN/m^3	13

Generally, it is expected that the shoring systems will be provided with tie-back rock anchors to ensure their stability. It is further recommended that the toe of the shoring be adequately supported to resist toe failure.

The geotechnical design of grouted rock anchors in sedimentary bedrock is based upon two possible failure modes. The anchor can fail either by shear failure along the grout/rock interface or by pullout of a 60 to 90 degree cone of rock with the apex of the cone near the middle of the bonded length of the anchor.

The anchor derives its capacity from the bonded portion, or fixed anchor length, at the base of the anchor. An unbonded portion, or free anchor length, is also usually provided between the rock surface and the start of the bonded length. A factored tensile grout to rock bond resistance value at ULS of **1.0 MPa**, incorporating a resistance factor of 0.3, can be used. A minimum grout strength of 40 MPa is recommended. Further, the bonded portion of the rock anchor should be fully extended below the sound bedrock surface.

It is recommended that the anchor drill hole diameter be within 1.5 to 2 times the rock anchor tendon diameter and the anchor drill holes be inspected by geotechnical personnel and should be flushed clean prior to grouting. The use of a grout tube to place grout from the bottom up in the anchor holes is further recommended.

The geotechnical capacity of each rock anchor should be proof tested at the time of construction. More information on testing can be provided upon request. Compressive strength testing is recommended to be completed for the rock anchor grout. A set of grout cubes should be tested for each day grout is prepared.

Soldier Pile and Lagging System

The active earth pressure acting on a soldier pile and lagging shoring system can be calculated using a rectangular earth pressure distribution with a maximum pressure of 0.65 K γ H for strutted or anchored shoring or a triangular earth pressure distribution with a maximum value of K γ H for a cantilever shoring system. H is the height of the excavation. The active earth pressure should be used where wall movements are permissible while the at-rest pressure should be used if no movement is permissible.

The total unit weight should be used above the groundwater level while the submerged unit weight should be used below the groundwater level.

The hydrostatic groundwater pressure should be added to the earth pressure distribution wherever the submerged unit weights are used for earth pressure calculations should the level on the groundwater not be lowered below the bottom of the excavation. If the groundwater level is lowered, the total unit weight for the soil should be used full weight, with no hydrostatic groundwater pressure component.

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.

At least 150 mm of OPSS Granular A should be used for bedding for sewer and water pipes when placed on soil subgrade. The bedding should be increased to a minimum thickness of 300 mm where located over a bedrock subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe should consist of OPSS Granular A. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to a minimum of 99% of the material's 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) should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

6.5 Groundwater Control

Groundwater Control for Building Construction

It is anticipated that groundwater infiltration into the excavations should be low through the sides of the excavation and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. 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) Category 3 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, 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.

Long-Term Groundwater Control

Since the structure will be founded above the long-term groundwater table, the drainage system will not impact the long-term groundwater table.

Impacts on Neighboring Structures

Based on our observations, a local groundwater lowering is anticipated under short-term conditions due to construction of the proposed building. The neighboring structures are expected to be founded within the glacial till deposit and/or over a bedrock bearing surface. No issues are expected with respect to groundwater lowering that would cause long term damage to adjacent structures surrounding the proposed building. It should be noted that the extent of any significant groundwater lowering will take place within a limited range of the subject site due to the low permeability of the native soils.

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.

Where excavations are completed in proximity of existing structures which may be adversely affected due to the freezing conditions. In particular, where a shoring system is constructed, the soil behind the shoring system will be subjected to freezing conditions and could result in heaving of the structure(s) placed within or above frozen soil. Provisions should be made in the contract document to protect the walls of the excavations from freezing, if applicable.

7.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

- ❏ Review of the geotechnical aspects of the excavating contractor's shoring design and bedrock excavation face protection system, prior to construction.
- ❏ Review proposed foundation drainage design and requirements, including the implementation of the system and associated underfloor drainage system.
- ❏ Review of structural drawings from a geotechnical perspective.
- ❏ 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.
- ❏ Field density tests to determine the level of compaction achieved.

A report confirming the work has been conducted in general accordance with the recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations provided in this report are preliminary in nature and are in accordance with our present understanding of the project. We request permission to review our recommendations when the drawings and specifications are completed.

A geotechnical investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we request immediate notification 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 its 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 Main and Main Developments Inc. 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.

Drew Petahtegoose, B.Eng.

David J. Gilbert, P.Eng.

Report Distribution

- ❑ Main and Main Developments Inc. (1 digital copy)
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APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

TEST HOLE LOGS BY OTHERS

SYMBOLS AND TERMS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. BH 1-22

BORINGS BY CME 55 Power Auger **DATE** February 3, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	57.06
Concrete slab 0.15							
FILL: Crushed stone 0.30		SS	1	66			
FILL: Brown silty sand, trace gravel		SS	2	49		1	56.06
1.52		SS	3	88			
		SS	4	90		2	55.06
GLACIAL TILL: Brown silty clay, some sand, gravel, trace cobbles and boulders		SS	5	80			
		SS	6	43		3	54.06
		SS	7	0			
		SS	8	40		4	53.06
4.90							
		RC	1	68	0	5	52.06
Weathered shale **BEDROCK**		RC	2	71	0	6	51.06
7.50						7	50.06
		RC	3	76	10		
BEDROCK: Poor quality, grey limestone with interbedded shale						8	49.06
		RC	4	89	37		
9.14		RC	5	95	29	9	48.06
End of Borehole							
(GWL @ 7.00m - March 2, 2022)							

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. BH 2-22

BORINGS BY CME 55 Power Auger **DATE** February 4, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	57.05
Concrete slab 0.21		G	1				
FILL: Crushed stone 0.34		SS	2	81			
FILL: Brown silty sand, some gravel		SS	3	71		1	56.05
1.52		SS	4	74		2	55.05
		SS	5	100			
		SS	6	85		3	54.05
GLACIAL TILL: Brown silty clay, some sand, gravel, trace cobbles and boulders		SS	7	0			
		SS	8	0		4	53.05
		SS	9	0			
5.97						5	52.05
Weathered shale **BEDROCK**		RC	1	68	0	6	51.05
6.70		RC	2	89	0		
		RC	3	100	100	7	50.05
BEDROCK: Poor to good quality, grey limestone with interbedded shale		RC	4	82	51	8	49.05
		RC	5	87	18	9	48.05
9.35							
End of Borehole							
(GWL @ 7.01m - March 2, 2022)							

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. BH 3-22

BORINGS BY CME 55 Power Auger **DATE** February 16, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.02
Asphaltic concrete 0.05		AU	1				
FILL: Brown silty sand, some gravel 0.76							
FILL: Brown silty sand, some clay, trace gravel		SS	2	100	43	1	55.02
		SS	3	63	15	2	54.02
2.29							
GLACIAL TILL: Dense, brown silty clay, some rock fragments, gravel, trace cobbles and boulders		SS	4	71	33	3	53.02
		SS	5	75	37		
		SS	6	54	35	4	52.02
4.57							
Weathered shale **BEDROCK**		SS	7	75	50+	5	51.02
		SS	8	63	50+		
6.40		SS	9	75	50+	6	50.02
		RC	1	50	0	7	49.02
BEDROCK: Poor to fair quality, grey limestone with interbedded shale						8	48.02
		RC	2	100	70		
- mud seam at 9.1m depth						9	47.02
9.50		RC	3	100	66		
End of Borehole							
(GWL @ 6.02m - March 2, 2022)							

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. BH 4-22

BORINGS BY CME 55 Power Auger **DATE** February 15, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.21
Asphalt 0.05		AU	1				
FILL: Brown silty sand, some gravel 0.76							
FILL: Brown silty sand, some clay, trace gravel 1.52		SS	2	79	14	1	55.21
		SS	3	71	20	2	54.21
GLACIAL TILL: Compact to very dense, brown silty clay, some rock fragments, gravel, trace cobbles and boulders		SS	4	67	79		
		SS	5	100	50+	3	53.21
3.81		SS	6	100	50+	4	52.21
Weathered shale **BEDROCK**		SS	7	88	50+	5	51.21
		SS	8	50	50+		
6.07						6	50.21
		RC	1	93	47	7	49.21
BEDROCK: Poor to excellent quality, grey limestone with interbedded shale							
		RC	2	100	100	8	48.21
8.92							
End of Borehole							
(GWL @ 6.21m - March 2, 2022)							

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. BH 5-22

BORINGS BY CME 55 Power Auger **DATE** February 17, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.05		AU	1			0	56.33
		SS	2	100	72	1	55.33
FILL: Brown silty sand, some gravel, trace clay		SS	3	75	53	2	54.33
		SS	4	71	84	3	53.33
3.05							
GLACIAL TILL: Very dense to compact, brown silty clay with rock fragments, gravel, trace cobbles and boulders		SS	5	100	63	4	52.33
		SS	6	83	41	5	51.33
		SS	7	83	26		
5.33							
Weathered shale **BEDROCK**		SS	8	60	18	6	50.33
		RC	1	66	0		
6.65		SS	9	67	23		
		RC	2	95	93	7	49.33
BEDROCK: Excellent quality, grey limestone with interbedded shale						8	48.33
		RC	3	95	95	9	47.33
9.27							
End of Borehole							
(GWL @ 6.28m - March 2, 2022)							

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

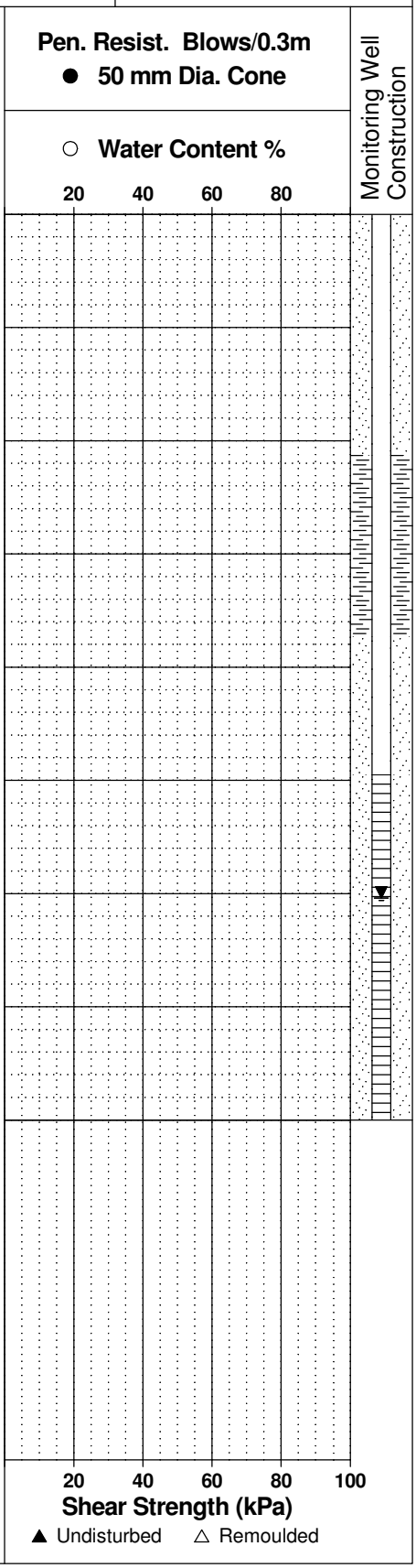
FILE NO. PG4915

REMARKS

HOLE NO. BH 6-22

BORINGS BY CME 55 Power Auger **DATE** February 17, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	55.99
Asphaltic concrete 0.05		AU	1				
FILL: Brown silty clay, some gravel 0.76		SS	2	83	59	1	54.99
GLACIAL TILL: Very dense to dense, brown silty clay, some rock fragments, gravel, trace cobbles and boulders		SS	3	75	29	2	53.99
		SS	4	79	39		
3.05						3	52.99
Weathered shale **BEDROCK**		SS	5	71	85		
		SS	6	75	50+	4	51.99
4.78						5	50.99
BEDROCK: Fair to good quality, grey shale		RC	1	100	0	6	49.99
		RC	2	100	41	7	48.99
8.00		RC	3	100	82	8	47.99
End of Borehole							
(GWL @ 6.04m - March 2, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

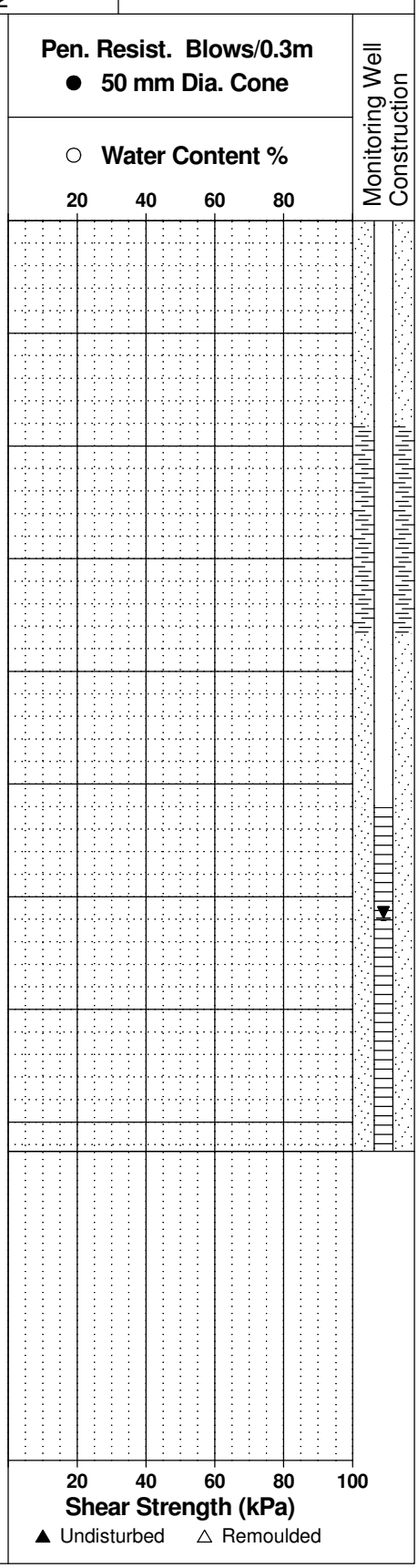
FILE NO. PG4915

REMARKS

HOLE NO. BH 7-22

BORINGS BY CME 55 Power Auger **DATE** February 18, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.05		AU	1			0	56.18
FILL: Brown silty sand, some gravel, trace clay		SS	2	79	35	1	55.18
		SS	3	83	32	2	54.18
2.29							
GLACIAL TILL: Very dense, brown silty clay, some rock fragments, gravel, trace cobbles and boulders		SS	4	0	50+	3	53.18
3.05		SS	5	100	50+		
Weathered shale **BEDROCK**		RC	1	84	0	4	52.18
4.42							
		RC	2	88	30	5	51.18
BEDROCK: Poor to good quality, grey limestone						6	50.18
		RC	3	80	38	7	49.18
		RC	4	100	100	8	48.18
8.26							
End of Borehole							
(GWL @ 6.19m - March 2, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

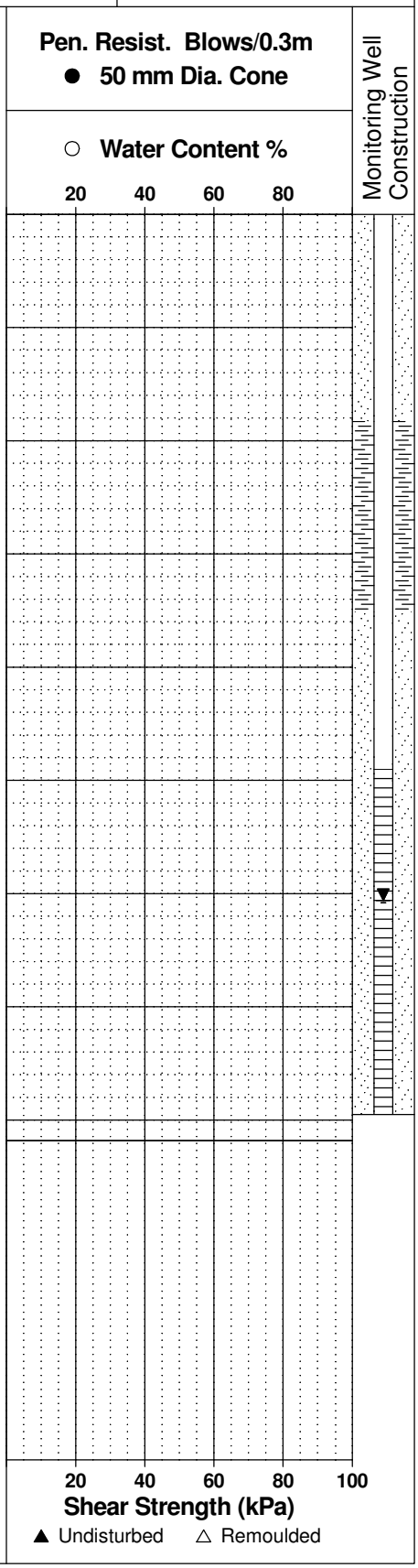
FILE NO. PG4915

REMARKS

HOLE NO. BH 8-22

BORINGS BY CME 55 Power Auger **DATE** February 18, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.04
Asphaltic concrete 0.05		AU	1				
FILL: Brown silty sand, some gravel, trace clay		SS	2	88	24	1	55.04
		SS	3	83	14	2	54.04
2.29							
Weathered shale **BEDROCK**		SS	4	58	50+		
		SS	5	0	50+	3	53.04
		RC	1	76	0	4	52.04
4.32							
BEDROCK: Poor to good quality, grey shale		RC	2	41	0	5	51.04
						6	50.04
		RC	3	98	60	7	49.04
		RC	4	100	100	8	48.04
8.18							
End of Borehole							
(GWL @ 6.06m - March 2, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. BH 1-21

BORINGS BY CME-55 Low Clearance Drill **DATE** 2021 December 20

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									
Asphalt 0.08		AU	1			0	57.49		
FILL: Brown silty sand with topsoil 0.30									
FILL: Brown silty clay with sand, trace bricks and debris		SS	2	33	19	1	56.49		
		SS	3	42	11	2	55.49		
2.44		SS	4	63	50+				
GLACIAL TILL: Very dense brown sandy silt with rock fragments, gravel, trace cobbles and boulders		SS	5	67	50+	3	54.49		
		SS	6	75	50+	4	53.49		
		SS	7	88	46	5	52.49		
5.18									
Weathered shale **BEDROCK**		SS	8	29	50+	6	51.49		
		SS	9	33	50+				
7.01		SS	10	0	50+	7	50.49		
BEDROCK: Poor to good quality grey shale with limestone		RC	1	48	40				
		RC	2	92	79	8	49.49		
		RC	3	100	100	9	48.49		
		RC	4	100	83	10	47.49		
- Mud seam present at 11.02 m depth		RC	5	69	0				
		RC	6	100	77	11	46.49		
11.28									
End of Borehole									
(GWL at 7.45 m depth - Jan 6, 2022)									

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

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FILE NO. PG4915

REMARKS

HOLE NO. BH 2-21

BORINGS BY CME-55 Low Clearance Drill **DATE** 2021 December 20

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	57.30
TOPSOIL 0.05		AU	1				
FILL: Brown silty sand with gravel, trace topsoil 0.10						1	56.30
FILL: Brown silty sand some gravel		SS	2	38	6		
		SS	3	75	4	2	55.30
		SS	4	54	6		
3.20						3	54.30
Weathered Shale **BEDROCK**		SS	5	33	17		
		SS	6	33	26	4	53.30
4.88		SS	7	13	50+		
BEDROCK: Poor quality black to grey shale with limestone		SS	8	13	50+	5	52.30
		RC	1	85	33	6	51.30
		RC	2	100	30	7	50.30
		RC	3	100	32	8	49.30
- Good Quality by 8.45 m depth		RC	4	100	81	9	48.30
		RC	5	100	85	10	47.30
- Mud seam present at 11.07 m depth		RC	6	75	78	11	46.30
11.30							
End of Borehole							
(GWL at 7.24 m depth - Jan 6, 2022)							

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

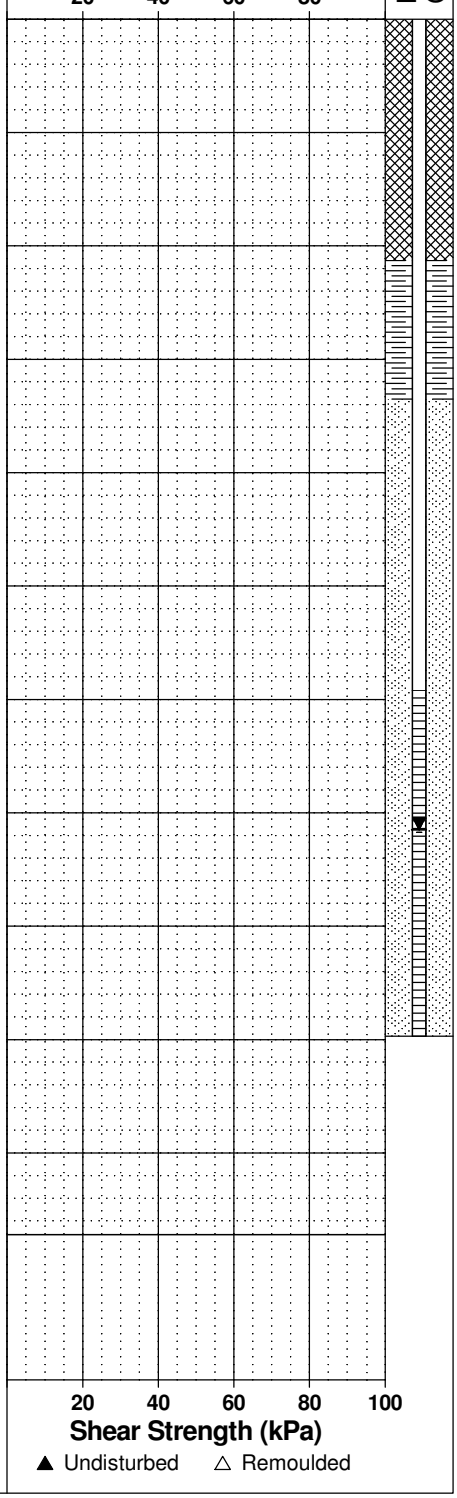
REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** 2021 December 21

FILE NO. PG4915

HOLE NO. BH 3-21

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 %	Monitoring Well Construction
GROUND SURFACE						0	57.19		
TOPSOIL 0.05		AU	1						
FILL: Brown silty sand with gravel and topsoil 0.10		AU	2						
0.41									
FILL: Brown silty sand		SS	3	58	20	1	56.19		
Compact brown **SILTY SAND** with clay, gravel, trace rock fragments									
1.98		SS	4	63	19	2	55.19		
Weathered shale **BEDROCK**		SS	5	100	34				
		SS	6	70	50+	3	54.19		
3.66									
BEDROCK: Poor to fair quality black shale with limstone		RC	1	0	0	4	53.19		
		RC	2	56	0	5	52.19		
		RC	3	84	27	6	51.19		
		RC	4	100	57	7	50.19		
		RC	5	100	0	8	49.19		
- Excellent Quality limestone with interbedded shale by 8.28 m depth		RC	6	75	100	9	48.19		
		RC	7	83	56	10	47.19		
10.72									
End of Borehole									
(GWL at 7.15 m depth - Jan 6, 2022)									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

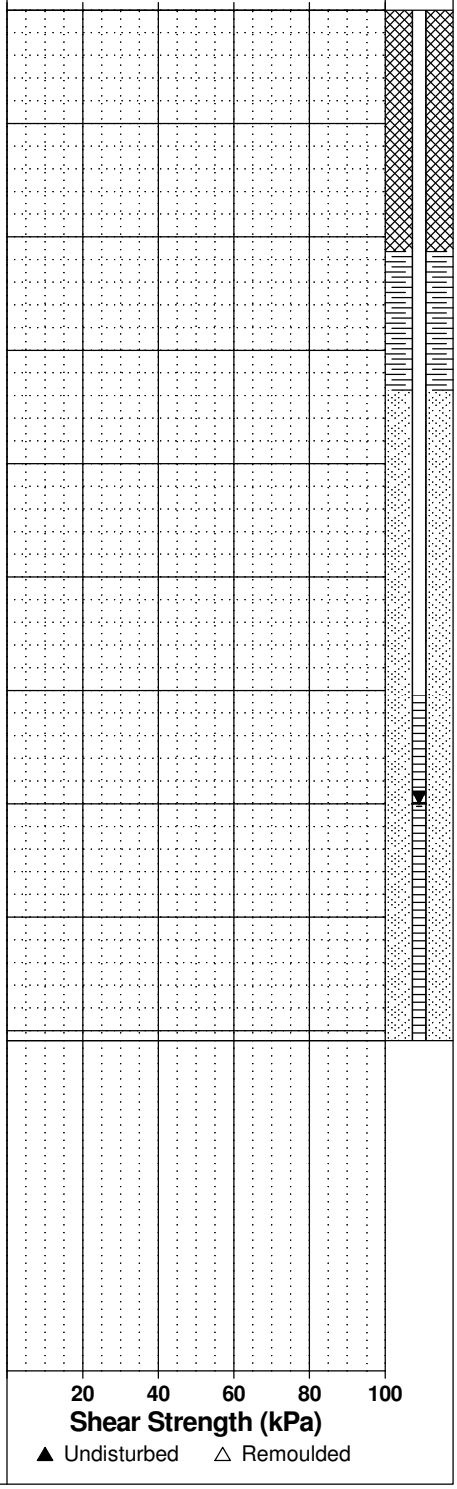
HOLE NO. BH 4-21

BORINGS BY CME-55 Low Clearance Drill **DATE** 2021 December 21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	57.02
FILL: Brown silty sand with gravel, trace topsoil		AU	1				
0.13		AU	2				
FILL: Brown silty sand some gravel, trace clay		SS	3	54	13	1	56.02
1.68							
FILL: Brown silty clay with rock fragments, trace sand		SS	4	79	26	2	55.02
2.44		SS	5	67	42		
Weathered shale **BEDROCK**						3	54.02
		SS	6	75	50+		
		SS	7	38	50+	4	53.02
4.65		SS	8	100	50+		
BEDROCK: Poor to fair quality black shale		RC	1	87	29	5	52.02
						6	51.02
		RC	2	100	35	7	50.02
		RC	3	100	57	8	49.02
		RC	4	46	69		
9.09						9	48.02
End of Borehole							
(GWL at 7.00 m depth - Jan 6, 2022)							

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

Monitoring Well Construction



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

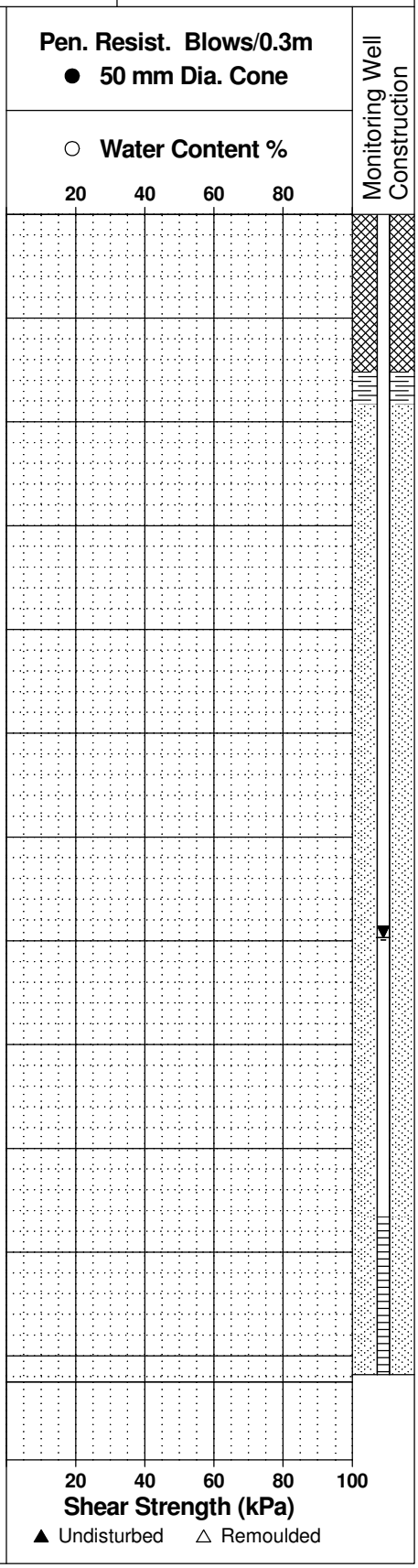
FILE NO. PG4915

REMARKS

HOLE NO. BH 5-21

BORINGS BY CME-55 Low Clearance Drill **DATE** 2021 December 21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.94
TOPSOIL with brown silty sand, gravel and organics 0.30		AU	1				
FILL: Brown silty sand, some gravel, trace rock fragments, clay and cobbles		SS	2	21	5	1	55.94
		SS	3	17	6	2	54.94
2.44		SS	4	33	50+		
Weathered shale **BEDROCK**		SS	5	13	50+	3	53.94
		SS	6	8	50+	4	52.94
4.57							
BEDROCK: Fair to poor quality black shale with limestone		RC	1	93	50	5	51.94
		RC	2	86	28	6	50.94
		RC	3	78	0	7	49.94
- Fair quality by 7.5 m depth						8	48.94
		RC	4	97	67		
- Good to excellent quality by 9.1 m depth						9	47.94
		RC	5	100	100	10	46.94
		RC	6	100	62	11	45.94
11.25							
End of Borehole							
(GWL at 6.97 m depth - Jan 6, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

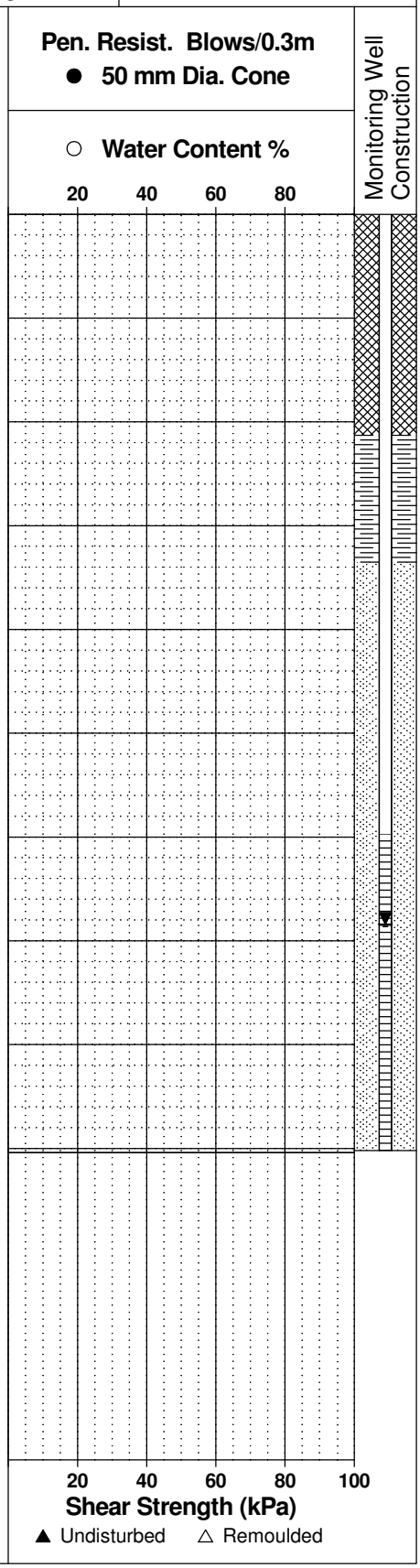
FILE NO. PG4915

REMARKS

HOLE NO. BH 6-21

BORINGS BY CME-55 Low Clearance Drill **DATE** 2021 December 23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.82
TOPSOIL with brown silty sand, gravel and organics 0.30		AU	1				
FILL: Brown silty clay with sand, trace garvel and brick fragments		SS	2	83	17	1	55.82
		SS	3	13	22	2	54.82
		SS	4	42	11	3	53.82
3.35		SS	5	42	29		
Weathered shale **BEDROCK**		SS	6	25	50+	4	52.82
4.95		SS	7	33	50+	5	51.82
BEDROCK Poor to good quality black shale with interbedded limestone		RC	1	96	51	6	50.82
		RC	2	89	27	7	49.82
		RC	3	100	87	8	48.82
9.04						9	47.82
End of Borehole							
(GWL at 6.84 m depth - Jan 6, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

REMARKS

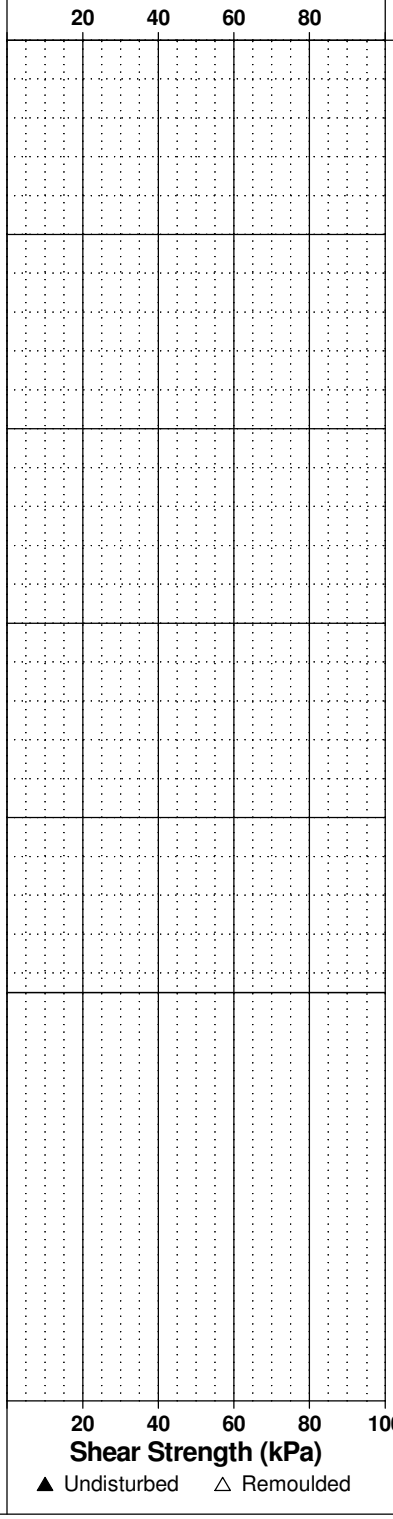
BORINGS BY Excavator **DATE** 2021 December 20

FILE NO. PG4915

HOLE NO. TP 1-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.16
Asphalt 0.07							
FILL: Brown silty sand with crushed stone 0.40		G	1				
FILL: Brown silty sand, some concrete, crushed stone, brick and metal fragments		G	2			1	55.16
1.40							
GLACIAL TILL: Brown silty sand some rock fragments, gravel, trace cobbles		G	3			2	54.16
2.55							
Weathered shale **BEDROCK**		G	4			3	53.16
3.95							
Poor quality shale **BEDROCk**		G	5			4	52.16
4.90							
End of Test Pit Refusal to excavation on bedrock surface 4.9 m depth							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



Piezometer Construction

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SOIL PROFILE AND TEST DATA

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Proposed High-Rise Complex
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FILE NO. PG4915

REMARKS

HOLE NO. TP 2-21

BORINGS BY Excavator **DATE** 2021 December 20

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 %	Piezometer Construction
GROUND SURFACE									
Asphalt 0.08						0	56.27		
FILL: Brown silty sand with crushed stone 0.40		G	1						
FILL: Brown silty sand some gravel, crushed stone, metal fragments, brick fragments, and glass 0.95		G	2						
FILL: Brown silty clay to clayey silt trace sand and cobbles 1.25		G	3			1	55.27		
Brown **SILTY SAND** to **SANDY SILT** trace gravel, and clay 1.80		G	4						
GLACIAL TILL: Brown silty sand, trace gravel, rock fragments, cobbles and boulders		G	5			2	54.27		
		G	6						
		G	7			3	53.27		
3.50 End of Test Pit									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

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REMARKS

HOLE NO. TP 3-21

BORINGS BY Excavator **DATE** 2021 December 20

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 %	Piezometer Construction
GROUND SURFACE									
Asphalt 0.08						0	56.63		
FILL: Brown silty sand, some brick fragments, gravel, cobbles, crushed stone, metal and plastic debris		G	1						
		G	2			1	55.63		
2.20						2	54.63		
Brown **SILTY SAND** with rock fragments		G	3						
		G	4			3	53.63		
		G	5			4	52.63		
4.40									
Weathered shale **BEDROCK**									
4.90		G	6			5	51.63		
Poor quality shale **BEDROCK**									
5.25									
End of Test Pit									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. TP 4-21

BORINGS BY Excavator **DATE** 2021 December 20

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 %	Piezometer Construction
GROUND SURFACE									
FILL: Brown silty sand with gravel and organics 0.15		G	1			0	57.36		
FILL: Brown silty sand 0.55									
FILL: Brown silty sand with gravel, some cobbles and boulders		G	2			1	56.36		
		G	3			2	55.36		
		G	4			3	54.36		
		G	5			4	53.36		
		G	6			5	52.36		
5.00									
End of Test Pit TP terminated on bedrock surface 5.0 m depth									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

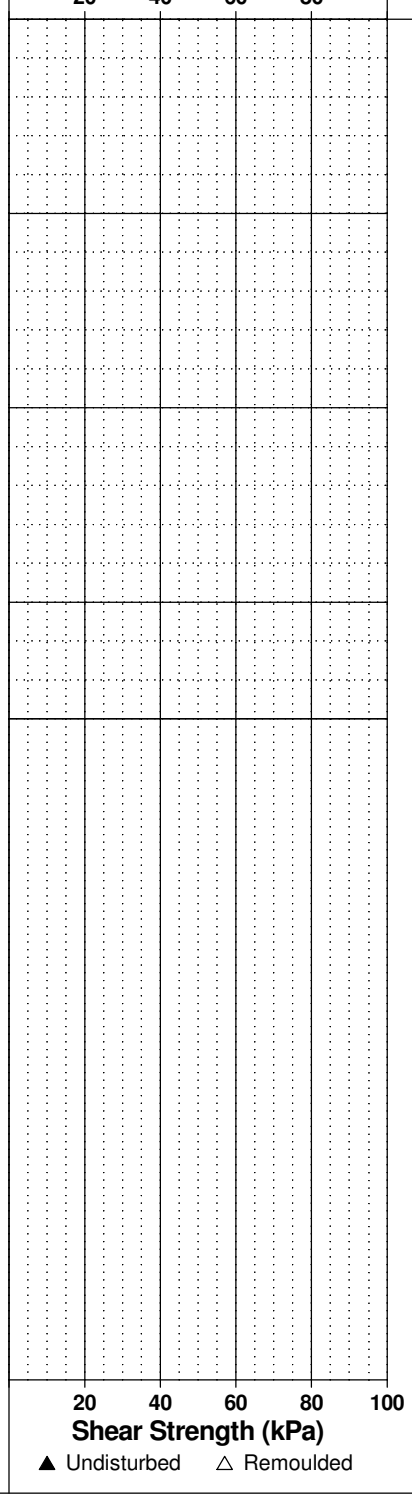
FILE NO. PG4915

REMARKS

HOLE NO. TP 5-21

BORINGS BY Excavator **DATE** 2021 December 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 %	Piezometer Construction
GROUND SURFACE									
FILL: Brown silty sand with organics						0	57.37		
0.20									
FILL: Brown silty sand with gravel, cobbles, trace brick fragments		G	1						
		G	2			1	56.37		
		G	3						
						2	55.37		
		G	4						
						3	54.37		
3.60		G	5						
End of Test Pit									
TP terminated on bedrock surface at 3.60 m depth									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. TP 6-21

BORINGS BY Excavator **DATE** 2021 December 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 %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.29						0	56.84		
FILL: Brown silty sand some gravel, debris (brick, metal), and rock fragments		G	1			1	55.84		
		G	2						
2.10						2	54.84		
Brown **SILTY SAND** with rock fragments		G	3						
		G	4			3	53.84		
		G	5						
4.20						4	52.84		
Weathered shale **BEDROCK**									
4.90									
End of Test Pit TP terminated on bedrock surface at 4.9 m depth									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %

20 40 60 80

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
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. TP 7-21

BORINGS BY Excavator **DATE** 2021 December 21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
Asphalt 0.09						0	56.39		
FILL: Brown silty sand with crushed stone and gravel 0.39		G	1						
FILL: Brown silty sand with rock fragments, gravel and debris 0.90		G	2						
Brown **SILTY SAND** trace gravel		G	3			1	55.39		
1.60		G	4						
GLACIAL TILL: Brown silty sand with rock fragments, gravel, cobbles, trace boulders		G	5			2	54.39		
						3	53.39		
3.60		G	6						
End of Test Pit									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. TP 8-21

BORINGS BY Excavator **DATE** 2021 December 21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	56.02		
Asphalt 0.08		G	1						
FILL: Brown silty sand with gravel and crushed stone 0.29									
FILL: Brown silty clay with clayey sand, some gravel, trace rock and brick fragments 0.90		G	2						
Brown **SILTY SAND** some gravel, rock fragments and cobbles		G	3			1	55.02		
2.10						2	54.02		
GLACIAL TILL: Brown silty sand some gravel, rock fragments, trace cobbles and boulders		G	4						
3.50		G	5			3	53.02		
End of Test Pit									

20 40 60 80

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
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. TP 9-21

BORINGS BY Excavator **DATE** 2021 December 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 %	Piezometer Construction
GROUND SURFACE									
Asphalt 0.08						0	56.02		
FILL: Brown silty sand with gravel and crushed stone 0.35		G	1						
FILL: Brown silty sand with rock fragments, gravel and debris		G	2						
1.00						1	55.02		
Brown **SILTY SAND** some rock fragments		G	3						
1.90						2	54.02		
GLACIAL TILL: Brown silty sand some rock fragments, trace gravel, cobbles and boulders		G	4						
						3	53.02		
3.50		G	5						
End of Test Pit									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. TP10-21

BORINGS BY Excavator **DATE** 2021 December 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 %	Piezometer Construction
GROUND SURFACE									
Asphalt 0.07		G	1			0	55.99		
FILL: Brown silty sand with gravel and crushed stone 0.29									
FILL: Brown silty sand with rock fragments, gravel and debris		G	2						
0.91						1	54.99		
Brown **SILTY SAND** some rock fragments, trace gravel and cobbles		G	3						
2.21						2	53.99		
GLACIAL TILL: Brown silty sand some rock fragments, trace gravel, cobbles and boulders									
						3	52.99		
3.30		G	4						
End of Test Pit									

20 40 60 80

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
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. TP11-21

BORINGS BY Excavator **DATE** 2021 December 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 %	Piezometer Construction
GROUND SURFACE									
Asphalt 0.08						0	56.45		
FILL: Brown silty sand with gravel and crushed stone 0.45		G	1						
FILL: Brown silty sand with rock fragments, wood and construction debris (concrete and metal) 1.00		G	2			1	55.45		
Brown **SILTY SAND** trace rock fragments		G	3						
		G	4			2	54.45		
		G	5						
		G	6			3	53.45		
		G	7						
3.90									
Weathered shale **BEDROCK**						4	52.45		
4.50									
End of Test Pit									
TP terminated on bedrock surface 4.50 m depth									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. TP12-21

BORINGS BY Excavator **DATE** 2021 December 22

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 %	Piezometer Construction
GROUND SURFACE						0	56.48		
Asphalt 0.07									
FILL: Brown silty sand with gravel and crushed stone 0.48		G	1						
FILL: Brown silty sand some rock fragments, gravel and debris		G	2			1	55.48		
1.40									
Stiff to very stiff brown **SILTY CLAY** to **CLAYEY SILT** trace gravel		G	3						
1.90									
Brown **SILTY SAND** some rock fragments		G	4			2	54.48		
2.60									
GLACIAL TILL: Brown silty sand some rock fragments, gravel, cobbles and boulders		G	5			3	53.48		
4.10		G	6			4	52.48		
End of Test Pit									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. TP13-21

BORINGS BY Excavator **DATE** 2021 December 22

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 %	Piezometer Construction
GROUND SURFACE						0	56.72		
Asphalt 0.08		G	1						
FILL: Brown silty sand with gravel and crushed stone 0.49									
FILL: Brown silty sand, some gravel and cobbles		G	2			1	55.72		
1.10									
FILL: Brown silty clay some rock fragments, gravel and debris		G	3						
1.50									
Brown **SILTY SAND** with rock fragments		G	4			2	54.72		
						3	53.72		
3.50									
GLACIAL TILL: Brown silty sand with rock fragments, gravel, trace cobbles and boulders		G	5						
		G	6			4	52.72		
4.50									
Weathered shale **BEDROCK**									
4.90									
End of Test Pit									
TP terminated on bedrock surface at 4.9 m depth									

Shear Strength (kPa) 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. TP14-21

BORINGS BY Excavator **DATE** 2021 December 22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
Asphalt 0.08		G	1			0	56.06		
FILL: Brown silty sand with gravel and crushed stone 0.29									
FILL: Brown silty sand some rock fragments, gravel, trace clay 0.80		G	2						
Brown **SILTY CLAY** trace gravel		G	3			1	55.06		
1.20									
Brown **SILTY SAND** some rock fragments, trace gravel		G	4						
1.90									
GLACIAL TILL: Brown silty sand some rock fragments, gravel, trace cobbles and boulders		G	5			2	54.06		
		G	6			3	53.06		
3.80		G	7						
End of Test Pit									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. TP15-21

BORINGS BY Excavator **DATE** 2021 December 22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
Asphalt 0.08		G	1			0	56.12		
FILL: Brown silty sand with gravel and crushed stone 0.29									
FILL: Brown silty sand some rock fragments, trace sand and clay		G	2			1	55.12		
1.20									
Brown **SILTY SAND** some rock fragments and cobbles		G	3						
		G	4			2	54.12		
3.10									
GLACIAL TILL: Brown silty sand with rock fragments, gravel, trace cobbles and boulders 3.40		G	5			3	53.12		
End of Test Pit									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. TP16-21

BORINGS BY Excavator **DATE** 2021 December 22

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 %	Piezometer Construction
GROUND SURFACE						0	56.22		
Asphalt 0.08									
FILL: Brown silty sand with gravel and crushed stone 0.50		G	1						
FILL: Brown silty clay with rock fragments, gravel and organics 1.10		G	2			1	55.22		
Brown **SILTY SAND** some rock fragments 1.90		G	3						
GLACIAL TILL: Brown silty sand some rock fragments, trace gravel, cobbles and boulders		G	4			2	54.22		
		G	5			3	53.22		
3.50		G	6						
End of Test Pit									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. TP17-21

BORINGS BY Excavator **DATE** 2021 December 22

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 %	Piezometer Construction
GROUND SURFACE									
Asphalt 0.08		G	1			0	56.01		
FILL: Brown silty sand with gravel and crushed stone 0.20		G	2						
FILL: Brown silty sand with rock fragments, trace clay, gravel and cobbles		G	3			1	55.01		
		G	4			2	54.01		
		G	5			3	53.01		
5.00						4	52.01		
GLACIAL TILL: Grey silty sand trace clay, gravel, cobbles and boulders		G	6			5	51.01		
5.50									
End of Test Pit									

20 40 60 80

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
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

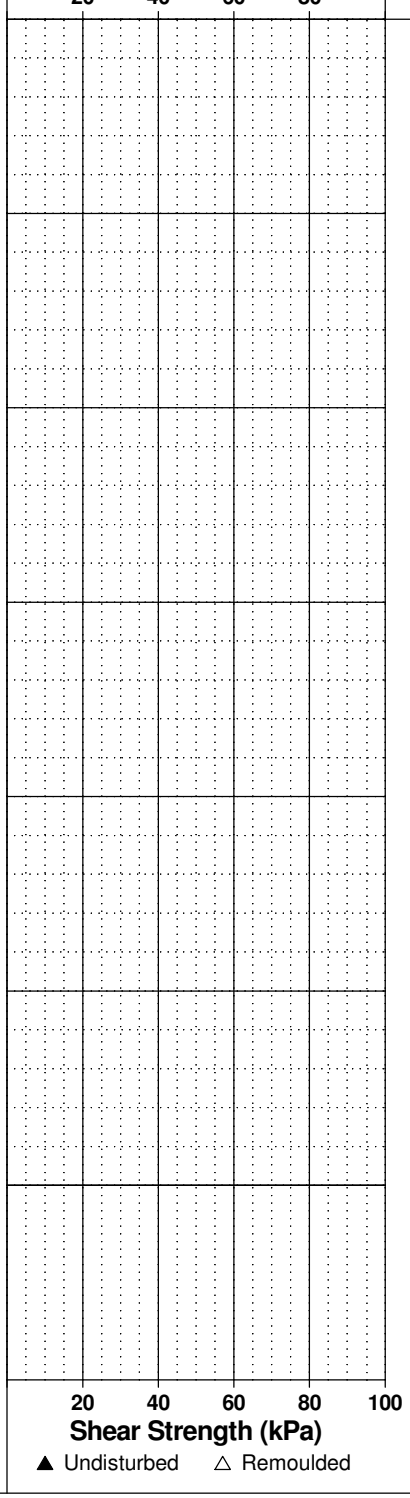
FILE NO. PG4915

REMARKS

HOLE NO. TP18-21

BORINGS BY Excavator **DATE** 2021 December 22

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 %	Piezometer Construction
GROUND SURFACE									
Asphalt 0.08		G	1			0	56.56		
FILL: Brown silty sand with gravel and crushed stone 0.29									
FILL: Brown silty sand with rock fragments, gravel and cobbles		G	2						
		G	3			1	55.56		
- Trace clay by 1.2 m depth									
		G	4			2	54.56		
		G	5			3	53.56		
		G	6			4	52.56		
						5	51.56		
6.00 End of Test Pit		G	7			6	50.56		



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
3-33 Selkirk Street and 2 Montreal Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE4546

REMARKS

HOLE NO. BH 1-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 18, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.08						0	56.23
FILL: Brown silty sand with crushed stone 0.59		AU	1				
FILL: Brown clayey silt with sand, trace gravel		SS	2	58	10	1	55.23
		SS	3	42	11	2	54.23
GLACIAL TILL: Dense to very dense, dark brown silty sand with shale fragments		SS	4	79	31	3	53.23
		SS	5	46	57		
		SS	6	71	70	4	52.23
4.57							
BEDROCK: Weathered black shale		SS	7	75	72	5	51.23
5.18							
End of Borehole							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
3-33 Selkirk Street and 2 Montreal Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE4546

REMARKS

HOLE NO. BH 2-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 18, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: Volatile Organic Rdg. (ppm) / Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE									
Asphaltic concrete 0.10						0	56.61		
FILL: Brown silty sand with crushed stone 0.60		AU	1						
FILL: Brown clayey silt with sand, trace gravel 1.50		SS	2	71	8	1	55.61		
GLACIAL TILL: Compact, dark brown silty sand with shale fragments 2.29		SS	3	62	28	2	54.61		
		SS	4	69	50+				
BEDROCK: Weathered black shale		SS	5	58	49	3	53.61		
		SS	6	83	63	4	52.61		
		SS	7		50+				
4.85 End of Borehole									

Photo Ionization Detector: ● Volatile Organic Rdg. (ppm); ○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
3-33 Selkirk Street and 2 Montreal Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE4546

REMARKS

HOLE NO. BH 3-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 18, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: Volatile Organic Rdg. (ppm) / Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE									
Asphaltic concrete 0.10						0	55.97		
FILL: Brown silty sand with crushed stone 0.60		AU	1						
FILL: Brown clayey silt with some, trace gravel 1.50		SS	2	29	8	1	54.97		
GLACIAL TILL: Dense to compact, dark brown silty sand with shale fragments 2.29		SS	3	21	10	2	53.97		
		SS	4	88	59	3	52.97		
BEDROCK: Weathered black shale		SS	5	79	48				
		SS	6	67	20	4	51.97		
		SS	7	62	22				
5.11						5	50.97		
End of Borehole									

Photo Ionization Detector: ● Volatile Organic Rdg. (ppm); ○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
3-33 Selkirk Street and 2 Montreal Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE4546

REMARKS

HOLE NO. BH 4-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 18, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: Volatile Organic Rdg. (ppm) / Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE									
Asphaltic concrete 0.10						0	56.29		
FILL: Brown silty sand with crushed stone 0.63		AU	1						
FILL: Brown clayey silt, trace sand, gravel and asphalt		SS	2	58	4	1	55.29		
1.80		SS	3	92	48				
GLACIAL TILL: Dense, dark brown silty sand with shale fragments 2.29						2	54.29		
		SS	4	100	50+				
						3	53.29		
BEDROCK: Weathered black shale		SS	5	79	50				
		SS	6	70	50+	4	52.29		
4.70		SS	7	80	50+				
End of Borehole									

Photo Ionization Detector: ● Volatile Organic Rdg. (ppm); ○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
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DATUM Geodetic

FILE NO. PE4546

REMARKS

HOLE NO. BH 5-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 18, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.17
Asphaltic concrete 0.10							
FILL: Brown silty sand with crushed stone		AU	1				
0.60							
FILL: Brown clayey silt, trace sand, gravel and mica		SS	2	42	9	1	55.17
1.52							
		SS	3	71	15	2	54.17
Compact to dense, brown **SILTY SAND**		SS	4	75	31		
		SS	5	89	50+	3	53.17
3.81							
BEDROCK: Weathered black shale		SS	6	70	50+	4	52.17
4.70		SS	7	100	50+		
End of Borehole							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
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FILE NO. PE4546

REMARKS

HOLE NO. BH 6-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 18, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.10						0	56.04
FILL: Brown silty sand with crushed stone 0.56		AU	1				
FILL: Brown silty sand with shale fragmetns 1.52		SS	2	4	7	1	55.04
GLACIAL TILL: Very dense, dark brown silty sand with gravel, cobbles, boulders and shale fragments 3.05		SS	3	64	50+	2	54.04
		SS	4	71	61		
BEDROCK: Weathered black shale		SS	5	67	50+	3	53.04
		SS	6	100	50+	4	52.04
4.70 End of Borehole		SS	7	80	50+		

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
3-33 Selkirk Street and 2 Montreal Road
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DATUM Geodetic

FILE NO. PE4546

REMARKS

HOLE NO. BH 7-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 18, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.08						0	56.31
FILL: Brown silty sand with crushed stone 0.56		AU	1				
FILL: Dark brown silt, trace sand and gravel		SS	2	58	21	1	55.31
		SS	3	79	30	2	54.31
2.29							
GLACIAL TILL: Dense to very dense, brown silty sand-gravel and shale fragments		SS	4	88	48	3	53.31
		SS	5	71	64		
		SS	6	70	50+	4	52.31
4.70		SS	7	20	50+		
End of Borehole							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
3-33 Selkirk Street and 2 Montreal Road
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FILE NO. PE4546

REMARKS

HOLE NO. BH 8-20

BORINGS BY CME-55 Low Clearance Drill **DATE** September 21, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: Volatile Organic Rdg. (ppm) / Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE									
Asphaltic concrete 0.08						0	56.06		
FILL: Brown silty sand with crushed stone 0.60		AU	1						
Brown **CLAYEY SILT,** trace sand 1.52		SS	2	58	15	1	55.06		
GLACIAL TILL: Dark brown silty sand-gravel and shale fragments		SS	3	67	41	2	54.06		
2.84		SS	4	64	50+				
End of Borehole									

Photo Ionization Detector: ○ Lower Explosive Limit % (20, 40, 60, 80)

RKI Eagle Rdg. (ppm) (100, 200, 300, 400, 500)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. BH 1

BORINGS BY CME 45 Power Auger **DATE** April 3, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.08
Asphaltic concrete 0.10							
FILL: Brown silty clay with sand, gravel, trace brick 0.51		AU	1				
FILL: Light brown silty sand with gravel		SS	2	79	23	1	55.08
1.52							
FILL: Brown sandy silt to silty sand, trace shale fragments and clay		SS	3	83	37	2	54.08
- shale fragments increasing with depth		SS	4	88	27		
3.05						3	53.08
		SS	5	83	45		
		SS	6	100	50+	4	52.08
		SS	7	88	87		
BEDROCK: Heavily fractured to fractured, black shale		SS	8	78	50+	5	51.08
		SS	9	71	43	6	50.08
			10	90	50+	7	49.08
		SS	11	75	11		
8.23						8	48.08
End of Borehole							
(GWL @ 6.02m - April 12, 2019)							

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. BH 2

BORINGS BY CME 45 Power Auger **DATE** April 3, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.13						0	56.09
FILL: Brown silty sand with crushed stone 0.60		AU	1				
FILL: Brown silty sand, some clay, gravel and shale fragments		SS	2	88	22	1	55.09
1.98		SS	3	100	50	2	54.09
		SS	4	88	50+		
		SS	5	80	50+	3	53.09
		SS	6	87	45	4	52.09
BEDROCK: Heavily fractured to fractured, black shale		SS	7	71	50+		
		SS	8	30	36	5	51.09
		RC	1	100	44	6	50.09
		RC	2	35	8		
8.18							
End of Borehole							
(GWL @ 5.56m - April 12, 2019)							

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. BH 3

BORINGS BY CME 45 Power Auger **DATE** April 5, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.47
Asphaltic concrete 0.15							
FILL: Brown silty sand with crushed stone 0.60		AU	1				
		SS	2	54	5	1	55.47
FILL: Brown silty sand with clay, gravel, trace plastic and topsoil		SS	3	62	11	2	54.47
2.44		SS	4	67	51		
FILL: Brown silty sand with gravel and crushed stone, trace clay		SS	5	79	78	3	53.47
4.09		SS	6	70	50+	4	52.47
		SS	7	60	50+		
		SS	8	100	50+	5	51.47
BEDROCK: Heavily fractured to fractured, black shale		SS	9	100	50+	6	50.47
		SS	10	100	50+	7	49.47
7.67		SS	11	0	50+		
End of Borehole							
(GWL @ 5.94m - April 12, 2019)							

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. BH 4

BORINGS BY CME 45 Power Auger **DATE** April 5, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.15						0	56.50
FILL: Crushed stone with sand 0.60		AU	1				
FILL: Brown silty clay, some sand, gravel, shale fragments, trace topsoil 1.45		SS	2	46	5	1	55.50
		SS	3	42	24	2	54.50
FILL: Dark brown silty sand with shale fragments and gravel		SS	4	54	71		
		SS	5	100	50+	3	53.50
3.96		SS	6	100	50+	4	52.50
		SS	7	100	50+		
		SS	8	100	50+	5	51.50
BEDROCK: Heavily fractured to fractured, black shale		SS	9	67	50+	6	50.50
		SS	10	0	50+	7	49.50
		SS	11	0	50+		
8.13						8	48.50
End of Borehole							
(GWL @ 5.95m - April 12, 2019)							

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

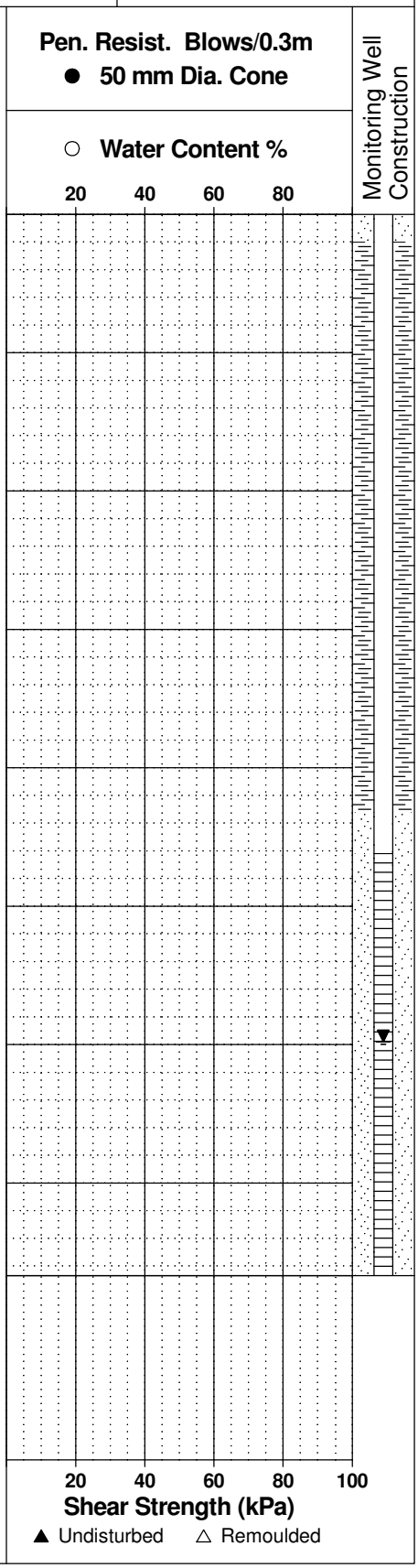
FILE NO. PG4915

REMARKS

HOLE NO. BH 5

BORINGS BY CME 45 Power Auger **DATE** April 5, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.18						0	56.55
FILL: Dark brown silty clay with sand and gravel, some topsoil and shale fragments		AU	1				
- clay content decreasing with depth		SS	2	50	7	1	55.55
2.21		SS	3	54	29	2	54.55
FILL: Brown silty sand with crushed stone, gravel and shale fragments, trace clay 2.90		SS	4	62	56		
		SS	5	100	65	3	53.55
GLACIAL TILL: Very dense, grey sandy silt to silty sand, some gravel, trace clay		SS	6	83	46	4	52.55
		SS	7	100	68		
5.26		SS	8	33	50+	5	51.55
BEDROCK: Heavily fractured to fractured, black shale		SS	9	44	50+	6	50.55
		SS	10	0	50+	7	49.55
7.67							
End of Borehole							
(GWL @ 5.98m - April 12, 2019)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. BH 6

BORINGS BY CME 45 Power Auger **DATE** April 4, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.11
Asphaltic concrete 0.13							
FILL: Brown silty sand with crushed stone, some clay 0.60		AU	1				
FILL: Light brown silty clay with sand and gravel, trace topsoil 1.37		SS	2	67	21	1	55.11
		SS	3	88		2	54.11
		SS	4	100	46		
FILL: Brown silty sand with gravel and shale fragments, trace concrete		SS	5	92	72	3	53.11
		SS	6	92	70	4	52.11
4.72		SS	7	67	50+		
		SS	8	100	58	5	51.11
BEDROCK: Heavily fractured to fractured, black shale		RC	1	78	31	6	50.11
		RC	2	79	0	7	49.11
8.25						8	48.11
End of Borehole							
(GWL @ 5.56m - April 12, 2019)							

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
3-33 Selkirk Street, Ottawa, Ontario

DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. BH 7

BORINGS BY CME 45 Power Auger **DATE** April 5, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.74
Asphaltic concrete 0.13							
FILL: Brown silty sand to sandy silt with crushed stone 0.46		AU	1				
FILL: Dark brown silty clay with sand and gravel, some topsoil, trace organics and shale fragments		SS	2	42	15	1	55.74
- clay content decreasing with depth		SS	3	33	19	2	54.74
2.21							
		SS	4	58	61	3	53.74
FILL: Brown silty sand with crushed stone and gravel, some shale fragments		SS	5	100	50+		
		SS	6	0	50+	4	52.74
4.85		SS	7	82	50+		
		SS	8	12	94	5	51.74
BEDROCK: Heavily fractured to fractured, black shale		SS	9	62	51	6	50.74
		SS	10	8	8	7	49.74
		SS	11	0	50+		
7.92							
End of Borehole							
(GWL @ 6.22`m - April 12, 2019)							

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
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FILE NO. PG4915

REMARKS

HOLE NO. BH 8

BORINGS BY CME 45 Power Auger **DATE** April 3, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.15						0	56.71
FILL: Brown silty sand with crushed stone 0.51		AU	1				
		SS	2	54	8	1	55.71
FILL: Brown silty sand, trace clay, gravel and brick		SS	3	46	9	2	54.71
		SS	4	75	17		
		SS	5	58	62	3	53.71
3.66							
		SS	6	100	87	4	52.71
		SS	7	88	53		
BEDROCK: Heavily fractured to fractured, black shale		SS	8	0	50+	5	51.71
		SS	9	25	14	6	50.71
		SS	10	38	33	7	49.71
7.62							
End of Borehole							
(GWL @ 6.16m - April 12, 2019)							

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
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FILE NO. PG4915

REMARKS

HOLE NO. BH 9

BORINGS BY CME 45 Power Auger **DATE** April 4, 2019

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 %	Monitoring Well Construction
GROUND SURFACE									
Asphaltic concrete 0.10						0	56.66		
FILL: Brown silty sand with crushed stone 0.60		AU	1						
		SS	2	88	10	1	55.66		
		SS	3	54	12	2	54.66		
		SS	4	83	12				
FILL: Dark brown to black silty clay with gravel, cobbles, sand and shale fragments, trace topsoil		SS	5	100	12	3	53.66		
		SS	6	12	23	4	52.66		
		SS	7	33	13	5	51.66		
5.64		SS	8	75	25				
		SS	9	100	56	6	50.66		
GLACIAL TILL: Compact to very dense, grey sandy silt to silty sand with gravel and shale fragments		SS	10	83	91	7	49.66		
		SS	11	88	67	8	48.66		
8.23									
End of Borehole									
(GWL @ 4.04m - April 12, 2019)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed High-Rise Complex
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DATUM Geodetic

FILE NO. PG4915

REMARKS

HOLE NO. BH10

BORINGS BY CME 45 Power Auger **DATE** May 4, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	57.07
Concrete slab 0.13		AU	1				
FILL: Brown silty sand with gravel		SS	2	67		1	56.07
1.22							
		AU	3			2	55.07
		SS	4	50		3	54.07
GLACIAL TILL: Dark brown silty sand with gravel, cobbles and shale fragments		SS	5	12			
		SS	6	17		4	53.07
		SS	7	8			
		SS	8	10		5	52.07
5.79							
		RC	1	44	0	6	51.07
		RC	2	100	0		
BEDROCK: Heavily fractured to fractured, black shale		RC	3	74	0	7	50.07
		RC	4	58	28		
7.92							
End of Borehole							
(GWL @ 6.43m - April 12, 2019)							

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

LOCATION: 2 Montreal Road, Ottawa, Ontario
CONTRACTOR: Badger Daylighting Ltd./ Strata Drilling Group
EQUIPMENT USED: Hydrovac, Geomachine GM 100 - Direct Push, Air Rotary
OVM TYPE: RKI Eagle
BORING DATE: May 13 and 15, 2019
DATUM: Local (referenced to the catch basin on the Western portion of the site with an assumed elevation of 100.00 mald. Exp, 2014.)

RECORD OF MONITORING WELL: MW19-01

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY %	Soil Vapour Concentration (ppmv) ⊕ 50 100 150 200 / Soil Vapour Concentration (%LEL) □ 20 40 60 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Ground Surface		99.99						Stickup = 0.77 m
	Sandy LOAM, moist, brown		0.10						
	FILL (SAND, trace clay), moist, brown			1	GRAB	n/a ⊕		BTEX, F1-F4, METALS	
	— Roots at 0.45 m								
1				2	GRAB	n/a ⊕			
			98.39						
	FILL (sandy GRAVEL), moist, brown		1.60	3	DP	33			
2									
				4	DP	33 ⊕			
3									
			96.64						
	Fractured SHALE and SAND, moist to dry, brown		3.35	5	DP	73 ⊕			
4				6	DP	73 ⊕		BTEX, F1-F4, FOC, PAH, VOC	
			95.54						
	BEDROCK		4.45						
5									
6									
7									28-May-2019 ▽
8									
9									
			90.59						
	End of MONITORING WELL.		9.40						
10									

DEPTH SCALE
1 : 50

GOLDER

LOGGED: LM/JE
CHECKED: CV/SC

IOL (AUTO) 18113796-1485 BH_LOGS.GPJ IOL.GDT 1-13-20

LOCATION: 2 Montreal Road, Ottawa, Ontario
CONTRACTOR: Badger Daylighting Ltd./ Strata Drilling Group
EQUIPMENT USED: Hydrovac, Geomachine GM 100 - Direct Push, Air Rotary
OVM TYPE: RKI Eagle
BORING DATE: May 13 and 15, 2019
DATUM: Local (referenced to the catch basin on the Western portion of the site with an assumed elevation of 100.00 mald. Exp, 2014.)

RECORD OF MONITORING WELL: MW19-02

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY %	Soil Vapour Concentration (ppmv) ⊕ 50 100 150 200 / Soil Vapour Concentration (%LEL) □ 20 40 60 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Ground Surface		99.98						Stickup = 0.84 m
	Sandy LOAM, moist, brown								
	FILL (SAND), moist, brown		0.10						
			99.28	1	GRAB	n/a ⊕			
	FILL (GRAVEL, trace sand, trace cobbles), moist, brown		0.70						
1				2	GRAB	n/a ⊕		BTEX, F1-F4, GRAIN SIZE, METALS	
			98.33						
	FILL (SAND, some gravel), moist, brown		1.65						
2				3	DP	30			
				4	DP	30 ⊕			
3				5	DP	53			
4				6	DP	53 ⊕			
5				7	DP	27			
			94.28	8	DP	27 ⊕		BTEX, F1-F4, GRAIN SIZE, PAH, VOC	
	Fractured SHALE and SAND, trace gravel, brown-black		5.70						
6			93.97						
	BEDROCK		6.01						
7									28-May-2019 ▽
8									
9									
			90.58						
	End of MONITORING WELL.		9.40						
10									

DEPTH SCALE
1 : 50

GOLDER

LOGGED: LM/JE
CHECKED: CV/SC

IOL (AUTO) 18113796-1485_BH_LOGS.GPJ IOL.GDT 1-13-20

LOCATION: 2 Montreal Road, Ottawa, Ontario
CONTRACTOR: Badger Daylighting Ltd./ Strata Drilling Group
EQUIPMENT USED: Hydrovac, Geomachine GM 100 - Direct Push, Air Rotary
OVM TYPE: RKI Eagle
BORING DATE: May 14 and 16, 2019
DATUM: Local (referenced to the catch basin on the Western portion of the site with an assumed elevation of 100.00 mald. Exp, 2014.)

SHEET 1 OF 1

RECORD OF MONITORING WELL: MW19-03

DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY %	Soil Vapour Concentration (ppmv) ⊕ 50 100 150 200 / Soil Vapour Concentration (%LEL) □ 20 40 60 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface		99.92						Stickup = 0.97 m
0	Sandy LOAM, moist, brown		0.10						
	FILL (SAND), moist, brown		99.42						
	FILL (sandy GRAVEL), moist, brown		0.50	1	GRAB	n/a	⊕		
1				2	GRAB	n/a	⊕		
				3	DP	25			
2				4	DP	25	⊕		
	Fractured SHALE, some sand, trace gravel, dry, brown		97.12 2.80						
3				5	DP	33	⊕	BTEX, F1-F4, GRAIN SIZE METALS, PAH, VOC	
	BEDROCK		95.91 4.01						
4									
5									
6									
7									28-May-2019 ▽
8									
9									
			90.52						
	End of MONITORING WELL.		9.40						
10									

DEPTH SCALE
1 : 50

GOLDER

LOGGED: LM/JE
CHECKED: CV/SC

IOL (AUTO) 18113796-1485_BH_LOGS.GPJ IOL.GDT 1-13-20

LOCATION: 2 Montreal Road, Ottawa, Ontario
CONTRACTOR: Badger Daylighting Ltd./ Strata Drilling Group
EQUIPMENT USED: Hydrovac, Geomachine GM 100 - Direct Push, Air Rotary
OVM TYPE: RKI Eagle
BORING DATE: May 13 and 17, 2019
DATUM: Local (referenced to the catch basin on the Western portion of the site with an assumed elevation of 100.00 mald. Exp, 2014.)

SHEET 1 OF 1

RECORD OF MONITORING WELL: MW19-04

DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY %	Soil Vapour Concentration (ppmv) ⊕ 50 100 150 200 / Soil Vapour Concentration (%LEL) □ 20 40 60 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface		99.91						Stickup = 0.91 m
0	Sandy LOAM, moist, brown		0.05						
	FILL (SAND), moist, brown — Roots at 0.2 m			1	GRAB	n/a ⊕			
1				2	GRAB	n/a ⊕			
			98.31						
	FILL (sandy GRAVEL, trace gravel), moist, brown		1.60	3	DP	27			
2				4	DP	27 ⊕			
			97.11						
	Fractured SHALE, dry, black		2.80						
3				5	DP	100 ⊕		BTEX, F1-F4, GLYCOLS, METALS, PAH, PESICIDES, VOC	
			96.20						
	BEDROCK		3.71						
4									
5									
6									
									28-May-2019 ▽
7									
8									
9									
			90.51						
	End of MONITORING WELL.		9.40						
10									

DEPTH SCALE
1 : 50

GOLDER

LOGGED: LM/JE
CHECKED: CV/SC

IOL (AUTO) 18113796-1485_BH_LOGS.GPJ IOL.GDT 1-13-20

LOCATION: 2 Montreal Road, Ottawa, Ontario
CONTRACTOR: Badger Daylighting Ltd./ Strata Drilling Group
EQUIPMENT USED: Hydrovac, Geomachine GM 100 - Direct Push, Air Rotary
OVM TYPE: RKI Eagle
BORING DATE: May 14 and 16, 2019
DATUM: Local (referenced to the catch basin on the Western portion of the site with an assumed elevation of 100.00 mald. Exp, 2014.)

RECORD OF MONITORING WELL: MW19-05

DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY %	Soil Vapour Concentration (ppmv) ⊕ 50 100 150 200 / Soil Vapour Concentration (%LEL) □ 20 40 60 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface		99.83						Stickup = 0.81 m
0	TOPSOIL		0.10						
	FILL (SAND), moist, brown		99.23						
	FILL (sandy GRAVEL), moist, brown		0.60	1	GRAB	n/a	⊕		
1				2	GRAB	n/a	⊕		
2			97.53	3	GRAB	n/a	⊕		
	Fractured SHALE, some sand, trace gravel, moist, brown		2.30	4	DP	16	⊕		
3				5	DP	20	⊕	BTEX, F1-F4 DRY BULK DENSITY GLYCOLS, METALS PAH, PCB, VOC	
			96.28						
	BEDROCK		3.55						
4									
5									
6									
7									28-May-2019 ▽
8									
9			90.43						
	End of MONITORING WELL.		9.40						
10									

DEPTH SCALE
1 : 50

GOLDER

LOGGED: LM/JE
CHECKED: CV/SC

IOL (AUTO) 18113796-1485_BH_LOGS.GPJ IOL.GDT 1-13-20

LOCATION: 2 Montreal Road, Ottawa, Ontario
CONTRACTOR: Badger Daylighting Ltd./ Strata Drilling Group
EQUIPMENT USED: Hydrovac, Geomachine GM 100 - Direct Push, Air Rotary
OVM TYPE: RKI Eagle
BORING DATE: May 14 and 16, 2019
DATUM: Local (referenced to the catch basin on the Western portion of the site with an assumed elevation of 100.00 mald. Exp, 2014.)

RECORD OF MONITORING WELL: MW19-06/SV19-04

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY %	Soil Vapour Concentration (ppmv) ⊕ 50 100 150 200 / Soil Vapour Concentration (%LEL) □ 20 40 60 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Ground Surface		99.78						Stickup = 0.80 m
	Sandy LOAM, moist, brown								
	FILL (SAND), moist, brown		0.10	1	GRAB	n/a	⊕	BTEX, F1-F4, FOC	
1									
			98.28	2	GRAB	n/a	⊕		
	Fractured SHALE, some sand, trace gravel, moist, black-brown		1.50	3	DP	43			
2				4	DP	43		BTEX, F1-F4, FOC, GLYCOLS, METALS, PAH, PCB, VOC	
			97.07						
	BEDROCK		2.71						
3									
4									
5									
6									
									28-May-2019 ▽
7									
8									
9			90.69						
	End of MONITORING WELL.		9.10						
10									

DEPTH SCALE
1 : 50

GOLDER

LOGGED: LM/JE
CHECKED: CV/SC

IOL (AUTO) 18113796-1485 BH_LOGS.GPJ IOL.GDT 1-13-20

LOCATION: 2 Montreal Road, Ottawa, Ontario
CONTRACTOR: Badger Daylighting Ltd./ Strata Drilling Group
EQUIPMENT USED: Hydrovac, Geomachine GM 100 - Direct Push, Air Rotary
OVM TYPE: RKI Eagle
BORING DATE: May 14 and 16, 2019
DATUM: Local (referenced to the catch basin on the Western portion of the site with an assumed elevation of 100.00 mald. Exp, 2014.)

RECORD OF MONITORING WELL: MW19-07

DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY %	Soil Vapour Concentration (ppmv) ⊕ 50 100 150 200 / Soil Vapour Concentration (%LEL) □ 20 40 60 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface		99.73						Stickup = 0.98 m
0	Sandy LOAM, moist, brown								
	FILL (SAND), moist, brown		0.20						
	FILL (sandy GRAVEL, trace cobbles), moist, brown			1	GRAB	n/a	⊕	BTEX, F1-F4, FOC	
1				2	GRAB	n/a	⊕		
				3	DP	33			
2				4	DP	33	⊕		
			96.83						
3	Fractured SHALE, some sand, trace gravel, dry, brown-black		2.90	5	DP	33	⊕	BTEX, F1-F4, FOC, GLYCOLS, METALS, PAH, PCB, VOC	
			96.18						
	BEDROCK		3.55						
4									
5									
6									28-May-2019 ▽
7									
8									
9			90.33						
	End of MONITORING WELL.		9.40						
10									

DEPTH SCALE
1 : 50

GOLDER

LOGGED: LM/JE
CHECKED: CV/SC

IOL (AUTO) 18113796-1485_BH_LOGS.GPJ IOL.GDT 1-13-20

LOCATION: 2 Montreal Road, Ottawa, Ontario
CONTRACTOR: Badger Daylighting Ltd./ Strata Drilling Group
EQUIPMENT USED: Hydrovac, Geomachine GM 100 - Direct Push, Air Rotary
OVM TYPE: RKI Eagle
BORING DATE: May 14 and 21, 2019
DATUM: Local (referenced to the catch basin on the Western portion of the site with an assumed elevation of 100.00 mald. Exp, 2014.)

RECORD OF MONITORING WELL: MW19-08

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY %	Soil Vapour Concentration (ppmv) ⊕ 50 100 150 200 / Soil Vapour Concentration (%LEL) □ 20 40 60 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Ground Surface		99.32						Stickup = 0.88 m
	FILL (COBBLES and CONSTRUCTION DEBRIS, some sand)		0.00	1	GRAB	n/a	⊕	FOC	
1				2	DP	5	⊕		
				3	DP	30			
2									
				4	DP	30	⊕		
3				5	DP	60	⊕	BTEX, F1-F4, GLYCOLS, METALS, PAH, VOC	
			95.77						
	Fractured SHALE, some sand, some clay, moist, black		3.55						
4			95.22						
	BEDROCK		4.10						
5									
6									28-May-2019 ▽
7									
8									
			90.52						
	End of MONITORING WELL.		8.80						
9									
10									

DEPTH SCALE
1 : 50

GOLDER

LOGGED: LM/JE
CHECKED: CV/SC

LOCATION: 2 Montreal Road, Ottawa, Ontario
CONTRACTOR: Badger Daylighting Ltd./ Strata Drilling Group
EQUIPMENT USED: Hydrovac, Geomachine 2006 GM 100 - Direct Push, Air Rotary
OVM TYPE: RKI Eagle
BORING DATE: May 14 and 17, 2019
DATUM: Local (referenced to the catch basin on the Western portion of the site with an assumed elevation of 100.00 mald. Exp, 2014.)

RECORD OF MONITORING WELL: MW19-09

DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY %	Soil Vapour Concentration (ppmv) ⊕ 50 100 150 200 / Soil Vapour Concentration (%LEL) □ 20 40 60 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface		99.44						Stickup = 0.68 m
0	Sandy LOAM, some organics, moist, brown		0.00 / 99.14						
	FILL (SAND), moist, brown		0.30	1	GRAB	n/a	⊕		
	— Roots at 0.8 m		98.63 / 0.81						
1	FILL (sandy GRAVEL), moist, brown			2	GRAB	n/a	⊕	GRAIN SIZE	
2				3	DP	80			
				4	DP	60	⊕		
3				5	DP	68	⊕	BTEX, F1-F4, GLYCOLS, METALS, PAH, VOC	
			95.64						
	Fractured SHALE, dry, brown		3.80 / 95.43						
4	BEDROCK		4.01						
5									
6									
7									28-May-2019 ▽
8			90.94						
	End of MONITORING WELL.		8.50						
9									
10									

DEPTH SCALE
1 : 50

GOLDER

LOGGED: LM/JE
CHECKED: CV/SC

IOL (AUTO) 18113796-1485_BH_LOGS.GPJ IOL.GDT 1-13-20

exp Energy Services Ltd.
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TEST HOLE # TH201

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 25-Sep-14 **COMPLETED** 30-Sep-14 **WEATHER** Sunny 21°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing EstateDrilling **GROUND ELEV.** 100.93 m **TOP OF PIPE ELEV.** 101.68 m

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** 0.05 m **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** 7.57 mbgs / Elev 93.36 m 14-Oct-14

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 30 **EASTING** 44 76 18

BENCHMARK Catch basin on the western portion of the subject property, Assumed Elev. = 100.00 m

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	⊗ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION Casing Type: Monument	ELEVATION (m)
						mbgs				
	GB TH201-1					Brown to black SAND (fill), some to trace gravel, silt, & clay, moist to damp, no staining, petroleum odour from 5.3 to 7.6 mbgs	◆25			
1	GB TH201-2			VOC, F1-F4, PAH, PCB, Inorganics			◆45			100
	GB TH201-3						◆35			
	SS TH201-4	38	1 1 1 3 (2)				◆40			
2										99
	SS TH201-5	58	4 9 14 18 (23)				◆65			
3										98
	SS TH201-6	83	9 25 32 41 (57)				◆85			
4	SS TH201-7	75	20 50/3"				◆90			97
	SS TH201-8	94	12 16 50/5"				◆75			
5										96
	SS TH201-9	100	18 24 12 10 (36)				◆380			
6										95

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

(Continued Next Page)

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TEST HOLE # TH201

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	❽ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION	ELEVATION (m)
	SS TH201-10	58	4 5 12 9 (17)	VOC, F1-F4, PAH, Inorganics		mbgs Brown to black SAND (fill), some to trace gravel, silt, & clay, moist to damp, no staining, petroleum odour from 5.3 to 7.6 mbgs *(continued from 0.00 mbgs)*	⊗ is			
7	SS TH201-11	83	35 47 31 31 (78)					◆ 475		94
						7.62 Black SILTY CLAY (weathered mudstone), wet, no staining, petroleum odour	◆ 265			
8	SS TH201-12	88	20 48 25 20 (73)							93
	SS TH201-13	75	10 21 41 50 (62)	VOC, F1-F4, PAH, Inorganics			⊗ is			
9						9.14				92

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH202

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 25-Sep-14 **COMPLETED** 01-Oct-14 **WEATHER** Sunny 21°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** n/a **TOP OF PIPE ELEV.** n/a

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** n/a **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** n/a

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 42 **EASTING** 44 76 26

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	⊗ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
						mbgs			
	GB TH202-1					Brown to black SAND (fill), some to trace gravel, silt, clay & shale fragments, moist to damp, no staining, petroleum odour from 3.7 to 4.6 mbgs	◆25		
1									
	GB TH202-2			VOC, F1-F4, PAH, PCB, Inorganics			◆55		
	GB TH202-3						◆30		
	SS TH202-4	25	14 9 9 8 (18)				◆nd		
2									
	SS TH202-5	42	9 6 9 6 (15)				◆30		
3									
	SS TH202-6	25	9 6 5 3 (11)				◆55		
	SS TH202-7	33	6 5 10 50/5"				◆80		
4									
						4.57			
	SS TH202-8	50	8 50/6"			Black SILTY CLAY (weathered shale), trace gravel, moist, black staining from 6.7 to 8.2 mbgs, petroleum odour	◆95		
5									
	SS TH202-9	83	50/6"				◆340		
6									

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

(Continued Next Page)

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TEST HOLE # TH202

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	☢ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
	SS TH202-10	67	50/3"			mbgs Black SILTY CLAY (weathered shale), trace gravel, moist, black staining from 6.7 to 8.2 mbgs, petroleum odour *(continued from 4.57 mbgs)*	◆ 200		
7	SS TH202-11	67	12 33 50/4"	VOC, F1-F4, PAH, Inorganics, pH			◆ 450		
	SS TH202-12	67	50/3"				◆ 285		
8						8.23			
	RC					Black MUDSTONE, fossilized, petroleum odour			
9						9.14			

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH203

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 25-Sep-14 **COMPLETED** 01-Oct-14 **WEATHER** Sunny 21°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** n/a **TOP OF PIPE ELEV.** n/a

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** n/a **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** n/a

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 58 **EASTING** 44 76 21

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	❂ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
						mbgs			
	GB TH203-1			VOC, F1-F4, PAH, PCB, Inorganics		Brown to black SAND (fill), some to trace gravel, silt, & clay, moist, no staining, no odour	◆35		
1	GB TH203-2						◆nd		
	GB TH203-3						◆10		
	SS TH203-4	29	1 5 5 6 (10)				⊗is		
2									
	SS TH203-5	44	4 6 5 7 (11)				◆nd		
3									
	SS TH203-6	63	6 5 6 5 (11)				◆25		
	SS TH203-7	46	5 8 5 4 (13)				◆30		
4									
	SS TH203-8	42	4 4 4 5 (8)				◆75		
5						5.18			
	SS TH203-9	71	9 54 27 38 (81)			Black SILTY CLAY (weathered mudstone), some sand & gravel, moist, black staining from 6.7 to 7.6 mbgs, petroleum odour from 6.1 to 10.4 mbgs. Test Hole terminated at auger refusal. Due to caving, well could not be installed	◆170		
6									

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

(Continued Next Page)

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TEST HOLE # TH203

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	⊗ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
	SS TH203-10	83	21 32 32 50/2"			mbgs Black SILTY CLAY (weathered mudstone), some sand & gravel, moist, black staining from 6.7 to 7.6 mbgs, petroleum odour from 6.1 to 10.4 mbgs. Test Hole terminated at auger refusal. Due to caving, well could not be installed *(continued from 5.18 mbgs)*		⊗5	
7	SS TH203-11	111	24 31 50/4"	VOC, F1-F4, PAH, Inorganics				⊗8	
	SS TH203-12	75	22 25 32 50/5"				◆385		
8									
	SS TH203-13	58	18 17 15 50/1"				◆210		
9									
	AU								
10						10.36			

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH203A

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 06-Oct-14 **COMPLETED** 06-Oct-14 **WEATHER** Partly Sunny 15°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** 100.86 m **TOP OF PIPE ELEV.** 101.68 m

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** 0.05 m **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** 7.53 mbgs / Elev 93.33 m 14-Oct-14

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 58 **EASTING** 44 76 21

BENCHMARK Catch basin on the western portion of the subject property, Assumed Elev. = 100.00 m

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	⊗ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION Casing Type: Monument	ELEVATION (m)
	AU					mbgs Brown to black SAND (fill), some to trace gravel, silt, & clay, moist, no staining, no odour				100
1										
2										99
3										98
4										97
5						5.18 Black SILTY CLAY (weathered mudstone), some sand & gravel, moist, black staining from 6.7 to 7.6 mbgs, petroleum odour from 6.1 to 9.1 mbgs				96
6										95

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH203A

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	❽ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION	ELEVATION (m)
						mbgs				
7						Black SILTY CLAY (weathered mudstone), some sand & gravel, moist, black staining from 6.7 to 7.6 mbgs, petroleum odour from 6.1 to 9.1 mbgs *(continued from 5.18 mbgs)*				94
8										93
9						9.14				92

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH204

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 25-Sep-14 **COMPLETED** 01-Oct-14 **WEATHER** Sunny 21°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** n/a **TOP OF PIPE ELEV.** n/a

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 2.44 mbgs **MONITOR DIA** n/a **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** n/a

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 23 **EASTING** 44 76 26

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	⊗ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
						mbgs			
	GB TH204-1			VOC, F1-F4, PAH, PCB, Inorganics		Brown to black SAND (fill), some to trace gravel, silt, & clay, moist, no staining, no odour	◆80		
1									
	GB TH204-2						◆35		
	GB TH204-3						◆25		
2									
	GB TH204-4								
	SS TH204-5	25	1 1 1 1 (2)				◆45 ◆40		
3						3.05			
	SS TH204-6	75	30 50/5"			Black SILTY CLAY (weathered mudstone), some sand & gravel, moist to damp, black staining from 7.6 to 8.2 mbgs, petroleum odour from 5.5 to 9.8 mbgs	◆20		
4	SS TH204-7	83	9 22 34 36 (56)				◆15		
	SS TH204-8	92	20 50/5"				◆30		
5									
	SS TH204-9	71	15 30 27 27 (57)				◆85		
6									

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH204

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	☢ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
	SS TH204-10	46	26 33 12 12 (45)			mbgs Black SILTY CLAY (weathered mudstone), some sand & gravel, moist to damp, black staining from 7.6 to 8.2 mbgs, petroleum odour from 5.5 to 9.8 mbgs *(continued from 3.05 mbgs)*	◆100		
7	SS TH204-11	50	50/4"				⊗is		
	SS TH204-12	67	50/4"	VOC, F1-F4, PAH, Inorganics			⊗is		
8									
	SS TH204-13	50	50/6"				◆385		
9									
	SS TH204-14	50	50/6"				◆265		
						9.75			

TEST HOLE LOG - January 2014

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TEST HOLE # TH205

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 25-Sep-14 **COMPLETED** 25-Sep-14 **WEATHER** Sunny 21°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR Veolia Environmental Services **GROUND ELEV.** n/a **TOP OF PIPE ELEV.** n/a

DRILLING EQUIPMENT Hydrovacuum **DAYLIGHTING TO** 2.44 mbgs **MONITOR DIA** n/a **TH DIA** 0.15 m

DRILLING METHOD n/a **WATER LEVEL** n/a

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 34 **EASTING** 44 76 37

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	☢ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
	GB TH205-1			VOC, F1-F4, PAH, PCB, Inorganics		Brown to black SAND (fill), some to trace gravel, silt, & clay, moist, no staining, no odour. Abandoned due to insufficient clearance between drill rig and fence	◆35		
1	GB TH205-2						◆30		
	GB TH205-3						◆25		
2	GB TH205-4					mbgs 2.44	◆40		

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH205A

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 06-Oct-14 **COMPLETED** 06-Oct-14 **WEATHER** Partly Sunny 15°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** 100.85 m **TOP OF PIPE ELEV.** 101.49 m

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** 0.05 m **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** 7.47 mbgs / Elev 93.38 m 14-Oct-14

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 34 **EASTING** 44 76 37

BENCHMARK Catch basin on the western portion of the subject property, Assumed Elev. = 100.00 m

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	❂ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION Casing Type: Monument	ELEVATION (m)
	AU					mbgs Brown to black SAND (fill), some to trace gravel, silt, & clay, moist, no staining, no odour				100
1										
2	SS TH205A-4	71	9 10 7 5 (17)				◆nd			99
	SS TH205A-5	63	8 11 11 10 (22)				◆nd			98
3										
	SS TH205A-6	58	10 8 6 5 (14)				◆25			
4	SS TH205A-7	63	6 13 12 12 (25)				◆25			97
						4.27 Black SILTY CLAY (weathered mudstone), some sand & gravel, moist to wet, black staining from 6.1 to 7.6 mbgs, petroleum odour from 6.1 to 9.1 mbgs				
	SS TH205A-8	58	19 50/4"				◆50			96
5										
	SS TH205A-9	67	50/5"				◆50			95
6										

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH205A

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	☢ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION	ELEVATION (m)
	SS TH205A-10	17	1 13 7 6 (20)			mbgs Black SILTY CLAY (weathered mudstone), some sand & gravel, moist to wet, black staining from 6.1 to 7.6 mbgs, petroleum odour from 6.1 to 9.1 mbgs *(continued from 4.27 mbgs)*	◆75			
7	SS TH205A-11	67	17 50/5"	VOC, F1-F4, PAH, Inorganics			⊗is			94
	SS TH205A-12	50	50/6"				◆175			93
8										
	SS TH205A-13	33	50/5"	Grain Size			◆150			92
9						9.14				

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH206

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 24-Sep-14 **COMPLETED** 02-Oct-14 **WEATHER** Sunny 20°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** 100.80 m **TOP OF PIPE ELEV.** 101.54 m

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** 0.05 m **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** 7.39 mbgs / Elev 93.41 m 14-Oct-14

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 46 **EASTING** 44 76 37

BENCHMARK Catch basin on the western portion of the subject property, Assumed Elev. = 100.00 m

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is)	⊗ SOIL VAPOUR CONCENTRATION (%LEL)	WELL CONSTRUCTION Casing Type: Monument	ELEVATION (m)
						mbgs	100 200 300 400	20 40 60 80		
1	GB TH206-1			VOC, F1-F4, PAH, PCB, Inorganics		Brown to black SAND (fill), some to trace gravel, silt, & clay, some metal wire found from 2.1 to 3.1 mbgs, moist to wet, no staining, no odour	◆25			100
	GB TH206-2						◆nd			
	GB TH206-3						◆10			
2	SS TH206-4	33	3 10 11 6 (21)				◆nd			99
	SS TH206-5	38	5 9 8 6 (17)				◆25			98
3	SS TH206-6	75	9 9 14 8 (23)				◆5			
4	SS TH206-7	46	2 3 3 4 (6)				◆35			97
	SS TH206-8	46	3 4 2 2 (6)				◆65			96
5	SS TH206-9	42	2 2 4 3 (6)				◆140			95
6						6.10				

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH206

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	⊗ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION	ELEVATION (m)
	SS TH206-10	67	32 50/2"			Black SILTY CLAY (weathered mudstone), some to trace gravel, damp to wet, no staining, petroleum odour		⊗ 15		94
7	SS TH206-11	67	24 50/2"	VOC, F1-F4, PAH, Inorganics				⊗ 25		
	SS TH206-12	42	25 50/1"					⊗ 23		93
8										
	SS TH206-13	33	21 50/2"					⊗ 5		92
9						9.14 mbgs				

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH207

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 24-Sep-14 **COMPLETED** 29-Sep-14 **WEATHER** Sunny 20°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** 100.78 m **TOP OF PIPE ELEV.** 101.43 m

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** 0.05 m **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** 7.41 mbgs / Elev 93.37 m 14-Oct-14

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 45 **EASTING** 44 76 34

BENCHMARK Catch basin on the western portion of the subject property, Assumed Elev. = 100.00 m

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	⊗ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION Casing Type: Monument	ELEVATION (m)
						mbgs				
						Brown to black SAND (fill), some to trace gravel, silt, & clay, moist to wet, black staining & petroleum odour from 3.7 to 6.1 mbgs				
	GB TH207-1						◆15			
1										100
	GB TH207-2			VOC, F1-F4, PAH, PCB, Inorganics			◆45			
	GB TH207-3						◆35			
	SS TH207-4	46	8 14 16 18 (30)				◆nd			99
2										
	SS TH207-5	42	6 7 8 5 (15)				◆20			98
3										
	SS TH207-6	71	6 6 7 9 (13)				◆35			97
4	SS TH207-7	50	4 5 8 6 (13)	pH			◆65			
	SS TH207-8	63	5 4 3 3 (7)				◆70			96
5										
	SS TH207-9	42	2 5 4 6 (9)				◆50			95
6						6.10				

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

(Continued Next Page)

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TEST HOLE # TH207

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	⊗ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION	ELEVATION (m)
	SS TH207-10 RC	167	50/4"	VOC, F1-F4, PAH, Inorganics		6.25 mbgs Black SILTY CLAY (weathered mudstone), some sand & gravel, black staining, petroleum odour Black MUDSTONE, fossilized, black staining, petroleum odour 11.58	◆275			94 93 92 91 90
7										
8										
9										
10										
11										

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH208

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 25-Sep-14 **COMPLETED** 02-Oct-14 **WEATHER** Sunny 21°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** n/a **TOP OF PIPE ELEV.** n/a

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** n/a **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** n/a

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 66 **EASTING** 44 76 39

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	⊗ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
						mbgs			
1	GB TH208-1					Brown to black SAND (fill), some to trace gravel, silt, & clay, moist, no staining, petroleum odour from 3.7 to 4.6 mbgs. Layer of coarse sand from 1.5 to 1.8 mbgs	◆ nd		
	GB TH208-2			VOC, F1-F4, PAH, PCB, Inorganics			◆ 75		
	GB TH208-3						◆ 75		
2	SS TH208-4	54	1 1 1 4 (2)				◆ 65		
	SS TH208-5	46	8 14 9 6 (23)				◆ 70		
3	SS TH208-6	79	10 5 6 3 (11)				◆ 180		
4	SS TH208-7	89	20 33 50/4"				◆ 350		
	SS TH208-8	117	50/6"			4.57 Black SILTY CLAY (weathered mudstone), some sand & gravel, no staining, petroleum odour	◆ 310		
5	SS TH208-9	117	50/6"				◆ 400		
6									

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH208

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	☢ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
	SS TH208-10	117	50/4"	VOC, F1-F4, PAH, Inorganics		Black SILTY CLAY (weathered mudstone), some sand & gravel, no staining, petroleum odour *(continued from 4.57 mbgs)*	◆475		
7	SS TH208-11	67	50/3"				◆400		
	RC					7.32 Black MUDSTONE, fossilized, petroleum odour from 7.3 to 7.9 mbgs			
8									
9						9.14			

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH209

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 24-Sep-14 **COMPLETED** 02-Oct-14 **WEATHER** Sunny 20°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** n/a **TOP OF PIPE ELEV.** n/a

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** n/a **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** n/a

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 57 **EASTING** 44 76 47

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	⊗ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
mbgs									
1	GB TH209-1					Brown to black SAND (fill), some to trace gravel, silt, & clay, moist to damp, black staining from 5.2 to 6.7 mbgs, petroleum odour from 5.2 to 9.8 mbgs	◆ nd		
	GB TH209-2						◆ 45		
	GB TH209-3			VOC, F1-F4, PAH, PCB, Inorganics			◆ 85		
2	SS TH209-4	8					◆ nd		
	SS TH209-5		10 12 17 30 (29)				◆ 10		
3	SS TH209-6	75	11 12 19 25 (31)				◆ 30		
4	SS TH209-7	94	11 22 50/6"				◆ 80		
	SS TH209-8	75	25 50/6"				◆ 90		
5									
	SS TH209-9	67	1 16 26 27 (42)				◆ 265		
6									

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH209

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	☢ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
	SS TH209-10	42	15 50/3"	VOC, F1-F4, PAH, Inorganics		Brown to black SAND (fill), some to trace gravel, silt, & clay, moist to damp, black staining from 5.2 to 6.7 mbgs, petroleum odour from 5.2 to 9.8 mbgs *(continued from 0.00 mbgs)*	⊗ is		
7	SS TH209-11	50	50/5"				◆ 380		
	SS TH209-12	50	50/6"				◆ 225		
8									
	SS TH209-13	17	50/2"				◆ 185		
9									
	SS TH209-14	50	50/5"	VOC, F1-F4, PAH, Inorganics			◆ 135		
						9.75			

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH210

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 25-Sep-14 **COMPLETED** 03-Oct-14 **WEATHER** Sunny 21°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** 100.36 m **TOP OF PIPE ELEV.** 100.99 m

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** 0.05 m **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** 6.99 mbgs / Elev 93.37 m 14-Oct-14

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 65 **EASTING** 44 76 55

BENCHMARK Catch basin on the western portion of the subject property, Assumed Elev. = 100.00 m

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	❂ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION Casing Type: Monument	ELEVATION (m)
						mbgs				
	GB TH210-1					FILL comprised of brick, concrete, asphalt, wood & metal fragments	⊗ is			100
1	GB TH210-2					1.22	⊗ is			
	GB TH210-3			VOC, F1-F4, PAH, PCB, Inorganics		Brown SAND (fill), some to trace gravel, silt, clay, & concrete fragments, moist, no staining, no odour	◆ 60			99
	SS TH210-4	29	4 10 12 15 (22)				◆ nd			
2										
	SS TH210-5	63	1 8 12 21 (20)				◆ nd			98
3										
	SS TH210-6	150	11 50/4"				◆ 25			97
4	SS TH210-7	67	31 21 20 29 (41)				◆ 15			
	SS TH210-8	75	13 36 46 50/5"				◆ 65			96
5						5.18				
	SS TH210-9	33	50/5"			Black SILTY CLAY (weathered mudstone), some sand & gravel, moist, black staining from 7.6 to 9.1 mbgs, petroleum odour from 6.1 to 9.1 mbgs	◆ 50			95
6										

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH210

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	❽ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION	ELEVATION (m)
	SS TH210-10	117	50/6"			mbgs Black SILTY CLAY (weathered mudstone), some sand & gravel, moist, black staining from 7.6 to 9.1 mbgs, petroleum odour from 6.1 to 9.1 mbgs *(continued from 5.18 mbgs)*	◆145			94
7	SS TH210-11	67	50/6"				◆295		▼	
	SS TH210-12	39	15 31 50/5"	VOC, F1-F4, PAH, Inorganics			⊗is			93
8										
	SS TH210-13	50	50/4"				◆410			92
9						9.14				

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH211

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 24-Sep-14 **COMPLETED** 06-Oct-14 **WEATHER** Sunny 20°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** n/a **TOP OF PIPE ELEV.** n/a

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 2.44 mbgs **MONITOR DIA** n/a **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** n/a

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 56 **EASTING** 44 76 60

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	⊗ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
						mbgs			
	GB TH211-1			Grain Size		Brown SAND (fill), some to trace gravel, silt, & clay, moist, no staining, no odour	◆25		
1	GB TH211-2			VOC, F1-F4, PAH, PCB, Inorganics			◆55		
	GB TH211-3						◆45		
2	GB TH211-4								
	SS TH211-5	50	1 1 2 4 (3)				◆95 ◆nd		
						2.74			
3	SS TH211-6	75	1 1 8 19 (9)			Black SILTY CLAY (weathered mudstone), some sand & gravel, black staining from 7.6 to 9.1 mbgs, petroleum odour from 6.7 to 9.1 mbgs	◆nd		
4	SS TH211-7	71	8 21 26 50/5"				◆25		
	SS TH211-8	33	50/6"				◆50		
5									
	SS TH211-9	33	50/5"				◆150		
6									

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH211

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	☢ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
	SS TH211-10	0	50/4"			mbgs Black SILTY CLAY (weathered mudstone), some sand & gravel, black staining from 7.6 to 9.1 mbgs, petroleum odour from 6.7 to 9.1 mbgs *(continued from 2.74 mbgs)*	⊗ is		
7	SS TH211-11	50	50/5"				◆ 100		
	SS TH211-12	33	24 14 50/2"	VOC, F1-F4, PAH, Inorganics			⊗ is		
8									
	SS TH211-13	33	50/2"				◆ 200		
						8.99			

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH212

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 24-Sep-14 **COMPLETED** 30-Sep-14 **WEATHER** Sunny 20°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** 100.65 m **TOP OF PIPE ELEV.** 101.31 m

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** 0.05 m **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** 7.27 mbgs / Elev 93.38 m 14-Oct-14

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 49 **EASTING** 44 76 53

BENCHMARK Catch basin on the western portion of the subject property, Assumed Elev. = 100.00 m

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	⊗ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION Casing Type: Monument	ELEVATION (m)
						mbgs				
						Brown SAND (fill), some to trace gravel, silt, & clay, moist, no staining, no odour				
	GB TH212-1			pH			◆25			100
1										
	GB TH212-2			VOC, F1-F4, PAH, PCB, Inorganics			◆65			
	GB TH212-3						◆45			
	SS TH212-4	38	1 2 1 1 (3)				◆25			99
2										
	SS TH212-5	54	2 1 1 2 (2)				◆20			98
3										
	SS TH212-6	42	4 9 11 11 (20)				◆35			97
	SS TH212-7	67	2 4 10 27 (14)			3.96	◆70			
4						Black SILTY CLAY (weathered mudstone), some sand & gravel, no staining, petroleum odour from 5.2 to 6.6 mbgs				
	SS TH212-8	75	30 50/4"				◆85			96
5										
	SS TH212-9	92	25 50/5"	VOC, F1-F4, PAH, Inorganics			⊗is			95
6										

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH212

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	☢ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION	ELEVATION (m)
	SS TH212-10	42	30 50/3"			mbgs Black SILTY CLAY (weathered mudstone), some sand & gravel, no staining, petroleum odour from 5.2 to 6.6 mbgs *(continued from 3.96 mbgs)*	◆85			
	RC					6.55 Black MUDSTONE, fossilized, petroleum odour from 7.3 to 9.1 mbgs				94
7										
										93
8										
										92
9						9.14				

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH213

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 25-Sep-14 **COMPLETED** 06-Oct-14 **WEATHER** Sunny 21°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** n/a **TOP OF PIPE ELEV.** n/a

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** n/a **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** n/a

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 68 **EASTING** 44 76 50

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	❂ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
						mbgs			
	GB TH213-1			VOC, F1-F4, PAH, PCB, Inorganics		Brown to grey SAND & GRAVEL (fill), some silt, moist, no staining, no odour			
						0.61	◆ nd		
1						FILL comprised of brick, concrete, asphalt, wood & metal fragments			
	GB TH213-2						⊗ is		
	GB TH213-3						⊗ is		
	SS TH213-4	67	50/5"				◆ nd		
2						2.13			
	SS TH213-5	88	11 14 16 19 (30)			Black SILTY CLAY (weathered mudstone), some sand & gravel, no staining, petroleum odour from 6.1 to 8.2 mbgs	◆ nd		
3									
	SS TH213-6	133	50/6"				◆ 25		
4	SS TH213-7	83	7 40 50/4"				◆ 25		
	SS TH213-8	67	14 50/5"				◆ 25		
5									
	SS TH213-9	75	17 50/3"				◆ 50		
6									

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH213

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	☢ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
	SS TH213-10	67	50/4"	VOC, F1-F4, PAH, Inorganics		Black SILTY CLAY (weathered mudstone), some sand & gravel, no staining, petroleum odour from 6.1 to 8.2 mbgs *(continued from 2.13 mbgs)*	⊗ is		
7	SS TH213-11	33	50/4"				◆ 75		
	SS TH213-12	50	50/4"				◆ 50		
8	SS TH213-13	33	50/5"				◆ 50		
						8.99			

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH214

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 25-Sep-14 **COMPLETED** 07-Oct-14 **WEATHER** Sunny 21°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** n/a **TOP OF PIPE ELEV.** n/a

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** n/a **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** n/a

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 73 **EASTING** 44 76 60

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	❂ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
						mbgs			
	GB TH214-1					FILL comprised of brick, concrete, asphalt, wood & metal fragments	⊗ is		
1	GB TH214-2						⊗ is		
	GB TH214-3						⊗ is		
	SS TH214-4	25	2 50/6"			1.52 Brown to grey SAND (fill), some to trace gravel, silt, clay, concrete & brick fragments, moist, no staining, no odour	◆ 25		
2									
	SS TH214-5	58	31 21 14 27 (35)			2.44 Black SILTY CLAY (weathered mudstone), some sand & gravel, no staining, petroleum odour from 6.1 to 7.6 mbgs	◆ nd		
3									
	SS TH214-6	83	1 16 27 36 (43)	Grain Size			◆ nd		
4	SS TH214-7	83	17 29 19 26 (48)				◆ 25		
	SS TH214-8		25 50/3"				◆ 50		
5									
	SS TH214-9	50	50/2"				◆ 75		
6									

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH214

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	☢ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
	SS TH214-10	67	50/6"			mbgs Black SILTY CLAY (weathered mudstone), some sand & gravel, no staining, petroleum odour from 6.1 to 7.6 mbgs *(continued from 2.44 mbgs)*	◆ 100		
7	SS TH214-11	33	50/2"	VOC, F1-F4, PAH, Inorganics			⊗ is		
	SS TH214-12	33	50/3"	VOC, F1			⊗ is		
8									
	SS TH214-13	33	50/3"				◆ 25		
						8.99			

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH215

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario **PROJECT NUMBER** 14004

DATE STARTED 24-Sep-14 **COMPLETED** 07-Oct-14 **WEATHER** Sunny 20°C **GAS METER TYPE** RKI Eagle 2

DRILLING CONTRACTOR George Downing Estate Drilling **GROUND ELEV.** n/a **TOP OF PIPE ELEV.** n/a

DRILLING EQUIPMENT CME 55 Truck mount **DAYLIGHTING TO** 1.52 mbgs **MONITOR DIA** n/a **TH DIA** 0.15 m

DRILLING METHOD Hollow Stem Auger **WATER LEVEL** n/a

FIELD STAFF JW **LOGGED BY** DKS **CHECKED BY** DKS **NORTHING** 503 12 60 **EASTING** 44 76 72

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	❽ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
						mbgs			
	GB TH215-1					FILL comprised of brick, concrete, asphalt, wood & metal fragments	⊗is		
1						0.91			
	GB TH215-2			VOC, F1-F4, PAH, PCB, Inorganics		Brown to grey SAND (fill), some to trace gravel, silt, clay, concrete & brick fragments, moist to damp, no staining, no odour	◆30		
	GB TH215-3						◆40		
	SS TH215-4	42	10 7 9 10 (16)				◆nd		
2									
	SS TH215-5	63	14 28 27 50/5"				◆nd		
3									
	SS TH215-6	100	25 50/6"				◆25		
						3.81			
4	SS TH215-7	67	21 50/6"			Black SILTY CLAY (weathered mudstone), some sand & gravel, no staining, petroleum odour from 6.7 to 8.2 mbgs	◆25		
	SS TH215-8	50	10 12 50/6"				◆50		
5									
	SS TH215-9	50	21 50/6"				◆50		
6									

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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TEST HOLE # TH215

CLIENT Imperial Oil

PROJECT LOCATION 2 Montreal Road, Ottawa, Ontario

PROJECT NUMBER 14004

DEPTH (mbgs)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	ANALYSIS	GRAPHIC LOG	MATERIAL DESCRIPTION	◆ SOIL VAPOUR CONCENTRATION (ppmv) ○ (nm) ⊗ (is) 100 200 300 400	☢ SOIL VAPOUR CONCENTRATION (%LEL) 20 40 60 80	WELL CONSTRUCTION
	SS TH215-10	50	50/5"			mbgs Black SILTY CLAY (weathered mudstone), some sand & gravel, no staining, petroleum odour from 6.7 to 8.2 mbgs *(continued from 3.81 mbgs)*	◆75		
7	SS TH215-11	42	25 14 5 4 (19)	VOC, F1-F4, PAH, Inorganics			◆125		
	SS TH215-12	150	50/5"	VOC, F1-F4, PAH, Inorganics			◆75		
8									
	SS TH215-13	0	1 0 0 0 (0)			8.99	⊗is		

TEST HOLE LOG - January 2014

ppmv = parts per million by volume; %LEL = % lower explosive limit; nd = not detected; is = insufficient sample for screening; nm = not measured; n/a = not applicable; mbgs = metres below ground surface; masl = metres above sea level

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 x 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

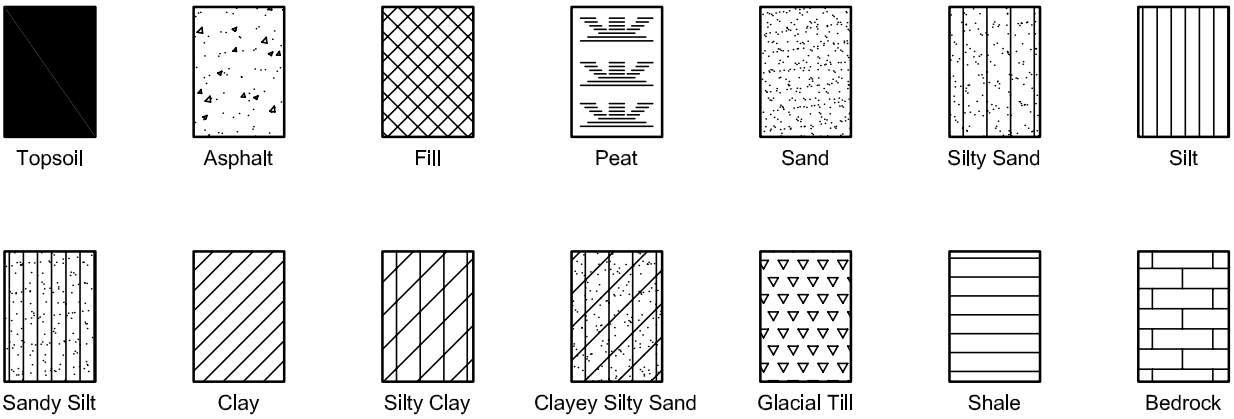
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void 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.

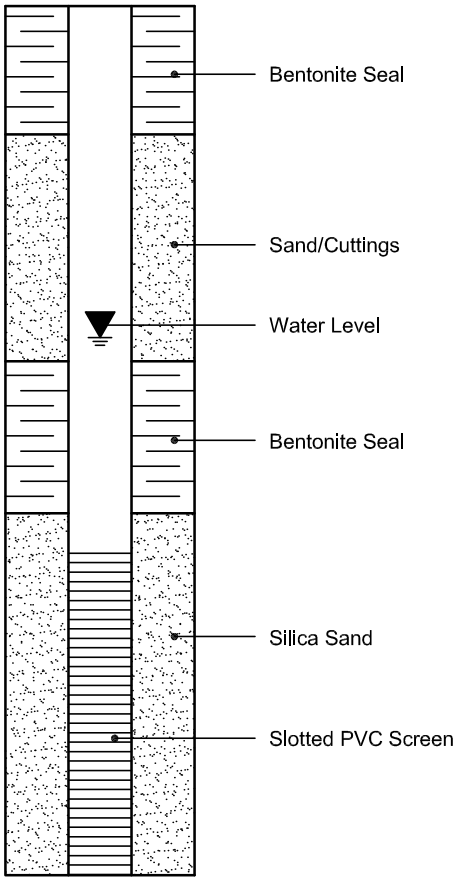
SYMBOLS AND TERMS (continued)

STRATA PLOT

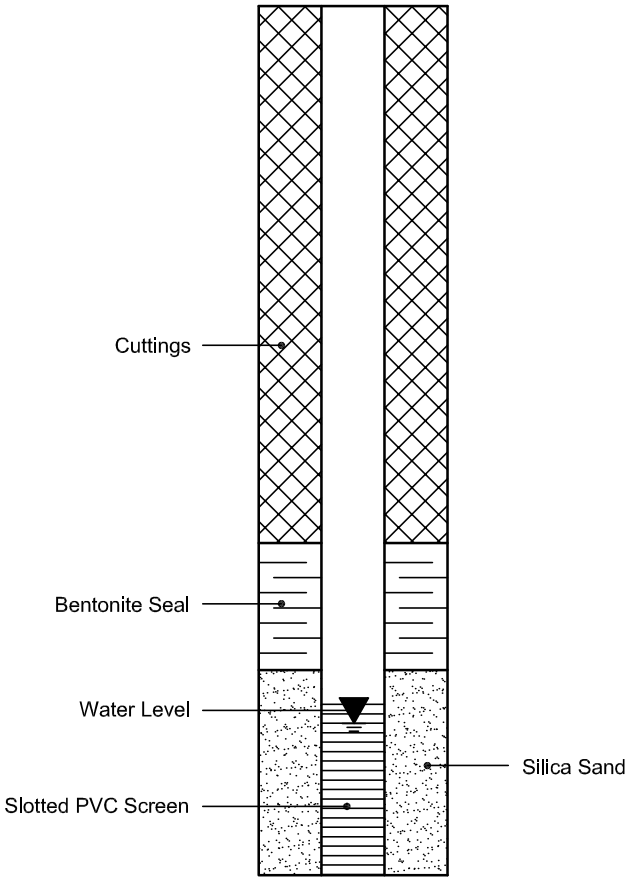


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURE 3 & 4 - SHEAR WAVE VELOCITY TEST PROFILES

DRAWING PG4915-1 - TEST HOLE LOCATION PLAN

DRAWING PG4915-2 - BEDROCK CONTOUR PLAN

DRAWING PG4915-3 - SOUND BEDROCK CONTOUR PLAN

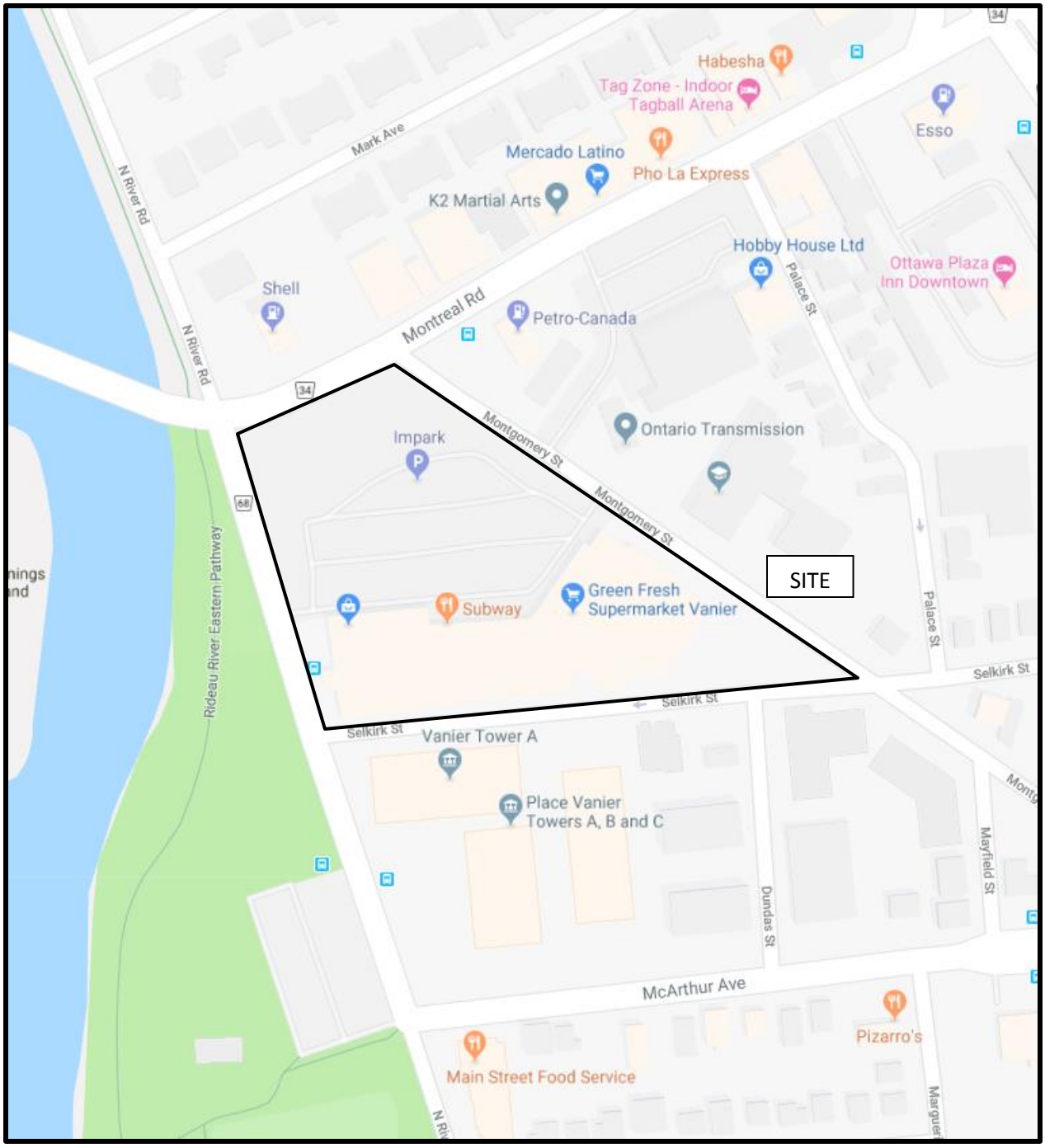
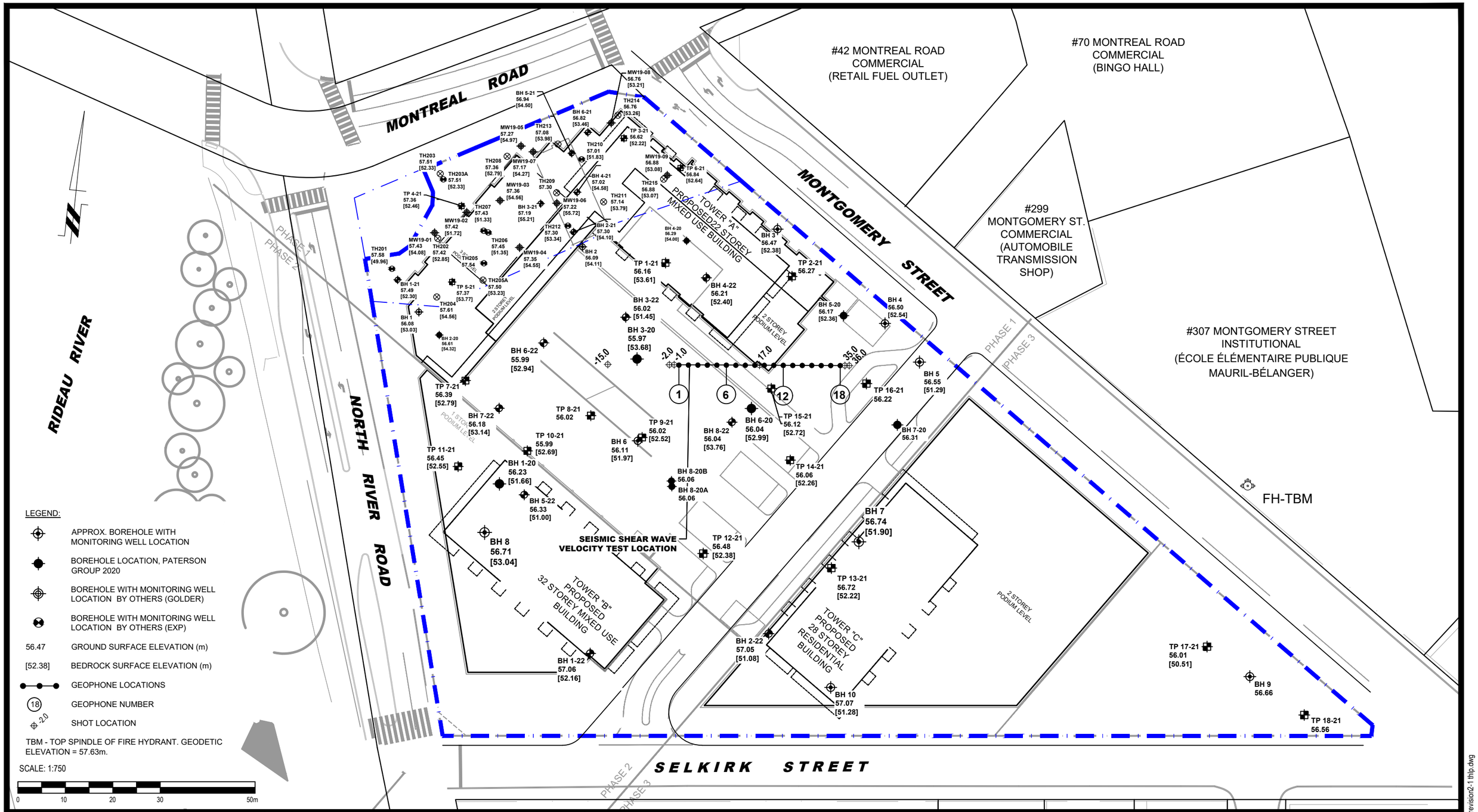


FIGURE 1

KEY PLAN



LEGEND:

- APPROX. BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION, PATERSON GROUP 2020
- BOREHOLE WITH MONITORING WELL LOCATION BY OTHERS (GOLDER)
- BOREHOLE WITH MONITORING WELL LOCATION BY OTHERS (EXP)
- 56.47 GROUND SURFACE ELEVATION (m)
- [52.38] BEDROCK SURFACE ELEVATION (m)
- GEOPHONE LOCATIONS
- (18) GEOPHONE NUMBER
- -2.0 SHOT LOCATION

TBM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 57.63m.

SCALE: 1:750

0 10 20 30 50m

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NO.	REVISIONS	DATE	INITIAL

MAIN AND MAIN DEVELOPMENTS

GEOTECHNICAL INVESTIGATION
3-33 SELKIRK STREET AND 2 MONTREAL ROAD
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:750	Date: 11/2021
Drawn by: RCG	Report No.: PG4915-1
Checked by: RG	**PG4915-1**
Approved by: DJG	Revision No.: 2

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#42 MONTREAL ROAD
COMMERCIAL
(RETAIL FUEL OUTLET)

#70 MONTREAL ROAD
COMMERCIAL
(BINGO HALL)

#299
MONTGOMERY ST.
COMMERCIAL
(AUTOMOBILE
TRANSMISSION
SHOP)

#307 MONTGOMERY STREET
INSTITUTIONAL
(ÉCOLE ÉLÉMENTAIRE PUBLIQUE
MAURIL-BÉLANGER)

MONTREAL ROAD

MONTGOMERY STREET

NORTH RIVER ROAD

SELKIRK STREET

RIDEAU RIVER

PROPOSED 22 STOREY MIXED USE BUILDING "TOWER "A"

TOWER "B" PROPOSED 32 STOREY MIXED USE BUILDING

TOWER "C" PROPOSED 28 STOREY RESIDENTIAL BUILDING

2 STOREY PODIUM LEVEL

PHASE 1
PHASE 2
PHASE 3

MW19-08 56.76 [53.21]
BH 5-21 56.94 [54.50]
MW19-05 57.27 [54.97]
TH213 57.08 [53.98]
BH 6-21 56.82 [53.46]
TH214 56.76 [53.26]
TP 3-21 56.62 [52.22]
TH210 57.01 [51.83]
MW19-09 56.88 [53.08]
TP 6-21 56.84 [52.64]
TH203 57.51 [52.33]
TH208 57.36 [52.79]
MW19-07 57.17 [54.27]
TH203A 57.51 [52.33]
BH 4-21 57.02 [54.58]
TH215 56.88 [53.07]
TH209 57.30
MW19-03 57.36 [54.56]
TP 4-21 57.36 [52.46]
TH207 57.43 [51.33]
BH 3-21 57.19 [55.21]
MW19-06 57.22 [55.72]
TH211 57.14 [53.79]
MW19-02 57.42 [51.72]
TH212 57.30 [53.34]
BH 2-21 57.30 [54.10]
BH 4-20 56.29 [54.00]
BH 3 56.47 [52.38]
MW19-01 57.43 [54.08]
TH206 57.45 [51.35]
TH201 57.58 [49.96]
TH202 57.42 [52.85]
MW19-04 57.35 [54.55]
BH 2 56.09 [54.11]
TH205 57.54
TP 1-21 56.16 [53.61]
TP 2-21 56.27
BH 1-21 57.49 [52.30]
TP 5-21 57.37 [53.77]
TH205A 57.50 [53.23]
BH 4-22 56.21 [52.40]
BH 3-22 56.02 [51.45]
BH 5-20 56.17 [52.36]
BH 4 56.50 [52.54]
TH204 57.61 [54.56]
BH 1 56.08 [53.03]
BH 2-20 56.61 [54.32]
BH 3-20 55.97 [53.68]
BH 6-22 55.99 [52.94]
TP 7-21 56.39 [52.79]
BH 7-22 56.18 [53.14]
TP 8-21 56.02
TP 16-21 56.22
BH 5 56.55 [51.29]
TP 9-21 56.02 [52.52]
TP 10-21 55.99 [52.69]
BH 6 56.11 [51.97]
BH 8-22 56.04 [53.76]
BH 6-20 56.04 [52.99]
TP 15-21 56.12 [52.72]
BH 7-20 56.31
TP 11-21 56.45 [52.55]
BH 1-20 56.23 [51.66]
BH 8-20B 56.06
BH 8-20A 56.06
TP 14-21 56.06 [52.26]
BH 5-22 56.33 [51.00]
BH 7 56.74 [51.90]
BH 8 56.71 [53.04]
SEISMIC SHEAR WAVE VELOCITY TEST LOCATION
TP 12-21 56.48 [52.38]
TP 13-21 56.72 [52.22]
BH 2-22 57.05 [51.08]
BH 1-22 57.06 [52.16]
BH 10 57.07 [51.28]
TP 17-21 56.01 [50.51]
BH 9 56.66
TP 18-21 56.56
FH-TBM
-15.0
-2.0
-1.0
17.0
35.0
36.0
1
6
12
18

LEGEND:

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- BOREHOLE WITH MONITORING WELL LOCATION BY OTHERS (GOLDER)
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- (18) GEOPHONE NUMBER
- -2.0 SHOT LOCATION
- 54.00 BEDROCK CONTOUR(m)

TBM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 57.63m.

SCALE: 1:750

0 10 20 30 50m

patersongroup
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NO.	REVISIONS	DATE	INITIAL

MAIN AND MAIN DEVELOPMENTS

GEOTECHNICAL INVESTIGATION
3-33 SELKIRK STREET AND 2 MONTREAL ROAD

OTTAWA, ONTARIO

Title:

BEDROCK CONTOUR PLAN

Scale: 1:750	Date: 11/2021
Drawn by: RCG	Report No.: PG4915-1
Checked by: RG	**PG4915-2**
Approved by: DJG	Revision No.: 2

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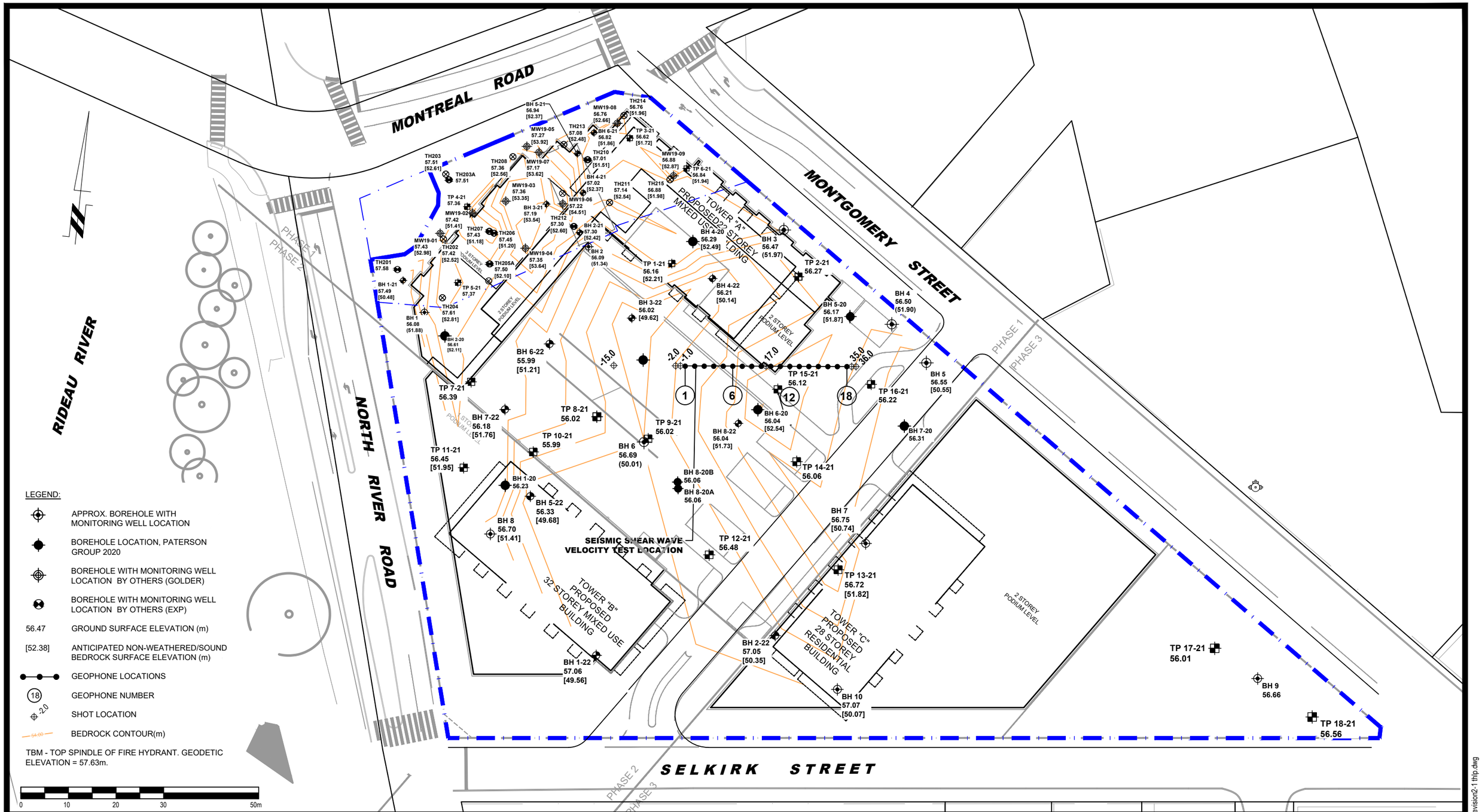

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- BOREHOLE WITH MONITORING WELL LOCATION BY OTHERS (GOLDER)
- BOREHOLE WITH MONITORING WELL LOCATION BY OTHERS (EXP)
- 56.47 GROUND SURFACE ELEVATION (m)
- [52.38] ANTICIPATED NON-WEATHERED/SOUND BEDROCK SURFACE ELEVATION (m)
- GEOPHONE LOCATIONS
- (18) GEOPHONE NUMBER
- ⊗ 2.0 SHOT LOCATION
- 54.00 BEDROCK CONTOUR(m)

TBM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 57.63m.

0 10 20 30 50m

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NO.	REVISIONS	DATE	INITIAL

MAIN AND MAIN DEVELOPMENTS

GEOTECHNICAL INVESTIGATION
3-33 SELKIRK STREET AND 2 MONTREAL ROAD
OTTAWA, ONTARIO

Title:

SOUND BEDROCK CONTOUR PLAN

Scale: 1:750	Date: 11/2021
Drawn by: RCG	Report No.: PG4915-1
Checked by: RG	PG4915-3
Approved by: DJG	Revision No.: 2

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patersongroup **memorandum**

consulting engineers

re: **Geotechnical Response to City Comments**
Proposed High-Rise Complex
3-33 Selkirk Street and 2 Montreal Road - Ottawa

to: Main and Main Developments Inc.– **Ms. Emily Roukhkian** – emily@mainandmain.ca

date: June 14, 2021

file: PG4915-MEMO.02

Further to your request, Paterson Group (Paterson) prepared the current memorandum to address the geotechnical-related review comments provided by the City of Ottawa. The following memorandum should be read in conjunction with the current Geotechnical Investigation Report (Paterson Group Report PG4915-1 Revision 2, dated June 17, 2020).

Geotechnical Investigation

Comment: *The report does not speak to the footing drains and how they will be integrated into the site service design. Footing drains are to be independently connected unless utilizing a pumping system with electrical and pump backup with an integrated ICD. Ensure you speak to this in the report and on drawings if necessary.*

Response: Based on the findings of the field investigation program, the long-term groundwater level is anticipated at a depth ranging between 6 to 7 m below existing grade and within the bedrock. It is also understood that the proposed building will be provided one basement level which will generally consist of underground parking. Based on this, the building and basement level will be founded above the long-term groundwater table.

Section 6.1 of the aforementioned geotechnical report provides recommendations for the foundation drainage system as based on the number of basement levels proposed for the proposed building. Provided that the proposed building will be provided with one basement level located above the long-term groundwater table, it is recommended that a foundation drainage system be provided along the exterior perimeter of the buildings foundation.

It is expected that insufficient room will be available for exterior backfill and most likely will be a blind pour against a shoring system. Based on this, the following methodology is proposed for implementing the foundation drainage system:

- A composite drainage membrane (such as DeltaDrain 6000, MiraDrain G100N or equivalent) should be placed against the shoring system and bedrock excavation face extending between finished grade to the founding elevation. The foundation wall should be blind-poured against this composite drainage board layer.

- ❒ It is recommended that 150 mm diameter sleeves at 3 m centres be cast in the footing or at the foundation wall/footing interface to allow the infiltration of water to flow to an interior perimeter drainage pipe.
- ❒ The interior perimeter drainage pipe should be connected to an interior underfloor drainage pipe located below the basement floor. The underfloor drainage system should direct water to the appropriate sump pit(s) within the lower basement area.
- ❒ For preliminary design purposes, it is recommended that the underfloor drainage pipe consist of a 150 mm diameter perforated pipe placed in each bay of the basement parking level. The final spacing of the underfloor drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed by the geotechnical consultant.

Based on this methodology, water carried by the foundation and underfloor drainage system will generally consist of surface water and will not consist of groundwater/long-term dewatering of the groundwater table. Water managed by this system will be directed to the appropriate building sump pit.

It is expected that the successful implementation of this system throughout the subject site will result in a long-term infiltration rate of less than 30,000 L/day of surface water. Peak periods of infiltration (i.e.- short-term conditions) should be anticipated during heavy rainfall and snow-melt events.

We trust that this information satisfies your immediate requirements.

Best Regards,

Paterson Group Inc.

Drew Petahtegoose, B.Eng.

David J. Gilbert, P.Eng.

patersongroup **memorandum**

consulting engineers

re: **Geotechnical Response to City Comments**
Proposed High-Rise Complex
3-33 Selkirk Street and 2 Montreal Road - Ottawa

to: Main and Main Developments Inc.– **Ms. Emily Roukhkian** – emily@mainandmain.ca

date: March 30, 2022

file: PG4915-MEMO.03

Further to your request, Paterson Group (Paterson) prepared the current memorandum to address the geotechnical related review comments provided by the City of Ottawa. The following memorandum should be read in conjunction with the current Geotechnical Investigation Report (Paterson Group Report PG4915-1 Revision 3, dated March 26, 2022).

Geotechnical Investigation

Comment 3.6: *As there will be blasting as part of the excavation work, a pre-blast survey and report are required and will be part of the conditions of the agreement. Monitoring of all sewers and watermains, will be required coupled with pre and post CCTV surveys. Document the monitoring requirements in the report.*

Response: Reference should be made to Section 5.2 of the current Geotechnical Investigation Report (Paterson Group Report PG4915-1 Revision 3, dated March 26, 2022) which has been updated to reflect the requested monitoring and surveying guidelines. It is understood that the developer has engaged a company to complete a pre-construction survey for the neighbouring properties.

Comment 3.7: *Please submit a letter stating that the latest Grading and Servicing Plan has been reviewed and that it complies with the recommendations and statements of the latest Geotechnical Investigation.*

Response: Reference should be made to Paterson Group Memorandum PG4915-MEMO.04, dated March 26, 2022 which documents our review of site servicing and grading plans for the subject site. In summary, the current (Revision 2) site servicing and grading plans prepared by Lithos are considered acceptable from a geotechnical perspective.

Comment 3.8: *Report does not speak or relate to the USF elevation in terms of groundwater table from information provided in Section 4.3 and Table 1. Revise.*

Response: Based on the findings of the field investigation program, the long-term groundwater level is anticipated at a depth ranging between 6 to 7 m below existing grade and within the bedrock. It is also understood that the proposed development will be provided one basement level which will generally consist of underground parking with a geodetic finished floor elevation of approximately 53.74 m.

Based on these details, the proposed structures will be founded approximately 3 to 4 m below the existing ground surface and above the long-term groundwater table. Given this, the recommendations provided in *Section 5.3 – Foundation Design* of the current Geotechnical Investigation Report will not be impacted by the long-term groundwater table and have considered its presence satisfactorily from a geotechnical perspective.

Comment 3.9: *Please speak to the foundation design at the proposed USF.*

Response: Reference should be made to Section 5.3 of the current Geotechnical Investigation Report which provides bearing resistance values, design and construction considerations for the proposed foundation at the proposed USF.

Comment 3.10: *The underground parking garage walls are considered retaining walls (regardless if it forms part of the building) and are over 1m in exposed height and holding back adjacent lands. As per City of Ottawa Slope Stability Guidelines for Development Application an engineering report is required to be prepared by a qualified engineer for any retaining walls 1m or greater in height that address the global stability of the wall. An Internal Compound Stability (ICS) analysis from a professional Geotechnical Engineer/ Structural Engineer licensed in the Province of Ontario is required to check for global stability. The retaining wall is to have a factor of safety of at least 1.5 for static conditions (as calculated through SLIDE) and 1.1 for seismic conditions. The report shall provide structural details of the retaining wall. The retaining wall design is required as part of the site plan stage, not at the time of building permit application submission.*

Response: It is understood the proposed development will be provided with one basement level consisting of an underground parking level with an anticipated preliminary finished floor elevation of 53.74 m. A global stability analysis was carried out using SLIDE to calculate the factor of safety based on the results of our investigation and assuming the foundation wall would be backfilled prior to the construction of the basement floor and overlying podium deck slabs. The cross-section considers a typical section of the future building excavation should consideration be given to using an open-cut excavation rather than supporting the overburden by the use of a temporary shoring system, which is considered to be a worst-case scenario. The cast-in-place foundation wall modelled considering a cohesion consisting of $0.1f'_c$ for 30 MPa 28-day compressive strength concrete, as is typically considered for high-rise foundation structures.

Theoretically, a factor of safety of 1.0 represents a condition where the slope is stable. However, due to intrinsic limitations of the calculation methods and the variability of the subsoil and groundwater conditions, a factor of safety greater than one is usually required to ascertain that the risks of failure are acceptable. A global stability minimum factor of safety of 1.5 is generally recommended for conditions where the failure of the retaining wall would endanger permanent structures. An analysis considering seismic loading was also completed. A horizontal acceleration of 0.16g (half of 0.32g, the peak ground acceleration value for the Ottawa area) was considered for the seismic loading condition. A factor of safety of 1.1 is considered to be satisfactory for stability analyses including seismic loading.

The results of the static and seismic analysis at Section A are shown on the attached Figures 1A and 1B, respectively. The results indicate the factor of safety was 13.31 and 3.75 under static conditions and when considering a seismic loading, respectively. Based on this, the global stability factor of safety exceeds 1.5 and 1.1 for static and seismic conditions, respectively. Therefore, the proposed foundation wall is considered acceptable from a geotechnical and global stability perspective.

It is not recommended to sequence backfilling the exterior side of the foundation wall prior to a sufficient lateral support system having been constructed to support the backfilled foundation wall. Given this, the foundation wall is not anticipated to act as a retaining wall at the time of construction based on the above-noted sequencing, from a geotechnical perspective.

Based on this, plans providing structural details for a retaining wall which would consist of the building's foundation wall will not be prepared by Paterson at this time. Reference should be made to *Section 5.5 – Basement Wall* of the Current Geotechnical Report for design parameters and considerations of the foundation wall structure from a geotechnical perspective.

Comment 3.11: *Site dewatering during construction may be subject to volume restriction thus is recommended that you reach out to City of Ottawa Sewer Use Program in advance to discuss discharge details. Provide correspondence in appendix.*

Response: This comment has been noted. It will be the responsibility of the excavation and dewatering contractor to obtain a Sewer Discharge Permit, if required, to carry out temporary dewatering measures and in cooperation with the City of Ottawa at the time of construction.

We trust that this information satisfies your immediate requirements.

Best Regards,

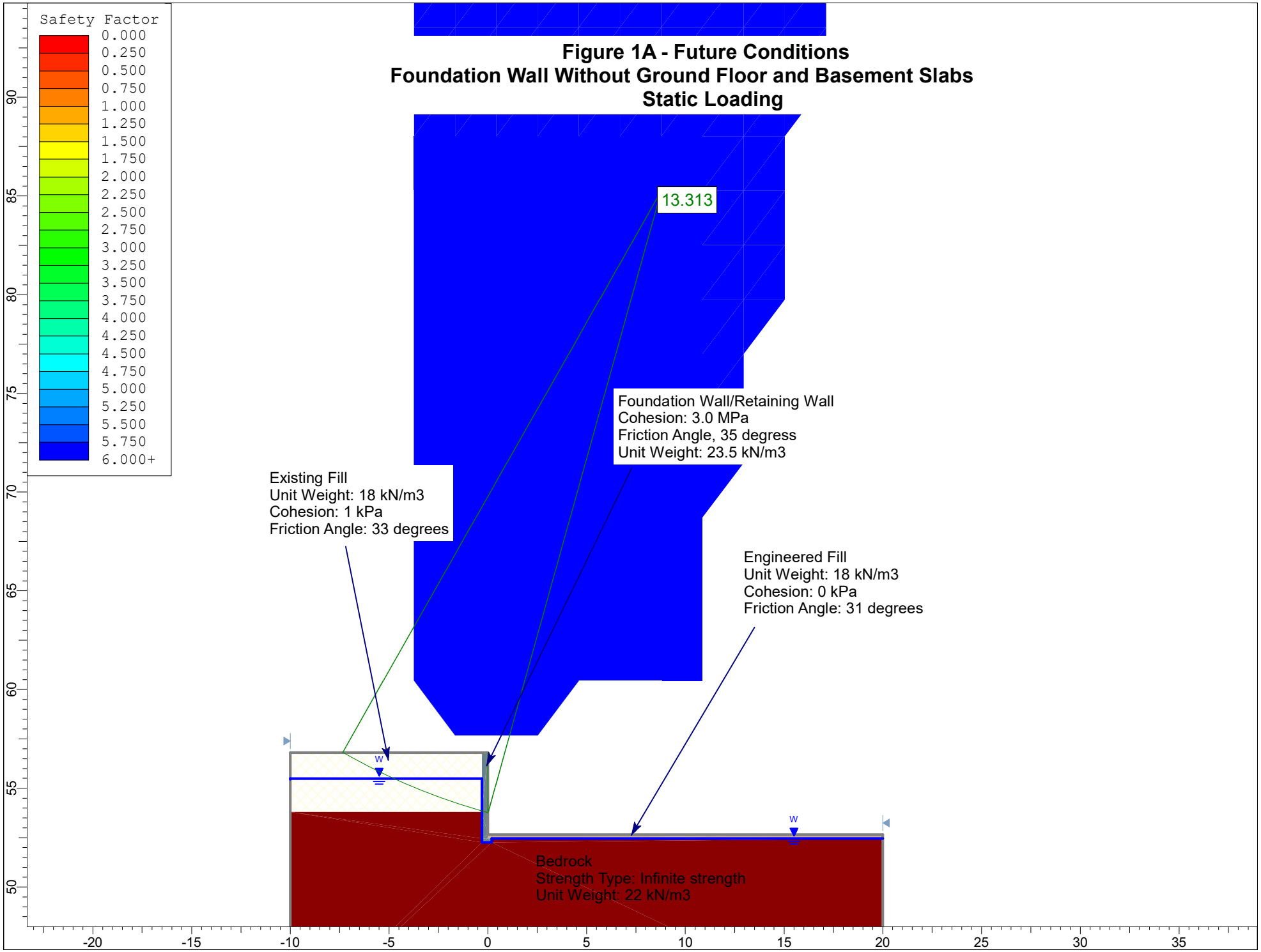
Paterson Group Inc.

Drew Petahtegoose, B.Eng.

David J. Gilbert, P.Eng.

Attachments

- Figure 1A – Slope Stability Section – Section A – Static Loading – Future Conditions
- Figure 1B – Slope Stability Section – Section A – Seismic Loading – Future Conditions


Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 1A - Future Conditions
Foundation Wall Without Ground Floor and Basement Slabs
Static Loading
13.313
Foundation Wall/Retaining Wall
Cohesion: 3.0 MPa
Friction Angle, 35 degress
Unit Weight: 23.5 kN/m3
Existing Fill
Unit Weight: 18 kN/m3
Cohesion: 1 kPa
Friction Angle: 33 degrees
Engineered Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 22 kN/m3
w
w
90
85
80
75
70
65
60
55
50
-20
-15
-10
-5
0
5
10
15
20
25
30
35

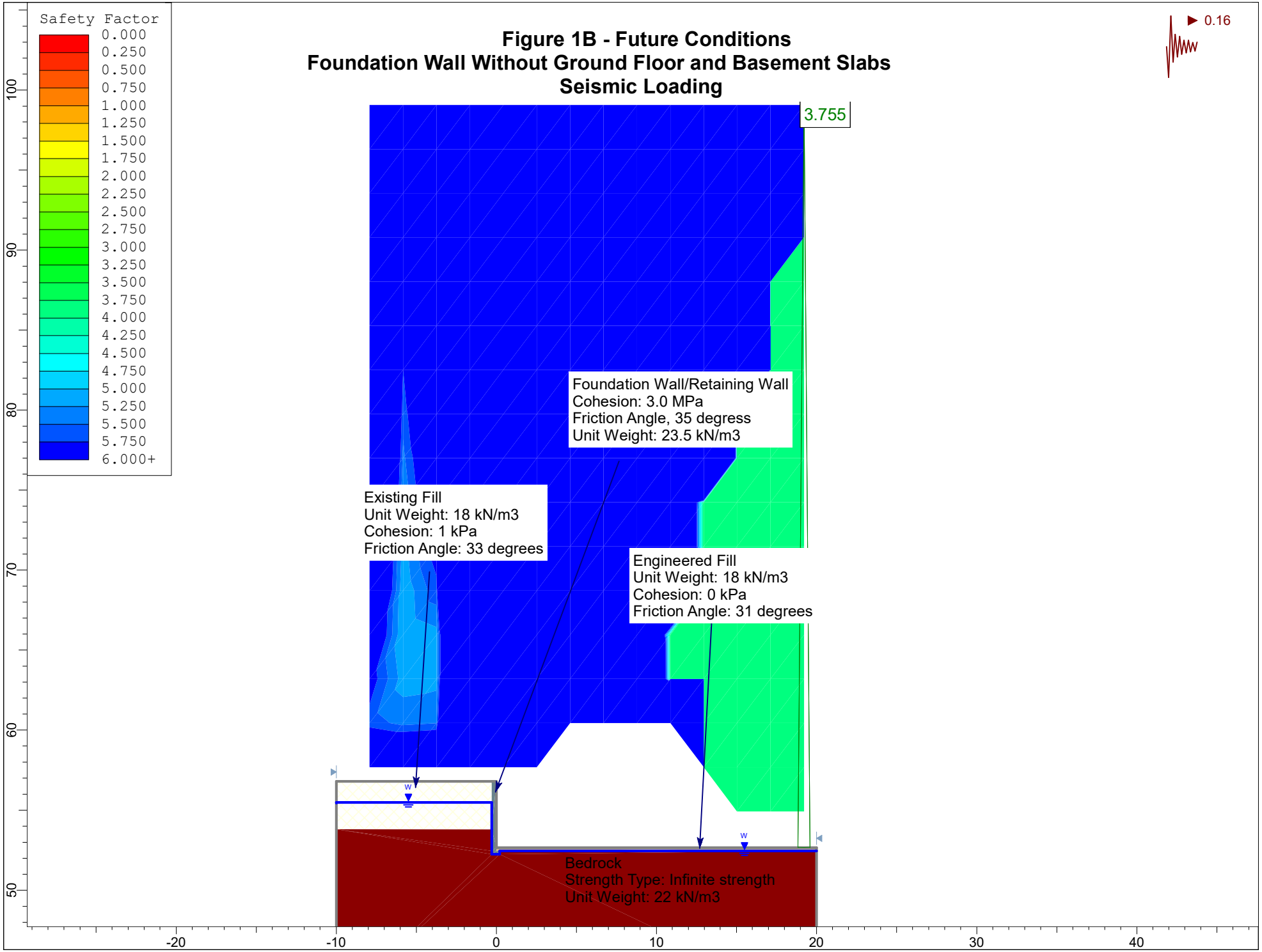


Figure 1B - Future Conditions
Foundation Wall Without Ground Floor and Basement Slabs
Seismic Loading
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
3.755
Foundation Wall/Retaining Wall
Cohesion: 3.0 MPa
Friction Angle, 35 degress
Unit Weight: 23.5 kN/m3
Existing Fill
Unit Weight: 18 kN/m3
Cohesion: 1 kPa
Friction Angle: 33 degrees
Engineered Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 22 kN/m3
100
90
80
70
60
50
-20
-10
0
10
20
30
40

patersongroup **memorandum**

consulting engineers

re: **Geotechnical Review of Site Servicing and Grading Plans**
Proposed High-Rise Complex
3-33 Selkirk Street and 2 Montreal Road - Ottawa

to: Main and Main Developments Inc. – **Ms. Emily Roukhkian –** emily@mainandmain.ca

date: March 26, 2022

file: PG4915-MEMO.04

Further to your request and authorization, Paterson Group (Paterson) prepared the current memorandum to provide a review of the site servicing and grading plans prepared for the proposed development to be located at the subject site. The following memorandum should be read in conjunction with Paterson Report PG4915-1 Revision 3, dated March 26, 2022.

Grading Plan Review

Paterson reviewed the following drawings prepared by Lithos for the proposed development as part of this review:

- ❏ Site Grading Plan – Phase I – Mixed Use Development – 29 Selkirk Street – Project No. UD19-079 – Drawing No. SG-01 – Revision 2 dated March 18, 2022.
- ❏ Site Grading Plan - Phases I-II-III (preliminary) – Mixed Use Development – 29 Selkirk Street – Project No. UD19-079 – Drawing No. SS-03 – Revision 2 dated March 18, 2022.

Based on our review, the proposed grading is considered acceptable from a geotechnical perspective.

Site Servicing Plan Review

Paterson reviewed the following drawings prepared by Lithos for the proposed development as part of this review:

- ❏ Site Servicing Plan – Mixed Use Development – 29 Selkirk Street – Project No. UD19-079 – Drawing No. SS-01 – Revision 2 dated March 18, 2022.
- ❏ Site Servicing Plan Phases I-II-III (preliminary) – Mixed Use Development – 29 Selkirk Street – Project No. UD19-079 – Drawing No. SS-03 – Revision 2 dated March 18, 2022.

Based on our review, the relevant recommendations (i.e., adequate frost protection of services, pipe bedding and backfill) provided by Paterson in the aforementioned geotechnical investigation report have been satisfactorily incorporated into the above-noted drawings.

Reference should be made to *Section 6.4 – Pipe Bedding and Backfill* of Paterson Report PG4915-1 Revision 3, dated March 26, 2022, for the current recommendations for pipe bedding and backfill for this project from a geotechnical perspective.

We trust that the current submission meets your immediate requirements.

Best Regards,

Paterson Group Inc.

Drew Petahtegoose, B.Eng.

David J. Gilbert, P.Eng.