PATERSON GROUP

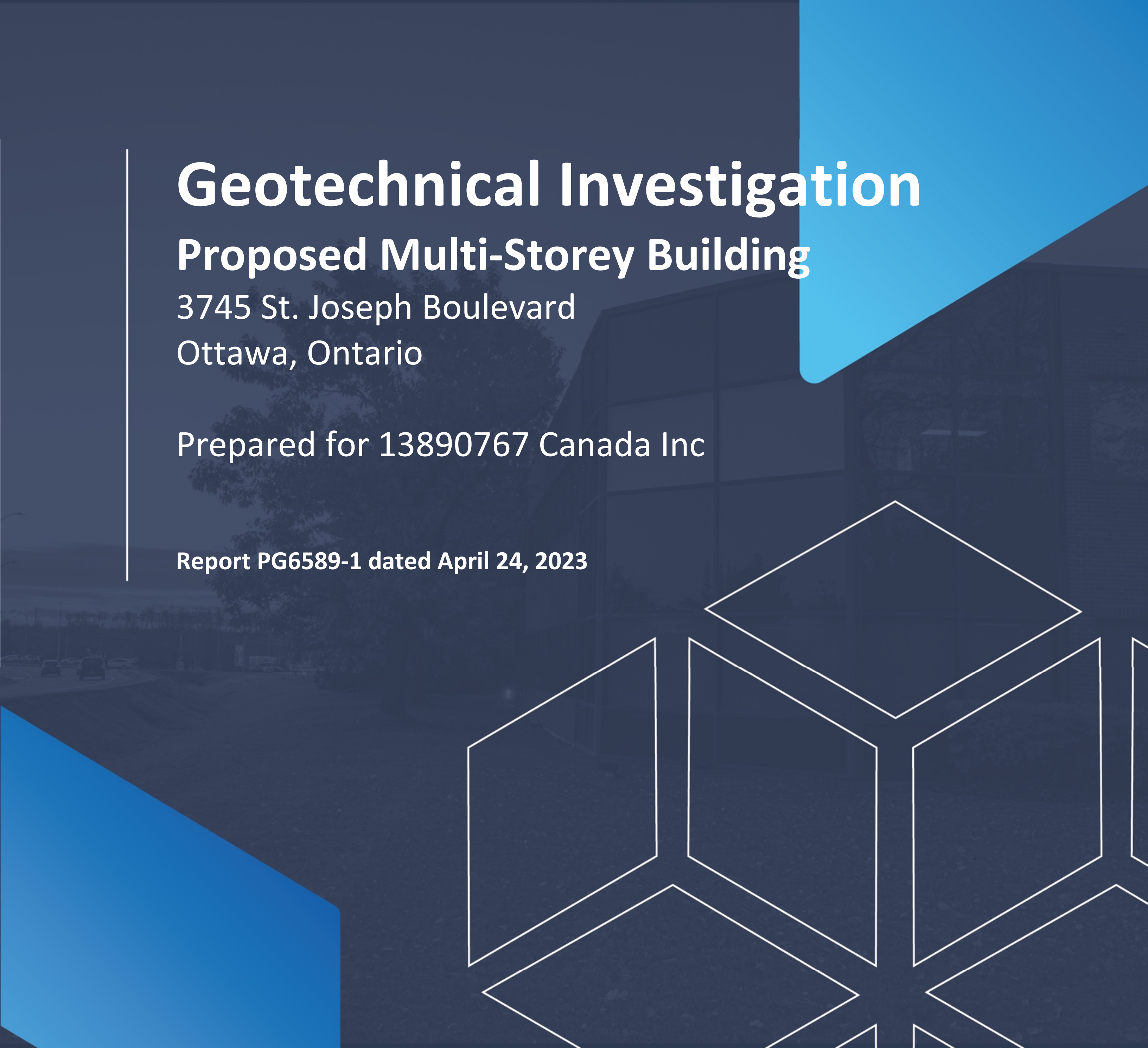
Geotechnical Investigation

Proposed Multi-Storey Building

3745 St. Joseph Boulevard
Ottawa, Ontario

Prepared for 13890767 Canada Inc

Report PG6589-1 dated April 24, 2023



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1.0 Introduction

Paterson Group (Paterson) was commissioned by 13890767 Canada Inc. to undertake a geotechnical investigation for the proposed multi-storey building to be located at 3745 St. Joseph Boulevard in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2 for the general site location).

The objectives of the geotechnical investigation were to:

- ❑ Determine the subsoil and groundwater conditions at this site by means of test holes.
- ❑ Provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

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

2.0 Proposed Development

Based on the available conceptual drawings, it is understood that the proposed development will consist of a mixed-use, multi-storey building with 2 levels of underground parking. It is anticipated that the proposed building will be immediately surrounded by asphalt-paved walkways and access lanes with landscaped margins. It is also anticipated that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the geotechnical investigation was carried out on April 17, 2023 and consisted of a total of 2 boreholes (BH 1-23 & BH 2-23) advanced to a maximum depth of 12.6 m below the existing grade. The borehole locations were distributed in a manner to provide general coverage within the proposed building footprint, taking into consideration underground services and available access. Previous investigations by Paterson and others included a total of 3 boreholes and 5 test pits advanced at the subject site to maximum depths of 7.2 m and 2.3 m, respectively.

The approximate locations of the test holes are shown on Drawing PG6589-1 - Test Hole Location Plan included in Appendix 2.

The recent boreholes were advanced using a low-clearance, track-mounted drill rig operated by a two-person crew. All fieldwork from the recent investigation was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The drilling procedure consisted of augering to the required depths at the selected borehole locations, and sampling and testing the overburden soils.

Sampling and In Situ Testing

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

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

Undrained shear strength testing was carried out in cohesive soils using a field vane apparatus.

The overburden thickness was evaluated by a dynamic cone penetration test (DCPT) completed at borehole BH 2-23. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at its tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment

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

Groundwater

A standpipe piezometer was installed in each borehole from the recent investigation, upon the completion of drilling and sampling, in order to permit monitoring of the groundwater levels. Groundwater level observations are discussed in Section 4.3 and are presented in the Soil Profile and Test Data Sheets in Appendix 1.

3.2 Field Survey

The recent borehole locations, and the ground surface elevation at each of these borehole locations, were surveyed by Paterson using a GPS unit with respect to a geodetic datum. The previous test hole locations were surveyed with respect to a temporary benchmark (TBM), consisting of the top spindle of a fire hydrant located along St. Joseph Boulevard with a geodetic elevation of 64.28 m. The locations of the test holes, and ground surface elevation at each test hole location, are presented on Drawing PG6589-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Review

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. All samples from the recent geotechnical investigation will be stored in the laboratory for 1 month after this report is completed. They will then be discarded unless we are otherwise directed.

3.4 Analytical Testing

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

4.0 Observations

4.1 Surface Conditions

The subject site is currently undeveloped and has a grass surface, with localized areas of mature trees. The site is bordered by commercial properties to the east, north, and west, and by St. Joseph Boulevard to the south. The existing ground surface across the subject site is relatively level at approximate geodetic elevation 61 to 62 m.

4.2 Subsurface Profile

Overburden

Generally, the subsurface conditions at the subject site consist of a surficial layer of fill and/or topsoil underlain by a deep silty clay deposit.

At the southern end of the site, an approximate 0.3 m thickness of topsoil was encountered overlying the silty clay. At the northern portion of the site, an approximate 0.3 to 1.8 m thickness of fill was present over the silty clay, which, at some test hole locations, was underlain by an approximate 0.1 to 0.7 m thickness of topsoil. Where encountered, the fill was observed to vary from silty clay to silty sand with varying amounts of organics, concrete, steel, wood, rubber, and trash. Further, refusal was encountered on a concrete slab in the fill at a depth of about 0.8 m in borehole BH 1.

The silty clay deposit was encountered underlying the fill and/or topsoil at approximate depths ranging from 0.1 to 1.8 m. The upper portion of the silty clay deposit consists of a very stiff to hard, brown silty clay crust, becoming a stiff, grey silty clay below depths of about 4.5 m.

Practical refusal to the DCPT was encountered in borehole BH 2-23 at a depth of 26.4 m below the existing ground surface.

Bedrock

Based on available geological mapping, the bedrock in the subject area consists of interbedded limestone and dolomite of the Gull River, with an overburden drift thickness of 15 to 25 m depth.

4.3 Groundwater

The groundwater levels were measured in piezometers on April 20, 2023. The observed groundwater levels are summarized in Table 1 below.

Table 1 - Summary of Groundwater Level Readings

Test Hole Number	Ground Surface Elevation (m)	Groundwater Level (m)	Groundwater Elevation (m)	Recording Date
BH 1-23	62.20	10.70	51.80	April 20, 2023
BH 2-23	61.42	1.84	59.58	April 20, 2023

Note: Ground surface elevations at borehole locations were surveyed by Paterson and are referenced to a geodetic datum.

It should be noted that surface water can become trapped within a backfilled borehole, which can lead to higher than typical groundwater level observations.

The long-term groundwater level can also be estimated based on the observed colour, moisture content and consistency of the recovered samples. Based on these observations, the long-term groundwater level is expected to range between approximately 4 to 5 m below ground surface.

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

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 foundation support for the proposed building consist of a raft foundation bearing on the undisturbed, stiff silty clay.

Should any portions of the underground parking levels extend beyond the overlying multi-storey building footprint, they can likely be supported on conventional spread footings bearing on the undisturbed, stiff silty clay.

Due to the presence of a deep silty clay deposit, a permissible grade raise restriction is required for the subject site.

The above and other considerations are discussed in the following paragraphs.

5.2 Site Grading and Preparation

Stripping Depth

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

Fill Placement

Engineered fill placed for grading beneath the proposed building, where required, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building and paved areas should be compacted to at least 98% of the material’s standard Proctor maximum dry density (SPMDD).

Non-specified existing fill, along with site-excavated soil, can be used as general landscaping fill where settlement of the ground surface is of minor concern. This material should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in thin lifts to at least 95% of the material’s SPMDD.

Protection of Subgrade (Raft Foundation)

Since the subgrade material will consist of a silty clay deposit, it is recommended that a minimum 75 mm thick lean concrete mud slab be placed on the undisturbed silty clay subgrade shortly after the completion of the excavation. The main purpose of the mudslab is to reduce the risk of disturbance of the subgrade under the traffic of workers and equipment.

The final excavation to the raft bearing surface level and the placing of the mud slab should be done in smaller sections to avoid exposing large areas of the silty clay to potential disturbance due to drying.

5.3 Foundation Design

Conventional Spread Footings

Pad footings, up to 5 m wide, and strip footings up to 3 m wide, placed on an undisturbed, stiff silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS.

The bearing resistance value at SLS will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

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

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 silty clay bearing medium when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V, passes only through in situ soil or engineered fill of the same or higher capacity as the soil.

Raft Foundation

Due to the anticipated structural loads, it is expected that a raft foundation will be required to support the proposed multi-storey building. For our design calculations, 2 levels of underground parking was considered which would extend approximately 7 to 8 m below the existing ground surface.

The maximum SLS contact pressure is **200 kPa** for a raft foundation bearing on the undisturbed, stiff silty clay. It should be noted that the weight of the raft slab and everything above has to be included when designing with this value. The loading conditions for the contact pressure are based on sustained loads, that are generally taken to be 100% Dead Load and 50% Live Load. The factored bearing resistance (contact pressure) at ULS can be taken as **300 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

The modulus of subgrade reaction was calculated to be **8 MPa/m** for a contact pressure of 200 kPa. The design of the raft foundation is required to consider the relative stiffness of the reinforced concrete slab and the supporting bearing medium. A common method of modeling the soil structure interaction is to consider the bearing medium to be elastic and to assign a subgrade modulus. However, silty clay is not elastic and limits have to be placed on the stress ranges of a particular modulus.

Using the contact pressures provided above, the proposed building 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 the in-situ bearing medium soils above the groundwater table when a plane extending down and out from the bottom edges of the footing, at a minimum of 1.5H:1V, passes only through in situ soil or engineered fill of the same or higher capacity as that of the bearing medium.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class D**. Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code 2012 for a full discussion of the earthquake design requirements.

5.5 Basement Floor Slab

For a building with a raft slab foundation, a granular layer of OPSS Granular A will be required to allow for the installation of sub-floor services above the raft slab foundation. The thickness of the OPSS Granular A crushed stone will be dependent on the piping requirements.

A sub-slab drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided under the lowest level floor slab. The spacing of the sub-slab drainage pipes can be determined at the time of construction to confirm groundwater infiltration levels, if any. This is discussed further in Section 6.1.

5.6 Basement Wall

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

Where undrained conditions are anticipated (i.e. below the groundwater level), 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 Ko· ɣ ·H where:

K_o = at-rest earth pressure coefficient of the applicable retained soil (0.5)
ɣ = unit weight of fill of the applicable retained soil (kN/m3)
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 $0.375 \cdot a \ \cdot H^2/g$ where:

$a_c = (1.45\text{-}a_{max}/g)a_{max}$
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 $P_o = 0.5\ K_o \cdot \gamma \cdot H^2$, where K = 0.5 for the soil conditions noted above.

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

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

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

5.7 Pavement Design

Should asphalt-paved access lanes and parking areas be present at finished grades surrounding the proposed building, the following pavement structures would be recommended.

Table 2 - 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 – Either fill, in-situ soil, or OPSS Granular B Type I or II material over in-situ soil or fill.	

Table 3 - Recommended Pavement Structure - Access Lanes

Thickness (mm)	Material Description
40	**Wear Course –** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course –** HL-8 or Superpave 19 Asphaltic Concrete
150	**BASE –** OPSS Granular A Crushed Stone
500	**SUBBASE –** OPSS Granular B Type II
SUBGRADE – Either fill, in-situ soil, or OPSS Granular B Type I or II material over fill or in-situ soil.	

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

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

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

Pavement Structure Drainage

The pavement structure performance is dependent on the moisture condition at the contact zone between the subgrade material and granular base. Failure to provide adequate drainage under conditions of heavy wheel loading could result in the subgrade fines pumped into the stone subbase voids, thereby reducing the load bearing capacity.

Due to the low permeability of the subgrade materials at this site, consideration should be provided to installing subdrains during the pavement construction as per City of Ottawa standards. The subdrains should be provided for catch basins and extend at least 3 m in four orthogonal directions. The clear crushed stone surrounding the drainage lines should be wrapped with suitable filter cloth. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be shaped to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

As the proposed building will extend below the groundwater level, a groundwater suppression system is recommended for the perimeter foundation walls. The groundwater suppression system would consist of installing a waterproofing membrane (such as Tremco Paraseal, or approved equivalent) as the outermost layer from the face of the foundation wall, and over a composite drainage board (such as Delta Drain 6000 or approved equivalent) installed on the exterior portion of the foundation wall. The waterproofing membrane is recommended to extend between the bottom of the raft foundation and up to 4 m below finished grades. The composite drainage board is recommended to extend from the top of raft foundation elevation, up to 300 mm below finished grades.

The composite drainage board should be hydraulically connected to 150 mm diameter sleeves cast in the foundation wall just above the foundation wall and raft interface, to allow for the infiltration of water to flow to an interior perimeter drainage pipe. The drainage sleeves should be spaced at 3 m center-to-center along the perimeter foundation wall.

Underslab Drainage System

An underslab drainage system is recommended to control water infiltration below the lowest level floor slab for the building. For preliminary design purposes, it is recommended that 150 mm perforated pipes be placed at approximate 6 m centres underlying the lowest level floor slab. The spacing of the underslab drainage system should be confirmed by the geotechnical consultant at the time of completing the excavation when water infiltration can be better assessed.

Foundation Backfill

Backfill against the exterior sides of the foundation walls, where required, should consist of free-draining, non-frost susceptible granular materials, such as clean sand or OPSS Granular B Type I granular material.

6.2 Protection of Footings Against Frost Action

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

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

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

6.3 Excavation Side Slopes

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

Unsupported Excavations

The excavation side slopes in the overburden, above the groundwater level, and 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 at this site 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.

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.

Temporary Shoring

Due to the anticipated depth of excavation of the building and the proximity of the proposed building to the site boundaries, temporary shoring may be required to support the overburden soils of the adjacent properties.

The design and approval of the temporary shoring system will be the responsibility of the shoring contractor and the shoring designer who is a licensed professional engineer and is hired by the shoring contractor. It is the responsibility of the shoring contractor to ensure that the temporary shoring is in compliance with safety requirements, designed to avoid any damage to adjacent structures, and include dewatering control measures.

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

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

The temporary shoring system may consist of a soldier pipe and lagging system which could be anchored or braced.

Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be added to the earth pressures described below. The earth pressure acting on the shoring system may be calculated using the following parameters.

Table 4 - Soil Parameters

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 , kN/m$_3$	21
Submerged Unit Weight , kN/m$_3$	13

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible. The dry unit weight should be calculated above the groundwater level while the effective unit weight should be calculated below the groundwater table.

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

6.4 Pipe Bedding and Backfill

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

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

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

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) and above the cover material should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 225 mm thick loose lifts and compacted to a minimum of 98% of the material’s SPMDD. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

6.5 Groundwater Control

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

Groundwater Control for Building Construction

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

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Persons 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.

Impacts on Neighbouring Properties

As the portion of the proposed building located below the groundwater level will have a waterproofing membrane, long-term dewatering around the proposed building is not anticipated. Accordingly, neighbouring properties are not expected to be impacted by excavation and/or dewatering associated with the proposed development.

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 using 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 into the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a low to slightly aggressive corrosive environment.

6.8 Landscaping Considerations

As the proposed building will include 2 underground levels, the foundation will be located well below the depth of influence of tree roots. Accordingly, there are no required tree planting setbacks for the proposed development, from a geotechnical perspective.

7.0 Recommendations

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

☐ Review of the Grading Plan, from a geotechnical perspective.

☐ Review of the proposed groundwater infiltration control system and requirements.

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

☐ Sampling and testing of the concrete and fill materials.

☐ Observation of all subgrades prior to backfilling.

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

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

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

All excess soils, with the exception of engineered crushed stone fill, generated by construction activities that will be transported on-site or off-site should be handled as per *Ontario Regulation 406/19: On-Site and Excess Soil Management.*

8.0 Statement of Limitations

The recommendations provided are in accordance with the present understanding of the project. Paterson requests permission to review the recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests 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 the suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than 13890767 Canada 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.

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Report Distribution:

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APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

BOREHOLE LOGS BY OTHERS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Building - 3745 St. Joseph Blvd.
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

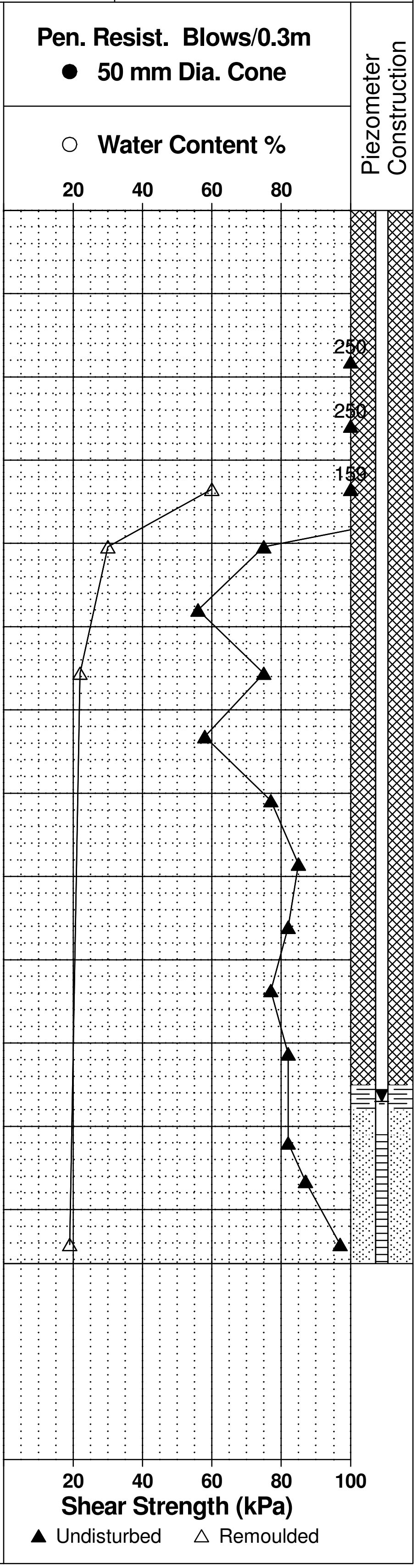
DATE April 17, 2023

FILE NO. PG6589

HOLE NO. BH 1-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD
Ground Surface					
FILL: Crushed stone 0.08					
FILL: Topsoil, trace organics, clay, sand, brick and crushed stone 0.30		AU	1		
		SS	2	67	13
		SS	3	83	P
		SS	4	100	P
Hard to very stiff, brown **SILTY CLAY**		SS	5	100	P
- stiff and grey by 3.8m depth					
12.65					
End of Borehole					
(GWL @ 10.70m - April 20, 2023)					

DEPTH (m)	ELEV. (m)
0	62.20
1	61.20
2	60.20
3	59.20
4	58.20
5	57.20
6	56.20
7	55.20
8	54.20
9	53.20
10	52.20
11	51.20
12	50.20



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Building - 3745 St. Joseph Blvd.
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

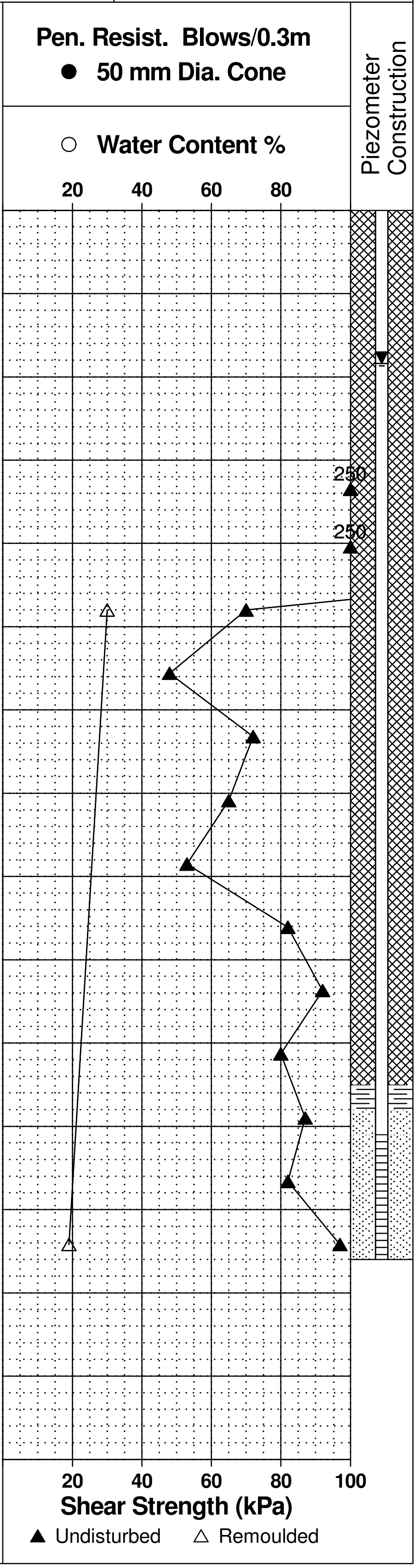
DATE April 17, 2023

FILE NO. **PG6589**

HOLE NO. **BH 2-23**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD
Ground Surface					
TOPSOIL 0.15		AU	1		
FILL: Brownsilty clay, trace topsoil, wood chips and gravel		SS	2	50	9
1.83		SS	3	100	50+
Hard to very stiff, brown **SILTY CLAY**		SS	4	100	11
		SS	5	100	P
- stiff and grey by 4.4m depth					
12.65					
Dynamic Cone Penetration Test commenced at 12.65m depth. Cone pushed to 25.2m depth.					

DEPTH (m)	ELEV. (m)
0	61.48
1	60.48
2	59.48
3	58.48
4	57.48
5	56.48
6	55.48
7	54.48
8	53.48
9	52.48
10	51.48
11	50.48
12	49.48
13	48.48
14	47.48
15	46.48



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Building - 3745 St. Joseph Blvd.
Ottawa, Ontario

DATUM Geodetic

REMARKS

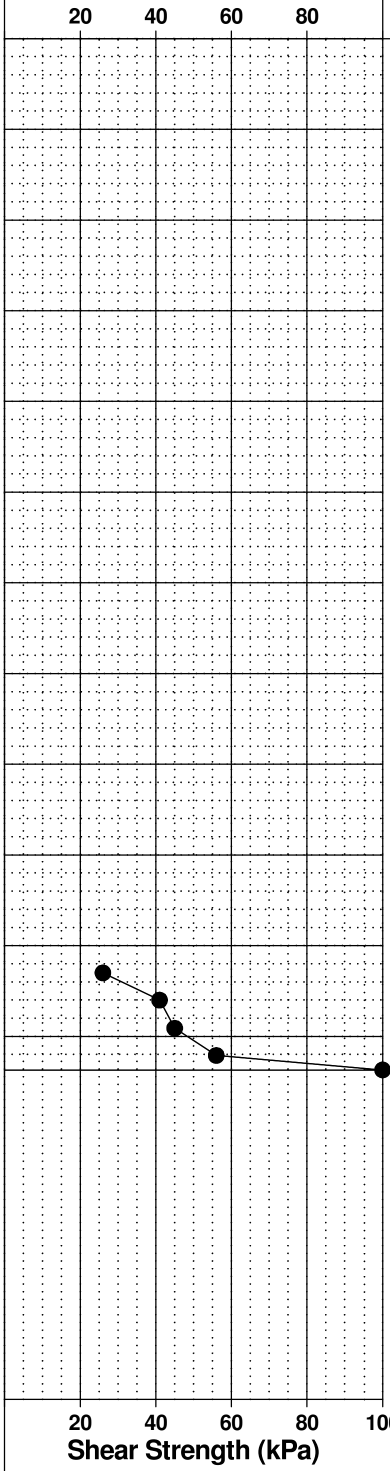
BORINGS BY CME-55 Low Clearance Drill

DATE April 17, 2023

FILE NO. PG6589

HOLE NO. BH 2-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD				
Ground Surface									
Dynamic Cone Penetration Test commenced at 12.65m depth. Cone pushed to 25.2m depth.						15	46.48		
						16	45.48		
						17	44.48		
						18	43.48		
						19	42.48		
						20	41.48		
						21	40.48		
						22	39.48		
						23	38.48		
						24	37.48		
						25	36.48		
26.37						26	35.48		
End of Borehole Practical DCPT refusal at 26.37m depth. (GWL @ 1.84m - April 20, 2023)									



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 3735 St. Joseph Blvd.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant, north side of St. Joseph Boulevard, in front of subject site. Geodetic elevation of 63.50m was provided for the TBM.

REMARKS

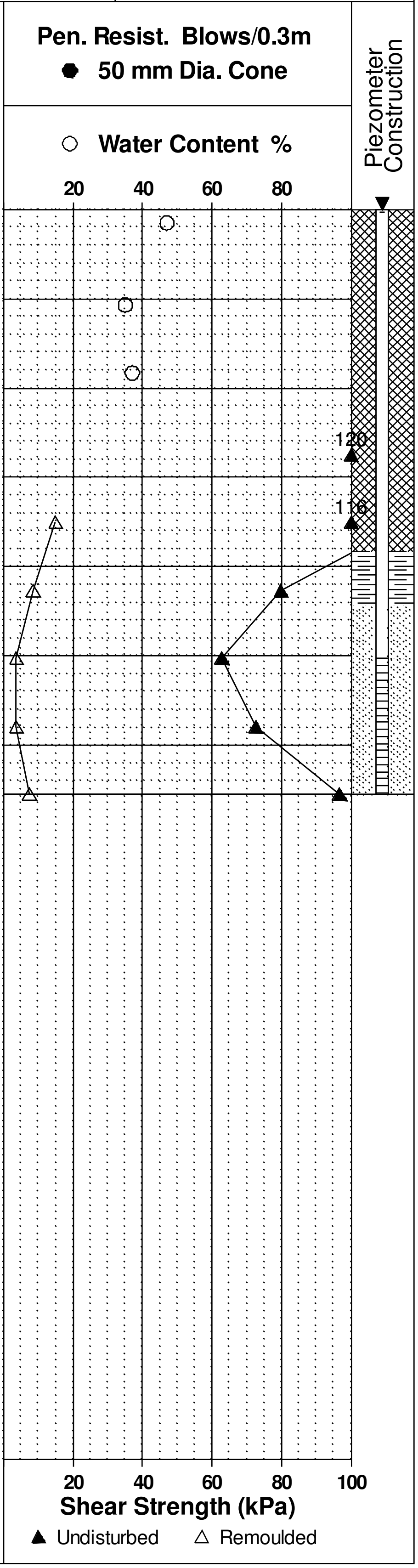
BORINGS BY CME 55 Power Auger

DATE April 14, 2014

FILE NO. PG3215

HOLE NO. BH 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
GROUND SURFACE							
TOPSOIL 0.30		AU	1			0	61.66
		SS	2	83	9	1	60.66
		SS	3		13		
						2	59.66
						3	58.66
Very stiff to stiff, brown **SILTY CLAY**							
						4	57.66
						5	56.66
						6	55.66
6.55							
End of Borehole (GWL @ ground surface - April 25, 2014)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Limited Fill Assessment Program
3735 St. Joseph Boulevard
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the north side of St. Joseph Blvd., in front of subject site. Geodetic elevation = 63.50m.

REMARKS

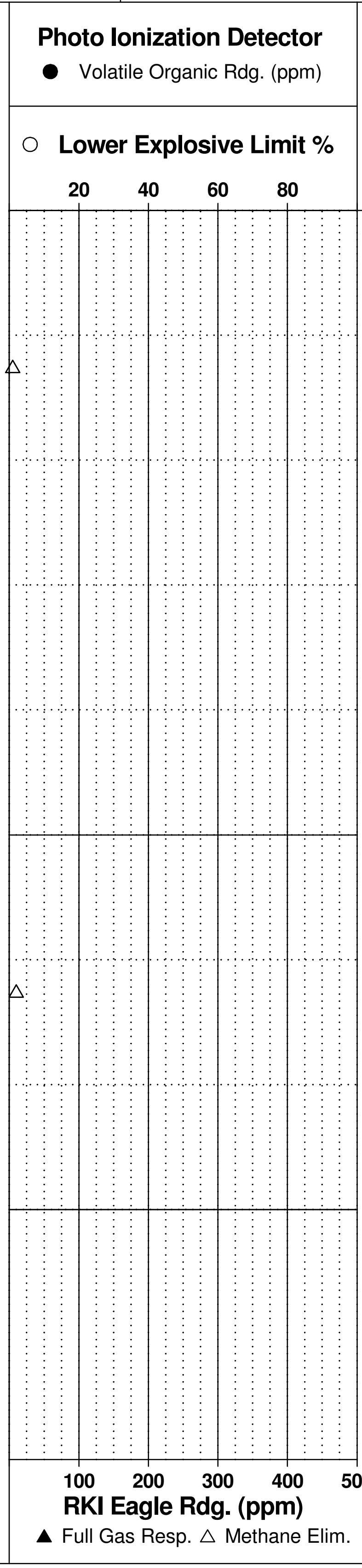
BORINGS BY Backhoe

DATE January 14, 2014

FILE NO. PE3204

HOLE NO. TP 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
GROUND SURFACE						0	62.12
FILL: Brown silty clay with sand and construction debris	▨	G	1				
	▨					1	61.12
	▨	G	2				
1.60							
End of Test Pit TP terminated on suspected concrete slab at 1.60m depth							



Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

Limited Fill Assessment Program
3735 St. Joseph Boulevard
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the north side of St. Joseph Blvd., in front of subject site. Geodetic elevation = 63.50m.

REMARKS

BORINGS BY Backhoe

DATE January 14, 2014

FILE NO. PE3204

HOLE NO. TP 3

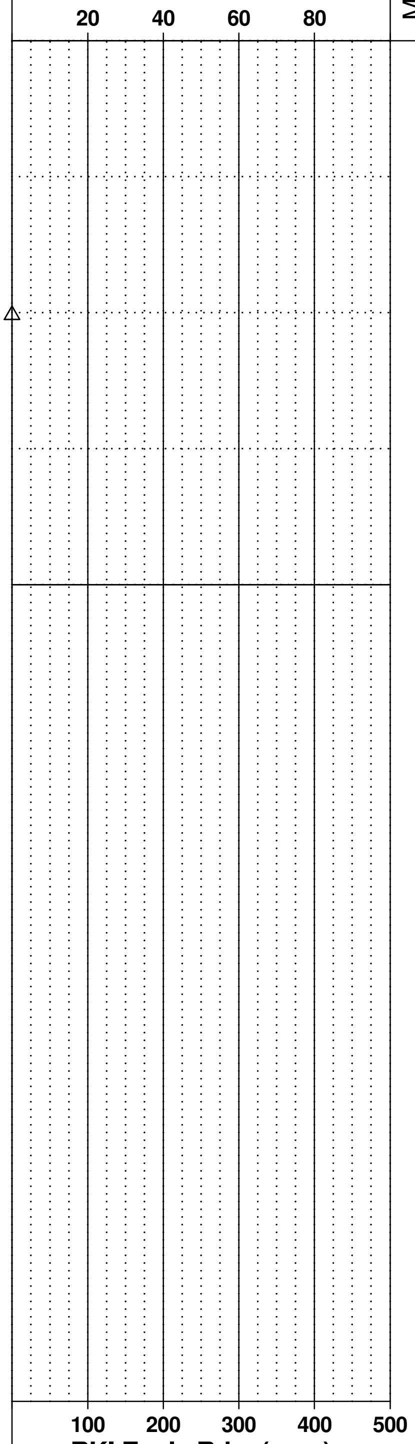
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	62.11
Brown **SILTY CLAY,** trace sand	▨	G	1				
0.80							
End of Test Pit							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

Monitoring Well Construction



RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE AND TEST DATA

Limited Fill Assessment Program
3735 St. Joseph Boulevard
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the north side of St. Joseph Blvd., in front of subject site. Geodetic elevation = 63.50m.

REMARKS

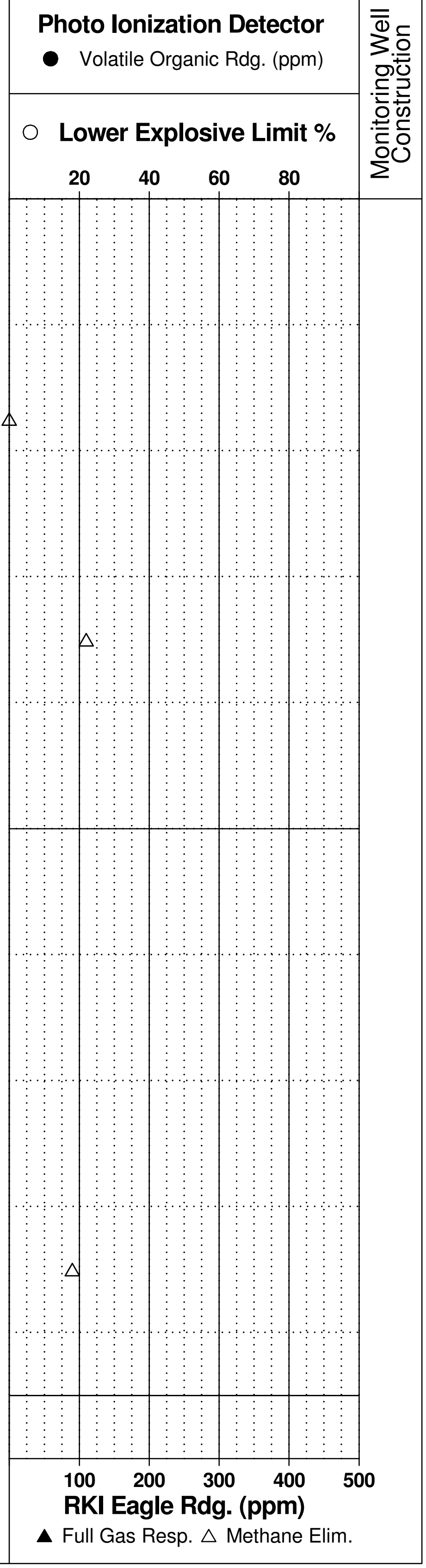
BORINGS BY Backhoe

DATE January 14, 2014

FILE NO. PE3204

HOLE NO. TP 4

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	61.19
FILL: Brown silty clay, trace gravel and wood		G	1				
0.60							
TOPSOIL		G	2				
0.80							
						1	60.19
Grey **SILTY CLAY**		G	3				
1.90							
End of Test Pit							



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SOIL PROFILE AND TEST DATA

Limited Fill Assessment Program
3735 St. Joseph Boulevard
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the north side of St. Joseph Blvd., in front of subject site. Geodetic elevation = 63.50m.

REMARKS

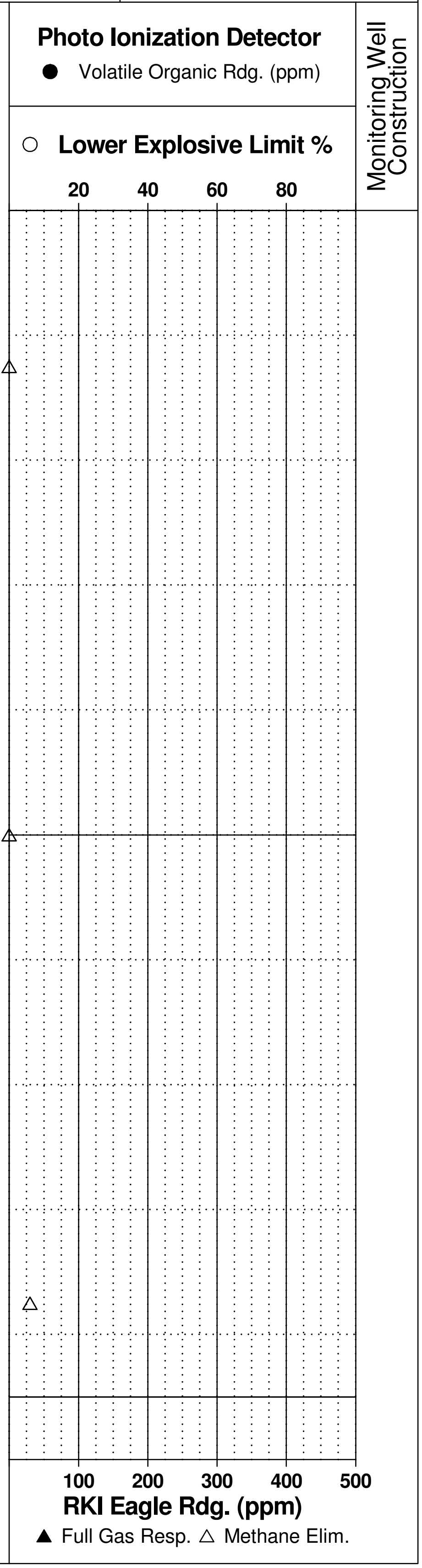
BORINGS BY Backhoe

DATE January 14, 2014

FILE NO. PE3204

HOLE NO. TP 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	61.66
FILL: Brown silty sand with clay and construction debris		G	1				
		G	2			1	60.66
1.60 Grey **SILTY CLAY**		G	3				
1.90 End of Test Pit							



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SOIL PROFILE AND TEST DATA

Limited Fill Assessment Program
3735 St. Joseph Boulevard
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the north side of St. Joseph Blvd., in front of subject site. Geodetic elevation = 63.50m.

REMARKS

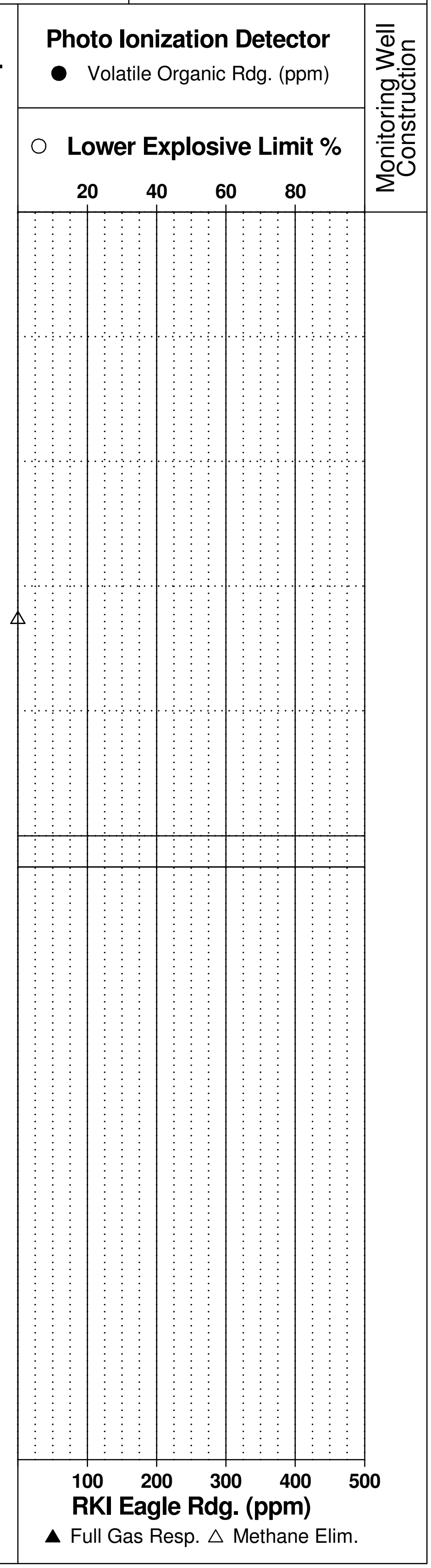
BORINGS BY Backhoe

DATE January 14, 2014

FILE NO. PE3204

HOLE NO. TP 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	62.22
TOPSOIL	■						
0.30							
Brown **SILTY CLAY,** trace sand	▨	G	1			1	61.22
1.05							
End of Test Pit							



Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

Limited Fill Assessment Program
3735 St. Joseph Boulevard
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the north side of St. Joseph Blvd., in front of subject site. Geodetic elevation = 63.50m.

REMARKS

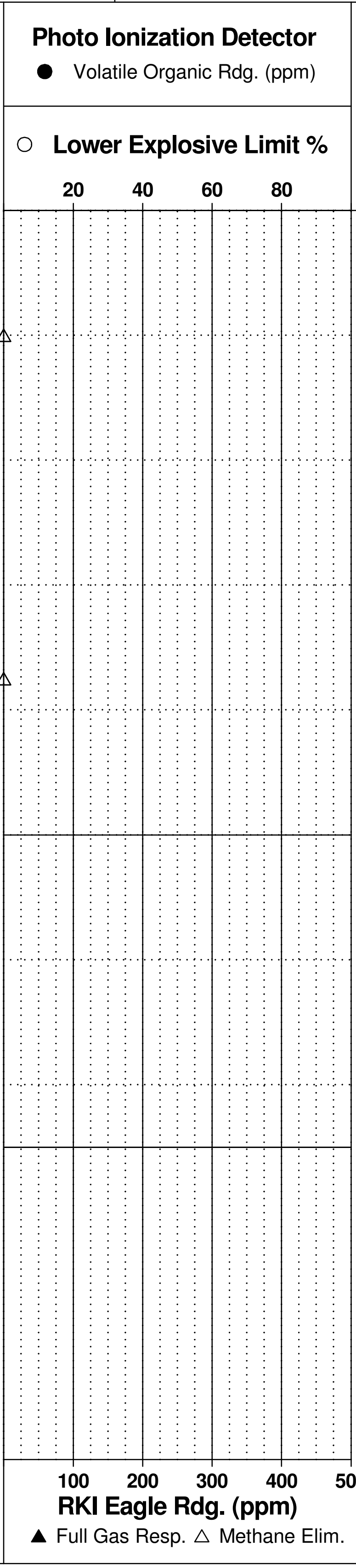
BORINGS BY Backhoe

DATE January 14, 2014

FILE NO. PE3204

HOLE NO. TP 7

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	62.29
FILL: Brown silty sand with gravel and construction debris	▨	G	1				
0.40							
Brown **SILTY CLAY,** trace sand	▨	G	2			1	61.29
1.50							
End of Test Pit							



Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Limited Fill Assessment Program
3735 St. Joseph Boulevard
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the north side of St. Joseph Blvd., in front of subject site. Geodetic elevation = 63.50m.

REMARKS

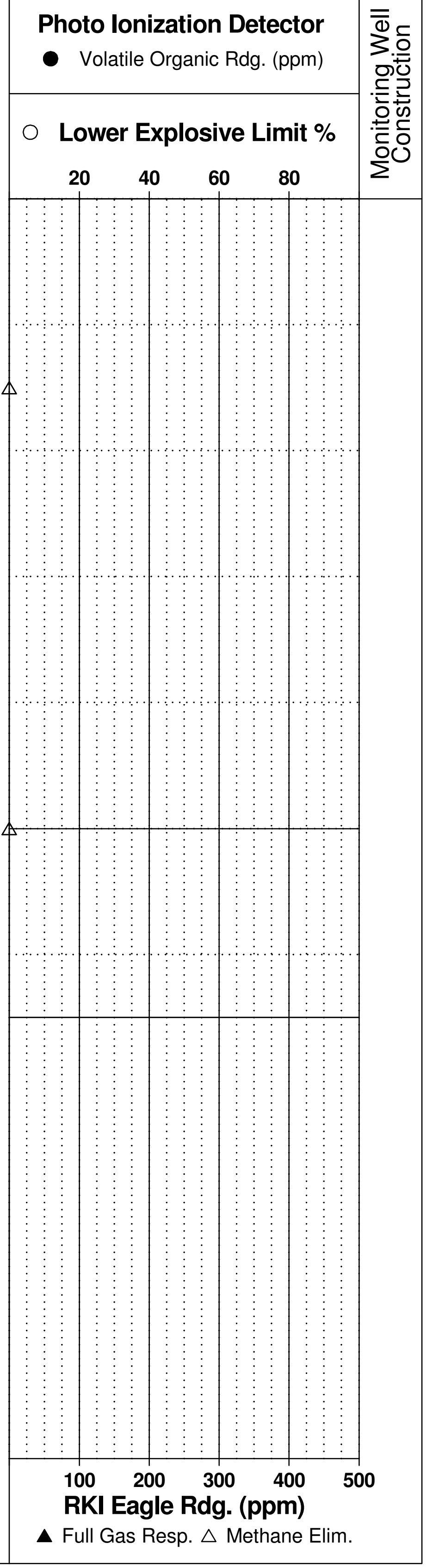
BORINGS BY Backhoe

DATE January 14, 2014

FILE NO. PE3204

HOLE NO. TP 9

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	62.00
FILL: Brown silty sand with construction debris	▨	G	1				
	▨	G	2			1	61.00
1.30							
End of Test Pit TP terminated on suspected concrete slab at 1.30m depth							



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 strength of cohesionless soils is the relative density, 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.

Relative Density	‘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 vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

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 is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

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 NXL size core. However, it can be used on smaller core sizes, such as BX, 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
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC% - Natural moisture 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 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)

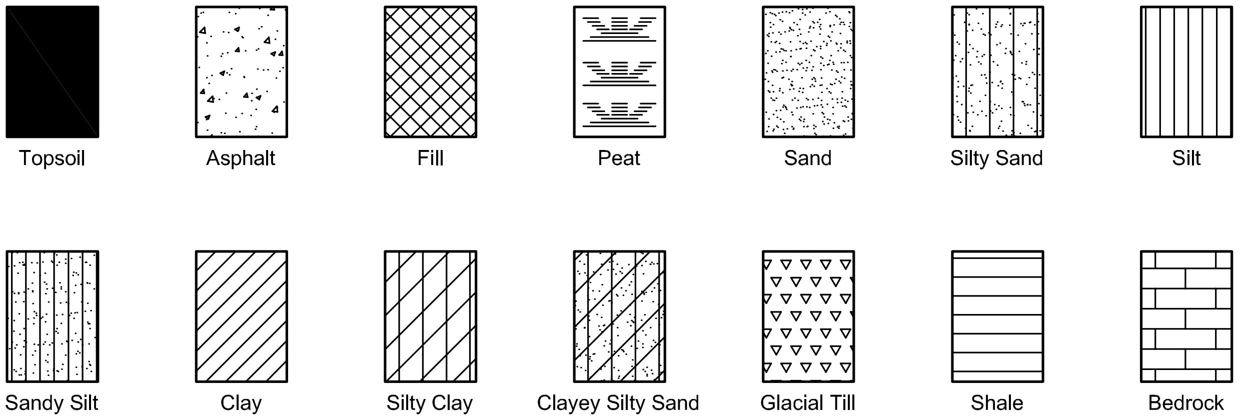
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

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.

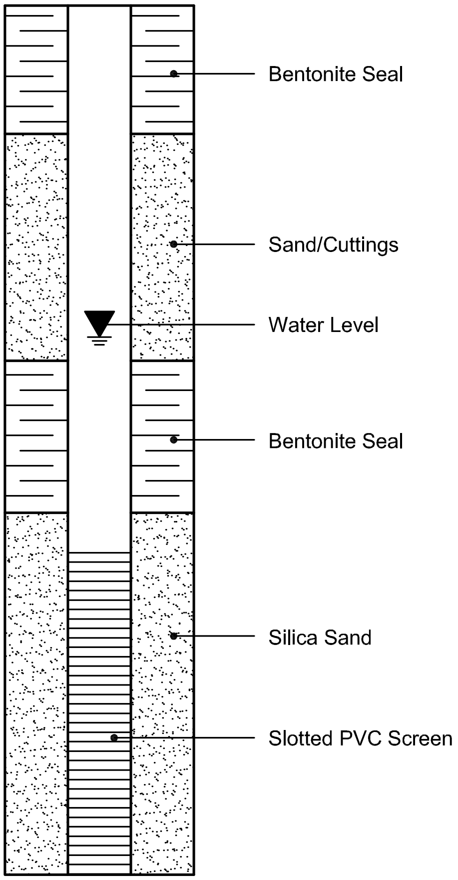
SYMBOLS AND TERMS (continued)

STRATA PLOT

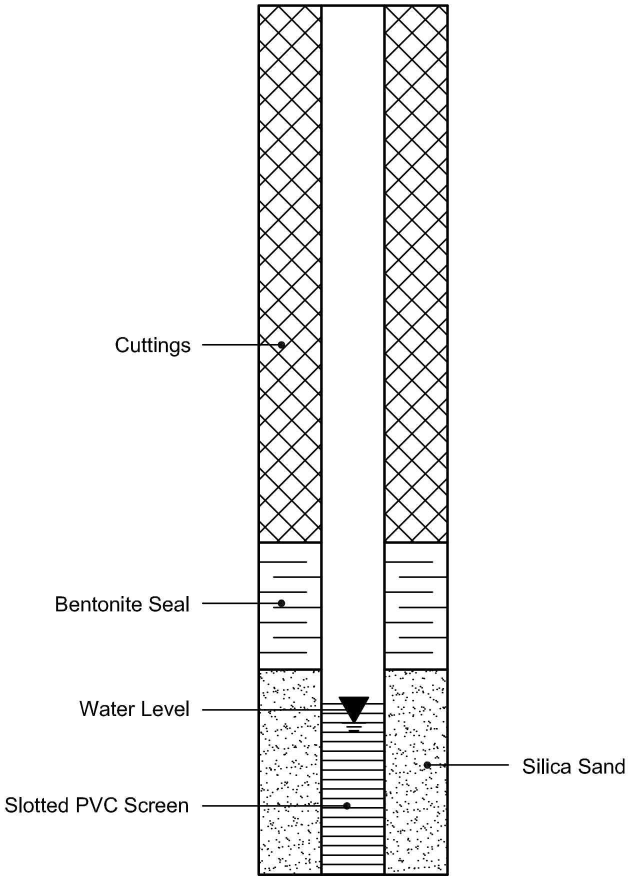


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Log of Borehole 1

Trow

Project No: OTGE00019796A

Project: Geotechnical Investigation-Proposed Commercial Development

Location: 3735 Saint Joseph Boulevard, Ottawa, Ontario

Figure No. 2

Feuille. 1 of 1

Date Drilled: 'November 11, 2008

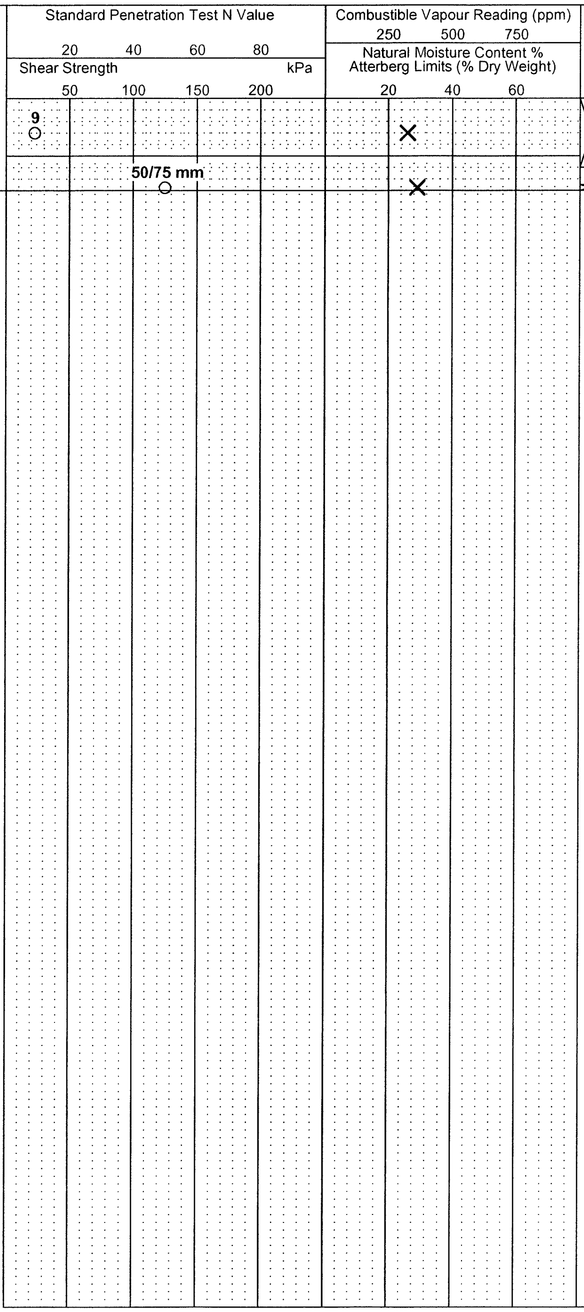
Drill Type:

Datum: Geodetic

Logged by: Checked by:

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◫	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	├──○
Dynamic Cone Test	──	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	SAMPLES	Natural Unit Wt. kN/m³
	▨	**FILL** Silty clay, rootlets in upper levels, occasional rock and concrete fragments, reworked, brown, moist (loose)	61 60.2	0	☒	
		Auger Refusal @ 0.8 m depth on concrete slab **Notes** -Moved borehole 2 m south met refusal @ 0.75 m depth -Moved borehole 5 m west met refusal @ 1.1 m depth				



NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Borehole backfilled upon completion of drilling
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00019796A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	Dry	1.7

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole 4

Trow

Project No: OTGE00019796A

Project: Geotechnical Investigation-Proposed Commercial Development

Location: 3735 Saint Joseph Boulevard, Ottawa, Ontario

Figure No. 5

Feuille. 1 of 1

Date Drilled: 'November 11, 2008

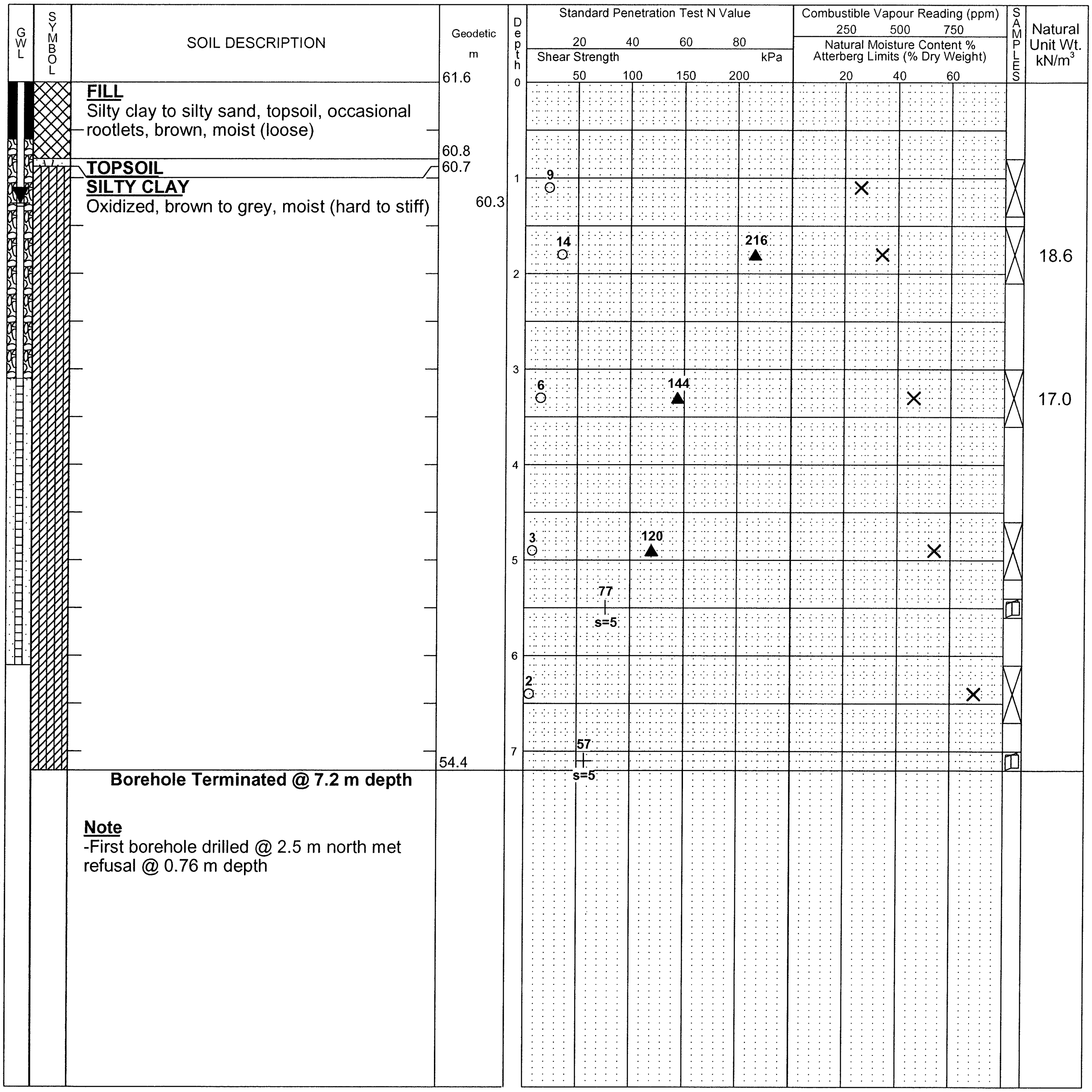
Drill Type:

Datum: Geodetic

Logged by: Checked by:

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test —
Shelby Tube ■
Shear Strength by Vane Test + S

Combustible Vapour Reading ☐
Natural Moisture Content ✕
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲



FILL
Silty clay to silty sand, topsoil, occasional rootlets, brown, moist (loose)

TOPSOIL

SILTY CLAY
Oxidized, brown to grey, moist (hard to stiff)

Borehole Terminated @ 7.2 m depth

Note
-First borehole drilled @ 2.5 m north met refusal @ 0.76 m depth

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. A 19 mm slotted pipe was installed in the borehole upon completion of drilling
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00019796A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
completion	3.0	6.1
1 day	2.9	-
7 days	1.1	-
23 days	1.3	-

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Test Pit 3a

Trow

Project No: OTGE00019796A

Project: Geotechnical Investigation-Proposed Commercial Development

Location: 3735 Saint Joseph, Ottawa, Ontario

Figure No. 9

Feuille. 1 of 1

Date Drilled: 'November 14, 2008

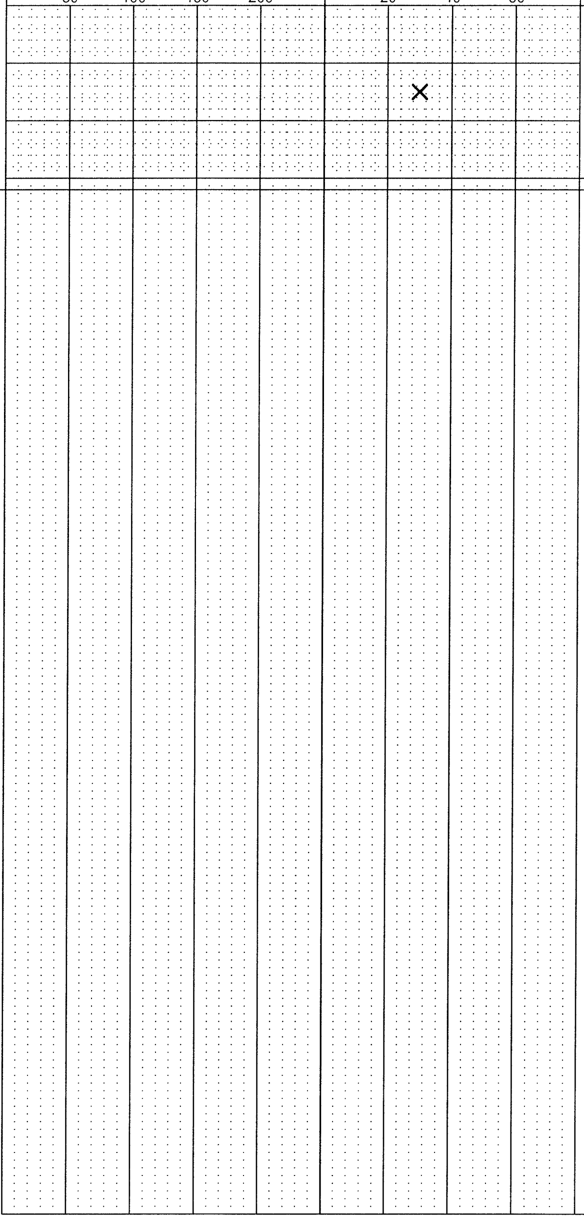
Drill Type:

Datum: Geodetic

Logged by: _________ Checked by:_________

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◨	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—⊖
Dynamic Cone Test	—	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
	▨	**FILL** Silty clay, concrete and wood rubbles, wet	61.2	0				
				1				
		-Concrete slab @ 1.5 m depth Backhoe Bucket Refusal @ 1.6	59.6					



NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Test Pit backfilled upon completion of excavtion
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00019796A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	Dry	-

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Test Pit 3b

Trow

Project No: OTGE00019796A

Project: Geotechnical Investigation-Proposed Commercial Development

Location: 3735 Saint Joseph, Ottawa, Ontario

Figure No. 10

Feuille. 1 of 1

Date Drilled: 'November 14, 2008

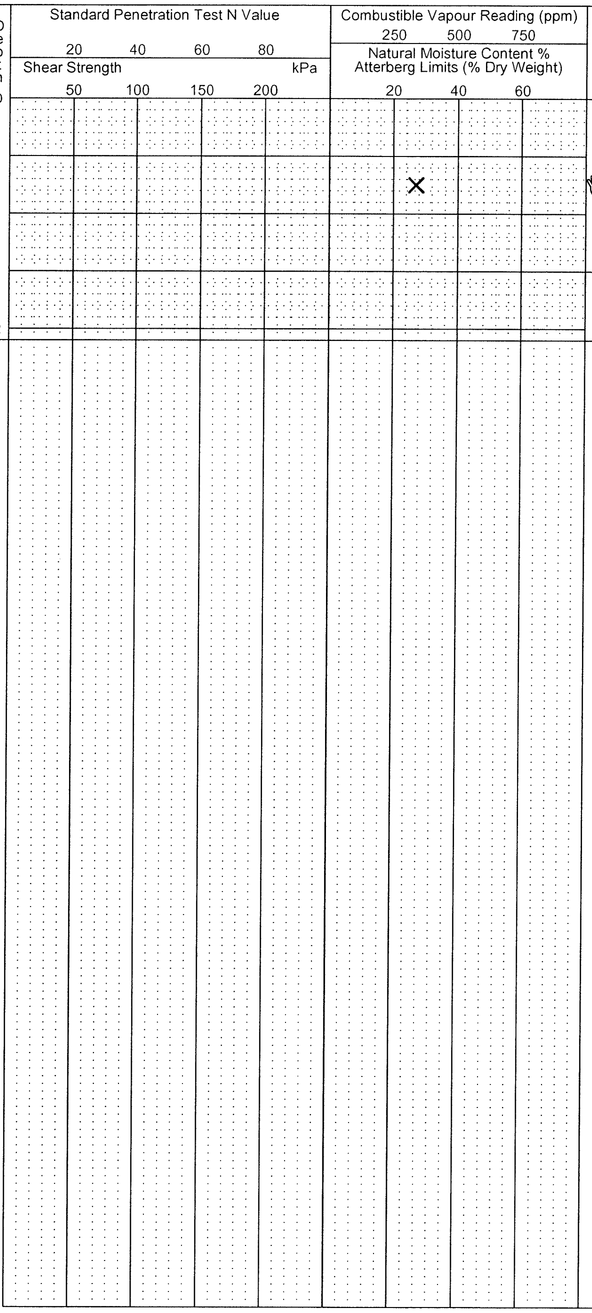
Drill Type:

Datum: Geodetic

Logged by: Checked by:

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◨	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	SAMPLES	Natural Unit Wt. kN/m³
			60.7	0		
	▨	**FILL** Silty clay, reworked brown/grey, moist				
					☝	
				1		
		TOPSOPIL	59.2			
		SILTY CLAY Brown, dry	58.9			
			58.6	2		
		Test Pit Terminated @ 2.1 m depth				



NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Test Pit backfilled upon completion of excavtion
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00019796A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	Dry	-

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Test Pit 4a

Trow

Project No: OTGE00019796A

Project: Geotechnical Investigation-Proposed Commercial Development

Location: 3735 Saint Joseph, Ottawa, Ontario

Figure No. 13

Feuille. 1 of 1

Date Drilled: 'November 14, 2008

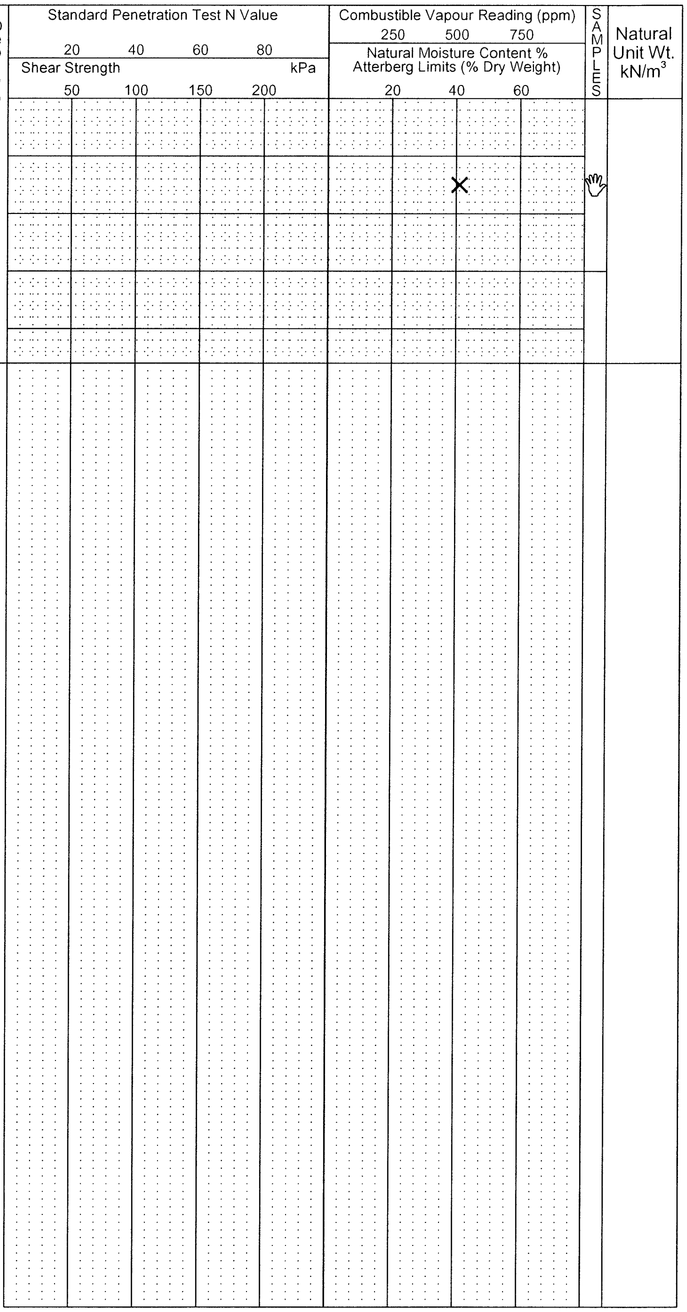
Drill Type:

Datum: Geodetic

Logged by: Checked by:

Split Spoon Sample	☒	Combustible Vapour Reading	☐
Auger Sample	◨	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	├─○
Dynamic Cone Test	—	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
	▩	**FILL** Silty clay, rubber tires, truck steel dumper, garbage bags, wood, steel pipes, light brown/grey, moist	61.2	0
				1
		-Concrete slab @ 1.4 m depth	59.7	
		TOPSOIL Silty clay, organics, dark brown	59.2	2
	▥	**SILTY CLAY** Brown, moist	58.9	
		Test Pit Terminated @ 2.3 m depth		



NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Test Pit backfilled upon completion of excavtion
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00019796A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	1.8	-

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Test Pit 6

Trow

Project No: OTGE00019796A
Project: Geotechnical Investigation-Proposed Commercial Development
Location: 3735 Saint Joseph, Ottawa, Ontario

Figure No. 16
Feuille. 1 of 1

Date Drilled: 'November 14, 2008
Drill Type:
Datum: Geodetic
Logged by: Checked by:

Split Spoon Sample	☒	Combustible Vapour Reading	□
Auger Sample	◨	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	├──○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	+ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value 20 40 60 80 Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
			61.6	0				
		TOPSOIL Silty clay, plant fibres, swampy odour, black, moist	61.3					
	▨	**SILTY CLAY** Brown, moist	60.7					
		Test Pit Terminated @ 0.9 m depth						

NOTES:
1. Borehole/Test Pit data requires Interpretation by Trow before use by others
2. Test Pit backfilled upon completion of excavtion
3. Field work supervised by a Trow representative
4. See Notes on Sample Descriptions
5. This Figure is to read with Trow Associates Inc. report OTGE00019796A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	Dry	-

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 57260

Report Date: 24-Apr-2023

Order Date: 18-Apr-2023

Project Description: PG6589

	Client ID:	BH2-23-SS5	-	-	-
	Sample Date:	17-Apr-23 09:00	-	-	-
	Sample ID:	2316219-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	70.9	-	-	-
General Inorganics					
pH	0.05 pH Units	7.23	-	-	-
Resistivity	0.1 Ohm.m	51.5	-	-	-
Anions					
Chloride	10 ug/g dry	40	-	-	-
Sulphate	10 ug/g dry	32	-	-	-

APPENDIX 2

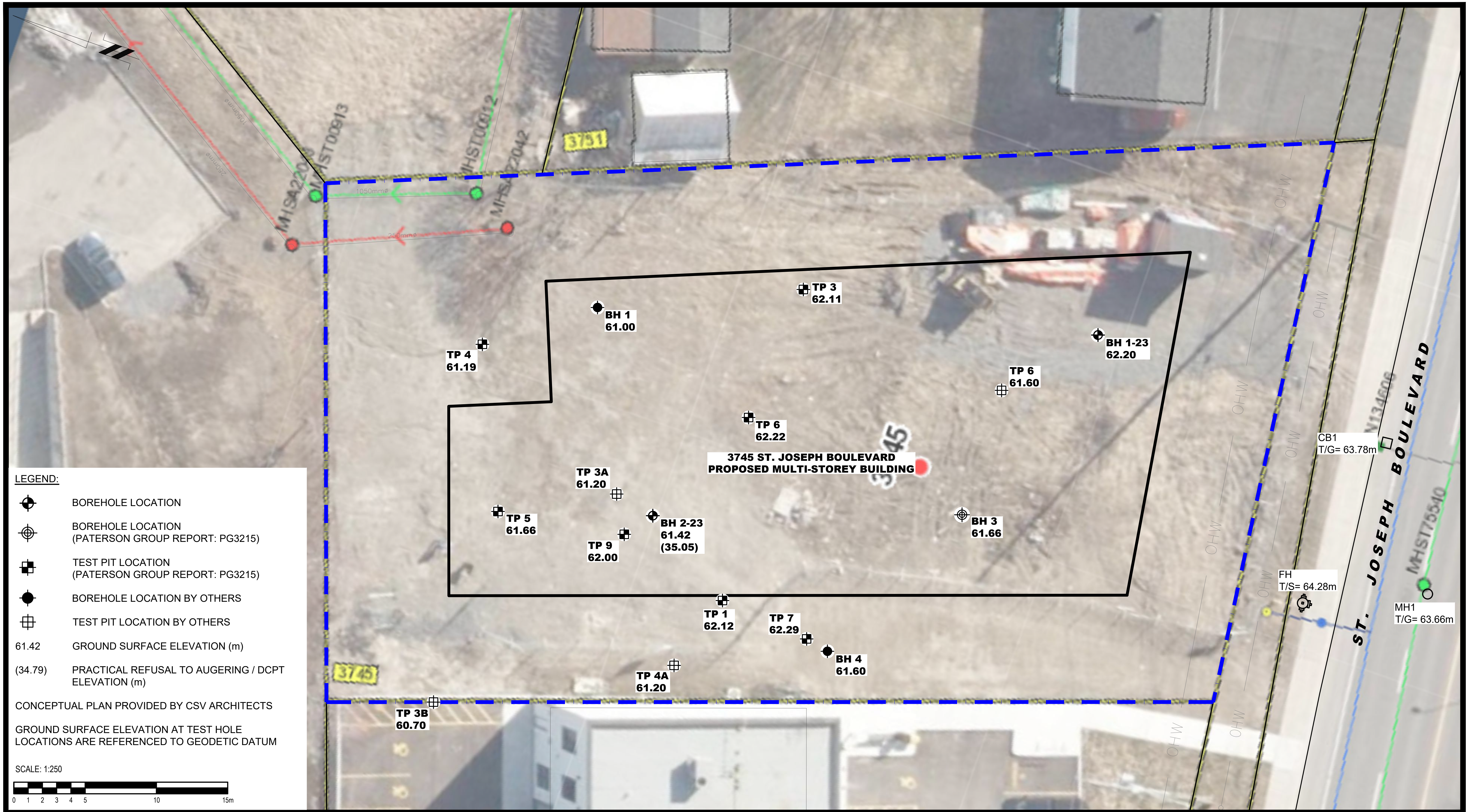
FIGURE 1 - KEY PLAN

DRAWING PG6589-1 - TEST HOLE LOCATION PLAN

FIGURE 1

KEY PLAN

PATERSON GROUP



LEGEND:

⌖	BOREHOLE LOCATION
◎	BOREHOLE LOCATION (PATERSON GROUP REPORT: PG3215)
▚	TEST PIT LOCATION (PATERSON GROUP REPORT: PG3215)
●	BOREHOLE LOCATION BY OTHERS
⊞	TEST PIT LOCATION BY OTHERS
61.42	GROUND SURFACE ELEVATION (m)
(34.79)	PRACTICAL REFUSAL TO AUGERING / DCPT ELEVATION (m)

CONCEPTUAL PLAN PROVIDED BY CSV ARCHITECTS

GROUND SURFACE ELEVATION AT TEST HOLE LOCATIONS ARE REFERENCED TO GEODETIC DATUM

SCALE: 1:250

0 1 2 3 4 5 10 15m

PATERSON GROUP

9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

13890767 CANADA INC.

GEOTECHINCAL INVESTIGATION
PROPOSED MULTI-STOREY BUILDING
3475 ST. JOSEPH BOULEVARD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:250

Drawn by: YA

Checked by: SD

Approved by: SD

Date: 04/2023

Report No.: PG6589-1

Dwg. No.: **PG6589-1**

Revision No.:

11x17

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