PATERSON GROUP

Consulting Engineers
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
Tel: (613) 226-7381

Geotechnical Engineering
Environmental Engineering
Hydrogeology
Materials Testing
Building Science
Rural Development Design
Retaining Wall Design
Noise and Vibration Studies

patersongroup.ca

April 11, 2025
PG7514-LET.01

1000772034 Ontario Inc.
30 Sai Crescent
Ottawa, Ontario
K1G 5N8

Attention: **Mark Janczarski**

Subject: **Geotechnical Investigation Update**
Proposed Commercial Building
4405 and 4409 Innes Road, Ottawa, Ontario

Dear Mark Janczarski,

Paterson Group (Paterson) was commissioned by 1000772034 Ontario Inc. to conduct a geotechnical investigation for the proposed two-storey commercial building to be located at 4405 and 4409 Innes Road within the City of Ottawa, Ontario.

The objectives of the assessment were to:

- Determine the subsoil and groundwater conditions at the site based on existing boreholes previously completed within the subject site by this firm.
- Provide geotechnical recommendations pertaining to the design of the proposed development, including construction considerations which may affect the design.

The following letter report presents a summary of our findings and provides geotechnical recommendations pertaining to the proposed development. Investigating the presence or potential presence of contamination on the subject site was not part of the scope of work of the present investigation. Therefore, the present report does not address environmental issues.

Proposed Development

Based on the available conceptual plan, it is understood that the proposed development will consist of one two-storey slab-on-grade commercial building at the subject site.

Further, it is understood that the remainder of the site will generally be occupied by asphalt-paved parking areas, access roads, and loading zones with landscaped margins. It is also expected that the subject site will be municipally serviced.

1.0 Existing Site Conditions

The subject site is currently occupied by a one-storey commercial building with the associated parking areas and access lanes. The ground surface throughout the subject site is relatively flat and at grade with Innes Road. The subject site is bordered to the north and west by grassed yards and further by residential dwellings, to the east by a neighboring parking lot, and to the south by Innes Road.

In addition, based on available historical aerial photographs, it is understood that a building located approximately at the center of the subject site has been demolished. A historical aerial photograph of the subject site and its surroundings is provided in Figure 2, attached to the current letter report.

2.0 Field Investigation

The field program for the investigation was conducted on April 23, 2014, and consisted of advancing six boreholes to a maximum depth of 37.5 m below the ground surface.

The boreholes were drilled using a track-mounted drill rig operated by a two-person crew and were reviewed in the field by Paterson personnel under the direction of a senior engineer from the Geotechnical Division. The test hole procedures consisted of augering to the required depths at the selected locations and sampling the overburden.

The test holes were placed in a manner to provide general coverage of the subject site, taking into consideration existing site features and underground services. The borehole locations and elevations were referenced to a temporary benchmark (TBM) consisting of the top of a manhole located on the north side of Innes Road between 4405 and 4409 Innes Road. An assumed elevation of 100 m was assigned to the TBM. The approximate locations of the test holes are shown on Drawing PG7514-1 – Test Hole Location Plan attached to the present letter report.

2.1 Subsurface Conditions

Overburden

Generally, the soil profile encountered in the test holes consists of an asphaltic pavement structure and/or topsoil over a stiff to very stiff brown silty clay crust, which was further underlain by a firm to soft grey silty clay layer.

The subsurface conditions observed in the test holes are presented in detail in the Soil Profile and Data Sheets attached to the end of this letter report.

Bedrock

Based on available geological mapping, the bedrock in the area consists of interbedded limestone and dolomite of the Gull River Formation, with a drift thickness of 30 to 50 m.

2.2 Groundwater

The long-term groundwater level can 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 at an approximate depth of **2.5 to 3.0 m** below the existing 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.

3.0 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed commercial building. It is expected that the proposed slab-on-grade building will be founded on conventional shallow footings placed on an undisturbed, brown, silty clay bearing surface.

Due to the presence of a silty clay deposit, permissible grade restrictions are recommended for this site. If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

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

3.1 Site Grading and Preparation

Stripping Depth

Asphaltic concrete, topsoil, and deleterious fill, such as those containing significant amounts of organic materials or construction debris/remnants, should be stripped from under any building, paved areas, pipe bedding, and other settlement-sensitive structures. Care should be taken not to disturb adequate bearing soils below the founding level during site preparation activities. Disturbance of the subgrade may result in having to sub-excavate the disturbed material and the placement of additional suitable fill material.

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 the final grade.

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. The fill should be placed in a maximum 300 mm thick loose lifts and compacted by 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 lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be placed to increase the subgrade level for areas to be paved, the non-specified existing fill should be compacted in 300 mm lifts and compacted to a minimum density of 95% of the respective SPMDD.

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 CCW MiraDRAIN 2000 or Delta-Terraxx.

3.2 Foundation Design

Bearing Resistance Values

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, in-situ, stiff, brown 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.

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, in-situ, firm to soft, grey silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **75 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **150 kPa**. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS.

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 footings.

The bearing resistance value at SLS, provided above, 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 soil bearing medium 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.

Permissible Grade Raise

Based on the undrained shear strength testing carried out within the silty clay layer, a permissible grade raise restriction of **0.5 m** is recommended for grading within 5 m of the proposed buildings and using soil fill. A post-development groundwater lowering of 0.5 m was considered in our permissible grade raise calculations.

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

3.3 Design for Earthquakes

It is expected that the footings of the proposed commercial building will be founded over an undisturbed, stiff, brown, silty clay bearing surface. Due to the thick silty clay layer observed across the subject site, a seismic site response **Class E** is applicable for design purposes according to the 2024 Ontario Building Code (OBC).

Reference should be made to the latest revision of the OBC for a full discussion of the earthquake design requirements. The soils underlying the site are not susceptible to liquefaction.

3.4 Slab-on-Grade Construction

With the removal of all topsoil and deleterious materials within the footprint of the proposed building, a soil subgrade approved by Paterson personnel at the time of construction, is considered to be an acceptable subgrade surface on which to commence backfilling for the floor slab construction.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

It is recommended that the upper 200 mm of sub-slab fill consist of OPSS Granular A crushed stone compacted to a minimum of 98% of the materials SPMDD. All backfill material within the footprint of the building footprint should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD.

All fill placed to raise the subgrade for the slab-on-grade should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 98% of the materials SPMDD and as verified by Paterson field personnel.

3.5 Pavement Design

Car only parking areas and access lanes are anticipated at this site. The proposed pavement structures are shown in Tables 1 and 2.

Table 1 - 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 placed over in situ soil or fill.	

Table 2 - Recommended Pavement Structure - Access Lanes and Heavy Traffic 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
400	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill.	

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

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. Weak subgrade conditions may be experienced over service trench fill materials. This may require the use of a geotextile, such as Terratrack 200 or equivalent, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable compaction equipment.

Pavement Structure Drainage

The satisfactory performance of the pavement structure is largely dependent on the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing load carrying capacity.

Due to the low permeability of the subgrade materials consideration should be given to installing subdrains during the pavement construction as per City of Ottawa standards. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to the drainage lines.

4.0 Design and Construction Precautions

4.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system be provided for the proposed structures. The system should consist of a 100 mm to 150 mm diameter perforated and corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, which is placed at the footing level around the exterior perimeter of the structure. The pipe should have positive outlet, such as a gravity connection to the storm sewer.

Foundation Backfill

If the proposed buildings include below-grade space, backfill against the exterior sides of the foundation walls 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 geo-composite board, such as Delta Terraxx, MiraDrain G100N or equivalent, connected to the perimeter foundation drainage system.

If the proposed buildings do not include below-grade space, then backfill against the exterior sides of the foundation wall may consist of on-site excavated fill, provided it is maintained in an unfrozen state and at a suitable moisture content for compaction. Imported granular materials, such as clean sand or OPSS Granular B Type II granular material, should otherwise be used for this purpose.

4.2 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.

4.3 Excavation Side Slopes

Temporary Side Slopes

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 sufficient room will be available in selected areas 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 subsoil at this site is considered to be mainly Type 2 and Type 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.

4.4 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 or Granular B Type II with a maximum size of 25 mm. The bedding layer should be increased to a minimum thickness of 300 mm where the subgrade consists of grey silty clay. The bedding and cover materials should be placed in maximum 225 mm thick lifts and compacted to 98% of the SPMDD.

It should generally be possible to re-use the moist (not wet) site-generated fill above the cover material if the excavation and filling operations are carried out in dry weather conditions. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

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. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

Clay Seals

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long and should extend from trench wall to trench wall. Generally, the seals should extend from the frost line and fully penetrate the bedding, sub-bedding, and cover material.

The barriers should consist of relatively dry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the material's SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

4.5 Groundwater Control

Groundwater Control for Building Construction

Based on our observations, it is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. Provisions should be carried out for using higher capacity open sump systems for excavations undertaken below the bedrock surface.

The contractor should be prepared to direct water away from all subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

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.

4.6 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/pile caps/grade beams are protected with sufficient soil cover to prevent freezing at founding level.

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

4.7 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 (GU – General Use 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 moderate to aggressive corrosive environment.

4.8 Landscaping Considerations

Tree Planting Restrictions

Paterson completed a soils review of the site to determine applicable tree planting setbacks, in accordance with the City of Ottawa *Tree Planting in Sensitive Marine Clay Soils* (2017 Guidelines) for trees planted within a public right-of-way (ROW).

Atterberg limits testing was not completed for recovered silty clay samples at selected locations during the initial investigation. However, to stay on the conservative side, the silty clay will be assumed to be highly sensitive for tree planting. As such, the tree planting setback limits are 7.5 m for small (mature height up to 7.5 m) and medium size trees (mature tree height 7.5 to 14 m), provided that the following conditions are met.

- ❑ The underside of footing (USF) is 2.1 m or greater below the lowest finished grade for footings within 10 m from the tree, as measured from the center of the tree trunk and verified by means of the Grading Plan.

- A small tree must be provided with a minimum of 25 m3 of available soils volume while a medium tree must be provided with a minimum of 30 m3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

- The tree species must be small (mature tree height up to 7.5 m) to medium size (mature tree height 7.5 m to 14 m) as confirmed by the Landscape Architect.

- The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall).

- Grading surrounding the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree), as noted on the Grading Plan.

It should be noted that the above-mentioned setback may be reduced, provided that additional fieldwork, including Atterberg limits testing, is carried out to assess the in-situ soils at the subject site.

5.0 Recommendations

It is also recommended that the following be carried out by Paterson once preliminary and/or detailed designs of the proposed development have been prepared:

- Review preliminary and detailed grading, servicing, and structural plan(s) from a geotechnical perspective.

In addition, it is a requirement for the foundation design data provided herein to be applicable that a material testing and observation program be performed by the geotechnical consultant. The following aspects of the program should be performed by Paterson:

- Review and inspection of the installation of the foundation drainage systems.

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

- Sampling and testing of the concrete and fill materials.

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

- Observation of all subgrades prior to backfilling

- ❑ Field density tests to determine the level of compaction achieved.

- ❑ Sampling and testing of the bituminous concrete, including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation 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 ***Ontario Regulation 406/19: On-Site and Excess Soil Management.***

6.0 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 hole 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 letter report applies only to the project described in this document. Use of this report for the purposes other than those described herein or by person(s) other than 1000772034 Ontario Inc. or their agents, is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

We trust that the current submission meets your immediate requirements.

Best Regards,

Paterson Group Inc.

Yashar Ziaeimehr, M.Sc., EIT

Faisal I. Abou-Seido, P.Eng.

Attachments

- ❑ Soil Profile and Test Data Sheets
- ❑ Symbols and Terms
- ❑ Analytical Testing Results
- ❑ Figure 1 – Key Plan
- ❑ Figure 2 – Aerial Photograph - 2017
- ❑ Drawing PG7514-1 – Test Hole Location Plan

Report Distribution

- ❑ 1000772034 Ontario Inc. (e-mail copy)
- ❑ Paterson Group (1 copy)

PATERSON GROUP
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

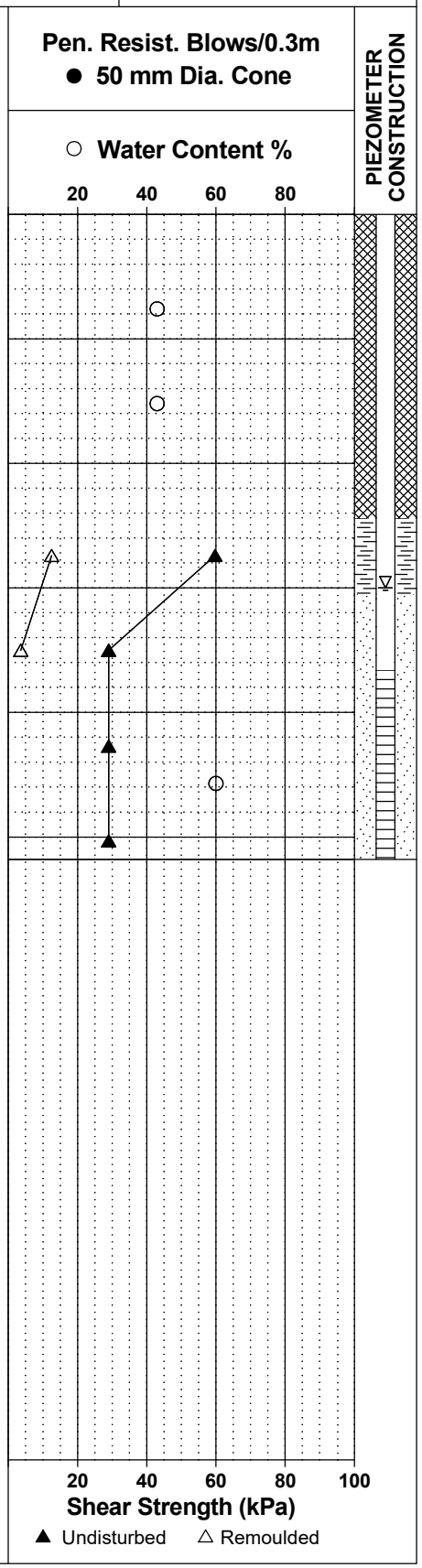
SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Building
4405 and 4409 Innes Road, Ottawa, Ontario

EASTING: **NORTHING:** **ELEVATION:** 100.25
DATUM: TBM - Top of manhole cover located in front of subject property, north side of Innes Road. An arbitrary elevation of 100.00m was assigned to the TBM.
REMARKS:
BORINGS BY: CME 55 Power Auger **DATE:** April 23, 2014

FILE NO. PG7514
HOLE NO. BH 1

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.30		AU	1			0	100.25
		SS	2	50	3	1	99.25
		SS	3	83	4	2	98.25
Stiff, brown **SILTY CLAY**							
- firm to soft by 3.0 m depth						3	97.25
- grey by 3.5 m depth						4	96.25
5.18		SS	4	83	P	5	95.25
End of Borehole							
(GWL at 3.0 m depth based on field observations)							



PATERSON GROUP
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

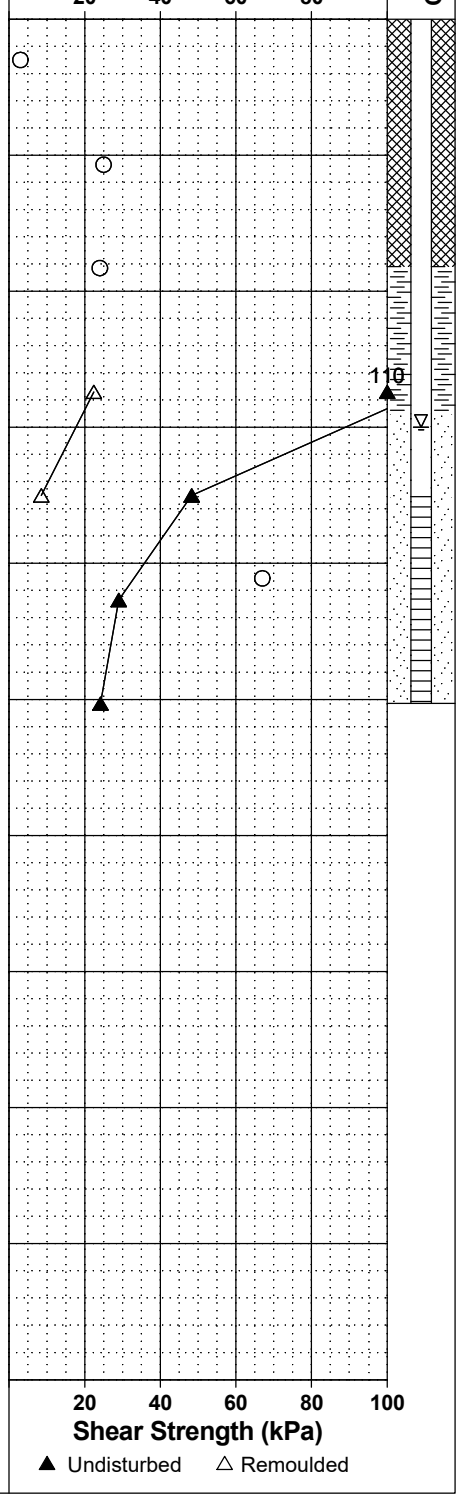
SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Building
4405 and 4409 Innes Road, Ottawa, Ontario

EASTING: **NORTHING:** **ELEVATION:** 100.62
DATUM: TBM - Top of manhole cover located in front of subject property, north side of Innes Road. An arbitrary elevation of 100.00m was assigned to the TBM.
REMARKS:
BORINGS BY: CME 55 Power Auger **DATE:** April 23, 2014

FILE NO. PG7514
HOLE NO. BH 2

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.62
Asphaltic concrete 0.10							
FILL: Brown silty sand with gravel 0.46		AU	1				
0.76						1	99.62
Brown **SILTY CLAY** with organics		SS	2	50	9		
		SS	3	58	7	2	98.62
Very stiff to stiff, brown **SILTY CLAY**							
- firm to soft by 3.0 m depth						3	97.62
- grey by 3.5 m depth							
		SS	4	83	P	4	96.62
5.03						5	95.62
Dynamic Cone Penetration Test commenced at 5.03 m depth. Cone pushed to 32.9 m depth.						6	94.62
						7	93.62
						8	92.62
						9	91.62
						10	90.62



PATERSON GROUP
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

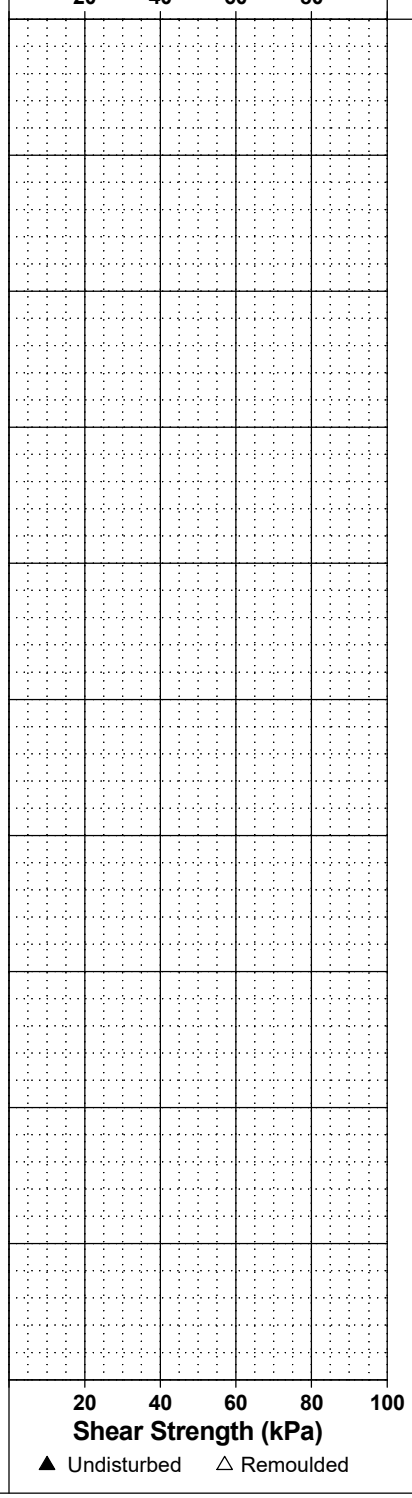
SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Building
4405 and 4409 Innes Road, Ottawa, Ontario

EASTING: **NORTHING:** **ELEVATION:** 100.62
DATUM: TBM - Top of manhole cover located in front of subject property, north side of Innes Road. An arbitrary elevation of 100.00m was assigned to the TBM.
REMARKS:
BORINGS BY: CME 55 Power Auger **DATE:** April 23, 2014

FILE NO. PG7514
HOLE NO. BH 2

SAMPLE 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
						10	90.62		
						11	89.62		
						12	88.62		
						13	87.62		
						14	86.62		
						15	85.62		
						16	84.62		
						17	83.62		
						18	82.62		
						19	81.62		
						20	80.62		



PATERSON GROUP
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Building
4405 and 4409 Innes Road, Ottawa, Ontario

EASTING: **NORTHING:** **ELEVATION:** 100.62
DATUM: TBM - Top of manhole cover located in front of subject property, north side of Innes Road. An arbitrary elevation of 100.00m was assigned to the TBM.
REMARKS:
BORINGS BY: CME 55 Power Auger **DATE:** April 23, 2014

FILE NO. PG7514
HOLE NO. BH 2

SAMPLE 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
						20	80.62		
						21	79.62		
						22	78.62		
						23	77.62		
						24	76.62		
						25	75.62		
						26	74.62		
						27	73.62		
						28	72.62		
						29	71.62		
						30	70.62		

Pen. Resist. Blows/0.3m: 20 40 60 80
Shear Strength (kPa): 20 40 60 80 100
▲ Undisturbed △ Remoulded

PATERSON GROUP
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Building
4405 and 4409 Innes Road, Ottawa, Ontario

EASTING: **NORTHING:** **ELEVATION:** 100.62
DATUM: TBM - Top of manhole cover located in front of subject property, north side of Innes Road. An arbitrary elevation of 100.00m was assigned to the TBM.
REMARKS:
BORINGS BY: CME 55 Power Auger **DATE:** April 23, 2014

FILE NO. PG7514
HOLE NO. BH 2

SAMPLE 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
						30	70.62		
						31	69.62		
						32	68.62		
						33	67.62		
						34	66.62		
						35	65.62		
						36	64.62		
						37	63.62		
37.49 End of Borehole (GWL at 2.2 m depth based on field observations)									

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

PATERSON GROUP
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

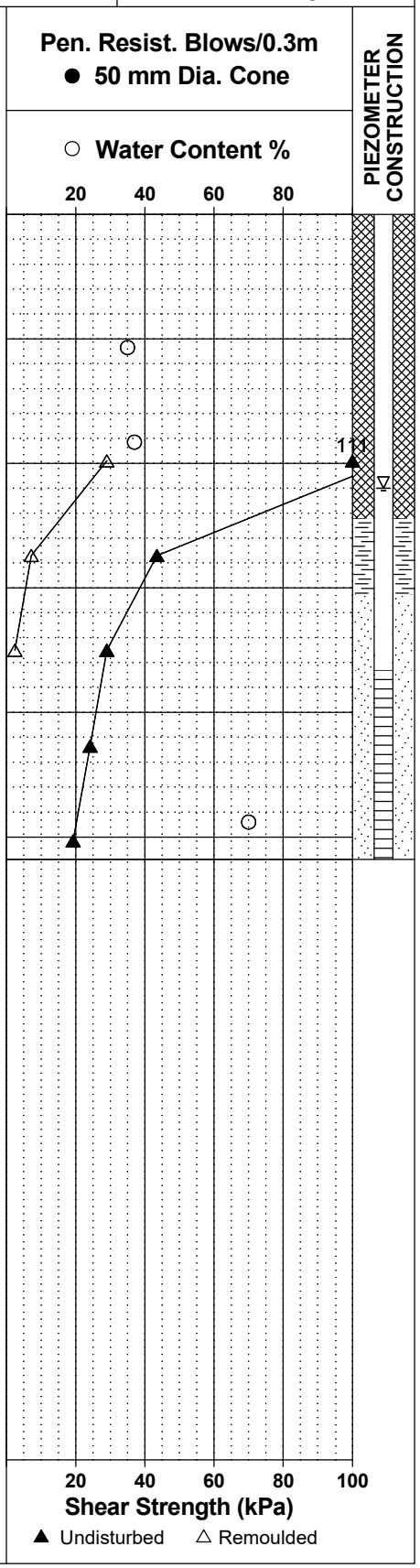
SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Building
4405 and 4409 Innes Road, Ottawa, Ontario

EASTING: **NORTHING:** **ELEVATION:** 100.09
DATUM: TBM - Top of manhole cover located in front of subject property, north side of Innes Road. An arbitrary elevation of 100.00m was assigned to the TBM.
REMARKS:
BORINGS BY: CME 55 Power Auger **DATE:** April 23, 2014

FILE NO. PG7514
HOLE NO. BH 3

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.09
TOPSOIL 0.30		AU	1				
Very stiff to stiff, brown **SILTY CLAY**		SS	2	17	2	1	99.09
- firm by 2.3 m depth		SS	3	92	3	2	98.09
- soft and grey by 3.5 m depth						3	97.09
						4	96.09
5.18		SS	4	92	P	5	95.09
End of Borehole (GWL at 2.2 m depth based on field observations)							



PATERSON GROUP
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

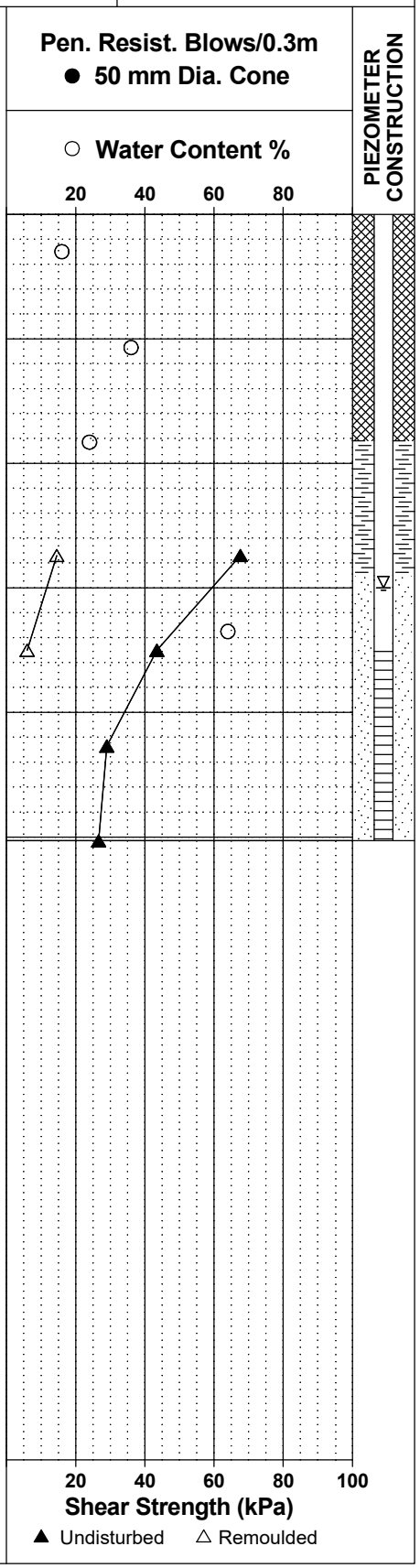
SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Building
4405 and 4409 Innes Road, Ottawa, Ontario

EASTING: **NORTHING:** **ELEVATION:** 100.13
DATUM: TBM - Top of manhole cover located in front of subject property, north side of Innes Road. An arbitrary elevation of 100.00m was assigned to the TBM.
REMARKS:
BORINGS BY: CME 55 Power Auger **DATE:** April 23, 2014

FILE NO. PG7514
HOLE NO. BH 4

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.13
FILL: Gravel 0.15		AU	1				
Dark brown **SILTY CLAY,** some roots		SS	2	58	7	1	99.13
1.37		SS	3	50	4	2	98.13
Stiff to firm, brown **SILTY CLAY**						3	97.13
- grey by 3.5 m depth		SS	4	100	P	4	96.13
5.03						5	95.13
End of Borehole							
(GWL at 3.0 m depth based on field observations)							



PATERSON GROUP
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

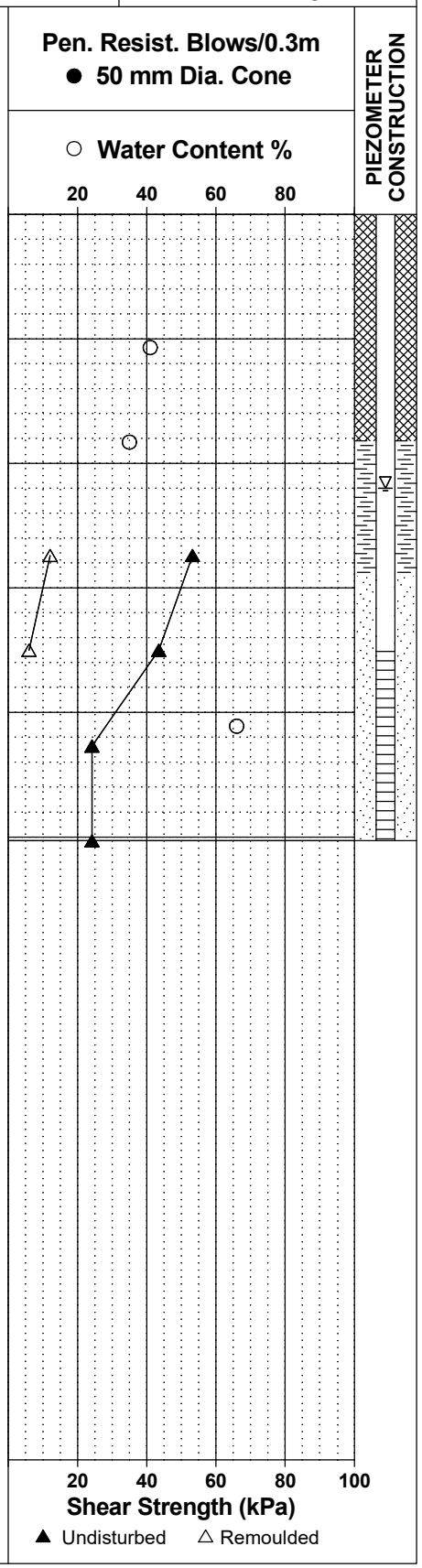
SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Building
4405 and 4409 Innes Road, Ottawa, Ontario

EASTING: **NORTHING:** **ELEVATION:** 100.40
DATUM: TBM - Top of manhole cover located in front of subject property, north side of Innes Road. An arbitrary elevation of 100.00m was assigned to the TBM.
REMARKS:
BORINGS BY: CME 55 Power Auger **DATE:** April 23, 2014

FILE NO. PG7514
HOLE NO. BH 5

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.10		AU	1			0	100.40
		SS	2	83	5	1	99.40
		SS	3	92	6	2	98.40
Stiff to firm, grey **SILTY CLAY**							
						3	97.40
- soft by 3.5 m depth							
		SS	4	92	P	4	96.40
5.03						5	95.40
End of Borehole							
(GWL at 2.2 m depth based on field observations)							



PATERSON GROUP
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
TEL: (613) 226-7381

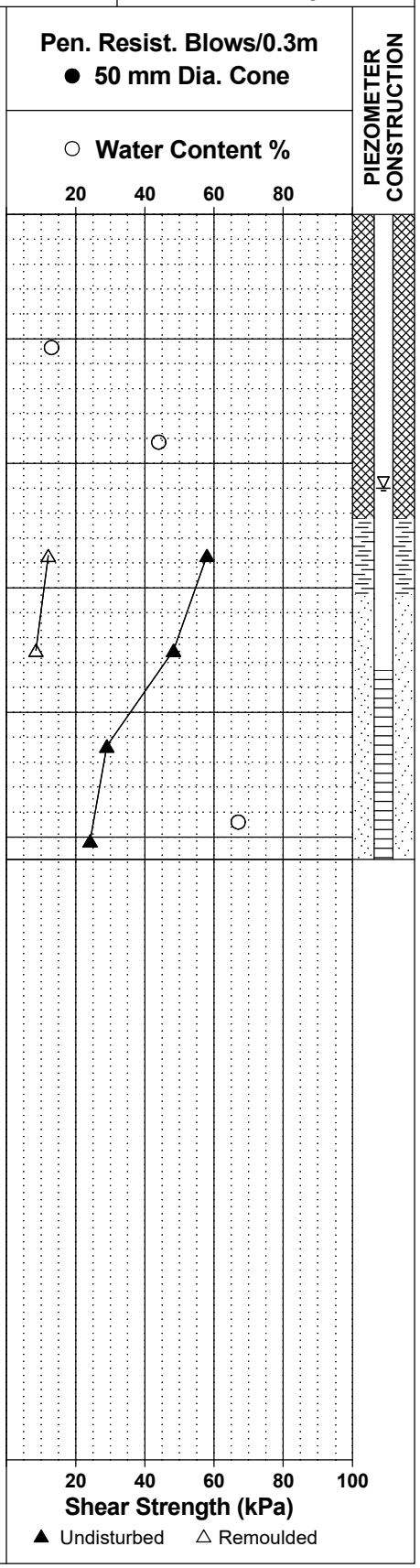
SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Building
4405 and 4409 Innes Road, Ottawa, Ontario

EASTING: **NORTHING:** **ELEVATION:** 100.49
DATUM: TBM - Top of manhole cover located in front of subject property, north side of Innes Road. An arbitrary elevation of 100.00m was assigned to the TBM.
REMARKS:
BORINGS BY: CME 55 Power Auger **DATE:** April 23, 2014

FILE NO. PG7514
HOLE NO. BH 6

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.10		AU	1			0	100.49
FILL: Gravel							
1.07		SS	2	33	7	1	99.49
		SS	3	75	4	2	98.49
Stiff to firm, brown **SILTY CLAY**							
- grey by 2.7 m depth						3	97.49
						4	96.49
- soft by 4.5 m depth		SS	4	100	P	5	95.49
5.18							
End of Borehole							
(GWL at 2.2 m depth based on field observations)							



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

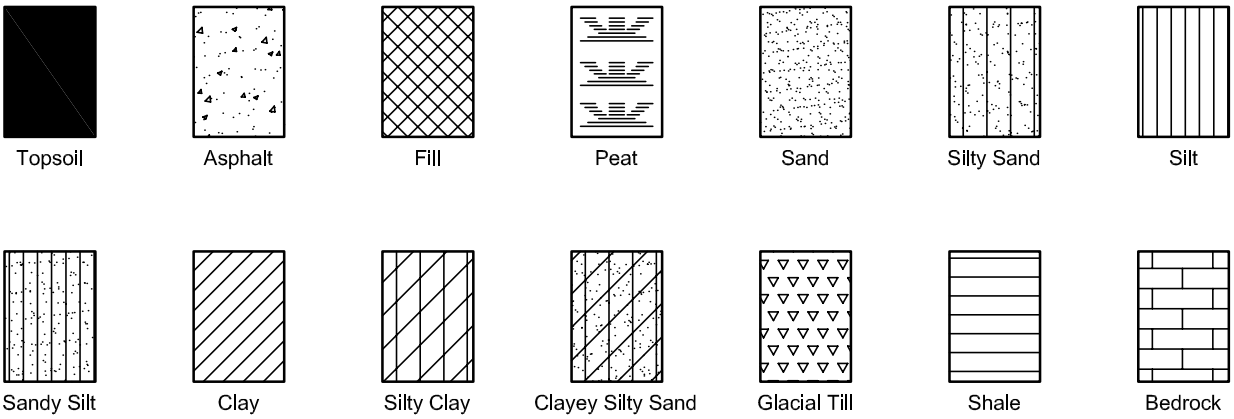
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

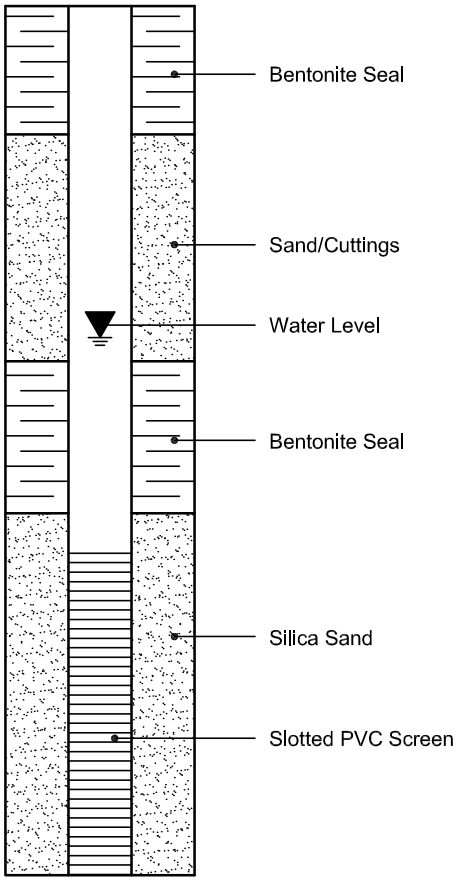
SYMBOLS AND TERMS (continued)

STRATA PLOT

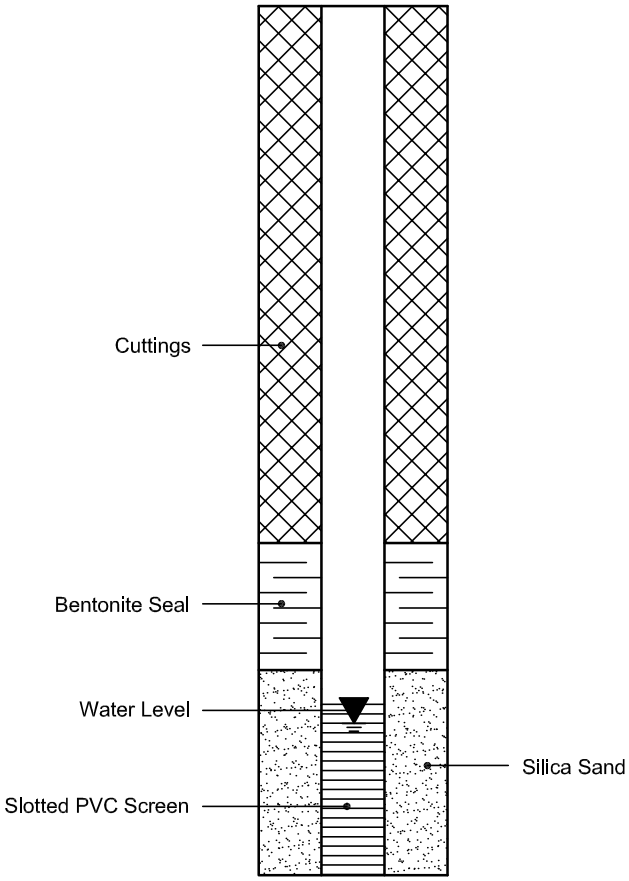


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis

Report Date: 29-Apr-2014
Order Date:24-Apr-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 15353

Project Description: PG3218

	Client ID:	BH3-SS3	-	-	-
	Sample Date:	23-Apr-14	-	-	-
	Sample ID:	1417248-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	69.1	-	-	-
General Inorganics					
pH	0.05 pH Units	7.72	-	-	-
Resistivity	0.10 Ohm.m	30.4	-	-	-
Anions					
Chloride	5 ug/g dry	49	-	-	-
Sulphate	5 ug/g dry	17	-	-	-

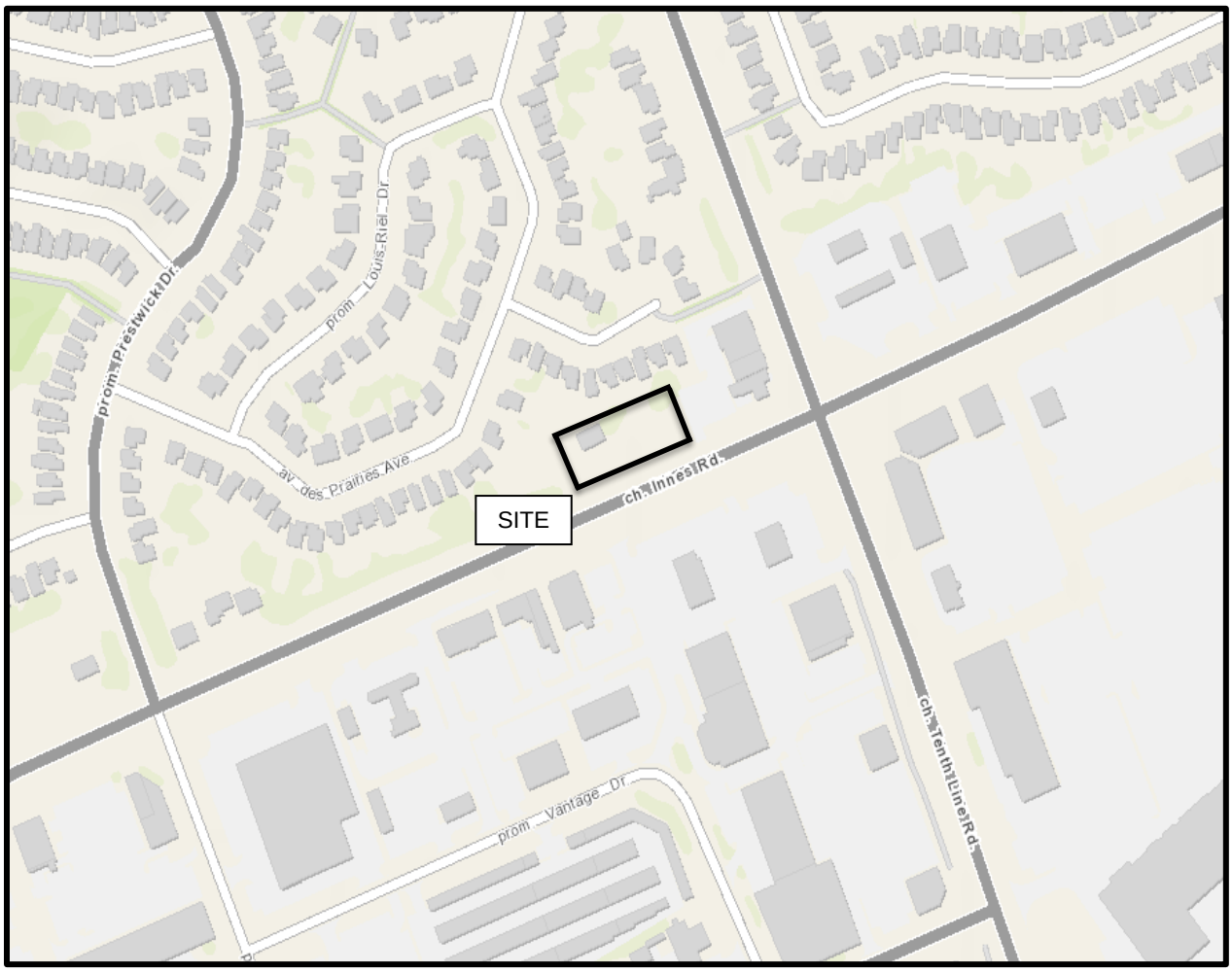


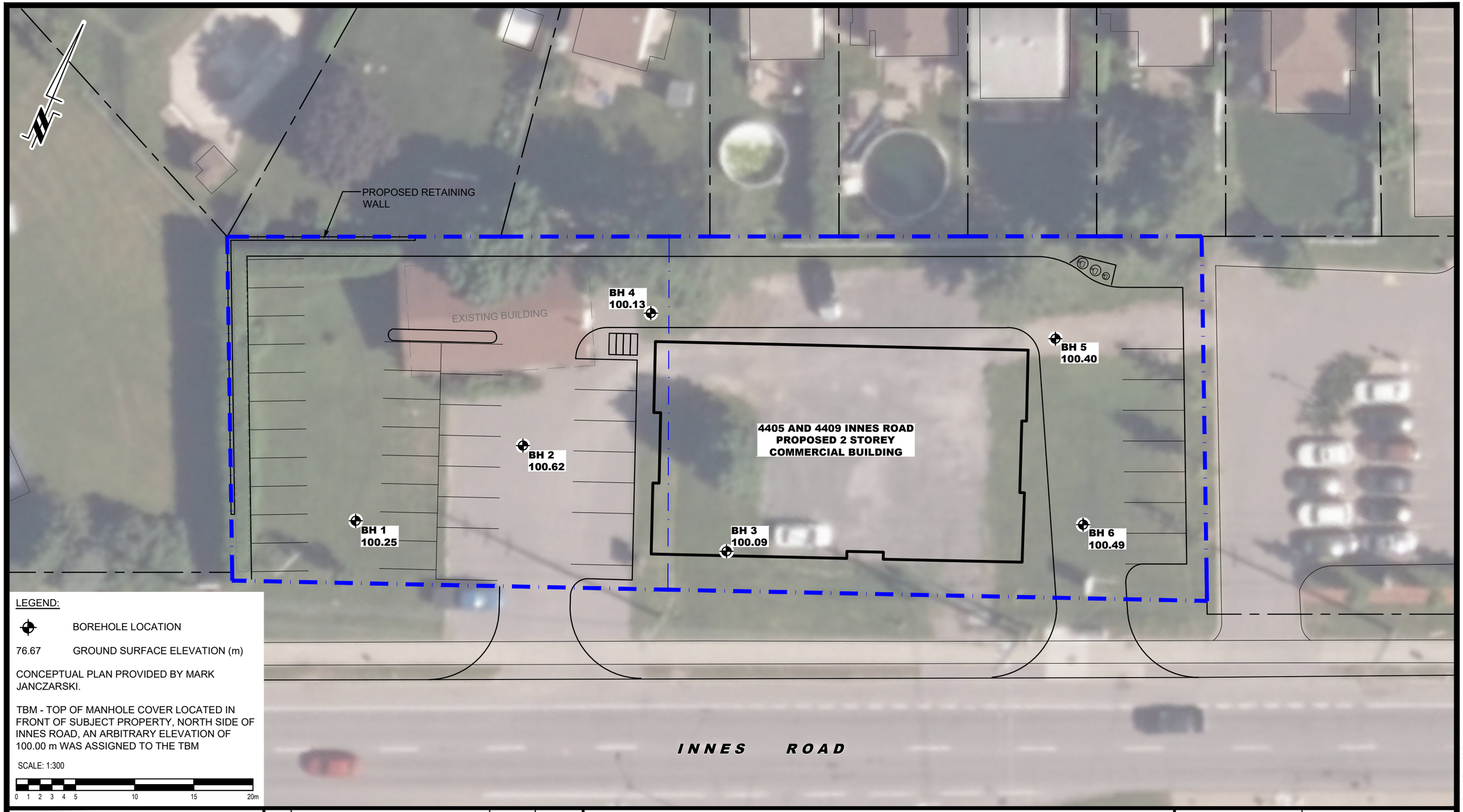
FIGURE 1

KEY PLAN

FIGURE 2

Aerial Photograph - 2017

PATERSON GROUP



LEGEND:

BOREHOLE LOCATION

76.67 GROUND SURFACE ELEVATION (m)

CONCEPTUAL PLAN PROVIDED BY MARK JANCZARSKI.

TBM - TOP OF MANHOLE COVER LOCATED IN FRONT OF SUBJECT PROPERTY, NORTH SIDE OF INNES ROAD, AN ARBITRARY ELEVATION OF 100.00 m WAS ASSIGNED TO THE TBM

SCALE: 1:300

0 1 2 3 4 5 10 15 20m

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

NO.	REVISIONS	DATE	INITIAL

1000772034 ONTARIO INC.
GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL BUILDING
4405 AND 4409 INNES ROAD
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:300	Date: 04/2025
Drawn by: ZS	Report No.: PG7514-LET.01
Checked by: YZ	Dwg. No.: PG7514-1
Approved by: FA	Revision No.:

p:\autocad drawings\geotechnical\pg75xx\pg7514\pg7514-1-test hole location plan.dwg

11x17