Geotechnical Engineering

Environmental Engineering

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Materials Testing

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Geotechnical Investigation

Proposed Car Dealership
Block 11 - Citigate Development
555 Dealership Drive
Ottawa, Ontario

Prepared For

BBS Construction

September 20, 2018

Report: PG4547-1 Revision 1

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by BBS Construction to conduct a geotechnical investigation for the proposed car dealership to be located at 555 Dealership Drive, in the City of Ottawa (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objective of the current preliminary investigation was to:

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

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

Investigating the presence or potential presence of contamination on the subject property was not part of the scope of work of this present investigation.

2.0 Proposed Development

It is understood that the proposed development will consist of low rise commercial building of slab-on-grade construction along with at grade paved parking areas and access lanes.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on May 31, 2018. At that time, six (6) boreholes were drilled to a maximum depth varying from 5.2 to 6.7 m below existing ground surface. Previous investigations were conducted by this firm within the subject site on August 2000, May 2012 and June 2014. The relevant test holes within the subject site from the current and previous investigations are presented in Drawing PG4547-1 - Test Hole Location Plan in Appendix 2. The test hole locations were determined in the field by Paterson personnel taking into consideration site features and underground services.

The boreholes were completed with a track-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer from our geotechnical department. The test pits completed during the previous geotechnical investigations consisted of excavating to the required depths at the selected locations and sampling and testing the overburden.

Sampling and In-Situ Testing

Soil samples were recovered using a 50 mm diameter split-spoon sampler or from the auger flights. Additionally, soil samples recovered from the open test pits during our previous geotechnical investigations were recovered along the sidewalls of the open test pits. All soil samples were visually inspected and initially classified on site. The split-spoon and grab samples were placed in sealed plastic bags. All samples were transported to the our laboratory for examination and classification. The depths at which the grab, split spoon and auger samples were recovered from the test holes are presented as G, SS and AU, respectively, on the Soil Profile and Test Data sheets in Appendix 1. Split spoon samples were also obtained in the same interval as the undrained shear strength testing for the purposes of soil classification and laboratory review.

In conjunction with the recovery of the split spoon samples, Standard Penetration Testing (SPT) was conducted. The SPT results are recorded as “N” values on the Soil Profile & 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 conducted in cohesive soils using a field vane apparatus. 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

Flexible polyethylene standpipes were installed in all boreholes to monitor groundwater levels subsequent to the completion of the sampling program. Additionally, groundwater infiltration levels were noted at the time of excavation and observations are noted on the Soil Profile and Test Data sheets presented in Appendix 1.

Sample Storage

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

3.2 Field Survey

The borehole locations completed during our current geotechnical investigation were determined in the field by Paterson personnel taking into consideration site features and the presence of underground and aboveground services. The ground surface elevation at each borehole location completed during our current investigation was surveyed by Paterson personnel. The boreholes were surveyed with respect to a temporary benchmark (TBM), consisting of the top spindle of the fire hydrant located along dealership drive, in the south corner of the subject site. A geodetic elevation of 96.85 m was provided for the TBM based on a topo survey plan prepared by Farley, Smith and Denis Surveying LTD.

The test holes completed during our previous geotechnical investigations were located and surveyed in the field by Novatech Engineering Consultants Limited (Novatech). It is understood that the elevations are referenced to a geodetic datum.The test hole locations and ground surface elevation at each test hole are presented on Drawing PG4547-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the investigation were examined in our laboratory. The results are presented in the Soil Profile and Test Data sheets presented in Appendix 1.

4.0 Observations

4.1 Surface Conditions

The site is currently at grade with the adjacent roadways due to an in-filling program completed as part of the development works for the proposed commercial development Citigate 416 Corporate. Paterson personnel completed periodic inspections in fall and early winter of 2015. At that time, the fill material was noted to consist of a brown silty clay mixed with gravel and cobbles. The site is relatively flat except for an approximately 1.5 to 2 m high fill pile, which is running north/south down the central portion of the subject block. The existing fill pile was noted to consist mainly of a brown silty clay with sand, gravel, cobbles and boulders.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile at the test hole locations consists of approximately 0.8 to 1.9 m of imported brown silty clay to silty sand fill with gravel, cobbles and boulders overlying a native, very stiff to stiff brown silty clay crust to approximately 3 m below existing ground surface. The stiff brown silty clay was observed to be underlain by a stiff to firm grey silty clay, which in turn is overlying a compact to dense glacial till deposit.

Specific details of the soil profile at each test hole location are presented on the Soil Profile and Test Data sheets in Appendix 1. It should be noted that the test holes completed for the previous investigations were done prior to the placement of the existing fill pile.

Available Bedrock Mapping

Based on available geological mapping, the subject site is located in an area where the bedrock consists of interbedded limestone and dolomite of the Gull River formation. The overburden drift thickness is estimated to be between 5 to 15 m.

4.3 Groundwater

Groundwater levels were noted at the test hole locations at the time of drilling and summarized in Table 1. It is important to note that groundwater readings at piezometers can be influenced by surface water perched within the borehole backfill material. Additionally, surface water tends to get perched within the shallow fill layer due to the nature of the underlying cohesion silty clay layer slowing the water from penetrating deeper. Groundwater conditions can also be estimated based on the observed colour, moisture levels and consistency of the recovered soil samples. Based on these observations, it is estimated that the long-term groundwater level can be expected between 3 and 4 m below existing ground surface. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

Table 1 - Summary of Groundwater Level Readings

Test Hole Number	Ground Elevation, m	Groundwater Levels, m		Recording Date
		Depth	Elevation	
PG4547 - Current Investigation				
BH 1-18	95.38	0.92	94.46	June 7, 2018
BH 2-18	95.20	0.67	94.53	June 7, 2018
BH 3-18	94.92	0.03	94.89	June 7, 2018
BH 4-18	95.03	0.09	94.94	June 7, 2018
BH 5-18	95.60	1.31	94.29	June 7, 2018
BH 6-18	96.30	2.00	94.30	June 7, 2018
PG2449 - June 27, 2014 (Field Observations)				
BH3	94.76	2.00	92.76	June 27, 2014
PG2449 - May 25, 2012 (Field Observations)				
TP12	93.84	1.00	92.34	May 25, 2012
TP13	94.76	0.90	93.86	May 25, 2012
TP14	94.23	1.20	93.03	May 25, 2012
G7892 - October 23, 2000 (Field Observations)				
TP85	94.30	1.30	93.00	October 9, 2012

Note: The ground surface elevation at each borehole location completed during our current investigation was surveyed by Paterson personnel. The boreholes were surveyed with respect to a temporary benchmark (TBM), consisting of the top spindle of the fire hydrant located along dealership drive, north of the subject site along the east side of the roadway. A geodetic elevation of 96.85 m was provided for the TBM based on the survey plan prepared by Farley Smith and Dennis Surveying LTD.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is satisfactory for the proposed car dealership. It is expected that the proposed building will be founded on conventional spread footing foundations placed on an undisturbed, very stiff to stiff silty clay bearing surface.

A permissible grade raise restriction is required for the proposed development due to the presence of a silty clay layer. The recommended permissible grade raise restrictions are further discussed in Subsection 5.3.

Paterson personnel witnessed the removal of the topsoil layer and placement of the fill material across the subject site during the in-filling program completed across the site in fall to early winter of 2015. Based on our observations of the placement of the upper layers of the imported fill, the fill is considered suitable as a subgrade material below the car parking areas and access lanes. Consideration could be given to leaving the existing fill below the building footprint, outside of the lateral support zone of the footings. However, the existing fill should be proof-rolled at the time of construction and approved by the geotechnical consultant based on the fill performance at that time.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and fill, such as those containing organic or deleterious materials, should be stripped from under any buildings and other settlement sensitive structures. It is anticipated that the existing fill, free of deleterious material, can be left in place below the proposed building footprint, outside of lateral support zones for the footings, and below the proposed parking area and access lane. However, it is recommended that the existing fill layer be proof-rolled several times and approved by the geotechnical consultant at the time of construction. Any poor performing areas should be removed and replaced with an approved fill.

Fill Placement

Fill used for grading purposes beneath the proposed building, unless otherwise specified, such as the existing fill layer, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The fill should be tested and approved prior to delivery to the site. It should be placed in lifts no greater than 300 mm in thickness and compacted using suitable compaction equipment for the specified lift thickness. Fill placed beneath the building areas should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and be compacted at minimum by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD.

5.3 Foundation Design

Bearing Resistance Values

Strip footings, up to 2 m wide, and pad footings, up to 5 m wide, founded on an undisturbed, very stiff to 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**. Footings designed using the above-noted bearing resistance value at SLS will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively. Engineered fill can also be used as a subgrade material and footings can be designed using the above mentioned bearing resistance values.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, have been removed prior to the placement of concrete for footings. The bearing surface is to be approved by the geotechnical consultant at the time of placement of the footings.

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. Above the groundwater level, adequate lateral support is provided to a stiff silty clay or engineered fill 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.

Settlement/Grade Raise

Consideration must be given to potential settlements which could occur due to the presence of the silty clay deposit and the combined loads from the proposed footings, any groundwater lowering effects, and grade raise fill. The foundation loads to be considered for the settlement case are the continuously applied loads which consist of the unfactored dead loads and the portion of the unfactored live load that is considered to be continuously applied.

Due to the silty clay underlying the subject site, a permissible grade raise of **2 m** is recommended for grading within 6 m of the building footprint. A permissible grade raise restriction of **2.5 m** is recommended for the parking areas and access lanes. It should be noted that the permissible grade raise values noted above are measured from the **original ground surface**, below the existing fill observed on site.

Generally, the potential long term settlement is evaluated based on the compressibility characteristics of the silty clay. The total and differential settlements will be dependent on characteristics of the proposed buildings. For design purposes, the total and differential settlements are estimated to be 25 and 20 mm, respectively. A post-development groundwater lowering of 0.5 m was assumed.

The potential post construction total and differential settlements are dependent on the position of the long term groundwater level when buildings are situated over deposits of compressible silty clay. Efforts can be made to reduce the impacts of the proposed development on the long term groundwater level by placing clay dykes in the service trenches, reducing the sizes of paved areas, leaving green spaces to allow for groundwater recharge or limiting planting of trees to areas away from the buildings. However, it is not economically possible to control the groundwater level.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for the foundations considered at this site. The soils underlying the proposed shallow foundations are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Slab on Grade Construction

With the removal of all topsoil and deleterious fill, containing organic matter, within the footprint of the proposed building, undisturbed native soil surface or existing fill approved by the geotechnical consultant at the time of construction will be considered acceptable subgrade on which to commence backfilling for floor slab construction. Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. It is recommended that the upper 200 mm of sub-slab fill consist of Granular A crushed stone.

5.6 Pavement Design

Car only parking, access lanes, heavy truck parking areas and local access lanes are anticipated at this site. The proposed pavement structures are shown in Tables 2 and 3.

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 placed over in situ soil or fill

Table 3 - Recommended Pavement Structure - Heavy Truck Parking and Access Lanes

Thickness (mm)	Material Description
40	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course -** HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**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 I or Type II material.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's SPMDD using suitable compaction equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping 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 its load carrying capacity.

Where silty clay is encountered at subgrade level, consideration should be given to installing subdrains at the catch basin locations during the pavement construction. These drains should be constructed according to City of Ottawa specifications. The drains should be connected to a positive outlet. The subgrade surface should be crowned to promote water flow to the drainage lines. The subdrains will help drain the pavement structure, especially in early Spring when the subgrade is saturated and weaker and, therefore, more susceptible to permanent deformation.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be provided for the proposed structure. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

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 where frost heave sensitive structures, such as a concrete sidewalk, will be placed. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material may be used for this purpose. A composite drainage system, such as Delta Drain 6000, Miradrain G100 or equivalent, should be placed against the foundation wall to promote drainage toward the perimeter drainage pipe.

6.2 Protection of Footings Against Frost Action

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

A minimum of 2.1 m thick soil cover (or equivalent) should be provided for other exterior unheated footings.

6.3 Excavation Side Slopes

The side slopes of excavations in the soil and fill overburden materials should be either 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 for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

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

6.4 Pipe Bedding and Backfill

At least 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe should consist of OPSS Granular A. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to a minimum of 95% of the material's SPMDD.

Generally, it should be possible to re-use the moist (not wet) brown silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet silty clay should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being re-used.

Trench backfill material within the frost zone (approximately 1.8 m below finished grade) should match the soils exposed at the trench walls to reduce differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be low and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

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

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

6.6 Winter Construction

The subsurface conditions at this site mostly consist of frost susceptible materials. In presence of water and freezing conditions ice could form within the soil mass. Heaving and settlement upon thawing could occur. Precautions should be taken if winter construction is considered for this project.

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, 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.

The trench excavations should be constructed in a manner that will avoid the introduction of frozen materials into the trenches. As well, pavement construction is difficult during winter. The subgrade consists of frost susceptible soils which will experience total and differential frost heaving as the work takes place. In addition, the introduction of frost, snow or ice into the pavement materials, which is difficult to avoid, could adversely affect the performance of the pavement structure. Additional information could be provided, if required.

6.7 Landscaping Considerations

Tree Planting Restrictions

It should be noted that the clay present within 1.5 m below design footing level of a low sensitivity clay. It is recommended that trees placed within 4 m of the foundation wall should consist of low water demanding trees with shallow roots systems that extend less than 1.5 m in depth. Trees placed greater than 4 m from the foundation wall may consist of typical street trees, which are typically moderate water demand species with roots extending to a maximum depth of 2 m below ground surface.

It is well documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils that shrink on drying can result in long-term differential settlements of the structures. Tree varieties that have the most pronounced effect on foundations are seen to consist of poplars, willows and some maples (i.e. Manitoba Maples) and, as such, they should not be considered in the landscaping design.

7.0 Recommendations

It is recommended that the following be completed once the master plan and site development are determined:

- ❑ Review detailed grading plan(s) from a geotechnical perspective.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ 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 placing backfilling materials.
- ❑ Field density tests to ensure that the specified level of compaction has been 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 material testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review the grading plan once available. Also, our recommendations should be reviewed when the project drawings and specifications are complete.

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, we request that we be notified immediately in order to permit reassessment of our recommendations.

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 BBS Construction or their agent(s) is not authorized without review by this firm for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

September 20, 2018

Nick Giamberardino, B.Eng

David J. Gilbert, P.Eng.

Report Distribution:

- ❑ BBS Construction (3 copies)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Bldg. - Block 11 - 555 Dealership Dr.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the south side of Dealership Drive, across from subject site. Geodetic elevation = 96.85m.

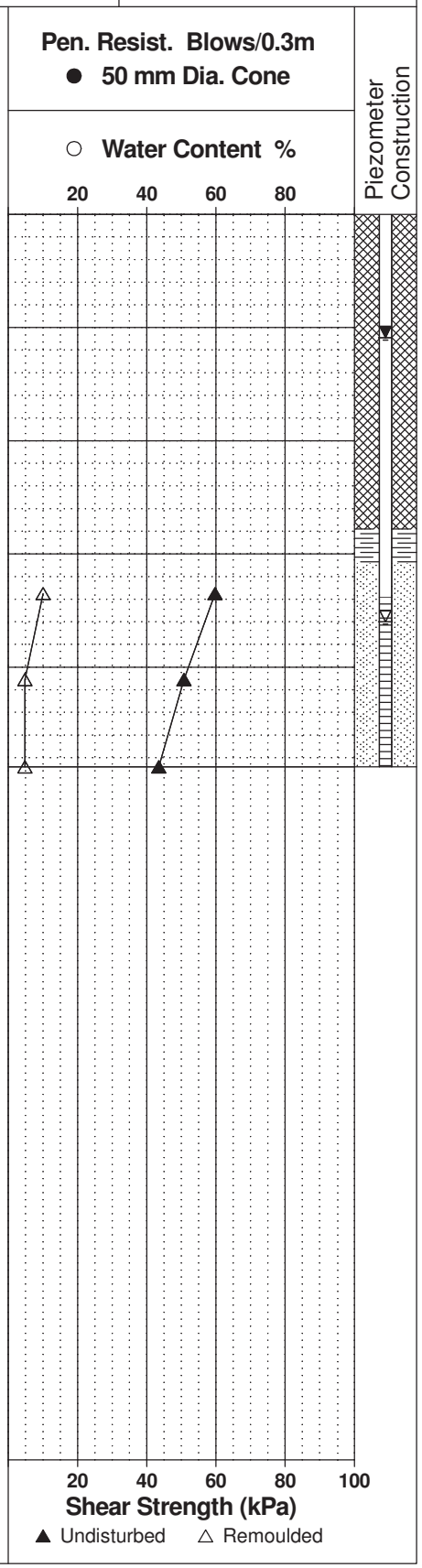
FILE NO. PG4547

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** May 31, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.38
FILL: Brow silty sand, trace clay, gravel, cobbles, boulders		AU	1				
		SS	2	0	7	1	94.38
1.83		SS	3	42	23	2	93.38
		SS	4	100	4		
Stiff to firm, brown **SILTY CLAY**						3	92.38
- grey by 4.6m depth						4	91.38
4.88							
End of Borehole							
(GWL @ 1.09m - June 7, 2018)							
(Long term GWL @ 3.6m depth based on field observations)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Bldg. - Block 11 - 555 Dealership Dr.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the south side of Dealership Drive, across from subject site. Geodetic elevation = 96.85m.

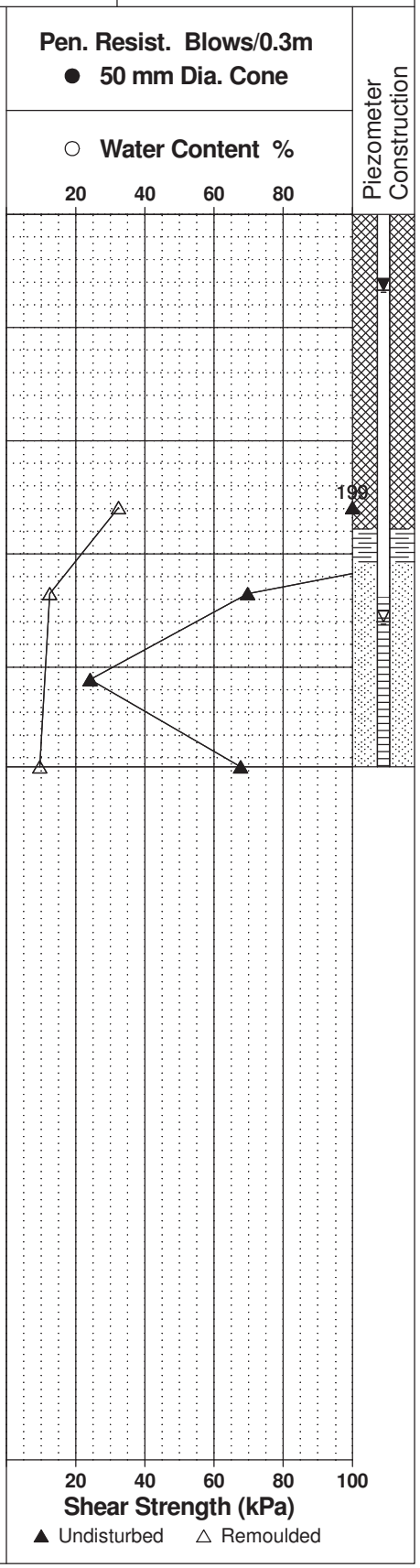
FILE NO. PG4547

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** May 31, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.20
FILL: Brown silty sand with clay, trace gravel, cobbles, boulders		AU	1				
		SS	2	58	10	1	94.20
1.52							
		SS	3	100	8	2	93.20
Very stiff to stiff, brown **SILTY CLAY**						3	92.20
- firm to stiff and grey by 3.8m depth						4	91.20
4.88							
End of Borehole							
(GWL @ 0.67m - June 7, 2018)							
(Long term GWL @ 3.6m depth based on field observations)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Bldg. - Block 11 - 555 Dealership Dr.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the south side of Dealership Drive, across from subject site. Geodetic elevation = 96.85m.

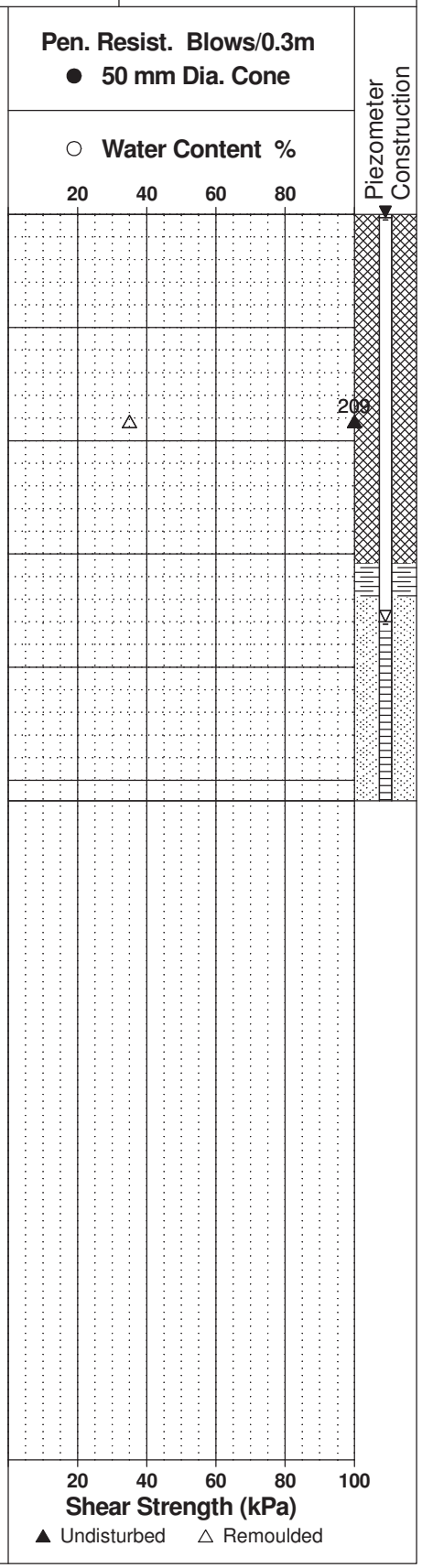
FILE NO. PG4547

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** May 31, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.92
FILL: Brown silty sand, some clay, trace gravel, cobbles, boulders		AU	1				
0.60							
		SS	2	83	7	1	93.92
Hard, brown **SILTY CLAY**							
2.29						2	92.92
GLACIAL TILL: Grey silty clay, some sand, trace gravel		SS	3	83	7	3	91.92
		SS	4	38	7	4	90.92
		SS	5	58	5	5	89.92
5.18							
End of Borehole							
(GWL @ 0.03m - June 7, 2018)							
(Long term GWL @ 3.6m depth based on field observations)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Bldg. - Block 11 - 555 Dealership Dr.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the south side of Dealership Drive, across from subject site. Geodetic elevation = 96.85m.

FILE NO. PG4547

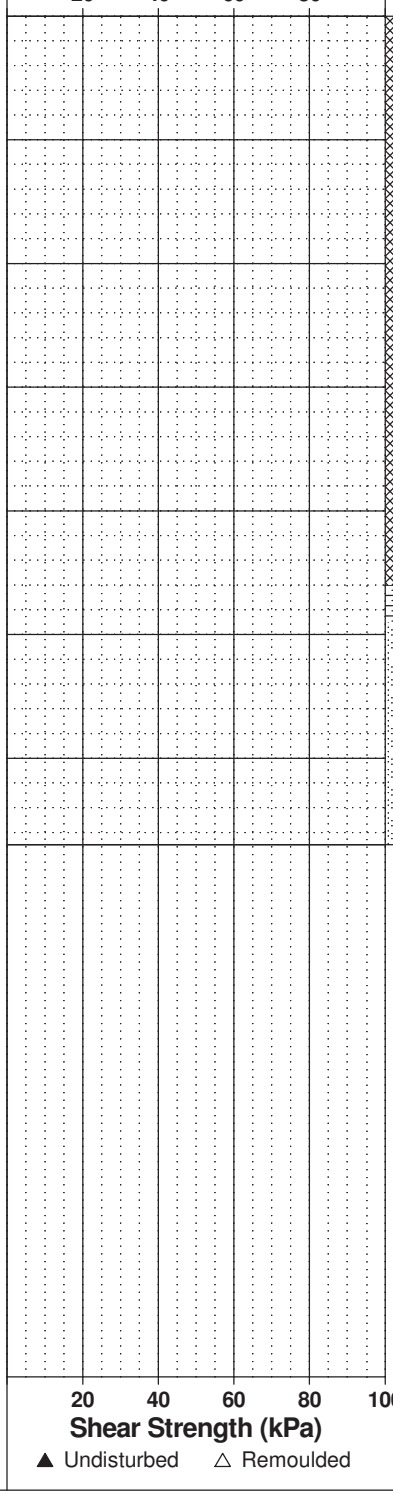
REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** May 31, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
FILL: Brown silty clay, some sand, trace gravel		AU	1			0	95.03
0.60							
Very stiff, brown **SILTY CLAY**		SS	2	79	13	1	94.03
		SS	3	88	8	2	93.03
1.98							
		SS	4	92	50+		
		SS	5	62	29	3	92.03
GLACIAL TILL: Grey silty clay, some sand, gravel, cobbles, boulders		SS	6	58	6	4	91.03
		SS	7	54	7	5	90.03
		SS	8	62	2	6	89.03
		SS	9	33	11		
6.70							
End of Borehole							
(GWL @ 0.09m - June 7, 2018)							
(Long term GWL @ 3.6m depth based on field observations)							

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



Piezometer Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Bldg. - Block 11 - 555 Dealership Dr.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the south side of Dealership Drive, across from subject site. Geodetic elevation = 96.85m.

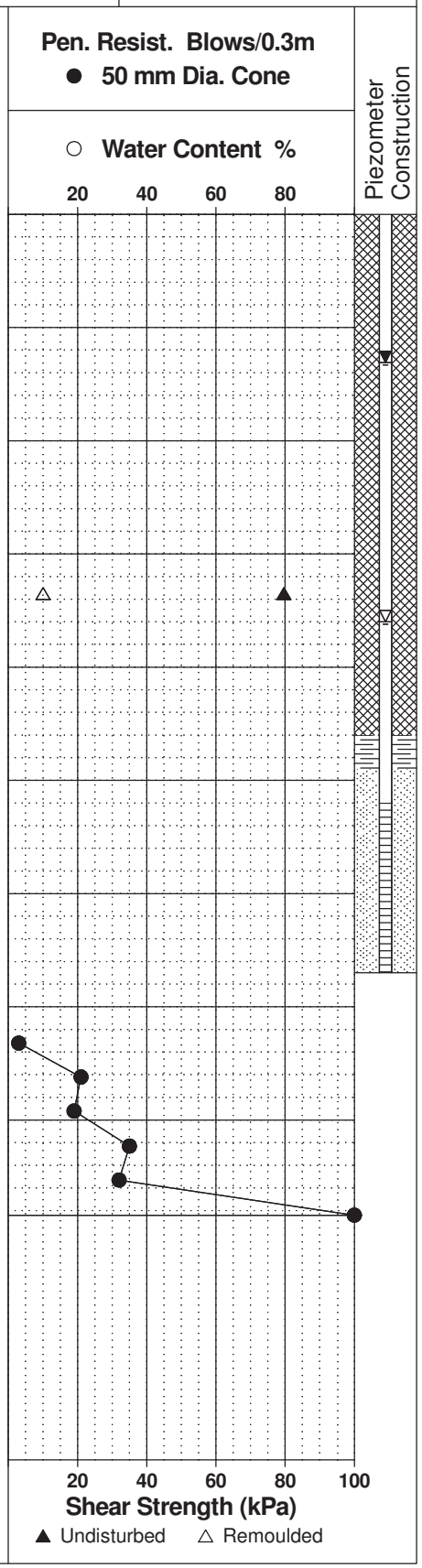
FILE NO. PG4547

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** May 31, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.60
FILL: Brown silty clay, trace sand and gravel		AU	1				
		SS	2	42	6	1	94.60
		SS	3	58	10	2	93.60
2.29							
Stiff, brown **SILTY CLAY,** trace gravel		SS	4	100	7	3	92.60
3.81							
GLACIAL TILL: Grey silty clay, some sand, gravel, cobbles, boulders		SS	5	62	28	4	91.60
		SS	6	46	4	5	90.60
		SS	7	38	5	6	89.60
6.70							
Dynamic Cone Penetration Test commenced at 6.70m depth.						7	88.60
Inferred **GLACIAL TILL**						8	87.60
8.84							
End of Borehole							
Practical DCPT refusal at 8.84m depth							
(GWL @ 1.31m - June 7, 2018)							
(Long term GWL @ 3.6m depth based on field observations)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Bldg. - Block 11 - 555 Dealership Dr.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the south side of Dealership Drive, across from subject site. Geodetic elevation = 96.85m.

FILE NO. PG4547

REMARKS

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** May 31, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	96.30
FILL: Brown silty clay, trace sand, gravel, cobbles, boulders		AU	1				
		SS	2	8	5	1	95.30
		SS	3	62	5	2	94.30
2.29							
		SS	4	83	9	3	93.30
Very stiff to stiff, brown **SILTY CLAY**		SS	5	88	6		
		SS	6	100	5	4	92.30
4.57							
GLACIAL TILL: Grey silty clay, some sand, gravel, cobbles and boulders		SS	7	21	14	5	91.30
5.18							
End of Borehole							
(GWL @ 2.00m - June 7, 2018)							
(Long term GWL @ 3.6m depth based on field observations)							

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

20 40 60 80

Piezometer Construction

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

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Supplemental Geotechnical Investigation
Commercial Development-4225/4123 Strandherd Drive
Ottawa, Ontario

DATUM Ground surface elevations provided Novatech Engineering Consultants Limited.

FILE NO. PG2449

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** June 27, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.76
TOPSOIL 0.30		AU	1				
Stiff, brown **SILTY CLAY,** trace rootlets and organics		SS	2	100	12	1	93.76
		SS	3	33	12	2	92.76
2.29							
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders, trace clay		SS	4	25	21	3	91.76
		SS	5	42	12		
		SS	6	50	11	4	90.76
		SS	7	12	20	5	89.76
		SS	8	4	40		
						6	88.76
6.70							
End of Borehole							
(GWL @ 2.0m depth based on field observations)							

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

Piezometer Construction

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

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-4337/4225 Strandherd Dr.
Ottawa, Ontario

DATUM Ground surface elevations provided Novatech Engineering Consultants Limited.

FILE NO. PG2449

REMARKS

HOLE NO. TP12

BORINGS BY Hydraulic Shovel **DATE** May 25, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	93.84		
TOPSOIL 0.28		G	1						
						1	92.84		
		G	2						▽
Stiff, brown **SILTY CLAY,** trace sand to 0.6m depth						2	91.84		
- stiff to firm and grey by 2.8m depth						3	90.84		
						4	89.84		
5.49						5	88.84		
GLACIAL TILL: Compact, grey silty clay with sand, gravel, cobbles, boulders 5.79									
End of Test Pit									
(Groundwater infiltration at 1.5m depth)									

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

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-4337/4225 Strandherd Dr.
Ottawa, Ontario

DATUM Ground surface elevations provided Novatech Engineering Consultants Limited.

FILE NO. PG2449

REMARKS

HOLE NO. TP13

BORINGS BY Hydraulic Shovel **DATE** May 25, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	94.76		
TOPSOIL 0.25									
Stiff, brown **SILTY CLAY**						1	93.76		
1.22									
GLACIAL TILL: Dense, brown silty clay with sand, gravel, cobbles, boulders						2	92.76		
- grey by 2.1m depth						3	91.76		
						4	90.76		
						5	89.76		
6.10						6	88.76		
End of Test Pit									
(Groundwater infiltration at 0.9m depth)									

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

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development-4337/4225 Strandherd Dr.
Ottawa, Ontario

DATUM Ground surface elevations provided Novatech Engineering Consultants Limited.

FILE NO. PG2449

REMARKS

HOLE NO. TP14

BORINGS BY Hydraulic Shovel **DATE** May 25, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.23
TOPSOIL							
0.30							
		G	1			1	93.23
Stiff, brown **SILTY CLAY**						2	92.23
		G	2			3	91.23
- firm and grey by 3.7m depth						4	90.23
5.18						5	89.23
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles, boulders							
6.10						6	88.23
End of Test Pit							
(Groundwater infiltration at 1.2m depth)							

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

20 40 60 80

Piezometer Construction

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

JOHN D. PATERSON & ASSOCIATES LTD.
Consulting Geotechnical and Environmental Engineers
28 Concourse Gate, Nepean, Ont. K2E 7T7

SOIL PROFILE & TEST DATA

Preliminary Geotechnical Investigation
Proposed Nortel Campus, Metal Exports Ltd.
Strandherd Drive, Nepean, Ontario

DATUM Ground surface elevations provided by Webster and Simmonds Surveying Limited.

FILE NO. **G7892**

REMARKS

HOLE NO. **TP74**

BORINGS BY Hydraulic Shovel DATE 23 October 00

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	PIEZOMETER CONSTRUCTION
GROUND SURFACE						0	94.87	20 40 60 80	
Brown TOPSOIL 0.20									
GLACIAL TILL: Brown silty sand to sandy silt, some boulders, cobbles and gravel -grey @ 2.4m depth						1	93.87		
						2	92.87		
						3	91.87		
4.00						4	90.87		
End of Test Pit (TP dry upon completion)									

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

JOHN D. PATERSON & ASSOCIATES LTD.
Consulting Geotechnical and Environmental Engineers
28 Concourse Gate, Nepean, Ont. K2E 7T7

SOIL PROFILE & TEST DATA

Preliminary Geotechnical Investigation
Proposed Nortel Campus, Metal Exports Ltd.
Strandherd Drive, Nepean, Ontario

DATUM Ground surface elevations provided by Webster and Simmonds Surveying Limited.

FILE NO. **G7892**

REMARKS

HOLE NO. **TP78**

BORINGS BY Hydraulic Shovel DATE 23 October 00

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	PIEZOMETER CONSTRUCTION
GROUND SURFACE						0	94.59	20 40 60 80	
Brown TOPSOIL 0.20									
Stiff, greyish brown SILTY **CLAY**						1	93.59		▽
2.20						2	92.59		
GLACIAL TILL: Grey silty sand to sandy silt, some boulders, cobbles and gravel						3	91.59		
3.30									
End of Test Pit									
(Open hole WL @ 1.6m depth)									

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

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Consulting Geotechnical and Environmental Engineers
28 Concourse Gate, Nepean, Ont. K2E 7T7

SOIL PROFILE & TEST DATA

Preliminary Geotechnical Investigation
Proposed Nortel Campus, Metal Exports Ltd.
Strandherd Drive, Nepean, Ontario

DATUM Ground surface elevations provided by Webster and Simmonds Surveying Limited.

FILE NO. G7892

REMARKS

HOLE NO. TP79

BORINGS BY Hydraulic Shovel **DATE** 23 October 00

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	PIEZOMETER CONSTRUCTION
GROUND SURFACE									
Brown TOPSOIL 0.20						0	94.75		
GLACIAL TILL: Dense, brown silty sand to sandy silt with boulders, cobbles and gravel -grey @ 2.5m depth						1	93.75		
						2	92.75		
						3	91.75		
						4	90.75		
4.50 End of Test Pit (TP dry upon completion)									

20 40 60 80

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

JOHN D. PATERSON & ASSOCIATES LTD.
Consulting Geotechnical and Environmental Engineers
28 Concourse Gate, Nepean, Ont. K2E 7T7

SOIL PROFILE & TEST DATA

Preliminary Geotechnical Investigation
Proposed Nortel Campus, Metal Exports Ltd.
Strandherd Drive, Nepean, Ontario

DATUM Ground surface elevations provided by Webster and Simmonds Surveying Limited.

FILE NO. **G7892**

REMARKS

HOLE NO. **TP80**

BORINGS BY Hydraulic Shovel DATE 23 October 00

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	PIEZOMETER CONSTRUCTION
GROUND SURFACE						0	94.39		
Brown TOPSOIL 0.20									
Grey SILTY CLAY 0.35						1	93.39		
GLACIAL TILL: Dense, grey silty sand to sandy silt with boulders, cobbles and gravel						2	92.39		
						3	91.39		
						4	90.39		
4.60 End of Test Pit									
(TP dry upon completion)									

Water Content % scale: 20 40 60 80

Shear Strength (kPa) scale: 20 40 60 80 100

▲ Undisturbed △ Remoulded

JOHN D. PATERSON & ASSOCIATES LTD.
Consulting Geotechnical and Environmental Engineers
28 Concourse Gate, Nepean, Ont. K2E 7T7

SOIL PROFILE & TEST DATA

Preliminary Geotechnical Investigation
Proposed Nortel Campus, Metal Exports Ltd.
Strandherd Drive, Nepean, Ontario

DATUM Ground surface elevations provided by Webster and Simmonds Surveying Limited.

FILE NO. **G7892**

REMARKS

HOLE NO. **TP85**

BORINGS BY Hydraulic Shovel DATE 23 October 00

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	PIEZOMETER CONSTRUCTION
GROUND SURFACE						0	94.30		
Brown TOPSOIL 0.20									
Stiff, brown SILTY CLAY						1	93.30		
2.40						2	92.30		
Firm, grey SILTY CLAY		G	1			3	91.30		
3.20									
GLACIAL TILL: Brown silty sand to sandy silt, some boulders, cobbles and gravel						4	90.30		
5.00						5	89.30		
End of Test Pit									
(Open hole WL @ 1.3m depth)									

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

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

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

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

CONSOLIDATION TEST

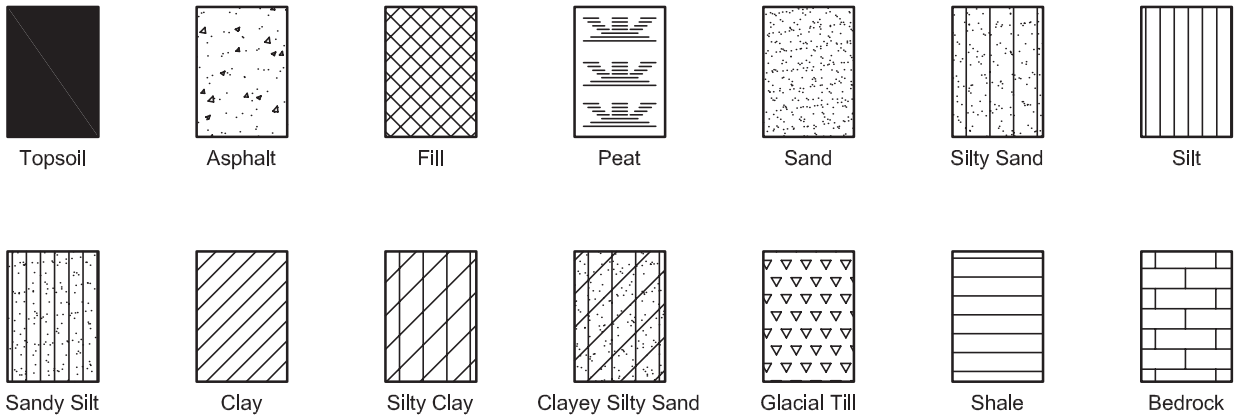
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

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

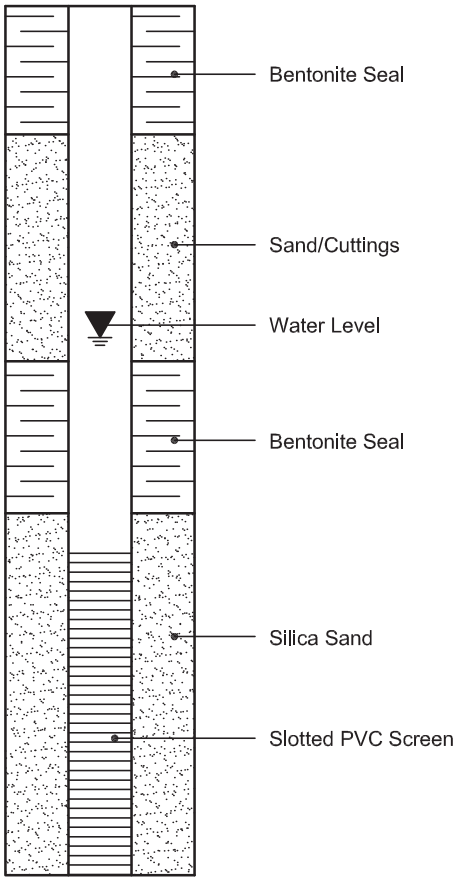
SYMBOLS AND TERMS (continued)

STRATA PLOT

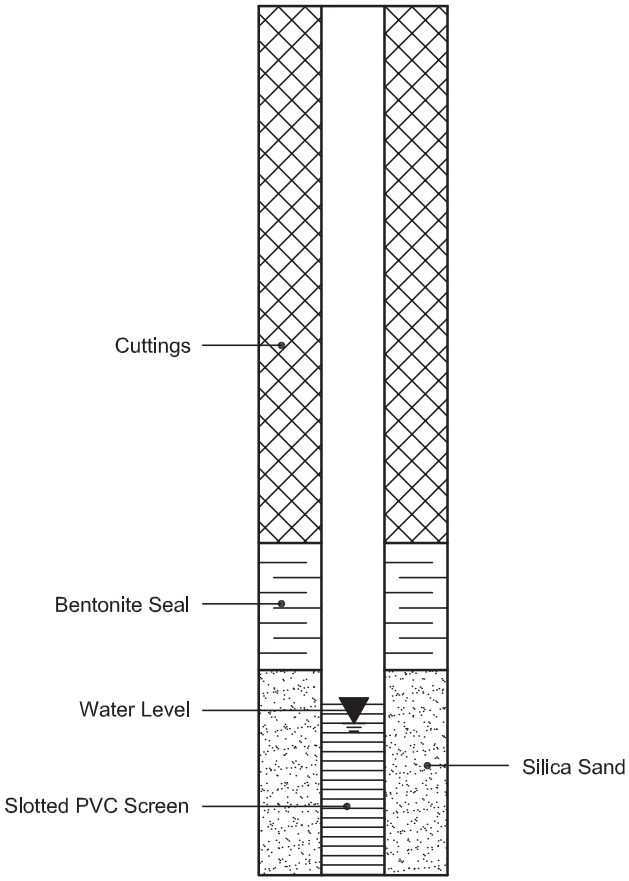


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



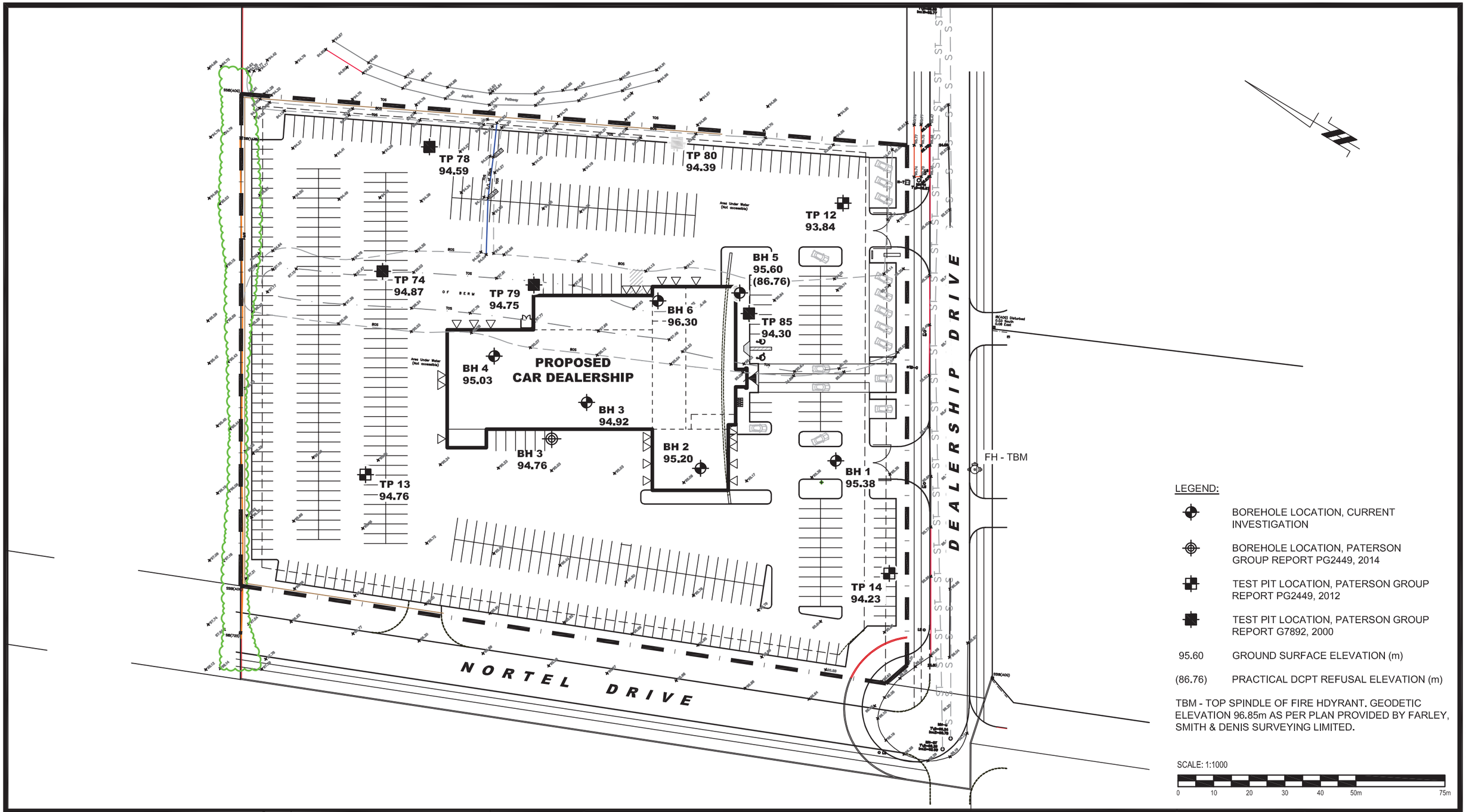
APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG4547-1 - TEST HOLE LOCATION PLAN

FIGURE 1

KEY PLAN



LEGEND:

- BOREHOLE LOCATION, CURRENT INVESTIGATION
- BOREHOLE LOCATION, PATERSON GROUP REPORT PG2449, 2014
- TEST PIT LOCATION, PATERSON GROUP REPORT PG2449, 2012
- TEST PIT LOCATION, PATERSON GROUP REPORT G7892, 2000

95.60 GROUND SURFACE ELEVATION (m)

(86.76) PRACTICAL DCPT REFUSAL ELEVATION (m)

TBM - TOP SPINDLE OF FIRE HDYRANT. GEODETIC ELEVATION 96.85m AS PER PLAN PROVIDED BY FARLEY, SMITH & DENIS SURVEYING LIMITED.

SCALE: 1:1000

0 10 20 30 40 50m 75m

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NO.	REVISIONS	DATE	INITIAL
0			

BBS CONSTRUCTION

GEOTECHNICAL INVESTIGATION
PROP. CAR DEALERSHIP - BLOCK 11 - 555 DEALERSHIP DRIVE
OTTAWA, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Scale: 1:1000	Date: 06/2018
Drawn by: MPG	Report No.: PG4547-1
Checked by: NG	Dwg. No.: PG4547-1
Approved by: DJG	Revision No.: 0

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