Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Paterson Group Inc.
Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

patersongroup

Geotechnical Investigation

Proposed Commercial Development
20 Frank Nighbor Place
Ottawa, Ontario

Prepared For

SiteCast Construction

February 9, 2018

Report: PG4409-1

Table of Contents

Page

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by SiteCast Construction to conduct a geotechnical investigation for the proposed commercial development to be located at 20 Frank Nighbor Place, in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan presented in Appendix 2).

The objective of the investigation was to:

- ❑ determine the subsoil and groundwater conditions at this site by means of test holes and available soils information.
- ❑ provide geotechnical recommendations for the design of the proposed development based on the results of the test holes and other soil information available.

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 site was not part of the scope of work of this investigation.

2.0 Proposed Development

The proposed development will consist of a one-storey slab on grade commercial building, as well as associated access roads and landscaped areas. It is also expected that the subject site will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

A geotechnical investigation was carried out by Paterson Group for the subject site and adjacent properties. The test holes located within the subject site of the current investigation include three (3) test pits (TP 1 to TP 3). The test hole locations were located in the field in a manner to provide general coverage of the subject site. The test hole data from the neighbouring site (BH 1-02, TP4 and TP6 to TP10, inclusive) has been included with the current report for information purposes. The test hole locations are shown on Drawing PG4409-1 - Test Hole Location Plan in Appendix 2.

The test pits were excavated using a rubber-tire backhoe. The boreholes were advanced using a track-mounted rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of our personnel under the direction of a senior engineer from our geotechnical department. The drilling procedures consisted of advancing each test hole to the required depths at the selected locations and sampling and testing the overburden.

Sampling and In Situ Testing

Soil samples from the test pits were recovered from the side walls of the open excavation. Soil samples from the boreholes were recovered from the auger flights or using a 50 mm diameter split-spoon sampler. All soil samples were initially classified on site, placed in sealed plastic bags and transported to our laboratory for further review. The depths at which the grab, auger and split spoon samples were recovered from the test hole are shown as G, AU and SS, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

Subsurface conditions observed in the test holes were recorded in detail in the field. Reference should be made to the Soil Profile and Test Data sheets for specific details of the soil profile encountered at each test hole.

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

Undrained shear strength testing, using a vane apparatus, was carried out at regular intervals of depth in cohesive soils.

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

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

Groundwater

Flexible PVC standpipes were installed in all boreholes to permit monitoring of the groundwater levels following completion of the sampling program. The groundwater level observations are presented on the Soil Profile and Test Data sheets in Appendix 1.

3.2 Field Survey

The test hole locations were selected in the field by Paterson personnel in a manner to provide general coverage of the subject site taking into consideration underground utilities and existing site features. Ground surface elevations were referenced to a temporary benchmark (TBM), consisting of the top spindle of a fire hydrant located on the north side of Frank Nighbor Place. A geodetic elevation of 95.64 m was provided to the TBM. The locations of the test holes and TBM are presented on Drawing PG4409-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the site were visually examined in our laboratory by a geotechnical engineer to confirm the results of the field logging.

3.4 Analytical Testing

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

4.0 Observations

4.1 Surface Conditions

The subject site is currently used as farmland and is relatively flat and at grade with surrounding properties. The site is bordered to the north by a drainage ditch followed by Highway 417, to the east by an existing commercial development, to the south by Frank Nighbor Place and to the west by vacant lands.

4.2 Subsurface Profile

Generally, the soil profile at the test hole locations consists of fill and/or topsoil overlying a discontinuous layer of sandy silt/silty sand, in turn overlying a deep silty clay deposit. Practical refusal to DCPT was encountered at depths ranging from 15.6 to 21.1 m at the test hole locations. Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profiles encountered at each test hole location.

Based on available geological mapping, the local bedrock consists of either sandstone of the Nepean Formation or interbedded limestone and shale of the Verulam Formation. The overburden thickness is expected to range from 10 to 25 m.

4.3 Groundwater

Groundwater levels were measured in the open excavation of the test pits completed within the subject site. The groundwater levels vary between 2.6 and 3.0 m depth at the test pits completed within the subject site. The groundwater level readings are presented in the Soil Profile and Test Data sheet in Appendix 1.

It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

The subject site is considered acceptable for the proposed development from a geotechnical perspective. It is expected that the proposed structure will be founded over conventional shallow footings placed on an undisturbed, stiff silty clay bearing surface.

Due to the presence of the sensitive silty clay layer, the subject site will be subjected to grade raise restrictions.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and fill, containing deleterious materials and significant amounts of organics, should be stripped from under any buildings and other settlement sensitive structures. Existing fill should be reviewed by the geotechnical consultant at the time of construction to confirm if the material can remain in place. Care should be taken not to disturb adequate bearing soils below the founding level during site preparation activities.

Any soft areas should be removed and replaced in accordance with the following fill placement recommendations.

Fill Placement

Fill used for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building 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 at least compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD. Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Bearing Resistance Values

Strip footings, up to 3 m wide, and pad footings, up to 6 m wide, placed on an undisturbed, stiff silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa** incorporating a geotechnical resistance factor of 0.5 at ULS.

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

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

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 stiff silty clay or engineered fill above the groundwater table when a plane extending horizontally and vertically from the underside of the footing at a minimum of 1.5H:1V passing through in situ soil of the same or higher bearing capacity as the bearing medium soil.

Permissible Grade Raise

A permissible grade raise restriction of **2 m** above original ground surface can be used for design purposes. If greater permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class D** 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, such as those containing significant amounts of organic materials, within the footprint of the proposed building, the native soil surface or existing fill approved by the geotechnical consultant at the time of construction will be considered to be an acceptable subgrade on which to commence backfilling for floor slab construction.

OPSS Granular B Type II or Granular A Crushed stone are recommended for backfilling below the floor slab. It is recommended that the upper 150 to 200 mm of sub-slab fill consist of OPSS Granular A crushed stone. All backfill materials within the footprint of the proposed building should be placed in maximum 300 mm loose lifts and compact to at least 98% of the material's SPMDD. Any soft or poor performing 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.

5.6 Pavement Structure

For design purposes, the pavement structure presented in the following tables could be used for the design of car only parking areas and access lanes.

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 silty clay or OPSS Granular B Type I or II material placed over in situ soil or fill	

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

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 vibratory 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.

Consideration should be given to installing subdrains at each catch basin during the pavement construction. These drains should be at least 3 m long and extend in four orthogonal directions or longitudinally when placed along a curb. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be shaped to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

A perimeter foundation drainage system is recommended to be provided for the proposed building to provide an outlet for surface water trapped within the backfill material below any sidewalk structure. Trapped water within subgrade soils can lead to more significant frost heave for sidewalks adjacent to slab-on-grade buildings. The system should consist of a 150 mm diameter, geotextile-wrapped, perforated, corrugated, plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, placed at the footing level around the exterior perimeter of the buildings. 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, unless used in conjunction with a drainage geocomposite, such as Delta Drain 6000, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 Protection of Footings Against Frost Action

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

Exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the structure proper and require additional protection. The recommended minimum thickness of soil cover is 2.1 m (or equivalent).

6.3 Excavation Side Slopes

Temporary Side Slopes

The temporary excavation side slopes anticipated should either be cut back at acceptable slopes or retained by shoring systems from the beginning 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 subsurface soil is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should maintain safe working distance from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

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

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications & 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 soil subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to a minimum of 300 mm above the obvert of the pipe should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts and compacted to 95% of the material’s SPMDD. 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 reduce the potential 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 SPMDD.

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, subbedding and cover material. The barriers should consist of relatively dry and compatible 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.

6.5 Groundwater Control

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. It is anticipated that groundwater infiltration into the excavations should be low and controllable using open sumps.

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

6.6 Winter Construction

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

The subsoil conditions at this site 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.

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

The trench excavations should be carried out in a manner to avoid the introduction of frozen materials, snow or ice 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. Also, 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.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The results of the chloride content, pH and resistivity indicate the presence of a severe to very aggressive environment for exposed ferrous metals at this site.

7.0 Recommendations

For the foundation design data provided herein to be applicable, a materials testing and observation services program is required to be completed. The following aspects should be performed by the geotechnical consultant:

- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials.
- ❑ Observation of the placement of the foundation insulation, if applicable.
- ❑ 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 the construction has been conducted in general accordance with the recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations 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 and our recommendations when the drawings and specifications are complete.

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

The recommendations provided in this report are intended for the use of design professionals associated with this project. Contractors bidding on or undertaking the work should examine the factual information contained in this report and the site conditions, satisfy themselves as to the adequacy of the information provided for construction purposes, supplement the factual information if required, and develop their own interpretation of the factual information based on both their and their subcontractors construction methods, equipment capabilities and schedules.

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 SiteCast Construction Corporation or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Nathan F. S. Christie, P.Eng.

David J. Gilbert, P.Eng.

Report Distribution:

- ❑ SiteCast Construction Corporation (3 copies)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Terry Fox Retail Centre, Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM Geodetic

FILE NO. G8733

REMARKS

HOLE NO. TP 1

BORINGS BY Backhoe **DATE** Sep 9, 02

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	95.11		
Topsoil 0.05									
FILL: Brown silty fine sand with crushed stone, gravel and organic matter		G	1						
0.84						1	94.11		
Brown **SILTY** fine **SAND**		G	2						
1.12									
Stiff, brown **SILTY CLAY/CLAYEY SILT**, trace sand		G	3						
- olive grey by 2.1m depth		G	4			2	93.11		
						3	92.11		
3.45		G	5						
End of Test Pit									
(Open hole GWL @ 2.6m 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

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Terry Fox Retail Centre, Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM Geodetic

FILE NO. G8733

REMARKS

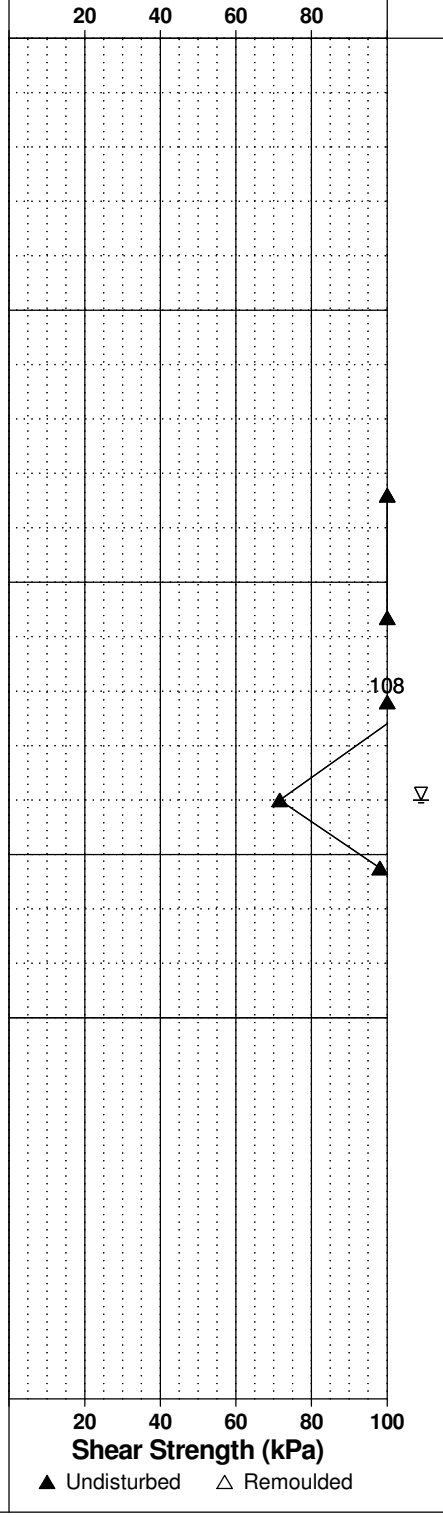
HOLE NO. TP 2

BORINGS BY Backhoe **DATE** Sep 9, 02

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.55
Topsoil 0.05							
FILL: Brown silty fine sand with with crushed stone, gravel and organic matter		G	1				
0.84						1	94.55
Stiff to very stiff, brown **SILTY CLAY/CLAYEY SILT** with trace sand and organic matter		G	2				
		G	3			2	93.55
- olive grey by 2.6m depth							
3.35						3	92.55
Grey **SILTY CLAY/CLAYEY SILT** with sand seams, shells and gravel 3.55		G	4				
End of Test Pit							
(Open hole GWL @ 3.0m depth)							

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

Piezometer Construction



patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Terry Fox Retail Centre, Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM Geodetic

FILE NO. G8733

REMARKS

HOLE NO. TP 3

BORINGS BY Backhoe **DATE** Sep 9, 02

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.25
Topsoil 0.05							
FILL: Dark brown silty fine sand with gravel, occasional boulders		G	1				
0.76							
Brown **SILTY** fine **SAND**		G	2				
1.07						1	94.25
Brown **CLAYEY SILT** to **SILTY CLAY** with sand		G	3			2	93.25
- olive grey by 2.7m depth						3	92.25
3.35							
Grey **SILTY CLAY/CLAYEY SILT**, trace white shell pieces 3.50		G	4				
End of Test Pit							
(Open hole GWL @ 2.7m 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

Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Terry Fox Retail Centre, Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM Geodetic

FILE NO. G8733

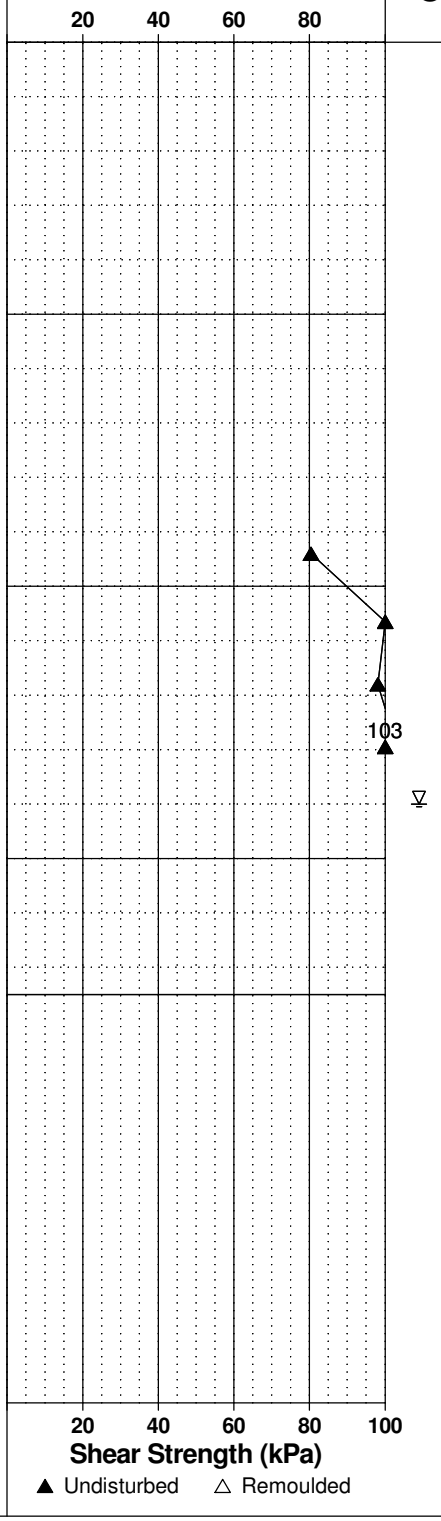
REMARKS

HOLE NO. TP 4

BORINGS BY Backhoe **DATE** Sep 9, 02

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.98
FILL: Brown silty fine sand with asphalt fragments, crushed stone, gravel, occasional cobbles		G	1			1	93.98
1.22							
PEAT: Dark brown silt with organic matter	1.32	G	2				
Brown **SILTY** fine **SAND**		G	3				
1.62							
		G	4			2	92.98
Stiff to very stiff, brown **CLAYEY SILT** to **SILTY CLAY**, trace sand							
- olive grey by 2.7m depth						3	91.98
3.50		G	5				
End of Test Pit							
(Open hole GWL @ 2.8m depth)							

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



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Terry Fox Retail Centre, Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM Geodetic

FILE NO. G8733

REMARKS

HOLE NO. TP 6

BORINGS BY Backhoe **DATE** Sep 10, 02

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	95.34		
25mm Topsoil over									
FILL: Brown silty clay with crushed stone and organic matter		G	1			1	94.34		
1.65									
TOPSOIL: Dark brown clayey silt with organic matter 1.85		G	2						
Brown **CLAYEY SILT** to **SILTY CLAY**						2	93.34		
2.74									
Grey fine **SILTY** fine **SAND**, trace clay		G	3			3	92.34		▽
3.50									
End of Test Pit									
(Open hole GWL @ 2.8m 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

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Terry Fox Retail Centre, Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM Geodetic

FILE NO. G8733

REMARKS

HOLE NO. TP 7

BORINGS BY Backhoe **DATE** Sep 10, 02

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.46
25mm Topsoil over							
FILL: Brown clayey silt with occasional crushed stone and organic matter		G	1				
1.14						1	94.46
TOPSOIL: Dark brown clayey silt with organic matter 1.37							
Stiff to very stiff, brown **CLAYEY SILT** to **SILTY CLAY**, trace sand		G	2				
- grey by 2.3m depth						2	93.46
		G	3				
3.35						3	92.46
End of Test Pit							
(Open hole GWL @ 2.5m depth)							

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

20 40 60 80

108

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

Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Terry Fox Retail Centre, Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM Geodetic

FILE NO. G8733

REMARKS

HOLE NO. TP 8

BORINGS BY Backhoe **DATE** Sep 9, 02

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	94.29		
25mm Topsoil over **FILL**: Brown clayey silt with occasional crushed stone									
0.40									
TOPSOIL: Dark brown clayey silt with organic matter									
0.51									
Brown **CLAYEY SILT** to **SILTY CLAY**		G	1			1	93.29		
1.12									
Brown fine **SANDY SILTY** to **SILTY** fine **SAND**, trace clay		G	2						
1.40									
		G	3			2	92.29		▽
Brown **SILTY CLAY/CLAYEY SILT**, trace sand									
						3	91.29		
- olive grey by 3.2m depth		G	4						
3.40									
End of Test Pit									
(Open hole GWL @ 2.4m depth)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Terry Fox Retail Centre, Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM Geodetic

FILE NO. G8733

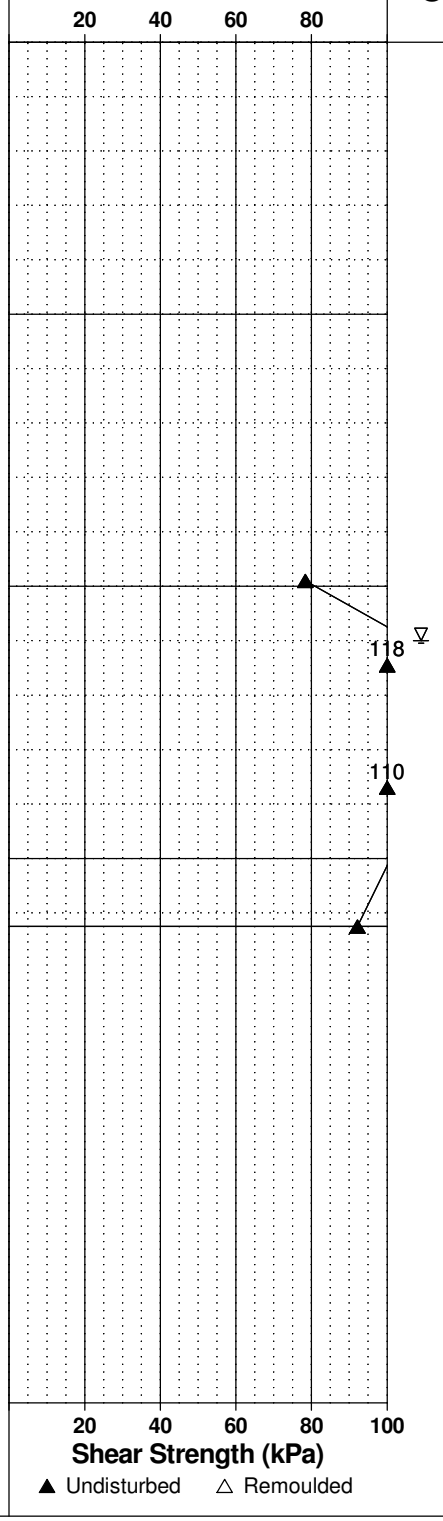
REMARKS

HOLE NO. TP 9

BORINGS BY Backhoe **DATE** Sep 10, 02

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.37
TOPSOIL 0.36							
FILL: Brown sandy silt to silty sand, trace clay 0.71		G	1				
Stiff to very stiff, olive grey **CLAYEY SILT** to **SILTY CLAY**		G	2			1	92.37
- occasional thin fine to medium silty sand seams							
		G	3			2	91.37
- grey-brown by 2.4m depth							
3.25						3	90.37
End of Test Pit (Open hole GWL @ 2.2m depth)							

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



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Terry Fox Retail Centre, Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM Geodetic

FILE NO. G8733

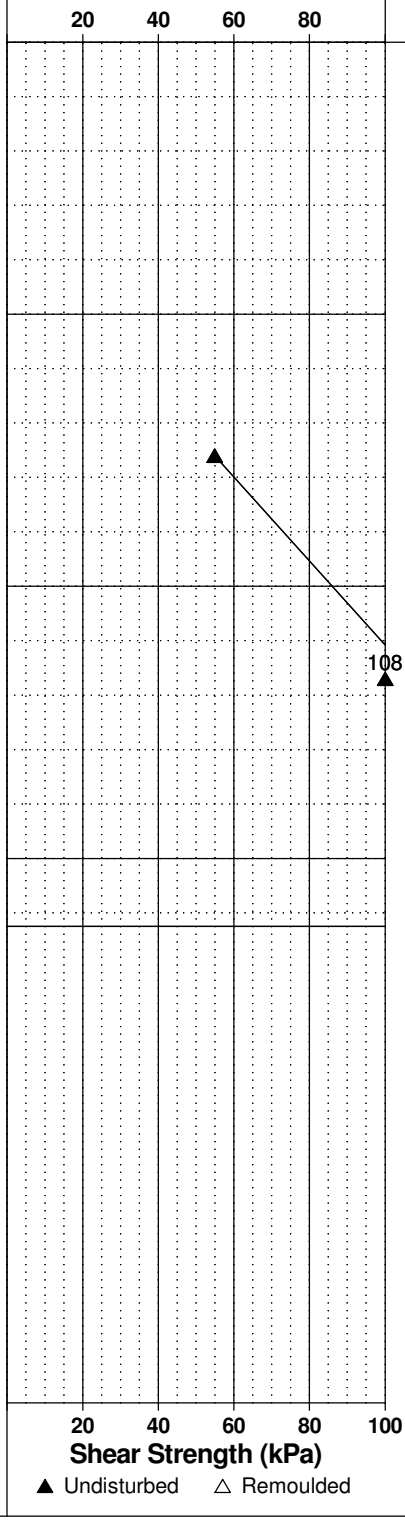
REMARKS

HOLE NO. TP10

BORINGS BY Backhoe **DATE** Sep 10, 02

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.50
TOPSOIL 0.20							
Brown fine **CLAYEY SILT**, trace sand		G	1			1	92.50
1.07							
Stiff, grey **CLAYEY SILT** to **SILTY CLAY**, trace sand		G	2			2	91.50
- gravel and cobbles by 1.5m depth							
3.25		G	3			3	90.50
End of Test Pit							
(Open hole GWL @ 2.7m depth)							

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



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Terry Fox Retail Centre, Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM Geodetic

FILE NO. G8733

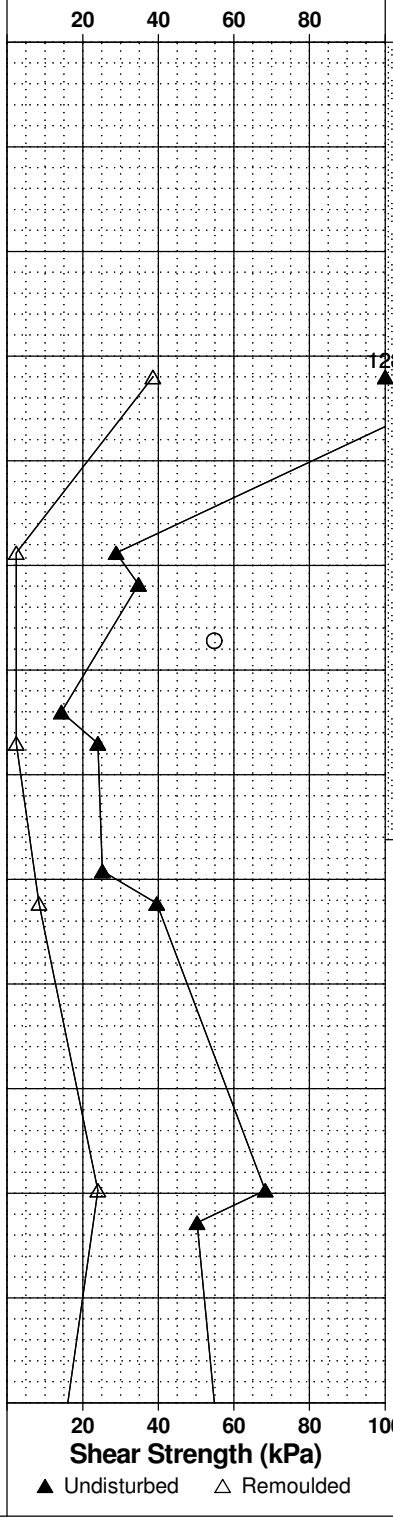
REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** Sep 12, 02

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.08
Topsoil 0.35							
PEAT: Dark brown silt with organic matter		SS	1	21	5	1	92.08
1.83		SS	2	42	6	2	91.08
Loose grey fine **SANDY SILT** with trace clay 2.21		SS	3	100	5	3	90.08
Very stiff grey **SILTY CLAY/CLAYEY SILT**		TW	4			4	89.08
- firm by 4.9m depth		TW	5			5	88.08
- soft by 6.4m depth		TW	6			6	87.08
- firm by 8.2m depth		SS	7	100	2	7	86.08
- firm to stiff by 11.0m depth		SS	8	100	1	8	85.08
13.00						9	84.08
						10	83.08
						11	82.08
						12	81.08
						13	80.08

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



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Terry Fox Retail Centre, Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM Geodetic

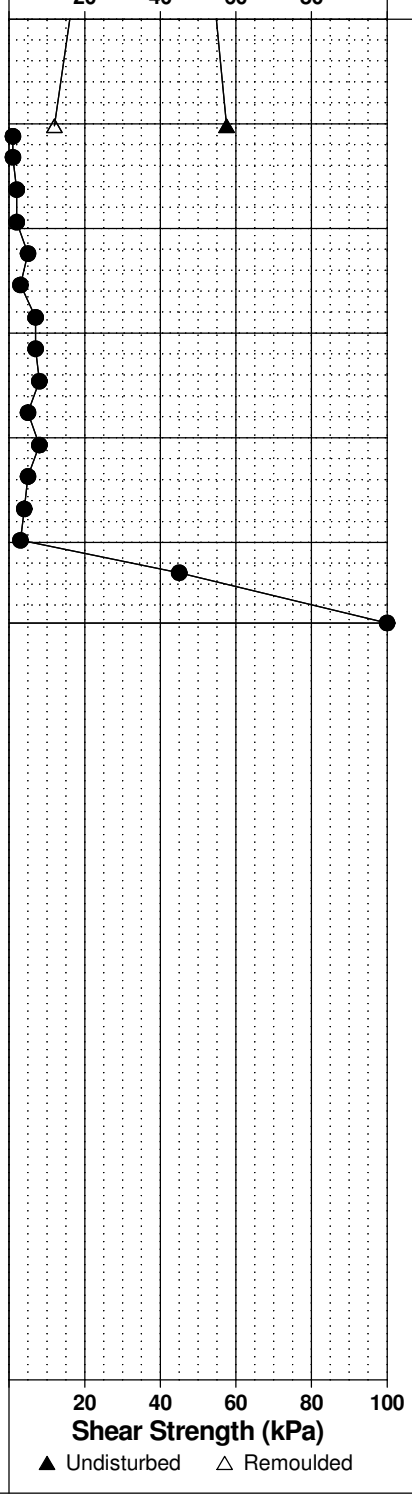
FILE NO. G8733

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** Sep 12, 02

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
Stiff grey **SILTY CLAY/CLAYEY SILT**						13	80.08		
14.12						14	79.08		
Dynamic Cone Penetration Test commenced @ 14.12m						15	78.08		
						16	77.08		
						17	76.08		
						18	75.08		
18.77									
End of Borehole Inferred bedrock @ 18.77m depth (GWL @ 4.65m-Sept. 19/02)									



patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Retail Building, 20 Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Approximate geodetic elevation = 95.64m.

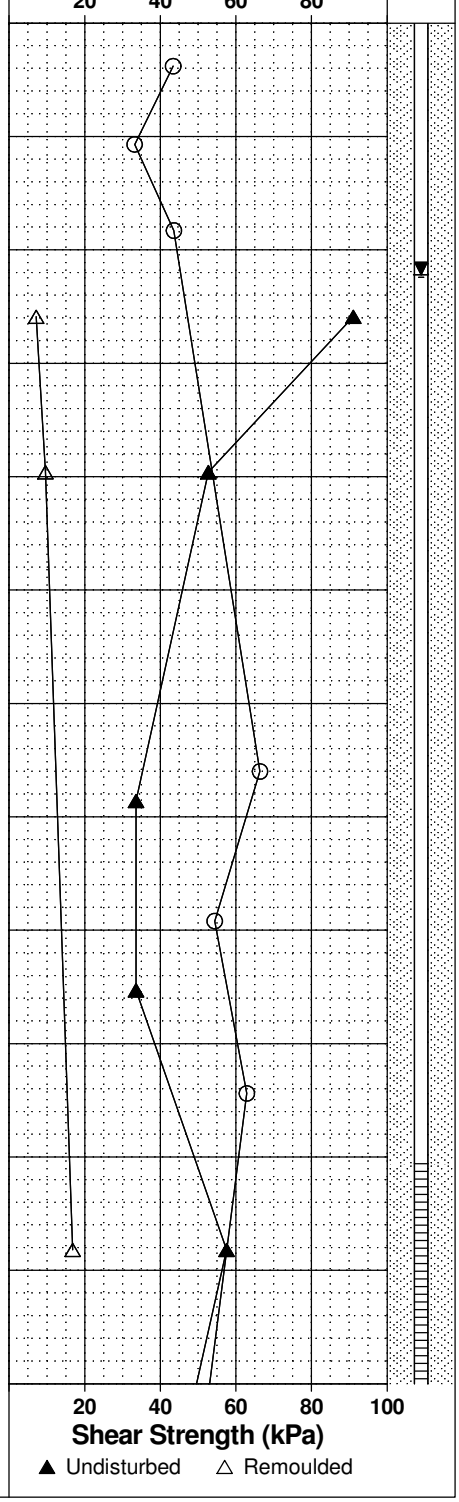
FILE NO. PG0575

REMARKS

HOLE NO. BH 1

BORINGS BY CME 45 Power Auger **DATE** Mar 23, 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.53
TOPSOIL 0.20		AU	1				
Very stiff to stiff, brown **SILTY CLAY**		SS	2	83	3	1	92.53
		SS	3	83	2	2	91.53
- grey-brown by 2.3m depth							
- grey by 3.0m depth		TW	4	100		3	90.53
						4	89.53
		TW	5	100		5	88.53
- firm by 5.2m depth							
		TW	6	100		6	87.53
						7	86.53
		SS	7	100	1	8	85.53
						9	84.53
		SS	8	100	1		
						10	83.53
						11	82.53
						12	81.53



patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Retail Building, 20 Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Approximate geodetic elevation = 95.64m.

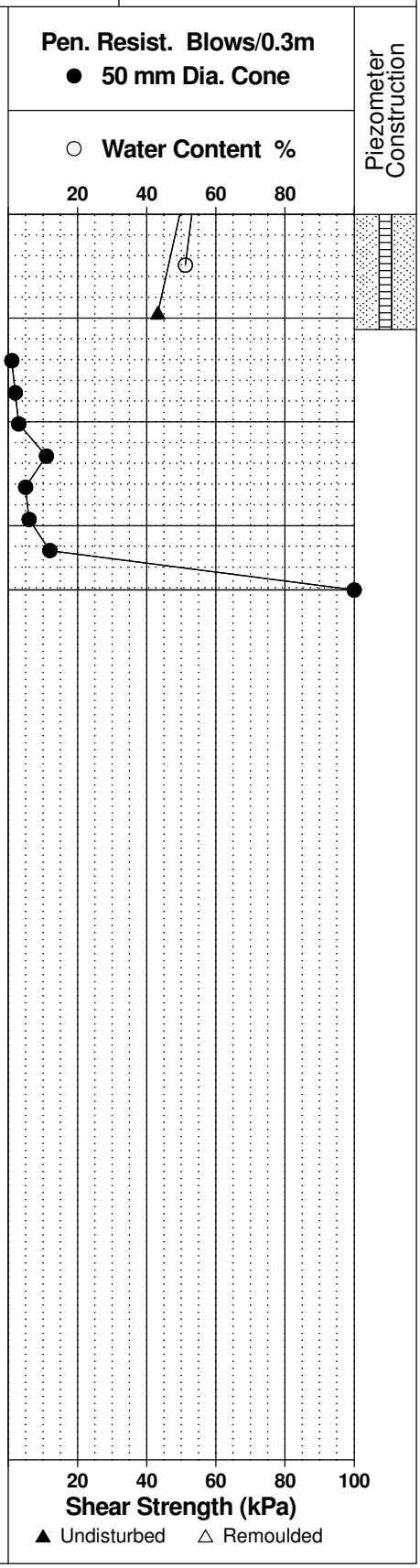
FILE NO. PG0575

REMARKS

HOLE NO. BH 1

BORINGS BY CME 45 Power Auger **DATE** Mar 23, 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Stiff to firm, grey **SILTY CLAY**		SS	9	10	1	12	81.53
13.10						13	80.53
Dynamic Cone Penetration Test commenced @ 13.11m depth Inferred **SILTY CLAY**						14	79.53
15.20						15	78.53
Inferred **GLACIAL TILL**							
15.62							
End of Borehole DCPT refusal @ 15.62m depth (GWL @ 2.22m-Mar. 31/05)							



patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Retail Building, 20 Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Approximate geodetic elevation = 95.64m.

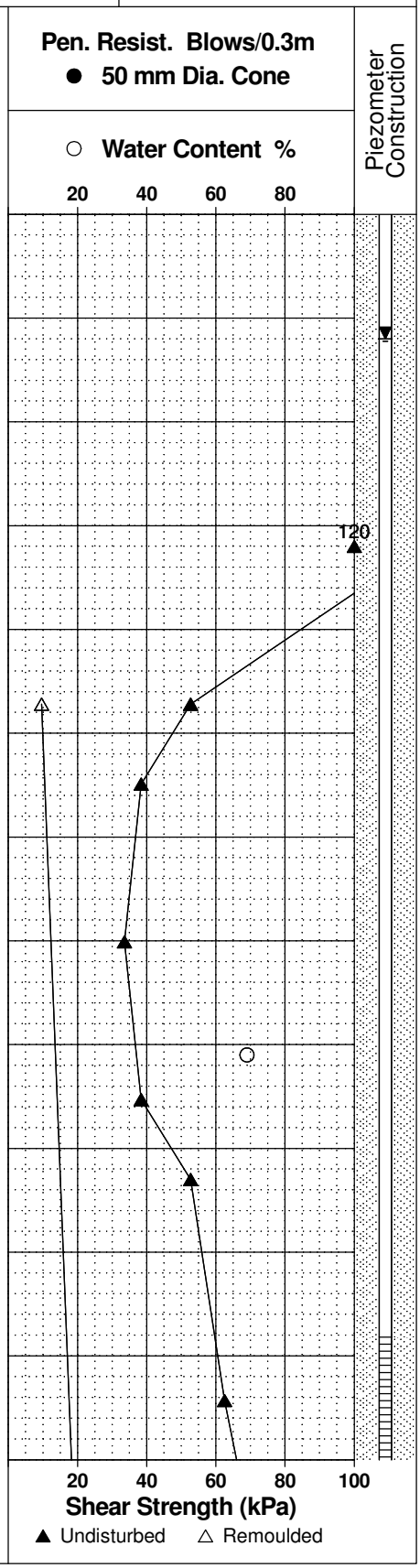
FILE NO. PG0575

REMARKS

HOLE NO. BH 2

BORINGS BY CME 45 Power Auger **DATE** Mar 23, 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.13
TOPSOIL 0.25		AU	1				
		SS	2	100	7	1	92.13
		SS	3	83	5	2	91.13
Very stiff to stiff, grey-brown **SILTY CLAY**		SS	4	83	5	3	90.13
- grey by 4.0m depth		TW	5	83		4	89.13
- firm by 5.0m depth						5	88.13
		SS	6	100	1	6	87.13
		TW	7	100		7	86.13
- stiff by 9.0m depth						8	85.13
						9	84.13
						10	83.13
		SS	8	100	1	11	82.13
						12	81.13



patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Retail Building, 20 Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Approximate geodetic elevation = 95.64m.

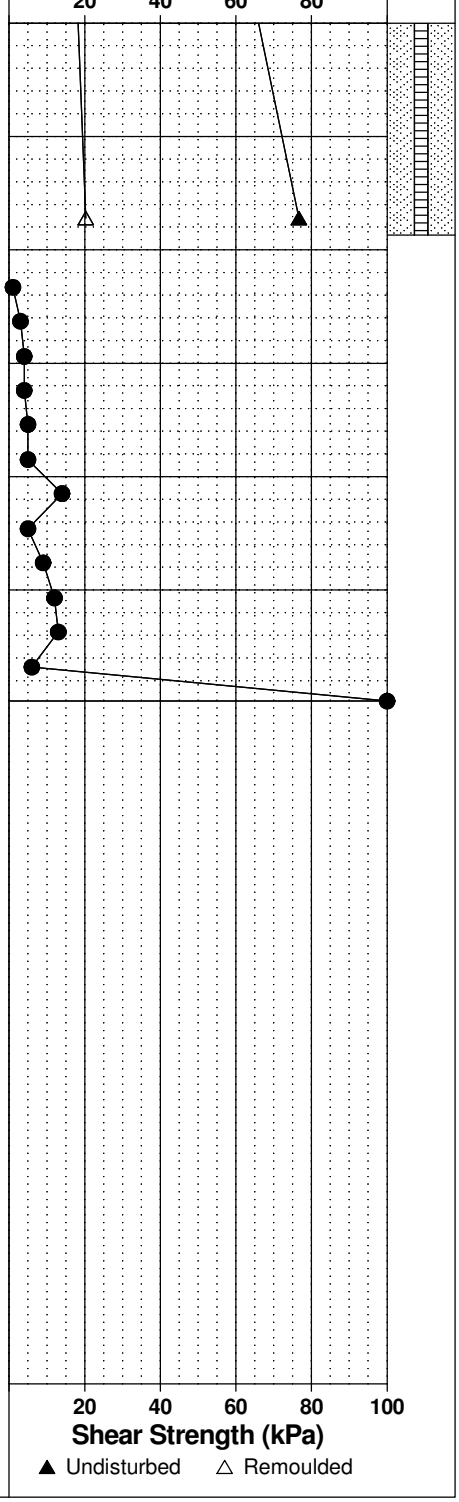
FILE NO. PG0575

REMARKS

HOLE NO. BH 2

BORINGS BY CME 45 Power Auger **DATE** Mar 23, 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Stiff, grey **SILTY CLAY**		SS	9	100	1	12	81.13
						13	80.13
13.87							
Dynamic Cone Penetration Test commenced @ 13.87m depth						14	79.13
Inferred **SILTY CLAY**						15	78.13
						16	77.13
16.80							
Inferred **GLACIAL TILL**						17	76.13
17.98							
End of Borehole							
DCPT refusal @ 17.98m depth							
(GWL @ 1.20m-Mar. 31/05)							



patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Retail Building, 20 Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Approximate geodetic elevation = 95.64m.

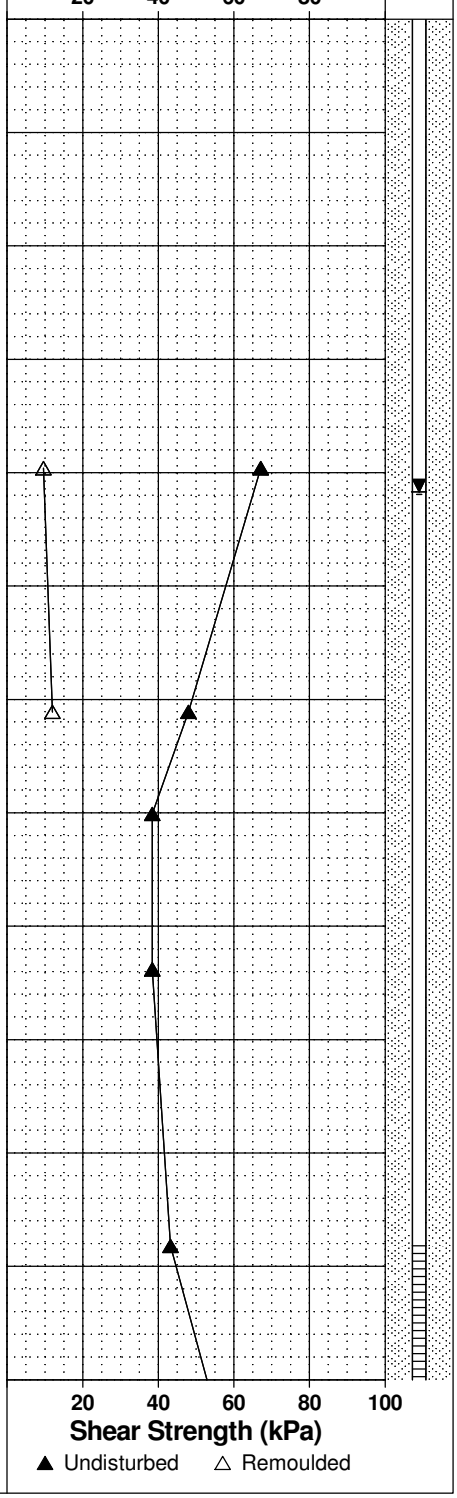
FILE NO. PG0575

REMARKS

HOLE NO. BH 3

BORINGS BY CME 45 Power Auger **DATE** Mar 22, 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.37
		AU	1				
FILL: Brown silty clay with sand, gravel and cobbles		SS	2	17	18	1	94.37
		SS	3	8	6	2	93.37
		SS	4	0	5		
3.05						3	92.37
		SS	5	100	2		
Stiff, brown **SILTY CLAY**						4	91.37
- grey by 4.6m depth		TW	6	4		5	90.37
		TW	7	100			
- firm by 6.0m depth		TW	8	100		6	89.37
						7	88.37
		TW	9	100		8	87.37
						9	86.37
		SS	10	100	1	10	85.37
						11	84.37
						12	83.37



patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Retail Building, 20 Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Approximate geodetic elevation = 95.64m.

FILE NO. PG0575

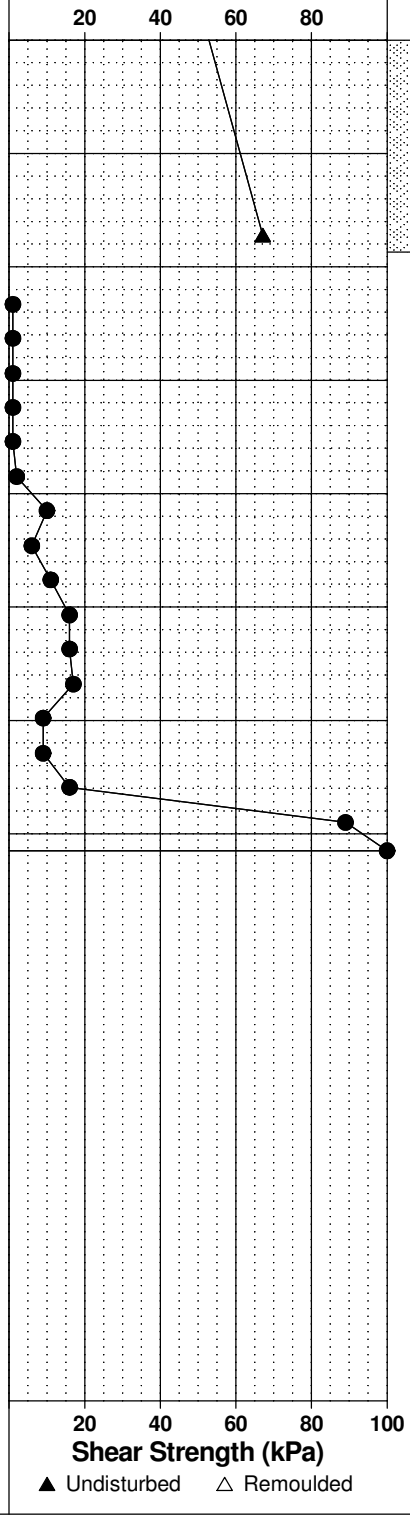
REMARKS

HOLE NO. BH 3

BORINGS BY CME 45 Power Auger **DATE** Mar 22, 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Firm, grey **SILTY CLAY**		SS	11		1	12	83.37
		TW	12	100		13	82.37
13.87						14	81.37
Dynamic Cone Penetration Test commenced @ 13.87m depth Inferred **SILTY CLAY**						15	80.37
15.50						16	79.37
Inferred **GLACIAL TILL**						17	78.37
						18	77.37
19.15						19	76.37
End of Borehole DCPT refusal @ 19.15m depth (GWL @ 4.17m-Mar. 31/05)							

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



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Retail Building, 20 Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Approximate geodetic elevation = 95.64m.

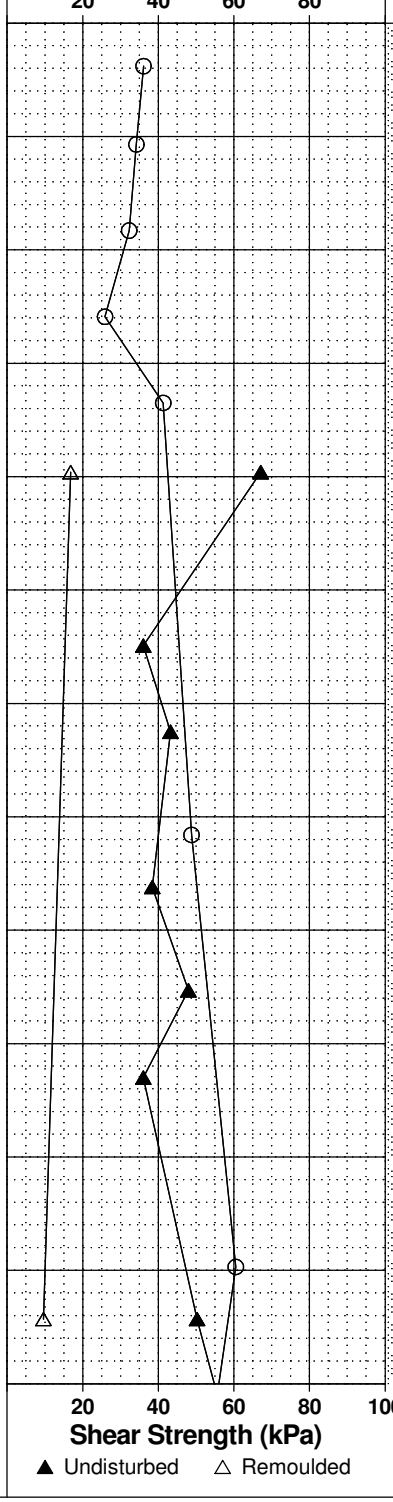
FILE NO. PG0575

REMARKS

HOLE NO. BH 4

BORINGS BY CME 45 Power Auger **DATE** Mar 23, 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.59
FILL: Brown silty clay with sand, gravel and cobbles		AU	1				
		SS	2	75	10	1	94.59
1.68							
TOPSOIL 1.78		SS	3	67	21	2	93.59
Compact, brown **SILTY** fine **SAND/SANDY SILT** 1.83							
		SS	4	83	3		
Stiff, brown **SILTY CLAY**						3	92.59
		SS	5	83	3		
- fine sand and sandy silt layers to 4.0m depth						4	91.59
- firm and grey by 4.3m depth		TW	6	75		5	90.59
						6	89.59
						7	88.59
		SS	7	12	1		
						8	87.59
						9	86.59
						10	85.59
- stiff by 10.7m depth						11	84.59
		SS	8	100	1		
						12	83.59



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Retail Building, 20 Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Approximate geodetic elevation = 95.64m.

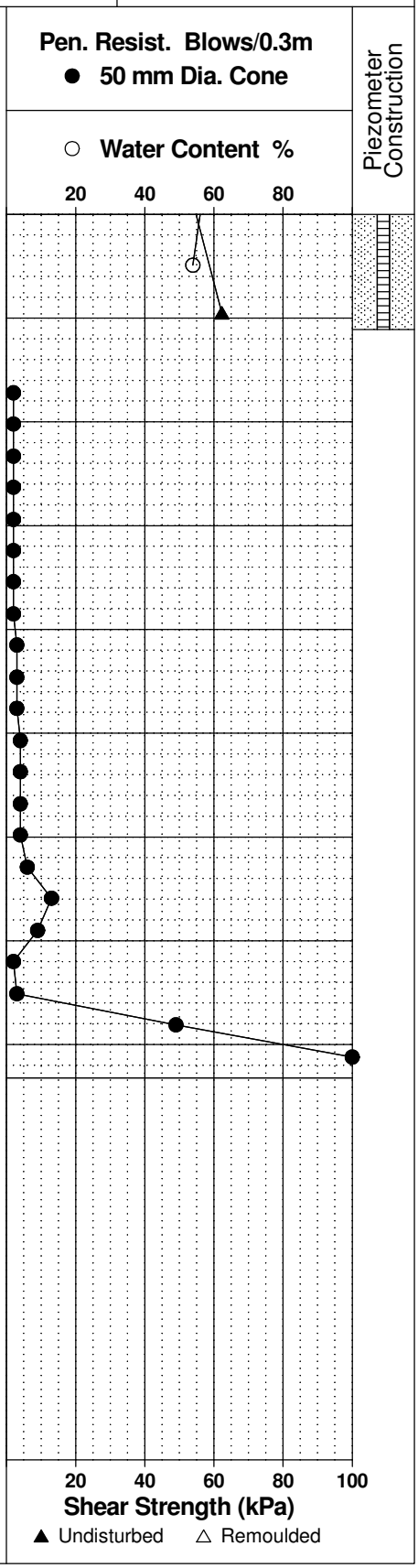
FILE NO. PG0575

REMARKS

HOLE NO. BH 4

BORINGS BY CME 45 Power Auger **DATE** Mar 23, 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Stiff, grey **SILTY CLAY**		SS	9	100	1	12	83.59
13.11						13	82.59
Dynamic Cone Penetration Test commenced @ 13.11m depth						14	81.59
Inferred **SILTY CLAY**						15	80.59
						16	79.59
						17	78.59
17.70						18	77.59
Inferred **GLACIAL TILL**						19	76.59
20.32						20	75.59
End of Borehole							
DCPT refusal @ 20.32m depth							
(GWL @ 0.37m-Mar. 31/05)							



patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Retail Building, 20 Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Approximate geodetic elevation = 95.64m.

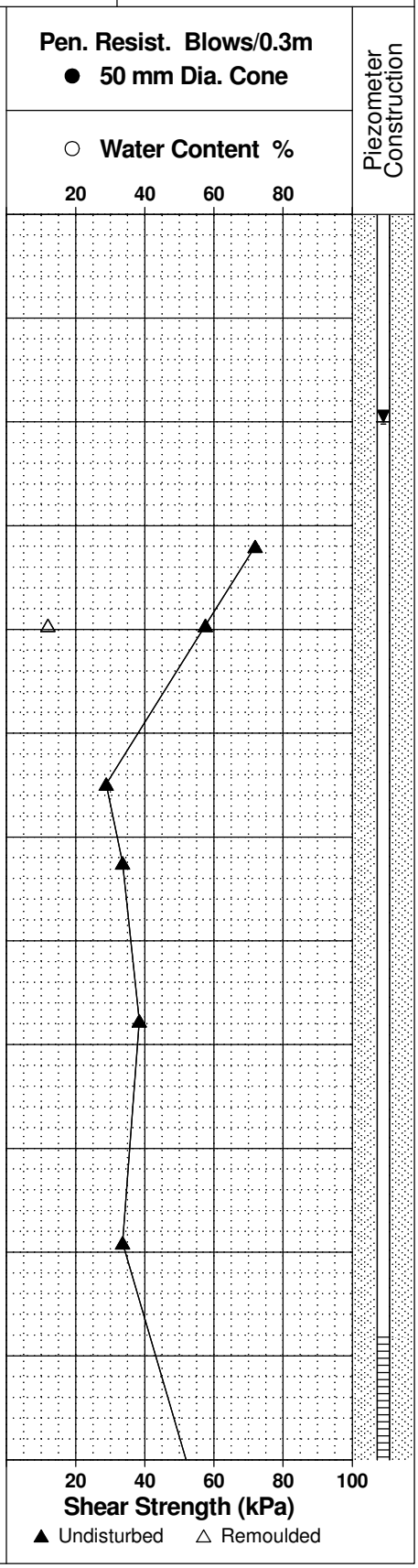
FILE NO. PG0575

REMARKS

HOLE NO. BH 5

BORINGS BY CME 45 Power Auger **DATE** Mar 24, 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.18
TOPSOIL 0.18		AU	1				
Loose, brown **SANDY SILT/SILTY SAND**		SS	2	75	4	1	93.18
1.37		SS	3	83	3	2	92.18
Very stiff to stiff, brown **SILTY CLAY**		SS	4	83	2	3	91.18
- grey by 3.8m depth						4	90.18
		TW	5	100		5	89.18
- firm by 5.2m depth						6	88.18
						7	87.18
						8	86.18
						9	85.18
		SS	6	100	1	10	84.18
						11	83.18
						12	82.18



patersongroup Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Retail Building, 20 Frank Nighbor Place
Ottawa (Kanata), Ontario

DATUM TBM - Top spindle of fire hydrant (see plan). Approximate geodetic elevation = 95.64m.

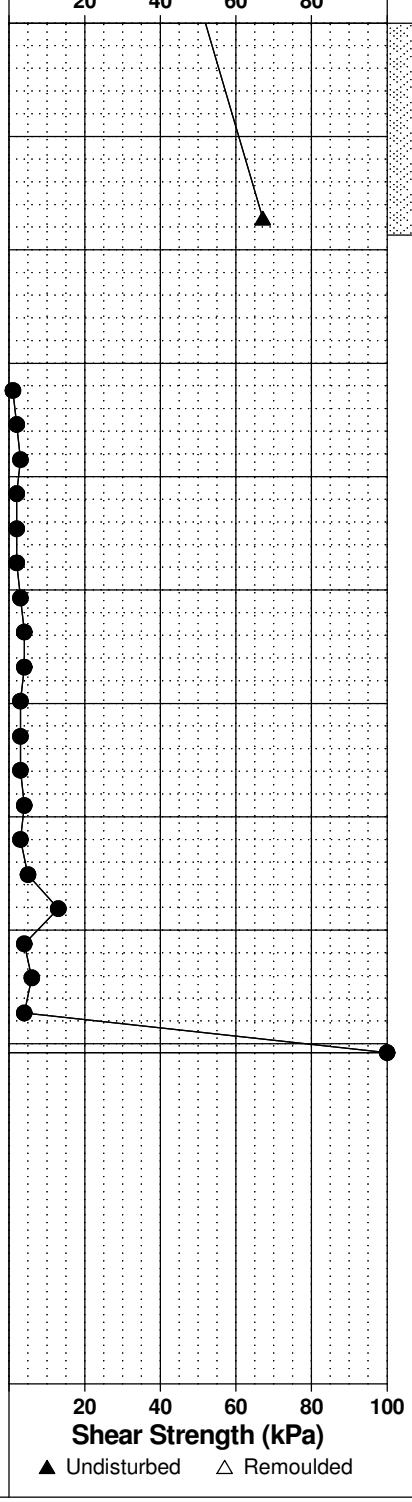
FILE NO. PG0575

REMARKS

HOLE NO. BH 5

BORINGS BY CME 45 Power Auger **DATE** Mar 24, 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
Stiff, grey **SILTY CLAY**		TW	7	100		12	82.18
						13	81.18
13.87						14	80.18
Dynamic Cone Penetration Test commenced @ 13.87m depth						15	79.18
						16	78.18
Inferred **SILTY CLAY**						17	77.18
						18	76.18
						19	75.18
						20	74.18
21.08						21	73.18
End of Borehole							
DCPT refusal @ 21.08m depth							
(GWL @ 2.00m-Mar. 31/05)							



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

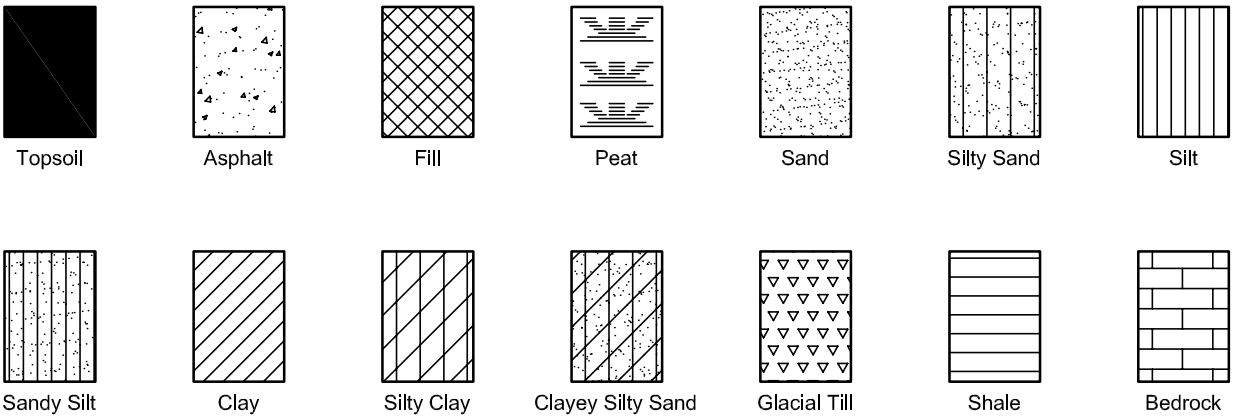
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

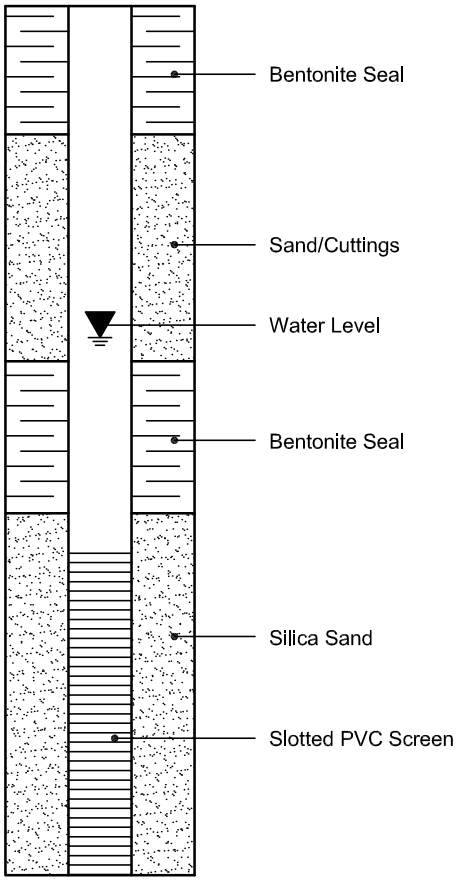
SYMBOLS AND TERMS (continued)

STRATA PLOT

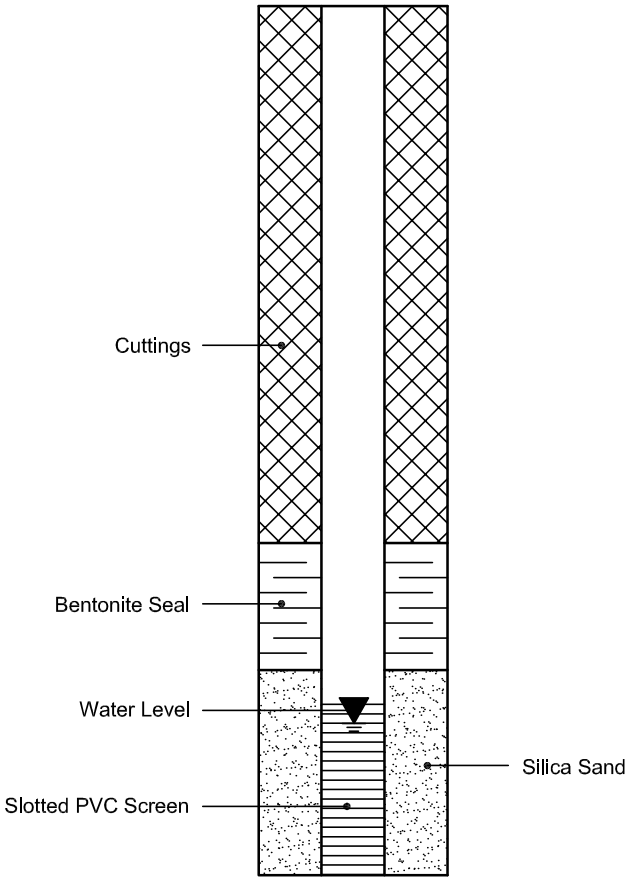


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



ACCUTEST LABORATORIES LTD

REPORT OF ANALYSIS

Client: Paterson Group
28 Concourse Gate, Unit 1
Nepean, ON
K2E 7T7
Attention: Mr. Miguel Larivière

Report Number: 2505446
Date: 2005-04-11
Date Submitted: 2005-04-04

Project: PG 2575

P.O. Number: 3213
Matrix: Soil

								GUIDELINE		
LAB ID:			377141							
Sample Date:			2005-03-23							
Sample ID:			BH-1 SS2							
PARAMETER	UNITS	MDL						TYPE	LIMIT	UNITS
Chloride	%	0.001	0.062							
Electrical Conductivity	mS/cm	0.01	0.81							
pH			7.6							
Resistivity	ohm-cm	1	1230							
Sulphate	%	0.01	0.02							

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:

Lorna Wilson
Agriculture Lab Supervisor

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG4409-1 - TEST HOLE LOCATION PLAN

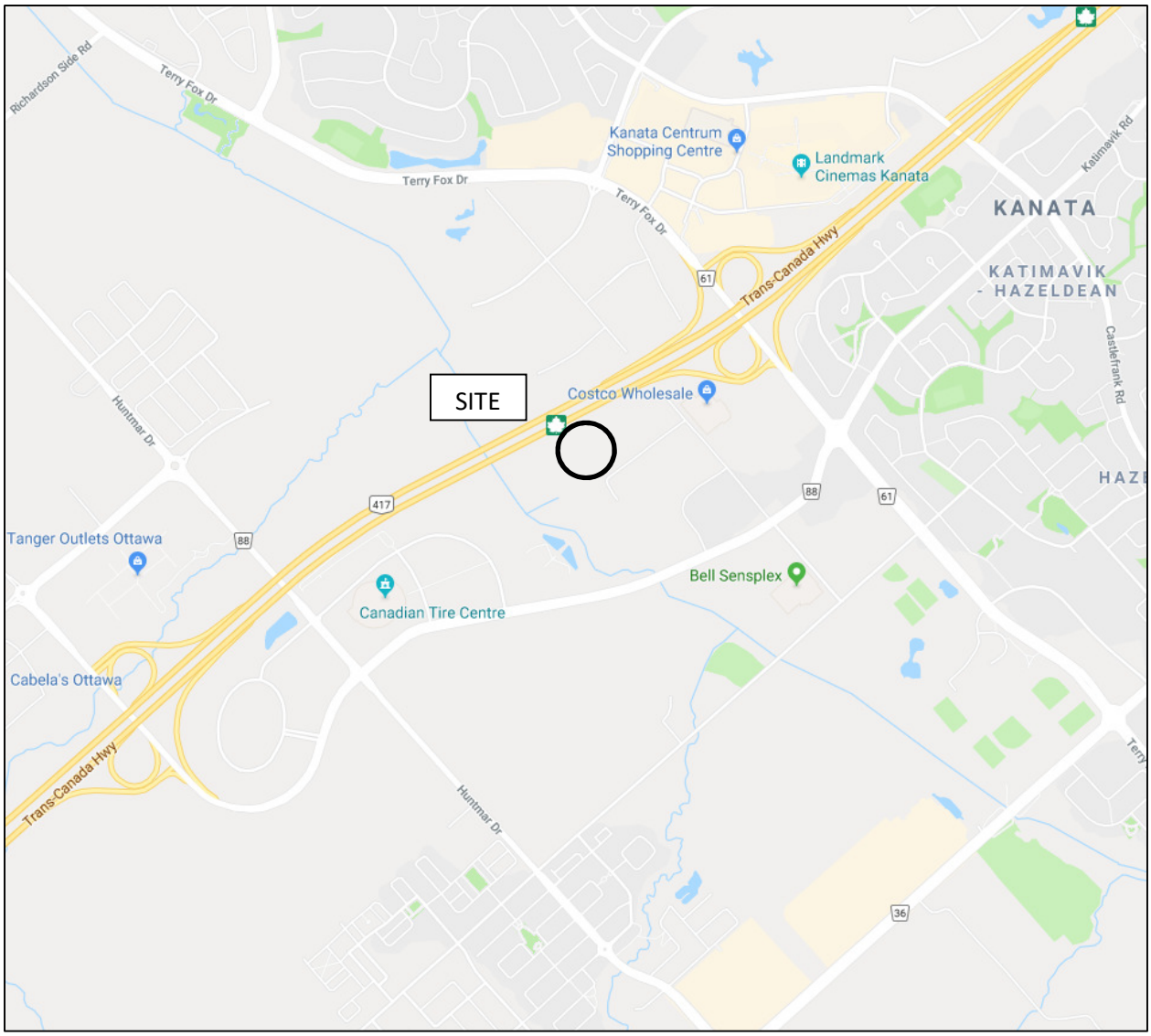
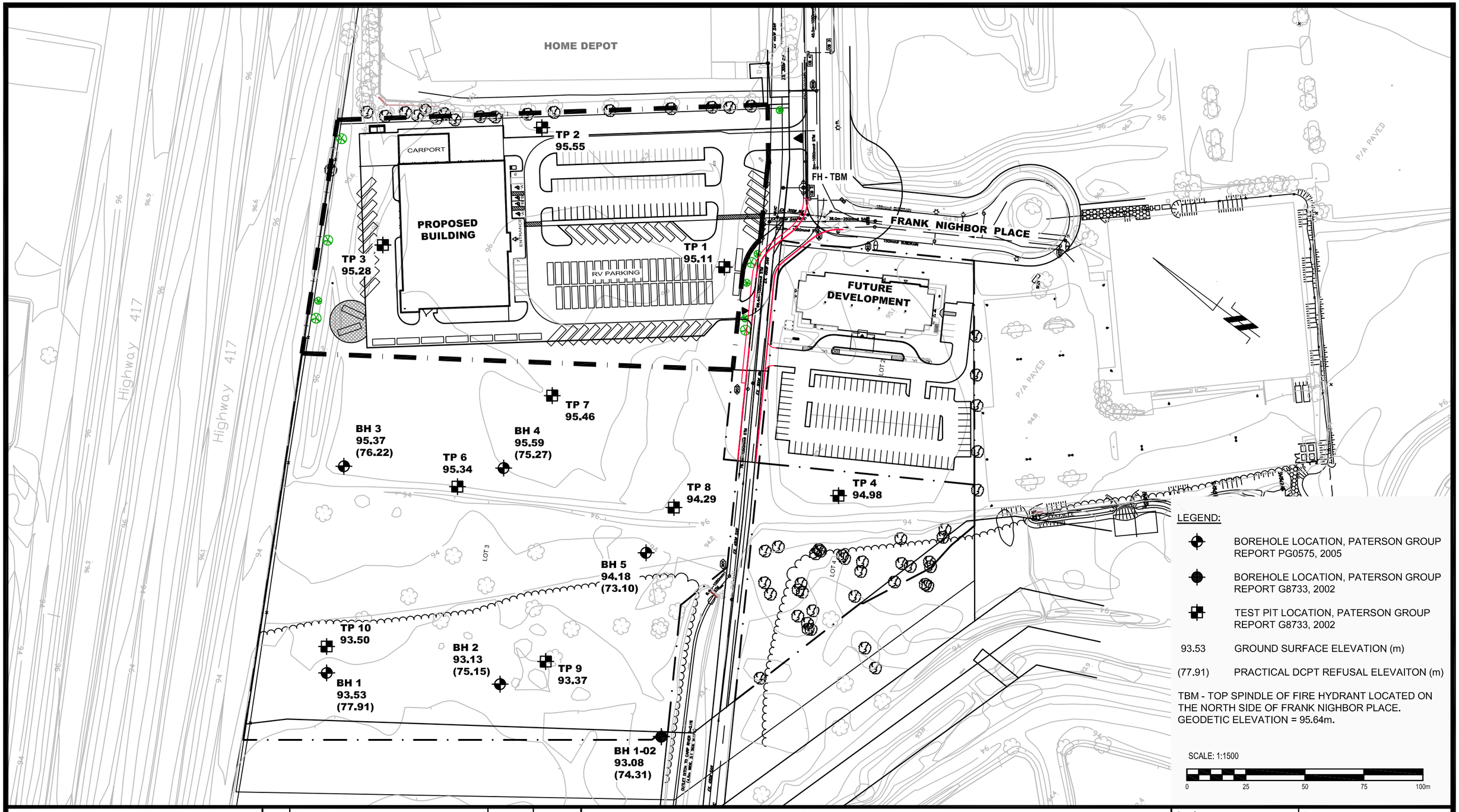


FIGURE 1

KEY PLAN



patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

SITECAST CONSTRUCTION

GEOTECHNICAL INVESTIGATION
PROPOSED RV SHOWROOM - 20 FRANK NIGHBOR PLACE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1500	Date: 01/2018
Drawn by: MPG	Report No.: PG4409-1
Checked by: NC	Dwg. No.: PG4409-1
Approved by: DJG	Revision No.: 0

p:\autocad drawings\geotechnical\pg44xx\pg4409-1 thlp.dwg