Geotechnical Engineering

Environmental Engineering

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Materials Testing

Building Science

Archaeological Services

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Geotechnical Investigation

Proposed Commercial Development
197 Trainyards Drive
Ottawa, Ontario

Prepared For

Controlex Corporation

January 17, 2019

Report PG3298-2 Revision 1

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1.0 Introduction

Paterson Group (Paterson) was commissioned by Controlex Corporation to conduct a supplemental geotechnical investigation for the proposed commercial development to be located at 197 Train Yards Drive, in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2).

The objectives of the current investigation were to:

- ❑ determine the subsurface soil and groundwater conditions by means of boreholes.
- ❑ provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

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

2.0 Proposed Development

Specific details of the proposed development were not available at the time of writing this report. However, it is expected that a commercial building of slab-on-grade construction and/or multi-storey commercial buildings, are anticipated for this site. Associated at-grade parking areas, access lanes and landscaped areas are further anticipated.

An existing building is currently occupying the north and northwest portion of the subject site. It is expected that this building will be demolished prior to commencing the construction of the proposed development.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the present geotechnical investigation was conducted on August 1, 2014 by advancing a total of twelve (12) boreholes to a maximum depth of 9.4 m below existing ground surface. The test hole locations were distributed in a manner to provide general coverage of the subject site. Relevant test holes completed during our previous investigations have been emended to the current geotechncial report. The locations of the test holes are presented on Drawing PG3298-2 - Test Hole Location Plan included in Appendix 2.

The test holes were completed using both truck and track mounted drill rigs operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel with the direction of a senior engineer. The drilling procedure consisted of augering to the required depths at the selected locations to sample and test the overburden.

Sampling and In Situ Testing

Soil samples were recovered using a 50 mm diameter split-spoon sampler or the auger flights. The split-spoon and auger samples were classified on site and placed in sealed plastic bags. All samples were transported to the laboratory. The depths at which the split-spoon and auger samples were recovered from the test holes are presented as SS and AU, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples and 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.

Overburden thickness was evaluated by a Dynamic Cone Penetration Test (DCPT) at BH 1 and BH 12 as part of our current investigation. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, and a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone 300 mm into the soil.

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.

Groundwater

Groundwater monitoring wells were installed at BH 3, BH 8 and BH 11 of the current investigation. Standpipes were installed in all remaining boreholes to permit the monitoring of water levels subsequent to the sampling program completion.

Sample Storage

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

3.2 Field Survey

The test hole locations were selected and determined in the field by Paterson personnel to provide general coverage of the subject site. Ground surface elevations at test hole locations are referenced to a temporary benchmark (TBM), consisting of the top of spindle of the fire hydrant located along the south side of Belfast Road. A geodetic elevation of 69.57m was provided for the TBM.

The location and ground surface elevation at each test hole location are presented on Drawing PG3298-2 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the subject site were examined in the laboratory to review the field logs.

3.4 Analytical Testing

One soil sample was submitted for analytical tests to determine the concentration of sulphate, chloride, resistivity and pH. The laboratory test results are presented in Appendix 1 and discussed in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is bordered to the north by Belfast Road, to the east by an existing access road, to the south and west by commercial buildings. The subject site is currently a vacant gravel covered lot used primarily as an excess parking area. The general site topography is flat and at similar elevations to all surrounding properties.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile at the borehole locations consists of a silty sand with gravel fill material underlain by a brown silty sand fill layer. The abovenoted fill layers are underlain by a native silty sand layer and/or a compact to very dense glacial till. The glacial till consists of a silty sand matrix with gravel, cobbles and boulders. Practical refusal to augering was noted at BH 2 on inferred large boulders. Practical refusal to DCPT was encountered at BH 1 and BH 12 at a depth of 6.4 m and 9.3 m, respectively.

Bedrock

Based on available geological mapping, bedrock in the area of the subject site consists of shale bedrock from the Carlsbad Formation. The overburden drift thickness is estimated to be between 10 and 20 m depth.

4.3 Groundwater

Groundwater levels were measured at the piezometers and monitoring wells in the borehole locations of the current investigation on August 7, 2014. Our groundwater measurements are presented in Table 1 below. The groundwater elevation is subject to seasonal fluctuations and could vary at the time of construction.

Table 1 - Summary of Groundwater Levels			
Borehole Number	**Measured Groundwater Level**		**Recording Date**
	Depth (m)	**Elevation (m)**	
Groundwater Levels Based on Current Investigation (Report PG3298)			
BH 1	1.91	66.91	August 7, 2014
BH 2	2.18	67.30	August 7, 2014
BH 3	2.28	66.91	August 7, 2014
BH 4	1.65	67.14	August 7, 2014
BH 5	3.28	66.18	August 7, 2014
BH 6	1.56	67.45	August 7, 2014
BH 7	1.63	66.88	August 7, 2014
BH 8	1.73	67.33	August 7, 2014
BH 9	1.55	67.38	August 7, 2014
BH 10	1.65	67.00	August 7, 2014
BH 11	1.87	67.11	August 7, 2014
Groundwater Levels Based on Previous Investigation (Report S5305)			
BH 1	1.52	67.47	December 7, 1990
BH 2	N/A	N/A	December 7, 1990
BH 3	1.30	67.41	December 7, 1990
BH 4	1.24	67.61	December 7, 1990
BH 5	0.56	67.96	December 7, 1990
BH 6	1.60	67.58	December 7, 1990
BH 7	1.45	67.62	December 7, 1990
BH 8	0.73	67.67	December 7, 1990
BH 9	N/A	N/A	December 7, 1990
BH 10	0.61	67.93	December 7, 1990

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is satisfactory for the proposed development. The proposed commercial buildings could be founded on conventional style shallow foundations placed on an undisturbed, compact silty sand, glacial till or engineered fill bearing surface.

Boulders, within the existing fill, greater in diameter than 300 mm are recommended to be removed from below the proposed buildings footprint. The bearing surface can be reinstated by backfilling with an engineered fill approved by the geotechnical consultant or a lean concrete in-filled trench extending to an approved native soil bearing surface. In addition, the bearing surface should be compacted using suitable compaction equipment to 98% of its SPMDD.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil, asphalt, and deleterious fill, such as material containing high content of organic materials, should be stripped from under the proposed buildings footprint and other settlement sensitive structures.

It is anticipated that the existing fill within the proposed building footprint, free of deleterious material and significant amounts of organics, can be left in place below the proposed building footprint outside of lateral support zones for the footings. 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 noted during the proof-rolling operation should be removed and replaced with an approved fill.

Fill Placement

Fill placed for grading beneath the buildings' areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The backfill material should be tested and approved prior to delivery to the site. The engineered fill should be placed in maximum 300 mm thick lifts and compacted to 98% of standard Proctor maximum dry density (SPMDD).

Alternatively, a near vertical trench extending to an undisturbed, compact glacial till bearing surface and backfilled with a minimum 15 MPa lean concrete could be used to support the proposed footings, where required due to excessive unsuitable fill below the design underside of footing level.

Non-specified existing fill along with site-excavated soil can be placed as general landscaping fill where surface settlement is a minor concern. The material should be spread in thin lifts and at a minimum compacted by the tracks of the spreading equipment to minimize voids. If the material is to be placed to increase the subgrade level for areas to be paved, the fill should be compacted in maximum 300 mm lifts and compacted to 95% of SPMDD. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Shallow Foundation

Footings placed on an undisturbed, compact silty sand, glacial till bearing or engineered backfill surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **100 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **180 kPa**. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS.

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

The bearing resistance value at SLS will be subjected to potential post-construction total and differential settlements of 25 and 15 mm, respectively.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to a compact silty sand or glacial till bearing medium with a plane extending horizontally and vertically from the footing perimeter at a minimum of 1.5H:1V, passing through in situ soil or engineered fill of equal or higher capacity.

5.4 Design for Earthquakes

Foundations constructed at the subject site can be designed using a seismic site response **Class C** as defined in the Ontario Building Code 2012 (OBC 2012; Table 4.1.8.4.A). The soils underlying the site are not susceptible to liquefaction.

5.5 Slab-on-Grade Construction

All topsoil and deleterious materials should be removed, within the proposed buildings footprints. The native soil surface or existing silty sand fill, free of organics and deleterious materials, and approved by the geotechnical consultant at the time of construction should be considered to be an acceptable subgrade surface on which to commence backfilling for the floor slab. The upper 200 mm of sub-slab fill should consist of an OPSS Granular A material for slab-on-grade construction. All backfill material within the proposed buildings footprints should be placed in maximum 300 mm lifts and compacted to a minimum of 98% of the SPMDD.

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

5.6 Pavement Structure

Car only parking and heavy truck parking areas, as well as access lanes are anticipated at this site. The proposed pavement structures are presented 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 - In situ soil, or OPSS Granular B Type I or II material placed over in situ soil

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
400	**SUBBASE** - OPSS Granular B Type II
	SUBGRADE - In situ soil, or OPSS Granular B Type I or II material placed over in situ soil

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 98% of the SPMDD.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

A perimeter foundation drainage system is recommended for the proposed buildings. The system should consist of a 100 to 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear 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 foundation exterior walls should consist of free-draining non frost susceptible granular materials. The majority of the site excavated soil is considered to be frost susceptible and not recommended for placement as backfill against the foundation walls, unless placed in conjunction with a drainage geocomposite (Miradrain G100N or Delta Drain 6000) connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be placed 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 of 1.5 m of soil cover alone, or a combination of soil cover and foundation insulation should be provided.

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

6.3 Excavation Side Slopes

The excavation side slopes in the overburden material should either be excavated at acceptable slopes or retained by shoring systems from the beginning of the excavation until the structure is backfilled.

The excavation side slopes above the local groundwater elevation extending to a maximum depth of 3 m should be excavated at 1H:1V or shallower. The shallower slope is required for excavation below local groundwater elevation. The subsurface soil is considered to be mainly 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 be installed at all times 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 be remain exposed for extended periods of time.

6.4 Pipe Bedding and Backfill

At least 150 mm of OPSS Granular A should be placed 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 a minimum of 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 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 minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the SPMDD.

6.5 Groundwater Control

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

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

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

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

6.6 Winter Construction

Precautions should be provided if winter construction is considered for this project.

The subsurface conditions mainly 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 installation of straw, propane heaters, tarpaulins or other suitable means. Any excavation base should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the buildings and the footings are protected with sufficient soil cover to prevent freezing at founding level.

The trench excavations should be constructed in a manner to avoid the introduction of frozen materials, snow or ice into the trenches.

6.7 Corrosion Potential and Sulphate

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

7.0 Recommendations

For the foundation design data provided to be applicable a materials testing and observation services program is required to be completed. The following aspects 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 used.
- ❑ 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 provided in the report are in accordance with Paterson's present understanding of the project. Paterson request permission to review the recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from the test locations, Paterson requests immediate notification to permit reassessment of the recommendations.

The recommendations provided should only be used by the design professionals associated with this project. The recommendations are not intended for contractors bidding on or constructing the project. The latter should evaluate the factual information provided in the report. The contractor should also determine the suitability and completeness for the intended construction schedule and methods. Additional testing may be required for the contractors purpose.

The present report applies only to the project described in the report. The use of the report for purposes other than those described above or by person(s) other than Controlex Corporation or their agents is not authorized without review by Paterson.

Paterson Group Inc.

Faisal I. Abou-Seido, P.Eng.

David J. Gilbert, P.Eng.

Report Distribution:

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APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TEST RESULT

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 197 Trainyards Drive
Ottawa, Ontario

DATUM TBM - Bottom of flange of fire hydrant, located on south side of Belfast Road, in front of subject site. Geodetic elevation = 69.57m.

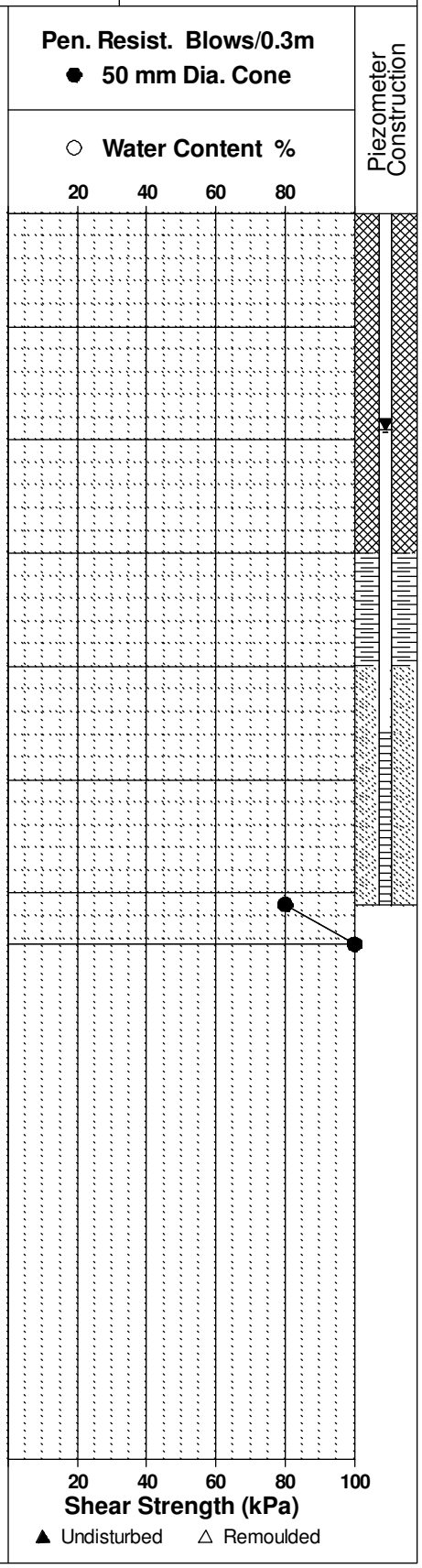
FILE NO. PG3298

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** August 1, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.82
FILL: Brown gravel, sand with silt and cobbles		AU	1				
0.60							
		SS	2	62	10	1	67.82
Compact to loose, brown **SILTY SAND**		SS	3	83	3	2	66.82
- grey by 2.0m depth		SS	4	42	4		
- some gravel by 2.7m depth						3	65.82
3.20		SS	5	75	26		
		SS	6	61	73	4	64.82
GLACIAL TILL: Grey to black silt, gravel, sand, shale fragments, cobbles and boulders		SS	7	50	50+	5	63.82
		SS	8	60	50+		
						6	62.82
6.45							
End of Borehole							
Dynamic Cone Penetration Test commenced at 6.10m depth. Practical DCPT refusal at 6.45m depth.							
(GWL @ 1.91m-August 7, 2014)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 197 Trainyards Drive
Ottawa, Ontario

DATUM TBM - Bottom of flange of fire hydrant, located on south side of Belfast Road, in front of subject site. Geodetic elevation = 69.57m.

FILE NO. PG3298

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** August 1, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.48
FILL: Brown silty sand with gravel		AU	1				
0.53							
FILL: Brown silty sand		SS	2	83	5	1	68.48
1.45							
Loose, brown **SILTY SAND**		SS	3	83	7	2	67.48
2.21							
GLACIAL TILL: Grey to black silt, gravel, sand, shale fragments, cobbles and boulders		SS	4	86	50+		
2.59							
End of Borehole							

Practical refusal to augering at 2.59m depth

(GWL @ 2.18m-August 7, 2014)

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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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 197 Trainyards Drive
Ottawa, Ontario

DATUM TBM - Bottom of flange of fire hydrant, located on south side of Belfast Road, in front of subject site. Geodetic elevation = 69.57m.

FILE NO. PG3298

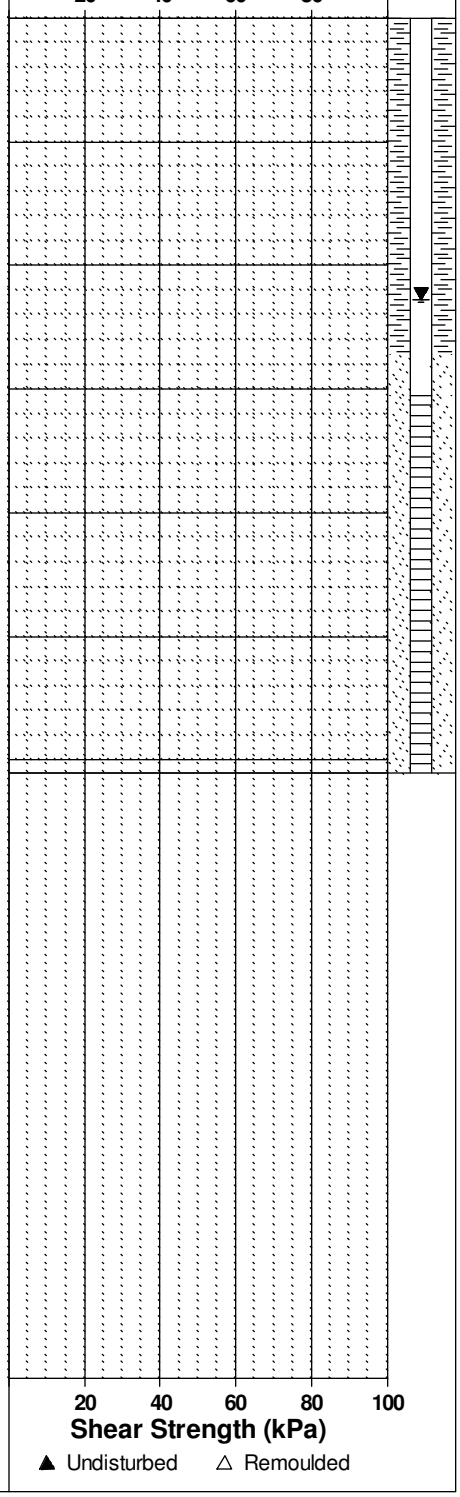
REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** August 1, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.19
		AU	1				
		SS	2	67	14	1	68.19
FILL: Brown silty sand, some gravel		SS	3	75	10	2	67.19
2.74		SS	4	58	32		
		SS	5	67	31	3	66.19
GLACIAL TILL: Brown to black silt, gravel, sand, shale fragments, cobbles and boulders		SS	6	83	38	4	65.19
		SS	7	75	74	5	64.19
		SS	8	100	50+		
6.10						6	63.19
End of Borehole							
(GWL @ 2.28m-August 7, 2014)							

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



Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

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Ottawa, Ontario

DATUM TBM - Bottom of flange of fire hydrant, located on south side of Belfast Road, in front of subject site. Geodetic elevation = 69.57m.

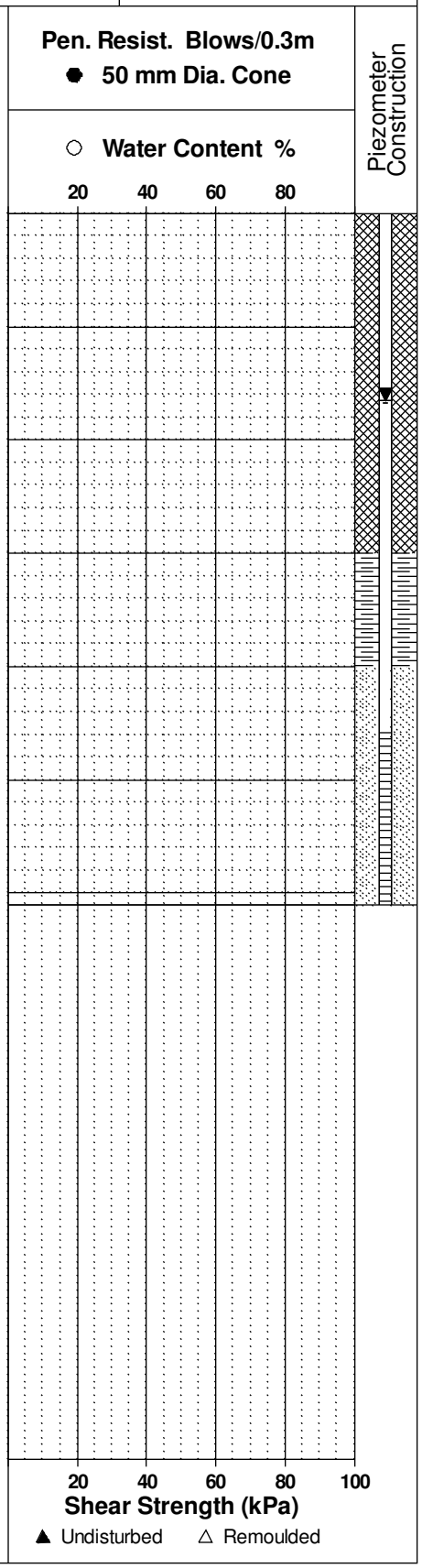
FILE NO. PG3298

REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** August 1, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.79
FILL: Brown silty sand with gravel		AU	1				
0.66							
		SS	2	42	6	1	67.79
Loose to very loose, brown **SILTY SAND**		SS	3	67	3	2	66.79
- grey by 2.0m depth							
2.34							
		SS	4	50	16	3	65.79
		SS	5	83	28		
GLACIAL TILL: Brown to black silt, gravel, sand, shale fragments, cobbles and boulders		SS	6	33	56	4	64.79
		SS	7	83	70	5	63.79
		SS	8	60	50+		
6.10						6	62.79
End of Borehole							
(GWL @ 1.65m-August 7, 2014)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 197 Trainyards Drive
Ottawa, Ontario

DATUM TBM - Bottom of flange of fire hydrant, located on south side of Belfast Road, in front of subject site. Geodetic elevation = 69.57m.

FILE NO. PG3298

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** August 1, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.46
FILL: Brown silty sand with gravel		AU	1				
		AU	2				
0.69							
FILL: Brown silty sand		SS	3	71	5	1	68.46
1.45							
Loose, brown **SILTY SAND,** trace gravel		SS	4	50	10	2	67.46
2.21							
		SS	5	67	28	3	66.46
		SS	6	42	26		
GLACIAL TILL: Brown to grey silt, gravel, sand, shale fragments and cobbles, trace clay		SS	7	83	18	4	65.46
		SS	8	83	29	5	64.46
		SS	9	74	43		
6.22		SS	10		50+	6	63.46
End of Borehole							
(GWL @ 3.28m-August 7, 2014)							

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 - 197 Trainyards Drive
Ottawa, Ontario

DATUM TBM - Bottom of flange of fire hydrant, located on south side of Belfast Road, in front of subject site. Geodetic elevation = 69.57m.

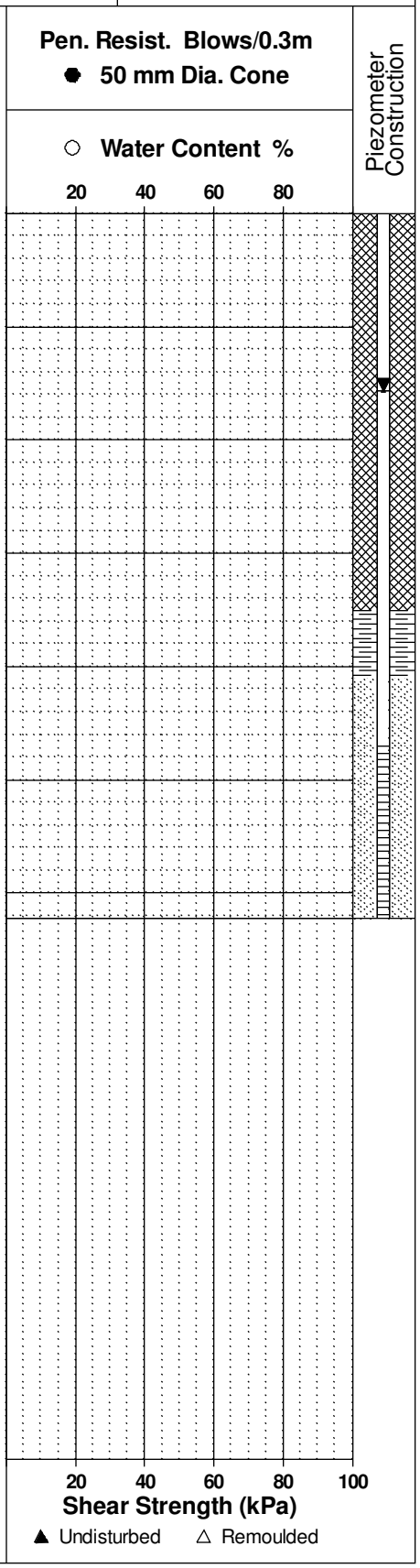
FILE NO. PG3298

REMARKS

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** August 1, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.01
FILL: Gravel with sand		AU	1				
0.30							
FILL: Brown silty sand, trace clay, topsoil and gravel		AU	2				
0.69							
		SS	3	83	11	1	68.01
FILL: Brown silty sand							
		SS	4	83	5	2	67.01
2.21							
		SS	5	50	31		
		SS	6	100	50+	3	66.01
GLACIAL TILL: Brown to grey silt, gravel, sand, shale fragments, cobbles and boulders		SS	7		50+	4	65.01
		SS	8	40	50+		
						5	64.01
						6	63.01
6.22		SS	9		50+		
End of Borehole							
(GWL @ 1.56m-August 7, 2014)							



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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 197 Trainyards Drive
Ottawa, Ontario

DATUM TBM - Bottom of flange of fire hydrant, located on south side of Belfast Road, in front of subject site. Geodetic elevation = 69.57m.

FILE NO. PG3298

REMARKS

HOLE NO. BH 7

BORINGS BY CME 55 Power Auger **DATE** August 1, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.51
FILL: Brown silty sand, some gravel		AU	1				
0.71							
		SS	2	62	10	1	67.51
Loose to compact, brown **SILTY SAND,** trace gravel		SS	3	67	9	2	66.51
- grey by 2.0m depth		SS	4	33	11		
		SS	5	91	50+	3	65.51
3.40							
		SS	6	83	50+	4	64.51
GLACIAL TILL: Black silt, gravel, sand, shale fragments, cobbles and boulders		SS	7	67	50+	5	63.51
		SS	8	50	50+		
6.10						6	62.51
End of Borehole							
(GWL @ 1.63m-August 7, 2014)							

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 - 197 Trainyards Drive
Ottawa, Ontario

DATUM TBM - Bottom of flange of fire hydrant, located on south side of Belfast Road, in front of subject site. Geodetic elevation = 69.57m.

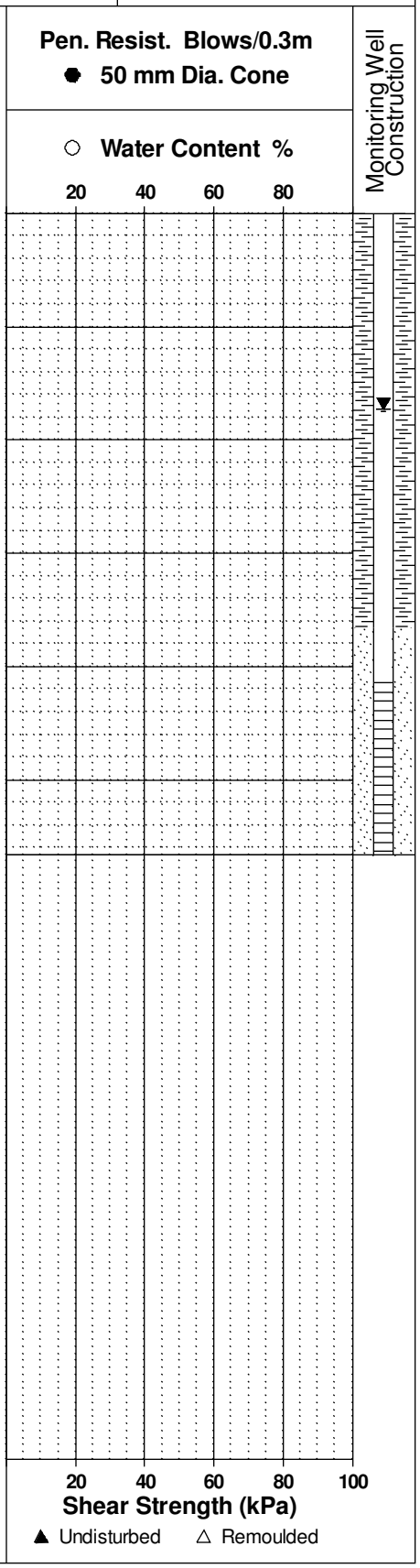
FILE NO. PG3298

REMARKS

HOLE NO. BH 8

BORINGS BY CME 55 Power Auger **DATE** August 1, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.06
FILL: Gravel with sand							
0.30		AU	1				
FILL: Brown silty sand, trace gravel							
- some clay by 0.7m depth		SS	2	67	8	1	68.06
1.45							
Loose, brown **SILTY SAND**		SS	3	71	7	2	67.06
2.21		SS	4	100	50+		
						3	66.06
		SS	5	100	71		
GLACIAL TILL: Brown to grey silt, gravel, sand, shale fragments, cobbles and boulders		SS	6	71	50+	4	65.06
		SS	7	100	50+		
		RC	1	38		5	64.06
5.66							
End of Borehole							
(GWL @ 1.73m-August 7, 2014)							



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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 197 Trainyards Drive
Ottawa, Ontario

DATUM TBM - Bottom of flange of fire hydrant, located on south side of Belfast Road, in front of subject site. Geodetic elevation = 69.57m.

FILE NO. PG3298

REMARKS

HOLE NO. BH 9

BORINGS BY CME 55 Power Auger **DATE** August 1, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.93
FILL: Gravel with sand		AU	1				
		AU	2				
0.69							
FILL: Brown silty sand		SS	3	67	8	1	67.93
		SS	4	50	7	2	66.93
- trace gravel by 2.2m depth		SS	5	12	20		
2.97						3	65.93
		SS	6	67	8		
		SS	7	75	50+	4	64.93
GLACIAL TILL: Brown silt, gravel, sand, shale fragments, cobbles and boulders		SS	8	73	50+	5	63.93
		SS	9	60	50+		
6.22		SS	10	100	50+	6	62.93
End of Borehole							
(GWL @ 1.55m-August 7, 2014)							

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 - 197 Trainyards Drive
Ottawa, Ontario

DATUM TBM - Bottom of flange of fire hydrant, located on south side of Belfast Road, in front of subject site. Geodetic elevation = 69.57m.

FILE NO. PG3298

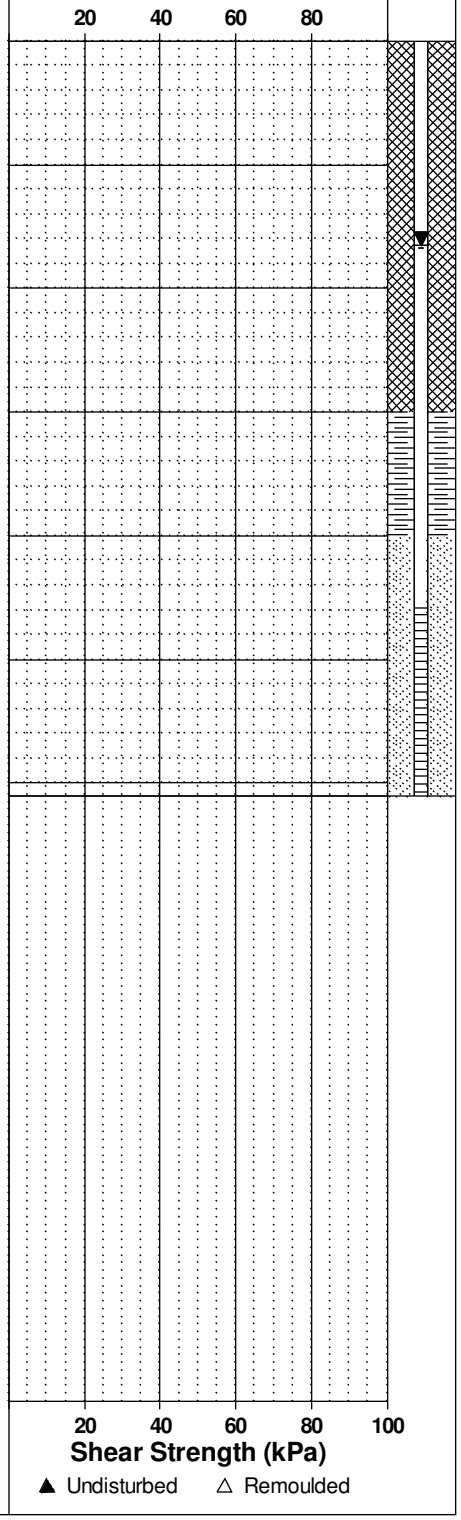
REMARKS

HOLE NO. BH10

BORINGS BY CME 55 Power Auger **DATE** August 1, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.65
FILL: Dark grey crushed stone		AU	1				
0.79							
		SS	2	42	13	1	67.65
FILL: Brown silty sand		SS	3	58	4	2	66.65
2.80		SS	4	67	15		
		SS	5	12	5	3	65.65
GLACIAL TILL: Brown silt, gravel, sand, shale fragments and cobbles, trace clay		SS	6	33	5	4	64.65
		SS	7	17	13	5	63.65
		SS	8	60	50+		
6.10						6	62.65
End of Borehole							
(GWL @ 1.65m-August 7, 2014)							

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



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 197 Trainyards Drive
Ottawa, Ontario

DATUM TBM - Bottom of flange of fire hydrant, located on south side of Belfast Road, in front of subject site. Geodetic elevation = 69.57m.

FILE NO. PG3298

REMARKS

HOLE NO. BH11

BORINGS BY CME 55 Power Auger **DATE** August 1, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE						0	68.98		
FILL: Brown silty sand with gravel		AU	1						
- some clay by 0.7m depth		SS	2	58	8	1	67.98		
		SS	3	67	4	2	66.98		
2.36									
		SS	4	83	6	3	65.98		
		SS	5	42	4				
GLACIAL TILL: Grey to black silt, gravel, sand, shale fragments and cobbles, trace clay		SS	6	33	2	4	64.98		
		SS	7	42	3	5	63.98		
		SS	8	58	12				
6.10						6	62.98		
End of Borehole									
(GWL @ 1.87m-August 7, 2014)									

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

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Commercial Development - 197 Trainyards Drive
Ottawa, Ontario

DATUM TBM - Bottom of flange of fire hydrant, located on south side of Belfast Road, in front of subject site. Geodetic elevation = 69.57m.

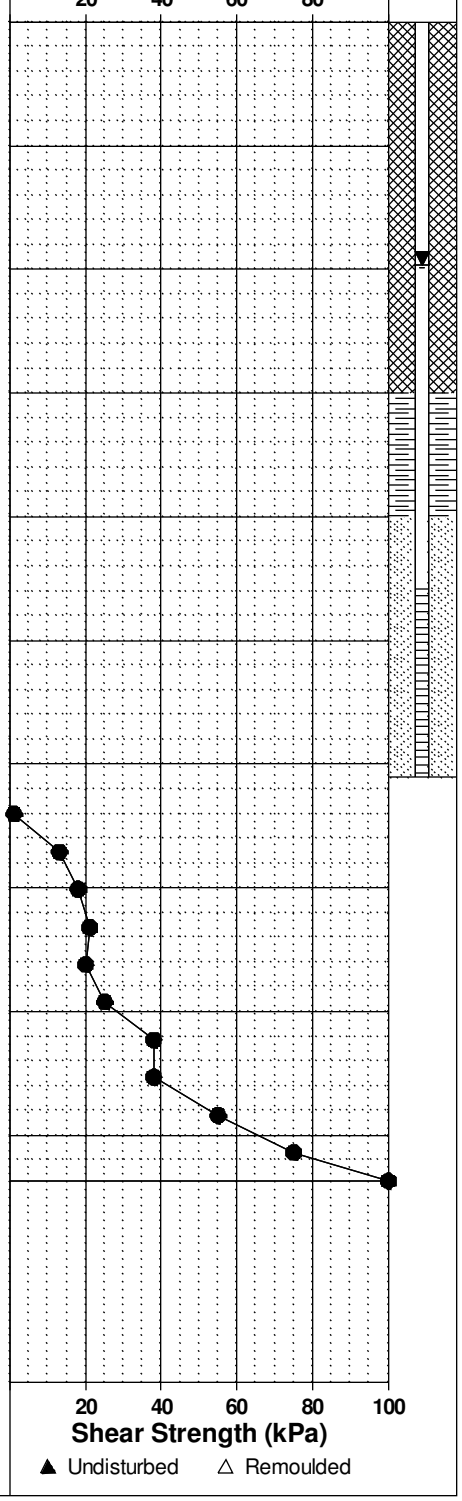
FILE NO. PG3298

REMARKS

HOLE NO. BH12

BORINGS BY CME 55 Power Auger **DATE** August 1, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.60
FILL: Brown silty sand with gravel		AU	1				
		SS	2	42	12	1	67.60
1.37							
Loose to compact, brown **SILTY SAND,** trace clay		SS	3	83	7	2	66.60
		SS	4	42	14		
3.35						3	65.60
		SS	5	83	4		
Loose, black **SAND,** trace silt							
3.81							
		SS	6	42	5	4	64.60
GLACIAL TILL: Grey silt, gravel, sand, shale fragments and cobbles, trace clay		SS	7	17	11	5	63.60
		SS	8	50	2		
6.10						6	62.60
Dynamic Cone Penetration Test commenced at 6.10m depth.							
Inferred **GLACIAL TILL**						7	61.60
						8	60.60
						9	59.60
9.37							
End of Borehole							
Practical DCPT refusal at 9.37m depth.							
(GWL @ 1.96m-August 7, 2014)							



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Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development, Ottawa Trainyards
Ottawa, Ontario

DATUM TBM - Top of manhole cover located at the intersection of Trainyards Drive and Terminal Avenue. Assumed geodetic elevation = 67.90m.

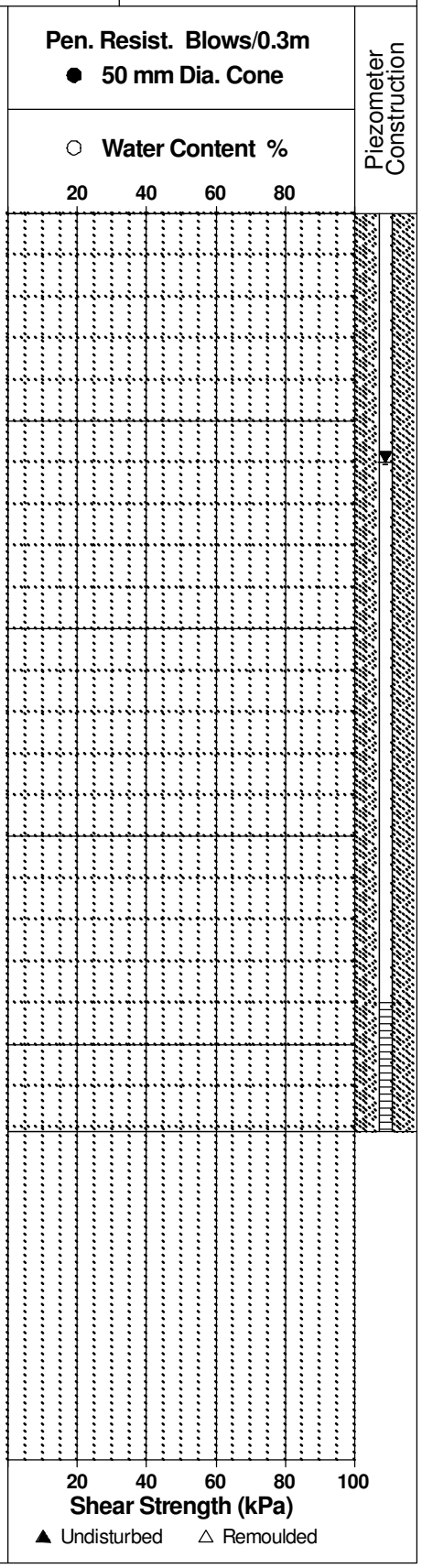
FILE NO. PG1663

REMARKS

HOLE NO. BH10

BORINGS BY CME 55 Power Auger **DATE** 13 May 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.90
FILL: Dark brown silty sand with gravel		AU	1				
0.30							
FILL: Brown silty sand							
0.90		SS	2	21	12	1	67.90
Brown **SILTY CLAY** with sand seams		SS	3	50	12		
2.13						2	66.90
Compact, grey-brown **SILTY SAND**, trace gravel		SS	4	50	9		
3.00						3	65.90
Compact, grey **SANDY SILT**		SS	5	67	13		
		SS	6	17	13	4	64.90
4.42							
End of Borehole							
(GWL @ 1.20m-May 27/08)							



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development, Ottawa Trainyards
Ottawa, Ontario

DATUM TBM - Top of manhole cover located at the intersection of Trainyards Drive and Terminal Avenue. Assumed geodetic elevation = 67.90m.

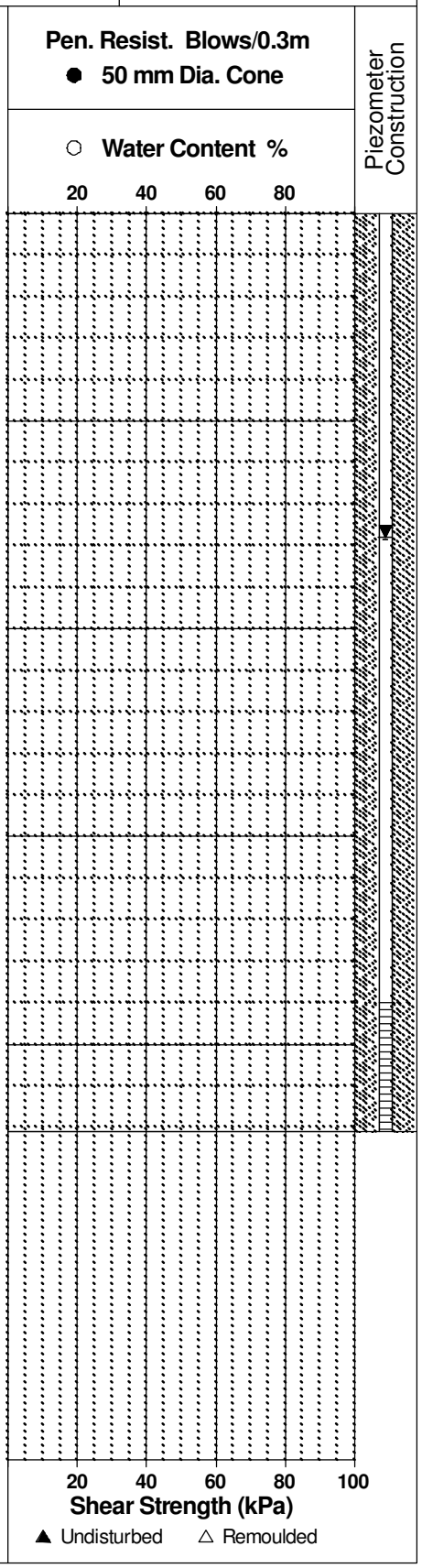
FILE NO. PG1663

REMARKS

HOLE NO. BH16

BORINGS BY CME 55 Power Auger **DATE** 20 May 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.83
FILL: Sand and gravel		AU	1				
0.46							
		SS	2	42	17	1	67.83
Compact to loose, brown **SILTY SAND**		SS	3	33	5	2	66.83
2.59		SS	4	50	15		
Compact, grey **SAND**						3	65.83
3.20		SS	5	58	40		
GLACIAL TILL: Dense to compact, grey sandy silt, trace clay and gravel		SS	6	42	22	4	64.83
4.42							
End of Borehole							
(GWL @ 1.56m-May 27/08)							



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development, Ottawa Trainyards
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hydraulic Shovel **DATE** 21 August 2008

FILE NO. PG1663

HOLE NO. TP10

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			
FILL: Topsoil, trace sand and clay		G	1			1			
		G	2			2			
		G	3						
3.20						3			
FILL: Grey-blue silty sand, trace crushed stone and concrete		G	4						
4.20		G	5			4			
End of Test Pit									

Water Content % scale: 20 40 60 80

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

▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development, Ottawa Trainyards
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hydraulic Shovel **DATE** 21 August 2008

FILE NO. PG1663

HOLE NO. TP19

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
FILL: Brown silty sand with clay		G	1				
0.60							
Asphaltic concrete 0.70							
FILL: Brown silty sand with crushed stone		G	2				
1.00						1	
FILL: Brown silty sand with gravel and cobbles		G	3				
1.60							
FILL: Dark brown silty clay with sand, trace gravel		G	4				
2.30						2	
Brown **SILTY CLAY**, trace sand							
2.60							
End of Test Pit							

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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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development, Ottawa Trainyards
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hydraulic Shovel **DATE** 21 August 2008

FILE NO. PG1663

HOLE NO. TP20

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
FILL: Brown silty sand with gravel		G	1				
0.50							
Asphaltic concrete 0.60							
FILL: Brown silty sand with crushed stone		G	2				
0.90							
FILL: Brown silty sand with gravel and cobbles						1	
1.50							
FILL: Brown silty sand, trace clay, gravel, asphalt and organic matter		G	3				
2.00						2	
Blue to brown **SILTY SAND**		G	4				
2.20							
End of Test Pit							

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 Engineers and Geologists
28 Concourse Gate, Nepean, Ontario K2E 7T7

SOIL PROFILE & TEST DATA

Proposed Office / Warehouse Development
820 Belfast Road
Ottawa, Ontario

DATUM Geodetic Elevation

FILE NO. S5305

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger DATE 3 December 1990

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.99
Dark brown, silty fine sand TOPSOIL 0.25							
Loose, brown to greyish brown SAND with silty sand and sandy silt seams and layers		SS	1	88	7	1	67.99
		SS	2	96	5		
1.83						2	66.99
Loose to compact, grey SILT with clayey silt seams		SS	3	58	13		
		SS	4	75	5	3	65.99
3.43							
TILL: Stiff, dark grey clayey silt with some gravel 3.66							
End of Borehole							
(GWL @ 1.52 m - Dec. 7/90)							

Penetration Resistance Blows/.3m
50 mm Diameter Cone

○ Moisture Content %

20 40 60 80 100

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remolded

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SOIL PROFILE & TEST DATA

Proposed Office / Warehouse Development
820 Belfast Road
Ottawa, Ontario

DATUM Geodetic Elevation

FILE NO. S5305

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger DATE 3 December 1990

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.14
Loose, brown, silty sand TOPSOIL							
0.46							
Compact, brown SAND with silty sand and sandy silt seams and layers		SS	5	75	12	1	68.14
		SS	6	100	5		
1.80							
Loose to stiff, grey CLAYEY SILT with silt seams and a trace of gravel		SS	7	96	3	2	67.14
		SS	8	54	5	3	66.14
3.66							
End of Borehole							
(Standpipe blocked - Dec. 7/90)							

Penetration Resistance Blows/.3m
50 mm Diameter Cone

Moisture Content %

20 40 60 80 100

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remolded

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SOIL PROFILE & TEST DATA

Proposed Office / Warehouse Development
820 Belfast Road
Ottawa, Ontario

DATUM Geodetic Elevation

FILE NO. **S5305**

REMARKS

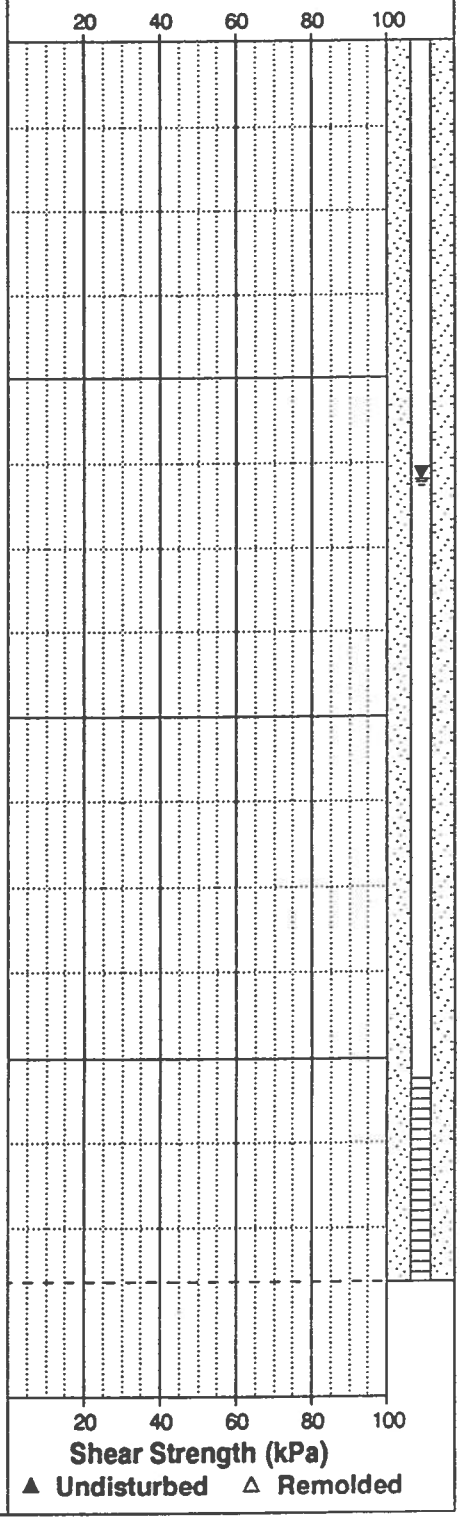
HOLE NO. **BH 3**

BORINGS BY CME 55 Power Auger DATE 3 December 1990

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.71
Dark brown, silty sand TOPSOIL		G	9				
0.60							
Loose, brown **SAND** with some silt and silty sand and sandy silt seams		SS	10	92	10	1	67.71
		SS	11	67	2	2	66.71
2.20							
Loose, grey to greyish brown **SAND** with silt seams		SS	12	71	7	3	65.71
		SS	13	71	6		
3.66							
End of Borehole							
(GWL @ 1.30 m - Dec. 7/90)							

Penetration Resistance Blows/.3m
50 mm Diameter Cone

Moisture Content %



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SOIL PROFILE & TEST DATA

Proposed Office / Warehouse Development
820 Belfast Road
Ottawa, Ontario

DATUM Geodetic Elevation

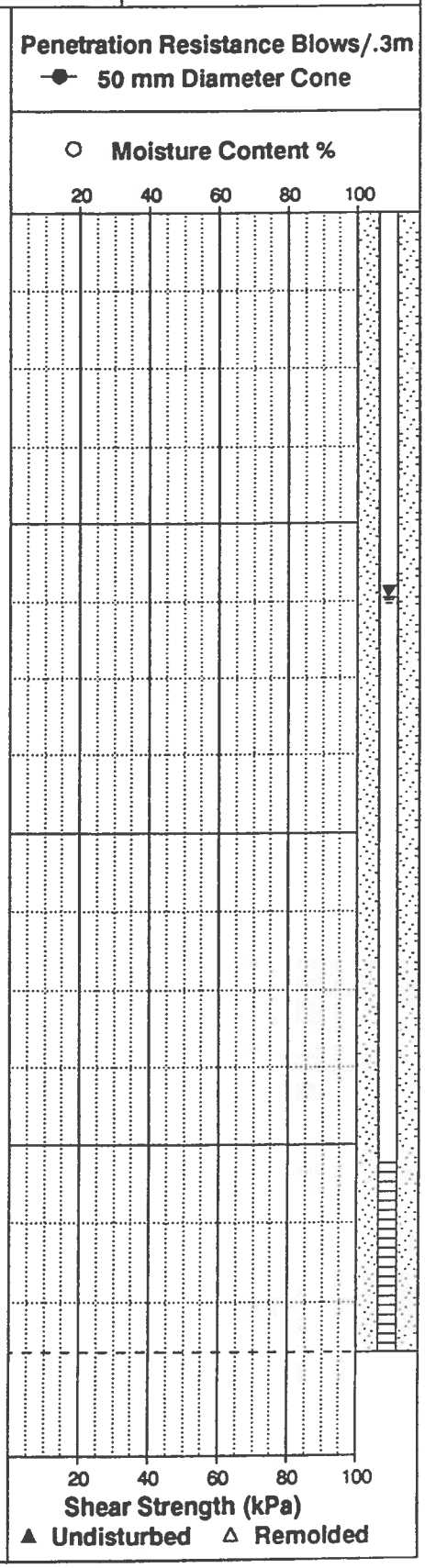
FILE NO. **S5305**

REMARKS

HOLE NO. **BH 4**

BORINGS BY CME 55 Power Auger DATE 3 December 1990

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.85
FILL: Loose, dark grey, sand with some gravel							
0.60							
FILL: Greyish brown clayey sandy silt		SS	14	58	6		
0.84						1	67.85
Loose, greyish brown **SANDY SILT** with some clay							
1.45		SS	15	92	5		
Loose, greyish brown **SAND** with sandy silt and clayey silt seams							
1.85						2	66.85
Loose, grey **SILT** with silty clay seams		TW	16	100			
2.40		SS	17	42	9		
TILL: Stiff, grey clayey silt with some sand and gravel						3	65.85
		SS	18	58	10		
Loose, grey **SILTY SAND**							
3.66							
End of Borehole							
(GWL @ 1.24 m - Dec. 7/90)							



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SOIL PROFILE & TEST DATA

Proposed Office / Warehouse Development
820 Belfast Road
Ottawa, Ontario

DATUM Geodetic Elevation

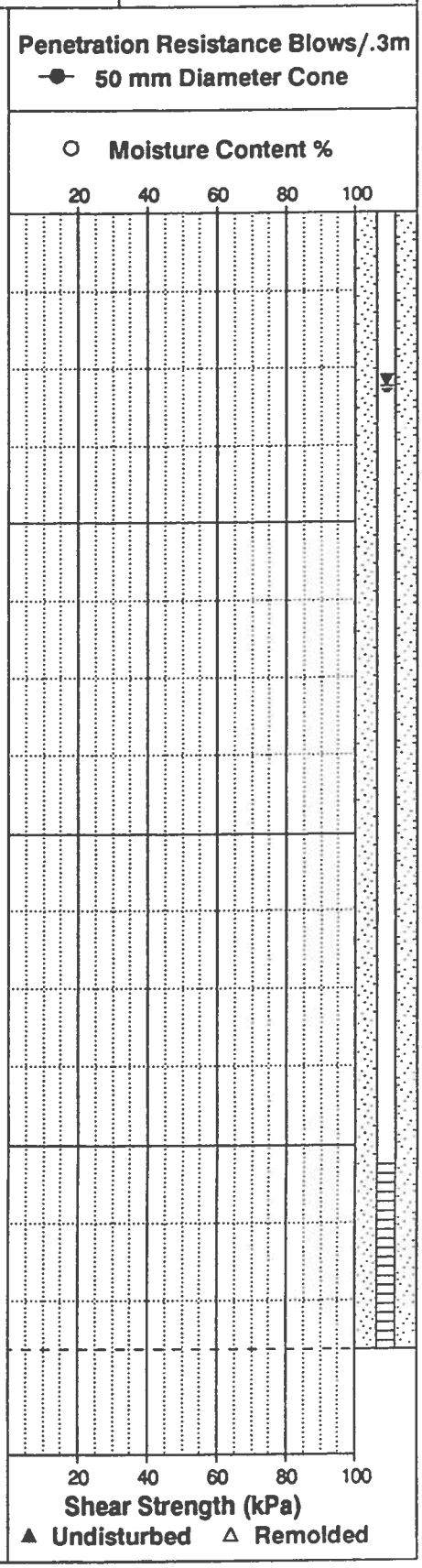
FILE NO. **S5305**

REMARKS

HOLE NO. **BH 5**

BORINGS BY CME 55 Power Auger DATE 3 December 1990

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.49
Dark brown, silty sand TOPSOIL 0.18							
Compact, brown **SAND**		SS	19	46	10	1	67.49
1.58		SS	20	71	14		
Stiff to compact, grey **CLAYEY SILT/SILT** with silty clay seams						2	66.49
2.20		SS	21	50	10		
TILL: Loose, grey clayey silt with some sand and gravel						3	65.49
		SS	22	79	4		
3.66							
End of Borehole							
(GWL @ 0.56 m - Dec. 7/90)							



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DATUM Geodetic Elevation

FILE NO. **S5305**

REMARKS

HOLE NO. **BH 6**

BORINGS BY CME 55 Power Auger DATE 4 December 1990

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.18
Dark brown, silty fine sand **TOPSOIL**							
0.46		G	24				
Loose, light brown **SILTY FINE SAND**							
0.76		SS	25	67	10	1	68.18
		SS	26	83	7		
Loose, brown **SAND** with silty sand and sandy silt seams						2	67.18
		SS	27	92	5		
		SS	28	100		3	66.18
3.25							
TILL: Compact to dense, dark grey clayey silt with some sand and gravel							
3.45							
End of Borehole							
(Auger refusal on inferred bedrock)							
(GWL @ 1.60 m - Dec. 7/90)							

Penetration Resistance Blows/.3m
50 mm Diameter Cone

Moisture Content %

20 40 60 80 100

20 40 60 80 100

Shear Strength (kPa)
▲ Undisturbed △ Remolded

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DATUM Geodetic Elevation

FILE NO. **S5305**

REMARKS

HOLE NO. **BH 7**

BORINGS BY CME 55 Power Auger

DATE 4 December 1990

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.07
Loose, dark brown **SILTY SAND** with some gravel and organics		G	29				
0.60							
Compact, brown **SILTY SAND** with clayey silt seams		SS	30	71	11	1	68.07
1.50							
Loose to compact, brown to greyish brown **SAND** with sandy silt and clayey silt seams and layers		SS	31	92	5	2	67.07
		SS	32	92	10		
3.10						3	66.07
Firm, grey **CLAYEY SILT** with silty sand seams		SS	33	100	8		
3.50							
TILL: Loose, grey silty sand with some gravel							
3.66							
End of Borehole							
(GWL @ 1.45 m - Dec 7/90)							

Penetration Resistance Blows/.3m
50 mm Diameter Cone

Moisture Content %

20 40 60 80 100

20 40 60 80 100

Shear Strength (kPa)

▲ **Undisturbed** △ **Remolded**

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SOIL PROFILE & TEST DATA

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Ottawa, Ontario

DATUM Geodetic Elevation

FILE NO. **S5305**

REMARKS

HOLE NO. **BH 8**

BORINGS BY CME 55 Power Auger

DATE 4 December 1990

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.40
Dark brown, silty **TOPSOIL** 0.08		G	34				
Loose, dark brown **SILTY SAND** with some organics 0.76		SS	35	100	4	1	67.40
Very stiff, brownish grey to olive grey **CLAYEY SILT** with some sand		SS	36	100	4		
2.13						2	66.40
End of Borehole							
(GWL @ 0.73 m - Dec. 7/90)							

Penetration Resistance Blows/.3m
50 mm Diameter Cone

Moisture Content %

20 40 60 80 100

20 40 60 80 100

Shear Strength (kPa)

▲ **Undisturbed** △ **Remolded**

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Ottawa, Ontario

DATUM Geodetic Elevation

FILE NO. **S5305**

REMARKS

HOLE NO. **BH 9**

BORINGS BY CME 55 Power Auger

DATE 4 December 1990

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.19
Dark brown, silty sand TOPSOIL — 0.08							
Dark brown SILTY SAND with some organics — 0.60							
Stiff, olive grey CLAYEY SILT with some gravel		SS	37	100	7	1	67.19
1.37							
End of Borehole							
(No groundwater level reading was taken in this borehole.)							

Penetration Resistance Blows/.3m
50 mm Diameter Cone

Moisture Content %

20 40 60 80 100

20 40 60 80 100

Shear Strength (kPa)
▲ Undisturbed △ Remolded

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SOIL PROFILE & TEST DATA

Proposed Office / Warehouse Development
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Ottawa, Ontario

DATUM Geodetic Elevation

FILE NO. **S5305**

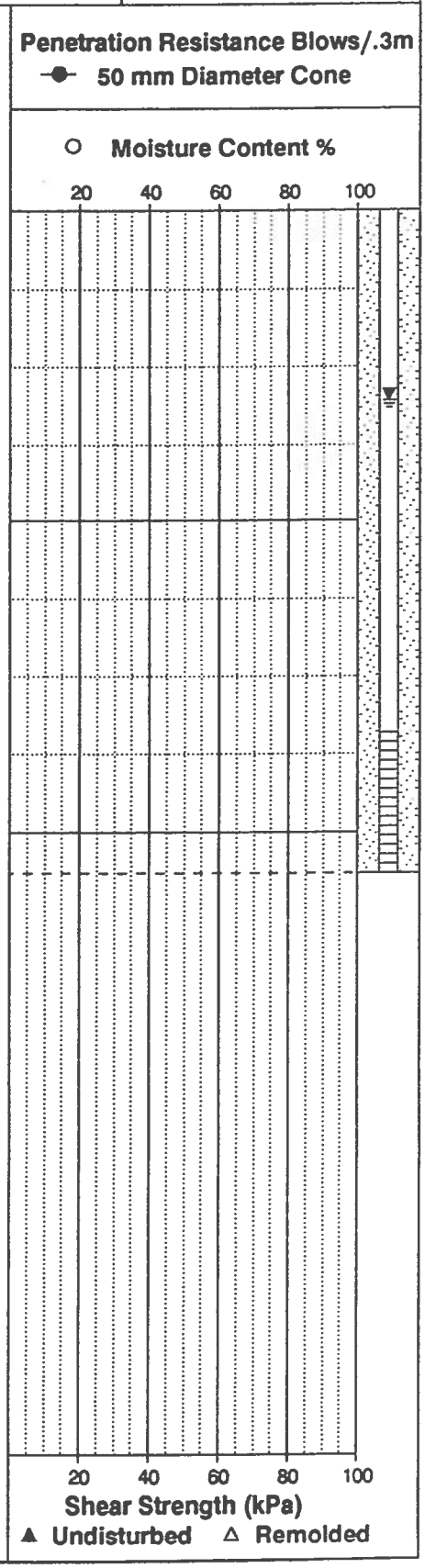
REMARKS

HOLE NO. **BH10**

BORINGS BY CME 55 Power Auger

DATE 4 December 1990

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.54
Dark brown silty sand **TOPSOIL**							
0.45							
Loose, brown **SILTY SAND** with some silt and clay		SS	38	71	6	1	67.54
1.62		SS	39	83	20		
Compact, grey **SILT** with clayey silt seams						2	66.54
2.13							
End of Borehole							
(GWL @ 0.61 m - Dec. 7/90)							



SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

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

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

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

CONSOLIDATION TEST

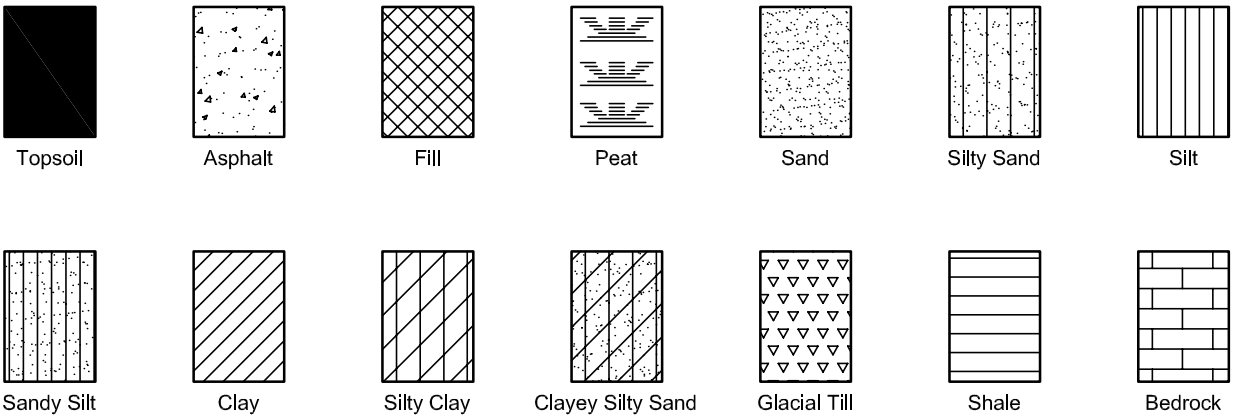
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

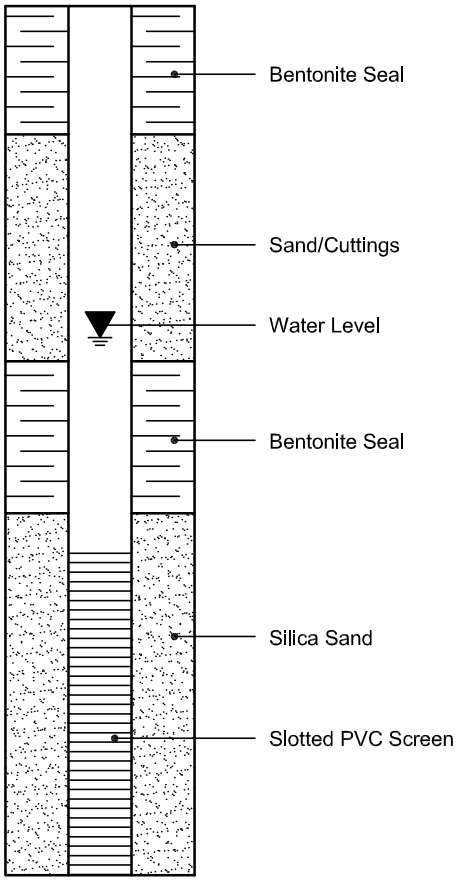
SYMBOLS AND TERMS (continued)

STRATA PLOT

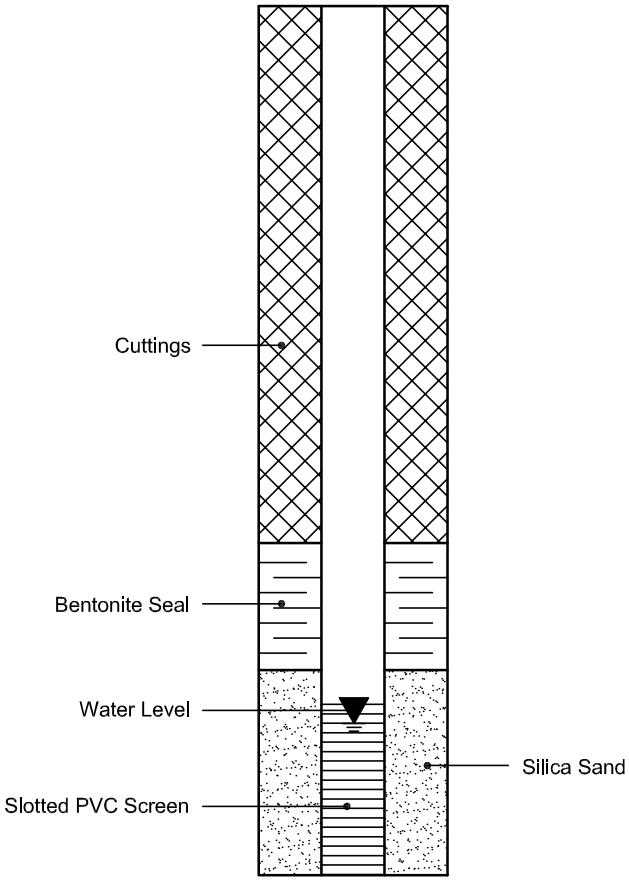


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis

Report Date: 14-Aug-2014
Order Date:8-Aug-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16400

Project Description: PG3298

	Client ID:	BH6-SS5	-	-	-
	Sample Date:	01-Aug-14	-	-	-
	Sample ID:	1432257-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	94.2	-	-	-
General Inorganics					
pH	0.05 pH Units	7.86	-	-	-
Resistivity	0.10 Ohm.m	21.7	-	-	-
Anions					
Chloride	5 ug/g dry	66	-	-	-
Sulphate	5 ug/g dry	272	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG3298-2 - TEST HOLE LOCATION PLAN

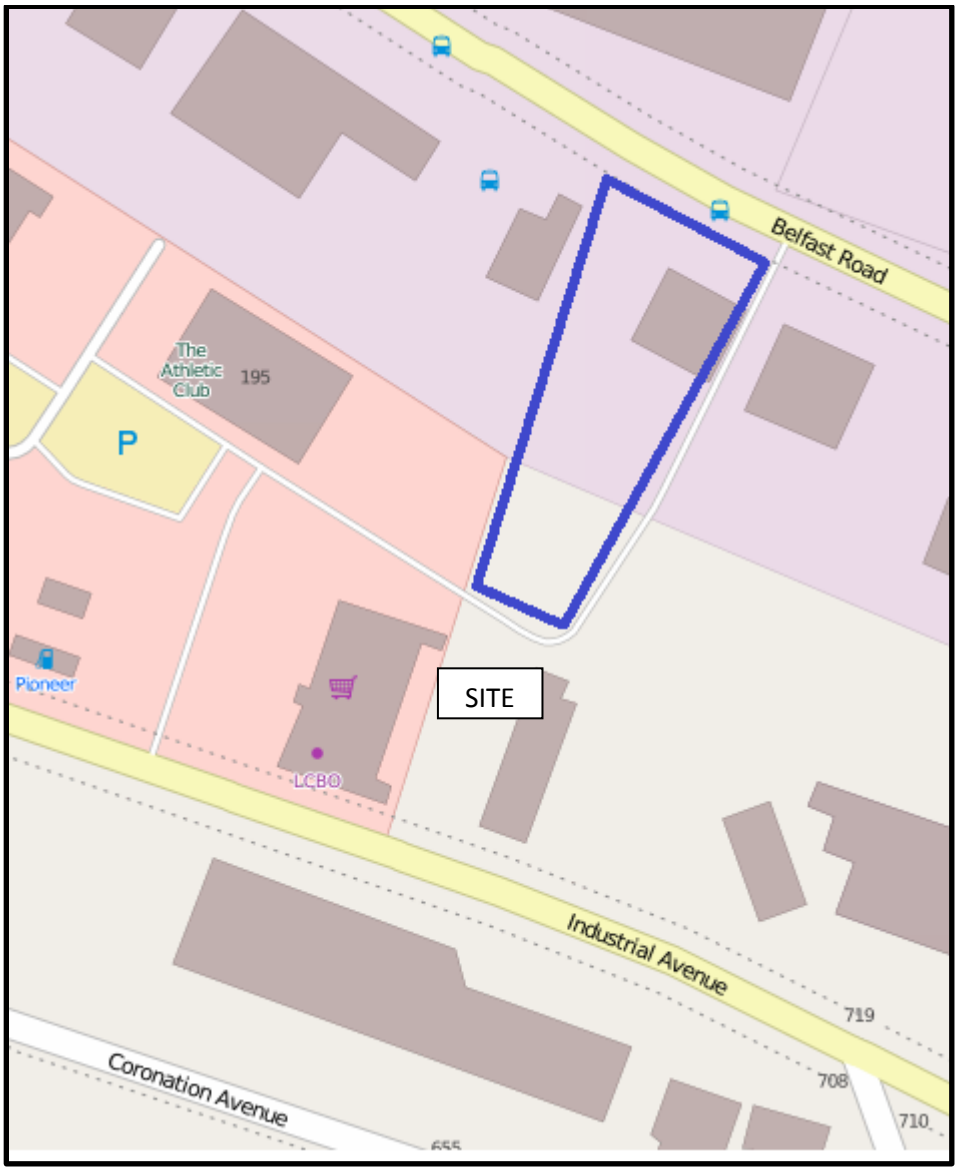
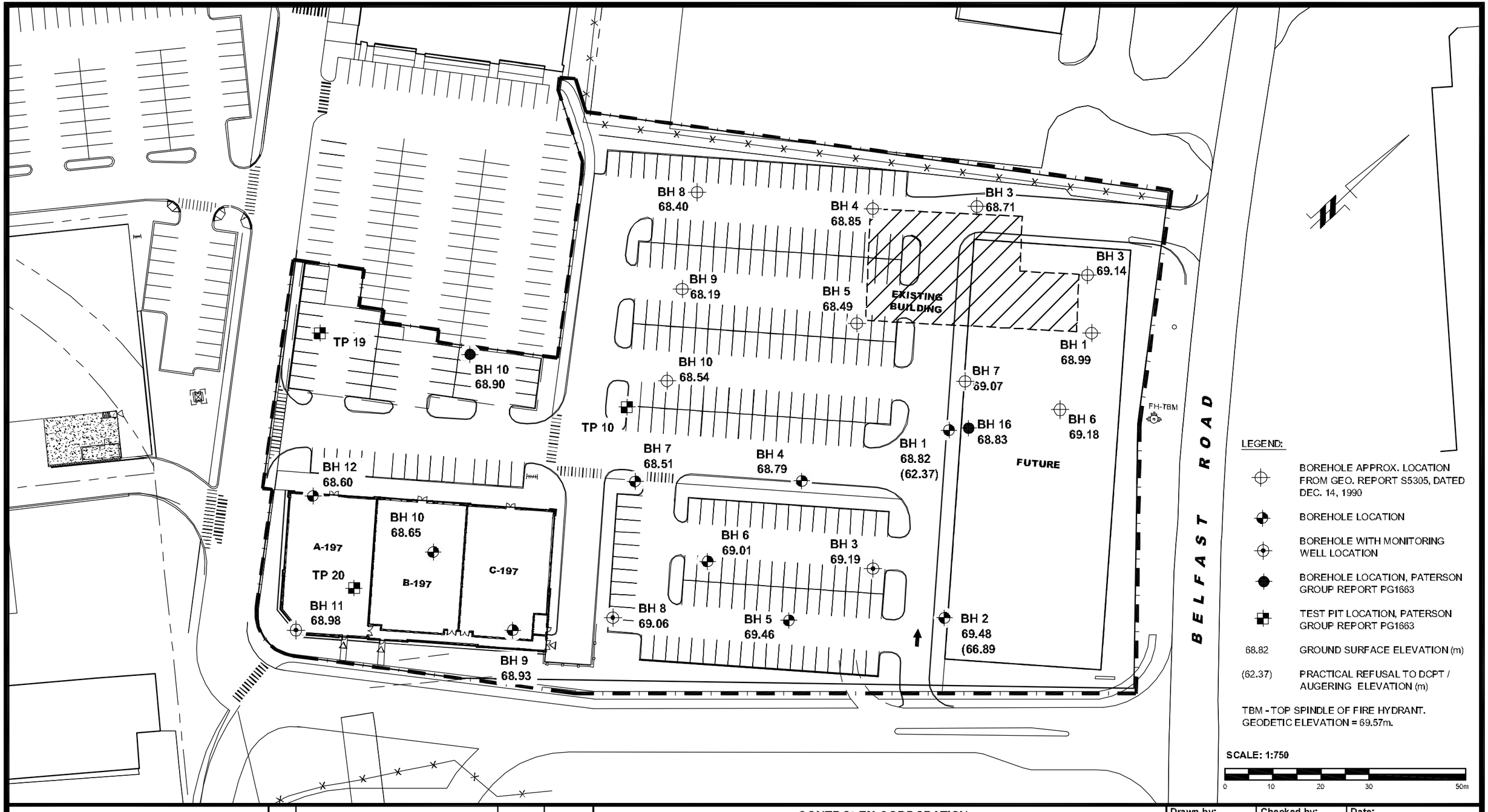


FIGURE 1

KEY PLAN

patersongroup



LEGEND:

- BOREHOLE APPROX. LOCATION FROM GEO. REPORT S5305, DATED DEC. 14, 1990
- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION, PATERSON GROUP REPORT PG1663
- TEST PIT LOCATION, PATERSON GROUP REPORT PG1663
- 68.82 GROUND SURFACE ELEVATION (m)
- (62.37) PRACTICAL REFUSAL TO DCPT / AUGERING ELEVATION (m)

TBM - TOP SPINDLE OF FIRE HYDRANT.
GEODETIC ELEVATION = 69.57m.

SCALE: 1:750

0 10 20 30 50m

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consulting engineers

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NO.	REVISIONS	DATE	INITIAL

CONTROLEX CORPORATION

GEOTECHNICAL INVESTIGATION
PROP. COMMERCIAL DEVELOPMENT - 197 TRAINYARDS DRIVE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Drawn by:	Checked by:	Date:
MPG	DJG	10/2014
Scale: 1:750		Drawing No.: PG3298-2
Report No.: PG3298-2		

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