PATERSON GROUP

Geotechnical Investigation

Proposed Office Building Addition

415 West Hunt Club Road
Ottawa, Ontario

Prepared for Costco Wholesale Corporation

Report PG6623-1 dated May 11, 2023

Table of Contents

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Costco Wholesale Corporation to conduct a geotechnical investigation for the proposed office building addition to be located at 415 West Hunt Club Road in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2 of this report for the general site location).

The objectives of the geotechnical investigation were to:

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

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

2.0 Proposed Development

Based on the available drawings, the proposed development will consist of a two-storey office building with an approximate footprint of 2,200 m^2 and a slab-on-grade, which will be built as an addition to the existing office building located at the site.

The proposed development will require a portion of the existing parking areas to be demolished in order to accommodate the building addition. It is also anticipated that the proposed office building addition will be serviced by municipal services.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on May 3, 2023, and consisted of a total of 3 boreholes which were advanced to a maximum depth of 7.5 m below the existing surface. Previous geotechnical investigations were completed by others prior to construction of the existing office building, and consisted of 25 boreholes advanced to a maximum depth of 18.1 m, including bedrock coring. The borehole locations are determined by Paterson in a manner to provide general coverage of the subject site taking consideration site features and underground services. The locations of the boreholes are shown on Drawing PG6623-1 - Test Hole Location Plan included in Appendix 2.

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

Sampling and In-Situ Testing

Soil samples were recovered from the boreholes using two different techniques, namely, sampled directly from the auger flights (AU) or collected using a 50 mm diameter split-spoon (SS) sampler. All samples were visually inspected and initially classified on site. The auger and split-spoon samples were placed in sealed plastic bags. All samples were transported to our laboratory for further examination and classification. The depths at which the auger and split spoon samples were recovered from the boreholes are shown as AU and SS, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

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

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

Groundwater

Groundwater monitoring wells were installed in all boreholes to permit monitoring of the groundwater levels subsequent to the completion of the field program. The measured groundwater levels are presented and discussed in Section 4.3, and are also provided on the Soil Profile and Test Data sheets in Appendix 1.

All monitoring wells should be decommissioned in accordance with Ontario Regulations O.Reb 903 by a qualified licensed well technician prior to construction.

3.2 Field Survey

The borehole locations were selected by Paterson to provide general coverage of the proposed development, taking into consideration the existing site features, and underground utilities. The location, and ground surface elevation at each borehole location, were surveyed by Paterson using a handheld GPS unit, and referenced to a geodetic datum. The borehole locations, and ground surface elevation at each borehole location, are presented on Drawing PG6623-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were collected from the current investigation and visually examined in our laboratory to review the results of the field logging. Two (2) grain size analysis were completed by others on select soil samples as part of the previous investigations, and the results are presented in Appendix 1.

All samples from the current investigation will be stored in the laboratory for a period of one (1) month after issuance of this report. They will then be discarded unless we are otherwise directed.

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 by determining the concentration of sulphate and chloride, the resistivity, and the pH. The results are presented in Appendix 1 and are further discussed in Section 6.7.

4.0 Observations

4.1 Surface Conditions

The proposed office building addition is to be located immediately to the south of the existing office building, in an area which currently consists of an asphalt-paved parking lot with landscaped margins. Based on discussions with the client, it is understood that the existing office building is founded on end-bearing piles extending to the bedrock.

The subject site is bordered to the south by West Hunt Club Road, to the east by Roydon Place, to the north by the existing office building, and to the west by asphalt-paved parking areas.. The ground surface across the site is relatively level and at-grade with the surrounding roadways at an approximate geodetic elevation of 87.5 m.

Available aerial photography indicates that a tank farm was located in near vicinity to the proposed office building addition as recently as 1976. By 1991, the tank farm is no longer present, and earthworks are visible on the aerial photograph. It is understood from available reports that environmental site remediations have been conducted in the past at this site.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile at the subject site consists of a layer of asphaltic concrete which is underlain by a 600 mm to 700 mm thickness of fill, and subsequently by a compact to dense, brown silty sand deposit. However, previous boreholes by others, at the southern boundary of the existing office building, noted fill thicknesses up to approximately 3.5 m.

The fill was generally observed to consist of brown sand with gravel, crushed stone, and trace topsoil.

Underlying the fill layer, the silty sand deposit extended to the entire depth of the investigation, and was observed to consist of compact to dense brown silty sand. Some gravel content was observed at 6.6 m depth in borehole BH 1-23.

Bedrock

Practical refusal to augering/bedrock was encountered within the close proximity of the subject site by others during the previous investigations and ranged from 14.3 to 16.1 m depth. Where bedrock was cored, it was observed to consist of poor to excellent quality limesonte.

Reference should be made to the Soil Profile and Test Data Sheets in Appendix 1 for details of soil and bedrock profile encountered at each borehole location.

4.3 Groundwater

Groundwater levels were measured in the monitoring wells on May 8, 2023 and are summarized in Table 1 below.

Table 1 - Summary of Groundwater Level Readings

Test Hole Number	Ground Surface Elevation (m)	Groundwater Level (m)	Groundwater Elevation (m)	Recording Date
BH1-23	87.66	4.96	82.70	May 8, 2023
BH2-23	87.58	4.92	82.66	May 8, 2023
BH3-23	87.54	5.01	82.53	May 8, 2023

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

The groundwater table can also be estimated based on the observed colour, moisture content and consistency of the recovered samples. Based on the measured groundwater levels and the aforementioned observations, the long-term groundwater are expected be between about 5 to 6 m below ground surface.

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

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed building addition. It is recommended that the proposed building addition be founded on conventional spread footings placed on an undisturbed, compact to dense silty sand bearing surface.

Based on the borehole logs completed by others, up to 3.5 m of existing fill may be present near the boundary with the existing office building. Should fill be encountered at the underside of footing elevation, it should be sub-excavated to the surface of the undisturbed, compact to dense silty sand bearing surface. Engineered fill or lean concrete can then be placed from the compact to dense silty sand bearing surface, up to the underside of footing (USF) elevation, to support the footings.

Where sub-excavation extends below the foundations of the existing office building, it may need to be done in stages in order to maintain lateral support of the existing foundations.

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

5.2 Site Grading and Preparation

Stripping Depth and Preparation

Topsoil, asphalt, and deleterious fill should be stripped from under any buildings and other settlement sensitive structures.

Based on the fill observed within the boreholes, it is anticipated that the existing fill within the proposed building addition footprint, free of deleterious material and significant amounts of organics, can be left in place below the proposed building slab-on-grade, outside of the lateral support zones for the footings.

It is recommended that the existing fill layer be proof-rolled with several passes of a vibratory drum roller, under dry conditions and above freezing temperatures, and which is approved by Paterson personnel 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

Engineered fill placed for grading beneath the proposed building addition, where required, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery. The fill should be placed in maximum 300 mm thick loose lifts and compacted by suitable compaction equipment. Fill placed beneath the building addition should be compacted to a minimum 98% of the 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.

Lean Concrete Filled Trenches

As discussed above, where the undisturbed, compact to dense silty sand bearing surface is encountered below the USF elevation, lean concrete could be used to reinstate grades for footing support. Zero-entry vertical trenches would be excavated to the undisturbed, compact to dense silty sand bearing surface, and backfilled with lean concrete (minimum 17 MPa 28-day compressive strength) to the founding elevation. Typically, the excavation side walls will be used as the form to support the concrete. The trench excavation should be at least 150 mm wider than all sides of the footing at the base of excavation. The additional width of the concrete poured against an undisturbed trench sidewall will suffice in providing a direct transfer of the footing load to the underlying bearing surface. Once the trench excavation is approved by the geotechnical engineer, lean concrete can be poured up to the proposed founding elevation.

5.3 Foundation Design

Bearing Resistance Values

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, founded on an undisturbed, compact to dense silty sand 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 factor of 0.5.

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 given for footings will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to an undisturbed, compact to dense silty sand above the groundwater table when a plane extending horizontally and vertically from the footing perimeter at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

5.4 Design for Earthquakes

Based on the subsurface profile encountered across the subject site, the site class for seismic site response can be taken as **Class D** according to in Table 4.1.8.4.A of the Ontario Building Code (OBC) 2012. Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest version of the OBC 2012 for a full discussion of the earthquake design requirements.

5.5 Slab-on-Grade Construction

With the removal of all topsoil and deleterious fill, the existing fill or native soil subgrade approved by the geotechnical consultant at the time of excavation will be considered an acceptable subgrade on which to commence backfilling for floor slab construction.

It is recommended that the slab-on-grade subgrade be proof-rolled with a suitably sized vibratory drum roller making several passes, under dry conditions, prior to sub-slab fill placement. Any poor performing areas should be removed and replaced with an engineered fill, such as OPSS Granular B Type II.

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

5.6 Pavement Design

Car only parking areas and access lanes may be expected along with the proposed building addition. 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 – OPSS Granular B Type I or II material placed over in-situ soil or engineered fill	

Table 3 - Recommended Pavement Structure – Access Lanes and Heavy Loading 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 – OPSS Granular B Type I or II material placed over in-situ soil or engineered fill	

Other Considerations

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

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

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

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is understood that the proposed structure will not contain below-grade space, therefore, a perimeter foundation drainage system is not considered to be required. However, should the proposed structure contain occupied below-grade space, it is recommended that a perimeter foundation drainage system be provided for the below-grade areas. The system, where required, should consist of a 150 mm diameter perforated and corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, which is placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free draining, non-frost susceptible granular materials. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, can be used for this purpose.

Excavated on-site fill and/or silty sand could also be re-used for backfilling the exterior sides of the foundation walls. However, this material would need to be maintained in an unfrozen state and at a suitable moisture content for compaction if it is to be re-used on-site.

6.2 Protection of Footings Against Frost Action

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

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

6.3 Excavation Side Slopes

Excavation Side Slopes

The side slopes of excavations in the overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is anticipated 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, such as 3H:1V.

The subsurface soil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

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

It is recommended that a trench box is used to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

6.4 Pipe Bedding and Backfill

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

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

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

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

6.5 Groundwater Control

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

Permit to Take Water

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

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Persons as stipulated under O.Reg. 63/16.

If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

Impacts on Neighboring Structures

Based on the observed existing groundwater level and depths of shallow foundations, it is not anticipated that the proposed construction will extend below

the groundwater level. Therefore, no adverse effects from short-term or long-term dewatering are expected for surrounding structures.

6.6 Winter Construction

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

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

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

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. The results are indicative that Type 10 Portland 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 in indicative of an aggressive to very aggressive corrosive environment.

7.0 Recommendations

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

- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

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

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

8.0 Statement of Limitations

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

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

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

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Costco Wholesale Corporation, or their agents, is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.

Sok Kim

Scott S. Dennis, P.Eng.

Report Distribution:

- ❑ Costco Wholesale Corporation (email copy)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LOG OF BOREHOLE BY OTHERS

GRAIN SIZE ANALYSIS BY OTHERS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Office Expansion - 415 Hunt Club Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** May 3, 2023

FILE NO. PG6623

HOLE NO. BH 1-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.66
Asphaltic concrete 0.05							
FILL: Brown silty sand with gravel and crushed stone, trace asphalt fragments 0.76		AU	1				
		SS	2	75	24	1	86.66
		SS	3	100	34	2	85.66
Dense to compact, brown **SILTY SAND**		SS	4	83	36	3	84.66
		SS	5	100	29		
- compact by 3.7m depth		SS	6	75	14	4	83.66
		SS	7	83	14	5	82.66
		SS	8	83	11		
- some gravel by 6.6m depth		SS	9	83	11	6	81.66
6.71							
End of Borehole							
(GWL @ 4.96m - May 8, 2023)							

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

Monitoring Well Construction

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Office Expansion - 415 Hunt Club Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** May 3, 2023

FILE NO. PG6623

HOLE NO. BH 2-23

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	87.58		
Asphaltic concrete 0.05									
FILL: Brown silty sand with gravel and crushed stone, trace asphalt fragments 0.69		AU	1						
		SS	2	83	10	1	86.58		
		SS	3	83	11	2	85.58		
		SS	4	92	14				
		SS	5	100	12	3	84.58		
Compact, brown **SILTY SAND**									
		SS	6	71	20	4	83.58		
		SS	7	83	19	5	82.58		
		SS	8	92	24				
		SS	9	75	26	6	81.58		
6.71 End of Borehole									
(GWL @ 4.92m - May 8, 2023)									

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

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Office Expansion - 415 Hunt Club Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** May 3, 2023

FILE NO. PG6623

HOLE NO. BH 3-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.54
Asphaltic concrete 0.05							
FILL: Brown silty sand with gravel and crushed stone, trace topsoil 0.60		AU	1				
		SS	2	100	10	1	86.54
		SS	3	100	25	2	85.54
Compact to dense, brown **SILTY SAND**		SS	4	100	30	3	84.54
		SS	5	100	35		
		SS	6	100	38	4	83.54
		SS	7	83	48	5	82.54
- compact to very loose by 5.1m depth		SS	8	83	30		
		SS	9	50	2	6	81.54
7.52							
End of Borehole							
(GWL @ 5.01m - May 8, 2023)							

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

Monitoring Well Construction

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

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, 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. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	'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 shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

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, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

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 NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, 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, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water 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 at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2 / (D10 \times D60)$
Cu	-	Uniformity coefficient = D60 / D10

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

CONSOLIDATION TEST

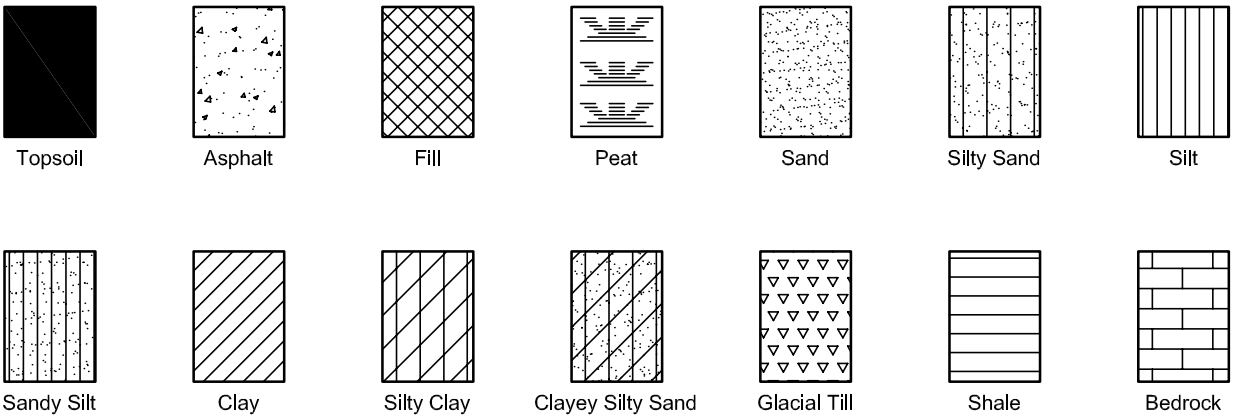
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

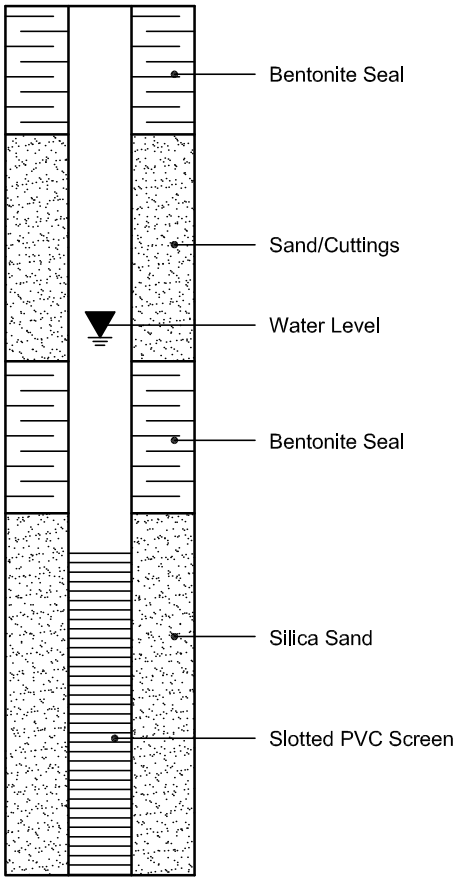
SYMBOLS AND TERMS (continued)

STRATA PLOT

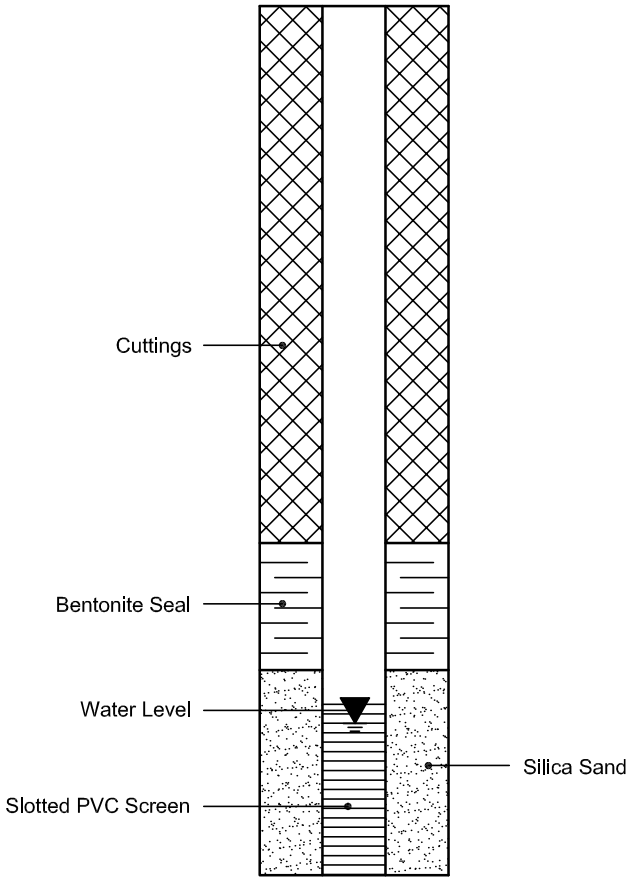


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Log of Borehole 1

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢——
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ▩ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project *Geotechnical Investigation. Proposed* Dwg. No. *2*

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. *MA14531A*

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
		FILL Silty sand with trace gravel, frozen in the upper 0.3m depth, brown to dark brown, moist (compact) Hydrocarbon odour	88.0	0
		SAND Fine to medium, sandy silt seams, light grey, moist to wet (compact)	84.2	4
		Terminated @ 6.1m Depth	81.9	6

N Value — Shear Strength: 20 40 60 80

Natural Moisture Content and Atterberg Limits % Dry Weight: 10 20 30

Natural Unit Weight KN/m³

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 8, 2001 using a CME-55 truck mounted drill rig to a termination depth at 6.1m.
3. A 19mm slotted standpipe was installed in the borehole
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Comple	dry to	5.3
-tion	5.3	
5days	dry	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 1A

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ×
Dynamic Cone Test —— Plastic & Liquid Limit ⊢—
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ⊠ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Additional Geotechnical Investigation. Dwg. No. 2

Proposed Costco Regional Office. Hunt Club Road and Roydon

Place. City of Ottawa, Ontario Project No. MA14531B

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
		FILL Silty sand with trace gravel, frozen in the upper 0.3m depth, brown to dark brown, moist (compact) Hydrocarbon odour	88.0	0
		SAND Fine to medium, sandy silt seams, light grey, moist to wet (compact)	84.2	4
		SAND AND GRAVEL TILL Some silt, grey, wet (compact)	74.0	14
		WEATHERED BEDROCK	73.8	
		LIMESTONE BEDROCK Dolomitic veins, grey (good quality)	73.6	
		Terminated @ 16.4m Depth	71.6	16

N Value — Shear Strength: 20 40 60 80

Natural Moisture Content and Atterberg Limits % Dry Weight: 10 20 30

Natural Unit Weight KN/m³

Run 1

Run 2

NOTES

1. Borehole No. 1A is located 3.8m south and 7.0m east of Borehole No. 1.
2. Borehole was augered without sampling from ground surface to 6.1m

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on March 1, 2001 using a CME-55 truck mounted drill to a a termination depth at 16.4m.
3. Borehole backfilled upov completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531B

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	14.4-14.5	100	0
2	14.5-16.4	100	87
3			
4			

Notes: Borehole core drileld from 14.4m to 16.4m depth.

Log of Borehole 2

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢——
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ⊠ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project *Geotechnical Investigation. Proposed* Dwg. No. *3*

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. *MA14531A*

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
		FILL Silty sand with trace to some gravel, light brown to dark grey moist (compact) Hydrocarbon odour and Staining	88.2	0
			85.3	3
		FILL Silty sand with rock fragments, cobbles and boulders, grey, moist		
			84.4	4
		SILTY SAND Fine to medium, sandy silt seams, brown to grey, moist (dense to compact)		
			81.5	6
		Terminated @ 6.7m Depth		

N Value — Shear Strength: 20 40 60 80

Natural Moisture Content and Atterberg Limits % Dry Weight: 10 20 30

Natural Unit Weight KN/m³

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 8, 2001 using a CME-55 truck mounted drill rig to a termination depth at 6.7m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Comple -tion	dry to 5.5	5.5

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 3

Trow

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Rock Core
Field Vane Test
Water Level: Est.: Measured: Perched:
Natural Moisture
Plastic & Liquid Limit
Undrained Triaxial at 0
Overburden Pressure 15 ⊕ 5
% Strain at Failure 10
Penetrometer

Project Geotechnical Investigation. Proposed Dwg. No. 4

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
		FILL Silty sand with trace to some gravel, brown to grey to dark brown, moist (compact) Hydrocarbon odour	88.0	0
		SAND Fine to medium, occasional silt seams, trace gravel, wet (dense)	83.4	5
		Terminated @ 6.7m Depth	81.3	6

N Value 20 40 60 80
Shear Strength

Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30

Natural Unit Weight KN/m³

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 8, 2001 using a CME-55 truck mounted drill rig to a termination depth at 6.7m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Comple -tion	dry to 5.8	5.8

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 4

Trow

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Rock Core
Field Vane Test S
Natural Moisture
Plastic & Liquid Limit
Undrained Triaxial at Overburden Pressure 15 % Strain at Failure 0 5 10
Penetrometer
Water Level: Est.: Measured: Perched:

Project Geotechnical Investigation. Proposed Dwg. No. 5

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth	N Value / Shear Strength (20 40 60 80)	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight KN/m³
		FILL Silty sand with trace to some gravel, brown to grey moist (compact) Hydrocarbon odour and Staining	87.9	0			
		FILL Rock fragments in silty sand matrix, grey, moist	85.0	3	100mm		
				4	50mm		
		SAND Medium to coarse, trace silt, brown to grey brown, moist to wet (dense)	82.7	5			
		Terminated @ 6.7m Depth	81.2	6			

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 8, 2001 using a CME-55 truck mounted drill rig to a termination depth at 6.7m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Comple -tion	dry to 5.9	5.9

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 5

Trow

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Rock Core
Field Vane Test
Water Level: Est.: Measured: Perched:
Natural Moisture
Plastic & Liquid Limit
Undrained Triaxial at 0
Overburden Pressure 15 ⊕ 5
% Strain at Failure 10
Penetrometer

Project Geotechnical Investigation. Proposed Dwg. No. 6

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
		FILL Silty sand with trace to some gravel, occasional rootlets, brown to dark grey, moist (dense to compact) Hydrocarbon odour	88.3	0
		SAND Fine to medium, occasional silt seams or partings, trace to some gravel, brown to grey, moist to wet (compact)	85.3	3
			81.9	6
		Terminated @ 6.7m Depth	81.6	

N Value / Shear Strength: 20 40 60 80

Natural Moisture Content and Atterberg Limits % Dry Weight: 10 20 30

Natural Unit Weight KN/m³

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 8, 2001 using a CME-55 truck mounted drill rig to a termination depth at 6.7m.
3. A 19mm slotted standpipe was installed in the borehole
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Comple	dry to	5.8
-tion	5.8	
5days	6.4	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 5A

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢—
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ⊠ Overburden Pressure 15 ⊕5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲

Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project *Additional Geotechnical Investigation.* Dwg. No. *3*

Proposed Costco Regional Office. Hunt Club Road and Roydon

Place. City of Ottawa, Ontario Project No. *MA14531B*

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth	N Value / Shear Strength (20 40 60 80)	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight KN/m³
		FILL Silty sand with trace to some gravel, occasional rootlets, brown to dark grey, moist (dense to compact) Hydrocarbon odour	88.3	0			
			85.3	2			
		SAND Fine to medium, occasional silt seams or partings, trace to some gravel, brown to grey, moist to wet (compact)		4			
				6			
				8			
				10			
				12			
			74.6	14			
		SAND AND GRAVEL Grey, very wet (compact)	73.1				
		LIMESTONE BEDROCK Some clay seams and shale seams, fractured (fair quality)		16			Run 1
			71.4				
		Terminated @ 16.9m depth					

Notes
1. Borehole 5A is located 3.2m west and 0.9m south of borehole No. 5.
2. Borehole augered without sampling from ground surface to 6.1m depth.

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on March 1 and 5, 2001 using a CME-55 truck mounted drill rig to a termination depth at 16.9m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531B

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	15.3-16.9	81	53
2			
3			
4			

Notes: Borehole core drileld from 15.2m to 16.9m depth.

Log of Borehole 6

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢——
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ⊠ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Geotechnical Investigation. Proposed Dwg. No. 7

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
		FILL Silty sand with trace to some gravel, brown to dark grey, moist (compact) Hydrocarbon odour	87.8	0
		SILTY SAND Dark grey to black, wet (compact) Hydrocarbon Odour	82.5	5
		SAND Fine to medium, trace gravel, silt seams, grey, wet (loose)	81.8	6
		Terminated @ 7.6m Depth	80.2	7

N Value 20 40 60 80
Shear Strength

Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30

Natural Unit Weight KN/m³

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 12, 2001 using a CME-55 truck mounted drill rig to a termination depth at 7.6m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 7

Trow

Auger Sample ☒
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —
Shelby Tube ●● ■ Plastic & Liquid Limit ⊢—
Rock Core ▩ Undrained Triaxial at 0
Field Vane Test + S Overburden Pressure 15 ⊕ 5
% Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Geotechnical Investigation. Proposed Dwg. No. 8

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth	N Value / Shear Strength (20 40 60 80)	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight KN/m³
		FILL Silty sand with trace to some gravel, some rock fragments or cobbles, some silty clay pockets, brown to grey, moist (compact to dense to loose) Hydrocarbon odour	88.1	0			
		SAND Fine to medium, grey to grey brown, wet (dense)	83.5	5			
		Terminated @ 6.0m Depth	82.1	6			

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 12, 2001 using a CME-55 truck mounted drill rig to a termination depth at 6.0m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 8

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢——
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ▩ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Geotechnical Investigation. Proposed Dwg. No. 9

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
		FILL Silty sand with some gravel, trace clay, brown to grey, moist to wet (compact to loose)	87.9	0
		Hydrocarbon odour		1
				2
				3
			84.1	4
		FILL Silty sand with rock fragments, some cobbles, grey, moist (compact)		
			83.2	5
		SAND Fine to medium, horizontally layered, some silt seams, brown to grey, wet (dense)		
			81.9	6
		Terminated @ 6.0m Depth		

N Value 20 40 60 80 — Shear Strength

Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30

Natural Unit Weight KN/m³

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 12, 2001 using a CME-55 truck mounted drill rig to a termination depth at 6.0m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 9

Trow

Auger Sample ☒
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢——
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ▩ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Geotechnical Investigation. Proposed Dwg. No. 10

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth	N Value / Shear Strength 20 40 60 80	Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30	Natural Unit Weight KN/m³
		FILL Silty sand with trace gravel, brown to grey, moist (compact)	87.7	0			
		Hydrocarbon odour		1			
				2			
			84.7	3			
		SAND Fine to medium, sandy silt seams, iron staining, brown to grey, moist to wet (compact to loose)		4			
				5			
			81.7	6			
		Terminated @ 6.0m Depth					

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 12, 2001 using a CME-55 truck mounted drill rig to a termination depth at 6.0m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	ROD %
1			
2			
3			
4			

Notes:

Log of Borehole 10

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢—⊣
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ▩ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲

Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Geotechnical Investigation. Proposed Dwg. No. 11

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
		FILL Silty sand with trace to some gravel, some rock fragments, some silty clay layers or pockets, brown to grey (compact)	88.1	0
				1
				2
				3
			84.5	
		FILL Silty sand with rock fragments, cobbles and boulders, brown, moist (compact)		4
			83.5	
		SAND Fine to medium, horizontally layered, brown, moist to wet (compact to dense)		5
			82.1	6
		Terminated @ 6.0m Depth		

N Value
20 40 60 80
Shear Strength

Natural Moisture Content and Atterberg Limits
% Dry Weight
10 20 30

Natural Unit Weight KN/m^3

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 12, 2001 using a CME-55 truck mounted drill rig to a termination depth at 6.0m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 11

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢—
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ▩ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Geotechnical Investigation. Proposed Dwg. No. 12

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth	N Value / Shear Strength (20 40 60 80)	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight KN/m³
		FILL Silty sand with some gravel, brown to grey (compact)	87.9	0			
				1			
			85.8	2			
		SAND Fine to medium, horizontally layered, brown to grey, moist to wet (compact to dense)		3			
				4			
				5			
			81.9	6			
		Terminated @ 6.0m Depth					

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 12, 2001 using a CME-55 truck mounted drill rig to a termination depth at 6.0m.
3. A 19mm slotted standpipe was installed in the borehole
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
1day	5.9	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 11A

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢—
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ▨ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲

Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Additional Geotechnical Investigation. Dwg. No. 4

Proposed Costco Regional Office. Hunt Club Road and Roydon

Place. City of Ottawa, Ontario Project No. MA14531B

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth	N Value / Shear Strength (20 40 60 80)	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight KN/m³
		FILL Silty sand with some gravel, brown to grey (compact)	87.9	0			
			85.8	2			
		SAND Fine to medium, horizontally layered, brown to grey, moist to wet (compact to dense)		4			
			81.9	6			
		POWER AUGER TO REFUSAL		8			
				10			
				12			
			73.6	14			
		POSSIBLE TILL	73.1				
		Refusal to Augers @ 14.8m Depth					

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on March 5, 2001 using a CME-55 truck mounted drill rig to an auger refusal depth at 14.8m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531B

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 12

Trow

Auger Sample ⊠
SPT (N) Value ○○▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢—
Shelby Tube ●●■ Undrained Triaxial at 0
Rock Core ▩ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Geotechnical Investigation. Proposed Dwg. No. 13

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth	N Value / Shear Strength 20 40 60 80	Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30	Natural Unit Weight KN/m³
		FILL Silty sand with trace to some gravel, brown to grey, moist (compact)	87.8	0			
		Hydrocarbon Odour		1			
				2			
			85.5				
		SAND Fine to medium, horizontally layered, light brown, moist (compact)		3			
			84.1				
		Terminated @ 3.7m Depth					

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 12, 2001 using a CME-55 truck mounted drill rig to a termination depth at 3.7m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 13

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ×
Dynamic Cone Test ——
Shelby Tube ●● ■ Plastic & Liquid Limit ⊢—
Rock Core ▩ Undrained Triaxial at 0
Field Vane Test + S Overburden Pressure 15 ⊕ 5
% Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Geotechnical Investigation. Proposed Dwg. No. 14

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
		FILL Silty sand with trace, organic rootlets, brown to grey, moist (compact)	87.8	0
		Hydrocarbon Odour		1
			86.3	
		SAND Fine to medium, horizontally layered, some silt seams, light grey to grey brown, moist to wet (compact)		2
				3
				4
			83.2	
		Terminated @ 4.6m Depth		

N Value 20 40 60 80 Shear Strength

Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30

Natural Unit Weight KN/m^3

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 12, 2001 using a CME-55 truck mounted drill rig to a termination depth at 4.6m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 14

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test ——
Plastic & Liquid Limit ⊢—⊣
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ▩ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Geotechnical Investigation. Proposed Dwg. No. 15

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth	N Value / Shear Strength (20 40 60 80)	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight KN/m³
		FILL Silty sand with trace, organic rootlets, brown to grey, moist	87.6	0			
		SAND Fine to medium, some gravel, light brown, moist (compact)	86.9	1			
		Terminated @ 2.1m Depth	85.5	2			

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 13, 2001 using a CME-55 truck mounted drill rig to a termination depth at 2.1m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 15

Trow

Auger Sample ☒
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢—⊣
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ▩ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Geotechnical Investigation. Proposed Dwg. No. 16

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth	N Value / Shear Strength 20 40 60 80	Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30	Natural Unit Weight KN/m³
		FILL Silty sand with trace organic rootlets, brown, moist (compact)	87.9	0			
		Hydrocarbon Odour		1			
			86.4				
		SAND Fine to medium, some silt seams or pockets, light grey to brown, moist to wet (compact to dense)		2			
				3			
				4			
				5			
			82.7				
		Terminated @ 5.2m Depth					

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 13, 2001 using a CME-55 truck mounted drill rig to a termination depth at 5.2m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 16

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢—
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ⊠ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Geotechnical Investigation. Proposed Dwg. No. 17

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
		FILL Silty sand with trace organic rootlets, trace gravel, brown, moist (compact)	87.6	0
				1
				2
		SAND Fine to medium, trace silt, light grey to brown, moist to wet (compact)	85.6	
				3
				4
		Terminated @ 4.6m Depth	83.0	

N Value 20 40 60 80
Shear Strength

Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30

Natural Unit Weight KN/m³

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 13, 2001 using a CME-55 truck mounted drill rig to a termination depth at 4.6m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 17

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test ——
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ▩ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Geotechnical Investigation. Proposed Dwg. No. 18
Costco Regional Office. Hunt Club Road and Roydon Avenue
City of Ottawa, Ontario Project No. MA14531A
Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth	N Value / Shear Strength (20 40 60 80)	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight KN/m³
		FILL Silty sand to clayey silt with some gravel, brown, moist (compact)	87.7	0			
		SAND Fine to medium, trace silt, light brown, moist to wet (compact)	86.8	1			
				2			
				3			
				4			
				5			
			82.0	6			
		Terminated @ 6.7m Depth	81.0				

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 13, 2001 using a CME-55 truck mounted drill rig to a termination depth at 6.7m.
3. A 19mm slotted standpipe was installed in the borehole
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Comple -tion	5.7	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	ROD %
1			
2			
3			
4			

Notes:

Log of Borehole 17A

Trow

Auger Sample ☒
SPT (N) Value ○○ ▨ Natural Moisture ×
Dynamic Cone Test —— Plastic & Liquid Limit ⊢—
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ▩ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▽

Project *Additional Geotechnical Investigation.* Dwg. No. *5*

Proposed Costco Regional Office. Hunt Club Road and Roydon

Place.City of Ottawa, Ontario Project No. *MA14531B*

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth	N Value / Shear Strength (20 40 60 80)	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight KN/m³
		FILL Silty sand to clayey silt with some gravel, brown, moist (compact)	87.7	0			
			86.8				
		SAND Fine to medium, trace silt, light brown, moist to wet (compact)		2			
				4			
				6			
				8			
				10			
				12			
			74.0	14			
		SAND AND GRAVEL TO SAND AND GRAVEL TILL Grey, very wet (compact)					
			71.6	16			Run 1
		LIMESTONE BEDROCK Calcite and Dolomitic veins, light grey (poor to excellent quality)					Run 2
			70.1				
		Terminated @ 17.6m Depth					

NOTES
1. Borehole 17A is located 1.3m east and 1.6m north of Borehole No. 17.
2. Borehole augered without sampling from ground surface to 6.1m depth.

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on March 2, 2001 using a CME-55 truck mounted drill rig to a termination depth at 17.6m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531B

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	15.9-16.4	84	39
2	16.4-17.6	98	100
3			
4			

Notes: Borehole core drileld from 16.1m to 17.6m depth.

Log of Borehole 18

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test ——
Shelby Tube ●● ■ Plastic & Liquid Limit ⊢—⊣
Rock Core ⊠ Undrained Triaxial at 0
Field Vane Test + S Overburden Pressure 15 ⊕ 5
% Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project Geotechnical Investigation. Proposed Dwg. No. 19
Costco Regional Office. Hunt Club Road and Roydon Avenue
City of Ottawa, Ontario Project No. MA14531A
Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
		FILL Silty sand with some gravel, oxidized stains, brown, moist (compact)	87.5	0
		-some clay pockets below 2.3m depth		1 2 3
		SAND Fine to medium, some silt, light brown, moist to wet (compact)	83.9	4
		Terminated @ 6.7m Depth	82.2	5

N Value 20 40 6D 80
Shear Strength
Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30
Natural Unit Weight KN/m³

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 13, 2001 using a CME-55 truck mounted drill rig to a termination depth at 5.3m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	ROD %
1			
2			
3			
4			

Notes:

Log of Borehole 19

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢—
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ▩ Overburden Pressure 15 ⊕ 5
Field Vane Test + S % Strain at Failure 10
Water Level: Est.: ▽ Measured: ▼ Perched: ▼ Penetrometer ▲

Project Geotechnical Investigation. Proposed Dwg. No. 20

Costco Regional Office. Hunt Club Road and Roydon Avenue

City of Ottawa, Ontario Project No. MA14531A

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
		FILL Silty sand with trace organic, brown, moist (loose)	87.6	0
		SAND Fine to medium, horizontally layered, some silt seams, grey brown to grey, moist to wet (compact)	84.6	3
		Terminated @ 4.6m Depth	83.0	4

N Value 20 40 60 80 Shear Strength

Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30

Natural Unit Weight KN/m³

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 12, 2001 using a CME-55 truck mounted drill rig to a termination depth at 4.6m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 20

Trow

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Rock Core
Field Vane Test
Water Level: Est.: Measured: Perched:
Natural Moisture
Plastic & Liquid Limit
Undrained Triaxial at Overburden Pressure 15 % Strain at Failure 10
Penetrometer

Project Geotechnical Investigation. Proposed Costco Regional Office. Hunt Club Road and Roydon Avenue
City of Ottawa, Ontario
Borehole Location Refer to Drawing No. 1

Dwg. No. 21
Project No. MA14531A

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
		FILL Silty sand with occasional gravel, brown to grey brown, moist to wet (compact)	88.0	0
		SAND Fine to medium, horizontally layered, brown, moist (compact)	86.0	2
			82.0	6
		Terminated @ 6.7m Depth	81.3	

N Value 20 40 60 80
Shear Strength

Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30

Natural Unit Weight KN/m3

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on February 12, 2001 using a CME-55 truck mounted drill rig to a termination depth at 6.7m.
3. A 19mm slotted standpipe was installed in the borehole
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531A

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Comple -tion	6.0	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1			
2			
3			
4			

Notes:

Log of Borehole 20A

Trow

Auger Sample ⊠
SPT (N) Value ○○ ▨ Natural Moisture ✖
Dynamic Cone Test —— Plastic & Liquid Limit ⊢—⊣
Shelby Tube ●● ■ Undrained Triaxial at 0
Rock Core ⊠ Overburden Pressure 15 ⊕5
Field Vane Test + S % Strain at Failure 10
Penetrometer ▲
Water Level: Est.: ▽ Measured: ▼ Perched: ▼

Project *Additional Geotechnical Investigation.* Dwg. No. *6*

Proposed Costco Regional Office. Hunt Club Road and Roydon Place. City of Ottawa, Ontario Project No. *MA14531B*

Borehole Location Refer to Drawing No. 1

GWL	SYMBOL	Soil Description	Geodetic Elev. m	Depth
			88.0	0
		FILL Silty sand with occasional gravel, brown to grey brown, moist to wet (compact)		
			86.0	2
		SAND Fine to medium, horizontally layered, brown, moist (compact)		4
				6
				8
				10
				12
				14
			72.7	
		SAND AND GRAVEL TILL Occasional rock fragments, grey (very dense)	71.6	16
		LIMESTONE BEDROCK Fractured with mud seams in the upper levels, calcite and dolomitic veins, grey (very poor to excellent quality)	69.9	18
		Terminated @ 18.1m Depth		

NOTES
1. BH 20A is located 1.9m N and 0.4m E of BH 20.
2. Borehole augered without sampling from GS to 6.1m depth.

N Value (Shear Strength): 20 40 60 80

Natural Moisture Content and Atterberg Limits % Dry Weight: 10 20 30

Natural Unit Weight KN/m³

Run 1

Run 2

NOTES:
1. Borehole data requires interpretation assistance from OMM/Trow before use by others
2. Borehole drilled on March 5, 2001, 2001 using a CME-55 truck mounted drill rig to a termination depth at 18.1m.
3. Borehole backfilled upon completion of drilling
4. See Notes on Sample Descriptions
5. This Drawing to be read with OMM/Trow Consulting Engineers report MA14531B

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	15.3-16.4	89	0
2	16.4-18.1	97	96
3			
4			

Notes: Borehole core drileld from 15.3m to 18.1m depth.

Trow Consulting Engineers Ltd.
6 Antares Drive, Unit 7, Nepean
Ontario, Canada, K2E 8A9
Telephone: (613) 723-2411
Fax: (613) 727-9580

Grain Size Analysis

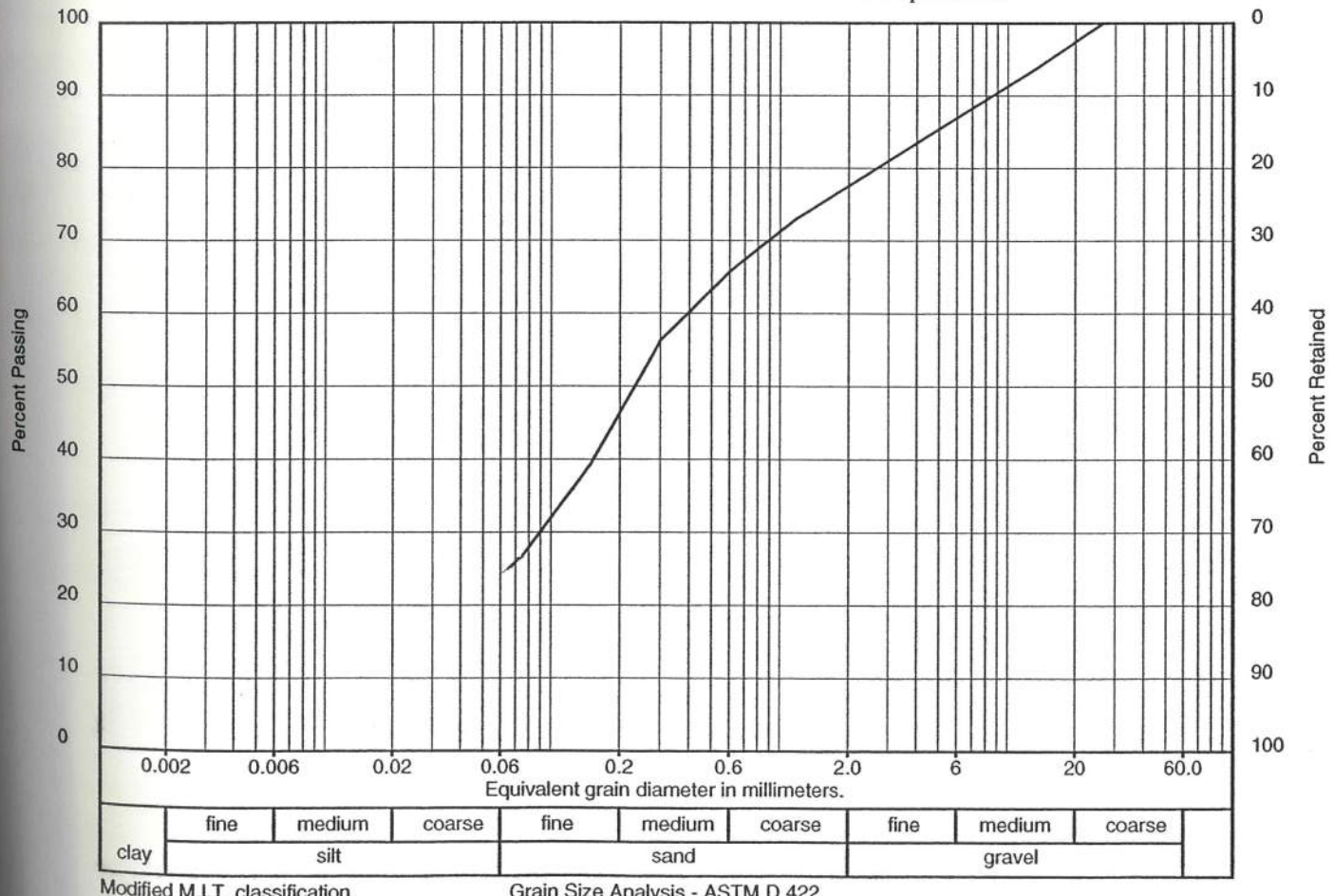
Drawing No. 22

Project No.: MA14531A
Project Name: Proposed Costco Headquarters
Sample ID: 45312
Sample Location: Borehole No.2 GS1- 0m to 0.75m

Material Supplier: Geotechnical investigation
Material Sampled By: CR
Sampling Date: 08/02/01
Testing Specification: no limits
Sample Description: Silty Sand. Some gravel

SIEVE SIZE	% PASSING	
	SPECS.	SAMPLE
26.5		100.0
13.2		93.6
9.5		90.9
4.75		85.0
2.36		78.9
1.18		73.1
0.6		65.7
0.3		56.3
0.15		39.4
0.075		26.8

* Out of Specification



Modified M.I.T. classification

Grain Size Analysis - ASTM D 422

Trow Consulting Engineers Ltd.
6 Antares Drive, Unit 7, Nepean
Ontario, Canada, K2E 8A9
Telephone: (613) 723-2411
Fax: (613) 727-9580

Grain Size Analysis

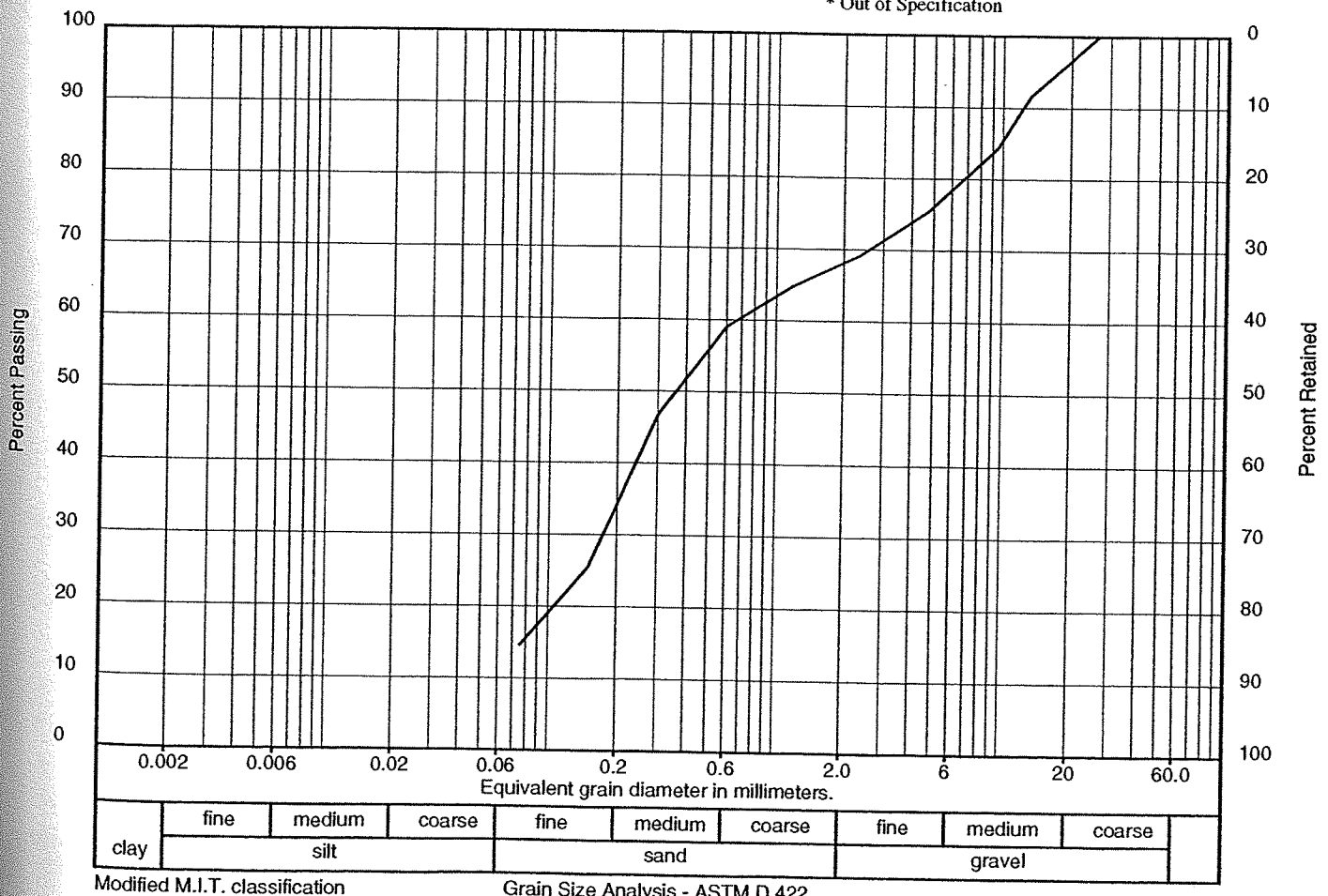
Drawing No. 23

Project No.: MA14531A
Project Name: Proposed Costco Headquarters
Sample ID: 45319
Sample Location: Borehole No.9 GS1- 0m to 0.75m

Material Supplier: Geotechnical investigation
Material Sampled By: CR
Sampling Date: 08/02/01
Testing Specification: no limits
Sample Description: Silty Sand. Some gravel

SIEVE SIZE	% PASSING	
	SPECS.	SAMPLE
26.5		100.0
13.2		91.6
9.5		84.4
4.75		75.4
2.36		69.2
1.18		64.8
0.6		59.0
0.3		46.7
0.15		25.5
0.075		14.5

* Out of Specification



Modified M.I.T. classification

Grain Size Analysis - ASTM D 422

Certificate of Analysis

Report Date: 09-May-2023

Client: Paterson Group Consulting Engineers

Order Date: 4-May-2023

Client PO: 57401

Project Description: PG6623

	Client ID:	BH2-23-SS3	-	-	-
	Sample Date:	03-May-23 09:00	-	-	-
	Sample ID:	2318372-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	86.5	-	-	-
General Inorganics					
pH	0.05 pH Units	7.75	-	-	-
Resistivity	0.1 Ohm.m	4.6	-	-	-
Anions					
Chloride	10 ug/g dry	1470	-	-	-
Sulphate	10 ug/g dry	172	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG6623-1 - TEST HOLE LOCATION PLAN

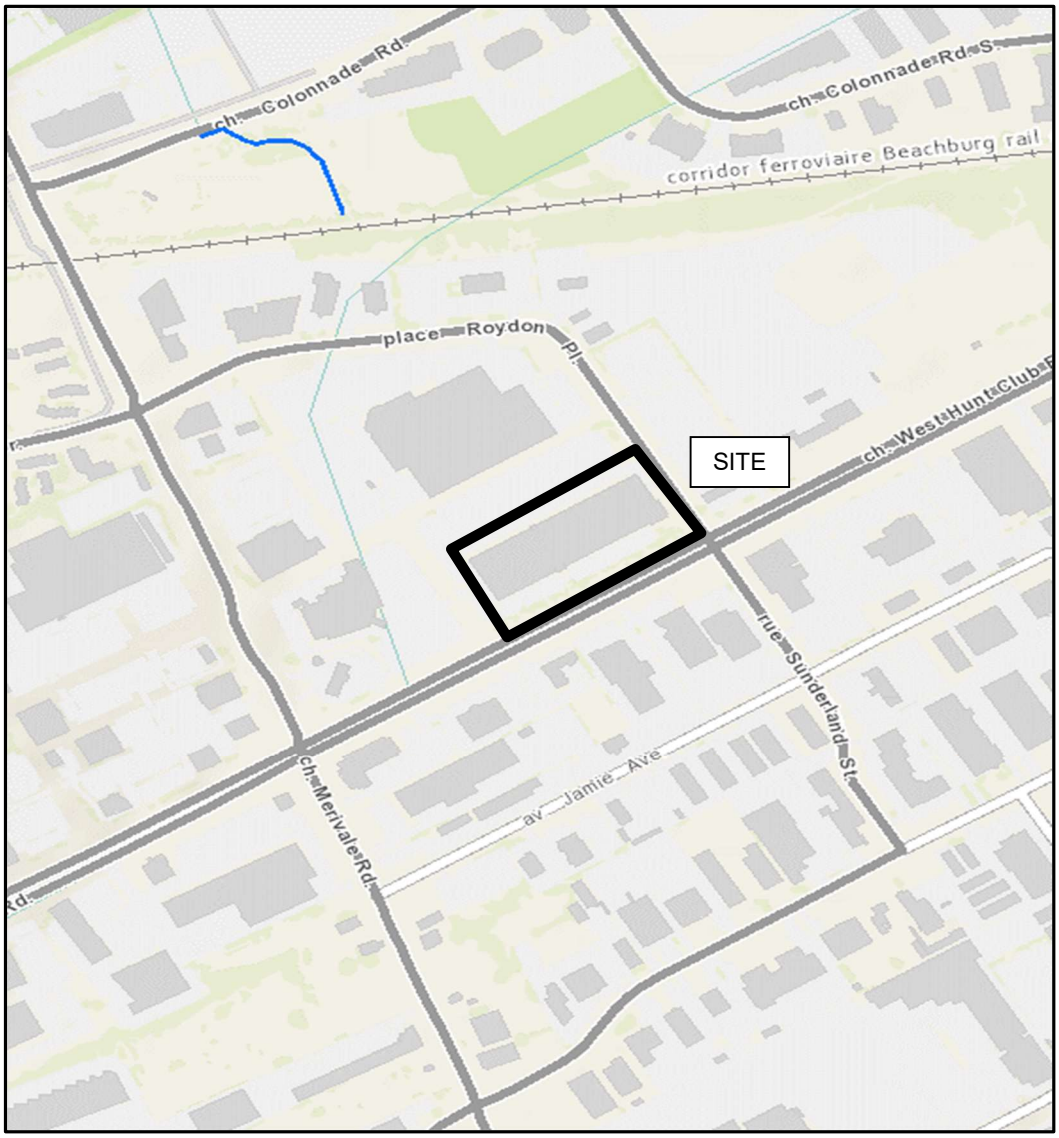
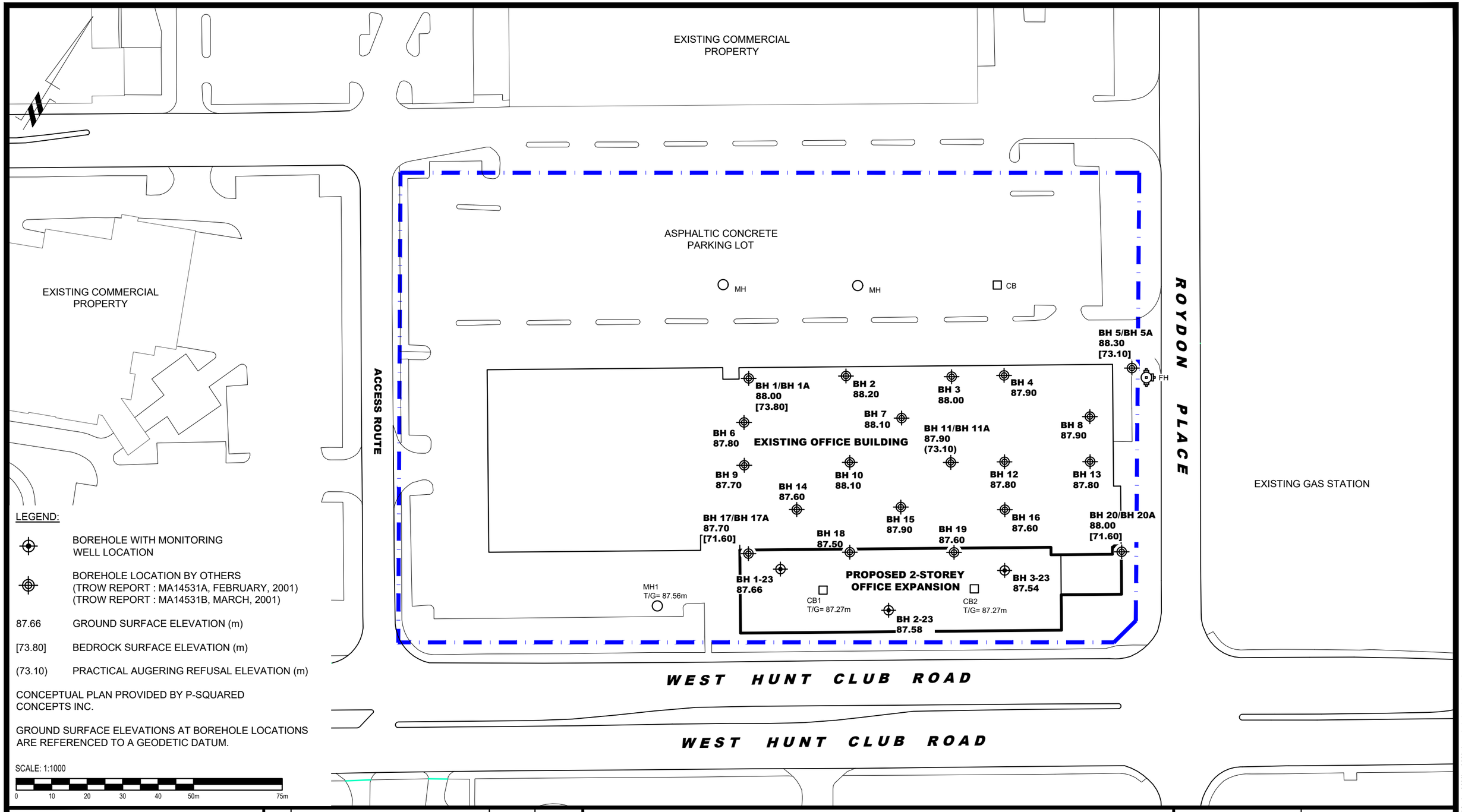


FIGURE 1

KEY PLAN

PATERSON GROUP



LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION BY OTHERS (TROW REPORT : MA14531A, FEBRUARY, 2001) (TROW REPORT : MA14531B, MARCH, 2001)
- 87.66 GROUND SURFACE ELEVATION (m)
- [73.80] BEDROCK SURFACE ELEVATION (m)
- (73.10) PRACTICAL AUGERING REFUSAL ELEVATION (m)

CONCEPTUAL PLAN PROVIDED BY P-SQUARED CONCEPTS INC.

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:1000

0 10 20 30 40 50m 75m

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

NO.	REVISIONS	DATE	INITIAL

COSTCO WHOLESALE CORPORATION

GEOTECHNICAL INVESTIGATION
PROPOSED OFFICE EXPANSION
415 HUNT CLUB ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:1000	Date: 05/2023
Drawn by: YA	Report No.: PG6623-1
Checked by: ND	Dwg. No.: PG6623-1
Approved by: SD	Revision No.:

11x17

p:\autocad drawings\geotechnical\pg66xx\pg6623\pg6623-1-test hole location plan.dwg