574 Northcliffe Ave.
Slope Assessment

Geotechnical Slope Assessment

Project Location:
574 Northcliffe Ave. Dundas, ON

Prepared for:
Columbia Northcliffe Camp Inc.
1003 Main Street West
Hamilton, ON L8S 4P3

Prepared by:
MTE Consultants
520 Bingemans Centre Drive
Kitchener, ON N2B 3X9

August 27, 2021

MTE File No.: 45800-200rev1

Engineers, Scientists, Surveyors.

Contents

Tables

Appendices

1.0 Introduction

MTE Consultants Inc. (MTE) was retained by Columbia International College to complete a geotechnical assessment of the ravine slopes on the east and west sides of the property for proposed site works at the Columbia International College Northcliffe Campus, located at 574 Northcliffe Avenue, in Dundas, Ontario.

The property currently comprises a Columbia International College building with a circle drive aisle and associated parking areas. The site is bordered to the north by a Sisters of the Precious Blood building, fields and Northcliffe Avenue; to the east by a large ravine and forested area and Highway 6; to the south by a forested area and Highway 403; and to the west by a ravine and forested area, as shown on **Figure 1 in Appendix A**.

It is understood that a proposed gymnasium will be located northeast of the existing building in a field area. It is further understood that new septic beds will be constructed as part of the development. The existing features and proposed site development details are shown on **Figure 2 in Appendix A.**

Along the east and west sides of the property, grades slope downwards approximately 20 to 30 m in height into deep ravines with creek/wetland areas located along the base of the ravines.

The purpose of this geotechnical assessment is to analyze the stability of the ravine slopes as they pertain to the proposed development, located between the two ravines.

2.0 Previous and Concurrent Work

MTE is currently completing a hydrogeology study at the subject site. The results of this investigation will be summarized in a separate report. Previous to this report, MTE completed a geotechnical investigation for the subject development.

The subsurface conditions at the site utilized in this geotechnical assessment were obtained during the previous MTE investigations at the subject site.

3.0 Site Inspection

A geotechnical inspection of the subject slope was completed by Dan Gonser, P.Eng. of MTE Consultants on April 19, 2021 in accordance with the Ministry of Natural Resources and Forestry (MNR) slope inspection guidelines. Based on the MNR slope rating criteria, the subject slope would have a rating of 34, indicating a slight potential for instability. Based on the MNR guidelines, a preliminary study including slope modelling with a detailed report would be required.

Observations made during the slope inspection on April 19, 2021 are summarized hereinafter;

- The slopes are generally inclined steeper than 2.0 horizontal to 1.0 vertical based on available topographic information, which is consistent with observations made onsite. Portions of the subject slope are inclined up to 1.0 horizontal to 1.0 vertical.
- The existing slopes are generally vegetated with mature trees, although some erosion gullies have formed which created bare areas on the slope. It appears the gullies are a result of overland surface flow on the face of the slope.

- A small creek is located along the toe of the slope on the west side of the subject site. A wetland area is present at the toe of the slope on the east side of the subject site.
- Based on the Ontario Geological Survey (OGS) mapping of the area, the subsurface conditions comprise clay to silt textured till at the site with the ravine areas mapped as Queenston Shale bedrock. This mapping was confirmed onsite from the borehole drilling, which found a relatively shallow till deposit overlying the shale bedrock.
- The slope is approximately 20 to 30 m in overall height based on Conservation Halton online GIS mapping.

The slope inspection and rating criteria are summarized in the following table:

Table 1 - Results of Slope Inspection

MNR Inspection Criteria	Commentary	Rating Value
Slope Inclination	The slope is inclined at 2.0 H to 1.0 V or steeper	16
Soil Stratigraphy	Based on the site boreholes, the slope comprises predominately shale bedrock. Based on available geological mapping, the surficial deposits of the ravines are shown to be shale bedrock.	0
Seepage from Slope Face	At the time of inspection, seepage was not noted to be occurring from the slope.	0
Slope Height	The overall slope is approximately 20 to 30 m in height.	8
Vegetation Cover on Slope Face	The slope is well vegetated with mature trees and heavy shrubs	0
Table Land Drainage	The subject site drains over the face of the slope and gullies were noted emanating from the top of slope.	4
Proximity of Watercourse to Slope Toe	The creek and wetland areas are located near the toe of the slopes	6
Previous Landslide Activity	No previous landslide activity was noted	0

4.0 Site Investigation and Soil Conditions

Previous investigative work at the site involved the drilling of 21 boreholes and the installation of 16 monitoring wells. The locations of the boreholes/monitoring wells are shown on **Figures 2 in Appendix A** and the logs are provided in **Appendix B**.

Reference is given to previous MTE reports for full details of the sampling and investigative programs that have been completed at the site.

In general, the soil conditions comprise topsoil/fill and silt till overlying shale bedrock at depths in the range of 1.8 to 6.7 m below ground surface. In the area of the proposed building, the bedrock was generally at ±3 m below ground surface. Based on the Ontario Geological Survey (OGS) mapping and confirmed by site observation, the shale bedrock is part of the Queenston Formation.

5.0 Discussion and Recommendations

The project involves the proposed construction of a gymnasium and associated site works at the Columbia International College, Northcliffe Campus. The existing top of bank was staked by Conservation Halton (CH) and was surveyed by Cunningham McConnell Ltd (CML). Site topographic information was surveyed by CML and provided to MTE. It is noted that the ravines could not be surveyed by CML and as such, the CH online topographic information was utilized to supplement the information provided by CML.

The subsurface soil and groundwater conditions at the site were determined during the aforementioned MTE investigations. A geological cross section of the site, produced for the hydrogeological assessment was utilized in assessing the soil conditions. The geological cross section is provided on **Figure 3 in Appendix A.**

Using the topographical information available, it was estimated that portions of the existing slope were inclined approaching a 1.0 horizontal to 1.0 vertical inclination. As such, a slope stability model was created using GeoStudio 2019 to assess this 'worst case scenario'.

The software calculates the factor of safety against failure by calculating all forces and moments for a series of idealized vertical slices through the ground with a bottom boundary chosen to represent a "trial" failure surface. A factor of safety for slope stability is then defined as the total forces or moments acting to destabilize the slope divided by the total forces acting to resist failure. A factor of safety of unity indicates incipient failure since the analytical destabilizing and stabilizing forces are equal. Based on CH policy, a target factor of safety of 1.5 is required for the site.

Soil information obtained from the aforementioned borehole drilling, as well as local area experience and published correlations, was utilized to determine soil parameters for the slope models. The soil parameters used are noted in the following table:

Table 2 - Soil Parameters used in Slope Analysis

Soil Type	Unit Weight (kN/m^3)	Effective Cohesion (kPa)	Angle of Internal Friction (°)
Silt Till	21.0	0 to 10	30 to 34
Shale Bedrock	23.0	20 to 30	40 to 45

The ravine slopes at the subject site were determined to have a stable slope inclination of approximately 2.0 horizontal to 1.0 vertical for a factor of safety of 1.5. The approximate location of the 2.0 horizontal to 1.0 vertical line, as determined based on the CH contours, is provided on **Figure 2 in Appendix A.**

Along the area of the subject site, the creek and wetland areas are in close proximity to the toe of the slope. Based on the MNR's *River & Stream Systems: Erosion Hazard Limit Technical Guide*, a toe erosion allowance of 0 to 5 m is recommended for soft rock (Shale) conditions. A toe erosion allowance for the site was selected to be 4 m. Based on the relatively small size of the creek and wetland areas, the selected toe erosion allowance is considered to be a conservative estimate.

In accordance with CH policies, a 6 m access allowance is required from the top of slope. This results in a development setback limit of 10 m from the stable top of slope. The proposed development setback limit is shown on **Figure 2 in Appendix A.**

It is noted that portions of the existing access driveway and parking areas are located within the stable slope setback (based on a factor of safety of 1.5) or access allowance. For areas located within the access allowance, the driveways are considered to provide suitable access to the slope face. For areas located within the stable slope setback, it is MTE's geotechnical opinion that a factor of safety of 1.3 should be utilized for accessing the suitability of the site access. In this regard, based on the analysis discussed above, MTE would consider that a slope inclination of approximately 1.0 horizontal to 1.0 vertical is considered suitable for a factor of safety of 1.3. As the existing slopes are inclined at 1.0 horizontal to 1.0 vertical or less, the existing site access is considered suitable.

Based on the above information, the proposed development is located outside of the development setback limit and is provided with suitable site access.

The following design and construction recommendations are provided for the project:

- Following construction of roof drains, stormwater should not be allowed to drain over the face of the slope. The water should either be directed away from the slope or contained in storm sewers and outletted at the toe of the slope.
- No additional fill should be placed at the crest or face of the slope. No excavation work should be conducted at the bottom of slope. All excavation work should be minimized, as much as possible, and grading of the redevelopment should adhere to existing grades where it is feasible. No infiltration should be placed within the slope setback areas.

6.0 Limitations of Report

Services performed by MTE Consultants Inc. (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Geotechnical Engineering & Consulting profession practicing under similar conditions in the same geographic area were the services are provided. No other warranty or representation expressed or implied as to the accuracy of the information, conclusions or recommendations is included or intended in this report.

This report was completed for the sole use of the Client. This report is not intended to be exhaustive in scope or to imply a risk-free site. As such, this report may not deal with all issues potentially applicable to the site and may omit aspects which are or may be of interest to the reader.

In addition, it should be recognized that a soil sample result represents one distinct portion of a site at the time it is collected, and that the findings of this report are based on conditions as they existed during the time period of the investigation. The material in the report reflects our best judgment using the information available at the time the report was written. The soil and groundwater conditions between and beyond the test holes may differ from those encountered in the test holes. Should subsurface conditions arise that are different from those in the test holes MTE should be notified to determine whether or not changes should be made as a result of these conditions.

It should be recognized that the passage of time may affect the views, conclusions and recommendations (if any) provided in this report because groundwater conditions of a property can change, along with regulatory requirements. All design details were not known at the time of submission of this report and it is recommended MTE should be retained to review the final design documents prior to construction to confirm they are consistent with our report recommendations. Should additional or new information become available, MTE recommends that it be brought to our attention in order that we may determine whether it affects the contents of this report.

Any use which another party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by another party as a result of decisions made or actions taken, based upon this report. Others with interest in the site should undertake their own investigations and studies to determine how or if the condition affects them or their plans. The contractors bidding on this project or undertaking the construction should make their own interpretation of the factual information and draw their own conclusions as to how subsurface conditions may affect their work.

The benchmark and elevations provided in this report are primarily established to identify differences between the test hole locations and should not be used for other purposes such as, planning, development, grading, and excavation.

All of which is respectfully submitted,

MTE Consultants Inc.

LICENSED PROFESSIONAL ENGINEER
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Appendix A

Figures

REFERENCES:

- AERIAL IMAGE FROM GOOGLE EARTH

Engineers, Scientists, Surveyors

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SCALE: N.T.S

CLIENT	COLUMBIA INTERNATIONAL COLLEGE CANADA	TITLE	LOCATION PLAN
PROJECT	COLUMBIA INTERNATIONAL COLLEGE PROPOSED GYMNASIUM	Reviewed By	DMG
		Prepared By	DXG
		Drawn By	DXG
SITE	574 NORTHCLIFFE AVENUE, DUNDAS, ONT	Date	APR. 2021
		Project No.	45800-200
		Figure No.	1

N

NORTH

\\mte85.local\mte\DWG\P\45800\200\BHFIGURES\45800-200-BHFIGURES(2021).dwg 1 LOCATION PLAN Plotted By: DGross January 11, 2021 11:00 a.m.

P:\P\45800\200\BH Figures 2021 Slope\45800-200-BHFIGURES(2021).dwg

SITE PLAN

Plotted By: DGross

January 11, 2021 11:00 a.m.

N

NORTH

LEGEND

MTE MONITORING WELL

BH103-19 MTE BOREHOLE

TOE OF SLOPE

TOP OF SLOPE

2:1 SETBACK

DEVELOPMENT SETBACK LINE

PROPERTY LINE

0 30 60 90 120 150m

Scale(11x17): 1:3000

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CLIENT
COLUMBIA INTERNATIONAL COLLEGE CANADA

PROJECT
COLUMBIA INTERNATIONAL COLLEGE PROPOSED GYMNASIUM

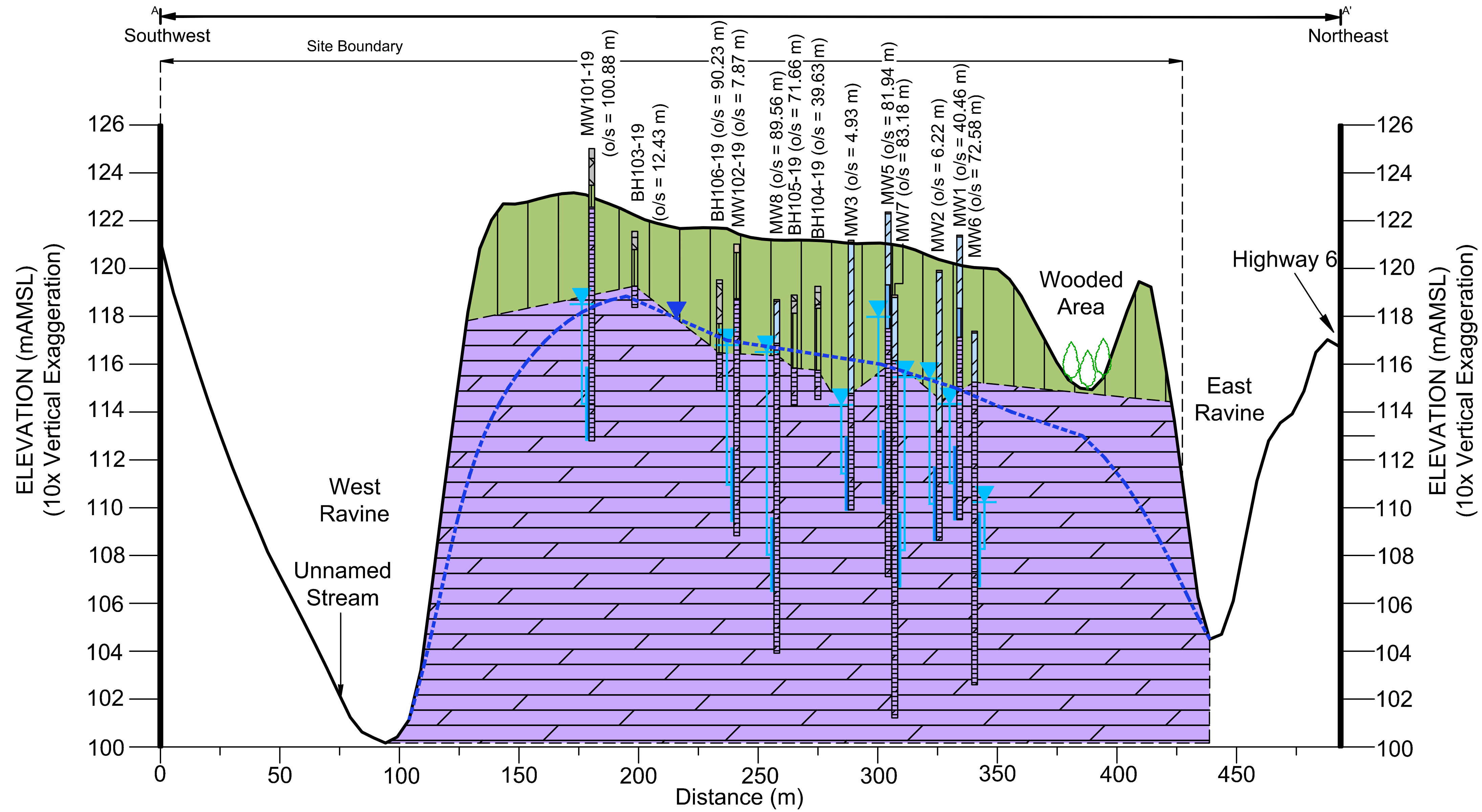
SITE
574 NORTHCLIFFE AVENUE, DUNDAS, ONT

TITLE
SITE PLAN

Reviewed By	DMG		
Prepared By	DXG	Project No.	45800-200
Drawn By	DXG	Figure No.	2
Date	APRIL, 2021		

Project: 45800-200 CAD: P:\P\45800\200\CROSS-SECTIONS\45800-200-GWR1_DXG.DWG

GWR1.2



LEGEND

Ground Surface (Inferred)

Water Table (Interpreted)

Borehole Lithology

- Topsoil
- Silt Till
- Sand
- Gravel
- Clay
- Silt
- Fill
- Bedrock (Shale)

Interpreted Geology

- Clay and Silt Till (Halton Till)
- Bedrock (Shale)

MW1 (o/s = 60.01 m) — Offset Distance — ID

Water Level (Jan. 6, 2020)

Well / Borehole

Screen

Notes:

The geological sequence is based on professional interpretation from the soils encountered during drilling Actual geological conditions may vary between the tested locations.

The inferred ground surface has been projected on the geological cross-section. Differences between the ground surface and monitoring wells presented on the geological cross-section is a result of offset distances.

The inferred ground surface was generated from a topographic survey completed for the Site by IBI Group provided to MTE on July 11, 2019.

MTE

Engineers, Scientists, Surveyors

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CLIENT	COLUMBIA INTERNATIONAL COLLEGE CANADA
PROJECT	COLUMBIA INTERNATIONAL COLLEGE PROPOSED GYMNASIUM
SITE	574 NORTHCLIFFE AVENUE, DUNDAS, ONT
TITLE	GEOLOGICAL CROSS-SECTION A-A'
Reviewed By	DMG
Designed By	DXG
Drawn By	DXG
Date	APRIL, 2021
Project No.	45800-200
Figure No.	3

April 25, 2021 — 5:30 PM — Plotted By: DGross

Appendix B

Borehole Logs

MTE

Client: Sisters of St. Joseph

Project: Sisters of St. Joseph EA

Location: 574 Northcliffe Avenue, Hamilton, ON

Borehole Number: MW1

Job Number: 31950-501

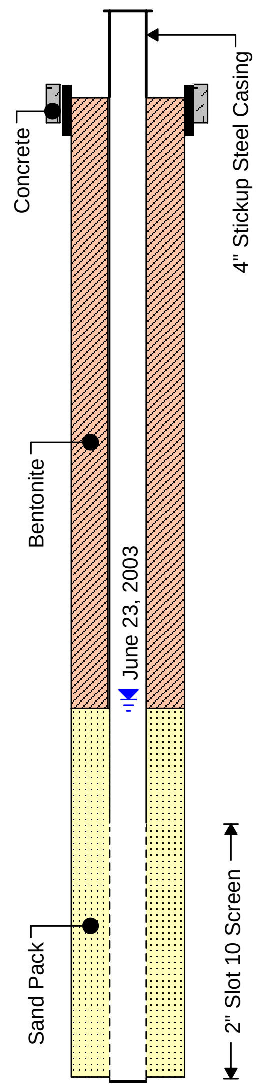
Drill Date: June 20, 2003

Elevation (m)	Soil Description	Number	Type	N-Value
	Ground Elevation			
0.00	**TOPSOIL**	C-1	SS	28
	CLAY loose, light red-brown, fine, some silt with pebbles, dry, no staining or odours	C-2	SS	60
3.05	**SILT** compact, red, fine, some clay, dry, no staining or odours	C-3	SS	60
4.27	**SHALE** very dense, red, fine, slightly moist, some small pebbles, no staining or odours	C-4	SS	60
11.89	**END OF BOREHOLE**			

Standard Penetration Graph: 25 50 75

Headspace (ppm)

Groundwater Observations and Well Details



Reviewed By: RJF

Method: CME-55 Track-Mounted Auger Drill Rig

Notes: C-x indicates hollow stem core number

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Logged By: REW

Sheet: 1 of 1

Client: Sisters of St. Joseph

Project: Sisters of St. Joseph EA

Location: 574 Northcliffe Avenue, Hamilton, ON

Borehole Number: MW2

Job Number: 31950-501

Drill Date: June 20, 2003

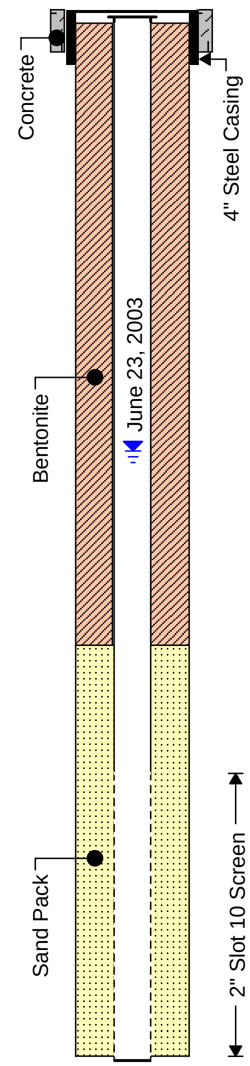
Depth (m)	Elevation (m)	Soil Description
0.0		Ground Elevation
0.00	0.00	**TOPSOIL**
		CLAY loose, light red-brown, fine, some silt with pebbles, dry, no staining or odours
6.71	6.71	**SHALE** very dense, red, fine, slightly moist, some small pebbles, no staining or odours
11.28	11.28	**END OF BOREHOLE**

Number	Type	N-Value
C-1	SS	28
C-2	SS	60
C-3	SS	60
C-4	SS	60

Standard Penetration Graph: 25 50 75

Headspace (ppm)

Groundwater Observations and Well Details



Reviewed By: RJF

Method: CME-55 Track-Mounted Auger Drill Rig

Notes: C-x indicates hollow stem core number

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Sheet: 1 of 1

Client: Sisters of St. Joseph

Project: Sisters of St. Joseph EA

Location: 574 Northcliffe Avenue, Hamilton, ON

Borehole Number: MW3

Job Number: 31950-501

Drill Date: June 20, 2003

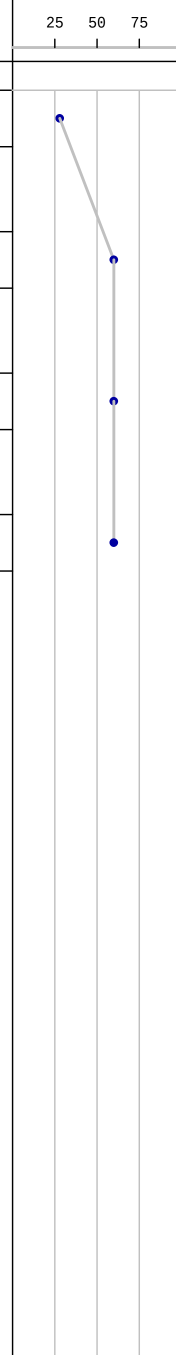
Elevation (m)	Soil Description	Number	Type	N-Value
	Ground Elevation			
0.00	**TOPSOIL**	C-1	SS	28
	CLAY loose, light red-brown, fine, some silt with pebbles, dry, no staining or odours	C-2	SS	60
		C-3	SS	60
		C-4	SS	60
6.40	**SHALE** very dense, red, fine, slightly moist, some small pebbles, no staining or odours			
11.28	**END OF BOREHOLE**			

Depth (ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 22.0, 24.0, 26.0, 28.0, 30.0, 32.0, 34.0, 36.0, 38.0, 40.0, 42.0, 44.0

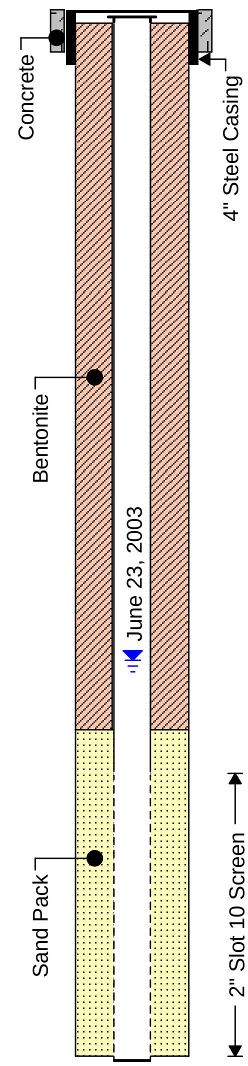
Depth (m): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0

Symbol | Headspace (ppm)

Standard Penetration Graph



Groundwater Observations and Well Details



Reviewed By: RJF

Method: CME-55 Truck-Mounted Auger Drill Rig

Notes: C-x indicates hollow stem core number

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Sheet: 1 of 1

Client: Sisters of St. Joseph

Project: Sisters of St. Joseph EA

Location: 574 Northcliffe Avenue, Hamilton, ON

Borehole Number: MW4

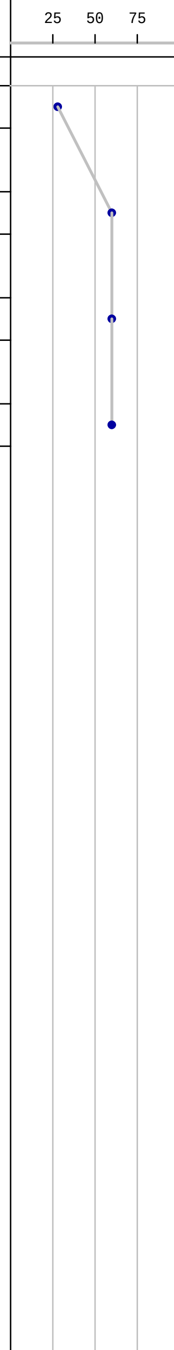
Job Number: 31950-501

Drill Date: October 16, 2007

Depth (m)	Elevation (m)	Soil Description
0.0	0.00	Ground Elevation
0.0	0.00	**TOPSOIL**
		CLAY loose, light red-brown, fine, some silt with pebbles, dry, no staining or odours
4.0	3.96	**SHALE** very dense, red, fine, slightly moist, some small pebbles, no staining or odours
	14.63	becoming grey
	17.37	**END OF BOREHOLE**

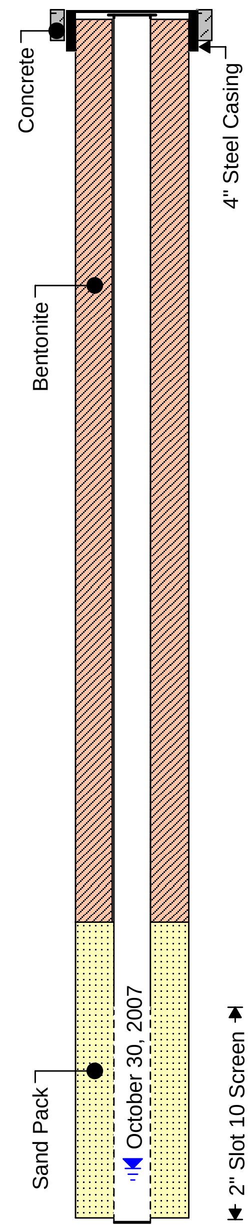
Number	Type	N-Value
C-1	SS	28
C-2	SS	60
C-3	SS	60
C-4	SS	60

Standard Penetration Graph



Headspace (ppm)

Groundwater Observations and Well Details



Reviewed By: RJF

Method: CME-75 Truck-Mounted Auger Drill Rig

Notes: C-x indicates hollow stem core number

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Sheet: 1 of 1

Client: Sisters of St. Joseph

Project: Sisters of St. Joseph EA

Location: 574 Northcliffe Avenue, Hamilton, ON

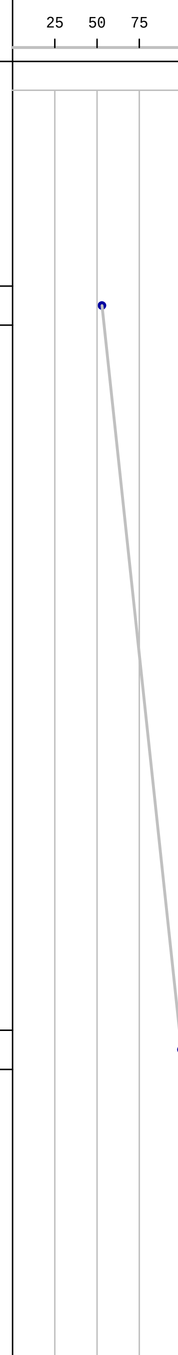
Borehole Number: MW5

Job Number: 31950-501

Drill Date: March 26, 2013

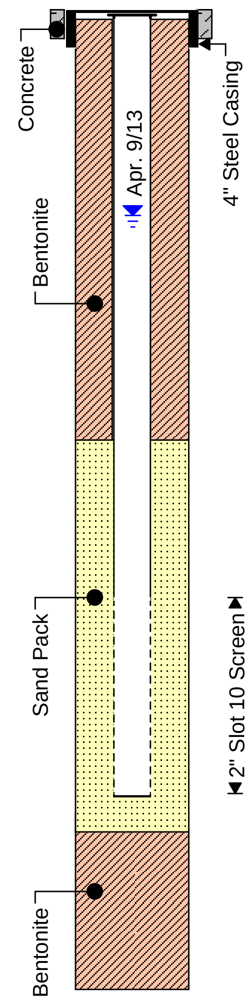
Elevation (m)	Soil Description	Number	Type	N-Value
	Ground Elevation			
0.00	**TOPSOIL**			
	CLAY loose, light red-brown, fine, some silt with pebbles, dry, no staining or odours			
3.05	**SILT** compact, red, fine, some clay, dry, no staining or odours	C-1	SS	53
4.88	**SHALE** very dense, red, fine, moist at 7 m, saturated at 10.2 m, no staining or odours			
		C-2	SS	100
15.24	**END OF BOREHOLE**			

Standard Penetration Graph



Headspace (ppm)

Groundwater Observations and Well Details



Notes:

S1 - Soil sample collected from 3 to 3.66 m bgs for analysis of NO3, NH3, pH and grain size

S2 - Soil sample collected from 14.6 to 15.2 m bgs for analysis of NO3, NH3, pH and grain size

Reviewed By: RJF

Method: CME-55 Track-Mounted Auger Drill Rig

Notes: C-x indicates hollow stem core number

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Sheet: 1 of 1

Client: Sisters of St. Joseph

Project: Sisters of St. Joseph EA

Location: 574 Northcliffe Avenue, Hamilton, ON

Borehole Number: MW6

Job Number: 31950-501

Drill Date: March 27, 2013

Depth (m)	Elevation (m)	Soil Description	Number	Type	N-Value
0.0		Ground Elevation			
0.0	0.00	**TOPSOIL**			
		CLAY loose, light brown, fine, some silt with pebbles, slightly moist, no staining or odours			
2.13	2.13	**SHALE** compact, red, fine, some clay, moist at 8.5 m, no staining or odours	C-1	SS	100
10.06	10.06	red-grey shale, saturated	C-2	SS	100
14.78	14.78	**END OF BOREHOLE**			

Notes:

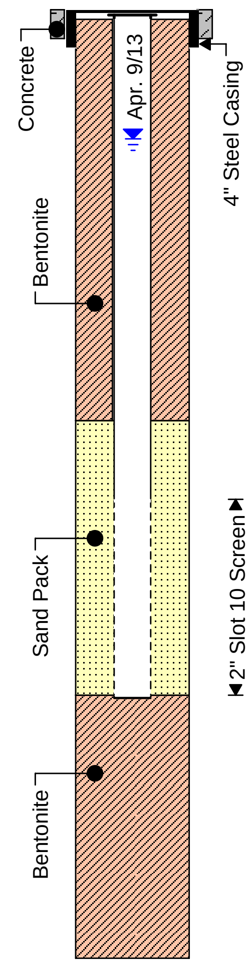
S1 - Soil sample collected from 3 to 3.3 m bgs for analysis of NO3, NH3 and pH

S2 - Soil sample collected from 14.2 to 14.8 m bgs for analysis of NO3, NH3 and pH

Standard Penetration Graph: 25 50 75

Headspace (ppm)

Groundwater Observations and Well Details



Reviewed By: RJF

Method: CME-55 Track-Mounted Auger Drill Rig

Notes: C-x indicates hollow stem core number

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Sheet: 1 of 1

Client: Sisters of St. Joseph

Project: Sisters of St. Joseph EA

Location: 574 Northcliffe Avenue, Hamilton, ON

Borehole Number: MW7

Job Number: 31950-501

Drill Date: March 28, 2013

Depth (m)	Elevation (m)	Soil Description	Number	Type	N-Value
0.0		Ground Elevation			
0.0	0.00	**TOPSOIL**			
		CLAY loose, light brown, fine, some silt with pebbles, slightly moist, no staining or odours			
	2.74	**SHALE** compact, red, fine, some clay, saturated at 7 m, no staining or odours	C-1	SS	99
			C-2	SS	100
	17.68	**END OF BOREHOLE**			

Notes:

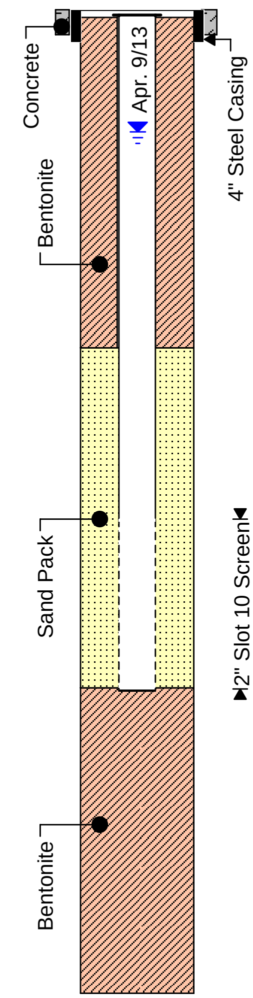
S1 - Soil sample collected from 3 to 3.66 m bgs for analysis of NO3, NH3, pH and grain size

S2 - Soil sample collected from 14.6 to 14.8 m bgs for analysis of NO3, NH3 and pH

Standard Penetration Graph: 25 50 75

Headspace (ppm)

Groundwater Observations and Well Details



Reviewed By: RJF

Method: CME-55 Track-Mounted Auger Drill Rig

Notes: C-x indicates hollow stem core number

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Sheet: 1 of 1

Client: Sisters of St. Joseph

Project: Sisters of St. Joseph EA

Location: 574 Northcliffe Avenue, Hamilton, ON

Borehole Number: MW8

Job Number: 31950-501

Drill Date: April 2, 2013

Depth (m)	Elevation (m)	Soil Description	Number	Type	N-Value
0.0		Ground Elevation			
0.0	0.00	**TOPSOIL**			
		CLAY loose, light brown, fine, some silt with pebbles, slightly moist, no staining or odours			
2.0	1.83	**SHALE** compact, red, fine, some clay, wet at 5.5 m, no staining or odours	C-1	SS	68
			C-2	SS	100
	14.78	**END OF BOREHOLE**			

Notes:

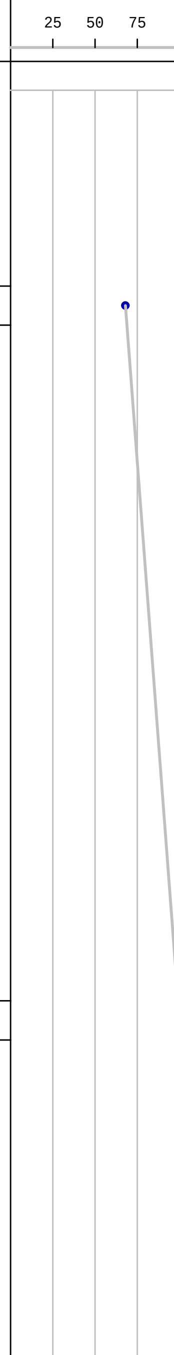
S1 - Soil sample collected from 3 to 3.66 m bgs for analysis of NO3, NH3 and pH

S2 - Soil sample collected from 14.6 to 14.8 m bgs for analysis of NO3, NH3 and pH

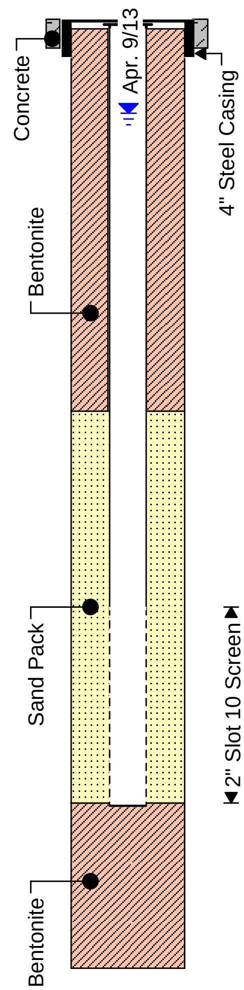
Depth scale: ft 0.0–64.0; m 0.0–18.0

Headspace (ppm)

Standard Penetration Graph



Groundwater Observations and Well Details



Reviewed By: RJF

Method: CME-55 Track-Mounted Auger Drill Rig

Notes: C-x indicates hollow stem core number

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Logged By: BIM

Sheet: 1 of 1

Client: Sisters of St. Joseph

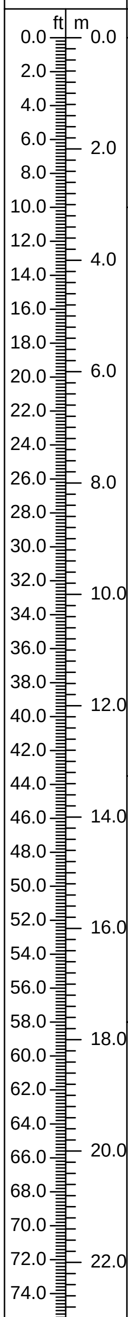
Project: Sisters of St. Joseph EA

Location: 574 Northcliffe Avenue, Hamilton, ON

Borehole Number: MW9

Job Number: 31950-501

Drill Date: March 27-28, 2013



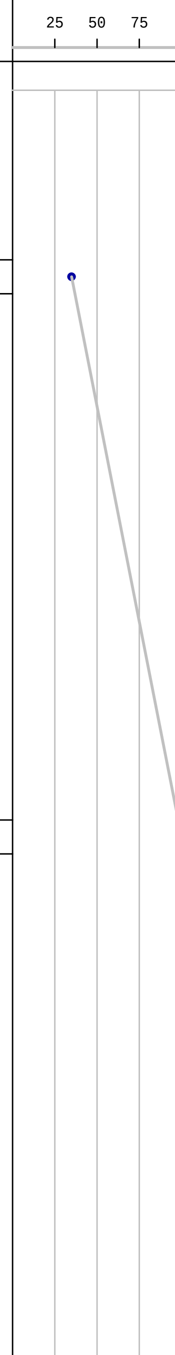
Elevation (m)	Soil Description	Number	Type	N-Value
	Ground Elevation			
0.00	**TOPSOIL**			
	CLAY compact, light brown, fine, some silt with pebbles, wet at 2.4 m, no staining or odours			
3.05	**SHALE** very dense, red, fine, some clay, wet at 7.6 m, no staining or odours	C-1	SS	35
13.26	very dense, grey, fine, dry, no staining or odours	C-2	SS	100
17.68	**END OF BOREHOLE**			

Notes:

S1 - Soil sample collected from 2.7 to 3 m bgs for analysis of NO3, NH3 and pH

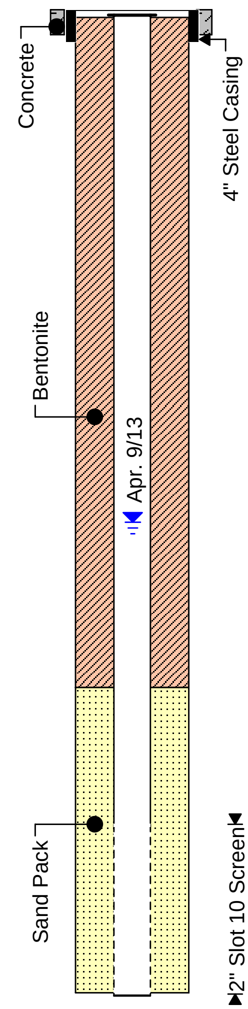
S2 - Soil sample collected from 13.1 to 13.25 m bgs for analysis of NO3, NH3 and pH

Standard Penetration Graph



Headspace (ppm)

Groundwater Observations and Well Details



Reviewed By: RJF

Method: CME-55 Track-Mounted Auger Drill Rig

Notes: C-x indicates hollow stem core number

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Sheet: 1 of 1

ID Number: MW101-19

Project: Columbia International College Gymnasium

Project No: 45800-200

Client: Columbia International College Canada

Site Location: 574 Northcliffe Avenue, Dundas, ON

Drill Date: 6/5/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Solid Stem Augers

Protective Cover: Monument Casing

SUBSURFACE PROFILE

Soil Description	Elevation (masl) / Depth (m)
Ground Surface	125.0 / 0.0
FILL dark brown/black sandy silt (topsoil), wet; grey to brown/grey clayey silt, trace to some gravel and sand, wet	123.5 / 1.5
CLAYEY SILT TILL hard mottled grey/brown to red clayey silt, trace sand and gravel, DTPL	122.6 / 2.4
SHALE very weathered red shale sedimentary deposit, very moist	114.3 / 10.7
grey	112.8 / 12.2
Drilling Terminated	

SAMPLE

Number	Type	Dynamic Cone / Standard Penetration	Shear Strength (PP) kPa	Water Content %
1	SS	14		17
2	SS	50	>200	13
3	SS	86/280mm		10
4	SS	50/125mm		6
5	SS	50/50mm		
6	SS	50/25mm		

Shear Strength (FV) kPa: 50 100 150 200

Groundwater Observations and Standpipe Details

Concrete

Bentonite

Sand Pack

6.5 mbgs (June 13, 2019)

51mm PVC Riser

51mm Slotted Screen

Field Technician: M. Dalgliesh

Drafted by: O. Byvelds

Reviewed by: D. Gonser

MTE

Sheet: 1 of 1

ID Number: MW102-19

Project: Columbia International College Gymnasium

Project No: 45800-200

Client: Columbia International College Canada

Site Location: 574 Northcliffe Avenue, Dundas, ON

Drill Date: 6/5/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Solid Stem Augers

Protective Cover: Monument Casing

SUBSURFACE PROFILE

Depth (m)	Soil Description	Elevation (masl) / Depth (m)
0	Ground Surface	125.0 / 0.0
0.0	**TOPSOIL** dark brown sandy silt, very moist	
	SILT TILL dense to very dense red silt, some clay and sand, trace gravel, occasional bedrock fragments, very moist	122.7 / 2.3
2.3	**SHALE** very weathered red shale sedimentary deposit, moist	
6.1	grey	118.9 / 6.1
12.2	Drilling Terminated	112.8 / 12.2

SAMPLE

Number	Type	Standard Penetration	Water Content (%)
1	SS	32	10
2	SS	82/280mm	12
3	SS	92/280mm	7
4	SS	50/125mm	4
5	SS	50/115mm	4
6	SS	50/75mm	5
7	SS	50/25mm	9
8	SS	50/50mm	4

Dynamic Cone
Standard Penetration 20 40 60 80
Shear Strength (PP) kPa
Shear Strength (FV) kPa 50 100 150 200
Water Content % 10 20 30

Groundwater Observations and Standpipe Details

Concrete
4.4 mbgs (June 13, 2019)
Bentonite
Sand Pack
51mm PVC Riser
51mm Slotted Screen

Field Technician: M. Dalgliesh

Drafted by: O. Byvelds

Reviewed by: D. Gonser

MTE

Sheet: 1 of 1

ID Number: BH103-19

Project: Columbia International College Gymnasium

Project No: 45800-200

Client: Columbia International College Canada

Site Location: 574 Northcliffe Avenue, Dundas, ON

Drill Date: 6/6/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Solid Stem Augers

Protective Cover: N/A

SUBSURFACE PROFILE			SAMPLE					
Soil Description	Elevation (masl)	Depth (m)	Number	Type	Dynamic Cone / Standard Penetration (20 40 60 80)	Shear Strength (PP) kPa / Shear Strength (FV) kPa (50 100 150 200)	Water Content % (10 20 30)	Groundwater Observations and Standpipe Details
Ground Surface	121.6	0.0						
FILL dark brown/black sandy silt (topsoil), very moist	121.3	0.3						Cuttings
dark brown sandy silt, some gravel, organic roots, very moist	120.8	0.8						
SILT AND CLAY TILL very stiff to hard brown/red to red silt and clay, trace sand, occasional bedrock fragments, DTPL			1	SS	12	150	22	
			2	SS	30	>200	20	Bentonite
	119.3	2.3						
SHALE very weathered red shale sedimentary deposit, very moist			3	SS	86/280mm		6	
	118.4	3.2	4	SS	50/125mm		5	Dry cave
Drilling Terminated								

Depth: ft 0, 2, 4, 6, 8, 10, 12, 14, 16; m 0, 2, 4

Borehole dry upon drilling completion

Field Technician: M. Dalgliesh

Drafted by: O. Byvelds

Reviewed by: D. Gonser

MTE

Sheet: 1 of 1

ID Number: BH104-19

Project: Columbia International College Gymnasium

Project No: 45800-200

Client: Columbia International College Canada

Site Location: 574 Northcliffe Avenue, Dundas, ON

Drill Date: 6/6/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Solid Stem Augers

Protective Cover: N/A

SUBSURFACE PROFILE

Soil Description	Elevation (masl) / Depth (m)
Ground Surface	119.2 / 0.0
FILL dark brown/black sandy silt (topsoil), very moist	118.9 / 0.3
dark brown silt, some sand and gravel, trace clay and organics (rootlets), very moist	118.4 / 0.8
6 inch layer of topsoil	
SILT TILL loose to very dense brown/red to brown silt, some clay and sand, trace gravel, occasional bedrock fragments, moist to very moist	115.7 / 3.5
SHALE very weathered red shale sedimentary deposit, moist	114.5 / 4.7
Drilling Terminated	

SAMPLE

Number	Type	Standard Penetration	Water Content (%)
1	SS	8	19
2	SS	28	14
3	SS	50	12
4	SS	53	8
5	SS	50/150mm	9

Dynamic Cone / Standard Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200

Water Content %: 10 20 30

Groundwater Observations and Standpipe Details

← Cuttings

← Bentonite

← Dry cave

Borehole dry upon drilling completion

Field Technician: M. Dalgliesh

Drafted by: B.Graul

Reviewed by: D. Gonser

MTE

Sheet: 1 of 1

ID Number: BH105-19

Project: Columbia International College Gymnasium

Project No: 45800-200

Client: Columbia International College Canada

Site Location: 574 Northcliffe Avenue, Dundas, ON

Drill Date: 6/6/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Solid Stem Augers

Protective Cover: N/A

SUBSURFACE PROFILE		SAMPLE					
Soil Description	Elevation (masl) / Depth (m)	Number	Type	Dynamic Cone / Standard Penetration	Shear Strength (PP) kPa / Shear Strength (FV) kPa	Water Content %	Groundwater Observations and Standpipe Details
Ground Surface	118.9						
FILL dark brown/black sandy silt (topsoil), very moist	0.0						
dark brown clayey silt, some gravel, wet	118.6 / 0.3						
SILT TILL compact to very dense brown/red silt, some clay, trace sand and gravel, occasional bedrock fragments, very moist to wet	118.1 / 0.8	1	SS	19		14	Cuttings
		2	SS	40		26	
		3	SS	86/280mm		7	
SHALE very weathered red shale sedimentary deposit, moist	115.9 / 3.0	4	SS	50/75mm		14	Bentonite
		5	SS	50/50mm		8	Dry cave
Drilling Terminated	114.3 / 4.6						Borehole dry upon drilling completion

Field Technician: M. Dalgliesh

Drafted by: B.Graul

Reviewed by: D. Gonser

MTE

Sheet: 1 of 1

ID Number: BH106-19

Project: Columbia International College Gymnasium

Project No: 45800-200

Client: Columbia International College Canada

Site Location: 574 Northcliffe Avenue, Dundas, ON

Drill Date: 6/6/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Solid Stem Augers

Protective Cover: N/A

SUBSURFACE PROFILE | **SAMPLE**

Elevation (masl) / Depth (m)	Soil Description	Sample Number	Type	Standard Penetration	Shear Strength (PP) kPa	Water Content %	Groundwater Observations and Standpipe Details
119.5	Ground Surface						
0.0	**FILL** dark brown/black sandy silt (topsoil), very moist loose to compact dark brown to borwn/red silt, some clay and gravel, trace sand, wet	1	SS	4		19	Cuttings
		2	SS	21		14	
117.7 / 1.8	**SANDY SILT TILL** compact brown/red sandy silt, trace clay and gravel, wet						
117.2 / 2.3	**CLAYEY SILT TILL** hard red clayey silt, trace sand and gravel, occasional bedrock fragments, DTPL	3	SS	59	>200	9	Bentonite
116.5 / 3.0	**SHALE** very weathered red shale sedimentary deposit, moist	4	SS	50/125mm		9	
		5	SS	50/50mm		6	Dry cave
114.9 / 4.6	Drilling Terminated						Borehole dry upon drilling completion

Dynamic Cone: 20 40 60 80
Shear Strength (FV) kPa: 50 100 150 200
Water Content %: 10 20 30

Depth: ft 0–16; m 0–4

Field Technician: M. Dalgliesh

Drafted by: B.Graul

Reviewed by: D. Gonser

MTE

ID Number: BH107-19

Project: Columbia International College Gymnasium

Project No: 45800-200

Client: Columbia International College Canada

Site Location: 574 Northcliffe Avenue, Dundas, ON

Drill Date: 6/6/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Solid Stem Augers

Protective Cover: N/A

SUBSURFACE PROFILE

Depth (ft / m)	Soil Description	Elevation (masl) / Depth (m)
0 / 0	Ground Surface	119.1
0 / 0	**TOPSOIL** dark brown/black sandy silt, very moist	119.1 / 0.0
	SILT TILL compact to very dense dark brown to brown/red silt, some gravel, trace to some clay and sand, occasional bedrock fragments, very moist to wet	118.7 / 0.4
	SILT AND CLAY TILL hard red silt and clay, some sand, trace gravel, occasional bedrock fragments, DTPL	116.8 / 2.3
	SHALE very weathered red shale sedimentary deposit, very moist	116.1 / 3.0
	Drilling Terminated	114.5 / 4.6

SAMPLE AND TEST RESULTS

Dynamic Cone (×); Standard Penetration (●) 20 40 60 80; Shear Strength (PP) kPa (▲); Shear Strength (FV) kPa (■) 50 100 150 200; Water Content % (●) 10 20 30

Number	Type	Standard Penetration	Shear Strength (PP) kPa	Water Content %
				17
1	SS	27		16
2	SS	82/280mm		13
3	SS	86/305mm	>200	10
4	SS	50/125mm		8
5	SS	50/50mm		5

Groundwater Observations and Standpipe Details

Cuttings

Bentonite

Dry cave

Borehole dry upon drilling completion

Field Technician: M. Dalgliesh

Drafted by: B.Graul

Reviewed by: D. Gonser

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Sheet: 1 of 1

ID Number: BH108-19

Project: Columbia International College Gymnasium

Project No: 45800-200

Client: Columbia International College Canada

Site Location: 574 Northcliffe Avenue, Dundas, ON

Drill Date: 6/6/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

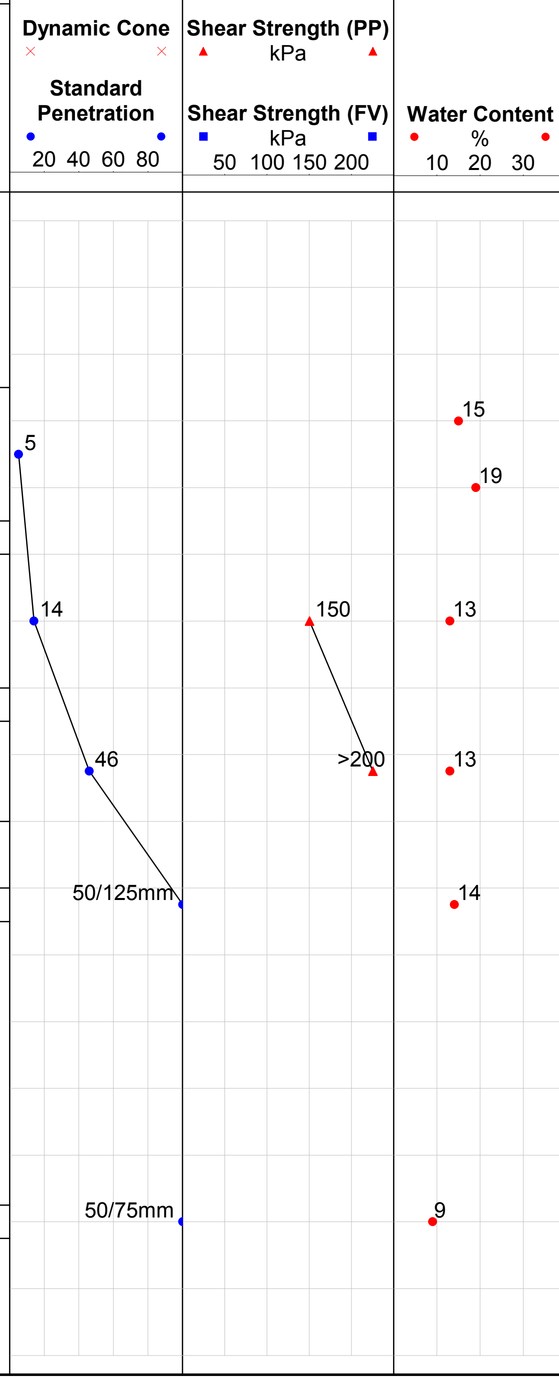
Drill Method: Solid Stem Augers

Protective Cover: N/A

SUBSURFACE PROFILE / **SAMPLE**

Depth (m)	Soil Description	Elevation (masl)	Depth (m)
0.0	Ground Surface	118.0	
0.0	**FILL** dark brown/black sandy silt (topsoil), very moist		0.0
0.8	loose to compact layered dark brown/red silt, some sand and clay, trace gravel and topsoil, very moist	117.2	0.8
1.2	305mm saturated layer	116.8	1.2
1.7	**CLAYEY SILT TILL** compact stiff brown/red clayey silt, some sand, trace gravel, occasional bedrock fragments, very moist	116.3	1.7
2.3	150mm saturated layer	115.7	2.3
3.0	**SHALE** very weathered red shale sedimentary deposit, moist	115.0	3.0
4.6	Drilling Terminated	113.4	4.6

Number	Type
1	SS
2	SS
3	SS
4	SS
5	SS



Groundwater Observations and Standpipe Details

Cuttings

Bentonite

Dry cave

Borehole dry upon drilling completion

Field Technician: M. Dalgliesh

Drafted by: B.Graul

Reviewed by: D. Gonser

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Sheet: 1 of 1