Geotechnical Investigation

Monfort School Parking Addition
350 Den Haag Drive
Ottawa, Ontario

Prepared for:

Conseil des Ecole Catholiques du Centre-Est (CECCE)
4000 rue Labelle.
Ottawa, Ontario
K1J 1A1

Attention: Melissa Bernard

LRL File No.: 180550

June, 2019

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APPENDICES

1 INTRODUCTION

LRL Associates Ltd. (LRL) was retained by Conseil des Ecole Catholiques du Centre-Est (CECCE) to perform a geotechnical investigation for a parking addition, located at 350 Den Haag Drive, Ottawa Ontario.

The purpose of the investigation was to identify the subsurface conditions at the proposed parking addition area by the completion of a borehole drilling program. Based on the visual and factual information obtained, this report will provide a summary of the findings, and guidelines for pavement structure and subgrade preparation.

This report has been prepared in consideration of the terms and conditions noted above. Should there be any changes in the design features, which may relate to the geotechnical recommendations provided in the report, LRL should be advised in order to review the report recommendations.

2 SITE AND PROJECT DESCRIPTION

The site under investigation currently encompasses the Monfort Elementary Catholic School, located at 350 Den Haag Drive, Ottawa ON. The site consists of the main school building, an asphalted parking at the south west portion, playground areas, and a bus loop at the front of the school. The site has an approximate surface area of 23,000 m^2, and is civically located at 350 Den Haag Drive, Ottawa ON.

It is our understanding that construction will consist of the addition of eight (8) new parking lots located near the entranceway of the bus loop pick-up area.

3 PROCEDURE

The fieldwork for this investigation was carried out on June 11, 2019. Prior to the fieldwork, the area to be investigated was cleared for the presence of any underground services and utilities. The drilling area was concentrated in the general vicinity of where the proposed parking lot additions will be constructed. A total of three (3) boreholes, labelled BH1 through BH3 were drilled, where it was possible to do so. The approximate locations of the boreholes are shown in Figure 1, included in **Appendix A**.

The boreholes were advanced using a truck mount CME 55 drill rig equipped with 200 mm diameter continuous flight hollow stem augers, supplied and operated by George Downing Estate Drilling. A “two man” crew experienced with geotechnical drilling operated the drill rig and equipment.

Sampling of the overburden materials encountered in the boreholes was carried out using a 50.8 mm diameter drive open conventional spoon sampler in conjunction with standard penetration testing (SPT) “N” values. The SPT were conducted following the method **ASTM D1586** and the results of SPT, in terms of the number of blows per 0.3 m of split-spoon sampler penetration after first 0.15 m designated as “N” value.

The boreholes were advanced to depths of 1.8 and 3.0 m below ground surface (bgs). Upon completion, the boreholes were backfilled and compacted using a combination of silica sand, and bentonite.

The fieldwork was supervised throughout by a member of our engineering staff who oversaw the drilling activities, cared for the samples obtained and logged the subsurface conditions encountered within each of the boreholes. All soil samples collected from the boreholes were placed and sealed in plastic bags to prevent moisture loss. The recovered soil samples collected from the boreholes were classified based on visual examination of the materials recovered and the results of the in-situ testing.

Furthermore, all boreholes were located using a Garmin Etrex Legend GPS (Global Positioning System) receiver using NAD 83 datum (North American Datum). LRL's field personnel determined the existing grade elevations at the borehole locations through a topographic survey carried out using a temporary site benchmark (TBM). The TBM used was the top of a catch basin lid located at the entrance of the bus loop. The elevation assigned to the TBM was 100.00 m. Ground surface elevations of boring locations are shown on their respective boreholes logs.

4 SUBSURFACE SOIL AND GROUNDWATER CONDITIONS

4.1 General

A review of local surficial geology maps provided by the Department of Energy, Mines and Resources Canada suggest that the surficial geology for this area is Ottawa Formation Bedrock; consisting of limestone with some shaly partings.

The subsurface conditions encountered in the boreholes were classified based on visual and tactile examination of the materials recovered from the boreholes. The soil descriptions presented in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil were conducted according to the procedure **ASTM D2487** and judgement, and LRL does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The subsurface soil conditions encountered at boreholes are given in their respective logs presented in **Appendix B**. A greater explanation of the information presented in the borehole logs can be found in **Appendix C** of this report. These logs indicate the subsurface conditions encountered at a specific test location only. Boundaries between zones on the logs are often not distinct, but are rather transitional and have been interpreted as such.

4.2 Topsoil

Topsoil was found at the surface of all boring locations. It had thicknesses ranging from 125 – 355 mm.

This material was classified as topsoil based on colour and the presence of organic material and is intended as identification for geotechnical purposes only. It does not constitute a statement as to the suitability of this layer for cultivation and sustaining plant growth.

4.3 Fill

Underlying the topsoil at all boring locations, a layer of fill material was encountered, and extended to depths ranging from 0.9 – 1.7 m bgs. This material can generally be described as a heterogeneous mixture of sand-silt-clay, with some gravel sized stone, some organic material near the surface, and brown in colour. Standard penetration tests were carried out in the fill material and the STP "N" values were found ranging from 5 to 20, indicating the material is loose at the surface, and becoming compact with increased depth.

4.4 Bedrock

Limestone bedrock with shaly partings was encountered in all boring locations, and extended to depths of 1.8 and 3.0 m bgs (end of exploration depth). This was found to be in a weathered state, and was able to be drilled and sampled without the need for coring.

4.5 Groundwater Conditions

Groundwater was carefully monitored and measured during this field investigation. During drilling, no groundwater was encountered. Immediately after completion of drilling, water was not encountered in any boreholes. No long term groundwater monitoring was carried out as part of this scope.

It should be noted that groundwater levels could fluctuate with seasonal weather conditions, (i.e., rainfall, droughts, spring thawing) and due to construction activities at or in the vicinity of the site.

5 RECOMMENDED PAVEMENT STRUCTURE

It is anticipated that the subgrade soil for the new parking areas will consist mostly of fill material, and potentially bedrock. The construction of the parking areas will be acceptable over these materials, once all debris, organic material, or otherwise deleterious material are removed from the subgrade area. Furthermore, the subgrade must be compacted (with the exception where the subgrade consists of bedrock) using a suitable heavy duty compacting equipment and approved by a geotechnical engineer prior to placing any granular base material.

The following are recommended pavement structures for light and heavy duty pavements proposed as part of this project.

For light duty parking areas and access roads, the pavement should consist of:

50 mm of HL3 A/C Surface Course over

150 mm of OPSS Granular A base over

300 mm of OPSS Granular B Type II subbase

For heavy duty parking areas and access roads, the pavement should consist of:

40 mm of HL3 A/C Surface Course over

50 mm of HL8 A/C Binder Course over

150 mm of OPSS Granular A base over

400 mm of OPSS Granular B, Type II subbase

Performance Graded Asphaltic Cement (PGAC) 58-34 is recommended for this project.

The base and subbase granular materials shall conform to **OPSS 1010** material specifications. Any proposed materials shall be tested and approved by a geotechnical engineer prior to delivery to the site and shall be compacted to 98-100% of its Standard Proctor Maximum Dry Density (SPMDD). Asphaltic concrete shall conform to **OPSS 1150** and be placed and compacted to at least 95% of the maximum relative density. The mix and its constituents shall be reviewed, tested and approved by a geotechnical engineer prior to delivery to the site.

5.1 Subgrade Preparation

The proposed subgrade shall be stripped of top soil, vegetation, debris and other obvious objectionable material. The subgrade shall be shaped, crowned and proof-rolled in the presence of a geotechnical engineer. Any resulting loose, soft or unstable areas shall be sub-excavated down to an adequate bearing layer and replaced with approved backfill and compacted to at least 98% of its SPMDD. Granular materials should be placed in layers not exceeding approximately 300 mm, within ± 2% of its optimum moisture content.

The preparation of subgrade shall be scheduled and carried out in manner so that a protective cover of overlying granular material (if required) is placed as quickly as possible in order to avoid unnecessary circulation by heavy equipment, except on unexcavated or protected surfaces. Frost protection of the surface shall be implemented if works are carried out during the winter months.

Where the asphaltic concrete surface of existing roadways is affected by the excavating process, the damaged zones should be saw cut and any damaged or loose pieces of asphaltic concrete should be removed down to the binder course or its entire depth, where only one (1) layer exists. The existing base should be scarified and proof-rolled with any soft areas excavated and replaced to the proper level with Granular A. Where two (2) layers of asphalt exist on an access lane, the surface course should be grinded over a width of 150 mm to allow the new surface course to overlap the binder layer and not create one straight vertical joint.

6 INSPECTION SERVICES

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the site do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design.

All subgrade areas and any engineered fill areas for the proposed pavement structure should be inspected by LRL Associates Ltd. to ensure that a suitable subgrade has been reached and properly prepared.

In-situ density testing should be carried out on the pavement granular materials, and backfill to ensure the materials meet the specifications from a compaction point of view.

If the new pavement construction is to be constructed during winter months, the subgrade should be protected from freezing temperatures using suitable construction techniques.

7 REPORT CONDITIONS AND LIMITATIONS

It is stressed that the information presented in this report is provided for the guidance of the designers and is intended for this project only. The use of this report as a construction document or its use by a third party beyond the client specifically listed in the report is neither intended nor authorized by LRL. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible contamination resulting from previous uses or activities at this site or adjacent properties, and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this report.

The recommendations provided in this report are based on subsurface data obtained at the specific test locations only. Boundaries between zones presented on the Borehole Logs are often not distinct but transitional and were interpreted. Experience indicates that the subsurface soil and groundwater conditions can vary significantly between and beyond the test locations. For this reason, the recommendations given in this report are subject to a field verification of the subsurface soil conditions at the time of construction.

The report recommendations are applicable only to the project described in the report. Any changes to the project will require a review by LRL Associates Ltd., to insure compatibility with the recommendations contained in this project.

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we may be of further services to you, please do not hesitate to contact the undersigned.

Yours truly,
LRL Associates Ltd.

LICENSED PROFESSIONAL ENGINEER
June 28, 2019
B. W. JOHNSON
100510537
PROVINCE OF ONTARIO

Bradley Johnson, P.Eng.
Geotechnical Engineer

APPENDIX A

Site and Borehole Location and Site Plan

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5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

PROJECT

GEOTECHNICAL INVESTIGATION
MONTFORT SCHOOL - PARKING ADDITION
350 DEN HAAG DRIVE
OTTAWA, ONTARIO

DRAWING TITLE

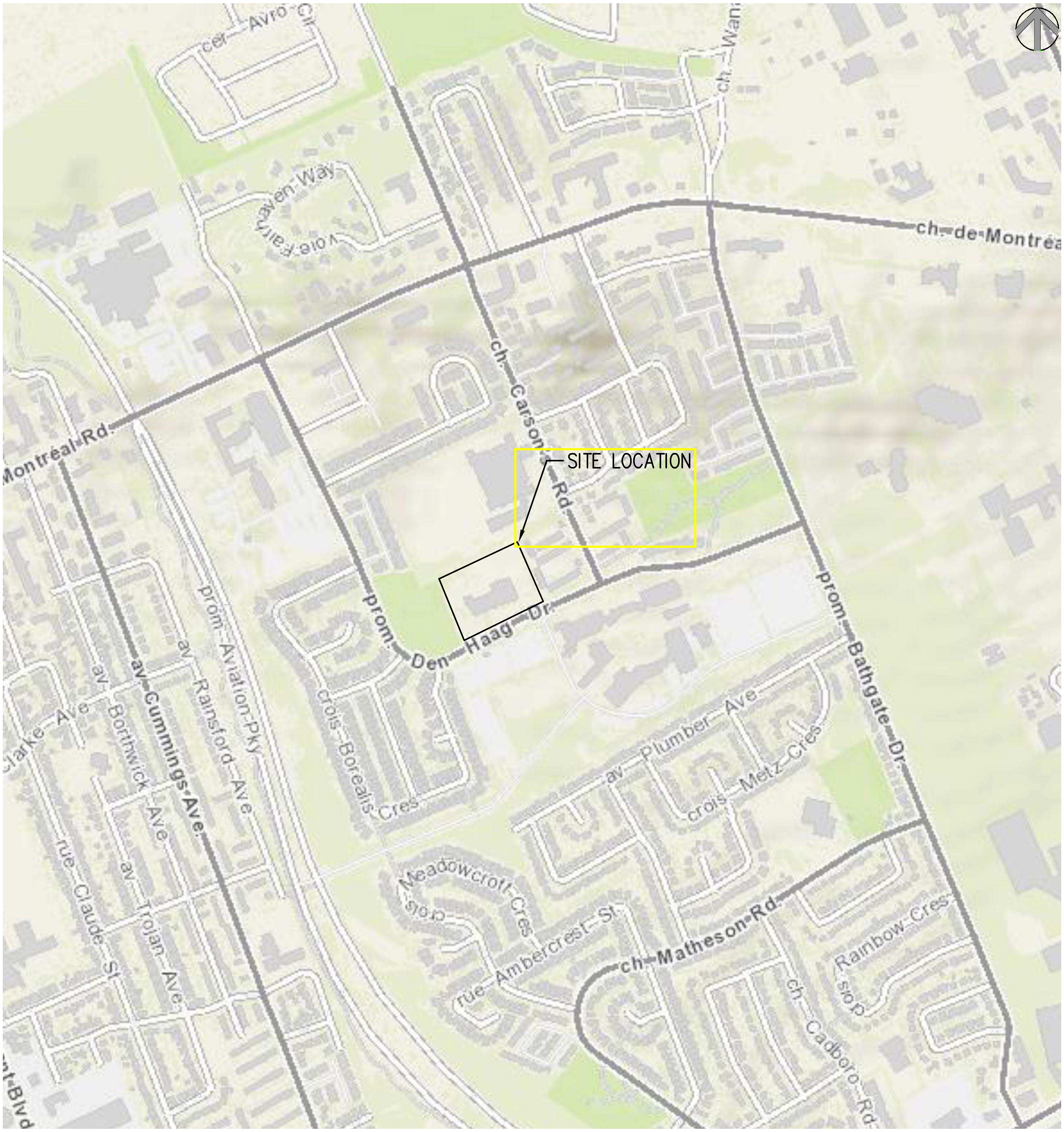
SITE LOCATION
SOURCE: GEO-OTTAWA

CLIENT
CECCE

DATE
JUNE, 2019

PROJECT
180550

FIGURE 1



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PROJECT

GEOTECHNICAL INVESTIGATION
MONTFORT SCHOOL - PARKING ADDITION
350 DEN HAAG DRIVE
OTTAWA, ONTARIO

DRAWING TITLE

BOREHOLE LOCATION
SOURCE: Imagery 2019 Google, Digital Globe Map Data

CLIENT

CECCE

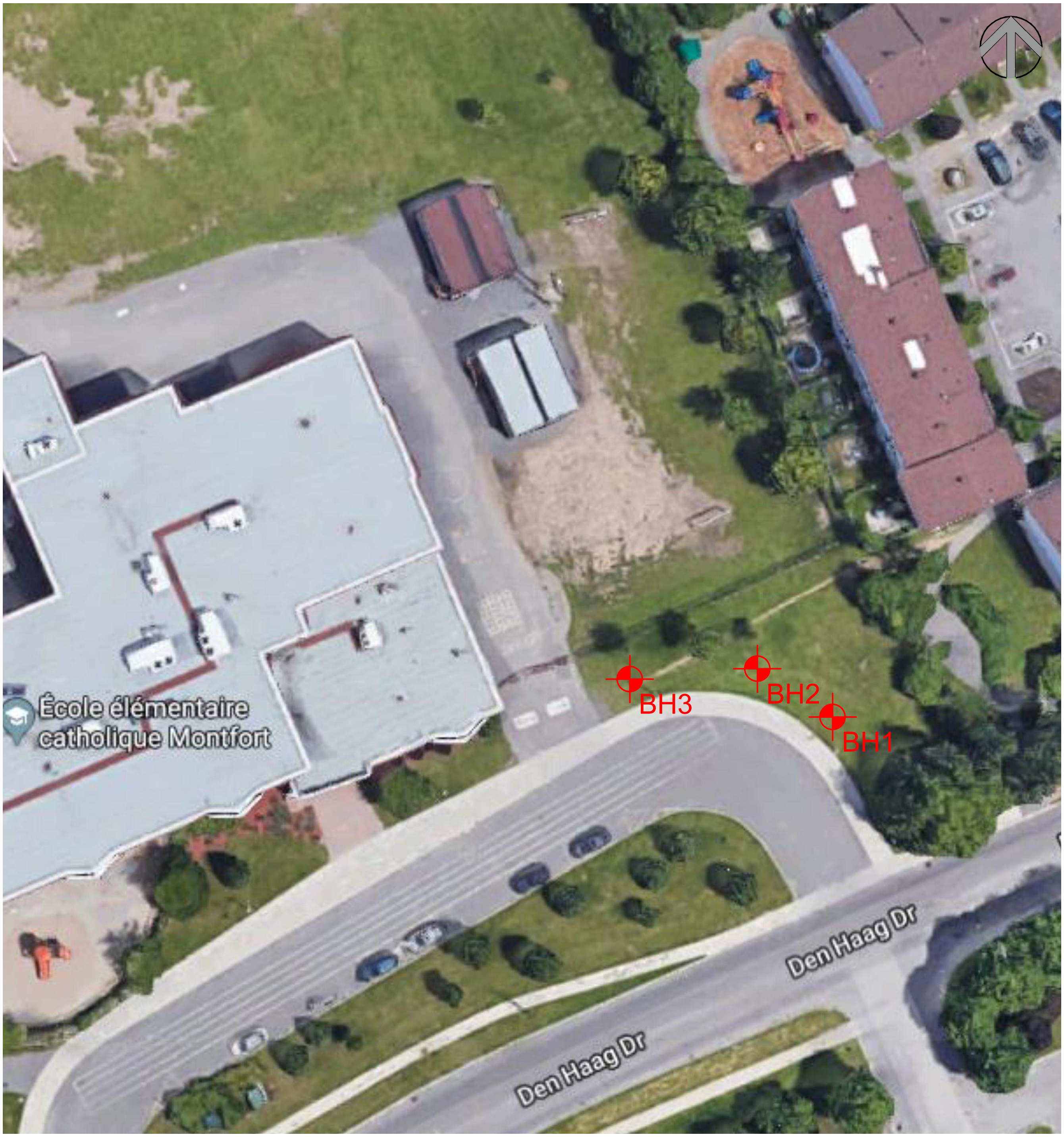
DATE

JUNE, 2019

PROJECT

180550

FIGURE 2



APPENDIX B

Borehole Logs

Borehole Log: BH1

Project No.: 180550

Client: CECCE

Date: June 11, 2019

Project: Montfort School - Parking Addition

Location: 350 Den Haag Drive, Ottawa ON

Field Personnel: BJ

Driller: George Downing Estate Drilling Ltd.

Drilling Equipment: Track Mount CME 55

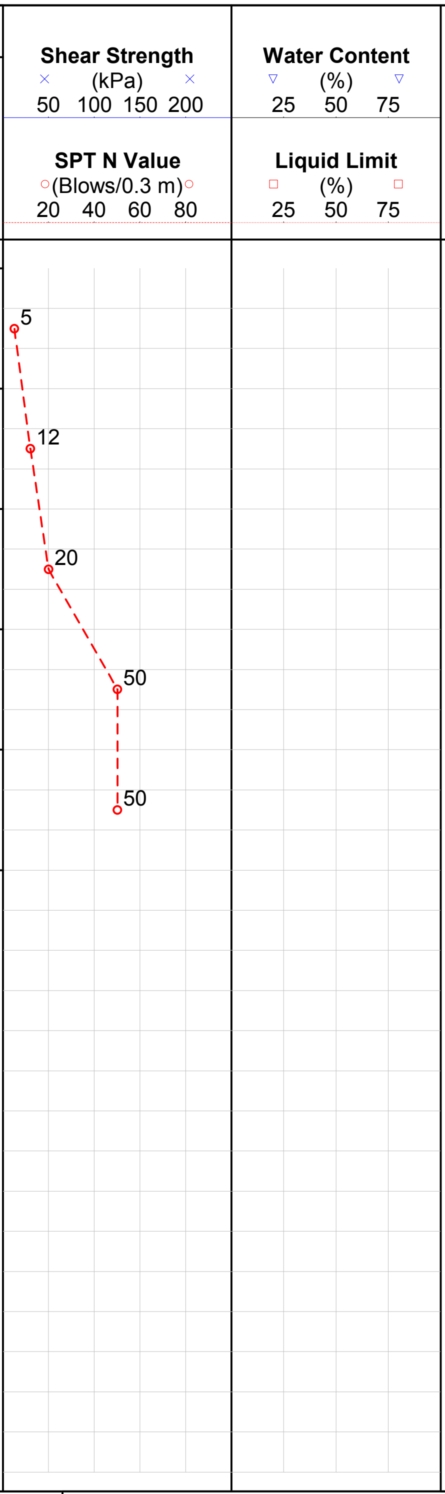
Drilling Method: HSA

SUBSURFACE PROFILE

Depth	Soil Description	Elev./Depth(m)	Lithology
ft 0 / m 0	Ground Surface	100.43	
	Topsoil- about 355 mm thick.	0.00 100.07	
	Fill- sand-silt-clay, some organics near the surface, dark, brown, moist, compact.	0.36 98.75	
	BEDROCK- limestone with shaly partings, weathered, grey.	1.68 97.43	
ft 10 / m 3	End of Borehole	3.00	

SAMPLE DATA

Type	Sample Number	N or RQD	Recovery (%)
	SS1	5	67
	SS2	12	100
	SS3	20	83
	SS4	50+	
	SS5	50+	



Water Level (Standpipe or Open Borehole)

Easting: 450776 m

Northing: 5032091 m

Site Datum: Catch Basin Lid at Entrance of Bus Loop (100.00 m)

Groundsurface Elevation: 100.43 m

Top of Riser Elev.: N/A

Hole Diameter: 200 mm

NOTES:
No water encountered during drilling.

Borehole Log: BH2

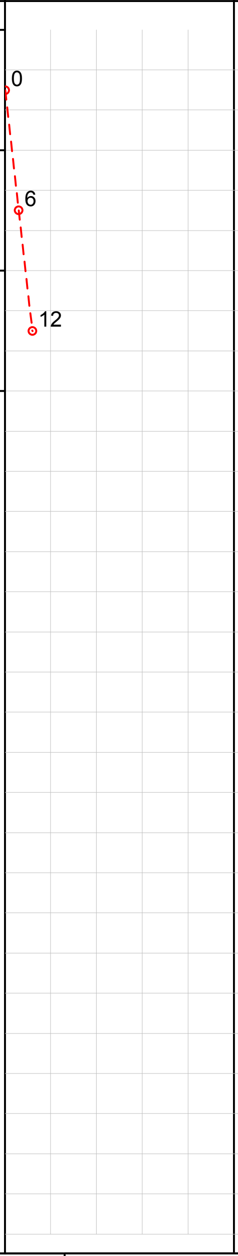
Project No.: 180550
Project: Monfort School - Parking Addition
Client: CECCE
Location: 350 Den Haag Drive, Ottawa ON
Date: June 11, 2019
Field Personnel: BJ
Driller: George Downing Estate Drilling Ltd.
Drilling Equipment: Truck Mount CME 55
Drilling Method: HSA

SUBSURFACE PROFILE / SAMPLE DATA

Soil Description	Elev./Depth(m)	Type	Sample Number	N or RQD	Recovery (%)
Ground Surface	100.24				
Topsoil- about 250 mm thick.	0.00 99.99				
Fill- sand-silt-clay, organics near the surface, some gravel sized stone, brown, moist, compact.	0.25 99.07		SS1	6	100
			SS2	12	100
BEDROCK- limestone with shaly partings, weathered, grey.	1.17 98.42		SS3	33	
End of Borehole	1.82				

Shear Strength × (kPa) × 50 100 150 200

SPT N Value ○(Blows/0.3 m)○ 20 40 60 80



Water Content ▽ (%) ▽ 25 50 75

Liquid Limit □ (%) □ 25 50 75

Water Level (Standpipe or Open Borehole)

Easting: 450767 m
Northing: 5032097 m
Site Datum: Catch Basin Lid at Entrance of Bus Loop (100.00 m)
Groundsurface Elevation: 100.237
Top of Riser Elev.: N/A
Hole Diameter: 200 mm

NOTES:
No water encountered during drilling.

Borehole Log: BH3

Project No.: 180550

Project: Monfort School - Parking Addition

Client: CECCE

Location: 350 Den Haag Drive, Ottawa ON

Date: June 11, 2019

Field Personnel: BJ

Driller: George Downing Estate Drilling Ltd.

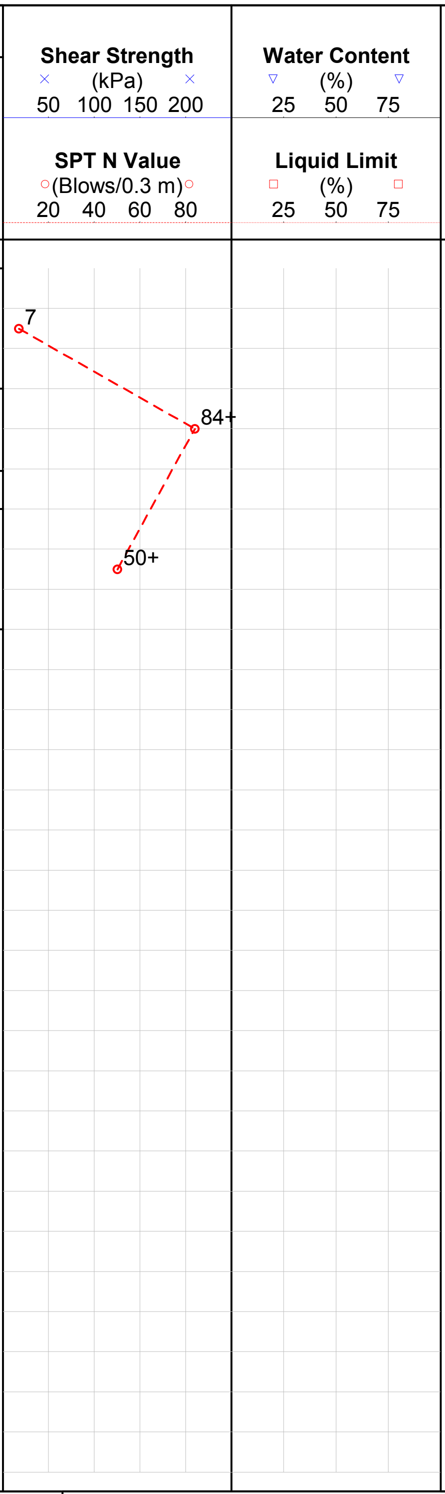
Drilling Equipment: Truck Mount CME 75

Drilling Method: HSA

SUBSURFACE PROFILE / SAMPLE DATA

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	99.55 0.00					
	Topsoil- about 125 mm thick.	0.30					
	Fill- sand-silt-clay, some gravel sized stone, organics near the surface, brown, moist, compact.				SS1	7	100
					SS2	84+	
	BEDROCK- limestone with shaly partings, weathered, grey.	98.64 0.91			SS3	50+	
	End of Borehole	97.73 1.82					

Water Level (Standpipe or Open Borehole)



Easting: 450455 m

Northing: 5032098 m

Site Datum: Catch Basin Lid at Entrance of Bus Loop

Groundsurface Elevation: 99.55 m

Top of Riser Elev.: N/A

Hole Diameter: 200 mm

NOTES:
No water encountered during drilling.

APPENDIX C

Symbols and Terms Used in Auger Hole Logs

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Symbols and Terms Used on Borehole and Test Pit Logs

1. Soil Description

The soil descriptions presented in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves some judgement and LRL Associates Ltd. does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice. Boundaries between zones on the logs are often not distinct but transitional and were interpreted.

a. Proportion

The proportion of each constituent part, as defined by the grain size distribution, is denoted by the following terms:

Term	Proportions
"trace"	1% to 10%
"some"	10% to 20%
prefix (i.e. "sandy" silt)	20% to 35%
"and" (i.e. sand "and" gravel)	35% to 50%

b. Compactness and Consistency

The state of compactness of granular soils is defined on the basis of the Standard Penetration Number (N) as per ASTM D-1586. It corresponds to the number of blows required to drive 300 mm of the split spoon sampler using a metal drop hammer that has a weight of 62.5 kg and free fall distance of 760 mm. For a 600 mm long split spoon, the blow counts are recorded for every 150 mm. The "N" value is obtained by adding the number of blows from the 2nd and 3rd count. Technical refusal indicates a number of blows greater than 50.

The consistency of clayey or cohesive soils is based on the shear strength of the soil, as determined by field vane tests and by a visual and tactile assessment of the soil strength.

The state of compactness of granular soils is defined by the following terms:

State of Compactness Granular Soils	Standard Penetration Number "N"	Relative Density (%)
Very loose	0 – 4	<15
Loose	4 – 10	15 – 35
Compact	10 - 30	35 – 65
Dense	30 - 50	65 - 85
Very dense	> 50	> 85

The consistency of cohesive soils is defined by the following terms:

Consistency Cohesive Soils	Undrained Shear Strength (C_u) (kPa)	Standard Penetration Number "N"
Very soft	<12.5	<2
Soft	12.5 - 25	2 - 4
Firm	25 - 50	4 - 8
Stiff	50 - 100	8 - 15
Very stiff	100 - 200	15 - 30
Hard	>200	>30

c. Field Moisture Condition

Description (ASTM D2488)	Criteria
Dry	Absence of moisture, dusty, dry to touch.
Moist	Dump, but not visible water.
Wet	Visible, free water, usually soil is below water table.

2. Sample Data

a. Elevation depth

This is a reference to the geodesic elevation of the soil or to a benchmark of an arbitrary elevation at the location of the borehole or test pit. The depth of geological boundaries is measured from ground surface.

b. Type

Symbol	Type	Letter Code
⌇	Auger	AU
⧗	Split Spoon	SS
‖	Shelby Tube	ST
⫴	Rock Core	RC

c. Sample Number

Each sample taken from the borehole is numbered in the field as shown in this column.

LETTER CODE (as above) – Sample Number.

d. Recovery (%)

For soil samples this is the percentage of the recovered sample obtained versus the length sampled. In the case of rock, the percentage is the length of rock core recovered compared to the length of the drill run.

3. Rock Description

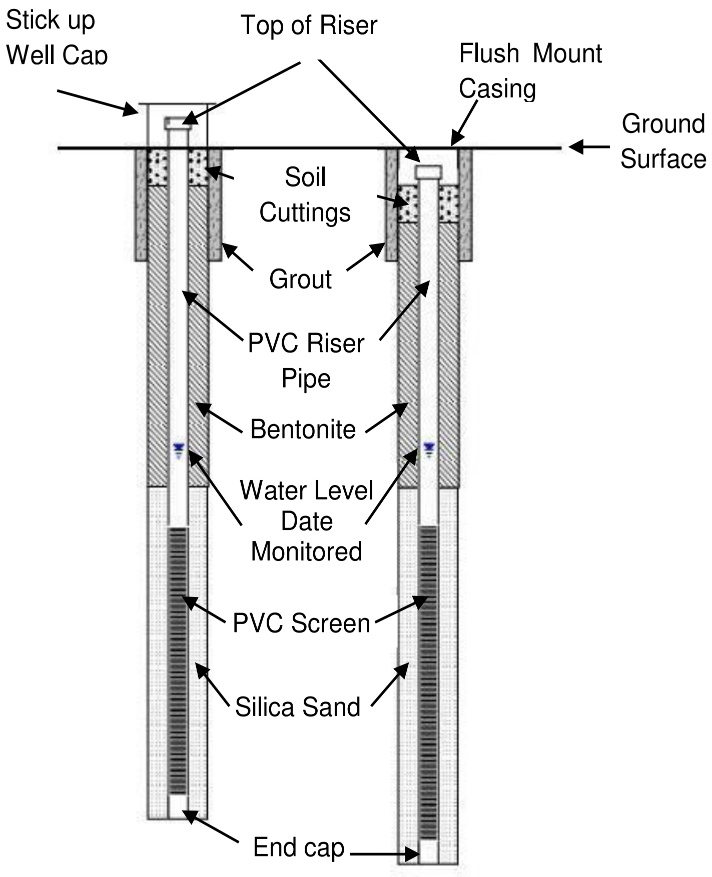
Rock Quality Designation (RQD) is a rough measure of the degree of jointing or fracture in a rock mas. The RQD is calculated as the cumulative length of rock pieces recovered having lengths of 100 mm or more divided by the length of coring. The qualitative description of the bedrock based on RQD is given below.

Rock Quality Designation (RQD) (%)	Description of Rock Quality
0 –25	Very poor
25 – 50	Poor
50 – 75	Fair
75 – 90	Good
90 – 100	Excellent

Strength classification of rock is presented below.

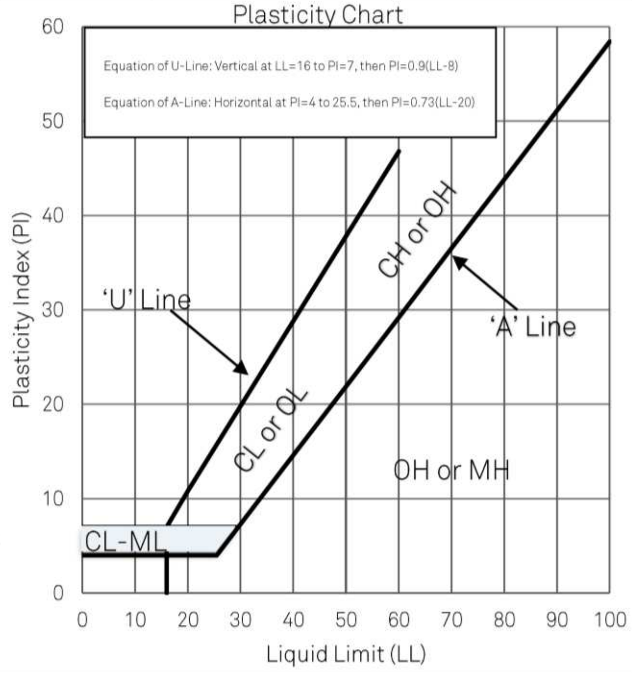
Strength Classification	Range of Unconfined Compressive Strength (MPa)
Extremely weak	< 1
Very weak	1 – 5
Weak	5 – 25
Medium strong	25 – 50
Strong	50 – 100
Very strong	100 – 250
Extremely strong	> 250

4. General Monitoring Well Data



5. Classification of Soils for Engineering Purposes (ASTM D2487)

(United Soil Classification System)

Major divisions			Group Symbol	Typical Names	Classification Criteria			
Coarse-grained soils More than 50% retained on No. 200 sieve* (>0.075 mm)	Gravels More than 50% of coarse fraction retained on No. 4 sieve(4.75 mm)	Clean gravels <5% fines	GW	Well-graded gravel	If 15% sand add "with sand" to group name.	Classification on basis of percentage of fines: Less than 5% pass No. 200 sieve - GW, GP, SW, SP More than 12% pass No. 200 sieve - GM, GC, SM, SC 5 to 12% pass No. 200 sieve - Borderline classifications, use of dual symbols	$C_u = \frac{D_{60}}{D_{10}} \geq 4$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravel			Not meeting either Cu or Cc criteria for GW	
		Gravels with >12% fines	GM	Silty gravel			Atterberg limits below "A" line or PI less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravel			Atterberg limits on or above "A" line and PI > 7	If fines are organic add "with orgnic fines" to group name
	Sands 50% or more of coarse fraction passes No. 4 sieve(<4.75 mm)	Clean sands <5% fines	SW	Well-graded sand	If 15% gravel add "with gravel to group name		$C_u = \frac{D_{60}}{D_{10}} \geq 6$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sand			Not meeting either Cu or C ccriteria for SW	
		Sands with >12% fines	SM	Silty sand			Atterberg limits below "A" line or PI less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sand			Atterberg limits on or above "A" line and PI > 7	If fines are organic add "with orgnic fines" to group name
Fine-grained soils50% or more passes No. 200 sieve* (<0.075 mm)	Silts and Clays Liquid Limit <50%	Inorganic	ML	Silt	If 15 to 29% coarse-grained, add "with sand" or "with gravel" as appropriate. If > 30% coarse-grained, add "sandy" or "gravelly" as appropriate. Class as organic when oven dried liquid limit is < 75% of undried liquid limit.	 		
			CL	Lean Clay -low plasticity				
		Organic	OL	Organic clay or silt (Clay plots above 'A' Line)				
	Silts and Clays Liquid Limit >50%	Inorganic	MH	Elastic silt				
			CH	Fat Clay -high plasticity				
		Organic	OH	Organic clay or silt (Clay plots above 'A' Line)				
	Highly Organic Soils		PT	Peat, muck and other highly organic soils				