Houle Chevrier Engineering

Geotechnical Investigation
Proposed Additon
Residential Structure
630 Cummings Avenue
Ottawa, Ontario

a GEMTEC company

Houle Chevrier Engineering

Submitted to:

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Geotechnical Investigation
Proposed Additon
Residential Structure
630 Cummings Avenue
Ottawa, Ontario

May 18, 2016
Project: 64365.01

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the proposed additions to the residential structure located at 630 Cummings Avenue in the City of Ottawa, Ontario (refer to Key Plan, Figure 1). The purpose of the investigation was to identify the general subsurface conditions at the site by means of four (4) test pits and, based on the factual information obtained, to provide engineering guidelines on the geotechnical design aspects of the project, including construction considerations, which could influence design decisions.

This investigation was performed in accordance with our proposal dated April 13, 2016.

2.0 PROJECT AND SITE DESCRIPTION

Plans are being prepared to construct additions to the north and south sides of a residential structure located at 630 Cummings Avenue in the City of Ottawa, Ontario. It is understood that the north side addition will be about 148 square metres in plan area, and the south side addition will be about 84 square metres in plan area. It is further understood that the proposed additions will consist of two (2) storeys and a basement level.

Surficial geology maps of the Ottawa area indicate that the overburden deposits at the site are composed of sand and gravel with possible boulders. Bedrock geology and drift thickness maps indicate that the bedrock is composed of interbedded limestone and shale of the Lindsay formation located between 3 to 5 metres below ground surface. Fill materials from the past development of this site should also be expected. Part of the area proposed for the addition appears to be raised with respect to the surrounding terrain.

3.0 SUBSURFACE INVESTIGATION

The field work for this investigation was carried out on April 28, 2016. At that time, four (4) test pits, numbered 16-1 to 16-4, inclusive, were advanced at the site using a backhoe supplied and operated by a Maurice Yelle Ltd. Test pits 16-1 and 16-2 were advanced on the north side of the site, and test pits 16-3 and 16-4 on the south side.

Test pits 16-1 and 16-3 were advanced adjacent to the foundation wall to the level of the underside of the spread footing, about 1.3 and 1.8 metres below ground surface, respectively. A hand auger hole was advanced in the bottom of test pits 16-1 and 16-3 to depths of about 2.3 and 2.8 metres below ground surface, respectively. Test pits 16-2 and 16-4 were advanced outside the proposed addition footprints to a depth of about 2.4 and 2.7 metres below ground surface, respectively.

The groundwater levels were observed in the open test pits upon completion of the test pits.

The field work was supervised and carried out by a member of our engineering staff. Following the field work, the soil samples were returned to our laboratory for examination by a

geotechnical engineer. Select samples were tested for water content and grain size distribution. A soil sample was sent to Paracel Laboratories for basic chemical testing relating to corrosion of buried concrete and steel.

The ground surface elevations at the test pit locations on the site were measured by Houle Chevrier Engineering Ltd. personnel using our Trimble R10 GPS survey instrument. The ground surface elevations were measured relative to geodetic datum.

Descriptions of the subsurface conditions logged in the test pits are provided on the Record of Test Pit sheets in Appendix A. Results of the soil classification testing are provided on the Record of Test Pit sheets as well as in Appendix B. The approximate locations of the test pits are shown on the Test Pit Location Plan, Figure 2.

4.0 SUBSURFACE CONDITIONS

4.1 General

As previously indicated, the soil and groundwater conditions identified in the test pits are given on the Record of Test Pit sheets in Appendix A. The logs indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. Subsurface conditions at other than the test locations may vary from the conditions encountered in the test holes. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties.

The groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. These conditions may vary seasonally or as a consequence of construction activities in the area.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves judgement and Houle Chevrier Engineering Ltd. does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The following presents an overview of the subsurface conditions encountered in the test holes advanced during this investigation.

4.2 Topsoil, Topsoil Fill

A surficial layer of topsoil/topsoil fill was encountered at all test pit locations. The topsoil/topsoil fill can generally be described as dark brown silty sand, trace gravel and clay, with organic material and roots. Cobbles and boulders were noted in test pit 16-2, and miscellaneous debris was noted in test pit 16-3. The thickness of the topsoil/topsoil fill ranges from about 250 to 330 millimetres.

4.3 Fill/Possible Fill Material

Fill/possible fill material (herein known as fill) was encountered below the topsoil at all test pit locations. The fill material has a thickness ranging from about 0.6 to 1.5 metres and extends to depths ranging from about 0.9 to 1.8 metres below ground surface (elevation 74.4 to 76.4 metres, geodetic datum). The fill a can generally be described as brown, red brown or grey brown, fine to coarse grained sand with varying amounts silt, gravel and cobbles and boulders. Organic material and miscellaneous debris such as steel, pipes, brick, etc were also noted in the fill material.

One (1) grain size distribution test carried out on a sample of the fill recovered from test pit 16-3 is provided on Figure B1 in Appendix B along with the grain size distribution envelope for Ontario Provincial Standard Specification (OPSS) Granular B Type I. The sample generally meets the requirements for OPSS Granular B Type I, however some sorting to remove the debris may be required.

The moisture content measured in the fill material was about 10 percent.

4.4 Gravelly Sand

A native deposit of brown gravelly sand with trace to some silt was encountered below the fill material in test pit 16-2 at a depth of about 0.9 metres below ground surface (elevation 76.4 metres, geodetic datum). The thickness of the gravelly sand deposit is about 1.1 metres.

The moisture content measured in the gravelly sand deposit was about 6 percent.

One (1) grain size distribution test carried out on a sample of the gravelly sand deposit recovered from test pit 16-4 is provided on Figure B2 in Appendix B along with the grain size distribution envelope for OPSS Granular B Type I. The sample generally meets the requirements for OPSS Granular B Type I.

4.5 Sand

A native deposit of sand was encountered in all test pit locations. The deposit of sand can be described as brown to grey brown sand, with some gravel, trace silt. Hand auger refusal was encountered within the sand deposit at test pit 16-1 and 16-3 at depths of about 2.3 and 2.8 metres below ground surface, respectively, (elevation 74.7 and 73.9 metres, geodetic datum).

The moisture content measured in the sand deposit was about 12 percent.

4.6 Groundwater Levels

No groundwater inflow was observed upon completion of the test pits on April 28, 2016. It should be noted the groundwater levels could be higher during wet periods of the year, such as the early spring or fall or following periods of heavy precipitation.

4.7 Inferred Bedrock

Backhoe refusal was encountered at a depth of about 2.7 metres (elevation 73.2 metres, geodetic datum) in test pit 16-4 on the inferred bedrock surface. It should be noted that the bedrock surface was not observed due to flowing sand, and that refusal can also occur on large boulders.

4.8 Soil Chemistry Relating to Corrosion

The results of chemical testing on a sample of soil from test pit 16-3 are provided in Appendix C and summarized below:

- pH 7.60
- Sulphate Content 8 micrograms per gram (µg/g)
- Chloride Content <5 micrograms per gram (µg/g)
- Resistivity 326 Ohm metre (Ohm.m)

4.9 Existing Foundation

The following observations were made with respect to the foundation walls and the spread footing at test pits 16-1 and 16-3.

- The foundations consist of cast-in-place concrete walls bearing on cast-in-place concrete spread footings. The footings have a thickness of about 250 millimetres and project about 450 millimetres from the foundation walls.
- The underside of the spread footing is about 1.3 metres below ground surface at the location of test pit 16-1 and about 1.8 metres below ground surface at test pit 16-3.
- No voids were observed between the foundation walls and the spread footings or between the spread footings and the underlying, native sand deposit.
- A clay tile perimeter drainage system is located adjacent to the top of the footing at test pit 16-1 and about 100 millimetres below the top of footing at test pit 16-3.

5.0 PROPOSED BUILDING ADDITION

5.1 General

The information in the following sections is provided for the guidance of the design engineers and Architect and is intended for the design of this project only. 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 retained for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities of this site or adjacent properties, and/or resulting from the introduction onto the site from materials from offsite sources are outside the terms of reference for this report.

5.2 Excavation

The excavations for the proposed building additions will be carried out through fill material and native deposits of sand/gravelly sand.

The sides of the excavation should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the act, soils at this site can be classified as Type 3. That is, open cut excavations within overburden deposits should be carried out with side slopes of 1 horizontal to 1 vertical, or flatter.

Sloughing of the sand deposits may occur if sands become saturated. The excavation side could be stabilized using somewhat flatter side slopes (at 3 horizontal to 1 vertical, or flatter).

5.2.1 Excavation Next to Existing Building Foundation

The underside of footing level should match the existing underside of footing where the new foundation wall butts up to the existing foundation wall.

Where this is not practicable, it is recommended that the bottom of the excavation for the proposed addition be located beyond a line extending down and out from the bottom edge of the existing building foundations at 1 horizontal to 1 vertical, or flatter, to prevent undermining of the existing building foundation. Other possible options included localized underpinning of the existing foundations.

5.2.2 Groundwater Pumping

Any groundwater inflow from the overburden deposits should be relatively small and controlled by pumping from filtered sumps within the excavation. It is not expected that short term pumping during excavation will have a significant effect on nearby structures and services.

5.3 Foundations

Based on the results of the test pit investigation, the native deposits of sand are considered suitable for the support of the addition on conventional spread footing foundations. The topsoil layer and fill material are considered to be highly compressible and are not suitable for the

support of the proposed additions or concrete floor slabs. Therefore, all topsoil, organic deposits, fill material and disturbed material should be removed from the proposed addition footprint.

In areas where subexcavation of topsoil, organic material, fill material or disturbed material is required below the proposed founding level, the grade could be raised with compacted granular material (engineered fill). The engineered fill should consist of granular material meeting OPSS requirements for Granular B Type I or II. The granular material should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value.

To allow for distribution of the loads beneath the footings, the engineered fill should extend at least 0.3 metres horizontally beyond the edge of the footings and down and out from this point at 1 horizontal to 1 vertical, or flatter. The excavation for the building should be sized to accommodate this fill placement.

Spread footing foundations bearing directly on undisturbed native sand, gravelly sand, or on a pad of engineered fill above native soil deposits, should be sized using a net geotechnical reaction at Serviceability Limit State (SLS) of 100 kilopascals and a factored net geotechnical resistance at Ultimate Limit States (ULS) resistance of 200 kilopascals.

The post construction total and differential settlement of footings at SLS should be less than 25 and 20 millimeters, respectively, provided that all loose or disturbed soil is removed from the bearing surfaces and from below the granular fill. Since any settlement of the additions will be differential with respect to the existing building, the addition should be structurally separated from the existing building.

5.4 Frost Protection of Foundations

The overburden soil cover over the existing footings was measured to be about 1.3 and 1.8 metres. All exterior footings in heated portions of the proposed addition should be provided with at least 1.5 metres of earth cover for frost protection purposes. Isolated, unheated exterior footings and/or piers adjacent to surfaces which are cleaned of snow cover during the winter months should be provided with a minimum of 1.8 metres of earth cover.

In order to allow for the reduced soil cover found at this site (to match the level of the proposed footings with the existing footings), the required frost protection could be provided by means of a combination of earth cover and extruded polystyrene insulation. An insulation detail could be provided upon request.

5.5 Foundation Wall Backfill and Drainage

To avoid frost adhesion and possible heaving, the foundations should be backfilled with imported, free draining, non-frost susceptible granular material such as that meeting OPSS

Granular B Type I or II requirements. Alternatively, a bond break such as a double layer of 6 mil polyethylene sheeting or a propriety drainage system (e.g. System Platon) could be placed on the foundation walls and the walls backfilled with native or imported material. Some of the native sand and some fill material (see Figures B2 and B3) are considered to be non frost susceptible and could be used for foundation backfill; it should be stockpiled for assessment by geotechnical personnel prior to placement.

Where the backfill will ultimately support areas of hard surfacing (pavement, sidewalks or other similar surfaces), the backfill should be placed in maximum 200 millimetre thick lifts and should be compacted to at least 95 percent of the standard Proctor maximum dry density value using suitable vibratory compaction equipment.

Where future landscaped areas will exist next to the proposed structures and if some settlement of the backfill is acceptable, the backfill could be compacted to at least 90 percent of the standard Proctor maximum dry density value.

Where areas of hard surfacing (concrete, sidewalk, pavement, etc.) abut the proposed building, a gradual transition should be provided between those areas of hard surfacing underlain by non-frost susceptible granular wall backfill and those areas underlain by existing frost susceptible native materials to reduce the effects of differential frost heaving. It is suggested that granular frost tapers be constructed from the underside of footing grade to the underside of the granular base/subbase material for the hard surfaced areas. The frost tapers should be sloped at 1 horizontal to 1 vertical, or flatter.

The foundation walls for the basement should be damp proofed and a perforated plastic foundation drain with a surround of clear crushed stone should be installed on the exterior of the foundation walls. The drain should outlet by gravity to a storm sewer, ditch, or a sump from which the water is pumped. To avoid loss of sand backfill into the voids in the clear stone (and possible post construction settlement of the ground around the building), a nonwoven geotextile should be placed between the clear stone and any sand backfill material.

5.6 Basement Slab and Slab on Grade Support

To provide predictable settlement performance of the basement slab, all organic, fill, or disturbed material should be removed from below the slab area.

The grade within the proposed addition could be raised, where necessary, with granular material meeting OPSS requirements for Granular B Type I or II. The use of Granular B Type II material is preferred under wet conditions. The granular base for the proposed slab on grade should consist of at least 150 millimetres of OPSS Granular A.

OPSS documents allow recycled asphaltic concrete and concrete to be used in Granular A. Since the source of recycled material cannot be determined, it is suggested that any granular

materials used beneath the floor slab be composed of virgin material (100 percent crushed rock) only, for environmental reasons.

All imported granular materials should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value using suitable vibratory equipment.

The floor slabs should be appropriately moist or wet cured to minimize shrinkage cracking and slab curling.

5.7 Seismic Site Classification and Liquefaction Potential

The subsurface conditions at the site are composed of fill over native deposits of sand with varying amounts of silt, gravel, cobbles and boulders. The bedrock surface is inferred at about 2.7 metres.

As such, seismic Site Class D could be used for the seismic design of the building addition.

There is no potential for liquefaction of the overburden deposits at this site.

5.8 Corrosion of Buried Concrete and Steel

The measured sulphate concentration in the sample of soil recovered from test pit 16-3 was 8 micrograms per grams. According to Canadian Standards Association (CSA) “Concrete Materials and Methods of Concrete Construction”, the concentration of sulphate can be classified as low. Therefore any concrete in contact with the native soil could be batched with General Use (GU) cement. The effects of freeze thaw in the presence of de-icing chemical (sodium chloride) use on the roadway should be considered in selecting the air entrainment and the concrete mix proportions for any concrete.

Based on the resistivity of the sample, the soil in this area can be classified as non aggressive towards unprotected steel. It should be noted that the corrosivity of the soil/groundwater could vary throughout the year due to the application sodium chloride for de-icing.

6.0 ADDITIONAL CONSIDERATIONS

6.1 Winter Construction

In the event that construction is required during freezing temperatures, the soil below the footings should be protected immediately from freezing using insulation, propane heaters and insulated tarpaulins, or other suitable means.

Any excavations should be opened for as short a time as practicable and the excavations should be carried out only in lengths which allow all of the construction operations, including backfilling, to be fully completed in one working day. In addition, the backfill should be excavated, stored and replaced without being disturbed by frost or contaminated by snow or ice.

6.2 Excess Soil Management

This report does not constitute an excess soil management plan. The disposal requirements for excess soil from the site have not been assessed.

6.3 Effects of Construction Induced Vibration

Some of the construction operations (such as granular material compaction, excavation, etc.) will cause ground vibration on and off of the site. The vibrations will attenuate with distance from the source, but may be felt at nearby structures. The magnitude of the vibrations will be much less than that required to cause damage to the nearby structures or services in good condition.

6.4 Design Review and Construction Observation

The details for the proposed construction were not available to us at the time of preparation of this report. It is recommended that the final design drawings be reviewed by the geotechnical engineer as the design progresses to ensure that the guidelines provided in this report have been interpreted as intended.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed excavations do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design. The subgrade surfaces for the proposed building should be inspected by experienced geotechnical personnel to ensure that suitable materials have been reached and properly prepared. The placing and compaction of earth fill and imported granular materials should be inspected to ensure that the materials used conform to the grading and compaction specifications.

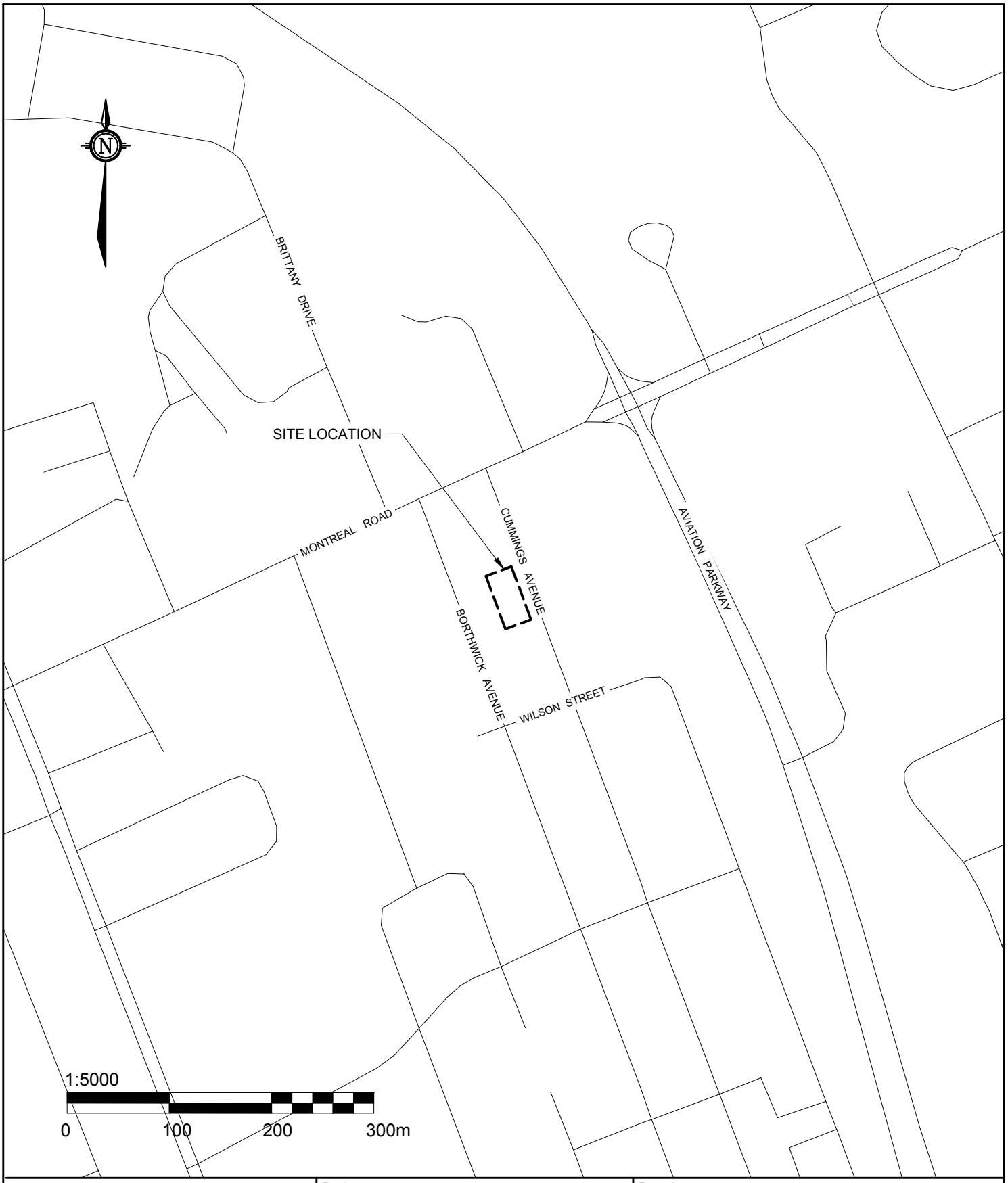
The native soils at this site are sensitive to disturbance from construction operations, from ponded water and frost. The construction operations should therefore be carried out in a manner that will prevent disturbance to the subgrade surfaces.

All foundation surfaces and any engineered fill areas for the proposed structures should be inspected by Houle Chevrier Engineering Ltd. to ensure that a suitable subgrade has been reached and properly prepared. In situ density testing should be carried out on any engineered fill used beneath the building addition. In accordance with Section 4.2.2.2 of the Ontario Building Code, full time inspection is required during placing and compaction of engineered fill and imported granular materials below foundations to ensure that the materials used conform to the grading and compaction specifications.

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

Blasco Vijayabaskaran, E.I.T.

Luc Bouchard, P.Eng. ing.



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Project	Drawing
GEOTECHNICAL INVESTIGATION PROPOSED ADDITION 630 CUMMINGS AVENUE, OTTAWA,ON	KEY PLAN

Drwn By	Chkd By	Date	Project No.	Revision No.	
P.C.	B.V.	MAY 2016	64365.01	0	**FIGURE 1**

P:\0. Files\64300\64365.01\Drafting\Drawings\64365.01_FG1_Cummings_2016-05-13.dwg, 13/05/2016 4:14:53 PM, DWG To PDF.pc3

LEGEND

TP 16-1
99.99
TEST PIT LOCATION IN PLAN
(current investigation by Houle Chevrier Engineering Ltd.)
GROUND SURFACE ELEVATION
GEODETIC DATUM

Scale 1:400

0 8 16 24m

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Client: A. SAAD			Project: 64365.01
Location: 630 CUMMINGS AVENUE OTTAWA, ON			
Drwn by: P.C.	Chkd by: B.V.	TEST PIT LOCATION PLAN	
Date: MAY 2016	Rev.: 0	**FIGURE 2**	

P:\0. Files\64300\64365.01\Drafting\Drawings\64365.01_FG2_Cummings_2016-05-13.dwg, 13/05/2016 4:15:24 PM, DWG To PDF.pc3

APPENDIX A

Record of Test Pit sheets

PROJECT: 64365.01

RECORD OF TEST PIT 16-1

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: April 28, 2016

TYPE OF EXCAVATOR: Backhoe

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) (Natural. V - +, Remoulded. V - ⊕) 20 40 60 80	WATER CONTENT (PERCENT) Wp W Wl 20 40 60 80	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		77.02					Backfilled with excavated material
	Dark brown silty sand, some organic material, roots, trace clay (TOPSOIL)		76.77	1				
	Grey brown, fine to medium grained sand, some silt, some gravel, cobbles, steel debris, miscellaneous debris (FILL)		0.25	2				
1			75.88					
	Red brown, medium grained sand, trace silt, trace gravel, trace organic material (FILL)		1.14	3				
			75.75					
	Brown to grey brown SAND, some gravel, trace silt		1.27	4				No groundwater observed
2			74.68					
	End of Test Pit/Hand auger refusal		2.34					
3								

DEPTH SCALE

1 to 15

Houle Chevrier Engineering

LOGGED: B.V.

CHECKED:

TESTPIT LOG 64365.01_630 CUMMINGS_GNT01_V01_2016-05-03.GPJ HOULE CHEVRIER FEB 9 2011.GDT 5-18-16

PROJECT: 64365.01

RECORD OF TEST PIT 16-2

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: April 28, 2016

TYPE OF EXCAVATOR: Backhoe

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) (Natural. V - +, Remoulded. V - ⊕) 20 40 60 80	WATER CONTENT (PERCENT) Wp — W — Wl 20 40 60 80	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		77.28					Backfilled with excavated material
	Dark brown silty sand, trace gravel, some organic material, roots, cobbles and boulders (TOPSOIL)		76.98	1				
	Grey, fine to medium grained sand, trace silt, trace gravel (possible FILL)		0.30 / 76.82	2				
	Red brown, medium to coarse grained sand, some gravel, some cobbles, trace silt (possible FILL)		0.46 / 76.37	3				
1	Brown GRAVELLY SAND, trace to some silt		0.91 / 75.30	4		○	Sieve (See Fig. B2)	No groundwater observed
2	Grey brown SAND, some gravel, trace silt		1.98 / 74.84	5				
	End of Test Pit Test pit terminated due to side walls sloughing.		2.44					
3								

TESTPIT LOG 64365.01_630 CUMMINGS_GNT01_V01_2016-05-03.GPJ HOULE CHEVRIER FEB 9 2011.GDT 5-18-16

DEPTH SCALE

1 to 15

Houle Chevrier Engineering

LOGGED: B.V.

CHECKED:

PROJECT: 64365.01

RECORD OF TEST PIT 16-3

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: April 28, 2016

TYPE OF EXCAVATOR: Backhoe

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) — Natural. V - +, Remoulded. V - ⊕ (20 40 60 80)	WATER CONTENT (PERCENT) — Wp, W, Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		76.73					Backfilled with excavated material
	Dark brown silty sand, trace gravel, some organic material, miscellaneous debris		76.40	1				
	Brown to grey brown, fine to medium grained sand, some gravel, cobbles, boulders, trace silt, brick debris (FILL)		0.33	2		○	Sieve (See Fig. B1)	
1								
	Grey brown SAND, some gravel, trace silt		74.90 1.83	3		○		No groundwater observed
2								
	End of Test Pit/Hand auger refusal		73.89 2.84	4				
3								

DEPTH SCALE

1 to 15

Houle Chevrier Engineering

LOGGED: B.V.

CHECKED:

TESTPIT LOG 64365.01_630 CUMMINGS_GNT01_V01_2016-05-03.GPJ HOULE CHEVRIER FEB 9 2011.GDT 5-18-16

PROJECT: 64365.01

RECORD OF TEST PIT 16-4

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: April 28, 2016

TYPE OF EXCAVATOR: Backhoe

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) (Natural. V - +, Remoulded. V - ⊕) 20 40 60 80	WATER CONTENT (PERCENT) Wp W Wl 20 40 60 80	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		75.93					Backfilled with excavated material
	Dark brown silty sand, trace gravel, some organic material, roots (TOPSOIL)		75.68	1				
	Grey brown, fine to medium grained sand, trace to some silt (possible FILL)		0.25 75.60	2				
	Dark brown silty sand, some gravel, cobbles, roots, trace organic material (possible FILL)		0.33	3				
1								
			74.41					No groundwater observed
	Grey to grey brown SAND, some gravel, trace silt		1.52	4				
2								
			73.24					
	End of Test Pit Backhoe refusal		2.69					
3								

DEPTH SCALE

1 to 15

Houle Chevrier Engineering

LOGGED: B.V.

CHECKED:

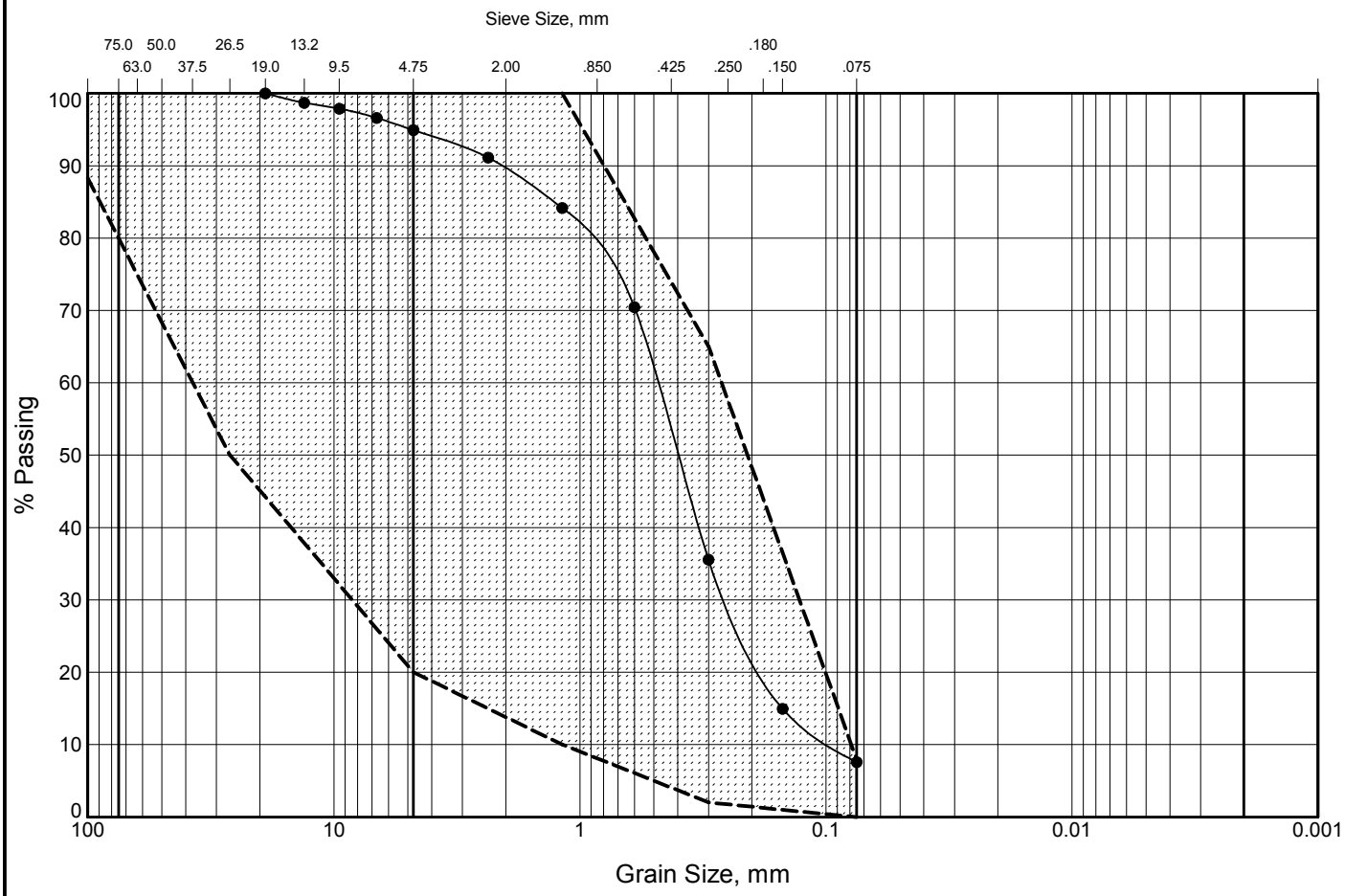
TESTPIT LOG 64365.01_630 CUMMINGS_GNT01_V01_2016-05-03.GPJ HOULE CHEVRIER FEB 9 2011.GDT 5-18-16

APPENDIX B

Laboratory Test Results
Figure B1 and B2

GRAIN SIZE DISTRIBUTION

FIGURE B1



COBBLES	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Legend	Test pit	Sample	Depth (m)	% Gravel	% Sand	% Silt & Clay
●	16-3	2	0.3 - 1.8	5	87	8

– – – – Gradation Envelope: OPSS 1010 - GRANULAR B TYPE I

Houle Chevrier Engineering

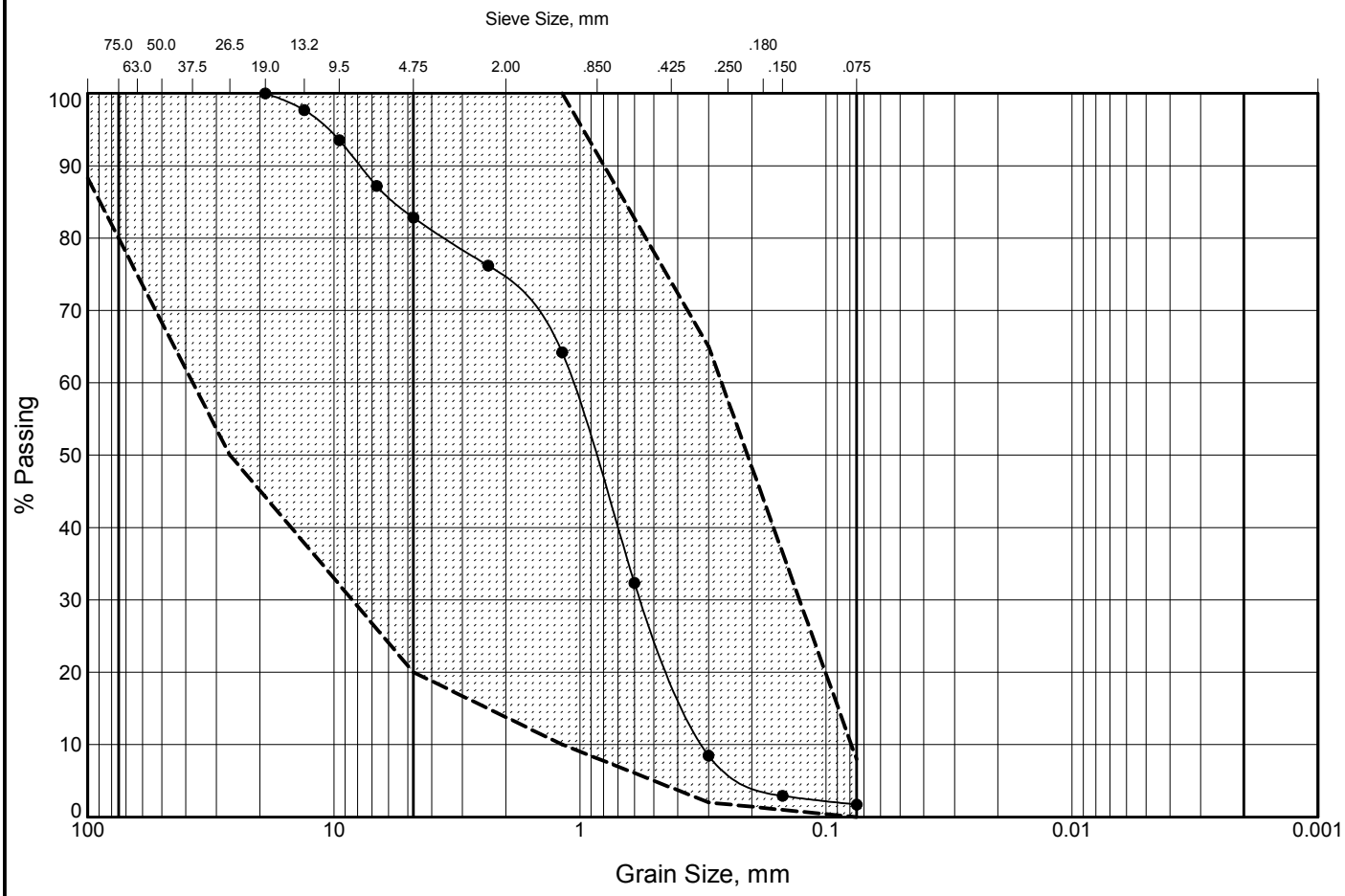
Date: May 2016

Project: 64365.01

SOILS GRAIN SIZE GRAPH UNIFIED % (SIEVE) 64365.01_630 CUMMINGS_GNT01_V01_2016-05-03.GPJ HOULE CHEVRIER FEB 9 2011.GDT 5-16-16

GRAIN SIZE DISTRIBUTION

FIGURE B2



COBBLES	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Legend	Test pit	Sample	Depth (m)	% Gravel	% Sand	% Silt & Clay
●	16-2	4	0.9 - 2.0	17	81	2

– – – – Gradation Envelope: OPSS 1010 - GRANULAR B TYPE I

Houle Chevrier Engineering

Date: May 2016

Project: 64365.01

SOILS GRAIN SIZE GRAPH UNIFIED % (SIEVE) 64365.01_630 CUMMINGS_GNT01_V01_2016-05-03.GPJ HOULE CHEVRIER FEB 9 2011.GDT 5-16-16

APPENDIX C

Chemical Test Results on Soil Sample
Sample Relating to Corrosion
Paracel Laboratories Ltd. Order No. 1619251

PARACEL LABORATORIES LTD.
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1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Houle Chevrier

32 Steacie Drive
Kanata, ON K2K 249
Attn: Blasco Vitayabaskaran

Client PO:
Project: 64365.01
Custody:

Report Date: 9-May-2016
Order Date: 4-May-2016

Order #: 1619251

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1619251-01	BH 16-5/3 SA3
1619251-02	BH 16-2 SA3

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Houle Chevrier
Client PO:

Report Date: 09-May-2016
Order Date: 4-May-2016
Project Description: 64365.01

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	6-May-16	6-May-16
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	4-May-16	5-May-16
Resistivity	EPA 120.1 - probe, water extraction	5-May-16	5-May-16
Solids, %	Gravimetric, calculation	5-May-16	5-May-16

Certificate of Analysis
Client: Houle Chevrier
Client PO:

Report Date: 09-May-2016
Order Date: 4-May-2016
Project Description: 64365.01

	Client ID:	BH 16-5/3 SA3	BH 16-2 SA3	-	-
	Sample Date:	28-Apr-16	28-Apr-16	-	-
	Sample ID:	1619251-01	1619251-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	90.5	95.3	-	-
General Inorganics					
pH	0.05 pH Units	7.60	7.51	-	-
Resistivity	0.10 Ohm.m	326	170	-	-
Anions					
Chloride	5 ug/g dry	<5	7	-	-
Sulphate	5 ug/g dry	8	12	-	-

Certificate of Analysis
Client: Houle Chevrier
Client PO:

Report Date: 09-May-2016
Order Date: 4-May-2016
Project Description: 64365.01

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	5	ug/g						
Sulphate	ND	5	ug/g						
General Inorganics									
Resistivity	ND	0.10	Ohm.m						

Certificate of Analysis
Client: Houle Chevrier
Client PO:

Report Date: 09-May-2016
Order Date: 4-May-2016
Project Description: 64365.01

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Sulphate	30.9	5	ug/g dry	30.5			1.4	20	
General Inorganics									
pH	7.83	0.05	pH Units	7.81			0.3	10	
Resistivity	39.4	0.10	Ohm.m	38.9			1.2	20	
Physical Characteristics									
% Solids	82.2	0.1	% by Wt.	83.7			1.8	25	

Certificate of Analysis
Client: Houle Chevrier
Client PO:

Report Date: 09-May-2016
Order Date: 4-May-2016
Project Description: 64365.01

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	102	5	ug/g	ND	102	78-113			
Sulphate	138	5	ug/g	30.5	107	78-111			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

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e: paracel@paracellabs.com

Chain of Custody
(Lab Use Only)

Page ___ of ___

Client Name: HOULE CHEVRIER ENGINEERING LTD	Project Reference: 64365.01
Contact Name: BLASCO VJ	Quote #
Address: 32 STGACIE DR. OTTAWA, ONT K2K 2A9	PO #
Telephone: 613-836-1422	Email Address: BLASCO@HCEGL.CA

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☑ Regular
Date Required: _____

Criteria: ☐ O. Reg. 153/04 (As Amended) Table _ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: _____ ☐ Other: _____

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1619251

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Required Analyses: CHLORIDE	pH/SO4	ELEC. RESIST.		350	m						
1	BH 16-5/3 SA 3	S		1	04/28/16		☒	☒	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	BH 16-2 SA 3	S		1	04/28/16		☒	☒	☒	☐	☑	☐	☐	☐	☐	☐	☐	☐
3							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Comments:

Method of Delivery: Walk-in

Relinquished By (Sign):	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Gregory Davidson	Date/Time: May 4/16 2:05	Date/Time: MAY 4/16 5:37	Date/Time: MAY 4/16 5:40
Date/Time: May 04, 2016 14:04	Temperature: 25.1 °C	Temperature: 11.9 °C	pH Verified [X] By: N/A

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hydrogeology

materials testing & inspection

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