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Geotechnical Investigation
Proposed Residential Development
Huntley Chase Subdivision
2727 Carp Road
Ottawa, Ontario

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Submitted to:

Cavanagh Developments
9094 Cavanagh Road
Ashton, Ontario
K0A 1B0

Geotechnical Investigation
Proposed Residential Development
Huntley Chase Subdivision
2727 Carp Road
Ottawa, Ontario

April 11, 2022
Project: 100020.002 - V04

experience • knowledge • integrity

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April 11, 2022

File: 100020.002 - V04

Cavanagh Developments
9094 Cavanagh Road
Ashton, Ontario
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Attention: Ben Houle, P.Eng., Project Engineer, Land Development

Re: Geotechnical Investigation
Proposed Residential Development
Huntley Chase Subdivision
2727 Carp Road, Ottawa, Ontario

Please find enclosed our geotechnical investigation report for the above noted project based on the scope of work provided in our proposal dated December 14, 2020. The updated report (Version 04) includes an update to the site plan layout that was provided by Novatech Engineers, Planners and Landscape Architects on April 4, 2022. This report was prepared by Lauren Ashe, M.A.Sc., P.Eng., and reviewed by Brent Wiebe, P.Eng.

Do not hesitate to contact the undersigned if you have any questions or require additional information.

Lauren Ashe, P.Eng., M.A.Sc.

Brent Wiebe, P.Eng.

LA/BW

Enclosures
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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the proposed residential development of Huntley Chase Subdivision located at 2727 Carp Road in Ottawa, Ontario. The purpose of the investigation was to identify the general subsurface conditions at the site by means of a limited number of test holes and, based on the factual information obtained, to provide engineering guidelines on the geotechnical design aspects of the project, including construction considerations that could influence design decisions.

A previous hydrogeological investigation and terrain analysis was carried out at this site by GEMTEC Consulting Engineers and Scientists Limited (GEMTEC). The results of that investigation are provided in the following report:

- Report to 1384341 Ontario Ltd, titled "Hydrogeological Investigation and Terrain Analysis, Proposed Newill Subdivision, 2727 Carp Road, Ottawa, Ontario" dated November 10, 2020 (Project No. 61318.15).

2.0 BACKGROUND

2.1 Project Description

Plans are being prepared for the residential development of Huntley Chase Subdivision located at 2727 Carp Road in Ottawa, Ontario. Based on the updated plan provided, the overall site is about 73 hectares in size and is currently comprised of wooded areas and former agriculture fields with an east-west aligned creek (Huntley Creek) located within the northern portion of the site. The site is bordered to the southeast by William Mooney Road, to the northeast by Carp Road and to the northwest and southeast by existing residential developments and wooded areas.

The proposed residential development will include 78 single family dwellings. The rural subdivision design will include an open ditch drainage system. The houses will feature conventional perimeter drains that will be connected to a sump from which the water is pumped to roadside ditches or outlet by gravity to a suitable outlet, if possible. The houses will be serviced by private wells and septic systems.

2.2 Site Geology

Based on a review of surficial geology maps of the area, the subsurface conditions at the site generally consist of glacial till in the northeast portion and deposits of silty clay and sandy silt within the eastern portion of the site. Surficial geology maps indicate the presence of organic material (i.e. peat) within the southwest portion of the site.

Bedrock geology maps indicate that the depth to bedrock across the site varies, with near surface bedrock (i.e., between 0 and 5 metres below ground surface) within the southern portion of the site increasing to about 5 to 10 metres below ground surface within the northern portion of the

site. Bedrock is mapped as interbedded limestone and shale of the Verulam formation within the northern portion of the site and limestone of the Bobcaygeon formation within the southern portion of the site.

Fill material associated with previous development may also be present within portions of the site.

2.3 Description of Slopes

A site reconnaissance was carried out on March 30, 2021 by a member of our engineering staff to observe the existing slopes.

Cross-sections of the slope were positioned along Huntley Creek using the preliminary grading plan. The cross sections were positioned at key locations based on slope geometry and height. Sections A-A' to C-C', inclusive, are located along the south slope of Huntley Creek and Sections D-D' and E'E were positioned along the north slope of Huntley Creek. The locations of the five cross sections considered are provided on the Site Plan, Figure 1. The geometries of these cross sections are summarized in the following table:

Table 2.1 – Geometries of Cross Sections

Cross Section	Slope Height (metres)	Overall inclination from horizontal (Degrees)
A-A'	2.7	11
B-B'	2.7	7
C-C'	2.3	26
D-D'	2.0	9
E-E'	2.7	9

It is noted that cross section C-C' is located on the slope which extends down to the 1:100 year flood plain identified by the Mississippi Valley Conservation Authority (MVCA). At the time of the site visit, the water level in Huntley Creek had extended to the toe of the slope at section C-C'. The slopes along Huntley Creek are relatively flat with the exception of Section C-C', which has an overall inclination of about 26 degrees (about 2H:1V). In general, the slopes are vegetated with long grasses, shrubs and small to large trees. Fill material (i.e., concrete blocks, asphaltic concrete pieces, scrap metal, etc.) and boulders were observed along the slopes in some areas.

Huntley Creek meanders within the corridor. No signs of active soil erosion or overall slope instability (i.e., rotational failures, tension cracks, etc.) were observed, however it is noted that the water levels were relatively high at the time of the site visit. Photographs of the slopes are provided in Appendix E.

3.0 SUBSURFACE INVESTIGATION

3.1 Geotechnical Investigation

The fieldwork for this investigation was carried out between January 28, 2021 and February 18, 2021. During that time, a total of 12 test pits, 12 boreholes and 2 piezocones were advanced at the site. The test pits were advanced using a track mount excavator supplied and operated by Thomas Cavanagh Construction Limited. The boreholes and piezocones were advanced using a track mounted drill rig supplied and operated by George Downing Estate Drilling Ltd.

Details for the test holes advanced for the detailed design of the residential development are provided below:

- Twelve (12) test pits, numbered TP21-01 to TP21-12, inclusive, were advanced to depths ranging from about 2.7 to 3.0 metres below ground surface. Infiltration testing was carried out at the test pit locations.
- Twelve (12) boreholes, numbered BH21-01 to BH21-12, inclusive, were advanced to depths ranging from about 2.3 to 6.7 metres below ground surface.
- Two (2) piezocones, numbered CPT21-03 and CPT21-08, were advanced to depths of 8.2 and 9.0 metres below ground surface, respectively. It is noted that a third piezocone, CPT21-05, encountered near-surface practical push refusal and, as such, has not been included in this report.

Standard penetration tests were carried out in the boreholes and samples of the soils encountered were recovered using a 50 millimetre diameter split barrel sampler. In situ vane shear testing was carried out, where possible, in the boreholes to measure the undrained shear strength of the silty clay.

Well screens were sealed in the overburden at boreholes BH21-01, BH21-03, BH21-04, BH21-06, BH21-08 and BH21-11 to measure the groundwater levels. Data Loggers were installed in each of the above noted well screens to provide near continuous water level data.

The fieldwork was supervised throughout by a member of our engineering staff who directed the drilling and piezocone operations, test pit excavation, logged the samples and carried out the in-situ testing. Following the fieldwork, the soil samples were returned to our laboratory for examination by a geotechnical engineer. Selected samples of the soil were tested for water content, Atterberg limits, shrinkage limits, and grain size distribution testing. Samples of the soil recovered from boreholes BH21-01 and BH21-12 were sent to an accredited laboratory for basic chemical testing relating to corrosion of buried concrete and steel.

The borehole, test pit and piezocone locations were positioned in the field by GEMTEC personnel using our Trimble R10 GPS survey instrument. The ground surface elevations at the boreholes, test pits and piezocones were also determined using our Trimble R10 GPS survey instrument.

The elevations are referenced to geodetic datum. Additional details on the piezocone investigation are provided in Section 3.2.

Descriptions of the subsurface conditions logged in the boreholes and test pits are provided on the Record of Borehole and Test Pit sheets in Appendix A. The results of the laboratory tests are provided on the borehole and test pit logs and in Appendix B. The results of the piezocones are provided on the Record of Piezocone sheets in Appendix C. The results of chemical testing completed on two soil samples are provided in Appendix D. The approximate locations of the test holes are shown on the Site Plan, Figure 1.

3.2 Piezocone Investigation

In order to supplement the borehole data, piezocone probes were advanced south of Huntley Creek to provide soil strength data which will assist with foundation design, determination of grade raise restrictions and slope stability assessment. The field work for the cone penetration testing (CPT) was carried out on February 19, 2021 in conjunction with the geotechnical investigation. At that time, three (3) piezocones, numbered CPT21-03, CPT21-05 and CPT21-08, were advanced at the site using a track mounted drill rig supplied and operated by George Downing Estate Drilling Ltd. The piezocones were pushed into the soil adjacent to three (3) of the boreholes (boreholes BH21-03, BH21-04 and BH21-08). A summary of the CPT details are provided in Table 3.1.

Table 3.1 – CPT Details

CPT	Corresponding Borehole	CPT depth (metres)
CPT21-03	BH21-03	8.2
CPT21-05[1]	BH21-04	-
CPT21-08	BH21-08	9.0

Notes:
1. CPT21-05 encountered near-surface practical push refusal of the drill rig and, as such, has not been included in this report.

The piezocones were terminated due to practical push refusal of the geotechnical drill rig at depths ranging between about 8.2 and 9.0 metres below ground surface (elevation 107.9 and 116.01 metres, geodetic).

The results of the CPT tests are provided in Appendix C.

3.3 Infiltration Testing

GEMTEC carried out soil infiltration testing at the test pit locations in order to determine the permeability and field saturated hydraulic conductivity of the soils at various locations throughout the site.

The results of the infiltration testing have been provided in a separate letter, dated May 12, 2021.

4.0 SUBSURFACE CONDITIONS

4.1 General

As previously indicated, the soil and groundwater conditions identified in the boreholes and test pits are given on the Record of Borehole and Test Pit sheets in Appendix A. The borehole and test pit 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. The precision with which subsurface conditions are indicated depends on the method of drilling, the frequency and recovery of samples, the method of sampling, and the uniformity of the subsurface conditions. 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 GEMTEC 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 boreholes advanced during this investigation.

4.2 Topsoil

A layer of topsoil was encountered at ground surface at all of the borehole and test pit locations (with the exception of test pit TP21-09, which had been previously cleared of topsoil). The thickness of the topsoil ranges from about 50 to 300 millimetres.

The water content of the topsoil ranges between about 30 and 101 percent.

4.3 Fill Material

Fill material was encountered underlying the topsoil at boreholes BH21-05, BH21-08 and BH21-10. Fill material is variable in nature but can generally be described as brown and dark brown

sand, silty clay and silty sand with organic material and wood chips. The fill material ranges in thickness from 0.2 to 0.8 metres.

The water content of one sample of the fill material is about 29 percent.

4.4 Sand

Native deposits of sand were encountered underlying the topsoil and/or fill material in boreholes BH21-03, BH21-04, BH21-07, BH21-09, BH21-10, BH21-12, as well as in all test pits (with the exception of TP21-01) and underlying the silty clayey sand deposits in borehole BH21-05. The sand deposits can be described as reddish brown, brown, grey brown and grey in colour with varying grain sizes ranging between fine to coarse grained and containing varying amounts of silt and gravel.

The sand deposits were encountered between ground surface and about 3.1 metres below surface grade (elevation 111.7 to 117.6 metres, geodetic) and extend to depths of about 0.6 to 5.0 metres below surface grade (elevation 109.7 to 117.0 metres, geodetic). The thickness of the sand deposits ranges between about 0.1 and 3.3 metres.

Standard penetration tests carried out in the sand deposits encountered in the boreholes gave N values generally ranging from 6 to 33 blows per 0.3 metres of penetration, which indicates a very loose to compact relative density. One N value of 2 blows per 0.3 metres of penetration was encountered in borehole BH21-03 at a depth of about 2 metres below ground surface, which indicates a very loose relative density; however, it is noted that the blow counts recorded in sand deposits below the water table may not be representative of the in-situ density of the deposit as a result of the upward flow of saturated, disturbed sand into the hollow stem augers, resulting in disturbance and lower blow counts.

The results of grain size distribution tests undertaken on samples of the sand are provided in Appendix B and are summarized in Table 4.1.

Table 4.1 – Summary of Grain Size Distribution Test (Sand Deposits)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH21-03	4	2.3 – 2.9	0	89	11	-
TP21-02	1	0.3-0.5	4	72	12	12
TP21-04	1	0.4-0.6	0	86	6	8
TP21-06	1	0.3-0.6	0	67	15	18
TP21-07	1	0.5-0.6	0	87	4	9

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
TP21-09	1	0.6-0.8	0	83	8	9
TP21-10	1	0.4-0.6	0	93	2	5
TP21-11	1	0.5-0.6	3	65	18	14
TP21-12	1	0.5-0.7	0	96	0	4

The water content of the sand deposits ranges from about 10 to 32 percent.

4.5 Silty Clayey Sand

Native deposits of 'sandy clayey silt', 'sand and silt with some clay' , 'sand with some silt and clay' and 'silty clayey sand' (herein referred to as silty clayey sand deposits) were encountered underlying the topsoil and/or fill material in boreholes BH21-02, BH21-05, BH21-06, BH21-11 and underlying the sand deposits in boreholes BH21-04 and BH21-05 and test pits TP21-01, TP21-03, TP21-11 at depths ranging between about 0.1 and 1.5 metres below surface grade (elevation 113.8 to 116.9 metres, geodetic). The silty clayey sand deposits have a thickness ranging between about 0.3 and 2.2 metres and extend to depths ranging between about 0.6 to 2.3 metres below surface grade (elevation 111.7 to 116.4 metres, geodetic).

The silty clayey sand deposits can be described as brown and grey brown and contain varying amounts of gravel.

Standard penetration tests carried out in the silty clayey sand deposits in the boreholes gave N values ranging from 3 to 14 blows per 0.3 metres of penetration, indicating a very loose to compact relative density.

The results of grain size distribution tests undertaken on samples of the silty clayey sand deposits are provided in Appendix B and are summarized in Table 4.2.

Table 4.2 – Summary of Grain Size Distribution Test (Silty Clayey Sand Deposits)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH21-02	3	1.5-2.1	1	45	32	22
BH21-05	3	1.5-2.1	0	25	48	27
BH21-11	2	0.8-1.4	14	33	35	18
BH21-12	2	0.8–1.4	14	33	35	18
TP21-01	1	0.3-0.6	0	42	23	35
TP21-03	1	0.4-0.8	0	20	49	31
TP21-11	2	0.9-12	0	44	29	27

The results of the Atterberg limit tests carried out on samples of the silty clayey sand deposits recovered from boreholes BH21-02, BH21-05 and BH21-12 are provided in Appendix B. The results are summarized in Table 4.3.

Table 4.3 – Summary of Atterberg Limit Test Results (Silty Clayey Sand Deposits)

Borehole / Sample No.	Water Content (%)	Liquid Limits (%)	Plastic Limits (%)	Plasticity Index
21-02 / 3	16	26	11	15
21-05 / 3	24	25	11	14
21-12 / 2	31	26	12	14

This testing indicates that the samples of silty clayey sand tested from the boreholes has a low plasticity.

The water content of the silty clayey sand deposits ranges from about 16 to 37 percent.

4.6 Silty Clay

Native deposits of ‘silty clay’, ‘clayey silt’ and ‘silt and clay’ (herein referred to as silty clay) were encountered in boreholes BH21-03, BH21-06, BH21-07, BH21-08, BH21-10, and BH21-12 and test pits TP21-04, TP21-06 to TP21-10, inclusive, at depths ranging between about 0.1 and 3.5 metres below surface grade (elevation 112.6 to 117.1 metres, geodetic). Where fully penetrated, the silty clay deposits extend to depths ranging from about 2.7 to 4.9 metres below ground surface (elevation 110.5 to 114.7 metres, geodetic).

The silty clay deposits are grey brown and grey and contain varying amounts of sand. Silty sand seams were observed within the silty clay deposits at some locations.

Boreholes BH21-03, BH21-07 and BH21-08 were terminated within the silty clay deposits at depths of about 5.9 to 6.7 metres below surface grade (elevation 108.3 to 109.7 metres, geodetic).

Standard penetration tests carried out in the silty clay deposits gave N values ranging from 'static weight of hammer (WH)' to 13 blows per 0.3 metres of penetration, which reflect a firm to very stiff consistency. In situ vane shear strength tests carried out in the silty clay deposits in boreholes BH21-07 and BH21-12 at depths ranging between about 3.9 to 5.2 metres below surface grade gave undrained shear strengths ranging from about 54 to 57 kilopascals, reflecting a stiff consistency.

A continuous profile of the undrained shear strength in the silty clay was determined at the piezocone locations (CPT21-03 and CPT21-08) using the following equation by Lunne et al (1997):

$$C_u = (Q_t - \sigma_v)/N_{kt}$$

Where;

- C_u = Undrained shear strength (kilopascals)
- Q_t = Cone Tip Stress (kilopascals)
- σ_v = Total overburden pressure (kilopascals)
- N_{kt} = Factor of 15 assumed

The results of the piezocone data show that the undrained shear strength of the silty clay ranges between about 39 and 185 kilopascals, with an average undrained shear strength of about 99 kilopascals, which reflects a stiff (bordering on very stiff) consistency, on average.

The results of grain size distribution tests undertaken on samples of the silty clay deposits are provided in Appendix B and are summarized in Table 4.4.

Table 4.4 – Summary of Grain Size Distribution Test (Silty Clay Deposits)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH21-03	6	3.8-4.4	0	15	49	36
BH21-10	4	2.3-2.9	1	9	55	35
BH21-06	3	1.5-2.1	0	7	53	40

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH21-07	3	1.5-2.1	0	7	53	40
BH21-08	4	2.3-2.9	0	17	46	37
TP21-07	2	0.8-1.0	0	21	32	47
TP21-08	1	0.5-0.8	0	19	42	39

The results of the Atterberg limit tests carried out on samples of the silty clay are provided in Appendix B. The results are summarized in Table 4.5.

Table 4.5 – Summary of Atterberg Limit Test Results (Silty Clay Deposits)

Borehole / Sample No.	Water Content (%)	Liquid Limits (%)	Plastic Limits (%)	Plasticity Index
BH21-03 / 6	24	26	13	13
BH21-06 / 3	24	36	16	20
BH21-07 / 3	25	34	16	18
BH21-08 / 4	23	27	14	13
BH21-10 / 4	28	31	17	17

This testing indicates that the samples of silty clay tested from the boreholes has a low plasticity.

The water content of the silty clay ranges from about 16 to 42 percent.

4.7 Glacial Till

Deposits of glacial till were encountered in boreholes BH21-01, BH21-02, BH21-04, BH 21-06, BH21-09, BH21-10 and BH21-11 and test pits TP21-01, TP21-03, TP21-05 and TP21-08 at depths ranging between about 0.1 and 4.9 metres below surface grade (elevation 111.5 to 117.3 metres, geodetic). With the exception of borehole BH21-11, the glacial till was not fully penetrated but was proven to depths ranging from about 2.3 to 6.7 metres below ground surface (elevation ranging from about 119.6 to 115.4 metres, geodetic). The thickness of the glacial till deposit in borehole BH21-11 is about 3.2 metres.

The glacial till is a heterogeneous mixture of all grain sizes, which at this site, can be described as brown to grey silty sand, sand and silt and gravelly sand with varying amounts of clay. Although

not encountered in the borehole and test pit locations directly, glacial till deposits are known to contain cobbles and boulders.

Standard penetration tests carried out in the glacial till deposits gave N values ranging from 7 to over 100 blows per 0.3 metres of penetration, which indicates a loose to very dense relative density.

The results of grain size distribution tests undertaken on samples of the glacial till are provided in Appendix B and are summarized in Table 4.6.

Table 4.6 – Summary of Grain Size Distribution Test (Glacial Till)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH21-01	2	0.8-1.4	8	57	35	
BH21-04	4	2.3-2.9	2	43	50	5
BH21-04	6	3.8-4.4	23	69	8	
TP21-05	1	0.7-1.0	15	52	17	16

The water content of the glacial till ranges from about 7 to 33 percent.

4.8 Sand and Silty Sand (Lower Deposits)

Deposits of sand with some gravel and silty sand were encountered below the glacial till in borehole BH21-11 and below the silty clay in borehole BH21-12 at depths of about 4.6 and 6.1 metres below surface grade, respectively (elevation 112.4 and 110.5 metres, geodetic).

Boreholes BH21-11 and BH21-12 were terminated within the lower sandy deposit at depth of about 5.2 and 6.7 metres below surface grade, respectively (elevation 111.7 and 109.9 metres, geodetic) as a result of the upward flow of saturated sand into the hollow stem augers.

Standard penetration tests carried out in the lower sandy deposits gave N values of 'Weight of Hammer (WH)' and 3 blows per 0.3 metres of penetration, which indicates a very loose relative density; however it is noted that blow counts recorded in sand deposits below the water table may not be representative of the in-situ density of the deposit as a result of the upward flow of saturated, disturbed sand into the hollow stem augers, resulting in lower blow counts.

4.9 Auger Refusal on Inferred Bedrock

Auger refusal on inferred bedrock was encountered in boreholes BH21-01, BH21-02 and BH21-09 at depths ranging between 2.3 and 4.1 metres below surface grade (elevation 112.8 to 115.4 metres, geodetic).

It is noted that auger refusal can occur on boulders within glacial till deposits and may not necessarily be representative of the upper surface of the bedrock.

4.10 Groundwater Levels

Well screens were installed in the overburden at boreholes BH21-01, BH21-03, BH21-04, BH21-06, BH21-08 and BH21-11. Data loggers were installed in all of the well screens to provide continuous groundwater level monitoring over the 2021 spring freshet. The groundwater levels measured in the well screens on March 4, 2021 are summarized in Table 4.7.

Table 4.7 – Groundwater Depth and Elevation (March 4, 2021)

Borehole No.	Groundwater Depth Below Existing Ground Surface (metres)	Groundwater Elevation (metres, geodetic datum)
BH21-01	1.6	115.7
BH21-03	2.0	114.1
BH21-04	3.2	112.9
BH21-06	1.4	115.7
BH21-08	1.8	113.3
BH21-11	1.3	115.6

The groundwater levels may be higher during wet periods of the year such as the early spring or following periods of precipitation.

4.11 Soil Chemistry Relating to Corrosion

The results of chemical testing on soil samples recovered from boreholes BH21-01 and BH21-12 are provided in Appendix D and are summarized in Table 4.8.

Table 4.8 – Summary of Corrosion Testing

Parameter	Borehole BH21-01 Sample No. 3 Depth: 1.5 to 2.1 m	Borehole BH21-12 Sample No. 4 Depth 2.3 to 2.9
Chloride Content (ug/g)	33	14
Resistivity (Ohm.m)	43.7	60.0
pH	7.6	7.7
Sulphate Content (ug/g)	12	16

5.0 GEOTECHNICAL GUIDELINES

5.1 General

The information in the following sections is provided for the guidance of the design engineers 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. The 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 and have not been addressed.

5.2 Site Grade Raise Restrictions

Some areas of the development are underlain by deposits of sensitive silty clay, which has a limited capacity to support loads imposed by grade raise fill material, pavement structures and foundations for the houses. The placement of fill material on this site must therefore be carefully planned and controlled so that the stress imposed by the fill material does not result in excessive consolidation of the silty clay deposits. Concrete slabs, granular base materials, overall grade raise and pavement structures are considered grade raise filling. Groundwater lowering also results in a stress increase on the underlying sensitive silty clay deposit.

The proposed roadway grading plan indicates the proposed grades for the roadways within the development are generally up to about 1.5 metres above original grade. It is noted that the proposed grading plan for the residential dwellings was not available at the time of preparation of this report. Based on the results of the subsurface investigation, the maximum thickness of any grade raise filling should be limited to about 2.5 metres in areas of the site underlain by silty clay (i.e., boreholes BH21-03, BH21-06, BH21-07, BH21-08 and BH21-10 located in the central portion of the site, south of Huntley Creek). This assumes that the fill material used to raise the grade around the houses consists of relatively light weight fill material such as silty sand or silty clay (i.e. having a bulk unit weight of less than 17 kilonewtons per cubic metre.

It should be noted that the grade raise restrictions provided above are highly dependent on the depth of the proposed footings relative to the silty clay deposits. This information is not currently available; as such some assumptions were made in the determination of the grade raise restriction values.

The proposed grades for the roadways within the development are generally up to about 1.5 metres above original grade. Based on our review of the preliminary roadway grading plan, the proposed grade raise is within the maximum permissible grade raise.

It is recommended that the proposed grading plan for the development be reviewed by GEMTEC as the design progresses.

No grade raise restrictions apply to areas of the site underlain by sand, silty clayey sand and glacial till deposits, from a geotechnical perspective.

5.3 Proposed Buildings

5.3.1 Excavation

The excavations for the foundations should be taken through topsoil and fill material to expose undisturbed native deposits of sand, sandy clayey silt, silty clay and/or glacial till. The sides of the excavations should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, the shallow native overburden deposits can be classified as Type 3 and, accordingly, allowance should be made for excavation side slopes of 1 horizontal to 1 vertical extending upwards from the base of the excavation.

The groundwater level in the monitoring wells installed in boreholes BH21-01, BH21-03, BH21-04, BH21-06, BH21-08 and BH21-11 ranged from 1.4 to 3.2 metres below ground surface (elevation 112.9 to 115.7 metres, geodetic) in March, 2021. To minimize, not eliminate, issues with temporary and long term groundwater control (e.g., pumping from basement sump pits), we suggest that the depth of excavation for basement construction be limited to about 150 millimetres above the seasonal high groundwater level. This is suggested to reduce the potential for disturbance of the more permeable deposits during construction. Provided the basement excavations are kept above these limits it is anticipated that groundwater inflow during construction can be managed by pumping from filtered sumps within the excavations. It is not expected that short term pumping during excavation will have any significant effect on nearby structures and services. It is noted that GEMTEC is carrying out a groundwater monitoring program at the site over the spring freshet to determine the seasonal high groundwater level.

Excavation within the sandy deposits below the groundwater level, if required, could result in significant groundwater inflow and cause sloughing of the soil into the excavation as well as disturbance to the soils at the base of the excavation. In such conditions it may be necessary to flatten the excavation side slopes.

Groundwater inflow from the silty clay and glacial till deposits into the excavations should be relatively small and controlled by pumping from filtered sumps within the excavations.

Suitable detention and filtration will be required before discharging water.

5.3.2 Foundation Design

The native deposits of sand, silty clayey sand, silty clay and glacial till are considered suitable for the support of residential structures founded on conventional spread footing foundations.

In areas where proposed founding level is above the level of the native soil, or where subexcavation of disturbed material is required below proposed founding level, imported granular material (engineered fill) should be used. The engineered fill should consist of granular material meeting OPSS requirements for Granular B Type II and should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. In areas where groundwater inflow is encountered, pumping should be carried out from sumps in the excavation during placement of the engineered fill. To allow spread of load beneath the footings, the engineered fill should extend horizontally at least 0.3 metres beyond the footings and then down and out from this point at 1 horizontal to 1 vertical, or flatter. The excavations for the residential dwellings should be sized to accommodate this fill placement. The engineered fill should be placed in accordance with the site grade raise restrictions.

Given the gradation (i.e., poorly graded) of some of the native sand deposits at this site (the upper 0.8 metres encountered in test pits TP21-02, TP21-04, TP21-06, TP21-07 and TP21-09 to TP21-12, inclusive), we recommend that an allowance be made for a 150 millimetre thick layer of OPSS Granular A below the footings in these areas. The OPSS Granular A should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. The subgrade surface should be inspected by qualified geotechnical personnel at the time of construction and, depending on the gradation of the sand deposits encountered, it may be possible to omit the requirement for the OPSS Granular A layer below the footings.

Spread footings founded on or within native undisturbed sand, silty clayey sand, silty clay and glacial till deposits, or on a pad of compacted granular material above native, undisturbed soil should be sized using an allowable bearing pressure of 100 kilopascals. Provided that any loose or disturbed soil is removed from the bearing surfaces, and the grade raise restrictions provided above are adhered to, the settlement of the footings should be less than 25 millimetres.

5.3.3 Seismic Site Class

Based on the results of the investigation, it is anticipated that the proposed foundations will be supported on deposits of sand, silty clayey sand, silty clay, glacial till or stiff to very stiff silty clay or a pad of engineered fill constructed on the native soil deposits.

The seismic design provisions of the 2012 Ontario Building Code (OBC) depend, in part, on the average properties in the upper 30 metres of soil and/or rock below founding level. Based on these values, this site can be assigned a Site Class of C for seismic design purposes.

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

5.3.4 Frost Protection of Foundations

All exterior footings should be provided with at least 1.5 metres of earth cover for frost protection purposes. Isolated (unheated) footings that are located in areas that are to be cleared of snow should be provided with at least 1.8 metres of earth cover for frost protection purposes.

Alternatively, the required frost protection could be provided by means of a combination of earth cover and extruded polystyrene insulation. Further details regarding the insulation of foundations could be provided, if necessary.

5.3.5 Backfill and Drainage

5.3.5.1 Basement Foundation Walls

In accordance with the Ontario Building Code, the following alternatives could be considered for drainage of the basement foundation walls:

- Damp proof the exterior of the foundation walls and backfill the walls with free draining, non-frost susceptible sand or sand and gravel such as that meeting OPSS requirements for Granular B Type I or II. OR
- Damp proof the exterior of the foundation walls, install an approved proprietary drainage material on the exterior of the foundation walls and backfill the walls with native material or imported soil.

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 compaction equipment. Where future landscaped areas will exist next to the proposed structure 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.

A perforated drain should be installed around the basement area at the level of the bottom of the footings. The drain should outlet by gravity to a drainage swale or the roadside ditch, or to a sump pit from which the water is pumped to a suitable outlet.

5.3.5.2 Garage Foundation Walls and Isolated Piers

To avoid adfreeze and possible jacking (heaving) of the foundation walls, the interior and exterior of the garage foundation walls should be backfilled with free draining, non-frost susceptible sand or sand and gravel such as that meeting OPSS requirements for Granular B Type I or II. The backfill within the garage should be compacted in maximum 300 millimetres thick lifts to at least 95 percent of the standard Proctor dry density value using suitable vibratory compaction equipment.

The backfill against isolated (unheated) walls or piers should consist of free draining, non-frost susceptible material, such as sand or sand and gravel meeting OPSS Granular B Type I or II requirements. Other measures to prevent frost jacking of these foundation elements could be provided, if required.

5.3.6 Lateral Earth Pressures

Foundation walls that are backfilled with granular material such as that meeting OPSS Granular B Type I or II requirements should be designed to resist “at rest” earth pressures calculated using the following formula:

$P_o = 0.5\ K_o\ \gamma\ H^2$

where;

- P_o: Static “At Rest” thrust (kilonewtons per metre);
- γ: Moist material unit weight (kilonewtons per cubic metre);
- K_o: “At Rest” earth pressure coefficient;
- H: Wall height (metre).

Seismic shaking can increase the forces on the retaining wall. The total “At Rest” thrust acting on the walls (P_{oe}) during a seismic event is composed of a static component (P_o) and a dynamic component (P_e), that is:

$P_{oe} = P_o + P_e$

The dynamic at rest thrust component (P_e), which acts only during seismic loading conditions, should be calculated using the following formula:

$P_e = 0.5\ (K_{oe} – K_o)\ \gamma\ H^2$

where;

- P_e: Total “At Rest” thrust (kilonewtons per metre);
- γ: Moist material unit weight (kilonewtons per cubic metre);
- K_o “At Rest” earth pressure coefficient
- K_{oe}: Dynamic “At Rest” earth pressure coefficient;
- H: Wall height (metre).

The static thrust component (P_o) acts at a point located H/3 above the base of the wall. During seismic shaking, the dynamic at rest thrust component (P_o) acts at a point located about 0.6H above the base of the wall.

For design purposes, the parameters provided in Table 5.1 can be used to calculate the thrust acting on the walls during static and seismic loading conditions.

Table 5.1 – Summary of Design Parameters (Building Foundation Walls)

Parameter	OPSS Granular B Type I	OPSS Granular B Type II
Material Unit Weight, γ (kilonewtons per cubic metre)	22	22
Estimated Friction Angle (degrees)	34	38
"At Rest" Earth Pressure Coefficient, K_o, assuming horizontal backfill behind the structure	0.44	0.38
Dynamic "At Rest" Earth Pressure Coefficient, K_{oe}, assuming horizontal backfill behind the structure	0.44[1]	0.38[1]

Notes:

1) According to the 2015 National Building Code of Canada, the peak ground acceleration (PGA) for this site is 0.24 for Site Class C. The dynamic at rest earth pressure coefficient was calculated using the method suggested by Mononobe and Okabe, assuming a horizontal seismic coefficient, kh, of 0.13 and assuming that the vertical seismic coefficient, kv, is zero.

Heavy construction traffic should not be allowed to operate adjacent to foundation walls for the proposed buildings (within about 2 metres horizontal) during construction, without the approval of the designers.

5.3.7 Basement Floor Slabs

To provide predictable settlement performance of basement slabs, all topsoil, loose soil, or debris should be removed from the slab area. The base of the floor slab should consist of at least 200 millimetres of 19 millimetre clear crushed stone. Any necessary grade raise fill should consist of either 19 millimetre clear crushed stone or OPSS Granular B Type II. OPSS documents allow recycled asphaltic concrete and concrete to be used in Granular B Type II material. Since the source of recycled material cannot be determined or controlled, it is suggested that any imported Granular B Type II materials be composed of 100 percent crushed rock only.

The clear crushed stone should be nominally compacted in maximum 300 millimetre thick lifts with at least 3 passes of a diesel plate compactor. The Granular B Type II should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density value using suitable vibratory compaction equipment.

The ACI 302.1R-04 "Guide for Concrete Floor and Slab Construction" should be referenced for design purposes.

A polyethylene vapour retarder is recommended below the floor slabs.

5.3.8 Corrosion of Buried Concrete and Steel

According to Canadian Standards Association (CSA) “Concrete Materials and Methods of Concrete Construction”, the concentration of sulphate in the soil samples recovered from boreholes BH21-01 and BH21-12 can be classified as low. For low exposure conditions, any concrete that will be in contact with the native soil or groundwater could be batched with General Use (GU) type cement. The effects of freeze thaw in the presence of de-icing chemical (sodium chloride) near the building should be considered in selecting the air entrainment and the concrete mix proportions for any exposed concrete.

Based on the resistivity and pH of the soil samples tested, the soil can be generally classified as non-aggressive toward unprotected steel. It is noted that the corrosivity of the soil could vary throughout the year due to the application sodium chloride for de-icing.

5.4 Roadway Construction

5.4.1 General Considerations

The existing silty clayey sand, silty clay and glacial till subgrade materials have been identified as moderately to highly frost susceptible and measured moisture content is sufficiently high for frost heaving to occur. Furthermore, the groundwater level (measured in March, 2021) is within 1.8 metres below surface grade at some locations (i.e., within the zone of frost penetration).

Based on the preliminary grading plan provided to us, the proposed grade raise for the roadways ranges between 0.0 and 1.5 metres. Elimination of the potential for future frost heaving would require a subexcavation of all materials to a depth of 1.8 metres from final surface grade and replacement with non-frost susceptible subgrade soils and a suitable pavement structure; however, it is recognized that this approach may be cost prohibitive and that some amount of reduced performance may be acceptable given the low volume nature of the roadways within the proposed subdivision. Risk of frost heave may be further reduced through the provision of adequate subsurface drainage.

GEMTEC recommends carrying out a review of the final grading plan as the design progresses.

5.4.2 Subgrade Preparation

In preparation for roadway construction at this site, all surficial topsoil and any soft, wet or deleterious materials should be removed from the proposed roadways. Any subexcavated areas could be filled with compacted earth borrow. Based on the preliminary grading plan, the roadway grades will be raised in some areas. In these areas, material which meets OPSS specifications for Select Subgrade Material or Earth Borrow could be used. The Select Subgrade Material or Earth Borrow should be placed in maximum 300 millimetre thick lifts and compacted to at least 95 percent of the standard Proctor maximum dry density value using vibratory compaction equipment. Prior to placing granular material for the roadway, the exposed subgrade should be heavily proof rolled and inspected and approved by geotechnical personnel. Any soft areas

evident from the proof rolling should be subexcavated and replaced with suitable earth borrow approved by the geotechnical engineer.

The roadway subgrade surfaces should be made smooth and crowned or sloped prior to placing the granular materials to promote drainage of the roadway base and subbase materials.

5.4.3 Pavement Design

The following minimum pavement structure is suggested for local roadways at this site, assuming that the roadways will not be used as collector roads or bus routes:

- 90 millimetre thick layer of asphaltic concrete (40 millimetres of Superpave 12.5 Traffic Level B over 50 millimetres of Superpave 12.5 Traffic Level B); over
- 150 millimetre thick layer of base (OPSS Granular A); over
- 400 millimetre thick layer of subbase (OPSS Granular B Type II);

5.4.4 Effects of Subgrade Disturbance

If the roadway subgrade surface becomes disturbed or wetted due to construction operations or precipitation, or the granular pavement materials are to be used by construction traffic, the Granular B Type II thicknesses provided above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase. The contractor should be responsible for providing suitable access for construction equipment.

The required thickness of the subbase materials will depend on a number of factors, including contractor workmanship and schedule, contractor methodology, soil types and weather conditions, and should be assessed by geotechnical personnel at the time of construction. In our opinion, the preferred approach from a geotechnical point of view is to:

- Proof roll the subgrade conditions at the time of construction under the supervision of experienced geotechnical personnel.
- Adjust the thickness of the subbase material and include a woven geotextile separator, as required. Unit rate allowances should be made in the contract for subexcavation and replacement with OPSS Granular B Type II.

5.4.5 Granular Material Placement

The pavement granular materials should be compacted in maximum 300 millimetre thick lifts to at least 99 percent of standard Proctor maximum dry density using suitable vibratory compaction equipment.

5.4.6 Asphaltic Cement

Performance graded PG 58-34 asphaltic cement is recommended for local roadways.

5.4.7 Transition Treatments

In areas where the new pavement structure will abut existing pavements (e.g., Carp Road, William Mooney Road and Cyd Street), the depths of the granular materials should taper up or down at 5 horizontal to 1 vertical, or flatter, to match the depths of the granular material(s) exposed in the existing pavement.

5.4.8 Pavement Drainage

Based on preliminary information provided to GEMTEC, the rural subdivision design will include an open ditch drainage system The subgrade surfaces should be crowned and shaped towards the ditches in order to promote drainage of the roadway base and subbase materials. The bottom of the OPSS Granular B Type II should be at least 0.3 metres above the bottom of the ditch and the granular material should extend into the ditch slopes.

5.5 Sensitive Marine Clay – Effects of Trees

Areas of the site are underlain by silty clay, a material which is known to be susceptible to shrinkage with a change/reduction in moisture content. Research by the Institute for Research in Construction (formerly the Division of Building Research) of the National Research Council of Canada has shown that trees can cause a reduction of moisture content in the silty clays in the Ottawa area, which can result in significant settlement/damage to nearby buildings supported on shallow foundations, or hard surfaced areas. Therefore, deciduous tree planting should be carried in accordance with the guidelines identified in the City of Ottawa document titled: “Tree Planting in Sensitive Marine Clay Soils – 2017 Guidelines”.

The City of Ottawa Tree Planting Guideline indicates that sensitive marine clay soils with a modified plasticity index of less than 40 percent are considered to have a low/medium potential for soil volume change. Clay soils with a modified plasticity index that exceeds 40 percent are considered to have a high potential for soil volume change.

As part of the geotechnical investigation, a soil sample at 150 metre spacing was tested in our laboratory to determine the Atterberg limits for the sensitive marine clay. A summary of the test results is provided in Table 5.2.

Table 5.2 – Summary of Modified Plasticity Index

Borehole / Sample No.	Plastic Limit[1] (%)	Liquid Limit[1] (%)	Plasticity Index[1]	Modified Plasticity Index[2]	Shrinkage Limit[3] (%)
BH21-03 / 6	13	26	13	13	-
BH21-06 / 3	16	36	20	16	18
BH21-07 / 3	16	34	18	16	-
BH21-08 / 4	14	27	13	14	-
BH21-10 / 4	14	31	17	17	-

1. Calculated in accordance with ASTM D4318.
2. The modified plasticity index (PI_m) was calculated using the following formula, where PI is the plasticity index determined in accordance with ASTM D4318: PI_m = PI x (% passing the 425 micrometre sieve / 100).
3. Calculated in accordance with ASTM D4943, which was discontinued in 2017 by the ASTM Sponsoring Committee responsible for the standard.

The modified plasticity index of the samples tested ranges from about 13 to 17 percent. As such, the potential for soil volume change, as defined by the City of Ottawa, is low/medium. For this site, the low/medium potential clay soils encompass a portion of the site (i.e., the central portion of the site, south of Huntley Creek).

In accordance with the City of Ottawa Tree Planting Guidelines, tree planting restrictions apply where clay soils with low/medium potential for volume change are present between the underside of footing and a depth of 3.5 metres below finished grade (refer to the City of Ottawa document titled: “Tree Planting in Sensitive Marine Soils - 2017 Guidelines”).

According to the City of Ottawa 2017 Tree Planting Guidelines, the tree to foundation setbacks within the development can be reduced to 4.5 metres for small to medium sized trees (i.e., trees with a mature height of less than 14 metres), provided that all the following conditions are met:

- For footings within 10 metres of the proposed tree, the underside of footing must be 2.1 metres or greater below finished grade;
- The foundations are reinforced with a minimum of two upper and two lower 15M bars in the foundation wall;
- Grading surrounding the tree must promote draining to the tree root zone; and,
- A small size tree (i.e., a tree with a mature height of less than 7.5 metres) must be provided with a minimum of 25 cubic metres of available soil volume. For medium size trees (i.e., trees with a mature height of between 7.5 and 14 metres), a minimum soil volume of 30 cubic metres must be provided.

5.6 Slope Stability Assessment – Huntley Creek

5.6.1 General

The purpose of this slope stability assessment is to establish the 'Erosion Hazard Limit' for the site. This limit constitutes a safe setback for any proposed development at the site with respect to slope stability. The Erosion Hazard Limit was determined based on the Natural Hazard Policies set forth in Section 3.1 of the Provincial Policy Statements of the Planning Act of Ontario. Current regulations restrict development within the Erosion Hazard Limit.

The slope stability analyses were carried out at Sections 'A-A' to 'D-D', inclusive, using SLIDE, a state of the art, two dimensional limit equilibrium slope stability program. The results of the slope stability analyses are provided in Appendix E.

5.6.2 Soil Strength Parameters

The soil conditions used in the stability analyses were based, in part, on the results of the boreholes and test pits advanced across the site. The slope stability analyses were carried out using silty clay strength parameters based on site specific studies in the Ottawa area. To determine the existing factor of safety against overall rotational failure, the slope stability analyses were carried out using drained soil parameters, which reflect long term conditions.

The subsurface conditions encountered in boreholes BH21-03 and BH21-07 advanced on the south side of Huntley Creek generally consist of sand overlying silty clay. The subsurface conditions encountered in boreholes BH21-04 and BH21-05 advanced on the north side of Huntley Creek generally consist of silty clayey sand, sand and glacial till. The soil parameters used in the analyses are summarized in Table 5.3.

Table 5.3 – Soil Parameters

Soil Type	Effective Angle of Internal Friction, φ (degrees)	Effective Cohesion, c′ (kilopascals)	Unit Weight,γ kN/m^3
Sand	32	0	19
Silty Clay	30	10	17.5

The results of a stability analysis are highly dependent on the assumed groundwater conditions. As a conservative approach, we have assumed full hydrostatic saturation with the groundwater level at ground surface and groundwater flow horizontally towards the slope

The slope stability analyses were carried out using soil parameters, groundwater conditions and a slope profile that attempt to model the slopes in question but do not exactly represent the actual conditions. For the purposes of this study, a computed factor of safety of less than 1.0 to 1.3 is

considered to represent a slope bordering on failure to marginally stable, respectively; a factor of safety of 1.3 to 1.5 is considered to indicate a slope that is less likely to fail in the long term and provides a degree of confidence against failure ranging from marginal (1.3) to adequate (1.4 and greater) should conditions vary from the assumed conditions. A factor of safety of 1.5, or greater, is considered to indicate adequate long term stability.

5.6.3 Existing Conditions

The slope stability analyses indicated that the existing slopes, in their current configurations, have the following factors of safety against overall rotational failure:

Table 5.4 – Existing Factor of Safety

Cross Section	Existing Factor of Safety	Figure
A-A	4.2	E1
B-B	5.0	E2
C-C	2.5	E3
D-D	4.0	E4
E-E	4.2	E5

Based on the results of the analyses, the slopes along Huntley Creek are considered stable under "worst case" conditions. The results of the stability analyses agree with our field observations on March 30, 2021.

The slopes along Huntley Creek were also analysed for pseudo-static (seismic) conditions using the undrained silty clay strength parameters. A seismic coefficient of 0.12 was used in the pseudo-static analyses (i.e., half of the Peak Ground Acceleration for the area). The slope stability analyses indicate that the existing slopes, in their current configurations, have a factor of safety against failure of greater than 1.1 for pseudo-static conditions, which is considered acceptable. The results of the pseudo-static analyses are provided on Figures E1 to E5 in Appendix E.

5.6.4 Setback Requirements

For unstable slopes, the distance from the unstable slope to the safe setback line is called 'Erosion Hazard Limit'. In accordance with the Ministry of Natural Resources (MNR) Technical Guide "Understanding Natural Hazards" dated 2001, the Erosion Hazard Limit consists of three components: (1) Stable Slope Allowance, (2) Toe Erosion Allowance, and (3) Erosion Access Allowance.

The Stable Slope Allowance, as described in the MNR procedures, is the area where a factor of safety of less than 1.5 against overall rotational failure is calculated. At Sections A-A', to E-E',

inclusive, the slope stability analyses indicate that the existing Huntley Creek slopes, in their current configurations, have a factor of safety against failure of greater than 1.5 (refer to Table 5.5 above). Therefore, the Stable Slope Allowance described in the MNR procedures is not required.

In accordance with the MNR documents, a minimum Toe Erosion Allowance of between 5.0 to 8.0 metres is required for clay soils and a minimum Erosion Allowance of between 5.0 to 15.0 metres is required for sandy soils.

No evidence of active soil erosion was observed at the time of the site visit, however, given the relatively high water levels and the creek's meander, a Toe Erosion Allowance of 8 metres should be used. The Toe Erosion Allowance is applied to the crest of the slope.

The MNR procedures also include the application of a 6 metre wide Erosion Access Allowance beyond the Toe Erosion Allowance to allow for access by equipment to repair a possible failed slope. However, based on the preliminary development plans, the Erosion Access Allowance is not required (i.e., for cases where rear lot lines of residential lots are not constructed right up to the Erosion Hazard Limit).

The Erosion Hazard Limit (setback) for the Huntley Creek slopes is located about 8.0 metres from the crest of the existing slopes. It is noted that minimum setbacks from the watercourse established by the Mississippi Valley Conservation Authority will also need to be considered.

6.0 ADDITIONAL CONSIDERATIONS

6.1 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.

6.2 Monitoring Well Abandonment

All monitoring wells installed as part of this investigation should be decommissioned by a licensed well technician in accordance with Provincial regulations. The well abandonment could be carried out in advance of or during construction.

6.3 Disposal of Excess Soil

It is noted that 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, including naturally occurring source of contamination, are outside the terms of reference for this report. This report does not constitute a Phase II

Environmental Site Assessment (ESA) nor does it constitute a contaminated material management plan.

6.4 Design Review and Construction Observation

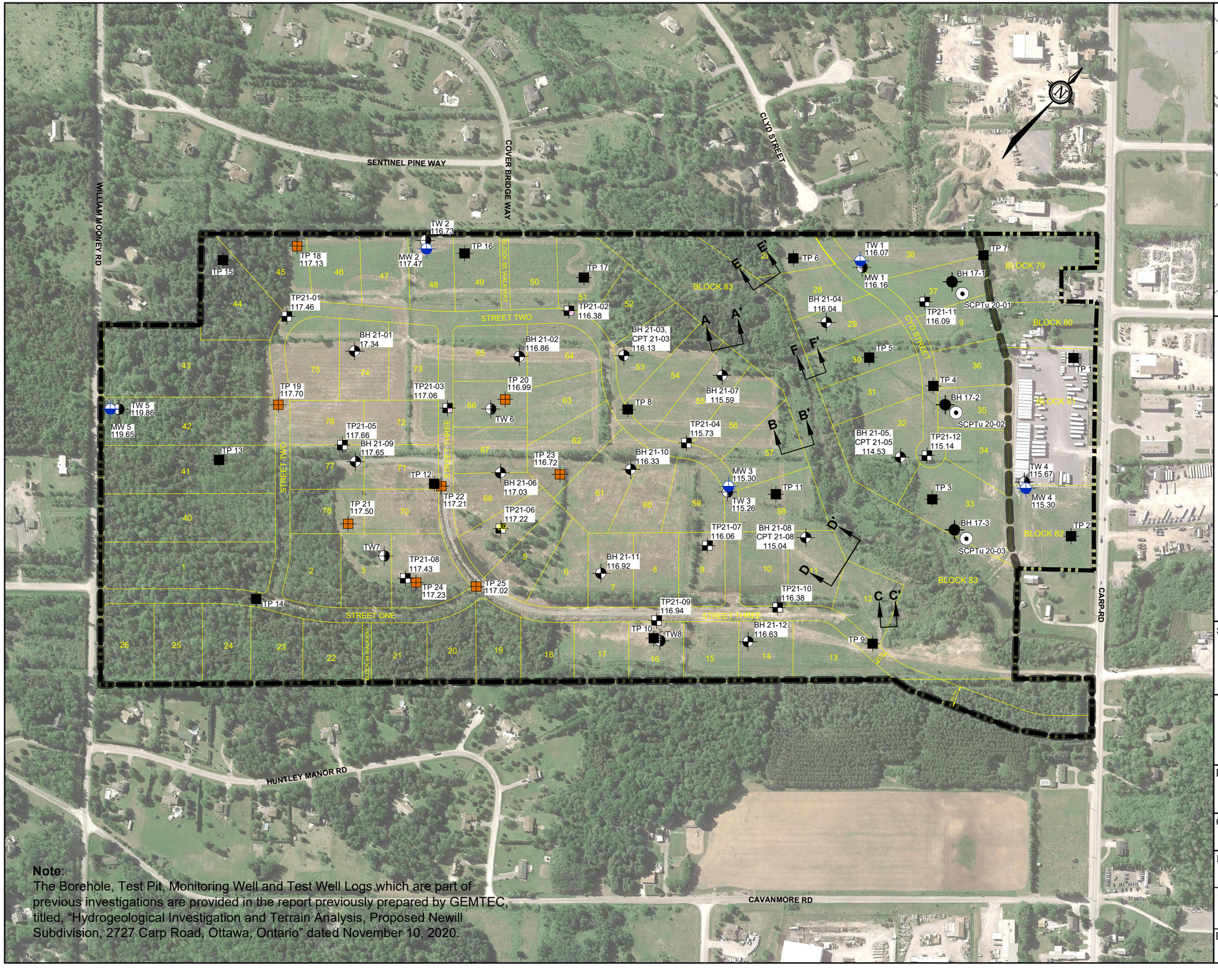
The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed excavations do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design. The subgrade surfaces for the houses, services, and roadways 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.

7.0 CLOSURE

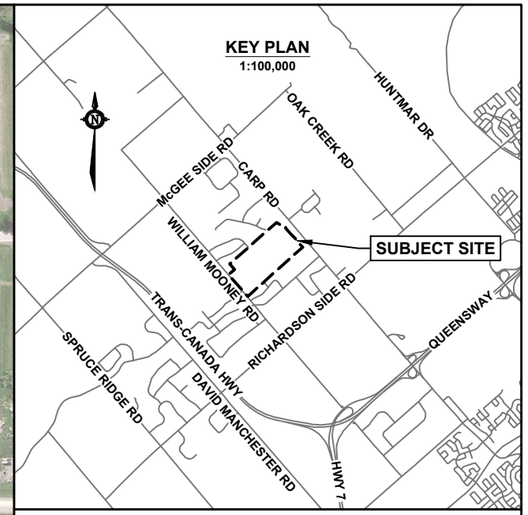
We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

Lauren Ashe, M.A.Sc., P.Eng.
Geotechnical Engineer

Brent Wiebe, P.Eng.
VP Operations - Ontario



Note:
The Borehole, Test Pit, Monitoring Well and Test Well Logs which are part of previous investigations are provided in the report previously prepared by GEMTEC, titled, "Hydrogeological Investigation and Terrain Analysis, Proposed Newill Subdivision, 2727 Carp Road, Ottawa, Ontario" dated November 10, 2020.



LEGEND

- BH/TP/MW/TW/CPT # ← BH/TP/MW/TW/CPT ID
- XX.XX ← GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM
- **CONE PENETRATION LOCATION** (current investigation by GEMTEC)
- **BOREHOLE LOCATION** (current investigation by GEMTEC)
- **TEST PIT LOCATION** (current investigation by GEMTEC)
- **BOREHOLE LOCATION** (previous investigation by GEMTEC, July, 2017)
- **TEST PIT LOCATION** (previous investigation by GEMTEC, March, 2003)
- **TEST PIT LOCATION** (previous investigation by GEMTEC, May, 2019)
- **MONITORING WELL LOCATION** (previous investigation by GEMTEC)
- **TEST WELL LOCATION** (previous investigation by GEMTEC)
- **PROPERTY BOUNDARY**
- **SUBJECT SITE**
- A — A' **CROSS-SECTION LOCATION**

Scale 1:5000

0 100 200 300m

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Drawing: SITE PLAN

Client: THOMAS CAVANAGH CONSTRUCTION LTD.

Project		GEOTECHNICAL INVESTIGATION PROPOSED RESIDENTIAL SUBDIVISION 2727 CARP ROAD OTTAWA, ONTARIO
100020.002		
Drwn by: S.L.	Chkd by: L.A.	
Date: APRIL, 2022	Rev. 3	**FIGURE 1**

APPENDIX A

Record of Borehole and Test Pit Sheets
Boreholes BH21-01 to BH21-12
Test Pits TP21-01 to TP21-12
List of Abbreviations and Symbols

RECORD OF BOREHOLE 21-01

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Feb 17 2021

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		117.34							
		TOPSOIL		0.05							
	Power Auger Hollow Stem Auger (260mm OD)	Loose to very dense, brown to grey, silty sand, trace clay, trace gravel, possible cobbles and boulders (GLACIAL TILL)			1	SS	150	7			Above ground protective casing (PVC pipe stickup 0.98 metres)
1					2	SS	180	22			Bentonite
2					3	SS	130	50 blows/130mm		M	51 millimetre diameter slotted PVC pipe
					4	SS	80	23			
3					5	SS	250	> 100 blows/300mm			Filter Pack
		End of Borehole		113.99 3.35							
		Auger Refusal on Inferred Bedrock									
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
21/03/04	1.6 ▽	115.7

GEMTEC
Consulting Engineers and Scientists

LOGGED: A.S.
CHECKED: L.A.

GEO - BOREHOLE LOG 100020.002_BOREHOLES_2021-03-17.GPJ GEMTEC 2018.GDT 8/4/21

RECORD OF BOREHOLE 21-02

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Feb 17 2021

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (260mm OD)	Ground Surface		116.86						
		TOPSOIL		0.05	1	SS	50	5		
		Compact, brown SILTY, CLAYEY SAND, trace gravel			2	SS	510	10		
2					3	SS	610	14	MH	Borehole backfilled with cuttings
				114.57						
		Loose to dense, grey silty sand, trace clay, trace gravel, possible cobbles and boulders (GLACIAL TILL)		2.29	4	SS	560	8		
3					5	SS	360	39		
4				112.80	6	SS	30	50 blows/130 mm		
		End of Borehole		4.06						
		Auger Refusal on Inferred Bedrock								
5										
6										
7										
8										
9										
10										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % — W_P W W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: A.S.
CHECKED: L.A.

GEO - BOREHOLE LOG 100020.002_BOREHOLES_2021-03-17.GPJ GEMTEC 2018.GDT 8/4/21

RECORD OF BOREHOLE 21-03

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Feb 17 2021

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (260mm OD)	Ground Surface		116.13						Above ground protective casing (PVC pipe stickup 0.97 metres)
		TOPSOIL		115.93						
		Compact, reddish brown, fine grained SAND, trace to some silt		0.20	1	SS	300	10		
				115.52						
1		Loose, grey brown to grey, medium to coarse grained SAND, some silt		0.61	2	SS	50	8		
					3	SS	300	2		
2					4	SS	360	12	M	Bentonite
3					5	SS	410	10		Filter Pack
				112.62						
		Very stiff to stiff, grey SILT and CLAY, some sand		3.51						
4					6	SS	610	4	MH	
					7	SS	610	4		51 millimetre diameter slotted PVC pipe
5					8	SS	610	3		
6					9	SS	610	WH		
				109.42						
		End of Borehole		6.71						
7										
8										
9										
10										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
21/03/04	2.0 ▽	114.1

GEMTEC
Consulting Engineers and Scientists

LOGGED: A.S.
CHECKED: L.A.

GEO - BOREHOLE LOG 100020.002_BOREHOLES_2021-03-17.GPJ GEMTEC 2018.GDT 8/4/21

RECORD OF BOREHOLE 21-04

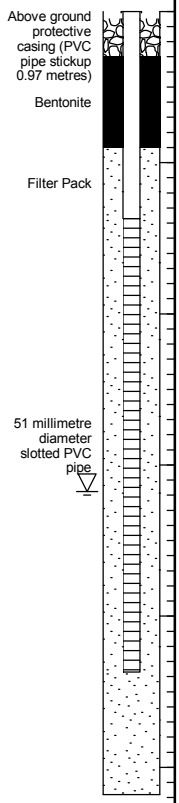
CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Feb 11 2021

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING
		Ground Surface	116.04					
		TOPSOIL	0.07					
		Loose, brown, fine to medium grained SAND, trace to some silt, trace gravel		1	SS	355	6	
				2	SS	254	7	
			114.52					
		Grey brown SILTY, CLAYEY SAND	1.52					
			114.21	3	SS	406	11	
	Power Auger / Hollow Stem Auger (260mm OD)	Compact, grey brown silt and sand, trace gravel, trace clay, possible cobbles and boulders (GLACIAL TILL)	1.83	4	SS	406	28	MH
			112.99					
		Dense, grey brown gravelly silty sand, some clay, possible cobbles and boulders (GLACIAL TILL)	3.05	5	SS	355	43	
			112.23					
		Compact to dense, medium to coarse grained gravelly sand, trace silt, possible cobbles and boulders (GLACIAL TILL)	3.81	6	SS	406	21	M
				7	SS	406	33	
			110.86					
		End of Borehole	5.18					

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
21/03/04	3.2 ▽	112.9

GEMTEC
Consulting Engineers and Scientists

LOGGED: M.L
CHECKED: L.A.

GEO - BOREHOLE LOG 100020.002_BOREHOLES_2021-03-17.GPJ GEMTEC 2018.GDT 8/4/21

RECORD OF BOREHOLE 21-05

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Feb 11 2021

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		114.70						
0	Power Auger Hollow Stem Auger (260mm OD)	TOPSOIL		0.10						
		Brown fine grained sand with organic material and wood chips (FILL MATERIAL)			1	SS	355	3		
				113.79						
1		Very stiff, grey brown SANDY, CLAYEY SILT		0.91	2	SS	355	3		
					3	SS	610	7	MH	
2					4	SS	355	3		Borehole backfilled with cuttings
				111.65						
3		Compact to dense, grey fine to medium grained SAND, some silt		3.05	5	SS	355	14		
					6	SS	406	33		
4										
					7	SS	305	2		
5				109.67						
		Grey SILTY SAND, trace to some clay		5.03						
				109.37						
		End of Borehole		5.33						
6		Note: Borehole terminated as a result of sand heaving into hollow stem auger								
7										
8										
9										
10										

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA
NATURAL REMOULDED
WATER CONTENT, %
W_P W W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: M.L
CHECKED: L.A.

GEO - BOREHOLE LOG 100020.002_BOREHOLES_2021-03-17.GPJ GEMTEC 2018.GDT 8/4/21

RECORD OF BOREHOLE 21-06

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

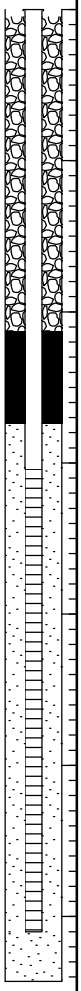
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Feb 18 2021

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING
0	Power Auger Hollow Stem Auger (260mm OD)	Ground Surface		117.03					
		TOPSOIL		116.88 / 0.15					
		Loose, brown SILTY, CLAYEY SAND, trace gravel		116.42 / 0.61	1	SS	250	4	
1		Very stiff, brown SILT and CLAY, trace sand			2	SS	610	5	
2					3	SS	610	13	MH
				114.59 / 2.44	4	SS	610	8	
3		Very stiff, grey SILTY CLAY			5	SS	610	2	
				113.22 / 3.81	6	SS	100	16	
4		Compact, grey sand and gravel, trace silt, possible cobbles and boulders (GLACIAL TILL)		112.46 / 4.57	7	SS	360	14	
5		Compact to dense, grey silty sand some gravel, trace to some clay, possible cobbles and boulders (GLACIAL TILL)			8	SS	410	39	
6					9	SS	200	85 blows / 80mm	
				110.60 / 6.43					
		End of Borehole							
7									
8									
9									
10									

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
21/03/04	1.4 ▽	115.7

GEMTEC
Consulting Engineers and Scientists

LOGGED: M.L
CHECKED: L.A.

GEO - BOREHOLE LOG 100020.002_BOREHOLES_2021-03-17.GPJ GEMTEC 2018.GDT 8/4/21

RECORD OF BOREHOLE 21-07

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Feb 17 2021

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (260mm OD)	Ground Surface		115.59							
		TOPSOIL		115.29	1	SS	200	7			
		Loose, brown, fine grained SAND, some silt		0.30							
1				114.68	2	SS	510	9			
		Very stiff, grey brown SILT and CLAY, trace sand		0.91							
2					3	SS	610	12		MH	
					4	SS	610	9			
3					5	SS	610	4			Borehole backfilled with cuttings
				111.93							
		Stiff, grey SILTY CLAY, some sand		3.66	6	SS	610	2			
4											
5					7	SS	610	3			
				109.65							
6		End of Borehole		5.94							
7											
8											
9											
10											

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Consulting Engineers and Scientists

LOGGED: A.S.
CHECKED: L.A.

GEO - BOREHOLE LOG 100020.002_BOREHOLES_2021-03-17.GPJ GEMTEC 2018.GDT 8/4/21

RECORD OF BOREHOLE 21-08

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Feb 16 2021

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (260mm OD)	Ground Surface		115.04							
		TOPSOIL		114.79							
		Brown silty clay with organic material (FILL MATERIAL)		0.25	1	SS	409	15			
				114.28							
1		Very stiff, grey brown SILT and CLAY, some sand		0.76	2	SS	610	4		MH	
					3	SS	610	3			
2					4	SS	610	6			Bentonite
3					5	SS	610	6			Filter Pack
4				111.08							
		Stiff, grey SILTY CLAY, some sand		3.96	6	SS	457	1			
					7	SS	457	3			51 millimetre diameter slotted PVC pipe
5		Loose, grey silty sand seam from 5.3 to 6.1 metres			8	SS	203	7			
6					9	SS	610	1			
				108.33							
		End of Borehole		6.71							
7											
8											
9											
10											

Above ground protective casing (PVC pipe stickup 1.02 metres)

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
21/03/04	1.8 ▽	113.3

GEMTEC
Consulting Engineers and Scientists

LOGGED: M.L
CHECKED: L.A.

GEO - BOREHOLE LOG 100020.002_BOREHOLES_2021-03-17.GPJ GEMTEC 2018.GDT 8/4/21

RECORD OF BOREHOLE 21-09

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Feb 18 2021

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		117.65							
	Power Auger Hollow Stem Auger (260mm OD)	TOPSOIL		0.05							
		Compact, grey SAND, some gravel			1	SS	250	16			
1				117.04							
		Compact, grey brown silty sand, some clay, some gravel, possible cobbles and boulders (GLACIAL TILL)		0.61	2	SS	250	10			
2					3	SS	200	20			
				115.39							
		End of Borehole		2.26							
		Refusal on Inferred Bedrock									
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

Borehole backfilled with cuttings

GEMTEC
Consulting Engineers and Scientists

LOGGED: M.L
CHECKED: L.A.

GEO - BOREHOLE LOG 100020.002_BOREHOLES_2021-03-17.GPJ GEMTEC 2018.GDT 8/4/21

RECORD OF BOREHOLE 21-10

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Feb 18 2021

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (260mm OD)	Ground Surface		116.33							
		TOPSOIL		0.10							
		Dark brown silty sand with organic material (FILL MATERIAL)		116.03	1	SS	410	7			
		Loose, brown fine grained SAND, some silt		0.30							
1		Very stiff, grey brown SILTY CLAY, some sand		115.42 0.91	2	SS	410	4			
					3	SS	510	10			
2											
		Very stiff to stiff, grey, CLAYEY SILT, trace gravel, trace sand		113.89 2.44	4	SS	610	3		MH	
3					5	SS	610	4			Borehole backfilled with cuttings
4					6	SS	610	2			
					7	SS	510	8			
5		Compact, grey silty sand, some clay, some gravel, possible cobbles and boulders (GLACIAL TILL)		111.45 4.88							
					8	SS	250	15			
6					9	SS	250	18			
		End of Borehole		109.62 6.71							
7											
8											
9											
10											

GEMTEC
Consulting Engineers and Scientists

LOGGED: M.L
CHECKED: L.A.

GEO - BOREHOLE LOG 100020.002_BOREHOLES_2021-03-17.GPJ GEMTEC 2018.GDT 8/4/21

RECORD OF BOREHOLE 21-11

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Feb 18 2021

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		116.92						
0	Power Auger / Hollow Stem Auger (260mm OD)	TOPSOIL		116.77 0.15						Above ground protective casing (PVC pipe stickup 0.94 metres)
		Very stiff, grey brown SANDY, CLAYEY SILT			1	SS	200	3		
1					2	SS	360	12	MH	
				115.52 1.40						
		Loose to dense, grey brown to grey, silty sand, some clay, some gravel, possible cobbles and boulders (GLACIAL TILL)			3	SS	360	35		Bentonite
2					4	SS	410	12		Filter Pack
3					5	SS	300	8		51 millimetre diameter slotted PVC pipe
4					6	SS	300	25		
				112.35 4.57						
		Very loose, grey medium to coarse grained SAND, some gravel			7	SS	300	3		
5				111.74 5.18						
		End of Borehole Note: Sand heaving into hollow stem auger								
6										
7										
8										
9										
10										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA
NATURAL REMOULDED
WATER CONTENT, %
W_P W W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
21/03/04	1.3 ▽	115.6

GEMTEC
Consulting Engineers and Scientists

LOGGED: M.L
CHECKED: L.A.

GEO - BOREHOLE LOG 100020.002_BOREHOLES_2021-03-17.GPJ GEMTEC 2018.GDT 8/4/21

RECORD OF BOREHOLE 21-12

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Feb 16 2021

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		116.63						
0	Power Auger Hollow Stem Auger (260mm OD)	TOPSOIL		116.43						
		Compact, brown, fine to medium grained SAND, trace silt		0.20 116.02	1	SS	406	15		
		Loose, grey brown SAND and SILT, some clay, some gravel		0.61	2	SS	457	7	MH	
1										
					3	SS	457	7		
2				114.43						
		Very stiff to stiff, grey brown to grey SILTY CLAY, some sand		2.20	4	SS	508	9		
3					5	SS	610	3		Borehole backfilled with cuttings
4										
					6	SS	610	4		
5										
					7	SS	610	2		
6				110.53						
		Very loose, grey SILTY SAND		6.10 109.92	8	SS	152	WH		
		End of Borehole Note: Sand heaving into hollow stem auger upon completion of borehole.		6.71						
7										
8										
9										
10										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % — W_P W W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: M.L
CHECKED: L.A.

GEO - BOREHOLE LOG 100020.002_BOREHOLES_2021-03-17.GPJ GEMTEC 2018.GDT 8/4/21

RECORD OF TEST PIT 21-01

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 28 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		117.46			10 20 30 40 50 60 70 80 90		
	TOPSOIL		0.10					
	Brown to grey brown SILTY, CLAYEY SAND			1	GS		MH	Test Pit backfilled with excavated material
				2	GS			
1			116.26					
	Grey silty clay, some sand, some gravel, possible cobbles and boulders (GLACIAL TILL)		1.20					
2			114.72					
	End of Test Pit		2.74					No groundwater seepage observed upon completion of excavating
3								
4								
5								
6								
7								
8								
9								
10								

GEMTEC
Consulting Engineers and Scientists

LOGGED: M.L
CHECKED: L.A.

GEO - TESTPIT LOG 100020.002_TESTPITS_2021-03-17.GPJ GEMTEC 2018.GDT 17/3/21

RECORD OF TEST PIT 21-02

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 28 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		116.38			10 20 30 40 50 60 70 80 90		
	TOPSOIL		116.23 / 0.15					
	Dark brown SILTY SAND		116.03 / 0.35	1	GS		MH	Test pit backfilled with excavated material
1	Brown SAND, some silt, some clay, trace gravel							
			114.98 / 1.40	2	GS			Groundwater seepage observed at 1.3 metres upon completion of excavating
2	Brown to grey SAND, some silt							
				3	GS			
3	End of Test Pit		113.38 / 3.00					
4								
5								
6								
7								
8								
9								
10								

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Consulting Engineers and Scientists

LOGGED: M.L
CHECKED: L.A.

GEO - TESTPIT LOG 100020.002_TESTPITS_2021-03-17.GPJ GEMTEC 2018.GDT 17/3/21

RECORD OF TEST PIT 21-03

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 28 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		117.06			10 20 30 40 50 60 70 80 90		
	TOPSOIL		116.91 / 0.15					
	Dark brown SILTY SAND		116.66 / 0.40					
1	Brown SANDY, CLAYEY SILT			1	GS		MH	Test pit backfilled with excavated material
2			115.16 / 1.90					Groundwater seepage observed at 2.7 metres upon completion of excavating
	Grey sand and gravel, some cobbles, possible cobbles and boulders (GLACIAL TILL)							
3			114.06					
	End of Test Pit		3.00					
4								
5								
6								
7								
8								
9								
10								

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LOGGED: M.L
CHECKED: L.A.

GEO - TESTPIT LOG 100020.002_TESTPITS_2021-03-17.GPJ GEMTEC 2018.GDT 17/3/21

RECORD OF TEST PIT 21-04

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 28 2021

DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED / WATER CONTENT, % W_P W W_L	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		115.73					Test pit backfilled with excavated material
	TOPSOIL		0.10					
	Dark brown SILTY SAND		115.38					
	Brown SAND, trace silt, trace clay		0.35	1	GS		MH	
1			114.83					
	Grey brown SILTY CLAY, some sand		0.90	2	GS			
2								No groundwater seepage observed upon completion of excavating
3	End of Test Pit		112.73 3.00					
4								
5								
6								
7								
8								
9								
10								

SHEAR STRENGTH (Cu), kPA: 10 20 30 40 50 60 70 80 90

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LOGGED: M.L
CHECKED: L.A.

GEO - TESTPIT LOG 100020.002_TESTPITS_2021-03-17.GPJ GEMTEC 2018.GDT 17/3/21

RECORD OF TEST PIT 21-05

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 28 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		117.66					
	TOPSOIL		117.58 / 0.08					
	Dark brown SILTY SAND		0.20					
	Grey brown sand, some gravel, some silt, some clay, possible cobbles and boulders (GLACIAL TILL)			1	GS	10 20 30 40 50 60 70 80 90	MH	Test Pit backfilled with excavated material
3	End of Test Pit		114.66 / 3.00					No groundwater seepage observed upon completion of excavating
10								

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
21/01/13	1.3 ▽	117.16

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CHECKED: L.A.

GEO - TESTPIT LOG 100020.002_TESTPITS_2021-03-17.GPJ GEMTEC 2018.GDT 17/3/21

RECORD OF TEST PIT 21-06

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 28 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		117.22			10 20 30 40 50 60 70 80 90		
	TOPSOIL		0.08 / 116.95					
	Dark brown SILTY SAND with roots and organic material		0.27	1	GS		MH	Test Pit backfilled with excavated material
	Brown fine to medium grained SAND, some silt, some clay		116.42					
1	Grey brown SILTY CLAY, some sand		0.80					
2			115.02					
	Grey SILTY CLAY		2.20					
3	End of Test Pit		114.22 / 3.00					No groundwater seepage observed upon completion of excavating
4								
5								
6								
7								
8								
9								
10								

GEMTEC
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LOGGED: M.L
CHECKED: L.A.

GEO - TESTPIT LOG 100020.002_TESTPITS_2021-03-17.GPJ GEMTEC 2018.GDT 17/3/21

RECORD OF TEST PIT 21-07

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 28 2021

DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	ADDITIONAL LAB. TESTING
0	Ground Surface		116.06			
	TOPSOIL		0.15			
	Dark brown SILTY SAND		0.20			
	Brown fine to medium grained SAND, trace silt, trace clay		115.26	1	GS	MH
1	Grey brown SANDY, SILTY CLAY		0.80	2	GS	MH
			114.66			
	Grey SILTY CLAY, trace to some sand		1.40	3	GS	
2						
3	End of Test Pit		113.06 3.00			
4						
5						
6						
7						
8						
9						
10						

SHEAR STRENGTH (Cu), kPA
+ NATURAL ⊕ REMOULDED
10 20 30 40 50 60 70 80 90

WATER CONTENT, %
W_P W W_L

WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION

Test Pit backfilled with excavated material ▽

No groundwater seepage observed upon completion of excavating

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
21/01/13	1.3 ▽	115.55

LOGGED: M.L
CHECKED: L.A.

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GEO - TESTPIT LOG 100020.002_TESTPITS_2021-03-17.GPJ GEMTEC 2018.GDT 17/3/21

RECORD OF TEST PIT 21-08

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 28 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		117.43			10 20 30 40 50 60 70 80 90		
	TOPSOIL		0.10 / 117.13					
	Dark brown SILTY SAND		0.30					
	Brown to grey brown SILT and CLAY, some sand			1	GS		MH	Test Pit backfilled with excavated material
1								
2								
			114.69					
	Grey silty clay, some sand, some gravel, possible cobbles and boulders (GLACIAL TILL)		2.74 / 114.43					
3	End of Test Pit		3.00					Groundwater seepage observed at about 0.7 metres below ground surface upon completion of excavating
4								
5								
6								
7								
8								
9								
10								

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
21/01/13	1.6 ▽	116.50

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CHECKED: L.A.

GEO - TESTPIT LOG 100020.002_TESTPITS_2021-03-17.GPJ GEMTEC 2018.GDT 17/3/21

RECORD OF TEST PIT 21-09

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 28 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		116.94					Test Pit backfilled with excavated material
	Brown fine to medium grained SAND, trace silt, trace clay			1	GS		MH	
1			115.84					
	Grey brown SILTY CLAY, some sand		1.10	2	GS			
2								
3	End of Test Pit		113.94 / 3.00					Groundwater seepage observed at about 1.1 metres below ground surface upon completion of excavating
4								
5								
6								
7								
8								
9								
10								

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LOGGED: M.L
CHECKED: L.A.

GEO - TESTPIT LOG 100020.002_TESTPITS_2021-03-17.GPJ GEMTEC 2018.GDT 17/3/21

RECORD OF TEST PIT 21-10

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 28 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		116.38			10 20 30 40 50 60 70 80 90		
	TOPSOIL		0.10					
1	Brown fine to medium grained SAND, trace silt, trace clay			1	GS		MH	Test Pit backfilled with excavated material
2			114.28					
	Grey brown SILTY CLAY, some sand		2.10	2	GS			
3			113.38					
	End of Test Pit		3.00					Groundwater seepage observed at about1.5 metres below ground surface upon completion of excavating
4								
5								
6								
7								
8								
9								
10								

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LOGGED: M.L
CHECKED: L.A.

GEO - TESTPIT LOG 100020.002_TESTPITS_2021-03-17.GPJ GEMTEC 2018.GDT 17/3/21

RECORD OF TEST PIT 21-11

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 28 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		116.09					
	TOPSOIL		115.89 / 0.20					
	Brown SAND, some silt, some clay, trace gravel			1	GS		MH	Test Pit backfilled with excavated material
1			115.19 / 0.90					
	Brown SILTY CLAYEY SAND			2	GS		MH	
2								
				3	GS			
3			113.09					
	End of Test Pit		3.00					Groundwater seepage observed at about 2.3 metres below ground surface upon completion of excavating
4								
5								
6								
7								
8								
9								
10								

SHEAR STRENGTH (Cu), kPA: 10 20 30 40 50 60 70 80 90

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LOGGED: M.L
CHECKED: L.A.

GEO - TESTPIT LOG 100020.002_TESTPITS_2021-03-17.GPJ GEMTEC 2018.GDT 17/3/21

RECORD OF TEST PIT 21-12

CLIENT: Cavanagh Developments
PROJECT: Huntley Chase Subdivision, 2727 Carp Road
JOB#: 100020.002
LOCATION: See Site Plan - Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 28 2021

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		115.14			10 20 30 40 50 60 70 80 90		
	TOPSOIL		114.94					
	Grey brown fine to medium grained SAND, trace clay		0.20	1	GS		MH	Test Pit backfilled with excavated material
1			114.04					
	Grey SANDY SILT		1.10	2	GS			
2								
3	End of Test Pit		112.14 3.00					Groundwater seepage observed at about 0.9 metres below ground surface upon completion of excavating
4								
5								
6								
7								
8								
9								
10								

GEMTEC
Consulting Engineers and Scientists

LOGGED: M.L
CHECKED: L.A.

GEO - TESTPIT LOG 100020.002_TESTPITS_2021-03-17.GPJ GEMTEC 2018.GDT 17/3/21

ABBREVIATIONS AND TERMINOLOGY USED ON RECORDS OF BOREHOLES AND TEST PITS

SAMPLE TYPES	
AS	Auger sample
CA	Casing sample
CS	Chunk sample
BS	Borros piston sample
GS	Grab sample
MS	Manual sample
RC	Rock core
SS	Split spoon sampler
ST	Slotted tube
TO	Thin-walled open shelby tube
TP	Thin-walled piston shelby tube
WS	Wash sample

SOIL TESTS	
w	Water content
PL, w_p	Plastic limit
LL, w_L	Liquid limit
C	Consolidation (oedometer) test
D_R	Relative density
DS	Direct shear test
G_S	Specific gravity
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	Organic content test
UC	Unconfined compression test
γ	Unit weight

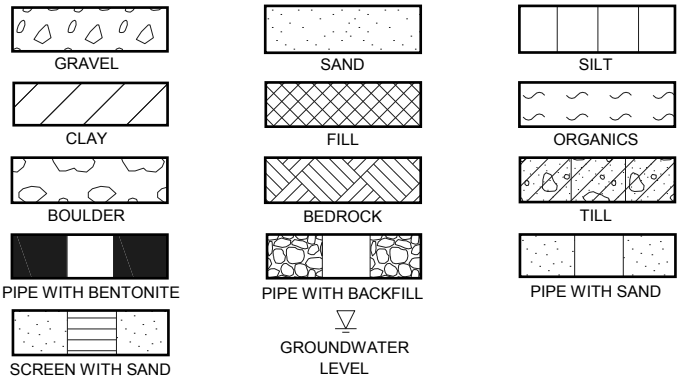
PENETRATION RESISTANCE

Standard Penetration Resistance, N
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 millimetres (30 in.) required to drive a 50 mm split spoon sampler for a distance of 300 mm (12 in.). For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.

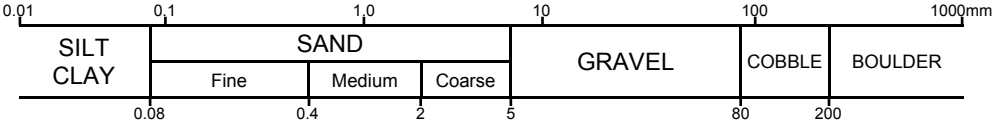
Dynamic Penetration Resistance
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive a 50 mm (2 in.) diameter 60° cone attached to 'A' size drill rods for a distance of 300 mm (12 in.).

WH	Sampler advanced by static weight of hammer and drill rods
WR	Sampler advanced by static weight of drill rods
PH	Sampler advanced by hydraulic pressure from drill rig
PM	Sampler advanced by manual pressure

COHESIONLESS SOIL Compactness		COHESIVE SOIL Consistency	
SPT N-Values	**Description**	**Cu, kPa**	**Description**
0-4	Very Loose	0-12	Very Soft
4-10	Loose	12-25	Soft
10-30	Compact	25-50	Firm
30-50	Dense	50-100	Stiff
>50	Very Dense	100-200	Very Stiff
		>200	Hard

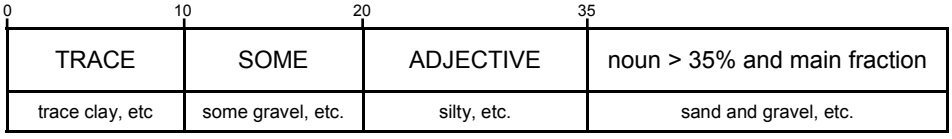


GRAIN SIZE



DESCRIPTIVE TERMINOLOGY

(Based on the CANFEM 4th Edition)



LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERING STATE	
Fresh	No visible sign of rock material weathering
Faintly weathered	Weathering limited to the surface of major discontinuities
Slightly weathered	Penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material
Moderately weathered	Weathering extends throughout the rock mass but the rock material is not friable
Completely weathered	Rock is wholly decomposed and in a friable condition but the rock and structure are preserved

CORE CONDITION
Total Core Recovery (TCR) The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run
Solid Core Recovery (SCR) The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.
Rock Quality Designation (RQD) The percentage of solid drill core, greater than 100 mm length, as measured along the centerline axis of the core, relative to the length of the total core run. RQD varies from 0% for completed broken core to 100% for core in solid segments.

BEDDING THICKNESS	
Description	**Thickness**
Thinly laminated	< 6 mm
Laminated	6 - 20 mm
Very thinly bedded	20 - 60 mm
Thinly bedded	60 - 200 mm
Medium bedded	200 - 600 mm
Thickly bedded	600 - 2000 mm
Very thickly bedded	2000 - 6000 mm

DISCONTINUITY SPACING	
Description	**Spacing**
Very close	20 - 60 mm
Close	60 - 200 mm
Moderate	200 - 600 mm
Wide	600 -2000 mm
Very wide	2000 - 6000 mm

ROCK QUALITY	
RQD	**Overall Quality**
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

ROCK COMPRESSIVE STRENGTH	
Comp. Strength, MPa	**Description**
1 - 5	Very weak
5 - 25	Weak
25 - 50	Moderate
50 - 100	Strong
100 - 250	Very strong

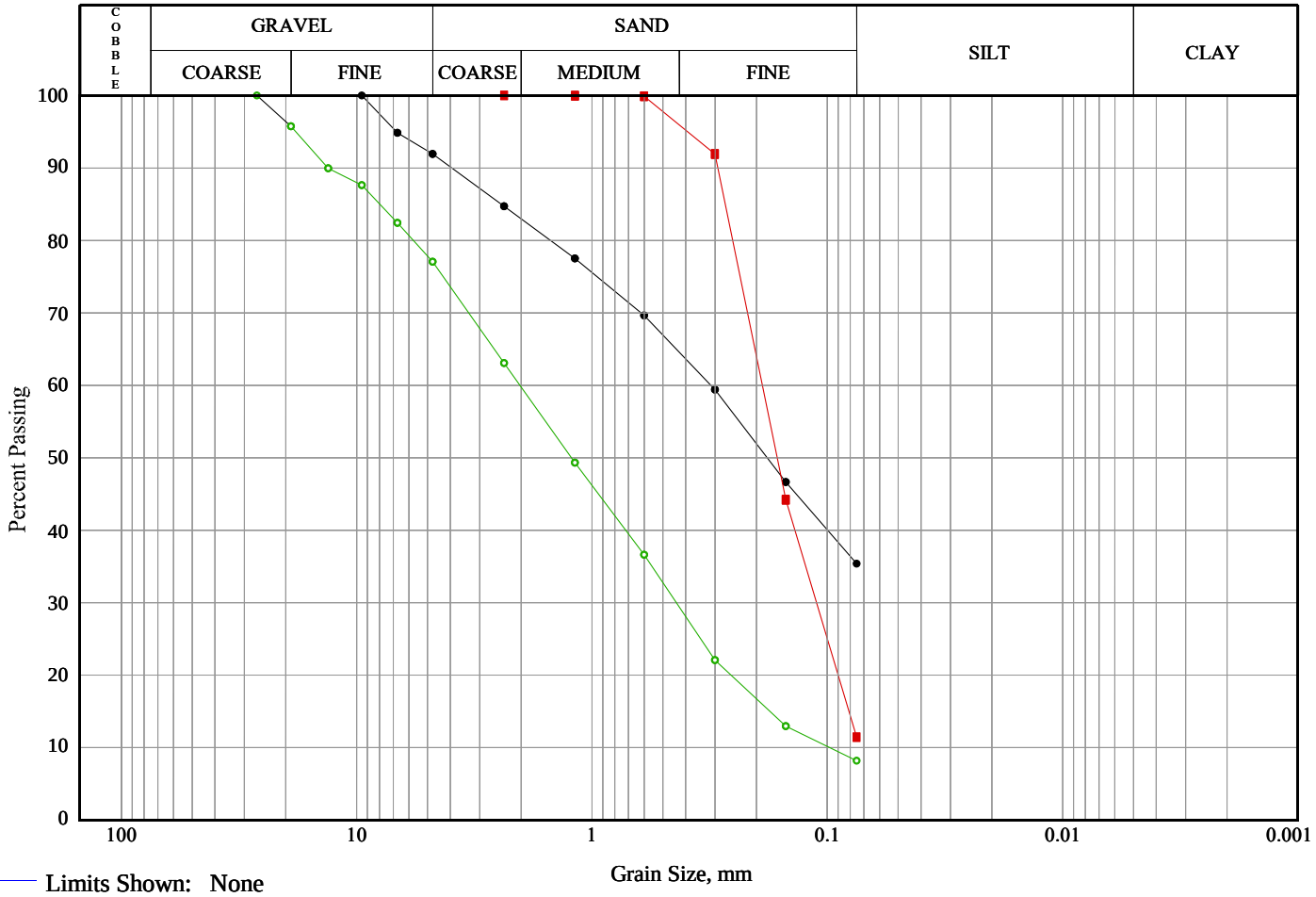
APPENDIX B

Laboratory Test Results

GEMTEC
Consulting Engineers and Scientists

Client:	Thomas Cavanagh Construction Ltd.
Project:	Geotechnical Investigation, Proposed Residential Develo
Project #:	100020002

Soils Grading Chart



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
●—	Glacial Till Deposits	BH21-01	SA 2	0.76-1.37	8.1	56.6	35.4	
■—	Sand Deposits	BH21-03	SA 4	2.28-2.89	0.0	88.6	11.4	
○—	Glacial Till Deposits	BH21-04	SA 6	3.81-4.42	23.0	68.9	8.2	

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
●—	Sand and silt , trace gravel	N/A	---	---	---	0.18	0.31	2.43	---
■—	Sand , some silt	N/A	---	0.08	0.11	0.16	0.19	0.27	---
○—	Gravelly sand , trace silt	N/A	0.10	0.18	0.44	1.22	2.02	7.97	---

GEMTEC
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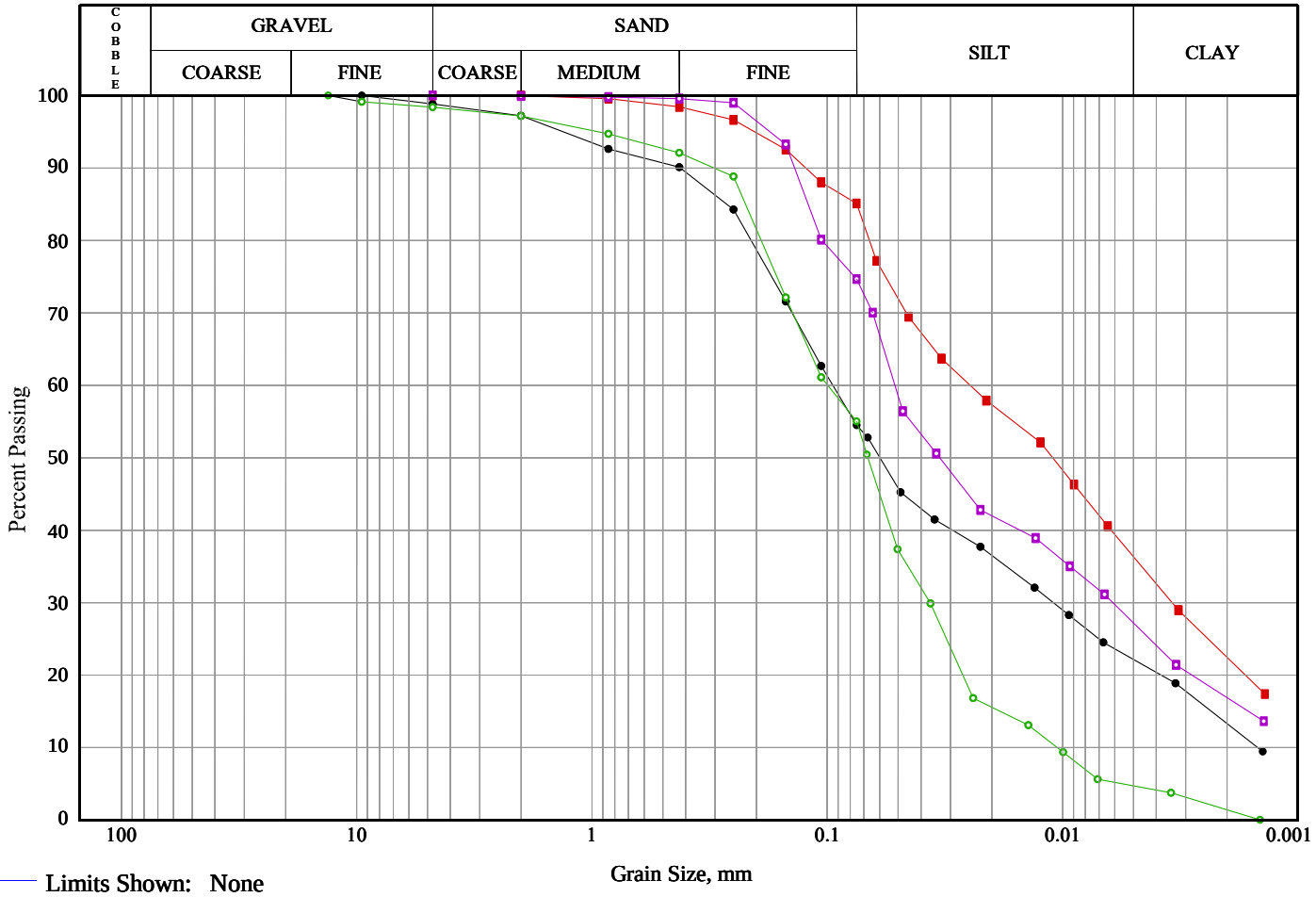
Client:	Thomas Cavanagh Construction Ltd.
Project:	Geotechnical Investigation, Proposed Residential Develo
Project #:	100020002

Soils Grading Chart



Limits Shown: None

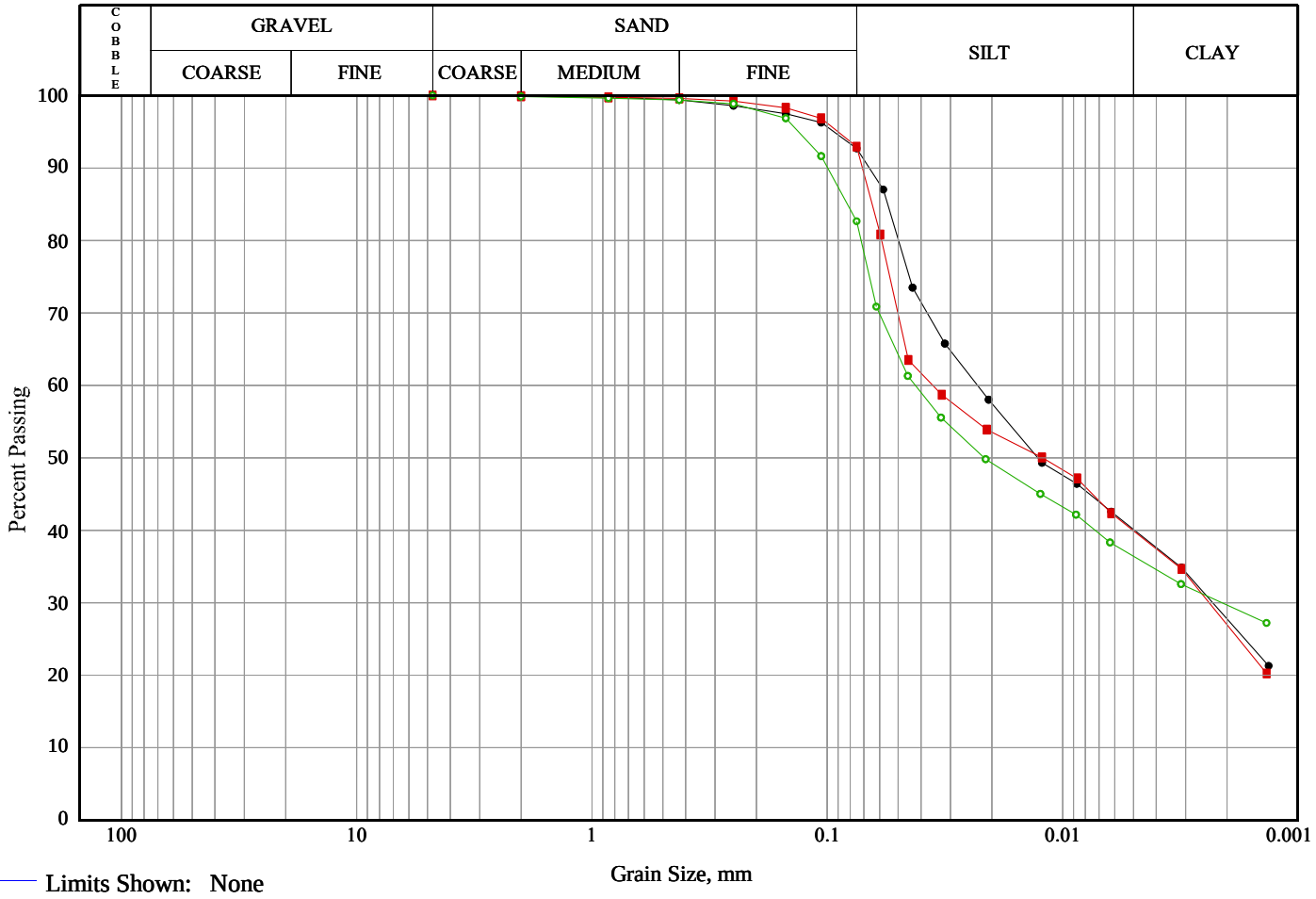
Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
	Silty Clayey Sand Deposits	BH21-02	SA 3	1.52-2.13	1.2	44.4	32.3	22.2
	Silty Clay Deposits	BH21-03	SA 6	3.81-4.42	0.0	14.9	48.8	36.3
	Glacial Till Deposits	BH21-04	SA 4	2.28-2.89	1.6	43.4	50.3	4.7
	Silty Clayey Sand Deposits	BH21-05	SA 3	1.52-2.13	0.0	25.3	47.4	27.2

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
	Silty clayey sand , trace gravel	CL	0.00	0.00	0.01	0.06	0.09	0.27	32.3
	Silt and clay , some sand	CL	---	---	0.00	0.01	0.02	0.07	48.8
	Silt and sand , trace gravel, trace clay	N/A	0.01	0.02	0.04	0.07	0.10	0.22	50.3
	Sandy clayey silt	CL	---	0.00	0.01	0.03	0.05	0.12	47.4

GEMTEC
Consulting Engineers and Scientists

Client:	Thomas Cavanagh Construction Ltd.
Project:	Geotechnical Investigation, Proposed Residential Develo
Project #:	100020002

Soils Grading Chart



Limits Shown: None

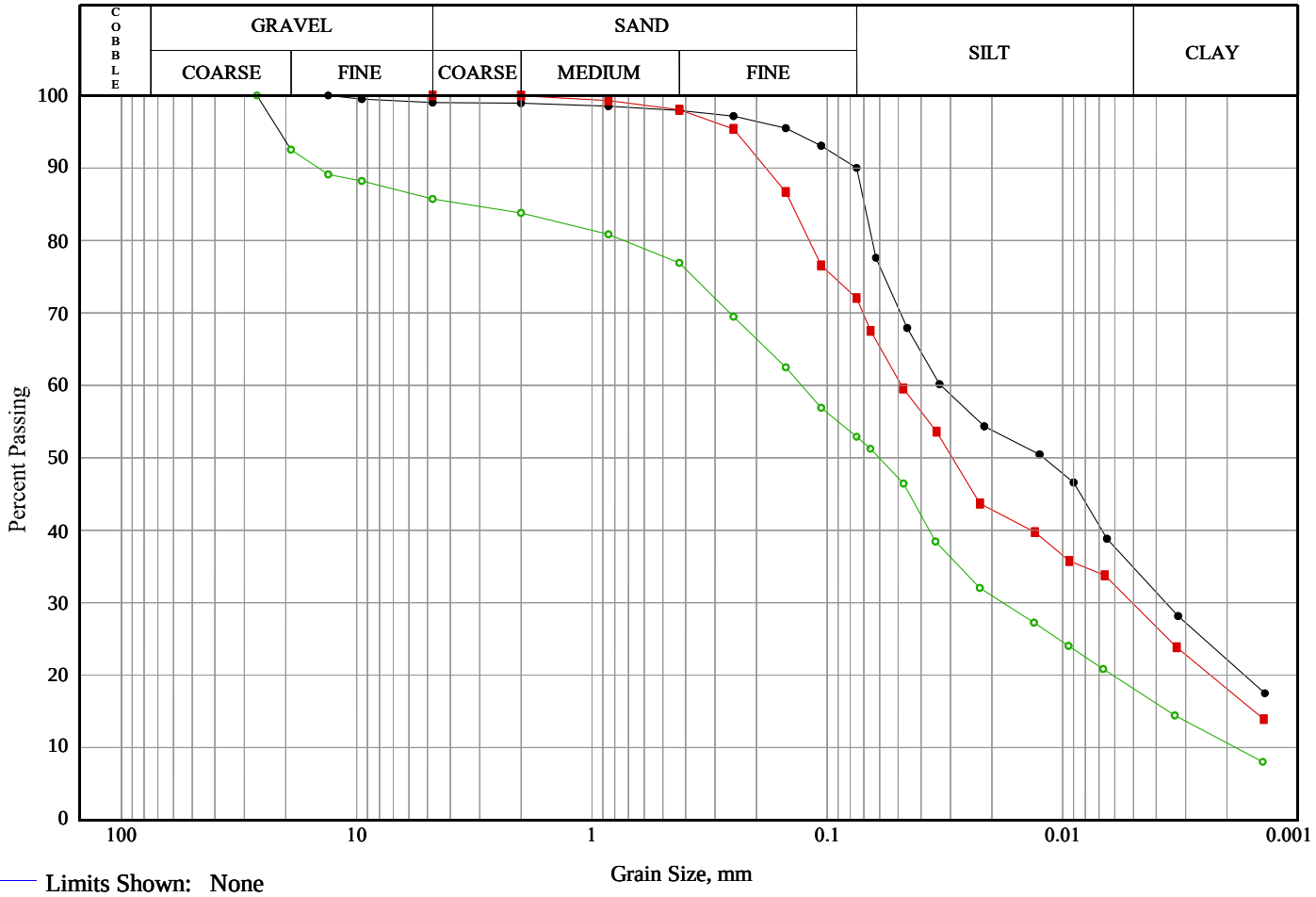
Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
●	Silty Clay Deposits	BH21-06	SA 3	1.52-2.13	0.0	7.3	52.6	40.1
■	Silty Clay Deposits	BH21-07	SA 3	1.52-2.13	0.0	7.1	53.0	39.9
○	Silty Clay Deposits	BH21-08	SA 4	2.28-2.89	0.0	17.4	46.2	36.4

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
●	Silt and clay , trace sand	CL	---	---	0.00	0.01	0.02	0.06	52.6
■	Silt and clay , trace sand	CL	---	---	0.00	0.01	0.04	0.06	53.0
○	Silt and clay , some sand	CL	---	---	0.00	0.02	0.04	0.08	46.2

GEMTEC
Consulting Engineers and Scientists

Client:	Thomas Cavanagh Construction Ltd.
Project:	Geotechnical Investigation, Proposed Residential Develo
Project #:	100020002

Soils Grading Chart



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
●—	Silty Clay Deposits	BH21-10	SA 4	2.28-2.89	1.0	9.0	55.2	34.8
■—	Silty Clayey Sand Deposits	BH21-11	SA 2	0.76-1.37	0.0	28.0	42.2	29.8
○—	Silty Clayey Sand Deposits	BH21-12	SA 2	0.76-1.37	14.3	32.8	34.8	18.1

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
●—	Clayey silt , trace gravel, trace sand	CL	---	---	0.00	0.01	0.03	0.07	55.2
■—	Sandy clayey silt	N/A	---	0.00	0.01	0.03	0.05	0.14	42.2
○—	Sand and silt , some gravel, some clay	CL	0.00	0.00	0.02	0.06	0.13	3.45	34.8

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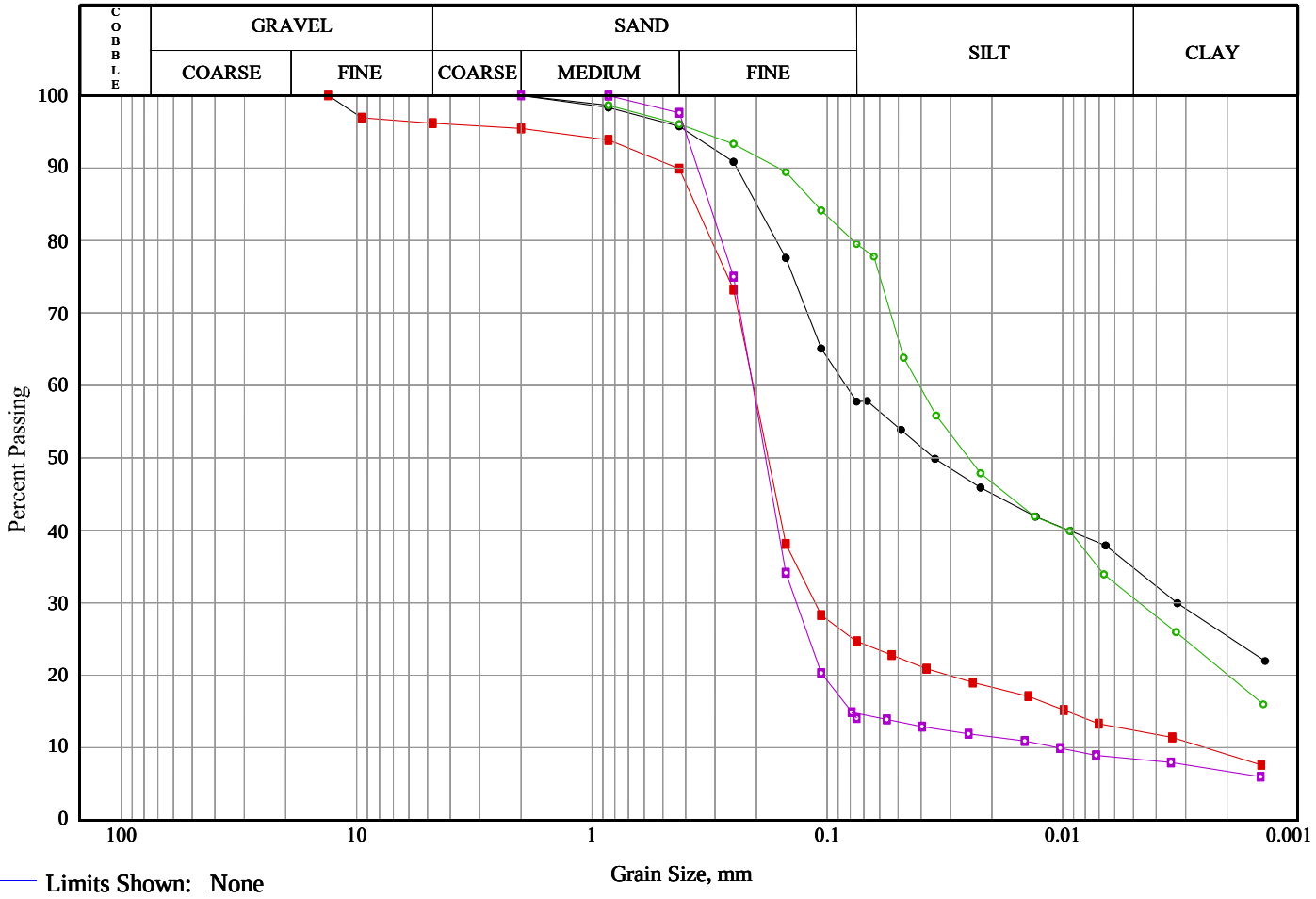
Consulting Engineers and Scientists

Client:	Thomas Cavanagh Construction Ltd.
Project:	Geotechnical Investigation, Proposed Residential Develo
Project #:	100020002

Soils Grading Chart



Limits Shown: None

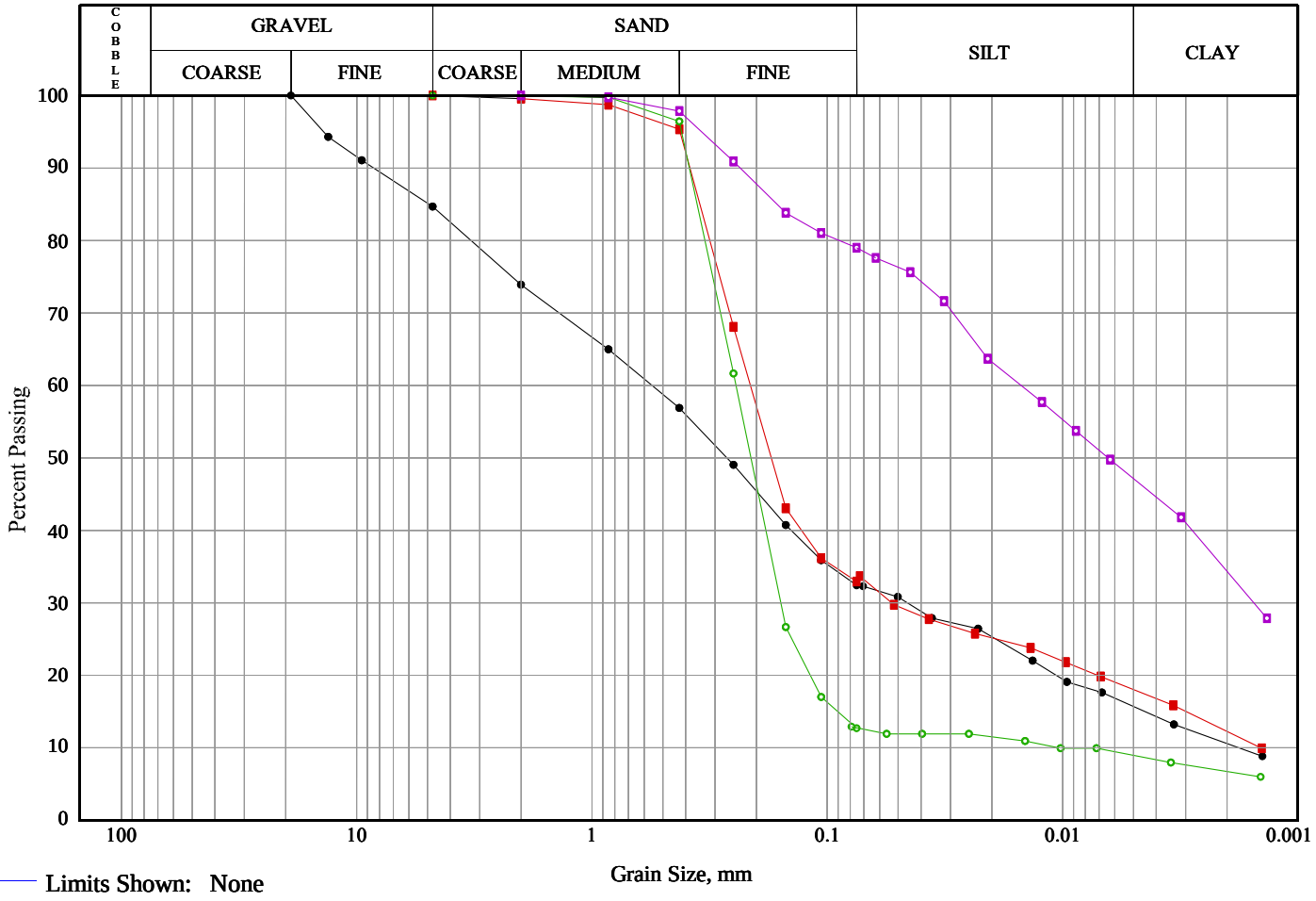
Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
	Silty Clayey Sand Deposits	TP21-01	SA 1	0.25-0.55	0.0	42.3	22.9	34.8
	Sand Deposits	TP21-02	SA 1	0.30-0.55	3.8	71.6	12.2	12.4
	Silty Clayey Sand Deposits	TP21-03	SA 1	0.40-0.75	0.0	20.5	48.8	30.6
	Sand Deposits	TP21-04	SA 1	0.40-0.55	0.0	86.0	5.6	8.4

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
	Silty clayey sand	N/A	---	---	0.00	0.04	0.08	0.20	22.9
	Sand , some silt, some clay , trace gravel	N/A	0.00	0.01	0.11	0.18	0.21	0.36	12.2
	Sandy clayey silt	N/A	---	---	0.00	0.03	0.04	0.11	48.8
	Sand , trace silt, trace clay	N/A	0.01	0.08	0.14	0.18	0.21	0.32	5.6

GEMTEC
Consulting Engineers and Scientists

Client:	Thomas Cavanagh Construction Ltd.
Project:	Geotechnical Investigation, Proposed Residential Develo
Project #:	100020002

Soils Grading Chart



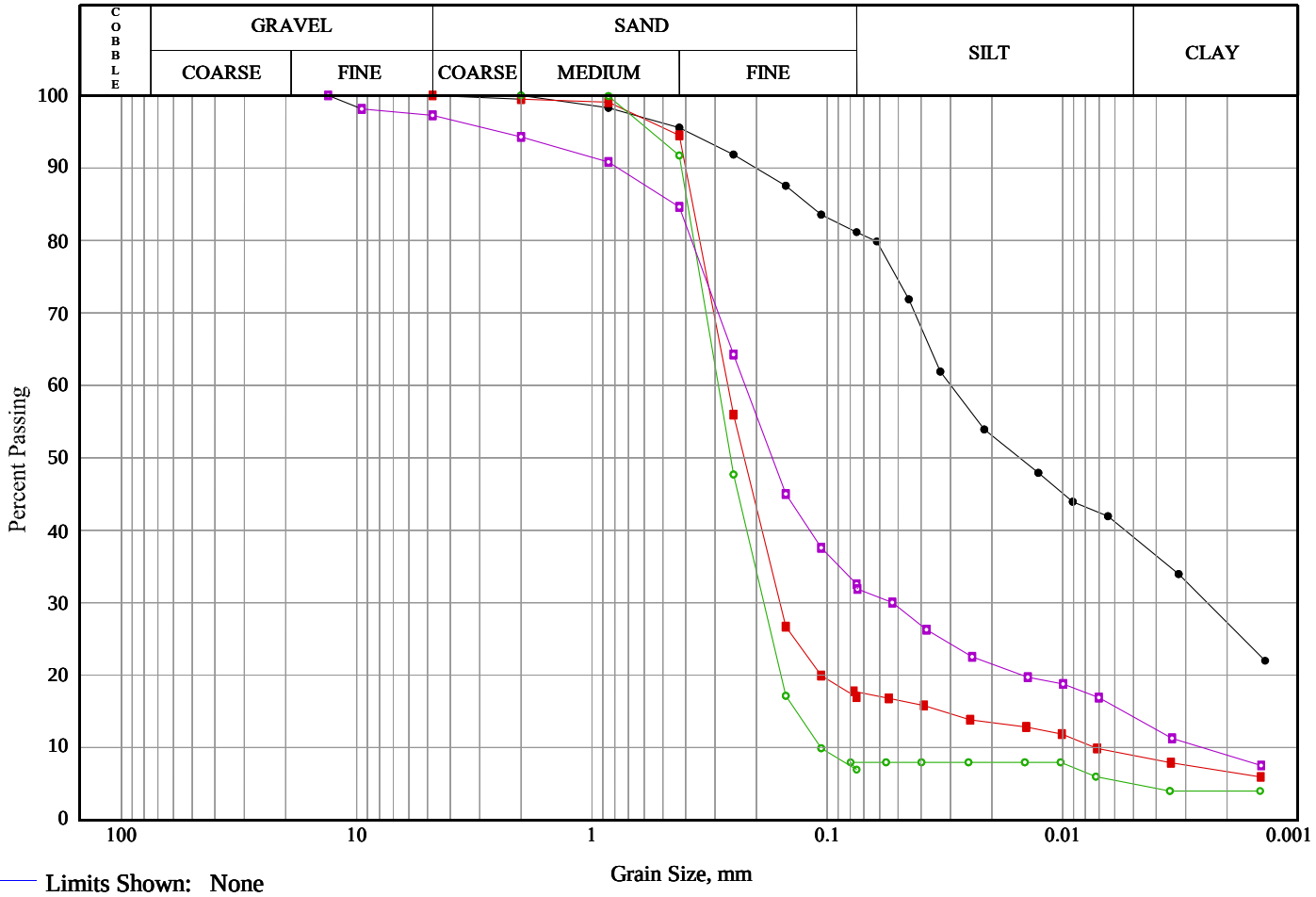
Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
	Glacial Till Deposits	TP21-05	SA 1	0.7-1.0	15.3	52.3	16.7	15.7
	Sand Deposits	TP21-06	SA 1	0.25-0.55	0.0	67.1	14.9	18.0
	Sand Deposits	TP21-07	SA 1	0.45-0.60	0.0	87.3	3.7	8.9
	Silty Clay Deposits	TP21-07	SA 2	0.75-1.03	0.0	21.0	31.8	47.1

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
	Sand , some gravel, some silt, some clay	N/A	0.00	0.00	0.05	0.27	0.56	4.92	16.7
	Sand , some silt, some clay	N/A	0.00	0.00	0.05	0.17	0.21	0.35	14.9
	Sand , trace silt, trace clay	N/A	0.01	0.09	0.16	0.21	0.24	0.36	3.7
	Sandy silty clay	N/A	---	---	0.00	0.01	0.02	0.16	31.8

GEMTEC
Consulting Engineers and Scientists

Client:	Thomas Cavanagh Construction Ltd.
Project:	Geotechnical Investigation, Proposed Residential Develo
Project #:	100020002

Soils Grading Chart



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
	Silty Clay Deposits	TP21-08	SA 1	0.50-0.75	0.0	18.9	42.1	39.0
	Sand Deposits	TP21-09	SA 1	0.55-0.75	0.0	83.1	8.0	8.9
	Sand Deposits	TP21-10	SA 1	0.40-0.55	0.0	93.1	2.0	5.0
	Sand Deposits	TP21-11	SA 1	0.45-0.60	2.7	64.7	18.3	14.2

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
	Silt and clay , some sand	N/A	---	---	0.00	0.02	0.03	0.12	42.1
	Sand , trace silt, trace clay	N/A	0.01	0.03	0.16	0.23	0.26	0.37	8.0
	Sand , trace silt, trace clay	N/A	0.11	0.14	0.19	0.26	0.29	0.39	2.0
	Sand , some silt, some clay , trace gravel	N/A	0.00	0.01	0.05	0.17	0.22	0.44	18.3

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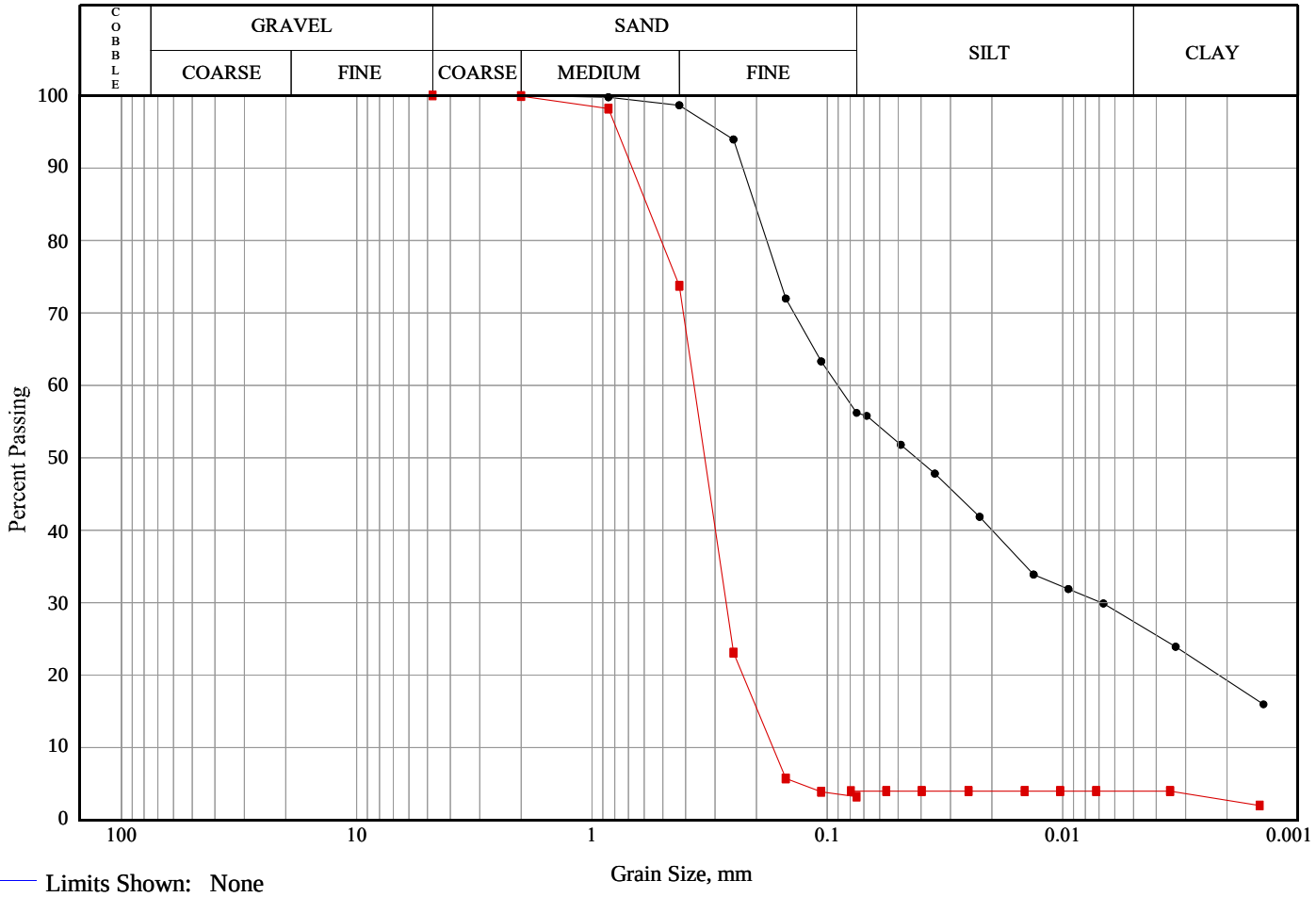
Consulting Engineers and Scientists

Client:	Thomas Cavanagh Construction Ltd.
Project:	Geotechnical Investigation, Proposed Residential Develo
Project #:	100020002

Soils Grading Chart

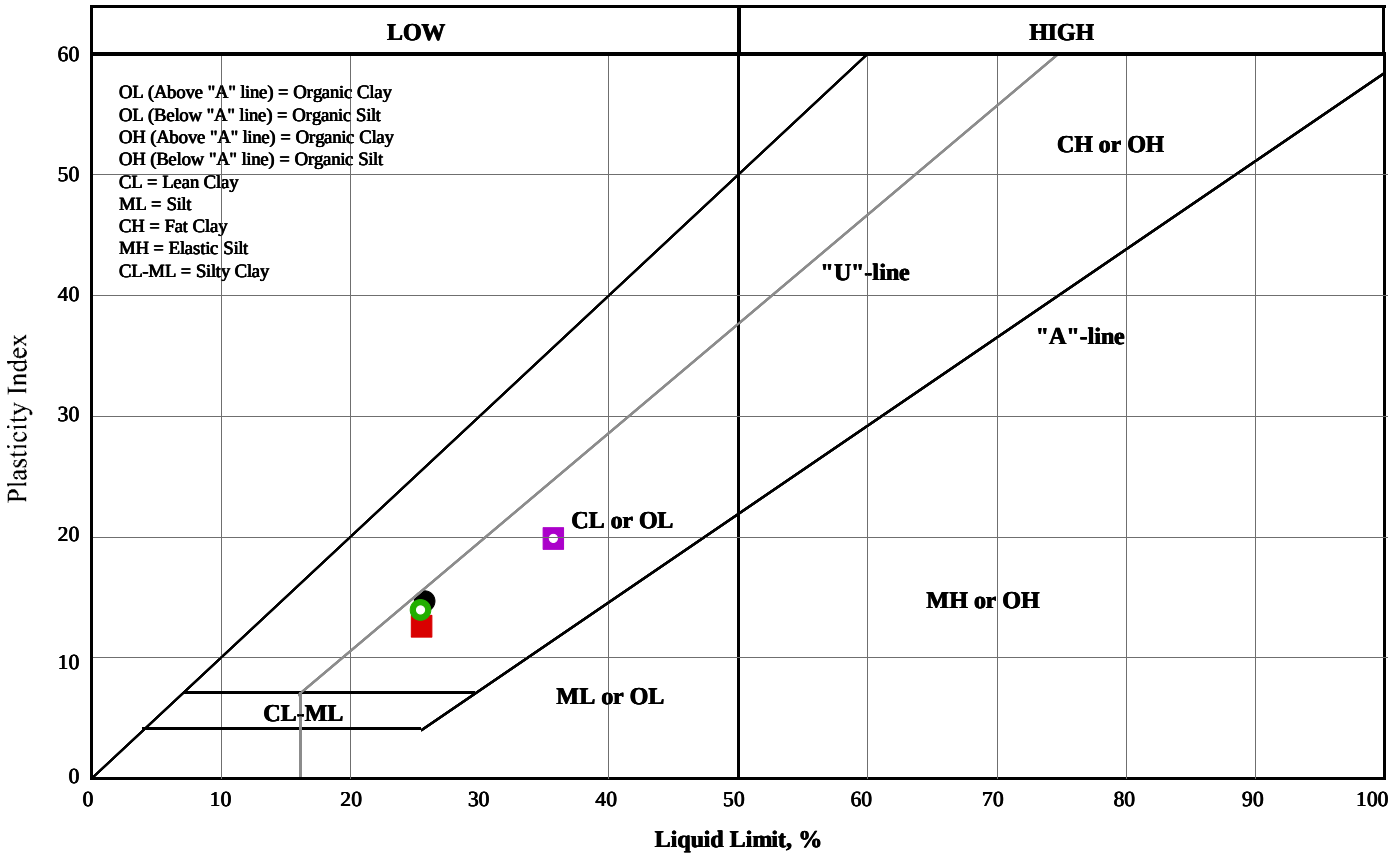


Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
●—	Silty Clayey Sand Deposits	TP21-11	SA 2	0.9-1.2	0.0	43.8	28.8	27.4
■—	Sand Deposits	TP21-12	SA 1	0.5-0.65	0.0	96.8	0.0	4.0

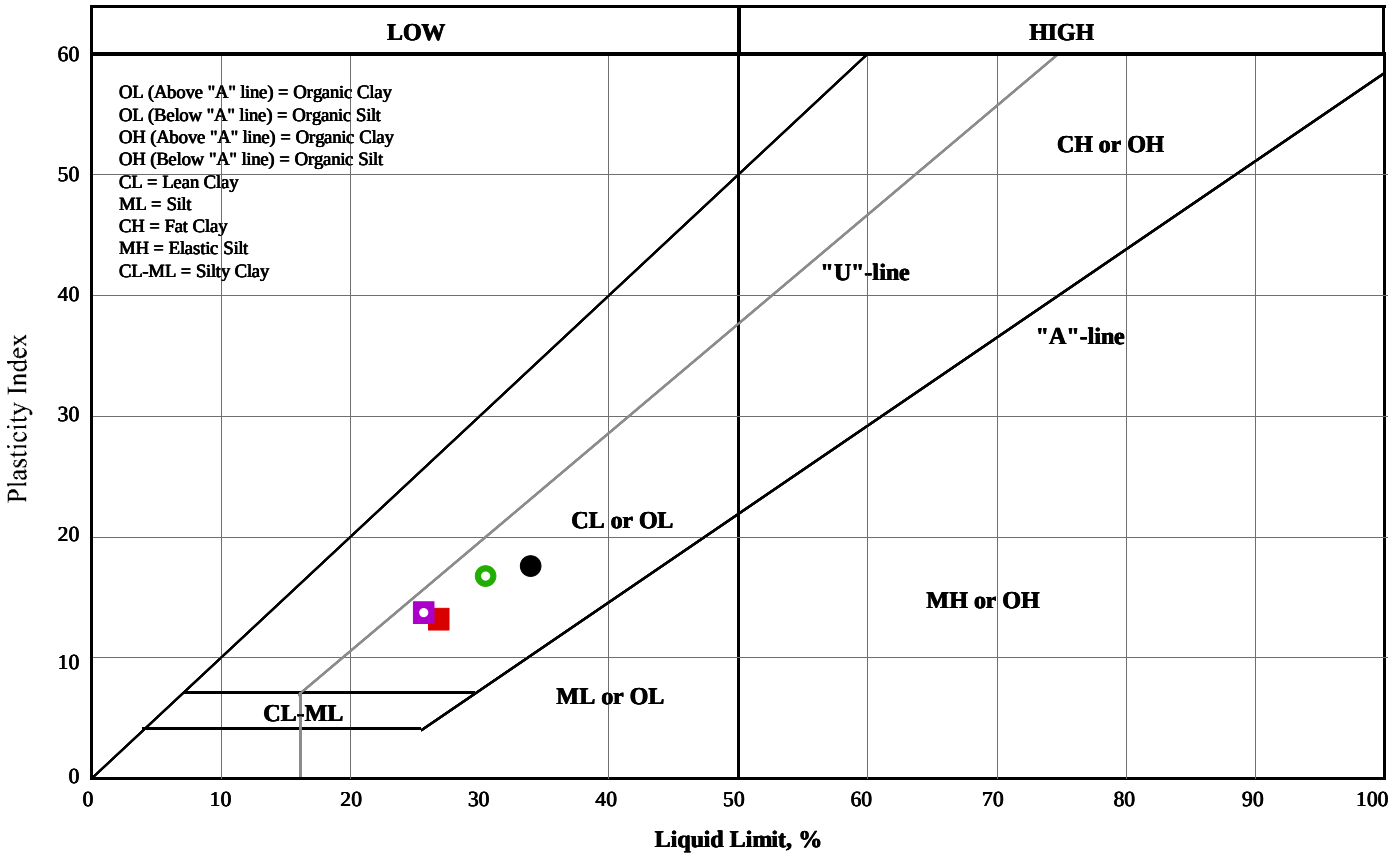
Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
●—	Silty clayey sand	N/A	---	---	0.01	0.04	0.09	0.20	28.8
■—	Sand , trace clay	SP	0.17	0.20	0.27	0.33	0.37	0.58	---

GEMTEC Consulting Engineers and Scientists	Client: Thomas Cavanagh Construction Ltd.	Plasticity Chart
	Project: Geotechnical Investigation, Proposed Residential Develo	
	Project #: 100020002	



Symbol	Borehole /Test Pit	Sample Number	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Non-Plastic	Moisture Content, %
●	BH21-02	SA 3	1.52-2.13	25.8	11.1	14.7	☐	16.23
■	BH21-03	SA 6	3.81-4.42	25.5	12.9	12.6	☐	24.24
○	BH21-05	SA 3	1.52-2.13	25.4	11.5	13.9	☐	23.39
▫	BH21-06	SA 3	1.52-2.13	35.7	15.8	19.9	☐	23.96

GEMTEC Consulting Engineers and Scientists	Client: Thomas Cavanagh Construction Ltd.	Plasticity Chart
	Project: Geotechnical Investigation, Proposed Residential Develo	
	Project #: 100020002	



Symbol	Borehole /Test Pit	Sample Number	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Non-Plastic	Moisture Content, %
●	BH21-07	SA 3	1.52-2.13	33.9	16.4	17.6	☐	24.49
■	BH21-08	SA 4	2.28-2.89	26.8	13.7	13.2	☐	22.97
○	BH21-10	SA 4	2.28-2.89	30.5	13.7	16.7	☐	27.65
◘	BH21-12	SA 2	0.76-1.37	25.7	12.0	13.7	☐	30.72

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Shrinkage Limit

ASTM D4943

Volume of Shrinkage Dish	
Mass of Glass Plate (g):	**37.33**
Mass of Shrinkage Dish (g) (m):	**20.70**
Mass of Shrinkage Dish, Plate, Grease and Water (g):	**75.40**
Mass of Water (g):	**17.37**
Volume of Shrinkage Dish:	**17.0**

Test Specimen	
Specimen No:	**1**
Mass of Shrinakge Dish, m (g):	**20.75**
Mass of Shrinkage Dish and Wet Soil, m_w (g):	**52.11**
Mass of Shrinkage Dish and Dry Soil, m_d (g):	**43.52**
Mass of Wax-Coated Soil in Air, m_{sxa} (g):	**25.17**
Mass of Wax-Coated Soil in Water, m_{sxw} (g):	**10.1**

Calculated Shrinkage Limit	
Specimen No:	**1**
Mass of Dry Soil, m_s (g):	**22.77**
Water Content of Soil when Placed in Dish, w (%):	**37.73**
Mass of Water Displaced by Wax-Coated Soil, m_{wsx} (g):	**15.07**
Volume of Dry Soil and Wax, V_{dx} (cm^3):	**15.07**
Mass of Wax, m_x (g):	**2.40**
Volume of Wax, V_x (cm^3):	**2.67**
Volume of Dry Soil, V_d (cm^3):	**12.40**
Shrinkage Limit, SL	**17.54**

Specific Gravity of Wax = 0.908 at15.5°C

Specific Gravity of Wax = 0.900 at 20°C

Density of Water (g/cm^3) = 1.000 (g/cm^3)

Project No: 100020.002	**Tested By: K.N.**
Project Name: 2727 Carp Road, Ottawa	**Checked By: K.S.**
Date Tested: Mar 9, 2021	**Sample No: BH 21-06 SA 3**
Sample Date: N/A	**Source:**
Remarks:	**Depth: 1.52-2.13**

APPENDIX C

Piezocone Test Results
CPT21-03 and CPT21-08

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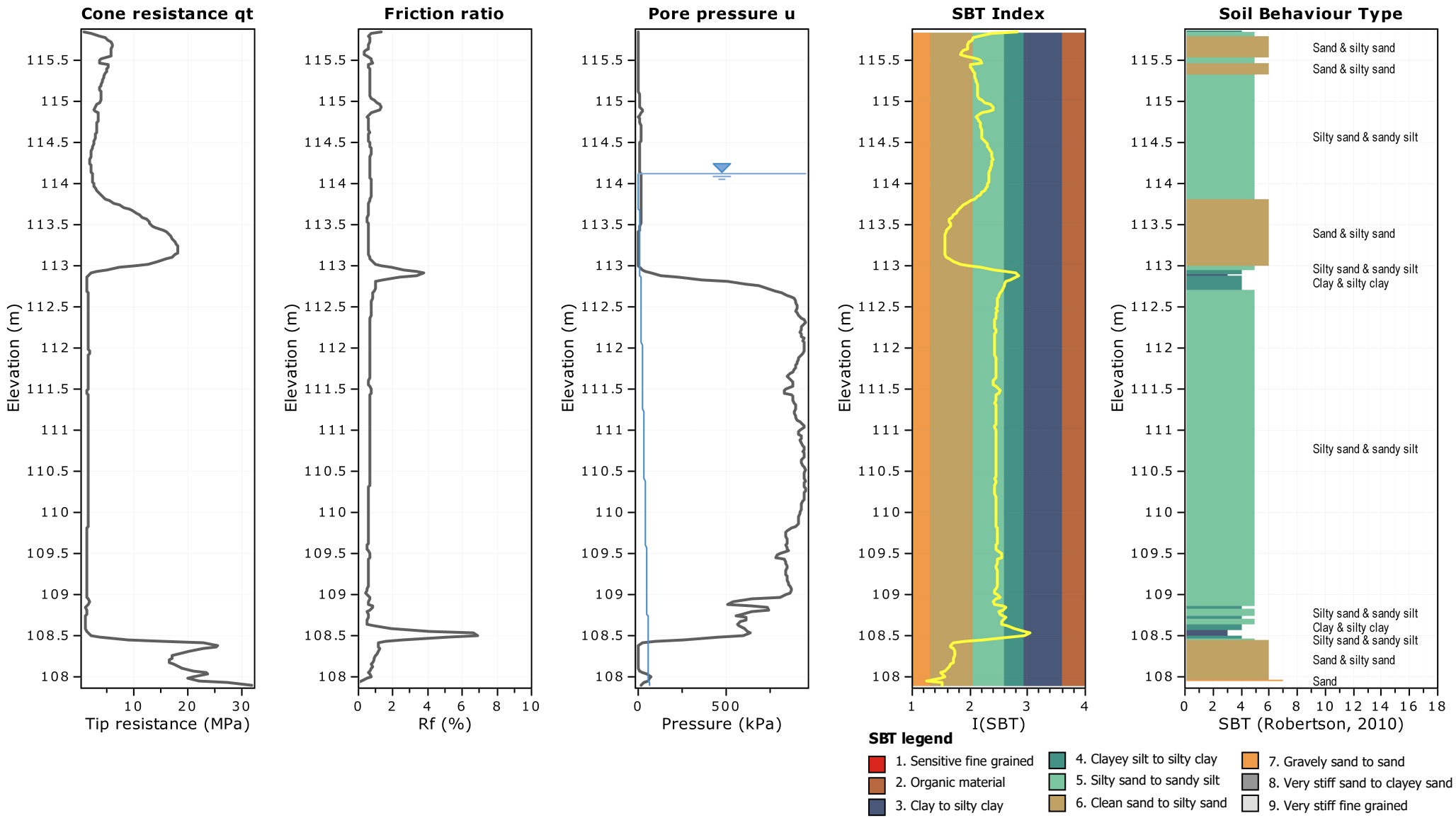
www.gemtec.ca

CPT: CPT21-03
Total depth: 8.22 m, Date: 21/03/19
Surface Elevation: 116.12 m
Coords: X:5016575.91, Y:422417.57
Cone Operator: George Downing Drilling

Project: **Huntley Chase Subdivision**
Location: **2727 Carp Road, Ottawa, Ontario**



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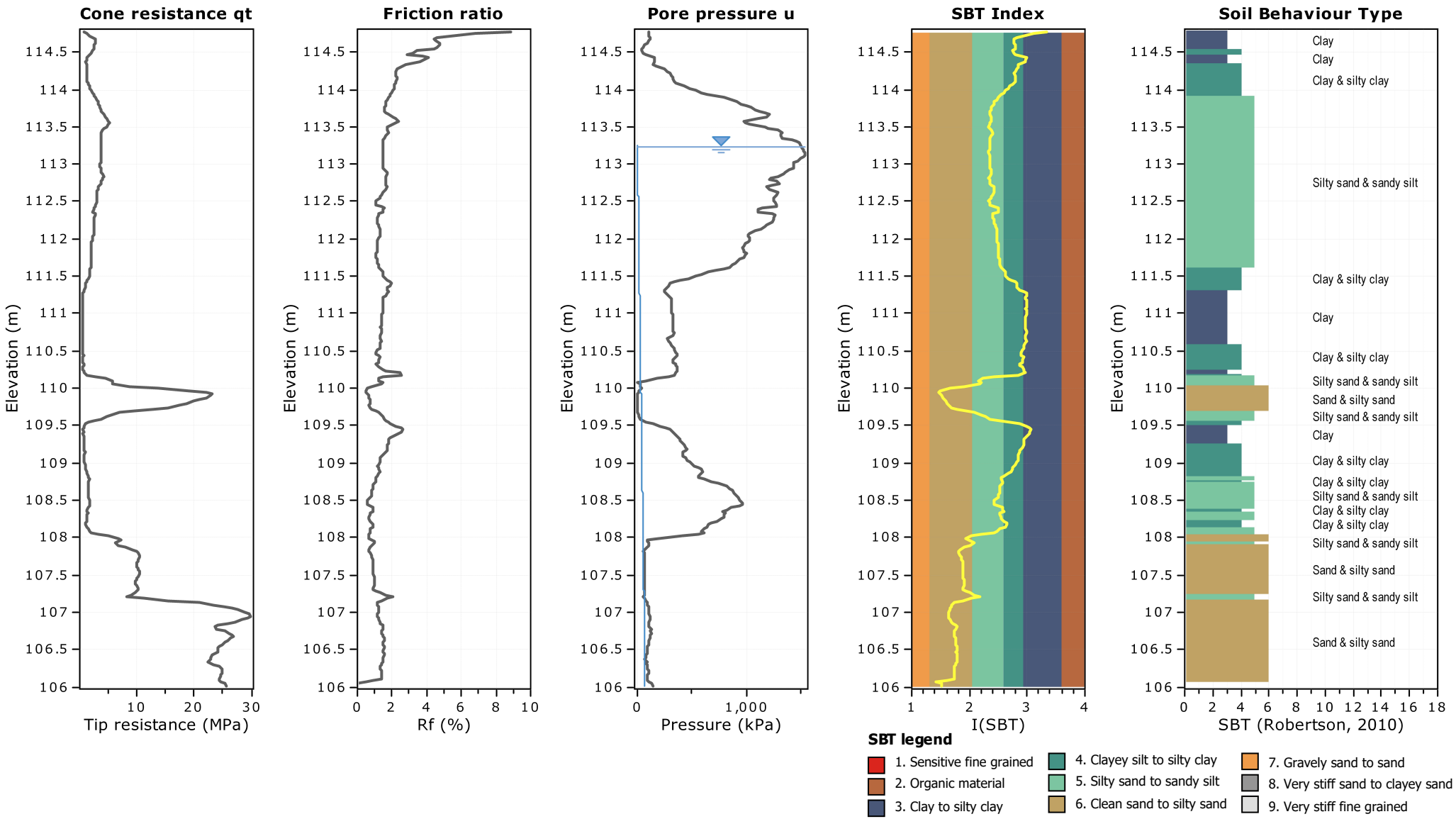
Consulting Engineers and Scientists
www.gemtec.ca

CPT: CPT21-08
Total depth: 9.03 m, Date: 21/03/19
Surface Elevation: 115.04 m
Coords: X:5016554.08, Y:422764.40
Cone Operator:

Project: **Huntley Chase Subdivision**
Location: **2727 Carp Road, Ottawa, Ontario**



APPENDIX D

Chemical Analysis of Soil Samples
Samples Relating to Corrosion
(Paracel Laboratories Ltd. Order No. 2109337)

PARACEL LABORATORIES LTD.

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RESPONSIVE.
RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Lauren Ashe

Client PO:
Project: 100020.002
Custody:

Report Date: 2-Mar-2021
Order Date: 24-Feb-2021

Order #: 2109337

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

Paracel ID	Client ID
2109337-01	BH21-01 SA3
2109337-02	BH21-12 SA4

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Any use of these results implies your agreement that our total liabilty in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

Certificate of Analysis

Report Date: 02-Mar-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 24-Feb-2021

Client PO:

Project Description: 100020.002

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	26-Feb-21	26-Feb-21
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	1-Mar-21	1-Mar-21
Resistivity	EPA 120.1 - probe, water extraction	1-Mar-21	1-Mar-21
Solids, %	Gravimetric, calculation	26-Feb-21	26-Feb-21

Certificate of Analysis

Report Date: 02-Mar-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 24-Feb-2021

Client PO:

Project Description: 100020.002

	Client ID:	BH21-01 SA3	BH21-12 SA4	-	-
	Sample Date:	24-Feb-21 11:21	24-Feb-21 13:32	-	-
	Sample ID:	2109337-01	2109337-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	76.8	78.9	-	-
General Inorganics					
pH	0.05 pH Units	7.62	7.72	-	-
Resistivity	0.10 Ohm.m	43.7	60.0	-	-
Anions					
Chloride	5 ug/g dry	33	14	-	-
Sulphate	5 ug/g dry	12	16	-	-

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

Report Date: 02-Mar-2021

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 24-Feb-2021

Client PO:

Project Description: 100020.002

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	13.9	5	ug/g dry	32.7			NC	20	
Sulphate	17.0	5	ug/g dry	11.9			NC	20	
General Inorganics									
pH	7.73	0.05	pH Units	7.72			0.1	2.3	
Resistivity	5.47	0.10	Ohm.m	5.50			0.5	20	
Physical Characteristics									
% Solids	94.2	0.1	% by Wt.	92.7			1.6	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	127	5	ug/g	32.7	94.5	82-118			
Sulphate	111	5	ug/g	11.9	98.9	80-120			

Qualifier Notes:

QC Qualifiers :

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.
NC: Not Calculated

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.

PARACEL LABORATORIES

Paracel ID: 2109337

Head Office
300-2319 St. Laurent Blvd.
Ottawa, Ontario K1G 4J8
p: 1-800-749-1947
e: paracel@paracellabs.com

Chain of Custody
(Lab Use Only)

Page 1 of 1

Client Name: Gemtec	Project Reference: 100020.002	**Turnaround Time:**	
Contact Name: Lauren Ashe	Quote #	☐ 1 Day	☐ 3 Day
Address: 32 Steacie Dr. Kanata, ON K2K 2A9	PO #	☐ 2 Day	☒ Regular
Telephone: (613) 836-1422	Email Address: Lauren.ashe@gemtec.ca	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)

Required Analyses

Paracel Order Number: 2109337

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	Chloride	pH/SO4	Elec. Conductivity	Elec. Resistivity			
1		S		1			☐	☐	☐	☐	☐	☐	☐	✓	✓	✓	✓	☐	☐	☐
2	BH21-01 SA3			1	Feb 24	11:21	☐	☐	☐	☐	☐	☐	☐	✓	✓	☐	✓	☐	☐	☐
3	BH21-12 SA4			1	Feb 24	1:32	☐	☐	☐	☐	☐	☐	☐	✓	✓	☐	✓	☐	☐	☐
4							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Comments:

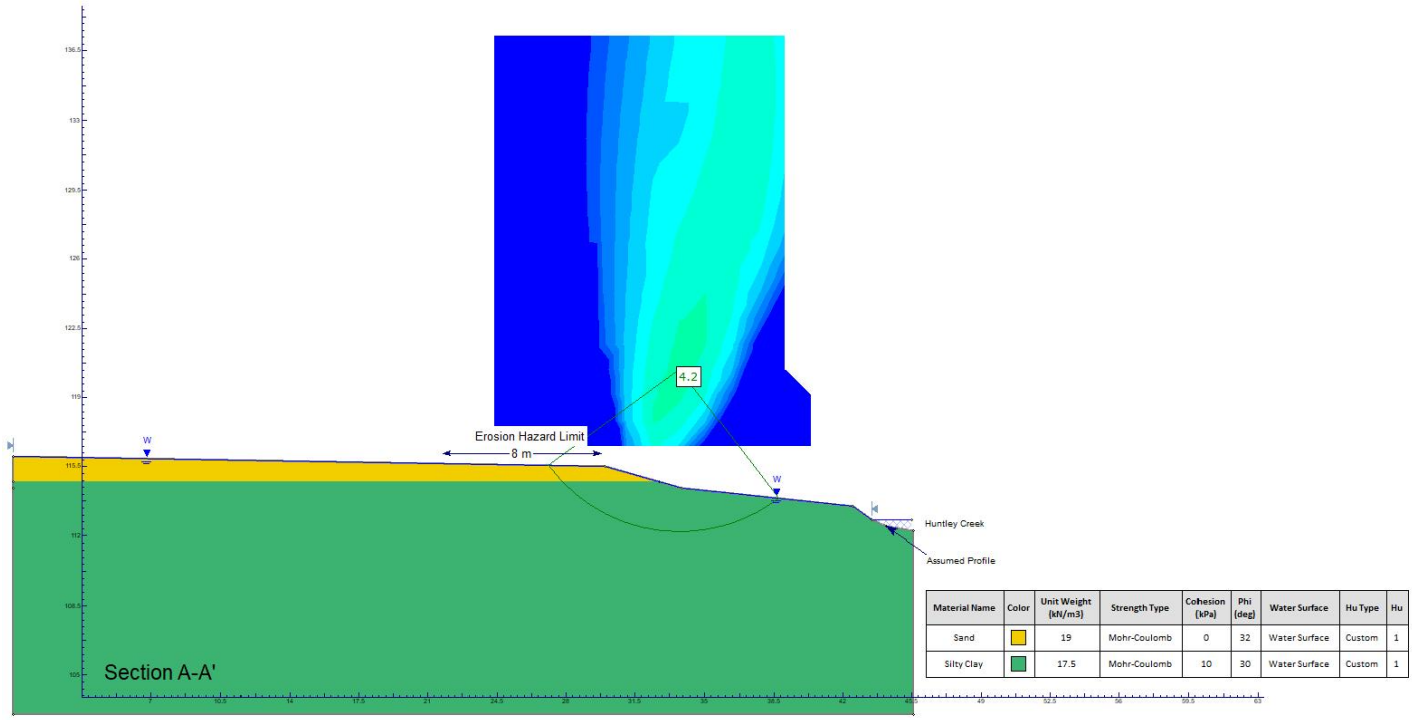
Method of Delivery: Drop Box

Relinquished By (Sign):	Received by Driver/Depot: Ally	Received at Lab: Jinneeparm Dale	Verified By:
Relinquished By (Print): Karel Neil	Date/Time: Feb 24 21 1605	Date/Time: Feb 25, 2021 12:36	Date/Time: 2-25-21 12:31
Date/Time: Feb 24 21 2:23	Temperature: 20.6 °C	Temperature: 10.6 °C	pH Verified [ ] By:

APPENDIX E

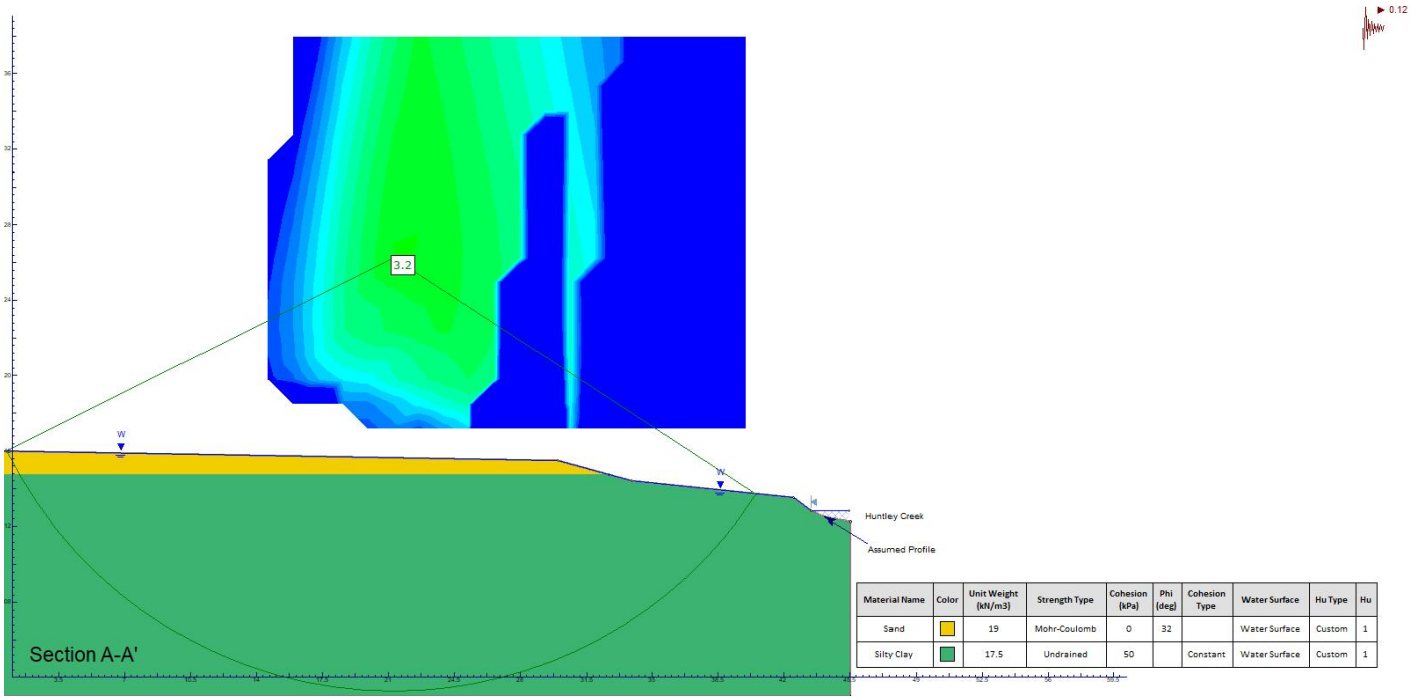
Slope Stability Analyses
Figures E1 to E5 (Cross Sections)
Figures E6 and E7 (Photographs)

A) EXISTING CONDITIONS



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Sand		19	Mohr-Coulomb	0	32	Water Surface	Custom	1
Silty Clay		17.5	Mohr-Coulomb	10	30	Water Surface	Custom	1

B) PSEUDO-STATIC CONDITIONS



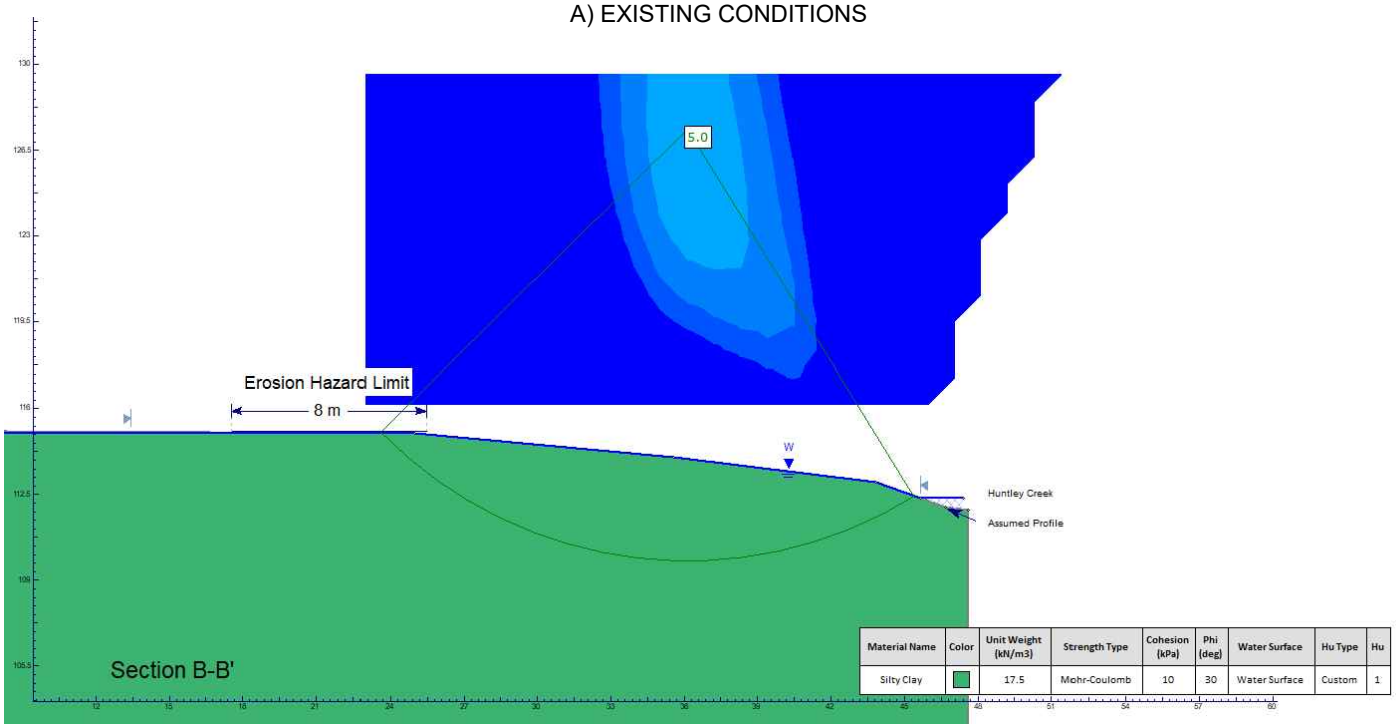
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion Type	Water Surface	Hu Type	Hu
Sand		19	Mohr-Coulomb	0	32		Water Surface	Custom	1
Silty Clay		17.5	Undrained	50		Constant	Water Surface	Custom	1

GEMTEC
Consulting Engineers and Scientists
32 Steacie Drive, Ottawa, ON K2K 2A9
T: (613) 836-1422 | www.gemtec.ca | ottawa@gemtec.ca

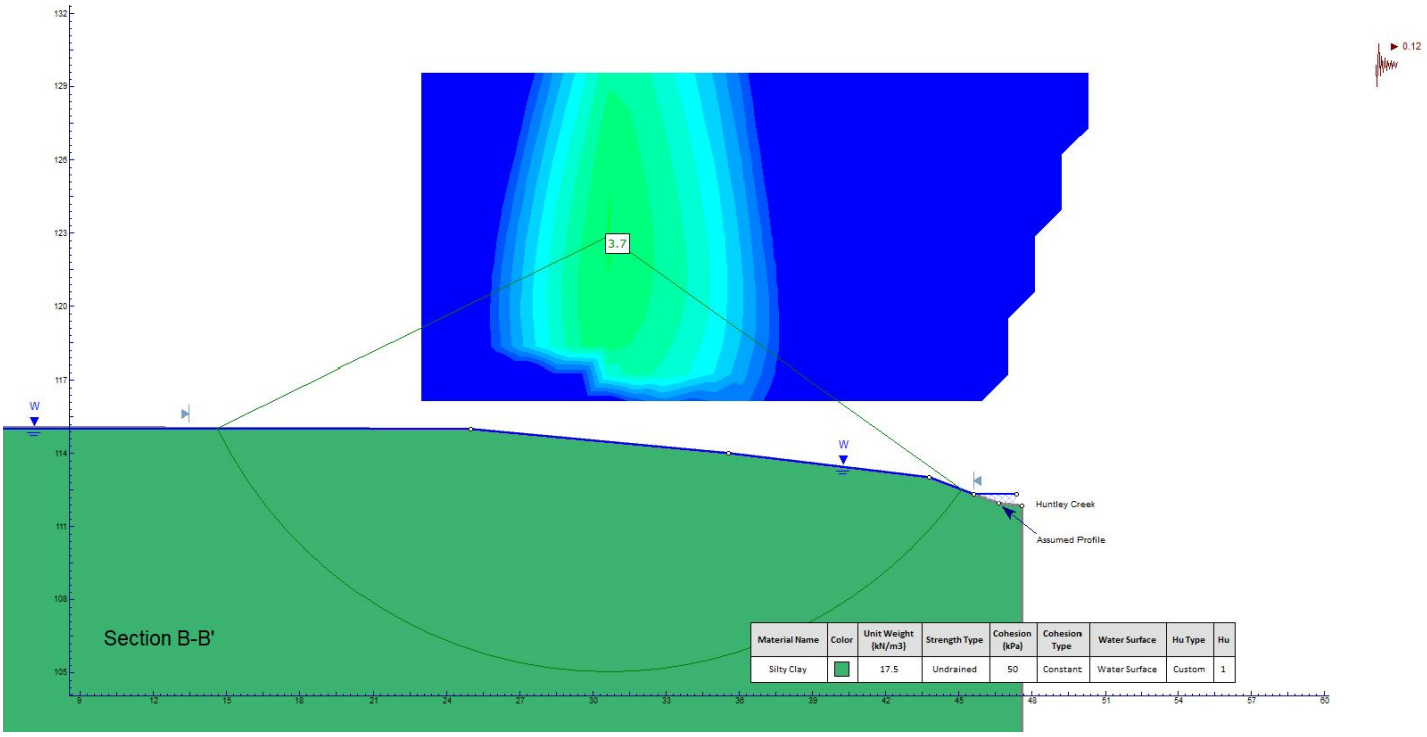
Project	Client
GEOTECHNICAL INVESTIGATION PROPOSED RESIDENTIAL DEVELOPMENT 2727 CARP ROAD OTTAWA, ONTARIO	THOMAS CAVANAGH CONSTRUCTION LTD.
	Drawing: SLOPE STABILITY ANALYSES SECTION A-A'

Drwn By	Chkd By	Date	Project No.	Rev No.	
S.L.	L.A.	APRIL, 2022	100020.002	2	**FIGURE E1**

A) EXISTING CONDITIONS



B) PSEUDO-STATIC CONDITIONS



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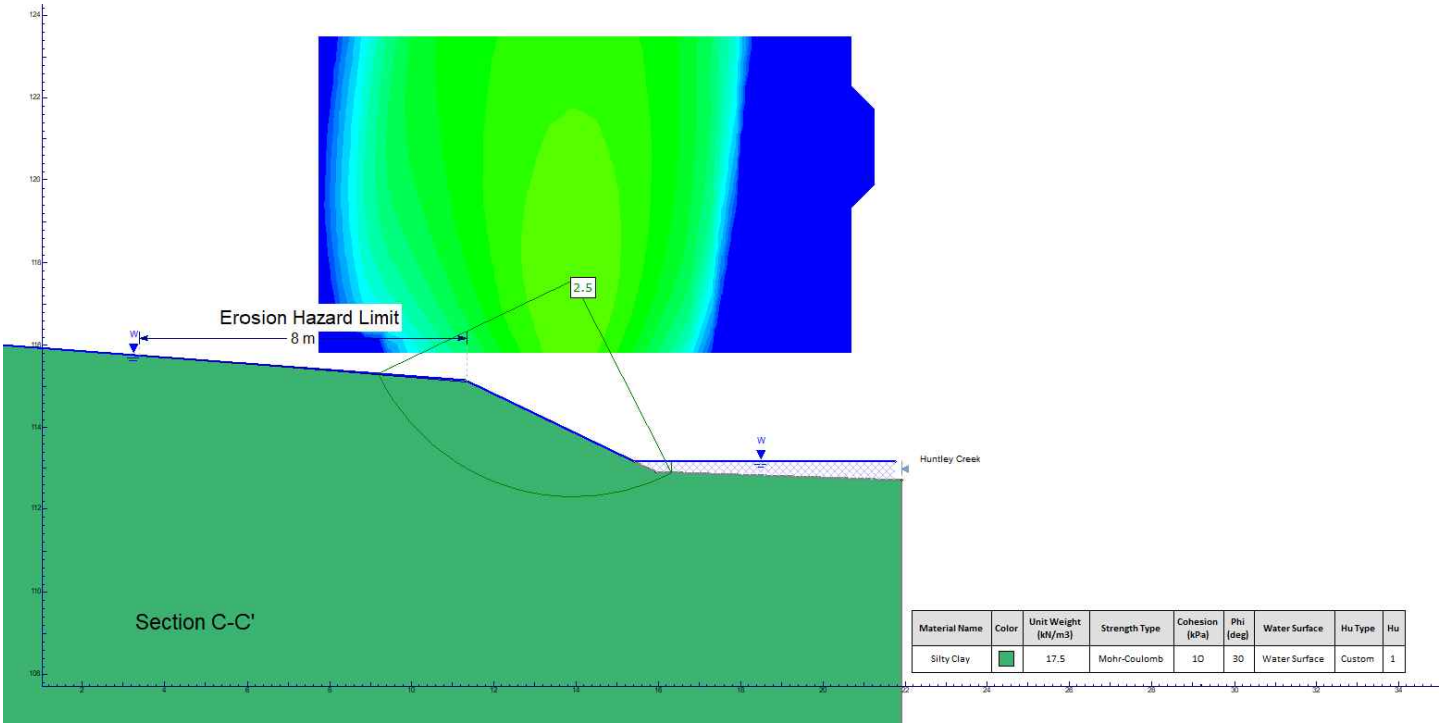
Project	Client
GEOTECHNICAL INVESTIGATION PROPOSED RESIDENTIAL DEVELOPMENT 2727 CARP ROAD OTTAWA, ONTARIO	THOMAS CAVANAGH CONSTRUCTION LTD.
	Drawing: SLOPE STABILITY ANALYSES SECTION B-B'

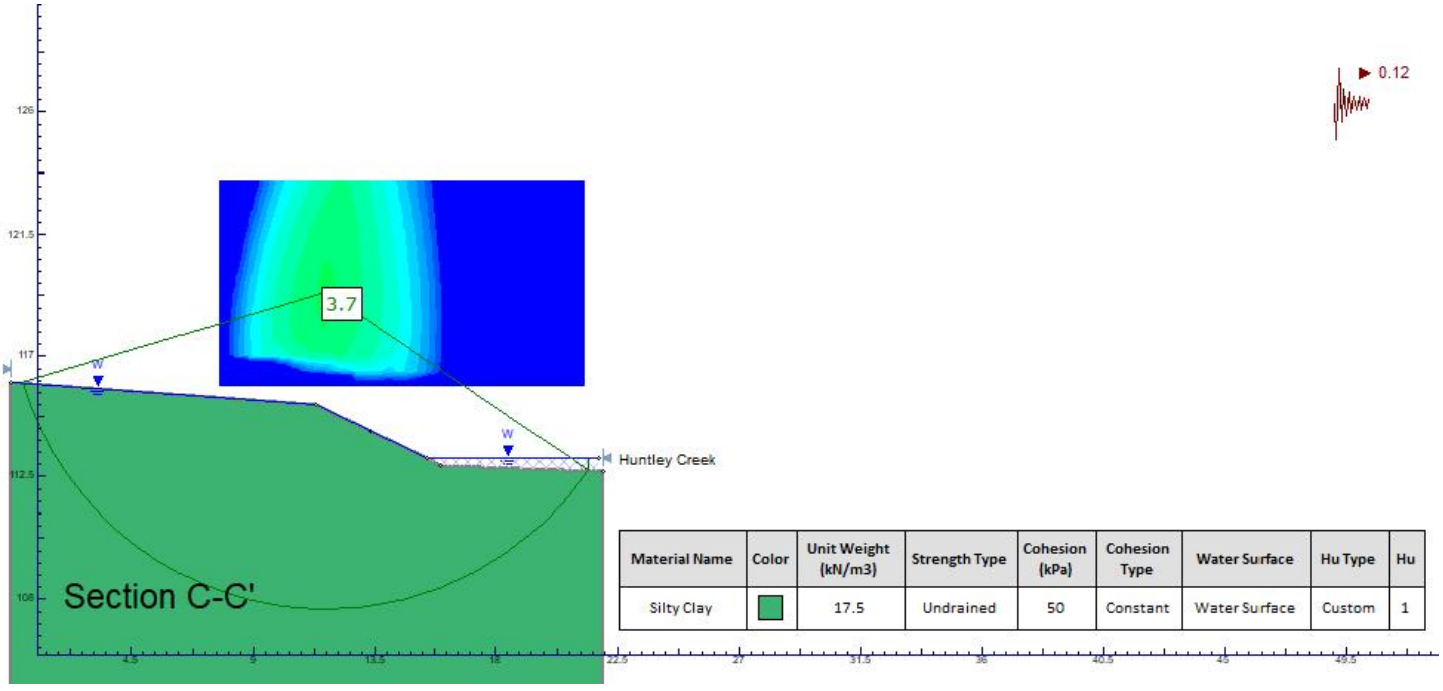
Drwn By	Chkd By	Date	Project No.	Rev No.	
S.L.	L.A.	APRIL, 2022	100020.002	2	**FIGURE E2**

A) EXISTING CONDITIONS



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Silty Clay		17.5	Mohr-Coulomb	10	30	Water Surface	Custom	1

B) PSEUDO-STATIC CONDITIONS



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Cohesion Type	Water Surface	Hu Type	Hu
Silty Clay		17.5	Undrained	50	Constant	Water Surface	Custom	1

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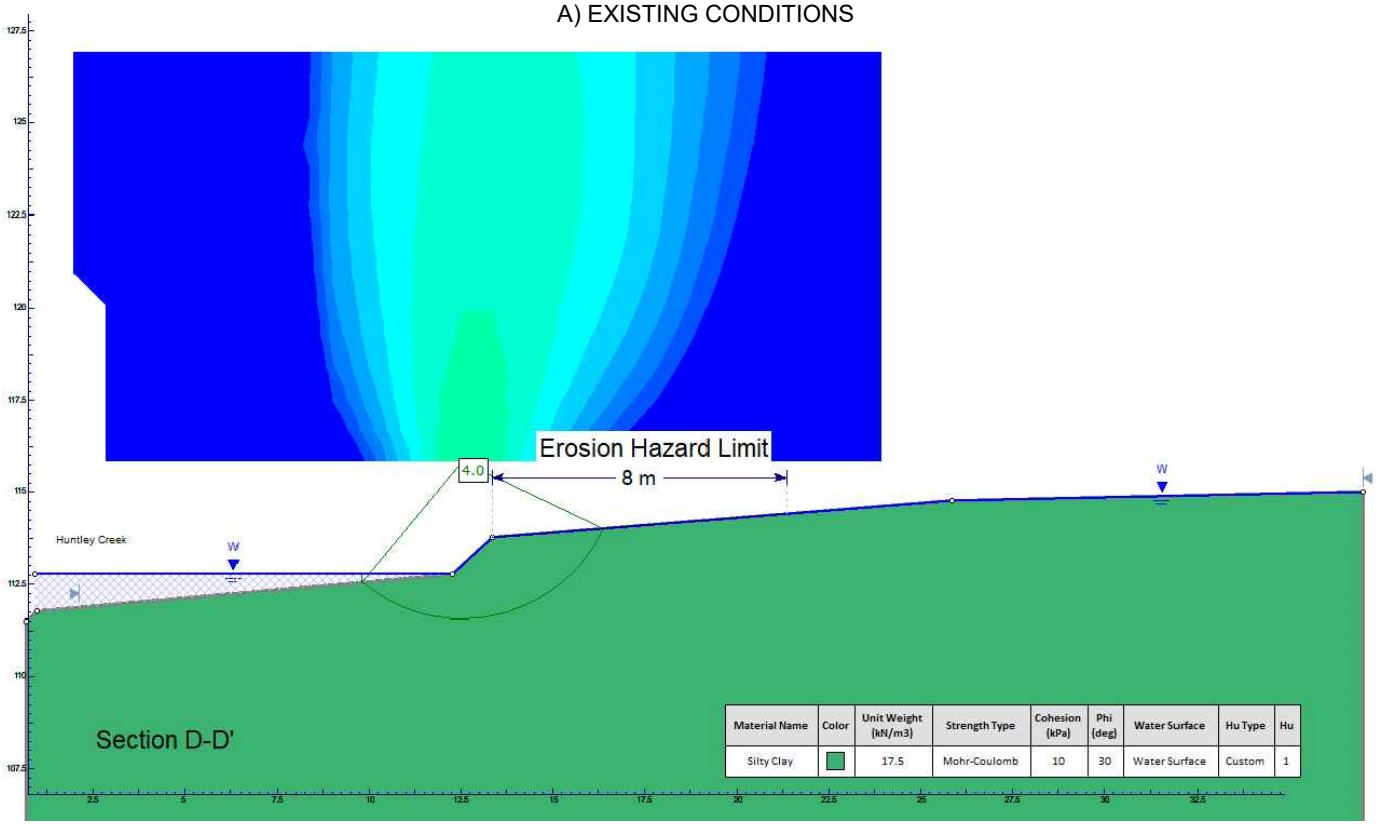
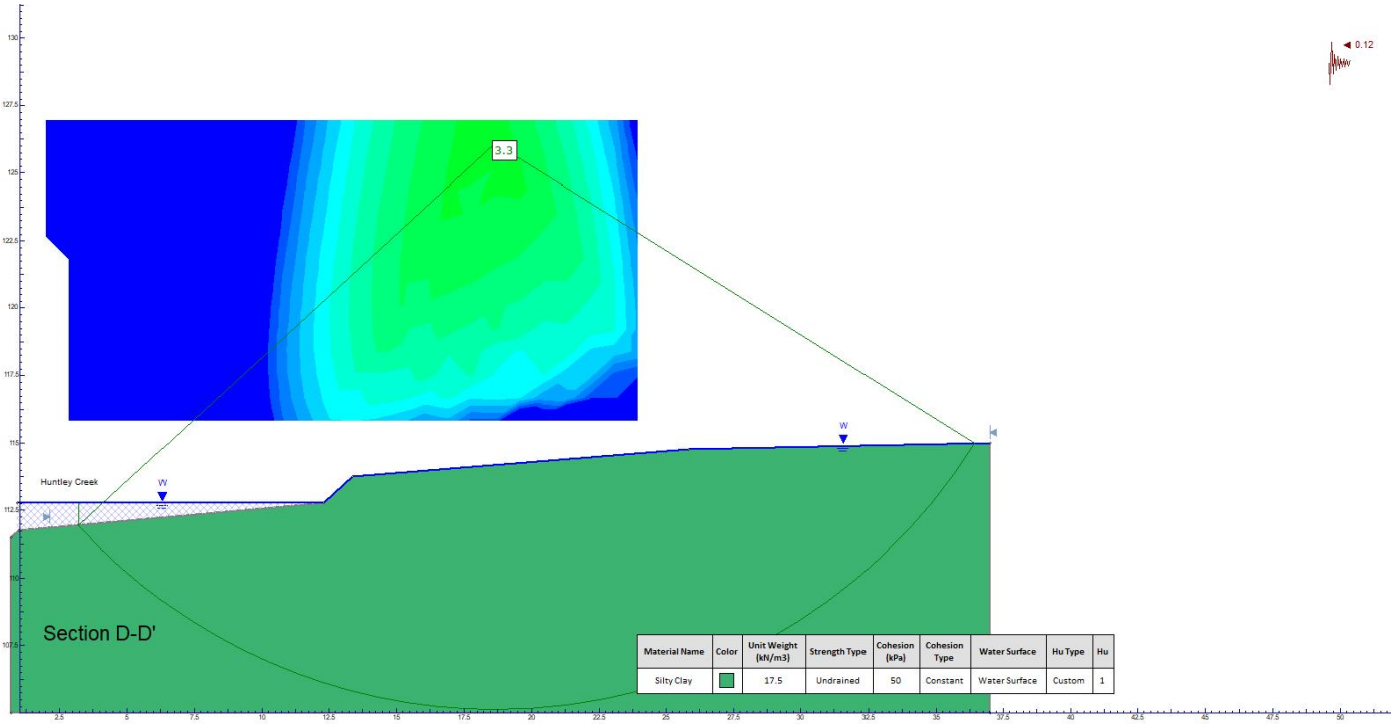
Client	THOMAS CAVANAGH CONSTRUCTION LTD.
Drawing	SLOPE STABILITY ANALYSES SECTION C-C'

Drwn By	Chkd By	Date	Project No.	Rev No.	
S.L.	L.A.	APRIL, 2022	100020.002	2	**FIGURE E3**

A) EXISTING CONDITIONS



B) PSEUDO-STATIC CONDITIONS



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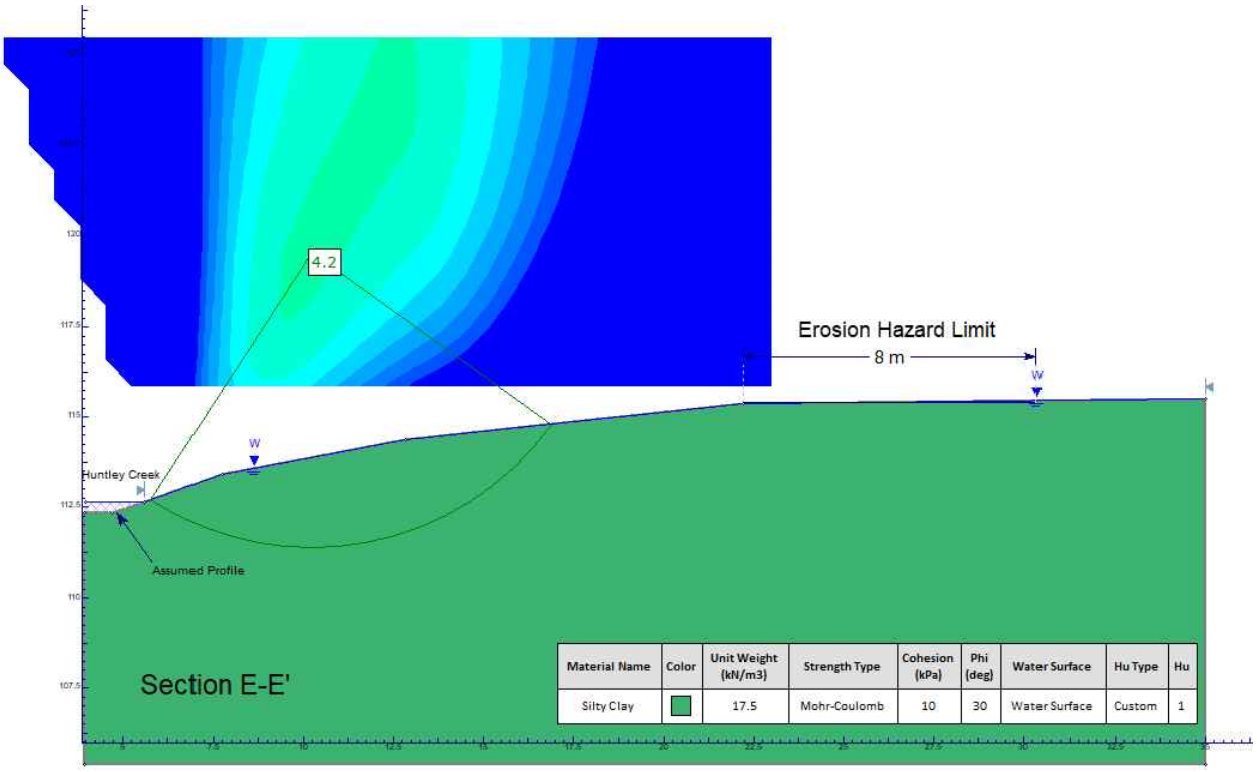
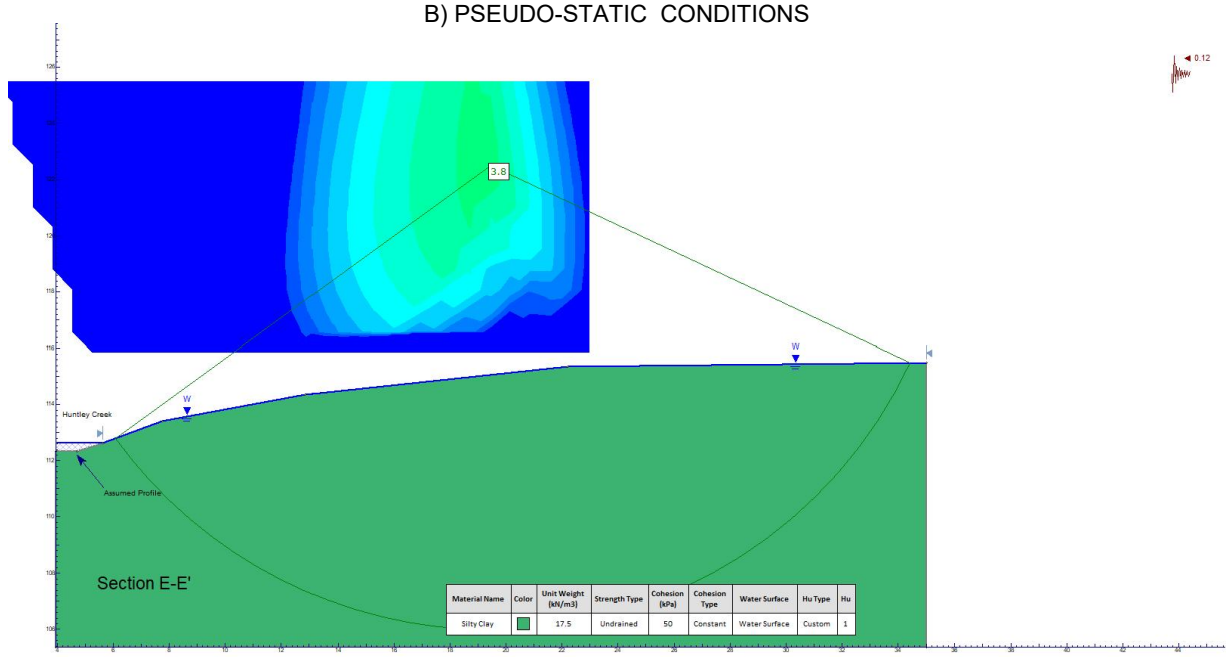
Project: GEOTECHNICAL INVESTIGATION PROPOSED RESIDENTIAL DEVELOPMENT 2727 CARP ROAD OTTAWA, ONTARIO			Client: THOMAS CAVANAGH CONSTRUCTION LTD.		
			Drawing: SLOPE STABILITY ANALYSES SECTION D-D'		
Drwn By: S.L.	Chkd By: L.A.	Date: APRIL, 2022	Project No.: 100020.002	Rev No.: 2	**FIGURE E4**

A) EXISTING CONDITIONS



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Silty Clay		17.5	Mohr-Coulomb	10	30	Water Surface	Custom	1

B) PSEUDO-STATIC CONDITIONS



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Cohesion Type	Water Surface	Hu Type	Hu
Silty Clay		17.5	Undrained	50	Constant	Water Surface	Custom	1

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Project	Client
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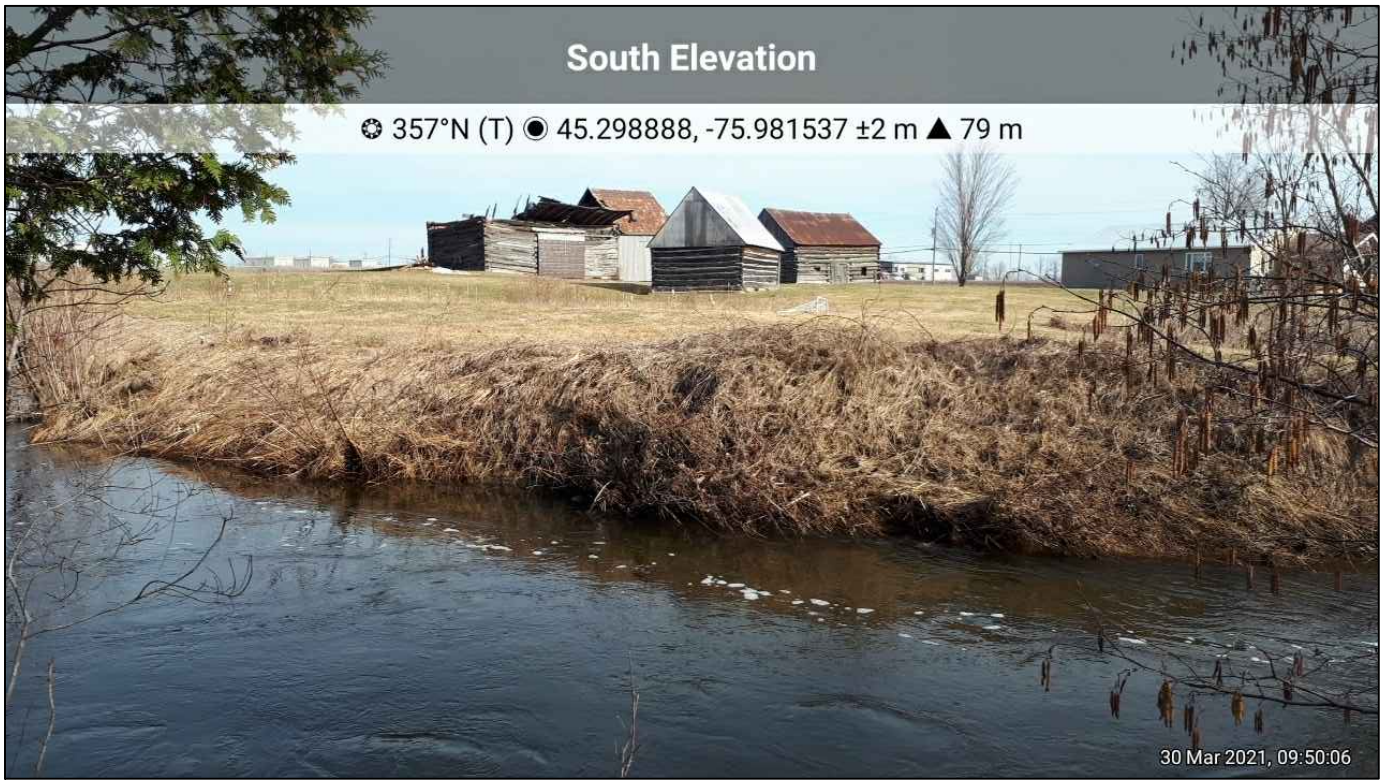
	Drawing: SLOPE STABILITY ANALYSES SECTION E-E'

Drwn By	Chkd By	Date	Project No.	Rev No.	
S.L.	L.A.	APRIL, 2022	100020.002	2	**FIGURE E5**

E.6A - NORTH AND SOUTH BANKS OF HUNTLEY CREEK



E.6B - NORTH BANK OF HUNTLEY CREEK

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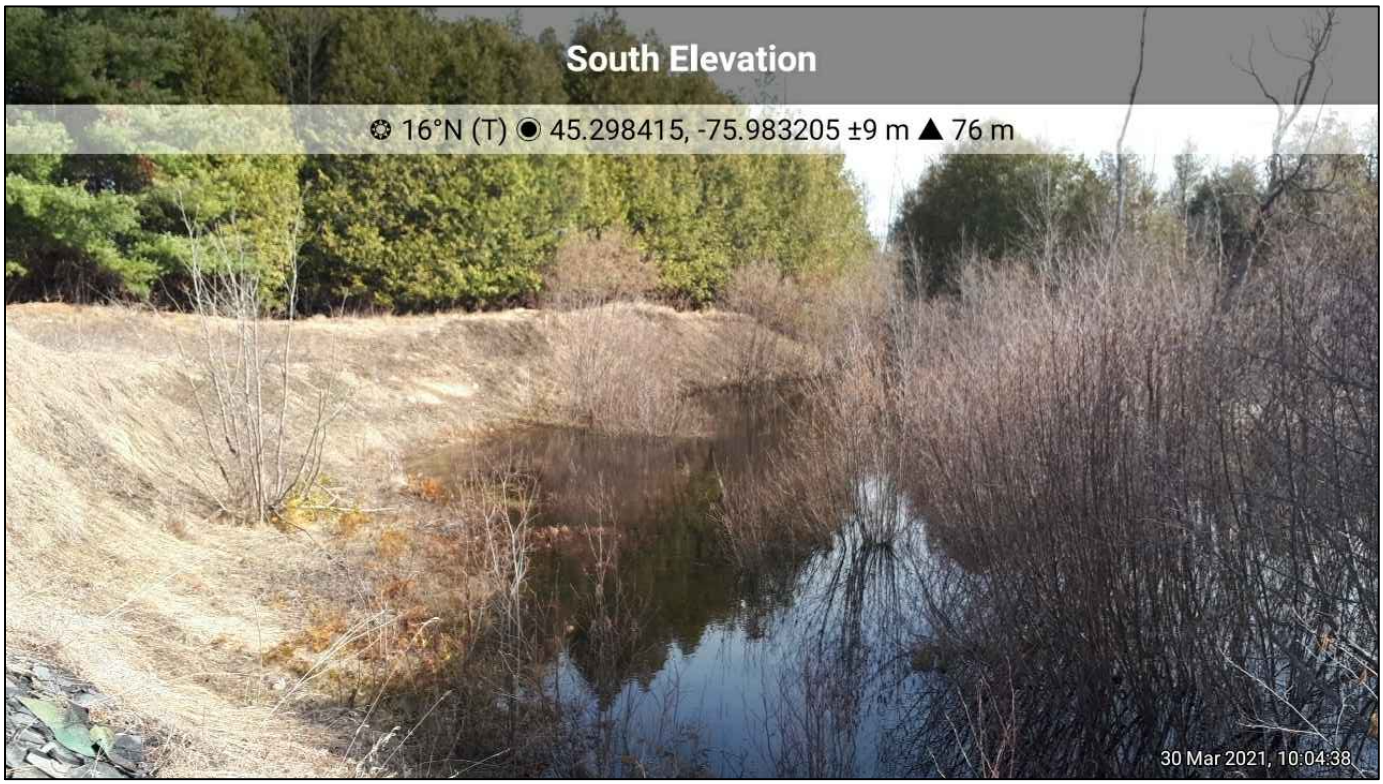
S.L.	L.A.	APRIL, 2022	100020.002	**FIGURE E.6**



E.7A - SLOPES IN AREA OF SECTION C-C' LOOKING NORTH

E.7B - HUNTLEY CREEK, LOOKING NORTH

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S.L.	L.A.	APRIL, 2022	100020.002	

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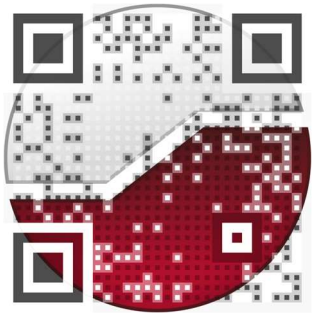

civil	civil
geotechnical	géotechnique
environmental	environnementale
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

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