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Geotechnical Investigation
And Slope Stability Assessment
Proposed Commercial Development
225 Maple Creek Court
Ottawa, Ontario

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Submitted to:

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And Slope Stability Assessment
Proposed Commercial Development
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Ottawa, Ontario

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Project: 100227.103

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation and slope stability assessment carried out for the proposed commercial development to be located at 225 Maple Creek Court in Ottawa, Ontario. This report was updated based on additional information on the proposed development, and supersedes the previous documents provided.

The purpose of the investigation was to identify the general subsurface and groundwater conditions at the site by means of a limited number of boreholes and test pits and, based on the factual information obtained, to provide engineering guidelines and recommendations on the geotechnical design aspects of the project. This report also presents the results of a slope stability assessment carried out at the south corner of the property at Huntley Creek to establish the Limit of Hazard Lands at the site.

This report is subject to the Conditions and Limitations of This Report, which follows the text of the report, and which are considered an integral part of the report.

2.0 BACKGROUND

2.1 Project Description

Plans are being prepared for a proposed commercial development to be located at 225 Maple Creek Court in Ottawa, Ontario. Based on the drawing titled “Grading Plan, 225 Maple Creek Court, Iron Recycling Facility, C01”, dated April 29, 2024, and “Cassell Investment Holdings Inc. Site Plan, 225 Maple Creek Court, Part Lot 7, Concession 2, Geographic Township of Huntley, CITY OF OTTAWA” dated April 25, 2024 provided to GEMTEC by ZanderPlan Inc., the development will include a reinforced concrete slab on grade with partitions, with an approximate plan area of about 540 square metres, to be located in the central portion of the property. The slab on grade is referred to as a ‘cement pad’ on the drawing and this term has been adopted in this report. Grass swales and berms will be constructed in portions of the site, and portions of the site will be gravel surfaced road and parking.

The property is currently a relatively vacant parcel of land with some isolated structures on site. Currently, a gravel roadway is present around the property. Huntley Creek and an associated wetland is located within (and beyond) the southern corner of the property.

Aerial digital imagery of the site indicates filling and/or earthworks have been carried out at the site at various times, and portions of the site have been used previously as a trailer yard or similar. The position of the creek and the creek slopes also appear to have been modified over time.

2.2 Site Geology

A review of surficial geology maps and reported well records by the Ministry of the Environment, Conservation and Parks of Ontario (MECP) in the vicinity of the site, indicates that the site is

underlain by glaciomarine deposits of sand and gravel over glacial till. As described above, fill material is also likely to be present of large portions of the site.

Bedrock geology maps indicate that interbedded limestone and shale of the Verulam Formation is present beneath the soil units at depths ranging from about 5 to 10 metres below ground surface sloping down to the northeast.

3.0 METHODOLOGY

3.1 Subsurface Investigation

The fieldwork for geotechnical investigation was carried out on August 2, 2023, and April 30, 2024. During those dates three boreholes (numbered 23-01 to 23-03 inclusive) and one test pit (numbered 24-01) were advanced at the approximate locations shown on the Site Plan, Figure 1. Test pit 24-01 was advanced adjacent to borehole 23-01 to study the characteristics of the clay encountered at the site in response to queries from the City of Ottawa.

The boreholes were advanced using a truck mounted hollow stem auger drill rig supplied and operated by George Downing Estate Drilling Ltd. of Grenville-Sur-La-Rouge, Quebec. The boreholes were advanced to depths ranging from about 4.3 to 4.7 metres below the existing ground surface.

A standpipe piezometer (monitoring well) was installed in borehole 23-01 for subsequent measurement of the groundwater level.

The test pit was advanced using a mini excavator supplied and operated by Glenview Iron and Metal, to a depth of about 2.1 metres below the existing ground surface.

The fieldwork was supervised by a member of our engineering staff who directed the drilling operations and test pit excavation, logged the boreholes and samples, and carried out the in-situ testing. 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.

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, grain size distribution, Atterberg limit, and shrinkage limit testing. One soil sample was sent to Paracel Laboratories Ltd. for basic chemical testing relating to corrosion of buried concrete and steel.

The borehole and test pit locations were selected by GEMTEC personnel and positioned at the site relative to existing site features. The locations and ground surface elevations of the boreholes and test pit were surveyed using our Trimble R10 GPS survey instrument. The elevation is referenced to geodetic datum NAD83 (CSRS) Epoch 2010, vertical network CGVD28.

3.2 Description of Slope at Huntly Creek

A site reconnaissance was carried out on July 19, 2022, by a member of our engineering staff. On that day the geometry of the slope along Huntley Creek was measured at one location identified as Section A-A' using precision GPS surveying equipment. The location of Section A-A' is provided on Figure 1 following the text of this report. Later a series of hand augerholes were advanced in the vicinity of the slopes along Section A-A'.

An illustration of the slope at Section A-A' is provided in Appendix D. The slope at Section A-A' has an inclination of about 30 degrees from horizontal with an overall height of about 1.9 metres.

In general, the slope of the existing creek is heavily vegetated with grass, shrubs, and small to large trees which made personnel access challenging. From the accessible portions of the slopes no signs of overall slope instability (i.e., rotational failures) or erosion were observed at the site.

4.0 SUBSURFACE CONDITIONS

4.1 General

Descriptions of the subsurface conditions logged in the boreholes and test pit are provided on the Record of Test Hole Sheets in Appendix A. The results of the laboratory classification testing are provided on the Record of Borehole Sheets and in Appendix B. The results of the chemical analysis are provided in Appendix C.

The following sections provide a description of the subsurface conditions encountered in the boreholes advanced as part of this investigation.

4.2 Fill Material

Layers of fill material were encountered from ground surface in the boreholes and test pit. The fill material extends to depths ranging from about 0.6 to 1.5 metres below the existing ground surface.

The fill material is variable in composition but generally consists of sand and gravel, over silty sand, with some gravel. Records of the placement of the fill were not provided to GEMTEC and as such the fill material is considered to be 'uncontrolled', i.e., non-engineered.

Standard penetration tests carried out in the fill material gave N values ranging from 13 to 32 blows per 0.3 metres of penetration, which indicates a compact to dense relative density.

The measured water contents of three samples of the fill material ranged from about 5 to 9 percent.

4.3 Silty Sand with Organics

A layer of silty sand, with organic material inclusive of wood fragments was encountered below the fill material in borehole 23-03 and extends to a depth of about 2.3 metres below the existing ground surface.

Two standard penetration tests carried out in the silty sand gave N values of 3 and 4 blows per 0.3 metres of penetration, which indicates a very loose relative density.

The measured water content of two samples of the silty sand material is about 30 and 39 percent.

4.4 Silty Clay

Native deposits of silty clay with silty sand seams were encountered below the fill material in borehole 23-01 and test pit 24-01. In borehole 23-01, the silty clay has a thickness of about 2.1 metres and extends to a depth of about 2.7 metres below the existing ground surface. The full depth of the clay encountered at the borehole and test pit has been weathered to a grey brown crust.

Standard penetration tests carried out in the weathered silty clay crust gave N values ranging from 3 to 20 blows per 0.3 metres of penetration. In-situ vane shear strength tests carried out in the weathered clay gave an undrained shear strength ranging from about 90 to 180 kilopascals, which indicates a stiff to very stiff consistency.

One grain size distribution test was carried out on one sample of the weathered clay. The results are provided in Appendix B and are summarized in Table 4.1.

Table 4.1 – Summary of Grain Size Distribution Test (Silty Clay)

Test Pit ID	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
24-01	3	0.8 to 1.6	0	32	53	15

The high percentage of sand in the grain size distribution testing may be from the sand seams encountered within the silty clay deposit, and not representative of the deposit as a whole.

One Atterberg limit test was carried out on one sample of the weathered clay. The results are provided in Appendix B and are summarized in Table 4.2. The weathered clay is classified as a clay of low plasticity. The measured water contents of four samples of the weathered clay ranged from about 17 to 29 percent.

Table 4.2 – Summary of Atterberg Limits Test Results (Silty Clay)

Test Pit ID	Sample Number	Sample Depth (metres)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Water Content (%)
24-01	3	0.8 to 1.6	26	17	9	29

A shrinkage limit test was carried out on one sample of the weathered clay, in general accordance with ASTM D4943 (which was discontinued in 2017 by the ASTM Sponsoring Committee responsible for the standard). The modified plasticity index (PI_m) was also calculated for the weathered clay sample using the following formula and the results of the Atterberg limits and grain size distribution testing described previously:

$$PI_m = PI \times (\% \text{ passing the 425 micrometre sieve} / 100)$$

The test and calculation results are provided in Appendix B and are summarized in Table 4.3.

Table 4.3 – Summary of Modified Plasticity Index (Silty Clay)

Test Pit ID / Sample No.	Shrinkage Limit (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Modified Plasticity Index (%)
24-01 / 3	11	26	17	9	9

4.5 Glacial Till

Native deposits of glacial till were encountered below the fill material, weathered silty clay, and/or silty sand deposit. The glacial till was not fully penetrated in the boreholes but was proven to depths ranging from about 4.3 to 4.7 metres below the existing ground surface.

The glacial till can be generally described as grey brown silty sand, with some gravel. Although not directly encountered in the boreholes, the glacial till is known to contain cobbles and boulders.

Standard penetration tests carried out in the glacial till gave N values ranging from 15 to greater than 50 blows per 0.3 metres of penetration, which indicates a compact to very dense relative density.

The results of one grain size distribution test carried out on a sample of the glacial till are provided in Appendix B and summarized in Table 4.4. The measured water content of seven samples of the glacial till ranged from about 9 to 16 percent.

Table 4.4 – Summary of Grain Size Distribution Tests (Glacial Till)

Borehole ID	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt and Clay (%)
23-03	5	3.1 to 3.7	14	57	29

4.6 Auger Refusal

Practical auger refusal was encountered in the boreholes at depths ranging from about 4.3 to 4.7 metres below the existing ground surface. Practical auger refusal can occur on cobbles and boulders, or other hard strata, and may not necessarily be representative of the upper surface of the bedrock.

4.7 Groundwater Levels

The groundwater levels were measured in the monitoring well of borehole 23-01 on August 9 and August 30, 2023, and are summarized in Table 4.5. The groundwater level may be higher during wet periods of the year such as the early spring or following periods of precipitation.

Table 4.5 – Summary of Groundwater Levels

Borehole ID	Groundwater Depth (metres)	Groundwater Elevation (metres)	Date of Reading
23-01	1.2	112.4	August 9, 2023
	1.5	112.1	August 30, 2023

4.8 Chemistry Relating to Corrosion

The results of chemical testing on a soil sample recovered from borehole 23-01 are provided in Appendix C and summarized in Table 4.6.

Table 4.6 – Summary of Corrosion Testing

Parameter	Borehole 23-01 Sample 3
Conductivity (µS/cm)	138
Resistivity (Ohm.m)	72.4
pH	7.59
Chloride Content (µg/g)	<10

Parameter	Borehole 23-01 Sample 3
Sulphate Content (µg/g)	12

5.0 RECOMMENDATIONS AND GUIDELINES

5.1 Grade Raise Restrictions

The subsurface conditions at the site consist of fill material over native deposits of weathered silty clay crust over glacial till. The grading plan shows a proposed grade raise of about 0.5 metres at the cement pad location.

Based on the results of the subsurface investigation, no grade raise restrictions are applicable across the site. The settlement due to compression of the native soils as a result of fill material placement should be relatively small and should occur during or shortly after the fill material placement. However, some increased settlement and/or uneven settlements may occur in the longer term where fill has been placed over any topsoil layers, or soils containing significant quantity of organic material.

5.2 Excavation

The excavations for the proposed cement pad and swales will be relatively minor, and carried out through the fill material and possibly into the upper portion of the native overburden.

The sides of the excavations within the overburden soils 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 majority of the soils at this site can be classified as Type 3 soils, and, as such an allowance should be made for 1 horizontal to 1 vertical, or flatter, excavation slopes.

Zones of very loose fill silty sand were also identified in the boreholes, which would be classified as Type 4 soils and which would require 3 horizontal to 1 vertical, or flatter, excavation slopes. It should be noted that where more than one soil type is encountered in an excavation the highest soil type applies to the full depth of the excavation. Careful inspection of the fill material and sandy deposits should be carried out during excavation to determine the appropriate soil types.

5.3 Groundwater Management

Based on the results of the investigation, it is anticipated that the groundwater inflow into excavations could be handled by pumping from within the excavations, noting that relatively shallow excavation depths are anticipated. It is not expected that short term pumping during excavation will have a significant effect on nearby structures and services. The contractor should be required to submit an excavation and groundwater management plan for review.

Suitable detention and filtration will be required before discharging the water to a sewer or ditch. The amount of water entering the excavation for the construction of the cement pad will likely not exceed 50,000 litres per day and, therefore, it is not anticipated that an Environmental Activity and Sector Registry (EASR) will be required.

5.4 Slab on Grade (Supported on Engineered Fill)

The fill material and any topsoil, inclusive of any buried (former) topsoil layers, and the very loose silty sand containing significant quantity of organic material is not considered suitable for support of slab on grade structures.

To prevent long term settlement and distortion or cracking of the cement pad, any fill or soils with significant organic material such as the silty sand layer, where encountered, should be removed from below the proposed slab to expose the native overburden deposits of weathered silty clay or glacial till. The subgrade surface should then be proof rolled with suitable vibratory compaction equipment under dry conditions and any noted soft or disturbed areas should be sub-excavated, subject to inspection of the geotechnical engineer.

Where subexcavation of soil is required, or in areas where the underside of the cement pad is above the level of the native soil, the grade could be raised with granular material meeting Ontario Provincial Standard Specifications (OPSS) requirements for Granular B Type II. The granular material should be compacted in maximum 200 millimetre thick lifts to at least 98 percent of the material's standard Proctor maximum dry density value using suitable vibratory compaction equipment.

5.4.1 Granular Base

The grade below the slabs could then be raised where necessary, with material meeting OPSS requirements for Granular B Type II. The granular base for slab on grade structures should consist of at least 150 millimetres of OPSS Granular A, compacted in maximum 200 millimetre thick lifts to at least 98 percent of the material's standard Proctor maximum dry density value using suitable vibratory compaction equipment.

OPSS documents allow recycled asphaltic concrete and concrete to be used in Granular A. Since the source of recycled material cannot be determined, it is suggested that any granular materials used beneath the floor slab be composed of virgin material only, for environmental reasons.

To provide adequate spread of load below the slab on grade, the granular material should extend at least 0.5 metres horizontally beyond the edge of the slab and down and out from this point at 1 horizontal to 1 vertical, or flatter.

5.4.2 Bearing Resistances

For the proposed cement pad installed on compacted engineered fill (as per recommendations provided herein) over the native, undisturbed overburden deposits of stiff weathered crust or compact or better glacial till, the bearing resistance for settlement at Serviceability Limit State (SLS) of 150 kilopascals and a factored geotechnical resistance at Ultimate Limit State (ULS) of 300 kilopascals. However, the applicable value may be limited by any insulation below the slab as described later in this report.

Provided that the subgrade surface and engineered fill are prepared as described in this report, the post construction total and differential settlement of the cement pad at SLS should be less than 25 and 15 millimetres, respectively.

5.4.3 Frost Protection

The native soils at this site are considered to be frost susceptible. The depth of frost penetration can extend to 1.8 metres below ground surface. An allowance should be made for providing thermal protection for the proposed cement pad. The use of polystyrene insulation could be considered in combination with the thickness of (non-frost susceptible) engineered fill.

If insulation is required, a minimum 75 millimetre thick layer of extruded polystyrene insulation should be placed over the subgrade surface below the proposed slab on grade and the insulation should extend horizontally beyond the outer edges of the slab on grade such that the horizontal extent of the insulation beyond the edges of the slab should be equal to or greater than 1.8 metres minus the thickness of engineered fill below the slab. An insulation detail can be provided if requested.

The type of insulation used below the slab will depend on the stresses imposed on the insulation. The stress on the insulation should not exceed about 35 percent of the insulation's quoted compressive strength due to the time dependant creep characteristics of this material. The allowable stress levels for several strengths of insulation are provided in Table 5.1. Other equivalent insulation types such as Foamular C–300, 400, 600, and 1000, or expanded EPS products such as StyroRail could also be considered.

Table 5.1 – Allowable Stress Levels – Expanded Polystyrene Insulation

Insulation Type	Maximum Allowable Stress (kilopascals)
Dow SM (or equivalent)	70
Dow Highload 40 (or equivalent)	95
Dow Highload 60 (or equivalent)	145

5.5 Seismic Site Class and Liquefaction Potential

Based on the results of the investigation, it is anticipated that the proposed cement pad will be supported on deposits of weathered silty clay crust and/or glacial till or on a pad of engineered fill constructed on the weathered silty clay crust and/or glacial till.

In accordance with Table 4.1.8.4.A. of the 2012 Ontario Building Code, the seismic site class can be determined based on the Average Standard Penetration Resistance or the Soil Undrained Shear Strength. Based on the results of the standard penetration carried out as part of this investigation, it is recommended that seismic Site Class D be used for the design of the development.

There is no potential for liquefaction of the soils at this site in the vicinity of the cement pad, assuming the very loose silty sand is removed from below the pad or compacted.

5.6 Roadway Recommendations

The details of the proposed access roadways at the site were not known by GEMTEC at the time of preparing this report. However, it is understood that a gravel surfaced roadway is currently under consideration. The guidelines are therefore considered preliminary and to be confirmed as the design progresses.

5.6.1 Subgrade Preparation

In preparation for construction of access roadways, any soft, wet, or deleterious material should be removed from the subgrade surface.

Fill material is likely to be encountered in the roadway areas, with portions of which may have been placed over soils which are compressible or prone to long term settlement. It may not be necessary to remove all of the fill material from within the pavement areas provided that some future settlement of the surface can be tolerated. It is however suggested that any exposed fill material which contains an abundance of organic material or otherwise deleterious material be subexcavated and replaced with suitable earth borrow. Prior to placing granular fill for the pavement area, the exposed subgrade should be heavily proof rolled with a large (10 tonne) vibratory steel drum roller under dry conditions. Any soft areas evident from the proof rolling should be subexcavated and replaced with suitable, compacted earth borrow.

If needed, the grade below the pavement areas could then be raised with compacted granular material such as that meeting OPSS specifications for OPSS Select Subgrade Material (SSM), Granular B Type I, II, or III and/or reuse of existing fill material which meets SSM as a minimum. Grade raise fill material placed below the roadway should be placed in maximum 300 millimetre thick lifts and compacted to at least 95 percent of the material's standard Proctor maximum dry density value using suitable vibratory compaction equipment.

In areas where abrupt changes in the frost susceptibility of the subgrade materials are encountered, frost tapers and/or some subexcavation of materials may be required to avoid future localized differential frost heaving of the pavement structure. The frost taper and subexcavation requirements should be assessed at the time of construction by geotechnical personnel.

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

5.6.2 Pavement Design

In the absence of detailed traffic data, a preliminary granular pavement structure for heavy truck traffic is provided as follows:

- 300 millimetres of OPSS Granular A; over
- 500 millimetres of OPSS Granular B Type II.

The details of the proposed roadways were not available to GEMTEC at the time of this report and the provided pavement structure should be re-evaluated as the design progresses.

The granular pavement structure will require periodic maintenance to regrade the surface. An OPSS Granular M may be used instead of a Granular A surfacing material to reduce the frequency of required maintenance and minimize dust clouds caused by passing vehicles.

5.6.3 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 need to be increased. 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; and,
- Adjust the thickness of the subbase material and /or 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 I.

5.6.4 Granular Material Placement

All imported granular materials should be placed in maximum 200 millimetre thick lifts and should be compacted to at least 99 percent of the material's standard Proctor maximum dry density value using suitable vibratory compaction equipment.

5.6.5 Pavement Drainage

Adequate drainage of the pavement granular materials and subgrade is important for the long-term performance of the pavement at this site.

We recommend that swales or ditches be implemented to promote drainage around the road surface areas. The granular base and subbase materials should be crowned and extend horizontally to the ditches or swales. Where possible, the bottom of the swales/ditches should be at least about 0.3 metres below the bottom of the Granular B Type I.

5.7 Corrosion of Buried Concrete and Steel

The measured sulphate concentration in the soil sample recovered from borehole 23-01 was 12 micrograms per gram. According to the Canadian Standards Association "Concrete Materials and Methods of Concrete Construction" (CSA A23.1-14 Table 3), the degree of sulphate exposure stemming from the soils is negligible (less than 0.10 percent). Therefore, any concrete in contact with the soil at this site could be batched with General Use (GU) cement. However, the effects of freeze thaw in the presence of de-icing chemicals (sodium chloride) use on the roadway should be considered in selecting the air entrainment and the concrete mix proportions for any concrete.

Based on the resistivity and pH of the soil sample, the soil of the site can be classified as non-aggressive towards unprotected steel. The manufacturer of any buried steel elements that will be in contact with the soil and groundwater should be consulted to ensure that the durability of the intended product is appropriate. It is noted that the corrosivity of the soil and groundwater could vary throughout the year due to the application of sodium chloride for de-icing.

5.8 Sensitive Marine Clay – Effects of Trees

Based on the results of the investigation, portions of the site are underlain by 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 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 Guidelines 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.

The modified plasticity index of the sample of the silty clay provided in Table 4.3 is about 9 percent. As such, the potential for soil volume change, as defined by the City of Ottawa, is low/medium.

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”) – as is likely the case at the site.

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) with further information and recommendations on planting trees near foundations provided in the City of Ottawa Tree Planting in Sensitive Marine Clay Soils – 2017 Guidelines.

6.0 SLOPE STABILITY ASSESSMENT

6.1 General

GEMTEC has performed a slope stability assessment is to establish the ‘Limit of Hazard Lands for the site. This limit constitutes a safe setback for any proposed development at the site with respect to slope stability. The Limit of Hazard Lands 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 Limit of Hazard Lands.

The slope stability analyses were carried out at Section A-A’ using SLIDE 2018, a commercial two-dimensional limit equilibrium slope stability program by RocScience Inc. The slope stability analyses were carried out using soil parameters, groundwater conditions, and a cross section profile that attempt to model the slopes in question but do not exactly represent the actual conditions.

The Bishop Simplified Method was used for the stability analyses. Both static and pseudo-static (seismic) conditions were considered.

6.2 Input Parameters

The soil conditions used in the stability analyses were based on the results of the boreholes advanced across the site, as well as our previous experience in similar soil conditions.

In order to determine the shallow subsurface conditions in the vicinity of the slope, two hand augerholes, were advanced at the site by GEMTEC personnel during a site visit. The subsurface conditions encountered in the augerholes were determined based on tactile examination of the material recovered on the flights of the auger. Due to the relatively shallow nature of the hand augerholes formal logs were not prepared. Details of the hand augerholes and conditions encountered within the augerholes are provided below:

- One augerhole was advanced at the crest (top) of the slope along Section A-A' and encountered about 150 millimetres of granular fill material over silty sand with organic matter. The hand augerhole was terminated at a depth of about 1.8 metres below ground surface in the silty sand. Groundwater seepage was not observed in the hand augerhole.
- A second augerhole was advanced along the midpoint of the slope along Section A-A' and encountered about 150 millimetres of topsoil over silty sand with organic matter. The hand augerhole was terminated at a depth of about 1.5 metres below ground surface in the silty sand. Groundwater seepage was observed at a depth of about 0.9 metres below ground surface, where the soils recovered from the hand augerhole were in a wet condition.

The profile of Section A-A' was modeled using the measured geometry shown on Figure D1 in Appendix D, noting that GEMTEC understand that the current grade at the site is not likely to change significantly.

The slope stability analyses were carried out using reasonably conservative strength parameters and bulk unit weights typical of the area in which the subject site is located. Drained soil strength parameters were used for the static condition to reflect long term conditions. The undrained shear strength parameters of silty clay were used for the pseudo-static (seismic) condition. The soil parameters used in the analyses are summarizes in Table 6.1 below.

Table 6.1 – Slope Stability Soil Parameters

Soil Type	Friction Angle, ϕ (degrees)	Cohesion, c (kPa)	Undrained Shear Strength, S_u (kPa)	Unit Weight, γ (kN/m^3)
Fill Material	32	0	-	19
Silty Sand with Organics	26	0	-	18
Silty Clay	30	7.5	60	17
Glacial Till	34	0	-	22

While the groundwater level was measured from about 1.2 to 1.5 metres below existing ground surface in borehole 23-01, as a conservative approach we have assumed the groundwater level to follow the ground surface for the static condition and to be at the base of the fill material for the pseudo-static condition. The results of stability analysis are highly dependent on the groundwater conditions.

For the seismic conditions, the horizontal seismic coefficient (k_h) was determined by using half of the peak ground acceleration (PGA) for the site. A horizontal seismic coefficient of 0.14 was used for the slope.

6.3 Results of Analyses

For the purposes of this study, a computed factor of safety for static stability of less than 1.0 to 1.3 is considered to represent a slope bordering on failure to marginally stable, respectively; a static 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). A factor of safety of 1.5, or greater, is considered to indicate adequate long term static stability.

Under seismic condition, a factor of safety above 1.1 is considered to indicate adequate long term stability.

The results of the slope stability analyses are provided in Appendix D. Based on the results of the analyses of the existing slope conditions, the slope along the existing creek has a minimum factor of safety of less than 1.0 in the static case, and also in the seismic case. As such, the slopes are not considered to be stable in their existing condition.

6.4 Setback Requirements

For unstable slopes the distance from the unstable slope to the safe setback line is called ‘Limit of Hazard Lands’. In accordance with the Ministry of Natural Resources (MNR) Technical Guide “Understanding Natural Hazards” dated 2001, the Limit of Hazard Lands 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, encompasses the area where a factor of safety of less than 1.5 against overall rotational failure is calculated. At Sections A-A’, the slope stability analyses indicate that the existing slope along the creek in its current configuration has a factor of safety against failure of less than 1.0 (refer to Figures D2 and D3 in Appendix D). Therefore, the **Stable Slope Allowance** described in the MNR procedures extends about 7 metres horizontally from the crest of the slope at Section A-A’.

The toe of the slope is located about 10 metres from the edge of the creek, and in accordance with the MNR documents, a minimum Toe Erosion Allowance of between 5 metres is required for

soft/firm cohesive soils, loose granular, (sand, silt) fill materials where no erosion was observed, with a bankfull width of 5 to 30 metres. Therefore, a **Toe Erosion Allowance** of 5 metres can be applied from the edge of the existing Huntley Creek.

The MNR procedures also include the application of a 6 metre wide **Erosion Access Allowance** beyond the Stable Slope Allowance to allow for access by equipment to repair a possible failed slope. Parking and pavement areas are acceptable within the Erosion Access Allowance, however, no structures or services should be constructed within this allowance.

Based on the above information, the Limit of Hazard Lands for the slope adjacent to Huntley Creek will be about **13 metres**, as measured from the crest of the slope shown on Figure 1.

7.0 ADDITIONAL CONSIDERATIONS

7.1 Effects of Construction Induced Vibration

Some of the construction operations (such as granular material compaction, excavation, etc.) will cause ground vibration on and off the site. The vibrations will attenuate with distance from the source but may be felt at nearby structures. Assuming that any excavating is carried out in accordance with the guidelines in this report, the magnitude of the vibrations will be much less than that required to cause damage to the nearby structures or services in good condition. Precondition surveys of the adjacent structures should be considered.

7.2 Winter Construction

Most of the soils at this site are highly frost susceptible and prone to significant ice lensing. In order to carry out the work during freezing temperatures, the excavation should be opened for as short a time as practicable and the excavations should be carried out only in lengths that allow all of the construction operations, including backfilling, to be fully completed in one working day. The materials on the sides of the trenches should not be allowed to freeze. In addition, the backfill should be excavated, stored, and replaced without being disturbed by frost or contaminated by snow or ice.

7.3 Excess Soil Management Plan

This report does not constitute an excess soil management plan. The disposal requirements for excess soil from the site have not been assessed. Consultation on this matter can be provided upon request.

7.4 Abandonment of Monitoring Wells

The monitoring well installed as part of this investigation should be decommissioned by a licensed well technician in accordance with Ontario Regulation 903, as amended by Ontario Regulation 128/03. The well abandonment could be carried out in advance of or during construction.

8.0 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.

Feitao Zeng, Ph.D., CEP
Geotechnical Analyst

Alex Meacoe, P.Eng.
Senior Geotechnical Engineer

FZ/WAM/DC

Enclosures
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CONDITIONS AND LIMITATIONS OF THIS REPORT

1. **Standard of Care:** GEMTEC has prepared this report in a manner consistent with generally accepted engineering or environmental consulting practice in the jurisdiction in which the services are provided at the time of the report. No other warranty, expressed or implied is made.
2. **Copyright:** The contents of this report are subject to copyright owned by GEMTEC, save to the extent that copyright has been legally assigned by us to another party or is used by GEMTEC under license. To the extent that GEMTEC owns the copyright in this report, it may not be copied without our prior written agreement for any purpose other than the purpose indicated in this report. The methodology (if any) contained in this report is provided to the Client in confidence and must not be disclosed or copied to third parties without the prior written agreement of GEMTEC. Disclosure of that information may constitute an actionable breach of confidence or may otherwise prejudice our commercial interests.
3. **Complete Report:** This report is of a summary nature and is not intended to stand alone without reference to the instructions given to GEMTEC by the Client, communications between GEMTEC and the Client and to any other reports prepared by GEMTEC for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. GEMTEC cannot be responsible for use of portions of the report without reference to the entire report.
4. **Basis of Report:** This Report has been prepared for the specific site, development, design objectives and purposes that were described to GEMTEC by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document, subject to the limitations provided herein, are only valid to the extent that this report expressly addresses the proposed development, design objectives and purposes. Any change of site conditions, purpose or development plans may alter the validity of the report and GEMTEC cannot be responsible for use of this report, or portions thereof, unless GEMTEC is requested to review any changes and, if necessary, revise the report.
5. **Time Dependence:** If the proposed project is not undertaken by the Client within 18 months following the issuance of this report, or within the timeframe understood by GEMTEC to be contemplated by the Client, the guidance and recommendations within the report should not be considered valid unless reviewed and amended or validated by GEMTEC in writing.
6. **Use of This Report:** The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without GEMTEC's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, GEMTEC may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process.

   Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.
7. **No Legal Representations:** GEMTEC makes no representations whatsoever concerning the legal significance of its findings, or as to other legal matters touched on in this report, including but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.
8. **Decrease in Property Value:** GEMTEC shall not be responsible for any decrease, real or perceived, of the property or site's value or failure to complete a transaction, as a consequence of the information contained in this report.
9. **Reliance on Provided Information:** The evaluation and conclusions contained in this report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations. information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of misstatements, omissions,

misrepresentations. or fraudulent acts of the Client or other persons providing information relied on by us. We are entitled to rely on such representations, information and instructions and are not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

10. **Investigation Limitations:** Site investigation programs are a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions but even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions.

    The data derived from the site investigation program and subsequent laboratory testing are interpreted by trained personnel and extrapolated across the site to form an inferred geological representation and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Conditions between and beyond the borehole/test hole locations may differ from those encountered at the borehole/test hole locations and the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies. Accordingly, GEMTEC does not warrant or guarantee the exactness of of the subsurface descriptions.

    Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

    In addition, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

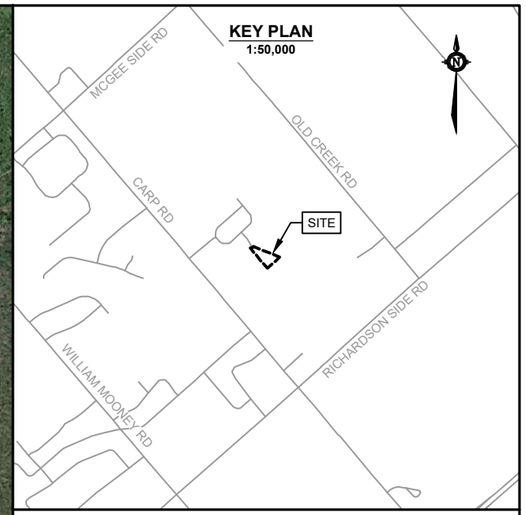
11. **Sample Disposal:** GEMTEC will dispose of all uncontaminated soil and/or rock samples 60 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fill materials or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

12. **Follow-Up and Construction Services:** All details of the design were not known at the time of submission of GEMTEC's report. GEMTEC should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of GEMTEC's report.

    During construction, GEMTEC should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of GEMTEC's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in GEMTEC's report. Adequate field review, observation and testing during construction are necessary for GEMTEC to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, GEMTEC's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

13. **Changed Conditions:** Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that GEMTEC be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that GEMTEC be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

14. **Drainage:** Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. GEMTEC takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



LEGEND

- BH # — BOREHOLE ID
- TP # — TEST PIT ID
- XX.XX — GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM
- BH #/ TP # XX.XX — MULTIPLE TEST HOLES ADVANCED ADJACENT TO EACH OTHER
- BOREHOLE LOCATION (current investigation by GEMTEC)
- APPROXIMATE SITE BOUNDARY
- APPROXIMATE CEMENT PAD BOUNDARY
- APPROXIMATE LIMIT OF HAZARD LANDS
- APPROXIMATE SLOPE CREST LOCATION
- A — A' APPROXIMATE CROSS SECTION LOCATION

GENERAL NOTE(S)

1. Coordinate system: NAD83, UTM ZONE 18
2. Contains information licensed under the Open Government Licence – Ontario.
3. Maps Data: Google, @2023 CNES / Airbus, First Base Solutions, Maxar Technologies
4. Geographic dataset source: Ontario GeoHub.

SCALE

1:1,000

0 20 40 60m

DRAWING

SITE PLAN

CLIENT

GLENVIEW IRON AND METAL

PROJECT

GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
225 MAPLE CREEK COURT
OTTAWA, ONTARIO

DRAWN BY	CHECKED BY
C.Z./ S.L.	F.Z.
PROJECT NO.	REVISION NO.
100227.103	2
DATE	FIGURE NO.
MAY 2024	FIGURE 1

GEMTEC
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APPENDIX A

Record of Test Hole Sheets
List of Abbreviations and Symbols
Boreholes 23-01 to 23-03
Test Pit 24-01

RECORD OF BOREHOLE 23-01

CLIENT: Glenview Iron and Metal
PROJECT: Geotechnical Investigation, Proposed Commercial Development, 225 Maple Creek Court, Ottawa, Ontario
JOB#: 100227.103
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 2 2023

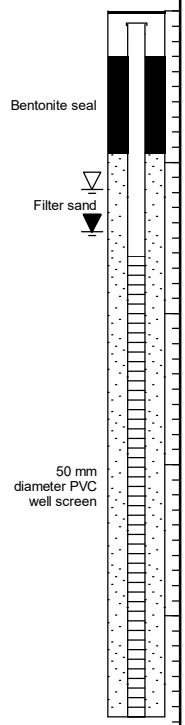
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		113.54				
		Dense, grey brown sand and gravel (FILL MATERIAL)		112.93 / 0.61	1	SS	330	32
1		Stiff to very stiff, grey brown SILTY CLAY, with silty sand seams (WEATHERED CRUST)			2	SS	510	3
2					3	SS	560	20
					4	SS	610	20
3		Compact to very dense, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		110.80 / 2.74	5	SS	305	>50
4					6	SS	305	15
		End of Borehole Auger Refusal		108.87 / 4.67				
5								
6								
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

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
23/08/09	1.2 ▽	112.4
23/08/30	1.5 ▼	112.1

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CHECKED: WAM

GEO - BOREHOLE LOG 100227.103_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 9/5/24

RECORD OF BOREHOLE 23-02

CLIENT: Glenview Iron and Metal
PROJECT: Geotechnical Investigation, Proposed Commercial Development, 225 Maple Creek Court, Ottawa, Ontario
JOB#: 100227.103
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 2 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	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		113.63								
	Power Auger / Hollow Stem Auger (210mm OD)	Compact, grey brown sand and gravel (FILL MATERIAL)		113.02 / 0.61	1	SS	305	14	●			
1		Compact, grey brown silty sand, some gravel (FILL MATERIAL)		112.11 / 1.52	2	SS	510	13	●			
2		Dense to very dense, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)			3	SS	535	38	●			Native backfill
					4	SS	535	53	●			
3					5	SS	200	>50				
4					6	SS	535	76	●			
		End of Borehole Auger Refusal		109.11 / 4.52								
5												
6												
7												
8												
9												
10												

10 20 30 40 50 60 70 80 90

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GEO - BOREHOLE LOG 100227.103_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 9/5/24

RECORD OF BOREHOLE 23-03

CLIENT: Glenview Iron and Metal
PROJECT: Geotechnical Investigation, Proposed Commercial Development, 225 Maple Creek Court, Ottawa, Ontario
JOB#: 100227.103
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 2 2023

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
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		113.73						
		Grey sand and gravel (FILL MATERIAL)		113.53						
		Compact, grey brown silty sand, some gravel (FILL MATERIAL)		0.20 112.97	1	SS	405	27		
1		Very loose, dark brown SILTY SAND, some gravel, with organics (wood fragments)		0.76	2	SS	255	3		
2					3	SS	80	4		Native backfill
		Very dense, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		111.44 2.29	4	SS	310	>50		
3					5	SS	405	71	M	
4					6	SS	380	>50		
		End of Borehole Auger Refusal		109.41 4.32						
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

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LOGGED: CC
CHECKED: WAM

GEO - BOREHOLE LOG 100227.103_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 9/5/24

RECORD OF TEST PIT 24-01

CLIENT: Glenview Iron and Metal
PROJECT: Geotechnical Investigation, Proposed Commercial Development, 225 Maple Creek Court, Ottawa, Ontario
JOB#: 100227.103
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 30 2024

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		113.6			10 20 30 40 50 60 70 80 90		Native backfill
	Grey brown sand and gravel (FILL MATERIAL)		113.3					
	Grey brown silty sand, some gravel (FILL MATERIAL)		0.2	1	GS			
				2	GS			
			112.8					
1	Stiff to very stiff, grey brown SILTY CLAY, with silty sand seams (WEATHERED CRUST)		0.8	3	GS	+ at ~20; >> at ~90	MH	
				4	GS			
2			111.5					Groundwater observed within open test pit at about 1.6 metres below ground surface
	End of Test Pit		2.1					
3								
4								
5								
6								
7								
8								
9								
10								

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GEO - TESTPIT LOG 100227.103 GINT TEST PIT LOGS.GPJ GEMTEC 2018.GDT 9/5/24

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

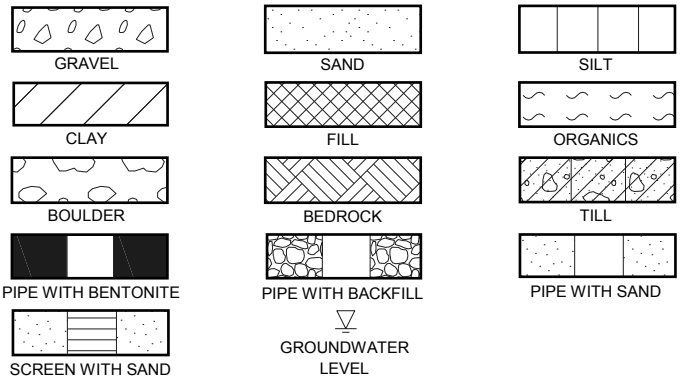
PENETRATION RESISTANCE

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.

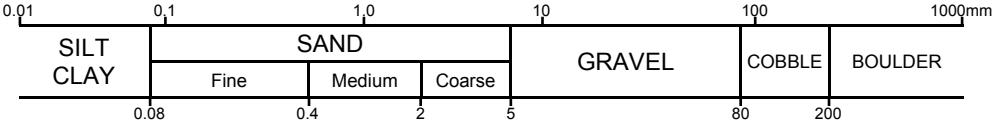
Dynamic Penetration Resistance
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive a 50 mm (2 in.) diameter 60° cone attached to 'A' size drill rods for a distance of 300 mm (12 in.).

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

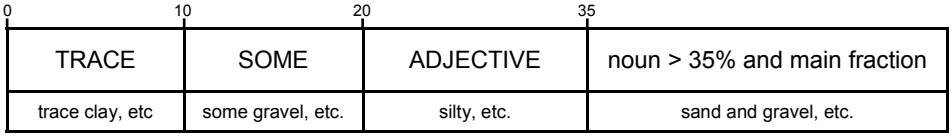


GRAIN SIZE



DESCRIPTIVE TERMINOLOGY

(Based on the CANFEM 4th Edition)



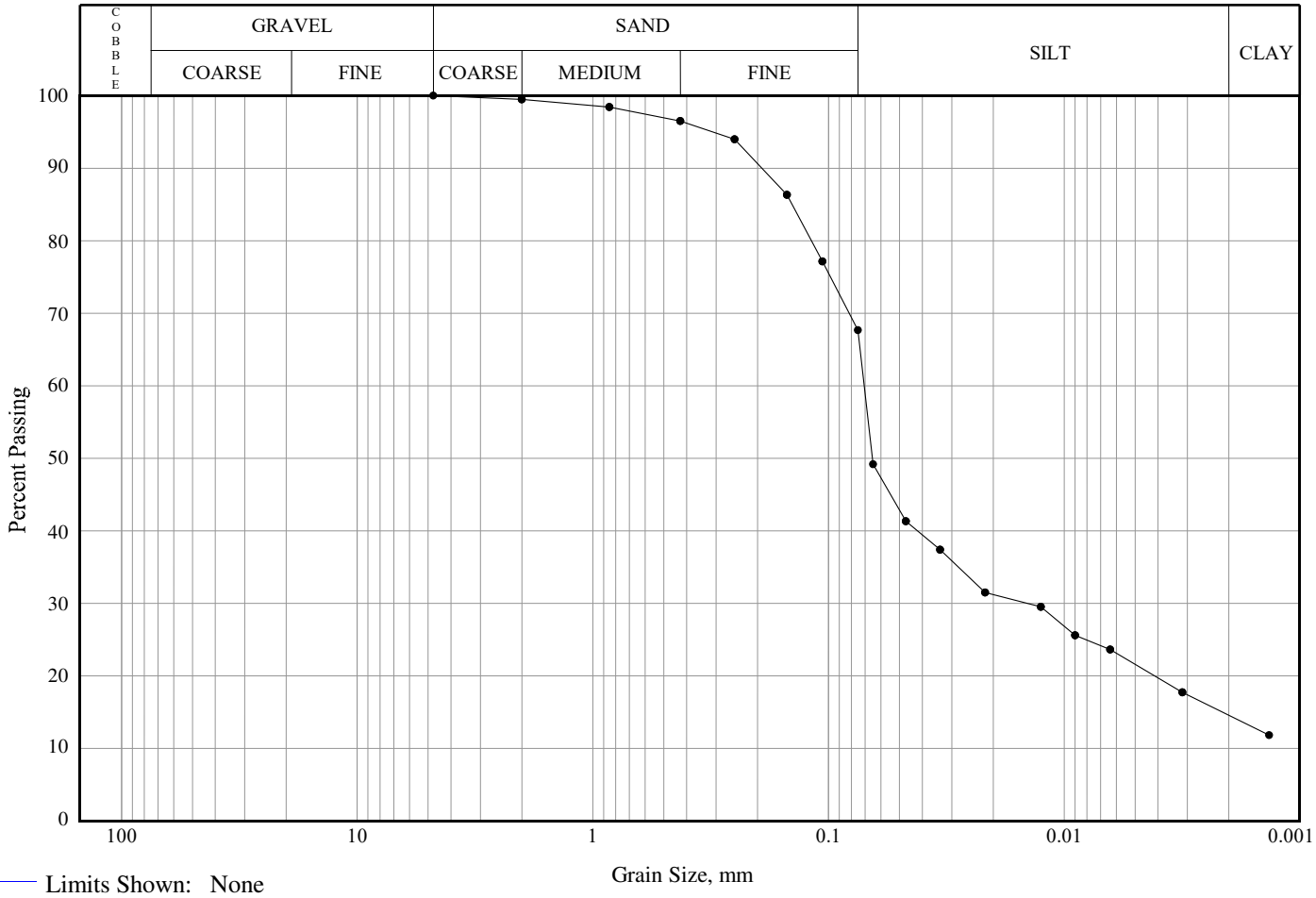
APPENDIX B

Laboratory Test Results

GEMTEC
Consulting Engineers and Scientists

Client:	Glenview Iron and Metal
Project:	225 Maple Creek
Project #:	100227103

Soils Grading Chart (LS-702/ ASTM D-422)



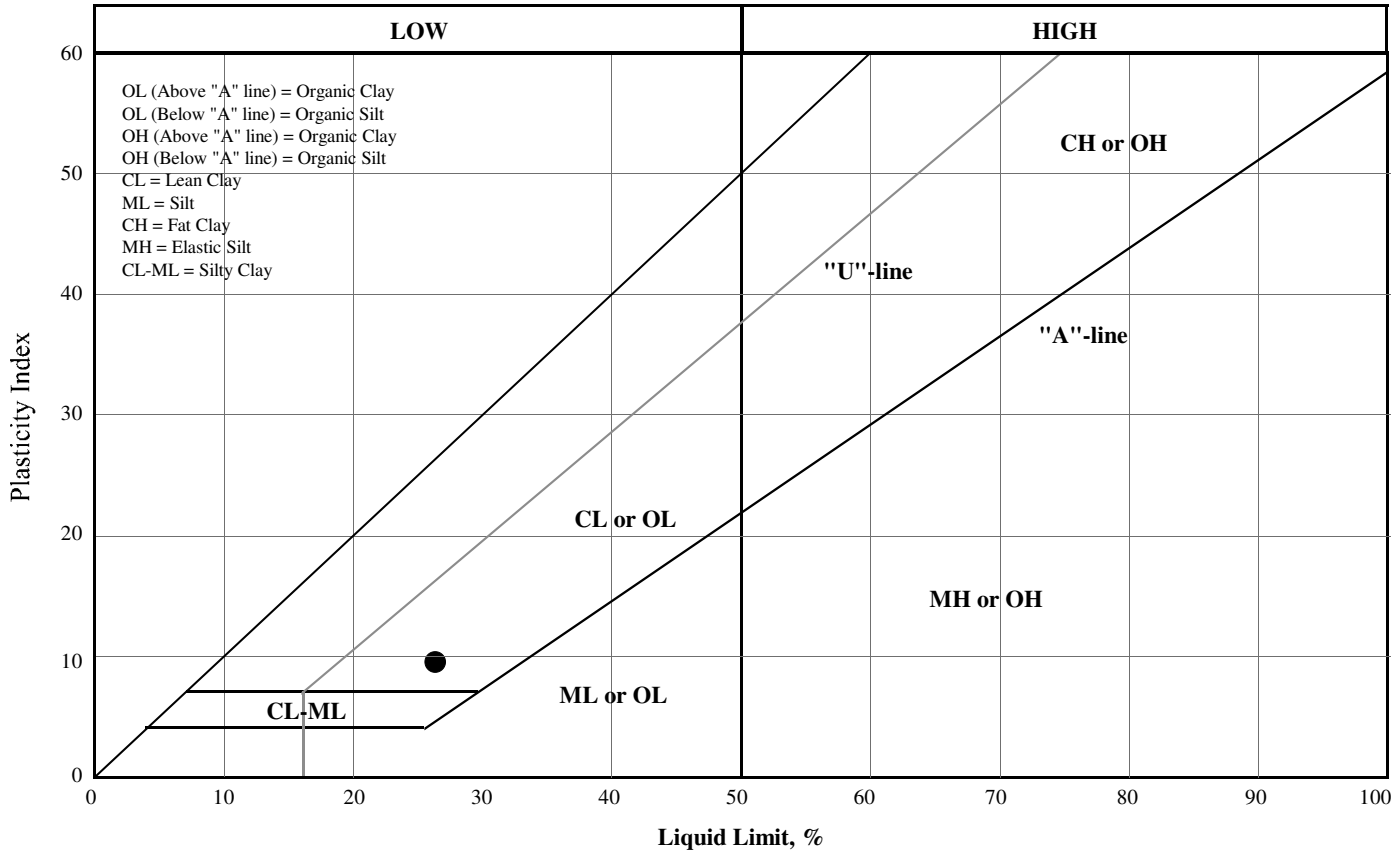
Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
—●—	WEATHERED CRUST	TP24-01	3	0.8-1.6	0.0	32.4	53.1	14.5

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
—●—	Sandy silt , some clay	CL	---	0.002	0.01	0.07	0.07	0.14	53.1

Note: More information available upon request

GEMTEC Consulting Engineers and Scientists, Ottawa, ON	Client: Terry and Cathy Little	Plasticity Chart (LS-7034/ASTM D4318)
	Project: 225 Maple Creek – Iron Recycling Operation	
	Project #: 100227103	



Symbol	Borehole /Test Pit	Sample Number	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Non-Plastic	Moisture Content, %
●	24-01	3	0.8-1.6	26.3	16.8	9.5	N/A	28.8

Note: More information available upon request

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Shrinkage Limit

ASTM D4943

Volume of Shrinkage Dish		
Mass of Shrinkage Dish (g) (m):	**20.68**	**20.82**
Mass of Shrinkage Dish and Grease(g) (m):	**20.74**	**20.95**
Mass of Glass Plate (g):	**37.35**	**37.35**
Mass of Shrinkage Dish, Plate, Grease and Water (g):	**75.28**	**75.48**
Mass of Water (g):	**17.19**	**17.18**
Volume of Shrinkage Dish:	**17.19**	**17.18**

Test Specimen		
Specimen Dish:	**SL4**	**SL5**
Mass of Shrinakge Dish, m (g):	**20.68**	**20.82**
Mass of Shrinkage Dish and Grease, m_{dxg} (g):	**20.75**	**20.93**
Mass of Shrinkage Dish and Wet Soil, m_w (g):	**54.42**	**54.22**
Mass of Shrinkage Dish and Dry Soil, m_d (g):	**46.96**	**46.86**
Mass of Wax-Coated Soil in Air, m_{sxa} (g):	**27.59**	**27.31**
Mass of Wax-Coated Soil in Water, m_{sxw} (g):	**13.6**	**13.2**

Calculated Shrinkage Limit		
Specimen Dish:	**SL4**	**SL5**
Mass of Dry Soil, m_s (g):	**26.28**	**26.04**
Water Content of Soil when Placed in Dish, w (%):	**28.39**	**28.26**
Mass of Water Displaced by Wax-Coated Soil, m_{wsx} (g):	**13.99**	**14.11**
Volume of Dry Soil and Wax, V_{dx} (cm^3):	**13.99**	**14.11**
Mass of Wax, m_x (g):	**1.31**	**1.27**
Volume of Wax, V_x (cm^3):	**1.46**	**1.41**
Volume of Dry Soil, V_d (cm^3):	**12.53**	**12.70**
Shrinkage Limit, SL:	**10.67**	**11.02**
Average Shrinkage Limit, $SI_{avg.}$:	**10.84**	

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.: 100227.103	**Tested By: K. Neil**
Project Name: 225 Maple Creek Court, Ottawa	**Checked By: K.Smith**
Date Tested: May 3, 2024	**Sample No: TP24-01 SA 3**
Sample Date:	**Source:**
Remarks:	**Depth: 0.8-1.6**

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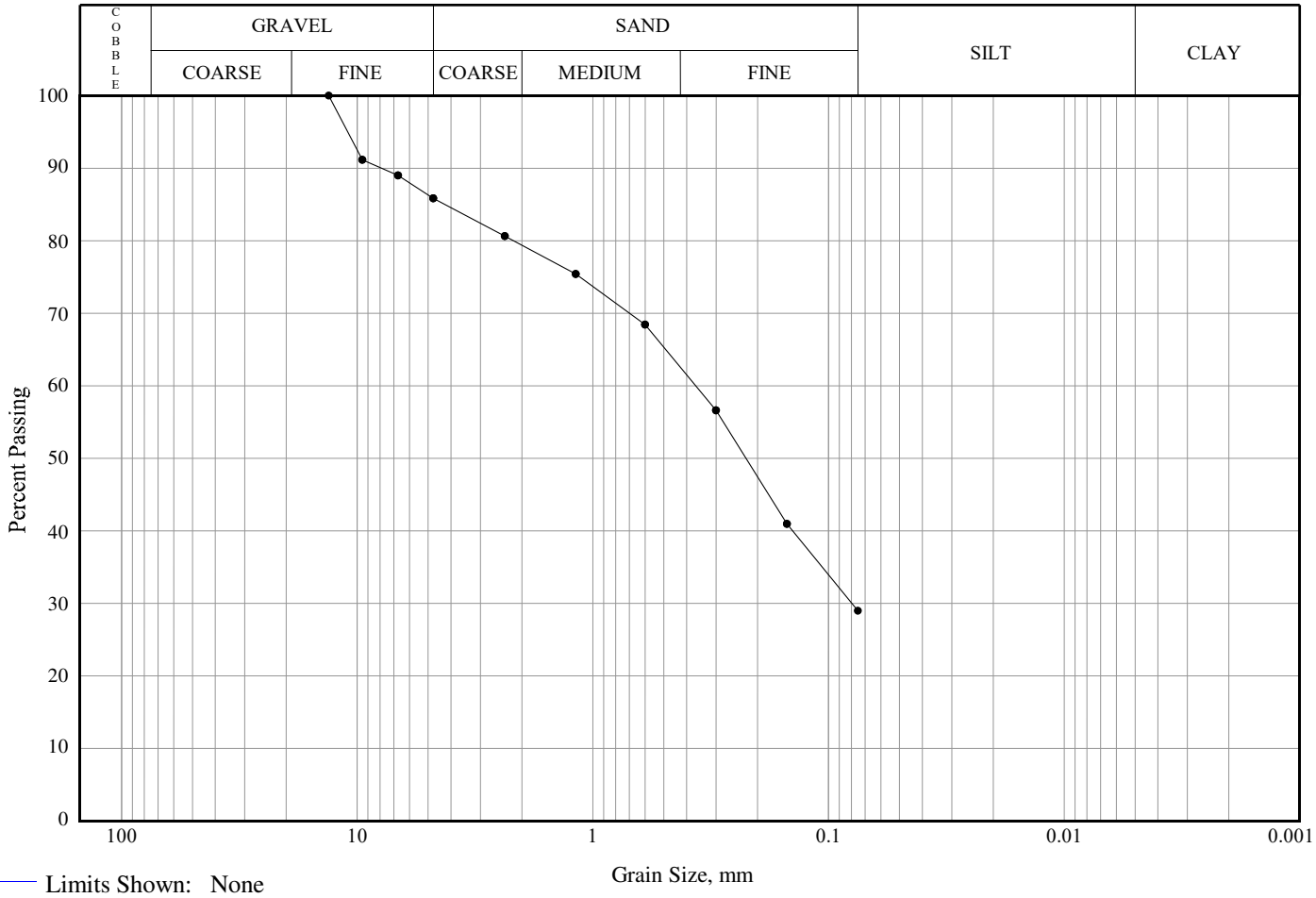
Consulting Engineers and Scientists

Client:	Glenview Iron and Metal
Project:	225 Maple Creek
Project #:	100227103

Soils Grading Chart



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
—●—	GLACIAL TILL	23-03	5	3.05-3.66	14.2	56.9	28.9	

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
—●—	Silty sand , some gravel	N/A	---	---	0.08	0.22	0.37	4.24	---

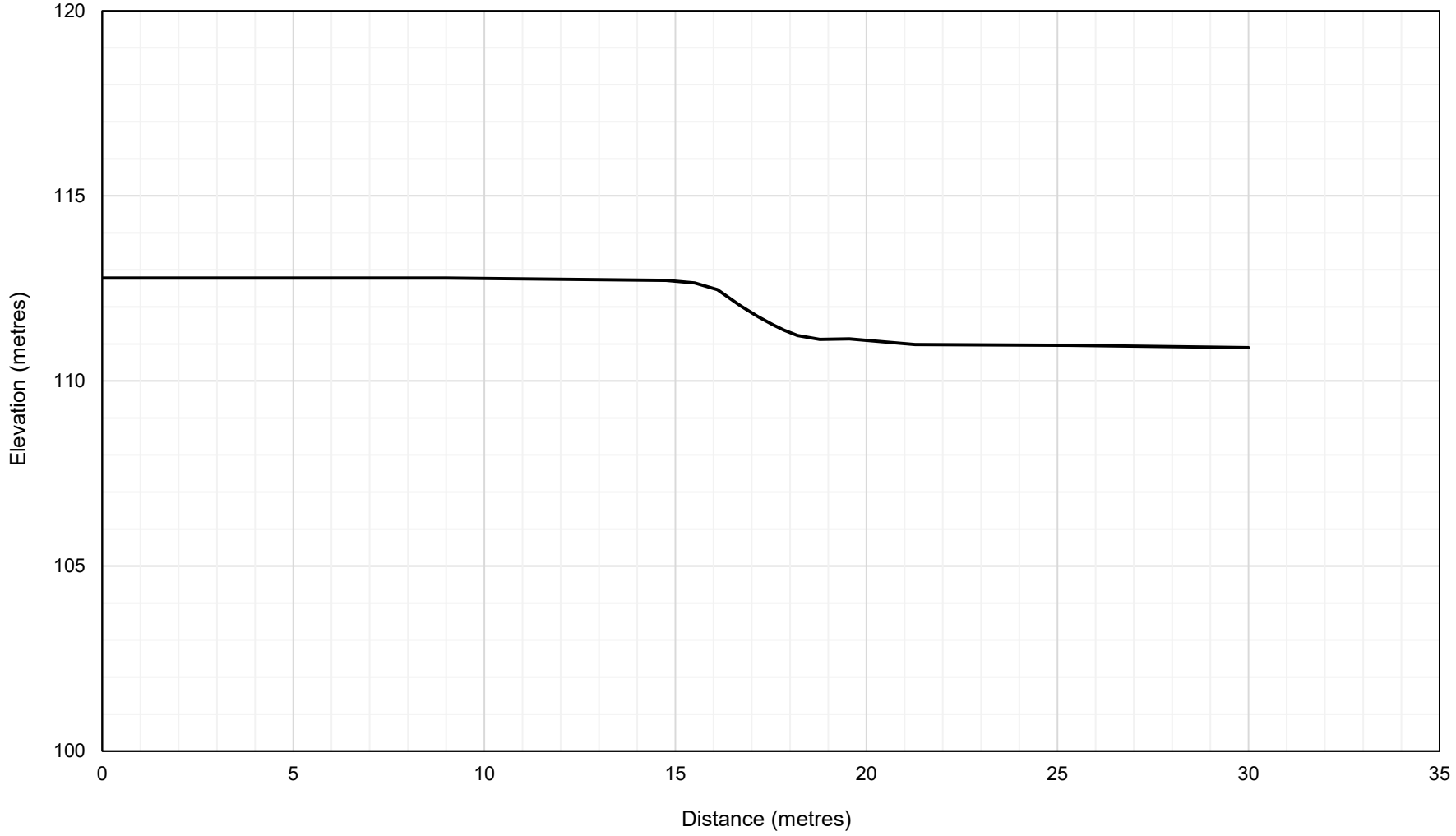
APPENDIX C

Chemical Analysis of Soil Sample
Sample Relating to Corrosion
(Paracel Laboratories Ltd. Order No. 2332229)

	Client ID:	BH 23-01 SA#3 Depth - 5'-7'	-	-	-		
	Sample Date:	02-Aug-23 10:00	-	-	-	-	-
	Sample ID:	2332229-01	-	-	-		
	Matrix:	Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	84.3	-	-	-	-	-
General Inorganics							
Conductivity	5 uS/cm	138	-	-	-	-	-
pH	0.05 pH Units	7.59	-	-	-	-	-
Resistivity	0.1 Ohm.m	72.4	-	-	-	-	-
Anions							
Chloride	10 ug/g	<10	-	-	-	-	-
Sulphate	10 ug/g	12	-	-	-	-	-

APPENDIX D

Slope Stability Assessment



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Slope Section A-A'

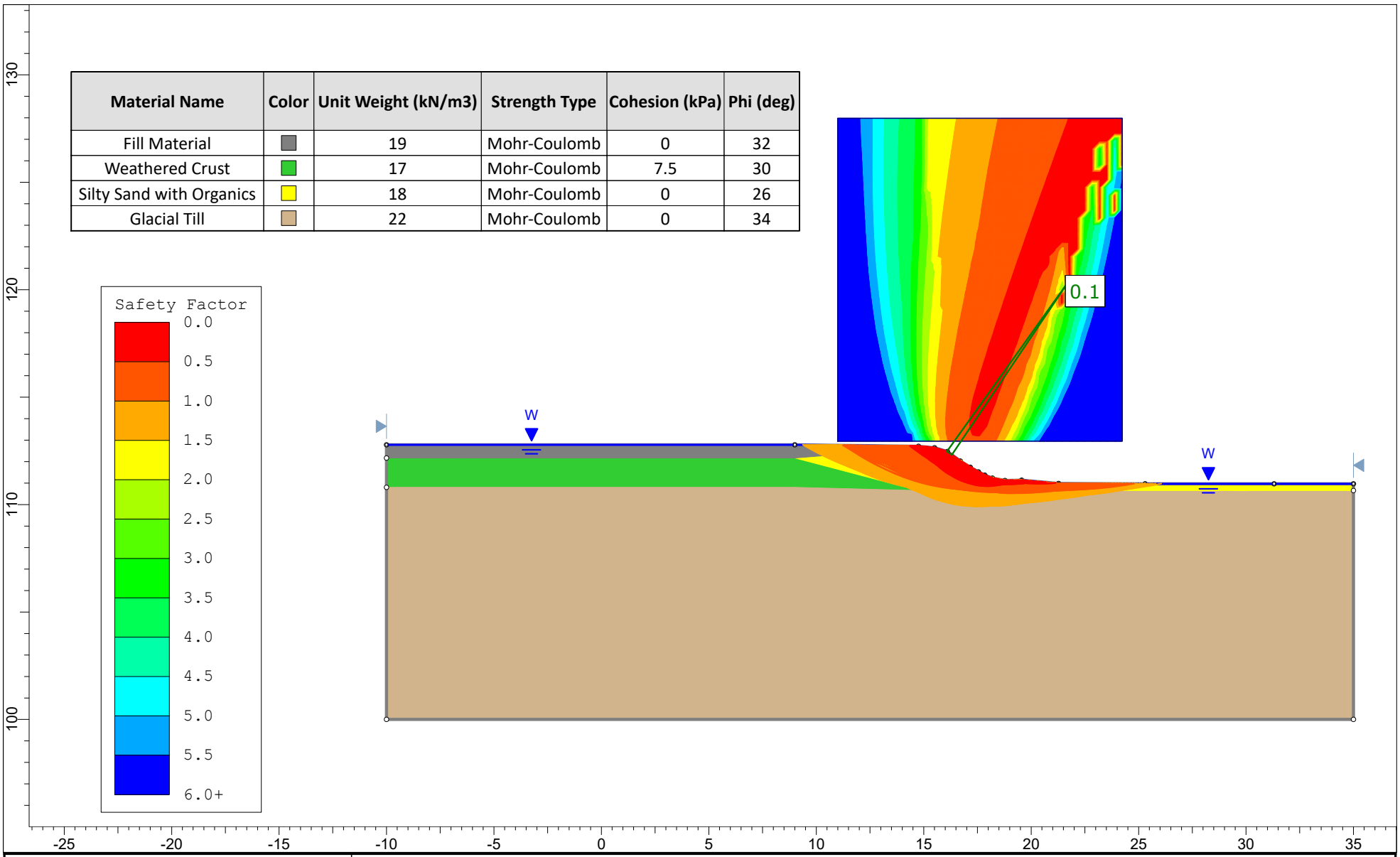
Proposed Commercial Development, 225 Maple Creek Court

Ottawa, Ontario

Project No.	100227.103
Drawn:	FZ
Date:	2023-09-19

FIGURE D1

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Fill Material		19	Mohr-Coulomb	0	32
Weathered Crust		17	Mohr-Coulomb	7.5	30
Silty Sand with Organics		18	Mohr-Coulomb	0	26
Glacial Till		22	Mohr-Coulomb	0	34



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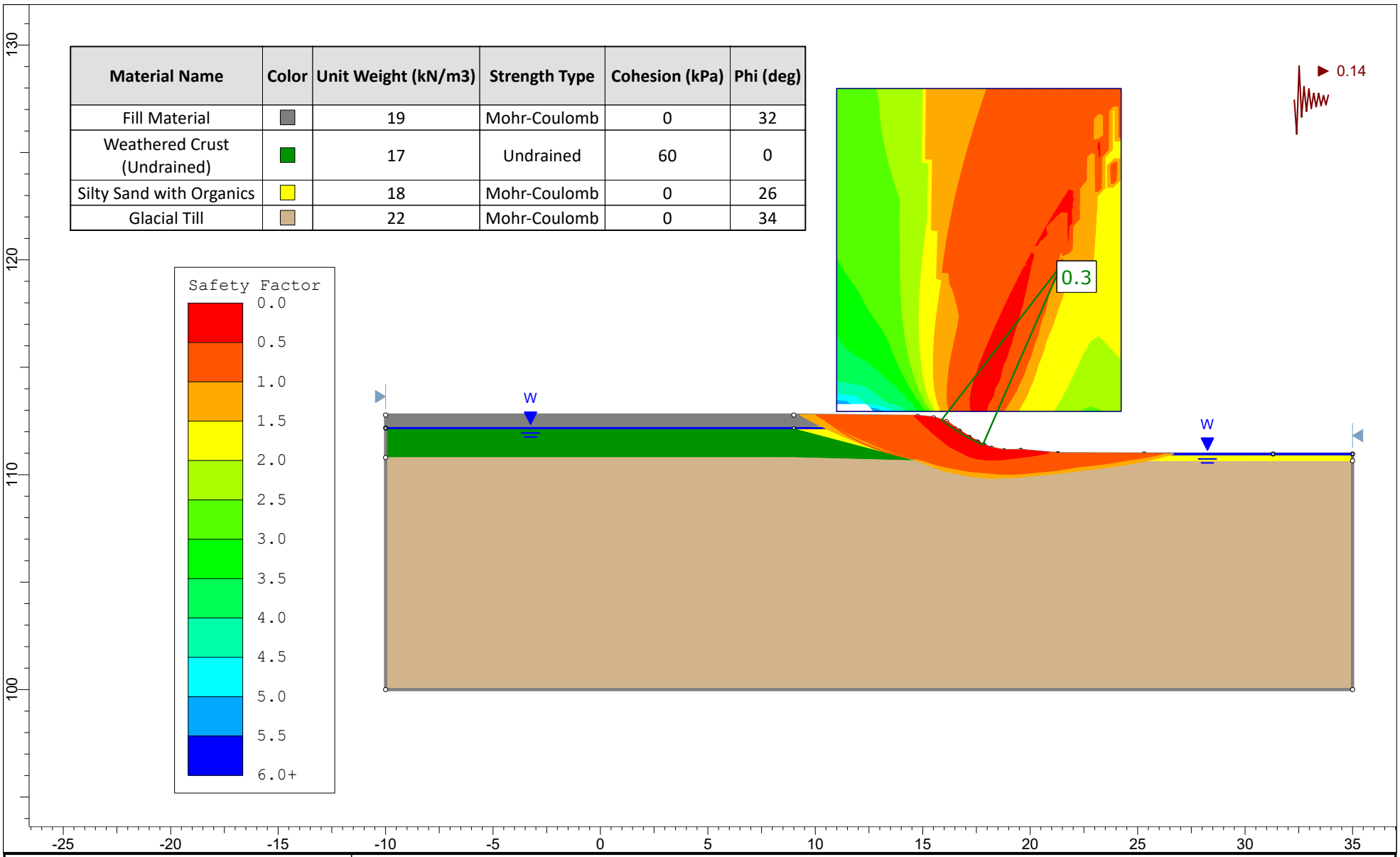
SLIDEINTERPRET 8.022

Project	Slope Stability Assessment, Proposed Commercial Development, 225 Maple Creek Court, Ottawa, Ontario		
Analysis Description	Section A-A', Static Analysis		
Drawn By	FZ	*Location*	Ottawa, Ontario
Date	October 2023	*Project Number*	100227.103
			Figure Number D2

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Fill Material		19	Mohr-Coulomb	0	32
Weathered Crust (Undrained)		17	Undrained	60	0
Silty Sand with Organics		18	Mohr-Coulomb	0	26
Glacial Till		22	Mohr-Coulomb	0	34



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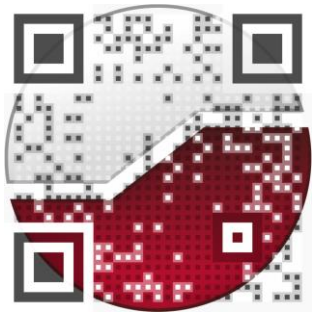
SLIDEINTERPRET 8.022

Project	Slope Stability Assessment, Proposed Commercial Development, 225 Maple Creek Court, Ottawa, Ontario		
Analysis Description	Section A-A', Pseudo-static Analysis		
Drawn By	FZ	*Location*	Ottawa, Ontario
Date	October 2023	*Project Number*	100227.103
			Figure Number D3

experience • knowledge • integrity



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

expérience • connaissance • intégrité