APPENDIX I
Slope Stability Analysis

Lakeshore Development Inc | METROLINX

Lakeshore Development Inc.
Park Lawn GO

Slope Stability Analysis

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2021-12-17	0	Charlie Harrison	Kai-Sing Ho	Mark Armstrong	Final Report
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Date	**Rev.**	**Prepared By**	**Checked By**	**Approved By**	**Status**

Executive Summary

Lakeshore Development Inc. (“the Developer”) has proposed the new Park Lawn GO Station to be developed in partnership with Metrolinx, located at the north end of 2150 Lake Shore Boulevard West in the City of Toronto (“the Project”). Hatch was retained by the Developer to undertake an Environmental Assessment (EA) for the proposed Park Lawn GO Station on the Lakeshore West rail corridor. The Initial Business Case (IBC) (2016) recognized Park Lawn as a strategic location of dense development and growth, as well as opportunity to integrate with local transit in the area. The Park Lawn GO Station will provide a stop between Mimico GO Station and Exhibition GO Station. The Park Lawn GO Station will be located 100 metres south of the Gardiner Expressway, 300 metres northwest of Lake Shore Boulevard West, on both sides of Park Lawn Road, and both sides of the Lakeshore West rail corridor within the City of Toronto.

As a component of the EA, this Slope Stability Analysis has been prepared to investigate the long-term slope stability of the northern embankment slope within the Toronto and Region Conservation Authority (TRCA) regulated area for the design of the proposed Park Lawn GO Station north platform. This involved a geotechnical drilling investigation and slope stability assessments for the design of the platform located approximately between Mile 5.82 and 5.94 of the GO Oakville Subdivision as requested by the TRCA. This report provides a summary of the geotechnical investigation and provides the factual information regarding the subsurface conditions of the site. Based on the laboratory results and the observations made during the geotechnical site investigation, the Report provides a summary of the Slope Stability Analysis, which includes the slope stability assessment and erosion protection allowances for the site.

The proposed construction of the passenger platform along the northern side of the embankment is 5 metres in width. The platform is overhanging the crest of the slope and therefore, it will require the construction of a retaining wall to support the embankment widening and potentially assist in mitigating any slope stability issues. The slope stability assessment takes into consideration both the slope stability and erosion consideration. The main objective is to ensure that an adequate factor of safety (FS) against slope instability is achieved for the embankment side slopes when considering the proposed construction of the proposed passenger platform. In addition to this, the assessment will determine the linear length of slope that requires improvement in order to support the proposed passenger platform. This assessment was prompted based on the TRCAs concerns regarding the long-term reliability of the current configuration of the existing retaining wall at the base at the eastern extent of the slope, as well as the current geomorphic erosion of the Mimico Creek alignment.

A total of three (3) boreholes were advanced to the west of Park Lawn Road at depths ranging from 6.9 metres to 17.1 metres below ground surface. This report describes the geotechnical investigation of these soil samples which were conducted at Hatch Advanced Soil Laboratory in Niagara Falls, Ontario (a Canadian Council of Independent Laboratories (CCIL) certified laboratory). The study includes examination of groundwater and subsurface conditions based on a variety of material parameters including: soil classification during drilling; in-situ SPT data; laboratory testing of representative soil samples; and correlations between soil index testing and SPT data to other index values and shear strength. Additionally, toe erosion considerations were investigated for the shoreline along the south bank of Mimico Creek based on a 100 year projection of the existing retaining wall. The

results suggest that the estimated extent of potential toe erosion assumes the existing retaining wall will not be sufficient to resist active erosion induced by Mimico Creek.

This report recommends the construction of a rigid retaining wall that would provide resistance to lateral movement from the retained soils and platform loads and achieve structural independence from any lateral support from the soil downslope of the wall. This concept was selected given the constraint that no construction is to take place at the toe of the slope, which predicates the use of top-down construction techniques. The retaining wall would support the proposed passenger platform by providing suitable bearing capacity for construction of a slab-on-grade, as well as support the existing Metrolinx rail alignments.

Hatch has identified several potential failure mechanisms for the existing retaining wall based on the results of the Fluvial Geomorphology and Meander Beltwidth Assessment. Failure mechanisms include inadequate bearing capacity due to loss of foundation soils from erosion; overturning of the wall as a result of the scour and erosion of the wall’s foundation soils; and sliding due to the loss of support on the assumed cantilevered portion of the retaining wall. These failure mechanisms further support the need for a rigid retaining wall to support the proposed passenger platform, as any of the identified risks associated with the existing platform would lead to detrimental impacts.

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Glossary of Terms and Acronyms

asl:	above sea level
BH:	Borehole
CCIL:	Canadian Council of Independent Laboratories
Developer:	Lakeshore Development Inc.
EA:	Environmental Assessment
FS:	Factor of Safety
IBC:	Initial Business Case
lbs.:	Pound-mass
LTSTOS:	Long-Term Stable Top of Slope
mbgs:	metres below ground surface
SPT:	Standard Penetration Test
TPAP:	Transit Project Assessment Process
TRCA:	Toronto and Region Conservation Authority

1. Introduction

Lakeshore Development Inc. (“the Developer”) has proposed the new Park Lawn GO Station to be developed in partnership with Metrolinx, located at the north end of 2150 Lake Shore Boulevard West in the City of Toronto (“the Project”). Hatch was retained by the Developer to undertake an Environmental Assessment (EA) for the proposed Park Lawn GO Station on the Lakeshore West rail corridor. The Initial Business Case (IBC) (2016) recognized Park Lawn as a strategic location of dense development and growth, as well as opportunity to integrate with local transit in the area. The Park Lawn GO Station has the opportunity to provide a stop between Mimico GO Station and Exhibition GO Station. The Park Lawn GO Station will be located 100 meters south of the Gardiner Expressway, 300 meters northwest of Lake Shore Boulevard West, on both sides of Park Lawn Road, and both sides of the Lakeshore West rail corridor within the City of Toronto.

Hatch was retained by the Developer to conduct a geotechnical drilling investigation and slope stability assessments for the design of the proposed Park Lawn GO Station Platforms (Mile 5.64 to 5.88 of GO Oakville Subdivision) based upon a request from the Toronto and Region Conservation Authority (TRCA). The site is located along Metrolinx’ Lakeshore West rail corridor between Mimico Creek and the Gardiner Expressway rail grade separation in the City of Toronto, Ontario as presented in Figure 1-1. Within the TRCA regulated land (Mile 5.82 to Mile 5.94), the proposed Park Lawn GO Station platforms are expected to extend from the Park Lawn Road rail bridge (Mile 5.82) to approximately 20 to 30 m east of the existing Mimico Creek rail bridge (Mile 5.94). Within the project limits, the rail embankment consists of four (4) active railway tracks. The northern embankment slope is vegetated and is bound by Mimico Creek to the west and undeveloped vegetated space to the east. The toe of the northern slope consists of a mix of existing erosion protection measures including a concrete gravity retaining wall, gabion baskets and rip-rap (>600 mm diameter). The south side of the embankment consists of an existing noise wall separating the rail corridor from private development to the south.

The purpose of the geotechnical investigation was to obtain information on the subsurface conditions at the site by means of advancing a limited number of boreholes, and to assess the geotechnical engineering characteristics of the subsoils by means of field and laboratory tests.

Two boreholes were advanced at the top of the embankment (rail track level) and one borehole was advanced at the toe of the slope to obtain the subsurface soils and groundwater conditions. The site topographic plans were provided to Hatch by the Park Lawn GO Station design team.

The purpose of the slope stability assessment is to assess the long-term slope stability of the northern embankment slope within the TRCA regulated area for the design of the proposed Park Lawn GO Station north platforms.

This report summarizes the geotechnical investigation work, and factual information including the subsurface conditions and laboratory test results. Based on the results of the geotechnical investigation, the results of the slope stability assessment and erosion protection allowances for the site are provided.

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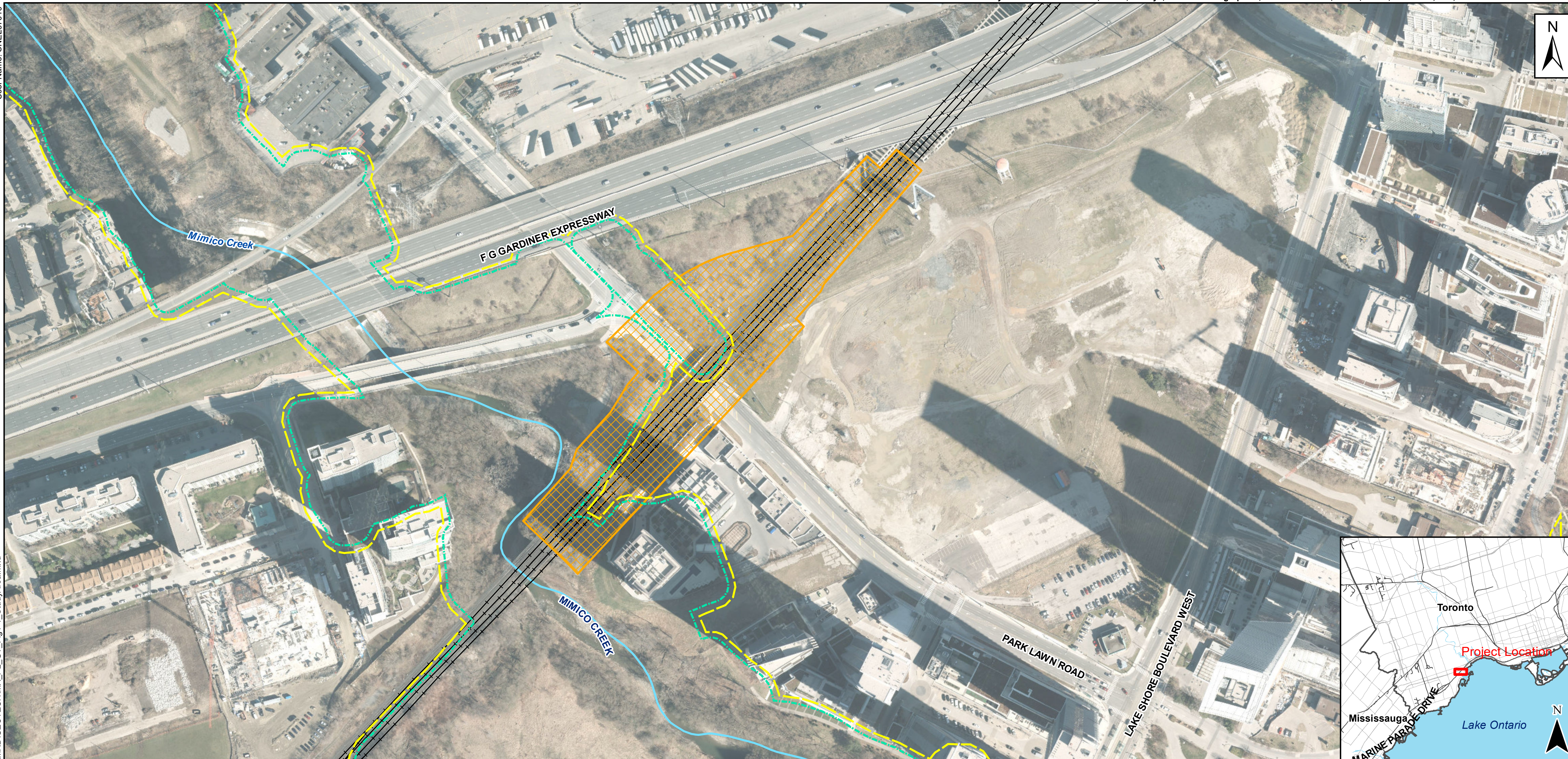

LEGEND

- Proposed Project Footprint (approximate)
- Toronto Region Conservation Authority (TRCA) Regulated Area
- Ravine and Natural Feature By-law
- Property Boundary
- Railway
- Permanent Watercourse

NOTES

1. Coordinate system - UTM NAD 1983 Zone 17N.
2. Sources: Roads, Railways, Watercourses - Land Information Ontario;
3. Station Footprint Based on Preliminary Station Design.

0 50 100 200 Meters

1:3,000

Project:	**Park Lawn GO Station**
Figure Title:	**Site Location**
Prepared By: HATCH	**Date: December 17, 2021**
Version: PL.GT.100-1 / **Review:**	**Figure:** 1-1 / **Page:** 1 of 1

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2. Geotechnical Investigation

2.1 Utility Clearances

All boreholes were marked on the site by Hatch engineering staff. All utilities within the area including railway signals, public and private utility owners were contacted and clearances were obtained prior to commencing the field work.

2.2 Borehole Locations

A total of three (3) boreholes (i.e., BHs 21-S5, 21-07, and 21-08) were advanced west of Park Lawn Road in the locations shown on the borehole location plan attached in Appendix A. The boreholes were advanced to depths ranging from 6.9 m to 17.1 m below ground surface (mbgs). Borehole details including coordinates, surface elevations and termination depths are provided in Table 2-1. BH21-S5 and BH21-07 were terminated on power auger refusal on suspected bedrock. BH21-08 encountered bedrock at a depth of 6.5 m and was cored to the termination depth of the borehole at 17.1 mbgs.

Table 2-1: Borehole Details

Borehole Number	Easting (m)	Northing (m)	Ground Surface Elevation (masl)	Borehole Termination Depth (mbgs)
BH21-S5	622,147	4,831,322	87.0	6.9
BH21-07	622,167	4,831,349	87.1	8.7
BH21-08	622,126	4,831,332	79.5	17.1

Groundwater conditions were observed during the drilling and immediately following the drilling in the open boreholes. No monitoring wells were installed as part of the field work for this investigation. However, groundwater monitoring wells were installed in boreholes advanced to support the geotechnical investigation for the proposed station buildings at the locations indicated in the borehole location plan in Appendix A.

2.3 Drilling and Sampling Methodology

Borehole drilling was carried out by a track mounted CME55 drill rig owned and operated by Geo-Environmental Drilling. Geotechnical engineering staff from Hatch provided fulltime supervision of the field work and were tasked with directing drilling operations, confirming borehole locations, logging the soil samples retrieved from the boreholes, observing the changes in ground water levels and directing the boreholes backfilling operations. Borehole drilling was advanced using 206 mm outside diameter hollow stem augers. Representative samples of the soil strata penetrated were obtained during drilling, utilizing a 50 mm diameter split barrel sampler. The sampler was advanced by dropping a 63.5 kg (140 lbs.) hammer from a free-fall height of 760 mm, in accordance with the Standard Penetration test method (ASTM D1586).

2.4 Laboratory Testing

All soil samples retrieved from this geotechnical investigation were shipped to the Hatch Advanced Soil Laboratory in Niagara Falls, Ontario (a Canadian Council of Independent Laboratories (CCIL) certified laboratory) for detailed examination by the geotechnical engineer and completion of assigned laboratory testing on select samples.

Representative samples were selected for testing including moisture content, particle size distribution, Atterberg Limits, and specific gravity in accordance with the standards listed in Table 2-2. Laboratory test results are provided in the individual boreholes logs attached in Appendix B and enclosed in Appendix C.

Table 2-2: Standards Used for the 2019 Geotechnical Investigation

Name	Standard
Standard Test Methods for Laboratory Determination of Water Content of Soil and Rock by Mass	ASTM D2216
Standard Test Methods for Particle-Size Distribution of Soils using Sieve Analysis	ASTM D6913
Standard Test Method for Particle Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis	ASTM D7928
Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils	ASTM D4318
Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer	ASTM D854

3. Subsurface Conditions

The details of the advanced boreholes and pertinent laboratory testing results are presented on the individual borehole logs attached in Appendix B of this report. Appendix B also contains a set of explanatory notes detailing terminology used in the borehole logs.

In general, the subsurface conditions at all borehole locations consist of topsoil overlying silty sand to sandy silt fill underlain by native silt with clay to with various amounts of sand and clay extending to the borehole termination depths in BH21-S5 and BH21-07 and to bedrock in BH21-08.

3.1 Topsoil

Surficial topsoil was encountered in all three advanced boreholes and varied in thickness from 150 mm to 600 mm. The topsoil is primarily composed of sand and gravel with organics, rootlets, some silt and is dark brown and moist.

It should be noted that in our experience the thickness of topsoil could vary considerably in between and beyond borehole locations and thicker topsoil is normally expected in low-lying areas and around watercourses.

3.2 Sandy Silt to Silty Sand (FILL)

Fill was encountered in all three boreholes below the surficial topsoil. The fill thickness varied from 2.2 m to 3.0 m within the top of embankment boreholes (i.e., BH21-S5 and BH21-07) and approximately 4.0 m at the toe of embankment (BH21-08).

The fill consisted of predominantly cohesionless Sand and Gravel (BH21-08), and/or Silty Sand/Sandy Silt (BH21-S5 and BH21-07), some clay to clayey, brown and dry to moist.

SPT 'N' values in the fill materials were in the range from 10 to 30 blows per 0.6 m of penetration, corresponding to a compact relative density. SPT 'N' values in the silty sand/sandy silt fill materials were in the range from 6 to 31 blows per 0.6 m of penetration, corresponding to a loose to dense relative density. Water content of the fill samples ranged from 4 to 18 percent.

The grain size distribution results of two (2) selected samples are summarized in Table 3-1, and presented in Appendix B. The grain size distribution is as follows:

Gravel Sized Particles:	6 to 8%
Sand Sized Particles:	33 to 79%
Fine (Silt & Clay) Sized Particles:	15 to 59%

3.3 Clayey Silt to Silty Clay (CL-ML)

Beneath the fill layer, silt to silty Clay material was encountered in all three advanced boreholes. The clayey silt to silty clay layers extended to the termination depth of BH21-S5 and BH21-07 on power auger refusal and to the bedrock surface in BH21-08. SPT 'N' values within the native silt to clayey silt ranged from 7 to 23 blows per 0.3 m of penetration, corresponding to a firm to very stiff condition. Water content in this layer was between 15 and 21 percent. Atterberg's limits carried out on select samples within the deposit indicate low plasticity to non-plastic behavior.

The grain size distribution results of seven (7) selected samples are summarized in Table 3-1, and presented in Appendix C. The grain size distribution is as follows:

Gravel Sized Particles:	0 to 1%
Sand Sized Particles:	1 to 32%
Silt Sized Particles:	52 to 89%
Clay Sized Particles:	9 to 22%

Table 3-1: Particle Size Analysis Results

Borehole Number	Sample No.	Depth (m)	Particle Size Distribution [1]			
			Gravel (%)	Sand (%)	Silt (%) [2]	Clay (%) [2,3]
BH21-S5	3	1.5	0	4	78	18
BH21-S5	5	3.0	0	1	85	14
BH21-S5	7	4.6	0	2	89	9
BH21-S5	8	6.1	1	4	86	9
BH21-07	5	3.1	0	4	81	15
BH21-07	7	4.6	0	1	81	18
BH21-07	9	7.6	1	9	68	22
BH21-08	3	1.5	8	33	59	
BH21-08	5	3.1	6	79	15	
BH21-08	7	4.6	1	32	52	15

Notes:
1. Gravel, sand, silt, and clay are defined as granular particles ranging in size from 4.75 mm to 75 mm, 0.075 mm to <4.75 mm, 0.002 mm to <0.075 mm, and <0.002 mm.
2. The percentage of silt and clay particles present in the soil samples was determined by a hydrometer test.
3. The presence of clay-sized particles is not an indication of clay=type soil being present, just soil particles that are smaller than the upper limit (0.002 mm) used to characterize clay-sized particles.

Atterberg Limits tests conducted on nine (9) selected samples are summarized in Table 3-2, and presented in Appendix C. Three samples were found to be non-plastic. The results of the completed tests are as follows:

Liquid Limit:	20 to 29%
Plastic Limit:	16 to 18%
Plasticity Index:	7 to 11%

Table 3-2: Atterberg Limits and Natural Moisture Content Test Results

Borehole Number	Sample No.	Depth	Atterberg Limits			Natural Water Content
			Liquid Limit	Plastic Limit	Plasticity Index [1,2]	
		m	%	%	%	%
BH21-S5	3	1.5 – 2.1	27	16	11	18
BH21-S5	5	3.1 – 3.7	28	18	9	17
BH21-S5	7	4.6 – 5.2	20	Non-plastic		15
BH21-S5	8	6.1 – 6.7	25	16	9	17
BH21-07	3	1.5 – 2.1	22	Non-plastic		11
BH21-07	5	3.1 – 3.7	25	18	7	17
BH21-07	7	4.6 – 5.2	24	16	7	21
BH21-07	9	7.6 – 8.2	29	18	11	23
BH21-08	7	4.6 – 5.2	28	Non-plastic		22

Notes:
1. The plasticity index (I_p) is the difference between the liquid limit and the plastic limit.
2. I_p values of less than about 12 can be considered of low plasticity and not meeting the characteristics typical of a clay bearing soil.

3.4 Groundwater Observations

Wet soil conditions (wet sampler) were observed in BH21-07 at a depth of 5.0 mbgs. No standing water was observed in the open boreholes at the termination of drilling all boreholes. No monitoring well was installed as part of the investigation program. Groundwater monitoring wells were installed in boreholes to the east of the TRCA regulated lands, as shown on Figure A-1.

The groundwater observations within these wells are presented in Table 3-3.

Table 3-3: Groundwater Monitoring Well Installation Summary

Borehole Number	Easting (m)	Northing (m)	Ground Surface Elevation (masl)	Groundwater Level (mbgs)	Groundwater Elevation (masl)
BH21-S3	622,255.1	4,831,459.0	86.9	1.7	85.2
BH21-S4	622,309.1	4,831,448.5	87.0	7.7	79.2
BH21-S6	622,266.7	4,831,361.7	85.4	9.1	76.2

It should be noted that groundwater levels are subject to seasonal variations and may be impacted by significant weather events. Seepage and perched water conditions, particularly during excavation operations, could also exist in the permeable soil layers.

3.5 Toe Erosion Consideration

An estimate of the rate of erosion of the shoreline along the south bank of Mimico Creek has been provided by Water's Edge - Fluvial Geomorphology and Meander Beltwidth Assessment (Appendix J of the EPR). The estimate indicates that erosion at the toe of the slope, along the inside bend of Mimico Creek to the east of the existing retaining wall, will be approximately 5.1 to 6.9 m per 100 years where no erosion protection measures are provided (Table 6, Appendix J of this EPR). The extent of the estimated potential toe erosion is illustrated on Figures D-1 and D-2. The extent of the potential estimated toe erosion, extending to the southwest, is parallel to the existing retaining wall. The estimated extent of potential toe erosion assumes the existing retaining wall will not be sufficient to resist active erosion induced by Mimico Creek. The estimated proposed toe erosion is shown on Figures D-3 and D-4, but not on Figure D-8 and D-9, which illustrate the slip surfaces as 1) the indicated toe erosion would obscure the slope stability results, and 2) it is assumed that as the toe erosion progresses even a few metres, the slope would likely fail, assuming the absence of the existing retaining wall.

Water Edge's report notes that the creek's erosion rate is negligible where erosion measures, in the form of the concrete retaining wall and gabion baskets, are applied. The negligible erosion rate assumes the erosion protection measures are placed on solid foundations and maintained indefinitely.

Although the measurement points that Water's Edge used in their assessment are located at the inside bend of Mimico Creek, the rate of erosion and the location of the estimated erosion does provide insight into how the exiting retaining wall could be affected. The following has been concluded based on the findings of the Water's Edge Report:

- Erosion will occur upstream of the eastern end of the creek where no erosion protection measures are applied;
- The wall height is sufficient to protect the slope above the wall during high flow (100 year flood) events (Water's Edge, 2021);
- No information is available regarding the construction of the existing wall. Scour protection measures at the base of the wall should be checked prior to relying on the wall for long term protection of the embankment slopes; and
- Metrolinx has noted that the Mimico Creek Bridge including the associated retaining wall and erosion protection structures are inspected annually.

4. Slope Stability Assessment

4.1 General

An adequate factor of safety (FS) against slope instability must be achieved for the embankment side slopes when considering the proposed construction of a passenger platform along the northern side of the embankment. The proposed passenger platform will be approximately 5 m wide with the exception of a wider platform area adjacent to the western end of the proposed GO Station (Figure D-1). The wider portion of the platform is discussed further in Section 5.0. In this regard, a design objective FS of 1.5 for the long-term condition have been selected in accordance with accepted design requirements. This objective FS is consistent with the minimum acceptable TRCA design value.

The commercially available computer program, SLOPE/W (GeoStudio 2019) from GEO-SLOPE International Ltd., was used to perform the slope stability assessment. The slope assessment was based on the following inputs to develop the model used in Slope/W:

- Slope geometry taken from available topographic survey data for the site;
- Material types identified in the geotechnical boreholes advanced within the TRCA regulated lands (BH21-07, 08, and S5);
- Engineering parameters of the subsurface soils from the soil descriptions, in-situ testing, and laboratory index testing; and
- Groundwater conditions based on engineering experience and judgement.

4.2 Purpose

The purpose of the slope stability assessment is to determine the impact of the proposed GO Station development on the existing TRCA regulated lands north of the existing rail embankment and to establish the long-term stable top of slope (LTSTOS) with regards to both slope stability and erosion considerations. The assessment also aims to determine the linear length of slope that requires improvement to support the proposed construction of a passenger platform along the north side of the existing rail tracks.

The primary concern with regards to the stability of the TRCA regulated lands along Mimico Creek are twofold:

- Based on discussion with TRCA staff, the retaining wall at the base at the eastern extent of the slope cannot be relied upon in its current configuration over the long-term life of the project; and
- Geomorphological erosion of the TRCA regulated lands due to the existing alignment of Mimico Creek, estimated at approximately 5 to 7 m per 100 years (Water's Edge, 2021).

4.3 Long-Term Stable Top of Slope

The LTSTOS is defined as the location of the head scarp of the slip surface with an FS ≥ 1.5. For the purposes of this assessment, the following two methods were used to determine the most conservative estimate for the LTSTOS for a given slope section:

- Graphical method for:
  - i) Layout the 100 year toe erosion zone to determine the LTSTOS, which is taken as 7 m from the edge of Mimico Creek, or where the erosion zone intersects bedrock;
  - ii) From the stable toe of slope determined in Step i), measure a slope angle of 1.4:1 in bedrock and 1.8:1 in soil. Where both soil and rock are present, a 1.4:1 slope to the top of the bedrock surface is measured; from the estimated top of the 1.4:1 rock slope, a slope of 1.8:1 is measured so that it projects to the ground surface; and
  - iii) The projection of the slope, determined as per Step ii), is taken as the LTSTOS, as shown on Figures 4-1 and 4-2.

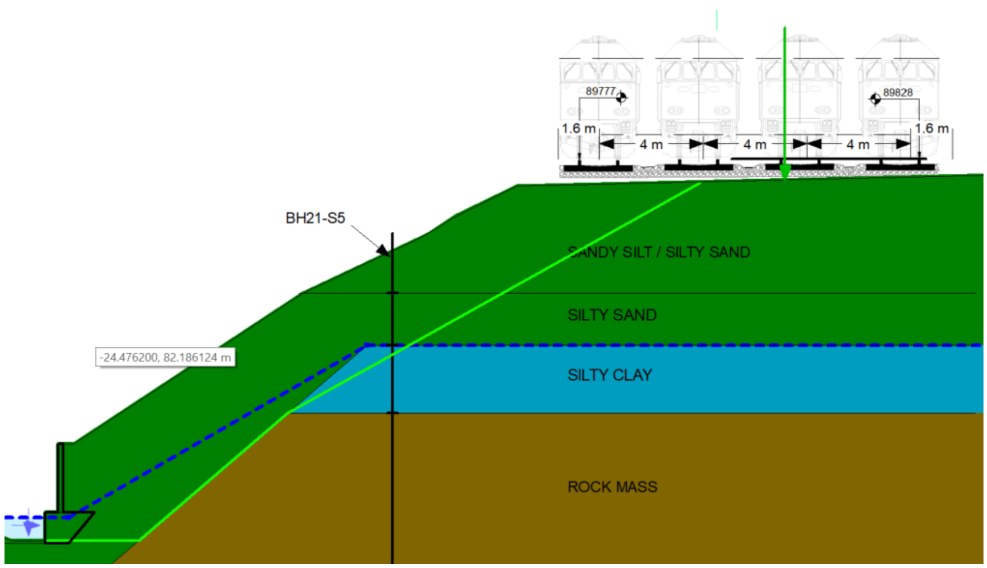


Figure 4-1: Estimated LTSTOS for Section A-A' based on the Graphical Method with the Vertical Arrow Indicating the LTSTOS based on the Slope Stability Model

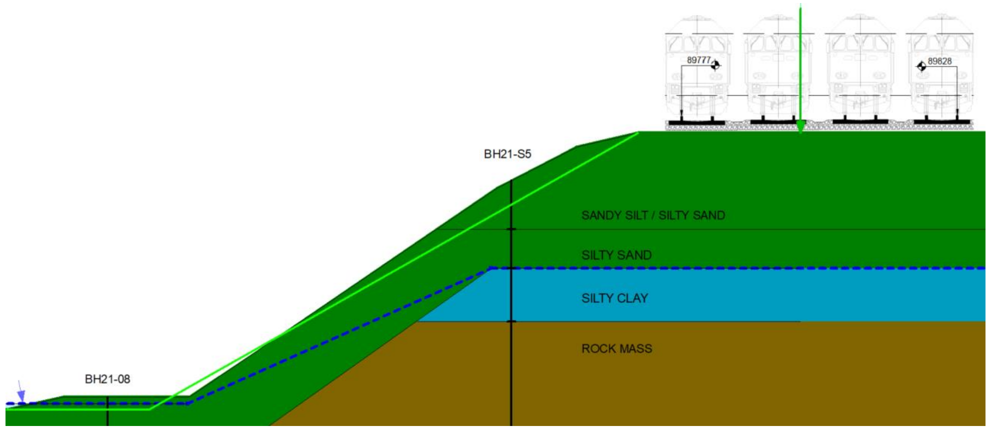


Figure 4-2: Estimated LTSTOS for Section B-B' based on the Graphical Method with the Vertical Arrow Indicating the LTSTOS based on the Slope Stability Model

- Slope Stability Model

  i) The slope stability of the slope is assessed using the limit equilibrium (LE) method, as described in Section 4.5;

  ii) Slip surfaces ranging from 1.0 ≤ FS ≤ 1.5 are assessed by plotting the full range on the cross section, with the critical slip surface (lowest FS) shown with a bold, white line; and

  iii) The slip surface that has a surface projection the furthest back from the slip surface head scarp, as determined by the results of Step ii), is taken as the LTSTOS, as shown on Figures 4-1 and 4-2.

4.4 Existing Slope Condition

The location of Mimico Creek in relation to the adjacent infrastructure is shown on Figure A-1. The slope surfaces are generally vegetated and covered by trees, bushes, and grass. The toe of the north embankment slope is susceptible to erosion by Mimico Creek. The ongoing erosion has led to the construction of a concrete retaining wall to the east of the Park Lawn Bridge along the southern bank of Mimico Creek to protect the embankment and the eastern abutment of the existing Mimico Creek bridge. Additional slope reinforcement has been placed further to the east of the existing retaining wall in the form of a gabion basket wall and armor stone revetment to support the slope where historical instability has been observed (Beacon Environmental Limited, 2017). The erosion mitigation measures have been documented by Water's Edge (Appendix J of this EPR).

Evidence of existing slope instabilities, such as exposed roots, leaning vegetation, and slope repair works, were noted during the field investigation site visits (as noted in Appendix J of this EPR).

4.5 Methodology

The stability of the railway embankment was carried out using the commercially available limit equilibrium software Slope/W.

The Morgenstern-Price method was used to assess the stability of the slopes as it balances both the force and moment of the sliding surfaces being assessed. The slope assessment was based on the following inputs to develop the model used in Slope/W:

- Slope geometry taken from available topographic survey data for the site;
- Material types identified in the geotechnical boreholes advanced within the railway embankment and the TRCA regulated area (BH21-07, S5, and 08) as discussed in Section 3 of this report;
- Engineering parameters of the subsurface soils from the soil descriptions, in-situ testing, and laboratory index testing as discussed in Section 4.7 of this report;
- Groundwater conditions based on site investigation findings, engineering experience and judgement; and
- The existing slope inclination ranges from 1.5 horizontal to 1 vertical (1.5H:1V) at the western limits of the site, i.e., east of the Mimico Creek bridge abutment, to flatter than 2.5H:1V at the eastern limits of the site west of Park Lawn Road.

4.6 Slope Geometry

The existing conditions at the TRCA regulated lands, as described above and indicated on Figure 1-1, were taken from the available topographic survey data received on February 23, 2021, as shown on Figure D-1. The latest topographic survey provides coverage of not only the existing rail tracks, but also extends to the north to provide topographic data for the remainder of the slopes, the retaining wall at the base of the slope and the creek channel. The data also provides further detail of the eastern portion of the slope where there is a flat lying area between the slope and the creek.

Three cross sections were selected for analysis at the locations shown on Figure D-1. The cross sections, were imported into Slope/W so that the slope could be used to develop the geometry for each section. The slope geometry was smoothed out to simplify the geometry so that the geometry would not cause irregularities with the slope stability assessment of each section.

The slope stability model geometry, for the existing conditions, is shown on Figures D-3 to D-5.

4.7 Material Parameters

The material parameters for the subsurface soil conditions at the site were developed based on the following:

- Soil classification during drilling;
- In-situ SPT data;
- Laboratory Testing of representative soil samples; and
- Correlations between soil index testing and SPT data to other index values and shear strength.

The material parameters used for this assessment are summarized in Table 4-1.

Table 4-1: Summary of Materials and Material Parameters

Material	Soil Description Summary	SPT N Value [1]	Unit Weight [2]	Cohesion [3,4]	Friction Angle [3,4]
		N	γ	c'	ϕ
		blows/0.3 m	kN/m³	kPa	
Fill	Sandy Silt to Silty Sand, trace gravel	8 to 19	20	0	34
Silt	Silt to Silty Clay	10 to 31	17	3	30
Rock Mass	Shale	n/a	23	100	35

NOTES:

1. Energy corrected SPT blow counts, N_{60} (assumed that SPT driving method had energy efficiency of 60%) were used to assess the shear strength of the in-situ soil conditions.
2. Saturated unit weight for each material were assessed using N_{60}, but final values were selected using engineering experience and judgement.
3. The selected shear strength values for cohesionless and cohesive soils are approximately the average minus one standard deviation of N_{60}, with final values selected based on engineering experience and judgement.
4. The shear strength for the Rock Mass were estimated based on local engineering experience and judgement with similar rock mass conditions in the area surrounding the site.

4.8 Proposed GO Station Platforms

4.8.1 Purpose

The proposed construction of the passenger platform, which is shown on each of the Slope/W sections to the left of the indicated train alignments, is approximately 5 m in width. The proposed platform can be seen to overhang the crest of the slope in Sections 0+034 (A-A') and 0+086 (B-B'), which will require the construction of a retaining wall to support the embankment widening and potentially assist in mitigating any slope stability issues.

4.8.2 Support and Mitigation Concept

The concept for supporting the proposed passenger platform, and mitigating the hazard of the slope instability, is to construct a rigid retaining wall that would provide the following:

- Wall will be constructed using top-down construction as no construction at the toe of the slope was given as a constraint;
- Wall is assumed to be rigid,
- Embedment into bedrock to provide resistance to lateral movement from the retained soils, platform loads, and the existing Metrolinx rail alignments:
  - Unmitigated LTSTOS is located within the existing Metrolinx rail alignments, which results in the rail loads also be carried by the proposed retaining wall;
- Structural independence from any lateral support from the soil downslope of the wall and retained by the existing retaining wall; and
- Support of the proposed passenger platform by providing suitable bearing capacity for construction of a slab-on-grade.

The slope stability model geometry, for the proposed construction, is shown on Figures D-6 to D-7.

4.9 Groundwater Conditions

The groundwater table is assumed to be approximately level with the creek water level past the toe of the slope. Within the embankment area, the groundwater level was assumed at a depth of 5.0 m, consistent with investigation observations, site conditions (elevation of Park Lawn Road) to the east, and other investigations in the vicinity of the site (see Figure A-1).

4.10 Slope Stability Results

4.10.1 Existing Conditions

The slope stability results for the existing conditions for each of the three sections considered are shown on Figures D-8 to D-13, summarized below, and in Table 4-2. The sliding surface shown in white is the critical sliding surface representing the lowest FS. Stable top of slope is taken as either the surface expression of the critical sliding surface at the top of the slope when it has a FS ≥ 1.5 or other sliding surface when the critical sliding surface has a FS < 1.5, as is the case for Section 0+086. The potential erosion due to the 100 year erosion rate is indicated on Figures D-3 and D-4, as well as Figures D-8 and D-9, by the black hatched areas at the toe of each slope. The following are summaries of the results for each of the three sections:

Section 0+034 (A-A'): Figure D-8 illustrates slip surfaces ranging from 1.0 ≤ FS ≤ 1.5. Results for the existing slope conditions indicate that the slope has an FS ≅ 1.0, shown on Figure D-8, which is lower than the industry accepted minimum FS of 1.5 for slope stability. The LTSTOS is taken as the slip surface that has a surface projection the furthest from the crest of the slope, as indicated on Figure D-8 by the vertical green arrow. A minimum set-back of 5 m is indicated by the vertical red arrow, which is a further allowance for the potential toe erosion due to Mimico Creek.

Section 0+086 (B-B'): Figure D-9 illustrates slip surfaces ranging from 1.0 ≤ FS ≤ 1.5. Results for the existing slope conditions indicate that the slope has an FS ≅ 1.0, shown on Figure D-9, which is lower than the industry accepted minimum FS of 1.5 for slope stability. The LTSTOS is taken as the slip surface that has a surface projection the furthest from the crest of the slope, as indicated on Figure D-9 by the vertical green arrow. A minimum set-back of 5 m is indicated by the vertical red arrow, which is a further allowance for the potential toe erosion due to Mimico Creek; it is provided for reference purposes only given that Mimico Creek is not expected to affect this section of the slope.

Section 0+125 (C-C'): The stability assessment indicates that the slope has a FS greater than 1.5 as shown on Figure D-10. The stable top of slope considering the estimated FS = 1.9, which is located at the crest of the slope, as indicated by the vertical green arrow on Figure D-10.

The LTSTOS was assessed based the methodology summarized in Section 4.3. The assessment of the LTSTOS for Sections 0+034 and 0+086 resulted in the limited equilibrium method being the most conservative approach to determining the LTSTOS, as indicated on Figures D-8 and D-9. The vertical green arrows, shown on Figures D-8 to D-10 indicated the location of the LTSTOS for the existing conditions. The mitigated LTSTOS is taken as the face of the proposed retaining wall in Figures D-11 and D-12, with the LTSTOS for the existing conditions not changing for Section C-C'.

Table 4-2: Stability Assessment Results

Section	Figure	Approximate Slope Inclination	Minimum FS [1]	Long Term Slope Stability [5]	
				Toe	Crest
			ratio	m	m
0+034 (A-A')	Figure D-8	33	1.0 [2]	4 [6i]	10
0+086 (B-B')	Figure D-9	34	1.0 [2]	7 [6ii]	8
0+0125 (C-C')	Figure D-10	20	3.1 [3]	-2 [6iii]	0
General Site Conditions	Figure D-13	32	1.6 [3]	0 [6iv]	7
0+034 (A-A')	Figure D-11	33	2.2 [4]	0 [7]	9 [8]
0+086 (B-B')	Figure D-12	34	2.5 [4]	0 [7]	11 [8]

NOTES:

1. The minimum FS is based on a minimum slip surface thickness of 1.0 m, based on the entry and exit ranges (thick re lines with solid circles) shown on the slope stability assessment figures.
2. Minimum FS values are truncated at FS = 1.0 as the range of slip surfaces illustrated on Figures D-8 and D-9 is 1.0 ≤ FS ≤ 1.5.
3. The referenced FS values are for the slip surfaces with the lowest FS values.
4. Minimum FS values are based on:
   i) Retaining wall embedment 1.0 m into bedrock, which will be assessed during detailed design and could be required to be deeper
   ii) The presence of bedrock along Sections A-A' and B-B' is at about 80 masl
5. The long-term stable toe and top of the slopes is based on Method 2 as described in Section 4.3.
6. The long-term stable toe of the slope is:
   i) governed by the presence of bedrock along Section A-A.
   ii) governed by the offset distance of Mimico Creek from the existing toe of slope, which results in the estimated toe erosion being the maximum estimated value for the 100 year erosion rate.
   iii) estimated to be downslope of the existing toe as illustrated on Figure D-10.
   iv) constrained to the toe of the existing slope in order to characterize the general stability of the slope not impacted by erosion of Mimico Creek.
7. The long-term stable top of the slopes is assumed to be the south bank of Mimico Creek.
8. The LTSTOS is measured from the face of the proposed retaining wall.

Based on the preceding summaries, a rigid retaining wall is proposed along the western end of the site (Station 0+034 to 0+086) to: create the required platform space at the top of the existing slope; provide lateral support to the platforms and existing Metrolinx rail alignments; reinforce the slope (i.e. increase FS); and provide long-term protection for the proposed GO Station development without affecting the existing erosion protection system of the creek.

4.10.2 Proposed Retaining Wall

The slope stability results for Sections 0+034 and 0+086 indicate additional support and mitigation are required to improve stability. The critical sliding surfaces for each of the two sections have a FS > 2, as shown on Figures D-11 and D-12.

Sliding surfaces with a FS ≤ 1.5, if any, would be downslope of the rigid retaining wall, which would not affect the stability of the proposed passenger platform, as discussed in Section 5.

5. Discussion

5.1 Existing Conditions

The existing conditions used for the slope stability assessment, as shown on the figures referenced above, is based on: available information; observations of the site based on previous reports; site visits by Hatch field staff; and engineering experience and judgement. The existing slope conditions are shown on photos in Appendix E. The design requirements for the proposed construction, relating to the slopes, as illustrated for the existing conditions in the slope stability assessment, are based on TRCA requirements (TRCA, 2007). The assessment described above and discussed in this Section are aimed towards meeting the requirements of TRCA (TRCA, 2007).

5.2 Reliance on Existing Retaining Wall

5.2.1 Existing Condition

The existing retaining wall at the toe of the western extent of the railway embankment was repaired in 2017; however, it cannot be relied upon to support the slope over the design life of the proposed construction of the GO Station passenger platform. The retaining wall, as discussed below, is susceptible to scour and erosion due to the water flowing in Mimico Creek. As such, the existing retaining wall, in its current configuration, which is assumed to be a cast-in-place cantilevered wall with no tie-back anchors, is ignored when assessing the slope stability of the proposed station platform.

The existing retaining wall is intended to stabilize the railway embankment and the Mimico Creek rail bridge west of the west end of the proposed GO Station platform. Hatch understands that as part of Metrolinx's rail operations, maintenance and obligations under Transport Canada, the Mimico Creek Bridge and adjacent banks are inspected annually. The tracks are also inspected at least twice a week. Although these inspections are not specific to the creek embankments, any erosion or other issues are reported.

5.2.2 Potential Failure Mechanisms

The potential failure mechanisms for the existing retaining wall are directly related to the conclusions drawn from the Fluvial Geomorphology and Meander Beltwidth Assessment (Appendix J of this EPR). The failure mechanisms can be described as:

- Bearing capacity failure due to the loss of foundation soils due to erosion;
- Overturning of the wall due to scour and erosion of the retaining wall's foundation soils; and
- Sliding due to the loss of support provided by the weight of soil on the assumed cantilevered portion of the retaining wall, which is provided by the soil directly behind the wall.

These potential failure mechanisms lead to the assumption that the existing retaining wall cannot be relied upon to provide support for the station platform. It should be noted that any failure of the existing retaining wall would lead to detrimental impacts to the stability of the station platform and railway embankment. This is the driving factor in proposing the use of a retaining wall to support the proposed passenger platform.

5.2.3 Impact of Loss of Existing Wall on Proposed GO Station Platform

The loss of the existing retaining wall on the proposed GO Station development is expected to be negligible, as the proposed retaining wall will be designed to be independent of any support of the slope retained by the existing retaining wall. The loss of the existing retaining wall would likely lead to a failure mass entering the waterway of Mimico Creek, but there would be no impact on the stability of the proposed rigid retaining wall and the proposed passenger platform.

5.3 Proposed Construction of the Passenger Platform

The proposed passenger platform would be constructed along the northern edge of the existing rail alignment and be approximately 5 m wide along the majority of its length. A wider platform is proposed adjacent to the proposed GO Station as indicated on Figure D-1 where the proposed station footprint intersects Section C-C'. Although this wider platform section was not considered in the slope stability assessment discussed above, the adjacent embankment slopes can be regraded to accommodate the wider platform as the existing slope in this area is inclined at approximately 2.75H:1V. Regrading can be completed to accommodate the wider platform and provide a slope angle of no more than 1.8H:1V, which is the assessed stable slope angle to accommodate a suitable LTSTOS.

5.4 Proposed Construction of the Rigid Retaining Wall

5.4.1 Design Requirements

The following design requirements should be considered in the design of the proposed retaining wall:

- Independence of the wall from lateral support from the soil retained by the existing retaining wall (i.e. no passive resistance generated by soil downslope of the proposed retaining wall);
- The live and dead loading effects from the construction of the proposed passenger platform and the existing Metrolinx rail alignments will be carried by the proposed retaining wall, which will be designed as a non-yielding wall; and
- Embedment of the wall into the rock mass to a depth that will provide an adequate level of overturning resistance.

The slope stability assessment assumed a nominal embedment depth of one metre; however, this does not indicate in any way what the minimum embedment depth should be, as discussed below.

The proposed retaining wall structure will utilize top-down construction methodology (i.e., caisson wall or similar), which is independent of the groundwater elevation. Tunnels and below ground structures will be constructed with waterproofing as necessary to limit ingress of groundwater into the structures.

5.4.2 Applicability of Slope Stability Assessment to Proposed Wall Design

The rigid retaining wall considered for the slope stability assessment utilizes material properties that will not allow a sliding surface to form that goes through the wall. This then pushes the critical sliding surface to form below the base of the wall, which requires the critical sliding surface to pass through the rock mass.

The Limit Equilibrium Method (LEM) does not estimate any deformations that would be required to assess the design of the proposed rigid retaining wall. The lack of deformations with the LEM then treats the proposed wall as a perfectly rigid element in the model, which meets the design requirements discussed in the preceding section.

This assessment is based upon the 10 percent design for the EA. Development of the retaining wall design will be progressed as part of the detailed design of the GO Station.

The proposed retaining wall will be embedded into the rock mass underlying the existing soil embankment. Even when considering the 100 year erosion rate along Mimico Creek, the rock mass will not be exposed by the anticipated erosion during the design life of the proposed retaining wall – 75 years. This assumes that the existing retaining wall cannot be relied on for erosion mitigation. In the unlikely event that bedrock is exposed due to erosion during the design life of the proposed retaining wall, the rock mass consists of shale, which is moderately resistant to erosion. Undermining of the proposed retaining wall, which will be embedded to the rock mass to resist overturning and sliding, is considered to have a very low probability of occurrence.

5.5 Maintenance and Monitoring

The proposed new retaining wall and infrastructure ownership would be conveyed to Metrolinx once the new structures are commissioned. The long-term operation, surveillance, and maintenance of the new structures will be the responsibility of Metrolinx.

Site grading should be designed to divert all surface run-off away from the existing tracks, for example by land drainage ditch, and to reduce the saturation of the foundation materials. If the installation of ditch is not feasible due to land constraints, a design for subsoil drainage should be considered.

Vegetation cover and tree roots on the existing slopes should be maintained in order to minimize soil erosion at the slope surface. Where vegetation cover cannot be maintained, the vegetation should be reinstated or alternate erosion protection provided to resist the erosional forces induced by surface water runoff over the slope surfaces. Where slopes will be disturbed, the slopes should be regraded to a maximum angle that will reduce the likelihood of erosion on the slopes.

Positive surface drainage should be provided to collect surface run-off and divert water away from the Site. Any standing water, ponding and saturated soil conditions should be avoided to minimize the risk of embankment settlement.

The surface water collected on the constructed surfaces at the top of the existing embankment should be directed to the local stormwater conveyance system, within the property of the north station building, or within the 2150 Lake Shore Development, to be confirmed during detailed design. This could require the need for a detention system to attenuate the additional flow to the stormwater conveyance system.

The preceding recommendations should be followed for where the pavilion and elevator/stairs, as well as the sloped walkway will be constructed at the west end of the proposed new passenger platform. This includes during and post-construction. Any ground disturbance should be protected with erosion and sediment control mitigation measures. Where disturbed ground will be reinstated as a soil slope adequate vegetation should be reinstated to promote slope stability. Recommendations for types and amount of vegetation will be provided and reviewed by agencies as required at detailed design.

Hatch understands the following will be carried out, at a minimum, for operations, maintenance and surveillance of the proposed retaining wall and associated infrastructure:

- Metrolinx is committed to protecting infrastructure supporting rail operations;
- Metrolinx observes the condition of the toe wall at Mimico Creek on route to the annual bridge inspection of the rail carrying bridge and wingwalls;
- Any imminent failures would be reported and repair options assessed;
- An inspection report for the retaining wall structures at Mimico Creek is completed on a five year cycle; and
- If observations during the five year inspection reports point to maintenance or repairs, Metrolinx will assess best methods to stabilize the retaining wall and/or slope.

6. References

Beacon Environmental Limited. (2017). *Mimico Creek Conceptual Design GO Transit Oakville Mile 5.94. .* Prepared for the City of Toronto. Document No. 217212. .

PoO. (2001). *Understanding Natural Hazards. Published by the Province of Ontario as part of the OMNT Collection. ISBN 0-7794-1008-4.* Published by the Province of Ontario as part of the OMNT Collection.

TRCA. (2007). *Geotechnical Engineering Design and Submission Requirements.* Published by the Toronto and Region Conservation Authority.

Water's Edge. (2021). *Park Lawn GO Fluvial Geomorphic and Meander Beltwidth Assessment Draft Report.* Prepared for Hatch, 2800 Speakman Drive, Mississauga, ON. Document No. WE 20030. .

7. Closure and Limitations

This Report has been prepared by Hatch Ltd. (“Hatch”) for the sole and exclusive benefit of the Developer (the “Client”) in accordance with the agreement between Hatch and Client. This Report shall not be relied upon by any other party without the prior written consent of Hatch.

Any use of this report by the Client is subject to the terms and conditions provided in the agreement between Hatch and Client including the limitations on liability set out therein. Without limiting the foregoing, Hatch explicitly disclaims all responsibility for losses, claims, expenses or damages, if any, suffered by a third party as a result of any reliance on this Report, including for any decisions made or actions made by such a third party and based on this Report (“Claims”), and such third party’s use or review of the Report shall constitute its agreement to waive all such Claims and release Hatch in respect thereof.

This report is meant to be read in full, and sections should not be read or relied upon out of context. While it is believed that the information contained herein is reliable under the conditions and subject to the limitations set forth herein, this Report is based in part on information not within the control of Hatch and Hatch therefore cannot and does not guarantee the accuracy of such information based in whole or in part on information not within the control of Hatch. The comments in it reflect Hatch’s professional judgment in light of the information available to it at the time of preparation.

This report contains the expression of the professional opinion of Hatch exercising reasonable care, skill and judgment and based upon information available at the time of preparation. Hatch has conducted this investigation in accordance with the methodology outlined herein. It is important to note that the methods of evaluation employed, while aimed at minimizing the risk of unidentified problems, cannot guarantee their absence. The quality of the information, conclusions and estimates contained herein is consistent with the intended level of accuracy as set out in this report, as well as the circumstances and constraints under which this report was prepared.

Appendix A

Site Plan and Borehole Location Plan

Notes:

1. Borehole locations are approximate and will be confirmed based on final structure locations, presence of underground utilities and site access restrictions.
2. Access to borehole locations will be from approved Access Areas/Routes shown on drawing. No crossing of the tracks is anticipated to complete the work.
3. Each borehole location is expected to be in 3 m x 3m to allow for the drill rig and work area in the vicinity of each borehole location. Approximate clearances to the nearest track are provided in the work plan.
4. Muster areas will be the same as Access/Staging areas identified in the drawing depending on the work location. Muster points for each work day to confirmed in the morning safety briefing.
5. Identified Metrolinx right-of-way property limits are approximate and should be confirmed by the property owner.
6. No removal of fencing, vegetation or regrading are required to complete the work. Revisions to the work plan may be required once approval to complete a site visit is granted.
7. Erosion and Sediment Control (ESC) measures will be implemented prior to, and maintained during the drilling program, to prevent entry of sediment into the water. All damaged erosion and sediment control measures should be repaired and/or replaced within 48 hours of the inspection.
8. Disturbed areas will be minimized to the extent possible, and temporarily or permanently stabilized or restored as the work progresses.
9. The erosion and sediment control strategies outlined on the plans are not static and may need to be upgraded/amended as site conditions change to minimize sediment laden runoff from leaving the work areas. If the prescribed measures on the plans are not effective in preventing the release of a deleterious substance, including sediment, then alternative measures must be implemented immediately to minimize potential ecological impacts. TRCA Enforcement Officer should be immediately contacted. Additional ESC measures to be kept on site and used as necessary.
10. An Environmental Monitor will attend the site to inspect all new controls, as well as on a regular basis, or following rain/snowmelt event, to monitor all works, and in particular works related to erosion and sediment controls, dewatering or unwatering, restoration and in- or near- water works. Should concerns arise on site the Environmental Monitor will contact the TRCA Enforcement Officer as well as the proponent.
11. All activities, including maintenance procedures, will be controlled to prevent the entry of petroleum products, debris, rubble, concrete or other deleterious substances into the water. Vehicular refueling and maintenance will be conducted a minimum of 30 metres from the water.
12. All grades within the Regulatory Flood Plain will be maintained or matched.
13. The proponent/contractor shall monitor the weather several days in advance of the onset of the project to ensure that the works will be conducted during favourable weather conditions. Should an unexpected storm arise, the contractor will remove all unfixed items from the Regional Storm Flood Plain that would have the potential to cause a spill or an obstruction to flow, e.g., fuel tanks, porta- potties, machinery, equipment, construction materials, etc.
14. All dewatering/unwatering shall be treated and released to the environment at least 30 metres from a watercourse or wetland and allowed to drain through a well-vegetated area. No dewatering effluent shall be sent directly to any watercourse, wetland or forest, or allowed to drain onto disturbed soils within the work area. These control measures shall be monitored for effectiveness and maintained or revised to meet the objective of preventing the release of sediment laden water.

Borehole No.	Coordinates		Ground Surface Elevation (masl)
	Easting (m)	Northing (m)	
BH21-S5	622147.5	4831322.0	87.05
BH21-07	622166.9	4831349.3	87.12
BH21-08	622126.0	4831332.3	79.48

Monitoring Well No.	Coordinates	
	Easting (m)	Northing (m)
MW21-S3	622255.1	4831459.0
MW21-S4	622309.1	4831448.5
MW21-S6	622266.7	4831361.7

Legend:

BHXX-XX Borehole Location

MW21-XX Monitoring Well Location

Mile 5.64-5.88 Oakville Subdivision

FCR(Park Lawn) LP

Park Lawn Road, Toronto, ON

Park Lawn GO Station - Borehole Location Plan for Slope Stability Assessment

Figure No. A-1

HATCH

Appendix B

Borehole Logs

BASIS FOR SOIL DESCRIPTION

(Based on ASTM D 2488-17, with modifications)

UNIFIED CLASSIFICATION (in order of description)

Soil Name (BLOCK LETTERS);
Plasticity or grading characteristics for major components,
Plasticity or grading characteristics for secondary components,
Colour of soil,
Other minor components - name, plasticity or particle characteristics and colour,
Moisture conditions,
Consistency,
Structure, and
Additional observations such as ORIGIN or other significant features not relating to the composition, condition or structure of the soil.
The terms used in the unified classification are described below:

PARTICLE SIZE DISTRIBUTION

Clay	Silt	Sand			Gravel		Cobble	Boulder
		Fine	Medium	Coarse	Fine	Coarse		

0.002m 0.075m 4.75mm 75mm 300mm

CLASSIFICATION OF SOILS

The Classification of soils is based on particle size distribution and plasticity, in general accordance with ASTM D 2488 - 17 Standard Practice for Description and Identification of Soils

SOIL NAME

The Soil Name is based on the grain size characteristics and plasticity. As most soils are a combination of a range of constituents, the primary soil is described and modified by minor components, as follows:

Coarse Grained Soil (<50% Clay and Silt content)		Fine Grained Soil (>50% Clay and Silt content)	
% Fines	**Modifier**	**% Fines**	**Modifier**
≤ 5%	Omit, or use “trace”	≤ 15%	Omit, or use “trace”
> 5% ≤ 15%	Describe as ‘with clay/silt’ as applicable	> 15% ≤ 30%	Describe as ‘with sand/gravel’ as applicable
> 15%	Prefix soil as ‘silty/clayey’ as applicable	> 30%	Prefix soil as ‘sandy/gravelly’ as applicable

PLASTICITY

Plasticity of clay and silt, both alone and in mixtures with coarser material, are described as:

Descriptive Term	Range of Liquid Limit	Field Guide to Plasticity
Of low plasticity	≤ 35%	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit
Of medium plasticity	> 35% ≤ 50 %	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit
Of high plasticity	>50%	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

GRADING CHARACTERISTICS

For coarse grained soils only, grading is described as follows:

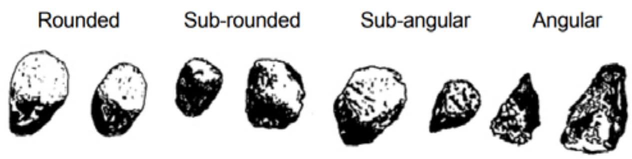
Descriptive Term	Characteristics
Well Graded	Having good representation of all particle sizes
Poorly Graded	With one or more intermediate sizes poorly represented
Gap Graded	With one or more intermediate sizes absent
Uniform	Essentially of one size

BASIS FOR SOIL DESCRIPTION

(Based on ASTM D 2488-17, with modifications)

PARTICLE SHAPE

The particle shape of equidimensional particles may be described as 'rounded', 'sub-rounded', 'sub-angular' or 'angular' as shown in the sketches overleaf. Two-dimensional particles with the third dimension small by comparison may be described as 'flaky' or 'platy'. One-dimensional particles with the other two dimensions small by comparison may be described as 'elongated'



COLOUR

The soil colour is described for soil in the 'moist' condition, using simple terms such as **'black', 'white', 'grey', 'brown', 'red', 'orange', 'yellow', 'green'** or **'blue'**. These may be modified as necessary by **'pale', 'dark'** or **'mottled'**. Borderline colours may be described as red-brown. Where a soil colour consists of a primary colour with a secondary mottling it should be described as: **(primary colour)** mottled **(secondary colour)**, eg. **grey** mottled **red-brown** clay.

MOISTURE CONDITION

Descriptive Term	General	Granular Soil	Cohesive Soil
Dry' (D)		Cohesionless and free running	Hard and friable or powdery, well dry of plastic limit
'Moist' (M)	Soil feels cool, darkened in colour	Particles tend to cohere	Soil may be moulded by hand
'Wet' (W)		Soil particles tend to cohere, free water forms when squeezed	Soil usually weakened and free water forms when handled

CONSISTENCY (Cohesive soils)

The consistency of cohesive soil is based on the undrained shear strength and is generally estimated, with or without the aid of a pocket penetrometer or shear vane test.

Descriptive Term	Undrained Shear Strength (kPa)	Field Guide to Consistency
'Very Soft' (VS)	≤ 12	Exudes between the fingers when squeezed in hand
'Soft' (S)	>12 ≤ 25	Can be moulded by light finger pressure
'Firm' (F)	>25 ≤ 50	Can be moulded by strong finger pressure
'Stiff' (St)	> 50 ≤ 100	Cannot be moulded by fingers
Very Stiff' (VSt)	>100 ≤ 200	Can be indented by thumb nail
'Hard' (H)	>200	Can be indented with difficulty by thumb nail

BASIS FOR SOIL DESCRIPTION

(Based on ASTM D 2488-17, with modifications)

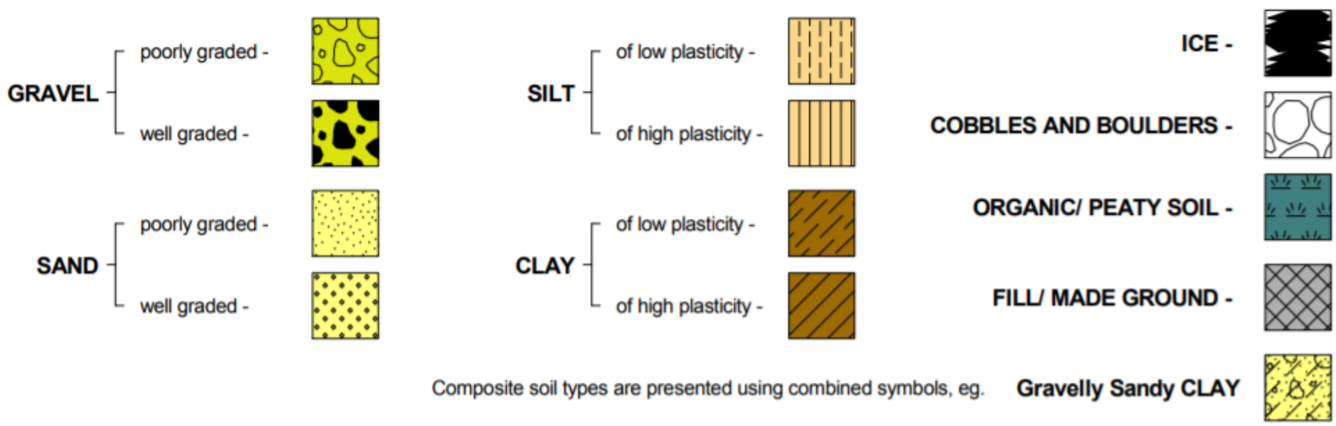
DENSITY (Granular soils)

The density of a non-cohesive soil is described via the Density Index (relative density), which is generally assessed using a penetration test and published correlations.

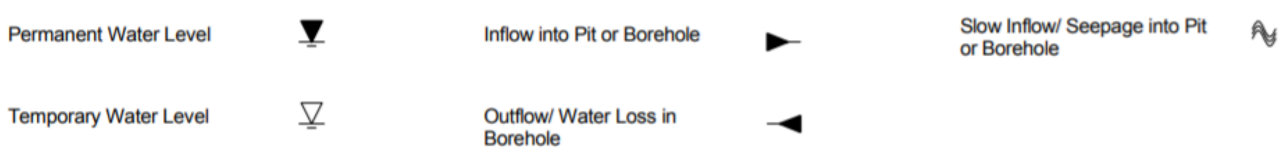
Descriptive Term	Density Index (%)	SPT N-Value	Scala blows per 100mm	CPT q_c (MPa)*
'Very Loose' (VL)	≤ 15	0-4	0-2	<5
‘Loose' (L)	>15 ≤ 35	4-10	2-6	5-10
‘Compact' (C)	>35 ≤ 65	10-30	6-16	10-15
‘Dense' (D)	>65 ≤ 85	30-50	16-26	15-20
‘Very Dense' (VD)	>85	>50	>26	>20

* At an effective overburden pressure of 100k

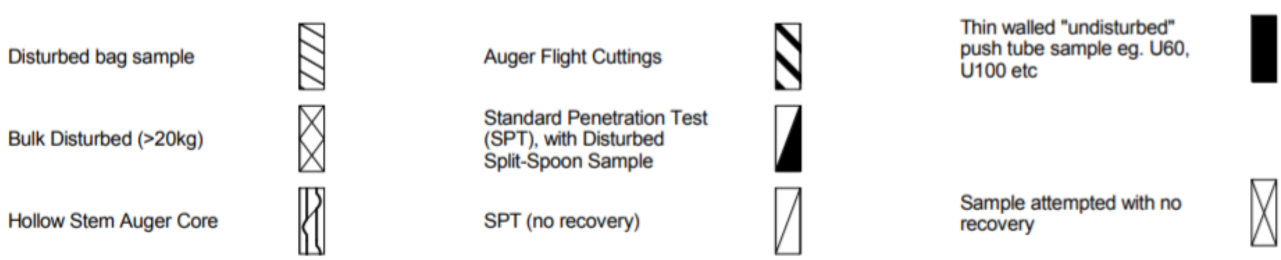
GRAPHIC SYMBOLS FOR SOILS



GROUNDWATER OBSERVATIONS



SAMPLE TYPES



BASIS FOR ROCK DESCRIPTION

(Based on ISRM - Basic Geotechnical Description of Rock Masses, with modifications)

RUN AND RECOVERY

Every time the core barrel is lifted to recover a sample of the core one run is completed. The core recovery represents the ratio of core recovered to the length drilled for the corresponding core run and is expressed as a percentage. Intervals where no core is recovered are described as Core Loss and are denoted by CL.

ROCK QUALITY DESIGNATION (RQD)

Rock Quality Designation (RQD) is an index or measure of the quality of a rock mass. RQD is determined by the ratio of sound core recovered in pieces over 100mm to the length of the core run drilled. Mechanical breaks are discounted in the calculation. RQD is not determined for extremely to highly weathered rock.

The descriptive terms assigned to RQD are as follows:

RQD (%)	Rock Description
< 25	Very Poor
25 to 50	Poor
50 to 75	Fair
75 to 90	Good
90 to 100	Excellent

DEFECT SPACING

The defect spacing is a measure of the distance between natural discontinuities (drilling breaks are ignored), and is generally expressed in millimeters. The descriptive terms assigned to defect spacing are as follows:

Defect Spacing (mm)	Term
> 2,000	Extremely Wide
600 - 2,000	Very Wide
200 - 600	Wide
60 - 200	Moderately Wide
20 - 60	Moderately Narrow
6 - 20	Narrow
< 6	Very Narrow

DEFECT LOG

The defect log provides a graphical description of each defect in the recovered core sample observed during logging.

DEFECT DESCRIPTION AND COMMENTS

The defect description is an annotated description of rock defects including inclination/ dip, type, infill type and amount, apaerture, planarity, roughness and frequency of the defect. Other comments are also included under the defect description title.

The description format of an individual defect is as follows:

Inclination	*Type*	*Infill*	*Amount*	*Aperture*	*Planarity*	*Roughness*	*Frequency*
30°	J	Fe	Fi	Mw	Pl	Sm	C

Inclination

For specific defects, the inclination of each individual defect is noted in degrees and is measured perpendicular to the core axis. For example, in a vertically drilled borehole, an inclination of 0° corresponds to a horizontal defect and an inclination of 90°corresponds to a vertical defect.

Continue overleaf...

HATCH

BASIS FOR ROCK DESCRIPTION

(Based on ISRM - Basic Geotechnical Description of Rock Masses, with modifications)

ROCK CLASSIFICATION (in order of description)

Rock Name (BLOCK LETTERS);
Grain Size,
Texture and Fabric,
Colour,
Other minor components - name, particle characteristics and colour,
Strength,
Weathering,
Structure of the rock,
Defects - type, orientation, sapcing, roughness, waviness and persistency, and
Additional rock mass observations noted from larger exposures.

WEATHERING

The Rock material weathering terms are deined in the Table below. The terms have been adopted from a combination of those used in AS1726-1981 and 1993.

Term	Symbol	Description
Residual Soil	RS	Soil developed on extremely weathered rock. The mass structure and substance fabric are no longer evident. There is a large change in volume but the soil has not been significantly transported.
Extremely Weathered Rock	XW	Rock substance affected by weathering to the extent that the rock exhibits soil properties, ie. it can be remoulded and classified in accordance with the Unified Soil Classification System.
Highly Weathered Rock	HW	Rock is weathered to such an extent that it shows considerable change in appearance and loss in strength. Chemical or physical decomposition of individual minerals are usually evident. The colour and strength of the original fresh rock is no longer recognisable.
Moderately Weathered Rock	MW	Rock is affected by weathering to the extent that staining extends throughout the whole of the rock substance and the original colour of the fresh rock is no longer recognisable. There is usually a significant loss in rock strength.
Slightly Weathered Rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh Rock	Fr	Rock shows no sign of decomposition or staining.

ROCK STRENGTH

The rock strength terms defined in AS1726-1993 and generally based on Point Load index testing. In weaker rocks Unconfined Compressive Strength testing may provide a better estimate for the rock strength. In the absence of either Point Load or Unconfined Compression Strength testing, the rock strength may be based on field estimates as discribed in the Table below.

Term	Symbol	Point load index (MPa) Is_{50}	Unconfined Compression (MPa) UCS	Field guide to strength
Extremely Low	EL	$\leq$ 0.03	$\leq$ 0.7	Easily remoulded by hand to a material with soil properties.
Very Low	VL	> 0.03 $\leq$ 0.1	> 0.7 $\leq$ 2.4	Material crumbles under firm blows with sharp end of pick, can be peeled with knife, too hard to cut a triaxial sample by hand, pieces up to 30mm thick can be broken by finger pressure.
Low	L	> 0.1 $\leq$ 0.3	> 2.4 $\leq$ 7.0	Easily scored with a knife, indentations 1mm to 3mm show in the specimen with firm blows of the pick point, has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be brocken by hand. Sharp edges of core may be friable and break during handling.
Medium	M	> 0.3 $\leq$ 1.0	> 7.0 $\leq$ 24	Readily scored with a knife, a piece of 150mm long by 50mm diameter can be broken by hand with difficulty.
High	H	> 1.0 $\leq$ 3.0	> 24 $\leq$ 70	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow, rock rings under hammer blows.
Very High	VH	> 3.0 $\leq$ 10	> 70 $\leq$ 240	Hand specimen break with pick after more than one blow, rock rings under hammer blows.
Extremely High	EH	> 10	> 240	Specimen requires many blows with geological pick to break through intact material, rock rings under hammer blows.

Continue overleaf...

HATCH BOREHOLE REPORT

BH21 - 07

Sheet 1 of 1

Client: FCR

Project: Park Lawn

Location: Park Lawn - TRCA Area

Project No.: H/363590

Datum: NAD83

Platform:

Contractor: Geo Environmental

Rig Type/ Mounting: CME-55

Date Logged: 2/3/2021

Driller: K.K.

Hole Diameter (mm): 200

Date Reviewed: 2/3/2021

Easting: 622,166.9 m

Northing: 4,831,349.3 m

Surface Elevation: 87.12 m

Bottom Elevation: 78.42 m

Total Depth: 8.7 m

Logged By: N.W.

Reviewed By: O.E.

Method: Hollow Stem Auger

Elevation (m)	Depth (m)	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Moisture Condition	Consistency/ Density	Recovery %	Blows	Comments and Additional Observations	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index
	0.0	Topsoil, sandy silt with clay, brown, trace to some rootlets and organics, compact, dry to moist	D-M	C	50%	3, 3, 7, 9	SS1 taken from .00-.61m. N= 10	27					
		Silty SAND, brown, compact, moist (FILL)	M	C									
86.1	1.0	-------- clayey, oxidized, trace gravel from 0.8 m, dry to moist	D-M	C	75%	9, 14, 12, 11	SS2 taken from .76-1.37m. N= 26	16					
		-------- trace to some rootlets at 1.7 m	D-M	C	83%	9, 10, 21, 18	SS3 taken from 1.52-2.13m. N= 31 Non-plastic	11					
85.1	2.0				83%	7, 10, 11, 12	SS4 taken from 2.29-2.90m. N= 21	15					
84.1	3.0	SILT, with clay, trace sand, light brown, occasional sand lenses, compact, dry to moist (NATIVE)	D-M	C	100%	5, 7, 8, 8	SS5 taken from 3.05-3.66m. N= 15	17	0	4	96		
83.1	4.0	-------- grey, loose, moist from 4.1 m	M	L	100%	3, 3, 4, 5	SS6 taken from 3.81-4.42m. N= 7	20					
					100%	4, 4, 4, 5	SS7 taken from 4.57-5.18m. N= 8 Non-plastic	21	0	1	99		
82.1	5.0	-------- wet from 5.0 m	W	L									
81.1	6.0	-------- moist to wet from 6.1 m	M-W	L	100%	4, 4, 4, 6	SS8 taken from 6.10-6.71m. N= 8						
80.1	7.0				83%	6, 4, 4, 4	SS9 taken from 7.62-8.23m. N= 8	23	1	9	90	29	11
79.1	8.0	-------- trace gravel, wet from 8.1 m	W	L									
		Weathered Rock, grey, dry	D				SS10 taken from 8.60-8.70m.						
78.1	9.0	Drilling Refusal. **Drillhole BH21 - 07 terminated at 8.7m.**					Backfilled with bentonite chips to surface						
77.1	10.0												

Notes:

BOREHOLE REPORT

HATCH

BH21 - 08

Client:	FCR	**Project No.:**	H/363590
Project:	Park Lawn	**Datum:**	NAD83
Location:	Park Lawn - TRCA Area	**Platform:**	
Contractor:	Geo Environmental	**Rig Type/ Mounting:**	CME-55
Date Logged:	2/4/2021	**Driller:**	K.K.
Hole Diameter (mm):	200	**Date Reviewed:**	2/25/2021

Easting:	622,126.0 m
Northing:	4,831,332.3 m
Surface Elevation:	79.48 m
Bottom Elevation:	62.38 m
Total Depth:	17.1 m
Logged By:	N.W.
Reviewed By:	O.E.

Method: Hollow Stem Auger

Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Moisture Condition	Recovery %	Blows	Comments and Additional Observations	Field Water Content	Percent Gravel	Percent Sand	Percent Fines
TOPSOIL, silty sand, brown, trace to some organics, oxidised, compact, dry to moist	D-M / M	16%	6 8 7 6	SS1 taken from .00-.61m. N= 15	11			
Sandy SILT, with gravel, some clay, grey, compact, moist (FILL) -------- trace to some organics from 0.8 m, moist to wet	M-W	16%	4 5 5 7	SS2 taken from .76-1.37m. N= 10	12			
		16%	4 5 7 7	SS3 taken from 1.52-2.13m. N= 12	12	5	36	59
-------- cobbles from 2.3 m	M-W	16%	8 9 12 20	SS4 taken from 2.29-2.90m. N= 21	9			
-------- brown from 3.0 m, dense	M-W	16%	18 17 13 14	SS5 taken from 3.05-3.66m. N= 30	4	6	79	15
		16%	17 17 12 8	SS6 taken from 3.81-4.42m. N= 29	17			
Sandy SILT, some clay, greyish green, compact, dry to moist (NATIVE) -------- trace to some organics from 4.6 m	D-M / D-M / M	16%	4 5 7 9	SS7 taken from 4.57-5.18m. N= 12	22	1	32	67
-------- 10 cm sand and gravel lense, smell of hydrocarbons, brown from 5.0 m, moist		16%	24 8 8 8	SS8 taken from 5.33-5.94m. N= 16	7			
		16%	12 50	SS9 taken from 6.10-6.71m.				

Start of Coring at 6.5m.

Continued on Rock Core Log sheet.

Depth (m)	Elevation (m)
1.0	78.5
2.0	77.5
3.0	76.5
4.0	75.5
5.0	74.5
6.0	73.5
7.0	72.5
8.0	71.5
9.0	70.5
10.0	69.5

Notes:

HATCH

BOREHOLE LOG
ROCK CORE FORMAT

BH21 - 08

Client: FCR
Project: Park Lawn
Location: Park Lawn - TRCA Area
Project No.: H/363590
Datum: NAD83
Platform:

Easting: 622,126.0 m
Northing: 4,831,332.3 m
Surface Elevation: 79.48 m
Bottom Elevation: 62.38 m
Total Depth: 17.1 m
Logged By: N.W.
Reviewed By: O.E.

Contractor: Geo Environmental **Rig Type/ Mounting:** CME-55 **Bearing:** N/A **Date Logged:** 2/4/2021
Driller: K.K. **Hole Diameter (mm):** 200 **Plunge:** Vertical **Date Checked:** 2/25/2021

Water	Elevation (m)	Depth (m)	Method	Run #/TCR	Graphic Log	Geological Unit	Rock Description: ROCK TYPE; Grain size, texture and fabric, colour, general defect conditions, minor constituents.	Weathering/ Cementation	Estimated Strength (ES VS S MW W VW EW)	Is(50) [UCS] MPa	Defect Spacing mm (2000 600 200 [100] 60 20)	RQD %	Defect Log	Defect Description: Inclination, type, infill, amount, aperture, planarity, roughness, frequency (Specific / General)
	78.5	1.0												
	77.5	2.0												
	76.5	3.0												
	75.5	4.0												
	74.5	5.0												
	73.5	6.0					***Resuming in Rock Core Format 6.5m.***							
	72.5	7.0		1 / 0 %			CORE LOSS from 6.50m to 8.00m.					0		
	71.5	8.0		2 / 75 %			SEDIMENTARY: Shale, fine to very fine grained, medium weak, slightly weathered -------- strong from 8.5 m	SW				57		90° Cz Ir Ro Clay infill cg 90° Jt Pl Sm Clay infill cg 90° Jt Pl Sm Clay infill cg 90° Fz Pl Ro Clay infill cg
	70.5	9.0										19		90° Jt Pl Sm Clay infill cg 90° Jt Pl Sm Clay infill cg 90° Jt Pl Sm Clay infill cg
	69.5	10.0												

Notes:

Defect Description Legend

Type		Planarity	Roughness	Infill Amount
Dl Drilling Induced	Sm Seam	Pl Planar	Ro Rough	cn Clean
Jt Joint	Cz Crushed Zone	Ir Irregular	Sm Smooth	sn Stained
Pt Parting on Contact	Fz Fractured Zone	Cu Curved	Po Polished	vn Veneer
Sh Shear Seam	Band Weak Band	Un Undulose	Sl Slickenside	cg Coating
Cs Crushed Seam		St Stepped		

HATCH

BOREHOLE LOG

ROCK CORE FORMAT

BH21 - 08

Client: FCR

Project: Park Lawn

Location: Park Lawn - TRCA Area

Project No.: H/363590

Datum: NAD83

Platform:

Easting: 622,126.0 m

Northing: 4,831,332.3 m

Surface Elevation: 79.48 m

Bottom Elevation: 62.38 m

Total Depth: 17.1 m

Logged By: N.W.

Reviewed By: O.E.

Contractor: Geo Environmental **Rig Type/ Mounting:** CME-55 **Bearing:** N/A **Date Logged:** 2/4/2021

Driller: K.K. **Hole Diameter (mm):** 200 **Plunge:** Vertical **Date Checked:** 2/25/2021

Water	Elevation (m)	Depth (m)	Method	Run #/TCR	Graphic Log	Geological Unit	Rock Description ROCK TYPE; Grain size, texture and fabric, colour, general defect conditions, minor constituents.	Weathering/ Cementation	Estimated Strength ES VS S MW W VW EW	$Is_{(50)}$ [UCS] MPa	Defect Spacing mm 2000 600 200 [100] 60 20	RQD %	Defect Log	Defect Description Inclination, type, infill, amount, aperture, planarity, roughness, frequency Specific / General
			HQ-3 Coring	3 / 100 %			SEDIMENTARY: Shale, fine to very fine grained, medium weak, slightly weathered *(Continued)*	SW				19		90° Cz Pl Ro Clay infill cg 90° Fz Pl Ro Clay infill cg
	68.5	11.0		4 / 100 %			-------- iron staining, visible fossils at 11.0 m					62		90° Jt Pl Sm Clay infill cg 90° Fz Pl Ro Clay infill cg
	67.5	12.0												90° Jt Pl Sm Clay infill cg 90° Jt Pl Sm Clay infill cg 90° Fz Pl Ro Clay infill cg
	66.5	13.0		5 / 94 %			-------- very strong from 12.5 m					54		90° Jt Pl Sm Clay infill cg 90° Jt Pl Sm Clay infill cg 90° Jt Pl Sm Clay infill cg 90° Fz Pl Ro Clay infill cg
	65.5	14.0		6 / 100 %			-------- strong from 14.1 m					92		90° Jt Pl Sm Clay infill cg 90° Jt Pl Sm Clay infill cg DI
	64.5	15.0												DI 90° Jt Pl Sm Clay infill cg 45° DI Pl Sm 90° Jt Pl Sm Clay infill cg 90° Jt Pl Sm Clay infill cg 90° Jt Pl Sm Clay infill cg
	63.5	16.0		7 / 100 %								94		90° Jt Pl Sm Clay infill cg DI DI 90° Jt Pl Sm Clay infill cg 90° Jt Pl Sm Clay infill cg 90° Jt Pl Sm Clay infill cg
	62.5	17.0												90° Jt Pl Sm Clay infill cg
							To Target Depth. **Drillhole BH21 - 08 terminated at 17.1m.**							
	61.5	18.0												
	60.5	19.0												
	59.5	20.0												

Notes:

Defect Description Legend

Type				Planarity		Roughness		Infill Amount	
DI	Drilling Induced	Sm	Seam	Pl	Planar	Ro	Rough	cn	Clean
Jt	Joint	Cz	Crushed Zone	Ir	Irregular	Sm	Smooth	sn	Stained
Pt	Parting on Contact	Fz	Fractured Zone	Cu	Curved	Po	Polished	vn	Veneer
Sh	Shear Seam	Band	Weak Band	Un	Undulose	Sl	Slickenside	cg	Coating
Cs	Crushed Seam			St	Stepped				

HATCH BOREHOLE REPORT

BH21 - S5

Sheet 1 of 1

Client: FCR
Project: Park Lawn
Location: Park Lawn - TRCA Area
Project No.: H/363590
Datum: NAD83
Platform:

Easting: 622,147.5 m
Northing: 4,831,322.0 m
Surface Elevation: 87.05 m
Bottom Elevation: 80.15 m
Total Depth: 6.9 m
Logged By: N.W.
Reviewed By: O.E.

Contractor: Geo Environmental **Rig Type/ Mounting:** CME-55 **Date Logged:** 2/3/2021
Driller: K.K. **Hole Diameter (mm):** 200 **Date Reviewed:** 2/25/2021

Method: Hollow Stem Auger

Elevation (m)	Depth (m)	Soil Description (TYPE; plasticity or particle characteristics (size, grading, shape, roundness), colour, structure, accessory components.)	Moisture Condition	Consistency/ Density	Recovery %	Blows	Comments and Additional Observations	Field Water Content	Percent Gravel	Percent Sand	Percent Fines	Liquid Limit	Plastic Index	Other Tests
		Topsoil, sand and gravel, dark brown, trace to some rootlets and organics, compact, moist	M	C	16%	4 5 8 9	SS1 taken from .00-.61m. N= 13	8						
86.1	1.0	Silty SAND, some clay, brown, oxidised, compact, dry to moist (FILL)	D-M	C	16%	4 8 10 9	SS2 taken from .76-1.37m. N= 18	14						
					16%	3 3 3 4	SS3 taken from 1.52-2.13m. N= 6	18	0	4	96	27	11	
85.1	2.0	-------- trace to some rootlets at 1.8 m	D-M	C										
		SILT, with clay, trace sand, trace to some rootlets, brown, oxidised, compact (NATIVE)	D-M	C	16%	7 11 12 16	SS4 taken from 2.29-2.90m. N= 23	15						
84.1	3.0	-------- dark brown staining from 3.0 m	D-M	C	16%	5 7 9 12	SS5 taken from 3.05-3.66m. N= 16	17	0	1	99	28	10	
83.1	4.0	-------- occasional sand lenses from 3.8 m	D-M	C	16%	5 8 10 15	SS6 taken from 3.81-4.42m. N= 18	18						
		-------- grey from 4.3 m	D-M	C										
82.1	5.0	-------- brown staining from 4.6 m	D-M	C	16%	3 5 9 11	SS7 taken from 4.57-5.18m. N= 14 Non-plastic	15	0	2	98			
81.1	6.0				16%	4 8 11 12	SS8 taken from 6.10-6.71m. N= 19	17	1	4	95	25	9	
80.1	7.0	Drilling Refusal. **Drillhole BH21 - S5 terminated at 6.9m.**					Backfilled with bentonite chips to surface							
79.1	8.0													
78.1	9.0													
77.1	10.0													

Notes:

Appendix C

Laboratory Test Results

Lab Determination of Water (Moisture) Content of Soils and Rock by Mass, Method A

HATCH
Geotechnical Laboratory

ASTM D 2216

Date:	February. 24 2021	**First Capital Realty**	
Project Number:	H/363590	85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3	
Project:	**Park Lawn - TRCA**	**Attn:**	Nina Warrier

Sample	As Noted in Table Below
Source	BH21-07

Sample	Depth m	Moisture %	Sample/Test Notes
SS1	0.3	27	
SS2	0.76	16	
SS3	1.52	11	Air Dry at 60̊ C
SS4	2.29	15	
SS5	3.05	17	Air Dry at 60̊ C
SS6	3.81	20	
SS7	4.57	21	Air Dry at 60̊ C
SS9	7.62	23	Air Dry at 60̊ C

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb 24.2021
Reviewed By:	N. Warrier	**Date:**	March 1.2021

Notice: The test data given herein pertain to the sample provide, and may not be applicable to other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

Lab Determination of Water (Moisture) Content of Soils and Rock by Mass, Method A

HATCH
Geotechnical Laboratory

ASTM D 2216

Date:	February. 24 2021	**First Capital Realty**	
Project Number:	H/363590	85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3	
Project:	**Park Lawn - TRCA**	**Attn:**	Nina Warrier

Sample	As Noted in Table Below
Source	BH21-08

Sample	Depth m	Moisture %	Sample/Test Notes
SS1	0.3	11	
SS2	0.76	12	
SS3	1.52	12	
SS4	2.29	9	
SS5	3.05	4	
SS6	3.81	17	Air Dry at 60°C
SS7	4.57	22	
SS8	5.33	7	Air Dry at 60°C

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb 24.2021
Reviewed By:	N. Warrier	**Date:**	March 1.2021

Notice: The test data given herein pertain to the sample provide, and may not be applicable to other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

Lab Determination of Water (Moisture) Content of Soils and Rock by Mass, Method A

HATCH
Geotechnical Laboratory

ASTM D 2216

Date: February. 24 2021
Project Number: H/363590
Project: **Park Lawn - TRCA**

First Capital Realty
85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3
Attn: Nina Warrier

Sample	As Noted in Table Below
Source	BH21-S5

Sample	Depth m	Moisture **%**	Sample/Test Notes
SS1	0.3	8	
SS2	0.76	14	
SS3	1.52	18	Air Dry at 60°C
SS4	2.29	15	
SS5	3.05	17	Air Dry at 60°C
SS6	3.81	18	
SS7	4.57	15	Air Dry at 60°C
SS8	6.1	17	Air Dry at 60°C

Reported By: R. Serluca, Laboratory Manager. **Date:** Feb 24.2021
Reviewed By: N. Warrier **Date:** March 1.2021

Notice: The test data given herein pertain to the sample provide, and may not be applicable to other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

Test for Determination of Particle Size Analysis of Soils

Geotechnical Laboratory

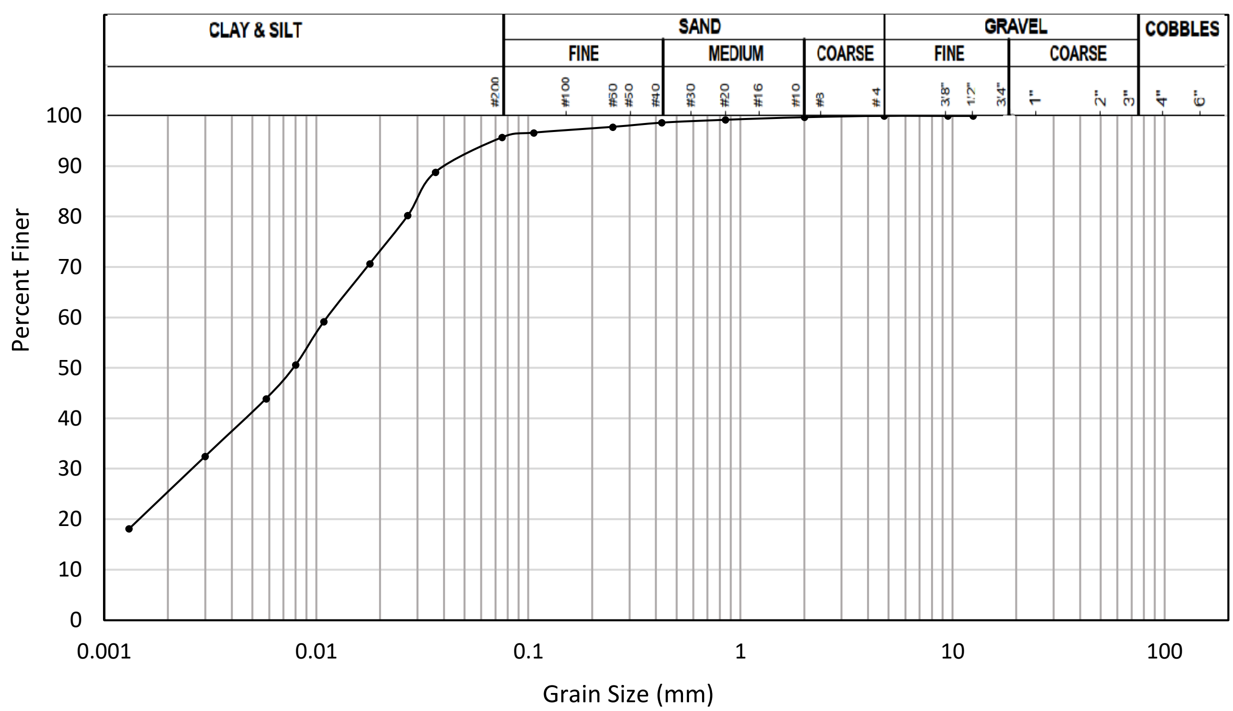
MTO LS-702

Date: February.24.2021
Project Number: H/363590
Project: **Park Lawn - TRCA**

First Capital Realty
85 Hanna Ave. Suite 400, Toronto, ON. MK6 3S3
Attn: Nina Warrier

Sample	SS3	**Depth**	1.52 to 2.13 m
Source	BH21-S5		

Sieve (mm)	% Passing	Sieve (mm)	% Passing	Size (mm)	% Passing
75	100.0	4.75	100.0	0.0364	88.8
63	100.0	2	99.7	0.0270	80.2
53	100.0	0.850	99.2	0.0179	70.7
37.5	100.0	0.425	98.7	0.0109	59.2
26.5	100.0	0.250	97.8	0.0080	50.6
19	100.0	0.106	96.7	0.0058	43.9
13.2	100.0	0.075	95.7	0.0030	32.5
9.5	100.0			0.0013	18.2



Comments:

Reported By: R. Serluca, Laboratory Manager. **Date:** Feb.24.21
Reviewed By: N. Warrier **Date:** Feb.28.21

Notice: The test data given herein pertain to the sample provide, and may not be applicable to other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

Test for Determination of Particle Size Analysis of Soils

Geotechnical Laboratory

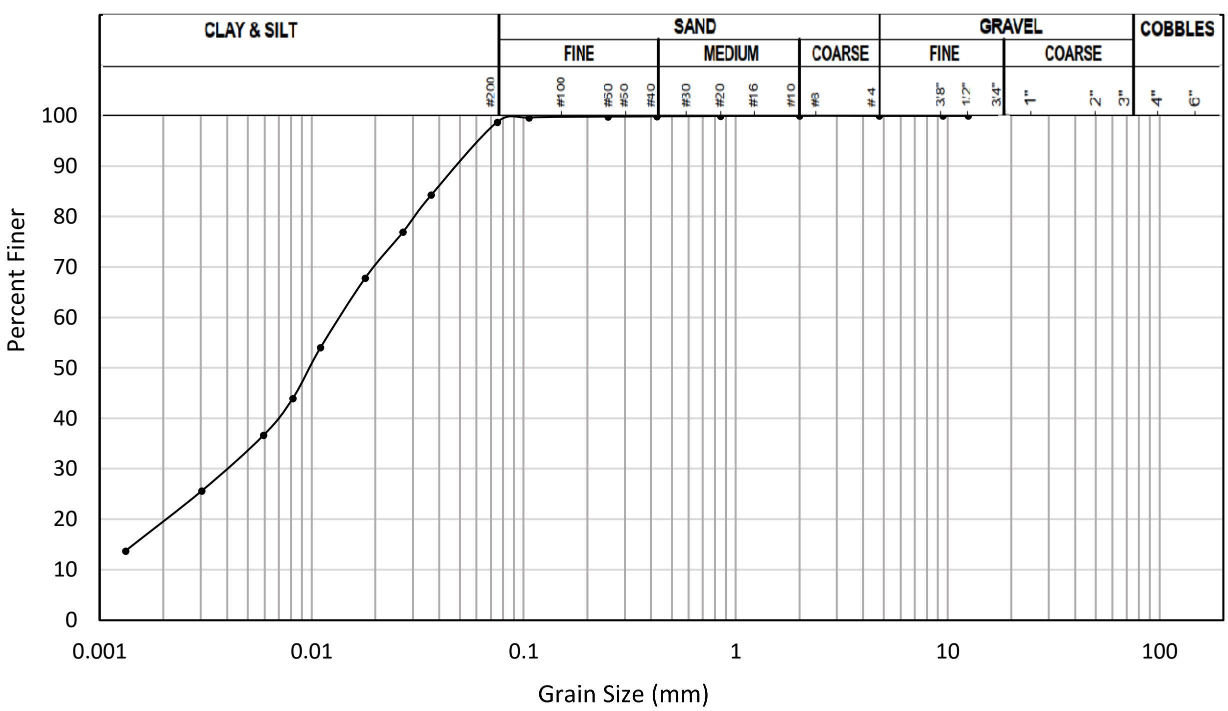
MTO LS-702

Date: February.24.2021
Project Number: H/363590
Project: **Park Lawn - TRCA**

First Capital Realty
85 Hanna Ave. Suite 400, Toronto, ON. MK6 3S3
Attn: Nina Warrier

Sample	SS5	**Depth**	3.05 to 3.66 m
Source	BH21-S5		

Sieve (mm)	% Passing	Sieve (mm)	% Passing	Size (mm)	% Passing
75	100.0	4.75	100.0	0.0366	84.3
63	100.0	2	100.0	0.0270	77.0
53	100.0	0.850	99.9	0.0179	67.8
37.5	100.0	0.425	99.9	0.0110	54.1
26.5	100.0	0.250	99.8	0.0081	44.0
19	100.0	0.106	99.7	0.0059	36.7
13.2	100.0	0.075	98.8	0.0030	25.7
9.5	100.0			0.0013	13.7



Comments:

Reported By: R. Serluca, Laboratory Manager. **Date:** Feb.24.21
Reviewed By: N. Warrier **Date:** Feb.28.21

Notice: The test data given herein pertain to the sample provide, and may not be applicable to other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

Test for Determination of Particle Size Analysis of Soils

HATCH
Geotechnical Laboratory

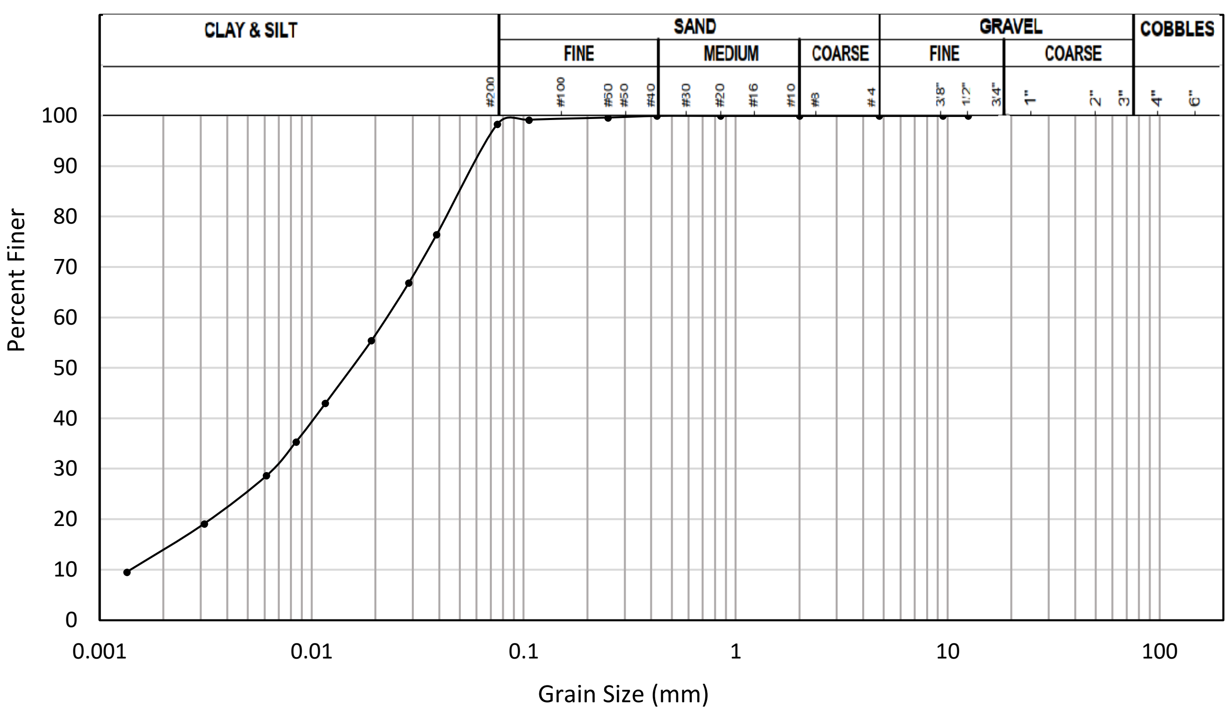
MTO LS-702

Date: February.24.2021
Project Number: H/363590
Project: **Park Lawn - TRCA**

First Capital Realty
85 Hanna Ave. Suite 400, Toronto, ON. MK6 3S3
Attn: Nina Warrier

Sample	SS7	**Depth**	4.57 to 5.18 m
Source	BH21-S5		

Sieve (mm)	% Passing	Sieve (mm)	% Passing	Size (mm)	% Passing
75	100.0	4.75	100.0	0.0389	76.5
63	100.0	2	100.0	0.0287	66.9
53	100.0	0.850	100.0	0.0191	55.4
37.5	100.0	0.425	100.0	0.0116	43.0
26.5	100.0	0.250	99.6	0.0084	35.4
19	100.0	0.106	99.2	0.0061	28.7
13.2	100.0	0.075	98.3	0.0031	19.1
9.5	100.0			0.0013	9.6



Comments:

Reported By: R. Serluca, Laboratory Manager. **Date:** Feb.24.21
Reviewed By: N. Warrier **Date:** Feb.28.21

Notice: The test data given herein pertain to the sample provide, and may not be applicable to other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

Test for Determination of Particle Size Analysis of Soils

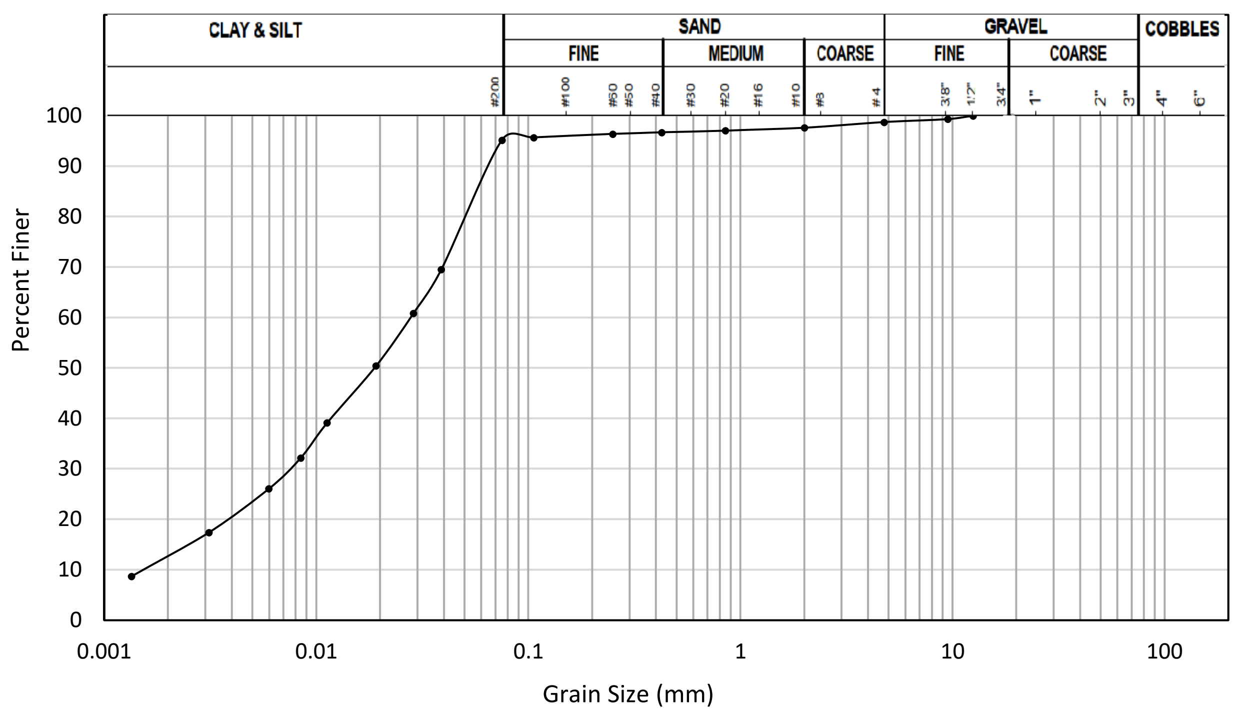
HATCH
Geotechnical Laboratory

MTO LS-702

Date:	February.24.2021	**First Capital Realty**	
Project Number:	H/363590	85 Hanna Ave. Suite 400, Toronto, ON. MK6 3S3	
Project:	**Park Lawn - TRCA**	**Attn:**	Nina Warrier

Sample	SS8	**Depth**	6.10 to 6.71 m
Source	BH21-S5		

Sieve (mm)	% Passing	Sieve (mm)	% Passing	Size (mm)	% Passing
75	100.0	4.75	98.7	0.0389	69.6
63	100.0	2	97.7	0.0287	60.9
53	100.0	0.850	97.1	0.0191	50.4
37.5	100.0	0.425	96.7	0.0112	39.1
26.5	100.0	0.250	96.4	0.0084	32.2
19	100.0	0.106	95.7	0.0060	26.1
13.2	100.0	0.075	95.2	0.0031	17.4
9.5	99.4			0.0013	8.7



Comments: Material is shaley. Slakes after washing and drying.

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb.24.21
Reviewed By:	N. Warrier	**Date:**	Feb.28.21

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Test for Determination of Particle Size Analysis of Soils

HATCH
Geotechnical Laboratory

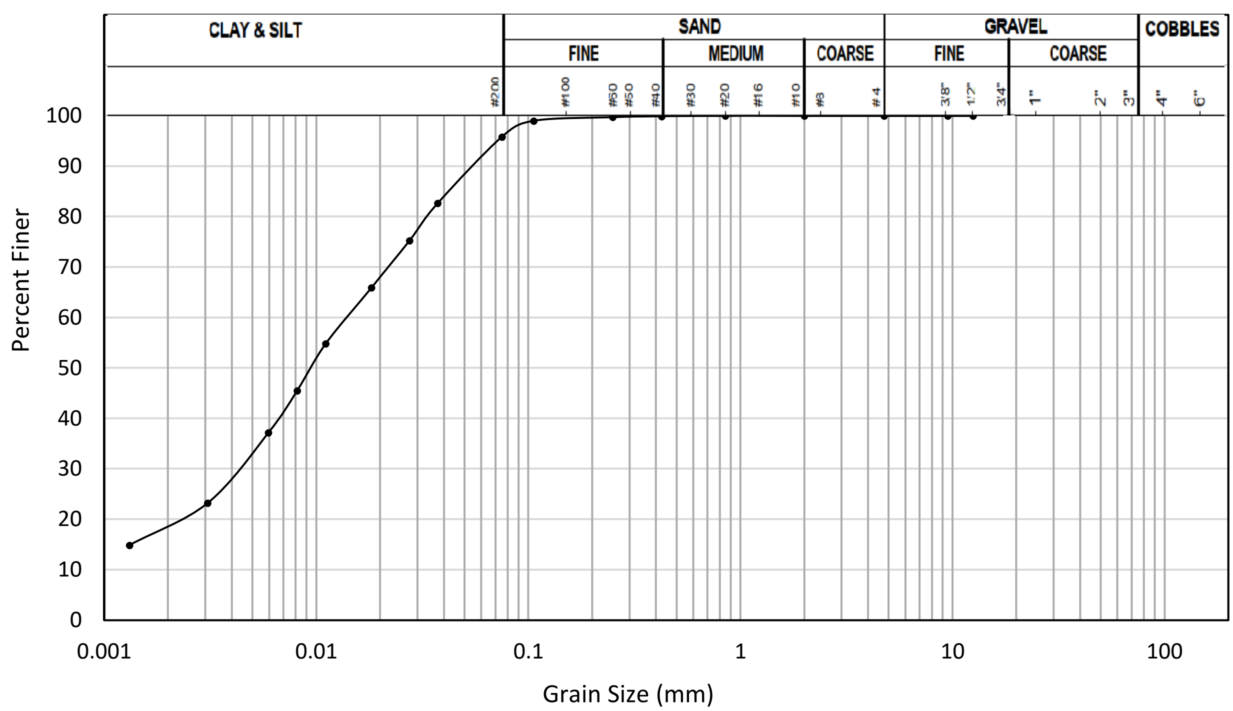
MTO LS-702

Date: February.24.2021
Project Number: H/363590
Project: **Park Lawn - TRCA**

First Capital Realty
85 Hanna Ave. Suite 400, Toronto, ON. MK6 3S3
Attn: Nina Warrier

Sample	SS5	**Depth**	3.05 to 3.66 m
Source	BH21-07		

Sieve (mm)	% Passing	Sieve (mm)	% Passing	Size (mm)	% Passing
75	100.0	4.75	100.0	0.0374	82.7
63	100.0	2	100.0	0.0275	75.3
53	100.0	0.850	100.0	0.0182	66.0
37.5	100.0	0.425	99.9	0.0111	54.8
26.5	100.0	0.250	99.7	0.0081	45.5
19	100.0	0.106	99.0	0.0059	37.2
13.2	100.0	0.075	95.8	0.0031	23.2
9.5	100.0			0.0013	14.9



Comments:

Reported By: R. Serluca, Laboratory Manager. **Date:** Feb.24.21
Reviewed By: N. Warrier **Date:** Feb.28.21

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Test for Determination of Particle Size Analysis of Soils

HATCH
Geotechnical Laboratory

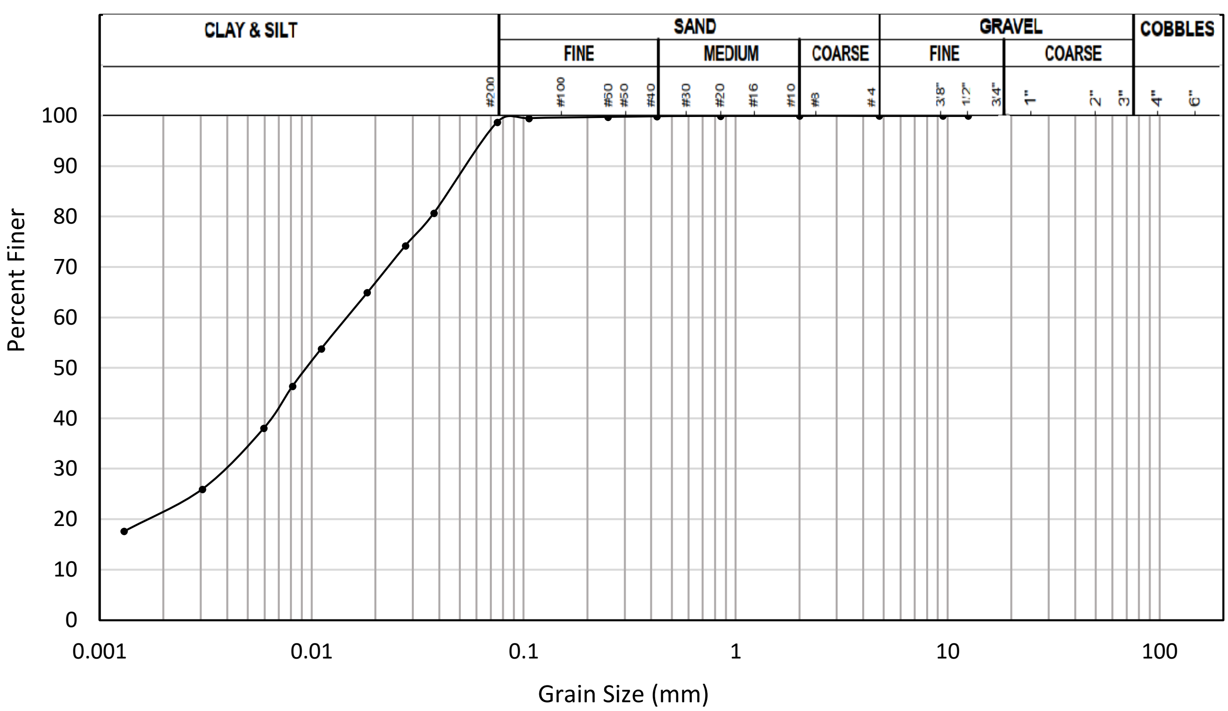
MTO LS-702

Date: February.24.2021
Project Number: H/363590
Project: **Park Lawn - TRCA**

First Capital Realty
85 Hanna Ave. Suite 400, Toronto, ON. MK6 3S3
Attn: Nina Warrier

Sample	SS7	**Depth**	4.57 to 5.18 m
Source	BH21-07		

Sieve (mm)	% Passing	Sieve (mm)	% Passing	Size (mm)	% Passing
75	100.0	4.75	100.0	0.0377	80.7
63	100.0	2	100.0	0.0277	74.3
53	100.0	0.850	100.0	0.0183	65.0
37.5	100.0	0.425	99.9	0.0111	53.8
26.5	100.0	0.250	99.8	0.0081	46.4
19	100.0	0.106	99.5	0.0059	38.1
13.2	100.0	0.075	98.8	0.0030	26.0
9.5	100.0			0.0013	17.6



Comments:

Reported By: R. Serluca, Laboratory Manager. **Date:** Feb.24.21
Reviewed By: N. Warrier **Date:** Feb.28.21

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Test for Determination of Particle Size Analysis of Soils

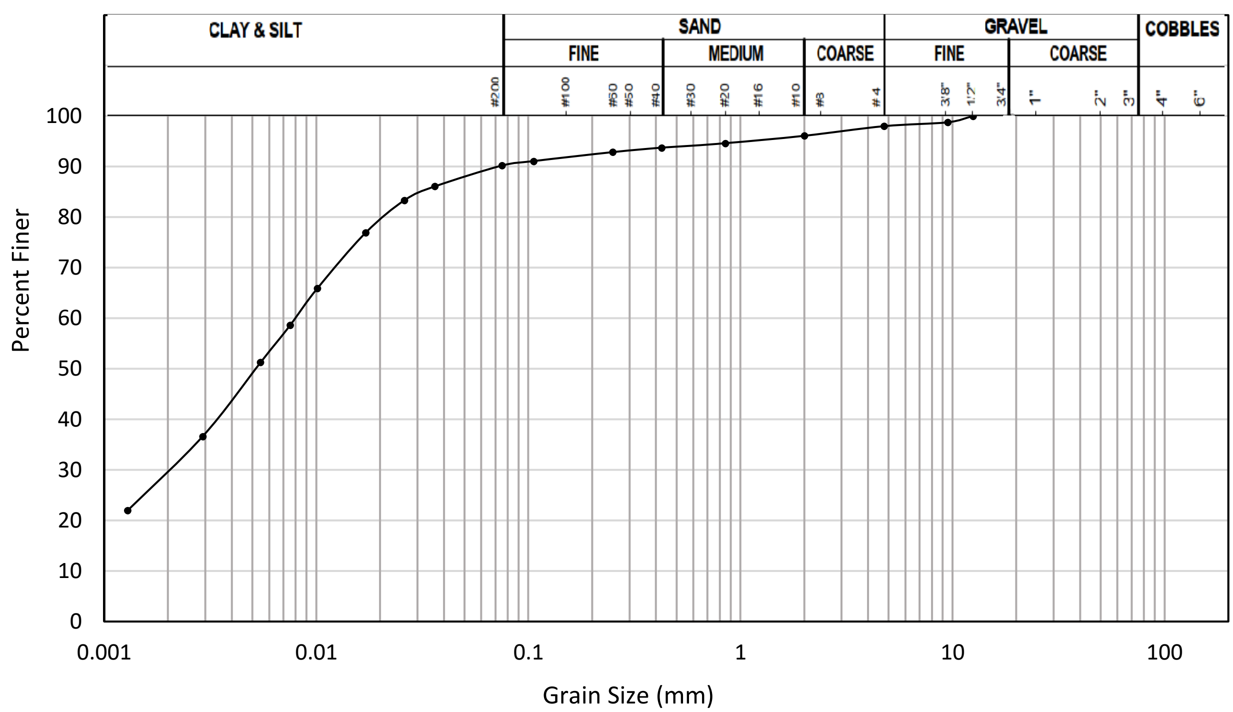
HATCH
Geotechnical Laboratory

MTO LS-702

Date:	February.24.2021	**First Capital Realty**	
Project Number:	H/363590	85 Hanna Ave. Suite 400, Toronto, ON. MK6 3S3	
Project:	**Park Lawn - TRCA**	**Attn:**	Nina Warrier

Sample	SS9	**Depth**	7.62 to 8.23 m
Source	BH21-07		

Sieve (mm)	% Passing	Sieve (mm)	% Passing	Size (mm)	% Passing
75	100.0	4.75	98.0	0.0363	86.1
63	100.0	2	96.1	0.0261	83.4
53	100.0	0.850	94.6	0.0171	76.9
37.5	100.0	0.425	93.7	0.0101	66.0
26.5	100.0	0.250	92.9	0.0075	58.6
19	100.0	0.106	91.1	0.0055	51.3
13.2	100.0	0.075	90.2	0.0029	36.6
9.5	98.8			0.0013	22.0



Comments:

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb.24.21
Reviewed By:	N. Warrier	**Date:**	Feb.28.21

Test for Determination of Particle Size Analysis of Soils

HATCH
Geotechnical Laboratory

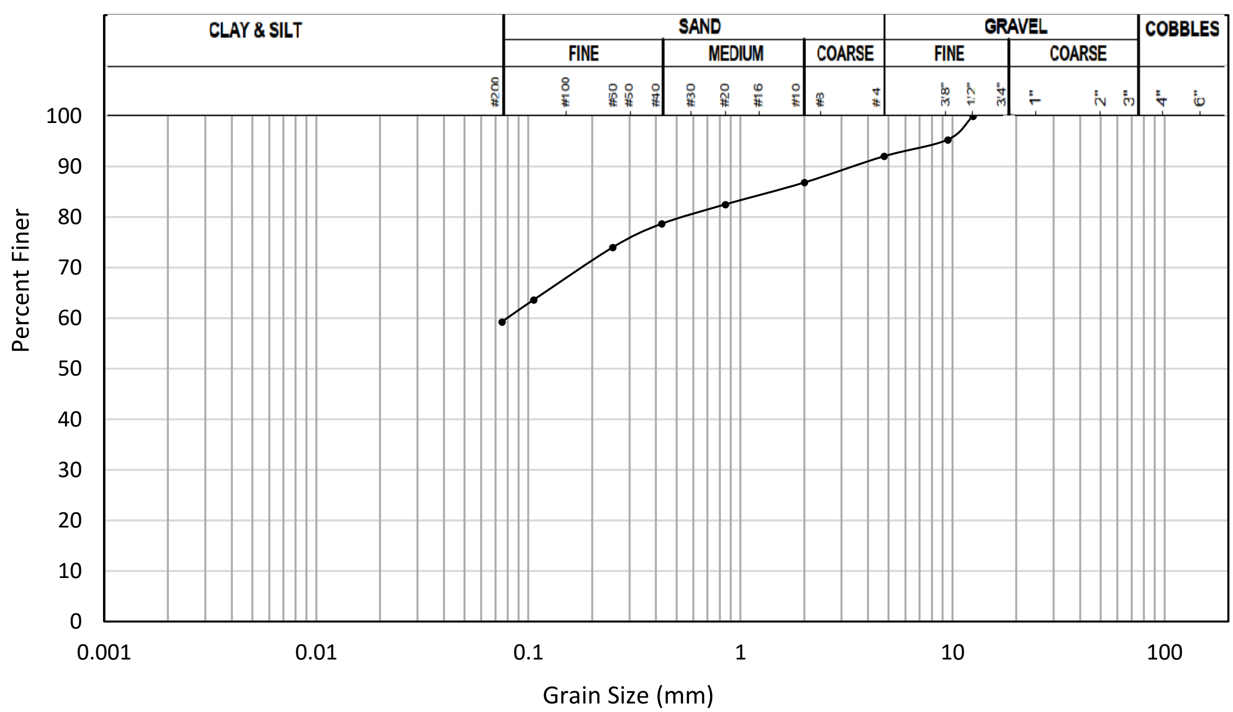
MTO LS-702

Date: February.24.2021
Project Number: H/363590
Project: **Park Lawn - TRCA**

First Capital Realty
85 Hanna Ave. Suite 400, Toronto, ON. MK6 3S3
Attn: Nina Warrier

Sample	SS3	**Depth**	1.52 to 2.13 m
Source	BH21-08		

Sieve (mm)	% Passing	Sieve (mm)	% Passing	Size (mm)	% Passing
75	100.0	4.75	92.1		
63	100.0	2	86.9		
53	100.0	0.850	82.5		
37.5	100.0	0.425	78.7		
26.5	100.0	0.250	74.1		
19	100.0	0.106	63.7		
13.2	100.0	0.075	59.3		
9.5	95.3				



Comments:

Reported By: R. Serluca, Laboratory Manager. **Date:** Feb.24.21
Reviewed By: N. Warrier **Date:** Feb.28.21

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Test for Determination of Particle Size Analysis of Soils

HATCH
Geotechnical Laboratory

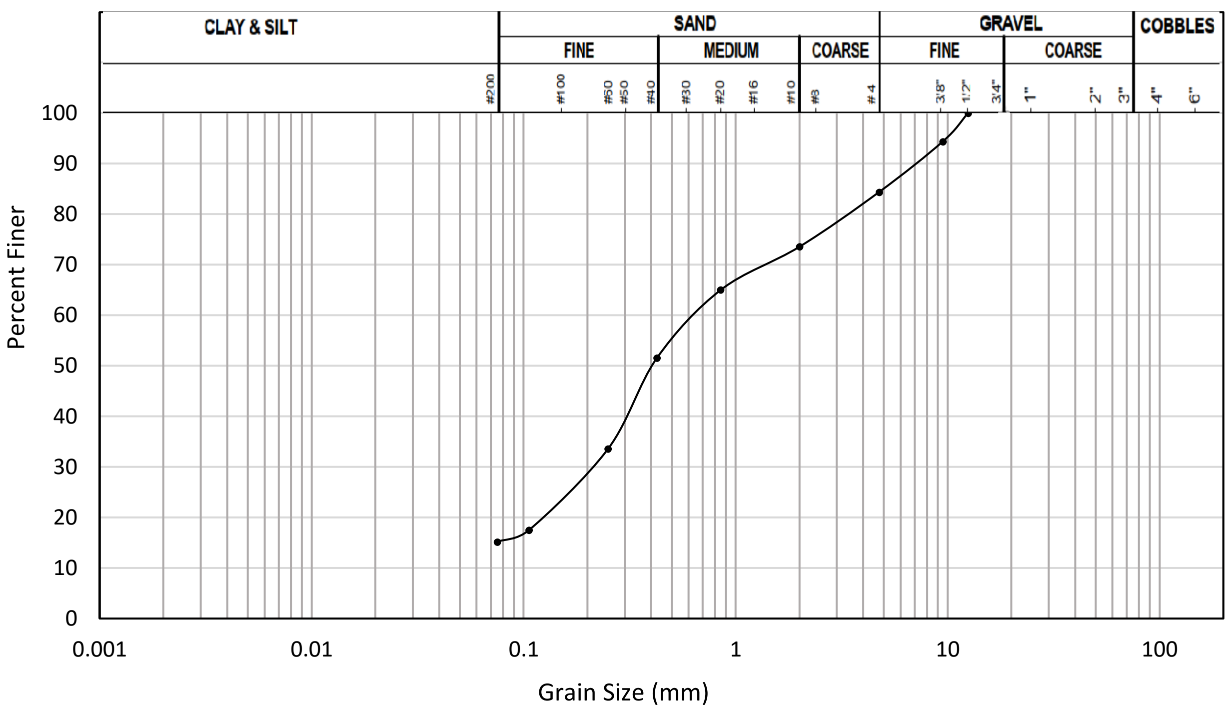
MTO LS-702

Date: February.24.2021
Project Number: H/363590
Project: **Park Lawn - TRCA**

First Capital Realty
85 Hanna Ave. Suite 400, Toronto, ON. MK6 3S3
Attn: Nina Warrier

Sample	SS5	**Depth**	3.05 to 3.66 m
Source	BH21-08		

Sieve (mm)	% Passing	Sieve (mm)	% Passing	Size (mm)	% Passing
75	100.0	4.75	84.4		
63	100.0	2	73.6		
53	100.0	0.850	65.0		
37.5	100.0	0.425	51.6		
26.5	100.0	0.250	33.6		
19	100.0	0.106	17.5		
13.2	100.0	0.075	15.2		
9.5	94.4				



Comments:

Reported By: R. Serluca, Laboratory Manager. **Date:** Feb.24.21
Reviewed By: N. Warrier **Date:** Feb.28.21

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Test for Determination of Particle Size Analysis of Soils

HATCH
Geotechnical Laboratory

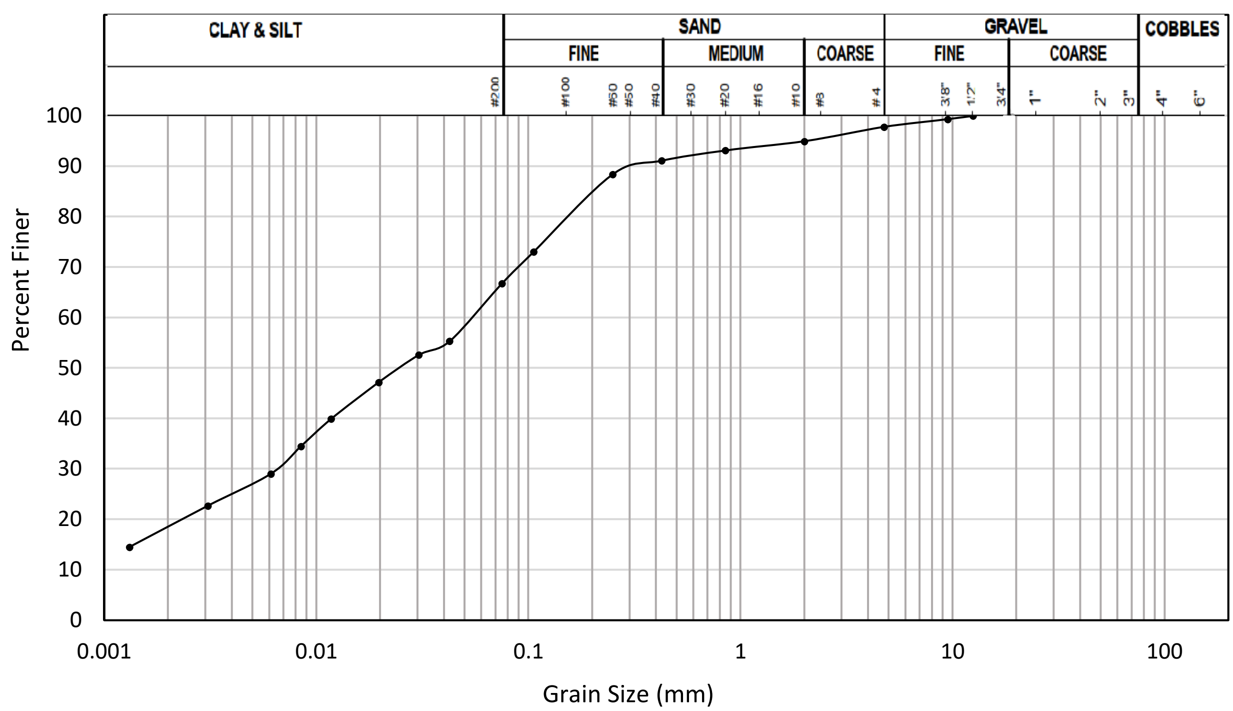
MTO LS-702

Date: February.24.2021
Project Number: H/363590
Project: **Park Lawn - TRCA**

First Capital Realty
85 Hanna Ave. Suite 400, Toronto, ON. MK6 3S3
Attn: Nina Warrier

Sample	SS7	**Depth**	4.57 to 5.18 m
Source	BH21-08		

Sieve (mm)	% Passing	Sieve (mm)	% Passing	Size (mm)	% Passing
75	100.0	4.75	97.8	0.0425	55.3
63	100.0	2	95.0	0.0304	52.6
53	100.0	0.850	93.1	0.0197	47.2
37.5	100.0	0.425	91.1	0.0117	39.9
26.5	100.0	0.250	88.4	0.0085	34.5
19	100.0	0.106	73.1	0.0061	29.0
13.2	100.0	0.075	66.7	0.0031	22.7
9.5	99.3			0.0013	14.5



Comments:

Reported By: R. Serluca, Laboratory Manager. **Date:** Feb.24.21
Reviewed By: N. Warrier **Date:** Feb.28.21

Notice: The test data given herein pertain to the sample provide, and may not be applicable to other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

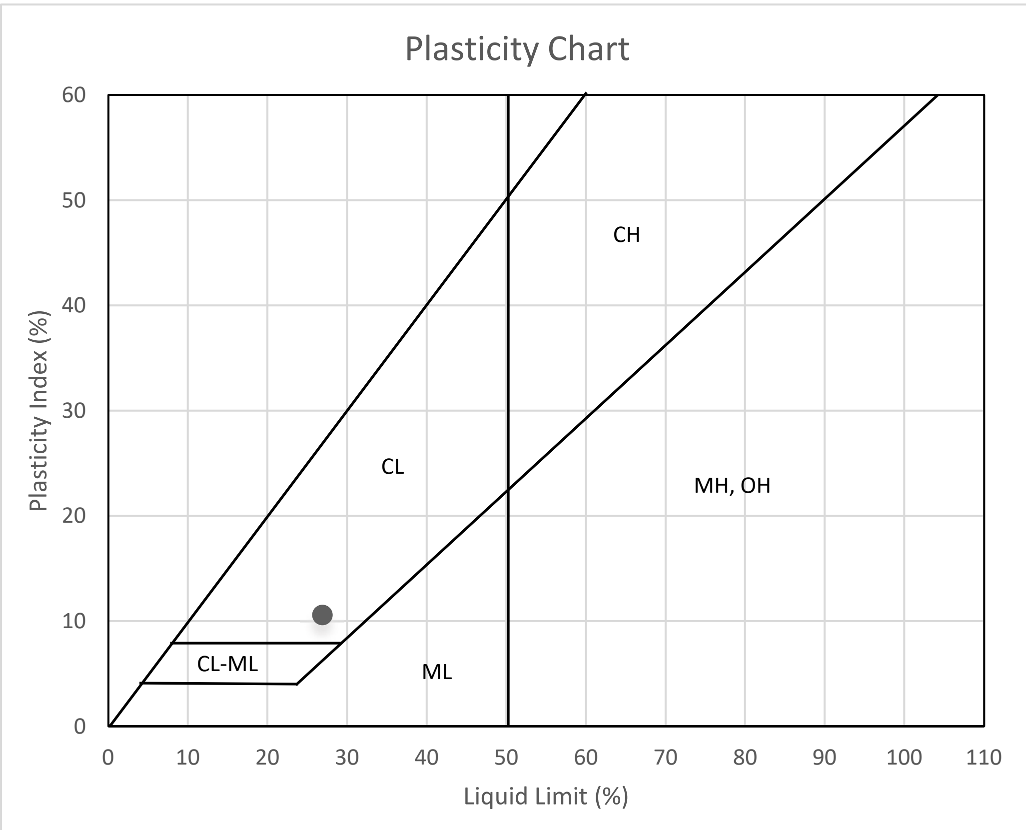
Liquid Limit, Plastic Limit and Plasticity Index of Soils.

HATCH
Geotechnical Laboratory

MTO LS-703 & 704

Date:	February 24.2021	**First Capital Realty**	
Project Number:	H/363590	85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3	
Project:	**Park Lawn - TRCA**	**Attn:**	Nina Warrier

Sample	SS3	**Depth**	1.52 to 2.13 m
Source	BH21-S5		



Liquid Limit	27%
Plastic Limit	16%
Plasticity Index	11%

Comments:

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb.24.21
Reviewed By:	N. Warrier	**Date:**	Feb.26.21

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Suite 300, 4342 Queen St, Niagara Falls, Ontario, Canada, L2E 7J7 Tel:1 (905) 374 5200 www.hatch.com.

Liquid Limit, Plastic Limit and Plasticity Index of Soils.

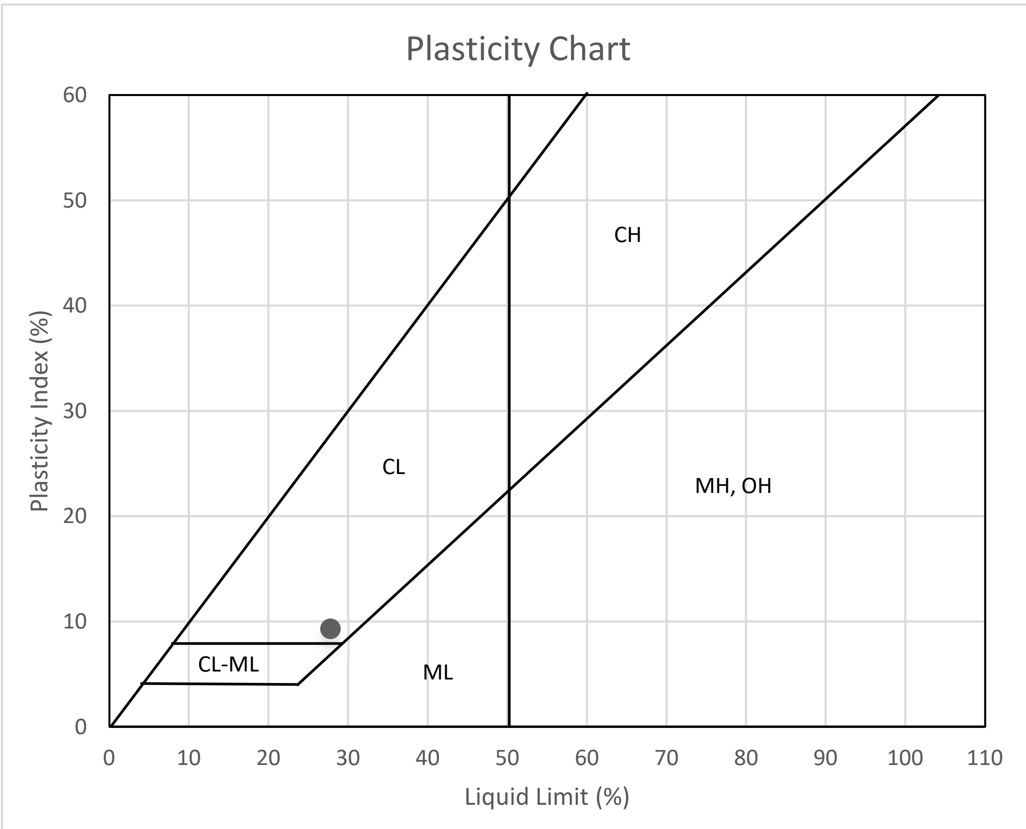
HATCH
Geotechnical Laboratory

MTO LS-703 & 704

Date: February 24.2021
Project Number: H/363590
Project: **Park Lawn - TRCA**

First Capital Realty
85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3
Attn: Nina Warrier

Sample	SS5	**Depth**	3.05 to 3.66 m
Source	BH21-S5		



Liquid Limit	28%
Plastic Limit	18%
Plasticity Index	9%

Comments:

Reported By: R. Serluca, Laboratory Manager. **Date:** Feb.24.21
Reviewed By: N. Warrier **Date:** Feb.26.21

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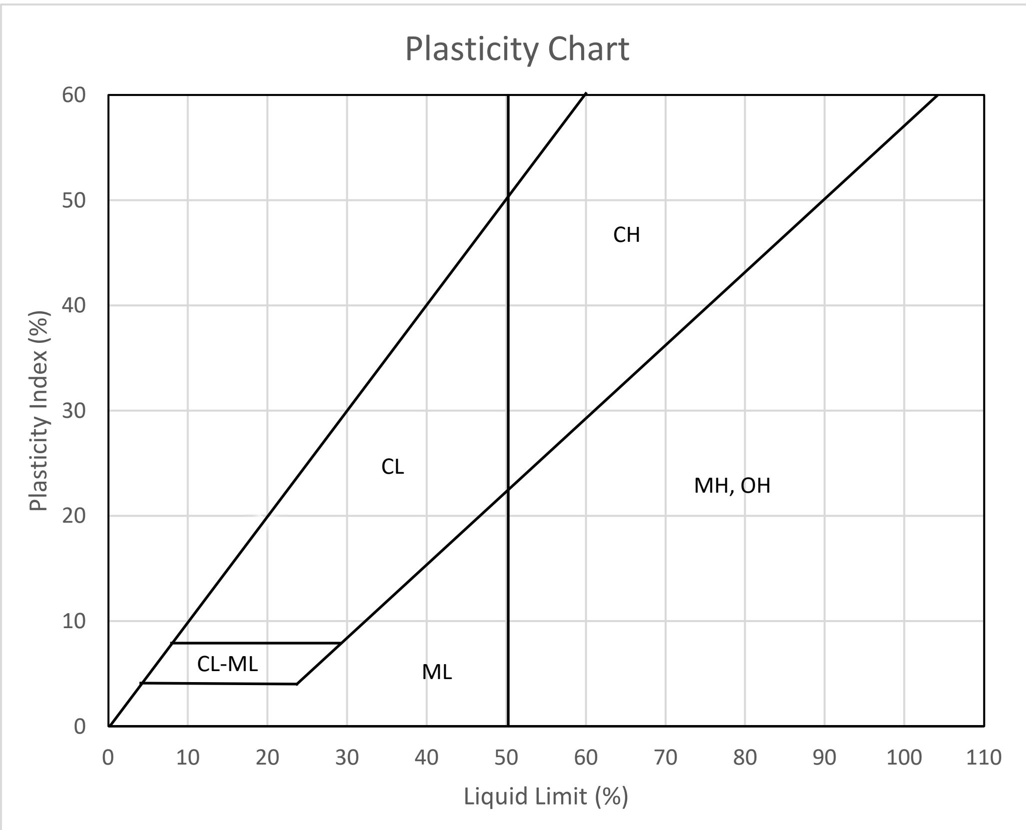
Liquid Limit, Plastic Limit and Plasticity Index of Soils.

HATCH
Geotechnical Laboratory

MTO LS-703 & 704

Date:	February 24.2021	**First Capital Realty**	
Project Number:	H/363590	85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3	
Project:	**Park Lawn - TRCA**	**Attn:**	Nina Warrier

Sample	SS7	**Depth**	4.57 to 5.18 m
Source	BH21-S5		



Liquid Limit	20%
Plastic Limit	Non-plastic
Plasticity Index	Non-plastic

Comments:

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb.24.21
Reviewed By:	N. Warrier	**Date:**	Feb.26.21

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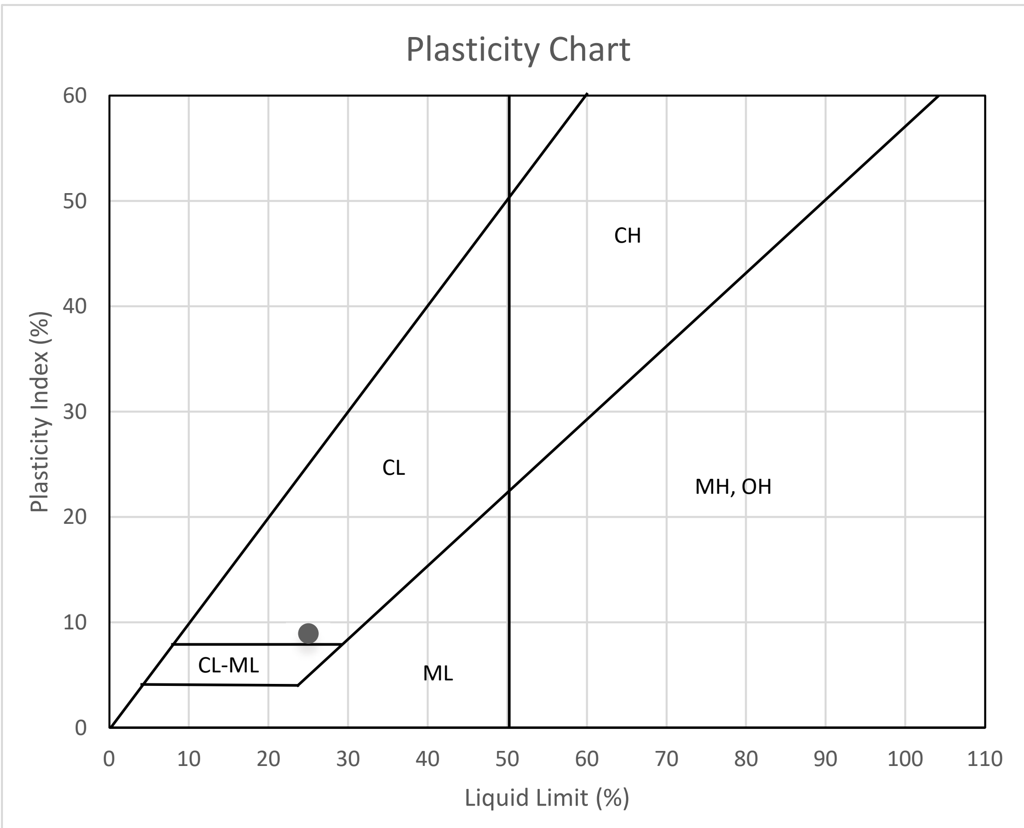
Liquid Limit, Plastic Limit and Plasticity Index of Soils.

HATCH
Geotechnical Laboratory

MTO LS-703 & 704

Date:	February 24.2021	**First Capital Realty**	
Project Number:	H/363590	85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3	
Project:	**Park Lawn - TRCA**	**Attn:**	Nina Warrier

Sample	SS8	**Depth**	6.10 to 6.71 m
Source	BH21-S5		



Liquid Limit	25%
Plastic Limit	16%
Plasticity Index	9%

Comments:

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb.24.21
Reviewed By:	N. Warrier	**Date:**	Feb.26.21

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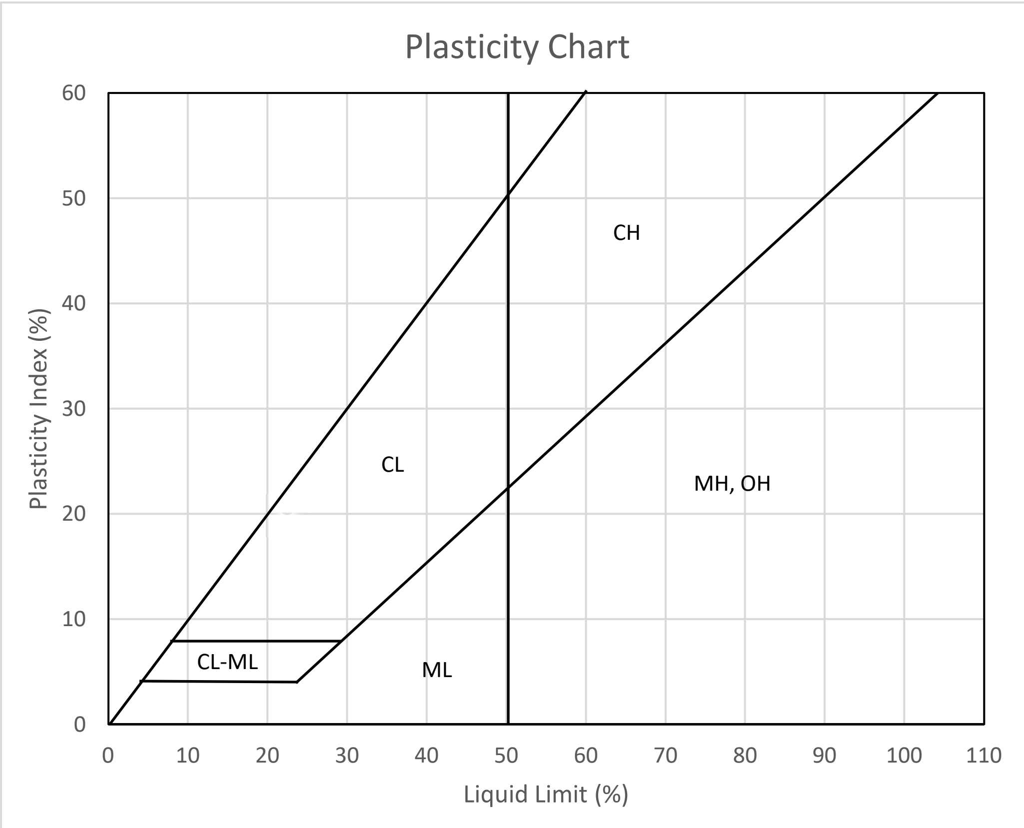
Liquid Limit, Plastic Limit and Plasticity Index of Soils.

MTO LS-703 & 704

HATCH
Geotechnical Laboratory

Date:	February 24.2021	**First Capital Realty**	
Project Number:	H/363590	85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3	
Project:	**Park Lawn - TRCA**	**Attn:**	Nina Warrier

Sample	SS3	**Depth**	1.52 to 2.13 m
Source	BH21-07		



Liquid Limit	22%
Plastic Limit	Non-plastic
Plasticity Index	Non-plastic

Comments:

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb.24.21
Reviewed By:	N. Warrier	**Date:**	Feb.26.21

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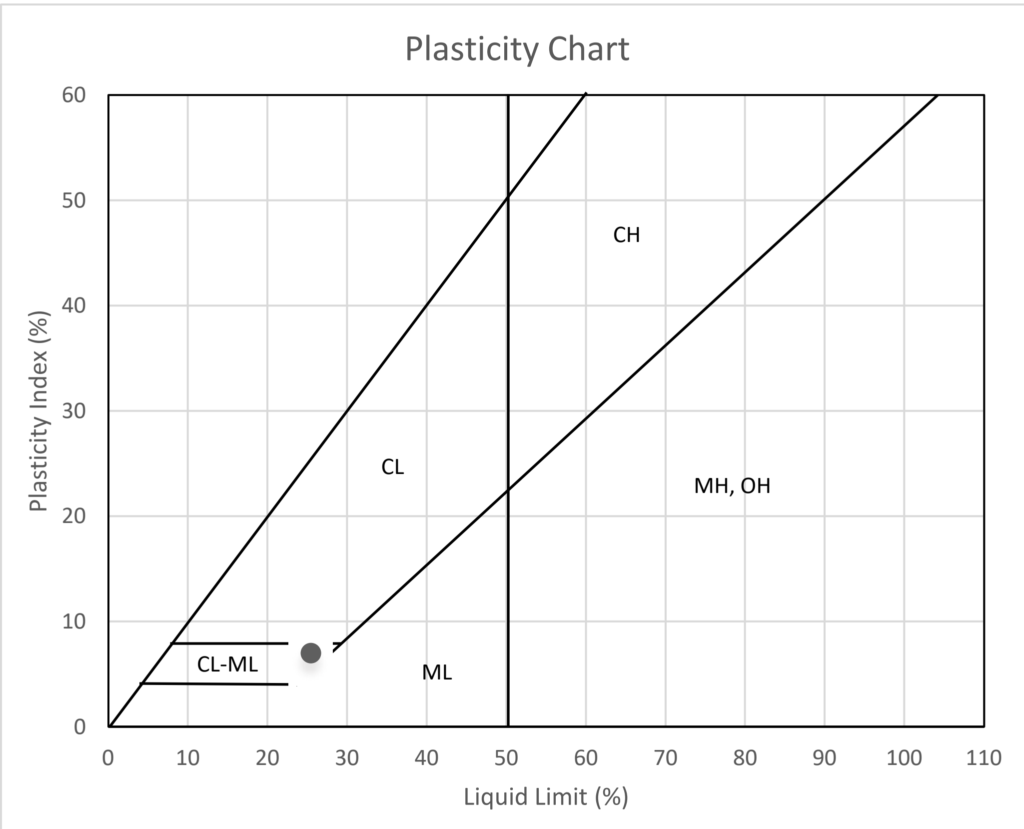
Liquid Limit, Plastic Limit and Plasticity Index of Soils.

HATCH
Geotechnical Laboratory

MTO LS-703 & 704

Date:	February 24.2021	**First Capital Realty**	
Project Number:	H/363590	85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3	
Project:	**Park Lawn - TRCA**	**Attn:**	Nina Warrier

Sample	SS5	**Depth**	3.05 to 3.66 m
Source	BH21-07		



Liquid Limit	25%
Plastic Limit	18%
Plasticity Index	7%

Comments:

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb.24.21
Reviewed By:	N. Warrier	**Date:**	Feb.26.21

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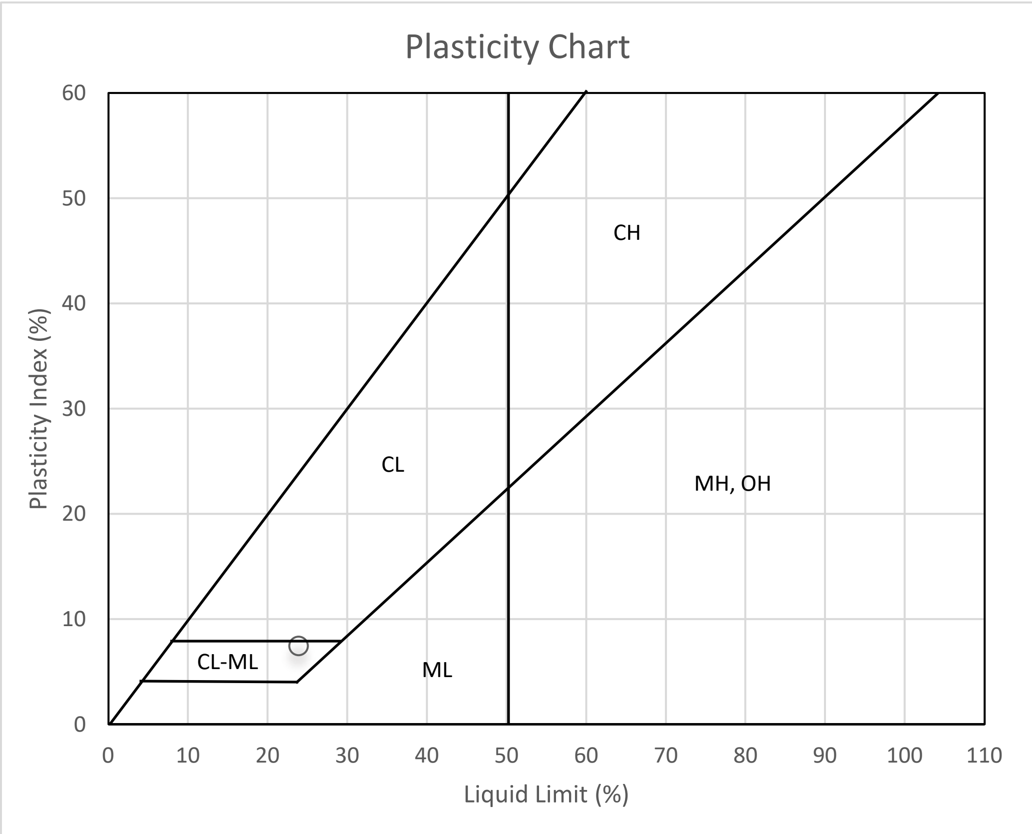
Liquid Limit, Plastic Limit and Plasticity Index of Soils.

HATCH
Geotechnical Laboratory

MTO LS-703 & 704

Date:	February 24.2021	**First Capital Realty**	
Project Number:	H/363590	85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3	
Project:	**Park Lawn - TRCA**	**Attn:**	Nina Warrier

Sample	SS7	**Depth**	4.57 to 5.18 m
Source	BH21-07		



Liquid Limit	24%
Plastic Limit	16%
Plasticity Index	7%

Comments:

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb.24.21
Reviewed By:	N. Warrier	**Date:**	Feb.26.21

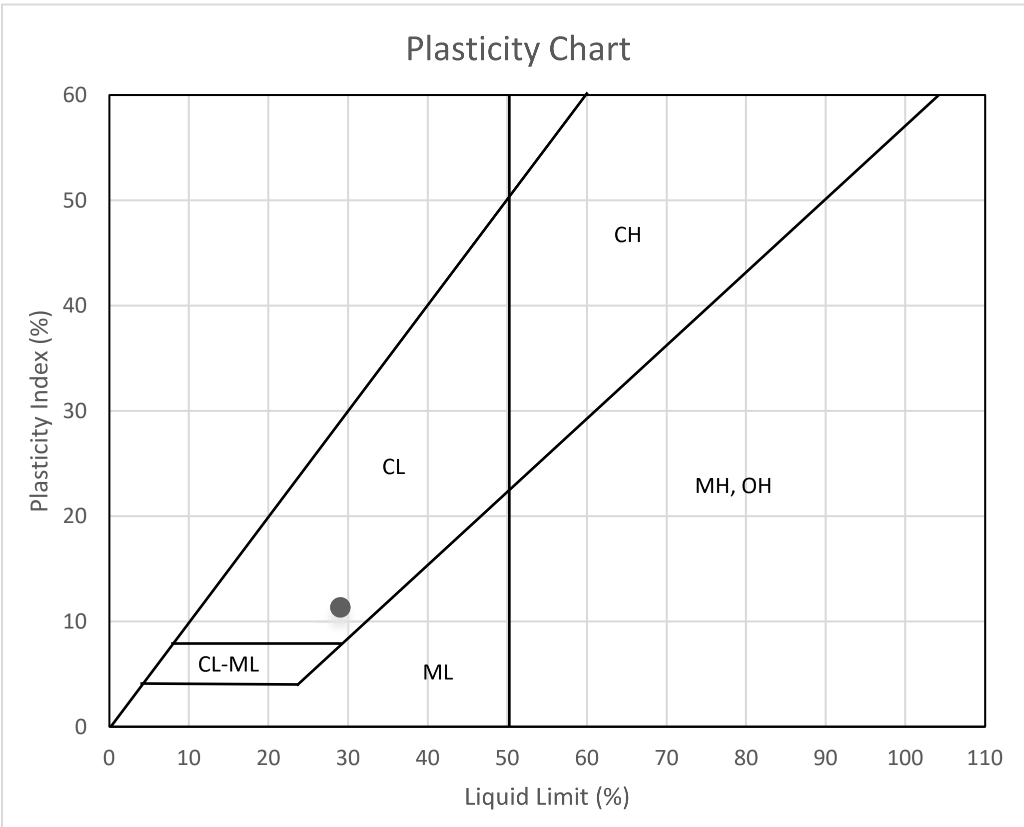
Liquid Limit, Plastic Limit and Plasticity Index of Soils.

HATCH
Geotechnical Laboratory

MTO LS-703 & 704

Date:	February 24.2021	**First Capital Realty**	
Project Number:	H/363590	85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3	
Project:	**Park Lawn - TRCA**	**Attn:**	Nina Warrier

Sample	SS9	**Depth**	7.62 to 8.23 m
Source	BH21-07		



Liquid Limit	29%
Plastic Limit	18%
Plasticity Index	11%

Comments:

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb.24.21
Reviewed By:	N. Warrier	**Date:**	Feb.26.21

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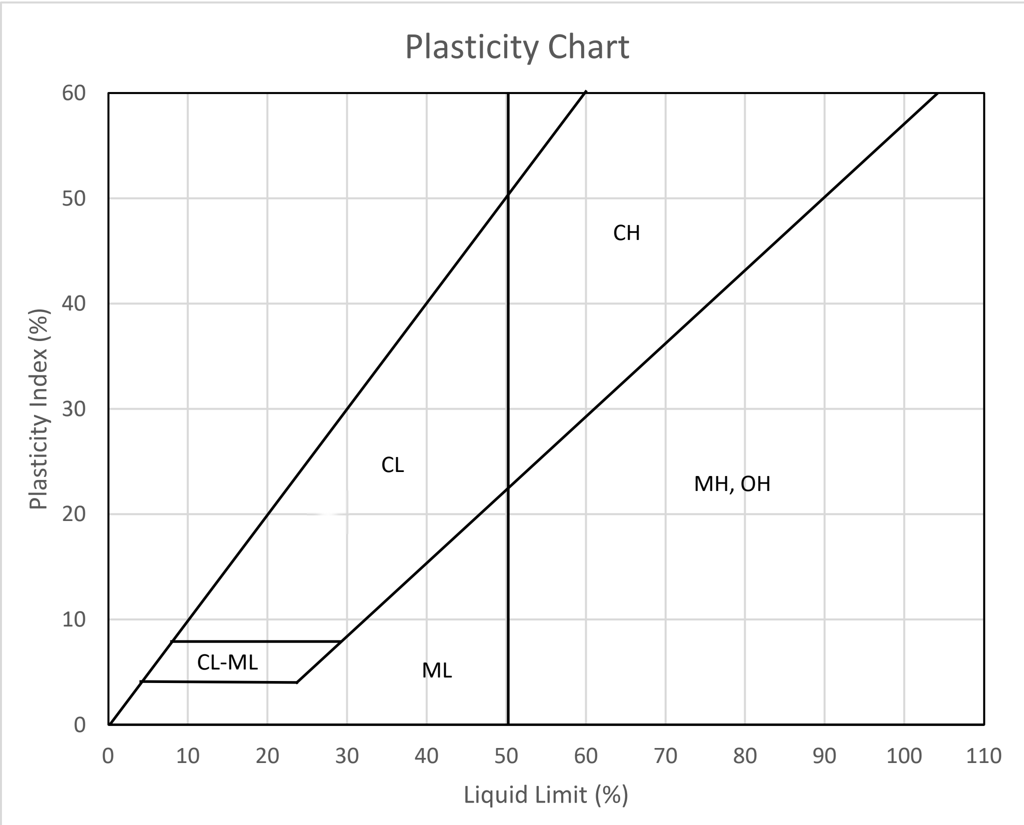
Liquid Limit, Plastic Limit and Plasticity Index of Soils.

HATCH
Geotechnical Laboratory

MTO LS-703 & 704

Date:	February 24.2021	**First Capital Realty**	
Project Number:	H/363590	85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3	
Project:	**Park Lawn - TRCA**	**Attn:**	Nina Warrier

Sample	SS7	**Depth**	4.57 to 5.18 m
Source	BH21-08		



Liquid Limit	28%
Plastic Limit	Non-plastic
Plasticity Index	Non-plastic

Comments:

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb.24.21
Reviewed By:	N. Warrier	**Date:**	Feb.26.21

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Determination of Specific Gravity of Soils

HATCH
Geotechnical Laboratory

MTO LS-705

Date:	February 24.2021	**First Capital Realty**
Project Number:	H/363590	85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3
Project:	**Park Lawn - TRCA**	**Attn:** Nina Warrier

Sample	SS5	**Depth**	3.05 to 3.66 m
Source	BH21-S5		

Specimen	G1	G2	G3
Pycnometer I.D	36	26	48
Mass of Pycnometer (mf)	42.97	42.43	42.57
Mass of dry specimen + Pycnometer (ms)	66.28	69.16	73.23
Mass of dry soil (mo=ms-mf)	23.31	26.73	30.66
Mass of pycnometer + water (ma)	143.9	142.76	143.35
Mass of pycnometer+ soil + water (mb)	158.63	159.59	162.67
Mass of water displaced (ma+mo)-mb	8.58	9.90	11.34
Temperature of contents (Tx)	22	22.00	22
Specific Gravity G (mo/mo+(ma-mb)	2.717	2.700	2.704
Maximum diff. in G (<0.02)		0.017	
Average Specific Gravity		2.707	
Correction Factor to 20*C		0.9996	
Average Specific Gravity at 20*C		**2.706**	

TEST NOTES

Test on oven dried specimen, portion passing 2.00 mm sieve.

Removal of entrapped air by Vacuum and agitation.

Fluid used - distilled water

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb.26.2021
Reviewed By:	N. Warrier	**Date:**	March 2.2021

Determination of Specific Gravity of Soils

HATCH
Geotechnical Laboratory

MTO LS-705

Date:	February 24.2021	**First Capital Realty**	
Project Number:	H/363590	85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3	
Project:	**Park Lawn - TRCA**	**Attn:**	Nina Warrier

Sample	SS8	**Depth**	6.10 to 7.71 m
Source	BH21-S5		

Specimen	G1	G2	G3
Pycnometer I.D	66	48	36
Mass of Pycnometer (mf)	43.71	42.57	42.97
Mass of dry specimen + Pycnometer (ms)	74.04	76.87	68.85
Mass of dry soil (mo=ms-mf)	30.33	34.30	25.88
Mass of pycnometer + water (ma)	144.14	143.35	143.9
Mass of pycnometer+ soil + water (mb)	163.4	165.10	160.28
Mass of water displaced (ma+mo)-mb	11.07	12.55	9.5
Temperature of contents (Tx)	22	22.00	22
Specific Gravity G (mo/mo+(ma-mb)	2.740	2.733	2.724
Maximum diff. in G (<0.02)		0.016	
Average Specific Gravity		2.732	
Correction Factor to 20*C		0.9996	
Average Specific Gravity at 20*C		**2.731**	

TEST NOTES

Test on oven dried specimen, portion passing 2.00 mm sieve.
Removal of entrapped air by Vacuum and agitation.
Fluid used - distilled water

Reported By:	R. Serluca, Laboratory Manager.	**Date:**	Feb.26.2021
Reviewed By:	N. Warrier	**Date:**	March 2.2021

Determination of Specific Gravity of Soils

HATCH
Geotechnical Laboratory

MTO LS-705

Date: February 24.2021
Project Number: H/363590
Project: **Park Lawn - TRCA**

First Capital Realty
85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3
Attn: Nina Warrier

Sample	SS7	**Depth**	4.57 to 5.18 m
Source	BH21-07		

Specimen	G1	G2	G3
Pycnometer I.D	66	63	113
Mass of Pycnometer (mf)	43.71	43.18	42.99
Mass of dry specimen + Pycnometer (ms)	72.88	69.40	66.37
Mass of dry soil (mo=ms-mf)	29.17	26.22	23.38
Mass of pycnometer + water (ma)	144.14	142.99	142.43
Mass of pycnometer+ soil + water (mb)	162.43	159.37	157.07
Mass of water displaced (ma+mo)-mb	10.88	9.84	8.74
Temperature of contents (Tx)	22	22.00	22
Specific Gravity G (mo/mo+(ma-mb)	2.681	2.665	2.675
Maximum diff. in G (<0.02)		0.016	
Average Specific Gravity		2.674	
Correction Factor to 20*C		0.9996	
Average Specific Gravity at 20*C		**2.673**	

TEST NOTES
Test on oven dried specimen, portion passing 2.00 mm sieve.
Removal of entrapped air by Vacuum and agitation.
Fluid used - distilled water

Reported By: R. Serluca, Laboratory Manager. **Date:** Feb.26.2021
Reviewed By: N. Warrier **Date:** March 2.2021

Suite 300, 4342 Queen St, Niagara Falls, Ontario, Canada, L2E 7J7 Tel:1 (905) 374 5200 www.hatch.com.

Determination of Specific Gravity of Soils

HATCH
Geotechnical Laboratory

MTO LS-705

Date: February 24.2021
Project Number: H/363590
Project: **Park Lawn - TRCA**

First Capital Realty
85 Hanna Ave. Suite 400 Toronto ON. MK6 3S3
Attn: Nina Warrier

Sample	SS3	**Depth**	1.52 to 2.13m
Source	BH21-08		

Specimen	G1	G2	G3
Pycnometer I.D	113	63	26
Mass of Pycnometer (mf)	42.99	43.18	42.43
Mass of dry specimen + Pycnometer (ms)	69.76	72.56	70.19
Mass of dry soil (mo=ms-mf)	26.77	29.38	27.76
Mass of pycnometer + water (ma)	142.43	142.99	142.76
Mass of pycnometer+ soil + water (mb)	159.15	161.26	160.03
Mass of water displaced (ma+mo)-mb	10.05	11.11	10.49
Temperature of contents (Tx)	22	22.00	22
Specific Gravity G (mo/mo+(ma-mb)	2.664	2.644	2.646
Maximum diff. in G (<0.02)		0.019	
Average Specific Gravity		2.651	
Correction Factor to 20*C		0.9996	
Average Specific Gravity at 20*C		**2.650**	

TEST NOTES
Test on oven dried specimen, portion passing 2.00 mm sieve.
Removal of entrapped air by Vacuum and agitation.
Fluid used - distilled water

Reported By: R. Serluca, Laboratory Manager. **Date:** Feb.26.2021
Reviewed By: N. Warrier **Date:** March 2.2021

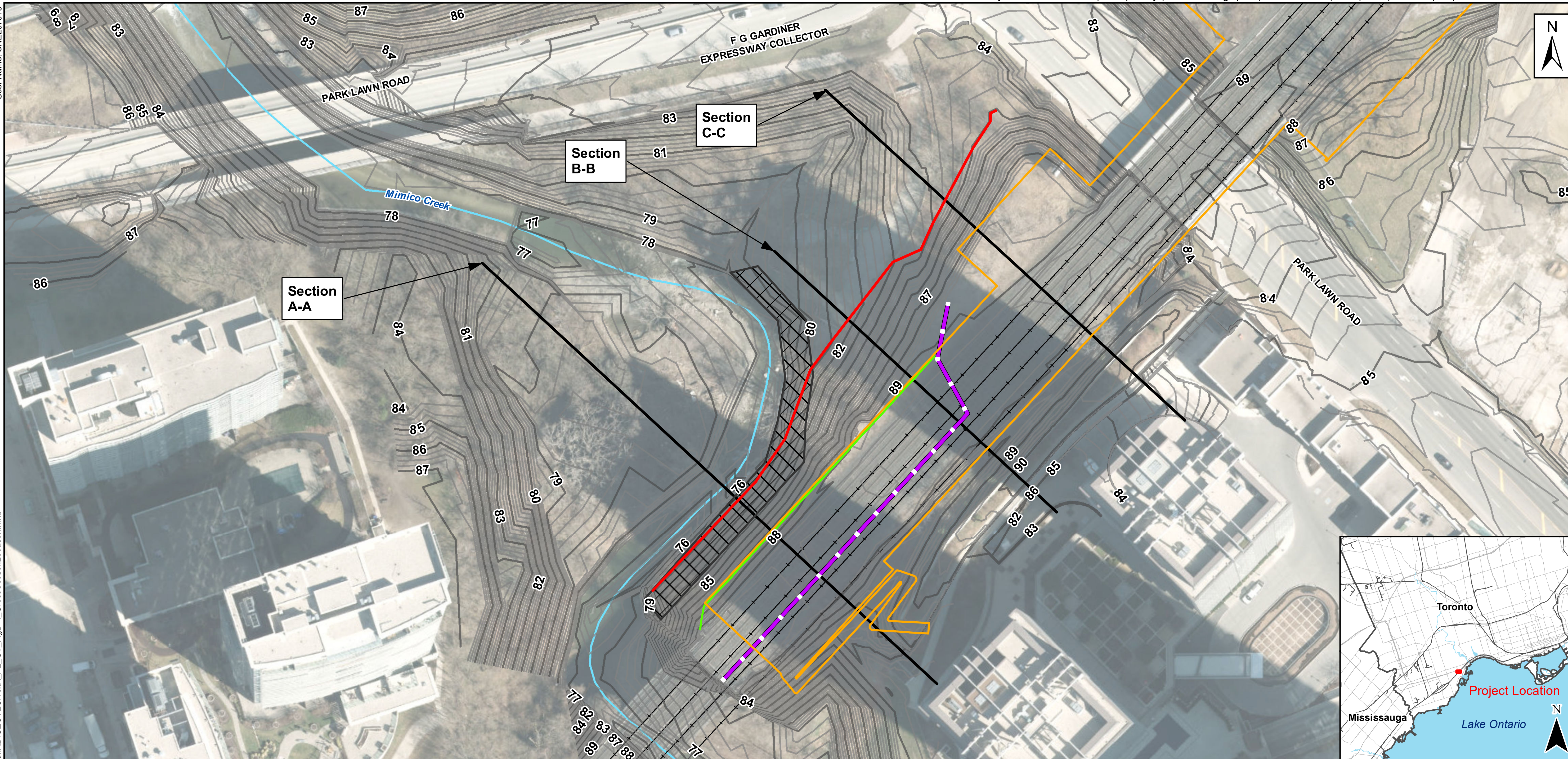
Notice: The test data given herein pertain to the sample provide, and may not be applicable to other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

Appendix D

Cross-Section Location Plan and Stability Assessment Results

Aerial Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

User Name: SNEL97010



LEGEND

- Unmitigated Long-Term Stable Top of Slope
- Existing Toe of Slope
- Railway
- Mimico Creek
- Proposed Station Footprint
- Proposed Retaining Wall
- Erosion Allowance Zone

1:1,000

0 10 20 40 Meters

NOTES

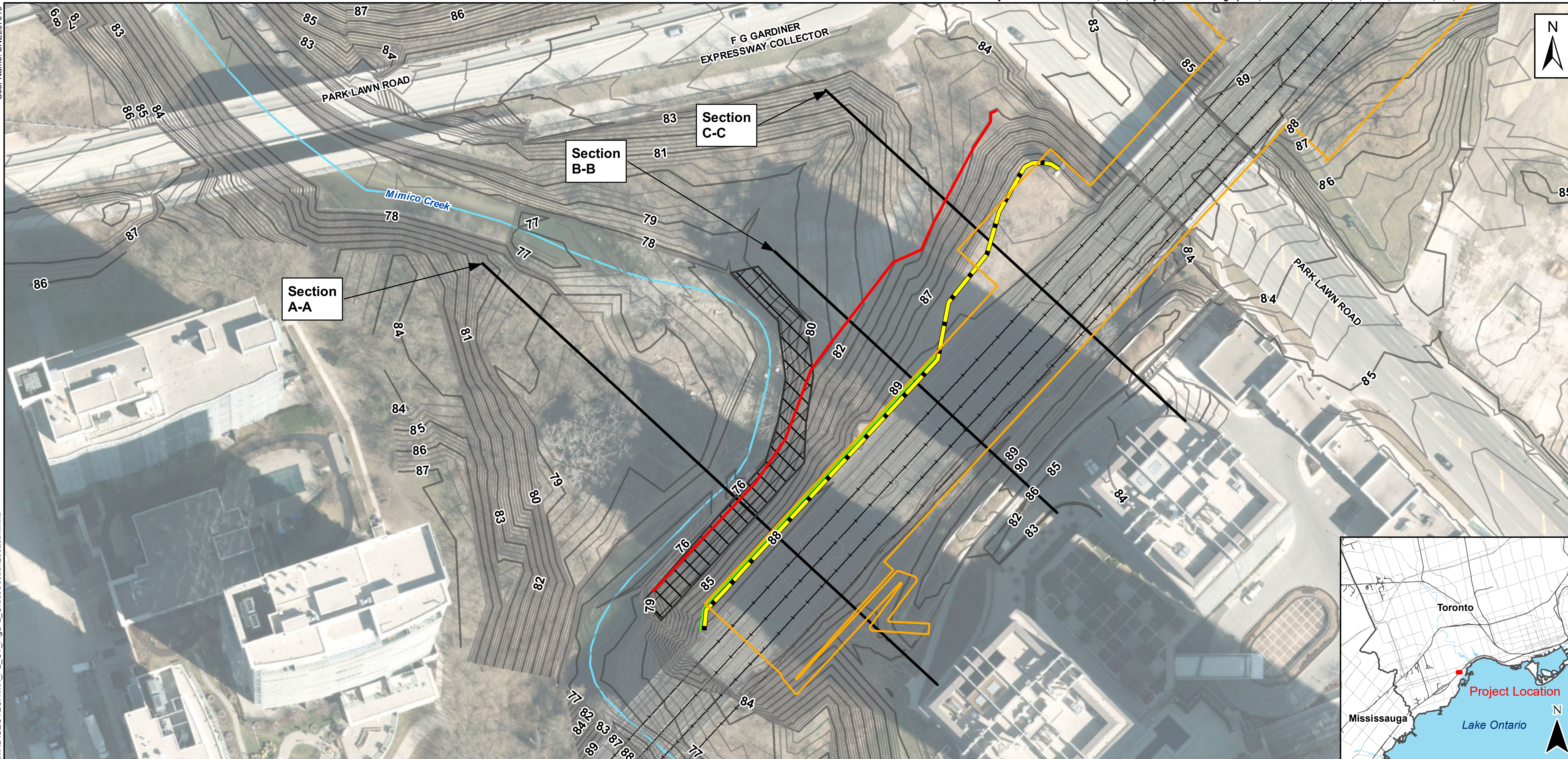
1. Coordinate system - UTM NAD 1983 Zone 17N.
2. Sources: Roads, Railways, Watercourses - Land Information Ontario;
3. Station Footprint Based on 10% Station Design;
4. The location and extents of the proposed retaining wall are approximate only. further analyses will be required to finalize both the location and extent of this wall, which will be carried out at a later stage of the design process;
5. LTSTOP meets minimum slope gradient of 1.8H:1V;
6. Preliminary wall length shown on drawing. Final wall length to be determined during wall design.
7. The Red Dashed Line represents the LTSTOS, which is based on:
a) Plot all slip surfaces in the range of 1.0 ≤ FS ≤ 1.5.
b) LTSTOS taken as the location furthest from the crest of the slope where a slip surface is projected to intersect the table land.

Project:	**Park Lawn GO Station**
Figure Title:	**Cross-Sections Location**
Prepared By: HATCH	**Date: December 17, 2021**
Version: PL.GT.100-1	**Review:**
Figure: D-1	**Page: 1 of 1**

Document Path: T:\Maps\GIS_Data\Metrolinx\ParkLawn\MXD\GEOTECH\MX_PL_GT_FigD-1_CrossSectionLocation.mxd

Aerial Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

User Name: SNEL97010



LEGEND

- Mitigated Long-Term Stable Top of Slope
- Existing Toe of Slope
- Railway
- Mimico Creek
- Proposed Station Footprint
- Proposed Retaining Wall
- Erosion Allowance Zone

NOTES

1. Coordinate system - UTM NAD 1983 Zone 17N.
2. Sources: Roads, Railways, Watercourses - Land Information Ontario;
3. Station Footprint Based on 10% Station Design;
4. The location and extents of the proposed retaining wall are approximate only. further analyses will be required to finalize both the location and extent of this wall, which will be carried out at a later stage of the design process;
5. LTSTOP meets minimum slope gradient of 1.8H:1V;
6. Preliminary wall length shown on drawing. Final wall length to be determined during wall design.

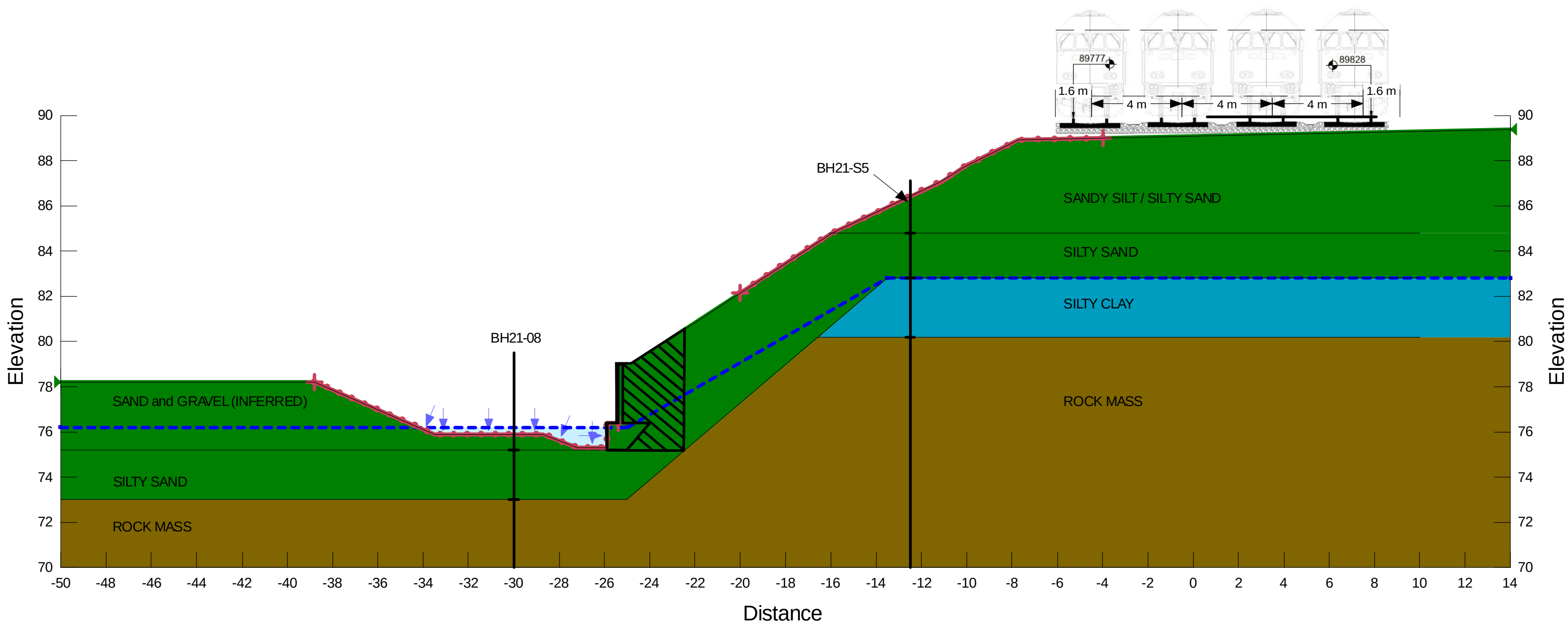
1:1,000

0 10 20 40 Meters

Project:	**Park Lawn GO Station**
Figure Title:	**Cross-Sections Location**
Prepared By: HATCH	**Date: December 17, 2021**
Version: PL.GT.100-1	**Review:**
Figure: D-2	**Page:** 1 of 1

Document Path: T:\Maps\GIS_Data\Metrolinx\ParkLawn\MXD\GEOTECH\MX_PL_GT_FigD-2_CrossSectionLocation.mxd

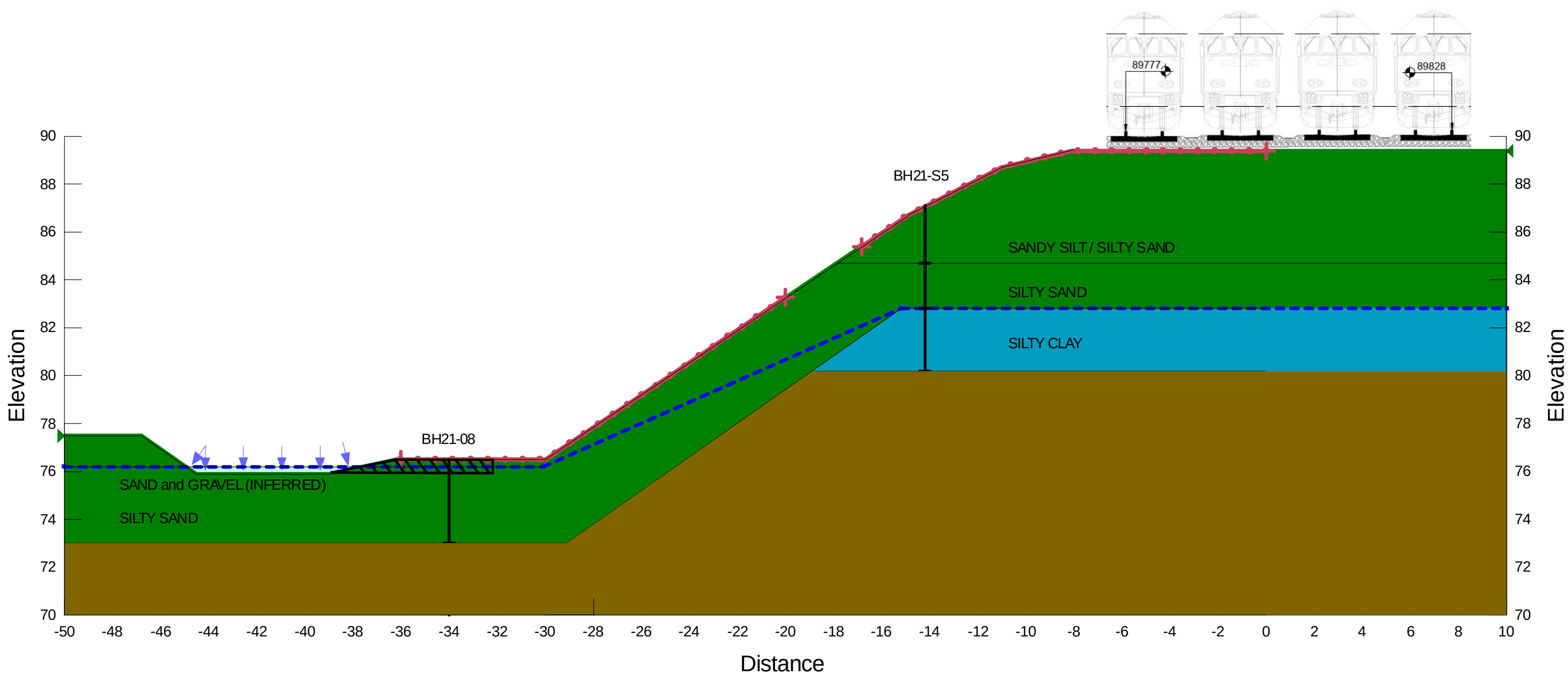
Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Embankment Fill	20	0	34
	Rock Mass	23	100	35
	Silt	17	3	30



NOTES:
1. BOREHOLE LOCATIONS ARE APPROXIMATE ONLY, AND OFFSET BASED ON THEIR LOCATION RELATIVE TO THE SECTION BEING CONSIDERED.
2. THE GROUNDWATER LEVEL FOR THE SECTION IS APPROXIMATE AND BASED ON ENGINEERING EXPERIENCE AND JUDGEMENT.
3. THE TRAIN AND PROPOSED PASSENGER PLATFORM SCHEMATIC IS APPROXIMATE AND SHOWN FOR REFERENCE ONLY.
4. DIMENSIONS FOR THE TRAIN AND PROPOSED PASSENGER PLATFORM ARE APPROXIMATE ONLY.

0+034 - Existing Conditions - Definition	
SLOPE/W - Morgenstern-Price (Minimum Slip Surface Depth: 1 m)	
TRCA Lands Slope Stability Assessment	FIGURE D-3

	Embankment Fill	20	0	34
	Rock Mass	23	100	35
	Silt	17	3	30



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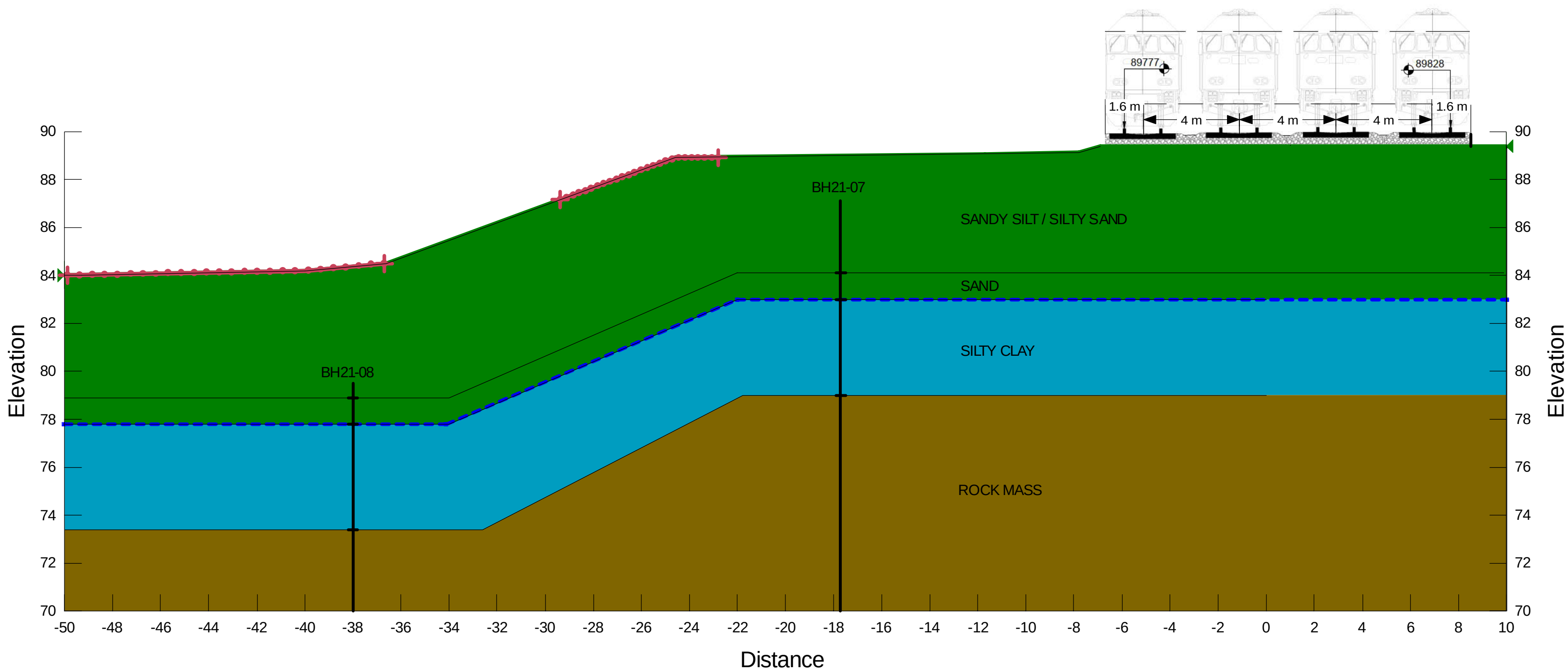
3. THE TRAIN AND PROPOSED PASSENGER PLATFORM SCHEMATIC IS APPROXIMATE AND SHOWN FOR REFERENCE ONLY.
4. DIMENSIONS FOR THE TRAIN AND PROPOSED PASSENGER PLATFORM ARE APPROXIMATE ONLY.

0+086 - Existing Conditions - Definition	
SLOPE/W - Morgenstern-Price (Minimum Slip Surface Depth: 1 m)	
TRCA Lands Slope Stability Assessment	FIGURE D-4

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Embankment Fill	20	0	34
	Rock Mass	23	100	35
	Silt	17	3	30



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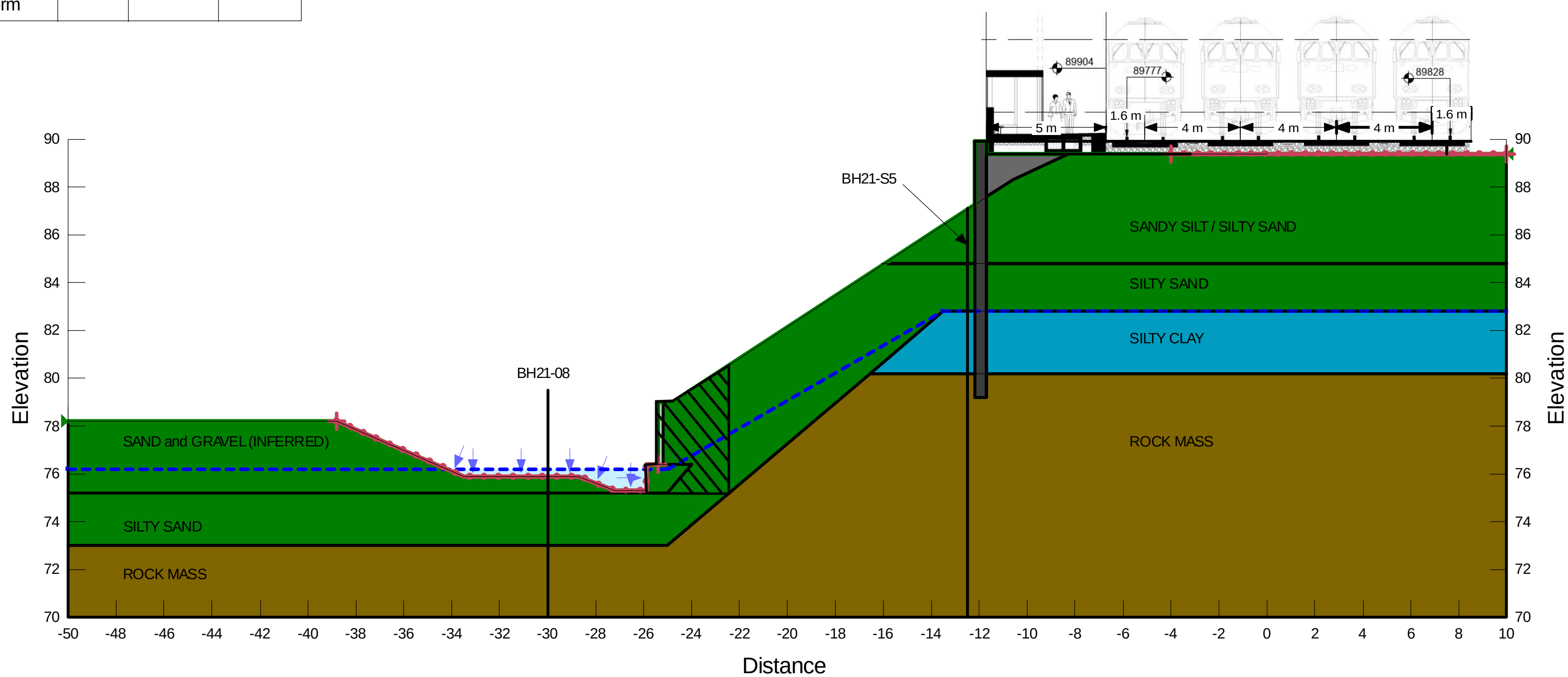
4. DIMENSIONS FOR THE TRAIN AND PROPOSED PASSENGER PLATFORM ARE APPROXIMATE ONLY.

0+125 - Existing Conditions - Definition	
SLOPE/W - Morgenstern-Price (Minimum Slip Surface Depth: 1 m)	
TRCA Lands Slope Stability Assessment	FIGURE D-5

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete	24	10,000	45
	Embankment Fill	20	0	34
	Rock Mass	23	100	35
	Silt	17	3	30
	Structural Fill - Platform	22	0	36



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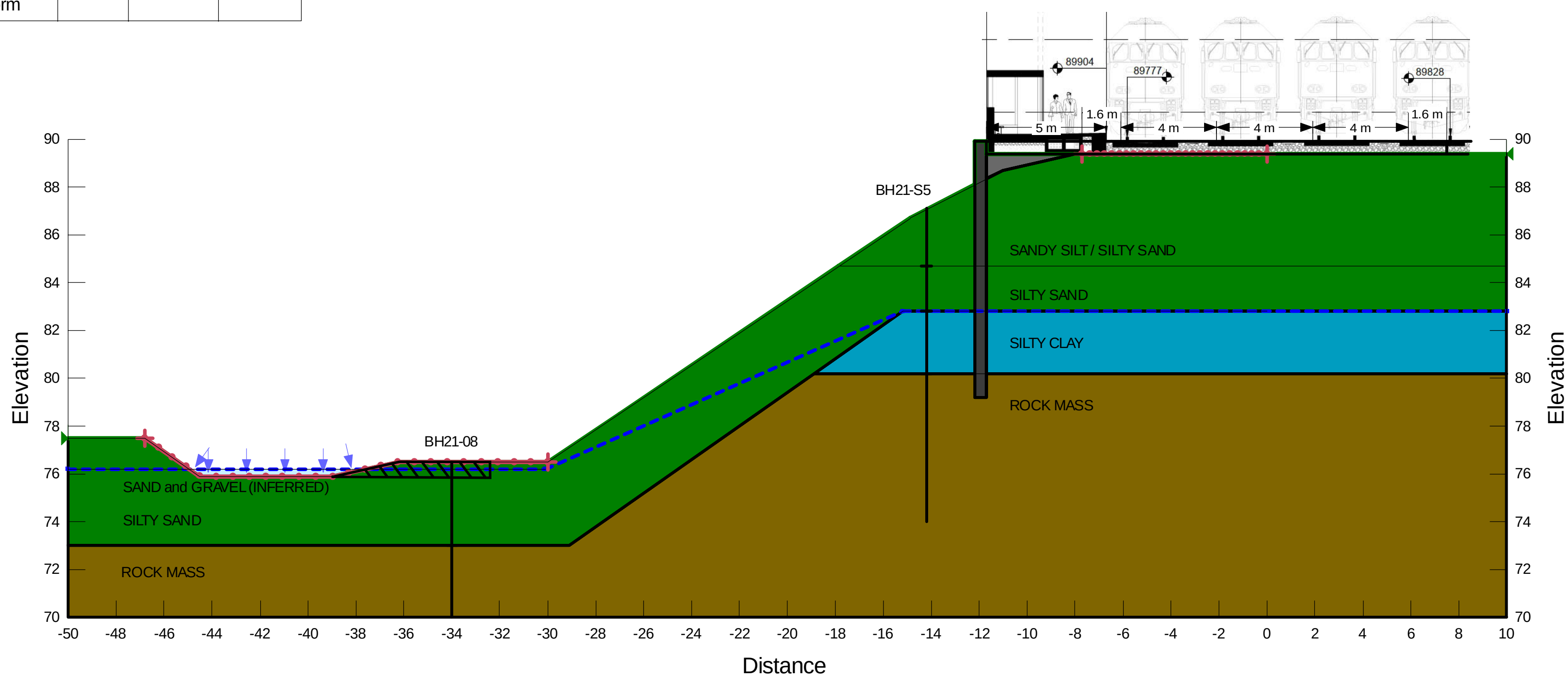
4. DIMENSIONS FOR THE TRAIN AND PROPOSED PASSENGER PLATFORM ARE APPROXIMATE ONLY.

0+034 - Rigid Wall - Definition	
SLOPE/W - Morgenstern-Price (Minimum Slip Surface Depth: 5 m)	
TRCA Lands Slope Stability Assessment	FIGURE D-6

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete	24	10,000	45
	Embankment Fill	20	0	34
	Rock Mass	23	100	35
	Silt	17	3	30
	Structural Fill - Platform	22	0	36



NOTES:
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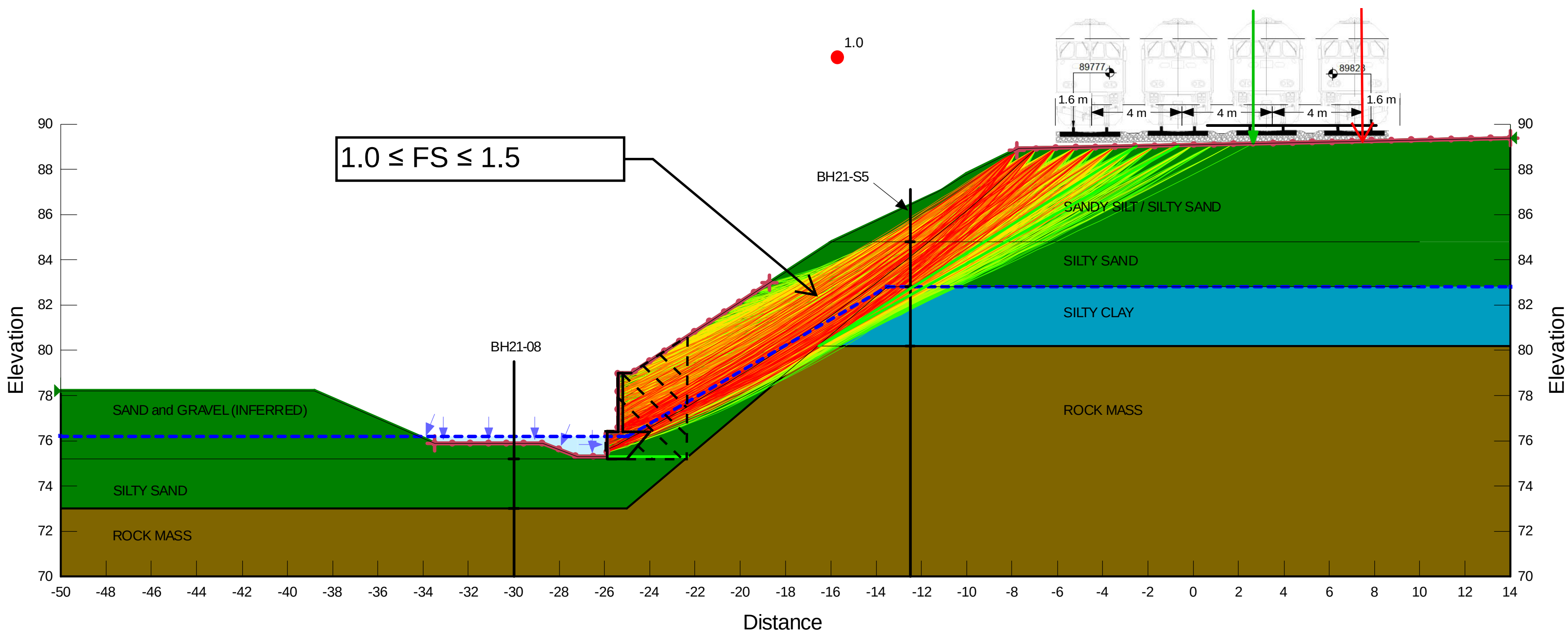
4. DIMENSIONS FOR THE TRAIN AND PROPOSED PASSENGER PLATFORM ARE APPROXIMATE ONLY.

0+086 - Rigid Wall - Definition	
SLOPE/W - Morgenstern-Price (Minimum Slip Surface Depth: 5 m)	
TRCA Lands Slope Stability Assessment	FIGURE D-7

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Embankment Fill	20	0	34
	Rock Mass	23	100	35
	Silt	17	3	30



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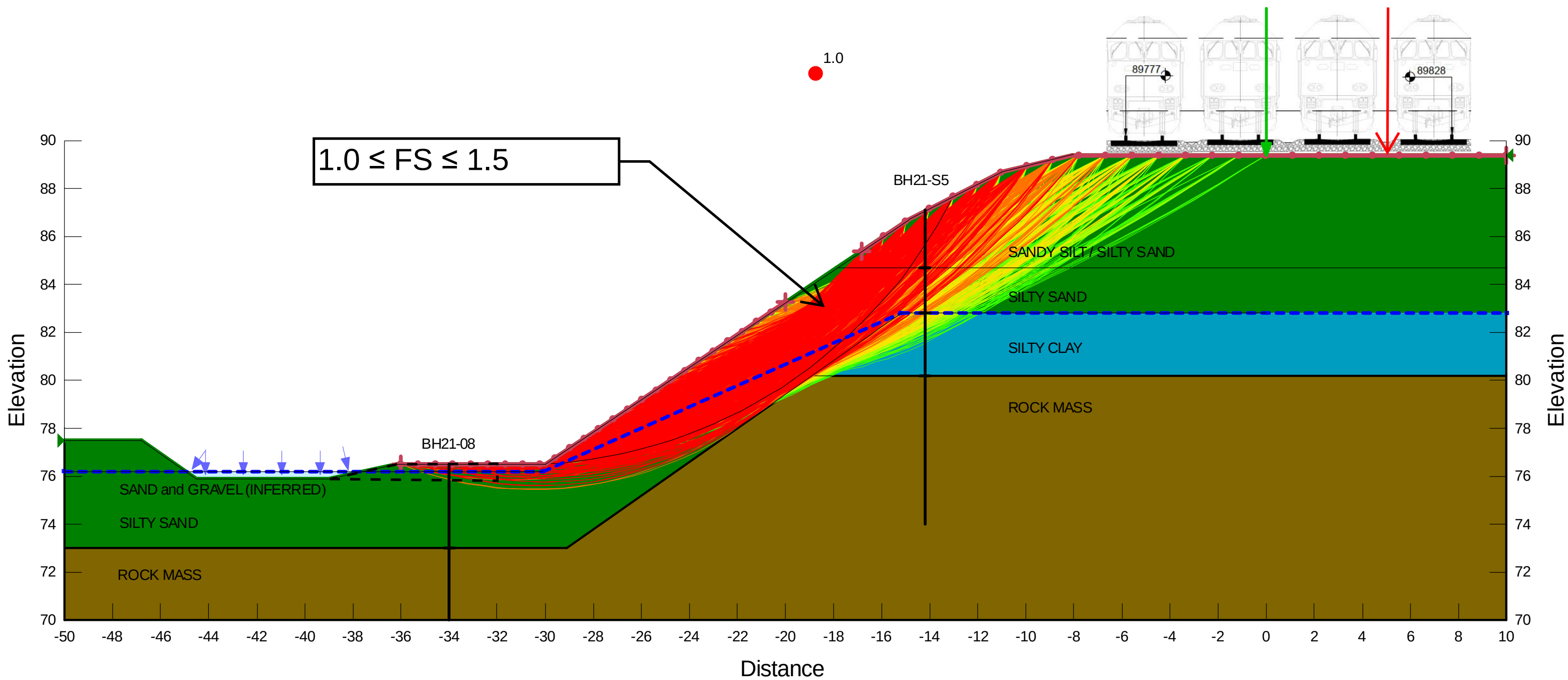
4. DIMENSIONS FOR THE TRAIN AND PROPOSED PASSENGER PLATFORM ARE APPROXIMATE ONLY.
5. SLIDING SURFACE SHOWN IN WHITE IS THE CRITICAL SLIDING SURFACE OR THE SLIDING SURFACE WITH THE LOWEST FACTOR OF SAFETY FOR THE GIVEN SECTION AND SCENARIO CONSIDERED.

0+034 - Existing Conditions	
SLOPE/W - Morgenstern-Price (Minimum Slip Surface Depth: 1 m)	
TRCA Lands Slope Stability Assessment	FIGURE D-8

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Embankment Fill	20	0	34
	Rock Mass	23	100	35
	Silt	17	3	30



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4. DIMENSIONS FOR THE TRAIN AND PROPOSED PASSENGER PLATFORM ARE APPROXIMATE ONLY.
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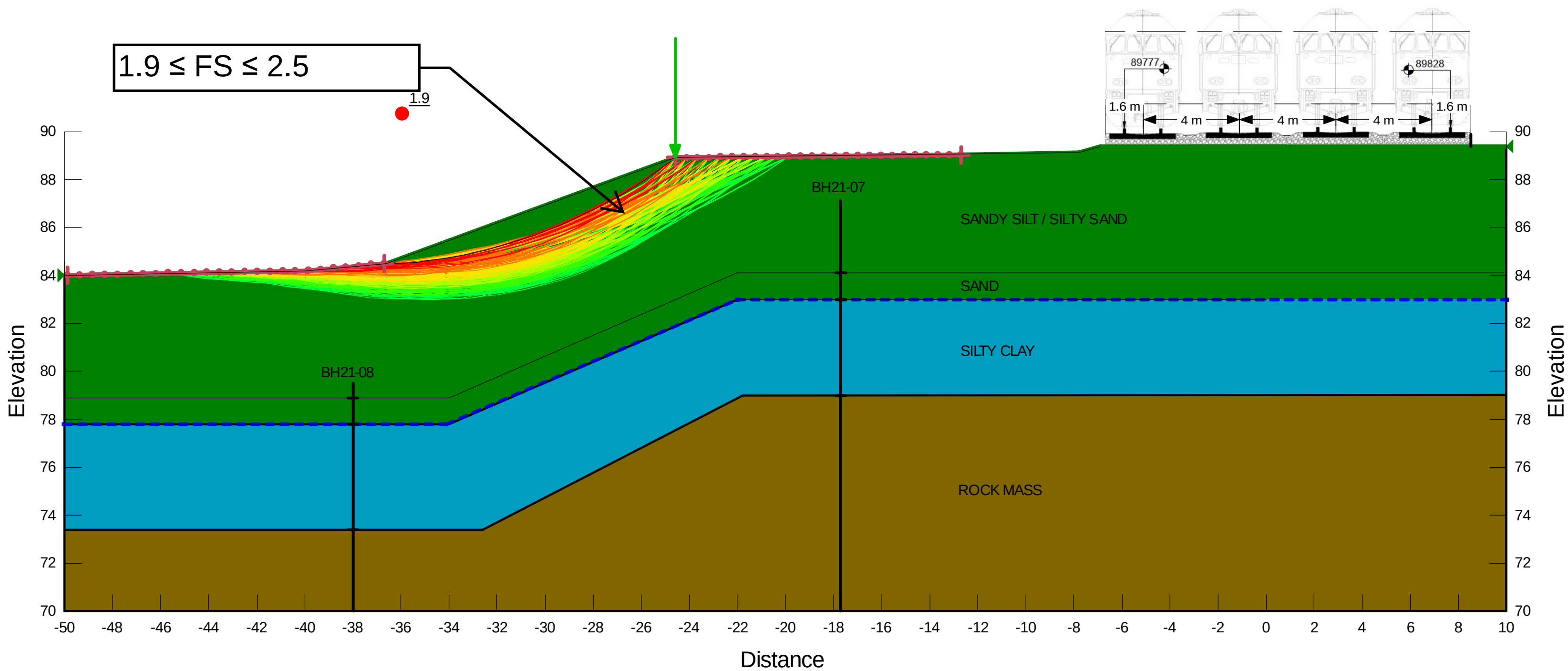
0+086 - Existing Conditions	
SLOPE/W - Morgenstern-Price (Minimum Slip Surface Depth: 1 m)	
TRCA Lands Slope Stability Assessment	FIGURE D-9

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Embankment Fill	20	0	34
	Rock Mass	23	100	35
	Silt	17	3	30



NOTES:

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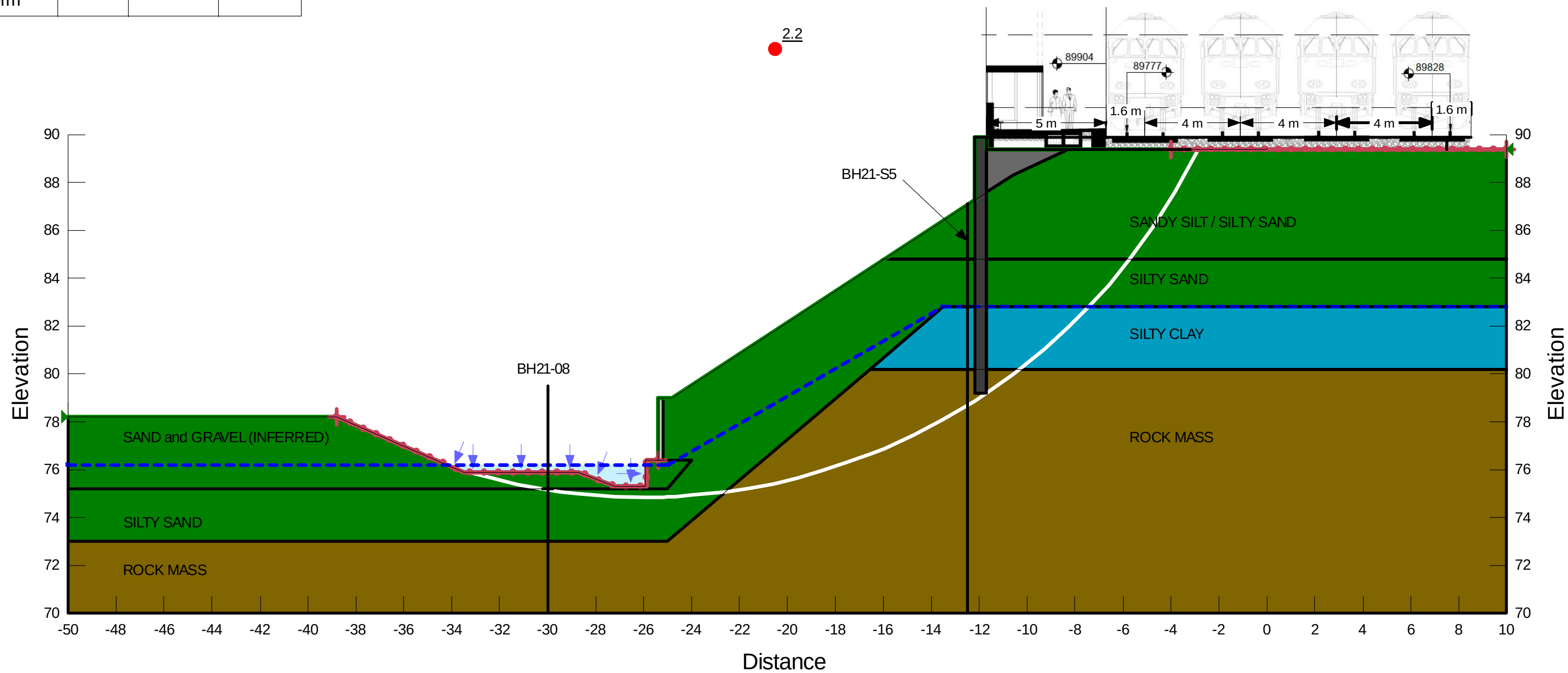
5. SLIDING SURFACE SHOWN IN WHITE IS THE CRITICAL SLIDING SURFACE OR THE SLIDING SURFACE WITH THE LOWEST FACTOR OF SAFETY FOR THE GIVEN SECTION AND SCENARIO CONSIDERED.

0+125 - Existing Conditions	
SLOPE/W - Morgenstern-Price (Minimum Slip Surface Depth: 1 m)	
TRCA Lands Slope Stability Assessment	FIGURE D-10

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete	24	10,000	45
	Embankment Fill	20	0	34
	Rock Mass	23	100	35
	Silt	17	3	30
	Structural Fill - Platform	22	0	36



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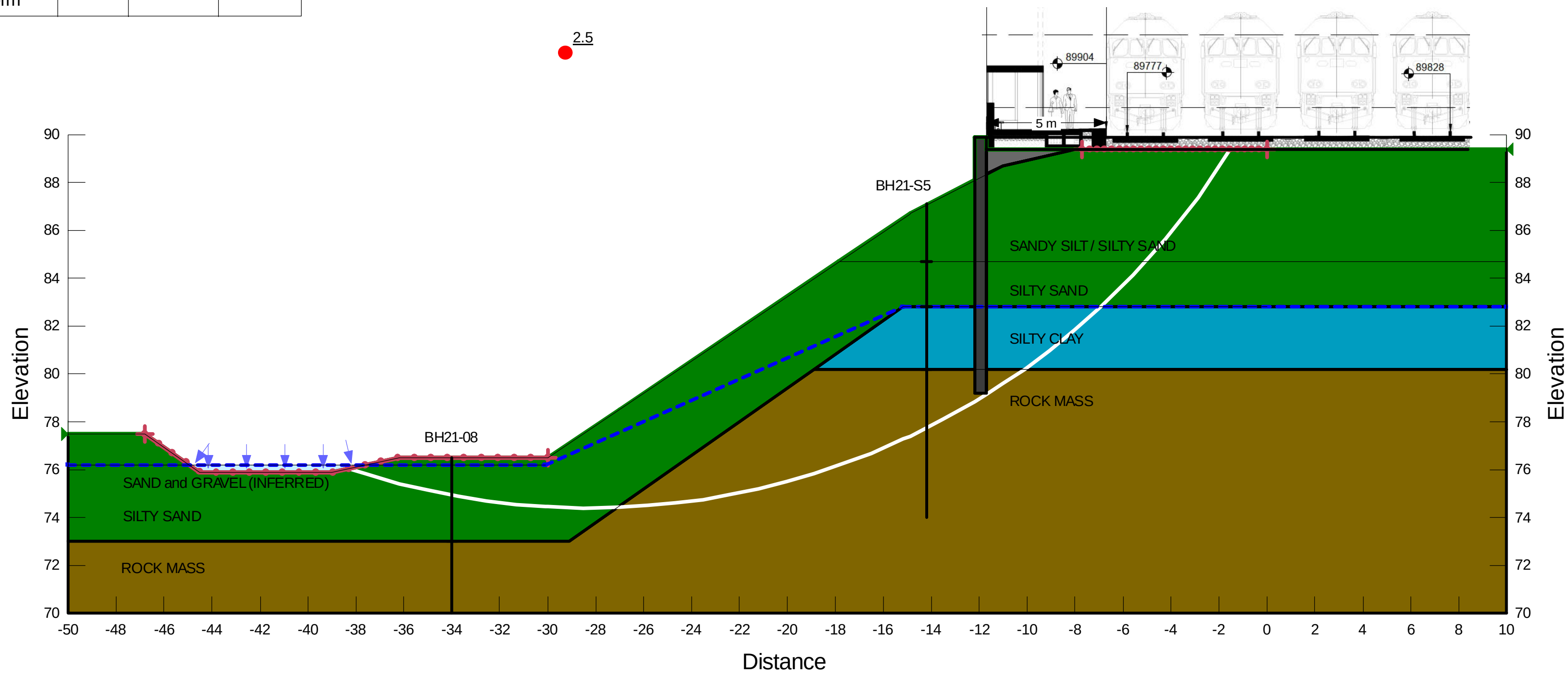
0+034 - Rigid Wall	
SLOPE/W - Morgenstern-Price (Minimum Slip Surface Depth: 5 m)	
TRCA Lands Slope Stability Assessment	FIGURE D-11

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete	24	10,000	45
	Embankment Fill	20	0	34
	Rock Mass	23	100	35
	Silt	17	3	30
	Structural Fill - Platform	22	0	36



NOTES:

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2. THE GROUNDWATER LEVEL FOR THE SECTION IS APPROXIMATE AND BASED ON ENGINEERING EXPERIENCE AND JUDGEMENT.
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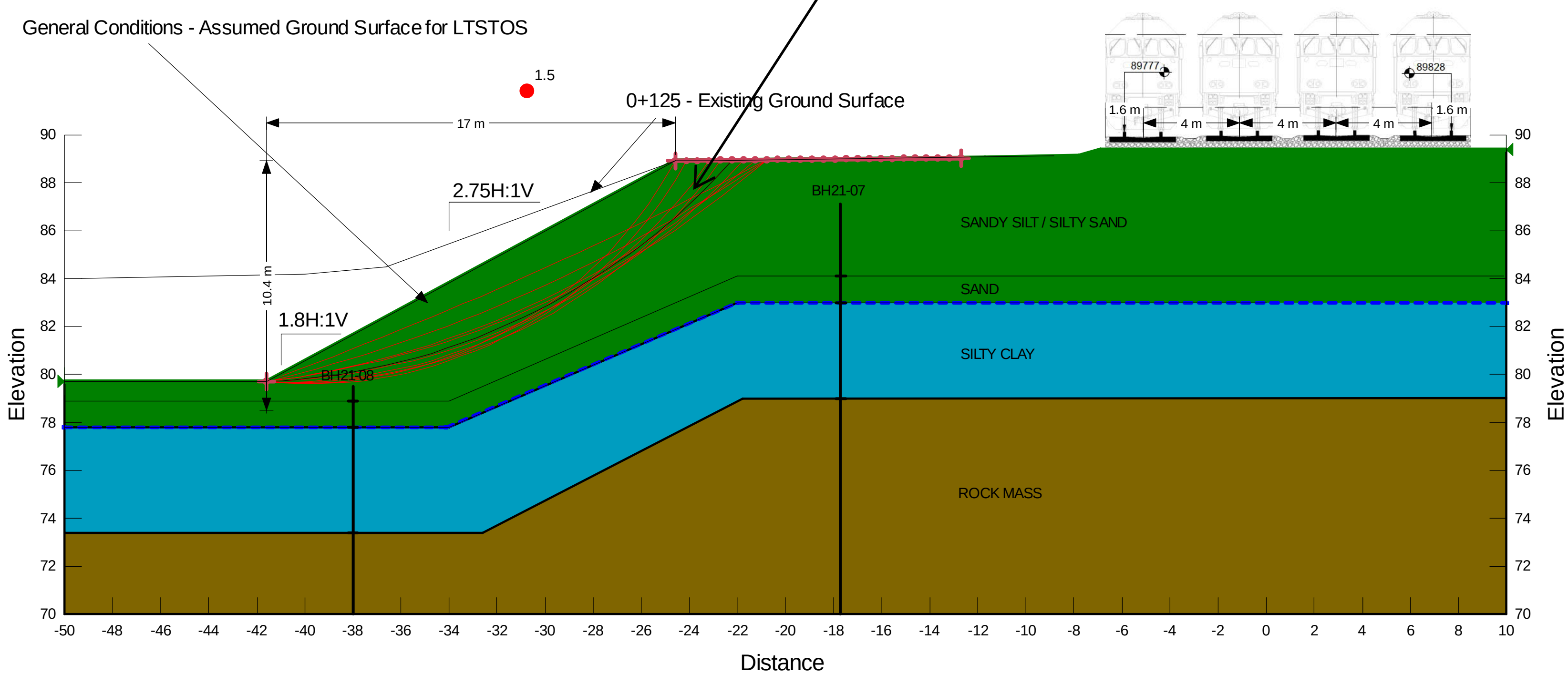
4. DIMENSIONS FOR THE TRAIN AND PROPOSED PASSENGER PLATFORM ARE APPROXIMATE ONLY.
5. SLIDING SURFACE SHOWN IN WHITE IS THE CRITICAL SLIDING SURFACE OR THE SLIDING SURFACE WITH THE LOWEST FACTOR OF SAFETY FOR THE GIVEN SECTION AND SCENARIO CONSIDERED.

0+086 - Rigid Wall	
SLOPE/W - Morgenstern-Price (Minimum Slip Surface Depth: 5 m)	
TRCA Lands Slope Stability Assessment	FIGURE D-12

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Embankment Fill	20	0	34
	Rock Mass	23	100	35
	Silt	17	3	30



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4. DIMENSIONS FOR THE TRAIN AND PROPOSED PASSENGER PLATFORM ARE APPROXIMATE ONLY.
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General Slope Conditions LTSTOS	
SLOPE/W - Morgenstern-Price (Minimum Slip Surface Depth: 1 m)	
TRCA Lands Slope Stability Assessment	FIGURE D-13

Appendix E

Site Photos

Photograph 1: View of Existing Erosion Protection measures and retaining wall at the toe of the embankment slope at the west end of the site (Looking West towards Mimico Creek Bridge).

Photograph 2: View of slope condition and rip-rap protection East of the existing retaining wall

Photograph 3: Close up view existing Gabion Basket wall and Rip-Rap at the toe of the embankment Slope transitioning north (away from the embankment)

Photograph 4: View of the erosion protection measures looking East towards Park Lawn Rd.

Photograph 5: Photograph 4: View of the erosion protection measures looking East towards Park Lawn Rd.

Photograph 6: View of from the top of rail embankment at the Park Lawn Road Bridge (Looking East towards Mimico Creek)

Photograph 7: View of the West End of the Existing Retaining wall at the Mimico Creek East Abutment