PRELIMINARY GEOTECHNICAL INVESTIGATION AND SLOPE STABILITY ANALYSIS, ROUGE PARK GATEWAY, TORONTO, ONTARIO

ROUGE NATIONAL URBAN PARK FIELD UNIT, PARKS CANADA AGENCY

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1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by Parks Canada Agency (PCA) to undertake a preliminary geotechnical investigation and slope stability analyses for the new Rouge Gateway Visitor Learning Centre at Zoo Road, Parking Lot No. 4, Toronto, ON. PCA intends to proceed with the Rouge Gateway Project, to provide visitors of Rouge National Urban Park with information and orientation.

The site is a land parcel approximately 12 acres in size which is owned by PCA. The site is generally located on the south east corner of Zoo Road and Meadowvale Road, north of Highway 401 and south of Highway 407. The nearest known municipal address is 1749 Meadowvale Road, Toronto, ON.

A water course (Little Rouge Creek) runs through the east side of the site along with a multi-use pathway. The site is located in close proximity to a range of uses – open space and parks, zoo, residential, institutional and industrial.

This preliminary geotechnical study is required to support a future land development permitting. The prepared technical study will form part of a future Official Plan and Zoning By-law Amendment complete application under the Planning Act.

The scope of the preliminary geotechnical investigation and slope stability analysis is to determine the subsurface conditions at the borehole locations, and provide preliminary geotechnical recommendations on the following:

- Foundations
- Slab and permanent drainage
- Excavations and backfill
- Earthquake considerations
- Earth pressures
- Pavements
- Slope Stability Assessment

The preliminary geotechnical recommendations associated with buildings are for general guidance and planning purpose only since the ultimate locations of future structures are unknown. Additional project-specific site investigations would be required for such structures.

This report is provided on the basis of the terms of reference presented above and in WSP's proposal for this preliminary geotechnical work, and on the assumption that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. This is a preliminary study and it will be necessary to carry out additional borings and reporting before the recommendations can be finalized.

The site investigation follows generally accepted practices for geotechnical consultants in Ontario. The format and contents are guided by Client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for PCA. Third party use of this report without WSP Canada Inc. consent is prohibited.

2 REVIEW OF REGIONAL GEOLOGY

The project area is situated within the Iroquois Plain physiographic region defined by Chapman and Putnam (1984) as represented in the OGS Earth application accessible through the Ministry of Northern Development and Mines Web Page (http://www.geologyontario.mndm.gov.on.ca/). The Iroquois Plain is a strip of land 3 to 5 km wide between the glacial Lake Iroquois shoreline and the present shoreline of Lake Ontario (Karrow, 2005). Over most of the study area, it is represented at ground surface by sand plains.

Surficial geological mapping of the site (Ontario Geological Survey, 2003) indicates that native subsurface materials over most of the area generally consist of sand, gravel, minor silt and clay that are considered to be coarse-textured glaciolacustrine deposits. These materials are expected to behave as unconfined aquifers. To the east and west of the site, there are two areas of modern alluvial deposits associated with the floodplains of the Rouge River to the west and Little Rouge Creek to the east. These deposits may contain varying proportions of gravel, sand, silt and clay and may contain organic remains. They are expected act as local aquifers or aquitards, depending on the composition.

To the north, there is a sandy silt to silty sand-textured till on Paleozoic terrain. This till is expected to behave as an aquitard. In the walls of the river valleys on either side of the site, there are undifferentiated older tills that may include stratified deposits. These are expected to behave as aquitards.

Bedrock geological mapping for southern Ontario indicates that bedrock underlying the site consists of black shales of the Blue Mountain Formation. The shale is expected to behave as an aquitard, except when fractured or weathered, where it may behave as a weak aquifer.

3 FIELD AND LABORATORY WORK

3.1 GEOTECHNICAL BOREHOLES AND FIELD TESTING

A total of fourteen boreholes (BH20-1 to BH20-11) were drilled at the site as shown on the attached **Drawing 1**. Boreholes BH20-1 to BH20-6 and BH20-11 were drilled for preliminary subsurface investigation for future developments. The remaining boreholes were drilled near the top of the valley slope for slope stability assessment.

Borehole elevations and coordinates were recorded upon completion of field work by WSP. Approximate UTM coordinates and existing ground elevations were noted using GPS system and referenced to a local benchmark Toronto Station 12020050046 attached in the drawings section of this report. A summary of the borehole data is presented in **Table 2.1**. Contractors performing any work referenced to the borehole elevations should confirm the borehole elevations for their work.

Table 3-1 Summary of Borehole Information

Borehole/ Park Block	Easting	Northing	Approximate Ground Elevation (m)	Depth of Borehole (m)	Note
	NAD83, UTM Zone 17				
Toronto Station 12020050046	646976.8	4852441.7	123.4		For reference only
BH 20-1	647052.8	4853370.1	131.3	6.7	Monitoring Well
BH 20-2	647003.9	4853330.6	130.8	6.7	Monitoring Well
BH 20-3	647113.7	4853360.6	131.4	6.7	Monitoring Well
BH 20-4	647066.8	4853257.6	130.1	6.7	Monitoring Well
BH 20-5	647040.5	4853214.9	130.2	9.8	Monitoring Well
BH 20-6	647173.0	4853210.3	130.9	6.7	Monitoring Well
BH 20-7	647113.3	4853409.1	132.2	30.6	Monitoring Well
BH 20-8	647155.6	4853388.6	132.1	30.5	Monitoring Well
BH 20-8A	647154.7	4853390.0	132.1	3.1	Monitoring Well
BH 20-9	647175.9	4853308.2	131.2	36.7	Monitoring Well
BH 20-9A	647175.1	647175.0	131.3	6.1	Monitoring Well
BH 20-10	647211.4	4853247.0	130.7	36.6	Monitoring Well
BH 20-10A	647210.3	4853246.7	130.7	6.1	Monitoring Well
BH 20-11	647172.0	4853264.7	130.8	6.7	Monitoring Well

Prior to drilling operations, underground utilities were cleared at the borehole locations.

The field investigation work was undertaken on June 16 to July 9, 2020 by a drilling sub-contractor under the direction and supervision of WSP personnel. Borehole logging services were provided by the engineering staff of WSP. All the boreholes were advanced with power auger drilling machines equipped with hollow stem augers and

mud rotary. The soil stratigraphy was recorded by observing the quality and changes of augured materials which were retrieved from the boreholes, and by sampling the soils at regular intervals of depth using a 50 mm O.D. split spoon sampler, in accordance with the Standard Penetration Test (ASTM D 1586) method. This sampling method recovers samples from the soil strata, and the number of blows (SPT 'N'-values) required to drive the sampler 300 mm depth into the undisturbed soil gives an indication of the compactness or consistency of the sampled soil material. It should be noted that the split spoon sampler used limits the particle size of the samples retrieved to less than 50 mm. As such any particles greater than that are not retrieved or represented within the laboratory particle size distribution analyses. The SPT 'N' values are indicated on the borehole log sheets (Refer to borehole logs in **Appendix A**). Soil samples were visually classified in the field and later re-evaluated by a geotechnical engineer in our laboratory.

Groundwater conditions in the boreholes were observed during and upon completion of drilling.

As listed in **Table 2-1**, fourteen (14) monitoring wells of 50 mm diameter were installed to enable the longer-term monitoring of groundwater levels.

The installed monitoring wells are comprised of 50 mm diameter, Schedule 40 polyvinyl chloride (PVC) environmental-grade flush threaded pipe and machine slotted No. 10 screen. The bottom of the well screen was covered with a PVC cap to prevent the influx of sediment. The annular space surrounding the screen was backfilled with commercial silica sand to at least 300 mm above the screen. The monitoring wells were constructed in accordance with O. Reg. 903 (as amended) by extending a bentonite seal from above the sand pack to the surface. A lockable protective above ground stick-up casing was provided to protect the riser pipe.

These monitoring wells should not be decommissioned until completion of the hydrogeological investigation or long-term groundwater study. The monitoring wells must then be sealed in accordance with O. Reg. 903 (as amended) prior to construction, such decommissioning is not part of this current scope of work. It is important that the abandoned wells be fully grouted and sealed to reduce/ prevent possible groundwater communication with the proposed excavation areas of the project.

3.2 GEOTECHNICAL LABORATORY TESTING

The soil samples recovered from the boreholes were taken to WSP's laboratory where they were re-examined. Representative soil samples were selected for geotechnical index testing. The testing program consisted of the measurement of the natural water contents of all available soil samples and grain size analyses of six (6) selected samples and consistency (Atterberg) limit tests on five (5) soil samples taken from the boreholes. The results of the particle size distribution tests and consistency (Atterberg) limit tests are enclosed in **Appendix B** of this report and are also summarized on the associated borehole log sheets.

4 SUBSURFACE CONDITIONS

The borehole locations are shown on **Drawing 1**. The subsurface conditions in the boreholes are presented on the individual borehole log sheets in **Appendix A** and summarized in the following subsections.

4.1 SOIL CONDITIONS

4.1.1 TOPSOIL

Topsoil was encountered at the surface of boreholes BH 20-1, 20-2, 20-7, 20-8, 20-9, 20-10 and 20-11 with approximate thicknesses ranging from 50 mm to 230 mm below ground surface (bgs). Topsoil quantities should not be calculated from the borehole information, as large variations in depth may exist between and beyond the boreholes.

4.1.2 GRANULAR FILL

Granular fill was encountered at the surface of boreholes BH20-3 and 20-4, 20-5 and 20-6 and extended to approximate depths ranging from 300 mm to 400 mm bgs.

4.1.3 FILL

Underlying the topsoil and granular fill, soil fill was encountered at all borehole locations, except BH20-9 where native soil was encountered below 150 mm thick topsoil layer. The fill depth ranges from 0.7 m to 1.5m bgs. The fill generally consisted of sand to sandy material and was observed to also contain silt and trace to some of gravel, and cobbles/boulder (BH20-7, BH20-10).

SPT 'N' values in these fill materials ranged from 4 to 95 blows per 300 mm of penetration, corresponding to a loose very dense state. Higher blow counts may be attributed to cobbles, boulders and other obstructions. Water contents of the fill samples ranged from 1% to 20%.

4.1.4 SANDY SILT

Below the fill and topsoil material, deposits of sandy silt were encountered extending to depths ranging from 1.5 m to 2.2 m bgs in boreholes BH20-1, 20-2, 20-4, 20-6, 20-8 and 20-9. This deposit was found to be in a compact to very dense state, with measured SPT 'N' values of 22 to 64 blows per 300 mm of penetration.

This deposit was generally found to be moist to wet with measured water contents ranging from 5% to 19%.

4.1.5 SAND AND SANDY GRAVEL

Below the fill and topsoil material, deposits of sand and sandy gravel were encountered extending to depths ranging from 1.5 to 4.1 m bgs in boreholes BH20-5, 20-10 and 20-11. This deposit was found to be in a compact to very dense state, with measured SPT 'N' values of 16 to 64 blows per 300 mm of penetration.

This deposit was generally found to be moist to wet with measured water contents ranging from 6% to 15%.

4.1.6 SILTY CLAY TILL

Below the fill, sand, sandy gravel and sandy silt materials, a native undisturbed deposit of silty clay till was encountered extending to depths ranging from 3.0 m to 32.9 bgs in boreholes BH20-1, 20-2, 20-3, 20-4, 20-6, 20-9, 20-10 and 20-11. This deposit was found to be in a soft to hard consistency, with measured SPT 'N' values of 3 to greater than 90 blows per 300 mm of penetration. This deposit was generally found to be moist with measured water contents ranging from 6% to 17%.

Below the sandy silt till / silty sand till materials, a native undisturbed deposit of silty clay till was encountered extending to depths ranging from 9.8 m to 30.0 bgs in boreholes BH20-5, 20-7 and 20-8 and found interbedded between a sandy silt till deposit in BH20-10 from 33.1m to 34.6m bgs. This deposit was found to be in a very soft to hard consistency, with measured SPT 'N' values of 1 to greater than 95 blows per 300 mm of penetration. This deposit was generally found to be moist with measured water contents ranging from 7% to 25%.

Three (3) selected samples (BH20-8/SS14, BH20-9/SS7, BH20-10/SS7) were subjected to grain size analyses. The gradation curves for these tests are presented in **Appendix B** and summarized below:

Gravel:	5 to 9 %
Sand:	23 to 40 %
Silt:	35 to 49 %
Clay:	16 to 22 %

Two (2) Atterberg Limit tests were performed on selected samples (BH20-9/SS7, BH20-10/SS7) and the results are provided in **Appendix B** and summarized as follows:

Liquid Limit (W_L):	16 to 18
Plastic Limit (W_P):	12
Plasticity Index (PI):	4 to 6

The soil is classified as CL-ML according to the Unified Soil Classification System with low activity.

4.1.7 SILTY SAND TILL/ SANDY SILT TILL

Below the silty clay till material in Boreholes BH20-1, 20-3, 20-9 and 20-10, native undisturbed deposits of silty sand till / sandy silt till was encountered extending to depths ranging from termination of borehole at 6.7 m to termination of borehole as deep as 36.7m bgs. This deposit was found to be in a compact to very dense state, with measured SPT 'N' values of 15 to greater than 50 blows per 300 mm of penetration. This deposit was generally found to be moist with measured water contents ranging from 7% to 15%.

Below the fill, sandy silt and sandy gravel materials, a native undisturbed deposit of silty sand till / sandy silt till was encountered extending to depths ranging from 3 m to 5.7 bgs in boreholes BH 20-5, BH20-7 and 20-8. This deposit was found to be in a very loose to very dense consistency, with measured SPT 'N' values of 1 to greater than 50 blows per 300 mm of penetration. This deposit was generally found to be moist with measured water contents ranging from 6% to 14%.

Three (3) selected samples (BH20-1/SS6, BH20-5/SS6, BH20-7/SS5) were subjected to grain size analyses. The gradation curves for these tests are presented in **Appendix B** and summarized below:

Gravel:	5 to 11 %
Sand:	36 to 49 %
Silt:	30 to 40 %
Clay:	12 to 15 %

Three (3) Atterberg Limit tests were performed on the above samples (BH20-1/SS6, BH20-5/SS6, BH20-7/SS5) and the results are provided in **Appendix B** and summarized as follows:

Liquid Limit (W_L): NV to 15
Plastic Limit (W_P): NP to 11
Plasticity Index (PI): NP to 4

The soil is classified as ML/SC-SM according to the Unified Soil Classification System.

4.1.8 SILTY SAND

Below the silty clay till material, a deposit of silty sand was encountered extending to the borehole termination at boreholes BH20-7 and 20-8. This non-cohesive deposit was found to be in a very dense state, with measured SPT 'N' values of greater than 50 blows per 300 mm of penetration. This deposit was generally found to be moist to wet with measured water contents ranging from 9% to 19%.

4.2 GROUNDWATER CONDITIONS

Groundwater levels were measured in the monitoring wells and summarized in **Table 4.1** below**:**

Table 4.1 Summary of Groundwater Levels

BOREHOLE NO.	WELL INSTALLATION DATE	EXISTING GROUND ELEVATION (m)	DATE OF WATER MEASUREMENT	SCREEN DEPTH (m)		GROUNDWATER LEVEL ELEVATION (m)
				From	To	
BH 20-1	16/06/2020	131.3	July 13, 2020	4.6	6.1	129.7
BH 20-2	16/06/2020	130.8	July 13, 2020	4.6	6.1	129.7
BH 20-3	20/06/2020	131.4	July 13, 2020	4.6	6.1	129.8
BH 20-4	17/06/2020	130.1	July 13, 2020	4.6	6.1	128.3
BH 20-5	17/06/2020	130.2	July 13, 2020	4.6	6.1	124.6
BH 20-7	29/06/2020	132.2	August 12, 2020	27.4	30.5	Dry (to 101.7)
BH 20-8	25/06/2020	132.1	August 12, 2020	27.4	30.5	Dry (to 101.6)
BH 20-8A	25/06/2020	132.1	August 12, 2020	1.5	3.0	Dry (to 129.1)
BH 20-9	03/07/2020	131.2	August 12, 2020	33.5	36.6	99.7
BH 20-9A	03/07/2020	131.3	July 13, 2020 August 12, 2020	4.6	6.1	126.5 125.3
BH 20-10	09/07/2020	130.7	July 13, 2020 August 12, 2020	33.5	36.6	103.0 99.9
BH 20-10A	09/07/2020	130.7	July 13, 2020 August 12, 2020	4.6	6.1	126.8 128.6
BH 20-11	18/06/2020	130.8	July 13, 2020	4.6	6.1	129.0

*NM – Not yet Measured

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

5 DISCUSSIONS AND RECOMMENDATIONS

5.1 GENERAL

The scope of the preliminary geotechnical investigation and slope stability analysis is to determine the subsurface conditions at the borehole locations, and provide preliminary geotechnical recommendations including for foundations, excavation and backfill, and stability assessment of the Little Rouge Creek valley slope.

5.2 SITE PREPARATION, SUBEXCAVATIONS AND GRADING

5.2.1 SITE PREPARATION

The site should be stripped of all disturbed soils and other unsuitable materials.

Following stripping, the site should be graded to the pre-grade level and approved. The pre-grade should be shaped properly to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate.

Any engineered fill for re-grading the site or backfill should be select, clean material, free of topsoil, organic or other foreign and unsuitable matter.

5.2.2 PRE-CONSOLIDATION

Utilizing the borehole information, a preliminary review of the potential settlement has been carried out for the site. Based on WSP's review, settlement more than allowable limits could occur under foundations or grade raises.

To mitigate the potential for the noted settlements, techniques such as "dig and replace", prefabricated vertical drains ("wick drains") or surcharging may be considered to achieve sufficient consolidation to proceed with construction.

Digging and replacing the soft / loose soils will require dewatering, excavations and shoring and fill replaced will have to be engineered. The soft clays are not suitable for reuse as engineered fill unless the material is sufficiently dried to its optimal moisture content, properly pulverized, placed and compacted.

Wick drains are composed of a plastic core encased by a geotextile for the purpose of expediting consolidation of slow draining soils and is done in conjunction with surcharging. These prefabricated wick drains are used to shorten pore water travel distance, reducing the surcharging time. Although soil wicking helps to achieve shorter timelines, there is an additional cost associated with its application and risk of providing a path for groundwater from underlying aquifers to reach the surface, further hydrogeological studies must be conducted to focus on such phenomena.

With the available information, it is, at minimum, recommended to surcharge the site prior to servicing and building construction. The surcharge fill used for pre-consolidation will increase pore water pressures initially, but with time the water will drain away and the soil voids will compress.

Further geotechnical investigations into the depth of the loose and soft soils, consolidation properties and delineation are required to provide further recommendations on the matter. Recommendations which may be provided are parameters of surcharge fill piles, estimated settlement, estimated time for suitable consolidation and settlement monitoring.

5.2.3 ENGINEERED FILL

In the areas where earth fill is required for site grading purposes, an engineered fill layer may be constructed below building foundations, roads, parking, boulevards, etc.

General guidelines for the placement and preparation of engineered fill are presented in **Appendix E**. Bearing capacity values of 100 kPa at SLS and 150 kPa at ULS can be used in engineered fill, provided that all the existing non-engineered fill is removed and replaced with engineered fill and the site has been sufficiently pre-consolidated as recommended in Section 5.2.2.

To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential. Despite full time supervision, it has been found that contractors sometimes bulldoze loose fill into areas and compact only the surface. The inspector, either busy on other portions of the site or absent outside of regular work hours will be unaware of this condition. For this reason, we cannot guarantee the performance of the engineered fill, and this guarantee must be the responsibility of the contractor. The owner and his representatives must accept the risk involved in the use of engineered fill and offset this risk with the monetary savings of avoiding deep foundations. This potential problem must be recognized and discussed at a pre-construction meeting. Procedures can then be instigated to reduce the risk of settlement resulting from un-compacted fill.

The inorganic native silty clay till is considered suitable for use as engineered fill, provided that their moisture contents at the time of construction are at or near optimum. The fill may be considered suitable for use as engineered fill, but must be examined, cleaned of topsoil, organic or other foreign and unsuitable matter prior to its placement and approved by a WSP engineer. The clayey and clay materials are likely to be excavated in cohesive chunks or blocks and will be difficult to compact. It should be pulverized and placed in thin layers not exceeding 150 to 200 mm and compacted using heavy equipment suitable for these types of soils (e.g. heavy sheepsfoot compactors). This material will require aeration prior to placement when it is found to be above optimum moisture contents, as determined by laboratory testing and field density tests at the time of construction.

5.3 SEWERS

As a part of the site development, a network of new storm and sanitary sewers and services are assumed to be generally within 3 to 4 m below the final grade and will outfall to existing sewers. Watermains are expected to be greater than 1.2 m deep.

5.3.1 TRENCHING

Excavations can be carried out with a heavy hydraulic backhoe, but caution must be taken when travelling on wet silt during construction due to its sensitivity to liquefaction under vibration. Similar caution must be taken when travelling on soft clays as it is susceptible to deep rutting causing difficulties in travelling on its surface. Upon examination, it was also found that the soft clays slump easily under its own weight. Trench walls will require shoring or specified sloping when soft clays and wet silt are encountered.

Native materials may contain boulders. Possible large obstructions such as buried concrete pieces could also be found in the fill material. Provisions must be made in the excavation contract for the removal of possible boulders in the till or obstructions in the fill material.

The yield of groundwater seepage is expected to be limited from the silty clay materials in excavations and can be controlled by pumping from sumps and pits. Dewatering required in non-cohesive materials should be determined by hydrogeological studies.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the overburden soils can be classified as Type 3 soil above groundwater table and Type 4 below groundwater table.

5.3.2 BEDDING

The undisturbed clay will provide adequate support for the sewer pipes and will allow for the use of class B bedding structure. The bedding material should consist of compacted Granular 'A' made up of 20 mm crusher run limestone or equivalent. The recommended minimum thickness of granular bedding below the invert of the pipes is 150 mm. The thickness of the bedding may, however, have to be increased depending on site conditions, pipe diameter and / or in accordance with local standards, especially where the excavation base consists of soft soil. In the case that groundwater infiltration exists and if wet or weak subgrade conditions are encountered, especially when the soil at the trench base level consists of wet, dilatant silt or clay, a Class A type bedding may be required.

After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300 mm above the obvert of the pipe, or as set out by the local Authority, should be placed.

The subgrade condition must be inspected and approved by geotechnical personnel. The bedding should conform to the current Ontario Provincial Standard specifications and / or standards set by the local municipalities.

In exceptional circumstances where the use of compaction equipment is not possible, the contractor sometimes chooses a poorly graded bedding material such as clear stone. To avoid the loss of soil fines from the subgrade, uniformly graded clear stone should not be used unless, below the granular bedding material, a suitable, approved non-woven geotextile filter fabric is placed. The geotextile should extend along the sides of the trench and should be wrapped all around the poorly graded bedding material.

5.3.3 BACKFILLING OF TRENCHES

Based on visual and tactile examination, the select on-site excavated inorganic native soils are considered to be suitable for re-use as backfill in the service trenches provided their moisture contents at the time of construction are at or near (±2%) optimum. The organics in the fill must be separated and discarded and as outline in the engineered fill section of this report. The silty and clayey soils are in a moist to saturated state and will require aeration prior to backfill.

The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content, and each layer should be compacted to at least 98% SPMDD. The degree of compaction should be increased to 100% within the top 1.0 m of the subgrade. Unsuitable materials such as organic soils, boulders, cobbles/rocks greater than 100mm diameter, frozen soils, etc. should not be used for backfilling.

Clayey soils should not be used in confined areas and structures (e.g. around catchbasins and laterals under roadways) where heavy compaction equipment cannot be operated. The use of imported granular fill together with an appropriate frost taper would be preferable in confined areas and around structures.

5.4 FOUNDATIONS

The building(s) can be supported on undisturbed native soil by spread and strip footings or helical piers for a bearing capacity of 100 kPa at SLS (Serviceability Limit State), and for a factored geotechnical resistance of 150 kPa at ULS (Ultimate Limit State), within the native soil, once all pre-consolidation and engineered fill conditions are met.

The proposed building(s) can also be supported by spread and strip footings founded on greater than 1.0 m of engineered fill for a bearing capacity of 150 kPa at the serviceability limit states (SLS) and for a factored geotechnical resistance of 225 kPa at the ultimate limit states (ULS), provided all requirements for pre-consolidation and engineered fill are adhered to. Prior to the placement of the engineered fill, all of the existing fill and surficially softened native soils must be removed and the exposed surface proof rolled. Any soft spots revealed during proof rolling must be sub-excavated and re-engineered. The engineered fill consisting of approved inorganic material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential.

Foundations designed to the specified bearing capacity at the Serviceability Limit States (SLS) are expected to settle less than 25 mm total and 19 mm differential in the native soil. All footing bases must be inspected by this office to confirm the design bearing values.

All footings exposed to seasonal freezing conditions must have at least 1.2 metres of soil cover for frost protection.

Where it is necessary to place footings at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line drawn up from the base of the lower footing. The lower footing must be installed first to help minimize the risk of undermining the upper footing.

In the vicinity of the existing buried utilities, all footings must be lowered to undisturbed native soils, or alternatively the services must be structurally bridged.

It should be noted that the recommended bearing capacities have been calculated by WSP from the borehole information for the preliminary design stage only. The investigation and comments are necessarily on-going as new information of the underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by WSP to validate the information for use during the construction stage.

5.5 SLAB ON GRADE

Concrete slabs can be supported on the native soils provided disturbed, softened or loose native soils are removed and the base thoroughly proof rolled. The fill required to raise the grade can consist of inorganic soil, placed in shallow lifts and compacted to 98 % of Standard Proctor Maximum Dry Density (SPMDD).

A moisture barrier consisting of at least 200 mm of 19 mm clear crushed stone should be installed under the grade supported slab.

It is recommended to design grade supported slabs as floating slabs independent of foundations and grade beams in order to reduce the effect of differential movements, if any, between slabs and other components. Unheated grade supported slabs should be insulated in order to reduce the frost heave.

For structures with a basement or partial basement area, a perimeter drainage system and underfloor drainage will be required. The drainage system shown on the attached **Drawing 2** is recommended for basement walls where open cut procedures are used. In the areas without a basement and if the floor slab is less than 300 mm above the exterior grade, then the drainage system shown on the attached **Drawing 3** is recommended.

5.6 PAVEMENTS

5.6.1 RECOMMENDED PAVEMENT STRUCTURE

Based on the borehole information, the recommended pavement structures for parking lots and driveways are provided in **Table 5-1**. The assumed traffic in the recommended pavement structures consists of mainly automobiles, pick up trucks and other light weight vehicles (Class 1 to 3 of FHWA classification).

In addition, a functional design life of eight to ten years has been used to establish the pavement recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out.

TABLE 5-1: RECOMMENDED PAVEMENT STRUCTURE

PAVEMENT LAYER	COMPACTION REQUIREMENTS	LIGHT DUTY PAVEMENT**	HEAVY DUTY PAVEMENT**
Asphaltic Concrete	92.0 to 96.5% Maximum Relative Density (MRD)	40 mm OPSS HL 3 65 mm OPSS HL 8	40 mm OPSS HL 3 80 mm OPSS HL 8
OPSS Granular A (Base)	100% SPMDD*	150 mm	150 mm
OPSS Granular B Type II (Subbase)	100% SPMDD*	200 mm	300 mm
Subgrade	Prepared as per Section 5.4.2 and other applicable sections of this report.		

* Denotes Standard Proctor Maximum Dry Density, ASTM-D698.

**Light duty pavement structure is provided for areas of less vehicle traffic such as parking stalls, and heavy-duty pavement structure is provided for areas of high vehicle traffic such as access routes and entrances and driveways to parking stalls. The assumed traffic consists of mainly automobiles, pick up trucks and other light weight vehicles (Class 1 to 3 of FHWA classification).

The material specifications and placing, spreading and rolling of the asphalt and granular materials should be in accordance with OPS Specifications or as required by the local authorities.

We note that the recommended pavement structure above should be considered preliminary only. If required, a more refined pavement structure design can be performed based on targeted pavement investigation, specific traffic data and design life requirements. A detailed pavement design will involve specific laboratory tests to determine the frost susceptibility and strength characteristics of the subgrade soils, as well as other data input from the client.

5.6.2 SUBGRADE PREPARATION

Depending on the design grades of the proposed developments, the subgrade can ultimately be in cut or fill. The subgrade should be visually inspected and proof rolled. All unsuitable materials including existing fills containing organics should be removed. The identified soft areas should be sub-excavated and replaced with engineered fill. In any areas where grade raising is proposed, the reader is also referenced to Section 5.2.2 (“Pre-consolidation”).

A minimum of 300 mm of subgrade soil should be scarified and recompacted to at least 98% of SPMDD. The subgrade should be sloped (preferably at a minimum grade of 2%) to promote effective drainage toward the catch basins.

The subgrade should be inspected and approved by qualified geotechnical personnel. Stringent construction control procedures should be maintained to ensure uniform subgrade moisture and density conditions are achieved.

Additional comments on the construction of parking areas and access roadways are as follows:

1) As part of the subgrade preparation, proposed entrance and parking areas should be stripped of the obvious objectionable material. The subgrade should be properly shaped, crowned then proof-rolled in the full-time presence of a representative of this office. The primary purposes of proof rolling are to identify the soft or spongy areas, check the subgrade compaction, to carry out the intent of the design, and to provide uniform support for the pavement structure. Soft/loose subgrade areas should be sub-excavated and properly replaced with suitable approved backfill compacted to 98% SPMDD. Backfill to raise the grade to the

subgrade surface level can consist of inorganic soil, placed in shallow lifts and compacted to 98 % of Standard Proctor Maximum Dry density (SPMDD).

2) The locations and extent of sub-drainage required within the paved areas and the required lot grading to promote the subgrade drainage, including considerations for frost-treatment of proposed storm infrastructure should be designed by qualified civil engineer.

3) The most severe loading conditions on light-duty pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted access lanes, half-loads during paving, etc., may be required, especially if construction is carried out during unfavorable weather.

It is recommended that WSP be retained to review the final pavement structure designs and drainage plans prior to construction to ensure that they are consistent with the recommendations of this report.

Prior to pouring concrete for curbs, sidewalks and walkways, the subgrade must be inspected by WSP to confirm that they are founded on competent ground which has been cleaned of ponded water and all disturbed, softened, loosened, organic and other deleterious material. Concrete mix designs should be reviewed by WSP prior to pouring concrete and should be tested for air voids, slump and strength during construction.

Frequent field density tests should be carried out on both the asphalt and granular base and sub-base materials to ensure that the required degree of compaction is achieved.

5.7 EARTH PRESSURES

The lateral earth pressures acting on possible retaining walls or underground structures may be calculated from the following expression:

$$p = K (\gamma h + q)$$

where p = Lateral earth pressure in kPa acting at depth h

K = Earth pressure coefficient equal to 0.5 for vertical walls and horizontal backfill used for permanent construction. Water pressure must be considered, if continuous wall drains are not used.

γ = Unit weight of backfill, a value of 21 kN/m^3 may be assumed

h = Depth to point of interest in meters

q = Equivalent value of surcharge on the ground surface in kPa

In addition, a hydrostatic pressure behind the wall should be added to the above lateral earth pressure.

5.8 EARTHQUAKE CONSIDERATIONS

Based on the borehole information, the site for the proposed building can be classified as **'Class E'** for seismic site response according to Table 4.1.8.4.A of OBC 2012.

5.9 SLOPE STABILITY ASSESSMENT

5.9.1 GENERAL

A water course (Little Rouge Creek) runs through the east side of the site along with a multi-use pathway. The “Technical Guide, River & Stream Systems: Erosion Hazard Limit” document published by the Ontario Ministry of Natural Resources in 2002 (the Guide) provides recommendations for assessment of the Long Term Stable Top of Slope (LTSTOS). In accordance with the Guide, this preliminary geotechnical study includes stability assessment of the west valley slopes of the creek located within the land property.

The west valley slope stability assessment consisted of a site reconnaissance visit and field investigation with borehole drilling along the crest of the west valley slopes. Limit-equilibrium slope stability analyses were also conducted based on the information obtained from the field study.

The topographic contour plans prepared by WSP were referenced in the assessment of the existing slope stability. The topographic contours are shown on Borehole Location, Cross Section and LTSTOS Plan attached as **Figure D-1** in **Appendix D**.

5.9.2 SITE RECONNAISSANCE VISIT

A visual inspection of the existing south valley slopes of the Little Rouge Creek was conducted by a geotechnical engineer of WSP on July 29, 2020.

General information pertaining to existing slope features such as slope profile, vegetation/tree cover, slope drainage, watercourse features, as well as erosion features were obtained during the field inspection. Pictures of the site taken during our site visit are shown in **Appendix C** of this report. Slope Stability Rating Table at each selected slope profile cross section is included in **Appendix F** of this report. A summary of the results of the visual inspection is presented below.

SLOPE TOPOGRAPHY

The valley corridor is generally characterized by meandering valleys and creek. The corridor within the site property limits has a total length of about 250 m. The west valley slopes are mostly vegetated with trees and grasses. The toes of west valley slopes are separated from the creek banks by terraces/toe buffers which is greater than 15 m.

Based on the provided topographic plans, the west valley slopes height within the site property limits ranges from about 14 to 27 m from the inferred top of slope to toe of slope or floodplain. The average slope inclinations range from about 28 to 37 degrees corresponding to 1V:1.9H to 1V:1.3H. Site pictures showing representative slope features and topography are presented in **Appendix C**. The locations of the pictures are shown in **Figure D-1**.

SURFICIAL SLOPE CHARACTERISTICS

The west valley slopes are generally vegetated with mature trees and grasses as shown in the representative pictures included in **Appendix C**. The terrace or floodplain areas are also covered with trees, grasses and some areas with small shrubs. The tree growth along the west valley slopes is generally straight and upright except for a very few leaning trees. No visible evidence of tension cracks nor seepage on the slope faces was noted within the limits of the subject slopes during our site inspection.

A drainage channel/gulley was observed at the location between Cross Section 2-2' and 3-3' (BH20-8 and 20-9). Local slump failures of the bank of drainage channel/gulley were observed at some locations as shown in the **Pictures C-C**.

Creek bank toe erosion was also observed at locations where the creek meanders and makes sharp turn-round as shown in the **Pictures C-3-R and C-4-R**. The pictures show failed soil slumps, exposed tree roots and soil erosions. However, the buffer zone/terrace between the creek bank and the toe of slope is much greater than 15 m, as directed by the Guide, the erosion setback of the creek is not required.

In general, no slope instability issues are observed except for the localized slump/slough of the bank of drainage channel/gulley.

SLOPE STABILITY RATING

Based on the results of the site inspection, and geological conditions encountered during WSP's geotechnical investigation of the site, WSP conducted Slope Stability Ratings for four locations along the length of the slope indicated by cross-sections 1-1', 2-2', 3-3', and 4-4' shown in Figure D-1, in accordance with the Guide. The ratings for each of these cross sections are attached as Tables 1 to 4 in Appendix F. A review of the Slope Stability Ratings shows that a rating value of 33 was obtained for each cross section. According to the Guide, a slope with a rating ranging from 25 to 35, the potential for instability is considered 'slight', requiring a topographic survey to confirm the field measurements and preliminary slope stability study using the geologically inferred subsurface soil and/or bedrock conditions. Nonetheless, WSP was requested to complete a full intrusive investigation and slope stability assessment to provide the stable top of slope line location for future development.

5.9.3 SLOPE STABILITY ANALYSES

In addition to the site reconnaissance visit, detailed limit-equilibrium analyses were conducted as part of the stability assessment of the existing west valley slopes. The representative slope cross-sections chosen for the analyses and the summary of soil design parameters used in the analyses are presented in the following subsections. The results of the analyses are presented in **Appendix D** of this report.

SLOPE CROSS-SECTIONS

Four representative slope cross-sections (1-1', 2-2', 3-3' and 4-4') were chosen for the limit-equilibrium slope stability analyses based on the site topographic plans and the site reconnaissance observations. The locations of the selected slope cross-sections are shown in **Figure D-1**.

SOIL PROFILES AND DESIGN PARAMETERS

Boreholes BH20-7 to 20-10 were drilled along the crest of the west valley slopes as shown in **Figure D-1**. The subsurface soil profile at the borehole locations generally consisted of fill material underlain predominately by glacial tills consisting of clayey and sandy textures. Cohesionless sandy/silty/gravely soils were also encountered at varying depths.

The individual subsurface soil layers were encountered at variable elevations between the boreholes. The soil design parameters are presented in **Table 5-2**. The soil design parameters were estimated based on correlations of field tests and index properties of soils with published data, and also by back-calculating from the existing steepest slopes.

Table 5-2 Soil Profiles and Design Parameters for Limit-Equilibrium Analyses

SOIL TYPE	SOIL UNIT WEIGHT (kN/m^3)	EFFECTIVE STRESS PARAMETERS	
		c' (kPa)	Φ' (Degree)
Loose Fill	18	0	26
Compact to Very Dense Fill	19.5	0	30
Compact Silty Sand (Till) to Sandy Silty (Till)	20	0	32
Very Dense Silty Sand (Till) to Sandy Silty (Till)	21	0	36
Dense to Very Dense Sand	20	0	37
Very Stiff to Hard Silty Clay Till	21	5	34
Firm to Stiff Silty Clay Till	20	3	30

Groundwater levels measured at each cross-section location are shown in **Table 5-3**. Based on the deep monitoring wells installed in the boreholes drilled along the crest of slope (BH20-7 to 20-10), a design groundwater level of 100.0 masl (meter above sea level) was adopted at the toe of the slopes or creek level. The nested shallow monitoring wells (BH20-8A to 20-10A) installed in the boreholes drilled along the slope indicate shallow water levels measured were dry (to 129.1) to 125.3 masl, a design groundwater level of 129.0 masl was adopted at the crest of slope. A seepage analysis was conducted to determine the phreatic line (groundwater surface) using the above design groundwater levels as boundary conditions.

Table 5-3 Summary of Groundwater Levels at Slope Locations

CROSS SECTION	BOREHOLE NO.	EXISTING GROUND ELEVATION (m)	DATE OF WATER MEASUREMENT	SCREEN DEPTH (m)		GROUNDWATER LEVEL ELEVATION (m)
				From	To	
1-1’	BH20-7	132.2	August 12, 2020	27.4	30.5	Dry (to 101.7)
2-2’	BH20-8	132.1	August 12, 2020	27.4	30.5	Dry (to 101.6)
	BH20-8A	132.1	August 12, 2020	1.5	3.0	Dry (to 129.1)
3-3’	BH20-9	131.2	August 12, 2020	33.5	36.6	99.7
	BH20-9A	131.3	July 13, 2020 August 12, 2020	4.6	6.1	126.5 125.3
4-4’	BH20-10	130.7	July 13, 2020 August 12, 2020	33.5	36.6	103.0 99.9
	BH20-10A	130.7	July 13, 2020 August 12, 2020	4.6	6.1	126.8 128.6

LIMIT-EQUILIBRIUM ANALYSES

Two-dimensional limit-equilibrium analyses were carried out for the selected slope cross-sections using the commercially available software **SLIDE 2 Modeler Ver. 2020**.

A Design Minimum Factor of Safety (FOS) of 1.40 to 1.50 is recommended in Table 4.3 of the Guide (Section 4.3.3.1 Design Minimum Factors of Safety) for Infrastructure and Public Use, such as those

containing structures. It is noted, however, that based on our previous experience, Toronto and Region Conservation Authority (TRCA) requires a FOS greater than 1.5 for this project type (development and property severances).

Except for Cross Section 4-4' (FOS=1.5), the FOSs of the existing slope at Cross Sections 1-1' to 3-3' as analysed are less than 1.5. In order to obtain the slope with a minimum FOS of 1.5, imaginary slope profiles have been created to assess a sufficiently stable slope gradient at Cross Sections 1-1' to 3-3'.

The results of the analyses are presented in **Appendix D**. The factors of safety against circular slope failure obtained from the analyses are tabulated in **Table 5-4**.

Table 5-4 Factors of Safety against Circular Slope Failure

ANALYSIS CASE	EXISTING SLOPE PROFILE AND FOS	IMAGINARY SLOPE PROFILE WITH FOS ≥ 1.5	FACTOR OF SAFETY FOR IMAGINARY SLOPE PROFILE	SETBACK FOR IMAGINARY SLOPE*
Slope Cross Section 1-1'	1.6H:1V (FOS<1.5)	2.0H:1V	1.517	4.5 m
Slope Cross Section 2-2'	1.3H:1V for Top Section of Slope 1.6H:1V for Overall Slope (FOS<1.5)	1.9H:1V	1.528	10.5 m
Slope Cross Section 3-3'	1.6H:1V (FOS<1.5)	1.9H:1V	1.504	7.6 m
Slope Cross Section 4-4'	1.9H:1V (FOS=1.5)	-	-	No setback required

* The setbacks are measured from the crest of existing slope to the crest of imaginary slope.

5.9.4 COMMENTS ON SLOPE STABILITY

1. The distance between the Little Rouge Creek and the toe of the slope is greater than 15 m. In accordance with the Guide, no Toe erosion allowance is required for the analyses of the LTSTOS.
2. The LTSTOS location was determined based on the above stability analyses, and considering an additional Toe erosion allowance does not apply. The slope with 1.9H:1V to 2.0H:1V inclinations at the site as shown on **Figures D-1** to **D-5** are considered stable in terms of long-term stability. A setback distance as shown in Table 5.4 is recommended for the long-term stability of the valley slopes. The LTSTOS lines S1-S2 and S3-S4 are shown on Borehole Location, Cross Section and LTSTOS Plan**, D-1** in **Appendix D,** which result in a stable top of slope line from nil to 10.5 m from the top of existing slope at Sections 1-1' to 4-4'. The LTSTOS Lines must be reviewed by TRCA for their approval.
3. In addition to the above LTSTOS, an Erosion Access Allowance (EAA) may be required to consider possible external conditions which could have an adverse effect on the existing natural condition of the slope, and to provide access to the slope in emergencies. The required EAA should be determined by TRCA.
4. Foundations for future development should be founded behind the EAA contour. In addition, any foundations near the slope should be founded below an imaginary 3H:1V line drawn up from the toe of the long term stable slope. Should this requirement be not met, a geotechnical engineer should be consulted for further elevations.
5. Local slump failures were observed at a drainage channel/gully during the site reconnaissance visit. Sufficient erosion protection, such as rip rap placed on geotextile/fabric may be considered as a

mitigation measure for the existing drainage channel/gully, subject to approval from local conservation authorities.

6. In order to prevent soil erosion at the slope surface, the vegetation and trees on the existing slopes must be preserved. Surface water must be directed away from the slopes.
7. The configuration of the slope should not be altered without prior consultation with a geotechnical engineer. The slope should not be steepened.
8. Site development and construction activities should be conducted in a manner which do not result in surface erosion of the slope, maintain appropriate temporary excavation slopes in accordance with OHSA requirements. Construction access should be limited within the LTSTOS boundary and stockpiling and storage of vehicles and machinery must be prohibited.
9. As part of a construction sediment and erosion control plan, sediment control fence must be erected and maintained during construction to isolate the work area from adjoining slope and valley system.

6 GENERAL COMMENTS AND LIMITATIONS OF REPORT

This report is intended solely for the Client named. The material in it reflects our best judgment considering the information available to WSP Canada Inc. at the time of preparation. Unless otherwise agreed in writing by WSP Canada Inc., it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on the information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

7 CLOSURE

Thank you for the opportunity to be of service to you. Should you have any questions or require further clarification on any aspect of this report, please do not hesitate to contact this office.

SIGNATURES

Amar Persaud, M.Eng., P.Eng.
Geotechnical Engineer

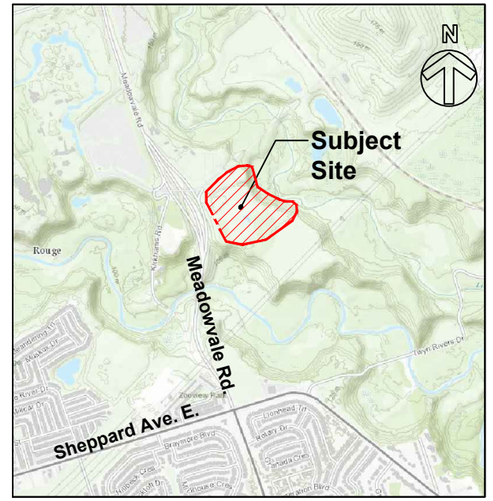
Derek Wang, P.Eng.
Senior Geotechnical Engineer

Garnet Brenchley, P.Eng.
Senior Geotechnical Engineer

DRAWINGS

BOREHOLE LOCATION PLAN

DRAINAGE AND BACKFILL RECOMMENDATIONS



Key Plan

N.T.S.

Legend:

- Monitoring Well Location (WSP 2020)

25 12.5 0 25 metres

BOREHOLE LOCATION PLAN

GEOTECHNICAL INVESTIGATION
Proposed Toronto Zoo Parking Lot #4
Toronto, Ontario

DATE: JULY 2020	SCALE: AS SHOWN
PROJECT: 201-04948-00	FILE NO.:

wsp

FIGURE 1

STATION: 12020050046

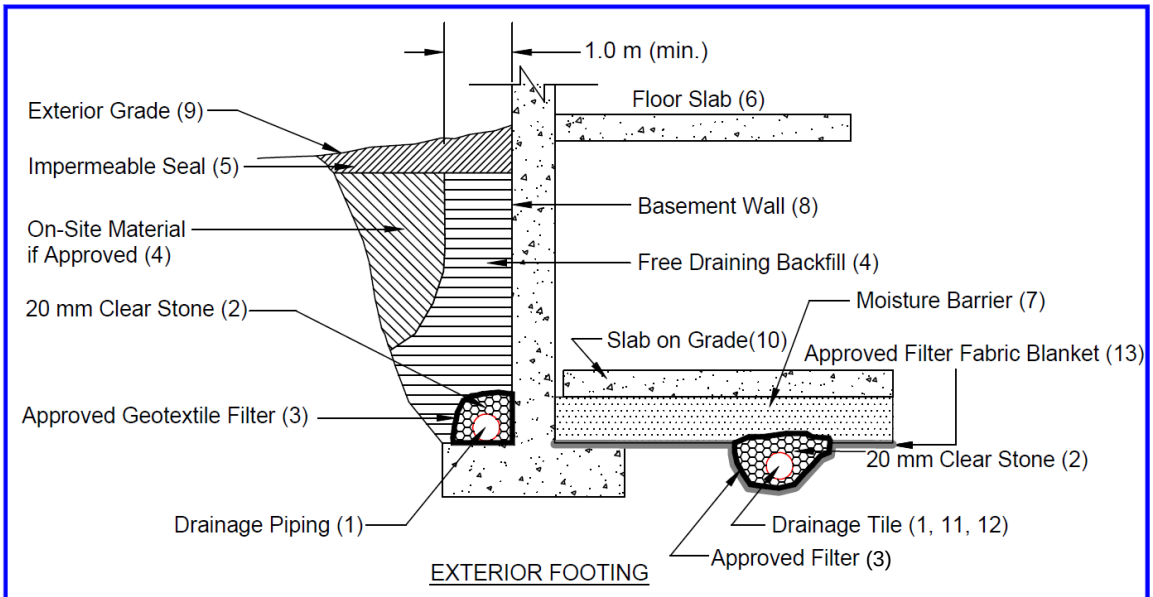
Also known as:	050046
Monument status:	Existing
Toronto status:	1
Monument type:	BM
Horizontal datum:	TOR_H-1974
Horizontal accuracy:	UNCLASSIFIED
Latitude:	N43°48'37.4xxxx"
Longitude:	W79°10'22.0xxxx"
Ellipsoidal elevation:	124.xxx
Ellipsoidal elevation order:	Unclassified
UTM-17 Easting:	E646964.xxx
UTM-17 Northing:	N4852220.xxx
UTM-17 Cmbd sc-fact:	0.99984621
UTM-17 Mrdnl convg:	1°15'54.5"
MTM-10 Easting:	E331124.xxx
MTM-10 Northing:	N4852105.xxx
MTM-10 Cmbd sc-fact:	0.99988907
MTM-10 Mrdnl convg:	0°13'35.4"
Vertical datum:	CGVD-1928:PRE-1978
Vertical accuracy:	Tor third order
Orthometric elev:	123.537
Meridional defl:	
Prime vert defl:	
Undulation:	

Location: Created on 2010/10/10.
Township: City of Toronto BM IN CONCRETE BASE OF LARGE HYDRO TRANSFORMER ON WEST SIDE OF MEADOWVALE ROAD, 200M NORTH OF SHEPPARD AVENUE EAST, AND 30M SOUTH OF KIRKHAMS ROAD. BM IN EAST FACE OF CONCRETE PAD, 0.4M SOUTH OF THE NORTHEAST CORNER.

Maintenance: Toronto: last maintained: 2005/12/07

(Reference sketch for 12020050046 is not available.)

Drawing 2

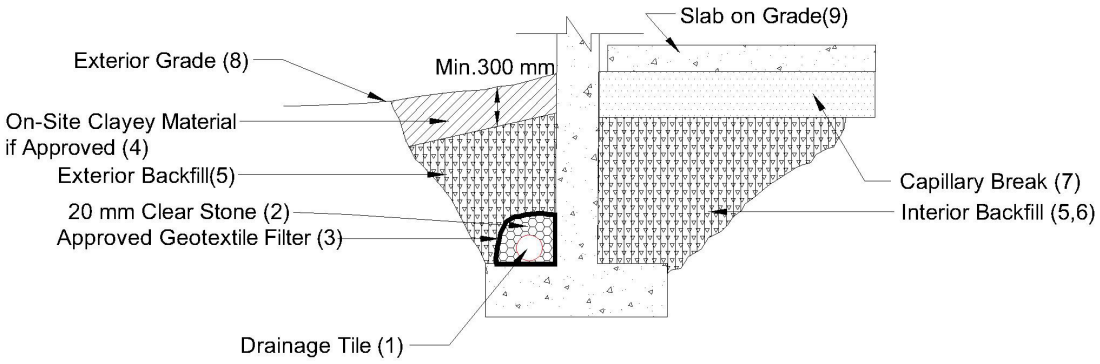


Notes

1. Drainage piping to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved geotextile filter fabrics (Terrafix 270R or equivalent).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18") of the wall. Use hand controlled light compaction equipment within 1.8 m (6') of wall. The minimum width of the Granular 'B' backfill must be 1.0 m.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted. Maximum thickness of seal to be 0.5 m.
6. Do not backfill until wall is supported by basement floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
8. Basement wall to be damp proofed /water proofed as per OBC requirements.
9. Exterior grade to slope away from building min 2%.
10. Slab on grade should not be structurally connected to the wall or footing. Waterproof the slab and the slab-to-wall joint.
11. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab.
12. Drainage piping placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
13. The entire subgrade to be covered with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
14. Do not connect the underfloor drains to perimeter drains.
15. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Basement with Underfloor Drainage
(not to scale)

Drawing 3



EXTERIOR FOOTING

Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved geotextile filter (Terrafix 270R or equivalent).
4. The on-site clayey material, if approved, can be used as backfill in the upper 300 mm.
5. The interior and exterior fill adjacent to foundation walls should be OPSS Granular 'B' Type I. Compact to at least 98% SPMDD.
6. Do not use heavy compaction equipment within 450 mm (18") of the wall. Place fill on both sides simultaneously.
7. Capillary break to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors (consult with architect).
8. Exterior grade to slope away from building at min. 2%.
9. Slab on grade should not be structurally connected to the wall or footing.
10. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Slab on Grade Construction Without Underfloor Drainage
(not to scale)

APPENDIX

A

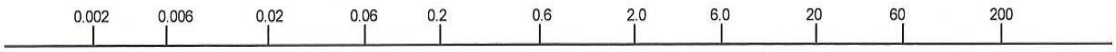
-EXPLANATION OF TERMS USED IN THE RECORD OF BOREHOLE
-LOGS OF BOREHOLES

FIGURE 1A: NOTES ON SAMPLE DESCRIPTIONS

1. All sample descriptions included in this report generally follow the Unified Soil Classification. Laboratory grain size analyses provided by SPL also follow the same system. Different classification systems may be used by others, such as the system by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis and/or Atterberg Limits testing have been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Figure 1B: Explanation of Terms Used in the Record of Boreholes

Sample Type

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Dimension type sample
FS	Foil sample
NR	No recovery
RC	Rock core
SC	Soil core
SS	Spoon sample
SH	Shelby tube Sample
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

Penetration Resistance

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) required to drive a 50 mm (2 in) drive open sampler for a distance of 300 mm (12 in).

WH – Samples sinks under "weight of hammer"

Dynamic Cone Penetration Resistance, N_d:

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

Textural Classification of Soils

Classification	Particle Size
Boulders	> 200 mm
Cobbles	75 mm - 200 mm
Gravel	4.75 mm - 75 mm
Sand	0.075 mm – 4.75 mm
Silt	0.002 mm-0.075 mm
Clay	<0.002 mm

Coarse Grain Soil Description (50% greater than 0.075 mm)

Terminology	Proportion
Trace	0-10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-40%
And (e.g. sand and gravel)	> 40%

Soil Description

a) Cohesive Soils(*)

Consistency	Undrained Shear Strength (kPa)	SPT "N" Value
Very soft	<12	0-2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very stiff	100-200	15-30
Hard	>200	>30

(*) Hierarchy of Shear Strength prediction

1. Lab triaxial test
2. Field vane shear test
3. Lab. vane shear test
4. SPT "N" value
5. Pocket penetrometer

b) Cohesionless Soils

Density Index (Relative Density)	SPT "N" Value
Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Soil Tests

w	Water content
w_p	Plastic limit
w_l	Liquid limit
C	Consolidation (oedometer) test
CID	Consolidated isotropically drained triaxial test
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement
D_R	Relative density (specific gravity, Gs)
DS	Direct shear test
ENV	Environmental/ chemical analysis
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified proctor compaction test
SPC	Standard proctor compaction test
OC	Organic content test
U	Unconsolidated Undrained Triaxial Test
V	Field vane (LV-laboratory vane test)
γ	Unit weight

LOG OF BOREHOLE BH20- 1

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Solid Stem Auger
ENCL NO.: 2
PROJECT LOCATION: Toronto, ON
Diameter: 110 mm
ORIGINATED BY JL
DATUM: UTM NAD83 ZONE 17
Date: Jun/16/2020
BH LOCATION: N 4853370.1 E 647052.8
Equipment: Aardvark CME 55 (Track)

SOIL PROFILE

ELEV (m)	DEPTH (m)	DESCRIPTION
131.3		Ground Surface
131.1	0.0	**TOPSOIL:** 170 mm
	0.2	**FILL:** sand fill, trace silt, trace clay, brown, moist, compact.
130.6	0.7	**SANDY SILT:** trace gravel, trace clay, brown, moist, compact.
129.8	1.5	**SILTY CLAY TILL:** trace gravel, some sand, grey, moist, very stiff to firm.
128.3	3.0	**SANDY SILT TILL:** trace gravel, some clay, brown, moist, dense to compact.
124.6	6.7	**END OF BOREHOLE**

SAMPLES

NUMBER	TYPE	"N" BLOWS / 0.3 m	Natural moisture content	Remarks / Grain size distribution (%) GR SA SI CL
1	SS	12		
2	SS	26		
3	SS	17		
4	SS	7		
5	SS	38		
6	SS	15	Non-plastic	11 36 40 13
7	SS	15		

GROUND WATER CONDITIONS: W. L. 129.6 m Aug 12, 2020; bentonite; sand; screen; sand

ELEVATION: 131, 130, 129, 128, 127, 126, 125

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m^3)

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Notes:
1). Borehole was open and dry upon completion of drilling;
2). A 50mm dia. monitoring well was installed upon completion of drilling.

Water Level Readings:

Date	Depth (m.b.g.s.)
July 13, 2020	1.56
Aug 12, 2020	1.65

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 2

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Solid Stem Auger
ENCL NO.: 3
PROJECT LOCATION: Toronto, ON
Diameter: 110 mm
ORIGINATED BY JL
DATUM: UTM NAD83 ZONE 17
Date: Jun/16/2020
BH LOCATION: N 4853330.6 E 647003.9
Equipment: Aardvark CME 55 (Track)

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
130.8	Ground Surface											
130.7	**TOPSOIL:** 125 mm											
0.1	**FILL:** sand fill, trace silt, trace clay, brown, moist, compact.		1	SS	12							
130.1												
0.7	**SANDY SILT:** trace gravel, trace clay, grey, moist, compact.		2	SS	24	▽	130					
129.4							W. L. 129.7 m Aug 12, 2020					
1.5	**SILTY CLAY TILL:** with sand, trace gravel, grey, moist, soft to very stiff.		3	SS	23		129					
							bentonite					
			4	SS	16		128					
			5	SS	8		127					
							sand					
			6	SS	4		126					
							screen					
							125					
			7	SS	15		sand					
124.1												
6.7	**END OF BOREHOLE**											

Notes:
1). Borehole was open and dry upon completion of drilling;
2). A 50mm dia. monitoring well was installed upon completion of drilling.

Water Level Readings:

Date	Depth (m.b.g.s.)
July 13, 2020	1.10
Aug 12, 2020	1.15

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 3

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Solid Stem Auger
ENCL NO.: 4
PROJECT LOCATION: Toronto, ON
Diameter: 110 mm
ORIGINATED BY JL
DATUM: UTM NAD83 ZONE 17
Date: Jun/20/2020
BH LOCATION: N 4853360.6 E 647113.7
Equipment: Aardvark CME 55 (Track)

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m
131.4	Ground Surface			
0.0 / 131.0	**GRANULAR FILL:** 400 mm	1	SS	20
0.4 / 130.4	**FILL:** sandy gravel fill, trace silt, brown, moist, compact.			
1.0	**SILTY CLAY TILL:** trace sand, brown to grey, moist, firm to very stiff.	2	SS	21
		3	SS	11
		4	SS	6
		5	SS	12
4.1 / 127.3	**SANDY SILT TILL:** trace gravel, trace clay, grey, moist, compact.	6	SS	33
		7	SS	25
6.7 / 124.7	**END OF BOREHOLE**			

Notes:
1). Borehole was open and dry upon completion of drilling;
2). A 50mm dia. monitoring well was installed upon completion of drilling.

Water Level Readings:

Date	Depth (m.b.g.s.)
July 13, 2020	1.56
Aug 12, 2020	2.74

GROUND WATER CONDITIONS: bentonite; W. L. 128.7 m Aug 12, 2020; sand; screen; sand

ELEVATION: 131, 130, 129, 128

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 4

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Solid Stem Auger
ENCL NO.: 5
PROJECT LOCATION: Toronto, ON
Diameter: 110 mm
ORIGINATED BY JL
DATUM: UTM NAD83 ZONE 17
Date: Jun/17/2020
BH LOCATION: N 4853257.6 E 647066.8
Equipment: Aardvark CME 55 (Track)

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION
130.1	Ground Surface				
0.0 / 129.8	**GRANULAR FILL:** 300 mm	1	SS	11	130
0.3 / 129.4	**FILL:** sandy gravel to sand fill, trace silt, trace clay, brown, moist, compact.				
0.7	**SANDY SILT:** trace clay, brown to grey, moist to wet, dense to compact.	2	SS	33	129
		3	SS	17	W. L. 128.5 m Aug 12, 2020
127.9					bentonite
2.2	**SILTY CLAY TILL:** trace gravel, some sand, grey, moist, soft to stiff.	4	SS	3	
	auger grinding, cobbles/boulders inferred	5	SS	9	127
					126 sand
		6	SS	6	125 screen
					124
123.4		7	SS	10	sand
6.7	**END OF BOREHOLE**				

Notes:
1). Borehole was open and dry upon completion of drilling;
2). A 50mm dia. monitoring well was installed upon completion of drilling.

Water Level Readings:

Date	Depth (m.b.g.s.)
July 13, 2020	1.83
Aug 12, 2020	1.61

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 5

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Solid Stem Auger
ENCL NO.: 6
PROJECT LOCATION: Toronto, ON
Diameter: 110 mm
ORIGINATED BY JL
DATUM: UTM NAD83 ZONE 17
Date: Jun/17/2020
BH LOCATION: N 4853214.9 E 647040.5
Equipment: Aardvark CME 55 (Track)

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
130.2	Ground Surface											
0.0 / 129.8	**GRANULAR FILL:** 360 mm		1	SS	44		130					
0.4	**FILL:** sandy gravel to sand fill, trace silt, trace clay, brown, moist, dense to loose.		2	SS	9		129					
128.7												
1.5	**SANDY GRAVEL:** some silt, trace clay, brown, moist to wet, very dense.		3	SS	50/ 50mm							
	spoon wet		4	SS	85	▽	bentonite W. L. 128.0 m Aug 12, 2020					
	auger grinding, cobbles/boulders inferred		5	SS	70		127					
126.1							126					
4.1	**SANDY SILT TILL:** trace gravel, some clay, brown, moist, very loose.		6	SS	1		sand		Non-plastic			5 41 39 15
124.4							125					
5.7	**SILTY CLAY TILL:** trace gravel, some sand, containing silty sand layer, grey, moist, soft to very soft.		7	SS	4		screen 124					
							123					
			8	SS	1		bentonite 122					
			9	SS	2		121					
120.4												
9.8	**END OF BOREHOLE**											

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 5

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Solid Stem Auger
ENCL NO.: 6
PROJECT LOCATION: Toronto, ON
Diameter: 110 mm
ORIGINATED BY JL
DATUM: UTM NAD83 ZONE 17
Date: Jun/17/2020
BH LOCATION: N 4853214.9 E 647040.5
Equipment: Aardvark CME 55 (Track)

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m							GR SA SI CL
	Continued											
	Notes: 1). Borehole was open upon completion of drilling; 2). Water was at a depth of 6.1m bgs upon completion of drilling; 3). A 50mm dia. monitoring well was installed upon completion of drilling. Water Level Readings: Date Depth (m.b.g.s.) July 13, 2020 5.53 Aug 12, 2020 2.21											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 6

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Solid Stem Auger
ENCL NO.: 7
PROJECT LOCATION: Toronto, ON
Diameter: 110 mm
ORIGINATED BY JL
DATUM: UTM NAD83 ZONE 17
Date: Jun/18/2020
BH LOCATION: N 4853210.3 E 647173
Equipment: Aardvark CME 55 (Track)

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION
130.9	Ground Surface						
0.0 / 130.5	**GRANULAR FILL:** 400 mm		1	SS	25		
0.4 / 130.2	**FILL:** sandy gravel to sand fill, trace silt, trace clay, brown, moist, compact.						
0.7	**SANDY SILT:** trace clay, brown to grey, moist, dense to compact.		2	SS	35		130
128.7			3	SS	16		129
2.2	**SILTY CLAY TILL:** trace gravel, grey, moist, hard to very stiff.		4	SS	55		128
			5	SS	27		127
			6	SS	24		126
			7	SS	27		125
124.2							
6.7	**END OF BOREHOLE** Notes: 1). Borehole was open upon completion of drilling; 2). Water was at a depth of 5.5m bgs upon completion of drilling.						

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 7

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 8
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jun/25/2020 to Jun/29/2020
BH LOCATION: N 4853409.1 E 647113.3
Equipment: Aardvark CME 55 (Track)

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
132.2	Ground Surface							
132.0 / 0.1	**TOPSOIL:** 50mm						concrete	
	FILL: gravelly sand, containing cobbles/boulders, brown, moist, very dense.		1	SS	95/ 200mm		132	
			2	SS	52		131	
130.8 / 1.4	**SILTY SAND TILL:** trace gravel, some clay, brown, moist, very dense to compact.		3	SS	51		bentonite	
			4	SS	18		130	
			5	SS	15		129	9 49 30 12
	---------- sandy gravel layer		6	SS	24		128	
126.5 / 5.7	**SILTY CLAY TILL:** trace gravel, some sand to sandy containing cobbles/boulders, grey, moist to wet, very stiff to hard.		7	SS	22		127	
			8	SS	42		126	
			9	SS	66/ 230mm		125	
							124	
							123	

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 7

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 8
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jun/25/2020 to Jun/29/2020
BH LOCATION: N 4853409.1 E 647113.3
Equipment: Aardvark CME 55 (Track)

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION
	Continued						
11	**SILTY CLAY TILL:** trace gravel, some sand to sandy containing cobbles/boulders, grey, moist to wet, very stiff to hard.(Continued)		10	SS	50/ 76mm		122
12			11	SS	50/ 100mm		120
13							119
14			12	SS	50/ 76mm		118
15						bentonite grout	
	---------- silty sand till layer		13	SS	50/ 76mm		117
16							116
17			14	SS	50/ 130mm		
							115
18							
			15	SS	50/ 50mm		114
19							
							113
20			16	SS	50/		

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 7

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 8
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jun/25/2020 to Jun/29/2020
BH LOCATION: N 4853409.1 E 647113.3
Equipment: Aardvark CME 55 (Track)

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued											
	SILTY CLAY TILL: trace gravel, some sand to sandy containing cobbles/boulders, grey, moist to wet, very stiff to hard.(Continued)				80mm		112					
21												
			17	SS	95/ 250mm		111		○			
22												
							110					
23			18	SS	50/ 130mm				○			
							109					
24												
							108					
			19	SS	95/ 230mm				○			
25												
							107					
26												
			20	SS	96/ 280mm				○			
							106					
27												
							sand 105					
			21	SS	88/ 280mm				○			
28												
							104					
							screen					
29			22	SS	98/ 230mm				○			
103.0							103					
29.3	**SILTY SAND:** trace gravel, containing cobbles, grey, wet, very dense.											
30												

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 7

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 8
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jun/25/2020 to Jun/29/2020
BH LOCATION: N 4853409.1 E 647113.3
Equipment: Aardvark CME 55 (Track)

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued											
	SILTY SAND: trace gravel, containing cobbles, grey, wet, very dense.(Continued)						102					
101.6			23	SS	50/ 100mm		sand		○			
30.6	**END OF BOREHOLE** Notes: 1). A 50mm dia. monitoring well was installed upon completion of drilling. Water Level Readings: Date Depth (m.b.g.s.) Aug 12, 2020 Dry											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
$+^{3}$, $\times^{3}$: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 8

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 9
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jun/23/2020 to Jun/25/2020
BH LOCATION: N 4853388.6 E 647155.6
Equipment: Aardvark CME 55 (Track)

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m
132.1	Ground Surface			
132.0 / 0.1	**TOPSOIL:** 75mm			
	FILL: sand, trace gravel, containing large pieces of obstructions, brown, moist, compact to very dense.	1	SS	16
		2	SS	50/ 150mm
130.7 / 1.5	**SANDY SILT:** trace gravel, trace clay, brown, moist, very dense.	3	SS	64
129.9 / 2.2	**SANDY SILT TILL:** trace gravel, trace to some clay, brown, moist, very dense.	4	SS	50/ 50mm
129.2 / 3.0	**SILTY CLAY TILL:** trace gravel, grey, moist, hard.	5	SS	84/ 200mm
		6	SS	50/ 100mm
		7	SS	95/ 170mm
		8	SS	50/ 40mm
		9	SS	60/ 150mm

GROUND WATER CONDITIONS: concrete; bentonite

ELEVATION: 132, 131, 130, 129, 128, 127, 126, 125, 124, 123

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 8

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 9
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jun/23/2020 to Jun/25/2020
BH LOCATION: N 4853388.6 E 647155.6
Equipment: Aardvark CME 55 (Track)

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued											
	SILTY CLAY TILL: trace gravel, grey, moist, hard.(Continued)											
11			10	SS	68		121					
12			11	SS	50/ 100mm		120					
13							119					
14			12	SS	50/ 80mm		118					
15								bentonite grout				
			13	SS	50/ 100mm		117					
16							116					
17			14	SS	50/ 100mm							9 40 35 16
							115					
18							114					
			15	SS	50/ 80mm							
19							113					
20			16	SS	50/							

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 8

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 9
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jun/23/2020 to Jun/25/2020
BH LOCATION: N 4853388.6 E 647155.6
Equipment: Aardvark CME 55 (Track)

ELEV DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION
	Continued						
	SILTY CLAY TILL: trace gravel, grey, moist, hard.(Continued)				50mm		112
21			17	SS	95/ 200mm		111
22							110
23			18	SS	50/ 80mm		109
24							108
			19	SS	50/ 150mm		
25							107
26			20	SS	95/ 200mm		106
27							sand
			21	SS	50/ 50mm		
28							104
29							screen
			22	SS	95/ 230mm		103
30	102.1						

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 8

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 9
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jun/23/2020 to Jun/25/2020
BH LOCATION: N 4853388.6 E 647155.6
Equipment: Aardvark CME 55 (Track)

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued											
30.0	**SILTY SAND:** trace gravel, grey, wet, very dense.						102					
101.6												
			23	SS	50/ 50mm		sand					
30.5	**END OF BOREHOLE**											

Note:
1). A 50mm dia. monitoring well was installed upon completion of drilling.

Water Level Readings:
Date Depth (m.b.g.s.)
Aug 12, 2020 Dry

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 8A

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 10
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY JL
DATUM: UTM NAD83 ZONE 17
Date: Jun/25/2020
BH LOCATION: N 4853381 E 647154.7
Equipment: Aardvark CME 55 (Track)

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
132.1	Ground Surface											
132.0 / 0.1	**TOPSOIL:** 75mm						concrete					
	FILL: sand, trace gravel, containing large pieces of obstructions, brown, moist.						bentonite					
130.7 / 1.5	**SANDY SILT:** trace gravel, trace clay, brown, moist.						sand					
129.9 / 2.2	**SANDY SILT TILL:** trace gravel, trace to some clay, brown, moist.						screen					
129.2 / 3.1	**SILTY CLAY TILL:** trace gravel, grey, moist.											
	END OF BOREHOLE											

Note:
1). A 50mm dia. monitoring well was installed upon completion of drilling.

Water Level Readings:

Date	Depth (m.b.g.s.)
July 13, 2020	Dry
Aug 12, 2020	Dry

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 9

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 11
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jun/30/2020 to Jul/03/2020
BH LOCATION: N 4853308.2 E 647175.9
Equipment: Aardvark CME 55 (Track)

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
131.2	Ground Surface											
131.0	**TOPSOIL:** 150 mm						concrete					
0.2	**SANDY SILT:** trace gravel, trace clay, brown, moist, dense.		1	SS	32		131					
1			2	SS	39		130					
129.8												
1.5	**SILTY CLAY TILL:** trace gravel, some sand to sandy, grey, moist, soft to hard.		3	SS	30		bentonite					
2			4	SS	30		129					
3			5	SS	22		128					
4			6	SS	5		127					
5			7	SS	4		126					5 40 39 16
6			8	SS	14		125					
7			9	SS	18		124					
8							123					
9							122					
10												

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GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 9

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 11
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jun/30/2020 to Jul/03/2020
BH LOCATION: N 4853308.2 E 647175.9
Equipment: Aardvark CME 55 (Track)

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued											
	SILTY CLAY TILL: trace gravel, some sand to sandy, grey, moist, soft to hard.(Continued)											
	sand layer		10	SS	40		121					
							120					
			11	SS	66		119					
			11A	SS	50/ 130mm		118					
			12	SS	50/ 130mm		117					
			13	SS	50/ 100mm		116					
			14	SS	50/ 130mm		115					
							114					
								bentonite grout				
			15	SS	50/ 130mm		113					
							112					
			16	SS	50/							

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 9

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 11
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jun/30/2020 to Jul/03/2020
BH LOCATION: N 4853308.2 E 647175.9
Equipment: Aardvark CME 55 (Track)

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued											
	SILTY CLAY TILL: trace gravel, some sand to sandy, grey, moist, soft to hard.(Continued)				50mm							
21			17	SS	50/ 130mm		110					
22							109					
23			18	SS	50/ 50mm		108					
24							107					
25			19	SS	94/ 230mm		106					
26			20	SS	90/ 280mm		105					
27							104					
28			21	SS	50/ 100mm		103					
29			22	SS	90/ 280mm		102					
30												

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 9

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 11
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jun/30/2020 to Jul/03/2020
BH LOCATION: N 4853308.2 E 647175.9
Equipment: Aardvark CME 55 (Track)

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued											
	SILTY CLAY TILL: trace gravel, some sand to sandy, grey, moist, soft to hard.(Continued)						101					
			23	SS	88/ 280mm				○			
31							100					
						▽		W. L. 99.7 m Aug 12, 2020				
32			24	SS	50/ 100mm		99		○			
98.3												
33 32.9	**SANDY SILT TILL:** trace gravel, trace to some clay, grey, moist to wet, very dense.						sand					
			25	SS	50/ 50mm							
34							97					
35							screen					
			26	SS	50/ 80mm		96		○			
36							95					
94.5							sand					
36.7	**END OF BOREHOLE**		27	SS	50/ 100mm				○			

Notes:
1). A 50mm dia. monitoring well was installed upon completion of drilling.

Water Level Readings:

Date	Depth (m.b.g.s.)
Aug 12, 2020	31.56

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20- 9A

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 12
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY JL
DATUM: UTM NAD83 ZONE 17
Date: Jul/03/2020
BH LOCATION: N 4853307.7 E 647175.1
Equipment: Aardvark CME 55 (Track)

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
131.3	Ground Surface											
131.0	**TOPSOIL:** 150 mm						concrete					
0.2	**SANDY SILT:** trace gravel, trace clay, brown, moist.						131					
129.8							130					
1.5	**SILTY CLAY TILL:** trace gravel, some sand to sandy, grey, moist.						bentonite					
							128					
							127					
							sand					
							126					
							screen					
125.2							W. L. 125.3 m Aug 12, 2020					
6.1	**END OF BOREHOLE**											

Note:
1). A 50mm dia. monitoring well was installed upon completion of drilling.

Water Level Readings:

Date	Depth (m.b.g.s.)
July 13, 2020	4.78
Aug 12, 2020	5.92

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20-10

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 13
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jul/07/2020 to Jul/09/2020
BH LOCATION: N 4853247 E 647211.4
Equipment: Aardvark CME 55 (Track)

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
130.7	Ground Surface					
130.6	**TOPSOIL:** 130mm				concrete	
0.1	**FILL:** sandy silt, trace gravel, dark brown to brown, moist, loose.	1	SS	4		
130.0					130	
0.7	**SAND:** trace to some gravel, trace clay, containing cobbles/boulders, brown, moist, dense.	2	SS	33		
129.2					bentonite	
1.5	**SILTY CLAY TILL:** trace gravel, some sand to sandy, containing wet silty sand layers, grey, moist to wet, stiff to hard.	3	SS	40	129	
		4	SS	22	128	
		5	SS	16	127	
		6	SS	24	126	
		7	SS	8	125	6 23 49 22
		8	SS	15	124	
		9	SS	18	123	
					122	
					121	

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20-10

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 13
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jul/07/2020 to Jul/09/2020
BH LOCATION: N 4853247 E 647211.4
Equipment: Aardvark CME 55 (Track)

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
	Continued						
11	**SILTY CLAY TILL:** trace gravel, some sand to sandy, containing wet silty sand layers, grey, moist to wet, stiff to hard.(Continued)		10	SS	59		120
12			11	SS	56		119
13							118
14			12	SS	50		117
15							116
16			13	SS	66		115
17			14	SS	50/ 100mm		114
18						bentonite grout	113
			15	SS	50/ 130mm		112
19							
20			16	SS	50/		111

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20-10

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 13
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jul/07/2020 to Jul/09/2020
BH LOCATION: N 4853247 E 647211.4
Equipment: Aardvark CME 55 (Track)

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION
	Continued				
	SILTY CLAY TILL: trace gravel, some sand to sandy, containing wet silty sand layers, grey, moist to wet, stiff to hard.(Continued)			50mm	
		17	SS	50/ 50mm	
		18	SS	50/ 130mm	
		19	SS	50/ 100mm	
		20	SS	50/ 130mm	
		21	SS	50/ 130mm	
		22	SS	48	
100.7					

SOIL PROFILE | SAMPLES | GROUND WATER CONDITIONS | ELEVATION | STRATA PLOT

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED
● QUICK TRIAXIAL
+ FIELD VANE & Sensitivity
× LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m³) | REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20-10

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 13
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY MH
DATUM: UTM NAD83 ZONE 17
Date: Jul/07/2020 to Jul/09/2020
BH LOCATION: N 4853247 E 647211.4
Equipment: Aardvark CME 55 (Track)

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m
	Continued			
30.0	**SANDY SILT TILL:** trace gravel, some clay, grey, wet, very dense.	23	SS	50/ 100mm
31				
32		24	SS	50/ 130mm
33 97.6				
33.1	**SILTY CLAY TILL:** trace gravel, some sand, grey, moist, hard.	25	SS	50/ 130mm
34				
96.1				
34.6	**SANDY SILT TILL:** trace gravel, trace to some clay, grey, wet, very dense.	26	SS	50/ 100mm
35				
36				
94.1				
36.6	**END OF BOREHOLE**	27	SS	50/ 50mm

Notes:
1). A 50mm dia. monitoring well was installed upon completion of drilling.

Water Level Readings:
Date Depth (m.b.g.s.)
July 13, 2020 27.66
Aug 12, 2020 30.83

GROUND WATER CONDITIONS: W. L. 99.9 m Aug 12, 2020

ELEVATION: 100, 99, 98, sand, 97, 96, screen, 95, sand

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20-10A

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Hollow Stem Auger/Mud Rotary
ENCL NO.: 14
PROJECT LOCATION: Toronto, ON
Diameter: 203 mm
ORIGINATED BY JL
DATUM: UTM NAD83 ZONE 17
Date: Jul/09/2020
BH LOCATION: N 4853246.7 E 647210.3
Equipment: Aardvark CME 55 (Track)

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
130.7	Ground Surface										
130.6	**TOPSOIL:** 130mm						concrete				
0.1	**FILL:** sandy silt, trace gravel, dark brown to brown, moist.										
130.0							130				
0.7	**SAND:** trace to some gravel, trace clay, containing cobbles/boulders, brown, moist.										
1											
129.2							129				
1.5	**SILTY CLAY TILL:** trace gravel, some sand to sandy, containing wet silty sand layers, grey, moist to wet.						W. L. 128.6 m Aug 12, 2020				
2											
							128				
3											
							127				
4							sand				
							126				
5							screen				
							125				
6											
124.6											
6.1	**END OF BOREHOLE**										

Notes:
1). A 50mm dia. monitoring well was installed upon completion of drilling.

Water Level Readings:

Date	Depth (m.b.g.s.)
July 13, 2020	3.90
Aug 12, 2020	2.08

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20-11

PROJECT: Geotechnical Investigation for Rouge Gateway Project
REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)
Method: Solid Stem Auger
ENCL NO.: 15
PROJECT LOCATION: Toronto, ON
Diameter: 110 mm
ORIGINATED BY JL
DATUM: UTM NAD83 ZONE 17
Date: Jun/18/2020
BH LOCATION: N 4853264.7 E 647172
Equipment: Aardvark CME 55 (Track)

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
130.8	Ground Surface											
0.0 / 130.5	**TOPSOIL:** 230 mm											
0.2 / 129.8	**FILL:** sand fill, trace silt, trace clay, brown, moist, very loose to compact.		1	SS	4							
0.9 / 128.3	**SANDY GRAVEL:** trace silt, trace clay, grey, moist, compact to dense.		2	SS	22		130					
			3	SS	33	▽ bentonite W. L. 128.6 m Aug 12, 2020	129					
2.4 / 124.0	**SILTY CLAY TILL:** trace gravel, some sand, grey, moist, hard to very stiff.		4	SS	31		128					
			5	SS	11		127					
						sand	126					
			6	SS	10	screen	125					
			7	SS	20	sand						
6.7	**END OF BOREHOLE** Notes: 1). Borehole was open and dry upon completion of drilling; 2). A 50mm dia. monitoring well was installed upon completion of drilling. Water Level Readings: Date Depth (m.b.g.s.) July 13, 2020 1.71 Aug 12, 2020 2.20											

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

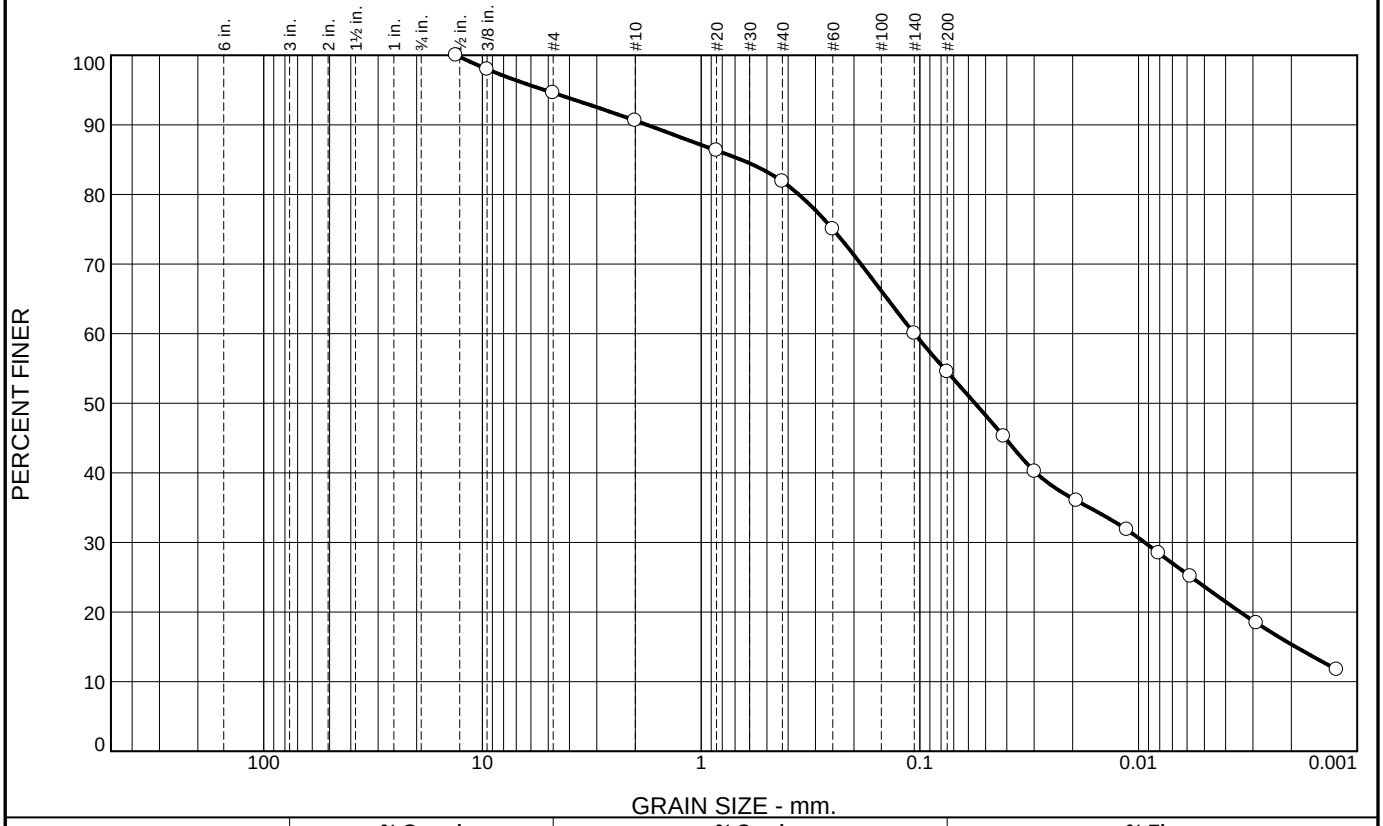
APPENDIX

B

-GRAIN SIZE DISTRIBUTION CURVES

-ATTERBERG LIMIT TEST RESULTS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.4	4.0	8.7	27.4	39.1	15.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
13.2mm	100.0		
9.5mm	98.0		
4.75mm	94.6		
2mm	90.6		
0.850mm	86.3		
0.425mm	81.9		
0.250mm	75.0		
0.106mm	60.0		
0.075mm	54.5		
0.0413 mm.	45.2		
0.0299 mm.	40.2		
0.0192 mm.	36.0		
0.0113 mm.	31.8		
0.0081 mm.	28.5		
0.0058 mm.	25.1		
0.0029 mm.	18.4		
0.0012 mm.	11.7		

* (no specification provided)

Soil Description

Sand and silt, some clay, trace gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 1.7676 D_{85}= 0.6569 D_{60}= 0.1058
D_{50}= 0.0559 D_{30}= 0.0094 D_{15}= 0.0019
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

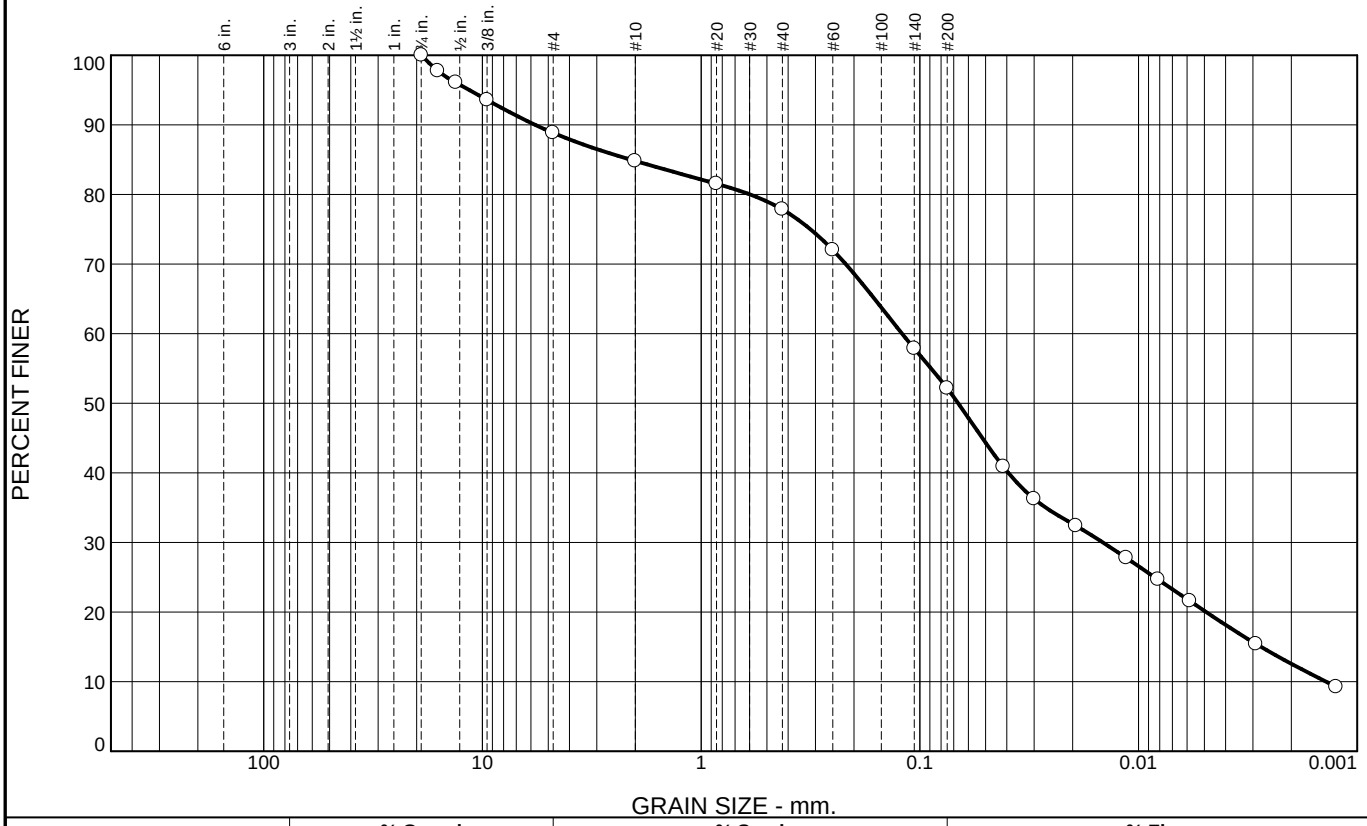
Location: BH20-5 SS6
Sample Number: 20MM-850

Date: 16/07/20

Client: Parks Canada
Project: PCA Rouge Gateway

Project No: 201-04948-00 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	11.1	4.1	7.0	25.6	39.6	12.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
19mm	100.0		
16mm	97.7		
13.2mm	96.1		
9.5mm	93.6		
4.75mm	88.9		
2mm	84.8		
0.850mm	81.5		
0.425mm	77.8		
0.250mm	72.0		
0.106mm	57.9		
0.075mm	52.2		
0.0415 mm.	40.9		
0.0300 mm.	36.3		
0.0193 mm.	32.4		
0.0114 mm.	27.8		
0.0081 mm.	24.7		
0.0058 mm.	21.6		
0.0029 mm.	15.4		
0.0012 mm.	9.3		

* (no specification provided)

Soil Description

Sand and silt, some clay, some gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 5.7330 D_{85}= 2.0989 D_{60}= 0.1206
D_{50}= 0.0667 D_{30}= 0.0145 D_{15}= 0.0028
D_{10}= 0.0014 C_u= 86.84 C_c= 1.26

Classification

USCS= ML AASHTO= A-4(0)

Remarks

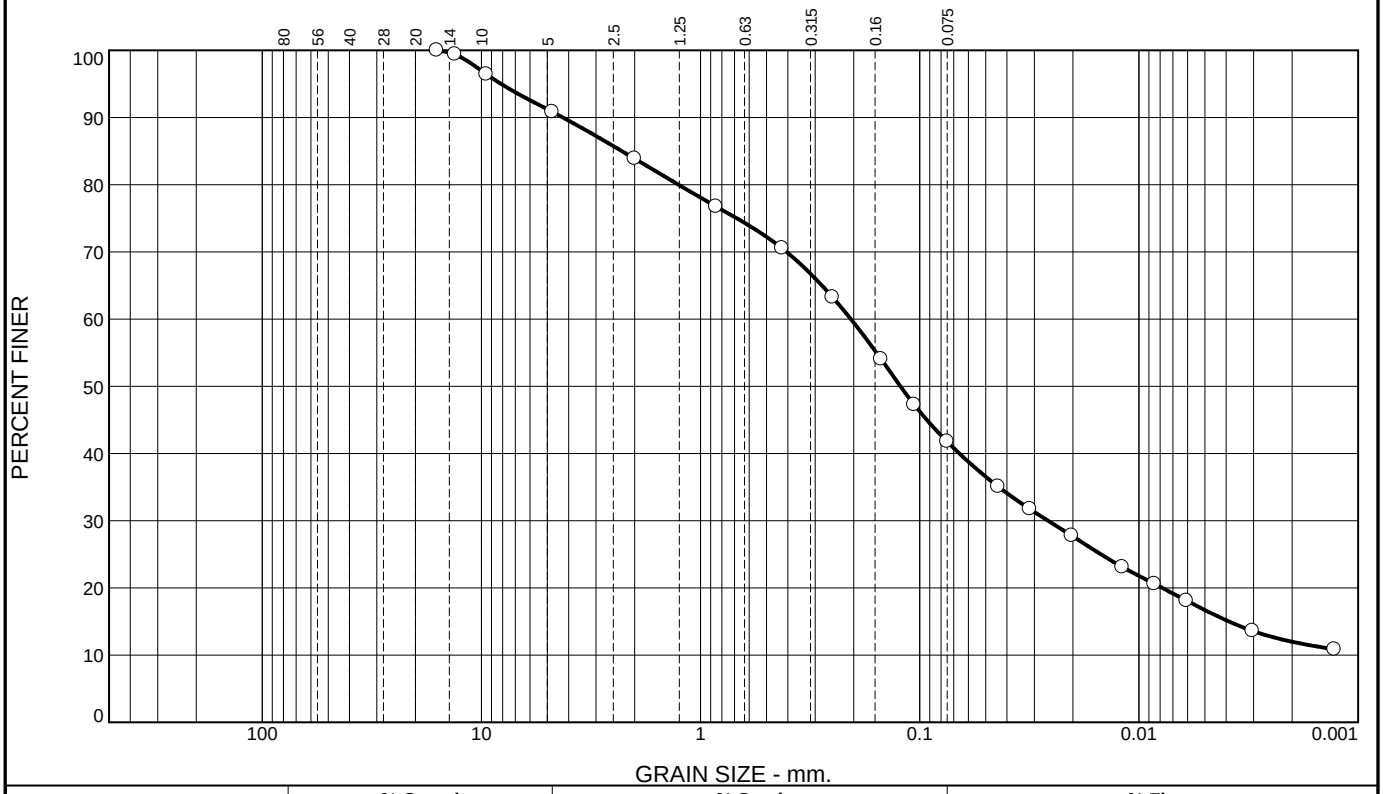
Location: BH20-1 SS6
Sample Number: 20MM-851

Date: 16/07/20

Client: Parks Canada
Project: PCA Rouge Gateway

Project No: 201-04948-00 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	9	7	13	29	30	12

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
16.00	100		
13.20	99		
9.50	96		
4.75	91		
2.00	84		
0.85	77		
0.425	71		
0.250	63		
0.150	54		
0.106	47		
0.075	42		
0.0439 mm.	35		
0.0315 mm.	32		
0.0202 mm.	28		
0.0119 mm.	23		
0.0085 mm.	21		
0.0061 mm.	18		
0.0030 mm.	14		
0.0013 mm.	11		

* (no specification provided)

Soil Description

Silty Sand Till

Atterberg Limits

PL= 11 LL= 15 PI= 4

Coefficients

D_{90}= 4.2528 D_{85}= 2.2867 D_{60}= 0.2062
D_{50}= 0.1225 D_{30}= 0.0260 D_{15}= 0.0039
D_{10}= C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-4(0)

Remarks

Source of Sample: Site Drilling
Sample Number: 20-7_SS5

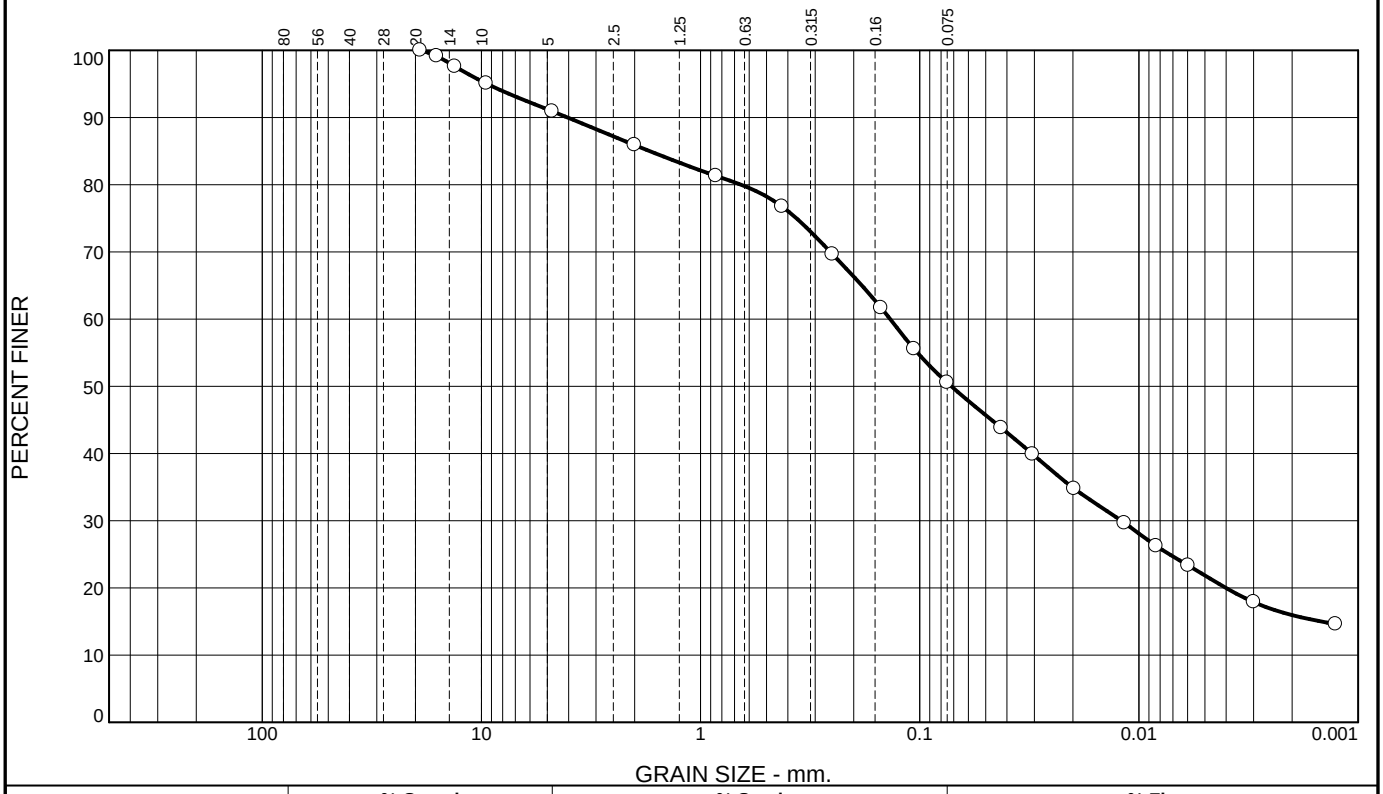
Date: July 24, 2020

Client: Parks Canada Agency (PCA)
Project: Rouge Park Gateway

Project No: 201-04948-00 **Figure** 20-7_SS5

Tested By: Bruce Shan & LXQ & S.L

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	9	5	9	26	35	16

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
19.00	100		
16.00	99		
13.20	98		
9.50	95		
4.75	91		
2.00	86		
0.85	81		
0.425	77		
0.250	70		
0.150	62		
0.106	56		
0.075	51		
0.0425 mm.	44		
0.0305 mm.	40		
0.0197 mm.	35		
0.0116 mm.	30		
0.0083 mm.	26		
0.0060 mm.	23		
0.0030 mm.	18		
0.0013 mm.	15		

* (no specification provided)

Soil Description

Silty clay till

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 4.0456 D_{85}= 1.7085 D_{60}= 0.1365
D_{50}= 0.0718 D_{30}= 0.0120 D_{15}= 0.0015
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: Site Drilling
Sample Number: 20-8_SS14

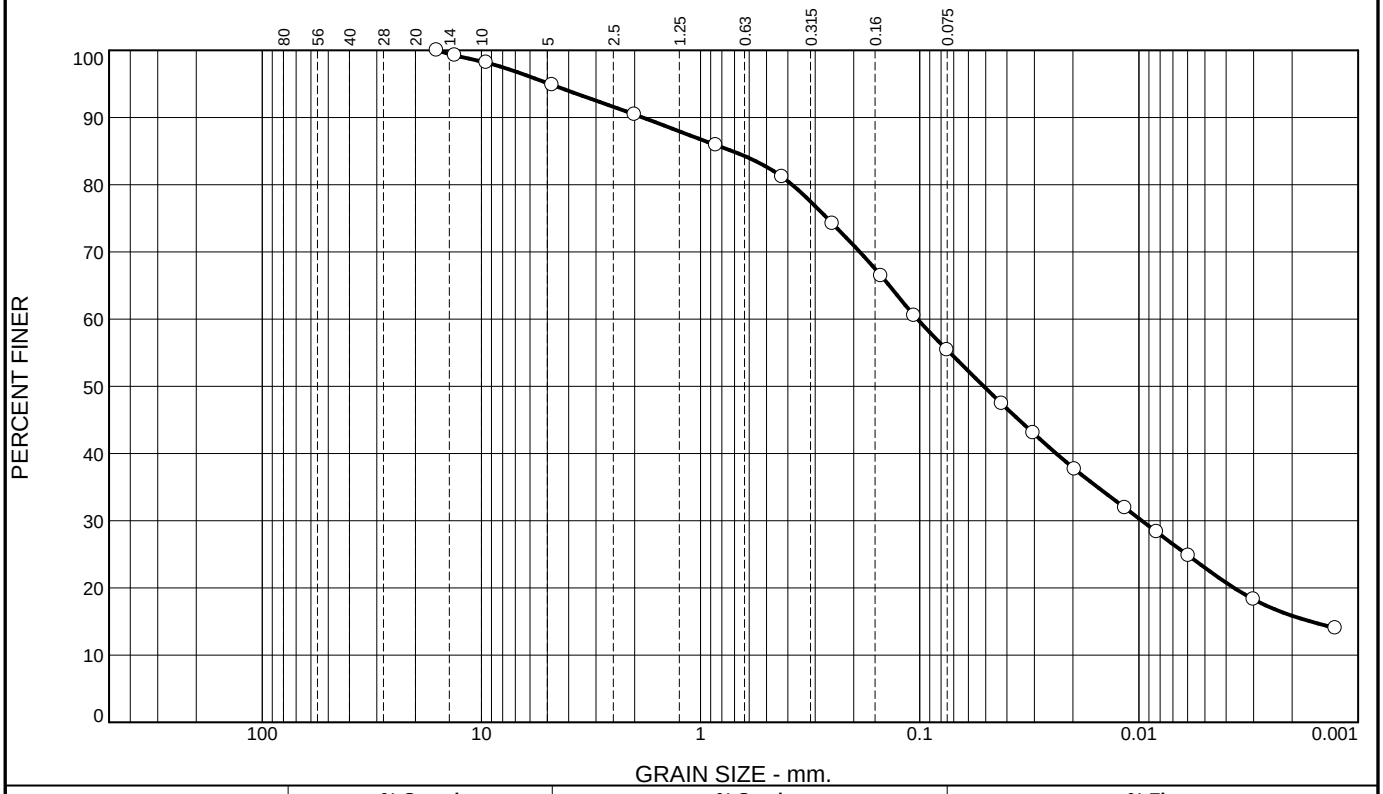
Date: July 24, 2020

Client: Parks Canada Agency (PCA)
Project: Rouge Park Gateway

Project No: 201-04948-00 **Figure** 20-8_SS14

Tested By: Bruce Shan & LXQ & S.L

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	5	5	9	26	39	16

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
16.00	100		
13.20	99		
9.50	98		
4.75	95		
2.00	90		
0.85	86		
0.425	81		
0.250	74		
0.150	66		
0.106	61		
0.075	55		
0.0422 mm.	47		
0.0304 mm.	43		
0.0196 mm.	38		
0.0116 mm.	32		
0.0083 mm.	28		
0.0059 mm.	25		
0.0030 mm.	18		
0.0013 mm.	14		

* (no specification provided)

Soil Description

Silty Clay Till

Atterberg Limits

PL= 12 LL= 16 PI= 4

Coefficients

D_{90}= 1.8376 D_{85}= 0.7178 D_{60}= 0.1026
D_{50}= 0.0511 D_{30}= 0.0097 D_{15}= 0.0016
D_{10}= C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(0)

Remarks

Source of Sample: Site Drilling
Sample Number: 20-9_SS7

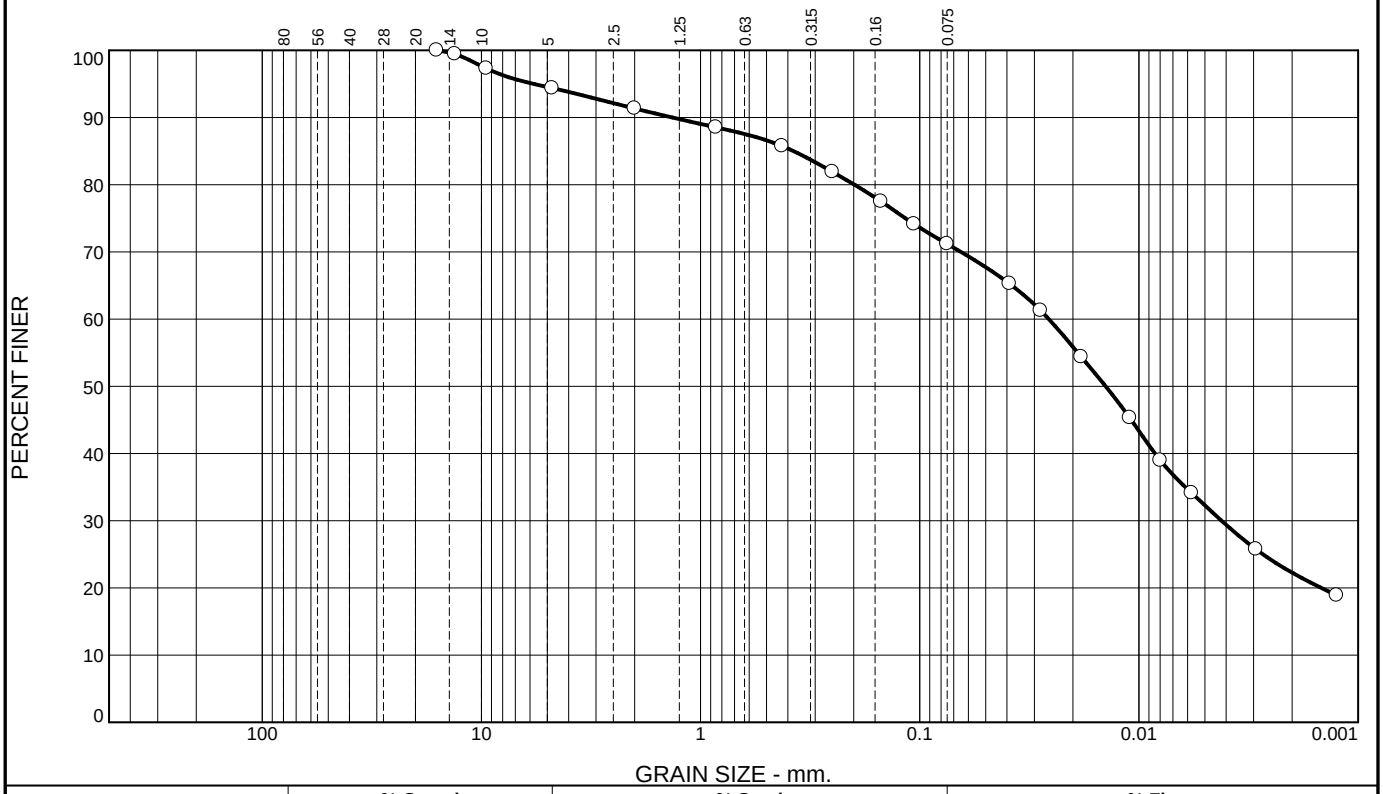
Date: July 24, 2020

Client: Parks Canada Agency (PCA)
Project: Rouge Park Gateway

Project No: 201-04948-00 **Figure** 20-9_SS7

Tested By: Bruce Shan & LXQ & S.L

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	6	3	5	15	49	22

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
16.00	100		
13.20	99		
9.50	97		
4.75	94		
2.00	91		
0.85	89		
0.425	86		
0.250	82		
0.150	77		
0.106	74		
0.075	71		
0.0390 mm.	65		
0.0281 mm.	61		
0.0183 mm.	54		
0.0110 mm.	45		
0.0080 mm.	39		
0.0057 mm.	34		
0.0029 mm.	26		
0.0013 mm.	19		

* (no specification provided)

Soil Description

Silty Clay Till

Atterberg Limits

PL= 12 LL= 18 PI= 6

Coefficients

D_{90}= 1.3464 D_{85}= 0.3769 D_{60}= 0.0258
D_{50}= 0.0142 D_{30}= 0.0042 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(1)

Remarks

Source of Sample: Site Drilling
Sample Number: 20-10_SS7

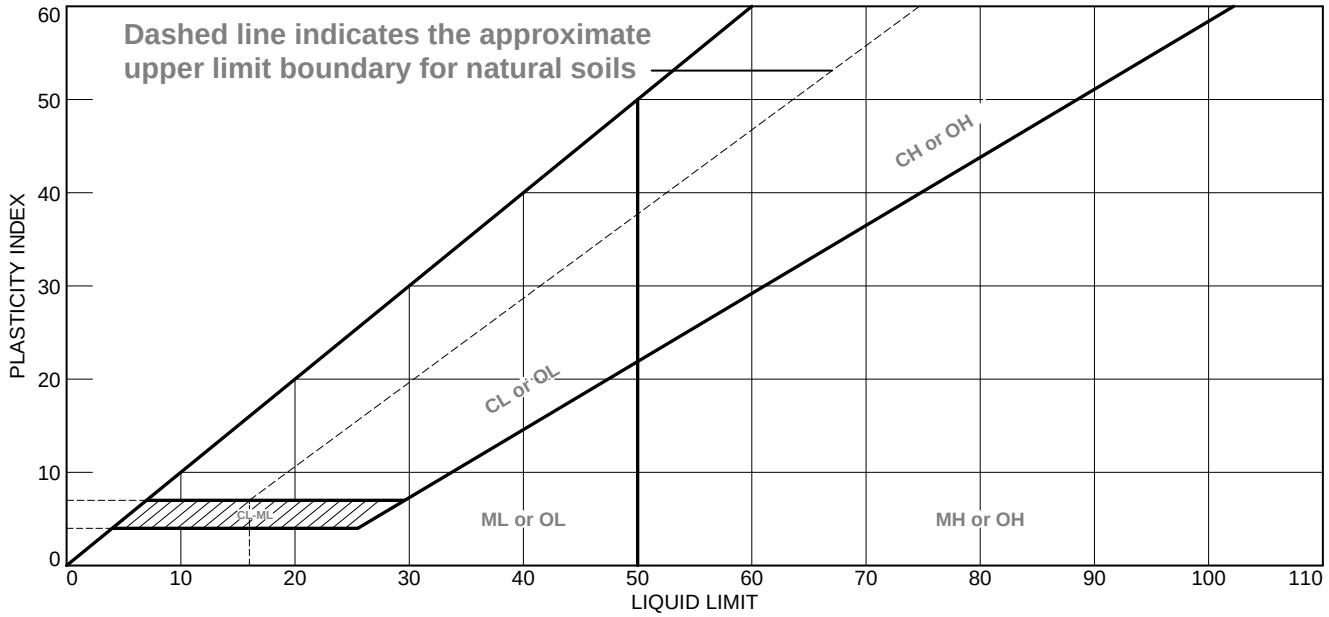
Date: July 24, 2020

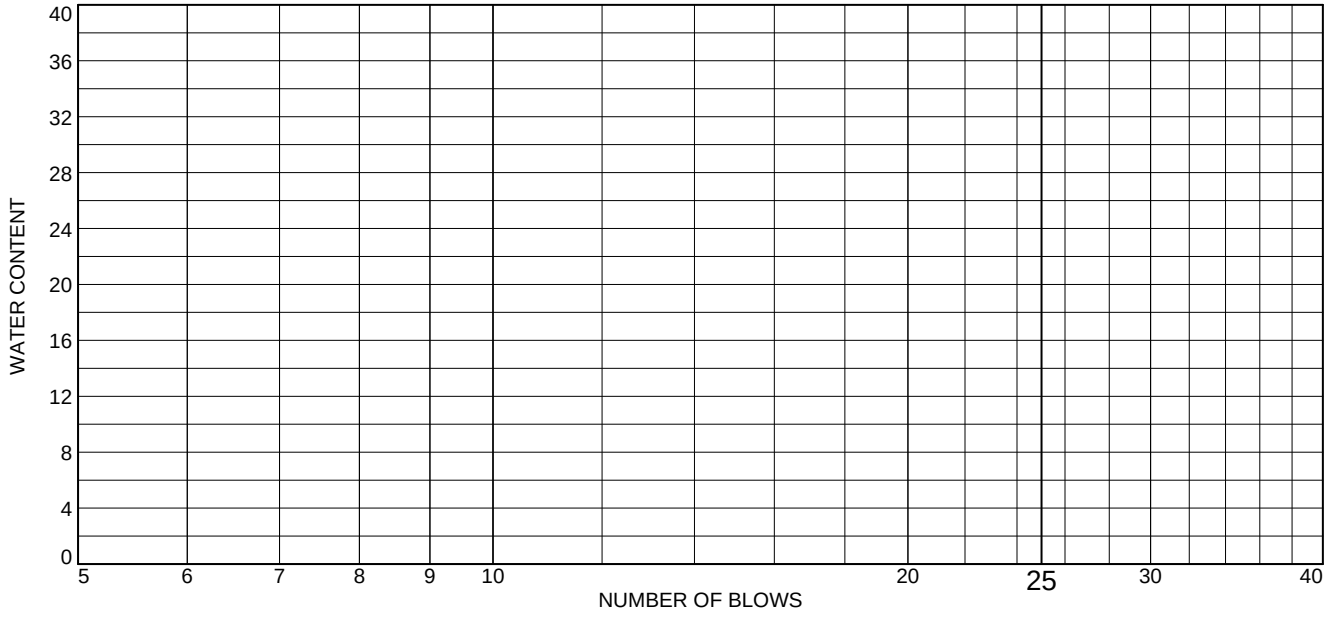
Client: Parks Canada Agency (PCA)
Project: Rouge Park Gateway

Project No: 201-04948-00 **Figure** 20-10_SS7

Tested By: Bruce Shan & LXQ & S.L

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Sand and silt, some clay, some gravel	NV	NP	NP	77.8	52.2	ML

Project No. 201-04948- **Client:** Parks Canada

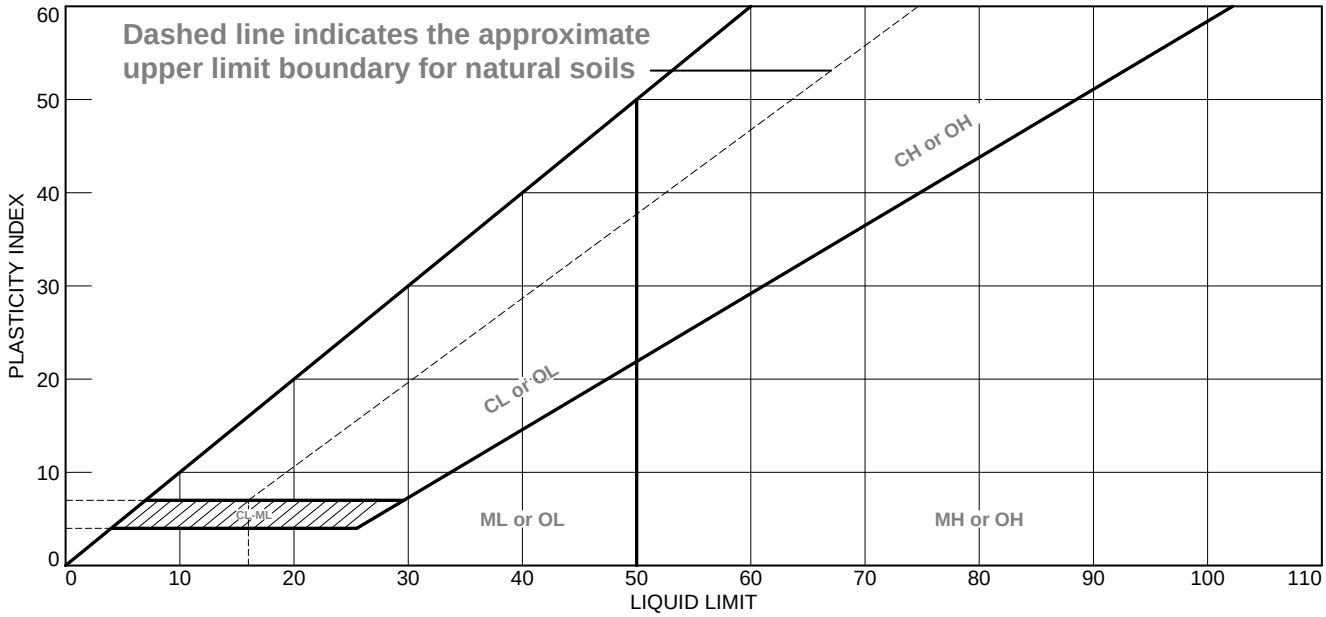
Project: PCA Rouge Gateway

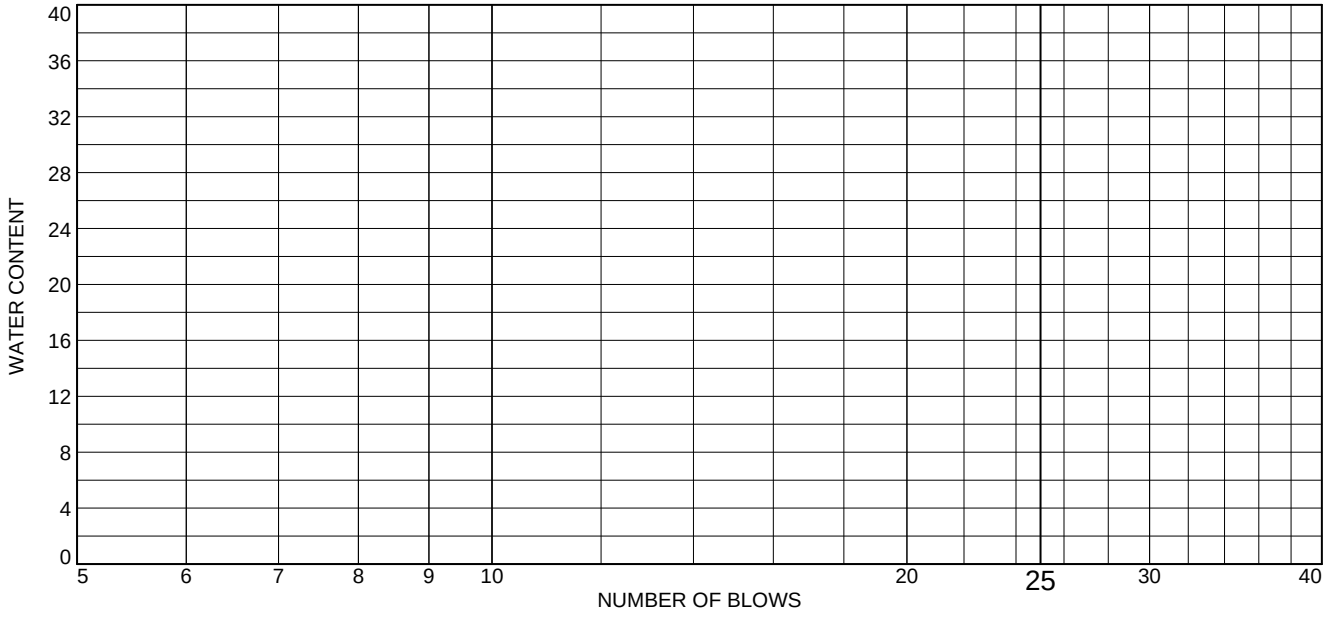
Location: BH20-1 SS6
Sample Number: 20MM-851

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Sand and silt, some clay, trace gravel	NV	NP	NP	81.9	54.5	ML

Project No. 201-04948- **Client:** Parks Canada

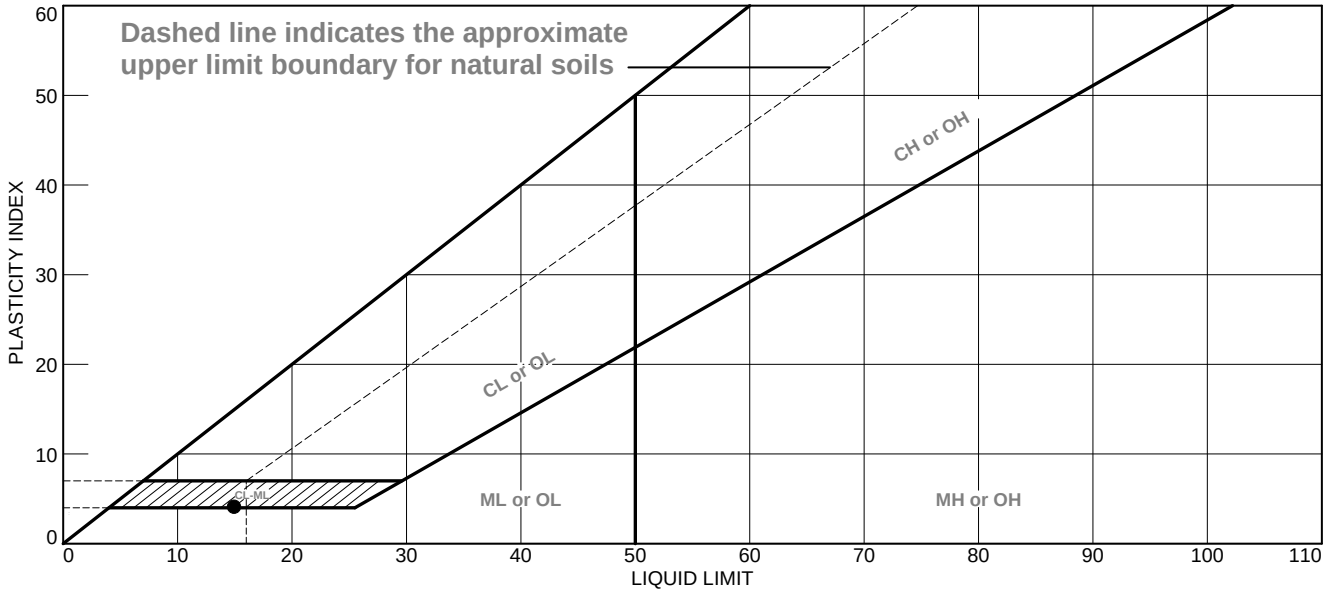
Project: PCA Rouge Gateway

Location: BH20-5 SS6
Sample Number: 20MM-850

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silty Sand Till	15	11	4	71	42	SC-SM

Project No. 201-04948-00 **Client:** Parks Canada Agency (PCA)

Project: Rouge Park Gateway

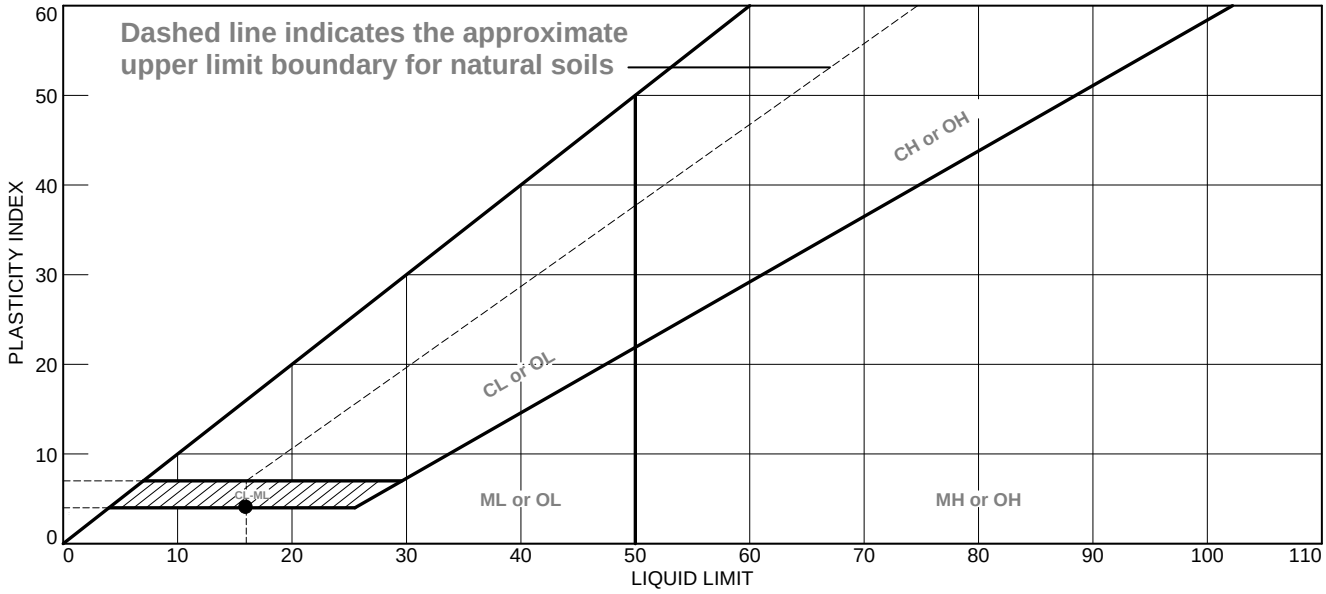
Source of Sample: Site Drilling
Sample Number: 20-7_SS5

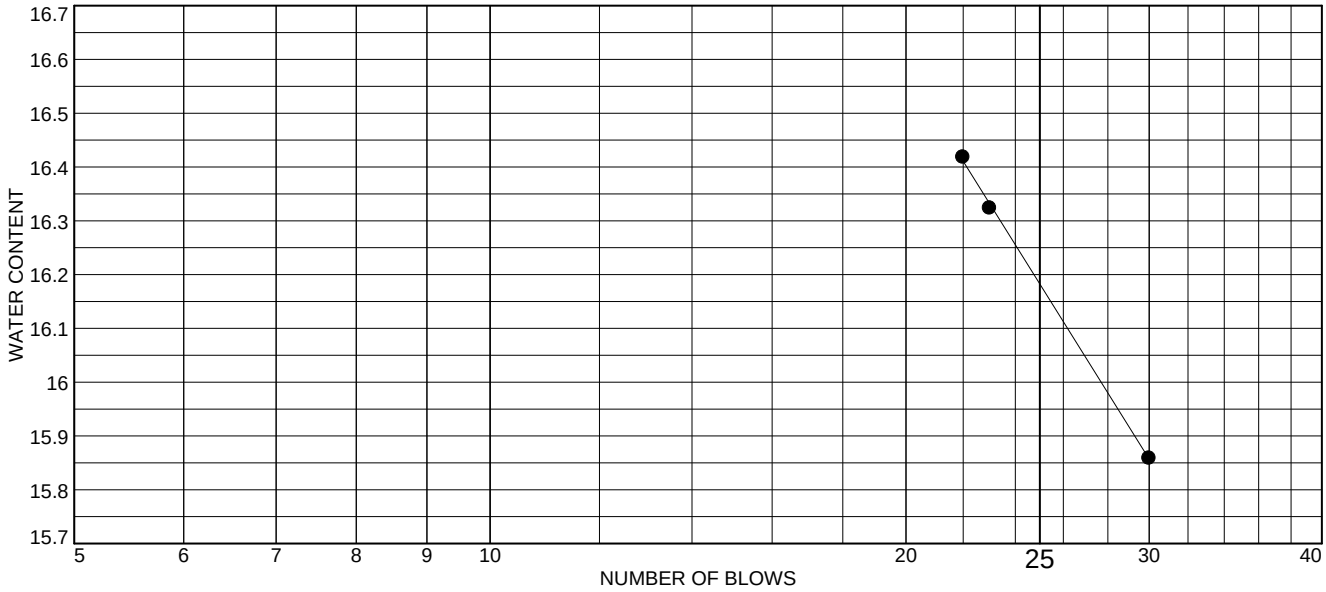
Remarks:

Figure 20-7_SS5

Tested By: LXQ

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silty Clay Till	16	12	4	81	55	CL-ML

Project No. 201-04948-00 **Client:** Parks Canada Agency (PCA)

Project: Rouge Park Gateway

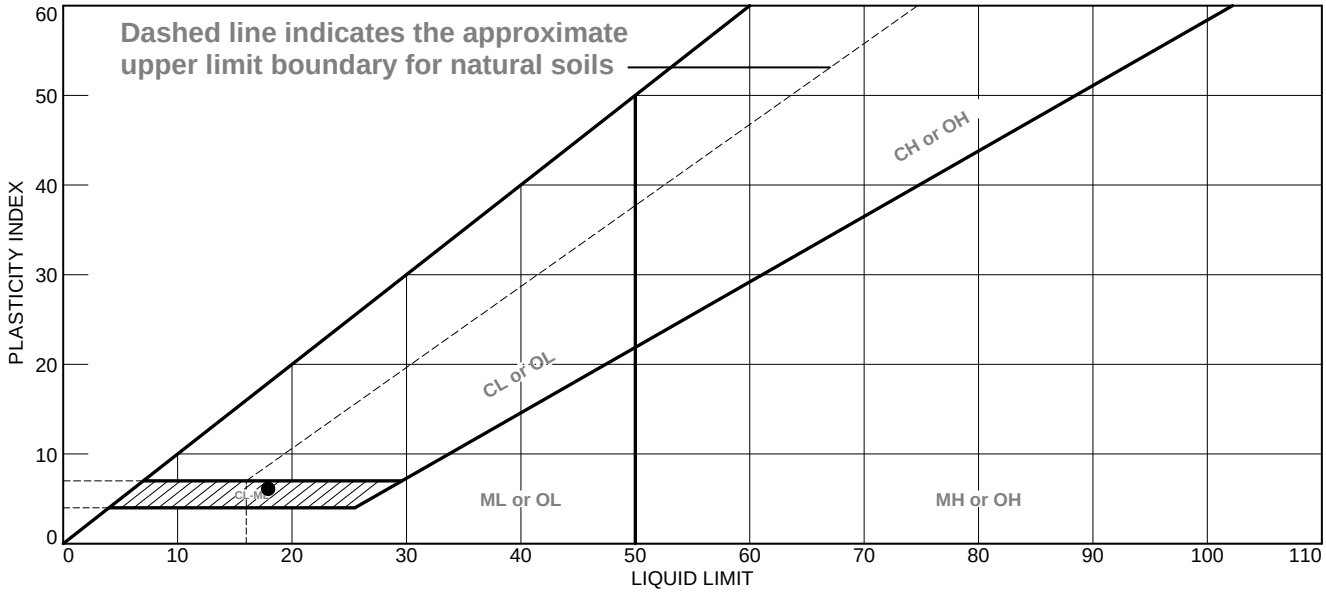
Source of Sample: Site Drilling
Sample Number: 20-9_SS7

Remarks:

Figure 20-9_SS7

Tested By: LXQ

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silty Clay Till	18	12	6	86	71	CL-ML

Project No. 201-04948-00 **Client:** Parks Canada Agency (PCA)

Project: Rouge Park Gateway

Source of Sample: Site Drilling
Sample Number: 20-10_SS7

Remarks:

Figure 20-10_SS7

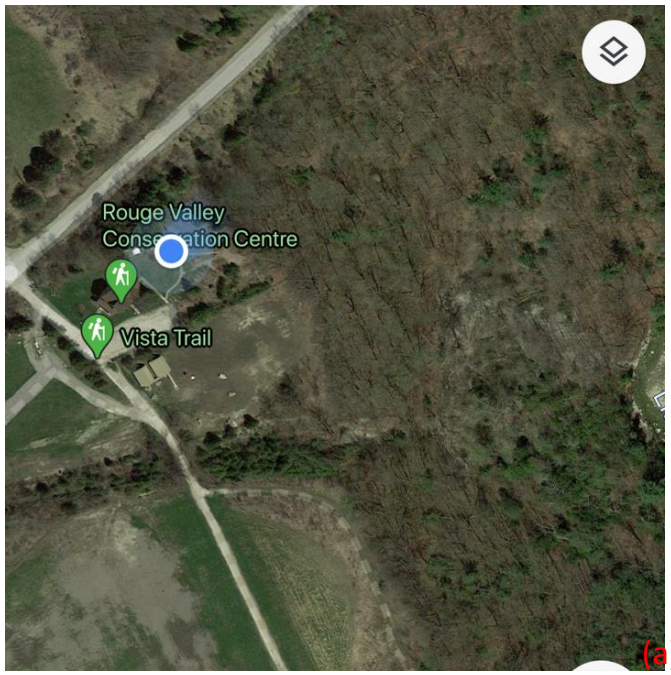
Tested By: LXQ

APPENDIX

C

SITE RECONNAISSANCE PHOTOGRAPHS

Pictures C-1-T: Cross section 1-1', Top of Slope



(a)


(b)

(d)


(c)

Pictures C-1-M: Cross section 1-1', Middle of Slope

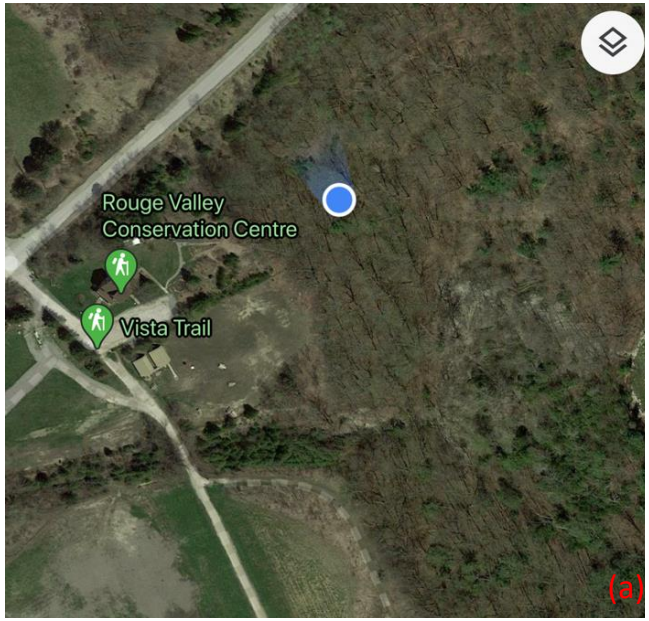
(a)

(b)

(d)

(c)

Pictures C-1-B: Cross section 1-1', Bottom of Slope



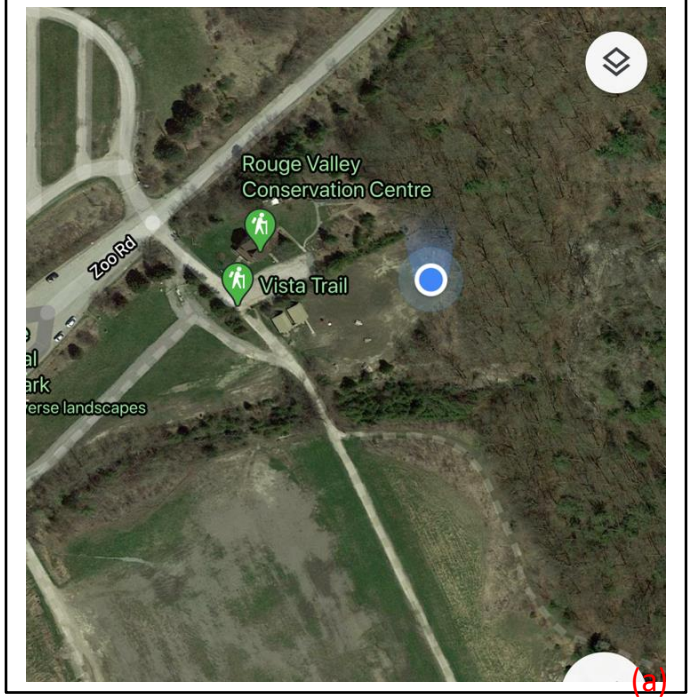
(a)

(b)

(C)

(d)

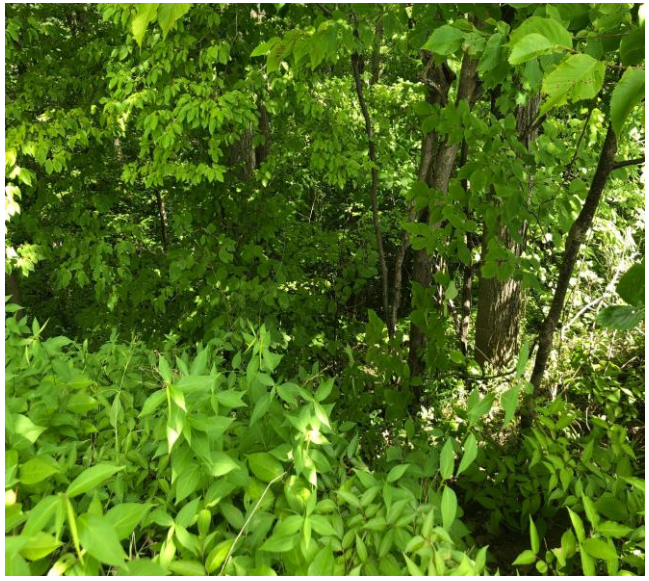
Pictures C-2-T: Cross section 2-2', Top of Slope



(a)

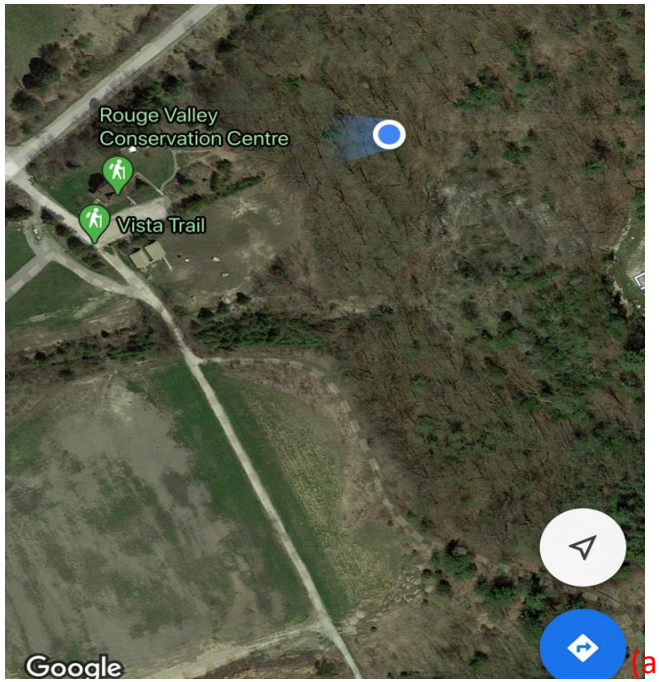
(b)

(C)



(d)

Pictures C-2-B: Cross section 2-2', Bottom of Slope



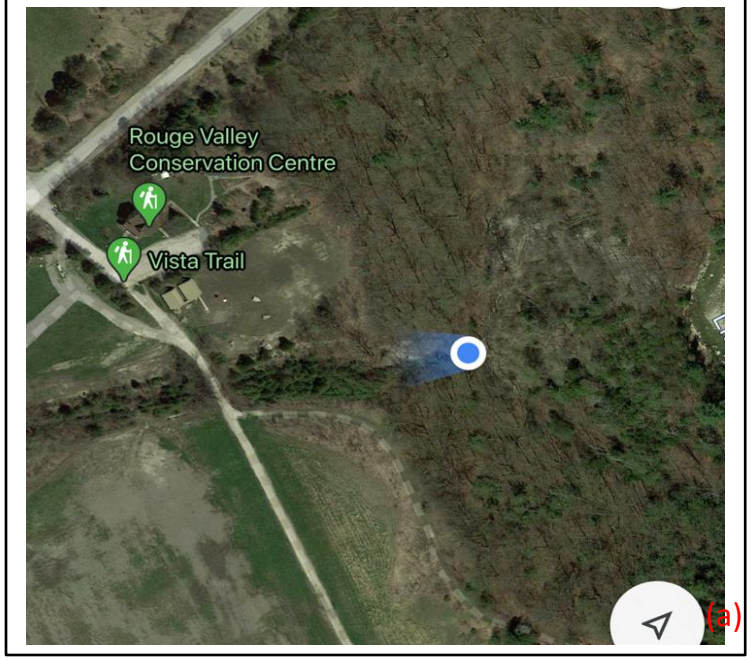
(a)

(b)

(c)

(d)

Pictures C-C: Existing Drainage Channel, Between Cross Sections 1 and 2



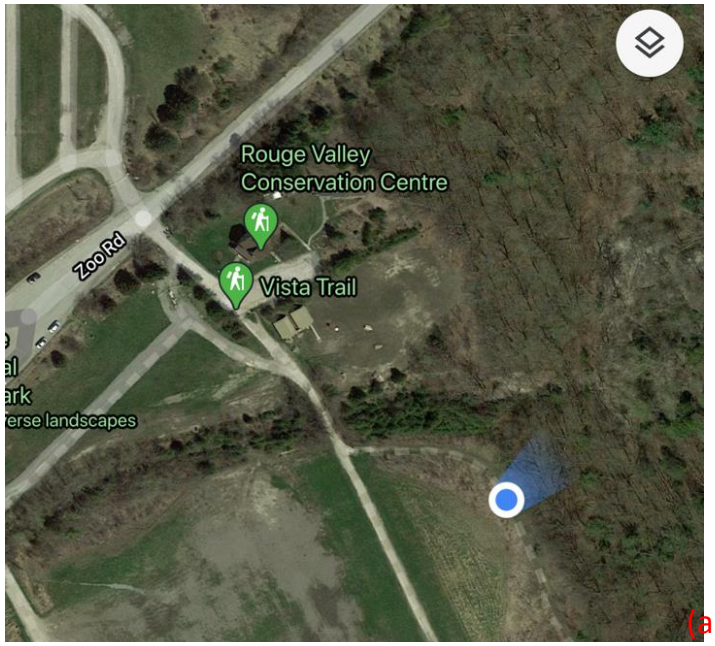
(a)

(b)

(c)

(d)

Pictures C-3-T: Cross section 3-3', Top of Slope



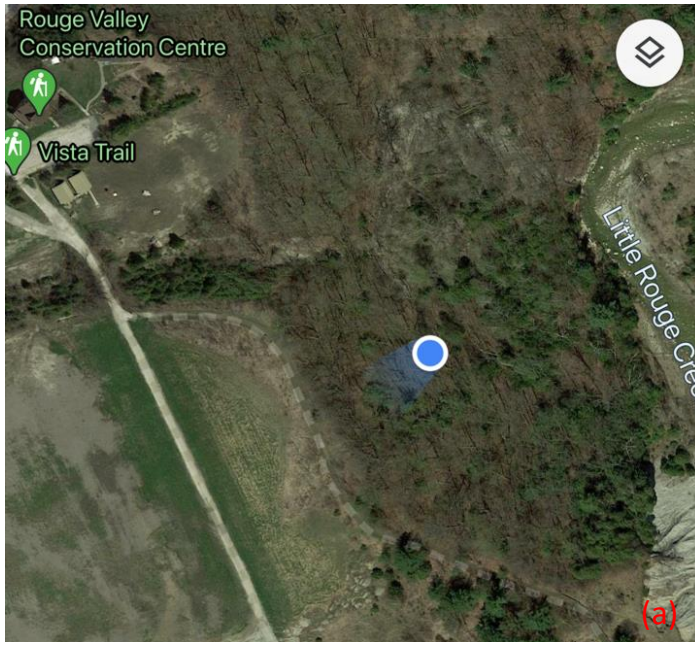
(a)


(b)


(d)


(c)

Pictures C-3-T: Cross section 3-3', Bottom of Slope



Pictures C-3-R: Cross section 3-3', Little Rouge Creek

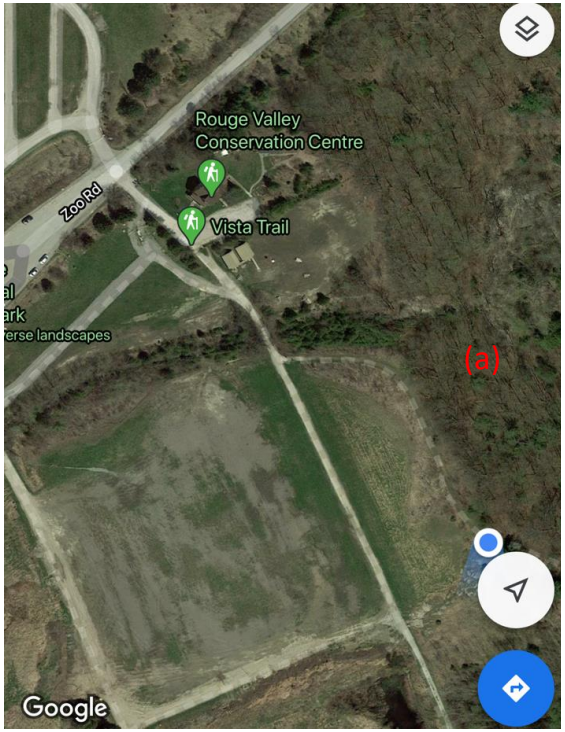
(a)

(b)

(c)

(d)

Pictures C-4-T: Cross section 4-4', Top of Slope



Pictures C-4-M: Cross section 4-4', Middle of Slope

(a)

(b)

(d)

(c)

Pictures C-4-B: Cross section 4-4', Bottom of Slope

(a)

(b)

(d)

(c)

Pictures C-4-R: Cross section 4-4', Little Rouge Creek

(a)

(b)

(c)

(d)

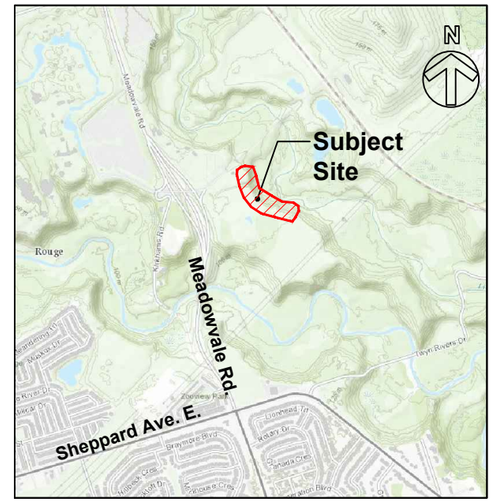
APPENDIX

D

– BOREHOLE LOCATION, CROSS SECTION AND LTSTOS PLAN

– CROSS SECTION PROFILES

– SLOPE STABILITY ANALYSIS RESULTS



Key Plan

N.T.S.

Legend:

- Monitoring Well Location (WSP 2020)
- LTSTOS (Long-Term-Stable Top-of-Slope)

25 12.5 0 25 metres

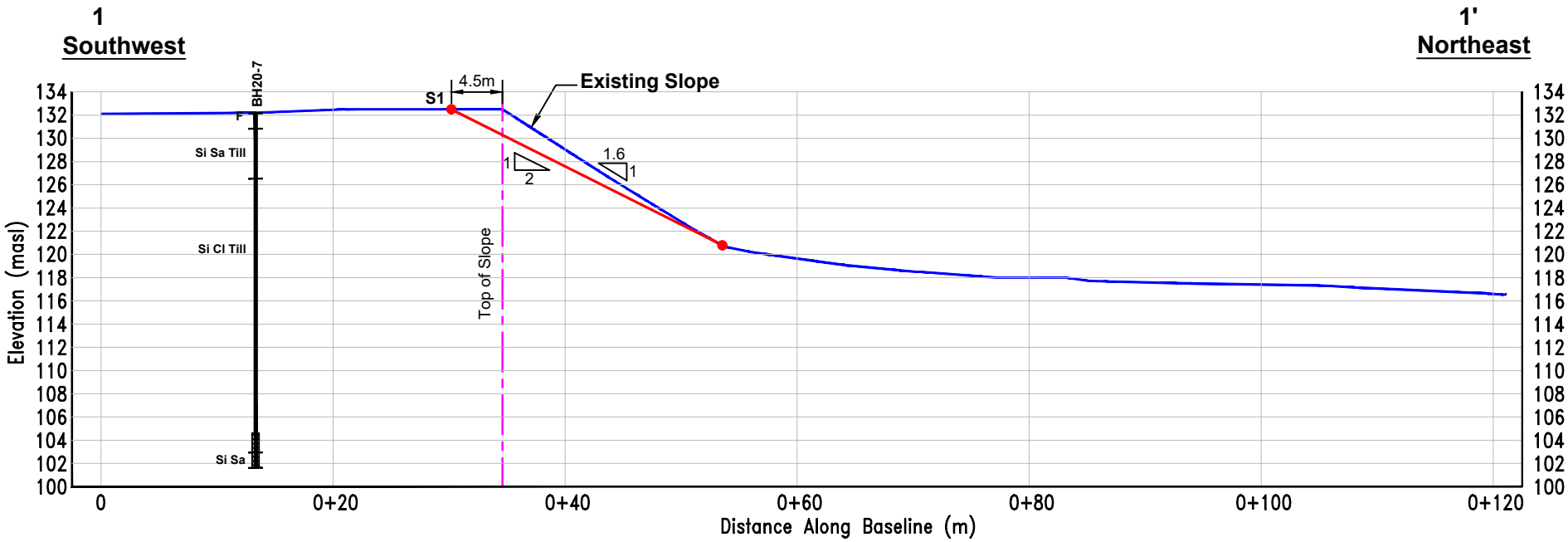
BOREHOLE LOCATION, CROSS SECTION AND LTSTOS PLAN

PRELIMINARY GEOTECHNICAL INVESTIGATION AND SLOPE STABILITY ANALYSIS
Rouge Park Gateway,
Toronto, Ontario

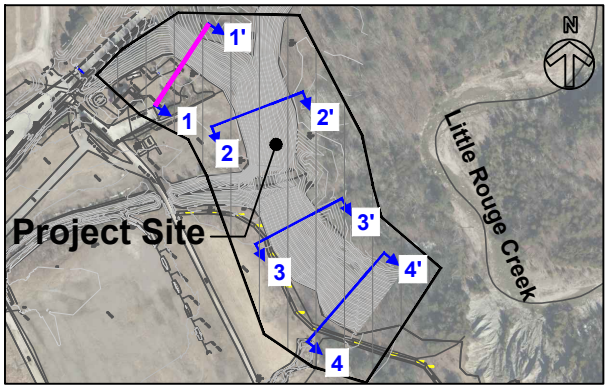
DATE: AUGUST 2020	SCALE: AS SHOWN
PROJECT: 201-04948-00	FILE NO.:

wsp

FIGURE **D-1**



Cross Section 1-1'



Key Plan

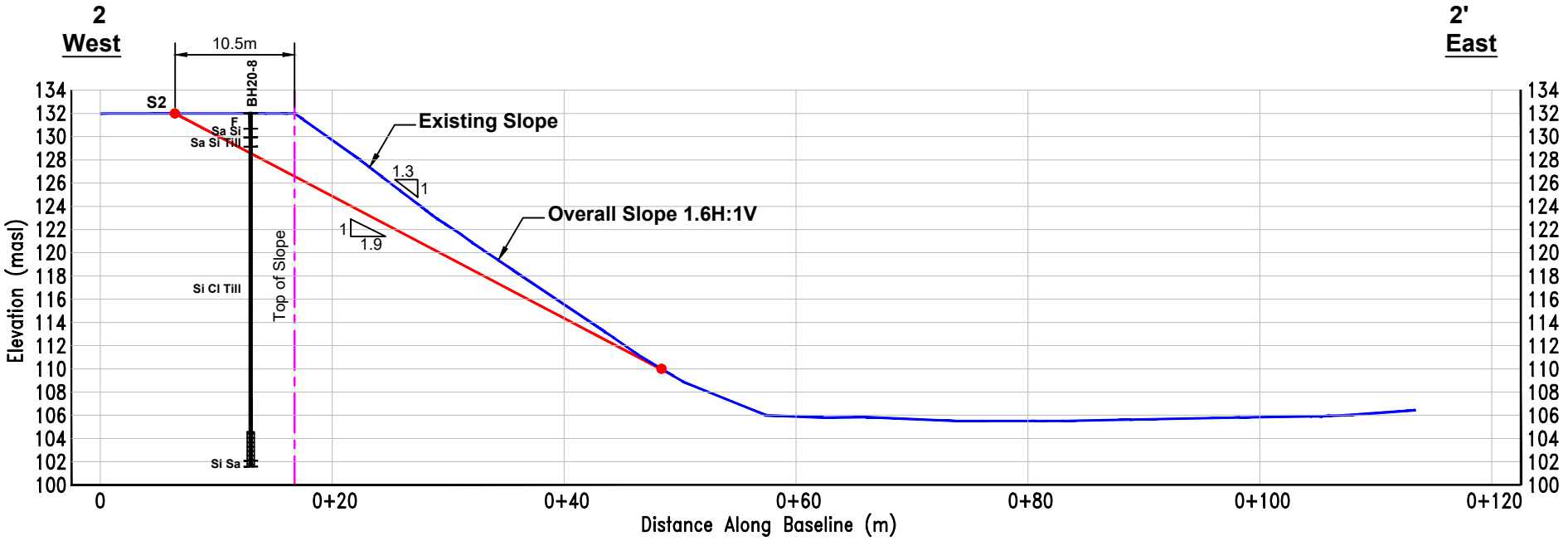
N.T.S.

CROSS SECTION 1-1'

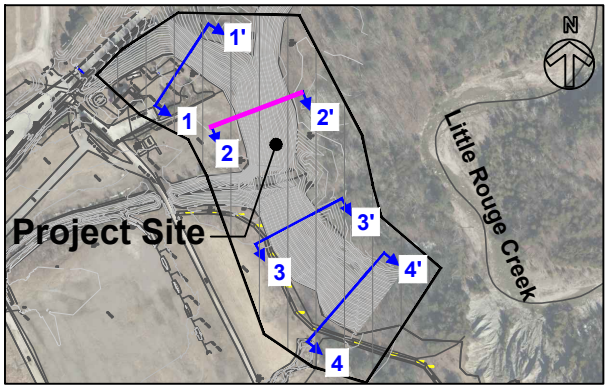
PRELIMINARY GEOTECHNICAL INVESTIGATION AND SLOPE STABILITY ANALYSIS
Rouge Park Gateway,
Toronto, Ontario

DATE: AUGUST 2020	NOT TO SCALE
PROJECT: 201-04948-00	FILE NO.:

FIGURE
D-2



Cross Section 2-2'



Key Plan

N.T.S.

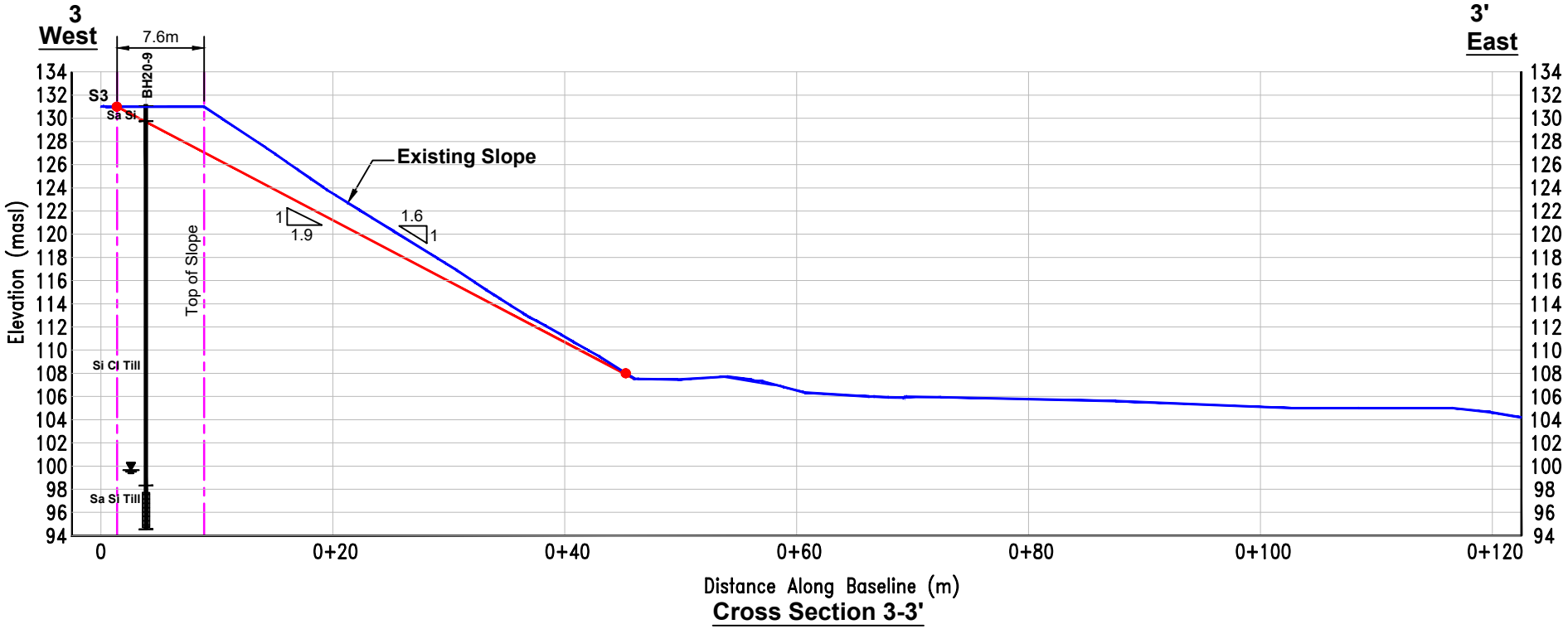
CROSS SECTION 2-2'

PRELIMINARY GEOTECHNICAL
INVESTIGATION AND SLOPE
STABILITY ANALYSIS
Rouge Park Gateway,
Toronto, Ontario

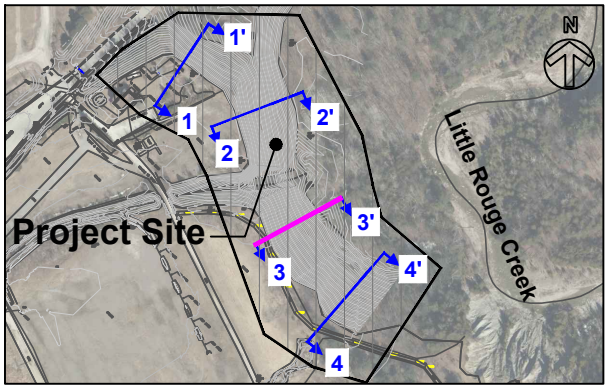
DATE: AUGUST 2020	NOT TO SCALE
PROJECT: 201-04948-00	FILE NO.:

wsp

FIGURE
D-3



Cross Section 3-3'



Key Plan

N.T.S.

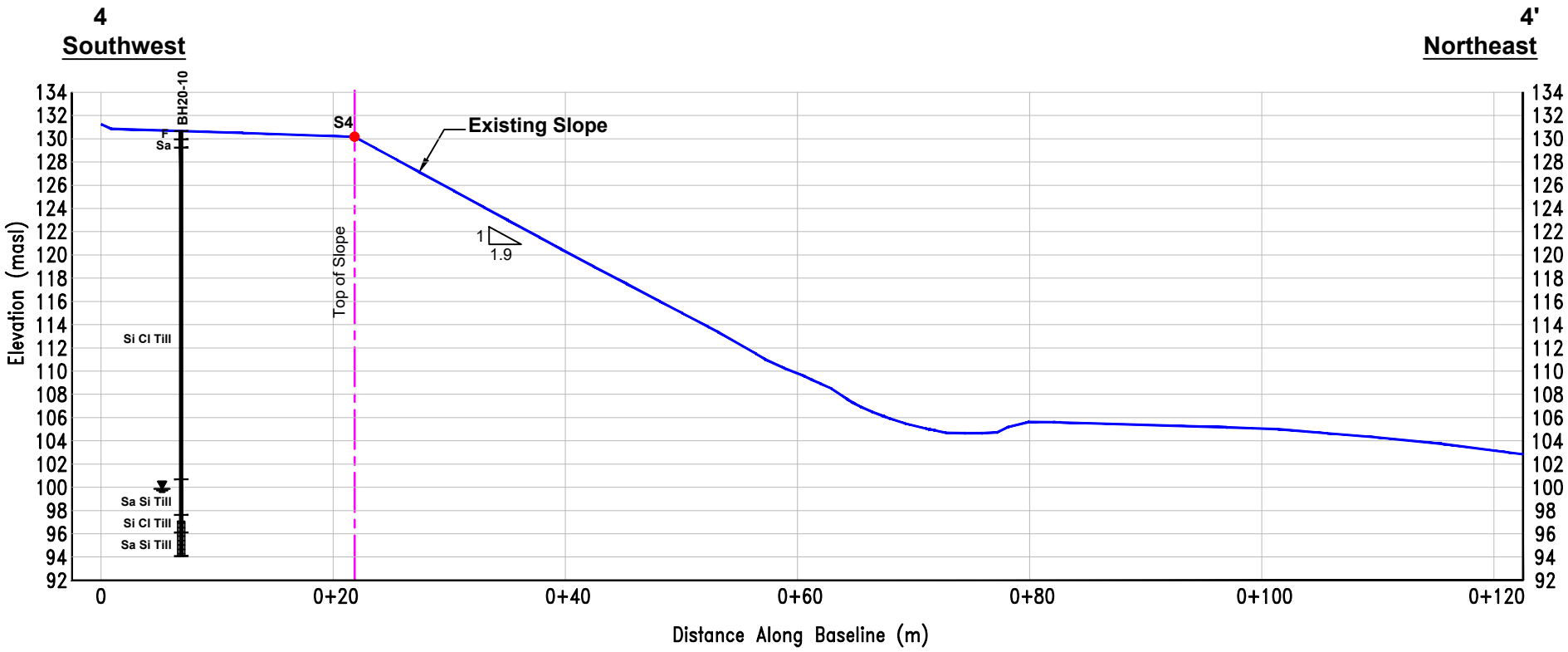
CROSS SECTION 3-3'

PRELIMINARY GEOTECHNICAL INVESTIGATION AND SLOPE STABILITY ANALYSIS
Rouge Park Gateway,
Toronto, Ontario

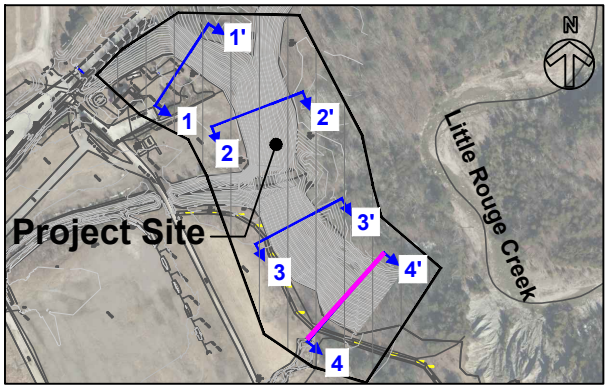
DATE: AUGUST 2020	NOT TO SCALE
PROJECT: 201-04948-00	FILE NO.:

wsp

FIGURE
D-4



Cross Section 4-4'



Key Plan

N.T.S.

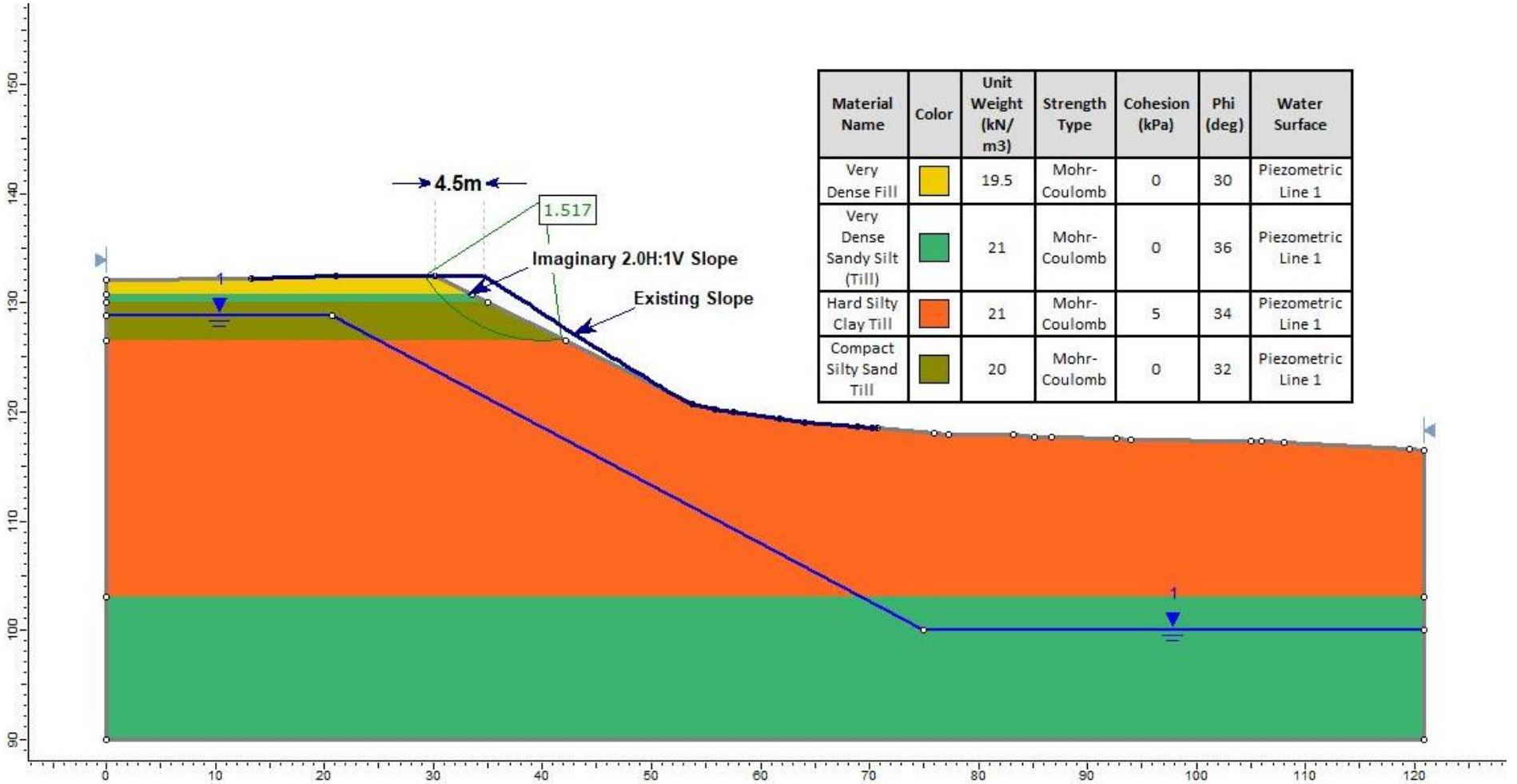
CROSS SECTION 4-4'

PRELIMINARY GEOTECHNICAL
INVESTIGATION AND SLOPE
STABILITY ANALYSIS
Rouge Park Gateway,
Toronto, Ontario

DATE: AUGUST 2020	NOT TO SCALE
PROJECT: 201-04948-00	FILE NO.:

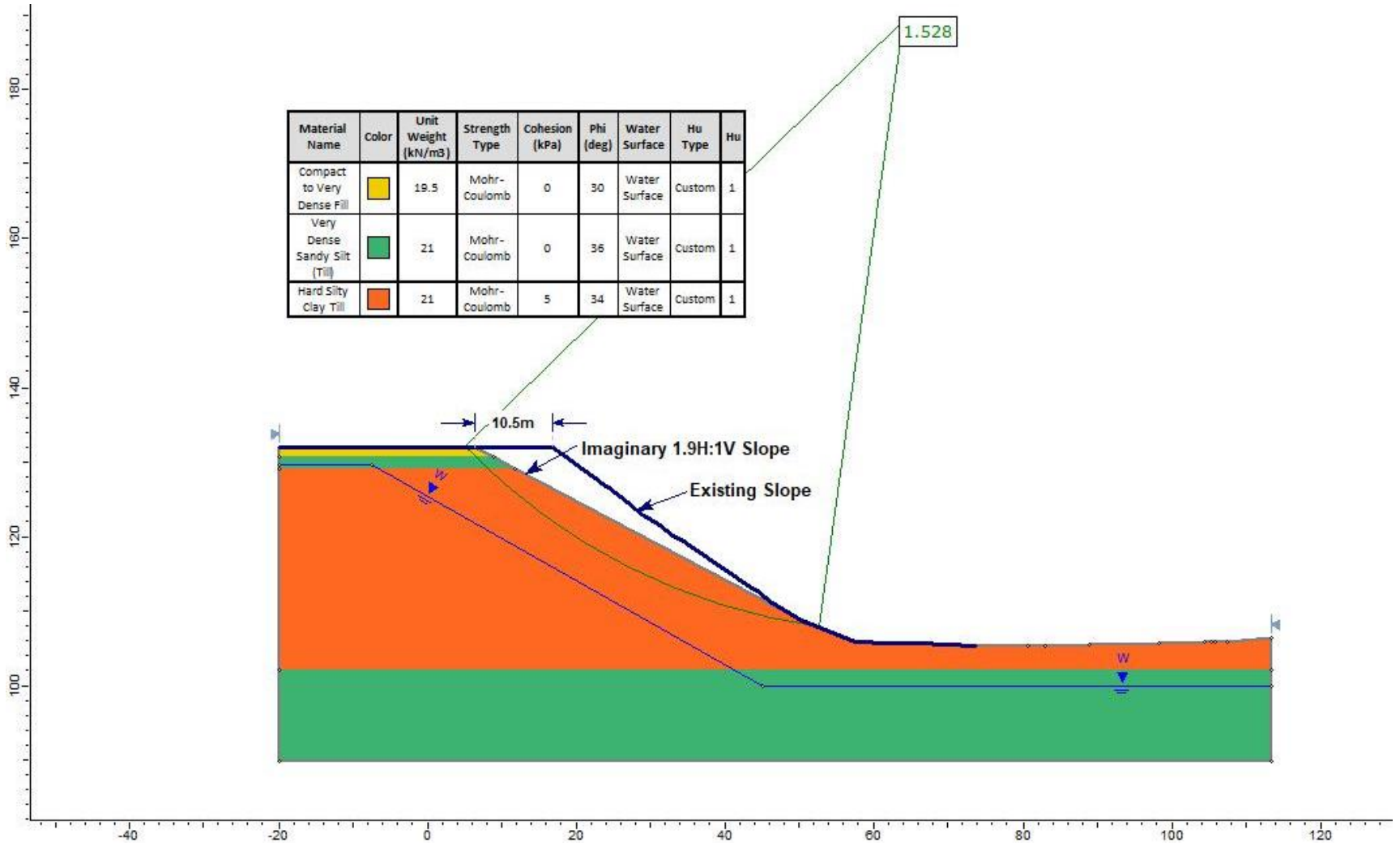
WSP

FIGURE
D-5

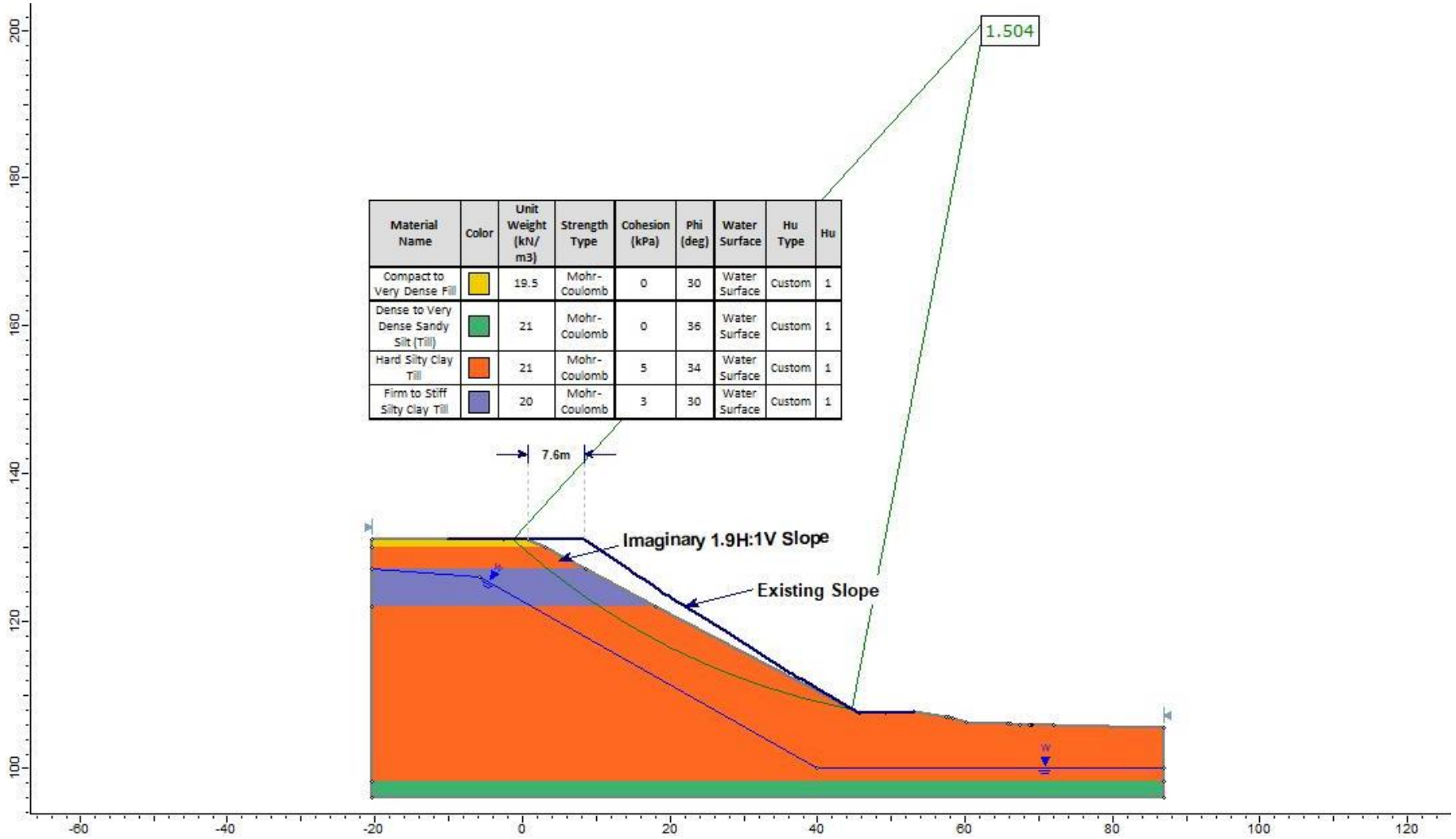


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface
Very Dense Fill		19.5	Mohr-Coulomb	0	30	Piezometric Line 1
Very Dense Sandy Silt (Till)		21	Mohr-Coulomb	0	36	Piezometric Line 1
Hard Silty Clay Till		21	Mohr-Coulomb	5	34	Piezometric Line 1
Compact Silty Sand Till		20	Mohr-Coulomb	0	32	Piezometric Line 1

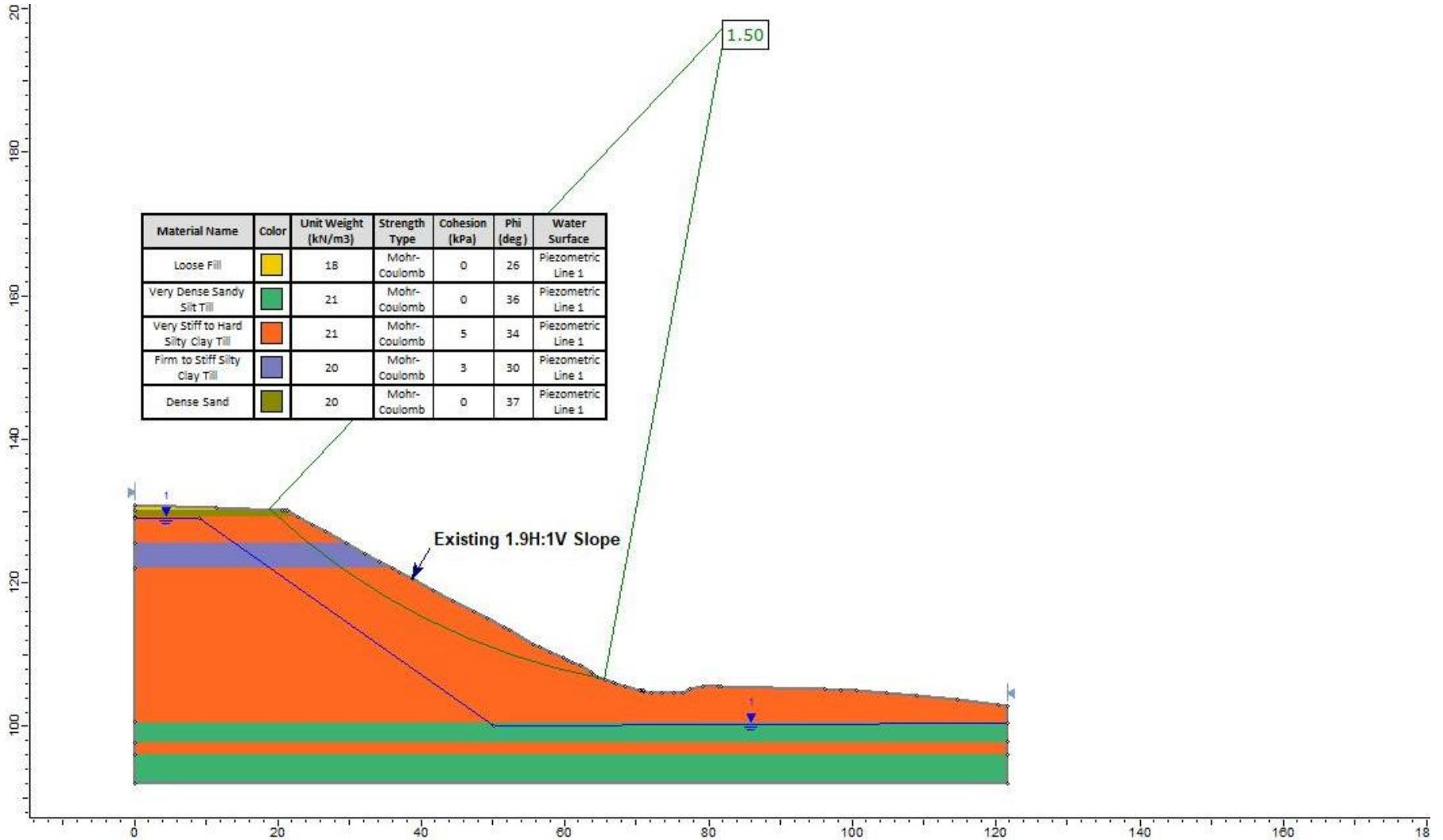
Slope Stability Analysis of Imaginary 2:0H:1V Slope (FOS=1.517), Cross Section 1-1'



Slope Stability Analysis of Imaginary 1.9H:1V Slope (FOS=1.528), Cross Section 2-2'



Slope Stability Analysis of Imaginary 1.9H:1V Slope (FOS=1.504), Cross Section 3-3'



Slope Stability Analysis of Existing 1.9H:1V Slope, Cross Section 4-4'

APPENDIX

E

ENGINEERED FILL GUIDELINE

1. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a WSP engineer prior to placement of fill.

2. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

3. Full-time geotechnical inspection by WSP Consultants Limited during placement of engineered fill is required. Work cannot commence or continue without the presence of the WSP representative.

4. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

5. A bearing capacity of 100 kPa at SLS 150 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

6. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

7. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from WSP prior to footing concrete placements. All excavations must be backfilled under full time supervision by WSP Consultants Limited to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of WSP Consultants Limited.

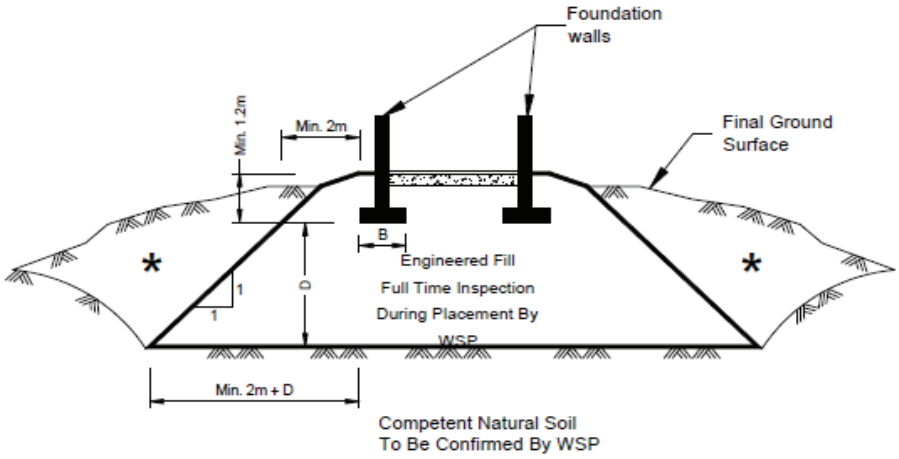
8. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

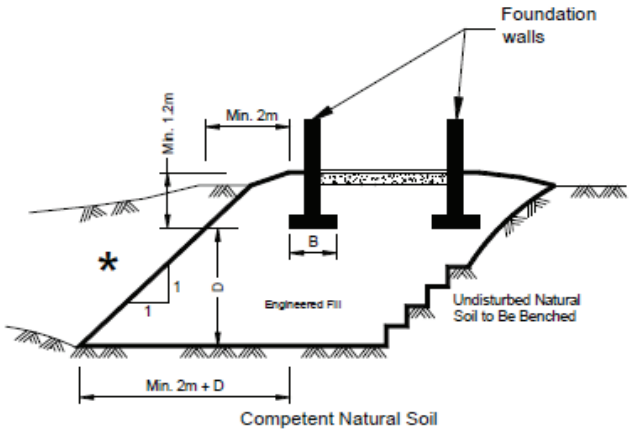
9. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

10. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks

are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

11. These guidelines are to be read in conjunction with WSP report attached.





* Backfill in this area to be as per the WSP report.

APPENDIX

F

SLOPE STABILITY RATING TABLES

TABLE 1
SLOPE STABILITY RATING CHART CROSS SECTION 1-1'
ROUGE GATEWAY VISITOR LEARNING CENTRE AT ZOO ROAD, PARKING LOT NO. 4, TORONTO, ONTARIO

Site Location:	Zoo Road, Toronto, Ontario	File No.	201-04948-00
Property Owner:	Parks Canada	Inspection Date:	July 29, 2020
Inspected By:	D. Wang	Weather:	Sunny, 29 °C

Inspection Task		Rating Options	Assigned Rating
1. SLOPE INCLINATION			
Degrees	**Horizontal: Vertical**		
a) 18 or less	3:1 or flatter	0	**16**
b) 18 to 26	2:1 to more than 3:1	6	
c) more than 26	Steeper than 2:1	16	
2. SOIL STRATIGRAPHY			
a) Shale, Limestone, Granite (Bedrock)		0	
b) Sand, Gravel		6	
c) Glacial Till		9	**9**
d) Clay, Silt		12	
e) Fill		16	
f) Leda Clay		24	
3. SEEPAGE FROM SLOPE FACE			
a) None or near bottom only		0	**0**
b) Near mid-slope only		6	
c) Near crest only or from several levels		12	
4. SLOPE HEIGHT			
a) 2 m or less		0	
b) 2.1 to 5 m		2	**8**
c) 5.1 to 10 m		4	
d) more than 10 m		8	
5. VEGETATION COVER ON SLOPE FACE			
a) Well vegetated, heavy shrubs or forested with mature trees		0	**0**
b) Light Vegetation; Mostly grass, weeds, occasional trees, shrubs		4	
c) No vegetation, bare		8	
6. TABLE LAND DRAINAGE			
a) Table land flat, no apparent drainage over slope		0	**0**
b) Minor drainage over slope, no active erosion		2	
c) Drainage over slope, active erosion, gullies		4	
7. PROXIMITY OF WATERCOURSE TO SLOPE TOE			
a) 15 m or more from slope toe		0	**0**
b) Less than 15 m from slope toe		6	
8. PREVIOUS LANDSLIDE ACTIVITY			
a) No		0	**0**
b) Yes		6	
		RATING VALUES TOTAL	**33**

SLOPE INSTABILITY RATING		INVESTIGATION REQUIREMENTS
1. Low Potential	<24	Site inspection only, confirmation, report letter
2. Slight Potential	25 - 35	Site inspection and surveying, preliminary study, detailed report
3. Moderate Potential	>35	Boreholes, piezometers, lab tests, surveying detailed report

Notes:
a) Choose only one rating value from each category; compare total rating value with above requirements
b) If there is a waterbody (stream, creek, river, pond, bay, lake) at the slope toe, the potential for toe erosion and undercutting should be evaluated in detail and protection provided if required.
c) For leda clay and rock slopes, additional evaluation must be carried out

Source: Table 4.2 Slope Stability Rating Chart (Technical Guide - River and Stream Systems - Erosion Hazard Limit - 2002, Ontario Ministry of Natural Resources)

TABLE 2
SLOPE STABILITY RATING CHART CROSS SECTION 2-2'
ROUGE GATEWAY VISITOR LEARNING CENTRE AT ZOO ROAD, PARKING LOT NO. 4, TORONTO, ONTARIO

Site Location:	Zoo Road, Toronto, Ontario	File No.	201-04948-00
Property Owner:	Parks Canada	Inspection Date:	July 29, 2020
Inspected By:	D. Wang	Weather:	Sunny, 29 °C

Inspection Task		Rating Options	Assigned Rating
1. SLOPE INCLINATION			
Degrees	**Horizontal: Vertical**		
a) 18 or less	3:1 or flatter	0	**16**
b) 18 to 26	2:1 to more than 3:1	6	
c) more than 26	Steeper than 2:1	16	
2. SOIL STRATIGRAPHY			
a) Shale, Limestone, Granite (Bedrock)		0	
b) Sand, Gravel		6	
c) Glacial Till		9	**9**
d) Clay, Silt		12	
e) Fill		16	
f) Leda Clay		24	
3. SEEPAGE FROM SLOPE FACE			
a) None or near bottom only		0	**0**
b) Near mid-slope only		6	
c) Near crest only or from several levels		12	
4. SLOPE HEIGHT			
a) 2 m or less		0	
b) 2.1 to 5 m		2	**8**
c) 5.1 to 10 m		4	
d) more than 10 m		8	
5. VEGETATION COVER ON SLOPE FACE			
a) Well vegetated, heavy shrubs or forested with mature trees		0	**0**
b) Light Vegetation; Mostly grass, weeds, occasional trees, shrubs		4	
c) No vegetation, bare		8	
6. TABLE LAND DRAINAGE			
a) Table land flat, no apparent drainage over slope		0	**0**
b) Minor drainage over slope, no active erosion		2	
c) Drainage over slope, active erosion, gullies		4	
7. PROXIMITY OF WATERCOURSE TO SLOPE TOE			
a) 15 m or more from slope toe		0	**0**
b) Less than 15 m from slope toe		6	
8. PREVIOUS LANDSLIDE ACTIVITY			
a) No		0	**0**
b) Yes		6	
		RATING VALUES TOTAL	**33**

SLOPE INSTABILITY RATING		INVESTIGATION REQUIREMENTS
1. Low Potential	<24	Site inspection only, confirmation, report letter
2. Slight Potential	25 - 35	Site inspection and surveying, preliminary study, detailed report
3. Moderate Potential	>35	Boreholes, piezometers, lab tests, surveying detailed report

Notes:
a) Choose only one rating value from each category; compare total rating value with above requirements
b) If there is a waterbody (stream, creek, river, pond, bay, lake) at the slope toe, the potential for toe erosion and undercutting should be evaluated in detail and protection provided if required.
c) For leda clay and rock slopes, additional evaluation must be carried out

Source: Table 4.2 Slope Stability Rating Chart (Technical Guide - River and Stream Systems - Erosion Hazard Limit - 2002, Ontario Ministry of Natural Resources)

TABLE 3
SLOPE STABILITY RATING CHART CROSS SECTION 3-3'
ROUGE GATEWAY VISITOR LEARNING CENTRE AT ZOO ROAD, PARKING LOT NO. 4, TORONTO, ONTARIO

Site Location:	Zoo Road, Toronto, Ontario	File No.	201-04948-00
Property Owner:	Parks Canada	Inspection Date:	July 29, 2020
Inspected By:	D. Wang	Weather:	Sunny, 29 °C

Inspection Task		Rating Options	Assigned Rating
1. SLOPE INCLINATION			
Degrees	**Horizontal: Vertical**		
a) 18 or less	3:1 or flatter	0	**16**
b) 18 to 26	2:1 to more than 3:1	6	
c) more than 26	Steeper than 2:1	16	
2. SOIL STRATIGRAPHY			
a) Shale, Limestone, Granite (Bedrock)		0	
b) Sand, Gravel		6	
c) Glacial Till		9	**9**
d) Clay, Silt		12	
e) Fill		16	
f) Leda Clay		24	
3. SEEPAGE FROM SLOPE FACE			
a) None or near bottom only		0	**0**
b) Near mid-slope only		6	
c) Near crest only or from several levels		12	
4. SLOPE HEIGHT			
a) 2 m or less		0	
b) 2.1 to 5 m		2	**8**
c) 5.1 to 10 m		4	
d) more than 10 m		8	
5. VEGETATION COVER ON SLOPE FACE			
a) Well vegetated, heavy shrubs or forested with mature trees		0	**0**
b) Light Vegetation; Mostly grass, weeds, occasional trees, shrubs		4	
c) No vegetation, bare		8	
6. TABLE LAND DRAINAGE			
a) Table land flat, no apparent drainage over slope		0	**0**
b) Minor drainage over slope, no active erosion		2	
c) Drainage over slope, active erosion, gullies		4	
7. PROXIMITY OF WATERCOURSE TO SLOPE TOE			
a) 15 m or more from slope toe		0	**0**
b) Less than 15 m from slope toe		6	
8. PREVIOUS LANDSLIDE ACTIVITY			
a) No		0	**0**
b) Yes		6	
		RATING VALUES TOTAL	**33**

SLOPE INSTABILITY RATING		INVESTIGATION REQUIREMENTS
1. Low Potential	<24	Site inspection only, confirmation, report letter
2. Slight Potential	25 - 35	Site inspection and surveying, preliminary study, detailed report
3. Moderate Potential	>35	Boreholes, piezometers, lab tests, surveying detailed report

Notes:
a) Choose only one rating value from each category; compare total rating value with above requirements
b) If there is a waterbody (stream, creek, river, pond, bay, lake) at the slope toe, the potential for toe erosion and undercutting should be evaluated in detail and protection provided if required.
c) For leda clay and rock slopes, additional evaluation must be carried out

Source: Table 4.2 Slope Stability Rating Chart (Technical Guide - River and Stream Systems - Erosion Hazard Limit - 2002, Ontario Ministry of Natural Resources)

TABLE 4
SLOPE STABILITY RATING CHART CROSS SECTION 4-4'
ROUGE GATEWAY VISITOR LEARNING CENTRE AT ZOO ROAD, PARKING LOT NO. 4, TORONTO, ONTARIO

Site Location:	Zoo Road, Toronto, Ontario	File No.	201-04948-00
Property Owner:	Parks Canada	Inspection Date:	July 29, 2020
Inspected By:	D. Wang	Weather:	Sunny, 29 °C

Inspection Task		Rating Options	Assigned Rating
1. SLOPE INCLINATION			
Degrees	**Horizontal: Vertical**		
a) 18 or less	3:1 or flatter	0	**16**
b) 18 to 26	2:1 to more than 3:1	6	
c) more than 26	Steeper than 2:1	16	
2. SOIL STRATIGRAPHY			
a) Shale, Limestone, Granite (Bedrock)		0	
b) Sand, Gravel		6	
c) Glacial Till		9	**9**
d) Clay, Silt		12	
e) Fill		16	
f) Leda Clay		24	
3. SEEPAGE FROM SLOPE FACE			
a) None or near bottom only		0	**0**
b) Near mid-slope only		6	
c) Near crest only or from several levels		12	
4. SLOPE HEIGHT			
a) 2 m or less		0	
b) 2.1 to 5 m		2	**8**
c) 5.1 to 10 m		4	
d) more than 10 m		8	
5. VEGETATION COVER ON SLOPE FACE			
a) Well vegetated, heavy shrubs or forested with mature trees		0	**0**
b) Light Vegetation; Mostly grass, weeds, occasional trees, shrubs		4	
c) No vegetation, bare		8	
6. TABLE LAND DRAINAGE			
a) Table land flat, no apparent drainage over slope		0	**0**
b) Minor drainage over slope, no active erosion		2	
c) Drainage over slope, active erosion, gullies		4	
7. PROXIMITY OF WATERCOURSE TO SLOPE TOE			
a) 15 m or more from slope toe		0	**0**
b) Less than 15 m from slope toe		6	
8. PREVIOUS LANDSLIDE ACTIVITY			
a) No		0	**0**
b) Yes		6	
		RATING VALUES TOTAL	**33**

SLOPE INSTABILITY RATING		INVESTIGATION REQUIREMENTS
1. Low Potential	<24	Site inspection only, confirmation, report letter
2. Slight Potential	25 - 35	Site inspection and surveying, preliminary study, detailed report
3. Moderate Potential	>35	Boreholes, piezometers, lab tests, surveying detailed report

Notes:
a) Choose only one rating value from each category; compare total rating value with above requirements
b) If there is a waterbody (stream, creek, river, pond, bay, lake) at the slope toe, the potential for toe erosion and undercutting should be evaluated in detail and protection provided if required.
c) For leda clay and rock slopes, additional evaluation must be carried out

Source: Table 4.2 Slope Stability Rating Chart (Technical Guide - River and Stream Systems - Erosion Hazard Limit - 2002, Ontario Ministry of Natural Resources)