



GEOTECHNICAL DATA REPORT, ROUGE PARK GATEWAY, TORONTO, ONTARIO

ROUGE NATIONAL URBAN PARK FIELD UNIT, PARKS
CANADA AGENCY

PROJECT NO.: 201-04948-00
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TABLE OF CONTENTS

1	INTRODUCTION	1
2	REVIEW OF REGIONAL GEOLOGY.....	2
3	FIELD AND LABORATORY WORK	3
3.1	GEOTECHNICAL BOREHOLES AND FIELD TESTING.....	3
3.2	GEOTECHNICAL LABORATORY TESTING	4
4	SUBSURFACE CONDITIONS	5
4.1	SOIL CONDITIONS.....	5
4.1.1	TOPSOIL.....	5
4.1.2	GRANULAR FILL	5
4.1.3	FILL	5
4.1.4	SANDY SILT.....	5
4.1.5	SAND AND SANDY GRAVEL	5
4.1.6	SILTY CLAY TILL.....	6
4.1.7	SILTY SAND TILL/ SANDY SILT TILL.....	6
4.1.8	SILTY SAND.....	7
4.2	GROUNDWATER CONDITIONS.....	7
5	GENERAL COMMENTS AND LIMITATIONS OF REPORT	8
6	CLOSURE.....	9

DRAWINGS

BOREHOLE LOCATION PLAN (DRAWING 1)
COSINE BENCHMARK

APPENDICES

A -EXPLANATION OF TERMS USED IN THE RECORD OF
BOREHOLE

-LOGS OF BOREHOLES

B -GRAIN SIZE DISTRIBUTION CURVES

-ATTERBERG LIMIT TEST RESULTS

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, and to be a destination visitor experience itself.

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 geotechnical data report has been requested for providing the factual data retrieved from the site drilling program and does not contain recommendations. WSP will consult with any parties engaged with PCA to provide recommendations and guidance pertaining to the geotechnical aspects of the site.

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 prepared.

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 of 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 to 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 the 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**. The boreholes BH20-1 to BH20-6 and BH20-11 were drilled across the site for preliminary subsurface investigation for future developments. The remaining boreholes were drilled along the top of 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. 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 with approximate thicknesses 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 1.45 m 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 top soil 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 top soil material, deposits of sand and sandy gravel were encountered extending to depths ranging from 1.45 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 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 (WL):	16 to 18
Plastic Limit (WP):	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 20-6	18/06/2020	130.9	NM	4.6	6.1	NM
BH 20-7	29/06/2020	132.2	NM	27.4	30.5	NM
BH 20-8	25/06/2020	132.1	NM	27.4	30.5	NM
BH 20-8A	25/06/2020	132.1	NM	1.5	3.0	NM
BH 20-9	03/07/2020	131.2	NM	33.5	36.6	NM
BH 20-9A	03/07/2020	131.3	July 13, 2020	4.6	6.1	126.5
BH 20-10	09/07/2020	130.7	July 13, 2020	33.5	36.6	103.0
BH 20-10A	09/07/2020	130.7	July 13, 2020	4.6	6.1	126.8
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 GENERAL COMMENTS AND LIMITATIONS OF REPORT

This report is intended solely for the Client named. The material in it reflects our best judgment in light of 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 data 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 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 factual 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.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

6 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

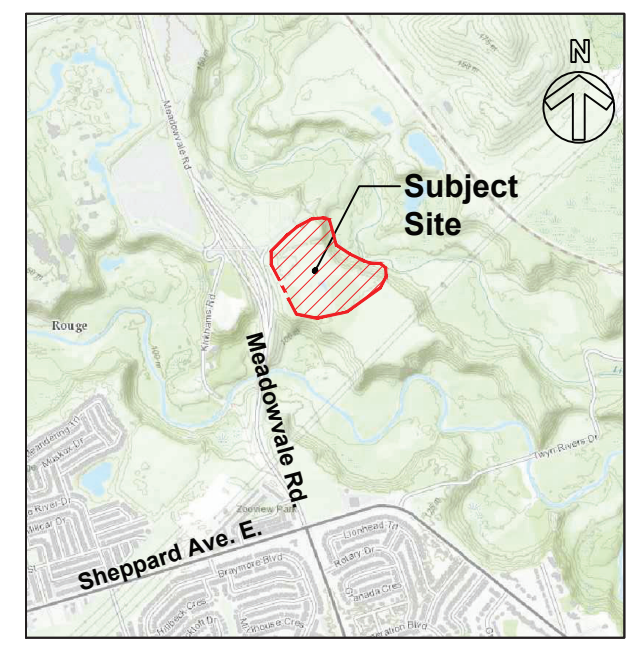


Derek Wang, P.Eng.
Senior Geotechnical Engineer

DRAWINGS

BOREHOLE LOCATION PLAN (DRAWING 1)





Key Plan
N.T.S.

Legend:

-  Monitoring Well Location (WSP 2020)



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.:



	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:	<p>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 KIRKHAM'S ROAD. BM IN EAST FACE OF CONCRETE PAD, 0.4M SOUTH OF THE NORTHEAST CORNER.</p>	
Maintenance:	<p>Toronto: last maintained: 2005/12/07 (Reference sketch for 12020050046 is not available.)</p>	

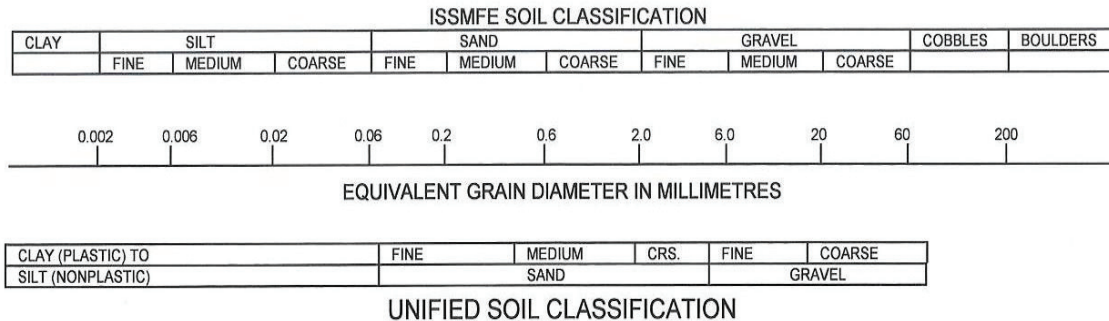
APPENDIX

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.



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, G _s)
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- 4

PROJECT: Geotechnical Investigation for Rouge Gateway Project - Site Analysis
 CLIENT: Parks Canada Agency (PCA)
 PROJECT LOCATION: Toronto, ON
 DATUM: UTM NAD83 ZONE 17
 BH LOCATION: N 4853257.6 E 647066.8

Method: Solid Stem Auger
 Diameter: 110 mm
 Date: Jun/17/2020
 Equipment: Aardvark CME 55 (Track)

REF. NO.: 201-04948-00
 ENCL NO.: 5
 ORIGINATED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40						
130.1	Ground Surface														
0.0	GRANULAR FILL: 300 mm														
129.8	FILL: sandy gravel to sand fill, trace silt, trace clay, brown, moist, compact.		1	SS	11										
0.3															
129.4															
0.7	SANDY SILT: trace clay, brown to grey, moist to wet, dense to compact.		2	SS	33										
1															
2															
127.9	SILTY CLAY TILL: trace gravel, some sand, grey, moist, soft to stiff.		3	SS	17										
2.2															
3															
127	auger grinding, cobbles/boulders inferred		4	SS	3										
4															
5															
126															
6															
125															
7															
124															
123.4															
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														

W. L. 128.3 m
 Jul 13, 2020
 bentonite

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

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

WSP 2014-01-20 10:00 AM 2014-01-20 10:00 AM 2014-01-20 10:00 AM 2014-01-20 10:00 AM



LOG OF BOREHOLE BH20- 5

PROJECT: Geotechnical Investigation for Rouge Gateway Project - Site Analysis
 CLIENT: Parks Canada Agency (PCA)
 PROJECT LOCATION: Toronto, ON
 DATUM: UTM NAD83 ZONE 17
 BH LOCATION: N 4853214.9 E 647040.5

Method: Solid Stem Auger
 Diameter: 110 mm
 Date: Jun/17/2020
 Equipment: Aardvark CME 55 (Track)

REF. NO.: 201-04948-00
 ENCL NO.: 6
 ORIGINATED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40							60
130.2	Ground Surface															
0.0	GRANULAR FILL: 360 mm															
129.8	FILL: sandy gravel to sand fill, trace silt, trace clay, brown, moist, dense to loose.		1	SS	44											
0.4			2	SS	9											
128.7	SANDY GRAVEL: some silt, trace clay, brown, moist to wet, very dense. spoon wet auger grinding, cobbles/boulders inferred		3	SS	50/ 50mm											
1			4	SS	85											
2			5	SS	70											
3			6	SS	1											
4			7	SS	4											
126.1	SANDY SILT TILL: trace gravel, some clay, brown, moist, very loose.															
4.1			6	SS	1											
5			7	SS	4											
124.4			8	SS	1											
5.7	SILTY CLAY TILL: trace gravel, some sand, containing silty sand layer, grey, moist, soft to very soft.															
6			7	SS	4											
7			8	SS	1											
9.8	END OF BOREHOLE															

WSP 2021-06-24 10:30 AM 2021-06-24 10:30 AM
 WSP 2021-06-24 10:30 AM 2021-06-24 10:30 AM

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- 6

PROJECT: Geotechnical Investigation for Rouge Gateway Project - Site Analysis
 CLIENT: Parks Canada Agency (PCA)
 PROJECT LOCATION: Toronto, ON
 DATUM: UTM NAD83 ZONE 17
 BH LOCATION: N 4853210.3 E 647173

Method: Solid Stem Auger
 Diameter: 110 mm
 Date: Jun/18/2020
 Equipment: Aardvark CME 55 (Track)

REF. NO.: 201-04948-00
 ENCL NO.: 7
 ORIGINATED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)									
130.9	Ground Surface																
0.0	GRANULAR FILL: 400 mm		1	SS	25												
130.5	FILL: sandy gravel to sand fill, trace silt, trace clay, brown, moist, compact.																
0.4																	
130.2	SANDY SILT: trace clay, brown to grey, moist, dense to compact.		2	SS	35												
0.7																	
1			3	SS	16												
128.7	SILTY CLAY TILL: trace gravel, grey, moist, hard to very stiff.																
2.2																	
2.2			4	SS	55												
3																	
4			5	SS	27												
5																	
6			6	SS	24												
6																	
6			7	SS	27												
6																	
124.2	END OF BOREHOLE																
6.7	Notes: 1). Borehole was open upon completion of drilling; 2). Water was at a depth of 5.5m 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.)																

WSP 2014-01-20 10:00 AM 2014-01-20 10:00 AM 2014-01-20 10:00 AM 2014-01-20 10:00 AM

GROUNDWATER ELEVATIONS
 Measurement

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



LOG OF BOREHOLE BH20- 7

PROJECT: Geotechnical Investigation for Rouge Gateway Project - Site Analysis
 CLIENT: Parks Canada Agency (PCA)
 PROJECT LOCATION: Toronto, ON
 DATUM: UTM NAD83 ZONE 17
 BH LOCATION: N 4853409.1 E 647113.3

Method: Hollow Stem Auger/Mud Rotary
 Diameter: 203 mm
 Date: Jun/25/2020 to Jun/29/2020
 Equipment: Aardvark CME 55 (Track)

REF. NO.: 201-04948-00
 ENCL NO.: 8
 ORIGINATED BY MH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)	
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40							60
132.2	Ground Surface															
130.4	TOPSOIL: 50mm FILL: gravelly sand, containing cobbles/boulders, brown, moist, very dense.		1	SS	95/ 200mm											concrete
130.8			2	SS	52											
1.4	SILTY SAND TILL: trace gravel, some clay, brown, moist, very dense to compact.		3	SS	51											bentonite
			4	SS	18											
			5	SS	15											
			6	SS	24											
126.5	SILTY CLAY TILL: trace gravel, some sand to sandy containing cobbles/boulders, grey, moist to wet, very stiff to hard.		7	SS	22											
			8	SS	42											
			9	SS	66/ 230mm											9 49 30 12

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ ε=3% Strain at Failure

WSP/PCA/PCO/PAW/2020/06/25/2020



LOG OF BOREHOLE BH20-7

PROJECT: Geotechnical Investigation for Rouge Gateway Project - Site Analysis	REF. NO.: 201-04948-00
CLIENT: Parks Canada Agency (PCA)	Method: Hollow Stem Auger/Mud Rotary
PROJECT LOCATION: Toronto, ON	ENCL NO.: 8
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)
	ORIGINATED BY MH

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)	
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			"N" BLOWS 0.3 m	20	40	60	80							100
Continued																		
101.6	SILTY SAND: trace gravel, containing cobbles, grey, wet, very dense. (Continued)		23	SS	50/100mm													
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.)																	

WSP SOIL RECORDING REPORT FILE
 2020 06 29 10:57:00 AM
 2020 06 29 10:57:00 AM

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 - Site Analysis
 CLIENT: Parks Canada Agency (PCA)
 PROJECT LOCATION: Toronto, ON
 DATUM: UTM NAD83 ZONE 17
 BH LOCATION: N 4853388.6 E 647155.6

Method: Hollow Stem Auger/Mud Rotary
 Diameter: 203 mm
 Date: Jun/23/2020 to Jun/25/2020
 Equipment: Aardvark CME 55 (Track)

REF. NO.: 201-04948-00
 ENCL NO.: 9
 ORIGINATED BY MH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40						
132.1	Ground Surface														
132.0	TOPSOIL: 75mm FILL: sand, trace gravel, containing large pieces of obstructions, brown, moist, compact to very dense.		1	SS	16										
131.0			2	SS	50/ 50mm										
130.7	SANDY SILT: trace gravel, trace clay, brown, moist, very dense.		3	SS	64										
129.9	SANDY SILT TILL: trace gravel, trace to some clay, brown, moist, very dense.		4	SS	50/ 50mm										
129.2	SILTY CLAY TILL: trace gravel, grey, moist, hard.		5	SS	84/ 200mm										
128.0			6	SS	50/ 100mm										
127.0			7	SS	95/ 170mm										
126.0			8	SS	50/ 40mm										
123.0			9	SS	60/ 150mm										

Continued Next Page

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES

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

WSP 2021-06-23 10:30 AM 2021-06-23 10:30 AM 2021-06-23 10:30 AM 2021-06-23 10:30 AM



LOG OF BOREHOLE BH20- 8

PROJECT: Geotechnical Investigation for Rouge Gateway Project - Site Analysis
 CLIENT: Parks Canada Agency (PCA)
 PROJECT LOCATION: Toronto, ON
 DATUM: UTM NAD83 ZONE 17
 BH LOCATION: N 4853388.6 E 647155.6

Method: Hollow Stem Auger/Mud Rotary
 Diameter: 203 mm
 Date: Jun/23/2020 to Jun/25/2020
 Equipment: Aardvark CME 55 (Track)

REF. NO.: 201-04948-00
 ENCL NO.: 9
 ORIGINATED BY: MH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20 40 60 80 100	20 40 60 80 100	W _p	w	W _L	20 40 60 80 100	10 20 30			
Continued	SILTY CLAY TILL: trace gravel, grey, moist, hard. (Continued)				50mm		112									GR SA SI CL	
21			17	SS	95/200mm		111										
22							110										
23			18	SS	50/80mm		109										
24							108										
25			19	SS	50/150mm		107										
26							106										
27							105										
28			21	SS	50/50mm		104										
29							103										
30			22	SS	95/230mm		103										

WSP/PCA/PCO/PAW/2020/12/08/10:30:00

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

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT					POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)				
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			"N" BLOWS 0.3 m	SHEAR STRENGTH (kPa)							WATER CONTENT (%)			
	Continued						20	40	60	80	100	W _p	W	W _L	GR	SA	SI	CL
30.0	SILTY SAND: trace gravel, grey, wet, very dense.					102												
101.6																		
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.)		25	SS	50/50mm													

WSP SOIL RECORDING REPORT FILE
 2020 06 25 10:27:00 AM EST

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 - Site Analysis
 CLIENT: Parks Canada Agency (PCA)
 PROJECT LOCATION: Toronto, ON
 DATUM: UTM NAD83 ZONE 17
 BH LOCATION: N 4853308.2 E 647175.9

Method: Hollow Stem Auger/Mud Rotary
 Diameter: 203 mm
 Date: Jun/30/2020 to Jul/03/2020
 Equipment: Aardvark CME 55 (Track)

REF. NO.: 201-04948-00
 ENCL NO.: 11
 ORIGINATED BY: MH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)				
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80				100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L
Continued	SILTY CLAY TILL: trace gravel, some sand to sandy, grey, moist, soft to hard.(Continued)				50mm													
21			17	SS	50/ 30mm													
22																		
23			18	SS	50/ 50mm													
24																		
25			19	SS	94/ 230mm													
26																		
27			20	SS	90/ 280mm													
28																		
29			21	SS	50/ 100mm													
30																		
			22	SS	90/ 280mm													

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

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

WSP/201-04948-00/2020/07/03/10:30 AM/2020/07/03/10:30 AM/2020/07/03/10:30 AM/2020/07/03/10:30 AM



LOG OF BOREHOLE BH20- 9

PROJECT: Geotechnical Investigation for Rouge Gateway Project - Site Analysis
 CLIENT: Parks Canada Agency (PCA)
 PROJECT LOCATION: Toronto, ON
 DATUM: UTM NAD83 ZONE 17
 BH LOCATION: N 4853308.2 E 647175.9

Method: Hollow Stem Auger/Mud Rotary
 Diameter: 203 mm
 Date: Jun/30/2020 to Jul/03/2020
 Equipment: Aardvark CME 55 (Track)

REF. NO.: 201-04948-00
 ENCL NO.: 11
 ORIGINATED BY: MH

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			"N" BLOWS 0.3 m	SHEAR STRENGTH (kPa)						
Continued														
101	SILTY CLAY TILL: trace gravel, some sand to sandy, grey, moist, soft to hard. (Continued)		23	SS	88/ 280mm									
100														
99			24	SS	50/ 100mm									
98.3														
32.9	SANDY SILT TILL: trace gravel, trace to some clay, grey, moist to wet, very dense.													
97			25	SS	50/ 50mm									
96			26	SS	50/ 80mm									
95														
94.5			27	SS	50/ 100mm									
36.7	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.)													

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

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

WSP 2019-07-01 10:00 AM 2019-07-01 10:00 AM 2019-07-01 10:00 AM 2019-07-01 10:00 AM



LOG OF BOREHOLE BH20- 9A

PROJECT: Geotechnical Investigation for Rouge Gateway Project - Site Analysis
 CLIENT: Parks Canada Agency (PCA)
 PROJECT LOCATION: Toronto, ON
 DATUM: UTM NAD83 ZONE 17
 BH LOCATION: N 4853307.7 E 647175.1

Method: Hollow Stem Auger/Mud Rotary
 Diameter: 203 mm
 Date: Jul/03/2020
 Equipment: Aardvark CME 55 (Track)

REF. NO.: 201-04948-00
 ENCL NO.: 12
 ORIGINATED BY JL

SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m							
131.3	Ground Surface											
130.0	TOPSOIL: 150 mm											
0.2	SANDY SILT: trace gravel, trace clay, brown, moist.											
129.8	SILTY CLAY TILL: trace gravel, some sand to sandy, grey, moist.											
127.0												
126.5												
125.2												
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											

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

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

WSP 2014-07-23 10:00 AM 2014-07-23 10:00 AM 2014-07-23 10:00 AM 2014-07-23 10:00 AM



LOG OF BOREHOLE BH20-10

PROJECT: Geotechnical Investigation for Rouge Gateway Project - Site Analysis
 CLIENT: Parks Canada Agency (PCA)
 PROJECT LOCATION: Toronto, ON
 DATUM: UTM NAD83 ZONE 17
 BH LOCATION: N 4853247 E 647211.4

Method: Hollow Stem Auger/Mud Rotary
 Diameter: 203 mm
 Date: Jul/07/2020 to Jul/09/2020
 Equipment: Aardvark CME 55 (Track)

REF. NO.: 201-04948-00
 ENCL NO.: 13
 ORIGINATED BY: MH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20 40 60 80 100	20 40 60 80 100						
130.7	Ground Surface														GR SA SI CL
130.0	TOPSOIL: 130mm FILL: sandy silt, trace gravel, dark brown to brown, moist, loose.		1	SS	4		concrete								
130.0	SAND: trace to some gravel, trace clay, containing cobbles/boulders, brown, moist, dense.		2	SS	33										
129.2	SILTY CLAY TILL: trace gravel, some sand to sandy, containing wet silty sand layers, grey, moist to wet, stiff to hard.		3	SS	40		bentonite								
129.2			4	SS	22										
129.2			5	SS	16										
129.2			6	SS	24										
129.2			7	SS	8										6 23 49 22
129.2			8	SS	15										
129.2			9	SS	18										

Continued Next Page

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES

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

WSP 2021-07-09 10:30 AM 2021-07-09 10:30 AM 2021-07-09 10:30 AM 2021-07-09 10:30 AM



LOG OF BOREHOLE BH20-10

PROJECT: Geotechnical Investigation for Rouge Gateway Project - Site Analysis
 CLIENT: Parks Canada Agency (PCA)
 PROJECT LOCATION: Toronto, ON
 DATUM: UTM NAD83 ZONE 17
 BH LOCATION: N 4853247 E 647211.4

Method: Hollow Stem Auger/Mud Rotary
 Diameter: 203 mm
 Date: Jul/07/2020 to Jul/09/2020
 Equipment: Aardvark CME 55 (Track)

REF. NO.: 201-04948-00
 ENCL NO.: 13
 ORIGINATED BY: MH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)				
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)							W _p	W	W _L	GR SA SI CL
30.0	SANDY SILT TILL: trace gravel, some clay, grey, wet, very dense.		23	SS	50/100mm													
31																		
32			24	SS	50/130mm													
33																		
33.1	SILTY CLAY TILL: trace gravel, some sand, grey, moist, hard.		25	SS	50/130mm													
34																		
35			26	SS	50/100mm													
36																		
36.6	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.) July 13, 2020 27.66		27	SS	50/50mm													

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

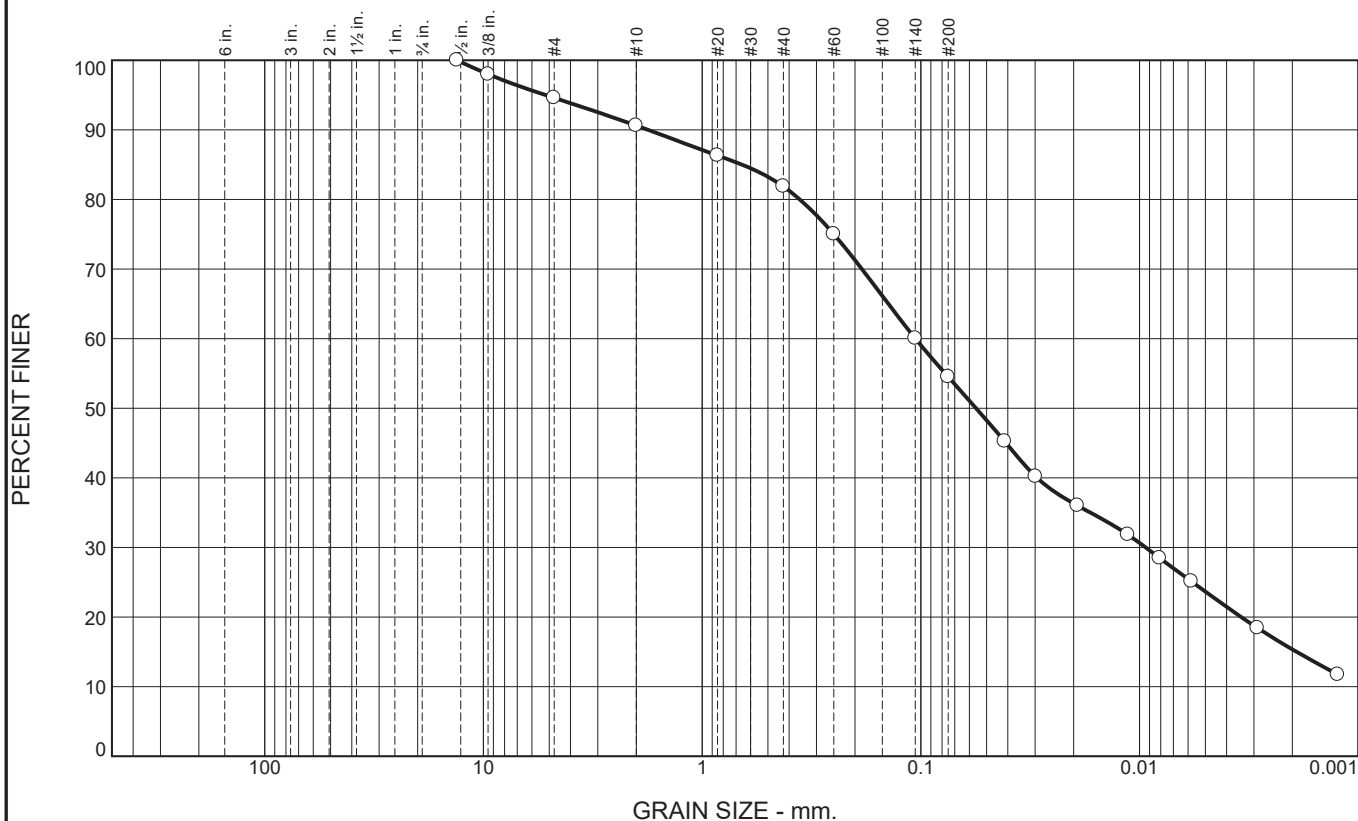
GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

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		

Soil Description
Sand and silt, **Sandy Silt Till**, some clay, trace gravel

Atterberg Limits
 PL= NP LL= NV PI= NP

Coefficients
 D₉₀= 1.7676 D₈₅= 0.6569 D₆₀= 0.1058
 D₅₀= 0.0559 D₃₀= 0.0094 D₁₅= 0.0019
 D₁₀= C_u= C_c=

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

Remarks

* (no specification provided)

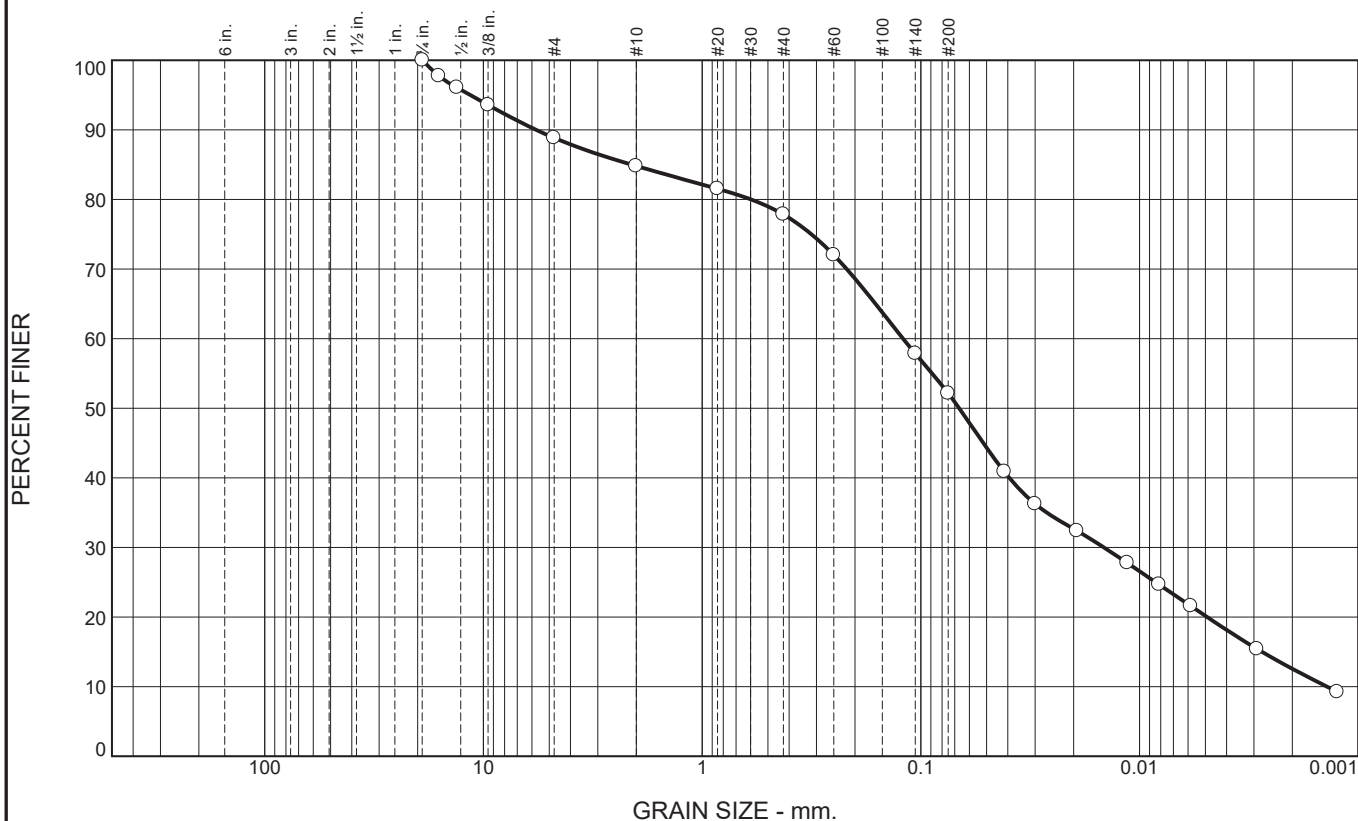
Location: BH20-5 SS6
Sample Number: 20MM-850

Date: 16/07/20

	<p>Client: Parks Canada Agency</p> <p>Project: Rouge Park Gateway</p> <p>Project No: 201-04948-00</p>
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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		

Soil Description

Sand and silt, **Sandy silt till** some clay,
some gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D₉₀= 5.7330 D₈₅= 2.0989 D₆₀= 0.1206
D₅₀= 0.0667 D₃₀= 0.0145 D₁₅= 0.0028
D₁₀= 0.0014 C_u= 86.84 C_c= 1.26

Classification

USCS= ML AASHTO= A-4(0)

Remarks

* (no specification provided)

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

Date: 16/07/20

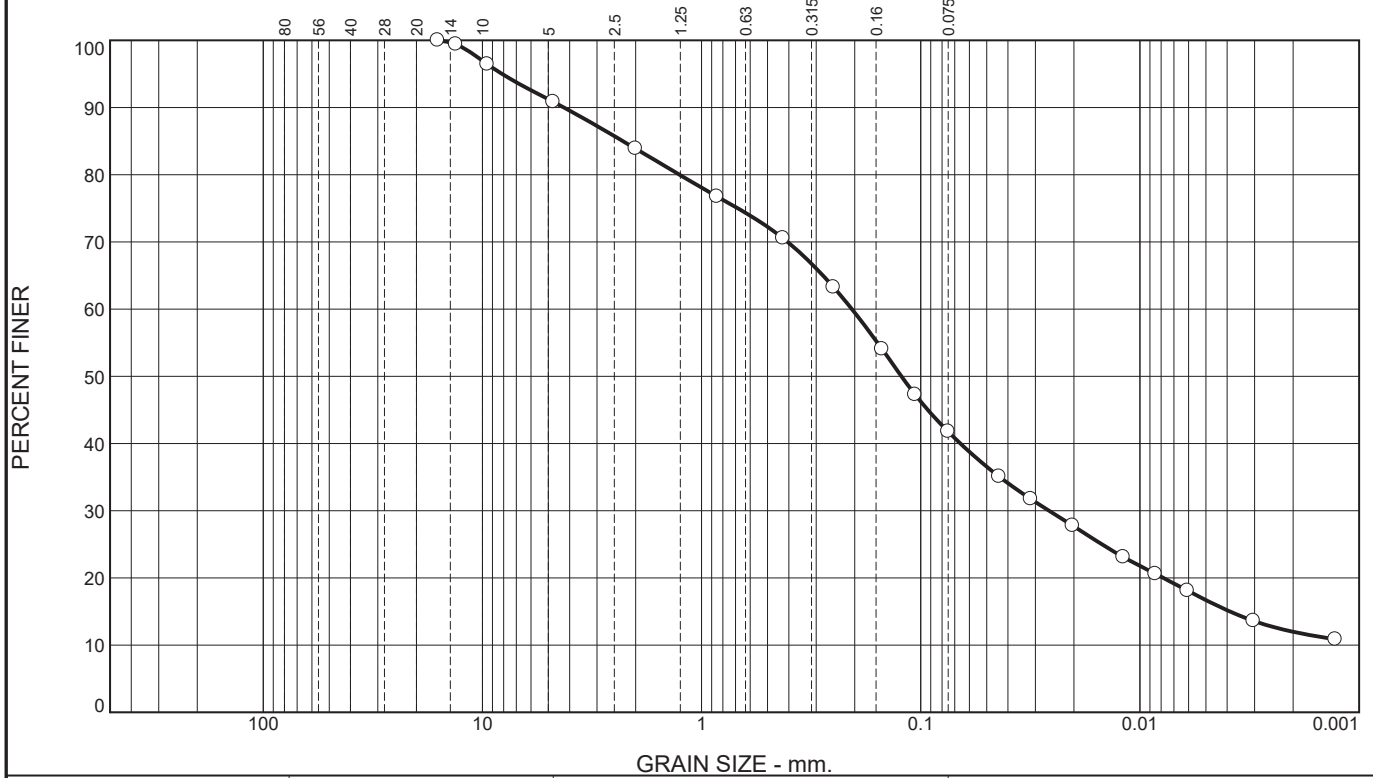


Client: Parks Canada Agency
Project: Rouge Park Gateway

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		

Soil Description

Sandy Clayey Silt Silty sand till

Atterberg Limits

PL= 11 LL= 15 PI= 4

Coefficients

D₉₀= 4.2528 D₈₅= 2.2867 D₆₀= 0.2062
 D₅₀= 0.1225 D₃₀= 0.0260 D₁₅= 0.0039
 D₁₀= C_u= C_c=

Classification

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

Remarks

* (no specification provided)

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

Date: July 24, 2020



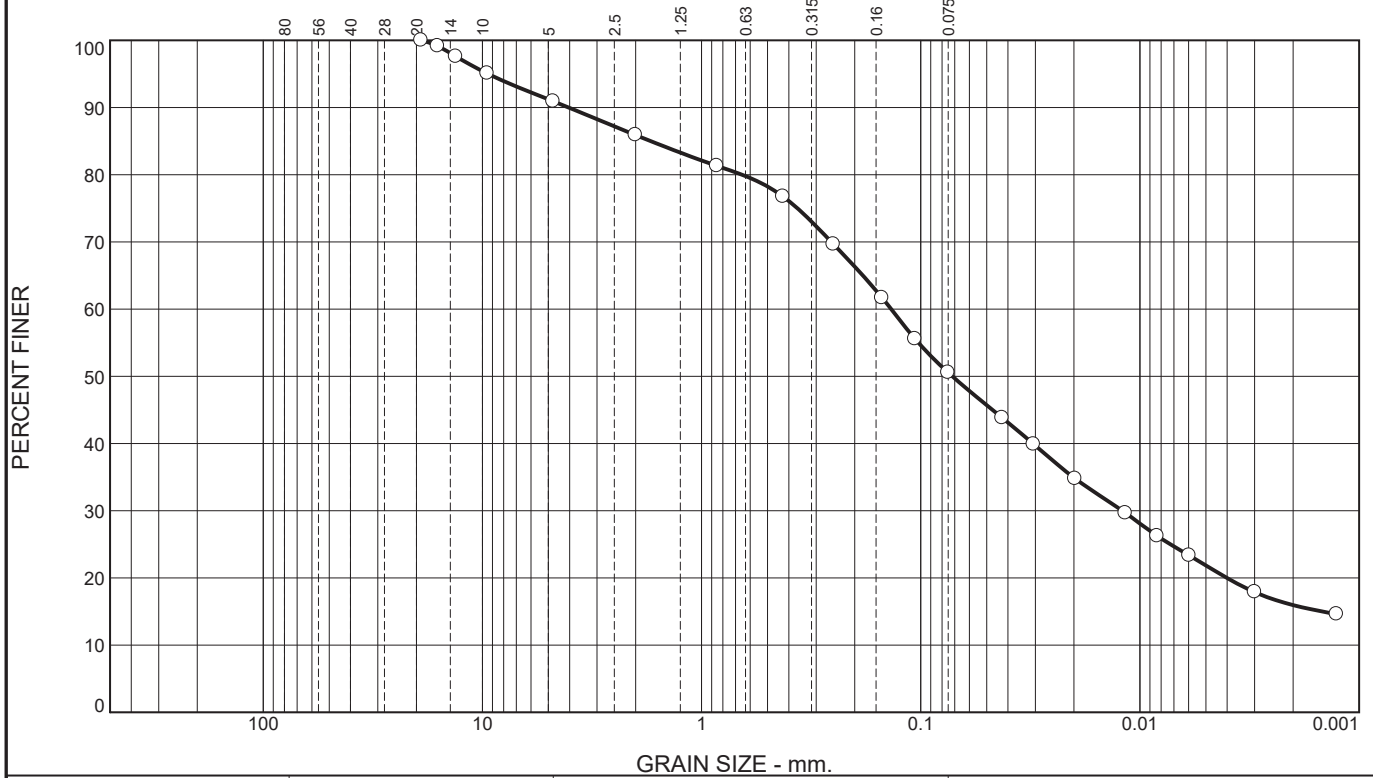
Client: Parks Canada Agency
 Project: Chester Station Easier Access Rouge Park Gateway

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

PL= **Atterberg Limits** PI=

LL= **Coefficients** D₆₀= 0.1365

D₉₀= 4.0456 D₈₅= 1.7085 D₁₅= 0.0015

D₅₀= 0.0718 D₃₀= 0.0120 C_c=

D₁₀= C_u=

USCS= **Classification** AASHTO=

Remarks

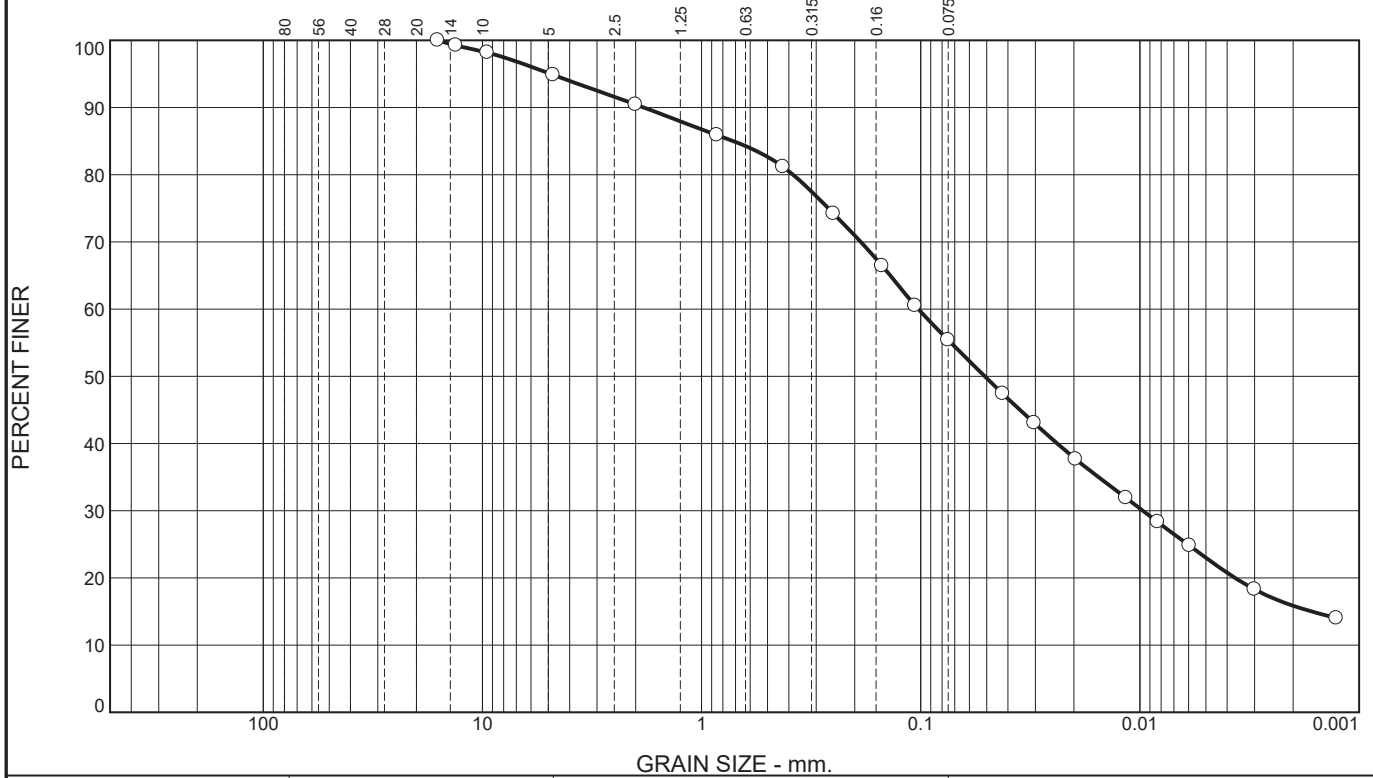
Source of Sample: Site Drilling
Sample Number: 20-8_SS14

Date: July 24, 2020

	<p>Client: Parks Canada Agency (PCA)</p> <p>Project: Chester Station Easier Access Rouge Park Gateway</p> <p>Project No: 201-04948-00</p>	<p>Figure 20-8 SS14</p>
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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		

Soil Description

Sandy Clayey Silt Silty Clay Till

Atterberg Limits

PL= 12 LL= 16 PI= 4

Coefficients

D₉₀= 1.8376 D₈₅= 0.7178 D₆₀= 0.1026
D₅₀= 0.0511 D₃₀= 0.0097 D₁₅= 0.0016
D₁₀= C_u= C_c=

Classification


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

Remarks

* (no specification provided)

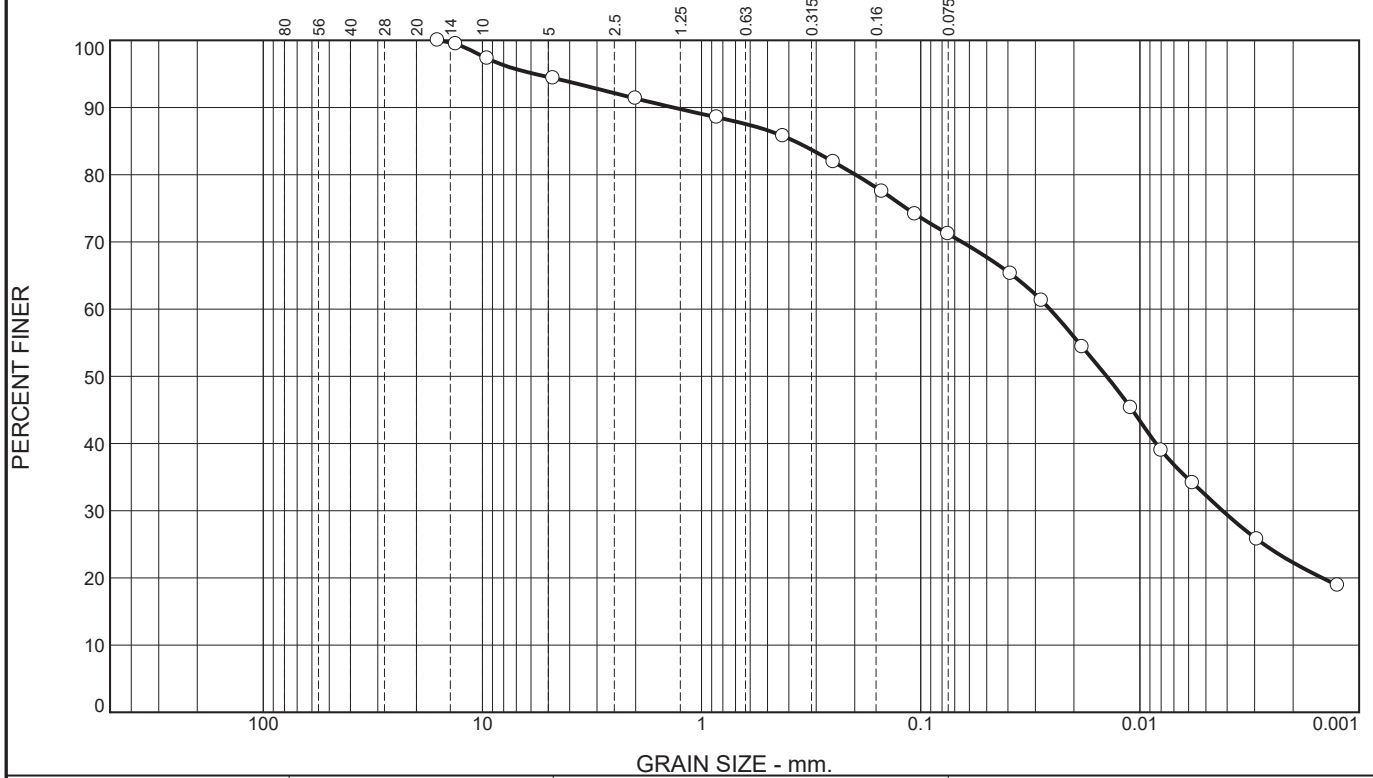
Source of Sample: Site Drilling
Sample Number: 20-9_SS7

Date: July 24, 2020

	<p>Client: Parks Canada Agency (PCA) Project: Rouge Park Gateway</p>	<p>Project No: 201-04948-00 Figure 20-9 SS7</p>
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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		

Soil Description
Clayey Silt with Sand Silty Clay Till

Atterberg Limits
 PL= 12 LL= 18 PI= 6

Coefficients
 D₉₀= 1.3464 D₈₅= 0.3769 D₆₀= 0.0258
 D₅₀= 0.0142 D₃₀= 0.0042 D₁₅=
 D₁₀= C_u= C_c=

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

Remarks

* (no specification provided)

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

Date: July 24, 2020



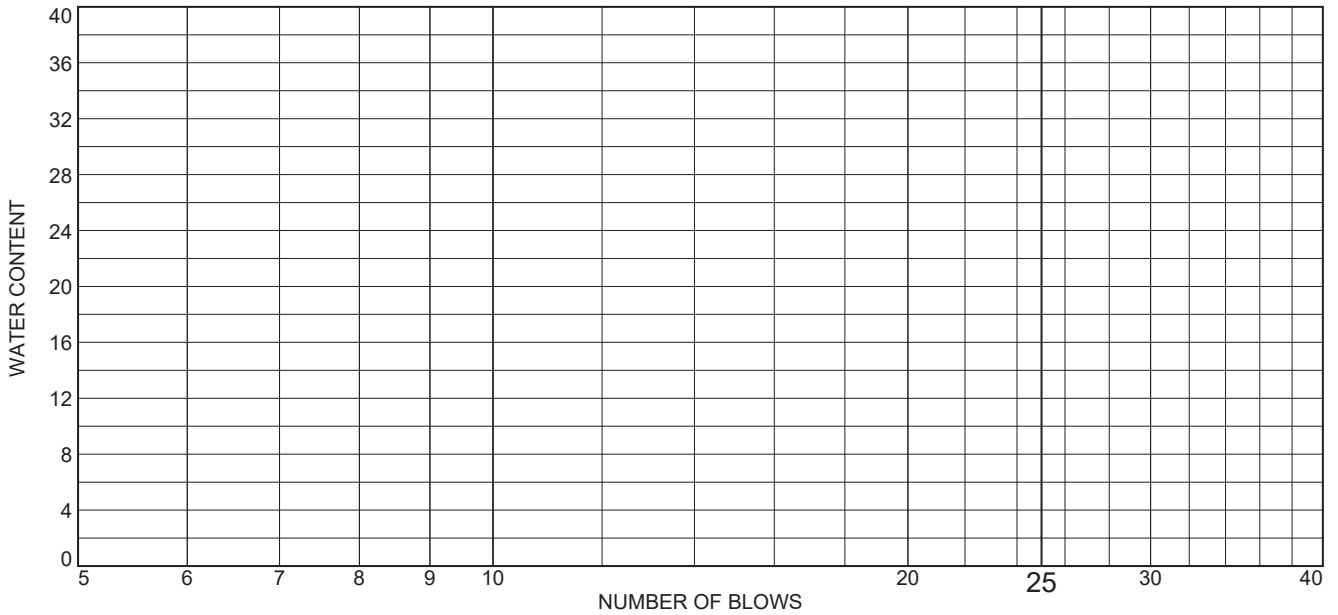
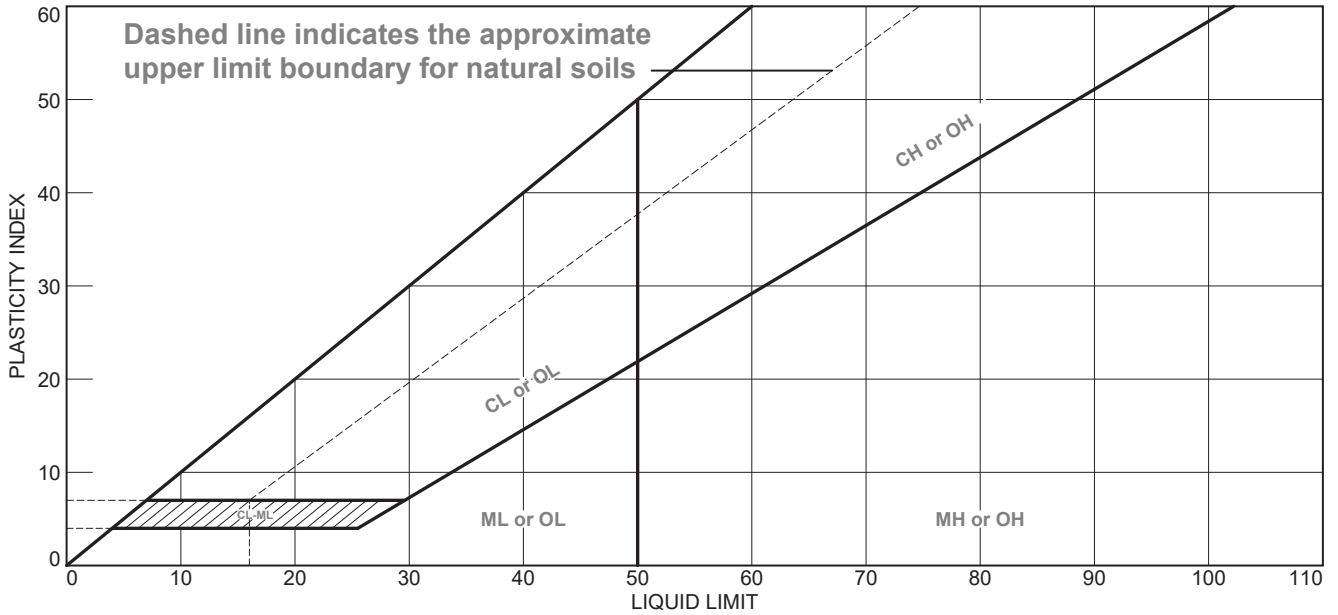
Client: Parks Canada Agency (PCA)
Project: Chester Station Easier Access Rouge Park Gateway

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, Sandy Silt Till , some clay, some graveNV	50	NP	NP	77.8	52.2	ML

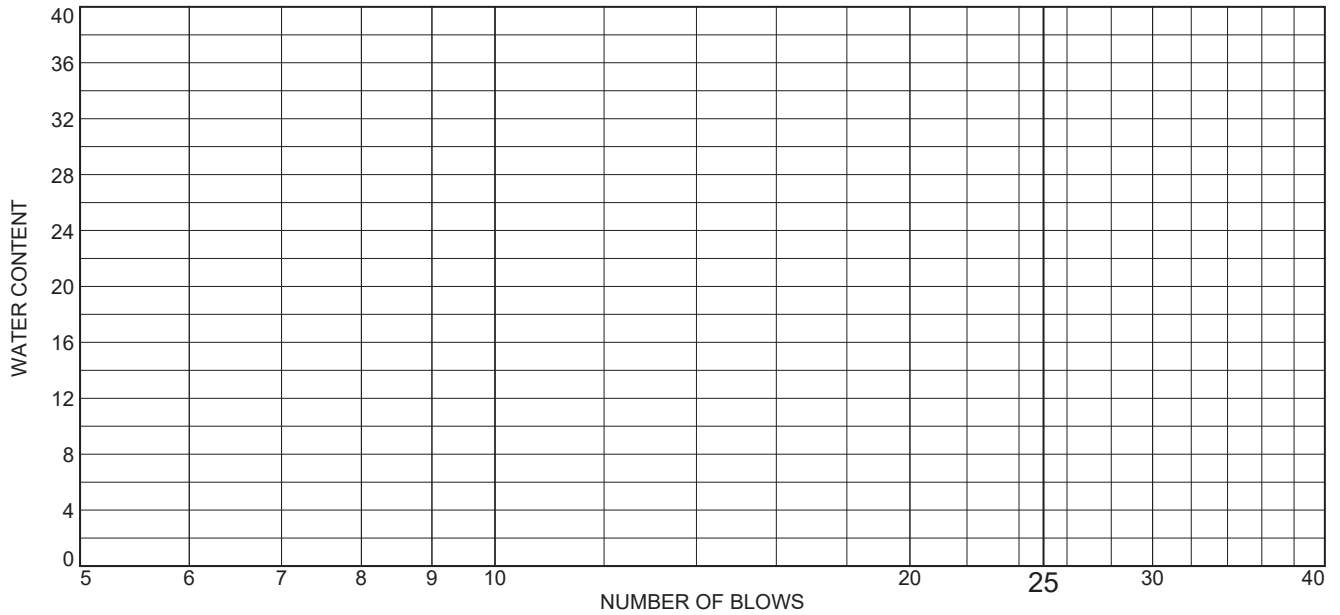
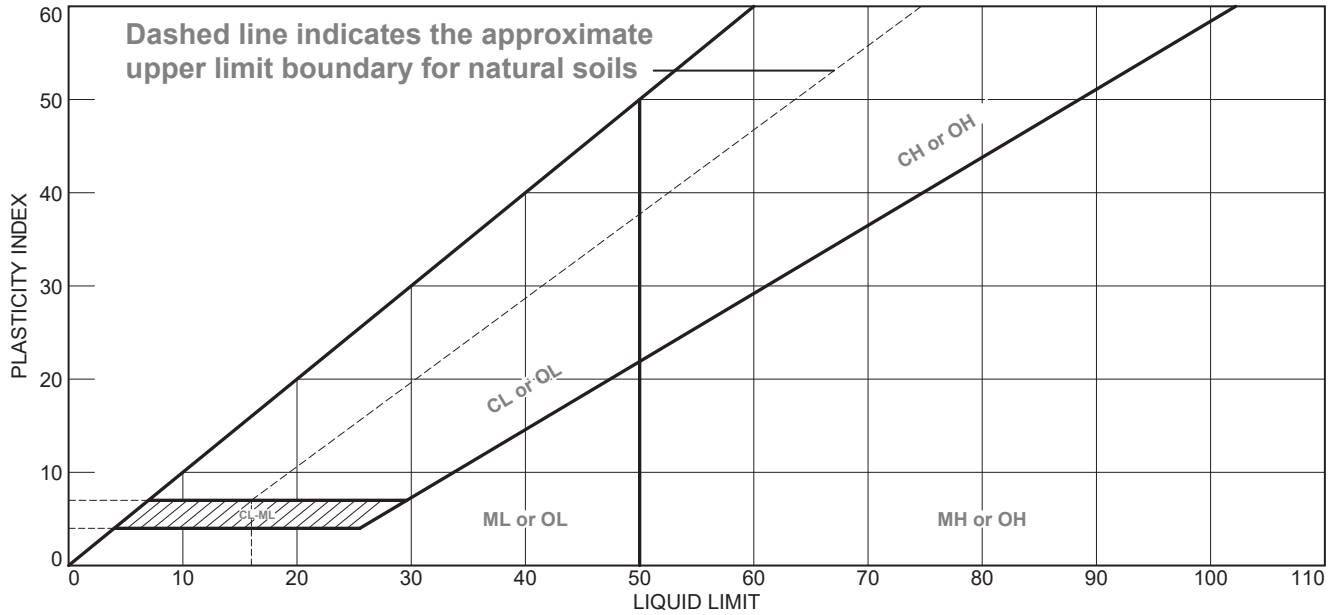
Project No. 201-04948-00 **Client:** Parks Canada Agency
Project: PCA Rouge Park Gateway
Location: BH20-1 SS6
Sample Number: 20MM-851

Remarks:

Figure



LIQUID AND PLASTIC LIMITS TEST REPORT



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
Sand and silt, Sandy Silt Till , some clay, trace gravel NV	50	NP	NP	81.9	54.5	ML

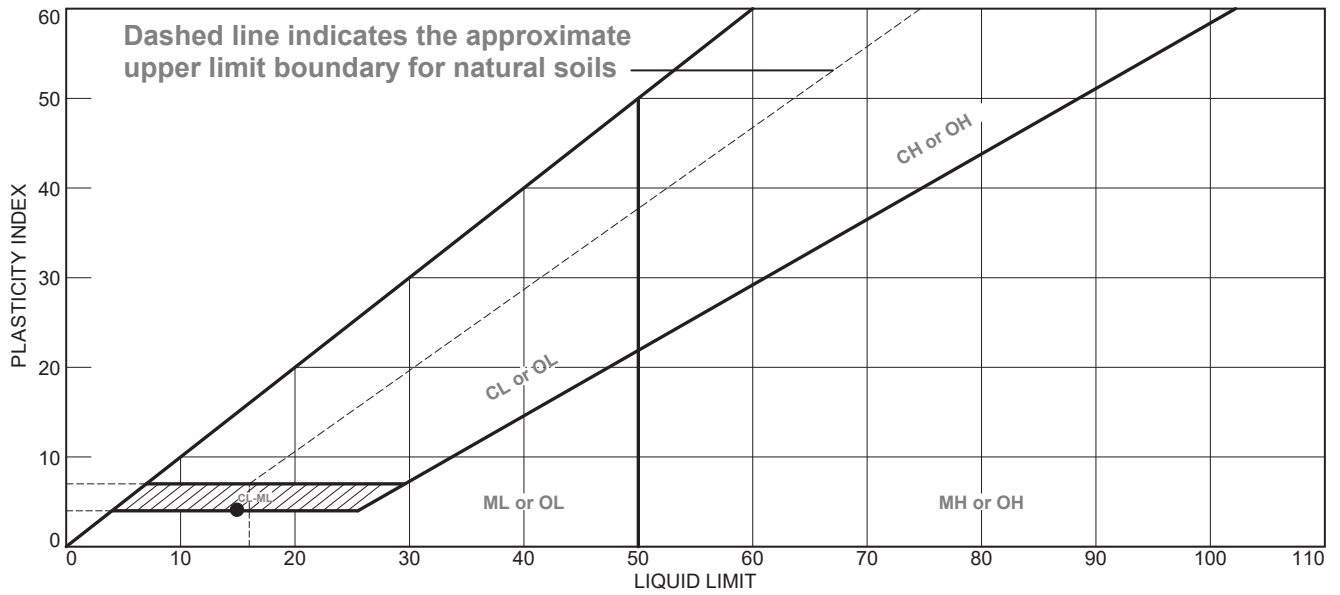
Project No. 201-04948-00 **Client:** Parks Canada Agency
Project: PCA Rouge Park Gateway
Location: BH20-5 SS6
Sample Number: 20MM-850

Remarks:

Figure



LIQUID AND PLASTIC LIMITS TEST REPORT



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

Project No. 201-04948-00 **Client:** Parks Canada Agency (PCA)
Project: Chester Station Easier Access
Source of Sample: Site Drilling
Sample Number: 20-7_SS5

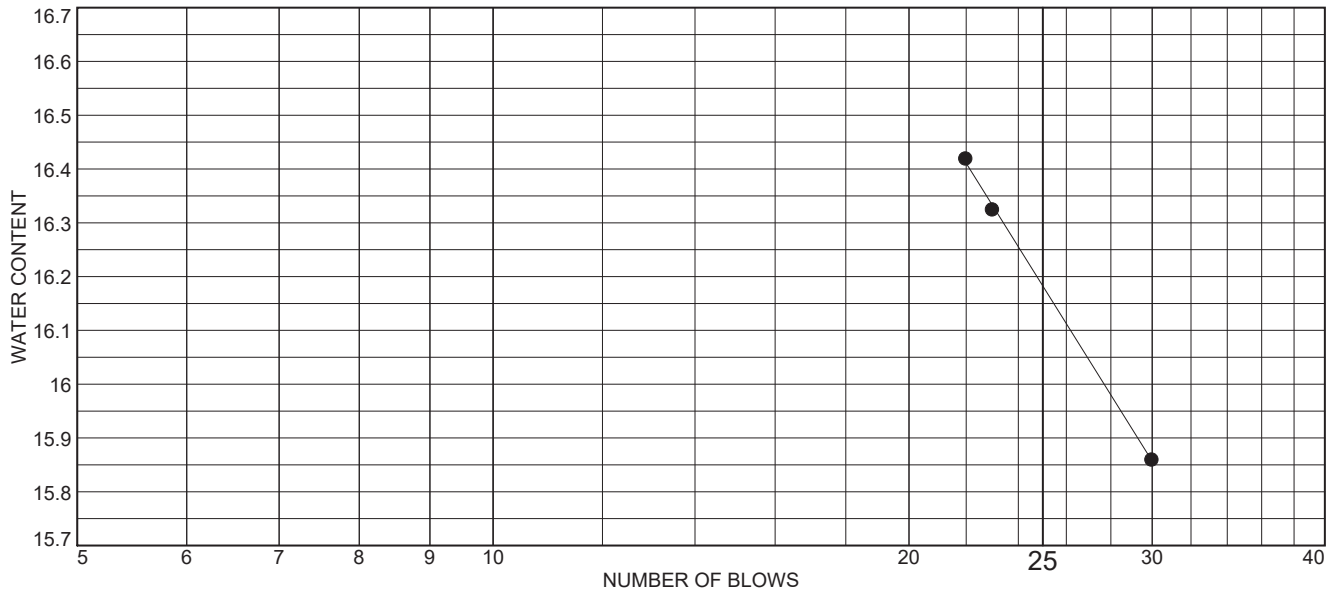
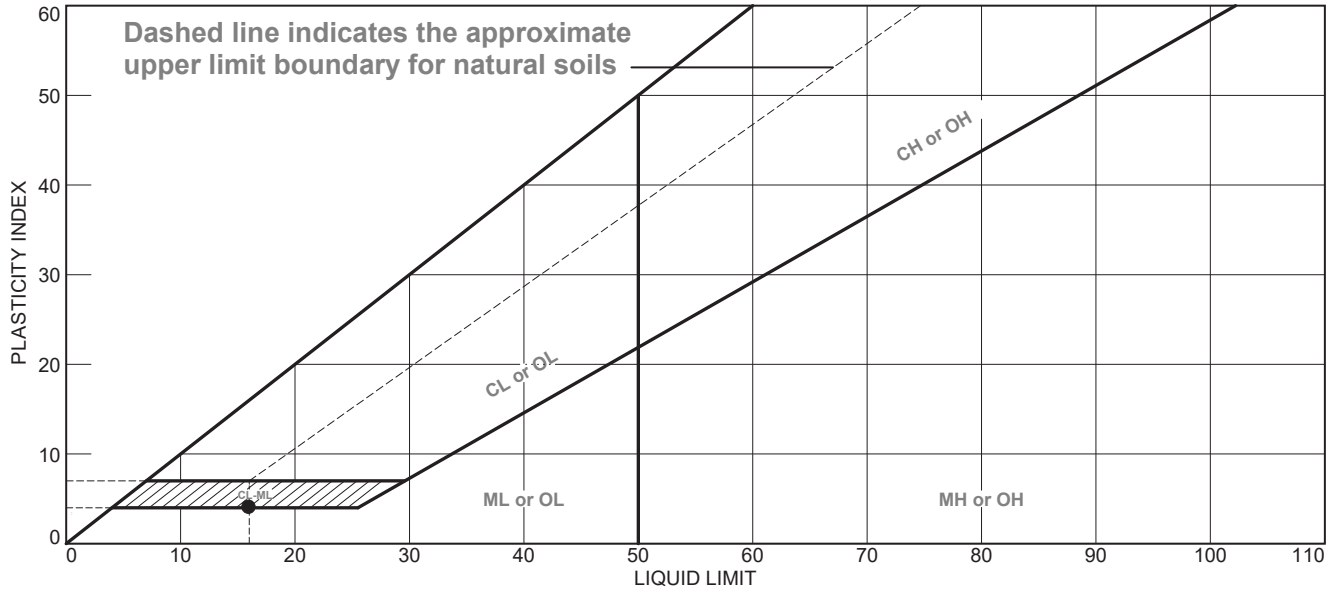
Remarks:



Figure 20-7 SS5

Tested By: LXQ

LIQUID AND PLASTIC LIMITS TEST REPORT



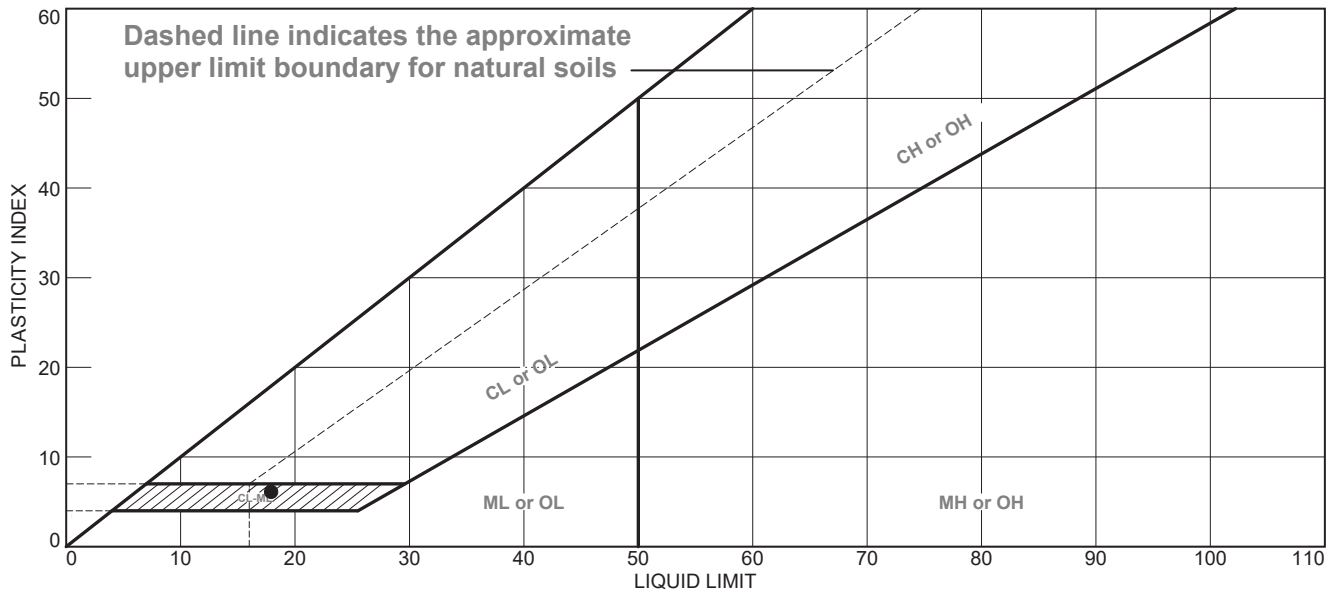
MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● Sandy Clayey Silt Silty Caly till	16	12	4	81	55	CL-ML

Project No. 201-04948-00 Client: Parks Canada Agency (PCA) Project: Chester Station Easier Access 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
●	Clayey Silt with Sand <i>Silty Clay Till</i>	18	12	6	86	71	CL-ML

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

Project: Chester Station Easier Access

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

Remarks:



Figure 20-10 SS7

Tested By: LXQ