FINAL REPORT

FOUNDATION INVESTIGATION REPORT

New Material Storage Facility at Haileybury Patrol Yard, Timiskaming Shores

Agreement No. 5015-E-0007
Assignment No. 10
Geocres No. 31M-126

Prepared for:
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Foundation Investigation Report

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1 FOUNDATION INVESTIGATION REPORT

1.1 Introduction

This report presents the results of a geotechnical investigation carried out by EXP Services Inc. (EXP) for the proposed new material (including winter sand/salt) storage facility at the Haileybury Patrol Yard, located in Timiskaming Shores, Northeastern Ontario. The work was undertaken under Agreement # 5015-E-0007, Assignment No. 10. The terms of reference (TOR) were as presented in the Ministry of Transportation (MTO) email received on March 12, 2019.

The purpose of this investigation is to establish existing subsurface conditions at the proposed location of the patrol yard structure within construction limits defined by MTO. The site-specific geotechnical investigation consisted of field investigation including visual inspection, drilling, soil sampling, and laboratory testing. Factual results of the investigation and laboratory testing are included in this report. The report has been prepared specifically and solely for the project described in the report.

1.2 Site Description and Geological Setting

1.2.1 Site Description

The Haileybury Patrol Yard is located on West Road, approximately 1 km east of the Hwy 11 and West Road junction in the Town of Haileybury, Timiskaming Shores, Northeastern Ontario (see Key Map on Drawing 1, Appendix B). The site is bound by West Road to the south, a residential home and farm land to the west, and by farm land to the north and east.

A paved roadway and parking area lead from the site entrance on West Road to an approximately 40x65 m garages/office, which is located approximately 60 m northwest of entrance gate. The proposed new storage facility will be located approximately 40 m north from the garages/office and approximately 110m northwest from the site entrance.

The topography of the site is considered flat lying with borehole elevations ranging from 259.8 to 260.1 m. The ground surface of the proposed material storage facility is paved on the east and west and has gravel near the northwest end of the facility. The area beyond the east boundary of the proposed facility consists of bush with mature trees. Photographs of the site and core samples of the Sand and Gravel Till encountered in borehole BH19-H-1 are included in Appendix A.

1.2.2 Geological Setting

According the Ministry of Northern Development and Mines, Map 2555 (Quaternary Geology of Ontario, East-Central Sheet, 1991), the site is located at the boundary between a glaciolacustrine plain and bedrock knob landforms. The glaciolacustrine deposits consisting of silt and clay with minor sand is a basin and quiet water deposits and according to Map 2543 (Bedrock Geology of Ontario, East-Central

Sheet, 1991), the bedrock geology of the site is of conglomerate, wacke, arkose, quartz arenite, argillite of the Cobalt Group (Huronian Supergroup).

1.3 Investigation Procedures

1.3.1 General

The field investigation was performed between April 8 and 12, 2019. The field program consisted of drilling four (4) sampled boreholes (BH19-H-1 to BH19-H-4). The boreholes were strategically located at the patrol yard to provide the subsurface information for the design of the proposed material storage facility. The borehole locations are shown on Drawing 1 in Appendix B.

The borehole locations (referenced to the MTM NAD83 coordinate system) and their ground surface elevations were surveyed by EXP personnel, with reference to the benchmark (BM) established on a18mm diameter anchor bolt set horizontally in concrete foundation located at the east side of the existing sand dome facility. The elevation of the BM was considered 260.293 m based on the drawing provided with TOR. The BM location is shown on Drawing 1, in Appendix B.

The boreholes were advanced using a truck mounted CME-55 drill rig, equipped with a hollow stem augers and diamond bit NW casing. All borehole drilling and sampling operations were performed by a specialist drilling contractor, Landcore Drilling Services. The locations, elevations and depths of boreholes are shown below in Table 1.1.

Table 1.1. Locations, elevations and depths of boreholes completed by EXP Services Inc.

BH #	Location	MTM NAD83 Northing	MTM NAD83 Easting	Ground Elevation (m)	Borehole Depth (m)
BH19-H-1	Proposed new materials storage facility footprint	5257092.15	288600.63	260.1	15.3
BH19-H-2	Proposed new materials storage facility footprint	5257130.08	288605.36	259.8	5.3
BH19-H-3	Proposed new materials storage facility footprint	5257081.13	288653.44	259.9	5.9
BH19-H-4A/B	Proposed new materials storage facility footprint	5257125.15	288653.29	259.8	15.0

During the drilling of the boreholes, soil samples were obtained using a 51 mm outside diameter (O.D.) split-spoon sampler in accordance with Standard Penetration Test (SPT) procedures (ASTM D 1586), at intervals shown on the attached borehole logs (Appendix C). The original field (uncorrected) SPT “N” values were recorded on the borehole logs as recommended in the Canadian Foundation Engineering Manual (CFEM pg. 40) and used to provide an assessment of in-situ consistency of cohesive soils or relative density of non-cohesive soils. Field vane testing was conducted in cohesive soil to measure the in-situ undrained shear strength of this soil. Field vane test was conducted with the standard MTO vane

(6" tampered vane, 2.5" diameter) in accordance with ASTM D2573-08. When a hard stratum was reached sampling of hard material was performed by diamond core drilling, using a 1.5 m long NQ double tube wireline core barrel. The water supply from the site, Haileybury Patrol Yard was used for soil sampling (wash boring) and rock coring.

Upon completion of the drilling operations, groundwater level measurements were carried out in the open holes. The groundwater levels encountered in the boreholes are shown on the borehole logs and presented below in Table 1.9. The boreholes were decommissioned by bentonite/cement mixtures in accordance with the Ministry of the Environment Regulation 903, as amended by Regulation 128/03 (the well regulation under the Ontario Water Resources Act).

The fieldwork was supervised by a member of EXP's engineering staff who directed the drilling and sampling operation, logged borehole data in accordance with MTO and/or ASTM standards for soils classification, and retrieved soil samples for subsequent laboratory testing and identification.

All the recovered soil samples were placed in labelled moisture-proof bags and returned to EXP's Sudbury and Brampton laboratory for additional visual, textual and olfactory examination, and sampling for laboratory testing.

1.3.2 Available Documents

The available report of the previous investigation for Haileybury Patrol Yard (formerly known as Tri-Town Patrol Yard) in the MTO GEOCRES library is:

Geocres No. 31M-001: "Proposed Site of D.H.O Patrol Garage at Secondary Hwy No. 558 and Tri-town By-pass", July 19, 1961

Geocres No. 31M-096: "Foundation Investigation and Design Report, Proposed Sand/Salt Storage Facility, Haileybury Patrol Yard" prepared by Genivar Inc., January 15, 2013

The details of four boreholes completed by Genivar Inc. (Genivar) for Haileybury Patrol Yard are outlined in Table 1.2 and the borehole locations are shown on Drawings in Appendix B. The ground elevations mentioned in Table 1.2 are in reference to BM noted in Section 1.3.1 and Drawing 1 in Appendix B. The borehole logs are included in Appendix H.

Table 1.2. Summary of boreholes completed by Genivar Inc.

BH #	MTM NAD83 Northing	MTM NAD83 Easting	Ground Elevation (m)	Borehole Depth (m)
BH12-1	5256348.1	596922.5	259.9	11.1
BH12-2	5256331.4	596921.8	259.9	10.4
BH12-3	5256352.0	596899.7	260.0	11.1

BH #	MTM NAD83 Northing	MTM NAD83 Easting	Ground Elevation (m)	Borehole Depth (m)
BH12-4	5256333.1	596898.3	259.9	10.4

1.3.3 Laboratory Testing

All samples returned to the laboratory were subjected to visual examination and classification. The laboratory testing program included the determination of natural moisture content, particle size distribution and Atterberg Limits tests for approximately 25% of the collected soil samples. In addition, one consolidation test and a unit weight test were performed on representative cohesive sample. Soil chemical (Corrosivity and Contamination) package tests were performed on two soil samples. All the laboratory tests were carried out in accordance with MTO and/or ASTM standards as appropriate.

The laboratory test results are provided on the attached borehole log sheets in Appendix C. The results of the grain size analyses are presented graphically in Appendix D.

1.4 Subsurface Conditions

The detailed subsurface soil and groundwater conditions encountered in the boreholes advanced during this investigation, together with the results of the laboratory tests carried out on selected soil samples, are presented on the borehole log sheets in Appendix C. Laboratory test results are provided in Appendix D. The “Explanation of Terms Used in Report” preceding the borehole logs in Appendix C forms an integral part of and should be read in conjunction with this report.

A borehole location plan and stratigraphic section along the proposed material storage facility are provided in Appendix B. It should be noted that the stratigraphic boundaries indicated on the borehole logs and stratigraphic section are inferred from non-continuous sampling, observations of drilling progress and results of Standard Penetration Tests. These boundaries typically represent transitions from one soil type to another and should not be regarded as exact planes of geological change. Further, subsurface conditions may vary between and beyond the borehole locations.

In general, the stratigraphic sequence at the proposed structure site consists of top sand and gravel fill, underlain by native silty clay, varved silty clay and silt to clayey silt deposits followed by sand and gravel till with cobbles and boulder, followed by bedrock. A summary of the soil and groundwater conditions encountered in the boreholes is provided below.

1.4.1 Asphalt

Asphalt was encountered at the surface of EXP’s borehole BH19-H-3 and all Genivar’s borehole BH12-1 to BH12-4, and ranged in thickness from approximately 0.1 m to 0.2 m. Asphalt thicknesses may further vary beyond the borehole locations.

1.4.2 Fill: Gravelly Sand

A gravelly sand fill layer was encountered at the surface of EXP's boreholes BH19-H-1, BH19-H-2 and BH19-H-4 and, below the layer of asphalt for EXP's borehole BH19-H-3, Genivar's borehole BH12-1 to BH12-4. The approximate elevations of the surface and base of the fill and the thickness of fill as encountered in boreholes are summarized in Table 1.3 below:

Table 1.3. Summary of sand and gravel fill layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
BH19-H-1 (EXP)	260.1	258.6	0.0	1.5
BH19-H-2 (EXP)	259.8	258.3	0.0	1.5
BH19-H-3 (EXP)	259.7	258.4	0.2	1.3
BH19-H-4A/B (EXP)	259.8	258.3	0.0	1.5
BH12-1 (Genivar)	259.8	258.5	0.1	1.3
BH12-2 (Genivar)	259.8	258.5	0.1	1.3
BH12-3 (Genivar)	260.0	257.9	0.1	2.0
BH12-4 (Genivar)	259.8	258.6	0.1	1.3

This layer consists of gravelly sand with some silt, some to occasional cobbles, some organics. The material is brown in color, and moist to damp. The SPT "N" values within this layer ranged from 10 to 64 blows per 300 mm penetration, corresponding to compact to very dense compactness condition.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follows:

Moisture Content: (EXP and Genivar)

- 3% to 40.7%

Grain Size Distribution: (EXP and Genivar)

- 14% to 20% gravel;
- 61% to 71% sand; and
- 9% to 16% fines

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The result of grain size distribution tests performed by EXP is also provided on Figure 1, in Appendix D. The results of tests performed by Genivar are shown on the borehole logs attached in Appendix H.

1.4.3 Silty Clay (Varved)

A layer of native varved silty clay was encountered below the sand and gravel fill in EXP's borehole BH19-H-2, and below the native silty clay in EXP's boreholes BH19-H-1 and BH19-H-4A. The approximate elevations of the surface and base of the deposit and the thickness of deposit as encountered in boreholes are summarized in Table 1.4 below:

Table 1.4. Summary of silty clay layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
BH19-H-1 (EXP)	257.8	255.5	2.3	2.3
BH19-H-2 (EXP)	258.3	257.5	1.5	0.8
BH19-H-4A/B (EXP)	257.5	256.9	2.3	0.6

The composition of this layer is silty clay, and trace sand. The material is brown to grey in color with orange molting, and frozen to wet. The SPT "N" values within this layer ranged from 5 to 22 blows per 300 mm penetration, suggesting firm to very stiff material in consistency. Laboratory testing performed on selected sample consisted of moisture content, grain size distribution and Atterberg Limit tests. The test results are as follow:

Moisture Content: (EXP)

- 21.3% to 40.3%

Grain Size Distribution: (EXP)

- 0% gravel;
- 2% sand;
- 53% silt; and
- 45% clay

Atterberg limits: (EXP)

- Liquid Limit: 38%
- Plastic Limit: 21%
- Plasticity Index: 17%

The results of the moisture content, grain size distribution and Atterberg Limit tests are provided on the record of borehole sheets in Appendix C. The results of grain size distribution and Atterberg Limit tests performed by EXP are also provided on Figures 2 and 6, respectively, in Appendix D.

1.4.4 Silty Clay/ Clayey Silt

A layer of native silty clay was encountered in all EXP's and Genivar's boreholes. A layer of silty clay was encountered below sand and gravel fill in EXP's boreholes BH19-H-1, BH-19-2 and BH19-H-4A/B; silty clay to clayey silt was encountered below sand and gravel fill in Genivar's boreholes BH12-1 to BH12-4. The approximate elevations of the surface and base of the deposit and the thickness of deposit as encountered in boreholes are summarized in Table 1.5 below:

Table 1.5. Summary of silty clay/ clayey silt

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
BH19-H-1 (EXP)	258.6	257.8	1.5	0.8
BH19-H-2 (EXP)	257.5	256	2.3	1.5
BH19-H-3 (EXP)	258.4	255.9	1.5	2.5
BH19-H-4A/B (EXP)	258.3	257.5	1.5	0.8
	256.8	255.2	3.0	1.6
BH12-1 (Genivar)	258.5	255.5	1.4	3.0
BH12-2 (Genivar)	258.5	254.1	1.4	4.4
BH12-3 (Genivar)	257.9	254.3	2.1	3.6
BH12-4 (Genivar)	258.6	254.2	1.4	4.4

The composition of this layer is silt and clay, trace sand and trace gravel. The material is brown to grey in color with orange/brown molting and frozen to wet. The SPT "N" values within this layer ranged from 1 to 13 blows per 300 mm penetration, suggesting very soft to stiff material in consistency. In addition, in-situ shear vane tests were performed in EXP's boreholes BH19-H-1 to BH-19-H-3, no shear was

experienced up to 100 lbs. In-situ shear vane test performed by Genivar ranged from 80 kPa to 100 kPa, confirming stiff consistency. The corresponding sensitivity ranged from 3.2 to 4.7, medium to sensitive clay soil.

Laboratory testing performed on selected sample consisted of moisture content, grain size distribution and Atterberg Limit tests. The test results are as follow:

Moisture Content: (EXP and Genivar)

- 8.1% to 46%

Grain Size Distribution: (EXP and Genivar)

- 0% to 3% gravel;
- 1% to 7% sand;
- 35% to 59% silt; and
- 34% to 62% clay

Atterberg limits: (EXP and Genivar)

- Liquid Limit: 26% to 50%
- Plastic Limit: 19% to 23%
- Plasticity Index: 7% to 30%

One-dimensional consolidation test was performed on Shelby Tube sample of clayey silt from BH19-H-2 TW5 (Depth: ~3.0 m). The result of the test is summarized below:

- Moisture Content = 31.4%
- Initial Void Ratio (e_0) = 0.991
- Pre-consolidation Pressure (p'_c) = 480 kPa
- Compression Index (C_c) = 0.39
- Recompression Index (C_r) = 0.033

The results of the moisture content grain size distribution and Atterberg Limit tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution test and Atterberg Limit tests performed by EXP are also provided on Figures 5 and 8, respectively, in Appendix D. The results of tests performed by Genivar are shown on the borehole logs attached in Appendix H.

1.4.5 Silt/ Silt to Clayey Silt

A layer of silt to clayey silt was encountered below varved silty clay in EXP's borehole 19BH-H-1; below silty clay deposit in EXP's boreholes BH19-H-2 to BH19-H-4, and a layer of silt with some clay was encountered below the clayey silt to silty clay layer in Genivar's boreholes BH12-1 and BH12-3. Borehole BH19-H-2 is terminated within this layer. The approximate elevations of the surface and base of the deposit and the thickness of deposit as encountered in boreholes are summarized in Table 1.6 below:

Table 1.6. Summary of silt/ silt to clayey silt layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
BH19-H-1 (EXP)	255.5	254.3	4.6	1.2
BH19-H-2 (EXP)	256.0	254.5	3.8	1.5
BH19-H-3 (EXP)	255.9	254.6	4.0	1.3
BH19-H-4A/B (EXP)	255.2	254.6	4.6	0.6
BH12-1 (Genivar)	255.5	254.2	4.4	1.3
BH12-3 (Genivar)	254.3	251.5	5.7	2.8

The composition of this layer is silt/ molted silt, clayey silt and some clay, trace sand. The material is brown grey to grey, and wet. The SPT "N" values within this layer ranged from 17 blows per 300 mm penetration to 100 blows per 76 mm, suggesting very stiff to hard material in consistency. In-situ shear vane test ranged from 27 kPa to greater than 100 kPa, firm to very stiff consistency. The corresponding sensitivity was about 2.0 and 3.6, medium sensitivity silt/ silt to clayey silt layer.

Laboratory testing performed on selected sample consisted of moisture content, grain size distribution and Atterberg Limit tests. The test results are as follow:

Moisture Content: (EXP and Genivar)

- 8% to 22%

Grain Size Distribution: (EXP and Genivar)

- 0% to 3% gravel;
- 3% to 7% sand;
- 72% to 79% silt; and

- 18% to 22% clay

Atterberg limits: (EXP and Genivar)

- Liquid Limit: 22% to 24%
- Plastic Limit: 18% to 20%
- Plasticity Index: 2% to 5%

The results of the EXP's moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The result of the grain size distribution test and Atterberg Limit tests performed by EXP are also provided on Figures 3 and 7, respectively, in Appendix D. The results of tests performed by Genivar are shown on the borehole logs attached in Appendix H.

1.4.6 Silty Sand Till

A layer of native silty sand till was encountered in all Genivar's boreholes, below silt deposit in boreholes BH12-1 and BH12-3; below silty clay to clayey silt deposit in boreholes BH12-2 and BH12-4. Boreholes BH12-2, BH12-3 and BH12-4 are terminated within this layer. The approximate elevations of the surface and base of the deposit and the thickness of deposit as encountered in boreholes are summarized in Table 1.7 below:

Table 1.7. Summary of silty sand till layer

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
BH12-1 (Genivar)	254.2	250.9	5.7	3.3
BH12-2 (Genivar)	254.1	251.6	5.7	2.5
BH12-3 (Genivar)	254.3	251.5	5.7	2.8
BH12-4 (Genivar)	254.2	250.2	5.7	4.0

The composition of this till layer is silty sand, with some gravel and trace clay. The material is grey in color, and wet. The SPT "N" values within this layer were between 15 and 100 blows per 300 mm penetration, suggesting compact to very dense in consistency. Auger refusal was frequently encountered in this layer in Genivar's boreholes BH12-2 and BH12-4 during drilling.

Laboratory testing performed on selected sample consisted of moisture content and grain size distribution tests. The test results are as follow:

Moisture Content: (Genivar)

- 6% to 25%

Grain Size Distribution: (Genivar)

- 18% gravel;
- 41% sand;
- 33% silt; and
- 8% clay

The results of tests performed by Genivar are shown on the borehole logs attached in Appendix H.

1.4.7 Sand and Gravel Till with Cobbles and Boulder/ Gravelly Sand Till

A layer of sand and gravel till with cobbles and boulder was encountered below the silt to clayey silt in EXP's boreholes BH19-H-1, BH19-H-3 and BH19-H-4A/B; below silty sand till in Genivar's borehole BH12-1. EXP's boreholes BH19-H-1, BH19-H-3 and Genivar's borehole BH12-1 are terminated in this layer. Auger and spoon refusal were encountered in this layer in all EXP's boreholes during drilling and the till deposit was cored to advance boreholes. The approximate elevations of the surface and base of the deposit and the thickness of deposit as encountered in boreholes are summarized in Table 1.8 below:

Table 1.8. Summary of sand and gravel till with cobbles and boulder/ gravelly sand till

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)
	Top	Bottom		
BH19-H-1	254.3	244.8	5.8	9.5
BH19-H-3	254.6	254.0	5.3	0.6
BH19-H-4A/B	254.6	246.3	5.2	8.3
BH12-1 (Genivar)	250.9	248.7	9.0	2.2

The composition of this till layer is gravel and sand, with cobbles and boulder, trace to some silt, trace clay. The material is grey in color, and wet. The SPT "N" values within this layer were 50 blows per 300 mm to 50 blows per 102 mm penetration, suggesting very dense in consistency.

Laboratory testing performed on selected sample consisted of moisture content and grain size distribution test. The test results are as follow:

Moisture Content: (EXP and Genivar)

- 1% to 21.1%

Grain Size Distribution: (EXP and Genivar)

- 33% to 43% gravel;
- 43% to 46% sand;
- 18% silt; and
- 6% clay
- 11% fines

The results of the EXP's moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The result of the grain size distribution tests performed by EXP is also provided on Figure 4, in Appendix D. The results of tests performed by Genivar are shown on the borehole logs attached in Appendix H.

1.4.8 Bedrock

The bedrock was encountered below the till deposit in BH 19-H-4B at a depth about 13.6 m below the ground surface with elevation about 246.3 m. The bedrock was confirmed using coring a depth of 1.5 m.

Based on the bedrock core recovered, the bedrock is identified as metamorphosed conglomerate. In general, the bedrock sample is described as grey groundmass with medium to fine grained with well-developed foliation. The Rock Quality Designation (RQD) measured on the core samples is about 91.7%, indicating a rock mass of very good quality. Based on the International Society for Rock Mechanics and Rock Engineering classification (ISRM 1980) the rock is described as very high strength (R5 grade) with an estimated Uniaxial Compressive Strength (UCS) of between 100 and 250 MPa. Photographs of rock cores are included in Appendix E.

1.5 Groundwater Conditions

Information regarding groundwater levels at the site was obtained by measuring water levels in the open holes of all the boreholes after completion of drilling. The groundwater levels measured in the boreholes are shown on Table 1.9 and on the borehole logs. Water levels measured in open boreholes might not be stabilized due to the relatively short period of observation.

Table 1.9 Groundwater data

Borehole	Date of Drilling	Ground surface Elevation (m)	Groundwater Elevation (m)	Groundwater Depth (m)
BH19-H-1	4/11/2019	260.1	254.9	5.2
BH19-H-2	4/9/2019	259.8	Dry in open hole	
BH19-H-3	4/8/2019	259.9	256.8	3.1
BH19-H-4A/B	4/11/2019	259.8	Not measured[1]	
BH12-1 (Genivar)	5/31/2012	259.9	256.9	3.0
BH12-2 (Genivar)	6/1/2012	259.9	257.8	2.1
BH12-3 (Genivar)	6/1/2012	260.0	258.0	2.0[2]
BH12-4 (Genivar)	6/4/2012	259.9	257.7	2.2

Notes:

[1]Since wash boring technique was used to advanced borehole, accurate groundwater levels at these holes could not be measured in the open holes at the time of drilling operations.

[2]The groundwater level measured in piezometer on next day of completion of drilling.

During current investigation, four hours after borehole drilling, the unstabilized groundwater level was measured within the silty clay to clayey silt deposit approximately 3 m below ground surface (Elev. 256.9 m). However, the groundwater elevation measured in one piezometer installed during previous investigation was at about 2.0 m below ground surface (Elev. 258.0 m). Seasonal variations in the water tables should be expected, with higher levels occurring during wetter periods of the year and lower levels during drier periods.

1.6 Chemical Analyses

One (1) soil sample was selected for chemical analyses, and were sent via courier, in a secure cooler under chain of custody, to AGAT Laboratories., a CALA-certified and accredited laboratory in Mississauga, Ontario.

The sample SS3 from borehole BH19-H-3 was analyzed for corrosivity chemical analysis. The analytical results are summarized in Table 1.10 below and are presented in Appendix D.

Table 1.10. Corrosivity chemical analysis

Sample Identification	pH (unitless)	Soluble Chloride (ppm)	Soluble Sulphate (ppm)	Resistivity (ohm-cm)	Conductivity (mS/cm)	Redox Potential (mV)
BH19-H-3-SS3 Silty Clay	8.16	3750	89	156	6.4	181

1.7 Environmental Analyses

In addition to corrosivity testing, two (2) samples of fill materials from BH 19-H-2 (AG2) and BH 19-H-1 (AG1) were analyzed for metals and general inorganics parameters and BTEX/ Petroleum Hydrocarbons (PHCs) – (F1-F4), respectively. The analytical results (Certificate of Analysis) are compiled in Appendix D.

1.8 CLOSURE

A subsurface investigation is a limited sampling of a site; the subsurface conditions have been established only at the test hole locations. Should conditions at the site be encountered which differ from those reported at the test locations, we require that we be notified immediately in order to assess this additional information and our recommendations, as appropriate. It may then be necessary to perform additional investigation and analysis.

Contractors bidding on or undertaking any proposed work at this site should, relative to the subsurface conditions, decide on their own investigations, if deemed necessary, as well as their own interpretations of the factual results provided herein, so they may draw their own conclusions as to how the subsurface conditions may affect them.

This Foundation Investigation Report has been prepared by Sugitha Anandakumar, M.Eng., EIT, Nimesh Tamrakar, M.Eng., P.Eng. and Silvana Micic, Ph.D., P.Eng., and reviewed by TaeChul Kim, M.E.Sc., P.Eng. and Stan E. Gonsalves, M.Eng., P.Eng., MTO Designated Foundation Contact. The field investigation was conducted by Phillips Laframboise.

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May 30 '19
PROVINCE OF ONTARIO

Encl.

2 LIMITATIONS AND USE OF REPORT

BASIS OF REPORT

This report ("Report") is based on site conditions known or inferred by the geotechnical investigation undertaken as of the date of the Report. Should changes occur which potentially impact the geotechnical condition of the site, or if construction is implemented more than one year following the date of the Report, the recommendations of EXP may require re-evaluation.

The Report is provided solely for the guidance of design engineers and on the assumption that the design will be in accordance with applicable codes and standards. Any changes in the design features which potentially impact the geotechnical analyses or issues concerning the geotechnical aspects of applicable codes and standards will necessitate a review of the design by EXP. Additional field work and reporting may also be required.

Where applicable, recommended field services are the minimum necessary to ascertain that construction is being carried out in general conformity with building code guidelines, generally accepted practices and EXP's recommendations. Any reduction in the level of services recommended will result in EXP providing qualified opinions regarding the adequacy of the work. EXP can assist design professionals or contractors retained by the Client to review applicable plans, drawings, and specifications as they relate to the Report or to conduct field reviews during construction.

Contractors contemplating work on the site are responsible for conducting an independent investigation and interpretation of the borehole results contained in the Report. The number of boreholes necessary to determine the localized underground conditions as they impact construction costs, techniques, sequencing, equipment and scheduling may be greater than those carried out for the purpose of the Report.

Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates are based on investigations performed in accordance with the standard of care set out below and require the exercise of judgment. As a result, even comprehensive sampling and testing programs implemented with the appropriate equipment by EXPerienced personnel may fail to locate some conditions. All investigations or building envelope descriptions involve an inherent risk that some conditions will not be detected. All documents or records summarizing investigations are based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated. Some conditions are subject to change over time. The Report presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, these should be disclosed to EXP to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation conducted for the purpose of the Report.

RELIANCE ON INFORMATION PROVIDED

The evaluation and conclusions contained in the Report are based on conditions in evidence at the time of site inspections and information provided to EXP by the Client and others. The Report has been

prepared for the specific site, development, building, design or building assessment objectives and purpose as communicated by the Client. EXP has relied in good faith upon such representations, information and instructions and accepts no responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of any misstatements, omissions, misrepresentation or fraudulent acts of persons providing information. Unless specifically stated otherwise, the applicability and reliability of the findings, recommendations, suggestions or opinions EXPressed in the Report are only valid to the extent that there has been no material alteration to or variation from any of the information provided to EXP.

STANDARD OF CARE

The Report has been prepared in a manner consistent with the degree of care and skill exercised by engineering consultants currently practicing under similar circumstances and locale. No other warranty, EXPressed or implied, is made. Unless specifically stated otherwise, the Report does not contain environmental consulting advice.

COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment form part of the Report. This material includes, but is not limited to, the terms of reference given to EXP by its client ("Client"), communications between EXP and the Client, other reports, proposals or documents prepared by EXP for the Client in connection with the site described in the Report. In order to properly understand the suggestions, recommendations and opinions EXPressed in the Report, reference must be made to the Report in its entirety. EXP is not responsible for use by any party of portions of the Report.

USE OF REPORT

The information and opinions EXPressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. No other party may use or rely upon the Report in whole or in part without the written consent of EXP. Any use of the Report, or any portion of the Report, by a third party are the sole responsibility of such third party. EXP is not responsible for damages suffered by any third party resulting from unauthorised use of the Report.

REPORT FORMAT

Where EXP has submitted both electronic file and a hard copy of the Report, or any document forming part of the Report, only the signed and sealed hard copy shall be the original documents for record and working purposes. In the event of a dispute or discrepancy, the hard copy shall govern. Electronic files transmitted by EXP have utilize specific software and hardware systems. EXP makes no representation about the compatibility of these files with the Client's current or future software and hardware systems. Regardless of format, the documents described herein are EXP's instruments of professional service and shall not be altered without the written consent of EXP.

Appendix A – Photographs

Photo 1: Haileybury Patrol Yard - existing sand dome, borehole BH19-H-1 facing south

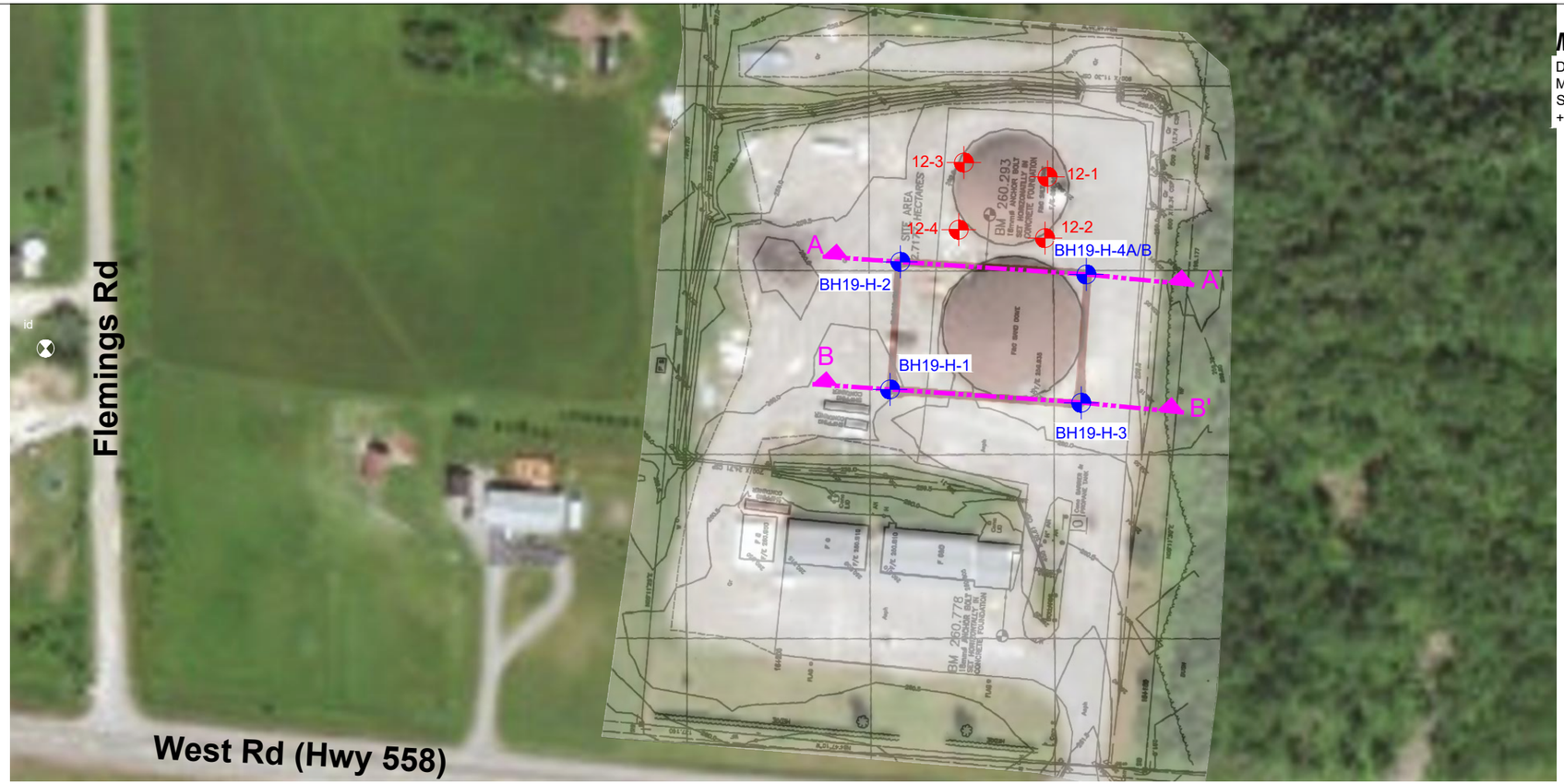
Photo 2: Haileybury Patrol Yard, borehole BH19-H-2 facing north

Photo 3: Haileybury Patrol Yard - existing Gambrel style shed and sand dome, borehole BH19-H-3 facing southeast

Photo 4: Haileybury Patrol Yard - existing sand/salt dome, borehole BH19-H-4A/B facing northwest

Photo 5: Sand and Gravel Till Cores with Cobbles and Boulder from BH19-H-1

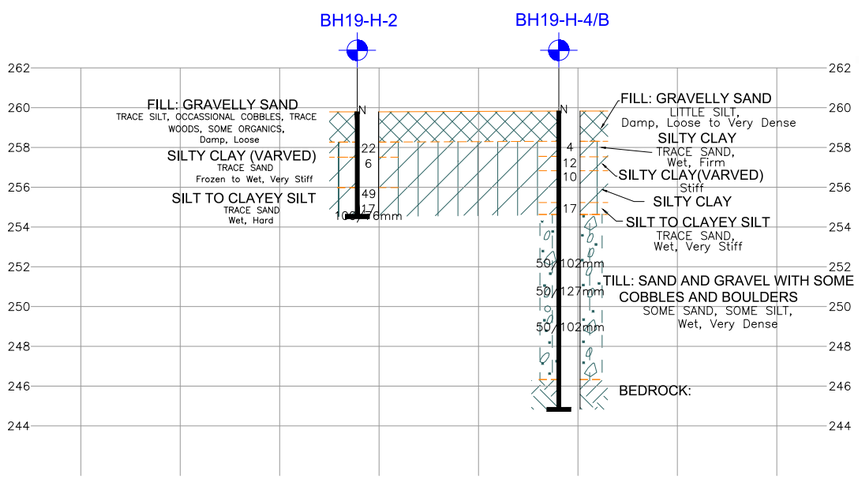
Appendix B – Drawings

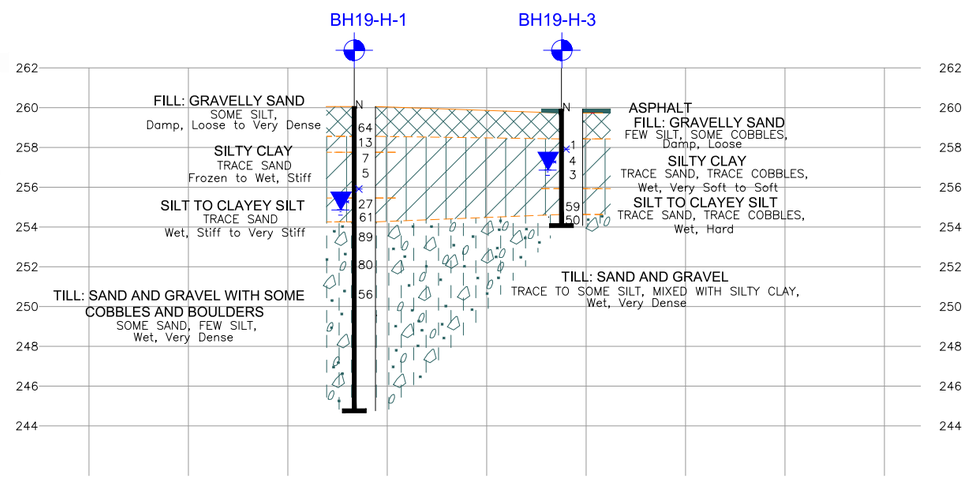


PLAN

METRIC

DIMENSIONS ARE IN METERS AND/OR MILLMETERS UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETERS +METERS





SECTION A-A'

SECTION B-B'

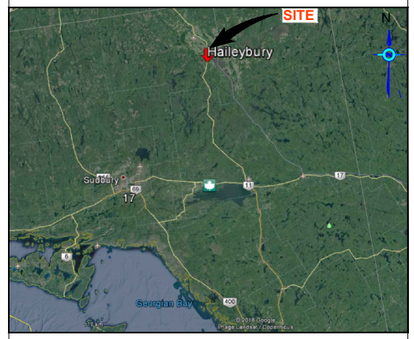
CONT. No. 5015-E-0007
GWP No. -
Assignment No. 10

Various Patrol Yards, Sudbury and North Bay Areas
PATROL YARD AT HAILEYBURY
ON HWY 558 (West Rd)
BOREHOLE LOCATION PLAN AND SOIL STRATA

SHEET 1

exp. **exp Services Inc.**

KEY PLAN



LEGEND

- Borehole Location
- Existing Borehole Location
- N — Standard Penetration Test (Blows/0.3 m)
- Groundwater level measured in open hole

SOIL STRATA SYMBOLS

- ASPHALT
- FILL
- SILTY CLAY (VARVED) CLAYEY SILT
- TILL: SAND AND GRAVEL WITH SOME COBBLES AND BOULDERS
- BEDROCK

BH No.	ELEV.	MTM CO-ORDINATES (ZONE ON-10)	
		NORTHING	EASTING
BH19-H-1	260.1	5257089	288605
BH19-H-2	259.8	5257124	288607
BH19-H-3	259.9	5257085	288657
BH19-H-4A	259.8	5257119	288658
BH19-H-4B	259.8	5257119	288658

NOTES

This drawing is for subsurface information only. The proposed structure details/ works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents

The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in the report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

SCALE: HOR 0 5 30 m; VERT 0 6 m

	SM	SUBMISSION FOR MTO REVIEW
DATE	BY	DESCRIPTION
		GEOCRES NO. 31M-126
		PROJECT NO. ADM-00233185-K0
SUBM'D SH	CHECKED SM	DATE May. 30, 19
DRAWN SH	CHECKED SM	APPROVED SG DWG. 1

Appendix C – Borehole Logs

Explanation of Terms Used on Borehole Records

SOIL DESCRIPTION

Terminology describing common soil genesis:

Topsoil: mixture of soil and humus capable of supporting good vegetative growth.

Peat: fibrous fragments of visible and invisible decayed organic matter.

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 geotechnical site investigation.

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.

Terminology describing soil structure:

Desiccated: having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.

Stratified: alternating layers of varying material or color with the layers greater than 6 mm thick.

Laminated: alternating layers of varying material or color with the layers less than 6 mm thick.

Fissured: material breaks along plane of fracture.

Varved: composed of regular alternating layers of silt and clay.

Slickensided: fracture planes appear polished or glossy, sometimes striated.

Blocky: cohesive soil that can be broken down into small angular lumps which resist further breakdown.

Lensed: inclusion of small pockets of different soil, such as small lenses of sand scattered through a mass of clay; not thickness.

Seam: a thin, confined layer of soil having different particle size, texture, or color from materials above and below.

Homogeneous: same color and appearance throughout.

Well Graded: having wide range in grain sized and substantial amounts of all predominantly on grain size.

Uniformly Graded: predominantly on grain size.

All soil sample descriptions included in this report follow generally the ASTM D2487-11 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) with some modification to reflect current MTO practices. The system divides soils into three major categories: (1) coarse grained, (2) fine-grained, and (3) highly organic. The soil is then subdivided based on either gradation or plasticity characteristics. The system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification. The classification excludes particles larger than 76 mm. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually in accordance with ASTM D2488-09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems. Others may use different classification systems; one such system is the ISSMFE Soil Classification.

ISSMFE SOIL CLASSIFICATION

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

0.002	0.006	0.02	0.06	0.2	0.6	2.0	6.0	20	60	200

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

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

UNIFIED SOIL CLASSIFICATION

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present and as described below in accordance with Note 16 in ASTM D2488-09a:

Table a: Percent or Proportion of Soil, Pp

	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5≤Pp≤10%
Little	15≤Pp≤25%
Some	30≤Pp≤45%
Mostly	50≤Pp≤100%

The standard terminology to describe cohesionless soils includes the compactness as determined by the Standard Penetration Test 'N' value:

Table b: Apparent Density of Cohesionless Soil

	'N' Value (blows/0.3 m)
Very Loose	N<5
Loose	5≤N<10
Compact	10≤N<30
Dense	30≤N<50
Very Dense	50≤N

The standard terminology to describe cohesive soils includes consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests or similar field and laboratory analysis, Standard Penetration Test 'N' values can also be used to provide an approximate indication of the consistency and shear strength of fine grained, cohesive soils:

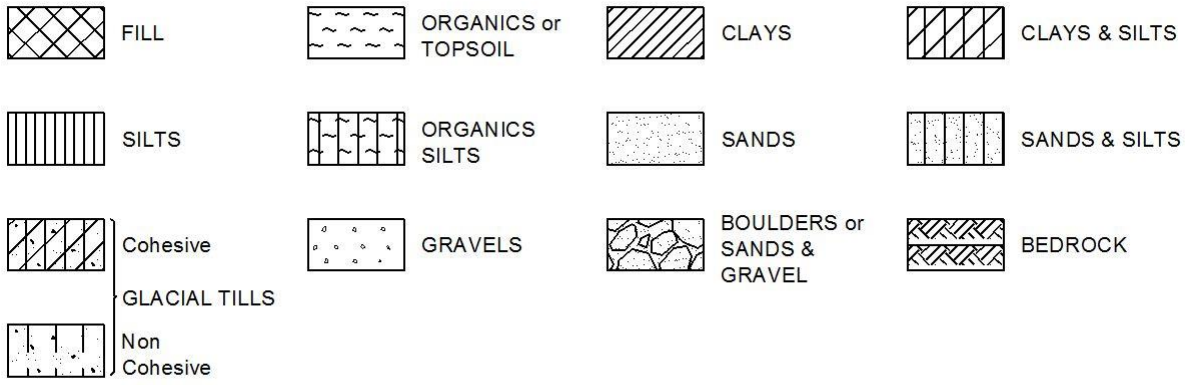
Table c: Consistency of Cohesive Soil

Consistency	Vane Shear Measurement (kPa)	'N' Value
Very Soft	<12.5	<2
Soft	12.5-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

Note: 'N' Value - The Standard Penetration Test records the number of blows of a 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler 1 foot (305mm). For split spoon samples where full penetration is not achieved, the number of blows is reported over the sampler penetration in meters (e.g. 50/0.15).

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



WATER LEVEL MEASUREMENT

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

SS	Split spoon sample (obtained from the Standard Penetration Test)
WS	Wash sample
BS	Bulk sample
TW	Thin wall sample or Shelby tube
PS	Piston sample
AS	Auger sample
VT	Vane test
GS	Grab sample
HQ, NQ, etc.	Rock core samples obtained with the use of standard size diamond drilling bits

STRESS AND STRAIN

u_w	kPa	Pore water pressure
r_u	1	Pore pressure ratio
σ	kPa	Total normal stress
σ'	kPa	Effective normal stress
τ	kPa	Shear stress
$\sigma_1, \sigma_2, \sigma_3$	kPa	Principal stresses
ε	%	Linear strain
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	Principal strains
E	kPa	Modulus of linear deformation
G	kPa	Modulus of shear deformation
μ	1	Coefficient of friction

MECHANICALL PROPERIES OF SOIL

m_v	kPa^{-1}	Coefficient of volume change
c_c	1	Compression index
c_s	1	Swelling index
c_r	1	Recompression index
c_v	m^2/s	Coefficient of consolidation
H	m	Drainage path
T_V	1	Time factor
U	%	Degree of consolidation
σ'_{v0}	kPa	Effective overburden pressure
σ'_P	kPa	Preconsolidation pressure
τ_f	kPa	Shear strength
c'	kPa	Effective cohesion intercept
ϕ'	$-^\circ$	Effective angle of internal friction
c_u	kPa	Apparent cohesion intercept
ϕ_u	$-^\circ$	Apparent angle of internal friction
τ_R	kPa	Residual shear strength
τ_r	kPa	Remoulded shear strength
S_t	1	Sensitivity = c_u/τ_r

PHYSICAL PROPERTIES OF SOIL

P_s	kg/m^3	Density of solid particles
γ_s	kN/m^3	Unit weight of solid particles
ρ_w	kg/m^3	Density of water
γ_w	kN/m^3	Unit weight of water
ρ	kg/m^3	Density of soil
γ	kN/m^3	Unit weight of soil
ρ_d	kg/m^3	Density of dry soil
γ_d	kN/m^3	Unit weight of dry soil
ρ_{sat}	kg/m^3	Density of saturated soil
γ_{sat}	kN/m^3	Unit weight of saturated soil
ρ'	kg/m^3	Density of submerged soil
γ'	kN/m^3	Unit weight of submerged soil
e	1, %	Void ratio
n	1, %	Porosity
w	1, %	Water content
S_r	%	Degree of saturation
W_L	%	Liquid limit
W_P	%	Plastic limit
W_s	%	Shrinkage limit
I_P	%	Plasticity index = $(W_L - W_P)$
I_L	%	Liquidity index = $(W - W_P)/I_P$
I_C	%	Consistency index = $(W_L - W)/I_P$
e_{max}	1, %	Void ratio in loosest state
e_{min}	1, %	Void ratio in densest state
I_D	1	Density index = $(e_{max} - e)/(e_{max} - e_{min})$
D	mm	Grain diameter
D_n	mm	N percent - diameter
C_u	1	Uniformity coefficient
h	m	Hydraulic head or potential
q	m^3/s	Rate of discharge
v	m/s	Discharge velocity
i	1	Hydraulic gradient
k	m/s	Hydraulic conductivity
j	kN/m^3	Seepage force

RECORD OF BOREHOLE No 19-H-1

1 OF 2 **METRIC**

W.P. _____ LOCATION Haileybury Patrol Yard, West Road, Haileybury ON, MTM ON10 ORIGINATED BY PL

DIST Timiskaming HWY 11 BOREHOLE TYPE CME 55, Hollow stem auger drill, NW Casing COMPILED BY NT/ SA

DATUM Geodetic DATE 2019.04.08 - 2019.04.11 LATITUDE 47.452875 LONGITUDE 79.714836 CHECKED BY SM

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
260.1	Ground Surface							
0.0	**FILL: GRAVELLY SAND** some silt, brown, damp, loose to very dense	1	AS		17	67		(16)
	- becoming gravelly sand fill changing to silty clay, trace sand, frozen	2	SS	64				
258.6								
1.5	**SILTY CLAY** trace sand, brown to grey, some orange mottling, frozen to wet, stiff	3	SS	13				
257.8								
2.3	**SILTY CLAY (VARVED)** trace sand, brown to grey, some orange mottling, frozen to wet, firm to stiff	4	SS	7	0	2	53	45
		5	SS	5				
255.5								
4.6	**SILT TO CLAYEY SILT** trace sand, grey, wet, stiff to very stiff	6	SS	27	1	7	74	18
		7	SS	61				
254.3	-Auger and Spoon refusal @ 5.8 m, start coring to advance borehole							
5.8	**TILL: SAND AND GRAVEL WITH SOME COBBLES AND BOULDERS** some sand, few silt, grey, wet, very dense	8	NQ					
	Run 1 Length 0.28 m	9	SS	89				
	Run 2 Length 0.79 m	10	NQ					
	Run 3 Length 0.88 m	11	SS	80	43	46		(11)
		12	NQ					
	Run 4 Length 0.77 m	13	SS	56				
	-Attempted to drive spoon @ 10.67 m. Spoon bouncing.	14	NQ					
	Run 5 Length 1.52 m	15	NQ					

GROUND WATER CONDITIONS: ▽

ELEVATION SCALE: 260, 259, 258, 257, 256, 255, 254, 253, 252, 251, 250, 249

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × P. PENETROMETER
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
20 40 60

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)

Vane attempted no shear

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Continued Next Page

RECORD OF BOREHOLE No 19-H-1 2 OF 2 METRIC

W.P. _____ LOCATION Haileybury Patrol Yard, West Road, Haileybury ON, MTM ON10 ORIGINATED BY PL

DIST Timiskaming HWY 11 BOREHOLE TYPE CME 55, Hollow stem auger drill, NW Casing COMPILED BY NT/ SA

DATUM Geodetic DATE 2019.04.08 - 2019.04.11 LATITUDE 47.452875 LONGITUDE 79.714836 CHECKED BY SM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × P. PENETROMETER 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	TILL: SAND AND GRAVEL WITH SOME COBBLES AND BOULDERS some sand, few silt, grey, wet, very dense *(continued)*						248				
	Run 6 Length 1.53 m		16	NQ			247				
	-Attempted to drive spoon @ 13.72 m. Spoon bouncing. Run 7 Length 1.57 m		17	NQ			246				
244.8							245				
15.3	**End of borehole at 15.3 m depth.**										

Notes:
1. This record of borehole is to be read with the report presented above.
2. Groundwater level was measured in open hole before starting coring.
3. Groundwater level measured at 5.18 m below ground surface.

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO HAILEYBURY BH LOGS.GPJ ONTARIO MTO.GDT 5/29/19

RECORD OF BOREHOLE No 19-H-2

1 OF 1 **METRIC**

W.P. _____ LOCATION Haileybury Patrol Yard, West Road, Haileybury ON, MTM ON10 ORIGINATED BY PL

DIST Timiskaming HWY 11 BOREHOLE TYPE CME 55, Hollow stem auger drill COMPILED BY NT/ SA

DATUM Geodetic DATE 2019.04.09 - 2019.04.09 LATITUDE 47.453216 LONGITUDE 79.714774 CHECKED BY SM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × P. PENETROMETER 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
259.8	Ground Surface										
0.0	**FILL: GRAVELLY SAND** trace silt, occassional cobbles, trace woods, some organics, blackish brown, damp, loose		1	AS							
	- becoming gravelly sand fill changing to silty clay, trace wood, some organics, frozen		2	AS			259				
258.3											
1.5	**SILTY CLAY (VARVED)** trace sand, brown to grey, some orange mottling, frozen to wet, very stiff		3	SS	22		258				
257.5											
2.3	**SILTY CLAY** trace sand, brown to grey, wet, firm		4	SS	6		257				
			5	TW							0 1 42 57 Vane attempted no shear
256.0											
3.8	**SILT TO CLAYEY SILT** trace sand, brown to grey, wet, hard		6	SS	49		256				3 3 72 22
			7	SS	17		255				
254.5			8	SS	100/ 76mm						
5.3	**Auger and Spoon refusal @ 5.26 m on possible till with cobbles and boulders** **End of borehole at 5.26 m depth.**										

Notes:
1. This record of borehole is to be read with the report presented above.
2. No groundwater encountered in open hole upon completion of drilling.
3. Borehole open up to 5.2 m below ground surface upon completion of drilling.

+ ³, × ³: Numbers refer to Sensitivity ○ ³% STRAIN AT FAILURE

ONTARIO MTO HAILEYBURY BH LOGS.GPJ ONTARIO MTO.GDT 5/29/19

RECORD OF BOREHOLE No 19-H-3

1 OF 1 **METRIC**

W.P. _____ LOCATION Haileybury Patrol Yard, West Road, Haileybury ON, MTM ON10 ORIGINATED BY PL

DIST Timiskaming HWY 11 BOREHOLE TYPE CME 55, Hollow stem auger drill COMPILED BY NT/ SA

DATUM Geodetic DATE 2019.04.08 - 2019.04.08 LATITUDE 47.452777 LONGITUDE 79.714135 CHECKED BY SM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × P. PENETROMETER 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
259.9	Ground Surface										
259.7 0.0	<<B>ASPHALT **178 mm asphalt**										
0.2	**FILL: GRAVELLY SAND** few silt, some cobbles, brown, damp, loose		1	AS					○		21 70 (9)
	-unable to drive spoon due to cobbles, becoming gravelly sand fill changing to silty clay		2	AS			259		○		
258.4											
1.5	**SILTY CLAY** trace sand, trace cobbles, brown to grey, orange mottling, wet, very soft to soft		3	SS	1		258		○		
	-sample disturbed by attempted vane		4	SS	4*				○		Vane attempted no shear
	-sample disturbed by attempted vane		5	SS	3*	▽	257		○		Vane attempted no shear 0 4 55 41
255.9							256	2.0 +			
4.0	**SILT TO CLAYEY SILT** trace sand, trace cobbles, brown to grey, orange mottling, wet, hard			VANE					○		
			6	SS	59		255		○		2 4 75 19
254.6											
5.3	**TILL: SAND AND GRAVEL** trace to some silt, mixed with silty clay, grey wet, very dense		7	SS	50				○		
254.0											
5.9	**Auger and Spoon refusal @ 5.9 m on till with cobbles and boulders End of borehole at 5.9 m depth.**										

Notes:
1. This record of borehole is to be read with the report presented above.
2. Borehole open up to 4.3 m below ground surface upon completion of drilling.
3. Groundwater level was measured at 3.05 m depth in open hole upon completion of drilling.
* sample disturbed by attempted vane

+ ³, × ³: Numbers refer to Sensitivity ○ ³% STRAIN AT FAILURE

ONTARIO MTO HAILEYBURY BH LOGS.GPJ ONTARIO MTO.GDT 5/29/19

RECORD OF BOREHOLE No 19-H-4A

1 OF 1 **METRIC**

W.P. _____ LOCATION Haileybury Patrol Yard, West Road, Haileybury ON, MTM ON10 ORIGINATED BY PL

DIST Timiskaming HWY 11 BOREHOLE TYPE CME 55, Hollow stem auger drill, NW Casing COMPILED BY NT/ SA

DATUM Geodetic DATE 2019.04.09 - 2019.04.11 LATITUDE 47.453173 LONGITUDE 79.714139 CHECKED BY SM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × P. PENETROMETER 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
259.8	Ground Surface										
0.0	**FILL: GRAVELLY SAND** little silt, brown, damp, loose to very dense		1	AS					○		14 71 (15)
	- Unable to drive spoon. Becoming gravelly sand fill changing to silty clay, trace sand, wet		2	AS			259		○		
258.3											
1.5	**SILTY CLAY** trace sand, brown , wet, firm		3	SS	4		258		○		0 2 53 45
257.5											
2.3	**SILTY CLAY (VARVED)** trace sand, brown to grey, wet, stiff - Shelby tube broken off in hole, spoon sample taken within shelby tube		4	SS	12				○		
256.9							257				
2.9	-Unable to advance auger due to broken shelby tube in hole. Relocate borehole 1 m to south, see BH19-H-4B for further detail										
	End of borehole at 2.9 m depth.										
	Notes: 1. This record of borehole is to be read with the report presented above.										

$+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No 19-H-4B

1 OF 2 **METRIC**

W.P. _____ LOCATION Haileybury Patrol Yard, West Road, Haileybury ON, MTM ON10 ORIGINATED BY PL

DIST Timiskaming HWY 11 BOREHOLE TYPE CME 55, Hollow stem auger drill, NW Casing COMPILED BY NT/ SA

DATUM Geodetic DATE 2019.04.09 - 2019.04.11 LATITUDE 47.453173 LONGITUDE 79.714139 CHECKED BY SM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
259.8	Ground Surface						259
0.0	- Auger advanced to 3.05 m depth, see BH19-H-4A for detail						258
256.8							257
3.0	**SILTY CLAY** trace sand, grey with brown mottling, wet, stiff		5	SS	10		
			6	TW			256
255.2							
4.6	**SILT TO CLAYEY SILT** trace sand, grey with brown mottling, wet, very stiff		7	SS	17		255
254.6							
5.2	-Auger and Spoon refusal @ 5.18 m, switch to coring to advance borehole		8	NQ			
	TILL: SAND AND GRAVEL WITH SOME COBBLES AND BOULDERS some sand, some silt, grey, wet, very dense		9	NQ			254
	Run 1 Length 0.74 m						
	Run 2 Length 0.12 m		10	SS	50/ 102mm		
	Run 3 Length 0.74 m		11	NQ			252
			12	SS	50/ 127mm		
	Run 4 Length 1.71 m		13	NQ			250
			14	SS	50/ 102mm		
	Run 5 Length 1.14 m		15	NQ			249
							248

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × P. PENETROMETER
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	1	56	43

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO HAILEYBURY BH LOGS.GPJ ONTARIO MTO.GDT 5/29/19

RECORD OF BOREHOLE No 19-H-4B 2 OF 2 METRIC

W.P. _____ LOCATION Haileybury Patrol Yard, West Road, Haileybury ON, MTM ON10 ORIGINATED BY PL

DIST Timiskaming HWY 11 BOREHOLE TYPE CME 55, Hollow stem auger drill, NW Casing COMPILED BY NT/ SA

DATUM Geodetic DATE 2019.04.09 - 2019.04.11 LATITUDE 47.453173 LONGITUDE 79.714139 CHECKED BY SM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × P. PENETROMETER 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	TILL: SAND AND GRAVEL WITH SOME COBBLES AND BOULDERS some sand, some silt, grey, wet, very dense *(continued)*									
	Run 6 Length 1.46 m		16	NQ			247			
246.3										
13.5	**BEDROCK:** metamorphosed conglomerate, medium to fine grained, grey groundmass with well developed foliation, strong NQ Coring						246			
	Length (m) RQD(%) Run 7 1.5 91.7%		17	NQ						
244.8							245			
15.0	**End of borehole at 15.0 m depth.**									

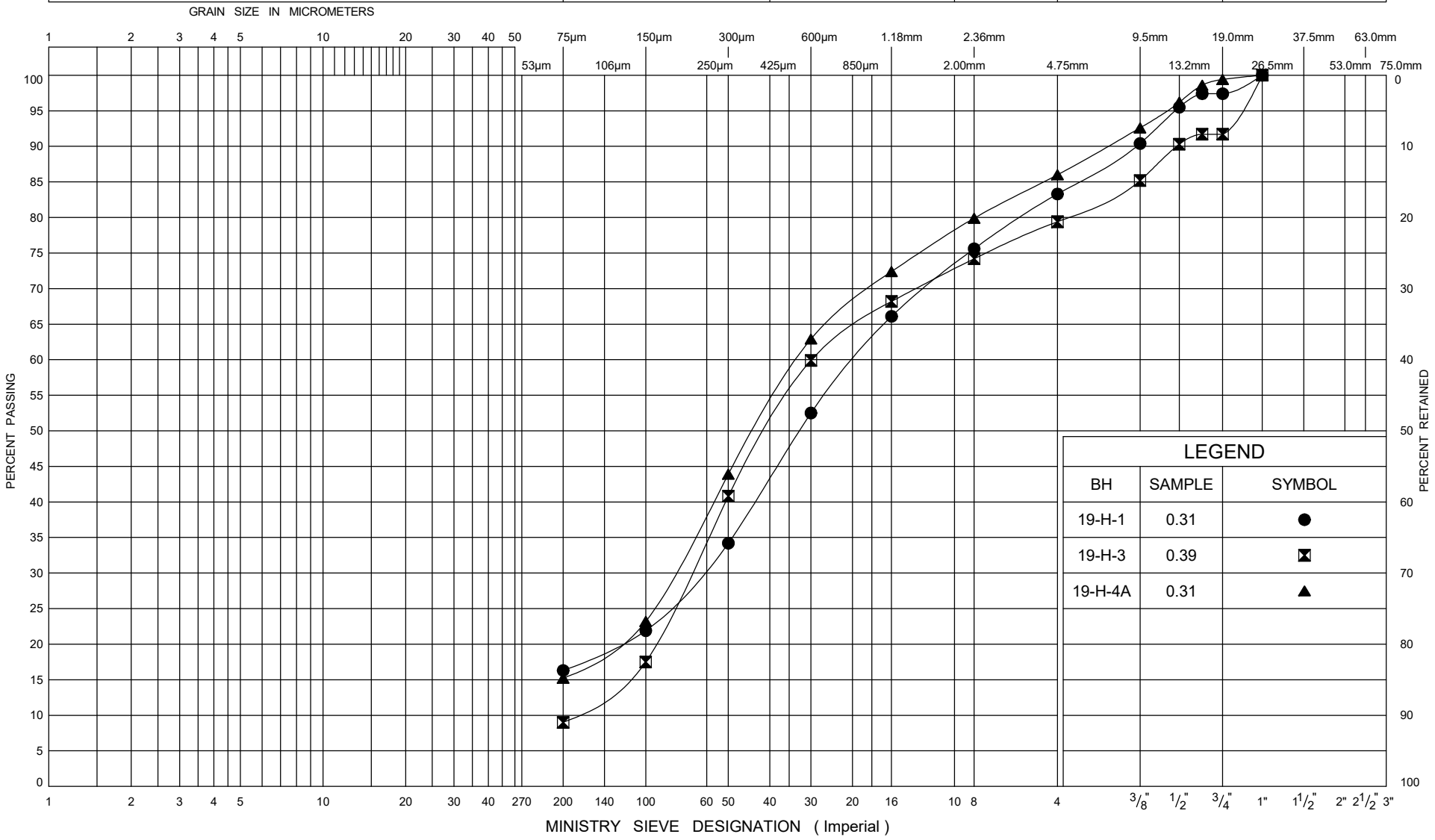
Notes:
1. This record of borehole is to be read with the report presented above.
2. Since water was used to advanced borehole, no groundwater level was measured in open hole.

$+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO HAILEYBURY BH LOGS.GPJ ONTARIO MTO.GDT 5/29/19

Appendix D – Laboratory Data

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

Gravelly Sand Fill

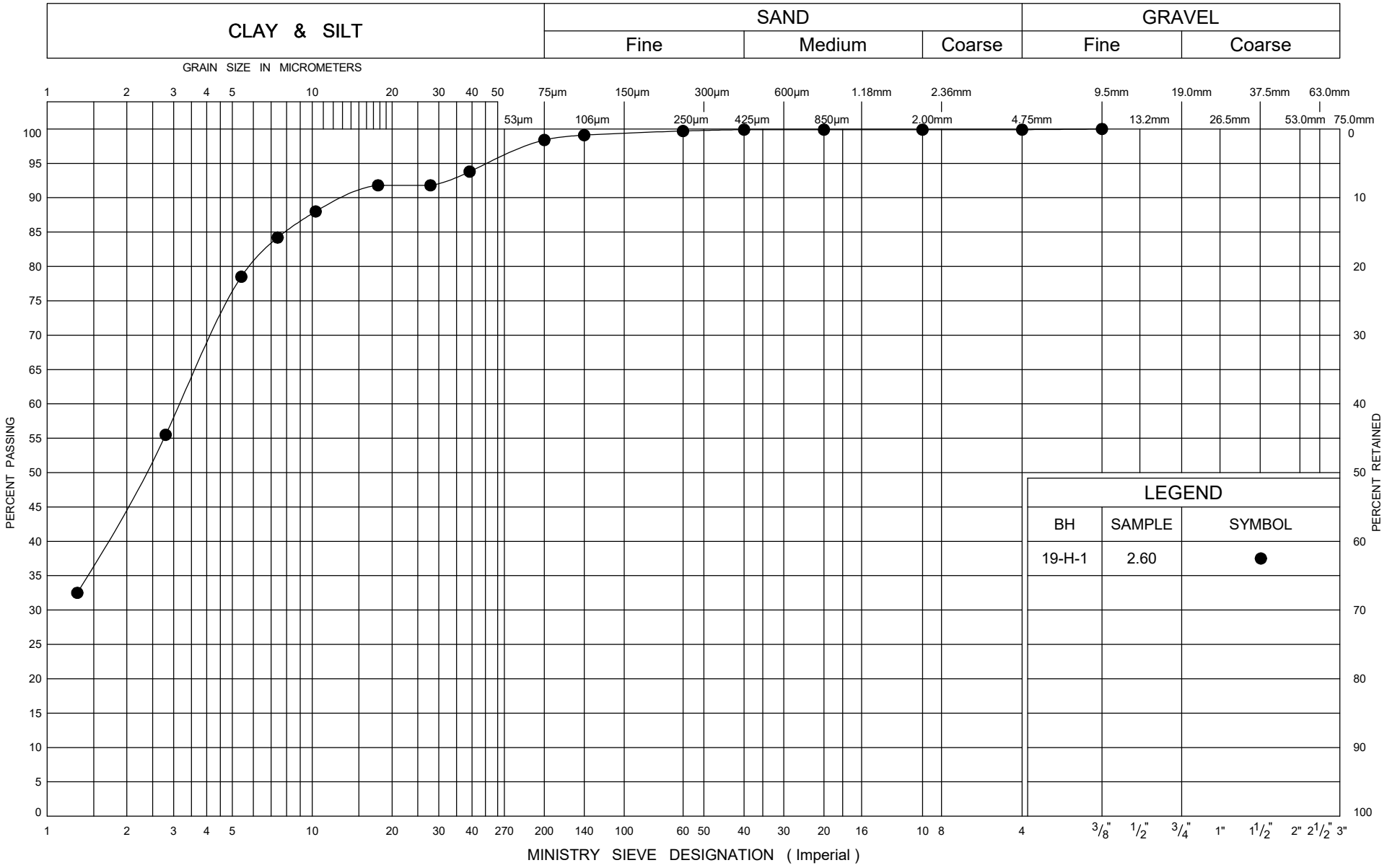
FIG No 1

W P

5015-E-0007, Assignment 10

ONTARIO MOT GRAIN SIZE HAILEYBURY BH LOGS.GPJ ONTARIO MOT.GDT 5/14/19

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

Silty Clay (Varved)

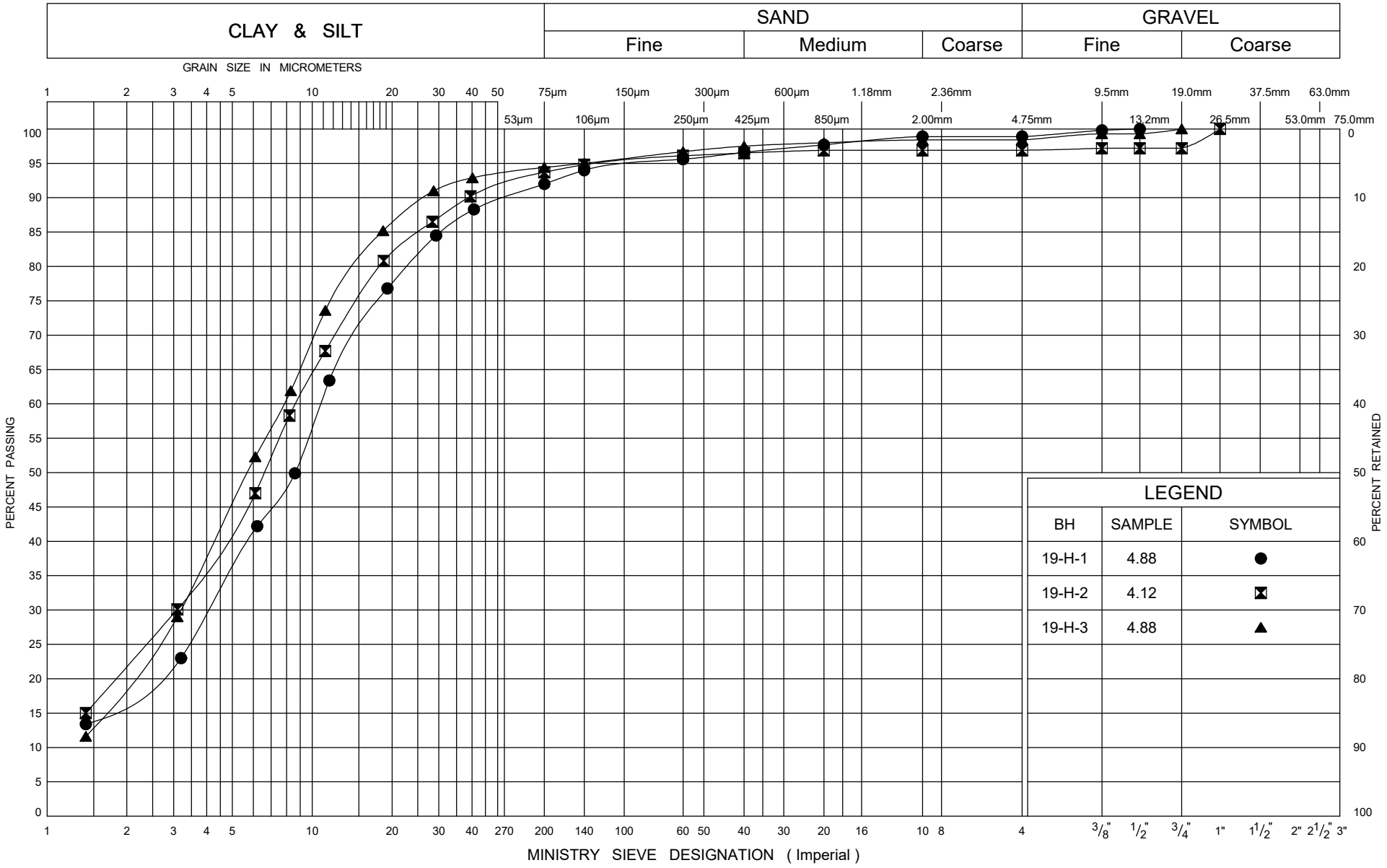
FIG No 2

W P

5015-E-0007, Assignment 10

ONTARIO MOT GRAIN SIZE HAILEYBURY BH LOGS.GPJ ONTARIO MOT.GDT 5/14/19

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

Silt to Clayey Silt

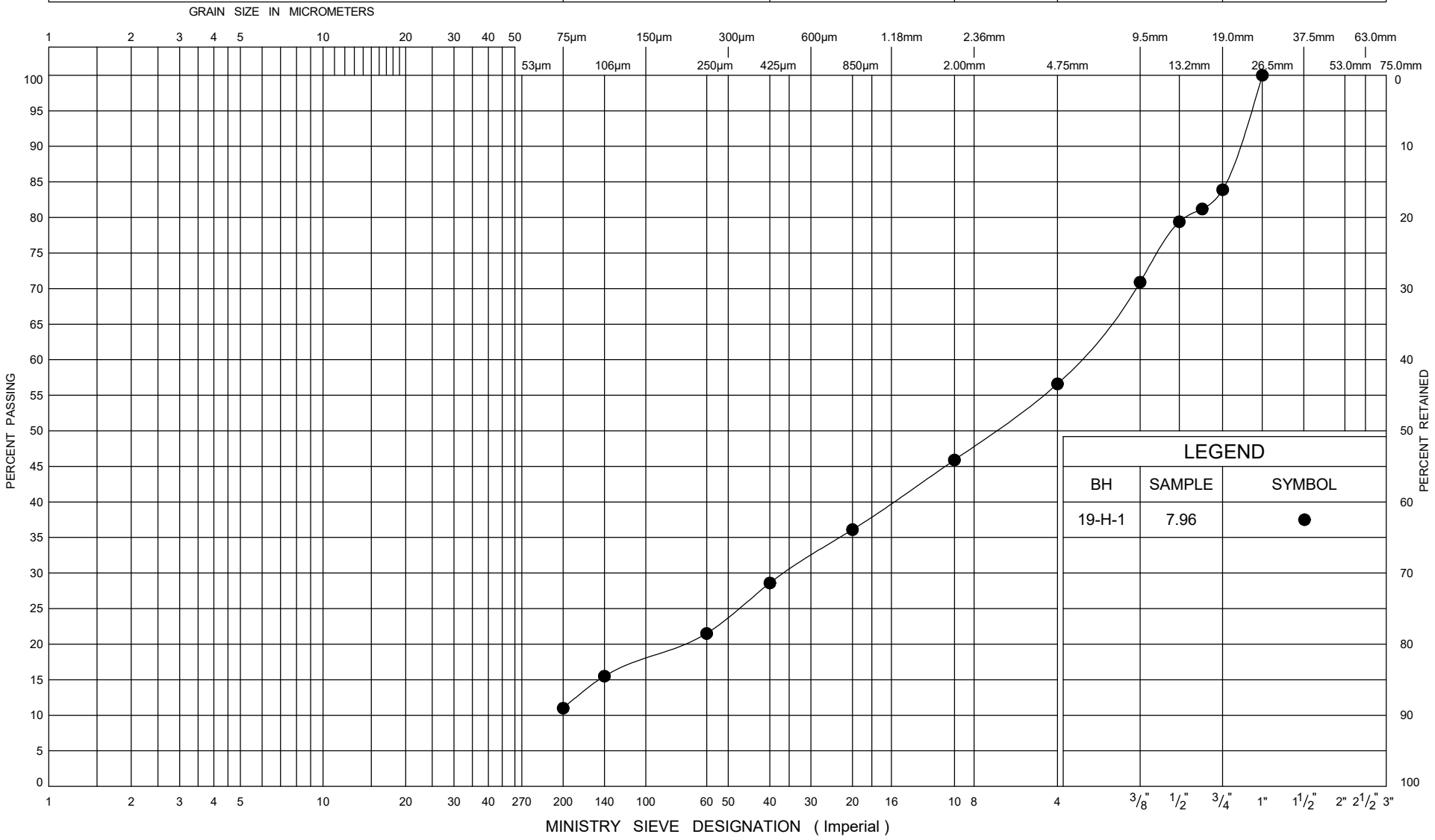
FIG No 3

W P

5015-E-0007, Assignment 10

ONTARIO MOT GRAIN SIZE HAILEYBURY BH LOGS.GPJ ONTARIO MOT.GDT 5/14/19

UNIFIED SOIL CLASSIFICATION SYSTEM



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Ontario

GRAIN SIZE DISTRIBUTION

Sand and Gravel Till

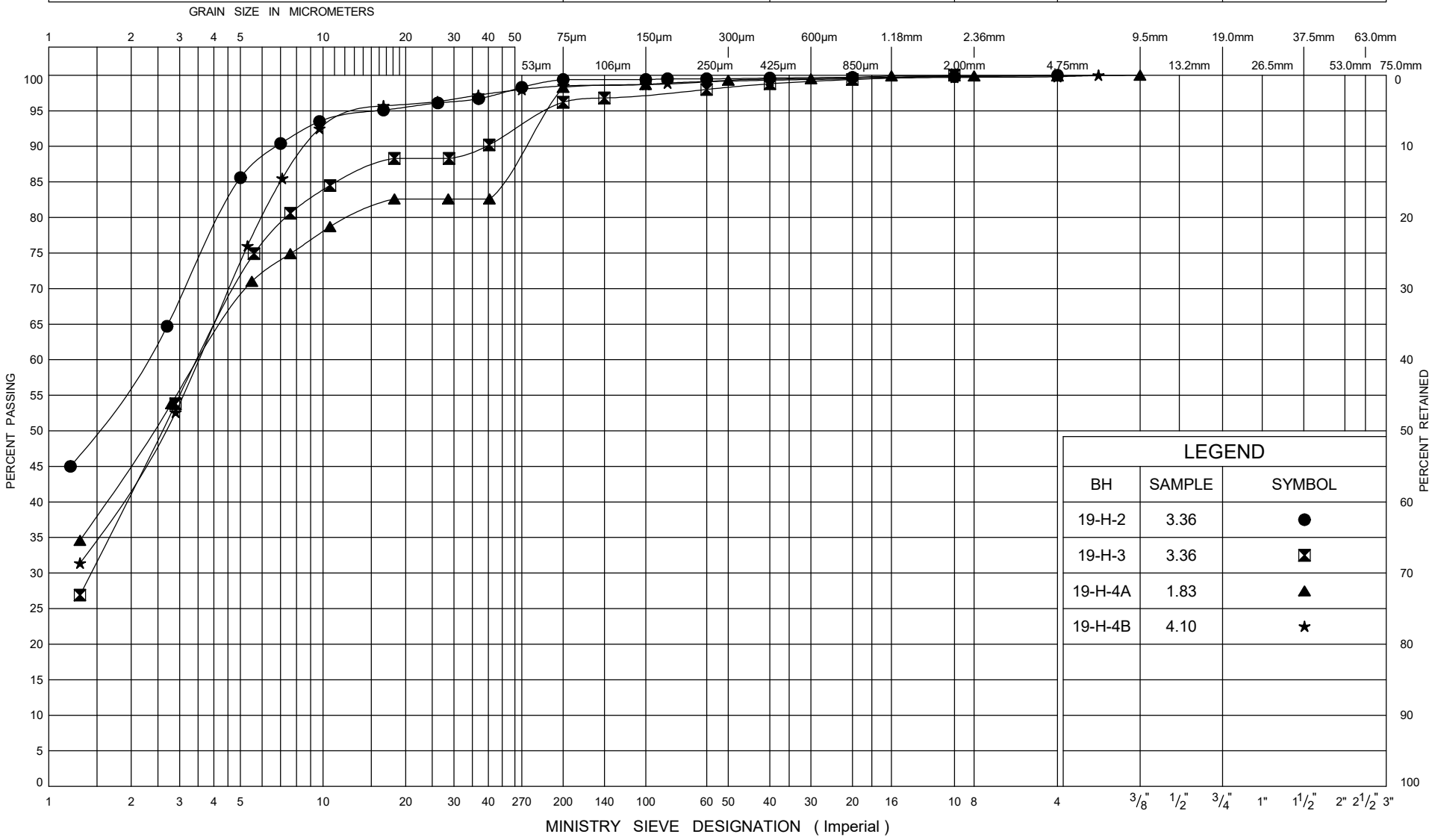
FIG No 4

W P

5015-E-0007, Assignment 10

ONTARIO MOT GRAIN SIZE HAILEYBURY BH LOGS.GPJ ONTARIO MOT.GDT 5/14/19

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

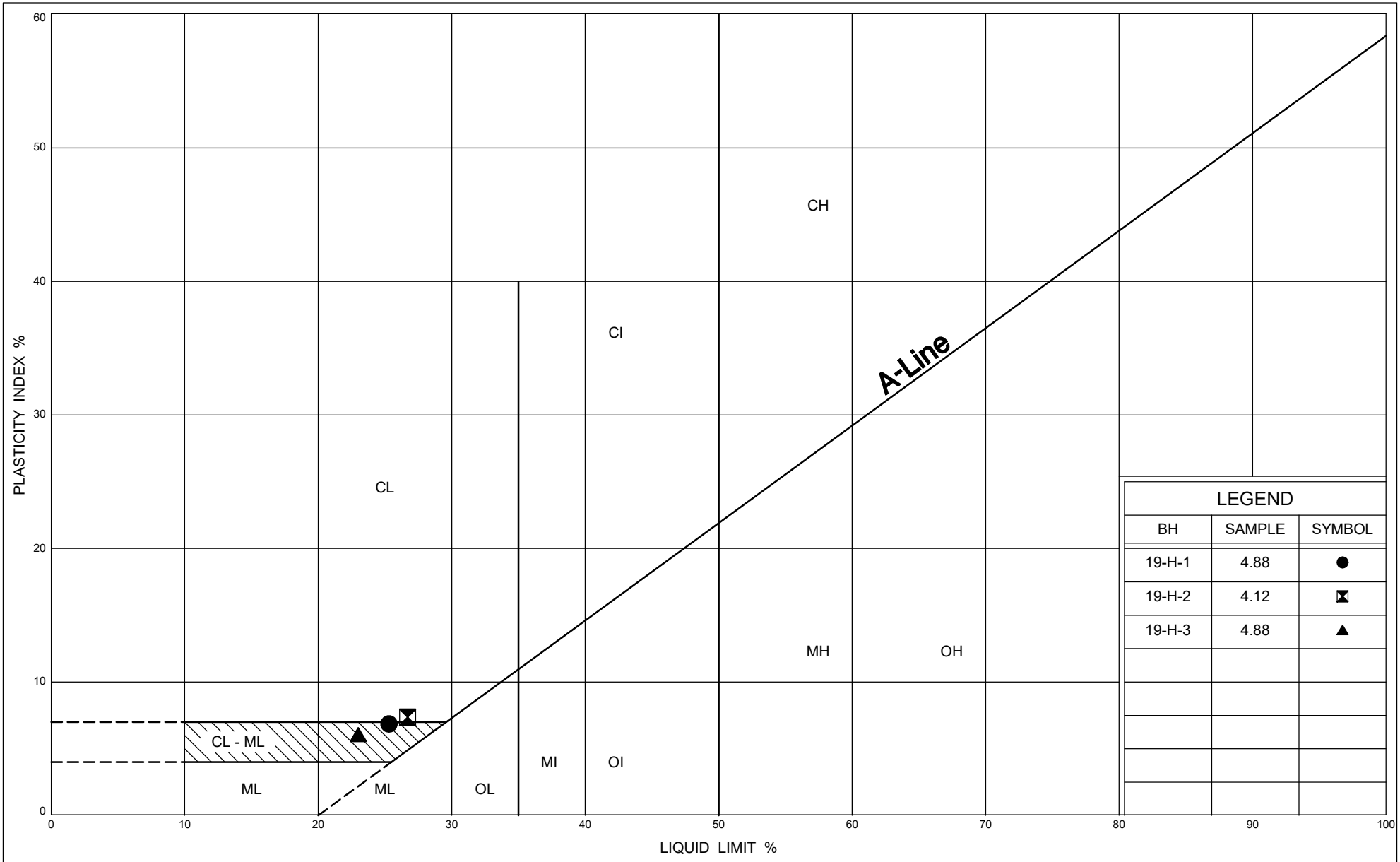
Silty Clay

FIG No 5

W P

5015-E-0007, Assignment 10

ONTARIO MOT GRAIN SIZE HAILEYBURY BH LOGS.GPJ ONTARIO MOT.GDT 5/14/19



ONTARIO MOT PLASTICITY CHART HAILEYBURY BH LOGS.GPJ ONTARIO MOT.GDT 5/14/19

Ministry of Transportation
Ontario

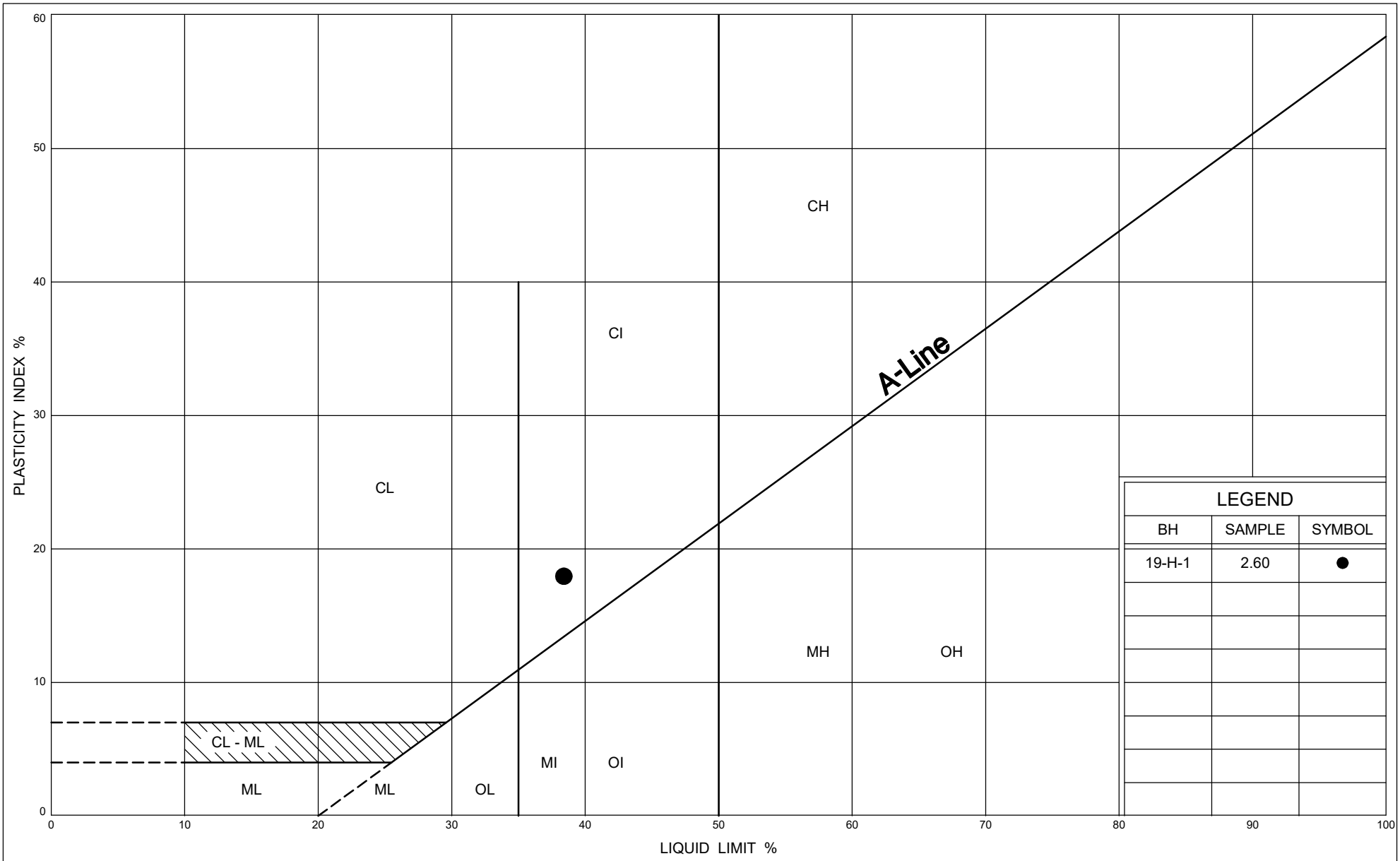
PLASTICITY CHART

Silt to Clayey Silt

FIG No 7

W P

5015-E-0007, Assignment 10



ONTARIO MOT PLASTICITY CHART HAILEYBURY BH LOGS.GPJ ONTARIO MOT.GDT 5/14/19

Ministry of Transportation
Ontario

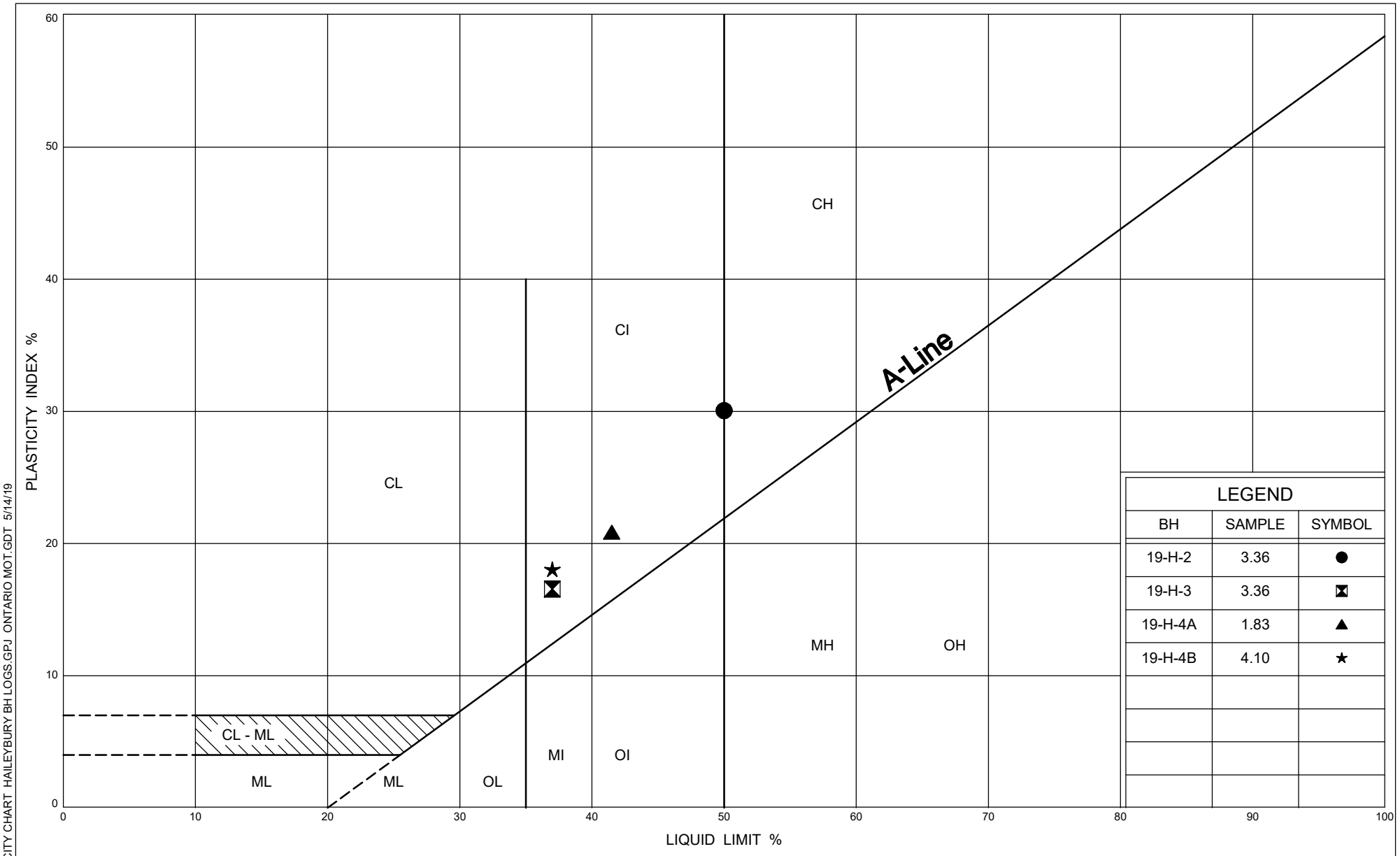
PLASTICITY CHART

Silty Clay (Varved)

FIG No 6

W P

5015-E-0007, Assignment 10



Ministry of Transportation
Ontario

PLASTICITY CHART

Silty Clay

FIG No 8

W P

5015-E-0007, Assignment 10

ONTARIO MOT PLASTICITY CHART HAILEYBURY BH LOGS.GPJ ONTARIO MOT.GDT 5/14/19

exp Services Inc.

1595 Clark Boulevard
Brampton, ON
L6T 4V1
Tel.: 905-793-9800
Fax: 905-793-0641

Consolidation Test Summary Data Sheet (ASTM: D 2435)

Project No.: adm-00233185-k0 adm-300

Project Name: MTO-Haileybury

Borehole No. BH 19-H-2

Client Job No.:

Sample No. Shelby-

Sample Location:

Depth: 10'-12'

Sample Description: Silty Clay, trace Sand; brown; Stiff; Desiccated

Water Content Determination	Before Test		After Test
	Specimen	Trimmings	Specimen
Wt. of wet sample + Ring (tare) - g	220.48	215.37	216.78
Wt. of dry sample + Ring (tare) - g	189.12	161.32	189.12
Wt. of water (W_w) - g	31.36	54.05	27.66
Wt. of Ring - g	101.08	3.16	101.08
Wt. of dry soil (Ws) - g	88.04	158.16	88.04
Water Content (W) - %	35.6	34.2	31.4
Average (W) - %	34.9		31.4

Apparatus:

Machine No.	2
Cell No.	2
Ring No.	2
Diameter of Ring (in) :	2.5
Height of Ring - H_1 (in):	0.7835
Area of Ring (in^2) :	4.9087

Load Factor: 1.55 lb. on Hanger

500 lb/ft2 on Sample

Test Data

Initial Dial Reading (in) :	0.03
Final Dial Reading (in) :	0.0931
Difference (in) :	0.0631
Machine Correction 0 to 0 (in) :	0.0047
Change in Ht., specimen, delta H (in) :	0.0584
Final Ht. of specimen, $H_2=H_1$-delta H :	0.7251

Spec. Gr.of Solids (G) : (estimated)	2.78
Spec. Gr.of Solids (G) : (determined)	
Initial Height of Specimen, H_1(in):	0.7835

Calculations	Before Test	After Test
Height of Specimen, H_1, H_2 (in):	0.7835	0.7251
Ht of Solids, H_s (in):	0.3935	0.3935
Ht. of Voids, H_v (in):	0.3900	0.3316
Ht. of Water, H_w (in):	0.3897	0.3437
Saturation, Sr (%):	99.9	100.0
Void ratio (e):	0.991	0.842

Comments:

Reported By: Willie Rodych

Date Reported: May 8,2019

exp Services Inc.

1595 Clark Boulevard

Brampton, ON

L6T 4V1

Tel.: 905-793-9800

Fax: 905-793-0641

Consolidation Test
Determination of Void Ratio
(ASTM: D 2435)

Project No.	adm-00233185-k0 adm-300
Project Name	Lab Testing
Client Job No.:	
Sample No.	BH 19-H-2 Shelby- 10'-12'
Sample Location	

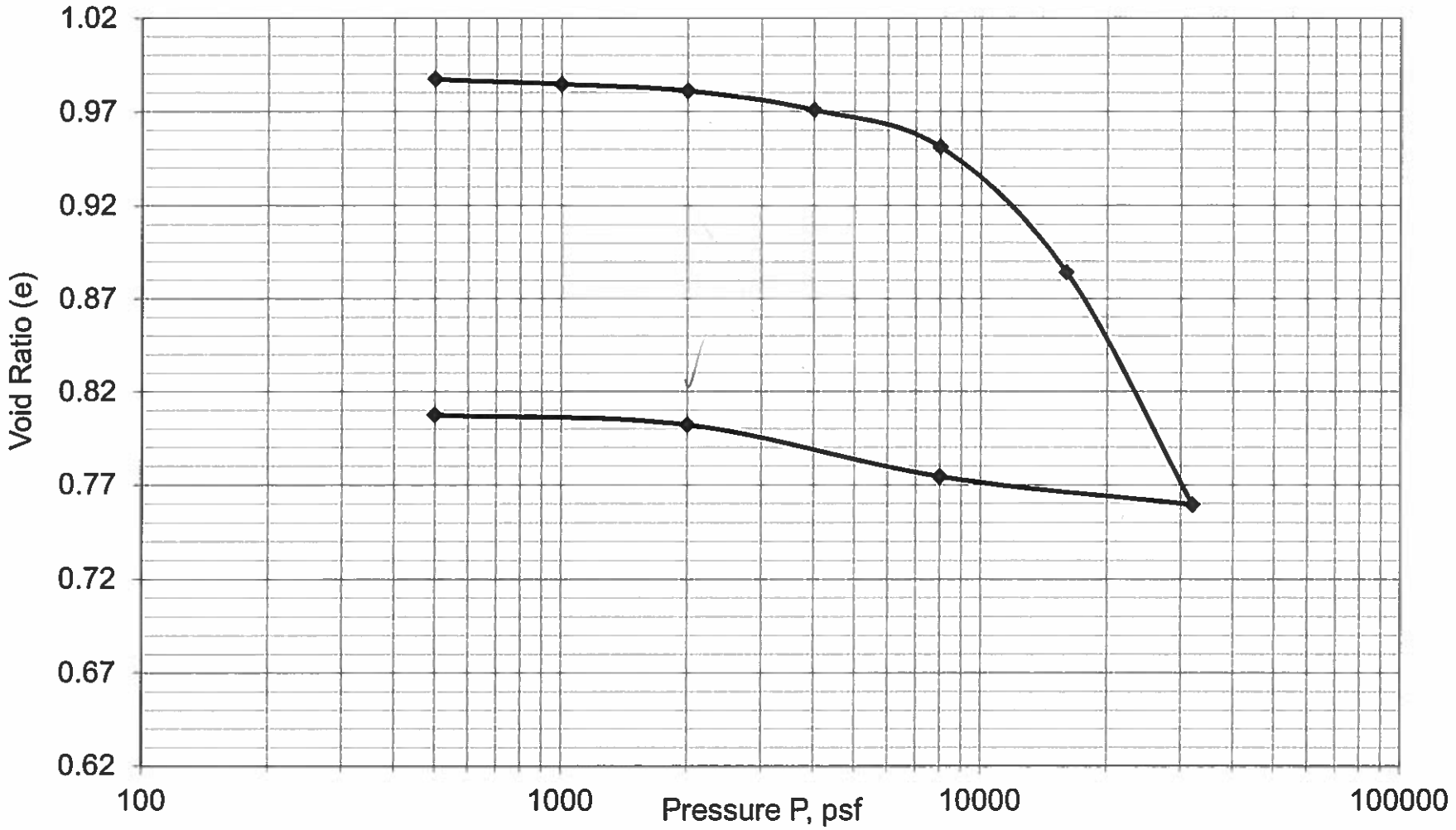
Height of Solids (in):	0.394
Initial Height of Voids (in):	0.390
Initial Void Ratio (e_o):	0.991
Initial Dial Reading:	0.030

Load No.	Hanger Load (lbs.)	Pressure on sample (lb/ft^2)	Final Dial Reading	Decrease in Height of Voids (in)	Machine Deflection (in)	Net Decrease in Height of Voids (in)	Height of Voids (in)	Void Ratio (e)
1	1.55	500	0.0330	0.0030	0.0015	0.0015	0.3885	0.987
2	3.1	1000	0.0350	0.0050	0.0025	0.0025	0.3875	0.985
3	6.2	2000	0.0377	0.0077	0.0038	0.0039	0.3861	0.981
4	12.4	4000	0.0430	0.0130	0.0051	0.0079	0.3821	0.971
5	24.8	8000	0.0524	0.0224	0.0067	0.0157	0.3743	0.951
6	49.6	16000	0.0806	0.0506	0.0086	0.0420	0.3480	0.884
7	99.2	32000	0.1318	0.1018	0.0107	0.0911	0.2989	0.759
8	24.8	8000	0.1242	0.0942	0.0090	0.0852	0.3048	0.774
9	6.2	2000	0.1114	0.0814	0.0071	0.0743	0.3157	0.802
10	1.55	500	0.1080	0.0780	0.0058	0.0722	0.3178	0.807
11								
12								
13								
14								
15								

Tested By:	Willie Rodych
Date:	4/28/2019

Graph - e vs log P

Sample Test No.: 319575-6



exp Services Inc.

1595 Clark Boulevard

Brampton, ON

L6T 4V1

Tel.: 905-793-9800

Fax: 905-793-0641

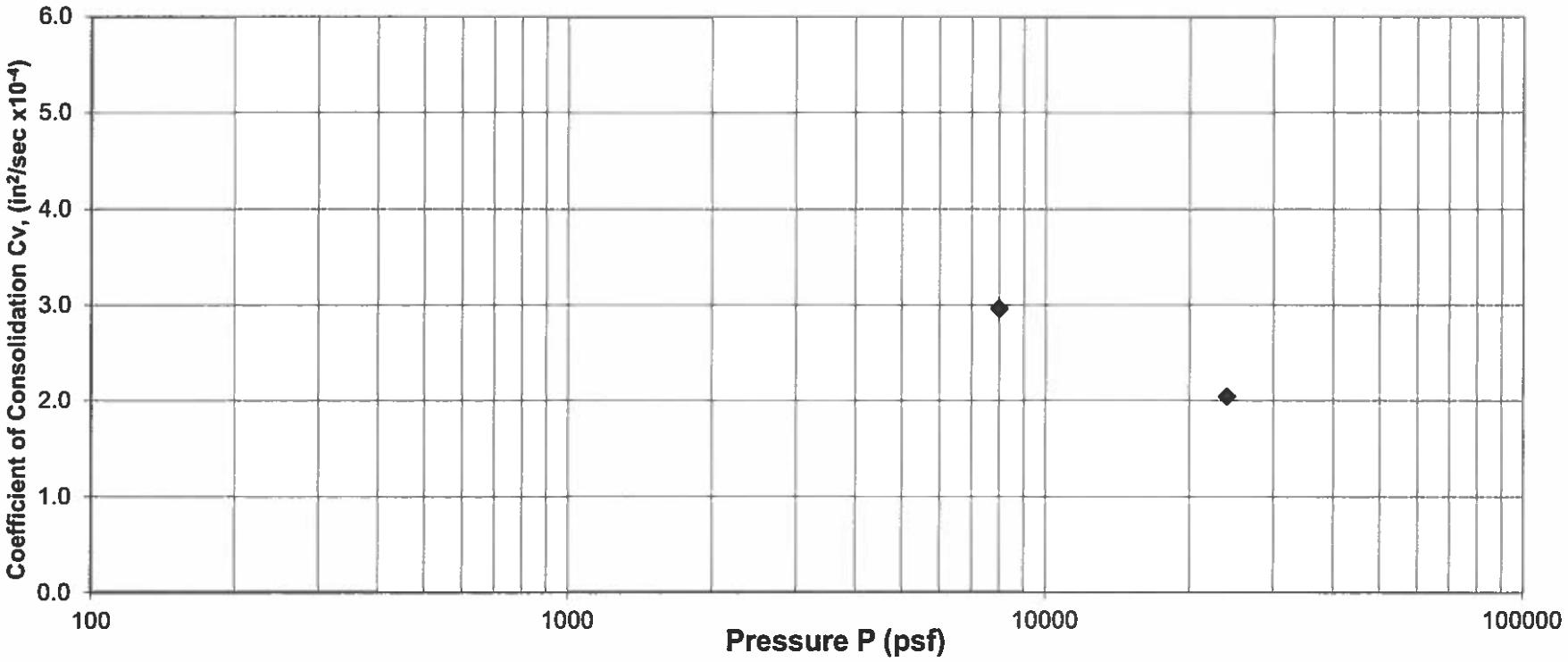
Consolidation Test
Coefficient of Consolidation
(ASTM: D 2435)

Project No.: adm-00233185-k0 adm-300
Project Name: Lab Testing
Client Job No.:
Site Location:
Sample No. BH 19-H-2 Shelby- 10'-12'

Initial Height of Sample (in):	0.7835
Initial Dial Reading:	0.0300

Load No.	Pressure on sample (lb/ft^2)	Dial Reading at 50% Consolidation	Decrease in Height of Sample (in)	Machine Deflection (in)	Net Decrease in Height of Voids (in)	Height of Sample $2H_{dr}$ (in)	Length of Drainage (in) H_{dr} (in)	Length of Drainage (in) $(H_{dr})^2$ (in)	t_{50} seconds	C_v (in^2/sec)
1	500									
2	1000									
3	2000									
4	4000									
5	8000									
6	16000	0.0622	0.0322	0.0086	0.0236	0.7599	0.3800	0.1444	96	3.0E-04
7	32000	0.1009	0.0709	0.0107	0.0602	0.7233	0.3617	0.1308	126	2.0E-04
8										
9										
10										
11										
12										
13										
14										
15										

Graph - Cv vs log P



exp Services Inc.
The new identity of Trow Associates Inc.
1595 Clark Blvd.
Brampton, Ontario, L6T 4V1
Tel.: (905) 793-9800
Fax.: (905) 793-0641
www.exp.com

Unit Weight of Soil (ST02)

Project No.: adm-00233185-k0 adm-300 ***Date Started:*** 5/8/2019

Project Name: Lab Testing

Project PM: Silvana Micic

(Test No)	*(Borehole No)*	*(Sample Method)*	*(Sample No)*	*(Depth)*	*(Density KN/m3)*	*(Test Status)*
319575-3	BH 19-H-2	Shelby		10'-12'	19.10	Distributed

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: EXP. SERVICES INC.
885 REGENT ST
SUDBURY, ON P3E5M4
(705) 674-9681

ATTENTION TO: Jeff Newman

PROJECT: 233185-KO

AGAT WORK ORDER: 19U458711

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Supervisor

DATE REPORTED: Apr 26, 2019

PAGES (INCLUDING COVER): 7

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 19U458711

PROJECT: 233185-KO

CLIENT NAME: EXP. SERVICES INC.

ATTENTION TO: Jeff Newman

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

DATE RECEIVED: 2019-04-18

DATE REPORTED: 2019-04-26

		SAMPLE DESCRIPTION:		19-H-3-SS3
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2019-04-08
Parameter	**Unit**	**G / S**	**RDL**	**144668**
Sulfide (S2-)	%		0.05	<0.05
Chloride (2:1)	µg/g		20	3750
Sulphate (2:1)	µg/g		20	89
pH (2:1)	pH Units		NA	8.16
Electrical Conductivity (2:1)	mS/cm		0.005	6.40
Resistivity (2:1)	ohm.cm		1	156
Redox Potential (2:1)	mV		5	181

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

144668 EC, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil). Resistivity is a calculated parameter.
*Sulphide analyzed at AGAT 5623 McAdam
PI note: Redox Potential is not an accredited parameter.
Elevated RDL indicates the degree of sample dilution prior to the analysis in order to keep analytes within the calibration range of the instrument and to reduce matrix interference.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 19U458711

PROJECT: 233185-KO

CLIENT NAME: EXP. SERVICES INC.

ATTENTION TO: Jeff Newman

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2019-04-18

DATE REPORTED: 2019-04-26

		SAMPLE DESCRIPTION:		19-H-2-AG2
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2019-04-09
Parameter	Unit	G / S	RDL	144666
Antimony	µg/g		0.8	<0.8
Arsenic	µg/g		1	3
Barium	µg/g		2	149
Beryllium	µg/g		0.5	0.6
Boron	µg/g		5	6
Boron (Hot Water Soluble)	µg/g		0.10	<0.10
Cadmium	µg/g		0.5	<0.5
Chromium	µg/g		2	95
Cobalt	µg/g		0.5	16.4
Copper	µg/g		1	37
Lead	µg/g		1	14
Molybdenum	µg/g		0.5	<0.5
Nickel	µg/g		1	53
Selenium	µg/g		0.4	<0.4
Silver	µg/g		0.2	0.2
Thallium	µg/g		0.4	<0.4
Uranium	µg/g		0.5	1.5
Vanadium	µg/g		1	66
Zinc	µg/g		5	105
Chromium VI	µg/g		0.2	<0.2
Cyanide	µg/g		0.040	0.065
Mercury	µg/g		0.10	<0.10
Electrical Conductivity	mS/cm		0.005	2.49
Sodium Adsorption Ratio	NA		NA	16.2
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.33

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

144666 EC was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio. SAR is a calculated parameter.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: EXP. SERVICES INC.

AGAT WORK ORDER: 19U458711

PROJECT: 233185-KO

ATTENTION TO: Jeff Newman

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Apr 26, 2019			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	138612		<0.8	<0.8	NA	< 0.8	123%	70%	130%	104%	80%	120%	108%	70%	130%
Arsenic	138612		5	5	0.0%	< 1	106%	70%	130%	101%	80%	120%	88%	70%	130%
Barium	138612		34	35	2.9%	< 2	96%	70%	130%	97%	80%	120%	93%	70%	130%
Beryllium	138612		0.9	1.1	NA	< 0.5	111%	70%	130%	107%	80%	120%	107%	70%	130%
Boron	138612		26	25	3.9%	< 5	85%	70%	130%	110%	80%	120%	86%	70%	130%
Boron (Hot Water Soluble)	143239		0.29	0.26	NA	< 0.10	106%	60%	140%	95%	70%	130%	84%	60%	140%
Cadmium	138612		<0.5	<0.5	NA	< 0.5	93%	70%	130%	107%	80%	120%	102%	70%	130%
Chromium	138612		29	29	0.0%	< 2	99%	70%	130%	102%	80%	120%	78%	70%	130%
Cobalt	138612		15.7	15.7	0.0%	< 0.5	98%	70%	130%	106%	80%	120%	91%	70%	130%
Copper	138612		24	23	4.3%	< 1	95%	70%	130%	100%	80%	120%	87%	70%	130%
Lead	138612		4	4	NA	< 1	102%	70%	130%	101%	80%	120%	99%	70%	130%
Molybdenum	138612		<0.5	<0.5	NA	< 0.5	107%	70%	130%	106%	80%	120%	91%	70%	130%
Nickel	138612		35	34	2.9%	< 1	98%	70%	130%	102%	80%	120%	86%	70%	130%
Selenium	138612		2.2	2.1	4.7%	< 0.4	98%	70%	130%	100%	80%	120%	93%	70%	130%
Silver	138612		<0.2	<0.2	NA	< 0.2	108%	70%	130%	107%	80%	120%	98%	70%	130%
Thallium	138612		<0.4	<0.4	NA	< 0.4	104%	70%	130%	101%	80%	120%	97%	70%	130%
Uranium	138612		0.8	0.8	NA	< 0.5	109%	70%	130%	101%	80%	120%	102%	70%	130%
Vanadium	138612		36	36	0.0%	< 1	102%	70%	130%	104%	80%	120%	87%	70%	130%
Zinc	138612		74	73	1.4%	< 5	101%	70%	130%	103%	80%	120%	89%	70%	130%
Chromium VI	144757		<0.2	<0.2	NA	< 0.2	107%	70%	130%	102%	80%	120%	101%	70%	130%
Cyanide	135207		<0.040	<0.040	NA	< 0.040	99%	70%	130%	104%	80%	120%	98%	70%	130%
Mercury	138612		<0.10	<0.10	NA	< 0.10	103%	70%	130%	93%	80%	120%	100%	70%	130%
Electrical Conductivity	142019		0.116	0.121	4.2%	< 0.005	103%	90%	110%	NA			NA		
Sodium Adsorption Ratio	138612		15.1	15.2	0.7%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	138612		7.89	7.91	0.3%	NA	99%	80%	120%	NA			NA		
Corrosivity Package															
Sulfide (S2-)	144668	144668	< 0.05	< 0.05	NA	< 0.05	100%	80%	120%						
Chloride (2:1)	145204		1780	1780	0.0%	< 2	97%	80%	120%	106%	80%	120%	104%	70%	130%
Sulphate (2:1)	145204		10800	11000	1.8%	< 2	109%	80%	120%	109%	80%	120%	110%	70%	130%
pH (2:1)	143193		7.80	7.83	0.4%	NA	99%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	142019		0.116	0.121	4.2%	< 0.005	103%	90%	110%	NA			NA		
Redox Potential (2:1)	143193		160	160	0.0%	< 5	101%	70%	130%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

AGAT Laboratories

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Quality Assurance

CLIENT NAME: EXP. SERVICES INC.

AGAT WORK ORDER: 19U458711

PROJECT: 233185-KO

ATTENTION TO: Jeff Newman

SAMPLING SITE:

SAMPLED BY:

Soil Analysis (Continued)

RPT Date: Apr 26, 2019			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL

Certified By:

AGAT Laboratories

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Method Summary

CLIENT NAME: EXP. SERVICES INC.

AGAT WORK ORDER: 19U458711

PROJECT: 233185-KO

ATTENTION TO: Jeff Newman

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulfide (S2-)	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential (2:1)		McKeague 4.12 & SM 2580 B	REDOX POTENTIAL ELECTRODE
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER

AGAT Laboratories

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Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 1944587 11

Cooler Quantity: 1

Arrival Temperatures: 4.5 | 4.7 | 4.4
4 | 38. | 3.1 | 2.9

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: exp
Contact: Jeff Newman
Address: Sudbury

Phone: Fax:

Reports to be sent to:
1. Email: jeff.newman@exp.com
2. Email: [illegible].lan.macmillan@exp.com

Regulatory Requirements:

☐ No Regulatory Requirement

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Sewer Use
☐ Sanitary ☐ Storm
Region (Indicate One)
☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 233185-K0
Site Location: MTO Haileybury
Sampled By:
AGAT Quote #: SOA PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Is this submission for a **Record of Site Condition?** ☐ Yes ☒ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☒ No

Invoice Information:

Bill To Same: Yes ☒ No ☐

Company: ?
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics (☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (Incl. Hydrides) / ORPs: ☐ B-HWS ☐ Cr ☐ CN ☐ Cr6+ ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR)	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	Corrosivity
19-H-2-AG2	Apr 9/19	-	1	S			✓												
19-H-3-SS3	Apr 8/19	-	1	S															✓

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Jeff Newman	Apr 18/19	910	Ashley Istead	Apr 18/19	915am
				Apr 22	8:45

Page 1 of 1

No: T 076842

AGAT Laboratories

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CLIENT NAME: EXP. SERVICES INC.
885 REGENT ST
SUDBURY, ON P3E5M4
(705) 674-9681

ATTENTION TO: Ian MacMillan

PROJECT: ADM-00233185-K0

AGAT WORK ORDER: 19U464857

TRACE ORGANICS REVIEWED BY: Pinkal Patel, Report Reviewer

DATE REPORTED: May 14, 2019

PAGES (INCLUDING COVER): 8

VERSION*: 2

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

NOTES

VERSION 2:Partial report for sample "19-H-1-SS2" issued May 14, 2019.

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 19U464857

PROJECT: ADM-00233185-K0

CLIENT NAME: EXP. SERVICES INC.

ATTENTION TO: Ian MacMillan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2019-05-08

DATE REPORTED: 2019-05-13

		SAMPLE DESCRIPTION:		19-H-1-SS2
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2019-05-08
Parameter	**Unit**	**G / S**	**RDL**	**182120**
Benzene	µg/g		0.02	<0.02
Toluene	µg/g		0.05	<0.05
Ethylbenzene	µg/g		0.05	<0.05
Xylene Mixture	µg/g		0.05	<0.05
F1 (C6 to C10)	µg/g		5	<5
F1 (C6 to C10) minus BTEX	µg/g		5	<5
F2 (C10 to C16)	µg/g		10	<10
F3 (C16 to C34)	µg/g		50	<50
F4 (C34 to C50)	µg/g		50	<50
Gravimetric Heavy Hydrocarbons	µg/g		50	NA
Moisture Content	%		0.1	25.6
Surrogate	**Unit**	**Acceptable Limits**		
Terphenyl	%	60-140		96

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

182120 Results are based on sample dry weight.
The C6-C10 fraction is calculated using Toluene response factor.
Xylenes is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contribution.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.
Quality Control Data is available upon request.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Jinkal Patel

AGAT Laboratories

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Quality Assurance

CLIENT NAME: EXP. SERVICES INC.

AGAT WORK ORDER: 19U464857

PROJECT: ADM-00233185-K0

ATTENTION TO: Ian MacMillan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date:			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	182264		<0.8	<0.8	NA	< 0.8	91%	70%	130%	95%	80%	120%	94%	70%	130%
Arsenic	182264		3	3	NA	< 1	101%	70%	130%	94%	80%	120%	98%	70%	130%
Barium	182264		109	110	0.6%	< 2	105%	70%	130%	100%	80%	120%	116%	70%	130%
Beryllium	182264		<0.5	<0.5	NA	< 0.5	99%	70%	130%	98%	80%	120%	76%	70%	130%
Boron	182264		7	7	NA	< 5	101%	70%	130%	104%	80%	120%	76%	70%	130%
Boron (Hot Water Soluble)	2		NA	NA	NA	< 0.10	100%	60%	140%	102%	70%	130%	NA	60%	140%
Cadmium	182264		<0.5	<0.5	NA	< 0.5	99%	70%	130%	101%	80%	120%	99%	70%	130%
Chromium	182264		30	31	3.8%	< 2	103%	70%	130%	102%	80%	120%	112%	70%	130%
Cobalt	182264		10.0	10.3	2.7%	< 0.5	105%	70%	130%	105%	80%	120%	103%	70%	130%
Copper	182264		20	20	2.0%	< 1	95%	70%	130%	101%	80%	120%	97%	70%	130%
Lead	182264		9	9	0.5%	< 1	105%	70%	130%	104%	80%	120%	100%	70%	130%
Molybdenum	182264		<0.5	<0.5	NA	< 0.5	108%	70%	130%	100%	80%	120%	98%	70%	130%
Nickel	182264		25	25	1.2%	< 1	103%	70%	130%	108%	80%	120%	110%	70%	130%
Selenium	182264		0.5	0.5	NA	< 0.4	103%	70%	130%	92%	80%	120%	96%	70%	130%
Silver	182264		<0.2	<0.2	NA	< 0.2	99%	70%	130%	99%	80%	120%	95%	70%	130%
Thallium	182264		<0.4	<0.4	NA	< 0.4	101%	70%	130%	113%	80%	120%	107%	70%	130%
Uranium	182264		0.5	0.5	NA	< 0.5	112%	70%	130%	116%	80%	120%	121%	70%	130%
Vanadium	182264		41	43	5.5%	< 1	103%	70%	130%	112%	80%	120%	111%	70%	130%
Zinc	182264		52	52	1.1%	< 5	93%	70%	130%	102%	80%	120%	103%	70%	130%
Chromium VI	182119	182119	<0.2	<0.2	NA	< 0.2	108%	70%	130%	100%	80%	120%	102%	70%	130%
Cyanide	182122	182122	<0.040	<0.040	NA	< 0.040	98%	70%	130%	99%	80%	120%	104%	70%	130%
Mercury	182264		<0.10	<0.10	NA	< 0.10	127%	70%	130%	109%	80%	120%	110%	70%	130%
Electrical Conductivity	182119	182119	0.099	0.108	8.7%	< 0.005	109%	90%	110%	NA			NA		
Sodium Adsorption Ratio	182119	182119	1.30	1.38	5.5%		NA			NA			NA		
pH, 2:1 CaCl2 Extraction	182119	182119	5.59	5.61	0.4%		100%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Corrosivity Package -new															
Chloride (2:1)	178497		10	9	NA	< 2	93%	80%	120%	89%	80%	120%	89%	70%	130%
Sulphate (2:1)	178497		10	9	NA	< 2	92%	80%	120%	93%	80%	120%	97%	70%	130%
pH (2:1)	182124	182124	6.04	6.01	0.5%		99%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	182119	182119	0.099	0.108	8.7%	< 0.005	109%	90%	110%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL

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Quality Assurance

CLIENT NAME: EXP. SERVICES INC.

AGAT WORK ORDER: 19U464857

PROJECT: ADM-00233185-K0

ATTENTION TO: Ian MacMillan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis (Continued)

RPT Date:			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

AGAT Laboratories

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Quality Assurance

CLIENT NAME: EXP. SERVICES INC.

AGAT WORK ORDER: 19U464857

PROJECT: ADM-00233185-K0

ATTENTION TO: Ian MacMillan

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date:			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (Soil)															
Benzene	174969		< 0.02	< 0.02	NA	< 0.02	90%	60%	130%	85%	60%	130%	89%	60%	130%
Toluene	174969		< 0.05	< 0.05	NA	< 0.05	88%	60%	130%	89%	60%	130%	86%	60%	130%
Ethylbenzene	174969		< 0.05	< 0.05	NA	< 0.05	101%	60%	130%	87%	60%	130%	79%	60%	130%
Xylene Mixture	174969		< 0.05	< 0.05	NA	< 0.05	97%	60%	130%	81%	60%	130%	82%	60%	130%
F1 (C6 to C10)	174969		< 5	< 5	NA	< 5	96%	60%	130%	86%	85%	115%	80%	70%	130%
F2 (C10 to C16)	173534		< 10	< 10	NA	< 10	100%	60%	130%	95%	80%	120%	70%	70%	130%
F3 (C16 to C34)	173534		< 50	< 50	NA	< 50	104%	60%	130%	98%	80%	120%	76%	70%	130%
F4 (C34 to C50)	173534		< 50	< 50	NA	< 50	95%	60%	130%	87%	80%	120%	116%	70%	130%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: EXP. SERVICES INC.

AGAT WORK ORDER: 19U464857

PROJECT: ADM-00233185-K0

ATTENTION TO: Ian MacMillan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulfide (S2-)	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Redox Potential 1	INOR-93-6066	G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 2	INOR-93-6066	G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 3	INOR-93-6066	G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER

AGAT Laboratories

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Method Summary

CLIENT NAME: EXP. SERVICES INC.

AGAT WORK ORDER: 19U464857

PROJECT: ADM-00233185-K0

ATTENTION TO: Ian MacMillan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Benzene	VOL-91-5009	EPA SW-846 5035 & 8260D	P&T GC/MS
Toluene	VOL-91-5009	EPA SW-846 5035 & 8260D	P&T GC/MS
Ethylbenzene	VOL-91-5009	EPA SW-846 5035 & 8260D	P&T GC/MS
Xylene Mixture	VOL-91-5009	EPA SW-846 5035 & 8260D	P&T GC/MS
F1 (C6 to C10)	VOL-91-5009	CCME Tier 1 Method	P&T GC/FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	CCME Tier 1 Method	P&T GC/FID
F2 (C10 to C16)	VOL-91-5009	CCME Tier 1 Method	GC/FID
F3 (C16 to C34)	VOL-91-5009	CCME Tier 1 Method	GC/FID
F4 (C34 to C50)	VOL-91-5009	CCME Tier 1 Method	GC/FID
Gravimetric Heavy Hydrocarbons	VOL-91-5009	CCME Tier 1 Method	BALANCE
Moisture Content	VOL-91-5009	CCME Tier 1 Method	BALANCE
Terphenyl	VOL-91-5009		GC/FID

AGAT Laboratories

ILG

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 19U464857

Cooler Quantity:

Arrival Temperatures: A.1 | 19.0 | 19.1
Ice Pack 7.2 | 8.8 | 8.6

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes: on ice

Report Information:

Company: exp
Contact: Ian.Macmillan@exp.com
Address: Sudbury

Phone: Fax:

Reports to be sent to:
1. Email: Ian.Macmillan@exp.com
2. Email:

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐Ind/Com ☐Res/Park ☐Agriculture
Soil Texture (Check One) ☐Coarse ☐Fine

☐ Sewer Use
☐Sanitary ☐Storm
Region (Indicate One) ☐MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☒ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☒ No

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: ADM-00233185-KO
Site Location: MTO
Sampled By: PL
AGAT Quote #: SOA PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☒ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N
19-G-1-SS2	May 8/19		5	S	No rush	
19-H-1-SS2			2		*Rush 2 day - no M&I	
19-PS-1-SS2			5		No rush	
19-P-1-SS2						
19-D-2-SS2						
19-D-2-SS4						
19-PS-2-SS3						
19-G-1-SS3						
19-P-2-SS3						

Field Filtered - Metals, Hg, CrVI

O. Reg 153

Metals and Inorganics	All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (Incl. Hydrides)	ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr⁶⁺ ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☒ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	Corrosivity
✓						✓	✓							✓
✓						✓	✓							✓
✓						✓	✓							✓
✓						✓	✓							✓
✓						✓	✓							✓

Samples Relinquished By (Print Name and Sign): Jeff Newman	Date: May 8/19	Time: 235	Samples Received By (Print Name and Sign): B.Bowen / B.Banas	Date: 05/08/19	Time: 2:34	Page 1 of 1	
Samples Relinquished By (Print Name and Sign):	Date:	Time:	Samples Received By (Print Name and Sign): Simon	Date: 19/5/9	Time: 847	N°: T 087566	
Samples Relinquished By (Print Name and Sign):	Date:	Time:	Samples Received By (Print Name and Sign):	Date:	Time:		

Document ID: DIV-78-1511-015

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

Date Issued: July 16, 2015

Appendix E –
Rock Core Photographs

Project No: ADM 00233185-K0
BH No: 19-H-4B Run No: 1
Sample Depth: 13.5 m to 15 m
Elevation: 246.3 m to 244.8 m
Description: Metamorphosed Conglomerate
Date: April 8 to 11, 2019

Figure E1. Rock core from BH19-H-4B

Appendix H –
Records of Borehole from Previous Investigation

RECORD OF BOREHOLE No BH12-1

1 OF 1 **METRIC**

LOCATION HAILEYBURY PATROL YARD N 5 256 348.1; E 596 922.5 ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT COMPILED BY JW

DATUM GEODETIC DATE 5.31.12 - 5.31.12 CHECKED BY RK

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (30 60 90 120 150) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
259.9											
259.8 / 0.1	**ASPHALT:**75 mm THICK										
	GRANULAR FILL: GRAVELLY SAND TO SAND, SOME GRAVEL, TRACE SILT, BROWN, COMPACT, MOIST		1	SS	32						
			2	SS	19		259				
258.5											
1.4	**CLAYEY SILT TO SILTY CLAY:** CLAYEY SILT TO SILTY CLAY, TRACE FINE SAND		3	SS	9		258				
	GREY TO BROWN GREY, FIRM TO STIFF, MOIST TO WET		4	SS	7						
			5	SS	6	▼	257				0 2 45 53
			6	SS	7		256				
255.5											
4.4	**SILT:** MOTTLED SILT, SOME CLAY, TRACE SAND		7	SS	18		255				
	BROWN GREY TO GREY, VERY STIFF, WET										
254.2							254				
5.7	**SILTY SAND TILL:** SILTY FINE SAND TILL, SOME GRAVEL, TRACE CLAY, WITH FREQUENT COBBLES AND BOULDERS		8	SS	37						
	GREY, DENSE TO VERY DENSE, WET		9	SS	100		253				
							252				
250.9							251				
9.0	**GRAVELLY SAND TILL:** SOME SILT, TRACE CLAY, WITH FREQUENT COBBLES AND BOULDERS		10	SS	71						33 43 18 6
	GREY, VERY DENSE, WET						250				
248.7			11	SS	100		249				
11.1	END OF BOREHOLE										

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT HAILEYBURY.GPJ ONTARIO MOT.GDT 7/25/12

RECORD OF BOREHOLE No BH12-2

1 OF 1

METRIC

LOCATION HAILEYBURY PATROL YARD N 5 256 331.4; E 596 921.8 ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT COMPILED BY JW

DATUM GEODETIC DATE 6.1.12 - 6.1.12 CHECKED BY RK

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (30 60 90 120 150) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
259.9											
259.8 / 0.1	**ASPHALT:**75 mm THICK										
	GRANULAR FILL: GRAVELLY SAND TO SAND, SOME GRAVEL BROWN, DENSE TO COMPACT, MOIST		1	SS	48						
258.5			2	SS	10		259				18 75 (7)
1.4	**SILTY CLAY TO CLAYEY SILT:** SILTY CLAY TO CLAYEY SILT, TRACE FINE SAND BROWN TO GREY, FIRM TO STIFF, MOIST TO WET BROWN		3	SS	9	▼	258				
			4	SS	5		257	4.7	46		0 2 37 61
	GREY		5	TW	PH						
			6	SS	3		256				
			7	SS	4		255				0 7 59 34
254.1								3.2			
5.7	**SILTY SAND TILL:** SILTY FINE SAND TILL, SOME GRAVEL, SOME CLAY, WITH FREQUENT COBBLES AND BOULDERS GREY, VERY DENSE, WET		8	SS	62		254				
			9	SS	100		253				
			10	SS	80		252				
251.6											
8.2	DYNAMIC CONE PENETRATION TEST BELOW 8.2 m DEPTH.						251				
249.5							250				
10.4	END OF BOREHOLE										

$+^{3}$, $\times^{3}$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT HAILEYBURY.GPJ ONTARIO MOT.GDT 7/25/12

RECORD OF BOREHOLE No BH12-3

1 OF 1 **METRIC**

LOCATION HAILEYBURY PATROL YARD N 5 256 352.0; E 596 899.7 ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT COMPILED BY JW

DATUM GEODETIC DATE 6.1.12 - 6.4.12 CHECKED BY RK

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
260.0									
259.9 / 0.1	**ASPHALT:**75 mm THICK								
	GRANULAR FILL: GRAVELLY SAND TO SAND AND GRAVEL, SOME COBBLES BROWN, DENSE TO COMPACT, MOIST		1	SS	37				30 61 (9)
			2	SS	42		259		
257.9			3	SS	10		258		
2.1	**SILTY CLAY TO CLAYEY SILT:** SILTY CLAY TO CLAYEY SILT, TRACE SAND BROWN GREY TO BROWN, STIFF, WET		4	SS	7		257		
			5	SS	10				0 3 35 62
			6	SS	5		256		
254.3			7	SS	6		255		
5.7	**SILT:** SILT, SOME CLAY, TRACE SAND GREY, FIRM TO VERY STIFF, WET		8	SS	4		254		
			9	SS	15		253		0 3 79 18
251.5							252		
8.5	**SILTY SAND TILL:** SILTY SAND TILL, SOME GRAVEL, TRACE CLAY, WITH FREQUENT COBBLES AND BOULDERS GREY, COMPACT TO VEY DENSE, WET		10	SS	22		251		
							250		
248.9			11	SS	100		249		
11.1	END OF BOREHOLE								

SOIL PROFILE | SAMPLES | DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) | PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L | WATER CONTENT (%) (10 20 30)

SHEAR STRENGTH kPa (30 60 90 120 150)
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

45

3.6

H

+^{3}, ×^{3}: Numbers refer to Sensitivity ○$^{3\%}$ STRAIN AT FAILURE

ONTARIO MOT HAILEYBURY.GPJ ONTARIO MOT.GDT 7/25/12

RECORD OF BOREHOLE No BH12-4

1 OF 1 **METRIC**

LOCATION HAILEYBURY PATROL YARD N 5 256 333.7; E 596 898.3 ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT COMPILED BY JW

DATUM GEODETIC DATE 6.4.12 - 6.4.12 CHECKED BY RK

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (30 60 90 120 150) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
259.9											
259.8 / 0.1	**ASPHALT:**65 mm THICK										
	GRANULAR FILL: GRAVELLY SAND, SOME COBBLES		1	SS	35						
	BROWN, DENSE TO COMPACT, MOIST		2	SS	10		259				35 58 (7)
258.6											
1.4	**CLAYEY SILT TO SILTY CLAY:** CLAYEY SILT TO SILTY CLAY, TRACE FINE SAND, TRACE ROOTLETS AT THE UPPER 0.5 m		3	SS	7		258				
	BROWN TO GREY, FIRM TO STIFF, MOIST TO WET		4	SS	6	▼					
			5	SS	3		257		45		0 3 35 62
	BROWN		6	TW	PH		256				
	GREY		7	SS	4		255	4.0			
254.2											
5.7	**SILTY SAND TILL:** SILTY SAND TILL, SOME GRAVEL, TRACE CLAY		8	SS	21		254				
	GREY, COMPACT TO VERY DENSE, WET		9	SS	15		253				
			10	SS	62		252				18 41 33 8
250.2							251				
9.8	DYNAMIC CONE PENETRATION TEST BELOW 9.8 m DEPTH.						250				
249.6											
10.4	END OF BOREHOLE										

$+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT HAILEYBURY.GPJ ONTARIO MOT.GDT 7/25/12