FOUNDATION INVESTIGATION REPORT

Highway 11/12 Coldwater Road Interchange
High Mast Light Pole Relocations
Orillia Township, District of Owen Sound
Ministry of Transportation, Ontario

GWP 2494-15-00

Submitted to:

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Distribution List

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MINISTRY OF TRANSPORTATION, ONTARIO
GWP 2494-15-00

1.0 INTRODUCTION

Golder Associates Ltd. (Golder), a member of WSP, has been retained by McIntosh Perry Consulting Engineers Ltd. (McIntosh Perry) on behalf of the Ministry of Transportation, Ontario (MTO) to provide preliminary design foundation engineering services as part of the design-build ready assignment for the Highway 11 interchange improvements at the Highway 12 (Coldwater Road) north junction and Highway 12 (Old Barrie Road) south junction.

The Coldwater Road interchange improvements includes the replacement of the existing Coldwater Road Underpass bridge structure and reconfiguration of the existing interchange ramps, as well as the design of two noise barrier walls, a stormwater management pond, and four high mast light pole relocations. This report addresses the foundation investigation for the relocation of four existing 35 m high, high mast light poles (HMLPs). Foundation investigations for the noise barrier walls, stormwater management pond, and bridge structure, as well as the Old Barrie Road interchange improvements are addressed in separate reports.

2.0 SITE DESCRIPTION

The orientation (i.e., north, south, east, and west) stated in the text of this report is referenced to project north and therefore may differ from magnetic north shown on Drawing 1. For the purpose of this report, Highway 12 / Coldwater Road is oriented in a west-east direction on a slight skew to Highway 11, which generally runs in a north-south direction.

In general, the topography in the area, including the Highway 11 platform is relatively flat with the exception of the elevated Highway 12/Coldwater Road platform and associated interchange ramps. The ground surface within the vicinity of the interchange is landscaped with grass cover and a few limited zones of tree cover along the perimeter (interior and exterior) of the interchange ramps. The land use in the area (i.e., beyond the MTO right-of-way) is a mix of residential and commercial properties.

3.0 INVESTIGATION PROCEDURES

The fieldwork for this subsurface exploration program included a total of four boreholes (Boreholes HMLP-1 to HMLP-4). Borehole HMLP-4 was advanced on 10 May 2022 and Borehole HMLP-1 to HMLP-3 were advanced between 31 October and 2 November 2022. The approximate locations of the boreholes are shown in Drawing 1.

The boreholes were advanced using a Diedrich D-50 track-mounted drilling rig, supplied and operated by Walker Drilling Ltd. (Walker) of Utopia, Ontario, equipped with 108 millimetre (mm) inside diameter hollow-stem augers. Traffic control was performed in accordance with the Ontario Traffic Manual Book 7 – Temporary Conditions by Alliance Traffic Control Inc. of Etobicoke, Ontario.

Soil samples were generally obtained at 0.75 metre (m) and 1.5 m intervals of depth, using 50 mm outside diameter split-spoon samplers driven by an automatic hammer in accordance with Standard Penetration Test (SPT) procedures (ASTM D1586)[1]. Field vane shear tests were conducted in cohesive soils for measurement of undrained shear strengths (ASTM D2573)[2] using an MTO Standard 'N'-size vane.

The groundwater levels in the open boreholes were observed during and upon completion of drilling. The boreholes were backfilled in accordance with Ontario Regulation 903 Wells (as amended).

The field work was monitored by members of Golder's technical staff who located the boreholes in the field, arranged for the clearance of underground utilities, supervised the drilling and sampling operations, logged the boreholes, and examined the soil samples. The soil samples were identified in the field, placed in individually labelled containers, and transported to Golder's geotechnical laboratory in Mississauga for further examination and laboratory testing. Index and classification testing consisting of water contents, grain size distributions, and Atterberg limits determinations were carried out on selected soil samples. The geotechnical laboratory testing was completed according to MTO LS and ASTM standards, as applicable. Further, four soil samples were obtained using appropriate protocols and submitted to a specialist analytical laboratory under chain of custody procedures for testing a suite of parameters including pH, resistivity, conductivity, chlorides, sulphates, and sulphides.

The as-drilled borehole locations and corresponding ground surface elevations were surveyed on-site by Callon Dietz Inc. of London, Ontario. The NAD83 Canadian Spatial Reference System (CSRS) V6:2010 MTM Zone 10 northing and easting coordinates, World Geodetic System 1984 (WGS 84) geographic coordinates, ground surface elevations (referenced to the Canadian Geodetic Vertical Datum (CGVD) 1928:1978 adjustment), and borehole depths at each location are presented on the borehole records in Appendix A and are summarized below.

Borehole No.	Location (MTM And 83 Zone 10)		Location (WGS 84)		Ground Surface Elevation (m)	Borehole Depth (m)
	Northing	Easting	Latitude (º)	Longitude (º)		
HMLP-1	4941167.0	308976.7	44.610507	-79.447381	255.8	12.8
HMLP-2	4941281.0	309099.3	44.611532	-79.445836	256.3	12.8
HMLP-3	4941112.0	309117.4	44.610011	-79.445609	256.8	12.8
HMLP-4	4941051.0	309237.5	44.609461	-79.444096	257.7	12.8

[1] ASTM D1586/D1586M-18 Standard Test Method for Standard Penetration Test (SPT) and Split Barrel Sampling of Soils.

[2] ASTM D2573/D2573M-18 Standard Test Method of Field Vane Shear Test in Saturated Fine-Grained Soils.

4.0 SITE GEOLOGY AND SUBSURFACE CONDITOINS

4.1 Regional Geology

Based on the Surficial Geology of Southern Ontario[3] mapping, the Coldwater Road interchange site is located within a glaciolacustrine plain deposit, primarily consisting of sand and gravel with minor silt and clay foreshore and basinal deposits, bordered by stone-poor, sandy silt to silty sand till deposits.

Based on geological mapping by the Ministry of Northern Development and Mines (MNDM)[4], the site is underlain by bedrock from the Ordovician era consisting of limestone, dolostone, shale, arkose, and sandstone from the Simcoe Group.

4.2 Subsurface Conditions

The detailed subsurface soil and groundwater conditions encountered in the boreholes and the results of the in situ and laboratory testing are given on the Record of Borehole sheets contained in Appendix A. The detailed results of the geotechnical laboratory testing are contained in Appendix B. The results of the in situ field tests (i.e., SPT 'N' values and field vane undrained shear strengths), as presented in the Record of Borehole sheets and in the subsections below, are uncorrected. The stratigraphic boundaries shown in the Record of Borehole sheets are inferred from non-continuous sampling and therefore, represent transitions between soil types rather than exact planes of geological change. The subsurface conditions will vary between and beyond the borehole locations.

In general, the subsurface soils encountered at the site generally consisted of surficial layers of topsoil and/or fill materials underlain by a deposit of silty sand to sand, which is interrupted by relatively thin deposits of silt and clayey-silt to silt. Detailed descriptions of the subsurface conditions encountered in the boreholes are provided in the following subsections.

4.2.1 TOPSOIL – SILTY SAND (SM)

A 50 mm to 700 mm thick layer of dark brown to brown, moist, silty sand topsoil, trace to some gravel, trace to some organics was encountered at the ground surface in Boreholes HMLP-1 to HMLP-4 (Elev. 257.7 m to 255.8 m).

SPT 'N'-values measured within the topsoil were 7 blows and 21 blows indicating a loose to compact state of compactness.

Materials designated as topsoil were classified based solely on visual and textural evidence. Testing of organic content or for other nutrients was not carried out. Therefore, the use of materials classified as topsoil cannot be relied upon for support and growth of landscape vegetation.

4.2.2 SILTY SAND (SM) to SAND (SP-SM) FILL

A 0.5 m to 1.7 m thick deposit of brown, moist, silty sand to sand fill, trace gravel was encountered below the topsoil in Boreholes HMLP-1 to HMLP-3. The surface of the silty sand to sand fill was encountered between Elevations 256.3m and 255.7 m.

[3] Ministry of Natural Resources, Surficial Geology of Southern Ontario. Ontario Geological Society Electronic Mapping.

[4] Ministry of Northern Development of Mines. Bedrock Geology of Ontario – Southern Sheet, Ontario Geological Survey – Map 2544.

SPT ‘N’-values measured within the silty sand to sand fill ranged from 5 blows to 19 blows per 0.3 m of penetration, indicating a loose to compact state of compactness.

Water contents measured on two samples of the silty sand to sand fill were 9% and 15%.

4.2.3 CLAYEY SILT-SILT (CL-ML) FILL

A 1.5 m thick deposit of brown, moist, sandy clayey silt-silt fill, was encountered below sand fill in Borehole HMLP-2. The clayey silt-silt fill was encountered at Elevation 255.6 m and extended to Elevation 254.1m.

SPT ‘N’-values measured within the clayey silt-silt fill ranged from 14 to 23 blows per 0.3 m of penetration, indicating a stiff to very stiff consistency.

Water contents measured on two samples of the clayey silt-silt fill were 15% and 16%.

The results of a grain size distribution test completed on one sample of the clayey-silt to silt fill are presented in Figure B-1 in Appendix B.

Atterberg limits testing on one sample of the clayey silt-silt fill yielded a liquid limit of about 21%, a plastic limit of about 16%, and a corresponding plasticity index of about 5%, indicating clayey silt of low plasticity to a slightly plastic silt. The results of the Atterberg limits test are presented in Figure B-2 in Appendix B.

4.2.4 SILTY SAND (SM) to SAND (SP-SM)

A 3.0 m to 6.5 m thick upper deposit of brown, moist to wet, silty sand, trace clay was encountered below the silty sand to sand fill in Boreholes HMLP-1 and HML-3, the clayey-silt to silt fill in Borehole HMLP-2 and the topsoil in Borehole HMLP-4. The surface of the upper silty sand to sand deposit was encountered between Elevation 257.0 m and 254.1 m.

SPT ‘N’-values measured within the upper silty sand to sand deposit ranged from 2 blows to 70 blows per 0.3 m of penetration, indicating a very loose to very dense state of compactness.

The water contents measured on six samples of the upper silty sand to sand deposit range from 5% to 16%.

The results of grain size distribution tests completed on four samples of the upper silty sand to sand deposits are presented in Figure B-3 in Appendix B.

4.2.5 SILT (ML)

A 0.8 m to 3.0 m thick deposit of brown, moist to wet, silt, trace gravel, trace sand, trace to some clay was encountered below the upper silty sand to sand deposit in Boreholes HMLP-1 to Borehole HMLP-4. The surface of the silt deposit was encountered between Elevations 252.1 m and 248.4 m.

SPT ‘N’-values measured within the silt deposit ranged between 11 blows and 75 blows per 0.3 m of penetration, indicating a compact to very dense state of compactness.

Water contents measured on five samples of the silt deposit range from about 19% to 22%.

The results of grain size distribution tests completed on four samples of the silt deposit are presented in Figure B-4 in Appendix B.

Atterberg limits testing on five samples of the silt deposit yielded liquid limits of about 20% to 22%, plastic limits of about 17% to 19%, and corresponding plasticity indices of about 1% to 3%, indicating a silt of slight plasticity. The results of the Atterberg limits tests are presented in Figure B-5 in Appendix B.

4.2.6 CLAYEY SILT-SILT (CL-ML) to CLAYEY SILT (CL)

A 0.8 m to 1.5 m thick deposit of brown, wet, clayey silt-silt to clayey silt, trace to some sand, trace gravel was encountered below the silt deposit in Boreholes HMLP-1 to HMLP-4. The surface of the clayey silt to silt deposit was encountered between Elevation 250.2 m and 247.5 m.

SPT 'N'-values measured within the clayey silt-silt to clayey silt deposit were 19 blows and 21 blows per 0.3 m of penetration, indicating a very stiff consistency. In one instance, the split-spoon sampler did not penetrate the entire SPT depth, due to refusal conditions (i.e., split-spoon bouncing) on an inferred cobble (or possible boulder) obstruction.

Water contents measured on three samples of the clayey silt-silt to clayey silt range from about 15% to 24%.

The results of grain size distribution tests completed on a sample of the clayey silt-silt to clayey silt deposit are presented in Figure B-6 in Appendix B.

Atterberg limits testing on three samples of the clayey silt-silt to clayey silt yielded liquid limits of about 18% to 24%, plastic limits of about 13% to 16%, and corresponding plasticity indices of about 5% to 8%, indicating a clayey silt-silt to clayey silt of low plasticity. The results of the Atterberg limits tests are presented in Figure B-7 in Appendix B.

4.2.7 SILTY SAND (SM) to SAND (SP-SM) - Lower

A lower deposit of brown, wet, silty sand to sand, trace gravel, trace silt, trace clay was encountered below the clayey silt-silt to clayey silt deposit in Boreholes HMLP-1 to HMLP-4. The surface of the deposit was encountered between Elevations 249.4 m and 246.0 m and Boreholes HMLP-1 to HMP-4 were terminated after penetrating 1.1 m to 6.4 m into the deposit.

SPT 'N'-values measured within the lower silty sand to sand deposit ranged from 9 blows to 58 blows per 0.3 m of penetration, indicating a loose to very dense state of compactness.

The water contents measured on five samples of the lower silt sand to sand deposit range from 11% to 19%.

The results of grain size distribution test completed on five samples of the lower silty sand to sand deposit are presented in Figure B-8 in Appendix B.

4.3 Groundwater Conditions

The groundwater levels were measured within the open boreholes upon completion of drilling. The observed groundwater conditions are summarized in the table below. Groundwater levels are subject to seasonal fluctuations and variations due to precipitation events and snow melt conditions.

Borehole No.	Groundwater Level		Date	Reading Type
	Depth (m)	Elevation (m)		
HMLP-1	5.6	250.2	31 Oct. 2022	Open borehole (upon completion of drilling)
HMLP-2	4.2	252.1	1 Nov. 2022	
HMLP-3	8.2	248.6	2 Nov. 2022	
HMLP-4	5.6	252.1	10 May 2021	

4.4 Analytical Testing

The results of analytical testing of four soil samples, which were submitted to Bureau Veritas (an accredited analytical testing laboratory), are detailed in the laboratory test report (Certificate of Analysis) included in Appendix C and are summarized below.

Borehole and Sample No.	Depth / Elevation (m)	Resistivity (ohm-cm)	Conductivity (µmho/cm)	pH	Chloride (µg/g)	Sulphate (µg/g)	Sulphide (mg/kg)
HMLP-1 Sample No. 3	1.8 / 254.0	13,000	76	7.86	<20[1]	<20[1]	0.8
HMLP-2 SA Sample No. 3	1.8 / 254.5	11,000	95	7.18	<20[1]	<20[1]	<0.5
HMLP-3 Sample No. 3	1.8 / 255.0	18,000	55	7.12	<20[1]	<20[1]	0.7
HMLP-4 Sample No. 3	1.8 / 255.8	19,000	53	7.36	<20[1]	<20[1]	0.9

Note 1: Chloride and sulphate concentrations are less than the reportable detection limit (RDL).

5.0 CLOSURE

The field drilling program was supervised by Mr. Kevin Rupke, P.Geo., C.E.T. and Mr. Maor Levy under the overall direction of Mr. Mark Henderson, P.Eng., and Mr. David Muldowney, P.Eng. The Foundation Investigation Report was prepared by Mr. Mark Henderson, P.Eng., and Mr. David Muldowney, P.Eng., an MTO Foundations Designated Contact, conducted an independent technical and quality control review of the report.

Signature Page

Golder Associates Ltd.

Mark Henderson, P.Eng.
Geotechnical Engineer

David Muldowney, P.Eng.
MTO Foundations Designated Contact / Senior Engineer

MH/DAM/ca

https://golderassociates.sharepoint.com/sites/120052/project files/6 deliverables/2. reporting/07 - hmlp/3. final/rev0/19135676-r-rev0-8000-coldwater hmlp fir 13jan_23.docx

TABLE 1
GEOTECHNICAL DESIGN PARAMETERS FOR HIGH MAST LIGHT POLE FOUNDATIONS

Reference Borehole	Ground Surface Elevation at Reference Borehole (m)	Design Groundwater Elevation[1] (m)	Stratum	Depth Relative to Existing Ground Surface (m)[2]	Elevation in Reference Borehole (m)	Design Parameters[3, 4]						
						S_u (kPa)	Φ'	γ (kN/m^3)	γ' (kN/m^3)	n_h (kPa/m)	K_p	$K_{p2:1}$
HMLP-1	255.8	251.5	Silty sand topsoil	0.0 to 0.1	255.8 to 255.7	-	27	12	2	-	-	-
			Compact silty sand fill	0.1 to 0.7	255.7 to 255.1	-	34	20	10	6500	3.54	1.34
			Loose to compact silty sand	0.7 to 3.7	255.1 to 252.1	-	32	19	9	6500	3.25	1.23
			Compact silt (above the groundwater level)	3.7 to 4.3	252.1 to 251.5	-	30	18	8	6500	3.00	1.12
			Compact silt (below the groundwater level)	4.3 to 5.6	251.5 to 250.2		30	18	8	4500	3.00	1.12
			Clayey silt-silt	5.6 to 6.4	250.2 to 249.4	100	30	17	7	4500	3.00	1.12
			Compact to dense sand	6.4 to 11.1	249.4 to 244.7	-	32	19	9	11000	3.25	1.23
			Dense silty sand	11.1 to 12.8	244.7 to 243.0	-	32	19	9	11000	3.25	1.23
HMLP-2	256.3	251.5	Silty sand topsoil	0.0 to 0.2	256.3 to 256.1	-	27	12	2	-	-	-
			Compact sand fill	0.2 to 0.7	256.1 to 255.6	-	34	20	10	6000	3.54	1.34
			Stiff to very stiff clayey silt-silt fill	0.7 to 2.2	255.6 to 254.1	100	30	17	7	6500	3.00	1.12
			Loose to very dense silty sand (above the groundwater level)	2.2 to 4.1	254.1 to 251.5	-	32	19	9	6500	3.25	1.23
			Dense silty sand (below the groundwater level)	4.1to 7.9	251.5 to 248.8	-	32	19	9	11000	3.25	1.23
			Silt	7.9 to 8.7	248.4 to 247.6	-	30	18	8	4500	3.00	1.12
			Clayey silt	8.7 to 10.2	247.6 to 246.1	100	30	17	7	4500	3.00	1.12
			Compact to very dense sand	10.2 to 12.8	246.1 to 243.5	-	32	19	9	11000	3.25	1.23
HMLP-3	256.8	251.5	Compact silty sand topsoil	0.0 to 0.5	256.8 to 256.3	-	27	12	2	-	-	-
			Loose to compact silty sand fill	0.5 to 2.2	256.3 to 254.6	-	34	20	10	2500	3.54	1.34
			Loose sand	2.2 to 5.0	254.6 to 251.8	-	32	19	9	2500	3.25	1.23
			Compact silt (above the groundwater level)	5.0 to 5.3	251.8 to 251.5	-	30	18	8	6500	3.00	1.12
			Compact silt (above the groundwater level)	5.3 to 7.2	251.85 to 249.6	-	30	18	8	4500	3.00	1.12
			Very stiff clayey silt	7.2 to 8.7	249.6 to 248.1	100	30	17	7	4500	3.00	1.12
			Loose to dense sand	8.7 to 12.8	248.1 to 244.0	-	32	19	9	11000	3.25	1.23
HMLP-4	257.7	251.5	Loose silty sand topsoil	0.0 to 0.7	257.7 to 257.0	-	27	12	2	-	-	-
			Very loose to compact sand (above the groundwater level)	0.7 to 3.7	257.0 to 254.0	-	32	19	9	2500	3.25	1.23
			Compact to dense sand (above the groundwater level)	3.7 to 6.2	254.0 to 251.5	-	32	19	9	6500	3.25	1.23
			Very loose to dense sand (above the groundwater level)	6.2 to 7.2	251.5 to 250.5	-	32	19	9	4500	3.25	1.23
			Dense to very dense silt	7.2 to 10.2	250.5 to 247.5	-	30	18	8	11000	3.00	1.12
			Very stiff clayey silt	10.2 to 11.7	247.5 to 246.0	100	30	17	7	4500	3.00	1.12
			Compact silty sand	11.7 to 12.8	246.0 to 244.9	-	32	19	9	1000	3.25	1.23

NOTES:

1. The design groundwater level was evaluated using stabilized groundwater level readings from standpipe piezometers previously installed in support of the Highway 12 Coldwater Road Underpass replacement (i.e., stabilized piezometer readings from Boreholes CR-7 and CR-3 rounded up to the nearest 0.5 m).

2. Depths are given at the existing borehole location or proposed pole locations relative to the estimated proposed ground surface following construction, including any regrading. Although Su, φ' and Kp parameters are given for the full depth of the soil, the passive resistance in the upper 1.8 m should be neglected in the high mast light pole design to account for frost action. Design parameters are not provided for topsoil materials since lateral load resistance of these soils should be neglected.

3. Design parameters:
   s_u = undrained shear strength (kPa);
   φ' = effective friction angle (degrees);

TABLE 1
GEOTECHNICAL DESIGN PARAMETERS FOR HIGH MAST LIGHT POLE FOUNDATIONS

γ = bulk unit weight (kN/m3);
γ' = effective unit weight below the groundwater level (kN/m3);
n_h = constant of horizontal subgrade reaction (kPa/m);
K_p = passive earth pressure coefficient; and
$K_{p2:1}$ = passive earth pressure coefficient adjusted to account for 2H:1V sloping ground within two caisson diameters of the foundation element.

Kp values are unfactored and should be reduced by an appropriate factor that considers the allowable deflection of the caisson to account for the fact that a large strain would be required for mobilization of the full passive lateral earth pressure.

4. Where both undrained shear strength and effective friction angle parameters are provided for cohesive materials, the structural assessment should be completed for both undrained and drained conditions, and the selected design should be based on the more conservative approach.

MINISTRY OF TRANSPORTATION, ONTARIO

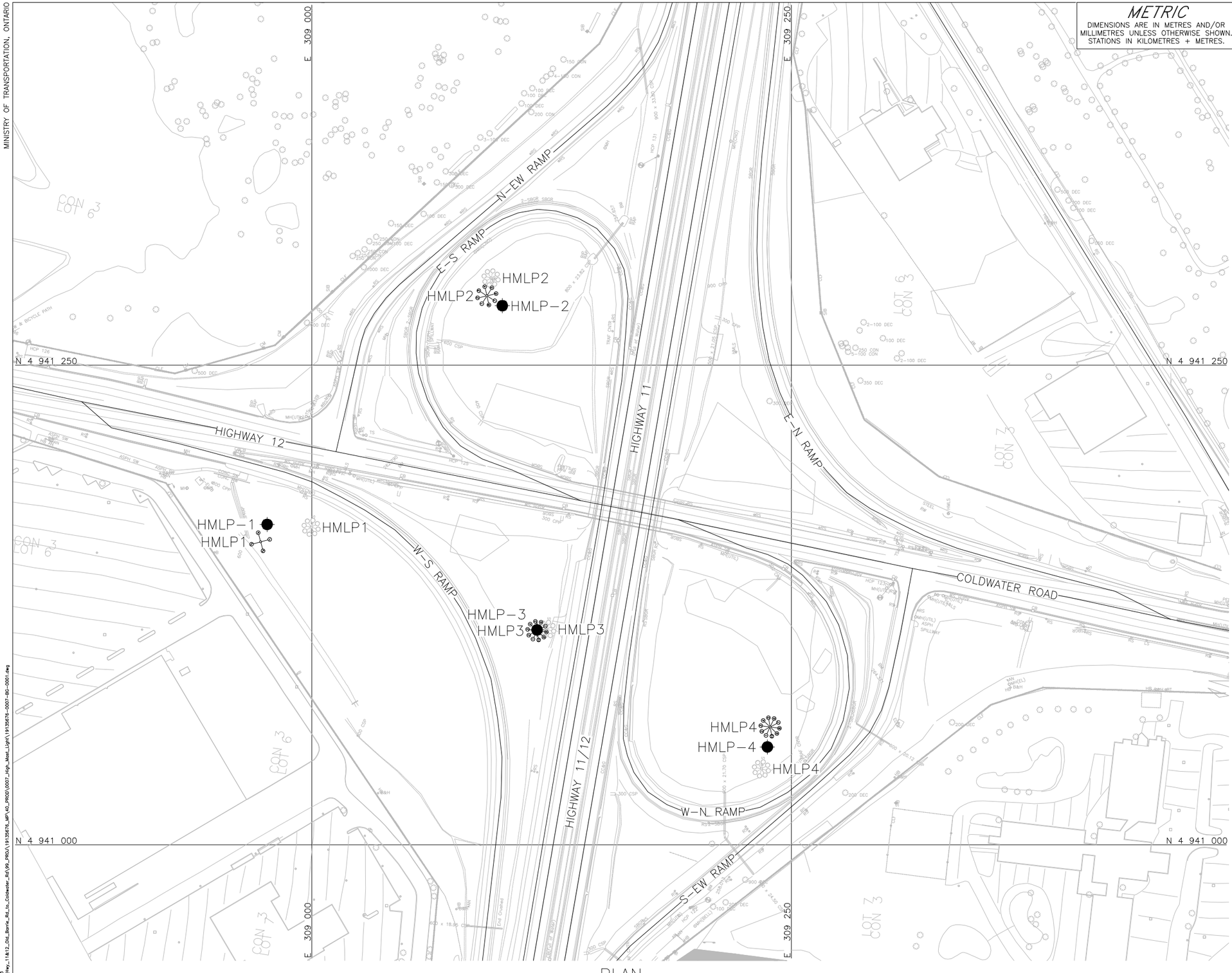
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 2129-18-00

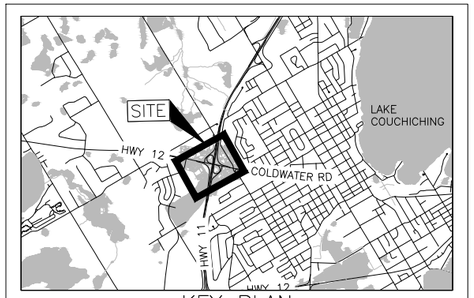
HIGHWAY 11/12 INTERCHANGE
HIGH MAST LIGHT POLE (HMLP) RELOCATION
BOREHOLE LOCATION PLAN

SHEET

WSP GOLDER



PLAN
SCALE
20 0 20 40 m



KEY PLAN
SCALE
1 0 1 2 km

LEGEND

- Borehole – Current
- Existing HMLP
- Proposed HMLP

BOREHOLE CO-ORDINATES (NAD 83 MTM ZONE 10)

No.	ELEVATION	NORTHING	EASTING
HMLP-1	255.8	4941167.0	308976.7
HMLP-2	256.3	4941281.0	309099.3
HMLP-3	256.8	4941112.0	309117.4
HMLP-4	257.7	4941051.0	309237.5

LICENSED PROFESSIONAL ENGINEER
M. S. HENDERSON
100523882
Jan. 06, 2023
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
D. A. MULDOWNEY
100164716
Jan. 06, 2023
PROVINCE OF ONTARIO

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.

REFERENCE

Base plans provided in digital format by McIntosh Perry, drawing file nos. x_197147_BASE.dwg, received May 19, 2021.

NO.	DATE	BY	REVISION
.	.	.	.

Geocres No. 31D-813

HWY. 11/12		PROJECT NO. 19135676	DIST. .
SUBM'D. MH	CHKD. .	DATE: 01/06/2023	SITE: .
DRAWN: DD/ZS/SA	CHKD. MH	APPD. DAM	DWG. 1

PLOT DATE: January 6, 2023
FILENAME: S:\Clients\MTO\Hwy_11&12_Old_Barrie_Rd_to_Coldwater_Rd\99_PROJ\19135676_MP\40_PROD\0007_High_Mast_Light\19135676-0007-BD-0001.dwg

Photograph 1: Existing HMLP-1 facing east
(background includes the existing HMLP-3 and HMLP-4 to the left)

Photograph 2: Existing HMLP-2, facing south
(background includes the existing HMLP-3 to the left and HMLP-1 to the right)

Photograph 3: Existing HMLP-3, facing west
(background includes the existing HMLP-1 to the right and HMLP-2 to the far right)

Photograph 4: Existing HMLP-4, facing east

APPENDIX A

Record of Boreholes

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS
MINISTRY OF TRANSPORTATION, ONTARIO

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>200	>8
COBBLES	Not Applicable	75 to 200	3 to 8
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
FINES	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY COMPONENTS[1,2]

Percentage by Mass	Modifier
> 35	Use 'and' to combine primary and secondary component (*i.e.,* SAND and gravel)
> 20 to 35	Primary soil name prefixed with "gravelly, sandy" as applicable
> 10 to 20	some (*i.e.,* some sand)
≤ 10	trace (*i.e.,* trace fines)

1. Only applicable to components not described by Primary Group Name.
2. Classification of Primary Group Name based on Unified Soil Classification System (ASTM D2487) for coarse-grained soils; fine-grained soils described per current MTO Soil Classification System.

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)
An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve friction (f_s) are recorded electronically at 25 mm penetration intervals.

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

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC / SC	Rock core / Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample
OD / ID	Outer Diameter / Inner Diameter
HSA / SSA	Hollow-Stem Augers / Solid-Stem Augers

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

COARSE-GRAINED SOILS

Compactness[1]

Term	SPT 'N' (blows/0.3m)[2]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

1. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.
2. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.

FINE-GRAINED SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1,2] (blows/0.3m)
Very Soft	< 12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	> 200	> 30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time
FoS	factor of safety

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ. where $\gamma = \rho \cdot g$ (i.e., mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_L or LL	liquid limit
w_P or PL	plastic limit
I_P or PI	plasticity index = $(w_l - w_p)$
NP	non-plastic
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
$C_{\alpha(e)}$	secondary compression index
C_α	rate of secondary compression
$C_{\alpha(\varepsilon)}$	modified secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
c′	effective cohesion
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q or q'	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$
2 shear strength = (compressive strength)/2

PROJECT 19135676

RECORD OF BOREHOLE No HMLP-1 SHEET 1 OF 1 METRIC

G.W.P. 2494-15-00 LOCATION N 4941167.0; E 308976.7 MTM NAD 83 ZONE 10 (LAT. 44.610506; LONG. -79.447381) ORIGINATED BY KR

DIST Central HWY 11/12 BOREHOLE TYPE 108 mm ID Hollow Stem Augers COMPILED BY MH

DATUM Geodetic DATE October 31, 2022 CHECKED BY DAM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
255.8	GROUND SURFACE						
0.0 / 0.1	TOPSOIL (50 mm) - SILTY SAND (SM), some organics Dark brown Moist		1A 1B	SS	11		
255.1							255
0.7	Silty sand (SM), trace clay (FILL) Compact Brown Moist		2	SS	7		
	SILTY SAND (SM), trace clay Loose to compact Brown Moist		3	SS	8		254
			4	SS	19		253
252.1			5	SS	22		
3.7	SILT (ML), trace clay, trace sand Compact Brown Wet		6	SS	12		252
			7	SS	11		251
250.2						▽	
5.6	CLAYEY SILT-SILT (CL-ML), some sand, trace gravel Brown Wet						250
249.4			8A 8B	SS	32		
6.4	SAND (SP-SM), trace gravel, trace to some silt Compact to dense Brown Wet						249
			9	SS	31		248
							247
			10	SS	39		
							246
244.7			11A 11B	SS	18		245
11.1	SILTY SAND (SM), trace gravel, trace clay Dense Brown Wet -Approximately 0.3 m of heave inside augers at 12.2 m depth (Elev. 253.6 m).						244
243.0			12	SS	32		
12.8	END OF BOREHOLE NOTES: 1. Borehole caved to a depth of 6.7 m below ground surface (Elev. 249.1 m) upon completion of drilling. 2. Groundwater encountered at a depth of 5.6 m below ground surface (Elev. 250.2 m) upon completion of drilling.						

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED; 20 40 60 80 100

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
	0	57	42	1
	0	6	89	5
	5	83	(12)	
	2	79	17	2

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

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RECORD OF BOREHOLE No HMLP-2

SHEET 1 OF 1 **METRIC**

PROJECT 19135676
G.W.P. 2494-15-00
DIST Central HWY 11/12
DATUM Geodetic

LOCATION N 4941281.0; E 309099.3 MTM NAD 83 ZONE 10 (LAT. 44.611532; LONG. -79.445835)
BOREHOLE TYPE 108 mm ID Hollow Stem Augers
DATE November 1, 2022

ORIGINATED BY KR
COMPILED BY MH
CHECKED BY DAM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100)	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
256.3	GROUND SURFACE						256				
0.0	TOPSOIL (220 mm) - SILTY SAND (SM), trace gravel, some organics Dark brown Moist		1A 1B	SS	10						
0.2 255.6											
0.7	Sand (SP-SM), trace silt (FILL) Compact Brown Moist		2	SS	23		255				0 24 62 14
	Sandy clayey-silt-silt (FILL) Stiff to very stiff Brown Moist		3	SS	14						
254.1 2.2	SILTY SAND (SM), trace clay Loose to very dense Brown Moist		4	SS	17		254				
			5	SS	14		253				
			6	SS	8	▽	252				0 84 15 1
			7	SS	35		251				
			8	SS	70		250				
248.4	- Becoming wet at about 7.6 m (Elev. 248.7 m)		9A 9B	SS	45		249				
7.9 247.6	SILT (ML), trace gravel, trace sand, trace clay Brown Wet						248				3 4 86 7
8.7	CLAYEY SILT (CL), some sand, trace gravel Brown Wet		10	SS	100/0.07		247				
246.1	- Split-spoon refusal (i.e. hammer bouncing) at 9.4 m depth (Elev. 246.9 m)										
10.2	SAND (SP-SM), trace silt Compact to very dense Brown Wet		11	SS	19		246				0 93 (7)
							245				
243.5			12	SS	58		244				
12.8	END OF BOREHOLE NOTES: 1. Borehole caved to a depth of 9.0 m below ground surface (Elev. 247.3 m) upon completion of drilling. 2. Groundwater encountered at a depth of 4.2 m below ground surface (Elev. 252.1 m) upon completion of drilling.										

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

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RECORD OF BOREHOLE No HMLP-3

SHEET 1 OF 1 **METRIC**

PROJECT 19135676
G.W.P. 2494-15-00
DIST Central HWY 11/12
DATUM Geodetic

LOCATION N 4941112.0; E 309117.4 MTM NAD 83 ZONE 10 (LAT. 44.610011; LONG. -79.445608)
BOREHOLE TYPE 108 mm ID Hollow Stem Augers
DATE November 2, 2022

ORIGINATED BY KR
COMPILED BY MH
CHECKED BY DAM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
256.8	GROUND SURFACE								
0.0 / 256.3	TOPSOIL (530 mm) - SILTY SAND (SM), some gravel, some organics Compact Dark brown Moist		1	SS	21		256		
0.5	Silty sand (SM), trace gravel (FILL) Loose to compact Brown Moist		2	SS	19				
			3	SS	5		255		
254.6 / 2.2	- Trace organics in Sample No. 2. SAND (SP-SM), trace silt, trace clay Loose to compact Brown Moist		4	SS	5		254		0 92 7 1
			5	SS	5				
			6	SS	6		253		
251.8	- Becoming wet at about 4.6 m depth (Elevation 252.2 m)		7A 7B	SS	19		252		
5.0	SILT (ML), trace gravel, trace sand, trace clay Compact Brown Wet		8	SS	27		251		2 6 89 3
249.6									
7.2	CLAYEY SILT (CL), trace sand, trace gravel Very stiff Brown Wet		9	SS	19	▽	249		3 6 68 23
248.1									
8.7	SAND (SP-SM), trace silt Loose to dense Brown Wet		10	SS	33		248		0 95 (5)
			11	SS	9		247		
							246		
244.0			12	SS	38		245		
12.8	END OF BOREHOLE NOTES: 1. Borehole caved to a depth of 8.6 m below ground surface (Elev. 248.2 m) upon completion of drilling. 2. Groundwater encountered at a depth of 8.2 m below ground surface (Elev. 248.6 m) upon completion of drilling.								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED; 20 40 60 80 100

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

WATER CONTENT (%): 10 20 30

+3, ×3: Numbers refer to Sensitivity

○3% STRAIN AT FAILURE

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RECORD OF BOREHOLE No HMLP-4

SHEET 1 OF 1

METRIC

PROJECT 19135676

G.W.P. 2494-15-00

LOCATION N 4941051.0; E 309237.5 MTM NAD 83 ZONE 10 (LAT. 44.609461; LONG. -79.444096)

ORIGINATED BY KR

DIST Central HWY 11/12

BOREHOLE TYPE 108 mm ID Hollow Stem Augers

COMPILED BY MH

DATUM Geodetic

DATE May 10, 2022

CHECKED BY DAM

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
257.7	GROUND SURFACE							
0.0 / 257.0	TOPSOIL (680 mm) - SILTY SAND (SM), trace organics Loose Dark brown Moist	1	SS	7				
0.7	SAND (SP), trace silt, trace clay Very loose to dense Brown Moist	2	SS	6				
		3	SS	2				
		4	SS	12				
		5	SS	9				
		6	SS	20	0	97	2	1
		7	SS	18				
		8	SS	34				
250.5								
7.2	SILT (ML), some clay, trace sand Dense to very dense Brown Wet	9	SS	39	0	2	82	16
		10	SS	75				
247.5								
10.2	CLAYEY SILT-SILT (CL-ML), trace to some sand Very stiff Brown Wet	11	SS	21				
246.0								
11.7	SILTY SAND (SM), trace clay Compact Brown Wet	12	SS	13	0	81	18	1
244.9								
12.8	END OF BOREHOLE NOTES: 1. Borehole caved to a depth of 6.1 m below ground surface (Elev. 251.6 m) upon completion of drilling. 2. Groundwater encountered at a depth of 5.6 m below ground surface (Elev. 252.1 m) upon completion of drilling.							

GROUND WATER CONDITIONS: ▽

ELEVATION SCALE: 257, 256, 255, 254, 253, 252, 251, 250, 249, 248, 247, 246, 245

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED; 20 40 60 80 100

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 (%)

+ 3, × 3: Numbers refer to Sensitivity

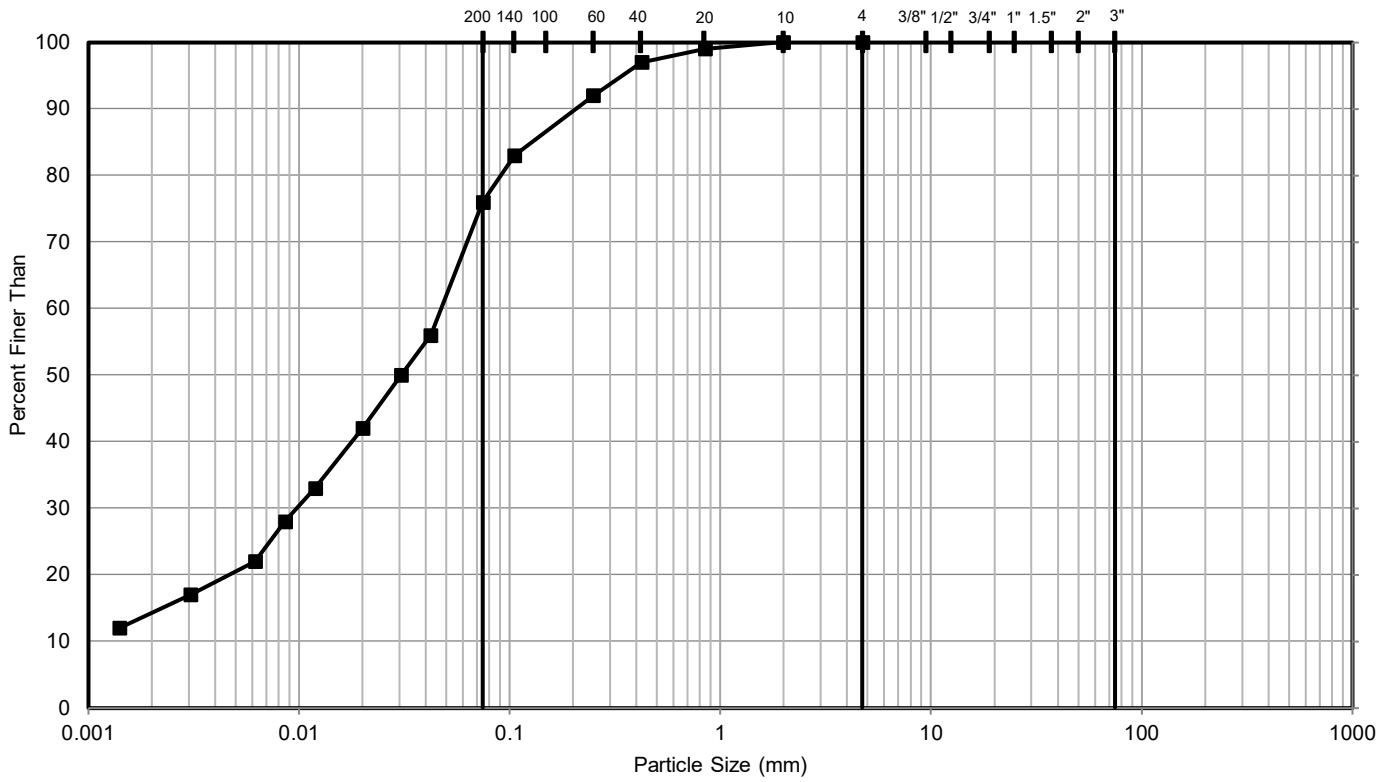
○ 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTO\HWY_11&12_OLD_BARRIE_RD_TO_COLDWATER_RD\02_DATA\GINTHWY_11&12_OLD_BARRIE_RD_TO_COLDWATER_RD.GPJ GAL-GTA.GDT 1/6/23

APPENDIX B

Geotechnical Laboratory Testing

GRAIN SIZE DISTRIBUTION



FINES (Silt, Clay)	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		

Symbol	Sample Location	Sample Number	Depth (m)	Elevation (m)
■	HMLP-2	2	0.8 - 1.4	255.5 to 254.9

CLIENT

McIntosh Perry / MTO

PROJECT

HIGHWAY 11/12 COLDWATER ROAD INTERCHANGE
HIGH MAST LIGHT POLES

CONSULTANT

WSP GOLDER

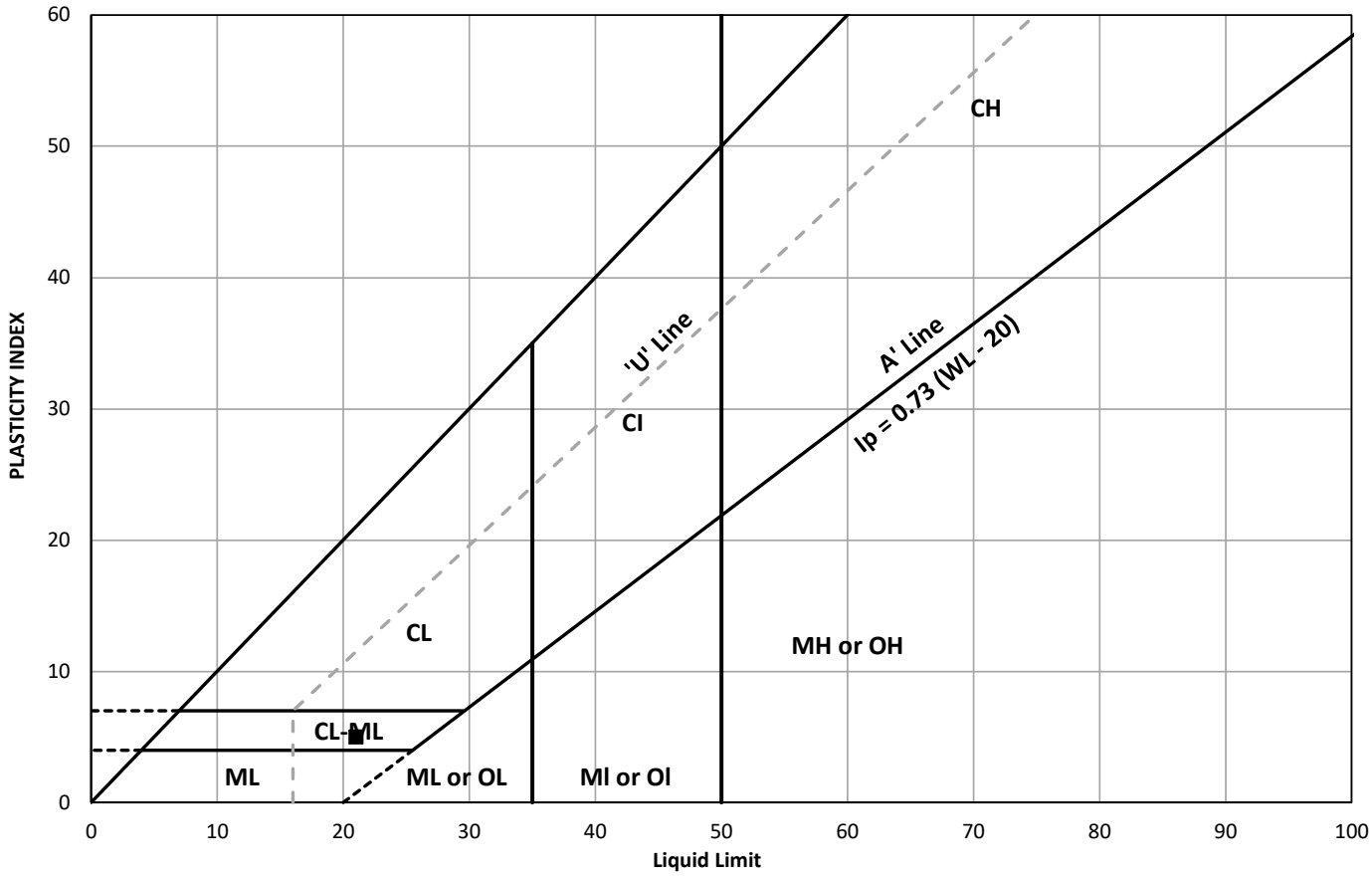
YYYY-MM-DD	2022-12-05
DESIGNED	MH
PREPARED	MH
REVIEWED	DAM
APPROVED	DAM

TITLE

GRAIN SIZE DISTRIBUTION
CLAYEY SILT-SILT (CL-ML) (FILL)

PROJECT NO.	CONTROL	REV.	FIGURE
19135676	0	0	B-1

PLASTICITY CHART



	Sample Location	Sample / Specimen Number	Depth (m)	Natural Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
■	HMLP-2	2	0.8 - 1.4	15.2	21	16	5	-0.16

CLIENT

McIntosh Perry / MTO

CONSULTANT

wsp GOLDER

YYYY-MM-DD	2022-12-09
DESIGNED	MH
PREPARED	MH
REVIEWED	DAM
APPROVED	DAM

PROJECT

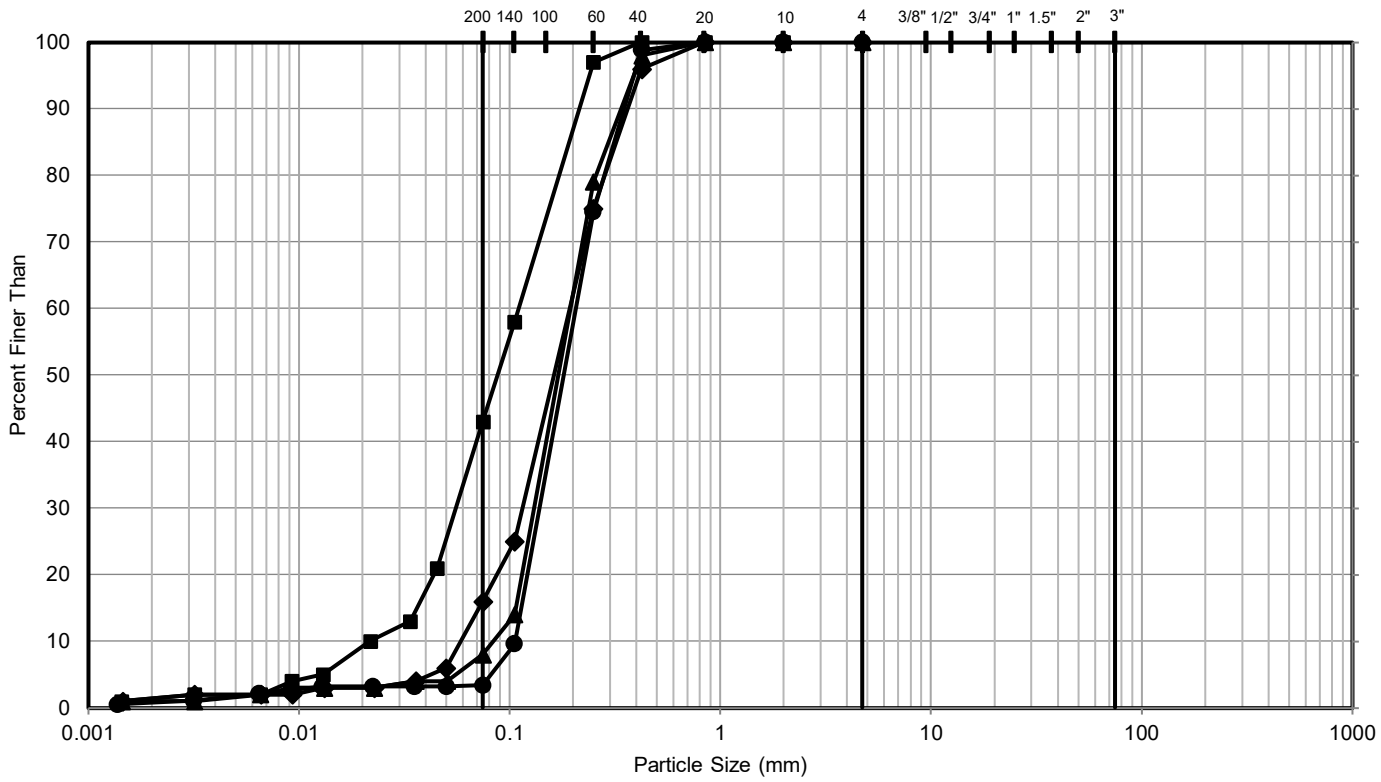
HIGHWAY 11/12 COLDWATER ROAD INTERCHANGE
HIGH MAST LIGHT POLES

TITLE

PLASTICITY CHART
CLAYEY SILT-SILT (CL-ML) (FILL)

PROJECT NO.	CONTROL	REV.	FIGURE
19135676	0	0	B-2

GRAIN SIZE DISTRIBUTION



FINES (Silt, Clay)	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		

Symbol	Sample Location	Sample Number	Depth (m)	Elevation (m)
■	HMLP-1	2	0.8 - 1.4	255.0 to 254.4
◆	HMLP-2	6	3.8 - 4.4	252.5 to 251.9
▲	HMLP-3	4	2.3 - 2.9	254.5 to 253.9
●	HMLP-4	6	3.8 - 4.4	253.9 to 253.3

CLIENT

McIntosh Perry / MTO

PROJECT

HIGHWAY 11/12 COLDWATER ROAD INTERCHANGE
HIGH MAST LIGHT POLES

CONSULTANT

WSP GOLDER

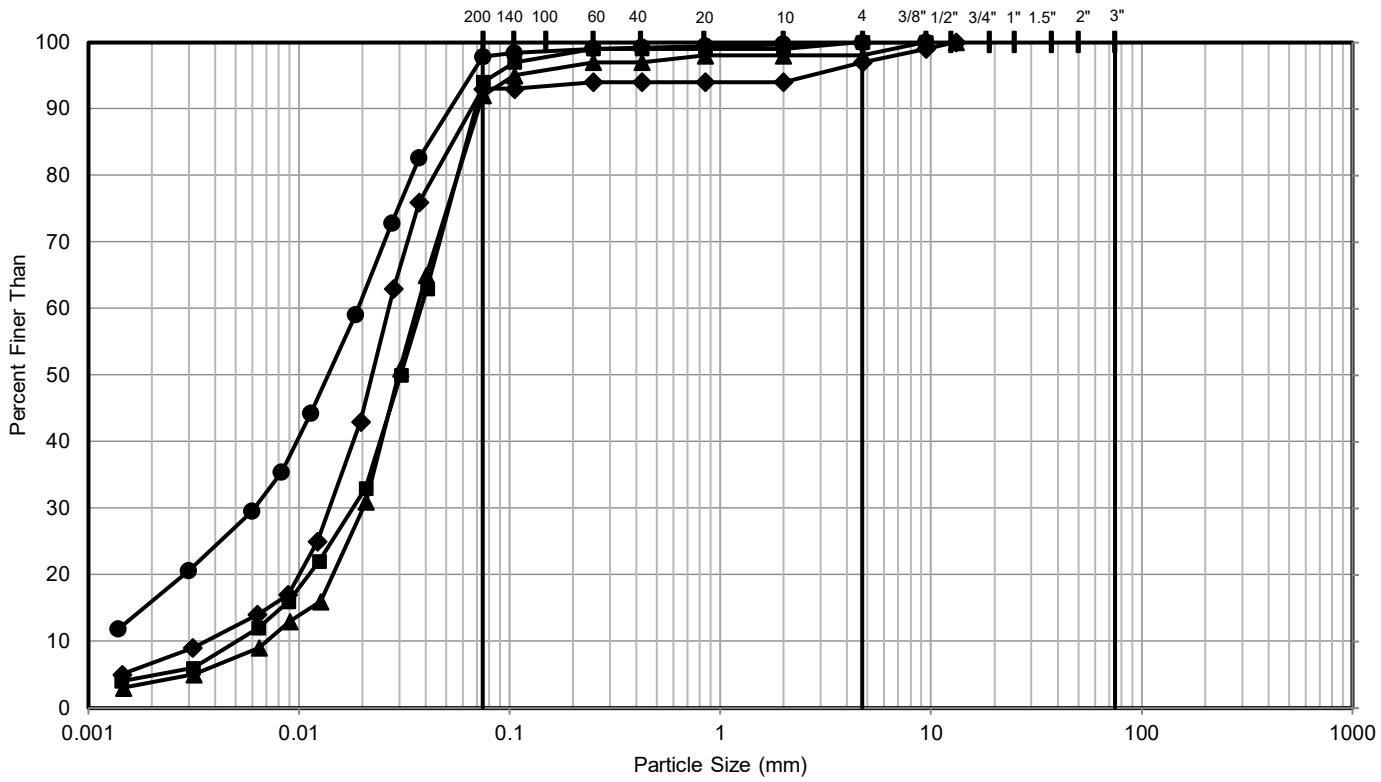
YYYY-MM-DD	2022-12-05
DESIGNED	MH
PREPARED	MH
REVIEWED	DAM
APPROVED	DAM

TITLE

GRAIN SIZE DISTRIBUTION
SILTY SAND (SM) to SAND (SP-SM) - Upper

PROJECT NO.	CONTROL	REV.	FIGURE
19135676	0	0	B-3

GRAIN SIZE DISTRIBUTION



FINES (Silt, Clay)	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		

Symbol	Sample Location	Sample Number	Depth (m)	Elevation (m)
■	HMLP-1	7	4.6 - 5.2	251.2 to 250.6
◆	HMLP-2	9B	7.9 - 8.2	248.4 to 248.1
▲	HMLP-3	8	6.1 - 6.7	250.7 to 250.1
●	HMLP-4	9	7.6 - 8.2	250.1 to 249.5

CLIENT

McIntosh Perry / MTO

PROJECT

HIGHWAY 11/12 COLDWATER ROAD INTERCHANGE
HIGH MAST LIGHT POLES

CONSULTANT

WSP GOLDER

YYYY-MM-DD	2022-12-05
DESIGNED	MH
PREPARED	MH
REVIEWED	DAM
APPROVED	DAM

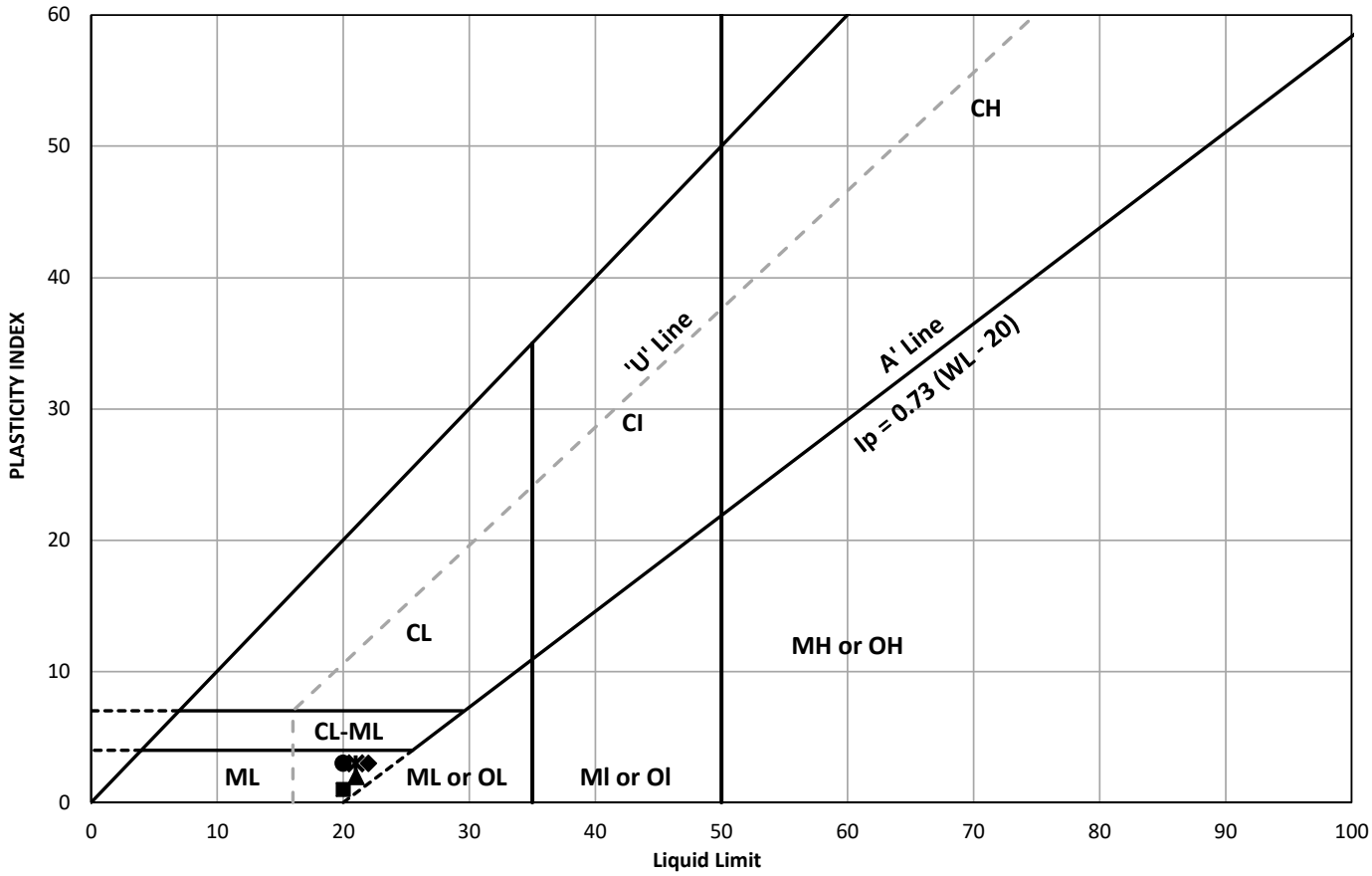
TITLE

GRAIN SIZE DISTRIBUTION
SILT (ML)

PROJECT NO.	CONTROL	REV.	FIGURE
19135676	0	0	B-4

PATH: https://wsponline-my.sharepoint.com/personal/mark_henderson_wsp_com1/Documents/Microsoft Teams Chat Files | FILE NAME: HMLP - Figures 1 to 8 mh (1).xlsm

PLASTICITY CHART



	Sample Location	Sample / Specimen Number	Depth (m)	Natural Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
■	HMLP-1	7	4.6 - 5.2	20.7	20	19	1	1.70
◆	HMLP-2	9B	7.9 - 8.2	21.8	22	19	3	0.93
▲	HMLP-3	8	6.1 - 6.7	22.3	21	19	2	1.65
●	HMLP-4	9	7.6 - 8.2	21	20	17	3	1.33
✳	HMLP-4	10	9.1 - 9.8	19.2	21	18	3	0.40

CLIENT

McIntosh Perry / MTO

PROJECT

HIGHWAY 11/12 COLDWATER ROAD INTERCHANGE
HIGH MAST LIGHT POLES

CONSULTANT

wsp GOLDER

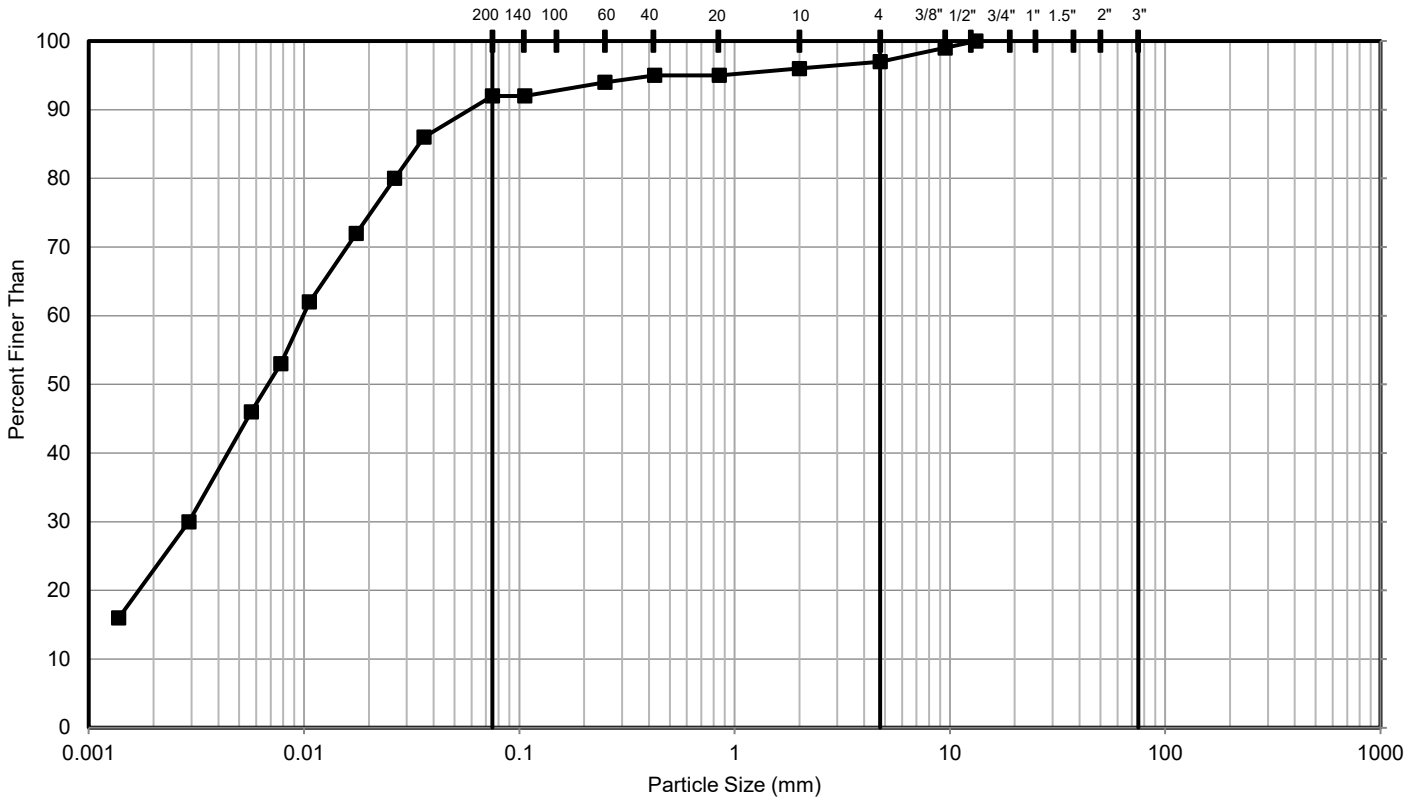
YYYY-MM-DD	2022-12-09
DESIGNED	MH
PREPARED	MH
REVIEWED	DAM
APPROVED	DAM

TITLE

PLASTICITY CHART
SILT (ML)

PROJECT NO.	CONTROL	REV.	FIGURE
19135676	0	0	B-5

GRAIN SIZE DISTRIBUTION



FINES (Silt, Clay)	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		

Symbol	Sample Location	Sample Number	Depth (m)	Elevation (m)
■	HMLP-3	9	7.6 - 8.2	249.2 to 248.6

CLIENT

McIntosh Perry / MTO

PROJECT

HIGHWAY 11/12 COLDWATER ROAD INTERCHANGE

CONSULTANT

WSP GOLDER

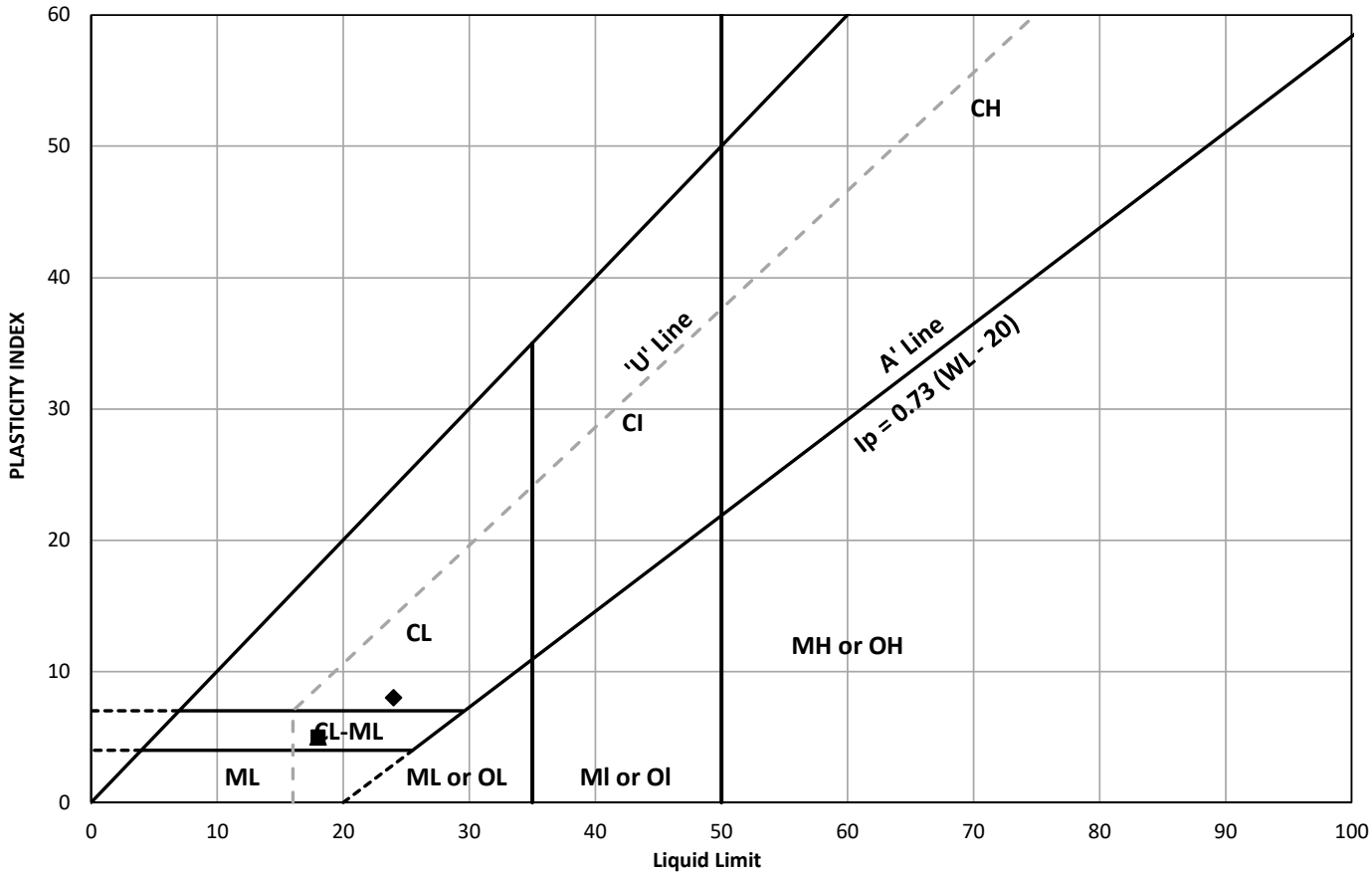
YYYY-MM-DD	2022-12-05
DESIGNED	MH
PREPARED	MH
REVIEWED	DAM
APPROVED	DAM

TITLE

GRAIN SIZE DISTRIBUTION
CLAYEY SILT (CL)

PROJECT NO.	CONTROL	REV.	FIGURE
19135676	0	0	B-6

PLASTICITY CHART



	Sample Location	Sample / Specimen Number	Depth (m)	Natural Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
■	HMLP-1	8A	6.1 - 6.4	14.7	18	13	5	0.34
◆	HMLP-3	9	7.6 - 8.2	24.3	24	16	8	1.04
▲	HMLP-4	11	10.7 - 11.3	21.4	18	13	5	1.68

CLIENT

McIntosh Perry / MTO

PROJECT

HIGHWAY 11/12 COLDWATER ROAD INTERCHANGE
HIGH MAST LIGHT POLES

CONSULTANT

wsp GOLDER

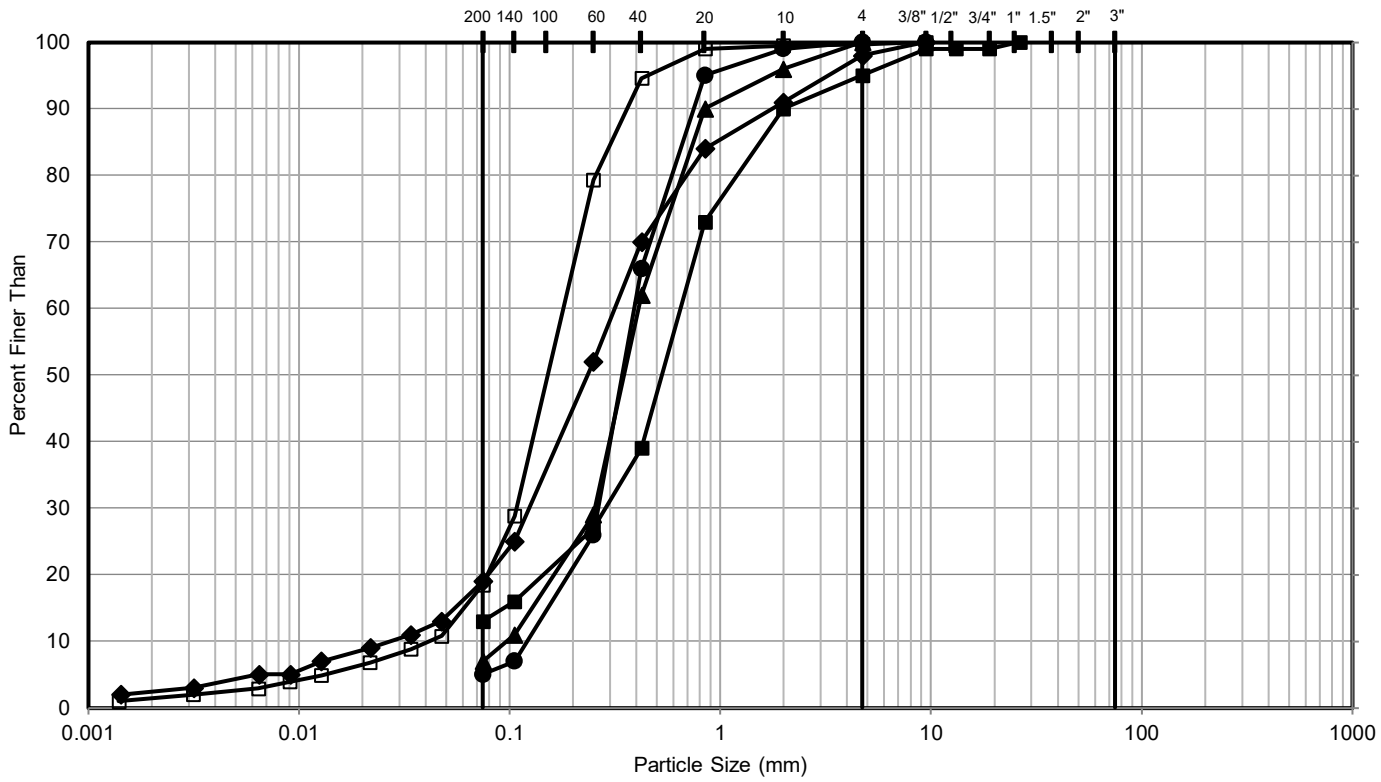
YYYY-MM-DD	2022-12-09
DESIGNED	MH
PREPARED	MH
REVIEWED	DAM
APPROVED	DAM

TITLE

PLASTICITY CHART
CLAYEY SILT-SILT (CL-ML) to CLAYEY SILT (CL)

PROJECT NO.	CONTROL	REV.	FIGURE
19135676	0	0	B-7

GRAIN SIZE DISTRIBUTION



FINES (Silt, Clay)	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		

Symbol	Sample Location	Sample Number	Depth (m)	Elevation (m)
■	HMLP-1	10	9.1 - 9.8	246.7 to 246.1
◆	HMLP-1	12	12.2 - 12.8	243.6 to 243.0
▲	HMLP-2	11	10.7 - 11.3	245.6 to 245.0
●	HMLP-3	10	9.1 - 9.8	247.7 to 247.1
□	HMLP-4	12	12.2 - 12.8	245.5 to 244.9

CLIENT

McIntosh Perry / MTO

PROJECT

HIGHWAY 11/12 COLDWATER ROAD INTERCHANGE
HIGH MAST LIGHT POLES

CONSULTANT

wsp GOLDER

YYYY-MM-DD	2022-12-05
DESIGNED	MH
PREPARED	MH
REVIEWED	DAM
APPROVED	DAM

TITLE

GRAIN SIZE DISTRIBUTION
SILTY SAND (SM) to SAND (SP-SM) - Lower

PROJECT NO.	CONTROL	REV.	FIGURE
19135676	0	0	B-8

APPENDIX C

Analytical Laboratory Test Results

Your P.O. #: 19135676/8000/8004
Your Project #: 19135676
Site Location: HWY 11/12, ORILLIA
Your C.O.C. #: N/A

Attention: Mark Henderson

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2022/11/23
Report #: R7401682
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2X4109
Received: 2022/11/14, 18:17

Sample Matrix: Soil
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Chloride (20:1 extract)	4	2022/11/18	2022/11/19	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	4	2022/11/18	2022/11/18	CAM SOP-00414	OMOE E3530 v1 m
Moisture (Subcontracted) (1, 2)	4	N/A	2022/11/23	AB SOP-00002	CCME PHC-CWS m
Sulphide in Soil (1)	4	N/A	2022/11/20	AB SOP-00080	EPA9030B/SM4500S2-DF
pH CaCl2 EXTRACT	4	2022/11/18	2022/11/18	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	4	2022/11/14	2022/11/18	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	4	2022/11/18	2022/11/18	CAM SOP-00464	EPA 375.4 m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE , Calgary, AB, T2E 6P8
(2) Offsite analysis requires that subcontracted moisture be reported.

Your P.O. #: 19135676/8000/8004
Your Project #: 19135676
Site Location: HWY 11/12, ORILLIA
Your C.O.C. #: N/A

Attention: Mark Henderson

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2022/11/23
Report #: R7401682
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2X4109
Received: 2022/11/14, 18:17

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Ankita Bhalla, Project Manager
Email: Ankita.Bhalla@bureauveritas.com
Phone# (905) 817-5700

==========

This report has been generated and distributed using a secure automated process.
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Bureau Veritas Job #: C2X4109
Report Date: 2022/11/23

Golder Associates Ltd
Client Project #: 19135676
Site Location: HWY 11/12, ORILLIA
Your P.O. #: 19135676/8000/8004
Sampler Initials: MH

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		UHM318			UHM318			UHM319		
Sampling Date		2022/10/31			2022/10/31			2022/11/01		
COC Number		N/A			N/A			N/A		
	UNITS	HMLP-1 SS3	RDL	QC Batch	HMLP-1 SS3 Lab-Dup	RDL	QC Batch	HMLP-2 SS3	RDL	QC Batch
Calculated Parameters										
Resistivity	ohm-cm	13000		8347960				11000		8347960
Inorganics										
Soluble (20:1) Chloride (Cl-)	ug/g	<20	20	8354122				<20	20	8354122
Conductivity	umho/cm	76	2	8353989				95	2	8353989
Available (CaCl2) pH	pH	7.86		8353926				7.18		8353926
Soluble (20:1) Sulphate (SO4)	ug/g	<20	20	8354143	<20	20	8354143	<20	20	8354143
Sulphide	mg/kg	0.8 (1)	0.5	8360245				<0.5 (1)	0.5	8360245
Physical Testing										
Moisture-Subcontracted	%	3.5	0.30	8364470				14	0.30	8364470

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
(1) Sample extracted past method-specified hold time. Analyzed past method specified hold time

Bureau Veritas ID		UHM319			UHM320			UHM320		
Sampling Date		2022/11/01			2022/11/02			2022/11/02		
COC Number		N/A			N/A			N/A		
	UNITS	HMLP-2 SS3 Lab-Dup	RDL	QC Batch	HMLP-3 SS3	RDL	QC Batch	HMLP-3 SS3 Lab-Dup	RDL	QC Batch
Calculated Parameters										
Resistivity	ohm-cm				18000		8347960			
Inorganics										
Soluble (20:1) Chloride (Cl-)	ug/g	<20	20	8354122	<20	20	8354122			
Conductivity	umho/cm				55	2	8353989	55	2	8353989
Available (CaCl2) pH	pH				7.12		8353926	7.11		8353926
Soluble (20:1) Sulphate (SO4)	ug/g				<20	20	8354143			
Sulphide	mg/kg	0.8	0.5	8360245	0.7 (1)	0.5	8360245			
Physical Testing										
Moisture-Subcontracted	%				8.9	0.30	8364470			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
(1) Sample extracted past method-specified hold time. Analyzed past method specified hold time

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Bureau Veritas Job #: C2X4109
Report Date: 2022/11/23

Golder Associates Ltd
Client Project #: 19135676
Site Location: HWY 11/12, ORILLIA
Your P.O. #: 19135676/8000/8004
Sampler Initials: MH

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		UHM321		
Sampling Date		2022/05/10		
COC Number		N/A		
	UNITS	**HMLP-4 SS3**	**RDL**	**QC Batch**
Calculated Parameters				
Resistivity	ohm-cm	19000		8347960
Inorganics				
Soluble (20:1) Chloride (Cl-)	ug/g	<20	20	8354122
Conductivity	umho/cm	53	2	8353989
Available (CaCl2) pH	pH	7.36		8353926
Soluble (20:1) Sulphate (SO4)	ug/g	<20	20	8354143
Sulphide	mg/kg	0.9 (1)	0.5	8360245
Physical Testing				
Moisture-Subcontracted	%	6.2	0.30	8364470

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) Sample extracted past method-specified hold time. Analyzed past method specified hold time

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Bureau Veritas Job #: C2X4109
Report Date: 2022/11/23

Golder Associates Ltd
Client Project #: 19135676
Site Location: HWY 11/12, ORILLIA
Your P.O. #: 19135676/8000/8004
Sampler Initials: MH

TEST SUMMARY

Bureau Veritas ID: UHM318
Sample ID: HMLP-1 SS3
Matrix: Soil

Collected: 2022/10/31
Shipped:
Received: 2022/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8354122	2022/11/18	2022/11/19	Alina Dobreanu
Conductivity	AT	8353989	2022/11/18	2022/11/18	Gurparteek KAUR
Moisture (Subcontracted)	BAL	8364470	N/A	2022/11/23	Richard Ly
Sulphide in Soil	SPEC	8360245	N/A	2022/11/20	Bailey Morrison
pH CaCl2 EXTRACT	AT	8353926	2022/11/18	2022/11/18	Taslima Aktar
Resistivity of Soil		8347960	2022/11/18	2022/11/18	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8354143	2022/11/18	2022/11/18	Samuel Law

Bureau Veritas ID: UHM318 Dup
Sample ID: HMLP-1 SS3
Matrix: Soil

Collected: 2022/10/31
Shipped:
Received: 2022/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate (20:1 Extract)	KONE/EC	8354143	2022/11/18	2022/11/18	Samuel Law

Bureau Veritas ID: UHM319
Sample ID: HMLP-2 SS3
Matrix: Soil

Collected: 2022/11/01
Shipped:
Received: 2022/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8354122	2022/11/18	2022/11/19	Alina Dobreanu
Conductivity	AT	8353989	2022/11/18	2022/11/18	Gurparteek KAUR
Moisture (Subcontracted)	BAL	8364470	N/A	2022/11/23	Richard Ly
Sulphide in Soil	SPEC	8360245	N/A	2022/11/20	Bailey Morrison
pH CaCl2 EXTRACT	AT	8353926	2022/11/18	2022/11/18	Taslima Aktar
Resistivity of Soil		8347960	2022/11/18	2022/11/18	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8354143	2022/11/18	2022/11/18	Samuel Law

Bureau Veritas ID: UHM319 Dup
Sample ID: HMLP-2 SS3
Matrix: Soil

Collected: 2022/11/01
Shipped:
Received: 2022/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8354122	2022/11/18	2022/11/19	Alina Dobreanu
Sulphide in Soil	SPEC	8360245	N/A	2022/11/20	Bailey Morrison

Bureau Veritas ID: UHM320
Sample ID: HMLP-3 SS3
Matrix: Soil

Collected: 2022/11/02
Shipped:
Received: 2022/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8354122	2022/11/18	2022/11/19	Alina Dobreanu
Conductivity	AT	8353989	2022/11/18	2022/11/18	Gurparteek KAUR
Moisture (Subcontracted)	BAL	8364470	N/A	2022/11/23	Richard Ly

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Golder Associates Ltd
Client Project #: 19135676
Site Location: HWY 11/12, ORILLIA
Your P.O. #: 19135676/8000/8004
Sampler Initials: MH

TEST SUMMARY

Bureau Veritas ID: UHM320 **Collected:** 2022/11/02
Sample ID: HMLP-3 SS3 **Shipped:**
Matrix: Soil **Received:** 2022/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphide in Soil	SPEC	8360245	N/A	2022/11/20	Bailey Morrison
pH CaCl2 EXTRACT	AT	8353926	2022/11/18	2022/11/18	Taslima Aktar
Resistivity of Soil		8347960	2022/11/18	2022/11/18	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8354143	2022/11/18	2022/11/18	Samuel Law

Bureau Veritas ID: UHM320 Dup **Collected:** 2022/11/02
Sample ID: HMLP-3 SS3 **Shipped:**
Matrix: Soil **Received:** 2022/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	8353989	2022/11/18	2022/11/18	Gurparteek KAUR
pH CaCl2 EXTRACT	AT	8353926	2022/11/18	2022/11/18	Taslima Aktar

Bureau Veritas ID: UHM321 **Collected:** 2022/05/10
Sample ID: HMLP-4 SS3 **Shipped:**
Matrix: Soil **Received:** 2022/11/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8354122	2022/11/18	2022/11/19	Alina Dobreanu
Conductivity	AT	8353989	2022/11/18	2022/11/18	Gurparteek KAUR
Moisture (Subcontracted)	BAL	8364470	N/A	2022/11/23	Richard Ly
Sulphide in Soil	SPEC	8360245	N/A	2022/11/20	Bailey Morrison
pH CaCl2 EXTRACT	AT	8353926	2022/11/18	2022/11/18	Taslima Aktar
Resistivity of Soil		8347960	2022/11/18	2022/11/18	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8354143	2022/11/18	2022/11/18	Samuel Law

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.0°C

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8353926	Available (CaCl2) pH	2022/11/18			101	97 - 103			0.21	N/A
8353989	Conductivity	2022/11/18			106	90 - 110	<2	umho/cm	0.55	10
8354122	Soluble (20:1) Chloride (Cl-)	2022/11/19	126	70 - 130	108	70 - 130	<20	ug/g	NC	35
8354143	Soluble (20:1) Sulphate (SO4)	2022/11/18	124	70 - 130	112	70 - 130	<20	ug/g	NC	35
8360245	Sulphide	2022/11/20	23 (1)	75 - 125	112	75 - 125	<0.5	mg/kg	NC	30
8364470	Moisture-Subcontracted	2022/11/23					<0.30	%		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Matrix spike exceeds acceptance limits due to matrix interference.

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Bureau Veritas Job #: C2X4109
Report Date: 2022/11/23

Golder Associates Ltd
Client Project #: 19135676
Site Location: HWY 11/12, ORILLIA
Your P.O. #: 19135676/8000/8004
Sampler Initials: MH

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Cristina Carriere, Senior Scientific Specialist

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

Suwan (Sze Yeung) Fock, B.Sc., Scientific Specialist

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Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com

BUREAU VERITAS

6740 Campobello Road, Mississauga, Ontario L5N 2L8
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266
CAM FCD-01191/6

WORK ORDER

CHAIN OF CUSTODY RECORD

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)	
Company Name:	Golder Associates Ltd.	Company Name:	Golder Associates Ltd.	Quotation #:	
Contact Name:	Canada Accounts Payable	Contact Name:	Mark Henderson	P.O. #/ AFE#:	19135676/8000/8004
Address:	6925 Century Ave. Suite 100	Address:	6925 Century Ave. Suite 100	Project #:	19135676
	Mississauga, ON		Mississauga, ON L5N 7K2	Site Location:	Hwy 11/12, Orillia
Phone:	905-567-4444 Fax: 905-567-6561	Phone:	647-233-7791 Fax: 905-567-6561	Site #:	
Email:	canadaaccountspayableinvoices@golder	Email:	mark.henderson@wsp.com;	Site Location Province:	Ontario
				Sampled By:	MH/ML

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY

Turnaround Time (TAT) Required

[X] Regular TAT (5-7 days) Most analyses

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Rush TAT (Surcharges will be applied)

[ ] 1 Day [ ] 2 Days [ ] 3-4 Days

Date Required:

Rush Confirmation #:

Regulation 153

[X] Table 1 [ ] Res/Park [ ] Med/ Fine
[ ] Table 2 [ ] Ind/Comm [ ] Coarse
[ ] Table 3 [ ] Agri/ Other
[ ] Table ____

FOR RSC (PLEASE CIRCLE) Y / N

Other Regulations

[ ] CCME [ ] Sanitary Sewer Bylaw
[ ] MISA [ ] Storm Sewer Bylaw
[ ] PWQO Region ____
[ ] Other (Specify)
[ ] REG 558 (MIN. 3 DAY TAT REQUIRED)
[ ] REG 406 Table ____

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS

Analysis Requested

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	REG 153 ICPMS METALS	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	Corrosivity Package (+ Sulphide)	HOLD- DO NOT ANALYZE	COMMENTS
1	HMLP-1 SS3	2022-10-31	AM	SOIL	2								X		2 Jars, no redox.
2	HMLP-2 SS3	2022-11-01	AM	SOIL	2								X		2 Jars, no redox.
3	HMLP-3 SS3	2022-11-02	AM	SOIL	2								X		2 Jars, no redox.
4	HMLP-4 SS3	2022-05-10	AM	SOIL	2								X		2 Jars, no redox.
5															
6															
7															
8															
9															
10															

LABORATORY USE ONLY

CUSTODY SEAL Y / N		COOLER TEMPERATURES
Present	Intact	
N	N	4|4|4

COOLING MEDIA PRESENT: (Y) / N

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Maor Levy	2022/11/14	18:15	Avni Avni Pandya	2022/11/14	18:17

14-Nov-22 18:17
Ankita Bhalla
C2X4109
AVI ENV-961

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