

# **Final Foundation Investigation Report (FIR)**

**Highway 61 Culvert Replacement**

**Station 20+040, Township of Blake**

**Gannett Fleming**

**Ontario Ministry of Transportation (MTO)**

**GWP 6176-15-00**

**GEOCRES No. 52A00-263**

**Assignment No.: 6020-E-0021**

**Latitude: 48.245358; Longitude: -89.482498**

**September 15, 2022**

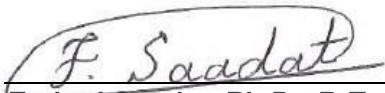
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# Gannett Fleming GWP 6176-15-00

Prepared by:

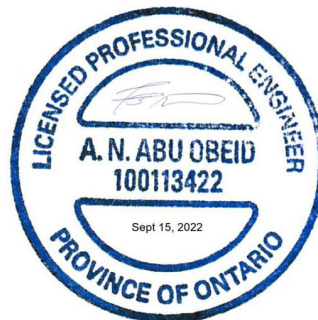


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2022-09-15

## Revisions and publications log

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0A	December 29, 2021	Draft FIR issued for Client information only
0B	April 7, 2022	Draft FIDR issued for review and comment
0C	May 29, 2022	Revised Draft FIDR issued for review and comment
1A	September 15, 2022	Final FIR Issued

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# 1

## 1 Introduction

Englobe Corp. (Englobe) has been retained by Gannett Fleming (Client), on behalf of the Ministry of Transportation of Ontario (MTO, Owner), to carry out a foundation investigation and prepare Foundation Investigation (FIR) and Foundation Investigation and Design (FIDR) Reports for the proposed replacement of an existing culvert at approximate Station 20+040 on Highway No. 61 in the Township of Blake, Ontario (Site) shown on Drawing No. 1, Appendix A. This assignment was performed at the request of the Client as per the project Terms of Reference outlined in MTO Request for Quotation (RFQ) Version 3.2 under Assignment Number 6020-E-0021 (GEOCREs No. 52A00-263).

# 2

## 2 Site Description

The existing 66.7 m long culvert structure is crossing Highway 61 at approximate Station 20+040 approximately 65 m north of Blake Hall Road, in Township of Blake. Highway 61, at the culvert crossing is a two-lane undivided highway with asphalt surface and partially paved shoulders on both sides running in an approximate north-south direction, as shown on Drawing No. 1, Appendix A. Highway 61 is constructed on an embankment about 12.5 m wide (including shoulders) and up to approximately 7.7 m in height above the crown of the culvert, with the centreline of the roadway at an approximate elevation 234.5 m at the culvert location. The pavement surface is generally in good to fair condition with some longitudinal and transverse cracks across the asphalt surface. The topography of the surrounding area varies in the vicinity of the crossing. The sides of the roadway at the culvert crossing were observed to be heavily vegetated with bushes, shrubs, and mature trees. Minor bank and embankment erosion were also noted in Gannett Fleming (GF) Culvert Inspection Report. Existing infrastructure observed at the culvert location included overhead hydro line crossing Highway 61 at the culvert crossing.

The existing culvert structure is crossing Highway 61 at skew alignment (approximately 50 degree) from east (upstream) to west (downstream). The existing culvert structure is a 1.43 m wide and 1.4 m high at the upstream and 1.35 m wide and 1.07 m high at the downstream, as shown on Drawing No. 2 in Appendix A and described in detail and shown on the sketches and Figures in GF Culvert Inspection Report in Appendix D. The existing CSP culvert was observed to be damaged and corroded. At the inlet, extension of the culvert barrel has separated at the foreslope and signs of planar foreslope slipping. At the outlet, the culvert was observed to be severely corroded with the loss of the culvert barrel bottom. The channel dimensions were described by GF in general as 1 m wide channel upstream (US) with banks at approximately 2H:1V and water depth of 210 mm; with no information provided for the channel downstream (DS) as the culvert was dry. The top of the culvert elevations at the inlet and outlet are El. 227.1 and El. 226.4 m, respectively with clearance of 1220 mm and 1070 mm, respectively. Flow through the culvert is from east/right (Rt) to the west/left (Lt) as shown on Drawing No. 2 in Appendix A.

## 2.1 Site Physiography and Surficial Geology

Based on published Northern Ontario Geology Terrain Study (NOEGTS) of the general area by J. F. Gartner, J.D. Mollard, and M.A. Road (1981), the Site is located within the Glaciolacustrine Plain of the Glaciolacustrine Landform. The native overburden/sediments within the immediate project area consist mainly of sand and silt deposits.



## 3 Investigation Procedures

### 3.1 Site Investigation

The purpose of the geotechnical investigation was to explore and record the subsurface conditions at both ends of the proposed replacement culvert and in the roadway embankment at the culvert crossing. The fieldwork was carried out between October 19 and November 17, 2021 and consisted of two boreholes on the roadway extending to a maximum depth of 20.4 m below existing ground/road surface (mbgs) and two boreholes off the roadway at the culvert inlet and outlet extending to a maximum depth of 6.7 mbgs.

The fieldwork included locating the boreholes, clearing the borehole locations of underground services, in-situ sampling and testing operations, logging of the boreholes, labeling and preparation of samples for transportation to the Englobe North Bay laboratory, plus overall drill supervision.

Englobe's staff visited the Site before the planned site investigation to mark out the proposed borehole locations. Utility clearance was obtained from Ontario-1-Call. Public utility authorities were informed, and all utility clearance documents were obtained before the commencement of drilling work. A traffic control plan was prepared and implemented by Workforce Inc. of Sudbury, Ontario, according to Ontario Traffic Manual Book 7 during the fieldwork. The drilling rigs used for drilling were owned and operated by Maple Leaf Drilling Ltd. of Sunnyside, Manitoba. Boreholes were advanced using a CME 750 track mounted drill and a B20 portable drilling rig.

The fieldwork for this investigation included four (4) sampled boreholes (BH). BH Nos. 1 and 2 were advanced in the roadway shoulders through the embankment. BH Nos. 3 and 4 were advanced at the inlet (Rt) and outlet (Lt) ends of the culvert, respectively. The locations of the boreholes are shown on Drawing No. 2 in Appendix A and are provided in the following Table 1.

**Table 1 Borehole Locations**

Borehole No.	Borehole Location (MTM Nad 83)		Borehole Location (Geographic)	
1	N 5345312.0	E 343232.9	Lat: 48.24543°	Long: - 89.48248°
2	N 5345322.0	E 343212.9	Lat: 48.24552°	Long: - 89.48274°
3	N 5345297.2	E 343261.1	Lat: 48.24529°	Long: - 89.48210°
4	N 5345315.0	E 343191.0	Lat: 48.24545°	Long: - 89.48304°

BH Nos. 1 and 2 were advanced using a hallow stem auger aided by track-mounted CME 750 drilling rig equipped with wash boring equipment, N-size casing, rock coring equipment (NQ size core) and

routine geotechnical sampling equipment. BH Nos. 3 and 4, which were drilled off the roadway near the inlet and outlet, were advanced using a B20 portable drilling rig equipped a solid stem auger.

Soil samples were obtained at regular intervals of depth at the borehole locations using a standard 51 mm split spoon sampler advanced in accordance with the Standard Penetration Test (SPT) procedures (ASTM D1586). All soil samples taken during this investigation were stored in labeled airtight containers for transport to the Englobe North Bay laboratory for visual examination and select laboratory testing.

Groundwater conditions in the open boreholes were observed during the advancement of the individual boreholes. Two 19 mm diameter standpipes were installed in Borehole Nos. 3 and 4 prior to backfilling to allow for follow-up monitoring of the stabilized groundwater levels. The remaining boreholes were backfilled upon completion of drilling in accordance with requirements of Ontario Regulation 903.

The location of the individual boreholes was determined in the field using highway chainage established by the Ministry of Transportation and offsets relative to highway centreline. The MTO coordinates, northing and easting, were then established for the boring locations using coordinates from MTM Zone 15, NAD 83 CSRS. Elevations contained in this report are referenced to an on-site geodetic datum. The borehole elevations are based on the GPS RTK survey carried out by Englobe.

## 4

## 4 Laboratory Investigation

All soil and rock samples obtained during the investigation were transported to Englobe Laboratory in Thunder Bay, Ontario. This laboratory is certified by the Ministry of Transportation Ontario (MTO) under RAQS program at Medium Complexity level for Soil and Rock Testing including Testing for Foundation Engineering. All retrieved samples were subjected to visual identification and tactile categorization to describe the soils. The laboratory tests to determine index properties were performed in accordance with the Ministry of Transportation Ontario (MTO) test procedures, which follow the American Society for Testing Materials (ASTM) test procedures. Laboratory testing consisted of grain size distribution; sieve and hydrometer analysis according to ASTM D422 and LS-702, Atterberg's Limits ASTM D4318 and LS-703/704, water content ASTM D2216 and LS-701. The results of the laboratory testing are presented on the individual Record of Borehole Sheets (Appendix B), with a summary of results presented on the laboratory sheets in Appendix C (Figures Nos. L-1 to L-6).

Chemical tests on one representative soil and one surface water samples to determine the soil and water corrosivity characteristics (pH, chloride, resistivity, sulphate) were carried out by an accredited independent laboratory (Bureau Veritas in Mississauga) to assess soil condition for buried structural steel and concrete elements.



# 5

## 5 Subsurface Conditions

The subsurface conditions revealed by the investigation program are summarized in Table 2 below and on the stratigraphic profile presented on Drawing No. 2 (Appendix A) and on the detailed Records of Borehole Logs (Appendix B). It should be noted that the stratigraphic delineation presented on the borehole logs and soil strata plot is interpreted from the results of non-continuous sampling, response to drilling progress, recorded SPT 'N'-values, plus field observations. Typically, such boundaries represent transitions from one zone to another and are not an exact demarcation of specific geological units. Additional consideration should be given to the fact that subsurface conditions may vary markedly between adjacent boreholes and beyond any specific boring location and are shown on the drawings for illustration purposes only.

**Table 2 Summary of Generalized Stratigraphy in Boreholes with Depth and Elevation (m)**

Resource	Depths/Elevations (m)			
	Borehole No. 1	Borehole No. 2	Borehole No. 3	Borehole No. 4
Asphalt	0.04 (El. 234.2)	0.04 (El. 234.8)	--	--
Pavement Granular Base: Compact Sand and Gravel	0.04 - 0.8 (El. 234.2 - 233.5)	0 - 0.6 (El. 234.8 - 234.2)	--	--
Embankment Fill: Compact to Loose Sand with some Silt and Gravel	0.8 - 3.9 (El. 233.5 - 230.3)	0.6 - 6.1 (El. 234.2 - 228.7)	--	--
Embankment Fill: Soft to Stiff SILT and CLAY with some Sand, trace Gravel	3.9 - 10.5 (El. 230.3 - 223.7)	6.1 - 8.4 (El. 228.7 - 226.4)	--	--
Embankment Fill: Soft to Stiff SILT with trace Clay and Sand and asphalt debris and wood/organic inclusions	--	8.4 - 9.1 (El. 226.4 - 225.7)	--	--
Native: Firm to Stiff Silt and Clay	--	9.1 - 11.7 (El. 225.7 - 223.1)	0 - 2.3 (226.5 - 224.2)	--
Native: Loose to Dense SILT/Silty Sand	10.5 - 20.4 (El. 223.7 - 213.8)	11.7 - 15.9 (El. 223.1 - 219.0)	2.3 - 6.7 (El. 224.2 - 219.8)	0 - 6.7 (El. 225.9 - 219.2)
Inferred Bedrock/Boulders	--	15.9 (El. 219.0)	--	--

### 5.1 Asphalt and Pavement Structure

A thin layer of approximate 40 mm asphalt was observed in both BH Nos. 1 and 2 which were drilled on the shoulders through the embankment. The asphalt is underlain by a granular fill layer mainly consisting of brown sand and gravel with traces of silt. The granular fill was observed to extend to approximately 0.8 m depth in BH No. 1 and 0.6 m depth in BH No. 2.

## 5.2 Embankment Fill

The embankment fill materials below the pavement structure at Borehole Nos. 1 and 2 varied with depth and extended down to an approximate depth of 10.5 m (El. 223.7 m). The encountered fill was mainly loose to compact sand that extended to 3.9 m depth (El. 230.3 m) in BH No. 1 and 6.1 m depth (El. 228.7 m) in BH No. 2. The embankment fill changed to silt and clay fill with depth that extended to 10.5 m depth (El. 223.7 m) in BH No. 1 and to 9.1 m (El. 225.7 m) in BH No. 2. Remnants of asphalt debris and wood/organic material were also encountered in BH No.2 at approximately 8.4 m depth (El. 226.4 m).

Immediately below the pavement structure, the embankment fill is mainly composed of brown sand with different proportions of gravel, silt and clay. The sand fill in BH No.1 is approximately 3.1 m thick (from El. 233.5 m to 230.3 m) and in BH No. 2, the sand fill is approximately 5.5 m thick (from between El. 234.2 m to 228.7 m). The sand fill moisture/water contents (wc) varied from dry to damp (approximately 7%).

The results for grain size analyses of representative samples of the sand fill are summarized in Table 3 and presented on Figure Nos. L-1 in Appendix C

**Table 3 Particle Size Distribution Results of the Sand Fill**

Sample Tested	Sample Depth / Elev. (m)	Grain Size Analysis (%)				Soil Classification
		Gravel	Sand	Silt	Clay	
BH No. 1 / SS-2	1.1 (233.1)	2	79	19		SM
BH No. 2 / SS-4	2.6 (232.2)	14	67	19		SM

The sand fill layer was generally loose to compact, based on recorded SPT 'N' values ranging between 4 and 31 blows/300 mm.

The sand fill layer was underlain by silt and clay fill deposit approximately 2.3 m to 6.6 m thick. The silt and clay fill was encountered in BH No. 1 between El. 230.3 m and 223.7 m and in BH No. 2 between El. 228.7 and 226.4 m. The silt and clay fill included minor portions of sand and gravel and was observed to be reddish brown to grey and moist.

The moisture content within the silt and clay fill was found to be as high as approximately 40%. Representative soil samples underwent grain size analysis and Atterberg's limits (Liquid Limit (LL), Plastic Limit (PL) and Plasticity Index (PI)) and the results are summarized in Table 4 and provided in Figures No. L-2 and L-6, Appendix C.

**Table 4 Particle Size Distribution and Atterberg Limit Results of the Silt and Clay Fill**

Sample Tested	Sample Depth / Elev. (m)	Grain Size Analysis (%)				Atterberg Limits (%)			Water content (%)	Soil Classification
		Gravel	Sand	Silt	Clay	LL	PL	PI		
BH No. 1 / SS-7	4.8 (229.4)	4	17	43	37	53	27	26	42	CH
BH No. 2 / SS-10	7.2 (227.6)	0	6	43	51	56	29	27	37	CH

The silt and clay fill layer was observed to be soft to stiff, based on recorded SPT 'N' values ranging between 2 and 31 blows/300 mm.

Below the silt and clay fill layer, a thin layer (approximately 0.7 m thick) of silt fill with different portions of clay and sand, and organic material and asphalt debris inclusions was encountered in BH No. 2, extending to 9.1 m depth (El. 225.7 m).

## 5.3 Native Silt and Clay (CH)

Underlying the embankment fill at BH No. 2 and at surface at BH No. 3, a native deposit of grey to brown silt and clay with traces sand was encountered. The silt and clay layer thickness ranges between 2.3 to 2.6 m and was observed at El. 225.7 m in BH No. 2 and at El. 226.5 m in in BH No. 3 extending down to El. 223.1 and El.224.2, respectively.

The natural moisture content within the silt and clay was measured at approximately 30 to 32%. Representative soil samples underwent grain size analysis and Atterberg's limits the results are summarized in Table 5 and provided in Figures No. L-3 and L-6, Appendix C.

**Table 5 Particle Size Distribution and Atterberg Limit Results of the Native Silt and Clay**

Sample Tested	Sample Depth / Elev. (m)	Grain Size Analysis (%)				Atterberg Limits (%)			Water Content (%)	Soil Classification
		Gravel	Sand	Silt	Clay	LL	PL	PI		
BH No. 2 / SS-15	11.0 (223.8)	0	1	51	47	51	26	25	30	CH
BH No. 3 / SS-2	1.0 (225.5)	0	2	61	37	--	--	--	32	CH

The consistency of this silt and clay deposit generally varied from soft to very stiff, based on recorded SPT 'N' values ranging from 2 to 20 blows/300 mm.

## 5.4 Native Silt/Silty Sand

Below the native silt and clay in BH Nos. 2 and 3, below the fill in BH No 1, and at the surface in BH No 4, a native deposit of brown to grey silt was encountered. The silt extended to the maximum depth of drilling in all boreholes. In BH No. 1, the silt deposit transitioned into silty sand at approximately El. 217.4 m and changed back to silt at El. 215.9 m extending to the maximum depth of drilling to approximately El. 213.8 m. The lower portion of this deposit consisted mainly of silt and sand with some gravel. Occasional cobbles and boulders were encountered at greater depth. Auger and SPT split spoon refusals were encountered in BH No. 2 at El. 219.0 m on suspected/possible bedrock or boulders.

The natural moisture content within the silt/silty sand was approximately 13 to 30 %. Gradation analyses were carried out on nine (9) samples of this deposit, and the results are summarized in Table 6 and provided in Figure No. L-4 and L-5, Appendix C.

**Table 6 Particle Size Distribution and Atterberg Limit Results of the Silt/Silty Sand**

Sample Tested	Sample Depth / Elev. (m)	Grain Size Analysis (%)				Water Content (%)	Soil Classification
		Gravel	Sand	Silt	Clay		
BH No. 1 / SS-16	11.7 (221.5)	0	1	96	3	26	ML
BH No. 1 / SS-20	16.8 (217.4)	0	68	32		24	SM
BH No. 1 / SS-22	20.0 (214.2)	13	31	49	7	13	ML to SM
BH No. 2 / SS-17	12.5 (222.3)	0	1	92	7	26	ML
BH No. 3 / SS-5	3.4 (223.1)	0	0	89	11	27	ML
BH No. 3 / SS-5	4.9 (220.3)	0	4	85	11	21	ML
BH No. 4 / SS-3	1.7 (224.2)	0	3	85	12	30	ML
BH No. 4 / SS-6	4.1 (221.8)	0	4	88	8	25	ML
BH No. 4 / AS-9	6.4 (219.5)	0	2	92	6	26	ML

The silt/sandy silt deposit was observed to be very loose to dense based on recorded SPT 'N' values ranging from 0 to 27 blows/300 mm. Higher SPT 'N' values (41 to 63 blows/300 mm) were encountered probably due to presence of cobbles and boulders in this deposit.

## 5.5 Inferred Bedrock/Boulders

Underlying the above-described silt/sandy silt in BH No 2., auger and SPT split spoon sampler refusals on suspected/possible bedrock or boulders were encountered. The refusal was encountered at a depth of 15.9 (El. 219.0 m). No rock coring was performed, and bedrock was not sampled.

## 5.6 Groundwater Conditions

Groundwater and cave-in levels were measured in the open boreholes during the course of the fieldwork as summarized in Table 7. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix B).

**Table 7 Groundwater Levels**

BH No.	Drilling Date	Ground Surface Elev. (m)	Borehole Bottom		Monitoring Date	GW in Well		Monitoring Date	GW in Well	
			Depth (m)	Elev. (m)		Depth (m)	Elev. (m)		Depth (m)	Elev. (m)
BH No. 1	Oct 19 - 23, 2021	234.2	20.4	213.8	--	--	--	--	--	--
BH No. 2	Oct 21 - 24, 2021	234.8	15.9	219.0	--	--	--	--	--	--
BH No. 3	Nov 16 - 17, 2021	226.5	6.7	219.8	Nov 22, 2021	0.5	226.0	Dec 21, 2021	0.6	225.9
BH No. 4	Nov 17, 2021	225.9	6.7	219.2	Nov 22, 2021	0.6	225.3	Dec 21, 2021	0.7	225.2

The groundwater and surface water levels should be expected to fluctuate seasonally/yearly. The stabilized groundwater level is anticipated to correspond with the creek water level. The lowest creek level is anticipated to be above the average invert elevation of the culvert at elevation 225.4 m.

## 5.7 Soil Corrosivity Testing

A representative soil sample collected from BH No. 1 and water sample collected from BH No.3 were subjected to corrosivity chemical tests by Bureau Veritas Laboratories in Thunder Bay to determine its potential corrosivity by measuring resistivity, pH, sulphate and chloride content of the sample within the estimated infrastructure depths. The results are presented in Table 8.

**Table 8 Soil and Water Corrosivity Chemical Analysis Results**

BH No.	Sample	Depth (Elev.) (m)	pH	Sulphate (%)	Chloride (%)	Resistivity (Ohm-cm)
BH No. 1	SS-10	7.2 (227.0)	7.63	0.0670	0.0490	780
BH No. 3	Water	--	7.58	0.0039	0.0017	--

# 6

## 6 General Comments

The field investigation was carried out using track mounted CME 750 drilling rigs and a portable B20 drilling rig owned and operated by Maple Leaf Drilling Ltd. Laboratory testing of select soil samples was undertaken at the Englobe Laboratory in North Bay. The fieldwork for this site investigation was under the full-time supervision of Englobe technical staff. The report was written by Mr. Farbod Sadaat, Ph.D., P.Eng., and peer reviewed by Mr. Ala Abu Obeid, M.Sc., P.Eng., PMP. The report was also reviewed by the MTO Designated Contact Mike Tanos, P.Eng., with independent review by Jake Berghamer, P.Eng.

## 7 STATEMENT OF LIMITATIONS

The design recommendations given in this geotechnical report are applicable only to the project described in the text and only if constructed substantially in accordance with details of alignment and elevations stated in the report. Since all details of the design may not be known, in our analysis certain assumptions had to be made. The actual conditions, however, may vary from those assumed, in which case changes and modifications may be required to our geotechnical recommendations.

The comments in this report are intended solely for the guidance of the design engineer and address the geotechnical conditions only. The number of boreholes required to determine the localized conditions between boreholes directly affecting construction costs, equipment, scheduling, etc. would in fact be greater than what has been carried out for design purposes. Therefore, contractors bidding on this project or undertaking this work should make their own interpretations of the factual borehole results and carry out further work as they deem necessary to assess the scope of the project.

Foundation Design of this report is intended solely for the use of the client and the design team for the detail design of this specific project on behalf of the Ministry of Transportation and is not intended to be included in the tender documents; and shall not be used for any other purposes or by any other parties including the construction Contractor.

# Appendix A

## Drawings

Drawing No. 1 - Site Location Plan & Key Map

Drawing No. 2 - Borehole Location Plan & Embankment Profile



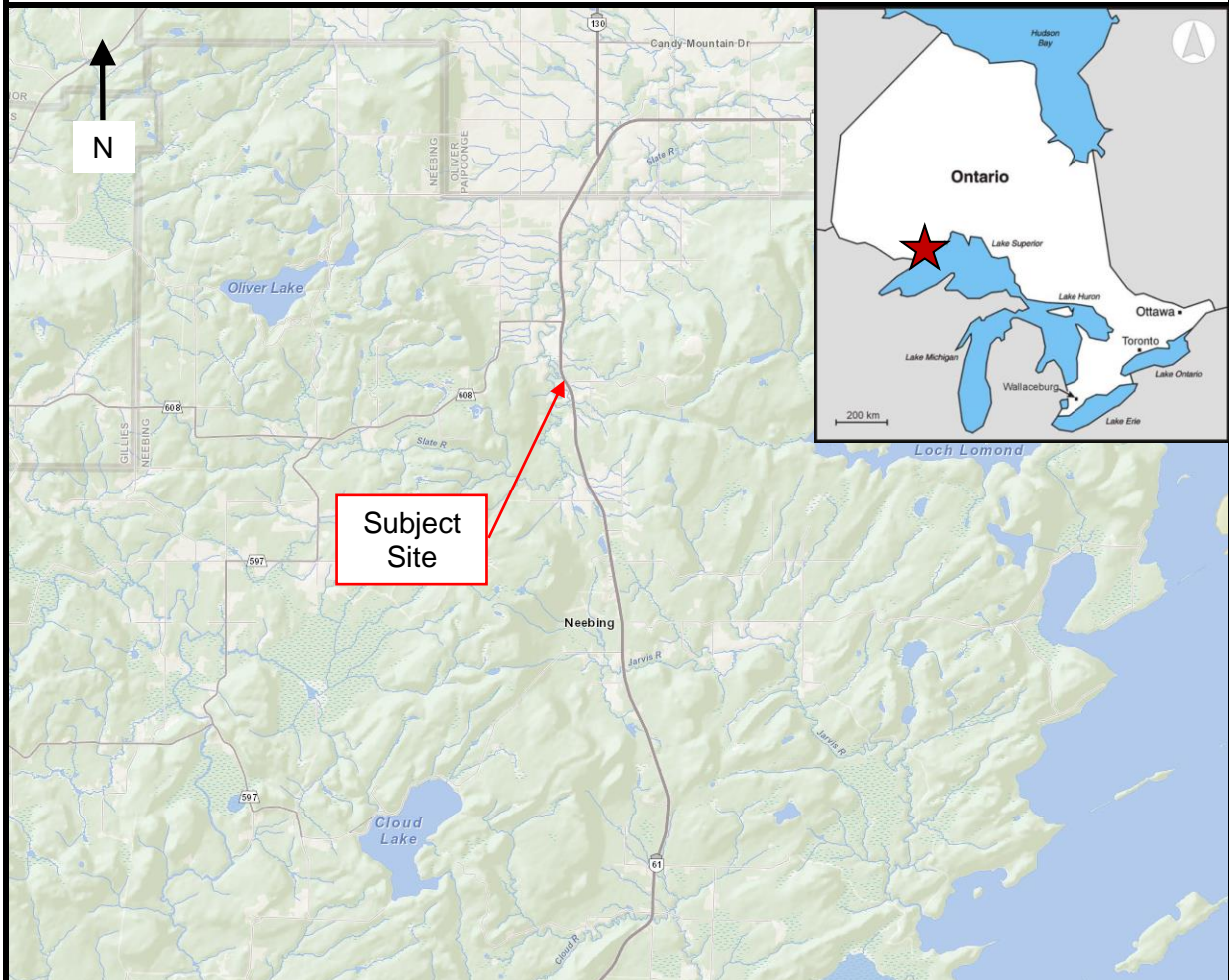
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# KEY PLAN

Drawing No. 1

NOT TO SCALE



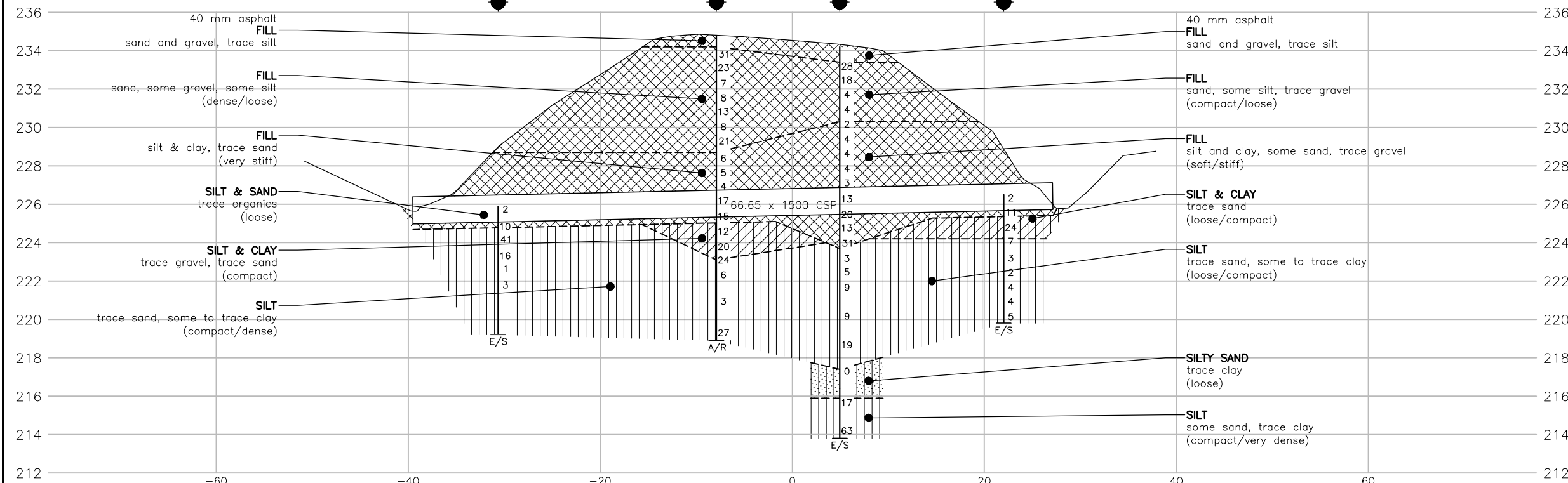
## FINAL FOUNDATION INVESTIGATION REPORT

Station 20+040 Culvert  
Culvert Replacement  
Highway No. 61, Twp. of Blake Assignment  
Number 6020-E-0021  
GWP 6176-15-00

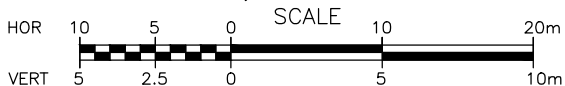
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September 2021



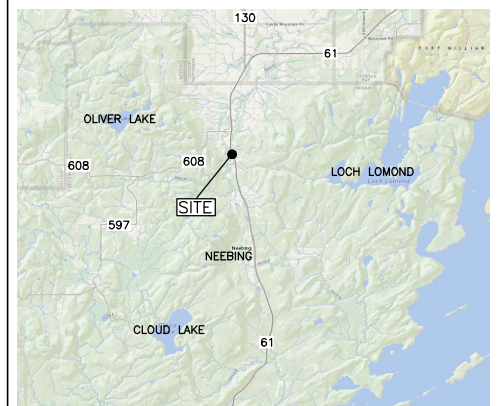


SECTION A-A, STATION 20+040



SHEET

2



KEY PLAN  
N.T.S.

BOREHOLE No.	ELEVATION	O/S	NORTHING	EASTING
1	234.2	4.9 m Rt	5345312.0	343232.9
2	234.8	7.9 m Lt	5345322.0	343212.9
3	226.5	22.0 m Rt	5345297.2	343261.1
4	225.9	30.6 m Lt	5345314.9	343191.0

NOTES:

The boundaries between soil strata have been established at the borehole locations only. The boundaries illustrated and stratigraphy between boreholes on this drawing are assumed based on borehole data and may vary. They are intended for design only.

Base plan and alignment provided in digital format  
by Aecom on July 27, 2021

Coordinates based on MTM Zone 15 NAD83 CSRS

GEOCRES No. 52A00-263

REVISIONS	DEC/21	DM	DRAFT					
	MAY/22	DM	REVISED DRAFT					
	SEP/22	DM	FINAL					
	DESCRIPTION							
DESIGN	CHK		CODE		LOAD		DATE JUN/22	
DRAWN	DM	CHK	FS	SITF	STRUCT	SCHFME	DWG 2	



# Appendix B

## Subsurface Data

Enclosure No. 1      List of Abbreviations and Symbols  
Enclosure Nos. 2 to 7   Record of Borehole Sheets



**eNGLOBE**



## LIST OF SYMBOLS AND DEFINITIONS FOR GEOTECHNICAL SAMPLING AND COMMON LITHOLOGIES

The following is a reference sheet for commonly used symbols and definitions within this report and in any figures or appendices, including borehole logs and test results. Symbols and definitions conform to the standard proposed by the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) wherever possible. Discrepancies may exist when comparing to third-party results using the Unified Soil Classification System (USCS).

### PART A – SOILS

#### Standard Penetration Test (SPT) 'N'

The number of blows required to drive a 50-mm (2 in) split barrel sampler 300 mm (12 in). The standard hammer has a mass of 63.5 kg (140 lbs) and is dropped vertically from a height of 760 mm (30 in). Additional information can be found in ASTM D1586-11 and in §4.5.2 of the CFEM 4<sup>th</sup> Ed.

For penetration less than 300 mm, 'N' is recorded with the penetration that was achieved.

#### Non-Cohesive Soils

The relative density of non-cohesive soils relates empirically to SPT 'N' as follows:

Relative Density	'N'
Very Loose	0 – 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	> 50

#### Cohesive Soils

The consistency and undrained shear strength of cohesive soils relates empirically to SPT 'N' as follows:

Consistency	Undrained Shear Strength (kPa)	'N'
Very Soft	< 12	0 – 2
Soft	12 – 25	2 – 4
Firm	25 – 50	4 – 8
Stiff	50 – 100	8 – 15
Very Stiff	100 – 200	15 – 30
Hard	> 200	> 30

### PART B – ROCK

The following parameters are used to describe core recovery and to infer the quality of a rockmass.

#### Total Core Recovery, TCR (%)

The total length of solid drill core recovered, regardless of the quality or length of the pieces, taken as a percentage of the length of the core run.

#### Solid Core Recovery, SCR (%)

The total length of solid, full-diameter drill core recovered, taken as a percentage of the length of the core run.

#### Rock Quality Designation, RQD (%)

The sum of the lengths of solid drill core greater than 100 mm long, taken as a percentage of the length of the core run. RQD is commonly used to infer the quality of the rockmass, as follows:

Rockmass Quality	RQD (%)
Very Poor	< 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	> 90

#### Weathering

The terminology used to describe the degree of weathering for recovered rock core is defined as follows, as suggested by the *Geological Society of London*:

**Completely weathered:** All rock material is decomposed and/or disintegrated to soil. The original mass structure is largely intact.

**Highly weathered:** More than half the rock material is decomposed and/or disintegrated to soil. Fresh or discolored rock is present either as a discontinuous framework or as core stone.

**Moderately weathered:** Less than half the rock material is decomposed and/or disintegrates to soil. Fresh or discolored rock is present either as a continuous framework or as core stone.

**Slightly weathered:** Discoloration indicates weathering of rock material and discontinuity of surfaces. All the rock material may be discolored by weathering and may be somewhat weaker than its fresh condition.

**Fresh:** No visible signs of weathering.

### PART C – SAMPLING SYMBOLS

Symbol	Description
SS	Split spoon sample
TW	Thin-walled (Shelby Tube) sample
PH	Sampler advanced by hydraulic pressure
WH	Sampler advanced by static weight
SC	Soil core

### PART D – IN-SITU AND LAB TESTING

#### SOIL NAMING CONVENTIONS

Particle sizes are described as follows:

Particle Size Descriptor	Size (mm)
Boulder	> 300
Cobble	75 – 300
Gravel	Coarse 19 – 75 Fine 4.75 – 19
Sand	Coarse 2.0 – 4.75 Medium 0.425 – 2.0 Fine 0.075 – 0.425
Silt	0.002 – 0.075
Clay	< 0.002

The principle constituent of a soil is written in uppercase. The minor constituents of a soil are written according to the following convention:

Descriptive Term	Proportion of Soil (%)
Trace	1 – 10
Some	10 – 20
(ey) or (y)	20 – 35
And	35 – 50

**Eg.:** A soil comprising 65% Silt, 21% Sand and 14% Clay would be described as a: Sandy SILT, Some Clay

# RECORD OF BOREHOLE No. 1

1 OF 2

METRIC

W.P. GWP 6176-15-00 LOCATION 20+051, 5.5 m Rt, Blake Twp. ORIGINATED BY RT  
 DIST Thunder Bay HWY 61 BOREHOLE TYPE Hollow Stem Auger COMPILED BY DM  
 DATUM Geodetic DATE 2021.10.19 - 2021.10.23 MTM Zone 15 343232.879 E 5345311.999 N  
 LATITUDE 48.245425 LONGITUDE -89.482477 CHECKED BY FS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE								WATER CONTENT (%)				GR
234.2 0.0	40 mm asphalt		1	AS			234									2	79	(19)		
233.5 0.8	FILL - SAND & GRAVEL - trace silt, brown						233													
	FILL - SAND - some silt, trace gravel, brown, compact to loose		2	SS	28		232													
			3	SS	18		231													
	- some gravel		4	SS	4		230													
		5	SS	4	229															
230.3 3.9	FILL - SILT & CLAY - some sand, trace gravel, brown/red, soft to stiff		6	SS	2		230									4	17	43	37	
	- damp, high plasticity		7	SS	4		229													
	- trace organics		8	SS	4		228													
	- trace sand		9	SS	4		227													
			10	SS	3		226													
	- brown/grey/red		11	SS	13		225													
	- moist		12	SS	20		224													
			13	SS	13		223													
			14	SS	31		222													
			15	SS	3		221													
223.7 10.5	SILT - trace clay, sand, grey, moist to wet, loose to compact		16	SS	5		223								0	1	96	3		
			17	SS	9		222													
	- some clay, trace sand						221													
			18	SS	9		220													

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO GWP 6176-15-00 - HIGHWAY 61 - CULVERT 20+040.GPJ ONTARIO MTO.GDT 22-4-6

# RECORD OF BOREHOLE No. 1

2 OF 2

**METRIC**

W.P. GWP 6176-15-00 LOCATION 20+051, 5.5 m Rt, Blake Twp. ORIGINATED BY RT  
 DIST Thunder Bay HWY 61 BOREHOLE TYPE Hollow Stem Auger COMPILED BY DM  
 DATUM Geodetic DATE 2021.10.19 - 2021.10.23 MTM Zone 15 343232.879 E 5345311.999 N  
 LATITUDE 48.245425 LONGITUDE -89.482477 CHECKED BY FS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT  w <sub>p</sub>	NATURAL MOISTURE CONTENT  w	LIQUID LIMIT  w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)			GR	SA	SI	CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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+ <sup>3</sup>, × <sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No. 2

1 OF 2

METRIC

W.P. GWP 6176-15-00 LOCATION 20+071, 7.6 m Lt, Blake Twp. ORIGINATED BY RT  
DIST Thunder Bay HWY 61 BOREHOLE TYPE Hollow Stem Auger COMPILED BY DM  
DATUM Geodetic DATE 2021.10.24 - 2021.10.21 MTM Zone 15 343212.878 E 5345322.019 N  
LATITUDE 48.245516 LONGITUDE -89.482745 CHECKED BY FS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE												
234.8 0.0	40 mm asphalt		1	AS																
234.2 0.6	FILL - SAND & GRAVEL - trace silt, brown		2	SS	31															
	FILL - SAND - some gravel, silt, brown, dense to loose		3	SS	23															
			4	SS	7															
			5	SS	8															
			6	SS	13															
	- silty, some clay, trace gravel, brown/red, compact		7	SS	8															
	- some gravel, trace silt, brown, loose		8	SS	21															
	- some clay, compact																			
228.7 6.1	FILL - SILT & CLAY - trace sand, organics, brown/red, very stiff		9	SS	6															
	- high plasticity		10	SS	5															
			11	SS	4															
226.4 8.4	FILL - SILT - trace clay, sand, compact		12	SS	17															
	- wood/organics																			
225.7 9.1	SILT & CLAY - trace sand, gravel, grey/red, compact		13	SS	15															
			14	SS	12															
	- brown/red, high plasticity		15	SS	20															
223.1 11.7	SILT - trace clay, sand, brown/grey, moist, compact		16	SS	24															
	- some sand, clay, grey, wet, loose		17	SS	6															
			18	SS	3															

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO GWP 6176-15-00 - HIGHWAY 61 - CULVERT 20+040.GPJ ONTARIO MTO GDT 22-4-6

# RECORD OF BOREHOLE No. 2

2 OF 2

**METRIC**

W.P. GWP 6176-15-00 LOCATION 20+071, 7.6 m Lt, Blake Twp. ORIGINATED BY RT  
 DIST Thunder Bay HWY 61 BOREHOLE TYPE Hollow Stem Auger COMPILED BY DM  
 DATUM Geodetic DATE 2021.10.24 - 2021.10.21 MTM Zone 15 343212.878 E 5345322.019 N  
 LATITUDE 48.245516 LONGITUDE -89.482745 CHECKED BY FS

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR  SA  SI  CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa						WATER CONTENT (%)									
						○ UNCONFINED                      + FIELD VANE ● QUICK TRIAXIAL                  × LAB VANE															
									20	40	60	80	100								
									40	80	120	160	200								
219.0			19	SS	27																
15.9	End of Borehole at 15.85 m bgs due to suspected Bedrock/Boulders				50/0 mm				219									Auger Refusal, Spoon Refusal			

# RECORD OF BOREHOLE No. 3

1 OF 1

METRIC

W.P. GWP 6176-15-00 LOCATION 20+027, 22.0 m Rt, Blake ORIGINATED BY MQ  
DIST Thunder Bay HWY 61 BOREHOLE TYPE Solid Stem Auger COMPILED BY DM  
DATUM Geodetic DATE 2021.11.16 - 2021.11.17 MTM Zone 15 343261.061 E 5345297.218 N  
LATITUDE 48.245291 LONGITUDE -89.482099 CHECKED BY FS

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100					
226.5	SILT & CLAY - trace sand, brown, moist, loose to compact		1	SS	2											Groundwater Level at 0.5 m bgs (Elevation 226.0 m) Nov 22, 2021 0 2 61 37
0.0			2	SS	11											
	- trace sand		3	SS	24											Groundwater Level at 0.6 m bgs (Elevation 225.9 m) Dec 21, 2021
224.2																
2.3	SILT - some clay, trace sand, dark grey, moist, loose		4	SS	7											0 0 89 11
			5	SS	3											
			6	SS	2											0 4 85 11
			7	SS	4											
			8	SS	4											
			9	SS	5											
219.8	End of Borehole at 6.7 m bgs															
6.7																

# RECORD OF BOREHOLE No. 4

1 OF 1

**METRIC**

W.P. GWP 6176-15-00 LOCATION 20+073, 32.0 m Lt ORIGINATED BY MQ  
 DIST Thunder Bay HWY 61 BOREHOLE TYPE Solid Stem COMPILED BY DM  
 DATUM Geodetic DATE 2021.11.17 - 2021.11.17 MTM Zone 15 343190.96 E 5345314.916 N  
 LATITUDE 48.245453 LONGITUDE -89.483041 CHECKED BY FS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE	WATER CONTENT (%)					
225.9 0.0	SILT & SAND - trace organics, grey/brown, wet, loose																

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE



# Appendix C

## Borehole Plan and Laboratory Data

Figure No. L-1: Fill: Sand Grain Size Distribution Curve

Figure No. L-2: Fill: Silt and Clay Grain Size Distribution Curve

Figure No. L-3: Native: Silt and Clay Grain Size Distribution Curve

Figure No. L-4: Native: Silt Grain Size Distribution Curve

Figure No. L-5: Native: Silty Sand Grain Size Distribution Curve

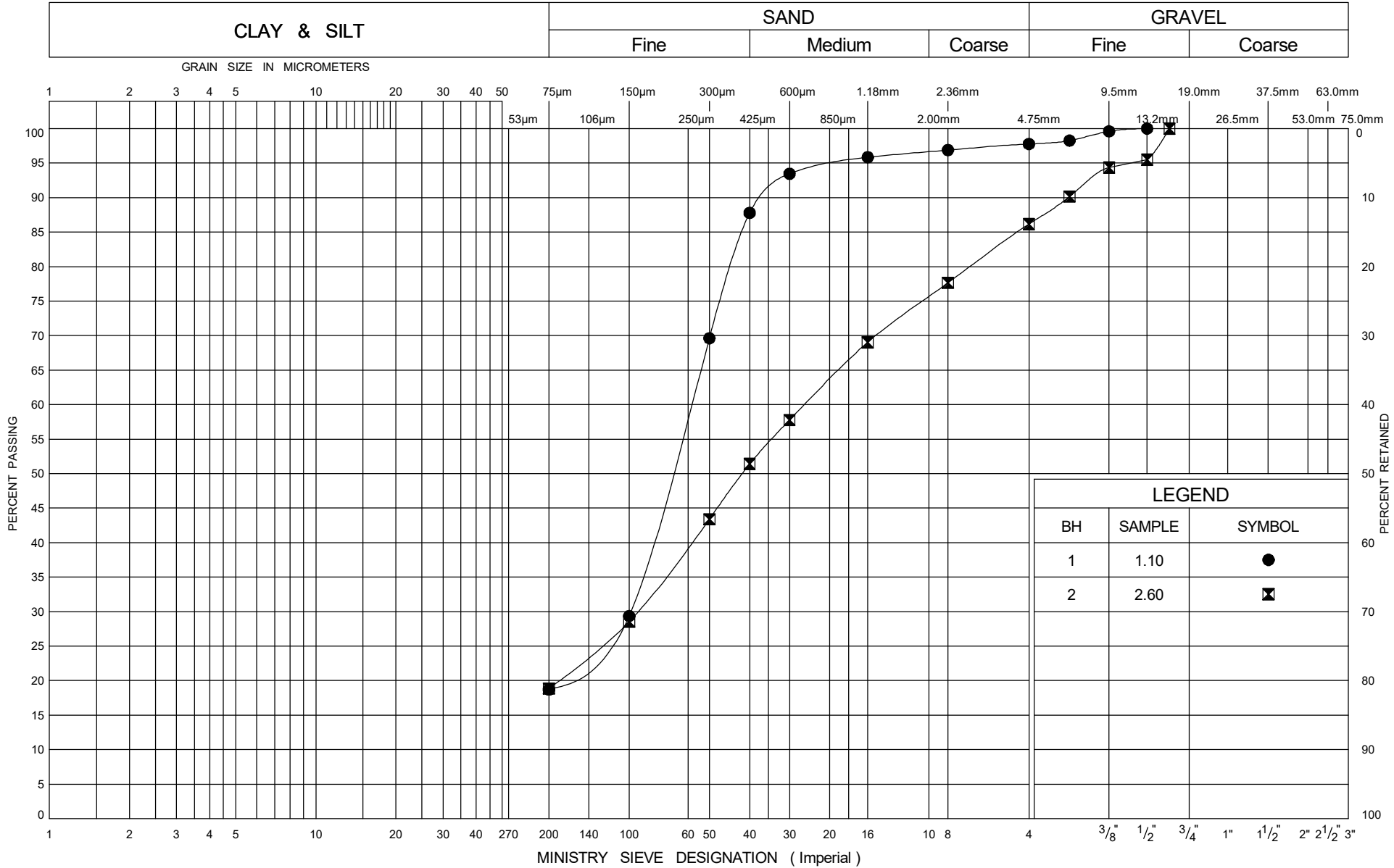
Figure No. L-6: Atterberg Limits Summary

Chemical Test Results



**eNGLOBE**

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FILL - SAND

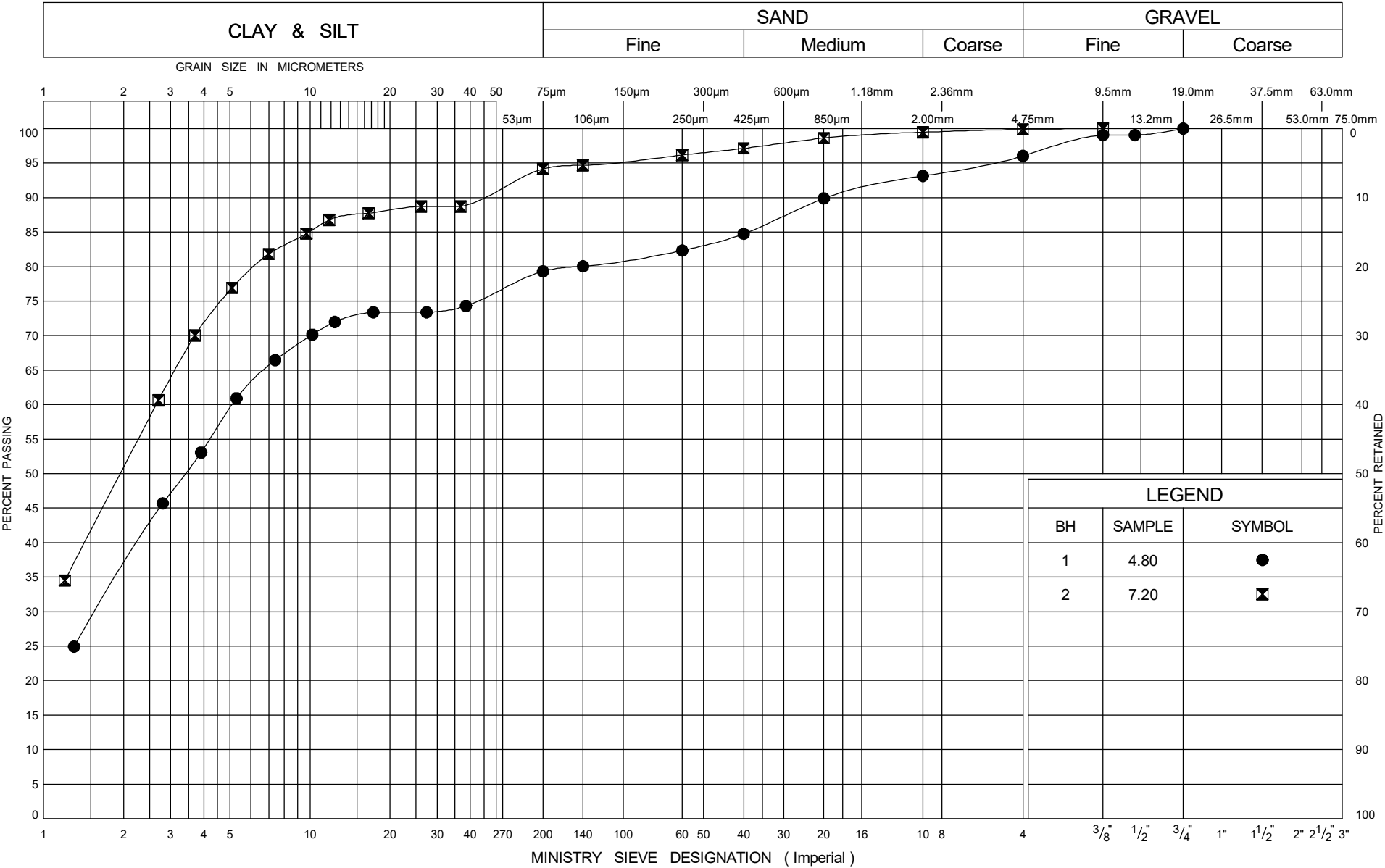
Figure: L-1

GWP 6176-15-00

Highway 61, NWR



UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FILL - SILT & CLAY

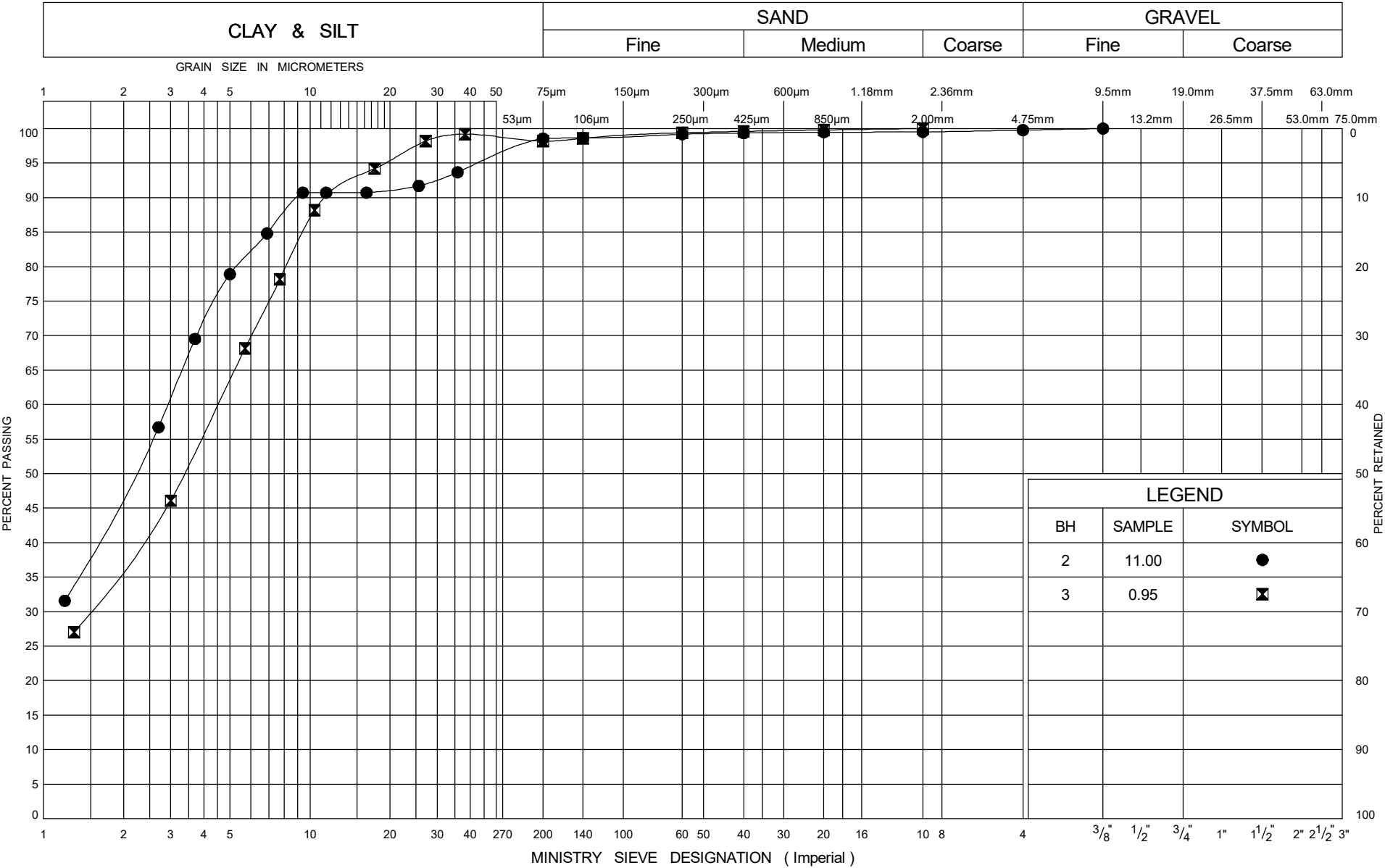


Figure: L-2

GWP 6176-15-00

Highway 61, NWR

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND		
BH	SAMPLE	SYMBOL
2	11.00	●
3	0.95	⊠

GRAIN SIZE DISTRIBUTION

SILT & CLAY

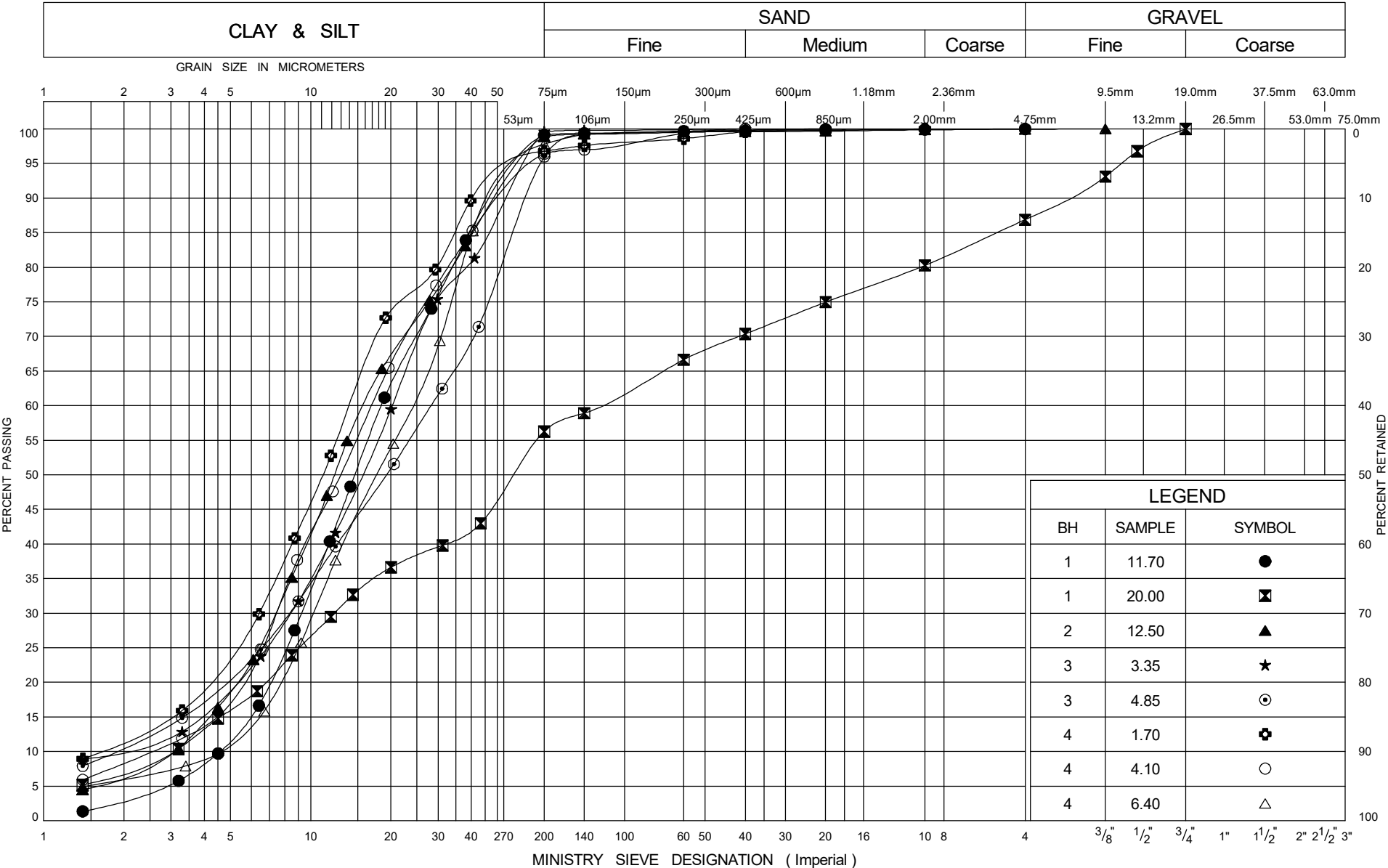
Figure: L-3

GWP 6176-15-00

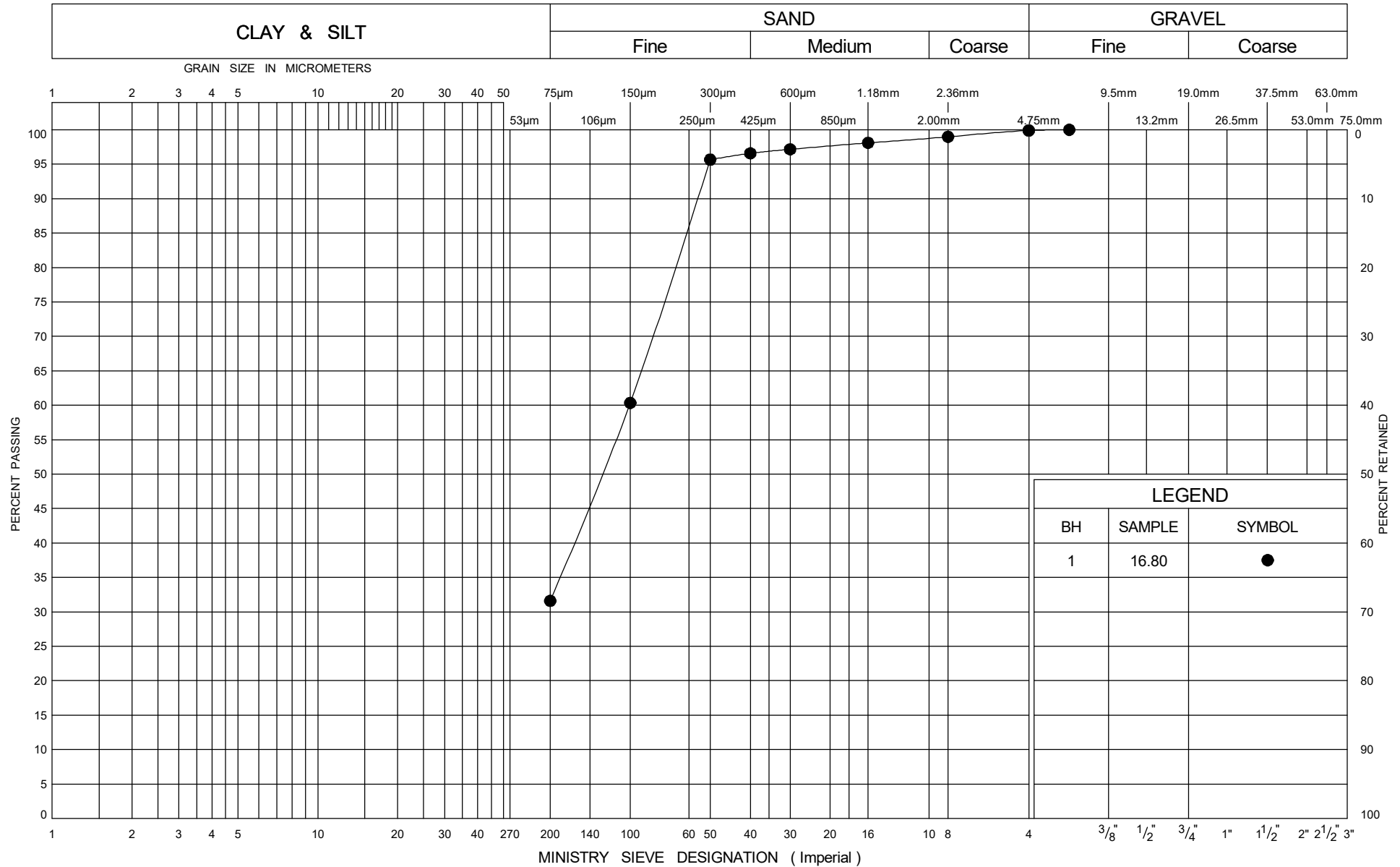
Highway 61



UNIFIED SOIL CLASSIFICATION SYSTEM



## UNIFIED SOIL CLASSIFICATION SYSTEM



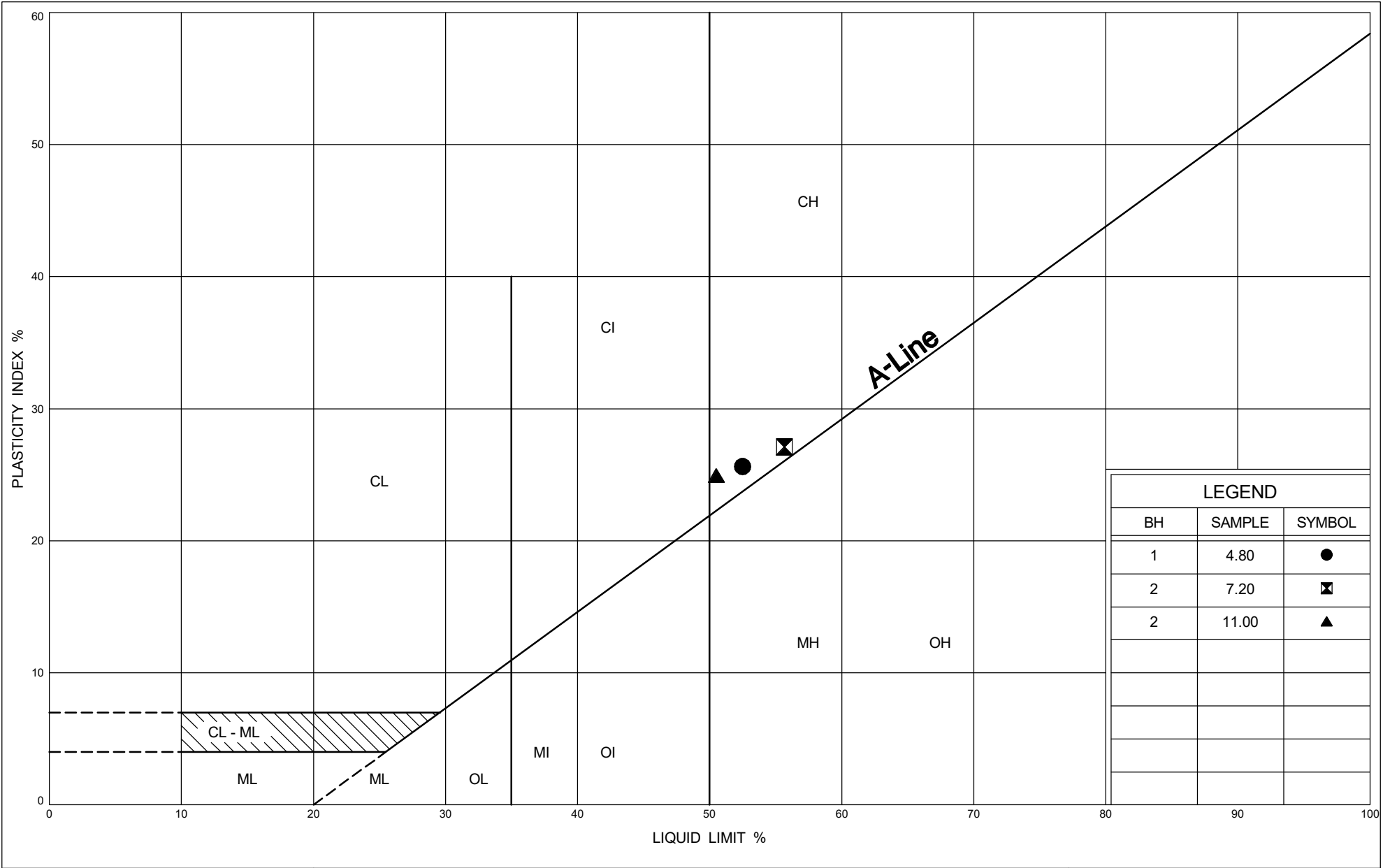
GRAIN SIZE DISTRIBUTION

SILTY SAND

Figure: L-5

GWP 6176-15-00

Highway 61, NWR





Your Project #: 2109931  
Site Location: HIGHWAY 61, NEEBING, ON  
Your C.O.C. #: na

**Attention: Diana McKay**

DST Consulting Engineers Inc  
Thunder Bay - Standing Offer  
605 Hewitson Street  
Thunder Bay, ON  
CANADA P7B 5V5

**Report Date: 2022/01/07**  
Report #: R6953568  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C1Z7709**

**Received: 2021/11/29, 12:17**

Sample Matrix: Soil  
# Samples Received: 4

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Chloride (20:1 extract)	4	2021/12/06	2021/12/06	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	4	2021/12/03	2021/12/03	CAM SOP-00414	OMOE E3530 v1 m
pH CaCl2 EXTRACT	4	2022/01/07	2021/12/02	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	4	2021/12/21	2022/01/07	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	4	2021/12/03	2022/01/06	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.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.





Your Project #: 2109931  
Site Location: HIGHWAY 61, NEEBING , ON  
Your C.O.C. #: na

**Attention: Diana McKay**

DST Consulting Engineers Inc  
Thunder Bay - Standing Offer  
605 Hewitson Street  
Thunder Bay, ON  
CANADA P7B 5V5

**Report Date: 2022/01/07**  
Report #: R6953568  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C1Z7709**

**Received: 2021/11/29, 12:17**

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Deepthi Shaji, Project Manager

Email: Deepthi.Shaji@bureauveritas.com

Phone# (905)817-5700 Ext:7065843

=====

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 2

Page 2 of 9

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

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.



BUREAU  
VERITAS

Bureau Veritas Job #: C1Z7709  
Report Date: 2022/01/07

DST Consulting Engineers Inc  
Client Project #: 2109931  
Site Location: HIGHWAY 61, NEEBING, ON  
Sampler Initials: RT

### RESULTS OF ANALYSES OF SOIL

Bureau Veritas ID		RK0370			RK0370			RK0371		
Sampling Date		2021/10/15 14:00			2021/10/15 14:00			2021/10/23 09:30		
COC Number		na			na			na		
	UNITS	20+375 BH2, S#15	RDL	QC Batch	20+375 BH2, S#15 Lab-Dup	RDL	QC Batch	20+040 BH1, S#10	RDL	QC Batch
<b>Calculated Parameters</b>										
Resistivity	ohm-cm	1500		7746098				780		7746098
<b>Inorganics</b>										
Soluble (20:1) Chloride (Cl-)	ug/g	180	20	7764954	170	20	7764954	490	20	7764954
Conductivity	mS/cm	0.661	0.002	7770495				1.28	0.002	7770495
Available (CaCl2) pH	pH	7.17		7770243				7.63		7770243
Soluble (20:1) Sulphate (SO4)	ug/g	300	20	7760268	310	20	7760268	670	20	7760268
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate										

Bureau Veritas ID		RK0372	RK0373		
Sampling Date		2021/10/25 11:50	2021/10/28 13:30		
COC Number		na	na		
	UNITS	14+588 BH1, S#15	26+418 BH2, S#10	RDL	QC Batch
<b>Calculated Parameters</b>					
Resistivity	ohm-cm	2300	2100		7746098
<b>Inorganics</b>					
Soluble (20:1) Chloride (Cl-)	ug/g	260	270	20	7764954
Conductivity	mS/cm	0.439	0.469	0.002	7770495
Available (CaCl2) pH	pH	5.13	7.21		7770243
Soluble (20:1) Sulphate (SO4)	ug/g	<20	<20	20	7760268
RDL = Reportable Detection Limit QC Batch = Quality Control Batch					



BUREAU  
VERITAS

Bureau Veritas Job #: C1Z7709

Report Date: 2022/01/07

DST Consulting Engineers Inc

Client Project #: 2109931

Site Location: HIGHWAY 61, NEEBING, ON

Sampler Initials: RT

## TEST SUMMARY

**Bureau Veritas ID:** RKO370  
**Sample ID:** 20+375 BH2, S#15  
**Matrix:** Soil

**Collected:** 2021/10/15  
**Shipped:**  
**Received:** 2021/11/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7764954	2021/12/06	2021/12/06	Alina Dobreanu
Conductivity	AT	7770495	2021/12/03	2021/12/03	Kien Tran
pH CaCl2 EXTRACT	AT	7770243	2021/12/02	2021/12/02	Taslina Aktar
Resistivity of Soil		7746098	2022/01/07	2022/01/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7760268	2021/12/03	2022/01/06	Avneet Kour Sudan

**Bureau Veritas ID:** RKO370 Dup  
**Sample ID:** 20+375 BH2, S#15  
**Matrix:** Soil

**Collected:** 2021/10/15  
**Shipped:**  
**Received:** 2021/11/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7764954	2021/12/06	2021/12/06	Alina Dobreanu
Sulphate (20:1 Extract)	KONE/EC	7760268	2021/12/30	2022/01/06	Avneet Kour Sudan

**Bureau Veritas ID:** RKO371  
**Sample ID:** 20+040 BH1, S#10  
**Matrix:** Soil

**Collected:** 2021/10/23  
**Shipped:**  
**Received:** 2021/11/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7764954	2021/12/06	2021/12/06	Alina Dobreanu
Conductivity	AT	7770495	2021/12/03	2021/12/03	Kien Tran
pH CaCl2 EXTRACT	AT	7770243	2021/12/02	2021/12/02	Taslina Aktar
Resistivity of Soil		7746098	2022/01/07	2022/01/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7760268	2021/12/03	2022/01/06	Avneet Kour Sudan

**Bureau Veritas ID:** RKO372  
**Sample ID:** 14+588 BH1, S#15  
**Matrix:** Soil

**Collected:** 2021/10/25  
**Shipped:**  
**Received:** 2021/11/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7764954	2021/12/06	2021/12/06	Alina Dobreanu
Conductivity	AT	7770495	2021/12/03	2021/12/03	Kien Tran
pH CaCl2 EXTRACT	AT	7770243	2021/12/02	2021/12/02	Taslina Aktar
Resistivity of Soil		7746098	2022/01/07	2022/01/07	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7760268	2021/12/03	2022/01/06	Avneet Kour Sudan

**Bureau Veritas ID:** RKO373  
**Sample ID:** 26+418 BH2, S#10  
**Matrix:** Soil

**Collected:** 2021/10/28  
**Shipped:**  
**Received:** 2021/11/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7764954	2021/12/06	2021/12/06	Alina Dobreanu
Conductivity	AT	7770495	2021/12/03	2021/12/03	Kien Tran
pH CaCl2 EXTRACT	AT	7770243	2021/12/02	2021/12/02	Taslina Aktar
Resistivity of Soil		7746098	2022/01/07	2022/01/07	Automated Statchk



BUREAU  
VERITAS

Bureau Veritas Job #: C1Z7709  
Report Date: 2022/01/07

DST Consulting Engineers Inc  
Client Project #: 2109931  
Site Location: HIGHWAY 61, NEEBING , ON  
Sampler Initials: RT

## TEST SUMMARY

**Bureau Veritas ID:** RKO373  
**Sample ID:** 26+418 BH2, S#10  
**Matrix:** Soil

**Collected:** 2021/10/28  
**Shipped:**  
**Received:** 2021/11/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate (20:1 Extract)	KONE/EC	7760268	2021/12/03	2022/01/06	Avneet Kour Sudan



### GENERAL COMMENTS

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

Package 1	16.7°C
-----------	--------

Results relate only to the items tested.



**BUREAU  
VERITAS**

Bureau Veritas Job #: C1Z7709

Report Date: 2022/01/07

## QUALITY ASSURANCE REPORT

DST Consulting Engineers Inc

Client Project #: 2109931

Site Location: HIGHWAY 61, NEEBING , ON

Sampler Initials: RT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7760268	Soluble (20:1) Sulphate (SO <sub>4</sub> )	2022/01/06	112	70 - 130	99	70 - 130	<20	ug/g	1.9	35
7764954	Soluble (20:1) Chloride (Cl <sup>-</sup> )	2021/12/06	93	80 - 120	107	80 - 120	<20	ug/g	6.0	35
7770243	Available (CaCl <sub>2</sub> ) pH	2021/12/02			100	N/A				
7770495	Conductivity	2021/12/03			99	90 - 110	<0.002	mS/cm		

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.



BUREAU  
VERITAS

Bureau Veritas Job #: C1Z7709

Report Date: 2022/01/07

DST Consulting Engineers Inc

Client Project #: 2109931

Site Location: HIGHWAY 61, NEEBING , ON

Sampler Initials: RT

### VALIDATION SIGNATURE PAGE

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

---

Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

---

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



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

## CHAIN OF CUSTODY RECORD

Page \_\_\_\_ of \_\_\_\_

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required	
Company Name: <b>DST Consulting Engineers</b>	Company Name: <b>DST Consulting Engineers</b>	Quotation #:	<input checked="" type="checkbox"/> Regular TAT (5-7 days) Most analyses		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS		
Contact Name: <b>Accounts Payable</b>	Contact Name: <b>Diana McKay</b>	P.O. #/ AFE#:			Rush TAT (Surcharges will be applied)		
Address: <b>605 Hewitson St.</b>	Address: <b>same</b>	Project #:	<b>2109931</b>		<input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 3-4 Days		
Phone: _____ Fax: _____	Phone: _____ Fax: _____	Site Location: <b>Highway 61, Neebing Ontario</b>	Site #:		Date Required:		
Email: <b>ap@dstgroup.com</b>	Email: <b>dmckay@dstgroup.com</b>	Site Location Province: _____ Ontario	Sampled By: <b>RT, DM</b>		Rush Confirmation #:		
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS LABORATORIES' DRINKING WATER CHAIN OF CUSTODY						LABORATORY USE ONLY	
<b>Regulation 153</b>		<b>Other Regulations</b>		<b>Analysis Requested</b>		<b>CUSTODY SEAL</b>	
<input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/ Fine		<input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw				<b>Y / N</b>	
<input checked="" type="checkbox"/> Table 2 <input checked="" type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse		<input type="checkbox"/> MISA <input type="checkbox"/> Storm Sewer Bylaw				<b>Present</b> <b>Intact</b>	
<input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/ Other		<input type="checkbox"/> PWQO <input type="checkbox"/> Region _____				<b>N</b> <b>N/A</b> <b>16/17/17</b>	
<input type="checkbox"/> Table _____		<input type="checkbox"/> Other (Specify) _____				<b>Ym</b>	
<b>FOR RSC (PLEASE CIRCLE) Y / N</b>		<input type="checkbox"/> REG 558 (MIN. 3 DAY TAT REQUIRED)				<b>COOLING MEDIA PRESENT: Y / N</b>	
<input type="checkbox"/> REG 406 Table _____		<input type="checkbox"/> REG 406 Table _____				<b>COMMENTS</b>	
<b>Include Criteria on Certificate of Analysis: Y / N</b>		<b>SAMPLES MUST BE KEPT COOL (&lt; 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS</b>					
<b>SAMPLE IDENTIFICATION</b>		<b>DATE SAMPLED (YYYY/MM/DD)</b>	<b>TIME SAMPLED (HH:MM)</b>	<b>MATRIX</b>	<b># OF CONTAINERS SUBMITTED</b>	<b>FIELD FILTERED (CIRCLE) Metals / Hg / Cr / V</b>	<b>DO NOT ANALYZE</b>
1	20+375 BH2, S#15	2021/10/15	14:00	Soil	1		
2	20+040 BH1, S#10	2021/10/23	9:30	Soil	1		
3	14+588 BH1, S#15	2021/10/25	11:50	Soil	1		
4	26+418 BH2, S#10	2021/10/28	13:30	Soil	1		
5							
6							
7							
8							
9							
10							
<b>RELINQUISHED BY: (Signature/Print)</b>		<b>DATE: (YYYY/MM/DD)</b>	<b>TIME: (HH:MM)</b>	<b>RECEIVED BY: (Signature/Print)</b>		<b>DATE: (YYYY/MM/DD)</b>	<b>TIME: (HH:MM)</b>
Ron Morrison		Nov. 29/21	10:17	James Klapperich		2021/11/29	12:17
						12/11/30	0859

Rec'd In Thunder Bay

M1129-160

SPJ

Enu-1560

C12 7709





Your Project #: 2109931  
 Site Location: HWY 61  
 Your C.O.C. #: na

**Attention: Mathew Quick**

Englobe Corp.  
 Thunder Bay - Standing Offer  
 605 Hewitson Street  
 Thunder Bay, ON  
 CANADA P7B 5V5

**Report Date: 2022/02/01**  
 Report #: R6985321  
 Version: 2 - Revision

**CERTIFICATE OF ANALYSIS – REVISED REPORT**

**BV LABS JOB #: C1AD315**

**Received: 2021/12/22, 11:50**

Sample Matrix: Water  
 # Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Chloride by Automated Colourimetry	1	N/A	2022/01/21	CAM SOP-00463	SM 23 4500-Cl E m
Chloride by Automated Colourimetry	2	N/A	2022/01/04	CAM SOP-00463	SM 23 4500-Cl E m
Chloride by Automated Colourimetry	1	N/A	2022/01/07	CAM SOP-00463	SM 23 4500-Cl E m
Total Cyanide	3	2022/01/04	2022/01/04	CAM SOP-00457	OMOE E3015 5 m
Total Cyanide	1	2022/01/07	2022/01/07	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2022/01/20	2022/01/21	CAM SOP-00449	SM 23 4500-F C m
Fluoride	1	2022/01/06	2022/01/07	CAM SOP-00449	SM 23 4500-F C m
Fluoride	2	2021/12/24	2021/12/29	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	1	2022/01/07	2022/01/07	CAM SOP-00453	EPA 7470A m
Mercury in Water by CVAA	3	2021/12/29	2021/12/30	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	1	N/A	2022/01/06	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	3	N/A	2021/12/30	CAM SOP-00447	EPA 6020B m
Animal and Vegetable Oil and Grease	1	N/A	2022/01/05	CAM SOP-00326	EPA1664B m,SM5520B m
Animal and Vegetable Oil and Grease	3	N/A	2021/12/30	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2022/01/05	2022/01/05	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	3	2021/12/29	2021/12/29	CAM SOP-00326	EPA1664B m,SM5520B m
pH	1	2022/01/20	2022/01/21	CAM SOP-00413	SM 4500H+ B m
pH	1	2022/01/06	2022/01/07	CAM SOP-00413	SM 4500H+ B m
pH	2	2021/12/24	2021/12/29	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2022/01/06	CAM SOP-00444	OMOE E3179 m
Phenols (4AAP)	3	N/A	2021/12/29	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2022/01/21	CAM SOP-00464	EPA 375.4 m
Sulphate by Automated Colourimetry	1	N/A	2022/01/07	CAM SOP-00464	EPA 375.4 m
Sulphate by Automated Colourimetry	2	N/A	2021/12/29	CAM SOP-00464	EPA 375.4 m
Total Kjeldahl Nitrogen in Water	1	2022/01/06	2022/01/06	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	1	2021/12/29	2022/01/04	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	2	2021/12/29	2022/01/06	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	1	2022/01/06	2022/01/07	CAM SOP-00407	SM 23 4500 P B H m
Total Phosphorus (Colourimetric)	3	2021/12/29	2022/01/04	CAM SOP-00407	SM 23 4500 P B H m
Mineral/Synthetic O & G (TPH Heavy Oil) (1)	1	2022/01/05	2022/01/05	CAM SOP-00326	EPA1664B m,SM5520F m



Your Project #: 2109931  
Site Location: HWY 61  
Your C.O.C. #: na

**Attention: Mathew Quick**

Englobe Corp.  
Thunder Bay - Standing Offer  
605 Hewitson Street  
Thunder Bay, ON  
CANADA P7B 5V5

**Report Date: 2022/02/01**  
Report #: R6985321  
Version: 2 - Revision

**CERTIFICATE OF ANALYSIS – REVISED REPORT**

**BV LABS JOB #: C1AD315**

**Received: 2021/12/22, 11:50**

Sample Matrix: Water  
# Samples Received: 4

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Mineral/Synthetic O & G (TPH Heavy Oil) (1)	3	2021/12/29	2021/12/29	CAM SOP-00326	EPA1664B m, SM5520F m
Total Suspended Solids	1	2022/01/07	2022/01/10	CAM SOP-00428	SM 23 2540D m
Total Suspended Solids	3	2021/12/29	2021/12/30	CAM SOP-00428	SM 23 2540D 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.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

(1) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease



Your Project #: 2109931  
Site Location: HWY 61  
Your C.O.C. #: na

**Attention: Mathew Quick**

Englobe Corp.  
Thunder Bay - Standing Offer  
605 Hewitson Street  
Thunder Bay, ON  
CANADA P7B 5V5

**Report Date: 2022/02/01**  
Report #: R6985321  
Version: 2 - Revision

**CERTIFICATE OF ANALYSIS – REVISED REPORT**

**BV LABS JOB #: C1AD315**  
**Received: 2021/12/22, 11:50**

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to your Project Manager.  
Deepthi Shaji, Project Manager  
Email: Deepthi.Shaji@bureauveritas.com  
Phone# (905)817-5700 Ext:7065843

=====

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



BUREAU  
VERITAS

Bureau Veritas Job #: C1AD315  
Report Date: 2022/02/01

Englobe Corp.  
Client Project #: 2109931  
Site Location: HWY 61

### OIL & GREASE - A/V/M/T (WATER)

Bureau Veritas ID				RLX569	RLX571	RLX572		
Sampling Date				2021/12/20 11:25	2021/12/20 15:55	2021/12/20 14:30		
COC Number				na	na	na		
	UNITS	Criteria	Criteria-2	BH4 26+420 LT	BH3 20+40 LT	BH3 20+370 RT	RDL	QC Batch
Calculated Parameters								
Total Animal/Vegetable Oil and Grease	mg/L	150	-	<0.50	<0.50	<0.50	0.50	7753651
Petroleum Hydrocarbons								
Total Oil & Grease	mg/L	-	-	<0.50	<0.50	<0.50	0.50	7758374
Total Oil & Grease Mineral/Synthetic	mg/L	15	0.5	<0.50	<0.50	<0.50	0.50	7758395
No Fill	No Exceedance							
Grey	Exceeds 1 criteria policy/level							
Black	Exceeds both criteria/levels							
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								
Criteria: City of Thunder Bay By-Law Nr BL 27/2019								
Discharges to Sanitary and Combined Sewers - A, Storm Sewer B respectively								
Criteria-2: Ontario Provincial Water Quality Objectives								
Ref. to MOEE Water Management document dated Feb.1999								

Bureau Veritas ID				RLX574		
Sampling Date				2021/12/20		
COC Number				na		
	UNITS	Criteria	Criteria-2	DUP 1	RDL	QC Batch
Calculated Parameters						
Total Animal/Vegetable Oil and Grease	mg/L	150	-	<0.50	0.50	7765119
Petroleum Hydrocarbons						
Total Oil & Grease	mg/L	-	-	<0.50	0.50	7766387
Total Oil & Grease Mineral/Synthetic	mg/L	15	0.5	<0.50	0.50	7766400
No Fill	No Exceedance					
Grey	Exceeds 1 criteria policy/level					
Black	Exceeds both criteria/levels					
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						
Criteria: City of Thunder Bay By-Law Nr BL 27/2019						
Discharges to Sanitary and Combined Sewers - A, Storm Sewer B respectively						
Criteria-2: Ontario Provincial Water Quality Objectives						
Ref. to MOEE Water Management document dated Feb.1999						



## RESULTS OF ANALYSES OF WATER

Bureau Veritas ID					RLX569			RLX569		
Sampling Date					2021/12/20 11:25			2021/12/20 11:25		
COC Number					na			na		
	UNITS	Criteria	Criteria B	Criteria-2	BH4 26+420 LT	RDL	QC Batch	BH4 26+420 LT Lab-Dup	RDL	QC Batch

<b>Inorganics</b>										
Fluoride (F-)	mg/L	10	-	-	0.14	0.10	7792030			
Total Kjeldahl Nitrogen (TKN)	mg/L	100	-	-	<0.10	0.10	7757516			
pH	pH	5.5:10.5	6.0:10.0	6.5:8.5	7.93		7792055			
Phenols-4AAP	mg/L	1	-	0.001	<0.0010	0.0010	7756961			
Total Phosphorus	mg/L	10	-	0.01	<b>0.12</b>	0.040	7758252			
Total Suspended Solids	mg/L	350	15	-	<b>300</b>	10	7756985			
Dissolved Sulphate (SO4)	mg/L	1500	-	-	23	1.0	7792108	23	1.0	7792108
Total Cyanide (CN)	mg/L	2	-	-	<0.0050	0.0050	7763702			
Dissolved Chloride (Cl-)	mg/L	1500	-	-	240	3.0	7792105	240	3.0	7792105

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate Criteria, Criteria B: City of Thunder Bay By-Law Nr BL 27/2019 Discharges to Sanitary and Combined Sewers - A, Storm Sewer B respectively Criteria-2: Ontario Provincial Water Quality Objectives Ref. to MOEE Water Management document dated Feb.1999	



### RESULTS OF ANALYSES OF WATER

Bureau Veritas ID					RLX571		RLX572		
Sampling Date					2021/12/20 15:55		2021/12/20 14:30		
COC Number					na		na		
	UNITS	Criteria	Criteria B	Criteria-2	BH3 20+40 LT	RDL	BH3 20+370 RT	RDL	QC Batch
Inorganics									
Fluoride (F-)	mg/L	10	-	-	<0.10	0.10	<0.10	0.10	7754486
Total Kjeldahl Nitrogen (TKN)	mg/L	100	-	-	<0.10	0.10	0.18	0.10	7757516
pH	pH	5.5:10.5	6.0:10.0	6.5:8.5	7.58		7.22		7754492
Phenols-4AAP	mg/L	1	-	0.001	0.0011	0.0010	<0.0010	0.0010	7756961
Total Phosphorus	mg/L	10	-	0.01	0.11	0.040	2.2	0.20	7758252
Total Suspended Solids	mg/L	350	15	-	150	10	7600	100	7756985
Dissolved Sulphate (SO4)	mg/L	1500	-	-	39	1.0	12	1.0	7754526
Total Cyanide (CN)	mg/L	2	-	-	<0.0050	0.0050	<0.0050	0.0050	7763702
Dissolved Chloride (Cl-)	mg/L	1500	-	-	17	1.0	68	1.0	7754537
No Fill	No Exceedance								
Grey	Exceeds 1 criteria policy/level								
Black	Exceeds both criteria/levels								
RDL = Reportable Detection Limit									
QC Batch = Quality Control Batch									
Criteria,Criteria B: City of Thunder Bay By-Law Nr BL 27/2019									
Discharges to Sanitary and Combined Sewers - A, Storm Sewer B respectively									
Criteria-2: Ontario Provincial Water Quality Objectives									
Ref. to MOEE Water Management document dated Feb.1999									



BUREAU  
VERITAS

Bureau Veritas Job #: C1AD315  
Report Date: 2022/02/01

Englobe Corp.  
Client Project #: 2109931  
Site Location: HWY 61

## RESULTS OF ANALYSES OF WATER

Bureau Veritas ID					RLX574			RLX574		
Sampling Date					2021/12/20			2021/12/20		
COC Number					na			na		
	UNITS	Criteria	Criteria B	Criteria-2	DUP 1	RDL	QC Batch	DUP 1 Lab-Dup	RDL	QC Batch
Inorganics										
Fluoride (F-)	mg/L	10	-	-	0.16	0.10	7769228	0.13	0.10	7769228
Total Kjeldahl Nitrogen (TKN)	mg/L	100	-	-	<0.10	0.10	7767598			
pH	pH	5.5:10.5	6.0:10.0	6.5:8.5	7.59		7769240	7.51		7769240
Phenols-4AAP	mg/L	1	-	0.001	<0.0010	0.0010	7767296	<0.0010	0.0010	7767296
Total Phosphorus	mg/L	10	-	0.01	0.073	0.040	7767532			
Total Suspended Solids	mg/L	350	15	-	54	10	7770137			
Dissolved Sulphate (SO4)	mg/L	1500	-	-	23	1.0	7769137	23	1.0	7769137
Total Cyanide (CN)	mg/L	2	-	-	<0.0050	0.0050	7770379			
Dissolved Chloride (Cl-)	mg/L	1500	-	-	250	3.0	7769147	260	3.0	7769147
No Fill	No Exceedance									
Grey	Exceeds 1 criteria policy/level									
Black	Exceeds both criteria/levels									
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										
Criteria,Criteria B: City of Thunder Bay By-Law Nr BL 27/2019										
Discharges to Sanitary and Combined Sewers - A, Storm Sewer B respectively										
Criteria-2: Ontario Provincial Water Quality Objectives										
Ref. to MOEE Water Management document dated Feb.1999										



BUREAU  
VERITAS

Bureau Veritas Job #: C1AD315  
Report Date: 2022/02/01

Englobe Corp.  
Client Project #: 2109931  
Site Location: HWY 61

### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID					RLX569	RLX571	RLX572		
Sampling Date					2021/12/20 11:25	2021/12/20 15:55	2021/12/20 14:30		
COC Number					na	na	na		
	<b>UNITS</b>	<b>Criteria</b>	<b>Criteria B</b>	<b>Criteria-2</b>	<b>BH4 26+420 LT</b>	<b>BH3 20+40 LT</b>	<b>BH3 20+370 RT</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Metals</b>									
Mercury (Hg)	mg/L	0.1	0.001	0.0002	<0.00010	0.00010	<0.00010	0.00010	7757969
Dissolved Aluminum (Al)	ug/L	50000	-	-	13	<4.9	280	4.9	7754368
Dissolved Antimony (Sb)	ug/L	5000	-	20	<0.50	<0.50	<0.50	0.50	7754368
Dissolved Arsenic (As)	ug/L	1000	-	100	<1.0	4.7	1.6	1.0	7754368
Dissolved Barium (Ba)	ug/L	-	-	-	130	74	39	2.0	7754368
Dissolved Beryllium (Be)	ug/L	-	-	11	<0.40	<0.40	<0.40	0.40	7754368
Dissolved Bismuth (Bi)	ug/L	5000	-	-	<1.0	<1.0	<1.0	1.0	7754368
Dissolved Boron (B)	ug/L	-	-	200	13	<10	12	10	7754368
Dissolved Cadmium (Cd)	ug/L	1000	1	0.2	0.16	<0.090	<b>0.32</b>	0.090	7754368
Dissolved Calcium (Ca)	ug/L	-	-	-	89000	99000	70000	200	7754368
Dissolved Chromium (Cr)	ug/L	5000	200	-	<5.0	<5.0	<5.0	5.0	7754368
Dissolved Cobalt (Co)	ug/L	5000	-	0.9	0.78	<b>1.7</b>	<b>3.5</b>	0.50	7754368
Dissolved Copper (Cu)	ug/L	3000	10	5	<b>5.2</b>	1.1	3.8	0.90	7754368
Dissolved Iron (Fe)	ug/L	50000	-	300	<100	<b>400</b>	<b>580</b>	100	7754368
Dissolved Lead (Pb)	ug/L	5000	50	5	<0.50	<0.50	0.69	0.50	7754368
Dissolved Lithium (Li)	ug/L	-	-	-	16	16	15	5.0	7754368
Dissolved Magnesium (Mg)	ug/L	-	-	-	41000	34000	24000	50	7754368
Dissolved Manganese (Mn)	ug/L	5000	-	-	150	480	700	2.0	7754368
Dissolved Molybdenum (Mo)	ug/L	5000	-	40	1.6	3.7	1.1	0.50	7754368
Dissolved Nickel (Ni)	ug/L	3000	50	25	3.6	3.1	6.1	1.0	7754368
Dissolved Phosphorus (P)	ug/L	10000	-	-	<100	<100	<100	100	7754368
Dissolved Potassium (K)	ug/L	-	-	-	730	1000	530	200	7754368
Dissolved Selenium (Se)	ug/L	5000	-	100	<2.0	<2.0	<2.0	2.0	7754368
Dissolved Silicon (Si)	ug/L	-	-	-	11000	10000	13000	50	7754368
Dissolved Silver (Ag)	ug/L	5000	-	0.1	<0.090	<0.090	<0.090	0.090	7754368
Dissolved Sodium (Na)	ug/L	-	-	-	190000	9700	25000	100	7754368

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Criteria, Criteria B: City of Thunder Bay By-Law Nr BL 27/2019 Discharges to Sanitary and Combined Sewers - A, Storm Sewer B respectively Criteria-2: Ontario Provincial Water Quality Objectives Ref. to MOEE Water Management document dated Feb.1999	





### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID					RLX569	RLX571	RLX572											
Sampling Date					2021/12/20 11:25	2021/12/20 15:55	2021/12/20 14:30											
COC Number					na	na	na											
	UNITS	Criteria	Criteria B	Criteria-2	BH4 26+420 LT	BH3 20+40 LT	BH3 20+370 RT	RDL	QC Batch									
Dissolved Strontium (Sr)	ug/L	-	-	-	230	81	100	1.0	7754368									
Dissolved Tellurium (Te)	ug/L	-	-	-	<1.0	<1.0	<1.0	1.0	7754368									
Dissolved Thallium (Tl)	ug/L	-	-	0.3	<0.050	<0.050	<0.050	0.050	7754368									
Dissolved Tin (Sn)	ug/L	5000	-	-	<1.0	<1.0	<1.0	1.0	7754368									
Dissolved Titanium (Ti)	ug/L	5000	-	-	<5.0	<5.0	11	5.0	7754368									
Dissolved Tungsten (W)	ug/L	-	-	30	<1.0	<1.0	<1.0	1.0	7754368									
Dissolved Uranium (U)	ug/L	-	-	5	4.4	3.2	1.2	0.10	7754368									
Dissolved Vanadium (V)	ug/L	5000	-	6	1.1	<0.50	1.1	0.50	7754368									
Dissolved Zinc (Zn)	ug/L	3000	50	30	<5.0	<5.0	11	5.0	7754368									
Dissolved Zirconium (Zr)	ug/L	-	-	4	<1.0	<1.0	<1.0	1.0	7754368									
No Fill	No Exceedance																	
Grey										Exceeds 1 criteria policy/level								
Black																		
RDL = Reportable Detection Limit																		
QC Batch = Quality Control Batch																		
Criteria,Criteria B: City of Thunder Bay By-Law Nr BL 27/2019																		
Discharges to Sanitary and Combined Sewers - A, Storm Sewer B respectively																		
Criteria-2: Ontario Provincial Water Quality Objectives																		
Ref. to MOEE Water Management document dated Feb.1999																		



BUREAU  
VERITAS

Bureau Veritas Job #: C1AD315  
Report Date: 2022/02/01

Englobe Corp.  
Client Project #: 2109931  
Site Location: HWY 61

### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID					RLX574			RLX574		
Sampling Date					2021/12/20			2021/12/20		
COC Number					na			na		
	UNITS	Criteria	Criteria B	Criteria-2	DUP 1	RDL	QC Batch	DUP 1 Lab-Dup	RDL	QC Batch
Metals										
Mercury (Hg)	mg/L	0.1	0.001	0.0002	<0.00010	0.00010	7769670			
Dissolved Aluminum (Al)	ug/L	50000	-	-	<4.9	4.9	7767223	<4.9	4.9	7767223
Dissolved Antimony (Sb)	ug/L	5000	-	20	<0.50	0.50	7767223	<0.50	0.50	7767223
Dissolved Arsenic (As)	ug/L	1000	-	100	<1.0	1.0	7767223	<1.0	1.0	7767223
Dissolved Barium (Ba)	ug/L	-	-	-	130	2.0	7767223	130	2.0	7767223
Dissolved Beryllium (Be)	ug/L	-	-	11	<0.40	0.40	7767223	<0.40	0.40	7767223
Dissolved Bismuth (Bi)	ug/L	5000	-	-	<1.0	1.0	7767223	<1.0	1.0	7767223
Dissolved Boron (B)	ug/L	-	-	200	11	10	7767223	<10	10	7767223
Dissolved Cadmium (Cd)	ug/L	1000	1	0.2	0.26	0.090	7767223	0.26	0.090	7767223
Dissolved Calcium (Ca)	ug/L	-	-	-	89000	200	7767223	88000	200	7767223
Dissolved Chromium (Cr)	ug/L	5000	200	-	<5.0	5.0	7767223	<5.0	5.0	7767223
Dissolved Cobalt (Co)	ug/L	5000	-	0.9	0.69	0.50	7767223	0.66	0.50	7767223
Dissolved Copper (Cu)	ug/L	3000	10	5	1.6	0.90	7767223	1.5	0.90	7767223
Dissolved Iron (Fe)	ug/L	50000	-	300	<100	100	7767223	<100	100	7767223
Dissolved Lead (Pb)	ug/L	5000	50	5	<0.50	0.50	7767223	<0.50	0.50	7767223
Dissolved Lithium (Li)	ug/L	-	-	-	15	5.0	7767223	15	5.0	7767223
Dissolved Magnesium (Mg)	ug/L	-	-	-	39000	50	7767223	39000	50	7767223
Dissolved Manganese (Mn)	ug/L	5000	-	-	140	2.0	7767223	140	2.0	7767223
Dissolved Molybdenum (Mo)	ug/L	5000	-	40	1.8	0.50	7767223	1.6	0.50	7767223
Dissolved Nickel (Ni)	ug/L	3000	50	25	3.2	1.0	7767223	3.5	1.0	7767223
Dissolved Phosphorus (P)	ug/L	10000	-	-	<100	100	7767223	<100	100	7767223
Dissolved Potassium (K)	ug/L	-	-	-	660	200	7767223	640	200	7767223
Dissolved Selenium (Se)	ug/L	5000	-	100	<2.0	2.0	7767223	<2.0	2.0	7767223
Dissolved Silicon (Si)	ug/L	-	-	-	11000	50	7767223	11000	50	7767223
Dissolved Silver (Ag)	ug/L	5000	-	0.1	<0.090	0.090	7767223	<0.090	0.090	7767223
No Fill	No Exceedance									
Grey	Exceeds 1 criteria policy/level									
Black	Exceeds both criteria/levels									
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										
Criteria,Criteria B: City of Thunder Bay By-Law Nr BL 27/2019										
Discharges to Sanitary and Combined Sewers - A, Storm Sewer B respectively										
Criteria-2: Ontario Provincial Water Quality Objectives										
Ref. to MOEE Water Management document dated Feb.1999										



BUREAU  
VERITAS

Bureau Veritas Job #: C1AD315

Report Date: 2022/02/01

Englobe Corp.

Client Project #: 2109931

Site Location: HWY 61

### ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID					RLX574			RLX574		
Sampling Date					2021/12/20			2021/12/20		
COC Number					na			na		
	UNITS	Criteria	Criteria B	Criteria-2	DUP 1	RDL	QC Batch	DUP 1 Lab-Dup	RDL	QC Batch
Dissolved Sodium (Na)	ug/L	-	-	-	180000	100	7767223	180000	100	7767223
Dissolved Strontium (Sr)	ug/L	-	-	-	230	1.0	7767223	230	1.0	7767223
Dissolved Tellurium (Te)	ug/L	-	-	-	<1.0	1.0	7767223	<1.0	1.0	7767223
Dissolved Thallium (Tl)	ug/L	-	-	0.3	<0.050	0.050	7767223	<0.050	0.050	7767223
Dissolved Tin (Sn)	ug/L	5000	-	-	<1.0	1.0	7767223	<1.0	1.0	7767223
Dissolved Titanium (Ti)	ug/L	5000	-	-	<5.0	5.0	7767223	<5.0	5.0	7767223
Dissolved Tungsten (W)	ug/L	-	-	30	<1.0	1.0	7767223	<1.0	1.0	7767223
Dissolved Uranium (U)	ug/L	-	-	5	4.7	0.10	7767223	4.7	0.10	7767223
Dissolved Vanadium (V)	ug/L	5000	-	6	0.92	0.50	7767223	1.0	0.50	7767223
Dissolved Zinc (Zn)	ug/L	3000	50	30	<5.0	5.0	7767223	<5.0	5.0	7767223
Dissolved Zirconium (Zr)	ug/L	-	-	4	<1.0	1.0	7767223	<1.0	1.0	7767223

No Fill

No Exceedance

Grey

Exceeds 1 criteria policy/level

Black

Exceeds both criteria/levels

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

Criteria, Criteria B: City of Thunder Bay By-Law Nr BL 27/2019

Discharges to Sanitary and Combined Sewers - A, Storm Sewer B  
respectively

Criteria-2: Ontario Provincial Water Quality Objectives

Ref. to MOEE Water Management document dated Feb.1999



**BUREAU  
VERITAS**

Bureau Veritas Job #: C1AD315

Report Date: 2022/02/01

Englobe Corp.

Client Project #: 2109931

Site Location: HWY 61

## TEST SUMMARY

**Bureau Veritas ID:** RLX569  
**Sample ID:** BH4 26+420 LT  
**Matrix:** Water

**Collected:** 2021/12/20  
**Shipped:**  
**Received:** 2021/12/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	7792105	N/A	2022/01/21	Alina Dobreanu
Total Cyanide	SKAL/CN	7763702	2022/01/04	2022/01/04	Aditiben Patel
Fluoride	ISE	7792030	2022/01/20	2022/01/21	Surinder Rai
Mercury in Water by CVAA	CV/AA	7757969	2021/12/29	2021/12/30	Gagandeep Rai
Dissolved Metals by ICPMS	ICP/MS	7754368	N/A	2021/12/30	Azita Fazaeli
Animal and Vegetable Oil and Grease	BAL	7753651	N/A	2021/12/30	Automated Statchk
Total Oil and Grease	BAL	7758374	2021/12/29	2021/12/29	Saumya Modh
pH	AT	7792055	2022/01/20	2022/01/21	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7756961	N/A	2021/12/29	Louise Harding
Sulphate by Automated Colourimetry	KONE	7792108	N/A	2022/01/21	Avneet Kour Sudan
Total Kjeldahl Nitrogen in Water	SKAL	7757516	2021/12/29	2022/01/04	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	7758252	2021/12/29	2022/01/04	Shivani Shivani
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7758395	2021/12/29	2021/12/29	Saumya Modh
Total Suspended Solids	BAL	7756985	2021/12/29	2021/12/30	Shaneil Hall

**Bureau Veritas ID:** RLX569 Dup  
**Sample ID:** BH4 26+420 LT  
**Matrix:** Water

**Collected:** 2021/12/20  
**Shipped:**  
**Received:** 2021/12/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	7792105	N/A	2022/01/21	Alina Dobreanu
Sulphate by Automated Colourimetry	KONE	7792108	N/A	2022/01/21	Avneet Kour Sudan

**Bureau Veritas ID:** RLX571  
**Sample ID:** BH3 20+40 LT  
**Matrix:** Water

**Collected:** 2021/12/20  
**Shipped:**  
**Received:** 2021/12/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	7754537	N/A	2022/01/04	Alina Dobreanu
Total Cyanide	SKAL/CN	7763702	2022/01/04	2022/01/04	Aditiben Patel
Fluoride	ISE	7754486	2021/12/24	2021/12/29	Neil Dassanayake
Mercury in Water by CVAA	CV/AA	7757969	2021/12/29	2021/12/30	Gagandeep Rai
Dissolved Metals by ICPMS	ICP/MS	7754368	N/A	2021/12/30	Azita Fazaeli
Animal and Vegetable Oil and Grease	BAL	7753651	N/A	2021/12/30	Automated Statchk
Total Oil and Grease	BAL	7758374	2021/12/29	2021/12/29	Saumya Modh
pH	AT	7754492	2021/12/24	2021/12/29	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	7756961	N/A	2021/12/29	Louise Harding
Sulphate by Automated Colourimetry	KONE	7754526	N/A	2021/12/29	Avneet Kour Sudan
Total Kjeldahl Nitrogen in Water	SKAL	7757516	2021/12/29	2022/01/06	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	7758252	2021/12/29	2022/01/04	Shivani Shivani
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7758395	2021/12/29	2021/12/29	Saumya Modh
Total Suspended Solids	BAL	7756985	2021/12/29	2021/12/30	Shaneil Hall



BUREAU  
VERITAS

Bureau Veritas Job #: C1AD315

Report Date: 2022/02/01

Englobe Corp.

Client Project #: 2109931

Site Location: HWY 61

## TEST SUMMARY

**Bureau Veritas ID:** RLX572  
**Sample ID:** BH3 20+370 RT  
**Matrix:** Water

**Collected:** 2021/12/20  
**Shipped:**  
**Received:** 2021/12/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	7754537	N/A	2022/01/04	Alina Dobreanu
Total Cyanide	SKAL/CN	7763702	2022/01/04	2022/01/04	Aditiben Patel
Fluoride	ISE	7754486	2021/12/24	2021/12/29	Neil Dassanayake
Mercury in Water by CVAA	CV/AA	7757969	2021/12/29	2021/12/30	Gagandeep Rai
Dissolved Metals by ICPMS	ICP/MS	7754368	N/A	2021/12/30	Azita Fazaeli
Animal and Vegetable Oil and Grease	BAL	7753651	N/A	2021/12/30	Automated Statchk
Total Oil and Grease	BAL	7758374	2021/12/29	2021/12/29	Saumya Modh
pH	AT	7754492	2021/12/24	2021/12/29	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	7756961	N/A	2021/12/29	Louise Harding
Sulphate by Automated Colourimetry	KONE	7754526	N/A	2021/12/29	Avneet Kour Sudan
Total Kjeldahl Nitrogen in Water	SKAL	7757516	2021/12/29	2022/01/06	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	7758252	2021/12/29	2022/01/04	Shivani Shivani
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7758395	2021/12/29	2021/12/29	Saumya Modh
Total Suspended Solids	BAL	7756985	2021/12/29	2021/12/30	Shaneil Hall

**Bureau Veritas ID:** RLX574  
**Sample ID:** DUP 1  
**Matrix:** Water

**Collected:** 2021/12/20  
**Shipped:**  
**Received:** 2021/12/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	7769147	N/A	2022/01/07	Alina Dobreanu
Total Cyanide	SKAL/CN	7770379	2022/01/07	2022/01/07	Aditiben Patel
Fluoride	ISE	7769228	2022/01/06	2022/01/07	Neil Dassanayake
Mercury in Water by CVAA	CV/AA	7769670	2022/01/07	2022/01/07	Gagandeep Rai
Dissolved Metals by ICPMS	ICP/MS	7767223	N/A	2022/01/06	Azita Fazaeli
Animal and Vegetable Oil and Grease	BAL	7765119	N/A	2022/01/05	Automated Statchk
Total Oil and Grease	BAL	7766387	2022/01/05	2022/01/05	Saumya Modh
pH	AT	7769240	2022/01/06	2022/01/07	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	7767296	N/A	2022/01/06	Louise Harding
Sulphate by Automated Colourimetry	KONE	7769137	N/A	2022/01/07	Avneet Kour Sudan
Total Kjeldahl Nitrogen in Water	SKAL	7767598	2022/01/06	2022/01/06	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	7767532	2022/01/06	2022/01/07	Shivani Shivani
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7766400	2022/01/05	2022/01/05	Saumya Modh
Total Suspended Solids	BAL	7770137	2022/01/07	2022/01/10	Shaneil Hall

**Bureau Veritas ID:** RLX574 Dup  
**Sample ID:** DUP 1  
**Matrix:** Water

**Collected:** 2021/12/20  
**Shipped:**  
**Received:** 2021/12/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	7769147	N/A	2022/01/07	Alina Dobreanu
Fluoride	ISE	7769228	2022/01/06	2022/01/07	Neil Dassanayake
Dissolved Metals by ICPMS	ICP/MS	7767223	N/A	2022/01/06	Azita Fazaeli
pH	AT	7769240	2022/01/06	2022/01/07	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	7767296	N/A	2022/01/06	Louise Harding



BUREAU  
VERITAS

Bureau Veritas Job #: C1AD315

Report Date: 2022/02/01

Englobe Corp.

Client Project #: 2109931

Site Location: HWY 61

## TEST SUMMARY

**Bureau Veritas ID:** RLX574 Dup

**Sample ID:** DUP 1

**Matrix:** Water

**Collected:** 2021/12/20

**Shipped:**

**Received:** 2021/12/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate by Automated Colourimetry	KONE	7769137	N/A	2022/01/07	Avneet Kour Sudan



### GENERAL COMMENTS

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

Package 1	1.7°C
Package 2	0.3°C

Revised report[2022/02/01] - Criteria included in the report as per client request.

**Results relate only to the items tested.**

BUREAU  
VERITAS

Bureau Veritas Job #: C1AD315

Report Date: 2022/02/01

## QUALITY ASSURANCE REPORT

Englobe Corp.

Client Project #: 2109931

Site Location: HWY 61

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7754368	Dissolved Aluminum (Al)	2021/12/30	105	80 - 120	104	80 - 120	<4.9	ug/L				
7754368	Dissolved Antimony (Sb)	2021/12/30	105	80 - 120	100	80 - 120	<0.50	ug/L	NC	20		
7754368	Dissolved Arsenic (As)	2021/12/30	101	80 - 120	100	80 - 120	<1.0	ug/L	NC	20		
7754368	Dissolved Barium (Ba)	2021/12/30	103	80 - 120	99	80 - 120	<2.0	ug/L	NC	20		
7754368	Dissolved Beryllium (Be)	2021/12/30	100	80 - 120	96	80 - 120	<0.40	ug/L	NC	20		
7754368	Dissolved Bismuth (Bi)	2021/12/30	98	80 - 120	96	80 - 120	<1.0	ug/L				
7754368	Dissolved Boron (B)	2021/12/30	98	80 - 120	96	80 - 120	<10	ug/L	NC	20		
7754368	Dissolved Cadmium (Cd)	2021/12/30	103	80 - 120	98	80 - 120	<0.090	ug/L	NC	20		
7754368	Dissolved Calcium (Ca)	2021/12/30	102	80 - 120	99	80 - 120	<200	ug/L				
7754368	Dissolved Chromium (Cr)	2021/12/30	101	80 - 120	99	80 - 120	<5.0	ug/L	NC	20		
7754368	Dissolved Cobalt (Co)	2021/12/30	101	80 - 120	98	80 - 120	<0.50	ug/L	NC	20		
7754368	Dissolved Copper (Cu)	2021/12/30	102	80 - 120	97	80 - 120	<0.90	ug/L	NC	20		
7754368	Dissolved Iron (Fe)	2021/12/30	100	80 - 120	98	80 - 120	<100	ug/L				
7754368	Dissolved Lead (Pb)	2021/12/30	97	80 - 120	96	80 - 120	<0.50	ug/L	NC	20		
7754368	Dissolved Lithium (Li)	2021/12/30	101	80 - 120	98	80 - 120	<5.0	ug/L				
7754368	Dissolved Magnesium (Mg)	2021/12/30	102	80 - 120	100	80 - 120	<50	ug/L				
7754368	Dissolved Manganese (Mn)	2021/12/30	102	80 - 120	101	80 - 120	<2.0	ug/L				
7754368	Dissolved Molybdenum (Mo)	2021/12/30	105	80 - 120	101	80 - 120	<0.50	ug/L	NC	20		
7754368	Dissolved Nickel (Ni)	2021/12/30	99	80 - 120	97	80 - 120	<1.0	ug/L	NC	20		
7754368	Dissolved Phosphorus (P)	2021/12/30	110	80 - 120	114	80 - 120	<100	ug/L				
7754368	Dissolved Potassium (K)	2021/12/30	103	80 - 120	101	80 - 120	<200	ug/L				
7754368	Dissolved Selenium (Se)	2021/12/30	104	80 - 120	101	80 - 120	<2.0	ug/L	NC	20		
7754368	Dissolved Silicon (Si)	2021/12/30	104	80 - 120	101	80 - 120	<50	ug/L				
7754368	Dissolved Silver (Ag)	2021/12/30	100	80 - 120	97	80 - 120	<0.090	ug/L	NC	20		
7754368	Dissolved Sodium (Na)	2021/12/30	104	80 - 120	102	80 - 120	<100	ug/L	NC	20		
7754368	Dissolved Strontium (Sr)	2021/12/30	100	80 - 120	99	80 - 120	<1.0	ug/L				
7754368	Dissolved Tellurium (Te)	2021/12/30	105	80 - 120	100	80 - 120	<1.0	ug/L				
7754368	Dissolved Thallium (Tl)	2021/12/30	96	80 - 120	96	80 - 120	<0.050	ug/L	NC	20		
7754368	Dissolved Tin (Sn)	2021/12/30	105	80 - 120	98	80 - 120	<1.0	ug/L				
7754368	Dissolved Titanium (Ti)	2021/12/30	103	80 - 120	99	80 - 120	<5.0	ug/L				
7754368	Dissolved Tungsten (W)	2021/12/30	101	80 - 120	98	80 - 120	<1.0	ug/L				



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VERITAS

Bureau Veritas Job #: C1AD315

Report Date: 2022/02/01

## QUALITY ASSURANCE REPORT(CONT'D)

Englobe Corp.

Client Project #: 2109931

Site Location: HWY 61

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7754368	Dissolved Uranium (U)	2021/12/30	102	80 - 120	99	80 - 120	<0.10	ug/L	NC	20		
7754368	Dissolved Vanadium (V)	2021/12/30	101	80 - 120	99	80 - 120	<0.50	ug/L	NC	20		
7754368	Dissolved Zinc (Zn)	2021/12/30	103	80 - 120	99	80 - 120	<5.0	ug/L	NC	20		
7754368	Dissolved Zirconium (Zr)	2021/12/30	106	80 - 120	102	80 - 120	<1.0	ug/L				
7754486	Fluoride (F-)	2021/12/29	111	80 - 120	104	80 - 120	<0.10	mg/L	0.47	20		
7754492	pH	2021/12/29			102	98 - 103			0.52	N/A		
7754526	Dissolved Sulphate (SO4)	2021/12/29	NC	75 - 125	106	80 - 120	<1.0	mg/L	1.3	20		
7754537	Dissolved Chloride (Cl-)	2022/01/04	110	80 - 120	105	80 - 120	<1.0	mg/L	3.8	20		
7756961	Phenols-4AAP	2021/12/29	101	80 - 120	98	80 - 120	<0.0010	mg/L	NC	20		
7756985	Total Suspended Solids	2021/12/30					<10	mg/L	NC	25	99	85 - 115
7757516	Total Kjeldahl Nitrogen (TKN)	2022/01/04	102	80 - 120	102	80 - 120	<0.10	mg/L	18	20	103	80 - 120
7757969	Mercury (Hg)	2021/12/30	95	75 - 125	99	80 - 120	<0.00010	mg/L	NC	20		
7758252	Total Phosphorus	2022/01/04	89	80 - 120	96	80 - 120	<0.020	mg/L	0.22	20	94	80 - 120
7758374	Total Oil & Grease	2021/12/29			100	85 - 115	<0.50	mg/L	1.8	25		
7758395	Total Oil & Grease Mineral/Synthetic	2021/12/29			96	85 - 115	<0.50	mg/L	3.2	25		
7763702	Total Cyanide (CN)	2022/01/04	96	80 - 120	99	80 - 120	<0.0050	mg/L	2.9	20		
7766387	Total Oil & Grease	2022/01/05			100	85 - 115	<0.50	mg/L	4.3	25		
7766400	Total Oil & Grease Mineral/Synthetic	2022/01/05			96	85 - 115	<0.50	mg/L	4.8	25		
7767223	Dissolved Aluminum (Al)	2022/01/06	103	80 - 120	99	80 - 120	<4.9	ug/L	NC	20		
7767223	Dissolved Antimony (Sb)	2022/01/06	108	80 - 120	101	80 - 120	<0.50	ug/L	NC	20		
7767223	Dissolved Arsenic (As)	2022/01/06	103	80 - 120	99	80 - 120	<1.0	ug/L	NC	20		
7767223	Dissolved Barium (Ba)	2022/01/06	104	80 - 120	102	80 - 120	<2.0	ug/L	2.4	20		
7767223	Dissolved Beryllium (Be)	2022/01/06	101	80 - 120	97	80 - 120	<0.40	ug/L	NC	20		
7767223	Dissolved Bismuth (Bi)	2022/01/06	96	80 - 120	95	80 - 120	<1.0	ug/L	NC	20		
7767223	Dissolved Boron (B)	2022/01/06	99	80 - 120	94	80 - 120	<10	ug/L	5.7	20		
7767223	Dissolved Cadmium (Cd)	2022/01/06	104	80 - 120	99	80 - 120	<0.090	ug/L	1.2	20		
7767223	Dissolved Calcium (Ca)	2022/01/06	NC	80 - 120	101	80 - 120	<200	ug/L	0.76	20		
7767223	Dissolved Chromium (Cr)	2022/01/06	100	80 - 120	97	80 - 120	<5.0	ug/L	NC	20		
7767223	Dissolved Cobalt (Co)	2022/01/06	99	80 - 120	96	80 - 120	<0.50	ug/L	4.1	20		
7767223	Dissolved Copper (Cu)	2022/01/06	103	80 - 120	97	80 - 120	<0.90	ug/L	6.0	20		
7767223	Dissolved Iron (Fe)	2022/01/06	101	80 - 120	98	80 - 120	<100	ug/L	NC	20		

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VERITAS

Bureau Veritas Job #: C1AD315

Report Date: 2022/02/01

## QUALITY ASSURANCE REPORT(CONT'D)

Englobe Corp.

Client Project #: 2109931

Site Location: HWY 61

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7767223	Dissolved Lead (Pb)	2022/01/06	96	80 - 120	95	80 - 120	<0.50	ug/L	NC	20		
7767223	Dissolved Lithium (Li)	2022/01/06	105	80 - 120	100	80 - 120	<5.0	ug/L	2.9	20		
7767223	Dissolved Magnesium (Mg)	2022/01/06	NC	80 - 120	98	80 - 120	<50	ug/L	0.53	20		
7767223	Dissolved Manganese (Mn)	2022/01/06	101	80 - 120	99	80 - 120	<2.0	ug/L	0.90	20		
7767223	Dissolved Molybdenum (Mo)	2022/01/06	109	80 - 120	100	80 - 120	<0.50	ug/L	12	20		
7767223	Dissolved Nickel (Ni)	2022/01/06	97	80 - 120	96	80 - 120	<1.0	ug/L	8.6	20		
7767223	Dissolved Phosphorus (P)	2022/01/06	113	80 - 120	112	80 - 120	<100	ug/L	NC	20		
7767223	Dissolved Potassium (K)	2022/01/06	103	80 - 120	99	80 - 120	<200	ug/L	3.3	20		
7767223	Dissolved Selenium (Se)	2022/01/06	101	80 - 120	98	80 - 120	<2.0	ug/L	NC	20		
7767223	Dissolved Silicon (Si)	2022/01/06	104	80 - 120	100	80 - 120	<50	ug/L	1.5	20		
7767223	Dissolved Silver (Ag)	2022/01/06	99	80 - 120	100	80 - 120	<0.090	ug/L	NC	20		
7767223	Dissolved Sodium (Na)	2022/01/06	NC	80 - 120	99	80 - 120	<100	ug/L	0.37	20		
7767223	Dissolved Strontium (Sr)	2022/01/06	101	80 - 120	98	80 - 120	<1.0	ug/L	0.42	20		
7767223	Dissolved Tellurium (Te)	2022/01/06	103	80 - 120	100	80 - 120	<1.0	ug/L	NC	20		
7767223	Dissolved Thallium (Tl)	2022/01/06	96	80 - 120	95	80 - 120	<0.050	ug/L	NC	20		
7767223	Dissolved Tin (Sn)	2022/01/06	108	80 - 120	100	80 - 120	<1.0	ug/L	NC	20		
7767223	Dissolved Titanium (Ti)	2022/01/06	104	80 - 120	98	80 - 120	<5.0	ug/L	NC	20		
7767223	Dissolved Tungsten (W)	2022/01/06	101	80 - 120	99	80 - 120	<1.0	ug/L	NC	20		
7767223	Dissolved Uranium (U)	2022/01/06	107	80 - 120	104	80 - 120	<0.10	ug/L	0.64	20		
7767223	Dissolved Vanadium (V)	2022/01/06	102	80 - 120	98	80 - 120	<0.50	ug/L	10	20		
7767223	Dissolved Zinc (Zn)	2022/01/06	97	80 - 120	95	80 - 120	<5.0	ug/L	NC	20		
7767223	Dissolved Zirconium (Zr)	2022/01/06	112	80 - 120	101	80 - 120	<1.0	ug/L	NC	20		
7767296	Phenols-4AAP	2022/01/06	102	80 - 120	100	80 - 120	<0.0010	mg/L	NC	20		
7767532	Total Phosphorus	2022/01/07	96	80 - 120	98	80 - 120	<0.020	mg/L	0.12	20	98	80 - 120
7767598	Total Kjeldahl Nitrogen (TKN)	2022/01/06	NC	80 - 120	105	80 - 120	<0.10	mg/L	7.7	20	103	80 - 120
7769137	Dissolved Sulphate (SO4)	2022/01/07	NC	75 - 125	103	80 - 120	<1.0	mg/L	3.5	20		
7769147	Dissolved Chloride (Cl-)	2022/01/07	NC	80 - 120	103	80 - 120	<1.0	mg/L	2.7	20		
7769228	Fluoride (F-)	2022/01/07	110	80 - 120	101	80 - 120	<0.10	mg/L	20	20		
7769240	pH	2022/01/07			102	98 - 103			1.0	N/A		
7769670	Mercury (Hg)	2022/01/07	94	75 - 125	98	80 - 120	<0.00010	mg/L	NC	20		
7770137	Total Suspended Solids	2022/01/10					<10	mg/L	0	25	97	85 - 115

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Bureau Veritas Job #: C1AD315

Report Date: 2022/02/01

## QUALITY ASSURANCE REPORT(CONT'D)

Englobe Corp.

Client Project #: 2109931

Site Location: HWY 61

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7770379	Total Cyanide (CN)	2022/01/07	84	80 - 120	96	80 - 120	<0.0050	mg/L	NC	20		
7792030	Fluoride (F-)	2022/01/21	108	80 - 120	102	80 - 120	<0.10	mg/L	NC	20		
7792055	pH	2022/01/21			102	98 - 103			0.27	N/A		
7792105	Dissolved Chloride (Cl-)	2022/01/21	NC	80 - 120	105	80 - 120	<1.0	mg/L	0.64	20		
7792108	Dissolved Sulphate (SO4)	2022/01/21	NC	75 - 125	102	80 - 120	<1.0	mg/L	1.0	20		

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.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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 (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

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  $\leq 2 \times \text{RDL}$ ).



BUREAU  
VERITAS

Bureau Veritas Job #: C1AD315

Report Date: 2022/02/01

Englobe Corp.

Client Project #: 2109931

Site Location: HWY 61

### VALIDATION SIGNATURE PAGE

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

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Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

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BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



**IMMEDIATE TEST**

6540 Campbell Rd  
Phone: 905-817-5700  
CAM-FED-11191/6

22-Dec-21 11:50

Deepthi Shaji  
CIAD315

# CHAIN OF CUSTODY RECORD

Page 1 of 1

Invoice Information				Project Information (where applicable)				Turnaround Time (TAT) Required																			
Company Name: #1457 DST Consulting Engineers Inc.				Quotation #:				<input checked="" type="checkbox"/> Regular TAT (5-7 days) Most analyses																			
Contact Name: Accounts Payable				P.O. #/ AFE#:				PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS																			
Address: 605 Hewitson Street				Project #: 2109931				Rush TAT (Surcharges will be applied)																			
Phone: (807) 623-2929 Fax: (807) 623-1792				Site Location: HWY 61				<input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 3-4 Days																			
Email: ap@dstgroup.com				Site #:				Date Required:																			
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS LABORATORIES' DRINKING WATER CHAIN OF CUSTODY				Site Location Province: ON				Rush Confirmation #:																			
J.L. ENV-728				Sampled By: MQ				LABORATORY USE ONLY																			
<b>Regulation 153</b> <input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/ Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/ Other <input type="checkbox"/> Table _____ <b>FOR RSC (PLEASE CIRCLE) Y / N</b>				<b>Other Regulations</b> <input type="checkbox"/> CCME <input checked="" type="checkbox"/> Sanitary Sewer Bylaw <input type="checkbox"/> MISA <input type="checkbox"/> Storm Sewer Bylaw <input type="checkbox"/> PWQO Region _____ <input type="checkbox"/> Other (Specify) _____ <input type="checkbox"/> REG 558 (MIN. 3 DAY TAT REQUIRED) <input type="checkbox"/> REG 406 Table _____				<b>Analysis Requested</b> <div style="display: flex; justify-content: space-between;"> <div>             # OF CONTAINERS SUBMITTED              FIELD FILTERED (CIRCLE) Metals / Hg / CVI           </div> <div>             Cyanide              Chloride              Colour              Fluoride              pH              Sulphate              Mercury              Metals              TON              O&amp;G (total, animal, vegetable, mineral, synthetic)              Phenol              TSS           </div> <div>             HOLD - DO NOT ANALYZE           </div> </div>																			
Include Criteria on Certificate of Analysis: Y / N				COOLING MEDIA PRESENT: (Y) / N				COMMENTS																			
SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS																											
SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CVI	Cyanide	Chloride	Colour	Fluoride	pH	Sulphate	Mercury	Metals	TON	O&G (total, animal, vegetable, mineral, synthetic)	Phenol	TSS	HOLD - DO NOT ANALYZE	COMMENTS								
1 BH4 26+420 LT	2021-12-20	11:25	GW	9	X	X	X	X	X	X	X	X	X	X	X	X	X	X									
2 BH4 20+40 RT	2021-12-20	17:05	GW	9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Mercury was not field filtered, preservative washed out							
3 BH3 20+40 LT	2021-12-20	15:55	GW	9	X	X	X	X	X	X	X	X	X	X	X	X	X	X									
4 BH3 20+370 RT	2021-12-20	14:30	GW	9	X	X	X	X	X	X	X	X	X	X	X	X	X	X									
5 BH4 20+385 LT	2021-12-20	13:05	GW	9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
6 Dup 1	2021-12-20		GW	9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
7																											
8																											
9																											
10																											
RELINQUISHED BY: (Signature/Print)				DATE: (YYYY/MM/DD)				TIME: (HH:MM)				RECEIVED BY: (Signature/Print)				DATE: (YYYY/MM/DD)				TIME: (HH:MM)				BV JOB #			
Jordan Mamos				2021-12-20				11:45				Michelle Ruth mkruth				2021/12/22				11:50							
												J.L.				2021/12/23				08:50							

Rec'd In Thunder Bay

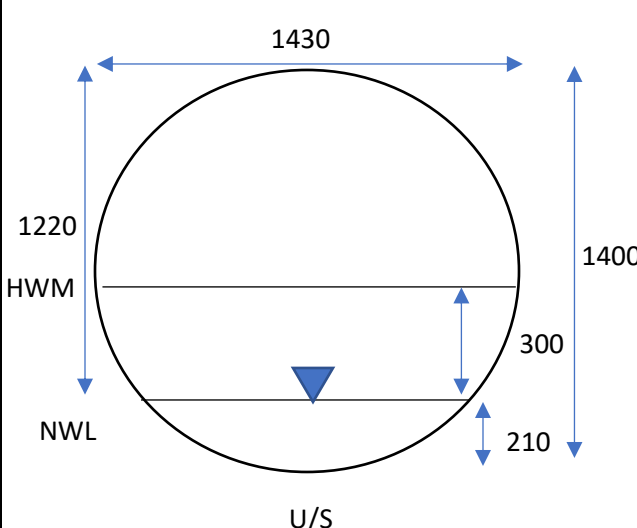
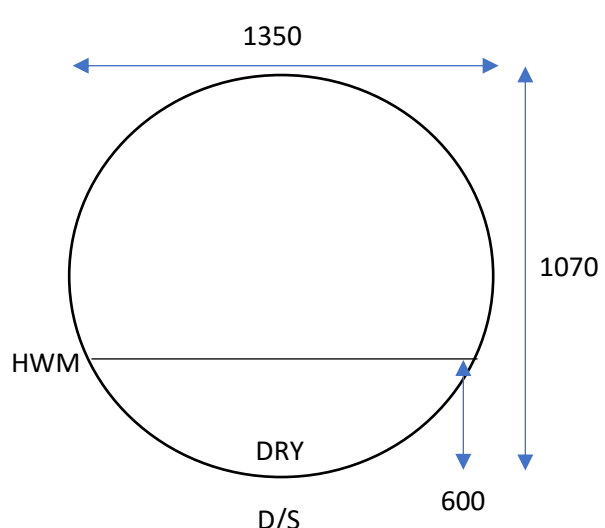
0/0/12, 0/0/12

**Appendix D**  
**Culvert Inspection Report**  
**(as provided by Gannett Fleming)**



**eNGLOBE**

## FIELD INSPECTION FORM

A. GENERAL INFORMATION			
<b>Project #</b>	6176-15-00 - Highway 61	<b>Project Description</b>	From 0.5km north of Jarvis Bay Road to 0.4km South of Hwy 130
<b>Date</b>	October 5, 2021	<b>Weather Conditions</b>	Sunny
<b>Inspector 1</b>	David Jackson	<b>Inspector 2 /Reviewer</b>	-
B. CULVERT ID / LOCATION			
<b>Culvert ID</b>	C9	<b>Chainage</b>	20+040
<b>UTM Easting</b>	343230.6382	<b>UTM Northing</b>	5345305.4154
<b>Description</b>	North of the Blake Hall Road & Highway 61 intersection		
C. STRUCTURE DETAILS			
<b>Material – CSP</b>			
<b>Dimensions – 1430 x 1400 US / 1350 x 1070 DS</b>			
<b>Clearance (soffit to normal water level) – 1220 mm / dry</b>			
<b>High Water Mark (on structure) – 300 mm from NWL / 600 from bottom</b>			
<b>Structures (U/S / D/S of Crossing) – Blake Hall Road culvert</b>			
<b>Debris – DS trees</b>			
D. ENVIRONMENTAL CONDITIONS			
<b>Watercourse Type and Creek Material – Mud/muck</b>			
<b>Bank Conditions (stability) – Stable with minor erosion</b>			
<b>Channel Dimensions (width and depth) – 1m, 2:1, 210mm US and DS</b>			
<b>Observed Flow Conditions (ephemeral/permanent) – Permanent</b>			
E. SITE CONDITIONS			
<b>Road Condition (sag, settlement, etc.) – OK</b>			
<b>Physical Culvert Condition (rust, damage, etc.) – Skew, rust, damage</b>			
<b>Culvert Appearance (general comments) – Replace</b>			
<b>Site Sketch –</b> <div style="display: flex; justify-content: space-around; align-items: flex-end; margin-top: 20px;"> <div style="text-align: center;">  <p>1430</p> <p>1220</p> <p>HWM</p> <p>NWL</p> <p>300</p> <p>210</p> <p>U/S</p> </div> <div style="text-align: center;">  <p>1350</p> <p>HWM</p> <p>600</p> <p>D/S</p> </div> </div>			



**Corrugated Steel Pipe Culvert (Culvert #9) @ 23+675**

**C9 - #1 – Upstream Channel Conditions**



**C9 - #2 – Upstream Face of the Culvert**





**C9 - #3 – Downstream Channel Conditions**



**C9 - #4 – Downstream Face of the Culvert**

