



Englobe

Soils Materials Environment

**Submitted to AECOM Canada Ltd.
189 Wyld Street Suite 103, North Bay, Ontario P1B 1Z2
On Behalf of the Ontario Ministry of Transportation**

**Culvert Replacement
Highway 118
Station 10+754 - Twp. of Dysart
GWP 5339-11-00**

FINAL FOUNDATION INVESTIGATION REPORT

Date: November 2, 2016
Ref. N°: 15/04/15020-F12

Geocres No. 31E-368

Submitted to AECOM Canada Ltd.
189 Wyld Street Suite 103, North Bay, Ontario P1B 1Z2
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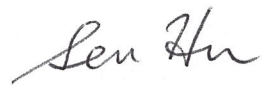
Culvert Replacement
Highway 118
Station 10+754 - Twp. of Dysart
GWP 5339-11-00

Final Foundation Investigation Report

Prepared by:

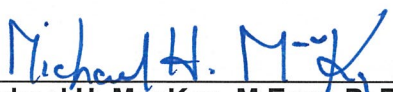



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2016-11-02

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Test results mentioned herein are only valid for the sample(s) stated in this report.

Englobe's subcontractors who may have accomplished work either on site or in laboratory are duly qualified as stated in our Quality Manual's procurement procedure. Should you require any further information, please contact your Project Manager."

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Attention: **Mr. Jason Wright**

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1 hard copy	File

1 INTRODUCTION

Englobe Corp. (Englobe), formerly LVM-Merlex, a Division of EnGlobe Corp., has been retained by AECOM Canada Ltd. on behalf of the Ministry of Transportation of Ontario (MTO) to carry out a foundation investigation at an existing centreline culvert site. The site is located at Station 10+754 in the Township of Dysart on Highway 118, about 125 m east of Camp White Pine Road.

The foundation investigation location was specified by the MTO in the Terms of Reference for work under Agreement No. 5014-E-0004: GWP 5339-11-00 for Detailed Design. The terms of reference for the scope of work are outlined in Englobe's Proposal P-14-199-R2, dated January 15, 2015. The purpose of this investigation was to determine the subsurface conditions in the area of the existing culvert for the contract preparation of the Detailed Design package. Englobe investigated the foundation area by the drilling of boreholes, carrying out in-situ tests, and performing laboratory testing on select samples.

2 SITE DESCRIPTION

A 750 mm Corrugated Steel Pipe (CSP) culvert is located on Highway 118 at Station 10+754 in the Township of Dysart, Ontario. The topography in the area of this site is generally rolling. The existing highway embankment currently supports two undivided lanes of highway, running in a west-east direction. The existing highway at the culvert location is constructed on a fill embankment some 3.2 m in height above the culvert invert (at centreline), with centreline at Elevation 396.8 m at the culvert location. At the north slope, the maximum height of the embankment is approximately 3.5 m. At the south slope, the maximum height of embankment fill is approximately 2.9 m above the culvert invert. The existing embankment slopes in the area of the culvert have been generally established at an angle of approximately 1.7H:1V to 1.9H:1V at the north and south slopes. The culvert at this location is a 750 mm diameter Corrugated Steel Pipe (CSP) culvert, some 21.5 m in length. Flow through the culvert is from the south to the north (right to left).

Observed infrastructure at the culvert location includes overhead wires to the north of the highway embankment.

2.1 SITE PHYSIOGRAPHY AND SURFICIAL GEOLOGY

The topography on this section of Highway 118 is generally rolling. Layers of earth overlie bedrock. Organic materials were also observed in the region. Within the project area, the native overburden consists primarily of silty sands to sands overlying bedrock.

Bedrock, based on Ontario Geologic Survey (OGS) Map MRD-126, in the area consists of felsic plutonic rocks including tonalite, granodiorite, monzogranite, syenogranite and derived gneisses and migmatites.

3 INVESTIGATION PROCEDURES

The fieldwork for this investigation was carried out between April 25th, 2016 and May 5th, 2016 during which time four (4) sampled boreholes, were advanced. Two (2) boreholes were advanced through the embankment, and one (1) borehole was advanced adjacent to each inlet (south) and outlet (north) end of the culvert, respectively (total of two (2) inlet and outlet boreholes).

The field investigation was carried out using a truck and a bombardier mounted CME drilling rigs equipped with hollow stem augers, standard augers, casing equipment and routine geotechnical sampling equipment. Soil samples were obtained at the borehole locations at regular intervals of depth using the standard 50 mm O.D. split spoon sampler advanced in accordance with the Standard Penetration Test (SPT) procedures (ASTM D-1586). The SPT method involves advancing a 50 mm O.D. split spoon sampler with the force of a 63.5 kg hammer freely dropping 760 mm. The number of blows per 300 mm penetration was recorded as the “N” value. If refusal to further advance of the augers was encountered within the proposed depth of borehole, the boring was advanced through diamond drilling using NQ size coring equipment. All samples taken during this investigation were stored in labeled airtight containers for transport to our North Bay laboratory for visual examination and select laboratory testing.

Groundwater conditions in the open boreholes were observed during the advancement of and immediately following completion of the individual boreholes. A 19 mm diameter standpipe was installed in Borehole Nos. 2 and 3 prior to backfilling to allow for further monitoring of the shallow groundwater levels. All open boreholes were backfilled upon completion with compacted auger cuttings in the same general order in which they were removed, and where necessary, bentonite pellet backfill was added to the boreholes to bring them up to grade in accordance with requirements of Ontario Regulation 903. At the boreholes through the embankment, the upper portion of the hole, where necessary, was backfilled with an asphalt cold patch to seal the existing asphalt surface.

The fieldwork for this investigation was under the full time direction of a senior member of the Englobe engineering staff (Jame Lavigne), who was responsible for 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 transport to the Englobe North Bay laboratory, plus overall drill supervision. All samples received a visual confirmatory inspection in the laboratory. Laboratory testing of select samples included routine testing for natural moisture content determination and particle size analysis. The results of the laboratory testing are presented on the individual Record of Borehole Sheets (Appendix 2), with

a summary of results presented on the laboratory sheets in Appendix 3 (Figures Nos. L-1 to L-3 and Table No. L-4).

The location of the individual boreholes was determined in the field using highway chainage established by Callon Dietz Inc. (Callon Dietz) and offsets relative to highway centreline. The MTO co-ordinates, northing and easting, were then established for the boring locations using coordinates from MTM Zone 10, NAD 83 CSRS. The borehole elevations are based on coordinating the borehole locations with the highway survey carried out by Callon Dietz. Elevations contained in this report are referenced to geodetic datum.

4 SUBSURFACE CONDITIONS

Details of the subsurface conditions revealed by the investigation program are presented on the enclosed Records of Borehole Logs (Appendix 2) and on Drawing No. 2 (Appendix 3). Please note that the stratigraphic delineation presented on the borehole logs and soil strata plot are the results of non-continuous sampling, response to drilling progress, the results of SPT, plus field observations. Typically such boundaries represent transitions from one zone to another and are not an exact demarcation of specific geological unit. 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.

4.1 CULVERT STATION 10+754, TWP OF DYSART

A plan and profile illustrating the borehole locations and stratigraphic sequences is shown on Drawing No. 2, Appendix 3. During the course of the exploration program, four (4) sampled boreholes were put down at this site, with Borehole Nos. 3 and 4 advanced through the embankment, Borehole No. 2 advanced adjacent to the culvert inlet, and Borehole No. 1 advanced adjacent to the culvert outlet. At the time of the subsurface investigation, the ground surface elevations at Boreholes Nos. 1 to 4 were recorded at Elevations 393.4, 393.5, 396.8, and 396.8 m, respectively.

4.1.1 Pavement Structure

Borehole Nos. 3 and 4, were advanced through the embankment. Borehole No. 3 confirmed the pavement structure consisted of 125 mm asphalt concrete overlying a layer of crushed gravel base/subbase approximately 175 mm thick. Borehole No. 4 was advanced through the shoulder, where a layer of crushed gravel base/subbase approximately 300 mm thick was encountered.

4.1.2 Embankment Fill

Underlying the pavement structure at Borehole Nos. 3 and 4, a layer of embankment fill described as of dark brown to brown sand, gravelly to trace gravel, silty to trace silt, trace clay was penetrated. Cobble/boulder sized rock pieces were encountered in the embankment fill

layer. The natural moisture content measured for recovered samples from this deposit was generally in the order of 3 to 16%. Three gradation (sieve) analyses were carried out on three (3) samples of this deposit, the results of which indicated 23 to 31% gravel size particles, 35 to 71% sand size particles, and 6 to 34% silt and clay size particles (Figure No. L-1, Appendix 3). Two (2) additional gradation (hydrometer) analyses were carried out on samples of this deposit, the results of which indicated 6 to 15% gravel size particles, 77 to 86% sand size particles, 3 to 6% silt size particles, 2 to 5% clay size particles (Figure No. L-1, Appendix 3). Based on SPT 'N' values of 3 to 29 blows per 300 mm penetration and 35 blows per 150 mm penetration, the relative density/compactness of this deposit was described as very loose to very dense, but generally compact on average. This embankment fill was encountered to depths of 3.7 and 3.4 m below grade at Borehole Nos. 3 and 4, respectively (Elevations 393.1 and 393.4 m, respectively).

4.1.3 Silty Sand

At surface at Borehole Nos. 1 and 2, a deposit of silty sand, trace gravel, trace clay was penetrated. The natural moisture content measured on samples of this deposit was in the order of 12 to 45%. A gradation (hydrometer) analysis was carried out on one (1) sample of this deposit, the results of which indicated 7% gravel size particles, 51% sand size particles, 37% silt size particles, and 5% clay size particles (Figure No. L-2, Appendix 3). An additional gradation (sieve) analysis was carried out on one (1) sample of this deposit, and indicated 6% gravel size particles, 53% sand size particles, and 41% silt and clay size particles (Figure No. L-2, Appendix 3). Based on SPT 'N' values of 2 to 16 blows per 300 mm penetration and 25 blows per 50 mm penetration, this deposit was described as very loose to very dense. This deposit was encountered to depths of 0.6 and 1.1 m below ground surface at Borehole Nos. 1 and 2, respectively (Elevations 392.8 and 392.4 m, respectively).

4.1.4 Sand

Underlying the silty sand at Borehole Nos. 1, and underlying the embankment fill at Borehole No. 3, a deposit of sand, with to some gravel, with silt, trace clay was penetrated. The natural moisture content measured on samples of this deposit ranged from 12 to 17%. A gradation (hydrometer) analysis was carried out on one (1) sample of this deposit, and indicated 15% gravel size particles, 62% sand size particles, 21% silt size particles, and 2% clay size particles (Figure No. L-3, Appendix 3). A gradation (sieve) analysis was carried out on one (1) sample of this deposit, and indicated 30% gravel size particles, 46% sand size particles, and 24% silt and clay size particles (Figure No. L-3, Appendix 3). Based on SPT 'N' values of 70 blows per 300 mm penetration to 10 blows per 50 mm penetration, this deposit was described as very dense. This deposit was encountered to depths of 1.7 and 4.4 m below ground surface at Borehole Nos. 1 and 3, respectively (Elevations 391.7 and 392.4 m, respectively).

4.1.5 **Bedrock**

Underlying the sands at Borehole Nos. 1 and 3, underlying the silty sands at Borehole No. 2, and underlying the embankment fill at Borehole No. 4, and bedrock was proven by diamond core drilling. The bedrock was described as black gneiss with thin pink granite. Based on RQD values of 8 to 86%, the bedrock was described as very poor to good quality. Based on visual review, the bedrock generally showed negligible weathering. Sampling in the bedrock was terminated at depths of 6.2, 4.2, 7.5, and 6.4 m below grade at Borehole Nos. 1 to 4, respectively (Elevations 387.2, 389.3, 389.3, and 390.4 m, respectively). Photos of rock cores recovered at Borehole Nos. 1 to 4 are shown in Enclosure No. 6, Appendix 4. It should be noted that, when encountered, the underlying bedrock surfaces in this area can be very erratic in nature, varying substantially in elevation over short horizontal distances.

4.2 **GROUNDWATER DATA**

At the time of this investigation (April 25th, 2016), the surface water level was observed at Elevation 393.4 m at the culvert outlet.

Measurements of the groundwater table and cave-in levels were undertaken, where possible, in the open boreholes during the advance of the individual borings and upon completion. A standpipe was installed in Borehole Nos. 2 and 3 to obtain post borehole completion water levels. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix B).

The groundwater levels were measured at Elevations 393.5 and 392.3 m at Borehole Nos. 2 and 3 during the site investigation period, respectively, respectively. The groundwater level was encountered at Elevations 393.4 and 394.3 m at Borehole Nos. 1 and 4, respectively, upon completion of sampling at the boreholes; however these water levels likely had not stabilized at the time of recording.

The groundwater was measured at Elevations 391.5 and 392.0 m at Borehole No. 2 and 3, respectively, at the time of decommissioning on August 15, 2016.

The groundwater and surface water levels will fluctuate seasonally/yearly.

Appendix 1 Key Plan

Drawing No. 1

Key Plan

MACRO KEY PLAN

NOT TO SCALE

Drawing No. 1



FOUNDATION INVESTIGATION REPORT

GWP 5339-11-00

Highway 118

Station 10+754 Culvert

Township of Dysart



Reference No: 15/04/15020-F12

November 2016

Appendix 2 Subsurface Data

Enclosure No. 1	List of Abbreviations and Symbols
Enclosure Nos. 2 to 5	Record of Borehole Sheet

LIST OF ABBREVIATIONS & DESCRIPTION OF TERMS

The abbreviations and terms, used to describe retrieved samples and commonly employed on the borehole logs, on the figures and in the report are as follows:

1. ABBREVIATIONS

AS	Auger Sample
CS	Chunk Sample
DS	Denison type sample
FS	Foil Sample
NFP	No Further Progress
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure
RC	Rock core with size & percentage of recovery
SS	Split Spoon
ST	Slotted Tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash Sample
WH	Sampler advanced by static weight of hammer and/or rods
Rec	% recovery from individual run of rock core
RQD	Rock quality designation (%)

2. PENETRATION RESISTANCE/"N"

Dynamic Cone Penetration Test (DCPT):

A continuous profile showing the number of blows for each 300 mm of penetration of a 50 mm diameter 60° cone attached to AW rod driven by a 63 kg hammer falling 760 mm.

Plotted as —●—●—●—●—

Standard Penetration Test (SPT) or "N" Values

The number of blows of a 63 kg hammer falling 760 mm required to advance a 50 mm O.D. drive open sampler 300 mm.

3. SOIL DESCRIPTION

a) *Cohesionless Soils:*

"N" (blows/0.3 m)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

b) *Cohesive Soils:*

Undrained Shear Strength (kPa)	Consistency
Less than 12	very soft
12 to 25	soft
25 to 50	firm
50 to 100	stiff
100 to 200	very stiff
over 200	hard

3. SOIL DESCRIPTION (Cont'd)

c) *Bedrock:*

RQD (%)	Classification
Less than 25	Very poor quality
25 to 50	Poor quality
50 to 75	Fair quality
75 to 90	Good quality
90 to 100	Excellent quality

d) *Method of Determination of Undrained Shear Strength of Cohesive Soils:*

+ 3.2 - Field Vane test in borehole.
The number denotes the sensitivity to remoulding.

D - Laboratory Vane Test

" - Compression test in laboratory

For a saturated cohesive soil the undrained shear strength is taken as one-half of the undrained compressive strength.

e) *Soil Moisture:*

Moisture	Described as
Dry	Below optimum moisture content
Moist	Near optimum moisture content
Wet	Above optimum moisture content

4. TERMINOLOGY

Terminology used for describing soil strata is based on the proportion of individual particle sizes present in the samples (please note that, with the exception of those samples subject to a grain-size analysis, all samples were classified visually and the accuracy of visual examination is not sufficient to determine exact grain sizing):

Trace, or occasional	Less than 10%
Some	10 to 20%
With	20 to 30%
Adjective (i.e. silty or sandy)	30 to 40%
And (i.e. sand and gravel)	40 to 60%

Terminology for cobbles and boulders is based on auger response and field observations:

Occasional	Obstructions encountered in borehole, however advance is not impeded
Numerous	Obstructions are essentially continuous over drilled length

SAMPLE DESCRIPTION NOTES:

1. **FILL:** The term fill is used to designate all man-made deposits of natural soil and/or waste materials. The reader is cautioned that fill materials can be very heterogeneous in nature and variable in depth, density and degree of compaction. Fill materials can be expected to contain organics, waste materials, construction materials, shot rock, rip-rap, and/or larger obstructions such as boulders, concrete foundations, slabs, abandoned tanks, etc.; none of which may have been encountered in the borehole. The description of the material penetrated in the borehole therefore may not be applicable as a general description of the fill material on the site as boreholes cannot accurately define the nature of fill material. During the boring and sampling process, retrieved samples may have certain characteristics that identify them as 'fill'. Fill materials (or possible fill materials) will be designated on the Borehole Logs. If fill material is identified on the site, it is highly recommended that testpits be put down to delineate the nature of the fill material. However, even through the use of testpits defining the true nature and composition of the fill material cannot be guaranteed. Fill deposits often contain pockets or seams of organics, organically contaminated soils or other deleterious material that can cause settlement or result in the production of methane gas. It should be noted that the origins and history of fill material is frequently very vague or non-existent. Often fill material may be contaminated beyond environmental guidelines and the material will have to be disposed of at a designated site (i.e. registered landfill). Unless requested or stated otherwise in this report, fill material on this site has not been tested for contaminants however, environmental testing of the fill material can be carried out at your request. Detection of underground storage tanks cannot be determined with conventional geotechnical procedures.
2. **TILL:** The term till indicates a material that is an unstratified, glacial deposit, heterogeneous in nature and, as such, may consist of mixtures and pockets of clay, silt, sand, gravel, cobbles and/or boulders. These heterogeneous deposits originate from a geological process associated with glaciation. It must be noted that due to the highly heterogeneous nature of till deposits, the description of the deposit on the borehole log may only be applicable to a very limited area and therefore, caution must be exercised when dealing with a till deposit. When excavating in till, contractors may encounter cobbles/boulders or possibly bedrock even if they are not indicated on the borehole logs. It must be appreciated that conventional geotechnical sampling equipment does not identify the nature or size of any obstruction.
3. **BEDROCK:** Auger refusal may be due to the presence of bedrock, but possibly could also be due to the presence of very dense underlying deposits, boulders or other large obstructions. Auger refusal is defined as the point at which an auger can no longer be practically advanced. It must be appreciated that conventional geotechnical sampling equipment does not differentiate between nature and size of obstructions that prevent further penetration of the boring below grade. Bedrock indicated on the borehole logs will be labeled 'possibly' or 'probable' etc. based on the response of the boring and sampling equipment, surrounding topography, etc. Bedrock can be proven at individual borehole locations, at your request, by diamond core drilling operations or, possibly, by testpits. It must also be appreciated that bedrock surfaces can be, and most times are, very erratic in nature (i.e. sheer drops, isolated rock knobs, etc.) and caution must be used when interpreting subsurface conditions between boreholes. A bedrock profile can be more accurately estimated, at the clients' request, through a series of closely positioned unsampled auger probes combined with core drilling.
4. **GROUNDWATER:** Although the groundwater table may have been encountered during this investigation and the elevation noted in the report and/or on the record of boreholes, it must be appreciated that the elevation of the groundwater table will fluctuate based upon seasonal conditions, localized changes, erratic changes in the underlying soil profile between boreholes, underlying soil layers with highly variable permeabilities, etc. These conditions may affect the design and type and nature of dewatering procedures. Cave-in levels recorded in borings give a general indication of the groundwater level in cohesionless soils however, it must be noted that cave-in levels may also be due to the relative density of the deposit, drilling operations etc.

METRIC**RECORD OF BOREHOLE NO. 1**

REFERENCE 15/04/15020-F12 DATUM Geodetic LOCATION N 4993499.9 E 377548.6 - Dysart Twp., Station 10+753.5 ORIGINATED BY JL
 PROJECT GWP 5339-11-00, Highway 118 BOREHOLE TYPE Track Mounted CME 45 - Hollow Stem Augers COMPILED BY DM
 CLIENT AECOM DATE (Started) 2016 April 25 TIME
 DATE (Completed) 2016 April 25 (Completed) CHECKED BY SH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)												
ELEV DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)											
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																							
						20	40	60	80	100	20	40	60																
393.4	Ground Surface																												
0.0	SILTY SAND - trace gravel, trace clay, trace organics, grass rootlets dark brown, wet (very loose)		1	SS	2									○		7 51 37 5													
392.8																													
0.6	SAND - with gravel with silt brown, wet (very dense)		2	SS	70						○					30 46 (24)													
391.7	Start Rock Coring		3	SS	50/100mm						○																		
1.7	BEDROCK - black gneiss, very poor quality		4	RC	REC=100% ROD=8%																								
	black gneiss with thin pink granite																												
	fair to good quality		5	RC	REC=95% ROD=60%																								
			6	RC	REC=100% ROD=86%																								
387.2	End of Sampling End of Borehole																												
6.2																													
COMMENTS								+ 3, × 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE					WATER LEVEL RECORDS <table border="1"> <thead> <tr> <th>Date (dd/mm/yy)/Time</th> <th>Water Depth (m)</th> <th>Cave In (m)</th> </tr> </thead> <tbody> <tr> <td>1) 16/4/25 3:30:00 PM</td> <td>0</td> <td>1.9</td> </tr> <tr> <td>2)</td> <td>-</td> <td>-</td> </tr> <tr> <td>3)</td> <td>-</td> <td>-</td> </tr> </tbody> </table>					Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)	1) 16/4/25 3:30:00 PM	0	1.9	2)	-	-	3)	-	-
Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)																											
1) 16/4/25 3:30:00 PM	0	1.9																											
2)	-	-																											
3)	-	-																											
The stratification lines represent approximate boundaries. The transition may be gradual.																													

MEL-GEO 15020 - BOREHOLE LOGS - F12.GPJ MEL-GEO.GDT 16/11/2

METRIC

RECORD OF BOREHOLE NO. 2



REFERENCE 15/04/15020-F12 DATUM Geodetic LOCATION N 4993475.6 E 377541.6 - Dysart Twp., Station 10+754 ORIGINATED BY JL
 PROJECT GWP 5339-11-00, Highway 118 BOREHOLE TYPE Track Mounted CME 45 - Hollow Stem Augers COMPILED BY DM
 CLIENT AECOM DATE (Started) 2016 April 26 TIME
 DATE (Completed) 2016 April 26 (Completed) CHECKED BY SH

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80			100
393.5	Ground Surface													
0.0	SILTY SAND - trace gravel brown/grey (compact/very dense)		1	SS	16									
392.4			2	SS	25/ 50mm									
1.1	Start Rock Coring													
	BEDROCK - black gneiss with thin pink granite poor to fair quality		3	RC	REC= 100% ROD= 35%									
			4	RC	REC= 97% ROD= 68%									
389.3	End of Sampling End of Borehole													
4.2														
COMMENTS							$+ 3, \times 3$: Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa \bigcirc 3% STRAIN AT FAILURE		WATER LEVEL RECORDS					
							Date (dd/mm/yy)/Time		Water Depth (m)		Cave In (m)			
							1) 16/4/26 3:00:00 PM		0		3.5			
							2) 16/4/26 3:05:00 PM		0		-			
							3) 16/8/15		2		-			

The stratification lines represent approximate boundaries. The transition may be gradual.

MEL-GEO 15020 - BOREHOLE LOGS - F12.GPJ MEL-GEO.GDT 16/11/2

Englobe Corp.

120 Progress Court, North Bay, On P1A 0C2 Phone: (705)476-2550 Fax: (705)476-8882 Email: northbay@englobecorp.com

METRIC

RECORD OF BOREHOLE NO. 3



REFERENCE 15/04/15020-F12 DATUM Geodetic LOCATION N 4993491.4 E 377544.6 - Dysart Twp., Station 10+752.5 ORIGINATED BY JL
 PROJECT GWP 5339-11-00, Highway 118 BOREHOLE TYPE Truck Mounted CME 45 - Hollow Stem Augers COMPILED BY DM
 CLIENT AECOM DATE (Started) 2016 May 5 TIME
 DATE (Completed) 2016 May 5 (Completed) CHECKED BY SH

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)												
ELEV DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa						WATER CONTENT (%)											
396.8	Ground Surface																								
0.0	125 mm asphalt 175 mm crushed gravel		1	SS	25																				
	EMBANKMENT FILL - sand, gravelly to trace gravel, silty to trace silt		2	SS	29																				
	dark brown/brown																								
	cobble/boulder sized rock pieces encountered between depths of 0.8 and 1.5 m		3	SS	25/ 75mm																				
	(compact/very dense)																								
	300 mm diameter boulder encountered at depth of 1.8 m		4	SS	12																				
			5	SS	13																				
393.1																									
3.7	wet		6	SS	10/ 50mm																				
392.4	SAND - some gravel, with silt, trace clay																								
4.4	dark brown, wet																								
	Start Rock Coring		7	RC	REC= 98% ROD= 40%																				
	BEDROCK - black gneiss with thin pink granite																								
	poor to fair quality		8	RC	REC= 95% ROD= 70%																				
389.3																									
7.5	End of Sampling End of Borehole																								
COMMENTS							+ 3, × 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE																		
							WATER LEVEL RECORDS <table border="1"> <thead> <tr> <th>Date (dd/mm/yy)/Time</th> <th>Water Depth (m)</th> <th>Cave In (m)</th> </tr> </thead> <tbody> <tr> <td>1) 16/5/5 11:40:00 AM</td> <td>4.2</td> <td>4.6</td> </tr> <tr> <td>2) 16/5/5 11:45:00 AM</td> <td>4.5</td> <td>-</td> </tr> <tr> <td>3) 16/8/15</td> <td>4.8</td> <td>-</td> </tr> </tbody> </table>							Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)	1) 16/5/5 11:40:00 AM	4.2	4.6	2) 16/5/5 11:45:00 AM	4.5	-	3) 16/8/15	4.8	-
Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)																							
1) 16/5/5 11:40:00 AM	4.2	4.6																							
2) 16/5/5 11:45:00 AM	4.5	-																							
3) 16/8/15	4.8	-																							

The stratification lines represent approximate boundaries. The transition may be gradual.

MEL-GEO 15020 - BOREHOLE LOGS - F12.GPJ MEL-GEO.GDT 16/11/2

Englobe Corp.

120 Progress Court, North Bay, On P1A 0C2 Phone: (705)476-2550 Fax: (705)476-8882 Email: northbay@englobecorp.com

METRIC

RECORD OF BOREHOLE NO. 4



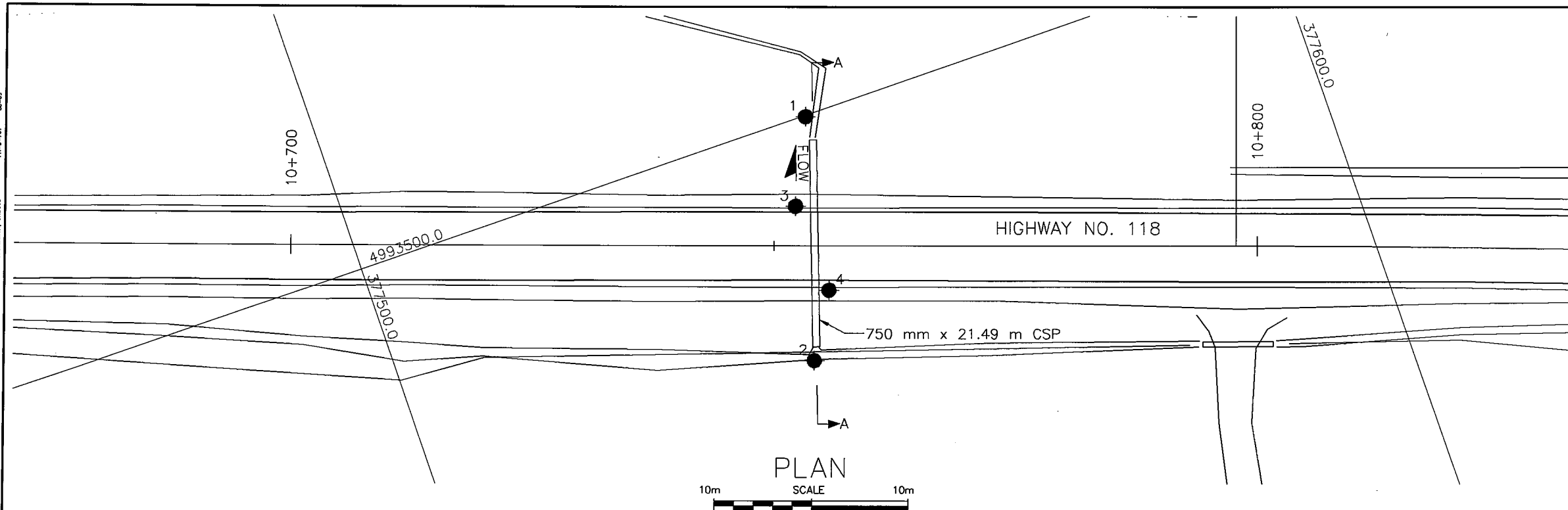
REFERENCE 15/04/15020-F12 DATUM Geodetic LOCATION N 4993482.0 E 377545.0 - Dysart Twp., Station 10+756 ORIGINATED BY JL
 PROJECT GWP 5339-11-00, Highway 118 BOREHOLE TYPE Truck Mounted CME 45 - Hollow Stem Augers COMPILED BY DM
 CLIENT AECOM DATE (Started) 2016 May 5 TIME
 DATE (Completed) 2016 May 5 (Completed) CHECKED BY SH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)	
							20	40	60	80	100		20	40	60		GR SA (SI CL)
396.8	Ground Surface		1	SS	26												23 68 (9)
0.0	300 mm crushed gravel		2	SS	35/150mm												
	EMBANKMENT FILL - sand, with to some gravel, trace silt, trace clay																
	brown, damp																
	(very loose/very dense)																
	cobble/boulder sized rock pieces encountered between depth of 0.6 and 1.5 m		3	SS	9												23 71 (6)
			4	SS	3												
393.4	Start Rock Coring		5	SS	12/150mm												15 77 3 5
3.4	BEDROCK - pink granite and black gneiss to black gneiss with thin pink granite		6	RC	REC=99% ROD=40%												
	poor quality		7	RC	REC=97% ROD=50%												
390.4	End of Sampling																
6.4	End of Borehole																
COMMENTS							+ 3, × 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE			WATER LEVEL RECORDS							
										Date (dd/mm/yy)/Time		Water Depth (m)		Cave In (m)			
The stratification lines represent approximate boundaries. The transition may be gradual.										1) 16/5/5 3:45:00 PM		2.5		3.3			
										2)		-		-			
										3)		-		-			

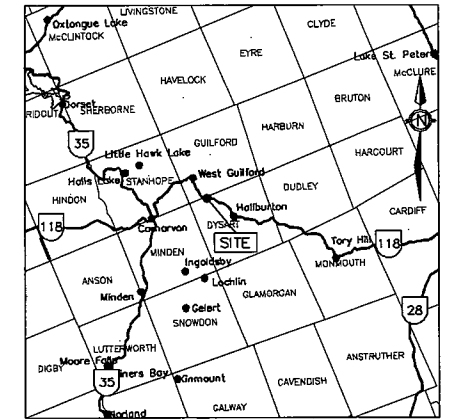
MEL-GEO 15020 - BOREHOLE LOGS - F12.GPJ MEL-GEO.GDT 16/11/2

Appendix 3 Borehole Plan and Lab Data

Drawing No. 2: Borehole Location and Soil Strata
Figure Nos. L-1 to L-3: Grain Size Distribution Curves
Table No. L-4: Lab Test Summary Sheet



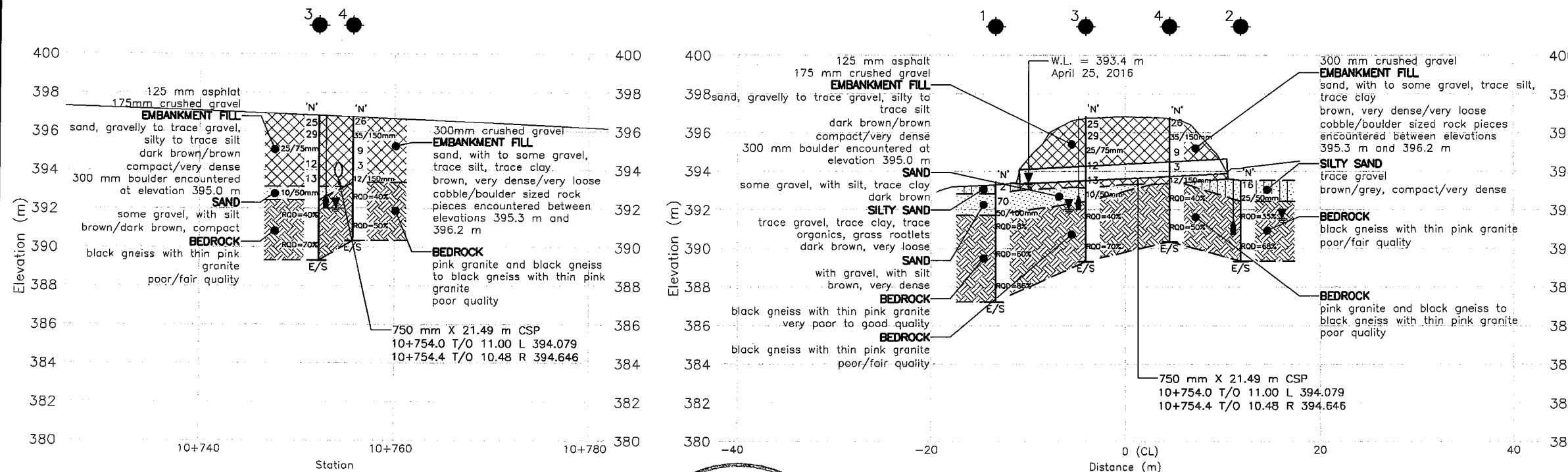
DISTRICT CONT. No. GWP No. 5339-11-00	DRAWING 2
HIGHWAY 118 CULVERT AT STA. 10+754 SITE NO.	
BOREHOLE LOCATIONS AND SOIL STRATIGRAPHY	



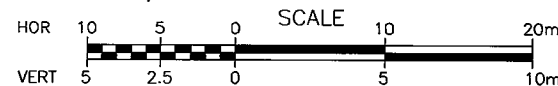
KEY PLAN
N.T.S.

LEGEND

- Borehole
- N
- Blows/0.3 m (Std Pen Test, 475 J/blow)
- Water Level at Time of Investigation
- E/S
- End of Sampling
- Piezometer



C/L PROFILE HWY 118



CROSS SECTION A-A



2016-11-02

This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The proposed structure location is shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contract Documents.

NOTES:

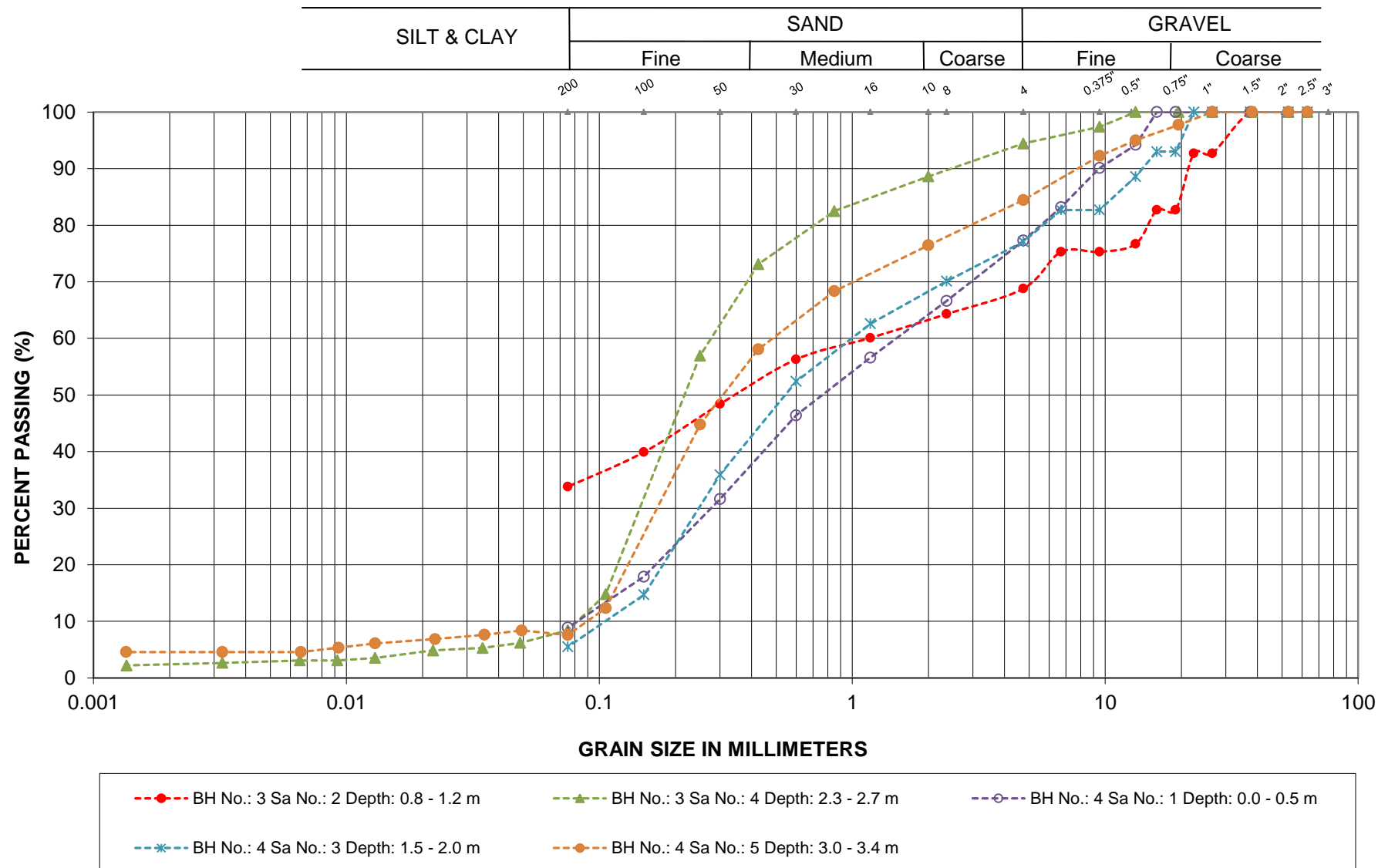
The boundaries between soil strata have been established at the borehole locations only. The boundaries illustrated and stratigraphy between boreholes on this drawing are assumed based on borehole data and may vary. They are intended for design only.

Base plan and alignment provided in digital format by Callon Dietz on June 6, 2016.
Cross sections provided on June 14, 2016.

Coordinates based on MTM Zone 10 NAD83 CSRS

GEOCREs No. 31E-368

DESIGN	CHK	CODE	LOAD	DATE NOV/16
DRAWN DM	CHK SH	SITE	STRUCT	SCHEME DWG 2

GRAIN SIZE ANALYSIS

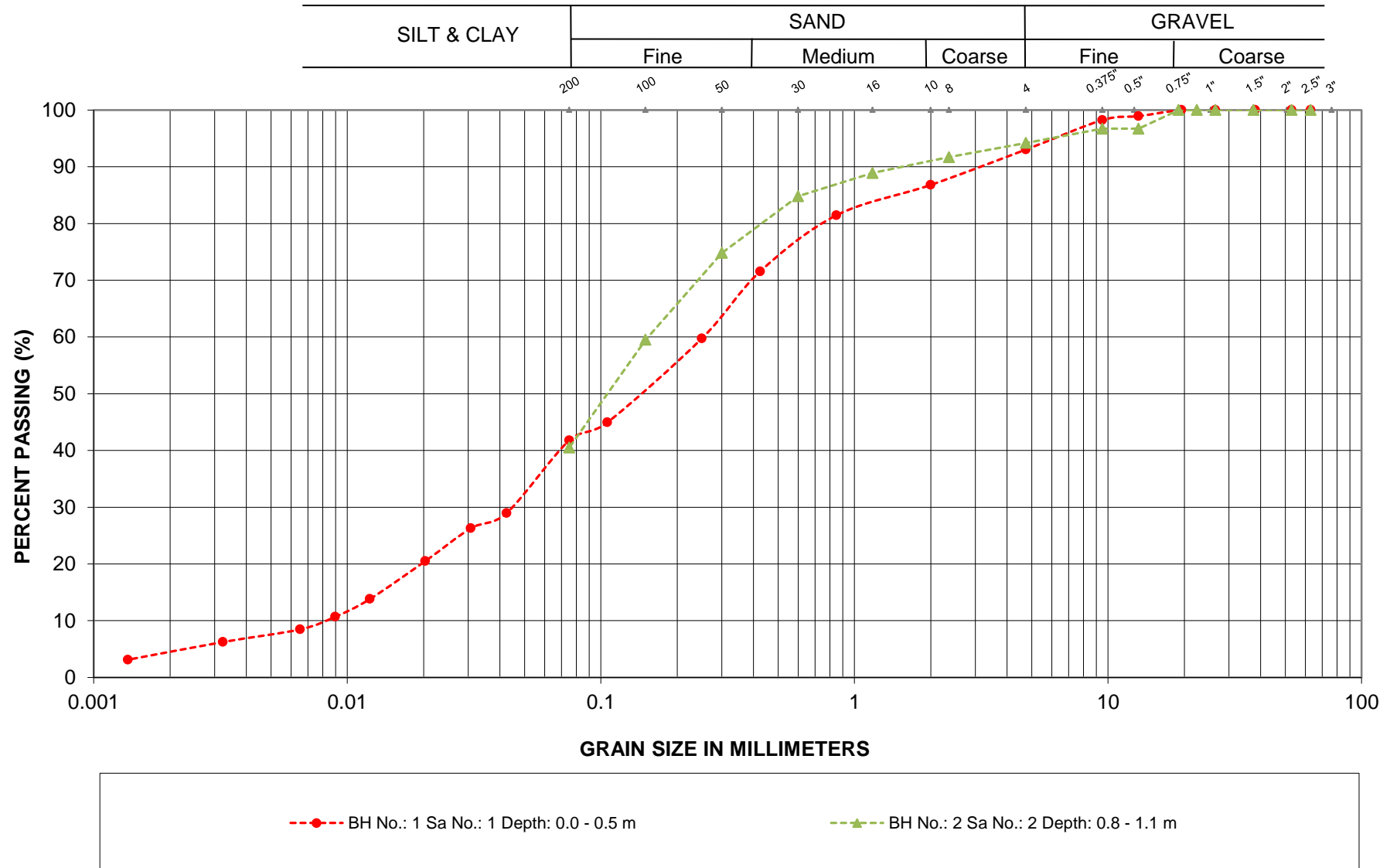
EMBANKMENT FILL

LOCATION: Hwy 118, Station 10+754
TWP of Dysart

Englobe Corp.

FIGURE L-1

GRAIN SIZE ANALYSIS



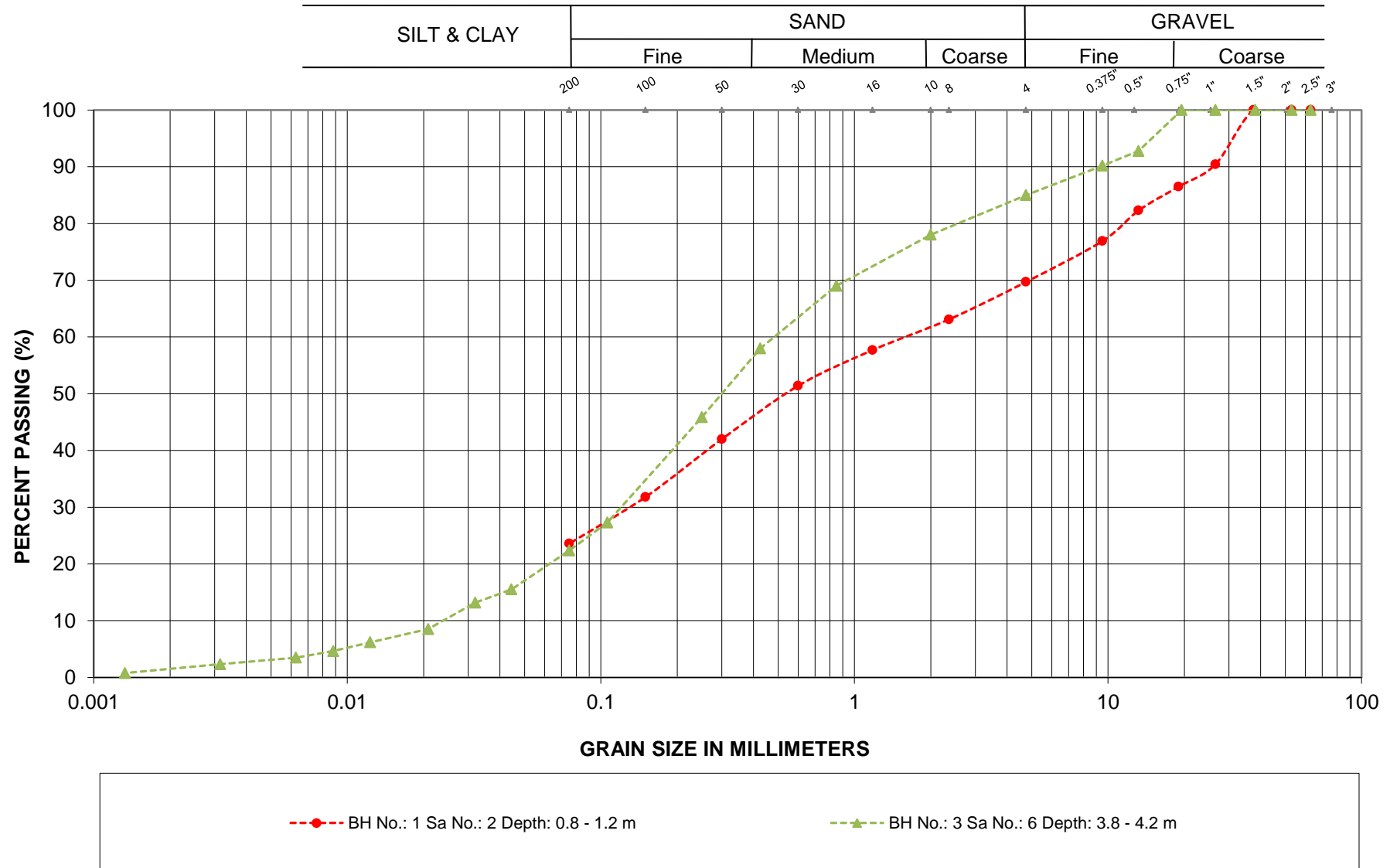
SILTY SAND

LOCATION: Hwy 118, Station 10+754
TWP of Dysart

Englobe Corp.

FIGURE L-2

GRAIN SIZE ANALYSIS



SAND

LOCATION: Hwy 118, Station 10+754
TWP of Dysart

Englobe Corp.

FIGURE L-3

Laboratory Tests - Summary Sheet



Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Unit Weight (kN/m ³)	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
1	1	0.0	7	51	37	5	44.6				2			
	2	0.8	30	46	24		12.8				70			
	3	1.5					12.1				50/ 100mm			
	4	1.7												Rec= 100%, RQD= 8%
	5	2.9												Rec= 95%, RQD= 60%
	6	4.6												Rec= 100%, RQD= 86%
2	1	0.0					14.1				16			
	2	0.8	6	53	41		12.4				25/ 50mm			
	3	1.1												Rec= 100%, RQD= 35%
	4	2.7												Rec= 97%, RQD= 68%
3	1	0.2					3.2				25			
	2	0.8	31	35	34		3.5				29			
	3	1.5					3.0				25/ 75mm			
	4	2.3	6	86	6	2	15.1				12			
	5	3.1					12.4				13			
	6	3.8	15	62	21	2	17.1				10/ 50mm			
	7	4.4												Rec= 98%, RQD= 40%
	8	6.0												Rec= 95%, RQD= 70%



Englobe

Table No. L-4
Sheet 2 of 2

Appendix 4 Photo Essay

Enclosure No. 6:

Photo Essay

Embankment at Culvert Location – Looking West

Photo: 1



Culvert Invert – Looking North

Photo: 2



Project: Hwy 118 – Culvert, Station 10+754, Township of Dysart

Photos Provided By: Englobe

Date: April 2016

Culvert Outlet – Looking Southeast

Photo: 3



Project: Hwy 118 – Culvert, Station 10+754, Township of Dysart

Photos Provided By: Englobe

Date: April 2016

Rock Cores – Borehole 1 (left) and Borehole 2 (right)

Photos: 4 and 5



Project: Hwy 118 – Culvert, Station 10+754, Township of Dysart

Photos Provided By: Englobe

Date: May 2016

Rock Cores – Borehole 3 (left) and 4 (right)

Photos: 6 and 7



Project: Hwy 118 – Culvert, Station 10+754, Township of Dysart

Photos Provided By: Englobe

Date: May 2016