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

Big Fournier Creek Culvert Replacement
Highway 63
Site No. 43-275/C
Stations 13+431 and 13+434 - Township of Poitras
GWP 5203-14-00

FINAL FOUNDATION INVESTIGATION REPORT

Date: November 28, 2019
Ref. No: P-0012533-0-00-001-F4-R2

Geocres No. 31L-202

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Final Foundation Investigation Report

	Geotechnical Recommendations	Earthquake Considerations
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	2019-11-27	
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		2019-11-27

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Property and Confidentiality

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1 INTRODUCTION

Englobe Corp. (Englobe), 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 twin culvert site. The culverts are located at Stations 13+431 and 13+434 (the Big Fournier Creek Culvert, Site No. 43-275/C) in the Township of Poitras on Highway 63, about 300 m west of Veteran Road (see Drawing No. 1, Appendix 1).

The foundation investigation location was specified by the MTO in the Terms of Reference for work under Agreement No. 5014-E-0055: GWP 5203-14-00 for Detail Design. The terms of reference for the scope of work are outlined in Englobe's Proposal P-15-168, dated November 20, 2015. The purpose of this investigation was to determine the subsurface conditions in the area of the existing culverts for the contract preparation of the Detail Design package. Englobe investigated the foundation area by the drilling of boreholes, carrying out in-situ tests, and performing laboratory testing on select soil samples.

2 SITE DESCRIPTION

Twin 1750 mm diameter Corrugated Steel Pipe (CSP) culverts are located on Highway 63 at Stations 13+431 and 13+434 in the Township of Poitras, Ontario. The overall topography in the area is generally hilly as illustrated on Map 31 L/11 of the National Topographic System (see Figure 1, Appendix 1) [1; see List of References at the end of this report].The existing highway embankment currently supports two undivided lanes of highway, generally running in a south-north direction. The existing highway at the culvert location is constructed on a fill embankment approximately 4.8 m in height above the culvert invert (at centreline), with centreline at Elevation 228.0 m at the culvert location. At the west slope, the maximum height of the embankment is approximately 4.7 m above the culvert invert. At the east slope, the maximum height of embankment fill is approximately 5.2 m above the culvert invert. The existing embankment slopes in the area of the culverts have been generally established at inclination angles of approximately 1.9H:1V to 2.2H:1V at the west and east, respectively. The culverts at this location are 1750 mm diameter Corrugated Steel Pipe (CSP) culvert, some 27 m in length. Flow through the culverts is from the west to the east (left to right).

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

2.1 SITE PHYSIOGRAPHY AND SURFICIAL GEOLOGY

The topography on this section of Highway 63 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 sands overlying bedrock.

Bedrock, based on Ontario Geologic Survey (OGS) Map MRD-126 [2], in the area consists of magmatic rocks and gneisses.

3 INVESTIGATION PROCEDURES

The fieldwork for this investigation was carried out on May 10th, 11th, and 16th, 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 (west) and outlet (east) 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. Dynamic Cone Penetration testing (DCPT) was carried out from the bottom of each sampled borehole to practical refusal (described as >100 blows per 300 mm penetration). All boreholes were advanced to their proposed depths. 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. 1 and 4 prior to backfilling to allow for further monitoring of the shallow groundwater levels. All open boreholes were backfilled upon completion in accordance with requirements of Ontario Regulation 903. Where applicable, boreholes were backfilled 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. 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-7 and Table No. L-8).

Section 6.8.2.2 of the RFP states that a minimum of one (1) chemical test package (including PH, water soluble sulphate, chloride, resistivity and electrical conductivity analyses) is required at the foundation element of the culvert. In accordance with requirements stated in the RFP, one set of soil chemical tests was carried out by AGAT Laboratories in Mississauga. The results of the chemical tests are presented in Appendix 3.

The location of the individual borehole was determined in the field using highway chainage established by Tulloch Engineering (Tulloch) 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 Tulloch. 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 BIG FOURNIER CREEK CULVERT, SITE NO. 43-275/C

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. 1 and 2 advanced through the embankment, Borehole No. 3 advanced adjacent to the culvert outlet, and Borehole No. 4 advanced adjacent to the culvert inlet. At the time of the subsurface investigation, the ground surface elevations at Boreholes Nos. 1 to 4 were recorded at Elevations 228.0, 227.9, 225.8, and 224.4 m, respectively.

4.1.1 Pavement Structure

Borehole Nos. 1 and 2, were advanced through the embankment. Borehole Nos. 1 and 2 established that the pavement structure consisted of 200 to 300 mm asphalt concrete overlying a layer of crushed gravel base/subbase approximately 350 mm thick at Borehole No. 1. A base layer was not observed at Borehole No. 2.

4.1.2 Embankment Fill

Underlying the pavement structure at Borehole Nos. 1 and 2, a layer of embankment fill described as brown sand and gravel to sand, with to trace gravel, some to trace silt, was penetrated. Cobble and boulder sized rock pieces were encountered in this layer. The natural moisture content measured for recovered samples from this deposit ranged from 2 to 17%. Gradation (sieve) analyses were carried out on three (3) samples of this deposit, the results of which indicated 29 to 46% gravel size particles, 48 to 60 sand size particles, and 6 to 12% silt and clay size particles (Figure No. L-1, Appendix 3). According to results of gradation testing and the criteria for Frost Susceptibility and Erodibility of soils stated in MTO *Pavement Design and Rehabilitation Manual* (2013) (PDRM), the embankment fill is classified as having low susceptibility to frost heaving (LSFH) and is non-erodible. Based on SPT 'N' values of 9 to 52 blows per 300 mm penetration and 25 blows per 0 mm penetration, the relative density/compactness of this deposit was described as loose to very dense, but generally compact on average. This embankment fill was encountered to depths of 5.2 and 3.5 m below grade at Borehole Nos. 1 and 2, respectively (Elevations 222.8 and 224.4 m, respectively).

4.1.3 Fill

At surface at Borehole No. 3, a layer of fill described as sand and gravel to sand with gravel, some to trace silt was penetrated. Some to trace grass rootlets, and cobble and boulder sized rock pieces were encountered in this layer. The natural moisture content measured on samples of this deposit generally ranged from 7 to 15% except a moisture content of 50% was encountered in one sample recovered near the bottom of the deposit. The elevated moisture content is likely due to the organic content within the fill layer. Gradation (sieve) analyses were carried out on two (2) samples of this deposit, and the results indicated 25 to 44% gravel size particles, 49 to 62% sand size particles, and 7 to 13% silt and clay size particles (Figure No. L-2, Appendix 3). According to results of gradation testing and the criteria for Frost Susceptibility and Erodibility of soils stated in the PDRM, the fill material is classified as having low susceptibility to frost heaving (LSFH) and is non-erodible. Based on SPT 'N' values of 13 to 44 blows per 300 mm penetration and 64 blows per 255 mm penetration, the relative density/compactness of this deposit was described as compact to very dense, but generally compact on average. This fill layer was encountered to a depth of 2.9 m below grade at Borehole No. 3 (Elevation 222.9 m).

4.1.4 Sand and Gravel

At surface at Borehole No. 4, a layer of sand and gravel, trace silt was penetrated. The natural moisture content measured on samples recovered from this deposit ranged from 9 to 16%. A gradation (sieve) analysis was carried out on one (1) sample of this deposit, and the results indicated 44% gravel size particles, 51% sand size particles, and 5% silt and clay size particles (Figure No. L-3, Appendix 3). According to results of gradation testing and the criteria for Frost Susceptibility and Erodibility of soils stated in the PDRM, the sand and gravel is classified as

having low susceptibility to frost heaving (LSFH) and is non-erodible. Based on SPT 'N' values of 31 to 64 blows per 300 mm penetration and 25 blows per 25 mm penetration, the relative density/compactness of this deposit was described as dense to very dense. This deposit was encountered to a depth of 2.7 m below grade at Borehole No. 4 (Elevation 221.7 m).

4.1.5 Sand

Underlying the embankment fills at Borehole Nos. 1 and 2, underlying the fill at Borehole No. 3, and underlying the sands and gravel at surface at Borehole No. 4, a deposit of sands, ranging from gravelly sands, trace silt to sands some to trace gravel, with to trace silt, trace clay, was penetrated. The natural moisture content measured on samples of this deposit ranged from about 10 to 32%. Trace organics were encountered in this deposit. Gradation (sieve) analyses were carried out on three (3) sample of this deposit, and the results indicated 20 to 37% gravel size particles, 54 to 79% sand size particles, and 1 to 9% silt and clay size particles (Figure No. L-4, Appendix 3). Gradation (hydrometer) analyses were carried out on five (5) sample of this deposit, and the results indicated 0 to 20% gravel size particles, 69 to 90% sand size particles, 5 to 29% silt size particles 1 to 4% and clay size particles (Figure No. L-4, Appendix 3). According to results of gradation testing and the criteria for Frost Susceptibility and Erodibility of soils stated in the PDRM, the sand is classified as having low susceptibility to frost heaving (LSFH) and is non-erodible. Based on SPT 'N' values of 9 to 49 blows per 300 mm penetration, the relative density/compactness of this deposit was described as loose to dense, but generally compact on average. The sand deposits were encountered to a depth of 8.1 m below grade at Borehole No. 2 (Elevation 219.8 m). Sampling was terminated in the sand deposit at depths of 18.7, 9.6, and 9.6 m below grade at Borehole Nos. 1, 3, and 4, respectively (Elevations 209.3, 216.2, and 214.8 m, respectively).

4.1.6 Sand and Silt

Underlying the upper sand at Borehole No. 2, a thin deposit of sand and silt, trace clay was penetrated. The natural moisture content measured on samples recovered from this deposit was in the order of 17%. A gradation (hydrometer) analysis was carried out on one (1) sample of this deposit, and the results indicated 0% gravel size particles, 55% sand size particles, 42% silt size particles, and 3% clay size particles (Figure No. L-5, Appendix 3). According to results of hydrometer testing and the criteria for Frost Susceptibility and Erodibility of soils stated in the PDRM, the sand and silt is classified as moderate susceptibility to frost heaving (MSFH) and is moderately erodible. This sand and silt layer was encountered to a depth of 8.7 m below grade at Borehole No. 2 (Elevation 219.2 m).

4.1.7 Lower Sand

Underlying the sand and silt at Borehole No. 2, a lower deposit of sand, trace gravel, trace silt, was penetrated. The natural moisture content measured on samples of this deposit was in the order of 13 to 25%. A gradation (sieve) analysis was carried out on one (1) sample of this deposit, and the results indicated 3% gravel size particles, 93% sand size particles, and 4% silt

and clay size particles (Figure No. L-6, Appendix 3). According to results of gradation testing and the criteria for Frost Susceptibility and Erodibility of soils stated in the PDRM, the lower sand is classified as having low susceptibility to frost heaving (LSFH) and is non-erodible. Based on SPT 'N' values of 10 to 32 blows per 300 mm penetration, the relative density/compactness of this deposit was described as compact to dense, but generally compact on average. This deposit was encountered to a depth of 14.8 m below grade at Borehole No. 2 (Elevations 213.1 m).

4.1.8 Silt

Underlying the lower sand at Borehole No. 2, a deposit of silt, trace gravel, with sand, trace clay was penetrated. The natural moisture content measured on samples of this deposit ranged from about 20 to 26%. A gradation (hydrometer) analysis was carried out on one (1) sample of this deposit, and the results indicated 2% gravel size particles, 27% sand size particles, 66% silt size particles, and 5% clay size particles (Figure No. L-7, Appendix 3). According to results of hydrometer testing and the criteria for Frost Susceptibility and Erodibility of soils stated in the PDRM, the silt is classified as highly susceptible to frost heaving (HSFH) and is highly erodible. Based on a SPT 'N' value of 10 blows per 300 mm penetration, the relative density/compactness of this deposit was described as compact. Sampling was terminated in this deposit at a depth of 16.9 m below grade at Borehole No. 2 (Elevation 211.0 m).

4.1.9 DCPT

Dynamic Cone Penetration Tests (DPCT) were carried out from the end of sampling at each of the borehole locations to practical refusal depth. DCPT practical refusal was encountered at depths of 20.4, 19.7, 15.7, and 15.9 m below grade at Borehole Nos. 1, 2, 3, and 4, respectively (Elevations 207.6, 208.2, 210.1, and 208.5 m, respectively).

4.2 GROUNDWATER DATA

At the time of this investigation (May 16, 2016), surface water was recorded at Elevation 223.4 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. 1 and 4 to obtain post borehole completion water levels. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix 2).

The groundwater levels were measured at Elevations 222.8 and 223.7 m at Borehole Nos. 1 and 4, respectively. The groundwater levels were encountered at Elevation 223.9 and 223.6 m at Borehole Nos. 2 and 3 upon completion of sampling at the boreholes.

The groundwater and surface water levels are expected to fluctuate seasonally/yearly.

REFERENCES

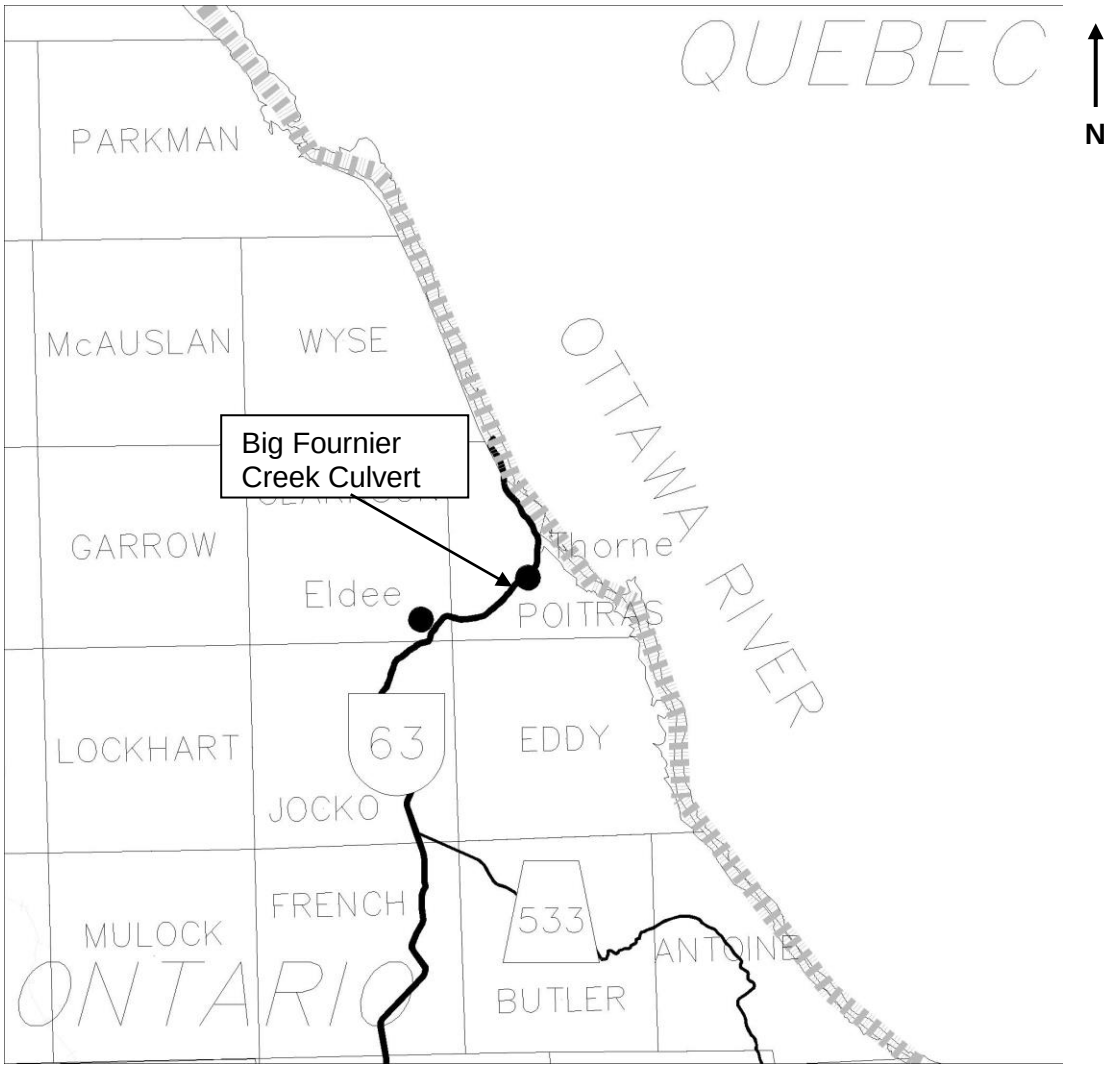
1. National Topographic System Index Maps, Temiscaming, Map 31 L/11, 1:50 000 scale.
2. Ontario Geological Survey, 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release---Data 126-Revision 1. ISBN 978-1-4435-5704-7 (CD) ISBN 978-1-4435-5705-4, Ontario Geological Survey, 2011.

Appendix 1 Key Plan

Drawing No. 1 Key Plan

MACRO KEY PLAN Drawing No.1

NOT TO SCALE



FOUNDATION INVESTIGATION
AND DESIGN REPORT
GWP 5203-14-00

Highway 63

Big Fournier Creek Culvert

Stations 13+431 and 13+434

Township of Poitras

Reference No: P-0012533-0-00-001-F4

September 2017

Englobe

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.

ENCLOSURE NO.: 2 (Pg. 1 of 2)

METRIC

RECORD OF BOREHOLE NO. 1

Englobe

REFERENCE P-0012533-0-00-001-F4 DATUM Geodetic LOCATION N 5167496.8 E 335933.8 - Poitras Twp., Station 13+435 ORIGINATED BY ELS

PROJECT GWP 5203-14-00 BOREHOLE TYPE Truck Mounted CME 75 - Hollow Stem Augers COMPILED BY DM

CLIENT AECOM DATE (Started) 2016 May 10 TIME (Completed) 5:19:00 PM CHECKED BY SH

DATE (Completed) 2016 May 10

ELEV / DEPTH	DESCRIPTION (see Enclosure No. 1)	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
228.0	Ground Surface						
0.0	300 mm asphalt 350 mm crushed gravel						
	EMBANKMENT FILL - sand and gravel to sand, with gravel, some to trace silt	1	AS				
	brown	2	SS	34	227		
	start advancing with casing using wash boring method at depth of 1.2 m	3	SS	21			31 57 (12)
	300 mm boulder encountered at depth of 2.3 m	4	SS	25/0mm	226		
	(very dense/compact)	5	SS	38	225		
		6	SS	42	224		46 48 (6)
222.8		7	SS	25	223		
5.2	SAND - some gravel, trace silt						
	dark brown, wet						
	(compact/dense)	8	SS	32	222		
	---------- brown				221		
		9	SS	35	220		
		10	SS	45	219		20 79 (1)
	grey	11	SS	25	218		
		12A	SS	49	217		
		12B	SS		216		
	Continued Next Page				215		

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

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

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

COMMENTS

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

+3, ×3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 100 kPa
○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 16/5/10 6:02:00 PM	3.3	7
2) 16/5/10 6:17:00 PM	5.4	9.5
3) 16/6/27 2:45:00 PM	5.2	9.5

MEL-GEO 16014 - BOREHOLE LOGS - F4.GPJ MEL-GEO.GDT 17/9/6

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ENCLOSURE NO.: 2 (Pg. 2 of 2)

METRIC

RECORD OF BOREHOLE NO. 1

REFERENCE P-0012533-0-00-001-F4 DATUM Geodetic LOCATION N 5167496.8 E 335933.8 - Poitras Twp., Station 13+435 ORIGINATED BY ELS

PROJECT GWP 5203-14-00 BOREHOLE TYPE Truck Mounted CME 75 - Hollow Stem Augers COMPILED BY DM

CLIENT AECOM DATE (Started) 2016 May 10 TIME (Completed) 5:19:00 PM CHECKED BY SH

DATE (Completed) 2016 May 10

ELEV / DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
	Continued from Previous Page		13	SS	40						2 90 6 2
	brown to reddish brown		14	SS	30		213				
			15	SS	23		212				
210.7							211				
17.3	SAND - gravelly, trace silt grey (compact/dense)		16	SS	38		210				37 54 (9)
209.3			17	SS	25						
18.7	End of Sampling						209				
207.6							208				
20.4	DCPT Refusal End of borehole										

MEL-GEO 16014 - BOREHOLE LOGS - F4.GPJ MEL-GEO.GDT 17/9/6

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

ENCLOSURE NO.: 3 (Pg. 1 of 2)

METRIC

RECORD OF BOREHOLE NO. 2

Englobe

REFERENCE P-0012533-0-00-001-F4 DATUM Geodetic LOCATION N 5167481.5 E 335929.0 - Poitras Twp., Station 13+420 ORIGINATED BY AT

PROJECT GWP 5203-14-00 BOREHOLE TYPE Truck Mounted CME 75 - Hollow Stem Augers COMPILED BY DM

CLIENT AECOM DATE (Started) 2016 May 11 TIME (Completed) CHECKED BY SH

DATE (Completed) 2016 May 11

ELEV / DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE)	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
227.9	Ground Surface										
0.0	200 mm asphalt		1	AS							
	EMBANKMENT FILL - sand, with to trace gravel, some silt										
	greyish brown to brown, damp		2	SS	52						29 60 (11)
	(loose/very dense)										
			3	SS	15						
			4	SS	9						
	cobbble sized rock pieces encountered		5	SS	25/25mm						
224.4											
3.5	SAND - some gravel, some silt, trace clay										
	trace organics		6	SS	11	▽					14 69 13 4
	dark brown to brown										
	(compact/very dense)		7	SS	25						
			8	SS	13						
			9A	SS	18	▨					
219.8			9B	SS							
8.1	SAND AND SILT - trace clay										0 55 42 3
219.2	(compact)										
8.7	SAND - trace gravel, trace silt										
	start advancing with casing using wash boring methods at depth of 9.8 m		10	SS	10						
	brown, wet										
	(compact/dense)		11	SS	17						
			12	SS	32						3 93 (4)
	Continued Next Page										

COMMENTS

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

+3, ×3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 100 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 16/5/11 4:00:00 PM	4 ▽	7.9 ▨
2)	- ▽	-
3)	- ▼	-

MEL-GEO 16014 - BOREHOLE LOGS - F4.GPJ MEL-GEO.GDT 17/9/6

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ENCLOSURE NO.: 3 (Pg. 2 of 2)

METRIC

RECORD OF BOREHOLE NO. 2

REFERENCE P-0012533-0-00-001-F4 DATUM Geodetic LOCATION N 5167481.5 E 335929.0 - Poitras Twp., Station 13+420 ORIGINATED BY AT

PROJECT GWP 5203-14-00 BOREHOLE TYPE Truck Mounted CME 75 - Hollow Stem Augers COMPILED BY DM

CLIENT AECOM DATE (Started) 2016 May 11 TIME (Completed) CHECKED BY SH

DATE (Completed) 2016 May 11

ELEV / DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
	Continued from Previous Page		13	SS	31			20 40 60 80 100	20 40 60		
213.1											
14.8	SILT - trace gravel, with sand, trace clay grey, wet (loose)		14	SS	10		213 212				2 27 66 5
211.0			15	SS			211				
16.9	End of Sampling casing filled with silt, cleaned casing and started DCPT at depth of 18.3 m						210 209				
208.2											
19.7	DCPT Refusal End of Borehole										

MEL-GEO 16014 - BOREHOLE LOGS - F4.GPJ MEL-GEO.GDT 17/9/6

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ENCLOSURE NO.: 4 (Pg. 1 of 2)

METRIC

RECORD OF BOREHOLE NO. 3

REFERENCE P-0012533-0-00-001-F4 DATUM Geodetic LOCATION N 5167478.7 E 335944.3 - Poitras Twp., Station 13+427 ORIGINATED BY JL

PROJECT GWP 5203-14-00 BOREHOLE TYPE Track Mounted CME 45 - Hollow Stem Augers COMPILED BY DM

CLIENT AECOM DATE (Started) 2016 May 16 TIME (Completed) CHECKED BY SH

DATE (Completed) 2016 May 16

ELEV / DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
225.8	Ground Surface					
0.0	FILL - sand and gravel to sand, with gravel, some to trace silt, some to trace grass rootlets cobble/boulder sized rock pieces encountered brown (compact/very dense)		1	SS	13	
			2	SS	21	
			3	SS	44	
			4	SS	64/255 mm	▽
222.9						
2.9	SAND - gravelly to trace gravel, trace silt brown, wet (compact)		5	SS	14	
			6	SS	16	▨
			7	SS	19	
			8	SS	13	
218.7						
7.1	SAND - with silt, trace clay brown to grey, wet (loose)		9	SS	9	
216.2			10	SS	10	
9.6	End of Sampling					
	Continued Next Page					

ELEVATION SCALE: 225, 224, 223, 222, 221, 220, 219, 218, 217, 216, 215, 214, 213, 212

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

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

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

WATER CONTENT (%): 20 40 60

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)

	GR	SA	SI	CL
225	25	62	(13)	
224	44	49	(7)	
222	31	63	(6)	
218	0	70	29	1

COMMENTS

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

+ ³, × ³ : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 100 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 16/5/16 12:20:00 PM	2.2 ▽	4.2 ▨
2)	- ▽	-
3)	- ▼	-

MEL-GEO 16014 - BOREHOLE LOGS - F4.GPJ MEL-GEO.GDT 17/9/6

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METRIC

RECORD OF BOREHOLE NO. 3

REFERENCE P-0012533-0-00-001-F4 DATUM Geodetic LOCATION N 5167478.7 E 335944.3 - Poitras Twp., Station 13+427 ORIGINATED BY JL

PROJECT GWP 5203-14-00 BOREHOLE TYPE Track Mounted CME 45 - Hollow Stem Augers COMPILED BY DM

CLIENT AECOM DATE (Started) 2016 May 16 TIME (Completed) CHECKED BY SH

DATE (Completed) 2016 May 16

ELEV / DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
	Continued from Previous Page							DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100 SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%): 20 40 60		
							211				
210.1											
15.7	DCPT Refusal End of Borehole										

MEL-GEO 16014 - BOREHOLE LOGS - F4.GPJ MEL-GEO.GDT 17/9/6

Englobe Corp.
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ENCLOSURE NO.: 5 (Pg. 1 of 2)

METRIC

RECORD OF BOREHOLE NO. 4

Englobe

REFERENCE P-0012533-0-00-001-F4 DATUM Geodetic LOCATION N 5167508.2 E 335925.4 - Poitras Twp., Station 13+440 ORIGINATED BY JL

PROJECT GWP 5203-14-00 BOREHOLE TYPE Track Mounted CME 45 - Hollow Stem Augers COMPILED BY DM

CLIENT AECOM DATE (Started) 2016 May 16 TIME (Completed) CHECKED BY SH

DATE (Completed) 2016 May 16

ELEV / DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
224.4	Ground Surface										
0.0	SAND and GRAVEL - trace silt trace grass rootlets dark brown to brown cobble sized rock pieces encountered between depth of 0.3 to 2.7 m (dense/very dense)		1	SS	29/230 mm		224				
			2	SS	31		223				
			3	SS	64		222				44 51 (5)
221.7			4	SS	25/25 mm						
2.7	SAND - some gravel, trace silt, trace clay greyish brown to grey, wet (compact/dense)		5	SS	16		221				13 77 9 1
			6	SS	15		220				
			7	SS	10		219				
			8	SS	41		218				20 74 5 1
			9	SS	22		217				
214.8			10	SS	10		216				
9.6	End of Sampling						215				
	Continued Next Page						214				
							213				
							212				
							211				

COMMENTS

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

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 100 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 16/5/16 5:35:00 PM	1.2	3
2) 16/5/16 5:40:00 PM	0.9	2.7
3) 16/6/27 2:40:00 PM	0.7	2.9

MEL-GEO 16014 - BOREHOLE LOGS - F4.GPJ MEL-GEO.GDT 17/9/6

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ENCLOSURE NO.: 5 (Pg. 2 of 2)

METRIC

RECORD OF BOREHOLE NO. 4

REFERENCE P-0012533-0-00-001-F4 DATUM Geodetic LOCATION N 5167508.2 E 335925.4 - Poitras Twp., Station 13+440 ORIGINATED BY JL

PROJECT GWP 5203-14-00 BOREHOLE TYPE Track Mounted CME 45 - Hollow Stem Augers COMPILED BY DM

CLIENT AECOM DATE (Started) 2016 May 16 TIME (Completed) CHECKED BY SH

DATE (Completed) 2016 May 16

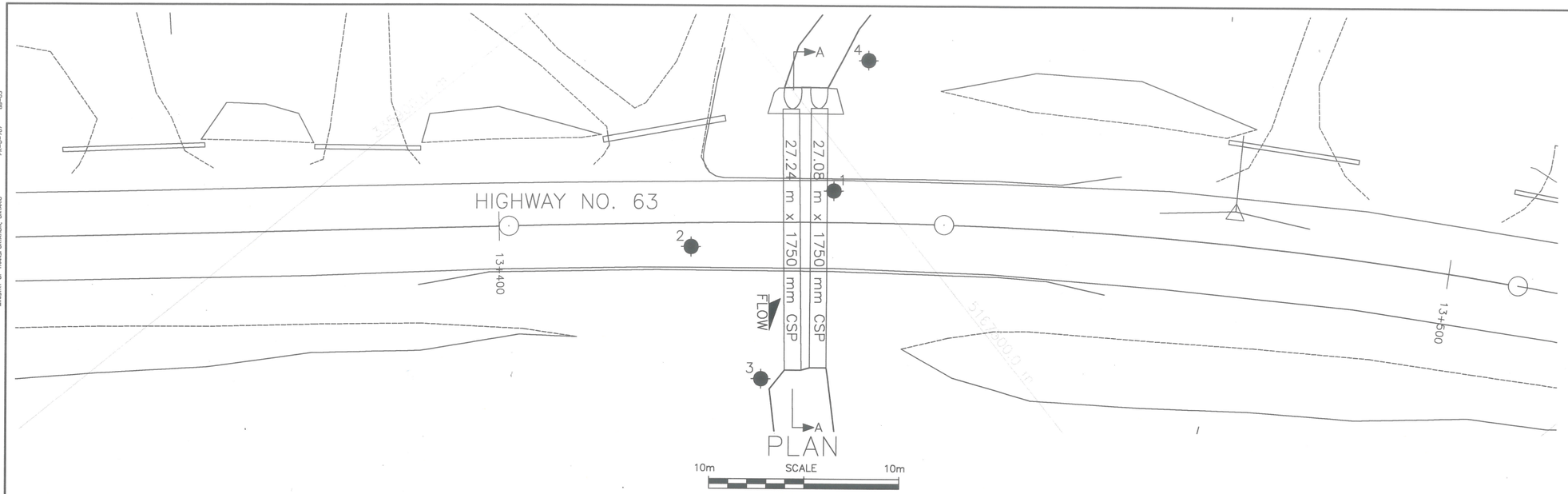
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
ELEV / DEPTH	DESCRIPTION (see Enclosure No. 1) Continued from Previous Page	STRATA PLOT	NUMBER	TYPE	"N" VALUES						
							210				
							209				
208.5											
15.9	DCPT Refusal End of Borehole										

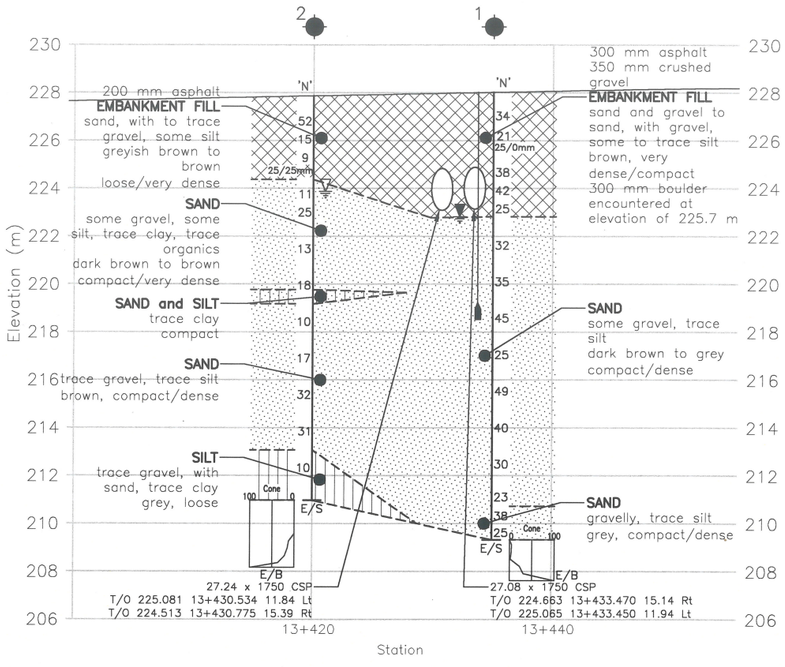
MEL-GEO 16014 - BOREHOLE LOGS - F4.GPJ MEL-GEO.GDT 17/9/6

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

Appendix 3 Borehole Plan and Lab Data

Drawing No. 2:	Borehole Location and Soil Strata
Figure Nos. L-1 to L-7:	Grain Size Distribution Curves
Table No. L-8:	Lab Test Summary Sheet
	Soil Chemical Tests



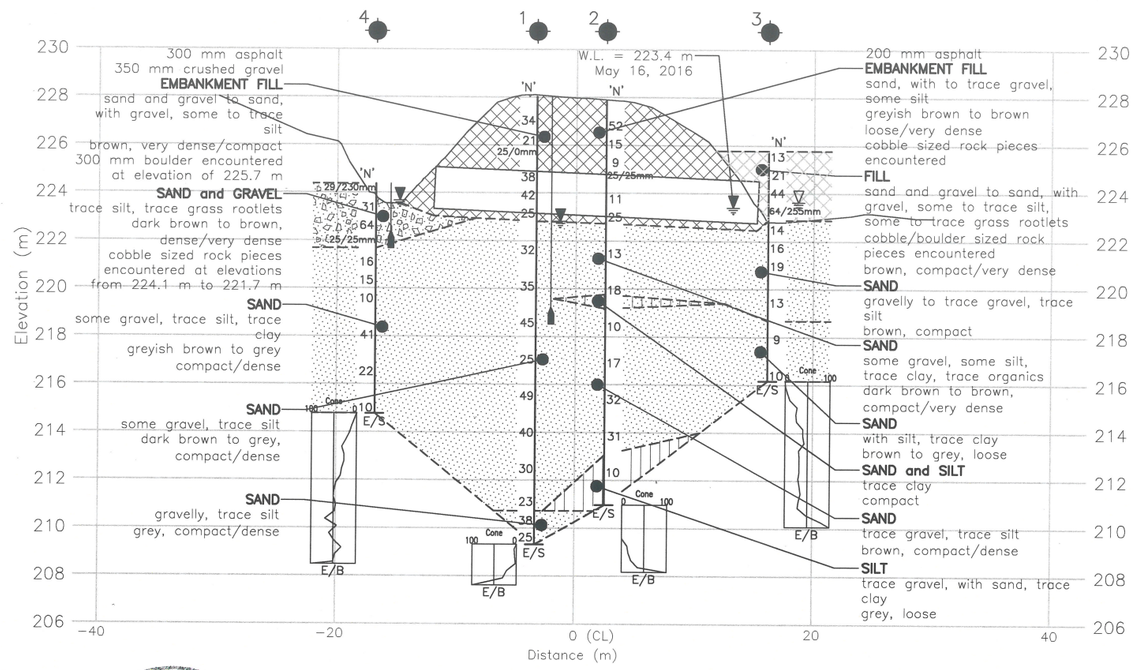


C/L PROFILE HWY 60

SCALE

HOR 10 5 0 10 20m

VERT 5 2.5 0 5 10m



CROSS SECTION A–A

SCALE

HOR 10 5 0 10 20m

VERT 5 2.5 0 5 10m

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.

LICENSED PROFESSIONAL ENGINEER
A. G. TEPYLO
100170806
PROVINCE OF ONTARIO

2019-11-27

REGISTERED PROFESSIONAL ENGINEER
M. H. MacKAY
PROVINCE OF ONTARIO

2019-11-27

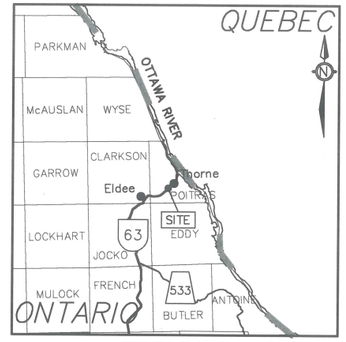
DISTRICT
CONT. No.
GWP No. 5203-14-00

HWY 63
CULVERTS AT STATION 13+431 AND 13+434

BOREHOLE LOCATIONS AND SOIL STRATIGRAPHY

DRAWING 2

Englobe



KEY PLAN
N.T.S.

LEGEND

N	Borehole w/ DCPT
	Blows/0.3 m (Std Pen Test, 475 J/blow)
E/S	End of Sampling
E/B	End of Borehole
	Piezometer
	Water Level in Piezometer
	Water Level in Open Borehole

BOREHOLE No.	ELEVATION	O/S	NORTHING	EASTING
1	228.0	3.3m Lt	5167496.8	335933.8
2	227.9	2.5m Rt	5167481.5	335929.0
3	225.8	16.2m Rt	5167478.7	335944.3
4	224.4	16.8m Lt	5167508.2	335925.4

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 June 29, 2016

Coordinates based on MTM Zone 10 NAD83 CSRS

GEOCRES No. 31L-202

REVISIONS			
AUG/16	DM	DRAFT	
SEP/17	DM	REVISED DRAFT	
NOV/19	DM	FINAL	

DESCRIPTION

DESIGN	CHK	CODE	LOAD	DATE NOV/19
DRAWN DM	CHK SH	SITE	STRUCT	SCHEME	DWG 2

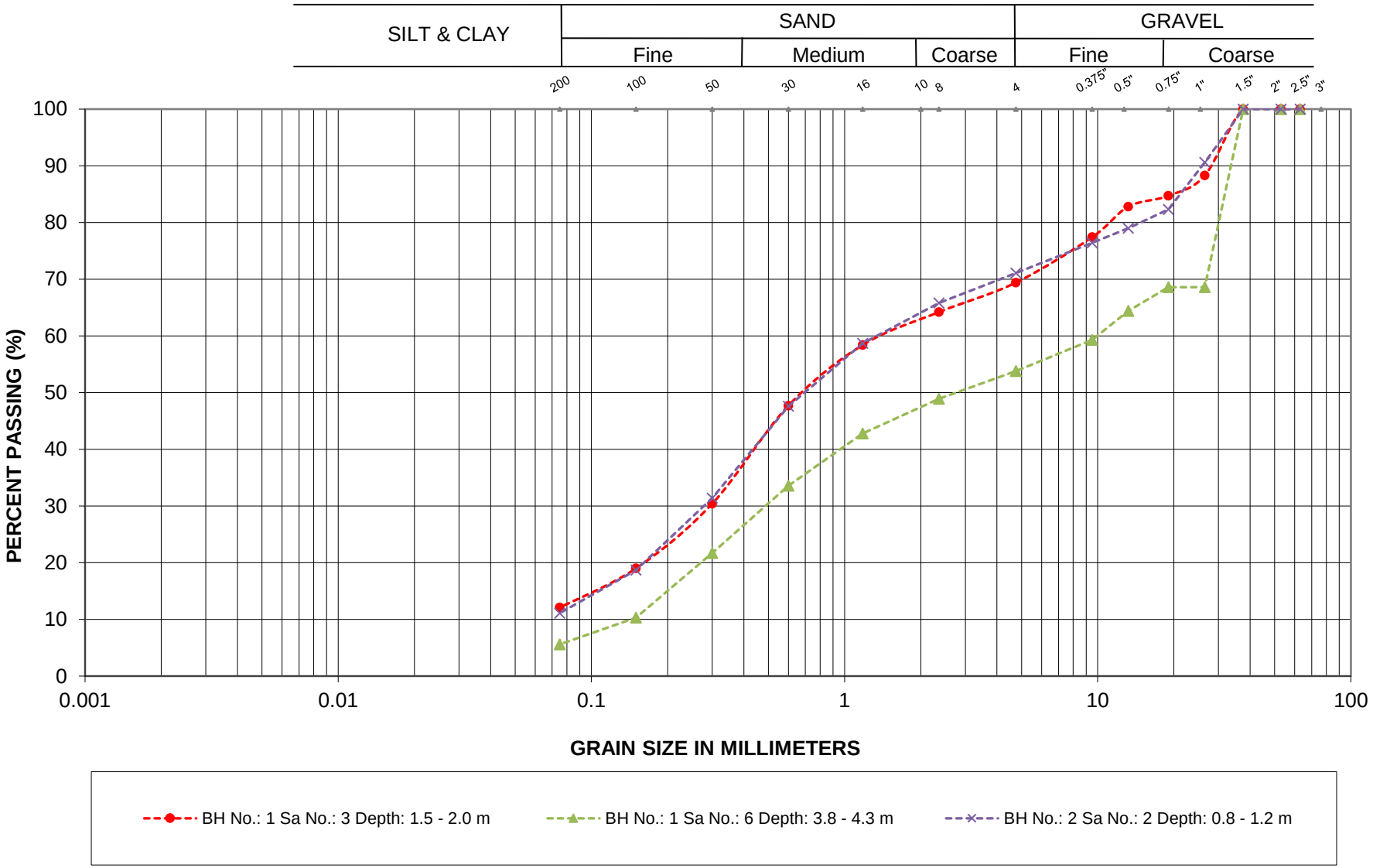
MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05

CAD FILE LOCATION AND NAME:G:\192\P-0012533 - P&F, Hwy 94 & 63 (16014) (AECOM)\FOUNDATIONS\Drawings\F4\P-0012533-0-00-001-F4 - 13+431 and 13+433.dwg
MODIFIED: 11/27/2019 3:44:59 PM BY: MITCDU
DATE PLOTTED: 11/27/2019 3:46:28 PM BY: DUNCAN MITCHELL

Reference No.: P-0012533-0-00-001-F4
Date: July 2016

Englobe

GRAIN SIZE ANALYSIS



EMBANKMENT FILL

LOCATION: Hwy 63, Big Fournier Culvert
TWP of Poitras

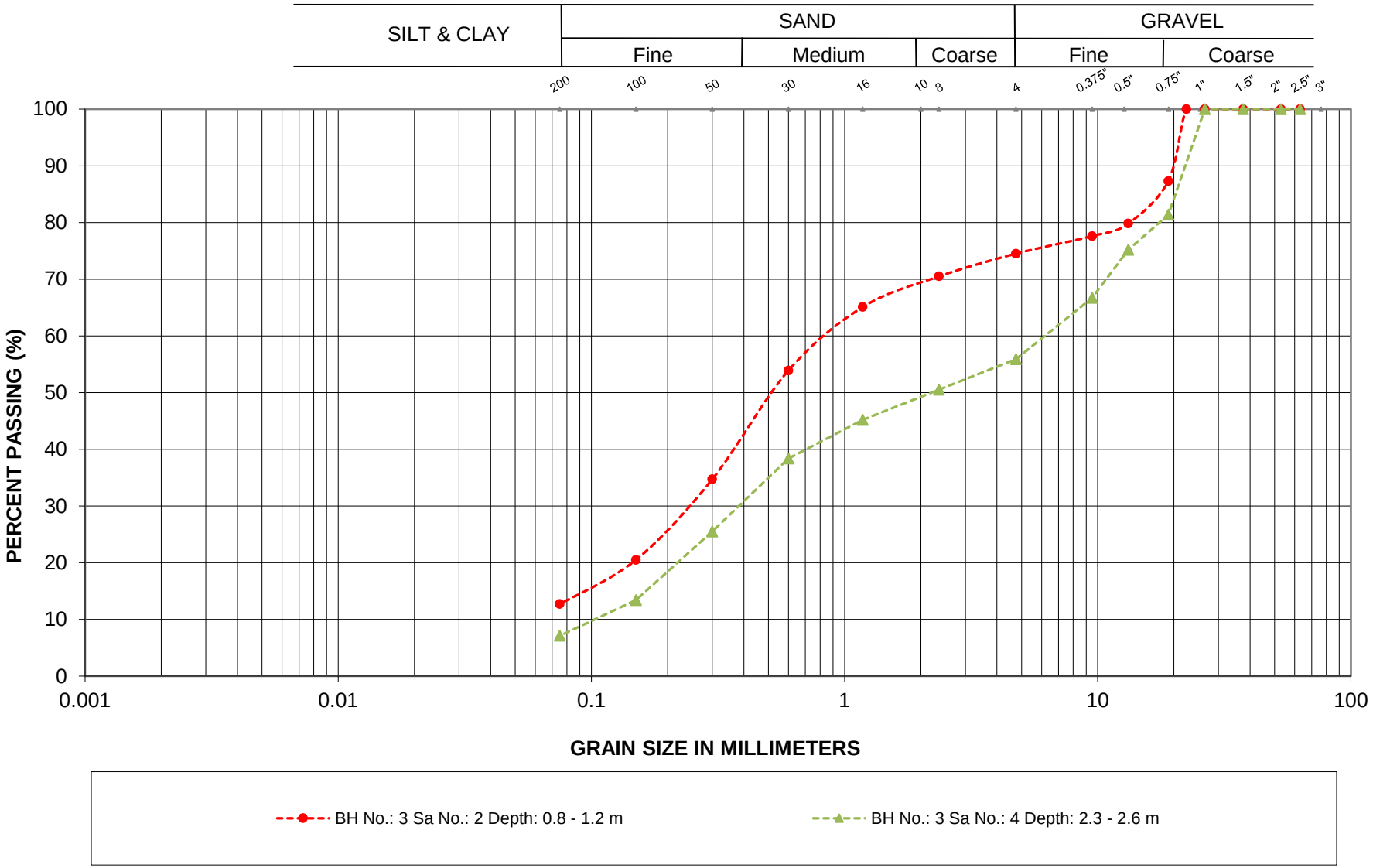
Englobe Corp.

FIGURE L-1

Reference No.: P-0012533-0-00-001-F4
Date: July 2016

Englobe

GRAIN SIZE ANALYSIS



FILL

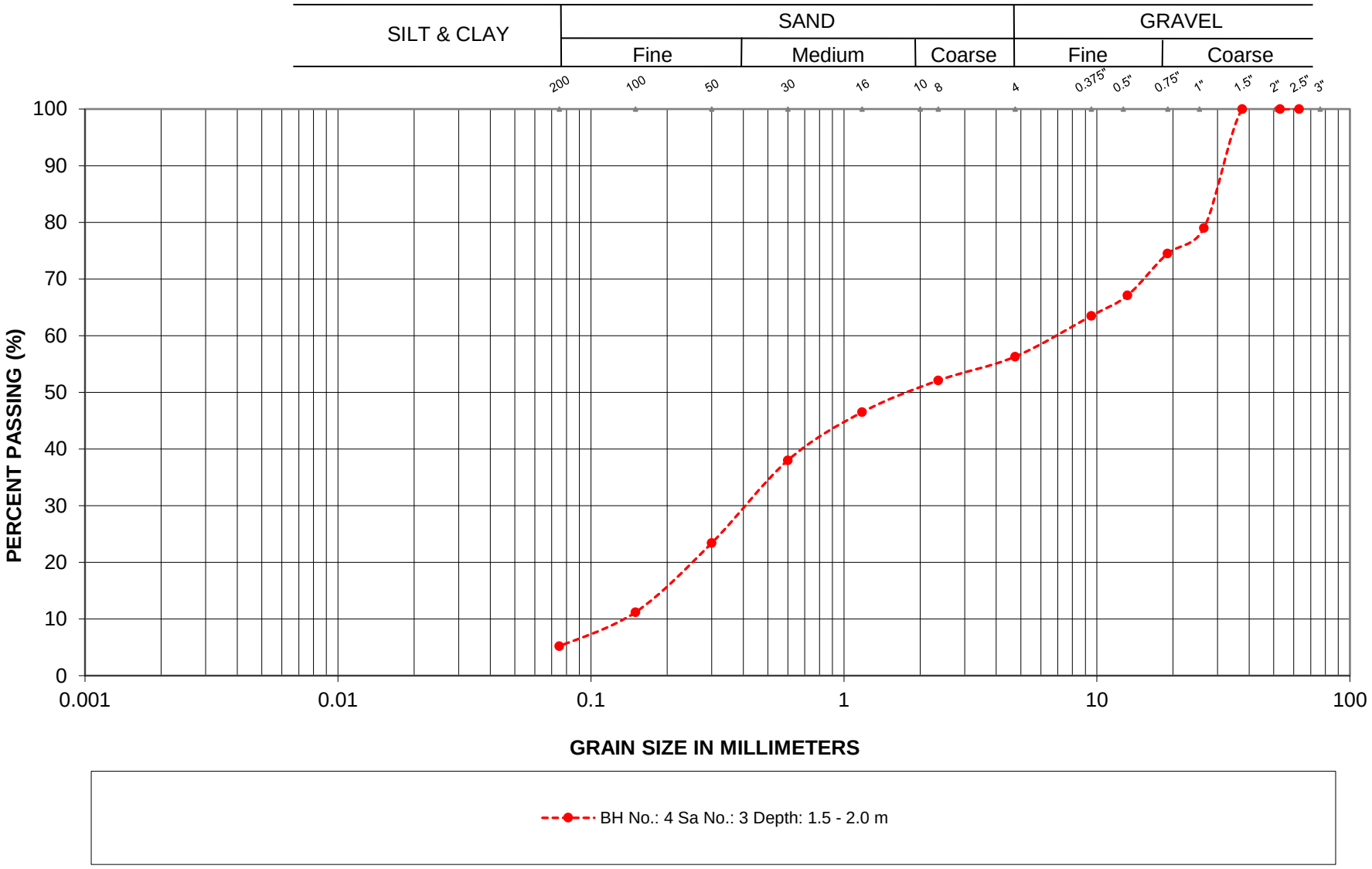
LOCATION: Hwy 63, Big Fournier Culvert
TWP of Poitras

Englobe Corp.

FIGURE L-2

Reference No.: P-0012533-0-00-001-F4
Date: July 2016

GRAIN SIZE ANALYSIS



SAND AND GRAVEL

LOCATION: Hwy 63, Big Fournier Culvert
TWP of Poitras

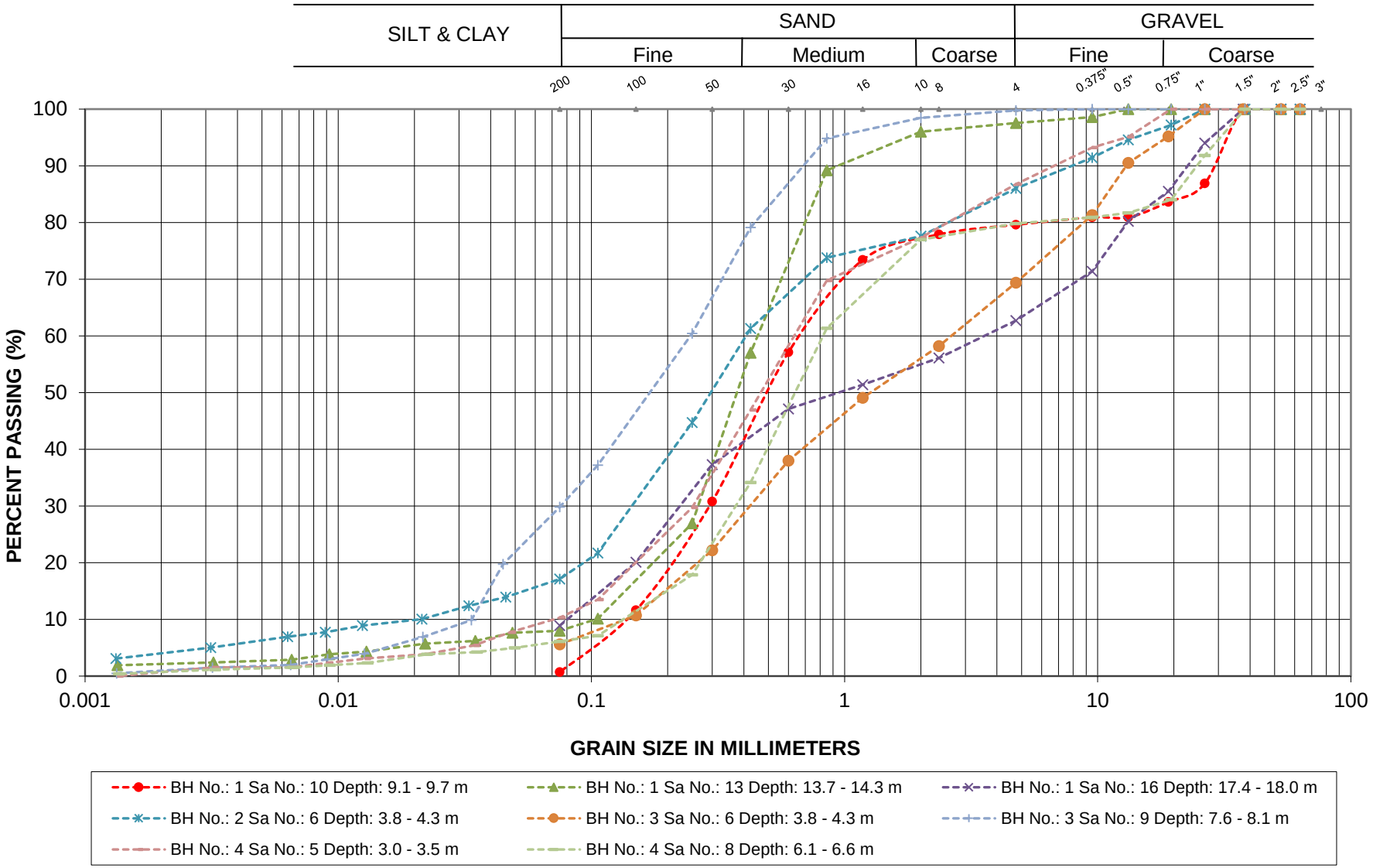
Englobe Corp.

FIGURE L-3

Reference No.: P-0012533-0-00-001-F4
Date: July 2016

Englobe

GRAIN SIZE ANALYSIS



SAND

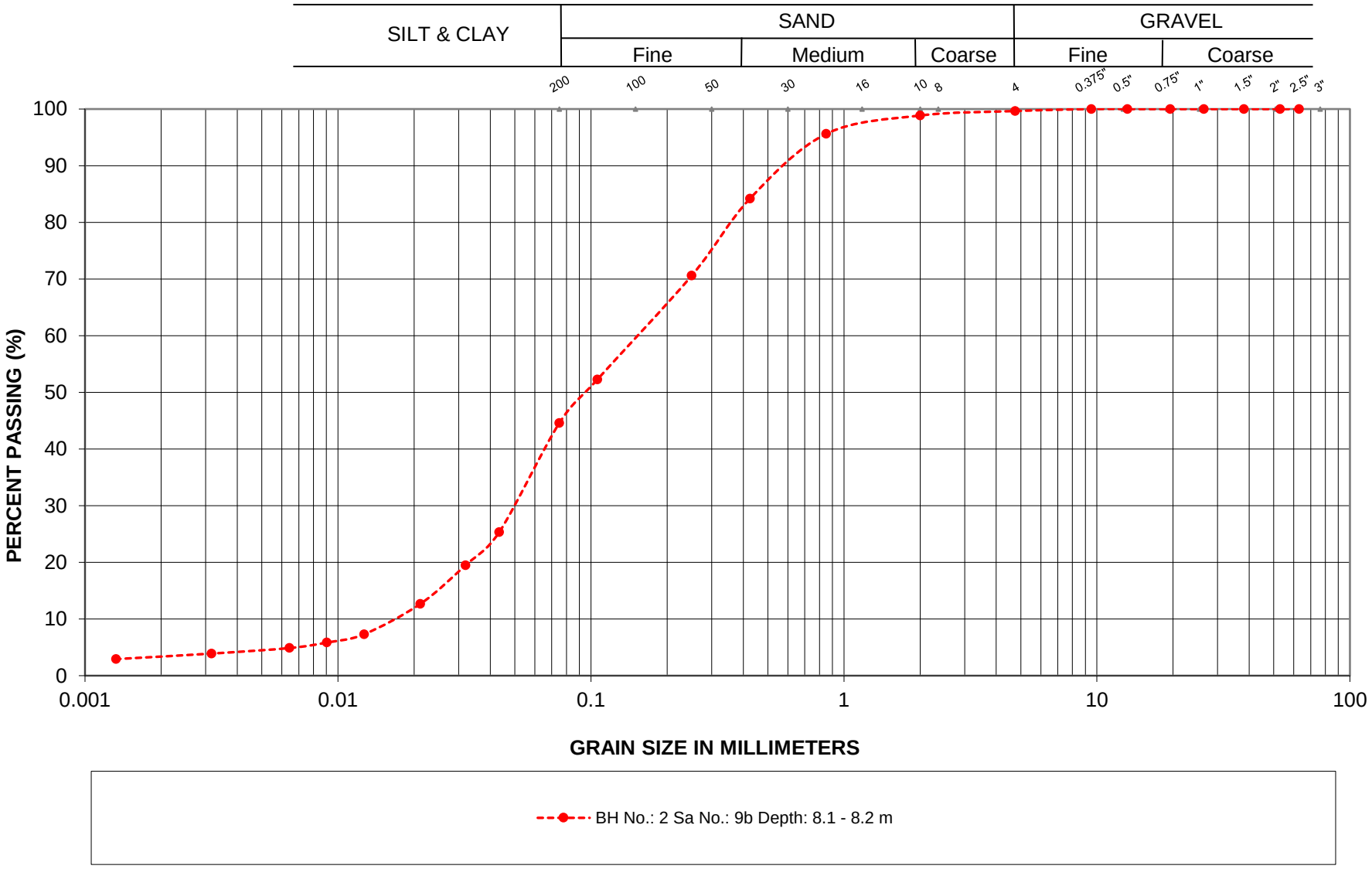
LOCATION: Hwy 63, Big Fournier Culvert
TWP of Poitras

Englobe Corp.

FIGURE L-4

Reference No.: P-0012533-0-00-001-F4
Date: July 2016

GRAIN SIZE ANALYSIS



SAND AND SILT

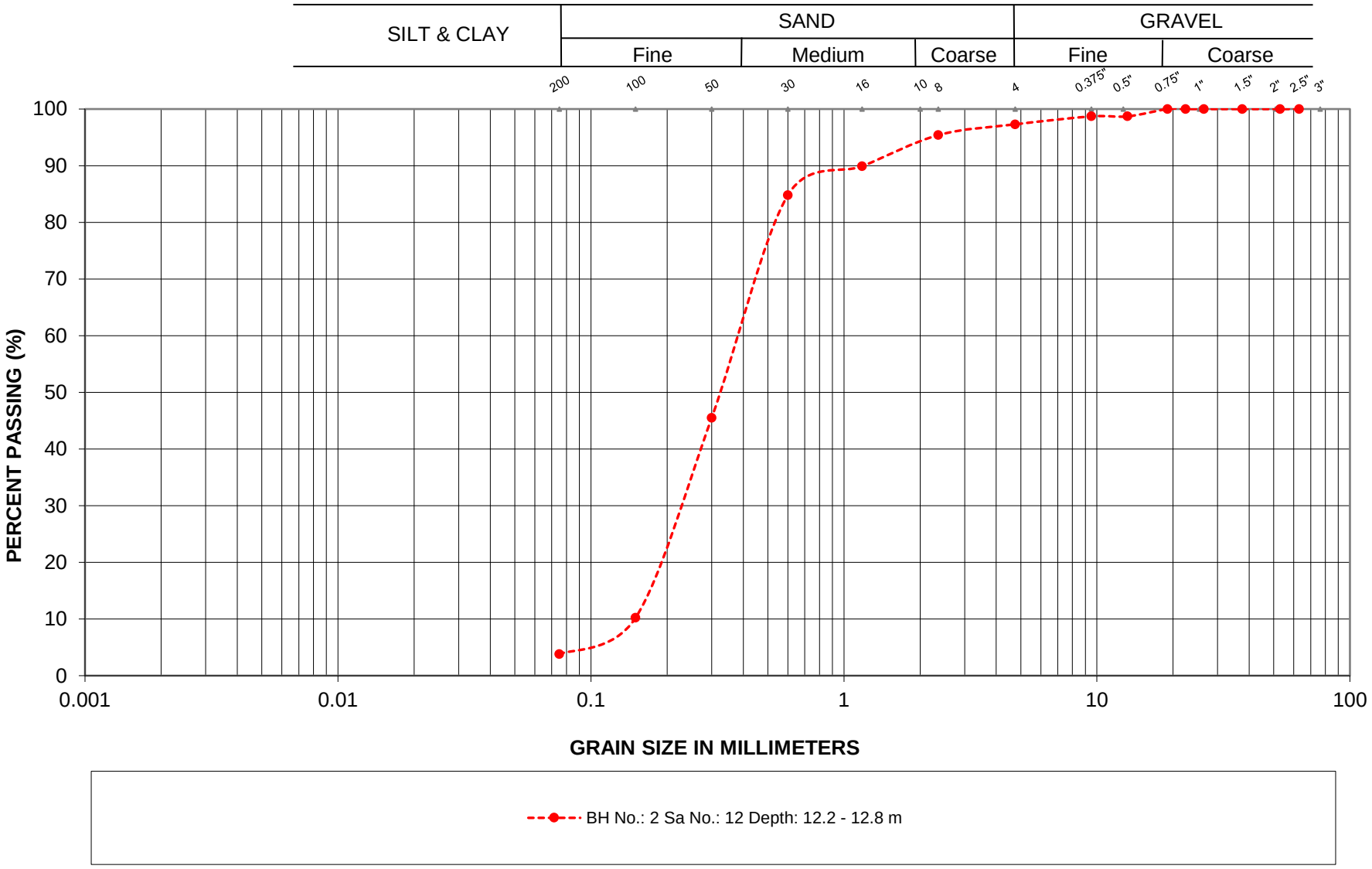
LOCATION: Hwy 63, Big Fournier Culvert
TWP of Poitras

Englobe Corp.

FIGURE L-5

Reference No.: P-0012533-0-00-001-F4
Date: July 2016

GRAIN SIZE ANALYSIS



lower SAND

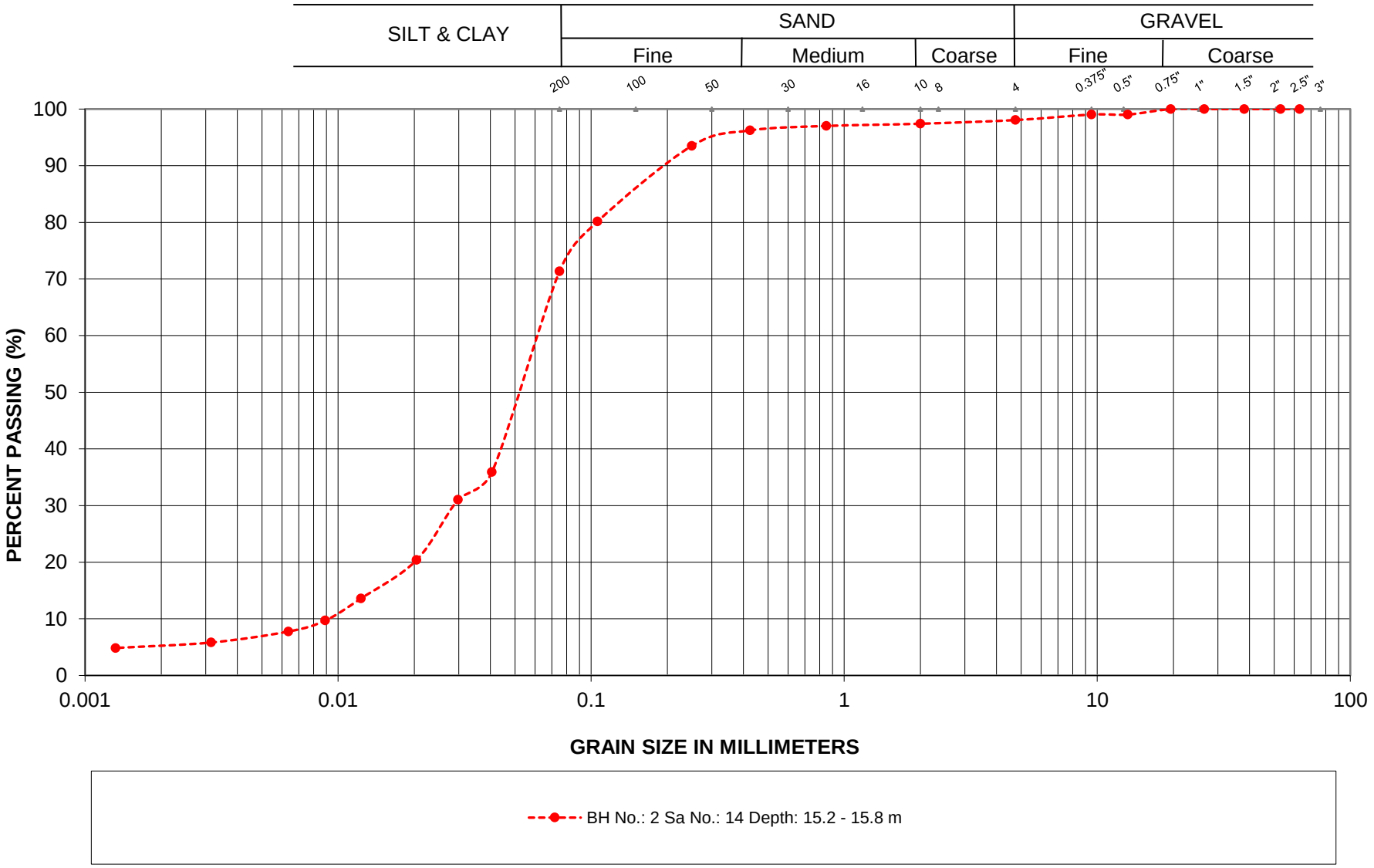
LOCATION: Hwy 63, Big Fournier Culvert
TWP of Poitras

Englobe Corp.

FIGURE L-6

Reference No.: P-0012533-0-00-001-F4
Date: July 2016

GRAIN SIZE ANALYSIS



SILT

LOCATION: Hwy 63, Big Fournier Culvert
TWP of Poitras

Englobe Corp.

FIGURE L-7

Laboratory Tests - Summary Sheet

Englobe

Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Unit Weight (kN/m3)	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
1	1	0.3					1.7							
	2	0.8					3.9				34			
	3	1.5	31	57	12		12.2				21			
	4	2.3									25/0mm			
	5	3.1					14.6				38			
	6	3.8	46	48	6		9.3				42			
	7	4.6					17.0				25			
	8	6.1					11.4				32			
	9	7.6					14.9				35			
	10	9.1	20	79	1		17.1				45			
	11	10.7					25.5				25			
	12A	12.2					15.1				49			
	12B	12.5					20.9							
	13	13.7	2	90	6	2	19.7				40			
	14	15.2					26.8				30			
	15	16.6					22.2				23			
	16	17.4	37	54	9		11.1				38			
	17	18.1									25			
2	1	0.0					5.6							
	2	0.8	29	60	11		5.1				52			
	3	1.5					2.6				15			
	4	2.3					10.2				9			
	5	3.1					3.0				25/25mm			
	6	3.81	14	69	13	4	16.2				11			
	7	4.57					10.2				25			
	8	6.1					32.1				13			

Laboratory Tests - Summary Sheet

Englobe

Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Unit Weight (kN/m3)	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
2	9A	7.6					23.5				18			
	9B	8.1	0	55	42	3	17.4							
	10	9.1					12.6				10			
	11	10.7					22.1				17			
	12	12.2	3	93	4		24.5				32			
	13	13.7					24.9				31			
	14	15.2	2	27	66	5	26.1				10			
	15	16.8					20.1							
3	1	0.0					11.2				13			
	2	0.8	25	62	13		14.8				21			
	3	1.5					7.0				44			
	4	2.3	44	49	7		49.6				64/255mm			
	5	3.1					26.5				14			
	6	3.8	31	63	6		12.2				16			
	7	4.6					11.9				19			
	8	6.1					23.8				13			
	9	7.6	0	7	29	1	19.9				9			
	10	9.1					22.6				10			
4	1	0.0					12.2				29/229mm			
	2	0.8					8.5				31			
	3	1.5	44	51	5		11.5				64			
	4	2.3					15.7				25/25mm			
	5	3.05	13	77	9	1	17.3				16			
	6	3.81					20.0				15			
	7	4.57					19.1				10			

Laboratory Tests - Summary Sheet

Englobe

Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Unit Weight (kN/m3)	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
4	8	6.1	20	74	5	1	16.2				41			
	9	7.6					19.6				22			
	10	9.1					16.7				10			

AGAT Laboratories

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

CLIENT NAME: ENGLOBE CORP
120 PROGRESS CRT.
NORTH BAY , ON P1A0C2
(705) 476-2550

ATTENTION TO: Victoria Steuernol

PROJECT: 16014

AGAT WORK ORDER: 16T117690

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Jul 27, 2016

PAGES (INCLUDING COVER): 5

VERSION*: 1

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

*NOTES

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

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MISSISSAUGA, ONTARIO
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Certificate of Analysis

AGAT WORK ORDER: 16T117690

PROJECT: 16014

CLIENT NAME: ENGLOBE CORP

ATTENTION TO: Victoria Steuernol

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

DATE RECEIVED: 2016-07-20

DATE REPORTED: 2016-07-27

SAMPLE DESCRIPTION:				F6, BH 1, Sa 8	F3, BH 2, Sa4-B	F4, BH 4, Sa 2	F1, BH 1, Sa 9		F5, BH 2, Sa 6
SAMPLE TYPE:				Soil	Soil	Soil	Soil		Soil
DATE SAMPLED:				7/18/2016	7/18/2016	7/18/2016	7/18/2016		7/18/2016
Parameter	Unit	G / S	RDL	7717962	7718034	7718036	7718038	RDL	7718040
Sulphide*	%		0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05
Chloride (2:1)	µg/g		2	133	12	<2	61	4	868
Sulphate (2:1)	µg/g		2	271	61	<2	19	4	37
pH (2:1)	pH Units		NA	6.70	7.93	6.88	7.42	NA	8.26
Electrical Conductivity (2:1)	mS/cm		0.005	0.567	0.188	0.047	0.164	0.005	1.54
Resistivity (2:1)	ohm.cm		1	1760	5320	21300	6100	1	649
Redox Potential (2:1)	mV		5	370	292	357	354	5	286

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

7717962-7718038 EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

7718040 EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Elevated RDL indicates the degree of sample dilution prior to the analysis for Anions in order to keep analyte within the calibration range of the instrument and to reduce matrix interference.

Certified By: Amanjot Bhela

AGAT Laboratories

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Quality Assurance

CLIENT NAME: ENGLOBE CORP

AGAT WORK ORDER: 16T117690

PROJECT: 16014

ATTENTION TO: Victoria Steuernol

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Jul 27, 2016			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Sulphide*	7717962	7717962	<0.05	<0.05	NA	< 0.05	110%	80%	120%	NA			NA		
Chloride (2:1)	7718040	7718040	868	860	0.9%	< 2	97%	80%	120%	100%	80%	120%	105%	70%	130%
Sulphate (2:1)	7718040	7718040	37	36	2.7%	< 2	94%	80%	120%	100%	80%	120%	108%	70%	130%
pH (2:1)	7718040	7718040	8.26	8.34	1.0%	NA	101%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	7718040	7718040	1.54	1.54	0.0%	< 0.005	99%	90%	110%	NA			NA		
Redox Potential (2:1)	7718040	7718040	286	286	0.0%	< 5	100%	70%	130%	NA			NA		

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

Certified By: Amanjot Bhela

AGAT Laboratories

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Method Summary

CLIENT NAME: ENGLOBE CORP

AGAT WORK ORDER: 16T117690

PROJECT: 16014

ATTENTION TO: Victoria Steuernol

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulphide*	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario
L4Z 1Y2
www.agatlabs.com · webearth.agatlabs.com
Ph.: 905.712.5100 · Fax: 905.712.5122 · Toll Free: 800.856.6261

Chain of Custody Record

Laboratory Use Only
Arrival Temperature: 16.1 117690
AGAT WO #:
Lab Temperature: 86849
Notes:

Client Information:

Company: Englobe Corp
Contact:
Address: 2- 120 Progress Court
North Bay, Ontario, P1A 0C2
Phone: 705-476-2550 Fax: 705-476-8882
Project: 16014 PO:
AGAT Quotation #:

Please note, if quotation number is not provided, client will be billed full price for analysis.

Regulatory Requirements:

☐ **Regulation 153/09** (reg. 511 Amend.)
Table ____ *Indicate one*
☐ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture *(check one)*
☐ Coarse ☐ Fine

☐ **Sewer Use**
Region ____ *Indicate one*
☐ Sanitary
☐ Storm

☐ **Regulation 558**
☐ **CCME**
☐ **Other** *(specify)*
☐ **Prov. Water Quality Objectives (PWQO)**
☐ **None**

Turnaround Time Required (TAT) Required*

Regular TAT
☑ 5 to 7 Working Days
Rush TAT (please provide prior notification)
Rush Surcharges Apply
☐ 3 Working Days
☐ 2 Working Days
☐ 1 Working Day
OR
Date Required (Rush surcharges may apply):
**TAT is exclusive of weekends and statutory holidays*

Invoice To:

Same: Yes ☑ No ☐
Company: Same
Contact:
Address:

Is this a drinking water sample? (potable water intended for human consumption) ☐ Yes ☑ No
If "Yes", please use the *Drinking Water Chain of Custody Form*

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

Legend Matrix

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

Report Information – reports to be sent to:

1. Name: Victoria Steuernol
   Email: Victoria.Steuernol@englobecorp.com
2. Name: Sen Hu
   Email: sen.hu@englobecorp.com

Sample Identification	Date Sampled	Time Sampled	Sample Matrix	# of Containers	Comments Site/Sample Information	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	ORPs: ☐ B-HWS ☐ Cl- ☐ CN- ☐ EC ☐ FOC ☐ Cr+6- ☐ SAR ☐ NO_3/NO_2 ☐ N-Total ☐ Hg ☐ pH	Nutrients: ☐ TP ☐ NO_3 ☐ NO_2 ☐ NH_3 ☐ NO_3/NO_3 ☐ TKN	VOC: ☐ VOC ☐ THM ☑ BTEX	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	TCLP: PHC F1 to F4	Sewer Use	Corrosivity Package
F6, BH 1, Sa 8			s	1																	X
F3, BH 2, Sa4-B			s	1																	X
F4, BH 4, Sa 2			s	1																	X
F1, BH 1, Sa 9			s	1																	X
F5, BH 2, Sa 6			s	1																	X

Samples Relinquished by (print name & sign):	Date/Time	Samples Received by (Print name & sign):	Date/Time
Victoria Steuernol	07/1/16 4pm	Sina	16/7/20 10:30
Samples Relinquished by (print name & sign):	Date/Time	Samples Received by (Print name & sign):	Date/Time

Pink Copy – Client
Yellow + Golden Copy – AGAT
White Copy – AGAT

Page ____ of ____
NO:

Document ID: DIV-78-1511.006
Date Issued: July 20, 2011

Appendix 4 Photo Essay

Enclosure No. 6: Photo Essay

Culvert Inlet – Looking West	Photo: 1

Culvert Outlet – Looking East	Photo: 2

Project: Hwy 63 – Big Fournier Creek Culvert	Photos Provided By: Englobe Date: May 2016