



# Englobe

Soils Materials Environment

## **Public Works and Government Services Canada**

### **Search and Rescue Station (SAR) Revitalization St. Catharine, Ontario**

### **Final Geotechnical Investigation Report**

Date: January 2, 2018

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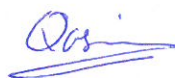
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Geotechnical Investigation Report | 124-B-0017786-0-01-100-GE-R-0001-00

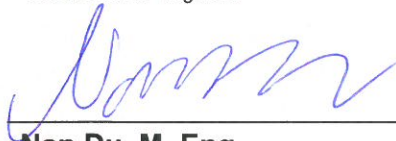
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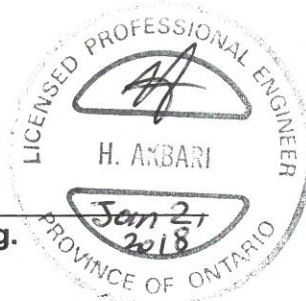
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Test results mentioned herein are only valid for the sample(s) stated in this report.

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REVISION AND PUBLICATION REGISTER		
Revision N°	Date	Modification And/Or Publication Details
0A	2017-09-28	Draft Geotechnical Report
0B	2017-11-08	Draft Geotechnical Report- Deep Foundation added to Section 7 Frost Protection added Under Slab-on-Grade in Section 8.
00	2018-01-02	Submission of Final Geotechnical Report

## 1 INTRODUCTION

Englobe Corp. has completed a geotechnical investigation for the proposed new building addition at Search and Rescue Station in St. Catharines, Ontario (hereinafter referred to as “Site”). It is understood that the new building will encroach partially into the footprint of the existing Office House basement. The building addition will be a single storey structure with no basement and approximately 2000sqf. The existing 1950’s building (Office House) and its ancillary buildings (garage and shop) will be demolished. The existing 1930’s heritage building (Gallery House) is to remain. The geotechnical investigation was completed at the request of Mr. Ray Kowalchuk, PWGSC Project Manager.

The purpose of this geotechnical investigation was to determine the general subsoil types and groundwater conditions within the project limits, and obtain samples for geotechnical laboratory examination and testing. Representative soil samples were also selected by Englobe and submitted for environmental analysis.

The results of the geotechnical investigation have been summarized and recommendations developed for the proposed new building addition including excavation and backfill considerations, temporary construction dewatering requirements, foundation considerations and disposal of excess materials.

## 2 PROJECT METHODOLOGY

The geotechnical investigation for this project consisted of the following components.

Subsequent to obtaining public and private service clearances at each borehole location, six (6) boreholes (BH1 to BH6) were advanced to approximately between 2.1 to 6.7 metres below ground surface (mbgs). The location of the boreholes is indicated on the attached Borehole Location Drawings provided in Appendix 1 and Borehole Logs is provided in Appendix 2. These boreholes were advanced on August 23, 2017. The boreholes were completed using a continuous flight of solid stem augers equipment supplied by Elite Drilling Limited operated under the continuous supervision of an Englobe field technician.

Subsoil samples were recovered at regular intervals of depth using a 50 mm O.D. split barrel sampler driven into the subsoil in accordance with the Standard Penetration Test (SPT) procedure (ASTM D1586). The recovered subsoil samples were visually examined in the field and then preserved and transported to the Englobe Toronto laboratory for geotechnical examination and testing. Additionally, select soil samples obtained from boreholes were also submitted to Eurofins Environmental Testing Canada (Eurofins) for environmental analysis. The boreholes were then promptly backfilled upon completion in conformance with Ontario Regulation 903 requirements (as amended). One (1) monitoring well was installed at borehole

location BH6 upon completion of the borehole. Water levels were measured when the drilling activities were completed on August 23, 2017, and prior to the well development on August 31, 2017. The results of water level monitoring are provided on the borehole logs in Appendix 2.

The borehole locations were surveyed by Englobe using SOKKIA GRX2 GNSS Receiver GPS connected to MAGNET Enterprise network referenced to MTM Zone 10 (NAD27-74 Adjustment). A summary of the Boreholes coordinates and elevations are summarized in Table 1.

Table 1 Summary of Boreholes Coordinates and Elevations

BOREHOLE NO.	COORDINATES, M		ELEVATION, MASL	BOREHOLE DEPTH, MBGS (ELEVATION, MASL)
	NORTHING	EASTING		
BH1	4,788,311.500	327,613.083	79.4	6.7 (72.7)
BH2	4,788,327.641	327,591.149	79.3	6.7 (72.6)
BH3	4,788,326.052	327,613.587	79.4	2.1 (77.3)
BH4	4,788,329.645	327,597.976	79.3	6.7 (72.6)
BH5	4,788,308.119	327,599.376	79.4	6.7 (72.7)
BH6	4,788,308.311	327,591.815	79.4	6.7 (72.7)

In the laboratory, each soil sample was examined as to its visual and textural characteristics by the project engineer. Moisture content determinations were carried out on all samples. In addition, Atterberg limits, unit weight, grain size analysis and hydrometer testing were completed on representative soil samples.

Representative subsoil samples were selected by Englobe and submitted to Eurofins for one or more of the following environmental analysis in accordance with Ontario Regulation 153/04 (as amended) and the Canadian Council of Ministers of the Environment (CCME) for metals and inorganic parameters, Volatile Organic compounds (VOCs), Petroleum Hydrocarbons (F1-F4), Polycyclic Aromatic Hydrocarbon (PAHs), and Ontario Regulation 558 for TCLP, metals/inorganics and Volatile Organic Compounds (VOCs). Two (2) select soil samples were also tested for Corrosivity. In addition, One (1) water sample from monitoring well BH6 was submitted to Eurofins and tested for Ontario Regulation 153/04 (as amended) and the CCME metals and inorganic parameters, VOCs, PHCs and PAHs. The complete chemical test results, including Eurofins Certificate of Analysis are provided in Appendix 4.

### 3 LABORATORY TESTING RESULTS

Soil samples recovered during this investigation were preserved and transported to the Englobe Toronto geotechnical laboratory for additional testing. Moisture content testing was completed on all recovered samples with the results plotted on the borehole logs attached in Appendix 2.

Three (3) representative samples were selected and tested to determine their gradation and hydrometer analysis, three (3) representative soil samples were tested for Atterberg limits, three (3) representative soil samples were tested for unit weight. The complete laboratory test results are included in Appendix 3.

The soil samples will be stored for a period of three (3) months from the date of sampling. After this time, they will be discarded unless arrangements are made for extended storage.

### 4 SUBSOIL CONDITIONS

The approximate borehole locations are indicated on the attached Borehole Location Drawing in Appendix 1, with the Borehole Logs provided in Appendix 2. The general subsoil conditions are outlined briefly below.

A concrete sidewalk was observed at BH 1 and BH3. The average concrete thicknesses was 130mm.

#### 4.1 TOPSOIL

Topsoil was encountered at all borehole locations except BH1 and BH3. The average topsoil thickness was approximately 130 mm.

#### 4.2 FILL (SILTY SAND/ SANDY SILT/ SILTY CLAYEY/ SAND AND GRAVEL/ SANDY SILTY CLAY/CLAYEY SILT)

A fill layer composed of Silty Sand/ Sandy Silt/ Silty Clayey/ Sand and Gravel/ Sandy Silty Clay/Clayey Silt, was encountered in all boreholes below the topsoil or pavement structure. The fill layer also consisted of cobbles and shale fragments.

This layer was very loose/soft to compact/very stiff in relative consistency/density, having SPT 'N' values ranging from 3 blows per 300 mm to 21 blows per 300 mm penetration. The in-situ moisture content of this material ranged from 6 to 23 (moist to wet) percent. The laboratory test results are presented in Appendix 3. A summary of testing for this layer is briefly outlined in Table 2.



Table 2 Summary of Gradation Results – Fill

BOREHOLE NO.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES, %				ATTERBERG LIMITS, %		
		GRAVEL	SAND	FINES		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
				SILT	CLAY			
BH4	SS2	20	17	23	40	39	20	19
BH6	SS3	32	21	18	29	38	19	19

### 4.3 SILT CLAY (CL)

The silty clay, some sand to sandy was encountered at all borehole locations below the Fill layer. All boreholes were terminated within this layer. This cohesions layers was soft to stiff in relative density, having SPT 'N' values ranging from 4 per 300 mm to 9 blows per 50 mm of penetration. The in-situ moisture content of this material ranged from about 12 to 27 (moist to very moist) percent. The laboratory test result are presented in Appendix 3.

A summary of testing for this layer is briefly outlined in Table 3 below.

Table 3 Summary of Gradation Results – Silty Clay

BOREHOLE NO.	SAMPLE NO.	GRAIN SIZE DISTRIBUTION ANALYSES, %				ATTERBERG LIMITS, %		
		GRAVEL	SAND	FINES		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
				SILT	CLAY			
BH1	SS6	7	20	38	35	27	14	13

## 5 GROUNDWATER

One (1) monitoring well was installed in borehole BH6 to measure the stabilized groundwater level at the site. Stabilized groundwater was encountered at depths in the range of 1.7 mbgs, elevations of 77.7 m. It should be noted that the mean elevation of Lake Ontario around this area is approximately elevations of 74.8.

Table 4 summarises the measured ground water levels in each monitoring well.

Table 4 Summary of water level depth and elevation

BOREHOLE NO.	WELL ELEVATION, mASL	SCREEN DEPTH, mbgs	GROUNDWATER LEVEL, MBGS (ELEVATION, MASL)
BH6	79.4	4.4 – 5.9	1.7 (77.7)

## 6 ENVIRONMENTAL ANALYSIS RESULTS

### 6.1 Ontario Regulation 153/04 (O. Reg. 153/04) Standards

The soil analytical results were compared to the Full Depth Generic Site Condition Standards presented in the Ontario Ministry of the Environment and Climate Change's (MOECC's) "*Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act*", Ontario Regulation 153/04 (O. Reg. 153/04), as amended. The following Site-specific information was used to determine the most applicable evaluation standards:

- ▶ The Site is located in the City of St. Catharines. Based on an interview with onsite staff, groundwater is used as a source of potable water at the Site;
- ▶ The Site located within 30 metres of a water body (Lake Ontario);
- ▶ The Site is currently utilized for residential purposes (rescue crews live at the Site) and industrial purposes (maintenance, fuelling and repair of ships and boats). Based on available information, Englobe understands that no future change in the land use of the property has been proposed at this time;
- ▶ Based on observations, the soil samples obtained is generally comprised of topsoil, sand and gravel, silt, and native silty clay.

Based on the aforementioned information, for the purpose of the environmental sampling, the soil analytical results have been compared to the Residential / Parkland / Institutional / Industrial / Commercial / Community property use standards within 30 meters of a water body in a potable groundwater condition for coarse textured soil as listed on Table 8 of the MOECC standards document (the MOECC Table 8 Standards).

The Toxicity Characteristic Leachate Procedure (TCLP) analytical results were evaluated against the Table 4 Leachate Quality Criteria referenced in Ontario Regulation 347 (as amended by O. Reg. 558/00).

Sixteen (16) soil samples with two (2) duplicate samples (sample ID: DUP-1, duplicate sample of BH-5-SS4 for analysis of PHCs, VOCs and PAHs, and DUP-2 duplicate sample of BH-5-SS-5 for analysis of Metals and Inorganics) were selected by Englobe and submitted to Eurofins for environmental analysis of Metal and Inorganic parameters, Volatile Organic compounds (VOCs), Petroleum Hydrocarbons Fractions F1-F4 (PHCs), Polycyclic Aromatic Hydrocarbon (PAHs) in accordance with Ontario Regulation 153/04 (as amended by Ontario Regulation 511/09). The bulk analysis results were then compared to the Residential / Parkland / Institutional / Industrial / Commercial / Community Property Use standards in a portable groundwater condition as listed on Table 8 of the MOECC Standards document (the MOECC Table 8 Standards – Soil). The Eurofins Certificate of Analysis is provided in Appendix 4. A summary of exceedances detected in the soil samples analyzed is provided in Table 5 below:

Table 5 Summary of Soil Sample Exceedances – O. Reg. 153/04

SAMPLE ID	ANALYTICAL PARAMETER	UNITS	CONCENTRATION	MOECC TABLE 8 STANDARDS – Residential / Parkland / Institutional / Commercial / Community / Industrial Property Use
BH2-SS1	Barium	ug/g	1630	220
	Copper	ug/g	673	92
	Lead	ug/g	204	120
	Mercury	ug/g	1.8	0.27
	Zinc	ug/g	1070	290
	PHCs F3	ug/g	300	240
	PHCs F4	ug/g	150	120
	SVOC - Fluoranthene	ug/g	0.72	0.69
BH2-SS5	EC	mS/cm	1.42	0.70
BH4-SS1	Mercury	ug/g	0.3	0.27
BH4-SS6	SAR	-	0.78	0.70
BH5-SS5	EC	mS/cm	0.84	0.70
BH6-SS5	EC	mS/cm	1.28	0.70

**Notes:**

XX – Test result exceeds the MOECC Table 8 O. Reg. 153/04 Standards.

For the remaining analytical results of the soil samples analyzed as shown in appendix 4, concentrations of the parameters analyzed either were not detected (within detection limits) or did not exceed the MOECC Table 8 Standards.

It should be noted that pH value of sample BH3-SS2 at depths between 0.8 mbg and 1.4 mbg is 10.7 which is not within the surface soil guidelines (between 5 to 9 for soil that is no more than 1.5 metres beneath the soil surface).

One (1) composite soil sample collected from boreholes BH1 and BH3, and one (1) composite soil sample collected from boreholes BH2 and BH4 to BH6 were submitted to the laboratory for Toxicity Characteristic Leaching Procedure (TCLP) analysis (VOCs and metals/inorganics). The results of the TCLP analysis (Appendix 4) indicated that the analyzed soil samples meet the Ontario Regulation 558/00 Schedule 4 criteria for the analyzed parameters; and therefore, are classified as non-hazardous for disposal purposes. The Eurofins Certificate of Analysis is provided in Appendix 4..

One (1) water sample (Sample ID: BH/MW-6) and a duplicate sample (DUP-1, duplicate sample of BH/MW-6 for all analyzed parameters) was collected from the monitoring well BH6 using low flow sampling techniques and submitted to Eurofins and tested for Ontario Regulation 153/04 (as amended) for metals and inorganic parameters, VOCs, PHCs and

PAHs. In addition, a trip blank sample provided by Eurofins was also submitted for VOCs analysis. The groundwater analysis results were then compared with the All Types of Property Use Standards in a portable groundwater condition as outlined in Table 8 of the MOECC standards document (the MOECC Table 8 Standards – Groundwater). A summary of exceedances detected in the groundwater sample analyzed is provided in Table 6 below:

Table 6 Summary of Groundwater Sample Exceedances – O. Reg. 153/04

SAMPLE ID	ANALYTICAL PARAMETER	UNITS	CONCENTRATION	MOECC TABLE 8 STANDARDS – Residential / Parkland / Institutional / Commercial / Community / Industrial Property Use
BH6	Cobalt	ug/L	7.7	3.8

**Notes:**

XX – Test result exceeds the MOECC Table 8 O. Reg. 153/04 Standards.

For the remaining analytical results of the groundwater sample analyzed as shown in appendix 4, concentrations of the parameters analyzed either were not detected (within detection limits) or did not exceed the MOECC Table 8 Groundwater Standards.

### 6.1.1 Canadian Council of Ministers of The Environment (CCME) Standards

As requested by the Client, the soil and groundwater results were also compared to the criteria as outlined in the Canadian Council of Ministers of the Environment (CCME) Standards. Since the Site is currently used for residential and industrial purposes, Englobe conservatively chooses the more stringent standards to compare the analytical results of soil and groundwater samples (Residential/Parkland Land Use) to. Tables 7 and 8 below summarizes the exceedances of soil and groundwater samples collected from the Site and submitted for analysis respectively.

Table 7 Summary of Soil Sample Exceedances – CCME Standards

SAMPLE ID	ANALYTICAL PARAMETER	UNITS	CONCENTRATION/VALUE	CCME SOIL QUALITY GUIDELINES FOR THE PROTECTION OF ENVIRONMENTAL AND HUMAN HEALTH RESIDENTIAL / PARKLAND LAND USE
BH2-SS1	Beryllium	ug/g	1,630	500
	Copper	ug/g	673	63
	Lead	ug/g	204	140
	Zinc	ug/g	1,070	200
	pH	-	10.7	6-8
BH6-SS2	pH	-	8.2	6-8

**Notes:**

XX – Test result exceeds the CCME Soil Quality Guidelines for Residential/Parkland Land Use.

Parameters of Benzene, Ethylbenzene and Toluene are non-detectable in the soil samples submitted for analysis but detection limits of the above noted parameters are higher the CCME Standards.

Table 8 Summary of Groundwater Sample Exceedances – CCME Standards

SAMPLE ID	ANALYTICAL PARAMETER	UNITS	CONCENTRATION /VALUE	CCME WATER QUALITY GUIDELINES FOR THE PROTECTION OF AQUATIC LIFE, FRESH WATER, MARINE
BH/MW-6	Chloride	ug/L	194,000	120,000
	Uranium	ug/L	19	1

**Notes:**

XX – Test result exceeds the CCME Water Quality Guidelines – Fresh Water, Marine.

Parameters of Cadmium, Anthracene, Benz[a]anthracene, Fluoranthene, Pyrene and Chromium VI are non-detectable in the groundwater submitted for analysis, but detection limits of the above noted parameters are higher than the CCME Standards.

## 7 FOUNDATION CONSIDERATIONS

### 7.1 Shallow Foundation

It is understood that proposed new building will be a one storey building with no basement.

Based on the results of our geotechnical investigation, it should be possible to employ conventional spread and strip footings on native soil to support the building. The design bearing capacity of the soil and corresponding depth are summarized in Table 6.

Table 9 Bearing Pressure for Settlement (SLS), Factored Ultimate Soil Bearing Pressure (ULS) and Corresponding Founding Level

BEARING PRESSURE FOR SETTLEMENT (SLS), FACTORED ULTIMATE SOIL BEARING PRESSURE (ULS) AND CORRESPONDING FOUNDING LEVEL		
DEPTH, mbgs (Elev)	SLS	ULS
3.3 (76.7)	75	113

Both the total and differential settlement resulting from loads not exceeding the allowable loads recommended herein are estimated to be 25 mm and 10 mm respectively.

The base of the foundation excavations must be inspected by a qualified geotechnical engineer prior to concrete pour in order to confirm soil bearing capacity.

All footings must be founded below frost depth of 1.2 m.

### 7.2 Deep Foundation

Another alternative is to deep foundation system such as helical piles. The advantage of this method is to reduce the amount excavated soil and dewatering.

Helical piles are suitable for supporting the proposed building foundations. The shaft must be grouted within the soils to prevent buckling. The pile would need to be founded in stiff silty clay

at 6.0 mbgs (Elev. 72.00). The recommended ULS and SLS bearing resistance for 300 mm diameter helix, founded at approximate elevation of 72.00 would be 120 kPa and 90 kPa respectively.

The contractor must monitor and check the torque values when installing the piles to confirm the bearing capacity of the pile has been achieved. The minimum pile spacing (centre to centre) is three times the diameter of helix.

Helical piles have slender shafts that offer limited resistance to lateral loads for vertically installed shafts. In order to increase the lateral capacity of the helical piers foundations the size of the helical piles can be increased by installing the piles with a grouted column to increase the effective width of the shaft. Alternatively battered helical piles can be installed to resist lateral forces.

It is recommended that the helical piles be designed and installed by experienced specialist contractors. The allowable pile capacity proposed above should also be further confirmed based on the contractor selected system and specific helical pile configuration to be used.

All helical pile caps should have a permanent earth cover of 1.2 m for frost protection. The drilling and installation of the piles should be supervised by a Geotechnical Engineer.

## **8 FLOOR SLAB**

Slab-on-grade construction may be employed for the new building. After properly grading the subgrade soils and proof rolling the exposed surface to identify any soft spots or areas exhibiting excessive deflections, (any soft or spongy areas should be sub-excavated and backfilled with approved compacted granular material placed in uniform lifts not exceeding 200 mm loose thickness and compacted to 100 percent SPMD), a moisture barrier consisting of an approximately 200 mm layer of clear crushed stone should be placed over the prepared subgrade. The 19 mm clear stone should be placed by rafting it in over the prepared subgrade, taking care at all times to mitigate potential disturbance to the subgrade from foot and traffic compaction.

The upper fill material is mainly sand/gravel with clay and some silt, this material is not considered frost susceptible. As a precautionary measure we recommend installing 50 mm thick rigid insulations below the 200 mm clear stone and covering about 500 mm of exposed foundation walls.

## 9 EARTHQUAKE CONSIDERATIONS

The Ontario Building Code stipulates that a building should be designed to withstand a minimum live load due to earthquake.

The Canadian Foundation Engineering Manual (4<sup>th</sup> Edition) describes the equivalent static force procedures that can be used to calculate a design seismic base shear proportional to the weight of the building that is to be constructed.

In this regards the site classification for seismic site response E (Soft soil) should be used for foundation supported on soil for earthquake load and effects in accordance with Table 4.1.8.4.A of the 2012 Ontario Building Code.

## 10 EXCAVATION AND BACKFILL CONSIDERATIONS

The investigation results suggest that the excavation should be able to carry out to the depth required for the underground services and shallow foundation construction using conventional excavation equipment. Excavation side slopes in the upper 3.5 mbgs are expected to remain relatively stable when they are cut back and maintained at an angle not steeper than 45 degrees (1H:1V sloped from the base of the excavation). In the event that wet seams or zones were encountered during the excavation, some sloughing to flatter slopes (as flat as 3H:1V) should be expected during construction. If steeper excavation are contemplated in the upper subsoils, they must be properly shored to temporarily support the excavation sidewalls and any surcharge loads that may be applied during the construction period. Regardless, all excavations must be carried out in accordance with the Ontario Occupational Health and Safety Act (OHSA). The subsoils encountered at the site, as per OHSA criteria, would typically be considered:

Moist to Very Moist, Loose to Compact, Fill – Type 4

Moist to Very Moist, Soft to Stiff, Silty Clay – Type 3

Soil that will be generated as result of excavations can be used as backfill material as long as it is maintained within 2% of its optimum moisture content level as determined by a Standard Proctor Maximum Dry Density (SPMDD) test.

The on-site soil can be used as engineer fill material provided its moisture content remains within two (2) percentage points of the optimum value. In the event imported soil is required to be used as engineered fill, it should be free of deleterious matter and its moisture content should be within 2 percentage points of optimum and the soil must comply with the residential/parkland property use criteria set in Table 8 of the ***“Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act”***; ***Ministry Of the Environmental, April 15, 2011.***

The fill should be placed in loose lifts that do not exceed 200 mm in thickness, compacted at least 100 percent Standard Proctor Maximum Dry Density (SPMDD). This will require full time inspection by a qualified geotechnical inspector.

The zone of engineered fill placement should extend at least 1.0 m beyond the exterior edges of any exterior footings and should extend outward at a 45 degree angle to eliminate any edge effects on the bearing capacity that will be realised.

## **11 DEWATERING AND DRAINAGE CONSIDERATIONS**

Groundwater measurements conducted in one (1) well indicated the stabilized water level at the site is 1.7 mbgs, elevations in order of 77.7 m. Therefore, dewatering will be necessary in order to pour the foundations.

Dewatering facilities will be needed during construction. It is expected that mostly they will be comprised of pumps placed in strategically located sumps.

## **12 ASPHALT CONCRETE PAVEMENT**

All deleterious material that is encountered must be stripped from the areas in which an asphalt concrete pavement is to be constructed on native soil or engineered fill.

The exposed subgrade should be subjected to proof rolling in the presence of a geotechnical engineer. It should also be compacted to a minimum 98% of its Standard Proctor Maximum Dry Density.

Where soft spots or areas of high deflection are identified during proof-rolling, these areas should be properly repaired by sub-excavating and replacing any obviously objectionable materials (topsoil for instance) with an additional 150 mm depth of Granular B Type I meeting OPSS 1010 requirements underlain by a reinforced geotextile (Terrafix 270R or equivalent).

Where required, the pavement subbase should be constructed using OPSS 1010 Granular B Type I material compacted to 100 percent of Standard Proctor Maximum Dry Density (SPMDD). The pavement base should be constructed using OPSS 1010 Granular A material compacted to 100 percent of SPMDD.

All HL 8 (15% RAP) binder course and HL 3 surface course hot-mix asphalt should be produced and placed meeting OPSS 1150 and 310 requirements. A joint transition treatment will be necessary where old and new asphalt pavement layers abut. The recommended transition treatment consists of milling the old surface layer approximately 300 mm wide and 50 mm deep to provide better pavement tie-in to adjacent new asphalt pavement structure.

It is recommended that all construction joints at the ends of the pavement be cleaned with stiff bristle brooms and compressed air to remove all dust, dirt and other foreign matter. A tack



coat should be applied to all construction joints prior to the placement of asphalt concrete to ensure an adequate bond between the old and new pavements.

The paved roadways and parking areas should be shaped and crowned to provide drainage. Provided this will be done, and all excavations for the sewer and buried utilities are backfilled and compacted to a dense state, the minimum pavement thicknesses detailed in the Table 10 are recommended.

Based on the SPT data the resilient modulus of the existing fill at a depth of 500 mm below ground surface is estimated to be 40 MPa.

Table 10 Minimum Pavement Thickness

DESCRIPTION	PARKING (LIGHT DUTY)	ROADS (HEAVY DUTY)	MATERIALS
Surface Course Asphalt	60 mm	40 mm	HL-3 Asphalt
Binder Course Asphalt	-	60 mm	HL-8 (20% RAP) Asphalt
Base Course	150 mm	150 mm	19 mm Crusher Run Limestone or Granular A
Sub-base Course	200 mm	300 mm	Granular B (Type I)

Sub-drains are recommended to be installed behind the curbs and gutters along the roadways and parking areas.

## 13 SOIL CORROSIVITY

Two (2) subsoil samples were submitted to Eurofins for corrosivity analysis. The laboratory results are presented in Appendix 4. The samples were analysed for chloride, electrical conductivity, hydrogen sulphide, pH, Redox potential, resistivity and sulphate concentrations.

To determine the potential for corrosion, the laboratory results were compared to the American Water Works Association (AWWA) corrosivity rating system, as shown on Tables 11. AWWA rating is based on 10 points criteria. If a soil's Total Points is 10 or above, then protection is required as per C105/A21.5 (ANSI/AWWA, 1999) and A674-00 (ASTM 2000).

Table 11 Summary of Potential for Corrosion

PARAMETER	AWWA RATING SYSTEM		TEST RESULTS (ASSIGNED POINTS)	
	RESULT	ASSIGNED POINTS	BH3-SS2	BH6-SS2
Resistivity (ohm-cm)	< 700	10	1790 (1)	2860 (0)
	700 – 1,000	8		
	1,000 – 1,200	5		
	1,200 – 1,500	2		
	1,500 – 2,000	1		
	> 2,000	0		
PH	0 - 2	5	10.7 (0)	8.2 (0)
	2 - 4	3		
	4 - 6.5	0		
	6.5 - 7.5	0		
	7.5 - 8.5	0		
	> 8.5	3		
Redox Potential (mV)	> 100	0	285 (0)	341 (0)
	50 - 100	3.5		
	0 - 50	4		
	< 0	5		
Sulfides	Positive	3.5	1 (0)	<1 (0)
	Trace	2		
	Negative	0		
Moisture Content (%)	Poor drainage	2	Fair (1)	Fair (1)
	Fair drainage	1		
	Good drainage	0		
TOTAL POINTS			2	1

Corrosion protection is required if total points calculated based on (AWWA) corrosivity rating system equals or exceeds 10. The test result shows a total point value of two for BH3-SS2 (0.76 to 1.37 m depth) and one (1) for BH6-SS2 (0.76 to 1.37 m depth), which indicates that the subsoil have not significant corrosion potential. In addition, percentage of sulphate (SO<sub>4</sub>) in the soil samples testes are between 0.02% to 0.06%, and based on this analysis, there is not a significant potential for sulphate attack on concrete. Accordingly, normal Type (GU) Portland cement can be used in subsurface concrete.

## 14 CLOSING REMARKS

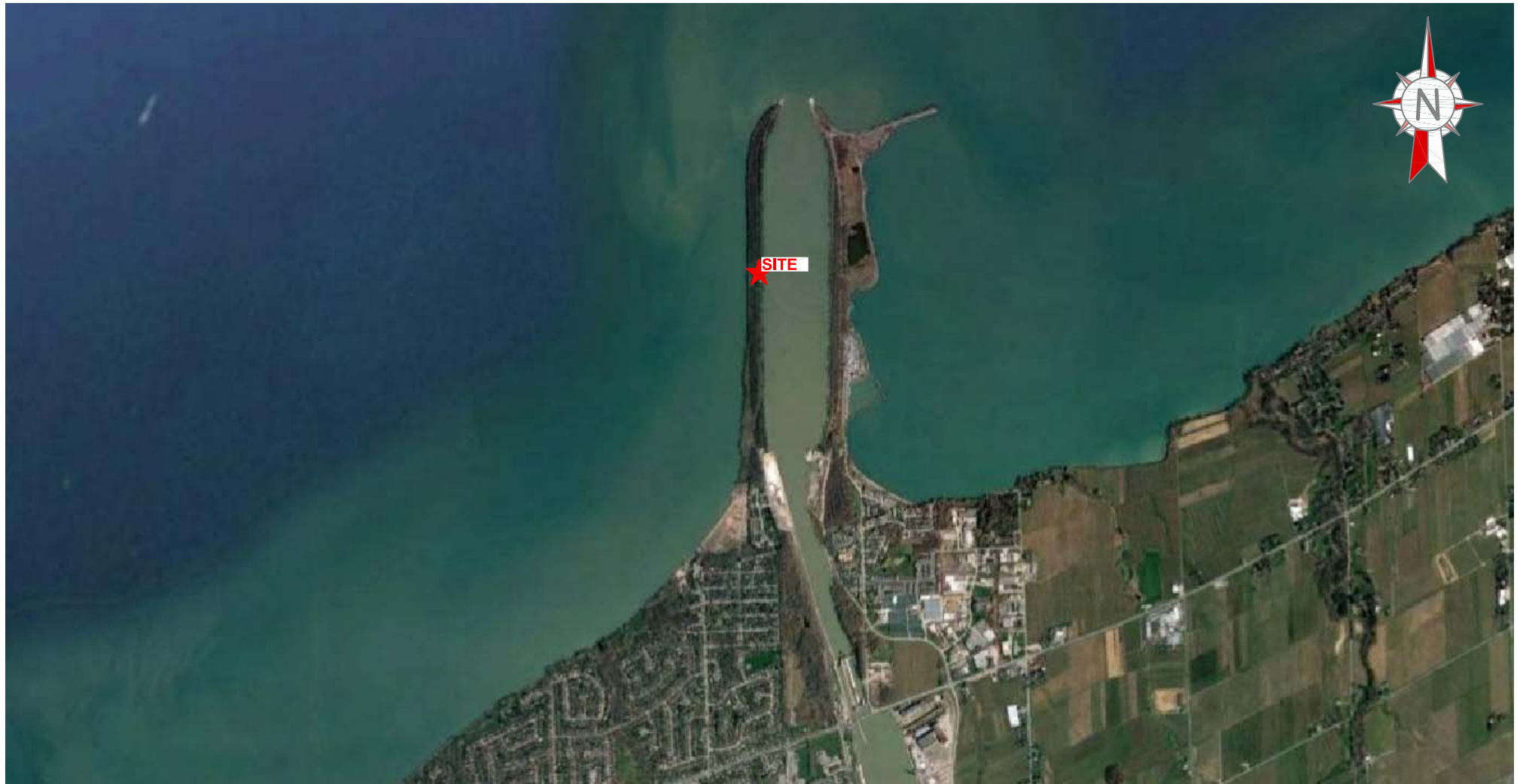
The comments provided in this report have been developed for the use of Public Works and Government Services Canada. It should be noted that on the borehole logs, the soil boundaries indicated are inferred from non-continuous sampling and observations during drilling and should not be interpreted as exact planes of geological change. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design. Also, the subsoil and groundwater conditions have been determined at the borehole location only.

The recommended bearing capacity has been calculated by Englobe from the information obtained from the borehole data.

It is further noted that, depending on the time of year the fieldwork was completed, water levels should be expected to vary, perhaps significantly, from those observed at the time of this investigation.

## **Appendix 1**

## **Borehole Location Plan**



**SITE LOCATION**

**NOTES :**

- 1 - REFERENCES : Google Earth 2017.
- 2 - Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

**PORT WELLER  
SEARCH AND RESCUE(SAR) STATION  
REVITALIZATION**  
ST. CATHARINES, ON.

Title

**SITE LOCATION PLAN**



1821, Albion Road, Unit 7  
Toronto (Ontario) M9W 5W8  
Telephone : 416.213.1060  
Fax : 416.213.1070

Prepared **M. Kamala**

Drawn **M. Kamala**

Checked **Q.Cheema**

Discipline **GEOTECHNICAL ENGINEERING**

Scale **N.T.S.**

Date **2017/09/15**

Project manager

**H. Akbari**

Sequence no.

**01 of 02**

M. dept.	Project	Work pkg.	Sub-w.p.	Disc.	Type	Drawing no.	Rev.
<b>124</b>	<b>B-0017786</b>	<b>0-01</b>	<b>100</b>	<b>PE</b>	<b>D</b>	<b>01</b>	<b>00</b>





BOREHOLE LOCATION

**NOTES :**

- 1 - REFERENCES : Google Earth 2017.
- 2 - Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

**PORT WELLER  
SEARCH AND RESCUE (SAR) STATION  
REVITALIZATION**  
ST. CATHARINES, ON

Title

**BOREHOLE LOCATION PLAN**



1821, Albion Road, Unit 7  
Toronto (Ontario) M9W 5W8  
Telephone : 416.213.1060  
Fax : 416.213.1070

Prepared **M. Kamala**

Drawn **M. Kamala**

Checked **Q.Cheema**

Discipline **GEOTECHNICAL ENGINEERING**

Scale **N.T.S.**

Date **2017/09/15**

Project manager

**H. Akbari**

Sequence no.

**02 of 02**

M. dept.	Project	Work pkg.	Sub-w.p.	Disc.	Type	Drawing no.	Rev.
124	B-0017786	0-01	001	PE	D	02	00

## Appendix 2

## Borehole Logs

# LOG OF No. BH1

Englobe

Project No. B-0017786-0-01

DRAWING No. 2

Project: Port Weller Search and Rescue Station (SAR)

Sheet No. 1 of 1

Location: St. Catharines, ON

N 4,788,311.500 E 327,613.083

Date Drilled: 23/8/2017

Drill Type: Solid Stem Augers

Datum: Geodetic (MTM - NAD 27, Zone 10)

Split Spoon Sample



Auger Sample



SPT (N) Value



Dynamic Cone Test



Shelby Tube



Shear Strength by

Vane Test



Natural Moisture Content



Atterberg Limits



Undrained Triaxial at

% Strain at Failure



Shear Strength by

Penetrometer Test



GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH m	Standard Penetration Test N Value		Natural Moisture Content %		SAMPLING	Natural Unit Weight kN/m <sup>3</sup>
					20	40	60	80		
		PORTLAND CONCRETE (130 mm)	79.4	0						
		FILL: silty sand, some gravel, contains cobbles, loose to compact, brown, moist	79.2							
				1						
				2						
		turns wet, grey								
		contains shale fragments								
		SILTY CLAY: some sand to sandy, some gravel, soft to stiff, grey, wet	75.7							
		SS6: Gr: 7%, Sa: 20%, Si: 38%, Cl: 35%								
				5						
				6						
		Terminated at 6.7 m	72.7							
		Borehole advanced using continuous flight of solid stem augering equipment on August 23, 2017 by Elite Drilling.								
		Water was encountered upon completion of drilling at 2.9 mbgs.								

Checked By: H. Akbari

Logged By: N. Du

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	2.9	

LOG A GWWL02\_ENGLOBE P-0017786-0-01 BOREHOLE LOGS.GPJ LOG A GWWL02.GDT 14/9/17



# Englobe

DRAWING No. 2

Sheet No. 1 of 1

Location: St. Catharines, ON

N 4.788,327.641 E 327,591.149

Date Drilled: 23/8/2017

Drill Type: Solid Stem Augers

Datum: Geodetic (MTM - NAD 27, Zone 10)

### Split Spoon Sample



Auger Sample



SPT (N) Value



### Dynamic Cone Test



Shelby Tube



Shear Strength by

### Vane Test



### Natural Moisture Content



### Atterberg Limits



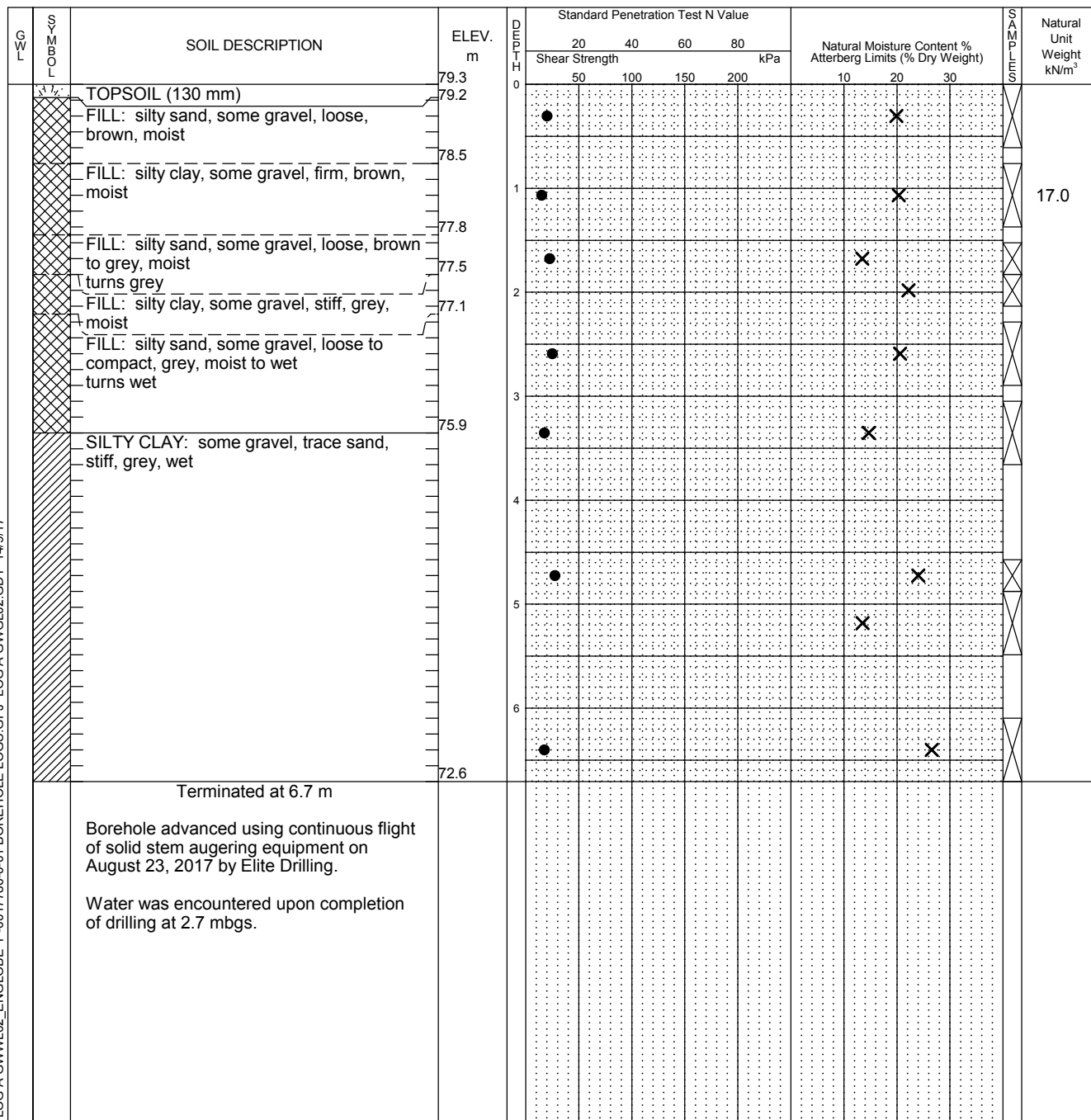
Undrained Triaxial at



### % Strain at Failure



### Shear Strength by



Time	Water Level (m)	Depth to Cave (m)
Upon Completion	2.7	

# LOG OF No. BH3

Englobe

Project No. B-0017786-0-01

DRAWING No. 2

Project: Port Weller Search and Rescue Station (SAR)

Sheet No. 1 of 1

Location: St. Catharines, ON

N 4,788,326.052 E 327,613.587

Date Drilled: 23/8/2017

Drill Type: Solid Stem Augers

Datum: Geodetic (MTM - NAD 27, Zone 10)

Split Spoon Sample



Auger Sample



SPT (N) Value



Dynamic Cone Test



Shelby Tube



Shear Strength by



Vane Test

Natural Moisture Content



Atterberg Limits



Undrained Triaxial at



% Strain at Failure



Shear Strength by



Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH m	Standard Penetration Test N Value				Natural Moisture Content % Atterberg Limits (% Dry Weight)			SAMPLES	Natural Unit Weight kN/m <sup>3</sup>
					20	40	60	80	10	20	30		
		PORTLAND CONCRETE (130 mm)	79.4	0									
		FILL: silty sand, some gravel, very loose to compact, brown, moist	79.3										
				1									
				2									
		Terminated at 2.1 m	77.3										
		Borehole advanced using continuous flight of solid stem augering equipment on August 23, 2017 by Elite Drilling.											
		No Water was encountered upon completion of drilling.											

LOG A GWWL02\_ENGLOBE P-0017786-0-01 BOREHOLE LOGS.GPJ LOG A GWWL02.GDT 14/9/17

Checked By: H. Akbari

Logged By: N. Du

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	none	

## Englobe

DRAWING No. 2

Sheet No. 1 of 1

Location: St. Catharines, ON

N 4,788,329.645 E 327,597.976

Date Drilled: 23/8/2017

Drill Type: Solid Stem AugersDatum: Geodetic (MTM - NAD 27, Zone 10)

Split Spoon Sample



Auger Sample



SPT (N) Value



### Dynamic Cone Test



Shelby Tube



Shear Strength by



## Vane Test



### Natural Moisture Content



### Atterberg Limits



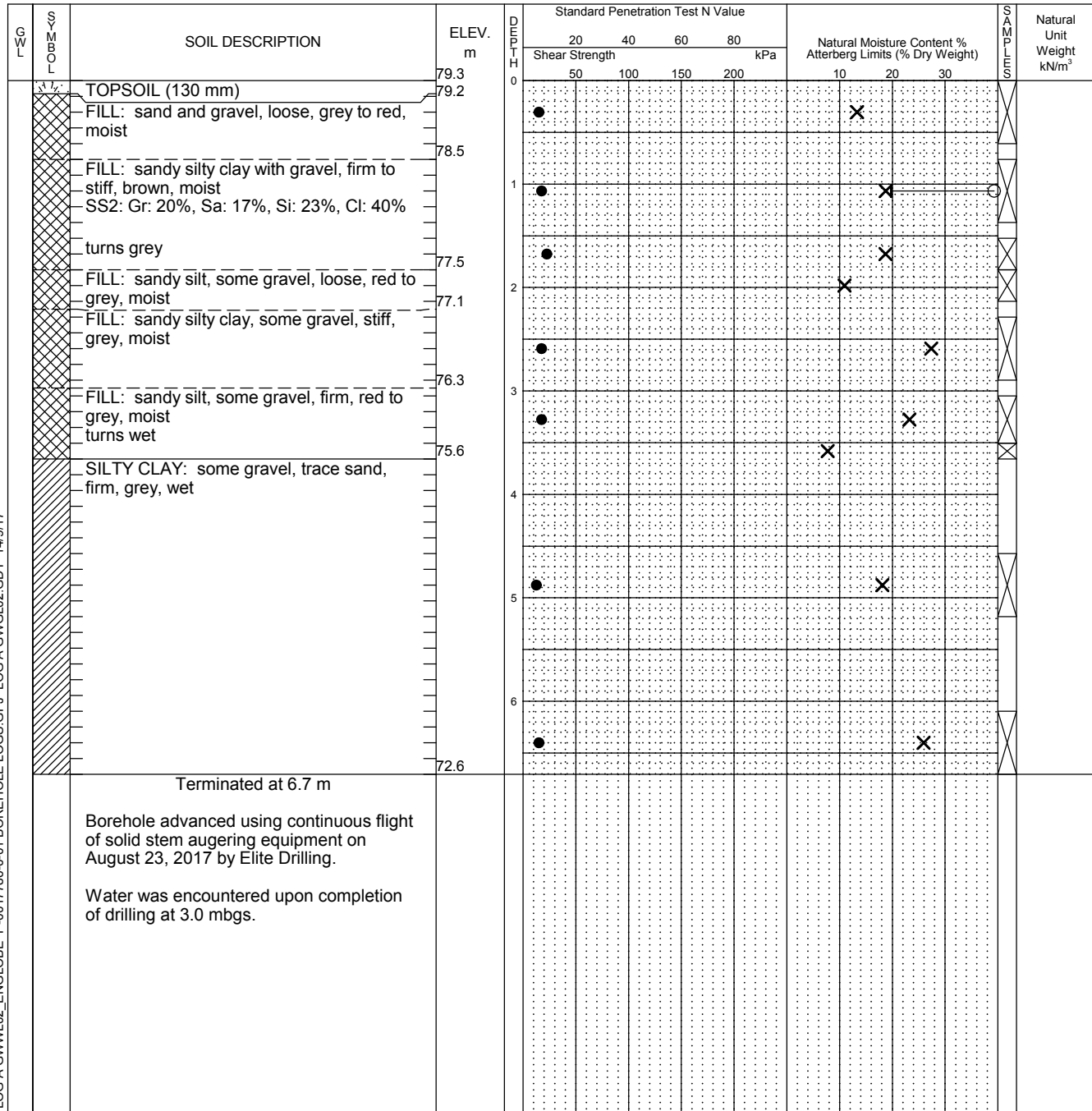
Undrained Triaxial at



### % Strain at Failure



### Shear Strength by Dilatometer Test



Checked By: H.Akbari

Logged By: N. Du

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	3.0	

# LOG OF No. BH5

Englobe

Project No. B-0017786-0-01

DRAWING No. 2

Project: Port Weller Search and Rescue Station (SAR)

Sheet No. 1 of 1

Location: St. Catharines, ON

N 4,788,308.119 E 327,599.376

Date Drilled: 23/8/2017

Drill Type: Solid Stem Augers

Datum: Geodetic (MTM - NAD 27, Zone 10)

Split Spoon Sample



Auger Sample



SPT (N) Value



Dynamic Cone Test



Shelby Tube



Shear Strength by  
Vane Test



Natural Moisture Content



Atterberg Limits



Undrained Triaxial at

% Strain at Failure



Shear Strength by  
Penetrometer Test



GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m	DEPTH m	Standard Penetration Test N Value				Natural Moisture Content % Atterberg Limits (% Dry Weight)			SAMPLES	Natural Unit Weight kN/m <sup>3</sup>
					Shear Strength								
					20	40	60	80	10	20	30		
		TOPSOIL (130 mm)	79.4	0									
		FILL: silty clay, some gravel, firm to stiff, brown to red, moist	79.3										
		turns grey		1									
				2									
			76.7										
		SILTY CLAY: some gravel, trace sand, firm to stiff, grey to red, wet		3									
		turns wet		4									
		contains sand pockets, wet		5									
				6									
			72.7										
		Terminated at 6.7 m											
		Borehole advanced using continuous flight of solid stem augering equipment on August 23, 2017 by Elite Drilling.											
		Water was encountered upon completion of drilling at 3.7 mbgs.											

Checked By: H. Akbari

Logged By: N. Du

Time	Water Level (m)	Depth to Cave (m)
Upon Completion	3.7	

LOG A GWWL02\_ENGLOBE P-0017786-0-01 BOREHOLE LOGS.GPJ LOG A GWWL02.GDT 14/9/17

# LOG OF No. BH6

Englobe

Project No. B-0017786-0-01

DRAWING No. 2

Project: Port Weller Search and Rescue Station (SAR)

Sheet No. 1 of 1

Location: St. Catharines, ON

N 4,788,308.311 E 327,591.815

Date Drilled: 23/8/2017

Drill Type: Solid Stem Augers

Datum: Geodetic (MTM - NAD 27, Zone 10)

Split Spoon Sample



Auger Sample



SPT (N) Value



Dynamic Cone Test



Shelby Tube



Shear Strength by



Vane Test

Natural Moisture Content



Atterberg Limits



Undrained Triaxial at



% Strain at Failure



Shear Strength by



Penetrometer Test



## **Appendix 3**

## **Geotechnical Laboratory Results**

## GRAIN SIZE ANALYSIS AND HYDROMETER TEST REPORT

### MTO LS-602, 702, AND 703/704

PROJECT: B-0017786    CLIENT/JOB NAME: Public Works & Government Services    CONTRACT NUMBER:                     

ROS ID: 70231    PROJECT/LOCATION: Geotechnical Investigation Services/ Port Weller

SAMPLING LOCATION:	BH1 SS6	GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SAMPLING DEPTH, m	4.5 - 5.2	SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
SAMPLING METHOD:	Split Spoon	53.0	100.0	0.037	58.1
SAMPLED BY:	ND, Englobe	37.5	100.0	0.026	52.4
SAMPLE DESCRIPTION:	Sandy Silty Clay, trace Gravel	26.5	100.0	0.017	47.3
SAMPLING DATE:	2017-08-24	19.0	100.0	0.010	42.1
SAMPLE RECEIVED DATE:	2017-08-24	13.2	98.1	0.007	38.3
		9.5	96.5	0.005	34.7
		4.75	93.3	0.003	30.0
		2.36	89.1	0.001	22.2
		1.18	86.2	ATTERBERG LIMITS, %	
		0.60	82.4		
		0.30	79.3	Plastic Limit	13.7
		0.15	77.2	Liquid Limit	27.3
		0.075	73.4	Plastic Index	13.6

GRAIN SIZE PROPORTIONS, %	
% GRAVEL ( > 4.75 mm):	6.7
% SAND ( 75 µm to 4.75 mm):	19.9
% Silt ( 5 µm to 75 µm):	38.7
% Clay ( < 5 µm):	34.7
SUSCEPTIBILITY TO FROST HEAVING:	Low

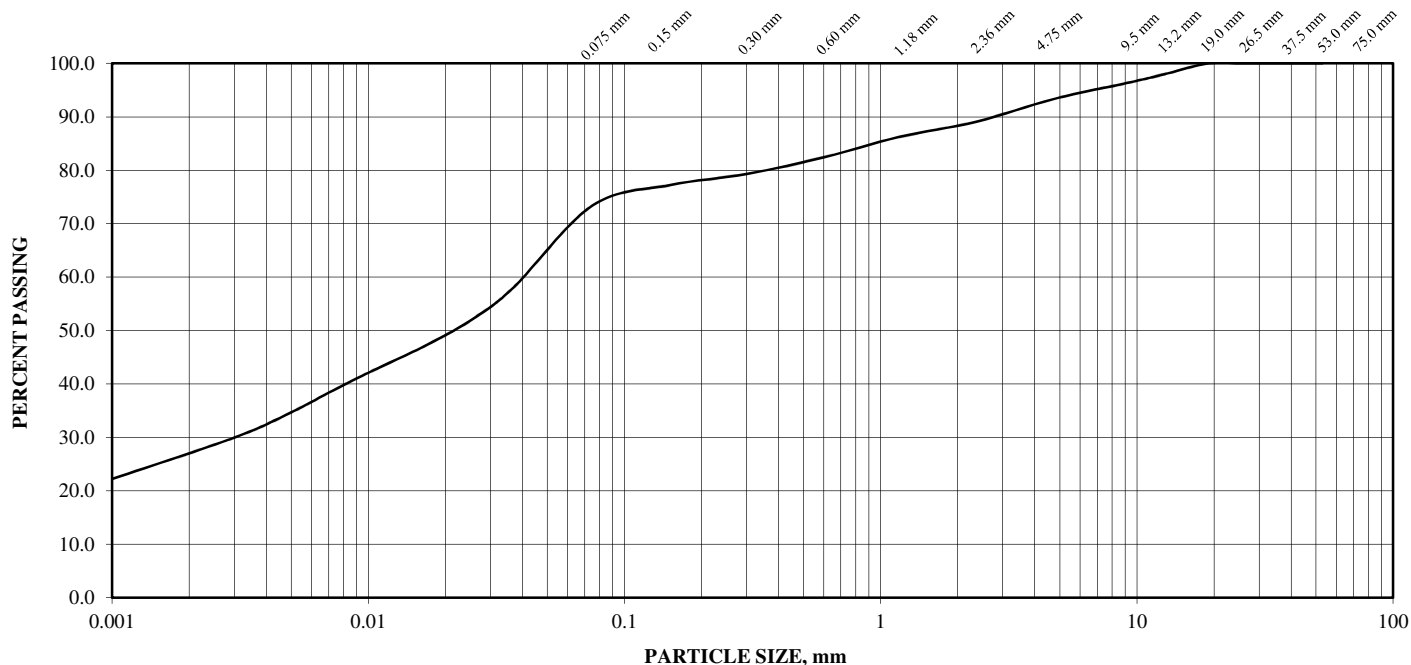
### PARTICLE SIZE DISTRIBUTION, MTO LS-702

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	GRAVEL
------	------	----------------	-----------	-------------	-------------	-------------	--------

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL
---------------------	-----------	-------------	-------------	-------------	---------------



**PARTNERS IN QUALITY INFRASTRUCTURE**

Engineering / Research / Development / Education  
 Soil / Rock / Aggregates / Slags / Asphalt / Cement / Concrete / Byproducts

**ISO 9001**

## GRAIN SIZE ANALYSIS AND HYDROMETER TEST REPORT

### MTO LS-602, 702, AND 703/704

PROJECT: B-0017786    CLIENT/JOB NAME: Public Works & Government Services    CONTRACT NUMBER: -

ROS ID: 70231    PROJECT/LOCATION: Geotechnical Investigation Services/ Port Weller

SAMPLING LOCATION:	BH4 SS2	GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SAMPLING DEPTH, m	0.76 - 1.37	SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
SAMPLING METHOD:	Split Spoon	53.0	100.0	0.037	53.2
SAMPLED BY:	ND, Englobe	37.5	100.0	0.026	50.0
SAMPLE DESCRIPTION:	Sandy Silty Clay with Gravel	26.5	100.0	0.017	48.2
SAMPLING DATE:	2017-08-24	19.0	100.0	0.010	44.6
SAMPLE RECEIVED DATE:	2017-08-24	13.2	94.4	0.007	42.4
		9.5	88.5	0.005	39.5
		4.75	79.8	0.003	36.1
		2.36	71.2	0.001	27.3
		1.18	67.0	ATTERBERG LIMITS, %	
		0.60	65.1		
		0.30	63.7	Plastic Limit	19.8
		0.15	63.0	Liquid Limit	39.3
		0.075	62.6	Plastic Index	19.5

GRAIN SIZE PROPORTIONS, %	
% GRAVEL ( > 4.75 mm):	20.2
% SAND ( 75 µm to 4.75 mm):	17.2
% Silt ( 5 µm to 75 µm):	23.1
% Clay ( < 5 µm):	39.5
SUSCEPTIBILITY TO FROST HEAVING:	Low

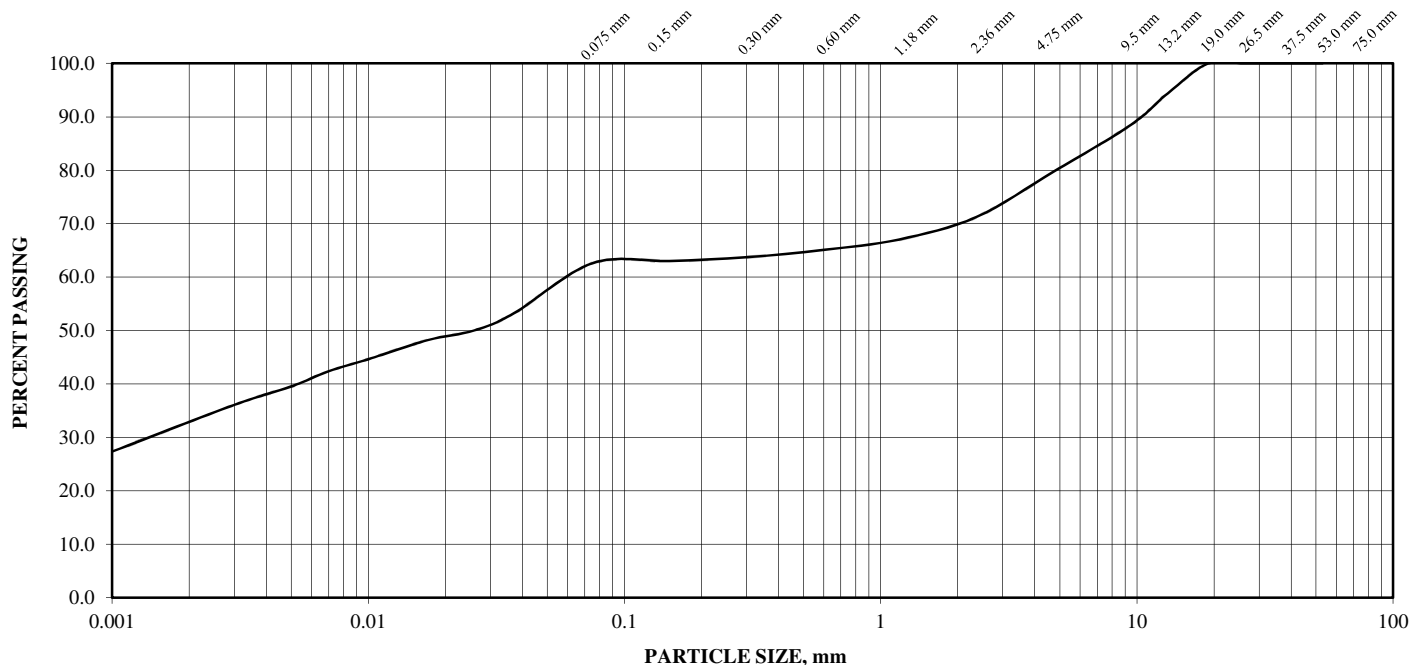
### PARTICLE SIZE DISTRIBUTION, MTO LS-702

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	GRAVEL
------	------	----------------	-----------	-------------	-------------	-------------	--------

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL
---------------------	-----------	-------------	-------------	-------------	---------------



### PARTNERS IN QUALITY INFRASTRUCTURE

Engineering / Research / Development / Education  
 Soil / Rock / Aggregates / Slags / Asphalt / Cement / Concrete / Byproducts

ISO 9001



## GRAIN SIZE ANALYSIS AND HYDROMETER TEST REPORT

### MTO LS-602, 702, AND 703/704

PROJECT: B-0017786    CLIENT/JOB NAME: Public Works & Government Services    CONTRACT NUMBER: -

ROS ID: 70231    PROJECT/LOCATION: Geotechnical Investigation Services/ Port Weller

SAMPLING LOCATION:	BH6 SS3	GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SAMPLING DEPTH, m	1.5 - 2.1	SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
SAMPLING METHOD:	Split Spoon	53.0	100.0	0.037	36.0
SAMPLED BY:	ND, Englobe	37.5	100.0	0.026	33.8
SAMPLE DESCRIPTION:	Sandy Silty Clay and Gravel	26.5	100.0	0.017	32.9
SAMPLING DATE:	2017-08-24	19.0	100.0	0.010	31.4
SAMPLE RECEIVED DATE:	2017-08-24	13.2	91.1	0.007	30.4
		9.5	81.6	0.005	28.8
		4.75	67.5	0.003	26.0
		2.36	53.8	0.001	20.9
		1.18	50.0	ATTERBERG LIMITS, %	
		0.60	48.6		
		0.30	47.6	Plastic Limit	19.1
		0.15	47.2	Liquid Limit	38.3
		0.075	46.5	Plastic Index	19.2

GRAIN SIZE PROPORTIONS, %	
% GRAVEL ( > 4.75 mm):	32.5
% SAND ( 75 µm to 4.75 mm):	21.0
% Silt ( 5 µm to 75 µm):	17.7
% Clay ( <5 µm):	28.8
SUSCEPTIBILITY TO FROST HEAVING:	Low

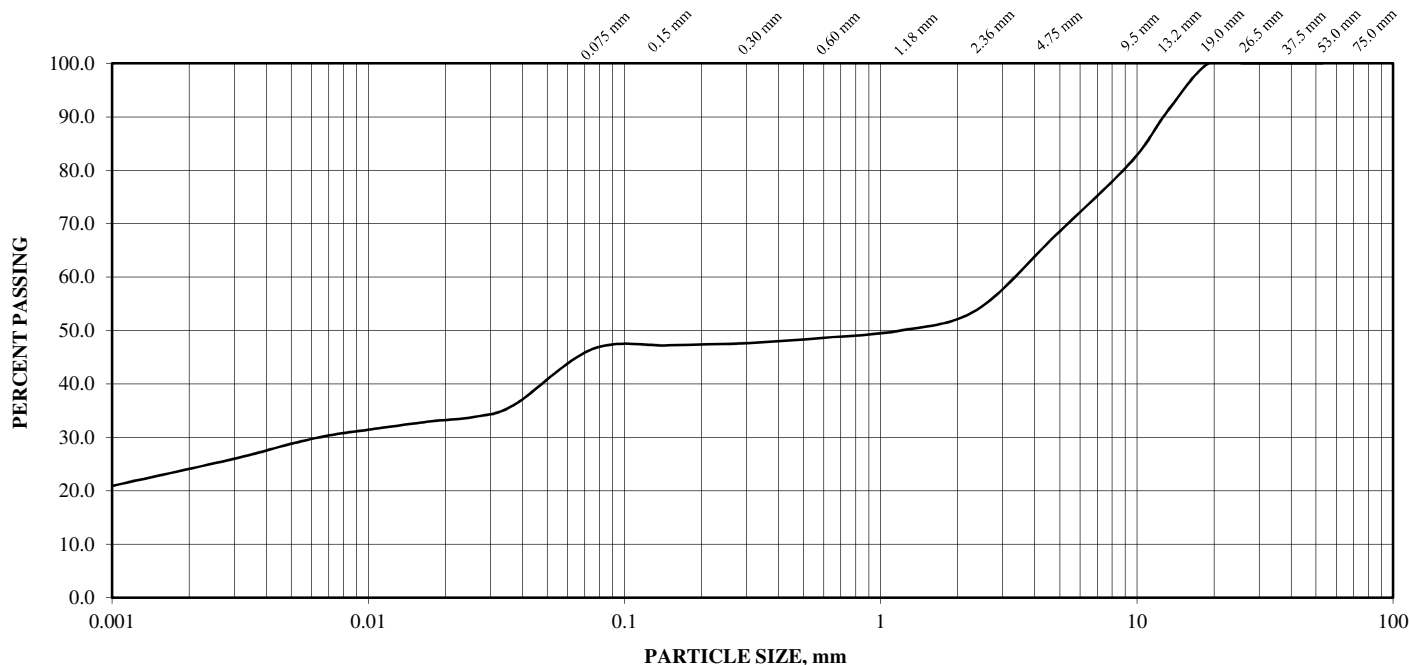
### PARTICLE SIZE DISTRIBUTION, MTO LS-702

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	GRAVEL
------	------	----------------	-----------	-------------	-------------	-------------	--------

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL
---------------------	-----------	-------------	-------------	-------------	---------------



### PARTNERS IN QUALITY INFRASTRUCTURE

Engineering / Research / Development / Education  
 Soil / Rock / Aggregates / Slags / Asphalt / Cement / Concrete / Byproducts

ISO 9001

## **Appendix 4**

## **Environmental Test Results**

Client: EnGlobe Corp. (Toronto)  
1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#: A10825  
Invoice to: EnGlobe Corp.

Report Number: 1716238  
Date Submitted: 2017-08-25  
Date Reported: 2017-09-01  
Project: B-0017786  
COC #: 821408

Page 1 of 31


Temperature: 3.6

---


**Dear Nan Du:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:

APPROVAL:   
Addrine Thomas, Inorganics Supervisor

Addrine  
Thomas  
2017.09.01  
16:02:16 -04'00'

APPROVAL:   
Long Qu, Organics Supervisor

Charlie  
Long Qu  
2017.09.01  
16:27:04  
-04'00'

All analysis is completed in Ottawa, Ontario (unless otherwise indicated).

Eurofins Ottawa is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on our CALA scope of accreditation. It can be found at <http://www.cala.ca/scopes/2602.pdf>.

Eurofins (Ottawa) is certified and accredited for specific parameters by OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils). Licensed by Ontario MOE for specific tests in drinking water.

Eurofins (Mississauga) is accredited for specific parameters by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required.

Client: EnGlobe Corp. (Toronto)  
1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#: A10825  
Invoice to: EnGlobe Corp.

Report Number: 1716238  
Date Submitted: 2017-08-25  
Date Reported: 2017-09-01  
Project: B-0017786  
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.			
					1316328 Soil Reg153  2017-08-12 BH-1-SS-1	1316329 Soil Reg153  2017-08-12 BH-1-SS-3B	1316330 Soil Reg153  2017-08-12 BH-1-SS-4	1316331 Soil Reg153  2017-08-12 BH-2-SS-1
Inorganics	Antimony	1	ug/g	STD 1.3	<1	1		<1
	Arsenic	1	ug/g	STD 18	4	12		4
	Barium	1	ug/g	STD 220	14	14		1630*
	Beryllium	1	ug/g	STD 2.5	<1	<1		<1
	Boron (Hot Water Soluble)	0.5	ug/g	STD 1.5	0.6	<0.5		<0.5
	Boron (total)	5	ug/g	STD 36	16	16		8
	Cadmium	0.5	ug/g	STD 1.2	<0.5	<0.5		<0.5
	Chromium Total	1	ug/g	STD 70	24	13		21
	Cobalt	1	ug/g	STD 22	12	15		12
	Copper	1	ug/g	STD 92	4	48		673*
	Cyanide (CN-)	0.03	ug/g	STD 0.051	<0.03	<0.03		<0.03
	Lead	1	ug/g	STD 120	5	16		204*
	Mercury	0.1	ug/g	STD 0.27	<0.1	<0.1		1.8*
	Molybdenum	1	ug/g	STD 2	1	<1		<1
	Nickel	1	ug/g	STD 82	32	25		20
	Selenium	1	ug/g	STD 1.5	<1	<1		<1
	Silver	0.2	ug/g	STD 0.5	<0.2	0.3		<0.2
	Thallium	1	ug/g	STD 1	<1	<1		<1
	Uranium	0.5	ug/g	STD 2.5	0.8	<0.5		0.7
	Vanadium	2	ug/g	STD 86	28	14		22
	Zinc	2	ug/g	STD 290	55	53		1070*
Misc/Others	Electrical Conductivity	0.05	mS/cm	STD 0.7	0.16	0.23		0.22
	pH - CaCl2	2.0			7.8	7.7		7.7
	Sodium Adsorption Ratio	0.01		STD 5	0.78	0.30		0.12
Moisture	Moisture-Humidite	0.1	%		6.6		2.2	15.9
Petroleum Hydrocarbo	Alpha-androstrane	0	%		94		88	108

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Client: EnGlobe Corp. (Toronto)  
1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#: A10825  
Invoice to: EnGlobe Corp.

Report Number: 1716238  
Date Submitted: 2017-08-25  
Date Reported: 2017-09-01  
Project: B-0017786  
COC #: 821408

					Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316328 Soil Reg153  2017-08-12 BH-1-SS-1	1316329 Soil Reg153  2017-08-12 BH-1-SS-3B	1316330 Soil Reg153  2017-08-12 BH-1-SS-4	1316331 Soil Reg153  2017-08-12 BH-2-SS-1
Group	Analyte	MRL	Units	Guideline					
Petroleum Hydrocarbons	Petroleum Hydrocarbons F2	10	ug/g	STD 10	<10		<10	<10	
	Petroleum Hydrocarbons F3	20	ug/g	STD 240	<20		<20	300*	
	Petroleum Hydrocarbons F4	20	ug/g	STD 120	20		<20	150*	
PHC (Hydrocarbons)**	Petroleum Hydrocarbons F1	10	ug/g	STD 25	<10		<10	<10	
	Petroleum Hydrocarbons F1-BTEX	10	ug/g		<10		<10	<10	
Semi-Volatiles	1+2-methylnaphthalene	0.05	ug/g		<0.05		<0.05	<0.05	
	Acenaphthene	0.05	ug/g	STD 0.072	<0.05		<0.05	<0.05	
	Acenaphthylene	0.05	ug/g	STD 0.093	<0.05		<0.05	<0.05	
	Anthracene	0.05	ug/g	STD 0.22	<0.05		<0.05	0.18	
	Benz[a]anthracene	0.05	ug/g	STD 0.36	<0.05		<0.05	0.27	
	Benzo[a]pyrene	0.05	ug/g	STD 0.3	<0.05		<0.05	0.24	
	Benzo[b]fluoranthene	0.05	ug/g	STD 0.47	<0.05		<0.05	0.38	
	Benzo[ghi]perylene	0.05	ug/g	STD 0.68	<0.05		<0.05	0.15	
	Benzo[k]fluoranthene	0.05	ug/g	STD 0.48	<0.05		<0.05	0.20	
	Chrysene	0.05	ug/g	STD 2.8	<0.05		<0.05	0.31	
	Dibenz[a h]anthracene	0.05	ug/g	STD 0.1	<0.05		<0.05	0.07	
	Fluoranthene	0.05	ug/g	STD 0.69	<0.05		<0.05	0.72*	
	Fluorene	0.05	ug/g	STD 0.19	<0.05		<0.05	<0.05	
	Indeno[1 2 3-cd]pyrene	0.05	ug/g		<0.05		<0.05	0.16	
	Methylnaphthalene, 1-	0.05	ug/g		<0.05		<0.05	<0.05	
	Methylnaphthalene, 2-	0.05	ug/g		<0.05		<0.05	<0.05	
	Naphthalene	0.05	ug/g	STD 0.09	<0.05		<0.05	<0.05	
	Phenanthrene	0.05	ug/g	STD 0.69	<0.05		<0.05	0.46	
	Pyrene	0.05	ug/g	STD 1	<0.05		<0.05	0.57	
Subcontracted	Chromium VI	0.2	ug/g	STD 0.66	<0.2	<0.2		<0.2	
VOCs Surrogates**	1,2-dichloroethane-d4	0	%		110		117	116	

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Group	Analyte	MRL	Units	Guideline					
VOCs Surrogates**	4-bromofluorobenzene	0	%		83			80	118
	Toluene-d8	0	%		110			115	87
Volatile Organics**	Acetone	0.50	ug/g	STD 0.5	<0.50			<0.50	<0.50
	Benzene	0.02	ug/g	STD 0.02	<0.02			<0.02	<0.02
	Bromodichloromethane	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Bromoform	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Carbon Tetrachloride	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Chlorobenzene	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Chloroform	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Dibromochloromethane	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Dichlorobenzene, 1,2-	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Dichlorobenzene, 1,3-	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Dichlorobenzene, 1,4-	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Dichlorodifluoromethane	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Dichloroethane, 1,1-	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Dichloroethane, 1,2-	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Dichloroethylene, 1,1-	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Dichloroethylene, 1,2-cis-	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Dichloroethylene, 1,2-trans-	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Dichloropropane, 1,2-	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Dichloropropene, 1,3-	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Dichloropropylene, 1,3-cis-	0.05	ug/g		<0.05			<0.05	<0.05
	Dichloropropylene, 1,3-trans-	0.05	ug/g		<0.05			<0.05	<0.05
	Ethylbenzene	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Ethylene dibromide	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05
	Hexane (n)	0.05	ug/g	STD 0.05	<0.05			<0.05	<0.05

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Group	Analyte	MRL	Units	Guideline					
Volatile Organics**	Methyl Ethyl Ketone	0.50	ug/g	STD 0.5	<0.50		<0.50	<0.50	
	Methyl Isobutyl Ketone	0.50	ug/g	STD 0.5	<0.50		<0.50	<0.50	
	Methyl tert-Butyl Ether (MTBE)	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Methylene Chloride	0.05	ug/g		<0.05		<0.05	<0.05	
	Styrene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Tetrachloroethane, 1,1,1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Tetrachloroethane, 1,1,2,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Tetrachloroethylene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Toluene	0.20	ug/g	STD 0.2	<0.20		<0.20	<0.20	
	Trichloroethane, 1,1,1-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Trichloroethane, 1,1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Trichloroethylene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Trichlorofluoromethane	0.05	ug/g	STD 0.25	<0.05		<0.05	<0.05	
	Vinyl Chloride	0.02	ug/g	STD 0.02	<0.02		<0.02	<0.02	
	Xylene Mixture	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Xylene, m/p-	0.05	ug/g		<0.05		<0.05	<0.05	
	Xylene, o-	0.05	ug/g		<0.05		<0.05	<0.05	

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Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.			
					1316332 Soil Reg153  2017-08-12 BH-2-SS-4	1316333 Soil Reg153  2017-08-12 BH-2-SS-5	1316334 Soil Reg153  2017-08-12 BH-3-SS-1	1316335 Soil Reg153  2017-08-12 BH-3-SS-2
Inorganics	Antimony	1	ug/g	STD 1.3		<1		<1
	Arsenic	1	ug/g	STD 18		5		7
	Barium	1	ug/g	STD 220		122		60
	Beryllium	1	ug/g	STD 2.5		<1		<1
	Boron (Hot Water Soluble)	0.5	ug/g	STD 1.5		<0.5		<0.5
	Boron (total)	5	ug/g	STD 36		6		14
	Cadmium	0.5	ug/g	STD 1.2		<0.5		<0.5
	Chromium Total	1	ug/g	STD 70		13		17
	Cobalt	1	ug/g	STD 22		8		9
	Copper	1	ug/g	STD 92		31		35
	Cyanide (CN-)	0.03	ug/g	STD 0.051		<0.03		<0.03
	Lead	1	ug/g	STD 120		7		33
	Mercury	0.1	ug/g	STD 0.27		<0.1		<0.1
	Molybdenum	1	ug/g	STD 2		<1		<1
	Nickel	1	ug/g	STD 82		16		19
	Selenium	1	ug/g	STD 1.5		<1		<1
	Silver	0.2	ug/g	STD 0.5		<0.2		0.2
	Thallium	1	ug/g	STD 1		<1		<1
	Uranium	0.5	ug/g	STD 2.5		<0.5		0.5
	Vanadium	2	ug/g	STD 86		20		17
	Zinc	2	ug/g	STD 290		46		85
Misc/Others	Chloride	0.002	%	STD N/A				0.008
	Electrical Conductivity	0.05	mS/cm	STD 0.7		1.42*		0.56
	pH	2.0						10.7
	pH - CaCl2	2.0				7.8		11.8
	Resistivity	1	ohm-cm					1790

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					Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316332 Soil Reg153  2017-08-12 BH-2-SS-4	1316333 Soil Reg153  2017-08-12 BH-2-SS-5	1316334 Soil Reg153  2017-08-12 BH-3-SS-1	1316335 Soil Reg153  2017-08-12 BH-3-SS-2
Group	Analyte	MRL	Units	Guideline					
Misc/Others	SO4	0.01	%						0.06
	Sodium Adsorption Ratio	0.01		STD 5		0.59			1.41
Moisture**	Moisture-Humidite	0.1	%		21.2		6.2		
PHC (Hydrocarbons)**	Petroleum Hydrocarbons F1	10	ug/g	STD 25	<10		<10		
	Petroleum Hydrocarbons F1-BTEX	10	ug/g		<10		<10		
	Petroleum Hydrocarbons F2	10	ug/g	STD 10	<10		<10		
	Petroleum Hydrocarbons F3	20	ug/g	STD 240	<20		60		
	Petroleum Hydrocarbons F4	20	ug/g	STD 120	<20		<20		
PHC Surrogate**	Alpha-androstrane	0	%		86		94		
Semi-Volatiles	1+2-methylnaphthalene	0.05	ug/g		<0.05		<0.05		
	Acenaphthene	0.05	ug/g	STD 0.072	<0.05		<0.05		
	Acenaphthylene	0.05	ug/g	STD 0.093	<0.05		<0.05		
	Anthracene	0.05	ug/g	STD 0.22	<0.05		<0.05		
	Benz[a]anthracene	0.05	ug/g	STD 0.36	<0.05		<0.05		
	Benzo[a]pyrene	0.05	ug/g	STD 0.3	<0.05		<0.05		
	Benzo[b]fluoranthene	0.05	ug/g	STD 0.47	<0.05		<0.05		
	Benzo[ghi]perylene	0.05	ug/g	STD 0.68	<0.05		<0.05		
	Benzo[k]fluoranthene	0.05	ug/g	STD 0.48	<0.05		<0.05		
	Chrysene	0.05	ug/g	STD 2.8	<0.05		<0.05		
	Dibenz[a h]anthracene	0.05	ug/g	STD 0.1	<0.05		<0.05		
	Fluoranthene	0.05	ug/g	STD 0.69	<0.05		<0.05		
	Fluorene	0.05	ug/g	STD 0.19	<0.05		<0.05		
	Indeno[1 2 3-cd]pyrene	0.05	ug/g		<0.05		<0.05		
	Methylnaphthalene, 1-	0.05	ug/g		<0.05		<0.05		
	Methylnaphthalene, 2-	0.05	ug/g		<0.05		<0.05		
	Naphthalene	0.05	ug/g	STD 0.09	<0.05		<0.05		

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Group	Analyte	MRL	Units	Guideline					
Semi-Volatiles	Phenanthrene	0.05	ug/g	STD 0.69	<0.05			<0.05	
	Pyrene	0.05	ug/g	STD 1	<0.05			<0.05	
Subcontracted	Chromium VI	0.2	ug/g	STD 0.66			<0.2		<0.2
	REDOX Potential	0	mV						285
	S2-	1	ug/g						1
VOCs Surrogates**	1,2-dichloroethane-d4	0	%		117			117	
	4-bromofluorobenzene	0	%		110			86	
	Toluene-d8	0	%		89			102	
Volatile Organics**	Acetone	0.50	ug/g	STD 0.5	<0.50			<0.50	
	Benzene	0.02	ug/g	STD 0.02	<0.02			<0.02	
	Bromodichloromethane	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Bromoform	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Carbon Tetrachloride	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Chlorobenzene	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Chloroform	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Dibromochloromethane	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Dichlorobenzene, 1,2-	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Dichlorobenzene, 1,3-	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Dichlorobenzene, 1,4-	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Dichlorodifluoromethane	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Dichloroethane, 1,1-	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Dichloroethane, 1,2-	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Dichloroethylene, 1,1-	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Dichloroethylene, 1,2-cis-	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Dichloroethylene, 1,2-trans-	0.05	ug/g	STD 0.05	<0.05			<0.05	
	Dichloropropane, 1,2-	0.05	ug/g	STD 0.05	<0.05			<0.05	

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Group	Analyte	MRL	Units	Guideline					
Volatile Organics**	Dichloropropene, 1,3-	0.05	ug/g	STD 0.05	<0.05		<0.05		
	Dichloropropylene, 1,3-cis-	0.05	ug/g		<0.05		<0.05		
	Dichloropropylene, 1,3-trans-	0.05	ug/g		<0.05		<0.05		
	Ethylbenzene	0.05	ug/g	STD 0.05	<0.05		<0.05		
	Ethylene dibromide	0.05	ug/g	STD 0.05	<0.05		<0.05		
	Hexane (n)	0.05	ug/g	STD 0.05	<0.05		<0.05		
	Methyl Ethyl Ketone	0.50	ug/g	STD 0.5	<0.50		<0.50		
	Methyl Isobutyl Ketone	0.50	ug/g	STD 0.5	<0.50		<0.50		
	Methyl tert-Butyl Ether (MTBE)	0.05	ug/g	STD 0.05	<0.05		<0.05		
	Methylene Chloride	0.05	ug/g		<0.05		<0.05		
	Styrene	0.05	ug/g	STD 0.05	<0.05		<0.05		
	Tetrachloroethane, 1,1,1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05		
	Tetrachloroethane, 1,1,2,2-	0.05	ug/g	STD 0.05	<0.05		<0.05		
	Tetrachloroethylene	0.05	ug/g	STD 0.05	<0.05		<0.05		
	Toluene	0.20	ug/g	STD 0.2	<0.20		<0.20		
	Trichloroethane, 1,1,1-	0.05	ug/g	STD 0.05	<0.05		<0.05		
	Trichloroethane, 1,1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05		
	Trichloroethylene	0.05	ug/g	STD 0.05	<0.05		<0.05		
	Trichlorofluoromethane	0.05	ug/g	STD 0.25	<0.05		<0.05		
	Vinyl Chloride	0.02	ug/g	STD 0.02	<0.02		<0.02		
	Xylene Mixture	0.05	ug/g	STD 0.05	<0.05		<0.05		
	Xylene, m/p-	0.05	ug/g		<0.05		<0.05		
	Xylene, o-	0.05	ug/g		<0.05		<0.05		

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Client: EnGlobe Corp. (Toronto)  
1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#:  
Invoice to: EnGlobe Corp.

Report Number: 1716238  
Date Submitted: 2017-08-25  
Date Reported: 2017-09-01  
Project: B-0017786  
COC #: 821408

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.			
					1316336 Soil Reg153  2017-08-12 BH-4-SS-1	1316337 Soil Reg153  2017-08-12 BH-4-SS-5A	1316338 Soil Reg153  2017-08-12 BH-4-SS-6	1316339 Soil Reg153  2017-08-12 BH-5-SS-1
Inorganics	Antimony	1	ug/g	STD 1.3	<1		<1	<1
	Arsenic	1	ug/g	STD 18	5		4	5
	Barium	1	ug/g	STD 220	85		91	124
	Beryllium	1	ug/g	STD 2.5	<1		<1	<1
	Boron (Hot Water Soluble)	0.5	ug/g	STD 1.5	<0.5		<0.5	<0.5
	Boron (total)	5	ug/g	STD 36	7		7	9
	Cadmium	0.5	ug/g	STD 1.2	<0.5		<0.5	<0.5
	Chromium Total	1	ug/g	STD 70	15		19	25
	Cobalt	1	ug/g	STD 22	7		10	13
	Copper	1	ug/g	STD 92	32		24	27
	Cyanide (CN-)	0.03	ug/g	STD 0.051	<0.03		<0.03	<0.03
	Lead	1	ug/g	STD 120	65		7	15
	Mercury	0.1	ug/g	STD 0.27	0.3*		<0.1	<0.1
	Molybdenum	1	ug/g	STD 2	<1		<1	<1
	Nickel	1	ug/g	STD 82	16		22	28
	Selenium	1	ug/g	STD 1.5	<1		<1	<1
	Silver	0.2	ug/g	STD 0.5	<0.2		<0.2	<0.2
	Thallium	1	ug/g	STD 1	<1		<1	<1
	Uranium	0.5	ug/g	STD 2.5	<0.5		0.5	0.6
	Vanadium	2	ug/g	STD 86	18		26	33
	Zinc	2	ug/g	STD 290	100		49	85
Misc/Others	Electrical Conductivity	0.05	mS/cm	STD 0.7	0.22		0.78*	0.22
	pH - CaCl2	2.0			7.7		7.9	7.8
	Sodium Adsorption Ratio	0.01		STD 5	0.11		1.14	0.13
Moisture**	Moisture-Humidite	0.1	%		11.6	19.2		17.0
PHC (Hydrocarbons)	Petroleum Hydrocarbons F1	10	ug/g	STD 25	<10	<10		<10

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					Lab I.D.	1316336	1316337	1316338	1316339
					Sample Matrix	Soil Reg153	Soil Reg153	Soil Reg153	Soil Reg153
					Sample Type				
					Sampling Date	2017-08-12	2017-08-12	2017-08-12	2017-08-12
					Sample I.D.	BH-4-SS-1	BH-4-SS-5A	BH-4-SS-6	BH-5-SS-1
Group	Analyte	MRL	Units	Guideline					
PHC (Hydrocarbons)**	Petroleum Hydrocarbons F1-BTEX	10	ug/g		<10	<10		<10	
	Petroleum Hydrocarbons F2	10	ug/g	STD 10	<10	<10		<10	
	Petroleum Hydrocarbons F3	20	ug/g	STD 240	<20	<20		<20	
	Petroleum Hydrocarbons F4	20	ug/g	STD 120	<20	<20		<20	
PHC Surrogate**	Alpha-androstrane	0	%		98	72		86	
Semi-Volatiles	1+2-methylnaphthalene	0.05	ug/g		<0.05	<0.05		<0.05	
	Acenaphthene	0.05	ug/g	STD 0.072	<0.05	<0.05		<0.05	
	Acenaphthylene	0.05	ug/g	STD 0.093	<0.05	<0.05		<0.05	
	Anthracene	0.05	ug/g	STD 0.22	<0.05	<0.05		<0.05	
	Benz[a]anthracene	0.05	ug/g	STD 0.36	<0.05	<0.05		<0.05	
	Benzo[a]pyrene	0.05	ug/g	STD 0.3	<0.05	<0.05		<0.05	
	Benzo[b]fluoranthene	0.05	ug/g	STD 0.47	<0.05	<0.05		<0.05	
	Benzo[ghi]perylene	0.05	ug/g	STD 0.68	<0.05	<0.05		<0.05	
	Benzo[k]fluoranthene	0.05	ug/g	STD 0.48	<0.05	<0.05		<0.05	
	Chrysene	0.05	ug/g	STD 2.8	<0.05	<0.05		<0.05	
	Dibenz[a h]anthracene	0.05	ug/g	STD 0.1	<0.05	<0.05		<0.05	
	Fluoranthene	0.05	ug/g	STD 0.69	<0.05	<0.05		<0.05	
	Fluorene	0.05	ug/g	STD 0.19	<0.05	<0.05		<0.05	
	Indeno[1 2 3-cd]pyrene	0.05	ug/g		<0.05	<0.05		<0.05	
	Methylnaphthalene, 1-	0.05	ug/g		<0.05	<0.05		<0.05	
	Methylnaphthalene, 2-	0.05	ug/g		<0.05	<0.05		<0.05	
	Naphthalene	0.05	ug/g	STD 0.09	<0.05	<0.05		<0.05	
	Phenanthrene	0.05	ug/g	STD 0.69	<0.05	<0.05		<0.05	
	Pyrene	0.05	ug/g	STD 1	<0.05	<0.05		<0.05	
Subcontracted	Chromium VI	0.2	ug/g	STD 0.66	<0.2		<0.2	<0.2	
VOCs Surrogates**	1,2-dichloroethane-d4	0	%		116	115		118	

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					Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316336 Soil Reg153  2017-08-12 BH-4-SS-1	1316337 Soil Reg153  2017-08-12 BH-4-SS-5A	1316338 Soil Reg153  2017-08-12 BH-4-SS-6	1316339 Soil Reg153  2017-08-12 BH-5-SS-1
Group	Analyte	MRL	Units	Guideline					
VOCs Surrogates**	4-bromofluorobenzene	0	%			109	80		89
	Toluene-d8	0	%			88	106		91
Volatile Organics**	Acetone	0.50	ug/g	STD 0.5		<0.50	<0.50		<0.50
	Benzene	0.02	ug/g	STD 0.02		<0.02	<0.02		<0.02
	Bromodichloromethane	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Bromoform	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Carbon Tetrachloride	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Chlorobenzene	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Chloroform	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Dibromochloromethane	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Dichlorobenzene, 1,2-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Dichlorobenzene, 1,3-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Dichlorobenzene, 1,4-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Dichlorodifluoromethane	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Dichloroethane, 1,1-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Dichloroethane, 1,2-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Dichloroethylene, 1,1-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Dichloroethylene, 1,2-cis-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Dichloroethylene, 1,2-trans-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Dichloropropane, 1,2-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Dichloropropene, 1,3-	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Dichloropropylene, 1,3-cis-	0.05	ug/g			<0.05	<0.05		<0.05
	Dichloropropylene, 1,3-trans-	0.05	ug/g			<0.05	<0.05		<0.05
	Ethylbenzene	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Ethylene dibromide	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05
	Hexane (n)	0.05	ug/g	STD 0.05		<0.05	<0.05		<0.05

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					1316336 Soil Reg153  2017-08-12 BH-4-SS-1	1316337 Soil Reg153  2017-08-12 BH-4-SS-5A	1316338 Soil Reg153  2017-08-12 BH-4-SS-6	1316339 Soil Reg153  2017-08-12 BH-5-SS-1
Group	Analyte	MRL	Units	Guideline				
Volatile Organics**	Methyl Ethyl Ketone	0.50	ug/g	STD 0.5	<0.50	<0.50		<0.50
	Methyl Isobutyl Ketone	0.50	ug/g	STD 0.5	<0.50	<0.50		<0.50
	Methyl tert-Butyl Ether (MTBE)	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Methylene Chloride	0.05	ug/g		<0.05	<0.05		<0.05
	Styrene	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Tetrachloroethane, 1,1,1,2-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Tetrachloroethane, 1,1,2,2-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Tetrachloroethylene	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Toluene	0.20	ug/g	STD 0.2	<0.20	<0.20		<0.20
	Trichloroethane, 1,1,1-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Trichloroethane, 1,1,2-	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Trichloroethylene	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Trichlorofluoromethane	0.05	ug/g	STD 0.25	<0.05	<0.05		<0.05
	Vinyl Chloride	0.02	ug/g	STD 0.02	<0.02	<0.02		<0.02
	Xylene Mixture	0.05	ug/g	STD 0.05	<0.05	<0.05		<0.05
	Xylene, m/p-	0.05	ug/g		<0.05	<0.05		<0.05
	Xylene, o-	0.05	ug/g		<0.05	<0.05		<0.05

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Group	Analyte	MRL	Units	Guideline	Lab I.D.	Sample Matrix	Sample Type	Sampling Date	Sample I.D.
					1316340	1316341	1316342	1316343	1316343
Inorganics	Antimony	1	ug/g	STD 1.3	Soil Reg153	Soil Reg153	Soil Reg153	Soil Reg153	Soil Reg153
	Arsenic	1	ug/g	STD 18	2017-08-12	2017-08-12	2017-08-12	2017-08-12	2017-08-12
	Barium	1	ug/g	STD 220	BH-5-SS-4	BH-5-SS-5	BH-6-SS-2	BH-6-SS-5	BH-6-SS-5
	Beryllium	1	ug/g	STD 2.5					
	Boron (Hot Water Soluble)	0.5	ug/g	STD 1.5					
	Boron (total)	5	ug/g	STD 36					
	Cadmium	0.5	ug/g	STD 1.2					
	Chromium Total	1	ug/g	STD 70					
	Cobalt	1	ug/g	STD 22					
	Copper	1	ug/g	STD 92					
	Cyanide (CN-)	0.03	ug/g	STD 0.051					
	Lead	1	ug/g	STD 120					
	Mercury	0.1	ug/g	STD 0.27					
	Molybdenum	1	ug/g	STD 2					
	Nickel	1	ug/g	STD 82					
	Selenium	1	ug/g	STD 1.5					
	Silver	0.2	ug/g	STD 0.5					
	Thallium	1	ug/g	STD 1					
	Uranium	0.5	ug/g	STD 2.5					
	Vanadium	2	ug/g	STD 86					
	Zinc	2	ug/g	STD 290					
Misc/Others	Chloride	0.002	%	STD N/A					
	Electrical Conductivity	0.05	mS/cm	STD 0.7					
	pH	2.0							
	pH - CaCl2	2.0							
	Resistivity	1	ohm-cm						

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					Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316340 Soil Reg153  2017-08-12 BH-5-SS-4	1316341 Soil Reg153  2017-08-12 BH-5-SS-5	1316342 Soil Reg153  2017-08-12 BH-6-SS-2	1316343 Soil Reg153  2017-08-12 BH-6-SS-5
Group	Analyte	MRL	Units	Guideline					
Misc/Others	SO4	0.01	%					0.02	
	Sodium Adsorption Ratio	0.01		STD 5		1.10	0.35	1.10	
Moisture**	Moisture-Humidite	0.1	%		10.9		15.1	20.8	
PHC (Hydrocarbons)**	Petroleum Hydrocarbons F1	10	ug/g	STD 25	<10		<10	<10	
	Petroleum Hydrocarbons F1-BTEX	10	ug/g		<10		<10	<10	
	Petroleum Hydrocarbons F2	10	ug/g	STD 10	<10		<10	<10	
	Petroleum Hydrocarbons F3	20	ug/g	STD 240	<20		<20	<20	
	Petroleum Hydrocarbons F4	20	ug/g	STD 120	<20		<20	<20	
PHC Surrogate**	Alpha-androstrane	0	%		112		84	77	
Semi-Volatiles	1+2-methylnaphthalene	0.05	ug/g		<0.05		<0.05	<0.05	
	Acenaphthene	0.05	ug/g	STD 0.072	<0.05		<0.05	<0.05	
	Acenaphthylene	0.05	ug/g	STD 0.093	<0.05		<0.05	<0.05	
	Anthracene	0.05	ug/g	STD 0.22	<0.05		<0.05	<0.05	
	Benz[a]anthracene	0.05	ug/g	STD 0.36	<0.05		<0.05	<0.05	
	Benzo[a]pyrene	0.05	ug/g	STD 0.3	<0.05		<0.05	<0.05	
	Benzo[b]fluoranthene	0.05	ug/g	STD 0.47	<0.05		<0.05	<0.05	
	Benzo[ghi]perylene	0.05	ug/g	STD 0.68	<0.05		<0.05	<0.05	
	Benzo[k]fluoranthene	0.05	ug/g	STD 0.48	<0.05		<0.05	<0.05	
	Chrysene	0.05	ug/g	STD 2.8	<0.05		<0.05	<0.05	
	Dibenz[a h]anthracene	0.05	ug/g	STD 0.1	<0.05		<0.05	<0.05	
	Fluoranthene	0.05	ug/g	STD 0.69	<0.05		<0.05	<0.05	
	Fluorene	0.05	ug/g	STD 0.19	<0.05		<0.05	<0.05	
	Indeno[1 2 3-cd]pyrene	0.05	ug/g		<0.05		<0.05	<0.05	
	Methylnaphthalene, 1-	0.05	ug/g		<0.05		<0.05	<0.05	
	Methylnaphthalene, 2-	0.05	ug/g		<0.05		<0.05	<0.05	
	Naphthalene	0.05	ug/g	STD 0.09	<0.05		<0.05	<0.05	

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COC #: 821408

					Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316340 Soil Reg153  2017-08-12 BH-5-SS-4	1316341 Soil Reg153  2017-08-12 BH-5-SS-5	1316342 Soil Reg153  2017-08-12 BH-6-SS-2	1316343 Soil Reg153  2017-08-12 BH-6-SS-5
Group	Analyte	MRL	Units	Guideline					
Semi-Volatiles	Phenanthrene	0.05	ug/g	STD 0.69	<0.05		<0.05	<0.05	
	Pyrene	0.05	ug/g	STD 1	<0.05		<0.05	<0.05	
Subcontracted	Chromium VI	0.2	ug/g	STD 0.66		<0.2	<0.2	<0.2	
	REDOX Potential	0	mV				341		
	S2-	1	ug/g				<1		
VOCs Surrogates**	1,2-dichloroethane-d4	0	%		116		117	116	
	4-bromofluorobenzene	0	%		113		116	97	
	Toluene-d8	0	%		89		86	88	
Volatile Organics**	Acetone	0.50	ug/g	STD 0.5	<0.50		<0.50	<0.50	
	Benzene	0.02	ug/g	STD 0.02	<0.02		<0.02	<0.02	
	Bromodichloromethane	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Bromoform	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Carbon Tetrachloride	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Chlorobenzene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Chloroform	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Dibromochloromethane	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Dichlorobenzene, 1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Dichlorobenzene, 1,3-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Dichlorobenzene, 1,4-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Dichlorodifluoromethane	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Dichloroethane, 1,1-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Dichloroethane, 1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Dichloroethylene, 1,1-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Dichloroethylene, 1,2-cis-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Dichloroethylene, 1,2-trans-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	
	Dichloropropane, 1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05	

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1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#:  
Invoice to: EnGlobe Corp.

Report Number: 1716238  
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					1316340 Soil Reg153  2017-08-12 BH-5-SS-4	1316341 Soil Reg153  2017-08-12 BH-5-SS-5	1316342 Soil Reg153  2017-08-12 BH-6-SS-2	1316343 Soil Reg153  2017-08-12 BH-6-SS-5
Group	Analyte	MRL	Units	Guideline				
Volatile Organics**	Dichloropropene, 1,3-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Dichloropropylene, 1,3-cis-	0.05	ug/g		<0.05		<0.05	<0.05
	Dichloropropylene, 1,3-trans-	0.05	ug/g		<0.05		<0.05	<0.05
	Ethylbenzene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Ethylene dibromide	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Hexane (n)	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Methyl Ethyl Ketone	0.50	ug/g	STD 0.5	<0.50		<0.50	<0.50
	Methyl Isobutyl Ketone	0.50	ug/g	STD 0.5	<0.50		<0.50	<0.50
	Methyl tert-Butyl Ether (MTBE)	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Methylene Chloride	0.05	ug/g		<0.05		<0.05	<0.05
	Styrene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Tetrachloroethane, 1,1,1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Tetrachloroethane, 1,1,2,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Tetrachloroethylene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Toluene	0.20	ug/g	STD 0.2	<0.20		<0.20	<0.20
	Trichloroethane, 1,1,1-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Trichloroethane, 1,1,2-	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Trichloroethylene	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Trichlorofluoromethane	0.05	ug/g	STD 0.25	<0.05		<0.05	<0.05
	Vinyl Chloride	0.02	ug/g	STD 0.02	<0.02		<0.02	<0.02
	Xylene Mixture	0.05	ug/g	STD 0.05	<0.05		<0.05	<0.05
	Xylene, m/p-	0.05	ug/g		<0.05		<0.05	<0.05
	Xylene, o-	0.05	ug/g		<0.05		<0.05	<0.05

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					Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316344 Soil Reg153  2017-08-12 DUP-1	1316345 Soil Reg153  2017-08-12 DUP-2
Group	Analyte	MRL	Units	Guideline			
Inorganics	Antimony	1	ug/g	STD 1.3			<1
	Arsenic	1	ug/g	STD 18			4
	Barium	1	ug/g	STD 220			95
	Beryllium	1	ug/g	STD 2.5			<1
	Boron (Hot Water Soluble)	0.5	ug/g	STD 1.5			0.7
	Boron (total)	5	ug/g	STD 36			8
	Cadmium	0.5	ug/g	STD 1.2			<0.5
	Chromium Total	1	ug/g	STD 70			20
	Cobalt	1	ug/g	STD 22			11
	Copper	1	ug/g	STD 92			21
	Cyanide (CN-)	0.03	ug/g	STD 0.051			<0.03
	Lead	1	ug/g	STD 120			8
	Mercury	0.1	ug/g	STD 0.27			<0.1
	Molybdenum	1	ug/g	STD 2			<1
	Nickel	1	ug/g	STD 82			23
	Selenium	1	ug/g	STD 1.5			<1
	Silver	0.2	ug/g	STD 0.5			<0.2
	Thallium	1	ug/g	STD 1			<1
	Uranium	0.5	ug/g	STD 2.5			0.7
	Vanadium	2	ug/g	STD 86			28
	Zinc	2	ug/g	STD 290			50
Misc/Others	Electrical Conductivity	0.05	mS/cm	STD 0.7			0.84*
	pH - CaCl2	2.0					7.8
	Sodium Adsorption Ratio	0.01		STD 5			1.07
Moisture**	Moisture-Humidite	0.1	%			16.9	
PHC (Hydrocarbons)	Petroleum Hydrocarbons F1	10	ug/g	STD 25		<10	

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		Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.			1316344 Soil Reg153  2017-08-12 DUP-1	1316345 Soil Reg153  2017-08-12 DUP-2
Group	Analyte	MRL	Units	Guideline		
PHC (Hydrocarbons)**	Petroleum Hydrocarbons F1-BTEX	10	ug/g		<10	
	Petroleum Hydrocarbons F2	10	ug/g	STD 10	<10	
	Petroleum Hydrocarbons F3	20	ug/g	STD 240	<20	
	Petroleum Hydrocarbons F4	20	ug/g	STD 120	<20	
PHC Surrogate**	Alpha-androstrane	0	%		86	
Semi-Volatiles	1+2-methylnaphthalene	0.05	ug/g		<0.05	
	Acenaphthene	0.05	ug/g	STD 0.072	<0.05	
	Acenaphthylene	0.05	ug/g	STD 0.093	<0.05	
	Anthracene	0.05	ug/g	STD 0.22	<0.05	
	Benz[a]anthracene	0.05	ug/g	STD 0.36	<0.05	
	Benzo[a]pyrene	0.05	ug/g	STD 0.3	<0.05	
	Benzo[b]fluoranthene	0.05	ug/g	STD 0.47	<0.05	
	Benzo[ghi]perylene	0.05	ug/g	STD 0.68	<0.05	
	Benzo[k]fluoranthene	0.05	ug/g	STD 0.48	<0.05	
	Chrysene	0.05	ug/g	STD 2.8	<0.05	
	Dibenz[a h]anthracene	0.05	ug/g	STD 0.1	<0.05	
	Fluoranthene	0.05	ug/g	STD 0.69	<0.05	
	Fluorene	0.05	ug/g	STD 0.19	<0.05	
	Indeno[1 2 3-cd]pyrene	0.05	ug/g		<0.05	
	Methylnaphthalene, 1-	0.05	ug/g		<0.05	
	Methylnaphthalene, 2-	0.05	ug/g		<0.05	
	Naphthalene	0.05	ug/g	STD 0.09	<0.05	
	Phenanthrene	0.05	ug/g	STD 0.69	<0.05	
	Pyrene	0.05	ug/g	STD 1	<0.05	
Subcontracted	Chromium VI	0.2	ug/g	STD 0.66		<0.2
VOCs Surrogates**	1,2-dichloroethane-d4	0	%		117	

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Group	Analyte	MRL	Units	Guideline			
VOCs Surrogates**	4-bromofluorobenzene	0	%			113	
	Toluene-d8	0	%			89	
Volatile Organics**	Acetone	0.50	ug/g	STD 0.5		<0.50	
	Benzene	0.02	ug/g	STD 0.02		<0.02	
	Bromodichloromethane	0.05	ug/g	STD 0.05		<0.05	
	Bromoform	0.05	ug/g	STD 0.05		<0.05	
	Carbon Tetrachloride	0.05	ug/g	STD 0.05		<0.05	
	Chlorobenzene	0.05	ug/g	STD 0.05		<0.05	
	Chloroform	0.05	ug/g	STD 0.05		<0.05	
	Dibromochloromethane	0.05	ug/g	STD 0.05		<0.05	
	Dichlorobenzene, 1,2-	0.05	ug/g	STD 0.05		<0.05	
	Dichlorobenzene, 1,3-	0.05	ug/g	STD 0.05		<0.05	
	Dichlorobenzene, 1,4-	0.05	ug/g	STD 0.05		<0.05	
	Dichlorodifluoromethane	0.05	ug/g	STD 0.05		<0.05	
	Dichloroethane, 1,1-	0.05	ug/g	STD 0.05		<0.05	
	Dichloroethane, 1,2-	0.05	ug/g	STD 0.05		<0.05	
	Dichloroethylene, 1,1-	0.05	ug/g	STD 0.05		<0.05	
	Dichloroethylene, 1,2-cis-	0.05	ug/g	STD 0.05		<0.05	
	Dichloroethylene, 1,2-trans-	0.05	ug/g	STD 0.05		<0.05	
	Dichloropropane, 1,2-	0.05	ug/g	STD 0.05		<0.05	
	Dichloropropene, 1,3-	0.05	ug/g	STD 0.05		<0.05	
	Dichloropropylene, 1,3-cis-	0.05	ug/g			<0.05	
	Dichloropropylene, 1,3-trans-	0.05	ug/g			<0.05	
	Ethylbenzene	0.05	ug/g	STD 0.05		<0.05	
	Ethylene dibromide	0.05	ug/g	STD 0.05		<0.05	
	Hexane (n)	0.05	ug/g	STD 0.05		<0.05	

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Group	Analyte	MRL	Units	Guideline			
Volatile Organics**	Methyl Ethyl Ketone	0.50	ug/g	STD 0.5	<0.50		
	Methyl Isobutyl Ketone	0.50	ug/g	STD 0.5	<0.50		
	Methyl tert-Butyl Ether (MTBE)	0.05	ug/g	STD 0.05	<0.05		
	Methylene Chloride	0.05	ug/g		<0.05		
	Styrene	0.05	ug/g	STD 0.05	<0.05		
	Tetrachloroethane, 1,1,1,2-	0.05	ug/g	STD 0.05	<0.05		
	Tetrachloroethane, 1,1,2,2-	0.05	ug/g	STD 0.05	<0.05		
	Tetrachloroethylene	0.05	ug/g	STD 0.05	<0.05		
	Toluene	0.20	ug/g	STD 0.2	<0.20		
	Trichloroethane, 1,1,1-	0.05	ug/g	STD 0.05	<0.05		
	Trichloroethane, 1,1,2-	0.05	ug/g	STD 0.05	<0.05		
	Trichloroethylene	0.05	ug/g	STD 0.05	<0.05		
	Trichlorofluoromethane	0.05	ug/g	STD 0.25	<0.05		
	Vinyl Chloride	0.02	ug/g	STD 0.02	<0.02		
	Xylene Mixture	0.05	ug/g	STD 0.05	<0.05		
	Xylene, m/p-	0.05	ug/g		<0.05		
	Xylene, o-	0.05	ug/g		<0.05		

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### QC Summary

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 325094 <b>Analysis/Extraction Date</b> 2017-09-01 <b>Instrument</b>			
<b>Method</b> SUBCONTRACT P-INORG <b>Analyst</b> SDC			
Chromium VI	<0.2 ug/g	100	80-120
<b>Run No</b> 332261 <b>Analysis/Extraction Date</b> 2017-08-28 <b>Instrument</b> pH Meter			
<b>Method</b> Ag Soil <b>Analyst</b> R_E			
pH		100	90-110
pH - CaCl <sub>2</sub>			90-110
<b>Method</b> Cond-Soil <b>Analyst</b> R_E			
Electrical Conductivity		99	85-115
<b>Method</b> Resistivity - soil <b>Analyst</b> R_E			
Resistivity			
<b>Run No</b> 332265 <b>Analysis/Extraction Date</b> 2017-08-28 <b>Instrument</b> Manual			
<b>Method</b> C CSA A23.2-4B <b>Analyst</b> C_F			
Chloride		100	90-110
<b>Run No</b> 332276 <b>Analysis/Extraction Date</b> 2017-08-28 <b>Instrument</b> Electrical Conductivity Mete			

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### QC Summary

Analyte	Blank	QC % Rec	QC Limits
<b>Method</b> Cond-Soil <b>Analyst</b> AJS			
Electrical Conductivity	<0.05 mS/cm	100	85-115
<b>Run No</b> 332278 <b>Analysis/Extraction Date</b> 2017-08-28 <b>Instrument</b> Skalar CN Analyzer			
<b>Method</b> C SM4500-CNC <b>Analyst</b> C_F			
Cyanide (CN-)	<0.03 ug/g	112	75-125
<b>Run No</b> 332321 <b>Analysis/Extraction Date</b> 2017-08-28 <b>Instrument</b> GC/MS			
<b>Method</b> EPA 8260 <b>Analyst</b> JYL			
Tetrachloroethane, 1,1,1,2-	<0.05 ug/g	100	80-120
Trichloroethane, 1,1,1-	<0.05 ug/g	101	80-120
Tetrachloroethane, 1,1,2,2-	<0.05 ug/g	116	80-120
Trichloroethane, 1,1,2-	<0.05 ug/g	100	80-120
Dichloroethane, 1,1-	<0.05 ug/g	118	80-120
Dichloroethylene, 1,1-	<0.05 ug/g	103	80-120
Dichlorobenzene, 1,2-	<0.05 ug/g	113	80-120
Dichloroethane, 1,2-	<0.05 ug/g	105	80-120
Dichloropropane, 1,2-	<0.05 ug/g	98	80-120
Dichlorobenzene, 1,3-	<0.05 ug/g	105	80-120
Dichloropropene, 1,3-	<0.05 ug/g		
Dichlorobenzene, 1,4-	<0.05 ug/g	110	80-120

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### QC Summary

Analyte	Blank	QC % Rec	QC Limits
Acetone	<0.50 ug/g	91	70-130
Benzene	<0.02 ug/g	100	60-130
Bromodichloromethane	<0.05 ug/g	102	80-120
Bromoform	<0.05 ug/g	106	60-130
Dichloroethylene, 1,2-cis-	<0.05 ug/g	101	80-120
Dichloropropene, 1,3-cis-	<0.05 ug/g	91	80-120
Carbon Tetrachloride	<0.05 ug/g	100	80-120
Chloroform	<0.05 ug/g	106	80-120
Dibromochloromethane	<0.05 ug/g	98	80-120
Dichlorodifluoromethane	<0.05 ug/g	116	70-130
Methylene Chloride	<0.05 ug/g	102	70-130
Ethylbenzene	<0.05 ug/g	89	80-120
Ethylene dibromide	<0.05 ug/g	99	80-120
Hexane (n)	<0.05 ug/g	81	70-130
m/p-xylene	<0.05 ug/g	96	80-120
Methyl Ethyl Ketone	<0.50 ug/g	94	70-130
Methyl Isobutyl Ketone	<0.50 ug/g	86	70-130
Methyl tert-Butyl Ether (MTBE)	<0.05 ug/g	101	70-130

Guideline = O.Reg 153-T8-Res/Com

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Client: EnGlobe Corp. (Toronto)  
1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#:  
Invoice to: EnGlobe Corp.

Report Number: 1716238  
Date Submitted: 2017-08-25  
Date Reported: 2017-09-01  
Project: B-0017786  
COC #: 821408

### QC Summary

Analyte	Blank	QC % Rec	QC Limits
Chlorobenzene	<0.05 ug/g	94	80-120
o-xylene	<0.05 ug/g	96	80-120
Styrene	<0.05 ug/g	90	80-120
Dichloroethylene, 1,2-trans-	<0.05 ug/g	90	80-120
Dichloropropene, 1,3-trans-	<0.05 ug/g	102	80-120
Tetrachloroethylene	<0.05 ug/g	99	80-120
Toluene	<0.20 ug/g	90	80-120
Trichloroethylene	<0.05 ug/g	98	80-120
Trichlorofluoromethane	<0.05 ug/g	114	70-130
Vinyl Chloride	<0.02 ug/g	119	80-120
Xylene Mixture	<0.05 ug/g		
<b>Run No</b> 332324 <b>Analysis/Extraction Date</b> 2017-08-28 <b>Instrument</b> GC/FID			
<b>Method</b> CCME <b>Analyst</b> JYL			
Petroleum Hydrocarbons F1	<10 ug/g	95	80-120
Petroleum Hydrocarbons F1-BTEX	<10 ug/g		
<b>Run No</b> 332346 <b>Analysis/Extraction Date</b> 2017-08-29 <b>Instrument</b> iCAP OES			
<b>Method</b> Ag Soil <b>Analyst</b> H_F			
Sodium Adsorption Ratio	<0.01		

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### QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 332411 Analysis/Extraction Date 2017-08-30 Instrument Manual			
Method AG SOIL Analyst C_F			
SO4	<0.01 %	100	70-130
Run No 332414 Analysis/Extraction Date 2017-08-29 Instrument			
Method P 8270 Analyst JLD			
Methlynaphthalene, 1-	<0.05 ug/g	71	50-140
Methlynaphthalene, 2-	<0.05 ug/g	73	50-140
Acenaphthene	<0.05 ug/g	68	50-140
Acenaphthylene	<0.05 ug/g	63	50-140
Anthracene	<0.05 ug/g	73	50-140
Benz[a]anthracene	<0.05 ug/g	83	50-140
Benzo[a]pyrene	<0.05 ug/g	81	50-140
Benzo[b]fluoranthene	<0.05 ug/g	124	50-140
Benzo[ghi]perylene	<0.05 ug/g	83	50-140
Benzo[k]fluoranthene	<0.05 ug/g	89	50-140
Chrysene	<0.05 ug/g	81	50-140
Dibenz[a h]anthracene	<0.05 ug/g	83	50-140
Fluoranthene	<0.05 ug/g	81	50-140

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COC #: 821408

### QC Summary

Analyte	Blank	QC % Rec	QC Limits
Fluorene	<0.05 ug/g	69	50-140
Indeno[1 2 3-cd]pyrene	<0.05 ug/g	89	50-140
Naphthalene	<0.05 ug/g	67	50-140
Phenanthrene	<0.05 ug/g	79	50-140
Pyrene	<0.05 ug/g	80	50-140
<b>Run No 332416 Analysis/Extraction Date 2017-08-29 Instrument</b>			
<b>Method P 8270 Analyst JLD</b>			
1+2-methylnaphthalene	<0.05 ug/g		
<b>Run No 332438 Analysis/Extraction Date 2017-08-30 Instrument iCAP OES</b>			
<b>Method Boron HWE Analyst H_F</b>			
Boron (Hot Water Soluble)	<0.5 ug/g	91	70-130
<b>Run No 332450 Analysis/Extraction Date 2017-08-30 Instrument Oven</b>			
<b>Method C SM2540B Analyst JLD</b>			
Moisture-Humidite		100	80-120
<b>Method CCME Analyst JLD</b>			
Petroleum Hydrocarbons F2	<10 ug/g	116	80-120
Petroleum Hydrocarbons F3	<20 ug/g	116	80-120
Petroleum Hydrocarbons F4	<20 ug/g	116	80-120
<b>Run No 332457 Analysis/Extraction Date 2017-08-30 Instrument Cetac Hg Analyzer</b>			

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Project: B-0017786  
COC #: 821408

### QC Summary

Analyte	Blank	QC % Rec	QC Limits
<b>Method</b> M SM3112B-3500B		<b>Analyst</b> AJS	
Mercury	<0.1 ug/g	96	80-120
<b>Run No</b> 332467	<b>Analysis/Extraction Date</b> 2017-08-29	<b>Instrument</b>	
<b>Method</b> P 8270		<b>Analyst</b> JLD	
Methlynaphthalene, 1-	<0.05 ug/g	71	50-140
Methlynaphthalene, 2-	<0.05 ug/g	73	50-140
Acenaphthene	<0.05 ug/g	68	50-140
Acenaphthylene	<0.05 ug/g	63	50-140
Anthracene	<0.05 ug/g	73	50-140
Benz[a]anthracene	<0.05 ug/g	83	50-140
Benzo[a]pyrene	<0.05 ug/g	81	50-140
Benzo[b]fluoranthene	<0.05 ug/g	124	50-140
Benzo[ghi]perylene	<0.05 ug/g	83	50-140
Benzo[k]fluoranthene	<0.05 ug/g	89	50-140
Chrysene	<0.05 ug/g	81	50-140
Dibenz[a h]anthracene	<0.05 ug/g	83	50-140
Fluoranthene	<0.05 ug/g	81	50-140
Fluorene	<0.05 ug/g	69	50-140

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### QC Summary

Analyte	Blank	QC % Rec	QC Limits
Indeno[1 2 3-cd]pyrene	<0.05 ug/g	89	50-140
Naphthalene	<0.05 ug/g	67	50-140
Phenanthrene	<0.05 ug/g	79	50-140
Pyrene	<0.05 ug/g	80	50-140
Run No 332468 Analysis/Extraction Date 2017-08-30 Instrument			
Method EPA 200.8 Analyst H_D			
Silver	<0.2 ug/g	106	70-130
Arsenic	<1 ug/g	96	70-130
Boron (total)	<5 ug/g	98	70-130
Barium	<1 ug/g	98	70-130
Beryllium	<1 ug/g	98	70-130
Cadmium	<0.5 ug/g	107	70-130
Cobalt	<1 ug/g	102	70-130
Chromium Total	<1 ug/g	101	70-130
Copper	<1 ug/g	104	70-130
Molybdenum	<1 ug/g	95	70-130
Nickel	<1 ug/g	104	70-130
Lead	<1 ug/g	103	70-130

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Report Number: 1716238  
Date Submitted: 2017-08-25  
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Project: B-0017786  
COC #: 821408

### QC Summary

Analyte	Blank	QC % Rec	QC Limits
Antimony	<1 ug/g	90	70-130
Selenium	<1 ug/g	98	70-130
Thallium	<1 ug/g	103	70-130
Uranium	<0.5 ug/g	102	70-130
Vanadium	<2 ug/g	99	70-130
Zinc	<2 ug/g	108	70-130
<b>Run No</b> 332513 <b>Analysis/Extraction Date</b> 2017-08-28 <b>Instrument</b>			
<b>Method</b> SUBCONTRACT-SA-INORG <b>Analyst</b> AET			
REDOX Potential		100	
S2-			
<b>Run No</b> 332535 <b>Analysis/Extraction Date</b> 2017-08-31 <b>Instrument</b> GC/FID			
<b>Method</b> CCME <b>Analyst</b> S_V			
Petroleum Hydrocarbons F2	<10 ug/g	75	80-120
Petroleum Hydrocarbons F3	<20 ug/g	75	80-120
Petroleum Hydrocarbons F4	<20 ug/g	75	80-120
<b>Method</b> MOISTURE MISS <b>Analyst</b> S_V			
Moisture-Humidite	<0.1 %		
<b>Run No</b> 332571 <b>Analysis/Extraction Date</b> 2017-08-31 <b>Instrument</b>			
<b>Method</b> EPA 200.8 <b>Analyst</b> H_D			

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### QC Summary

Analyte	Blank	QC % Rec	QC Limits
Boron (total)	<5 ug/g	90	70-130

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Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO  
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Certificate of Analysis

Client: EnGlobe Corp. (Toronto)  
1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#: A10825  
Invoice to: EnGlobe Corp.

Report Number: 1716239  
Date Submitted: 2017-08-25  
Date Reported: 2017-09-01  
Project: B-0017786  
COC #: 821409


Page 1 of 6

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**Dear Nan Du:**

**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**


Report Comments:

  
Addrine Thomas  
2017.09.01  
11:53:55 -04'00'

APPROVAL:

---

Addrine Thomas, Inorganics Supervisor

  
Charlie  
Long Qu  
2017.09.0  
1 15:35:58  
-04'00'

APPROVAL:

---

Long Qu, Organics Supervisor

All analysis is completed in Ottawa, Ontario (unless otherwise indicated).

Eurofins Ottawa is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on our CALA scope of accreditation. It can be found at <http://www.cala.ca/scopes/2602.pdf>.

Eurofins(Ottawa) is certified and accredited for specific parameters by OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils). Licensed by Ontario MOE for specific tests in drinking water.

Eurofins(Mississauga) is accredited for specific parameters by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required.

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					Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316346 REG 347 LCH Soil 2017-08-23 TCLP-1	1316347 REG 347 LCH Soil 2017-08-23 TCLP-2
Group	Analyte	MRL	Units	Guideline			
Cyanide	Cyanide (free)	0.05	mg/L	LQC 20.0		<0.05	<0.05
General Chemistry	F	0.10	mg/L	LQC 150.0		0.24	0.23
	Moisture-Humidite	0.1	%			11.0	17.9
	NO2 + NO3 as N	0.10	mg/L	LQC 1000.0		<0.10	<0.10
Mercury	Hg	0.001	mg/L	LQC 0.1		<0.001	<0.001
Metals	Ag	0.01	mg/L	LQC 5		<0.01	<0.01
	As	0.02	mg/L	LQC 2.5		<0.02	<0.02
	B	0.1	mg/L	LQC 500.0		<0.1	<0.1
	Ba	0.01	mg/L	LQC 100.0		0.79	0.59
	Cd	0.008	mg/L	LQC 0.5		<0.008	<0.008
	Cr	0.05	mg/L	LQC 5.0		<0.05	<0.05
	Pb	0.01	mg/L	LQC 5.0		<0.01	<0.01
	Se	0.02	mg/L	LQC 1.0		<0.02	<0.02
	U	0.01	mg/L	LQC 10.0		<0.01	<0.01
Others	REG 558 Leach					Y	Y
	Zero Headspace Extraction					Y	Y
VOCs	1,1-dichloroethylene	0.0005	mg/L	LQC 1.4		<0.0005	<0.0005
	1,2-dichlorobenzene	0.0004	mg/L	LQC 20.0		<0.0004	<0.0004
	1,2-dichloroethane	0.0002	mg/L	LQC 0.5		<0.0002	<0.0002
	1,4-dichlorobenzene	0.0004	mg/L	LQC 0.5		<0.0004	<0.0004
	Benzene	0.0005	mg/L	LQC 0.5		<0.0005	<0.0005
	Carbon Tetrachloride	0.0002	mg/L	LQC 0.5		<0.0002	<0.0002
	Chloroform	0.0005	mg/L	LQC 10.0		<0.0005	<0.0005
	Dichloromethane	0.004	mg/L	LQC 5.0		<0.004	<0.004
	Methyl Ethyl Ketone (MEK)	0.01	mg/L	LQC 200.0		<0.01	<0.01

**Guideline = REG 558 (mg/L)**

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COC #: 821409

					Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1316346 REG 347 LCH Soil 2017-08-23 TCLP-1	1316347 REG 347 LCH Soil 2017-08-23 TCLP-2
Group	Analyte	MRL	Units	Guideline			
VOCs	Monochlorobenzene	0.0002	mg/L	LQC 8.0		<0.0002	<0.0002
	Tetrachloroethylene	0.0003	mg/L	LQC 3.0		<0.0003	<0.0003
	Trichloroethylene	0.0003	mg/L	LQC 5.0		<0.0003	<0.0003
	Vinyl Chloride	0.0002	mg/L	LQC 0.2		<0.0002	<0.0002
VOCs Surrogates (%REC)	1,2-dichloroethane-d4	0	%			114	102
	4-bromofluorobenzene	0	%			106	101
	Toluene-d8	0	%			95	96

**Guideline = REG 558 (mg/L)**

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Report Number: 1716239  
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Project: B-0017786  
COC #: 821409

## QC Summary

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 290004 <b>Analysis/Extraction Date</b> 2017-08-30 <b>Analyst</b> TJB			
<b>Method</b> V 8260B			
Methyl Ethyl Ketone	<0.01 mg/L	108	60-130
<b>Run No</b> 332345 <b>Analysis/Extraction Date</b> 2017-08-29 <b>Analyst</b> H_F			
<b>Method</b> C MOEE Reg 347			
REG 558 Leach			
Zero Headspace Extraction			
<b>Method</b> C SM2540B			
Moisture-Humidite			80-120
<b>Run No</b> 332411 <b>Analysis/Extraction Date</b> 2017-08-30 <b>Analyst</b> C_F			
<b>Method</b> C SM4500-CNC			
Cyanide (CN-)	<0.05 mg/L	104	75-125
<b>Run No</b> 332448 <b>Analysis/Extraction Date</b> 2017-08-30 <b>Analyst</b> H_D			
<b>Method</b> SM 4500-FC			
F	<0.10 mg/L	101	90-110
<b>Run No</b> 332452 <b>Analysis/Extraction Date</b> 2017-08-29 <b>Analyst</b> H_D			
<b>Method</b> C SM4500-NO3-F			
NO2 + NO3 as N	<0.10 mg/L	96	80-120

### Guideline = REG 558 (mg/L)

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## QC Summary

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 332458 <b>Analysis/Extraction Date</b> 2017-08-30 <b>Analyst</b> AJS			
<b>Method</b> M SM3112B-3500B			
Mercury	<0.001 mg/L	95	76-123
<b>Run No</b> 332480 <b>Analysis/Extraction Date</b> 2017-08-30 <b>Analyst</b> H_D			
<b>Method</b> SM 4500-FC			
F	<0.10 mg/L	101	90-110
<b>Run No</b> 332498 <b>Analysis/Extraction Date</b> 2017-08-29 <b>Analyst</b> TJB			
<b>Method</b> V 8260B			
Dichloroethylene, 1,1-	<0.0005 mg/L	112	60-130
Dichlorobenzene, 1,2-	<0.0004 mg/L	116	60-130
Dichloroethane, 1,2-	<0.0002 mg/L	104	60-130
Dichlorobenzene, 1,4-	<0.0004 mg/L	98	60-130
Benzene	<0.0005 mg/L	105	60-130
Carbon Tetrachloride	<0.0002 mg/L	106	60-130
Chloroform	<0.0005 mg/L	103	60-130
Methylene Chloride	<0.004 mg/L	97	60-130
Chlorobenzene	<0.0002 mg/L	102	60-130
Tetrachloroethylene	<0.0003 mg/L	104	60-130

### Guideline = REG 558 (mg/L)

\* = Guideline Exceedence

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# Certificate of Analysis

Client: EnGlobe Corp. (Toronto)  
1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#:  
Invoice to: EnGlobe Corp.

Report Number: 1716239  
Date Submitted: 2017-08-25  
Date Reported: 2017-09-01  
Project: B-0017786  
COC #: 821409

## QC Summary

Analyte	Blank	QC % Rec	QC Limits
Trichloroethylene	<0.0003 mg/L	104	60-130
Vinyl Chloride	<0.0002 mg/L	108	60-130
<b>Run No</b> 332570 <b>Analysis/Extraction Date</b> 2017-08-31 <b>Analyst</b> H_D			
<b>Method</b> EPA 200.8			
Silver	<0.01 mg/L	100	70-130
Arsenic	<0.02 mg/L	99	70-130
Boron (total)	<0.1 mg/L	73	70-130
Barium	<0.01 mg/L	103	70-130
Cadmium	<0.008 mg/L	111	70-130
Chromium Total	<0.05 mg/L	103	70-130
Lead	<0.01 mg/L	102	70-130
Selenium	<0.02 mg/L	99	70-130
Uranium	<0.01 mg/L	91	70-130

### Guideline = REG 558 (mg/L)

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Client: EnGlobe Corp. (Toronto)  
1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#: A10832  
Invoice to: EnGlobe Corp.

Report Number: 1717130  
Date Submitted: 2017-09-07  
Date Reported: 2017-09-13  
Project: B-0017786  
COC #: 192520


Page 1 of 13

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**Dear Nan Du:**


**Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).**

Report Comments:

  
Addrine  
Thomas  
2017.09.13  
13:15:52 -04'00'

APPROVAL:

Addrine Thomas, Inorganics Supervisor

  
Charlie  
Long Qu  
2017.09.13  
13:30:22  
-04'00'

APPROVAL:

Long Qu, Organics Supervisor

All analysis is completed in Ottawa, Ontario (unless otherwise indicated).

Eurofins Ottawa is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on our CALA scope of accreditation. It can be found at <http://www.cala.ca/scopes/2602.pdf>.

Eurofins(Ottawa) is certified and accredited for specific parameters by OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils). Licensed by Ontario MOE for specific tests in drinking water.

Eurofins(Mississauga) is accredited for specific parameters by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required.



# Certificate of Analysis

Client: EnGlobe Corp. (Toronto)  
1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#: A10832  
Invoice to: EnGlobe Corp.

Report Number: 1717130  
Date Submitted: 2017-09-07  
Date Reported: 2017-09-13  
Project: B-0017786  
COC #: 192520

					1319057 GW (Reg 153)  2017-09-06 BH/MW-6	1319058 GW (Reg 153)  2017-09-06 DUP-1	1319059 GW (Reg 153)  2017-09-06 Trip Blank
Group	Analyte	MRL	Units	Guideline			
Cyanide	Cyanide (free)	5	ug/L	STD 5	<5	<5	
General Chemistry	Cl	1000	ug/L	STD 790000	194000	186000	
	Conductivity	5	uS/cm		4630	4640	
	pH	1.00			7.67	7.65	
Mercury	Hg	0.0001	ug/L	STD 0.1	<0.0001	<0.0001	
Metals	Ag	0.1	ug/L	STD 0.3	<0.1	<0.1	
	As	1	ug/L	STD 13	<1	<1	
	B	10	ug/L	STD 1700	340	340	
	Ba	10	ug/L	STD 610	40	40	
	Be	0.5	ug/L	STD 0.5	<0.5	<0.5	
	Cd	0.1	ug/L	STD 0.5	<0.1	<0.1	
	Co	0.2	ug/L	STD 3.8	7.7*	7.8*	
	Cr	1	ug/L	STD 11	<1	<1	
	Cr(VI)	10	ug/L	STD 25	<10	<10	
	Cu	1	ug/L	STD 5	14*	14*	
	Mo	5	ug/L	STD 23	<5	<5	
	Na	2000	ug/L	STD 490000	224000	249000	
	Ni	5	ug/L	STD 14	11	11	
	Pb	1	ug/L	STD 1.9	<1	<1	
	Sb	0.5	ug/L	STD 1.5	<0.5	<0.5	
	Se	1	ug/L	STD 5	<1	<1	
	Tl	0.1	ug/L	STD 0.5	<0.1	<0.1	
	U	1	ug/L	STD 8.9	19*	19*	
	V	1	ug/L	STD 3.9	2	2	
	Zn	10	ug/L	STD 160	<10	<10	

**Guideline = O.Reg 153-T1-Groundwater**
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Client: EnGlobe Corp. (Toronto)  
1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#: A10832  
Invoice to: EnGlobe Corp.

Report Number: 1717130  
Date Submitted: 2017-09-07  
Date Reported: 2017-09-13  
Project: B-0017786  
COC #: 192520

					Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1319057 GW (Reg 153)  2017-09-06 BH/MW-6	1319058 GW (Reg 153)  2017-09-06 DUP-1	1319059 GW (Reg 153)  2017-09-06 Trip Blank
Group	Analyte	MRL	Units	Guideline				
Others	Alpha-androstrane	0	%			96	106	
	F1 (C6-C10)	20	ug/L	STD 420		<20	<20	
	F2 (C10-C16)	20	ug/L	STD 150		<20	<20	
	F3 (C16-C34)	50	ug/L	STD 500		<50	<50	
	F4 (C34-C50)	50	ug/L	STD 500		<50	<50	
Semi-Volatiles	1+2-methylnaphthalene	0.1	ug/L			<0.1	<0.1	
	1-methylnaphthalene	0.1	ug/L	STD 2		<0.1	<0.1	
	2-methylnaphthalene	0.1	ug/L	STD 2		<0.1	<0.1	
	Acenaphthene	0.1	ug/L	STD 4.1		<0.1	<0.1	
	Acenaphthylene	0.1	ug/L	STD 1		<0.1	<0.1	
	Anthracene	0.1	ug/L	STD 0.1		<0.1	<0.1	
	Benzo(a)anthracene	0.1	ug/L	STD 0.2		<0.1	<0.1	
	Benzo(a)pyrene	0.01	ug/L	STD 0.01		<0.01	<0.01	
	Benzo(b)fluoranthene	0.05	ug/L	STD 0.1		<0.05	<0.05	
	Benzo(g,h,i)perylene	0.1	ug/L	STD 0.2		<0.1	<0.1	
	Benzo(k)fluoranthene	0.05	ug/L	STD 0.1		<0.05	<0.05	
	Chrysene	0.05	ug/L	STD 0.1		<0.05	<0.05	
	Dibenzo(a,h)anthracene	0.1	ug/L	STD 0.2		<0.1	<0.1	
	Fluoranthene	0.1	ug/L	STD 0.4		<0.1	<0.1	
	Fluorene	0.1	ug/L	STD 120		<0.1	<0.1	
	Indeno(1,2,3-c,d)pyrene	0.1	ug/L	STD 0.2		<0.1	<0.1	
	Naphthalene	0.1	ug/L	STD 7		<0.1	<0.1	
	Phenanthrene	0.1	ug/L	STD 0.1		<0.1	<0.1	
	Pyrene	0.1	ug/L	STD 0.2		<0.1	<0.1	
VOCs	1,1,1,2-tetrachloroethane	0.5	ug/L	STD 1.1		<0.5	<0.5	<0.5

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M9W 5W8  
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Invoice to: EnGlobe Corp.

Report Number: 1717130  
Date Submitted: 2017-09-07  
Date Reported: 2017-09-13  
Project: B-0017786  
COC #: 192520

					Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1319057 GW (Reg 153)  2017-09-06 BH/MW-6	1319058 GW (Reg 153)  2017-09-06 DUP-1	1319059 GW (Reg 153)  2017-09-06 Trip Blank
Group	Analyte	MRL	Units	Guideline				
VOCs	1,1,1-trichloroethane	0.4	ug/L	STD 0.5		<0.4	<0.4	<0.4
	1,1,2,2-tetrachloroethane	0.5	ug/L	STD 0.5		<0.5	<0.5	<0.5
	1,1,2-trichloroethane	0.4	ug/L	STD 0.5		<0.4	<0.4	<0.4
	1,1-dichloroethane	0.4	ug/L	STD 0.5		<0.4	<0.4	<0.4
	1,1-dichloroethylene	0.5	ug/L	STD 0.5		<0.5	<0.5	<0.5
	1,2-dichlorobenzene	0.4	ug/L	STD 0.5		<0.4	<0.4	<0.4
	1,2-dichloroethane	0.2	ug/L	STD 0.5		<0.2	<0.2	<0.2
	1,2-dichloropropane	0.5	ug/L	STD 0.5		<0.5	<0.5	<0.5
	1,3,5-trimethylbenzene	0.3	ug/L			<0.3	<0.3	<0.3
	1,3-dichlorobenzene	0.4	ug/L	STD 0.5		<0.4	<0.4	<0.4
	1,3-Dichloropropylene (cis+trans)	0.3	ug/L	STD 0.5		<0.3	<0.3	<0.3
	1,4-dichlorobenzene	0.4	ug/L	STD 0.5		<0.4	<0.4	<0.4
	Acetone	30	ug/L	STD 2700		<30	<30	<30
	Benzene	0.5	ug/L	STD 0.5		<0.5	<0.5	<0.5
	Bromodichloromethane	0.3	ug/L	STD 2		<0.3	<0.3	<0.3
	Bromoform	0.4	ug/L	STD 5		<0.4	<0.4	<0.4
	Bromomethane	0.5	ug/L	STD 0.89		<0.5	<0.5	<0.5
	c-1,2-Dichloroethylene	0.4	ug/L	STD 1.6		<0.4	<0.4	<0.4
	c-1,3-Dichloropropylene	0.2	ug/L			<0.2	<0.2	<0.2
	Carbon Tetrachloride	0.2	ug/L	STD 0.2		<0.2	<0.2	<0.2
	Chloroethane	0.2	ug/L			<0.2	<0.2	<0.2
	Chloroform	0.5	ug/L	STD 2		<0.5	<0.5	<0.5
	Dibromochloromethane	0.3	ug/L	STD 2		<0.3	<0.3	<0.3
	Dichlorodifluoromethane	0.5	ug/L	STD 590		<0.5	<0.5	<0.5
	Dichloromethane	4.0	ug/L	STD 5		<4.0	<4.0	<4.0

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Client: EnGlobe Corp. (Toronto)  
1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#: A10832  
Invoice to: EnGlobe Corp.

Report Number: 1717130  
Date Submitted: 2017-09-07  
Date Reported: 2017-09-13  
Project: B-0017786  
COC #: 192520

					Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1319057 GW (Reg 153)  2017-09-06 BH/MW-6	1319058 GW (Reg 153)  2017-09-06 DUP-1	1319059 GW (Reg 153)  2017-09-06 Trip Blank
Group	Analyte	MRL	Units	Guideline				
VOCs	Ethylbenzene	0.5	ug/L	STD 0.5		<0.5	<0.5	<0.5
	Ethylene Dibromide	0.2	ug/L	STD 0.2		<0.2	<0.2	<0.2
	Hexane	5	ug/L	STD 5		<5	<5	<5
	m/p-xylene	0.4	ug/L			<0.4	<0.4	<0.4
	Methyl Ethyl Ketone (MEK)	10	ug/L	STD 400		<10	<10	<10
	Methyl Isobutyl Ketone (MIBK)	10	ug/L	STD 640		<10	<10	<10
	Methyl Tert Butyl Ether (MTBE)	2	ug/L	STD 15		<2	<2	<2
	Monochlorobenzene	0.2	ug/L	STD 0.5		<0.2	<0.2	<0.2
	o-xylene	0.4	ug/L			<0.4	<0.4	<0.4
	Styrene	0.5	ug/L	STD 0.5		<0.5	<0.5	<0.5
	t-1,2-Dichloroethylene	0.4	ug/L	STD 1.6		<0.4	<0.4	<0.4
	t-1,3-Dichloropropylene	0.2	ug/L			<0.2	<0.2	<0.2
	Tetrachloroethylene	0.3	ug/L	STD 0.5		<0.3	<0.3	<0.3
	Toluene	0.5	ug/L	STD 0.8		<0.5	<0.5	<0.5
	Trichloroethylene	0.3	ug/L	STD 0.5		<0.3	<0.3	<0.3
	Trichlorofluoromethane	0.5	ug/L	STD 150		<0.5	<0.5	<0.5
	Vinyl Chloride	0.2	ug/L	STD 0.5		<0.2	<0.2	<0.2
	Xylene; total	0.5	ug/L	STD 72		<0.5	<0.5	<0.5
VOCs Surrogates (%REC)	1,2-dichloroethane-d4	0	%			98	93	103
	4-bromofluorobenzene	0	%			119	105	104
	Toluene-d8	0	%			95	98	94

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# Certificate of Analysis

Client: EnGlobe Corp. (Toronto)  
1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#: A10832  
Invoice to: EnGlobe Corp.

Report Number: 1717130  
Date Submitted: 2017-09-07  
Date Reported: 2017-09-13  
Project: B-0017786  
COC #: 192520

## QC Summary

Analyte	Blank	QC % Rec	QC Limits
<b>Run No</b> 290004 <b>Analysis/Extraction Date</b> 2017-09-11 <b>Analyst</b> TJB			
<b>Method</b> CCME O.Reg 153/04			
Petroleum Hydrocarbons F1	<20 ug/L	84	60-140
<b>Method</b> V 8260B			
Dichloropropene, 1,3-			
Acetone	<30 ug/L	117	60-130
Methyl Ethyl Ketone	<10 ug/L	111	60-130
Methyl Isobutyl Ketone	<10 ug/L	102	60-130
Methyl tert-Butyl Ether (MTBE)	<2 ug/L	113	60-130
<b>Run No</b> 332900 <b>Analysis/Extraction Date</b> 2017-09-07 <b>Analyst</b> JLD			
<b>Method</b> CCME O.Reg 153/04			
Petroleum Hydrocarbons F2	<20 ug/L	100	60-140
Petroleum Hydrocarbons F3	<50 ug/L	100	60-140
Petroleum Hydrocarbons F4	<50 ug/L	100	60-140
<b>Run No</b> 332909 <b>Analysis/Extraction Date</b> 2017-09-07 <b>Analyst</b> SKH			
<b>Method</b> EPA 200.8			
Silver	<0.1 ug/L	107	89-111
Arsenic	<1 ug/L	104	91.7-108.2

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M9W 5W8  
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Report Number: 1717130  
Date Submitted: 2017-09-07  
Date Reported: 2017-09-13  
Project: B-0017786  
COC #: 192520

## QC Summary

Analyte	Blank	QC % Rec	QC Limits
Boron (total)	<10 ug/L	106	84.9-115
Barium	<10 ug/L	98	93.4-106.5
Beryllium	<0.5 ug/L	105	89.5-110.4
Cadmium	<0.1 ug/L	103	93.5-106.4
Cobalt	<0.2 ug/L	104	92.7-107.2
Chromium Total	<1 ug/L	102	94-106
Copper	<1 ug/L	101	92.4-107.6
Molybdenum	<5 ug/L	100	92.8-107.2
Nickel	<5 ug/L	104	93-106.9
Lead	<1 ug/L	101	92.4-107.5
Antimony	<0.5 ug/L	105	89.6-110.3
Selenium	<1 ug/L	98	87.4-112.6
Thallium	<0.1 ug/L	102	90.4-109.5
Uranium	<1 ug/L	101	92.7-107.2
Vanadium	<1 ug/L	104	93-106.9
Zinc	<10 ug/L	101	91.5-108.4
<b>Run No</b> 332958 <b>Analysis/Extraction Date</b> 2017-09-08 <b>Analyst</b> H_D			
<b>Method</b> SM 2510B			

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M9W 5W8  
Attention: Mr. Nan Du  
PO#: A10832  
Invoice to: EnGlobe Corp.

Report Number: 1717130  
Date Submitted: 2017-09-07  
Date Reported: 2017-09-13  
Project: B-0017786  
COC #: 192520

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
Conductivity	<5 uS/cm	99	90-110
<b>Method</b> SM 4500-H+B			
pH	6.59	100	90-110
<b>Run No</b> 332976 <b>Analysis/Extraction Date</b> 2017-09-07 <b>Analyst</b> TJB			
<b>Method</b> V 8260B			
Tetrachloroethane, 1,1,1,2-	<0.5 ug/L	118	60-130
Trichloroethane, 1,1,1-	<0.4 ug/L	115	60-130
Tetrachloroethane, 1,1,2,2-	<0.5 ug/L	109	60-130
Trichloroethane, 1,1,2-	<0.4 ug/L	98	60-130
Dichloroethane, 1,1-	<0.4 ug/L	116	60-130
Dichloroethylene, 1,1-	<0.5 ug/L	116	60-130
Dichlorobenzene, 1,2-	<0.4 ug/L	103	60-130
Dichloroethane, 1,2-	<0.2 ug/L	113	60-130
Dichloropropane, 1,2-	<0.5 ug/L	105	60-130
1,3,5-trimethylbenzene	<0.3 ug/L	118	60-130
Dichlorobenzene, 1,3-	<0.4 ug/L	108	60-130
Dichlorobenzene, 1,4-	<0.4 ug/L	101	60-130
Benzene	<0.5 ug/L	109	60-130

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Client: EnGlobe Corp. (Toronto)  
1821 Albion Road, Unit 7  
Toronto, ON  
M9W 5W8  
Attention: Mr. Nan Du  
PO#: A10832  
Invoice to: EnGlobe Corp.

Report Number: 1717130  
Date Submitted: 2017-09-07  
Date Reported: 2017-09-13  
Project: B-0017786  
COC #: 192520

**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
Bromodichloromethane	<0.3 ug/L	105	60-130
Bromoform	<0.4 ug/L	91	60-130
Bromomethane	<0.5 ug/L	118	60-130
Dichloroethylene, 1,2-cis-	<0.4 ug/L	101	60-130
Dichloropropene, 1,3-cis-	<0.2 ug/L	104	60-130
Carbon Tetrachloride	<0.2 ug/L	117	60-130
Chloroethane	<0.2 ug/L	112	60-130
Chloroform	<0.5 ug/L	112	60-130
Dibromochloromethane	<0.3 ug/L	106	60-130
Dichlorodifluoromethane	<0.5 ug/L	106	60-130
Methylene Chloride	<4.0 ug/L	85	60-130
Ethylbenzene	<0.5 ug/L	110	60-130
Ethylene dibromide	<0.2 ug/L	100	60-130
Hexane (n)	<5 ug/L	120	60-130
m/p-xylene	<0.4 ug/L	112	60-130
Chlorobenzene	<0.2 ug/L	111	60-130
o-xylene	<0.4 ug/L	112	60-130

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# Certificate of Analysis

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## QC Summary

Analyte	Blank	QC % Rec	QC Limits
Styrene	<0.5 ug/L	97	60-130
Dichloroethylene, 1,2-trans-	<0.4 ug/L	105	60-130
Dichloropropene, 1,3-trans-	<0.2 ug/L	103	60-130
Tetrachloroethylene	<0.3 ug/L	120	60-130
Toluene	<0.5 ug/L	112	60-130
Trichloroethylene	<0.3 ug/L	91	60-130
Trichlorofluoromethane	<0.5 ug/L	104	60-130
Vinyl Chloride	<0.2 ug/L	104	60-130
<b>Run No</b> 332977 <b>Analysis/Extraction Date</b> 2017-09-11 <b>Analyst</b> TJB			
<b>Method</b> V 8260B			
Xylene Mixture			
<b>Run No</b> 332986 <b>Analysis/Extraction Date</b> 2017-09-11 <b>Analyst</b> C_F			
<b>Method</b> C SM4500-CNC			
Cyanide (CN-)	<5 ug/L	112	75-125
<b>Run No</b> 333003 <b>Analysis/Extraction Date</b> 2017-09-11 <b>Analyst</b> SKH			
<b>Method</b> M SM3120B-3500C			
Sodium	<2000 ug/L	101	82-118
<b>Run No</b> 333010 <b>Analysis/Extraction Date</b> 2017-09-11 <b>Analyst</b> AJS			

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**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
<b>Method</b> M SM3112B-3500B			
Mercury	<0.0001 ug/L	100	76-123
<b>Run No</b> 333047	<b>Analysis/Extraction Date</b> 2017-09-11	<b>Analyst</b> JLD	
<b>Method</b> P 8270			
1+2-methylnaphthalene	<0.1 ug/L		
<b>Run No</b> 333054	<b>Analysis/Extraction Date</b> 2017-09-11	<b>Analyst</b> JLD	
<b>Method</b> P 8270			
Methylnaphthalene, 1-	<0.1 ug/L	60	50-140
Methylnaphthalene, 2-	<0.1 ug/L	60	50-140
Acenaphthene	<0.1 ug/L	56	50-140
Acenaphthylene	<0.1 ug/L	54	50-140
Anthracene	<0.1 ug/L	62	50-140
Benz[a]anthracene	<0.1 ug/L	70	50-140
Benzo[a]pyrene	<0.01 ug/L	69	50-140
Benzo[b]fluoranthene	<0.05 ug/L	72	50-140
Benzo[ghi]perylene	<0.1 ug/L	58	50-140
Benzo[k]fluoranthene	<0.05 ug/L	76	50-140
Chrysene	<0.05 ug/L	68	50-140

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**QC Summary**

Analyte	Blank	QC % Rec	QC Limits
Dibenz[a h]anthracene	<0.1 ug/L	62	50-140
Fluoranthene	<0.1 ug/L	64	50-140
Fluorene	<0.1 ug/L	60	50-140
Indeno[1 2 3-cd]pyrene	<0.1 ug/L	64	50-140
Naphthalene	<0.1 ug/L	52	50-140
Phenanthrene	<0.1 ug/L	64	50-140
Pyrene	<0.1 ug/L	64	50-140
<b>Run No 333087 Analysis/Extraction Date 2017-09-12 Analyst AET</b>			
<b>Method SUBCONTRACT P-INORG</b>			
Chromium VI	<10.0 ug/L	92	80-120
<b>Run No 333140 Analysis/Extraction Date 2017-09-13 Analyst H_F</b>			
<b>Method SM 4110</b>			
Chloride	<1000 ug/L	97	90-110

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**Sample Comment Summary**

Sample ID: 1319057 BH/MW-6 Metals spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte. Metals duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the MRL. Sodium analysis for this report performed from nitric acid preserved bottle.

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