Englobe
Soils Materials Environment

Mr. Corby Kirwin

GEOTECHNICAL ENGINEERING REPORT

December 21, 2020

Proposed Transit Building Addition
Clark Street South, Woodstock, Ontario

160-B-0022503-01-100-GE-R-0001-00

FINAL REPORT

Englobe

Prepared by:

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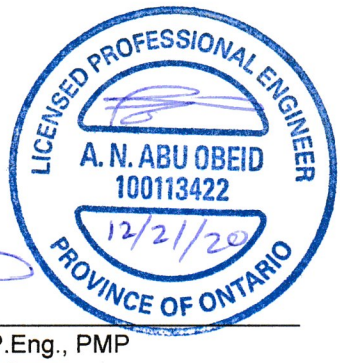
Geotechnical Engineer



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Revision and Publication Register		
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00	2020-12-21	Final Report Issued to Client

Property and Confidentiality

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1 Introduction

Englobe Corp. (Englobe) was retained by SPH Engineering, to perform a Geotechnical Investigation on a property located at Clark Street South, Woodstock, Ontario as shown on the Location Plan, Drawing 1 in Appendix 1. This work, in accordance with Englobe Proposal 2020-P160-0243 dated July 15, 2020, was authorized by Mr. Corby Kirwin.

The proposed project involves the construction of a building addition featuring slab-on-grade construction with repair and/or install of light and heavy pavement structures as shown on the Site Plan, Drawing 2 in Appendix 1.

The anticipated design loads and the design grades for the proposed building are not known at the time of this report preparation.

The purpose of this investigation was to determine the subsurface conditions at the site and based on that information, provide geotechnical design parameters and recommendations for aspects of the proposed development including, foundations, slab-on-grade, excavation and groundwater control, site drainage, site servicing and backfill and pavements.

2 Investigation Procedure

2.1 Field Program

The fieldwork for this investigation was performed on September 1, 2020 and involved drilling three (3) boreholes located as shown on the Site Plan, Drawing 2 in Appendix 1.

At the time of fieldwork, the study area comprised a paved parking lot. The site topography within the study area was generally level. The field investigation was carried out in general conformance with the professional standards set out in the Canadian Foundation Engineering Manual (CFEM 2006, 4th Edition), applicable Ontario Regulations and ASTM International. The following is a summary of field investigation tasks:

- Utility locates and drilling coordination were carried out by Englobe prior to mobilization to site.
- The boreholes were advanced to sampling depths ranging from 4.6 m using a Marooka Drill Rig equipped with solid stem augers supplied and operated by London Soil Test Ltd. under the supervision of an Englobe drilling supervisor. The boreholes were logged by Englobe geotechnical supervisor.
- The level of the ground surface at each borehole location was related to a local benchmark, which was taken a nail set in asphalt at the south west corner of existing building on the site (the approximate location of benchmark is shown on the Site Plan, Drawing 2 in Appendix 1). The elevation of the benchmark assigned an arbitrary elevation of 100.00 m.

- Soil samples were recovered from the boreholes at regular depth intervals using a 50 mm outside diameter split spoon sampler in accordance with ASTM D1586 Standard Penetration Test (SPT).
- Groundwater observations were noted, and measurements were carried out in the open boreholes during and upon completion of drilling and noted on borehole logs.
- The boreholes were backfilled with soil cuttings and bentonite in accordance with Ontario Regulation 903 as amended, under the Ontario Water Resources Act.

2.2 Laboratory Testing

All soil samples recovered during this investigation were returned to our laboratory for visual examination and moisture content testing. The moisture content values are shown on the appended borehole logs.

One grain size distribution analysis was performed on a sample of the sandy silt deposit, found at the depth of 1.8± m from Borehole 03-20. The test results are shown graphically on Figure 1 in Appendix 3 and summarized in Table 1 Section 3 (Subsurface Conditions).

The soil samples will be stored for a period of three months from the date of this report. After this time, they will be discarded unless prior arrangements have been made for longer storage.

3 Subsurface Conditions

This section presents a brief summary of the subsurface soil and groundwater conditions encountered during the geotechnical investigation. The full details of the subsoil and groundwater conditions are presented on borehole logs in Appendix 2.

The boreholes revealed a surface layer of asphalt concrete (130 mm to 150 mm thick), followed by granular fill material, followed by a fill deposit with material ranging from silt to clayey silt to silty sand, overlying a native silt to sandy silt.

The granular fill material (230 mm to 480 mm thick), observed under the asphalt concrete, consists of sand to gravelly sand to sand and gravel and penetrated to depths ranging from 0.36 to 0.61 metres below the surface (mbgs).

A fill layer is observed under the granular fill, generally comprises of silt to clayey to silty sand with occasional interlayer of sand to sand and gravel to sandy silt. The fill layer penetrated to depths ranging from 1.22 to 1.83 mbgs.

A native deposit generally comprised of silt to sandy silt, trace to some clay, trace to some gravel was observed in all boreholes 01-20 to 03-20 and extended to the termination depth of 4.6 mbgs. The SPT N-values in the silt to sandy silt deposits ranges from 5 to 61 blows per 300 mm penetration of the split spoon sampler indicating loose to very dense in compactness

condition. Moisture contents within the native silt to sandy silt deposit ranged from 5% to 14%, generally moist and wet below 4.2 mbgs.

The results of the particle size distribution analysis from a sample of sandy silt from Borehole 03-20 are provided in Figure 1, Appendix 3 and summarized in Table 1.

Table 1 Particle Size Distribution Analyses

Borehole and Sample Number	Sample Depth (m)	Soil Type	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 03-20, SS-3	1.83– 2.29	Sandy Silt, some gravel and clay	15	35	32	18

Based on the grain size distribution results, the native silty to sandy silt soil is estimated to have a coefficient of permeability (k) of 1.0 x 10^{-6} cm/sec and corresponding percolation T-time is between 20 to 50 mins/cm as described by the Unified Soil Classification System in Supplementary Standard SB-6 of the Ontario Building Code (OBC).

Geological conditions are innately variable. Information about the subsurface stratigraphy is only available at discrete borehole locations at the time of report preparation. To develop recommendations from the available information, it is necessary to make some assumptions concerning conditions at locations between boreholes. Adequate inspection should be provided during construction to check that these assumptions are reasonable.

4 Groundwater

All the boreholes were dry and open at the completion of drilling with no ground water observed.

Saturated soil samples were encountered at a depth of 4.2 m. Typically, the grey colour of the native silt to sandy silt deposit encountered at 2.6 m depth is indicative of permanent saturated conditions and therefore, the long-term groundwater table should be expected to be at this depth. Perched groundwater may occur above this depth particularity following heavy rainfall or snow melt.

It is important to note that the groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. These elevations and conditions may vary locally due to seasonal fluctuations, groundwater regimes encountered at the site or as a consequence of construction activities on the site or adjacent sites.

5 Environmental Analysis Results

A total of three (3) subsoil samples were selected by Englobe and submitted to ALS Environmental for environmental analysis (metals & inorganic, electrical conductivity (EC), sodium adsorption ratio (SAR) and PHC F1-F4 parameters) in accordance with Ontario

Regulation 153/04 (as amended by Ontario Regulation 511/09). The bulk analysis results were then compared with O.Reg.153/04 Table 1 criteria (Full Depth Background Site Condition Standards for Residential/ Parkland/ Institutional/ Industrial/ Commercial Property Use). The complete environmental analysis results, including the ALS Certificate of Analysis, are given in Appendix 4. With the exception of exceedances of O.Reg.153 (as amended by O.Reg.511/09) criteria for:

- Sodium Adsorption Ratio: (BH01-20 S-4, BH02-20 S-1 and BH03-20 S2)
- Electrical Conductivity: (BH03-20 S2)
- Hydrocarbons
    - F1 to F3 including F1-BTEX (BH01-20 S-4)
    - F2 only (BH03-20 S2)
- Volatile Organic Compounds:
    - Ethylbenzene: (BH01-20 S-4)
    - Xylenes (Total): (BH01-20 S-4, BH02-20 S-1)

The results did not indicate any other exceedances of the parameters tested for all the remaining samples and analysis criteria.

6 Discussion and Recommendations

Shallow foundations and grade supported floor slabs for the building addition are considered technically feasible. Several factors exist within the study area that could impact construction of the proposed development, including:

- Presence of pavement and fill materials;
- Relatively low strength of the upper soils;
- Frost susceptibility of subsurface soil; and,
- Potential presence of cobble and boulders in the silt to sandy silt deposit.
- Proximity to existing building that may likely require the existing footings to be underpinned.

6.1 Shallow Foundation Design

It is understood that there will be no basement area for the proposed building addition. To avoid unpredicted settlement, the new addition footings should be constructed at the same founding elevations of the existing building footings otherwise underpinning of the existing adjacent footings may be required.

Based on the investigation, competent ground is approximately 3.0 m below finished floor grades at the proposed building addition, in areas where the native soil has not been disturbed, as represented by Boreholes 01-20 and 03-20. All fill and other weak upper soil must be removed from new foundation areas, and footings founded on approved native compact subgrades depths listed in Table 2, may provide a serviceability limits state (SLS) design pressure of 100 kPa and factored ultimate limit state (ULS) pressure of 150 kPa. A geotechnical resistance factor of 0.5 has been applied.

Table 2 Depth to Competent Bearing Surface

Borehole No.	Ground Surface Elevation (m)	Depth to Bearing Stratum (m)	Elevation of Bearing Strata (m)
BH 01-20	99.82	3.0	96.82
BH 02-20	99.95	3.0	96.95
BH 03-20	99.61	3.0	96.61

Where required, the approved native subgrade can be raised to a higher founding level by constructing structural fill consisting of approved imported sand and gravel such as OPSS.MUNI 1010 Granular B Type 1 placed in 150 mm thick lifts with each lift compacted to 100% Standard Proctor Maximum Dry Density (SPMDD). Structural fill shall extend at least 1.0 m beyond the outer edges of the building where it may be sloped downward to the approved native subgrade level at a gradient not steeper than 1 horizontal to 1 vertical if embedded and at a slope of 3 horizontal to 1 vertical if exposed. The above recommended soil bearing pressures may be also used for the design of footings founded on structural fill.

Compaction testing by experienced geotechnical personnel should be carried out to examine and approve structural fill materials, and to verify that the specified degree of compaction has been achieved.

In order to minimize the disturbance of soil subgrades it is recommended that foundation excavations be carried out using a smooth-blade bucket.

The native mineral soils are susceptible to disturbance by workers during foundation construction and, therefore, it is recommended that a working slab of lean concrete (mud slab) be placed in the footing areas immediately after excavation and inspection to protect the founding soils during placement of formwork and reinforcing steel.

The total and differential settlements of footings not more than two metres in width and subjected to the maximum serviceability limit states pressures, are estimated to not exceed 25 and 20 mm, respectively.

To provide sufficient protection against heave due to frost action, all exterior footings and footings in non-heated areas must incorporate a minimum depth of soil cover of 1.2 m between the footing subgrade and the finished ground surface.

The site classification for seismic site response has been determined in accordance with Table 4.1.8.4.-A of the Ontario Building Code. The site classification for seismic site response may be taken as Site Class D.

The footing areas must be checked by a geotechnical engineer from Englobe to ensure that the soil conditions encountered at the time of construction are suitable to support the design pressure. Any disturbed soil identified during the inspection should be removed from the footing areas and replaced with concrete.

6.2 Slab-on-Grade Construction

The floor of the proposed building addition represented by Boreholes 01-20 to 03-20 may be constructed using conventional slab-on-grade techniques following removal of pavement and any loose or fill material (noted upto 1.83 m thick). The subgrade shall then be proof-rolled and inspected to evaluate the subgrade soil condition. Any spongy zones revealed during the proof-rolling shall be sub-excavated. Fill required to raise grades beneath the slab-on-grade floor or to backfill sub-excavated zones should comprise of approved materials such as OPSS.MUNI 1010 Granular B Type 1 placed in 150 mm thick lifts with each lift compacted to 100% Standard Proctor Maximum Dry Density (SPMDD).

A minimum 150 mm thick layer of OPSS.MUNI 1010 Granular A material compacted to 100% SPMDD should be placed on an approved subgrade soil, directly beneath the slab for leveling and uniform support purposes.

A modulus of subgrade reaction (k) of 25 MPa/m may be used for the design of the floor slabs on granular structural fill. The slab-on-grade floor should be independent of all load-bearing walls and columns.

To achieve a reasonable level of performance from a grade-supported floor slab, it is essential to have a relatively uniform subgrade. Cracking, differential movements, and poor performance of floor slabs may be related to variations in the subgrade support. Uniformity in material, moisture content and density would be required. This level of uniformity would require the same type of material throughout the entire subgrade, placed at a similar moisture content and density.

To prevent the migration of moisture vapour into the building from beneath ground floor slabs, particularly where moisture sensitive floor coverings are placed, a vapour retarder shall be placed directly beneath the floor slab that meets the requirements of the designer and flooring manufacturer. Prior to installing moisture sensitive floor coverings, the moisture content of the concrete slab must be determined at operational conditions by internal relative humidity testing to ensure an acceptable slab moisture level. It should be noted that it typically takes more than 90 days at operational conditions to lower the slabs internal relative humidity to 85%. Different flooring systems have different responses to slab moisture (i.e., some systems can tolerate more moisture than others), and the flooring contractor must assess the floor moisture levels with respect to their flooring components.

No underfloor drains are required provided the exterior grades are lower than the finished floor slab and positively sloped away from the building.

The water to cement ratio and slump of the concrete utilized in the floor slab should be strictly controlled to minimize shrinkage of the slab. Control joints should be sawed into the slab at maximum 4 m spacings within 12 hours of initial concrete placement in order to pre-locate shrinkage cracks. The saw-cut depths should be ¼ of the slab thickness.

During placement of concrete at the construction site, testing should be performed to determine the slump, temperature, and air entrainment of the concrete; and concrete cylinders should be cast for compressive strength testing.

6.3 Excavations and Groundwater Control

Temporary excavations to conventional depths for installation of foundation at this site must comply with O.Reg. 213/91 under the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The predominant soils encountered in the boreholes would be classified as Type 3 soils (O.Reg. 213/91, s. 226(4)). Temporary side slopes must be cut at an inclination of 1 horizontal to 1 vertical or less from the base of the excavation (exclusive of groundwater effects) as per O.Reg. 213/91, s. 234(2). If groundwater seepage is occurring into the excavations, then the slopes must be trimmed back to a flatter angle to achieve stability.

Particular care will be required to minimize loss of ground or settlement on the adjacent building. Where space limitations do not permit overburden cut slopes at inclinations specified above, a steeper cut slope can be employed with temporary shoring along the sides of the proposed excavation. The temporary shoring design must include appropriate factors of safety, and any possible surcharge loading must be taken into account. The support system must comply with sections 234 to 239 and 241 of O.Reg. 213/91. Temporary protective structures, bracing, shoring, anchors, and sheeting are the responsibility of the contractor and shall be designed by a Professional Engineer licensed in Ontario.

Levels of permanent saturation are indicated by the change in colour of the native silt to sandy silt from brown to grey in Boreholes 01-20 to 03-20 at a depth of about 2.3 m. All boreholes remained dry and open at the time of drilling. Based on the borehole findings, it is anticipated that groundwater and surface water entering open excavations may be controlled using a properly constructed gravity dewatering system with conventional sump pumping techniques.

6.4 Site Servicing and Backfill

The contacted fill and any encountered loose native soils may not be suitable to support the site services pipes without undergoing possible detrimental post-construction settlement. Any fill and/or loose native soils must be removed from below the pipe invert. Sub-excavated fill or loose native soils should be replaced with OPSS.MUNI 1010 Granular A to ensure adequate support for the pipe. The fill should be placed in 150 mm thick lifts and compacted to a

minimum 100% SPMDD. The native compact silt to silty sand or well compacted granular fill are generally considered suitable for support of buried pipes.

The pipe bedding for the services should be conventional Class B pipe bedding comprising a minimum 150 mm thick layer of OPSS.MUNI 1010 Granular A aggregate below the pipe invert. The bedding course may be thickened if portions of the subgrade become wet during excavation. OPSS.MUNI 1010 Granular A type aggregate should be provided around the pipe to at least 300 mm above the top, and the bedding materials must be placed in lifts not exceeding 150 mm and should be compacted to 98% SPMDD. Service lines installed outside of heated areas should be provided with a minimum 1.2 m of soil cover or equivalent insulation for frost protection.

The trenches above the specified pipe cover material should be backfilled with inorganic soils that are not excessively wet placed in 150 mm thick lifts and compacted to at least 98% SPMDD. Where the service trenches enter the building, the trench backfill must be compacted as structural fill to a minimum of 100% SPMDD. Any trench backfill below a pavement structure should be compacted to 100% SPMDD within 1 m from the top of subgrade level.

Excavated material which is not excessively wet may be used as utility trench backfill, providing it is free of organic and deleterious materials. Excessively wet soil should be wasted, or it may be used as backfill within non-settlement sensitive areas, such as landscaped areas.

Use of imported granular fill is recommended as backfill in areas where use of heavy compaction equipment is limited, such as around manholes and adjacent to retaining walls.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed. Care should be taken to direct surface runoff away from the excavations. Should construction extend into the winter season then backfilling operations should be planned to ensure that backfill material is kept to a minimum and ensured that frozen material is not used as backfill.

Particular attention must be made to backfilling service connections where the trenches are narrow. If work is carried out during very dry weather, then water could be added to the backfill to improve compaction.

Frequent inspection and compaction testing by experienced geotechnical personnel should be carried out to examine and approve backfill material, and to verify that the specified degree of compaction has been achieved.

6.5 Underpinning of Existing Footings

The underpinning should be carried out in limited sections by excavating the soil below the existing foundation in a controlled manner. The borehole findings indicate that underpinning may be carried out within low strength soil material, thus it is recommended that the underpinning be carried out with maximum vertical underpinning lifts each 0.5 m deep. Initial excavation should be carried out to 0.5 m below the existing footing depth adjacent to the building wall with a 0.5 m bench extending from the edge of the existing foundation followed by

a downward slope of 1:1. Underpinning trenches can then be cut through the berm with a width of 1.2 m, and it is recommended that a distance of 3.5 m be maintained between underpinning sections which are carried out at the same time. Each underpinning section must be excavated and concreted (minimum 25 MPa at 28 days) in one day. The second and third series of underpinning sections can then be extended through the berm in a similar manner. Within loose soil conditions the maximum vertical lift of underpinning should not exceed 500 mm, and the construction joints between underpinning sections shall be staggered from one level to the next.

It will be required to retain a specialist contractor and structural engineer to design the underpinning system. If the underpinning excavation may affect the stability of an adjacent building or structure, the contractor shall take precautions to prevent damage to the adjacent building or structure as per O.Reg. 213/91, s. 229.

6.6 Pavement Structure

Prior to undertaking any pavement construction work, the drainage and sub-drainage should be carefully assessed, noting that provision of proper drainage is fundamental to the performance of the roadway to mitigate frost-related movements and minimize seasonal loss of subgrade support (subgrade softening in spring). In this regard, proper drainage consists of installation of subdrains/ditches, having the invert at least 0.6 m below the top of subgrade and leading to a positive outlet. The subdrains should extend out of each face of catch basins located in parking areas, and parallel to the edge of the pavement for catch basins on the side of roadways. Pavements should also be provided with a centre-to-edge cross-fall of 2 percent.

Preparation of pavement subgrades should be carried out as outlined for slab-on-grade construction Section 6.2. The approved subgrade in pavement areas may be raised to design subgrade level with approved on-site mineral soil, providing it is placed in maximum 150 mm thick lifts and each lift is compacted to at least 98% SPMDD.

It is anticipated that new pavement areas will be subjected to either light or heavy traffic. Light duty areas are defined as passenger car parking only. Heavy duty areas are main driveways and routes where Federal Highway Administration (FHWA) Class 4 to Class 13 trucks and buses would travel. Heavy duty areas are restricted to less than 50 trucks per day. Under dry subgrade and weather conditions during construction, the following minimum pavement designs may be provided.

Table 3 Pavement Designs

PAVEMENT CLASSIFICATION	HL 3 SURFACE ASPHALT	HL 8 BASE ASPHALT	OPSS.MUNI 1010 GRANULAR A BASE	OPSS.MUNI 1010 GRANULAR B TYPE 1 SUB-BASE
Light Duty	35 mm	40 mm	150 mm	300 mm
Heavy Duty	40 mm	50 mm	150 mm	450 mm

To provide a competent support for the asphalt layers, the pavement granular materials shall be compacted to 100% SPMDD. The asphalt must be supplied and placed in accordance with OPSS forms 310 and 1150.

6.7 Removal of Site Excavated Material

Soil samples from each borehole were submitted to the ALS Environmental Laboratory in London and subjected to metals and inorganic, electrical conductivity (EC), sodium adsorption ratio (SAR) and PHC F1-F4 parameters. The Certificate of Analysis is provided in Appendix 4. The test results indicate that the Table 1 Soil Standards under Ont. Reg. 153/04 as amended have been exceeded for the EC, SAR and PHC parameters. The SAR and conductivity exceedances may be the result of the application of road salt and PHC parameters exceedances may due to oil spill.

Based on the investigation, it is not possible to delineate clean soil present at the site in continuous or discontinues subsurface layers of fill material and native deposits. In addition, based on the borehole locations and sampling results, it is not possible to conclude a horizontally potential clean soil zone within the areas. Based on testing results, the excavated soil from the site may be transferred to a licensed Ministry of the Environment, Conservation and Parks (MECP) landfill for final disposal.

Prior to removal of excavated soil from the site, a copy of the test results should be forwarded to authorities at the receiving sites for approval.

7 Statement of Limitations

The geotechnical recommendations provided in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known at the time of report preparation, we recommend that we be retained during the final design stage to verify that the geotechnical recommendations have been correctly interpreted in the design. Also, if any further clarification and/or elaboration are needed concerning the geotechnical aspects of the project, Englobe should be contacted. We recommend that we be retained during construction to confirm that the subsurface conditions do not deviate materially from those encountered in the test holes and to ensure that our recommendations are properly understood. Quality assurance testing and inspection services during construction are a necessary part of the evaluation of the subsurface conditions.

The geotechnical recommendations provided in this report are intended for the use of the Client or its agent and may not be used by a Third Party without the expressed written consent of Englobe and the Client. They are not intended as specifications or instructions to contractors. Any use which a contractor makes of this report, or decisions made based on it, are the responsibility of the contractor. The contractor must also accept the responsibility for means and methods of construction, seek additional information if required, and draw their own

conclusions as to how the subsurface conditions may affect their work. Englobe accepts no responsibility and denies any liability whatsoever for any damages arising from improper or unauthorized use of the report or parts thereof.

It should be noted that the soil boundaries indicated on the borehole logs are inferred from noncontinuous 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 locations only.

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

It is important to note that the geotechnical assessment involves a limited sampling of the site gathered at specific test hole locations and the conclusions in this report are based on this information gathered and in accordance with normally accepted practices. The subsurface geotechnical, hydrogeological, environmental and geologic conditions between and beyond the test holes will differ from those encountered at the test holes. Also such conditions are not uniform and can vary over time. Should subsurface conditions be encountered which differ materially from those indicated at the test holes, we request that we be notified in order to assess the additional information and determine whether or not changes should be made as a result of the conditions. Englobe will not be responsible to any party for damages incurred as a result of failing to notify Englobe that differing site or subsurface conditions are present upon becoming aware of such conditions.

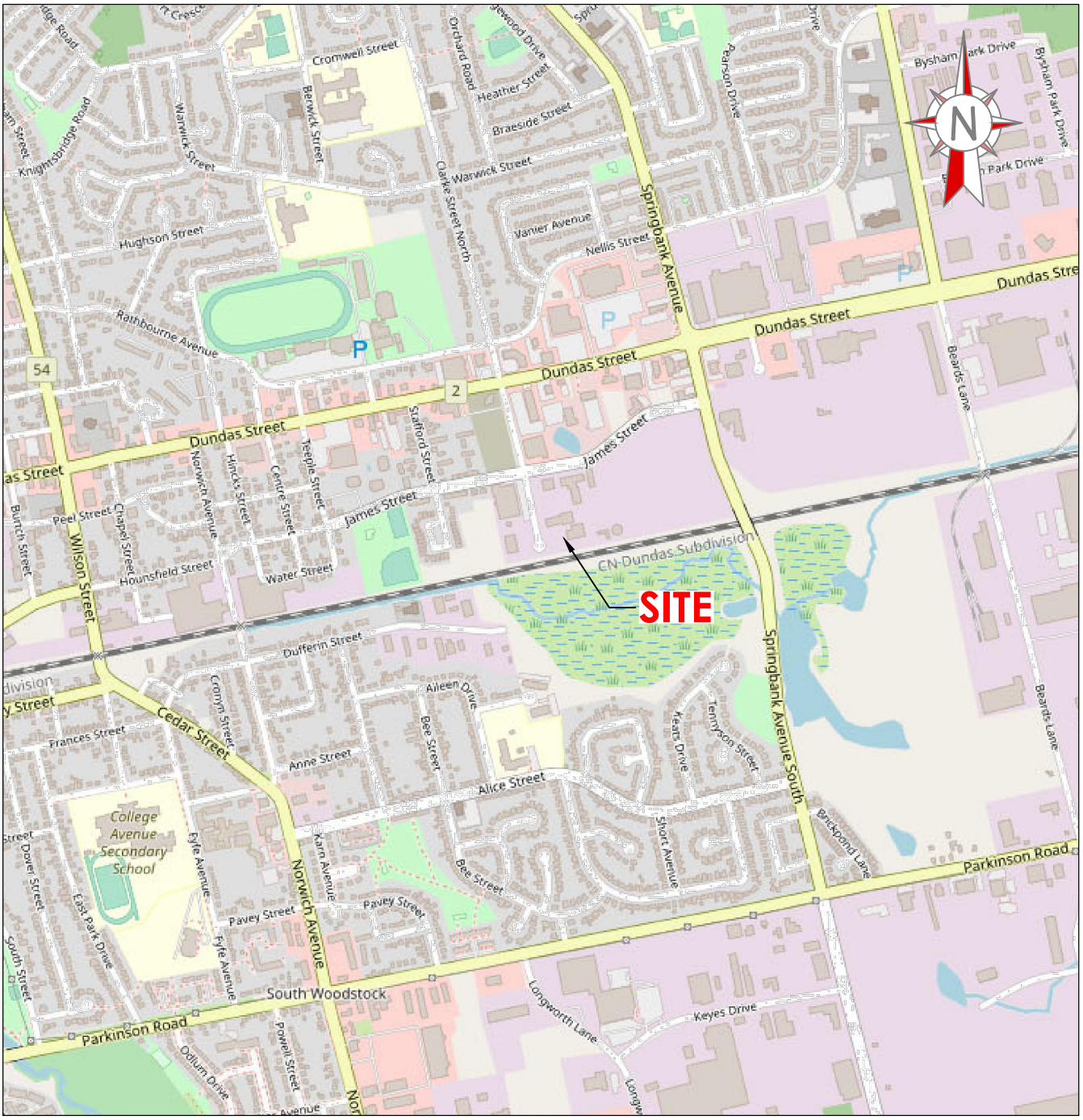
The professional services provided for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise stated specifically in the report. The recommendations and opinions given in this report are based on our professional judgment and are for the guidance of the Client or its Agent in the design of the specific project. No other warranties or guarantees, expressed or implied, are made.

The Englobe recommendations are contingent upon provision of a consistently competent, stable subgrade, which is properly drained and free of soft spots and objectionable materials such as organics.

All construction works should only be completed during periods of favourable weather. The need for continuous construction supervision by a qualified, experienced technician, and quality control testing during construction projects cannot be over-emphasized. All materials and construction services required should be in accordance with Ontario Provincial Standard Specifications.

Appendix 1 Drawings

Drawing 1: Location Plan
Drawing 2: Site Plan



NOTES:

1-REFERENCE: © OpenStreetMap contributors (2020).

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

0 100 200 300 400 500 m

SCALE 1:15000

Project

Transit Building Addition

Clark Street South, Woodstock, Ontario

Title

LOCATION PLAN

Englobe

12-60 Meg Drive
London (Ontario) N6E 3T6
Telephone : 519.685.6400
Fax : 519.685.0943

Prepared	E.Ciochon	Discipline	GEOTECHNICAL	Project manager	A.Steward
Drawn	E.Ciochon	Scale	1 : 15000	Sequence no.	01 of 02
Checked	A.Stewart	Date	2020-11-03		

M. dept.	Project	Disc.	Dwg no.	Rev.
160	B-0022503-1	GE	001	00

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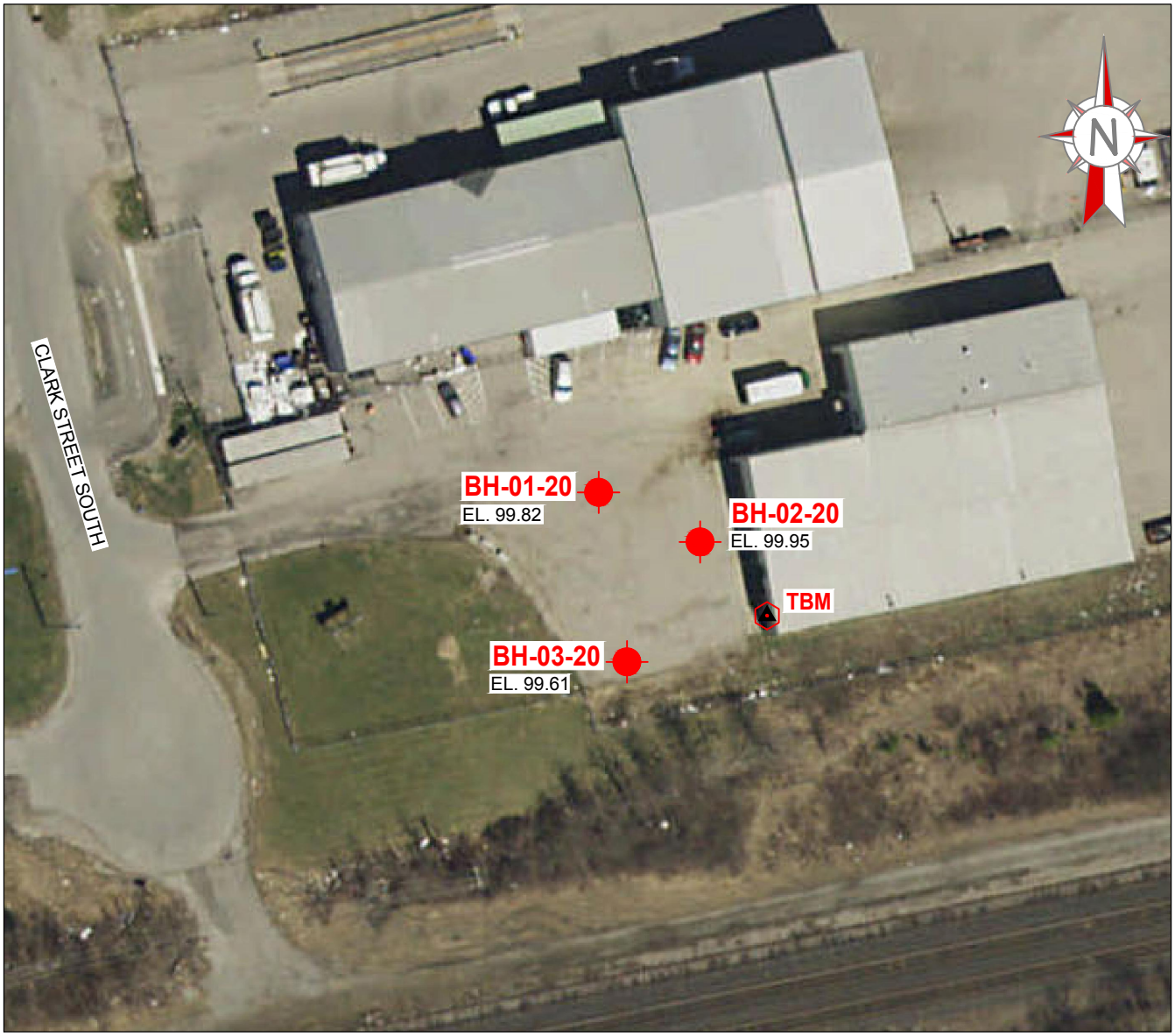

LEGEND:

BOREHOLE LOCATION

EL. 99.61 GROUND SURFACE ELEVATION (m)

TBM TEMPORARY BENCHMARK

0 10 20 30 m

SCALE 1:750

NOTES:

1-REFERENCE: MINISTRY OF NATURAL RESOURCES AND FORESTRY @ Queen's Printer for Ontario, 2015 Aerial Photograph (2020).

2-TEMPORARY BENCHMARK: Top of finished floor at southwest corner of existing garage, Elevation 100.00 m (assumed local datum).

3-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

Transit Building Addition

Clark Street South, Woodstock, Ontario

Title

SITE PLAN

Englobe

12-60 Meg Drive
London (Ontario) N6E 3T6
Telephone : 519.685.6400
Fax : 519.685.0943

Prepared	E.Ciochon	Discipline	GEOTECHNICAL	Project manager	A.Steward
Drawn	E.Ciochon	Scale	1 : 750	Sequence no.	02 of 02
Checked	A.Stewart	Date	2020-11-03		

M. dept.	Project	Disc.	Dwg no.	Rev.
160	B-0022503-1	GE	002	00

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Appendix 2 Borehole Logs

List of Abbreviations
Boreholes BH-01-20 to BH-05-20

LIST OF ABBREVIATIONS

The abbreviations commonly employed on the borehole logs, on the figures, and in the text of the report, are as follows:

Sample Types		Soil Tests and Properties	
AS	Auger Sample	SPT	Standard Penetration Test
CS	Chunk Sample	UC	Unconfined Compression
RC	Rock Core	FV	Field Vane Test
SS	Split Spoon	ø	Angle of internal friction
TW	Thinwall, Open	γ	Unit weight
WS	Wash Sample	w_p	Plastic limit
BS	Bulk Sample	w	Water content
GS	Grab Sample	w_l	Liquid limit
WC	Water Content Sample	I_L	Liquidity index
TP	Thinwall, Piston	I_p	Plasticity index
		PP	Pocket penetrometer

Penetration Resistances	
Dynamic Penetration Resistance	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) diameter 60 º cone a distance 300 mm (12 in.). The cone is attached to 'A' size drill rods and casing is not used.
Standard Penetration Resistance, N (ASTM D1586)	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a standard split spoon sampler 300 mm (12 in.)
WH	sampler advanced by static weight of hammer
PH	sampler advanced by hydraulic pressure
PM	sampler advanced by manual pressure

Soil Description

Cohesionless Soils	**SPT N-Value**	**Relative Density (D_r)**
Compactness Condition	(blows per 0.30 m)	(%)
Very Loose	0 to 4	0 to 20
Loose	4 to 10	20 to 40
Compact	10 to 30	40 to 60
Dense	30 to 50	60 to 80
Very Dense	over 50	80 to 100

Cohesive Soils	**Undrained Shear Strength (C_u)**	
Consistency	**kPa**	**psf**
Very Soft	less than 12	less than 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very Stiff	100 to 200	2000 to 4000
Hard	over 200	over 4000

DTPL	Drier than plastic limit
APL	About plastic limit
WTPL	Wetter than plastic limit

Englobe

Englobe
12 - 60 Meg Drive, London, ON, N6E 3T6
CONSULTING SOILS AND MATERIALS ENGINEERS
Phone: 519-685-6400 Fax: 519-685-0943

LOG OF BOREHOLE NO.
01-20

REF. NO.: B-0022503-1
CLIENT: SPH Engineering Inc.
PROJECT: Transit Building Addition
LOCATION: Clark Street South, Woodstock, Ontario
DATUM ELEVATION: Assumed 100m, Top of finished floor at SW corner of existing garage

Encl. No. 1 (Sheet 1 of 1)
DRILLING DATA:
METHOD: Solid Stem Auger
DIAMETER: 200 mm
DATE: Sep 1, 2020

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa (▲ Field Vane Test ★ Compression Test) (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
99.82											
	0	ASPHALT CONCRETE (150 mm):									
		GRANULAR FILL (460 mm): sand, some gravel, brown, moist									
99		FILL: silt, trace to some sand and gravel, compact, brown, moist			1	ss	12			3	
	1				2	ss	21				
98		SILT: trace to some sand and gravel, with dilatant sand seams, loose to very dense, brown, moist			3	ss	5			6	
	2	-- turns grey			4	ss	7			11	
97		-- compact			5	ss	13			9	
	3										
96		-- very dense, saturated sand seams			6	ss	61			8	
	4	Borehole Terminated. Open and dry at completion.									

LOG OF BOREHOLE B-0022503-1.GPJ ATK_DAV.GDT 21/12/20

Englobe
12 - 60 Meg Drive, London, ON, N6E 3T6
CONSULTING SOILS AND MATERIALS ENGINEERS
Phone: 519-685-6400 Fax: 519-685-0943

LOG OF BOREHOLE NO. 02-20

REF. NO.: B-0022503-1
CLIENT: SPH Engineering Inc.
PROJECT: Transit Building Addition
LOCATION: Clark Street South, Woodstock, Ontario
DATUM ELEVATION: Assumed 100m, Top of finished floor at SW corner of existing garage

Encl. No. 2 (Sheet 1 of 1)
DRILLING DATA:
METHOD: Solid Stem Auger
DIAMETER: 200 mm
DATE: Sep 1, 2020

Elev. metres	Depth metres	SUBSURFACE PROFILE – DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
99.95	0	ASPHALT CONCRETE (130 mm):								
		GRANULAR FILL (480 mm): sand to gravelly sand, brown, moist								
		FILL: clayey silt with sand, very soft, brown, moist			1	ss	5		3	
		SANDY SILT: some gravel, compact to dense, brown, moist			2	ss	15		14	
					3	ss	14		10	
					4	ss	17		11	
					5	ss	45		10	
		Borehole Terminated. Open and dry at completion.								

Penetration Resistance Blows/ft: 20, 40, 60, 80
Undrained Shear Strength kPa: ▲ Field Vane Test ★ Compression Test: 20, 40, 60, 80

Elevation scale: 99, 98, 97, 96, 95
Depth scale: 0, 1, 2, 3, 4, 5

Englobe
12 - 60 Meg Drive, London, ON, N6E 3T6
CONSULTING SOILS AND MATERIALS ENGINEERS
Phone: 519-685-6400 Fax: 519-685-0943

LOG OF BOREHOLE NO. 03-20

REF. NO.: B-0022503-1
CLIENT: SPH Engineering Inc.
PROJECT: Transit Building Addition
LOCATION: Clark Street South, Woodstock, Ontario
DATUM ELEVATION: Assumed 100m, Top of finished floor at SW corner of existing garage

Encl. No. 3 (Sheet 1 of 1)
DRILLING DATA:
METHOD: Solid Stem Auger
DIAMETER: 200 mm
DATE: Sep 1, 2020

SUBSURFACE PROFILE

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	● Penetration Resistance Blows/ft (20 40 60 80); Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
99.61	0	ASPHALT CONCRETE (150 mm):									
		GRANULAR FILL (230 mm): sand and gravel, brown, moist									
99		FILL: silty sand, some gravel, dark brown, moist -- brown sand and gravel -- black sand seams -- dark brown sandy silt			1	ss	7			2	
	1				2	ss	10			10	
98		-- brown silt, some sand and gravel									
	2	SANDY SILT: trace to some gravel, some clay, with dilatant sand seams, loose to compact, grey, moist			3	ss	8			10	
97		-- compact grey silty sand, trace clay, trace to some gravel			4	ss	27			9	
96	3										
	4	-- sand, some gravel, wet			5	ss	20			5	
		Borehole Terminated. Open and dry at completion.									

Appendix 3 Grain Size Distribution Analyses

Figure 1

60 Meg Drive Unit 12
London, Ontario
N6E 3T6

GRAIN SIZE AND HYDROMETER ANALYSIS REPORT
LS-602, 702 & 703/704

PROJECT NUMBER:	B-22503	PROJECT NAME:	Transit Building Addition, Clark Street South, Woodstock	CLIENT:	SPH Engineering Inc.
LAB NUMBER:	S-764	SAMPLE ID:	Borehole 3 Sample 3	SAMPLE DEPTH:	1.83 - 2.29m
SAMPLED BY:	Ed VanPuymbroech, BSc	DATE RECEIVED	September 4, 2020	DATE COMPLETED:	September 15, 2020

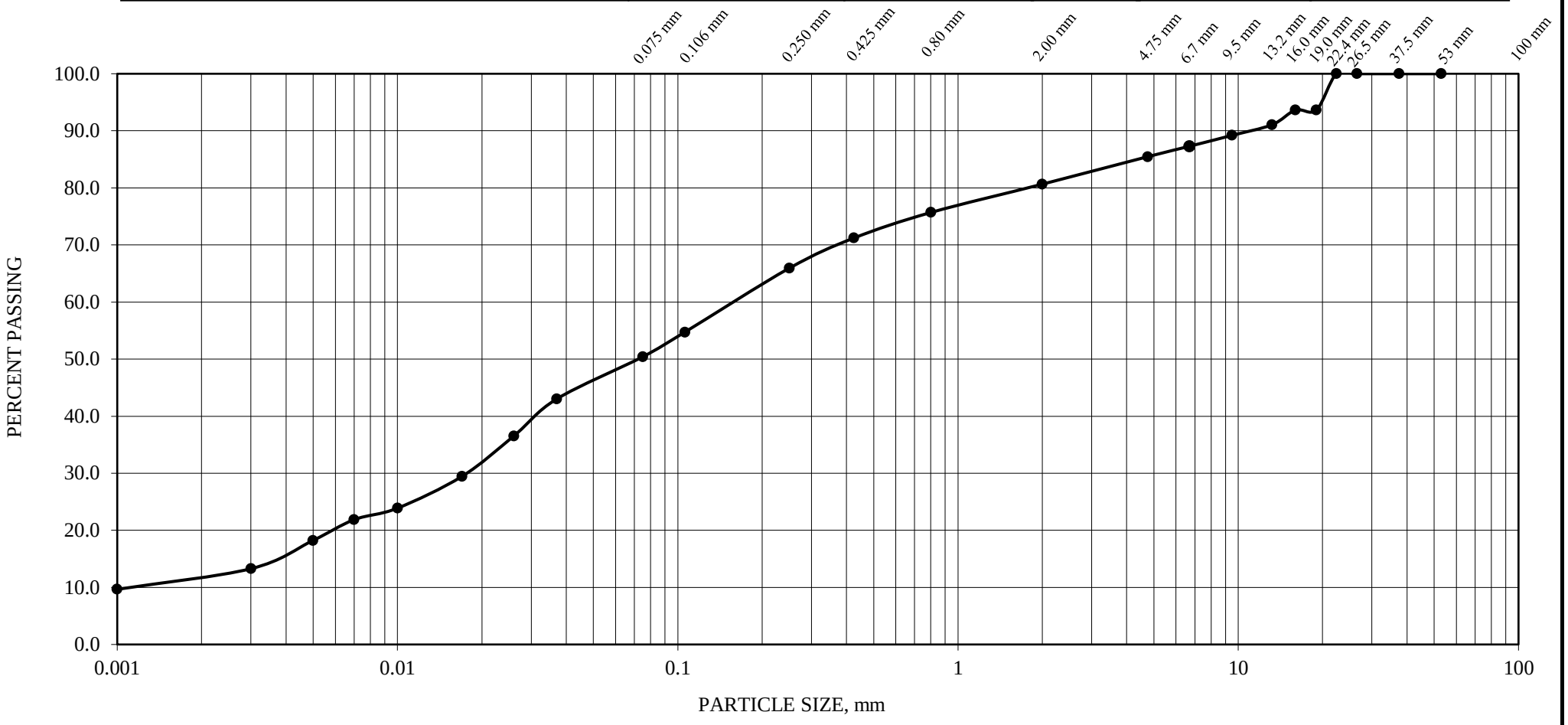
PARTICLE SIZE DISTRIBUTION, MTO LS-702

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



Coefficients					
D60	0.17378	D30	0.01768	D10	0.0012

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	% PASSING	DIAMETER mm	% PASSING
53	100.0	0.037	43.0
37.5	100.0	0.026	36.5
26.5	100.0	0.017	29.5
22.4	100.0	0.010	23.9
19	93.6	0.007	21.9
16	93.6	0.005	18.2
13.2	91.1	0.003	13.3
9.5	89.2	0.001	9.7
6.7	87.3	ATTERBERG LIMITS, %	
4.75	85.5		
2.00	80.7	Plastic Limit	
0.800	75.7		
0.425	71.2	Liquid Limit	
0.250	65.9		
0.106	54.7	Plastic Index	
0.075	50.4		

GRAIN SIZE PROPORTIONS, %	
% GRAVEL (> 4.75 mm):	14.5
% SAND (75 µm to 4.75 mm):	35.1
% Silt (5 µm to 75 µm):	32.2
% Clay (<5 µm):	18.2
SOIL DESCRIPTION:	Silty SAND, some Gravel and Clay

REMARKS

Figure: 1

TESTED BY: David McBay, C.Tech.
Laboratory Supervisor

REVIEWED BY Andrew Stewart, B.Eng., P.Eng.
Geotechnical Engineer

Appendix 4 ALS Lab Results

ALS Lab Work Order: L2501153

EnGlobe Corp. (London)
ATTN: ROB HELWIG
417 EXETER RD
LONDON ON N6E 2Z3

Date Received: 09-SEP-20
Report Date: 16-SEP-20 15:01 (MT)
Version: FINAL

Client Phone: 519-685-6400

Certificate of Analysis

Lab Work Order #: L2501153

Project P.O. #: NOT SUBMITTED
Job Reference: B-0022503-1
C of C Numbers:
Legal Site Desc:

Gayle Braun
Senior Account Manager

Summary of Guideline Exceedances

Guideline ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
Ontario Regulation 153/04 - April 15, 2011 Standards - T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use						
L2501153-1	BH01-20 S-4	Saturated Paste Extractables	SAR	16.5	2.4	SAR
		Volatile Organic Compounds	Ethylbenzene	0.495	0.05	ug/g
			Xylenes (Total)	1.03	0.05	ug/g
		Hydrocarbons	F1 (C6-C10)	80	25	ug/g
			F1-BTEX	78	25	ug/g
			F2 (C10-C16)	1830	10	ug/g
			F3 (C16-C34)	1020	240	ug/g
L2501153-2	BH02-20 S-1	Saturated Paste Extractables	SAR	15.3	2.4	SAR
		Volatile Organic Compounds	Xylenes (Total)	<0.076	0.05	ug/g
L2501153-3	BH03-20 S-2	Physical Tests	Conductivity	1.25	0.57	mS/cm
		Saturated Paste Extractables	SAR	8.09	2.4	SAR
		Hydrocarbons	F2 (C10-C16)	21	10	ug/g

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Physical Tests - SOIL

		Guide Limits				
Lab ID				L2501153-1	L2501153-2	L2501153-3
Sample Date				01-SEP-20	01-SEP-20	01-SEP-20
Sample ID				BH01-20 S-4	BH02-20 S-1	BH03-20 S-2
Analyte	**Unit**	**#1**	**#2**			
Conductivity	mS/cm	0.57	-	0.426	0.343	1.25
% Moisture	%	-	-	11.6	12.0	12.1
pH	pH units	-	-	7.61	7.62	7.57

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

ANALYTICAL REPORT

Saturated Paste Extractables - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID	Sample Date	Sample ID
				L2501153-1	01-SEP-20	BH01-20 S-4
				L2501153-2	01-SEP-20	BH02-20 S-1
				L2501153-3	01-SEP-20	BH03-20 S-2
SAR	SAR	2.4	-	16.5	15.3 SAR:M	8.09
Calcium (Ca)	mg/L	-	-	0.95	1.68	39.7
Magnesium (Mg)	mg/L	-	-	0.56	<0.50	2.91
Sodium (Na)	mg/L	-	-	81.8	71.8	196

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID: L2501153-1 / Sample Date: 01-SEP-20 / Sample ID: BH01-20 S-4	Lab ID: L2501153-2 / Sample Date: 01-SEP-20 / Sample ID: BH02-20 S-1	Lab ID: L2501153-3 / Sample Date: 01-SEP-20 / Sample ID: BH03-20 S-2
Antimony (Sb)	ug/g	1.3	-	<1.0	<1.0	<1.0
Arsenic (As)	ug/g	18	-	1.8	4.4	6.2
Barium (Ba)	ug/g	220	-	21.2	55.5	49.0
Beryllium (Be)	ug/g	2.5	-	<0.50	0.53	0.70
Boron (B)	ug/g	36	-	<5.0	8.7	14.1
Cadmium (Cd)	ug/g	1.2	-	<0.50	<0.50	<0.50
Chromium (Cr)	ug/g	70	-	8.0	17.4	21.1
Cobalt (Co)	ug/g	21	-	2.9	5.8	6.7
Copper (Cu)	ug/g	92	-	8.8	16.7	27.3
Lead (Pb)	ug/g	120	-	4.2	10.3	17.2
Molybdenum (Mo)	ug/g	2	-	<1.0	<1.0	<1.0
Nickel (Ni)	ug/g	82	-	6.4	13.1	15.6
Selenium (Se)	ug/g	1.5	-	<1.0	<1.0	<1.0
Silver (Ag)	ug/g	0.5	-	<0.20	<0.20	<0.20
Thallium (Tl)	ug/g	1	-	<0.50	<0.50	<0.50
Uranium (U)	ug/g	2.5	-	<1.0	<1.0	<1.0
Vanadium (V)	ug/g	86	-	15.6	30.8	37.2
Zinc (Zn)	ug/g	290	-	24.9	49.3	58.5

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Volatile Organic Compounds - SOIL

		Guide Limits				
Lab ID				L2501153-1	L2501153-2	L2501153-3
Sample Date				01-SEP-20	01-SEP-20	01-SEP-20
Sample ID				BH01-20 S-4	BH02-20 S-1	BH03-20 S-2
Analyte	**Unit**	**#1**	**#2**			
Benzene	ug/g	0.02	-	<0.0068	<0.0068	<0.0068
Ethylbenzene	ug/g	0.05	-	0.495	<0.018	<0.018
Toluene	ug/g	0.2	-	<0.080	<0.080	<0.080
o-Xylene	ug/g	-	-	0.302	<0.070 DLVH	<0.020
m+p-Xylenes	ug/g	-	-	0.732	<0.030	<0.030
Xylenes (Total)	ug/g	0.05	-	1.03	<0.076	<0.050
Surrogate: 4-Bromofluorobenzene	%	-	-	123.6	114.5	103.3
Surrogate: 1,4-Difluorobenzene	%	-	-	123.1	117.0	107.7

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Hydrocarbons - SOIL

		Guide Limits				
Lab ID				L2501153-1	L2501153-2	L2501153-3
Sample Date				01-SEP-20	01-SEP-20	01-SEP-20
Sample ID				BH01-20 S-4	BH02-20 S-1	BH03-20 S-2
Analyte	**Unit**	**#1**	**#2**			
F1 (C6-C10)	ug/g	25	-	80 DLHC	<5.0	<5.0
F1-BTEX	ug/g	25	-	78	<5.0	<5.0
F2 (C10-C16)	ug/g	10	-	1830	<10	21
F3 (C16-C34)	ug/g	240	-	1020	<50	<50
F4 (C34-C50)	ug/g	120	-	<50	<50	<50
Total Hydrocarbons (C6-C50)	ug/g	-	-	2930	<72	<72
Chrom. to baseline at nC50		-	-	YES	YES	YES
Surrogate: 2-Bromobenzotrifluoride	%	-	-	94.8	85.0	80.1
Surrogate: 3,4-Dichlorotoluene	%	-	-	123.0	101.2	101.8

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLVH	Detection Limit raised due to interference from Volatile Hydrocarbons on VOC method. Chromatographic elution of interfering peaks in the same region as test analytes prevents a

Reference Information

determination of whether VOC analyte is present or absent (above/below regular detection limits).

SAR:M Reported SAR represents a maximum value. Actual SAR may be lower if both Ca and Mg were detectable.

DLHC Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
BTX-511-HS-WT	Soil	BTEX-O.Reg 153/04 (July 2011)	SW846 8260

BTX is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

EC-WT	Soil	Conductivity (EC)	MOEE E3138

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

F1-F4-511-CALC-WT	Soil	F1-F4 Hydrocarbon Calculated Parameters	CCME CWS-PHC, Pub #1310, Dec 2001-S

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

F1-HS-511-WT	Soil	F1-O.Reg 153/04 (July 2011)	E3398/CCME TIER 1-HS

Fraction F1 is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

F2-F4-511-WT	Soil	F2-F4-O.Reg 153/04 (July 2011)	CCME Tier 1

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**

Petroleum Hydrocarbons (F2-F4 fractions) are extracted from soil with 1:1 hexane:acetone using a rotary extractor. Extracts are treated with silica gel to remove polar organic interferences. F2, F3, & F4 are analyzed by GC-FID. F4G-sg is analyzed gravimetrically.

Notes:
1. F2 (C10-C16): Sum of all hydrocarbons that elute between nC10 and nC16.
2. F3 (C16-C34): Sum of all hydrocarbons that elute between nC16 and nC34.
3. F4 (C34-C50): Sum of all hydrocarbons that elute between nC34 and nC50.
4. F4G: Gravimetric Heavy Hydrocarbons
5. F4G-sg: Gravimetric Heavy Hydrocarbons (F4G) after silica gel treatment.
6. Where both F4 (C34-C50) and F4G-sg are reported for a sample, the larger of the two values is used for comparison against the relevant CCME guideline for F4.
7. F4G-sg cannot be added to the C6 to C50 hydrocarbon results to obtain an estimate of total extractable hydrocarbons.
8. This method is validated for use.
9. Data from analysis of validation and quality control samples is available upon request.
10. Reported results are expressed as milligrams per dry kilogram, unless otherwise indicated.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

MET-200.2-CCMS-WT	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020B (mod)

Soil/sediment is dried, disaggregated, and sieved (2 mm). For tests intended to support Ontario regulations, the <2mm fraction is ground to pass through a 0.355 mm sieve. Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

SAR-R511-WT	Soil	SAR-O.Reg 153/04 (July 2011)	SW846 6010C

A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES. The concentrations of Na, Ca and Mg are reported as per CALA requirements for calculated parameters. These individual parameters are not for comparison to any guideline.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

XYLENES-SUM-CALC-WT	Soil	Sum of Xylene Isomer Concentrations	CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

Reference Information

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Quality Control Report

Workorder: L2501153 Report Date: 16-SEP-20

Client: EnGlobe Corp. (London)
417 EXETER RD
LONDON ON N6E 2Z3
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX-511-HS-WT	**Soil**							
Batch R5222688								
WG3402130-4 DUP		**WG3402130-3**						
Benzene		<0.0068	<0.0068	RPD-NA	ug/g	N/A	40	12-SEP-20
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	12-SEP-20
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	12-SEP-20
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	12-SEP-20
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	12-SEP-20
WG3402130-2 LCS								
Benzene			113.9		%		70-130	12-SEP-20
Ethylbenzene			100.8		%		70-130	12-SEP-20
m+p-Xylenes			100.9		%		70-130	12-SEP-20
o-Xylene			99.7		%		70-130	12-SEP-20
Toluene			102.0		%		70-130	12-SEP-20
WG3402130-1 MB								
Benzene			<0.0068		ug/g		0.0068	12-SEP-20
Ethylbenzene			<0.018		ug/g		0.018	12-SEP-20
m+p-Xylenes			<0.030		ug/g		0.03	12-SEP-20
o-Xylene			<0.020		ug/g		0.02	12-SEP-20
Toluene			<0.080		ug/g		0.08	12-SEP-20
Surrogate: 1,4-Difluorobenzene			122.8		%		50-140	12-SEP-20
Surrogate: 4-Bromofluorobenzene			110.2		%		50-140	12-SEP-20
WG3402130-5 MS		**WG3402130-3**						
Benzene			136.3		%		60-140	12-SEP-20
Ethylbenzene			117.2		%		60-140	12-SEP-20
m+p-Xylenes			115.6		%		60-140	12-SEP-20
o-Xylene			116.4		%		60-140	12-SEP-20
Toluene			119.3		%		60-140	12-SEP-20
EC-WT	**Soil**							
Batch R5224011								
WG3404346-4 DUP		**WG3404346-3**						
Conductivity		0.426	0.411		mS/cm	3.6	20	15-SEP-20
WG3404346-2 IRM		**WT SAR4**						
Conductivity			105.8		%		70-130	15-SEP-20
WG3404583-1 LCS								
Conductivity			98.9		%		90-110	15-SEP-20
WG3404346-1 MB								
Conductivity			<0.0040		mS/cm		0.004	15-SEP-20

Quality Control Report

Client: EnGlobe Corp. (London)
417 EXETER RD
LONDON ON N6E 2Z3
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-WT	**Soil**							
Batch R5224221								
WG3404702-4 DUP		**WG3404702-3**						
Conductivity		0.619	0.620		mS/cm	0.2	20	15-SEP-20
WG3404702-2 IRM		**WT SAR4**						
Conductivity			105.8		%		70-130	15-SEP-20
WG3405013-1 LCS								
Conductivity			98.7		%		90-110	15-SEP-20
WG3404702-1 MB								
Conductivity			<0.0040		mS/cm		0.004	15-SEP-20
F1-HS-511-WT	**Soil**							
Batch R5222688								
WG3402130-4 DUP		**WG3402130-3**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	30	12-SEP-20
WG3402130-2 LCS								
F1 (C6-C10)			112.2		%		80-120	12-SEP-20
WG3402130-1 MB								
F1 (C6-C10)			<5.0		ug/g		5	12-SEP-20
Surrogate: 3,4-Dichlorotoluene			117.8		%		60-140	12-SEP-20
WG3402130-6 MS		**L2501415-1**						
F1 (C6-C10)			94.3		%		60-140	12-SEP-20
F2-F4-511-WT	**Soil**							
Batch R5222478								
WG3402252-3 DUP		**WG3402252-5**						
F2 (C10-C16)		<10	<10	RPD-NA	ug/g	N/A	30	11-SEP-20
F3 (C16-C34)		<50	<50	RPD-NA	ug/g	N/A	30	11-SEP-20
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	30	11-SEP-20
WG3402252-2 LCS								
F2 (C10-C16)			97.2		%		80-120	11-SEP-20
F3 (C16-C34)			95.3		%		80-120	11-SEP-20
F4 (C34-C50)			95.9		%		80-120	11-SEP-20
WG3402252-1 MB								
F2 (C10-C16)			<10		ug/g		10	11-SEP-20
F3 (C16-C34)			<50		ug/g		50	11-SEP-20
F4 (C34-C50)			<50		ug/g		50	11-SEP-20
Surrogate: 2-Bromobenzotrifluoride			92.5		%		60-140	11-SEP-20
WG3402252-4 MS		**WG3402252-5**						
F2 (C10-C16)			90.1		%		60-140	11-SEP-20
F3 (C16-C34)			89.5		%		60-140	

Quality Control Report

Client: EnGlobe Corp. (London)
417 EXETER RD
LONDON ON N6E 2Z3
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-F4-511-WT	**Soil**							
Batch R5222478								
WG3402252-4 MS		**WG3402252-5**						
F3 (C16-C34)			89.5		%		60-140	11-SEP-20
F4 (C34-C50)			92.3		%		60-140	11-SEP-20
MET-200.2-CCMS-WT	**Soil**							
Batch R5224396								
WG3404339-2 CRM		**WT-SS-2**						
Antimony (Sb)			100.7		%		70-130	15-SEP-20
Arsenic (As)			98.2		%		70-130	15-SEP-20
Barium (Ba)			102.3		%		70-130	15-SEP-20
Beryllium (Be)			102.7		%		70-130	15-SEP-20
Boron (B)			8.8		mg/kg		3.5-13.5	15-SEP-20
Cadmium (Cd)			100.0		%		70-130	15-SEP-20
Chromium (Cr)			98.8		%		70-130	15-SEP-20
Cobalt (Co)			101.5		%		70-130	15-SEP-20
Copper (Cu)			103.4		%		70-130	15-SEP-20
Lead (Pb)			107.7		%		70-130	15-SEP-20
Molybdenum (Mo)			103.1		%		70-130	15-SEP-20
Nickel (Ni)			102.5		%		70-130	15-SEP-20
Selenium (Se)			0.15		mg/kg		0-0.34	15-SEP-20
Silver (Ag)			87.9		%		70-130	15-SEP-20
Thallium (Tl)			0.078		mg/kg		0.029-0.129	15-SEP-20
Uranium (U)			92.5		%		70-130	15-SEP-20
Vanadium (V)			98.8		%		70-130	15-SEP-20
Zinc (Zn)			101.5		%		70-130	15-SEP-20
WG3404339-6 DUP		**WG3404339-5**						
Antimony (Sb)		0.29	0.27		ug/g	7.4	30	15-SEP-20
Arsenic (As)		4.58	4.57		ug/g	0.3	30	15-SEP-20
Barium (Ba)		80.1	79.6		ug/g	0.7	40	15-SEP-20
Beryllium (Be)		0.69	0.68		ug/g	1.1	30	15-SEP-20
Boron (B)		9.5	9.4		ug/g	1.8	30	15-SEP-20
Cadmium (Cd)		0.278	0.259		ug/g	7.0	30	15-SEP-20
Chromium (Cr)		26.8	26.8		ug/g	0.2	30	15-SEP-20
Cobalt (Co)		11.2	11.6		ug/g	3.8	30	15-SEP-20
Copper (Cu)		30.9	31.6		ug/g	2.2	30	15-SEP-20
Lead (Pb)		23.1	25.3					

Quality Control Report

Client: EnGlobe Corp. (London)
417 EXETER RD
LONDON ON N6E 2Z3
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5224396								
WG3404339-6 DUP		**WG3404339-5**						
Lead (Pb)		23.1	25.3		ug/g	9.1	40	15-SEP-20
Molybdenum (Mo)		1.69	1.65		ug/g	2.7	40	15-SEP-20
Nickel (Ni)		25.9	26.5		ug/g	2.3	30	15-SEP-20
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	15-SEP-20
Silver (Ag)		<0.10	0.13	RPD-NA	ug/g	N/A	40	15-SEP-20
Thallium (Tl)		0.137	0.138		ug/g	0.3	30	15-SEP-20
Uranium (U)		0.586	0.599		ug/g	2.3	30	15-SEP-20
Vanadium (V)		29.9	30.5		ug/g	1.8	30	15-SEP-20
Zinc (Zn)		131	135		ug/g	2.5	30	15-SEP-20
WG3404339-4 LCS								
Antimony (Sb)			102.5		%		80-120	15-SEP-20
Arsenic (As)			102.3		%		80-120	15-SEP-20
Barium (Ba)			106.7		%		80-120	15-SEP-20
Beryllium (Be)			100.6		%		80-120	15-SEP-20
Boron (B)			99.2		%		80-120	15-SEP-20
Cadmium (Cd)			99.96		%		80-120	15-SEP-20
Chromium (Cr)			101.5		%		80-120	15-SEP-20
Cobalt (Co)			99.4		%		80-120	15-SEP-20
Copper (Cu)			98.5		%		80-120	15-SEP-20
Lead (Pb)			100.5		%		80-120	15-SEP-20
Molybdenum (Mo)			97.8		%		80-120	15-SEP-20
Nickel (Ni)			99.5		%		80-120	15-SEP-20
Selenium (Se)			102.1		%		80-120	15-SEP-20
Silver (Ag)			95.5		%		80-120	15-SEP-20
Thallium (Tl)			102.8		%		80-120	15-SEP-20
Uranium (U)			98.8		%		80-120	15-SEP-20
Vanadium (V)			103.3		%		80-120	15-SEP-20
Zinc (Zn)			99.2		%		80-120	15-SEP-20
WG3404339-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	15-SEP-20
Arsenic (As)			<0.10		mg/kg		0.1	15-SEP-20
Barium (Ba)			<0.50		mg/kg		0.5	15-SEP-20
Beryllium (Be)			<0.10		mg/kg		0.1	15-SEP-20
Boron (B)			<5.0		mg/kg		5	15-SEP-20

Quality Control Report

Client: EnGlobe Corp. (London)
417 EXETER RD
LONDON ON N6E 2Z3
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5224396								
WG3404339-1 MB								
Cadmium (Cd)			<0.020		mg/kg		0.02	15-SEP-20
Chromium (Cr)			<0.50		mg/kg		0.5	15-SEP-20
Cobalt (Co)			<0.10		mg/kg		0.1	15-SEP-20
Copper (Cu)			<0.50		mg/kg		0.5	15-SEP-20
Lead (Pb)			<0.50		mg/kg		0.5	15-SEP-20
Molybdenum (Mo)			<0.10		mg/kg		0.1	15-SEP-20
Nickel (Ni)			<0.50		mg/kg		0.5	15-SEP-20
Selenium (Se)			<0.20		mg/kg		0.2	15-SEP-20
Silver (Ag)			<0.10		mg/kg		0.1	15-SEP-20
Thallium (Tl)			<0.050		mg/kg		0.05	15-SEP-20
Uranium (U)			<0.050		mg/kg		0.05	15-SEP-20
Vanadium (V)			<0.20		mg/kg		0.2	15-SEP-20
Zinc (Zn)			<2.0		mg/kg		2	15-SEP-20
Batch R5224837								
WG3404627-2 CRM		**WT-SS-2**						
Antimony (Sb)			88.5		%		70-130	16-SEP-20
Arsenic (As)			102.4		%		70-130	16-SEP-20
Barium (Ba)			106.6		%		70-130	16-SEP-20
Beryllium (Be)			103.1		%		70-130	16-SEP-20
Boron (B)			8.9		mg/kg		3.5-13.5	16-SEP-20
Cadmium (Cd)			94.5		%		70-130	16-SEP-20
Chromium (Cr)			102.0		%		70-130	16-SEP-20
Cobalt (Co)			99.1		%		70-130	16-SEP-20
Copper (Cu)			100.6		%		70-130	16-SEP-20
Lead (Pb)			101.5		%		70-130	16-SEP-20
Molybdenum (Mo)			95.5		%		70-130	16-SEP-20
Nickel (Ni)			99.8		%		70-130	16-SEP-20
Selenium (Se)			0.11		mg/kg		0-0.34	16-SEP-20
Silver (Ag)			93.6		%		70-130	16-SEP-20
Thallium (Tl)			0.079		mg/kg		0.029-0.129	16-SEP-20
Uranium (U)			100.8		%		70-130	16-SEP-20
Vanadium (V)			101.1		%		70-130	16-SEP-20
Zinc (Zn)			96.8		%		70-130	16-SEP-20
WG3404627-6 DUP		**WG3404627-5**						

Quality Control Report

Client: EnGlobe Corp. (London)
417 EXETER RD
LONDON ON N6E 2Z3
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5224837								
WG3404627-6 DUP		**WG3404627-5**						
Antimony (Sb)		<0.10	0.11	RPD-NA	ug/g	N/A	30	16-SEP-20
Arsenic (As)		3.48	3.78		ug/g	8.3	30	16-SEP-20
Barium (Ba)		48.1	52.2		ug/g	8.2	40	16-SEP-20
Beryllium (Be)		0.46	0.53		ug/g	14	30	16-SEP-20
Boron (B)		9.3	12.5		ug/g	30	30	16-SEP-20
Cadmium (Cd)		0.088	0.082		ug/g	6.7	30	16-SEP-20
Chromium (Cr)		16.6	19.3		ug/g	15	30	16-SEP-20
Cobalt (Co)		7.13	7.80		ug/g	8.9	30	16-SEP-20
Copper (Cu)		15.9	17.0		ug/g	6.4	30	16-SEP-20
Lead (Pb)		6.17	6.70		ug/g	8.1	40	16-SEP-20
Molybdenum (Mo)		0.26	0.31		ug/g	18	40	16-SEP-20
Nickel (Ni)		14.7	16.3		ug/g	10	30	16-SEP-20
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	16-SEP-20
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	16-SEP-20
Thallium (Tl)		0.095	0.106		ug/g	11	30	16-SEP-20
Uranium (U)		0.462	0.526		ug/g	13	30	16-SEP-20
Vanadium (V)		28.0	33.2		ug/g	17	30	16-SEP-20
Zinc (Zn)		32.4	36.0		ug/g	10	30	16-SEP-20
WG3404627-4 LCS								
Antimony (Sb)			95.8		%		80-120	16-SEP-20
Arsenic (As)			98.5		%		80-120	16-SEP-20
Barium (Ba)			98.2		%		80-120	16-SEP-20
Beryllium (Be)			95.9		%		80-120	16-SEP-20
Boron (B)			92.1		%		80-120	16-SEP-20
Cadmium (Cd)			98.1		%		80-120	16-SEP-20
Chromium (Cr)			97.3		%		80-120	16-SEP-20
Cobalt (Co)			95.4		%		80-120	16-SEP-20
Copper (Cu)			95.4		%		80-120	16-SEP-20
Lead (Pb)			101.5		%		80-120	16-SEP-20
Molybdenum (Mo)			94.8		%		80-120	16-SEP-20
Nickel (Ni)			94.4		%		80-120	16-SEP-20
Selenium (Se)			99.1		%		80-120	16-SEP-20
Silver (Ag)			95.2		%		80-120	16-SEP-20

Quality Control Report

Client: EnGlobe Corp. (London)
417 EXETER RD
LONDON ON N6E 2Z3
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R5224837								
WG3404627-4 LCS								
Thallium (Tl)			100.8		%		80-120	16-SEP-20
Uranium (U)			103.0		%		80-120	16-SEP-20
Vanadium (V)			97.9		%		80-120	16-SEP-20
Zinc (Zn)			94.7		%		80-120	16-SEP-20
WG3404627-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	16-SEP-20
Arsenic (As)			<0.10		mg/kg		0.1	16-SEP-20
Barium (Ba)			<0.50		mg/kg		0.5	16-SEP-20
Beryllium (Be)			<0.10		mg/kg		0.1	16-SEP-20
Boron (B)			<5.0		mg/kg		5	16-SEP-20
Cadmium (Cd)			<0.020		mg/kg		0.02	16-SEP-20
Chromium (Cr)			<0.50		mg/kg		0.5	16-SEP-20
Cobalt (Co)			<0.10		mg/kg		0.1	16-SEP-20
Copper (Cu)			<0.50		mg/kg		0.5	16-SEP-20
Lead (Pb)			<0.50		mg/kg		0.5	16-SEP-20
Molybdenum (Mo)			<0.10		mg/kg		0.1	16-SEP-20
Nickel (Ni)			<0.50		mg/kg		0.5	16-SEP-20
Selenium (Se)			<0.20		mg/kg		0.2	16-SEP-20
Silver (Ag)			<0.10		mg/kg		0.1	16-SEP-20
Thallium (Tl)			<0.050		mg/kg		0.05	16-SEP-20
Uranium (U)			<0.050		mg/kg		0.05	16-SEP-20
Vanadium (V)			<0.20		mg/kg		0.2	16-SEP-20
Zinc (Zn)			<2.0		mg/kg		2	16-SEP-20
MOISTURE-WT	**Soil**							
Batch R5221766								
WG3402258-7 DUP		**L2500977-9**						
% Moisture		5.67	5.65		%	0.2	20	12-SEP-20
WG3402258-6 LCS								
% Moisture			100.3		%		90-110	12-SEP-20
WG3402258-5 MB								
% Moisture			<0.25		%		0.25	12-SEP-20
PH-WT	**Soil**							

Quality Control Report

Client: EnGlobe Corp. (London)
417 EXETER RD
LONDON ON N6E 2Z3
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-WT	**Soil**							
Batch R5223379								
WG3402335-1 DUP		**L2499649-11**						
pH		6.89	7.01	J	pH units	0.12	0.3	14-SEP-20
WG3403807-1 LCS								
pH			6.96		pH units		6.9-7.1	14-SEP-20
SAR-R511-WT	**Soil**							
Batch R5223977								
WG3404346-4 DUP		**WG3404346-3**						
Calcium (Ca)		0.64	0.95	J	mg/L	0.31	1	15-SEP-20
Sodium (Na)		79.5	81.8		mg/L	2.9	30	15-SEP-20
Magnesium (Mg)		<0.50	0.56	RPD-NA	mg/L	N/A	30	15-SEP-20
WG3404346-2 IRM		**WT SAR4**						
Calcium (Ca)			99.8		%		70-130	15-SEP-20
Sodium (Na)			99.7		%		70-130	15-SEP-20
Magnesium (Mg)			102.6		%		70-130	15-SEP-20
WG3404346-5 LCS								
Calcium (Ca)			100.3		%		80-120	15-SEP-20
Sodium (Na)			97.4		%		80-120	15-SEP-20
Magnesium (Mg)			95.8		%		80-120	15-SEP-20
WG3404346-1 MB								
Calcium (Ca)			<0.50		mg/L		0.5	15-SEP-20
Sodium (Na)			<0.50		mg/L		0.5	15-SEP-20
Magnesium (Mg)			<0.50		mg/L		0.5	15-SEP-20
Batch R5224538								
WG3404702-4 DUP		**WG3404702-3**						
Calcium (Ca)		6.32	6.25		mg/L	1.1	30	16-SEP-20
Sodium (Na)		109	108		mg/L	0.9	30	16-SEP-20
Magnesium (Mg)		<0.50	<0.50	RPD-NA	mg/L	N/A	30	16-SEP-20
WG3404702-2 IRM		**WT SAR4**						
Calcium (Ca)			109.1		%		70-130	16-SEP-20
Sodium (Na)			95.4		%		70-130	16-SEP-20
Magnesium (Mg)			106.0		%		70-130	16-SEP-20
WG3404702-5 LCS								
Calcium (Ca)			105.0		%		80-120	16-SEP-20
Sodium (Na)			103.0		%		80-120	16-SEP-20
Magnesium (Mg)			101.6		%		80-120	16-SEP-20
WG3404702-1 MB								

Quality Control Report

Client: EnGlobe Corp. (London)
417 EXETER RD
LONDON ON N6E 2Z3
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SAR-R511-WT	**Soil**							
Batch R5224538								
WG3404702-1 MB								
Calcium (Ca)			<0.50		mg/L		0.5	16-SEP-20
Sodium (Na)			<0.50		mg/L		0.5	16-SEP-20
Magnesium (Mg)			<0.50		mg/L		0.5	16-SEP-20

Quality Control Report

Workorder: L2501153 Report Date: 16-SEP-20

Client: EnGlobe Corp. (London)
417 EXETER RD
LONDON ON N6E 2Z3
Contact: ROB HELWIG

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

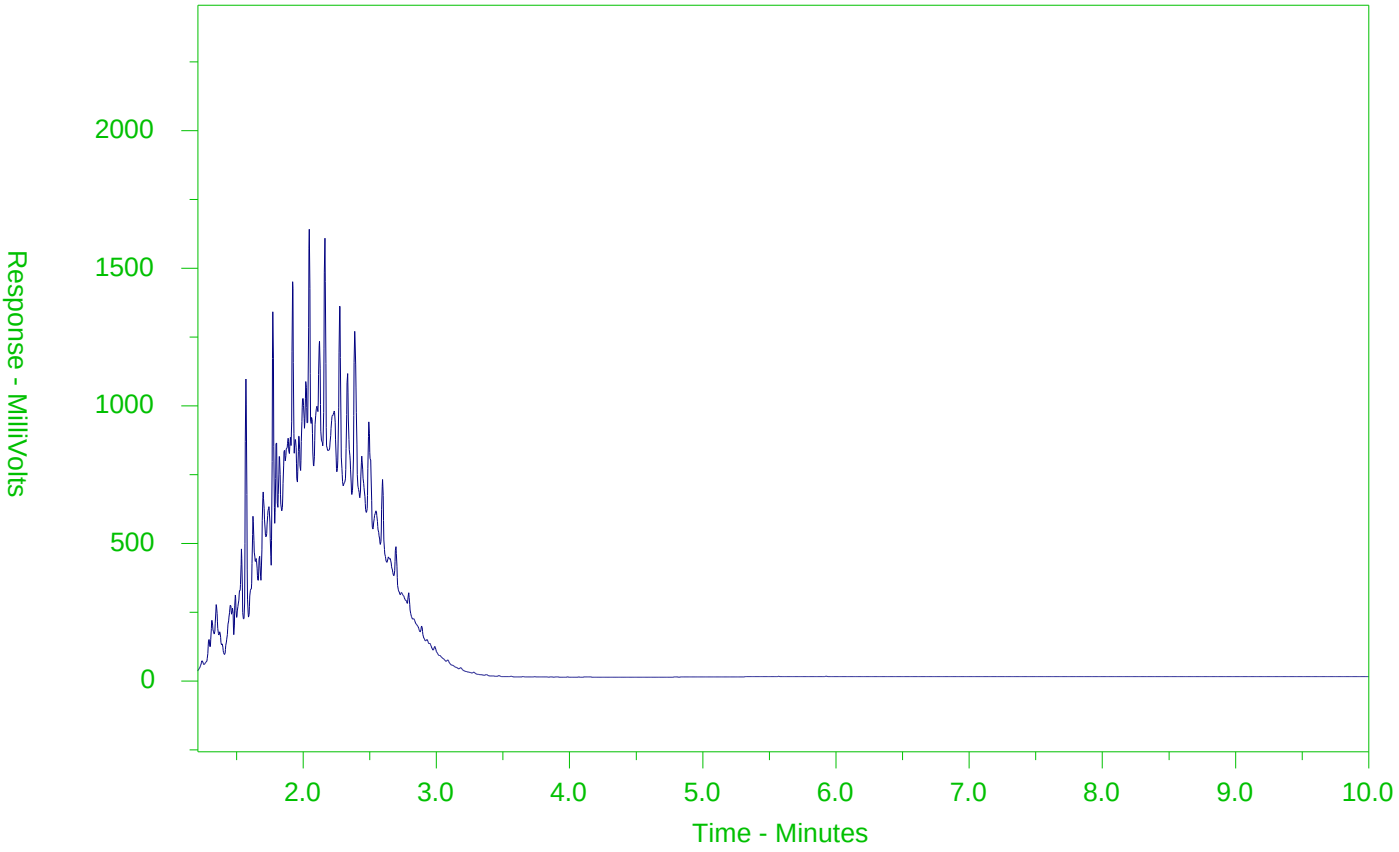
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2501153-1
Client Sample ID: BH01-20 S-4



←F2→	←F3→	←F4→	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

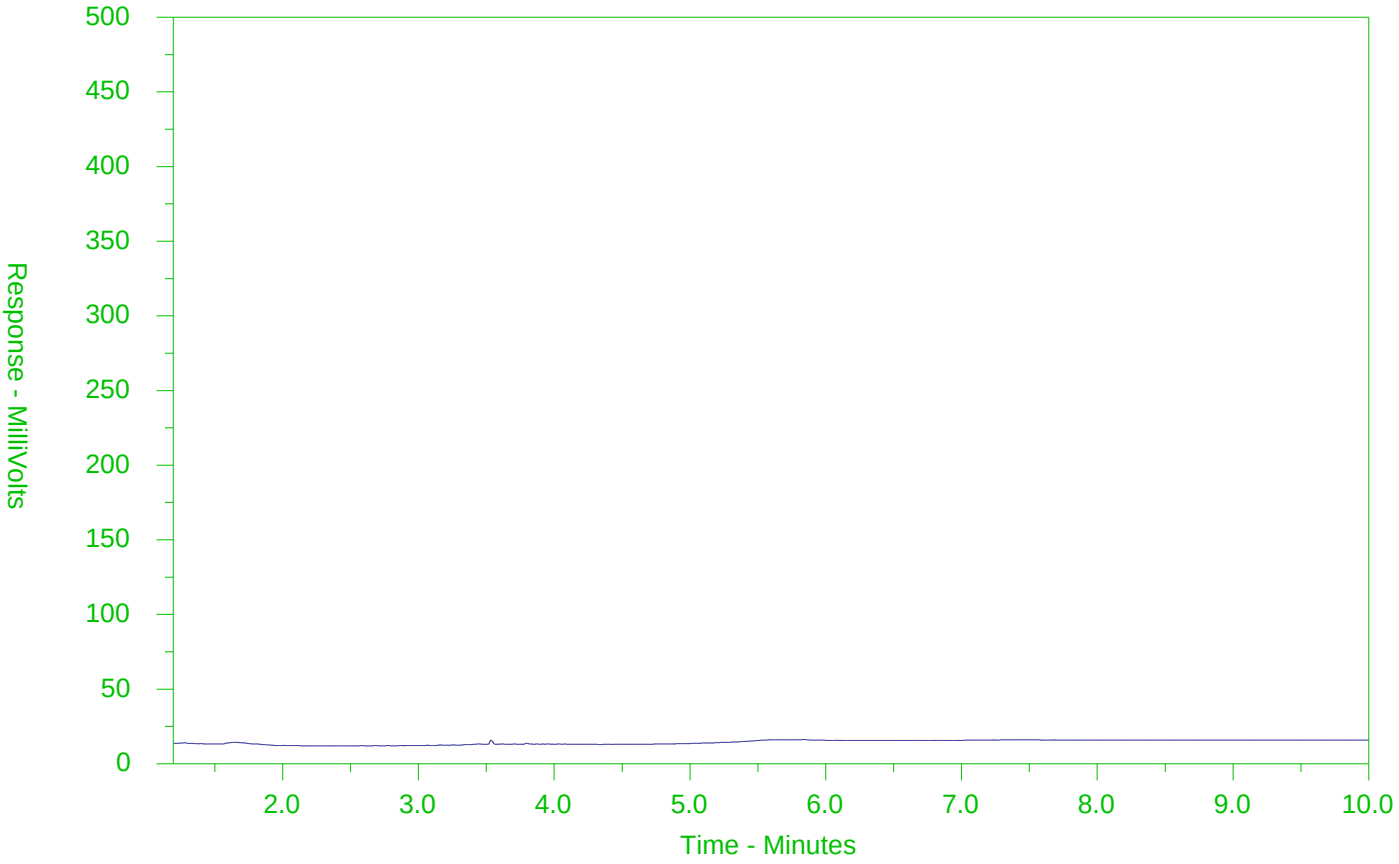
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2501153-2
Client Sample ID: BH02-20 S-1



←F2→	←F3→	←F4→	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

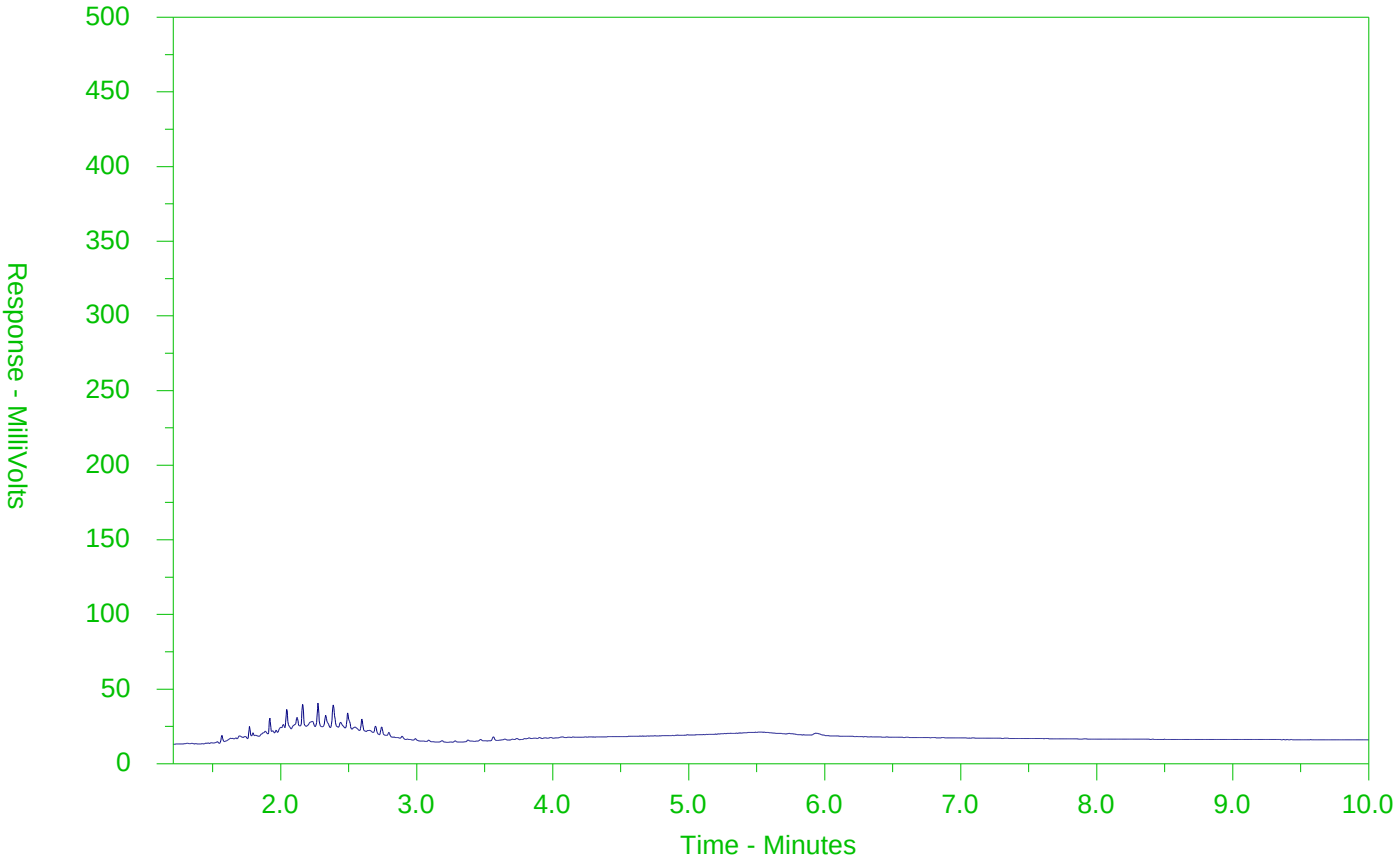
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2501153-3
Client Sample ID: BH03-20 S-2



←F2→	←F3→	←F4→	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

L2501153

L2501153-COFC

CHAIN OF CUSTODY

ALS Laboratory please tick →

CLIENT: Englobe Corp	TURNAROUND REQUIREMENTS : ☒ (Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):		FOR LABORATORY USE ONLY (Circle)
OFFICE:			Custody Seal Intact? Yes No N/A
B-0022503-1	ALS QUOTE NO.: Q-60333	COC SEQUENCE NUMBER (Circle)	Free ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER:		COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: 6.0 °C
Rob Helwig 519-668-9843		OF: 1 2 3 4 5 6 7	Other comment:
Ed VanPuymbroeck 519-619-5387	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY: / RECEIVED BY:
COC emai EDD FORMAT (or default):	*Ed VanPuymbroeck*		PS Hall
robert.helwig@englobecorp.com	DATE/TIME: 08/09/20 PM	DATE/TIME:	DATE/TIME: 9 Sept 20, 14:36
Email Invoice to (will default to PM if no other addresses are listed)			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required)							Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	Excess Soils pkg, Metals/Inorganics, PHC's F1-F4 BTEX only							
	BH01-20 S-4	2020-09-01 9:00	soil		4	x							
	BH02-20 S-1	2020-09-01 10:30	soil		4	x							
	BH03-20 S-2	2020-09-01 12:00	soil		4	x							
				TOTAL	12								

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfunc Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag

9-10-20
10:00 7-6