PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

GEOTECHNICAL INVESTIGATION

NEW SEARCH AND RESCUE STATION, 114 DIVISION STREET, COBOURG, ON

AUGUST 3, 2017

CONFIDENTIAL

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Confidential

Public Works and Government Services Canada
4900 Yonge Street
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Attention: Elisabeth Ohi, Architect, B.Env., OAA, LEED AP

Subject: Geotechnical Investigation
Proposed Search and Rescue Station
114 Division Street, Cobourg, ON
Client ref.: R.084112.001

Dear Ms. Ohi:

We are pleased to submit our final report on a Geotechnical Investigation addressing subsurface conditions for the design and construction of the proposed replacement Search and Rescue Facility, located at 114 Division Street, in Cobourg Ontario.

The site currently supports two buildings (a residence and an office) and a temporary trailer. The proposed redevelopment shall include the demolition of the existing buildings and construction of a single one or two storey building that will include office and residential spaces.

This report summarizes the procedures and findings of our geotechnical investigation, which was completed in June 2017, including results of a borehole and laboratory testing program, and our general recommendations with regards to design and construction.

We trust that the information in this report meets with your present requirements. Please contact us if you have any questions.

Yours truly,

J. Stephen Ash, P.Eng., P.Geo., QP_{ESA}
Director, Environment

WSP ref.: 171-07055-00

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by Public Works and Government Services Canada (PWGSC) to complete a geotechnical investigation for a proposed replacement Search and Rescue Facility for the Canadian Coast Guard, at 114 Division Street, in Cobourg, Ontario. The Site Location is shown on **Figure 1**.

This geotechnical report provides information on subsurface conditions at the site, including a description of the existing soil profile and groundwater conditions. Based on the investigation findings, WSP has provided select geotechnical recommendations for consideration in the design and construction of proposed structures and underground services.

1.1 BACKGROUND INFORMATION

The investigated site is located at 114 Division Street, in Cobourg, Ontario. The Site is located on the south shore of Lake Ontario. An existing municipal parking lot exists to the north of the Site, Cobourg beach is to the east of the Site, a publicly accessible pier is to the south of the Site, and the Cobourg Harbour to the west of the Site. There are two permanent buildings (an office and a residential structure) on the Site. At the time of the investigation, a temporary (office style) trailer was situated between the two permanent buildings. The Site all includes communication lines and towers that support the day to day operations of the Search and Rescue Facility.

In review of historic images, aerial photography, and mapping, it is WSP's opinion that the investigated site was infilled from Lake Ontario in two (2) stages. The first stage of infill was the pier (which includes the access road along the front of the Search and Rescue Facility). During the second stage of infill, the land mass in which the existing buildings stand was created. It is likely that this second stage of infill completed in conjunction with the construction of the adjacent Cobourg Beach; however this cannot be confirmed at this time.

In review of Chapman and Putnam's physiography of Southern Ontario, and the Ministry of Northern Development and Mines' Miscellaneous Release Data (MRD) 228, it was established that the site is within the Iroquois Plains physiographic region.

In review of the Ministry of Northern Development and Mines' MRD 128-Revised, it was established that the site's surficial geology generally consists of coarse-textured lacustrine (lakebed) deposits.

In review of the Ministry of Northern Development and Mines' MRD 219, it was established that the site's bedrock geology consists of Lindsay Formation limestone (middle Ordovician age; upper Simcoe Group).

2 INVESTIGATION METHODOLOGY

2.1 FIELD INVESTIGATION

WSP completed a borehole investigation for the site between June 19 and 22, 2017. Buried utility clearances were completed (including public and private locates) prior to equipment mobilization. A total of fifteen (15) boreholes were advanced to depths ranging from approximately 2.9 to 11.0 m below ground level (mBGL), and were located as illustrated on **Figure 1**. Several of the boreholes encountered practical refusal, on presumed boulders within existing rock fill layers. In these boreholes, numerous attempts at the borehole locations were made to auger past the boulders. An additional borehole (BH17-2R) was added to during the investigation, between boreholes BH17-1 and BH17-2, as both boreholes encountered practical refusal at relatively shallow depths. Several of the boreholes encountered wet flowing sands below the fill and rock fill material. Five of the boreholes (BH17-5, BH17-7, BH17-8, BH17-10 and BH17-13) were extended by dynamic cone penetration testing (DCPT) methods to depths ranging from 6.1 to 6.7 mBGL. Other boreholes which encountered flowing sands, were advanced using wash and bore techniques.

WSP field personnel supervised the drilling operations and recorded the subsurface conditions encountered in the boreholes. The boreholes were advanced using a commercial track-mount drill rig equipped with continuous flight hollow augers, and SPT hammer sampling system. Dynamic cone penetration testing (DCPT) was also completed at selected locations and depths. Soil samples were generally recovered at approximately 0.75 to 1.5 m intervals while using 51 mm outside diameter split-spoon samplers, driven in accordance with the SPT procedures (i.e. ASTM D1586). The results of the SPTs in terms of N values are referred to in this report as consistency for cohesive soils and relative density for non-cohesive materials. Soil samples recovered from the boreholes were placed in moisture proof bags and transported to our CCIL-certified laboratory for detailed classification and testing.

The boreholes were checked for groundwater seepage and general stability upon completion, and were backfilled using compacted cuttings and bentonite chips, where required.

2.2 LABORATORY TESTING

2.2.1 GEOTECHNICAL LABORATORY TESTING

Upon completion of drilling, recovered soil samples were transported to the WSP geotechnical laboratory for more detailed visual examinations and engineering classifications. Selected soil samples were submitted to WSP's certified soils laboratory for geotechnical testing in accordance with Table 2-1 below. Geotechnical laboratory test results are provided on the borehole logs in **Appendix A**. Copies of the geotechnical laboratory test results are provided in **Appendix B**.

Table 2-1: Geotechnical Laboratory Testing Summary

Geotechnical Test	Procedure/Methodology	Number Of Samples
Particle Size Distribution Analysis	ASTM D422	Six (6) *including one (1) hydrometers*
Moisture Content Analysis	ASTM D2216	Eighty (80)

Unless requested in advance, the soil samples from the investigation will be stored in our laboratory facility for a period of three (3) months after the issuance of the final report.

2.2.2 ANALYTICAL LABORATORY TESTING

In addition to the physical laboratory analysis, analytical laboratory testing (chemical analysis) was performed on selected representative samples. The collected soil samples were inspected for evidence of contaminants using visual and olfactory methods. Following the screening, selected representative samples were submitted to SGS Laboratories (in Lakefield, ON) for analytical testing as follows:

- Six (6) samples analyzed for Metals and Inorganics;
- Six (6) samples analyzed for Petroleum Hydrocarbons (PHCs) fraction F1 to F4;
- Six (6) samples analyzed for Volatile Organic Content (VOCs); and
- Six (6) samples analyzed for Polyaromatic Hydrocarbons (PAHs).

SGS is a CALA-certified analytical laboratory. Testing was completed as per O.Reg. 153/04 and the Canadian Council of Ministers of the Environment (CCME) standards.

WSP appreciates that the subject site is under federal jurisdiction and that CCME-criteria will apply, however should excess soils be transferred to a property not under federal jurisdiction the O.Reg. 153-04 criteria will apply. At the current time the amount of testing under the SOW is considered adequate. An O. Reg 558/00 Schedule 4 TCLP analysis may be required in future, if soil must be taken to a licensed landfill site. Contact WSP if additional information or environmental testing is required.

3 SUBSURFACE FINDINGS

Based on the borehole information, the subsurface soil profile at the site comprises surficial layers of topsoil or asphalt, over fill materials, overlying sand, gravelly sand and gravel. It is noted that the site was created by infilling a shoreline area of Lake Ontario. Generally the base of the fill exhibited large quantities of boulders, which formed obstructions to drilling procedures. Occasional buried wood (logs, timber) was encountered at some of the investigated locations.

Borehole logs from the site investigation are included in **Appendix A**. The following sections provide a summary of the individual units encountered during drilling.

3.1 ASPHALT

Surficial layers of asphalt were encountered in boreholes BH17-7, BH17-9 and BH17-10. A second layer of buried asphalt was encountered in borehole BH17-10 at a depth of approximately 0.1 mBGL. All of the asphalt layers were generally were about 50 mm thick.

3.2 TOPSOIL

Surficial layers of topsoil were encountered in twelve of the boreholes (i.e., all of the boreholes with the exception of BH17-7, BH17-9 and BH17-10). The topsoil layers ranged in thickness from approximately 100 mm to 610 mm. The topsoil was observed in generally damp to moist, loose state. The topsoil was observed to have a silty texture, with a highly organic content. As such it is expected to be devoid of structural engineering properties.

3.3 FILL

Layers of fill were encountered immediately beneath the asphalt or topsoil in all fifteen (15) of the boreholes. The fill extended to the depth of practical refusal (ranging from approximately 2.9 to 3.1) in boreholes BH17-1, BH17-2, and BH17-12. As result of the practical refusal in these three boreholes, an additional borehole, denoted as BH17-2R was advanced between all three (3) of the boreholes. In borehole BH17-10, as a result of caving of the sides, the borehole was continued by way of DCPT prior to reaching the native soil interface. Borehole BH17-9 was advanced within the original pier area and extended to a depth of approximately 4.6 mBGL. The fill in borehole BH17-10 extends to a depth of greater than 2.9 mBGL. This borehole is located with the original pier area and as such the depth of fill is expected to extend to depths similar to borehole BH17-9. The remaining boreholes penetrated fill extending to depths ranging from 1.4 to 2.9 mBGL. As mentioned previously the site area infill was completed in at least two stages. Photographic evidence suggests that the pier was infilled well before the rest of the site, and that different techniques were likely used. Dredging beneath the pier, prior to filling, may be the reason for the greater fill depth in this area; however, this cannot be confirmed using readily available records.

The fill layers were generally brown to grey in colour, and consist predominantly of sand (sand to gravelly sand to sand and gravel) with varying amounts of gravel and silt. Occasional organics and debris such as brick and wood were encountered within the fill.

At the time of the investigation, the fill layers were found to be moist to wet. Laboratory moisture content test results ranged from 1 to 38 %. Based on SPT N values (0 to 36), the fill is generally considered to be very loose to dense. Rock obstructions in the fill contributed to higher measured N values.

Laboratory particle size distribution analysis was completed on a selected sample from the unit. The result is presented on the borehole log in **Appendix A** and the particle size distribution plots included in **Appendix B**. **Table 3-1** below provides a summary of the data (as per USCS Classification System).

Table 3-1: Summary of Laboratory Particle Size Analyses (Fill Unit)

Borehole No.	Sample No.	Depth (mBGL)	Gravel (> 4.75 mm) (%)	Sand (0.075 to 4.75 mm) (%)	Silt and Clay (<0.075 mm) (%)
BH17-1	SS2	0.8 – 1.4	16	66	18

3.4 SAND

Layers of sand were encountered in ten (10) of boreholes (BH17-2R, BH17-3 to BH17-9 and BH17-11 and BH17-13). The sand layers were encountered immediately beneath the fill in all of the boreholes in which it was encountered, with the exception of borehole BH17-7, where it was encountered immediately beneath a layer of sand and gravel. The sand was first encountered at depths ranging from approximately 1.4 to 4.6 mBGL. In boreholes BH17-5, BH17-7, BH17-8 and BH17-13 the sand extended to the depth at which the DCPT was conducted (approximately 2.9 to 3.7 mBGL). In borehole BH17-3 and BH17-9 the upper layers of sand extend to depths of 7.8 and 8.0 mBGL, respectively. Deeper layers of sand were encountered from approximately 8.5 to 10.8 mBGL (refusal) and from approximately 8.4 to 8.7 mBGL in borehole BH17-3 and BH17-9, respectively. The sand extended to the full depth of the investigation (approximately 6.1 mBGL) in boreholes BH17-2R, BH17-4, BH17-6 and BH17-11. The sand was observed to be grey in colour, and contained varying amounts of silt and gravel.

At the time of the investigation, the sand was found to be wet to saturated. Laboratory moisture content test results ranged from 11% to 41%. Based on SPT N values (1 to 34), the sand is generally considered to be very loose to dense.

Laboratory particle size distribution analyses were completed on selected samples from the unit. The results are presented on the borehole logs in **Appendix A** and the particle size distribution plots included in **Appendix B**. **Table 3-2** below provides a summary of the data (as per USCS Classification System).

Table 3-2: Summary of Laboratory Particle Size Analyses (Sand Unit)

Borehole No.	Sample No.	Depth (mBGL)	Gravel (> 4.75 mm) (%)	Sand (0.075 to 4.75 mm) (%)	Silt and Clay (<0.075 mm) (%)
BH17-2R	SS6	3.8 – 4.4	0	96	4
BH17-4	SS5	3.0 – 3.7	1	95	4
BH17-8	SS4	2.3 – 2.9	0	95	5
BH17-13	SS4	2.3 – 2.9	4	86	10

3.5 SAND AND GRAVEL

Layers described as sand and gravel were encountered immediately beneath the fill material in borehole BH17-7, and interbedded between layers of sand in boreholes BH17-3 and BH17-9. The sand and gravel was first encountered at depths ranging from 1.5 to 8.0 mBGL, and extended to depths ranging from 2.2 to 8.5 mBGL. The sand and gravel generally appeared grey in colour, and occasionally contained trace amounts of silt.

At the time of the investigation, the sand was found to be wet to saturated. Laboratory moisture content test results ranged from 7% to 19%. Based on SPT N values (28 to 46), the sand and gravel is generally considered to be compact to dense.

Laboratory particle size distribution analysis was completed on a selected sample of the sand and gravel. Results are presented on borehole logs in **Appendix A** and particle size distribution plot is included in **Appendix B**. A summary of the analyses is provided in **Table 3-3** below (per USCS Classification System).

Table 3-3: Summary of Laboratory Particle Size Analyses (Sand and Gravel Unit)

Borehole No.	Sample No.	Depth (mBGL)	Gravel (> 4.75 mm) (%)	Sand (0.075 to 4.75 mm) (%)	Silt and Clay (<0.075 mm) (%)	Between 0.005 and 0.075 mm (%)
BH17-3	SS9	7.8 – 8.2	34	40	26	17

3.6 GRAVEL

A layer described as (rounded) gravel was encountered immediately beneath the sand in borehole BH17-9. The gravel was first encountered at a depth of 8.7 mBGL, and extended to the depth of practical refusal (approximately 11.0 mBGL).

At the time of the investigation, the gravel was found to be submerged. Based on SPT N values (>50), the gravel is generally considered to be very dense.

3.7 WOOD

Woody material, presumed to be buried logs or timber but of unknown origin, was encountered immediately beneath the fill in borehole BH17-14. The wood was first encountered at a depth of approximately 2.4 mBGL, and was the cause of practical refusal in this borehole (at approximately 3.0 mBGL). The wood appears to be submerged below the groundwater table.

3.8 DYNAMIC CONE PENETRATION TESTING (DCPT)

Dynamic Cone Penetration Testing (DCPT) was completed in boreholes BH17-5, BH17-7, BH17-8, BH17-10 and BH17-13. DCPT values are presented on the borehole logs in **Appendix A**. It should be noted that the DCPT values do not represent SPT "N" values, and that the values may be affected as a result of increased drill rod friction with depth.

3.9 PRACTICAL REFUSAL

Practical refusal to further borehole advancement was encountered in boreholes BH17-1, BH17-2, BH17-3, BH17-9, BH17-12, and BH17-14. The cause of practical refusal in boreholes BH17-1, BH17-2 and BH17-12 is presumed to be due to boulders within the fill layer. Borehole BH17-14 encountered refusal on wood (logs, timber) as noted previously. The cause of practical refusal in boreholes BH17-3 and BH17-9 is presumed to be bedrock. The borehole logs provide details regarding the depth and cause of practical refusal.

In boreholes BH17-3 and BH17-9, the depth at which practical refusal was encountered was interpreted by WSP as being the depth of competent bedrock for the purpose of logging the boreholes. The bedrock in the vicinity generally consists of limestone bedrock. Limestone bedrock typically exhibits a certain degree of weathering and fracturing in its upper zone, which can be partially penetrated through the advancement boreholes using hydraulic drilling equipment.

3.10 GROUNDWATER

Groundwater observations were made within the boreholes upon completion. Groundwater seepage and accumulation during drilling operations was observed in all of the boreholes. Upon completion of drilling, groundwater levels were measured at depths ranging from approximately 0.9 to 4.0 mBGL. Borehole stability also was measured upon completion of the drilling operations. Nine (9) of the boreholes (BH17-2R, BH17-4 to BH17-9, BH17-13 and BH17-14) encountered borehole cave-in at depths ranging from approximately 1.5 to 4.6 mBGL. Although the groundwater seepage and accumulation varied across the site, it is expected that the stable groundwater level corresponds approximately to the level of Lake Ontario.

Groundwater levels are subject to seasonal fluctuations, specifically in response to extreme precipitation events and the spring thaw. As such variable levels should be anticipated, and groundwater could be encountered during construction, depending on site location and depth. Excavations within the saturated sand unit are expected to encounter immediate groundwater seepage.

3.11 ENVIRONMENTAL LABORATORY TESTING

In addition to the physical laboratory analyses described, chemical analyses were performed on selected representative samples. The collected soil samples were first inspected for evidence of contaminants using visual and olfactory methods. Following the screening, the samples were submitted to SGS Laboratories (in Lakefield, ON) for analytical testing as follows:

- Six (6) samples analyzed for Metals and Inorganics;
- Six (6) samples analyzed for Petroleum Hydrocarbons (PHCs) fraction F1 to F4;
- Six (6) samples analyzed for Volatile Organic Content (VOCs); and
- Six (6) samples analyzed for Polyaromatic Hydrocarbons (PAHs).

Testing was completed as per O.Reg. 153/04 and CCME standards. Test results were compared to CCME criteria for commercial properties; no exceedances were noted.

Test results were also compared to the Ministry of the Environment (MOE) guidelines listed in Table 8: Generic Site Condition Standards (SCSs) for Use within 30 m of a Water Body in a Potable Groundwater Condition for Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use of the *Soil, Groundwater and Sediment Standards for Use Under Part XV.I of the Environmental Protection Act (April 15, 2011)*, hereinafter referred to as the "MOE 2011 Table 8 SCSs". The tested soil samples met the relevant MOE guidelines, with the exceptions listed in **Table 3-4 below**. Copies of the laboratory certificate of analyses are provided in **Appendix C**.

Table 3-4: Metals and Inorganics Analysis Exceedances

BOREHOLE	SAMPLE I.D.	PARAMETER EXCEEDANCES MOE Table 3 Industrial/Commercial/Community Property Use
BH17-1	SS-4	Lead Mercury
BH17-13	SS-2	Cobalt EC

Analytical results were also compared to Table 3: Full Depth Generic Site Condition Standards (SCSs) in a Non-Potable Groundwater Condition for Industrial/Commercial/Community Property Use of the *Soil, Groundwater and Sediment Standards for Use Under Part XV.I of the Environmental Protection Act (April 15, 2011),* hereinafter referred to as the "MOE 2011 Table 3 SCSs". Sample SS-4 from borehole BH17-1 exceeded MOE 2011 Table 3 SCSs for lead, while sample SS-2 from borehole BH17-13 exceeded MOE 2011 Table 3 SCSs for electrical conductivity (EC).

Exceedances were marginally above standards for MOE 2011 Table 3 SCSs and MOE 2011 Table 8 SCSs. Any excess soil may be transported to another commercial or industrial property under federal jurisdiction, under the guidance of a Qualified Person (QP). Some excess soils may be transported to a non-federal jurisdiction Table 3 Industrial/Commercial/ Community property under the guidance of a QP. Further Testing, such as O. Reg 558/00 TCLP, may be required to confirm the quality of the excess soil for disposal. It should be noted that additional testing may also be required to meet the receiving property's acceptance criteria, at the discretion of the site QP.

4 GEOTECHNICAL RECOMMENDATIONS

It is understood that this proposed project shall include the demolishing of the existing structures and replacement of these structures with a single two-storey structure. This single structure will contain new office and residential space.

The following recommendations for design and construction of the proposed facility are based on the borehole information provided in **Section 3**. While we believe our findings are fairly representative, conditions may vary beyond the investigated locations. If significant differences in the subsurface conditions described above are found at a later time, WSP should be contacted immediately to revise our findings and recommendations, if necessary.

Recommendations are intended for the Client and Designers, and should not be construed as instructions to Contractors, who should form their own opinions about Site conditions for tendering purposes, and to determine appropriate equipment, construction methods, and their costs.

4.1 SITE PREPARATION

Any existing foundation elements, concrete debris, demolition debris, organic topsoil, wood and otherwise deleterious fill material should be removed and/or stripped from below the footprint of proposed future buildings, structures, and areas to be paved.

Prepared structural subgrade areas should be inspected and/or proof-rolled in the presence of the Geotechnical Engineer or qualified personnel working under their direct supervision. Loose or otherwise soft subsoils may require localized replacement.

Any new fill from onsite cuts or from offsite borrow sources should be approved by the Geotechnical Engineer prior to placement. Material should be placed in 200 mm maximum loose lifts and compacted to the following Standard Proctor Maximum Dry Density (SPMDD) standards (ASTM D698), based on presumptive loading conditions:

- Material placed below structurally loaded areas: 100 % SPMDD
- Material placed below parking areas/roadways: 98 % SPMDD
- Materials placed below general fill areas: 95 % SPMDD

Moisture adjustments may be required to compact materials to the required design standards, as directed by the Geotechnical Engineer.

Relatively flowing sand materials are a concern from the perspective of reduced foundation bearing capacity and settlement potential, and this material should be expected to be sensitive to disturbance in construction excavations. Construction in this material may require stabilization using specialized dewatering, geogrid, geotextile and/or other reinforcing elements.

4.2 EXCAVATIONS

Temporary excavations for the construction of underground structures and services must be carried out in accordance with the most recent version of the Canadian Occupational Health and Safety Regulation (SOR/86-304), whereas any excavations greater than 1.4 m, shall be sloped at a slope of 1:1 (Horizontal: Vertical) or flatter, without the use of appropriate reinforcement or shoring. However, based on the soil conditions, it is recommended that excavations should be carried out in accordance with the most recent version (O. Reg. 123/08) of the Occupational Health and Safety Act (OHSA). Based on the soil conditions encountered in the boreholes, for excavations to be placed solely within fill above the groundwater table, a Type 3 soil classification under the OHSA may be utilized. Temporary excavation side-slopes should extend to the base of the excavation and should not exceed 1:1 (Horizontal: Vertical) without appropriate reinforcement or shoring. Due to the flowing nature of the native sand, excavation into wet or saturated native sand, sand and gravel, and gravel, should be classified as Type 4 in accordance with OHSA. Thus, temporary excavation side-slopes must not exceed 3:1 (Horizontal: Vertical) without appropriate reinforcement or shoring designed by a qualified professional.

Excavation side slopes should be protected from exposure to precipitation and associated ground surface runoff, freeze/thaw, and should be inspected regularly for signs of instability. If localized instability is noted during excavation or if wet conditions are encountered, side slopes should be flattened as required to maintain safe working conditions.

4.3 SERVICING EXCAVATIONS AND BACKFILL

Shallow trench excavations completed within fill or competent granular material may be completed utilizing progressive vertical cut methods, or using an approved trench box. Trench excavations should avoid saturated soil layers of possible, and, should be protected from prolonged exposure to precipitation and runoff, and associated erosion. Excavations should be completed to the proposed trench subgrade level and in general accordance with SOR/86-304 and OPSD 802.010. The trench subgrade must be inspected and approved by the Geotechnical Engineer prior to bedding and pipe placements. Class B granular bedding compacted to a minimum 98 % of the standard Proctor maximum dry density (SPMDD), as per ASTM D698, may be a suitable option where relatively dry conditions exist. Fill should be wrapped in geotextile if fines migration is a concern. If the excavation extends into looser wet soils or sensitive soils, 19 mm to 25 mm diameter clear stone may be a reasonable substitute bedding material. The clear stone should be fully wrapped in a geotextile (Terrafix 300R, or an approved equivalent), and should be tamped in maximum 250 mm lifts.

4.4 MATERIAL REUSE

4.4.1 FROST SUSCEPTIBILITY

Based on the laboratory test results and guidance in The Canadian National Building Code 2015 (NBC 2015), Canadian Foundation Engineering Manual (CFEM 2006) and OPSS 212.05.01, the frost susceptibility of a fill material may be classified based on the amount of particles between the nominal sizes of 5 µm and 75 µm. Based on laboratory results of selected samples, the native soils contained less than approximately 17 % particles between the 5 and 75 µm size, and as such the native fine-grained soils are considered to have a low frost susceptibility.

The potential for actual frost heaving is complex, and also depends on other physical conditions, including temperature exposure, availability of moisture, and other material properties including texture and density.

The existing onsite material may be reused on the Site as trench or general backfill material, provided the material being used is properly segregated, inspected and approved by the Geotechnical Engineer. Existing fill material may be suitable for reuse provided the material is properly segregated, inspected and approved by the Geotechnical Engineer. Organic and otherwise deleterious material containing debris should be discarded.

Inspections and testing are recommended to classify and approve all materials to be used within the frost penetration zone.

4.4.2 FOUNDATION BACKFILL

Backfill for structural foundations should consist of a free-draining material, such as OPSS 1010 Granular B Type I, or an approved equivalent. Subdrains should be installed around the building footings and should consist of 100 mm perforated pipes wrapped in a geotextile. Subdrains should connect to a frost free outlet (e.g. stormwater system).

All imported material should be screened and approved by the Geotechnical Engineer before being delivered to the Site. Screening should also confirm that any imported fill meets applicable Environmental Standards.

4.5 GROUNDWATER CONTROL

As noted above, groundwater seepage was encountered in all of the boreholes during the drilling operations. Any excavation below the lake level shall encounter seepage. Saturated soils were observed through the investigation.

It is expected that due to the proximity to Lake Ontario, and the flowing nature of the native sands minimal excavations shall be completed as a part of this project. Minor seepage and accumulated water from precipitation and runoff should be

controllable with sumps and filtered pumps within the excavations. If deeper excavation and dewatering operations are to exceed 50,000 L/day a Permit to Take Water (PTTW) or Environmental Activity Sector Registry (EASR) from MOECC may be required for the construction. WSP should be contacted when final designs are made available to confirm relative design elevations and construction requirements with respect to soil and groundwater conditions, and to confirm that no additional permits are required.

4.6 SEISMIC SITE CLASS

For the purposes of earthquake design, the information relevant to the geotechnical conditions is attributed by the "Site Class". Based on the explored soil properties and in accordance with Table 4.1.8.4.A of the National Building Code (2015), it is recommended that the Site Class 'D' (i.e. stiff soils) be used for design.

4.7 FROST PENETRATION DEPTH

Based on Canadian Foundation Engineering Manual (CFEM 2016) and OPS Drawing 3090.101, the frost penetration depth for the Site is 1.2 mBGL. Therefore, foundation elements should be provided with at least 1.2 m of earth cover for frost protection, or an equivalent thickness of insulation installed according to manufacturer's specifications.

4.8 FOUNDATION SYSTEM

Based on the relatively low expected foundation loadings (i.e. up to two-storeys) it is expected that the proposed building may be supported on spread and continuous strip footings for column and load bearing walls, respectively. Ideally these footings would be founded on the undisturbed compact native soils. However, due to the proximity to the lake, the presence of existing rock fill and the extensive amount of dewatering that would be required to found the footing on the undisturbed native soil, construction of foundations on engineered fill or the existing fill may also be considered. Founding or placement of engineered fill on the existing fill can be completed provided that the following conditions are met:

- The proposed the building envelop should be fully subexcavated for the proposed construction, any fill containing deleterious material should be removed.
- A geotechnical engineer should assess and approve the existing fill during construction.
- The density of the existing fill should be maximized through the application of appropriate compaction efforts on the existing fill and prior to the placement of further fill or foundations. The native sand may be prone to disturbances during construction, care should be taken to protect any area where the subexcavation exposes the native sand.
    - The addition of more rock (i.e. 150mm minus stone or other material) may be required (at the discretion of the Geotechnical Engineer) to certify the existing fill.
    - Should additional (engineered) fill be placed over the stabilized engineered fill, a layer of of woven geotextile consisting of Terrafix400W (or equivalent, as approved by the Geotechnical Engineer) should be placed directly on the approved subgrade, in accordance to manufacturer's specifications, prior to the placement of any additional engineered fill.
- WSP must be retained to conduct full-time geotechnical inspections and monitoring of these materials throughout the duration of the construction earthworks operations.

As an alternative, the Client may wish to consider the alternative of soil mixing, to improve the existing fill on site as opposed to the above mentioned alternative. Soil mixing could minimize the required subexcavation, and would also minimize potential disturbances to the native sand resulting from compactive efforts on the existing fill. Should the Client wish to evaluate this alternative WSP can provide further information upon request.

Another option might be to construct the new building on the roadway area west of the existing structure. If that is considered partial or full depth subexcavation a loose and/or deleterious fill, as seen in BH 17-9 and BH 17-10, would be required.

Any loose, soft, wet or deleterious soils at the exposed bearing surfaces must be sub-excavated under direction of the Engineer, and be replaced with approved engineered fill compacted to 100% of the materials' SPMDD, unshrinkable fill, geotextile wrapped clear stone, or another pre-approved alternative.

Under the NBC 2015 and Canadian Foundation Engineering Manual (CFEM 2006), the factored (Φ=0.5) geotechnical resistance at Ultimate Limit States (ULS) and geotechnical reaction at Serviceability Limit States (SLS) for bearing on engineer-inspected granular fill materials, are 250 kPa and 150 kPa, respectively. The geotechnical reaction at SLS is based on a total allowable settlement of 25 mm and maximum differential settlement of 15 mm.

Due to the relatively high water table, and proximity to Lake Ontario, a 150 mm diameter perforated plastic (with a filter sock) perimeter drain should be installed at the footing level around the exterior of the footings.

Should larger load capacities be required, deep foundations shall be required. Deep foundations would need to extend to the bedrock (approximately 11 mBGL). Due to the nature of the existing fill (large amounts of boulders) it may be very difficult to penetrate this layer and reach the founding depth. WSP can provide further information on deep foundation options upon request.

4.9 FLOOR SLAB

It is understood that the proposed building will have a concrete floor slab on grade. If a service crawl space is to be provided, a structurally supported floor will be required, with pier pads founded on compacted material (minimum allowable bearing capacity of 150 kPa. If the crawl space is unheated all support piers must extend below the frost penetration depth, or be insulated. The crawl space grade should be situated at least 0.5m above the high groundwater level and an emergency sump/pump should be provided for permanent drainage control and flood protection. WSP can provide further design review comments for a service crawl space upon request.

Recommendations assume that the maximum concentrated floor slab loads will not exceed 15 kPa. Unsuitable materials shall be removed from beneath the floor slab areas, and replaced with approved engineered fill materials as described in the sections above. Prior to the placement of any fill, the exposed subgrade should be proof rolled a minimum 6 times using a minimum 8 tonne smooth drum roller. Engineered fill required to reinstate subgrade level (in the case of buried organic soils) may consist of imported inorganic soils or inorganic site soils from other excavations (as approved by the Engineer), placed in 200 mm thick loose lifts and compacted to 98 % of the materials' Standard Proctor Maximum Dry Density (SPMDD). All material should be approved by the Engineer prior to being delivered to the site. Floor slabs on grade should be constructed upon at least 200 mm of OPSS 1010 Granular A compacted to a minimum of 100 % of SPMDD for load distribution.

Provided the final site grade is elevated and sloped away from the structures, subdrains should not be required below floor areas. Moisture barrier is recommended below floor areas and/or crawl space areas in general accordance with the NBC 2015 (or OBC 2012) requirements for wet/damp subsurface conditions.

4.10 LATERAL EARTH PRESSURES

For the purpose of preliminary design it is assumed that lateral earth pressures are developed from free-draining granular backfill. The following unfactored earth pressure coefficients are recommended for design of retaining walls and underground structures.

- Unit weight of Granular Materials (compacted to 100% SPMDD) : 23 kN/m^3
- Passive Earth Pressure Coefficient, K_p =3.3
- Active Earth Pressure Coefficient, K_a =0.3

Active (yielding) lateral thrust may be derived from the expression:

$$P = K_a (\gamma h+q)$$

Where,

γ = unit weight (kN/m^3)

h = height of wall or structure (m)

q = surcharge loadings (kPa)

Triangular stress distributions should be assumed for active and/or passive loading cases in well drained soil/fill conditions.

4.11 SUGGESTED PAVEMENT STRUCTURE

Provided that exposed subgrade surfaces are prepared in accordance with recommendations in **Section 4.1**, the following asphalt pavement structures may be considered for this Site.

Table 4-1: Preliminary Asphalt Pavement Structure Design

PAVEMENT LAYER	STANDARD PAVEMENT STRUCTURE (CARS)	ENHANCED PAVEMENT STRUCTURE (PIER ACCESS WAY)	COMPACTION REQUIREMENTS
Asphaltic Concrete OPSS HL-4 (SP 12.5)	50 mm	40 mm	92% to 97% MRD
Asphaltic Concrete OPSS HL-8 (SP 19.0)	-	50 mm	
Base Course OPSS 1010 Granular 'A'	150 mm	150 mm	98% SPMDD
Subbase Course OPSS 1010 Granular 'B'	300 mm	300 mm	98% SPMDD

As noted in the table, if reconstructed, the pier access way (in front of the Search and Rescue Facility), the enhanced pavement structure should be used. Other areas of the site (i.e. car parking) may use the thinner pavement design.

For all applications, subgrade should be sloped towards catch basin structures at a minimum crossfall of 3%. Perforated, sub-drain stubs with a minimum length of 3 m should be installed at all catch basin locations to improve drainage. The use of perforated sub-drains at the curb lines or any low points in the subgrade also is suggested to provide positive drainage from the granular base and subbase layers.

5 DESIGN REVIEW, TESTING AND INSPECTION

WSP should be afforded the opportunity to complete a review of final foundation and servicing designs to verify that assumptions and geotechnical recommendations discussed in this report are appropriate. If not given this opportunity, WSP cannot assume liability for omissions, misinterpretations or deficiencies in our recommendations. Conditions beyond borehole locations may vary from those discussed in the report. WSP should be contacted if any significant subsurface variability is found at a later time. WSP should be requested to confirm requirements for soil handling and disposal, and the need for dewatering and a Permit to Take Water according to Provincial Regulations when more information is available.

WSP should be contacted to provide geotechnical material testing and inspections during construction operations. Exposed subgrade soils are to be inspected to confirm the material is stable and competent to support design loads. Inspections of seepage and groundwater conditions during construction are also required, to further address requirements for dewatering. Testing and inspections for general QA/QC should include sampling and laboratory testing of fill materials and asphalt, and compaction testing.

We trust that this report satisfies your requirements. Please contact our office if you have any questions.

Submitted by,

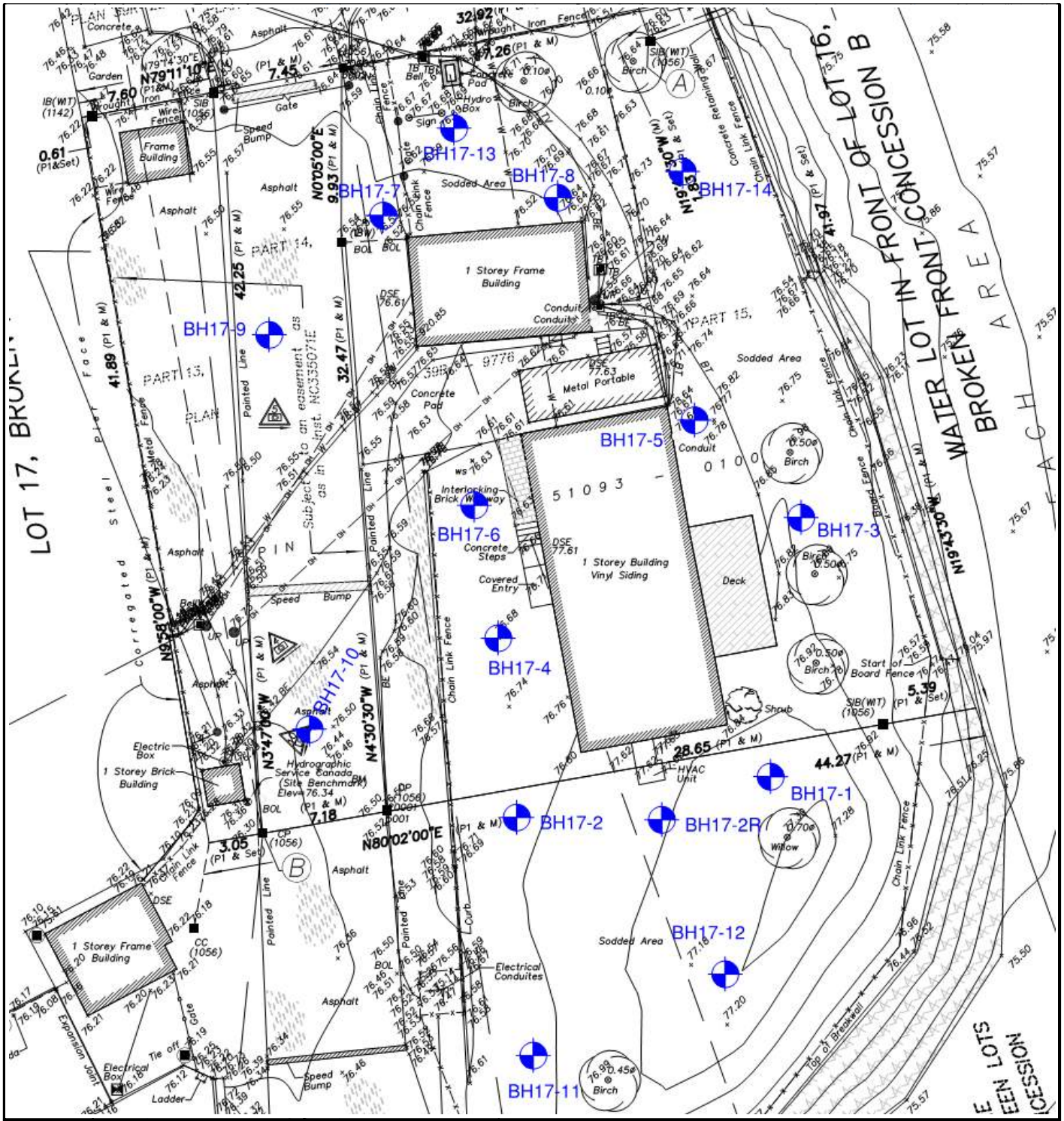
WSP Canada Inc.

Reviewed By:

Pete Hynes, P.Eng.
Project Engineer

J. Stephen Ash, P.Eng., P.Geo., QP_{ESA}
Director, Environment

FIGURES



LEGEND

BH17-1 — Approximate Location and Designation of Boreholes

BORE HOLE LOCATION PLAN

GEOTECHNICAL INVESTIGATION REPORT
New Search and Rescue Station
114 Division Street
Cobourg, Ontario

Data Source: Portions of base plan were prepared by IBW Surveyors as plan entitled "Plan of Survey Showing Topographic Detail (Shown as Harbour on Caddy Plan), Part of the Water Lot Lying in Front of Lot 17, Broken Front Concession B and Part of Water Lot Lying in Front of the Original Road Allowance Between Lots 16 and 17 (Known Locally as Division St.) Broken Front Concession B, (Geographic Township of Hamilton), Town of Cobourg, County of Northumberland" dated February 10, 2017, and provide to WSP by Public Works and Government Services Canada (PWGSC).

N W E S

DATE: AUGUST 2017	SCALE: N.T.S.
PROJECT: 171-07055-00	FILE. NO.:171-07055-00 F1
wsp	FIGURE 1

APPENDIX

A BOREHOLE LOGS

BOREHOLE NO. BH17-1

PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 20, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 77.23 m
REVIEWER: PH

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727535
Northing: 4870940

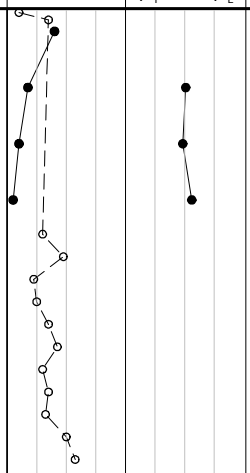
DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH (10 20 30)	MOISTURE CONTENT % (10 20 30) P_P P_L	REMARKS
0.0 – 0.2	TOPSOIL:										
0.2 – 1.4	FILL: Light brown gravelly sand FILL, moist, loose			SS1	4		25				
1.0				SS2	4	17	50				GSA SS2: Gravel: 16% Sand: 66% Silt & Clay: 18%
1.4 – 2.2	FILL: Grey sand FILL,some gravel, some silt, saturated, very loose			SS3	2	21	42				Groundwater at 1.8 m below ground surface in open hole upon completion of drilling.
2.2 – 2.9	FILL: Sand FILL, gravel, concrete chunks, black crsytaline material, saturated, dense			SS4	36	25	58				Auger grinding - difficulty getting through material
2.9	Borehole terminated upon refusal at 2.9 m below ground surface on PRESUMED BOULDER.										Borehole open upon completion

BOREHOLE NO. BH17-10

PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 22, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 76.34 m
REVIEWER: PH

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727526
Northing: 4870954

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	REMARKS
0.0 – 0.1	ASPHALT (50 mm)			SS1	16		46		
0.1 – 0.2	FILL Brown sand and gravel FILL, moist, compact								
0.2 – 1.0	ASPHALT			SS2	7	20	63		Groundwater at 0.9 m below ground surface upon completion of drilling
1.0 – 2.0	FILL Brown sand and gravel FILL, moist, compact			SS3	4	19	75		Borehole caved to 1.8 m upon completion of drilling
2.0 – 2.9	FILL: Brown sand FILL, trace silt, moist, compact to very loose - Black crystaline material, saturated - Grey - Wood fragments			SS4	2	22	100		
2.9	Sampling terminated at 2.9 m below ground surface (due to borehole cave-in), DCPT below to 6.1 m.								
6.1	End of Borehole / DCPT								



BOREHOLE NO. BH17-11

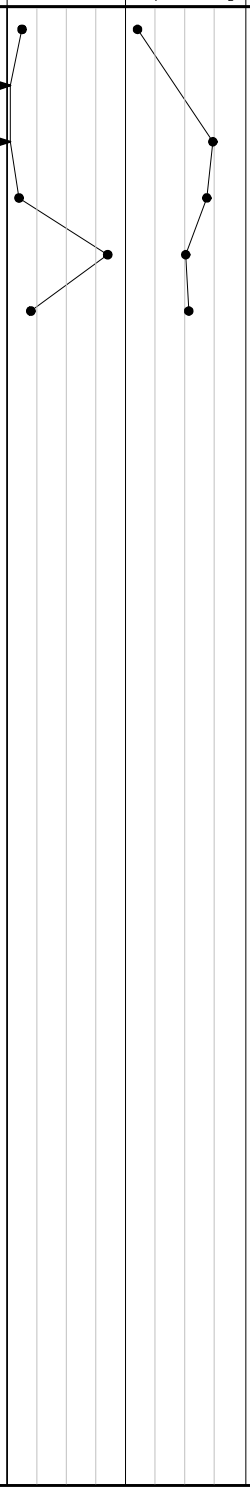
PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 22, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 76.62 m
REVIEWER: PH

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727528
Northing: 4870929

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	REMARKS
0.0 – 0.2	TOPSOIL								
0.2 – 2.2	FILL: Brown sandy gravel FILL, moist, loose			SS1	5	4	42		
2.2 – 2.9	FILL: Brown SAND, trace gravel, saturated (black silt bagged on its own), very loose			SS2	WOH		0		No sample recovery
2.9 – 6.1	FILL: Dark brown sandy gravel FILL, occasional cobbles, saturated, loose			SS3	WOH	29	25		No sample recovery
	SAND: Grey SAND, trace weathered rock, saturated, dense to loose			SS4	4	27	50		
				SS5	34	20	58		Groundwater at 3.0 m below ground surface upon completion of drilling
				SS6	8	21	58		Borehole caved to 4.3 m upon completion of drilling
6.1	Borehole terminated at 6.1 m below ground surface in SAND.			AS7					

CONE PENETRATION "N" VALUE 10 20 30 — SHEAR STRENGTH

MOISTURE CONTENT % 10 20 30 — P_P P_L



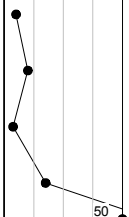
BOREHOLE NO. BH17-12

PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 19, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 77.19 m
REVIEWER: PH

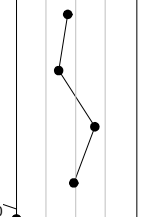
UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727533
Northing: 4870932

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	REMARKS
0.0 – 0.1	TOPSOIL			SS1	4	17	54		
0.1 – 0.8	FILL: Brown sandy gravel FILL, moist, loose			SS2	8	14	50		
0.8 – 1.5	FILL: Light to dark brown sand FILL, some gravel, moist, loose			SS3	3	26	4		Borehole caved to 1.8 m upon completion of drilling, dry
1.5 – 3.1	FILL: Brown sandy gravel FILL, moist, very loose to dense			SS4	14	19	25		
3.1	Borehole terminated upon auger refusal at 3.1 m below ground surface on presumed boulder.			SS5	50/ 50mm		0		

CONE PENETRATION "N" VALUE 10 20 30 — SHEAR STRENGTH



MOISTURE CONTENT % 10 20 30 — P_P P_L



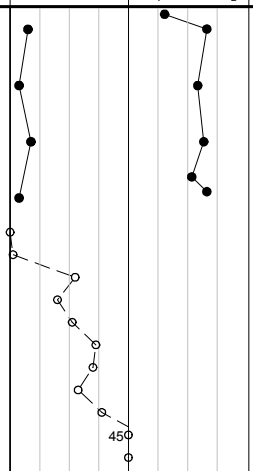
BOREHOLE NO. BH17-13

PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 21, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 76.66 m
REVIEWER: PH

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727529
Northing: 4870985

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	REMARKS
0.0									
0.2	TOPSOIL			SS1	6	12 26	42		
0.7	FILL: Black sand FILL, occasional cobbles, nail in tip of spoon, moist, loose			SS2	3	23	50		
1.4	FILL: Brownish grey SAND, trace gravel, saturated, very loose			SS3	7	25	58		
	SAND: Brown, grey and red layered SAND, wet, loose to very loose			SS4	3	21 26	100		Groundwater at 1.8 m below ground surface upon completion of drilling Borehole caved to 2.3 m upon completion of drilling GSA SS4: Gravel: 4% Sand: 86% Silt & Clay: 10%
2.9	- Brown - Grey								
	Sampling terminated at 2.9 m below ground surface (due to borehole cave-in), DCPT below to 6.1 m.								
6.1	End of Borehole / DCPT								

CONE PENETRATION "N" VALUE (10 20 30) — SHEAR STRENGTH



MOISTURE CONTENT % (10 20 30) — P_P P_L

BOREHOLE NO. BH17-14

PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 21, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 76.67 m
REVIEWER: PH

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727539
Northing: 4870978

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH (10 20 30)	MOISTURE CONTENT % (10 20 30) P_P P_L	REMARKS
0.0											
0.3	TOPSOIL										
	FILL: Brown sandy gravel FILL, saturated, loose to dense			SS1	1	20	75				
1.0				SS2	8	11	8				
2.0				SS3	4	29	17				Groundwater at 1.5 m below ground surface upon completion of drilling Augers grinding Borehole caved to 1.5 m upon completion of drilling
2.4	WOOD:			SS4	39	12	63				
3.0	Borehole terminated upon auger refusal at 3.0 m below ground surface in WOOD.										
4.0											
5.0											
6.0											
7.0											
8.0											
9.0											
10.0											
11.0											
12.0											
13.0											
14.0											
15.0											
16.0											
17.0											
18.0											
19.0											
20.0											

BOREHOLE NO. BH17-2

PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 19, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 76.90 m
REVIEWER: PH

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH (10 20 30)	MOISTURE CONTENT % (10 20 30) P_P P_L	REMARKS
0.0	TOPSOIL:			SS1	3	17					
0.6	FILL: Sand and gravel FILL, moist, loose			SS2	6	17					
1.0	- Saturated			SS3	6	12					
2.0											
2.3	FILL: Rock FILL										Groundwater at 2.3 m below ground surface in open hole upon completion of drilling. Borehole open upon completion
2.9	Borehole terminated upon refusal at 2.9 m below ground surface on PRESUMED BOULDER.										
3.0											
4.0											
5.0											
6.0											
7.0											
8.0											
9.0											
10.0											
11.0											
12.0											
13.0											
14.0											
15.0											
16.0											
17.0											
18.0											
19.0											
20.0											

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727525
Northing: 4870947

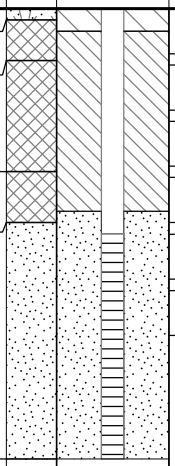
BOREHOLE NO. BH17-2R

PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 20, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 77.17 m
REVIEWER: PH

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727534
Northing: 4870937

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	"N" VALUE / SHEAR STRENGTH (10 20 30)	MOISTURE CONTENT % (10 20 30; P_P – P_L)	REMARKS
0.0 – 0.2	TOPSOIL:	SS1	4	17	50				
0.2 – 0.7	FILL: Brown sand FILL, trace gravel, moist, loose	SS2	3	30	4				
0.7 – 2.2	FILL: Red brick FILL, moist, very loose to compact	SS3	11	24	13				
2.2 – 2.9	FILL: Grey sand FILL, pockets of organics, rootlets, trace gravel, saturated, loose	SS4	9	20	50				
2.9 – 6.1	SAND: Grey SAND, trace silt, saturated, loose	SS5	5	23	67				
		SS6	10	21	92				GSA SS6: Sand: 96% Silt & Clay: 4%
6.1	Borehole terminated at 6.1 m below ground surface in SAND.								

STRATIGRAPHY / MONITOR DETAILS



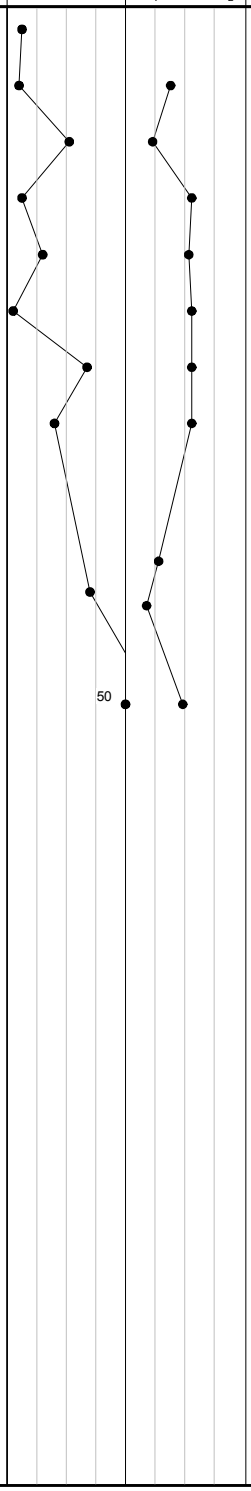
Groundwater at 4.0 m below ground surface upon completion of drilling
Borehole caved to 4.3 m upon completion of drilling

BOREHOLE NO. BH17-3

PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 20, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 76.91 m
REVIEWER: PH

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting:
Northing:

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	REMARKS
0.0	TOPSOIL:			SS1	5		33		
0.6	FILL: Brown sand FILL, trace silt, moist, loose			SS2	4	15	8		
1.4	FILL: Grey sandy gravel FILL, trace silt, trace metal, saturated, compact			SS3	21	9	54		
2.1	SAND: Grey SAND, trace silt, saturated, very loose to compact			SS4	5	22	67		
				SS5	12	21	100		Groundwater at 3.0 m below ground surface upon completion of drilling
				SS6	2	22	54		
				SS7	27	22	75		
				SS8	16	22	75		
7.8	GRAVELLY SAND: Grey GRAVELLY SAND, trace silt, saturated, compact			SS9	28	11 / 7	83		GSA SS9: Gravel: 34% Sand: 40% Silt & Clay: 26% Grinding from 8.5 to 9.1 m
8.5	SAND: Grey SAND, crushed rock (tip of spoon), saturated, very dense			SS10	50/ 25mm	19	4		
10.8	Borehole terminated upon refusal at 10.8 m below ground surface on PRESUMED BEDROCK.								



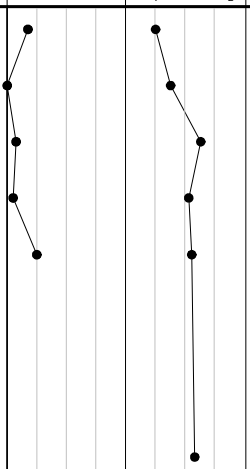
WSP GEOLOGIC (METRIC) DYNAMIC CONE & UTM 171-07055-00.GPJ WSP_ENV_V1.GDT 7/31/17

BOREHOLE NO. BH17-4

PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 20, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 76.71 m
REVIEWER: PH

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727524
Northing: 4870957

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	REMARKS
0.0							
0.3	TOPSOIL:						
	FILL: Black sand FILL, moist, very loose to loose	SS1	7	10	75		
1.0	- Light brown, trace gravel, saturated	SS2	0	15	17		
	- Brownish grey	SS3	3	25	50		
2.0							
2.1	SAND: Grey SAND, trace silt, saturated, very loose to compact	SS4	2	21	75		Groundwater at 2.1 m below ground surface upon completion of drilling
	- Grey						Borehole caved to 2.7 m upon completion of drilling
3.0		SS5	10	22	100		GSA SS5: Gravel: 1% Sand: 95% Silt & Clay: 4%
4.0							
5.0							
6.0							
6.1	Borehole terminated at 6.1 m below ground surface in SAND.	AS6		23			
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							
13.0							
14.0							
15.0							
16.0							
17.0							
18.0							
19.0							
20.0							



BOREHOLE NO. BH17-5

PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 20, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 76.79 m
REVIEWER: PH

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727543
Northing: 4870959

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH	MOISTURE CONTENT % (P_P – P_L)	REMARKS
0.0	TOPSOIL:			SS1	2	25	42				
0.6	FILL: Brownish light grey sand FILL, trace gravel, deleterious material (plastic), moist, very loose			SS2	0	22	42				
1.4	ROCK FILL: ROCK FILL, some sand and gravel, saturated, loose			SS3	6	15	25				Groundwater at 1.8 m below ground surface upon completion of drilling Borehole caved to 2.4 m upon completion of drilling
2.2	SAND: Brownish grey SAND, wet, very loose to loose - Trace roots / organic fragments			SS4	0	22	100				
				SS5	4	22	83				
3.7	Sampling terminated at 3.7 m below ground surface, DCPT below to 6.7 m.								42 48 44 47 47 42 50		
6.7	End of Borehole / DCPT										

BOREHOLE NO. BH17-6

PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 19, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 76.62 m
REVIEWER: PH

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727518
Northing: 4870971

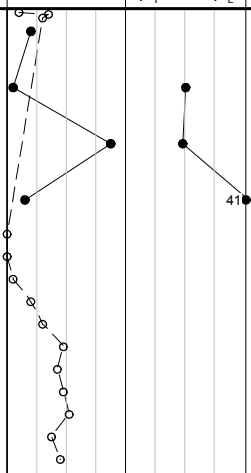
DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	CONE PENETRATION / "N" VALUE / SHEAR STRENGTH	MOISTURE CONTENT % (P_P – P_L)	REMARKS
0.0											
0.2	TOPSOIL:			SS1	3	1					
	FILL: Light brown to black sand FILL, moist, very loose										
1.0 / 0.9	ROCK FILL: ROCK FILL			AS1 / SS2		18					Groundwater at 0.9 m below ground surface upon completion of drilling Borehole caved to 1.5 m upon completion of drilling
2.0											
2.3	SAND: Grey SAND, some organics and rootlets at fill / native interface, saturated			SS4 SS5	7 2						
3.0				AS2		20					
4.0											
				AS3		22					
5.0											
6.0											
6.1	Borehole terminated at 6.1 m below ground surface in SAND.										
7.0											
8.0											
9.0											
10.0											
11.0											
12.0											
13.0											
14.0											
15.0											
16.0											
17.0											
18.0											
19.0											
20.0											

BOREHOLE NO. BH17-7

PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 21, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 76.56 m
REVIEWER: PH

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727519
Northing: 4870981

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	CONE PENETRATION / "N" VALUE / SHEAR STRENGTH (10 20 30)	MOISTURE CONTENT % (10 20 30) P_P P_L	REMARKS
0.0 – 0.1	ASPHALT (50 mm)										
0.1 – 0.6	FILL: Sand and gravel FILL, moist, loose			SS1	8		63				
0.6 – 1.5	FILL: Black crystaline material, loose			SS2	2	20	75				
1.5 – 2.2	FILL: Red and brown sand FILL, trace gravel			SS3	35	19	75				
2.2 – 2.9	FILL: Brown to grey sand FILL, trace gravel, wood organics, wet, very loose			SS4	6	41	100			41	Groundwater at 2.1 m below ground surface upon completion of drilling Borehole caved to 2.1 m upon completion of drilling
2.9 – 4.0	SAND AND GRAVEL: Light grey SAND AND GRAVEL, wet, dense										
4.0 – 6.1	SAND: Grey SAND, wet, loose										
	Sampling terminated at 2.9 m below ground surface, DCPT below to 6.1 m.										
6.1	End of Borehole / DCPT										



BOREHOLE NO. BH17-8

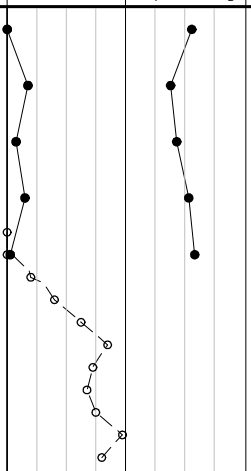
PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 21, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 76.72 m
REVIEWER: PH

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727536
Northing: 4870989

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	REMARKS
0.0							
0.3	TOPSOIL	SS1	0	22	38		
	FILL: Crushed rock and sandy gravel FILL, moist, very loose to loose	SS2	7	15	17		
1.4	SAND: Brown SAND, trace gravel, saturated, loose to very loose - Greyish brown, wet	SS3	3	17	8		
		SS4	6	21	75		GSA SS4: Sand: 95% Silt & Clay: 5%
		SS5	1	23	58		Groundwater at 3.0 m below ground surface upon completion of drilling
3.7	Sampling terminated at 3.7 m below ground surface, DCPT below to 6.1 m.						Borehole caved to 4.6 m upon completion of drilling
6.1	End of Borehole / DCPT						

STRATIGRAPHY

MONITOR DETAILS

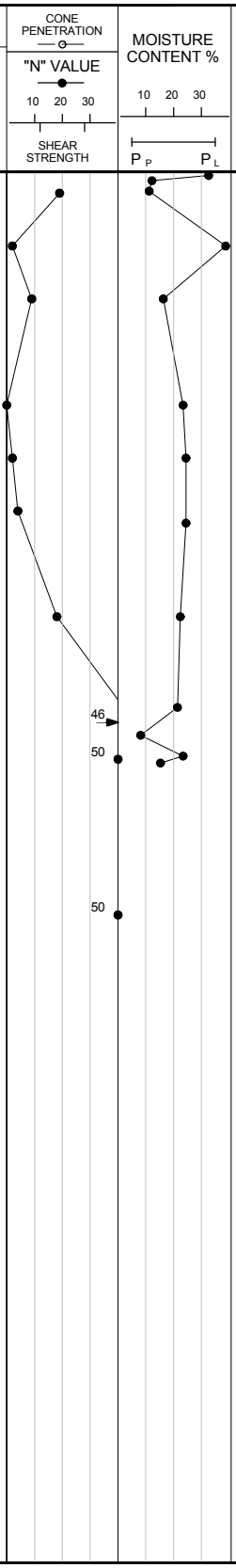


BOREHOLE NO. BH17-9

PROJECT NAME: COBOURG SEARCH AND RESCUE
PROJECT NO.: 171-07055-00
CLIENT: PWGSC
DATE COMPLETED: Jun 22, 2017
BOREHOLE TYPE: 200 mm DIA. SPLIT SPOON / HOLLOW STEM AUGER
SUPERVISOR: Ayjr
GROUND ELEVATION: 76.52 m
REVIEWER: PH

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 727512
Northing: 4870975

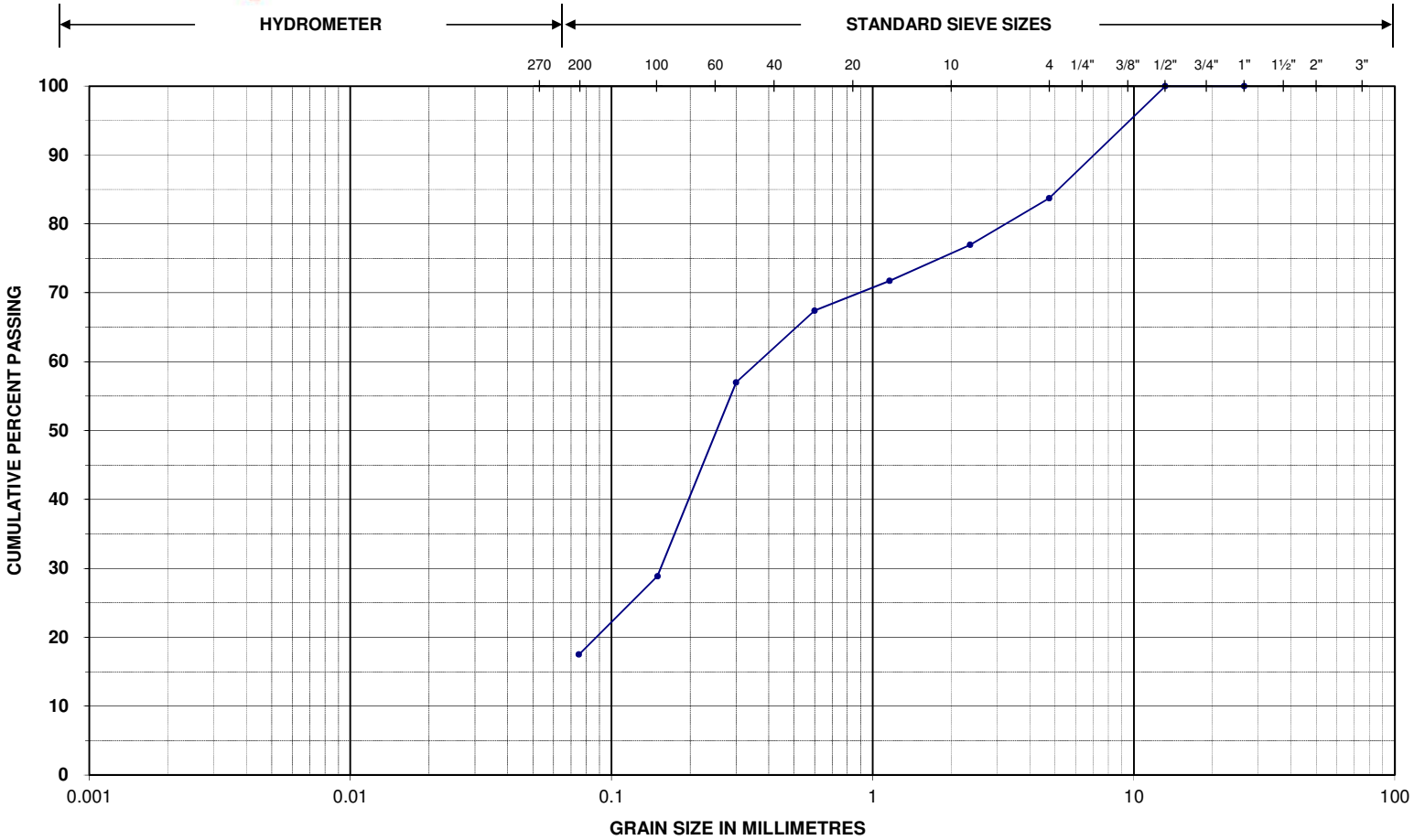
DEPTH (m)	STRATIGRAPHIC DESCRIPTION	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	REMARKS
0.0 – 0.1	ASPHALT		SS1	19	32, 12, 11	58		
0.1 – 0.3	FILL							
0.3 – 1.0	FILL: Black crystaline material FILL, moist, compact		SS2	2	38	83		
1.0 – 1.5	FILL: Brown SAND, crushed red brick, moist, compact to very loose		SS3	9	16	42		Groundwater at 1.8 m below ground surface upon completion of drilling
1.5 – 2.4	FILL: Brown gravelly sand FILL, trace rock, saturated, loose							
2.4 – 4.6	FILL: Brown to black sand FILL, trace to some silt, moist, loose; FILL: Grey SAND, trace silt, occasional wood fragments, saturated, very loose		SS4	0	23	75		Borehole caved to 3.0 m upon completion of drilling
			SS5	2	24	38		
4.6 – 5.0	SAND: Grey SAND, interbedded organic layers, trace silt, saturated, loose		SS6	4	24	100		
5.0 – 8.0	SAND: Grey SAND, trace silt, saturated, loose to dense		SS7	18	22	83		
			SS8	46	21, 8	100		
8.0 – 8.4	GRAVELLY SAND: Grey GRAVELLY SAND, trace silt, saturated, dense		SS9	50/ 0mm	23, 15			
8.4 – 8.7	SAND: Grey SAND, trace silt, saturated, very dense							
8.7 – 11.0	P-GRAVEL: Rounded GRAVEL (grinding), saturated, very dense		SS10	50/ 50mm		0		
11.0	Borehole terminated upon refusal at 11.0 m below ground surface on presumed BEDROCK.							



APPENDIX

B GEOTECHNICAL LABORATORY DATA

PARTICLE SIZE DISTRIBUTION



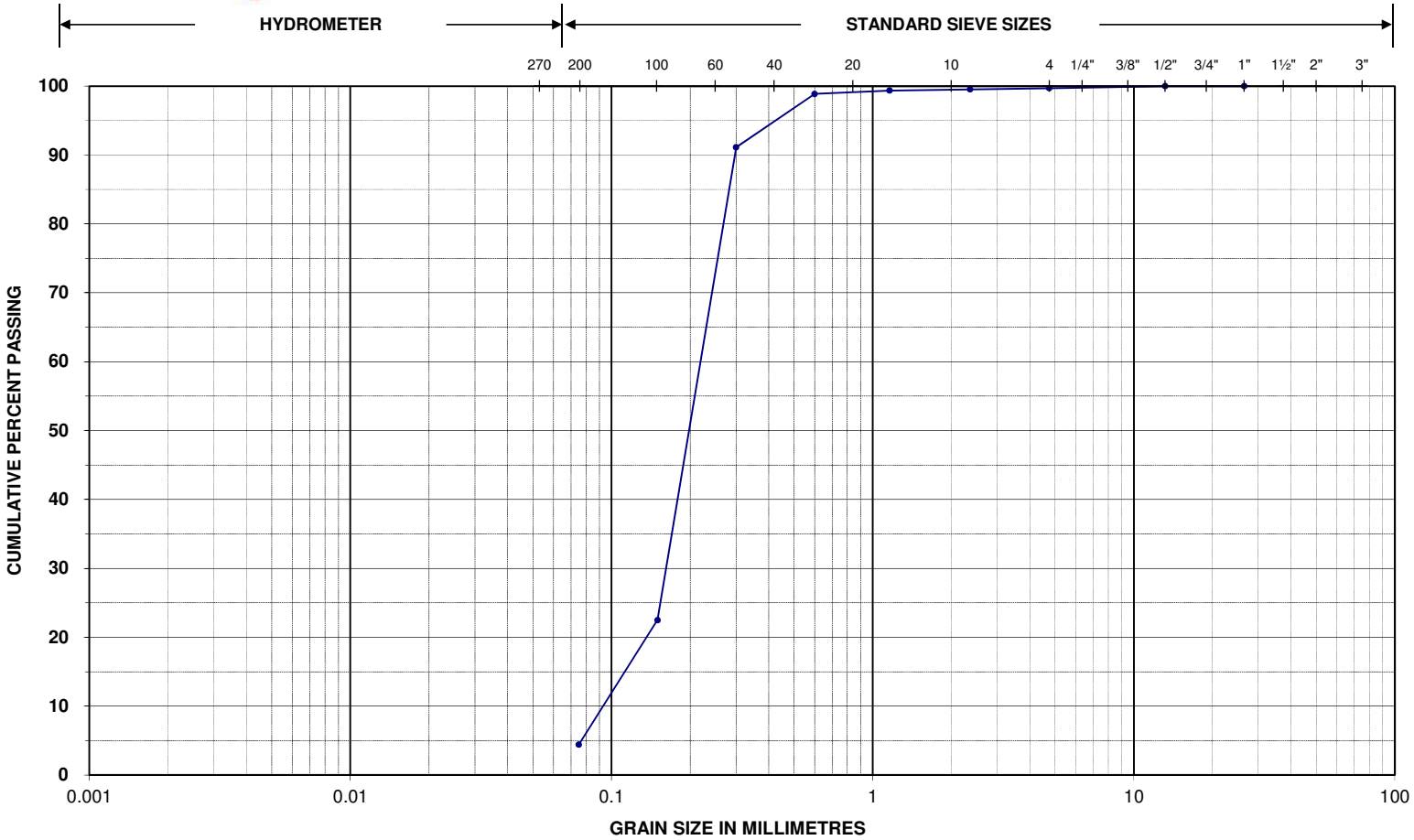
Unified Classification System

SILT AND CLAY	SAND	GRAVEL

Project Name:	Cobourg Search and Rescue	**Project No.:**	171-07055-00
Location ID.:	BH17-01	**Sample No./Depth:**	SS2 / 0.8-1.4m

Sieve Size	% Passing Coarse	**Sieve Size**	% Passing Fine
37.5 mm	100.0	**1.16 mm**	71.7
26.5 mm	100.0	**0.60 mm**	67.4
13.2 mm	100.0	**0.30 mm**	57.0
4.75 mm	83.7	**0.15 mm**	28.9
2.36 mm	77.0	**0.075 mm**	17.5

PARTICLE SIZE DISTRIBUTION



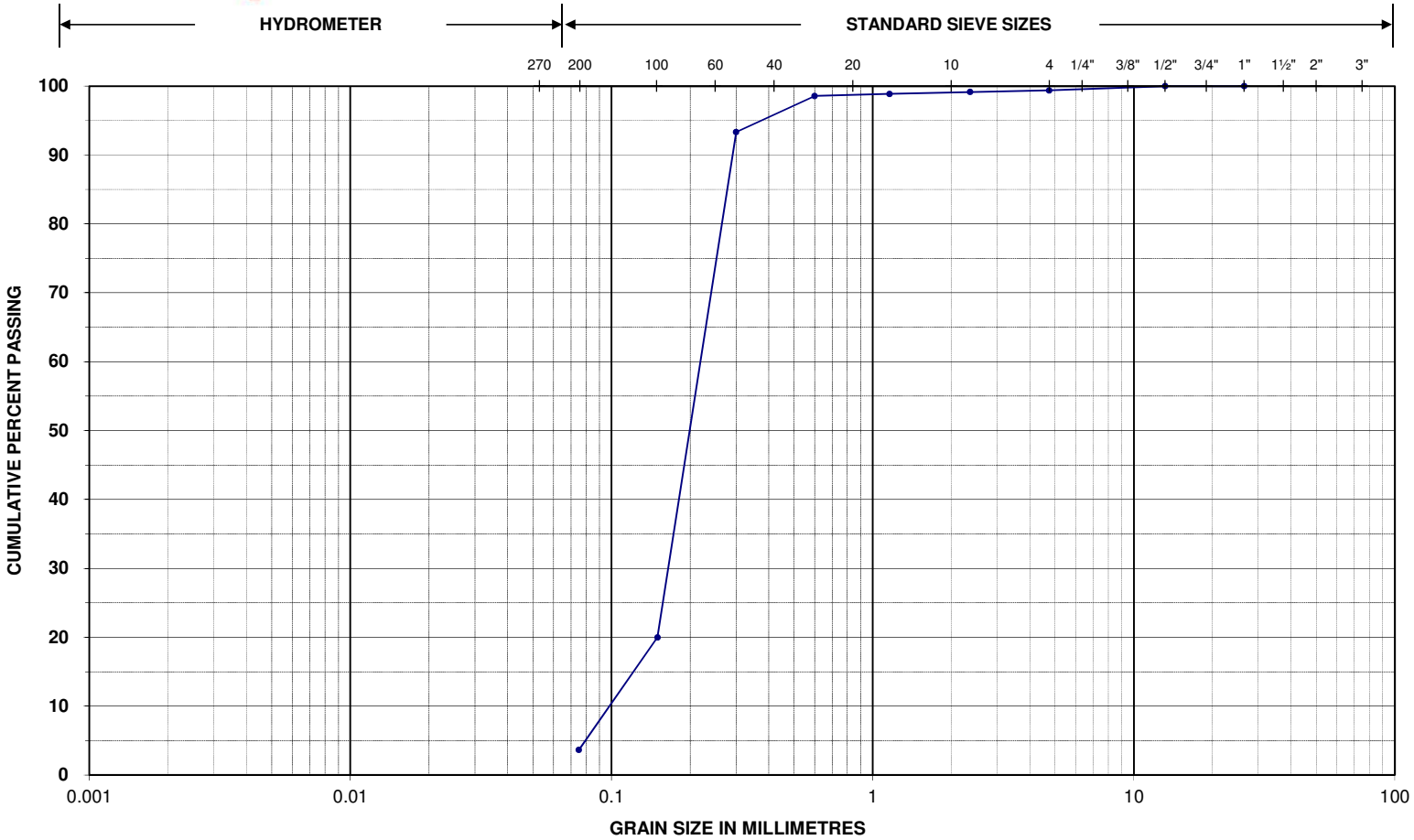
Unified Classification System

SILT AND CLAY	SAND	GRAVEL

Project Name:	Cobourg Search and Rescue	**Project No.:**	171-07055-00
Location ID.:	BH17-02R	**Sample No./Depth:**	SS6 / 3.8-4.4m

Sieve Size	% Passing Coarse	**Sieve Size**	% Passing Fine
37.5 mm	100.0	**1.16 mm**	99.4
26.5 mm	100.0	**0.60 mm**	98.9
13.2 mm	100.0	**0.30 mm**	91.1
4.75 mm	99.7	**0.15 mm**	22.5
2.36 mm	99.5	**0.075 mm**	4.4

PARTICLE SIZE DISTRIBUTION



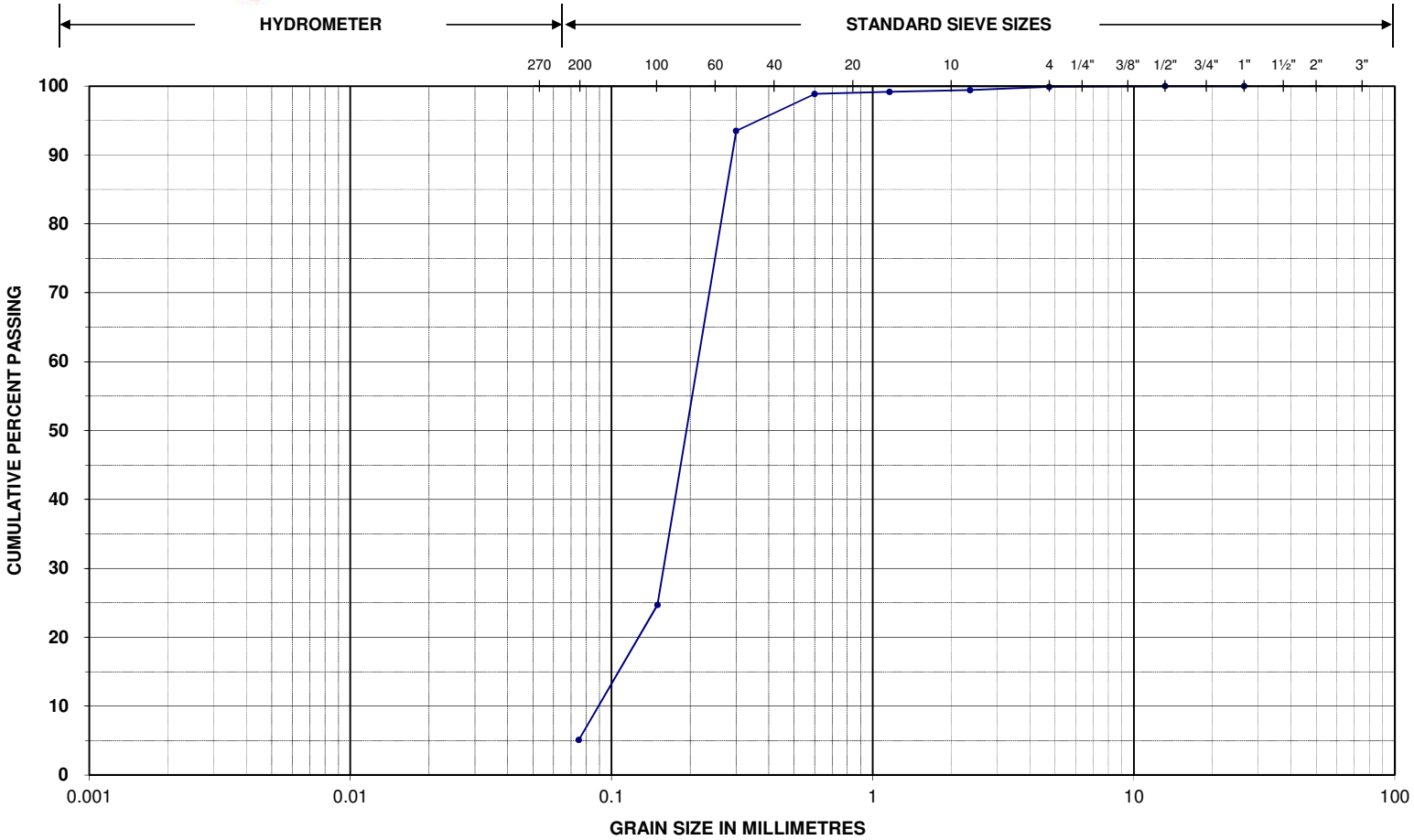
Unified Classification System

SILT AND CLAY	SAND	GRAVEL

Project Name:	Cobourg Search and Rescue	**Project No.:**	171-07055-00
Location ID.:	BH17-04	**Sample No./Depth:**	SS5 / 3.0-3.7m

Sieve Size	% Passing Coarse	**Sieve Size**	% Passing Fine
37.5 mm	100.0	**1.16 mm**	98.9
26.5 mm	100.0	**0.60 mm**	98.6
13.2 mm	100.0	**0.30 mm**	93.3
4.75 mm	99.4	**0.15 mm**	20.0
2.36 mm	99.1	**0.075 mm**	3.6

PARTICLE SIZE DISTRIBUTION



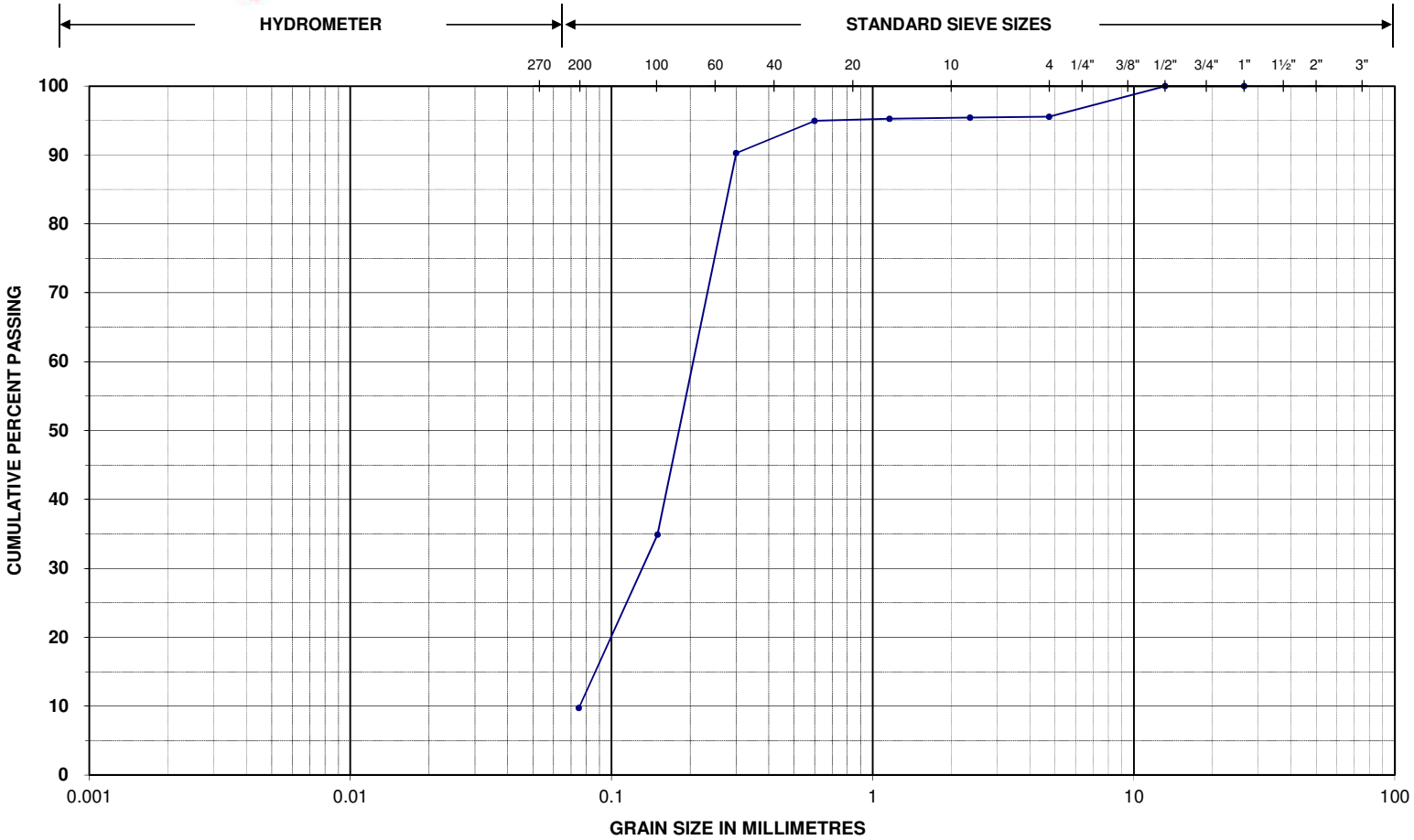
Unified Classification System

SILT AND CLAY	SAND	GRAVEL

Project Name:	Cobourg Search and Rescue	**Project No.:**	171-07055-00
Location ID.:	BH17-08	**Sample No./Depth:**	SS4 / 2.3-2.9m

Sieve Size	% Passing Coarse	**Sieve Size**	% Passing Fine
37.5 mm	100.0	**1.16 mm**	99.2
26.5 mm	100.0	**0.60 mm**	98.9
13.2 mm	100.0	**0.30 mm**	93.5
4.75 mm	99.9	**0.15 mm**	24.7
2.36 mm	99.4	**0.075 mm**	5.1

PARTICLE SIZE DISTRIBUTION



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

Project Name:	Cobourg Search and Rescue	**Project No.:**	171-07055-00
Location ID.:	BH17-13	**Sample No./Depth:**	SS4 / 2.3-2.9m

Sieve Size	% Passing Coarse	**Sieve Size**	% Passing Fine
37.5 mm	100.0	**1.16 mm**	95.3
26.5 mm	100.0	**0.60 mm**	95.0
13.2 mm	100.0	**0.30 mm**	90.3
4.75 mm	95.6	**0.15 mm**	34.9
2.36 mm	95.4	**0.075 mm**	9.7

MOISTURE CONTENTS

Project Location: Coborg Search and Rescue **Tech:** NLO/KLC
File No.: 171-07055-00 **Date:** 5-Jul-17

TIN NO.	21WSS	S39	Y57	F13	AT3
BOREHOLE NO.	BH17-1	BH17-1	BH17-1	BH17-2	BH17-2
SAMPLE & DEPTH	SS2	SS3	SS4	SS1	SS2
WT of TIN & WET SOIL (g)	37.9	120.1	107.4	103.1	79.2
WT of TIN & DRY SOIL (g)	34.6	104.4	88.9	90.7	69.8
WT of WATER (g)	3.3	15.7	18.5	12.4	9.5
TARE WT (g)	14.8	27.8	14.8	15.5	15.3
WT of DRY SOIL (g)	19.9	76.6	74.1	75.2	54.4
MOISTURE CONTENT	16.7%	20.6%	25.0%	16.5%	17.4%

TIN NO.	SA4	CH8	P3	SA9B	DW26
BOREHOLE NO.	BH17-2	BH17-2R	BH17-2R	BH17-2R	BH17-2R
SAMPLE & DEPTH	SS3	SS1	SS2	SS3	SS4
WT of TIN & WET SOIL (g)	145.1	97.2	78.5	79.6	140.7
WT of TIN & DRY SOIL (g)	131.3	87.0	63.8	67.5	119.8
WT of WATER (g)	13.8	10.2	14.7	12.2	20.9
TARE WT (g)	14.7	27.5	15.4	16.2	14.9
WT of DRY SOIL (g)	116.6	59.5	48.5	51.3	104.9
MOISTURE CONTENT	11.9%	17.2%	30.3%	23.7%	19.9%

TIN NO.	0S1	DW22	BHW9	114	BN18
BOREHOLE NO.	BH17-2R	BH17-2R	BH17-3	BH17-3	BH17-3
SAMPLE & DEPTH	SS5	SS6	SS2	SS3	SS4
WT of TIN & WET SOIL (g)	91.5	107.7	153.4	130.1	124.4
WT of TIN & DRY SOIL (g)	77.2	91.6	136.8	120.3	107.4
WT of WATER (g)	14.3	16.1	16.6	9.8	16.9
TARE WT (g)	15.1	14.7	27.5	14.9	28.7
WT of DRY SOIL (g)	62.1	76.9	109.3	105.4	78.7
MOISTURE CONTENT	23.0%	21.0%	15.2%	9.3%	21.5%

TIN NO.	WP32	JK9	HC4	MW1-6	TP3
BOREHOLE NO.	BH17-3	BH17-3	BH17-3	BH17-3	BH17-3
SAMPLE & DEPTH	SS5	SS6	SS7	SS8	SS9A
WT of TIN & WET SOIL (g)	148.0	117.9	116.0	101.8	84.7
WT of TIN & DRY SOIL (g)	127.3	99.5	97.9	86.5	78.1
WT of WATER (g)	20.7	18.4	18.1	15.3	6.6
TARE WT (g)	27.8	14.7	15.4	16.1	14.7
WT of DRY SOIL (g)	99.6	84.8	82.5	70.4	63.3
MOISTURE CONTENT	20.8%	21.7%	22.0%	21.7%	10.5%

TIN NO.	AR14	A5	S37	RR10	EA26
BOREHOLE NO.	BH17-3	BH17-3	BH17-3	BH17-4	BH17-4
SAMPLE & DEPTH	SS9B	SS10	SS11	SS1	SS2
WT of TIN & WET SOIL (g)	147.3	111.7	106.4	55.4	87.0
WT of TIN & DRY SOIL (g)	139.9	96.2	102.4	51.8	77.4
WT of WATER (g)	7.4	15.5	4.0	3.6	9.6
TARE WT (g)	27.8	15.1	28.6	16.1	14.9
WT of DRY SOIL (g)	112.1	81.1	73.8	35.7	62.5
MOISTURE CONTENT	6.6%	19.1%	5.4%	10.0%	15.4%

MOISTURE CONTENTS

Project Location: Coborg Search and Rescue **Tech:** NLO/KLC
File No.: 171-07055-00 **Date:** 5-Jul-17

TIN NO.	BE67	MR9	J7	AR5	S29
BOREHOLE NO.	BH17-4	BH17-4	BH17-4	BH17-4	BH17-5
SAMPLE & DEPTH	SS3	SS4	SS5	SS6	SS1
WT of TIN & WET SOIL (g)	106.5	64.8	128.6	101.6	101.2
WT of TIN & DRY SOIL (g)	88.1	56.1	108.4	87.7	86.4
WT of WATER (g)	18.4	8.7	20.2	13.9	14.8
TARE WT (g)	15.5	14.9	15.3	28.2	28.0
WT of DRY SOIL (g)	72.6	41.1	93.1	59.5	58.4
MOISTURE CONTENT	25.3%	21.2%	21.7%	23.3%	25.3%
TIN NO.					
BOREHOLE NO.	BH17-5	BH17-5	BH17-5	BH17-5	BH17-6
SAMPLE & DEPTH	SS2	SS3	SS4	SS5	SS1
WT of TIN & WET SOIL (g)	110.7	56.2	124.5	124.3	57.0
WT of TIN & DRY SOIL (g)	95.9	50.8	105.0	104.3	52.1
WT of WATER (g)	14.8	5.4	19.4	19.9	4.9
TARE WT (g)	28.1	15.3	15.0	15.1	15.2
WT of DRY SOIL (g)	67.9	35.6	90.1	89.3	36.9
MOISTURE CONTENT	21.7%	15.2%	21.6%	22.3%	13.3%
TIN NO.	P21	BP14	ST4	BH2-2	FD15
BOREHOLE NO.	BH17-6	BH17-6	BH17-6	BH17-6	BH17-6
SAMPLE & DEPTH	SS3	SS4	AS1	AS2	AS3
WT of TIN & WET SOIL (g)	105.3	56.2	80.2	69.7	124.2
WT of TIN & DRY SOIL (g)	87.7	50.8	70.1	69.2	105.9
WT of WATER (g)	17.6	5.4	10.1	0.5	18.2
TARE WT (g)	15.3	15.6	15.1	15.3	15.5
WT of DRY SOIL (g)	72.4	35.3	55.1	53.9	90.4
MOISTURE CONTENT	24.3%	15.3%	18.3%	1.0%	20.1%
TIN NO.	LA1	QTIP	LX10	RR2	B3
BOREHOLE NO.	BH17-6	BH17-7	BH17-7	BH17-7	BH17-7
SAMPLE & DEPTH	AS4	SS1B	SS1C	SS1D	SS2
WT of TIN & WET SOIL (g)	140.7	65.7	52.6	78.6	117.1
WT of TIN & DRY SOIL (g)	120.0	63.9	48.0	72.0	100.2
WT of WATER (g)	20.6	1.8	4.6	6.6	16.9
TARE WT (g)	27.7	15.6	14.8	15.4	15.2
WT of DRY SOIL (g)	92.4	48.3	33.2	56.6	85.1
MOISTURE CONTENT	22.3%	3.8%	13.9%	11.6%	19.9%
TIN NO.	DW55	O61	CR6	S25B	S25
BOREHOLE NO.	BH17-7	BH17-7	BH17-8	BH17-8	BH17-8
SAMPLE & DEPTH	SS3	SS4	SS1	SS2	SS3
WT of TIN & WET SOIL (g)	119.5	91.5	112.5	81.4	85.5
WT of TIN & DRY SOIL (g)	104.9	69.2	97.2	74.4	75.4
WT of WATER (g)	14.6	22.3	15.3	7.0	10.1
TARE WT (g)	28.1	14.7	28.1	28.1	16.0
WT of DRY SOIL (g)	76.8	54.5	69.1	46.3	59.3
MOISTURE CONTENT	19.0%	40.9%	22.1%	15.2%	17.1%

MOISTURE CONTENTS

Project Location: Coborg Search and Rescue **Tech:** NLO/KLC
File No.: 171-07055-00 **Date:** 5-Jul-17

TIN NO.	E1	GM2	H34	PJI	DW27
BOREHOLE NO.	BH17-8	BH17-8	BH17-9	BH17-9	BH17-9
SAMPLE & DEPTH	SS4	SS5	SS1A	SS1B	SS1C
WT of TIN & WET SOIL (g)	134.5	114.3	78.0	43.0	53.1
WT of TIN & DRY SOIL (g)	113.8	95.5	63.0	39.9	49.4
WT of WATER (g)	20.8	18.8	15.0	3.0	3.7
TARE WT (g)	14.9	14.9	15.8	15.0	14.8
WT of DRY SOIL (g)	98.8	80.6	47.2	24.9	34.6
MOISTURE CONTENT	21.0%	23.4%	31.7%	12.2%	10.8%

TIN NO.	CR-2	WD18	DP37	C524	OB10
BOREHOLE NO.	BH17-9	BH17-9	BH17-9	BH17-9	BH17-9
SAMPLE & DEPTH	SS2	SS3	SS4	SS5	SS6B
WT of TIN & WET SOIL (g)	122.6	67.0	94.4	80.3	115.7
WT of TIN & DRY SOIL (g)	96.3	59.8	79.6	67.8	96.2
WT of WATER (g)	26.3	7.2	14.8	12.5	19.5
TARE WT (g)	27.8	15.1	14.8	15.2	15.4
WT of DRY SOIL (g)	68.6	44.8	64.9	52.5	80.8
MOISTURE CONTENT	38.3%	16.0%	22.8%	23.8%	24.1%

TIN NO.	OS16	EA2	SW1	A2	DP23
BOREHOLE NO.	BH17-9	BH17-9	BH17-9	BH17-9	BH17-9
SAMPLE & DEPTH	SS7	SS8A	SS8B	SS9A	SS9B
WT of TIN & WET SOIL (g)	104.2	115.5	124.4	85.4	71.5
WT of TIN & DRY SOIL (g)	88.2	100.5	116.4	72.2	64.4
WT of WATER (g)	15.9	15.0	8.0	13.1	7.1
TARE WT (g)	14.9	27.4	15.0	14.8	15.3
WT of DRY SOIL (g)	73.3	73.1	101.4	57.5	49.1
MOISTURE CONTENT	21.7%	20.6%	7.9%	22.8%	14.5%

TIN NO.	AT5	MX22	WP41	AT27	CM2
BOREHOLE NO.	BH17-10	BH17-10	BH17-10	BH17-10	BH17-10
SAMPLE & DEPTH	SS1B	SS1E	SS2	SS3	SS4
WT of TIN & WET SOIL (g)	64.6	91.5	112.4	74.0	143.8
WT of TIN & DRY SOIL (g)	62.8	82.1	98.4	64.8	123.3
WT of WATER (g)	1.8	9.3	14.0	9.2	20.5
TARE WT (g)	15.0	15.2	27.6	15.4	28.9
WT of DRY SOIL (g)	47.9	66.9	70.8	49.4	94.4
MOISTURE CONTENT	3.8%	13.9%	19.8%	18.6%	21.7%

TIN NO.	LZ5	SC5	5B	5-5	DC2
BOREHOLE NO.	BH17-11	BH17-11	BH17-11	BH17-11	BH17-11
SAMPLE & DEPTH	SS1B	SS3	SS4	SS5	SS6
WT of TIN & WET SOIL (g)	62.6	68.5	109.3	110.2	114.4
WT of TIN & DRY SOIL (g)	58.2	56.4	89.0	94.1	97.4
WT of WATER (g)	4.4	12.1	20.3	16.1	17.0
TARE WT (g)	15.3	15.0	15.1	14.8	15.2
WT of DRY SOIL (g)	42.9	41.4	73.9	79.3	82.2
MOISTURE CONTENT	10.2%	29.3%	27.4%	20.3%	20.7%

MOISTURE CONTENTS

Project Location: Coborg Search and Rescue **Tech:** NLO/KLC
File No.: 171-07055-00 **Date:** 5-Jul-17

TIN NO.	BHWT4	A6	WP1	CA9	C12
BOREHOLE NO.	BH17-12	BH17-12	BH17-12	BH17-12	BH17-13
SAMPLE & DEPTH	SS1B	SS2	SS3	SS4	SS1A
WT of TIN & WET SOIL (g)	96.7	74.3	89.7	85.5	89.0
WT of TIN & DRY SOIL (g)	86.7	66.8	77.2	76.4	82.2
WT of WATER (g)	10.0	7.5	12.6	9.1	6.7
TARE WT (g)	27.8	15.0	28.0	28.4	28.0
WT of DRY SOIL (g)	58.8	51.9	49.2	48.0	54.2
MOISTURE CONTENT	17.0%	14.4%	25.5%	19.0%	12.4%

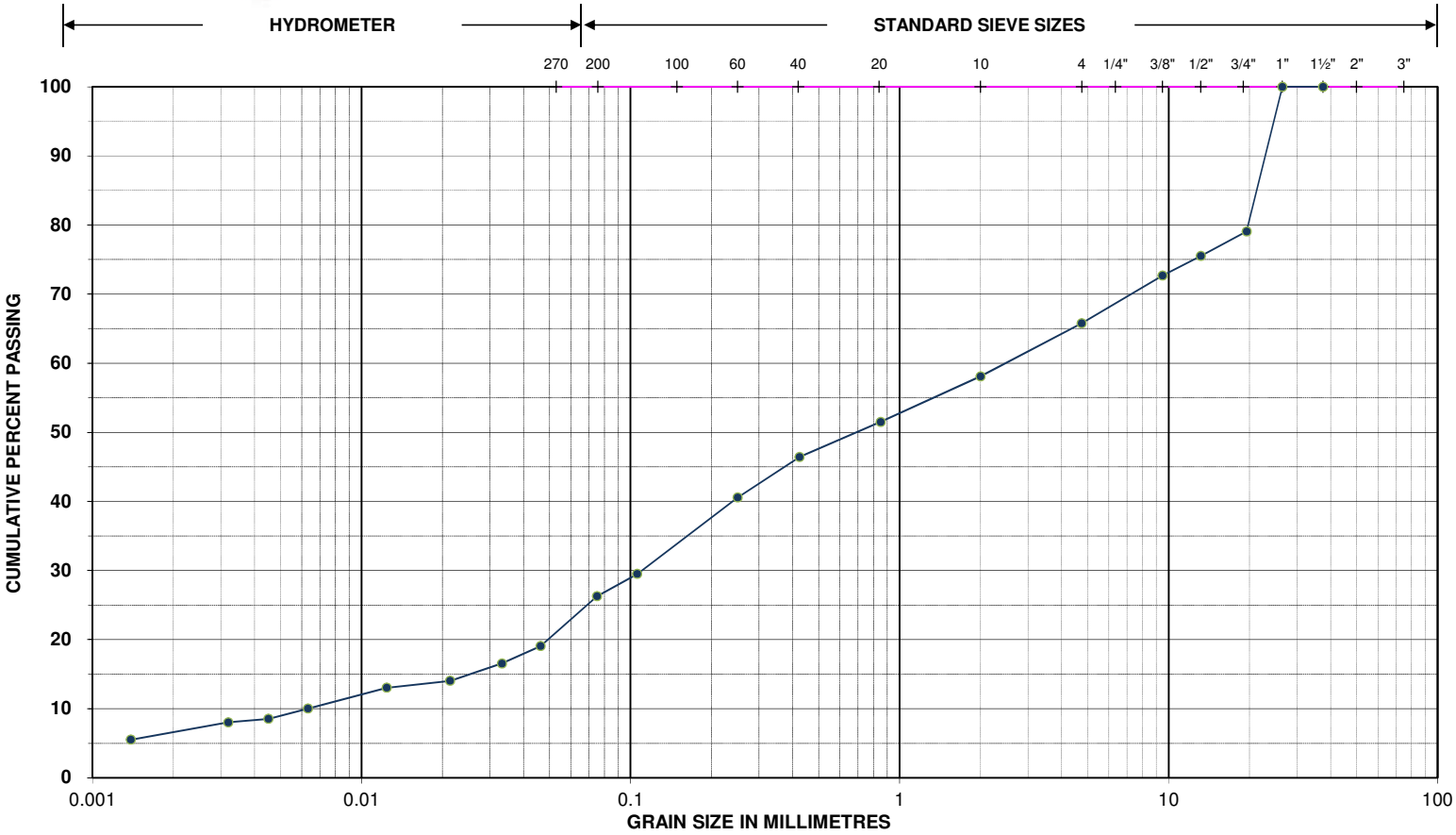
TIN NO.	S4	C02	SA21	LD10	AR18
BOREHOLE NO.	BH17-13	BH17-13	BH17-13	BH17-13	BH17-13
SAMPLE & DEPTH	SS1B	SS2	SS3	SS4A	SS4B
WT of TIN & WET SOIL (g)	59.0	88.3	114.1	76.2	146.1
WT of TIN & DRY SOIL (g)	50.0	77.3	94.0	65.6	122.1
WT of WATER (g)	9.1	11.0	20.1	10.6	24.0
TARE WT (g)	14.9	28.6	14.9	15.1	28.2
WT of DRY SOIL (g)	35.1	48.7	79.1	50.5	94.0
MOISTURE CONTENT	25.8%	22.5%	25.4%	21.0%	25.5%

TIN NO.	A2	IL31	B1	BH2	
BOREHOLE NO.	BH17-14	BH17-14	BH17-14	BH17-14	
SAMPLE & DEPTH	SS1	SS2	SS3	SS4	
WT of TIN & WET SOIL (g)	74.4	108.1	131.7	158.7	
WT of TIN & DRY SOIL (g)	64.9	98.8	105.4	145.0	
WT of WATER (g)	9.6	9.3	26.4	13.6	
TARE WT (g)	15.8	15.6	15.0	28.7	
WT of DRY SOIL (g)	49.0	83.2	90.4	116.3	
MOISTURE CONTENT	19.5%	11.2%	29.2%	11.7%	

TIN NO.					
BOREHOLE NO.					
SAMPLE & DEPTH					
WT of TIN & WET SOIL (g)					
WT of TIN & DRY SOIL (g)					
WT of WATER (g)					
TARE WT (g)					
WT of DRY SOIL (g)					
MOISTURE CONTENT					

TIN NO.					
BOREHOLE NO.					
SAMPLE & DEPTH					
WT of TIN & WET SOIL (g)					
WT of TIN & DRY SOIL (g)					
WT of WATER (g)					
TARE WT (g)					
WT of DRY SOIL (g)					
MOISTURE CONTENT					

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

Project Name:	Cobourg Search and Rescue	**Project No.:**	171-07055-00
Location ID.:	BH17-03	**Sample No./Depth:**	SS9 / 7.8-8.2m

Sieve Size	% Passing Coarse	**Sieve Size**	% Passing Fine	Hydrometer (mm)	% Passing
26.5 mm	100.0	**0.850 mm**	51.5	**0.046**	19.0
13.2 mm	75.5	**0.425 mm**	46.4	**0.021**	14.0
9.50 mm	72.7	**0.250 mm**	40.6	**0.006**	10.0
4.75 mm	65.8	**0.106 mm**	29.5	**0.003**	8.0
2.00 mm	58.1	**0.075 mm**	26.3	**0.001**	5.5

APPENDIX

C CHEMICAL LABORATORY DATA

FINAL REPORT

CA15545-JUN17 R

171-07055-00 Cobourg/Varius

Prepared for

WSP Canada Inc.

FINAL REPORT

CA15545-JUN17 R

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	WSP Canada Inc.	Project Specialist	Deanna Edwards, B.Sc, C.Chem
		Laboratory	SGS Canada Inc.
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Contact	Pete Hynes	Telephone	705-652-2000
Telephone	705.743.6850	Facsimile	705-652-6365
Facsimile		Email	deanna.edwards@sgs.com
Email	Peter.hynes@wspgroup.com	SGS Reference	CA15545-JUN17
Project	171-07055-00 Cobourg/Varius	Received	06/23/2017
Order Number		Approved	06/30/2017
Samples	Soil (6)	Report Number	CA15545-JUN17 R
		Date Reported	06/30/2017

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.

- nC6 and nC10 response factors within 30% of response factor for toluene: YES
- nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES
- C50 response factors within 70% of nC10 + nC16 + nC34 average: YES
- Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Temperature of Sample upon Receipt 21 degrees C
Cooling Agent Not Present
Custody Seal Not Present

Dichlorodifluoromethane matrix spike recovery is outside control limits. The overall quality control for this analysis has been assessed and meets method specific criteria.

SIGNATORIES

Deanna Edwards, B.Sc, C.Chem

Deanna Edwards

TABLE OF CONTENTS

RESULTS

		Sample Number	8	9	10	12		
		Sample Name	BH17-01/SS4	BH17-05/SS4	BH17-06/SS3	BH17-10/SS3		
		Sample Matrix	Soil	Soil	Soil	Soil		
		Sampled By	Arman Y	Arman Y	Arman Y	Arman Y		
		Sample Date	20/06/2017	21/06/2017	19/06/2017	22/06/2017		
Parameter	**Units**	**RL**	**Result**	**Result**	**Result**	**Result**	**L1**	**L2**

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED
L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Conductivity

Method: EPA 6010/SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Conductivity	mS/cm	0.002	0.26	0.08	0.21	0.08	0.47	0.57

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Free Cyanide	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.051	0.051

Hexavalent Chromium by IC

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-[ENV]IC-LAK-AN-008

Chromium VI	µg/g	0.2	0.4	< 0.2	< 0.2	< 0.2	0.66	0.66

Mercury by CVAAS

Method: EPA 7471A/EPA 245 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Mercury	µg/g	0.05	0.30	< 0.05	< 0.05	< 0.05	0.16	0.27

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-005

Barium	µg/g	0.01	120	5.0	12	8.0	210	220
Beryllium	µg/g	0.02	0.24	0.04	0.07	0.06	2.5	2.5
Boron	µg/g	1	6	1	2	2	36	36
Cadmium	µg/g	0.02	0.17	< 0.02	0.04	< 0.02	1	1.2
Chromium	µg/g	0.5	27	1.5	4.1	2.6	67	70
Cobalt	µg/g	0.01	3.8	0.58	1.1	0.93	19	21
Copper	µg/g	0.1	18	1.0	1.8	1.0	62	92
Lead	µg/g	0.1	157	2.4	3.8	3.4	45	120
Molybdenum	µg/g	0.1	1.0	< 0.1	0.2	< 0.1	2	2
Nickel	µg/g	0.1	9.0	1.0	1.9	1.5	37	82
Silver	µg/g	0.01	0.07	< 0.01	< 0.01	< 0.01	0.5	0.5
Thallium	µg/g	0.02	0.10	< 0.02	< 0.02	< 0.02	1	1
Uranium	µg/g	0.002	0.43	0.18	0.33	0.24	1.9	2.5
Vanadium	µg/g	3	19	< 3	7	5	86	86
Zinc	µg/g	0.7	63	4.2	8.5	5.8	290	290
Antimony	µg/g	0.8	< 0.8	< 0.8	< 0.8	< 0.8	1	1.3
Arsenic	µg/g	0.5	4.7	0.6	1.1	0.9	11	18
Selenium	µg/g	0.7	< 0.7	< 0.7	< 0.7	< 0.7	1.2	1.5

Moisture

RESULTS

		Sample Number	8	9	10	12		
		Sample Name	BH17-01/SS4	BH17-05/SS4	BH17-06/SS3	BH17-10/SS3		
		Sample Matrix	Soil	Soil	Soil	Soil		
		Sampled By	Arman Y	Arman Y	Arman Y	Arman Y		
		Sample Date	20/06/2017	21/06/2017	19/06/2017	22/06/2017		
Parameter	**Units**	**RL**	**Result**	**Result**	**Result**	**Result**	**L1**	**L2**

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED
L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Moisture (continued)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Moisture Content	%	-	23.5	18.4	27.2	19.1		

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

CCME F1 (C6-C10)	µg/g	10	< 10	< 10	< 10	< 10	17	25
CCME F1-BTEX (C6-C10)	µg/g	10	< 10	< 10	< 10	< 10		

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

CCME F2 (C10-C16)	µg/g	10	< 10	< 10	< 10	< 10	10	10
CCME F3 (C16-C34)	µg/g	50	< 50	< 50	< 50	< 50	240	240
CCME F4 (C34-C50)	µg/g	50	< 50	< 50	< 50	< 50	120	120
Chromatogram returned to baseline at nC50	Yes / No	-	YES	YES	YES	YES		

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

pH	no unit	0.05	8.23	7.95	7.90	7.99		

Semi-Volatile Organics

Method: EPA 3541/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005

Acenaphthene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.072
Acenaphthylene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.093	0.093
Anthracene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.16
Benzo(a)anthracene	µg/g	0.05	0.19	< 0.05	< 0.05	< 0.05	0.095	0.36
Benzo(a)pyrene	µg/g	0.05	0.13	< 0.05	< 0.05	< 0.05	0.05	0.3
Benzo(b)fluoranthene	µg/g	0.05	0.18	< 0.05	< 0.05	< 0.05	0.3	0.47
Benzo(ghi)perylene	µg/g	0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	0.68
Benzo(k)fluoranthene	µg/g	0.05	0.09	< 0.05	< 0.05	< 0.05	0.05	0.48
Chrysene	µg/g	0.05	0.16	< 0.05	< 0.05	< 0.05	0.18	2.8
Dibenzo(a,h)anthracene	µg/g	0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.1	0.1
Fluoranthene	µg/g	0.05	0.36	< 0.05	< 0.05	< 0.05	0.24	0.56
Fluorene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.12
Indeno(1,2,3-cd)pyrene	µg/g	0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.11	0.23
1-Methylnaphthalene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05		
2-Methylnaphthalene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05		

RESULTS

		Sample Number	8	9	10	12		
		Sample Name	BH17-01/SS4	BH17-05/SS4	BH17-06/SS3	BH17-10/SS3		
		Sample Matrix	Soil	Soil	Soil	Soil		
		Sampled By	Arman Y	Arman Y	Arman Y	Arman Y		
		Sample Date	20/06/2017	21/06/2017	19/06/2017	22/06/2017		
Parameter	**Units**	**RL**	**Result**	**Result**	**Result**	**Result**	**L1**	**L2**

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED
L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Semi-Volatile Organics (continued)

Method: EPA 3541/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005

Methylnaphthalene, 2-(1-)	µg/g	0.05	0.07	< 0.05	< 0.05	< 0.05	0.05	0.59
Naphthalene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.09
Phenanthrene	µg/g	0.05	0.19	< 0.05	< 0.05	< 0.05	0.19	0.69
Pyrene	µg/g	0.05	0.28	< 0.05	< 0.05	< 0.05	0.19	1
Surr Nitrobenzene-d5	Surr Rec %	-	68	82	88	84		
Surr 2-Fluorobiphenyl	Surr Rec %	-	71	79	84	79		
Surr 4-Terphenyl-d14	Surr Rec %	-	92	92	82	86		
Surr 2-Fluorophenol	Surr Rec %	-	82	94	94	96		
Surr Phenol-d6	Surr Rec %	-	90	99	98	102		
Surr 2,4,6-Tribromophenol	Surr Rec %	-	90	92	94	96		

Sodium adsorption ratio (SAR)

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-[ENV]ARD-LAK-AN-021

Sodium Adsorption Ratio	---	0.2	0.2	< 0.2	0.2	< 0.2	1	2.4

Volatile Organics

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Acetone	µg/g	0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.5	0.5
Bromomethane	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Carbon tetrachloride	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Chlorobenzene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Chloroform	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
1,2-Dichlorobenzene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
1,3-Dichlorobenzene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
1,4-Dichlorobenzene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Dichlorodifluoromethane	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
1,1-Dichloroethane	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
1,2-Dichloroethane	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
1,1-Dichloroethylene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
trans-1,2-Dichloroethylene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
cis-1,2-Dichloroethylene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
1,2-Dichloropropane	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
cis-1,3-dichloropropene	µg/g	0.03	< 0.03	< 0.03	< 0.03	< 0.03		
trans-1,3-dichloropropene	µg/g	0.03	< 0.03	< 0.03	< 0.03	< 0.03		
1,3-dichoropropene (total)	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Ethylenedibromide	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05

RESULTS

		Sample Number	8	9	10	12		
		Sample Name	BH17-01/SS4	BH17-05/SS4	BH17-06/SS3	BH17-10/SS3		
		Sample Matrix	Soil	Soil	Soil	Soil		
		Sampled By	Arman Y	Arman Y	Arman Y	Arman Y		
		Sample Date	20/06/2017	21/06/2017	19/06/2017	22/06/2017		
Parameter	**Units**	**RL**	**Result**	**Result**	**Result**	**Result**	**L1**	**L2**

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED
L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

n-Hexane	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Methyl ethyl ketone	µg/g	0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.5	0.5
Methyl isobutyl ketone	µg/g	0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.5	0.5
Methyl-t-butyl Ether	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Methylene Chloride	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Styrene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Tetrachloroethylene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
1,1,1,2-Tetrachloroethane	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
1,1,2,2-Tetrachloroethane	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
1,1,1-Trichloroethane	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
1,1,2-Trichloroethane	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Trichloroethylene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Trichlorofluoromethane	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.25
Vinyl Chloride	µg/g	0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.02	0.02
Benzene	µg/g	0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.02	0.02
Ethylbenzene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Toluene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.2	0.2
Xylene (total)	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
m/p-xylene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05		
o-xylene	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05		
Bromodichloromethane	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Bromoform	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Dibromochloromethane	µg/g	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	0.05
Surr 1,2-Dichloroethane-d4	Surr Rec %	-	104	102	104	104		
Surr 4-Bromofluorobenzene	Surr Rec %	-	99	98	99	99		
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-	92	90	92	91		

Water Soluble Boron

Method: O.Reg. 153/04 | Internal ref.: ME-CA-[ENV] SPE-LAK-AN-003

Water Soluble Boron	µg/g	0.5	< 0.5	< 0.5	< 0.5	< 0.5		

RESULTS

			Sample Number	14	15		
			Sample Name	BH17-11/SS6	BH17-13/SS2		
			Sample Matrix	Soil	Soil		
			Sampled By	Arman Y	Arman Y		
			Sample Date	19/06/2017	21/06/2017		
Parameter	**Units**	**RL**	**Result**	**Result**		**L1**	**L2**

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED
L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Conductivity

Method: EPA 6010/SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Conductivity	mS/cm	0.002	0.11	2.3	0.47	0.57

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Free Cyanide	µg/g	0.05	< 0.05	< 0.05	0.051	0.051

Hexavalent Chromium by IC

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-[ENV]IC-LAK-AN-008

Chromium VI	µg/g	0.2	< 0.2	< 0.2	0.66	0.66

Mercury by CVAAS

Method: EPA 7471A/EPA 245 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Mercury	µg/g	0.05	< 0.05	< 0.05	0.16	0.27

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-005

Barium	µg/g	0.01	7.0	18	210	220
Beryllium	µg/g	0.02	0.07	1.3	2.5	2.5
Boron	µg/g	1	2	2	36	36
Cadmium	µg/g	0.02	0.04	0.73	1	1.2
Chromium	µg/g	0.5	2.8	6.9	67	70
Cobalt	µg/g	0.01	1.0	37	19	21
Copper	µg/g	0.1	1.3	61	62	92
Lead	µg/g	0.1	5.9	26	45	120
Molybdenum	µg/g	0.1	0.1	0.2	2	2
Nickel	µg/g	0.1	1.6	40	37	82
Silver	µg/g	0.01	< 0.01	0.02	0.5	0.5
Thallium	µg/g	0.02	< 0.02	0.14	1	1
Uranium	µg/g	0.002	0.25	0.86	1.9	2.5
Vanadium	µg/g	3	6	8	86	86
Zinc	µg/g	0.7	17	96	290	290
Antimony	µg/g	0.8	< 0.8	< 0.8	1	1.3
Arsenic	µg/g	0.5	1.1	13	11	18
Selenium	µg/g	0.7	< 0.7	< 0.7	1.2	1.5

Moisture

RESULTS

		Sample Number	14	15		
		Sample Name	BH17-11/SS6	BH17-13/SS2		
		Sample Matrix	Soil	Soil		
		Sampled By	Arman Y	Arman Y		
		Sample Date	19/06/2017	21/06/2017		
Parameter	**Units**	**RL**	**Result**	**Result**	**L1**	**L2**

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED
L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Moisture (continued)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Moisture Content	%	-	16.9	16.6		

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

CCME F1 (C6-C10)	µg/g	10	< 10	< 10	17	25
CCME F1-BTEX (C6-C10)	µg/g	10	< 10	< 10		

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

CCME F2 (C10-C16)	µg/g	10	< 10	< 10	10	10
CCME F3 (C16-C34)	µg/g	50	< 50	< 50	240	240
CCME F4 (C34-C50)	µg/g	50	< 50	< 50	120	120
Chromatogram returned to baseline at nC50	Yes / No	-	YES	YES		

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

pH	no unit	0.05	8.14	7.50		

Semi-Volatile Organics

Method: EPA 3541/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005

Acenaphthene	µg/g	0.05	< 0.05	< 0.05	0.05	0.072
Acenaphthylene	µg/g	0.05	< 0.05	< 0.05	0.093	0.093
Anthracene	µg/g	0.05	< 0.05	< 0.05	0.05	0.16
Benzo(a)anthracene	µg/g	0.05	< 0.05	< 0.05	0.095	0.36
Benzo(a)pyrene	µg/g	0.05	< 0.05	< 0.05	0.05	0.3
Benzo(b)fluoranthene	µg/g	0.05	< 0.05	< 0.05	0.3	0.47
Benzo(ghi)perylene	µg/g	0.1	< 0.1	< 0.1	0.2	0.68
Benzo(k)fluoranthene	µg/g	0.05	< 0.05	< 0.05	0.05	0.48
Chrysene	µg/g	0.05	< 0.05	< 0.05	0.18	2.8
Dibenzo(a,h)anthracene	µg/g	0.06	< 0.06	< 0.06	0.1	0.1
Fluoranthene	µg/g	0.05	< 0.05	< 0.05	0.24	0.56
Fluorene	µg/g	0.05	< 0.05	< 0.05	0.05	0.12
Indeno(1,2,3-cd)pyrene	µg/g	0.1	< 0.1	< 0.1	0.11	0.23
1-Methylnaphthalene	µg/g	0.05	< 0.05	< 0.05		
2-Methylnaphthalene	µg/g	0.05	< 0.05	< 0.05		

RESULTS

		Sample Number	14	15		
		Sample Name	BH17-11/SS6	BH17-13/SS2		
		Sample Matrix	Soil	Soil		
		Sampled By	Arman Y	Arman Y		
		Sample Date	19/06/2017	21/06/2017		
Parameter	**Units**	**RL**	**Result**	**Result**	**L1**	**L2**

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED
L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Semi-Volatile Organics (continued)

Method: EPA 3541/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005

Methylnaphthalene, 2-(1-)	µg/g	0.05	< 0.05	< 0.05	0.05	0.59
Naphthalene	µg/g	0.05	< 0.05	< 0.05	0.05	0.09
Phenanthrene	µg/g	0.05	< 0.05	< 0.05	0.19	0.69
Pyrene	µg/g	0.05	< 0.05	< 0.05	0.19	1
Surr Nitrobenzene-d5	Surr Rec %	-	83	93		
Surr 2-Fluorobiphenyl	Surr Rec %	-	78	85		
Surr 4-Terphenyl-d14	Surr Rec %	-	86	94		
Surr 2-Fluorophenol	Surr Rec %	-	92	85		
Surr Phenol-d6	Surr Rec %	-	98	98		
Surr 2,4,6-Tribromophenol	Surr Rec %	-	90	96		

Sodium adsorption ratio (SAR)

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-[ENV]ARD-LAK-AN-021

Sodium Adsorption Ratio	---	0.2	< 0.2	< 0.2	1	2.4

Volatile Organics

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Acetone	µg/g	0.5	< 0.5	< 0.5	0.5	0.5
Bromomethane	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Carbon tetrachloride	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Chlorobenzene	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Chloroform	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
1,2-Dichlorobenzene	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
1,3-Dichlorobenzene	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
1,4-Dichlorobenzene	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Dichlorodifluoromethane	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
1,1-Dichloroethane	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
1,2-Dichloroethane	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
1,1-Dichloroethylene	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
trans-1,2-Dichloroethylene	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
cis-1,2-Dichloroethylene	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
1,2-Dichloropropane	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
cis-1,3-dichloropropene	µg/g	0.03	< 0.03	< 0.03		
trans-1,3-dichloropropene	µg/g	0.03	< 0.03	< 0.03		
1,3-dichoropropene (total)	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Ethylenedibromide	µg/g	0.05	< 0.05	< 0.05	0.05	0.05

RESULTS

		Sample Number	14	15		
		Sample Name	BH17-11/SS6	BH17-13/SS2		
		Sample Matrix	Soil	Soil		
		Sampled By	Arman Y	Arman Y		
		Sample Date	19/06/2017	21/06/2017		
Parameter	**Units**	**RL**	**Result**	**Result**	**L1**	**L2**

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED
L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

n-Hexane	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Methyl ethyl ketone	µg/g	0.5	< 0.5	< 0.5	0.5	0.5
Methyl isobutyl ketone	µg/g	0.5	< 0.5	< 0.5	0.5	0.5
Methyl-t-butyl Ether	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Methylene Chloride	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Styrene	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Tetrachloroethylene	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
1,1,1,2-Tetrachloroethane	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
1,1,2,2-Tetrachloroethane	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
1,1,1-Trichloroethane	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
1,1,2-Trichloroethane	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Trichloroethylene	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Trichlorofluoromethane	µg/g	0.05	< 0.05	< 0.05	0.05	0.25
Vinyl Chloride	µg/g	0.02	< 0.02	< 0.02	0.02	0.02
Benzene	µg/g	0.02	< 0.02	< 0.02	0.02	0.02
Ethylbenzene	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Toluene	µg/g	0.05	< 0.05	< 0.05	0.2	0.2
Xylene (total)	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
m/p-xylene	µg/g	0.05	< 0.05	< 0.05		
o-xylene	µg/g	0.05	< 0.05	< 0.05		
Bromodichloromethane	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Bromoform	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Dibromochloromethane	µg/g	0.05	< 0.05	< 0.05	0.05	0.05
Surr 1,2-Dichloroethane-d4	Surr Rec %	-	103	102		
Surr 4-Bromofluorobenzene	Surr Rec %	-	100	98		
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-	91	90		

Water Soluble Boron

Method: O.Reg. 153/04 | Internal ref.: ME-CA-[ENV] SPE-LAK-AN-003

Water Soluble Boron	µg/g	0.5	< 0.5	< 0.5		

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED L1	REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED L2
BH17-01/SS4					
Lead	EPA 3050/EPA 200.8	µg/g	157	45	120
2-and 1-methyl Naphthalene	EPA 3541/8270D	µg/g	0.07	0.05	
Benz(a)anthracene	EPA 3541/8270D	µg/g	0.19	0.095	
Benzo(a)pyrene	EPA 3541/8270D	µg/g	0.13	0.05	
Benzo(k)fluoranthene	EPA 3541/8270D	µg/g	0.09	0.05	
Fluoranthene	EPA 3541/8270D	µg/g	0.36	0.24	
Pyrene	EPA 3541/8270D	µg/g	0.28	0.19	
Mercury	EPA 7471A/EPA 245	µg/g	0.30	0.16	0.27
BH17-13/SS2					
Arsenic	EPA 3050/EPA 200.8	µg/g	13	11	
Cobalt	EPA 3050/EPA 200.8	µg/g	37	19	21
Nickel	EPA 3050/EPA 200.8	µg/g	40	37	
Conductivity	EPA 6010/SM 2510	mS/cm	2.3	0.47	0.57

HOLDING TIME SUMMARY

Sample Name	QC Batch Reference	Sample Number	Sampled	Received	Extracted/ Prepared	Analysed	Holding Time	Approved
Conductivity								
Method: EPA 6010/SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006								
BH17-01/SS4	EWL0429-JUN17	8	06/20/2017	06/23/2017	06/27/2017	06/27/2017	07/18/2017	06/28/2017
BH17-05/SS4	EWL0429-JUN17	9	06/21/2017	06/23/2017	06/27/2017	06/27/2017	07/19/2017	06/28/2017
BH17-06/SS3	EWL0429-JUN17	10	06/19/2017	06/23/2017	06/27/2017	06/27/2017	07/17/2017	06/28/2017
BH17-10/SS3	EWL0429-JUN17	12	06/22/2017	06/23/2017	06/27/2017	06/27/2017	07/20/2017	06/28/2017
BH17-11/SS6	EWL0429-JUN17	14	06/19/2017	06/23/2017	06/27/2017	06/27/2017	07/17/2017	06/28/2017
BH17-13/SS2	EWL0429-JUN17	15	06/21/2017	06/23/2017	06/27/2017	06/27/2017	07/19/2017	06/28/2017
Cyanide by SFA								
Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005								
BH17-01/SS4	SKA5063-JUN17	8	06/20/2017	06/23/2017	06/23/2017	06/27/2017	07/04/2017	06/28/2017
BH17-05/SS4	SKA5063-JUN17	9	06/21/2017	06/23/2017	06/23/2017	06/27/2017	07/05/2017	06/28/2017
BH17-06/SS3	SKA5063-JUN17	10	06/19/2017	06/23/2017	06/23/2017	06/27/2017	07/03/2017	06/28/2017
BH17-10/SS3	SKA5063-JUN17	12	06/22/2017	06/23/2017	06/23/2017	06/27/2017	07/06/2017	06/28/2017
BH17-11/SS6	SKA5063-JUN17	14	06/19/2017	06/23/2017	06/23/2017	06/27/2017	07/03/2017	06/28/2017
BH17-13/SS2	SKA5063-JUN17	15	06/21/2017	06/23/2017	06/23/2017	06/27/2017	07/05/2017	06/28/2017
Hexavalent Chromium by IC								
Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-[ENV]IC-LAK-AN-008								
BH17-01/SS4	DIO0420-JUN17	8	06/20/2017	06/23/2017	06/28/2017	06/28/2017	07/04/2017	06/29/2017
BH17-05/SS4	DIO0420-JUN17	9	06/21/2017	06/23/2017	06/28/2017	06/28/2017	07/05/2017	06/29/2017
BH17-06/SS3	DIO0420-JUN17	10	06/19/2017	06/23/2017	06/28/2017	06/28/2017	07/03/2017	06/29/2017
BH17-10/SS3	DIO0420-JUN17	12	06/22/2017	06/23/2017	06/28/2017	06/28/2017	07/06/2017	06/29/2017
BH17-11/SS6	DIO0420-JUN17	14	06/19/2017	06/23/2017	06/28/2017	06/28/2017	07/03/2017	06/29/2017
BH17-13/SS2	DIO0420-JUN17	15	06/21/2017	06/23/2017	06/28/2017	06/28/2017	07/05/2017	06/29/2017
Mercury by CVAAS								
Method: EPA 7471A/EPA 245 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004								
BH17-01/SS4	EHG0047-JUN17	8	06/20/2017	06/23/2017	06/27/2017	06/27/2017	07/18/2017	06/28/2017
BH17-05/SS4	EHG0047-JUN17	9	06/21/2017	06/23/2017	06/27/2017	06/27/2017	07/19/2017	06/28/2017
BH17-06/SS3	EHG0047-JUN17	10	06/19/2017	06/23/2017	06/27/2017	06/27/2017	07/17/2017	06/28/2017
BH17-10/SS3	EHG0047-JUN17	12	06/22/2017	06/23/2017	06/27/2017	06/27/2017	07/20/2017	06/28/2017
BH17-11/SS6	EHG0047-JUN17	14	06/19/2017	06/23/2017	06/27/2017	06/27/2017	07/17/2017	06/28/2017
BH17-13/SS2	EHG0047-JUN17	15	06/21/2017	06/23/2017	06/27/2017	06/27/2017	07/19/2017	06/28/2017
Metals in Soil - Aqua-regia/ICP-MS								
Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-005								
BH17-01/SS4	EMS0132-JUN17	8	06/20/2017	06/23/2017	06/26/2017	06/27/2017	12/17/2017	06/28/2017
BH17-05/SS4	EMS0132-JUN17	9	06/21/2017	06/23/2017	06/26/2017	06/27/2017	12/18/2017	06/28/2017
BH17-06/SS3	EMS0132-JUN17	10	06/19/2017	06/23/2017	06/26/2017	06/27/2017	12/16/2017	06/28/2017
BH17-10/SS3	EMS0132-JUN17	12	06/22/2017	06/23/2017	06/26/2017	06/27/2017	12/19/2017	06/28/2017

HOLDING TIME SUMMARY

Sample Name	QC Batch Reference	Sample Number	Sampled	Received	Extracted/ Prepared	Analysed	Holding Time	Approved
Metals in Soil - Aqua-regia/ICP-MS (continued)								
Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-005								
BH17-11/SS6	EMS0132-JUN17	14	06/19/2017	06/23/2017	06/26/2017	06/27/2017	12/16/2017	06/28/2017
BH17-13/SS2	EMS0132-JUN17	15	06/21/2017	06/23/2017	06/26/2017	06/27/2017	12/18/2017	06/28/2017
Moisture								
Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010								
BH17-01/SS4	GCM0348-JUN17	8	06/20/2017	06/23/2017	06/27/2017		08/19/2017	06/30/2017
BH17-05/SS4	GCM0348-JUN17	9	06/21/2017	06/23/2017	06/27/2017		08/20/2017	06/30/2017
BH17-06/SS3	GCM0348-JUN17	10	06/19/2017	06/23/2017	06/27/2017		08/18/2017	06/30/2017
BH17-10/SS3	GCM0348-JUN17	12	06/22/2017	06/23/2017	06/27/2017		08/21/2017	06/30/2017
BH17-11/SS6	GCM0348-JUN17	14	06/19/2017	06/23/2017	06/27/2017		08/18/2017	06/30/2017
BH17-13/SS2	GCM0348-JUN17	15	06/21/2017	06/23/2017	06/27/2017		08/20/2017	06/30/2017
Petroleum Hydrocarbons (F1)								
Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010								
BH17-01/SS4	GCM0344-JUN17	8	06/20/2017	06/23/2017	06/27/2017		07/04/2017	06/28/2017
BH17-05/SS4	GCM0344-JUN17	9	06/21/2017	06/23/2017	06/27/2017		07/05/2017	06/28/2017
BH17-06/SS3	GCM0344-JUN17	10	06/19/2017	06/23/2017	06/27/2017		07/03/2017	06/28/2017
BH17-10/SS3	GCM0344-JUN17	12	06/22/2017	06/23/2017	06/27/2017		07/06/2017	06/28/2017
BH17-11/SS6	GCM0344-JUN17	14	06/19/2017	06/23/2017	06/27/2017		07/03/2017	06/28/2017
BH17-13/SS2	GCM0344-JUN17	15	06/21/2017	06/23/2017	06/27/2017		07/05/2017	06/28/2017
Petroleum Hydrocarbons (F2-F4)								
Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010								
BH17-01/SS4	GCM0356-JUN17	8	06/20/2017	06/23/2017	06/27/2017		07/04/2017	06/30/2017
BH17-05/SS4	GCM0356-JUN17	9	06/21/2017	06/23/2017	06/27/2017		07/05/2017	06/30/2017
BH17-06/SS3	GCM0356-JUN17	10	06/19/2017	06/23/2017	06/27/2017		07/03/2017	06/30/2017
BH17-10/SS3	GCM0356-JUN17	12	06/22/2017	06/23/2017	06/27/2017		07/06/2017	06/30/2017
BH17-11/SS6	GCM0356-JUN17	14	06/19/2017	06/23/2017	06/27/2017		07/03/2017	06/30/2017
BH17-13/SS2	GCM0356-JUN17	15	06/21/2017	06/23/2017	06/27/2017		07/05/2017	06/30/2017
pH								
Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001								
BH17-01/SS4	ARD0066-JUN17	8	06/20/2017	06/23/2017	06/26/2017	06/26/2017	07/20/2017	06/26/2017
BH17-05/SS4	ARD0066-JUN17	9	06/21/2017	06/23/2017	06/26/2017	06/26/2017	07/21/2017	06/26/2017
BH17-06/SS3	ARD0066-JUN17	10	06/19/2017	06/23/2017	06/26/2017	06/26/2017	07/19/2017	06/26/2017
BH17-10/SS3	ARD0066-JUN17	12	06/22/2017	06/23/2017	06/26/2017	06/26/2017	07/22/2017	06/26/2017
BH17-11/SS6	ARD0066-JUN17	14	06/19/2017	06/23/2017	06/26/2017	06/26/2017	07/19/2017	06/26/2017
BH17-13/SS2	ARD0066-JUN17	15	06/21/2017	06/23/2017	06/26/2017	06/26/2017	07/21/2017	06/26/2017
Semi-Volatile Organics								
Method: EPA 3541/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005								

HOLDING TIME SUMMARY

Sample Name	QC Batch Reference	Sample Number	Sampled	Received	Extracted/ Prepared	Analysed	Holding Time	Approved

Semi-Volatile Organics (continued)

Method: EPA 3541/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005

BH17-01/SS4	GCM0340-JUN17	8	06/20/2017	06/23/2017	06/26/2017	06/26/2017	08/19/2017	06/30/2017
BH17-05/SS4	GCM0340-JUN17	9	06/21/2017	06/23/2017	06/26/2017	06/26/2017	08/20/2017	06/30/2017
BH17-06/SS3	GCM0340-JUN17	10	06/19/2017	06/23/2017	06/26/2017	06/26/2017	08/18/2017	06/30/2017
BH17-10/SS3	GCM0340-JUN17	12	06/22/2017	06/23/2017	06/26/2017	06/26/2017	08/21/2017	06/30/2017
BH17-11/SS6	GCM0340-JUN17	14	06/19/2017	06/23/2017	06/26/2017	06/26/2017	08/18/2017	06/30/2017
BH17-13/SS2	GCM0340-JUN17	15	06/21/2017	06/23/2017	06/26/2017	06/26/2017	08/20/2017	06/30/2017

Sodium adsorption ratio (SAR)

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-[ENV]ARD-LAK-AN-021

BH17-01/SS4		8	06/20/2017	06/23/2017	06/27/2017	06/27/2017	12/17/2017	06/27/2017
BH17-05/SS4		9	06/21/2017	06/23/2017	06/27/2017	06/27/2017	12/18/2017	06/27/2017
BH17-06/SS3		10	06/19/2017	06/23/2017	06/27/2017	06/27/2017	12/16/2017	06/27/2017
BH17-10/SS3		12	06/22/2017	06/23/2017	06/27/2017	06/27/2017	12/19/2017	06/27/2017
BH17-11/SS6		14	06/19/2017	06/23/2017	06/27/2017	06/27/2017	12/16/2017	06/27/2017
BH17-13/SS2		15	06/21/2017	06/23/2017	06/27/2017	06/27/2017	12/18/2017	06/27/2017

Volatile Organics

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

BH17-01/SS4	GCM0343-JUN17	8	06/20/2017	06/23/2017	06/26/2017	06/26/2017	07/04/2017	06/27/2017
BH17-05/SS4	GCM0343-JUN17	9	06/21/2017	06/23/2017	06/26/2017	06/26/2017	07/05/2017	06/27/2017
BH17-06/SS3	GCM0343-JUN17	10	06/19/2017	06/23/2017	06/26/2017	06/26/2017	07/03/2017	06/27/2017
BH17-10/SS3	GCM0343-JUN17	12	06/22/2017	06/23/2017	06/26/2017	06/26/2017	07/06/2017	06/27/2017
BH17-11/SS6	GCM0343-JUN17	14	06/19/2017	06/23/2017	06/26/2017	06/26/2017	07/03/2017	06/27/2017
BH17-13/SS2	GCM0343-JUN17	15	06/21/2017	06/23/2017	06/26/2017	06/26/2017	07/05/2017	06/27/2017

Water Soluble Boron

Method: O.Reg. 153/04 | Internal ref.: ME-CA-[ENV] SPE-LAK-AN-003

BH17-01/SS4	ESG0117-JUN17	8	06/20/2017	06/23/2017	06/27/2017	06/27/2017	08/19/2017	06/27/2017
BH17-05/SS4	ESG0117-JUN17	9	06/21/2017	06/23/2017	06/27/2017	06/27/2017	08/20/2017	06/27/2017
BH17-06/SS3	ESG0117-JUN17	10	06/19/2017	06/23/2017	06/27/2017	06/27/2017	08/18/2017	06/27/2017
BH17-10/SS3	ESG0117-JUN17	12	06/22/2017	06/23/2017	06/27/2017	06/27/2017	08/21/2017	06/27/2017
BH17-11/SS6	ESG0117-JUN17	14	06/19/2017	06/23/2017	06/27/2017	06/27/2017	08/18/2017	06/27/2017
BH17-13/SS2	ESG0117-JUN17	15	06/21/2017	06/23/2017	06/27/2017	06/27/2017	08/20/2017	06/27/2017

QC SUMMARY

Conductivity

Method: EPA 6010/SM 2510 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0429-JUN17	mS/cm	0.002	<0.002	0	10	99	90	110	NA		

Cyanide by SFA

Method: SM 4500 I Internal ref.: ME-CA-IENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Free Cyanide	SKA5063-JUN17	µg/g	0.05	<0.05	ND	20	114	80	120	107	75	125

Hexavalent Chromium by IC

Method: EPA218.6/EPA3060A I Internal ref.: ME-CA-IENVIIC-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	DIO0420-JUN17	µg/g	0.2	<0.2	ND	20	93	80	120	91	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/EPA 245 | Internal ref.: ME-CA-IENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EHG0047-JUN17	µg/g	0.05	< 0.05	ND	20	101	80	120	83	70	130

Metals in aqueous samples - ICP-OES

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-IENVISPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
SAR Calcium	ESG0127-JUN17	mg/L	0.09	<0.09	2	20	99	80	120	NV	70	130
SAR Magnesium	ESG0127-JUN17	mg/L	0.02	<0.02	2	20	100	80	120	94	70	130
SAR Sodium	ESG0127-JUN17	mg/L	0.15	<0.15	1	20	99	80	120	92	70	130

QC SUMMARY

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0132-JUN17	µg/g	0.01	<0.01	17	20	96	70	130	94	70	130
Arsenic	EMS0132-JUN17	µg/g	0.5	<0.5	2	20	96	70	130	97	70	130
Barium	EMS0132-JUN17	µg/g	0.01	<0.01	2	20	102	70	130	94	70	130
Beryllium	EMS0132-JUN17	µg/g	0.02	<0.02	5	20	99	70	130	85	70	130
Boron	EMS0132-JUN17	µg/g	1	<1	3	20	98	70	130	88	70	130
Cadmium	EMS0132-JUN17	µg/g	0.02	<0.02	10	20	102	70	130	95	70	130
Cobalt	EMS0132-JUN17	µg/g	0.01	<0.01	1	20	94	70	130	96	70	130
Chromium	EMS0132-JUN17	µg/g	0.5	<0.5	2	20	94	70	130	99	70	130
Copper	EMS0132-JUN17	µg/g	0.1	<0.1	2	20	92	70	130	91	70	130
Molybdenum	EMS0132-JUN17	µg/g	0.1	<0.1	2	20	101	70	130	114	70	130
Nickel	EMS0132-JUN17	µg/g	0.1	<0.1	1	20	94	70	130	95	70	130
Lead	EMS0132-JUN17	µg/g	0.1	<0.1	9	20	101	70	130	103	70	130
Antimony	EMS0132-JUN17	µg/g	0.8	<0.8	ND	20	100	70	130	110	70	130
Selenium	EMS0132-JUN17	µg/g	0.7	<0.7	ND	20	99	70	130	95	70	130
Thallium	EMS0132-JUN17	µg/g	0.02	<0.02	0	20	100	70	130	109	70	130
Uranium	EMS0132-JUN17	µg/g	0.002	<0.002	3	20	102	70	130	NV	70	130
Vanadium	EMS0132-JUN17	µg/g	3	<3	2	20	94	70	130	96	70	130
Zinc	EMS0132-JUN17	µg/g	0.7	<0.7	8	20	91	70	130	90	70	130

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 | Internal ref.: ME-CA-IENVIGC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
CCME F1 (C6-C10)	GCM0344-JUN17	µg/g	10	<10	ND	30	87	80	120	100	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 | Internal ref.: ME-CA-IENVIGC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
CCME F2 (C10-C16)	GCM0356-JUN17	µg/g	10	< 10	ND	30	115	80	120	99	60	140
CCME F3 (C16-C34)	GCM0356-JUN17	µg/g	50	< 50	ND	30	115	80	120	99	60	140
CCME F4 (C34-C50)	GCM0356-JUN17	µg/g	50	< 50	ND	30	115	80	120	99	60	140

pH

Method: SM 4500 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	ARD0066-JUN17	no unit	0.05		0	20	100	80	120			

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3541/8270D | Internal ref.: ME-CA-IENVIGC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1-Methylnaphthalene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	96	50	140	94	50	140
2-Methylnaphthalene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	95	50	140	95	50	140
Acenaphthene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	97	50	140	95	50	140
Acenaphthylene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	95	50	140	94	50	140
Anthracene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	96	50	140	97	50	140
Benzo(a)anthracene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	97	50	140	100	50	140
Benzo(a)pyrene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	93	50	140	98	50	140
Benzo(b)fluoranthene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	93	50	140	97	50	140
Benzo(ghi)perylene	GCM0340-JUN17	µg/g	0.1	< 0.1	ND	40	94	50	140	97	50	140
Benzo(k)fluoranthene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	93	50	140	99	50	140
Chrysene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	95	50	140	93	50	140
Dibenzo(a,h)anthracene	GCM0340-JUN17	µg/g	0.06	< 0.06	ND	40	94	50	140	98	50	140
Fluoranthene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	95	50	140	98	50	140
Fluorene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	95	50	140	96	50	140
Indeno(1,2,3-cd)pyrene	GCM0340-JUN17	µg/g	0.1	< 0.1	ND	40	94	50	140	101	50	140
Naphthalene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	97	50	140	94	50	140
Phenanthrene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	98	50	140	98	50	140
Pyrene	GCM0340-JUN17	µg/g	0.05	< 0.05	ND	40	95	50	140	97	50	140

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-IENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	93	60	130	115	50	140
1,1,1-Trichloroethane	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	96	60	130	115	50	140
1,1,2,2-Tetrachloroethane	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	97	60	130	118	50	140
1,1,2-Trichloroethane	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	102	60	130	123	50	140
1,1-Dichloroethane	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	101	60	130	120	50	140
1,1-Dichloroethylene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	94	60	130	103	50	140
1,2-Dichlorobenzene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	93	60	130	113	50	140
1,2-Dichloroethane	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	105	60	130	127	50	140
1,2-Dichloropropane	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	97	60	130	118	50	140
1,3-Dichlorobenzene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	93	60	130	112	50	140
1,4-Dichlorobenzene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	93	60	130	112	50	140
Acetone	GCM0343-JUN17	µg/g	0.5	< 0.5	ND	50	111	50	140	128	50	140
Benzene	GCM0343-JUN17	µg/g	0.02	< 0.02	ND	50	100	60	130	121	50	140
Bromodichloromethane	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	100	60	130	120	50	140
Bromoform	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	94	60	130	112	50	140
Bromomethane	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	112	50	140	114	50	140
Carbon tetrachloride	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	100	60	130	119	50	140
Chlorobenzene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	91	60	130	111	50	140
Chloroform	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	101	60	130	123	50	140
cis-1,2-Dichloroethylene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	101	60	130	121	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-IENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0343-JUN17	µg/g	0.03	< 0.03	ND	50	102	60	130	117	50	140
Dibromochloromethane	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	102	60	130	122	50	140
Dichlorodifluoromethane	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	80	50	140	38	50	140
Ethylbenzene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	89	60	130	110	50	140
Ethylenedibromide	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	102	60	130	123	50	140
n-Hexane	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	102	60	130	95	50	140
m/p-xylene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	88	60	130	108	50	140
Methyl ethyl ketone	GCM0343-JUN17	µg/g	0.5	< 0.5	ND	50	115	50	140	134	50	140
Methyl isobutyl ketone	GCM0343-JUN17	µg/g	0.5	< 0.5	ND	50	110	50	140	131	50	140
Methyl-t-butyl Ether	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	107	60	130	125	50	140
Methylene Chloride	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	102	60	130	119	50	140
o-xylene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	89	60	130	109	50	140
Styrene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	91	60	130	111	50	140
Tetrachloroethylene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	96	60	130	114	50	140
Toluene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	96	60	130	116	50	140
trans-1,2-Dichloroethylene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	99	60	130	114	50	140
trans-1,3-dichloropropene	GCM0343-JUN17	µg/g	0.03	< 0.03	ND	50	104	60	130	118	50	140
Trichloroethylene	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	96	60	130	115	50	140
Trichlorofluoromethane	GCM0343-JUN17	µg/g	0.05	< 0.05	ND	50	97	50	140	97	50	140
Vinyl Chloride	GCM0343-JUN17	µg/g	0.02	< 0.02	ND	50	93	50	140	80	50	140

QC SUMMARY

Water Soluble Boron

Method: O.Reg. 153/04 | Internal ref.: ME-CA-IENVI SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Water Soluble Boron	ESG0117-JUN17	µg/g	0.5	<0.5	ND	20	98	80	120	129	70	130

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

-- End of Analytical Report --

SGS

SGS Environment, Health and Safety

Request for Laboratory Services and CHAIN OF CUSTODY

No:

Page 1 of 1

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Laboratory Information Section - Lab use only

Received By: Breanne Curry
Received Date: 062317 (mm\dd\yy)
Received Time: 15:15 am / pm (circle)
Received By (signature): [signature]
Custody Seal Present: Y (N) (circle)
Custody Seal Intact: Y (N)
Cooling Agent Present: Y (N) Type:
Temperature Upon Receipt (°C) 21x3
LAB LIMS #: CA15545-Jun17

REPORT INFORMATION

Company: WSP GROUP
Contact: PETER HYNES
Address: 294 RINK ST, SUIT 103
PETERBOROUGH, ON K9J 2X2
Phone: 705 743-6850
Fax: 705 743 6854
Email: PETER.HYNES@WSP.COM

INVOICE INFORMATION

☒ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email:

PROJECT INFORMATION

Quotation #: 1
P.O. #:
Project #: 171-07055-00
Site Location/ID: COBOURG / VARIOS

TURNAROUND TIME (TAT) REQUIRED

☒ Regular TAT (5-7days) — TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 3pm or on weekends : TAT begins the next business day

RUSH TAT (Additional Charges May Apply) ☐ 1 Day ☐ 2 Days ☐ 3-4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: Rush Confirmation ID:

REGULATIONS

Regulation 153 (2011): ☒ Table 1 ☒ Table 2 ☒ Table 3 ☒ Table ____ ☐ Res/Park ☐ Ind/Com ☐ Agri/Other Soil Texture: ☐ Coarse ☐ Medium ☐ Fine

Other Regulations: ☐ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ MMER ☐ CCME ☐ Other: ☐ MISA

Sewer By-Law: ☐ Sanitary ☐ Storm Municipality:

DRINKING WATER SAMPLES (POTABLE WATER FOR HUMAN CONSUMPTION) MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	PHC F1-F4	VOC	PAH	METALS & HYDRIDES									COMMENTS: Field Filtered (F) Preserved (P)
1	BH17-~~04~~ 01/SS4	JUNE 20/17	11:20	8		X	X	X	X									
2	BH17-05/SS4	JUNE 21/17	9:20	8		X	X	X	X									
3	BH17-06/SS3 ~~SS1~~	JUNE 19/17	10:30	6		X	X	X	X									F1
4	BH17-06/SS4	JUNE 19/17	10:30	2		X												
5	BH17-~~10~~/~~SS3~~ SS3	JUNE 22/17	16:40	8		X	X	X	X									
6	BH17-~~10~~/~~SS2~~ SS2	JUNE 22/17	16:40	2		X												F1
7	BH17-11/SS6	JUNE 19/17	11:40	8		X	X	X	X									
8	BH17-13/SS2	JUNE 21/17	14:13	8		X	X	X	X									
9																		
10																		

06/26/2017

Observations/Comments/Special instructions

Sampled By (NAME): ARMAN YAZDANI	Signature: [signature]	Date: 06/22/17 (mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Mike Nowicki	Signature: [signature]	Date: 06/23/17 (mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.1
Date of Issue: 25 July, 2016

SGS

SAMPLE INTEGRITY REPORT

Project Number: 171-07055-01

ONTARIO REGULATION 153/04

SGS Sample ID CA15545-Jun17

Date / Time Sampled Jun 19, 20, 21, 22, 2017

Client Sample ID See CofC

	ALL
Sample Submission General Sample Integrity Violations	
Temperature >10 C upon receipt if not sampled same day	☑
No evidence of cooling trend initiated if sampled same day	☐
Chain of Custody not submitted	☐
Chain of Custody incomplete	☐
Chain of Custody not signed / dated	☐
Chain of Custody not a current version	☐
Bottles / Samples listed on CoC but not received	☐
Bottles / Samples received but not listed on the CoC	☐
Sample container received empty	☐

BH-17-10/SS2 matches tests for BH-17-10/SS3, and BH-17-10/SS3 matches tests for BH-17-10/SS2

Sample Specific Sample Integrity Violations							
Sample received past hold time	☐	☐	☐	☐	☐	☐	☐
Incorrect preservation (including no preservation where required)	☐	☐	☐	☐	☐	☐	☐
Headspace present in VOC vial (aqueous)	☐	☐	☐	☐	☐	☐	☐
Sample(s) received frozen	☐	☐	☐	☐	☐	☐	☐
Bottle(s) broken or damaged in transport	☐	☐	☐	☐	☐	☐	☐
Discrepancy between sample label and chain of custody	☐	☐	☐	☐	☐	☐	☐
Analysis requirements absent / unclear	☐	☐	☐	☐	☐	☐	☐
Missing or incorrect sample label(s)	☐	☐	☐	☐	☐	☐	☐
Inappropriate sample container used	☐	☐	☐	☐	☐	☐	☐
Insufficient number of bottles received	☐	☐	☐	☐	☐	☐	☐
Insufficient sample volume	☐	☐	☐	☐	☐	☐	☐
Sample contains multiple phases	☐	☐	☐	☐	☐	☐	☐
Sediment Log							
Groundwater samples contain visible sediment / particulate	☐	☐	☐	☐	☐	☐	☐
Groundwater contains greater than 1cm of sediment / particulate matter in bottle	☐	☐	☐	☐	☐	☐	☐

Additional Comments/Remarks:

No issues upon receipt ☐ Initials: KCS

Please proceed with the testing as noted. Should be 6 samples for PHC, VOC PAH and Metals & Inorganics. I believe we had to take samples from the next samples in some cases do low yields in the samples. Based on F1 comments, BH-17-06/SS4 and BH17-10/SS3 would be F2 to F4 not F1 to F4. With that being said if there is sufficient sample in the 6 bottles (not know exactly how many vials were sent and which ones were vials) you could omit the two 2-bottle samples.

06/26/2017