APPENDIX F

GEOTECHNICAL INVESTIGATION REPORT

GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Geotechnical Investigation

Proposed Passmore Avenue Road Improvements
From Markham Road to 450 m West of Markham Road
City of Toronto, Ontario

Prepared For:

Morrison Hershfield Limited

GeoPro Project No.: 16-1406-01

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GeoPro CONSULTING LIMITED

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1 INTRODUCTION

GeoPro Consulting Limited (GeoPro) was retained by Morrison Hershfield Limited (the Client) to conduct a geotechnical investigation for the proposed road improvements on Passmore Avenue, in the City of Toronto, Ontario. It is understood that the proposed road section of Passmore Avenue from Markham Road to 450 m west of Markham Road will be widened from a 2-lane rural section to a 4-lane urban section.

The purpose of this geotechnical investigation was to obtain information on the existing subsurface conditions by means of a limited number of boreholes, in-situ tests and laboratory tests of soil samples to provide required geotechnical design information. Based on GeoPro's interpretation of the obtained data, geotechnical comments and recommendations related to the project designs are provided.

This report is prepared with the condition that the design will be in accordance with all applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practice. Furthermore, the recommendations and opinions in this report are applicable only to the proposed project as described above. On-going liaison and communication with GeoPro during the design stage and construction phase of the project is strongly recommended to confirm that the recommendations in this report are applicable and/or correctly interpreted and implemented. Also, any queries concerning the geotechnical aspects of the proposed project shall be directed to GeoPro for further elaboration and/or clarification.

This report is provided on the basis of the terms of reference presented in our approved proposal prepared based on our understanding of the project. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this report can be relied upon.

This report deals with geotechnical issues only. The geo-environmental (chemical) aspects of the subsurface conditions, including the consequences of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources were not investigated and were beyond the scope of this assignment. However, limited chemical testing was carried out on selected soil samples for excess soil disposal purposes.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. Laboratory testing, for most part, follows ASTM or CSA Standards or modifications of these standards that have become standard practice in Ontario.

This report has been prepared for the Client only. Third party use of this report without GeoPro's consent is prohibited. The limitations to the report presented above form an integral part of the report and they must be considered in conjunction with this report.

2 INVESTIGATION PROCEDURE

2.1 Existing Pavement Condition Survey

A visual pavement condition survey was completed, identifying general pavement surface distresses and roadway drainage characteristics. The survey was conducted in general accordance with MTO SP-022 Flexible Pavement Condition Rating Guidelines for Municipalities. Photographs of the typical pavement distresses and general conditions with annotated comments are provided in Appendix A.

2.2 Borehole and Asphalt Concrete Core Investigation

Field work for the geotechnical investigation was carried out on December 9, 2016, during which time four (4) boreholes (Boreholes BH1 to BH4) were advanced to depths ranging from about 6.2 m to 6.6 m below the existing ground surface. In addition, the pavement was cored at nine locations (AC1 to AC9) using a core drill in order to obtain samples of the existing asphalt concrete for thickness measurements, visual examination and asbestos analysis. The borehole and core locations are shown on Borehole and Core Location Plan, Drawing 1. Borehole logs are provided in Enclosures 2 to 5 and pavement core photographs are provided in Appendix B.

The boreholes were advanced using truck-mounted continuous flight auger equipment supplied by a specialist drilling subcontractor under the supervision of a GeoPro engineering staff. Soil samples were recovered at regular intervals of depth using a 50 mm O.D. split-spoon sampler driven into the soil in accordance with the Standard Penetration Test (SPT) procedure described in ASTM D1586 - 11 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.

Groundwater condition observations were made in the open boreholes during drilling and upon completion of drilling. Borehole BH1 was backfilled and sealed upon completion of drilling. Monitoring well (51 mm in diameter) was installed in each of the Boreholes BH2 to BH4 to monitor the groundwater levels.

All soil samples obtained during this investigation were brought to our laboratory for further examination and geotechnical classification testing on selected soil samples. The elevations at the as-drilled borehole locations were not available at the time of preparing the report. The borehole locations plotted on the Borehole Location Plan, Drawing 1 were based on the measurement of the site features and should be considered to be approximate.

2.3 Laboratory Testing

In the laboratory, each soil sample was examined as to its visual and textural characteristics by the project engineer. Moisture content determinations were carried out on all subsoil samples. Four samples of the granular base/subbase materials were analyzed for comparison with the City of Toronto Standard Specifications TS 1010 gradation requirements, and three subgrade soil samples were tested for grain size analysis to assess their drainage characteristics and frost susceptibility. The complete laboratory test results are shown in Figures 1 to 3.

Nine (9) asphalt concrete samples were collected and submitted to AGAT Laboratories for testing of the presence of asbestos filler in the asphalt concrete. The asbestos analysis results are provided in Appendix C.

3 PAVEMENT AND SUBSURFACE CONDITIONS

3.1 Existing Pavement Conditions

In general, the condition of the existing flexible pavement on Passmore Avenue from Markham Road to 450 m west of Markham Road is considered to be poor with localized very poor areas. The most significant distresses are extensive moderate to severe alligator cracking; frequent slight to severe longitudinal and transverse cracking; frequent slight to severe edge cracking; frequent slight to moderate edge cracking; frequent slight to severe pavement edge breaks; intermittent slight to moderate wheel rutting; intermittent slight to moderate patching and slight to moderate distortion. The ride quality of this section is generally considered to be poor. Selected photographs of typical distresses are provided in Appendix A.

This section of roadway has generally been constructed to a rural cross section (open ditches). The overall surface drainage is generally considered to be poor. Observations along the roadway indicate that pavement surface water generally follows along the existing pavement grades and is being directed to ditches. However, the drainage is impaired by poor grading and surface distresses with unsealed cracks allowing surface water to infiltrate into the underlying pavement and subgrade. At some sections, ditches were observed to be shallow to non-existent and not free-flowing.

3.2 Subsurface Conditions

The borehole locations are shown on Drawing 1. Notes on sample descriptions are presented in Enclosure 1A. Explanations of terms used in the borehole logs are presented in Enclosure 1B. The subsurface conditions in the boreholes (Boreholes BH1 to BH4) are presented in the individual borehole logs (Enclosure 2 to 5 inclusive). Detailed descriptions of the major soil strata encountered in the boreholes drilled at the site are provided in the following.

Existing Pavement Structure

A flexible pavement structure was observed on Passmore Avenue. The range and average thickness of pavement structure is summarized in the following table.

Section	Pavement Structure, mm		
	Asphalt Concrete Range (Average)	Granular Base/Subbase Range (Average)	Total Thickness (Average)
BH1	60	640	700
BH2 to BH4	110 - 120 (113)	560 - 570 (563)	670 - 680 (677)
AC1	50	-	-
AC2 to AC9	90 - 130 (115)	-	-

Fill Materials

Fill materials consisting of silt, clayey silt, sandy silt and sand and silt were encountered below the granular base/subbase in all boreholes and extended to depths ranging from about 1.1 m to 2.1 m below the existing ground surface. For cohesionless fill materials, SPT N values ranging from 11 to 26 blows per 300 mm penetration indicated a compact relative density. For cohesive fill materials, SPT N values ranging from 11 to 16 blows per 300 mm penetration indicated a stiff to very stiff consistency. The in-situ moisture content measured in the soil samples ranged from approximately 8% to 22%.

Sand and Silt Till

Sand and Silt Till deposit was encountered below the fill materials in all boreholes and extended to depths ranging from about 5.6 m to 6.6 m below the existing ground surface. Boreholes BH1 and BH3 were terminated in this deposit. SPT N values ranging from 23 to greater than 100 blows per 300 mm penetration indicated a compact to very dense relative density. The natural moisture content measured in the soil samples ranged from approximately 5% to 11%.

Silty Sand

Silty Sand deposit was encountered below or within the sand and silt till deposit in Boreholes BH2 and BH4 and extended to depths ranging from about 6.4 m to 6.6 m below the existing ground surface. SPT N values ranging from 33 to greater than 100 blows per 300 mm penetration indicated a dense to very dense relative density. The natural moisture content measured in the soil samples ranged from approximately 14% to 15%.

3.3 Groundwater Conditions

Groundwater condition observations made in the boreholes during and immediately upon completion of drilling are shown in the borehole logs and are also summarized in the following table.

BH No.	BH Depths (m)	Depth of Water Encountered during Drilling (mBGS)	Water Level upon Completion of Drilling (mBGS)	Cave-in Depth upon Completion of Drilling (mBGS)
BH1	6.6	-	Dry	Open
BH2	6.6	-	5.5	5.6
BH3	6.2	-	Dry	Open
BH4	6.4	-	5.9	Open

Note: mBGS = meters below ground surface

The monitoring wells construction details and the measured groundwater level is shown in the borehole logs and also summarized in the following table.

Monitoring Well ID	Screen Interval (mBHS)	Water Level (mBGS)
		Date of Monitoring (December 19, 2016)
BH2	3.6 ~ 6.6	4.52
BH3	3.2 ~ 6.2	2.18
BH4	3.4 ~ 6.4	Dry

Note: mBGS = meters below ground surface

It should be noted that groundwater levels can vary and are subject to seasonal fluctuations in response to weather events.

3.4 Topsoil Thickness Measurements

Seven test pits were taken in the existing ditches and boulevard. The thickness of topsoil and organic matter was measured in each test pit. The measured thicknesses ranged from 140 mm to 190 mm with an average of 165 mm. The topsoil and organic matter thicknesses are shown in the following table.

Test Pit Number	Thickness of Topsoil (mm)
TP1	190
TP2	160
TP3	140
TP4	160
TP5	180
TP6	150
TP7	170

4 LABORATORY TEST RESULTS

4.1 Grain Size Analysis Results

Sieve analyses were completed on four samples of the recovered granular base/subbase materials, and the results were compared to TS 1010 Granular A and Granular B Type I specifications. The grain size distribution curves for these samples are presented in Figures 1 and 2, and a summary of the results is provided in the following table.

Sample	TS 1010 Granular A	TS 1010 Granular B Type I
BH1 AS1A	Does not meet TS 1010 due to excessive percentages passing all sieves	Does not meet TS 1010 due to excessive fines (25.9% passing 0.075 mm sieve)
BH2 AS1B	Does not meet TS 1010 due to excessive percentages passing all sieves	Does not meet TS 1010 due to excessive fines (30.5% passing 0.075 mm sieve)
BH3 AS1A	Does not meet TS 1010 due to excessive percentages passing all sieves	Does not meet TS 1010 due to excessive fines (19.1% passing 0.075 mm sieve)
BH4 AS1B	Does not meet TS 1010 due to excessive percentages passing most sieves	Does not meet TS 1010 due to excessive fines (30.6% passing 0.075 mm sieve)

Grain size analysis of three subgrade samples confirmed the visual description of the subgrade soils. In addition, the soil was examined and compared to frost susceptibility characteristics in accordance with the MTO Pavement Design and Rehabilitation Manual. The summarized results are provided in the following table, and the grain size distribution curves of these samples are presented in Figure 3.

Soil Sample	Description	Susceptibility of Frost Heaving
BH1 SS3	Silt and Sand Till, some Clay, trace Gravel	Low
BH2 SS6	Silt Sand, trace Clay, trace Gravel	Low
BH3 SS4	Silt and Sand Till, some Clay, trace Gravel	Low

4.2 Asbestos Analysis Results

Nine (9) asphalt concrete samples were submitted to AGAT Laboratories (AGAT) in Mississauga, Ontario to determine if asbestos fibres are present in the existing asphalt concrete. To analyze

asbestos in asphalt samples, AGAT uses a method modified from EPA/NIOSH methodology protocols, and typically expresses results using semi-qualitative ranges.

Based on the analytical results, no asbestos was identified in Core AC1, and detected chrysotile asbestos content is less than 0.5% Reported Detection Limit (RDL) in cores AC5, AC8 and AC9, chrysotile asbestos content is higher than 0.5 % RDL in cores AC2 to AC4, AC6 and AC7. Therefore, the asphalt concrete in the pavement structure at this site would be considered as an asbestos containing material. The existing asphalt concrete should not be reused in recycled hot-mix asphalt mixtures and need to be disposed off-site after removing. The asbestos analysis test results are attached in Appendix C.

5 DISCUSSION AND RECOMMENDATIONS

This report contains the findings of GeoPro's geotechnical investigation, together with geotechnical engineering recommendations and comments. These recommendations and comments are based on factual information and are intended only for use by the design engineers. The number of boreholes may not be sufficient to determine all factors that may affect construction methods and costs. Subsurface conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and conditions may become apparent during construction that could not be detected or anticipated at the time of the site investigation. The anticipated construction conditions are also discussed, but only to the extent that they may influence design decisions. The construction methods discussed, however, express GeoPro's opinion only and are not intended to direct contractors on how to carry out construction. Contractors should also be aware that the data and interpretation presented in this report may not be sufficient to assess all factors that may have an effect on construction.

The design drawings of the project were not available when this report was prepared. Once the design drawings and detailed site plan are available, this report will be reviewed by GeoPro, and further recommendations will be provided as needed.

5.1 Pavement Designs

5.1.1 Traffic Data Analysis

Passmore Avenue is considered to be a Collector Roadway. The Client provided GeoPro with traffic data in an email dated January 3, 2017 (2016 AADT of about 8,475, 14% of commercial vehicles and 2% annual growth rate of traffic).

The traffic data was interpreted by GeoPro to estimate the number of Equivalent Single Axle Loads (ESALs) for pavement design purposes. Traffic loading repetitions were determined for the 15-year pavement design life period that is considered typical for municipal pavements of this type. On this basis, the ESAL applications during the design period were calculated in accordance with the Appendix D of MTO MI-183 Adaption and Verification of AASHTO Pavement Design Guide for Ontario Conditions. This traffic data and the ESALs are presented in the following table. The

detailed traffic analysis and estimated ESALs for the 15-year pavement design life are given in Appendix D, Traffic Data Analyses.

Parameters	Traffic Data
AADT (2016)	8,475
Commercial Vehicle Percentage	14.0%
Annual Growth Rate	2.0%
Estimated Total Design ESALs (15-Year)	2,221,000

5.1.2 Pavement Design

The subgrade soils along the length of subject roadway section generally consisted of cohesive/cohesionless fill materials, cohesionless sand and silt till and silty sand based on GeoPro's borehole information. As such, the resilient modulus of subgrade has been assumed to be 25 MPa. The pavement designs were developed based on the 1993 AASHTO Guide for Design of Pavement Structures and MTO MI-183 Adaption and Verification of AASHTO Pavement Design Guide for Ontario Conditions. The pavement design parameters are summarized in the following table.

Design Parameters	Values
Design Life	15 Years
ESALs over Analysis Period	2,221,000
Initial Serviceability Index	4.4
Terminal Serviceability Index	2.2
Reliability Level, %	85
Overall Standard Deviation	0.45
Design Subgrade Resilient Modulus, MPa	25
Calculated Design Structure Number	116
Reconstructed Pavements/Widening Lanes	
Layer Coefficient of Hot Mix Asphalt	0.42
Layer Coefficient of Granular Base Course	0.14
Layer Coefficient of Granular Subbase Course	0.09
Drainage Coefficients of Base and Subbase Courses	1.0

5.1.3 Pavement Widening and Reconstruction Recommendations

Passmore Avenue will be widened to a 4-lane urban road (curb and gutter) within the project limits. Based on the pavement condition survey, the borehole information, laboratory testing, pavement structural capacity analysis and the assumed traffic, the existing pavement structure from Markham Road to 450 m west of Markham Road is considered to be not adequate to accommodate the anticipated traffic. Therefore, a full depth reconstruction in conjunction with drainage and subdrainage improvements is recommended for the proposed road improvements.

The proposed road widening construction and existing lanes reconstruction should be carried out in general accordance with City of Toronto Drawing T-216.02.6, Flexible Pavement for All Road Classifications, and the recommended pavement structures are shown in the following table.

Material		**Pavement Structure Thickness (mm)**
Hot-Mix Asphalt (TS 1150)	HL 1 Surface Course	40
	HL 8 (HS) Binder Course	120
Granular Materials (TS 1010)	Granular A Base (19 mm Crusher Run Limestone)	150
	Granular B Type I Subbase (or Equivalent Material)	350
Total Thickness		**660**
Constructed Pavement Structural Number		120
Design Structural Number		116

The construction sequence should be carried out as follows:

- Existing lanes: completely remove the existing asphalt and granular base/subbase materials and dispose off-site;
- Widening lanes: completely remove the existing topsoil and any other obviously deleterious materials;
- Excavate subgrade to the depth required to accommodate the new pavement structure; the prepared subgrade should be carefully proof-rolled in the presence of the geotechnical engineer from GeoPro; any soft/loose or wet areas or other obviously deleterious materials must be excavated and properly replaced with approved material;
- Backfilling of sub-excavated areas and fine grading may be carried out using TS 1010 Granular B Type I. All backfill materials should be placed in uniform lifts not exceeding 200 mm loose thickness and compacted to at least 98 percent Standard Proctor Maximum Dry Density (SPMDD). The finished subgrade should be provided with a grade of 3 percent towards the positive drainages;
- Place a minimum of 350 mm TS 1010 Granular B Type I subbase course; place in loose lifts not exceeding 200 mm thickness, compact to 100 percent of SPMDD;
- Place 150 mm of TS 1010 Granular A base course compacted to 100 percent of SPMDD; and
- Place 160 mm thickness of hot-mix asphalt (120 mm of TS 1150 HL 8 (HS) binder course placed in two lifts, and one lift of 40 mm of TS 1150 HL 1 surface course), produced and placed in accordance with TS 310. The surface of the completed pavement should be provided with a grade of 2 percent.

The constructed pavement Structural Number is 120, which is greater than the Design Structural Number (116). As such, the pavements are structurally adequate for the expected traffic loads in the 15-year design period.

5.1.4 Drainage Improvements

Control of surface water is an important factor in achieving a good pavement service life. Therefore, we recommend that provisions be made to drain the new pavement subgrade and its granular layers. It is understood that the proposed road improvements are anticipated to consist of typical urban section (concrete curb/gutter and catchbasins). To provide positive drainage across the pavement platform, the surface of pavement should be sloped at a grade of 2 percent and the pavement subgrade should be sloped at a grade of 3 percent towards the subdrains. Subdrains should be designed and constructed in accordance with T-216.02-8, Roadway Subdrains, and the subdrain pipe should be connected to a positive outlet.

5.1.5 General Pavement Recommendations

5.1.5.1 Pavement Materials

The following hot-mix asphalt mix types should be selected:

- HL 1 Surface Course; and
- HL 8 (HS) Binder Course

These hot mix asphalt mixes should be designed and produced in conformance with TS 1150 requirements.

Granular A and Granular B Type I material should be used as base course and subbase course, respectively. Both Granular A and Granular B Type I material should meet TS 1010 specifications.

5.1.5.2 Asphalt Cement Grade

It is recommended that PGAC 64-28 be used in the TS 1150 HL 1 surface course to provide adequate resistance to rutting and shoving due to the heavy truck/buses traffic, and PGAC 58-28 be used in the TS 1150 HL 8 (HS) binder course on Passmore Avenue. Performance graded asphalt cement PGAC 64-28 and 58-28 should conform to TS 1101 requirements.

5.1.5.3 Tack Coat

A tack coat (SS1) should be applied to all construction joints prior to placing hot-mix asphalt to create an adhesive bond. Prior to placing hot-mix asphalt, SS1 tack coat must also be applied to all existing surfaces and between all new lifts in accordance with OPSS 308 requirements.

5.1.5.4 Compaction

All granular base and subbase materials should be placed in uniform lifts not exceeding 200 mm loose thickness and compacted to 100 percent of the material SPMDD at ±2 percent of the materials Optimum Moisture Content (OMC). Hot-mix asphalt should be placed and compacted in accordance with TS 310 specifications.

5.1.5.5 Pavement Tapers

At the limits of construction, appropriate tapering of the pavement thickness to match the existing pavement structure should be implemented in accordance with OPSS and the applicable local municipality specifications.

5.1.5.6 Subgrade Preparation

All topsoil, organics, soft/loose and otherwise disturbed soils should be stripped from the subgrade area. The exposed subgrade soils will be disturbed by construction traffic when wet; especially if site work is carried out during periods of wet weather. Under inclement weather conditions, an adequate granular working surface may be required to facilitate construction traffic as well as to minimize subgrade disturbance and to protect its integrity.

Immediately prior to placing the granular subbase, the exposed subgrade should be compacted and then proofrolled with a heavy rubber tired vehicle (such as a loaded gravel truck) in conjunction with inspection by a geotechnical engineer from GeoPro. The subgrade should be inspected for signs of rutting or displacement. Areas displaying signs of rutting or displacement should be recompacted and retested, or the material should be subexcavated and replaced with well-compacted clean fill materials approved by the geotechnical engineer from GeoPro.

The fill materials may consist of either granular material or local inorganic soils provided that its moisture content is within ±2 percent of OMC. Fill should be placed and compacted in accordance with TS 501 and the final 300 mm of the subgrade should be compacted to 98 percent of SPMDD.

5.1.5.7 Reuse and Disposal of Existing Pavement Materials

It should be noted that gradation analyses of the selected samples of the existing granular base and subbase materials do not meet the TS 1010 granular A and B Type I gradation specifications with excessive content of fines. Therefore, the existing excavated granular materials could not be reused as subbase/base materials, however, they can be reused as subgrade material to replace soft, wet or otherwise disturbed areas identified during proofrolling, subject to the environmental quality of the granular materials.

Due to the presence of asbestos in the existing asphalt concrete, the existing asphalt concrete should be removed and disposed off-site.

5.1.5.8 Maintenance

Routine maintenance should be considered to extend the life of the pavement. Systematic routine preventative maintenance is strongly recommended for all newly constructed pavements. Crack routing and sealing will generally be required within 2 to 3 years after pavement construction. As the pavement ages, it will also be necessary to patch areas of medium to high severity distresses, such as potholes and ravelling.

5.2 Storm and Sanitary Sewer Installations

It is understood that new storm and sanitary sewers connecting the existing storm and sanitary sewers will be carried out in conjunction with the proposed road improvements. It is further understood that all of the sewers will be installed with conventional open cut method.

5.2.1 Conventional (Open Cut) Installation of the Proposed Sewer

The invert depths of the proposed site services are not available at the time of preparing the report. We have assumed that the majority of the sewer installations will require excavations up to 4.0 m below the existing ground surface. According to the results of this investigation, the soils at the proposed founding depths are generally anticipated to be in the native sand and silt till. The native soils are considered to be suitable for supporting the pipes, provided the integrity of the base of the trench can be maintained during construction. The suitability of the existing fill materials to support the pipes, if encountered at the base of the trenches, should be further assessed during construction. This assessment will require inspection during construction by qualified geotechnical personnel from GeoPro to determine the suitability of the fill materials for supporting the pipes.

It should be noted that some difficulties may be encountered in excavating the hard/very dense tills at some locations. In addition, these tills are inferred containing cobbles and boulders, as previously noted. Once the actual service invert depths are finalized, the following comments and recommendations should be reviewed and revised as necessary.

5.2.2 Trenching Excavation and Temporary Groundwater Control

Based on the results of this investigation, the site trenching excavation will be carried out through the existing pavement structure, existing fill materials and the native sand and silt till and silty sand deposits. The trench excavation will be at, above or below the measured groundwater tables depending on the locations.

Groundwater control during excavation within the fill materials and native silty sand soils above the prevailing groundwater tables and glacial till deposits can be handled, as required, by pumping from properly constructed and filtered sumps located within the excavations. However, more significant groundwater seepage should be expected from the cohesionless silty sand deposits below the prevailing groundwater tables. Depending upon the actual thickness and extent of

these soils layers, some form of positive (pro-active) groundwater control or depressurization using well points/eductors may be required to maintain the stability of the base and side slopes of the trench excavations, in addition to pumping from sumps. The groundwater level should be lowered to at least 1 m below the excavation base prior to excavating for the site services.

Where excavations are conducted by conventional temporary open cuts, side slopes should not be steeper than 1.0 horizontal to 1 vertical (1.0H:1V). However, depending upon the construction procedures adopted by the contractor, actual groundwater seepage conditions, the success of the contractor's groundwater control methods and weather conditions at the time of construction, some flattening and/or blanketing of the slopes may be required, especially in looser/softer zones (i.e. in fills or wet sandy/silty deposits) or where localized seepage is encountered. Care should be taken to direct surface runoff away from the open excavations and all excavations should be carried out in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. According to OHSA, the native sand and silt till would be classified as Type 2 soil above groundwater table and Type 3 soil below groundwater table; and shallow fill materials and cohesionless silty sand soil would be classified as Type 3 soils above groundwater table and Type 4 soil below groundwater table and unless supported by shoring or other approved retaining method, the excavations will require minimum side slopes of 3H:1V. In addition, care must be taken during excavation to ensure that adequate support is provided for any existing structures and underground services located adjacent to the excavations.

The excavated material should be placed well back from the edge of the excavation and stockpiling of materials adjacent to the excavation should be prohibited, to minimize surcharge loading near the excavation crest.

5.2.3 Temporary Shoring and Trench Boxes

It is understood that for the majority of the service installations, the extent of the excavations will have to be minimized to allow for traffic to continue using a reduced portion of the existing roadway. Where side slopes of excavations are steepened to limit the extent of the excavation, some form of trench support system such as a trench box system will be required. The earth pressure on the shoring system should be evaluated by using the pressure distribution diagram shown on Drawing 2. It must be emphasized that a trench liner box provides protection for construction personnel but does not provide any lateral support for the adjacent excavation walls, underground services or existing structures. In the case of trench box excavation work, the tolerance for disturbance of any structure founded above a 1 horizontal to 1 vertical line projected up from the base of the excavation should be assessed prior to construction. If adjacent structures and/or utilities or existing pavement structure open for traffic are susceptible to damage from construction induced settlement, then excavation support using sheet piles or a strutted soldier pile and lagging wall must be considered. It is therefore, imperative that any underground services or existing structures adjacent to the excavations be accurately located prior to construction and adequate support provided where required. In addition, steepened excavations should be left open for as short a duration as possible and completely backfilled at the end of each

working day. Care should be taken to direct surface runoff away from the open excavations and all excavations should be carried out in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. In addition, care must be taken during excavation near underground structures (i.e. culvert, gas utilities, etc.) located within or adjacent to the excavation. The owner of the utility/service should also be contacted prior to excavating near their easement to confirm that the proposed excavation meets their requirements.

While the use of trench boxes is an effective and economical trench-support method, its use can cause increased loss of ground relative to properly braced shoring, especially when working close to granular base courses below existing pavements or along existing utility trenches backfilled with granular materials. Trench boxes also reduce the contractor's ability to compact backfill materials placed between the trench wall and the outer trench box shell, thereby increasing the likelihood of post-construction settlements along the trench walls. When trench boxes are used along existing roadways, settlements frequently occur along the trench wall, which may manifest months after completion of backfilling. In such cases, following the backfilling of the trench, road reconstruction should include a provision for saw-cutting the asphalt at least 1 m back from the trench walls, recompacting the upper trench backfill, and then repaving. Where permissible under the OHSA and where its use is considered to be a safe alternative for shoring and bracing, contractors may elect to utilize trench boxes for temporary trench wall support for trenches less than 6 m deep in Type 2 and 3 soils. Where trench depths exceed 6 m (or at any trench depth in Type 4 soil), Engineered Support Systems are required under the OHSA.

Further to the above and in consideration of the predominantly cohesionless fill materials and granular trench backfill materials from the existing underground utilities, if encountered, in close proximity to the proposed excavation above the invert elevations, some loss of ground should be expected for the sections of nearly vertical excavation where a trench box will be used. It is anticipated that in the cohesionless soils, the unsupported soils on the trench sides will relax, filling the void between the trench walls and trench box. This may lead to loss of ground below the pavement and potentially undermine and reduce the stability of the pavement structure adjacent to the open traffic lanes. In order to minimize this effect, the gap between the trench walls and trench box should be minimized during the excavation and trench box installation.

5.2.4 Pipe Support and Bedding

The bedding for the service pipes should be compatible with the type and class of pipe, the surrounding subsoil and anticipated loading conditions and should be designed in accordance with the standard specifications of the local municipality or Ontario Provincial Standard Specifications (OPSS). Where granular bedding is deemed to be acceptable, it should consist of at least 150 mm of OPSS Granular A or 19 mm crusher run limestone material. The thickness of the bedding may, however, may have to be increased (i.e. 300 mm to 450 mm) depending on the pipe diameter or in accordance with local standard specifications or if wet or weak subgrade conditions are encountered, especially when the soils at the trench base level consists of wet sandy/silty deposits. From springline to 300 mm above obvert of the pipe, sand cover could be used. All

bedding and cover material should be placed in 150 mm loose lifts and uniformly compacted to at least 95 percent of the materials Standard Proctor Maximum Dry Density (SPMDD).

To avoid the loss of soil fines from the subgrade, clear stone bedding material should not be used in any case for pipe bedding or to stabilize the bases.

5.2.5 Trench Backfill

Based on visual and tactile examination and the measured nature water contents of the soil samples, the majority of the on-site existing fill materials and native soils above the prevailing groundwater tables will generally be at or near their estimated optimum water contents for compaction. However, the existing fill materials and native silty/sandy soils below the prevailing groundwater tables may be wetter than their estimated optimum water contents for compaction, which should require some aeration prior to be reused as backfill materials.

The excavated materials at suitable water contents may be reused as trench backfill provided they are free of significant amounts of topsoil, organics or other deleterious material, and are placed and compacted as outlined below. It should also be noted that due to the predominantly fine-grained, silty nature of the majority of the existing fill and native soils, some difficulty would be expected in achieving adequate compaction, especially during wet weather.

The backfill should be placed in maximum 300 mm loose lifts at or near (±2%) their optimum moisture content and each lift should be compacted to at least 95% SPMDD. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling. (In pavement areas, the upper 1.2 m zone of the trench backfill below the subgrade should be a compacted to at least 98% SPMDD.)

It should be noted that if the soils for trench backfilling were placed and compacted at wet of their optimum water content (>2%), pumping and rolling conditions may be encountered, which would require mitigative measures in order to construct roads and utilities. This might include significant extra thicknesses of granular base, base reinforcement using geogrids or importing of better quality common fill.

Alternatively, if placement water contents at the time of construction are too high, or if there is a shortage of suitable in-situ material, then an approved imported sandy material which meets the requirements for OPSS Select Subgrade Material (“SSM”) could be used. It should be placed in loose lift thicknesses as indicated above and uniformly compacted to at least 95% SPMDD.

Normal post-construction settlement of the compacted trench backfill should be anticipated, with the majority of such settlement taking place within about 6 months following the completion of trench backfilling operations. This settlement may be compensated for, where necessary, by placing additional granular material prior to asphalt paving. Alternatively, if the asphalt binder course is placed shortly following the completion of trench backfilling operations in these areas,

any settlement that may be reflected by subsidence of the surface of the binder asphalt should be compensated for by placing an additional thickness of binder asphalt or by padding.

6 ENVIRONMENTAL SOIL ANALYTICAL RESULTS

6.1 Soil Sample Submission

It is understood that a Phase Two Environmental Site Assessment was being conducted by the Client (MH) at the sampling locations.

The following soil samples were submitted to ALS Environmental Laboratories in Richmond Hill, Ontario ("ALS") for chemical analyses.

Sample ID	Soil Depth (mBGS)	Primary Soil	Analytical Parameters
BH1 SS2	0.76 – 1.22	Organic Silt and Clayey Silt Fill	SAR, Metals and PAHs
BH1 SS6	4.57 – 5.03	Sand and Silt Till	PHCs/VOCs
BH2 SS2A	0.76 – 1.22	Clayey Silt Fill	SAR, Metals and PAHs
BH 2 SS5	3.05 – 3.51	Sand and Silt Till	PHCs/VOCs
BH3 SS3	1.52 – 1.98	Sand and Silt Till	SAR, Metals and PAHs
BH3 SS6	4.57 – 5.03	Sand and Silt Till	PHCs/VOCs
BH4 SS2	0.76 – 1.22	Sandy Silt to Sand and Silt Fill	SAR, Metals and PAHs
BH4 SS6	4.57 – 5.03	Sand and Silt Till	PHCs/VOCs
TCLP	Composite	-	Metals, VOCs and PAHs

Note: PAHs = Polycyclic Aromatic Hydrocarbons
PHCs = Petroleum Hydrocarbon Fractions F1 to F4
VOCs = Volatile Organic Compounds

6.2 Soil Analytical Results

6.2.1 O.Reg. 153/04 Results

A copy of the soil analytical results is provided in the Laboratory Certificates of Analysis, attached in Appendix E.

The soil analytical results were compared with the Ontario Ministry of the Environment and Climate Change ("MOECC") "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act", April 2011, Table 1: Full Depth Background Site Condition Standards for Residential/Parkland/Institutional/Industrial/Commercial/Community Property Uses ("2011 MOECC Table 1 Standards"); Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition ("2011 MOECC Table 2 Standards"), and Table 3: Full Depth Generic Site Condition Standards in a non-potable Ground Water Condition ("2011 MOECC Table 3 Standards").

Based on a comparison of the analytical results to the 2011 MOECC Standards, no exceedances were found for metals, PAHs and VOCs in the soil samples analysed. However, exceedances were noted for Sodium Adsorption Ratio (SAR) or PHCs (F2) in the tested soil samples. The exceedance values detected in the soil samples are summarized in the following table.

Soil Sample ID	Parameter	Detected Value	MOECC Table 1 Standards Guideline Value	MOECC Table 2 and 3 Standards (R/P/I) Guideline Value	MOECC Table 2 and 3 Standards (I/C/C) Guideline Value
BH1 SS2	SAR	4.79	2.4	5.0	12.0
BH1 SS6	F2	11	10	150	250
BH2 SS2A	SAR	46.5	2.4	5.0	12.0
BH3 SS3	SAR	> 55	2.4	5.0	12.0
BH3 SS6	F2	12	10	150	250
BH4 SS2	SAR	24.8	2.4	5.0	12.0

Note: R/P/I = Residential, Parkland and Institutional Property Use
I/C/C = Industrial, Commercial and Community property Use
0.57 = standard value exceeded by the analytical result

6.2.2 TCLP Results

To characterize the soil wastes, one composite soil sample was tested for TCLP analysis of metals, inorganic, VOCs and PAHs. The results were compared with the standards for respective parameters specified in Leachate Quality Criteria - Schedule 4 of O. Reg. 558/00.

The concentrations of analyzed parameters were non-detectable or below the detection limits, which are below the standards specified in O. Reg. 558/00. Therefore, the tested composite soil sample would be considered as non-hazardous wastes.

6.3 Discussion of Analytical Results

Based on the results, the soils at the site may have been impacted by SAR and PHCs. It should be noted that the samples selected for analysis were taken from the boreholes located on the roadways. The elevated SAR values in the tested soil samples may likely be attributed to the application of de-icing salt on the road. The sources of the elevated PHC concentrations were not known. Based on the results of soil sample analysis, GeoPro will recommend the following disposal options:

1) The soils generated at the Site near Borehole BH1 at the same tested sample depth can be re-used for the on-site road development, provided that the soils will not be in contact with groundwater, or re-used at a receiving site which is not considered as an environmentally sensitive site and would accept the soil as per test results.

2) The soil generated near Boreholes BH2 to BH4 at the same tested depths could be disposed of as non-hazardous wastes at a licensed landfill site.

It should be noted that the results of the chemical analysis refer only to the soil sample analyzed, which were obtained from specific sampling locations and sample depths, and that the soil chemistry may vary between and beyond the location and depth of the sample taken. Therefore, soil materials to be used on site or transported to other sites must be inspected during excavation for indication of variance in composition or any chemical/environmental constraints. If conditions indicate significant variations, further chemical analyses should be carried out.

Please note that the level of testing outlined herein is meant to provide a broad indication of soil quality based on the limited soil samples tested. The analytical results contained in this report should not be considered a warranty with respect to the soil quality or the use of the soil for any specific purpose. Furthermore, it must be noted that our scope of work was only limited to the review of the analytical results of the limited number of samples. The scope of work did not include any environmental evaluation or assessment of the subject site (such as a Phase One or Phase Two Environmental Site Assessment).

Sites accepting fill may have requirements relating to its aesthetic or engineering properties in addition to its chemical quality. Some receiving sites may have specific chemical testing protocol, which may require additional tests to meet the requirements. The requirements for accepting the fill at an off-site location must be confirmed in advance. GeoPro would be pleased to assist once the receiving sites are determined and the requirements of the receiving sites are available.

7 MONITORING AND TESTING

The geotechnical aspects of the final design drawings and specifications should be reviewed by this office prior to tendering and construction, to confirm that the intent of this report has been met. During construction, full-time engineered fill monitoring and sufficient foundation inspections, subgrade inspections, in-situ density tests and materials testing should be carried out to confirm that the conditions exposed are consistent with those encountered in the boreholes, and to monitor conformance to the pertinent project specification.

8 CLOSURE

We appreciate the opportunity to be of service to you and trust that this report provides sufficient geotechnical engineering information to facilitate the detailed design of this project. We look forward to providing you with continuing service during the construction stage. Please do not hesitate to contact our office should you wish to discuss, in further detail, any aspects of this project.

Yours very truly,

GEOPRO CONSULTING LIMITED

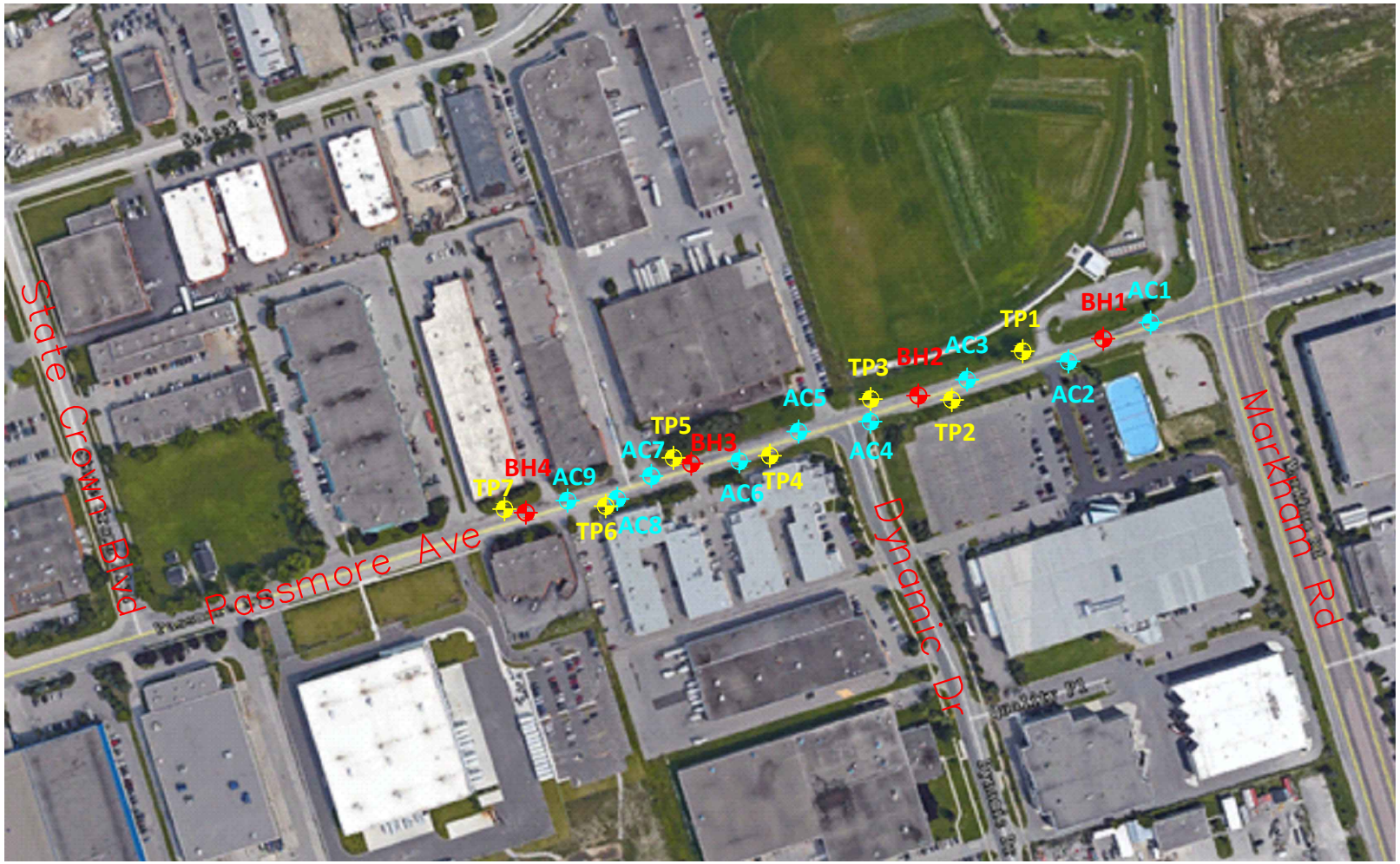
DRAFT

Jessica Yao, P.Eng.
Senior Geotechnical Engineer

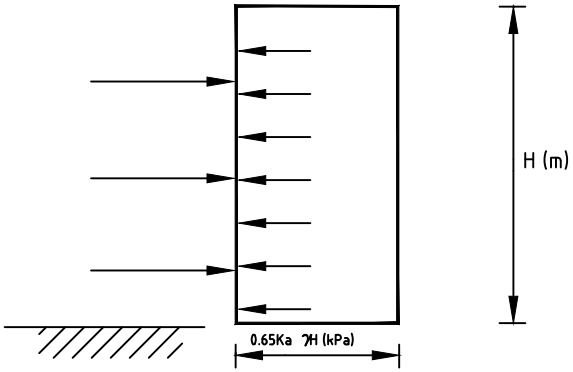
DRAFT

David B. Liu, P.Eng., Principal

DRAWINGS



BH1 Borehole Location AC1 Asphalt Core Location TP1 Test Pit Location	Client: Morrison Hershfield		Project No.: 16-1406	Drawing No.: 1
	Drawn: CC	Approved: DL	Title: Borehole and Core Location Plan	
	Date: December 2016	Scale: As shown	Project: Geotechnical Investigation for Passmore Avenue Road Improvements City of Toronto	
	Original Size: Letter	Rev: DL	GeoPro Consulting Limited	

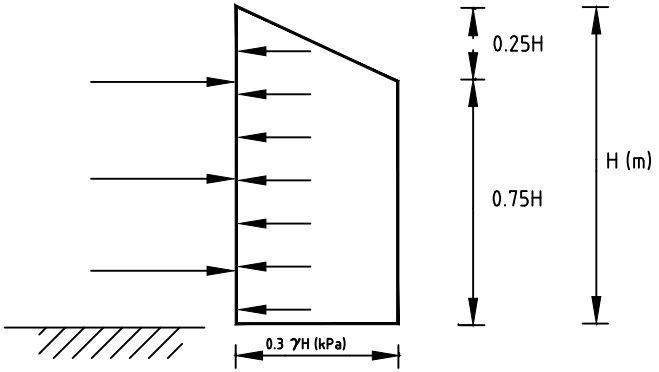


g = unit weight of soil = 21.0 kN/m^3

g' = submerged unit weight of soil (i.e. below ground water level)= 11.2 kN/m^3

Ka = 0.3

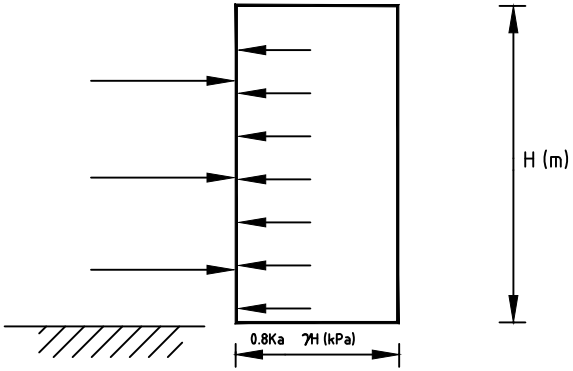
IN COMPACT TO VERY DENSE NON-COHESIVE SOILS (SANDS AND SILTS)



g = unit weight of soil = 21.5 kN/m^3

g' = submerged unit weight of soil (i.e. below ground water level)= 11.7 kN/m^3

IN COHESIVE CLAYS OR CLAYEY SOILS

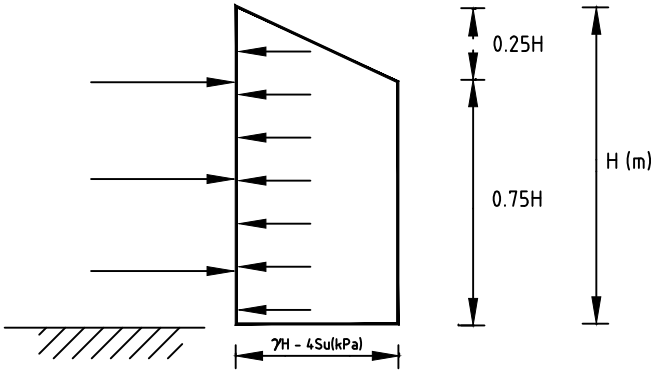


g = unit weight of soil = 19.0 kN/m^3

g' = submerged unit weight of soil (i.e. below ground water level)= 9.2 kN/m^3

Ka = 0.36

IN LOOSE OR DISTURBED NON-COHESIVE SOILS (SANDS AND SILTS)



γ = unit weight of soil = 19.0 kN/m^3

γ' = submerged unit weight of soil (i.e. below ground water level)= 9.2 kN/m^3

Su = 10 KPa

IN VERY SOFT TO FIRM COHESIVE CLAYS OR CLAYEY SOILS

Notes:
1. Check system for partial excavation condition.
2. If the free water level is above the base of the excavation, the hydrostatic pressure must be added to the above pressure distribution.
3. If surcharge loadings are present near the excavation, these must be included in the lateral pressure calculation.

Client:	**Morrison Hershfield**			Project No.: **16-1406**	Drawing No.: **2**
Drawn:	**TP**	Approved:	**DL**	Title:	**Earth Pressure Distribution on Braced Excavations**
Date:	**December 2016**	Scale:	**N.T.S**	Project:	**Geotechnical Investigation for Passmore Avenue Road Improvements City of Toronto**
Original Size:	**Letter**	Rev:	**DL**		GeoPro Consulting Limited

S:\Projects_Projects 2016\16-1406 MH Passmore Avenue Road Improvements Toronto\BH Plan & Drawing\16-1406 EARTH PRESSURE DISTRIBUTION ON BRACED EXCAVATIONS 20170112.dwg

ENCLOSURES

Enclosure 1A: Notes on Sample Descriptions

1. Each soil stratum is described according to the *Modified Unified Soil Classification System*. The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined according to Canadian Foundation Engineering Manual, 4th Edition. Different soil classification systems may be used by others. Please note that a description of the soil stratums is based on visual and tactile examination of the samples augmented with field and laboratory test results, such as a grain size analysis and/or Atterberg Limits testing. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

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Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Enclosure 1B: Explanation of Terms Used in the Record of Boreholes

Sample Type

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Dimension type sample
FS	Foil sample
NR	No recovery
RC	Rock core
SC	Soil core
SS	Spoon sample
SH	Shelby tube Sample
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

Penetration Resistance

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) required to drive a 50 mm (2 in) drive open sampler for a distance of 300 mm (12 in).

PM – Samples advanced by manual pressure
WR – Samples advanced by weight of sampler and rod
WH – Samples advanced by static weight of hammer

Dynamic Cone Penetration Resistance, N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) to drive uncased a 50 mm (2 in) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in).

Piezo-Cone Penetration Test (CPT):

An electronic cone penetrometer with a 60 degree conical tip and a projected end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurement of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

Textural Classification of Soils (ASTM D2487)

Classification	Particle Size
Boulders	> 300 mm
Cobbles	75 mm - 300 mm
Gravel	4.75 mm - 75 mm
Sand	0.075 mm – 4.75 mm
Silt	0.002 mm-0.075 mm
Clay	<0.002 mm(*)

(*) Canadian Foundation Engineering Manual (4th Edition)

Coarse Grain Soil Description (50% greater than 0.075 mm)

Terminology	Proportion
Trace	0-10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. sand and gravel)	> 35%

Soil Description

a) Cohesive Soils(*)

Consistency Value	Undrained Shear Strength (kPa)	SPT "N"
Very soft	<12	0-2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very stiff	100-200	15-30
Hard	>200	>30

(*) Hierarchy of Shear Strength prediction

1. Lab triaxial test
2. Field vane shear test
3. Lab. vane shear test
4. SPT "N" value
5. Pocket penetrometer

b) Cohesionless Soils

Density Index (Relative Density)	SPT "N" Value
Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Soil Tests

w	Water content
w_p	Plastic limit
w_l	Liquid limit
C	Consolidation (oedometer) test
CID	Consolidated isotropically drained triaxial test
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement
D_R	Relative density (specific gravity, Gs)
DS	Direct shear test
ENV	Environmental/ chemical analysis
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified proctor compaction test
SPC	Standard proctor compaction test
OC	Organic content test
U	Unconsolidated Undrained Triaxial Test
V	Field vane (LV-laboratory vane test)
γ	Unit weight

LOG OF BOREHOLE BH1

PROJECT: Geotechnical Investigation for Road Improvements
CLIENT: Morrison Hershfield
PROJECT LOCATION: Passmore Avenue, Toronto, ON
DATUM: N/A
BH LOCATION: See Borehole Location Plan

DRILLING DATA
Method: Continuous Flight Auger - Auto Hammer
Diameter: 155/205 mm
Date: Dec/09/2016

REF. NO.: 16-1406
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	Soil Head Space Vapors: PID (ppm)	Soil Head Space Vapors: CGI (ppm)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0 / 0.1	**ASPHALT CONCRETE:** (60 mm) / **GRANULAR BASE:** (290 mm)		1A	AS									
0.4	**GRANULAR SUBBASE:** (350 mm)		1B	AS									
0.7	**FILL:** silt, some sand, trace clay, trace rootlets, containing organics, black, moist, compact		2A	SS									
1.0	**FILL:** clayey silt, trace sand, trace organics, brown, moist, stiff		2B	SS	11								
1.4	**SAND AND SILT TILL:** some clay, trace gravel, trace cobbles and boulders, containing seams of sand, brown, moist, compact to very dense		3	SS	23								
			4	SS	50/125 mm								
			5	SS	50/150 mm								
	---becoming grey		6	SS	60								
			7	SS	53								
6.6	**END OF BOREHOLE** notes: 1) Borehole was open and dry upon completion of drilling.												

PID (ppm) scale: 2 4 6 8
CGI (ppm) scale: 1 2 3 4
WATER CONTENT (%) scale: 10 20 30

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH2

PROJECT: Geotechnical Investigation for Road Improvements
CLIENT: Morrison Hershfield
PROJECT LOCATION: Passmore Avenue, Toronto, ON
DATUM: N/A
BH LOCATION:

DRILLING DATA
Method: Continuous Flight Auger - Auto Hammer
Diameter: 155/205 mm
Date: Dec/09/2016

REF. NO.: 16-1406
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	Soil Head Space Vapors PID (ppm) 2 4 6 8	Soil Head Space Vapors CGI (ppm) 1 2 3 4	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (110 mm)												
0.1	**GRANULAR BASE:** (340 mm)		1A	AS			Concrete						
0.5	**GRANULAR SUBBASE:** (230 mm)		1B	AS									
0.7	**FILL:** clayey silt, trace sand, trace gravel, trace to some organics, brown to dark brown, moist, very stiff		2	SS	16								
1.4	**SAND AND SILT TILL:** some clay, trace gravel, trace cobbles and boulders, brown, moist, compact to dense		3	SS	30		Bentonite						
			4	SS	41								
			5	SS	37								
4.2	**SILTY SAND:** trace clay, trace gravel, brown, wet, dense		6	SS	33		W. L. 4.5 mBGL Dec 19, 2016 Sand Screen						
5.6	**SAND AND SILT TILL:** some clay, trace gravel, containing shale fragments, grey, moist, very dense		7	SS	71								
6.3	**SILTY SAND:** trace clay, trace gravel, brown, wet, very dense												
6.6	**END OF BOREHOLE**												

notes:
1) Water was at 5.5 m below ground surface (mBGS) upon completion of drilling.
2) Borehole was caved at 5.6 mBGS upon completion of drilling.
3) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading (mBGS):

Date	W.L. Depth
December 19, 2016	4.52

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +³, ×³: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH3

PROJECT: Geotechnical Investigation for Road Improvements
CLIENT: Morrison Hershfield
PROJECT LOCATION: Passmore Avenue, Toronto, ON
DATUM: N/A
BH LOCATION:

DRILLING DATA
Method: Continuous Flight Auger - Auto Hammer
Diameter: 155/205 mm
Date: Dec/09/2016

REF. NO.: 16-1406
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	PID (ppm)	CGI (ppm)	WATER CONTENT (%) PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (120 mm)												
0.1	**GRANULAR BASE:** (250 mm)		1A	AS			Concrete						
0.4	**GRANULAR SUBBASE:** (310 mm)		1B	AS									
0.7	**FILL:** sandy silt, trace clay, trace gravel, trace organics, containing pockets of clayey silt, brown, moist, compact		2	SS	16								
1.1	**SAND AND SILT TILL:** some clay, trace gravel, trace cobbles and boulders, containing pockets of sand, brown, moist, compact to very dense		3	SS	25		Bentonite						
			4	SS	50/125 mm	▽	W. L. 2.2 mBGL Dec 19, 2016						
			5	SS	50/150 mm								
	---becoming grey		6	SS	50/50 mm		Sand Screen						
			7	SS	50/120 mm								
6.2	**END OF BOREHOLE** notes: 1) Borehole was open and dry upon completion of drilling. Water Level Reading (mBGS): Date W.L. Depth December 19, 2016 2.18												

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^{3}$, $\times^{3}$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH4

PROJECT: Geotechnical Investigation for Road Improvements
CLIENT: Morrison Hershfield
PROJECT LOCATION: Passmore Avenue, Toronto, ON
DATUM: N/A
BH LOCATION:

DRILLING DATA
Method: Continuous Flight Auger - Auto Hammer
Diameter: 155/205 mm
Date: Dec/09/2016

REF. NO.: 16-1406
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
0.0	**ASPHALT CONCRETE:** (110 mm)					Concrete
0.1	**GRANULAR BASE:** (320 mm)	1A	AS			
0.4	**GRANULAR SUBBASE:** (240 mm)	1B	AS			
0.7	**FILL:** sandy silt to sand and silt, trace clay, trace gravel, containing shale fragments, containing pockets of clayey silt, brown, moist, compact	2	SS	26		
		3	SS	12		Bentonite
2.1	**SAND AND SILT TILL:** some to trace clay, trace gravel, containing cobbles and boulders, brown, moist, compact to very dense	4	SS	28		
		5	SS	84		
		6	SS	84		Sand / Screen
5.6	**SILTY SAND:** trace clay, trace gravel, containing pockets of sand, brown, wet, very dense	7	SS	50/150 mm		
6.4	**END OF BOREHOLE** notes: 1) Water was at 5.9 m below ground surface (mBGS) upon completion of drilling. 2) Borehole was open upon completion of drilling.					

Soil Head Space Vapors: PID (ppm) 2 4 6 8; CGI (ppm) 1 2 3 4

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ε=3% Strain at Failure

FIGURES

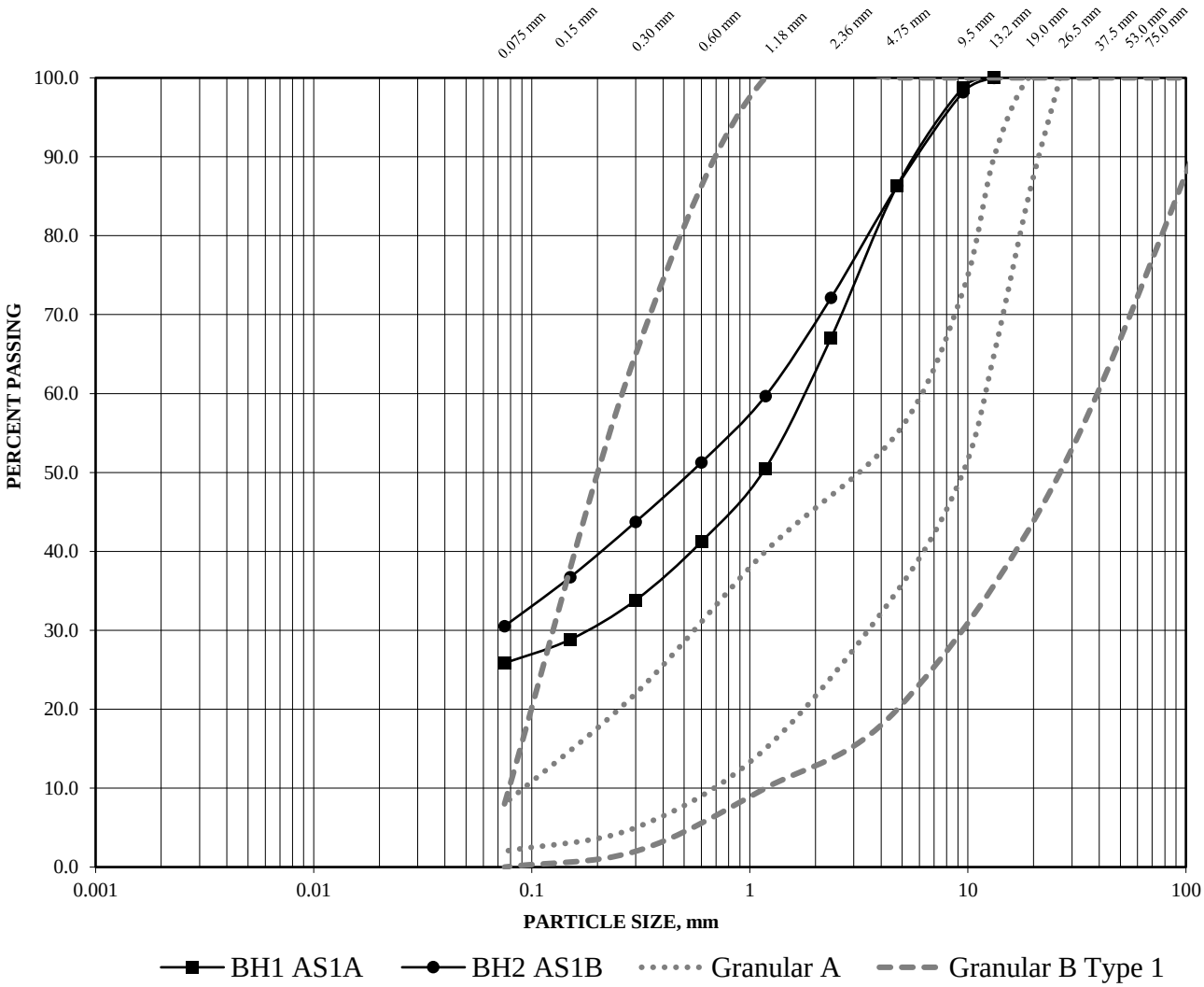
GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Figure 1

PARTICLE SIZE DISTRIBUTION

U.S. BUREAU	CLAY	SILT			VERY FINE SAND	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	GRAVEL		
UNIFIED	FINES (SILT & CLAY)					FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL	COBBLES	
M.I.T.	CLAY	SILT			SAND			GRAVEL			COBBLES	
		FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE					



Project No.	16-1406
Project Name	Passmore Avenue Road Improvements, Toronto

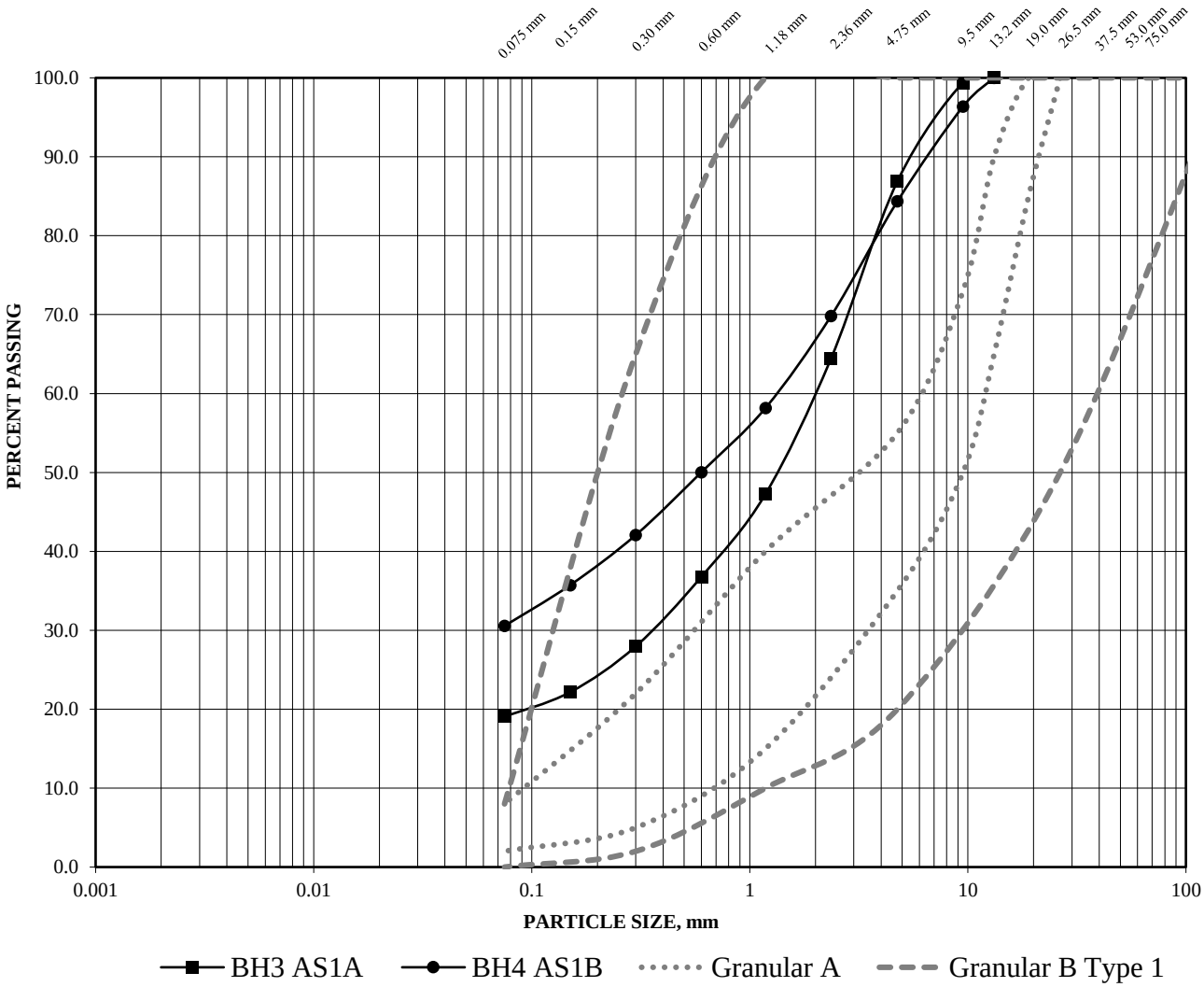
GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Figure 2

PARTICLE SIZE DISTRIBUTION

U.S. BUREAU	CLAY	SILT			VERY FINE SAND	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	GRAVEL		
UNIFIED	FINES (SILT & CLAY)					FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL	COBBLES	
M.I.T.	CLAY	SILT			SAND			GRAVEL			COBBLES	
		FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE					



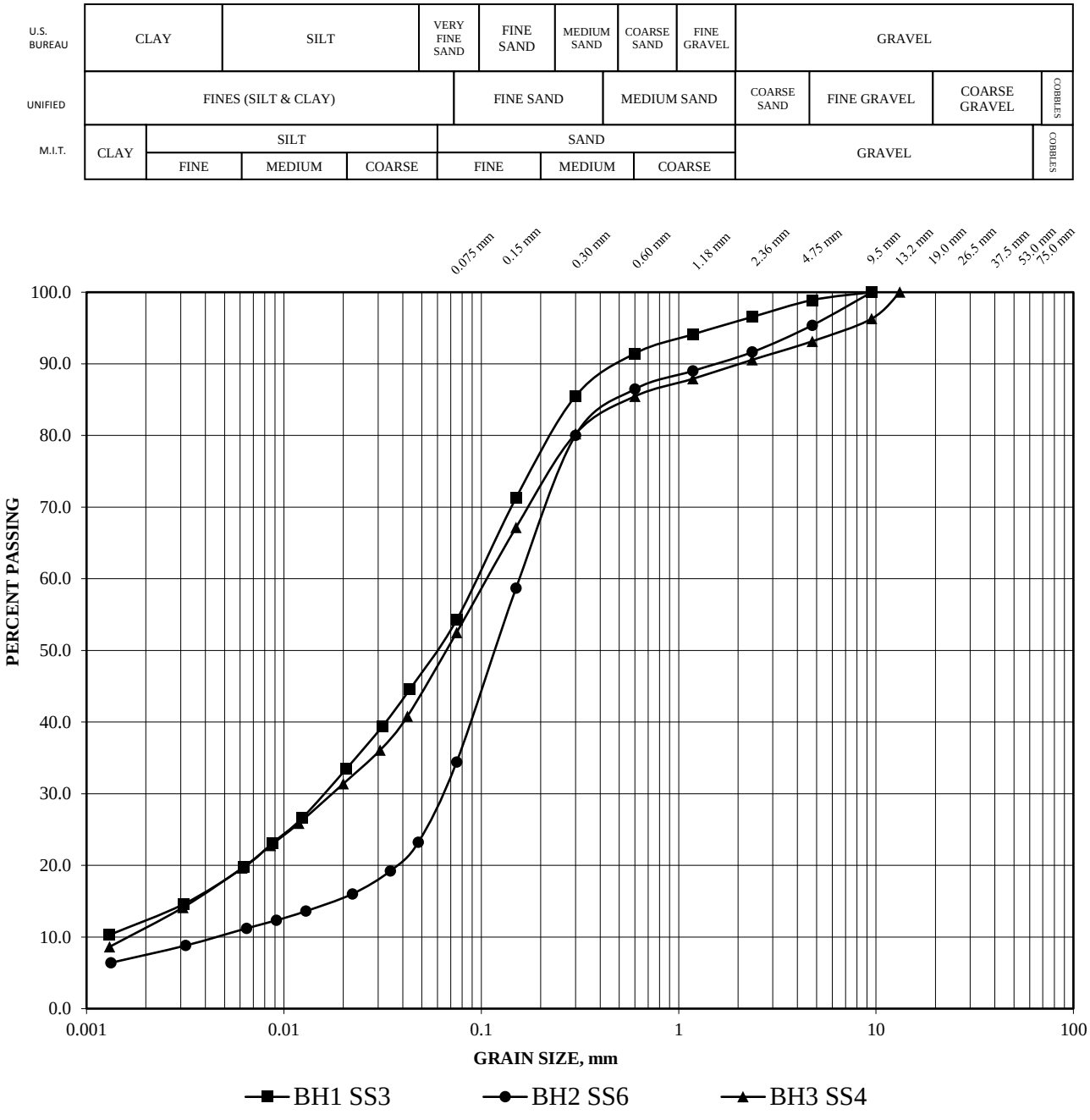
Project No.	16-1406
Project Name	Passmore Avenue Road Improvements, Toronto

GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Figure 3

GRAIN SIZE DISTRIBUTION



Project No.	16-1406
Project Name	Passmore Avenue Road Improvements, Toronto

APPENDIX A

Photograph 1 – Passmore Avenue, about 80 m west of Markham Road, looking west, showing moderate to severe alligator cracking, moderate to severe transverse cracking and moderate pavement edge breaks.

Photograph 2 – Passmore Avenue, about 20 m east of Dynamic Drive, looking west, showing moderate alligator cracking, moderate longitudinal and transverse cracking, severe pavement edge breaks.

Photograph 3 – Passmore Avenue, about 10 m east of Dynamic Drive, looking east, showing moderate alligator cracking, moderate to severe longitudinal and transverse cracking, moderate to severe pavement edge breaks and slight patching.

Photograph 4 – Passmore Avenue, about 95 m west of Dynamic Drive, looking west, showing moderate to severe edge cracking, moderate wheel rutting, slight alligator cracking, moderate longitudinal cracking, slight to moderate patching. Noting that water ponded on the shoulder without ditch observed.

Photograph 5 – Passmore Avenue, about 140 m west of Dynamic Drive, looking south, showing severe alligator cracking, severe distortion, slight to moderate patching, severe alligator cracking and pothole around maintenance hole. Noting that water ponded on the roadway and shoulder without ditch observed.

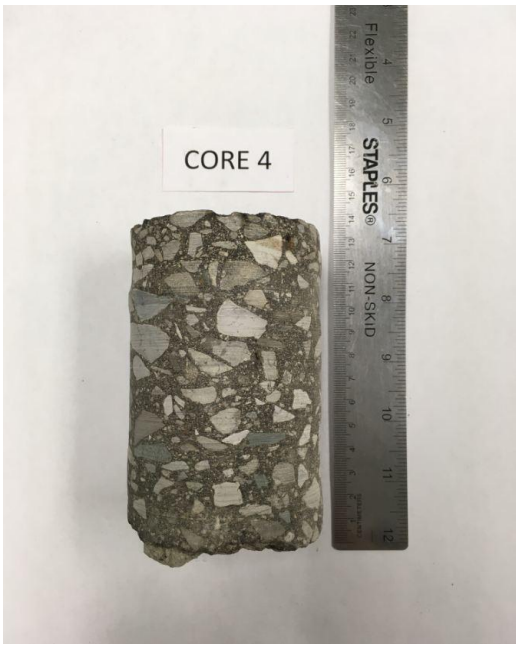
Photograph 6 – Passmore Avenue, about 200 m west of Dynamic Drive, looking north, showing slight longitudinal and transverse cracking, slight patching and moderate alligator cracking around maintenance hole.

APPENDIX B

Photograph 1 – AC Core 1

Photograph 2 – AC Core 2

Photograph 3 – AC Core 3



Photograph 4 – AC Core 4

Photograph 5 – AC Core 5

Photograph 6 – AC Core 6

Photograph 7 – AC Core 7

Photograph 8 – AC Core 8

Photograph 9 – AC Core 9

APPENDIX C

AGAT Laboratories

6310 ROPER ROAD
EDMONTON, ALBERTA
CANADA T6B 3P9
TEL (780)395-2525
FAX (780)462-2490
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
40 VOGELL ROAD UNIT 25-27
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1406

AGAT WORK ORDER: 16T174219

ASBESTOS REVIEWED BY: Whenhong Zou, Lab Analyst

DATE REPORTED: Jan 09, 2017

PAGES (INCLUDING COVER): 4

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (780) 395-2525

*NOTES

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

AGAT Laboratories

6310 ROPER ROAD
EDMONTON, ALBERTA
CANADA T6B 3P9
TEL (780)395-2525
FAX (780)462-2490
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 16T174219

PROJECT: 16-1406

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Clement

Bulk Asbestos

DATE RECEIVED: 2016-12-28

DATE REPORTED: 2017-01-09

Parameter	Unit	G / S	RDL	AC-1	AC-2	AC-3	AC-4	AC-5	AC-6	AC-7	AC-8
SAMPLE DESCRIPTION:				AC-1	AC-2	AC-3	AC-4	AC-5	AC-6	AC-7	AC-8
SAMPLE TYPE:				Asphalt	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt
DATE SAMPLED:				2016-12-09	2016-12-09	2016-12-09	2016-12-09	2016-12-09	2016-12-09	2016-12-09	2016-12-09
Asbestos (Bulk)	%		0.5	ND	0.9	0.7	0.7	<0.5	0.8	0.7	<0.5

Parameter	Unit	G / S	RDL	AC-9
SAMPLE DESCRIPTION:				AC-9
SAMPLE TYPE:				Asphalt
DATE SAMPLED:				2016-12-09
Asbestos (Bulk)	%		0.5	<0.5

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

8111523 Condition of sample was satisfactory at time of arrival in laboratory. Analysis done at AGAT 5623 McAdam Road Mississauga location.

"ND" - Not Detected

8111537-8111539 Condition of sample was satisfactory at time of arrival in laboratory. Analysis done at AGAT 5623 McAdam Road Mississauga location.

Asbestos Present: Chrysotile

8111540 Condition of sample was satisfactory at time of arrival in laboratory. Analysis done at AGAT 5623 McAdam Road Mississauga location.

A reported concentration of "<0.5%" indicates the presence of confirmed asbestos in trace quantities less than the RDL.

Asbestos Present: Chrysotile

8111541-8111542 Condition of sample was satisfactory at time of arrival in laboratory. Analysis done at AGAT 5623 McAdam Road Mississauga location.

Asbestos Present: Chrysotile

8111543-8111544 Condition of sample was satisfactory at time of arrival in laboratory. Analysis done at AGAT 5623 McAdam Road Mississauga location.

A reported concentration of "<0.5%" indicates the presence of confirmed asbestos in trace quantities less than the RDL.

Asbestos Present: Chrysotile

Certified By: Wenhong Zou

AGAT Laboratories

6310 ROPER ROAD
EDMONTON, ALBERTA
CANADA T6B 3P9
TEL (780)395-2525
FAX (780)462-2490
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 16T174219

PROJECT: 16-1406

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:Clement

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Asbestos (Bulk)	INORG 93-6010	EPA 600/R-93/116 & NIOSH 9002	PLM

AGAT Laboratories

1 Bag

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water intended for human consumption)

Report Information:

Company: GeoPro Consulting Limited
Contact: Bujing Guan
Address: Unit 37, 40 Vogell Road, Richmond Hill, Ontario
Phone: 905-237-8336 Fax: 905-248-3699
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: jessica@geoproconsulting.ca

Project Information:

Project: 16-1406
Site Location: Toronto
Sampled By: Clement
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☐ No ☐
Company:
Contact:
Address:
Email:

Regulatory Requirements:

☐ No Regulatory Requirement
(Please check all applicable boxes)

☐ Regulation 153/04
Table _____ *Indicate One*
☐ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture *(Check One)*
☐ Coarse
☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region _____ *Indicate One*

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
_____ *Indicate One*

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

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Laboratory Use Only

Work Order #: 16T174219
Cooler Quantity:
Arrival Temperatures:
Custody Seal Intact: ☐Yes ☐No ☐N/A
Notes:

Turnaround Time (TAT) Required:

Regular TAT ☐ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ 1 Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

Sample Matrix Legend

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions
AC-1	09/12/2016	AM	1 Bag	Asphalt	
AC-2					
AC-3					
AC-4					
AC-5					
AC-6					
AC-7					
AC-8					
AC-9					

(Check Applicable)

Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	ORPs: ☐B-HWS ☐Cr ☐CN ☐Cr^{6+} ☐EC ☐FOC ☐NO_3/NO_2 ☐Total N ☐Hg ☐pH ☐SAR	Nutrients: ☐TP ☐NH_3 ☐TKN ☐NO_3 ☐NO_2 ☐NO_3/NO_2	Volatiles: ☐VOC ☐BTEX ☐THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use	Asphalt for Asbestos
															X

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
[signature]	2016/12/28		[signature]	2016/12/28	2:15
[signature]	2016/12/28	4:35	Milan [signature]	Dec. 28/16	4:40pm

Page _____ of _____

AGAT WO: T 020630

APPENDIX D

TRAFFIC DATA AND ESTIMATED ESALs
Passmore Avenue
(From Markham Road to 450 m West of Markham Road)

Year	Annual Average Daily Traffic	Estimated Cumulative Annual ESALs
2016	8,475	-
2017	8,645	-
2018	8,817	128,400
2019	8,994	259,400
2020	9,174	393,000
2021	9,357	529,300
2022	9,544	668,300
2023	9,735	810,100
2024	9,930	954,700
2025	10,128	1,102,200
2026	10,331	1,252,700
2027	10,538	1,406,200
2028	10,748	1,562,800
2029	10,963	1,722,500
2030	11,183	1,885,400
2031	11,406	2,051,500
2032	11,634	2,221,000

Directional Factor (DF)	0.5
Lane Distribution Factor (LDF)	0.9
Combined Truck Factor (CTF)	0.74
Percent Commercial Vehicles	14.0%
Days Per Year For Truck Traffic	312

APPENDIX E

Morrison Hershfield Limited (Ottawa)
ATTN: CINDY ZHAO
235 Yorkland Blvd
Suite 600
Toronto ON M2J 1T1

Date Received: 12-DEC-16
Report Date: 19-DEC-16 13:52 (MT)
Version: FINAL

Client Phone: 416-499-3110

Certificate of Analysis

Lab Work Order #: L1869032

Project P.O. #: NOT SUBMITTED
Job Reference: 1160509
C of C Numbers: 15-573799
Legal Site Desc:

Mary-Lynn Pires
Client Services Supervisor

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1869032-1 BH1-SS2 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Physical Tests							
% Moisture	25.9		0.10	%	14-DEC-16	14-DEC-16	R3617125
Saturated Paste Extractables							
SAR	4.79		0.10	SAR		19-DEC-16	R3619976
Calcium (Ca)	145		1.0	mg/L		19-DEC-16	R3619976
Magnesium (Mg)	7.7		1.0	mg/L		19-DEC-16	R3619976
Sodium (Na)	218		1.0	mg/L		19-DEC-16	R3619976
Metals							
Antimony (Sb)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Arsenic (As)	3.2		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Barium (Ba)	158		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Beryllium (Be)	0.96		0.50	ug/g	16-DEC-16	16-DEC-16	R3619972
Boron (B)	9.6		5.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Cadmium (Cd)	<0.50		0.50	ug/g	16-DEC-16	16-DEC-16	R3619972
Chromium (Cr)	31.1		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Cobalt (Co)	8.6		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Copper (Cu)	29.1		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Lead (Pb)	11.4		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Molybdenum (Mo)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Nickel (Ni)	21.1		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Selenium (Se)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Silver (Ag)	<0.20		0.20	ug/g	16-DEC-16	16-DEC-16	R3619972
Thallium (Tl)	<0.50		0.50	ug/g	16-DEC-16	16-DEC-16	R3619972
Uranium (U)	1.6		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Vanadium (V)	46.2		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Zinc (Zn)	71.3		5.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Acenaphthylene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Anthracene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(a)anthracene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(a)pyrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(b)fluoranthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(g,h,i)perylene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(k)fluoranthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Chrysene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Dibenzo(ah)anthracene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Fluoranthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Fluorene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Indeno(1,2,3-cd)pyrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
1+2-Methylnaphthalenes	<0.042		0.042	ug/g		19-DEC-16	
1-Methylnaphthalene	<0.030		0.030	ug/g	13-DEC-16	19-DEC-16	R3619836
2-Methylnaphthalene	<0.030		0.030	ug/g	13-DEC-16	19-DEC-16	R3619836

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1869032-1 BH1-SS2 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Polycyclic Aromatic Hydrocarbons							
Naphthalene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Phenanthrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Pyrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Surrogate: 2-Fluorobiphenyl	94.9		50-140	%	13-DEC-16	19-DEC-16	R3619836
Surrogate: p-Terphenyl d14	91.9		50-140	%	13-DEC-16	19-DEC-16	R3619836
L1869032-2 BH1-SS6 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Physical Tests							
% Moisture	5.88		0.10	%	14-DEC-16	14-DEC-16	R3617125
Volatile Organic Compounds							
Acetone	<0.50		0.50	ug/g	13-DEC-16	14-DEC-16	R3616921
Benzene	<0.0068		0.0068	ug/g	13-DEC-16	14-DEC-16	R3616921
Bromodichloromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Bromoform	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Bromomethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Carbon tetrachloride	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Chlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Dibromochloromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Chloroform	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dibromoethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dichlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,3-Dichlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,4-Dichlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Dichlorodifluoromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1-Dichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1-Dichloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Methylene Chloride	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dichloropropane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
cis-1,3-Dichloropropene	<0.030		0.030	ug/g	13-DEC-16	14-DEC-16	R3616921
trans-1,3-Dichloropropene	<0.030		0.030	ug/g	13-DEC-16	14-DEC-16	R3616921
1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g		15-DEC-16	
Ethylbenzene	<0.018		0.018	ug/g	13-DEC-16	14-DEC-16	R3616921
n-Hexane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Methyl Ethyl Ketone	<0.50		0.50	ug/g	13-DEC-16	14-DEC-16	R3616921
Methyl Isobutyl Ketone	<0.50		0.50	ug/g	13-DEC-16	14-DEC-16	R3616921
MTBE	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Styrene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1869032-2 BH1-SS6 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Volatile Organic Compounds							
1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Tetrachloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Toluene	<0.080		0.080	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,1-Trichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,2-Trichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Trichloroethylene	<0.010		0.010	ug/g	13-DEC-16	14-DEC-16	R3616921
Trichlorofluoromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Vinyl chloride	<0.020		0.020	ug/g	13-DEC-16	14-DEC-16	R3616921
o-Xylene	<0.020		0.020	ug/g	13-DEC-16	14-DEC-16	R3616921
m+p-Xylenes	<0.030		0.030	ug/g	13-DEC-16	14-DEC-16	R3616921
Xylenes (Total)	<0.050		0.050	ug/g		15-DEC-16	
Surrogate: 4-Bromofluorobenzene	87.1		50-140	%	13-DEC-16	14-DEC-16	R3616921
Surrogate: 1,4-Difluorobenzene	96.1		50-140	%	13-DEC-16	14-DEC-16	R3616921
Hydrocarbons							
F1 (C6-C10)	<5.0		5.0	ug/g	13-DEC-16	15-DEC-16	R3616921
F1-BTEX	<5.0		5.0	ug/g		19-DEC-16	
F2 (C10-C16)	11		10	ug/g	13-DEC-16	16-DEC-16	R3618520
F3 (C16-C34)	55		50	ug/g	13-DEC-16	16-DEC-16	R3618520
F4 (C34-C50)	<50		50	ug/g	13-DEC-16	16-DEC-16	R3618520
Total Hydrocarbons (C6-C50)	<72		72	ug/g		19-DEC-16	
Chrom. to baseline at nC50	YES				13-DEC-16	16-DEC-16	R3618520
Surrogate: 2-Bromobenzotrifluoride	88.6		60-140	%	13-DEC-16	16-DEC-16	R3618520
Surrogate: 3,4-Dichlorotoluene	96.7		60-140	%	13-DEC-16	15-DEC-16	R3616921
L1869032-3 BH2-SS2A Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Physical Tests							
% Moisture	17.1		0.10	%	14-DEC-16	14-DEC-16	R3617125
Saturated Paste Extractables							
SAR	46.5		0.10	SAR		19-DEC-16	R3619976
Calcium (Ca)	12.3		1.0	mg/L		19-DEC-16	R3619976
Magnesium (Mg)	2.9		1.0	mg/L		19-DEC-16	R3619976
Sodium (Na)	699		1.0	mg/L		19-DEC-16	R3619976
Metals							
Antimony (Sb)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Arsenic (As)	4.2		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Barium (Ba)	147		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Beryllium (Be)	1.04		0.50	ug/g	16-DEC-16	16-DEC-16	R3619972
Boron (B)	9.4		5.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Cadmium (Cd)	<0.50		0.50	ug/g	16-DEC-16	16-DEC-16	R3619972
Chromium (Cr)	32.4		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Cobalt (Co)	9.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1869032-3 BH2-SS2A Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Metals							
Copper (Cu)	22.1		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Lead (Pb)	11.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Molybdenum (Mo)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Nickel (Ni)	21.3		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Selenium (Se)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Silver (Ag)	<0.20		0.20	ug/g	16-DEC-16	16-DEC-16	R3619972
Thallium (Tl)	<0.50		0.50	ug/g	16-DEC-16	16-DEC-16	R3619972
Uranium (U)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Vanadium (V)	43.8		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Zinc (Zn)	56.1		5.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Acenaphthylene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Anthracene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(a)anthracene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(a)pyrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(b)fluoranthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(g,h,i)perylene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(k)fluoranthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Chrysene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Dibenzo(ah)anthracene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Fluoranthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Fluorene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Indeno(1,2,3-cd)pyrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
1+2-Methylnaphthalenes	<0.042		0.042	ug/g		19-DEC-16	
1-Methylnaphthalene	<0.030		0.030	ug/g	13-DEC-16	19-DEC-16	R3619836
2-Methylnaphthalene	<0.030		0.030	ug/g	13-DEC-16	19-DEC-16	R3619836
Naphthalene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Phenanthrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Pyrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Surrogate: 2-Fluorobiphenyl	94.4		50-140	%	13-DEC-16	19-DEC-16	R3619836
Surrogate: p-Terphenyl d14	92.2		50-140	%	13-DEC-16	19-DEC-16	R3619836
L1869032-4 BH2-SS5 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Physical Tests							
% Moisture	8.97		0.10	%	14-DEC-16	14-DEC-16	R3617125
Volatile Organic Compounds							
Acetone	<0.50		0.50	ug/g	13-DEC-16	14-DEC-16	R3616921
Benzene	<0.0068		0.0068	ug/g	13-DEC-16	14-DEC-16	R3616921
Bromodichloromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Bromoform	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1869032-4 BH2-SS5 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Volatile Organic Compounds							
Bromomethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Carbon tetrachloride	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Chlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Dibromochloromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Chloroform	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dibromoethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dichlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,3-Dichlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,4-Dichlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Dichlorodifluoromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1-Dichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1-Dichloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Methylene Chloride	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dichloropropane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
cis-1,3-Dichloropropene	<0.030		0.030	ug/g	13-DEC-16	14-DEC-16	R3616921
trans-1,3-Dichloropropene	<0.030		0.030	ug/g	13-DEC-16	14-DEC-16	R3616921
1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g		15-DEC-16	
Ethylbenzene	<0.018		0.018	ug/g	13-DEC-16	14-DEC-16	R3616921
n-Hexane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Methyl Ethyl Ketone	<0.50		0.50	ug/g	13-DEC-16	14-DEC-16	R3616921
Methyl Isobutyl Ketone	<0.50		0.50	ug/g	13-DEC-16	14-DEC-16	R3616921
MTBE	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Styrene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Tetrachloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Toluene	<0.080		0.080	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,1-Trichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,2-Trichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Trichloroethylene	<0.010		0.010	ug/g	13-DEC-16	14-DEC-16	R3616921
Trichlorofluoromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Vinyl chloride	<0.020		0.020	ug/g	13-DEC-16	14-DEC-16	R3616921
o-Xylene	<0.020		0.020	ug/g	13-DEC-16	14-DEC-16	R3616921
m+p-Xylenes	<0.030		0.030	ug/g	13-DEC-16	14-DEC-16	R3616921
Xylenes (Total)	<0.050		0.050	ug/g		15-DEC-16	
Surrogate: 4-Bromofluorobenzene	91.2		50-140	%	13-DEC-16	14-DEC-16	R3616921
Surrogate: 1,4-Difluorobenzene	102.1		50-140	%	13-DEC-16	14-DEC-16	R3616921
Hydrocarbons							

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1869032-4 BH2-SS5 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Hydrocarbons							
F1 (C6-C10)	<5.0		5.0	ug/g	13-DEC-16	15-DEC-16	R3616921
F1-BTEX	<5.0		5.0	ug/g		19-DEC-16	
F2 (C10-C16)	<10		10	ug/g	13-DEC-16	16-DEC-16	R3618520
F3 (C16-C34)	<50		50	ug/g	13-DEC-16	16-DEC-16	R3618520
F4 (C34-C50)	<50		50	ug/g	13-DEC-16	16-DEC-16	R3618520
Total Hydrocarbons (C6-C50)	<72		72	ug/g		19-DEC-16	
Chrom. to baseline at nC50	YES				13-DEC-16	16-DEC-16	R3618520
Surrogate: 2-Bromobenzotrifluoride	86.1		60-140	%	13-DEC-16	16-DEC-16	R3618520
Surrogate: 3,4-Dichlorotoluene	103.8		60-140	%	13-DEC-16	15-DEC-16	R3616921
L1869032-5 BH3-SS3 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Physical Tests							
% Moisture	8.28		0.10	%	14-DEC-16	14-DEC-16	R3617125
Saturated Paste Extractables							
SAR	>55.	SAR:L	0.10	SAR		19-DEC-16	R3619976
Calcium (Ca)	<1.0		1.0	mg/L		19-DEC-16	R3619976
Magnesium (Mg)	<1.0		1.0	mg/L		19-DEC-16	R3619976
Sodium (Na)	323		1.0	mg/L		19-DEC-16	R3619976
Metals							
Antimony (Sb)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Arsenic (As)	2.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Barium (Ba)	31.9		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Beryllium (Be)	<0.50		0.50	ug/g	16-DEC-16	16-DEC-16	R3619972
Boron (B)	<5.0		5.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Cadmium (Cd)	<0.50		0.50	ug/g	16-DEC-16	16-DEC-16	R3619972
Chromium (Cr)	9.8		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Cobalt (Co)	4.3		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Copper (Cu)	9.1		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Lead (Pb)	4.7		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Molybdenum (Mo)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Nickel (Ni)	8.8		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Selenium (Se)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Silver (Ag)	<0.20		0.20	ug/g	16-DEC-16	16-DEC-16	R3619972
Thallium (Tl)	<0.50		0.50	ug/g	16-DEC-16	16-DEC-16	R3619972
Uranium (U)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Vanadium (V)	19.2		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Zinc (Zn)	21.8		5.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Acenaphthylene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Anthracene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1869032-5 BH3-SS3 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Polycyclic Aromatic Hydrocarbons							
Benzo(a)anthracene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(a)pyrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(b)fluoranthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(g,h,i)perylene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(k)fluoranthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Chrysene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Dibenzo(ah)anthracene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Fluoranthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Fluorene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Indeno(1,2,3-cd)pyrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
1+2-Methylnaphthalenes	<0.042		0.042	ug/g		19-DEC-16	
1-Methylnaphthalene	<0.030		0.030	ug/g	13-DEC-16	19-DEC-16	R3619836
2-Methylnaphthalene	<0.030		0.030	ug/g	13-DEC-16	19-DEC-16	R3619836
Naphthalene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Phenanthrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Pyrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Surrogate: 2-Fluorobiphenyl	91.1		50-140	%	13-DEC-16	19-DEC-16	R3619836
Surrogate: p-Terphenyl d14	87.3		50-140	%	13-DEC-16	19-DEC-16	R3619836
L1869032-6 BH3-SS6 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Physical Tests							
% Moisture	6.93		0.10	%	14-DEC-16	14-DEC-16	R3617125
Volatile Organic Compounds							
Acetone	<0.50		0.50	ug/g	13-DEC-16	14-DEC-16	R3616921
Benzene	<0.0068		0.0068	ug/g	13-DEC-16	14-DEC-16	R3616921
Bromodichloromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Bromoform	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Bromomethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Carbon tetrachloride	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Chlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Dibromochloromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Chloroform	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dibromoethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dichlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,3-Dichlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,4-Dichlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Dichlorodifluoromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1-Dichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1-Dichloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1869032-6 BH3-SS6 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Volatile Organic Compounds							
trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Methylene Chloride	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dichloropropane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
cis-1,3-Dichloropropene	<0.030		0.030	ug/g	13-DEC-16	14-DEC-16	R3616921
trans-1,3-Dichloropropene	<0.030		0.030	ug/g	13-DEC-16	14-DEC-16	R3616921
1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g		15-DEC-16	
Ethylbenzene	<0.018		0.018	ug/g	13-DEC-16	14-DEC-16	R3616921
n-Hexane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Methyl Ethyl Ketone	<0.50		0.50	ug/g	13-DEC-16	14-DEC-16	R3616921
Methyl Isobutyl Ketone	<0.50		0.50	ug/g	13-DEC-16	14-DEC-16	R3616921
MTBE	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Styrene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Tetrachloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Toluene	<0.080		0.080	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,1-Trichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,2-Trichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Trichloroethylene	<0.010		0.010	ug/g	13-DEC-16	14-DEC-16	R3616921
Trichlorofluoromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Vinyl chloride	<0.020		0.020	ug/g	13-DEC-16	14-DEC-16	R3616921
o-Xylene	<0.020		0.020	ug/g	13-DEC-16	14-DEC-16	R3616921
m+p-Xylenes	<0.030		0.030	ug/g	13-DEC-16	14-DEC-16	R3616921
Xylenes (Total)	<0.050		0.050	ug/g		15-DEC-16	
Surrogate: 4-Bromofluorobenzene	92.4		50-140	%	13-DEC-16	14-DEC-16	R3616921
Surrogate: 1,4-Difluorobenzene	105.1		50-140	%	13-DEC-16	14-DEC-16	R3616921
Hydrocarbons							
F1 (C6-C10)	<5.0		5.0	ug/g	13-DEC-16	15-DEC-16	R3616921
F1-BTEX	<5.0		5.0	ug/g		19-DEC-16	
F2 (C10-C16)	12		10	ug/g	13-DEC-16	16-DEC-16	R3618520
F3 (C16-C34)	57		50	ug/g	13-DEC-16	16-DEC-16	R3618520
F4 (C34-C50)	<50		50	ug/g	13-DEC-16	16-DEC-16	R3618520
Total Hydrocarbons (C6-C50)	<72		72	ug/g		19-DEC-16	
Chrom. to baseline at nC50	YES				13-DEC-16	16-DEC-16	R3618520
Surrogate: 2-Bromobenzotrifluoride	87.0		60-140	%	13-DEC-16	16-DEC-16	R3618520
Surrogate: 3,4-Dichlorotoluene	108.0		60-140	%	13-DEC-16	15-DEC-16	R3616921
L1869032-7 BH4-SS2 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Physical Tests							
% Moisture	8.13		0.10	%	14-DEC-16	14-DEC-16	R3617125
Saturated Paste Extractables							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1869032-7 BH4-SS2 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Saturated Paste Extractables							
SAR	24.8	SAR:M	0.10	SAR		19-DEC-16	R3619976
Calcium (Ca)	4.5		1.0	mg/L		19-DEC-16	R3619976
Magnesium (Mg)	<1.0		1.0	mg/L		19-DEC-16	R3619976
Sodium (Na)	191		1.0	mg/L		19-DEC-16	R3619976
Metals							
Antimony (Sb)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Arsenic (As)	2.1		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Barium (Ba)	36.7		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Beryllium (Be)	<0.50		0.50	ug/g	16-DEC-16	16-DEC-16	R3619972
Boron (B)	5.4		5.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Cadmium (Cd)	<0.50		0.50	ug/g	16-DEC-16	16-DEC-16	R3619972
Chromium (Cr)	13.2		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Cobalt (Co)	4.6		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Copper (Cu)	10.4		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Lead (Pb)	5.7		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Molybdenum (Mo)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Nickel (Ni)	10.1		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Selenium (Se)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Silver (Ag)	<0.20		0.20	ug/g	16-DEC-16	16-DEC-16	R3619972
Thallium (Tl)	<0.50		0.50	ug/g	16-DEC-16	16-DEC-16	R3619972
Uranium (U)	<1.0		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Vanadium (V)	24.6		1.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Zinc (Zn)	26.1		5.0	ug/g	16-DEC-16	16-DEC-16	R3619972
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Acenaphthylene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Anthracene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(a)anthracene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(a)pyrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(b)fluoranthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(g,h,i)perylene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Benzo(k)fluoranthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Chrysene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Dibenzo(ah)anthracene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Fluoranthene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Fluorene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Indeno(1,2,3-cd)pyrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
1+2-Methylnaphthalenes	<0.042		0.042	ug/g		19-DEC-16	
1-Methylnaphthalene	<0.030		0.030	ug/g	13-DEC-16	19-DEC-16	R3619836
2-Methylnaphthalene	<0.030		0.030	ug/g	13-DEC-16	19-DEC-16	R3619836
Naphthalene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1869032-7 BH4-SS2 Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Polycyclic Aromatic Hydrocarbons							
Phenanthrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Pyrene	<0.050		0.050	ug/g	13-DEC-16	19-DEC-16	R3619836
Surrogate: 2-Fluorobiphenyl	89.6		50-140	%	13-DEC-16	19-DEC-16	R3619836
Surrogate: p-Terphenyl d14	86.3		50-140	%	13-DEC-16	19-DEC-16	R3619836
L1869032-8 BH4-SS6 Sampled By: CLIENT on 09-DEC-16 @ 17:00 Matrix: SOIL							
Physical Tests							
% Moisture	7.18		0.10	%	14-DEC-16	14-DEC-16	R3617125
Volatile Organic Compounds							
Acetone	<0.50		0.50	ug/g	13-DEC-16	14-DEC-16	R3616921
Benzene	<0.0068		0.0068	ug/g	13-DEC-16	14-DEC-16	R3616921
Bromodichloromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Bromoform	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Bromomethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Carbon tetrachloride	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Chlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Dibromochloromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Chloroform	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dibromoethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dichlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,3-Dichlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,4-Dichlorobenzene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Dichlorodifluoromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1-Dichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1-Dichloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
cis-1,2-Dichloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
trans-1,2-Dichloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Methylene Chloride	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,2-Dichloropropane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
cis-1,3-Dichloropropene	<0.030		0.030	ug/g	13-DEC-16	14-DEC-16	R3616921
trans-1,3-Dichloropropene	<0.030		0.030	ug/g	13-DEC-16	14-DEC-16	R3616921
1,3-Dichloropropene (cis & trans)	<0.042		0.042	ug/g		15-DEC-16	
Ethylbenzene	<0.018		0.018	ug/g	13-DEC-16	14-DEC-16	R3616921
n-Hexane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Methyl Ethyl Ketone	<0.50		0.50	ug/g	13-DEC-16	14-DEC-16	R3616921
Methyl Isobutyl Ketone	<0.50		0.50	ug/g	13-DEC-16	14-DEC-16	R3616921
MTBE	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Styrene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,1,2-Tetrachloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,2,2-Tetrachloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1869032-8 BH4-SS6 Sampled By: CLIENT on 09-DEC-16 @ 17:00 Matrix: SOIL							
Volatile Organic Compounds							
Tetrachloroethylene	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Toluene	<0.080		0.080	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,1-Trichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
1,1,2-Trichloroethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Trichloroethylene	<0.010		0.010	ug/g	13-DEC-16	14-DEC-16	R3616921
Trichlorofluoromethane	<0.050		0.050	ug/g	13-DEC-16	14-DEC-16	R3616921
Vinyl chloride	<0.020		0.020	ug/g	13-DEC-16	14-DEC-16	R3616921
o-Xylene	<0.020		0.020	ug/g	13-DEC-16	14-DEC-16	R3616921
m+p-Xylenes	<0.030		0.030	ug/g	13-DEC-16	14-DEC-16	R3616921
Xylenes (Total)	<0.050		0.050	ug/g		15-DEC-16	
Surrogate: 4-Bromofluorobenzene	92.3		50-140	%	13-DEC-16	14-DEC-16	R3616921
Surrogate: 1,4-Difluorobenzene	103.0		50-140	%	13-DEC-16	14-DEC-16	R3616921
Hydrocarbons							
F1 (C6-C10)	<5.0		5.0	ug/g	13-DEC-16	15-DEC-16	R3616921
F1-BTEX	<5.0		5.0	ug/g		19-DEC-16	
F2 (C10-C16)	<10		10	ug/g	13-DEC-16	16-DEC-16	R3618520
F3 (C16-C34)	<50		50	ug/g	13-DEC-16	16-DEC-16	R3618520
F4 (C34-C50)	<50		50	ug/g	13-DEC-16	16-DEC-16	R3618520
Total Hydrocarbons (C6-C50)	<72		72	ug/g		19-DEC-16	
Chrom. to baseline at nC50	YES				13-DEC-16	16-DEC-16	R3618520
Surrogate: 2-Bromobenzotrifluoride	85.8		60-140	%	13-DEC-16	16-DEC-16	R3618520
Surrogate: 3,4-Dichlorotoluene	103.8		60-140	%	13-DEC-16	15-DEC-16	R3616921
L1869032-9 COMPOSITE-TCLP Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
Sample Preparation							
Initial pH	9.68		0.10	pH units	14-DEC-16	14-DEC-16	R3618031
Final pH	5.78		0.10	pH units	14-DEC-16	14-DEC-16	R3618031
TCLP Extractables							
Acenaphthene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Acenaphthylene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Anthracene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Benzo(a)anthracene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Benzo(a)pyrene	<0.0010		0.0010	mg/L	15-DEC-16	19-DEC-16	R3619761
Benzo(b)fluoranthene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Benzo(g,h,i)perylene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
TCLP Metals							
Arsenic (As)	<0.050		0.050	mg/L		15-DEC-16	R3618255
Barium (Ba)	0.51		0.50	mg/L		15-DEC-16	R3618255
Boron (B)	<2.5		2.5	mg/L		15-DEC-16	R3618255
Cadmium (Cd)	<0.0050		0.0050	mg/L		15-DEC-16	R3618255
Chromium (Cr)	<0.050		0.050	mg/L		15-DEC-16	R3618255

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1869032-9 COMPOSITE-TCLP Sampled By: CLIENT on 09-DEC-16 @ 09:00 Matrix: SOIL							
TCLP Metals							
Lead (Pb)	<0.050		0.050	mg/L		15-DEC-16	R3618255
Mercury (Hg)	<0.00010		0.00010	mg/L		16-DEC-16	R3618639
Selenium (Se)	<0.025		0.025	mg/L		15-DEC-16	R3618255
Silver (Ag)	<0.0050		0.0050	mg/L		15-DEC-16	R3618255
Uranium (U)	<0.25		0.25	mg/L		15-DEC-16	R3618255
TCLP VOCs							
1,1-Dichloroethylene	<0.025	VTHS	0.025	mg/L		16-DEC-16	R3618254
1,2-Dichlorobenzene	<0.025	VTHS	0.025	mg/L		16-DEC-16	R3618254
1,2-Dichloroethane	<0.025	VTHS	0.025	mg/L		16-DEC-16	R3618254
1,4-Dichlorobenzene	<0.025	VTHS	0.025	mg/L		16-DEC-16	R3618254
Benzene	<0.025	VTHS	0.025	mg/L		16-DEC-16	R3618254
Carbon tetrachloride	<0.025	VTHS	0.025	mg/L		16-DEC-16	R3618254
Chlorobenzene	<0.025	VTHS	0.025	mg/L		16-DEC-16	R3618254
Chloroform	<0.10	VTHS	0.10	mg/L		16-DEC-16	R3618254
Dichloromethane	<0.50	VTHS	0.50	mg/L		16-DEC-16	R3618254
Methyl Ethyl Ketone	<1.0	VTHS	1.0	mg/L		16-DEC-16	R3618254
Tetrachloroethylene	<0.025	VTHS	0.025	mg/L		16-DEC-16	R3618254
Trichloroethylene	<0.025	VTHS	0.025	mg/L		16-DEC-16	R3618254
Vinyl chloride	<0.050	VTHS	0.050	mg/L		16-DEC-16	R3618254
Surrogate: 4-Bromofluorobenzene	96.4		70-130	%		16-DEC-16	R3618254
Volatile Organic Compounds							
Surrogate: 1,4-Difluorobenzene	100.5		70-130	%		16-DEC-16	R3618254
Polycyclic Aromatic Hydrocarbons							
Benzo(k)fluoranthene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Chrysene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Dibenzo(ah)anthracene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Fluoranthene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Fluorene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Indeno(1,2,3-cd)pyrene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Naphthalene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Phenanthrene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Pyrene	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Quinoline	<0.0050		0.0050	mg/L	15-DEC-16	19-DEC-16	R3619761
Surrogate: d10-Acenaphthene	113.0		50-150	%	15-DEC-16	19-DEC-16	R3619761
Surrogate: d12-Chrysene	119.7		50-150	%	15-DEC-16	19-DEC-16	R3619761
Surrogate: d8-Naphthalene	101.6		50-150	%	15-DEC-16	19-DEC-16	R3619761
Surrogate: d10-Phenanthrene	113.8		50-150	%	15-DEC-16	19-DEC-16	R3619761

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
SAR:L	SAR is incalculable due to Ca and Mg below DL. Lowest possible SAR is reported as minimum value.
SAR:M	Reported SAR represents a maximum value. Actual SAR may be lower if both Ca and Mg were detectable.
VTHS	Volatile test was conducted on sample with headspace. Results may be biased low.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
F1-F4-511-CALC-WT	Soil	F1-F4 Hydrocarbon Calculated Parameters	CCME CWS-PHC, Pub #1310, Dec 2001-S

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

Hydrocarbon results are expressed on a dry weight basis.

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

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

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

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

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

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

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

F2-F4-511-WT Soil F2-F4-O.Reg 153/04 (July 2011) MOE DECPH-E3398/CCME TIER 1

Fractions F2, F3 and F4 are determined by extracting a soil sample with a solvent mix. The solvent recovered from the extracted soil sample is dried and treated to remove polar material. The extract is analyzed by GC/FID.

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

HG-TCLP-WT Waste Mercury (CVAA) for O.Reg 347 SW846 7470A

LEACH-TCLP-WT Waste Leachate Procedure for Reg 347 EPA 1311

Inorganic and Semi-Volatile Organic contaminants are leached from waste samples in strict accordance with US EPA Method 1311, "Toxicity Characteristic Leaching Procedure" (TCLP). Test results are reported in leachate concentration units (normally mg/L).

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

Dried, ground and sieved soil samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction. depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.

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

MET-TCLP-WT Waste O.Reg 347 TCLP Leachable Metals EPA 200.8

METHYLNAPS-CALC-WT Soil ABN-Calculated Parameters SW846 8270

MOISTURE-WT Soil % Moisture Gravimetric: Oven Dried

Reference Information

PAH-511-WT	Soil	PAH-O.Reg 153/04 (July 2011)	SW846 3510/8270

A representative sub-sample of soil is fortified with deuterium-labelled surrogates and a mechanical shaking techniqueis used to extract the sample with a mixture of methanol and toluene. The extracts are concentrated and analyzed by GC/MS. Depending on the analytical GC/MS column used benzo(j)fluoranthene may chromatographically co-elute with benzo(b)fluoranthene or benzo(k)fluoranthene.

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

PAH-TCLP-WT	Waste	PAH for O. Reg 347	SW846 8270 (PAH)

Samples are leached according to TCLP protocol and then the aqueous leachate is extracted and the resulting extracts are analyzed on GC/MSD. Depending on the analytical GC/MS column used benzo(j)fluoranthene may chromatographically co-elute with benzo(b)fluoranthene or benzo(k)fluoranthene.

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

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

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

VOC-1,3-DCP-CALC-WT	Soil	Regulation 153 VOCs	SW8260B/SW8270C
VOC-511-HS-WT	Soil	VOC-O.Reg 153/04 (July 2011)	SW846 8260 (511)

Soil and sediment samples are extracted in methanol and analyzed by headspace-GC/MS.

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

VOC-TCLP-WT	Waste	VOC for O. Reg 347	SW846 8260

A sample of waste is leached in a zero headspace extractor at 30–2 rpm for 18–2.0 hours with the appropriate leaching solution. After tumbling the leachate is analyzed directly by headspace technology, followed by GC/MS using internal standard quantitation.

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

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

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

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

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

Chain of Custody Numbers:

15-573799

GLOSSARY OF REPORT TERMS

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

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

Quality Control Report

Client: Morrison Hershfield Limited (Ottawa)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F1-HS-511-WT	**Soil**							
Batch R3616921								
WG2450584-4 DUP		**L1869032-2**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	30	15-DEC-16
WG2450584-2 LCS								
F1 (C6-C10)			96.2		%		80-120	14-DEC-16
WG2450584-1 MB								
F1 (C6-C10)			<5.0		ug/g		5	14-DEC-16
Surrogate: 3,4-Dichlorotoluene			87.6		%		60-140	14-DEC-16
WG2450584-7 MS		**L1869032-4**						
F1 (C6-C10)			95.7		%		60-140	15-DEC-16
F2-F4-511-WT	**Soil**							
Batch R3618520								
WG2450781-3 CRM		**ALS PHC2 IRM**						
F2 (C10-C16)			99.5		%		70-130	15-DEC-16
F3 (C16-C34)			101.4		%		70-130	15-DEC-16
F4 (C34-C50)			104.4		%		70-130	15-DEC-16
WG2450781-2 LCS								
F2 (C10-C16)			105.6		%		80-120	15-DEC-16
F3 (C16-C34)			102.3		%		80-120	15-DEC-16
F4 (C34-C50)			95.0		%		80-120	15-DEC-16
WG2450781-1 MB								
F2 (C10-C16)			<10		ug/g		10	15-DEC-16
F3 (C16-C34)			<50		ug/g		50	15-DEC-16
F4 (C34-C50)			<50		ug/g		50	15-DEC-16
Surrogate: 2-Bromobenzotrifluoride			83.5		%		60-140	15-DEC-16
MET-200.2-CCMS-WT	**Soil**							
Batch R3619972								
WG2452767-2 CRM		**WT-CANMET-TILL1**						
Antimony (Sb)			98.2		%		70-130	16-DEC-16
Arsenic (As)			103.8		%		70-130	16-DEC-16
Barium (Ba)			105.2		%		70-130	16-DEC-16
Beryllium (Be)			89.4		%		70-130	16-DEC-16
Cadmium (Cd)			94.5		%		70-130	16-DEC-16
Chromium (Cr)			104.5		%		70-130	16-DEC-16
Cobalt (Co)			100.0		%		70-130	16-DEC-16
Copper (Cu)			98.6		%		70-130	16-DEC-16
Lead (Pb)			91.4		%		70-130	16-DEC-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R3619972								
WG2452767-2 CRM		**WT-CANMET-TILL1**						
Molybdenum (Mo)			88.2		%		70-130	16-DEC-16
Nickel (Ni)			100.9		%		70-130	16-DEC-16
Selenium (Se)			90.9		%		70-130	16-DEC-16
Silver (Ag)			97.9		%		70-130	16-DEC-16
Thallium (Tl)			95.8		%		70-130	16-DEC-16
Uranium (U)			103.9		%		70-130	16-DEC-16
Vanadium (V)			105.2		%		70-130	16-DEC-16
Zinc (Zn)			96.5		%		70-130	16-DEC-16
WG2452767-4 LCS		**1+2**						
Antimony (Sb)			101.4		%		80-120	16-DEC-16
Arsenic (As)			97.4		%		80-120	16-DEC-16
Barium (Ba)			93.6		%		80-120	16-DEC-16
Beryllium (Be)			98.5		%		80-120	16-DEC-16
Boron (B)			98.8		%		80-120	16-DEC-16
Cadmium (Cd)			98.2		%		80-120	16-DEC-16
Chromium (Cr)			98.0		%		80-120	16-DEC-16
Cobalt (Co)			97.0		%		80-120	16-DEC-16
Copper (Cu)			96.0		%		80-120	16-DEC-16
Lead (Pb)			96.4		%		80-120	16-DEC-16
Molybdenum (Mo)			92.2		%		80-120	16-DEC-16
Nickel (Ni)			96.4		%		80-120	16-DEC-16
Selenium (Se)			94.5		%		80-120	16-DEC-16
Silver (Ag)			97.5		%		80-120	16-DEC-16
Thallium (Tl)			100.3		%		80-120	16-DEC-16
Uranium (U)			97.5		%		80-120	16-DEC-16
Vanadium (V)			100.0		%		80-120	16-DEC-16
Zinc (Zn)			87.5		%		80-120	16-DEC-16
WG2452767-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	16-DEC-16
Arsenic (As)			<0.10		mg/kg		0.1	16-DEC-16
Barium (Ba)			<0.50		mg/kg		0.5	16-DEC-16
Beryllium (Be)			<0.10		mg/kg		0.1	16-DEC-16
Boron (B)			<5.0		mg/kg		5	16-DEC-16
Cadmium (Cd)			<0.020		mg/kg		0.02	16-DEC-16
Chromium (Cr)			<0.50		mg/kg		0.5	16-DEC-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R3619972								
WG2452767-1 MB								
Cobalt (Co)			<0.10		mg/kg		0.1	16-DEC-16
Copper (Cu)			<0.50		mg/kg		0.5	16-DEC-16
Lead (Pb)			<0.50		mg/kg		0.5	16-DEC-16
Molybdenum (Mo)			<0.10		mg/kg		0.1	16-DEC-16
Nickel (Ni)			<0.50		mg/kg		0.5	16-DEC-16
Selenium (Se)			<0.20		mg/kg		0.2	16-DEC-16
Silver (Ag)			<0.10		mg/kg		0.1	16-DEC-16
Thallium (Tl)			<0.050		mg/kg		0.05	16-DEC-16
Uranium (U)			<0.050		mg/kg		0.05	16-DEC-16
Vanadium (V)			<0.20		mg/kg		0.2	16-DEC-16
Zinc (Zn)			<2.0		mg/kg		2	16-DEC-16
MOISTURE-WT	**Soil**							
Batch R3617125								
WG2451280-3 DUP		**L1869032-4**						
% Moisture		8.97	8.70		%	3.0	20	14-DEC-16
WG2451280-2 LCS								
% Moisture			99.6		%		90-110	14-DEC-16
WG2451280-1 MB								
% Moisture			<0.10		%		0.1	14-DEC-16
PAH-511-WT	**Soil**							
Batch R3619836								
WG2450768-2 LCS								
1-Methylnaphthalene			96.6		%		50-140	19-DEC-16
2-Methylnaphthalene			95.9		%		50-140	19-DEC-16
Acenaphthene			96.8		%		50-140	19-DEC-16
Acenaphthylene			94.4		%		50-140	19-DEC-16
Anthracene			92.5		%		50-140	19-DEC-16
Benzo(a)anthracene			94.9		%		50-140	19-DEC-16
Benzo(a)pyrene			92.1		%		50-140	19-DEC-16
Benzo(b)fluoranthene			95.8		%		50-140	19-DEC-16
Benzo(g,h,i)perylene			89.2		%		50-140	19-DEC-16
Benzo(k)fluoranthene			101.1		%		50-140	19-DEC-16
Chrysene			100.8		%		50-140	19-DEC-16
Dibenzo(ah)anthracene			91.8		%		50-140	19-DEC-16
Fluoranthene			88.5		%		50-140	19-DEC-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-511-WT	**Soil**							
Batch R3619836								
WG2450768-2 LCS								
Fluorene			94.1		%		50-140	19-DEC-16
Indeno(1,2,3-cd)pyrene			84.7		%		50-140	19-DEC-16
Naphthalene			99.4		%		50-140	19-DEC-16
Phenanthrene			97.2		%		50-140	19-DEC-16
Pyrene			90.2		%		50-140	19-DEC-16
WG2450768-1 MB								
1-Methylnaphthalene			<0.030		ug/g		0.03	19-DEC-16
2-Methylnaphthalene			<0.030		ug/g		0.03	19-DEC-16
Acenaphthene			<0.050		ug/g		0.05	19-DEC-16
Acenaphthylene			<0.050		ug/g		0.05	19-DEC-16
Anthracene			<0.050		ug/g		0.05	19-DEC-16
Benzo(a)anthracene			<0.050		ug/g		0.05	19-DEC-16
Benzo(a)pyrene			<0.050		ug/g		0.05	19-DEC-16
Benzo(b)fluoranthene			<0.050		ug/g		0.05	19-DEC-16
Benzo(g,h,i)perylene			<0.050		ug/g		0.05	19-DEC-16
Benzo(k)fluoranthene			<0.050		ug/g		0.05	19-DEC-16
Chrysene			<0.050		ug/g		0.05	19-DEC-16
Dibenzo(ah)anthracene			<0.050		ug/g		0.05	19-DEC-16
Fluoranthene			<0.050		ug/g		0.05	19-DEC-16
Fluorene			<0.050		ug/g		0.05	19-DEC-16
Indeno(1,2,3-cd)pyrene			<0.050		ug/g		0.05	19-DEC-16
Naphthalene			<0.050		ug/g		0.05	19-DEC-16
Phenanthrene			<0.050		ug/g		0.05	19-DEC-16
Pyrene			<0.050		ug/g		0.05	19-DEC-16
Surrogate: 2-Fluorobiphenyl			93.0		%		50-140	19-DEC-16
Surrogate: p-Terphenyl d14			87.9		%		50-140	19-DEC-16
SAR-R511-WT	**Soil**							
Batch R3619976								
WG2453891-2 IRM		**WT SAR1**						
Calcium (Ca)			87.8		%		70-130	19-DEC-16
Sodium (Na)			93.9		%		70-130	19-DEC-16
Magnesium (Mg)			86.8		%		70-130	19-DEC-16
WG2453891-1 MB								
Calcium (Ca)			<1.0		mg/L		1	19-DEC-16
Sodium (Na)			<1.0		mg/L		1	19-DEC-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SAR-R511-WT	**Soil**							
Batch R3619976								
WG2453891-1 MB								
Magnesium (Mg)			<1.0		mg/L		1	19-DEC-16
VOC-511-HS-WT	**Soil**							
Batch R3616921								
WG2450584-4 DUP		**L1869032-2**						
1,1,1,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
1,1,2,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
1,1,1-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
1,1,2-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
1,1-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
1,1-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
1,2-Dibromoethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
1,2-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
1,2-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
1,2-Dichloropropane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
1,3-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
1,4-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
Acetone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	14-DEC-16
Benzene		<0.0068	<0.0068	RPD-NA	ug/g	N/A	40	14-DEC-16
Bromodichloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
Bromoform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
Bromomethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
Carbon tetrachloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
Chlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
Chloroform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
cis-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
cis-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	14-DEC-16
Dibromochloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
Dichlorodifluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	14-DEC-16
n-Hexane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
Methylene Chloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
MTBE		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	14-DEC-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R3616921								
WG2450584-4 DUP		**L1869032-2**						
Methyl Ethyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	14-DEC-16
Methyl Isobutyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	14-DEC-16
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	14-DEC-16
Styrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
Tetrachloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	14-DEC-16
trans-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
trans-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	14-DEC-16
Trichloroethylene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	14-DEC-16
Trichlorofluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-DEC-16
Vinyl chloride		<0.020	<0.020	RPD-NA	ug/g	N/A	40	14-DEC-16
WG2450584-2 LCS								
1,1,1,2-Tetrachloroethane			82.9		%		60-130	14-DEC-16
1,1,2,2-Tetrachloroethane			81.5		%		60-130	14-DEC-16
1,1,1-Trichloroethane			83.7		%		60-130	14-DEC-16
1,1,2-Trichloroethane			83.0		%		60-130	14-DEC-16
1,1-Dichloroethane			84.6		%		60-130	14-DEC-16
1,1-Dichloroethylene			78.7		%		60-130	14-DEC-16
1,2-Dibromoethane			81.5		%		70-130	14-DEC-16
1,2-Dichlorobenzene			84.5		%		70-130	14-DEC-16
1,2-Dichloroethane			83.6		%		60-130	14-DEC-16
1,2-Dichloropropane			87.1		%		70-130	14-DEC-16
1,3-Dichlorobenzene			85.0		%		70-130	14-DEC-16
1,4-Dichlorobenzene			85.7		%		70-130	14-DEC-16
Acetone			102.6		%		60-140	14-DEC-16
Benzene			83.9		%		70-130	14-DEC-16
Bromodichloromethane			82.3		%		50-140	14-DEC-16
Bromoform			80.4		%		70-130	14-DEC-16
Bromomethane			85.6		%		50-140	14-DEC-16
Carbon tetrachloride			83.0		%		70-130	14-DEC-16
Chlorobenzene			85.3		%		70-130	14-DEC-16
Chloroform			82.3		%		70-130	14-DEC-16
cis-1,2-Dichloroethylene			82.7		%		70-130	14-DEC-16
cis-1,3-Dichloropropene			86.6		%		70-130	14-DEC-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R3616921								
WG2450584-2 LCS								
Dibromochloromethane			86.3		%		60-130	14-DEC-16
Dichlorodifluoromethane			63.2		%		50-140	14-DEC-16
Ethylbenzene			81.9		%		70-130	14-DEC-16
n-Hexane			83.2		%		70-130	14-DEC-16
Methylene Chloride			83.6		%		70-130	14-DEC-16
MTBE			84.8		%		70-130	14-DEC-16
m+p-Xylenes			84.3		%		70-130	14-DEC-16
Methyl Ethyl Ketone			95.6		%		60-140	14-DEC-16
Methyl Isobutyl Ketone			91.4		%		60-140	14-DEC-16
o-Xylene			87.1		%		70-130	14-DEC-16
Styrene			87.1		%		70-130	14-DEC-16
Tetrachloroethylene			83.3		%		60-130	14-DEC-16
Toluene			83.2		%		70-130	14-DEC-16
trans-1,2-Dichloroethylene			83.5		%		60-130	14-DEC-16
trans-1,3-Dichloropropene			87.2		%		70-130	14-DEC-16
Trichloroethylene			84.3		%		60-130	14-DEC-16
Trichlorofluoromethane			86.4		%		50-140	14-DEC-16
Vinyl chloride			77.7		%		60-140	14-DEC-16
WG2450584-1 MB								
1,1,1,2-Tetrachloroethane			<0.050		ug/g		0.05	14-DEC-16
1,1,2,2-Tetrachloroethane			<0.050		ug/g		0.05	14-DEC-16
1,1,1-Trichloroethane			<0.050		ug/g		0.05	14-DEC-16
1,1,2-Trichloroethane			<0.050		ug/g		0.05	14-DEC-16
1,1-Dichloroethane			<0.050		ug/g		0.05	14-DEC-16
1,1-Dichloroethylene			<0.050		ug/g		0.05	14-DEC-16
1,2-Dibromoethane			<0.050		ug/g		0.05	14-DEC-16
1,2-Dichlorobenzene			<0.050		ug/g		0.05	14-DEC-16
1,2-Dichloroethane			<0.050		ug/g		0.05	14-DEC-16
1,2-Dichloropropane			<0.050		ug/g		0.05	14-DEC-16
1,3-Dichlorobenzene			<0.050		ug/g		0.05	14-DEC-16
1,4-Dichlorobenzene			<0.050		ug/g		0.05	14-DEC-16
Acetone			<0.50		ug/g		0.5	14-DEC-16
Benzene			<0.0068		ug/g		0.0068	14-DEC-16
Bromodichloromethane			<0.050		ug/g		0.05	14-DEC-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R3616921								
WG2450584-1 MB								
Bromoform			<0.050		ug/g		0.05	14-DEC-16
Bromomethane			<0.050		ug/g		0.05	14-DEC-16
Carbon tetrachloride			<0.050		ug/g		0.05	14-DEC-16
Chlorobenzene			<0.050		ug/g		0.05	14-DEC-16
Chloroform			<0.050		ug/g		0.05	14-DEC-16
cis-1,2-Dichloroethylene			<0.050		ug/g		0.05	14-DEC-16
cis-1,3-Dichloropropene			<0.030		ug/g		0.03	14-DEC-16
Dibromochloromethane			<0.050		ug/g		0.05	14-DEC-16
Dichlorodifluoromethane			<0.050		ug/g		0.05	14-DEC-16
Ethylbenzene			<0.018		ug/g		0.018	14-DEC-16
n-Hexane			<0.050		ug/g		0.05	14-DEC-16
Methylene Chloride			<0.050		ug/g		0.05	14-DEC-16
MTBE			<0.050		ug/g		0.05	14-DEC-16
m+p-Xylenes			<0.030		ug/g		0.03	14-DEC-16
Methyl Ethyl Ketone			<0.50		ug/g		0.5	14-DEC-16
Methyl Isobutyl Ketone			<0.50		ug/g		0.5	14-DEC-16
o-Xylene			<0.020		ug/g		0.02	14-DEC-16
Styrene			<0.050		ug/g		0.05	14-DEC-16
Tetrachloroethylene			<0.050		ug/g		0.05	14-DEC-16
Toluene			<0.080		ug/g		0.08	14-DEC-16
trans-1,2-Dichloroethylene			<0.050		ug/g		0.05	14-DEC-16
trans-1,3-Dichloropropene			<0.030		ug/g		0.03	14-DEC-16
Trichloroethylene			<0.010		ug/g		0.01	14-DEC-16
Trichlorofluoromethane			<0.050		ug/g		0.05	14-DEC-16
Vinyl chloride			<0.020		ug/g		0.02	14-DEC-16
Surrogate: 1,4-Difluorobenzene			111.3		%		50-140	14-DEC-16
Surrogate: 4-Bromofluorobenzene			100.0		%		50-140	14-DEC-16
WG2450584-5 MS		**L1869032-2**						
1,1,1,2-Tetrachloroethane			86.2		%		50-140	14-DEC-16
1,1,2,2-Tetrachloroethane			86.8		%		50-140	14-DEC-16
1,1,1-Trichloroethane			85.7		%		50-140	14-DEC-16
1,1,2-Trichloroethane			88.1		%		50-140	14-DEC-16
1,1-Dichloroethane			87.6		%		50-140	14-DEC-16
1,1-Dichloroethylene			81.4		%		50-140	14-DEC-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R3616921								
WG2450584-5 MS		**L1869032-2**						
1,2-Dibromoethane			87.5		%		50-140	14-DEC-16
1,2-Dichlorobenzene			85.5		%		50-140	14-DEC-16
1,2-Dichloroethane			89.6		%		50-140	14-DEC-16
1,2-Dichloropropane			90.6		%		50-140	14-DEC-16
1,3-Dichlorobenzene			83.1		%		50-140	14-DEC-16
1,4-Dichlorobenzene			85.1		%		50-140	14-DEC-16
Acetone			117.4		%		50-140	14-DEC-16
Benzene			85.9		%		50-140	14-DEC-16
Bromodichloromethane			86.6		%		50-140	14-DEC-16
Bromoform			87.6		%		50-140	14-DEC-16
Bromomethane			86.6		%		50-140	14-DEC-16
Carbon tetrachloride			83.7		%		50-140	14-DEC-16
Chlorobenzene			86.1		%		50-140	14-DEC-16
Chloroform			83.9		%		50-140	14-DEC-16
cis-1,2-Dichloroethylene			85.7		%		50-140	14-DEC-16
cis-1,3-Dichloropropene			82.0		%		50-140	14-DEC-16
Dibromochloromethane			92.4		%		50-140	14-DEC-16
Dichlorodifluoromethane			72.3		%		50-140	14-DEC-16
Ethylbenzene			81.0		%		50-140	14-DEC-16
n-Hexane			86.3		%		50-140	14-DEC-16
Methylene Chloride			89.0		%		50-140	14-DEC-16
MTBE			86.2		%		50-140	14-DEC-16
m+p-Xylenes			83.2		%		50-140	14-DEC-16
Methyl Ethyl Ketone			105.7		%		50-140	14-DEC-16
Methyl Isobutyl Ketone			98.9		%		50-140	14-DEC-16
o-Xylene			86.9		%		50-140	14-DEC-16
Styrene			86.8		%		50-140	14-DEC-16
Tetrachloroethylene			82.3		%		50-140	14-DEC-16
Toluene			83.9		%		50-140	14-DEC-16
trans-1,2-Dichloroethylene			84.3		%		50-140	14-DEC-16
trans-1,3-Dichloropropene			83.9		%		50-140	14-DEC-16
Trichloroethylene			83.9		%		50-140	14-DEC-16
Trichlorofluoromethane			90.9		%		50-140	14-DEC-16
Vinyl chloride			81.5		%		50-140	14-DEC-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-TCLP-WT	**Waste**							
Batch R3618639								
WG2452919-2 LCS								
Mercury (Hg)			101.0		%		70-130	16-DEC-16
WG2452919-1 MB								
Mercury (Hg)			<0.00010		mg/L		0.0001	16-DEC-16
MET-TCLP-WT	**Waste**							
Batch R3618255								
WG2452554-2 LCS								
Silver (Ag)			98.8		%		70-130	15-DEC-16
Arsenic (As)			97.5		%		70-130	15-DEC-16
Boron (B)			91.8		%		70-130	15-DEC-16
Barium (Ba)			97.7		%		70-130	15-DEC-16
Cadmium (Cd)			97.1		%		70-130	15-DEC-16
Chromium (Cr)			95.1		%		70-130	15-DEC-16
Lead (Pb)			97.6		%		70-130	15-DEC-16
Selenium (Se)			96.3		%		70-130	15-DEC-16
Uranium (U)			99.7		%		70-130	15-DEC-16
WG2452554-1 MB								
Silver (Ag)			<0.0050		mg/L		0.005	15-DEC-16
Arsenic (As)			<0.050		mg/L		0.05	15-DEC-16
Boron (B)			<2.5		mg/L		2.5	15-DEC-16
Barium (Ba)			<0.50		mg/L		0.5	15-DEC-16
Cadmium (Cd)			<0.0050		mg/L		0.005	15-DEC-16
Chromium (Cr)			<0.050		mg/L		0.05	15-DEC-16
Lead (Pb)			<0.050		mg/L		0.05	15-DEC-16
Selenium (Se)			<0.025		mg/L		0.025	15-DEC-16
Uranium (U)			<0.25		mg/L		0.25	15-DEC-16
PAH-TCLP-WT	**Waste**							
Batch R3619761								
WG2452720-5 DUP		**L1869032-9**						
Acenaphthene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Acenaphthylene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Anthracene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Benzo(a)anthracene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Benzo(a)pyrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	19-DEC-16
Benzo(b)fluoranthene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Benzo(g,h,i)perylene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TCLP-WT	**Waste**							
Batch R3619761								
WG2452720-5 DUP		**L1869032-9**						
Benzo(k)fluoranthene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Chrysene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Dibenzo(ah)anthracene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Fluoranthene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Fluorene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Indeno(1,2,3-cd)pyrene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Naphthalene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Phenanthrene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Pyrene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
Quinoline		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	19-DEC-16
WG2452720-2 LCS								
Acenaphthene			93.0		%		50-130	19-DEC-16
Acenaphthylene			94.6		%		50-130	19-DEC-16
Anthracene			95.4		%		50-130	19-DEC-16
Benzo(a)anthracene			98.8		%		50-140	19-DEC-16
Benzo(a)pyrene			98.8		%		60-140	19-DEC-16
Benzo(b)fluoranthene			93.3		%		50-140	19-DEC-16
Benzo(g,h,i)perylene			99.0		%		50-140	19-DEC-16
Benzo(k)fluoranthene			94.1		%		50-150	19-DEC-16
Chrysene			99.9		%		50-140	19-DEC-16
Dibenzo(ah)anthracene			98.2		%		50-140	19-DEC-16
Fluoranthene			97.3		%		50-150	19-DEC-16
Fluorene			95.0		%		50-150	19-DEC-16
Indeno(1,2,3-cd)pyrene			96.7		%		50-140	19-DEC-16
Naphthalene			86.3		%		50-130	19-DEC-16
Phenanthrene			95.1		%		50-130	19-DEC-16
Pyrene			103.6		%		50-140	19-DEC-16
Quinoline			124.0		%		50-150	19-DEC-16
WG2452720-1 MB								
Acenaphthene			<0.0050		mg/L		0.005	19-DEC-16
Acenaphthylene			<0.0050		mg/L		0.005	19-DEC-16
Anthracene			<0.0050		mg/L		0.005	19-DEC-16
Benzo(a)anthracene			<0.0050		mg/L		0.005	19-DEC-16
Benzo(a)pyrene			<0.0010		mg/L		0.001	19-DEC-16
Benzo(b)fluoranthene			<0.0050		mg/L		0.005	19-DEC-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TCLP-WT	**Waste**							
Batch R3619761								
WG2452720-1 MB								
Benzo(g,h,i)perylene			<0.0050		mg/L		0.005	19-DEC-16
Benzo(k)fluoranthene			<0.0050		mg/L		0.005	19-DEC-16
Chrysene			<0.0050		mg/L		0.005	19-DEC-16
Dibenzo(ah)anthracene			<0.0050		mg/L		0.005	19-DEC-16
Fluoranthene			<0.0050		mg/L		0.005	19-DEC-16
Fluorene			<0.0050		mg/L		0.005	19-DEC-16
Indeno(1,2,3-cd)pyrene			<0.0050		mg/L		0.005	19-DEC-16
Naphthalene			<0.0050		mg/L		0.005	19-DEC-16
Phenanthrene			<0.0050		mg/L		0.005	19-DEC-16
Pyrene			<0.0050		mg/L		0.005	19-DEC-16
Quinoline			<0.0050		mg/L		0.005	19-DEC-16
Surrogate: d8-Naphthalene			98.6		%		50-150	19-DEC-16
Surrogate: d10-Phenanthrene			117.2		%		50-150	19-DEC-16
Surrogate: d12-Chrysene			119.7		%		50-150	19-DEC-16
Surrogate: d10-Acenaphthene			108.3		%		50-150	19-DEC-16
WG2452720-4 MS		**L1869032-9**						
Acenaphthene			89.4		%		50-150	19-DEC-16
Acenaphthylene			90.4		%		50-150	19-DEC-16
Anthracene			87.5		%		50-150	19-DEC-16
Benzo(a)anthracene			92.8		%		50-150	19-DEC-16
Benzo(a)pyrene			92.5		%		50-150	19-DEC-16
Benzo(b)fluoranthene			89.1		%		50-150	19-DEC-16
Benzo(g,h,i)perylene			89.7		%		50-150	19-DEC-16
Benzo(k)fluoranthene			89.0		%		50-150	19-DEC-16
Chrysene			93.7		%		50-150	19-DEC-16
Dibenzo(ah)anthracene			79.9		%		50-150	19-DEC-16
Fluoranthene			90.9		%		50-150	19-DEC-16
Fluorene			90.7		%		50-150	19-DEC-16
Indeno(1,2,3-cd)pyrene			88.3		%		50-150	19-DEC-16
Naphthalene			86.6		%		50-150	19-DEC-16
Phenanthrene			88.1		%		50-150	19-DEC-16
Pyrene			97.4		%		50-150	19-DEC-16
Quinoline			122.5		%		50-150	19-DEC-16
VOC-TCLP-WT	**Waste**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-TCLP-WT	**Waste**							
Batch R3618254								
WG2448725-1 LCS								
1,1-Dichloroethylene			91.7		%		70-130	16-DEC-16
1,2-Dichlorobenzene			88.1		%		70-130	16-DEC-16
1,2-Dichloroethane			98.0		%		70-130	16-DEC-16
1,4-Dichlorobenzene			85.9		%		70-130	16-DEC-16
Benzene			91.9		%		70-130	16-DEC-16
Carbon tetrachloride			88.5		%		60-140	16-DEC-16
Chlorobenzene			89.2		%		70-130	16-DEC-16
Chloroform			90.3		%		70-130	16-DEC-16
Dichloromethane			96.4		%		70-130	16-DEC-16
Methyl Ethyl Ketone			119.9		%		50-150	16-DEC-16
Tetrachloroethylene			88.0		%		70-130	16-DEC-16
Trichloroethylene			85.0		%		70-130	16-DEC-16
Vinyl chloride			88.0		%		60-130	16-DEC-16
WG2448725-2 MB								
1,1-Dichloroethylene			<0.025		mg/L		0.025	16-DEC-16
1,2-Dichlorobenzene			<0.025		mg/L		0.025	16-DEC-16
1,2-Dichloroethane			<0.025		mg/L		0.025	16-DEC-16
1,4-Dichlorobenzene			<0.025		mg/L		0.025	16-DEC-16
Benzene			<0.025		mg/L		0.025	16-DEC-16
Carbon tetrachloride			<0.025		mg/L		0.025	16-DEC-16
Chlorobenzene			<0.025		mg/L		0.025	16-DEC-16
Chloroform			<0.10		mg/L		0.1	16-DEC-16
Dichloromethane			<0.50		mg/L		0.5	16-DEC-16
Methyl Ethyl Ketone			<1.0		mg/L		1	16-DEC-16
Tetrachloroethylene			<0.025		mg/L		0.025	16-DEC-16
Trichloroethylene			<0.025		mg/L		0.025	16-DEC-16
Vinyl chloride			<0.050		mg/L		0.05	16-DEC-16
Surrogate: 1,4-Difluorobenzene			100.2		%		70-130	16-DEC-16
Surrogate: 4-Bromofluorobenzene			95.8		%		70-130	16-DEC-16

Legend:

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

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

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

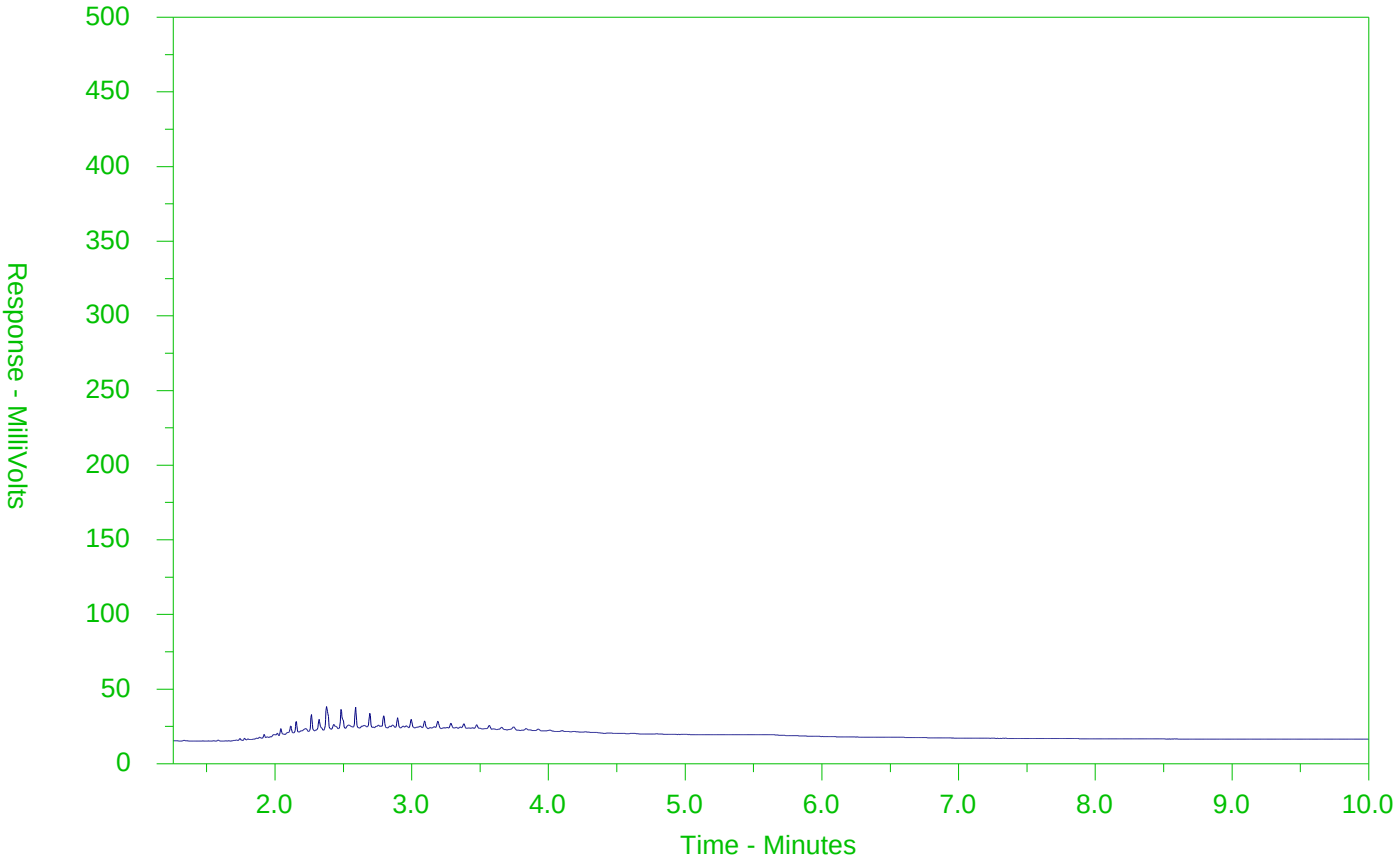
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where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

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

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

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1869032-2
Client Sample ID: BH1-SS6



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

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

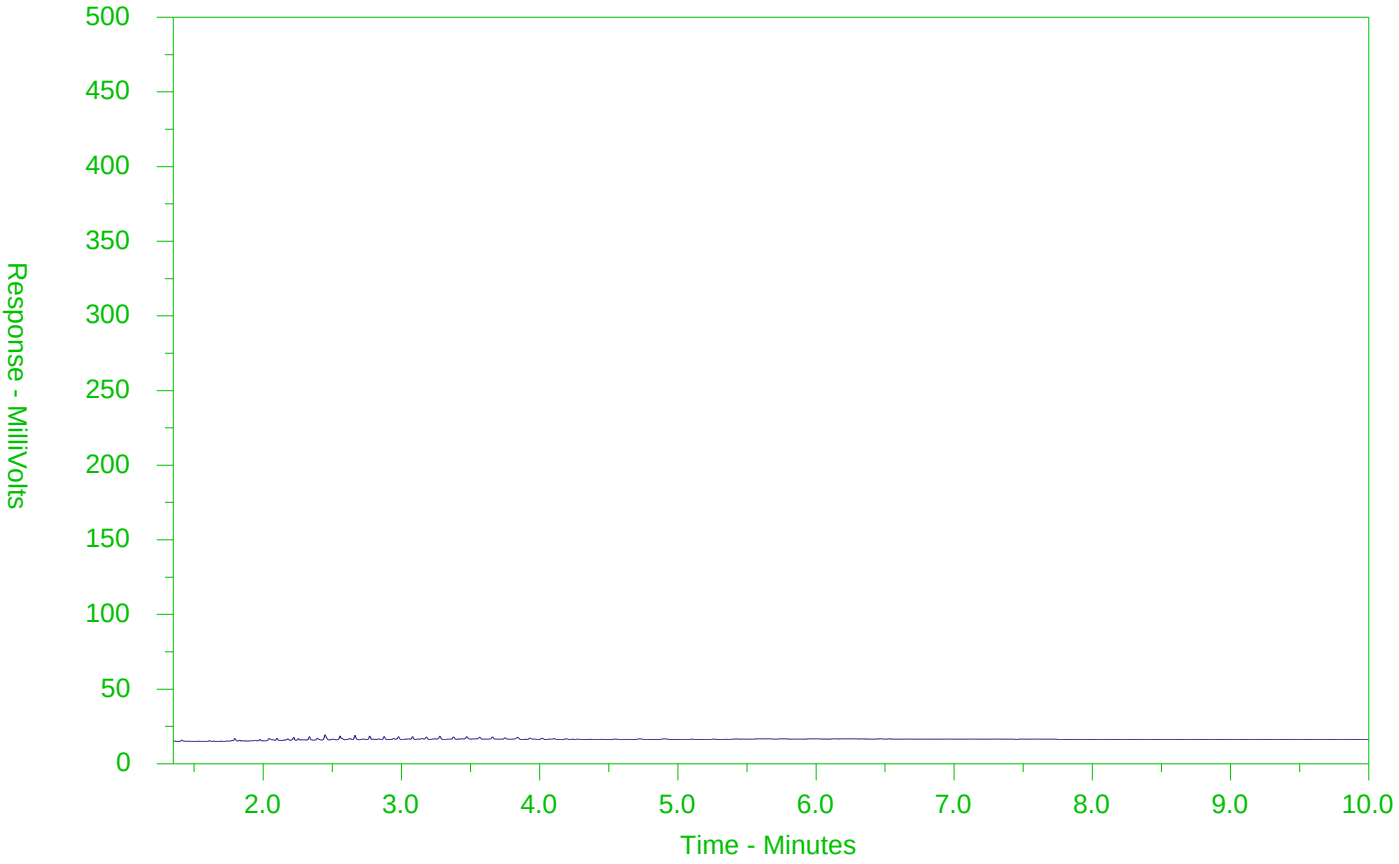
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

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

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

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1869032-4
Client Sample ID: BH2-SS5



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

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

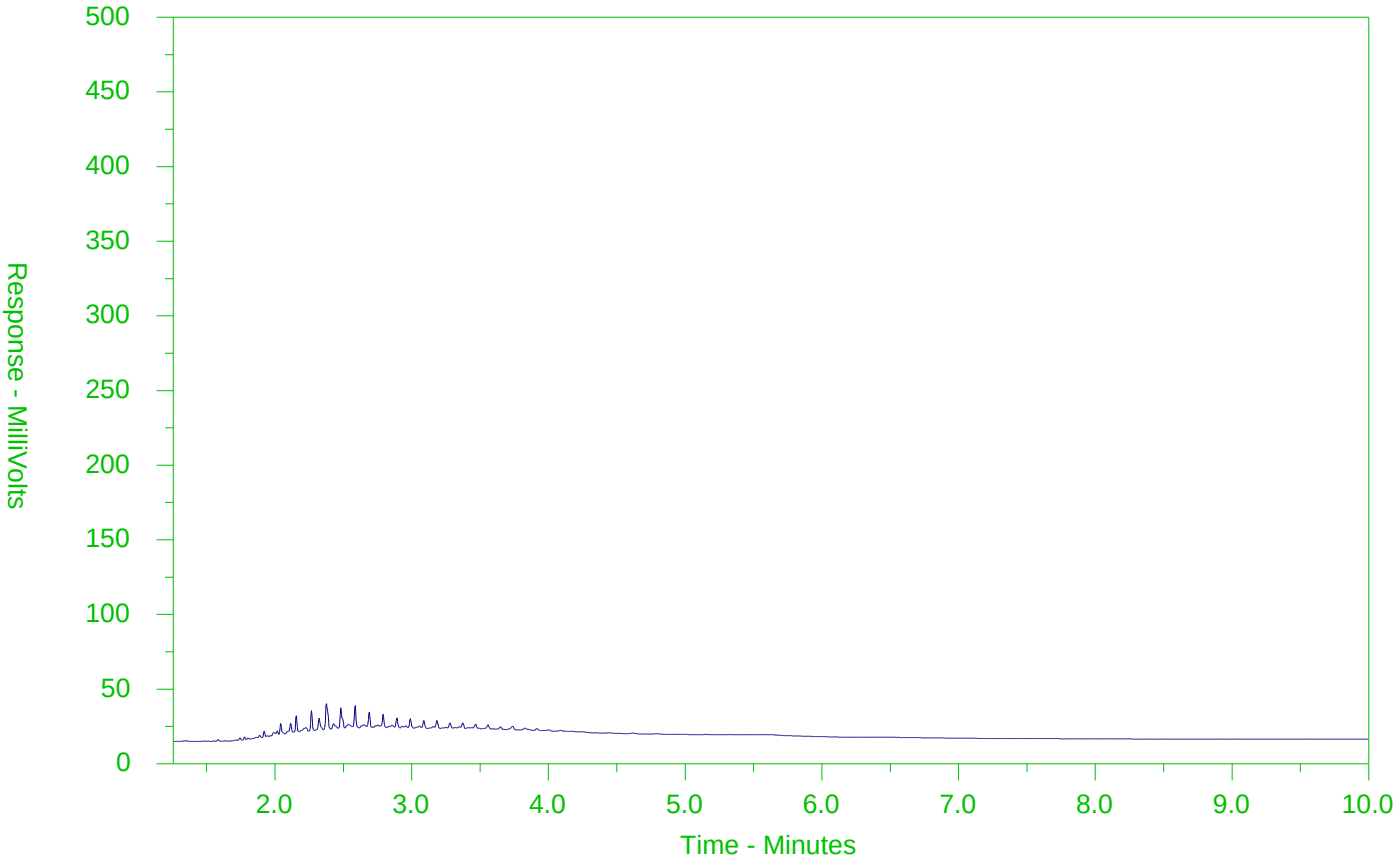
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

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

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

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1869032-6
Client Sample ID: BH3-SS6



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

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

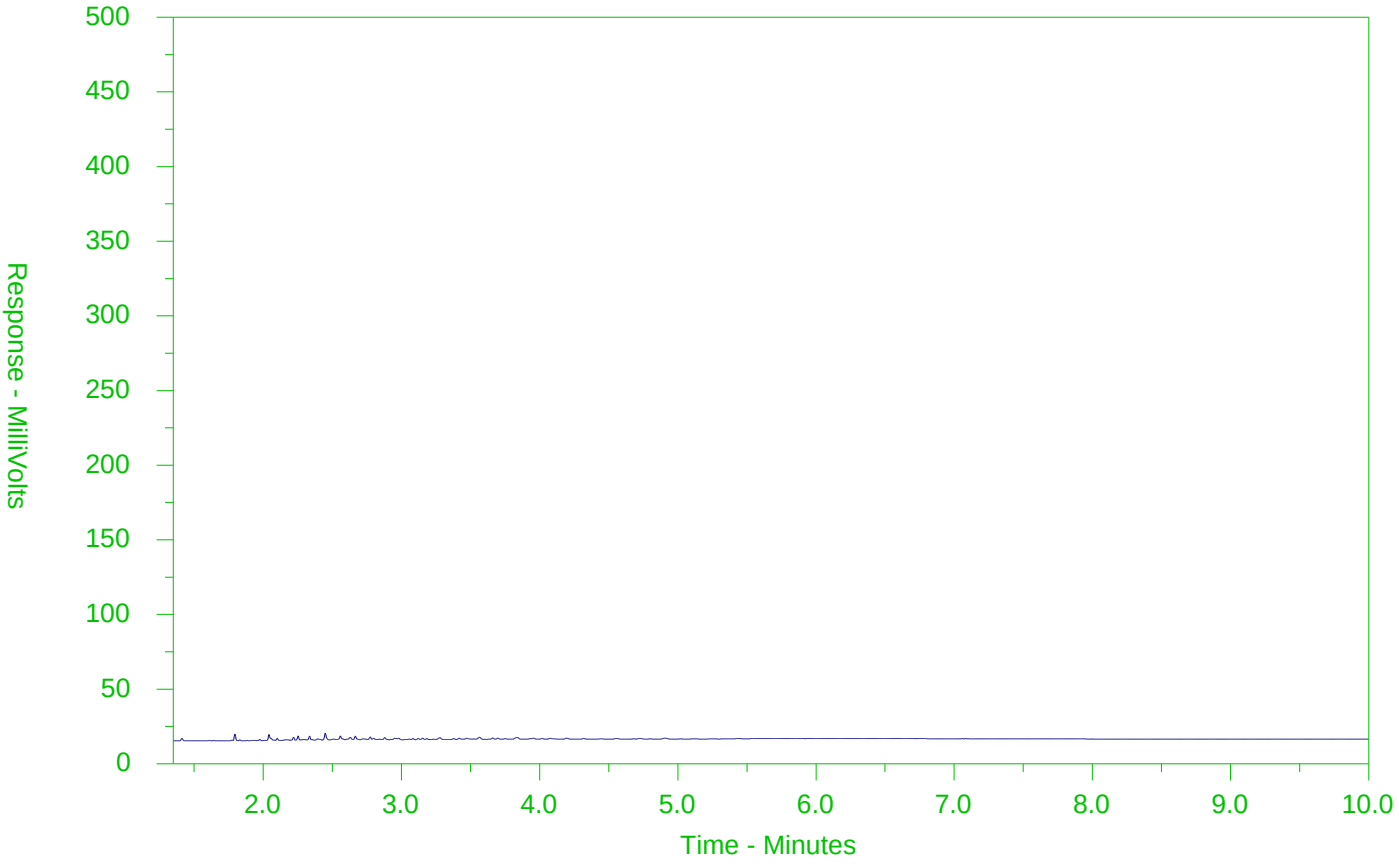
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

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

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

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1869032-8
Client Sample ID: BH4-SS6



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

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Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1869032-COFC

COC Number: 15 - 573799

Page of

Report To	Contact and company name below will appear on the final report
Company:	MHL
Contact:	Cindy Zhao
Phone:	
	Company address below will appear on the final report
Street:	
City/Province:	
Postal Code:	
Invoice To	Same as Report To ☒ YES ☐ NO
	Copy of Invoice with Report ☒ YES ☐ NO
Company:	
Contact:	

Project Information

ALS Account # / Quote #:	
Job #:	1160509
PO / AFE:	
LSD:	
ALS Lab Work Order # (lab use only)	Deeb A L1869032 al

Report Format / Distribution

Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☒ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: CZhao@manhattanslatfield.com
Email 2:
Email 3:

Invoice Distribution

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax:
Email 2:

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact:	Sampler:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	SAR Metal [P4-]	Dic./VOCs	Number of Containers
1	BH1 - SS2	09-Dec-16	9:00am	Soil	X		
2	BH1 - SS6					X	
3	BH2 - SS2A				X		
4	BH2 - SS5		5:00pm			X	
5	BH3 - SS3				X		
6	BH3 - SS6					X	
7	BH4 - SS2				X		
8	BH4 - SS6					X	

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐	
Ice Packs	☐	Ice Cubes ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☒				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C	
4.2				10.9

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Cindy Zhao	Date: Dec. 09	Time: 16:50pm	Received by: JS	Date: Dec 12/16	Time: 9:00	Received by:	Date: 12/12/2016	Time: 17:40

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

LIMITATIONS TO THE REPORT

This report is intended solely for the Client named. The report is prepared based on the work has been undertaken in accordance with normally accepted geotechnical engineering practices in Ontario.

The comments and recommendations given in this report are based on information determined at the limited number of the test hole and test pit locations. The boundaries between the various strata as shown on the borehole logs are based on non-continuous sampling and represent an inferred transition between the various strata and their lateral continuation rather than a precise plane of geological change. Subsurface and groundwater conditions between and beyond the test holes and test pits may differ significantly from those encountered at the test hole and test pit locations. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole and test pit locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The report reflects our best judgment based on the information available to GeoPro Consulting Limited at the time of preparation. Unless otherwise agreed in writing by GeoPro Consulting Limited, it shall not be used to express or imply warranty as to any other purposes. No portion of this report shall be used as a separate entity, it is written to be read in its entirety. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated.

The design recommendations given in this report are applicable only to the project designed and constructed completely in accordance with the details stated in this report.

Should any comments and recommendations provided in this report be made on any construction related issues, they are intended only for the guidance of the designers. The number of test holes and test pits may not be sufficient to determine all the factors that may affect construction activities, methods and costs. Such as, the thickness of surficial topsoil or fill layers may vary significantly and unpredictably; the amount of the cobbles and boulders may vary significantly than what described in the report; unexpected water bearing zones/layers with various thickness and extent may be encountered in the fill and native soils. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and make their own conclusions as to how the subsurface conditions may affect their work and determine the proper construction methods.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. GeoPro Consulting Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.