PHASE TWO ENVIRONMENTAL SITE ASSESSMENT PROPOSED STUDENT RESIDENCE -CARLETON UNIVERSITY, OTTAWA

AUGUST 24, 2020

ORIGINAL





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ORIGINAL

PROJECT NO.: 191-12948-00 DATE: AUGUST 24, 2020

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August 24, 2020

Original

CARLETON UNIVERSITY 1125 Colonel By Drive Ottawa, Ontario K1S 5B6

Attention: Dawn Blackman, Senior Project Manager

Dear Madam:

Subject: Phase Two Environmental Site Assessment - Proposed Student Residence, Carleton University

We are pleased to forward our revised report documenting the results of the Phase Two Environmental Site Assessment Update completed at the above-noted property. Revisions reflect recent discussions with the Ontario Ministry of the Environment, Conservation and Parks pertaining to the filing of a Record of Site Condition.

We trust that this information is sufficient for your current needs.

Please do not hesitate to contact the undersigned should you have any questions or require further assistance.

Yours sincerely,

Adrian Menyhart, P.Eng., ing., QPESA Environmental Engineer

WSP ref.: 191-12948-00

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This limitations statement is considered an integral part of this report.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY 1 INTRODUCTION.....1 1.1 Background.....1 1.2 Site Description and Property Ownership1 1.3 Current and Proposed Future Uses1 1.4 Applicable site Condition Standards1 2 2 21 **Physical Setting**

2.1	Flysical Setting
2.1.1	Water Bodies and Areas of Natural Significance
2.1.2	Topography and Surface Water Drainage3
2.2	Past Investigations3
2.3	Potential Contaminants of Concern4
3	SCOPE OF THE INVESTIGATION5
3.1	Overview of the Site Investigation5
3.2	Media Investigated5
3.3	Phase One Conceptual Site Model5
3.3.1	Potential Environmental Concerns and Potential Contaminants of Concern
3.3.2	Impact of Underground Utilities6
3.3.3	Geological and Hydrogeological Information
3.4	Deviations from Sampling and Analysis Plan6
3.5	Impediments6
4	INVESTIGATION METHOD7
4.1	General7
4.2	Drilling and Excavating7
4.3	Soil Sampling7
4.4	Field Screening Measurements8

4.5	Groundwater: Monitoring Well Installation8
4.6	Groundwater: Field Measurement of Water Quality Parameters
4.7	Groundwater: Monitoring and Sampling8
4.8	Sediment Sampling9
4.9	Analytical Testing9
4.10	Residue Management Practices9
4.11	Elevation Surveying9
4.12	Quality Assurance and Quality Control Measures9
5	REVIEW AND EVALUATION
5.1	Geology11
5.2	Groundwater: Elevations and Flow Direction11
5.3	Groundwater: Hydraulic Gradients11
5.4	Soil Texture11
5.5	Soil: Field Screening11
5.6	Soil Quality11
5.6.1	Metals12
5.6.2	Petroleum Hydrocarbons (PHCs)13
5.6.2 5.6.3	Petroleum Hydrocarbons (PHCs)
5.6.3	Volatile Organic Compounds (VOCs)13
5.6.3 5.6.4	Volatile Organic Compounds (VOCs)
5.6.3 5.6.4 5.6.5	Volatile Organic Compounds (VOCs)
5.6.3 5.6.4 5.6.5 5.7	Volatile Organic Compounds (VOCs) 13 Polycyclic Aromatic Hydrocarbons (PAHs) 13 TCLP 13 Groundwater Quality 13
5.6.3 5.6.4 5.6.5 5.7 5.7.1	Volatile Organic Compounds (VOCs) 13 Polycyclic Aromatic Hydrocarbons (PAHs) 13 TCLP 13 Groundwater Quality 13 Metals 14
5.6.3 5.6.4 5.6.5 5.7 5.7.1 5.7.2	Volatile Organic Compounds (VOCs) 13 Polycyclic Aromatic Hydrocarbons (PAHs) 13 TCLP 13 Groundwater Quality 13 Metals 14 Petroleum Hydrocarbons (PHCs) 14
5.6.3 5.6.4 5.6.5 5.7 5.7.1 5.7.2 5.7.3	Volatile Organic Compounds (VOCs) 13 Polycyclic Aromatic Hydrocarbons (PAHs) 13 TCLP 13 Groundwater Quality 13 Metals 14 Petroleum Hydrocarbons (PHCs) 14 Volatile Organic Compounds (VOCs) 14
5.6.3 5.6.4 5.6.5 5.7 5.7.1 5.7.2 5.7.3 5.7.4	Volatile Organic Compounds (VOCs) 13 Polycyclic Aromatic Hydrocarbons (PAHs) 13 TCLP 13 Groundwater Quality 13 Metals 14 Petroleum Hydrocarbons (PHCs) 14 Volatile Organic Compounds (VOCs) 14 Polycylic Aromatic Hydrocarbons (PAHs) 14
5.6.3 5.6.4 5.6.5 5.7 5.7.1 5.7.2 5.7.3 5.7.4 5.8	Volatile Organic Compounds (VOCs) 13 Polycyclic Aromatic Hydrocarbons (PAHs) 13 TCLP 13 Groundwater Quality 13 Metals 14 Petroleum Hydrocarbons (PHCs) 14 Volatile Organic Compounds (VOCs) 14 Polycylic Aromatic Hydrocarbons (PAHs) 14 Sediment Quality 14
5.6.3 5.6.4 5.6.5 5.7 5.7.1 5.7.2 5.7.3 5.7.4 5.8 5.9	Volatile Organic Compounds (VOCs) 13 Polycyclic Aromatic Hydrocarbons (PAHs) 13 TCLP 13 Groundwater Quality 13 Metals 14 Petroleum Hydrocarbons (PHCs) 14 Volatile Organic Compounds (VOCs) 14 Polycylic Aromatic Hydrocarbons (PAHs) 14 Sediment Quality 14 Quality Assurance and Quality Control Results 14

5.10.3	Contaminant Presence onsite18
5.10.4	Contaminant Distribution19
5.10.5	Phase Two CSM19
6	CONCLUSIONS20
6.1	Summary of Phase Two ESA Investigation Findings
6.2	Recommendations20
7	QUALIFICATIONS OF ASSESSORS
7.1	WSP Canada Inc21
7.2	Qualified Person21
7.3	Signatures21
8	REFERENCES22

TABLES

		In Text
TABLE 0-1	POTENTIAL ENVIRONMENTAL CONCERN AND POTENTIAL	
	CONTAMINANT OF CONCERN	
TABLE 2-1	POTENTIAL ENVIRONMENTAL	
	CONCERNS AND POTENTIAL	
	CONTAMINANTS OF CONCERN4	
TABLE 4-1	SUMMARY OF PARAMETERS	
	ANALYZED (DUPLICATE SAMPLES)	
	10	
TABLE 5-1	SUMMARY OF SOIL SAMPLES12	
TABLE 5-2	METALS EXCEEDANCES GREATER	
	THAN MECP TABLE 3 SCS IN SOIL 13	
TABLE 5-3	SUMMARY OF GROUNDWATER	
	SAMPLES13	
TABLE 5-5	REQUIRED PERFORMANCE	
	STANDARDS FOR SOIL AND	
	GROUNDWATER FOR QA/QC14	
TABLE 5-6	SUMMARY OF SOIL AND	
	GROUNDWATER QA/QC CONTROL	
	RESULTS15	

TABLE 5-7	SUMMARY OF AREAS OF POTENTIAL CONCERN16
	Following Text
TABLE 1	MONITORING WELL INSTALLATION AND GROUNDWATER LEVELS
TABLE 2	SUMMARY OF SOIL SAMPLES SUBMITTED FOR CHEMICAL
TABLE 3	ANALYSIS SUMMARY OF GROUNDWATER
	SAMPLES SUBMITTED FOR CHEMICAL ANALYSIS
TABLE 4	SOIL ANALYTICAL RESULTS - METALS
TABLE 5	SOIL ANALYTICAL RESULTS – PHCS AND BTEX
TABLE 6	SOIL ANALYTICAL RESULTS – VOCS
TABLE 7	SOIL ANALYTICAL RESULTS - PAHS
TABLE 8	GROUNDWATER ANALYTICAL
	RESULTS - METALS
TABLE 9	GROUNDWATER ANALYTICAL
	RESULTS – PHCS AND BTEX
TABLE 10	GROUNDWATER ANALYTICAL
	RESULTS – VOCS
TABLE 11	GROUNDWATER ANALYTICAL
	RESULTS – PAHS
TABLE 12	SUMMARY OF MAXIMUM
	CONCENTRATIONS IN SOIL
TABLE 13	SUMMARY OF MAXIMUM
	CONCENTRATIONS IN
	GROUNDWATER

FIGURES

Following Text

FIGURE 1	PHASE ONE CONCEPTUAL SITE
	MODEL
FIGURE 2	PHASE ONE SITE PLAN
FIGURE 3	BOREHOLE AND CROSS-SECTION
	LOCATION PLAN
FIGURE 4	GROUNDWATER CONTOURS
FIGURE 5	ANALYTICAL TESTING PLAN - SOIL
FIGURE 6	ANALYTICAL TESTING PLAN -
	GROUNDWATER
FIGURE 7	STRATIGRAPHIC CROSS-SECTION
	A-A'

FIGURE 8	STRATIGRAPHIC CROSS-SECTION B-B'
FIGURE 9	CONCEPTUAL SITE MODEL FOR HUMAN RECEPTORS
FIGURE 10	CONCEPTUAL SITE MODEL FOR ECOLOGICAL RECEPTORS

APPENDICES

- A PLAN OF SURVEY OF PHASE TWO PROPERTY
- B SAMPLING AND ANALYSIS PLAN
- C BOREHOLE LOGS
- D CERTIFICATES OF ANALYSIS
- D-1 SOIL
- D-2 TCLP
- D-3 GROUNDWATER

EXECUTIVE SUMMARY

WSP Canada Inc. (WSP) was retained by Ms. Dawn Blackman of Carleton University to conduct a Phase Two Environmental Site Assessment (ESA) at a portion of the Ottawa campus in Ottawa, Ontario (herein referred to as the "subject site" or the "Phase Two Property"), following the recommendations of the Phase One ESA completed by WSP Canada Inc. in November 2019 (revised August 2020). The subject site is being proposed for the future site of a student residence. Based on discussion with the Ontario Ministry of the Environment, Conservation and Parks, the filing of a Record of Site Condition will be required.

The Site is an irregular-shaped parcel of land with an area of approximately 1.2 hectares. It is located near the Campus Avenue and University Drive intersection, towards the north end of the Ottawa campus. The subject site skirts the Leeds residence and the Stormont Dundas residence. Based on the Phase One ESA completed for the Site, the subject site was first developed with a farmstead in the early 1900's, but has been used for temporary parking, access laneway and landscaped areas since the 1960's.

Based on the findings of the Phase One ESA, two potential contaminating activities (PCAs) contributing to the areas of potential environmental concern (APECs) included: PCA 30 Importation of fill material of unknown quality and PCA 46 rail yard, tracks and spurs. These PCAs resulted in two APECs at the subject, as follows: APEC1, east side of subject site, and APEC2, the east side of subject site. Investigation was recommended to assess the soil and groundwater conditions at the APECs. The potential contaminants of concern (PCOCs) associated with the APECs include metals, petroleum hydrocarbon compounds (PHCs), volatile organic compounds (VOCs), and polycyclic aromatic hydrocarbons (PAHs). The PCOCs associated with each APEC are as follows:

Table 0-1 Potential Environmental Concern and Potential Contaminant of Concern

POTENTIALLY CONTAMINATING ACTIVITY	POTENTIAL CONTAMINANTS OF CONCERN
PCA 30: Fill Material of Unknown Quality	Metals, PHCs, VOCs, PAHs
PCA 46. Rail yards, tracks and spurs	Metals, PHC, PAHs

Between October 23 and October 28, 2019, 10 environmental and geotechnical boreholes (three of which were completed as monitoring wells) were advanced to maximum depths ranging between 7.6 m and 12.6 m below grade. Three (3) boreholes were cored to depths between 15.5 and 19.3 m below grade

Based on the information collected in this Phase Two ESA, WSP provides the following findings:

Subsurface Condition

Based on the findings of the drilling investigation, the soil stratigraphy, with increasing depth, beneath the Phase Two subject site generally consisted of a layer of asphalt or topsoil, underlain by fill consisting of silty sand and gravel, silty clay and sand and gravel. Part of the sand and gravel fill layer is considered to be reworked native soils, either from the subject site or from areas off-site. Fill material was noted to extend to depths between 3.8 m and 7.6 m below grade. Beneath the fill layer, was native silty sand and gravel (glacial till). Bedrock was cored at three (3) borehole locations, to final depths of 15.5, 18.6 and 19.3 m below grade, at BH19-8, BH19-7 and BH19-2, respectively.

For the purposes of this assessment, the analytical results have been compared to the 2011 MECP Table 3 for full depth generic site conditions in a non-potable groundwater condition.

Soil Condition

 All soils were found to be in compliance with MECP Table 3 standards, with the exception of vanadium at borehole BH19-4, which was identified in the upper fill material.

Groundwater Condition

 All groundwater samples were found to be in compliance with MECP Table 3 standards, and is not considered to have been adversely impacted by historical activities.

Recommendations

Based on the findings of the Phase Two ESA, vanadium is present within a small area of the subject site, related to poor quality fill material. Given the scope of the proposed redevelopment of the site, the soils in the vicinity of the vanadium exceedance should be excavated and disposed of at a licensed landfill facility as part of site excavation works. It is recommended that WSP be present at the time of excavation, such that confirmatory samples can be collected following remedial excavation works.

Prior to site redevelopment, all three (3) groundwater monitoring wells must be decommissioned as per Ontario Regulation 903.

1 INTRODUCTION

1.1 BACKGROUND

WSP Canada Inc. (WSP) was retained by Ms. Dawn Blackman, Senior Project Manager with Carleton University, to conduct a Phase Two Environmental Site Assessment (ESA) for a portion of the Ottawa Campus, located at 1125 Colonel By Drive. The Phase Two subject site (herein is referred to as the "subject site") is located north of the Stormont and Dundas residence, and east of the Leeds residence, and bordered to the east by Campus Avenue. The location of the Phase Two Property is shown in **Figure 1**.

A Phase Two ESA was recommended to be carried out by WSP following completion of a Phase One ESA, prepared for the same subject site on November 5, 2019. The Phase One ESA identified two (2) areas of potential environmental concern (APECs) related to the importation of potentially impacted fill material at the subject site, and the presence of railway lines (former and present) to the east of the subject site. Locations of APEC-1 and APEC-2 and the 250-m Phase One ESA study area are shown in **Figure 1**.

1.2 SITE DESCRIPTION AND PROPERTY OWNERSHIP

The subject site is situated within the larger legal property known municipally as 1125 Colonel By Drive (refer to **Figure 1**), bearing the following legal description:

Nepean Concession B, Rideau Front, Part of Lots L, M, and N, of Registered Plan 4R196, Part 4

PINs Part of 04087-0065 (LT) and Part of 04087-0068 (LT).

The subject site is irregular in shape and is approximately 0.7 hectare in area. The subject site consists of landscaped lands, laneway and a temporary parking area. No buildings are present on the site.

A preliminary survey sketch was provided to WSP for review. The site was surveyed by Fairhall, Moffatt and Woodland Limited on November 6, 2019. The sketch is included in **Appendix A**.

The current Site Owner is Carleton University. The Owner's Representative for this project is Ms. Dawn Blackman.

1.3 CURRENT AND PROPOSED FUTURE USES

Based on the Phase One ESA completed for the Site, the subject site was first developed with a farmstead in the early 1900's, but has been used as temporary parking, access laneway and landscaped areas since the 1960's, all used by the residences. The proposed redevelopment will consist of a new student residence, and, as such, the filing of an RSC would not be required, as the land use within the University property will not be changing.

1.4 APPLICABLE SITE CONDITION STANDARDS

Soil and groundwater analytical results for this Phase Two ESA were compared to standards identified in the Ministry of the Environment, Conservation and Parks (MECP) publication, "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act," published on April 15, 2011 (hereinafter referred to as the "MECP SCS").

This selection of the applicable standard was applied based on the following:

- The proposed land use is residential (i.e. student residence);
- The water supply is the municipal water supplied by the City of Ottawa;
- The Phase Two Property is not considered to be environmentally sensitive as per Section 41 of Ontario Regulation (O. Reg.) 153/04; and
- The Phase Two Property is not a shallow soil property based on overburden thickness, or a property that includes all or

part of a water body or is adjacent to a water body or includes land that is within 30 meters of a water body, as per Section 43.1 of O. Reg. 153/04.

Based on the factors listed above, the MECP SCS listed in Table 3, Full Generic SCS in a Non-Potable Groundwater Water Condition. The applicable land use and soil texture would be residential, parkland, and institutional (RPI) property use for coarse-textured soils.

In the scope of the proposed redevelopment project of the subject site, it is anticipated that a large amount of soil will be excavated from the site, and will require disposal off-site. For soil management purposes, analytical results tables also included a comparison to MECP Table 1 Full Depth Background Site Condition Standards, which represent background standards in Ontario.

2 BACKGROUND INFORMATION

2.1 PHYSICAL SETTING

Based on Ministry of Energy, Northern Development and Mines mapping (accessed via Ontario Geological Survey (OGS) Earth, published by the Ontario Ministry of Natural Development, Mines and Forestry), the regional surficial geology on-site is clay plains, however, past investigations conducted in the study area have identified presence of fill material, underlined by till.

Based on physiography maps available through the OGS earth website (Chapman and Putnam, 1984), the Phase Two ESA Property is situated within clay plains of the St. Lawrence Lowlands.

According to bedrock maps provided by the OGS Earth website, bedrock in the area of the subject site consists of shale of the Billings Formation. Past investigations prepared by SPL Consultants (now WSP) in January 2013 and April 2013 identified depths to bedrock of approximately 12 to 13 m below grade at the subject site.

As part of the Phase One ESA site reconnaissance, a visual inspection of adjacent lands located within the Phase One Study Area was conducted from the boundary of the Site and from publicly accessible areas to identify any potentially contaminating activities. At the time of the Phase One ESA Site reconnaissance, adjacent land uses within the Phase One Study Area consisted of institutional and residential uses (university campus setting).

2.1.1 WATER BODIES AND AREAS OF NATURAL SIGNIFICANCE

The Rideau Canal is situated approximately 170 m to the west of the subject site, and an unevaluated wetland is located approximately 70 m to the west (see **Figure 1**).

There are no areas of natural significance registered within the subject site or Phase One ESA study area.

2.1.2 TOPOGRAPHY AND SURFACE WATER DRAINAGE

Topographic mapping available through the Natural Resources of Canada Website, Atlas of Canada Toporama, was reviewed. The surface topography in the area of the subject site is generally flat, with no significant topographic features. The mapping data shows a railway line to the east of the subject site, and several large buildings further to the south (off-site). The Rideau Canal is located to the west, and the Rideau River is located to the east.

Surface water drainage on-site is considered to occur through surface run-off to catch basins (along Campus Avenue and the parking areas), surface run-off to a storm grate located within the landscaped area, and through infiltration within grass covered areas.

2.2 PAST INVESTIGATIONS

SPL Consultants Limited (now WSP), conducted a Phase One ESA and Phase Two ESA for a portion of land immediately to the north of the Subject Site, however, the north end of the subject site overlaps south end of the former ESA study area.

The Phase One ESA, prepared by SPL in 2013, indicated that the land has been owned by Carleton University since the 1950's, and that the former property consisted of marshland, which had been filled to raise the grade. Fill is expected to be present between 5 to 6 meters below the ground. Impacted soil (with hydrocarbons, and polycyclic aromatic hydrocarbons) was identified on parts of that property. The SPL report also identified a landfill to the southeast of the 2012 Subject Site, with soil impacts identified by others in the past.

SPL later conducted a Phase Two ESA, in April 2013, for the same portion of land studied in for the Phase One ESA. SPL advanced 10 boreholes on the site (four of which were instrumented with monitoring wells). One borehole2 fell within the current Subject Site. Soils analysed from the borehole did not identify any exceedances of the applicable MECP Table 2 site condition standards, however, fill material was noted to extend to approximately 6 m below surrounding grade. In general,

the Phase Two ESA identified presence of fill with traces of wood, brick and slag. MECP Table 2 standards were selected based on various factors, including the potential presence of potable groundwater use. Based on a review of well records, a drilled well was located north of the subject site; the record indicated that the purposes of the well was for cooling associated with the University, and as such is not considered to be a potable source.

The nearest monitoring well installed as part of this 2013 investigation (located approximately 20 to 25 m north of the current subject site) had identified presence of several polycyclic aromatic hydrocarbon parameters above the site standard for groundwater.

A geotechnical report by Houle Chevrier in 2011 was prepared for the parking lot located immediately north of the Subject Site. The south end of their study area overlaps with the north end of the present Subject Site. One borehole was identified in this overlapped area, and fill material was identified in that borehole. Other boreholes drilled during the Houle Chevrier study identified fill material in all 12 boreholes (located across their subject site), and elevated concentrations of hydrocarbon and polycyclic aromatic hydrocarbon parameters in the fill (at a borehole located north of the subject site).

Other reports prepared for areas to the north, and northeast of the Subject Site also identified fill material of poor quality at depths extending to approximately 6 m below grade. Fill material located along the former and current railway line appeared to be impacted in many places, as evidenced by traces of wood, brick, ash, mortar and coal.

2.3 POTENTIAL CONTAMINANTS OF CONCERN

The areas of potential environmental concerns at the subject site and their associated potential contaminants of concern as identified in the Phase One ESAs are summarized as follows:

Table 2-1 Potential Environmental Concerns and Potential Contaminants of Concern

POTENTIALLY CONTAMINATING ACTIVITY	POTENTIAL CONTAMINANTS OF CONCERN
APEC1: Fill material (PCA30: Importation of Fill Material of Unknown Quality)	Metals, Petroleum Hydrocarbons, Volatile Organic Compounds, Polycyclic Aromatic Hydrocarbons.
APEC2: Railway lines (PCA 46. Rail yards, tracks and spurs)	Metals, Petroleum Hydrocarbons, Polycyclic Aromatic Hydrocarbons

Based on the identification of these PCAs, a Phase Two ESA was completed to further investigate these concerns and address any data gaps from previous ESA foe the subject site.

3 SCOPE OF THE INVESTIGATION

3.1 OVERVIEW OF THE SITE INVESTIGATION

The Phase Two ESA was conducted in general accordance with the general and specific objectives outlined in O. Reg. 153/04, as amended. The sampling methods complied with the requirements established by the MECP in the Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario, 1997 and technical updates provided to support regulatory amendments. Previous investigations provided an initial information base for the Phase Two Property; however, newer data were required to meet the requirements of O. Reg. 153/04. The tasks completed for the Phase Two ESA included:

- Preparation of a sampling and analysis plan (SAP) for the investigation to identify the required sampling of soil and groundwater in relation to the PCAs and APECs identified in the Phase One ESA for the Phase Two Property;
- During the drilling investigation, advancing 10 environmental/geotechnical boreholes of which three (3) were considered environmental boreholes, and completed as 51 mm monitoring wells to a maximum depth of 7.9 meter below the ground surface (mBGS) on the Phase Two Property between October 22 to October 26, 2019;
- Collection of groundwater samples from the three monitoring wells on November 4, 2019;
- Submitting soil and groundwater samples to a qualified laboratory for laboratory analysis of contaminant of Potential Concern (COPCs), including quality assurance/quality control (QA/QC) duplicates. Soil samples submitted were selected based on field observations and screened with a photoionization device (PID) and combustible gas indicator (CGI), to characterize the vertical and lateral extents of impacts. QA/QC duplicate samples were collected at a frequency of a minimum of 10% throughout the field program, in compliance with regulatory requirements; and
- Comparing results of analysis for soil and groundwater to the MECP Table 3 SCS.

3.2 MEDIA INVESTIGATED

Soil and groundwater at the APECs identified in the Phase One ESA were investigated as part of the Phase Two ESA investigation for the subject site. A SAP was developed by WSP prior to the field investigations, which outlined the proposed sample locations, analytical sampling, and rationale for sampling and analysis at each location. Sample locations are shown on **Figure 2** and the SAP is provided in **Appendix B**.

Sediment, as defined in O.Reg.153, is not present onsite. Therefore, samples of sediment were not collected during this Phase Two ESA.

3.3 PHASE ONE CONCEPTUAL SITE MODEL

A Phase One Conceptual Site Model (CSM) was developed in the Phase One ESA for the subject site. Two (2) APECs with potential for impacts to soil and/or groundwater have been identified on the Phase One Property and are presented as **Figure 1**.

Based on the review of records, interviews, and the site reconnaissance completed as part of the Phase One ESA, WSP identified two (2) PCAs for the subject site, including:

- 30. Importation of Fill of Unknown Quality
- 46. Rail Yards, Tracks and Spurs

Based on the above information, three APECs were identified for the Phase One Property:

<u>APEC1</u>: Central to Eastern portion of the subject site – Historical photos show the importation and storage of fill material of unknown quality. Poor quality fill material was identified on other areas of the Carleton University property. Filling appears to have been concentrated to the eastern side of the site.

<u>APEC2</u>: Eastern portion of the subject site – A railway line was formerly located at grade (immediately off-site to the east) from as early as the 1920's until the 1960's, when the line was shifted to a trench immediately adjacent to it. The railway lines (both older and newer) are located off-site to the east and are considered to have created an APEC along the eastern side

of the property.

Other PCAs, including a former landfill were identified within the Phase One Study Area, however, these activities were determined to not result in an APEC due to the nature of the landfill operation and the down-gradient location of the landfill, relative to the Phase One Property.

Information considered for the development of the Phase One CSM was gathered by WSP from numerous sources (i.e., historical aerial photographs, environmental database searches, physical setting sources, historical reports, interviews and a site reconnaissance), which reduces the potential for not identifying a former property use or PCA.

3.3.1 POTENTIAL ENVIRONMENTAL CONCERNS AND POTENTIAL CONTAMINANTS OF CONCERN

The potential environmental concerns at the Phase One Property and their associated potential contaminants of concern are summarized in Section 0 and Table 2-1.

3.3.2 IMPACT OF UNDERGROUND UTILITIES

Underground utility trenches, typically backfilled with permeable granular materials, have the potential to affect contaminant distribution and transport. Utilities servicing the subject site (natural gas, water, sewer, and hydro) may be a concern for contaminant transport on the subject site. Adjacent underground utilities may also affect local migration of contaminants in the subsurface.

3.3.3 GEOLOGICAL AND HYDROGEOLOGICAL INFORMATION

The Phase One Property slopes slightly to the southwest.

The inferred groundwater flow direction is anticipated to be towards the Rideau Canal to the west, or the Rideau River to the southeast.

Geological records indicate bedrock at the subject site consists consisting mainly of shale.

3.4 DEVIATIONS FROM SAMPLING AND ANALYSIS PLAN

The Phase Two ESA was conducted in general accordance with the sampling and analysis plan completed for the Phase Two ESA investigation, attached as **Appendix** B.

3.5 IMPEDIMENTS

Physical impediments encountered during the investigation included the presence of various subsurface utilities. As a result, certain boreholes were shifted slightly from locations established prior to the field work. The impediments are not considered to have altered the quality of the subsurface conditions or interpretation of results for this investigation.

4 INVESTIGATION METHOD

4.1 GENERAL

All methods used to complete the Phase Two ESA were in accordance with O. Reg. 153/04 and WSP Standard Operating Procedures (SOPs), and generally accepted industry practices.

4.2 DRILLING AND EXCAVATING

A WSP field representative inspected the subject site and identified the preferred borehole locations as per the SAP during each investigation program. The borehole and test pit location plan and cross-sections are depicted in **Figure 3**. The groundwater elevation contours based on the recent groundwater monitoring data are presented in **Figure 4**.

WSP arranged for the public and private service locates to be completed at the subject site, through Ontario One Call (ON1Call) and USL-1, respectively. Borehole drilling and well installation was completed during the week of October 21, 2019, by MECP's licensed drillers Marathon Underground and CCC Geotechnical and Environmental Drilling Ltd., both of Ottawa, Ontario. The drilling was completed using CME55 or CME75 drilling equipment. All drilling operations were conducted under full-time WSP supervision.

Between October 22, and October 26, 2019, 12 boreholes (BH19-1 to BH19-10) were drilled on-site using hollow-auger drilling equipment. The boreholes served for both environmental purposes as well as geotechnical purposes (geotechnical report presented under a separate cover). The majority of the boreholes were advanced to auger refusal, between 7.6 and 12.6 m below surrounding grade. Three of these boreholes were cored into bedrock, to depths between 15.5 and 19.3 mBGS. Boreholes BH19-4, BH19-6 and BH19-10 were considered to be of environmental importance, based on their locations within APECs. As such, these were instrumented with monitoring wells. Due to their auger depths and the anticipated groundwater levels, BH19-6 and BH19-10 were backfilled using slough and bentonite, such that the well screens intercept the groundwater table.

The borehole logs are included in Appendix C.

4.3 SOIL SAMPLING

Soil samples from the boreholes were collected and handled by WSP in accordance with generally accepted sampling and handling procedures used by the environmental consulting industry, WSP SOPs, and in general accordance with O. Reg. 153/04 and the guidelines provided by the MECP's Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario.

During the drilling program, soil samples were collected through continuous sampling in conjunction with standard auger drilling. Samples were collected from split spoons (SS), or rock cores (CORE). All non-dedicated equipment used at the environmental sampling locations was brushed, washed, and rinsed prior to being reused during the sampling program. Disposable nitrile gloves were used during sample collection and changed between each sample to minimize the potential for cross-contamination. Soil samples were described in the field by WSP field staff and observations were recorded in a dedicated field book.

Representative soil samples were conveyed directly into laboratory-supplied jars and methanol-preserved vials and were stored in a cooler at a temperature between 1 and 10°C. Samples selected for laboratory analysis were handled under standard chain of custody procedures and maintained on ice until received at the laboratory. The soil samples selected for laboratory analysis were considered representative of worst-case conditions, based on field screening results and visual and olfactory observations.

The soil sampling and analysis plan is provided in Appendix B.

4.4 FIELD SCREENING MEASUREMENTS

All soil samples recovered from the environmental boreholes were field screened for combustible and organic vapours using a RKI Eagle Type 2 with photoionization detector (PID) and combustible gas detector (CGD); the majority of the soil samples from remaining boreholes were also screened. The RKI Eagle Type 2 was rented from an specialist equipment rental supplier, Maxim Environmental and Safety Inc. (Maxim). Soil samples were also examined in the field for lithology as well as for aesthetic evidence of impacts (i.e., staining and odours).

Measurements were collected from each sample at the environmental borehole locations, as well as other borehole locations, where possible. All readings were below 15 ppm, and no reading were indicative of significant potential environmental concerns.

The PID was equipped with a 10.6 electron-volt (eV) lamp, which was calibrated with a known concentration of isobutylene. This instrument detects VOCs that emit below an ionization potential of 10.6 eV, which includes a wide range of chemicals such as solvents and fuels. The detection limit of the instrument ranges from 0 to 15,000 ppm and accuracy is +/- 10% for VOCs in the range of 0 and 2,000 ppm and +/- 20% of the reading above 2,000 ppm. The resolution of this instrument is 0.1 ppm for VOCs in the range of 0 and 1,000 ppm and 1 ppm for readings above 1,000 ppm. The PID provides an indication of total organic contamination in soil but does not measure concentrations of individual contaminants.

The CGI detects combustible vapours such as those associated with fuels. This instrument measures total combustible gases, calibrated to a known concentration of hexane. The instrument was operated in the methane elimination mode. The detection limit of the instrument ranges from 0 to 11,000 ppm (i.e., 100 % LEL of hexane). The CGI has an accuracy of 25 ppm below 1,000 ppm and 5% of the lower explosive limit (LEL) between 1,000 ppm and 100% LEL. As with the PID, it provides an indication of contamination but not specific chemical concentrations.

4.5 GROUNDWATER: MONITORING WELL INSTALLATION

As indicated in Section 4.2, three (3) boreholes were instrumented with a monitoring well, constructed as follows:

- Each monitoring well was constructed using 51 mm diameter well screens and PVC riser pipe;
- The screened interval was 3.05 m long with a No. 10 slot size screen;
- Sand pack, consisting of No. 2 silica sand, was placed around the well screen and the sand pack was extended to 0.3 m above the top of the screen;
- A bentonite seal was then placed around the PVC riser pipe up to within 0.3 m of the ground surface; and,
- The monitoring wells were completed with monument protective covers, with the exception of BH19-4, which was
 installed within flushmount casing.

The monitoring wells were completed in accordance with O. Reg. 903, by licenced well technicians from Marathon Underground.

4.6 GROUNDWATER: FIELD MEASUREMENT OF WATER QUALITY PARAMETERS

The groundwater prior to sampling was assessed using a YSI 556 handheld multi-parameter instrument, which measures pH, temperature, electrical conductivity (EC), dissolved oxygen (DO), oxidation-reduction potential (ORP), and total dissolved solids (TDSs). These field groundwater quality measurements were obtained after the removal of each well volume and were recorded in a dedicated field book. The instrument is calibrated by Maxim, with certificate of calibration available to WSP upon rental events.

4.7 GROUNDWATER: MONITORING AND SAMPLING

Groundwater levels were measured using a groundwater level (Solinst Dipper T-2) prior to purging and sampling activities.

monitoring data is presented in **Table 1** and the inferred groundwater elevation contours based on the November 4th 2019, groundwater monitoring elevations are presented in **Figure 4**.

Wells were developed by WSP by purging three well volumes or to dry (whichever occurred first) using intertia pump Waterra, and samples were collected from all five newly-installed wells. Water was sampled using a peristaltic pump using low-flow sampling techniques due to the high sediment content in wells BH19-6 and BH19-10. Groundwater was conveyed directly into dedicated laboratory-supplied bottles, stored at a temperature below 10°C, and maintained on ice prior to submittal to the laboratory.

4.8 SEDIMENT SAMPLING

As there are no surface water bodies on the Phase Two Property, no sediment was sampled as part of this investigation.

4.9 ANALYTICAL TESTING

Samples were submitted for chemical analysis to Paracel Laboratories, located in Ottawa, Ontario. Paracel Laboratories is a laboratory certified by the Canadian Association for Laboratory Accreditation (CALA).

4.10 RESIDUE MANAGEMENT PRACTICES

Excess soil cuttings from drilling operations were collected and contained in drums for removal off-site pending the laboratory results. Purged water collected from groundwater sampling was stored in the drums with the soil. All the drummed soil will be removed in conjunction with site redevelopment.

4.11 ELEVATION SURVEYING

The ground surface elevations of the completed monitoring wells were surveyed by Fairhall, Moffatt and Woodland Limited. Geodetic elevations of the ground surfaces at borehole locations was provided to WSP in a preliminary survey sketch, which was conducted on November 6, 2019. Note that elevation is missing for borehole BH19-8, due to surveyor field error.

The ground surface elevations are included on the borehole logs in Appendix C.

4.12 QUALITY ASSURANCE AND QUALITY CONTROL MEASURES

Quality assurance (QA) and quality control (QC) of the soil samples was monitored and maintained in a number of ways:

- The field investigation was completed using WSP's standard operating procedures for soil and groundwater sampling;
- Samples were given unique identifications as they were collected, typically identifying the project number, date, sample location and depth. The sample numbers were recorded in field notes for each location;
- All non-dedicated sampling and monitoring equipment (e.g. interface probe) was cleaned using Alconox[™] and distilled water following each use;
- A chain-of-custody form was filled out for the samples prior to submitting the samples to the laboratory. The chain-ofcustody documented sample movement from collection to receipt at the laboratory and provided sample identification, requested analysis and conditions of samples upon arrival at the laboratory (e.g., temperature, container status, etc.);
- Soil samples were randomly selected by the WSP field staff for duplicate testing. The number of QC samples submitted is equivalent to a minimum of 10% of the total number of samples submitted; and,
- Samples were randomly selected by the laboratory for QA checks. Generally, one sample for every ten samples submitted is checked. For each parameter, there is an acceptable upper and lower limit for the measured concentration of the parameter. Measured concentrations of analysed samples must fall within the upper and lower acceptable limits in order for the sample to be valid. If a result exceeds the upper or lower acceptable limits, the sample must be re-analysed.

The duplicate samples collected during this Phase Two ESA is summarized in Table 4-1.

Table 4-1	Summary of Parameters Analyzed (Duplicate Samples)						
MEDIA	SAMPLE IDS (DUPLICATE IDS)	PARAMETER ANALYZED					
Soil	BH19-6-DUP (duplicate sample of BH19-6-SS3)	РАН					
Groundwater	DUP (duplicate sample of BH19-4)	PHC, PAH, Metals					

5 REVIEW AND EVALUATION

5.1 GEOLOGY

A brief summary of the subsurface conditions encountered at the subject site is presented below. Borehole logs are included in **Appendix C**. The borehole log stratigraphy was used to create a north-south and east-west cross-sections for the subject site, provided as **Figures 5** and **6**.

Based on the findings of the drilling investigation, the soil stratigraphy, beneath the Phase Two subject site generally consisted of a layer of asphalt or topsoil, underlain by fill consisting of silty sand to silty sand and gravel, with occasional presence of silty clay fill. The sand and gravel fill layer is considered to be reworked native soils, either from the subject site or from areas immediately off-site. Fill material was noted to extend to depths ranging between 3.8 m and 7.6 mBGS. Beneath the fill layer, there was native silty sand and gravel till (glacial till), with some fragments of rock.

Bedrock was cored at three (3) borehole locations, to final depths of 15.5, 18.6 and 19.3 mBGS, at BH19-8, BH19-7 and BH19-2, respectively. Descriptions of the subsurface soil conditions at each borehole location are provided on the borehole logs (**Appendix C**).

5.2 GROUNDWATER: ELEVATIONS AND FLOW DIRECTION

A summary of the measured groundwater levels, well screen details, and calculated groundwater elevations are presented in **Table 1**. The groundwater levels measured on November 4, 2019 are also presented as groundwater elevation contours (see **Figure 4**). Based on groundwater elevations, the inferred groundwater flow direction at the subject site is in an eastern direction, towards the railway.

5.3 GROUNDWATER: HYDRAULIC GRADIENTS

The calculated horizontal hydraulic gradient was 0.01, based on groundwater levels measured on November 4, 2019 between the monitoring wells at BH19-4, BH19-6 and BH19-10.

The vertical hydraulic gradient cannot be calculated using existing wells onsite, however the vertical hydraulic flow direction is anticipated to be in a downward direction.

5.4 SOIL TEXTURE

Based on field observations and the high sand and gravel content, the subsurface soil conditions are classified as coarse textured. Therefore, the guidelines chosen for the Phase Two ESA are MECP SCS listed in Table 3, Full Generic SCS in a Non-Potable Groundwater Water Condition. The applicable land use and soil texture would be residential, parkland, and institutional (RPI) property use for coarse-textured soils.

5.5 SOIL: FIELD SCREENING

Soil headspace combustible and organic vapour concentrations recorded during the field screening procedures collected from environmental boreholes during this Phase Two ESA ranged from 0 to 5 ppm (CGD)/15 ppm (PID). The readings are recorded on the logs presented in **Appendix C**.

5.6 SOIL QUALITY

A summary of the soil samples submitted for laboratory analyses, including details of sampling location and depths is presented

below

in Table 5-1:

BOREHOLE	SAMPLE	DEPTH	DATE	DATE PARAMETERS AP		APEC #		
ID	ID	(MBGS)		Metals	PHCs	VOCs	PAHs	
BH12-3	SS2	0.8 – 1.4	1-Dec-12	√				1,2
BH12-3	SS4	1.8 – 2.4	1-Dec-12				1	1,2
BH12-3	SS5	2.4 - 3.1	1-Dec-12		√			1,2
BH12-3	SS8	6.1 – 6.7	1-Dec-12	4				1,2
BH12-3	SS10	9.1 – 9.8	1-Dec-12			4		1,2
BH19-2	SS5	2.3 - 2.9	23-Oct-19	4	√	1	1	1
BH19-4	SS2	1.8 - 2.4	28-Oct-19	4	1	1	1	1
BH19-6	SS3	1.5 - 2.1	24-Oct-19	4	1	1	1	1,2
BH19-6	DUP	1.5 - 2.1	24-Oct-19				1	1,2
BH19-6	SS8	5.3 - 5.9	24-Oct-19		✓	1	1	1,2
BH19-8	SS8	5.3 - 5.9	24-Oct-19	4	✓	1	1	1
BH19-10	SS8	5.3 - 5.9	24-Oct-19	4	1	1	1	1,2
BH19-10	SS10	6.9 - 7.5	24-Oct-19	4		4		1,2

Table 5-1Summary of Soil Samples

The soil analysis results from the present investigation are presented in Tables 4 to 7 and are discussed below.

Soil samples, with corresponding number of QA/QC samples, collected from the boreholes were submitted to the laboratory and analyzed for the following PCOCs: metals, PHCs, VOCs, and/or PAHs. One sample was also submitted for analysis of Toxicity Characteristic Leaching Procedure (TCLP), for evaluation of possible landfill disposal options.

The Laboratory Certificates of Analysis for the soil analysis completed during the present investigation are provided in **Appendix D**.

5.6.1 METALS

The soil analytical results for metals are summarized in **Table 4.** All soils and results that exceeded the MECP Table 3 SCS are presented in Table 5-2. Further comparison to MECP Table 1 standards is included in **Table 4**:

Table 5-2	Metals Exceedances	Greater Than MECP	Table 3 SCS in Soil
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Sample ID	MEOD	BH19-4-SS2	
Sample Depth (mbgs)	MECP Table 3	0 – 1.2	
Description of Material	SCS	Fill (silty sand)	

All units in µg/g

- - values met the MECP Table 3 SCS

NA – not analyzed

104 - Analytical result greater than the MECP Table 3 SCS

All other analytical results were found to be in compliance with MECP Table 3 standards.

5.6.2 PETROLEUM HYDROCARBONS (PHCS)

No exceedances of MECP Table 3 SCS were identified in the soil samples submitted for PHC analysis. One sample BH19-2-SS5 exceeded MECP Table 1 SCS for F1(C6 to C10) and F4 (C34 to C50). The soil analytical results for PHCs are summarized in **Table 5**.

5.6.3 VOLATILE ORGANIC COMPOUNDS (VOCS)

No exceedances of MECP Table 3 SCS were identified in the soil samples submitted for VOC analysis. The soil analytical results for VOCs are summarized in **Table 6**.

5.6.4 POLYCYCLIC AROMATIC HYDROCARBONS (PAHS)

No exceedances of MECP Table 3 SCS were identified in the soil samples submitted for PAH analysis. The soil analytical results for PAHs are summarized in **Table 7**.

5.6.5 TCLP

One composite sample, created by WSP using fill material from samples BH19-4-SS2, BH19-6-SS3 and BH19-10-SS8 was submitted for analysis. Based on a comparison with Ontario Regulation 558, Schedule 4, the soil material is not considered to be hazardous waste. C of As are included in **Appendix D-2**.

5.7 GROUNDWATER QUALITY

A summary of the groundwater samples submitted for laboratory analysis, including details of sampling location and screened depths is presented below in Table 5-3:

MONITORING WELL ID	SCREENED INTERVAL (MBGS)	DATE PARAMETERS			APEC #		
			Metals	PHCs	VOCs	PAHs	
BH19-4	4.5 - 7.5	Nov 4 2019	1	1	1	1	1,2
BH19-4 (DUP)	4.5 - 7.5	Nov 4 2019	1	1	1	1	1,2
BH19-6	4.6 - 7.9	Nov 4 2019	1	1	1	1	1,2
BH19-10	4.6 - 7.6	Nov 4 2019	1	~	1	1	1,2

Table 5-3 Summary of Groundwater Samples

Groundwater samples, including QA/QC samples were submitted to the laboratory and analyzed for the following PCOCs: Metals, PHCs, VOCs, and PAHs.

Summaries of the analytical results for each analyzed parameter are provided in Tables 8 to 11 and are discussed below.

The Laboratory Certificates of Analysis for the groundwater analysis completed during the Phase Two ESA are provided in **Appendix D-3**.

5.7.1 METALS

No exceedances of MECP Table 3 SCS were identified in the groundwater samples submitted for metals analysis. The groundwater analytical results for metals are summarized in **Table 8**.

5.7.2 PETROLEUM HYDROCARBONS (PHCS)

No exceedances of MECP Table 3 SCS were identified in the groundwater samples submitted for PHC analysis. The groundwater analytical results for PHCs are summarized in **Table 9**.

5.7.3 VOLATILE ORGANIC COMPOUNDS (VOCS)

No exceedances of MECP Table 3 SCS were identified in the groundwater samples submitted for VOC analysis. The groundwater analytical results for VOCs are summarized in **Table 10**.

5.7.4 POLYCYLIC AROMATIC HYDROCARBONS (PAHS)

No exceedances of MECP Table 3 SCS were identified in the groundwater samples submitted for PAHs analysis. The groundwater analytical results for PAHs are summarized in **Table 11**.

5.8 SEDIMENT QUALITY

No sediment sampling was conducted as part of this investigation.

5.9 QUALITY ASSURANCE AND QUALITY CONTROL RESULTS

Field duplicate samples were assessed as part of the QA/QC program during the Phase Two ESA. A minimum of one field duplicate sample was collected and analyzed for every ten samples for both soil and one field duplicate on each day of groundwater sampling. Field duplicate samples were evaluated based on the relative percent difference (RPD) in parameter concentrations. Where measured parameter concentrations were greater than five times the laboratory reportable detection limit (RDL), a RPD of less than 50% for soils and less than 30% for groundwater with the exception of certain parameters (see

Table 5-4 below) was deemed acceptable; for concentrations less than five times the RDL, the RPD could not be reliably calculated. A summary of the required performance standard for soil and groundwater sample homogeneity for QA/QC comparisons of the original to its duplicate sample is provided in Table 5-4.

Table 5-4 Required Performance Standards for Soil and Groundwater for QA/QC

REQUIRED QA/QC PARAMETER	REQUIRED PERFORMANCE STANDARD
Petroleum hydrocarbons	RPD should be ≤ 30% for water and ≤ 40% for soils
Polycyclic aromatic hydrocarbons	RPD should be \leq 30% for water and \leq 40% for soils
Volatile organic compounds	RPD should be ≤ 30% for water and ≤50% for soils
Hexavalent chromium	RPD should be ≤ 20% for water and ≤ 35% for soils

REQUIRED QA/QC PARAMETER	REQUIRED PERFORMANCE STANDARD
Moreury	PPD should be $\leq 20\%$ for water and $\leq 30\%$ for soils

Mercury	RPD should be $\leq 20\%$ for water and $\leq 30\%$ for soils
Metals, Hydrid metals, boron hot water soluble	RPD should be \leq 20% for water and \leq 30% for soils. BHWS \leq 30% water and \leq 40% soils
(BHWS)	

A summary of the field duplicates for soil and groundwater samples exceeding the acceptable RPDs are shown in Table 5-5.

Table 5-5 Summary of Soil and Groundwater QA/QC control Results

DATE SAMPLED	SAMPLE ID	FIELD DUPLICATE ID	MEDIA SAMPLED	RPD EXCEEDING REQUIRED STANDARDS
2019-10-24	BH19-6-SS3	BH19-6-DUP	Soil – PAHs	Benzo(b)fluoranthene, RPD = 42%
2019-11-04	BH19-4		GW – Metals, PHCs,BTEX,PAHs	No exceedances reported.

The only RPD exceedances was identified in a soil sample submitted for PAH analysis. The detected RPD consisted on only a marginal exceedance of the required standard, likely due to the heterogeneity of the fill material, and is not considered to affect the interpretation of the results.

Paracel Laboratories carried out internal QA/QC measures including process recoveries, blanks, and replicate samples. The laboratory QA/QC results are provided on the Certificates of Analysis in **Appendix D**; the results were acceptable and, therefore, suitable for consideration of the results in the interpretation of site conditions.

With respect to subsection 47(3) of O. Reg. 153/04, all certificates of analysis of analytical reports received pursuant to clause 47(2)(b) of the regulation comply with subsection 47(3), a certificate of analysis of analytical report has been received for each sample submitted for analysis, and all certificates of analysis or analytical reports received have been included in full in **Appendix D**.

5.10 PHASE TWO CONCEPTUAL SITE MODEL

Through analysis and interpretation of the Phase One ESA, Phase One CSM, and field data gathered during this Phase Two ESA, a Phase Two Conceptual Site Model was developed, which also included the following figures:

FIGURE 1	PHASE ONE CONCEPTUAL SITE MODEL
FIGURE 2	PHASE ONE SITE PLAN
FIGURE 3	BOREHOLE AND CROSS-SECTION LOCATION PLAN
	Plan view of all environmental sample locations, and location of cross-sections
FIGURE 4	GROUNDWATER CONTOURS
	Inferred groundwater contour prepared based on groundwater levels measured in on-site monitoring wells on November 4, 2019.
FIGURE 5	STRATIGRAPHIC CROSS-SECTION A-A'
	Stratigraphy shown parallel to groundwater flow. Extent of contamination shown is based on excavation completed at the time of remediation.
FIGURE 6	STRATIGRAPHIC CROSS-SECTION B-B'
	Stratigraphy shown perpendicular to groundwater flow. Extent of contamination shown is based on excavation completed at the time of remediation.
FIGURE 7	ANALYTICAL TESTING PLAN - SOIL

Plan view of all the soil samples collected and submitted for metals, PHCs, VOCs, and PAHs. This plan also identifies suspected areas of vanadium impacts.

FIGURE 8 ANALYTICAL TESTING PLAN - GROUNDWATER

Plan view of all the groundwater samples collected and submitted for metals, PHCs, VOCs, and PAHs.

FIGURE 9 CONCEPTUAL SITE MODEL FOR HUMAN RECEPTORS

Conceptual Site Model showing the source, contaminant release mechanism, exposure routes and human receptors based on the site condition.

FIGURE 10 CONCEPTUAL SITE MODEL FOR ECOLOGICAL RECEPTORS

Conceptual Site Model showing the source, contaminant release mechanism, exposure routes and ecological receptors based on the site condition.

Based on information obtained as part of the Phase One ESA, it was concluded that two areas of potential environmental concern (APECs) associated with past activities/operations exist at the Site. The table of APECs, prepared in accordance with clause 16(2)(a), Schedule D, O. Reg. 153/04, is summarized in **Table 5-6**.

 Table 5-6
 Summary of Areas of Potential Concern

AREAS OF POTENTIAL ENVIRONMENTAL CONCERN (APEC)	LOCATION OF APEC ON PHASE TWO PROPERTY	POTENTIALLY CONTAMINATING ACTIVITY (PCA)	LOCATION OF PCA ON-SITE OR OFF-SITE)	CONTAMINANT(S) OF POTENTIAL CONCERN	MEDIA POTENTIALLY IMPACTED (GROUNDWTER AND/OR SOIL)
APEC 1 Central portion side of subject site.		30. Fill Material of Unknown Quality	On-site	Metals, PHCs, VOCs, PAHs	Soil and Groundwater
APEC 2	PEC 2 East portion of 46. F subject site.		Off site	Metals, PHCs, PAHs	Soil and Groundwater

PHC – Petroleum hydrocarbons, including benzene, toluene, ethylbenzene and xylenes

VOCs – volatile organic compounds

PAHs – polycyclic aromatic hydrocarbons

5.10.1 PCAS AND APECS

5.10.1.1 AREAS WHERE POTENTIALLY CONTAMINATING ACTIVITY HAS OCCURRED

One on-site PCA and one off-site PCA were identified as Areas of Potential Environmental Concern on the subject site. These are related to the historical importation of fill material of unknown quality, and the presence of a historical and current rail line to the east of the subject site.

5.10.1.2 AREAS OF POTENTIAL ENVIRONMENTAL CONCERN

There are two APECs where PCAs may have affected the soil and/or groundwater at the Phase Two Property:

- <u>APEC 1 (Eastern portion of the Subject Site)</u>: The importation and storage of fill material of unknown quality from historical commercial operations at the site has the potential to impact soil at the subject site;
- <u>APEC 2 (Central and Eastern portion of the Subject Site)</u>: A railway line was formerly located at grade from as early as the 1920's until the 1960's, when the line was shifted to a trench immediately adjacent to it. The rail lines (both older and newer) are located offsite to the east.

5.10.1.3 SUBSURFACE STRUCTURES AND UTILITIES

Underground utilities can affect contaminant distribution and transport. Trenches excavated to install utility services, and the associated granular backfill may provide preferential pathways for horizontal contaminant migration in the shallow subsurface.

Based on utility drawings made available by Carleton University, as well as public and private locates obtained by WSP during the Phase Two ESA investigation, service lines were located at various locations on the subject site, including sanitary and storm sewers, natural gas lines, electrical conduits and water lines. As there are no identified groundwater impacts on the Phase Two Property, subsurface utilities are not anticipated to contribute to contaminant migration.

5.10.2 PHYSICAL SETTING

5.10.2.1 STRATIGRAPHY FROM GROUND SURFACE TO THE DEEPEST AQUIFER OR AQUITARD INVESTIGATED

Based on the findings of the drilling investigation, the soil stratigraphy, with increasing depth, beneath the Phase Two subject site generally consisted of a layer of asphalt or topsoil, underlain by fill consisting of silty sand to silty sand and gravel, with occasional presence of silty clay fill. The sand and gravel fill layer is considered to be reworked native soils, either from the subject site or from areas immediately off-site. Fill material was noted to extend to depths ranging between 3.8 m and 7.6 mBGS. Beneath the fill layer, there was native silty sand and gravel till (glacial till). Bedrock was cored at three (3) borehole locations, to final depths of 15.5, 18.6 and 19.3 mBGS, at BH19-8, BH19-7 and BH19-2, respectively.

Stratigraphic cross section is presented in **Figures 5** and **6**. Stratigraphic cross-sections A-A' and B-B' depict the subsurface condition oriented parallel and perpendicular to groundwater flow.

The groundwater elevation contours based on recent groundwater monitoring shown on Figure 4.

5.10.2.2 HYDROGEOLOGICAL CHARACTERISTICS

The results of the groundwater monitoring indicated that the primary near surface water table resides within the fill material (at boreholes BH19-4 and BH19-10), and within the glacial till layer, at BH19-6. No visual, olfactory or analytical evidence of impact was noted in the groundwater. The groundwater elevation contours based on recent groundwater monitoring in the wells are included in **Figure 4.** The average horizontal hydraulic gradient was calculated to be 0.01, using the groundwater elevation measured on November 4, 2019.

5.10.2.3 APPROXIMATE DEPTH TO BEDROCK

Inferred bedrock was encountered between 7.6 m and 12.6 mBGS (based on refusal to auger advancement). Bedrock was cored at BH19-2, BH19-7 and BH19-8, where bedrock was encountered at 11.4, 11.8 and 10.7 mBGS (respectively). Bedrock consisted of shale and limestone.

5.10.2.4 APPROXIMATE DEPTH TO WATER TABLE

Within the subject site, groundwater was observed to range between 4.5 m and 6.7 mBGS (elevations of 60.23 and 59.55 m).

5.10.2.5 SECTION 41 OR 43.1 OF THE REGULATION

Section 41 of O. Reg. 153/04 does not apply to the Site based on the following:

Section 41(1)(a) does not apply as the Site is not (i) within an area of natural significance, nor does it (ii) include or is adjacent to an area of natural significance or part of such an area, nor does it (iii) include land that is within 30 metres of an area of natural significance or part of such an area;

Section 43.1 of O. Reg. 153/04 does not apply to the Site based on the following:

Section 43.1(a) does not apply to the Site – The Site is not a shallow soil site, as defined in Section 43.1(3); overburden thickness is greater than 7.6 metres based on the drilling investigation completed onsite.

Based on the factors listed above, the MECP SCS Table 3 SCS would apply to the Phase Two Property.

5.10.2.6 SOIL BROUGHT FROM ANOTHER PROPERTY

Fill material of unknown quality imported for on-site grading was identified as a PCA on-site. The quality of this fill material was assessed.

The fill material was found to be in compliance with site standards, with one exception: vanadium was encountered above the site standards at BH19-4.

5.10.2.7 PROPOSED BUILDINGS AND STRUCTURES

The subject site is intended to be developed with a student residence building.

5.10.3 CONTAMINANT PRESENCE ONSITE

5.10.3.1 AREAS WHERE A CONTAMINANT IS PRESENT

Soil with contaminant concentrations greater than the Table 3 SCS was present in a localised location at BH19-4. Soil was marginally impacted with vanadium, a metals parameter.

5.10.3.2 ASSOCIATED CONTAMINANTS

Based on the initial Phase Two ESA, the associated contaminants in soil onsite was limited to vanadium. No other contaminants were identified on the subject site.

5.10.3.3 ASSOCIATED MEDIUM

Contaminants were only found in soil. No contaminants were identified in groundwater.

5.10.3.4 WHAT IS KNOWN ABOUT THE AREAS OF ENVIRONMENTAL IMPACT

Soil with contaminant concentrations greater than the Table 3 SCS was present in the fill material (silty clay) at BH19-4.

5.10.3.5 HORIZONTAL DISTRIBUTION OF CONTAMINANTS

The horizontal distribution of vanadium in soil is presented in **Figure 5** and vertical distribution of vanadium in soil is presented in cross-section **Figures 7**.

The area of impact is limited to an area surrounding BH19-4.

5.10.3.6 REASON FOR DISCHARGE

The majority of the imported fill material identified at the subject site was found to be compliant with the applicable site condition standards. The vanadium exceedance may be related to naturally occurring vanadium in silty clay fill, as there were no real sources of vanadium at the subject site, however, vanadium was not encountered within other fill samples.

5.10.3.7 MIGRATION OF CONTAMINANTS

Figure 5 provides delineation of the vanadium in plan view. Vanadium was the only contaminant identified on the subject site, and only limited to one soil sample, collected from BH19-4. All metals parameters in groundwater were found to be in compliance with site standards at that borehole monitoring well location, specifically, vanadium was not detected above laboratory detection limits.

As such, the on-site contaminant, vanadium, is not considered to have migrated vertically or horizontally with any significant distance and is considered to be localised around the upper fill material at BH19-4.

5.10.3.8 CLIMATIC OR METEOROLOGICAL CONDITIONS

Climatic or meteorological conditions are not considered to affect migration of the vanadium, as the borehole/monitoring

well was installed within a asphalt-covered surface. Infiltration through the asphalt would be considered negligible.

5.10.3.9 SOIL VAPOUR INTRUSION

Soil vapour intrusion is not considered to be a concern with respect to the identified contaminant due to the fact that metals do not readily volatilize and that as part of site redevelopment works, much of the shallow fill material where vanadium was identified would likely be removed from the property.

5.10.4 CONTAMINANT DISTRIBUTION

5.10.4.1 LATERAL AND VERTICAL DISTRIBUTION OF A CONTAMINANT

Cross-sections that include the required information are provided as:

Figure 5 Cross-section A-A'

Plan view figures that indicate the horizontal distribution of contaminants are provided as:

- Figure 7 Analytical Testing Plan – Soil.

5.10.5 PHASE TWO CSM

The subject site had no building onsite and the area where impacted soil was paved. The release mechanisms and transport pathways for human and ecological receptors are discussed herein and are shown in **Figures 9** and **10**.

5.10.5.1 THE RELEASE MECHANISMS AND CONTAMINANT TRANSPORT PATHWAY

The release mechanisms and transport pathway for the contaminants (vanadium) include:

- Ingestion and skin contact with contaminated soil during excavation works; and
- Wind Erosion for airborne particles for metals.

5.10.5.2 THE HUMAN AND ECOLOGICAL RECEPTOR

The potential human and ecological receptors exposed to the COCs include:

Human (onsite):

- Site worker, construction workers and utilities workers;

Ecological:

Soil organism.

As the contamination is limited to soil only, and that soils in that area are asphalt-covered, exposure to on-site and offsite receptor is limited.

5.10.5.3 RECEPTOR EXPOSURE POINTS AND ROUTES OF EXPOSURE 5.10.5.3.1 HUMAN RECEPTOR

Exposure point and complete exposure pathways for on-site human receptors include:

- Onsite soil ingestion, dermal contact (soil skin contact), and inhalation of particulate matter and vapours both outdoor and indoor air; and
- Offsite inhalation of particulate matter and vapours both outdoor and indoor air.

These would only be applicable if the soils are uncovered.

5.10.5.3.2 ECOLOGICAL RECEPTOR

Exposure point and complete exposure pathways for on-site ecological receptors include infiltration and adsorption to soil via the following:

- Root and volatilized contaminants update for terrestrial plants;
- Direct update via dermal contact and inhalation of volatilized contaminants for soil invertebrates;
- Ingestion, vapour and soil inhalation of plant and invertebrates effected by impacted soil for birds, mammals and amphibians; and
- Ingestion, vapour and soil inhalation of contaminants for birds, mammals and amphibians.

Impact to ecological receptors is considered to be minimal, due to the fact that impacted soils are currently asphalt-covered.

6 CONCLUSIONS

6.1 SUMMARY OF PHASE TWO ESA INVESTIGATION FINDINGS

The following assessments were completed at the Phase Two Property where soil and groundwater samples were collected and submitted for laboratory analysis for the PCOCs, including metals, PHCs, PAHs and VOCs as identified during the Phase One ESA.

Between October 23 and October 28, 2019, 12 environmental and geotechnical boreholes (three of which were completed as monitoring wells) were advanced to maximum depths ranging between 7.6 m and 12.6 mBGS. Three (3) boreholes were cored to depths between 15.5 and 19.3 mBGS.

Based on the information collected in this Phase Two ESA, WSP provides the following findings:

Subsurface Condition

Based on the findings of the drilling investigation, the soil stratigraphy, beneath the Phase Two subject site generally consisted of a layer of asphalt or topsoil, underlain by fill consisting of silty sand to silty sand and gravel, with occasional presence of silty clay fill. Part of the sand and gravel fill layer is considered to be reworked native soils, either from the subject site or from areas off-site. Fill material was noted to extend to depths between 3.8 m and 7.6 mBGS. Beneath the fill layer, there was native silty sand and gravel till (glacial till). Bedrock was cored at three (3) borehole locations, to final depths of 15.5, 18.6 and 19.3 mBGS, at BH19-8, BH19-7 and BH19-2, respectively.

For the purposes of this assessment, the analytical results have been compared to the 2011 MECP Table 3 for full depth generic site conditions in a non-potable groundwater condition.

Soil Condition

 All soils were found to be in compliance with MECP Table 3 standards, with the exception of vanadium at borehole BH19-4, which was identified in the upper fill material.

Groundwater Condition

 All groundwater samples were found to be in compliance with MECP Table 3 standards and is not considered to have been adversely impacted by historical activities.

6.2 RECOMMENDATIONS

Based on the findings of the Phase Two ESA, vanadium is present within a small area of the subject site, related to poor quality fill material. Given the scope of the proposed redevelopment of the site, the soils in the vicinity of the vanadium exceedance should be excavated and disposed of at a licensed landfill facility as part of site excavation works. It is recommended that WSP be present at the time of excavation, such that confirmatory samples can be collected following remedial excavation works.

Prior to site redevelopment, all three (3) groundwater monitoring wells must be decommissioned as per Ontario Regulation 903.

7 QUALIFICATIONS OF ASSESSORS

7.1 WSP CANADA INC.

WSP is a leading, full-service engineering company that has seen successful growth in the past decade with a Canadian contingent of approximately 8,000 people making a significant contribution to our 34,000 global staff, based in more than 500 offices, across 40 countries. WSP employs about 450 environment staff in Ontario including Professional Engineers, Professional Geoscientists, Biologists and Certified Technicians. The firm provides services to transform the built environment and restore the natural environment, and its expertise ranges from environmental remediation to urban planning, from engineering iconic buildings to designing sustainable transport networks, and from developing the energy sources of the future to enabling new ways of extracting essential resources.

7.2 QUALIFIED PERSON

Natalia Codoban, M.Eng., P.Eng, QP_{ESA} –Senior Hydrogeologist/Senior Env. Engineer

Natalia is a Senior Hydrogeologist / Environmental Engineer and Project Manager with over 14 years of experience in the environmental consulting field. She has academic background in Earth / Environmental Sciences and Geology and Environmental Engineering. She is a Professional Engineer in good standing and is a QP_{ESA}. Natalia has provided expertise to numerous Phase One and Phase Two ESAs, Contamination Overview Studies, landfill studies, hydrogeological investigations, and modelling groundwater flow and contaminant transport migration. Natalia reviewed the Phase Two ESA for this project.

Adrian Menyhart, P.Eng., ing. QPESA – Environmental Engineer/Project Manager

Adrian Menyhart is a Project Manager in the Ottawa, Ontario office of WSP Canada Inc. He has experience in conducting Phase One and Two Environmental Site Assessments on numerous residential, commercial, and industrial properties throughout Ontario and Quebec, from the conception stages, sampling programs, and reporting. Adrian has also successfully submitted several Record of Site Condition with the Ontario Ministry of the Environment, Conservation and Parks. Adrian managed completion of the Phase One ESA and Phase Two ESA and prepared ESA reports for this project.

7.3 SIGNATURES

This Phase Two ESA was conducted by the undersigned Qualified Person in general accordance with the requirements of O. Reg. 153/04.

Adrian Menyhart, P.Eng., ing., QP_{ESA} Project Engineer, Environment

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Natalia Codoban, M.Eng., P.Eng., QP_{ESA} Senior Environmental Engineer, Environment

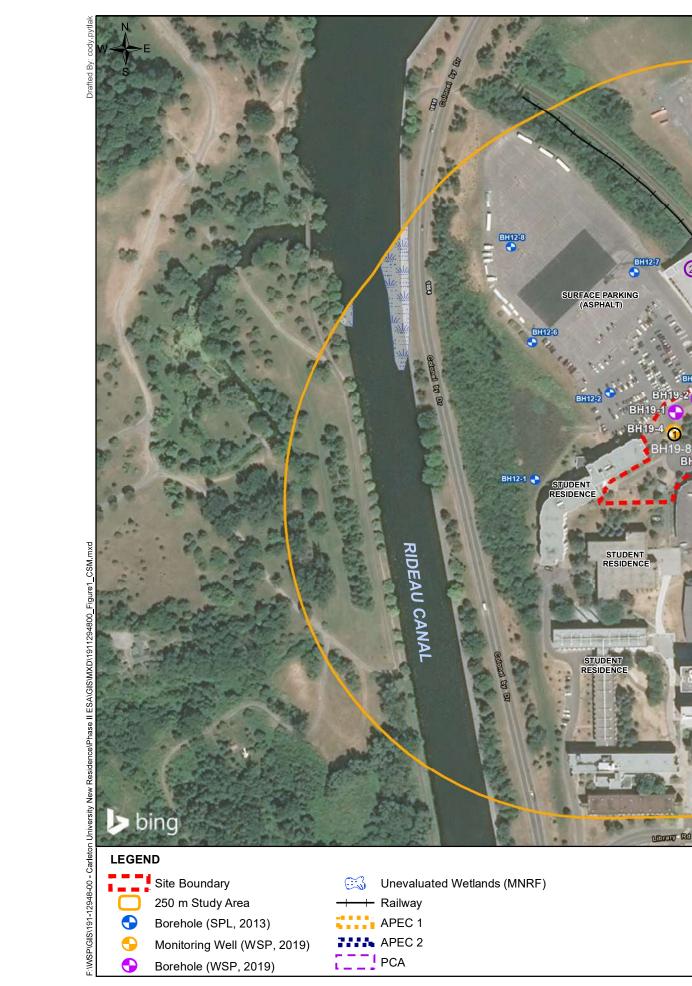
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- SPL Consultants Limited, April 3, 2013. Phase Two Environmental Site Assessment, North Property Development, Carleton University, 1125 Colonel By Drive, Ottawa, Ontario.

vsp

Table 1 Monitoring Well Installation and Groundwater Levels

Monitoring Well		ng Well ID	BH19-4	BH19-6	BH19-10
	Installed By		WSP	WSP	WSP
	Installation Date		28-Oct-19	24-Oct-19	24-Oct-19
	Well Status		Active	Active	Active
We	ell Inner Diameter	(mm)	50	50	50
Casing Type (Flushmo	ount / Monument)		Flushmount	Monument	Monument
Ground	Surface Elevation	(masl)	64.740	66.440	65.400
Bottom of Con	crete Seal/Top of	(mbgs)	0.3	0.3	0.3
	Bentonite Seal	(masl)	64.44	66.14	65.1
Bottom of Bentonite	Seal/Top of Sand	(mbgs)	3.5	3.5	4.3
Pack		(masl)	61.2	62.9	61.1
Т	on of Well Screen	(mbgs)	4.6	4.9	4.6
Top of Well Screen		(masl)	60.1	61.5	60.8
Screen Length		(m)	3.0	3.0	3.0
Bottom of Screen		(mbgs)	7.5	7.9	7.6
		(masl)	57.2	58.5	57.8
04-Nov-19	Depth of GW	(mbgs)	4.5	6.7	5.9
04-1100-19	GW Elevation	(masl)	60.2	59.8	59.6

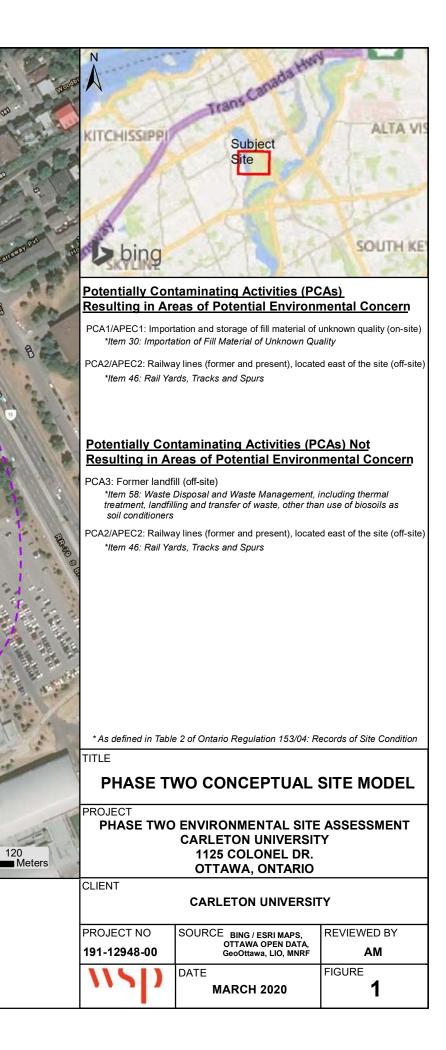


PARKING GARAGE

STUDENT RESIDENCE

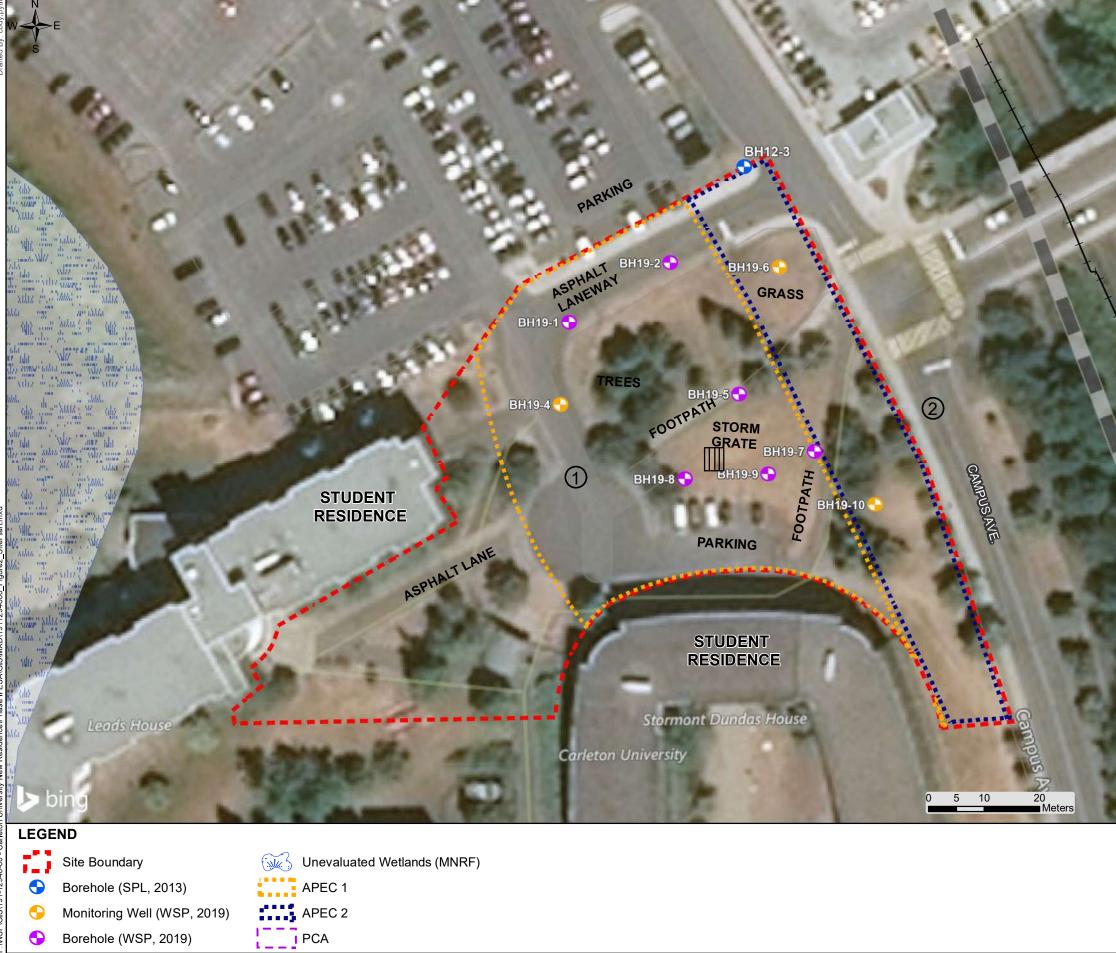
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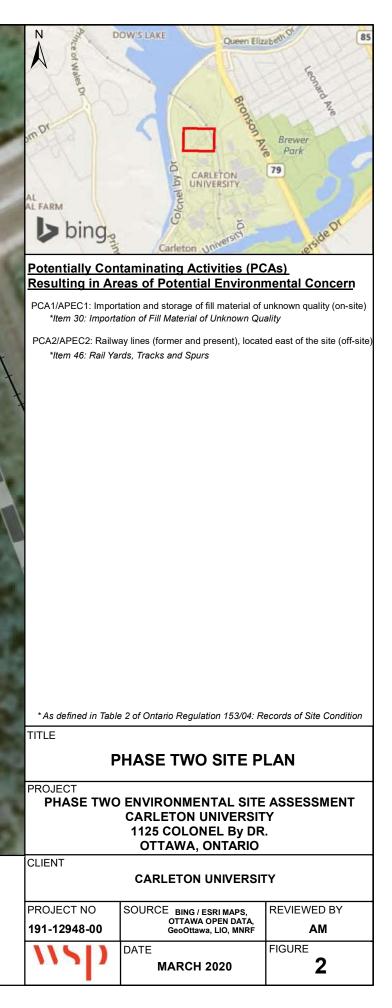
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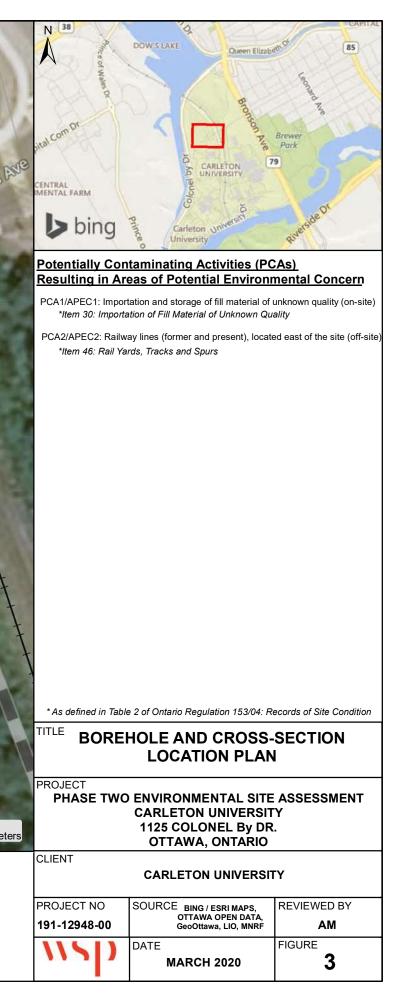
Site Boundary

Unevaluated Wetlands (MNRF)

APEC 1

APEC 2

- \bullet Monitoring Well (WSP, 2019)
- Borehole (WSP, 2019)
- \bullet Borehole (SPL, 2013)





• Monitoring Well (WSP, 2019)*

APEC 2

- Borehole (WSP, 2019)
- \bigcirc Borehole (SPL, 2013)

*Geodetic Groundwater elevations, Nov. 4, 201 (based on Preliminary survey sketch prepared b Fairhall, Moffatt, Woodland Lto

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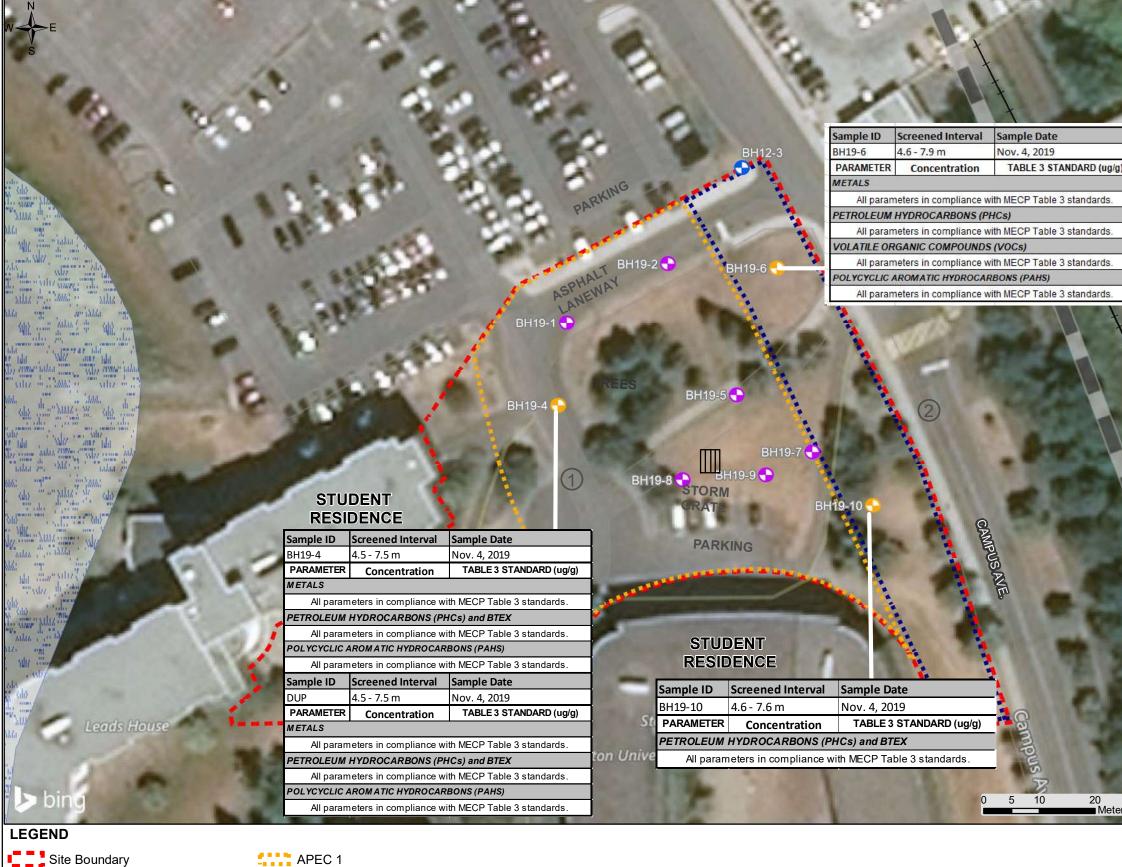
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LEGEND

- Site Boundary
 - Contraction Contractico Contra
 - Solution Monitoring Well (WSP, 2019)
 - Borehole (WSP, 2019)
 - Borehole (SPL, 2013)
- PCA APEC 1 APEC 2 Area of Vanadium Impacted Fill Material

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Site Boundary Unevaluated Wetlands (MNRF)

APEC 2

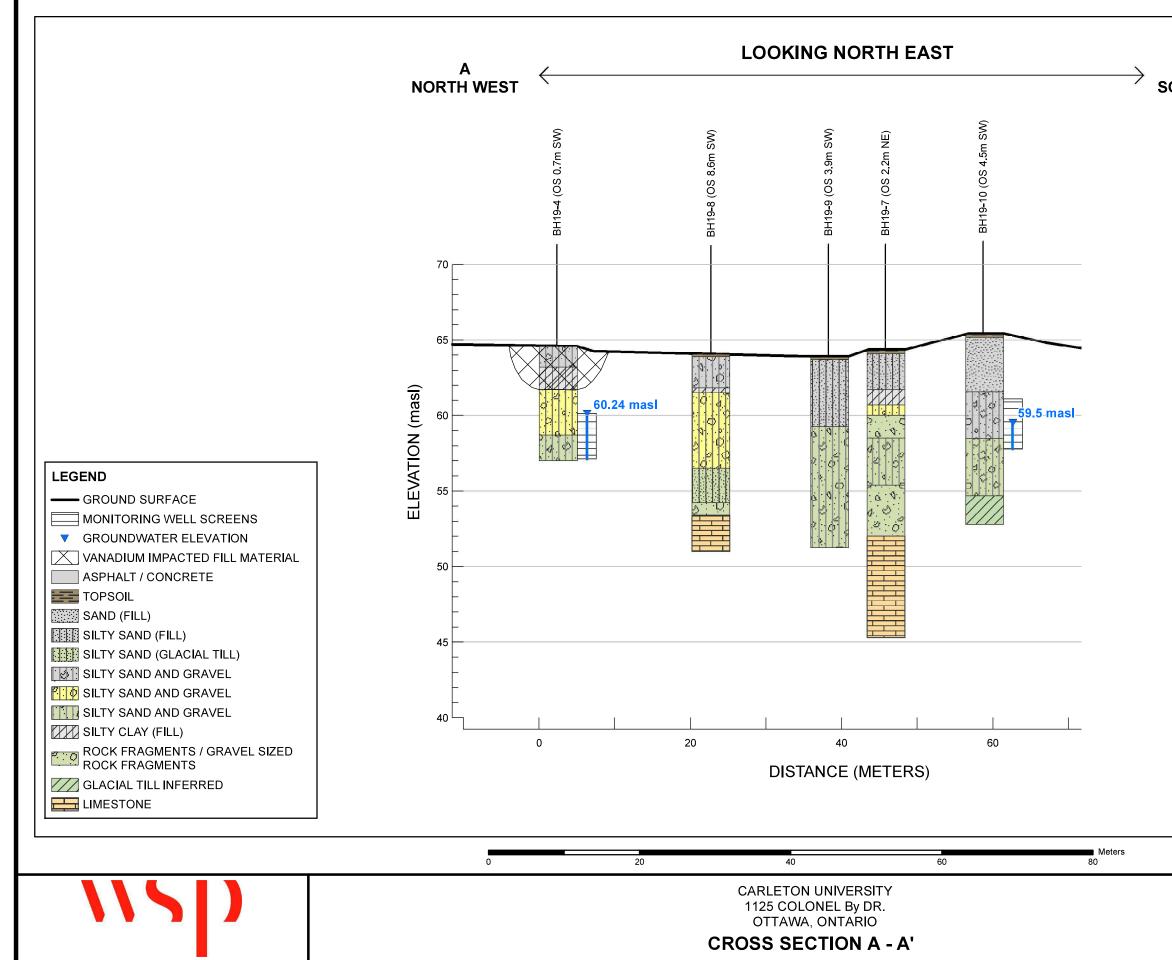
Monitoring Well (WSP, 2019) Borehole (WSP, 2019)

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	Resulting		eas of PO		<u>mental Concern</u>
	PCA1/APEC1	Import	ation and sto	rage of fill material of	unknown quality (on-site)
				aterial of Unknown Qu	
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	PCA2/APEC2	: Railwa	ay lines (form	er and present), locat	ed east of the site (off-site)
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	PROJECT N	0	SUURCE	BING / ESRI MAPS, TTAWA OPEN DATA,	REVIEWED BY
	191-12948-	00		eoOttawa, LIO, MNRF	AM
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	116		DATE		FIGURE
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l/caott1dat01.gcg.local/SPL Ottawa\Projects\191-12948-00 - Carleton University New Residence\Phase II ESA\GIS\MXD\Figure 5 Cross Section A-A'.mxd



A' SOUTH EAST

SCALE AS SHOWN 2X VERTICAL EXAGGERATION

FIGURE

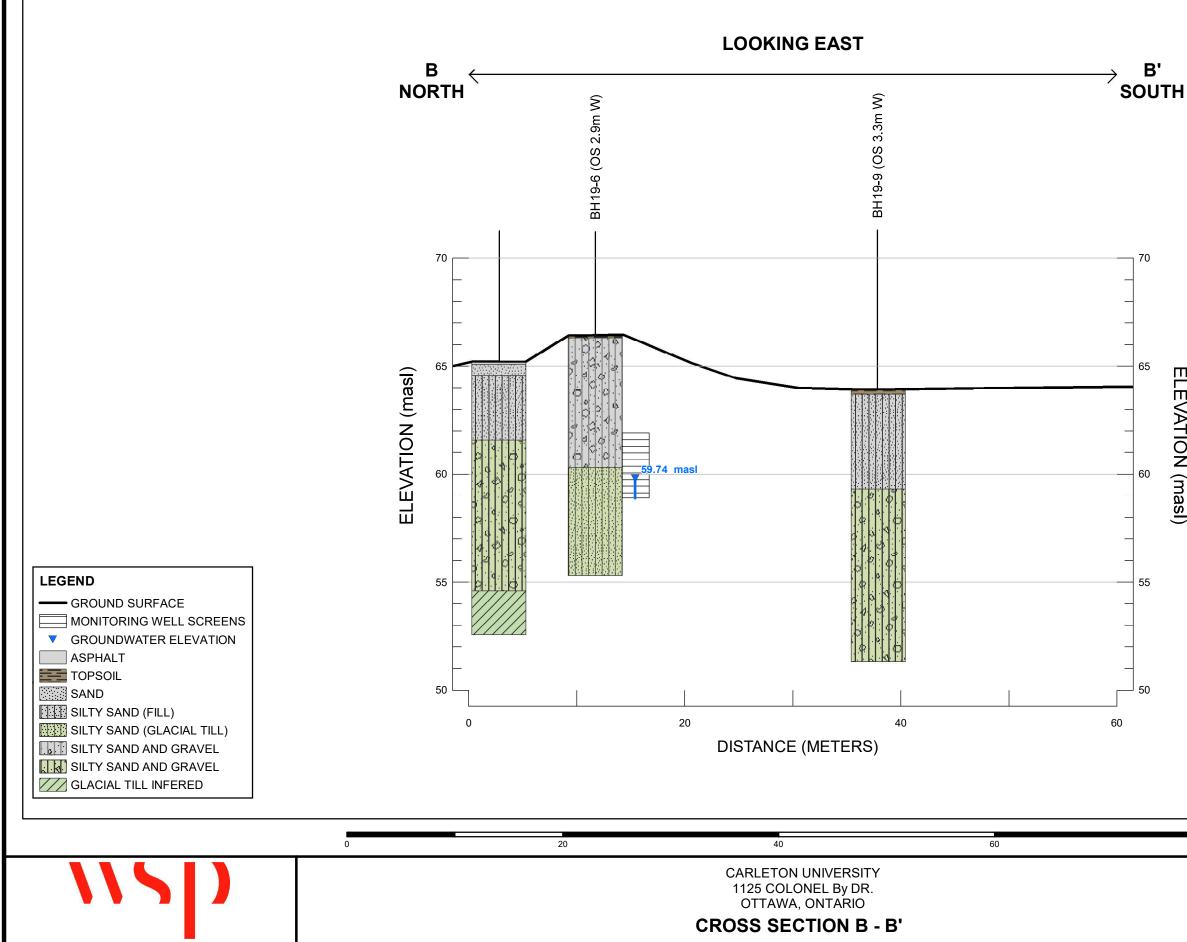
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PROJECT: 191-12948-00

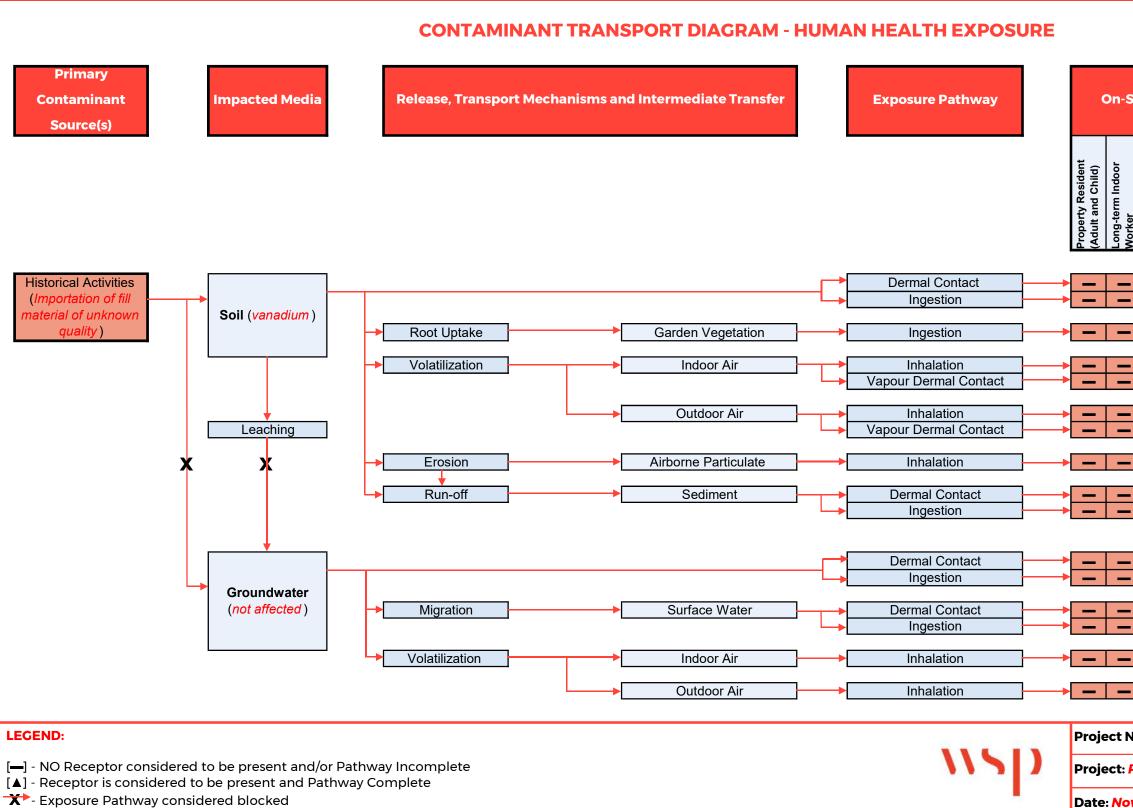
NOVEMBER 2019

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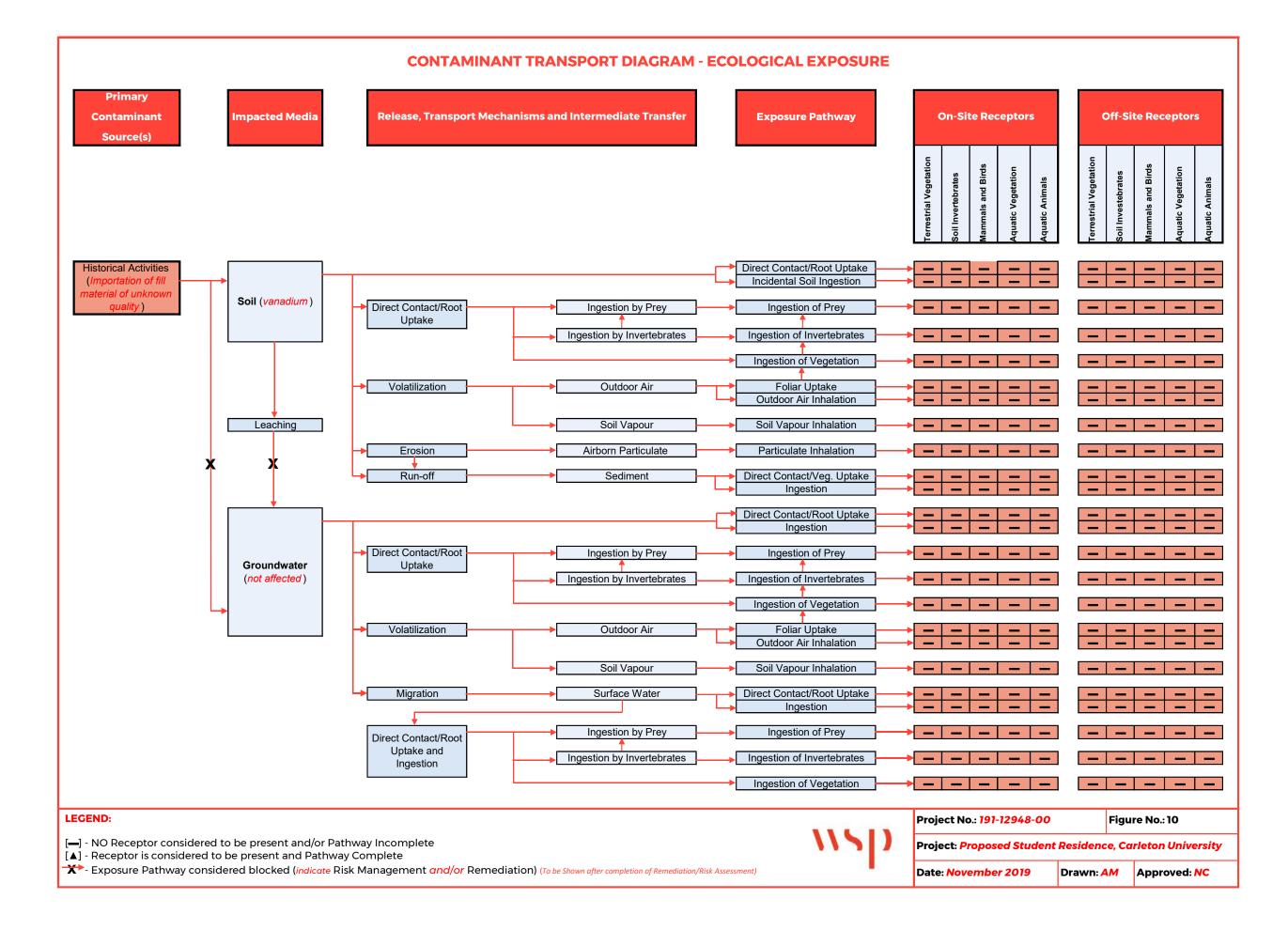
\caott1dat01.gcg.local\SPL Ottawa\Projects\191-12948-00 - Carleton University New Residence\Phase II ESA\GIS\MXD\Figure 6 Cross Section B-B'.mxd



Meters 80	SCALE 2X VERTICAL EXAC	AS SHOWN GERATION
	DATE: NOVEMBER 2019	FIGURE
	PROJECT: 191-12948-00	6



Site Receptors Off-Site						te Rec	eptoi	ſS		
Worker	Construction Worker	Landscape Worker	Property Visitor/ Trespasser		Property Resident (Adult and Child)	Long-term Indoor Worker	Construction Worker	Landscape Worker	Property Visitor/ Trespasser	
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Borehole	Sample	Depth	Date		Parameters					
		m		Metals	PHCs	VOCs	PAHs			
BH19-2	SS5	2.3 - 2.9	23-Oct-19	√	✓	✓	√	1		
BH19-4	SS2	1.8 - 2.4	28-Oct-19	1	✓	✓	√	1		
BH19-6	SS3	1.5 - 2.1	24-Oct-19	√	✓	✓	√	1,2		
BH19-6	DUP	1.5 - 2.1	24-Oct-19			✓		1,2		
BH19-6	SS8	5.3 - 5.9	24-Oct-19		✓	✓	✓	1,2		
BH19-8	SS8	5.3 - 5.9	24-Oct-19	√	✓	✓	✓	1		
BH19-10	SS8	5.3 - 5.9	24-Oct-19	√	✓	✓	✓	1,2		
BH19-10	SS10	6.9 - 7.5	24-Oct-19	√				1,2		
BH12-3	SS2	0.89 - 1.4	1-Dec-12	√				1		
BH12-3	SS4	1.8 - 2.4	1-Dec-12				✓	1		
BH12-3	SS5	2.4 - 3.1	1-Dec-12		✓			1		
BH12-3	SS8	6.1 - 6.7	1-Dec-12	√				1		
BH12-3	SS10	9.1 - 9.8	1-Dec-12			✓		1		

Table 2 Summary of Soil Samples Submitted for Chemical Analysis



Table 3 Summary of Groundwater Samples Submitted for Chemical Analysis

Monitoring Well ID	Screened Interval (mbgs)	Date		Parameters						
			Metals	PHCs	VOCs	PAHs				
BH19-4	4.5 - 7.5	Nov 4 2019	1	1	1	1	1,2			
BH19-4 (DUP)	4.5 - 7.5	Nov 4 2019	✓	✓	1	✓	1,2			
BH19-6	4.6 - 7.9	Nov 4 2019	✓	✓	1	✓	1,2			
BH19-10	4.6 - 7.6	Nov 4 2019		1	1		1,2			

Table 4 Soil Analytical Results - Metals

Parameter			BH19-2-SS5	BH19-4-SS2	BH19-6-SS3	BH19-8-SS8	BH19-10-SS8	BH19-10-SS10
Date of Collection		Table 1	Oct 23, 2019	28-Oct-19	Oct 24, 2019	Oct 24, 2019	Oct 24, 2019	Oct 24, 2019
Date Reported	Table 3 RPI CT	Table 1 RPIICC	Oct 31, 2019	Nov 01, 2019	Oct 31, 2019	Nov 08, 2019	Nov 08, 2019	Nov 08, 2019
Sampling Depth (mbgs)		N IICC	2.3 - 2.9	1.8 - 2.4	1.5 - 2.1	5.3 - 5.9	5.3 - 5.9	6.9 - 7.5
Antimony	7.5	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	18	18	3.6	3.9	1.7	1.9	4.4	2.2
Barium	390	220	197	<u>359</u>	48.2	152	123	54.9
Beryllium	4	2.5	0.6	0.7	<0.5	<0.5	<0.5	<0.5
Boron	120	36	9.6	6.5	5.7	11.5	7.8	7.5
Cadmium	1.2	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	160	70	59.1	<u>118</u>	12.9	14.5	20.3	14.7
Chromium VI	8	0.66	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cobalt	22	21	12.6	<u>21.5</u>	3.2	6.3	6.8	6.4
Copper	140	92	29.8	54.3	9.7	12.5	18.5	11.8
Lead	120	120	11.9	16.3	14.6	4.4	61.4	4.2
Mercury	0.27	0.27	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Molybdenum	6.9	2	1	<1.0	<1.0	<1.0	<u>2.6</u>	1.1
Nickel	100	82	33.8	62.8	6.3	12.3	14.9	10.6
Selenium	2.4	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	20	0.5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Thallium	1	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium	86	86	<1.0	104	<1.0	1.1	<1.0	<1.0
Zinc	340	290	62.9	121	20.3	26	25.9	24.7
		104	Concentration e	xceeds MECP Ta	able 3 site stand	ard		

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Concentrations exceeds MECP Table 1 background standard

Table 4 Soil Analytical Results - Metals

Parameter		BH12-3-SS2	BH12-3-SS8
Date of Collection	Table 3 RPI	Dec 01, 2012	Dec 01, 2012
Date Reported		Dec 10, 2012	Dec 10, 2012
Sampling Depth (mbgs)	01	0.8 - 1.4	6.1 - 6.7
Antimony	7.5	<1.0	<1.0
Arsenic	18	6.1	<1.0
Barium	390	31.3	32
Beryllium	4	<0.5	<0.5
Boron	120	-	-
Cadmium	1.2	<0.5	<0.5
Chromium	160	9.3	16.9
Chromium VI	8	<0.2	<0.2
Cobalt	22	5.8	2.6
Copper	140	8.5	7.8
Lead	120	13.9	2.5
Mercury	0.27	0.013	< 0.01
Molybdenum	6.9	3.8	<1.0
Nickel	100	11.3	4.5
Selenium	2.4	<1.0	<1.0
Silver	20	<0.2	<0.2
Thallium	1	<0.5	<0.5
Vanadium	86	16.1	17.2
Zinc	340	11.6	11.3

Table 5 Soil Analytical Results - PHCs & BTEX

Parameter			BH19-2-SS5	BH19-4-SS2	BH19-6-SS3	BH19-6-SS8	BH19-8-SS8	BH19-10-SS8		
Date of Collection	Table 3 RPI	Table 1	Oct 23, 2019	28-Oct-91	Oct 24, 2019	Oct 24, 2019	Oct 24, 2019	Oct 24, 2019		
Date Reported	СТ			RPIICC	Oct 31, 2019	Nov 01, 2019	Oct 31, 2019	Nov 08, 2019	Nov 08, 2019	Nov 08, 2019
Sampling Depth (mbgs)		N 100	2.3 - 2.9	1.8 - 2.4	1.5 - 2.1	5.3 - 5.9	5.3 - 5.9	5.3 - 5.9		
Benzene	0.21	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
Toluene	2.3	0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
Ethylbenzene	2	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
Total Xylenes	3.1	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
F1 (C6 to C10) minus BTEX	55	7	<7	<7	<u>27</u>	<7	<7	<7		
F2 (C10 to C16)	98	4	<4	<4	<4	<4	<4	<4		
F3 (C16 to C34)	300	8	<8	<8	75	<8	<8	<8		
F4 (C34 to C50)	2800	6	<6	<6	<u>123</u>	<6	<6	<6		
		104	Concentration e	xceeds MECP T	able 3 site stand	ard				

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Concentrations exceeds MECP Table 1 background standard

Table 5 Soil Analytical Results - PHCs & BTE)

Parameter		BH12-3-SS5
Date of Collection	Table 3 RPI	Dec 01, 2012
Date Reported		Dec 10, 2012
Sampling Depth (mbgs)	01	2.4 - 3.1
Benzene	0.21	-
Toluene	2.3	-
Ethylbenzene	2	-
Total Xylenes	3.1	-
F1 (C6 to C10) minus BTEX	55	<5
F2 (C10 to C16)	98	<10
F3 (C16 to C34)	300	117
F4 (C34 to C50)	2800	<50

Table 6 Soil Analytical Results - VOCs

Parameter			BH19-2-SS5	BH19-4-SS2	BH19-6-SS3	BH19-10-SS8
Date of Collection	Table 3 RPI	Table 1	Oct 23, 2019	28-Oct-91	Oct 24, 2019	Oct 24, 2019
Date Reported	CT	RPIICC	Oct 31, 2019	Nov 01, 2019	Oct 31, 2019	Nov 08, 2019
Sampling Depth (mbgs)		INFIICC	2.3 - 2.9	1.8 - 2.4	1.5 - 2.1	5.3 - 5.9
Acetone	16	0.5	<0.50	<0.50	<0.50	<0.50
Benzene	0.21	0.02	<0.02	<0.02	<0.02	<0.02
Bromodichloromethane	13	0.05	<0.05	<0.05	<0.05	<0.05
Bromoform	0.27	0.05	<0.05	<0.05	<0.05	<0.05
Bromomethane	0.05	0.05	<0.05	<0.05	<0.05	<0.05
Carbon Tetrachloride	0.05	0.05	<0.05	<0.05	<0.05	<0.05
Chlorobenzene	2.4	0.05	<0.05	<0.05	<0.05	<0.05
Chloroform	0.05	0.05	<0.05	<0.05	<0.05	<0.05
Dibromochloromethane	9.4	0.05	<0.05	<0.05	<0.05	<0.05
Dichlorobenzene, 1,2-	3.4	0.05	<0.05	<0.05	<0.05	<0.05
Dichlorobenzene, 1,3-	4.8	0.05	<0.05	<0.05	<0.05	<0.05
Dichlorobenzene, 1,4-	0.083	0.05	<0.05	<0.05	<0.05	<0.05
Dichlorodifluoromethane	16	0.05	<0.05	<0.05	<0.05	<0.05
Dichloroethane, 1,1-	3.5	0.05	<0.05	<0.05	<0.05	<0.05
Dichloroethane, 1,2-	0.05	0.05	<0.05	<0.05	<0.05	<0.05
Dichloroethylene, 1,1-	0.05	0.05	<0.05	<0.05	<0.05	<0.05
Dichloroethylene, cis- 1,2-	3.4	0.05	<0.05	<0.05	<0.05	<0.05
Dichloroethylene, trans- 1,2-	0.084	0.05	<0.05	<0.05	<0.05	<0.05
Dichloropropane, 1,2-	0.05	0.05	<0.05	<0.05	<0.05	<0.05
Dichloropropene, 1,3-	0.05	0.05	<0.05	<0.05	<0.05	<0.05
Ethylbenzene	2	0.05	<0.05	<0.05	<0.05	<0.05
Ethylene Dibromide	0.05	0.05	<0.05	<0.05	<0.05	<0.05
Hexane, n-	2.8	0.05	<0.05	<0.05	<0.05	<0.05
Methyl Ethyl Ketone	16	0.5	<0.50	<0.50	<0.50	<0.50
Methyl Isobutyl Ketone	1.7	0.5	<0.50	<0.50	<0.50	<0.50
Methyl tert-butyl ether	0.75	0.05	<0.05	<0.05	<0.05	<0.05
Methylene Chloride	0.1	0.05	<0.05	<0.05	<0.05	<0.05
Styrene	0.7	0.05	<0.05	<0.05	<0.05	<0.05
Tetrachloroethane, 1,1,1,2-	0.058	0.05	<0.05	<0.05	<0.05	<0.05
Tetrachloroethane, 1,1,2,2-	0.05	0.05	<0.05	<0.05	<0.05	<0.05
Tetrachloroethylene	0.28	0.05	<0.05	<0.05	<0.05	<0.05
Toluene	2.3	0.2	<0.05	<0.05	<0.05	<0.05
Trichloroethane, 1,1,1-	0.38	0.05	<0.05	<0.05	<0.05	<0.05
Trichloroethane, 1,1,2-	0.05	0.05	<0.05	<0.05	<0.05	<0.05
Trichloroethylene	0.061	0.05	<0.05	<0.05	<0.05	<0.05
Trichlorofluoromethane	4	0.25	<0.05	<0.05	<0.05	<0.05
Vinyl Chloride	0.02	0.02	<0.02	<0.02	<0.02	<0.02
Xylene Mixture	3.1	0.05	< 0.05	< 0.05	<0.05	< 0.05
104 Concentration exceeds MECP Table 3 site standard				10.05	<0.05	<0.05

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Concentration exceeds MECF Table 3 site standard

Table 6 Soil Analytical Results - VOCs

Parameter		BH12-3-SS10
Date of Collection		Dec 01, 2012
Date Reported	Table 3 RPI CT	Dec 10, 2012
Sampling Depth (mbgs)	CI	9.1 - 9.8
Acetone	16	<0.50
Benzene	0.21	<0.02
Bromodichloromethane	13	<0.05
Bromoform	0.27	<0.05
Bromomethane	0.05	<0.05
Carbon Tetrachloride	0.05	<0.05
Chlorobenzene	2.4	<0.05
Chloroform	0.05	<0.05
Dibromochloromethane	9.4	<0.05
Dichlorobenzene, 1,2-	3.4	<0.05
Dichlorobenzene, 1,3-	4.8	<0.05
Dichlorobenzene, 1,4-	0.083	<0.05
Dichlorodifluoromethane	16	<0.05
Dichloroethane, 1,1-	3.5	<0.05
Dichloroethane, 1,2-	0.05	<0.05
Dichloroethylene, 1,1-	0.05	<0.05
Dichloroethylene, cis- 1,2-	3.4	<0.05
Dichloroethylene, trans- 1,2-	0.084	<0.05
Dichloropropane, 1,2-	0.05	<0.05
Dichloropropene, 1,3-	0.05	<0.05
Ethylbenzene	2	<0.05
Ethylene Dibromide	0.05	<0.05
Hexane, n-	2.8	<0.05
Methyl Ethyl Ketone	16	<0.50
Methyl Isobutyl Ketone	1.7	<0.50
Methyl tert-butyl ether	0.75	<0.05
Methylene Chloride	0.1	<0.05
Styrene	0.7	<0.05
Tetrachloroethane, 1,1,1,2-	0.058	<0.05
Tetrachloroethane, 1,1,2,2-	0.05	<0.05
Tetrachloroethylene	0.28	<0.05
Toluene	2.3	<0.2
Trichloroethane, 1,1,1-	0.38	<0.05
Trichloroethane, 1,1,2-	0.05	<0.05
Trichloroethylene	0.061	<0.05
Trichlorofluoromethane	4	<0.05
Vinyl Chloride	0.02	<0.02
Xylene Mixture	3.1	<0.05

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Table 7 Soil Analytical Results - PAHs

Parameter			BH19-2-SS5	BH19-4-SS2	BH19-6-SS3	BH19-6-DUP	BH19-6-SS8	BH19-8-SS8
Date of Collection		Table 1	Oct 23, 2019	Oct 28, 2019	Oct 24, 2019	Oct 24, 2019	Oct 24, 2019	Oct 24, 2019
Date Reported	Table 3 RPI CT	Table 1 RPIICC	Oct 31, 2019	Nov 01, 2019	Oct 31, 2019	Oct 31, 2019	Nov 08, 2019	Nov 08, 2019
Sampling Depth (mbgs)			2.3 - 2.9	1.8 - 2.4	1.5 - 2.1	1.5 - 2.1	5.3 - 5.9	5.3 - 5.9
Acenaphthene	7.9	0.072	<0.02	0.02	0.02	0.04	<0.02	<0.02
Acenaphthylene	0.15	0.093	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene	0.67	0.16	0.03	0.05	0.04	0.1	<0.02	<0.02
Benz(a)anthracene	0.5	0.36	0.05	0.07	0.09	0.2	<0.02	<0.02
Benzo(a)pyrene	0.3	0.3	0.04	0.05	0.08	0.16	<0.02	<0.02
Benzo(b/j)fluoranthene	0.78	0.47	0.06	0.06	0.13	0.2	<0.02	<0.02
Benzo(ghi)perylene	6.6	0.68	0.03	0.03	0.05	0.13	<0.02	<0.02
Benzo(k)fluoranthene	0.78	0.48	0.03	0.03	0.06	0.11	<0.02	<0.02
Chrysene	7	2.8	0.07	0.07	0.1	0.2	<0.02	<0.02
Dibenz(a,h)anthracene	0.1	0.1	<0.02	<0.02	<0.02	0.03	<0.02	<0.02
Fluoranthene	0.69	0.56	0.14	0.19	0.21	0.46	<0.02	<0.02
Fluorene	62	0.12	<0.02	0.02	0.02	0.05	<0.02	<0.02
Indeno(1,2,3-cd)pyrene	0.38	0.23	0.02	0.03	0.05	0.1	<0.02	<0.02
1-Methylnaphthalene	0.99	0.59	<0.02	0.02	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene	0.99	0.59	<0.02	0.04	<0.02	0.02	<0.02	<0.02
Naphthalene	0.6	0.09	<0.01	0.03	0.02	0.02	<0.01	<0.01
Phenanthrene	6.2	0.69	0.09	0.16	0.16	0.38	<0.02	<0.02
Pyrene	78	1	0.11	0.15	0.16	0.37	<0.02	<0.02
Methylnaphthalene, 2-(1-)	0.99	0.59	<0.04	0.06	<0.04	<0.04	<0.04	<0.04
			104	Concentration e	xceeds MECP T	able 3 site stand	lard	

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Concentrations exceeds MECP Table 1 background standard

Table 7 Soil Analytical Results - PAHs

Parameter		BH19-10-SS8	BH12-3-SS4
Date of Collection	Table 3 RPI	Oct 24, 2019	Dec 01, 2012
Date Reported		Nov 08, 2019	Dec 10, 2019
Sampling Depth (mbgs)	01	5.3 - 5.9	1.8 - 2.4
Acenaphthene	7.9	<0.02	0.253
Acenaphthylene	0.15	<0.02	<0.05
Anthracene	0.67	<0.02	0.13
Benz(a)anthracene	0.5	<0.02	0.314
Benzo(a)pyrene	0.3	<0.02	0.279
Benzo(b/j)fluoranthene	0.78	<0.02	0.28
Benzo(ghi)perylene	6.6	<0.02	0.167
Benzo(k)fluoranthene	0.78	<0.02	0.251
Chrysene	7	<0.02	0.337
Dibenz(a,h)anthracene	0.1	<0.02	<0.05
Fluoranthene	0.69	<0.02	0.671
Fluorene	62	<0.02	0.14
Indeno(1,2,3-cd)pyrene	0.38	<0.02	0.186
1-Methylnaphthalene	0.99	<0.02	0.177
2-Methylnaphthalene	0.99	<0.02	0.111
Naphthalene	0.6	<0.01	0.388
Phenanthrene	6.2	<0.02	<0.05
Pyrene	78	<0.02	0.511
Methylnaphthalene, 2-(1-)	0.99	<0.04	0.288

Table 8 Groundwater Analytical Results - Metals

Parameter		BH19-4	DUP	BH19-6
Date of Collection	Table 3 RPI	Nov 04, 2019	Nov 04, 2019	Nov 04, 2019
Date Reported	CT	Nov 12, 2019	Nov 12, 2019	Nov 12, 2019
Screened Depth (mbgs)	01	4.5 - 7.5	4.5 - 7.5	4.6 - 7.9
Antimony	7.5	<0.5	<0.5	<0.5
Arsenic	18	<1	<1	<1
Barium	390	181	184	236
Beryllium	4	<0.5	<0.5	<0.5
Boron	120	72	71	55
Cadmium	1.2	<0.1	<0.1	<0.1
Chromium	160	<1	<1	<1
Chromium VI	8	<10	<10	<10
Cobalt	22	<0.5	<0.5	0.9
Copper	140	<0.5	<0.5	0.5
Lead	120	<0.1	<0.1	<0.1
Mercury	0.27	<0.1	<0.1	<0.1
Molybdenum	6.9	0.7	0.5	3.3
Nickel	100	<1	<1	2
Selenium	2.4	<1	<1	<1
Silver	20	<0.1	<0.1	<0.1
Thallium	1	<0.1	<0.1	<0.1
Uranium	23	0.2	0.1	0.3
Vanadium	86	<0.5	<0.5	<0.5
Zinc	340	6	<5	<5
Sodium	NA	402000	397000	651000

1150

Table 9	Groundwater Analytical Results - PHCs&BTEX
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Parameter		BH19-4	DUP	BH19-6	BH19-10
Date of Collection	Table 3 RPI	Nov 04, 2019	Nov 04, 2019	Nov 04, 2019	Nov 04, 2019
Date Reported		Nov 12, 2019	Nov 12, 2019	Nov 12, 2019	Nov 12, 2019
Screened Depth (mbgs)	01	4.5 - 7.5	4.5 - 7.5	4.6 - 7.9	4.6 - 7.6
Benzene	0.21	<0.5	<0.5	<0.5	<0.5
Toluene	2.3	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	2	<0.5	<0.5	<0.5	<0.5
Xylene Mixture	3.1	<0.5	<0.5	<0.5	<0.5
F1 (C6 to C10) minus BTEX	55	<25	<25	<25	<25
F2 (C10 to C16)	98	<100	<100	<100	<100
F3 (C16 to C34)	300	<100	<100	<100	<100
F4 (C34 to C50)	2800	<100	<100	<100	<100

Table 10 Groundwater Analytical Results - VOCs

Parameter		BH19-6	BH19-10
Date of Collection	Table 3 RPI	Nov 04, 2019	Nov 04, 2019
Date Reported		Nov 12, 2019	Nov 12, 2019
Screened Depth (mbgs)	01	4.6 - 7.9	4.6 - 7.6
Acetone	16	<5.0	<5.0
Benzene	0.21	<0.5	<0.5
Bromodichloromethane	13	<0.5	<0.5
Bromoform	0.27	<0.5	<0.5
Bromomethane	0.05	<0.5	<0.5
Carbon Tetrachloride	0.05	<0.2	<0.2
Chlorobenzene	2.4	<0.5	<0.5
Chloroform	0.05	<0.5	<0.5
Dibromochloromethane	9.4	<0.5	<0.5
Dichlorobenzene, 1,2-	3.4	<0.5	<0.5
Dichlorobenzene, 1,3-	4.8	<0.5	<0.5
Dichlorobenzene, 1,4-	0.083	<0.5	<0.5
Dichlorodifluoromethane	16	<1.0	<1.0
Dichloroethane, 1,1-	3.5	<0.5	<0.5
Dichloroethane, 1,2-	0.05	<0.5	<0.5
Dichloroethylene, 1,1-	0.05	<0.5	<0.5
Dichloroethylene, cis- 1,2-	3.4	<0.5	<0.5
Dichloroethylene, trans- 1,2-	0.084	<0.5	<0.5
Dichloropropane, 1,2-	0.05	<0.5	<0.5
Dichloropropene, 1,3-	0.05	<0.5	<0.5
Ethylbenzene	2	<0.5	<0.5
Ethylene Dibromide	0.05	<0.2	<0.2
Hexane, n-	2.8	<1.0	<1.0
Methyl Ethyl Ketone	16	<5.0	<5.0
Methyl Isobutyl Ketone	1.7	<5.0	<5.0
Methyl tert-butyl ether	0.75	<2.0	<2.0
Methylene Chloride	0.1	<5.0	<5.0
Styrene	0.7	<0.5	<0.5
Tetrachloroethane, 1,1,1,2-	0.058	<0.5	<0.5
Tetrachloroethane, 1,1,2,2-	0.05	<0.5	<0.5
Tetrachloroethylene	0.28	<0.5	<0.5
Toluene	2.3	<0.5	<0.5
Trichloroethane, 1,1,1-	0.38	<0.5	<0.5
Trichloroethane, 1,1,2-	0.05	<0.5	<0.5
Trichloroethylene	0.061	<0.5	<0.5
Trichlorofluoromethane	4	<1.0	<1.0
Vinyl Chloride	0.02	<0.5	<0.5
Xylene Mixture	3.1	<0.5	<0.5

Table 11 Groundwater Analytical Results - PAHs

Parameter		BH19-4	DUP	BH19-6
Date of Collection	Table 3 RPI	Nov 04, 2019	Nov 04, 2019	Nov 04, 2019
Date Reported		Nov 12, 2019	Nov 12, 2019	Nov 12, 2019
Screened Depth (mbgs)	01	4.5 - 7.5	4.5 - 7.5	4.6 - 7.9
Acenaphthene	7.9	<0.05	<0.05	<0.05
Acenaphthylene	0.15	<0.05	<0.05	<0.05
Anthracene	0.67	<0.01	<0.01	<0.01
Benz(a)anthracene	0.5	<0.01	<0.01	<0.01
Benzo(a)pyrene	0.3	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	0.78	<0.05	<0.05	<0.05
Benzo(g,h,i)perylene	6.6	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	0.78	<0.05	<0.05	<0.05
Chrysene	7	<0.05	<0.05	<0.05
Dibenz(a,h)anthracene	0.1	<0.05	<0.05	<0.05
Fluoranthene	0.69	<0.01	<0.01	<0.01
Fluorene	62	<0.05	<0.05	<0.05
Indeno(1,2,3-cd)pyrene	0.38	<0.05	<0.05	<0.05
Methyl Naphthalene, 2-and 1-	0.99	<0.10	<0.10	<0.10
Naphthalene	0.6	<0.05	<0.05	<0.05
Phenanthrene	6.2	<0.05	<0.05	<0.05
Pyrene	78	<0.01	<0.01	<0.01



Group	Parameter	Table 3 RPI CT	Maximum Concentration	Location
	Arsenic	18	6.1	BH12-3-SS2
	Barium	390	359	BH19-4-SS2
	Beryllium	4	0.7	BH19-4-SS2
	Boron	120	11.5	BH19-8-SS8
	Chromium	160	118	BH19-4-SS2
<u>0</u>	Cobalt	22	21.5	BH19-4-SS2
Metals	Copper	140	54.3	BH19-4-SS2
Σ	Lead	120	61.4	BH19-10-SS8
	Mercury	0.27	0.013	BH12-3-SS2
	Molybdenum	6.9	3.8	BH12-3-SS2
	Nickel	100	62.8	BH19-4-SS2
	Vanadium	86	104	BH19-4-SS2
	Zinc	340	121	BH19-4-SS2
S	F1 (C6 to C10) minus BTEX	55	27	BH19-6-SS3
PHCs	F3 (C16 to C34)	300	117	BH12-3-SS5
₽.	F4 (C34 to C50)	2800	123	BH19-6-SS3
	Acenaphthene	7.9	0.253	BH12-3-SS4
	Anthracene	0.67	0.13	BH12-3-SS4
	Benz(a)anthracene	0.5	0.314	BH12-3-SS4
	Benzo(a)pyrene	0.3	0.279	BH12-3-SS4
	Benzo(b/j)fluoranthene	0.78	0.28	BH12-3-SS4
S	Benzo(ghi)perylene	6.6	0.167	BH12-3-SS4
PAHs	Benzo(k)fluoranthene	0.78	0.251	BH12-3-SS4
۵.	Chrysene	7	0.337	BH12-3-SS4
	Dibenz(a,h)anthracene	0.1	0.03	BH19-6-DUP
	Fluoranthene	0.69	0.671	BH12-3-SS4
	Fluorene	62	0.14	BH12-3-SS4
	Indeno(1,2,3-cd)pyrene	0.38	0.186	BH12-3-SS4
	1-Methylnaphthalene	0.99	0.177	BH12-3-SS4
	2-Methylnaphthalene	0.99	0.111	BH12-3-SS4
S	Naphthalene	0.6	0.388	BH12-3-SS4
PAHs	Phenanthrene	6.2	0.38	BH19-6-DUP
<u>۵</u>	Pyrene	78	0.511	BH12-3-SS4
	Methylnaphthalene, 2-(1-)	0.99	0.288	BH12-3-SS4

Table 12 Summary of Maximum Concentrations in Soil

All other parameters below laboratory detection limits



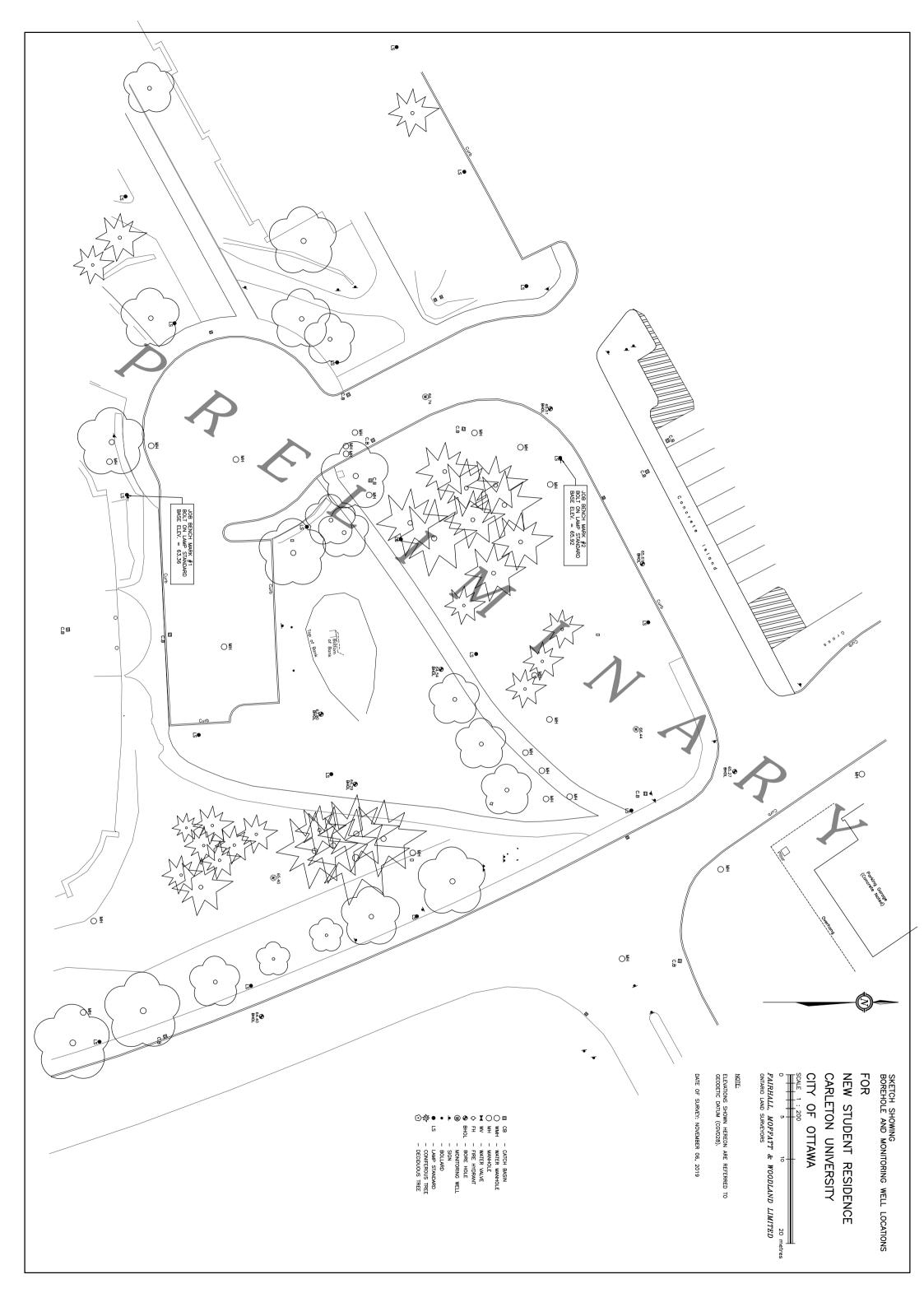
Table 13 Summary of Maximum Concentrations in Groundwater

Group	Parameter	Table 3 RPI CT	Maximum Concentration	Location
	Barium	390	236	BH19-6
	Boron	120	72	BH19-4
	Cobalt	22	0.9	BH19-6
<u>ى</u>	Copper	140	0.5	BH19-6
Metals	Molybdenum	6.9	3.3	BH19-6
Σ	Nickel	100	2	BH19-6
	Uranium	23	0.3	BH19-6
	Zinc	340	6	BH19-4
	Sodium	NA	651000	BH19-6

All other parameters below laboratory detection limits

APPENDIX

A PLAN OF SURVEY OF PHASE TWO PROPERTY



APPENDIX

B SAMPLING AND ANALYSIS PLAN

Sampling and Analysis Plan for Phase II ESA, Soil, Ottawa, Ontario

					Soil				
Sample Location	Proposed Borehole Depth (mbgs)	Туре	Reg 153 Metals and Inorganics (1 x 250 ml jar)	Reg 153 VOCs (1 x methanol vial and 1 x 120 ml jar)	Reg 153 PAHs (1 x 250 ml jar)	Reg 153 PHC F1-F4 and BTEX (1 x 120 ml jar and x 1 methanol vial)	Comments / Sampling Rationale	APEC #	
			Submit	Submit	Submit	Submit			
BH19-2-SS5	11.4 (to bedrock)	ВН	1	1	1	1	Hydrocarbon odour noted during field program.	1,2	
BH19-4-SS2	7.6	ВН	1	1	1	1	Assessment of upper fill material.	1,2	
BH19-6-SS3	11.1	ВН	1	1	1 (plus 1 dup)	1	Assessment of upper fill material.	1,2	
BH19-6-SS8	11.1	ВН		1	1	1	Assessment of deeper fill/native interface.	1,2	
BH19-8-SS8	15.5		1	1	1	1	Assessment of deeper fill material.	1	
BH19-10-SS8	12.6	ВН	1	1	1	1	Sample with 10 ppm vapour reading.	1,2	
BH19-10-SS10	12.6	ВН	1	1		Assessment of native material.			
Blind Field D	uplicates				1				
тота	LS		6	7	6	6			

			Gro	oundwater							
Sample Location	APEC	Monitoring Well Depth (mbgs)	Reg 153 Metals and Inorganics	Reg 153 VOCs	PAHs	Reg 153 PHC F1-F4	Environmental Investigation Notes				
BH19-4	BH19-4 APEC1		1 (plus 1 dup))	1 (plus 1 dup)	1 (plus 1 dup)					
BH19-6	APEC1, APEC2	7.9	1	1	1		Water may be silty. Develop/purge wells one				
BH19-10	BH19-10 APEC1, APEC2			1			week before sampling. Sample using peristaltic pump, at a low flow rate to avoid				
Blin	d Field Duplicates		1		1		silty water.				
	TOTALS		2	2	2	3					

APPENDIX

C BOREHOLE LOGS

CL I EN PROJI	ECT: Carleton University Northern Prop IT: Carleton University ECT LOCATION: Parking Lots P-6 and M: Geodetic		Devel	lopme	nt			DRILLING D Method: Hol Diameter: 20 Date: Dec/0	low Sten 03mm/N	0	oring				EF. NC		405-7	710/720)
BH LC	CATION: See Borehole Location Plan									PATION									
(m) ELEV	DESCRIPTION	STRATA PLOT		SAMPL	BS menors	GROUND WATER CONDITIONS	TION	DYNAMIC CO RESISTANCE 20 4 SHEAR STE O UNCONFI	0 60 RENGTH	80 1	L	PLASTI LIMIT W _P	CON	URAL STURE ITENT W O	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (Mg/m ³)	REN / GRA DISTF	MARKS AND IN SIZE RIBUTIOI
65.6		STRAT	NUMBER	ТҮРЕ		GROU	ELEVATION	QUICK TF		× LAB VA	ANE		TER CC		T (%) 30	۵.	NAT		(%) A SI (
0.0	Topsoil, some sand, some gravel, organics, brown, frozen, stiff (Fill)	×	1	SS	9		Sand						0						
65.0 0.6	Silty Sand, gravelly, trace organics, brown, damp, compact (Fill)	×	2	SS	15	CHURCHCARD	65						0			-		24 48	3 28
63.8			3	SS	24		64						>			-			
1.8	Silty Sand and Gravel, trace brick and slag fragments, moist, compact (Fill)	X	4	SS	20								0					44 26	
62.6			5	SS	14	THENER THE THE	63						0			-		28 43	3 29
3.0	Silty Clay, trace sand, grey, firm (Fill)		6	SS	7		Cuttir	gs					0			•			
61.0	Silty Sand and Gravel, brown,					aranananananan	65 64 63 -Cuttir												
4.6	moist, compact (Fill)		7	SS	26							0							
<u>59.5</u> 6.1	Gravel and Sand, trace silt, brown,						60 W. L. Dec 1	195.5 m 3, 2012								-		52 38	3 10
0.1	wet, very dense (Till)		8	SS	54	NGNGNGNGN	59					0				-			
58.0																			
7.6	Silty sand, trace gravel, brown, wet, compact (Till)		9	SS	13		58 -Bento							0					
							57									-			
56.5 9.1	Silty Sand, some gravel, brown, wet, dense (Till)		10	SS	33		56						>			-		19 59	9 22
			\vdash																

SPL SOIL LOG CARLETON UNIVERSITY NORTH PROPERTY DEVELOPMENT.GPJ SPL.GDT 3/4/13

SPL Consultants Limited

-	SPL Consultants Lim Geotechnical Environmental Materials Hydro	nite	d		L	og o	F BO	RE	IOLE	12-	3										
PROJ	ECT: Carleton University Northern Prop	perty [Deve	lopmei	nt			DRIL	LING	DATA											
CLIEN	IT: Carleton University	2		•				Meth	od: Hol	llow St	tem Au	uger/Co	oring								
PROJ	ECT LOCATION: Parking Lots P-6 and	P-7						Diam	eter: 2	03mm	/N size	e core				RI	EF. NC	D.: 14	405-7	10/720	
DATU	M: Geodetic							Date	Dec/0	01/201	2					Eľ	NCL N	0.:			
BH LC	OCATION: See Borehole Location Plan								MIC CO			TION									
	SOIL PROFILE		S	SAMPL	ES.	~~~		RESIS	MIC CO STANCE	PLOT				PLAST			LIQUID		±,	REMA	
(m)		D TO			- N	GROUND WATER CONDITIONS			1	L	1	30 10	00	PLASTIC NATURAL LIQU LIMIT CONTENT LIN W _P W W				POCKET PEN. (Cu) (kPa) ATIIBAL HNIT W	NATURAL UNIT WT (Mg/m ³)	ANI GRA I N	
ELEV DEPTH	DESCRIPTION	STRATA PLOT	н		BLOWS 0.3 m		ELEVATION		AR STI NCONF			Pa) FIELD	VANE	Ļ,		0	`	OCKE (Cu) (I	rural (Mg/i	DISTRIBU (%)	
		TRA	NUMBER	ТҮРЕ	"z	ROU	ILEV/		UICK TF 50 10			LAB VA 00 25				ONTEN 20 :	T (%) 30	ι.	-AN		
	Silty Sand, some gravel, brown,	161		-	-	$[\cdot \square \cdot]$														GR SA	SI UL
	wet, dense (Till)					: ∃ ∶	·														
54.9							Sand.														
10.7	Silty Sand, trace gravel, grey, wet, compact (Till)					1目	Scree	n I												1 83	16
	compact (Thi)		11	SS	17	目:									0						
							54														
		19																			
53.6 12.0	- Auger Refusal at 12.0 m. Switched to coring.]																		
12.0	Fresh to slightly weathered, very																				
	closely bedded shale with limestone partings. Completely						53														
	fractured.		RC	CORE			55														
	TCR = 39% SCR = 31%			00112]																
	RQD = 0%																				
52.0							-Bento 52	nite I													
13.6	Fresh to slightly weathered, very closely bedded shale with	Ŵ				-	52														
	limestone partings. Completely fractured.		RC	0000																	
			2	CORE																	
51.0	TCR = 93% SCR = 16%						51														
14.6	RQD = 16% END OF BOREHOLE																				
	Waterlevels:																				
	Date Depth																				
	<u>_Date Depth</u> Dec 18th, 2012 6.0 m																				

SPL SOIL LOG CARLETON UNIVERSITY NORTH PROPERTY DEVELOPMENT.GPJ SPL.GDT 3/4/13

O ^{8=3%} Strain at Failure

	_ W	/SP	BOREHOLE DRILLING RECORD : Page													
									Prepareo Reviewe					2019-10-2 2019-10-2		
Project Nar Site: Sector: Client:	Ca	rleton University New Residence rleton University rleton University							Geogra Surface	Number: phic Coord Elevation: PVC Elevat		191-12948-00 X = 367595.99354 mE Y = 5027711.34136 mN 65.51 m (<i>Geodetic</i>)				
Drilling Cor Drilling Equ Drilling Met Borehole D Drilling Flui Sampling N	uipment: thod: Diameter: id:	CCC CME 850 Hollow Stem Auger 203mm None Auger Sample	ODOUR F - Light M - Mediu P - Persis VISUAL D - Disse S - Satura	tent minated P	roduct	DC - SS - DP - ST - TU - MC -	Split Sp Manua Direct I Shelby DT32 L	nd Corer boon I Auger Push Tube iner Core Line	CHEMICAL AI PCB Po BTEX Be Xy Inorganics Inc Phenol. C. Ph VOC Vo r Diox. & Fur. Dia CAH Ch	NALYSIS Ily-Chlorinated Bip Inzene, Toluene, I Iene organic Compoun- ienolic Compounc Iatil Organic Com CAH)	ohenyls Ethylben; ds ds pounds (PH C ₁₀ PH F1- Metals	Semi Volatile Org Polycyclic Aromat C ₅₀ Petroleum Hydroc F4 Petroleum Hydroc Arsenic, Barium, C Cobalt, Copper, L Molybdenum, Nicl Leacheate Tests (ic Hydrocarbons arbons C ₁₀ C ₅₀ arbons F1-F4 (C Cadmium, Chrom ead, Manganese kel, Silver, Tin, Zi		
		GEOLOGY / LITHOLOGY	1	OBSE	RVAT	ONS			SAMPLES			MON				
<u>DEPTH</u> ELEVATION (m)	ЛОПОСУ	DESCRIPTION		VAPOR CONC. 1 - Isobutylene (ppm) H - Hexane (ppm)			TYPE	% RECOVERY N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS		
		Ground surface.														
65.43		ASPHALT- 80 mm SILTY SAND AND GRAVELtrace cla	/ v.				4S									
0.5 -		brown, moist, loose to compact (FILL)										-				
1.0 — - - - -				I - 0, H - 0			SS 2	25 3 4 3 3	SS1			_				
1.5 - - - 2.0 - -				I - 0, H - 0			SS 2	25 5 4 24 13	SS2			-				
2.30		SILTY CLAY, grey, moist, stiff (FILL)		I - 0, H - 0			ss 7	75 4 2 3 3	SS3			-				
3.0				I - 0, H - 0			ss e	30 Wł 1 1 1	H SS4			-				
<u>3.80</u> - 61.71		SAND AND GRAVEL cobbles and boulder infered, some silt, brown, moi very dense	st,	I - 0, H - 0			5S 7	75 4 31 50/1 mr	00 SS5			-				
1.5 — — — 5.0 — —				I - 0, H - 0			SS 5	50 13 50/1 mr	50 n SS6			-				
				I - 0, H - 0			ss	0 50/7 mr	⁷⁵ ⁿ SS7			+				
6.10 - 59.41 		SILTY SAND AND GRAVELtrace cla grey, moist (GLACIAL TILL)	у,	I - 0, H - 0			SS 5	50 Wł 9 11 9	H SS8			-				
		←- wet below 6.8 m		I - 0, H - 0			ss e	6 2 7 8 11	SS9			_				
7.5 -	H			I - 0,		F	ss e	50 6 11			-	F				

							B	OF	REF	Ю	LE DF	RILLIN	lG	REC	ORD :	19-01		
		_ N	/SP													ge 2 of 2		
											Prepared Reviewed					2019-10-23 2019-10-23		
	Project Na Site: Sector: Client:	Ca	rrleton University New Residence Irrleton University Irrleton University								Surface	lumber: hic Coordi Elevation: √C Elevati		191-12948-00 5: X = 367595,99354 mE Y = 5027711.34136 mN 65.51 m <i>(Geodetic)</i>				
	Drilling Eq Drilling Me Borehole I Drilling Flu	Drilling Company:CCCDrilling Equipment:CME 850Drilling Method:Hollow Stem AugerBorehole Diameter:203 mmDrilling Fluid:NoneSampling Method:Auger Sample				DUR Light Medium Persistent SUAL Disseminated Product Saturated with Product			TYPE mond Co t Spoon nual Aug ct Push by Tube 2 Liner cro Core ee Phas	orer F ger li e V e Liner	BTEX Ben Xyle norganics Inor Phenol. C. Phe /OC Vola & C/ Diox. & Fur. Diox CAH Chlo	-Chlorinated Bip zene, Toluene, E ne ganic Compound tolic Compounds til Organic Comp AH)	ithylben; Is s bounds (PH C ₁₀ -I PH F1-F Metals	Arsenic, Barium, C Cobalt, Copper, Le Molybdenum, Nick	tic Hydrocarbons		
			GEOLOGY / LITHOLOGY		OBSER			s		:	SAMPLES			MONIT	ORING WELL			
-17	<u>DEPTH</u> ELEVATION (m)	гітногобу	DESCRIPTION		VAPOR CONC. I - Isobutylene (ppm) H - Hexane (ppm)			<u>5</u>	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS		
		YYXX				++	$\left \right $	-		12								
סוברטיפהו א	8.5 -		SILTY SAND AND GRAVELtrace cla grey, moist (GLACIAL TILL)	у,	I - 0, H - 0			SS	40	27 10 14 11	SS11			-				
	9.0													-		9.0 -		
	9.5 – –				I - 0, H - 0			SS	75	3 7 9	SS12			-				
a remplate.v	10.0															10.0 —		
	10.5 <u>10.50</u> 55.01 11.0	<u>6/</u> 8/77	END OF BOREHOLE 1) Auguer refusal at 10.5 m in depth													10.5 — - - 11.0 —		
	11.5		End of boreho l e at 10.50 m.													11.0		
	12.0 —															12.0 —		
/perapport.v	12.5															- 12.5 — - -		
	13.0															13.0 —		
	13.5															13.5 - - - - 14.0		
	14.0															14.0 — - - 14.5 —		
	15.0																	
	15.5 — - - - - - - - - - - - - -															- - - - - - - - - - - - - - - - - - -		

	-W	/SP				B	OF	REF	HO	LE D	RILLIN	IG	REC	ORD: Pa	19-02 ge 1 of 3
		•••								Prepared Reviewed				Date (Start) Date (End):	
Project Nar Site: Sector: Client:	Ca	rleton University New Residence rleton University rleton University								Surface	Number: ohic Coordi Elevation: VC Elevati		: X = Y =	1-12948- 367614.35896 5027722.245 61 m (<i>Geodetic</i>	6 mE 75 mN
Drilling Cor Drilling Equ Drilling Met Borehole D Drilling Flui Sampling N	uipment: thod: Diameter: id:	CCC CME 850 Hollow Stem Auger 203mm Water Split Spoon	ODOUR F - Light M - Mediu P - Persis VISUAL D - Disse S - Satura	tent minated F	Produc	t t t	C - Dia S - Spli IA - Ma P - Dire T - She U - DT3 IC - Ma	TYPE mond C t Spoon nual Aug ct Push by Tub 2 Liner cro Core	orer E ger I e F e Liner	CHEMICAL AN PCB Pol BTEX Ber Xyl norganics Ino Phenol. C. Pho /OC Vol COC Vol Coix. & Fur Dic CAH Ch	IALYSIS y-Chlorinated Bipl nzene, Toluene, E ene rganic Compound anolic Compounds atil Organic Comp AH)	henyls thylbenz s s oounds (l	PH C ₁₀ PH F1-I Metals	Semi Volatile Org Polycyclic Aromati Sop Petroleum Hydroc F4 Petroleum Hydroc Arsenic, Barium, C Cobalt, Copper, L Molybdenum, Nich Leacheate Tests (ic Hydrocarbons arbons C ₁₀ C ₅₀ arbons F1-F4 (C Cadmium, Chron ead, Manganese kel, Silver, Tin, Z
		GEOLOGY / LITHOLOGY		OBSE	RVAT	IONS	5			SAMPLES			MON		
<u>DEPTH</u> ELEVATION (m)	ГІТНОГОĞY	DESCRIPTION		VAPOR CONC. I - Isobutylene (ppm) H - Hexane (pom)		NISUAL	SAMPLE	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
		Ground surface.													
0.08 - 65.53 - 0.5 - - -		ASPHALT- 75 mm SILTY SAND AND GRAVEL trace cla brown, moist, loose to very dense (FII					AS								
.0				I - 0, H - 0			ss	60 (3 8 50/12 mm	5 SS1			-		
.5				I - 0, H - 0	-		ss	10	31 6 3 6	SS2			-		
2.0				1 - 0,	-		ss	75					-		
- - - - - - - - - - - - - - - - - - -				H - 15	-				4 3 2 3	SS3			-		
.5 -		SILTY CLAY, grey, moist, stiff (FILL)		I - 0, H - 0	-		SS	50	1 1 2 2	SS4	Metals PHCs F1-F4 VOC PAH		-		
		rock fragments below 3.8 m in depth	1	I - 0, H - 15	;		ss	60	3 2 6 32	SS5			-		
.5 <u>4.60</u> - 61.01		SAND AND GRAVEL cobbles and boulder infered, some silt, brown, moi	st,	I - 0, H - 0			ss	40	10 36 50/75	SS6			-		
		very dense		I - 0, Н - 0			SS		50 50/75				2		
.0 — - - - -									mm	00/			-		
.5				I - 0, H - 0			SS	100	5 4 16 16	SS8			-		
<u>6.90</u> .0 <u>58.71</u>		SILTY SAND AND GRAVEL trace cla grey, moist (GLACIAL TILL)	у,	I - 0, H - 0			SS	100	11 15 17 16	SS9			_		
<u>.5</u> – - -															

		-W	/SP				B	OF	REF	10	LE D	RILLIN	IG	REC	ORD : Pa	19-02 ge 2 of 3
											Prepared Reviewed					2019-10-23 2019-10-23
Pro Site Sec Clie	tor:	Ca	rleton University New Residence rleton University rleton University								Geograp	Number: ohic Coordi Elevation:		s: X = Y =	1-12948- 367614.35896 5027722.245 51 m (<i>Geodeti</i>	6 mE 75 mN
Drill Drill Drill Bor Drill	ling Co ling Eq ling Me ehole [ling Flu	mpany: uipment: thod: Diameter:	CCC CME 850 Hollow Stem Auger	ODOUR F - Light M - Mediu P - Persis VISUAL D - Dissel S - Satura	tent minated P	Produc		C - Dia S - Spli A - Ma P - Dire T - She J - DT3 C - Ma	E TYPE mond Co t Spoon nual Aug ct Push lby Tube 2 Liner cro Core ee Phas	orer ger e e Liner	CHEMICAL AN PCB Pol 3TEX Ber Xyl norganics Ino Phenol. C. Phi /OC Vol C. Vol C. Vol C. & Fur. Dic CAH Ch	y-Chlorinated Bip nzene, Toluene, E ene rganic Compound enolic Compound latil Organic Comp AH	henyls Ethylben; Is s pounds (PH C ₁₀ - PH F1-F Metals	Semi Volatile Orga Polycyclic Aromati C ₂₀ Petroleum Hydroc Arsenic, Barium, C Cobalt, Copper, Lu Mołybdenum, Nick Leacheate Tests (c Hydrocarbons arbons C_{10} - C_{50} arbons F1-F4 (C_{10} - C_{5} 2admium, Chromium, 2ad, Manganese, cel, Silver, Tin, Zinc.
	-		GEOLOGY / LITHOLOGY	_	OBSE	RVAT	ONS	1			SAMPLES			MON		
ELEV. (r	<u>PTH</u> A <i>TION</i> n)	АЭОТОНЦІТ	DESCRIPTION		VAPOR CONC. I - Isobutylene (ppm) H - Hexane (ppm)			SAMPLE TYPE	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
2019-11-27		KXXXX														
			SILTY SAND AND GRAVEL trace cla grey, moist (GLACIAL TILL)	ıy,	I - 0, H - 0			ss	100	10 17 16 15	SS10			-		8.5 -
Data Template : WSP_TEMPLATE_GEOTECH.GDT 0.01 0.01 0.02 0.00 0.02 0.00 0.00 0.00										15						9.0-
ate : WSP IEV														-		9.5 - 10.0 -
					I - 0, H - 0			SS	100	11 18 28 26	SS11			-		10.5 -
	11.40															11.0 -
11.5	54.21		SHALE, black, fresh													11.5 -
12.0 - 																12.0 - 12.5 -
																13 <u>.</u> 0 -
																13.5 -
			- Run 1: 14.1 m - 14.6 m TCR - 100%													14.0 -
			SCR - 45% RQD- 25%													14.5 -
			Run 2: 14.6 m - 16.5 m TCR - 66% SCR - 17% RQD- 0%													15.0 - 15.5 -
Projet : EN			• •••													16.0

		-W	/SP				B	OF	REH	10	LE D	RILLIN	١G	REC	ORD : Pa	19-02 ge 3 of 3
											Prepared Reviewed					2019-10-23 2019-10-23
Site Se		Ca	rleton University New Residence rleton University rleton University								Geograp Surface	Number: ohic Coordi Elevation: 2VC Elevati		s: X = Y =	1-12948- 367614.3589 5027722.245 61 m (<i>Geodeti</i>	6 mE 75 mN
Dri Dri Boi Dri	lling Eq lling Me rehole [lling Flu	Diameter:	Hollow Stem Auger	ODOUR F - Light M - Mediu P - Persis VISUAL D - Disse S - Satura	stent minated F	Produc	D S M D S T M	IC - Dia S - Spli IA - Ma IP - Dire T - She U - DT IC - Ma	E TYPE mond Ca t Spoon nual Aug act Push Iby Tube 32 Liner cro Core ae Phas	prer jer e Liner	CHEMICAL AN PCB Pol BTEX Ber Xyl Inorganics Ino Phenol. C. Phe VOC Vol VOC Vol C. C. C. C. Cliox. & Fur. Dio CAH Chi	IALYSIS y-Chlorinated Bip y-chlorinated Bip rzene, Toluene, E ene rganic Compound anil Organic Com AH)	ohenyls Ethylben: ds s pounds (PH C ₁₀ PH F1- Metals	Semi Volatile Org Polycycic Aromato C ₅₀ Petroleum Hydroc Arsenic, Barium, O Cobalt, Copper, L Mołybdenum, Nick Leacheate Tests (ic Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C ₁₀ -C ₅₀ Cadmium, Chromium, ead, Manganese, kel, Silver, Tin, Zinc
			GEOLOGY / LITHOLOGY		OBSE		IONS	s			SAMPLES			MON		
ELE\ (<u>EPTH</u> /ATION m)	логоду	DESCRIPTION		VAPOR CONC. I - Isobutylene (ppm) H - Hexane (ppm)			5	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
																<u> </u>
	<u>16.20</u> 49.41		LIMESTONE with shale partings, fresh slightly weathered, grey	h to												- - 16.5 –
			Run 3: 16.2 m - 17.8 m TCR - 87% SCR - 87%													17.0-
			RQD- 87% Run 4: 17.8 m - 19.3 m													17.5 -
18.0 -			TCR - 100% SCR - 100% RQD- 100%													18.0 -
																18 <u>.</u> 5 - 19.0 –
- - - 19.5 –	19.30 46.31	Refusal														19.5 -
- - - 1 20.0			 Auger refusal at 14.1 m in depth. Switch to NQ coring. Coring completed at 19.3 m in depth 	th.												20.0 -
20.5 -			End of borehole at 19.30 m.													20.5 -
21.0 - 21.0 - -																21.0 -
21.5 -																21.5 -
22.0																22.0-
																22.5 -
23.5 -																23.0 -
																24.0

		/SP								Prepared Reviewed					Date (Start): Date (End):	
Project Nar Site: Sector: Client:	Ca	rleton University New Residence rleton University rleton University								Surface	Number: ohic Coordir Elevation: VC Elevatio		s:) F	< = 3 (= 5 64.7	1-12948-(367594.58573 5027696.5254 4 m (<i>Geodetic</i> 6 m (<i>Geodetic</i>	6 mE 6 mN ;)
Drilling Cor Drilling Equ Drilling Me Borehole D Drilling Flu Sampling M	uipment: thod: Diameter: id:	Marathon CME 55 Hollow Stem Auger 203mm None	S - Satur		Product	DC - SS - MA - DP - ST - TU - MC -	Diam Split S Manu Direct Shelb DT32 Macr	TYPE ond Co Spoon ual Auge t Push y Tube Liner o Core	rer E	CHEMICAL AN CCB Pol STEX Ber Xyla norganics Inor Phenol. C. Phe OC Vol COC Vol COC COC CAH Ch	ALYSIS y-Chlorinated Biph zene, Toluene, Ef ene ganic Compounds anolic Compounds atil Organic Comp AH)	nenyls thylben: s ounds (SV zene,PA PH PH	′OC ∖H I C₁₀-C I F1-F≠ ≫tals	Semi Volatile Orga Polycyclic Aromatiu 20 Petroleum Hydroce Arsenic, Barium, C Cobalt, Copper, Le Molybdenum, Nick Leacheate Tests (f	nic Compounds Hydrocarbons Irbons C ₁₀ -C ₅₀ Irbons F1-F4 (C admium, Chrom ad, Manganese el, Silver, Tin, Zi
		GEOLOGY / LITHOLOGY			RVATIO	ONS				SAMPLES			M	ONIT	ORING WELL	
<u>DEPTH</u> ELEVATION (m)	гітногоду	DESCRIPTION		VAPOR CONC. I - Isobutylene (ppm) H - Hexane (ppm)			TYPE	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM		DESCRIPTION	REMARKS
		Ground surface.														
- 0.04 - 64.70 - - - - - - - - - -		ASPHALT- 38 mm SILTY GRAVELLY SAND light brown damp to moist, compact (FILL)	/ n,			G <u>F</u>	RAB									C
.0 1.35				I - 0,			ss	67	6						— Bentonite	
.5 <u>-</u> 63.39 - - -		SILTY CLAY, trace sand, trace organ grey, moist (FILL)	nics,	Н-0					6655	SS1					— Riser	
.0				I - 0, H - 0		5	SS 1	100	1223	SS2	Metals PHCs F1-F4 VOC PAH					
.0 - <u>2.90</u> .0 - 61.84		SILTY SAND AND GRAVEL to grave	elly,	I - 0, H - 0		5	ss	75	5 6 15 14	SS3					— Cuttings and Bentonite	
.5 -		cobbles and boulder infered, brown, dense to very dense	moist,	I - 0,			SS	67	22							
- - - - -				H-0	-			5	22 19 40 0/100 mm	SS4					Bentonite	
.5 -				I - 0, H - 0		5	ss	21	50 50/75 mm	SS5					— Sand	
.0 — - - - .5 —				I - 0, H - 0		S	ss	42	29 28 15 12	SS6					— Screen	
<u>5.90</u> <u>58.84</u>		SILTY SAND AND GRAVEL trace cla	ay,	I - 0,			SS	54	4						SCREEN Diam.: 51 mm	
.5 —		grey, wet, compact to very dense (GLACIAL TILL)	-	H - 0					4 20 16	SS7					Open.: 0.25 mm Length: 3.05 m WATER Depth: 4.51 m	
				I - 0, H - 0			SS	38	3 4 8 10	SS8					Elev.: 60.15 m Date: 2019-11-04	
.5 <u>7.60</u> 57.14		END OF BOREHOLE	I	1-0,			ss	4 6	50/75							
U 1.17				H - 0		11		<u> </u>	50/75 mm	SS9						

		•		MC	DNI	ГО	R	IN	G١	NE	ELL DI	RILLIN	I G	REC	ORD :	
		N	/SP								Prepared Reviewed				Date (Start)	ge 2 of 2 2019-10-25 2019-10-25
	Project Na Site: Sector: Client:	Ca	rleton University New Residence rleton University rleton University								Project N Geograp Surface			s: X = Y = 64.7	1-12948- 367594.5857: 5027696.525- 74 m (Geodeti 56 m (Geodeti	00 3 mE 46 mN c)
	Drilling Con Drilling Equ Drilling Me Borehole D Drilling Flu Sampling N	uipment: thod: Diameter id:	Hollow Stem Auger	S - Satura	tent minated Pi	roduc		DC - Dia IS - Spl IA - Ma DP - Dir IT - She U - DT IC - Ma	E TYPE mond C it Spoon nual Au ect Push by Tub 32 Liner cro Core ee Phas	iorer E ger I e F e Liner	CHEMICAL AN PCB Poly BTEX Ben Xyle Inorganics Inor Phenol. C. Phe VOC Vola & C. Diox. & Fur. Dio CAH Chk	ALYSIS Chlorinated Bip zene, Toluene, E sne ganic Compound andic Compound atil Organic Comp AH)	henyls Ethylben: Is s sounds (SVOC zene,PAH PH C ₁₀ PH F1-I Metals	Semi Volatile Orga Polycyclic Aromat C ₅₀ Petroleum Hydroc Arsenic, Barium, C Cobalt, Copper, L	anic Compounds c Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C ₁₀ -C ₅₀ admium, Chromium, ad, Manganese, tel, Silver, Tin, Zinc.
			GEOLOGY / LITHOLOGY	_	OBSER		ION	-			SAMPLES			MON		
	<u>DEPTH</u> ELEVATION (m)	ГІТНОГОGY	DESCRIPTION		VAPOR CONC. I - Isobutylene (ppm) H - Hexane (ppm)			<u>`</u> `	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
RO - CARLETON UNIVERSITY NEW RESIDENCE.GPJ Type rapport: WSP_EN_WELL-ENVIRONMENTAL_Data Template: WSP_TEMPLATE_GEOTEC!			2) 37.5 mm monitoring well installed a m in depth 3) <u>DATE WATER LEVE</u> Nov 4, 2019 4.5 m End of borehole at 7.60 m.													8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 14.0 14.5 15.5
Projet : ENVIRO - CARLETON UI	5.0 -															

		W	/SP				E	SOF	ЯЕł	ЧC	Prepare	d by:	IG	REC	Date (Start)	ge 1 of 2 2019-10-22
Site See		Ca	rleton University New Residence rleton University rleton University								Geogra	Number: Number: phic Coordi Elevation: PVC Elevati		s: X = Y =	Date (End): 1-12948- 367626.86549 5027698.3936 54 m (Geodeti	9 mE 69 mN
Dri Dri Boi Dri	lling Eq lling Me rehole [lling Flu	Diameter:	Marathon CME 55 Hollow Stem Auger 203mm None Split Spoon	ODOUR F - Light M - Mediu P - Persis VISUAL D - Disser S - Satura	stent minated F	Produ	ct	SAMPL DC - Dia SS - Spi MA - Ma DP - Dir ST - Shi TU - DT MC - Ma	amond C it Spoor inual Au ect Push elby Tub 32 Liner	Corer n iger h be r re Liner	BTEX B. X Inorganics In Phenol. C. P VOC V VOC V Eliox. & Fur. D CAH C	NALYSIS oly-Chlorinated Bip enzene, Toluene, E ylene organic Compound henolic Compounds olatil Organic Comp CAH) ioxins & Furans hlorinated Aliphatic ydrocarbons	thylben; s bounds (PH C ₁₀ - PH F1-I Metals	Semi Volatile Org; Polycyclic Aromat; C ₅₀ Petroleum Hydroc F4 Petroleum Hydroc Arsenic, Barium, C Cobalt, Copper, L Molybdenum, Nic Leacheate Tests (c Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C ₁₀ -C ₅ cadmium, Chromium, cad, Manganese, cel, Silver, Tin, Zinc
			GEOLOGY / LITHOLOGY		OBSE		TION	ıs			SAMPLES			MON		
ELEV	<u>:PTH</u> /ATION m)	ЛОПОВА	DESCRIPTION		VAPOR CONC. I - Isobutylene (ppm) H - Hexane (ppm)		P D	_ %_	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
			Ground surface.													
0.5	0.20 64.34		TOPSOIL SAND and GRAVEL (to gravelly)dar brown, moist, very dense (FILL)	⁄	- I - 0, H - 0			SS	21	6655	SS1			-		
- - 1.0					I - 0, H - 0			SS	83	45 40 30 26	SS2			ł		1.0-
1.5 — - -	1.50 63.04 1.80		SILTY SAND, brown, moist (FILL)		I - 0, H - 0			SS	46	5645	SS3			I		1.5 - -
2.0	62.74 2.30		SILTY SAND, with organics, dark bro moist (FILL)	wn,						4 5	555			-		2.0-
2.5	62.24		SILTY CLAY, mixed with organics, so sand, dark brown, moist, firm (FILL)	me	I - 0, H - 0			SS	92	2 1 3 3	SS4					2.5
3.0 — - - 3.5 —	<u>3.05</u> 61.49		SAND and GRAVEL,some silt to silty brown, moist, compact to very dense	3	I - 0, H - 0			SS	38	6 4 8 20	SS5					3.0
4.0					I - 0, H - 0			SS	67	20 42 43 46	SS6			-		4.0-
4.5					I - 0, H - 0			SS	21	35 50/5 mm	0 _{SS7}					4.5 - - - 5.0 -
	5.30 59.24		SILTY SAND AND GRAVEL trace cla grey, wet (GLACIAL TILL)	у,	I - 0, H - 0			SS	67	7 8 9 16	SS8					5.5 -
6.0					I - 0, H - 0			ss	67	48 18 12 21	SS9			+		6.0
6.5 — - - 7.0 —														-		6.5 - - - 7.0
7.5 -					I - 0, H - 0			SS	33	10 16 22 37	SS10					7.5 -
- - - - -					I - 0, H - 0			SS	46	25 18 29	SS11					- - - 8.0

								E	3C	R	E⊦	ю	LE DF	RILLIN	IG	REC	ORD :	19-05
			_ N	/SP														ge 2 of 2
													Prepared Reviewed					2019-10-22 2019-10-22
	Proj Site: Sect Cliei	tor:	Ca	arleton University New Residence arleton University arleton University									Surface	lumber: hic Coordii Elevation: √C Elevati		: X = Y =	1-12948- 367626.86549 5027698.3936 54 m <i>(Geodetic</i>	9 mE 69 mN
	Drilli Drilli Bore Drilli	ing Eq ing Me ehole I ing Flu	Diamete	Hollow Stem Auger r: 203 mm None	ODOUR F - Light M - Mediu P - Persis VISUAL D - Disser S - Satura	tent ninated	Prod	ct	DC - SS - MA - DP - ST - TU - MC -	Diam Split : Manu Direc Shelb DT32 Macr	TYPE Spoon Jal Aug t Push Dy Tube Liner To Core	er Ir Liner	BTEX Ben Xyle norganics Inor Phenol. C. Phe /OC Vola & C/ Diox. & Fur. Diox CAH Chlo	-Chlorinated Bipł zene, Toluene, E ne ganic Compound tolic Compounds til Organic Comp AH)	thylben; s ounds (PH C ₁₀ - PH F1-F Metals	Semi Volatile Orga Potycyclic Aromati C ₅₀ Petroleum Hydroc: Arsenic, Barium, C Cobatl, Copper, Le Molybdenum, Nick Leacheate Tests (c Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C ₁₀ -C ₅₀ admium, Chromium, ad, Manganese, el, Silver, Tin, Zinc
				GEOLOGY / LITHOLOGY		OBSE			NS			ę	SAMPLES		1	MONI		
E	DEF LEVA (m	ATION	ГІТНОГОСУ	DESCRIPTION		VAPOR CONC. I- Isobutylene (ppm)		PD	-	TYPE	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
												0/150	0					
9. 8.	5 -			SILTY SAND AND GRAVEL trace cla grey, wet (GLACIAL TILL)	ıy,							mm				-		8.5 - - - -
9. 9.	0					I - 0, H - 0			5	ss	58	34 17 25 30	SS12					9.0
9.	5 -															-		9.5 -
10. Iemplate	0																	10.0 — - -
10. Data	5 -																	10.5 -
	0 	<u>11.30</u>		- END OF BOREHOLE	г													- - - - -
	5	55.24		1) Auguer refusal at 11.3 m in depth														11.5 — - -
112.				End of borehole at 11.30 m.														12.0 — - -
Indda 12.	5																	12.5 — - -
13.	0																	13.0 — - -
13.	5 -																	
14.	0																	14.0 —
14.	5 -																	14.5 — - -
15.	0																	15.0 —
15.	5 -																	- 15.5 — -
																		16.0

	•W	/SP	MC	DNI	TC	R	IN	GV	NE	Prepare	d by:	IG	REC	Date (Start):	ge 1 of 2 2019-10-24
Site:		rleton University New Residence rleton University								-	ed by: Number: aphic Coordii	nates	: X =	Date (End): 1-12948- 367633.9725 5027721.4950	1 mE
Sector: Client:	Ca	rleton University									e Elevation: PVC Elevati	on:	66.	44 m (Geodetic 24 m (Geodetic	c)
Drilling Co Drilling Eq Drilling Me Borehole I Drilling Flu Sampling I	uipment: ethod: Diameter: iid:	Hollow Stem Auger	ODOUR F - Light M - Mediu P - Persis VISUAL D - Disser S - Satura	tent minated F	Produ		DC - Dia SS - Spli MA - Ma DP - Dire ST - She TU - DT MC - Ma	E TYPE mond Co it Spoon nual Aug ect Push liby Tube 32 Liner cro Core ee Phas	orer ger e e Liner	BTEX B X Inorganics Ir Phenol. C. P VOC V VOC V Diox. & Fur. D CAH C	NALYSIS oly-Chlorinated Bipl tenzene, Toluene, E ylene oroganic Compound thenofic Compounds folatil Organic Comp (CAH) Jioxins & Furans hlorinated Allphatic tydrocarbons	thylbenz s ounds (l	PH C ₁₀ PH F1- Metals	Semi Volatile Orga Polycyclic Aromati -C ₅₀ Petroleum Hydroc: F4 Petroleum Hydroc: Arsenic, Barium, C Cobalt, Copper, Le Molybdenum, Nick Leacheate Tests (i	c Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C ₁₀ -C ₅₀ cadmium, Chromium, pad, Manganese, rel, Silver, Tin, Zinc.
		GEOLOGY / LITHOLOGY		OBSE			s			SAMPLES			MON		
<u>DEPTH</u> ELEVATION (m)	ГІТНОГОGY	DESCRIPTION		VAPOR CONC. I - Isobutylene (ppm) H - Hexane (pom)			<u></u>	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
0.13	N. N. M.	Ground surface.													
- 66.32 - 66.32		▲ TOPSOIL - 125 mm SILTY SAND AND GRAVEL brown, moist, loose to compact (FILL)	ſ	I - 0, H - 0	-		SS	71	4 10 12 30	SS1					- - - 0.5 — -
1.0 — - - - - - -				I - 0, H - 0			SS	75	13 15 11 21	SS2					1.0
$\begin{array}{c} & 0.13 \\ & 66.32 \\ 0.5 \\ 1.0 \\ 1.5 \\ 2.0 \\ 2.5 \\ 3.0 \\ 3.5 \\ 3.5 \\ 3.5 \\ 3.5 \\ 5.5 \\ 6.0 \\ 6.10 \\ 60.34 \\ 6.5 \\ 7.0 \\ 7.5 \\ 7.5 \\ 7.0 \\ 7.5 \\ 0.0 \\ 7.5 \\ 0.0 \\ 0$				I - 0, H - 0			SS	71	7 10 10 9	SS3	Metals PHCs F1-F4 VOC PAH	DUP		— Bentonite	1.5 - - - 2.0 -
2.5 -				I - 0, H - 0	-		SS	71	8 7 7 6	SS4			¥	— Riser	- - 2.5 – - -
3.0				I - 0, H - 0			SS	42	7 9 12 8	SS5					3.0 - 3.5 -
- - - - - - - -				I - 0, Н - 0	-		SS	50	19 6 5 5	SS6				∎—— Sand	4.0-
4.5				I - 0, H - 0	-		ss	38	2232	SS7				· · ·	4.5 -
5.0-									2						5.0-
5.5				I - 0, H - 0			SS	63	3 6 11 9	SS8	PHCs F1-F4 VOC PAH			Screen	5.5 - - - -
6.0 <u>6.10</u> - 60.34 - 6.5 -		SILTY SAND, some gravel to gravelly trace clay, grey, wet, compact to very	' ,	I - 0, H - 0			SS	42	9 11 50/7 mm	5 SS9				Diam.: 51 mm Open.: 0,25 mm Length: 3.05 m WATER Depth: 6.69 m	6.0 — - - - 6.5 —
7.0-		dense (GLACIAL TILL)		I - 0,			ss		16 50/12 mm					Elev.: 60.55 m Date: 2019-11-04	
7.5 -				H-0						SS10					- - 7.5 — - -
8.0				I - 0, H - 0			SS	58	3 10 13	SS11					

		14		MC	DNI	ТС	DF	311 R	NC	ΞV	VE	LL DF	RILLIN	lG	REC	ORD :	19-06 ge 2 of 2
			/SP									Prepared Reviewed				Date (Start)	2019-10-24 2019-10-24
Sit Se	-	Ca	rleton University New Residence rleton University rleton University									Project N Geograp Surface			: X = Y = 66.4	1-12948- 367633.9725 5027721.4950 4 m (<i>Geodeti</i> 24 m (<i>Geodeti</i>	00 1 mE 01 mN c)
Dri Dri Bo Dri	lling Eq lling Me rehole [lling Flu	Diameter	Hollow Stem Auger	ODOUR F - Light M - Mediu P - Persis VISUAL D - Disser S - Satura	tent minated F	Produ	ct	DC - SS - DP - ST - TU - MC -	Split S Manu Direc Shelb DT32 Macr	TYPE ond Co Spoon Jal Aug t Push y Tube Liner to Core	er li F Liner	CHEMICAL ANJ PCB Poly BTEX Ben Xyle norganics Inor Phenol. C. Phe /OC Vola & C/ Diox. & Fur. Diox CAH Chla	ALYSIS -Chlorinated Bip zene, Toluene, E ne ganic Compound: nolic Compound: til Organic Comp AH)	henyls Ethylbenz Is s soounds (PH C ₁₀ - PH F1-F Metals	Semi Volatile Org: Polycyclic Aromati C ₅₀ Petroleum Hydroc Arsenic, Barium, C Cobatt, Copper, L Molybdenum, Nick Leacheate Tests (c Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C ₁₀ -C ₅₀ cadmium, Chromium, cad, Manganese, cel, Silver, Tin, Zinc
		L	GEOLOGY / LITHOLOGY		OBSE			NS				SAMPLES	I		MONIT		
ELE	<u>EPTH</u> /ATION m)	ГІТНОГОБУ	DESCRIPTION		VAPOR CONC. I - Isobutylene (ppm) H - Hexane (ppm)			_	TYPE	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
-		XXXXX						\mathbf{H}	_		16						
8.5 -			SILTY SAND, some gravel to gravely trace clay, grey, wet, compact to very dense (GLACIAL TILL)	',											-		
9.0	-														_		9.0
9.5 -					I - 0, H - 0			5	ss	83	9 12 13 15	SS12			-		
10.0																	
-	-										50/75				-		-
11.0-	<u>11.10</u> 55.34		END OF BOREHOLE	ſ	I - 0, H - 0				ss	13	50/75 mm	SS13			-		 11.0
11.5 – - -			1) Auguer refusal at 11.1 m in depth 2) 37.5 mm monitoring well installed a m in depth	t 7.9													- 11.5 — - -
12.0	-		3) <u>DATE</u> <u>WATER LEVEL</u> Nov 4, 2019 6.7 m														- 12.0 — - -
12.5 -			End of borehole at 11.10 m.														12.5 — - -
13.0 —																	- - 13.0 — - -
14.0 -																	- - 14.0 —
14.5 -																	- - 14.5 —
15.0 -																	- - 15.0 —
15.5 -	- - - -																
																	16.0

	-W	/SP				B	ЭF	REF	10	LE DF	RILLIN	IG	REC	ORD : Pa	19-07 ge 1 of 3
										Prepared Reviewed					2019-10-2 2019-10-2
Project Nar Site: Sector: Client:	Ca	rleton University New Residence rleton University rleton University								Surface I	lumber: hic Coordi Elevation: VC Elevati		: X = Y =	1-12948- 367640.4787 5027688.217 29 m (<i>Geodeti</i>	1 mE 78 mN
Drilling Cor Drilling Equ Drilling Met Borehole D Drilling Flui Sampling N	uipment: thod: Diameter: id:	Hollow Stem Auger	ODOUR F - Light M - Media P - Persis VISUAL D - Disse S - Satur	stent minated F	Product		C - Dia S - Split A - Mar P - Dire T - She J - DT3 C - Mae	TYPE mond Co t Spoon hual Aug ct Push by Tube 2 Liner cro Core	prer E ger I e Liner	BTEX Ben Xyle norganics Inorg Phenol. C. Phe VOC Vola & C/ Diox. & Fur. Diox CAH Chic	-Chlorinated Bip zene, Toluene, E ne ganic Compound nolic Compounds (til Organic Comp AH)	ithylbenz s bounds (l	PH C ₁₀ - PH F1-F Metals	Semi Volatile Org; Polycyclic Aromati C ₅₀ Petroleum Hydroc 4 Petroleum Hydroc Arsenic, Barium, C Cobalt, Copper, Li Molybdenum, Nick Leacheate Tests (ic Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C Cadmium, Chromi ead, Manganese, kel, Silver, Tin, Zin
		GEOLOGY / LITHOLOGY	1	OBSE		IONS	5			SAMPLES			MONIT	FORING WELL	
<u>DEPTH</u> ELEVATION (m)	гітногоду	DESCRIPTION		VAPOR CONC. 1 - Isobutylene (ppm) H - Hexane (ppm)		+	SAMPLE TYPE	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
		Ground surface.													
0.15 64.14 0.5 -		TOPSOIL - 150 mm SILTY SANDgravelly to trace gravel, brown, moist, dense to very dense (F			-		ss	2	3 6 5 7	SS1			-		(
- - 1.0 - - - - -							SS	54	29 35 23 22	SS2			-		
1.5 - - - 2.0 - - -							ss	79	5 8 27 17	SS3			-		
2.5 - 61.99 - 61.69 - 61.69		SILTY SANDwith organics, dark brov \ moist (FILL)	/				SS	8	7 3 4 4	SS4			-		
3.0 - <u>3.05</u> - 61.24 		SILTY CLAY, with gravel, trace sand trace organics, grey, moist (FILL) SILTY SAND AND GRAVEL,brown, moist, compact	, /				ss	58	12 9 11 15	SS5			-		
3.80 - 60.49		ROCK FRAGMENTS			-		ss	46	49 40 56 59	SS6			-		
1.5 - - - 5.0 -							ss	38	3 38 49 28	SS7			-		
5.30 - 58.99 		SILTY SAND AND GRAVEL trace cla grey, wet, compact to very dense	ay,				ss	33	28 13 32 14 8	SS8			-		
		(GLACIAL TILL)					ss	8	9 12 21 17	SS9			-		
5.5 - - - - - - - - - - - - - - - - - - -							ss	58	17 28 26 12 5	SS10			-		
.5 _ _ _							ss	29	12 5 5 11 12	3310			-		

		-M	/SP				В	OF	REF	Ю	LE DI	RILLIN	1G	REC	ORD : Pa	19-07
											Prepared Reviewed					2019-10-27 2019-10-27
Sit Se		Ca	rleton University New Residence rleton University rleton University								Surface	Number: whic Coord Elevation: VC Elevat		: X = Y =	1-12948- 367640.4787 5027688.217 29 m (<i>Geodetic</i>	1 mE 78 mN
Dri Dri Bo Dri	illing Me orehole [illing Flu	uipment: thod: Diameter	Hollow Stem Auger	ODOUR F - Light M - Mediu P - Persis VISUAL D - Dissel S - Satura	stent minated F	Produc	t	DC - Dia IS - Spli IA - Ma DP - Dire IT - She IC - Ma	E TYPE mond C t Spoon nual Aug ct Push by Tub 2 Liner cro Core ee Phas	orer ger e Liner	BTEX Ber Xyla Inorganics Inor Phenol. C. Phe VOC Vol & C Diox. & Fur. Dio CAH ChI	r-Chlorinated Bip izene, Toluene, I ganic Compound nolic Compound atil Organic Com AH)	Ethylbenz Is s pounds (PH C ₁₀ - PH F1-F Metals	Semi Volatile Orga Polycyclic Aromati C ₅₀ Petroleum Hydroc 4 Petroleum Hydroc Arsenic, Barium, C Cobalt, Copper, L Mołybdenum, Nick Leacheate Tests (ic Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C ₁₀ -C ₅₀ Cadmium, Chromium, ead, Manganese, kel, Silver, Tin, Zinc
			GEOLOGY / LITHOLOGY		OBSE			s			SAMPLES	1		MONI		
ELE	<u>EPTH</u> VATION (m)	гітногобу	DESCRIPTION		VAPOR CONC. I- Isobutylene (ppm) H - Hexane (ppm)			5	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
2019-11-27		XXXXX								18						
	<u>8.40</u> 55.89		ROCK FRAGMENTS ,(Shale fragmen with occasional granite fragments)	ts		-		SS	29	16 17 17 12	SS12			-		
PLATE GEO			(GLACIAL TILL)					ss	8					-		9.0
9.5 - MZL 4SM	-									3 6 10 5	SS13			-		9.5 — - - -
Data Template : WSP TEMPLATE GEOTECH.GDT 	-							SS	21	15 15 10	SS14					10.0 - - - - 10.5 -
NMENTAL D								ss	29	9 21 17 16	SS15			-		10.5 -
VELL-ENVIRO						-		ss	33	16 11 50 50	SS16			-		- - 11.5 — -
> N 12.0 – dS	<u>11.80</u> 52.49		LIMESTONE with shale partings, fresh slightly weathered, grey <i>Run 1: 11.8 m - 12.4 m</i>	n to				COR	E	50	3310			_		
Type rapport			TCR - 9" Run 2: 12.4 m - 13.8 m TCR - 34%					COR	E		-					12.5
13.0 -	-															13.0 — - - - - - -
ISAN REVENUES	-		← Run 3: 13.8 m - 15.4 m TCR - 55″					COR	E		-					13.5 14.0
Projet: ENVIRO CARLETON UNIVERSITY NEW RESIDENCE.GPJ Type rapport: WSP_EN MSLL-ENVIRONMENTAL - - 111.0 -			RQD - 91%													- - - 14.5 — -
CARLETON	-															15.0
02IN 15.5 -	-		- Run 4: 15.4 m - 17.0 m TCR - 100% RQD - 33%					COR	E		-					- - 15.5 — - -
бі 16.0	-		<u></u>													16.0

		-N	/SP				B	OF	REF	10	LE DI	RILLIN	1G	REC	ORD: Pa	19-07 ge 3 of 3
											Prepared Reviewed					2019-10-27 2019-10-27
Si Si	roject Na ite: ector: lient:	Ca	rrleton University New Residence rrleton University rrleton University								Surface	Number: hic Coordi Elevation: VC Elevati		s: X = Y =	1-12948- 367640.4787 5027688.217 29 m <i>(Geodeti</i>	1 mE 78 mN
D D B D	rilling Co rilling Eq rilling Me orehole [rilling Flu ampling l	uipment: ethod: Diameter iid:	Hollow Stem Auger	ODOUR F - Light M - Mediu P - Persis VISUAL D - Disse S - Satura	stent minated P	Product	DC SS MJ DF ST TU M ¹	C - Dia S - Spli A - Ma P - Dire T - She J - DT3 C - Ma	TYPE mond Co t Spoon nual Aug ct Push by Tube 2 Liner cro Core	prer jer e Liner	BTEX Ben Xyle Inorganics Inor Phenol. C. Phe VOC Vola & C Diox. & Fur. Diox CAH Chi	r-Chlorinated Bip izene, Toluene, E ane ganic Compound nolic Compound atil Organic Comj AH)	Ethylben: Is s pounds (PH C ₁₀ PH F1- Metals	Semi Volatile Org Polycyclic Aromat -C ₅₀ Petroleum Hydroc F4 Petroleum Hydroc Arsenic, Barium, C Cobalt, Copper, L Molybdenum, Nict Leacheate Tests (c Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C ₁₀ C ₅₀ cadmium, Chromium, cad, Manganese, cel, Silver, Tin, Zinc
			GEOLOGY / LITHOLOGY		OBSE		ONS	8			SAMPLES	1		MON		
ELI	<u>DEPTH</u> EVATION (m)	гітногобу	DESCRIPTION		VAPOR CONC. I - Isobutylene (ppm) H - Hexane (ppm)		+	5	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
2019-11-27		K////XX														
	- - - -		LIMESTONE with shale partings, fres slightly weathered, grey	h to												- - - 16.5 –
17.0	-		Run 5: 17.0 m - 17.4 m TCR - 100% - RQD - 67%					COR	Ē		-					- - - - - - - -
	-		Run 6: 17.4 m - 18.6 m TCR - 100% RQD - 97%					OR	E		-					17.5 - - - - 18.0 -
10.0 1919	18.60		←End of borehole	,												
19.0	- 45.69 -	Refusal	End of borehole at 18.60 m.	/												19.0 —
19.5																- 19.5 – - -
ם 120.0 גר	-															20.0
. Dod 20.5	- - - -															20.5 - - - -
21.0	-															21.0
21.5	- - - -															- - 21.5 – - - -
22.0·	-															22.0
22.5																- - - - - -
23.0 - CARLEI	-															23.0
Projet: ENVIRO - CARETON UNIVERSITY NEW RESIDENCE (5P1 Type rapport: WSP EN WEILE ENVIRONMENTAL Data Template: WSP TEMPLATE GEOTECH.201 0.0 0																23.5 - - - - - - - - - - - - - - - - - - -

	W	/SP				B	OF	REF	10	LE D		IG	REC		19-08 ge 1 of 3
	me: Car	deton University New Residence deton University								Reviewed Project I Geograp	d by: Number: phic Coordi	nates	s: X = Y =	Date (End): 1-12948- mE mN	2019-10-24
Client:	Car	leton University									Elevation: VC Elevati	on:	m (Geodetic)	
Drilling Con Drilling Equ Drilling Me Borehole D Drilling Flu Sampling M	uipment: thod: Diameter: id:	Marathon CME 55 Hollow Stem Auger 203mm Water Split Spoon	ODOUR F - Light M - Mediu P - Persis VISUAL D - Dissel S - Satura	tent minated P	Produc	D S M D S T T	C - Dia S - Spli IA - Ma P - Dire T - She U - DT3 IC - Ma	E TYPE mond Co t Spoon nual Aug ct Push by Tube 2 Liner cro Core ee Phas	orer F ger F e F Liner	CHEMICAL AN PCB Pol BTEX Ben Xyl norganics Ino Phenol. C. Pho /OC Vol 0 C. Olox. & Fur Dic CAH Ch	IALYSIS ly-Chlorinated Biph nzene, Toluene, E ene rganic Compounds enolic Compounds latil Organic Comp JAH)	nenyls thylbenz s sounds (PH C ₁₀ - PH F1-f Metals	Semi Volatile Orga Polycyclic Aromati C ₅₀ Petroleum Hydroc: 4 Petroleum Hydroc: Cabatt, Copper, Le Mołybdenum, Nick Leacheate Tests (c Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C ₁ cadmium, Chromi ad, Manganese, cel, Silver, Tin, Zir
		GEOLOGY / LITHOLOGY		OBSE		IONS	8			SAMPLES			MONI		
<u>DEPTH</u> ELEVATION (m)	ГІТНОГОĞY	DESCRIPTION		VAPOR CONC. 1 - Isobutylene (ppm) H - Hexane (ppm)			<u>5</u>	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
	,	Ground surface.													
0.18 - 0.5 - -		TOPSOIL - 175 mm SILTY SAND AND GRAVEL (to grav dark brown, moist, compact (FILL)		I - 0, H - 0			SS	79	3 7 8 26	SS1					0
1.0				I - 0, H - 0			SS	58	20 14 12 13	SS2			+		1
1.5 - - - - -				I - 0, H - 0			SS	54	8 15 7 2	SS3			-		1
2.0 - 2.30									2				ł		2
2.5 _ 2.60		SILTY CLAY, moist, firm (FILL)		I - 0, H - 0			ss	38	4446	SS4					2
		SILTY SAND and GRAVEL (rock fragments), brown, wet, compact to dense	very	I - 0,			ss	16	-	334			+		3
3.5 - - - -				H - 0				46	5 19 28 50	SS5			-		3
4.0 - - - - - -				I - 0, H - 0			SS	54	15 57 66 62	SS6					2
1.5 - - - 5.0 -				I - 0, H - 0			SS	25	5 22 10 7	SS7			ł		2
5.5 – -				I - 0, H - 0			ss	42	6 19 10 11	SS8	Metals PHCs F1-F4 VOC PAH				ŧ
5.0				I - 0,			SS	8					+		6
5.5 - - - - -				H - 0					17 13 18 16	SS9					e
7.0				I - 0, H - 0			ss	58	44 55	SS10					-
7.5 <u>7.60</u>				I - 0, H - 0			ss	21	32 43 38	SS11			†		

								В	OF	REF	ю	LE DI	RILLIN	١G	REC	ORD :	19-08
		\square	. M	/SP													ge 2 of 3
												Prepared Reviewed					2019-10-24 2019-10-24
	Proj Site Sec Clie	: tor:	Ca	arleton University New Residence arleton University arleton University								Surface	ohic Coord E l evation:		: X = Y =	1-12948-(mE mN <i>Geodetic)</i>	00
	Drill Drill Bor Drill	ing Eq ing Me ehole [ing Flu	Diamete	Hollow Stem Auger r: 203 mm Water	S - Satura	um stent minated P ated with F Water Le	Product		GAMPLE DC - Dia SS - Spli MA - Ma DP - Dire ST - She ST - She TU - DT MC - Ma	mond C t Spoon nual Aug ct Push by Tub 2 Liner	orer E ger I e Liner	CHEMICAL AN PCB Poly BTEX Ben Norganics Inor Phenol. C. Phe /OC Vola /OC Vola COIX. & Fur. DO CAH Ch	y-Chlorinated Big Izene, Toluene, I ganic Compound molic Compound atil Organic Com AH)	ohenyls Ethylben; ds s pounds (PH C ₁₀ - PH F1-F Metals	Semi Volatile Orga Polycyclic Aromati C ₂₀ Petroleum Hydroc 4 Petroleum Hydroc Arsenic, Barium, C Cobalt, Copper, Le Molybdenum, Nick Leacheate Tests (c Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C ₁₀ -C ₅₀ admium, Chromium, ad, Manganese, rel, Silver, Tin, Zinc
				GEOLOGY / LITHOLOGY		OBSE			s		:	SAMPLES	Ι		MONI	ORING WELL	
-71		<u>PTH</u> A <i>TION</i> n)	гітногобу	DESCRIPTION		VAPOR CONC. I - Isobutylene (ppm) H - Hexane (ppm)			_%	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
1.1	-			SILTY SAND, some gravel to gravelly	,						46						-
יחוברשיפחו י				trace clay, grey, wet, compact to very dense (GLACIAL TILL)		I - 0, H - 0			SS	13	14 15 14 25	SS12			-		- - 8.5 - - - -
	9.0 														-		9.0 —
	9.5 -	9.90				I - 0, H - 0			SS	75	15 27 31 36	SS13			-		- - 9.5 - - -
ta rempi	0.0	3.30		GRAVEL SIZED ROCK FRAGMENT trace to some sand, sized fragments,		I - 0, H - 0			SS	17	11 55 98 4 6	SS14			-		10.0 — - - - 10.5 —
	1.0 -	10.70		LIMESTONE with shale partings, fresh slightly weathered, grey	n to				COR	E		-					10.3 - - - 11.0 -
1 אברר-בוא אוצר	- - 1.5 - -			Run1: 10.7 m - 11.9 m TCR - 40% RQD - 7%													 11.5
	- 2.0 - -			- Run 2: 11.9 - 12.5					COR	Ē		-					- - 12.0 — - - -
I ype ra	2.5			- R un 3: 12.5 m - 13.9 m					COR	Ē		-					12.5 -
	3.0																13.0 — - - 13.5 —
1 VEW RE	4.0			- Run 4: 13.9 m - 15.5 m					COR			-					- 14.0
	4.5 -																- - 14.5 — - -
	5.0 -																- - - - - - - -
	5.5	15.50	Refusal	 END OF BOREHOLE 1) Auguer refusal at 10.7 m in depth. 													- 15.5 — - - - 16.0

		•					В	80	REI	HO	LE DI	RILLIN	IG	REC	ORD :	
		N	/SP								Prepared				Date (Start)	ge 3 of 3
	Project Na Site: Sector: Client:	Ca	arleton University New Residence arleton University arleton University								Surface	-		s: X = Y =	mE Geodetic)	2019-10-24 00
	Drilling Cor Drilling Equ Drilling Me Borehole D Drilling Flu Sampling M	uipment thod: Diameter id:	Hollow Stem Auger r: 203 mm Water	ODOUR F - Light M - Mediu P - Persis VISUAL D - Disser S - Satura	tent ninated F	Produc	t	DC - D SS - S MA - N DP - D ST - S TU - D MC - N	LE TYPE plit Spoor lanual Au irect Pus helby Tut T32 Line lacro Cor Free Pha	Corer Iger h be re Liner	BTEX Ben Xyle Inorganics Inor Phenol. C. Phe VOC Vola & C, Diox. & Fur. Diox CAH Chk	Chlorinated Bip zene, Toluene, E ne ganic Compound nolic Compounds ttil Organic Comp AH)	thylben: Is s bounds (PH C ₁₀ - PH F1-I Metals	Semi Volatile Orga Polycyclic Aromati C ₅₀ Petroleum Hydroc 4 Petroleum Hydroc Arsenic, Barium, C Cobalt, Copper, L Molybdenum, Nick Leacheate Tests (ic Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C ₁₀ -C ₅₀ Cadmium, Chromium, ead, Manganese, kel, Silver, Tin, Zinc.
			GEOLOGY / LITHOLOGY		OBSE			۱s		1	SAMPLES			MONI		
1	<u>DEPTH</u> ELEVATION (m)	гітногобу	DESCRIPTION		VAPOR CONC. I - Isobutylene (ppm) H - Hexane (ppm)	- ■ ODOUR		`ŏ`	RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
16	.5 —		Switch to NQ coring 2) Borehole terminated at 15.5 m in de End of borehole at 15.50 m.	epth												
17 5	.00 															
17	.5 -															- - 17.5 — -
18	.0															- - 18.0 — -
18	.5 —															- - 18.5 — -
19	- - - - - 0.															- - 19.0 —
19	.5 _															- - 19.5 —
20	.0															- - - 20.0 —
20	-															- - - 20.5 —
- ype la	-															
21	0. 															21.0
21	.5															21.5 — - - -
22	.0															22.0
22	.5															22.5 -
23	.0 															23.0 —
23	.5 -															23.5 -

	W	/SP				B	OF	(EF	HO			IG	REC		ge 1 of 2
	-									Prepared Reviewed				Date (Start) Date (End):	
Site: Sector:	Ca	rleton University New Residence rleton University								Surface	ohic Coordi E le vation:		: X = Y =	1-12948- 367632.18573 5027684.160 m (<i>Geodetic</i>)	3 mE 79 mN
Client: Drilling Cor		rleton University Marathon	ODOUR			s		TYPE			VC Elevati	on:		. ,	
Drilling Equ Drilling Me Borehole D Drilling Flu Sampling M	uipment: thod: Diameter: iid:	CME 55 Hollow Stem Auger	F - Light M - Mediu P - Persis VISUAL D - Disser S - Satura	tent minated F	Produc		C - Dia S - Spli A - Mai P - Dire T - She U - DT3 C - Ma	mond Co Spoon nual Aug ct Push Iby Tube 2 Liner cro Core e Phas	orer ger e e Liner	PCB Poly BTEX Ben Xyle Inorganics Inor Phenol. C. Phe VOC Vola & C Diox. & Fur. Dio CAH Chl	y-Chlorinated Bip Izene, Toluene, E Iganic Compound Inolic Compound Il Organic Comp AH	Ethylbenz Is s pounds (PH C ₁₀ - PH F1-F Metals	Semi Volatile Org; Polycyclic Aromat C ₅₀ Petroleum Hydroc 4 Petroleum Hydroc Cobalt, Copper, L Molybdenum, Nic Leacheate Tests (c Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C Cadmium, Chrom ad, Manganese cel, Silver, Tin, Z
		GEOLOGY / LITHOLOGY		OBSE		IONS	\$		1	SAMPLES			MONI		
<u>DEPTH</u> ELEVATION (m)	ГІТНОГОБҮ	DESCRIPTION		VAPOR CONC. I- Isobutylene (ppm) H - Hexane (ppm)			SAMPLE	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
		Ground surface.				Π									
<u> </u>	$\overset{\underline{\Lambda h}_{\ell}}{\longrightarrow} \overset{\underline{\Lambda h}_{\ell}}{\longrightarrow}$	TOPSOIL - 200 mm		-			ss	63	1 3 5 10	SS1					
.5 -		SILTY SAND, with possible boulder/cobble, some gravel, trace cl	av.						10	001			_		
-		brown, moist. loose to dense (FILL)	iciy,				ss	50	36				-		
.0								00	36 32 19 20	SS2					
.5 —															
-							ss	50	12 9 5 5	SS3					
2.0									5	333			_		
-													-		
.5 -							SS	50	1 8 9 18	SS4					
									18				-		
-							ss	100	28				-		
3.5 -									28 36 37 28	SS5					
-													-		
1.0							SS	33	21 50/75 mm	SS6					
-													-		
^{.5} <u>4.60</u> 59.30		SILTY SAND AND GRAVEL trace cla	av/				ss	50	5				-		
.o —		grey, wet, loose to very dense (GLAC					33	50	5 7 12 15	SS7					
-		TILL)											-		
.5 -															
-															
.0— 				<u> </u>									ŀ		
5.5 -							SS	8		SS8					
-				<u> </u>									ŀ		
·.0				<u> </u>			ss	50	2				ŀ		
								50	2686	SS9					
7.5 -							\models		WH				ŀ		
	MAXXXXA						ss								

Project Name: Carleton University New Residence Site: Carleton University Sector:						Prepared I Reviewed Project N Geograp	umber:			Date (Start):	ge 2 of 2 2019-10-22 2019-10-22
Site: Carleton University						Project N	umber:			Date (Lind).	2013-10-22
Client: Carleton University						Surface E	nic Coordi Elevation: /C Elevati		: X = Y =	1-12948-(367632.18573 5027684.1607 m (<i>Geodetic</i>)	3 mE 79 mN
Drilling Company: Marathon ODUR Drilling Equipment: CME 55 F-Light Drilling Method: Hollow Stem Auger VISUAL Borehole Diameter: 203 mm D-Disseminated Drilling Fluid: None S-Saturate with Sampling Method: Split Spoon ¥ water L	ith Proc	duct	SAMPLI DC - Dia SS - Spl MA - Ma DP - Dir ST - She TU - DT MC - Ma	mond Co t Spoon nual Aug ct Push Iby Tube 2 Liner	orer P B P Ir P V Liner	BTEX Benz Xylen horganics Inorg Phenol. C. Pher /OC Volat & CA Diox. & Fur. Dioxi CAH Chlo	Chlorinated Bipl ene, Toluene, E e anic Compound iolic Compounds il Organic Comp	thylbenz s sounds (f	PH C ₁₀ -0 PH F1-F Metals	Semi Volatile Orga Potycyclic Aromati C ₂₀ Petroleum Hydroca A Petroleum Hydroca Cobalt, Copper, Le Molybdenum, Nick Leacheate Tests (h	c Hydrocarbons arbons C ₁₀ C ₅₀ arbons F1-F4 (C ₁₀ -C ₅₀ admium, Chromium, ad, Manganese, el, Silver, Tin, Zinc
	SERV		ıs		5	SAMPLES		_	MONIT	ORING WELL	
DEPTH ELEVATION (m) A 90 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	H - Hexane (ppm)	M P D		% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
		+			4						
SILTY SAND AND GRAVEL trace clay, grey, wet, loose to very dense (GLACIAL TILL)			SS	8	5 6 11 11	SS11			-		
					11				-		9.0
			SS	13	4643	SS12			-		- - 9.5 — - -
			SS	79	8 10 8 18	SS13			-		-
			SS	79	9 1951	0011			-		10.5 — - - 11.0 —
					25 31	SS14			_		
			SS	71	15 23 38 39	SS15					11.5 — - - 12.0 —
					40				-		12.0
12.5 - 12.60 51.30 - 51.30 - END OF BOREHOLE	-			100	16 20 22 50	SS16			-		12.5 — - -
$\begin{bmatrix} 1 \\ 1 \end{bmatrix} Auguer refusal at 12.6 m in depth \\ End of borehole at 12.60 m. \end{bmatrix}$											13.0 — - -
											13.5 - -
											-
											14.5 — - -
											15.5 -

		/SP								Prepared Reviewed				Date (Start): Date (End):	
Project Nar Site: Sector: Client:	Ca	rleton University New Residence rleton University rleton University								Geogra	Number: ohic Coordir Elevation: VC Elevatio		s: X = Y = 65.	1-12948- 367651.57696 5027678.510 4 m (Geodetic) 25 m (Geodetic)	6 mE 17 mN)
Drilling Cor Drilling Equ Drilling Met Borehole D Drilling Flui Sampling N	uipment: thod: Diameter: id:	Marathon CME 55 Hollow Stem Auger 203mm None Split Spoon	ODOUR F - Light M - Mediu P - Persis VISUAL D - Disse S - Satura	tent minated F	Product	DC SS MA DP ST TU MC	C – Diar - Split - Mar - Dire - Shel - DT3 C – Mac	TYPE mond C Spoon nual Aug ct Push by Tub 2 Liner cro Core e Phas	orer E ger I e F e Liner	CHEMICAL AN PCB Po BTEX Be Xyi norganics Ind Phenol. C. Ph /OC Vo Coox. & Fur. Dic CAH Ch		nenyls thylbenz s sounds (SVOC zene,PAH PH C ₁₀ PH F1 Metals	Semi Volatile Orga Polycyclic Aromati C50 Petroleum Hydroca F4 Petroleum Hydroca	anic Compounds ic Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C Cadmium, Chrom ead, Manganese cel, Silver, Tin, Z
		GEOLOGY / LITHOLOGY		OBSE		ons				SAMPLES			MON	ITORING WELL	
<u>DEPTH</u> ELEVATION (m)	ГІТНОГОĞY	DESCRIPTION		VAPOR CONC. I - Isobutylene (ppm) H - Hexane (pom)			SAMPLE TYPE	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
		Ground surface.													
0.15 65.25 0.5 -		TOPSOIL - 150 mm SAND, some silty to silty, trace grave gravelly, brown, moist. compact to de		I - 0, H - 0			SS	83	1 4 7 15	SS1					
		(FILL)		I - 0, H - 0			SS	92	15 15 22 14	SS2					
.5				I - 0, H - 0			SS	67	7 8 8 10	SS3				— Bentonite	
.5 -				I - 0, H - 0			SS	92	8 20 13 8	SS4				— Riser	
.0				I - 0, H - 0			SS	13	17 13 6 13	SS5				1	
<u>3.80</u> - 61.60		SILTY SAND AND GRAVEL trace cla grey, wet, loose to very dense (FILL) - Metalic fragments noted at 3.8 m in	-	I - 0, H - 0			SS	67 {	25 39 50/12 mm	5 SS6					
.5				I - 3, H - 10			SS	46 კ	32 50/10 mm	0 SS7					
.5 -				I - 3, H - 10			SS	71	8 17 18 14	SS8	Metals PHCs F1-F4 VOC PAH			Screen	
.0 - - - - - - - - -				I - 0, H - 0			SS	58	5635	SS9				 SCREEN Diam.: 51 mm Open.: 0.25 mm Length: 3.05 m WATER Depth: 5.85 m 	
.0 - 58.50		SILTY SAND AND GRAVEL trace cla grey, wet, loose to compact (GLACIA	•	I - 0, H - 0			SS	13	3 27 7	SS10	Metals VOC			Elev.: 60.40 m Date: 2019-11-04	
.5 -	LIX HA	TILL)		1					'	1	1		に目:		

			•		MC	DNI	ГC	DR	IN	G١	NE	ELL DI	RILLIN	IG	REC	ORD :	
			M	/SP								Prepared				Date (Start)	ge 2 of 2
	Proj Site Sec Clie	: tor:	Ca	rleton University New Residence rleton University rleton University								Surface			: X = Y = 65.4	Date (End): 1-12948- 367651.57696 5027678.510 m (Geodetic) 25 m (Geodetic)	6 mE 17 mN
	Drill Drill Bor Drill	ing Eq ing Me ehole I ing Flu	Diameter	Hollow Stem Auger	ODOUR F - Light M - Mediu P - Persis VISUAL D - Dissel S - Satura	stent minated P	Produc	t	DC – Dia SS – Spl MA – Ma DP – Dir ST – Sh TU – DT MC – Ma	E TYPE int Spoon inual Aug ect Push alby Tub 32 Liner acro Core ee Phas	orer E ger I e F e Liner	BTEX Ben Xyle norganics Inor Phenol. C. Phe VOC Vola & C Diox. & Fur. Dio CAH Chl	r-Chlorinated Bip zene, Toluene, E me ganic Compound nolic Compound atil Organic Comp AH)	thylben: Is s bounds (PH C ₁₀ - PH F1-F Metals	Semi Volatile Orga Polycyclic Aromati C ₅₀ Petroleum Hydroc 4 Petroleum Hydroc Arsenic, Barium, C Cobalt, Copper, Lo Molybdenum, Nick Leacheate Tests (c Hydrocarbons arbons C ₁₀ -C ₅₀ arbons F1-F4 (C ₁₀ -C ₅₀ cadmium, Chromium, aad, Manganese, rel, Silver, Tin, Zinc
				GEOLOGY / LITHOLOGY	1	OBSE	RVA	ΠΟΝ	s			SAMPLES			MONI	FORING WELL	
E		<u>PTH</u> A <i>TION</i> n)	ГІТНОГОGY	DESCRIPTION		VAPOR CONC. 1 - Isobutylene (ppm) H - Hexane (ppm)			_\%_	% RECOVERY	N (Blow/6")	NUMBER	ANALYSIS	DUPLICATE	DIAGRAM	DESCRIPTION	REMARKS
			KXXXX								50/50						
EUIECH.GUI 20	5			SILTY SAND AND GRAVEL trace cla grey, wet, loose to compact (GLACIAI TILL)							mm				-		8.5 - - - - - - -
5 Ц Ц	0-														-		9.0
	5					I - 1, H - 0			SS	100	1 6 13 35	SS12			-		- - 9.5 - - - -
. 10.	0																10.0 —
10. 10. 11.	-	<u>10.70</u> 54.70		- Glacial TIII Inferred		-											10.5 — - - 11.0 —
																	11.5
	0-1-0																- - - 12.0 —
he rapport.	5	<u>12.60</u> 52.80		- END OF BOREHOLE	[- - 12.5 — -
5 13.	0			 Augering ended at 10.7 m due to fle sands. Switch to DCPT. DCPT Refusal at 12.6 m in depth 	owing												- 13.0 — - -
				 3) 37.5 mm monitoring well installed a m in depth 4) <u>DATE</u> <u>WATER LEVEL</u> 	nt 7.6												13.5 -
				Nov 4, 2019 5.9 m End of borehole at 12.60 m.]												14.0 — -
14. NO NO 14.																	14.5 — - - 15.0 —
																	15.5 —
																	46.0

APPENDIX

D CERTIFICATES OF ANALYSIS

APPENDIX D-1 SOIL





RELIABLE.

351 Nash Road North, unit 9B Hamilton, ON L8H 7P4 1-800-749-1947 www.paracellabs.com

Certificate of Analysis

WSP Canada Inc. (Ottawa)

2611 Queensview Dr Ottawa, ON K2B 8K2 Attn: Adrian Menyhart

Client PO: Project: 191-12948-00 Custody: 119297

Report Date: 31-Oct-2019 Order Date: 25-Oct-2019

Order #: 1943704

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1943704-01	BH19-2-SS5
1943704-02	BH19-6-SS3
1943704-03	BH19-10-SS8
1943704-04	BH19-6-DUP

Approved By:

Mark Frata

Mark Foto, M.Sc. Lab Supervisor

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.



Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	24-Oct-19	28-Oct-19
Mercury by CVAA	EPA 7471B - CVAA, digestion	28-Oct-19	28-Oct-19
PHC F1	CWS Tier 1 - P&T GC-FID	29-Oct-19	30-Oct-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	25-Oct-19	30-Oct-19
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	28-Oct-19	28-Oct-19
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	23-Oct-19	29-Oct-19
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	29-Oct-19	30-Oct-19
Solids, %	Gravimetric, calculation	28-Oct-19	28-Oct-19

Order #: 1943704

Report Date: 31-Oct-2019 Order Date: 25-Oct-2019 Project Description: 191-12948-00



Order #: 1943704

Report Date: 31-Oct-2019 Order Date: 25-Oct-2019

Project Description: 191-12948-00

	Client ID: Sample Date: Sample ID:	BH19-2-SS5 23-Oct-19 09:00 1943704-01 Soil	BH19-6-SS3 24-Oct-19 09:00 1943704-02 Soil	BH19-10-SS8 23-Oct-19 09:00 1943704-03 Soil	BH19-6-DUP 24-Oct-19 09:00 1943704-04 Soil
Physical Characteristics	MDL/Units	0011	001	001	
% Solids	0.1 % by Wt.	84.4	92.1	90.6	92.4
Metals		•			02
Antimony	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Arsenic	1.0 ug/g dry	3.6	1.7	4.4	-
Barium	1.0 ug/g dry	197	48.2	123	-
Beryllium	0.5 ug/g dry	0.6	<0.5	<0.5	-
Boron	5.0 ug/g dry	9.6	5.7	7.8	-
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	-
Chromium	5.0 ug/g dry	59.1	12.9	20.3	-
Chromium (VI)	0.2 ug/g dry	<0.2	<0.2	<0.2	-
Cobalt	1.0 ug/g dry	12.6	3.2	6.8	-
Copper	5.0 ug/g dry	29.8	9.7	18.5	-
Lead	1.0 ug/g dry	11.9	14.6	61.4	-
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	-
Molybdenum	1.0 ug/g dry	1.0	<1.0	2.6	-
Nickel	5.0 ug/g dry	33.8	6.3	14.9	-
Selenium	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Silver	0.3 ug/g dry	<0.3	<0.3	<0.3	-
Thallium	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Uranium	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Vanadium	10.0 ug/g dry	62.9	20.3	25.9	-
Zinc	20.0 ug/g dry	64.7	<20.0	30.5	-
Volatiles					
Acetone	0.50 ug/g dry	<0.50	<0.50	<0.50	-
Benzene	0.02 ug/g dry	<0.02	<0.02	<0.02	-
Bromodichloromethane	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Bromoform	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Bromomethane	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Carbon Tetrachloride	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Chlorobenzene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Chloroform	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Dibromochloromethane	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Dichlorodifluoromethane	0.05 ug/g dry	<0.05	<0.05	<0.05	-
1,2-Dichlorobenzene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
1,3-Dichlorobenzene	0.05 ug/g dry	<0.05	<0.05	<0.05	-

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Order #: 1943704

Certificate of Analysis Client: WSP Canada Inc. (Ottawa) Client PO:

Report Date: 31-Oct-2019 Order Date: 25-Oct-2019

Project Description: 191-12948-00

Sample Date: Instruct in the integration integration in the integration integrate inttegrate inttegrate integrate inttegrate integrate integrate intte		Client ID:	BH19-2-SS5	BH19-6-SS3	BH19-10-SS8	BH19-6-DUP
Multinity Solid Control Solid Control Solid		Sample Date:	23-Oct-19 09:00 1043704-01	24-Oct-19 09:00	23-Oct-19 09:00	24-Oct-19 09:00 1043704-04
Color of the color of		MDL/Units	Soil	Soil	Soil	Soil
atte 0.06 wg dry <.0.05 <.0.05 <.0.05 <.0.05 Mate 0.05 wg dry <.0.05	1,4-Dichlorobenzene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
attent 0.05 ug gd y -0.05 -0.05 -0.05 -0.05 ylene 0.05 ug gd y -0.05 -0.05 -0.05 -0.05 oethylene 0.05 ug gd y -0.05 -0.05 -0.05 -0.05 oethylene 0.05 ug gd y -0.05 -0.05 -0.05 -0.05 poethylene 0.05 ug dr y -0.05 -0.05 -0.05 -0.05 poethylene 0.05 ug dr y -0.05 -0.05 -0.05 -0.05 poethylene 0.05 ug dr y -0.05	1,1-Dichloroethane	0.05 ug/g dry	<0.05	<0.05	<0.05	-
yhee 0.05 wg dy <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05	1,2-Dichloroethane	0.05 ug/g dry	<0.05	<0.05	<0.05	-
oethylene 0.05 wg dry <td>1,1-Dichloroethylene</td> <td>0.05 ug/g dry</td> <td><0.05</td> <td><0.05</td> <td><0.05</td> <td>-</td>	1,1-Dichloroethylene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
ordethylete 0.05 ug/d v/s <	cis-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
ppane 0.05 wg dry <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05	trans-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
opcopylene 0.05 ugg dy <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05	1,2-Dichloropropane	0.05 ug/g dry	<0.05	<0.05	<0.05	•
oropropylene 0.05 wg dry <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <td>cis-1,3-Dichloropropylene</td> <td>0.05 ug/g dry</td> <td><0.05</td> <td><0.05</td> <td><0.05</td> <td>-</td>	cis-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
opene, Iolal 0.05 w/g dry <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <td>trans-1,3-Dichloropropylene</td> <td>0.05 ug/g dry</td> <td><0.05</td> <td><0.05</td> <td><0.05</td> <td>-</td>	trans-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
0.05 ugg dry <0.05 <0.05 <0.05 <0.05 mide (dibromeetha 0.05 ugg dry <0.05	1,3-Dichloropropene, total	0.05 ug/g dry	<0.05	<0.05	<0.05	I
mide (dibronoethat $0.05 ugg dy$ < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 $< 0.$	Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	<0.05	•
0.05 ug/ dry < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05	Ethylene dibromide (dibromoethan	0.05 ug/g dry	<0.05	<0.05	<0.05	-
etone (2-Buttanone) 0.50 ug/g dy < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.50 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 $< 0.$	Hexane	0.05 ug/g dry	<0.05	<0.05	<0.05	-
I Ketone $0.50 \ ugg dry < 0.50 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05$	Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	<0.50	<0.50	<0.50	
M ether 0.05 ugd dy < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05	Methyl Isobutyl Ketone	0.50 ug/g dry	<0.50	<0.50	<0.50	-
oride $0.05 ugg dry$ < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05	Methyl tert-butyl ether	0.05 ug/g dry	<0.05	<0.05	<0.05	-
0.05 ug/dy < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05	Methylene Chloride	0.05 ug/g dry	<0.05	<0.05	<0.05	•
Information $0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ ugg dry < 0.05 \ u dry$	Styrene	0.05 ug/g dry	<0.05	<0.05	<0.05	•
Information $0.05 ug/g dry$ < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 </td <td>1,1,1,2-Tetrachloroethane</td> <td>0.05 ug/g dry</td> <td><0.05</td> <td><0.05</td> <td><0.05</td> <td>•</td>	1,1,1,2-Tetrachloroethane	0.05 ug/g dry	<0.05	<0.05	<0.05	•
Mene 0.05 ug/g dry <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05	1,1,2,2-Tetrachloroethane	0.05 ug/g dry	<0.05	<0.05	<0.05	-
0.05 ug/g dry < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05	Tetrachloroethylene	0.05 ug/g dry	<0.05	<0.05	<0.05	·
thane $0.05 ug/g dry$ < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05	Toluene	0.05 ug/g dry	<0.05	<0.05	<0.05	•
ethane $0.05 ug/g dry$ < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05	1,1,1-Trichloroethane	0.05 ug/g dry	<0.05	<0.05	<0.05	-
ne $0.05 ug/g dry$ < 0.05 $< 0.05 ug/g dry$ < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 </td <td>1,1,2-Trichloroethane</td> <td>0.05 ug/g dry</td> <td><0.05</td> <td><0.05</td> <td><0.05</td> <td>I</td>	1,1,2-Trichloroethane	0.05 ug/g dry	<0.05	<0.05	<0.05	I
methane 0.05 ug/g dry $< 0.05 \text{ ug/g dry}$ $< 0.05 \text{ ug/g dry}$ $< 0.02 \text{ ug/g dry}$ $< 0.05 $	Trichloroethylene	0.05 ug/g dry	<0.05	<0.05	<0.05	I
0.02 ug/g dry $< 0.02 ug/g dry$ $< 0.02 ug/g dry$ $< 0.02 ug/g dry$ $< 0.05 u/g dry$ <	Trichlorofluoromethane	0.05 ug/g dry	<0.05	<0.05	<0.05	·
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Vinyl chloride	0.02 ug/g dry	<0.02	<0.02	<0.02	·
0.05 ug/g dry < 0.05 $< 0.05 ug/g dry$ < 0.05 < 0.05 < 0.05 $0.05 ug/g dry$ $0.05 ug/g dry$ < 0.05 < 0.05 < 0.05 < 0.05 $0.05 ug/g dry$ < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 $0.05 ug/g dry$ < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 $0.05 ug/g dry$ $< 0.04%$ $< 0.04%$ $< 0.04%$ < 0.05 < 0.05 $0.05 ug/g dry$ < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 $0.05 ug/g dry$ < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 $0.05 ug/g dry$ < 0.04 $< 10%$ < 0.05 < 0.05 < 0.05 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 < 0.05 <	m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	<0.05	I
0.05 ug/g dry <0.05 <0.05 <0.05 <0.05 benzene Surrogate 104% 104% 107% methane Surrogate 64.8% 67.7% 67.8% Surrogate 104% 111% 112% C10) 7 ug/g dry <7	o-Xylene	0.05 ug/g dry	<0.05	<0.05	<0.05	I
benzene Surrogate 104% 107% 107% methane Surrogate 64.8% 67.7% 67.8% 112% Surrogate 110% 111% 112% 112% 112% 112% C10) 7 ug/g dry <7	Xylenes, total	0.05 ug/g dry	<0.05	<0.05	<0.05	I
methane Surrogate 64.8% 67.7% 67.8% Surrogate 110% 111% 112% C10) 7 ug/g dry <7	4-Bromofluorobenzene	Surrogate	104%	104%	107%	ı
Surrogate 110% 111% C10) 7 ug/g dry <7	Dibromofluoromethane	Surrogate	64.8%	67.7%	67.8%	I
210) 7 ug/g dry <7 27 27	Toluene-d8	Surrogate	110%	111%	112%	1
7 ug/g dry <7 27	Hydrocarbons	-				
	F1 PHCs (C6-C10)	7 ug/g dry	<7	27	<7	I
4 ug/g ury <4 <4	F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	·



Order #: 1943704

Report Date: 31-Oct-2019 Order Date: 25-Oct-2019

Project Description: 191-12948-00

	Client ID:	BH19-2-SS5	BH19-6-SS3	BH19-10-SS8	BH19-6-DUP
	Sample Date:	23-Oct-19 09:00	24-Oct-19 09:00	23-Oct-19 09:00	24-Oct-19 09:00
	Sample ID:	1943704-01	1943704-02	1943704-03	1943704-04
	MDL/Units	Soil	Soil	Soil	Soil
F3 PHCs (C16-C34)	8 ug/g dry	<8	75	<8	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	123	<6	-
Semi-Volatiles			-		
Acenaphthene	0.02 ug/g dry	<0.02	0.02	<0.02	0.04
Acenaphthylene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Anthracene	0.02 ug/g dry	0.03	0.04	<0.02	0.10
Benzo [a] anthracene	0.02 ug/g dry	0.05	0.09	<0.02	0.20
Benzo [a] pyrene	0.02 ug/g dry	0.04	0.08	<0.02	0.16
Benzo [b] fluoranthene	0.02 ug/g dry	0.06	0.13	<0.02	0.20
Benzo [g,h,i] perylene	0.02 ug/g dry	0.03	0.05	<0.02	0.13
Benzo [k] fluoranthene	0.02 ug/g dry	0.03	0.06	<0.02	0.11
Chrysene	0.02 ug/g dry	0.07	0.10	<0.02	0.20
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	<0.02	<0.02	0.03
Fluoranthene	0.02 ug/g dry	0.14	0.21	<0.02	0.46
Fluorene	0.02 ug/g dry	<0.02	0.02	<0.02	0.05
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	0.02	0.05	<0.02	0.10
1-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	<0.04	<0.04	<0.04
Naphthalene	0.01 ug/g dry	<0.01	0.02	<0.01	0.02
Phenanthrene	0.02 ug/g dry	0.09	0.16	<0.02	0.38
Pyrene	0.02 ug/g dry	0.11	0.16	<0.02	0.37
2-Fluorobiphenyl	Surrogate	77.8%	84.1%	66.6%	76.0%
Terphenyl-d14	Surrogate	89.5%	110%	93.2%	71.1%



Order #: 1943704

Report Date: 31-Oct-2019

Order Date: 25-Oct-2019

Project Description: 191-12948-00

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	5.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	5.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	5.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	10.0	ug/g						
Zinc	ND	20.0	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND ND	0.02 0.02	ug/g						
Pyrene	1.26	0.02	ug/g		94.1	50-140			
Surrogate: 2-Fluorobiphenyl			ug/g						
Surrogate: Terphenyl-d14	1.47		ug/g		110	50-140			
Volatiles									
Acetone	ND	0.50	ug/g						
Benzene	ND	0.02	ug/g						
Bromodichloromethane	ND	0.05	ug/g						
Bromoform	ND	0.05	ug/g						
Bromomethane	ND	0.05	ug/g						
Carbon Tetrachloride	ND	0.05	ug/g						
Chlorobenzene	ND	0.05	ug/g						
		0.05	/						
Chloroform	ND	0.05	ug/g						
Chloroform Dibromochloromethane Dichlorodifluoromethane	ND ND ND	0.05 0.05 0.05	ug/g ug/g ug/g						



Order #: 1943704

Report Date: 31-Oct-2019 Order Date: 25-Oct-2019

Project Description: 191-12948-00

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,2-Dichlorobenzene	ND	0.05	ug/g						
1,3-Dichlorobenzene	ND	0.05	ug/g						
1,4-Dichlorobenzene	ND	0.05	ug/g						
1,1-Dichloroethane	ND	0.05	ug/g						
1,2-Dichloroethane	ND	0.05	ug/g						
1,1-Dichloroethylene	ND	0.05	ug/g						
cis-1,2-Dichloroethylene	ND	0.05	ug/g						
trans-1,2-Dichloroethylene	ND	0.05	ug/g						
1,2-Dichloropropane	ND	0.05	ug/g						
cis-1,3-Dichloropropylene	ND	0.05	ug/g						
trans-1,3-Dichloropropylene	ND	0.05	ug/g						
1,3-Dichloropropene, total	ND	0.05	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Ethylene dibromide (dibromoethane	ND	0.05	ug/g						
Hexane	ND	0.05	ug/g						
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g						
Methyl Isobutyl Ketone	ND	0.50	ug/g						
Methyl tert-butyl ether	ND	0.05	ug/g						
Methylene Chloride	ND	0.05	ug/g						
Styrene	ND	0.05	ug/g						
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g						
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g						
Tetrachloroethylene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
1,1,1-Trichloroethane	ND	0.05	ug/g						
1,1,2-Trichloroethane	ND	0.05	ug/g						
Trichloroethylene	ND	0.05	ug/g						
Trichlorofluoromethane	ND	0.05	ug/g						
Vinyl chloride	ND	0.02	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: 4-Bromofluorobenzene	3.38		ug/g		106	50-140			
Surrogate: Dibromofluoromethane	2.64		ug/g		82.6	50-140			
Surrogate: Toluene-d8	3.44		ug/g		107	50-140			



Order #: 1943704

Report Date: 31-Oct-2019 Order Date: 25-Oct-2019

Project Description: 191-12948-00

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Metals			55,						
Antimony	1.2	1.0	ug/g dry	ND			0.0	30	
Arsenic	5.0	1.0	ug/g dry	5.3			7.4	30	
Barium	97.2	1.0	ug/g dry	104			6.9	30	
Beryllium	0.9	0.5	ug/g dry	0.8			12.4	30	
Boron	9.3	5.0	ug/g dry	9.6			2.7	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium (VI)	ND	0.2	ug/g dry	ND			0.0	35	
Chromium	34.3	5.0	ug/g dry	37.7			9.4	30	
Cobalt	7.5	1.0	ug/g dry	8.0			5.8	30	
Copper	16.3	5.0	ug/g dry	17.9			9.4	30	
Lead	10.6	1.0	ug/g dry	12.4			15.8	30	
Mercury	ND	0.1	ug/g dry ug/g dry	ND			0.0	30	
Molybdenum	ND	1.0	ug/g dry ug/g dry	ND			0.0	30	
Nickel	20.0	5.0	ug/g dry ug/g dry	21.8			8.6	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.3	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry ug/g dry	ND			0.0	30	
Vanadium	36.3	10.0	ug/g dry ug/g dry	39.6			8.8	30	
Zinc	65.2	20.0	ug/g dry ug/g dry	68.8			5.3	30	
	00.2	20.0	ug/g ury	00.0			0.0	00	
Physical Characteristics									
% Solids	92.3	0.1	% by Wt.	93.0			0.8	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND			0.0	40	
Acenaphthylene	ND	0.02	ug/g dry	ND			0.0	40	
Anthracene	0.026	0.02	ug/g dry	ND			0.0	40	
Benzo [a] anthracene	0.065	0.02	ug/g dry	0.032			69.1	40	QR-01
Benzo [a] pyrene	0.053	0.02	ug/g dry	0.028			62.4	40	QR-01
Benzo [b] fluoranthene	0.078	0.02	ug/g dry	0.041			62.2	40	QR-01
Benzo [g,h,i] perylene	0.037	0.02	ug/g dry	0.021			53.0	40	QR-01
Benzo [k] fluoranthene	0.038	0.02	ug/g dry	0.020			60.4	40	QR-01
Chrysene	0.074	0.02	ug/g dry	0.035			72.3	40	QR-01
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND			0.0	40	
Fluoranthene	0.151	0.02	ug/g dry	0.068			76.5	40	QR-01
Fluorene	ND	0.02	ug/g dry	ND			0.0	40	
Indeno [1,2,3-cd] pyrene	0.032	0.02	ug/g dry	ND			0.0	40	
1-Methylnaphthalene	ND	0.02	ug/g dry	ND			0.0	40	
2-Methylnaphthalene	ND	0.02	ug/g dry	ND			0.0	40	
Naphthalene	ND	0.01	ug/g dry	ND			0.0	40	
Phenanthrene	0.111	0.02	ug/g dry	0.040			93.3	40	QR-01
Pyrene	0.127	0.02	ug/g dry	0.059		50 4 40	72.6	40	QR-01
Surrogate: 2-Fluorobiphenyl	1.34		ug∕g dry		89.1	50-140			
Surrogate: Terphenyl-d14	1.45		ug∕g dry		96.6	50-140			
Volatiles									
Acetone	ND	0.50	ug/g dry	ND				50	
Benzene	ND	0.02	ug/g dry	ND				50	
Bromodichloromethane	ND	0.05	ug/g dry	ND				50	
Bromoform	ND	0.05	ug/g dry	ND				50	
Bromomethane	ND	0.05	ug/g dry	ND				50	
Carbon Tetrachloride	ND	0.05	ug/g dry	ND				50	
Chlorobenzene	ND	0.05	ug/g dry	ND				50	



Order #: 1943704

Report Date: 31-Oct-2019 Order Date: 25-Oct-2019

Project Description: 191-12948-00

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Chloroform	ND	0.05	ug/g dry	ND				50	
Dibromochloromethane	ND	0.05	ug/g dry	ND				50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND				50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Ethylene dibromide (dibromoethane	ND	0.05	ug/g dry	ND				50	
Hexane	ND	0.05	ug/g dry	ND				50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND				50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND				50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND				50	
Methylene Chloride	ND	0.05	ug/g dry	ND				50	
Styrene	ND	0.05	ug/g dry	ND				50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
Tetrachloroethylene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND				50	
Trichloroethylene	ND	0.05	ug/g dry	ND				50	
Trichlorofluoromethane	ND	0.05	ug/g dry	ND				50	
Vinyl chloride	ND	0.02	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: 4-Bromofluorobenzene	4.57		ug/g dry		111	50-140			
Surrogate: Dibromofluoromethane	3.01		ug/g dry		73.0	50-140			
Surrogate: Toluene-d8	4.62		ug/g dry		112	50-140			



Bromoform

Certificate of Analysis Client: WSP Canada Inc. (Ottawa) Client PO:

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit Notes
Hydrocarbons								
F1 PHCs (C6-C10)	196	7	ug/g		97.9	80-120		
F2 PHCs (C10-C16)	78	4	ug/g	ND	82.5	60-140		
F3 PHCs (C16-C34)	199	8	ug/g	ND	85.7	60-140		
F4 PHCs (C34-C50)	149	6	ug/g	ND	102	60-140		
Metals			00					
Antimony	46.1		ug/L	ND	91.8	70-130		
Arsenic	57.2		ug/L	2.1	110	70-130		
Barium	98.7		ug/L	41.7	114	70-130		
Beryllium	56.1		ug/L	ND	111	70-130		
Boron	49.5		ug/L	ND	91.3	70-130		
Cadmium	54.4		ug/L	ND	108	70-130		
Chromium (VI)	0.1		mg/L	ND	58.0	70-130		QM-05
Chromium	73.8		ug/L	15.1	117	70-130		
Cobalt	52.7		ug/L	3.2	99.0	70-130		
Copper	60.4		ug/L	7.2	106	70-130		
Lead	54.0		ug/L	5.0	98.1	70-130		
Mercury	1.70	0.1	ug/g	ND	113	70-130		
Molybdenum	48.5	0.1	ug/L	ND	96.6	70-130		
Nickel	63.1		ug/L	8.7	109	70-130		
Selenium	53.5		ug/L	ND	106	70-130		
Silver	45.2		ug/L	ND	90.3	70-130		
Thallium	47.3		ug/L	ND	94.4	70-130		
Uranium	52.0		ug/L	ND	103	70-130		
Vanadium	74.8		ug/L	15.9	118	70-130		
Zinc	80.2		ug/L	27.5	105	70-130		
Semi-Volatiles	0012		39, L	2710	100	10100		
Acenaphthene	0.181	0.02	ug/g	ND	96.1	50-140		
Acenaphthylene	0.160	0.02	ug/g	ND	85.3	50-140		
Anthracene	0.179	0.02	ug/g	ND	95.2	50-140		
Benzo [a] anthracene	0.203	0.02	ug/g	0.032	91.3	50-140		
Benzo [a] pyrene	0.177	0.02	ug/g	0.028	79.3	50-140		
Benzo [b] fluoranthene	0.283	0.02	ug/g	0.041	129	50-140		
Benzo [g,h,i] perylene	0.171	0.02	ug/g	0.021	79.8	50-140		
Benzo [k] fluoranthene	0.231	0.02	ug/g	0.020	112	50-140		
Chrysene	0.258	0.02	ug/g	0.035	119	50-140		
Dibenzo [a,h] anthracene	0.159	0.02	ug/g	ND	84.8	50-140		
Fluoranthene	0.233	0.02	ug/g	0.068	88.2	50-140		
Fluorene	0.174	0.02	ug/g	ND	92.8	50-140		
Indeno [1,2,3-cd] pyrene	0.150	0.02	ug/g	ND	79.6	50-140		
1-Methylnaphthalene	0.182	0.02	ug/g	ND	96.7	50-140		
2-Methylnaphthalene	0.203	0.02	ug/g	ND	108	50-140		
Naphthalene	0.184	0.01	ug/g	ND	97.7	50-140		
Phenanthrene	0.210	0.02	ug/g	0.040	90.4	50-140		
Pyrene	0.237	0.02	ug/g	0.059	94.5	50-140		
Surrogate: 2-Fluorobiphenyl	1.27		ug/g		84.3	50-140		
Volatiles								
Acetone	7.54	0.50	ug/g		75.4	50-140		
Benzene	2.79	0.02	ug/g		69.7	60-130		
Bromodichloromethane	2.48	0.05	ug/g		62.0	60-130		
Bromoform	2.05	0.05			00 6	60 120		

Report Date: 31-Oct-2019 Order Date: 25-Oct-2019

Project Description: 191-12948-00

ug/g

98.6

60-130

3.95

0.05



Order #: 1943704

Report Date: 31-Oct-2019 Order Date: 25-Oct-2019

Project Description: 191-12948-00

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Bromomethane	2.91	0.05	ug/g		72.7	50-140			
Carbon Tetrachloride	2.85	0.05	ug/g		71.2	60-130			
Chlorobenzene	3.59	0.05	ug/g		89.8	60-130			
Chloroform	2.46	0.05	ug/g		61.5	60-130			
Dibromochloromethane	3.98	0.05	ug/g		99.6	60-130			
Dichlorodifluoromethane	2.04	0.05	ug/g		51.0	50-140			
1,2-Dichlorobenzene	3.01	0.05	ug/g		75.3	60-130			
1,3-Dichlorobenzene	3.04	0.05	ug/g		76.0	60-130			
1,4-Dichlorobenzene	3.31	0.05	ug/g		82.7	60-130			
1,1-Dichloroethane	2.90	0.05	ug/g		72.6	60-130			
1,2-Dichloroethane	2.46	0.05	ug/g		61.6	60-130			
1,1-Dichloroethylene	2.88	0.05	ug/g		72.0	60-130			
cis-1,2-Dichloroethylene	2.59	0.05	ug/g		64.8	60-130			
trans-1,2-Dichloroethylene	2.92	0.05	ug/g		73.1	60-130			
1,2-Dichloropropane	3.55	0.05	ug/g		88.8	60-130			
cis-1,3-Dichloropropylene	2.85	0.05	ug/g		71.2	60-130			
trans-1,3-Dichloropropylene	2.72	0.05	ug/g		67.9	60-130			
Ethylbenzene	3.56	0.05	ug/g		89.0	60-130			
Ethylene dibromide (dibromoethane	3.04	0.05	ug/g		76.0	60-130			
Hexane	2.76	0.05	ug/g		68.9	60-130			
Methyl Ethyl Ketone (2-Butanone)	7.38	0.50	ug/g		73.8	50-140			
Methyl Isobutyl Ketone	6.36	0.50	ug/g		63.6	50-140			
Methyl tert-butyl ether	8.97	0.05	ug/g		89.7	50-140			
Methylene Chloride	3.16	0.05	ug/g		78.9	60-130			
Styrene	3.54	0.05	ug/g		88.4	60-130			
1,1,1,2-Tetrachloroethane	4.21	0.05	ug/g		105	60-130			
1,1,2,2-Tetrachloroethane	3.79	0.05	ug/g		94.8	60-130			
Tetrachloroethylene	3.40	0.05	ug/g		85.0	60-130			
Toluene	3.72	0.05	ug/g		93.1	60-130			
1,1,1-Trichloroethane	2.60	0.05	ug/g		64.9	60-130			
1,1,2-Trichloroethane	2.72	0.05	ug/g		68.0	60-130			
Trichloroethylene	2.95	0.05	ug/g		73.6	60-130			
Trichlorofluoromethane	3.38	0.05	ug/g		84.5	50-140			
Vinyl chloride	2.96	0.02	ug/g		74.1	50-140			
m,p-Xylenes	7.42	0.05	ug/g		92.8	60-130			
o-Xylene	3.73	0.05	ug/g		93.3	60-130			



Qualifier Notes:

QC Qualifiers :

QM-05 : The spike recovery was outside acceptance limits for the matrix spike due to matrix interference.

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable ND: Not Detected MDL: Method Detection Limit Source Result: Data used as source for matrix and duplicate samples %REC: Percent recovery. RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'. Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.

- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.
- When reported, data for F4G has been processed using a silica gel cleanup.

6	PARACEL	I H			Paracel ID	: 19437	04				4tawa : 1-80	19 S , Ont 0-74	t. Laurent I ario K1G 9-1947 paracellab	4J8		(1	Lab Use	Custod Oaly) 1297	
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raracei	Order Number:	rix	Air Volume	of Containers	Sample	Taken	s F1-F4+BTEN	9	~	Is by ICP			(cw						
	Sample ID/Location Name	Matrix	Air	to #	Date	Time	PHICS	VOCS	P.A.Hs	Metals	Hg	Cevi	(SWH) B						
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RELIABLE.

351 Nash Road North, unit 9B Hamilton, ON L8H 7P4 1-800-749-1947 www.paracellabs.com

Certificate of Analysis

WSP Canada Inc. (Ottawa)

2611 Queensview Dr Ottawa, ON K2B 8K2 Attn: Adrian Menyhart

Client PO: Project: 191-12948-00 Custody: 124106

Report Date: 8-Nov-2019 Order Date: 1-Nov-2019

Order #: 1944618

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Client ID Paracel ID 1944618-01 BH19-6-SS8 1944618-02 BH19-8-SS8 1944618-03 BH19-10-SS10

Approved By:

Dale Robertson, BSc Laboratory Director

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.



Order #: 1944618

Report Date: 08-Nov-2019 Order Date: 1-Nov-2019 Project Description: 191-12948-00

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	5-Nov-19	6-Nov-19
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	4-Nov-19	7 -N ov-19
Mercury by CVAA	EPA 7471B - CVAA, digestion	5-Nov-19	5 -N ov-19
PHC F1	CWS Tier 1 - P&T GC-FID	5-Nov-19	6-Nov-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	5-Nov-19	7 -N ov-19
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	5-Nov-19	5 -N ov-19
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	4-Nov-19	6-Nov-19
Solids, %	Gravimetric, calculation	5 -N ov-19	5 -N ov-19



Order #: 1944618

Report Date: 08-Nov-2019

Order Date: 1-Nov-2019

	Client ID: Sample Date:	BH19-6-SS8 24-Oct-19 09:00	BH19-8-SS8 24-Oct-19 09:00	BH19-10-SS10 24-Oct-19 09:00	-
	Sample Date: Sample ID:	1944618-01	1944618-02	1944618-03	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	93.7	93.5	91.5	-
Metals					
Antimony	1.0 ug/g dry	-	<1.0	<1.0	-
Arsenic	1.0 ug/g dry	-	1.9	2.2	-
Barium	1.0 ug/g dry	-	152	54.9	-
Beryllium	0.5 ug/g dry	-	<0.5	<0.5	-
Boron	5.0 ug/g dry	-	11.5	7.5	-
Cadmium	0.5 ug/g dry	-	<0.5	<0.5	-
Chromium	5.0 ug/g dry	-	14.5	14.7	-
Chromium (VI)	0.2 ug/g dry	-	<0.2	<0.2	-
Cobalt	1.0 ug/g dry	-	6.3	6.4	-
Copper	5.0 ug/g dry	_	12.5	11.8	-
Lead	1.0 ug/g dry	-	4.4	4.2	-
Mercury	0.1 ug/g dry	-	<0.1	<0.1	-
Molybdenum	1.0 ug/g dry	-	<1.0	1.1	-
Nickel	5.0 ug/g dry	-	12.3	10.6	-
Selenium	1.0 ug/g dry	-	<1.0	<1.0	-
Silver	0.3 ug/g dry	-	<0.3	<0.3	-
Thallium	1.0 ug/g dry	-	<1.0	<1.0	-
Uranium	1.0 ug/g dry	-	1.1	<1.0	-
Vanadium	10.0 ug/g dry	-	26.0	24.7	-
Zinc	20.0 ug/g dry	-	<20.0	<20.0	-
Volatiles					•
Benzene	0.02 ug/g dry	<0.02	<0.02	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	-	-
Toluene	0.05 ug/g dry	<0.05	<0.05	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	-	-
o-Xylene	0.05 ug/g dry	<0.05	<0.05	-	-
Xylenes, total	0.05 ug/g dry	<0.05	<0.05	-	-
Toluene-d8	Surrogate	112%	110%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	-	-



Order #: 1944618

Report Date: 08-Nov-2019

Order Date: 1-Nov-2019

	Client ID:	BH19-6-SS8	BH19-8-SS8	BH19-10-SS10	-
	Sample Date:	24-Oct-19 09:00	24-Oct-19 09:00	24-Oct-19 09:00	-
	Sample ID:	1944618-01	1944618-02	1944618-03	-
	MDL/Units	Soil	Soil	Soil	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	<0.02	-	-
Acenaphthylene	0.02 ug/g dry	<0.02	<0.02	-	-
Anthracene	0.02 ug/g dry	<0.02	<0.02	-	-
Benzo [a] anthracene	0.02 ug/g dry	<0.02	<0.02	-	-
Benzo [a] pyrene	0.02 ug/g dry	<0.02	<0.02	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	<0.02	<0.02	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	<0.02	<0.02	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	<0.02	<0.02	-	_
Chrysene	0.02 ug/g dry	<0.02	<0.02	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	<0.02	-	-
Fluoranthene	0.02 ug/g dry	<0.02	<0.02	-	-
Fluorene	0.02 ug/g dry	<0.02	<0.02	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	<0.02	-	-
1-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	-	-
2-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	<0.04	-	-
Naphthalene	0.01 ug/g dry	<0.01	<0.01	-	-
Phenanthrene	0.02 ug/g dry	<0.02	<0.02	-	-
Pyrene	0.02 ug/g dry	<0.02	<0.02	-	_
2-Fluorobiphenyl	Surrogate	91.4%	101%	-	-
Terphenyl-d14	Surrogate	121%	133%	-	-



Order #: 1944618

Report Date: 08-Nov-2019

Order Date: 1-Nov-2019

Project Description: 191-12948-00

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	5.0	ug/g						
Cobalt	ND ND	1.0 5.0	ug/g						
Copper Lead	ND	5.0 1.0	ug/g ug/g						
Mercury	ND	0.1	ug/g ug/g						
Molybdenum	ND	1.0	ug/g ug/g						
Nickel	ND	5.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	10.0	ug/g						
Zinc	ND	20.0	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene Chrysene	ND ND	0.02 0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g ug/g						
Fluoranthene	ND	0.02	ug/g ug/g						
Fluorene	ND	0.02	ug/g ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	0.982		ug/g		73.6	50-140			
Surrogate: Terphenyl-d14	1.33		ug/g		99.6	50-140			
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g		107	50 1 10			
Surrogate: Toluene-d8	3.43		ug/g		107	50-140			



Order #: 1944618

Report Date: 08-Nov-2019

Order Date: 1-Nov-2019

Project Description: 191-12948-00

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Metals									
Antimony	2.1	1.0	ug/g dry	2.0			4.6	30	
Arsenic	1.6	1.0	ug/g dry	1.3			22.0	30	
Barium	23.5	1.0	ug/g dry	21.6			8.4	30	
Beryllium	ND	0.5	ug/g dry	0.5			0.0	30	
Boron	8.0	5.0	ug/g dry	7.3			9.4	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium (VI)	ND	0.2	ug/g dry	ND				35	
Chromium	10.4	5.0	ug/g dry	9.4			10.0	30	
Cobalt	4.2	1.0	ug/g dry	3.9			5.6	30	
Copper	9.3	5.0	ug/g dry	8.6			7.6	30	
Lead	3.0	1.0	ug/g dry	2.7			9.1	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	7.7	5.0	ug/g dry	6.9			11.4	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	0.4	0.3	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND			0.0	30	
Vanadium	17.9	10.0	ug/g dry	16.2			9.7	30	
Zinc	ND	20.0	ug/g dry	ND			0.0	30	
Physical Characteristics									
% Šolids	86.1	0.1	% by Wt.	85.6			0.6	25	
Semi-Volatiles									
Acenaphthene	ND	0.40	ug/g dry	ND				40	
Acenaphthylene	ND	0.40	ug/g dry	ND			0.0	40	
Anthracene	ND	0.40	ug/g dry	ND			0.0	40	
Benzo [a] anthracene	ND	0.40	ug/g dry	ND			0.0	40	
Benzo [a] pyrene	ND	0.40	ug/g dry	ND			0.0	40	
Benzo [b] fluoranthene	ND	0.40	ug/g dry	ND			0.0	40	
Benzo [g,h,i] perylene	ND	0.40	ug/g dry	ND			0.0	40	
Benzo [k] fluoranthene	ND	0.40	ug/g dry	ND			0.0	40	
Chrysene	ND	0.40	ug/g dry	ND			0.0	40	
Dibenzo [a,h] anthracene	ND	0.40	ug/g dry	ND			0.0	40	
Fluoranthene	ND	0.40	ug/g dry	ND			0.0	40	
Fluorene	ND	0.40	ug/g dry	ND			0.0	40	
Indeno [1,2,3-cd] pyrene	ND	0.40	ug/g dry	ND			0.0	40	
1-Methylnaphthalene	ND	0.40	ug/g dry	ND			0.0	40	
2-Methylnaphthalene	ND	0.40	ug/g dry	ND			0.0	40	
Naphthalene	ND	0.20	ug/g dry	ND			0.0	40	
Phenanthrene	ND	0.40	ug/g dry	ND			0.0	40	
Pyrene	ND	0.40	ug/g dry	ND			0.0	40	
Surrogate: 2-Fluorobiphenyl	1.25		ug/g dry		88.4	50-140			
Surrogate: Terphenyl-d14	1.39		ug/g dry		98.6	50-140			
Volatiles			, .					= -	
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: Toluene-d8	3.91		ug/g dry		112	50-140			



2-Methylnaphthalene

Surrogate: 2-Fluorobiphenyl

Naphthalene

Volatiles

Ethylbenzene

m,p-Xylenes

Benzene

Toluene

Pyrene

Phenanthrene

Certificate of Analysis Client: WSP Canada Inc. (Ottawa) **Client PO:**

Ме

A	Result	Reporting	Units	Source	%REC	%REC	RPD	RPD	Notes
Analyte	recont	Limit	Child	Result		Limit		Limit	
Hydrocarbons									
F1 PHCs (C6-C10)	192	7	ug/g		95.8	80-120			
F2 PHCs (C10-C16)	84	4	ug/g	ND	98.8	60-140			
F3 PHCs (C16-C34)	240	8	ug/g	ND	115	60-140			
F4 PHCs (C34-C50)	172	6	ug/g	ND	130	60-140			
Vietals									
Antimony	40.8		ug/L	ND	80.0	70 - 130			
Arsenic	45.8		ug/L	ND	90.7	70-130			
Barium	51.9		ug/L	8.6	86.5	70 - 130			
Beryllium	50.1		ug/L	ND	99.8	70-130			
Boron	45.4		ug/L	ND	85.0	70 - 130			
Cadmium	46.4		ug/L	ND	92.7	70-130			
Chromium (VI)	0.1		mg/L	ND	70.5	70 - 130			
Chromium	52.5		ug/L	ND	97.5	70 - 130			
Cobalt	49.3		ug/L	1.6	95.5	70 - 130			
Copper	51.2		ug/L	ND	95.4	70 - 130			
Lead	43.3		ug/L	1.1	84.5	70 - 130			
Mercury	1.41	0.1	ug/g	ND	94.1	70 - 130			
Molybdenum	51.2		ug/L	ND	102	70 - 130			
Nickel	50.2		ug/L	ND	94.8	70 - 130			
Selenium	47.0		ug/L	ND	93.5	70 - 130			
Silver	45.2		ug/L	ND	90.2	70 - 130			
Thallium	43.7		ug/L	ND	87.2	70 - 130			
Uranium	45.3		ug/L	ND	90.2	70-130			
Vanadium	57.7		ug/L	ND	102	70 - 130			
Zinc	53.0		ug/L	ND	95.0	70 - 130			
Semi-Volatiles									
Acenaphthene	0.161	0.02	ug/g		96.4	50-140			
Acenaphthylene	0.136	0.02	ug/g		81.3	50 - 140			
Anthracene	0.164	0.02	ug/g		98.5	50-140			
Benzo [a] anthracene	0.158	0.02	ug/g		94.5	50 - 140			
Benzo [a] pyrene	0.130	0.02	ug/g		77.8	50-140			
Benzo [b] fluoranthene	0.206	0.02	ug/g		124	50 - 140			
Benzo [g,h,i] perylene	0.138	0.02	ug/g		82.9	50 - 140			
Benzo [k] fluoranthene	0.187	0.02	ug/g		112	50 - 140			
Chrysene	0.193	0.02	ug/g		116	50 - 140			
Dibenzo [a,h] anthracene	0.140	0.02	ug/g		84.0	50 - 140			
Fluoranthene	0.163	0.02	ug/g		97.6	50 - 140			
Fluorene	0.166	0.02	ug/g		99.6	50 - 140			
Indeno [1,2,3-cd] pyrene	0.119	0.02	ug/g		71.3	50 - 140			
1-Methylnaphthalene	0.151	0.02	ug/g		90.4	50 - 140			
2 Mothylpophtholopo	0.166	0.02			00.0	EO 140			

Report Date: 08-Nov-2019

Order Date: 1-Nov-2019

Project Description: 191-12948-00

0.166

0.160

0.170

0.167

2.53

4.29

4.46

8.79

1.40

0.02

0.01

0.02

0.02

0.02

0.05

0.05

0.05

ug/g

ug/g

ug/g

ug/g

ug/g

ug/g

ug/g

ug/g

ug/g

99.9

95.9

102

100

105

63.2

107

111

110

50-140

50-140

50-140

50-140

50-140

60-130

60-130

60-130

60-130



Report Date: 08-Nov-2019

Order Date: 1-Nov-2019

Project Description: 191-12948-00

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
o-Xylene	4.37	0.05	ug/g		109	60-130			



Login Qualifiers :

Container(s) - Labeled improperly/insufficient information -Applies to samples: BH19-8-SS8, BH19-10-SS10

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable ND: Not Detected MDL: Method Detection Limit Source Result: Data used as source for matrix and duplicate samples %REC: Percent recovery. RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'. Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.

- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.
- When reported, data for F4G has been processed using a silica gel cleanup.

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Client Name: USP CANA	DA- INC		Project	Ret	191-129	48-00								P	age j	of /	
Contact Name: ADVL HA	MENYHART		Quote	#:	19-029	Area and								Turn	aroun	d Time	e
Address:	Inverse and the		PO #1		All so A						_	1] 1 da	Y		C	3 day
2611 OLLENS VIEW	1 Adult		E-mail									1	🗆 2 da	Y		C	Regular
Telephone: 747 - 961 -			ad	Viav	1. menyhavi	EWSP.	im		_	_	_	Da	te Req	uired:	_	_	
Regulation 153/04	Other Regulation	N	latrix T	ype: S	(Soil/Sed.) GW (G	round Water)						Rec	quired	Analys	is		
Table 1 Res/Park Med/Fine	REG 558 PWQO	5	W (Su	rface W	aint) A (Air) O (Oth	nitary Sewer)			_		-	-	1	1			
Table 2 Ind/Comm Coarse				PIP		iei)											
Table 3 🔲 Agri/Other	🗆 SU - Sani 🛛 SU - Storm		and a	ners	Consta	Takan	4+BT			Б							
Table	Mun:	1450	ame	Containers	Sample	Taken	1-11			ls by		(SA)					
For RSC: Ves C No	Other:	Matrix	Air Volume	to 1	Date	Time	PHCs F1-F4+BTEX	VOCS	PAHS	Metals by ICP	HBH	B (HWS)					
Sample ID/Locatio		S	4	#	CTC-AVE		1	-	1	T				.9	503	1+	vid! -
1 <u>BH19-6-</u>		2	-		or in		ť		1	0		1	t		/v 1	1	
2 81119-8-5	58	+	-	2	1		ť		1				1	1	19	pmi	
3 BH 19-10-	5510	1	-	1	/		-		Η	-	-		\vdash	-	10-	1110	
4		-	-	-			+	+	Η	+	+	+		-	-		
5		-	-	-			-	+	Η	-	+	+		+		-	
6		-	-	-			+	+		-	+	+	-	-	-		
7		-	-	-			+	+		+	+	+	┝	+	-		
8		_	_	_			+	+	H	+	+	+	+	+	-		
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10			100	1	75		_				-		of Delin	-			
comments: -110, 2 Vate on No.3, Vate v	Part viol vead a read a ocr 33, 299	00	139	9201	ч,	-0			_	_		1	ara	Če	,		
Relinquished By (Sign):	Received By D		Depot:	Ter	115	Received at Lat	am	1		hm 9	li	erified ate/Ti	- N	val	1		7124
Relinquished By (Print): (AT) LIAN	MENYIMAT Temperature	01/	11	19	3 . 11	Temperature:-	WIL	i i	°C	(4,		H Ver	ified: [] By	1	11	110
Date/Time: Di Nov 1 2019 Chain of Custody (Env) xisx					Revision 3.0		1.04		-	-	-	-		-	-	-	



RELIABLE.

Certificate of Analysis

WSP Canada Inc. (Ottawa)

2611 Queensview Dr Ottawa, ON K2B 8K2 Attn: Adrian Menyhart

Client PO: Project: 191-12948-00 Custody: 124408

Report Date: 1-Nov-2019 Order Date: 28-Oct-2019

Order #: 1944109

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID **Client ID** BH19-4-SS2 1944109-01

Approved By:

Mark Fin

Mark Foto, M.Sc. Lab Supervisor

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.



Solids, %

Certificate of Analysis Client: WSP Canada Inc. (Ottawa) Client PO:

Analysis Summary Table

Analysis Gummary Table			
Analysis	Method Reference/Description	Extraction Date	Analysis Date
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	29-Oct-19	29-Oct-19
Mercury by CVAA	EPA 7471B - CVAA, digestion	29-Oct-19	29-Oct-19
PHC F1	CWS Tier 1 - P&T GC-FID	29-Oct-19	30-Oct-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	28-Oct-19	30-Oct-19
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	29-Oct-19	29-Oct-19
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	28-Oct-19	1-Nov-19
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	29-Oct-19	30-Oct-19

Gravimetric, calculation

Order #: 1944109

29-Oct-19

Report Date: 01-Nov-2019 Order Date: 28-Oct-2019

29-Oct-19



Report Date: 01-Nov-2019

Order Date: 28-Oct-2019

	Client ID:	BH19-4-SS2	<u> </u>	_	
	Sample Date:	28-Oct-19 13:20		-	-
	Sample ID:	1944109-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics			<u>г </u>		
% Solids	0.1 % by Wt.	64.6	-	-	-
Metals			· · · · ·		
Antimony	1.0 ug/g dry	<1.0	-	-	-
Arsenic	1.0 ug/g dry	3.9	-	-	-
Barium	1.0 ug/g dry	359	-	-	-
Beryllium	0.5 ug/g dry	0.7	-	-	-
Boron	5.0 ug/g dry	6.5	-	-	-
Cadmium	0.5 ug/g dry	<0.5	-	-	-
Chromium	5.0 ug/g dry	118	-	-	-
Chromium (VI)	0.2 ug/g dry	<0.2	-	-	-
Cobalt	1.0 ug/g dry	21.5	-	-	-
Copper	5.0 ug/g dry	54.3	-	-	-
Lead	1.0 ug/g dry	16.3	-	-	-
Mercury	0.1 ug/g dry	<0.1	-	-	-
Molybdenum	1.0 ug/g dry	<1.0	-	-	-
Nickel	5.0 ug/g dry	62.8	-	-	-
Selenium	1.0 ug/g dry	<1.0	-	-	-
Silver	0.3 ug/g dry	<0.3	-	-	-
Thallium	1.0 ug/g dry	<1.0	-	-	-
Uranium	1.0 ug/g dry	<1.0	-	-	-
Vanadium	10.0 ug/g dry	104	-	-	-
Zinc	20.0 ug/g dry	121	-	-	-
Volatiles					
Acetone	0.50 ug/g dry	<0.50	-	-	-
Benzene	0.02 ug/g dry	<0.02	-	-	-
Bromodichloromethane	0.05 ug/g dry	<0.05	-	-	-
Bromoform	0.05 ug/g dry	<0.05	-	-	-
Bromomethane	0.05 ug/g dry	<0.05	-	-	-
Carbon Tetrachloride	0.05 ug/g dry	<0.05	-	-	-
Chlorobenzene	0.05 ug/g dry	<0.05	-	-	-
Chloroform	0.05 ug/g dry	<0.05	-	-	-
Dibromochloromethane	0.05 ug/g dry	<0.05	-	-	-
Dichlorodifluoromethane	0.05 ug/g dry	<0.05	-	-	-
1,2-Dichlorobenzene	0.05 ug/g dry	<0.05	-	-	-
1,3-Dichlorobenzene	0.05 ug/g dry	<0.05	-	-	-



Report Date: 01-Nov-2019 Order Date: 28-Oct-2019

	-				
	Client ID:	BH19-4-SS2	-	-	-
	Sample Date: Sample ID:	28-Oct-19 13:20 1944109-01		-	-
٦	MDL/Units	Soil	-	-	-
1,4-Dichlorobenzene	0.05 ug/g dry	<0.05	-	-	-
1,1-Dichloroethane	0.05 ug/g dry	<0.05	-	-	-
1,2-Dichloroethane	0.05 ug/g dry	<0.05	-	-	-
1,1-Dichloroethylene	0.05 ug/g dry	<0.05	-	-	-
cis-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	-	-	-
trans-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	-	-	-
1,2-Dichloropropane	0.05 ug/g dry	<0.05	-	-	-
cis-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	-	-	-
trans-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	-	-	-
1,3-Dichloropropene, total	0.05 ug/g dry	<0.05	-	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	-
Ethylene dibromide (dibromoethar	0.05 ug/g dry	<0.05	-	-	-
Hexane	0.05 ug/g dry	<0.05	-	-	-
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	<0.50	-	-	-
Methyl Isobutyl Ketone	0.50 ug/g dry	<0.50	-	-	-
Methyl tert-butyl ether	0.05 ug/g dry	<0.05	-	-	-
Methylene Chloride	0.05 ug/g dry	<0.05	-	-	-
Styrene	0.05 ug/g dry	<0.05	-	-	-
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	<0.05	-	-	-
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	<0.05	-	-	-
Tetrachloroethylene	0.05 ug/g dry	<0.05	-	-	-
Toluene	0.05 ug/g dry	<0.05	-	-	-
1,1,1-Trichloroethane	0.05 ug/g dry	<0.05	-	-	-
1,1,2-Trichloroethane	0.05 ug/g dry	<0.05	-	-	-
Trichloroethylene	0.05 ug/g dry	<0.05	-	-	-
Trichlorofluoromethane	0.05 ug/g dry	<0.05	-	-	-
Vinyl chloride	0.02 ug/g dry	<0.02	-	-	<u> </u>
m,p-Xylenes	0.05 ug/g dry	<0.05	-	-	-
o-Xylene	0.05 ug/g dry	<0.05	-	-	-
Xylenes, total	0.05 ug/g dry	<0.05	-	-	-
4-Bromofluorobenzene	Surrogate	103%	-	-	-
Dibromofluoromethane	Surrogate	107%	-	-	-
Toluene-d8	Surrogate	107%	-	-	-
Hydrocarbons	7		,		
F1 PHCs (C6-C10)	7 ug/g dry	<7	-	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	-	-	-



Report Date: 01-Nov-2019 Order Date: 28-Oct-2019

			r		
	Client ID:	BH19-4-SS2	-	-	-
	Sample Date:	28-Oct-19 13:20 1944109-01	-	-	-
	Sample ID: MDL/Units	Soil	_	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	_	<u> </u>	
F4 PHCs (C34-C50)	6 ug/g dry	<6	_	<u> </u>	_
Semi-Volatiles			I		
Acenaphthene	0.02 ug/g dry	0.02	-	-	-
Acenaphthylene	0.02 ug/g dry	<0.02	-	_	-
Anthracene	0.02 ug/g dry	0.05	-	-	-
Benzo [a] anthracene	0.02 ug/g dry	0.07	-	-	-
Benzo [a] pyrene	0.02 ug/g dry	0.05	-	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	0.06	-	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	0.03	-	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	0.03	-	-	-
Chrysene	0.02 ug/g dry	0.07	-	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	-	-	-
Fluoranthene	0.02 ug/g dry	0.19	-	-	-
Fluorene	0.02 ug/g dry	0.02	-	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	0.03	-	-	-
1-Methylnaphthalene	0.02 ug/g dry	0.02	-	-	-
2-Methylnaphthalene	0.02 ug/g dry	0.04	-	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	0.06	-	-	-
Naphthalene	0.01 ug/g dry	0.03	-	-	-
Phenanthrene	0.02 ug/g dry	0.16	-	-	-
Pyrene	0.02 ug/g dry	0.15	-	-	-
2-Fluorobiphenyl	Surrogate	56.4%	-	-	-
Terphenyl-d14	Surrogate	58.8%	-	-	-



Order #: 1944109

Report Date: 01-Nov-2019 Order Date: 28-Oct-2019

Project Description: 191-12948-00

Method Quality Control: Blank

Hydrocarbons ug/g F1 PRCs (C16-C10) ND 7 ug/g B PRCs (C16-C34) ND 8 ug/g Antimory ND 10 ug/g Antimory ND 10 ug/g Arsenic ND 10 ug/g Arsenic ND 10 ug/g Boron ND 0.0 ug/g Chomium ND 0.0 ug/g Chomium ND 0.2 ug/g Chomium ND 0.2 ug/g Chomium ND 0.2 ug/g Chomium ND 0.2 ug/g Chomium ND 1.0 ug/g Cobat ND 1.0 ug/g Cadmium ND 1.0 ug/g Nickel ND 1.0 ug/g Silver ND 1.0 ug/g Anthracton ND 1.0 ug/g Anthracton ND 0.0 ug/g Silver ND 1.0	Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
F1 PHCs (C10) ND 7 ug/g P3 PHCs (C10-G16) ND 8 ug/g P3 PHCs (C16-G24) ND 8 ug/g Artenicol ND 1.0 ug/g Antimony ND 1.0 ug/g Arsenic ND 1.0 ug/g Barylin ND 0.0 ug/g Cadmium ND 0.0 ug/g Chornium (V) ND 0.0 ug/g Cobalt ND 1.0 ug/g Cobalt ND 1.0 ug/g Cobalt ND 1.0 ug/g Lead ND 1.0 ug/g Lead ND 1.0 ug/g Lead ND 1.0 ug/g Lead ND 1.0 ug/g Vanduum ND 1.0 ug/g Vanduum ND 1.0 ug/g Zinc ND 0.0 ug/g Zinc ND 0.0 ug/g Zinc	Hvdrocarbons									
F2 PHCs (C10-C16) ND 4 ug/g F3 PHCs (C34-C30) ND 6 ug/g Antimony ND 1.0 ug/g Assenic ND 1.0 ug/g Barium ND 1.0 ug/g Barium ND 1.0 ug/g Barium ND 1.0 ug/g Catmium ND 5.0 ug/g Barium ND 5.0 ug/g Catmium ND 5.0 ug/g Catmium ND 5.0 ug/g Catmium ND 5.0 ug/g Copper ND 5.0 ug/g Cathal ND 5.0 ug/g Molydadnum ND 1.0 ug/g Nokckel ND 1.0 ug/g Seterium ND 1.0 ug/g Varadum ND 1.0 ug/g Seterium ND 1.0 ug/g Seterium ND 0.0 ug/g Seterium	F1 PHCs (C6-C10)	ND	7	ug/a						
P3 PH2s (2562) ND 8 uğig Heta (25 ND 6 uğig Antmany ND 1.0 uğig Arsenio ND 1.0 uğig Barjum ND 1.0 uğig Barjum ND 1.0 uğig Barjum ND 0.0 uğig Cadmiun ND 0.5 uğig Cadmiun ND 5.0 uğig Cadmiun ND 5.0 uğig Copper ND 5.0 uğig Copper ND 5.0 uğig Vickal ND 1.0 uğig Vickal ND 1.0 uğig Selenium ND 1.0 uğig Vanadum ND 1.0 uğig Selenium ND 1.0 uğig Vanadum ND 0.02 uğig Zanophthere ND 0.02 uğig <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>										
F4 PHCs (C34-C50) ND 6 ug'g Antinonay ND 1.0 ug'g Arsenic ND 1.0 ug'g Barium ND 1.0 ug'g Barium ND 1.0 ug'g Barium ND 1.0 ug'g Barium ND 0.5 ug'g Chronium ND 0.5 ug'g Chronium (VI) ND 0.2 ug'g Copper ND 5.0 ug'g Copper ND 5.0 ug'g Melout ND 5.0 ug'g Vennum ND 1.0 ug'g Nikel ND 1.0 ug'g Nikel ND 1.0 ug'g Stivar ND 1.0 ug'g Stivar ND 1.0 ug'g Stivar ND 0.2 ug'g Stivar ND 0.2 ug'g Stivar ND 0.2 ug'g Barzo (a ju prene ND										
Metals ND 1.0 upig Arsenic ND 1.0 upig Baruim ND 1.0 upig Baruim ND 0.5 upig Baryim ND 0.5 upig Cadmium ND 0.5 upig Cadmium ND 5.0 upig Chromium (VI) ND 5.0 upig Copper ND 5.0 upig Copper ND 5.0 upig Copper ND 5.0 upig Mickel ND 1.0 upig Nickel ND 1.0 upig Selenium ND 1.0 upig Thailium ND 1.0 upig Vanadum ND 1.0 upig Acenaphthylene ND 0.2 upig Acenaphthylene ND 0.2 upig Berco ig antracene ND 0.2 upig <td>F4 PHCs (C34-C50)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	F4 PHCs (C34-C50)									
Antinony ND 1.0 ug'q Barum ND 1.0 ug'q Barum ND 1.0 ug'q Barum ND 1.0 ug'q Boron ND 5.0 ug'q Boron ND 5.0 ug'q Cadmium ND 5.0 ug'q Chomium (V) ND 0.5 ug'q Cobalt ND 1.0 ug'q Cobalt ND 1.0 ug'q Cobalt ND 1.0 ug'q Molydenum ND 1.0 ug'q Nickel ND 1.0 ug'q Silver ND 0.3 ug'q Inalium ND 1.0 ug'q Zine ND 0.2 ug'q Acenaphthene ND 0.2 ug'q Acenaphthene ND 0.2 ug'q Berzo [a] intracene ND 0.2 ug'q				00						
Asenici ND 1.0 ug'g Barum ND 1.0 ug'g Beryllun ND 0.5 ug'g Beryllun ND 0.5 ug'g Cadmium ND 0.5 ug'g Cadmium ND 0.5 ug'g Chromium (Vi) ND 0.2 ug'g Copper ND 5.0 ug'g Copper ND 1.0 ug'g Mercury ND 0.0 ug'g Mercury ND 1.0 ug'g Mercury ND 1.0 ug'g Mercury ND 1.0 ug'g Mercury ND 1.0 ug'g Vanadum ND 1.0 ug'g Vanadum ND 1.0 ug'g Acenaphthene ND 0.02 ug'g Acenaphthene ND 0.02 ug'g Barzo [a infracone ND 0.02 ug'		ND	10	na/a						
Barlum ND 1.0 uğ'g Beryllum ND 5.0 uğ'g Boron ND 5.0 uğ'g Chromium (Vi) ND 0.2 uğ'g Chromium (Vi) ND 0.2 uğ'g Cobati ND 1.0 uğ'g Cabati ND 1.0 uğ'g Lead ND 1.0 uğ'g Lead ND 1.0 uğ'g Silvar ND 1.0 uğ'g Silvar ND 1.0 uğ'g Silvar ND 1.0 uğ'g Zinc ND 1.0 uğ'g Zinc ND 1.0 uğ'g Zinc ND 0.0 uğ'g Aconaphthene ND 0.0 uğ'g Anthracene ND 0.02 uğ'g Benzo [a] anthracene ND 0.02 uğ'g Benzo [a] intrantene ND 0.02 uğ'g										
Bernillium ND 0.5 uğ'g Cadmium ND 5.0 ug'g Cadmium (V) ND 0.5 ug'g Chromium (V) ND 0.5 ug'g Chromium (V) ND 5.0 ug'g Copper ND 5.0 ug'g Copper ND 5.0 ug'g Mercury ND 0.1 ug'g Mercury ND 1.0 ug'g Nickel ND 1.0 ug'g Stlear ND 1.0 ug'g Stlear ND 0.0 ug'g Tarahum ND 1.0 ug'g Vanadum ND 1.0 ug'g Vanadum ND 0.0 ug'g Vanadum ND 0.0 ug'g Aconaphthene ND 0.02 ug'g Aconaphthene ND 0.02 ug'g Berzo bj Horanthene ND 0.02										
Boron ND 5.0 ug/g Cadmium ND 0.5 ug/g Chramium ND 5.0 ug/g Cobal ND 1.0 ug/g Cobal ND 1.0 ug/g Cobal ND 1.0 ug/g Marcury ND 0.1 ug/g Mokydenum ND 1.0 ug/g Nokkel ND 1.0 ug/g Selenium ND 1.0 ug/g Vanadum ND 1.0 ug/g Vanadum ND 1.0 ug/g Zinc ND 0.0 ug/g Semi-Volatiles Acenaphthylen ND Acenaphthylene ND 0.02 ug/g Berzo [a] anthracene ND 0.02 ug/g Berzo [a] pyrene ND 0.02 ug/g Berzo [a] anthracene ND 0.02 ug/g Berzo [a] anthracene ND										
Cadmium ND 0.5 ug/g Chromium ND 5.0 ug/g Cobalt ND 1.0 ug/g Copper ND 5.0 ug/g Copper ND 1.0 ug/g Mercury ND 0.1 ug/g Mercury ND 1.0 ug/g Nickel ND 1.0 ug/g Silver ND 0.3 ug/g Vanadium ND 1.0 ug/g Zinc ND 0.0 ug/g Zinc ND 0.0 ug/g Acenaphthone ND 0.02 ug/g Acenaphthone ND 0.02 ug/g Acenaphthone ND 0.02 ug/g Berzo (a) private ND	5									
Chromium (VI) ND 0.2 ug'g Chromium (VI) ND 5.0 ug'g Cobalt ND 1.0 ug'g Cobalt ND 1.0 ug'g Lead ND 1.0 ug'g Motydenum ND 1.0 ug'g Motydenum ND 1.0 ug'g Selenium ND 1.0 ug'g Selenium ND 1.0 ug'g Thallum ND 1.0 ug'g Vanadum ND 1.0 ug'g Acenaphthylen ND 0.0 ug'g Acenaphthylen ND 0.02 ug'g Benzo [a] anthracene ND 0.02 ug'g B										
Chronium ND 5.0 ug'g Cobalt ND 1.0 ug'g Copper ND 5.0 ug'g Mercury ND 0.1 ug'g Mercury ND 0.1 ug'g Nickel ND 0.1 ug'g Nickel ND 0.1 ug'g Silver ND 0.3 ug'g Vanadium ND 1.0 ug'g Zine ND 0.0 ug'g Acenaphthene ND 0.0 ug'g Acenaphthylene ND 0.02 ug'g Acenaphthylene ND 0.02 ug'g Benzo [a] prome ND </td <td></td> <td></td> <td>0.2</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>			0.2							
Cobalt ND 1.0 ug'g Copper ND 5.0 ug'g Lead ND 1.0 ug'g Mercury ND 0.1 ug'g Molydenum ND 1.0 ug'g Molydenum ND 1.0 ug'g Selenium ND 1.0 ug'g Selenium ND 1.0 ug'g Thallium ND 1.0 ug'g Vanadum ND 1.0 ug'g Canc ND 0.0 ug'g Semi-Volaties ND 1.0 ug'g Acenaphthene ND 0.02 ug'g Acenaphthyle ND 0.02 ug'g Acenaphthyle ND 0.02 ug'g Benzo [g] intracene ND 0.02 ug'g Benzo [g] huranthene ND 0.02 ug'g Chrysene ND 0.02 ug'g Fluorene ND <td< td=""><td></td><td></td><td>5.0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>			5.0							
Copper ND 5.0 ug/g Lead ND 1.0 ug/g Mercury ND 0.1 ug/g Mickal ND 5.0 ug/g Nickal ND 5.0 ug/g Silver ND 0.3 ug/g Silver ND 0.3 ug/g Vanadium ND 1.0 ug/g Zinc ND 1.0 ug/g Zanc ND 0.0 ug/g Acenaphthylene ND 0.02 ug/g Acenaphthylene ND 0.02 ug/g Benzo [a] anthracene ND 0.02 ug/g Benzo [a] anthracene ND 0.02 ug/g Benzo [b] fluoranthene ND 0.02 ug/g Benzo [b] anthracene ND 0.02 ug/g Dibenzo [b] fluoranthene ND 0.02 ug/g Pluoranthene ND 0.02 ug/g Renzo [b] fl		ND	1.0							
Mercury ND 0.1 uğig Nickal ND 1.0 uğig Nickal ND 5.0 uğig Silver ND 0.3 uğig Silver ND 0.3 uğig Vanadium ND 1.0 uğig Zinc ND 1.0 uğig Zinc ND 1.0 uğig Acenaphtimen ND 0.0 uğig Acenaphtimene ND 0.02 uğig Berzo [a] pyrene ND 0.02 uğig Berzo [a] nithracene ND 0.02 uğig Berzo [a] nithracene ND 0.02 uğig Pioranthene ND 0.02 uğig Pioranthene	Copper	ND	5.0							
Molybeinum ND 1.0 uğig Selenium ND 1.0 uğig Selenium ND 1.0 uğig Thallum ND 1.0 uğig Thallum ND 1.0 uğig Vanadium ND 1.0 uğig Zinc ND 20.0 uğig Zinc ND 0.02 uğig Acanaphthene ND 0.02 uğig Acanaphthylene ND 0.02 uğig Acanaphthylene ND 0.02 uğig Benzo [a] pyrene ND 0.02 uğig Benzo [a] hyrene ND 0.02 uğig Benzo [A] harthracene ND 0.02 uğig	Lead			ug/g						
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Benzo [a] pyrene ND 0.02 ug/g Benzo [b] fluoranthene ND 0.02 ug/g Benzo [k] fluoranthene ND 0.02 ug/g Benzo [k, l] perylene ND 0.02 ug/g Benzo [k, l] anthracene ND 0.02 ug/g Chrysene ND 0.02 ug/g Fluoranthene ND 0.02 ug/g Fluoranthene ND 0.02 ug/g Indeno [1,2,3-cd] pyrene ND 0.02 ug/g Indeno [1,2,3-cd] pyrene ND 0.02 ug/g 1-Methylnaphthalene ND 0.02 ug/g 2-Methylnaphthalene ND 0.02 ug/g Phenanthrene ND 0.02 ug/g Surrogate: 2-Fluorobiphenyl 1.19 ug/g 106 50-140 Surrogate: 2-Fluorobiphenyl-d14 1.42 ug/g 106 50-140 Surrogate: Terphenyl-d14 1.42 ug/g 106 50-140 Surrogate: Terph										
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00										
Dichlorodifluoromethane ND 0.05 ug/g	Dichlorodifluoromethane	ND	0.05							



Order #: 1944109

Report Date: 01-Nov-2019 Order Date: 28-Oct-2019

Project Description: 191-12948-00

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,2-Dichlorobenzene	ND	0.05	ug/g						
1,3-Dichlorobenzene	ND	0.05	ug/g						
1,4-Dichlorobenzene	ND	0.05	ug/g						
1,1-Dichloroethane	ND	0.05	ug/g						
1,2-Dichloroethane	ND	0.05	ug/g						
1,1-Dichloroethylene	ND	0.05	ug/g						
cis-1,2-Dichloroethylene	ND	0.05	ug/g						
trans-1,2-Dichloroethylene	ND	0.05	ug/g						
1,2-Dichloropropane	ND	0.05	ug/g						
cis-1,3-Dichloropropylene	ND	0.05	ug/g						
trans-1,3-Dichloropropylene	ND	0.05	ug/g						
1,3-Dichloropropene, total	ND	0.05	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Ethylene dibromide (dibromoethane	ND	0.05	ug/g						
Hexane	ND	0.05	ug/g						
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g						
Methyl Isobutyl Ketone	ND	0.50	ug/g						
Methyl tert-butyl ether	ND	0.05	ug/g						
Methylene Chloride	ND	0.05	ug/g						
Styrene	ND	0.05	ug/g						
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g						
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g						
Tetrachloroethylene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
1,1,1-Trichloroethane	ND	0.05	ug/g						
1,1,2-Trichloroethane	ND	0.05	ug/g						
Trichloroethylene	ND	0.05	ug/g						
Trichlorofluoromethane	ND	0.05	ug/g						
Vinyl chloride	ND	0.02	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: 4-Bromofluorobenzene	9.34	0.00	ug/g ug/g		117	50-140			
Surrogate: Dibromofluoromethane	8.56		ug/g ug/g		107	50-140			
0	8.30 8.22				107	50-140 50-140			
Surrogate: Toluene-d8	0.22		ug/g		103	<i>30-140</i>			



Order #: 1944109

Report Date: 01-Nov-2019 Order Date: 28-Oct-2019

Project Description: 191-12948-00

Method Quality Control: Duplicate

Hydrocarbons - - 4 FT PRG (26,510) 137 7 upg dry ND 12,2 30 FT PRG (26,510) 137 6 upg dry 188 11,2 30 FT PRG (26,500) 155 6 upg dry 188 5,0 30 Metals -	Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
F1 PLS VCO VCO VCO VCO VCO F2 PLS VCO 137 4 ugg dry 128 18 ugg dry 128 18 ugg dry 128 18 30 F3 PLS (CO 155 6 ugg dry 148 5.0 30 Hetals	Hydrocarbons									
F2 PHGs (C10-C16) 137 4 uýg dry 120 13.2 30 F3 PHGs (C34-C50) 155 6 uýg dry 148 5.0 30 Ardinony 2.1 1.0 uýg dry ND 0.0 30 Arsenic ND 1.0 uýg dry ND 0.0 30 Barlum 37.1 1.0 uýg dry ND 0.0 30 Barlum 37.1 1.0 uýg dry ND 0.0 30 Cadmium ND 0.5 uýg dry ND 0.0 30 Barlum S7.5 5.0 uýg dry ND 0.0 30 Cadali 2.2 1.0 uýg dry 10.4 17.0 30 Cadali 2.2 1.0 uýg dry ND 0.0 30 Cadali 2.6 1.0 uýg dry ND 0.0 30 Cadali 2.6 1.0 uýg dry ND 0.		ND	7	ua/a drv	ND				40	
F3 PHCs (216:C34) 218 8 ug²g dry 188 14.8 30 H PHCs (234:C50) 155 6 ug²g dry 148 5.0 30 Antimory 2.1 1.0 ug²g dry 1.1 0.0 30 Arsenic ND 1.0 ug²g dry 1.1 0.0 30 Barlum ND 0.5 ug²g dry ND 0.0 30 Beryllium ND 0.5 ug²g dry ND 0.0 30 Chromlum (V) ND 0.5 ug²g dry ND 0.0 30 Chromlum (V) ND 0.5 ug²g dry ND 0.0 30 Copper 5.5 5.0 ug²g dry ND 0.0 30 Cobati 2.8 1.0 ug²g dry ND 0.0 30 Mecury ND 0.1 ug²g dry ND 0.0 30 Modenum ND 1.0 ug²g dry ND 0.0 30 Nokat 5.3 5.0 ug²g dry ND								13.2		
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Carbon Tetrachloride ND 0.05 ug/g dry ND 50	Bromomethane	ND							50	
Unioropenzene ND 0.05 UQ/Q QrV ND 50	Chlorobenzene	ND	0.05	ug/g dry	ND				50	



Order #: 1944109

Report Date: 01-Nov-2019 Order Date: 28-Oct-2019

Project Description: 191-12948-00

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Chloroform	ND	0.05	ug/g dry	ND				50	
Dibromochloromethane	ND	0.05	ug/g dry	ND				50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND				50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Ethylene dibromide (dibromoethane	ND	0.05	ug/g dry	ND				50	
Hexane	ND	0.05	ug/g dry	ND				50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND				50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND				50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND				50	
Methylene Chloride	ND	0.05	ug/g dry	ND				50	
Styrene	ND	0.05	ug/g dry	ND				50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
Tetrachloroethylene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND				50	
Trichloroethylene	ND	0.05	ug/g dry	ND				50	
Trichlorofluoromethane	ND	0.05	ug/g dry	ND				50	
Vinyl chloride	ND	0.02	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: 4-Bromofluorobenzene	8.69		ug∕g dry		99.5	50-140			
Surrogate: Dibromofluoromethane	9.37		ug/g dry		107	50-140			
Surrogate: Toluene-d8	9.52		ug/g dry		109	50-140			



Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	178	7	ug/g		88.9	80-120			
F2 PHCs (C10-C16)	193	4	ug/g	120	84.1	60-140			
F3 PHCs (C16-C34)	387	8	ug/g	188	93.3	60-140			
F4 PHCs (C34-C50)	276	6	ug/g	148	94.6	60-140			
Metals									
Antimony	42.7		ug/L	ND	85.3	70-130			
Arsenic	47.1		ug/L	ND	93.2	70-130			
Barium	70.4		ug/L	19.0	103	70-130			
Beryllium	52.4		ug/L	ND	105	70-130			
Boron	46.0		ug/L	ND	87.6	70-130			
Cadmium	50.0		ug/L	ND	100	70-130			
Chromium (VI)	4.5	0.2	ug/g		90.5	70-130			
Chromium	57.3		ug/L	ND	106	70-130			
Cobalt	50.6		ug/L	1.3	98.5	70-130			
Copper	53.5		ug/L	ND	102	70-130			
Lead	46.2		ug/L	1.5	89.5	70-130			
Mercury	1.22	0.1	ug/g	ND	81.5	70-130			
Molybdenum	48.5		ug/L	ND	96.8	70-130			
Nickel	53.7		ug/L	ND	102	70-130			
Selenium	49.3		ug/L	ND	98.4	70-130			
Silver	46.0		ug/L	ND	92.0	70-130			
Thallium	47.7		ug/L	ND	95.3	70-130			
Uranium	46.0		ug/L	ND	91.9	70-130			
Vanadium	57.5		ug/L	ND	103	70-130			
Zinc	57.6		ug/L	ND	99.4	70-130			
Semi-Volatiles									
Acenaphthene	0.137	0.02	ug/g	ND	63.6	50-140			
Acenaphthylene	0.120	0.02	ug/g	ND	55.8	50-140			
Anthracene	0.139	0.02	ug/g	ND	64.5	50-140			
Benzo [a] anthracene	0.131	0.02	ug/g	ND	61.0	50-140			
Benzo [a] pyrene	0.118	0.02	ug/g		70.6	50-140			
Benzo [b] fluoranthene	0.164	0.02	ug/g	ND	76.1	50-140			
Benzo [g,h,i] perylene	0.114	0.02	ug/g		68.6	50-140			
Benzo [k] fluoranthene	0.138	0.02	ug/g	ND	64.0	50-140			
Chrysene	0.170	0.02	ug/g	ND	79.0	50-140			
Dibenzo [a,h] anthracene	0.116	0.02	ug/g		69.6	50-140			
Fluoranthene	0.154	0.02	ug/g	0.027	58.9	50-140			
Fluorene	0.126	0.02	ug/g	ND	58.7	50-140			
Indeno [1,2,3-cd] pyrene	0.116	0.02	ug/g		69.6	50-140			
1-Methylnaphthalene	0.131	0.02	ug/g	ND	60.7	50-140			
2-Methylnaphthalene	0.141	0.02	ug/g	ND	65.4	50-140			
Naphthalene	0.131	0.01	ug/g	ND	60.8	50-140			
Phenanthrene	0.157	0.02	ug/g	0.025	61.5	50-140			
Pyrene	0.154	0.02	ug/g	0.023	60.7	50-140			
Surrogate: 2-Fluorobiphenyl	0.959		ug/g		55.7	50-140			
Volatiles									
Acetone	8.99	0.50	ug/g		89.9	50-140			
Benzene	3.54	0.02	ug/g		88.6	60-130			
Bromodichloromethane	3.98	0.05	ug/g		99.4	60-130			
Bromoform	3.69	0.05	ug/g		92.3	60-130			

Order #: 1944109

Report Date: 01-Nov-2019

Order Date: 28-Oct-2019



Order #: 1944109

Report Date: 01-Nov-2019 Order Date: 28-Oct-2019

Project Description: 191-12948-00

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Bromomethane	2.53	0.05	ug/g		63.3	50-140			
Carbon Tetrachloride	3.65	0.05	ug/g		91.3	60-130			
Chlorobenzene	3.91	0.05	ug/g		97.8	60-130			
Chloroform	3.96	0.05	ug/g		99.1	60-130			
Dibromochloromethane	3.70	0.05	ug/g		92.5	60-130			
Dichlorodifluoromethane	3.57	0.05	ug/g		89.3	50-140			
1,2-Dichlorobenzene	3.83	0.05	ug/g		95.7	60-130			
1,3-Dichlorobenzene	4.02	0.05	ug/g		100	60-130			
1,4-Dichlorobenzene	3.97	0.05	ug/g		99.2	60-130			
1,1-Dichloroethane	4.04	0.05	ug/g		101	60-130			
1,2-Dichloroethane	3.95	0.05	ug/g		98.7	60-130			
1,1-Dichloroethylene	3.26	0.05	ug/g		81.5	60-130			
cis-1,2-Dichloroethylene	3.68	0.05	ug/g		92.0	60-130			
trans-1,2-Dichloroethylene	3.27	0.05	ug/g		81.8	60-130			
1,2-Dichloropropane	3.79	0.05	ug/g		94.8	60-130			
cis-1,3-Dichloropropylene	3.53	0.05	ug/g		88.1	60-130			
trans-1,3-Dichloropropylene	3.67	0.05	ug/g		91.8	60-130			
Ethylbenzene	4.15	0.05	ug/g		104	60-130			
Ethylene dibromide (dibromoethane	3.43	0.05	ug/g		85.6	60-130			
Hexane	3.85	0.05	ug/g		96.3	60-130			
Methyl Ethyl Ketone (2-Butanone)	9.19	0.50	ug/g		91.9	50-140			
Methyl Isobutyl Ketone	7.32	0.50	ug/g		73.2	50-140			
Methyl tert-butyl ether	6.38	0.05	ug/g		63.8	50-140			
Methylene Chloride	3.14	0.05	ug/g		78.6	60-130			
Styrene	3.83	0.05	ug/g		95.7	60-130			
1,1,1,2-Tetrachloroethane	4.13	0.05	ug/g		103	60-130			
1,1,2,2-Tetrachloroethane	3.34	0.05	ug/g		83.5	60-130			
Tetrachloroethylene	3.39	0.05	ug/g		84.6	60-130			
Toluene	3.72	0.05	ug/g		92.9	60-130			
1,1,1-Trichloroethane	3.53	0.05	ug/g		88.1	60-130			
1,1,2-Trichloroethane	2.96	0.05	ug/g		74.1	60-130			
Trichloroethylene	3.19	0.05	ug/g		79.7	60-130			
Trichlorofluoromethane	3.21	0.05	ug/g		80.4	50-140			
Vinyl chloride	4.40	0.02	ug/g		110	50-140			
m,p-Xylenes	7.79	0.05	ug/g		97.4	60-130			
o-Xylene	4.17	0.05	ug/g		104	60-130			



Qualifier Notes:

None

Sample Data Revisions None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable ND: Not Detected MDL: Method Detection Limit Source Result: Data used as source for matrix and duplicate samples %REC: Percent recovery. RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'. Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.

- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.
- When reported, data for F4G has been processed using a silica gel cleanup.

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APPENDIX D-2 TCLP





RELIABLE.

Certificate of Analysis

WSP Canada Inc. (Ottawa)

2611 Queensview Dr Ottawa, ON K2B 8K2 Attn: Adrian Menyhart

Client PO: Project: 191-12948-00 Custody: 124408

Report Date: 4-Nov-2019 Order Date: 28-Oct-2019

Order #: 1944108

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID **Client ID** TCLP 1944108-01

Approved By:

Mark Fre

Mark Foto, M.Sc. Lab Supervisor

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.



Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Flashpoint	ASTM D93 - Pensky-Martens Closed Cup	29-Oct-19	29-Oct-19
Metals, ICP-MS	TCLP EPA 6020 - Digestion - ICP-MS	30-Oct-19	30-Oct-19
REG 558 - Cyanide	MOE E3015- Auto Colour	30-Oct-19	30-Oct-19
REG 558 - Fluoride	EPA 340.2 - ISE	30-Oct-19	30-Oct-19
REG 558 - Mercury by CVAA	EPA 7470A - Cold Vapour AA	30-Oct-19	30-Oct-19
REG 558 - NO3/NO2	EPA 300.1 - IC	30-Oct-19	30-Oct-19
REG 558 - PAHs	EPA 625 - GC-MS	31-Oct-19	1-Nov-19
REG 558 - VOCs	EPA 624 - P&T GC-MS	31-Oct-19	1-Nov-19
Solids, %	Gravimetric, calculation	29-Oct-19	29-Oct-19

Report Date: 04-Nov-2019 Order Date: 28-Oct-2019

Order #: 1944108



Report Date: 04-Nov-2019

Order Date: 28-Oct-2019

Project Description: 191-12948-00

	Client ID:	TCLP	-	_	
	Sample Date:	28-Oct-19 13:35	-	-	-
	Sample ID:	1944108-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	92.9	-	-	-
Flashpoint	°C	>70	-	-	-
EPA 1311 - TCLP Leachate Inorga					
Fluoride	0.05 mg/L	0.23	-	-	-
Nitrate as N	1 mg/L	<1	-	-	-
Nitrite as N	1 mg/L	<1	-	-	-
Cyanide, free	0.02 mg/L	<0.02	-	-	-
EPA 1311 - TCLP Leachate Metals					
Arsenic	0.05 mg/L	<0.05	-	-	-
Barium	0.05 mg/L	1.13	-	-	-
Boron	0.05 mg/L	<0.05	-	-	-
Cadmium	0.01 mg/L	<0.01	-	-	-
Chromium	0.05 mg/L	<0.05	-	-	-
Lead	0.05 mg/L	<0.05	-	-	-
Mercury	0.005 mg/L	<0.005	-	-	-
Selenium	0.05 mg/L	<0.05	-	-	-
Silver	0.05 mg/L	<0.05	-	-	-
Uranium	0.05 mg/L	<0.05	-	-	-
EPA 1311 - TCLP Leachate Volati			-		
Benzene	0.005 mg/L	<0.005	-	-	-
Carbon Tetrachloride	0.005 mg/L	<0.005	-	-	-
Chlorobenzene	0.004 mg/L	<0.004	-	-	-
Chloroform	0.006 mg/L	<0.006	-	-	-
1,2-Dichlorobenzene	0.004 mg/L	<0.004	-	-	-
1,4-Dichlorobenzene	0.004 mg/L	<0.004	-	-	-
1,2-Dichloroethane	0.005 mg/L	<0.005	-	-	-
1,1-Dichloroethylene	0.006 mg/L	<0.006	-	-	-
Methyl Ethyl Ketone (2-Butanone)	0.30 mg/L	<0.30	-	-	-
Methylene Chloride	0.04 mg/L	<0.04	-	-	-
Tetrachloroethylene	0.005 mg/L	<0.005	-	-	-
Trichloroethylene	0.004 mg/L	<0.004	-	-	-
Vinyl chloride	0.005 mg/L	<0.005	-	-	-
4-Bromofluorobenzene	Surrogate	107%	-	-	-
Dibromofluoromethane	Surrogate	87.4%	-	-	-
Toluene-d8	Surrogate	97.8%	-	-	-

EPA 1311 - TCLP Leachate Organics



Client PO:

Order #: 1944108

Report Date: 04-Nov-2019 Order Date: 28-Oct-2019

Project Description: 191-12948-00

Client ID: TCLP -Sample Date: 28-Oct-19 13:35 --1944108-01 Sample ID: _ Soil **MDL/Units** -_ -0.0001 mg/L Benzo [a] pyrene <0.0001 ---Terphenyl-d14 Surrogate 119% ---



Order #: 1944108

Report Date: 04-Nov-2019 Order Date: 28-Oct-2019

Project Description: 191-12948-00

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
EPA 1311 - TCLP Leachate Inorga	nics								
Fluoride	ND	0.05	mg/L						
Nitrate as N	ND	1	mg/L						
Nitrite as N	ND	1	mg/L						
Cyanide, free	ND	0.02	mg/L						
EPA 1311 - TCLP Leachate Metals	5								
Arsenic	ND	0.05	mg/L						
Barium	ND	0.05	mg/L						
Boron	ND	0.05	mg/L						
Cadmium	ND	0.01	mg/L						
Chromium	ND	0.05	mg/L						
Lead	ND	0.05	mg/L						
Mercury	ND	0.005	mg/L						
Selenium	ND	0.05	mg/L						
Silver	ND	0.05	mg/L						
Uranium	ND	0.05	mg/L						
EPA 1311 - TCLP Leachate Organ									
Benzo [a] pyrene	ND	0.0001	mg/L						
Surrogate: Terphenyl-d14	0.21		mg/L		106	37.1-155.6			
EPA 1311 - TCLP Leachate Volatil	es								
Benzene	ND	0.005	mg/L						
Carbon Tetrachloride	ND	0.005	mg/L						
Chlorobenzene	ND	0.004	mg/L						
Chloroform	ND	0.006	mg/L						
1,2-Dichlorobenzene	ND	0.004	mg/L						
1,4-Dichlorobenzene	ND	0.004	mg/L						
1,2-Dichloroethane	ND	0.005	mg/L						
1,1-Dichloroethylene	ND	0.006	mg/L						
Methyl Ethyl Ketone (2-Butanone)	ND	0.30	mg/L						
Methylene Chloride	ND	0.04	mg/L						
Tetrachloroethylene	ND	0.005	mg/L						
Trichloroethylene	ND	0.004	mg/L						
Vinyl chloride	ND	0.005	mg/L		105	00 104			
Surrogate: 4-Bromofluorobenzene	0.719		mg/L		105	83-134			
Surrogate: Dibromofluoromethane	0.671		mg/L		97.5	78-124			
Surrogate: Toluene-d8	0.685		mg/L		99.6	76-118			



Order #: 1944108

Report Date: 04-Nov-2019 Order Date: 28-Oct-2019

Project Description: 191-12948-00

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
EPA 1311 - TCLP Leachate	e Inorganics								
Fluoride	0.11	0.05	mg/L	0.11			7.8	20	
Nitrate as N	ND	1	mg/L	ND				20	
Nitrite as N	ND	1	mg/L	ND				20	
Cyanide, free	ND	0.02	mg/L	ND				20	
EPA 1311 - TCLP Leachate	e Metals								
Arsenic	ND	0.05	mg/L	ND			0.0	29	
Barium	0.381	0.05	mg/L	0.373			2.1	34	
Boron	0.050	0.05	mg/L	ND			0.0	33	
Cadmium	ND	0.01	mg/L	ND			0.0	33	
Chromium	ND	0.05	mg/L	ND			0.0	32	
Lead	ND	0.05	mg/L	ND			0.0	32	
Mercury	ND	0.005	mg/L	ND			0.0	30	
Selenium	ND	0.05	mg/L	ND			0.0	28	
Silver	ND	0.05	mg/L	ND			0.0	28	
Uranium	ND	0.05	mg/L	ND			0.0	27	
Physical Characteristics			5						
% Solids	80.6	0.1	% by Wt.	80.4			0.2	25	



Method Quality Control: Spike

Report Date: 04-Nov-2019

Order Date: 28-Oct-2019

EPA 1311 - TCLP Leachate Inorganics Fluoride 0.69 0.05 mg/L 0.11 114 70-130 Nitrate as N 11 1 mg/L ND 107 81-112 Nitrite as N 9 1 mg/L ND 90.4 76-107 Cyanide, free 0.054 0.02 mg/L ND 109 60-136 EPA 1311 - TCLP Leachate Metals Arsenic 49.3 ug/L 37.3 100 83-116 Boron 45.8 ug/L 0.185 98.6 78-119 Chromium 49.5 ug/L 0.306 114 80-124 Lead 42.2 ug/L 0.306 114 80-124 Lead 42.2 ug/L 0.306 114 80-124 Lead 42.2 ug/L 0.196 83.2 81-125 Silver 42.6 ug/L 0.196 83.2 81-125 Uranium 46.6 ug/L 0.751 91.7 70-131 EPA 1311 - TCLP Leachate Organics mg/L <th>Analyte</th> <th>Result</th> <th>Reporting Limit</th> <th>Units</th> <th>Source Result</th> <th>%REC</th> <th>%REC Limit</th> <th>RPD</th> <th>RPD Limit</th> <th>Notes</th>	Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Fluoride 0.69 0.05 mg/L 0.11 11 70-130 Nitrate as N 11 1 mg/L ND 107 81-112 Nitrate as N 9 1 mg/L ND 109 81-112 Cyanide, free 0.054 0.02 mg/L ND 109 60-136 EPA 1311 - TCLP Leachate Metals stanic ug/L 0.211 98.2 83-119 Barium 87.3 ug/L 0.211 98.2 83-119 Boron 45.8 ug/L 0.181 88.6 78-119 Chromium 57.3 ug/L 0.306 114 80-124 Lead 42.2 ug/L 0.306 114 80-124 Lead 42.2 ug/L 0.104 85.0 70-128 Silver 42.6 ug/L 0.19 70-128 Uranium 46.6 ug/L 0.104 85.0 70-128 Surrogate: TerphenyLof14 0.22 mg/L 110 85-141 Cachon Tetrachloride 27.9 ug/L	EPA 1311 - TCLP Leachate I	norganics								
Nitrite as N 9 1 mg/L ND 90.4 76-107 Cyanide, free 0.054 0.02 mg/L ND 109 60-136 EPA 1311 - TCLP Leachate Metals			0.05	mg/L	0.11	114	70-130			
Cyanide, free 0.054 0.02 mg/L ND 109 60-136 EPA 1311 - TCLP Leachate Metals 83-119 Barium 87.3 ug/L 0.211 98.2 83-119 Barium 87.3 ug/L 4.83 82.0 71-128 Cadmium 49.5 ug/L 0.185 98.6 78-119 Chromium 57.3 ug/L 0.306 114 80-124 Lead 42.2 ug/L 0.306 82.7 77-126 Mercury 0.0327 0.005 mg/L ND 109 70-130 Selenium 41.8 ug/L 0.196 83.2 81-125 51 Bilver 42.6 ug/L 0.146 85.0 70-128 71-131 Uranium 46.6 ug/L 0.148 83.2 81-125 6 Benzoleal pyrene 0.246 0.0001 mg/L 93.2 39-123 Surrogate: Terphen	Nitrate as N	11	1	mg/L	ND	107	81-112			
V V Arsenic 49.3 ug/L 0.211 98.2 83-119 Barium 87.3 ug/L 37.3 100 83-116 Boron 45.8 ug/L 4.83 82.0 71-128 Cadmium 49.5 ug/L 0.306 714 80-124 Lead 42.2 ug/L 0.306 82.7 77-126 Mercury 0.0327 0.005 mg/L ND 109 70-130 Selenium 41.8 ug/L 0.196 83.2 81-125 Silver 42.6 ug/L 0.104 85.0 70-130 Selenium 41.8 ug/L 0.104 85.0 70-131 EPA 1311 - TCLP Leachate Organics Banzo [a] pyrene 0.0466 0.0001 mg/L 93.2 39-123 Surrogate: Terphenyl-d14 0.22 mg/L 109 37.1-155.6 EPA 1311 - TCLP Leachate Volatiles Banzon Tetrachloride 27.9 ug/L 69.8 44-137	Nitrite as N	9	1	mg/L	ND	90.4	76-107			
Arsenic 49.3 ug/L 0.211 98.2 83-119 Barium 87.3 ug/L 37.3 100 83-116 Boron 45.8 ug/L 37.3 100 83-116 Cadmium 49.5 ug/L 0.185 98.6 78-119 Chromium 57.3 ug/L 0.306 114 80-124 Lead 42.2 ug/L 0.896 82.7 77-126 Mercury 0.0327 0.005 mg/L ND 109 70-130 Selenium 41.8 ug/L 0.196 83.2 81-125 Silver 42.6 ug/L 0.104 85.0 70-130 Uranium 46.6 ug/L 0.71 91.7 70-131 EPA 1311 - TCLP Leachate Organics Benzo [a] pyrene 0.0466 0.0001 mg/L 93.2 39-123 Surrogate: Terphenyl-d14 0.22 mg/L 109 37.1-155.6 EPA 1311 - TCLP Leachate Volatiles Benzene 44.8 ug/L 69.8 49-149 </td <td>Cyanide, free</td> <td>0.054</td> <td>0.02</td> <td>mg/L</td> <td>ND</td> <td>109</td> <td>60-136</td> <td></td> <td></td> <td></td>	Cyanide, free	0.054	0.02	mg/L	ND	109	60-136			
Barium 87.3 ug/L 37.3 100 83-116 Boron 45.8 ug/L 4.83 82.0 71-128 Cadmium 49.5 ug/L 0.185 98.6 78-119 Chromium 57.3 ug/L 0.306 114 80-124 Lead 42.2 ug/L 0.896 82.7 77-126 Mercury 0.0327 0.005 mg/L ND 109 70-130 Selenium 41.8 ug/L 0.196 83.2 81-125 Silver 42.6 ug/L 0.104 85.0 70-131 EPA 1311 - TCLP Leachate Organics stanta 109 37.1-155.6 Benzene 0.0466 0.0001 mg/L 93.2 39-123 Surrogate: Terphenyl-d14 0.22 mg/L 109 37.1-155.6 EPA 1311 - TCLP Leachate Volatiles stanta 112 55-141 Carbon Tetrachloride 27.9 ug/L 69.8 49-137 Chlorobenzene 35.9 ug/L 89.8 64-137 Chlorobenzene	EPA 1311 - TCLP Leachate I	Metals								
Boron 45.8 ug/L 4.83 82.0 71-128 Cadmium 49.5 ug/L 0.185 98.6 78-119 Chromium 57.3 ug/L 0.306 114 80-124 Lead 42.2 ug/L 0.306 82.7 77-126 Mercury 0.0327 0.005 mg/L ND 109 70-130 Selenium 41.8 ug/L 0.196 83.2 81-125 Silver 42.6 ug/L 0.751 91.7 70-131 EPA 1311 - TCLP Leachate Organics gas.2 39-123 39-123 Surrogate: Terphenyl-d14 0.22 mg/L 109 37.155.6 EPA 1311 - TCLP Leachate Volatiles gas.2 39-123 39-123 Surrogate: Terphenyl-d14 0.22 mg/L 129 55-141 Carbon Tetrachloride 27.9 ug/L 69.8 49-149 Chlorobenzene 35.9 ug/L 83.1 58-138 1,2-Dichlorobenzene	Arsenic	49.3		ug/L	0.211	98.2	83-119			
Cadmium 49.5 ug/L 0.185 98.6 78-119 Chromium 57.3 ug/L 0.306 114 80-124 Lead 42.2 ug/L 0.896 82.7 77-126 Mercury 0.0327 0.005 mg/L 0.196 83.2 81-125 Silver 42.6 ug/L 0.104 85.0 70-130 Uranium 46.6 ug/L 0.751 91.7 70-131 EPA 1311 - TCLP Leachate Organics strogate: rerphenyl-d14 0.22 mg/L 93.2 39-123 Surrogate: Terphenyl-d14 0.22 mg/L 109 37.1-155.6 EPA 1311 - TCLP Leachate Volatiles strogate: 112 55-141 Carbon Tetrachloride 27.9 ug/L 69.8 49-149 Chlorobenzene 35.9 ug/L 89.8 64-137 Chlorobenzene 35.9 ug/L 89.8 61-137 Chlorobenzene 40.4 ug/L 97.8 63-1	Barium	87.3		ug/L	37.3	100	83-116			
Chromium 57.3 ug/L 0.306 114 80-124 Lead 42.2 ug/L 0.896 82.7 77-126 Mercury 0.0327 0.005 mg/L ND 109 70-130 Selenium 41.8 ug/L 0.104 85.0 70-128 Silver 42.6 ug/L 0.751 91.7 70-131 EPA 1311 - TCLP Leachate Organics Benzo [a] pyrene 0.0466 0.0001 mg/L 93.2 39-123 Surogate: Terphenyl-d14 0.22 mg/L 109 37.1-155.6 EPA 1311 - TCLP Leachate Volatiles Benze [a] pyrene 0.0466 0.0001 mg/L 93.2 39-123 Surogate: Terphenyl-d14 0.22 mg/L 109 37.1-155.6 EPA 1311 - TCLP Leachate Volatiles Benzene 44.8 ug/L 112 55-141 Carbon Tetrachloride 27.9 ug/L 69.8 49-149 Chlorobenzene 35.9 ug/L 89.8 64-137 C	Boron	45.8		ug/L	4.83	82.0	71-128			
Lead 42.2 ug/L 0.896 82.7 77-126 Mercury 0.0327 0.005 mg/L ND 109 70-130 Selenium 41.8 ug/L 0.196 83.2 81-125 Silver 42.6 ug/L 0.104 85.0 70-130 Uranium 46.6 ug/L 0.751 91.7 70-131 EPA 1311 - TCLP Leachate Organics surogate: 789.2 39-123 Surogate: Terphenyl-d14 0.22 mg/L 109 37.1-155.6 EPA 1311 - TCLP Leachate Volatiles surogate: 112 55-141 55-141 Garbon Tetrachloride 27.9 ug/L 69.8 49-149 Chlorobenzene 39.1 ug/L 89.8 64-137 Chlorobenzene 39.1 ug/L 81.1 58-138 1,2-Dichlorobenzene 40.4 ug/L 66.9 50-140 1,4-Dichlorobenzene 39.1 ug/L 63.132 12.2 1,2-Dichlorobenzene<	Cadmium	49.5		ug/L	0.185	98.6	78-119			
Mercury 0.0327 0.005 mg/L ND 109 70-130 Selenium 41.8 ug/L 0.196 83.2 81-125 Silver 42.6 ug/L 0.104 85.0 70-128 Uranium 46.6 ug/L 0.751 91.7 70-131 EPA 1311 - TCLP Leachate Organics Benzo [a] pyrene 0.0466 0.0001 mg/L 93.2 39-123 Surrogate: Terphenyl-d14 0.22 mg/L 109 37.1-155.6 EPA 1311 - TCLP Leachate Volatiles mg/L 102 55-141 Garbon Tetrachloride 27.9 ug/L 69.8 49-149 Chlorobenzene 35.9 ug/L 83.1 58-138 1,2-Dichlorobenzene 39.1 ug/L 83.1 58-138 1,2-Dichlorobenzene 39.1 ug/L 63 1322 1,2-Dichlorobenzene 38.4 ug/L 66.9 50-140 1,1-Dichloroethylene 38.3 ug/L 85.3 58-149 <td>Chromium</td> <td>57.3</td> <td></td> <td>ug/L</td> <td>0.306</td> <td>114</td> <td>80-124</td> <td></td> <td></td> <td></td>	Chromium	57.3		ug/L	0.306	114	80-124			
Selenium 41.8 ug/L 0.196 83.2 81-125 Silver 42.6 ug/L 0.104 85.0 70-128 Uranium 46.6 ug/L 0.751 91.7 70-131 EPA 1311 - TCLP Leachate Organics Benzo [a] pyrene 0.0466 0.0001 mg/L 93.2 39-123 Surrogate: Terphenyl-d14 0.22 mg/L 109 37.1-155.6 EPA 1311 - TCLP Leachate Volatiles Benzene 44.8 ug/L 112 55-141 Carbon Tetrachloride 27.9 ug/L 69.8 49-149 Chlorobenzene 35.9 ug/L 89.8 64-137 Chlorobenzene 30.1 58-138 1 58-138 1,2-Dichlorobenzene 39.1 ug/L 97.8 63-132 1,2-Dichlorobenzene 39.1 ug/L 95.9 43-153 1,2-Dichlorobenzene 39.1 ug/L 95.9 43-153 Methyl Ethyl Ketone (2-Butanone) 75.0 ug/L 95.9	Lead	42.2		ug/L	0.896	82.7	77-126			
Silver 42.6 ug/L 0.104 85.0 70-128 Uranium 46.6 ug/L 0.751 91.7 70-131 EPA 1311 - TCLP Leachate Organics ug/L 93.2 39-123 Benzo [a] pyrene 0.0466 0.0001 mg/L 93.2 39-123 Surrogate: Terphenyl-d14 0.22 mg/L 109 37.1-155.6 EPA 1311 - TCLP Leachate Volatiles Benzene 44.8 ug/L 112 55-141 Carbon Tetrachloride 27.9 ug/L 69.8 49-149 Chlorobenzene 35.9 ug/L 89.8 64-137 Chlorobenzene 39.1 ug/L 101 60-150 1,2-Dichlorobenzene 39.1 ug/L 97.8 63-132 1,2-Dichlorobenzene 39.1 ug/L 95.9 43-153 Methyl Ethyl Ketone (2-Butanone) 75.0 ug/L 95.9 43-153 Methylene Chloride 33.3 ug/L 83.3 58-149 Tetrachloroethylene 38.4 ug/L 95.9 43-153 Methyl Ethyl Ketone	Mercury	0.0327	0.005	mg/L	ND	109	70-130			
Uranium46.6ug/L0.75191.770-131EPA 1311 - TCLP Leachate Organicsng/L93.239-123Benzo [a] pyrene0.04660.0001mg/L93.239-123Surrogate: Terphenyl-d140.22mg/L10937.1-155.6EPA 1311 - TCLP Leachate Volatilesug/L11255-141Benzene44.8ug/L11255-141Carbon Tetrachloride27.9ug/L69.849-149Chlorobenzene35.9ug/L89.864-137Chlorobenzene39.1ug/L97.863-1321,2-Dichlorobenzene39.1ug/L97.863-1321,2-Dichlorobenzene39.1ug/L55.943-1531,2-Dichlorobenzene38.4ug/L95.943-153Methyl Ethyl Ketone (2-Butanone)75.0ug/L75.026-153Methylee Chloride33.3ug/L83.358-149Tetrachloroethylene46.9ug/L11752-135	Selenium	41.8		ug/L	0.196	83.2	81-125			
Benzo [a] pyrene 0.0466 0.0001 mg/L 93.2 39-123 Surrogate: Terphenyl-d14 0.22 mg/L 109 37.1-155.6 EPA 1311 - TCLP Leachate Volatiles Benzene 44.8 ug/L 112 55-141 Carbon Tetrachloride 27.9 ug/L 69.8 49-149 Chlorobenzene 35.9 ug/L 83.1 58-138 1,2-Dichlorobenzene 30.1 ug/L 101 60-150 1,4-Dichlorobenzene 39.1 ug/L 97.8 63-132 1,2-Dichlorobenzene 38.4 ug/L 95.9 43-153 1,2-Dichlorobenzene 38.4 ug/L 95.9 43-153 1,2-Dichlorobethylene 38.4 ug/L 95.9 43-153 Methyl Ethyl Ketone (2-Butanone) 75.0 ug/L 75.0 26-153 Methylene Chloride 33.3 ug/L 83.3 58-149 Tetrachloroethylene 37.5 ug/L 93.8 51-145 Trichloroethylene 46.9 ug/L 117 52-135 </td <td>Silver</td> <td></td> <td></td> <td>ug/L</td> <td>0.104</td> <td>85.0</td> <td>70-128</td> <td></td> <td></td> <td></td>	Silver			ug/L	0.104	85.0	70-128			
Benzo [a] pyrene0.04660.0001mg/L93.239-123Surrogate: Terphenyl-d140.22mg/L10937.1-155.6EPA 1311 - TCLP Leachate VolatilesBenzene44.8ug/L11255-141Carbon Tetrachloride27.9ug/L69.849-149Chlorobenzene35.9ug/L89.864-137Chloroform33.2ug/L83.158-1381,2-Dichlorobenzene40.4ug/L10160-1501,4-Dichlorobenzene39.1ug/L97.863-1321,2-Dichlorobenzene38.4ug/L95.943-153Methyl Ethyl Ketone (2-Butanone)75.0ug/L75.026-153Methylene Chloride33.3ug/L83.358-149Tetrachloroethylene37.5ug/L93.851-145Trichloroethylene46.9ug/L11752-135	Uranium	46.6		ug/L	0.751	91.7	70-131			
Surrogate: Terphenyl-d14 0.22 mg/L 109 37.1-155.6 EPA 1311 - TCLP Leachate Volatiles Benzene 44.8 ug/L 112 55-141 Carbon Tetrachloride 27.9 ug/L 69.8 49-149 Chlorobenzene 35.9 ug/L 89.8 64-137 Chloroform 33.2 ug/L 83.1 58-138 1,2-Dichlorobenzene 39.1 ug/L 101 60-150 1,4-Dichlorobenzene 39.1 ug/L 66.9 50-140 1,2-Dichlorobenzene 38.4 ug/L 95.9 43-153 1,2-Dichloroethane 26.8 ug/L 95.9 43-153 1,1-Dichloroethylene 38.4 ug/L 95.9 43-153 Methyl Ethyl Ketone (2-Butanone) 75.0 ug/L 75.0 26-153 Methylene Chloride 33.3 ug/L 83.3 58-149 Tetrachloroethylene 37.5 ug/L 93.8 51-145 Trichloroethylene 46.9 ug/L 117 52-135	EPA 1311 - TCLP Leachate	Organics								
EPA 1311 - TCLP Leachate Volatiles Benzene 44.8 ug/L 112 55-141 Carbon Tetrachloride 27.9 ug/L 69.8 49-149 Chlorobenzene 35.9 ug/L 89.8 64-137 Chloroform 33.2 ug/L 83.1 58-138 1,2-Dichlorobenzene 40.4 ug/L 101 60-150 1,4-Dichlorobenzene 39.1 ug/L 97.8 63-132 1,2-Dichloroethane 26.8 ug/L 66.9 50-140 1,1-Dichloroethylene 38.4 ug/L 95.9 43-153 Methyl Ethyl Ketone (2-Butanone) 75.0 ug/L 75.0 26-153 Methylene Chloride 33.3 ug/L 83.3 58-149 Tetrachloroethylene 37.5 ug/L 93.8 51-145 Trichloroethylene 46.9 ug/L 117 52-135			0.0001	mg/L		93.2	39-123			
Benzene44.8ug/L11255-141Carbon Tetrachloride27.9ug/L69.849-149Chlorobenzene35.9ug/L89.864-137Chloroform33.2ug/L83.158-1381,2-Dichlorobenzene40.4ug/L10160-1501,4-Dichlorobenzene39.1ug/L97.863-1321,2-Dichloroethane26.8ug/L66.950-1401,1-Dichloroethylene38.4ug/L95.943-153Methyl Ethyl Ketone (2-Butanone)75.0ug/L75.026-153Methylene Chloride33.3ug/L83.358-149Tetrachloroethylene37.5ug/L93.851-145Trichloroethylene46.9ug/L11752-135	Surrogate: Terphenyl-d14	0.22		mg/L		109	37.1-155.6			
Carbon Tetrachloride27.9ug/L69.849-149Chlorobenzene35.9ug/L89.864-137Chloroform33.2ug/L83.158-1381,2-Dichlorobenzene40.4ug/L10160-1501,4-Dichlorobenzene39.1ug/L97.863-1321,2-Dichloroethane26.8ug/L66.950-1401,1-Dichloroethylene38.4ug/L95.943-153Methyl Ethyl Ketone (2-Butanone)75.0ug/L75.026-153Methylene Chloride33.3ug/L83.358-149Tetrachloroethylene37.5ug/L93.851-145Trichloroethylene46.9ug/L11752-135	EPA 1311 - TCLP Leachate	Volatiles								
Chlorobenzene35.9ug/L89.864-137Chloroform33.2ug/L83.158-1381,2-Dichlorobenzene40.4ug/L10160-1501,4-Dichlorobenzene39.1ug/L97.863-1321,2-Dichloroethane26.8ug/L66.950-1401,1-Dichloroethylene38.4ug/L95.943-153Methyl Ethyl Ketone (2-Butanone)75.0ug/L75.026-153Methylene Chloride33.3ug/L83.358-149Tetrachloroethylene37.5ug/L93.851-145Trichloroethylene46.9ug/L11752-135	Benzene	44.8		ug/L		112	55-141			
Chloroform33.2ug/L83.158-1381,2-Dichlorobenzene40.4ug/L10160-1501,4-Dichlorobenzene39.1ug/L97.863-1321,2-Dichloroethane26.8ug/L66.950-1401,1-Dichloroethylene38.4ug/L95.943-153Methyl Ethyl Ketone (2-Butanone)75.0ug/L75.026-153Methylene Chloride33.3ug/L83.358-149Tetrachloroethylene37.5ug/L93.851-145Trichloroethylene46.9ug/L11752-135	Carbon Tetrachloride	27.9		ug/L		69.8	49-149			
1,2-Dichlorobenzene40.4ug/L10160-1501,4-Dichlorobenzene39.1ug/L97.863-1321,2-Dichloroethane26.8ug/L66.950-1401,1-Dichloroethylene38.4ug/L95.943-153Methyl Ethyl Ketone (2-Butanone)75.0ug/L75.026-153Methylene Chloride33.3ug/L83.358-149Tetrachloroethylene37.5ug/L93.851-145Trichloroethylene46.9ug/L11752-135	Chlorobenzene	35.9		ug/L		89.8	64-137			
1,4-Dichlorobenzene39.1ug/L97.863-1321,2-Dichloroethane26.8ug/L66.950-1401,1-Dichloroethylene38.4ug/L95.943-153Methyl Ethyl Ketone (2-Butanone)75.0ug/L75.026-153Methylene Chloride33.3ug/L83.358-149Tetrachloroethylene37.5ug/L93.851-145Trichloroethylene46.9ug/L11752-135	Chloroform	33.2		ug/L		83.1	58-138			
1,2-Dichloroethane26.8ug/L66.950-1401,1-Dichloroethylene38.4ug/L95.943-153Methyl Ethyl Ketone (2-Butanone)75.0ug/L75.026-153Methylene Chloride33.3ug/L83.358-149Tetrachloroethylene37.5ug/L93.851-145Trichloroethylene46.9ug/L11752-135	1,2-Dichlorobenzene	40.4		ug/L		101	60-150			
1,1-Dichloroethylene38.4ug/L95.943-153Methyl Ethyl Ketone (2-Butanone)75.0ug/L75.026-153Methylene Chloride33.3ug/L83.358-149Tetrachloroethylene37.5ug/L93.851-145Trichloroethylene46.9ug/L11752-135	1,4-Dichlorobenzene	39.1		ug/L		97.8	63-132			
Methyl Ethyl Ketone (2-Butanone)75.0ug/L75.026-153Methylene Chloride33.3ug/L83.358-149Tetrachloroethylene37.5ug/L93.851-145Trichloroethylene46.9ug/L11752-135	1,2-Dichloroethane	26.8		ug/L		66.9	50-140			
Methylene Chloride 33.3 ug/L 83.3 58-149 Tetrachloroethylene 37.5 ug/L 93.8 51-145 Trichloroethylene 46.9 ug/L 117 52-135	1,1-Dichloroethylene	38.4		ug/L		95.9	43-153			
Tetrachloroethylene 37.5 ug/L 93.8 51-145 Trichloroethylene 46.9 ug/L 117 52-135	, , ,			ug/L						
Trichloroethylene 46.9 ug/L 117 52-135	Methylene Chloride			ug/L		83.3	58-149			
	Tetrachloroethylene			ug/L		93.8				
Vinyl chloride 37.5 ug/L 93.7 31-159	Trichloroethylene			ug/L		117	52-135			
	Vinyl chloride	37.5		ug/L		93.7	31-159			



Login Qualifiers :

Sample - F1/BTEX/VOCs (soil) not submitted according to Reg. 153/04, Amended 2011 - not field preserved Applies to samples: TCLP

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable ND: Not Detected MDL: Method Detection Limit Source Result: Data used as source for matrix and duplicate samples %REC: Percent recovery. RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'. Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

Report Date: 04-Nov-2019 Order Date: 28-Oct-2019 Project Description: 191-12948-00

PARA LABORATORIE		racel ID:					aurent Bivd. o K1G 4J8 947 racellabs.com bs.com	Рага 194 1940		rder Jse C J8	an a	ber CLP UK		•	ain Of (Lab U 12	se Onh 244(n)8	
ent Name: 1.15 Canada T				Project	Ref:	91-120	148-00	No. A second	1910					_	-	<u> </u> of	2000	
ent Name: WSP Canada I. ntact Name: Alisan Meryl	and the second se			Quote #	t.	1:								Т	urnaro	und T		22.97
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lephone: 343-961-142	1				_				-	=	-	_	*					
Regulation 153/04	Other Regula		M	atrix T	ype: S	(Soil/Sed.) G	W (Ground Water)						Re	quired Ar	nalysis			
] Table 1 🔲 Res/Park 🗍 Med/Fine	PT] pwqo	S	W (Sur	face W P (P	aint) A (Air) (m/Sanitary Sewer) O (Other)	-	Г	Π	Π	Т	Т	TT	T		T	Τ
] Table 2 □ Ind/Comm ⊠ Coarse Table 3 □ Agri/Other] Table	E cent] MISA] SU - Storm		me	Containers	Sa	mple Taken	PHCs F1-F4+BTEX			Metals by ICP		5	cp 2				
For RSC: Ves INO	O Other:		Matrix	Air Volume	of Cor		_	HCs F	VOCS	PAHs	letals	Hg	R (HW	Tece				
Sample ID/Locatio	on Name		1.0	Air	# of	Date	Time		>	d I	2	T			. 9	tothe	1(+1v	ia -
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Chain of Custody (Env.) xlsx

APPENDIX D-3 GROUNDWATER





351 Nash Road North, unit 9B Hamilton, ON L8H 7P4 1-800-749-1947 www.paracellabs.com

Certificate of Analysis

WSP Canada Inc. (Ottawa)

2611 Queensview Dr Ottawa, ON K2B 8K2 Attn: Adrian Menyhart

Client PO: Project: 191-12948-00 Custody: 124027

Report Date: 12-Nov-2019 Order Date: 5-Nov-2019

Order #: 1945295

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

 Paracel ID
 Client ID
 Paracel ID
 Client ID

 1945295-01
 BH19-6
 <td

Approved By:

Dale Robertson, BSc Laboratory Director



Analysis Summary Table

Report Date: 12-Nov-2019 Order Date: 5-Nov-2019 Project Description: 191-12948-00

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	8-Nov-19	8-Nov-19
Chromium, hexavalent - water	MOE E3056 - colourimetric	7 -N ov-19	7 -N ov-19
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	6-Nov-19	7 -N ov-19
Metals, ICP-MS	EPA 200.8 - ICP-MS	6-Nov-19	6-Nov-19
PHC F1	CWS Tier 1 - P&T GC-FID	7 -N ov-19	8-Nov-19
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	12 -N ov-19	10-Nov-19
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	6-Nov-19	8-Nov-19
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	7 -N ov-19	8-Nov-19



Report Date: 12-Nov-2019 Order Date: 5-Nov-2019 Project Description: 191-12948-00

Summary of Exceedances

(If this page is blank then there are no exceedances)

Only those criteria that a sample exceeds will be highlighted in red

Regulatory Comparison:

Paracel Laboratories has provided regulatory guidelines on this report for informational purposes only and makes no representations or warranties that the data is accurate or reflects the current regulatory values. The user is advised to consult with the appropriate official regulations to evaluate compliance. Sample results that are highlighted have exceeded the selected regulatory limit. Calculated uncertainty estimations have not been applied for determining regulatory exceedances. Regulatory limits displayed in brackets, (), applies to medium and fine textured soils.

Criteria:

Client ID	Analyte	MDL / Units	Result	Reg 153/04 (2011)-Table 3 Non-Potable Groundwater
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PARACEL

Certificate of Analysis Client: WSP Canada Inc. (Ottawa)

Client PO:

Report Date: 12-Nov-2019 Order Date: 5-Nov-2019

Project Description: 191-12948-00

	Client ID:	BH19-6	BH19-4	BH19-10	DUP	Criteria:	
	Sample Date:	04-Nov-2019	04-Nov-2019	04-Nov-2019	04-Nov-2019		
	Sample ID:	1945295-01	1945295-02	1945295-03	1945295-04	Reg 153/04 (2011)-Table	3 Non-Potable
	Matrix:	Water	Water	Water	Water	Groundwater	
	MDL/Units						
Metals	- <u> </u>		i	i	ii		
Mercury	0.1 ug/L	<0.1	<0.1	-	<0.1	0.29	ug/L
Antimony	0.5 ug/L	<0.5	<0.5	-	<0.5	20,000	ug/L
Arsenic	1 ug/L	<1	<1	-	<1	1,900	ug/L
Barium	1 ug/L	236	181	-	184	29,000	ug/L
Beryllium	0.5 ug/L	<0.5	<0.5	-	<0.5	67	ug/L
Boron	10 ug/L	55	72	-	71	45,000	ug/L
Cadmium	0.1 ug/L	<0.1	<0.1	-	<0.1	2.7	ug/L
Chromium	1 ug/L	<1	<1	-	<1	810	ug/L
Chromium (VI)	10 ug/L	<10	<10	-	<10	140	ug/L
Cobalt	0.5 ug/L	0.9	<0.5	-	<0.5	66	ug/L
Copper	0.5 ug/L	0.5	<0.5	-	<0.5	87	ug/L
Lead	0.1 ug/L	<0.1	<0.1	-	<0.1	25	ug/L
Molybdenum	0.5 ug/L	3.3	0.7	-	0.5	9,200	ug/L
Nickel	1 ug/L	2	<1	-	<1	490	ug/L
Selenium	1 ug/L	<1	<1	-	<1	63	ug/L
Silver	0.1 ug/L	<0.1	<0.1	-	<0.1	1.5	ug/L
Sodium	200 ug/L	651000	402000	-	397000	2,300,000	ug/L
Thallium	0.1 ug/L	<0.1	<0.1	-	<0.1	510	ug/L
Uranium	0.1 ug/L	0.3	0.2	-	0.1	420	ug/L
Vanadium	0.5 ug/L	<0.5	<0.5	-	<0.5	250	ug/L
Zinc	5 ug/L	<5	6	-	<5	1,100	ug/L
Volatiles							
Acetone	5.0 ug/L	<5.0	-	<5.0	-	130,000	ug/L

OTTAWA . HAMILTON . CALGARY . MISSISSAUGA . KINGSTON . LONDON . NIAGARA . WINDSOR

Certificate of Analysis Client: WSP Canada Inc. (Ottawa) Client PO:

Report Date: 12-Nov-2019 Order Date: 5-Nov-2019 Project Description: 191-12948-00

	Client ID: Sample Date:	BH19-6 04-Nov-2019	BH19-4 04-Nov-2019	BH19-10 04-Nov-2019	DUP 04-Nov-2019	Criteria:
	Sample ID:	1945295-01	1945295-02	1945295-03	1945295-04	Reg 153/04 (2011)-Table 3 Non-Potable
	Matrix:	Water	Water	Water	Water	Groundwater
	MDL/Units					
Benzene	0.5 ug/L	<0.5	-	<0.5	-	44 ug/L
Bromodichloromethane	0.5 ug/L	<0.5	-	<0.5	-	85,000 ug/L
Bromoform	0.5 ug/L	<0.5	-	<0.5	-	380 ug/L
Bromomethane	0.5 ug/L	<0.5	-	<0.5	-	5.6 ug/L
Carbon Tetrachloride	0.2 ug/L	<0.2	-	<0.2	-	0.79 ug/L
Chlorobenzene	0.5 ug/L	<0.5	-	<0.5	-	630 ug/L
Chloroform	0.5 ug/L	<0.5	-	<0.5	-	2.4 ug/L
Dibromochloromethane	0.5 ug/L	<0.5	-	<0.5	-	82,000 ug/L
Dichlorodifluoromethane	1.0 ug/L	<1.0	-	<1.0	-	4,400 ug/L
1,2-Dichlorobenzene	0.5 ug/L	<0.5	-	<0.5	-	4,600 ug/L
1,3-Dichlorobenzene	0.5 ug/L	<0.5	-	<0.5	-	9,600 ug/L
1,4-Dichlorobenzene	0.5 ug/L	<0.5	-	<0.5	-	8 ug/L
1,1-Dichloroethane	0.5 ug/L	<0.5	-	<0.5	-	320 ug/L
1,2-Dichloroethane	0.5 ug/L	<0.5	-	<0.5	-	1.6 ug/L
1,1-Dichloroethylene	0.5 ug/L	<0.5	-	<0.5	-	1.6 ug/L
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	<0.5	-	1.6 ug/L
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	<0.5	-	1.6 ug/L
1,2-Dichloropropane	0.5 ug/L	<0.5	-	<0.5	-	16 ug/L
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	<0.5	-	
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	<0.5	-	
1,3-Dichloropropene, total	0.5 ug/L	<0.5	-	<0.5	-	5.2 ug/L
Ethylbenzene	0.5 ug/L	<0.5	-	<0.5	-	2,300 ug/L
Ethylene dibromide (dibromoeth	0.2 ug/L	<0.2	-	<0.2	-	0.25 ug/L

Certificate of Analysis Client: WSP Canada Inc. (Ottawa) Client PO:

Report Date: 12-Nov-2019 Order Date: 5-Nov-2019 Project Description: 191-12948-00

	Client ID:	BH19-6	BH19-4	BH19-10	DUP	
	Sample Date:	04-Nov-2019	04-Nov-2019	04-Nov-2019	04-Nov-2019	Criteria:
	Sample ID:	1945295-01	1945295-02	1945295-03	1945295-04	Reg 153/04 (2011)-Table 3 Non-Potable
	Matrix:	Water	Water	Water	Water	Groundwater
	MDL/Units					
Hexane	1.0 ug/L	<1.0	-	<1.0	-	51 ug/L
Methyl Ethyl Ketone (2-Butanon	5.0 ug/L	<5.0	-	<5.0	-	470,000 ug/L
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	-	<5.0	-	140,000 ug/L
Methyl tert-butyl ether	2.0 ug/L	<2.0	-	<2.0	-	190 ug/L
Methylene Chloride	5.0 ug/L	<5.0	-	<5.0	-	610 ug/L
Styrene	0.5 ug/L	<0.5	-	<0.5	-	1,300 ug/L
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	-	<0.5	-	3.3 ug/L
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	-	<0.5	-	3.2 ug/L
Tetrachloroethylene	0 <u>.</u> 5 ug/L	<0.5	-	<0.5	-	1.6 ug/L
Toluene	0.5 ug/L	<0.5	-	<0.5	-	18,000 ug/L
1,1,1-Trichloroethane	0.5 ug/L	<0.5	-	<0.5	-	640 ug/L
1,1,2-Trichloroethane	0.5 ug/L	<0.5	-	<0.5	-	4.7 ug/L
Trichloroethylene	0.5 ug/L	<0.5	-	<0.5	-	1.6 ug/L
Trichlorofluoromethane	1.0 ug/L	<1.0	-	<1.0	-	2,500 ug/L
Vinyl chloride	0.5 ug/L	<0.5	-	<0.5	-	0.5 ug/L
m,p-Xylenes	0 <u>.</u> 5 ug/L	<0.5	-	<0.5	-	
o-Xylene	0.5 ug/L	<0.5	-	<0.5	-	
Xylenes, total	0.5 ug/L	<0.5	-	<0.5	-	4,200 ug/L
4-Bromofluorobenzene	Surrogate	112%	-	112%	-	
Dibromofluoromethane	Surrogate	111%	-	109%	-	
Toluene-d8	Surrogate	96.9%	-	97.9%	-	
Benzene	0.5 ug/L	-	<0.5	-	<0.5	44 ug/L
Ethylbenzene	0.5 ug/L	-	<0.5	-	<0.5	2,300 ug/L
Toluene	0.5 ug/L	-	<0.5	-	<0.5	18,000 ug/L

Certificate of Analysis Client: WSP Canada Inc. (Ottawa)

Client PO:

Report Date: 12-Nov-2019 Order Date: 5-Nov-2019 Project Description: 191-12948-00

BH19-6 BH19-4 BH19-10 DUP **Client ID:** Sample Date: 04-Nov-2019 04-Nov-2019 04-Nov-2019 04-Nov-2019 Criteria: Sample ID: 1945295-01 1945295-02 1945295-03 1945295-04 Reg 153/04 (2011)-Table 3 Non-Potable Groundwater Matrix: Water Water Water Water **MDL/Units** m.p-Xylenes 0.5 ug/L < 0.5 < 0.5 --<0.5 o-Xylene 0.5 ug/L < 0.5 --<0.5 Xylenes, total 0.5 ug/L < 0.5 --4.200 ug/L Toluene-d8 97.9% 97.5% Surrogate --Hvdrocarbons <25 F1 PHCs (C6-C10) 25 ug/L <25 <25 <25 750 ug/L <100 F2 PHCs (C10-C16) 100 ug/L <100 <100 [1] <100 uq/L 150 <100 100 ug/L <100 <100 F3 PHCs (C16-C34) <100 [1] 500 ug/L <100 F4 PHCs (C34-C50) 100 ug/L <100 <100 [1] <100 500 ug/L Semi-Volatiles < 0.05 Acenaphthene 0.05 ua/L < 0.05 < 0.05 -600 ug/L < 0.05 < 0.05 Acenaphthylene 0.05 ug/L < 0.05 -1.8 ug/L < 0.01 Anthracene 0.01 ug/L < 0.01 < 0.01 -2.4 ug/L < 0.01 Benzo [a] anthracene 0.01 ug/L < 0.01 < 0.01 _ 4.7 ug/L < 0.01 Benzo [a] pyrene 0.01 ug/L < 0.01 < 0.01 ug/L -0.81 < 0.05 < 0.05 Benzo [b] fluoranthene 0.05 ug/L < 0.05 -0.75 uq/L Benzo [g,h,i] pervlene 0.05 ug/L < 0.05 < 0.05 < 0.05 _ 0.2 ug/L <0.05 Benzo [k] fluoranthene 0.05 ug/L < 0.05 < 0.05 0.4 ug/L -< 0.05 Chrysene 0.05 ug/L < 0.05 < 0.05 _ 1 ug/L < 0.05 0.05 ug/L Dibenzo [a,h] anthracene < 0.05 < 0.05 uq/L -0.52 < 0.01 Fluoranthene 0.01 ug/L < 0.01 < 0.01 -130 ug/L < 0.05 Fluorene 0.05 ug/L < 0.05 < 0.05 -400 ug/L < 0.05 Indeno [1,2,3-cd] pyrene 0.05 ug/L < 0.05 < 0.05 -< 0.05 1-Methylnaphthalene 0.05 ug/L < 0.05 -< 0.05 1,800 ug/L



Certificate of Analysis Client: WSP Canada Inc. (Ottawa)

Client PO:

	Client ID: Sample Date: Sample ID: Matrix: MDL/Units	BH19-6 04-Nov-2019 1945295-01 Water	BH19-4 04-Nov-2019 1945295-02 Water	BH19-10 04-Nov-2019 1945295-03 Water	DUP 04-Nov-2019 1945295-04 Water	Criteria: Reg 153/04 (2011)-Table 3 Non-Potable Groundwater
2-Methylnaphthalene	0.05 ug/L	<0.05	<0.05	-	<0.05	1,800 ug/L
Methylnaphthalene (1&2)	0.10 ug/L	<0.10	<0.10	-	<0.10	1,800 ug/L
Naphthalene	0.05 ug/L	<0.05	<0.05	-	<0.05	1,400 ug/L
Phenanthrene	0.05 ug/L	<0.05	<0.05	-	<0.05	580 ug/L
Pyrene	0.01 ug/L	<0.01	<0.01	-	<0.01	68 ug/L
2-Fluorobiphenyl	Surrogate	80.9%	85.3%	-	79.4%	
Terphenyl-d14	Surrogate	110%	120%	-	112%	

Certificate of Analysis Client: WSP Canada Inc. (Ottawa)

Client PO:

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Resu l t	%REC	%REC Limit	RPD	RPD Limit	Notes
/drocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
etals			<u>-</u>						
Mercury	ND	0.1	ug/L						
Antimony	ND	0.5	ug/L						
Arsenic	ND	1	ug/L						
Barium	ND	1							
	ND		ug/L						
Beryllium		0.5	ug/L						
Boron	ND	10	ug/L						
Cadmium	ND	0.1	ug/L						
Chromium (VI)	ND	10	ug/L						
Chromium	ND	1	ug/L						
Cobalt	ND	0.5	ug/L						
Copper	ND	0.5	ug/L						
Lead	ND	0.1	ug/L						
Molybdenum	ND	0.5	ug/L						
Nickel	ND	1	ug/L						
Selenium	ND	1	ug/L						
Silver	ND	0.1	ug/L						
Sodium	ND	200	ug/L						
Thallium	ND	0.1	ug/L						
Uranium	ND	0.1	ug/L						
Vanadium	ND	0.5	ug/L						
Zinc	ND	5	ug/L						
emi-Volatiles									
Acenaphthene	ND	0.05	ug/L						
Acenaphthylene	ND	0.05	ug/L						
Anthracene	ND	0.01	ug/L						
Benzo [a] anthracene	ND	0.01	ug/L						
Benzo [a] pyrene	ND	0.01	ug/L						
Benzo [b] fluoranthene	ND	0.05	ug/L						
Benzo [g,h,i] perylene	ND	0.05	ug/L						
Benzo [k] fluoranthene	ND	0.05	ug/L						
Chrysene	ND	0.05	ug/L						
Dibenzo [a,h] anthracene	ND	0.05	ug/L						
Fluoranthene	ND	0.01	ug/L						
Fluorene	ND	0.05	ug/L						
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/L						

Order #: 1945295

Certificate of Analysis Client: WSP Canada Inc. (Ottawa)

Client PO:

Method Quality Control: Blank

	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit Notes	
1-Methylnaphthalene	ND	0.05	ug/L						
2-Methylnaphthalene	ND	0.05	ug/L						
Methylnaphthalene (1&2)	ND	0.10	ug/L						
Naphthalene	ND	0.05	ug/L						
Phenanthrene	ND	0.05	ug/L						
Pyrene	ND	0.01	ug/L						
Surrogate: 2-Fluorobiphenyl	19.2		ug/L		96.1	50-140			
Surrogate: Terphenyl-d14	22.3		ug/L		112	50-140			
latiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1.2-Dichlorobenzene	ND	0.5	ug/L						
1.3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1.1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						
Methylene Chloride	ND	5.0	ug/L						
Styrene	ND	0.5	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						

Certificate of Analysis Client: WSP Canada Inc. (Ottawa) Client PO:

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Resu l t	%REC	%REC Limit	RPD	RPD Limit	Notes
Toluene	ND	0.5	ug/L						
1,1,1-Trichloroethane	ND	0.5	ug/L						
1,1,2-Trichloroethane	ND	0.5	ug/L						
Trichloroethylene	ND	0.5	ug/L						
Trichlorofluoromethane	ND	1.0	ug/L						
Vinyl chloride	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: 4-Bromofluorobenzene	86.2		ug/L		108	50-140			
Surrogate: Dibromofluoromethane	83.6		ug/L		105	50-140			
Surrogate: Toluene-d8	79.2		ug/L		99.0	50-140			
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	79.2		ug/L		99.0	50-140			

PARACEL LABORATORIES LTD.

Certificate of Analysis Client: WSP Canada Inc. (Ottawa)

Client PO:

Analyte

Method Quality Control: Duplicate

Reporting

Limit

Result

Hydrocarbons						
F1 PHCs (C6-C10)	ND	25	ug/L	ND		30
Metals						
Mercury	ND	0.1	ug/L	ND	0.0	20
Antimony	ND	0.5	ug/L	ND	0.0	20
Arsenic	ND	1	ug/L	ND	0.0	20
Barium	64.1	1	ug/L	61.8	3.6	20
Beryllium	ND	0.5	ug/L	ND	0.0	20
Boron	82	10	ug/L	86	5.0	20
Cadmium	ND	0.1	ug/L	ND	0.0	20
Chromium (VI)	ND	10	ug/L	ND	0.0	20
Chromium	ND	1	ug/L	ND	0.0	20
Cobalt	ND	0.5	ug/L	ND	0.0	20
Copper	1.10	0.5	ug/L	1.13	2.8	20
Lead	0.13	0.1	ug/L	ND	0.0	20
Molybdenum	ND	0.5	ug/L	ND	0.0	20
Nickel	ND	1	ug/L	ND	0.0	20
Selenium	1.4	1	ug/L	1.4	2.4	20
Silver	ND	0.1	ug/L	ND	0.0	20
Sodium	63700	200	ug/L	69900	9.2	20
Thallium	ND	0.1	ug/L	ND	0.0	20
Uranium	0.4	0.1	ug/L	0.4	12.7	20
Vanadium	ND	0.5	ug/L	ND	0.0	20
Zinc	ND	5	ug/L	ND	0.0	20
Volatiles						
Acetone	ND	5.0	ug/L	ND		30
Benzene	ND	0.5	ug/L	ND		30
Bromodichloromethane	ND	0.5	ug/L	ND		30
Bromoform	ND	0.5	ug/L	ND		30
Bromomethane	ND	0.5	ug/L	ND		30
Carbon Tetrachloride	ND	0.2	ug/L	ND		30
Chlorobenzene	ND	0.5	ug/L	ND		30
Chloroform	ND	0.5	ug/L	ND		30
Dibromochloromethane	ND	0.5	ug/L	ND		30
Dichlorodifluoromethane	ND	1.0	ug/L	ND		30
1,2-Dichlorobenzene	ND	0.5	ug/L	ND		30
1,3-Dichlorobenzene	ND	0.5	ug/L	ND		30
1,4-Dichlorobenzene	ND	0.5	ug/L	ND		30
1,1-Dichloroethane	ND	0.5	ug/L	ND		30
1,2-Dichloroethane	ND	0.5	ug/L	ND		30

Source

Result

Units

%REC

%REC

Limit

RPD

Limit

RPD

Report Date: 12-Nov-2019 Order Date: 5-Nov-2019 Project Description: 191-12948-00

Notes

Certificate of Analysis Client: WSP Canada Inc. (Ottawa) Client PO:

Method Quality Control: Duplicate

		Reporting		Source		%REC		RPD	
Analyte	Result	Limit	Units	Result	%REC	Limit	RPD	Limit	Notes
1,1-Dichloroethylene	ND	0.5	ug/L	ND				30	
cis-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
trans-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
1,2-Dichloropropane	ND	0.5	ug/L	ND				30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Ethylene dibromide (dibromoethane	ND	0.2	ug/L	ND				30	
Hexane	ND	1.0	ug/L	ND				30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND				30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND				30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND				30	
Methylene Chloride	ND	5.0	ug/L	ND				30	
Styrene	ND	0.5	ug/L	ND				30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
Tetrachloroethylene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
1,1,1-Trichloroethane	ND	0.5	ug/L	ND				30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND				30	
Trichloroethylene	ND	0.5	ug/L	ND				30	
Trichlorofluoromethane	ND	1.0	ug/L	ND				30	
Vinyl chloride	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: 4-Bromofluorobenzene	87.4		ug/L		109	50-140			
Surrogate: Dibromofluoromethane	53.1		ug/L		66.4	50-140			
Surrogate: Toluene-d8	78.9		ug/L		98.7	50-140			
Benzene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: Toluene-d8	78.9		ug/L		98.7	50-140			

Certificate of Analysis Client: WSP Canada Inc. (Ottawa)

Client PO:

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1690	25	ug/L		84.6	68 - 117			
F2 PHCs (C10-C16)	1560	100	ug/L		97.3	60-140			
F3 PHCs (C16-C34)	4050	100	ug/L		103	60 - 140			
F4 PHCs (C34-C50)	3230	100	ug/L		130	60 - 140			
Vietals									
Mercury	2.98	0.1	ug/L	ND	99.4	70 - 130			
Antimony	45.8		ug/L	ND	91.1	80-120			
Arsenic	49.6		ug/L	ND	98.9	80 - 120			
Barium	106		ug/L	61.8	88.3	80-120			
Beryllium	50.4		ug/L	ND	101	80 - 120			
Boron	123		ug/L	86	73.1	80-120			QM-07
Cadmium	45.2		ug/L	ND	90.4	80 - 120			
Chromium (VI)	179	10	ug/L	ND	89.5	70-130			
Chromium	56.8		ug/L	ND	113	80-120			
Cobalt	51.1		ug/L	ND	102	80-120			
Copper	49.0		ug/L	1.13	95.7	80-120			
Lead	42.7		ug/L	ND	85.1	80-120			
Molybdenum	49.6		ug/L	ND	98.8	80 - 120			
Nickel	48.4		ug/L	ND	96.4	80-120			
Selenium	46.7		ug/L	1.4	90.6	80 - 120			
Silver	43.6		ug/L	ND	87.1	80-120			
Sodium	9540		ug/L		95.4	80 - 120			
Thallium	36.7		ug/L	ND	73.3	80-120			QM-07
Uranium	40.9		ug/L	0.4	81.0	80 - 120			
Vanadium	58.2		ug/L	ND	116	80-120			
Zinc	47		ug/L	ND	90.4	80 - 120			
Semi-Volatiles									
Acenaphthene	4.90	0.05	ug/L		98.1	50-140			
Acenaphthylene	4.28	0.05	ug/L		85.5	50 - 140			
Anthracene	4.18	0.01	ug/L		83.6	50-140			
Benzo [a] anthracene	3.98	0.01	ug/L		79.6	50 - 140			
Benzo [a] pyrene	3.41	0.01	ug/L		68.2	50 - 140			
Benzo [b] fluoranthene	5.59	0.05	ug/L		112	50-140			
Benzo [g,h,i] perylene	3.44	0.05	ug/L		68.8	50 - 140			
Benzo [k] fluoranthene	5.98	0.05	ug/L		120	50-140			

Order #: 1945295

Report Date: 12-Nov-2019 Order Date: 5-Nov-2019

Project Description: 191-12948-00

Certificate of Analysis Client: WSP Canada Inc. (Ottawa)

Client PO:

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Chrysene	4.64	0.05	ug/L		92.8	50-140			
Dibenzo [a,h] anthracene	3.81	0.05	ug/L		76.3	50-140			
Fluoranthene	4.26	0.01	ug/L		85.2	50 - 140			
Fluorene	4.16	0.05	ug/L		83.2	50 - 140			
Indeno [1,2,3-cd] pyrene	3.18	0.05	ug/L		63.7	50 - 140			
1-Methylnaphthalene	4.73	0.05	ug/L		94.6	50 - 140			
2-Methylnaphthalene	5.23	0.05	ug/L		105	50-140			
Naphthalene	5.46	0.05	ug/L		109	50-140			
Phenanthrene	3.95	0.05	ug/L		79.0	50 - 140			
Pyrene	4.30	0.01	ug/L		86.1	50 - 140			
Surrogate: 2-Fluorobiphenyl	20.4		ug/L		102	50-140			
/olatiles									
Acetone	68.7	5.0	ug/L		68.7	50-140			
Benzene	31.2	0.5	ug/L		78.0	60-130			
Bromodichloromethane	32.4	0.5	ug/L		81.1	60-130			
Bromoform	31.1	0.5	ug/L		77.8	60-130			
Bromomethane	31.0	0.5	ug/L		77.4	50-140			
Carbon Tetrachloride	27.7	0.2	ug/L		69.2	60-130			
Chlorobenzene	35.3	0.5	ug/L		88.2	60-130			
Ch l oroform	31.2	0.5	ug/L		78.1	60-130			
Dibromochloromethane	31.0	0.5	ug/L		77.6	60-130			
Dichlorodifluoromethane	40.7	1.0	ug/L		102	50-140			
1,2-Dichlorobenzene	37.8	0.5	ug/L		94.6	60-130			
1,3-Dichlorobenzene	39.2	0.5	ug/L		97.9	60-130			
1,4-Dichlorobenzene	37.2	0.5	ug/L		93.0	60-130			
1,1-Dichloroethane	28.8	0.5	ug/L		71.9	60-130			
1,2-Dichloroethane	30.5	0.5	ug/L		76.2	60-130			
1,1-Dichloroethylene	26.2	0.5	ug/L		65.6	60-130			
cis-1,2-Dichloroethylene	28.2	0.5	ug/L		70.6	60-130			
trans-1,2-Dichloroethylene	25.7	0.5	ug/L		64.2	60-130			
1,2-Dichloropropane	35.2	0.5	ug/L		88.0	60-130			
cis-1,3-Dichloropropylene	35.9	0.5	ug/L		89.8	60-130			
trans-1,3-Dichloropropylene	34.6	0.5	ug/L		86.5	60-130			
Ethylbenzene	33.8	0.5	ug/L		84.4	60-130			
Ethylene dibromide (dibromoethane	39.8	0.2	ug/L		99.5	60-130			
Hexane	49.0	1.0	ug/L		122	60-130			
Methyl Ethyl Ketone (2-Butanone)	78.0	5.0	ug/L		78.0	50-140			



Certificate of Analysis Client: WSP Canada Inc. (Ottawa)

Client PO:

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methyl Isobutyl Ketone	59.5	5.0	ug/L		59.5	50-140			
Methyl tert-butyl ether	58.9	2.0	ug/L		58.9	50-140			
Methylene Chloride	28.5	5.0	ug/L		71.2	60-130			
Styrene	41.9	0.5	ug/L		105	60 - 130			
1,1,1,2-Tetrachloroethane	37.0	0.5	ug/L		92.4	60 - 130			
1,1,2,2-Tetrachloroethane	43.0	0.5	ug/L		108	60-130			
Tetrachloroethylene	37.6	0.5	ug/L		93.9	60-130			
Toluene	34.1	0.5	ug/L		85.2	60-130			
1,1,1-Trichloroethane	30.2	0.5	ug/L		75.5	60-130			
1,1,2-Trichloroethane	28.2	0.5	ug/L		70.4	60 - 130			
Trichloroethylene	29.0	0.5	ug/L		72.4	60-130			
Trichlorofluoromethane	36.1	1.0	ug/L		90.2	60 - 130			
Vinyl chloride	40.1	0.5	ug/L		100	50-140			
m,p-Xylenes	70.1	0.5	ug/L		87.6	60 - 130			
o-Xylene	34.8	0.5	ug/L		86.9	60-130			
Benzene	31.2	0.5	ug/L		78.0	60-130			
Ethylbenzene	33.8	0.5	ug/L		84.4	60-130			
Toluene	34.1	0.5	ug/L		85.2	60-130			
m,p-Xylenes	70.1	0.5	ug/L		87.6	60-130			
o-Xylene	34.8	0.5	ug/L		86.9	60-130			



Certificate of Analysis Client: WSP Canada Inc. (Ottawa) Client PO:

Report Date: 12-Nov-2019 Order Date: 5-Nov-2019 Project Description: 191-12948-00

Qualifier Notes:

Sample Qualifiers :

1: Sample decanted prior to analysis due to sediments.

QC Qualifiers :

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable ND: Not Detected MDL: Method Detection Limit Source Result: Data used as source for matrix and duplicate samples %REC: Percent recovery. RPD: Relative percent difference.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.

- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.
- When reported, data for F4G has been processed using a silica gel cleanup.

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

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