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Paterson Group Inc.

Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

patersongroup

Phase II-Environmental Site Assessment

16 and 20 Hamilton Avenue North
Ottawa, Ontario

Prepared For
Surface Developments

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Report: PE4341-1

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Executive Summary

A Phase II-ESA was conducted for 16 and 20 Hamilton Avenue North, Ottawa, Ontario. The focus of the Phase II-ESA was to assess APECs identified in the historical research and to confirm general soil and groundwater quality at the APEC locations.

The Phase II-ESA consisted of the drilling of nine (9) boreholes, and the installation of seven (7) groundwater monitoring wells to assess soil and groundwater quality at the subject site. Four previously existing groundwater monitoring wells were identified on the subject site. No information regarding the construction of these monitoring wells was made available.

Soil samples obtained from the boreholes were screened using visual observations and organic vapour measurements. Based on the screening results, samples were selected for analysis of petroleum hydrocarbons, fractions 1 through 4 (PHCs F1-F4), benzene, toluene, ethylbenzene and xylenes (BTEX), metals, and Polycyclic Aromatic Hydrocarbons (PAHs). Several analysed fill samples contained concentrations of PAHs and Metals in excess of the selected MECP standards. The fill material throughout the subject site is considered to be impacted.

Groundwater samples obtained from BH1, BH2, BH3, BH6, BH8, and BH9 were submitted for analytical testing for a combination of metals, PAHs, BTEX, and PHCs (F1-F4). All the tested parameters in the groundwater samples were in compliance with the selected MECP standards with the exception of several PAH parameters from BH3. Based on the analytical results from the surrounding monitoring wells, the impacted groundwater appears to be localized to the area surrounding BH3.

Recommendations

Soil

During redevelopment of the subject site a remediation program can be undertaken consisting of the excavation and disposal of the impacted material at an approved waste disposal facility.

Groundwater

Any impacted groundwater encountered during excavation work should be removed from site by a licenced pumping contractor or treated using an on-site pump and treat unit during the redevelopment work.

If the groundwater monitoring wells are not going to be used in the future, they should be decommissioned by a licensed contractor in accordance with Ontario Regulation 903. However, we recommend that they be maintained for future groundwater monitoring purposes.

1.0 INTRODUCTION

At the request of Surface Developments, Paterson Group conducted a Phase II Environmental Site Assessment of the properties located at 16 and 20 Hamilton Avenue, in the City of Ottawa, Ontario.

1.1 Site Description

Address:	16 and 20 Hamilton Avenue North, Ottawa, Ontario.
Legal Descriptions:	Part Lots 3 and 4, Plan 58 Hamilton West, City of Ottawa, Part Lots 3 and 4, Plan 157 Hamilton West, City of Ottawa
Property Identification Numbers:	04035 0139 and 04035 0137.
Location:	The subject site is located on the west side of Hamilton Avenue North between Wellington Street West and Armstrong Avenue, in Ottawa, Ontario.
Latitude and Longitude:	45° 24' 03" N, 75° 43' 50" W
Configuration:	Rectangular
Site Area:	1,100 m^2

1.2 Current and Proposed Future Uses

16 Hamilton Avenue North is currently a vacant lot used for parking. 20 Hamilton Avenue North is currently a one storey commercial building used as an office for a workers union.

It is Paterson's understanding that the property is to be redeveloped with a mixed use commercial and residential development.

1.3 Applicable Site Condition Standard

The site condition standards for the property were obtained from Table 3 of the document entitled "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act", prepared by the Ontario Ministry of the Environment, Conservation and Parks (MECP), April 2011. The MECP Table 3 Standards are based on the following considerations:

- ❑ Coarse-grained soil conditions
- ❑ Full Depth soil conditions
- ❑ Non-potable groundwater conditions
- ❑ Residential land use

Residential Land Use Standards were chosen based on the proposed future land use of the subject site.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The subject site is located on the west side of Hamilton Avenue North, between Armstrong Street and Wellington Street West, in the City of Ottawa in a mixed residential and commercial urban area. The subject site is approximately at grade with the adjacent properties with overland flow to the catch basins on Hamilton Avenue North.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation consisted of drilling of nine (9) boreholes on the Phase II ESA property. Boreholes were drilled to the maximum depth of 5.82 m below ground surface. Seven of the boreholes were instrumented with groundwater monitoring wells.

3.2 Media Investigated

During the subsurface investigation, soil and groundwater samples were obtained and submitted for laboratory analysis. There are no water bodies present in, on, or under the Phase II ESA property and as such, sediment sampling was not part of the Phase II ESA. The rationale for sampling and analyzing these media is based on the Contaminants of Potential Concern identified in the Phase I ESA Conceptual Site Model, discussed in Subsection 3.3.

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

The Geological Survey of Canada website on the Urban Geology of the National Capital Area were consulted as part of this assessment. Based on this information, bedrock in the area of the site consists of interbedded limestone and dolostone of the Gull River Formation. Based on the maps, the thickness of overburden ranges from 3 to 5 m. Overburden consists of glacial till deposits.

Contaminants of Potential Concern

Based on the areas of potential environmental concern on the subject site, the following Contaminants of Potential Concern (CPCs) were targeted:

- PAHs - this suite of parameters encompasses various complex hydrocarbons, commonly associated with coal and/or combustion. These parameters are considered to be associated with the former foundry on the subject site.

- Metals - (including Hg, Cr VI, and B Hot Water Soluble (where applicable)) – this suite of parameters encompasses various metals for which MECP standards exist. These parameters are considered to be associated with the former foundry on the subject site.

- BTEX – this suite of parameters includes Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX), associated with fuel oil. These parameters were selected as CPCs for the subject site due to the existing automotive service garage to the south of the subject site. BTEX are considered to be present in both the soil and groundwater.

- Petroleum Hydrocarbons Fractions 1 through 4 (PHCs F1-F4) – this suite of parameters encompasses gasoline (Fraction 1), diesel and fuel oil (Fraction 2), and heavy oils (Fractions 3 and 4). These parameters are considered to be associated with the former automotive service garage to the south of the subject site.

Buildings and Structures

The subject site is occupied by a single storey wood framed commercial building located on the southern portion of the subject site. The building is currently used for office purposes. The building is heated and cooled using a natural gas fired rooftop HVAC system.

Water Bodies

No creeks, rivers, streams, lakes or any other water body was identified in a 250m radius. The majority of the study area consists of residential dwellings, commercial businesses, and roads. The Ottawa River is the closest significant water body and is located approximately 1km north of the subject site.

Areas of Natural Significance

A search for areas of natural significance and features within a 250m radius study area was conducted on the Ontario Ministry of Natural Resources (MNR) website and the search did not reveal any areas of natural significance within a 250m radius.

Drinking Water Wells

The search returned 48 water well records within a 250m radius, all of which were drilled between 2007 and 2016. Based on the availability of municipal water, it is assumed that these wells are for groundwater monitoring purposes. The majority of these wells are clustered around an existing retail fuel outlet approximately 55m to the east and a former industrial facility approximately 55m to the north of the subject site. Based on the cross and/or downgradient locations of these well clusters of the wells at these locates are not considered to represent an area of environmental concern to the subject site.

Neighbouring Land Use

Neighbouring land use in a 250m radius is primarily residential and commercial with a City of Ottawa park located directly to the east of the subject site.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

The Areas of Potential Environmental Concern (APEC) identified in the Phase II ESA study area are summarized in Section 4.3 of this report. Other potentially contaminating activities (PCAs) within a 250m radius are not considered to pose an environmental concern to the Phase II ESA Property due to their separation distance and/or location downgradient or cross-gradient of the Phase II ESA property.

Assessment of Uncertainty and/or Absence of Information

A complete historical review as part of a Phase I ESA has yet not been completed for the subject site. However based on prior knowledge of the area, previous Phase I ESA work completed by Paterson for nearby properties, and a brief historical review completed prior to the start of the Phase II ESA program no additional significant environmental concerns are expected to be identified for the subject site.

3.4 Deviations from Sampling and Analysis Plan

The Sampling and Analysis Plan for this project is included in Appendix 1 of this report. No deviations from the Sampling and Analysis Plan were noted.

3.5 Impediments

Two impediments were identified during the Phase II ESA program. Construction on the north side of the subject site prevented drilling immediately adjacent to the north property line and interior walls, sub-slab services, and office finishes provided only limited locations for the placement of the interior boreholes. These impediments are not considered to have significantly affected the conclusions of this report.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was carried out in three stages on June 13, August 10, and September 7, 2018, and consisted of the drilling of nine boreholes on the subject site. The boreholes drilled during the June 13, 2018 field program were placed to address the APECs identified during the historical review. A delineation program was started on August 10, 2018 to complete work on the exterior of the subject site and the interior work was completed on September 7, 2018. Boreholes BH1 to BH7 were drilled using a truck-mounted CME 55 power auger drill rig and boreholes BH8 and BH9, which were located inside the building, were drilled using portable drilling equipment. All drilling occurred under full-time supervision of Paterson personnel. Borehole locations are shown on Drawing PE4341-1 - Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

As part of the subsurface investigation a total of 67 soil samples were obtained from the boreholes by means of split spoon sampling and direct sampling from auger flights. Split spoon samples were taken continuously from ground surface up to 5.82 m below existing grade, within the water table. The depths at which split spoon and auger samples were obtained from the boreholes are shown as "**SS**", and "**AU**" respectively on the Soil Profile and Test Data Sheets, appended to this report.

Site soils consist of a layer of fill material (predominantly clayey topsoil with some demolition debris), and till, over grey limestone. Practical refusal to augering was encountered between 5.0m and 5.82m below the existing grade.

4.3 Field Screening Measurements

All soil samples collected were submitted to a preliminary screening procedure, which included visual screening for colour and evidence of metals, as well as screening with a photo ionization detector (PID). The device's detection limit is 0.1 ppm, with a precision of +/- 0.1 ppm.

The soil vapours were measured by inserting the analyzer probe into the nominal headspace above the soil sample. Samples were then agitated and the peak readings recorded. Vapour readings were largely negligible and varied from 0 ppm to 1.5 ppm. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

Soil samples were selected for analysis based on visual appearance, location, and vapour readings.

4.4 Groundwater Monitoring Well Installation

Seven (7) groundwater monitoring wells were installed during the drilling programs carried out by George Downing Estate Drilling of Hawkesbury, Ontario, under full-time supervision by Paterson personnel. The monitoring wells consisted of 52 mm diameter Schedule 40 threaded PVC riser and screen. An additional two monitoring wells were installed by CCC Drilling of Ottawa, Ontario under the full-time supervision of Paterson personnel. The monitoring wells consisted of 30 mm diameter Schedule 40 threaded PVC riser and screen. A sand pack consisting of silica sand was placed around the screen, and a bentonite seal was placed above the screen to minimize cross-contamination.

Monitoring well construction details are provided on the Soil Profile and Test Data Sheets in Appendix 1.

Four additional monitoring wells were identified onsite by Paterson during the field program. No information was provided for these monitoring wells and the details of their construction is unknown. The location of the monitoring wells by others is shown on Drawing PE4341-1 – Test Hole Location Plan.

A summary of the monitoring well construction details is provided below in Table 1. Borehole elevations were surveyed to a geodetic benchmark with an elevation of 64.86 masl, provided by Farley, Smith and Dennis Surveying Ltd. The location of the benchmark is shown on PE4341-1 Test Hole Location Plan

Table 1: Monitoring Well Construction Details

Well ID	Ground Surface Elevation	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH1	63.92	5.23	2.23-5.23	1.23-5.23	0.10-1.23	Flushmount
BH2	64.18	5.61	2.61-5.61	1.61-5.61	0.10-1.61	Flushmount
BH3	63.81	5.74	2.74-5.74	1.74-5.74	0.10-1.74	Flushmount
BH4	63.83	5.82	2.82-5.82	1.82-5.82	0.10-1.82	Flushmount
BH6	63.63	5.00	2.00-5.00	1.75-5.00	0.10-1.75	Flushmount
BH8	63.96	5.13	2.13-5.13	1.50-5.13	0.10-1.50	Flushmount
BH9	63.96	5.03	2.03-5.03	1.50-5.03	0.10-1.50	Flushmount

4.5 Groundwater Sampling

Groundwater sampling protocols were followed using the MECP document entitled “Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario”, dated May 1996. Groundwater samples were obtained from each monitoring well, using dedicated sampling equipment. Standing water was purged from each well prior to sampling. Samples were stored in coolers to reduce analyte volatilization during transportation. Details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan in Appendix 1.

4.6 Analytical Testing

Based on the guidelines outlined in the Sampling and Analysis Plan appended to this report, the following soil and groundwater samples were submitted for analysis:

Table 2: Soil Samples Submitted

Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analysed				Rationale
		Metals	PAHs	PHCs	BTEX	
June 13, 2018						
BH1-SS2	0.76-1.37m, Fill	X				Investigate the potentially deleterious fill material identified on site.
BH2-SS2	0.76-1.37m, Fill	X	X			
BH3-SS2	0.76-1.37m, Fill		X			
August 10, 2018						
BH4-SS3	1.52-2.13m, Glacial Till		X			Delineate the impacted fill material vertically.
BH5-SS4	2.29-2.90m, Glacial Till		X	X	X	
BH6-SS2	0.76-1.37m, Fill		X			Delineate the impacted fill material horizontally.
BH7-SS3	1.52-2.13m, Silty Clay		X			
September 7, 2018						
BH8-G1	0.41 – 0.53 m, Fill	X				Assess the potentially deleterious fill material identified underneath the building slab.
BH8-SS5	1.83-2.44m, Glacial Till			X	X	Assess the soil near the groundwater table to address the automotive service garage to the south.
BH9-SS1	0.30-0.91m, Fill	X				Assess the potentially deleterious fill material identified underneath the building slab
BH9-SS4	2.13-2.29m, Glacial Till			X	X	Assess the soil near the groundwater table to address the automotive service garage to the south.

Table 3: Groundwater Samples Submitted

Sample ID	Screened Interval/ Stratigraphic Unit	Parameters Analysed				Rationale
		PAHs	VOCs	Metals	PHCs and BTEX	
June 20, 2018						
BH1-GW1	2.23-5.23m, Glacial Till	X	X	X		Assess the former use of the property as a foundry and machine shop
BH2-GW1	2.61-5.61m, Glacial Till			X		
BH3-GW1	2.74-5.74m, Glacial Till	X	X			
August 15, 2018						
BH4-GW1	2.82-5.82m, Glacial Till	X				Delineate the impacted groundwater identified during the June 2018 investigation.
BH6-GW1	2.00-5.00m, Glacial Till	X				
MWB-GW1	Unknown	X				Delineate the groundwater using the existing monitoring wells on site.
MWD-GW1	Unknown	X				
September 20, 2018						
BH8-GW1	2.13-5.13m, Glacial Till	X		X	X	Assess the groundwater condition underneath the building
BH9-GW1	2.03-5.03m, Glacial Till	X		X	X	

Paracel Laboratories (Paracel), of Ottawa, Ontario, performed the laboratory analysis on the samples submitted for analytical testing. Paracel is a member of the Standards Council of Canada/Canadian Association for Laboratory Accreditation (SCC/CALA). Paracel is accredited and certified by SCC/CALA for specific tests registered with the association.

4.7 Residue Management

Soil cuttings, purge water and fluids from equipment cleaning were retained on-site.

4.8 Elevation Surveying

Paterson completed a borehole elevation survey as part of the field program. The borehole elevations were referenced to a geodetic benchmark located on the east side of Hamilton Avenue North, provided by Farley, Smith and Dennis Surveyors Limited. The benchmark is shown on Drawing PE4341-1 – Test Hole Location Plan.

4.9 Quality Assurance and Quality Control Measures

A summary of quality assurance and quality control (QA/QC) measures, including sampling containers, preservation, labelling, handling, and custody, equipment cleaning procedures, and field quality control measurements is provided in the Sampling and Analysis Plan in Appendix 1.

5.0 REVIEW AND EVALUATION

5.1 Geology

Site geology details are provided in the Soil Profile and Test Data Sheets provided in Appendix 1. Site soils consist of:

- Asphaltic concrete was encountered at surface in each of the exterior boreholes, while concrete was encountered at the interior borehole locations (BH8 and BH9)
- Fill material was encountered below the asphaltic concrete/concrete to depths ranging from 0.91 m to 1.52m below grade. The fill consisted primarily of clayey topsoil with some demolition debris.
- Native in-situ stiff silty clay was found in some boreholes below the fill material.
- Native in-situ glacial till was encountered either below the clay or below the fill, extending to the inferred bedrock surface at depths ranging from 4.42m to 5.82m below the existing grade.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured using an electronic water level meter. Groundwater levels are summarized below in Table 4. All elevations are relative to a geodetic elevation, provided by Farley Smith and Denis Surveying Ltd.

Table 4: Groundwater Level Measurements				
Borehole Location	**Ground Surface Elevation (m)**	**Water Level Depth (m below grade)**	**Water Level Elevation (m ASL)**	**Date of Measurement**
BH1	63.92	3.33	60.59	September 20, 2018
BH2	64.18	3.64	60.54	
BH3	63.81	3.19	60.62	
BH4	63.83	3.89	59.94	
BH6	63.63	3.14	60.49	
BH8	63.96	3.33	60.63	
BH9	63.96	2.67	61.29	

Based on the groundwater elevations from the most recent sampling event, groundwater contour mapping was completed for the subject site. Based on the contour mapping, groundwater flow at the subject site appears to be in the northwestern direction. A horizontal hydraulic gradient of approximately 0.04 m/m was calculated. No free product was observed in the monitoring wells at the subject site. No visual or olfactory indications of contamination were noted during the groundwater monitoring events.

5.3 Fine-Medium Soil Texture

Based on the observed soil conditions at the subject site, fine-medium textured soil standards are not considered to apply to the subject site.

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in soil vapour readings of 0 ppm to 1.5 ppm. Field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets appended to this report. The field screening results were generally negligible. As a result, soil samples were selected for analytical testing based on visual observations and soil stratigraphy.

5.5 Soil Quality

Three (3) soil samples from the subsurface investigation were submitted for analysis of PHCs and BTEX, four (4) soil samples were submitted for metals, and six (6) were submitted for PAHs, as presented below in the tables below.

Table 5:
Analytical Test Results – Soil
BTEX/PHCs

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MECP Table 3 Residential Standards
		BH5-SS4	BH8-SS5	BH9-SS4	
Benzene	0.02	nd	nd	nd	0.21
Ethylbenzene	0.05	nd	nd	nd	2
Toluene	0.05	nd	nd	nd	2.3
Xylenes	0.05	nd	nd	nd	3.1
PHCs F1	7	nd	nd	nd	55
PHCs F2	4	32	nd	nd	98
PHCs F3	8	80	nd	9	300
PHCs F4	6	82	nd	nd	2800

Notes:
- **Bold and underlined** – Value exceeds selected MOECC standard
- MDL – Method Detection Limit
- nd – not detected above the MDL

Low levels of PHC F2, F3, and F4 concentrations were identified in the soil samples analysed. The soil is in compliance with the MECP Table 3 Standards for BTEX and PHCs.

Table 6:
Analytical Test Results – Soil
Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g)				MECP Table 3 Residential Standards
		BH1-SS2	BH2-SS2	BH8-G1	BH9-SS1	
Antimony	1	6.4	1.6	**41.1**	nd	7.5
Arsenic	1	5.8	3.8	17.3	1.8	18
Barium	1	319	212	193	135	390
Beryllium	0.5	0.7	0.6	nd	0.6	4
Boron	5	29.7	25.1	37.3	20.6	120
Cadmium	0.5	nd	nd	0.6	nd	1.2
Chromium	5	57.1	47.9	43.0	28.3	160
Chromium (VI)	0.2	NA	NA	nd	nd	8
Cobalt	1	14.9	10.9	19.5	9.5	22
Copper	5	54.3	63.8	**913**	15.8	140
Lead	1	**490**	58.2	**1070**	28.9	120
Mercury	0.1	**0.3**	nd	**0.6**	nd	0.27
Molybdenum	1	1.2	nd	2.1	nd	6.9
Nickel	5	39.4	17.5	42.8	15.3	100
Selenium	1	**3.6**	**2.7**	1.7	nd	2.4
Silver	0.3	nd	nd	0.3	nd	20
Thallium	1	nd	nd	nd	nd	1
Uranium	1	nd	nd	nd	nd	23
Vanadium	10	78.4	71.4	52.1	75.2	86
Zinc	20	206	97.1	268	50.1	340

Notes:
- **Bold and underlined** – Value exceeds selected MOECC standard
- MDL – Method Detection Limit
- nd – not detected above the MDL

Several metals concentrations exceeding the MECP Table 3 Residential Standards were identified in BH1-SS2, BH2-SS2 and BH8-G1. All of the metals exceedances were identified in the fill material on the subject site. All other metals results were in compliance with the MECP Table 3 Standards.

Table 7:
Analytical Test Results – Soil
PAHs

Parameter	MDL (µg/g)	Soil Samples (µg/g)						MECP Table 3 Residential Standards
		BH2-SS2	BH3-SS2	BH4-SS3	BH5-SS4	BH6-SS2	BH7-SS3	
Acenaphthene	0.02	nd	**302**	nd	nd	nd	0.06	7.9
Acenaphthylene	0.02	nd	**nd(16.0)**	nd	nd	nd	0.03	0.15
Anthracene	0.02	0.03	**451**	0.05	0.08	nd	0.20	0.67
Benzo[a]anthracene	0.02	0.05	**487**	0.02	0.02	nd	0.42	0.5
Benzo[a]pyrene	0.02	0.05	**371**	0.03	0.02	nd	**0.41**	0.3
Benzo[b]fluoranthene	0.02	0.06	**462**	0.02	nd	nd	0.36	0.78
Benzo[g,h,i]perylene	0.02	0.03	**171**	nd	nd	nd	0.17	6.6
Benzo[k]fluoranthene	0.02	0.03	**258**	0.02	nd	nd	0.17	0.78
Chrysene	0.02	0.06	**511**	0.03	0.03	nd	0.48	7
Dibenzo[a,h]anthracene	0.02	nd	**58.5**	nd	nd	nd	0.05	0.1
Fluoranthene	0.02	0.13	**1730**	0.05	0.05	nd	**1.01**	0.69
Fluorene	0.02	nd	**386**	nd	nd	nd	0.06	62
Indeno[1,2,3-cd]pyrene	0.02	0.03	**195**	nd	nd	nd	0.15	0.38
Methylnapthalene (1&2)	0.04	nd	**268**	nd	nd	nd	nd	0.99
Napthalene	0.01	0.04	**866**	nd	nd	nd	0.02	0.6
Phenanthrene	0.02	0.12	**1980**	0.05	0.07	nd	0.91	6.2
Pyrene	0.02	0.11	**1270**	0.04	0.05	nd	0.86	78

Notes:
- **Bold and underlined** – Value exceeds selected MOECC standard
- MDL – Method Detection Limit
- nd – not detected above the MDL

Several PAH concentrations were identified above the MECP Table 3 Standard in BH3-SS2 and BH7-SS3. All PAH concentrations above the MECP Table 3 Standards were identified in the fill material on the subject site. All other PAH results are in compliance with the MECP Table 3 Standard.

5.6 Groundwater Quality

Groundwater samples from the subject site were submitted for a combination of BTEX, PHC, VOCs, Metals, and/or PAH analysis. The groundwater samples were obtained from the screened intervals noted on Table 1. The results of the analytical testing are presented in the tables below.

Table 8:
Analytical Test Results – Groundwater
VOCs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MECP Table 3 Standards
		BH1-GW1	BH3-GW1	
Acetone	5.0	nd	nd	130000
Benzene	0.5	nd	nd	44
Bromodichloromethane	0.5	nd	nd	85000
Bromoform	0.5	nd	nd	380
Bromomethane	0.5	nd	nd	5.6
Carbon Tetrachloride	0.2	nd	nd	0.79
Chlorobenzene	0.5	nd	nd	630
Chloroform	0.5	nd	nd	2.4
Dibromochloromethane	0.5	nd	nd	82000
Dichlorodifluoromethane	1.0	nd	nd	4400
1,2-Dichlorobenzene	0.5	nd	nd	4600
1,3-Dichlorobenzene	0.5	nd	nd	9600
1,4-Dichlorobenzene	0.5	nd	nd	8
1,1-Dichloroethane	0.5	nd	nd	320
1,2-Dichloroethane	0.5	nd	nd	1.6
1,1-Dichloroethylene	0.5	nd	nd	1.6
cis-1,2-Dichloroethylene	0.5	nd	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	16
1,3-Dichloropropene	0.5	nd	nd	5.2
Ethylbenzene	0.5	nd	nd	2300
Ethylene dibromide	0.2	nd	nd	0.25
Hexane	1.0	nd	nd	51
Methyl Ethyl Ketone	5.0	nd	nd	470000
Methyl Isobutyl Ketone	5.0	nd	nd	140000
Methyl tert-butyl Ether	2.0	nd	nd	190
Methylene Chloride	5.0	nd	nd	610
Styrene	0.5	nd	nd	1300
1,1,1,2-Tetrachloroethane	0.5	nd	nd	3.3
1,1,2,2-Tetrachloroethane	0.5	nd	nd	3.2
Tetrachloroethylene	0.5	nd	nd	1.6
Toluene	0.5	nd	nd	18000
1,1,1-Trichloroethane	0.5	nd	nd	640
1,1,2-Trichloroethane	0.5	nd	nd	4.7
Trichloroethylene	0.5	nd	nd	1.6
Trichlorofluromethane	1.0	nd	nd	2500
Vinyl Chloride	0.5	nd	nd	0.5
Xylene	0.5	nd	nd	4200

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and underlined** – Value exceeds selected MOECC standards

All VOC parameters are in compliance with the selected MECP Table 3 standards.

Table 9:
Analytical Test Results – Groundwater
Metals

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)				MECP Table 3 Standards
		BH1-GW1	BH2-GW1	BH8-GW1	BH9-GW1	
Mercury	0.1	nd	nd	nd	nd	0.29
Antimony	0.5	nd	nd	2.4	0.5	20000
Arsenic	1	nd	1	nd	nd	1900
Barium	1	187	175	108	259	29000
Beryllium	0.5	nd	nd	nd	nd	67
Boron	10	127	141	94	148	45000
Cadmium	0.1	nd	nd	nd	nd	2.7
Chromium	1	nd	nd	nd	nd	810
Chromium (VI)	10	NA	NA	nd	nd	140
Cobalt	0.5	0.7	0.8	1.1	nd	66
Copper	0.5	1.6	1.3	7.3	5.1	87
Lead	0.1	nd	nd	0.2	0.2	25
Molybdenum	0.5	1.2	4.2	4.2	1.9	9200
Nickel	1	2	5	6	3	490
Selenium	1	nd	nd	nd	nd	63
Silver	0.1	nd	nd	nd	nd	1.5
Sodium	200	66400	157000	83600	91500	2300000
Thallium	0.1	nd	0.1	nd	nd	510
Uranium	0.1	2.3	3.9	3.7	0.5	420
Vanadium	0.5	0.7	0.7	0.8	nd	250
Zinc	5	nd	nd	10	8	1100

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and underlined** – Value exceeds selected MOECC standards
- NA – Parameter not analysed

All metals parameters are in compliance with the selected MECP Standards.

Table 10:
Analytical Test Results – Groundwater
PAHs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)				MECP Table 3 Standards
		BH1-GW1	BH3-GW1	BH4-GW1	BH6-GW1	
Acenaphthene	0.05	nd	0.48	nd	nd	600
Acenaphthylene	0.05	nd	0.08	nd	nd	1.8
Anthracene	0.01	nd	0.85	nd	nd	2.4
Benzo[a]anthracene	0.01	nd	1.63	nd	nd	4.7
Benzo[a]pyrene	0.01	nd	**1.41**	nd	nd	0.81
Benzo[b]fluoranthene	0.05	nd	**1.66**	nd	nd	0.75
Benzo[g,h,i]perylene	0.05	nd	**0.76**	nd	nd	0.2
Benzo[k]fluoranthene	0.05	nd	**0.88**	nd	nd	0.4
Chrysene	0.05	nd	**1.99**	nd	nd	1
Dibenzo[a,h]anthracene	0.05	nd	0.20	nd	nd	0.52
Fluoranthene	0.01	nd	4.70	nd	nd	130
Fluorene	0.05	nd	0.58	nd	nd	400
Indeno[1,2,3-cd]pyrene	0.05	nd	**0.72**	nd	nd	0.2
Methylnaphthalene (1&2)	0.10	nd	0.28	nd	nd	1800
Napthalene	0.05	nd	0.57	nd	nd	1400
Phenanthrene	0.05	nd	4.20	nd	nd	580
Pyrene	0.01	nd	3.72	nd	nd	68

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and underlined** – Value exceeds selected MECP standards

Table 10 (continued):
Analytical Test Results – Groundwater
PAHs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)				MECP Table 3 Standards
		MWB-GW1	MWD-GW1	BH8-GW1	BH9-GW1	
Acenaphthene	0.05	nd	nd	nd	nd	600
Acenaphthylene	0.05	nd	nd	nd	nd	1.8
Anthracene	0.01	nd	nd	0.01	nd	2.4
Benzo[a]anthracene	0.01	nd	nd	0.02	nd	4.7
Benzo[a]pyrene	0.01	nd	nd	0.02	nd	0.81
Benzo[b]fluoranthene	0.05	nd	nd	nd	nd	0.75
Benzo[g,h,i]perylene	0.05	nd	nd	nd	nd	0.2
Benzo[k]fluoranthene	0.05	nd	nd	nd	nd	0.4
Chrysene	0.05	nd	nd	0.06	nd	1
Dibenzo[a,h]anthracene	0.05	nd	nd	nd	nd	0.52
Fluoranthene	0.01	nd	nd	0.08	nd	130
Fluorene	0.05	nd	nd	0.08	0.08	400
Indeno[1,2,3-cd]pyrene	0.05	nd	nd	nd	nd	0.2
Methylnaphthalene (1&2)	0.10	nd	nd	nd	0.19	1800
Napthalene	0.05	nd	nd	nd	0.24	1400
Phenanthrene	0.05	nd	nd	0.21	0.17	580
Pyrene	0.01	nd	nd	0.07	nd	68

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and underlined** – Value exceeds selected MECP standards

PAHs exceeding the MECP Table 3 Standards were identified in BH3-GW1. All other groundwater samples were in compliance with the MECP Table 3 Standards.

Table 11: Analytical Test Results – Groundwater – BTEX and PHCs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MECP Table 3 Standards
		BH8-GW1	BH9-GW1	
Benzene	0.5	nd	nd	44
Ethylbenzene	0.5	nd	nd	2300
Toluene	0.5	nd	nd	18000
Xylenes	0.5	nd	nd	4200
PHCs F1	25	nd	nd	750
PHCs F2	100	nd	nd	150
PHCs F3	100	nd	nd	500
PHCs F4	100	nd	nd	500

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and underlined** – Value exceeds selected MECP standard

No BTEX or PHC parameters were detected in the groundwater samples. All BTEX and PHC parameters are in compliance with the selected MECP Standards.

The laboratory certificates of analysis are provided in Appendix 1.

5.7 Quality Assurance and Quality Control Results

All samples submitted as part of this Phase II ESA were handled in accordance with the Analytical Protocol with respect to holding time, preservation method, storage requirement, and container type.

As per Subsection 47(3) of O.Reg. 153/04 as amended by O.Reg. 269/11, a Certificate of Analysis has been received for each sample submitted for analysis, and all Certificates of Analysis are appended to this report.

Overall, the quality of the field data collected during this Phase II ESA is considered to be sufficient to meet the overall objectives of this assessment.

5.8 Phase II Conceptual Site Model

The following section has been prepared in accordance with the requirements of O.Reg. 153/04 as amended by O.Reg. 269/11 - Record of Site Condition regulation, made under the Environmental Protection Act. Conclusions and recommendations are discussed in a subsequent section.

Site Description

Potentially Contaminating Activities

Based on the results of the historical review completed for the subject site, several PCAs have been identified at the study site and with a 250m radius of the subject site. The rationale for identifying these PCAs is based on aerial photographs, previous reports for nearby properties, fire insurance plans, and personal interviews. One offsite and three onsite PCAs are considered to have created Areas of Potential Environmental Concern (APECs). The remaining PCAs are located at distances far enough away from the subject property such that they are not considered to have created APECs on site.

Areas of Potential Environmental Concern

Based on the results of the historical review completed for the subject site, three (3) APECs were identified at the subject site, on additional APEC was identified during the field program. The PCAs considered to represent APECs on the subject site are summarized below:

- The former on-site foundry; Item 34, Table 2, O.Reg. 153/04 as amended by O.Reg. 269/11 (“Metal Fabrication”).
- The former on site machine shop; Item 34, Table 2, O.Reg. 153/04 as amended by O.Reg. 269/11 (“Metal Fabrication”).
- The existing off-site automotive service garage; Item 52, Table 2, O.Reg. 153/04 as amended by O.Reg. 269/11 (“Storage, maintenance, fuelling and repair of equipment, vehicles, and material used to maintain transportation systems”).
- Fill material; Item 30, Table 2, O.Reg. 153/04 as amended by O.Reg. 269/11 (“Importation of Fill Material of Unknown Quality”).

Other PCAs within the Phase I study area are not considered to pose an area of potential environmental concern to the subject site due to their separation distance.

Contaminants of Potential Concern

Metals, PAHs, PHCs, and BTEX in the soil and groundwater were identified as Contaminants of Potential Concern with respect to the subject site.

Subsurface Structures and Utilities

Subsurface utilities on the subject property include electrical utilities, natural gas lines, telephone, cable lines, sewer lines, and water lines. No other subsurface structures were identified.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is provided in the Soil Profile and Test Data Sheets provided in Appendix 1. Stratigraphy consists of:

- A layer of fill material was encountered at all borehole locations. The fill was encountered below asphalt (Boreholes BH1 through BH7) or concrete (BH8 and BH9). The fill ranged in thickness from 0.91 m to 1.52 m and consisted primarily clayey topsoil with some demolition debris. Groundwater was not encountered in this layer.

- Native in-situ stiff silty clay was found in some boreholes below the fill material.

- Glacial till material was encountered at some boreholes beneath the layer of fill, up to a depth 5.82 m below grade. Groundwater was encountered in this unit between 2.67 and 4.13m below the existing grade.

Hydrogeological Characteristics

Groundwater was encountered in the glacial till unit on the subject site. Groundwater levels from seven (7) monitoring wells were measured at the subject site on September 20, 2018. The most recent groundwater levels indicate that the local groundwater flow is generally in a northwestern direction with a hydraulic gradient of 0.04 m/m.

Approximate Depth to Bedrock

Practical refusal to augering was encountered between 5.00m and 5.83m below the existing grade.

Approximate Depth to Water Table

Depth to the water table at the subject site varies between approximately 2.67 m and 4.13 m below existing grade.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation does not apply to the subject site as there are no areas of natural significance or bodies of water located on the subject site or within 30 m of the subject site. The subject site is not considered to be environmentally sensitive.

Section 43.1 of the Regulation does not apply to the subject site.

Fill Placement

It is expected that the fill material is a result of the various former uses of the subject site. The demolition debris within the fill material is considered to be from the previous building on 16 Hamilton Avenue. The fill material is considered to represent an APEC on the subject site.

Proposed Buildings and Other Structures

The proposed development for the subject site includes the demolition of all buildings and the construction of a mixed use development with ground floor retail uses and residential uses on the remaining floors.

Existing Buildings and Structures

The subject site is occupied by a single storey wood framed commercial building located on the southern portion of the subject site. The building is currently used for office purposes. The building is heated and cooled using a natural gas fired rooftop HVAC system.

Water Bodies

No water bodies are present on the subject site or within 250 m of the subject site.

Areas of Natural Significance

No areas of natural significance are present on the subject site or within 250 m of the subject site.

Environmental Condition

Areas Where Contaminants are Present

Suspected impacted soil was encountered across the majority of the subject property. Impacted groundwater was identified near the northern property boundary in BH3. The impacted groundwater appears to be limited to the northern portion of the property.

Types of Contaminants

Based on the potentially contaminating activities representing APECs on the subject property, the contaminants of potential concern (COCs) at the subject site were considered to be PAHs, Metals, PHCs and BTEX. These contaminants are related to the former use of the subject site as a foundry and machine shop as well as the existing automotive service garage on the property to the south.

Contaminated Media

Impacted fill material was identified throughout the subject site. Impacted groundwater was identified on the northern portion of the property.

What Is Known About Areas Where Contaminants Are Present

The source of the impacted fill material is expected to the former use of the subject site as a foundry and machine shop as well as demolition debris related to the removal of the building from 16 Hamilton Avenue. The impacted groundwater is expected to be related to a long term leaching through the fill material on the subject site.

Distribution of Contaminants

The contaminants are considered to be located in the fill material throughout the subject site. A small area of impacted groundwater was identified in the northern portion of the subject site.

Discharge of Contaminants

There is no ongoing discharge of contaminants on the subject site. The discharge of contaminants is suspected to be related to the former use of the site as a foundry and machine shop.

Migration of Contaminants

Approximately the entire the property is covered in an impermeable surface (asphaltic concrete or a building footprint) and as such the migration of contaminants is expected to be minimal.

Climatic and Meteorological Conditions

In general, climatic and meteorological conditions have the potential to affect contaminant distribution. Two ways by which climatic and meteorological conditions may affect contaminant distribution include the downward leaching of contaminants by means of the infiltration of precipitation, and the migration of contaminants via groundwater levels and/or flow, which may fluctuate seasonally. Based on the results of the Phase II ESA and the current site conditions it is expected that downward leaching is no longer an issue.

Potential for Vapour Intrusion

There is no potential for vapour intrusion at the subject site due to the low volatility of the impacted material and the lack of a basement in the existing subject building.

6.0 CONCLUSIONS

Assessment

A Phase II-ESA was conducted for 16 and 20 Hamilton Avenue North, Ottawa, Ontario. The focus of the Phase II-ESA was to assess APECs identified in the historical research and to confirm general soil and groundwater quality at the APEC locations.

The Phase II-ESA consisted of the drilling of nine (9) boreholes, and the installation of seven (7) groundwater monitoring wells to assess soil and groundwater quality at the subject site. Four previously existing groundwater monitoring wells were identified on the subject site. No information regarding the construction of these monitoring wells was made available.

Soil samples obtained from the boreholes were screened using visual observations and organic vapour measurements. Based on the screening results, samples were selected for analysis of petroleum hydrocarbons, fractions 1 through 4 (PHCs F1-F4), benzene, toluene, ethylbenzene and xylenes (BTEX), metals, and Polycyclic Aromatic Hydrocarbons (PAHs). Several analysed fill samples contained concentrations of PAHs and Metals in excess of the selected MECP standards. The fill material throughout the subject site is considered to be impacted.

Groundwater samples obtained from BH1, BH2, BH3, BH6, BH8, and BH9 were submitted for analytical testing for a combination of metals, PAHs, BTEX, and PHCs (F1-F4). All the tested parameters in the groundwater samples were in compliance with the selected MECP standards with the exception of several PAH parameters from BH3. Based on the analytical results from the surrounding monitoring wells, the impacted groundwater appears to be localized to the area surrounding BH3.

Recommendations

Soil

During redevelopment of the subject site a remediation program can be undertaken consisting of the excavation and disposal of the impacted material at an approved waste disposal facility.

Groundwater

Any impacted groundwater encountered during excavation work should be removed from site by a licenced pumping contractor or treated using an on-site pump and treat unit during the redevelopment work.

If the groundwater monitoring wells are not going to be used in the future, they should be decommissioned by a licensed contractor in accordance with Ontario Regulation 903. However, we recommend that they be maintained for future groundwater monitoring purposes.

7.0 STATEMENT OF LIMITATIONS

This Phase II - Environmental Site Assessment report has been prepared in general accordance with O.Reg. 153/04 and meets the requirements of CSA Z769-00. The conclusions presented herein are based on information gathered from a limited sampling and testing program. The test results represent conditions at specific test locations at the time of the field program.

The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only and test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes themselves.

Should any conditions be encountered at the subject site and/or historical information that differ from our findings, we request that we be notified immediately in order to allow for a reassessment.

This report was prepared for the sole use Surface Developments. Permission and notification from Surface Developments and Paterson will be required to release this report to any other party.

Paterson Group Inc.

Michael Beaudoin, P.Eng., QP_{esa}

Mark S. D'Arcy, P.Eng. QP_{esa}

Report Distribution:

- Surface Developments
- Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE4341-1 – TEST HOLE LOCATION PLAN

DRAWING PE4341-2 – ANALYTICAL TESTING PLAN - SOIL

DRAWING PE4341-3 – ANALYTICAL TESTING PLAN - GROUNDWATER

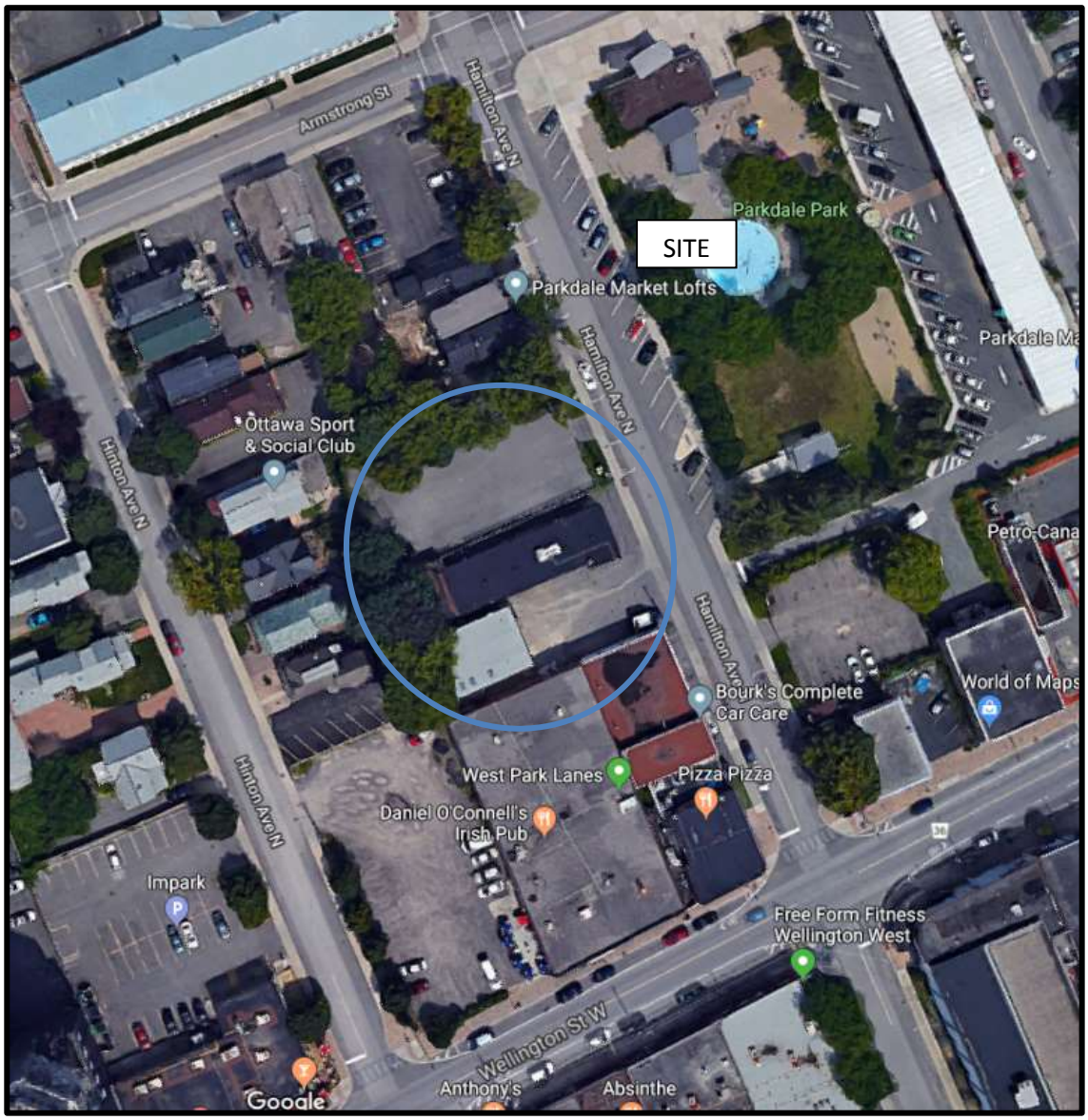

FIGURE 1

KEY PLAN

#89 HINTON AVENUE NORTH
RESIDENTIAL

#85 HINTON AVENUE NORTH
RESIDENTIAL

#89 HINTON AVENUE NORTH
RESIDENTIAL

#95 HINTON AVENUE NORTH
RESIDENTIAL

#97 HINTON AVENUE NORTH
RESIDENTIAL

#12 HAMILTON AVENUE NORTH
RESIDENTIAL

BH 7-18
63.74

MW B

BH 4-18
63.83
(59.94)

BH 3-18
63.81
(60.62)

MW A

MW E

#16 HAMILTON AVENUE NORTH
ASPHALTIC CONCRETE PARKING LOT

BH 6-18
63.63
(60.49)

MW D

MW C

BH 2-18
64.18
(60.54)

BH 5-18
63.90

BH 1-18
63.92
(60.59)

BH 8-18
63.96
(60.63)

BH 9-18
63.96
(61.29)

#20 HAMILTON AVENUE NORTH

#22 HAMILTON AVENUE NORTH
BOURK'S COMPLETE CAR CARE

AVENUE NORTH

HAMILTON

#366 PARKDALE AVENUE
PARKDALE PARK

FH - TBM

LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- MONITORING WELL LOCATION BY OTHERS
- 63.92 GROUND SURFACE ELEVATION (m)
- (60.59) GROUNDWATER SURFACE ELEVATION (m)

BM - TOP SPINDLE OF FIRE HYDRANT LOCATED NEAR THE SOUTHWEST CORNER OF 366 PARKDALE AVENUE. GEODETIC ELEVATION = 64.86m, AS PER FARLEY, SMITH AND DENNIS SURVEYING LTD.

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
0			

SURFACE DEVELOPMENTS

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
16 AND 20 HAMILTON AVENUE NORTH

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:250	Date: 08/2018
Drawn by: MPG	Report No.: PE4341-1
Checked by: AM	Dwg. No.: PE4341-1
Approved by: MSD	Revision No.: 0

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#89 HINTON AVENUE NORTH
RESIDENTIAL

#85 HINTON AVENUE NORTH
RESIDENTIAL

#89 HINTON AVENUE NORTH
RESIDENTIAL

#95 HINTON AVENUE NORTH
RESIDENTIAL

#97 HINTON AVENUE NORTH
RESIDENTIAL

#366 PARKDALE AVENUE
PARKDALE PARK

HAMILTON AVENUE NORTH

BH 7-18 - SS3 (1.52-2.13m) 10-August-2018

Parameter	Result	Standard (ug/g)
Benzo[a]pyrene	0.41	0.30
Fluoranthene	1.01	0.69

All other PAHs parameters are in compliance with MECP Table 3 Standards

BH 3-18 - SS2 (0.76-1.37m) 13-June-2018

Parameter	Result	Standard (ug/g)
Acenaphthene	302	7.9
Acenaphthylene	nd (16)	0.15
Anthracene	451	0.67
Benzo[a]anthracene	487	0.5
Benzo[a]pyrene	371	0.30
Benzo[b]fluoranthene	462	0.78
Benzo[g,h,i]perylene	171	6.6
Benzo[k]fluoranthene	258	0.78
Chrysene	511	7.0
Dibenzo[a,h]anthracene	58.5	0.1
Fluoranthene	1730	0.69
Flourene	386	62
Indeno[1,2,3-cd]pyrene	195	0.38
Methylnaphthalene (1&2)	268	0.99
Naphthalene	866	0.6
Phenanthrene	1980	6.2
Pyrene	1270	78

BH 4-18 - SS3 (1.52-2.13m) 10-August-2018
PAHs comply with MECP Table 3 Standards

BH 2-18 - SS2 (0.76-1.37m) 13-June-2018

Parameter	Result	Standard (ug/g)
Selenium	2.7	2.4

All other metal parameters comply with MECP Table 3 Standards
PAHs comply with MECP Table 3 Standards

BH 6-18 - SS2 (0.76-1.37m) 10-August-2018
PAHs comply with MECP Table 3 Standards

BH 5-18 - SS4 (2.29-2.90m) 10-August-2018
BTEX comply with MECP Table 3 Standards
PHCs comply with MECP Table 3 Standards
PAHs comply with MECP Table 3 Standards

BH 9-18 - SS1 (0.30-0.91m) 7-Sept-2018
Metals comply with MECP Table 3 Standards

BH 9-18 - SS4 (2.13-2.29m) 7-Sept-2018
PHCs comply with MECP Table 3 Standards
BTEX comply with MECP Table 3 Standards

BH 8-18 - G1 (0.13-0.61m) 7-Sept-2018

Parameter	Result	Standard (ug/g)
Antimonty	41.1	0.6
Copper	913	140
Lead	1070	120
Mercury	0.6	0.27

BH 8-18 - SS5 (1.83-2.44m) 7-Sept-2018
BTEX comply with MECP Table 3 Standards
PHCs comply with MECP Table 3 Standards

BH 1-18 - SS2 (0.76-1,37m) 13-June-2018

Parameter	Result	Standard (ug/g)
Mercury	0.3	0.27
Lead	490	120
Selenium	3.6	2.4

All other metal parameters comply with MECP Table 3 Standards

BH 7-18
63.74

MW B

BH 4-18
63.83
(59.94)

BH 3-18
63.81
(60.62)

MW A

MW E

#16 HAMILTON AVENUE NORTH
ASPHALTIC CONCRETE PARKING LOT

BH 6-18
63.63
(60.49)

MW D

MW C

BH 2-18
64.18
(60.54)

BH 5-18
63.90

BH 1-18
63.92
(60.59)

BH 8-18
63.96
(60.63)

BH 9-18
63.96
(61.29)

#20 HAMILTON AVENUE NORTH

FH - BM

LEGEND:

SOIL PARAMETERS COMPLY WITH MECP TABLE 3 STANDARDS

SOIL PARAMETERS EXCEED MECP TABLE 3 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- MONITORING WELL LOCATION BY OTHERS
- 63.96 GROUND SURFACE ELEVATION (m)
- (61.29) GROUNDWATER SURFACE ELEVATION (m)

BM - TOP SPINDLE OF FIRE HYDRANT LOCATED NEAR THE SOUTHWEST CORNER OF 366 PARKDALE AVENUE. GEODETIC ELEVATION = 64.86m, AS PER FARLEY, SMITH AND DENNIS SURVEYING LTD.

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
0			

SURFACE DEVELOPMENTS

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
16 AND 20 HAMILTON AVENUE NORTH

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL

Scale: 1:250	Date: 08/2018
Drawn by: MPG	Report No.: PE4341-1
Checked by: AM	Dwg. No.: PE4341-2
Approved by: MSD	Revision No.: 0

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#89 HINTON AVENUE NORTH
RESIDENTIAL

BH 3-18 - GW1 (2.74-5.74m) 20-June-2018

Parameter	Result	Standard (ug/g)
Benzo[a]pyrene	1.41	0.81
Benzo[b]fluoranthene	1.66	0.75
Benzo[g,h,i]perylene	0.76	0.2
Benzo[k]fluoranthene	0.88	0.4
Chrysene	1.99	1.0
Indeno[1,2,3-cd]pyrene	0.72	0.2

All other PAHs parameters comply with MECP Table 3 Standards
VOC complies with MECP Table 3 Standards

#12 HAMILTON AVENUE NORTH
RESIDENTIAL

MW B - GW1 (Unknown) 15-August-2018
PAHs comply with MECP Table 3 Standards

BH 4-18 - GW1 (2.82-5.82m) 15-August-2018
PAHs comply with MECP Table 3 Standards

#85 HINTON AVENUE NORTH
RESIDENTIAL

BH 7-18
63.74

MW B

BH 4-18
63.83
(59.94)

BH 3-18
63.81
(60.62)

MW A

MW E

BH 6-18 - GW1 (2.00-5.00m) 15-August-2018
PAHs comply with MECP Table 3 Standards

BH 6-18
63.63
(60.49)

BH 1-18 - GW1 (2.23-5.23m) 20-June-2018
PAHs comply with MECP Table 3 Standards
VOCs comply with MECP Table 3 Standards
Metals comply with MECP Table 3 Standards

BH 2-18 - GW1 (2.61-5.61m) 20-June-2018
Metals comply with MECP Table 3 Standards

#16 HAMILTON AVENUE NORTH
ASPHALTIC CONCRETE PARKING LOT

#89 HINTON AVENUE NORTH
RESIDENTIAL

MW D

MW C

BH 2-18
64.18
(60.54)

BH 5-18
63.90

BH 1-18
63.92
(60.59)

#95 HINTON AVENUE NORTH
RESIDENTIAL

BH 8-18
63.96
(60.63)

MW D - GW1 (Unknown) 15-August-2018
PAHs comply with MECP Table 3 Standards

BH 9-18
63.96
(61.29)

#20 HAMILTON AVENUE NORTH

#97 HINTON AVENUE NORTH
RESIDENTIAL

BH 8-18 - GW1 (2.13-5.13m) 20-Sept.-2018
PAHs comply with MECP Table 3 Standards
BTEX comply with MECP Table 3 Standards
PHCs comply with MECP Table 3 Standards
Metals comply with MECP Table 3 Standards

BH 9-18 - GW1 (2.03-5.03m) 20-Sept.-2018
PAHs comply with MECP Table 3 Standards
BTEX comply with MECP Table 3 Standards
PHCs comply with MECP Table 3 Standards
Metals comply with MECP Table 3 Standards

#22 HAMILTON AVENUE NORTH
BOURK'S COMPLETE CAR CARE

HAMILTON AVENUE NORTH

#366 PARKDALE AVENUE
PARKDALE PARK

FH - BM

LEGEND:

GROUNDWATER PARAMETERS COMPLY WITH MECP TABLE 3 STANDARDS

GROUNDWATER PARAMETERS EXCEED MECP TABLE 3 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- MONITORING WELL LOCATION BY OTHERS
- 63.92 GROUND SURFACE ELEVATION (m)
- (60.59) GROUNDWATER SURFACE ELEVATION (m)

BBM - TOP SPINDLE OF FIRE HYDRANT LOCATED NEAR THE SOUTHWEST CORNER OF 366 PARKDALE AVENUE. GEODETIC ELEVATION = 64.86m, AS PER FARLEY, SMITH AND DENNIS SURVEYING LTD.

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
0			

SURFACE DEVELOPMENTS

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
16 AND 20 HAMILTON AVENUE NORTH

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - GROUNDWATER

Scale: 1:250	Date: 08/2018
Drawn by: MPG	Report No.: PE4341-1
Checked by: MB	Dwg. No.: PE4341-3
Approved by: MSD	Revision No.: 0

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Paterson Group Inc.

Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

patersongroup

Sampling & Analysis Plan

16 and 20 Hamilton Avenue North
Ottawa, Ontario

Prepared For

Surface Developments

June 2018
Report: PE4341-SAP

Table of Contents

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Surface Developments to prepare a Phase II-Environmental Site Assessment (ESA) for the property at 16 and 20 Hamilton Avenue, in the City of Ottawa, Ontario. Based on the historical research completed by Paterson for the subject property, the following subsurface investigation program was developed:

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	General coverage of property to assess the former foundry, as identified on the fire insurance plans.	Intercept the groundwater table to facilitate the installation of a groundwater monitoring well.
BH2		
BH3		
BH4	To west of BH3 to delineate soil and groundwater impacts	
BH5	To south of BH3 to delineate soil impacts	Through the fill layer and into the native soil to assess soil quality
BH6	To east of BH3 to delineate soil and groundwater impacts	Intercept the groundwater table to facilitate the installation of a groundwater monitoring well.
BH7	To north of BH3 to delineate soil impacts	Through the fill layer and into the native soil to assess soil quality
BH8	Within existing building footprint to determine if impacted material exists beneath the building slab	Intercept the groundwater table to facilitate the installation of a groundwater monitoring well
BH9		

Test hole locations are shown on the Test Hole Location Plan appended to the main report.

At each borehole, split-spoon samples of overburden soils will be obtained at 0.76 m (2'6") intervals until five feet below the water table. All soil samples will be retained, and samples will be selected for submission following a preliminary screening analysis.

If it is considered necessary to drill into bedrock to intercept the groundwater table, boreholes will be advanced into bedrock as required using diamond coring equipment. Rock core samples will be retained for review, but not submitted for analysis.

Following borehole drilling, monitoring wells will be installed in selected boreholes for the measurement of water levels and the collection of groundwater samples.

2.0 ANALYTICAL TESTING PROGRAM

The analytical testing program for soil at the subject site is based on the following general considerations:

- In boreholes where there is visual or olfactory evidence of contamination, or where organic vapour meter or photoionization detector (PID) readings indicate the presence of contamination, the 'worst-case' sample from each borehole should be submitted for comparison with MOE site condition standards.
- In boreholes with evidence of contamination as described above, a sample should be submitted from the stratigraphic unit below the 'worst-case' sample to determine whether the contaminant(s) have migrated downward.
- At least one sample from each borehole should be submitted, in order to delineate the horizontal extent of contamination across the site.
- Parameters analyzed should be consistent with the Contaminants of Potential Concern identified in the Phase I ESA.

The analytical testing program for groundwater at the subject site is based on the following general considerations:

- Groundwater monitoring wells should be installed in all boreholes with visual or olfactory evidence of soil contamination, in stratigraphic units where soil contamination was encountered, where those stratigraphic units are at or below the water table (i.e. a water sample can be obtained).
- Groundwater monitoring well screens should straddle the water table at sites where the contaminants of concern are suspected to be LNAPLs.
- At least one groundwater monitoring well should be installed in a stratigraphic unit below the suspected contamination, where said stratigraphic unit is water-bearing.
- Parameters analyzed should be consistent with the Contaminants of Concern identified in the Phase I ESA and with the contaminants identified in the soil samples.

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

The purpose of environmental boreholes is to identify and/or delineate contamination within the soil and/or to install groundwater monitoring wells in order to identify contamination within the groundwater.

Equipment

The following is a list of equipment that is in addition to regular drilling equipment stated in the geotechnical drilling SOP:

- Glass soil sample jars
- two buckets
- cleaning brush (toilet brush works well)
- dish detergent
- methyl hydrate
- water (if not available on site - water jugs available in trailer)
- latex or nitrile gloves (depending on suspected contaminant)
- RKI Eagle organic vapour meter or MiniRae photoionization detector (depending on contamination suspected)

Determining Borehole Locations

If conditions on site are not as suspected, and planned borehole locations cannot be drilled, **call the office to discuss**. Alternative borehole locations will be determined in conversation with the field technician and supervising engineer.

After drilling is completed a plan with the borehole locations must be provided. Distances and orientations of boreholes with respect to site features (buildings, roadways, etc.) must be provided. Distances should be measured using a measuring tape or wheel rather than paced off. Ground surface elevations at each borehole should be surveyed relative to a geodetic benchmark, if one is available, or a temporary site benchmark which can be tied in at a later date if necessary.

Drilling Procedure

The actual drilling procedure for environmental boreholes is the same as geotechnical boreholes (see SOP for drilling and sampling) with a few exceptions as follows:

- Continuous split spoon samples (every 0.6 m or 2') or semi-continuous (every 0.76 m or 2'6") are required.
- Make sure samples are well sealed in plastic bags with no holes prior to screening and are kept cool but unfrozen.
- If sampling for VOCs, BTEX, or PHCs F1, a soil core from each soil sample which may be analyzed must be taken and placed in the laboratory-provided methanol vial.
- Note all and any odours or discolouration of samples.
- Split spoon samplers must be washed between samples.
- If obvious contamination is encountered, continue sampling until vertical extent of contamination is delineated.
- As a general rule, environmental boreholes should be deep enough to intercept the groundwater table (unless this is impossible/impractical - call project manager to discuss).
- If at all possible, soil samples should be submitted to a preliminary screening procedure on site, either using a RKI Eagle, PID, visual observations, etc. depending on type of suspected contamination.

Spoon Washing Procedure

All sampling equipment (spilt spoons, etc.) must be washed between samples in order to prevent cross contamination of soil samples.

- Obtain two buckets of water (preferably hot if available)
- Add a small amount of dish soap to one bucket
- Scrub spoons with brush in soapy water, inside and out, including tip
- Rinse in clean water
- Apply a small amount of methyl hydrate to the inside of the spoon. (A spray bottle or water bottle with a small hole in the cap works well)
- Allow to dry (takes seconds)
- Rinse with distilled water, a spray bottle works well.

The methyl hydrate eliminates any soap residue that may be on the spoon, and is especially important when dealing with suspected VOCs.

Screening Procedure

The RKI Eagle is used to screen most soil samples, particularly where petroleum hydrocarbon contamination is suspected. The MiniRae is used when VOCs are suspected, however it also can be useful for detecting petroleum. These tools are for screening purposes only and cannot be used in place of laboratory testing. Vapour results obtained from the RKI Eagle and the PID are relative and must be interpreted.

Screening equipment should be calibrated on an approximately monthly basis, more frequently if heavily used.

- Samples should be brought to room temperature; this is specifically important in colder weather. Soil must not be frozen.
- Turn instrument on and allow to come to zero - calibrate if necessary
- If using RKI Eagle, ensure instrument is in methane elimination mode unless otherwise directed.
- Ensure measurement units are ppm (parts per million) initially. RKI Eagle will automatically switch to %LEL (lower explosive limit) if higher concentrations are encountered.
- Break up large lumps of soil in the sample bag, taking care not to puncture bag.
- Insert probe into soil bag, creating a seal with your hand around the opening.
- Gently manipulate soil in bag while observing instrument readings.
- Record the highest value obtained in the first 15 to 25 seconds
- Make sure to indicate scale (ppm or LEL); also note which instrument was used (RKI Eagle 1 or 2, or MiniRae).
- Jar samples and refrigerate as per Sampling and Analysis Plan.

3.2 Monitoring Well Installation Procedure

Equipment

- 1.5 m x 5 cm threaded sections of Schedule 40 PVC slotted well screen (1.5 m x 3.2 cm if installing in cored hole in bedrock)
- 1.5 m x 5 cm threaded sections of Schedule 40 PVC riser pipe (1.5 m x 3.2 cm if installing in cored hole in bedrock)
- Threaded end-cap
- Slip-cap or J-plug
- Asphalt cold patch or concrete
- Silica Sand
- Bentonite chips (Holeplug)
- Steel flushmount casing

Procedure

- Drill borehole to required depth, using drilling and sampling procedures described above.
- If borehole is deeper than required monitoring well, backfill with bentonite chips to required depth. This should only be done on wells where contamination is not suspected, in order to prevent downward migration of contamination.
- Only one monitoring well should be installed per borehole.
- Monitoring wells should not be screened across more than one stratigraphic unit to prevent potential migration of contaminants between units.
- Where LNAPLs are the suspected contaminants of concern, monitoring wells should be screened straddling the water table in order to capture any free product floating on top of the water table.
- Thread the end cap onto a section of screen. Thread second section of screen if required. Thread risers onto screen. Lower into borehole to required depth. Ensure slip-cap or J-plug is inserted to prevent backfill materials entering well.
- As drillers remove augers, backfill borehole annulus with silica sand until the level of sand is approximately 0.3 m above the top of the screen.
- Backfill with holeplug until at least 0.3 m of holeplug is present above the top of the silica sand.
- Backfill remainder of borehole with holeplug or with auger cuttings (if contamination is not suspected).

- Install flushmount casing. Seal space between flushmount and borehole annulus with concrete, cold patch, or holeplug to match surrounding ground surface.

3.3 Monitoring Well Sampling Procedure

Equipment

- Water level metre or interface probe on hydrocarbon/LNAPL sites
- Spray bottles containing water and methanol to clean water level tape or interface probe
- Peristaltic pump
- Polyethylene tubing for peristaltic pump
- Flexible tubing for peristaltic pump
- Latex or nitrile gloves (depending on suspected contaminant)
- Allen keys and/or 9/16" socket wrench to remove well caps
- Graduated bucket with volume measurements
- Portable pH/Temperature/Conductivity analyzer
- Laboratory-supplied sample bottles

Sampling Procedure

- Locate well and use socket wrench or Allan key to open metal flush mount protector cap. Remove plastic well cap.
- Measure water level, with respect to existing ground surface, using water level meter or interface probe. If using interface probe on suspected NAPL site, measure the thickness of free product.
- Measure total depth of well.
- Clean water level tape or interface probe using methanol and water. Change gloves between wells.
- Calculate volume of standing water within well and record.
- Insert polyethylene tubing into well and attach to peristaltic pump. Turn on peristaltic pump and purge into graduated bucket. Purge at least three well volumes of water from the well. Measure and record field chemistry. Continue to purge, measuring field chemistry after every well volume purged, until appearance or field chemistry stabilizes.
- Note appearance of purge water, including colour, opacity (clear, cloudy, silty), sheen, presence of LNAPL, and odour. Note any other unusual features (particulate matter, effervescence (bubbling) of dissolved gas, etc.).

- Fill required sample bottles. If sampling for metals, attach 75-micron filter to discharge tube and filter metals sample. If sampling for VOCs, use low flow rate to ensure continuous stream of non-turbulent flow into sample bottles. Ensure no headspace is present in VOC vials.
- Replace well cap and flushmount casing cap.

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The QA/QC program for this Phase II ESA is as follows:

- All non-dedicated sampling equipment (split spoons) will be decontaminated according to the SOPs listed above.
- All groundwater sampling equipment is dedicated (polyethylene and flexible peristaltic tubing is replaced for each well).
- Where groundwater samples are to be analyzed for VOCs, one laboratory-provided trip blank will be submitted for analysis with every laboratory submission.
- Approximately one (1) field duplicate will be submitted for every ten (10) samples submitted for laboratory analysis. A minimum of one (1) field duplicate per project will be submitted. Field duplicates will be submitted for soil and groundwater samples where possible.
- Where multi-parameter analyzers are used to measure field chemistry, they will be calibrated on an approximately monthly basis, according to frequency of use.

5.0 DATA QUALITY OBJECTIVES

The purpose of setting data quality objectives (DQOs) is to ensure that the level of uncertainty in data collected during the Phase II ESA is low enough that decision-making is not affected, and that the overall objectives of the investigation are met.

The quality of data is assessed by comparing field duplicates with original samples. If the relative percent difference (RPD) between the duplicate and the sample is within 20%, the data are considered to be of sufficient quality so as not to affect decision-making. The RPD is calculated as follows:

$$RPD = \left| \frac{x_1 - x_2}{(x_1 + x_2)/2} \right| \times 100\%$$

Where x_1 is the concentration of a given parameter in an original sample and x_2 is the concentration of that same parameter in the field duplicate sample.

For the purpose of calculating the RPD, it is desirable to select field duplicates from samples for which parameters are present in concentrations above laboratory detection limits, i.e. samples which are expected to be contaminated. If parameters are below laboratory detection limits for selected samples or duplicates, the RPD may be calculated using a concentration equal to the laboratory detection limit.

It is also important to consider data quality in the overall context of the project. For example, if the DQOs are not met for a given sample, yet the concentrations of contaminants in both the sample and the duplicate exceed the MOE site remediation standards by a large margin, the decision-making usefulness of the sample may not be considered to be impaired. The proximity of other samples which meet the DQOs must also be considered in developing the Phase II Conceptual Site Model; often there are enough data available to produce a reliable Phase II Conceptual Site Model even if DQOs are not met for certain individual samples.

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

- The location of underground utilities
- Poor recovery of split-spoon soil samples
- Insufficient groundwater volume for groundwater samples
- Breakage of sampling containers following sampling or while in transit to the laboratory
- Elevated detection limits due to matrix interference (generally related to soil colour or presence of organic material)
- Elevated detection limits due to high concentrations of certain parameters, necessitating dilution of samples in laboratory
- Drill rig breakdowns
- Winter conditions
- Other site-specific impediments

Site-specific impediments to the Sampling and Analysis plan are discussed in the body of the Phase II ESA report.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
16 and 20 Hamilton Avenue North
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located near the southwest corner of 366 Parkdale Avenue. Geodetic elevation = 64.86m, as per Farley, Smith and Denis Surveying Ltd.

REMARKS

FILE NO. PE4341

HOLE NO. BH 1-18

BORINGS BY CME 55 Power Auger **DATE** June 13, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
UNDERSIDE OF FOUNDATION							
Asphaltic concrete 0.05						0	63.92
FILL: Crushed stone 0.18		AU	1				
FILL: Brown clayey topsoil, trace construction debris		SS	2	62	10	1	62.92
1.52							
Very stiff, brown **SILTY CLAY**		SS	3	79	13	2	61.92
2.29							
GLACIAL TILL: Brown silty sand, some clay, with gravel, cobbles, boulders		SS	4	96	22	3	60.92
		SS	5	42	13		
		SS	6	33	W	4	59.92
		SS	7	67	10	5	58.92
5.23							
End of Borehole							
Practical refusal to augering at 5.23m depth							
(GWL @ 3.33m - Sept. 20, 2018)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
16 and 20 Hamilton Avenue North
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located near the southwest corner of 366 Parkdale Avenue. Geodetic elevation = 64.86m, as per Farley, Smith and Denis Surveying Ltd.

REMARKS

FILE NO. PE4341

HOLE NO. BH 2-18

BORINGS BY CME 55 Power Auger **DATE** June 13, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
UNDERSIDE OF FOUNDATION						0	64.18
Asphaltic concrete 0.08							
FILL: Crushed stone 0.18		AU	1				
FILL: Brown clayey topsoil, trace ash/cinders		SS	2	54	6	1	63.18
1.52							
Stiff, brown **SILTY CLAY**		SS	3	50	9	2	62.18
2.29		SS	4	71	50+		
GLACIAL TILL: Brown silty sand, some clay, with gravel, cobbles, boulders		SS	5	75	41	3	61.18
		SS	6	54	9	4	60.18
		SS	7	42	28	5	59.18
5.61		SS	8	36	50+		
End of Borehole							
Practical refusal to augering at 5.61m depth							
(GWL @3.64m - Sept. 20, 2018)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

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16 and 20 Hamilton Avenue North
Ottawa, Ontario

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REMARKS

FILE NO. PE4341

HOLE NO. BH 3-18

BORINGS BY CME 55 Power Auger **DATE** June 13, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
UNDERSIDE OF FOUNDATION							
Asphaltic concrete 0.05							
FILL: Crushed stone 0.15		AU	1				
FILL: Brown clayey topsoil, trace construction debris		SS	2	38	11	1	62.81
1.52							
Stiff, brown **SILTY CLAY**		SS	3	50	7	2	61.81
2.29							
GLACIAL TILL: Brown silty sand, some clay, with gravel, cobbles, boulders		SS	4	92	26	3	60.81
		SS	5	42	10		
		SS	6	50	W	4	59.81
		SS	7	29	50+	5	58.81
5.74							
End of Borehole							
Practical refusal to augering at 5.74m depth							
(GWL @ 3.19m - Sept. 20, 2018)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

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16 and 20 Hamilton Avenue North
Ottawa, Ontario

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REMARKS

FILE NO. PE4341

HOLE NO. BH 4-18

BORINGS BY CME 55 Power Auger **DATE** August 10, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
UNDERSIDE OF FOUNDATION							
Asphaltic concrete 0.05		AU	1			0	63.83
FILL: Brown silty sand, some gravel		SS	2	46	7	1	62.83
1.52							
GLACIAL TILL: Brown silty clay with sand and gravel		SS	3	54	12	2	61.83
		SS	4	79	10		
3.05						3	60.83
GLACIAL TILL: Grey silty sand with gravel, cobbles, boulders, trace clay		SS	5	58	63	4	59.83
		SS	6	46	32		
		SS	7	54	19	5	58.83
		SS	8	100	50+		
5.82							
End of Borehole							
Practical refusal to augering at 5.82m depth							
(GWL @ 3.89m - Sept. 20, 2018)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

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REMARKS

FILE NO. PE4341

HOLE NO. BH 5-18

BORINGS BY CME 55 Power Auger **DATE** August 10, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: Volatile Organic Rdg. (ppm) / Lower Explosive Limit %	Monitoring Well Construction
UNDERSIDE OF FOUNDATION									
Asphaltic concrete 0.05		AU	1			0	63.90		
FILL: Brown silty sand, some gravel, clay, trace organics		SS	2	54	22	1	62.90		
1.37									
Stiff, brown **SILTY CLAY**		SS	3	58	9	2	61.90		
2.29									
GLACIAL TILL: Brown to grey silty sand with clay, gravel, cobbles, boulders		SS	4	62	16	3	60.90		
		SS	5	75	14				
		SS	6	17	15	4	59.90		
		SS	7	67	26	5	58.90		
5.18									
End of Borehole									

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)
○ Lower Explosive Limit %
20 40 60 80
100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE AND TEST DATA

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Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located near the southwest corner of 366 Parkdale Avenue. Geodetic elevation = 64.86m, as per Farley, Smith and Denis Surveying Ltd.

REMARKS

FILE NO. PE4341

HOLE NO. BH 6-18

BORINGS BY CME 55 Power Auger **DATE** August 10, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
UNDERSIDE OF FOUNDATION						0	63.63
Asphaltic concrete 0.05							
FILL: Gravel, some silty sand 0.15		AU	1				
FILL: Brown silty sand, some gravel 0.91		SS	2	54	14	1	62.63
Very stiff, brown **SILTY CLAY** 1.52		SS	3	79	20	2	61.63
GLACIAL TILL: Brown silty clay, some sand, gravel, cobbles, boulders 2.90		SS	4	42	58	3	60.63
GLACIAL TILL: Grey silty sand with gravel, cobbles, boulders, some clay 5.00		SS	5	42	23	4	59.63
End of Borehole		SS	6	33	7	5	58.63
Practical refusal to augering at 5.00m depth		SS	7	35	50+		
(GWL @ 3.14m - Sept. 20, 2018)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE AND TEST DATA

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REMARKS

FILE NO. PE4341

HOLE NO. BH 7-18

BORINGS BY CME 55 Power Auger **DATE** August 10, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: Volatile Organic Rdg. (ppm) / Lower Explosive Limit %	Monitoring Well Construction
UNDERSIDE OF FOUNDATION									
Asphaltic concrete 0.05		AU	1			0	63.74		
FILL: Brown silty sand, some gravel, trace organics		SS	2	67	11	1	62.74		
1.52									
Very stiff, brown **SILTY CLAY**		SS	3	67	9	2	61.74		
2.29		SS	4	33	50+				
GLACIAL TILL: Grey silty sand, some gravel, cobbles, boulders, trace clay		SS	5	83	42	3	60.74		
		SS	6	71	21	4	59.74		
4.42									
End of Borehole									

Photo Ionization Detector: ○ Lower Explosive Limit % — 20 40 60 80

RKI Eagle Rdg. (ppm) — 100 200 300 400 500

▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE AND TEST DATA

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REMARKS

BORINGS BY Portable Drill **DATE** September 7, 2018

FILE NO. PE4341

HOLE NO. BH 8-18

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
UNDERSIDE OF FOUNDATION							
Concrete Slab 0.13						0	63.96
FILL: Brown silty sand with gravel , trace slag concrete		G	1				
0.91		SS	2	75		1	62.96
Grey **SILTY CLAY** trace gravel		SS	3	100			
		SS	4	36		2	61.96
2.44		SS	5	29			
GLACIAL TILL: Dense, grey silty sand with clay, gravel, cobbles and boulders		SS	6	89		3	60.96
		SS	7	31			
		SS	8	96		4	59.96
		SS	9	68			
5.13						5	58.96
End of Borehole							
Practical refusal to augering at 5.13m depth							
(GWL @ 3.33m - Sept. 20, 2018)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
16 and 20 Hamilton Avenue North
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located near the southwest corner of 366 Parkdale Avenue. Geodetic elevation = 64.86m, as per Farley, Smith and Denis Surveying Ltd.

REMARKS

BORINGS BY Portable Drill **DATE** September 7, 2018

FILE NO. PE4341

HOLE NO. BH 9-18

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
UNDERSIDE OF FOUNDATION							
Concrete Slab		G	1			0	63.96
0.28							
FILL: Brown silty sand with sand		SS	2	38		1	62.96
0.91							
		SS	3	96			
Brown **SILTY CLAY** trace sand		SS	4	96		2	61.96
		SS	5	100			
3.05						3	60.96
		SS	6	33			
GLACIAL TILL: Dense, grey silty sand with gravel, some cobbles		SS	7	92		4	59.96
		SS	8	96			
5.03						5	58.96
End of Borehole							
Practical refusal to augeringl at 5.03m depth							
(GWL @ 2.67m - Sept. 20, 2018)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

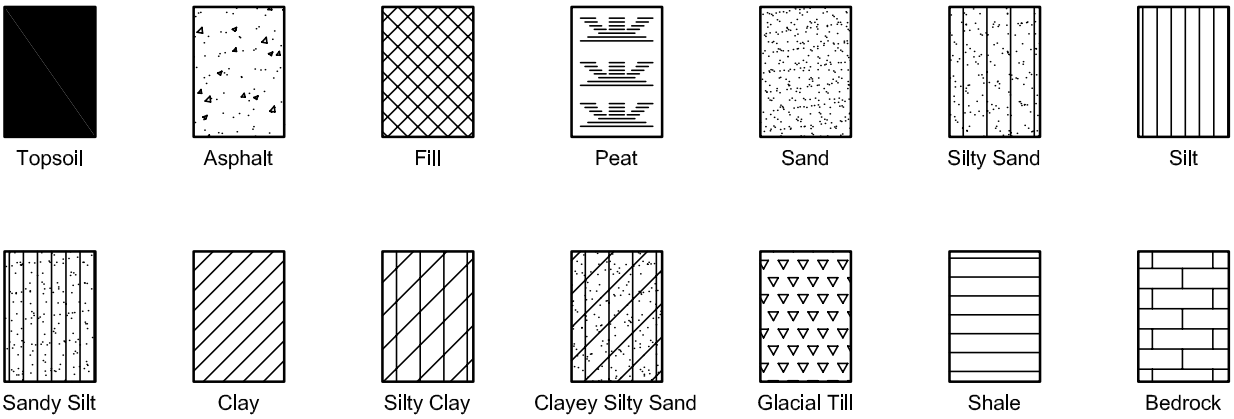
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

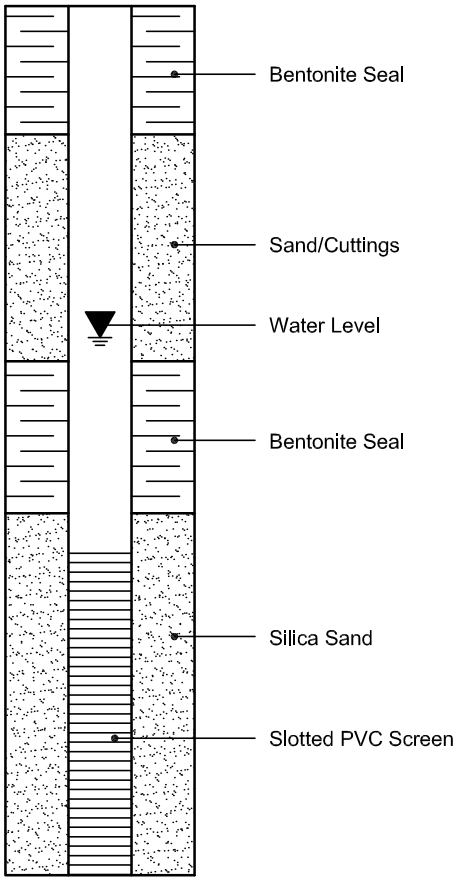
SYMBOLS AND TERMS (continued)

STRATA PLOT

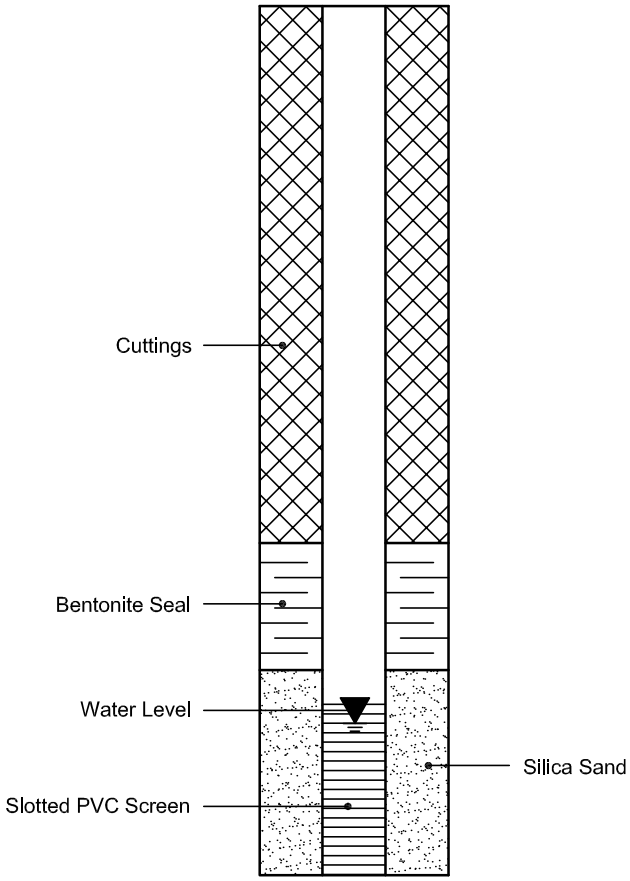


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Adrian Menyhart

Client PO: 24160
Project: PE4341
Custody: 117231

Report Date: 20-Jun-2018
Order Date: 13-Jun-2018

Order #: 1824400

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

Paracel ID	Client ID
1824400-01	BH1-SS2
1824400-02	BH2-SS2
1824400-03	BH3-SS2

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24160

Report Date: 20-Jun-2018
Order Date: 13-Jun-2018
Project Description: PE4341

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 7471B - CVAA, digestion	14-Jun-18	14-Jun-18
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	18-Jun-18	19-Jun-18
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	14-Jun-18	15-Jun-18
Solids, %	Gravimetric, calculation	15-Jun-18	15-Jun-18

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24160

Report Date: 20-Jun-2018
Order Date: 13-Jun-2018
Project Description: PE4341

	Client ID:	BH1-SS2	BH2-SS2	BH3-SS2	-
	Sample Date:	06/13/2018 09:00	06/13/2018 09:00	06/13/2018 09:00	-
	Sample ID:	1824400-01	1824400-02	1824400-03	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	80.7	88.6	81.0	-
Metals					
Antimony	1.0 ug/g dry	6.4	1.6	-	-
Arsenic	1.0 ug/g dry	5.8	3.8	-	-
Barium	1.0 ug/g dry	319	212	-	-
Beryllium	0.5 ug/g dry	0.7	0.6	-	-
Boron	5.0 ug/g dry	29.7	25.1	-	-
Cadmium	0.5 ug/g dry	<0.5	<0.5	-	-
Chromium	5.0 ug/g dry	57.1	47.9	-	-
Cobalt	1.0 ug/g dry	14.9	10.9	-	-
Copper	5.0 ug/g dry	54.3	63.8	-	-
Lead	1.0 ug/g dry	490	58.2	-	-
Mercury	0.1 ug/g dry	0.3	<0.1	-	-
Molybdenum	1.0 ug/g dry	1.2	<1.0	-	-
Nickel	5.0 ug/g dry	39.4	17.5	-	-
Selenium	1.0 ug/g dry	3.6	2.7	-	-
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	<1.0	<1.0	-	-
Vanadium	10.0 ug/g dry	78.4	71.4	-	-
Zinc	20.0 ug/g dry	206	97.1	-	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	-	<0.02	302 [2]	-
Acenaphthylene	0.02 ug/g dry	-	<0.02	<16.0 [1] [2]	-
Anthracene	0.02 ug/g dry	-	0.03	451 [2]	-
Benzo [a] anthracene	0.02 ug/g dry	-	0.05	487 [2]	-
Benzo [a] pyrene	0.02 ug/g dry	-	0.05	371 [2]	-
Benzo [b] fluoranthene	0.02 ug/g dry	-	0.06	462 [2]	-
Benzo [g,h,i] perylene	0.02 ug/g dry	-	0.03	171 [2]	-
Benzo [k] fluoranthene	0.02 ug/g dry	-	0.03	258 [2]	-
Chrysene	0.02 ug/g dry	-	0.06	511 [2]	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	-	<0.02	58.5 [2]	-
Fluoranthene	0.02 ug/g dry	-	0.13	1730 [2]	-
Fluorene	0.02 ug/g dry	-	<0.02	386 [2]	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	-	0.03	195 [2]	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24160

Report Date: 20-Jun-2018
Order Date: 13-Jun-2018
Project Description: PE4341

	Client ID:	BH1-SS2	BH2-SS2	BH3-SS2	-
	Sample Date:	06/13/2018 09:00	06/13/2018 09:00	06/13/2018 09:00	-
	Sample ID:	1824400-01	1824400-02	1824400-03	-
	MDL/Units	Soil	Soil	Soil	-
1-Methylnaphthalene	0.02 ug/g dry	-	<0.02	89.2 [2]	-
2-Methylnaphthalene	0.02 ug/g dry	-	0.02	179 [2]	-
Methylnaphthalene (1&2)	0.04 ug/g dry	-	<0.04	268 [2]	-
Naphthalene	0.01 ug/g dry	-	0.04	866 [2]	-
Phenanthrene	0.02 ug/g dry	-	0.12	1980 [2]	-
Pyrene	0.02 ug/g dry	-	0.11	1270 [2]	-
2-Fluorobiphenyl	Surrogate	-	104%	-	-
Terphenyl-d14	Surrogate	-	108%	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
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	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	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.55*		*ug/g*		*116*	*50-140*			
Surrogate: Terphenyl-d14	*1.63*		*ug/g*		*122*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	6.8	1.0	ug/g dry	6.4			5.7	30	
Arsenic	5.7	1.0	ug/g dry	5.8			2.2	30	
Barium	308	1.0	ug/g dry	319			3.6	30	
Beryllium	0.7	0.5	ug/g dry	0.7			1.1	30	
Boron	33.8	5.0	ug/g dry	29.7			12.8	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium	55.2	5.0	ug/g dry	57.1			3.4	30	
Cobalt	14.3	1.0	ug/g dry	14.9			4.4	30	
Copper	53.1	5.0	ug/g dry	54.3			2.2	30	
Lead	477	1.0	ug/g dry	490			2.7	30	
Mercury	0.224	0.1	ug/g dry	0.287			24.9	30	
Molybdenum	1.1	1.0	ug/g dry	1.2			3.0	30	
Nickel	35.8	5.0	ug/g dry	39.4			9.6	30	
Selenium	3.3	1.0	ug/g dry	3.6			9.0	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	ND			0.0	30	
Vanadium	75.5	10.0	ug/g dry	78.4			3.7	30	
Zinc	201	20.0	ug/g dry	206			2.4	30	
Physical Characteristics									
% Solids	82.9	0.1	% by Wt.	82.1			0.9	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND				40	
Acenaphthylene	ND	0.02	ug/g dry	ND			0.0	40	
Anthracene	ND	0.02	ug/g dry	ND			0.0	40	
Benzo [a] anthracene	ND	0.02	ug/g dry	ND			0.0	40	
Benzo [a] pyrene	ND	0.02	ug/g dry	ND			0.0	40	
Benzo [b] fluoranthene	ND	0.02	ug/g dry	ND			0.0	40	
Benzo [g,h,i] perylene	ND	0.02	ug/g dry	ND			0.0	40	
Benzo [k] fluoranthene	ND	0.02	ug/g dry	ND			0.0	40	
Chrysene	ND	0.02	ug/g dry	ND			0.0	40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND				40	
Fluoranthene	0.039	0.02	ug/g dry	0.036			9.2	40	
Fluorene	ND	0.02	ug/g dry	ND				40	
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g dry	ND			0.0	40	
1-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
2-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
Naphthalene	ND	0.01	ug/g dry	ND				40	
Phenanthrene	ND	0.02	ug/g dry	0.022			0.0	40	
Pyrene	0.032	0.02	ug/g dry	0.029			11.6	40	
Surrogate: 2-Fluorobiphenyl	*1.69*		*ug/g dry*		*111*	*50-140*			
Surrogate: Terphenyl-d14	*1.70*		*ug/g dry*		*112*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	50.6		ug/L	2.6	96.2	70-130			
Arsenic	52.9		ug/L	2.3	101	70-130			
Barium	179		ug/L	128	103	70-130			
Beryllium	42.7		ug/L	ND	84.8	70-130			
Boron	46.6		ug/L	11.9	69.3	70-130			QM-07
Cadmium	46.7		ug/L	ND	93.0	70-130			
Chromium	72.0		ug/L	22.8	98.3	70-130			
Cobalt	53.6		ug/L	6.0	95.3	70-130			
Copper	69.2		ug/L	21.7	95.0	70-130			
Lead	232		ug/L	196	71.5	70-130			
Mercury	1.55	0.1	ug/g	0.287	84.2	70-130			
Molybdenum	47.2		ug/L	ND	93.5	70-130			
Nickel	62.7		ug/L	15.8	93.8	70-130			
Selenium	45.8		ug/L	1.4	88.7	70-130			
Silver	45.8		ug/L	ND	91.4	70-130			
Thallium	44.0		ug/L	ND	87.6	70-130			
Uranium	49.8		ug/L	ND	98.9	70-130			
Vanadium	81.1		ug/L	31.3	99.5	70-130			
Zinc	129		ug/L	82.5	93.7	70-130			
Semi-Volatiles									
Acenaphthene	0.185	0.02	ug/g	ND	97.3	50-140			
Acenaphthylene	0.177	0.02	ug/g	ND	92.8	50-140			
Anthracene	0.180	0.02	ug/g	ND	94.4	50-140			
Benzo [a] anthracene	0.194	0.02	ug/g	ND	102	50-140			
Benzo [a] pyrene	0.183	0.02	ug/g	ND	96.1	50-140			
Benzo [b] fluoranthene	0.264	0.02	ug/g	ND	138	50-140			
Benzo [g,h,i] perylene	0.176	0.02	ug/g	ND	92.4	50-140			
Benzo [k] fluoranthene	0.254	0.02	ug/g	ND	134	50-140			
Chrysene	0.217	0.02	ug/g	ND	114	50-140			
Dibenzo [a,h] anthracene	0.182	0.02	ug/g	ND	95.8	50-140			
Fluoranthene	0.228	0.02	ug/g	0.036	101	50-140			
Fluorene	0.197	0.02	ug/g	ND	103	50-140			
Indeno [1,2,3-cd] pyrene	0.191	0.02	ug/g	ND	100	50-140			
1-Methylnaphthalene	0.177	0.02	ug/g	ND	93.1	50-140			
2-Methylnaphthalene	0.197	0.02	ug/g	ND	103	50-140			
Naphthalene	0.166	0.01	ug/g	ND	87.0	50-140			
Phenanthrene	0.200	0.02	ug/g	0.022	93.4	50-140			
Pyrene	0.223	0.02	ug/g	0.029	102	50-140			
Surrogate: 2-Fluorobiphenyl	*1.62*		*ug/g*		*107*	*50-140*			

Qualifier Notes:

Sample Qualifiers :

1 : Elevated detection limit due to dilution required because of high target analyte concentration.

2 : Surrogates not available due to extract dilution.

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.

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.

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Chain of Custody (Lab Use Only)

№ 117231

Page 1 of 1

Client Name: Paterson Group	Project Reference: PE4341		**Turnaround Time:**
Contact Name: ADRIAN MENYHART	Quote #		☐ 1 Day ☐ 3 Day
Address: 154 Colonnade Rd S	PO # 24160		☐ 2 Day ☑ Regular
Telephone: 613-226-7381	Email Address: amenyhart@patersongroup.ca		Date Required:

Criteria: ☑ O. Reg. 153/04 (As Amended) Table 3 ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ______ ☐ Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1824400

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Date	Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)							
1	BH1-SS2	S		1	June 13	am				✓	✓					-250ml-				
2	BH2-SS2 ✓	S		1 2 ✓	(")	(")			✓	✓	✓					↓				
3	BH3-SS2	S		1	(")	(")			✓											
4	BH3-SS3 ✓	S		2 ✓	(")	(")	✓									120ml + 1 vial				
5																				
6																				
7	HOLD																			
8																				
9																				
10																				

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): [signature]	Received by Driver/Depot: M. Trouse	Received at Lab: Sumpporn Dokmai	Verified By: [signature]
Relinquished By (Print): Adrian Menyhart	Date/Time: 13/06/18 4:10 PM	Date/Time: June 13, 2018 05:15	Date/Time: 061318 5:34
Date/Time: June 13 2018	Temperature: °C	Temperature: 20.7 °C	pH Verified [ ] By:

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Adrian Menyhart

Client PO: 24108
Project: PE4341
Custody: 116635

Report Date: 27-Jun-2018
Order Date: 21-Jun-2018

Order #: 1825681

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

Paracel ID	Client ID
1825681-01	BH1-GW1
1825681-02	BH2-GW1
1825681-03	BH3-GW1

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24108

Report Date: 27-Jun-2018
Order Date: 21-Jun-2018
Project Description: PE4341

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	25-Jun-18	27-Jun-18
Metals, ICP-MS	EPA 200.8 - ICP-MS	27-Jun-18	27-Jun-18
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	26-Jun-18	26-Jun-18
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	22-Jun-18	23-Jun-18

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24108

Report Date: 27-Jun-2018
Order Date: 21-Jun-2018
Project Description: PE4341

	Client ID:	BH1-GW1	BH2-GW1	BH3-GW1	-
	Sample Date:	06/20/2018 00:00	06/20/2018 00:00	06/20/2018 00:00	-
	Sample ID:	1825681-01	1825681-02	1825681-03	-
	MDL/Units	Water	Water	Water	-
Metals					
Mercury	0.1 ug/L	<0.1	<0.1	-	-
Antimony	0.5 ug/L	<0.5	<0.5	-	-
Arsenic	1 ug/L	<1	1	-	-
Barium	1 ug/L	187	175	-	-
Beryllium	0.5 ug/L	<0.5	<0.5	-	-
Boron	10 ug/L	127	141	-	-
Cadmium	0.1 ug/L	<0.1	<0.1	-	-
Chromium	1 ug/L	<1	<1	-	-
Cobalt	0.5 ug/L	0.7	0.8	-	-
Copper	0.5 ug/L	1.6	1.3	-	-
Lead	0.1 ug/L	<0.1	<0.1	-	-
Molybdenum	0.5 ug/L	1.2	4.2	-	-
Nickel	1 ug/L	2	5	-	-
Selenium	1 ug/L	<1	<1	-	-
Silver	0.1 ug/L	<0.1	<0.1	-	-
Sodium	200 ug/L	66400	157000	-	-
Thallium	0.1 ug/L	<0.1	0.1	-	-
Uranium	0.1 ug/L	2.3	3.9	-	-
Vanadium	0.5 ug/L	0.7	0.7	-	-
Zinc	5 ug/L	<5	<5	-	-
Volatiles					
Acetone	5.0 ug/L	<5.0	-	<5.0	-
Benzene	0.5 ug/L	<0.5	-	<0.5	-
Bromodichloromethane	0.5 ug/L	<0.5	-	<0.5	-
Bromoform	0.5 ug/L	<0.5	-	<0.5	-
Bromomethane	0.5 ug/L	<0.5	-	<0.5	-
Carbon Tetrachloride	0.2 ug/L	<0.2	-	<0.2	-
Chlorobenzene	0.5 ug/L	<0.5	-	<0.5	-
Chloroform	0.5 ug/L	<0.5	-	<0.5	-
Dibromochloromethane	0.5 ug/L	<0.5	-	<0.5	-
Dichlorodifluoromethane	1.0 ug/L	<1.0	-	<1.0	-
1,2-Dichlorobenzene	0.5 ug/L	<0.5	-	<0.5	-
1,3-Dichlorobenzene	0.5 ug/L	<0.5	-	<0.5	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	-	<0.5	-
1,1-Dichloroethane	0.5 ug/L	<0.5	-	<0.5	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24108

Report Date: 27-Jun-2018
Order Date: 21-Jun-2018
Project Description: PE4341

	Client ID:	BH1-GW1	BH2-GW1	BH3-GW1	-
	Sample Date:	06/20/2018 00:00	06/20/2018 00:00	06/20/2018 00:00	-
	Sample ID:	1825681-01	1825681-02	1825681-03	-
	MDL/Units	Water	Water	Water	-
1,2-Dichloroethane	0.5 ug/L	<0.5	-	<0.5	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	-	<0.5	-
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	<0.5	-
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	<0.5	-
1,2-Dichloropropane	0.5 ug/L	<0.5	-	<0.5	-
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	-
Ethylbenzene	0.5 ug/L	<0.5	-	<0.5	-
Ethylene dibromide (dibromoethan	0.2 ug/L	<0.2	-	<0.2	-
Hexane	1.0 ug/L	<1.0	-	<1.0	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	-	<5.0	-
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	-	<5.0	-
Methyl tert-butyl ether	2.0 ug/L	<2.0	-	<2.0	-
Methylene Chloride	5.0 ug/L	<5.0	-	<5.0	-
Styrene	0.5 ug/L	<0.5	-	<0.5	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	-	<0.5	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	-	<0.5	-
Tetrachloroethylene	0.5 ug/L	<0.5	-	<0.5	-
Toluene	0.5 ug/L	<0.5	-	<0.5	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	-	<0.5	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	-	<0.5	-
Trichloroethylene	0.5 ug/L	<0.5	-	<0.5	-
Trichlorofluoromethane	1.0 ug/L	<1.0	-	<1.0	-
Vinyl chloride	0.5 ug/L	<0.5	-	<0.5	-
m,p-Xylenes	0.5 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-Bromofluorobenzene	Surrogate	108%	-	102%	-
Dibromofluoromethane	Surrogate	112%	-	114%	-
Toluene-d8	Surrogate	93.6%	-	93.7%	-
Semi-Volatiles					
Acenaphthene	0.05 ug/L	<0.05	-	0.48	-
Acenaphthylene	0.05 ug/L	<0.05	-	0.08	-
Anthracene	0.01 ug/L	<0.01	-	0.85	-
Benzo [a] anthracene	0.01 ug/L	<0.01	-	1.63	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 24108

Report Date: 27-Jun-2018

Order Date: 21-Jun-2018

Project Description: PE4341

	Client ID:	BH1-GW1	BH2-GW1	BH3-GW1	-
	Sample Date:	06/20/2018 00:00	06/20/2018 00:00	06/20/2018 00:00	-
	Sample ID:	1825681-01	1825681-02	1825681-03	-
	MDL/Units	Water	Water	Water	-
Benzo [a] pyrene	0.01 ug/L	<0.01	-	1.41	-
Benzo [b] fluoranthene	0.05 ug/L	<0.05	-	1.66	-
Benzo [g,h,i] perylene	0.05 ug/L	<0.05	-	0.76	-
Benzo [k] fluoranthene	0.05 ug/L	<0.05	-	0.88	-
Chrysene	0.05 ug/L	<0.05	-	1.99	-
Dibenzo [a,h] anthracene	0.05 ug/L	<0.05	-	0.20	-
Fluoranthene	0.01 ug/L	<0.01	-	4.70	-
Fluorene	0.05 ug/L	<0.05	-	0.58	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	<0.05	-	0.72	-
1-Methylnaphthalene	0.05 ug/L	<0.05	-	0.11	-
2-Methylnaphthalene	0.05 ug/L	<0.05	-	0.16	-
Methylnaphthalene (1&2)	0.10 ug/L	<0.10	-	0.28	-
Naphthalene	0.05 ug/L	<0.05	-	0.57	-
Phenanthrene	0.05 ug/L	<0.05	-	4.20	-
Pyrene	0.01 ug/L	<0.01	-	3.72	-
2-Fluorobiphenyl	Surrogate	89.8%	-	77.7%	-
Terphenyl-d14	Surrogate	112%	-	106%	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Mercury	ND	0.1	ug/L						
Antimony	ND	0.5	ug/L						
Arsenic	ND	1	ug/L						
Barium	ND	1	ug/L						
Beryllium	ND	0.5	ug/L						
Boron	ND	10	ug/L						
Cadmium	ND	0.1	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						
Semi-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						
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	*15.9*		*ug/L*		*79.5*	*50-140*			
Surrogate: Terphenyl-d14	*14.4*		*ug/L*		*71.8*	*50-140*			
Volatiles									
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						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
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						
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	*83.6*		*ug/L*		*104*	*50-140*			
Surrogate: Dibromofluoromethane	*82.5*		*ug/L*		*103*	*50-140*			
Surrogate: Toluene-d8	*74.5*		*ug/L*		*93.2*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
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	20.6	1	ug/L	21.3			3.3	20	
Beryllium	ND	0.5	ug/L	ND			0.0	20	
Boron	23	10	ug/L	27			17.7	20	
Cadmium	ND	0.1	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	1.32	0.5	ug/L	1.31			1.1	20	
Lead	0.10	0.1	ug/L	ND			0.0	20	
Molybdenum	0.98	0.5	ug/L	0.89			10.3	20	
Nickel	ND	1	ug/L	ND			0.0	20	
Selenium	ND	1	ug/L	ND			0.0	20	
Silver	ND	0.1	ug/L	ND			0.0	20	
Sodium	15200	200	ug/L	15600			3.0	20	
Thallium	ND	0.1	ug/L	ND			0.0	20	
Uranium	ND	0.1	ug/L	ND			0.0	20	
Vanadium	ND	0.5	ug/L	ND			0.0	20	
Zinc	5	5	ug/L	5			0.6	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	
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	

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24108

Report Date: 27-Jun-2018
Order Date: 21-Jun-2018
Project Description: PE4341

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
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	*83.1*		*ug/L*		*104*	*50-140*			
Surrogate: Dibromofluoromethane	*92.2*		*ug/L*		*115*	*50-140*			
Surrogate: Toluene-d8	*75.2*		*ug/L*		*94.0*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Mercury	2.99	0.1	ug/L	ND	99.7	70-130			
Antimony	48.4		ug/L		96.8	80-120			
Arsenic	53.2		ug/L		106	80-120			
Barium	46.5		ug/L		93.0	80-120			
Beryllium	49.2		ug/L		98.3	80-120			
Boron	49		ug/L		98.5	80-120			
Cadmium	51.0		ug/L		102	80-120			
Chromium	51.6		ug/L		103	80-120			
Cobalt	50.6		ug/L		101	80-120			
Copper	50.7		ug/L		101	80-120			
Lead	45.0		ug/L		90.0	80-120			
Molybdenum	49.7		ug/L		99.5	80-120			
Nickel	50.7		ug/L		101	80-120			
Selenium	50.4		ug/L		101	80-120			
Silver	50.4		ug/L		101	80-120			
Sodium	1010		ug/L		101	80-120			
Thallium	45.9		ug/L		91.7	80-120			
Uranium	51.7		ug/L		103	80-120			
Vanadium	51.9		ug/L		104	80-120			
Zinc	50		ug/L		99.6	80-120			
Semi-Volatiles									
Acenaphthene	5.04	0.05	ug/L		101	50-140			
Acenaphthylene	4.67	0.05	ug/L		93.5	50-140			
Anthracene	4.34	0.01	ug/L		86.8	50-140			
Benzo [a] anthracene	4.27	0.01	ug/L		85.4	50-140			
Benzo [a] pyrene	4.95	0.01	ug/L		99.0	50-140			
Benzo [b] fluoranthene	5.90	0.05	ug/L		118	50-140			
Benzo [g,h,i] perylene	4.75	0.05	ug/L		94.9	50-140			
Benzo [k] fluoranthene	5.28	0.05	ug/L		106	50-140			
Chrysene	5.11	0.05	ug/L		102	50-140			
Dibenzo [a,h] anthracene	5.05	0.05	ug/L		101	50-140			
Fluoranthene	4.73	0.01	ug/L		94.6	50-140			
Fluorene	4.66	0.05	ug/L		93.2	50-140			
Indeno [1,2,3-cd] pyrene	5.20	0.05	ug/L		104	50-140			
1-Methylnaphthalene	4.31	0.05	ug/L		86.2	50-140			
2-Methylnaphthalene	4.67	0.05	ug/L		93.4	50-140			
Naphthalene	4.49	0.05	ug/L		89.9	50-140			
Phenanthrene	4.58	0.05	ug/L		91.6	50-140			
Pyrene	4.88	0.01	ug/L		97.5	50-140			
Surrogate: 2-Fluorobiphenyl	*13.2*		*ug/L*		*65.9*	*50-140*			
Volatiles									
Acetone	68.1	5.0	ug/L		68.1	50-140			
Benzene	27.0	0.5	ug/L		67.6	60-130			
Bromodichloromethane	29.4	0.5	ug/L		73.5	60-130			
Bromoform	35.0	0.5	ug/L		87.6	60-130			
Bromomethane	35.5	0.5	ug/L		88.7	50-140			
Carbon Tetrachloride	30.9	0.2	ug/L		77.2	60-130			
Chlorobenzene	31.4	0.5	ug/L		78.4	60-130			
Chloroform	30.8	0.5	ug/L		77.0	60-130			
Dibromochloromethane	34.2	0.5	ug/L		85.4	60-130			
Dichlorodifluoromethane	31.4	1.0	ug/L		78.4	50-140			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,2-Dichlorobenzene	33.4	0.5	ug/L		83.4	60-130			
1,3-Dichlorobenzene	33.6	0.5	ug/L		83.9	60-130			
1,4-Dichlorobenzene	34.7	0.5	ug/L		86.8	60-130			
1,1-Dichloroethane	30.0	0.5	ug/L		75.0	60-130			
1,2-Dichloroethane	30.0	0.5	ug/L		75.1	60-130			
1,1-Dichloroethylene	34.8	0.5	ug/L		87.0	60-130			
cis-1,2-Dichloroethylene	33.3	0.5	ug/L		83.2	60-130			
trans-1,2-Dichloroethylene	35.2	0.5	ug/L		88.1	60-130			
1,2-Dichloropropane	27.1	0.5	ug/L		67.8	60-130			
cis-1,3-Dichloropropylene	29.0	0.5	ug/L		72.6	60-130			
trans-1,3-Dichloropropylene	31.2	0.5	ug/L		78.0	60-130			
Ethylbenzene	27.9	0.5	ug/L		69.8	60-130			
Ethylene dibromide (dibromoethane	35.4	0.2	ug/L		88.6	60-130			
Hexane	34.6	1.0	ug/L		86.5	60-130			
Methyl Ethyl Ketone (2-Butanone)	66.4	5.0	ug/L		66.4	50-140			
Methyl Isobutyl Ketone	57.8	5.0	ug/L		57.8	50-140			
Methyl tert-butyl ether	68.1	2.0	ug/L		68.1	50-140			
Methylene Chloride	36.7	5.0	ug/L		91.8	60-130			
Styrene	28.3	0.5	ug/L		70.8	60-130			
1,1,1,2-Tetrachloroethane	34.9	0.5	ug/L		87.2	60-130			
1,1,2,2-Tetrachloroethane	36.4	0.5	ug/L		91.0	60-130			
Tetrachloroethylene	36.7	0.5	ug/L		91.6	60-130			
Toluene	30.5	0.5	ug/L		76.2	60-130			
1,1,1-Trichloroethane	30.1	0.5	ug/L		75.2	60-130			
1,1,2-Trichloroethane	32.8	0.5	ug/L		81.9	60-130			
Trichloroethylene	25.6	0.5	ug/L		64.1	60-130			
Trichlorofluoromethane	31.7	1.0	ug/L		79.2	60-130			
Vinyl chloride	33.8	0.5	ug/L		84.6	50-140			
m,p-Xylenes	60.2	0.5	ug/L		75.2	60-130			
o-Xylene	28.3	0.5	ug/L		70.8	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.

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Paracel ID: 1825681

Chain of Custody
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№ 116635

Page 1 of 1

Client Name: PATERSON GROUP	Project Reference: PE4341	**Turnaround Time:**	
Contact Name: ADRIAN MENYHART	Quote #	☐ 1 Day	☐ 3 Day
Address: 154 COLONNADE RD S	PO # 24108	☐ 2 Day	☑ Regular
Telephone: 613-226-7381	Email Address: amenyhart@patersongroup.ca	Date Required:	

Criteria: ☑ O. Reg. 153/04 (As Amended) Table 3 ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ☐ Other:

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Required Analyses

Paracel Order Number: 1825681

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)							
1	BH1 - GW1	GW		5	June 20 18	PM		✓	✓	✓	✓									✓
2	BH2 - GW1	GW		2	"	"				✓	✓									✓
3	BH3 - GW1	GW		3	"	"		✓	✓											✓
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Method of Delivery: Paracel

Comments:

Relinquished By (Sign):	Received by Driver/Depot: A. Scase	Received at Lab:	Verified By:
Relinquished By (Print): ADRIAN M.	Date/Time: 21/06/18 4:25 PM	Date/Time: 21/6/18 5:12	Date/Time:
Date/Time: JUNE 21 2018	Temperature:	Temperature: 19.6°C	pH Verified ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Mark D'Arcy

Client PO: 24859
Project: PE4341
Custody: 44419

Report Date: 22-Aug-2018
Order Date: 16-Aug-2018

Order #: 1833529

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

Paracel ID	Client ID
1833529-01	BH4-SS3
1833529-02	BH5-SS4
1833529-03	BH6-SS2
1833529-04	BH7-SS3

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24859

Report Date: 22-Aug-2018
Order Date: 16-Aug-2018
Project Description: PE4341

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	20-Aug-18	21-Aug-18
PHC F1	CWS Tier 1 - P&T GC-FID	20-Aug-18	21-Aug-18
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	17-Aug-18	21-Aug-18
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	17-Aug-18	20-Aug-18
Solids, %	Gravimetric, calculation	20-Aug-18	20-Aug-18

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24859

Report Date: 22-Aug-2018
Order Date: 16-Aug-2018
Project Description: PE4341

	Client ID:	BH4-SS3	BH5-SS4	BH6-SS2	BH7-SS3
	Sample Date:	08/10/2018 09:00	08/10/2018 09:00	08/10/2018 09:00	08/10/2018 09:00
	Sample ID:	1833529-01	1833529-02	1833529-03	1833529-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	77.7	89.3	77.5	76.7
Volatiles					
Benzene	0.02 ug/g dry	-	<0.02	-	-
Ethylbenzene	0.05 ug/g dry	-	<0.05	-	-
Toluene	0.05 ug/g dry	-	<0.05	-	-
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	-	-
Toluene-d8	Surrogate	-	85.2%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	-	<7	-	-
F2 PHCs (C10-C16)	4 ug/g dry	-	32	-	-
F3 PHCs (C16-C34)	8 ug/g dry	-	80	-	-
F4 PHCs (C34-C50)	6 ug/g dry	-	82	-	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	<0.02	<0.02	0.06
Acenaphthylene	0.02 ug/g dry	<0.02	<0.02	<0.02	0.03
Anthracene	0.02 ug/g dry	0.05	0.08	<0.02	0.20
Benzo [a] anthracene	0.02 ug/g dry	0.02	0.02	<0.02	0.42
Benzo [a] pyrene	0.02 ug/g dry	0.03	0.02	<0.02	0.41
Benzo [b] fluoranthene	0.02 ug/g dry	0.02	<0.02	<0.02	0.36
Benzo [g,h,i] perylene	0.02 ug/g dry	<0.02	<0.02	<0.02	0.17
Benzo [k] fluoranthene	0.02 ug/g dry	0.02	<0.02	<0.02	0.17
Chrysene	0.02 ug/g dry	0.03	0.03	<0.02	0.48
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	<0.02	<0.02	0.05
Fluoranthene	0.02 ug/g dry	0.05	0.05	<0.02	1.01
Fluorene	0.02 ug/g dry	<0.02	<0.02	<0.02	0.06
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	<0.02	<0.02	0.15
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	<0.01	<0.01	0.02
Phenanthrene	0.02 ug/g dry	0.05	0.07	<0.02	0.91
Pyrene	0.02 ug/g dry	0.04	0.05	<0.02	0.86
2-Fluorobiphenyl	Surrogate	89.3%	86.9%	76.6%	82.1%
Terphenyl-d14	Surrogate	105%	104%	97.4%	100%

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						
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	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.14*		*ug/g*		*85.8*	*50-140*			
Surrogate: Terphenyl-d14	*1.51*		*ug/g*		*113*	*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						
Surrogate: Toluene-d8	*6.06*		*ug/g*		*75.7*	*50-140*			

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)	644	4	ug/g dry	1340			70.2	30	QR-04
F3 PHCs (C16-C34)	354	8	ug/g dry	674			62.2	30	QR-04
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Physical Characteristics									
% Solids	79.9	0.1	% by Wt.	77.3			3.3	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND				40	
Acenaphthylene	ND	0.02	ug/g dry	ND			0.0	40	
Anthracene	ND	0.02	ug/g dry	ND			0.0	40	
Benzo [a] anthracene	ND	0.02	ug/g dry	ND			0.0	40	
Benzo [a] pyrene	ND	0.02	ug/g dry	ND				40	
Benzo [b] fluoranthene	ND	0.02	ug/g dry	ND				40	
Benzo [g,h,i] perylene	ND	0.02	ug/g dry	ND				40	
Benzo [k] fluoranthene	ND	0.02	ug/g dry	ND				40	
Chrysene	ND	0.02	ug/g dry	ND			0.0	40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND				40	
Fluoranthene	ND	0.02	ug/g dry	ND			0.0	40	
Fluorene	ND	0.02	ug/g dry	ND				40	
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g dry	ND				40	
1-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
2-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
Naphthalene	ND	0.01	ug/g dry	ND				40	
Phenanthrene	ND	0.02	ug/g dry	ND			0.0	40	
Pyrene	ND	0.02	ug/g dry	ND			0.0	40	
Surrogate: 2-Fluorobiphenyl	*0.817*		*ug/g dry*		*51.2*	*50-140*			
Surrogate: Terphenyl-d14	*1.52*		*ug/g dry*		*95.4*	*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	*8.97*		*ug/g dry*		*87.1*	*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)	176	7	ug/g		87.9	80-120			
F2 PHCs (C10-C16)	88	4	ug/g		110	80-120			
F3 PHCs (C16-C34)	200	8	ug/g		102	80-120			
F4 PHCs (C34-C50)	147	6	ug/g	ND	105	60-140			
Semi-Volatiles									
Acenaphthene	0.183	0.02	ug/g	ND	91.9	50-140			
Acenaphthylene	0.157	0.02	ug/g	ND	78.5	50-140			
Anthracene	0.157	0.02	ug/g	ND	78.9	50-140			
Benzo [a] anthracene	0.134	0.02	ug/g	ND	67.3	50-140			
Benzo [a] pyrene	0.170	0.02	ug/g	ND	85.2	50-140			
Benzo [b] fluoranthene	0.135	0.02	ug/g	ND	67.5	50-140			
Benzo [g,h,i] perylene	0.126	0.02	ug/g	ND	63.1	50-140			
Benzo [k] fluoranthene	0.118	0.02	ug/g	ND	59.0	50-140			
Chrysene	0.186	0.02	ug/g	ND	93.4	50-140			
Dibenzo [a,h] anthracene	0.120	0.02	ug/g	ND	60.2	50-140			
Fluoranthene	0.144	0.02	ug/g	ND	72.0	50-140			
Fluorene	0.155	0.02	ug/g	ND	77.7	50-140			
Indeno [1,2,3-cd] pyrene	0.136	0.02	ug/g	ND	68.2	50-140			
1-Methylnaphthalene	0.188	0.02	ug/g	ND	94.4	50-140			
2-Methylnaphthalene	0.202	0.02	ug/g	ND	101	50-140			
Naphthalene	0.193	0.01	ug/g	ND	97.0	50-140			
Phenanthrene	0.190	0.02	ug/g	ND	95.2	50-140			
Pyrene	0.155	0.02	ug/g	ND	77.8	50-140			
Surrogate: 2-Fluorobiphenyl	*1.21*		*ug/g*		*75.6*	*50-140*			
Volatiles									
Benzene	3.38	0.02	ug/g		84.6	60-130			
Ethylbenzene	3.41	0.05	ug/g		85.4	60-130			
Toluene	3.09	0.05	ug/g		77.2	60-130			
m,p-Xylenes	7.29	0.05	ug/g		91.1	60-130			
o-Xylene	3.65	0.05	ug/g		91.2	60-130			

Qualifier Notes:

QC Qualifiers :

QR-04 : Duplicate results exceeds RPD limits due to non-homogeneous matrix.

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.

PARACEL LABORATORIES LTD.

Paracel ID: 1833529

Head Office
300-2319 St. Laurent Blvd.
[Ottaw]a, Ontario K1G 4J8
[1-8]00-749-1947
[par]acel@paracellabs.com

Chain of Custody
(Lab Use Only)
№ 44419

Page 1 of 1

Client Name:	PATERSON GROUP
Contact Name:	MARK D'ARCY
Address:	154 COLONNADE RD. S.
Telephone:	
Project Reference:	6 164541
Quote #:	
PO #:	24859
Email Address:	mdarcy@patersongroup

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☑ Regular
Date Required: ____________

Criteria: ☑ O. Reg. 153/04 (As Amended) Table 3 ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ________ ☐ Other: ________

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1833529

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PAH	PHC/BTEX									
1	BH4 - SS3			1	/	/	/						-250mL				/
2	BH5 - SS4			2			/	/					-250mL+1vial-				/
3	BH5 - SS5 * HOLD			↓			/	/					↓				/
4	BH6 - SS2			1			/						-250mL				/
5	BH7 - SS3			↓			/						↓				/
6	BH7 - SS5 * HOLD			↓			/						↓				/
7																	
8																	
9																	
10							Hold per Adrian										

Comments: Received extra sample = Sample ID on Jar read = BH7-SS2 (250mL) AUG 10, 2018.
- Sample date on Jars + vials read = Aug 10, 2018.

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot:	Received at Lab: SUNEEPORN DOKMAI	Verified By:
Relinquished By (Print):	Date/Time: 16/08/18 3:30	Date/Time: Aug 16, 2018 05.50	Date/Time: Aug 16/18 7:34p
Date/Time:	Temperature: ___ °C PH	Temperature: 19.6 °C	pH Verified [ ] By:

Chain of Custody (Blank) - Rev 0.4 Feb 2016

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Mark D'Arcy

Client PO: 24858
Project: PE4341
Custody: 44418

Report Date: 22-Aug-2018
Order Date: 16-Aug-2018

Order #: 1833532

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

Paracel ID	Client ID
1833532-01	BH4-GW1
1833532-02	BH6-GW1
1833532-03	MWB-GW1
1833532-04	MWD-GW1

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24858

Report Date: 22-Aug-2018
Order Date: 16-Aug-2018
Project Description: PE4341

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	21-Aug-18	21-Aug-18

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 24858

Report Date: 22-Aug-2018

Order Date: 16-Aug-2018

Project Description: PE4341

	Client ID:	BH4-GW1	BH6-GW1	MWB-GW1	MWD-GW1
	Sample Date:	08/15/2018 09:00	08/15/2018 09:00	08/15/2018 09:00	08/15/2018 09:00
	Sample ID:	1833532-01	1833532-02	1833532-03	1833532-04
	MDL/Units	Water	Water	Water	Water
Semi-Volatiles					
Acenaphthene	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
Acenaphthylene	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
Anthracene	0.01 ug/L	<0.01	<0.01	<0.01	<0.01
Benzo [a] anthracene	0.01 ug/L	<0.01	<0.01	<0.01	<0.01
Benzo [a] pyrene	0.01 ug/L	<0.01	<0.01	<0.01	<0.01
Benzo [b] fluoranthene	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
Benzo [g,h,i] perylene	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
Benzo [k] fluoranthene	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
Chrysene	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
Dibenzo [a,h] anthracene	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
Fluoranthene	0.01 ug/L	<0.01	<0.01	<0.01	<0.01
Fluorene	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
Indeno [1,2,3-cd] pyrene	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
1-Methylnaphthalene	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
Methylnaphthalene (1&2)	0.10 ug/L	<0.10	<0.10	<0.10	<0.10
Naphthalene	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
Phenanthrene	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
Pyrene	0.01 ug/L	<0.01	<0.01	<0.01	<0.01
2-Fluorobiphenyl	Surrogate	77.1%	97.7%	85.6%	69.7%
Terphenyl-d14	Surrogate	121%	125%	117%	131%

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Semi-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						
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	*13.9*		*ug/L*		*69.6*	*50-140*			
Surrogate: Terphenyl-d14	*29.6*		*ug/L*		*148*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Semi-Volatiles									
Acenaphthene	4.32	0.05	ug/L		86.3	50-140			
Acenaphthylene	3.64	0.05	ug/L		72.9	50-140			
Anthracene	4.45	0.01	ug/L		89.0	50-140			
Benzo [a] anthracene	4.67	0.01	ug/L		93.4	50-140			
Benzo [a] pyrene	3.73	0.01	ug/L		74.6	50-140			
Benzo [b] fluoranthene	5.78	0.05	ug/L		116	50-140			
Benzo [g,h,i] perylene	3.71	0.05	ug/L		74.1	50-140			
Benzo [k] fluoranthene	5.78	0.05	ug/L		116	50-140			
Chrysene	6.05	0.05	ug/L		121	50-140			
Dibenzo [a,h] anthracene	3.66	0.05	ug/L		73.2	50-140			
Fluoranthene	4.12	0.01	ug/L		82.4	50-140			
Fluorene	3.81	0.05	ug/L		76.3	50-140			
Indeno [1,2,3-cd] pyrene	4.10	0.05	ug/L		81.9	50-140			
1-Methylnaphthalene	4.47	0.05	ug/L		89.4	50-140			
2-Methylnaphthalene	4.73	0.05	ug/L		94.6	50-140			
Naphthalene	4.07	0.05	ug/L		81.4	50-140			
Phenanthrene	4.68	0.05	ug/L		93.7	50-140			
Pyrene	4.21	0.01	ug/L		84.2	50-140			
Surrogate: 2-Fluorobiphenyl	*13.4*		*ug/L*		*67.1*	*50-140*			

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.

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Paracel ID: 1833532

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wa, Ontario K1G 4J8
800-749-1947
aracel@paracellabs.com

Chain of Custody (Lab Use Only) № 44418

Page 1 of 1

Client Name: PATERSON GROUP	Project Reference: PE4341
Contact Name: MARK D'ARCY	Quote #
Address: 154 COLONNADE RD S	PO # 24858
Telephone:	Email Address: mdarcy@patersongroup.ca

Turnaround Time: ☐ 1 Day ☐ 3 Day ☐ 2 Day ☑ Regular

Date Required:

Criteria: ☑ O. Reg. 153/04 (As Amended) Table 3 ☐ RSC Filing ☐ O. Reg 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ☐ Other:

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1833532

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PAH										
1	BH4 - GW1	GW		1	AUG 15		✓										
2	~~BH5 - GW1~~																
3	BH6 - GW1			1			✓										
4	MW8 - GW1			1			✓										
5	MW0 - GW1			1			✓										
6																	
7	BH3 - GW1 & HOLD			1			✓										
8																	
9																	
10																	

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): [signature]	Received by Driver/Depot: M. Dennise	Received at Lab: [illegible]	Verified By: [signature]
Relinquished By (Print): ADRIAN M	Date/Time: 16/08/18 3:30 PM	Date/Time: AUG 16, 2018 15.50	Date/Time: Aug 16/18 7:46pm
Date/Time: AUG 16 2018	Temperature: °C	Temperature: 19.4 °C	pH Verified [ ] By:

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Mike Beaudoin

Client PO: 24987
Project: PE4341
Custody: 44447

Report Date: 20-Sep-2018
Order Date: 14-Sep-2018

Order #: 1838005

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

Paracel ID	Client ID
1838005-01	BH8-18-G1
1838005-02	BH8-18-SS5
1838005-03	BH9-18-SS1
1838005-04	BH9-18-SS4

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24987

Report Date: 20-Sep-2018
Order Date: 14-Sep-2018
Project Description: PE4341

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	19-Sep-18	20-Sep-18
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	17-Sep-18	18-Sep-18
Mercury by CVAA	EPA 7471B - CVAA, digestion	18-Sep-18	19-Sep-18
PHC F1	CWS Tier 1 - P&T GC-FID	19-Sep-18	20-Sep-18
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	17-Sep-18	18-Sep-18
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	18-Sep-18	19-Sep-18
Solids, %	Gravimetric, calculation	20-Sep-18	20-Sep-18

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24987

Report Date: 20-Sep-2018
Order Date: 14-Sep-2018
Project Description: PE4341

	Client ID:	BH8-18-G1	BH8-18-SS5	BH9-18-SS1	BH9-18-SS4
	Sample Date:	09/07/2018 09:00	09/07/2018 09:00	09/13/2018 09:00	09/13/2018 09:00
	Sample ID:	1838005-01	1838005-02	1838005-03	1838005-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	94.8	76.9	87.6	88.4
Metals					
Antimony	1.0 ug/g dry	41.1	-	<1.0	-
Arsenic	1.0 ug/g dry	17.3	-	1.8	-
Barium	1.0 ug/g dry	193	-	135	-
Beryllium	0.5 ug/g dry	<0.5	-	0.6	-
Boron	5.0 ug/g dry	37.3	-	20.6	-
Cadmium	0.5 ug/g dry	0.6	-	<0.5	-
Chromium	5.0 ug/g dry	43.0	-	28.3	-
Chromium (VI)	0.2 ug/g dry	<0.2	-	<0.2	-
Cobalt	1.0 ug/g dry	19.5	-	9.5	-
Copper	5.0 ug/g dry	913	-	15.8	-
Lead	1.0 ug/g dry	1070	-	28.9	-
Mercury	0.1 ug/g dry	0.6	-	<0.1	-
Molybdenum	1.0 ug/g dry	2.1	-	<1.0	-
Nickel	5.0 ug/g dry	42.8	-	15.3	-
Selenium	1.0 ug/g dry	1.7	-	<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	<1.0	-	<1.0	-
Vanadium	10.0 ug/g dry	52.1	-	75.2	-
Zinc	20.0 ug/g dry	268	-	50.1	-
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	-	89.5%	-	92.8%
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	-	9
F4 PHCs (C34-C50)	6 ug/g dry	-	<6	-	<6

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24987

Report Date: 20-Sep-2018
Order Date: 14-Sep-2018
Project Description: PE4341

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						
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						
Surrogate: Toluene-d8	*2.84*		*ug/g*		*88.9*	*50-140*			

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	ND	1.0	ug/g dry	ND			0.0	30	
Arsenic	2.3	1.0	ug/g dry	2.3			3.0	30	
Barium	88.8	1.0	ug/g dry	84.9			4.5	30	
Beryllium	ND	0.5	ug/g dry	0.5			0.0	30	
Boron	8.9	5.0	ug/g dry	9.3			3.6	30	
Cadmium	ND	0.5	ug/g dry	0.6			0.0	30	
Chromium (VI)	ND	0.2	ug/g dry	ND				35	
Chromium	28.6	5.0	ug/g dry	28.1			1.8	30	
Cobalt	7.9	1.0	ug/g dry	7.7			1.9	30	
Copper	39.1	5.0	ug/g dry	37.8			3.6	30	
Lead	35.7	1.0	ug/g dry	34.0			5.1	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	20.0	5.0	ug/g dry	19.7			1.8	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	0.6	0.3	ug/g dry	0.6			0.3	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND			0.0	30	
Vanadium	25.1	10.0	ug/g dry	24.3			3.2	30	
Zinc	86.3	20.0	ug/g dry	83.4			3.4	30	
Physical Characteristics									
% Solids	68.6	0.1	% by Wt.	67.0			2.3	25	
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	*3.53*		*ug/g dry*		*96.5*	*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)	171	7	ug/g		85.3	80-120			
F2 PHCs (C10-C16)	99	4	ug/g	ND	110	60-140			
F3 PHCs (C16-C34)	274	8	ug/g	ND	125	60-140			
F4 PHCs (C34-C50)	189	6	ug/g	ND	136	60-140			
Metals									
Antimony	34.8		ug/L	ND	69.4	70-130			QM-07
Arsenic	36.9		ug/L	ND	72.0	70-130			
Barium	79.4		ug/L	34.0	90.9	70-130			
Beryllium	39.4		ug/L	ND	78.4	70-130			
Boron	41.1		ug/L	ND	74.7	70-130			
Cadmium	36.0		ug/L	ND	71.6	70-130			
Chromium (VI)	2.1	0.2	ug/g	ND	34.5	70-130			QM-01
Chromium	51.6		ug/L	11.2	80.8	70-130			
Cobalt	43.0		ug/L	3.1	79.8	70-130			
Copper	54.5		ug/L	15.1	78.8	70-130			
Lead	56.9		ug/L	13.6	86.6	70-130			
Mercury	1.49	0.1	ug/g	ND	99.4	70-130			
Molybdenum	35.6		ug/L	ND	70.8	70-130			
Nickel	47.8		ug/L	7.9	79.8	70-130			
Selenium	35.2		ug/L	ND	70.3	70-130			
Silver	34.5		ug/L	ND	68.5	70-130			QM-07
Thallium	43.2		ug/L	ND	86.3	70-130			
Uranium	43.2		ug/L	ND	85.9	70-130			
Vanadium	50.8		ug/L	ND	82.2	70-130			
Zinc	70.2		ug/L	33.4	73.7	70-130			
Volatiles									
Benzene	3.90	0.02	ug/g		97.5	60-130			
Ethylbenzene	2.76	0.05	ug/g		69.0	60-130			
Toluene	2.88	0.05	ug/g		71.9	60-130			
m,p-Xylenes	5.09	0.05	ug/g		63.6	60-130			
o-Xylene	2.85	0.05	ug/g		71.2	60-130			
Surrogate: Toluene-d8	*2.43*		*ug/g*		*75.8*	*50-140*			

Qualifier Notes:

QC Qualifiers :

QM-01 : The spike recovery for this QC sample is outside of established control limits due to sample matrix interference.

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.

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.

Paracel ID: 1838005

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Chain of Custody (Lab Use Only)

№ 44447

Page 1 of 1

Client Name: PATERSON	Project Reference: PE4341	**Turnaround Time:**	
Contact Name: MIKE BEAUDOIN	Quote #	☐ 1 Day	☐ 3 Day
Address: 154 Colonnade	PO # 24987	☐ 2 Day	☒ Regular
Telephone: 613-226-7381	Email Address: mbeaudoin@patersongroup.ca	Date Required:	

Criteria: ☒ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ____ ☐ Other: ____

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1838005

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHC F1-F4	BTEX	Metals ICP	CrVI	Hg						
1	BH8-18-SS61	S		1	Sept 7/18				X	X	X			250ml			
2	BH8-18-SS5	S		2			X	X						120ml + 1 vial			
3	BH9-18-SS1	S		1	Sept 13/18				X	X	X			250ml			
4	BH9-18-SS4	S		2			X	X						250ml + 1 vial			
5																	
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): [signature]	Received by Driver/Depot: [signature] J. Nelouse	Received at Lab: Sunateporn Dumai	Verified By: [signature]
Relinquished By (Print): MIKE B.	Date/Time: 14/09/18 4:00 PM	Date/Time: SEP 14, 2018 05.00	Date/Time: Sept 17/18 8:07a
Date/Time:	Temperature: °C	Temperature: 22.0 °C	pH Verified [ ] By: N/A

Chain of Custody (Blank) - Rev 0.4 Feb 2016

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Mike Beaudoin

Client PO: 24977
Project: PE4341
Custody: 118575

Report Date: 1-Oct-2018
Order Date: 21-Sep-2018

Order #: 1838687

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

Paracel ID	Client ID
1838687-01	BH8-18-GW1
1838687-02	BH9-18-GW1

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24977

Report Date: 01-Oct-2018
Order Date: 21-Sep-2018
Project Description: PE4341

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	27-Sep-18	27-Sep-18
Chromium, hexavalent - water	MOE E3056 - colourimetric	24-Sep-18	24-Sep-18
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	24-Sep-18	24-Sep-18
Metals, ICP-MS	EPA 200.8 - ICP-MS	27-Sep-18	28-Sep-18
PHC F1	CWS Tier 1 - P&T GC-FID	25-Sep-18	27-Sep-18
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	24-Sep-18	24-Sep-18
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	25-Sep-18	25-Sep-18

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 24977

Report Date: 01-Oct-2018

Order Date: 21-Sep-2018

Project Description: PE4341

	Client ID:	BH8-18-GW1	BH9-18-GW1	-	-
	Sample Date:	09/20/2018 09:00	09/20/2018 09:00	-	-
	Sample ID:	1838687-01	1838687-02	-	-
	MDL/Units	Water	Water	-	-
Metals					
Mercury	0.1 ug/L	<0.1	<0.1	-	-
Antimony	0.5 ug/L	2.4	0.5	-	-
Arsenic	1 ug/L	<1	<1	-	-
Barium	1 ug/L	108	259	-	-
Beryllium	0.5 ug/L	<0.5	<0.5	-	-
Boron	10 ug/L	94	148	-	-
Cadmium	0.1 ug/L	<0.1	<0.1	-	-
Chromium	1 ug/L	<1	<1	-	-
Chromium (VI)	10 ug/L	<10	<10	-	-
Cobalt	0.5 ug/L	1.1	<0.5	-	-
Copper	0.5 ug/L	7.3	5.1	-	-
Lead	0.1 ug/L	0.2	0.2	-	-
Molybdenum	0.5 ug/L	4.2	1.9	-	-
Nickel	1 ug/L	6	3	-	-
Selenium	1 ug/L	<1	<1	-	-
Silver	0.1 ug/L	<0.1	<0.1	-	-
Sodium	200 ug/L	83600	91500	-	-
Thallium	0.1 ug/L	<0.1	<0.1	-	-
Uranium	0.1 ug/L	3.7	0.5	-	-
Vanadium	0.5 ug/L	0.8	<0.5	-	-
Zinc	5 ug/L	10	8	-	-
Volatiles					
Benzene	0.5 ug/L	<0.5	<0.5	-	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	-	-
Toluene	0.5 ug/L	<0.5	<0.5	-	-
m,p-Xylenes	0.5 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	-	-
Toluene-d8	Surrogate	97.2%	96.5%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	-	-
Semi-Volatiles					

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 24977

Report Date: 01-Oct-2018

Order Date: 21-Sep-2018

Project Description: PE4341

	Client ID:	BH8-18-GW1	BH9-18-GW1	-	-
	Sample Date:	09/20/2018 09:00	09/20/2018 09:00	-	-
	Sample ID:	1838687-01	1838687-02	-	-
	MDL/Units	Water	Water	-	-
Acenaphthene	0.05 ug/L	<0.05	<0.05	-	-
Acenaphthylene	0.05 ug/L	<0.05	<0.05	-	-
Anthracene	0.01 ug/L	0.01	<0.01	-	-
Benzo [a] anthracene	0.01 ug/L	0.02	<0.01	-	-
Benzo [a] pyrene	0.01 ug/L	0.02	<0.01	-	-
Benzo [b] fluoranthene	0.05 ug/L	<0.05	<0.05	-	-
Benzo [g,h,i] perylene	0.05 ug/L	<0.05	<0.05	-	-
Benzo [k] fluoranthene	0.05 ug/L	<0.05	<0.05	-	-
Chrysene	0.05 ug/L	0.06	<0.05	-	-
Dibenzo [a,h] anthracene	0.05 ug/L	<0.05	<0.05	-	-
Fluoranthene	0.01 ug/L	0.08	<0.01	-	-
Fluorene	0.05 ug/L	0.08	0.08	-	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	<0.05	<0.05	-	-
1-Methylnaphthalene	0.05 ug/L	<0.05	0.06	-	-
2-Methylnaphthalene	0.05 ug/L	<0.05	0.14	-	-
Methylnaphthalene (1&2)	0.10 ug/L	<0.10	0.19	-	-
Naphthalene	0.05 ug/L	<0.05	0.24	-	-
Phenanthrene	0.05 ug/L	0.21	0.17	-	-
Pyrene	0.01 ug/L	0.07	<0.01	-	-
2-Fluorobiphenyl	Surrogate	75.7%	82.4%	-	-
Terphenyl-d14	Surrogate	101%	99.0%	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
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						
Metals									
Mercury	ND	0.1	ug/L						
Antimony	ND	0.5	ug/L						
Arsenic	ND	1	ug/L						
Barium	ND	1	ug/L						
Beryllium	ND	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						
Semi-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						
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	*17.6*		*ug/L*		*88.0*	*50-140*			
Surrogate: Terphenyl-d14	*20.8*		*ug/L*		*104*	*50-140*			
Volatiles									
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	*77.5*		*ug/L*		*96.9*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
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	ND	1	ug/L	ND			0.0	20	
Beryllium	ND	0.5	ug/L	ND			0.0	20	
Boron	ND	10	ug/L	ND			0.0	20	
Cadmium	ND	0.1	ug/L	ND			0.0	20	
Chromium (VI)	ND	10	ug/L	ND				20	
Chromium	ND	1	ug/L	ND			0.0	20	
Cobalt	ND	0.5	ug/L	ND			0.0	20	
Copper	ND	0.5	ug/L	ND			0.0	20	
Lead	ND	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	ND	1	ug/L	ND			0.0	20	
Silver	ND	0.1	ug/L	ND			0.0	20	
Sodium	ND	200	ug/L	ND			0.0	20	
Thallium	ND	0.1	ug/L	ND			0.0	20	
Uranium	ND	0.1	ug/L	ND			0.0	20	
Vanadium	ND	0.5	ug/L	ND			0.0	20	
Zinc	ND	5	ug/L	ND			0.0	20	
Volatiles									
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	*82.6*		*ug/L*		*103*	*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)	1960	25	ug/L		98.0	68-117			
F2 PHCs (C10-C16)	1580	100	ug/L		98.8	60-140			
F3 PHCs (C16-C34)	3790	100	ug/L		96.7	60-140			
F4 PHCs (C34-C50)	2090	100	ug/L		84.3	60-140			
Metals									
Mercury	3.03	0.1	ug/L	ND	101	70-130			
Antimony	44.2		ug/L	ND	88.5	80-120			
Arsenic	47.3		ug/L	ND	94.5	80-120			
Barium	44.7		ug/L	ND	89.3	80-120			
Beryllium	47.5		ug/L	ND	95.0	80-120			
Boron	41		ug/L	ND	82.4	80-120			
Cadmium	49.0		ug/L	ND	98.0	80-120			
Chromium (VI)	197	10	ug/L	ND	98.5	70-130			
Chromium	43.4		ug/L	ND	86.3	80-120			
Cobalt	41.4		ug/L	ND	82.8	80-120			
Copper	41.7		ug/L	ND	83.4	80-120			
Lead	43.3		ug/L	ND	86.6	80-120			
Molybdenum	39.2		ug/L	ND	78.5	80-120			QS-02
Nickel	43.2		ug/L	ND	86.1	80-120			
Selenium	50.0		ug/L	ND	99.9	80-120			
Silver	42.1		ug/L	ND	84.2	80-120			
Sodium	859		ug/L	ND	82.0	80-120			
Thallium	43.1		ug/L	ND	86.1	80-120			
Uranium	40.1		ug/L	ND	80.3	80-120			
Vanadium	43.4		ug/L	ND	86.8	80-120			
Zinc	50		ug/L	ND	98.4	80-120			
Semi-Volatiles									
Acenaphthene	4.65	0.05	ug/L		92.9	50-140			
Acenaphthylene	4.03	0.05	ug/L		80.5	50-140			
Anthracene	3.86	0.01	ug/L		77.2	50-140			
Benzo [a] anthracene	3.49	0.01	ug/L		69.8	50-140			
Benzo [a] pyrene	3.17	0.01	ug/L		63.4	50-140			
Benzo [b] fluoranthene	4.85	0.05	ug/L		97.0	50-140			
Benzo [g,h,i] perylene	3.14	0.05	ug/L		62.8	50-140			
Benzo [k] fluoranthene	5.71	0.05	ug/L		114	50-140			
Chrysene	4.15	0.05	ug/L		83.0	50-140			
Dibenzo [a,h] anthracene	3.79	0.05	ug/L		75.8	50-140			
Fluoranthene	4.15	0.01	ug/L		82.9	50-140			
Fluorene	4.01	0.05	ug/L		80.2	50-140			
Indeno [1,2,3-cd] pyrene	3.70	0.05	ug/L		74.1	50-140			
1-Methylnaphthalene	4.59	0.05	ug/L		91.8	50-140			
2-Methylnaphthalene	5.09	0.05	ug/L		102	50-140			
Naphthalene	4.74	0.05	ug/L		94.8	50-140			
Phenanthrene	4.03	0.05	ug/L		80.6	50-140			
Pyrene	4.09	0.01	ug/L		81.9	50-140			
Surrogate: 2-Fluorobiphenyl	*18.3*		*ug/L*		*91.4*	*50-140*			
Volatiles									
Benzene	36.4	0.5	ug/L		91.0	60-130			
Ethylbenzene	37.0	0.5	ug/L		92.4	60-130			
Toluene	38.8	0.5	ug/L		97.0	60-130			

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24977

Report Date: 01-Oct-2018
Order Date: 21-Sep-2018
Project Description: PE4341

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
m,p-Xylenes	81.9	0.5	ug/L		102	60-130			
o-Xylene	40.0	0.5	ug/L		100	60-130			

Qualifier Notes:

QC Qualifiers :

QS-02 : Spike level outside of control limits. Analysis batch accepted based on other QC included in the batch.

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.

Paracel ID: 1838687

PARACEL LABORATORIES LTD.

Head Office
300-2319 St. Laurent Blvd.
Ottawa, Ontario K1G 4J8
p: 1-800-749-1947
e: paracel@paracellabs.com

Chain of Custody (Lab Use Only)
Nº 118575

Page 1 of 1

Client Name: PATERSON GROUP	Project Reference: PE4341		**Turnaround Time:**
Contact Name: MIKE BEAUDOIN	Quote #		☐ 1 Day ☐ 3 Day
Address: 154 COLONNADE RD S.	PO # 24977		☐ 2 Day ☑ Regular
Telephone: 613-226-7381	Email Address: mbeaudoin@patersongroup.ca		Date Required:

Criteria: ☑ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ____ ☐ Other: ____

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1838687.

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)							
1	* BH8-18-GW1	GW		7	Sept 20/18		X		X	X	X	X								
2	* BH9-18-GW1	GW		7	Sept 20/18		X		X	X	X	X								
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments: * PAH bottles ID are BH8-18 / BH9-18 [illegible]
~~HOLD EXTRA 1L BOTTLE~~
Report as per [illegible] on COC [illegible]

Method of Delivery: Paracel

Relinquished By (Sign): Mike B.	Received by Driver/Depot: [signature]	Received at Lab: [signature]	Verified By: [signature]
Relinquished By (Print): MIKE B.	Date/Time: 21/09/18 3:40	Date/Time: Sep 24/18 5:02	Date/Time: [illegible] 24/18 5:38
Date/Time:	Temperature: °C	Temperature: 19.7 °C	pH Verified [✓] By: [signature]