Geotechnical Engineering

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Building Science

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Phase II - Environmental Site Assessment

1545 Bank Street
Ottawa, Ontario

Prepared For

Financial Eastern Star Group

August 27, 2018

Report: PE4330-2

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EXECUTIVE SUMMARY

Assessment

A Phase II-Environmental Site Assessment (ESA) was conducted for the property addressed 1545 Bank Street, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the Areas of Potential Environmental Concern for the subject site identified during the Phase I ESA. The Phase II-ESA consisted of drilling a total of (10) boreholes, six of which were completed as groundwater monitoring wells. The Phase II ESA summarizes the findings of three (3) field programs conducted during the interim of 2011 through 2018. Of the six (6) monitoring wells placed onsite, three (3) were readily located during the current investigation.

Soil samples were obtained from the boreholes and were screened using visual observations and vapour measurements. Site soils generally consist of a layer of fill material, over silty clay or silty sand till, followed by shaley limestone bedrock. Based on the screening results, various samples were selected for analysis of benzene, toluene, ethylbenzene and xylenes (BTEX) or volatile organic compounds (VOCs), petroleum hydrocarbons (PHCs F_1-F_4) and polycyclic aromatic hydrocarbons (PAHs). Based on the analytical results, native soil beneath the former tank nest on the northwestern corner of the site, exceeds the Ontario Ministry of the Environment, Conservation and Parks (MOECP) Table 7 Standards for benzene and xylenes.

Groundwater samples collected from BH1, BH2, BH6, BH7, BH8, BH9 and BH10 were analysed for a combination of BTEX, VOCs, PHCs and/or PAHs. A concentration of PHC (F_2) exceeding the MOECP Table 7 standard was identified in BH1 during the September 2011 sampling event. During a subsequent June 2012 sampling event, PHC (F_2) was not detected above the laboratory method detection limit, however benzene was identified in Sample BH1-GW2 at a concentration exceeding the MOECP Table 7 standard.

Concentrations of benzo[g,h,i]perylene, benzo[k]fluoranthene and PHC (F_3) exceeding MOECP Table 7 standards, were identified in a groundwater sample recovered from BH7, within the former waste oil tank nest. A concentration of PHC (F_3) exceeding the MOECP Table 7 standard was identified in the groundwater recovered from BH10, within the footprint of the former automotive service garage bays. Based on the laboratory Certificate of Analysis, this sample result may have been biased high by a non-mineral based compound.

Recommendations

It is recommended that a soil and groundwater remediation program be carried out at the Phase II Property. It is our understanding that the site will be redeveloped with a multi-storey, mixed-used building with two (2) levels of underground parking. The soil and groundwater impacts present on the Phase II Property are not considered to pose an immediate concern to the property as it is currently vacant.

It is recommended that the soil and groundwater remediation program be completed in conjunction with the redevelopment of the subject land. Prior to the remediation program a representative sample of impacted soil will require a leachate analysis in accordance with Ontario Regulation 558, for disposal at an approved waste disposal facility. It is recommended that Paterson personnel be on-site at the time of the remediation program in order to direct the segregation and excavation of impacted soils and to conduct confirmatory sampling as required.

It is also recommended that prior to the remedial activities, an additional attempt be made to locate BH1 and BH7 to confirm the groundwater quality at these locations. In addition to resampling BH1 and BH7, the groundwater from BH10 should be resampled in order to confirm the previous PHC results and to provide delineation of PAH parameters previously identified in BH7 (2015).

1.0 INTRODUCTION

At the request of Financial Eastern Star Group, Paterson Group (Paterson) conducted a Phase II-Environmental Site Assessment (ESA) of the property addressed 1545 Bank Street, in the City of Ottawa, Ontario. The purpose of this Phase II-ESA was to address areas of potential environmental concern identified in previous Phase I ESAs, as well as to supplement and update the findings of previous subsurface investigations which are summarized in this report.

1.1 Site Description

Address:	1545 Bank Street, Ottawa, Ontario.
Legal Description:	Part of Lot 6, Concession 1, Gloucester Township, Ottawa Front. Part of Block O (0.30 Reserve), Registered Plan M-171.
Property Identification Number:	04148-0218
Location:	The subject site is located at the northeast corner of the intersection of Bank Street and Evans Boulevard, in the City of Ottawa, Ontario. The subject site is shown on Figure 1 - Key Plan following the body of this report.
Latitude and Longitude:	45° 22' 50" N, 75° 40' 05" W
Configuration:	Irregular
Site Area:	0.22 hectares (approximate)

1.2 Property Ownership

The subject property is currently owned by Financial Eastern Star Group. Paterson was engaged to complete the Phase II-ESA at the subject site by Mr. James Liu with Financial Eastern Star Group. Mr. Liu can be reached by telephone at (613) 731-3815.

1.3 Current and Proposed Future Uses

The subject site is currently vacant. The former commercial building (automotive service garage and offices) is no longer present. It is our understanding that the subject site will be redeveloped as a multi-storey residential building with ground-floor commercial retail and two (2) levels of underground parking.

1.4 Applicable Site Condition Standard

The site condition standards for the property were obtained from Table 7 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 (MOECP), April 2011. The MOECP Table 7 Standards are based on the following considerations:

- ❒ Coarse-grained soil conditions
- ❒ Shallow soil conditions
- ❒ Non-potable groundwater conditions
- ❒ Residential land use

Results were also compared to the MOECP Table 1 Standards for off-site disposal purposes.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The subject site is located at the northeast corner of the intersection of Bank Street and Evans Boulevard, in the City of Ottawa, Ontario. The Phase II Property is located in an urban area surrounded by various sized residential and commercial structures. The site topography mimics the regional topography, which slopes down towards the northwest, towards Sawmill Creek. Site drainage consists a combination of of sheet flow to the catch basins along Bank Street to the west/northwest and surficial infiltration in gravel surfaced areas. The Phase II Property is situated in a municipally serviced area.

2.2 Past Investigations

Paterson has completed a modified Phase I ESA for the subject property in November of 2011, which incorporated an assessment of soil and groundwater conditions at the subject site via boreholes advanced as part of a concurrent geotechnical investigation.

In November of 2015, Paterson conducted a subsurface investigation to further characterize the soil and groundwater on the subject land.

The historical research identified the property as a retail fuel outlet (and automotive service garage) from the 1950s to 2009. A dry cleaning establishment occupied a portion of the office space from 1987 through 2010/2011. It was understood that the underground storage tanks (USTs) associated with the retail fuel outlet were removed following the closure of the retail fuel outlet in 2009, at which time a remediation program was carried out by Jacques Whitford Stantec Limited (JWSL). Based on a review of the JWSL report, contaminated soil was identified and removed from five (5) separate excavations on the property: in the vicinity of the former underground storage tanks, the former pump island, the former waste oil storage tank and the former underground hydraulic hoists within the garage bays. The remaining soil was subsequently tested and found to be in compliance with applicable MOECP remediation standards. A confirmatory test pit program was also completed and no further areas of contamination were identified.

Based on the findings of the Paterson investigations, impacted soil and groundwater were identified at BH1, within the former tank nest on the northwestern portion of the site. It was recommended that a remediation program be carried out in conjunction with the redevelopment of the land. It was specifically recommended that further investigation be carried out during the removal of the building foundation to assess the subsurface in the vicinity of the garage floor drain and oil-water separator.

Based on the July 2018 Phase I ESA conducted by Paterson for the subject land, historical on- or off-site potentially contaminating activities (PCAs) were considered to result in five (5) areas of potential environmental concern (APECs) on the Phase I and Phase II Property, as presented in Table 1.

Table 1
Areas of Potential Environmental Concern

Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern with respect to Phase I Property	Potentially Contaminating Activity	Location of PCA (on-site or off-site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater, Soil, and/or Sediment)
APEC 1 Resulting from a former on-site dry cleaner	Beneath and around former building	Item 37 - Operation of Dry Cleaning Equipment	On-site	VOCs	Soil and groundwater
APEC 2 Resulting from a former on-site automotive service garage	Beneath and around northern portion of former building	Item 52 – Storage, maintenance, fuelling and repair of equipment, vehicles, and material used to maintain transportation systems	On-site	BTEX, PHCs	Soil and groundwater
APEC 3 Resulting from a former underground waste oil tank	Northeast corner of property	Item 28 - Gasoline and Associated Products Storage in Fixed Tanks	On-site	BTEX, PHCs, PAHs	Soil and groundwater
APEC 4 Resulting from former on-site pump islands	West side of property	Item 28 - Gasoline and Associated Products Storage in Fixed Tanks	On-site	BTEX, PHCs	Soil and groundwater
APEC 5 Resulting from a former on-site underground fuel tank nest	Northwest corner of property	Item 28 - Gasoline and Associated Products Storage in Fixed Tanks	On-Site	BTEX, PHCs	Soil and groundwater

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The current subsurface investigation conducted as a component of this Phase II ESA consisted of two (2) boreholes (BH8 and BH9) at the subject site. Boreholes were drilled through overburden soils and cored into bedrock to depths of approximately 6.4 and 6.1m below ground surface (bgs). Each borehole was instrumented with a groundwater monitoring well.

Previous boreholes placed on the Phase II Property, BH1 through BH5 (2011) and BH6 through BH8 (2015), were completed to depths ranging from 1.9 to 8.1m below grade. Groundwater monitoring wells were previously installed in the overburden at BH1, while bedrock monitoring wells were installed at BH6, BH7 and BH8.

3.2 Media Investigated

During the subsurface investigations, soil samples and groundwater samples were obtained and submitted for laboratory analysis. The rationale for sampling and analyzing these media is based on the Contaminants of Potential Concern identified in the Phase I ESA.

Contaminants of potential concern (CPCs) for soil and groundwater are polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene, and xylenes (BTEX), petroleum hydrocarbons, fractions 1 through 4 (PHCs F1-F4) and/or volatile organic compounds (VOCs).

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

Based on drilling programs carried out in 2011 and 2015, the soil profile on the subject site consists of fill underlain by native silty clay with an underlying intermittent glacial till layer. Bedrock at the subject site was identified as an interbedded limestone and shale. Overburden at the subject site was found to range between approximately 1.80 to 3.20 m. Groundwater levels obtained from the subject site suggested that groundwater flow is in a southeasterly direction.

Contaminants of Potential Concern

The CPCs identified in the Phase I ESA are listed above in Section 3.2 of this report.

Existing Buildings and Structures

No buildings or structures exist on the subject property.

Water Bodies

No water bodies are located within the 250m study area. The nearest major water body is the Rideau River, located over 1 km to the north.

Areas of Natural Significance

There are no areas of natural significance within the 250 m study area.

Drinking Water Wells

Based on the level of development and the presence of municipal water services in the area, no drinking water wells are expected to be currently used in the Phase I Study Area.

Neighbouring Land Use

Neighbouring land use in the Phase I Study Area consists of commercial and residential properties. No potentially contaminating activities (PCAs) with the potential to generate areas of potential environmental concern (APECs) were identified within the Phase I Study Area. All of the PCAs identified within the Phase I Study Area are illustrated on Drawing PE4330-2 - Surrounding Land Use Plan, appended to the Phase I ESA report.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Table 1 in Section 2.2 of this report, PCAs identified on the subject site include a former retail fuel outlet (consisting of an underground fuel tank nest and pump islands), an automotive service garage, an underground waste oil tank and a dry cleaning facility.

Assessment of Uncertainty and/or Absence of Information

The presence of potentially contaminating activities was confirmed by a variety of independent sources, including, in some cases, previous analytical test results, which would exceed the currently applicable criteria. As such, the conclusions of this report are not affected by uncertainty which may be present with respect to the individual sources.

3.4 Deviations from Sampling and Analysis Plan

The Sampling and Analysis Plan for this project is included in Appendix 1 of this report. Insufficient groundwater was available in the monitoring well at BH6. The groundwater sample recovered was analysed for only PCH F_1 and not the entire PHC (F_1-F_4) parameter group. There were no other deviations from the Sampling and Analysis Plan.

3.5 Impediments

The borehole locations were constrained by the presence of underground services at the Phase II Property. No other physical impediments or denial of access were encountered during the Phase II ESA.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The original subsurface investigations were conducted on September 2, 2011 and November 20, 2015, and consisted of the placement of eight (8) boreholes on the Phase II Property. The current subsurface investigation was conducted on July 26, 2018 and consisted of the placement of two (2) boreholes on the Phase II Property. Boreholes BH1 through BH5 (2011) were completed on practical bedrock refusal at depths ranging from approximately 1.9 to 3.2mbgs. Borehole BH1 was completed with a groundwater monitoring well installation. Boreholes BH6 through BH10 (2015, 2018) were cored into the bedrock to depths ranging from approximately 5.1 to 8.1mbgs, and were completed with groundwater monitoring well installations to access the groundwater table.

The boreholes were placed to address the aforementioned areas of potential environmental concern (APECs) and to provide coverage of the site from a geotechnical perspective. The boreholes were drilled with a truck mounted CME 55 power auger drill rig. The truck mounted drill rig was provided by George Downing Estate Drilling of Hawkesbury, Ontario. Borehole locations are shown on Drawing PE4330-3 – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

A total of 37 soil samples were obtained from the boreholes by means of split spoon sampling and the sampling of shallow soils directly from auger flights. Split spoon samples were taken at approximate 0.76 to 1.52 m intervals. The depths at which split spoon and auger flight samples were obtained from the boreholes and test pits are shown as "**SS**" and "**AU**" respectively on the Soil Profile and Test Data Sheets, appended to this report.

Upon refusal of the augers, some of the boreholes were advanced into bedrock using a diamond coring system. Rock core samples were recovered and are shown as "**RC**" on the Soil Profile and Test Data Sheets.

The soil stratigraphy generally consists of asphaltic concrete or concrete over fill material or fill material from ground surface. The fill material primarily consists of brown silty sand with gravel. Crushed stone over a layer of silty sand fill, was identified at BH8. The fill material extends to depths ranging from approximately 0.4 to 2.1mbgs.

Native silty clay and or glacial till was identified beneath the fill material at all borehole locations with the exception of BH8, extending to depths of approximately 1.8 to 3.2mbgs. The native soils were underlain by shaley limestone bedrock. Fill material extended from ground surface to bedrock at BH8, placed within the former pump island excavation.

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 an RKI Eagle combustible gas detector and/or a MiniRae photoionization detector (PID). The detection limit of the RKI Eagle is 5 ppm, with a precision of +/- 5 ppm. The detection limit of the PID 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. The RKI Eagle combustible vapour readings and PID vapour readings were found to range from 5 to 25ppm, with the exception of 50ppm readings for Samples BH7-SS3 and BH6-AU1.

These readings are not considered to be indicative of the presence of volatile substances (such as gasoline). The vapour results cannot be used to identify the presence of heavier petroleum hydrocarbons such as heavy oil. Please refer to the Soil Profile and Test Data Sheets in Appendix 1 for soil sample headspace results.

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

4.4 Groundwater Monitoring Well Installation

Six (6) groundwater monitoring wells were installed on the Phase II Property by George Downing Estate Drilling of Hawkesbury, Ontario, under the full-time supervision by Paterson personnel, during the interim of 2011 through 2018. The monitoring wells consisted of 32mm or 50mm diameter Schedule 40 threaded PVC risers and screens. 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. A summary of monitoring well construction details is provided below in Table 2.

It should be noted that only the monitoring wells installed in BH6, BH9 and BH10 remain present on the Phase II Property.

Table 2
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[1]	86.75	3.18	1.68-3.18	1.20-3.18	0.3-1.20	Flushmount
BH6	87.28	8.08	5.08-8.08	5.38-8.08	0.3-5.38	Flushmount
BH7[1]	87.58	5.05	3.55-5.05	3.20-3.55	0.3-3.20	Flushmount
BH8[1]	86.93	5.23	3.73-5.23	3.40-5.23	0.3-3.40	Flushmount
BH9	87.68	6.38	3.38-6.38	3.00-6.38	0.3-3.00	Flushmount
BH10	87.58	6.10	3.10-6.10	2.80-6.10	0.3-2.80	Flushmount

Notes:
- 1 – monitoring wells damaged or no longer present on the Phase II Property

4.5 Field Measurement of Water Quality Parameters

Prior to the August 2018 groundwater sampling event, water quality parameters were measured in the field using a multi-parameter analyzer. Parameters measured in the field include temperature, electrical conductivity and pH. Monitoring wells were purged prior to sampling until at least three well volumes had been removed or until the well was purged dry. Field parameter values prior to sampling are summarized below in Table 3.

Table 3
Field Measurement of Water Quality Parameters

Borehole Location	Temperature (°C)	pH	Conductivity (µS/cm)	Date
BH6	17.1	8.71	58	August 2, 2018
BH9	16.4	7.34	103	August 2, 2018
BH10	16.5	7.49	134	August 2, 2018

4.6 Groundwater Sampling

Groundwater sampling protocols were followed using the MOECP 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.

4.7 Analytical Testing

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

Table 4
Soil Samples Submitted for Analytical Testing

Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analyzed				Rationale
		VOCs	PHC (F_1-F_4) / BTEX	PAH	pH	
September 22, 2011						
BH1-SS5	3.0-3.18mbgs; Native Glacial Till		X			To assess potential for residual PHCs within former UST excavation; based on highest combustible vapour reading.
BH5-SS2	0.76-1.37mbgs; Native Silty Clay		X			To assess potential for residual PHCs within former pump island excavation; based on olfactory observations.
November 23, 2015						
BH6-SS3	1.52-2.13mbgs; Native Silty Clay	X	X			To assess potential impacts from former dry cleaner; based on organic vapour reading closest to inferred water table.
BH7-SS4	2.29-2.49mbgs; Native Silty Clay		X	X		To assess potential impacts resulting from former waste oil storage; based on highest organic vapour reading.
BH8-SS4	2.28-2.67mbgs; Fill material		X			To assess potential for residual PHCs within former pump island excavation; based on location with respect to inferred water table.
July 26, 2018						
BH9-SS2	1.52-2.13 mbgs; Native Silty Clay	X	X		X	To assess potential for impacts resulting from the former dry cleaner; based on sample depth.
BH10-SS2	1.52-2.13 mbgs; Native Silty Clay	X	X		X	To assess potential for impacts beneath the automotive service garage; based on sample depth.

Table 5
Groundwater Samples Submitted for Analytical Testing

Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analyzed			Rationale
		VOCs	PHC (F_1-F_4)	PAH	
September 30, 2011					
BH1-GW1	1.68-3.18mbgs; Fill	X	X		To assess groundwater quality within former tank nest.
November 1, 2011					
BH2-GW1[1]	1.47-2.97mbgs; Native Glacial Till/Fill	X			To assess groundwater quality within former pump island and to assess potential groundwater impacts resulting from former dry cleaner.
June 25, 2012					
BH1-GW2	1.68-3.18mbgs; Fill	X	X		To confirm groundwater quality within former tank nest.
November 27, 2015					
BH6-GW1	5.08-8.08mbgs; Bedrock	X	X[2]		To assess potential groundwater impacts from the former on-site dry cleaner and retail fuel outlet.
BH7-GW1	3.55-5.05mbgs; Bedrock	X	X	X	To assess the groundwater in the vicinity of the former waste oil storage tank.
BH8-GW1	3.73-5.23mgbs; Bedrock	X	X		To assess potential groundwater impacts in the vicinity of the former pump island.
DUP[3]	5.08-8.08mbgs; Bedrock	X	X[2]		Quality Assurance/Quality Control
August 2, 2018					
BH6-GW2[4]	5.08-8.08mbgs; Bedrock	X			To reassess the quality of the groundwater at this location.
BH9-GW1	3.38-6.38mbgs; Bedrock	X	X		To assess the groundwater quality beneath the former automotive service garage bays.
BH10-GW1	3.10-6.10mbgs; Bedrock	X	X	X	To assess the groundwater quality beneath the former dry cleaner.
DUP[5]	3.38-6.38mbgs; Bedrock	X			Quality Assurance/Quality Control

Notes:
- 1 – sample retrieved from a piezometer installed for Geotechnical purposes
- 2 – sample analysed for PHC F_1 parameter only
- 3 – Duplicate of Sample BH6-GW1
- 4 – Sample labelled as BH6-GW1 on laboratory Certificate of Analysis
- 5 – Duplicate of Sample BH9-GW1

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.

4.8 Residue Management

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

4.9 Elevation Surveying

Monitoring well and borehole locations were surveyed using a laser level. Elevations were surveyed relative to the top spindle of the fire hydrant located near the northwest corner of the Phase II Property. The geodetic elevation of the benchmark is 87.426 meters above sea level (m ASL), as provided by Farley, Smith and Denis Surveying Ltd. The location of the site benchmark is shown on Drawing PE4330-3 – Test Hole Location Plan.

4.10 Quality Assurance and Quality Control Measures

A summary of quality assurance and quality control (QA/QC) measures, including sampling containers, preservation, labelling, handling, chain of custody, equipment cleaning procedures, and field quality control measurements are 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. The site stratigraphy generally consists of a layer of asphaltic concrete, concrete and/or fill material (crushed stone or silty sand and gravel) from ground surface over native silty clay and/or glacial till. Shaley limestone bedrock was encountered at depths ranging from approximately 1.8 to 3.2m below grade.

Groundwater was encountered near the overburden/bedrock interface, or deeper within the bedrock, at depths ranging from approximately 1.8 to 4.6m 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 6. All elevations are relative to the top spindle of the fire hydrant located near the northwest corner of the Phase II Property. It should be noted that groundwater levels are expected to fluctuate throughout the year with seasonal variations.

Table 6
Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m ASL)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1	86.75	1.46	85.29	September 30, 2011
BH2[1]	86.95	2.11	84.84	
BH6	87.28	1.99	85.29	November 27, 2015
BH7	87.58	2.19	85.39	
BH8	86.93	1.19	85.74	
BH6	87.28	4.60	82.68	August 2, 2018
BH9	87.68	1.84	85.84	
BH10	87.58	1.93	85.65	

Based on the groundwater elevations from the August 2018 monitoring event, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE4330-4 - Groundwater Contour Plan. Based on the contour mapping, groundwater flow at the subject site appears to be towards the southwest. A horizontal hydraulic gradient of approximately 0.12m/m was calculated.

5.3 Fine-Medium Soil Texture

Based on observed soil conditions, it is our opinion that fine- to medium-grained soil standards are not applicable at the subject site.

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in soil vapour readings ranging from 5ppm to 50ppm. Field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets appended to this report.

5.5 Soil Quality

During the interim of 2011 through 2018, a total of seven (7) soil samples were submitted to Paracel Laboratories for analysis of VOC, BTEX, PHC (F_1-F_4) and/or PAH parameters. The results of the analytical testing are presented in Tables 7, 8 and 9. The laboratory certificates of analysis are provided in Appendix 1.

Table 7
Analytical Test Results – Soil (2011)
BTEX and PHCs (F_1-F_4)

Parameter	MDL (µg/g)	Soil Samples (µg/g) September 22, 2011		MOECP Table 7 Standards Residential Coarse (µg/g)	MOECP Table 1 Standards Background (µg/g)
		BH1-SS5	BH5-SS2		
Benzene	0.02	**0.25**	nd	0.21	0.02
Ethylbenzene	0.05	1.15	nd	2	0.05
Toluene	0.05	1.13	nd	2.3	0.2
Xylenes	0.05	**7.48**	nd	3.1	0.05
PHC F_1	10	30	nd	55	25
PHC F_2	10	20	nd	98	10
PHC F_3	10	nd	nd	300	240
PHC F_4	10	nd	nd	2,800	120

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and underlined** – Value exceeds MOECP Table 3 Standard (coarse-grained)
- Underlined – Value exceeds MOECP Table 1 Standard

BTEX parameters exceeding the MOECP Table 7 coarse-grained, fine-grained and/or MOECP Table 1 standards were identified in soil Sample BH1-SS5. The PHC (F_1-F_2) parameters identified in soil Sample BH1-SS5 were in compliance with the MOECP Table 7 standards, although they exceed the Table 1 standards. No BTEX or PHC parameters were identified in soil Sample BH5-SS2, above the laboratory method detection limits.

Table 7 Continued
Analytical Test Results – Soil (2015)
BTEX and PHCs (F_1-F_4)

Parameter	MDL (µg/g)	Soil Samples (µg/g) November 20, 2015			MOECP Table 7 Standards Residential Coarse (µg/g)	MOECP Table 1 Standards Background (µg/g)
		BH6-SS3[1]	BH7-SS4	BH8-SS4		
Benzene	0.02	nd	nd	nd	0.21	0.02
Ethylbenzene	0.05	nd	nd	nd	2	0.05
Toluene	0.05	nd	nd	nd	2.3	0.2
Xylenes	0.05	nd	0.23	nd	3.1	0.05
PHC F_1	7	nd	9	nd	55	25
PHC F_2	4	nd	nd	nd	98	10
PHC F_3	8	nd	147	nd	300	240
PHC F_4	6	nd	119	nd	2,800	120

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and underlined** – Value exceeds MOECP Table 3 Standard (coarse-grained)
- Underlined – Value exceeds MOECP Table 1 Standard
- 1 – BTEX analysed as part of VOC parameters group

Xylenes, PHC F_3 and F_4 were identified in soil Sample BH7-SS4 at concentrations below the MOECC Table 7. The xylene concentration in this sample also exceeds the MOECP Table 1 standard. BTEX and PHC parameters were not identified above the laboratory method detection limits in the remaining samples analysed.

Table 7 Continued
Analytical Test Results – Soil (2018)
BTEX and PHCs (F_1-F_4)

Parameter	MDL (µg/g)	Soil Samples (µg/g) July 26, 2018		MOECP Table 7 Standards Residential Coarse (µg/g)	MOECP Table 1 Standards Background (µg/g)
		BH9-SS2[1]	BH10-SS2[1]		
Benzene	0.02	nd	nd	0.21	0.02
Ethylbenzene	0.05	nd	nd	2	0.05
Toluene	0.05	nd	nd	2.3	0.2
Xylenes	0.05	nd	nd	3.1	0.05
PHC F_1	7	nd	nd	55	25
PHC F_2	4	nd	nd	98	10
PHC F_3	8	nd	nd	300	240
PHC F_4	6	nd	nd	2,800	120

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- 1 – BTEX analysed as part of VOC parameter group

No BTEX or PHC parameters were detected in the soil analysed during the 2018 subsurface investigation. The results are in compliance with the MOECP Table 7 and Table 1 standards.

Table 8
Analytical Test Results – Soil (2015)
Volatile Organic Compounds

Parameter	MDL (µg/g)	Soil Sample (µg/g)			MOECP Table 7 Residential Coarse (µg/g)	MOECP Table 1 Residential (µg/g)
		Nov.20, 2015	July 26, 2018			
		BH6-SS3	BH9-SS2	BH10-SS2		
Acetone	0.5	nd	nd	nd	16	0.5
Benzene	0.02	nd	nd	nd	0.21	0.02
Bromodichloromethane	0.05	nd	nd	nd	13	0.05
Bromoform	0.05	nd	nd	nd	0.27	0.05
Bromomethane	0.05	nd	nd	nd	0.05	0.05
Carbon Tetrachloride	0.05	nd	nd	nd	0.05	0.05
Chlorobenzene	0.05	nd	nd	nd	2.4	0.05
Chloroform	0.05	nd	nd	nd	0.05	0.05
Dibromochloromethane	0.05	nd	nd	nd	9.4	0.05
1,2-Dichlorobenzene	0.05	nd	nd	nd	3.4	0.05
1,3-Dichlorobenzene	0.05	nd	nd	nd	4.8	0.05
1,4-Dichlorobenzene	0.05	nd	nd	nd	0.083	0.05
Dichlorodifluoromethane	0.05	nd	nd	nd	16	0.05
1,1-Dichloroethane	0.05	nd	nd	nd	3.5	0.05
1,2-Dichloroethane	0.05	nd	nd	nd	0.05	0.05
1,1-Dichloroethylene	0.05	nd	nd	nd	0.05	0.05
cis-1,2-Dichloroethylene	0.05	nd	nd	nd	3.4	0.05
trans-1,2-Dichloroethylene	0.05	nd	nd	nd	0.084	0.05
1,2-Dichloropropane	0.05	nd	nd	nd	0.05	0.05
1,3-Dichloropropylene, total	0.05	nd	nd	nd	0.05	0.05
1,2-Dibromoethane	0.05	nd	nd	nd	0.05	0.05
Ethylbenzene	0.05	nd	nd	nd	2	0.05
Hexane	0.05	nd	nd	nd	2.8	0.05
Methyl Ethyl Ketone	0.5	nd	nd	nd	16	0.5
Methyl Isobutyl Ketone	0.5	nd	nd	nd	1.7	0.5
Methyl tert-butyl ether	0.05	nd	nd	nd	0.75	0.05
Methylene Chloride	0.05	nd	nd	nd	0.1	0.05
Styrene	0.05	nd	nd	nd	0.7	0.05
1,1,1,2-Tetrachloroethane	0.05	nd	nd	nd	0.058	0.05
1,1,2,2-Tetrachloroethane	0.05	nd	nd	nd	0.05	0.05
Tetrachloroethylene	0.05	nd	nd	nd	0.28	0.05
Toluene	0.05	nd	nd	nd	2.3	0.2
1,1,1-Trichloroethane	0.05	nd	nd	nd	0.38	0.05
1,1,2-Trichloroethane	0.05	nd	nd	nd	0.05	0.05
Trichloroethylene	0.05	nd	nd	nd	0.061	0.05
Trichlorofluoromethane	0.05	nd	nd	nd	4	0.25
Vinyl Chloride	0.02	nd	nd	nd	0.02	0.02
Xylenes, total	0.05	nd	nd	nd	3.1	0.05

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL

No VOC parameters were detected in the samples analysed. All VOC parameters are in compliance with the MOECP Table 1 and 7 Standards.

Table 9
Analytical Test Results – Soil (2015)
PAHs

Parameter	MDL (µg/g)	Soil Sample (µg/g) November 20, 2015	MOECP Table 7 Residential Coarse (µg/g)	MOECP Table 1 Residential (µg/g)
		BH7-SS4		
Acenaphthene	0.02	0.04	7.9	0.072
Acenaphthylene	0.02	nd	0.15	0.093
Anthracene	0.02	0.04	0.67	0.16
Benzo[a]anthracene	0.02	0.24	0.5	0.36
Benzo[a]pyrene	0.02	0.25	0.3	0.3
Benzo[b]fluoranthene	0.02	0.36	0.78	0.47
Benzo[g,h,i]perylene	0.02	0.19	6.6	0.68
Benzo[k]fluoranthene	0.02	0.29	0.78	0.48
Chrysene	0.02	0.29	7	2.8
Dibenzo[a,h]anthracene	0.02	0.04	0.1	0.1
Fluoranthene	0.02	0.54	0.69	0.56
Fluorene	0.02	0.04	62	0.12
Indeno[1,2,3-cd]pyrene	0.02	0.17	0.38	0.23
Methylnaphthalene (1&2)	0.04	nd	0.99	0.59
Naphthalene	0.01	0.02	0.6	0.09
Phenanthrene	0.02	0.30	6.2	0.69
Pyrene	0.02	0.48	78	1

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL

All PAH parameters detected in soil Sample BH7-SS4 are in compliance with the MOECP Table 1 and 7 Standards.

Soil Samples BH9-SS2 and BH10-SS2 (2018) were analysed for pH. The results of the analytical testing indicated values of 7.49 and 7.69.

Maximum soil concentrations are summarized in Table 10 below.

Table 10
Maximum Concentrations – Soil

Parameter	Maximum Concentration (µg/g)	Borehole	Depth Interval (mbgs)
Benzene	**0.25**	BH1-SS5	3-3.18
Ethylbenzene	1.15		
Toluene	1.13		
Xylenes	**7.48**		
PHC F1	30		
PHC F2	20		
PHC F3	147	BH7-SS4	2.29-2.49
PHC F4	119		
Acenaphthene	0.04	BH7-SS4	2.29-2.49
Anthracene	0.04		
Benzo[a]anthracene	0.24		
Benzo[a]pyrene	0.25		
Benzo[b]fluoranthene	0.36		
Benzo[g,h,i]perylene	0.19		
Benzo[k]fluoranthene	0.29		
Chrysene	0.29		
Dibenzo[a,h]anthracene	0.04		
Fluoranthene	0.54		
Fluorene	0.04		
Indeno[1,2,3-cd]pyrene	0.17		
Naphthalene	0.02		
Phenanthrene	0.30		
Pyrene	0.48		

Notes:
- **Bold** – Value exceeds MOECC Table 7 Standard
- Underlined – Value exceeds MOECC Table 1 Standard

All other parameter concentrations were below laboratory detection limits.

5.6 Groundwater Quality

Groundwater samples from the monitoring wells installed in BH1, BH6, BH7, BH8, BH9 and BH10, and a groundwater sample collected from a Geotechnical piezometer installed in BH2, were submitted for laboratory analysis of VOC, BTEX, PHC (F1-F4) and PAH. The groundwater samples were obtained from the screened intervals noted on Table 2, above. The results of the analytical testing are presented below in Tables 11, 12 and 13. The laboratory certificates of analysis are provided in Appendix 1.

Table 11
Analytical Test Results – Groundwater
BTEX and PHCs (F_1-F_4) (2011/2012)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MOECP Table 7 Standards (µg/L)
		Sept.30, 2011	Nov.1, 2011	June 25, 2012	
		BH1-GW1	BH2-GW1[1]	BH1-GW2	
Benzene	0.5	nd	nd	**5.2**	0.5
Ethylbenzene	0.5	nd	nd	4.1	54
Toluene	0.5	nd	10.4	nd	320
Xylenes	0.5	28.1	nd	5.7	72
PHC F_1	25	401	nt	117	420
PHC F_2	100	**435**	nt	nd	150
PHC F_3	100	nd	nt	nd	500
PHC F_4	100	nd	nt	nd	500

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold** – Value exceeds MOECP Table 7 Standards
- 1 – PHC F_2-F_4 parameters were not tested due to a limited amount of groundwater available

Toluene and xylene concentrations were identified in the groundwater recovered from BH1 and BH2 during the 2011 sampling event. The concentrations were in compliance with the MOECP Table 7 standards. Concentrations of PHC F_1 and F_2 were identified in the sample recovered from BH1. While the F_1 concentration was in compliance with the MOECP Table 7 standard, the F_2 concentration was in excess of the Table 7 standard. The groundwater recovered from BH2 (2011) was not analysed for PHC parameters due to insufficient groundwater.

Concentrations of BTEX and PHC F_1 were identified in the second groundwater sample recovered from BH1 in 2012. The benzene concentration exceeded the MOECP Table 7 standard while remaining BTEX parameters identified were in compliance. The PHC F_1 parameter identified was in compliance with the MOECP Table 7 standard. No other PHC parameters were detected above the method detection limit.

Table 11 Continued
Analytical Test Results – Groundwater
BTEX and PHCs (F_1-F_4) (2015)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) Nov.27, 2017				MOECP Table 7 Standards (µg/L)
		BH6-GW1[1]	BH7-GW1	BH8-GW1	DUP[1]	
Benzene	0.5	nd	nd	nd	nd	0.5
Ethylbenzene	0.5	nd	nd	nd	nd	54
Toluene	0.5	1.4	nd	nd	1.0	320
Xylenes	0.5	1.3	nd	nd	0.9	72
PHC F_1	25	nd	nd	nd	nd	420
PHC F_2	100	nt	nd	nd	nt	150
PHC F_3	100	nt	**690**	nd	nt	500
PHC F_4	100	nt	nd	nd	nt	500

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold** – Value exceeds MOECP Table 7 Standards
- 1 – PHC F_2-F_4 parameters were not tested due to a limited amount of groundwater available

Toluene and xylene concentrations in compliance with the MOECP Table 7 standards were identified in groundwater samples recovered from BH6 and its duplicate. Otherwise, no BTEX concentrations were detected above the laboratory method detection limits in the groundwater samples analysed.

Petroleum hydrocarbon fraction F_3 was detected at a concentration exceeding the MOECP Table 7 standard in groundwater Sample BH7-GW1. No other PHC parameters were identified in the groundwater samples. As noted above, the groundwater sample from BH6 and the duplicate sample were not analysed for PHC F_2-F_4 due to an insufficient volume of groundwater available.

Table 11 Continued
Analytical Test Results – Groundwater
BTEX and PHCs (F_1-F_4) (2018)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) August 2, 2018				MOECP Table 7 Standards (µg/L)
		BH6-GW2[1]	BH9-GW1	BH10-GW1	DUP	
Benzene	0.5	nd	nd	nd	nd	0.5
Ethylbenzene	0.5	nd	nd	nd	nd	54
Toluene	0.5	nd	nd	nd	nd	320
Xylenes	0.5	nd	nd	nd	nd	72
PHC F_1	25	nt	nd	nd	nt	420
PHC F_2	100	nt	nd	nd	nt	150
PHC F_3	100	nt	nd	**4,490[2]**	nt	500
PHC F_4	100	nt	nd	471	nt	500

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- nt – not tested for this parameters
- **Bold** – Value exceeds MOECP Table 7 Standards
- 1 – Second sample recovered from BH6, although sample identified as BH6-GW1.
- 2 – Laboratory qualifier states: Some peak(s) in the GC-FID Chromatogram are not typical of petroleum hydrocarbon distillates. May be the result of high concentrations of non-mineral based compounds not completely removed by the method cleanup. Results may be biased high.

No BTEX parameters were identified above the laboratory method detection limit in any of the groundwater samples submitted for analytical testing. A PHC F_3 fraction exceeding the MOECP Table 7 standard was identified in groundwater Sample BH10-GW1. No other PHC concentrations were detected in the groundwater samples.

As noted above, the laboratory Certificate of Analysis indicated that the F_3 concentration may be a biased result. This monitoring well should be resampled to confirm the PHC concentrations.

Table 12 Continued
Analytical Test Results – Groundwater
Volatile Organic Compounds (2011/2012)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MOECP Table 7 Standards (µg/L)
		BH1-GW1	BH2-GW1	BH1-GW2	
		Sept. 30, 2011	Nov. 1, 2011	June 25, 2012	
Acetone	5.0	nd	47.0	nd	100,000
Benzene	0.5	nd	nd	**5.2**	0.5
Bromodichloromethane	0.5	nd	nd	nd	67,000
Bromoform	0.5	nd	nd	nd	5
Bromomethane	0.5	nd	nd	nd	0.89
Carbon Tetrachloride	0.2	nd	nd	nd	0.2
Chlorobenzene	0.5	nd	nd	nd	140
Chloroform	0.5	nd	nd	nd	2
Dibromochloromethane	0.5	nd	nd	nd	65,000
Dichlorodifluoromethane	1.0	nd	nd	nd	3,500
1,2-Dichlorobenzene	0.5	nd	nd	nd	150
1,3-Dichlorobenzene	0.5	nd	nd	nd	7,600
1,4-Dichlorobenzene	0.5	nd	nd	nd	0.5
1,1-Dichloroethane	0.5	nd	nd	nd	11
1,2-Dichloroethane	0.5	nd	nd	nd	0.5
1,1-Dichloroethylene	0.5	nd	nd	nd	0.5
cis-1,2-Dichloroethylene	0.5	nd	nd	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	nd	0.58
1,3-Dichloropropene	0.5	nd	nd	nd	0.5
1,2-Dibromoethane	0.2	nd	nd	nd	0.2
Ethylbenzene	0.5	nd	nd	4.1	54
Hexane	1.0	nd	nd	nd	5
Methyl Ethyl Ketone	5.0	nd	113	nd	21,000
Methyl Isobutyl Ketone	5.0	nd	nd	nd	5,200
Methyl tert-butyl Ether	2.0	nd	nd	nd	15
Methylene Chloride	5.0	nd	nd	nd	26
Styrene	0.5	nd	nd	nd	43
1,1,1,2-Tetrachloroethane	0.5	nd	nd	nd	1.1
1,1,2,2-Tetrachloroethane	0.5	nd	nd	nd	0.5
Tetrachloroethylene	0.5	nd	nd	nd	0.5
Toluene	0.5	nd	10.4	nd	320
1,2,4-Trichlorobenzene	0.5	nd	nd	nd	3
1,1,1-Trichloroethane	0.5	nd	nd	nd	23
1,1,2-Trichloroethane	0.5	nd	nd	nd	0.5
Trichloroethylene	0.5	nd	nd	nd	0.5
Trichlorofluoromethane	1.0	nd	nd	nd	2,000
Vinyl Chloride	0.5	nd	nd	nd	0.5
Xylenes	0.5	28.1	nd	5.7	72

Notes:
- MDL – Method Detection Limit; nd – not detected above the MDL
- **Bold** – concentration exceeds MOECP Table 7 standard

With one exception, the VOC concentrations detected in each sample were in compliance with MOECP Table 7 standards.

The benzene concentration (5.2 µg/L) detected in groundwater Sample BH1-GW1 which exceeds the MOECP Table 7 standard of 0.5µg/L.

Table 12 Continued
Analytical Test Results – Groundwater
Volatile Organic Compounds (2015)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) November 27, 2015				MOECP Table 7 Standards (µg/L)
		BH6-GW1	BH7-GW1	BH8-GW1	DUP	
Acetone	5.0	nd	nd	nd	nd	100,000
Benzene	0.5	nd	nd	nd	nd	0.5
Bromodichloromethane	0.5	0.9	nd	nd	0.9	67,000
Bromoform	0.5	nd	nd	nd	nd	5
Bromomethane	0.5	nd	nd	nd	nd	0.89
Carbon Tetrachloride	0.2	nd	nd	nd	nd	0.2
Chlorobenzene	0.5	nd	nd	nd	nd	140
Chloroform	0.5	**11.8**	nd	1.6	**11.8**	2
Dibromochloromethane	0.5	nd	nd	nd	nd	65,000
Dichlorodifluoromethane	1.0	nd	nd	nd	nd	3,500
1,2-Dichlorobenzene	0.5	nd	nd	nd	nd	150
1,3-Dichlorobenzene	0.5	nd	nd	nd	nd	7,600
1,4-Dichlorobenzene	0.5	nd	nd	nd	nd	0.5
1,1-Dichloroethane	0.5	nd	nd	nd	nd	11
1,2-Dichloroethane	0.5	nd	nd	nd	nd	0.5
1,1-Dichloroethylene	0.5	nd	nd	nd	nd	0.5
cis-1,2-Dichloroethylene	0.5	nd	nd	nd	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	nd	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	nd	nd	0.58
1,3-Dichloropropene	0.5	nd	nd	nd	nd	0.5
1,2-Dibromoethane	0.2	nd	nd	nd	nd	0.2
Ethylbenzene	0.5	nd	nd	nd	nd	54
Hexane	1.0	nd	nd	nd	nd	5
Methyl Ethyl Ketone	5.0	nd	nd	nd	nd	21,000
Methyl Isobutyl Ketone	5.0	nd	nd	nd	nd	5,200
Methyl tert-butyl Ether	2.0	nd	nd	nd	nd	15
Methylene Chloride	5.0	nd	nd	nd	nd	26
Styrene	0.5	nd	nd	nd	nd	43
1,1,1,2-Tetrachloroethane	0.5	nd	nd	nd	nd	1.1
1,1,2,2-Tetrachloroethane	0.5	nd	nd	nd	nd	0.5
Tetrachloroethylene	0.5	nd	nd	nd	nd	0.5
Toluene	0.5	1.4	nd	nd	1.0	320
1,2,4-Trichlorobenzene	0.5	nd	nd	nd	nd	3
1,1,1-Trichloroethane	0.5	nd	nd	nd	nd	23
1,1,2-Trichloroethane	0.5	nd	nd	nd	nd	0.5
Trichloroethylene	0.5	nd	nd	nd	nd	0.5
Trichlorofluoromethane	1.0	nd	nd	nd	nd	2,000
Vinyl Chloride	0.5	nd	nd	nd	nd	0.5
Xylenes	0.5	1.3	nd	nd	0.9	72

Notes:
- MDL – Method Detection Limit; nd – not detected above the MDL
- **Bold** – concentration exceeds MOECP Table 7 standard

No VOC parameters were identified above the laboratory detection limits in groundwater Sample BH7-GW1. The VOC parameters detected in the remaining samples analysed were in compliance with the MOECP Table 7 standards, with the exception of the chloroform concentrations identified in Sample BH6-GW1 and its duplicate. The chloroform is considered to have resulted from the use of chlorinated municipal water for bedrock coring and is expected to have dissipated by this time.

Table 12 Continued
Analytical Test Results – Groundwater
Volatile Organic Compounds (2018)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) August 2, 2018				MOECP Table 7 Standards (µg/L)
		BH6-GW2	BH9-GW1	BH10-GW1	DUP	
Acetone	5.0	nd	nd	nd	nd	100,000
Benzene	0.5	nd	nd	nd	nd	0.5
Bromodichloromethane	0.5	nd	nd	nd	nd	67,000
Bromoform	0.5	nd	nd	nd	nd	5
Bromomethane	0.5	nd	nd	nd	nd	0.89
Carbon Tetrachloride	0.2	nd	nd	nd	nd	0.2
Chlorobenzene	0.5	nd	nd	nd	nd	140
Chloroform	0.5	nd	nd	nd	nd	2
Dibromochloromethane	0.5	nd	nd	nd	nd	65,000
Dichlorodifluoromethane	1.0	nd	nd	nd	nd	3,500
1,2-Dichlorobenzene	0.5	nd	nd	nd	nd	150
1,3-Dichlorobenzene	0.5	nd	nd	nd	nd	7,600
1,4-Dichlorobenzene	0.5	nd	nd	nd	nd	0.5
1,1-Dichloroethane	0.5	nd	nd	nd	nd	11
1,2-Dichloroethane	0.5	nd	nd	nd	nd	0.5
1,1-Dichloroethylene	0.5	nd	nd	nd	nd	0.5
cis-1,2-Dichloroethylene	0.5	nd	nd	nd	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	nd	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	nd	nd	0.58
1,3-Dichloropropene	0.5	nd	nd	nd	nd	0.5
1,2-Dibromoethane	0.2	nd	nd	nd	nd	0.2
Ethylbenzene	0.5	nd	nd	nd	nd	54
Hexane	1.0	nd	nd	nd	nd	5
Methyl Ethyl Ketone	5.0	nd	nd	nd	nd	21,000
Methyl Isobutyl Ketone	5.0	nd	nd	nd	nd	5,200
Methyl tert-butyl Ether	2.0	nd	nd	nd	nd	15
Methylene Chloride	5.0	nd	nd	nd	nd	26
Styrene	0.5	nd	nd	nd	nd	43
1,1,1,2-Tetrachloroethane	0.5	nd	nd	nd	nd	1.1
1,1,2,2-Tetrachloroethane	0.5	nd	nd	nd	nd	0.5
Tetrachloroethylene	0.5	nd	nd	nd	nd	0.5
Toluene	0.5	nd	nd	nd	nd	320
1,2,4-Trichlorobenzene	0.5	nd	nd	nd	nd	3
1,1,1-Trichloroethane	0.5	nd	nd	nd	nd	23
1,1,2-Trichloroethane	0.5	nd	nd	nd	nd	0.5
Trichloroethylene	0.5	nd	nd	nd	nd	0.5
Trichlorofluoromethane	1.0	nd	nd	nd	nd	2,000
Vinyl Chloride	0.5	nd	nd	nd	nd	0.5
Xylenes	0.5	nd	nd	nd	nd	72

Notes:
- MDL – Method Detection Limit; nd – not detected above the MDL
- **Bold** – concentration exceeds MOECP Table 7 standard

No VOC parameters were identified in any of the groundwater samples analysed.

Table 13
Analytical Test Results – Groundwater
PAHs (2015, 2018)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MOECP Table 7 Standards (µg/L)
		Nov.27, 2015	Aug.2, 2018	
		BH7-GW1	BH10-GW1	
Acenaphthene	0.05	0.08	nd	17
Acenaphthylene	0.05	nd	nd	1
Anthracene	0.01	0.07	nd	1
Benzo[a]anthracene	0.01	0.42	nd	1.8
Benzo[a]pyrene	0.01	0.46	nd	0.81
Benzo[b]fluoranthene	0.05	0.73	nd	0.75
Benzo[g,h,i]perylene	0.05	**0.38**	nd	0.2
Benzo[k]fluoranthene	0.05	**0.54**	nd	0.4
Biphenyl	0.05	0.56	nd	1,000
Chrysene	0.05	0.10	nd	0.7
Dibenzo[a,h]anthracene	0.05	0.52	nd	0.4
Fluoranthene	0.01	0.06	nd	44
Fluorene	0.05	0.33	nd	290
Indeno[1,2,3-cd]pyrene	0.05	nd	nd	0.2
Methylnaphthalene (1&2)	0.05	nd	nd	1,500
Naphthalene	0.05	nd	nd	7
Phenanthrene	0.05	0.57	nd	380
Pyrene	0.01	0.47	nd	5.7

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold** – Value exceeds MOECP Table 7 Standard

PAH concentrations were identified in groundwater Sample BH7-GW1. The benzo[g,h,i]perylene and benzo[k]fluoranthene parameters exceed MOECP Table 7 standards, while the remaining parameter concentrations detected are in compliance with Table 7. No PAH parameters were detected in Sample BH10-GW1, above the laboratory method detection limit.

The maximum final concentrations of all parameters analyzed in groundwater are summarized in Table 14 below.

Table 14
Maximum Concentrations – Groundwater

Parameter	Maximum Concentration (µg/L)	Borehole/Sample Location	Depth Interval (mbgs)
Acetone	47.0	BH2-GW1	1.47-2.97; Fill and Native Glacial Till
Benzene	**5.2**	BH1-GW2	1.68-3.18; Fill
Methyl Ethyl Ketone	113	BH2-GW1	1.47-2.97; Fill and Native Glacial Till
Toluene	10.4	BH2-GW1	
Xylenes	5.7	BH1-GW2	1.68-3.18; Fill
PHC, F_1	117	BH1-GW2	
PHC, F_3	**4,490**	BH10-GW1	3.10-6.10; Bedrock
PHC, F_4	471	BH10-GW1	
Acenaphthene	0.08	BH7-GW1	3.55-5.05; Bedrock
Anthracene	0.07		
Benzo[a]anthracene	0.42		
Benzo[a]pyrene	0.46		
Benzo[b]fluoranthene	0.73		
Benzo[g,h,i]perylene	**0.38**		
Benzo[k]fluoranthene	**0.54**		
Biphenyl	0.56		
Chrysene	0.10		
Dibenzo[a,h]anthracene	0.52		
Fluoranthene	0.06		
Fluorene	0.33		
Phenanthrene	0.57		
Pyrene	0.47		

Notes:
- **Bold** – Value exceeds selected MOECC Standard

The concentrations of all other parameters were below laboratory detection limits.

5.7 Quality Assurance and Quality Control Results

As per the Sampling and Analysis Plan, duplicate groundwater samples were obtained from the monitoring well installed in BH9 during the current sampling event. Groundwater Sample BH9-GW1 and its duplicate were analyzed for VOCs, with no concentrations detected above the method detection limit and are therefore within acceptable QA/QC parameters.

As per Table 5 in Section 4.7 of this report, Sample BH6-GW1 and its duplicate collected during the 2015 sampling event, were also analysed for VOCs, with concentrations detected. The relative percent difference (RPD) calculations for the original and duplicate samples are provided below.

Table 15
QA/QC Calculations – Groundwater – November 27, 2015
Volatile Organic Compounds

Parameter	MDL (µg/L)	BH6-GW1	Dup	RPD (%)	QA/QC Result
Bromodichloromethane	0.5	0.9	0.9	0	Meets target
Chloroform	0.5	11.8	11.8	0	Meets target
Toluene	0.5	1.4	0.9	43	Exceeds Target
Xylenes, total	0.5	1.3	1.0	26	Exceeds Target

Notes:
- ❒ All other parameter concentrations were below laboratory detection limits for both original and duplicate samples, and as such, are within acceptable QA/QC parameters.

The RPD values for bromodichloromethane and chloroform were within 20%, and as such, are considered acceptable. The target range was exceeded for toluene and xylenes. However, during the most recent sampling event (2018), no VOC parameters were identified in Sample BH6-GW2. As such, the conclusions of the report are not considered to be affected.

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

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As indicated in the Phase I-ESA report and Section 2.2 of this report, the following PCAs are considered to result in APECs on the Phase II Property:

- ❒ Item 52 – Storage, maintenance, fuelling and repair of equipment, vehicles and material used to maintain transportation systems – based on a former automotive service garage on the Phase II Property (APEC 2).

- Item 28 - Gasoline and Associated Products Storage in Fixed Tanks – based on the presence of a former on-site underground storage tank (UST) for the storage of waste oil associated with the aforementioned automotive service garage (APEC 3).
- Item 28 – Gasoline and Associated Products Storage in Fixed Tanks – based on a former on-site retail fuel outlet (APEC 4 and APEC 5).
- Item 37 – Operation of Dry Cleaning Equipment – based on a former on-site dry cleaners and potential use of dry cleaning chemicals (APEC 1).

Various other potentially contaminating activities ranging from bulk fuel depots to spill records, were identified by various historical sources, for the neighbouring properties within 250m of the Phase II Property. Based on their separation distances and/or orientations with respect to the Phase II Property, these PCAs were not considered to represent APECs on the subject land. Off-site PCAs are depicted on Drawing PE4330-2 – Surrounding Land Use Plan, appended to the Phase I ESA report.

Contaminants of Potential Concern and Impacted Media

Contaminants of potential concern associated with the aforementioned PCAs include a combination of BTEX/PHCs (F1-F4), VOCs and/or PAHs in the soil and groundwater.

Subsurface Structures and Utilities

Underground service locates were completed prior to the subsurface investigation. Underground utilities on the Phase II Property include fibreoptic cable, electricity and natural gas. No private wells or septic systems are present on the Phase II Property or within 250m of the subject property. No other utilities or subsurface structures are present on the Phase II Property.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is illustrated on Drawings PE4330-7 and 8 - Cross-Section A-A' and B-B'. Stratigraphy consists of:

- Approximately 0.25m of asphaltic concrete was identified at ground surface, at BH3 and BH4, while approximately 0.15m of concrete was identified at BH9 and BH10, placed within the former building footprints. Fill was encountered at ground surface at the remaining borehole locations.

- Fill material generally consisted of brown silty sand or gravel and extended from ground surface (or beneath asphaltic concrete and concrete) to depths ranging from approximately 0.4m to 2.7m below grade. A 0.76m layer of crushed stone was identified at BH8, over brown silty sand fill which extended to a depth of approximately 2.7m below grade. No deleterious materials were identified in the fill material.

- Native silty clay was identified beneath the fill material at BH3, BH4, BH5, BH6, BH9 and BH10. The silty clay extended to depths of approximately 1.8 to 2.2m below grade.

- Native glacial till consisting of silty sand and gravel, was identified beneath the fill layer at BH1, BH2 and BH7. Glacial till consisting of silty clay with gravel, was identified beneath the native silty clay at BH9 and BH10. Glacial till extended to depths ranging from 2.0 to 3.2m below grade.

- Shalely limestone bedrock was encountered beneath the fill (BH8 only), silty clay or glacial till, at depths ranging from approximately 2.0 to 3.2m below grade. Groundwater was identified within this unit.

Hydrogeological Characteristics

The water table at the subject site was encountered in the bedrock. Groundwater was also identified within the overburden at BH1, installed within the UST excavation.

Groundwater monitoring events were completed at the Phase II Property in September 2011, November 2015 and August 2018. During the 2011 and 2015 sampling events, groundwater was encountered at depths between 1.2 and 2.2m below existing grade. During the most recent 2018 sampling event, the groundwater depths at BH9 and BH10 were similar, measured at 1.8 and 1.9m below grade; the groundwater level measured at BH6 was deeper, measured at 4.6m below grade. It is noted that water levels fluctuate with seasonal variations.

Based on the groundwater elevations measured during the August 2018 monitoring event, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE4330-4 - Groundwater Contour Plan.

Based on the contour mapping, groundwater flow at the subject site appears to be in a southwesterly direction. A horizontal hydraulic gradient of approximately 0.12 m/m was calculated.

Approximate Depth to Bedrock

Based on the results of the Phase II ESA investigation the approximate depth to bedrock at the subject site varies from 2 to 3.2mbgs.

Approximate Depth to Water Table

Depth to water table at the subject site varies between approximately 1.8 and 4.6m below existing grade.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation (Site Condition Standards, Environmentally Sensitive Areas) does not apply to the RSC Property, in that there are no Environmentally Sensitive Areas in the vicinity of the RSC Property, and the soil pH at the RSC Property is between 5 and 9.

Section 43.1 of the Regulation does apply to the RSC Property in that it appears from the information available to date, that more than one third of the Phase II Property consists of soil greater than or equal to 2m in depth beneath the soil surface. The soil depths across the site will be confirmed at the time of excavation.

Fill Placement

Fill placement has occurred at the subject site. The fill material consists of crushed stone or silty sand with gravel. No deleterious materials were identified in the fill material which is considered to be associated with the pavement structure, the former building structure foundations or the infilling of the former excavations. The fill material was not analysed as part of the current Phase II ESA.

Proposed Buildings and Other Structures

The Phase II Property will be redeveloped with a multi-storey mixed-use building with surface level parking and two levels of underground parking.

Existing Buildings and Structures

There are no buildings present on the Phase II Property, although the concrete floor slab of the former building structure remains in place.

Water Bodies

There are no water bodies on the Phase II Property or within the immediate vicinity of the subject land.

Areas of Natural Significance

No areas of natural significance are present on or within the vicinity of the Phase II Property.

Environmental Condition Prior to Site Remediation

Areas Where Contaminants are Present

Based on screening and analytical results, benzene and xylenes were present in soil at concentrations greater than the MOECP Table 7 Standards in the native glacial till, just above the bedrock, at BH1, within the former tank nest. Concentrations of benzene, PHC (F_3), benzo[g,h,i]perylene and benzo[k]fluroanthene were identified in the groundwater at BH1, BH7 and BH10, at concentrations exceeding the MOECP Table 7 standards. Areas where contaminants are present are shown by parameter group on Drawings PE4430-5 and 6 – Analytical Testing Plans.

Types of Contaminants

Based on the PCAs identified on the Phase II Property, Contaminants of Potential Concern (CPCs) include BTEX, VOCs, PHCs and/or PAHs in soil and groundwater.

Based on the results of the Phase II ESA, the contaminants of concern at the subject site are benzene and xylenes in soil, and benzene, PHC (F_3), benzo[g,h,i]perlyene and benzo[k]fluoranthene in groundwater.

Contaminated Media

Based on the results of the Phase II-ESA, impacted soil and groundwater exceeding the MOECP Table 7 standards, was identified beneath the Phase II Property.

What is Known About The Area Where Contaminants Are Present

Soil (native glacial till) impacted with a benzene and xylene concentration exceeding the MOECP Table 7 standard was identified at BH1, within the former tank nest, just above the bedrock.

Groundwater impacted with a benzene concentration exceeding the MOECP Table 7 standard was identified within the overburden at BH1. Concentrations of PAHs exceeding the MOECP Table 7 standards were identified within the bedrock at BH7, in the area of former waste oil storage. A concentration of PHC (F_3) exceeding the MOECP Table 7 standard was identified in the bedrock at BH7 and BH10, within the footprint of the former waste oil storage area nd automotive service garage bays.

Distribution of Contaminants

The approximate horizontal distribution of contaminants in soil is shown on the following Drawing PE4330-5A – Analytical Testing Plan – Soil (BTEX). The approximate horizontal distribution of contaminants in groundwater is shown on the following drawings:

- Drawing PE4330-6A – Analytical Testing Plan – Groundwater (BTEX, VOCs);
- Drawing PE4330-6B – Analytical Testing Plan – Groundwater (PHCs); and
- Drawing PE4330-6C – Analytical Testing Plan – Groundwater (PAHs).

The approximate vertical distribution of contaminants in soil and groundwater is shown on the following drawings:

- Drawing PE4330-7A – Cross-Section A-A' – Soil (BTEX);
- Drawing PE4330-7C – Cross-Section A-A' – Groundwater (BTEX/VOCs);
- Drawing PE4330-8B– Cross-Section B-B' – Groundwater (BTEX/VOCs);
- Drawing PE4330-8C – Cross-Section B-B' – Groundwater (PHC (F1-F4)); and
- Drawing PE4330-8D– Cross-Section B-B' – Groundwater (PAHs).

Discharge of Contaminants

Petroleum hydrocarbon and BTEX concentrations are expected to have been associated with direct releases to the subsurface from the former tank nest and the former underground waste oil tank and/or floor drain and oil-water separator within the former garage.

The PAH concentrations detected in the groundwater are considered to have been associated with a direct release from the former buried waste oil.

Migration of Contaminants

Physical transport of contaminated soil at the subject site does not appear to be occurring. The benzene impacted soil within the former tank nest is a residual concentration remaining subsequent to the former remedial excavation conducted by others.

Contaminant concentrations are considered to have migrated to the groundwater within the bedrock through downward leaching and/or through fluctuations in the groundwater table. Horizontal migration of groundwater contaminants may be affected by groundwater flow through the bedrock.

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, downward leaching, fluctuation of the groundwater table and groundwater flow may have had a limited effect on the distribution of benzene, PAH and PHC (F_3) contaminants at the Phase II Property.

Potential for Vapour Intrusion

There are no buildings currently on the Phase II Property and therefore no potential for vapour intrusion. All soil and contaminated groudwater will be removed from the Phase II Property as part of the redevelopment of the site. As such, there is no anticipated potential for future vapour intrusion on the subject land.

Contaminant Transport Diagram

Please refer to Drawing PE4330-18 which illustrates and provides narrative notes explaining the contaminant release mechanisms, contaminant transport pathways, human and ecological receptors, receptor exposure points, and routes of exposure at the Phase II Property.

6.0 CONCLUSIONS

Assessment

A Phase II-Environmental Site Assessment (ESA) was conducted for the property addressed 1545 Bank Street, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the Areas of Potential Environmental Concern for the subject site identified during the Phase I ESA. The Phase II-ESA consisted of drilling a total of (10) boreholes, six of which were completed as groundwater monitoring wells. The Phase II ESA summarizes the findings of three (3) field programs conducted during the interim of 2011 through 2018. Of the six (6) monitoring wells placed onsite, three (3) were readily located during the current investigation.

Soil samples were obtained from the boreholes and were screened using visual observations and vapour measurements. Site soils generally consist of a layer of fill material, over silty clay or silty sand till, followed by shaley limestone bedrock. Based on the screening results, various samples were selected for analysis of benzene, toluene, ethylbenzene and xylenes (BTEX) or volatile organic compounds (VOCs), petroleum hydrocarbons (PHCs F_1-F_4) and polycyclic aromatic hydrocarbons (PAHs). Based on the analytical results, native soil beneath the former tank nest on the northwestern corner of the site, exceeds the Ontario Ministry of the Environment, Conservation and Parks (MOECP) Table 7 Standards for benzene and xylenes.

Groundwater samples collected from BH1, BH2, BH6, BH7, BH8, BH9 and BH10 were analysed for a combination of BTEX, VOCs, PHCs and/or PAHs. A concentration of PHC (F_2) exceeding the MOECP Table 7 standard was identified in BH1 during the September 2011 sampling event. During a subsequent June 2012 sampling event, PHC (F_2) was not detected above the laboratory method detection limit, however benzene was identified in Sample BH1-GW2 at a concentration exceeding the MOECP Table 7 standard.

Concentrations of benzo[g,h,i]perylene, benzo[k]fluoranthene and PHC (F_3) exceeding MOECP Table 7 standards, were identified in a groundwater sample recovered from BH7, within the former waste oil tank nest. A concentration of PHC (F_3) exceeding the MOECP Table 7 standard was identified in the groundwater recovered from BH10, within the footprint of the former automotive service garage bays. Based on the laboratory Certificate of Analysis, this sample result may have been biased high by a non-mineral based compound.

Recommendations

It is recommended that a soil and groundwater remediation program be carried out at the Phase II Property. It is our understanding that the site will be redeveloped with a multi-storey, mixed-used building with two (2) levels of underground parking. The soil and groundwater impacts present on the Phase II Property are not considered to pose an immediate concern to the property as it is currently vacant.

It is recommended that the soil and groundwater remediation program be completed in conjunction with the redevelopment of the subject land. Prior to the remediation program a representative sample of impacted soil will require a leachate analysis in accordance with Ontario Regulation 558, for disposal at an approved waste disposal facility. It is recommended that Paterson personnel be on-site at the time of the remediation program in order to direct the segregation and excavation of impacted soils and to conduct confirmatory sampling as required.

It is also recommended that prior to the remedial activities, an additional attempt be made to locate BH1 and BH7 to confirm the groundwater quality at these locations. In addition to resampling BH1 and BH7, the groundwater from BH10 should be resampled in order to confirm the previous PHC results and to provide delineation of PAH parameters previously identified in BH7 (2015).

7.0 STATEMENT OF LIMITATIONS

This Phase II - Environmental Site Assessment report has been prepared in general accordance with O.Reg. 153/04 as amended by O.Reg. 269/11, 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 of Financial Eastern Star Group. Permission and notification from Financial Eastern Star Group and Paterson will be required to release this report to any other party.

Paterson Group Inc.

Karyn Munch, P.Eng., QP$_{ESA}$

Mark S. D'Arcy, P.Eng., QP$_{ESA}$

Report Distribution:

- ❒ Financial Eastern Star Group
- ❒ Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE4330-3 – TEST HOLE LOCATION PLAN

DRAWING PE4330-4 – GROUNDWATER CONTOUR PLAN

DRAWING PE4330-5A – ANALYTICAL TESTING PLAN - SOIL (BTEX)

DRAWING PE4330-5B – ANALYTICAL TESTING PLAN – SOIL (PHC (F_1-F_4), VOCs, PAHs)

DRAWING PE4330-6A – ANALYTICAL TESTING PLAN – GROUNDWATER (BTEX, VOCs)

DRAWING PE4330-6B – ANALTYICAL TESTING PLAN – GROUNDWATER (PHC (F_1-F_4))

DRAWING PE4330-6C – ANALYTICAL TESTING PLAN – GROUNDWATER (PAHs)

DRAWING PE4330-7A – CROSS-SECTION A-A' – SOIL (BTEX)

DRAWING PE4330-7B– CROSS-SECTION A-A' – SOIL (PHC (F_1-F_4), VOCs, PAHs)

DRAWING E4330-7C CROSS-SECTION A-A' – GROUNDWATER (BTEX/VOCs)

DRAWING PE4330-7D – CROSS-SECTION A-A' – GROUNDWATER (PHCs)

DRAWING PE4330-8A – CROSS-SECTION B-B' – SOIL (BTEX, PHC (F_1-F_4), VOCs, PAHs)

DRAWING PE4330-8B – CROSS-SECTION B-B' – GROUNDWATER (BTEX/VOCs)

DRAWING PE4330-8C – CROSS-SECTION B-B' – GROUNDWATER (PHC (F_1-F_4))

DRAWING PE4330-8D – CROSS-SECTION B-B' – GROUNDWATER (PAHs)

DRAWING PE4330-18 – CONTAMINANT TRANSPORT DIAGRAM

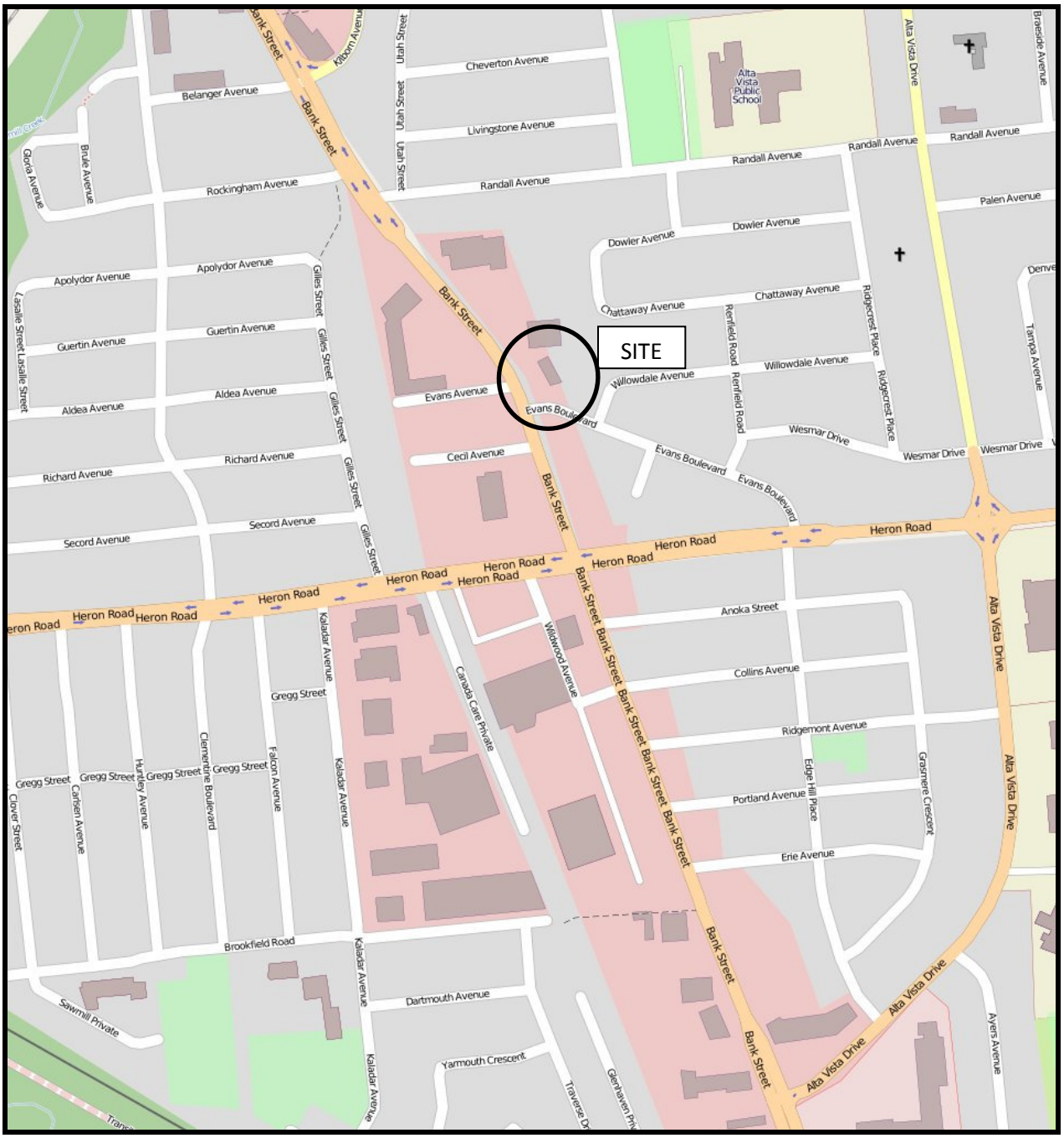

FIGURE 1

KEY PLAN

#1525 BANK STREET
RBC BANK/LOCAL HEROES BAR & GRILL

FORMER UNDERGROUND FUEL TANK NEST EXCAVATION

A

FH - BM

B'

CATCH BASIN (BLOCKED)

BH 7
87.58

CONC. PAD

FORMER UNDERGROUND WASTE OIL CONTAINER LOCATION

#1215 WILLOWDALE AVE RESIDENTIAL

#1211 WILLOWDALE AVE RESIDENTIAL

BH 1
86.75

BH 10
87.58
[85.55]
(85.65)

FORMER SERVICE BAY EXCAVATIONS

#1545 BANK STREET

CRUSHED STONE

ASPHALTIC CONCRETE

BH 3
87.44

BH 5
86.82

BH 8
86.93

BH 2
86.95

GAS CONNECTION

MAN DOOR

BH 9
87.68
[85.55]
(85.84)

BH 6
87.28
[85.15]
(82.68)

MAN DOOR

BANK STREET

B

FORMER PUMP ISLANDS REMEDIATION EXCAVATION

#1207 EVANS BLVD DENTAL OFFICE

#1207 WILLOWDALE AVE. RESIDENTIAL

BH 4
87.40

ASPHALTIC CONCRETE

A'

#1215 EVANS BLVD. RESIDENTIAL

EVANS BOULEVARD

LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION, CURRENT INVESTIGATION
- BOREHOLE LOCATION, PATERSON GROUP REPORT PE2422, 2015
- BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
- DESTROYED BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
- 87.68 GROUND SURFACE ELEVATION (m)
- [85.55] BEDROCK SURFACE ELEVATION (m)
- (85.65) GROUNDWATER SURFACE ELEVATION, AUG. 2018 (m)
- PHASE II PROPERTY BOUNDARY

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 87.426m.

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consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:300	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-3
Approved by: MSD	Revision No.: 0

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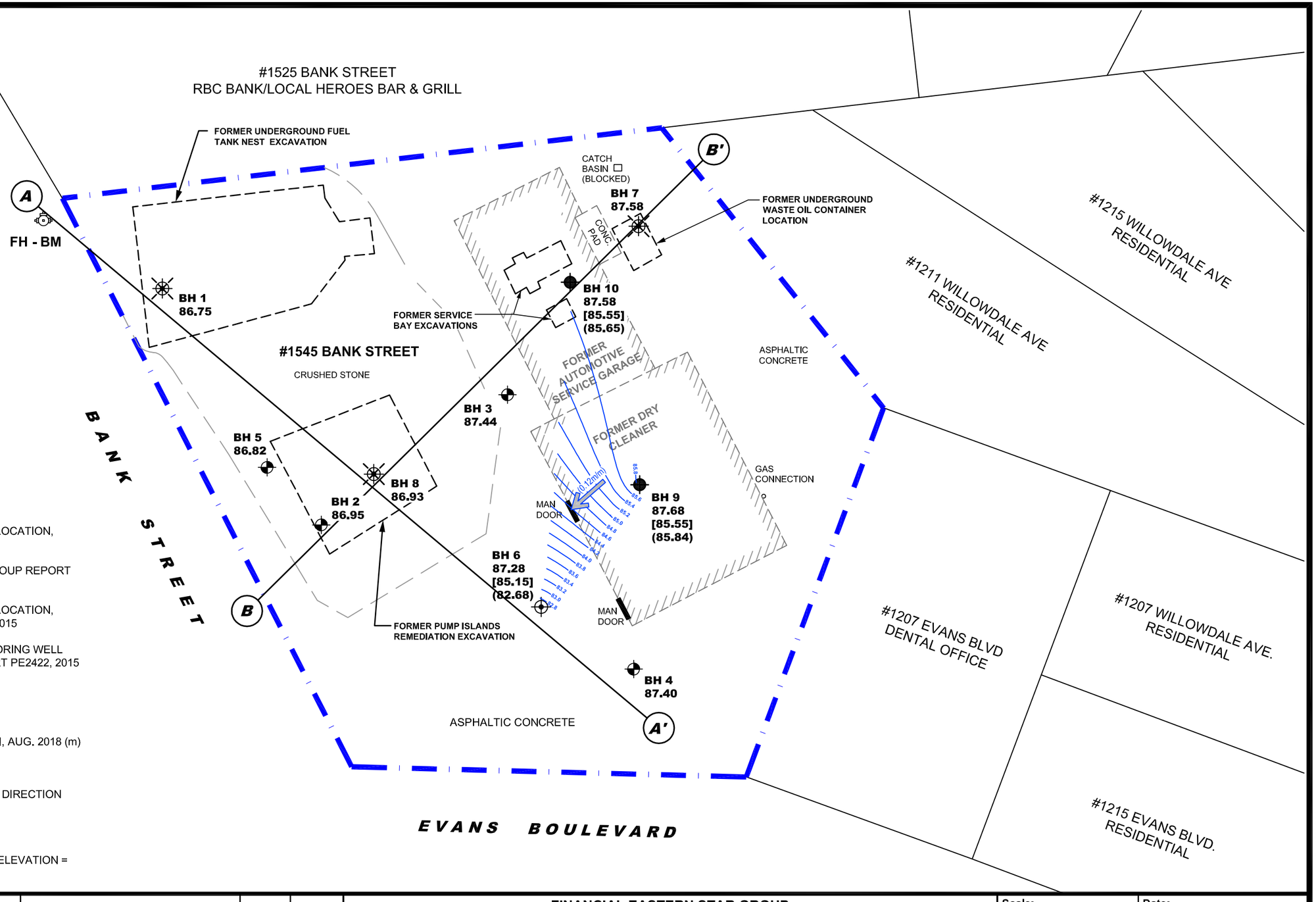
#1525 BANK STREET
RBC BANK/LOCAL HEROES BAR & GRILL



LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION, CURRENT INVESTIGATION
- BOREHOLE LOCATION, PATERSON GROUP REPORT PE2422, 2015
- BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
- DESTROYED BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
- 87.68 GROUND SURFACE ELEVATION (m)
- [85.55] BEDROCK SURFACE ELEVATION (m)
- (85.65) GROUNDWATER SURFACE ELEVATION, AUG. 2018 (m)
- 84.2 GROUNDWATER CONTOUR (m)
- (0.06m/m) APPROXIMATE GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)
- PHASE II PROPERTY BOUNDARY

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 87.426m.

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NO.	REVISIONS	DATE	INITIAL
0			

FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:

GROUNDWATER CONTOUR PLAN

Scale: 1:300	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-4
Approved by: MSD	Revision No.: 0

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#1525 BANK STREET
RBC BANK/LOCAL HEROES BAR & GRILL

FORMER UNDERGROUND FUEL TANK NEST EXCAVATION

FH - BM

BH1-SS5 (3.0-3.18m) - Sept.22, 2011

Parameter	Result	MOECP (µg/g)
Benzene	0.25	0.21
Xylenes	7.48	3.1

Toluene and Ethylbenzene comply with MOECP Table 7

BH 1
86.75

BH5-SS2 (0.76-1.37m) - Sept.22, 2011
BTEX complies with MOECP Table 7

BH8-SS4 (2.28-2.67m) - Nov.20, 2015
BTEX complies with MOECP Table 7

#1545 BANK STREET

CRUSHED STONE

BH 5
86.82

BH 2
86.95

BH 8
86.93

BH 3
87.44

FORMER SERVICE BAY EXCAVATIONS

CATCH BASIN (BLOCKED)

CONC. PAD

BH 7
87.58

BH7-SS4 (2.29-2.49m) - Nov.20, 2015
BTEX complies with MOECP Table 7

FORMER UNDERGROUND WASTE OIL CONTAINER LOCATION

BH 10
87.58
[85.55]
(85.65)

ASPHALTIC CONCRETE

BH9-SS2 (1.52-2.13m) - July 26, 2018
BTEX complies with MOECP Table 7

GAS CONNECTION

MAN DOOR

BH 9
87.68
[85.55]
(85.84)

BH 6
87.28
[85.15]
(82.68)

MAN DOOR

FORMER PUMP ISLANDS REMEDIATION EXCAVATION

BH 4
87.40

BH6-SS3 (0.76-1.37m) - Nov.20, 2015
BTEX complies with MOECP Table 7

ASPHALTIC CONCRETE

#1215 WILLOWDALE AVE RESIDENTIAL

#1211 WILLOWDALE AVE RESIDENTIAL

#1207 EVANS BLVD DENTAL OFFICE

#1207 WILLOWDALE AVE. RESIDENTIAL

#1215 EVANS BLVD. RESIDENTIAL

BANK STREET

EVANS BOULEVARD

LEGEND:

SOIL PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

SOIL PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION, CURRENT INVESTIGATION
- BOREHOLE LOCATION, PATERSON GROUP REPORT PE2422, 2015
- BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
- DESTROYED BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
- 87.68 GROUND SURFACE ELEVATION (m)
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- PHASE II PROPERTY BOUNDARY

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 87.426m.

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NO.	REVISIONS	DATE	INITIAL
0			

FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL - BTEX

Scale: 1:300	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-5A
Approved by: MSD	Revision No.: 0

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#1525 BANK STREET
RBC BANK/LOCAL HEROES BAR & GRILL

FORMER UNDERGROUND FUEL TANK NEST EXCAVATION

FH - BM

BH 1
86.75

BH1-SS5 (3.0-3.18m) - Sept.22, 2011
PHC (F1-F4) comply with MOECP Table 7

BH5-SS2 (0.76-1.37m) - Sept.22, 2011
PHC (F1-F4) comply with MOECP Table 7

BH8-SS4 (2.28-2.67m) - Nov.20, 2015
PHC (F1-F4) comply with MOECP Table 7

#1545 BANK STREET

CRUSHED STONE

BANK STREET

BH 5
86.82

BH 8
86.93

BH 2
86.95

BH 3
87.44

FORMER SERVICE BAY EXCAVATIONS

CATCH BASIN (BLOCKED)

BH 7
87.58

CONC. PAD

BH7-SS4 (2.29-2.49m) - Nov.20, 2015
PHC (F1-F4) and PAH comply with MOECP Table 7

FORMER UNDERGROUND WASTE OIL CONTAINER LOCATION

BH 10
87.58
[85.55]
(85.65)

ASPHALTIC CONCRETE

BH10-SS2 (1.52-2.13m) - July 26, 2018
VOCs and PHC (F1-F4) comply with MOECP Table 7

GAS CONNECTION

MAN DOOR

BH 9
87.68
[85.55]
(85.84)

BH9-SS2 (1.52-2.13m) - July 26, 2018
VOCs and PHC (F1-F4) comply with MOECP Table 7

BH 6
87.28
[85.15]
(82.68)

MAN DOOR

FORMER PUMP ISLANDS REMEDIATION EXCAVATION

BH 4
87.40

BH6-SS3 (0.76-1.37m) - Nov.20, 2015
VOCs and PHC (F1-F4) comply with MOECP Table 7

ASPHALTIC CONCRETE

#1211 WILLOWDALE AVE RESIDENTIAL

#1215 WILLOWDALE AVE RESIDENTIAL

#1207 EVANS BLVD DENTAL OFFICE

#1207 WILLOWDALE AVE. RESIDENTIAL

#1215 EVANS BLVD. RESIDENTIAL

EVANS BOULEVARD

LEGEND:

SOIL PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION, CURRENT INVESTIGATION
- BOREHOLE LOCATION, PATERSON GROUP REPORT PE2422, 2015
- BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
- DESTROYED BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
- 87.68 GROUND SURFACE ELEVATION (m)
- [85.55] BEDROCK SURFACE ELEVATION (m)
- (85.65) GROUNDWATER SURFACE ELEVATION, AUG. 2018 (m)
- PHASE II PROPERTY BOUNDARY

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 87.426m.

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FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN - SOIL - VOCs, PHCs (F1-F4), PAHs

Scale: 1:300	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-5B
Approved by: MSD	Revision No.: 0

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#1525 BANK STREET
RBC BANK/LOCAL HEROES BAR & GRILL

BH1-GW1 (1.68-3.1m) - Sept.30, 2011
BTEX and VOCs comply with MOECP Table 7

BH1-GW2 (1.68-3.1m) - June 25, 2012

Parameter	Result	MOECP (µg/g)
Benzene	**5.2**	0.5

Other BTEX and VOCs parameters comply with MOECP Table 7

FORMER UNDERGROUND FUEL TANK NEST EXCAVATION

FH - BM

BH 1
86.75

BH8-GW1 (3.73-5.23m) - Nov.27, 2015
BTEX and VOCs comply with MOECP Table 7

BH2-GW1 (1.47-2.97m) - Nov.1, 2011
BTEX and VOCs comply with MOECP Table 7

#1545 BANK STREET

CRUSHED STONE

BH 5
86.82

BH 8
86.93

BH 2
86.95

BH 3
87.44

BANK STREET

CATCH BASIN (BLOCKED)

BH 7
87.58

BH7-GW1 (3.55-5.05m) - Sept.30, 2011
BTEX and VOCs comply with MOECP Table 7

FORMER UNDERGROUND WASTE OIL CONTAINER LOCATION

CONC. PAD

BH10-GW1 (3.10-6.10m) - Aug.2, 2018
BTEX and VOCs comply with MOECP Table3

BH 10
87.58
[85.55]
(85.65)

FORMER SERVICE BAY EXCAVATIONS

FORMER AUTOMOTIVE SERVICE GARAGE

FORMER DRY CLEANER

ASPHALTIC CONCRETE

GAS CONNECTION

MAN DOOR

BH 9
87.68
[85.55]
(85.84)

BH9-GW1 (3.38-6.38m) - Aug.2, 2018
BTEX and VOCs comply with MOECP Table 7

BH 6
87.28
[85.15]
(82.68)

MAN DOOR

FORMER PUMP ISLANDS REMEDIATION EXCAVATION

BH 4
87.40

BH6-GW1 (5.08-8.08m) - Nov. 27, 2015

Parameter	Result	MOECP (ug/g)
Chloroform	**11.8**	**2**

BTEX and other VOC parameters comply with MOECP Table 7

BH6-GW2 (5.08-8.08m) - August 2, 2018
BTEX and VOCs comply with MOECP Table 7

ASPHALTIC CONCRETE

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#1211 WILLOWDALE AVE RESIDENTIAL

#1207 EVANS BLVD DENTAL OFFICE

#1207 WILLOWDALE AVE. RESIDENTIAL

#1215 EVANS BLVD. RESIDENTIAL

EVANS BOULEVARD

LEGEND:

GROUNDWATER PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

GROUNDWATER PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION, CURRENT INVESTIGATION
- BOREHOLE LOCATION, PATERSON GROUP REPORT PE2422, 2015
- BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
- DESTROYED BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
- 87.68 GROUND SURFACE ELEVATION (m)
- [85.55] BEDROCK SURFACE ELEVATION (m)
- (85.65) GROUNDWATER SURFACE ELEVATION, AUG. 2018 (m)
- PHASE II PROPERTY BOUNDARY

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 87.426m.

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FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET
OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN - GROUNDWATER - BTEX/VOCs

Scale: 1:300	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: AM	Dwg. No.: PE4330-6A
Approved by: MSD	Revision No.: 0

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#1525 BANK STREET
RBC BANK/LOCAL HEROES BAR & GRILL

BH1-GW1 (1.68-3.1m) - Sept. 30, 2011

Parameter	Result	MOECP (µg/g)
PHC (F2)	435	150

PHC F1, F3 and F4 comply with MOECP Table 7

BH1-GW2 (1.68-3.1m) - June 25, 2012
PHC (F1-F4) comply with MOECP Table 7

BH7-GW1 (3.55-5.05m) - Sept.30, 2011

Parameter	Result	MOECP (µg/g)
PHC (F3)	690	500

PHC F1, F2 and F4 comply with MOECP Table 7

BH10-GW1 (3.10-6.10m) - Aug.2, 2018

Parameter	Result	MOECP (µg/g)
PHC (F3)	4,490	500

PHC F1, F2 and F4 comply with MOECP Table 7

BH8-GW1 (3.73-5.23m) - Nov.27, 2015
PHC (F1-F4) comply with MOECP Table 7

BH2-GW1 (1.47-2.97m) - Nov.1, 2011
PHC (F1-F4) comply with MOECP Table 7

BH9-GW1 (3.38-6.38m) - Aug.2, 2018
PHC (F1-F4) comply with MOECP Table 7

BH6-GW1 (5.08-8.08m) - Nov.27, 2015
PHC (F1) complies with MOECP Table 7
*insufficient groundwater sample for analysis of PHC F2-F4

FORMER UNDERGROUND FUEL TANK NEST EXCAVATION
FORMER UNDERGROUND WASTE OIL CONTAINER LOCATION
FORMER SERVICE BAY EXCAVATIONS
FORMER PUMP ISLANDS REMEDIATION EXCAVATION
CATCH BASIN (BLOCKED)
CONC. PAD
ASPHALTIC CONCRETE
GAS CONNECTION
MAN DOOR
FH - BM
#1545 BANK STREET
CRUSHED STONE
BANK STREET
EVANS BOULEVARD
#1215 WILLOWDALE AVE RESIDENTIAL
#1211 WILLOWDALE AVE RESIDENTIAL
#1207 EVANS BLVD DENTAL OFFICE
#1207 WILLOWDALE AVE. RESIDENTIAL
#1215 EVANS BLVD. RESIDENTIAL

BH 1 86.75
BH 2 86.95
BH 3 87.44
BH 4 87.40
BH 5 86.82
BH 6 87.28 [85.15] (82.68)
BH 7 87.58
BH 8 86.93
BH 9 87.68 [85.55] (85.84)
BH 10 87.58 [85.55] (85.65)

LEGEND:

GROUNDWATER PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

GROUNDWATER PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

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- BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
- DESTROYED BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
- 87.68 GROUND SURFACE ELEVATION (m)
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- PHASE II PROPERTY BOUNDARY

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 87.426m.

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FINANCIAL EASTERN STAR GROUP
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET
OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN - GROUNDWATER - PHCs

Scale: 1:300	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-6B
Approved by: MSD	Revision No.: 0

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#1525 BANK STREET
RBC BANK/LOCAL HEROES BAR & GRILL

FORMER UNDERGROUND FUEL TANK NEST EXCAVATION

FH - BM

1

BH 1
86.75

BH7-GW1 (3.55-5.05m) - Sept.30, 2011

Parameter	Result	MOECP (µg/g)
Benzo[g,h,i]perylene	0.38	0.2
Benzo[k]fluoranthene	0.54	0.4

Other PAH parameters comply with MOECP Table 7

CATCH BASIN (BLOCKED)

BH 7
87.58

CONC. PAD

FORMER UNDERGROUND WASTE OIL CONTAINER LOCATION

BH10-GW1 (3.10-6.10m) - Aug.2, 2018
PAHs comply with MOECP Table 7

BH 10
87.58
[85.55]
(85.65)

FORMER SERVICE BAY EXCAVATIONS

#1545 BANK STREET

CRUSHED STONE

ASPHALTIC CONCRETE

BH 3
87.44

BH 5
86.82

BH 8
86.93

BH 2
86.95

BANK STREET

GAS CONNECTION

MAN DOOR

BH 9
87.68
[85.55]
(85.84)

BH 6
87.28
[85.15]
(82.68)

MAN DOOR

FORMER PUMP ISLANDS REMEDIATION EXCAVATION

BH 4
87.40

ASPHALTIC CONCRETE

EVANS BOULEVARD

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#1211 WILLOWDALE AVE RESIDENTIAL

#1207 EVANS BLVD DENTAL OFFICE

#1207 WILLOWDALE AVE. RESIDENTIAL

#1215 EVANS BLVD. RESIDENTIAL

LEGEND:

GROUNDWATER PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

GROUNDWATER PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

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- BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
- DESTROYED BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE2422, 2015
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- [85.55] BEDROCK SURFACE ELEVATION (m)
- (85.65) GROUNDWATER SURFACE ELEVATION, AUG. 2018 (m)
- PHASE II PROPERTY BOUNDARY

BM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 87.426m.

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FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:

ANALITICAL TESTING PLAN - GROUNDWATER - PAHs

Scale: 1:300	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-6C
Approved by: MSD	Revision No.: 0

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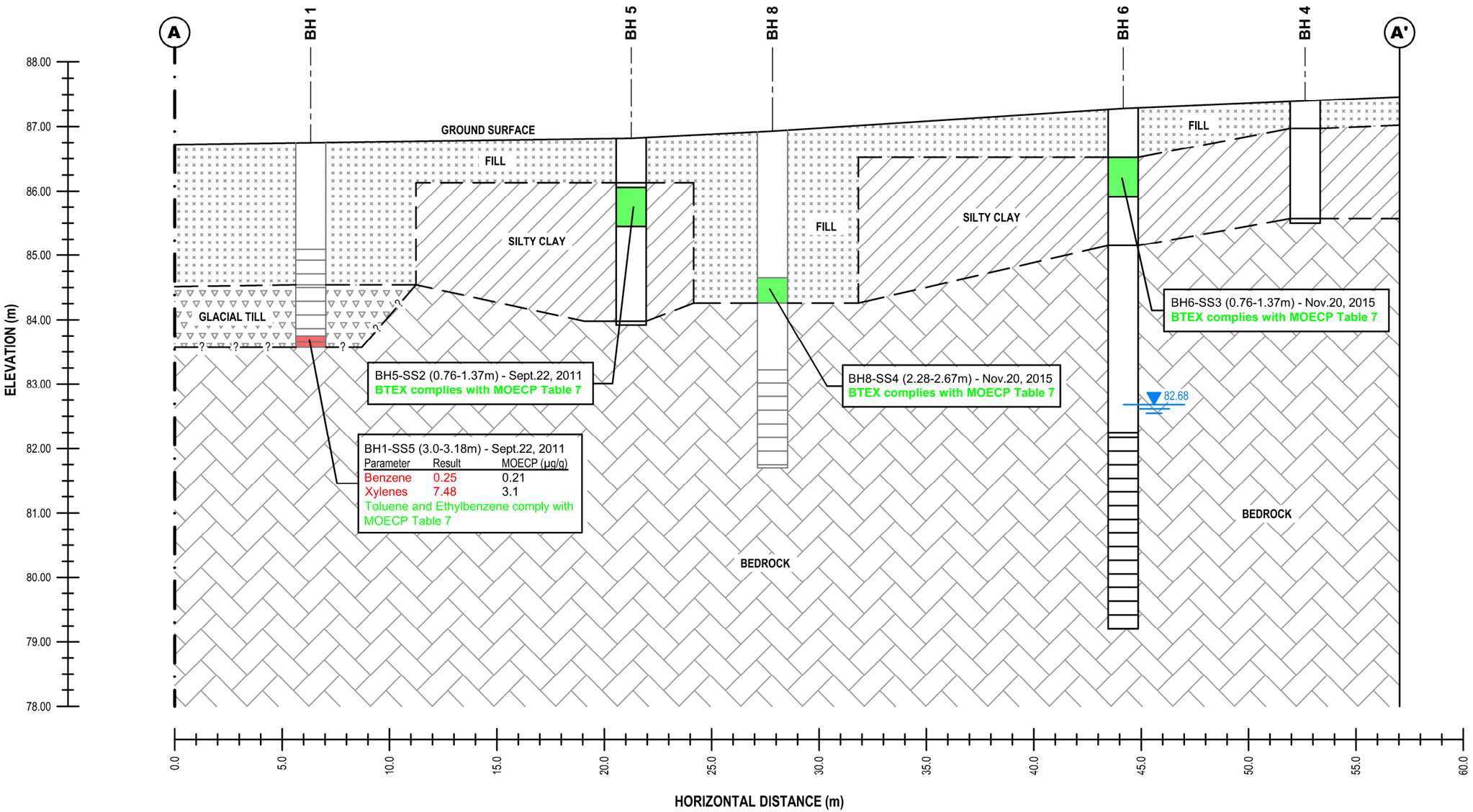

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FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A' - SOIL (BTEX)

Scale: AS SHOWN	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-7A
Approved by: MSD	Revision No.: 0

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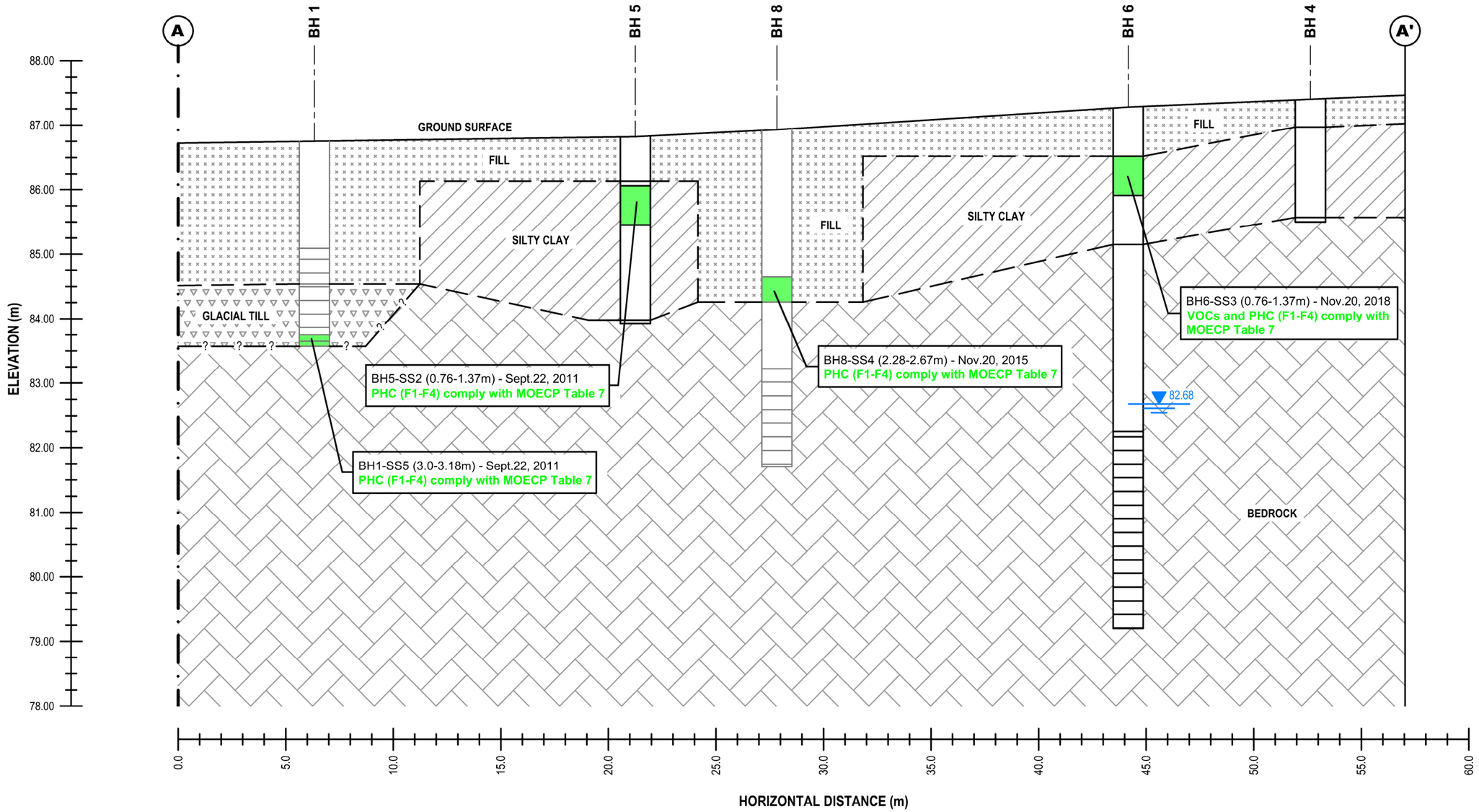

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FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A' - SOIL (VOCs, PHCs, PAHs)

Scale: AS SHOWN	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-7B
Approved by: MSD	Revision No.: 0

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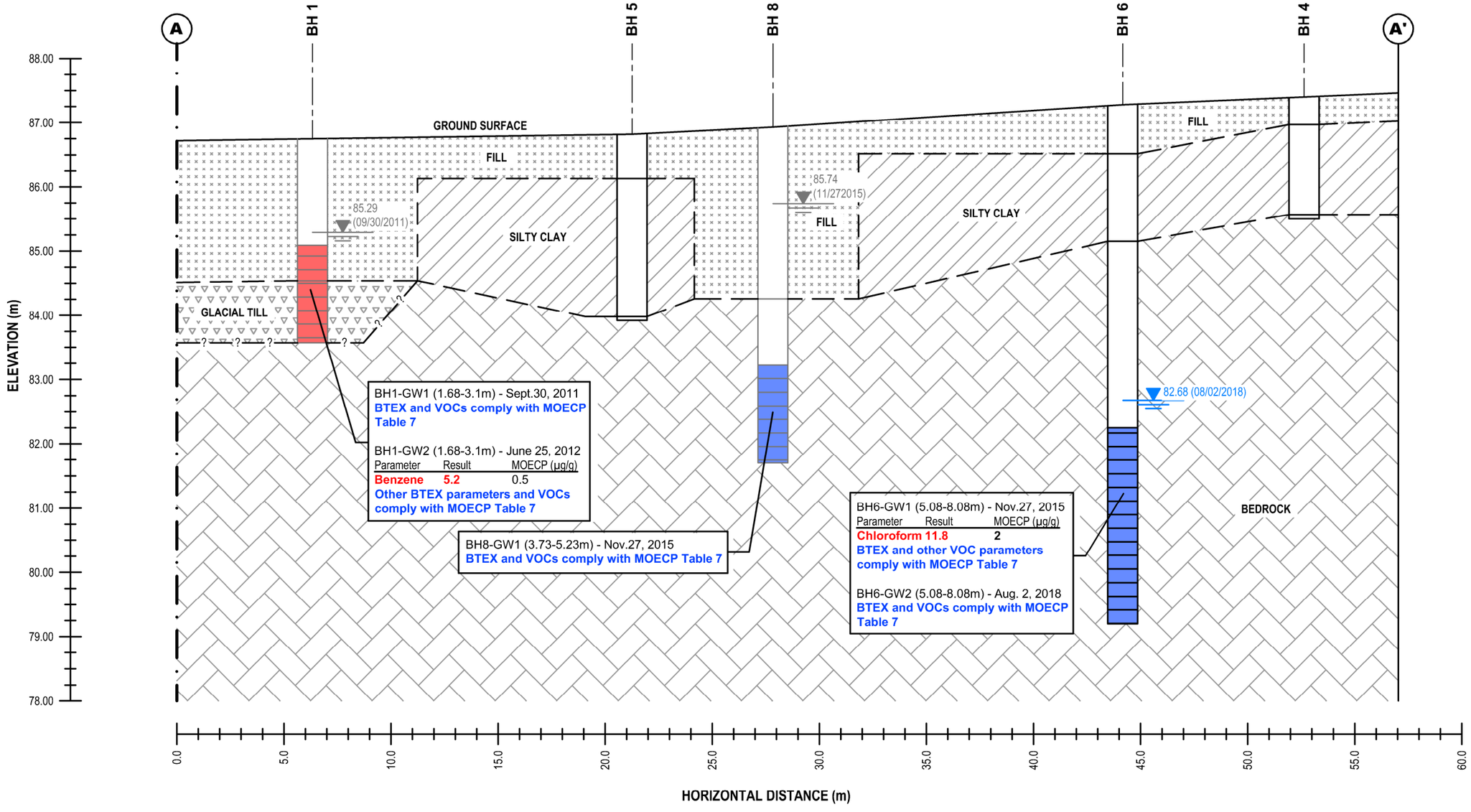

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FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:
CROSS-SECTION A-A' - GROUNDWATER (BTEX, VOCs)

Scale: AS SHOWN	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-7C
Approved by: MSD	Revision No.: 0

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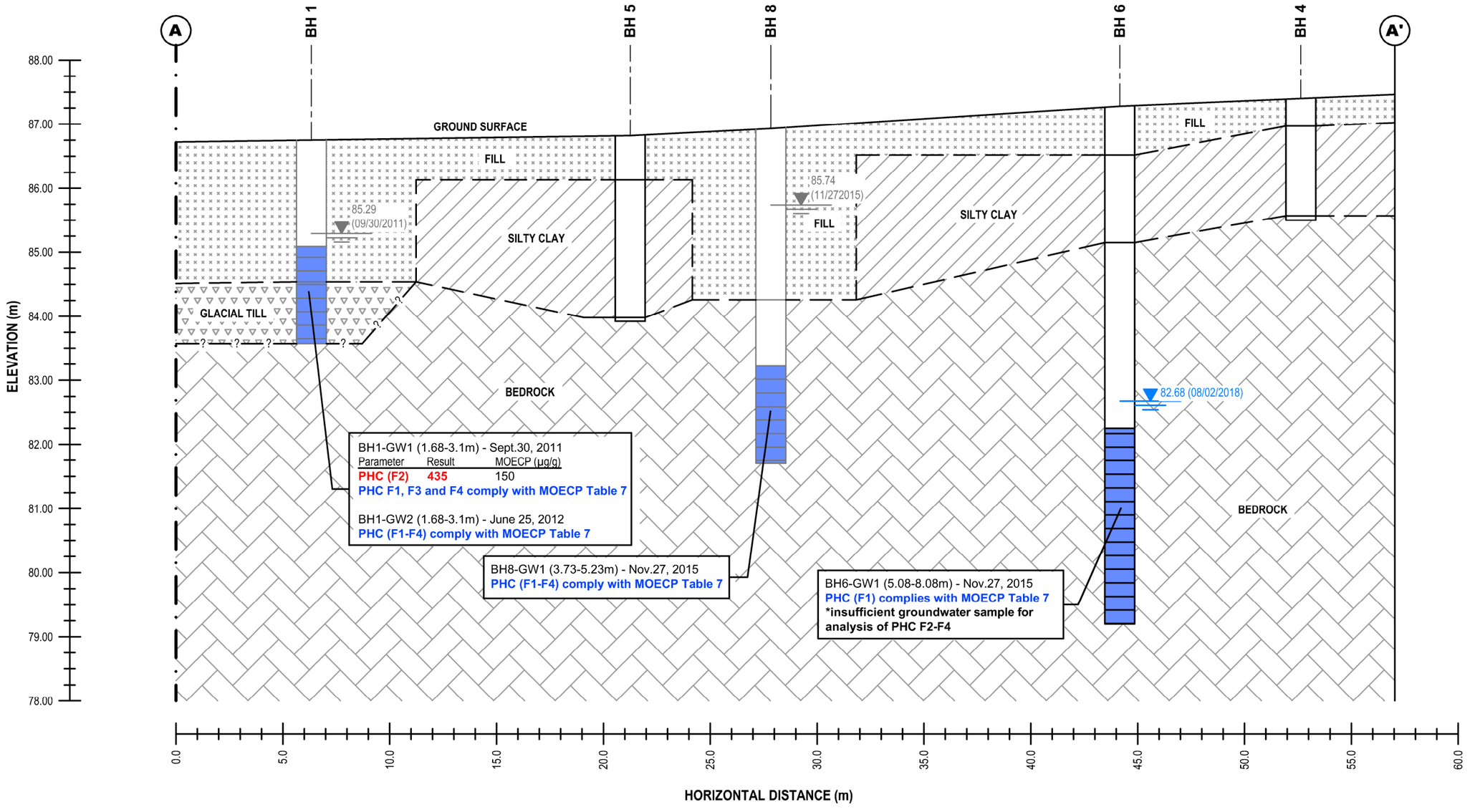

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FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A' - GROUNDWATER (PHCs)

Scale: AS SHOWN	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-7D
Approved by: MSD	Revision No.: 0

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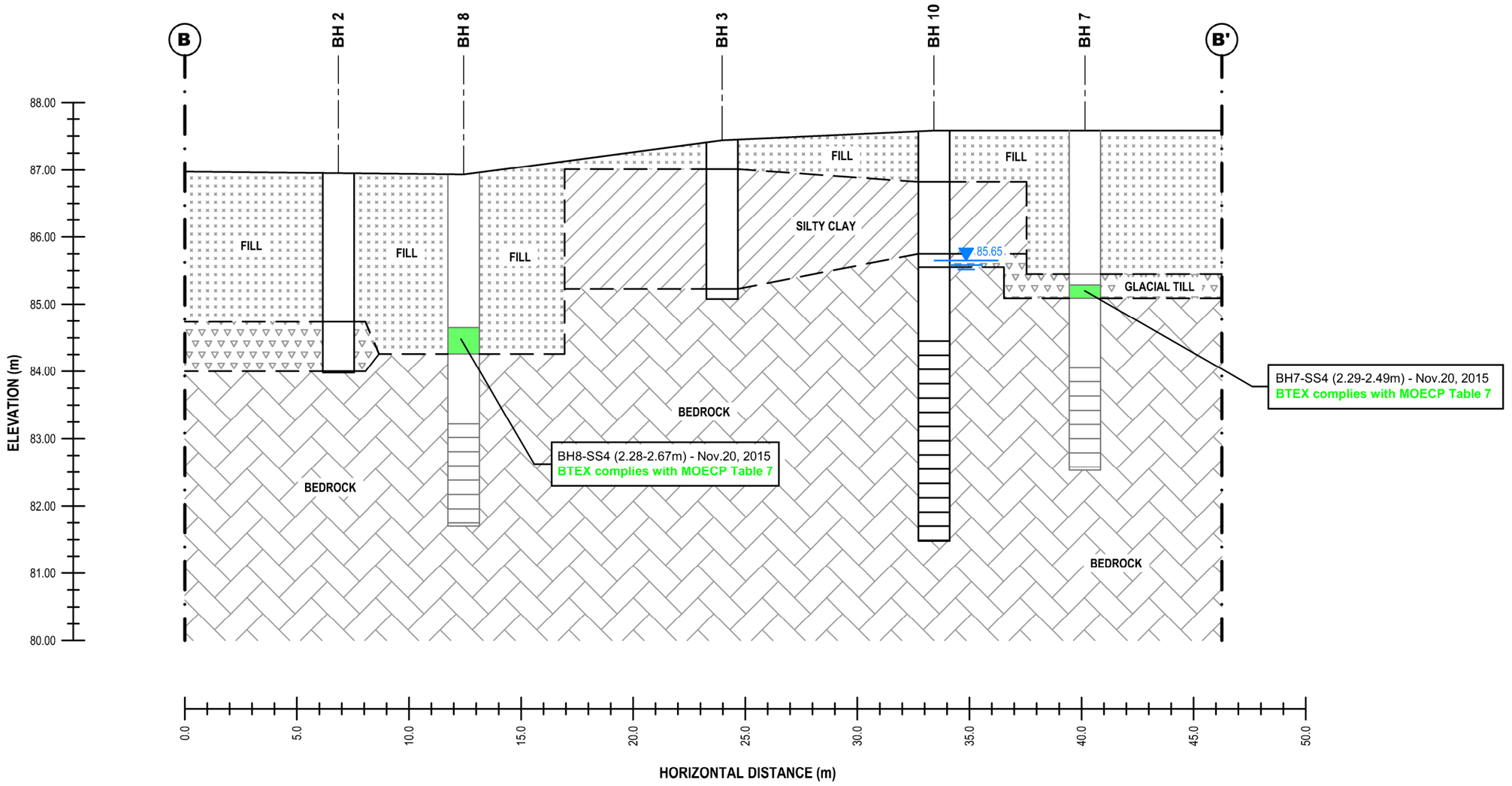

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FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:

CROSS-SECTION B-B' - SOIL (BTEX)

Scale: AS SHOWN	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-8A
Approved by: MSD	Revision No.: 0

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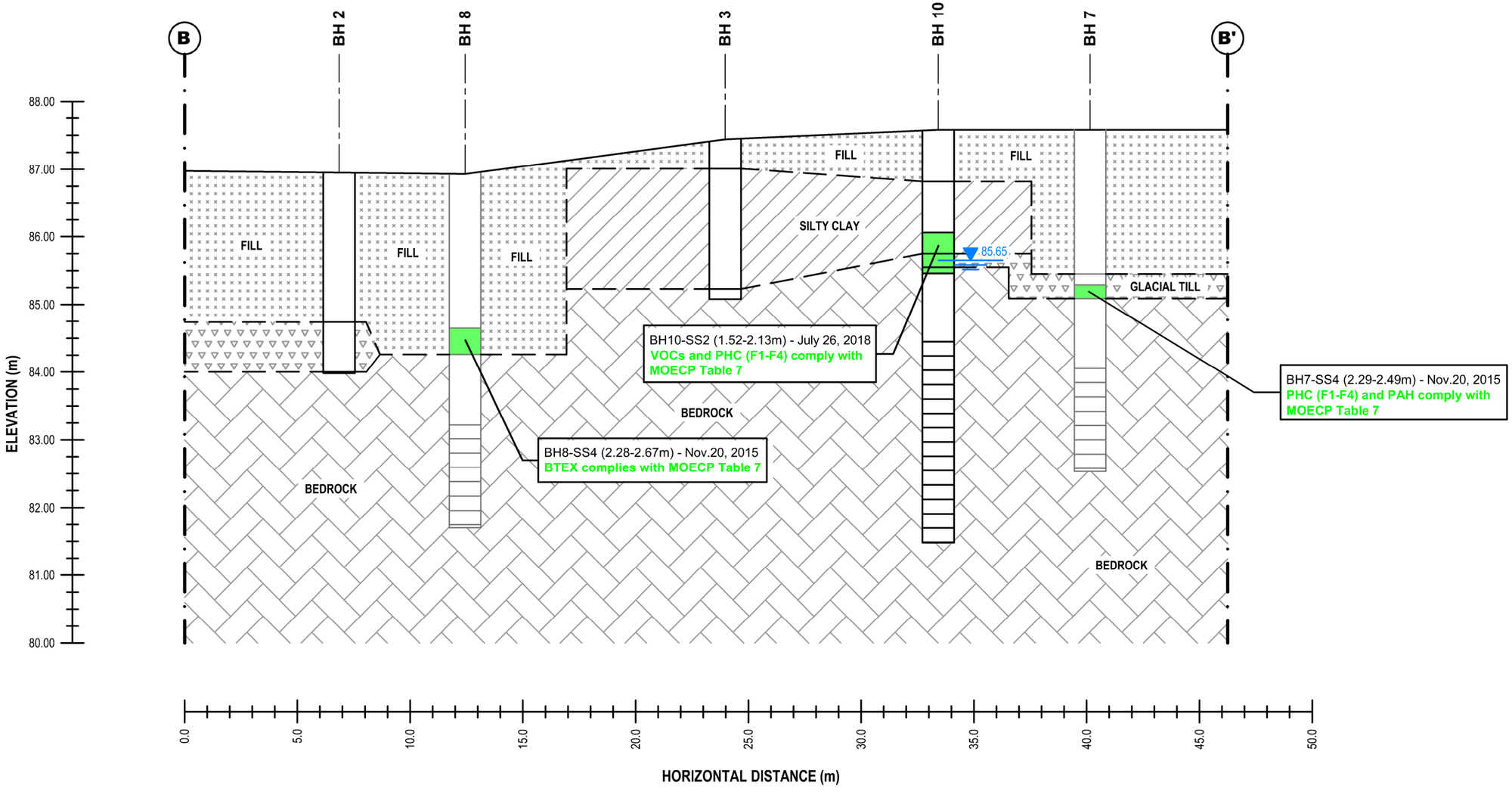

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FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:
CROSS-SECTION B-B' - SOIL (VOCs, PHCs, PAHs)

Scale: AS SHOWN	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-8B
Approved by: MSD	Revision No.: 0

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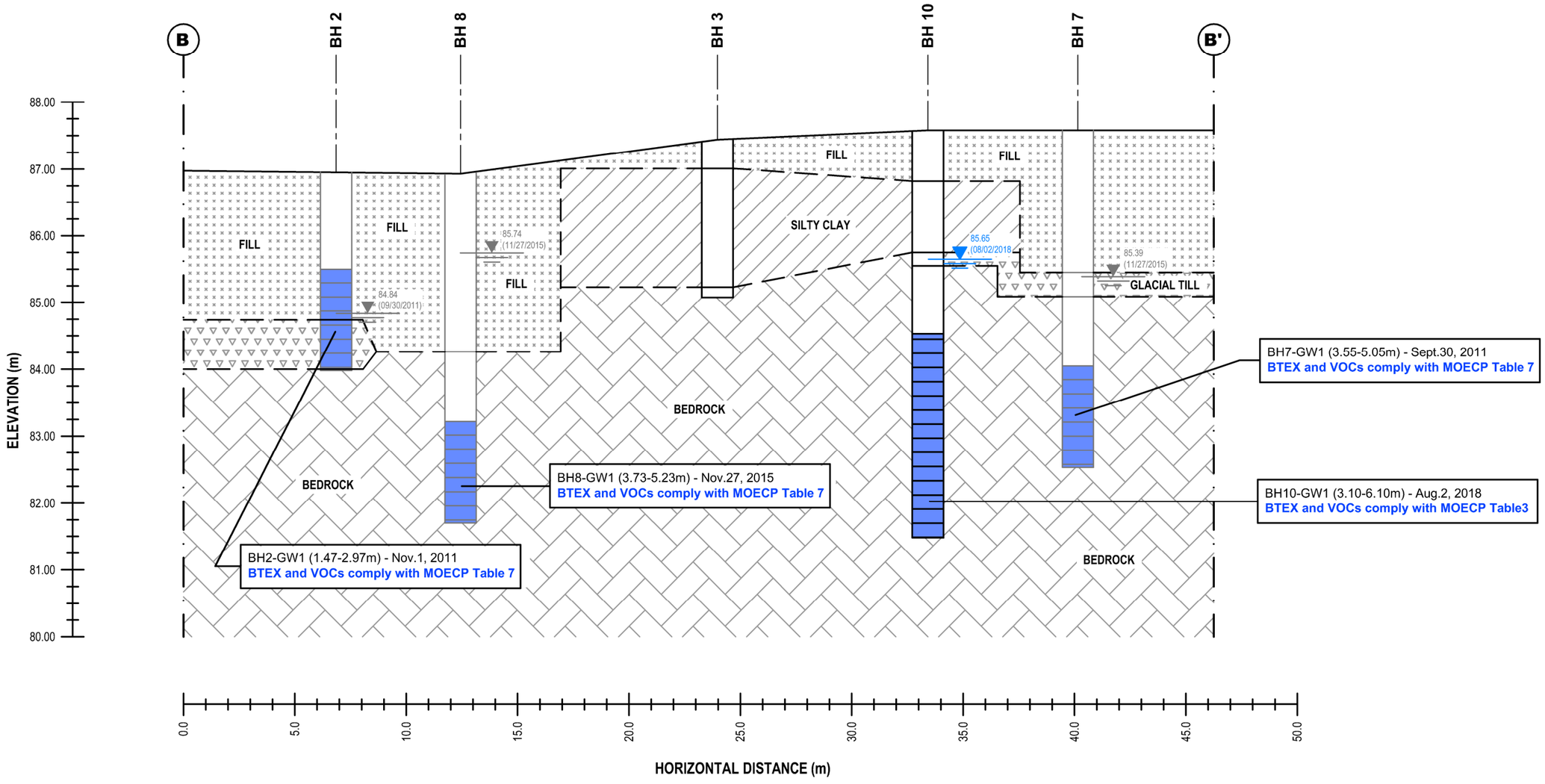

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FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:

CROSS-SECTION B-B' - GROUNDWATER (BTEX, VOCs)

Scale: AS SHOWN	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-8C
Approved by: MSD	Revision No.: 0

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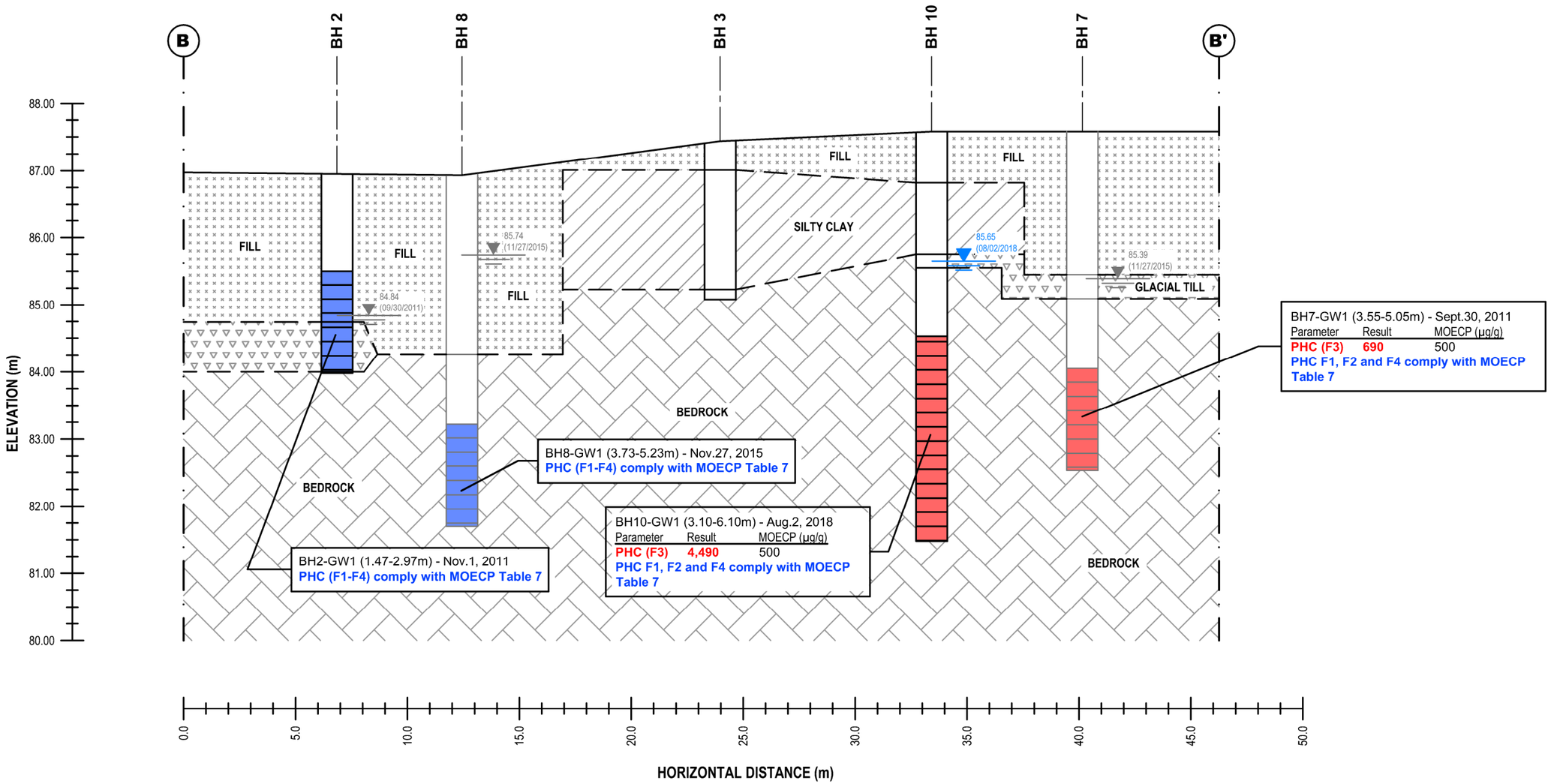

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FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:

CROSS-SECTION B-B' - GROUNDWATER (PHCs)

Scale: AS SHOWN	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-8D
Approved by: MSD	Revision No.: 0

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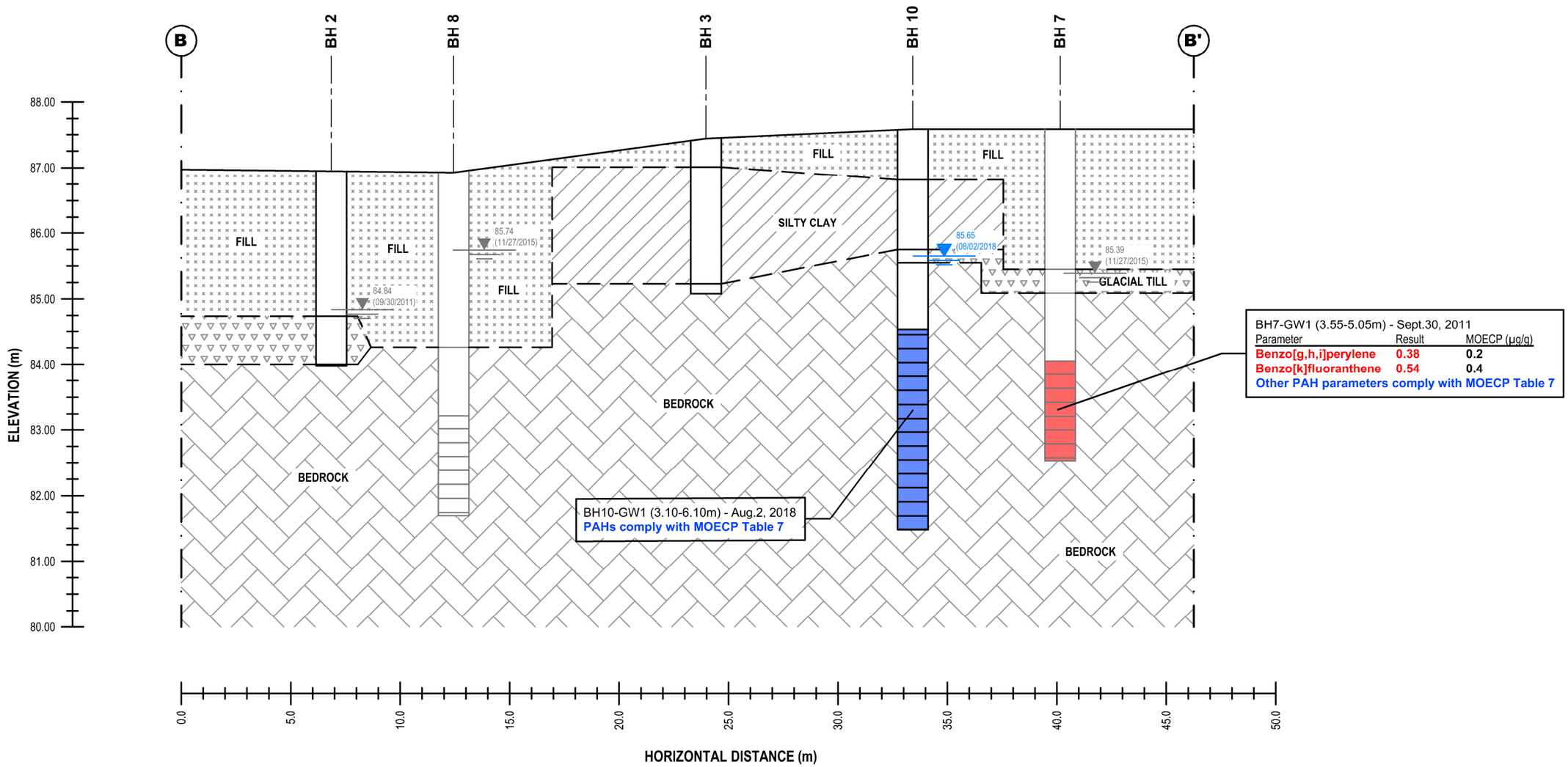

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FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1545 BANK STREET

OTTAWA, ONTARIO

Title:

CROSS-SECTION B-B' - GROUNDWATER (PAHs)

Scale: AS SHOWN	Date: 08/2018
Drawn by: MPG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-8E
Approved by: MSD	Revision No.: 0

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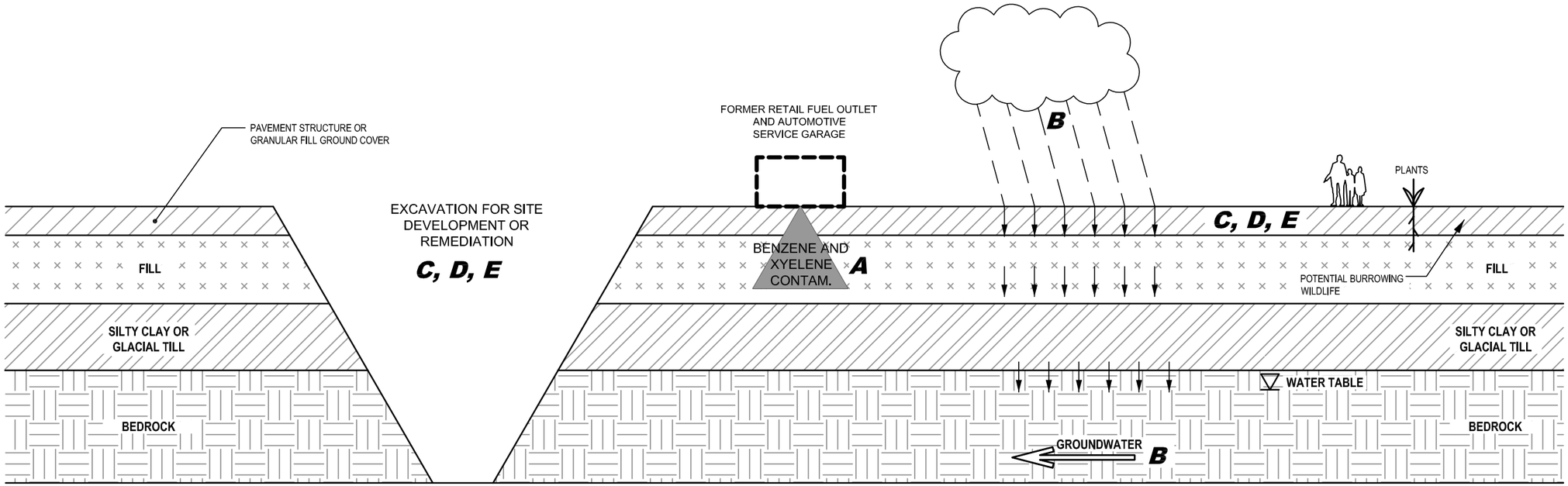

NARRATIVE NOTES:

Contaminant Release Mechanisms

A Contaminants of concern for the Phase II Property include benzene and xylenes in the soil and benzene, PHC F3 and PAHs(benzo[g,h,i] perylene and benzo[k] fluoranthene) in the groundwater. It is our interpretation that the contaminants were released directly to the subsurface through leaks in the former USTs and/or the associated fuel lines.

Contaminant Transport Pathways

B 1. Physical Transport – one potential contaminant transport pathway is the physical transport from one location to another of the impacted soil, either intentionally or unintentionally, by earth moving equipment, vehicle traffic, or pedestrian traffic. Physical transport of contaminants is not considered to have contributed to the movement of contaminants on the Phase II Property.

2. Precipitation/Infiltration/Leaching – The Phase II Property was largely paved during operation of the former retail fuel outlet and automotive service garage. Therefore precipitation / leaching / infiltration is not considered to have significantly affected contaminant transport. PHCs have a low solubility in groundwater and while some of the contaminant does dissolve in groundwater, the remaining portion floats on the surface of the water table. The plume of contamination beneath the subject property is considered to be a small residual dissolved phase plume within the upper zone of the groundwater table, as the source was removed and free product was not observed at the time of the Phase II groundwater sampling event. Seasonal fluctuations of the groundwater table and groundwater flow can contribute to migration of contaminants.

Human and Ecological Receptors

C 1. Human Receptors –Potential human receptors are considered to be limited to construction workers and environmental professionals who may contact the soil during the remediation and/or development of the site. The site is located in a municipally serviced area, there are no groundwater well users in the area who may be potential receptors.

2. Ecological Receptors – Potential Ecological receptors include plants whose root structures may intercept the contaminated soil layer (considered unlikely given the depth of the impacts), wildlife which may intercept the contaminated soil layer during burrowing, and groundwater/surface water receptors downgradient of the subject site at groundwater discharge points.

Receptor Exposure Points

D 1. Human Receptors – Exposure points for human receptors consist of remedial excavations, service trenches, excavations for site buildings, and/or test pits.

2. Ecological receptors – Based on the presence of asphaltic concrete and granular materials over most of the site and the depth of the impact soil, there is limited potential for contact with ecological receptors at ground surface. There is potential for contact with impacted groundwater and surface water receptors at downgradient discharge points. The most likely exposure points for ecological receptors include the root zones of plants and the burrows of burrowing wildlife.

Routes of Exposure

E 1. Human receptors – Routes of exposure for human receptors (construction workers and environmental professionals) includes dermal contact, accidental ingestion, and inhalation (impacted soil could be inhaled as particulate dust).

2. Ecological Receptors – Routes of exposure for ecological receptors include ingestion, dermal contact, and inhalation.

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NO.	REVISIONS	DATE	INITIAL
0			

FINANCIAL EASTERN STAR GROUP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT UPDATE
1545 BANK STREET

OTTAWA, ONTARIO

Title:

CONTAMINANT DISTRIBUTION DIAGRAM

Scale: N.T.S.	Date: 09/2018
Drawn by: RCG	Report No.: PE4330-2
Checked by: KM	Dwg. No.: PE4330-9
Approved by: MSD	Revision No.:

p:\autocad drawings\environmental\pe4330\pe4330-9 contaminant transport.dwg

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

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Sampling & Analysis Plan

Phase II Environmental Site Assessment
1545 Bank Street
Ottawa, Ontario

Prepared For

Financial Eastern Star Group

July 2018

Report: PE4330-SAP

Table of Contents

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Financial Eastern Star Group to conduct a Phase II Environmental Site Assessment (ESA) at 1545 Bank Street, in the City of Ottawa, Ontario. Based on the findings and recommendations of previous investigations (2011/2012 and 2015) and a more recent Phase I ESA (2018) completed by Paterson for the subject property, a subsurface investigation program, consisting of borehole drilling, was developed.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH9	Place borehole within footprint of former dry cleaners.	Core into bedrock to an approximate depth of 6mbgs for monitoring well installation, to address potential groundwater impacts associated with former automotive service garage.
BH10	Place borehole within footprint of former garage bays.	Core into bedrock to at least 6mbgs for monitoring well installation, to address potential groundwater impacts associated with the former dry cleaner.

At each borehole, split-spoon samples of overburden soils will be obtained at 0.76 m (2'6") intervals until practical refusal to augering. All soil samples will be retained, and samples will be selected for submission following a preliminary screening analysis.

Following borehole drilling, monitoring wells will be installed in selected boreholes (as above) for the measurement of water levels and the collection of groundwater samples. Borehole locations are shown on the Test Hole Location Plan appended to the main report.

2.0 ANALYTICAL TESTING PROGRAM

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

- ❒ At least one sample from each borehole should be submitted, in order to delineate the horizontal extent of contamination across the site.
- ❒ At least one sample from each stratigraphic unit should be submitted, in order to delineate the vertical extent of contamination at the site.
- ❒ In boreholes where there is visual or olfactory evidence of contamination, or where organic vapour meter or photoionization detector readings indicate the presence of contamination, the 'worst-case' sample from each borehole should be submitted for comparison with MOECC 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.
- ❒ 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 fire hydrant located near the northwest corner of the Phase II Property, with geodetic elevation of 87.426m above sea level (asl).

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, 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

- ❒ 5' x 2" [1.52 m x 50 mm] threaded sections of Schedule 40 PVC slotted well screen (5' x 1 ¼" [1.52 m x 32 mm] if installing in cored hole in bedrock)
- ❒ 5' x 2" [1.52 m x 50 mm] threaded sections of Schedule 40 PVC riser pipe (5' x 1 ¼" [1.52 m x 32 mm] 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
- ❒ pH/Temperature/Conductivity combo pen
- ❒ 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 combo pens 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 one half (0.5 x) 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.

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SOIL PROFILE AND TEST DATA

Phase II -Environmental Site Assessment
Proposed Retail / Condo Building - 1545 Bank Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the northwest corner of subject property. Approximate geodetic elevation = 87.426m.

REMARKS

FILE NO. PE2422

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** September 22, 2011

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 %	Piezometer Construction
GROUND SURFACE						0	86.95		
		SS	1	75	18				
FILL: Brown silty sand with gravel		SS	2	83	7	1	85.95		
		SS	3	17	3				
						2	84.95		
2.21									
GLACIAL TILL: Compact, brown silty sand with gravel, cobbles and boulders		SS	4	33	25				
2.95		SS	5	100	50+				
Inferred shale **BEDROCK** 2.97									
End of Borehole									
Practical refusal to augering @ 2.97m depth									
(GWL @ 2.11m-Sept. 30/11)									

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

Phase II -Environmental Site Assessment
Proposed Retail / Condo Building - 1545 Bank Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the northwest corner of subject property. Approximate geodetic elevation = 87.426m.

FILE NO. PE2422

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** September 22, 2011

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.44
25mm Asphaltic concrete over silty sand with gravel **FILL**		AU	1				
0.43							
Very stiff, brown **SILTY CLAY,** trace gravel		SS	2	83	10	1	86.44
		SS	3	100	13	2	85.44
2.21							
Inferred shale **BEDROCK**		SS	4	100	50+		
2.36							
End of Borehole							
Practical refusal to augering @ 2.36m depth							

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.

Piezometer Construction

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Consulting Engineers

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SOIL PROFILE AND TEST DATA

Phase II -Environmental Site Assessment
Proposed Retail / Condo Building - 1545 Bank Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the northwest corner of subject property. Approximate geodetic elevation = 87.426m.

REMARKS

FILE NO. PE2422

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** September 22, 2011

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.40
25mm Asphaltic concrete over brown silty sand with gravel **FILL**		AU	1				
0.43							
Very stiff, brown **SILTY CLAY**		SS	2	100	7	1	86.40
		SS	3	53	50+		
1.83							
Inferred shale **BEDROCK** 1.90							
End of Borehole							
Practical refusal to augering @ 1.90m depth							
(BH dry - Sept. 30/11)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Piezometer Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE AND TEST DATA

Phase II -Environmental Site Assessment
Proposed Retail / Condo Building - 1545 Bank Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the northwest corner of subject property. Approximate geodetic elevation = 87.426m.

FILE NO. PE2422

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** September 22, 2011

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.82
FILL: Brown silty sand with gravel							
0.69							
		SS	1	100	11	1	85.82
Very stiff, brown **SILTY CLAY**		SS	2	100	10	2	84.82
		SS	3	100	10		
2.84							
Inferred shale **BEDROCK** 2.90							
End of Borehole							
Practical refusal to augering @ 2.90m depth							
(GWL @ 1.86m-Sept. 30/11)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Piezometer Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II Environmental Site Assessment
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Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the northwest corner of subject property. Approximate geodetic elevation = 87.426m.

FILE NO. PE2422

REMARKS

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** November 20, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.28
FILL: Brown silty sand and gravel		AU	1				
0.76							
		SS	2	100	7	1	86.28
Very stiff, brown **SILTY CLAY,** trace sand		SS	3	100	12	2	85.28
2.13							
		SS	4	57	50+		
BEDROCK: Weathered shale						3	84.28
3.15		SS	5	50	50+		
		RC	1	100	90	4	83.28
		RC	2	96	66	5	82.28
BEDROCK: Grey shaley limestone						6	81.28
		RC	3	100	82	7	80.28
		RC	4	100	71	8	79.28
8.08							
End of Borehole							
(GWL @ 1.99m-Nov. 27, 2015)							
(GWL @ 4.60m - Aug. 2, 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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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
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Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the northwest corner of subject property. Approximate geodetic elevation = 87.426m.

FILE NO. PE2422

REMARKS

HOLE NO. BH 7

BORINGS BY CME 55 Power Auger **DATE** November 20, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.58
FILL: Brown silty sand and gravel		AU	1				
		SS	2	50	39	1	86.58
		SS	3	12	18	2	85.58
2.13							
GLACIAL TILL: Brown silty sand with gravel		SS	4	100	50+		
2.49						3	84.58
BEDROCK: Grey shaley limestone		RC	1	100	88	4	83.58
		RC	2	100	100		
5.05						5	82.58
End of Borehole							
(GWL @ 2.19m-Nov. 27, 2015)							

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

Phase II - Environmental Site Assessment
1545 Bank Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located near the northwest corner of subject property. Approximate geodetic elevation = 87.426m.

FILE NO. PE2422

REMARKS

HOLE NO. BH 8

BORINGS BY CME 55 Power Auger **DATE** November 20, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.93
FILL: Crushed stone		AU	1				
0.76							
		SS	2	50	11	1	85.93
FILL: Brown silt and sand		SS	3	67	14	2	84.93
		SS	4	67	50+		
2.67							
		SS	5	100	50+	3	83.93
BEDROCK: Grey shaley limestone		RC	1	100	90	4	82.93
		RC	2	100	46	5	81.93
5.23							
End of Borehole							
(GWL @ 1.19m-Nov. 27, 2015)							

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
1545 Bank Street
Ottawa, Ontario

DATUM BH - Top spindle of fire hydrant located near the northwest corner of subject site. Geodetic elevation = 87.426m.

FILE NO. PE4330

REMARKS

HOLE NO. BH 9

BORINGS BY Portable Drill **DATE** July 26, 2018

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							0	87.68
Concrete	0.15							
FILL: Brown silty sand, trace clay and gravel	0.76		AU	1			1	86.68
Very stiff, brown **SILTY CLAY**	1.52		SS	2	79	11		
GLACIAL TILL: Brown silty clay, trace sand and gravel	2.13		SS	3	83	16	2	85.68
			RC	1	97	50	3	84.68
BEDROCK: Black shale with mud seams			RC	2	83	63	4	83.68
			RC	3	100	60	5	82.68
							6	81.68
End of Borehole	6.38							
(GWL @ 1.84m - Aug. 2, 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
1545 Bank Street
Ottawa, Ontario

DATUM BH - Top spindle of fire hydrant located near the northwest corner of subject site. Geodetic elevation = 87.426m.

FILE NO. PE4330

REMARKS

HOLE NO. BH10

BORINGS BY Portable Drill **DATE** July 26, 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
GROUND SURFACE							0	87.58		
Concrete	0.15									
FILL: Brown silty sand, trace clay and gravel	0.76		AU	1						
Very stiff, brown **SILTY CLAY**			SS	2	71	11	1	86.58		
	1.83		SS	3	90	11				
GLACIAL TILL: Brown silty clay, trace sand	2.03						2	85.58		
			RC	1	100	60				
							3	84.58		
BEDROCK: Black shale with mud seams			RC	2	97	55	4	83.58		
							5	82.58		
			RC	3	94	90				
	6.10						6	81.58		
End of Borehole										
(GWL @ 1.93m - Aug. 2, 2018)										

Lower Explosive Limit % scale: 20 40 60 80

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

▲ Full Gas Resp. △ Methane Elim.

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

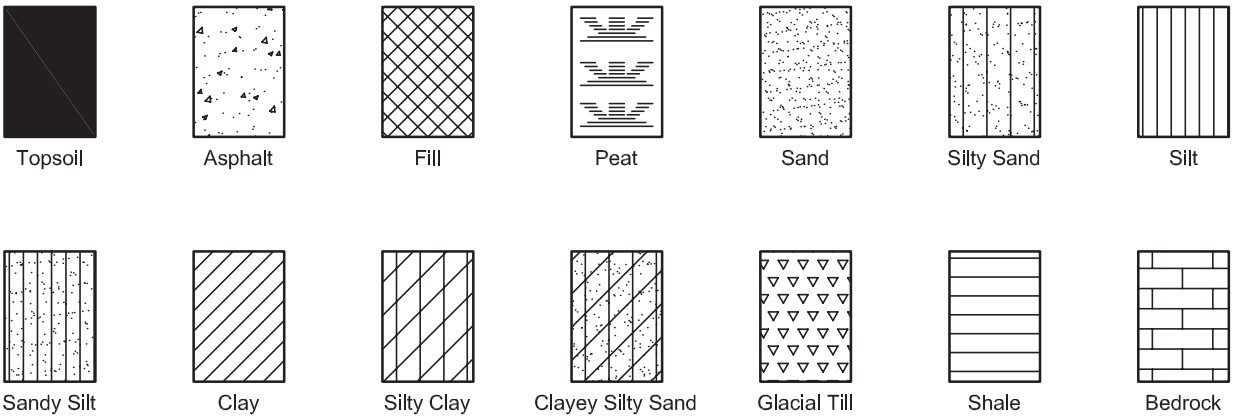
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void 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.

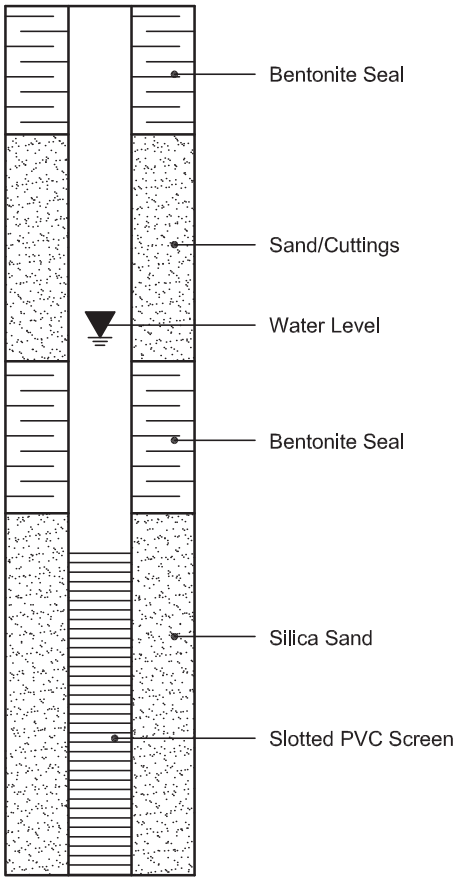
SYMBOLS AND TERMS (continued)

STRATA PLOT

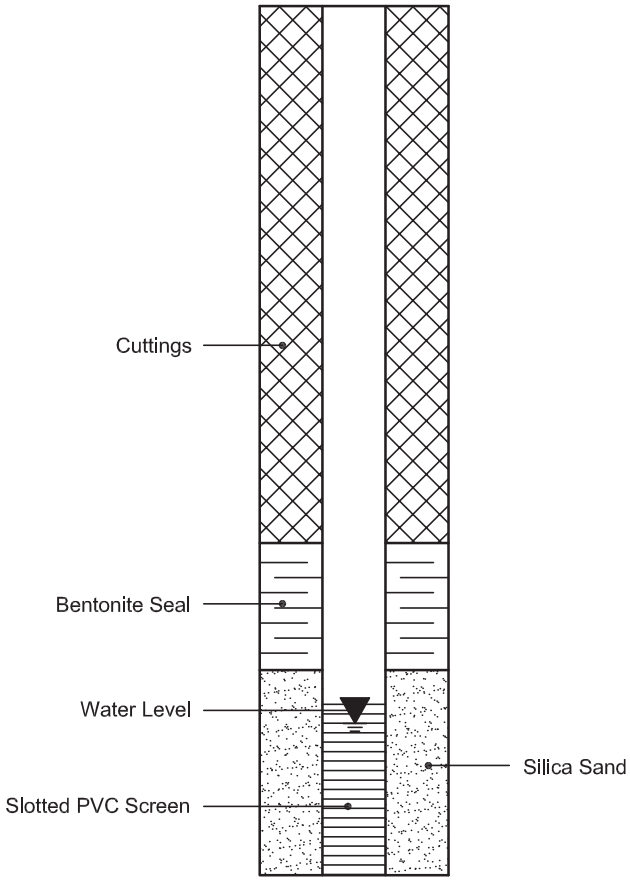


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

28 Concourse Gate, Unit 1
Nepean, ON K2E 7T7
Attn: Eric Leveque

Phone: (613) 226-7381
Fax: (613) 226-6344

Client PO: 11966
Project: PE2422
Custody: 88882

Report Date: 29-Sep-2011
Order Date: 23-Sep-2011

Order #: 1139272

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

Paracel ID	Client ID
1139272-01	BH1-SS5
1139272-02	BH5-SS2

Approved By:

Mark Foto, M.Sc. For Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 29-Sep-2011

Client: **Paterson Group Consulting Engineers**

Order Date:23-Sep-2011

Client PO: 11966 Project Description: PE2422

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX	EPA 8260 - P&T GC-MS	26-Sep-11	27-Sep-11
CCME PHC F1	CWS Tier 1 - P&T GC-FID	26-Sep-11	27-Sep-11
CCME PHC F2 - F4	CWS Tier 1 - GC-FID, extraction	26-Sep-11	27-Sep-11
Solids, %	Gravimetric, calculation	27-Sep-11	27-Sep-11

Certificate of Analysis

Report Date: 29-Sep-2011

Client: **Paterson Group Consulting Engineers**

Order Date:23-Sep-2011

Client PO: 11966

Project Description: PE2422

	Client ID:	BH1-SS5	BH5-SS2	-	-
	Sample Date:	22-Sep-11	22-Sep-11	-	-
	Sample ID:	1139272-01	1139272-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	87.5	78.2	-	-
Volatiles					
Benzene	0.02 ug/g dry	0.25	<0.02	-	-
Ethylbenzene	0.05 ug/g dry	1.15	<0.05	-	-
Toluene	0.05 ug/g dry	1.13	<0.05	-	-
m,p-Xylenes	0.05 ug/g dry	5.45	<0.05	-	-
o-Xylene	0.05 ug/g dry	2.03	<0.05	-	-
Xylenes, total	0.05 ug/g dry	7.48	<0.05	-	-
Toluene-d8	Surrogate	94.0%	95.1%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	10 ug/g dry	30	<10	-	-
F2 PHCs (C10-C16)	10 ug/g dry	20	<10	-	-
F3 PHCs (C16-C34)	10 ug/g dry	<10	<10	-	-
F4 PHCs (C34-C50)	10 ug/g dry	<10	<10	-	-

Certificate of Analysis

Report Date: 29-Sep-2011

Client: **Paterson Group Consulting Engineers**

Order Date:23-Sep-2011

Client PO: 11966 Project Description: PE2422

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	10	ug/g						
F2 PHCs (C10-C16)	ND	10	ug/g						
F3 PHCs (C16-C34)	ND	10	ug/g						
F4 PHCs (C34-C50)	ND	10	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	*7.54*		*ug/g*		*94.2*	*50-140*			

Certificate of Analysis
Client: **Paterson Group Consulting Engineers**
Client PO: 11966 Project Description: PE2422

Report Date: 29-Sep-2011
Order Date:23-Sep-2011

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	10	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	10	ug/g dry	ND				30	
F3 PHCs (C16-C34)	24	10	ug/g dry	25			1.5	30	
F4 PHCs (C34-C50)	ND	10	ug/g dry	ND				30	
Physical Characteristics									
% Solids	89.3	0.1	% by Wt.	93.5			4.7	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	*8.77*		*ug/g dry*	*ND*	*93.7*	*50-140*			

Certificate of Analysis

Report Date: 29-Sep-2011

Client: **Paterson Group Consulting Engineers**

Order Date:23-Sep-2011

Client PO: 11966

Project Description: PE2422

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	186	10	ug/g	ND	93.0	80-120			
F2 PHCs (C10-C16)	159	10	ug/g	ND	88.1	60-140			
F3 PHCs (C16-C34)	397	10	ug/g	ND	88.1	60-140			
F4 PHCs (C34-C50)	220	10	ug/g	ND	81.5	60-140			
Volatiles									
Benzene	0.707	0.02	ug/g	ND	64.8	50-140			
Ethylbenzene	1.85	0.05	ug/g	ND	71.5	50-140			
Toluene	9.30	0.05	ug/g	ND	73.7	50-140			
m,p-Xylenes	5.67	0.05	ug/g	ND	72.1	50-140			
o-Xylene	2.37	0.05	ug/g	ND	75.0	50-140			
Surrogate: Toluene-d8	*8.92*		*ug/g*		*95.4*	*50-140*			

Certificate of Analysis

Report Date: 29-Sep-2011

Client: **Paterson Group Consulting Engineers**

Order Date:23-Sep-2011

Client PO: 11966 Project Description: PE2422

Sample and QC Qualifiers Notes

None

Sample Data Revisions

None

Work Order Revisions/Comments:

None

Other Report Notes:

n/a: not applicable

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.

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Nº 88882

Page __ of __

Client Name: PATERSON	Project Reference: PE 2422
Contact Name: ERIC LEVEQUE	Quote #
Address: 28 CONCOURSE GATE UNIT 1	PO # 11966
Telephone: 226-7381	Email Address: eleveque@patersongroup.ca

TAT: [✓] Regular [ ] 2 Day [ ] 1 Day [ ] Same Day

Date Required: _____

Samples Submitted Under: [ ] O. Reg. 153/04 Table __ [✓] O. Reg 511/09 Table 1 [ ] PWQO [ ] CCME [ ] Sewer Use (Storm) [ ] Sewer Use (Sanitary) [ ] 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: 1139272

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	BTEX	PHC's (F1-F4)									
1	BH1-SS5	S		2	Sept		✓	✓		120 ml	+ vial						✓
2	BH5-SS2	S		2	22/11		✓	✓		250 ml	+ vial						✓
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Paracel

Relinquished By (Print & Sign): SEP 22/11	Received by Driver/Depot: T. DENISE	Received at Lab: SUNCEPORN
Date/Time:	Date/Time: 23/09/11 12:16PM	Date/Time: SEP 23 11 01:00
	Temperature: ___ °C	Temperature: 17.4 °C
	Verified By: M/C	
	Date/Time: Sept 23/11 2:26	
	pH Verified [ ] By: N/A	

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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: 19057
Project: PE2422
Custody: 106953

Report Date: 27-Nov-2015
Order Date: 23-Nov-2015

Order #: 1548079

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

Paracel ID	Client ID
1548079-01	BH6-SS3
1548079-02	BH7-SS4
1548079-03	BH8-SS4

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 27-Nov-2015

Client: **Paterson Group Consulting Engineers**

Order Date:23-Nov-2015

Client PO: 19057

Project Description: PE2422

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	25-Nov-15	27-Nov-15
PHC F1	CWS Tier 1 - P&T GC-FID	25-Nov-15	27-Nov-15
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	24-Nov-15	26-Nov-15
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	25-Nov-15	26-Nov-15
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	25-Nov-15	27-Nov-15
Solids, %	Gravimetric, calculation	24-Nov-15	24-Nov-15

Certificate of Analysis

Report Date: 27-Nov-2015

Client: **Paterson Group Consulting Engineers**

Order Date:23-Nov-2015

Client PO: 19057

Project Description: PE2422

	Client ID:	BH6-SS3	BH7-SS4	BH8-SS4	-
	Sample Date:	20-Nov-15	20-Nov-15	20-Nov-15	-
	Sample ID:	1548079-01	1548079-02	1548079-03	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	73.6	88.3	78.2	-
Volatiles					
Acetone	0.50 ug/g dry	<0.50	-	-	-
Benzene	0.02 ug/g dry	<0.02	-	-	-
Bromodichloromethane	0.05 ug/g dry	<0.05	-	-	-
Bromoform	0.05 ug/g dry	<0.05	-	-	-
Bromomethane	0.05 ug/g dry	<0.05	-	-	-
Carbon Tetrachloride	0.05 ug/g dry	<0.05	-	-	-
Chlorobenzene	0.05 ug/g dry	<0.05	-	-	-
Chloroform	0.05 ug/g dry	<0.05	-	-	-
Dibromochloromethane	0.05 ug/g dry	<0.05	-	-	-
Dichlorodifluoromethane	0.05 ug/g dry	<0.05	-	-	-
1,2-Dichlorobenzene	0.05 ug/g dry	<0.05	-	-	-
1,3-Dichlorobenzene	0.05 ug/g dry	<0.05	-	-	-
1,4-Dichlorobenzene	0.05 ug/g dry	<0.05	-	-	-
1,1-Dichloroethane	0.05 ug/g dry	<0.05	-	-	-
1,2-Dichloroethane	0.05 ug/g dry	<0.05	-	-	-
1,1-Dichloroethylene	0.05 ug/g dry	<0.05	-	-	-
cis-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	-	-	-
trans-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	-	-	-
1,2-Dichloropropane	0.05 ug/g dry	<0.05	-	-	-
cis-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	-	-	-
trans-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	-	-	-
1,3-Dichloropropene, total	0.05 ug/g dry	<0.05	-	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	-
Ethylene dibromide (dibromoethan	0.05 ug/g dry	<0.05	-	-	-
Hexane	0.05 ug/g dry	<0.05	-	-	-
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	<0.50	-	-	-
Methyl Isobutyl Ketone	0.50 ug/g dry	<0.50	-	-	-
Methyl tert-butyl ether	0.05 ug/g dry	<0.05	-	-	-
Methylene Chloride	0.05 ug/g dry	<0.05	-	-	-
Styrene	0.05 ug/g dry	<0.05	-	-	-
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	<0.05	-	-	-
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	<0.05	-	-	-
Tetrachloroethylene	0.05 ug/g dry	<0.05	-	-	-

Certificate of Analysis

Report Date: 27-Nov-2015

Client: **Paterson Group Consulting Engineers**

Order Date:23-Nov-2015

Client PO: 19057

Project Description: PE2422

	Client ID:	BH6-SS3	BH7-SS4	BH8-SS4	-
	Sample Date:	20-Nov-15	20-Nov-15	20-Nov-15	-
	Sample ID:	1548079-01	1548079-02	1548079-03	-
	MDL/Units	Soil	Soil	Soil	-
Toluene	0.05 ug/g dry	<0.05	-	-	-
1,1,1-Trichloroethane	0.05 ug/g dry	<0.05	-	-	-
1,1,2-Trichloroethane	0.05 ug/g dry	<0.05	-	-	-
Trichloroethylene	0.05 ug/g dry	<0.05	-	-	-
Trichlorofluoromethane	0.05 ug/g dry	<0.05	-	-	-
Vinyl chloride	0.02 ug/g dry	<0.02	-	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	-	-	-
o-Xylene	0.05 ug/g dry	<0.05	-	-	-
Xylenes, total	0.05 ug/g dry	<0.05	-	-	-
4-Bromofluorobenzene	Surrogate	106%	-	-	-
Dibromofluoromethane	Surrogate	104%	-	-	-
Toluene-d8	Surrogate	114%	-	-	-
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	-	0.18	<0.05	-
o-Xylene	0.05 ug/g dry	-	<0.05	<0.05	-
Xylenes, total	0.05 ug/g dry	-	0.23	<0.05	-
Toluene-d8	Surrogate	-	114%	113%	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	9	<7	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	147	<8	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	119	<6	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	-	0.04	-	-
Acenaphthylene	0.02 ug/g dry	-	<0.02	-	-
Anthracene	0.02 ug/g dry	-	0.04	-	-
Benzo [a] anthracene	0.02 ug/g dry	-	0.24	-	-
Benzo [a] pyrene	0.02 ug/g dry	-	0.25	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	-	0.36	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	-	0.19	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	-	0.29	-	-
Chrysene	0.02 ug/g dry	-	0.29	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	-	0.04	-	-
Fluoranthene	0.02 ug/g dry	-	0.54	-	-
Fluorene	0.02 ug/g dry	-	0.04	-	-

Certificate of Analysis

Report Date: 27-Nov-2015

Client: **Paterson Group Consulting Engineers**

Order Date:23-Nov-2015

Client PO: 19057

Project Description: PE2422

	Client ID:	BH6-SS3	BH7-SS4	BH8-SS4	-
	Sample Date:	20-Nov-15	20-Nov-15	20-Nov-15	-
	Sample ID:	1548079-01	1548079-02	1548079-03	-
	MDL/Units	Soil	Soil	Soil	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	-	0.17	-	-
1-Methylnaphthalene	0.02 ug/g dry	-	<0.02	-	-
2-Methylnaphthalene	0.02 ug/g dry	-	<0.02	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	-	<0.04	-	-
Naphthalene	0.01 ug/g dry	-	0.02	-	-
Phenanthrene	0.02 ug/g dry	-	0.30	-	-
Pyrene	0.02 ug/g dry	-	0.48	-	-
2-Fluorobiphenyl	Surrogate	-	53.6%	-	-
Terphenyl-d14	Surrogate	-	61.9%	-	-

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	*0.797*		*ug/g*		*59.8*	*50-140*			
Surrogate: Terphenyl-d14	*1.06*		*ug/g*		*79.5*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g						
Benzene	ND	0.02	ug/g						
Bromodichloromethane	ND	0.05	ug/g						
Bromoform	ND	0.05	ug/g						
Bromomethane	ND	0.05	ug/g						
Carbon Tetrachloride	ND	0.05	ug/g						
Chlorobenzene	ND	0.05	ug/g						
Chloroform	ND	0.05	ug/g						
Dibromochloromethane	ND	0.05	ug/g						
Dichlorodifluoromethane	ND	0.05	ug/g						
1,2-Dichlorobenzene	ND	0.05	ug/g						
1,3-Dichlorobenzene	ND	0.05	ug/g						
1,4-Dichlorobenzene	ND	0.05	ug/g						
1,1-Dichloroethane	ND	0.05	ug/g						
1,2-Dichloroethane	ND	0.05	ug/g						
1,1-Dichloroethylene	ND	0.05	ug/g						
cis-1,2-Dichloroethylene	ND	0.05	ug/g						
trans-1,2-Dichloroethylene	ND	0.05	ug/g						
1,2-Dichloropropane	ND	0.05	ug/g						
cis-1,3-Dichloropropylene	ND	0.05	ug/g						
trans-1,3-Dichloropropylene	ND	0.05	ug/g						
1,3-Dichloropropene, total	ND	0.05	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Ethylene dibromide (dibromoethane	ND	0.05	ug/g						
Hexane	ND	0.05	ug/g						
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g						
Methyl Isobutyl Ketone	ND	0.50	ug/g						
Methyl tert-butyl ether	ND	0.05	ug/g						
Methylene Chloride	ND	0.05	ug/g						
Styrene	ND	0.05	ug/g						
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g						
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Tetrachloroethylene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
1,1,1-Trichloroethane	ND	0.05	ug/g						
1,1,2-Trichloroethane	ND	0.05	ug/g						
Trichloroethylene	ND	0.05	ug/g						
Trichlorofluoromethane	ND	0.05	ug/g						
Vinyl chloride	ND	0.02	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: 4-Bromofluorobenzene	*8.76*		*ug/g*		*109*	*50-140*			
Surrogate: Dibromofluoromethane	*8.00*		*ug/g*		*100*	*50-140*			
Surrogate: Toluene-d8	*9.02*		*ug/g*		*113*	*50-140*			
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	*7.83*		*ug/g*		*97.9*	*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	
Physical Characteristics									
% Solids	85.2	0.1	% by Wt.	84.8			0.4	25	
Semi-Volatiles									
Acenaphthene	0.041	0.02	ug/g dry	0.040			1.4	40	
Acenaphthylene	ND	0.02	ug/g dry	ND			0.0	40	
Anthracene	0.036	0.02	ug/g dry	0.035			3.4	40	
Benzo [a] anthracene	0.246	0.02	ug/g dry	0.235			4.5	40	
Benzo [a] pyrene	0.268	0.02	ug/g dry	0.249			7.5	40	
Benzo [b] fluoranthene	0.339	0.02	ug/g dry	0.359			5.5	40	
Benzo [g,h,i] perylene	0.204	0.02	ug/g dry	0.191			6.5	40	
Benzo [k] fluoranthene	0.231	0.02	ug/g dry	0.289			22.2	40	
Chrysene	0.275	0.02	ug/g dry	0.289			5.3	40	
Dibenzo [a,h] anthracene	0.041	0.02	ug/g dry	0.036			12.7	40	
Fluoranthene	0.600	0.02	ug/g dry	0.542			10.3	40	
Fluorene	0.036	0.02	ug/g dry	0.037			1.4	40	
Indeno [1,2,3-cd] pyrene	0.186	0.02	ug/g dry	0.172			7.9	40	
1-Methylnaphthalene	ND	0.02	ug/g dry	ND			0.0	40	
2-Methylnaphthalene	0.023	0.02	ug/g dry	ND			0.0	40	
Naphthalene	0.018	0.01	ug/g dry	0.015			17.8	40	
Phenanthrene	0.313	0.02	ug/g dry	0.302			3.5	40	
Pyrene	0.502	0.02	ug/g dry	0.479			4.6	40	
Surrogate: 2-Fluorobiphenyl	*1.00*		*ug/g dry*	*ND*	*66.3*	*50-140*			
Surrogate: Terphenyl-d14	*0.901*		*ug/g dry*	*ND*	*59.7*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g dry	ND				50	
Benzene	ND	0.02	ug/g dry	ND				50	
Bromodichloromethane	ND	0.05	ug/g dry	ND				50	
Bromoform	ND	0.05	ug/g dry	ND				50	
Bromomethane	ND	0.05	ug/g dry	ND				50	
Carbon Tetrachloride	ND	0.05	ug/g dry	ND				50	
Chlorobenzene	ND	0.05	ug/g dry	ND				50	
Chloroform	ND	0.05	ug/g dry	ND				50	
Dibromochloromethane	ND	0.05	ug/g dry	ND				50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND				50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Ethylene dibromide (dibromoethane	ND	0.05	ug/g dry	ND				50	
Hexane	ND	0.05	ug/g dry	ND				50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND				50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND				50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND				50	
Methylene Chloride	ND	0.05	ug/g dry	ND				50	
Styrene	ND	0.05	ug/g dry	ND				50	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
Tetrachloroethylene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND				50	
Trichloroethylene	ND	0.05	ug/g dry	ND				50	
Trichlorofluoromethane	ND	0.05	ug/g dry	ND				50	
Vinyl chloride	ND	0.02	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: 4-Bromofluorobenzene	*6.41*		*ug/g dry*	*ND*	*109*	*50-140*			
Surrogate: Dibromofluoromethane	*6.17*		*ug/g dry*	*ND*	*105*	*50-140*			
Surrogate: Toluene-d8	*6.73*		*ug/g dry*	*ND*	*114*	*50-140*			
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	*6.73*		*ug/g dry*	*ND*	*114*	*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)	188	7	ug/g	ND	93.9	80-120			
F2 PHCs (C10-C16)	96	4	ug/g	ND	89.7	60-140			
F3 PHCs (C16-C34)	252	8	ug/g	ND	114	60-140			
F4 PHCs (C34-C50)	162	6	ug/g	ND	110	60-140			
Semi-Volatiles									
Acenaphthene	0.322	0.02	ug/g	0.040	149	50-140			QM-06
Acenaphthylene	0.156	0.02	ug/g	ND	82.4	50-140			
Anthracene	0.259	0.02	ug/g	0.035	119	50-140			
Benzo [a] anthracene	0.604	0.02	ug/g	0.235	196	50-140			QM-06
Benzo [a] pyrene	0.671	0.02	ug/g	0.249	224	50-140			QM-06
Benzo [b] fluoranthene	0.877	0.02	ug/g	0.359	275	50-140			QM-06
Benzo [g,h,i] perylene	0.562	0.02	ug/g	0.191	197	50-140			QM-06
Benzo [k] fluoranthene	0.739	0.02	ug/g	0.289	239	50-140			QM-06
Chrysene	0.718	0.02	ug/g	0.289	227	50-140			QM-06
Dibenzo [a,h] anthracene	0.331	0.02	ug/g	0.036	157	50-140			QM-06
Fluoranthene	0.323	0.02	ug/g	0.542	-116	50-140			QM-06
Fluorene	0.313	0.02	ug/g	0.037	147	50-140			QM-06
Indeno [1,2,3-cd] pyrene	0.548	0.02	ug/g	0.172	199	50-140			QM-06
1-Methylnaphthalene	0.182	0.02	ug/g	ND	96.6	50-140			
2-Methylnaphthalene	0.225	0.02	ug/g	ND	119	50-140			
Naphthalene	0.209	0.01	ug/g	0.015	103	50-140			
Phenanthrene	1.29	0.02	ug/g	0.302	523	50-140			QM-06
Pyrene	1.25	0.02	ug/g	0.479	409	50-140			QM-06
Surrogate: 2-Fluorobiphenyl	*0.881*		*ug/g*		*58.4*	*50-140*			
Volatiles									
Acetone	8.33	0.50	ug/g	ND	83.3	50-140			
Benzene	3.47	0.02	ug/g	ND	86.8	60-130			
Bromodichloromethane	3.21	0.05	ug/g	ND	80.3	60-130			
Bromoform	4.24	0.05	ug/g	ND	106	60-130			
Bromomethane	3.41	0.05	ug/g	ND	85.1	50-140			
Carbon Tetrachloride	3.03	0.05	ug/g	ND	75.7	60-130			
Chlorobenzene	3.53	0.05	ug/g	ND	88.2	60-130			
Chloroform	3.50	0.05	ug/g	ND	87.5	60-130			
Dibromochloromethane	3.80	0.05	ug/g	ND	95.0	60-130			
Dichlorodifluoromethane	3.84	0.05	ug/g	ND	96.1	50-140			
1,2-Dichlorobenzene	4.95	0.05	ug/g	ND	124	60-130			
1,3-Dichlorobenzene	4.35	0.05	ug/g	ND	109	60-130			
1,4-Dichlorobenzene	4.16	0.05	ug/g	ND	104	60-130			
1,1-Dichloroethane	3.06	0.05	ug/g	ND	76.6	60-130			
1,2-Dichloroethane	3.32	0.05	ug/g	ND	82.9	60-130			
1,1-Dichloroethylene	3.03	0.05	ug/g	ND	75.8	60-130			
cis-1,2-Dichloroethylene	4.66	0.05	ug/g	ND	116	60-130			
trans-1,2-Dichloroethylene	3.77	0.05	ug/g	ND	94.3	60-130			
1,2-Dichloropropane	2.71	0.05	ug/g	ND	67.9	60-130			
cis-1,3-Dichloropropylene	3.00	0.05	ug/g	ND	75.1	60-130			
trans-1,3-Dichloropropylene	2.45	0.05	ug/g	ND	61.1	60-130			
Ethylbenzene	2.97	0.05	ug/g	ND	74.3	60-130			
Ethylene dibromide (dibromoethane	4.09	0.05	ug/g	ND	102	60-130			
Hexane	3.24	0.05	ug/g	ND	81.0	60-130			
Methyl Ethyl Ketone (2-Butanone)	7.96	0.50	ug/g	ND	79.6	50-140			
Methyl Isobutyl Ketone	8.63	0.50	ug/g	ND	86.3	50-140			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methyl tert-butyl ether	8.01	0.05	ug/g	ND	80.1	50-140			
Methylene Chloride	3.02	0.05	ug/g	ND	75.5	60-130			
Styrene	3.31	0.05	ug/g	ND	82.7	60-130			
1,1,1,2-Tetrachloroethane	3.36	0.05	ug/g	ND	84.0	60-130			
1,1,2,2-Tetrachloroethane	3.85	0.05	ug/g	ND	96.3	60-130			
Tetrachloroethylene	4.81	0.05	ug/g	ND	120	60-130			
Toluene	3.47	0.05	ug/g	ND	86.8	60-130			
1,1,1-Trichloroethane	3.26	0.05	ug/g	ND	81.4	60-130			
1,1,2-Trichloroethane	3.12	0.05	ug/g	ND	78.0	60-130			
Trichloroethylene	3.74	0.05	ug/g	ND	93.6	60-130			
Trichlorofluoromethane	3.14	0.05	ug/g	ND	78.4	50-140			
Vinyl chloride	3.23	0.02	ug/g	ND	80.7	50-140			
m,p-Xylenes	6.39	0.05	ug/g	ND	79.9	60-130			
o-Xylene	3.20	0.05	ug/g	ND	79.9	60-130			
Benzene	3.47	0.02	ug/g	ND	86.8	60-130			
Ethylbenzene	2.97	0.05	ug/g	ND	74.3	60-130			
Toluene	3.47	0.05	ug/g	ND	86.8	60-130			
m,p-Xylenes	6.39	0.05	ug/g	ND	79.9	60-130			
o-Xylene	3.20	0.05	ug/g	ND	79.9	60-130			

Qualifier Notes:

QC Qualifiers :

QM-06 : Due to noted non-homogeneity of the QC sample matrix, the spike recoveries were out side the accepted range. Batch data accepted based on other 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.

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Chain of Custody

(Lab Use Only)

№ 106953

Page __ of __

Client Name: PATERSON

Project Reference: PE2422

Contact Name: MARK D'ARCY

Quote #

Address: 154 COLONNADE ROAD

PO # 19057

Telephone: 613-226-7381

Email Address: mdarcy@patersongroup.ca

TAT: [X] Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day

Date Required: _____

Criteria: [X] 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: 1548079

	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	BH6-SS3	S		2	Nov. 20, 2015		X	X										120+ vial		
2	BH7-SS4	S		3	↓		X		X									2x120+ vial		
3	BH8-SS4	S		2	↓		X											120+ vial		
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Xavier Redhead	Date/Time: 23/11/15 3:45pm	Date/Time: NOV 23/15	Date/Time: NOV 23/15
Date/Time: Nov. 23, 2015	Temperature: ___ °C	Temperature: 16.4 °C 5:25p	pH Verified [ ] By: NH 5:30p

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 24102
Project: PE4330
Custody: 44411

Report Date: 2-Aug-2018
Order Date: 27-Jul-2018

Order #: 1830664

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

Paracel ID	Client ID
1830664-01	BH9-SS2
1830664-02	BH10-SS2

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24102

Report Date: 02-Aug-2018
Order Date: 27-Jul-2018
Project Description: PE4330

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	30-Jul-18	31-Jul-18
PHC F1	CWS Tier 1 - P&T GC-FID	31-Jul-18	1-Aug-18
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	30-Jul-18	1-Aug-18
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	31-Jul-18	1-Aug-18
Solids, %	Gravimetric, calculation	31-Jul-18	31-Jul-18

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 24102

Report Date: 02-Aug-2018

Order Date: 27-Jul-2018

Project Description: PE4330

	Client ID:	BH9-SS2	BH10-SS2	-	-
	Sample Date:	07/26/2018 12:00	07/26/2018 12:00	-	-
	Sample ID:	1830664-01	1830664-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	74.7	74.5	-	-
General Inorganics					
pH	0.05 pH Units	7.49	7.69	-	-
Volatiles					
Acetone	0.50 ug/g dry	<0.50	<0.50	-	-
Benzene	0.02 ug/g dry	<0.02	<0.02	-	-
Bromodichloromethane	0.05 ug/g dry	<0.05	<0.05	-	-
Bromoform	0.05 ug/g dry	<0.05	<0.05	-	-
Bromomethane	0.05 ug/g dry	<0.05	<0.05	-	-
Carbon Tetrachloride	0.05 ug/g dry	<0.05	<0.05	-	-
Chlorobenzene	0.05 ug/g dry	<0.05	<0.05	-	-
Chloroform	0.05 ug/g dry	<0.05	<0.05	-	-
Dibromochloromethane	0.05 ug/g dry	<0.05	<0.05	-	-
Dichlorodifluoromethane	0.05 ug/g dry	<0.05	<0.05	-	-
1,2-Dichlorobenzene	0.05 ug/g dry	<0.05	<0.05	-	-
1,3-Dichlorobenzene	0.05 ug/g dry	<0.05	<0.05	-	-
1,4-Dichlorobenzene	0.05 ug/g dry	<0.05	<0.05	-	-
1,1-Dichloroethane	0.05 ug/g dry	<0.05	<0.05	-	-
1,2-Dichloroethane	0.05 ug/g dry	<0.05	<0.05	-	-
1,1-Dichloroethylene	0.05 ug/g dry	<0.05	<0.05	-	-
cis-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	<0.05	-	-
trans-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	<0.05	-	-
1,2-Dichloropropane	0.05 ug/g dry	<0.05	<0.05	-	-
cis-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	<0.05	-	-
trans-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	<0.05	-	-
1,3-Dichloropropene, total	0.05 ug/g dry	<0.05	<0.05	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	-	-
Ethylene dibromide (dibromoethan	0.05 ug/g dry	<0.05	<0.05	-	-
Hexane	0.05 ug/g dry	<0.05	<0.05	-	-
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	<0.50	<0.50	-	-
Methyl Isobutyl Ketone	0.50 ug/g dry	<0.50	<0.50	-	-
Methyl tert-butyl ether	0.05 ug/g dry	<0.05	<0.05	-	-
Methylene Chloride	0.05 ug/g dry	<0.05	<0.05	-	-
Styrene	0.05 ug/g dry	<0.05	<0.05	-	-
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	<0.05	<0.05	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 24102

Report Date: 02-Aug-2018

Order Date: 27-Jul-2018

Project Description: PE4330

	Client ID:	BH9-SS2	BH10-SS2	-	-
	Sample Date:	07/26/2018 12:00	07/26/2018 12:00	-	-
	Sample ID:	1830664-01	1830664-02	-	-
	MDL/Units	Soil	Soil	-	-
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	<0.05	<0.05	-	-
Tetrachloroethylene	0.05 ug/g dry	<0.05	<0.05	-	-
Toluene	0.05 ug/g dry	<0.05	<0.05	-	-
1,1,1-Trichloroethane	0.05 ug/g dry	<0.05	<0.05	-	-
1,1,2-Trichloroethane	0.05 ug/g dry	<0.05	<0.05	-	-
Trichloroethylene	0.05 ug/g dry	<0.05	<0.05	-	-
Trichlorofluoromethane	0.05 ug/g dry	<0.05	<0.05	-	-
Vinyl chloride	0.02 ug/g dry	<0.02	<0.02	-	-
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	-	-
4-Bromofluorobenzene	Surrogate	81.0%	83.9%	-	-
Dibromofluoromethane	Surrogate	102%	131%	-	-
Toluene-d8	Surrogate	63.4%	60.1%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	-	-

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						
Volatiles									
Acetone	ND	0.50	ug/g						
Benzene	ND	0.02	ug/g						
Bromodichloromethane	ND	0.05	ug/g						
Bromoform	ND	0.05	ug/g						
Bromomethane	ND	0.05	ug/g						
Carbon Tetrachloride	ND	0.05	ug/g						
Chlorobenzene	ND	0.05	ug/g						
Chloroform	ND	0.05	ug/g						
Dibromochloromethane	ND	0.05	ug/g						
Dichlorodifluoromethane	ND	0.05	ug/g						
1,2-Dichlorobenzene	ND	0.05	ug/g						
1,3-Dichlorobenzene	ND	0.05	ug/g						
1,4-Dichlorobenzene	ND	0.05	ug/g						
1,1-Dichloroethane	ND	0.05	ug/g						
1,2-Dichloroethane	ND	0.05	ug/g						
1,1-Dichloroethylene	ND	0.05	ug/g						
cis-1,2-Dichloroethylene	ND	0.05	ug/g						
trans-1,2-Dichloroethylene	ND	0.05	ug/g						
1,2-Dichloropropane	ND	0.05	ug/g						
cis-1,3-Dichloropropylene	ND	0.05	ug/g						
trans-1,3-Dichloropropylene	ND	0.05	ug/g						
1,3-Dichloropropene, total	ND	0.05	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Ethylene dibromide (dibromoethane	ND	0.05	ug/g						
Hexane	ND	0.05	ug/g						
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g						
Methyl Isobutyl Ketone	ND	0.50	ug/g						
Methyl tert-butyl ether	ND	0.05	ug/g						
Methylene Chloride	ND	0.05	ug/g						
Styrene	ND	0.05	ug/g						
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g						
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g						
Tetrachloroethylene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
1,1,1-Trichloroethane	ND	0.05	ug/g						
1,1,2-Trichloroethane	ND	0.05	ug/g						
Trichloroethylene	ND	0.05	ug/g						
Trichlorofluoromethane	ND	0.05	ug/g						
Vinyl chloride	ND	0.02	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: 4-Bromofluorobenzene	*2.75*		*ug/g*		*85.8*	*50-140*			
Surrogate: Dibromofluoromethane	*2.47*		*ug/g*		*77.2*	*50-140*			
Surrogate: Toluene-d8	*2.92*		*ug/g*		*91.1*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
pH	7.79	0.05	pH Units	7.79			0.0	10	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	22500	80	ug/g dry	25100			11.0	30	
F3 PHCs (C16-C34)	19200	160	ug/g dry	22800			17.1	30	
F4 PHCs (C34-C50)	586	120	ug/g dry	2440			123.0	30	QR-04
Physical Characteristics									
% Solids	90.4	0.1	% by Wt.	92.0			1.8	25	
Volatiles									
Acetone	ND	0.50	ug/g dry	ND				50	
Benzene	ND	0.02	ug/g dry	ND				50	
Bromodichloromethane	ND	0.05	ug/g dry	ND				50	
Bromoform	ND	0.05	ug/g dry	ND				50	
Bromomethane	ND	0.05	ug/g dry	ND				50	
Carbon Tetrachloride	ND	0.05	ug/g dry	ND				50	
Chlorobenzene	ND	0.05	ug/g dry	ND				50	
Chloroform	ND	0.05	ug/g dry	ND				50	
Dibromochloromethane	ND	0.05	ug/g dry	ND				50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND				50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Ethylene dibromide (dibromoethane	ND	0.05	ug/g dry	ND				50	
Hexane	ND	0.05	ug/g dry	ND				50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND				50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND				50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND				50	
Methylene Chloride	ND	0.05	ug/g dry	ND				50	
Styrene	ND	0.05	ug/g dry	ND				50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
Tetrachloroethylene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND				50	
Trichloroethylene	ND	0.05	ug/g dry	ND				50	
Trichlorofluoromethane	ND	0.05	ug/g dry	ND				50	
Vinyl chloride	ND	0.02	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: 4-Bromofluorobenzene	*3.37*		*ug/g dry*		*75.3*	*50-140*			
Surrogate: Dibromofluoromethane	*6.02*		*ug/g dry*		*134*	*50-140*			
Surrogate: Toluene-d8	*3.36*		*ug/g dry*		*75.0*	*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)	198	7	ug/g		99.2	80-120			
F2 PHCs (C10-C16)	94	4	ug/g		117	80-120			
F3 PHCs (C16-C34)	235	8	ug/g		120	80-120			
F4 PHCs (C34-C50)	147	6	ug/g		118	80-120			
Volatiles									
Acetone	10.1	0.50	ug/g		101	50-140			
Benzene	4.78	0.02	ug/g		120	60-130			
Bromodichloromethane	4.80	0.05	ug/g		120	60-130			
Bromoform	4.87	0.05	ug/g		122	60-130			
Bromomethane	4.52	0.05	ug/g		113	50-140			
Carbon Tetrachloride	4.35	0.05	ug/g		109	60-130			
Chlorobenzene	4.90	0.05	ug/g		123	60-130			
Chloroform	4.52	0.05	ug/g		113	60-130			
Dibromochloromethane	4.99	0.05	ug/g		125	60-130			
Dichlorodifluoromethane	4.73	0.05	ug/g		118	50-140			
1,2-Dichlorobenzene	4.63	0.05	ug/g		116	60-130			
1,3-Dichlorobenzene	3.54	0.05	ug/g		88.5	60-130			
1,4-Dichlorobenzene	3.87	0.05	ug/g		96.7	60-130			
1,1-Dichloroethane	4.74	0.05	ug/g		119	60-130			
1,2-Dichloroethane	4.42	0.05	ug/g		111	60-130			
1,1-Dichloroethylene	4.57	0.05	ug/g		114	60-130			
cis-1,2-Dichloroethylene	4.33	0.05	ug/g		108	60-130			
trans-1,2-Dichloroethylene	4.61	0.05	ug/g		115	60-130			
1,2-Dichloropropane	4.87	0.05	ug/g		122	60-130			
cis-1,3-Dichloropropylene	4.62	0.05	ug/g		115	60-130			
trans-1,3-Dichloropropylene	4.54	0.05	ug/g		114	60-130			
Ethylbenzene	4.95	0.05	ug/g		124	60-130			
Ethylene dibromide (dibromoethane	4.65	0.05	ug/g		116	60-130			
Hexane	4.22	0.05	ug/g		106	60-130			
Methyl Ethyl Ketone (2-Butanone)	9.50	0.50	ug/g		95.0	50-140			
Methyl Isobutyl Ketone	10.6	0.50	ug/g		106	50-140			
Methyl tert-butyl ether	11.7	0.05	ug/g		117	50-140			
Methylene Chloride	4.58	0.05	ug/g		114	60-130			
Styrene	4.71	0.05	ug/g		118	60-130			
1,1,1,2-Tetrachloroethane	4.94	0.05	ug/g		124	60-130			
1,1,2,2-Tetrachloroethane	4.85	0.05	ug/g		121	60-130			
Tetrachloroethylene	4.62	0.05	ug/g		115	60-130			
Toluene	4.61	0.05	ug/g		115	60-130			
1,1,1-Trichloroethane	4.24	0.05	ug/g		106	60-130			
1,1,2-Trichloroethane	4.48	0.05	ug/g		112	60-130			
Trichloroethylene	4.55	0.05	ug/g		114	60-130			
Trichlorofluoromethane	4.34	0.05	ug/g		109	50-140			
Vinyl chloride	4.46	0.02	ug/g		112	50-140			
m,p-Xylenes	9.23	0.05	ug/g		115	60-130			
o-Xylene	4.64	0.05	ug/g		116	60-130			
Surrogate: 4-Bromofluorobenzene	*1.76*		*ug/g*		*55.1*	*50-140*			

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: 1830664

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aracel@paracellabs.com

Chain of Custody
(Lab Use Only)
№ 44411

Page 1 of 1

Client Name: Paterson Group	Project Reference: PE4330
Contact Name: ADRIAN MENYHART	Quote #
Address: 154 Colonnade Rd S	PO # 24102
Telephone: 613-226-7381	Email Address: amenyhart@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: 1830664

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHC F1-F4	VOC	PH								Required Analyses
1	BH9-SS2	S		2	July 26 '18	PM	-	-	-								250ml + 1 Vial
2	BH10-SS2	S		2	"	PM	-	-	-								
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): ADRIAN M.	Date/Time: 27/07/18 4:10	Date/Time: July 27, 2018 05:00	Date/Time: July 27/18
Date/Time: July 27 2018	Temperature: °C	Temperature: 20.1 °C	pH Verified [ ] By:

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Certificate of Analysis

Paterson Group Consulting Engineers
28 Concourse Gate, Unit 1
Nepean, ON K2E 7T7
Attn: Eric Leveque

Phone: (613) 226-7381
Fax: (613) 226-6344

Client PO: 11568
Project: PE2422
Custody: 88893

Report Date: 5-Oct-2011
Order Date: 30-Sep-2011
Order #: 1140255

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

Paracel ID	Client ID
1140255-01	BH1-GW1

Approved By: Mark Foto

Mark Foto, M.Sc. For Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 05-Oct-2011

Client: **Paterson Group Consulting Engineers**

Order Date:30-Sep-2011

Client PO: 11568 Project Description: PE2422

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
CCME PHC F1	CWS Tier 1 - P&T GC-FID	3-Oct-11	4-Oct-11
CCME PHC F2 - F4	CWS Tier 1 - GC-FID, extraction	3-Oct-11	3-Oct-11
VOCs	EPA 624 - P&T GC-MS	3-Oct-11	4-Oct-11

Certificate of Analysis

Report Date: 05-Oct-2011

Client: **Paterson Group Consulting Engineers**

Order Date:30-Sep-2011

Client PO: 11568

Project Description: PE2422

	Client ID:	BH1-GW1	-	-	-
	Sample Date:	30-Sep-11	-	-	-
	Sample ID:	1140255-01	-	-	-
	MDL/Units	Water	-	-	-
Volatiles					
Acetone	5.0 ug/L	<5.0	-	-	-
Benzene	0.5 ug/L	<0.5	-	-	-
Bromodichloromethane	0.5 ug/L	<0.5	-	-	-
Bromoform	0.5 ug/L	<0.5	-	-	-
Bromomethane	0.5 ug/L	<0.5	-	-	-
Carbon Tetrachloride	0.2 ug/L	<0.2	-	-	-
Chlorobenzene	0.5 ug/L	<0.5	-	-	-
Chloroethane	1.0 ug/L	<1.0	-	-	-
Chloroform	0.5 ug/L	<0.5	-	-	-
Chloromethane	3.0 ug/L	<3.0	-	-	-
Dibromochloromethane	0.5 ug/L	<0.5	-	-	-
Dichlorodifluoromethane	1.0 ug/L	<1.0	-	-	-
1,2-Dibromoethane	0.2 ug/L	<0.2	-	-	-
1,2-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,3-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,1-Dichloroethane	0.5 ug/L	<0.5	-	-	-
1,2-Dichloroethane	0.5 ug/L	<0.5	-	-	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
1,2-Dichloroethylene, total	0.5 ug/L	<0.5	-	-	-
1,2-Dichloropropane	0.5 ug/L	<0.5	-	-	-
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	-	-
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	-	-
1,3-Dichloropropene, total	0.5 ug/L	<0.5	-	-	-
Ethylbenzene	0.5 ug/L	<0.5	-	-	-
Hexane	1.0 ug/L	<1.0	-	-	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	-	-	-
Methyl Butyl Ketone (2-Hexanone)	10.0 ug/L	<10.0	-	-	-
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	-	-	-
Methyl tert-butyl ether	2.0 ug/L	<2.0	-	-	-
Methylene Chloride	5.0 ug/L	<5.0	-	-	-

Certificate of Analysis

Report Date: 05-Oct-2011

Client: **Paterson Group Consulting Engineers**

Order Date:30-Sep-2011

Client PO: 11568

Project Description: PE2422

	Client ID:	BH1-GW1	-	-	-
	Sample Date:	30-Sep-11	-	-	-
	Sample ID:	1140255-01	-	-	-
	MDL/Units	Water	-	-	-
Styrene	0.5 ug/L	<0.5	-	-	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	-	-	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	-	-	-
Tetrachloroethylene	0.5 ug/L	<0.5	-	-	-
Toluene	0.5 ug/L	<0.5	-	-	-
1,2,4-Trichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	-	-	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	-	-	-
Trichloroethylene	0.5 ug/L	<0.5	-	-	-
Trichlorofluoromethane	1.0 ug/L	<1.0	-	-	-
1,3,5-Trimethylbenzene	0.5 ug/L	<0.5	-	-	-
Vinyl chloride	0.5 ug/L	<0.5	-	-	-
m,p-Xylenes	0.5 ug/L	<0.5	-	-	-
o-Xylene	0.5 ug/L	28.1	-	-	-
Xylenes, total	0.5 ug/L	28.1	-	-	-
4-Bromofluorobenzene	Surrogate	99.7%	-	-	-
Dibromofluoromethane	Surrogate	98.1%	-	-	-
Toluene-d8	Surrogate	111%	-	-	-

Hydrocarbons

F1 PHCs (C6-C10)	25 ug/L	401	-	-	-
F2 PHCs (C10-C16)	100 ug/L	435	-	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	-	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	-	-	-
F1 + F2 PHCs	125 ug/L	836	-	-	-
F3 + F4 PHCs	200 ug/L	<200	-	-	-

Certificate of Analysis
Client: **Paterson Group Consulting Engineers**
Client PO: 11568 Project Description: PE2422

Report Date: 05-Oct-2011
Order Date:30-Sep-2011

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						
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						
Chloroethane	ND	1.0	ug/L						
Chloroform	ND	0.5	ug/L						
Chloromethane	ND	3.0	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dibromoethane	ND	0.2	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloroethylene, total	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						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Butyl Ketone (2-Hexanone)	ND	10.0	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						
1,2,4-Trichlorobenzene	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						
1,3,5-Trimethylbenzene	ND	0.5	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	*30.9*		*ug/L*		*96.5*	*50-140*			
Surrogate: Dibromofluoromethane	*30.8*		*ug/L*		*96.4*	*50-140*			
Surrogate: Toluene-d8	*35.1*		*ug/L*		*110*	*50-140*			

Certificate of Analysis
Client: **Paterson Group Consulting Engineers**
Client PO: 11568 Project Description: PE2422

Report Date: 05-Oct-2011
Order Date:30-Sep-2011

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	
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	
Chloroethane	ND	1.0	ug/L	ND				30	
Chloroform	ND	0.5	ug/L	ND				30	
Chloromethane	ND	3.0	ug/L	ND				30	
Dibromochloromethane	ND	0.5	ug/L	ND				30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND				30	
1,2-Dibromoethane	ND	0.2	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	
Hexane	ND	1.0	ug/L	ND				30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND				30	
Methyl Butyl Ketone (2-Hexanone)	ND	10.0	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	
1,2,4-Trichlorobenzene	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	
1,3,5-Trimethylbenzene	ND	0.5	ug/L	ND				30	
Vinyl chloride	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: 4-Bromofluorobenzene	*35.0*		*ug/L*	*ND*	*110*	*50-140*			
Surrogate: Dibromofluoromethane	*29.9*		*ug/L*	*ND*	*93.5*	*50-140*			
Surrogate: Toluene-d8	*35.7*		*ug/L*	*ND*	*112*	*50-140*			

Certificate of Analysis
Client: **Paterson Group Consulting Engineers**
Client PO: 11568 Project Description: PE2422

Report Date: 05-Oct-2011
Order Date:30-Sep-2011

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1990	25	ug/L	ND	99.6	68-117			
F2 PHCs (C10-C16)	1360	100	ug/L	ND	85.0	60-140			
F3 PHCs (C16-C34)	3550	100	ug/L	ND	88.7	60-140			
F4 PHCs (C34-C50)	2480	100	ug/L	ND	103	60-140			
Volatiles									
Acetone	113	5.0	ug/L	ND	113	50-140			
Benzene	36.4	0.5	ug/L	ND	91.0	60-130			
Bromodichloromethane	48.5	0.5	ug/L	ND	121	60-130			
Bromoform	51.1	0.5	ug/L	ND	128	60-130			
Bromomethane	45.7	0.5	ug/L	ND	114	50-140			
Carbon Tetrachloride	49.8	0.2	ug/L	ND	125	60-130			
Chlorobenzene	31.2	0.5	ug/L	ND	78.1	60-130			
Chloroethane	38.5	1.0	ug/L	ND	96.2	50-140			
Chloroform	35.0	0.5	ug/L	ND	87.4	60-130			
Chloromethane	42.3	3.0	ug/L	ND	106	50-140			
Dibromochloromethane	45.0	0.5	ug/L	ND	112	60-130			
Dichlorodifluoromethane	40.3	1.0	ug/L	ND	101	50-140			
1,2-Dibromoethane	37.3	0.2	ug/L	ND	93.3	60-130			
1,2-Dichlorobenzene	36.4	0.5	ug/L	ND	90.9	60-130			
1,3-Dichlorobenzene	33.8	0.5	ug/L	ND	84.4	60-130			
1,4-Dichlorobenzene	40.3	0.5	ug/L	ND	101	60-130			
1,1-Dichloroethane	33.0	0.5	ug/L	ND	82.5	60-130			
1,2-Dichloroethane	35.6	0.5	ug/L	ND	89.1	60-130			
1,1-Dichloroethylene	40.8	0.5	ug/L	ND	102	60-130			
cis-1,2-Dichloroethylene	37.2	0.5	ug/L	ND	93.0	60-130			
trans-1,2-Dichloroethylene	41.8	0.5	ug/L	ND	104	60-130			
1,2-Dichloropropane	35.2	0.5	ug/L	ND	87.9	60-130			
cis-1,3-Dichloropropylene	35.8	0.5	ug/L	ND	89.6	60-130			
trans-1,3-Dichloropropylene	41.3	0.5	ug/L	ND	103	60-130			
Ethylbenzene	29.2	0.5	ug/L	ND	73.0	60-130			
Hexane	46.2	1.0	ug/L	ND	115	60-130			
Methyl Ethyl Ketone (2-Butanone)	123	5.0	ug/L	ND	123	50-140			
Methyl Butyl Ketone (2-Hexanone)	110	10.0	ug/L	ND	110	50-140			
Methyl Isobutyl Ketone	120	5.0	ug/L	ND	120	50-140			
Methyl tert-butyl ether	74.8	2.0	ug/L	ND	74.8	50-140			
Methylene Chloride	38.0	5.0	ug/L	ND	95.0	60-130			
Styrene	33.5	0.5	ug/L	ND	83.8	60-130			
1,1,1,2-Tetrachloroethane	38.0	0.5	ug/L	ND	94.9	60-130			
1,1,2,2-Tetrachloroethane	44.1	0.5	ug/L	ND	110	60-130			
Tetrachloroethylene	29.8	0.5	ug/L	ND	74.4	60-130			
Toluene	32.9	0.5	ug/L	ND	82.3	60-130			
1,2,4-Trichlorobenzene	44.3	0.5	ug/L	ND	111	60-130			
1,1,1-Trichloroethane	49.9	0.5	ug/L	ND	125	60-130			
1,1,2-Trichloroethane	35.9	0.5	ug/L	ND	89.8	60-130			
Trichloroethylene	48.5	0.5	ug/L	ND	121	60-130			
Trichlorofluoromethane	49.7	1.0	ug/L	ND	124	60-130			
1,3,5-Trimethylbenzene	34.6	0.5	ug/L	ND	86.6	60-130			
Vinyl chloride	35.9	0.5	ug/L	ND	89.7	50-140			
m,p-Xylenes	60.4	0.5	ug/L	ND	75.5	60-130			

Certificate of Analysis

Report Date: 05-Oct-2011

Client: **Paterson Group Consulting Engineers**

Order Date:30-Sep-2011

Client PO: 11568

Project Description: PE2422

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
o-Xylene	29.4	0.5	ug/L	ND	73.4	60-130			
Surrogate: 4-Bromofluorobenzene	*29.1*		*ug/L*		*91.0*	*50-140*			

Certificate of Analysis

Report Date: 05-Oct-2011

Client: **Paterson Group Consulting Engineers**

Order Date:30-Sep-2011

Client PO: 11568 Project Description: PE2422

Sample and QC Qualifiers Notes

None

Sample Data Revisions

None

Work Order Revisions/Comments:

None

Other Report Notes:

n/a: not applicable

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.

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Certificate of Analysis

Paterson Group Consulting Engineers

28 Concourse Gate, Unit 1
Nepean, ON K2E 7T7
Attn: Mark D'Arcy

Phone: (613) 226-7381
Fax: (613) 226-6344

Client PO: 11429
Project: PE2422
Custody: 85580

Report Date: 7-Nov-2011
Order Date: 1-Nov-2011

Order #: 1145091

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

Paracel ID	Client ID
1145091-01	BH2-GW1

Approved By: Mark Foto

Mark Foto, M.Sc. For Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 07-Nov-2011

Client: **Paterson Group Consulting Engineers**

Order Date:1-Nov-2011

Client PO: 11429 Project Description: PE2422

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
VOCs	EPA 624 - P&T GC-MS	4-Nov-11	5-Nov-11

Certificate of Analysis

Report Date: 07-Nov-2011

Client: **Paterson Group Consulting Engineers**

Order Date:1-Nov-2011

Client PO: 11429

Project Description: PE2422

	Client ID:	BH2-GW1	-	-	-
	Sample Date:	01-Nov-11	-	-	-
	Sample ID:	1145091-01	-	-	-
	MDL/Units	Water	-	-	-
Volatiles					
Acetone	5.0 ug/L	47.0	-	-	-
Benzene	0.5 ug/L	<0.5	-	-	-
Bromodichloromethane	0.5 ug/L	<0.5	-	-	-
Bromoform	0.5 ug/L	<0.5	-	-	-
Bromomethane	0.5 ug/L	<0.5	-	-	-
Carbon Tetrachloride	0.2 ug/L	<0.2	-	-	-
Chlorobenzene	0.5 ug/L	<0.5	-	-	-
Chloroethane	1.0 ug/L	<1.0	-	-	-
Chloroform	0.5 ug/L	<0.5	-	-	-
Chloromethane	3.0 ug/L	<3.0	-	-	-
Dibromochloromethane	0.5 ug/L	<0.5	-	-	-
Dichlorodifluoromethane	1.0 ug/L	<1.0	-	-	-
1,2-Dibromoethane	0.2 ug/L	<0.2	-	-	-
1,2-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,3-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,1-Dichloroethane	0.5 ug/L	<0.5	-	-	-
1,2-Dichloroethane	0.5 ug/L	<0.5	-	-	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
1,2-Dichloroethylene, total	0.5 ug/L	<0.5	-	-	-
1,2-Dichloropropane	0.5 ug/L	<0.5	-	-	-
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	-	-
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	-	-
1,3-Dichloropropene, total	0.5 ug/L	<0.5	-	-	-
Ethylbenzene	0.5 ug/L	<0.5	-	-	-
Hexane	1.0 ug/L	<1.0	-	-	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	113	-	-	-
Methyl Butyl Ketone (2-Hexanone)	10.0 ug/L	17.1	-	-	-
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	-	-	-
Methyl tert-butyl ether	2.0 ug/L	<2.0	-	-	-
Methylene Chloride	5.0 ug/L	<5.0	-	-	-

Certificate of Analysis

Report Date: 07-Nov-2011

Client: **Paterson Group Consulting Engineers**

Order Date:1-Nov-2011

Client PO: 11429

Project Description: PE2422

	Client ID:	BH2-GW1	-	-	-
	Sample Date:	01-Nov-11	-	-	-
	Sample ID:	1145091-01	-	-	-
	MDL/Units	Water	-	-	-
Styrene	0.5 ug/L	<0.5	-	-	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	-	-	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	-	-	-
Tetrachloroethylene	0.5 ug/L	<0.5	-	-	-
Toluene	0.5 ug/L	10.4	-	-	-
1,2,4-Trichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	-	-	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	-	-	-
Trichloroethylene	0.5 ug/L	<0.5	-	-	-
Trichlorofluoromethane	1.0 ug/L	<1.0	-	-	-
1,3,5-Trimethylbenzene	0.5 ug/L	<0.5	-	-	-
Vinyl chloride	0.5 ug/L	<0.5	-	-	-
m,p-Xylenes	0.5 ug/L	<0.5	-	-	-
o-Xylene	0.5 ug/L	<0.5	-	-	-
Xylenes, total	0.5 ug/L	<0.5	-	-	-
4-Bromofluorobenzene	Surrogate	95.7%	-	-	-
Dibromofluoromethane	Surrogate	82.2%	-	-	-
Toluene-d8	Surrogate	86.8%	-	-	-

Certificate of Analysis

Report Date: 07-Nov-2011

Client: **Paterson Group Consulting Engineers**

Order Date:1-Nov-2011

Client PO: 11429 Project Description: PE2422

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
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						
Chloroethane	ND	1.0	ug/L						
Chloroform	ND	0.5	ug/L						
Chloromethane	ND	3.0	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dibromoethane	ND	0.2	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloroethylene, total	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						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Butyl Ketone (2-Hexanone)	ND	10.0	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						
1,2,4-Trichlorobenzene	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						
1,3,5-Trimethylbenzene	ND	0.5	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	*29.6*		*ug/L*		*92.6*	*50-140*			
Surrogate: Dibromofluoromethane	*27.2*		*ug/L*		*85.0*	*50-140*			
Surrogate: Toluene-d8	*33.6*		*ug/L*		*105*	*50-140*			

Certificate of Analysis

Report Date: 07-Nov-2011

Client: **Paterson Group Consulting Engineers**

Order Date:1-Nov-2011

Client PO: 11429 Project Description: PE2422

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
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	
Chloroethane	ND	1.0	ug/L	ND				30	
Chloroform	ND	0.5	ug/L	ND				30	
Chloromethane	ND	3.0	ug/L	ND				30	
Dibromochloromethane	ND	0.5	ug/L	ND				30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND				30	
1,2-Dibromoethane	ND	0.2	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	
Hexane	ND	1.0	ug/L	ND				30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND				30	
Methyl Butyl Ketone (2-Hexanone)	ND	10.0	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	
1,2,4-Trichlorobenzene	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	
1,3,5-Trimethylbenzene	ND	0.5	ug/L	ND				30	
Vinyl chloride	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: 4-Bromofluorobenzene	*31.7*		*ug/L*	*ND*	*99.1*	*50-140*			
Surrogate: Dibromofluoromethane	*27.8*		*ug/L*	*ND*	*86.8*	*50-140*			
Surrogate: Toluene-d8	*30.9*		*ug/L*	*ND*	*96.6*	*50-140*			

Certificate of Analysis

Report Date: 07-Nov-2011

Client: **Paterson Group Consulting Engineers**

Order Date:1-Nov-2011

Client PO: 11429 Project Description: PE2422

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Volatiles									
Acetone	60.8	5.0	ug/L	ND	60.8	50-140			
Benzene	29.2	0.5	ug/L	ND	72.9	50-140			
Bromodichloromethane	33.4	0.5	ug/L	2.13	78.1	50-140			
Bromoform	21.9	0.5	ug/L	ND	54.8	50-140			
Bromomethane	5.55	0.5	ug/L	ND	13.9	50-140			
Carbon Tetrachloride	36.6	0.2	ug/L	ND	91.6	50-140			
Chlorobenzene	35.6	0.5	ug/L	ND	88.9	50-140			
Chloroethane	20.6	1.0	ug/L	ND	51.4	50-140			
Chloroform	35.7	0.5	ug/L	5.15	76.4	50-140			
Chloromethane	37.1	3.0	ug/L	ND	92.6	50-140			
Dibromochloromethane	27.8	0.5	ug/L	ND	69.5	50-140			
Dichlorodifluoromethane	22.8	1.0	ug/L	ND	56.9	50-140			
1,2-Dibromoethane	34.6	0.2	ug/L	ND	86.4	50-140			
1,2-Dichlorobenzene	33.5	0.5	ug/L	ND	83.8	50-140			
1,3-Dichlorobenzene	33.4	0.5	ug/L	ND	83.4	50-140			
1,4-Dichlorobenzene	30.5	0.5	ug/L	ND	76.3	50-140			
1,1-Dichloroethane	26.6	0.5	ug/L	ND	66.6	50-140			
1,2-Dichloroethane	30.7	0.5	ug/L	ND	76.8	50-140			
1,1-Dichloroethylene	25.2	0.5	ug/L	ND	63.1	50-140			
cis-1,2-Dichloroethylene	25.1	0.5	ug/L	ND	62.7	50-140			
trans-1,2-Dichloroethylene	29.9	0.5	ug/L	ND	74.8	50-140			
1,2-Dichloropropane	25.3	0.5	ug/L	ND	63.2	50-140			
cis-1,3-Dichloropropylene	26.9	0.5	ug/L	ND	67.2	50-140			
trans-1,3-Dichloropropylene	21.4	0.5	ug/L	ND	53.6	50-140			
Ethylbenzene	30.2	0.5	ug/L	ND	75.6	50-140			
Hexane	23.7	1.0	ug/L	ND	59.4	50-140			
Methyl Ethyl Ketone (2-Butanone)	52.7	5.0	ug/L	ND	52.7	50-140			
Methyl Butyl Ketone (2-Hexanone)	58.2	10.0	ug/L	ND	58.2	50-140			
Methyl Isobutyl Ketone	51.2	5.0	ug/L	ND	51.2	50-140			
Methyl tert-butyl ether	100	2.0	ug/L	ND	100	50-140			
Methylene Chloride	20.8	5.0	ug/L	ND	52.0	50-140			
Styrene	25.6	0.5	ug/L	ND	63.9	50-140			
1,1,1,2-Tetrachloroethane	31.8	0.5	ug/L	ND	79.6	50-140			
1,1,2,2-Tetrachloroethane	28.4	0.5	ug/L	ND	71.0	50-140			
Tetrachloroethylene	36.8	0.5	ug/L	ND	91.9	50-140			
Toluene	33.8	0.5	ug/L	ND	84.6	50-140			
1,2,4-Trichlorobenzene	52.5	0.5	ug/L	ND	131	50-140			
1,1,1-Trichloroethane	35.3	0.5	ug/L	ND	88.2	50-140			
1,1,2-Trichloroethane	27.8	0.5	ug/L	ND	69.6	50-140			
Trichloroethylene	32.0	0.5	ug/L	ND	79.9	50-140			
Trichlorofluoromethane	24.6	1.0	ug/L	ND	61.5	50-140			
1,3,5-Trimethylbenzene	33.0	0.5	ug/L	ND	82.4	50-140			
Vinyl chloride	36.5	0.5	ug/L	ND	91.2	50-140			
m,p-Xylenes	54.6	0.5	ug/L	ND	68.3	50-140			
o-Xylene	34.7	0.5	ug/L	ND	86.7	50-140			
Surrogate: 4-Bromofluorobenzene	*27.2*		*ug/L*		*84.9*	*50-140*			

Certificate of Analysis

Report Date: 07-Nov-2011

Client: **Paterson Group Consulting Engineers**

Order Date:1-Nov-2011

Client PO: 11429 Project Description: PE2422

Sample and QC Qualifiers Notes

None

Sample Data Revisions

None

Work Order Revisions/Comments:

None

Other Report Notes:

n/a: not applicable

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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Chain of Custody
(Lab Use Only)
Nº 85580

Page 1 of 1

Client Name: Paterson Group
Contact Name: Mark D'Arcy
Address: 28 Concourse Gate, Unit 1, Ottawa ON
Telephone: 613 226-7381

Project Reference: PG2474
Quote #
PO #
Email Address: mdarcy@patersongroup.ca

TAT: [X] Regular [ ] 2 Day [ ] 1 Day [ ] Same Day
Date Required: _____

Samples Submitted Under: [ ] O. Reg. 153/04 Table ___ [ ] O. Reg 511/09 Table ___ [ ] PWQO [ ] CCME [ ] Sewer Use (Storm) [ ] Sewer Use (Sanitary) [ ] 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: 1145091

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	Required Analyses: VOC's	
1	BH5-GW1	GW		2	Nov. 1/11	11am	x	→ Reads BH2-GW1 (use this ID per Tyler) -MJC
2								
3								
4								
5								
6								
7								
8								
9								
10								

Comments: Will call with P.O.#

Method of Delivery: Walk in

Relinquished By (Print & Sign): T. Robinson	Received by Driver/Depot:	Received at Lab: 8:30am	Verified By: MJC
Date/Time: Nov. 1 2011 11:50am	Date/Time:	Date/Time: Nov 1/11	Date/Time: Nov 1/11 1:00
	Temperature: ____ °C	Temperature: 2.8 °C	pH Verified [ ] By: N/A

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Certificate of Analysis

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

Phone: (613) 226-7381
Fax: (613) 226-6344

Client PO: 12527
Project: PE2422
Custody: 3368

Report Date: 27-Jun-2012
Order Date: 25-Jun-2012
Order #: 1226057

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

Paracel ID	Client ID
1226057-01	BH1-GW2

Approved By: Mark Foto

Mark Foto, M.Sc. For Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 27-Jun-2012
Order Date:25-Jun-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12527 Project Description: PE2422

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
CCME PHC F1	CWS Tier 1 - P&T GC-FID	26-Jun-12	27-Jun-12
CCME PHC F2 - F4	CWS Tier 1 - GC-FID, extraction	26-Jun-12	27-Jun-12
VOCs	EPA 624 - P&T GC-MS	26-Jun-12	27-Jun-12

Certificate of Analysis

Report Date: 27-Jun-2012
Order Date:25-Jun-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12527 Project Description: PE2422

	Client ID:	BH1-GW2	-	-	-
	Sample Date:	25-Jun-12	-	-	-
	Sample ID:	1226057-01	-	-	-
	MDL/Units	Water	-	-	-
Volatiles					
Acetone	5.0 ug/L	<5.0	-	-	-
Benzene	0.5 ug/L	5.2	-	-	-
Bromodichloromethane	0.5 ug/L	<0.5	-	-	-
Bromoform	0.5 ug/L	<0.5	-	-	-
Bromomethane	0.5 ug/L	<0.5	-	-	-
Carbon Tetrachloride	0.2 ug/L	<0.2	-	-	-
Chlorobenzene	0.5 ug/L	<0.5	-	-	-
Chloroethane	1.0 ug/L	<1.0	-	-	-
Chloroform	0.5 ug/L	<0.5	-	-	-
Chloromethane	3.0 ug/L	<3.0	-	-	-
Dibromochloromethane	0.5 ug/L	<0.5	-	-	-
Dichlorodifluoromethane	1.0 ug/L	<1.0	-	-	-
1,2-Dibromoethane	0.2 ug/L	<0.2	-	-	-
1,2-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,3-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,1-Dichloroethane	0.5 ug/L	<0.5	-	-	-
1,2-Dichloroethane	0.5 ug/L	<0.5	-	-	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
1,2-Dichloroethylene, total	0.5 ug/L	<0.5	-	-	-
1,2-Dichloropropane	0.5 ug/L	<0.5	-	-	-
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	-	-
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	-	-
1,3-Dichloropropene, total	0.5 ug/L	<0.5	-	-	-
Ethylbenzene	0.5 ug/L	4.1	-	-	-
Hexane	1.0 ug/L	<1.0	-	-	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	-	-	-
Methyl Butyl Ketone (2-Hexanone)	10.0 ug/L	<10.0	-	-	-
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	-	-	-
Methyl tert-butyl ether	2.0 ug/L	<2.0	-	-	-
Methylene Chloride	5.0 ug/L	<5.0	-	-	-

Certificate of Analysis

Report Date: 27-Jun-2012
Order Date:25-Jun-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12527 Project Description: PE2422

	Client ID:	BH1-GW2	-	-	-
	Sample Date:	25-Jun-12	-	-	-
	Sample ID:	1226057-01	-	-	-
	MDL/Units	Water	-	-	-
Styrene	0.5 ug/L	<0.5	-	-	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	-	-	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	-	-	-
Tetrachloroethylene	0.5 ug/L	<0.5	-	-	-
Toluene	0.5 ug/L	<0.5	-	-	-
1,2,4-Trichlorobenzene	0.5 ug/L	<0.5	-	-	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	-	-	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	-	-	-
Trichloroethylene	0.5 ug/L	<0.5	-	-	-
Trichlorofluoromethane	1.0 ug/L	<1.0	-	-	-
1,3,5-Trimethylbenzene	0.5 ug/L	0.9	-	-	-
Vinyl chloride	0.5 ug/L	<0.5	-	-	-
m,p-Xylenes	0.5 ug/L	4.5	-	-	-
o-Xylene	0.5 ug/L	1.2	-	-	-
Xylenes, total	0.5 ug/L	5.7	-	-	-
4-Bromofluorobenzene	Surrogate	112%	-	-	-
Dibromofluoromethane	Surrogate	104%	-	-	-
Toluene-d8	Surrogate	104%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	117	-	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	-	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	-	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	-	-	-

Certificate of Analysis

Report Date: 27-Jun-2012
Order Date:25-Jun-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12527 Project Description: PE2422

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						
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						
Chloroethane	ND	1.0	ug/L						
Chloroform	ND	0.5	ug/L						
Chloromethane	ND	3.0	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dibromoethane	ND	0.2	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloroethylene, total	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						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Butyl Ketone (2-Hexanone)	ND	10.0	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						
1,2,4-Trichlorobenzene	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						
1,3,5-Trimethylbenzene	ND	0.5	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	*90.9*		*ug/L*		*114*	*50-140*			
Surrogate: Dibromofluoromethane	*83.2*		*ug/L*		*104*	*50-140*			
Surrogate: Toluene-d8	*82.6*		*ug/L*		*103*	*50-140*			

Certificate of Analysis

Report Date: 27-Jun-2012
Order Date:25-Jun-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12527 Project Description: PE2422

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	
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	
Chloroethane	ND	1.0	ug/L	ND				30	
Chloroform	ND	0.5	ug/L	ND				30	
Chloromethane	ND	3.0	ug/L	ND				30	
Dibromochloromethane	ND	0.5	ug/L	ND				30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND				30	
1,2-Dibromoethane	ND	0.2	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	
Hexane	ND	1.0	ug/L	ND				30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND				30	
Methyl Butyl Ketone (2-Hexanone)	ND	10.0	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	
1,2,4-Trichlorobenzene	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	
1,3,5-Trimethylbenzene	ND	0.5	ug/L	ND				30	
Vinyl chloride	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: 4-Bromofluorobenzene	*90.6*		*ug/L*	*ND*	*113*	*50-140*			
Surrogate: Dibromofluoromethane	*80.3*		*ug/L*	*ND*	*100*	*50-140*			
Surrogate: Toluene-d8	*84.4*		*ug/L*	*ND*	*106*	*50-140*			

Certificate of Analysis

Report Date: 27-Jun-2012
Order Date:25-Jun-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12527 Project Description: PE2422

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	2020	25	ug/L	ND	101	68-117			
F2 PHCs (C10-C16)	1300	100	ug/L	ND	81.2	60-140			
F3 PHCs (C16-C34)	3140	100	ug/L	ND	78.4	60-140			
F4 PHCs (C34-C50)	1960	100	ug/L	ND	81.5	60-140			
Volatiles									
Acetone	122	5.0	ug/L	ND	122	50-140			
Benzene	32.4	0.5	ug/L	ND	81.0	60-130			
Bromodichloromethane	31.0	0.5	ug/L	ND	77.6	60-130			
Bromoform	25.0	0.5	ug/L	ND	62.6	60-130			
Bromomethane	31.0	0.5	ug/L	ND	77.6	50-140			
Carbon Tetrachloride	29.6	0.2	ug/L	ND	74.0	60-130			
Chlorobenzene	27.0	0.5	ug/L	ND	67.4	60-130			
Chloroethane	31.8	1.0	ug/L	ND	79.4	50-140			
Chloroform	31.0	0.5	ug/L	ND	77.6	60-130			
Chloromethane	25.2	3.0	ug/L	ND	63.1	50-140			
Dibromochloromethane	26.0	0.5	ug/L	ND	65.1	60-130			
Dichlorodifluoromethane	27.6	1.0	ug/L	ND	69.0	50-140			
1,2-Dibromoethane	26.2	0.2	ug/L	ND	65.6	60-130			
1,2-Dichlorobenzene	30.9	0.5	ug/L	ND	77.2	60-130			
1,3-Dichlorobenzene	33.7	0.5	ug/L	ND	84.2	60-130			
1,4-Dichlorobenzene	33.4	0.5	ug/L	ND	83.5	60-130			
1,1-Dichloroethane	32.1	0.5	ug/L	ND	80.2	60-130			
1,2-Dichloroethane	31.4	0.5	ug/L	ND	78.6	60-130			
1,1-Dichloroethylene	35.2	0.5	ug/L	ND	87.9	60-130			
cis-1,2-Dichloroethylene	34.9	0.5	ug/L	ND	87.2	60-130			
trans-1,2-Dichloroethylene	33.7	0.5	ug/L	ND	84.2	60-130			
1,2-Dichloropropane	34.6	0.5	ug/L	ND	86.5	60-130			
cis-1,3-Dichloropropylene	35.6	0.5	ug/L	ND	89.0	60-130			
trans-1,3-Dichloropropylene	38.2	0.5	ug/L	ND	95.4	60-130			
Ethylbenzene	27.0	0.5	ug/L	ND	67.4	60-130			
Hexane	29.8	1.0	ug/L	ND	74.6	60-130			
Methyl Ethyl Ketone (2-Butanone)	80.3	5.0	ug/L	ND	80.3	50-140			
Methyl Butyl Ketone (2-Hexanone)	91.2	10.0	ug/L	ND	91.2	50-140			
Methyl Isobutyl Ketone	85.2	5.0	ug/L	ND	85.2	50-140			
Methyl tert-butyl ether	75.1	2.0	ug/L	ND	75.1	50-140			
Methylene Chloride	32.7	5.0	ug/L	ND	81.7	60-130			
Styrene	27.0	0.5	ug/L	ND	67.5	60-130			
1,1,1,2-Tetrachloroethane	26.3	0.5	ug/L	ND	65.8	60-130			
1,1,2,2-Tetrachloroethane	28.1	0.5	ug/L	ND	70.3	60-130			
Tetrachloroethylene	24.8	0.5	ug/L	ND	62.0	60-130			
Toluene	34.4	0.5	ug/L	ND	86.0	60-130			
1,2,4-Trichlorobenzene	26.8	0.5	ug/L	ND	67.0	60-130			
1,1,1-Trichloroethane	30.3	0.5	ug/L	ND	75.6	60-130			
1,1,2-Trichloroethane	34.0	0.5	ug/L	ND	84.9	60-130			
Trichloroethylene	33.7	0.5	ug/L	ND	84.2	60-130			
Trichlorofluoromethane	27.1	1.0	ug/L	ND	67.7	60-130			
1,3,5-Trimethylbenzene	35.7	0.5	ug/L	ND	89.4	60-130			
Vinyl chloride	37.8	0.5	ug/L	ND	94.5	50-140			
m,p-Xylenes	54.4	0.5	ug/L	ND	68.0	60-130			

Certificate of Analysis

Report Date: 27-Jun-2012
Order Date:25-Jun-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12527 Project Description: PE2422

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
o-Xylene	26.8	0.5	ug/L	ND	67.0	60-130			
Surrogate: 4-Bromofluorobenzene	*51.1*		*ug/L*		*63.8*	*50-140*			

Certificate of Analysis

Report Date: 27-Jun-2012
Order Date:25-Jun-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12527 Project Description: PE2422

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
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.

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Chain of Custody
(Lab Use Only)
Nº 3368

Page ___ of ___

Client Name: Paterson Group	Project Reference: PE2422	TAT: [ ] Regular [ ] 3 Day
Contact Name: Mark D'Arcy	Quote #	~~[X]~~ 2 Day [ ] 1 Day
Address: 154 Colonnade Rd.	PO # 12527	Date Required:
Telephone: 613-226-7381	Email Address: mdarcy@patersongroup.ca	

Criteria: [ ] O. Reg. 153/04 Table __ [✓] O. Reg. 153/11 (Current) Table 7 [ ] 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: 1226057

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHC (F1-F4)	VOC									
1	BH1-GW2	GW		2	June 25/12	1:30PM	X	X		→ only 1 VOC vial							✓
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Paracel

Relinquished By (Print & Sign):	Received by Driver/Depot:	Received at Lab:	Verified By:
Mike Beaudoin	A. DeCOUSE	SUNEEPORN	MJC
Date/Time: June 25/12	Date/Time: 25/06/12 4:03 PM	Date/Time: JUN 25 2012 05:05	Date/Time: June 25/12 5:13
	Temperature: ____ °C	Temperature: 14.3 °C	pH Verified [ ] By: N/A

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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: 18986
Project: PE2422
Custody: 106254

Report Date: 7-Dec-2015
Order Date: 27-Nov-2015

Revised Repo **Order #: 1548392**

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

Paracel ID	Client ID
1548392-01	BH6-GW1
1548392-02	BH7-GW1
1548392-03	BH8-GW1
1548392-04	BH6-GW1

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PHC F1	CWS Tier 1 - P&T GC-FID	30-Nov-15	1-Dec-15
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	28-Nov-15	28-Nov-15
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	2-Dec-15	2-Dec-15
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	30-Nov-15	1-Dec-15

Certificate of Analysis

Report Date: 07-Dec-2015

Client: **Paterson Group Consulting Engineers**

Order Date:27-Nov-2015

Client PO: 18986

Project Description: PE2422

	Client ID:	BH6-GW1	BH7-GW1	BH8-GW1	BH6-GW1
	Sample Date:	27-Nov-15	27-Nov-15	27-Nov-15	27-Nov-15
	Sample ID:	1548392-01	1548392-02	1548392-03	1548392-04
	MDL/Units	Water	Water	Water	Water
Volatiles					
Acetone	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Benzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	0.5 ug/L	0.9	<0.5	<0.5	0.9
Bromoform	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Bromomethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Carbon Tetrachloride	0.2 ug/L	<0.2	<0.2	<0.2	<0.2
Chlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Chloroform	0.5 ug/L	11.8	<0.5	1.6	11.8
Dibromochloromethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Dichlorodifluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,3-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,2-Dichloropropane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,3-Dichloropropene, total	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Ethylene dibromide (dibromoethan	0.2 ug/L	<0.2	<0.2	<0.2	<0.2
Hexane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Methyl tert-butyl ether	2.0 ug/L	<2.0	<2.0	<2.0	<2.0
Methylene Chloride	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Styrene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Toluene	0.5 ug/L	1.4	<0.5	<0.5	1.0
1,1,1-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5

Certificate of Analysis

Report Date: 07-Dec-2015

Client: **Paterson Group Consulting Engineers**

Order Date:27-Nov-2015

Client PO: 18986

Project Description: PE2422

	Client ID:	BH6-GW1	BH7-GW1	BH8-GW1	BH6-GW1
	Sample Date:	27-Nov-15	27-Nov-15	27-Nov-15	27-Nov-15
	Sample ID:	1548392-01	1548392-02	1548392-03	1548392-04
	MDL/Units	Water	Water	Water	Water
1,1,2-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
Vinyl chloride	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
m,p-Xylenes	0.5 ug/L	0.8	<0.5	<0.5	<0.5
o-Xylene	0.5 ug/L	0.5	<0.5	<0.5	<0.5
Xylenes, total	0.5 ug/L	1.3	<0.5	<0.5	0.9
4-Bromofluorobenzene	Surrogate	97.2%	94.8%	95.5%	98.3%
Dibromofluoromethane	Surrogate	108%	113%	114%	116%
Toluene-d8	Surrogate	95.6%	98.5%	97.6%	97.1%
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	<25	<25
F2 PHCs (C10-C16)	100 ug/L	-	<100	<100	-
F3 PHCs (C16-C34)	100 ug/L	-	690	<100	-
F4 PHCs (C34-C50)	100 ug/L	-	<100	<100	-
F1 + F2 PHCs	125 ug/L	-	<125	<125	-
F3 + F4 PHCs	200 ug/L	-	690	<200	-
Semi-Volatiles					
Acenaphthene	0.05 ug/L	-	0.08	-	-
Acenaphthylene	0.05 ug/L	-	<0.05	-	-
Anthracene	0.01 ug/L	-	0.07	-	-
Benzo [a] anthracene	0.01 ug/L	-	0.42	-	-
Benzo [a] pyrene	0.01 ug/L	-	0.46	-	-
Benzo [b] fluoranthene	0.05 ug/L	-	0.73	-	-
Benzo [g,h,i] perylene	0.05 ug/L	-	0.38	-	-
Benzo [k] fluoranthene	0.05 ug/L	-	0.54	-	-
Chrysene	0.05 ug/L	-	0.56	-	-
Dibenzo [a,h] anthracene	0.05 ug/L	-	0.10	-	-
Fluoranthene	0.01 ug/L	-	0.52	-	-
Fluorene	0.05 ug/L	-	0.06	-	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	-	0.33	-	-
1-Methylnaphthalene	0.05 ug/L	-	<0.05	-	-
2-Methylnaphthalene	0.05 ug/L	-	<0.05	-	-
Methylnaphthalene (1&2)	0.10 ug/L	-	<0.10	-	-
Naphthalene	0.05 ug/L	-	<0.05	-	-
Phenanthrene	0.05 ug/L	-	0.57	-	-
Pyrene	0.01 ug/L	-	0.47	-	-

Certificate of Analysis

Report Date: 07-Dec-2015

Client: **Paterson Group Consulting Engineers**

Order Date:27-Nov-2015

Client PO: 18986

Project Description: PE2422

	Client ID:	BH6-GW1	BH7-GW1	BH8-GW1	BH6-GW1
	Sample Date:	27-Nov-15	27-Nov-15	27-Nov-15	27-Nov-15
	Sample ID:	1548392-01	1548392-02	1548392-03	1548392-04
	MDL/Units	Water	Water	Water	Water
2-Fluorobiphenyl	Surrogate	-	89.2%	-	-
Terphenyl-d14	Surrogate	-	84.2%	-	-

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						
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	*18.5*		*ug/L*		*92.7*	*50-140*			
Surrogate: Terphenyl-d14	*24.2*		*ug/L*		*121*	*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						
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						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
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	*77.2*		*ug/L*		*96.4*	*50-140*			
Surrogate: Dibromofluoromethane	*94.3*		*ug/L*		*118*	*50-140*			
Surrogate: Toluene-d8	*77.6*		*ug/L*		*97.0*	*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	
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	
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	*78.3*		*ug/L*	*ND*	*97.9*	*50-140*			
Surrogate: Dibromofluoromethane	*95.5*		*ug/L*	*ND*	*119*	*50-140*			
Surrogate: Toluene-d8	*78.6*		*ug/L*	*ND*	*98.3*	*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	ND	98.2	68-117			
F2 PHCs (C10-C16)	1500	100	ug/L	ND	83.2	60-140			
F3 PHCs (C16-C34)	2750	100	ug/L	ND	73.9	60-140			
F4 PHCs (C34-C50)	1920	100	ug/L	ND	77.3	60-140			
Semi-Volatiles									
Acenaphthene	4.72	0.05	ug/L	ND	94.3	50-140			
Acenaphthylene	4.15	0.05	ug/L	ND	83.0	50-140			
Anthracene	4.37	0.01	ug/L	ND	87.4	50-140			
Benzo [a] anthracene	4.09	0.01	ug/L	ND	81.9	50-140			
Benzo [a] pyrene	4.10	0.01	ug/L	ND	82.0	50-140			
Benzo [b] fluoranthene	4.43	0.05	ug/L	ND	88.5	50-140			
Benzo [g,h,i] perylene	4.48	0.05	ug/L	ND	89.6	50-140			
Benzo [k] fluoranthene	4.75	0.05	ug/L	ND	95.1	50-140			
Chrysene	4.37	0.05	ug/L	ND	87.5	50-140			
Dibenzo [a,h] anthracene	4.55	0.05	ug/L	ND	91.0	50-140			
Fluoranthene	4.39	0.01	ug/L	ND	87.8	50-140			
Fluorene	4.48	0.05	ug/L	ND	89.6	50-140			
Indeno [1,2,3-cd] pyrene	4.32	0.05	ug/L	ND	86.3	50-140			
1-Methylnaphthalene	4.82	0.05	ug/L	ND	96.4	50-140			
2-Methylnaphthalene	5.17	0.05	ug/L	ND	103	50-140			
Naphthalene	4.12	0.05	ug/L	ND	82.5	50-140			
Phenanthrene	4.21	0.05	ug/L	ND	84.2	50-140			
Pyrene	4.55	0.01	ug/L	ND	90.9	50-140			
Surrogate: 2-Fluorobiphenyl	*15.8*		*ug/L*		*79.1*	*50-140*			
Volatiles									
Acetone	72.0	5.0	ug/L	ND	72.0	50-140			
Benzene	35.1	0.5	ug/L	ND	87.8	50-140			
Bromodichloromethane	41.9	0.5	ug/L	ND	105	50-140			
Bromoform	35.5	0.5	ug/L	ND	88.7	50-140			
Bromomethane	29.3	0.5	ug/L	ND	73.3	50-140			
Carbon Tetrachloride	33.2	0.2	ug/L	ND	83.1	50-140			
Chlorobenzene	33.5	0.5	ug/L	ND	83.8	50-140			
Chloroform	34.9	0.5	ug/L	ND	87.2	50-140			
Dibromochloromethane	36.3	0.5	ug/L	ND	90.7	50-140			
Dichlorodifluoromethane	37.7	1.0	ug/L	ND	94.3	50-140			
1,2-Dichlorobenzene	32.8	0.5	ug/L	ND	82.0	50-140			
1,3-Dichlorobenzene	35.9	0.5	ug/L	ND	89.8	50-140			
1,4-Dichlorobenzene	31.2	0.5	ug/L	ND	78.0	50-140			
1,1-Dichloroethane	32.6	0.5	ug/L	ND	81.6	50-140			
1,2-Dichloroethane	29.5	0.5	ug/L	ND	73.7	50-140			
1,1-Dichloroethylene	33.7	0.5	ug/L	ND	84.3	50-140			
cis-1,2-Dichloroethylene	37.9	0.5	ug/L	ND	94.8	50-140			
trans-1,2-Dichloroethylene	33.8	0.5	ug/L	ND	84.4	50-140			
1,2-Dichloropropane	33.5	0.5	ug/L	ND	83.8	50-140			
cis-1,3-Dichloropropylene	33.4	0.5	ug/L	ND	83.5	50-140			
trans-1,3-Dichloropropylene	25.6	0.5	ug/L	ND	64.0	50-140			
Ethylbenzene	32.4	0.5	ug/L	ND	80.9	50-140			
Ethylene dibromide (dibromoethane	35.7	0.2	ug/L	ND	89.3	50-140			
Hexane	29.9	1.0	ug/L	ND	74.8	50-140			
Methyl Ethyl Ketone (2-Butanone)	72.5	5.0	ug/L	ND	72.5	50-140			
Methyl Isobutyl Ketone	66.9	5.0	ug/L	ND	66.9	50-140			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methyl tert-butyl ether	99.0	2.0	ug/L	ND	99.0	50-140			
Methylene Chloride	33.1	5.0	ug/L	ND	82.7	50-140			
Styrene	36.2	0.5	ug/L	ND	90.5	50-140			
1,1,1,2-Tetrachloroethane	33.9	0.5	ug/L	ND	84.7	50-140			
1,1,2,2-Tetrachloroethane	47.1	0.5	ug/L	ND	118	50-140			
Tetrachloroethylene	30.6	0.5	ug/L	ND	76.5	50-140			
Toluene	33.7	0.5	ug/L	ND	84.2	50-140			
1,1,1-Trichloroethane	35.1	0.5	ug/L	ND	87.8	50-140			
1,1,2-Trichloroethane	41.6	0.5	ug/L	ND	104	50-140			
Trichloroethylene	35.5	0.5	ug/L	ND	88.8	50-140			
Trichlorofluoromethane	26.4	1.0	ug/L	ND	66.1	50-140			
Vinyl chloride	32.6	0.5	ug/L	ND	81.6	50-140			
m,p-Xylenes	68.6	0.5	ug/L	ND	85.8	50-140			
o-Xylene	34.9	0.5	ug/L	ND	87.2	50-140			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

Revision 1 - This report includes additional VOC/F1 data (duplicate vial analysed for BH6-GW1).

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.

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Chain of Custody
(Lab Use Only)
№ 106254

Page 1 of 1

Client Name: PATERSON GROUP
Contact Name: MARK D'ARCY
Address: 154 COLONNADE
Telephone: 613-226-7381

Project Reference: PE2422
Quote #
PO # 18986
Email Address: mdarcy@patersongroup.ca

TAT: [X] Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day
Date Required:

Criteria: [X] 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: 1548392

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)	F (PHC)					
1	BH6-GW1	GW		2	Nov 27/15	AM		X						X					
2	BH7-GW1	GW		4	↓	↓	X	X	X										
3	BH8-GW1	GW		3	↓	↓	X	X											
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Comments:

Method of Delivery: Swift

Relinquished By (Sign): [signature]	Received by Driver/Depot: [signature] 10:65	Received at Lab: SUNEEPORN DOMMAI	Verified By: [signature]
Relinquished By (Print):	Date/Time:	Date/Time: NOV 27 2015 04:50	Date/Time: NOV 27/15 5:57
Date/Time:	Temperature: ____ °C	Temperature: 13.0 °C	pH Verified [ ] By: RS.

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 24864
Project: PE4330
Custody: 44416

Report Date: 9-Aug-2018
Order Date: 3-Aug-2018

Order #: 1831485

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

Paracel ID	Client ID
1831485-01	BH6-GW1
1831485-02	BH9-GW1
1831485-03	BH10-GW1
1831485-04	DUP

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PHC F1	CWS Tier 1 - P&T GC-FID	6-Aug-18	7-Aug-18
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	8-Aug-18	9-Aug-18
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	7-Aug-18	8-Aug-18
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	6-Aug-18	7-Aug-18

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 24864

Report Date: 09-Aug-2018

Order Date: 3-Aug-2018

Project Description: PE4330

	Client ID:	BH6-GW1	BH9-GW1	BH10-GW1	DUP
	Sample Date:	08/02/2018 00:00	08/02/2018 00:00	08/02/2018 00:00	08/02/2018 00:00
	Sample ID:	1831485-01	1831485-02	1831485-03	1831485-04
	MDL/Units	Ground Water	Ground Water	Ground Water	Ground Water
Volatiles					
Acetone	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Benzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Bromoform	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Bromomethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Carbon Tetrachloride	0.2 ug/L	<0.2	<0.2	<0.2	<0.2
Chlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Chloroform	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Dichlorodifluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,3-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,2-Dichloropropane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,3-Dichloropropene, total	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Ethylene dibromide (dibromoethan	0.2 ug/L	<0.2	<0.2	<0.2	<0.2
Hexane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Methyl tert-butyl ether	2.0 ug/L	<2.0	<2.0	<2.0	<2.0
Methylene Chloride	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Styrene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Toluene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 24864

Report Date: 09-Aug-2018

Order Date: 3-Aug-2018

Project Description: PE4330

	Client ID:	BH6-GW1	BH9-GW1	BH10-GW1	DUP
	Sample Date:	08/02/2018 00:00	08/02/2018 00:00	08/02/2018 00:00	08/02/2018 00:00
	Sample ID:	1831485-01	1831485-02	1831485-03	1831485-04
	MDL/Units	Ground Water	Ground Water	Ground Water	Ground Water
1,1,2-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
Vinyl chloride	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
o-Xylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Xylenes, total	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
4-Bromofluorobenzene	Surrogate	93.2%	93.2%	92.8%	94.3%
Dibromofluoromethane	Surrogate	90.9%	93.9%	92.0%	116%
Toluene-d8	Surrogate	93.9%	96.1%	93.7%	94.8%
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	4490 [1]	-
F4 PHCs (C34-C50)	100 ug/L	-	<100	471	-
Semi-Volatiles					
Acenaphthene	0.05 ug/L	-	-	<0.05	-
Acenaphthylene	0.05 ug/L	-	-	<0.05	-
Anthracene	0.01 ug/L	-	-	<0.01	-
Benzo [a] anthracene	0.01 ug/L	-	-	<0.01	-
Benzo [a] pyrene	0.01 ug/L	-	-	<0.01	-
Benzo [b] fluoranthene	0.05 ug/L	-	-	<0.05	-
Benzo [g,h,i] perylene	0.05 ug/L	-	-	<0.05	-
Benzo [k] fluoranthene	0.05 ug/L	-	-	<0.05	-
Chrysene	0.05 ug/L	-	-	<0.05	-
Dibenzo [a,h] anthracene	0.05 ug/L	-	-	<0.05	-
Fluoranthene	0.01 ug/L	-	-	<0.01	-
Fluorene	0.05 ug/L	-	-	<0.05	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	-	-	<0.05	-
1-Methylnaphthalene	0.05 ug/L	-	-	<0.05	-
2-Methylnaphthalene	0.05 ug/L	-	-	<0.05	-
Methylnaphthalene (1&2)	0.10 ug/L	-	-	<0.10	-
Naphthalene	0.05 ug/L	-	-	<0.05	-
Phenanthrene	0.05 ug/L	-	-	<0.05	-
Pyrene	0.01 ug/L	-	-	<0.01	-
2-Fluorobiphenyl	Surrogate	-	-	86.2%	-
Terphenyl-d14	Surrogate	-	-	106%	-

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						
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	*18.7*		*ug/L*		*93.7*	*50-140*			
Surrogate: Terphenyl-d14	*18.5*		*ug/L*		*92.3*	*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						
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						

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24864

Report Date: 09-Aug-2018
Order Date: 3-Aug-2018
Project Description: PE4330

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
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	*79.9*		*ug/L*		*99.9*	*50-140*			
Surrogate: Dibromofluoromethane	*75.8*		*ug/L*		*94.8*	*50-140*			
Surrogate: Toluene-d8	*72.5*		*ug/L*		*90.6*	*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	
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	
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	*73.5*		*ug/L*		*91.8*	*50-140*			
Surrogate: Dibromofluoromethane	*70.6*		*ug/L*		*88.2*	*50-140*			
Surrogate: Toluene-d8	*74.2*		*ug/L*		*92.7*	*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)	1760	25	ug/L		88.0	68-117			
F2 PHCs (C10-C16)	1780	100	ug/L		111	60-140			
F3 PHCs (C16-C34)	4640	100	ug/L		118	60-140			
F4 PHCs (C34-C50)	3280	100	ug/L		132	60-140			
Semi-Volatiles									
Acenaphthene	4.11	0.05	ug/L		82.2	50-140			
Acenaphthylene	3.78	0.05	ug/L		75.5	50-140			
Anthracene	5.12	0.01	ug/L		102	50-140			
Benzo [a] anthracene	4.55	0.01	ug/L		91.0	50-140			
Benzo [a] pyrene	5.36	0.01	ug/L		107	50-140			
Benzo [b] fluoranthene	5.90	0.05	ug/L		118	50-140			
Benzo [g,h,i] perylene	5.29	0.05	ug/L		106	50-140			
Benzo [k] fluoranthene	5.85	0.05	ug/L		117	50-140			
Chrysene	5.19	0.05	ug/L		104	50-140			
Dibenzo [a,h] anthracene	5.39	0.05	ug/L		108	50-140			
Fluoranthene	4.29	0.01	ug/L		85.7	50-140			
Fluorene	4.37	0.05	ug/L		87.3	50-140			
Indeno [1,2,3-cd] pyrene	5.66	0.05	ug/L		113	50-140			
1-Methylnaphthalene	5.07	0.05	ug/L		101	50-140			
2-Methylnaphthalene	5.61	0.05	ug/L		112	50-140			
Naphthalene	4.74	0.05	ug/L		94.7	50-140			
Phenanthrene	4.72	0.05	ug/L		94.4	50-140			
Pyrene	4.45	0.01	ug/L		89.0	50-140			
Surrogate: 2-Fluorobiphenyl	*16.7*		*ug/L*		*83.4*	*50-140*			
Volatiles									
Acetone	76.4	5.0	ug/L		76.4	50-140			
Benzene	35.5	0.5	ug/L		88.7	60-130			
Bromodichloromethane	39.4	0.5	ug/L		98.6	60-130			
Bromoform	47.3	0.5	ug/L		118	60-130			
Bromomethane	27.1	0.5	ug/L		67.8	50-140			
Carbon Tetrachloride	40.8	0.2	ug/L		102	60-130			
Chlorobenzene	38.4	0.5	ug/L		96.0	60-130			
Chloroform	35.8	0.5	ug/L		89.6	60-130			
Dibromochloromethane	45.9	0.5	ug/L		115	60-130			
Dichlorodifluoromethane	29.6	1.0	ug/L		74.1	50-140			
1,2-Dichlorobenzene	43.7	0.5	ug/L		109	60-130			
1,3-Dichlorobenzene	44.7	0.5	ug/L		112	60-130			
1,4-Dichlorobenzene	43.7	0.5	ug/L		109	60-130			
1,1-Dichloroethane	31.4	0.5	ug/L		78.4	60-130			
1,2-Dichloroethane	39.8	0.5	ug/L		99.4	60-130			
1,1-Dichloroethylene	28.9	0.5	ug/L		72.3	60-130			
cis-1,2-Dichloroethylene	25.5	0.5	ug/L		63.7	60-130			
trans-1,2-Dichloroethylene	29.9	0.5	ug/L		74.8	60-130			
1,2-Dichloropropane	37.3	0.5	ug/L		93.2	60-130			
cis-1,3-Dichloropropylene	39.1	0.5	ug/L		97.8	60-130			
trans-1,3-Dichloropropylene	41.9	0.5	ug/L		105	60-130			
Ethylbenzene	40.1	0.5	ug/L		100	60-130			
Ethylene dibromide (dibromoethane	42.2	0.2	ug/L		105	60-130			
Hexane	40.1	1.0	ug/L		100	60-130			
Methyl Ethyl Ketone (2-Butanone)	115	5.0	ug/L		115	50-140			
Methyl Isobutyl Ketone	106	5.0	ug/L		106	50-140			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methyl tert-butyl ether	88.0	2.0	ug/L		88.0	50-140			
Methylene Chloride	28.2	5.0	ug/L		70.4	60-130			
Styrene	38.2	0.5	ug/L		95.6	60-130			
1,1,1,2-Tetrachloroethane	44.9	0.5	ug/L		112	60-130			
1,1,2,2-Tetrachloroethane	42.0	0.5	ug/L		105	60-130			
Tetrachloroethylene	42.1	0.5	ug/L		105	60-130			
Toluene	37.9	0.5	ug/L		94.8	60-130			
1,1,1-Trichloroethane	38.6	0.5	ug/L		96.6	60-130			
1,1,2-Trichloroethane	39.6	0.5	ug/L		99.0	60-130			
Trichloroethylene	34.6	0.5	ug/L		86.5	60-130			
Trichlorofluoromethane	33.3	1.0	ug/L		83.3	60-130			
Vinyl chloride	32.9	0.5	ug/L		82.2	50-140			
m,p-Xylenes	84.2	0.5	ug/L		105	60-130			
o-Xylene	41.9	0.5	ug/L		105	60-130			

Qualifier Notes:

Sample Qualifiers :

1 : Some peak(s) in the GC-FID Chromatogram are not typical of petroleum hydrocarbon distillates. May be the result of high concentrations of non-mineral based compounds not completely removed by the method cleanup. Results may be biased high.

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: 1831485

PARACEL LABORATORIES LTD. | TRUSTED RESPONS RELIABLE

Chain of Custody
(Lab Use Only)
№ 44416

Page 1 of 1

Client Name: Paterson Group	Project Reference: PE4330	**Turnaround Time:**
Contact Name: ADRIAN MENYHART	Quote #	☐ 1 Day ☐ 3 Day
Address: 154 Colonnade Rd S.	PO # 24664	☐ 2 Day ☑ Regular
Telephone: 613-226-7381	Email Address: amenyhart@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: 1831485

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	Required Analyses: PAH	PHC F1-F4 BTEX	VOC
1	BH6 - GW1	GW		2	Nov 2 2018		✓		✓
2	BH9 - GW1	GW		3	"	"		✓	✓
3	BH10 - GW1	GW		4	"	"	✓	✓	✓
4	DUP	GW		2	"	"			✓
5									
6									
7									
8									
9									
10									

Comments:

Method of Delivery: Swift

Relinquished By (Sign):	Received by Driver/Depot: 1471	Received at Lab:	Verified By:
Relinquished By (Print): ADRIAN M.	Date/Time:	Date/Time: 3/8/18 9:46	Date/Time: 05/03/18 11:53a
Date/Time:	Temperature: °C	Temperature: 18.4 °C	pH Verified [ ] By: