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Phase II-Environmental Site Assessment

70 Beech Street and 75 Norman Street
Ottawa, Ontario

Prepared For
Beech Holdings Ltd.

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Report: PE2746-2

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EXECUTIVE SUMMARY

Assessment

A Phase II-ESA was conducted for 70 Beech Street and 75 Norman Street, Ottawa, Ontario. The focus of the Phase II-ESA was to assess APECs identified in the Phase I-ESA and to confirm general soil and groundwater quality at the APEC locations.

The Phase II-ESA consisted of the drilling of three (3) boreholes, and the installation of three (3) groundwater monitoring wells to assess soil and groundwater quality at the subject site. This Phase II-ESA also includes data collected from a prior Phase II-ESA, conducted between 2012 and 2016.

Soil samples obtained from the boreholes were screened using visual observations and organic vapour measurements. Based on the screening results, samples were selected for analysis of petroleum hydrocarbons, fractions 1 through 4 (PHCs F1-F4), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), and metals. Based on analytical test results, metals, PAHs, and PHCs were identified in the fill material at 70 Beech Street in excess of the site standards.

Groundwater samples were obtained from BH4 in 2016 and BH7, BH8 and BH9 in 2018. Groundwater samples were submitted for analysis of PHCs, BTEX, volatile organic compounds (VOCs), PAHs, and metals. All the tested parameters in the groundwater samples were in compliance with the selected MOECC Table 7 standards with the exception of the F1 PHC fraction, benzene and xylenes in Sample BH9-GW1. Although similar PHC/BTEX compounds were detected in the soil sample submitted for analysis from BH9, the exceedances noted in the groundwater collected from BH9-GW1 may not be representative of the actual groundwater quality. Limited amounts of groundwater were available for sampling in that well, and suspended sediment was encountered during the sampling event, which may have influenced the analytical results.

Recommendations

Fill material is present at the subject site which exceeds the MOECC Table 7 standards for a residential property. It is Paterson's understanding that the property will be redeveloped in the near future. It is our recommendation that an environmental site remediation program, consisting of the removal of all impacted soil, be completed concurrently with site redevelopment. At that time, all impacted soil will require disposal at a licensed landfill site.

Groundwater

The groundwater monitoring wells should be kept in good condition until site redevelopment. The groundwater at Borehole BH9 should be re-sampled in the near future (ideally before winter), in order to confirm the groundwater quality at that time.

1.0 INTRODUCTION

At the request of Beech Holdings Limited, Paterson Group conducted a Phase II Environmental Site Assessment of the property located at 70 Beech Street and 75 Norman Street, in the City of Ottawa, Ontario.

1.1 Site Description

Address:	70 Beech Street and 75 Norman Street, Ottawa, Ontario.
Legal Description:	Lot 46 N66 E23.5, Lots 47 and 48 Beech South, Plan 194250 (70 Beech Street), and Lot 43, Plan 194250 (75 Norman Street).
Property Identification Number:	04104-0061 (70 Beech Street) 04104-0058 (75 Norman Street)
Location:	The subject site is situated between Beech Street and Norman Street, in the City of Ottawa, approximately 35 m east of Preston Street. The subject site is shown on Figure 1 - Key Plan following the body of this report.
Latitude and Longitude:	45° 24' 01" N, -75° 42' 31" W.
Configuration:	Irregular.
Site Area:	1,186 square meters (approximate).

1.2 Property Ownership

The property is currently owned by Beech Holdings Ltd.

1.3 Current and Proposed Future Uses

The subject site is currently occupied by an automotive service garage (70 Beech Street) and a residential dwelling (75 Norman Street). It is Paterson's understanding that the subject site will be redeveloped with a multi-storey residential dwelling.

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 and Climate Change (MOECC), April 2011. The MOECC Table 3 Standards are based on the following considerations:

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

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The subject site is located south of Beech Street and north of Norman Street, to the east of Preston Street, in the City of Ottawa. The property is occupied by two buildings. The building at 70 Beech Street is occupied by a slab on grade automotive service garage (with a unit rented to an automotive detailing shop) and the building at 75 Norman Street consists of a two storey residential dwelling, rented as a duplex. Part of 70 Beech Street is used for vehicle parking by tenants of the building to the east.

2.2 Past Investigations

In 2012, Paterson conducted a Phase I-II ESA on the property at 70 Beech Street. A number of potential environmental concerns were noted, such as the use of the property at a welding shop, and a soil and groundwater investigation was conducted. Six boreholes were advanced on the property, with one groundwater monitoring well installed in one of the boreholes (BH4).

Metals and PAH concentrations exceeding the MOECC site standards were identified in soil samples collected during the investigation. Some hydrocarbon and PAH parameters were identified in the groundwater collected from BH4.

A return visit was conducted in 2016 as part of a Phase I-ESA update, and to re-assess the quality of the groundwater from BH4. The well was purged dry and sampled. All analytical test parameters (PHCs, VOC, and PAHs) were in compliance with the site standards.

Paterson prepared a Phase I-ESA in May 2018; no new findings or potentially contaminating activities were identified, with the exception of the operation of an automotive service garage in the building at 70 Beech Street.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation consisted of the drilling of 3 boreholes on the subject site, each equipped with groundwater monitoring wells. Boreholes were drilled to depths ranging from 1.09 m (2012) to 6.68 m below ground surface. Limestone bedrock was encountered between 0.71 and 1.85 m below grade. The focus of the Phase II-ESA was to assess areas of potential environmental concern identified during the Phase I-ESA assessment.

3.2 Media Investigated

During the subsurface investigation, 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 concern for soil and groundwater are metals, petroleum hydrocarbons (PHCs), volatile organic compounds (VOCs), and PAHs (polycyclic aromatic hydrocarbons) in soil and groundwater

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

The Geological Survey of Canada website on the Urban Geology of the National Capital Area were consulted as part of this assessment. Based on this information, bedrock in the area of the site consists of interbedded limestone and shale of the Verulam Formation. Based on the maps, the thickness of overburden ranges from 2 to 5 m. Overburden consists of till.

Actual subsurface conditions encountered during the Phase II-ESA are discussed in Section 5.1.

Contaminants of Potential Concern

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

- BTEX – this suite of parameters associated with fuels, as well as other solvents relating to degreasers and cleaners potentially used in the automotive industry. These parameters were selected as CPCs for the

subject site due to the presence of an automotive service garage. BTEX are considered to be present in both the soil and groundwater.

- Petroleum Hydrocarbons Fractions 1 through 4 (PHCs F1-F4) – this suite of parameters encompasses gasoline (Fraction 1), diesel and fuel oil (Fraction 2), and heavy oils (Fractions 3 and 4). These parameters were selected as CPCs for the Phase I site based on the presence of an automotive service garage, a former welding shop, and a former machine shop on the adjacent property to the east. PHCs are generally considered to be LNAPLs – light non-aqueous phase liquids, indicating that when present in sufficient concentrations above the solubility limit, they will partition into a separate phase above the water table, due to their lower density.

- Polycyclic aromatic hydrocarbons (PAHs) – this suite of parameters encompasses various complex hydrocarbons, commonly associated with coal and/or combustion of heavy-fraction hydrocarbons such as hydraulic or crankcase oil. PAHs were selected as a COC for the site based on the presence of an automotive service garage, as well as the former presence of a former machining shop on the adjacent property to the east and the previously identified PAH impacts in the soil. PAHs may be present in the soil matrix or dissolved in site groundwater.

- Metals – this suite of parameters encompasses various metals for which MOECC standards exist. Metals were selected as a CPC for the property based on the former presence of a welding shop on the property, a former machining shop adjacent to the east, and the previously identified metals in the fill.

Buildings and Structures

The property at 70 Beech Street is occupied by a single storey, slab on grade building, occupied by an automotive service garage in one unit, and an automotive detailing shop in the other. The property at 75 Norman Street is occupied by a two storey dwelling with a detached private garage at the rear of that lot.

Water Bodies

There are no water bodies on the subject site or in the study area.

Areas of Natural Significance

There are no areas of natural significance in the study area.

Drinking Water Wells

No drinking water wells are located at the subject site or within the Phase I study area. Several groundwater monitoring wells were identified in the study area, including one on the subject site.

This well was installed as part of Paterson's 2012 Phase II-ESA conducted on the 70 Beech Street property. During a recent sampling event, a groundwater sample was collected from borehole BH4 and all analytical test parameters were found to be in compliance with the MOECC site standards.

Neighbouring Land Use

Currently, neighbouring land use in the Phase I study area is primarily commercial and residential.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

Potentially Contaminating Activities resulting in Areas of Potential Environmental Concern identified on the subject site include the automotive service garage (and former welding shop), poor quality fill material on the property at 70 Beech Street, and the eastern side of the subject site as a result of the former machine shop to the east. Other potentially contaminating activities in the area are not considered to have created areas of potential environmental concern, based on their separation distances, and/or available documentation regarding those concerns.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of this Phase I ESA is considered to be sufficient to conclude that there are areas of potential environmental concern on the subject site. The presence of potentially contaminating activities was confirmed by a variety of independent sources, and 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. No deviations from the Sampling and Analysis Plan were noted.

3.5 Impediments

No significant impediments were encountered during the Phase II-ESA program. The groundwater monitoring well at BH9 was noted to produce only limited

amounts of water, and the sample submitted for analysis contained some suspended sediment.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was carried out on March 26 and May 4, 2018, and consisted of the drilling of three boreholes on the subject site. The boreholes were placed to address the Areas of Potential Environmental Concern created by the former welding shop, the present automotive service garage, the former machining shop (adjacent to the east) and the presence of poor quality fill. Boreholes BH7 to BH9 were drilled using a track-mounted power auger drill rig. Borehole BH7 was placed within the garage. All drilling occurred under full-time supervision of Paterson personnel. Borehole locations are shown on Drawing PE2746-4 - Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

As part of the subsurface investigation a total of 7 soil samples were obtained from the boreholes by means of split spoon sampling and direct sampling from auger flights. An additional 11 rock core samples were collected from the boreholes.

During the previous Phase I-II ESA investigation, 12 soil samples were observed from the boreholes.

Split spoon and rock core samples were taken continuously from ground surface up to 6.68 m below grade, within the upper water table. The depths at which split spoon and auger samples were obtained from the boreholes are shown as "**SS**", and "**AU**" respectively on the Soil Profile and Test Data Sheets, appended to this report.

Site soils consist of a layer of fill material consisting of gravel over silty sand and gravel, with some traces of mortar and coal. The fill was placed above the grey limestone bedrock.

4.3 Field Screening Measurements

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

The soil vapours were measured by inserting the analyzer probe into the nominal headspace above the soil sample. Samples were then agitated and the peak readings recorded. Vapour readings were largely negligible and varied from 0 ppm to 35 ppm. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

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

4.4 Groundwater Monitoring Well Installation

Three (3) groundwater monitoring wells were installed during the drilling program carried out in 2018 by George Downing Estate Drilling of Hawkesbury, Ontario, under full-time supervision by Paterson personnel. The monitoring wells consisted of 30 mm diameter Schedule 40 threaded PVC riser and screen. A sand pack consisting of silica sand was placed around the screen, and a bentonite seal was placed above the screen to minimize cross-contamination. Monitoring well construction details are provided on the Soil Profile and Test Data Sheets in Appendix 1. Note that the monitoring well installed at BH4 (2012) could not be located and is considered to have been destroyed.

A summary of the monitoring well construction details is provided below in Table 1. Boreholes were surveyed with respect to the catch basin located along the north property boundary.

Table 1: Monitoring Well Construction Details

Well ID	Ground Surface Elevation	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH4 (destroyed)	100.43	5.82	2.79 – 5.82	1.90 – 2.79	0.3 – 1.90	Flushmount
BH7	100.53	6.20	3.00 – 6.20	2.39 – 3.00	0.3 – 2.39	Flushmount
BH8	100.31	6.10	3.00 – 6.10	2.39 – 3.00	0.3 – 2.39	Flushmount
BH9	100.51	6.68	3.56 – 6.68	3.13 – 3.56	0.3 – 3.13	Flushmount

At the time of conducting the field components of this Phase II-ESA, BH4 (2012) could not be located and is suspected to have been damaged beyond use.

4.5 Groundwater Sampling

Groundwater sampling protocols were followed using the MOECC document entitled “Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario”, dated May 1996. Groundwater samples were obtained from each monitoring well, using dedicated sampling equipment. Standing water was purged from each well prior to sampling. Samples were stored in coolers to reduce analyte volatilization during transportation.

Details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan in Appendix 1.

4.6 Analytical Testing

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

Table 2: Soil Samples Submitted

Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analysed				Rationale
		PHC	BTEX	Metals	PAH	
Phase II Investigation - 2012						
BH1-SS2	0.75 – 1.29 m / Fill				X	Assessment of soils in former building footprint and in APEC created by former machine shop (east)
BH2-AU1	0.15 – 0.62 m / Fill			X		Assessment of soils in vicinity of former welding shop and automotive garage
BH3-SS2	0.75 – 1.0 m / Fill				X	Assessment of soils in vicinity of former welding shop/automotive garage and in APEC created by former machine shop (east)
BH5-SS2	0.75 – 1.0 m / Fill			X	X	Assessment of soils in vicinity of former welding shop and automotive garage
Present Phase II Investigation - 2018						
BH7-SS1	0.13 – 0.43 m / Fill	X	X	X	X	Assessment of soils beneath former welding shop and automotive garage
BH8-SS2	0.60 – 1.21 m / Fill	X	X	X	X	Assessment of soils in APEC created by former machine shop (east)
BH9-AU1	0.26 – 0.60 m / Fill	X	X	X	X	Assessment of soils in APEC created by former machine shop (east)

Table 3: Groundwater Samples Submitted

Sample ID	Screened Interval/ Stratigraphic Unit	Parameters Analysed				Rationale
		PHC F_1-F_4 BTEX	VOC	PAH	Metals	
August 3, 2016						
BH4-GW2	2.79 – 5.82 m / Bedrock	X	X	X		Assessment of groundwater in vicinity of former welding shop and automotive service garage
June 12, 2018						
BH7-GW1	2.39 – 6.20 m / Bedrock	X				Assessment of groundwater beneath the former welding shop and automotive service garage
BH8-GW1	2.39 – 6.10 m / Bedrock	X		X	X	Assessment of groundwater in APEC created by former machine shop (east)
BH9-GW1	3.50 – 6.68 m / Bedrock	X		X	X	Assessment of groundwater in APEC created by former machine shop (east)

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

4.7 Residue Management

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

4.8 Elevation Surveying

Boreholes were surveyed using the catch basin located in Beech Street, along the north property line, as a project benchmark.

4.9 Quality Assurance and Quality Control Measures

A summary of quality assurance and quality control (QA/QC) measures, including sampling containers, preservation, labelling, handling, and custody, equipment cleaning procedures, and field quality control measurements is provided in the Sampling and Analysis Plan in Appendix 1. No deviations from the QA/QC procedures in the Sampling & Analysis Plan were noted.

5.0 REVIEW AND EVALUATION

5.1 Geology

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

- Concrete slab was present at borehole BH7.
- Fill material was encountered at each of the borehole locations. With the exception of borehole BH7, fill was encountered at grade, to depths of approximately 1.8 m below grade. The fill consisted primarily of sand and gravel. Some traces of coal were identified in certain boreholes.
- Below the fill was grey limestone bedrock. The limestone is considered to act as an unconfined aquifer.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured using an electronic water level meter. Groundwater levels are summarized below in Table 4. All elevations are relative to the project benchmark.

Table 4: Groundwater Level Measurements – June 2018

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH7	100.53	4.57	95.96	June 12, 2018
BH8	100.31	4.93	95.38	June 12, 2018
BH9	100.51	5.28	95.23	June 12, 2018

Based on the groundwater elevations from the most recent sampling event (June 2018), groundwater contour mapping was completed for the bedrock aquifer unit. Groundwater contours are shown on Drawing PE2746-5 - Groundwater Contour Plan. Based on the contour mapping, groundwater flow at the subject site appears to be in a eastern direction. A horizontal hydraulic gradient of approximately 0.05 m/m was calculated. No free product was observed in the monitoring wells at the subject site. No visual or olfactory indications of contamination were noted during the groundwater monitoring events.

5.3 Fine-Medium Soil Texture

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

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in soil vapour readings of 0 ppm to 35 ppm. Field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets appended to this report. The field screening results were generally low . As a result, soil samples were selected for analytical testing based on visual observations and soil stratigraphy.

5.5 Soil Quality

Five (5) soil samples from the subsurface investigation were submitted for analysis of PHCs and BTEX as presented below in Tables 5 and 5.

Table 5:
Analytical Test Results – Soil – Phase II-ESA 2012
Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g) October 12, 2012		MOECC Table 7 Residential Standards
		BH2-AU1	BH5-SS2	
Antimony	1	1	2	7.5
Arsenic	1	4	11	18
Barium	1	310	329	390
Beryllium	0.5	nd	0.9	4
Boron	5.0	8.8	39.8	120
Cadmium	0.5	**2.2**	0.7	1.2
Chromium	5	142	24	160
Chromium VI	0.2	nd	nd	8
Cobalt	1	5	7	22
Copper	5	**504**	51	140
Lead	1	**257**	96	120
Mercury	0.1	0.2	0.1	0.27
Molybdenum	1	**37**	3	6.9
Nickel	5	92	20	100
Selenium	1	**4**	nd	2.4
Silver	0.3	1.4	nd	20
Thallium	1	nd	nd	1
Uranium	1	nd	nd	23
Vanadium	10	11	29	86
Zinc	20	216	95	340

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

All metals parameters in Sample BH5-SS2 were in compliance with MOECC Table 7 standards. Five parameters were detected in concentrations exceeding the site standards in Sample BH2-AU1.

Table 6:
Analytical Test Results – Soil – Phase II-ESA 2012
PAH

Parameter	MDL (µg/g)	Soil Samples (µg/g) October 12, 2012			MOECC Table 7 Residential Standards
		BH1-SS2	BH3-SS2	BH5-SS2	
Acenaphthene	0.02	**57.9**	0.14	< 0.04	7.9
Acenaphthylene	0.02	**2.57**	0.21	< 0.04	0.15
Anthracene	0.02	**164**	0.77	< 0.04	0.67
Benzo[a]anthracene	0.02	**198**	**1.40**	0.15	0.5
Benzo[a]pyrene	0.02	**140**	**0.90**	0.09	0.3
Benzo[b]fluoranthene	0.02	**232**	**1.98**	0.24	0.78
Benzo[g,h,i]perylene	0.02	**70.9**	0.53	0.09	6.6
Benzo[k]fluoranthene	0.02	**207**	0.97	0.11	0.78
Chrysene	0.02	**219**	1.42	0.22	7
Dibenzo[a,h]anthracene	0.02	**28.1**	**0.24**	0.05	0.1
Fluoranthene	0.02	**565**	**2.90**	0.20	0.69
Fluorene	0.02	**63.2**	0.15	0.04	62
Indeno[1,2,3-cd]pyrene	0.02	**72.2**	**0.55**	0.07	0.38
Methylnaphthalene	0.04	**35.4**	0.16	**2.06**	0.99
Naphthalene	0.01	**39.2**	0.08	**0.72**	0.6
Phenanthrene	0.02	**668**	1.78	0.44	6.2
Pyrene	0.02	**484**	2.53	0.21	78

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

Several PAH parameters were detected above the site standards in Samples BH3-SS2 and BH5-SS2, and all PAH parameters were detected above the standards in Sample BH1-SS2.

Table 7:
Analytical Test Results – Soil – Current Investigation
Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOECC Table 7 Residential Standards
		March 26, 2018		May 4, 2018	
		BH7-SS1	BH8-SS2	BH9-AU1	
Antimony	1	1	nd	2	7.5
Arsenic	1	14	3	2	18
Barium	1	216	80	289	390
Beryllium	0.5	nd	nd	nd	4
Boron	5.0	32.5	13.6	17.2	120
Cadmium	0.5	0.7	nd	**2.0**	1.2
Chromium	5	59	19	39	160
Cobalt	1	16	5	6	22
Copper	5	63	15	**153**	140
Lead	1	**142**	23	**325**	120
Mercury	0.1	0.1	nd	-	0.27
Molybdenum	1	3	**8**	**14**	6.9
Nickel	5	36	15	56	100
Selenium	1	nd	nd	nd	2.4
Silver	0.3	nd	nd	0.5	20
Thallium	1	nd	nd	nd	1
Uranium	1	1	2	nd	23
Vanadium	10	26	19	29	86
Zinc	20	109	73	316	340

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

Exceedances of metals parameters were detected in each of the samples.

Table 8:
Analytical Test Results – Soil – Current Investigation
PAH

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOECC Table 7 Residential Standards
		March 26, 2018		May 4, 2018	
		BH7-SS1	BH8-SS2	BH9-AU1	
Acenaphthene	0.02	nd	nd	nd	7.9
Acenaphthylene	0.02	0.03	0.02	0.02	0.15
Anthracene	0.02	0.04	0.03	nd	0.67
Benzo[a]anthracene	0.02	0.09	0.05	0.12	0.5
Benzo[a]pyrene	0.02	0.08	0.05	0.12	0.3
Benzo[b]fluoranthene	0.02	0.15	0.07	0.19	0.78
Benzo[g,h,i]perylene	0.02	0.06	0.04	0.18	6.6
Benzo[k]fluoranthene	0.02	0.07	0.05	0.09	0.78
Chrysene	0.02	0.12	0.07	0.16	7
Dibenzo[a,h]anthracene	0.02	nd	nd	0.02	0.1
Fluoranthene	0.02	0.18	0.13	0.32	0.69
Fluorene	0.02	nd	nd	0.03	62
Indeno[1,2,3-cd]pyrene	0.02	0.06	0.04	0.09	0.38
Methylnaphthalene	0.04	0.28	nd	0.68	0.99
Naphthalene	0.01	0.10	0.01	0.25	0.6
Phenanthrene	0.02	0.15	0.07	0.22	6.2
Pyrene	0.02	0.15	0.11	0.35	78

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

All PAH parameters were found to be in compliance with the MOECC Table 7 standards.

Table 9:
Analytical Test Results – Soil – Current Investigation
PHC and BTEX

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOECC Table 7 Residential Standards
		March 26, 2018		May 4, 2018	
		BH7-SS1	BH8-SS2	BH9-AU1	
PHC F1 (C6-C10)	7	nd	nd	8	55
PHC F2 (C10-C16)	4	nd	nd	**211**	98
PHC F3 (C16-C34)	8	60	26	**1930**	300
PHC F4 (C34-C50)	6	33	12	310	2800
Benzene	0.02	nd	nd	**0.34**	0.21
Ethylbenzene	0.05	nd	nd	0.17	2
Toluene	0.05	nd	nd	2.17	2.3
Xylenes	0.05	nd	nd	1.65	3.1

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

All PHC and BTEX parameters in Samples BH7-SS1 and BH8-SS2 were in compliance with the MOECC Table 7 standards. The PHC F2 and F3 parameters in Samples BH9-AU1, as well as benzene, were found to exceed the site standards.

Table 10: Maximum Concentrations – Soil			
Parameter	**Maximum Concentration (µg/g)**	**Borehole**	**Depth Interval (m BGS)**
Acenaphthene	**57.9**	BH1-SS2	0.75 – 1.29
Acenaphthylene	**2.57**	BH1-SS2	0.75 – 1.29
Anthracene	**164**	BH1-SS2	0.75 – 1.29
Benzo[a]anthracene	**198**	BH1-SS2	0.75 – 1.29
Benzo[a]pyrene	**140**	BH1-SS2	0.75 – 1.29
Benzo[b]fluoranthene	**232**	BH1-SS2	0.75 – 1.29
Benzo[g,h,i]perylene	**70.9**	BH1-SS2	0.75 – 1.29
Benzo[k]fluoranthene	**207**	BH1-SS2	0.75 – 1.29
Chrysene	**219**	BH1-SS2	0.75 – 1.29
Dibenzo[a,h]anthracene	**28.1**	BH1-SS2	0.75 – 1.29
Fluoranthene	**565**	BH1-SS2	0.75 – 1.29
Fluorene	**63.2**	BH1-SS2	0.75 – 1.29
Indeno[1,2,3-cd]pyrene	**72.2**	BH1-SS2	0.75 – 1.29
Methylnaphthalene	**35.4**	BH1-SS2	0.75 – 1.29
Naphthalene	**39.2**	BH1-SS2	0.75 – 1.29
Phenanthrene	**668**	BH1-SS2	0.75 – 1.29
Pyrene	**484**	BH1-SS2	0.75 – 1.29
Antimony	2	BH5-SS2/BH9-AU1	0.75 - 1.0
Arsenic	11	BH5-SS2	0.75 – 1.0
Barium	329	BH5-SS2	0.75 – 1.0
Beryllium	0.9	BH5-SS2	0.75 – 1.0
Boron	39.8	BH5-SS2	0.75 – 1.0
Cadmium	**2.2**	BH2-AU1	0.15 – 0.62
Chromium	143	BH2-AU1	0.15 – 0.62
Cobalt	16	BH7-SS1	0.13 – 1.43
Copper	**504**	BH2-AU1	0.15 – 0.62
Lead	**325**	BH9-AU1	0.26 – 0.60
Mercury	0.2	BH2-AU1	0.15 – 0.62
Molybdenum	**37**	BH2-AU1	0.15 – 0.62
Nickel	92	BH2-AU1	0.15 – 0.62
Selenium	**4**	BH2-AU1	0.15 – 0.62
Silver	1.4	BH2-AU1	0.15 – 0.62
Uranium	2	BH8-SS2	0.6 – 1.21
Vanadium	29	BH5-SS2/BH9-AU1	0.26 – 0.60
Zinc	316	BH9-AU1	0.26 – 0.60
PHC F1	8	BH9-AU1	0.26 – 0.60
PHC F2	**211**	BH9-AU1	0.26 – 0.60
PHC F3	**1930**	BH9-AU1	0.26 – 0.60
PHC F4	310	BH9-AU1	0.26 – 0.60
Benzene	**0.34**	BH9-AU1	0.26 – 0.60
Ethylbenzene	0.17	BH9-AU1	0.26 – 0.60
Toluene	2.17	BH9-AU1	0.26 – 0.60
Xylenes	1.65	BH9-AU1	0.26 – 0.60

All other analytical parameters were not detected above the analytical detection limits.

5.6 Groundwater Quality

A groundwater sample from BH4 was submitted for analysis in 2016, and samples from BH7, BH8 and BH9 were submitted as part of this Phase II-ESA. Groundwater samples were submitted for analysis of metals, PHC, BTEX and PAHs. One groundwater sample was submitted for analysis of VOCs, however VOCs are not considered to be a contaminant of potential concern. The groundwater samples were obtained from the screened intervals noted on Table 1. The results of the analytical testing are presented in Tables 11 to 14.

Table 11:
Analytical Test Results – Groundwater
VOCs

Parameter	MDL (µg/L)	Groundwater Sample (µg/L) August 3, 2016	MOECC Table 7 Standards
		BH4-GW2	
Acetone	5.0	nd	100,000
Benzene	0.5	nd	0.5
Bromodichloromethane	0.5	nd	67,000
Bromoform	0.5	nd	5
Bromomethane	0.5	nd	0.89
Carbon Tetrachloride	0.2	nd	0.2
Chlorobenzene	0.5	nd	140
Chloroform	0.5	nd	2
Dibromochloromethane	0.5	nd	65,000
Dichlorodifluoromethane	1.0	nd	3,500
1,2-Dichlorobenzene	0.5	nd	150
1,3-Dichlorobenzene	0.5	nd	7,600
1,4-Dichlorobenzene	0.5	nd	0.5
1,1-Dichloroethane	0.5	nd	11
1,2-Dichloroethane	0.5	nd	0.5
1,1-Dichloroethylene	0.5	nd	0.5
cis-1,2-Dichloroethylene	0.5	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	1.6
1,2-Dichloropropane	0.5	nd	0.58
1,3-Dichloropropene	0.5	nd	0.5
Ethylbenzene	0.5	nd	54
Ethylene dibromide	0.2	nd	nv
Hexane	1.0	nd	5
Methyl Ethyl Ketone	5.0	nd	21,000
Methyl Isobutyl Ketone	5.0	nd	5,200
Methyl tert-butyl Ether	2.0	nd	15
Methylene Chloride	5.0	nd	26
Styrene	0.5	nd	43
1,1,1,2-Tetrachloroethane	0.5	nd	1.1
1,1,2,2-Tetrachloroethane	0.5	nd	0.5
Tetrachloroethylene	0.5	nd	0.5
Toluene	0.5	nd	320
1,1,1-Trichloroethane	0.5	nd	23
1,1,2-Trichloroethane	0.5	nd	0.5

Table 11:
Analytical Test Results – Groundwater
VOCs

Parameter	MDL (µg/L)	Groundwater Sample (µg/L) August 3, 2016	MOECC Table 7 Standards
		BH4-GW2	
Trichloroethylene	0.5	nd	0.5
Trichlorofluromethane	1.0	nd	2,000
Vinyl Chloride	0.5	nd	0.5
Xylene	0.5	nd	72

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and underlined** – Value exceeds selected MOECC standards
- nv – No value for standard

None of the VOC parameters were detected in Sample BH4-GW2. All VOC parameters were found to be in compliance with the selected MOECC Table 7 standards.

Table 12:
Analytical Test Results – Groundwater
PHC F1-F4 and BTEX

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)				MOECC Table 7 Standards
		August 3, 2016	June 12, 2018			
		BH4-GW2	BH7-GW1	BH8-GW1	BH9-GW1	
PHC F1 (C6-C10)	25	nd	nd	nd	**665**	420
PHC F2 (C10-C16)	100	nd	nd	nd	nd	150
PHC F3 (C16-C34)	100	nd	nd	nd	nd	500
PHC F4 (C34-C50)	100	nd	nd	nd	nd	500
Benzene	0.5	nd	nd	nd	**4.8**	0.5
Ethylbenzene	0.5	nd	nd	nd	31.6	54
Toluene	0.5	nd	nd	nd	3.8	320
Xylenes	0.5	nd	nd	nd	**335**	72

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and underlined** – Value exceeds selected MOECC standards
- nv – No value for standard

None of the analytical test parameters were detected in Samples BH4-GW2, BH7-GW1 and BH8-GW1, all were in compliance with the MOECC Table 7 standards. The F1 PHC fraction, benzene and xylenes were detected above the site standard in Samples BH9-GW1. It should be noted that this monitoring well produced relatively little water, and the water sample contained some suspended sediment which could have influenced the analytical testing results.

Table 13:
Analytical Test Results – Groundwater
PAH

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MOECC Table 7 Standards
		August 3, 2016	June 12, 2018		
		BH4-GW2	BH8-GW1	BH9-GW1	
Acenaphthene	0.05	nd	nd	nd	17
Acenaphthylene	0.05	nd	nd	nd	1
Anthracene	0.01	0.05	0.02	nd	1
Benzo[a]anthracene	0.01	0.19	0.06	0.05	1.8
Benzo[a]pyrene	0.01	0.22	0.06	nd	0.81
Benzo[b]fluoranthene	0.05	0.10	nd	nd	0.75
Benzo[g,h,i]perylene	0.05	0.16	0.07	nd	0.2
Benzo[k]fluoranthene	0.05	0.09	nd	nd	0.4
Chrysene	0.05	0.23	0.08	0.07	0.7
Dibenzo[a,h]anthracene	0.05	nd	nd	nd	0.4
Fluoranthene	0.01	0.45	0.13	0.11	44
Fluorene	0.05	nd	nd	nd	290
Indeno[1,2,3-cd]pyrene	0.05	0.13	0.05	nd	0.2
Methylnapthalene	0.10	nd	nd	nd	1,500
Naphthalene	0.05	nd	0.07	0.12	7
Phenanthrene	0.05	0.24	0.08	0.08	380
Pyrene	0.01	0.38	0.11	nd	5.7

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and underlined** – Value exceeds selected MOECC standards
- nv – No value for standard

All PAH parameters were found to be in compliance with the MOECC Table 7 Standards.

Table 14:
Analytical Test Results – Groundwater
Metals

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)		MOECC Table 7Standards (µg/L)
		June 12, 2018		
		BH8-GW1	BH9-GW1	
Antimony	0.5	nd	1.2	16,000
Arsenic	1	2	1	1,500
Barium	1	1040	494	23,000
Beryllium	0.5	nd	nd	53
Boron	10	481	355	36,000
Cadmium	0.1	nd	nd	2.1
Chromium	1	nd	nd	640
Cobalt	0.5	1.1	0.5	52
Copper	0.5	1.1	2.9	69
Lead	0.1	0.2	0.2	20
Mercury	0.1	nd	nd	0.1
Molybdenum	0.5	5.1	6.8	7,300
Nickel	1	3	1	390
Selenium	1	nd	nd	50
Silver	0.1	nd	nd	1.2
Sodium	200	1,160,000	387,000	1,800,000
Thallium	0.1	nd	nd	400
Uranium	0.1	1.0	3.5	330
Vanadium	0.5	0.7	1.1	200
Zinc	5	11	nd	890

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and underlined** – Value exceeds selected MOECC standards
- nv – No value for standard

All metals parameters were found to be in compliance with the MOECC Table 7 standards.

5.7 Quality Assurance and Quality Control Results

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

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

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

5.8 Phase II Conceptual Site Model

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

Site Description

Potentially Contaminating Activities

Potentially Contaminating Activities resulting in Areas of Potential Environmental Concern identified on the subject site include the automotive service garage (and former welding shop), poor quality fill material on the property at 70 Beech Street, and the eastern side of the subject site as a result of the former machine shop to the east. Other potentially contaminating activities in the area are not considered to have created areas of potential environmental concern, based on their separation distances, and/or available documentation regarding those concerns.

Areas of Potential Environmental Concern

Based on the results of the Phase I ESA completed for the subject site, four (4) APECs were identified at the subject site. The PCAs considered to represent APECs on the subject site are summarized below:

- The former welding shop on the subject property; Item 34, Table 2, O.Reg. 153/04 as amended by O.Reg. 269/11 (“Metal Fabrication”).
- The automotive service garage on the subject property; Item 52, Table 2, O.Reg. 153/04 as amended by O.Reg. 269/11 (“Storage, maintenance, fuelling and repair of vehicles, and material used to maintain transportation systems”).

- Poor quality fill material below the subject property; no applicable Table number.
- Former machine shop (on adjacent property to the east); Item 34, Table 2, O.Reg. 153/04 as amended by O.Reg. 269/11 ("Metal Fabrication").

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

Contaminants of Potential Concern

Contaminants of potential concern include metals, PHCs, BTEX, and PAHs. These are based on the current and past uses of the subject property (and adjacent property to the east).

Subsurface Structures and Utilities

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

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is provided in the Soil Profile and Test Data Sheets provided in Appendix 1 and illustrated on Drawings PE2746-8A, B, C and D. Stratigraphy consists of:

- A layer of gravel or asphaltic concrete (or a concrete floor slab within the garage building)
- Fill material extending to a maximum depth of 1.85 m below ground surface. Fill material consisted of silty sand with gravel and/or clay. Traces of coal, mortar or metal were identified in certain boreholes, such as BH1, BH3, BH4 and BH7.
- Grey limestone bedrock was identified below the fill.

Hydrogeological Characteristics

Groundwater was encountered in the bedrock unit on the subject site. Groundwater levels from the three (3) monitoring wells were measured at the subject site on June 12, 2018. The most recent groundwater levels indicate that the local groundwater flow is in a eastern direction with a hydraulic gradient of 0.05 m/m. Groundwater contours are shown on Drawing PE2746-5.

Approximate Depth to Bedrock

Bedrock was encountered at depths ranging from 0.71 m to 1.85 m below ground surface.

Approximate Depth to Water Table

Depth to the water table at the subject site varies between approximately 4.57 m and 5.28 m below existing grade.

Sections 41 and 43.1 of the Regulation

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

Section 43.1 of the Regulation applies to the subject site as bedrock is located less than 2 m below ground surface and thus the site is considered to have shallow soils.

Fill Placement

Fill material is present beneath the subject property. The origin of the fill is unknown.

Proposed Buildings and Other Structures

The proposed development for the subject site includes the demolition of the three buildings on the property, and the construction of a multi-storey mixed use building, consisting of commercial and residential units.

Existing Buildings and Structures

The subject site is occupied by three buildings; a slab on grade garage building at 70 Beech Street and a two storey residential dwelling at 75 Norman Street with detached private garage.

Water Bodies

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

Areas of Natural Significance

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

Environmental Condition

Areas Where Contaminants are Present

The fill material encountered at the property was found to contain metals, PAH and PHC concentrations above the applicable site standards. Groundwater was in compliance with the site standards, with the exception of a sample collected from BH9.

Types of Contaminants

Based on the potentially contaminating activities representing APECs on the subject property, the contaminants of concern (COCs) at the subject site were considered to be metals, PAHs, PHC and BTEX. These were identified in the soil at the property. Only the F1 PHC fraction, benzene and xylenes were identified in one groundwater sample.

Contaminated Media

Soil (fill) was found to be contaminated, and groundwater from one monitoring well was found to be contaminated with the F1 fraction of PHCs, benzene and xylenes.

What Is Known About Areas Where Contaminants Are Present

Contaminants are present in the fill material, which was brought from an off-site source. The groundwater may have been impacted by on-site sources, however, based on the information collected from the other on-site wells, the impacts may be a result of high sediment in the sample, causing an erroneous result.

Distribution of Contaminants

Contaminants are considered to be dispersed primarily throughout the soil fill layer. Groundwater impacts appear to be located only in the area of BH9.

Discharge of Contaminants

Impacts in the fill layer may have been discharged through the importation of fill from impacted sources off-site, or, from the past and current activities which occurred on the subject site (e.g. former welding shop, automotive service garage, or adjacent machining shop).

Migration of Contaminants

Contaminants in the soil do not appear to have significantly migrated on the property with the possible exception of the BH9 location, where benzene impacts were noted in both the soil and the groundwater.

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 has not significantly affected contaminant distribution at the subject site as the majority of the parameters impacting the soil at the site have not been identified in the groundwater, with the exception of the groundwater at BH9.

Potential for Vapour Intrusion

The potential for vapour intrusion in the garage structure is considered to be very low based on the fact that no detections (with the exception of F3 and F4 PHC fractions) were identified in the soil or groundwater in Borehole BH7, which is located within the garage. Furthermore, vapours already present in the garage would outweigh any potential vapours arising from subsurface impacts on the property. The potential for vapour intrusion would also be very low in the proposed building, as all impacted soil/groundwater would be removed from the property during redevelopment, eliminating any potential sources of vapours.

6.0 CONCLUSIONS

Assessment

A Phase II-ESA was conducted for 70 Beech Street and 75 Norman Street, Ottawa, Ontario. The focus of the Phase II-ESA was to assess APECs identified in the Phase I-ESA and to confirm general soil and groundwater quality at the APEC locations.

The Phase II-ESA consisted of the drilling of three (3) boreholes, and the installation of three (3) groundwater monitoring wells to assess soil and groundwater quality at the subject site. This Phase II-ESA also includes data collected from a prior Phase II-ESA, conducted between 2012 and 2016.

Soil samples obtained from the boreholes were screened using visual observations and organic vapour measurements. Based on the screening results, samples were selected for analysis of petroleum hydrocarbons, fractions 1 through 4 (PHCs F1-F4), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), and metals. Based on analytical test results, metals, PAHs, and PHCs were identified in the fill material at 70 Beech Street in excess of the site standards.

Groundwater samples were obtained from BH4 in 2016 and BH7, BH8 and BH9 in 2018. Groundwater samples were submitted for analysis of PHCs, BTEX, volatile organic compounds (VOCs), PAHs, and metals. All the tested parameters in the groundwater samples were in compliance with the selected MOECC Table 7 standards with the exception of the F1 PHC fraction, benzene and xylenes in Sample BH9-GW1. Although similar PHC/BTEX compounds were detected in the soil sample submitted for analysis from BH9, the exceedances noted in the groundwater collected from BH9-GW1 may not be representative of the actual groundwater quality. Limited amounts of groundwater were available for sampling in that well, and suspended sediment was encountered during the sampling event, which may have influenced the analytical results.

Recommendations

Fill material is present at the subject site which exceeds the MOECC Table 7 standards for a residential property. It is Paterson's understanding that the property will be redeveloped in the near future. It is our recommendation that an environmental site remediation program, consisting of the removal of all impacted soil, be completed concurrently with site redevelopment. At that time, all impacted soil will require disposal at a licensed landfill site.

Groundwater

The groundwater monitoring wells should be kept in good condition until site redevelopment. The groundwater at Borehole BH9 should be re-sampled in the near future (ideally before winter), in order to confirm the groundwater quality at that time.

7.0 STATEMENT OF LIMITATIONS

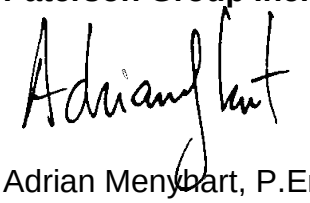
This Phase II - Environmental Site Assessment report has been prepared in general accordance with O.Reg. 153/04 as amended by O.Reg. 269/11, and meets the requirements of CSA Z769-00. The conclusions presented herein are based on information gathered from a limited sampling and testing program. The test 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 Beech Holdings Ltd. Permission and notification from Beech Holdings Ltd. and Paterson will be required to release this report to any other party.

Paterson Group Inc.



Adrian Menybart, P.Eng.

Mark S. D'Arcy, P.Eng.

Report Distribution:

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FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE2746-4 – TEST HOLE LOCATION PLAN

DRAWING PE2746-5 – GROUNDWATER CONTOUR PLAN

DRAWING PE2746-6A – ANALYTICAL TESTING PLAN – SOIL (PAH)

DRAWING PE2746-6B – ANALYTICAL TESTING PLAN – SOIL (METALS)

DRAWING PE2746-6C – ANALYTICAL TESTING PLAN – SOIL (PHC/BTEX)

DRAWING PE2746-7 – ANALYTICAL TESTING PLAN - GROUNDWATER

DRAWING PE2746-8A – CROSS-SECTION A-A' – SOIL (PAH)

DRAWING PE2746-8B – CROSS-SECTION A-A' – SOIL (METALS)

DRAWING PE2746-8C – CROSS-SECTION A-A' – SOIL (PHC/BTEX)

DRAWING PE2746-8D – CROSS-SECTION A-A' – GROUNDWATER

DRAWING PE2746-9A – CROSS-SECTION B-B' – SOIL (PAH)

DRAWING PE2746-9B – CROSS-SECTION B-B' – SOIL (METALS)

DRAWING PE2746-9C – CROSS-SECTION B-B' – SOIL (PHC/BTEX)

DRAWING PE2746-9D – CROSS-SECTION B-B' – GROUNDWATER

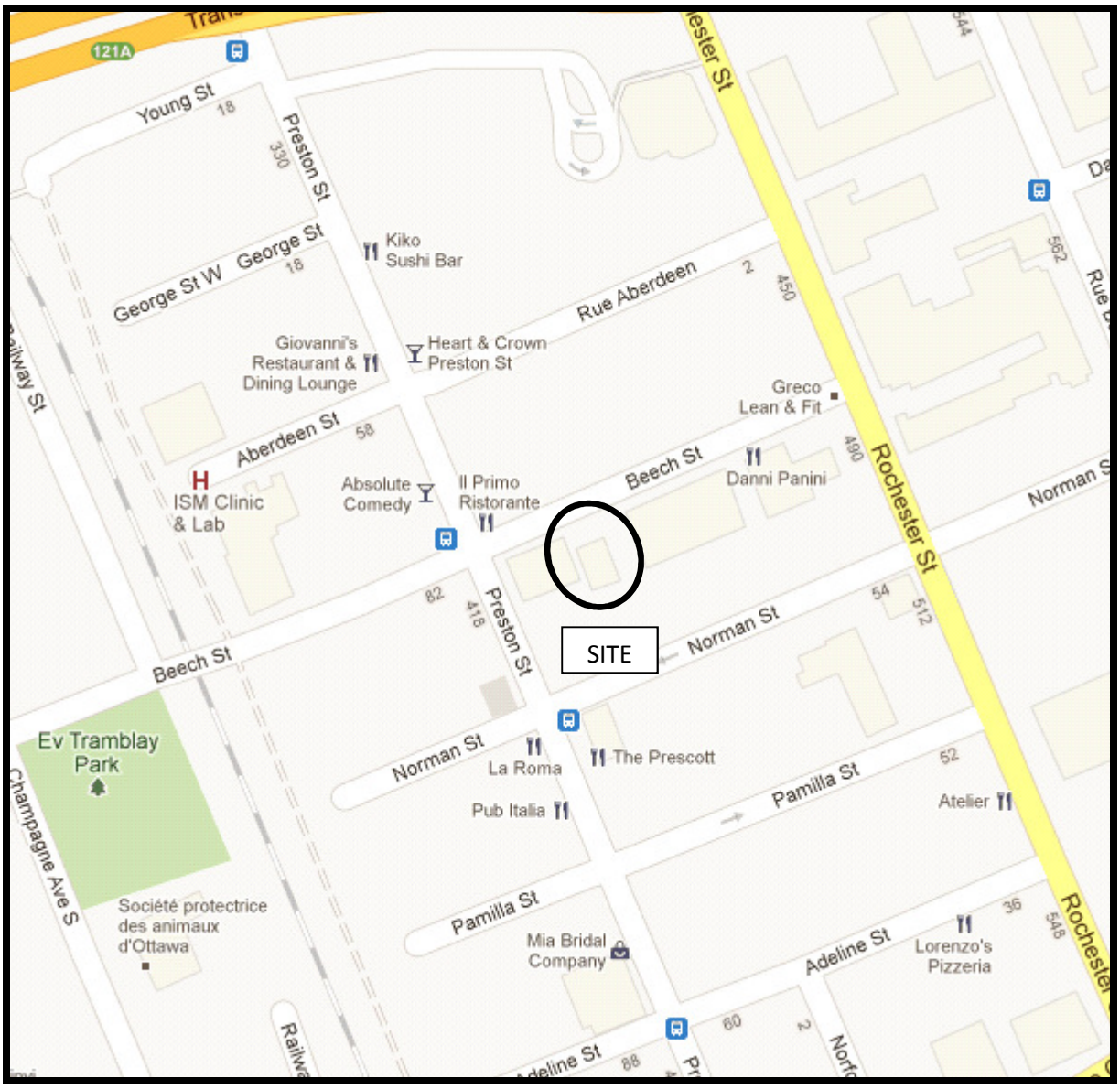
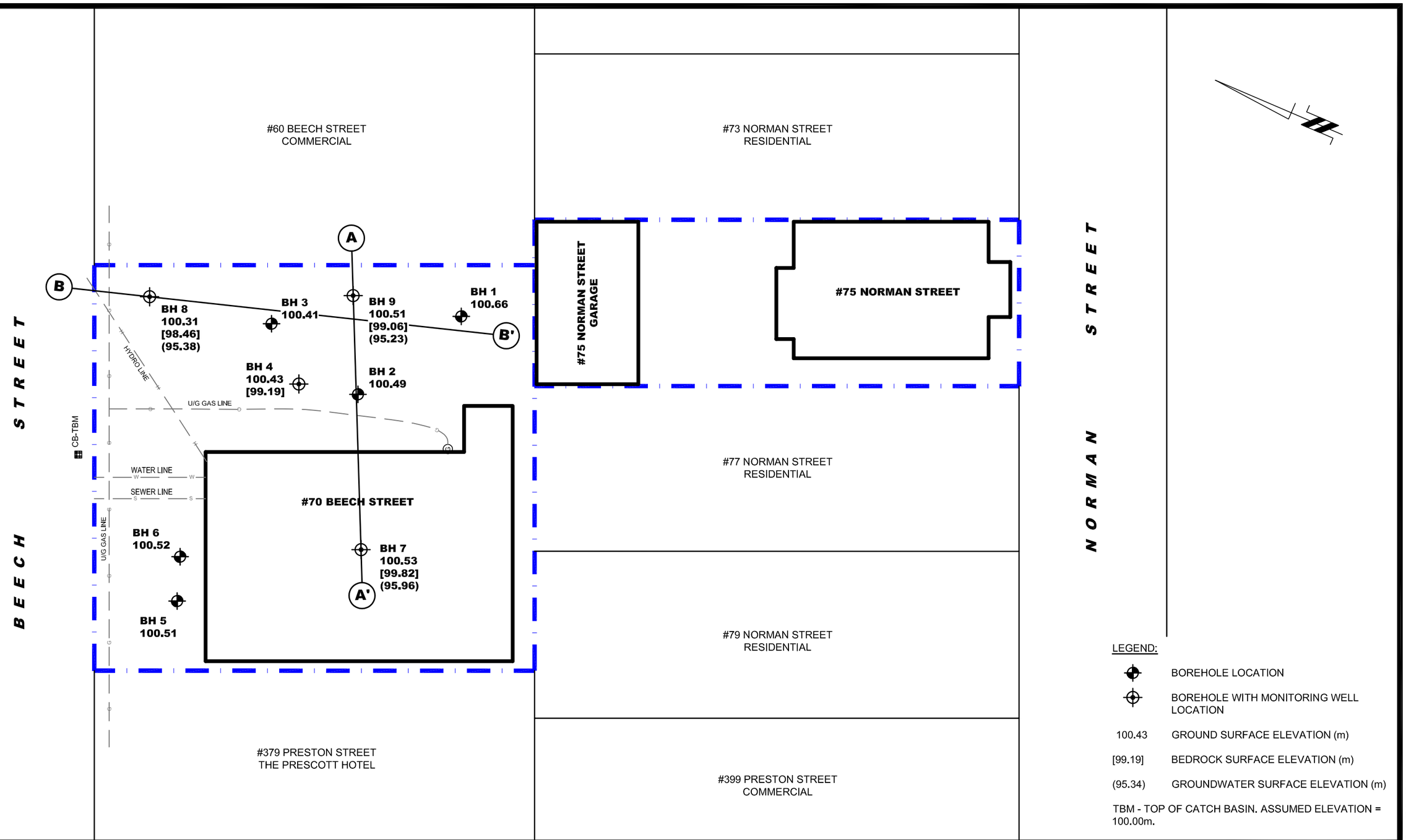


FIGURE 1

KEY PLAN



LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 100.43 GROUND SURFACE ELEVATION (m)
- [99.19] BEDROCK SURFACE ELEVATION (m)
- (95.34) GROUNDWATER SURFACE ELEVATION (m)

TBM - TOP OF CATCH BASIN. ASSUMED ELEVATION = 100.00m.

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NO.	REVISIONS	DATE	INITIAL
0			

BEECH HOLDINGS LIMITED

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
70 BEECH STREET AND 75 NORMAN STREET

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:250	Date: 07/2018
Drawn by: MPG	Report No.: PE2746-3
Checked by: AM	Dwg. No.: PE2746-4
Approved by: MSD	Revision No.: 0

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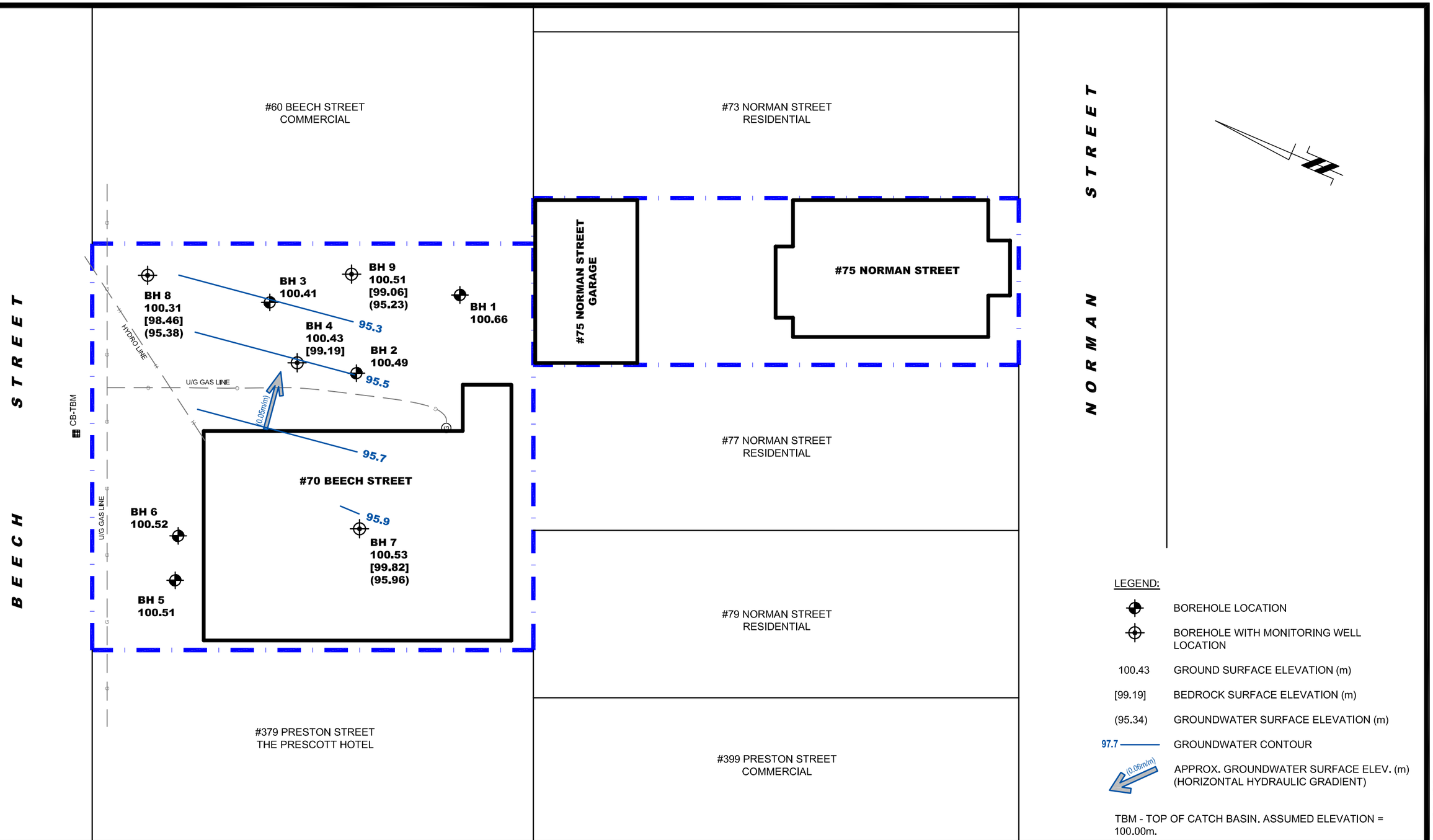

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NO.	REVISIONS	DATE	INITIAL
0			

BEECH HOLDINGS LIMITED

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
70 BEECH STREET AND 75 NORMAN STREET

OTTAWA, ONTARIO

Title:

GROUNDWATER CONTOUR PLAN

Scale: 1:250	Date: 07/2018
Drawn by: MPG	Report No.: PE2746-3
Checked by: AM	Dwg. No.: PE2746-5
Approved by: MSD	Revision No.: 0

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#60 BEECH STREET
COMMERCIAL

#73 NORMAN STREET
RESIDENTIAL

BH8-SS2 (0.60 - 1.21 m, fill) - March 23, 2018
All PAH parameters in compliance with MOECP Table 7 Standards

BH9-AU1 (0.26 - 0.60 m, fill) - May 4, 2018
All PAH parameters in compliance with MOECP Table 7 Standards

BEECH STREET

NORMAN STREET

#75 NORMAN STREET GARAGE

#75 NORMAN STREET

BH 8
100.31
[98.46]
(95.38)

BH 3
100.41

BH 9
100.51
[99.06]
(95.23)

BH 1
100.66

BH 4
100.43
[99.19]

BH 2
100.49

HYDRO LINE

U/G GAS LINE

CB-TBM

BH1-SS2 (0.75 - 1.29 m, fill) - October 12, 2012
All PAH parameters exceed MOECP Table 7 Standards

#77 NORMAN STREET
RESIDENTIAL

#70 BEECH STREET

BH3-SS2 (0.75 - 1.0 m, fill) - October 12, 2012

Parameter	Concentrations (ug/g)	Standard (ug/g)
Benzo[a]anthracene	1.40	0.5
Benzo[a]pyrene	0.90	0.3
Benzo[b]fluoranthene	0.98	0.78
Dibenzo[a,h]anthracene	0.24	0.1
Fluoranthene	2.90	0.69
Indeno[1,2,3-cd]pyrene	0.55	0.38

All other PAH in compliance with MOECP Table 7 Standards

BH 6
100.52

BH 5
100.51

BH 7
100.53
[99.82]
(95.96)

BH7-SS1 (0.13 - 0.43 m, fill) - March 23, 2018
All PAH parameters in compliance with MOECP Table 7 Standards

#379 PRESTON STREET
THE PRESCOTT HOTEL

#399 PRESTON STREET
COMMERCIAL

BH5-SS2 (0.75 - 1.0 m, fill) - October 12, 2012

Parameter	Concentrations (ug/g)	Standard (ug/g)
Indeno[1,2,3-cd]pyrene	0.96	0.38
Methylnaphthalene	2.06	0.99
Naphthalene	0.72	0.6

All other PAH in compliance with MOECP Table 7 Standards

LEGEND:

SOIL PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

SOIL PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 100.43 GROUND SURFACE ELEVATION (m)
- [99.19] BEDROCK SURFACE ELEVATION (m)
- (95.34) GROUNDWATER SURFACE ELEVATION (m)

TBM - TOP OF CATCH BASIN. ASSUMED ELEVATION = 100.00m.

paterson group
consulting engineers
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0			

BEECH HOLDINGS LIMITED

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
70 BEECH STREET AND 75 NORMAN STREET

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (PAH)

Scale: 1:250	Date: 07/2018
Drawn by: MPG	Report No.: PE2746-3
Checked by: AM	Dwg. No.: PE2746-6A
Approved by: MSD	Revision No.: 0

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BH8-SS2 (0.60 - 1.21 m, fill) - March 23, 2018

Parameter	Concentrations (ug/g)	Standard (ug/g)
Molybdenum	8	6.9

All other Metals in compliance with MOECP Table 7 Standards

BH9-AU1 (0.26 - 0.60 m, fill) - May 4, 2018

Parameter	Concentrations (ug/g)	Standard (ug/g)
Cadmium	2.0	1.2
Copper	153	140
Lead	325	120
Molybdenum	14	6.9

All other Metals in compliance with MOECP Table 7 Standards

BH2-AU1 (0.15 - 0.62 m, fill) - October 12, 2012

Parameter	Concentrations (ug/g)	Standard (ug/g)
Cadmium	2.2	1.2
Copper	504	140
Lead	257	120
Molybdenum	37	6.9
Selenium	4	2.4

All other metals in compliance with MOECP Table 7 Standards

BH5-SS2 (0.75 - 1.0 m, fill) - October 12, 2012

All metals parameters in compliance with MOECP Table 7 Standards

BH7-SS1 (0.13 - 0.43 m, fill) - March 23, 2018

Parameter	Concentrations (ug/g)	Standard (ug/g)
Lead	142	120

All other metals in compliance with MOECP Table 7 Standards

BH 8
100.31
[98.46]
(95.38)

BH 3
100.41

BH 9
100.51
[99.06]
(95.23)

BH 1
100.66

BH 4
100.43
[99.19]

BH 2
100.49

BH 6
100.52

BH 5
100.51

BH 7
100.53
[99.82]
(95.96)

#75 NORMAN STREET GARAGE

#75 NORMAN STREET

#77 NORMAN STREET
RESIDENTIAL

#70 BEECH STREET

#379 PRESTON STREET
THE PRESCOTT HOTEL

#399 PRESTON STREET
COMMERCIAL

BEECH STREET

NORMAN STREET

HYDRO LINE

U/G GAS LINE

CB-TBM

LEGEND:

SOIL PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

SOIL PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

BOREHOLE LOCATION

BOREHOLE WITH MONITORING WELL LOCATION

100.43 GROUND SURFACE ELEVATION (m)

[99.19] BEDROCK SURFACE ELEVATION (m)

(95.34) GROUNDWATER SURFACE ELEVATION (m)

TBM - TOP OF CATCH BASIN. ASSUMED ELEVATION = 100.00m.

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BEECH HOLDINGS LIMITED

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
70 BEECH STREET AND 75 NORMAN STREET

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (METALS)

Scale: 1:250	Date: 07/2018
Drawn by: MPG	Report No.: PE2746-3
Checked by: AM	Dwg. No.: PE2746-6B
Approved by: MSD	Revision No.: 0

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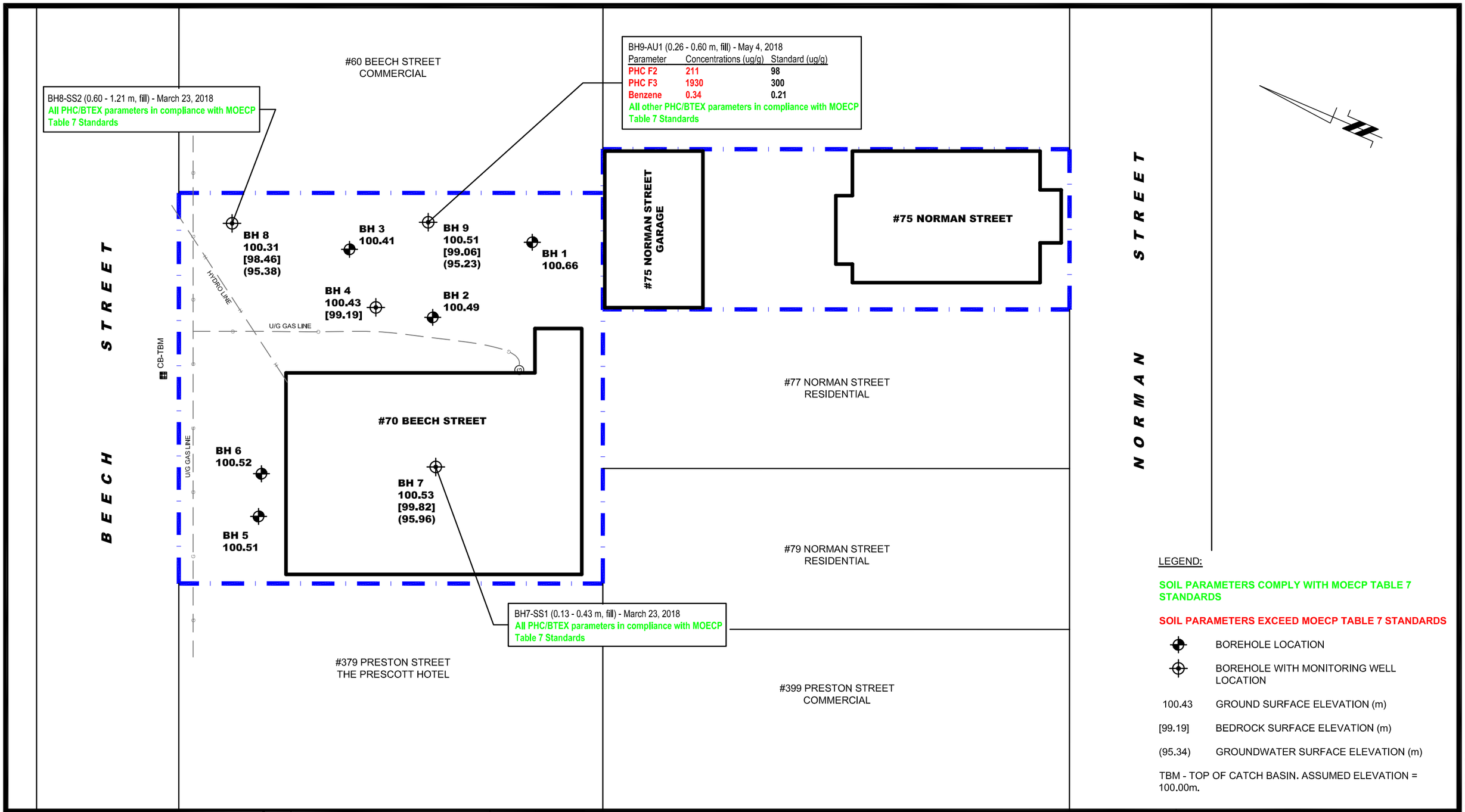

LEGEND:

SOIL PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

SOIL PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

⊕	BOREHOLE LOCATION
⊕	BOREHOLE WITH MONITORING WELL LOCATION
100.43	GROUND SURFACE ELEVATION (m)
[99.19]	BEDROCK SURFACE ELEVATION (m)
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70 BEECH STREET AND 75 NORMAN STREET

OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN - SOIL (PCH/BTEX)

Scale: 1:250	Date: 07/2018
Drawn by: MPG	Report No.: PE2746-3
Checked by: AM	Dwg. No.: PE2746-6C
Approved by: MSD	Revision No.: 0

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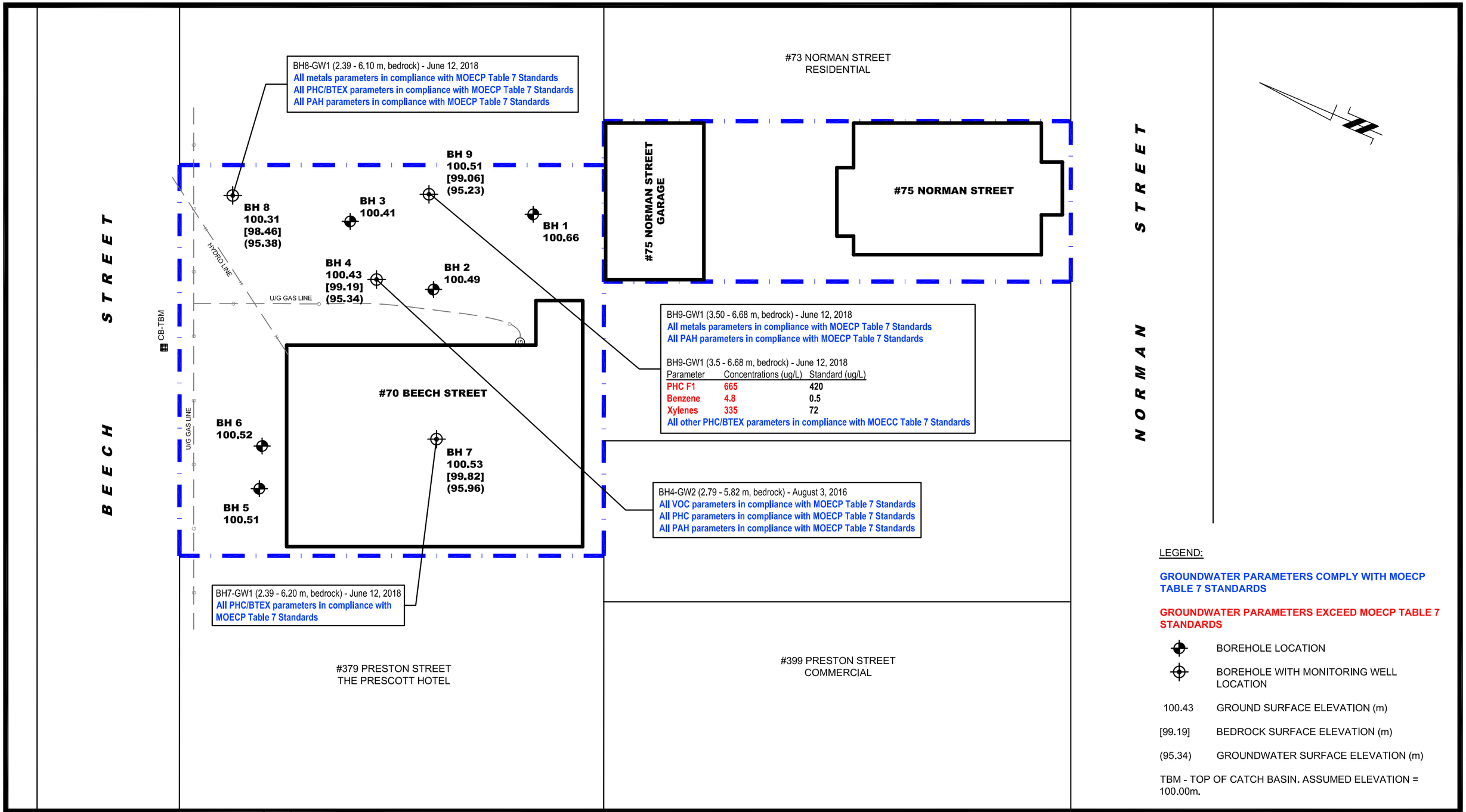

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BEECH HOLDINGS LIMITED

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
70 BEECH STREET AND 75 NORMAN STREET

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - GROUNDWATER

Scale: 1:250	Date: 07/2018
Drawn by: MPG	Report No.: PE2746-3
Checked by: AM	Dwg. No.: PE2746-7
Approved by: MSD	Revision No.: 0

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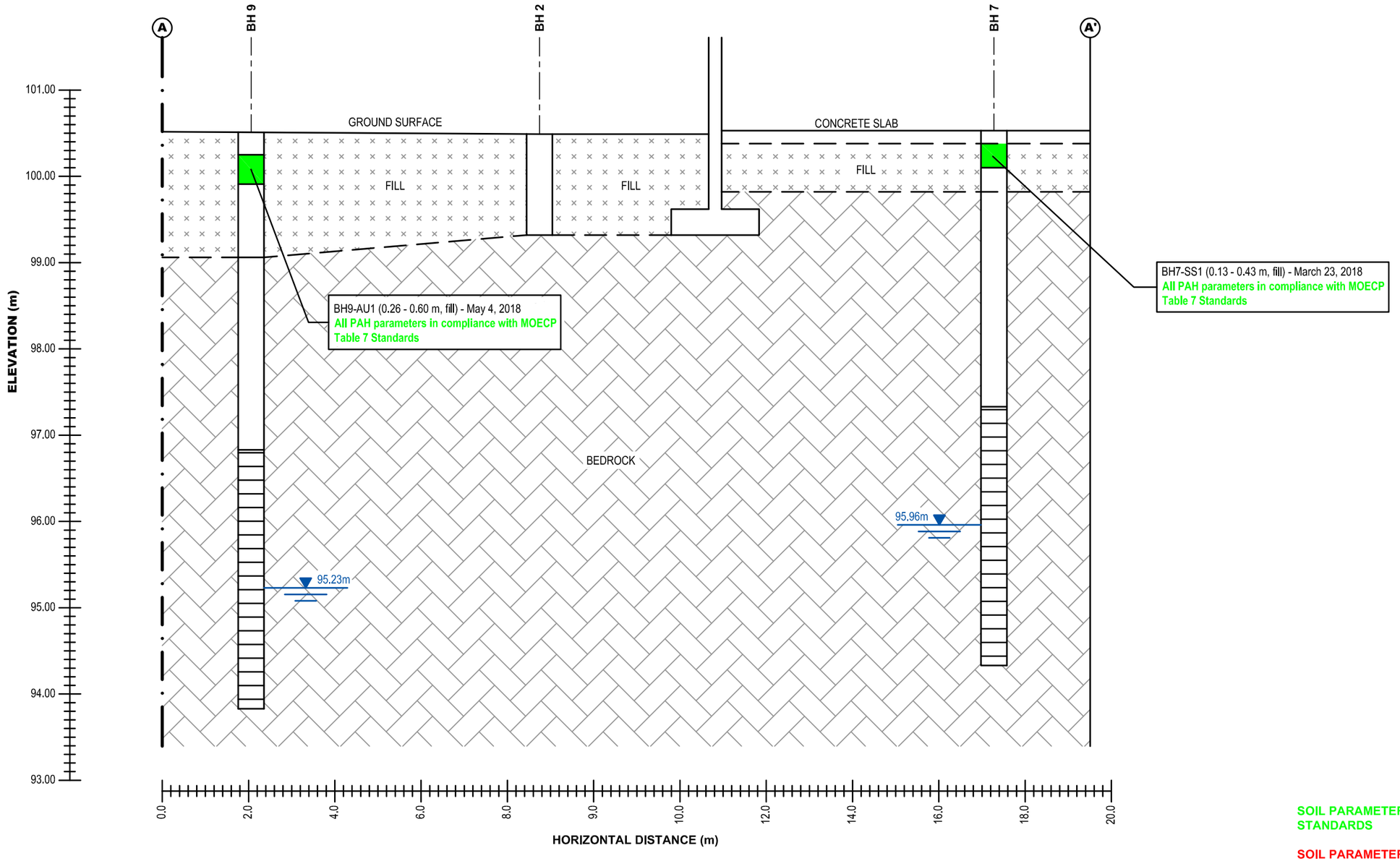

SOIL PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

SOIL PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

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BEECH HOLDINGS LIMITED

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
70 BEECH STREET AND 75 NORMAN STREET
OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 08/2018
Drawn by: MPG	Report No.: PE2746-3
Checked by: AM	Dwg. No.: PE2746-8A
Approved by: MSD	Revision No.: 0

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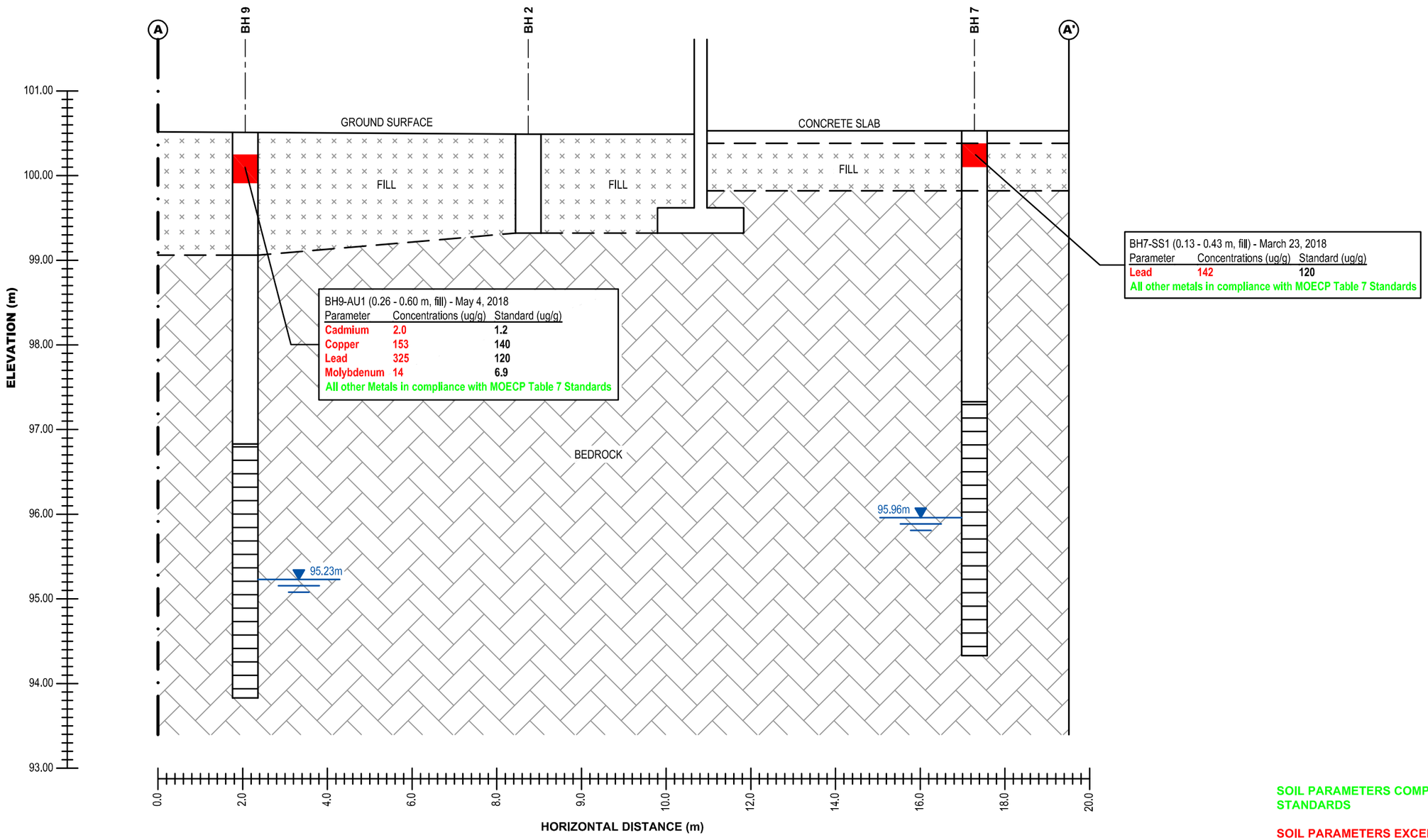

BH9-AU1 (0.26 - 0.60 m, fill) - May 4, 2018

Parameter	Concentrations (ug/g)	Standard (ug/g)
Cadmium	2.0	1.2
Copper	153	140
Lead	325	120
Molybdenum	14	6.9

All other Metals in compliance with MOECP Table 7 Standards

BH7-SS1 (0.13 - 0.43 m, fill) - March 23, 2018

Parameter	Concentrations (ug/g)	Standard (ug/g)
Lead	142	120

All other metals in compliance with MOECP Table 7 Standards

SOIL PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

SOIL PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

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BEECH HOLDINGS LIMITED

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70 BEECH STREET AND 75 NORMAN STREET
OTTAWA, ONTARIO

Title:
CROSS-SECTION A-A' - SOIL (METALS)

Scale: AS SHOWN	Date: 08/2018
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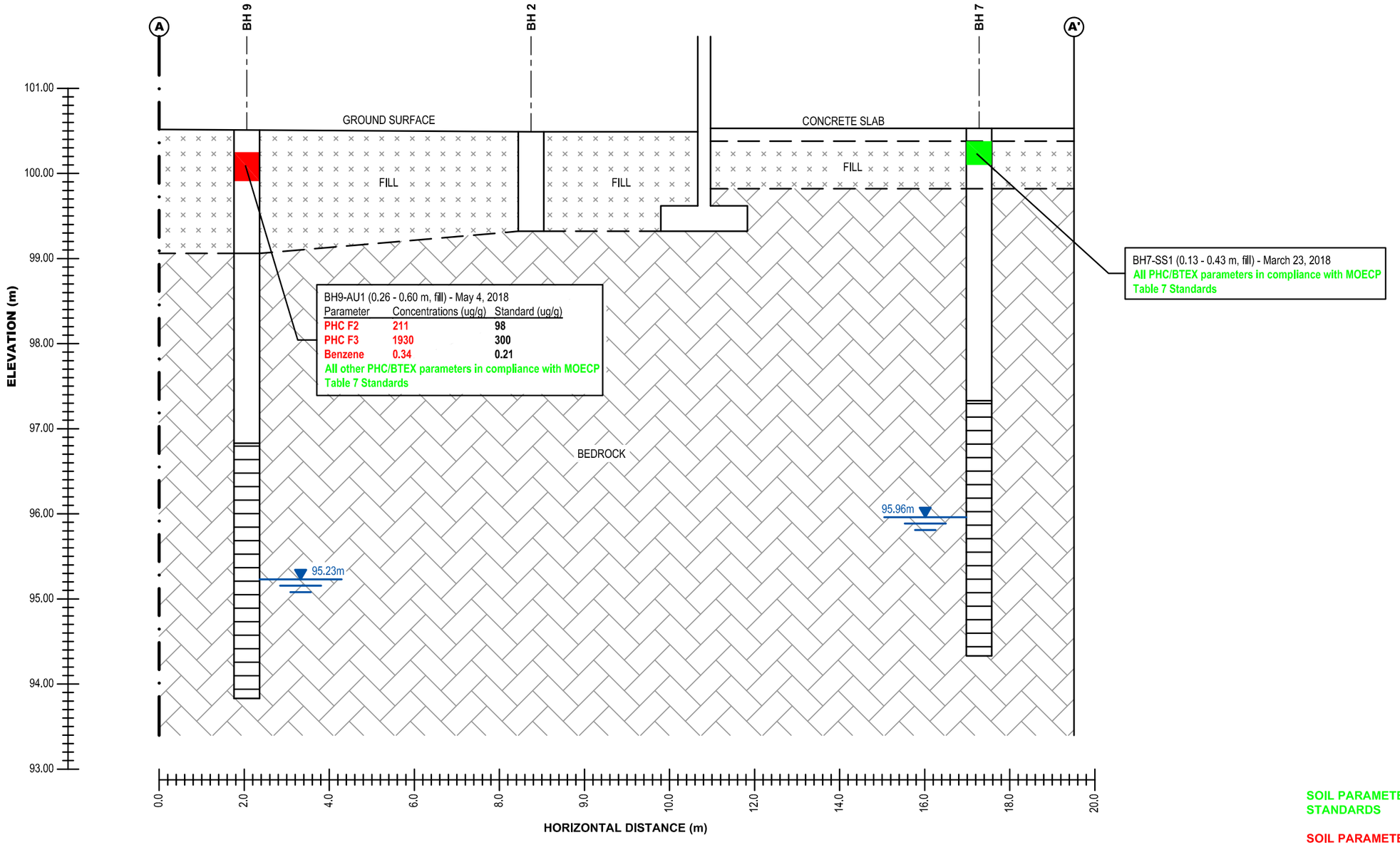

SOIL PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

SOIL PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

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BEECH HOLDINGS LIMITED

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
70 BEECH STREET AND 75 NORMAN STREET

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 08/2018
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Approved by: MSD	Revision No.: 0

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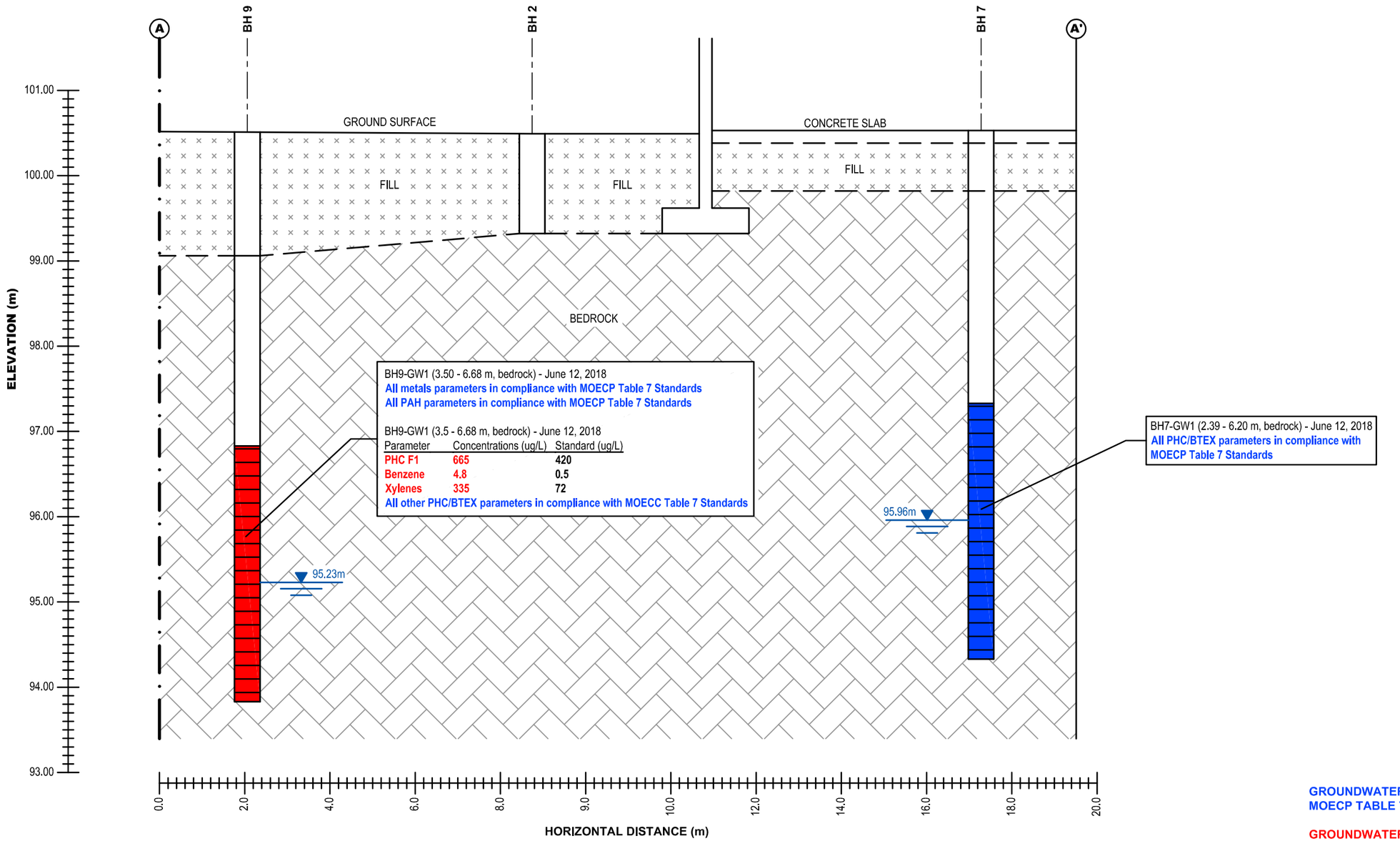

GROUNDWATER PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

GROUNDWATER PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
70 BEECH STREET AND 75 NORMAN STREET
OTTAWA, ONTARIO

Title:
CROSS-SECTION A-A' - GROUNDWATER

Scale: AS SHOWN	Date: 08/2018
Drawn by: MPG	Report No.: PE2746-3
Checked by: AM	Dwg. No.: PE2746-8D
Approved by: MSD	Revision No.: 0

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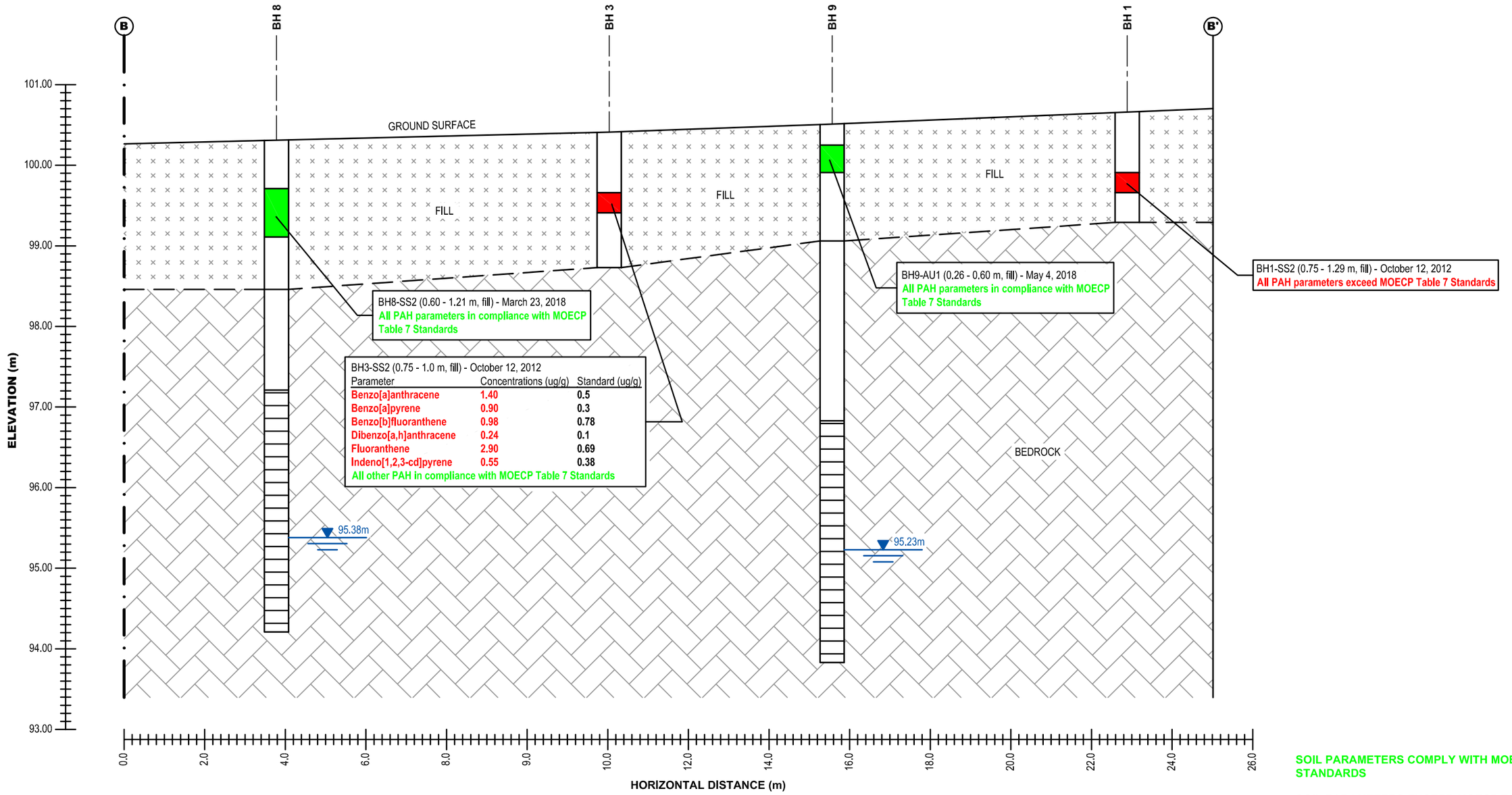

SOIL PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

SOIL PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

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70 BEECH STREET AND 75 NORMAN STREET

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 08/2018
Drawn by: MPG	Report No.: PE2746-3
Checked by: AM	Dwg. No.: PE2746-9A
Approved by: MSD	Revision No.: 0

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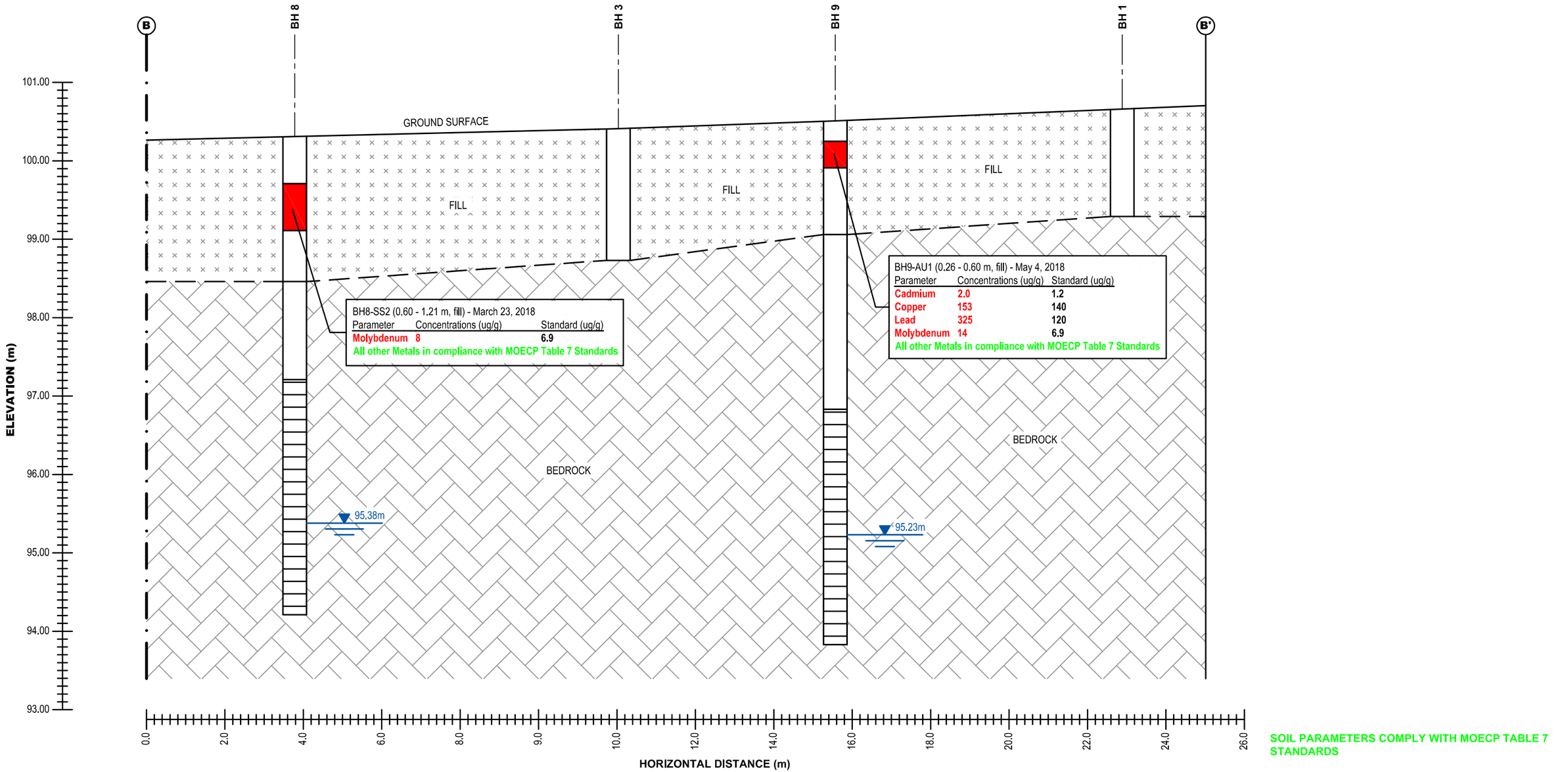

SOIL PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
70 BEECH STREET AND 75 NORMAN STREET

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Title:

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

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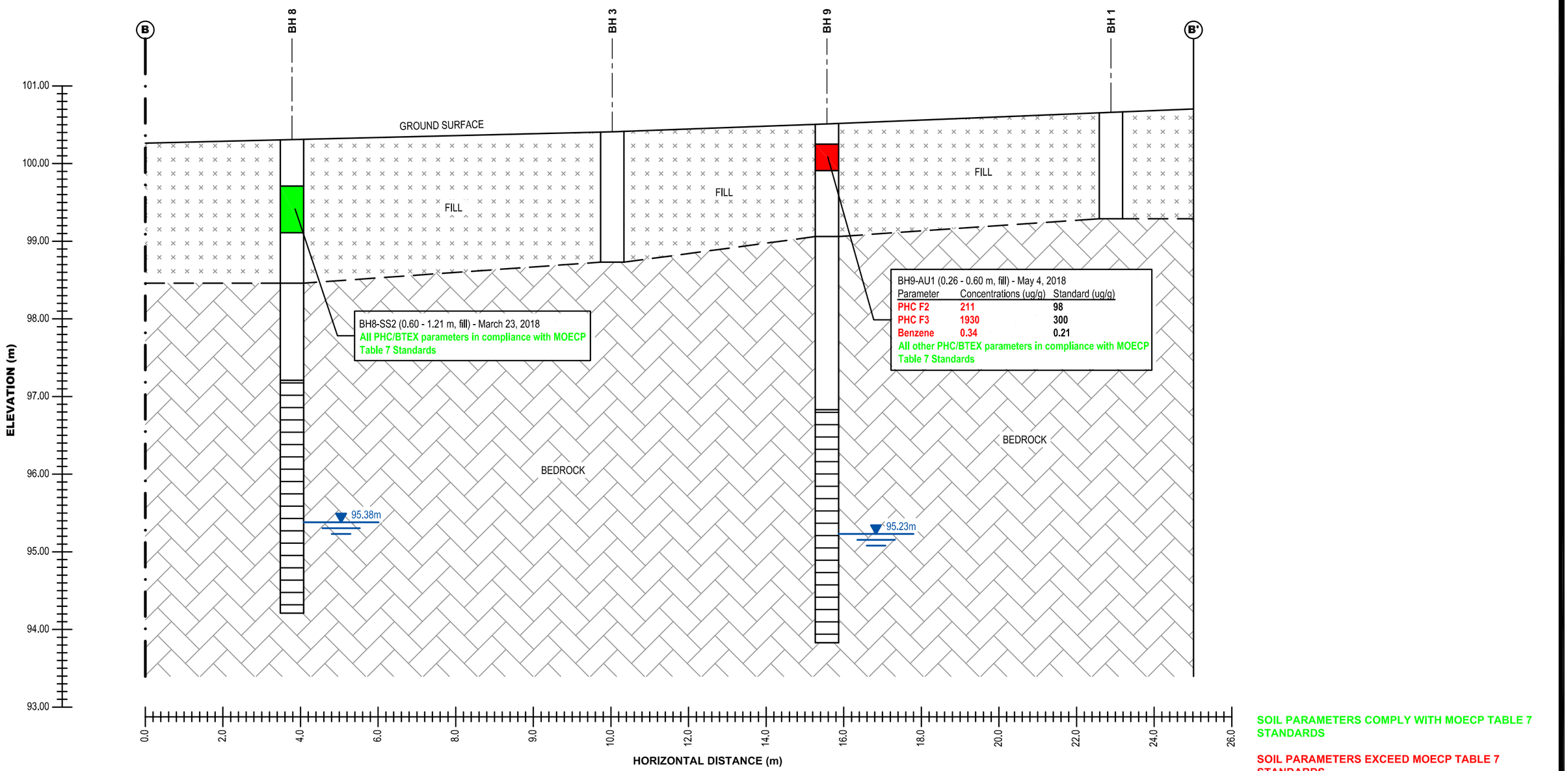

SOIL PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

SOIL PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

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OTTAWA, ONTARIO

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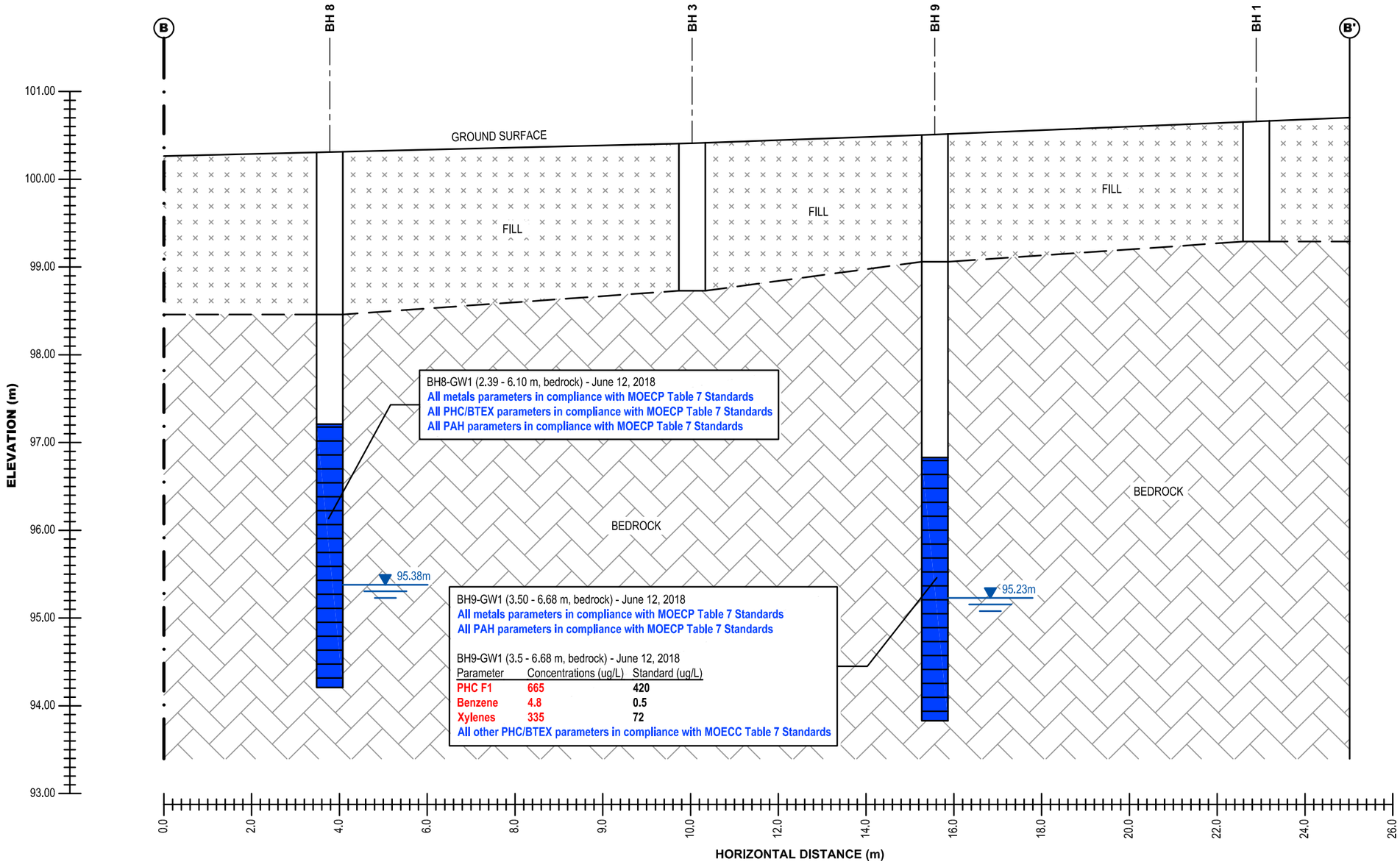

GROUNDWATER PARAMETERS COMPLY WITH MOECP TABLE 7 STANDARDS

GROUNDWATER PARAMETERS EXCEED MOECP TABLE 7 STANDARDS

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Paterson Group Inc.

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

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Sampling & Analysis Plan

70 Beech Street and 75 Norman Street
Ottawa, Ontario

Prepared For

Beech Holdings Ltd.

March 19, 2018
Report: PE2746-SAP

Table of Contents

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Beech Holdings Limited to prepare a Phase II-Environmental Site Assessment (ESA) for the property at 70 Beech Street and 75 Norman Street, in the City of Ottawa, Ontario. Based on the Phase I-ESA completed by Paterson for the subject property, the following subsurface investigation program was developed:

Borehole	Location & Rationale	Proposed Depth & Rationale
BH7	Within building at 70 Beech Street; to assess soil and groundwater beneath the former welding shop, currently an automotive service garage	Augered to bedrock, then cored to intercept groundwater table.
BH8	Along the east side of the property, to address potential impacts from the off-site former machining shop located on the adjacent property to the east.	Augered to bedrock, then cored to intercept groundwater table.
BH9	Along the east side of the property, to address previously identified soil impacts in that area and to address potential impacts from the off-site former machining shop located on the adjacent property to the east.	Augered to bedrock, then cored to intercept groundwater table.

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

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

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

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

2.0 ANALYTICAL TESTING PROGRAM

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

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

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

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

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

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

Determining Borehole Locations

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

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

Drilling Procedure

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

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

Spoon Washing Procedure

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

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

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

Screening Procedure

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

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

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

3.2 Monitoring Well Installation Procedure

Equipment

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

Procedure

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

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

3.3 Monitoring Well Sampling Procedure

Equipment

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

Sampling Procedure

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

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

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

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

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

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

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

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
70 Beech Street
Ottawa, Ontario

DATUM TBM - Top of catch basin located in front of subject site, on Beech Street. Assumed elevation = 100.00m.

FILE NO. PE2746

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** October 12, 2012

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	100.66		
FILL: Gravel 0.15		AU	1						
FILL: Dark brown silty sand with gravel and coal		SS	2	29	2	1	99.66		
1.37 End of Borehole									

Photo Ionization Detector: ● Volatile Organic Rdg. (ppm); ○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
70 Beech Street
Ottawa, Ontario

DATUM TBM - Top of catch basin located in front of subject site, on Beech Street. Assumed elevation = 100.00m.

FILE NO. PE2746

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** October 12, 2012

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	100.49		
FILL: Gravel 0.15		AU	1						
FILL: Brown silty sand with gravel and metal piece		SS	2		50+	1	99.49		
1.17									
End of Borehole									
Practical refusal to augering at 1.17m 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.

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
70 Beech Street
Ottawa, Ontario

DATUM TBM - Top of catch basin located in front of subject site, on Beech Street. Assumed elevation = 100.00m.

FILE NO. PE2746

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** October 12, 2012

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									
FILL: Gravel		AU	1			0	100.41		
0.20									
FILL: Brown silty sand with mortar and coal		SS	2	100	50+	1	99.41		
1.68									
End of Borehole									

Photo Ionization Detector: ● Volatile Organic Rdg. (ppm); ○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
70 Beech Street
Ottawa, Ontario

DATUM TBM - Top of catch basin located in front of subject site, on Beech Street. Assumed elevation = 100.00m.

FILE NO. PE2746

REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** October 12, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.43
FILL: Gravel 0.10		AU	1				
FILL: Dark brown silty sand with clay, gravel, coal		SS	2	35	50+	1	99.43
1.24							
		RC	1	92	83	2	98.43
BEDROCK: Grey limestone		RC	2	98	88	3	97.43
						4	96.43
		RC	3	100	97	5	95.43
5.82							
End of Borehole							
(GWL @ 5.09m-Oct. 18, 2012)							

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
70 Beech Street
Ottawa, Ontario

DATUM TBM - Top of catch basin located in front of subject site, on Beech Street. Assumed elevation = 100.00m.

FILE NO. PE2746

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** October 12, 2012

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	100.51		
25mm Asphaltic concrete over crushed stone 0.25		AU	1						
FILL: Brown silty sand with clay, gravel		SS	2	50	50+	1	99.51		
1.09 End of Borehole									

Photo Ionization Detector: ● Volatile Organic Rdg. (ppm); ○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
70 Beech Street
Ottawa, Ontario

DATUM TBM - Top of catch basin located in front of subject site, on Beech Street. Assumed elevation = 100.00m.

FILE NO. PE2746

REMARKS

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** October 12, 2012

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	100.52		
25mm Asphaltic concrete over crushed stone (0.25)		AU	1						
FILL: Brown silty clay with gravel and cobbles		SS	2	24	50+	1	99.52		
(1.27) End of Borehole									

Photo Ionization Detector: ● Volatile Organic Rdg. (ppm); ○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
70 Beech Street and 75 Norman Street
Ottawa, Ontario

DATUM TBM - Top of catch basin located in front of subject site, on Beech Street. Assumed elevation = 100.00m.

FILE NO. PE2746

REMARKS

HOLE NO. BH 7

BORINGS BY CME 55 Power Auger **DATE** March 26, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.53
Concrete slab 0.15							
FILL: Brown sand, gravel, cobbles, brick, trace coal		SS	1	58	6		
0.71		SS	2	30	50+		
		RC	1	100	92	1	99.53
		RC	2	100	80	2	98.53
BEDROCK		RC	3	98	93	3	97.53
		RC	4	97	97	4	96.53
						5	95.53
						6	94.53
6.20							
End of Borehole							
(GWL @ 4.57m - June 12, 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
70 Beech Street and 75 Norman Street
Ottawa, Ontario

DATUM TBM - Top of catch basin located in front of subject site, on Beech Street. Assumed elevation = 100.00m.

FILE NO. PE2746

REMARKS

HOLE NO. BH 8

BORINGS BY CME 55 Power Auger **DATE** March 26, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.31
FILL: Brown sand, gravel, cobbles, boulders		SS	1	21	13		
		SS	2	50	50+	1	99.31
		SS	3	54	50+		
1.85						2	98.31
		RC	1	100	78		
BEDROCK						3	97.31
		RC	2	100	92	4	96.31
						5	95.31
		RC	3	100	95		
6.10						6	94.31
End of Borehole							
(GWL @ 4.93m - June 12, 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
70 Beech Street and 75 Norman Street
Ottawa, Ontario

DATUM TBM - Top of catch basin located in front of subject site, on Beech Street. Assumed elevation = 100.00m.

FILE NO. PE2746

REMARKS

HOLE NO. BH 9

BORINGS BY CME 55 Power Auger **DATE** May 4, 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.51
FILL: Brown silty sand with gravel		AU	1				
		SS	2	47	50+	1	99.51
1.45							
BEDROCK		RC	1	100	98	2	98.51
		RC	2	100	100	3	97.51
		RC	3	100	93	4	96.51
		RC	4	100	93	5	95.51
6.68						6	94.51
End of Borehole							
(GWL @ 5.28m - June 12, 2018)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

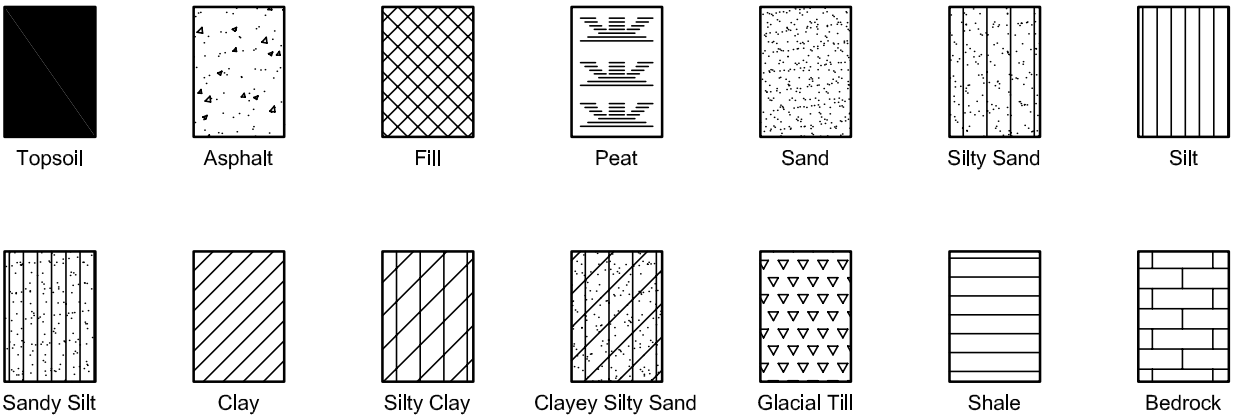
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

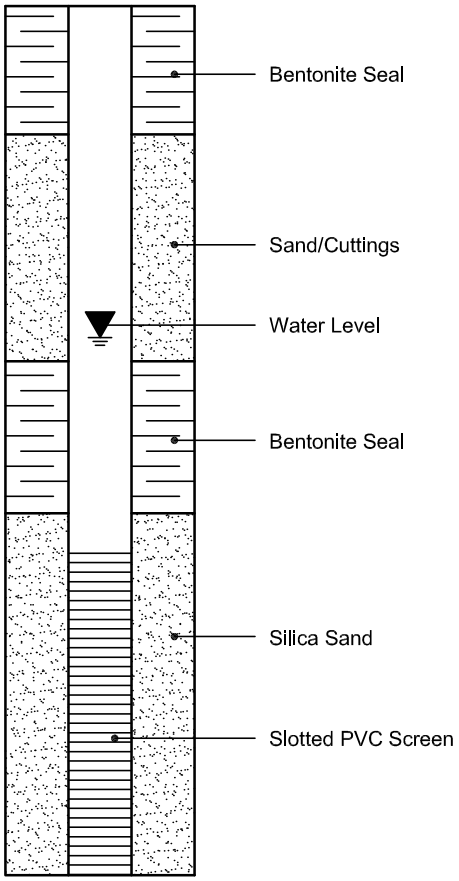
SYMBOLS AND TERMS (continued)

STRATA PLOT

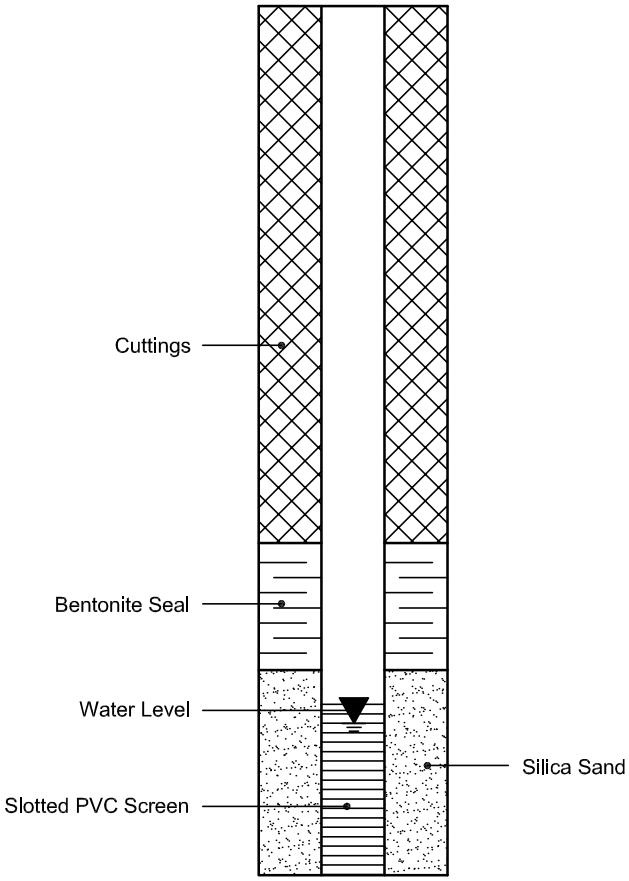


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers
154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Karyn Munch

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

Client PO: 12904
Project: PE2746
Custody: 92360

Report Date: 17-Oct-2012
Order Date: 15-Oct-2012
Order #: 1242028

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

Paracel ID	Client ID
1242028-01	BH1-SS2
1242028-02	BH2-AU1
1242028-03	BH3-SS2
1242028-04	BH5-SS2

Approved By: Mark Foto

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

Certificate of Analysis

Report Date: 17-Oct-2012
Order Date:15-Oct-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12904 Project Description: PE2746

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Chromium, hexavalent	MOE E3056 - Extraction, colourimetric	15-Oct-12	16-Oct-12
Mercury	EPA 7471A - CVAA, digestion	16-Oct-12	16-Oct-12
Metals	EPA 6020 - Digestion - ICP-MS	16-Oct-12	16-Oct-12
PAHs by GC-MS, standard scan	EPA 8270 - GC-MS, extraction	15-Oct-12	17-Oct-12
Solids, %	Gravimetric, calculation	15-Oct-12	15-Oct-12

Certificate of Analysis

Report Date: 17-Oct-2012
Order Date:15-Oct-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12904 Project Description: PE2746

	Client ID:	BH1-SS2	BH2-AU1	BH3-SS2	BH5-SS2
	Sample Date:	12-Oct-12	12-Oct-12	12-Oct-12	12-Oct-12
	Sample ID:	1242028-01	1242028-02	1242028-03	1242028-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	82.8	93.4	92.1	87.7
Metals					
Antimony	1 ug/g dry	-	1	-	2
Arsenic	1 ug/g dry	-	4	-	11
Barium	1 ug/g dry	-	310	-	329
Beryllium	0.5 ug/g dry	-	<0.5	-	0.9
Boron	5.0 ug/g dry	-	8.8	-	39.8
Cadmium	0.5 ug/g dry	-	2.2	-	0.7
Chromium	5 ug/g dry	-	142	-	24
Chromium (VI)	0.2 ug/g dry	-	<0.2	-	<0.2
Cobalt	1 ug/g dry	-	5	-	7
Copper	5 ug/g dry	-	504	-	51
Lead	1 ug/g dry	-	257	-	96
Mercury	0.1 ug/g dry	-	0.2	-	0.1
Molybdenum	1 ug/g dry	-	37	-	3
Nickel	5 ug/g dry	-	92	-	20
Selenium	1 ug/g dry	-	4	-	<1
Silver	0.3 ug/g dry	-	1.4	-	<0.3
Thallium	1 ug/g dry	-	<1	-	<1
Uranium	1 ug/g dry	-	<1	-	<1
Vanadium	10 ug/g dry	-	11	-	29
Zinc	20 ug/g dry	-	216	-	95
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	57.9	-	0.14	<0.04 [1]
Acenaphthylene	0.02 ug/g dry	2.57	-	0.21	<0.04 [1]
Anthracene	0.02 ug/g dry	164	-	0.77	<0.04 [1]
Benzo [a] anthracene	0.02 ug/g dry	198	-	1.40	0.15
Benzo [a] pyrene	0.02 ug/g dry	140	-	0.90	0.09
Benzo [b] fluoranthene	0.02 ug/g dry	232	-	1.98	0.24
Benzo [g,h,i] perylene	0.02 ug/g dry	70.9	-	0.53	0.09
Benzo [k] fluoranthene	0.02 ug/g dry	207	-	0.97	0.11
Biphenyl	0.02 ug/g dry	3.27	-	<0.04 [1]	0.08
Chrysene	0.02 ug/g dry	219	-	1.42	0.22

Certificate of Analysis

Report Date: 17-Oct-2012
Order Date:15-Oct-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12904 Project Description: PE2746

	Client ID:	BH1-SS2	BH2-AU1	BH3-SS2	BH5-SS2
	Sample Date:	12-Oct-12	12-Oct-12	12-Oct-12	12-Oct-12
	Sample ID:	1242028-01	1242028-02	1242028-03	1242028-04
	MDL/Units	Soil	Soil	Soil	Soil
Dibenzo [a,h] anthracene	0.02 ug/g dry	28.1	-	0.24	0.05
Fluoranthene	0.02 ug/g dry	565	-	2.90	0.20
Fluorene	0.02 ug/g dry	63.2	-	0.15	0.04
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	72.2	-	0.55	0.07
1-Methylnaphthalene	0.02 ug/g dry	15.4	-	0.08	0.96
2-Methylnaphthalene	0.02 ug/g dry	20.0	-	0.08	1.10
Methylnaphthalene (1&2)	0.04 ug/g dry	35.4	-	0.16	2.06
Naphthalene	0.01 ug/g dry	39.2	-	0.08	0.72
Phenanthrene	0.02 ug/g dry	668	-	1.78	0.44
Pyrene	0.02 ug/g dry	484	-	2.53	0.21
2-Fluorobiphenyl	Surrogate	94.5%	-	92.5%	90.4%
Terphenyl-d14	Surrogate	70.0%	-	53.6%	74.1%

Certificate of Analysis

Client: **Paterson Group Consulting Engineers**

Report Date: 17-Oct-2012
Order Date:15-Oct-2012

Client PO: 12904 Project Description: PE2746

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	ND	1	ug/g						
Arsenic	ND	1	ug/g						
Barium	ND	1	ug/g						
Beryllium	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	5	ug/g						
Cobalt	ND	1	ug/g						
Copper	ND	5	ug/g						
Lead	ND	1	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1	ug/g						
Nickel	ND	5	ug/g						
Selenium	ND	1	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1	ug/g						
Uranium	ND	1	ug/g						
Vanadium	ND	10	ug/g						
Zinc	ND	20	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						
Biphenyl	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.12*		*ug/g*		*84.0*	*50-140*			
Surrogate: Terphenyl-d14	*1.02*		*ug/g*		*76.4*	*50-140*			

Certificate of Analysis

Report Date: 17-Oct-2012
Order Date:15-Oct-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12904 Project Description: PE2746

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	1.3	1	ug/g dry	1.2			6.9	30	
Arsenic	3.6	1	ug/g dry	4.1			13.5	30	
Barium	309	1	ug/g dry	310			0.1	30	
Beryllium	ND	0.5	ug/g dry	ND			0.0	30	
Boron	8.1	5.0	ug/g dry	8.8			8.2	30	
Cadmium	3.47	0.5	ug/g dry	2.22			44.1	30	QR-01
Chromium (VI)	ND	0.2	ug/g dry	ND				35	
Chromium	133	5	ug/g dry	142			5.9	30	
Cobalt	4.8	1	ug/g dry	4.8			0.7	30	
Copper	487	5	ug/g dry	504			3.5	30	
Lead	263	1	ug/g dry	257			2.5	30	
Mercury	0.183	0.1	ug/g dry	0.173			5.3	35	
Molybdenum	33.0	1	ug/g dry	37.0			11.5	30	
Nickel	89.0	5	ug/g dry	91.6			2.9	30	
Selenium	ND	1	ug/g dry	3.8			0.0	30	
Silver	1.14	0.3	ug/g dry	1.44			23.7	30	
Thallium	ND	1	ug/g dry	ND			0.0	30	
Uranium	ND	1	ug/g dry	ND			0.0	30	
Vanadium	13.3	10	ug/g dry	11.1			17.6	30	
Zinc	200	20	ug/g dry	216			7.6	30	
Physical Characteristics									
% Solids	94.9	0.1	% by Wt.	95.1			0.2	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND				40	
Acenaphthylene	ND	0.02	ug/g dry	ND				40	
Anthracene	ND	0.02	ug/g dry	ND				40	
Benzo [a] anthracene	ND	0.02	ug/g dry	ND				40	
Benzo [a] pyrene	ND	0.02	ug/g dry	ND				40	
Benzo [b] fluoranthene	ND	0.02	ug/g dry	ND				40	
Benzo [g,h,i] perylene	ND	0.02	ug/g dry	ND				40	
Benzo [k] fluoranthene	ND	0.02	ug/g dry	ND				40	
Biphenyl	ND	0.02	ug/g dry	ND				40	
Chrysene	ND	0.02	ug/g dry	ND				40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND				40	
Fluoranthene	ND	0.02	ug/g dry	ND				40	
Fluorene	ND	0.02	ug/g dry	ND				40	
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g dry	ND				40	
1-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
2-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
Naphthalene	ND	0.01	ug/g dry	ND				40	
Phenanthrene	ND	0.02	ug/g dry	ND				40	
Pyrene	ND	0.02	ug/g dry	ND				40	
Surrogate: 2-Fluorobiphenyl	*1.19*		*ug/g dry*	*ND*	*67.9*	*50-140*			
Surrogate: Terphenyl-d14	*1.15*		*ug/g dry*	*ND*	*65.9*	*50-140*			

Certificate of Analysis

Report Date: 17-Oct-2012
Order Date:15-Oct-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12904 Project Description: PE2746

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	42.6		ug/L	0.5	84.3	70-130			
Arsenic	42.5		ug/L	1.7	81.7	70-130			
Barium	161		ug/L	124	74.6	70-130			
Beryllium	45.7		ug/L	0.09	91.2	70-130			
Boron	50.0		ug/L	3.5	93.0	70-130			
Cadmium	40.1		ug/L	0.89	78.5	70-130			
Chromium (VI)	4.6	0.2	ug/g	ND	92.5	89-123			
Chromium	91.4		ug/L	56.6	69.6	70-130			QS-02
Cobalt	42.3		ug/L	1.9	80.8	70-130			
Copper	53.8		ug/L	4.6	98.3	70-130			
Lead	142		ug/L	103	79.5	70-130			
Mercury	1.87	0.1	ug/g	0.173	113	72-128			
Molybdenum	53.0		ug/L	14.8	76.4	70-130			
Nickel	74.7		ug/L	36.7	76.1	70-130			
Selenium	41.5		ug/L	1.5	79.9	70-130			
Silver	24.6		ug/L	0.58	48.0	70-130			
Thallium	45.9		ug/L	0.02	91.9	70-130			
Uranium	47.9		ug/L	0.3	95.2	70-130			
Vanadium	46.6		ug/L	4.5	84.2	70-130			
Zinc	50.0		ug/L	4.9	90.1	70-130			
Semi-Volatiles									
Acenaphthene	0.146	0.02	ug/g	ND	66.7	50-140			
Acenaphthylene	0.144	0.02	ug/g	ND	66.0	50-140			
Anthracene	0.186	0.02	ug/g	ND	85.2	50-140			
Benzo [a] anthracene	0.158	0.02	ug/g	ND	72.4	50-140			
Benzo [a] pyrene	0.142	0.02	ug/g	ND	64.8	50-140			
Benzo [b] fluoranthene	0.151	0.02	ug/g	ND	69.1	50-140			
Benzo [g,h,i] perylene	0.135	0.02	ug/g	ND	61.8	50-140			
Benzo [k] fluoranthene	0.173	0.02	ug/g	ND	79.2	50-140			
Biphenyl	0.138	0.02	ug/g	ND	63.0	50-140			
Chrysene	0.183	0.02	ug/g	ND	83.7	50-140			
Dibenzo [a,h] anthracene	0.155	0.02	ug/g	ND	70.8	50-140			
Fluoranthene	0.144	0.02	ug/g	ND	65.8	50-140			
Fluorene	0.133	0.02	ug/g	ND	60.9	50-140			
Indeno [1,2,3-cd] pyrene	0.142	0.02	ug/g	ND	65.0	50-140			
1-Methylnaphthalene	0.174	0.02	ug/g	ND	79.4	50-140			
2-Methylnaphthalene	0.154	0.02	ug/g	ND	70.5	50-140			
Naphthalene	0.162	0.01	ug/g	ND	74.2	50-140			
Phenanthrene	0.160	0.02	ug/g	ND	73.3	50-140			
Pyrene	0.156	0.02	ug/g	ND	71.2	50-140			
Surrogate: 2-Fluorobiphenyl	*1.63*		*ug/g*		*93.3*	*50-140*			

Certificate of Analysis

Report Date: 17-Oct-2012
Order Date:15-Oct-2012

Client: **Paterson Group Consulting Engineers**

Client PO: 12904 Project Description: PE2746

Qualifier Notes:

Sample Qualifiers :

1 : Elevated detection limits due to the nature of the sample matrix.

QC Qualifiers :

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

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

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Chain of Custody
(Lab Use Only)
No. 92360

Page __ of __

Client Name: Paterson Group Inc.	Project Reference: PE2746	TAT: [X] Regular [ ] 3 Day	
Contact Name: Kaya Munch	Quote # 12904	[ ] 2 Day [ ] 1 Day	
Address: 154 Colonnade Road S	PO #	Date Required:	
Telephone: 613-226-7381	Email Address: kmunch@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: 1242028

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP/MS	Hg	CrVI	B (HWS)							
1	BH1-SS2	S		1	Oct.12	am			✓									- 250 mL -		✓
2	BH2-AU1	S		1	↓	↓				✓	✓	✓								✓
3	BH3-SS2	S		1					✓											✓
4	BH5-SS2	S		1	↓	↓			✓	✓	✓	✓						↓		✓
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Pick up

Relinquished By (Print & Sign):	Received by Driver/Depot:	Received at Lab:	Verified By:
K. Munch Kaya Munch	T. Scouse	SUNREPORN	WC
Date/Time: Oct. 15, 2012 10:30	Date/Time: 15/10/12 11:16 AM	Date/Time: OCT 15 2012 18:28	Date/Time: Oct 15/12 12:36
	Temperature: ___ °C	Temperature: 15.8 °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

Client PO: 20199
Project: PE2746
Custody: 109346

Report Date: 9-Aug-2016
Order Date: 4-Aug-2016

Order #: 1632216

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

Paracel ID	Client ID
1632216-01	BH4-GW2

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20199

Report Date: 09-Aug-2016
Order Date: 4-Aug-2016
Project Description: PE2746

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PHC F1	CWS Tier 1 - P&T GC-FID	5-Aug-16	7-Aug-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	4-Aug-16	5-Aug-16
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	5-Aug-16	5-Aug-16
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	5-Aug-16	7-Aug-16

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20199

Report Date: 09-Aug-2016
Order Date: 4-Aug-2016
Project Description: PE2746

	Client ID:	BH4-GW2	-	-	-
	Sample Date:	03-Aug-16	-	-	-
	Sample ID:	1632216-01	-	-	-
	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	-	-	-
Chloroform	0.5 ug/L	<0.5	-	-	-
Dibromochloromethane	0.5 ug/L	<0.5	-	-	-
Dichlorodifluoromethane	1.0 ug/L	<1.0	-	-	-
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-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	-	-	-
Ethylene dibromide (dibromoethan	0.2 ug/L	<0.2	-	-	-
Hexane	1.0 ug/L	<1.0	-	-	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	-	-	-
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	-	-	-
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	-	-	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	-	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20199

Report Date: 09-Aug-2016
Order Date: 4-Aug-2016
Project Description: PE2746

	Client ID:	BH4-GW2	-	-	-
	Sample Date:	03-Aug-16	-	-	-
	Sample ID:	1632216-01	-	-	-
	MDL/Units	Water	-	-	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	-	-	-
Trichloroethylene	0.5 ug/L	<0.5	-	-	-
Trichlorofluoromethane	1.0 ug/L	<1.0	-	-	-
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	97.1%	-	-	-
Dibromofluoromethane	Surrogate	105%	-	-	-
Toluene-d8	Surrogate	88.4%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	-	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	-	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	-	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	-	-	-
F1 + F2 PHCs	125 ug/L	<125	-	-	-
F3 + F4 PHCs	200 ug/L	<200	-	-	-
Semi-Volatiles					
Acenaphthene	0.05 ug/L	<0.05	-	-	-
Acenaphthylene	0.05 ug/L	<0.05	-	-	-
Anthracene	0.01 ug/L	0.05	-	-	-
Benzo [a] anthracene	0.01 ug/L	0.19	-	-	-
Benzo [a] pyrene	0.01 ug/L	0.22	-	-	-
Benzo [b] fluoranthene	0.05 ug/L	0.10	-	-	-
Benzo [g,h,i] perylene	0.05 ug/L	0.16	-	-	-
Benzo [k] fluoranthene	0.05 ug/L	0.09	-	-	-
Chrysene	0.05 ug/L	0.23	-	-	-
Dibenzo [a,h] anthracene	0.05 ug/L	<0.05	-	-	-
Fluoranthene	0.01 ug/L	0.45	-	-	-
Fluorene	0.05 ug/L	<0.05	-	-	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	0.13	-	-	-
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	0.24	-	-	-
Pyrene	0.01 ug/L	0.38	-	-	-

	Client ID:	BH4-GW2	-	-	-
	Sample Date:	03-Aug-16	-	-	-
	Sample ID:	1632216-01	-	-	-
	MDL/Units	Water	-	-	-
2-Fluorobiphenyl	Surrogate	138%	-	-	-
Terphenyl-d14	Surrogate	126%	-	-	-

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	*24.4*		*ug/L*		*122*	*50-140*			
Surrogate: Terphenyl-d14	*22.4*		*ug/L*		*112*	*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	*77.7*		*ug/L*		*97.1*	*50-140*			
Surrogate: Dibromofluoromethane	*87.0*		*ug/L*		*109*	*50-140*			
Surrogate: Toluene-d8	*67.8*		*ug/L*		*84.7*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	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	*79.2*		*ug/L*	*ND*	*99.0*	*50-140*			
Surrogate: Dibromofluoromethane	*80.4*		*ug/L*	*ND*	*101*	*50-140*			
Surrogate: Toluene-d8	*72.9*		*ug/L*	*ND*	*91.2*	*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)	1910	25	ug/L	ND	95.7	68-117			
F2 PHCs (C10-C16)	1980	100	ug/L	ND	110	60-140			
F3 PHCs (C16-C34)	3970	100	ug/L	ND	107	60-140			
F4 PHCs (C34-C50)	2390	100	ug/L	ND	96.4	60-140			
Semi-Volatiles									
Acenaphthene	3.85	0.05	ug/L	ND	76.9	50-140			
Acenaphthylene	3.60	0.05	ug/L	ND	72.0	50-140			
Anthracene	4.81	0.01	ug/L	ND	96.2	50-140			
Benzo [a] anthracene	4.19	0.01	ug/L	ND	83.9	50-140			
Benzo [a] pyrene	5.08	0.01	ug/L	ND	102	50-140			
Benzo [b] fluoranthene	4.72	0.05	ug/L	ND	94.4	50-140			
Benzo [g,h,i] perylene	4.87	0.05	ug/L	ND	97.3	50-140			
Benzo [k] fluoranthene	5.10	0.05	ug/L	ND	102	50-140			
Chrysene	4.44	0.05	ug/L	ND	88.9	50-140			
Dibenzo [a,h] anthracene	4.90	0.05	ug/L	ND	98.0	50-140			
Fluoranthene	4.64	0.01	ug/L	ND	92.8	50-140			
Fluorene	3.89	0.05	ug/L	ND	77.8	50-140			
Indeno [1,2,3-cd] pyrene	5.13	0.05	ug/L	ND	103	50-140			
1-Methylnaphthalene	5.76	0.05	ug/L	ND	115	50-140			
2-Methylnaphthalene	6.13	0.05	ug/L	ND	123	50-140			
Naphthalene	3.77	0.05	ug/L	ND	75.4	50-140			
Phenanthrene	4.36	0.05	ug/L	ND	87.2	50-140			
Pyrene	4.72	0.01	ug/L	ND	94.5	50-140			
Surrogate: 2-Fluorobiphenyl	*23.9*		*ug/L*		*119*	*50-140*			
Volatiles									
Acetone	119	5.0	ug/L	ND	119	50-140			
Benzene	34.4	0.5	ug/L	ND	86.1	50-140			
Bromodichloromethane	41.2	0.5	ug/L	ND	103	50-140			
Bromoform	41.4	0.5	ug/L	ND	104	50-140			
Bromomethane	24.8	0.5	ug/L	ND	62.0	50-140			
Carbon Tetrachloride	45.1	0.2	ug/L	ND	113	50-140			
Chlorobenzene	35.7	0.5	ug/L	ND	89.2	50-140			
Chloroform	38.0	0.5	ug/L	ND	95.0	50-140			
Dibromochloromethane	37.7	0.5	ug/L	ND	94.3	50-140			
Dichlorodifluoromethane	33.3	1.0	ug/L	ND	83.2	50-140			
1,2-Dichlorobenzene	37.1	0.5	ug/L	ND	92.8	50-140			
1,3-Dichlorobenzene	38.8	0.5	ug/L	ND	97.0	50-140			
1,4-Dichlorobenzene	39.6	0.5	ug/L	ND	99.0	50-140			
1,1-Dichloroethane	36.0	0.5	ug/L	ND	90.0	50-140			
1,2-Dichloroethane	42.4	0.5	ug/L	ND	106	50-140			
1,1-Dichloroethylene	36.0	0.5	ug/L	ND	90.0	50-140			
cis-1,2-Dichloroethylene	30.8	0.5	ug/L	ND	77.0	50-140			
trans-1,2-Dichloroethylene	30.5	0.5	ug/L	ND	76.2	50-140			
1,2-Dichloropropane	36.0	0.5	ug/L	ND	89.9	50-140			
cis-1,3-Dichloropropylene	30.3	0.5	ug/L	ND	75.8	50-140			
trans-1,3-Dichloropropylene	33.4	0.5	ug/L	ND	83.4	50-140			
Ethylbenzene	36.2	0.5	ug/L	ND	90.6	50-140			
Ethylene dibromide (dibromoethane	35.0	0.2	ug/L	ND	87.5	50-140			
Hexane	21.2	1.0	ug/L	ND	52.9	50-140			
Methyl Ethyl Ketone (2-Butanone)	85.3	5.0	ug/L	ND	85.3	50-140			
Methyl Isobutyl Ketone	103	5.0	ug/L	ND	103	50-140			

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20199

Report Date: 09-Aug-2016
Order Date: 4-Aug-2016
Project Description: PE2746

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methyl tert-butyl ether	97.5	2.0	ug/L	ND	97.5	50-140			
Methylene Chloride	32.5	5.0	ug/L	ND	81.3	50-140			
Styrene	33.8	0.5	ug/L	ND	84.5	50-140			
1,1,1,2-Tetrachloroethane	40.1	0.5	ug/L	ND	100	50-140			
1,1,2,2-Tetrachloroethane	37.3	0.5	ug/L	ND	93.2	50-140			
Tetrachloroethylene	34.4	0.5	ug/L	ND	85.9	50-140			
Toluene	33.4	0.5	ug/L	ND	83.6	50-140			
1,1,1-Trichloroethane	41.0	0.5	ug/L	ND	103	50-140			
1,1,2-Trichloroethane	35.2	0.5	ug/L	ND	88.0	50-140			
Trichloroethylene	27.8	0.5	ug/L	ND	69.4	50-140			
Trichlorofluoromethane	47.1	1.0	ug/L	ND	118	50-140			
Vinyl chloride	50.7	0.5	ug/L	ND	127	50-140			
m,p-Xylenes	68.9	0.5	ug/L	ND	86.2	50-140			
o-Xylene	38.0	0.5	ug/L	ND	95.0	50-140			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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)
№ 109346

Page 1 of 1

Client Name: Paterson	Project Reference: PE2746	**Turnaround Time:**
Contact Name: Mark Darcy	Quote #	☐ 1 Day ☐ 3 Day
Address: 154 Colonnade Rd S. Ottawa, ON	PO # 20199	☐ 2 Day ☑ Regular
Telephone: 613-226-7381	Email Address: mdarcy@patersongroup.ca.	Date Required:

Criteria: ☑ O. Reg. 153/04 (As Amended) 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: 163216

	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	BH4-GW2	GW		4	AUG.3/16		✓	✓	✓											✓
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments: PAH bottle reads GW1. -> Should read GW2 as per Mark- RS

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot: T. Flouse	Received at Lab: GURPREET DORMAL	Verified By:
Relinquished By (Print):	Date/Time: 04/08/16 10:25 AM	Date/Time: AUG 04 2016 11:15	Date/Time: 04/08/16 12:15
Date/Time:	Temperature: ___ °C	Temperature: 15.2 °C	pH Verified [ ] By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 23649
Project: PE2746
Custody: 116621

Report Date: 4-Apr-2018
Order Date: 28-Mar-2018

Order #: 1813287

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

Paracel ID	Client ID
1813287-01	BH7-SS1
1813287-02	BH8-SS2

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23649

Report Date: 04-Apr-2018
Order Date: 28-Mar-2018
Project Description: PE2746

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	2-Apr-18	3-Apr-18
Mercury by CVAA	EPA 7471B - CVAA, digestion	3-Apr-18	3-Apr-18
Metals, ICP-MS	EPA 6020 - Digestion - ICP-MS	4-Apr-18	4-Apr-18
PHC F1	CWS Tier 1 - P&T GC-FID	2-Apr-18	3-Apr-18
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	29-Mar-18	30-Mar-18
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	29-Mar-18	3-Apr-18
Solids, %	Gravimetric, calculation	4-Apr-18	4-Apr-18

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23649

Report Date: 04-Apr-2018

Order Date: 28-Mar-2018

Project Description: PE2746

	Client ID:	BH7-SS1	BH8-SS2	-	-
	Sample Date:	03/26/2018 09:00	03/26/2018 09:00	-	-
	Sample ID:	1813287-01	1813287-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	85.4	97.1	-	-
Metals					
Antimony	1 ug/g dry	1	<1	-	-
Arsenic	1 ug/g dry	14	3	-	-
Barium	1 ug/g dry	216	80	-	-
Beryllium	0.5 ug/g dry	<0.5	<0.5	-	-
Boron	5.0 ug/g dry	32.5	13.6	-	-
Cadmium	0.5 ug/g dry	0.7	<0.5	-	-
Chromium	5 ug/g dry	59	19	-	-
Cobalt	1 ug/g dry	16	5	-	-
Copper	5 ug/g dry	63	15	-	-
Lead	1 ug/g dry	142	23	-	-
Mercury	0.1 ug/g dry	0.1	<0.1	-	-
Molybdenum	1 ug/g dry	3	8	-	-
Nickel	5 ug/g dry	36	15	-	-
Selenium	1 ug/g dry	<1	<1	-	-
Silver	0.3 ug/g dry	<0.3	<0.3	-	-
Thallium	1 ug/g dry	<1	<1	-	-
Uranium	1 ug/g dry	1	2	-	-
Vanadium	10 ug/g dry	26	19	-	-
Zinc	20 ug/g dry	109	73	-	-
Volatiles					
Benzene	0.02 ug/g dry	<0.02	<0.02	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	-	-
Toluene	0.05 ug/g dry	<0.05	<0.05	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	-	-
o-Xylene	0.05 ug/g dry	<0.05	<0.05	-	-
Xylenes, total	0.05 ug/g dry	<0.05	<0.05	-	-
Toluene-d8	Surrogate	93.6%	93.1%	-	-
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	60	26	-	-
F4 PHCs (C34-C50)	6 ug/g dry	33	12	-	-
Semi-Volatiles					

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23649

Report Date: 04-Apr-2018

Order Date: 28-Mar-2018

Project Description: PE2746

	Client ID:	BH7-SS1	BH8-SS2	-	-
	Sample Date:	03/26/2018 09:00	03/26/2018 09:00	-	-
	Sample ID:	1813287-01	1813287-02	-	-
	MDL/Units	Soil	Soil	-	-
Acenaphthene	0.02 ug/g dry	<0.02	<0.02	-	-
Acenaphthylene	0.02 ug/g dry	0.03	0.02	-	-
Anthracene	0.02 ug/g dry	0.04	0.03	-	-
Benzo [a] anthracene	0.02 ug/g dry	0.09	0.05	-	-
Benzo [a] pyrene	0.02 ug/g dry	0.08	0.05	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	0.15	0.07	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	0.06	0.04	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	0.07	0.05	-	-
Chrysene	0.02 ug/g dry	0.12	0.07	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	<0.02	-	-
Fluoranthene	0.02 ug/g dry	0.18	0.13	-	-
Fluorene	0.02 ug/g dry	<0.02	<0.02	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	0.06	0.04	-	-
1-Methylnaphthalene	0.02 ug/g dry	0.12	<0.02	-	-
2-Methylnaphthalene	0.02 ug/g dry	0.16	<0.02	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	0.28	<0.04	-	-
Naphthalene	0.01 ug/g dry	0.10	0.01	-	-
Phenanthrene	0.02 ug/g dry	0.15	0.07	-	-
Pyrene	0.02 ug/g dry	0.15	0.11	-	-
2-Fluorobiphenyl	Surrogate	81.8%	83.4%	-	-
Terphenyl-d14	Surrogate	88.4%	101%	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Antimony	ND	1	ug/g						
Arsenic	ND	1	ug/g						
Barium	ND	1	ug/g						
Beryllium	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	5	ug/g						
Cobalt	ND	1	ug/g						
Copper	ND	5	ug/g						
Lead	ND	1	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1	ug/g						
Nickel	ND	5	ug/g						
Selenium	ND	1	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1	ug/g						
Uranium	ND	1	ug/g						
Vanadium	ND	10	ug/g						
Zinc	ND	20	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.18*		*ug/g*		*88.6*	*50-140*			
Surrogate: Terphenyl-d14	*1.59*		*ug/g*		*119*	*50-140*			
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*7.75*		*ug/g*		*96.9*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Metals									
Antimony	1.2	1	ug/g dry	ND			0.0	30	
Arsenic	1.7	1	ug/g dry	1.6			5.0	30	
Barium	30.4	1	ug/g dry	29.7			2.2	30	
Beryllium	ND	0.5	ug/g dry	ND			0.0	30	
Boron	7.0	5.0	ug/g dry	ND			0.0	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium	11.7	5	ug/g dry	11.9			1.9	30	
Cobalt	4.6	1	ug/g dry	4.7			3.8	30	
Copper	5.8	5	ug/g dry	6.1			5.3	30	
Lead	8.0	1	ug/g dry	8.1			0.1	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	ND	1	ug/g dry	ND			0.0	30	
Nickel	9.5	5	ug/g dry	9.5			0.5	30	
Selenium	ND	1	ug/g dry	ND			0.0	30	
Silver	ND	0.3	ug/g dry	ND			0.0	30	
Thallium	ND	1	ug/g dry	ND			0.0	30	
Uranium	ND	1	ug/g dry	ND			0.0	30	
Vanadium	17.1	10	ug/g dry	17.3			1.4	30	
Zinc	26.4	20	ug/g dry	25.7			2.5	30	
Physical Characteristics									
% Solids	94.0	0.1	% by Wt.	93.0			1.1	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND				40	
Acenaphthylene	ND	0.02	ug/g dry	ND				40	
Anthracene	0.122	0.02	ug/g dry	ND			0.0	40	
Benzo [a] anthracene	0.022	0.02	ug/g dry	0.047			72.4	40	QR-01
Benzo [a] pyrene	0.033	0.02	ug/g dry	0.057			53.4	40	QR-01
Benzo [b] fluoranthene	0.042	0.02	ug/g dry	0.077			58.7	40	QR-01
Benzo [g,h,i] perylene	0.048	0.02	ug/g dry	0.073			41.7	40	QR-01
Benzo [k] fluoranthene	0.040	0.02	ug/g dry	0.036			8.7	40	
Chrysene	0.052	0.02	ug/g dry	0.112			73.7	40	QR-01
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	0.020			0.0	40	
Fluoranthene	ND	0.02	ug/g dry	0.073			0.0	40	
Fluorene	ND	0.02	ug/g dry	ND				40	
Indeno [1,2,3-cd] pyrene	0.028	0.02	ug/g dry	0.048			50.8	40	QR-01
1-Methylnaphthalene	ND	0.02	ug/g dry	ND			0.0	40	
2-Methylnaphthalene	0.050	0.02	ug/g dry	0.070			33.8	40	
Naphthalene	0.031	0.01	ug/g dry	0.042			30.2	40	
Phenanthrene	0.112	0.02	ug/g dry	0.182			47.4	40	QR-01
Pyrene	0.043	0.02	ug/g dry	0.093			73.1	40	QR-01
Surrogate: 2-Fluorobiphenyl	*1.52*		*ug/g dry*		*65.7*	*50-140*			
Surrogate: Terphenyl-d14	*3.11*		*ug/g dry*		*134*	*50-140*			
Volatiles									
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: Toluene-d8	*5.24*		*ug/g dry*		*92.4*	*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)	180	7	ug/g		90.0	80-120			
F2 PHCs (C10-C16)	101	4	ug/g	ND	96.2	60-140			
F3 PHCs (C16-C34)	185	8	ug/g	ND	84.9	60-140			
F4 PHCs (C34-C50)	131	6	ug/g	ND	89.9	60-140			
Metals									
Antimony	45.8		ug/L	ND	91.5	70-130			
Arsenic	53.2		ug/L	ND	105	70-130			
Barium	63.2		ug/L	11.9	103	70-130			
Beryllium	47.7		ug/L	ND	95.3	70-130			
Boron	46.1		ug/L	ND	89.8	70-130			
Cadmium	48.8		ug/L	ND	97.5	70-130			
Chromium	55.2		ug/L	ND	101	70-130			
Cobalt	50.9		ug/L	1.9	98.0	70-130			
Copper	50.9		ug/L	ND	97.0	70-130			
Lead	50.8		ug/L	3.2	95.2	70-130			
Mercury	1.10	0.1	ug/g	ND	73.4	70-130			
Molybdenum	47.6		ug/L	ND	95.0	70-130			
Nickel	52.4		ug/L	ND	97.3	70-130			
Selenium	51.4		ug/L	ND	102	70-130			
Silver	50.7		ug/L	ND	101	70-130			
Thallium	48.7		ug/L	ND	97.3	70-130			
Uranium	50.1		ug/L	ND	99.9	70-130			
Vanadium	57.7		ug/L	ND	102	70-130			
Zinc	59.7		ug/L	ND	98.9	70-130			
Semi-Volatiles									
Acenaphthene	0.282	0.02	ug/g	ND	97.6	50-140			
Acenaphthylene	0.238	0.02	ug/g	ND	82.3	50-140			
Anthracene	0.242	0.02	ug/g	ND	83.6	50-140			
Benzo [a] anthracene	0.261	0.02	ug/g	0.047	74.2	50-140			
Benzo [a] pyrene	0.280	0.02	ug/g	0.057	77.2	50-140			
Benzo [b] fluoranthene	0.446	0.02	ug/g	0.077	127	50-140			
Benzo [g,h,i] perylene	0.345	0.02	ug/g	0.073	94.3	50-140			
Benzo [k] fluoranthene	0.322	0.02	ug/g	0.036	98.6	50-140			
Chrysene	0.421	0.02	ug/g	0.112	107	50-140			
Dibenzo [a,h] anthracene	0.245	0.02	ug/g	0.020	77.7	50-140			
Fluoranthene	0.367	0.02	ug/g	0.073	102	50-140			
Fluorene	0.268	0.02	ug/g	ND	92.8	50-140			
Indeno [1,2,3-cd] pyrene	0.298	0.02	ug/g	0.048	86.5	50-140			
1-Methylnaphthalene	0.244	0.02	ug/g	ND	84.4	50-140			
2-Methylnaphthalene	0.344	0.02	ug/g	0.070	95.0	50-140			
Naphthalene	0.303	0.01	ug/g	0.042	90.3	50-140			
Phenanthrene	0.546	0.02	ug/g	0.182	126	50-140			
Pyrene	0.404	0.02	ug/g	0.093	108	50-140			
Surrogate: 2-Fluorobiphenyl	*1.83*		*ug/g*		*79.2*	*50-140*			
Volatiles									
Benzene	4.62	0.02	ug/g		115	60-130			
Ethylbenzene	3.82	0.05	ug/g		95.6	60-130			
Toluene	3.42	0.05	ug/g		85.5	60-130			
m,p-Xylenes	7.20	0.05	ug/g		90.0	60-130			
o-Xylene	3.59	0.05	ug/g		89.8	60-130			

Qualifier Notes:

QC Qualifiers :

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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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Paracel ID: 1813287

Chain of Custody (Lab Use Only)
№ 116621

Page 1 of 1

Client Name: PATERSON GROUP	Project Reference: PE2746	**Turnaround Time:**	
Contact Name: ADRIAN MENYHART	Quote #	☐ 1 Day	☐ 3 Day
Address: 154 COLONNADE RD S.	PO # 23649	☐ 2 Day	☑ Regular
Telephone:	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)

Required Analyses

Paracel Order Number: 1813287

	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	BH7-SS1	S		2	MAR 26		/		/	/	/							~ 250mL + 1 vial		
2	BH8-SS2	S		2	MAR 26		/		/	/	/									
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Method of Delivery: PARACEL

Comments:

Relinquished By (Sign):	Received by Driver/Depot: M. SOUSA	Received at Lab: SUNEEPORN DOUMA	Verified By:
Relinquished By (Print): ADRIAN	Date/Time: 28/03/18 3 20 PM	Date/Time: MAR 28, 2018 04:05	Date/Time: 03/28/18 4:39
Date/Time: MAR 28 2018	Temperature: °C	Temperature: 18.7 °C	pH Verified [ ] By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 23755
Project: PE2746
Custody: 116628

Report Date: 11-May-2018
Order Date: 7-May-2018

Order #: 1819131

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

Paracel ID	Client ID
1819131-01	BH9-AU1

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23755

Report Date: 11-May-2018
Order Date: 7-May-2018
Project Description: PE2746

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	10-May-18	11-May-18
Metals, ICP-MS	EPA 6020 - Digestion - ICP-MS	10-May-18	11-May-18
PHC F1	CWS Tier 1 - P&T GC-FID	10-May-18	11-May-18
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	8-May-18	9-May-18
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	8-May-18	8-May-18
Solids, %	Gravimetric, calculation	10-May-18	10-May-18

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23755

Report Date: 11-May-2018

Order Date: 7-May-2018

Project Description: PE2746

	Client ID:	BH9-AU1	-	-	-
	Sample Date:	05/04/2018 12:00	-	-	-
	Sample ID:	1819131-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	93.6	-	-	-
Metals					
Antimony	1 ug/g dry	2	-	-	-
Arsenic	1 ug/g dry	2	-	-	-
Barium	1 ug/g dry	289	-	-	-
Beryllium	0.5 ug/g dry	<0.5	-	-	-
Boron	5.0 ug/g dry	17.2	-	-	-
Cadmium	0.5 ug/g dry	2.0	-	-	-
Chromium	5 ug/g dry	39	-	-	-
Cobalt	1 ug/g dry	6	-	-	-
Copper	5 ug/g dry	153	-	-	-
Lead	1 ug/g dry	325	-	-	-
Molybdenum	1 ug/g dry	14	-	-	-
Nickel	5 ug/g dry	56	-	-	-
Selenium	1 ug/g dry	<1	-	-	-
Silver	0.3 ug/g dry	0.5	-	-	-
Thallium	1 ug/g dry	<1	-	-	-
Uranium	1 ug/g dry	<1	-	-	-
Vanadium	10 ug/g dry	29	-	-	-
Zinc	20 ug/g dry	316	-	-	-
Volatiles					
Benzene	0.02 ug/g dry	0.34	-	-	-
Ethylbenzene	0.05 ug/g dry	0.17	-	-	-
Toluene	0.05 ug/g dry	2.17	-	-	-
m,p-Xylenes	0.05 ug/g dry	1.35	-	-	-
o-Xylene	0.05 ug/g dry	0.30	-	-	-
Xylenes, total	0.05 ug/g dry	1.65	-	-	-
Toluene-d8	Surrogate	103%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	8	-	-	-
F2 PHCs (C10-C16)	4 ug/g dry	211	-	-	-
F3 PHCs (C16-C34)	8 ug/g dry	1930	-	-	-
F4 PHCs (C34-C50)	6 ug/g dry	310	-	-	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	-	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23755

Report Date: 11-May-2018

Order Date: 7-May-2018

Project Description: PE2746

	Client ID:	BH9-AU1	-	-	-
	Sample Date:	05/04/2018 12:00	-	-	-
	Sample ID:	1819131-01	-	-	-
	MDL/Units	Soil	-	-	-
Acenaphthylene	0.02 ug/g dry	0.02	-	-	-
Anthracene	0.02 ug/g dry	<0.02	-	-	-
Benzo [a] anthracene	0.02 ug/g dry	0.12	-	-	-
Benzo [a] pyrene	0.02 ug/g dry	0.12	-	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	0.19	-	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	0.18	-	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	0.09	-	-	-
Chrysene	0.02 ug/g dry	0.16	-	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	0.02	-	-	-
Fluoranthene	0.02 ug/g dry	0.32	-	-	-
Fluorene	0.02 ug/g dry	0.03	-	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	0.09	-	-	-
1-Methylnaphthalene	0.02 ug/g dry	0.23	-	-	-
2-Methylnaphthalene	0.02 ug/g dry	0.45	-	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	0.68	-	-	-
Naphthalene	0.01 ug/g dry	0.25	-	-	-
Phenanthrene	0.02 ug/g dry	0.22	-	-	-
Pyrene	0.02 ug/g dry	0.35	-	-	-
2-Fluorobiphenyl	Surrogate	133%	-	-	-
Terphenyl-d14	Surrogate	91.1%	-	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23755

Report Date: 11-May-2018
Order Date: 7-May-2018
Project Description: PE2746

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Antimony	ND	1	ug/g						
Arsenic	ND	1	ug/g						
Barium	ND	1	ug/g						
Beryllium	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	5	ug/g						
Cobalt	ND	1	ug/g						
Copper	ND	5	ug/g						
Lead	ND	1	ug/g						
Molybdenum	ND	1	ug/g						
Nickel	ND	5	ug/g						
Selenium	ND	1	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1	ug/g						
Uranium	ND	1	ug/g						
Vanadium	ND	10	ug/g						
Zinc	ND	20	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.33*		*ug/g*		*99.5*	*50-140*			
Surrogate: Terphenyl-d14	*1.31*		*ug/g*		*97.9*	*50-140*			
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*3.65*		*ug/g*		*114*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Metals									
Antimony	ND	1	ug/g dry	ND			0.0	30	
Arsenic	ND	1	ug/g dry	ND			0.0	30	
Barium	142	1	ug/g dry	128			10.0	30	
Beryllium	0.71	0.5	ug/g dry	0.79			9.8	30	
Boron	14.3	5.0	ug/g dry	11.3			23.7	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium	27.6	5	ug/g dry	25.8			6.7	30	
Cobalt	9.7	1	ug/g dry	9.2			5.3	30	
Copper	22.1	5	ug/g dry	20.9			5.6	30	
Lead	13.9	1	ug/g dry	12.8			8.3	30	
Molybdenum	ND	1	ug/g dry	ND			0.0	30	
Nickel	23.2	5	ug/g dry	22.1			4.8	30	
Selenium	ND	1	ug/g dry	ND			0.0	30	
Silver	ND	0.3	ug/g dry	ND			0.0	30	
Thallium	ND	1	ug/g dry	ND			0.0	30	
Uranium	ND	1	ug/g dry	ND			0.0	30	
Vanadium	32.6	10	ug/g dry	30.5			6.8	30	
Zinc	52.7	20	ug/g dry	49.9			5.4	30	
Physical Characteristics									
% Solids	86.9	0.1	% by Wt.	89.9			3.4	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND				40	
Acenaphthylene	0.025	0.02	ug/g dry	ND			0.0	40	
Anthracene	0.242	0.02	ug/g dry	0.145			49.9	40	QR-04
Benzo [a] anthracene	0.098	0.02	ug/g dry	0.063			42.6	40	QR-04
Benzo [a] pyrene	0.091	0.02	ug/g dry	0.061			39.4	40	
Benzo [b] fluoranthene	0.073	0.02	ug/g dry	0.045			46.2	40	QR-04
Benzo [g,h,i] perylene	0.056	0.02	ug/g dry	0.038			38.2	40	
Benzo [k] fluoranthene	0.068	0.02	ug/g dry	0.042			45.6	40	QR-04
Chrysene	0.137	0.02	ug/g dry	0.090			41.8	40	QR-04
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND				40	
Fluoranthene	0.321	0.02	ug/g dry	0.170			61.3	40	QR-04
Fluorene	0.032	0.02	ug/g dry	0.027			15.9	40	
Indeno [1,2,3-cd] pyrene	0.049	0.02	ug/g dry	0.034			35.8	40	
1-Methylnaphthalene	0.039	0.02	ug/g dry	0.033			16.8	40	
2-Methylnaphthalene	0.036	0.02	ug/g dry	0.026			33.8	40	
Naphthalene	0.039	0.01	ug/g dry	0.031			23.7	40	
Phenanthrene	0.224	0.02	ug/g dry	0.134			50.0	40	QR-04
Pyrene	0.258	0.02	ug/g dry	0.138			60.8	40	QR-04
Surrogate: 2-Fluorobiphenyl	*2.12*		*ug/g dry*		*123*	*50-140*			
Surrogate: Terphenyl-d14	*1.75*		*ug/g dry*		*102*	*50-140*			
Volatiles									
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: Toluene-d8	*3.91*		*ug/g dry*		*103*	*50-140*			

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23755

Report Date: 11-May-2018
Order Date: 7-May-2018
Project Description: PE2746

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	197	7	ug/g		98.4	80-120			
F2 PHCs (C10-C16)	137	4	ug/g	ND	124	60-140			
F3 PHCs (C16-C34)	242	8	ug/g	ND	106	60-140			
F4 PHCs (C34-C50)	191	6	ug/g	ND	126	60-140			
Metals									
Antimony	41.8		ug/L	ND	83.4	70-130			
Arsenic	39.4		ug/L	ND	78.8	70-130			
Barium	99.8		ug/L	51.3	96.8	70-130			
Beryllium	46.1		ug/L	ND	91.6	70-130			
Boron	49.6		ug/L	ND	90.2	70-130			
Cadmium	39.7		ug/L	ND	79.0	70-130			
Chromium	54.6		ug/L	10.3	88.5	70-130			
Cobalt	47.1		ug/L	3.7	86.9	70-130			
Copper	51.8		ug/L	8.4	86.9	70-130			
Lead	52.4		ug/L	5.1	94.5	70-130			
Molybdenum	41.5		ug/L	ND	82.8	70-130			
Nickel	52.5		ug/L	8.9	87.3	70-130			
Selenium	40.1		ug/L	ND	79.6	70-130			
Silver	39.4		ug/L	ND	78.8	70-130			
Thallium	46.8		ug/L	ND	93.5	70-130			
Uranium	48.0		ug/L	ND	95.6	70-130			
Vanadium	56.9		ug/L	12.2	89.3	70-130			
Zinc	60.1		ug/L	20.0	80.3	70-130			
Semi-Volatiles									
Acenaphthene	0.186	0.02	ug/g		112	50-140			
Acenaphthylene	0.165	0.02	ug/g		98.9	50-140			
Anthracene	0.147	0.02	ug/g		88.2	50-140			
Benzo [a] anthracene	0.126	0.02	ug/g		75.9	50-140			
Benzo [a] pyrene	0.137	0.02	ug/g		82.1	50-140			
Benzo [b] fluoranthene	0.154	0.02	ug/g		92.2	50-140			
Benzo [g,h,i] perylene	0.143	0.02	ug/g		85.7	50-140			
Benzo [k] fluoranthene	0.181	0.02	ug/g		109	50-140			
Chrysene	0.151	0.02	ug/g		90.6	50-140			
Dibenzo [a,h] anthracene	0.130	0.02	ug/g		78.0	50-140			
Fluoranthene	0.138	0.02	ug/g		82.9	50-140			
Fluorene	0.171	0.02	ug/g		103	50-140			
Indeno [1,2,3-cd] pyrene	0.134	0.02	ug/g		80.6	50-140			
1-Methylnaphthalene	0.195	0.02	ug/g		117	50-140			
2-Methylnaphthalene	0.197	0.02	ug/g		118	50-140			
Naphthalene	0.180	0.01	ug/g		108	50-140			
Phenanthrene	0.152	0.02	ug/g		91.4	50-140			
Pyrene	0.148	0.02	ug/g		88.7	50-140			
Surrogate: 2-Fluorobiphenyl	*1.02*		*ug/g*		*76.6*	*50-140*			
Volatiles									
Benzene	3.56	0.02	ug/g		89.0	60-130			
Ethylbenzene	4.14	0.05	ug/g		104	60-130			
Toluene	3.99	0.05	ug/g		99.8	60-130			
m,p-Xylenes	8.61	0.05	ug/g		108	60-130			
o-Xylene	4.37	0.05	ug/g		109	60-130			

Qualifier Notes:

QC Qualifiers :

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

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Chain of Custody
(Lab Use Only)
№ 116628

Page 1 of 1

Client Name: PATERSON GROUP	Project Reference: PE2746
Contact Name: ADRIAN MENYHART	Quote #
Address: 154 COLONNADE RD S	PO # 23755
Telephone:	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: 1819131

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)							
1	BH9-AV1	S		2	MAY 4'18	PM	✓		✓	✓				250mL 1vial						✓
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot: T. LOUISE	Received at Lab: SURREPORT DOMINI	Verified By:
Relinquished By (Print): ADRIAN M.	Date/Time: 07/05/18 4:20 PM	Date/Time: MAY 07, 2018 09:14	Date/Time: May 07/2018
Date/Time: MAY 7 2018	Temperature: °C	Temperature: 18.6 °C	pH Verified [ ] By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 24161
Project: PE2746
Custody: 117230

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

Order #: 1824410

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

Paracel ID	Client ID
1824410-01	BH7-GW1
1824410-02	BH8-GW1
1824410-03	BH9-GW1

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24161

Report Date: 20-Jun-2018
Order Date: 13-Jun-2018
Project Description: PE2746

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	15-Jun-18	15-Jun-18
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	14-Jun-18	14-Jun-18
Metals, ICP-MS	EPA 200.8 - ICP-MS	15-Jun-18	20-Jun-18
PHC F1	CWS Tier 1 - P&T GC-FID	14-Jun-18	15-Jun-18
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	14-Jun-18	15-Jun-18
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	18-Jun-18	18-Jun-18

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 24161

Report Date: 20-Jun-2018

Order Date: 13-Jun-2018

Project Description: PE2746

	Client ID:	BH7-GW1	BH8-GW1	BH9-GW1	-
	Sample Date:	06/12/2018 09:00	06/12/2018 09:00	06/12/2018 09:00	-
	Sample ID:	1824410-01	1824410-02	1824410-03	-
	MDL/Units	Water	Water	Water	-
Metals					
Mercury	0.1 ug/L	-	<0.1	<0.1	-
Antimony	0.5 ug/L	-	<0.5	1.2	-
Arsenic	1 ug/L	-	2	1	-
Barium	1 ug/L	-	1040	494	-
Beryllium	0.5 ug/L	-	<0.5	<0.5	-
Boron	10 ug/L	-	481	355	-
Cadmium	0.1 ug/L	-	<0.1	<0.1	-
Chromium	1 ug/L	-	<1	<1	-
Cobalt	0.5 ug/L	-	1.1	0.5	-
Copper	0.5 ug/L	-	1.1	2.9	-
Lead	0.1 ug/L	-	0.2	0.2	-
Molybdenum	0.5 ug/L	-	5.1	6.8	-
Nickel	1 ug/L	-	3	1	-
Selenium	1 ug/L	-	<1	<1	-
Silver	0.1 ug/L	-	<0.1	<0.1	-
Sodium	200 ug/L	-	1160000	387000	-
Thallium	0.1 ug/L	-	<0.1	<0.1	-
Uranium	0.1 ug/L	-	1.0	3.5	-
Vanadium	0.5 ug/L	-	0.7	1.1	-
Zinc	5 ug/L	-	11	<5	-
Volatiles					
Benzene	0.5 ug/L	<0.5	<0.5	4.8	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	31.6	-
Toluene	0.5 ug/L	<0.5	<0.5	3.8	-
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	275	-
o-Xylene	0.5 ug/L	<0.5	<0.5	60.1	-
Xylenes, total	0.5 ug/L	<0.5	<0.5	335	-
Toluene-d8	Surrogate	96.8%	96.8%	97.6%	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	665	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	<100	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	<100	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	<100	-
Semi-Volatiles					
Acenaphthene	0.05 ug/L	-	<0.05	<0.05	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 24161

Report Date: 20-Jun-2018

Order Date: 13-Jun-2018

Project Description: PE2746

	Client ID:	BH7-GW1	BH8-GW1	BH9-GW1	-
	Sample Date:	06/12/2018 09:00	06/12/2018 09:00	06/12/2018 09:00	-
	Sample ID:	1824410-01	1824410-02	1824410-03	-
	MDL/Units	Water	Water	Water	-
Acenaphthylene	0.05 ug/L	-	<0.05	<0.05	-
Anthracene	0.01 ug/L	-	0.02	<0.01	-
Benzo [a] anthracene	0.01 ug/L	-	0.06	0.05	-
Benzo [a] pyrene	0.01 ug/L	-	0.06	<0.01	-
Benzo [b] fluoranthene	0.05 ug/L	-	<0.05	<0.05	-
Benzo [g,h,i] perylene	0.05 ug/L	-	0.07	<0.05	-
Benzo [k] fluoranthene	0.05 ug/L	-	<0.05	<0.05	-
Chrysene	0.05 ug/L	-	0.08	0.07	-
Dibenzo [a,h] anthracene	0.05 ug/L	-	<0.05	<0.05	-
Fluoranthene	0.01 ug/L	-	0.13	0.11	-
Fluorene	0.05 ug/L	-	<0.05	<0.05	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	-	0.05	<0.05	-
1-Methylnaphthalene	0.05 ug/L	-	<0.05	<0.05	-
2-Methylnaphthalene	0.05 ug/L	-	0.06	<0.05	-
Methylnaphthalene (1&2)	0.10 ug/L	-	<0.10	<0.10	-
Naphthalene	0.05 ug/L	-	0.07	0.12	-
Phenanthrene	0.05 ug/L	-	0.08	0.08	-
Pyrene	0.01 ug/L	-	0.11	<0.01	-
2-Fluorobiphenyl	Surrogate	-	72.6%	77.4%	-
Terphenyl-d14	Surrogate	-	81.4%	85.6%	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24161

Report Date: 20-Jun-2018
Order Date: 13-Jun-2018
Project Description: PE2746

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Metals									
Mercury	ND	0.1	ug/L						
Antimony	ND	0.5	ug/L						
Arsenic	ND	1	ug/L						
Barium	ND	1	ug/L						
Beryllium	ND	0.5	ug/L						
Boron	ND	10	ug/L						
Cadmium	ND	0.1	ug/L						
Chromium	ND	1	ug/L						
Cobalt	ND	0.5	ug/L						
Copper	ND	0.5	ug/L						
Lead	ND	0.1	ug/L						
Molybdenum	ND	0.5	ug/L						
Nickel	ND	1	ug/L						
Selenium	ND	1	ug/L						
Silver	ND	0.1	ug/L						
Sodium	ND	200	ug/L						
Thallium	ND	0.1	ug/L						
Uranium	ND	0.1	ug/L						
Vanadium	ND	0.5	ug/L						
Zinc	ND	5	ug/L						
Semi-Volatiles									
Acenaphthene	ND	0.05	ug/L						
Acenaphthylene	ND	0.05	ug/L						
Anthracene	ND	0.01	ug/L						
Benzo [a] anthracene	ND	0.01	ug/L						
Benzo [a] pyrene	ND	0.01	ug/L						
Benzo [b] fluoranthene	ND	0.05	ug/L						
Benzo [g,h,i] perylene	ND	0.05	ug/L						
Benzo [k] fluoranthene	ND	0.05	ug/L						
Chrysene	ND	0.05	ug/L						
Dibenzo [a,h] anthracene	ND	0.05	ug/L						
Fluoranthene	ND	0.01	ug/L						
Fluorene	ND	0.05	ug/L						
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/L						
1-Methylnaphthalene	ND	0.05	ug/L						
2-Methylnaphthalene	ND	0.05	ug/L						
Methylnaphthalene (1&2)	ND	0.10	ug/L						
Naphthalene	ND	0.05	ug/L						
Phenanthrene	ND	0.05	ug/L						
Pyrene	ND	0.01	ug/L						
Surrogate: 2-Fluorobiphenyl	*16.1*		*ug/L*		*80.7*	*50-140*			
Surrogate: Terphenyl-d14	*19.9*		*ug/L*		*99.4*	*50-140*			
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	*77.9*		*ug/L*		*97.4*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Metals									
Mercury	ND	0.1	ug/L	ND			0.0	20	
Antimony	ND	0.5	ug/L	ND			0.0	20	
Arsenic	ND	1	ug/L	ND			0.0	20	
Barium	ND	1	ug/L	ND			0.0	20	
Beryllium	ND	0.5	ug/L	ND			0.0	20	
Boron	ND	10	ug/L	ND			0.0	20	
Cadmium	ND	0.1	ug/L	ND			0.0	20	
Chromium	ND	1	ug/L	ND			0.0	20	
Cobalt	ND	0.5	ug/L	ND			0.0	20	
Copper	ND	0.5	ug/L	ND				20	
Lead	ND	0.1	ug/L	ND			0.0	20	
Molybdenum	ND	0.5	ug/L	ND			0.0	20	
Nickel	ND	1	ug/L	ND				20	
Selenium	ND	1	ug/L	ND			0.0	20	
Silver	ND	0.1	ug/L	ND			0.0	20	
Sodium	ND	200	ug/L	ND			0.0	20	
Thallium	ND	0.1	ug/L	ND			0.0	20	
Uranium	ND	0.1	ug/L	ND			0.0	20	
Vanadium	ND	0.5	ug/L	ND				20	
Zinc	ND	5	ug/L	6			0.0	20	
Volatiles									
Benzene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND			0.0	30	
Toluene	ND	0.5	ug/L	ND			0.0	30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: Toluene-d8	*77.5*		*ug/L*		*96.9*	*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)	2010	25	ug/L		100	68-117			
F2 PHCs (C10-C16)	1450	100	ug/L		90.8	60-140			
F3 PHCs (C16-C34)	4180	100	ug/L		107	60-140			
F4 PHCs (C34-C50)	2740	100	ug/L		111	60-140			
Metals									
Mercury	2.88	0.1	ug/L	ND	95.9	70-130			
Antimony	47.8		ug/L	ND	95.7	80-120			
Arsenic	58.5		ug/L	ND	117	80-120			
Barium	50.2		ug/L	ND	100	80-120			
Beryllium	58.8		ug/L	ND	118	80-120			
Boron	49		ug/L	ND	87.4	80-120			
Cadmium	49.1		ug/L	ND	98.2	80-120			
Chromium	52.8		ug/L	ND	106	80-120			
Cobalt	49.8		ug/L	ND	99.6	80-120			
Copper	47.2		ug/L	ND	94.5	80-120			
Lead	56.6		ug/L	ND	113	80-120			
Molybdenum	45.8		ug/L	ND	91.6	80-120			
Nickel	47.7		ug/L	ND	95.4	80-120			
Selenium	52.3		ug/L	ND	104	80-120			
Silver	47.1		ug/L	ND	94.1	80-120			
Sodium	1000		ug/L	ND	92.4	80-120			
Thallium	57.5		ug/L	ND	115	80-120			
Uranium	49.1		ug/L	ND	98.3	80-120			
Vanadium	53.3		ug/L	ND	107	80-120			
Zinc	56		ug/L	6	100	80-120			
Semi-Volatiles									
Acenaphthene	4.98	0.05	ug/L		99.6	50-140			
Acenaphthylene	4.81	0.05	ug/L		96.2	50-140			
Anthracene	4.25	0.01	ug/L		85.1	50-140			
Benzo [a] anthracene	4.14	0.01	ug/L		82.9	50-140			
Benzo [a] pyrene	4.13	0.01	ug/L		82.6	50-140			
Benzo [b] fluoranthene	5.05	0.05	ug/L		101	50-140			
Benzo [g,h,i] perylene	4.79	0.05	ug/L		95.8	50-140			
Benzo [k] fluoranthene	4.75	0.05	ug/L		95.1	50-140			
Chrysene	4.88	0.05	ug/L		97.6	50-140			
Dibenzo [a,h] anthracene	4.45	0.05	ug/L		89.0	50-140			
Fluoranthene	4.15	0.01	ug/L		83.1	50-140			
Fluorene	5.45	0.05	ug/L		109	50-140			
Indeno [1,2,3-cd] pyrene	4.72	0.05	ug/L		94.4	50-140			
1-Methylnaphthalene	4.61	0.05	ug/L		92.2	50-140			
2-Methylnaphthalene	5.13	0.05	ug/L		103	50-140			
Naphthalene	4.76	0.05	ug/L		95.2	50-140			
Phenanthrene	4.16	0.05	ug/L		83.2	50-140			
Pyrene	4.30	0.01	ug/L		86.1	50-140			
Surrogate: 2-Fluorobiphenyl	*17.5*		*ug/L*		*87.6*	*50-140*			
Volatiles									
Benzene	36.8	0.5	ug/L		92.0	60-130			
Ethylbenzene	38.2	0.5	ug/L		95.5	60-130			
Toluene	42.3	0.5	ug/L		106	60-130			
m,p-Xylenes	83.6	0.5	ug/L		104	60-130			

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 24161

Report Date: 20-Jun-2018
Order Date: 13-Jun-2018
Project Description: PE2746

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
o-Xylene	42.8	0.5	ug/L		107	60-130			

Qualifier Notes:

QC Qualifiers :

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

Paracel ID: 1824410

PARACEL LABORATORIES LTD.

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Chain of Custody (Lab Use Only)

№ 117230

Page 1 of 1

Client Name: PATERSON GROUP	Project Reference: PE2746
Contact Name: ADRIAN MENYHART	Quote #
Address: 154 Colonnade Rd. S.	PO # 24161
Telephone:	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: 1824410

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)							
1	BH7-GW1	GW		3	June 12 18	AM	✓													✓
2	BH8-GW1	GW		6	|	|	✓		✓	✓	✓									✓
3	BH9-GW1	GW		6			✓		✓	✓	✓									✓
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): [signature]	Received by Driver/Depot: [signature] ROUSE	Received at Lab: SIVAKEPORN DOKMAI	Verified By: [signature]
Relinquished By (Print): ADRIAN M.	Date/Time: 13/06/18 4:10 PM	Date/Time: JUN 13, 2018 05.15	Date/Time: JUN 13 2018 6:14
Date/Time: JUNE 13 2018	Temperature: °C	Temperature: 20.7 °C	pH Verified By: