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Phase II Environmental Site Assessment

1354 and 1376 Carling Avenue
Ottawa, Ontario

Prepared For

Holloway Lodging Corporation

December 5, 2016

Report: PE3896-2R

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EXECUTIVE SUMMARY

Assessment

Paterson Group was retained by Holloway Lodging Corporation, to prepare a Phase II Environmental Site Assessment for the property addressed 1354 and 1376 Carling Avenue, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the Areas of Potential Environmental Concern (APECs) for the subject site identified during the Phase I ESA conducted in October of 2016. The Phase II ESA was carried out in conjunction with a geotechnical investigation and consisted of drilling a total of 13 boreholes, six of which were installed with groundwater monitoring wells, to assess soil and groundwater quality at the subject site.

Soil samples obtained from the boreholes were screened using visual observations and vapour measurements. Soils on site generally consist of topsoil or pavement structure over fill material, underlain by native silty clay, followed by glacial till (consisting of a silty clay matrix over a sandy silt to silty sand matrix). The fill material beneath the pavement structure generally consists of brown silty sand or clay with gravel and traces of topsoil at some locations.

Occasional fragments of building debris or asphalt were also noted at several borehole locations, particularly BH10 and BH5. Pieces of what appeared to be coal or slag material were also identified in the fill material recovered from BH10.

The results of the combustible vapour screening identified readings ranging from less than 5 to 25 ppm, which are not indicative of volatile substances. There were however hydrocarbon odours detected in samples recovered from BH5 and BH10 as well as a suspect odour in samples recovered from BH2.

Based on the screening results in combination with field observations, soil samples from BHs 1, 2, 4, 5, and 10 through 13 were submitted for analytical testing of a combination of volatile organic compounds (VOCs), benzene, ethylbenzene, toluene and xylene (BTEX), petroleum hydrocarbons (PCHs, F_1-F_4), polycyclic aromatic hydrocarbons (PAHs) and/or metals. Based on the analytical test results, petroleum hydrocarbon fractions (F_2, F_3, and/or F_4) exceeding MOECC Table 3 standards were identified in Samples BH10-SS3 and BH5-SS2. Various PAH parameters exceeding MOECC Table 3 standards were identified in Sample BH10-SS2.

PHC and/or PAH parameters were also identified in Samples BH1-SS6, BH4-SS5, BH5-SS2 and BH5-SS3 at concentrations below the MOECC Table 3 standards. Metal parameters were identified in Sample BH10-SS2 at concentrations also below the MOECC Table 3 standards. No VOC or BTEX concentrations were identified in any samples submitted for analytical testing, above the laboratory detection limits.

Groundwater samples were collected from the monitoring wells installed in BH1, BH2, BH4, BH11 and BH12 on November 7, 2016 and submitted for analysis of BTEX or VOC and PHC (F_1-F_4) parameters. The groundwater sample recovered from BH4 was also submitted for analysis of PAH parameters. The groundwater from BH9 was not submitted for analytical testing as this well was placed for triangulation purposes; no APECs are present in the vicinity of BH9.

No parameter concentrations were identified above the method detection limits in any of the groundwater samples submitted for anlaysis. The groundwater is therefore considered to be in compliance with the MOECC Table 3 standards.

Recommendations

Soil

Based on the findings of the Phase II-ESA, it is recommended that a remediation of the impacted fill material be conducted at the subject property. Based on the current use of the eastern portion of the subject property for parking only, and the nature of the impacts, there is no immediate environmental concern to the property or its occupants. The remediation can therefore be carried out at the time of redevelopment.

It is recommended that Paterson personnel be on site at the time of the excavation activities in order to supervise delineation and removal of impacted soils and to conduct confirmatory sampling. Prior to off-site disposal of impacted material at a waste disposal facility, a leachate analysis of a representative sample of impacted soil will be required in accordance with Ontario Regulation 347/558.

Groundwater

It is recommended that an additional monitoring well be installed within the area of impacted soil, in accordance with O.Reg. 153/04 as amended, to confirm that the groundwater at this location is clean.

The existing monitoring wells should be kept viable until they are no longer required for sampling purposes, at which time they should be decommissioned by a licenced contractor in accordance with Ontario Regulation 903.

1.0 INTRODUCTION

At the request of Holloway Lodging Corporation, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment (ESA) for the property addressed 1354 and 1376 Carling Avenue, in the City of Ottawa, Ontario. The purpose of this Phase II ESA was to address potential environmental concerns identified in a Phase I ESA conducted by Paterson in October of 2016.

1.1 Site Description

Address:	1354 and 1376 Carling Avenue, Ottawa, Ontario.
Legal Description:	Part Blocks 6 and 7 Registered Plan 221 and Part of Road Allowance between Concession 1 (Ottawa Front) and Concession A (Rideau Front) closed by by-law 231-66, Instrument 511589, Geographic Township of Nepean, City of Ottawa.
Property Identification	
Number:	04002-0019 (LT) and 04002-0020 (LT)
Location:	The subject site is located on the south side of Carling Avenue between Meath Street and Archibald Street in the City of Ottawa, Ontario. The subject site is shown on Figure 1 - Key Plan following the body of this report.
Latitude and Longitude:	45° 23' 04" N, 75° 44' 12" W.
Configuration:	Rectangular (approximately)
Site Area:	0.93 hectares (approximate)

1.2 Property Ownership

The subject property is currently owned by Holloway Lodging Corporation. Paterson was engaged to complete the Phase II ESA at the subject site by Mr. Gavin MacDonald, with Holloway Lodging Corporation. Mr. MacDonald can be reached by telephone at (514) 516-2349.

1.3 Current and Proposed Future Uses

The Phase II Property is currently occupied by a hotel and parking structure. It is our understanding that the property will be redeveloped in stages, with multi-level residential buildings with 1 to 2 stories of underground parking.

1.4 Applicable Site Condition Standard

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

- ❒ Coarse-grained soil conditions.
- ❒ Surface soil and groundwater conditions.
- ❒ Non-potable groundwater conditions.
- ❒ Residential land use.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II Property is occupied by a hotel complex. The operational portion of the hotel, addressed 1376 Carling Avenue, generally consisting of the main lobby, dining area, water park and guest rooms, is 1 to 3 stories with a full basement level. A tower addressed 1354 Carling Avenue and situated on the eastern portion of the Phase II Property, is no longer operational. The tower has 7 stories and a full basement that is adjoined to that of the main building. A 2-storey parking structure occupies the easternmost portion of the Phase II Property. The remainder of the property consists of paved access lanes/parking areas or landscaped areas.

The Phase II Property is at grade with the adjacent roadways and gently slopes down to the south.

2.2 Past Investigations

According to the property owner, no previous Phase I or Phase II ESA reports have been completed for the subject land.

A Phase I ESA, in general accordance with Ontario Regulation (O.Reg.) 153/04, amended by O.Reg. 269/11, was conducted by Paterson in October of 2016. Based on the findings of the Phase I-ESA, eight (8) areas of potential environmental concern (APECs) were identified on the subject property. The APECs are discussed further in Section 3.3 Phase I Conceptual Site Model.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The Phase II-ESA was carried out during the interim of October 25 through October 31, 2016, in conjunction with a Geotechnical Investigation for the proposed development. The field program consisted of drilling a total of 13 boreholes across the Phase II Property. As per the Sampling and Analysis Plan appended to this report, the boreholes were placed to address the historical retail fuel outlet on the northwestern portion of the property (BH12 and BH13), the historical retail fuel outlet and automotive service garage on the northeastern portion of the Phase II Property (BH4 and BH10), the offsite historical retail fuel outlets northeast and east of the Phase II Property (BH11) and the former Department of Highways property north of the northwestern portion of the site (BH1). The exterior boreholes, BH1 through BH10 were placed to assess site conditions for both environmental and geotechnical assessments. Three (3) boreholes, BH11 through BH13 were placed for environmental purposes only, within the basement level of the garage structure and the basement level of 1376 Carling Avenue (the Beachcomber).

Further details of the subsurface investigation are provided in Section 4.0.

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 (CPCs) identified in the Phase I-ESA, in conjunction with the findings of the field program.

The CPCs for the soil and/or groundwater within the APECs identified on the Phase II Property, include benzene, toluene, ethylbenzene, and xylenes (BTEX), petroleum hydrocarbons, fractions 1 through 4 (PHCs F_1-F_4), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs) and metals.

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

Based on The Geological Survey of Canada website, bedrock in the area of the site consists of interbedded limestone and dolomite of the Gull River Formation. Overburden is reported to consist of Glacial Till of depths ranging from 5 to 10 m over the majority of the site and 10 to 15 m on the southwestern corner of the site.

The regional topography slopes down to the north, however the topography in the immediate vicinity of the Phase I Property slopes slightly down to the south. The local groundwater flow beneath the Phase I Property was inferred to be in a southerly direction.

Contaminants of Potential Concern

As noted above, the CPCs identified in this Phase I ESA included VOCs or BTEX, PHCs, PAHs and metals. CPCs may be encountered in the soil or groundwater in the vicinity of the historical on-site and off-site retail fuel outlets and/or automotive service garages, on the northeastern and northwestern portions of the Phase I Property. Potential mechanisms of contaminant transport within the groundwater system include advection, dispersion, and diffusion.

Existing Buildings and Structures

The subject site is occupied by an operational hotel with an interior water park. The portions of the hotel occupied by guest rooms are 3 stories, while the lobby and common areas are 1 to 2 stories. A tower, previously housing guest rooms, is present on the eastern portion of the Phase I Property and has 7 stories including the penthouse level; the tower was not operation at the time of the site visit due to the presence of asbestos. A basement level connects the tower to the main hotel building. Two access stairwells leading to the basement of the western portion of the hotel, are present on the west portion of the Phase I property along Meath Street. A garage structure is present on the eastern portion of the subject property. The garage consists of a below grade and an above grade level.

Water Bodies

There are no water bodies on the Phase I Property or within the Phase I study area. The closest water body is the Ottawa River, located approximately 2km to the northwest.

Areas of Natural Significance

No areas of natural significance were identified on the Phase I Property or in the Phase I study area.

Drinking Water Wells

No drinking water wells are located on the Phase I Property or within the Phase I study area.

Groundwater Monitoring Wells

No groundwater monitoring wells were observed on the Phase I Property or within the Phase I study area at the time of the site visit.

According to electronic mapping provided by the MOECC, there are 25 records for monitoring wells in the Phase I Study area at the following addresses: 1447 Carling Avenue, 848 Merivale Road and Thames Street. The properties at 1447 Carling Avenue and 848 Merivale Road are not considered to pose a concern to the Phase I Property based on their separation distances of over 150 m. The monitoring wells installed on Thames Street were installed as part of an Environmental Screening Program for a municipal water main replacement project and are not considered to be representative of a concern in the vicinity, based on the findings of the historical research conducted as part of the Phase I ESA. Records for the decommissioning of the aforementioned wells at 1447 Carling Avenue were also identified.

Neighbouring Land Use

Neighbouring land use in the Phase I study area is primarily commercial and residential with occasional community or institutional uses. Land use is shown on Drawing PE3896-2 - Surrounding Land Use Plan.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

Potentially contaminating activities (PCAs) that are considered to represent areas of potential environmental concern (APECs) on the Phase I Property are presented in Table 1 below.

Additional historical PCAs were identified within the Phase I study area, however these activities were not considered to represent APECs on the Phase I Property based on their respective separation distances and inferred orientations down or cross-gradient with respect to the Phase I Property.

Table 1
Areas of Potential Environmental Concern

Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern with respect to Phase I Property	Potentially Contaminating Activity	Location of PCA (on-site or off-site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater, Soil, and/or Sediment)
APEC 1: resulting from historical underground storage tanks (USTs) at former Ontario Department of Highways to the north of the western portion of the Phase I Property	Northwestern portion of the Phase I Property	Item 28, Table 2, O.Reg.153/04 as amended by O.Reg.269/11 ("Gasoline and Associated Products Storage in Fixed Tanks")	Off-site	VOCs, PHCs (F_1-F_4)	Soil and Groundwater
APEC 2: resulting from former on-site retail fuel outlet (3 USTs) on northwestern portion of Phase I Property	Northwestern portion of Phase I Property	Item 28, Table 2, O.Reg.153/04 as amended by O.Reg.269/11 ("Gasoline and Associated Products Storage in Fixed Tanks")	On-site	BTEX, PHCs (F_1-F_4)	Soil and Groundwater
APEC 3: resulting from on-site diesel generator	Northwestern portion of Phase I Property	Item 28, Table 2, O.Reg.153/04 as amended by O.Reg.269/11 ("Gasoline and Associated Products Storage in Fixed Tanks")	On-site	BTEX, PHCs (F_1-F_4)	Soil and Groundwater
APEC 4: Resulting from former retail fuel outlet (2 USTs) on northeastern portion of Phase I Property	Northeastern portion of Phase I Property	Item 28, Table 2, O.Reg.153/04 as amended by O.Reg.269/11 ("Gasoline and Associated Products Storage in Fixed Tanks")	On-site	BTEX, PHCs (F_1-F_4)	Soil and Groundwater

Table 1 Continued
Areas of Potential Environmental Concern

Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern with respect to Phase I Property	Potentially Contaminating Activity	Location of PCA (on-site or off-site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater, Soil, and/or Sediment)
APEC 5: Resulting from former automotive service garage on northeastern portion of Phase I Property	Northeastern portion of Phase I Property	Item 52, Table 2, O.Reg.153/04 as amended by O.Reg.269/11 ("Storage, maintenance, fuelling and repair of equipment, vehicles and material used to maintain transportation systems")	On-site	VOCs, PHCs (F_1-F_4), PAHs	Soil and Groundwater
APEC 6: Resulting from former retail fuel outlet (2 USTs) at 1330 Carling Avenue, across Archibald Street	Northeastern portion of Phase I Property	Item 28, Table 2, O.Reg.153/04 as amended by O.Reg.269/11 ("Gasoline and Associated Products Storage in Fixed Tanks")	Off-site	VOCs, PHCs (F_1-F_4)	Soil and Groundwater
APEC 7: Resulting from former retail fuel outlet (2 USTs) across Carling Avenue	Northeastern portion of Phase I Property	Item 28, Table 2, O.Reg.153/04 as amended by O.Reg.269/11 ("Gasoline and Associated Products Storage in Fixed Tanks")	Off-site	VOCs, PHCs (F_1-F_4)	Soil and Groundwater
APEC 8: Resulting from imported fill material	Eastern portion of Phase I Property	Item 30, Table 2, O.Reg.153/04 as amended by O.Reg.269/11 ("Importation of Fill Material of Unknown Quality")	On-site	Metals, PAHs	Soil and/or Groundwater

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 resulting from current and historical uses of neighbouring properties. The presence of potentially contaminating activities was confirmed by a variety of independent sources. 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. Duplicate samples were not submitted for analysis as part of this assessment and will be conducted during future work. A trip blank was not conducted during the groundwater sampling event; no VOC concentrations were detected in any of the groundwater samples submitted for analysis and therefore the lack of trip blank is not considered to affect QA/QC for this project. Otherwise, there were no deviations from the Sampling and Analysis Plan.

3.5 Impediments

Physical impediments encountered during the Phase II-ESA include the subject buildings and structures.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted during the interim of October 25 through October 31, 2016 and consisted of drilling 13 boreholes (BH1 to BH13). The boreholes were placed to address the aforementioned APECs as well as to provide data for the concurrent Geotechnical Investigation. The drilling contractors were George Downing Estate Drilling (Downing) of Hawkesbury, Ontario and CCC Environmental and Geotechnical Drilling Ltd. (CCC) of Ottawa, Ontario. The exterior boreholes conducted by Downing (BH1 through BH10) were advanced using a track-mounted low-clearance drill rig under the full-time supervision of Paterson personnel. The interior boreholes conducted by CCC (BH11 to BH13) were advanced using portable equipment, also under the full-time supervision of Paterson personnel. The borehole locations are identified on the attached Drawing PE3896-3 - Test Hole Location Plan.

The exterior boreholes were drilled to depths ranging from approximately 6.1 to 10.1 m below the existing surface grade. Boreholes were completed on practical refusal to augering at all locations with the exception of BH1, BH2 and BH4. Dynamic cone penetration tests (DCPTs) were conducted at BH2 and BH4, where inferred bedrock was encountered at approximately 10.1 m below grade. Boreholes BH1, BH2, BH4 and BH9 were instrumented with groundwater monitoring wells upon their completion.

The borehole completed within the bottom level of the parking structure (BH11), was completed to a depth of approximately 4.3 m below the pavement structure. Boreholes 12 and 13, completed within the Beachcomber mechanical room (1376 Carling Avenue) and former Beachcomber nightclub, were completed to depths of approximately 2.8 and 2.7 m below the respective floor slabs. Boreholes BH11 and BH12 were instrumented with a groundwater monitoring well upon their completion.

4.2 Soil Sampling

A total of 126 soil samples were obtained from the boreholes by means of split spoon sampling with the sampling of shallow soils directly from auger flights. Split spoon samples from the exterior boreholes were taken at approximate 0.76 to 1.52 m intervals, while continuous samples were taken from the interior boreholes advanced with portable equipment. The depths at which split spoon and auger flight 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 generally consist of a pavement structure over fill material underlain by native silty clay over Glacial Till. The upper till material consists of silty clay to clayey silt with gravel and occasional cobbles, while at depth, the till material becomes a sandy silt to silty sand with gravel and trace cobbles.

The fill material encountered beneath the pavement structure generally consists of brown, silty sand or silty clay with gravel, as well as some topsoil. Occasional brick fragments were identified in the fill material at BH3 and BH4, while larger pieces of brick were identified at BH10 and BH5. Pieces of glass and what appeared to be pieces of coal or slag, were also identified in the fill material at BH10.

Traces of asphalt were identified in the fill material at BH1, BH4 and BH9. It is considered likely that the asphalt in BH4 and BH9 is a result of the augering process, while that observed in BH1 is considered to be remnant asphalt from the original location of Carling Avenue prior to its realignment.

Specific details of the soil profile at each test hole location are presented on the Soil Profile and Test Data sheets appended to this report.

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 a soil vapour screening with an RKI Eagle gas detector with methane elimination and calibrated to hexane and/or a MiniRae photoionization detector with detection limit of 0.1 ppm and 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/manipulated gently as the measurements were taken. The peak reading registered within the first 15 seconds was recorded as the vapour measurement.

The parts per million (ppm) scale is used to measure concentrations of hydrocarbon vapours that are too low to register on the Lower Explosive Limit (LEL) scale. The explosive point, 100% LEL, represents the leanest mixture which will burn (or explode) if ignited.

The combustible vapour readings reported by the RKI Eagle were found to range from 0 ppm to 25 ppm, while those detected by the PID were less than 1 ppm. The readings are not indicative of volatile substances such as gasoline. It should be noted however that combustible vapours cannot be used to identify heavier products such as waste oil.

Please refer to the Soil Profile and Test Data sheets provided in Appendix 1, for soil sample headspace results.

Soil samples were selected for analytical testing based on visual appearance, odours, location, and vapour readings.

4.4 Groundwater Monitoring Well Installation

Four (4) groundwater monitoring wells were installed by Downing and two (2) groundwater monitoring wells were installed by CCC, under full-time supervision by Paterson personnel. The monitoring wells consisted of 50 mm diameter (exterior boreholes) or 32 mm (interior boreholes) Schedule 40 threaded PVC risers and screens. A sand pack consisting of silica sand was placed around the screen, and a bentonite seal was placed above the screen to minimize cross-contamination. Monitoring well construction details are provided on the Soil Profile and Test Data Sheets in Appendix 1. A summary of monitoring well construction details is provided below in Table 2.

Table 2: Monitoring Well Construction Details

Well ID	Ground Surface Elevation	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH1	75.28	6.1	3.1-6.1	2.4-6.1	0.3-2.4	PVC riser
BH2	75.13	6.1	3.1-6.1	2.4-6.1	0.3-2.4	PVC riser
BH4	74.48	6.1	3.1-6.1	2.4-6.1	0.3-2.4	PVC riser
BH9	74.28	6.1	3.1-6.1	2.4-6.1	0.3-2.4	PVC riser
BH11	72.67	4.3	1.3-4.3	0.8-4.3	0.3-0.8	PVC riser
BH12	71.49	2.8	1.3-2.8	0.8-2.8	0.3-0.8	PVC riser

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 groundwater and soil samples were submitted for analysis:

Table 3: Soil Samples Submitted

Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analyzed					Rationale
		BTEX	VOCs	PHCs (F_1-F4)	PAHs	Metals	
BH1-SS6	3.8-4.6m bgs; native silty clay	X		X			To address potential PHC impacts from off-site; sample closest to water table.
BH2-SS5/SS6	3.0-4.2m bgs; native silty clay		X				Odours detected in sample; sample combined due to low recovery.
BH4-SS5	3.0-3.6m bgs; native silty clay	X		X			Location of former tank nest; highest vapour reading and near water table.
BH5-SS2	1.8-2.4m bgs; fill material		X	X	X		Petroleum hydrocarbon odours detected; fill material dark in colour with building debris fragments (brick).
BH5-SS3*	2.6-3.2m bgs; fill material and native silty clay			X**			To delineate vertical extent of PHC impacts.
BH10-SS2	0.8-1.4m bgs; fill material				X	X	Fill material dark in colour with building debris (brick and glass) as well as fragments of coal or slag.
BH10-SS3	1.5-2.1 m bgs; fill material		X	X			Petroleum hydrocarbon odours.
BH10-SS5*	3.0-3.6m bgs; native silty clay			X**	X		To delineate vertical extent of PHC and PAH impacts.
BH11-SS2	1.2-1.8m bgs; native till		X	X			Highest vapour reading; closest sample to water table.
BH12-SS3	1.2-1.8m bgs; native till	X		X			Highest vapour reading; sample in water table.
BH13-SS3	1.2-1.8m bgs; native till	X		X			Highest vapour reading; sample in water table.

Notes:
- ❒ Samples denoted * were later submitted for delineation purposes.
- ❒ Samples denoted ** were submitted for PHC fractions with the exception of F_1

Table 4: Groundwater Samples Submitted						
Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analyzed				Rationale
		BTEX	PHC (F_1-F_4)	VOCs	PAHs	
BH1-GW1	3.1-6.1 m bgs; native silty clay		X	X		Assessment of groundwater quality at the subject site based on potential contaminants of concern.
BH2-GW1	3.1-6.1 m bgs; native silty clay		X	X		
BH4-GW1	3.1-6.1 m bgs; native silty clay		X	X	X	
BH11-GW1	1.3-4.3 m bgs; native till		X	X		
BH12-GW1	1.3-2.8 m bgs; native till	X	X			

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

4.7 Residue Management

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

4.8 Elevation Surveying

Borehole elevations were surveyed using a laser level. Ground surface elevations were surveyed relative to a benchmark (BM), consisting of the top spindle of a fire hydrant located at the southeast corner of the intersection of Archibald Street and Carling Avenue. As per the topographic plan prepared by Annis, O'Sullivan, vollebekk Ltd., the geodetic elevation is 75.14 m above sea level (ASL). The location of the site benchmark is shown on Drawing PE3896-3 – Test Hole Location Plan.

4.9 Quality Assurance and Quality Control Measures

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

5.0 REVIEW AND EVALUATION

5.1 Geology

Site geology details are provided in the Soil Profile and Test Data Sheets provided in Appendix 1. Site soils generally consist of a pavement structure (with the exception of BH1, BH12 and BH13 locations where topsoil or concrete floor slabs are present) underlain by fill material, followed by native silty clay and glacial till. According to geological mapping of the area, the underlying bedrock consists of interbedded limestone and dolomite of the Gull River Formation.

Fill material generally consisted of brown silty sand with some topsoil and clay, although traces of brick were identified in the fill material on the northeastern portion of the site. More significant quantities of brick were identified in the fill material at BH10, where pieces of glass and fragments of apparent coal or slag were also identified. Occasional pieces of asphalt were also identified in the fill material at BH4 and BH9 and are considered to have resulted from the augering process. Asphalt identified in the fill material at BH1 is considered to be the result of the original location of Carling Avenue, prior to its realignment in the early 1960's. Inferred bedrock was encountered at depths ranging from 6.1 m to 10.1 m across the site.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured using an electronic water level meter and are summarized below in Table 5. All elevations are relative to a geodetic benchmark with elevation of 75.14 m ASL, as discussed above. It should be noted that groundwater levels are expected to fluctuate throughout the year with seasonal variations.

Table 5: Groundwater Level Measurements				
Borehole Location	**Ground Surface Elevation (m ASL)**	**Water Level Depth (m below grade)**	**Water Level Elevation (m ASL)**	**Date of Measurement**
BH1	75.28	4.25	71.03	November 7, 2016
BH2	75.13	3.84	71.29	
BH4	74.48	2.95	71.53	
BH9	74.28	2.20	72.08	
BH11	72.67	1.31	71.36	
BH12	71.49	0.2	71.29	

Based on the groundwater elevations recorded on November 7, 2016, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE3986-6 - Groundwater Contour Plan. Based on the contour mapping, groundwater flow at the subject site generally appears to be towards the west. An average horizontal hydraulic gradient of approximately 0.006 m/m was calculated.

5.3 Fine-Medium Soil Texture

Coarse-grained soil standards have been used for the subject site as grain size analysis was not completed.

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in soil vapour readings of 0 ppm to 25 ppm. Field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets appended to this report.

5.5 Soil Quality

Eleven soil samples were submitted to Paracel Laboratories for analysis of BTEX, PHC (F_1-F_4), VOC, PAH and/or metal parameters. The results of the soil testing are presented in Tables 6 through 9. The laboratory certificates of analysis are provided in Appendix 1.

Table 6: Soil Analytical Test Results – BTEX and PHCs (F_1-F_4)

Parameter	MDL (µg/g)	Soil Samples (µg/g)				MOECC Table 3 Standards Residential Coarse (µg/g)
		BH1-SS6	BH4-SS5	BH5-SS2[1]	BH5-SS3[1]	
		Oct. 27, 2016	Oct. 28, 2016	Oct. 31, 2016		
Benzene	0.02	nd	nd	nd	Nt	0.21
Ethylbenzene	0.05	nd	nd	nd	Nt	2
Toluene	0.05	nd	nd	nd	Nt	2.3
Xylenes	0.05	nd	nd	nd	Nt	3.1
PHC F_1	7	nd	nd	nd	Nt	55
PHC F_2	4	nd	nd	nd	nd	98
PHC F_3	8	72	77	**525**	38	300
PHC F_4	6	160	53	721	42	2,800
PHC F_{4G}	50	Nt	Nt	575	Nt	2,800

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL; Nt – not tested for this parameter
- **bold** – concentration exceeds MOECC Table 3 standards
- 1 BTEX parameters tested as part of the VOC parameter group
- 2 sample exceeded hold time

Table 6 Continued: Soil Analytical Test Results – BTEX and PHCs (F_1-F_4)

Parameter	MDL (µg/g)	Soil Samples (µg/g)					MOECC Table 3 Standards Residential Coarse (µg/g)
		BH10[1]-SS3	BH10[2]-SS5	BH11[1]-SS2	BH12-SS3	BH13-SS3	
		Oct. 28, 2016		Oct. 31, 2016			
Benzene	0.02	nd	Nt	nd	nd	nd	0.21
Ethylbenzene	0.05	nd	Nt	nd	nd	nd	2
Toluene	0.05	nd	Nt	nd	nd	nd	2.3
Xylenes	0.05	nd	Nt	nd	nd	nd	3.1
PHC F_1	7	nd	Nt	nd	nd	nd	55
PHC F_2	4	**181**	Nt	nd	nd	nd	98
PHC F_3	8	**7,460**	nd	nd	nd	nd	300
PHC F_4	6	**5,460**	nd	nd	nd	nd	2,800
PHC F_{4G}	50	**6,590**	nd	Nt	Nt	Nt	2,800

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL; Nt – not tested for this parameter
- **bold** – concentration exceeds MOECC Table 3 standards
- 1 - BTEX parameters tested as part of the VOC parameter group
- 2 - sample exceeded hold time

No BTEX parameters were identified in any of the soil samples submitted for analysis. Petroleum hydrocarbon fractions F_3 and F_4 were identified in Samples BH1-SS6, BH4-SS5, and BH5-SS3 at concentrations below the MOECC Table 3 standards. PHC concentrations identified in Samples BH5-SS2 and BH10-SS3 exceed the MOECC Table 3 standards. PHC concentrations were not detected above the method detection limits in soil Sample BH10-SS5 or samples recovered from BH11, BH12 and BH13.

Table 7: Soil Analytical Test Results – VOCs

Parameter	MDL (µg/g)	Soil Samples (µg/g)				MOECC Table 3 Residential Standards (µg/g)
		BH2-SS5/SS6	BH5-SS2	BH10-SS3	BH11-SS2	
		Oct.27, 2016	Oct. 31, 2016	Oct. 28, 2016	Oct. 31, 2016	
Acetone	0.50	nd	nd	nd	nd	16
Benzene	0.02	nd	nd	nd	nd	0.21
Bromodichloromethane	0.05	nd	nd	nd	nd	13
Bromoform	0.05	nd	nd	nd	nd	0.27
Bromomethane	0.05	nd	nd	nd	nd	0.05
Carbon Tetrachloride	0.05	nd	nd	nd	nd	0.05
Chlorobenzene	0.05	nd	nd	nd	nd	2.4
Chloroform	0.05	nd	nd	nd	nd	0.05
Dibromochloromethane	0.05	nd	nd	nd	nd	9.4
Dichlorodifluoromethane	0.05	nd	nd	nd	nd	16
1,2-Dichlorobenzene	0.05	nd	nd	nd	nd	3.4
1,3-Dichlorobenzene	0.05	nd	nd	nd	nd	4.8
1,4-Dichlorobenzene	0.05	nd	nd	nd	nd	0.083
1,1-Dichlroethane	0.05	nd	nd	nd	nd	3.5
1,2-dichlorethane	0.05	nd	nd	nd	nd	0.05
1,1-Dichlroethylene	0.05	nd	nd	nd	nd	0.05
Cis-1,2-Dichloroethylene	0.05	nd	nd	nd	nd	3.4
Trans-1,2-dichloroethylene	0.05	nd	nd	nd	nd	0.084
1,2-dichloropropane	0.05	nd	nd	nd	nd	0.05
Cis-1,3-Dichloropropylene	0.05	nd	nd	nd	nd	N/V
Trans-1,3-Dichloropropylene	0.05	nd	nd	nd	nd	N/V
1,3-Dichloropropene, total	0.05	nd	nd	nd	nd	0.05
Ethylbenzene	0.05	nd	nd	nd	nd	2
Ethylene dibromide	0.05	nd	nd	nd	nd	0.05
Hexane	0.05	nd	nd	nd	nd	2.8
Methyl Ethyl ketone	0.05	nd	nd	nd	nd	16
Methyl Isobutyl ketone	0.05	nd	nd	nd	nd	1.7
Methyl tert-butyl ether	0.05	nd	nd	nd	nd	0.75
Methylene Chloride	0.05	nd	nd	nd	nd	0.1
Styrene	0.05	nd	nd	nd	nd	0.7
1,1,1,2-Tetrachloroethane	0.05	nd	nd	nd	nd	0.058
1,1,2,2-Tetrachloroethane	0.05	nd	nd	nd	nd	0.05
Tetrachloroethylene	0.05	nd	nd	nd	nd	0.28
Trichlorofluoromethane	0.05	nd	nd	nd	nd	4
Vinyl Chloride	0.02	nd	nd	nd	nd	0.02
Xylenes	0.05	nd	nd	nd	nd	3.1

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- N/V – no value provided by the MOECC

VOC parameters were not detected above the method detection limits, in any of the soil samples submitted for analytical testing.

Table 8: Soil Analytical Test Results – PAHs

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOECC Table 3 Standards Residential Coarse (µg/g)
		BH5-SS2	BH10-SS2	BH10-SS5	
		Oct.31, 2016	Oct. 28, 2016		
Acenaphthene	0.02	nd	1.26	nd	7.9
Acenaphthylene	0.02	0.15	0.12	nd	0.15
Anthracene	0.02	0.10	**3.37**	nd	0.67
Benzo[a]anthracene	0.02	0.16	**5.27**	nd	0.5
Benzo[a]pyrene	0.02	0.24	**5.74**	nd	0.3
Benzo[b]fluoranthene	0.02	0.26	**5.16**	nd	0.78
Benzo[ghi]perylene	0.02	0.21	3.76	nd	6.6
Benzo[k]fluoranthene	0.02	0.12	**3.60**	nd	0.78
Chrysene	0.02	0.19	5.49	nd	7
Dibenzo[a,h]anthracene	0.02	0.05	**1.01**	nd	0.1
Fluoranthene	0.02	0.25	**13.5**	nd	0.69
Fluorene	0.02	nd	1.55	nd	62
Indeno[1,2,3-cd]pyrene	0.02	0.17	**3.25**	nd	0.38
Methylnaphthalene	0.04	0.12	0.91	nd	0.99
Naphthalene	0.01	0.05	**0.70**	nd	0.6
Phenanthrene	0.02	0.07	**11.4**	nd	6.2
Pyrene	0.02	0.26	11.2	nd	78

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

Various PAH parameters were identified in soil Samples BH5-SS2 and BH10-SS2. All PAH concentrations detected in Sample BH5-SS2 are in compliance with the MOECC Table 3 standards, while 10 PAH parameters identified in Sample BH10-SS2 exceed the MOECC Table 3 standards. No PAH parameters were identified in Sample BH10-SS5, above the method detection limits.

Table 9: Soil Analytical Test Results – Metals					
Parameter	**MDL (µg/g)**	**Soil Sample (µg/g) Oct.28, 2016**			**MOECC Table 3 Standards Residential Coarse**
		BH7-AU1	**BH9-AU1**	**BH10-SS2**	
Antimony	0.2	nd	nd	nd	7.5
Arsenic	1.0	nd	nd	nd	18
Barium	0.5	132	96.3	246	390
Beryllium	0.2	nd	nd	nd	4
Boron	5.0	17.9	14.2	10.3	120
Boron, available	0.5	nd	nd	0.7	1.5
Cadmium	0.1	nd	nd	1.2	1.2
Chromium (total)	1.0	10.5	14.0	45.5	160
Chromium (VI)[1]	0.2	nd	nd	nd	8
Cobalt	0.1	5.1	5.4	10.7	22
Copper	0.5	35.8	13.9	34.2	140
Lead	1.0	18.6	10.6	101	120
Mercury[1]	0.05	nd	nd	nd	0.27
Molybdenum	0.5	nd	nd	nd	6.9
Nickel	0.5	10.9	12.0	23.5	100
Selenium	0.5	nd	nd	nd	2.4
Silver	0.2	nd	nd	nd	20
Thallium	0.05	nd	nd	nd	1
Uranium	0.05	nd	nd	nd	23
Vanadium	5.0	12.0	19.8	42.0	86
Zinc	5.0	10.7	16.7	101	340

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- 1 – Holding time for Chromium (VI) had been exceeded upon receipt of the sample at the laboratory.

All metal parameters identified in soil Sample BH10-SS2 are in compliance with MOECC Table 3 standards.

Table 10: Maximum Soil Concentrations			
Parameter	**Maximum Concentration**	**Borehole**	**Depth Interval (m BGS)**
PHC F_2	181	BH10-SS3	1.5-2.1 m bgs; fill material
PHC F_3	**7,460**		
PHC F_4	**5,460**		
PHC F_{4G}	**6,590**		
Acenapthene	1.26	BH10-SS2	0.8-1.4m bgs; fill material
Acenaphthylene	0.15	BH5-SS2	1.8-2.4m bgs; fill material
Anthracene	**3.37**	BH10-SS2	0.8-1.4m bgs; fill material
Benzo[a]anthracene	**5.27**		
Benzo[a]pyrene	**5.74**		
Benzo[b]fluoranthene	**5.16**		
Benzo[ghi]perylene	3.76		
Benzo[k]fluoranthene	**3.60**		
Chrysene	5.49		
Dibenzo[a,h]anthracene	**1.01**		
Fluoranthene	**13.5**		
Fluorene	1.55		
Indeno[1,2,3-cd]pyrene	**3.25**		
Methylnaphthalene	0.91		
Naphthalene	**0.70**		
Phenanthrene	**11.4**		
Pyrene	11.2		
Barium	246		
Boron	17.9		
Boron (available)	0.7		
Cadmium	1.2		
Chromium (Total)	45.5		
Cobalt	10.7		
Copper	35.8		
Lead	101		
Nickel	23.5		
Vanadium	42.0		
Zinc	101		
Notes: ❒ **bold** – exceeds MOECC Table 3 standard			

All other parameters analysed were not detected above the method detection limits.

5.6 Groundwater Quality

Groundwater samples from the monitoring wells installed in BH1A, BH2A, BH4A, BH11 and BH12 were submitted for laboratory analysis of a combination of VOC, BTEX, PHC (F_1-F_4) and PAH parameters. The groundwater samples were obtained from the screened intervals noted on Table 2, above. The results of the analytical testing are presented below in Tables 11, 12 and 13. The laboratory certificates of analysis are provided in Appendix 1.

Table 11: Groundwater Analytical Test Results - BTEX/PHC (F_1 – F_4)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)					MOECC Table 3 Residential Standards (µg/L)
		BH1-GW1	BH2-GW1	BH4-GW1	BH11-GW1	BH12-GW1	
		November 7, 2016					
Benzene	0.5	nd[1]	nd[1]	nd[1]	nd[1]	nd	44
Ethylbenzene	0.5	nd[1]	nd[1]	nd[1]	nd[1]	nd	2,300
Toluene	0.5	nd[1]	nd[1]	nd[1]	nd[1]	nd	18,000
Xylenes (total)	0.5	nd[1]	nd[1]	nd[1]	nd[1]	nd	4,200
PHC F_1	25	nd	nd	nd	nd	nd	750
PHC F_2	100	nd	nd	nd	nd	nd	150
PHC F_3	100	nd	nd	nd	nd	nd	500
PHC F_4	100	nd	nd	nd	nd	nd	500

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

No BTEX or PHC parameters were identified above the method detection limits in any of the samples submitted for analytical testing. The results are in compliance with MOECC Table 3 standards.

Table 12: Analytical Test Results – Groundwater
VOCs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) November 7, 2016				MOECC Table 3 Residential Standards (µg/L)
		BH1-GW1	BH2-GW1	BH4-GW1	BH11-GW1	
Acetone	5.0	nd	nd	nd	nd	130,000
Benzene	0.5	nd	nd	nd	nd	44
Bromodichloromethane	0.5	nd	nd	nd	nd	85,000
Bromoform	0.5	nd	nd	nd	nd	380
Bromomethane	0.5	nd	nd	nd	nd	5.6
Carbon Tetrachloride	0.2	nd	nd	nd	nd	0.79
Chlorobenzene	0.5	nd	nd	nd	nd	630
Chloroform	0.5	nd	nd	nd	nd	2.4
Dibromochloromethane	0.5	nd	nd	nd	nd	82,000
Dichlorodifluoromethane	1.0	nd	nd	nd	nd	4,400
1,2-Dichlorobenzene	0.5	nd	nd	nd	nd	4,600
1,3-Dichlorobenzene	0.5	nd	nd	nd	nd	9,600
1,4-Dichlorobenzene	0.5	nd	nd	nd	nd	8
1,1-Dichlroethane	0.5	nd	nd	nd	nd	320
1,2-dichlorethane	0.5	nd	nd	nd	nd	1.6
1,1-Dichlroethylene	0.5	nd	nd	nd	nd	1.6
Cis-1,2-Dichloroethylene	0.5	nd	nd	nd	nd	1.6
Trans-1,2-dichloroethylene	0.5	nd	nd	nd	nd	1.6
1,2-dichloropropane	0.5	nd	nd	nd	nd	16
Cis-1,3-Dichloropropylene	0.5	nd	nd	nd	nd	N/V
Trans-1,3-Dichloropropylene	0.5	nd	nd	nd	nd	N/V
1,3-Dichloropropene, total	0.5	nd	nd	nd	nd	5.2
Ethylbenzene	0.5	nd	nd	nd	nd	2,300
Ethylene dibromide	0.2	nd	nd	nd	nd	0.25
Hexane	1.0	nd	nd	nd	nd	51
Methyl Ethyl ketone	5.0	nd	nd	nd	nd	470,000
Methyl Isobutyl ketone	5.0	nd	nd	nd	nd	140,000
Methyl tert-butyl ether	2.0	nd	nd	nd	nd	190
Methylene Chloride	5.0	nd	nd	nd	nd	610
Styrene	0.5	nd	nd	nd	nd	1,300
1,1,1,2-Tetrachloroethane	0.5	nd	nd	nd	nd	3.3
1,1,2,2-Tetrachloroethane	0.5	nd	nd	nd	nd	3.2
Tetrachloroethylene	0.5	nd	nd	nd	nd	1.6
Trichlorofluoromethane	1.0	nd	nd	nd	nd	2,500
Vinyl Chloride	0.5	nd	nd	nd	nd	0.5
Xylenes	0.5	nd	nd	nd	nd	4,200

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- N/V – no value provided by the MOECC

No VOC parameters were identified above the method detection limits in any of the groundwater samples submitted for analytical testing. The results are therefore in compliance with the MOECC Table 3 standards.

Table 13: Groundwater Analytical Test Results – PAHs

Parameter	MDL (µg/L)	Groundwater Sample (µg/L) November 7, 2016	MOECC Table 3 Standards Residential Coarse (µg/L)
		BH4-GW1	
Acenaphthene	0.05	nd	7.9
Acenaphthylene	0.05	nd	0.15
Anthracene	0.01	nd	0.67
Benzo[a]anthracene	0.01	nd	0.5
Benzo[a]pyrene	0.01	nd	0.3
Benzo[b]fluoranthene	0.05	nd	0.78
Benzo[ghi]perylene	0.05	nd	6.6
Benzo[k]fluoranthene	0.05	nd	0.78
Chrysene	0.05	nd	7
Dibenzo[a,h]anthracene	0.05	nd	0.1
Fluoranthene	0.01	nd	0.69
Fluorene	0.05	nd	62
Indeno[1,2,3-cd]pyrene	0.05	nd	0.38
Methylnaphthalene	0.10	nd	0.99
Naphthalene	0.05	nd	0.6
Phenanthrene	0.05	nd	6.2
Pyrene	0.01	nd	78

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

No PAH parameters were identified in the groundwater sample recovered from BH4A. The results are therefore in compliance with MOECC Table 3 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.

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

The Phase II Property is located on the south side of Carling Avenue between Meath Street and Archibald Street, in the City of Ottawa, Ontario. The Phase II Property has an area of approximately 0.93 hectares, with approximately 170 m of frontage along Carling Avenue, 120 m of frontage along Meath Street and 105 m of frontage along Archibald Street. At the time of the Phase II Environmental Site Assessment (ESA), the Phase II Property was occupied by the Travelodge Ottawa West hotel, comprised of a 1 to 3 storey structure on the western portion of the property (currently operational) and a 7 storey tower on the eastern portion of the property (no longer in operation). A 2-storey parking structure (l level each above and below grade) is present on the eastern portion of the site. The remainder of the site was occupied by paved access laneways and parking areas, as well as landscaped areas along the northern portion of the property fronting onto Carling Avenue.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Column A of Table 2 outlined in Ontario Regulation 153/04 and amended by O.Reg. 269/11, potentially contaminating activities (PCAs) identified on the subject property or within the Phase I study area that were considered to result in APECs on the subject land are summarized in Table 1 presented in Section 3.3.

Other off-site PCAs were identified within the Phase I study area and not considered to represent an APEC on the subject property based on their separation distances and/or inferred orientations with respect to the subject land.

Contaminants of Concern

Based on the findings of the Phase II ESA, contaminants of concern include PHC F_2, F_3 and F_4 and various PAH parameters in fill material.

Subsurface Structures and Utilities

The Phase II Property is occupied by two multi-storey building structures connected via a full basement level. A buried storm water tank is present on the southwestern portion of the Phase II Property, immediately south of the building structure. With the exception of buried utilities, no other subsurface structures are present on the subject property.

Based on underground service locates conducted at the time of the Phase II ESA, natural gas, fibre optics, electricity and telephone services are buried on the northern portion of the subject property. A municipal sewer easement also runs along the northern portion of the Phase II Property, approximately parallel to Carling Avenue. Private electrical, water and sewer lines are also present over the remainder of the property. The approximate location of the sewer easement is shown on Drawing: PE3896-3 - Test Hole Location Plan. Based

Based on standard practice for subsurface utility installation, service trenches are expected to be present approximately 1 to 2 m below existing grade. In general, trench backfill may provide a preferential pathway for contaminant transport if the water table is at or above the base of the trenches. Based on the findings of the Phase II-ESA, the water table is present within the native silty clay below the fill. During seasonal fluctuations over time, the groundwater table may have risen sufficiently so, that existing or previous service trenches created preferential pathways for contaminants, particularly in the vicinity of BH5 and BH10, where impacted fill material was identified during the Phase II ESA. Although groundwater was not recovered from the immediate vicinity of the impacted soil, groundwater on the northeaster portion of the Phase II Property was in compliance with the MOECC Table 3 standards. The potential for service trenches to have provided preferential pathways for contaminants is considered to be low. Buried services in the vicinity of BH5 and BH10 include private electrical, water and sewer lines.

Physical Setting

Site Stratigraphy

Site stratigraphy is provided in the Soil Profile and Test Data Sheets provided in Appendix 1 and illustrated on Drawings PE3896-7 and 8 - Cross-Sections A-A' and B-B`. A general description of the site stratigraphy consists of the following:

- **Pavement Structure** consisting of 0.05 m of asphaltic concrete over crushed stone and silt, to depths ranging from approximately 0.6 to 1.0 m below ground surface; it should be noted that no pavement structure was encountered at BH1 (topsoil) or BHs 12 and 13 (concrete floor slab).

- **Fill Material** was encountered beneath the pavement structure at all boreholes locations on the exterior of the property (including BH11, within the parking structure, which has been referred to as an interior borehole). The fill material extended to depths ranging from approximately 1 to 2.8 m below grade. The fill generally consisted of brown silty sand with gravel and traces of clay, or brown silty clay with traces of sand and gravel. Further details pertaining to the fill material are provided below.

- **Native Silty Clay** – with the exception of BH6, 11 and 13, silty clay was encountered beneath the fill material at each of the borehole locations. The clay extended to depths ranging from 4.1 to 6.1 m below ground surface.

- **Glacial Till** - till material consisting of grey silty clay and/or sandy silt to silty sand with gravel and trace cobbles was identified beneath the silty clay material, at all boreholes with the exception of BH9, where sand was identified beneath the native silty clay. This was the deepest unit investigated at the time of the Phase II ESA. Boreholes were terminated on inferred bedrock at depths ranging from approximately 6.1 to 10.1 m below ground surface.

Hydrogeological Characteristics

Groundwater levels were measured at the subject site on November 7, 2016. The water table at the subject site was encountered in the overburden material.

The groundwater levels were measured at depths between approximately 2.2 and 4.3 m below the exterior grade. It is noted that water levels fluctuate with seasonal variations.

Based on the groundwater elevations recorded during the November, 2016 monitoring event, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE3896-6 - Groundwater Contour Plan. Based on the contour mapping, groundwater flow at the subject site appears to be in a westerly direction. An average horizontal hydraulic gradient of approximately 0.006 m/m was calculated.

Approximate Depth to Bedrock

At the time of the Phase II ESA, boreholes were terminated on inferred bedrock at depths ranging from approximately 6.1 to 10.1 m below ground surface.

Approximate Depth to Water Table

Depth to water table at the subject site varies between approximately 2.2 and 4.3 m below existing grade.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation (Site Condition Standards, Environmentally Sensitive Areas) and Section 43.1 do not apply to the subject site as the Phase II Property is not a shallow soil property and the Phase II Property is not within 30 m of a body of water.

Fill Placement

As noted above, fill material was encountered beneath the pavement structure at all boreholes locations on the exterior or the property (including BH11, within the parking structure, which has been referred to as an interior borehole). The fill material extended to depths ranging from approximately 1 to 2.8 m below grade. The fill generally consisted of brown silty sand with gravel and traces of clay, or brown silty clay with traces of sand and gravel.

Topsoil was identified within the fill material at BH1 through BH5, BH7 and BH8. A 0.3 m layer of topsoil was noted in BH7 at a depth of approximately 1.8 to 2.1 m below grade. Occasional fragments of asphalt were noted in the fill material at BH1, BH4 and BH9.

Building debris, including traces of wood and/or brick fragments, were noted in the fill material at BH3, BH5, BH8 and BH10. The pieces of brick were more substantial at BH10 where pieces of glass and possible fragments of coal or slag were also identified. The fill material encountered at BH5 and BH10 was noticeably darker than the fill material at the other borehole locations.

Proposed Buildings and Other Structures

It is our understanding that the Phase II Property will be redeveloped in two phases, with multi-storey residential buildings with one to two levels of underground parking.

Existing Buildings and Structures

The subject property is currently occupied by a hotel consisting of two above-grade multi-level buildings adjoined by a common basement level, and a parking structure, the locations of which are shown on Drawing PE3896-3 – Test Hole Location Plan.

Water Bodies

No bodies of water are present on the subject property or within the Phase I study area.

Areas of Natural Significance

No areas of natural significance were observed on the Phase I Property or within the Phase I study area.

Environmental Condition

Areas Where Contaminants are Present

Based on the findings of the Phase II ESA, PHC F_2, F_3 and/or F_4, as well as concentrations of various PAH parameters, are present in the fill material at concentrations exceeding the MOECC Table 3 standards. Fill material impacted with PHC F_2-F_4 and PAH parameters was identified at BH10, while fill material impacted with only PHC F_2 was identified at BH5. Analytical test results and estimated areas where contaminants are present, are shown on Drawings PE3896-5 – Analytical Testing Plans for soil.

Types of Contaminants

Based on the PCAs identified at the RSC Property and the findings of the Phase II ESA, prior to remediation, the Contaminants of Concern (COCs) include PAHs and PHCs F_2, F_3 and/or F_4 in the fill material.

Contaminated Media

As noted above, based on the results of the Phase II ESA, PHC and PAH parameters exceeding the MOECC Table 3 standards, were identified in the soil (fill material overlying native silty clay). Based on analytical testing, no CPCs were identified in the groundwater at concentrations exceeding the method detection limits. Based on the information to date, the groundwater is considered to be in compliance with the MOECC Table 3 standards.

As discussed in the Recommendations Section of this report, the quality of the groundwater should be confirmed in the immediate vicinity of BH5 and BH10, where contaminants were identified in the fill material.

What is Known About the Area Where Contaminants Are Present

Based on the findings of the Phase II ESA, impacted fill material was identified on the eastern portion of the site, in the vicinity of a former automotive service garage.

Distribution of Contaminants

The approximate horizontal distribution of contaminants on the Phase II Property is shown on Drawing PE3896-4 – Analytical Testing Plan (Soil). The approximate vertical distribution of contaminants in soil shown is on Drawing PE3896-7 – Cross-Section A-A` and Drawing PE3896-8 – Cross-Section B-B`.

Discharge of Contaminants

The PHC impacted soil identified at BH10 is expected to have been related to operations at the former on-site automotive service garage. Based on the shallow depth of the impacted soil and the nature of the impact, which suggests a heavier product such as motor oil, contaminants may have been released by spillage directly to the ground surface or through leaks in underground equipment.

The impacted soil identified at BH5 is located further south of the former garage building; hydrocarbon product may have been released directly to the ground surface as a result of improper waste disposal methods associated with the operation of the former garage.

The PAH impacts identified in the fill are considered to be associated with the apparent coal or slag material and/or the heavy petroleum hydrocarbon product identified in the soil recovered from BH10, as discussed above. It is also possible that both PHC and PAH impacts are associated with the physical movement of fill material during redevelopment.

Migration of Contaminants

The migration of contaminants may have resulted from physical transport of contaminated soil or impacted fill material, from another location on the Phase II Property. Based on analytical testing, there does not appear to be any impacts in the groundwater beneath the subject site and therefore fluctuations in the groundwater table and groundwater flow direction are not considered to have significantly affected contaminant transport.

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. Downward leaching is not considered to have affected contaminant distribution at the Phase II Property as the site is largely developed or paved and based on analytical test results the groundwater is in compliance with MOECC Table 3. Fluctuations in the groundwater level and groundwater flow are also not considered to have affected contaminant distribution based on the analytical test results which indicated that contaminant concentrations were not identified in any of the samples, above the laboratory method detection limits.

Potential for Vapour Intrusion

Given the location of PHC F_3 impacted soil outside the building footprint in the shallow fill material and the low-volatility of PAHs and PHC F_2, F_3 and F_4, the potential for vapours to be present within the subject structure is considered to be very low and not a safety hazard to hotel staff; the tower is not currently occupied by guests.

During redevelopment of the site, all soil exceeding the MOECC Table 3 Standards on the RSC property will be removed and disposed off-site. As such, there is no anticipated potential for future vapour intrusion at the Phase II Property.

Contaminant Transport Diagram

Please refer to Drawing PE3896-9 which illustrates and provides narrative notes explaining the contaminant release mechanisms, contaminant transport pathways, human and ecological receptors, receptor exposure points, and routes of exposure at the Phase II Property.

6.0 CONCLUSIONS

Assessment

Paterson Group was retained by Holloway Lodging Corporation, to prepare a Phase II Environmental Site Assessment for the property addressed 1354 and 1376 Carling Avenue, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the Areas of Potential Environmental Concern (APECs) for the subject site identified during the Phase I ESA conducted in October of 2016. The Phase II ESA was carried out in conjunction with a geotechnical investigation and consisted of drilling a total of 13 boreholes, six of which were installed with groundwater monitoring wells, to assess soil and groundwater quality at the subject site.

Soil samples obtained from the boreholes were screened using visual observations and vapour measurements. Soils on site generally consist of topsoil or pavement structure over fill material, underlain by native silty clay, followed by glacial till (consisting of a silty clay matrix over a sandy silt to silty sand matrix). The fill material beneath the pavement structure generally consists of brown silty sand or clay with gravel and traces of topsoil at some locations.

Occasional fragments of building debris or asphalt were also noted at several borehole locations, particularly BH10 and BH5. Pieces of what appeared to be coal or slag material were also identified in the fill material recovered from BH10.

The results of the combustible vapour screening identified readings ranging from less than 5 to 25 ppm, which are not indicative of volatile substances. There were however hydrocarbon odours detected in samples recovered from BH5 and BH10 as well as a suspect odour in samples recovered from BH2.

Based on the screening results in combination with field observations, soil samples from BHs 1, 2, 4, 5, and 10 through 13 were submitted for analytical testing of a combination of volatile organic compounds (VOCs), benzene, ethylbenzene, toluene and xylene (BTEX), petroleum hydrocarbons (PCHs, F_1-F_4), polycyclic aromatic hydrocarbons (PAHs) and/or metals. Based on the analytical test results, petroleum hydrocarbon fractions (F_2, F_3, and/or F_4) exceeding MOECC Table 3 standards were identified in Samples BH10-SS3 and BH5-SS2. Various PAH parameters exceeding MOECC Table 3 standards were identified in Sample BH10-SS2.

PHC and/or PAH parameters were also identified in Samples BH1-SS6, BH4-SS5, BH5-SS2 and BH5-SS3 at concentrations below the MOECC Table 3 standards. Metal parameters were identified in Sample BH10-SS2 at concentrations also below the MOECC Table 3 standards. No VOC or BTEX concentrations were identified in any samples submitted for analytical testing, above the laboratory detection limits.

Groundwater samples were collected from the monitoring wells installed in BH1, BH2, BH4, BH11 and BH12 on November 7, 2016 and submitted for analysis of BTEX or VOC and PHC (F_1-F_4) parameters. The groundwater sample recovered from BH4 was also submitted for analysis of PAH parameters. The groundwater from BH9 was not submitted for analytical testing as this well was placed for triangulation purposes; no APECs are present in the vicinity of BH9.

No parameter concentrations were identified above the method detection limits in any of the groundwater samples submitted for anlaysis. The groundwater is therefore considered to be in compliance with the MOECC Table 3 standards.

Recommendations

Soil

Based on the findings of the Phase II-ESA, it is recommended that a remediation of the impacted fill material be conducted at the subject property. Based on the current use of the eastern portion of the subject property for parking only, and the nature of the impacts, there is no immediate environmental concern to the property or its occupants. The remediation can therefore be carried out at the time of redevelopment.

It is recommended that Paterson personnel be on site at the time of the excavation activities in order to supervise delineation and removal of impacted soils and to conduct confirmatory sampling. Prior to off-site disposal of impacted material at a waste disposal facility, a leachate analysis of a representative sample of impacted soil will be required in accordance with Ontario Regulation 347/558.

Groundwater

It is recommended that an additional monitoring well be installed within the area of impacted soil, in accordance with O.Reg. 153/04 as amended, to confirm that the groundwater at this location is clean.

The existing monitoring wells should be kept viable until they are no longer required for sampling purposes, at which time they should be decommissioned by a licenced contractor in accordance with Ontario Regulation 903.

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 Holloway Lodging Corporation. Permission and notification from Holloway Lodging Corporation and Paterson will be required to release this report to any other party.

Paterson Group Inc.

Karyn Munch, P.Eng., QP_{ESA}

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

Report Distribution:

- Holloway Lodging Corporation (6 copies)
- Paterson Group (1 copy)

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE3896-3 – TEST HOLE LOCATION PLAN

DRAWING PE3896-4 – ANALYTICAL TESTING PLAN (SOIL)

DRAWING PE3896-5 – ANALYTICAL TESTING PLAN (GROUNDWATER)

DRAWING PE3896-6 – GROUNDWATER CONTOUR PLAN

DRAWING PE3896-7 – CROSS-SECTION A-A`

DRAWING PE3896-8– CROSS-SECTION B-B`

DRAWNG PE3896-9 – CONTAMINANT DISTRIBUTION DIAGRAM

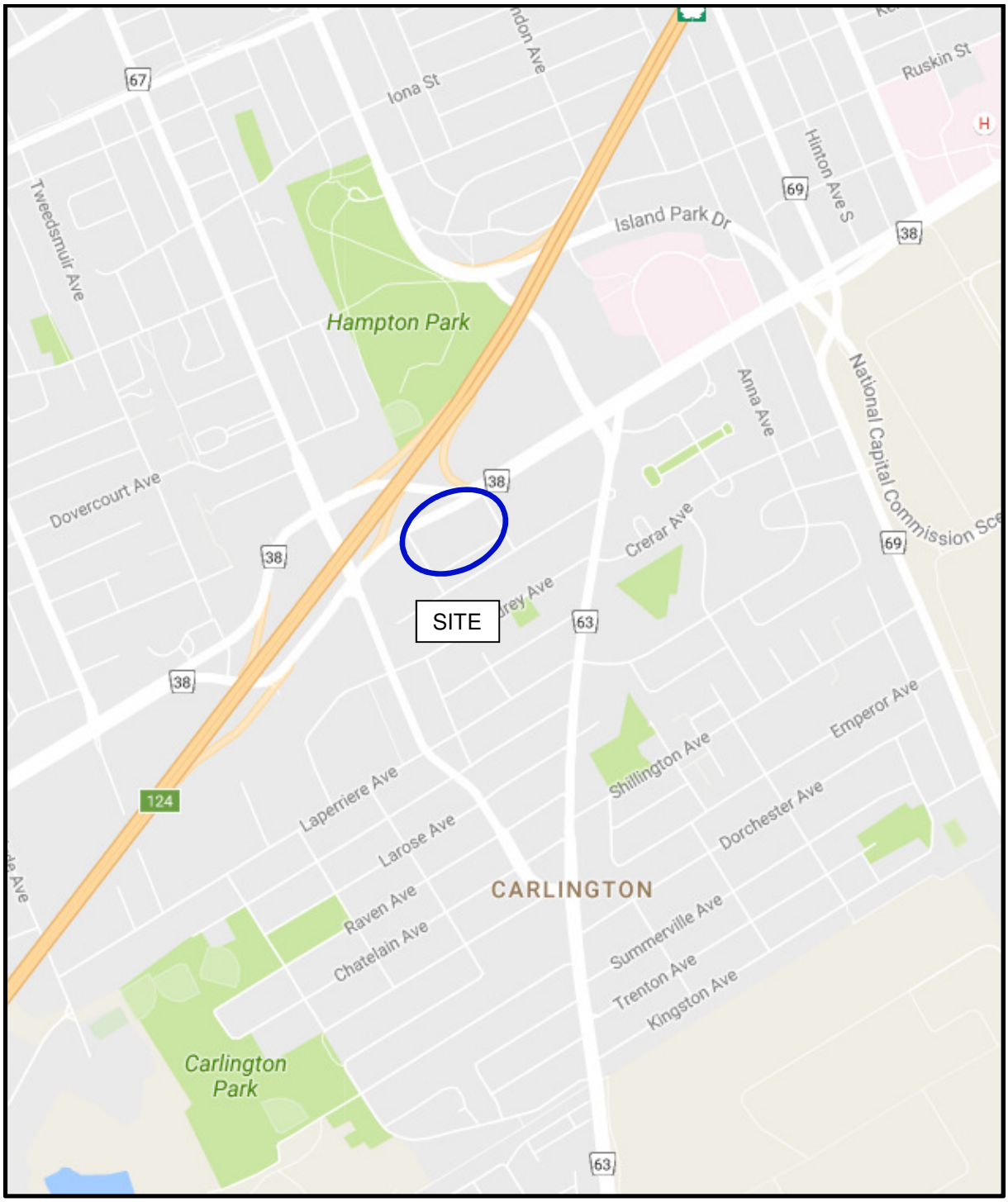
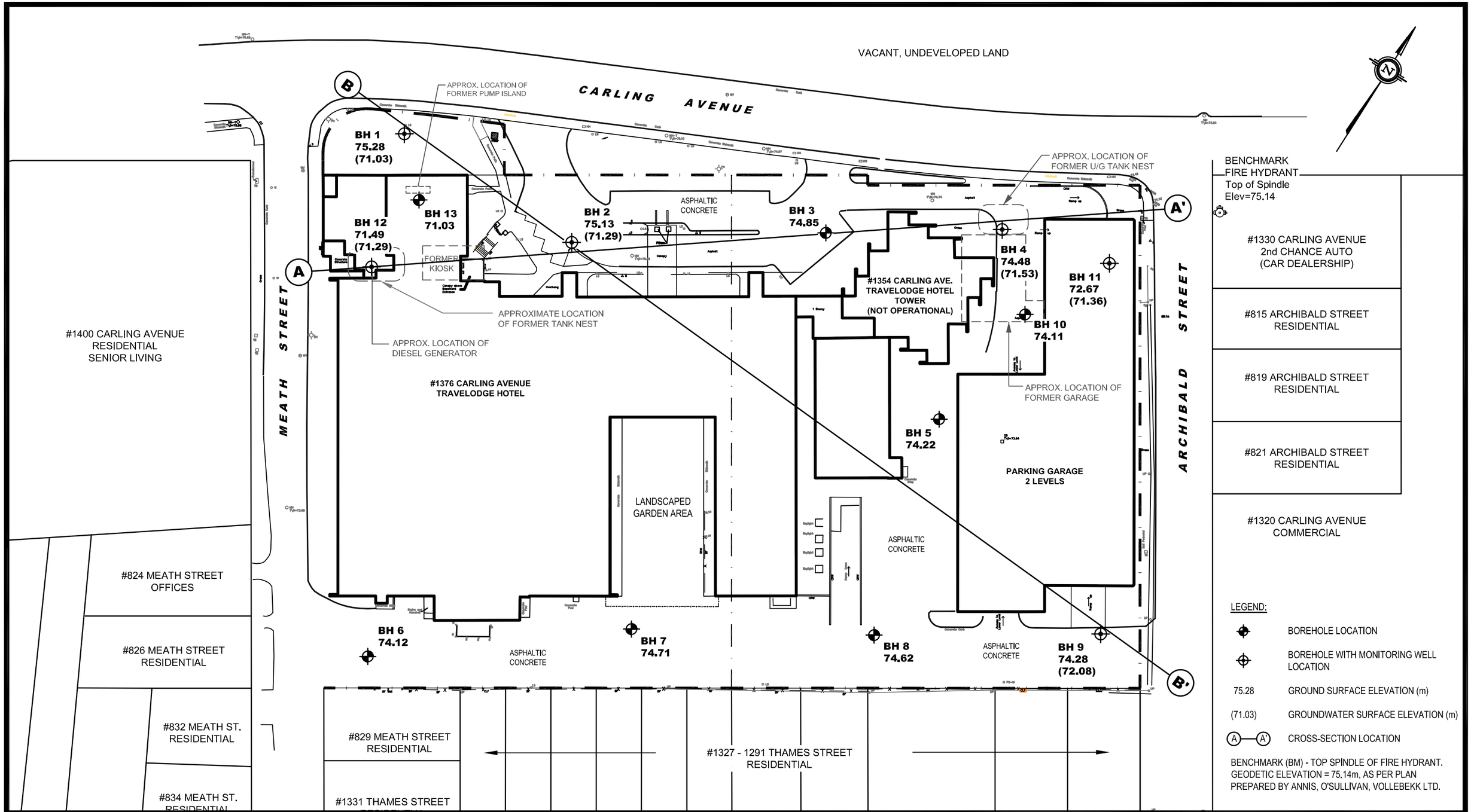


FIGURE 1

KEY PLAN



LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 75.28 GROUND SURFACE ELEVATION (m)
- (71.03) GROUNDWATER SURFACE ELEVATION (m)
- A — A' CROSS-SECTION LOCATION

BENCHMARK (BM) - TOP SPINDLE OF FIRE HYDRANT.
GEODETIC ELEVATION = 75.14m, AS PER PLAN
PREPARED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD.

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NO.	REVISIONS	DATE	INITIAL
0			

HOLLOWAY LODGING CORP.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1354 TO 1376 CARLING AVE.

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:750	Date: 11/2016
Drawn by: MPG	Report No.: PE3896-2
Checked by: KM	Dwg. No.: PE3896-3
Approved by: MSD	Revision No.: 0

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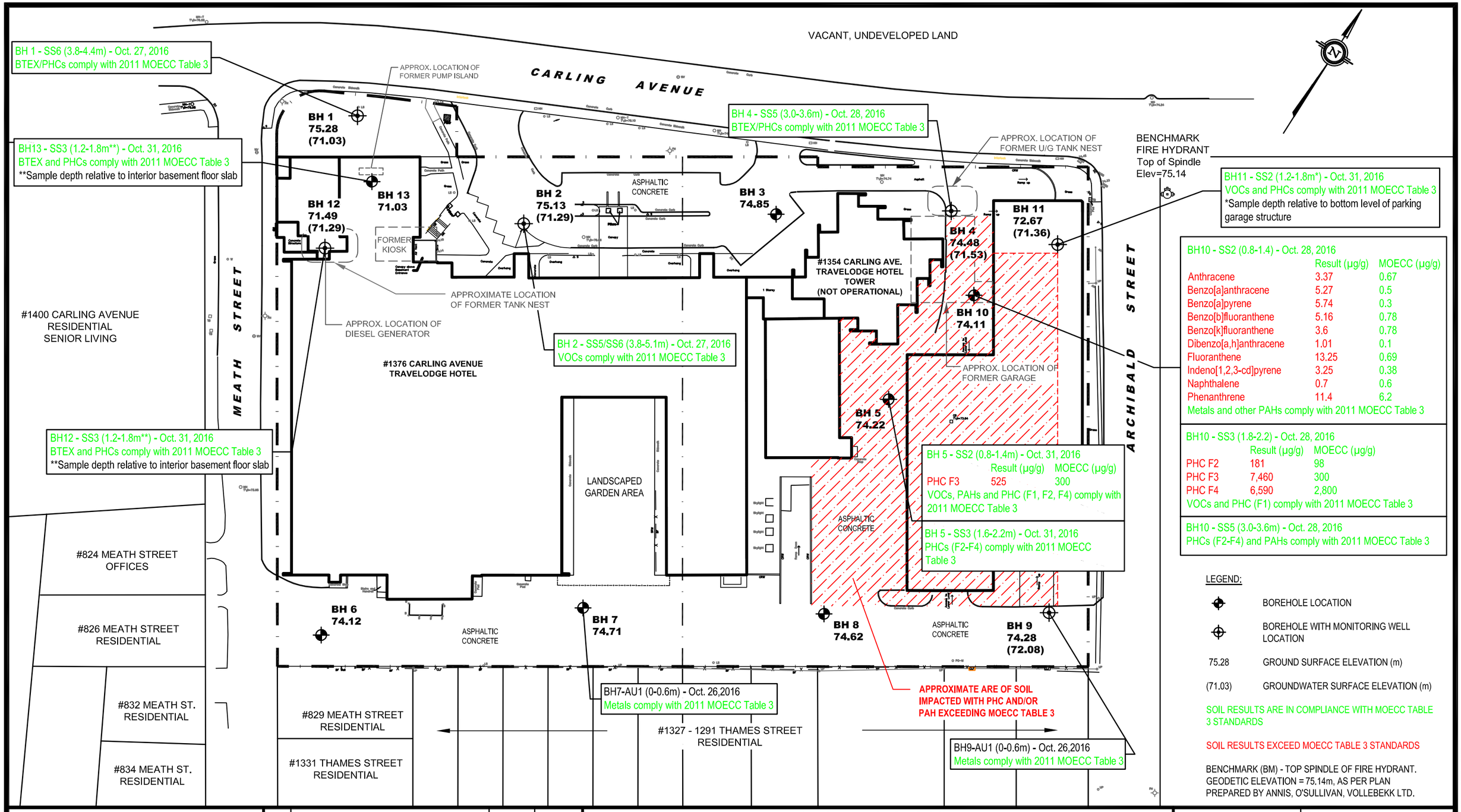

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HOLLOWAY LODGING CORP.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1354 TO 1376 CARLING AVE.

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL

Scale: 1:750	Date: 11/2016
Drawn by: MPG	Report No.: PE3896-2
Checked by: KM	Dwg. No.: PE3896-4
Approved by: MSD	Revision No.: 0

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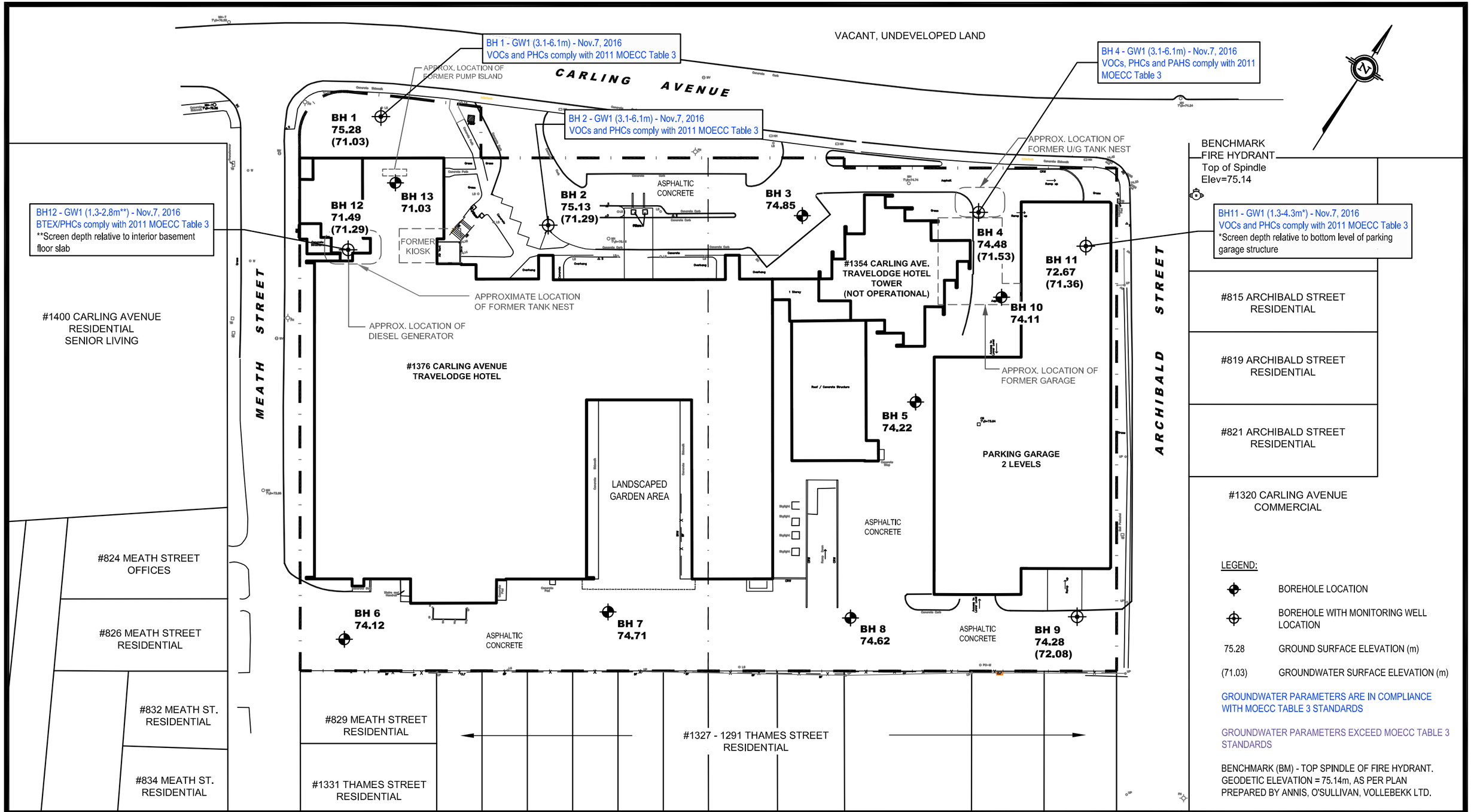

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NO.	REVISIONS	DATE	INITIAL
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HOLLOWAY LODGING CORP.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1354 TO 1376 CARLING AVE.
OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN - GROUNDWATER

Scale: 1:750	Date: 11/2016
Drawn by: MPG	Report No.: PE3896-2
Checked by: KM	Dwg. No.: PE3896-5
Approved by: MSD	Revision No.: 0

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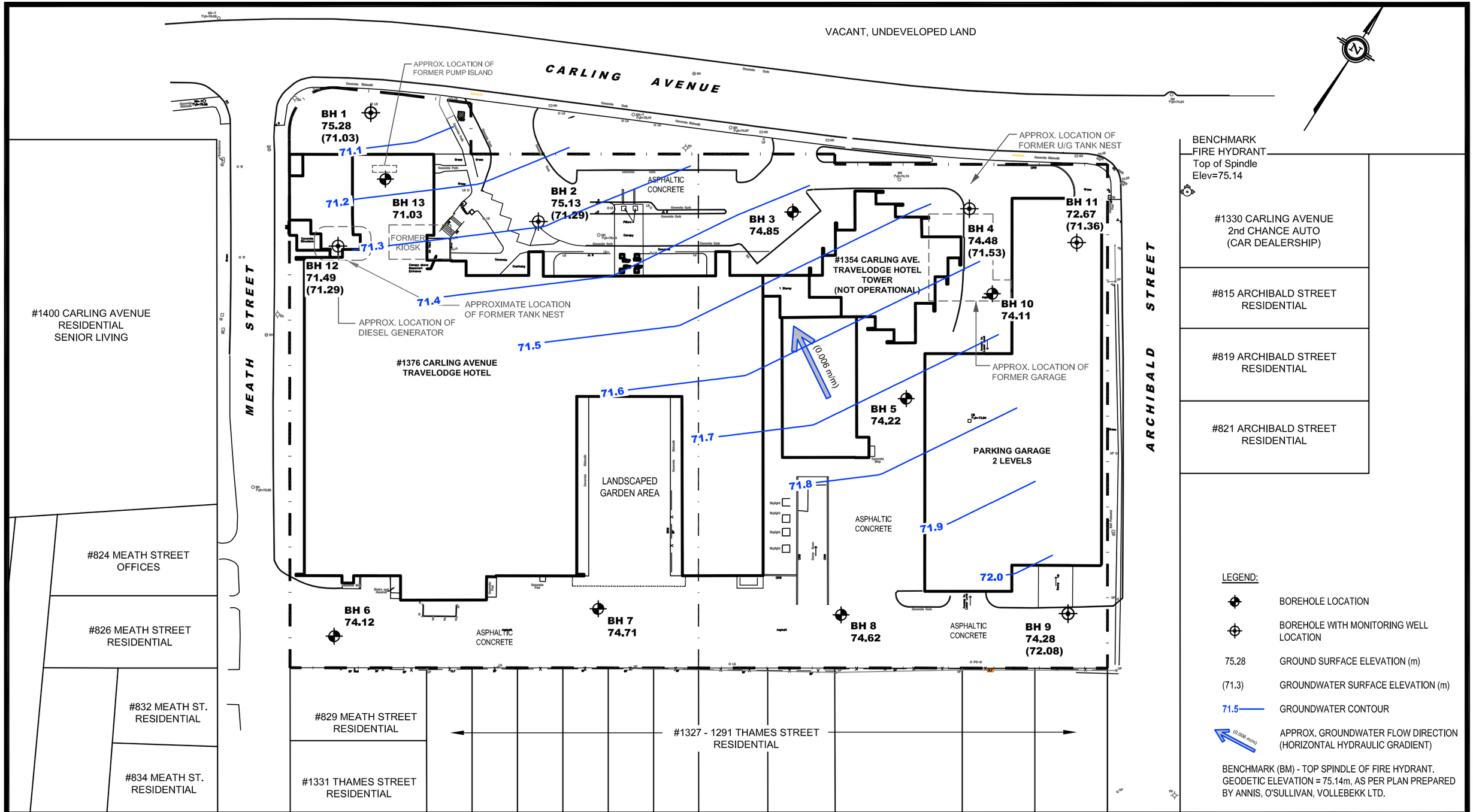

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 75.28 GROUND SURFACE ELEVATION (m)
- (71.3) GROUNDWATER SURFACE ELEVATION (m)
- 71.5 GROUNDWATER CONTOUR
- APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)

BENCHMARK (BM) - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 75.14m, AS PER PLAN PREPARED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD.

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HOLLOWAY LODGING CORP.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1354 TO 1376 CARLING AVE.

OTTAWA, ONTARIO

Title:

GROUNDWATER CONTOUR PLAN

Scale: 1:750	Date: 11/2016
Drawn by: RCG	Report No.: PE3896-2
Checked by: KM	Dwg. No.: PE3896-6
Approved by: MSD	Revision No.: 0

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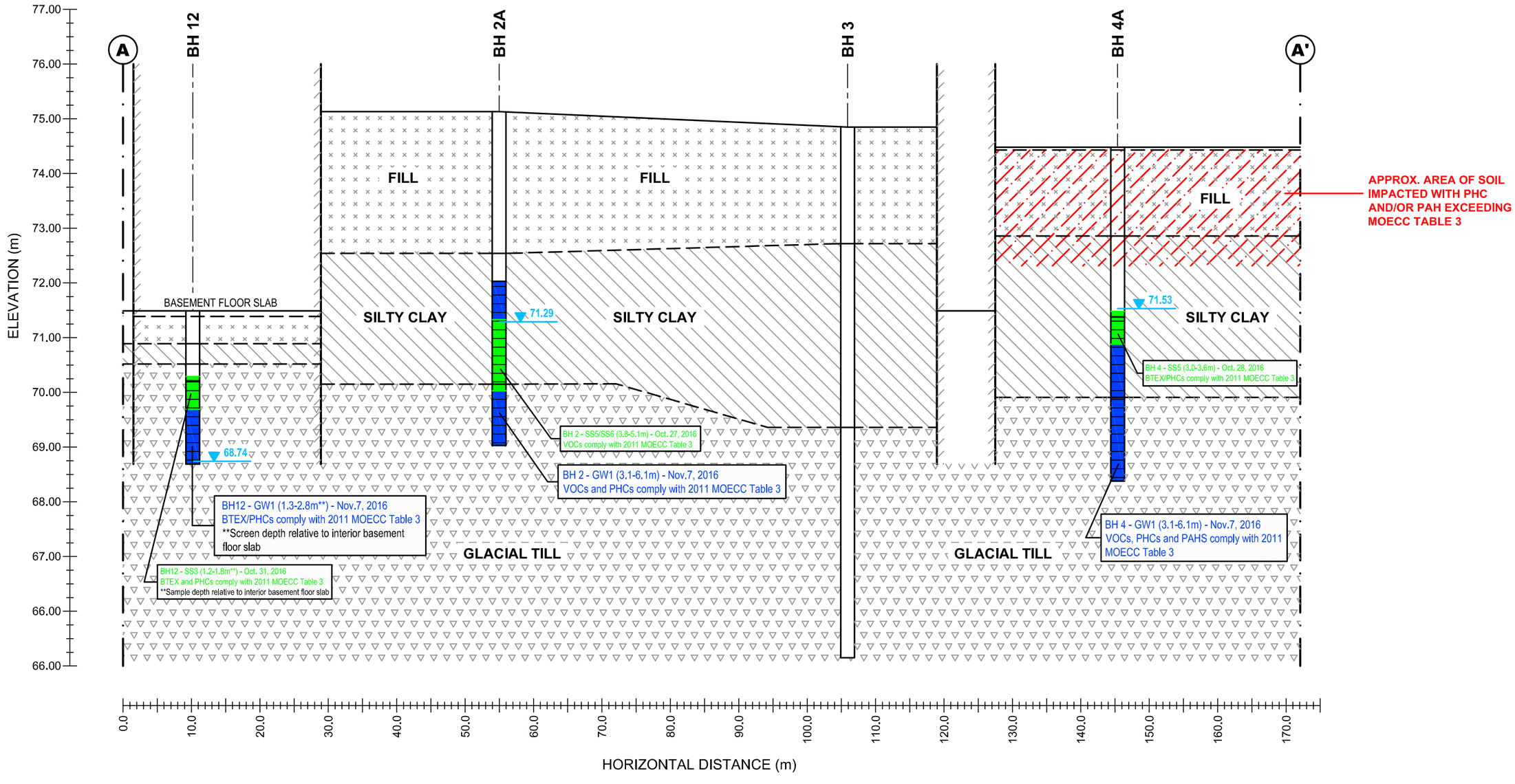

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HOLLOWAY LODGING CORP.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1354 TO 1376 CARLING AVENUE

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A'

Scale: AS SHOWN	Date: 11/2016
Drawn by: MPG	Report No.: PE3896-2
Checked by: KM	Dwg. No.: PE3896-7
Approved by: MSD	Revision No.: 0

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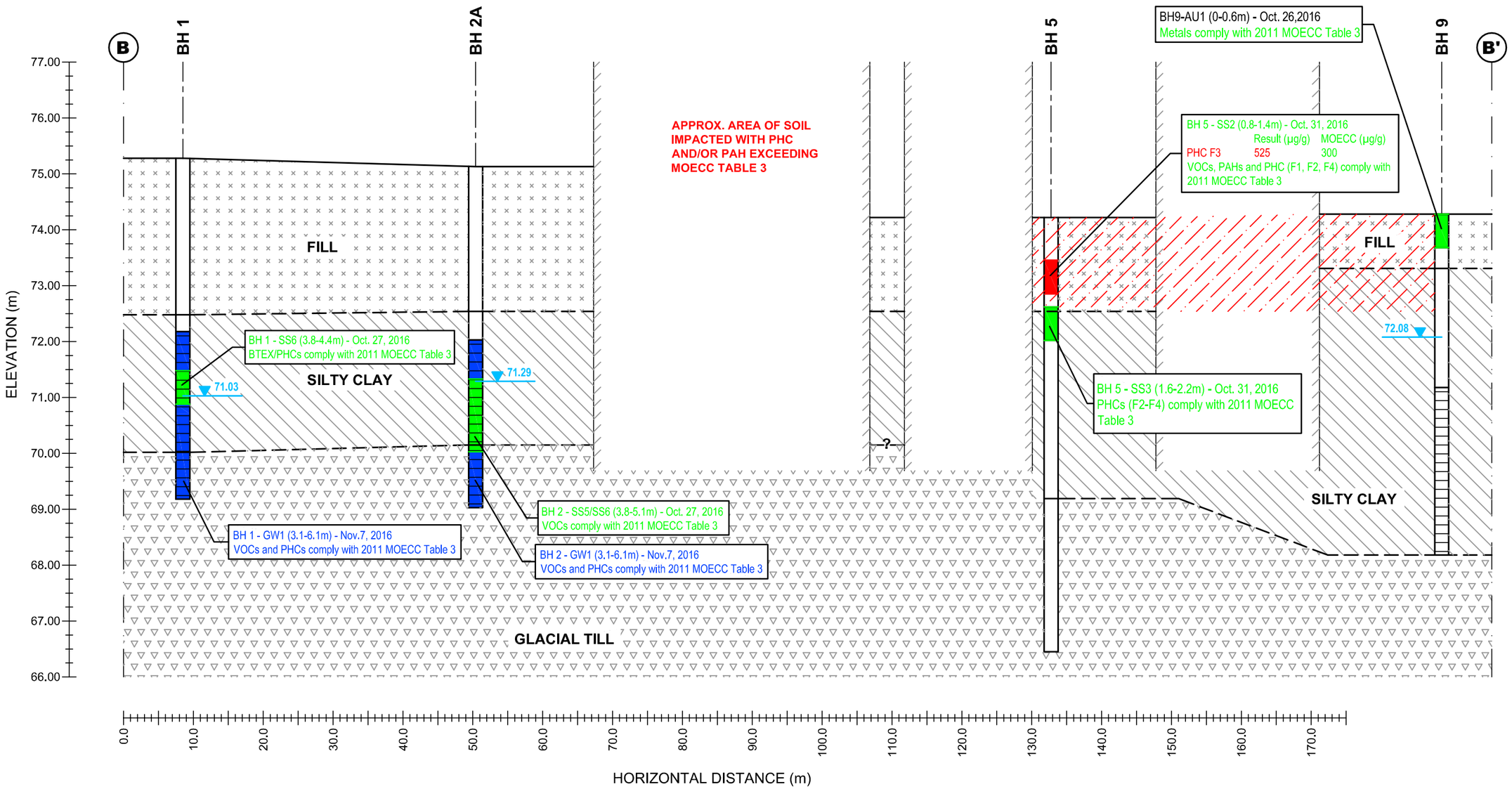

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HOLLOWAY LODGING CORP.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1354 TO 1376 CARLING AVENUE

OTTAWA, ONTARIO

Title:

CROSS-SECTION B-B'

Scale: AS SHOWN	Date: 11/2016
Drawn by: MPG	Report No.: PE3896-2
Checked by: KM	Dwg. No.: PE3896-8
Approved by: MSD	Revision No.: 0

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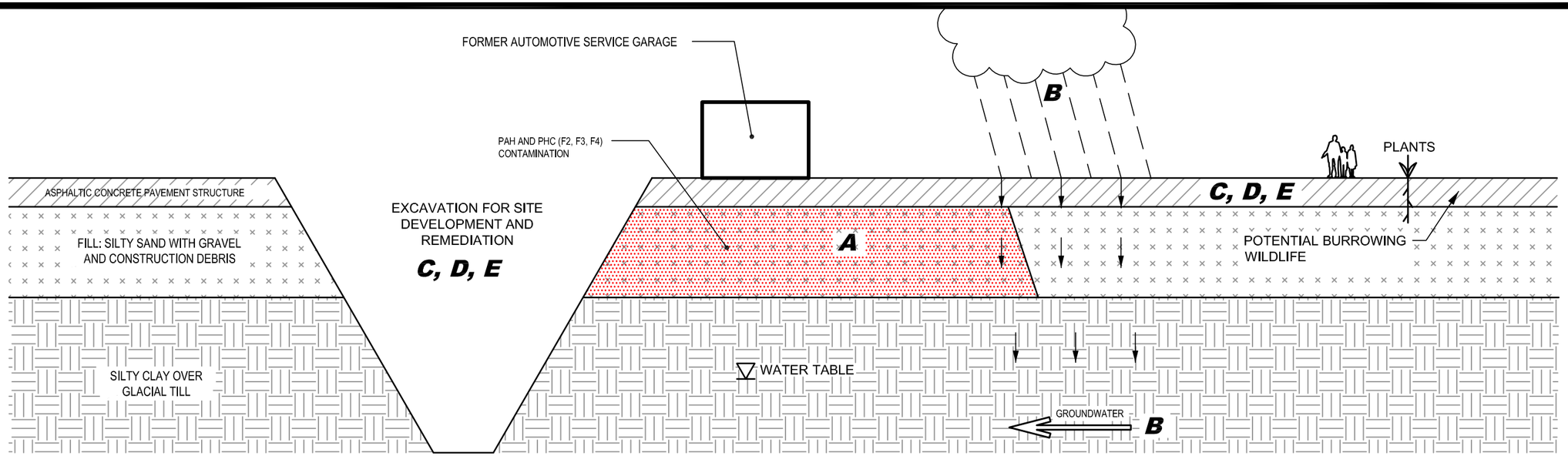

NARRATIVE NOTES:

CONTAMINANT RELEASE MECHANISMS

A PAH and PHC (F2, F3, F4) impacts exceeding MOECC Table 3 standards were identified in the fill material at two locations on the Phase II property. The groundwater considered to be in compliance with MOECC Table 3 Standards.

The PHC and PAH impacts are considered to be associated with the former automotive service garage located on this portion of the site.

CONTAMINANT TRANSPORT PATHWAYS

B
1. PHYSICAL TRANSPORT - A potential contaminant transport pathway is the physical transport from one location to another of contaminated soil. It is considered possible that impacted soil/fill was moved at the time the former garage was demolished or when the existing tower was developed.
2. PRECIPITATION/INFILTRATION/LEACHING - Due to the RSC property having been largely developed or paved, precipitation and infiltration are not considered to have significantly contributed to contaminant transport. PHC and PAH parameters are not considered to have migrated beyond the fill to the groundwater table based on groundwater testing in the area.
3. DIFFUSION AND DISPERSION - These contaminant transport pathways are not considered to apply to the Phase II Property, as the groundwater is in compliance with Table 3 Standards.

HUMAN AND ECOLOGICAL RECEPTIORS

C
1. HUMAN RECEPTORS - Although the subject site is occupied and open to the general public, it is covered in asphalt which greatly reduces the chances for humans to act as receptors. Potential human receptors are limited to construction workers and environmental professionals who may contact the soil/groundwater during site remediation or redevleopment.
2. ECOLOGICAL RECEPTORS - Traditionally, ecological receptors include plants and wildlife which may come into contact with the contaminated soil. In the case of this subject site, there are no significant plants on the property and no viable soil in which wildlife may burrow into.

RECEPTOR EXPOSURE POINTS

D
1. HUMAN RECEPTORS - Exposure points for humans consist of remedial excavation, excavation for site building.
2. ECOLOGICAL RECEPTORS - Given the location of the subject site in a built-up area, there are limited ecological receptor exposure points in the general vicinity of the site.

ROUTES OF EXPOSURE

E
1. HUMAN RECEPTORS - Routes of exposure for human receptors (construction workers and environmental professionals) include dermal contact, accidental ingestion, and inhalation (PHC vapours, or particulate dust containing PAH).
2. ECOLOGICAL RECEPTORS - Routes of exposure for ecological receptors include ingestion, dermal contact, and inhalation.

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NO.	REVISIONS	DATE	INITIAL
1	UPDATED SITE ADDRESS	13/09/2016	KM

HOLLOWAY LODGING CORP.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1354 TO 1376 CARLING AVENUE

OTTAWA, ONTARIO

Title:

CONTAMINANT DISTRIBUTION DIAGRAM

Scale: N.T.S.	Date: 11/2016
Drawn by: MPG	Report No.: PE3896-2
Checked by: KM	Dwg. No.: PE3896-9
Approved by: MSD	Revision No.: 0

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

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patersongroup

Sampling & Analysis Plan

Phase II Environmental Site Assessment,
1354 and 1376 Carling Avenue
Ottawa, Ontario

Prepared For

Holloway Lodging Corporation

October 21, 2016

Report: PE3896-SAP

TABLE OF CONTENTS

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Holloway Lodging Corporation, to conduct a Phase II-Environmental Site Assessment (ESA) for the property addressed 1354 and 1376 Carling Avenue in the City of Ottawa, Ontario. Based on the findings of the Phase I-ESA conducted by Paterson, a subsurface investigation program, consisting of borehole drilling, was developed. The Phase II ESA was conducted in conjunction with a Geotechnical Investigation.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	Located to address potential soil and/or groundwater impacts from former USTs associated with the Department of Highways previously located north of the Phase I Property.	To a depth of at least 1.5 m below the groundwater table, for the installation of a monitoring well.
BH2	Located for geotechnical purposes and to provide general coverage of the site.	To 10 m or practical auger refusal on inferred bedrock.
BH3	Located for geotechnical purposes and to provide general coverage of the site.	To 10 m or practical auger refusal on inferred bedrock.
BH4	Located to address potential soil and groundwater impacts from former USTs on northeastern portion of the Phase II Property.	To a depth of at least 1.5 m below the groundwater table, for the installation of a monitoring well.
BH5	Located for geotechnical purposes and to provide general coverage of the site.	To 10 m or practical auger refusal on inferred bedrock.
BH6	Located for geotechnical purposes and to provide general coverage of the site.	
BH7	Located for geotechnical purposes and to provide general coverage of the site.	
BH8	Located for geotechnical purposes and to provide general coverage of the site.	
BH9	Located for geotechnical purposes and to provide general coverage of the site.	To a depth of at least 1.5 m below the groundwater table, for the installation of a monitoring well.
BH10	Located to address potential soil and/or groundwater impacts associated with the former automotive service garage on the northeastern portion of the site.	To 10 m or practical auger refusal on inferred bedrock.
BH11	Located to address potential soil and/or groundwater impacts from former off-site retail fuel outlets east and northeast of the Phase II Property.	To a depth of at least 1.5 m below the groundwater table, for the installation of a monitoring well.
BH12	Located to address potential soil and/or groundwater impacts associated with the former on-site retail fuel outlet and existing diesel generator.	To a depth of at least 1.5 m below the groundwater table, for the installation of a monitoring well.
BH13		

Borehole 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 practical refusal to augering. All soil samples will be retained, and samples will be selected for submission following a preliminary screening analysis.

Following borehole drilling, monitoring wells will be installed in each borehole (as above).

2.0 ANALYTICAL TESTING PROGRAM

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

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

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

- ❒ Groundwater monitoring wells should be installed in all boreholes with visual or olfactory evidence of soil contamination, in stratigraphic units where soil contamination was encountered, where those stratigraphic units are at or below the water table (i.e. a water sample can be obtained).
- ❒ Groundwater monitoring well screens should straddle the water table at sites where the contaminants of concern are suspected to be LNAPLs.

- ❒ At least one groundwater monitoring well should be installed in a stratigraphic unit below the suspected contamination, where said stratigraphic unit is water-bearing.
- ❒ Parameters analyzed should be consistent with the Contaminants of Concern identified in the Phase I ESA and with the contaminants identified in the soil samples.

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

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

Determining Borehole Locations

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

After drilling is completed, a plan with the borehole locations must be provided. Distances and orientations of boreholes with respect to site features (buildings, roadways, etc.) must be provided. Distances should be measured using a measuring tape or wheel rather than paced off. Ground surface elevations at each borehole should be surveyed relative to a 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, 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 50 mm threaded sections of Schedule 40 PVC slotted well screen (1.5 m x 31 mm if installing in cored hole in bedrock)
- ❒ 1.5 m x 50 mm threaded sections of Schedule 40 PVC riser pipe (1.5 m x 31 mm if installing in cored hole in bedrock)
- ❒ Threaded end-cap
- ❒ Slip-cap or J-plug
- ❒ Asphalt cold patch or concrete
- ❒ Silica Sand
- ❒ Bentonite chips (Holeplug)
- ❒ Steel flushmount casing

Procedure

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

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

3.3 Monitoring Well Sampling Procedure

Equipment

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

Sampling Procedure

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

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

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

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

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

For the purpose of calculating the RPD, it is desirable to select field duplicates from samples for which parameters are present in concentrations above laboratory detection limits, i.e. samples which are expected to be contaminated. If parameters are below laboratory detection limits for selected samples or duplicates, the RPD may be calculated using a concentration equal to one half (0.5 x) the laboratory detection limit.

It is also important to consider data quality in the overall context of the project. For example, if the DQOs are not met for a given sample, yet the concentrations of contaminants in both the sample and the duplicate exceed the MOECC 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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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1354 - 1376 Carling Avenue
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located at the southeast corner of the intersection of Archibald St. & Carling Avenue. Geodetic elevation = 75.14m, as per plan prepared by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

FILE NO. PE3896

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** October 27, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	75.28
Topsoil and organics 0.10		AU	1				
FILL: Brown silty fine sand with gravel, topsoil, trace clay		SS	2	33	6	1	74.28
- asphalt by 1.8m depth		SS	3	21	13	2	73.28
2.20 **FILL:** Brown silty clay with sand, some gravel, trace asphalt 2.80		SS	4	33	5		
Very stiff to stiff, brown **SILTY CLAY**		SS	5	75	3	3	72.28
- stiff to firm and grey by 3.7m depth		SS	6	83	1	4	71.28
- trace sand and gravel by 4.3m depth		SS	7	75	2	5	70.28
5.26 **GLACIAL TILL:** Grey silty clay to clayey silt with sand, gravel, trace cobbles		SS	8	50	4	6	69.28
		SS	9	67	11		
7.16		SS	10	67	23	7	68.28
GLACIAL TILL: Grey sandy silt with clay, gravel, cobbles, trace boulders		SS	11	58	30	8	67.28
		SS	12	58	19	9	66.28
9.75		SS	13	75	31		
End of Borehole							
(GWL @ 4.25m-Nov. 7, 2016)							

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
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Ottawa, Ontario

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REMARKS

FILE NO. PE3896

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** October 27, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	75.13
FILL: Brown silty fine sand with gravel, trace clay and asphalt		AU	1				
0.60							
		SS	2	29	8	1	74.13
FILL: Brown silty clay, trace sand, gravel and topsoil		SS	3	42	6	2	73.13
2.59		SS	4	67	7		
Very stiff to stiff, brown **SILTY CLAY**		SS	5	25	4	3	72.13
		SS	6	79	3	4	71.13
- stiff to firm and grey by 4.0m depth							
4.98		SS	7	100	2	5	70.13
		SS	8	58	5		
GLACIAL TILL: Grey silty clay to clayey silt with sand and gravel		SS	9	58	6	6	69.13
7.32		SS	10	67	5	7	68.13
		SS	11	42	17	8	67.13
GLACIAL TILL: Grey sandy silt with clay, gravel, cobbles, trace boulders		SS	12	33	18	9	66.13
		SS	13		32		
9.75							
Dynamic Cone Penetration Test commenced at 9.75m depth. 10.13						10	65.13
End of Borehole							
(GWL @ 3.84m-Nov. 7, 2016)							

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

Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

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REMARKS

FILE NO. PE3896

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** October 28, 2016

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: 50mm Asphaltic concrete over red-brown silty fine sand with crushed stone and gravel, trace brick		AU	1			0	74.85		
1.22		SS	2	33	7	1	73.85		
FILL: Brown silty clay, trace sand and gravel		SS	3	75	9				
- some sand, brick and topsoil by 1.5m depth 2.13						2	72.85		
		SS	4	67	5				
Very stiff to stiff, brown **SILTY CLAY**		SS	5	83	2	3	71.85		
- firm by 3.0m depth		SS	6	83	2	4	70.85		
- grey by 3.8m depth		SS	7	92	2	5	69.85		
5.49									
GLACIAL TILL: Grey silty clay to clayey silt, some sand, trace gravel 5.70		SS	8	83	4				
GLACIAL TILL: Grey sandy silt with clay, gravel, trace cobbles and boulders		SS	9	92	10	6	68.85		
6.80		SS	10	73	50+	7	67.85		
GLACIAL TILL: Grey silty fine sand with gravel, some cobbles and boulders		SS	11	83	40				
		SS	12	56	50+	8	66.85		
- some running sand from 6.9 to 8.1m depth						9	65.85		
		SS	13	55	57				
9.70									
End of Borehole									
Practical refusal to augering at 9.70m 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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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
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Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located at the southeast corner of the intersection of Archibald St. & Carling Avenue. Geodetic elevation = 75.14m, as per plan prepared by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

FILE NO. PE3896

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** October 28, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	74.48
FILL: 50mm Asphaltic concrete over brown silty fine sand with crushed stone and gravel		AU	1				
0.76							
FILL: Red-brown sand, some asphalt		SS	2	67	3	1	73.48
1.12							
FILL: Brown silty clay, some sand, topsoil, trace gravel		SS	3	67	10	2	72.48
1.62							
Very stiff to stiff, brown **SILTY CLAY**		SS	4	75	3	3	71.48
		SS	5	33	2		
- firm and grey by 3.8m depth							
- trace sand by 4.3m depth		SS	6	83	1	4	70.48
4.57							
		SS	7	33	8	5	69.48
GLACIAL TILL: Grey silty clay to clayey silt, some sand, trace gravel		SS	8	67	21		
6.20						6	68.48
		SS	9	46	24		
		SS	10	100	43	7	67.48
GLACIAL TILL: Grey silty fine to medium sand with gravel, trace cobbles		SS	11	75	33	8	66.48
- some running sand from 6.2 to 9.75m depth		SS	12	83	30		
		SS	13			9	65.48
9.75							
Dynamic Cone Penetration Test commenced at 9.75m depth.						10	64.48
10.11							
End of Borehole							
(GWL @ 2.95m-Nov. 7, 2016)							

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

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1354 - 1376 Carling Avenue
Ottawa, Ontario

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REMARKS

FILE NO. PE3896

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** October 31, 2016

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	74.22		
FILL: 50mm Asphaltic concrete over red-brown silty fine sand with crushed stone and gravel		AU	1						
0.60									
FILL: Brown silty sand with clay, gravel, some topsoil, trace wood		SS	2	42	7	1	73.22		
1.68		SS	3	58	7	2	72.22		
Very stiff to stiff, brown **SILTY CLAY**									
- firm and grey by 3.0m depth		SS	4	67	2	3	71.22		
		SS	5	100	2	4	70.22		
5.03		SS	6	100	1	5	69.22		
GLACIAL TILL: Grey silty clay to clayey silt with sand, some gravel, trace cobbles		SS	7	50	6				
6.25						6	68.22		
GLACIAL TILL; Grey sandy silt with gravel, trace cobbles and boulders		SS	8	33	37				
- some running sand from 6.25 to 6.7m depth		SS	9	54	40	7	67.22		
7.77		SS	10	100	50+				
End of Borehole									
Practical refusal to augering at 7.77m depth									

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

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE AND TEST DATA

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Ottawa, Ontario

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REMARKS

FILE NO. PE3896

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** October 26, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	74.12
FILL: 50mm Asphaltic concrete over brow silty fine to medium sand with crushed stone and gravel		AU	1				
		SS	2	22	50+	1	73.12
1.07							
FILL: Brown silty clay with sand, gravel and cobbles		SS	3	67	8	2	72.12
2.21							
		SS	4	21	4		
GLACIAL TILL: Brown silty clay with sand, gravel, trace cobbles		SS	5	29	5	3	71.12
- grey by 3.7m depth		SS	6	83	7	4	70.12
4.72							
		SS	7	71	28	5	69.12
GLACIAL TILL: Compact, grey sandy silt to silty sand with gravel, cobbles, trace boulders		SS	8	76	50+		
6.15		SS	9	50	50+	6	68.12
End of Borehole							
Practical refusal to augering at 6.15m 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.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
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REMARKS

FILE NO. PE3896

HOLE NO. BH 7

BORINGS BY CME 55 Power Auger **DATE** October 26, 2016

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: 50mm Asphaltic concrete over brown silty fine sand with crushed stone, gravel, trace cobbles		AU	1			0	74.71		
0.69									
FILL: Brown to green silty clay, trace topsoil, sand and gravel		SS	2	67	8	1	73.71		
- some topsoil by 1.5m depth		SS	3	67	4				
1.83						2	72.71		
TOPSOIL									
2.13		SS	4	42	2				
Stiff, brown **SILTY CLAY**		SS	5	100	W	3	71.71		
- firm and grey by 3.35m depth									
4.11		SS	6	100	W	4	70.71		
GLACIAL TILL: Grey silty clay to clayey silt with gravel		SS	7	71	6				
5.18						5	69.71		
GLACIAL TILL: Compact, sandy silt to silty fine sand with gravel, cobbles, trace boulders		SS	8	50	23				
5.94									
End of Borehole									
Practical refusal to augering at 5.94m depth									

Lower Explosive Limit % scale: 20 40 60 80

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

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

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REMARKS

FILE NO. PE3896

HOLE NO. BH 8

BORINGS BY CME 55 Power Auger **DATE** October 26, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	74.62
FILL: 50mm Asphaltic concrete over brown silty fine sand, some crushed stone and gravel		AU	1				
0.76							
FILL: Brown silty clay with sand, gravel, trace wood, cobbles and topsoil		SS	2	50	11	1	73.62
1.83		SS	3	54	9	2	72.62
Very stiff to stiff, brown **SILTY CLAY**		SS	4	54	5		
		SS	5	67	3	3	71.62
- stiff to firm and grey by 3.2m depth		SS	6	92	2	4	70.62
4.70		SS	7	42	2		
GLACIAL TILL: Grey silty clay to clayey silt, some gravel		SS	8	17	6	5	69.62
		SS	9	17	6	6	68.62
6.78							
GLACIAL TILL: Compact, grey sandy silt to silty fine sand with gravel, cobbles, trace boulders		SS	10	35	50+	7	67.62
7.32							
End of Borehole							
Practical refusal to augering at 7.32m 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.

Monitoring Well Construction

patersongroup Consulting Engineers

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SOIL PROFILE AND TEST DATA

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REMARKS

FILE NO. PE3896

HOLE NO. BH 9

BORINGS BY CME 55 Power Auger **DATE** October 27, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	74.28
FILL: 50mm Asphaltic concrete over brown silty fine sand with crushed stone and gravel		AU	1				
0.60							
FILL: Brown silty clay with sand, trace gravel and asphalt		SS	2	42	9	1	73.28
0.97		SS	3	67	9	2	72.28
Very stiff to stiff, brown **SILTY CLAY**		SS	4	88	3		
- firm and grey by 3.0m depth		SS	5	100	W	3	71.28
		SS	6	100	W	4	70.28
		SS	7	100	2	5	69.28
		SS	8	67			
6.10						6	68.28
Grey fine to medium **SAND,** some gravel		SS	9	58	4		
7.32		SS	10	83	36	7	67.28
End of Borehole							
(GWL @ 2.20m-Nov. 7, 2016)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1354 - 1376 Carling Avenue
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located at the southeast corner of the intersection of Archibald St. & Carling Avenue. Geodetic elevation = 75.14m, as per plan prepared by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

FILE NO. PE3896

HOLE NO. BH10

BORINGS BY CME 55 Power Auger **DATE** October 28, 2016

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: 50mm Asphaltic concrete over crushed stone with silty sand and clay		AU	1			0	74.11		
0.90									
FILL: Brown silty sand with clay, some brick, glass, trace coal or slag		SS	2	50	6	1	73.11		
		SS	3	42	5	2	72.11		
2.18									
Very stiff to stiff, brown **SILTY CLAY**		SS	4	58	1	3	71.11		
		SS	5	92	W				
- firm to stiff and grey by 3.0m depth		SS	6	92	1	4	70.11		
5.08		SS	7	67	24	5	69.11		
GLACIAL TILL: Grey silty clay to clayey silt with sand, gravel, trace cobbles and boulders 5.26		SS	8	42	12				
6.02 **GLACIAL TILL:** Grey sandy silt with clay, gravel, cobbles and boulders		SS	9	58	12	6	68.11		
GLACIAL TILL: Grey silty fine to medium sand with gravel, cobbles, trace clay and boulders		SS	10	58	20	7	67.11		
- some running sand									
7.87		SS	11	80	50+				
End of Borehole									
Practical refusal to augering at 7.87m depth									

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

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1354 - 1376 Carling Avenue
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located at the southeast corner of the intersection of Archibald St. & Carling Avenue. Geodetic elevation = 75.14m, as per plan prepared by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

FILE NO. PE3896

HOLE NO. BH11

BORINGS BY Portable Drill **DATE** October 31, 2016

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: 50mm Asphaltic concrete over crushed stone		AU	1			0	72.67		
0.76						1	71.67		
GLACIAL TILL: Grey silty clay to clayey silt with sand, gravel, cobbles, trace boulders		SS	2			2	70.67		
		SS	3						
		SS	4			3	69.67		
		SS	5						
		SS	6			4	68.67		
4.27									
End of Borehole									
(GWL @ 1.31m-Nov. 7, 2016)									

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.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1354 - 1376 Carling Avenue
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located at the southeast corner of the intersection of Archibald St. & Carling Avenue. Geodetic elevation = 75.14m, as per plan prepared by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

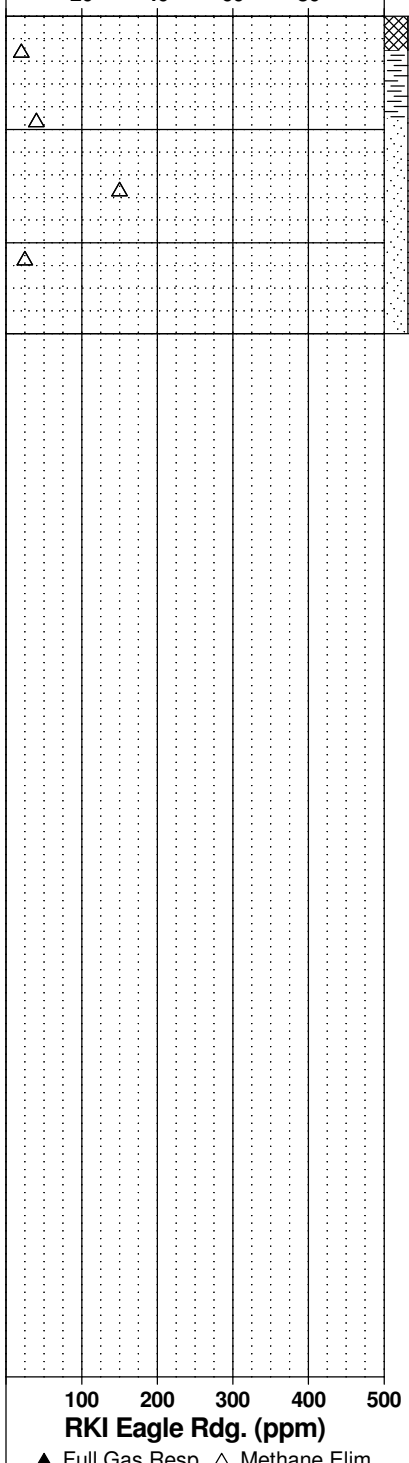
FILE NO. PE3896

HOLE NO. BH12

BORINGS BY Portable Drill **DATE** November 1, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Concrete slab 0.10		AU	1			0	71.49
FILL: Gravel, cobbles with sandy silt and clay 0.60							
Grey **SILTY CLAY** 0.97		SS	2	1000		1	70.49
GLACIAL TILL: Grey silty clay to clayey silt with sand, trace gravel and cobbles		SS	3	7			
		SS	4	83		2	69.49
2.80		SS	5				
End of Borehole							
Practical split spoon refusal at 2.80m depth							
(GWL @ 0.20m-Nov. 7, 2016)							

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



Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1354 - 1376 Carling Avenue
Ottawa, Ontario

DATUM BM - Top spindle of fire hydrant located at the southeast corner of the intersection of Archibald St. & Carling Avenue. Geodetic elevation = 75.14m, as per plan prepared by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

FILE NO. PE3896

HOLE NO. BH13

BORINGS BY Portable Drill **DATE** November 1, 2016

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									
Concrete slab 0.10									
FILL: Crushed stone 0.60		AU	1			0	71.03		
		SS	2	50		1	70.03		
GLACIAL TILL: Grey silty clay to clayey silt with sand, trace gravel and cobbles		SS	3	58					
		SS	4	100		2	69.03		
2.74		SS	5	100					
End of Borehole									
Practical split spoon refusal at 2.74m depth									

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

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

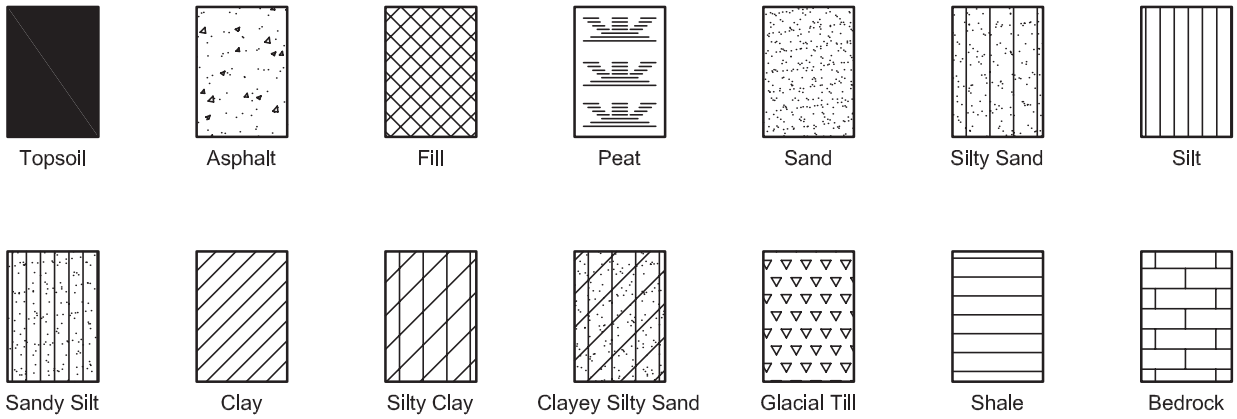
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

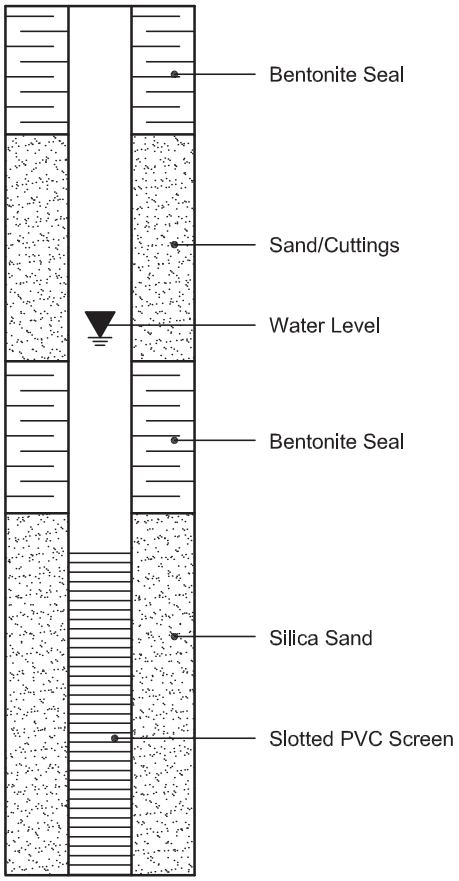
SYMBOLS AND TERMS (continued)

STRATA PLOT

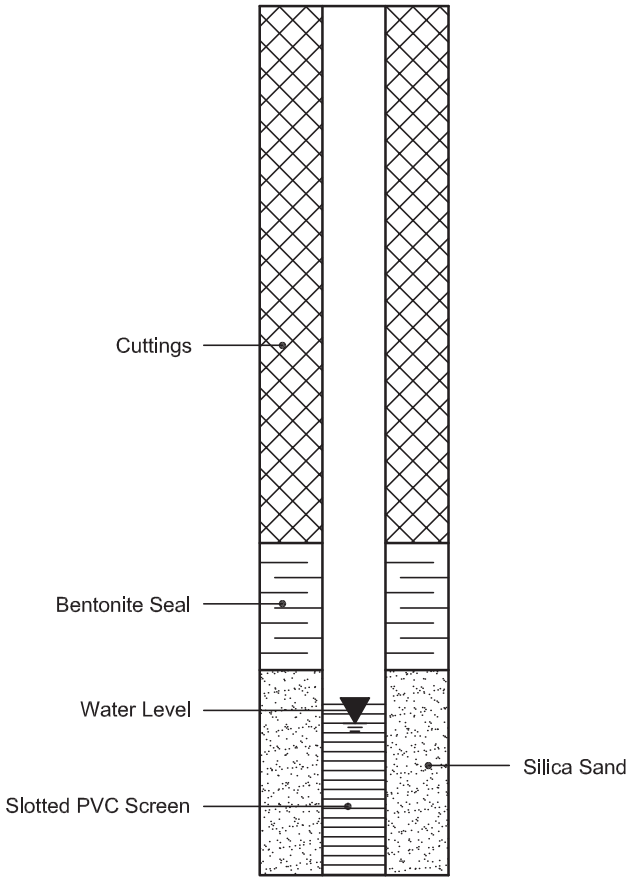


MONITORING WELL AND PIEZOMETER CONSTRUCTION

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

Client PO: 20920
Project: PE3896
Custody: 28919

Report Date: 4-Nov-2016
Order Date: 31-Oct-2016

Order #: 1645106

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

Paracel ID	Client ID
1645106-01	BH4-SS5
1645106-02	BH10-SS3
1645106-03	BH10-SS2
1645106-04	BH2-SS5/SS6

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20920

Report Date: 04-Nov-2016
Order Date: 31-Oct-2016
Project Description: PE3896

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Boron, available	MOE (HWE), EPA 200.7 - ICP-OES	2-Nov-16	2-Nov-16
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	2-Nov-16	3-Nov-16
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	1-Nov-16	4-Nov-16
Mercury by CVAA	EPA 7471B - CVAA, digestion	2-Nov-16	2-Nov-16
PHC F1	CWS Tier 1 - P&T GC-FID	2-Nov-16	3-Nov-16
PHC F4G (gravimetric)	CWS Tier 1 - Extraction Gravimetric	4-Nov-16	4-Nov-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	1-Nov-16	3-Nov-16
REG 153: Metals by ICP/OES, soil	based on MOE E3470, ICP-OES	2-Nov-16	2-Nov-16
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	1-Nov-16	2-Nov-16
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	2-Nov-16	3-Nov-16
Solids, %	Gravimetric, calculation	1-Nov-16	1-Nov-16

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 20920

Report Date: 04-Nov-2016

Order Date: 31-Oct-2016

Project Description: PE3896

	Client ID:	BH4-SS5	BH10-SS3	BH10-SS2	BH2-SS5/SS6
	Sample Date:	28-Oct-16	28-Oct-16	28-Oct-16	27-Oct-16
	Sample ID:	1645106-01	1645106-02	1645106-03	1645106-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	57.1	78.6	81.0	75.4
Metals					
Antimony	1.0 ug/g dry	-	-	<1.0	-
Arsenic	1.0 ug/g dry	-	-	<1.0	-
Barium	1.0 ug/g dry	-	-	246	-
Beryllium	1.0 ug/g dry	-	-	<1.0	-
Boron	1.0 ug/g dry	-	-	10.3	-
Boron, available	0.5 ug/g dry	-	-	0.7	-
Cadmium	0.5 ug/g dry	-	-	1.2	-
Chromium	1.0 ug/g dry	-	-	45.5	-
Chromium (VI)	0.2 ug/g dry	-	-	<0.2	-
Cobalt	1.0 ug/g dry	-	-	10.7	-
Copper	1.0 ug/g dry	-	-	34.2	-
Lead	1.0 ug/g dry	-	-	101	-
Mercury	0.1 ug/g dry	-	-	<0.1	-
Molybdenum	1.0 ug/g dry	-	-	<1.0	-
Nickel	1.0 ug/g dry	-	-	23.5	-
Selenium	1.0 ug/g dry	-	-	<1.0	-
Silver	0.5 ug/g dry	-	-	<0.5	-
Thallium	1.0 ug/g dry	-	-	<1.0	-
Uranium	1.0 ug/g dry	-	-	<1.0	-
Vanadium	1.0 ug/g dry	-	-	42.0	-
Zinc	1.0 ug/g dry	-	-	101	-
Volatiles					
Acetone	0.50 ug/g dry	-	<0.50	-	<0.50
Benzene	0.02 ug/g dry	-	<0.02	-	<0.02
Bromodichloromethane	0.05 ug/g dry	-	<0.05	-	<0.05
Bromoform	0.05 ug/g dry	-	<0.05	-	<0.05
Bromomethane	0.05 ug/g dry	-	<0.05	-	<0.05
Carbon Tetrachloride	0.05 ug/g dry	-	<0.05	-	<0.05
Chlorobenzene	0.05 ug/g dry	-	<0.05	-	<0.05
Chloroform	0.05 ug/g dry	-	<0.05	-	<0.05
Dibromochloromethane	0.05 ug/g dry	-	<0.05	-	<0.05
Dichlorodifluoromethane	0.05 ug/g dry	-	<0.05	-	<0.05
1,2-Dichlorobenzene	0.05 ug/g dry	-	<0.05	-	<0.05

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 20920

Report Date: 04-Nov-2016

Order Date: 31-Oct-2016

Project Description: PE3896

	Client ID:	BH4-SS5	BH10-SS3	BH10-SS2	BH2-SS5/SS6
	Sample Date:	28-Oct-16	28-Oct-16	28-Oct-16	27-Oct-16
	Sample ID:	1645106-01	1645106-02	1645106-03	1645106-04
	MDL/Units	Soil	Soil	Soil	Soil
1,3-Dichlorobenzene	0.05 ug/g dry	-	<0.05	-	<0.05
1,4-Dichlorobenzene	0.05 ug/g dry	-	<0.05	-	<0.05
1,1-Dichloroethane	0.05 ug/g dry	-	<0.05	-	<0.05
1,2-Dichloroethane	0.05 ug/g dry	-	<0.05	-	<0.05
1,1-Dichloroethylene	0.05 ug/g dry	-	<0.05	-	<0.05
cis-1,2-Dichloroethylene	0.05 ug/g dry	-	<0.05	-	<0.05
trans-1,2-Dichloroethylene	0.05 ug/g dry	-	<0.05	-	<0.05
1,2-Dichloropropane	0.05 ug/g dry	-	<0.05	-	<0.05
cis-1,3-Dichloropropylene	0.05 ug/g dry	-	<0.05	-	<0.05
trans-1,3-Dichloropropylene	0.05 ug/g dry	-	<0.05	-	<0.05
1,3-Dichloropropene, total	0.05 ug/g dry	-	<0.05	-	<0.05
Ethylbenzene	0.05 ug/g dry	-	<0.05	-	<0.05
Ethylene dibromide (dibromoethan	0.05 ug/g dry	-	<0.05	-	<0.05
Hexane	0.05 ug/g dry	-	<0.05	-	<0.05
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	-	<0.50	-	<0.50
Methyl Isobutyl Ketone	0.50 ug/g dry	-	<0.50	-	<0.50
Methyl tert-butyl ether	0.05 ug/g dry	-	<0.05	-	<0.05
Methylene Chloride	0.05 ug/g dry	-	<0.05	-	<0.05
Styrene	0.05 ug/g dry	-	<0.05	-	<0.05
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	-	<0.05	-	<0.05
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	-	<0.05	-	<0.05
Tetrachloroethylene	0.05 ug/g dry	-	<0.05	-	<0.05
Toluene	0.05 ug/g dry	-	<0.05	-	<0.05
1,1,1-Trichloroethane	0.05 ug/g dry	-	<0.05	-	<0.05
1,1,2-Trichloroethane	0.05 ug/g dry	-	<0.05	-	<0.05
Trichloroethylene	0.05 ug/g dry	-	<0.05	-	<0.05
Trichlorofluoromethane	0.05 ug/g dry	-	<0.05	-	<0.05
Vinyl chloride	0.02 ug/g dry	-	<0.02	-	<0.02
m,p-Xylenes	0.05 ug/g dry	-	<0.05	-	<0.05
o-Xylene	0.05 ug/g dry	-	<0.05	-	<0.05
Xylenes, total	0.05 ug/g dry	-	<0.05	-	<0.05
4-Bromofluorobenzene	Surrogate	-	98.2%	-	96.2%
Dibromofluoromethane	Surrogate	-	106%	-	96.9%
Toluene-d8	Surrogate	-	88.5%	-	88.2%
Benzene	0.02 ug/g dry	<0.02	-	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 20920

Report Date: 04-Nov-2016

Order Date: 31-Oct-2016

Project Description: PE3896

	Client ID:	BH4-SS5	BH10-SS3	BH10-SS2	BH2-SS5/SS6
	Sample Date:	28-Oct-16	28-Oct-16	28-Oct-16	27-Oct-16
	Sample ID:	1645106-01	1645106-02	1645106-03	1645106-04
	MDL/Units	Soil	Soil	Soil	Soil
Toluene	0.05 ug/g dry	<0.05	-	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	-	-	-
o-Xylene	0.05 ug/g dry	<0.05	-	-	-
Xylenes, total	0.05 ug/g dry	<0.05	-	-	-
Toluene-d8	Surrogate	90.5%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	181	-	-
F3 PHCs (C16-C34)	8 ug/g dry	77	7460	-	-
F4 PHCs (C34-C50)	6 ug/g dry	53	5460 [1]	-	-
F4G PHCs (gravimetric)	50 ug/g dry	-	6590	-	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	-	-	1.26	-
Acenaphthylene	0.02 ug/g dry	-	-	0.12	-
Anthracene	0.02 ug/g dry	-	-	3.37	-
Benzo [a] anthracene	0.02 ug/g dry	-	-	5.27	-
Benzo [a] pyrene	0.02 ug/g dry	-	-	5.74	-
Benzo [b] fluoranthene	0.02 ug/g dry	-	-	5.16	-
Benzo [g,h,i] perylene	0.02 ug/g dry	-	-	3.76	-
Benzo [k] fluoranthene	0.02 ug/g dry	-	-	3.60	-
Chrysene	0.02 ug/g dry	-	-	5.49	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	-	-	1.01	-
Fluoranthene	0.02 ug/g dry	-	-	13.5	-
Fluorene	0.02 ug/g dry	-	-	1.55	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	-	-	3.25	-
1-Methylnaphthalene	0.02 ug/g dry	-	-	0.39	-
2-Methylnaphthalene	0.02 ug/g dry	-	-	0.53	-
Methylnaphthalene (1&2)	0.04 ug/g dry	-	-	0.91	-
Naphthalene	0.01 ug/g dry	-	-	0.70	-
Phenanthrene	0.02 ug/g dry	-	-	11.4	-
Pyrene	0.02 ug/g dry	-	-	11.2	-
2-Fluorobiphenyl	Surrogate	-	-	107%	-
Terphenyl-d14	Surrogate	-	-	99.7%	-

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						
F4G PHCs (gravimetric)	ND	50	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	1.0	ug/g						
Boron, available	ND	0.5	ug/g						
Boron	ND	1.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	1.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	1.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.5	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	1.0	ug/g						
Zinc	ND	1.0	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.31*		*ug/g*		*98.6*	*50-140*			
Surrogate: Terphenyl-d14	*1.43*		*ug/g*		*107*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g						
Benzene	ND	0.02	ug/g						
Bromodichloromethane	ND	0.05	ug/g						
Bromoform	ND	0.05	ug/g						
Bromomethane	ND	0.05	ug/g						
Carbon Tetrachloride	ND	0.05	ug/g						
Chlorobenzene	ND	0.05	ug/g						
Chloroform	ND	0.05	ug/g						
Dibromochloromethane	ND	0.05	ug/g						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Dichlorodifluoromethane	ND	0.05	ug/g						
1,2-Dichlorobenzene	ND	0.05	ug/g						
1,3-Dichlorobenzene	ND	0.05	ug/g						
1,4-Dichlorobenzene	ND	0.05	ug/g						
1,1-Dichloroethane	ND	0.05	ug/g						
1,2-Dichloroethane	ND	0.05	ug/g						
1,1-Dichloroethylene	ND	0.05	ug/g						
cis-1,2-Dichloroethylene	ND	0.05	ug/g						
trans-1,2-Dichloroethylene	ND	0.05	ug/g						
1,2-Dichloropropane	ND	0.05	ug/g						
cis-1,3-Dichloropropylene	ND	0.05	ug/g						
trans-1,3-Dichloropropylene	ND	0.05	ug/g						
1,3-Dichloropropene, total	ND	0.05	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Ethylene dibromide (dibromoethane	ND	0.05	ug/g						
Hexane	ND	0.05	ug/g						
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g						
Methyl Isobutyl Ketone	ND	0.50	ug/g						
Methyl tert-butyl ether	ND	0.05	ug/g						
Methylene Chloride	ND	0.05	ug/g						
Styrene	ND	0.05	ug/g						
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g						
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g						
Tetrachloroethylene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
1,1,1-Trichloroethane	ND	0.05	ug/g						
1,1,2-Trichloroethane	ND	0.05	ug/g						
Trichloroethylene	ND	0.05	ug/g						
Trichlorofluoromethane	ND	0.05	ug/g						
Vinyl chloride	ND	0.02	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: 4-Bromofluorobenzene	*8.00*		*ug/g*		*100*	*50-140*			
Surrogate: Dibromofluoromethane	*8.56*		*ug/g*		*107*	*50-140*			
Surrogate: Toluene-d8	*7.32*		*ug/g*		*91.5*	*50-140*			
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*7.32*		*ug/g*		*91.5*	*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	
Metals									
Antimony	ND	1.0	ug/g dry	ND				30	
Arsenic	ND	1.0	ug/g dry	ND				30	
Barium	98.8	1.0	ug/g dry	101			2.6	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron, available	ND	0.5	ug/g dry	0.61			0.0	35	
Boron	10.3	1.0	ug/g dry	11.5			10.6	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium (VI)	ND	0.2	ug/g dry	ND				35	
Chromium	28.3	1.0	ug/g dry	29.1			3.1	30	
Cobalt	8.04	1.0	ug/g dry	8.47			5.2	30	
Copper	19.9	1.0	ug/g dry	20.6			3.5	30	
Lead	70.4	1.0	ug/g dry	86.9			21.0	30	
Mercury	ND	0.1	ug/g dry	ND				30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	17.6	1.0	ug/g dry	17.8			1.2	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.5	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	31.5	1.0	ug/g dry	32.3			2.4	30	
Zinc	56.2	1.0	ug/g dry	58.0			3.1	30	
Physical Characteristics									
% Solids	85.4	0.1	% by Wt.	86.5			1.3	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	
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	*1.38*		*ug/g dry*		*95.9*	*50-140*			
Surrogate: Terphenyl-d14	*1.34*		*ug/g dry*		*93.2*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g dry	ND				50	
Benzene	ND	0.02	ug/g dry	ND				50	
Bromodichloromethane	ND	0.05	ug/g dry	ND				50	
Bromoform	ND	0.05	ug/g dry	ND				50	
Bromomethane	ND	0.05	ug/g dry	ND				50	
Carbon Tetrachloride	ND	0.05	ug/g dry	ND				50	
Chlorobenzene	ND	0.05	ug/g dry	ND				50	
Chloroform	ND	0.05	ug/g dry	ND				50	
Dibromochloromethane	ND	0.05	ug/g dry	ND				50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND				50	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND				50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Ethylene dibromide (dibromoethane	ND	0.05	ug/g dry	ND				50	
Hexane	ND	0.05	ug/g dry	ND				50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND				50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND				50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND				50	
Methylene Chloride	ND	0.05	ug/g dry	ND				50	
Styrene	ND	0.05	ug/g dry	ND				50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
Tetrachloroethylene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND				50	
Trichloroethylene	ND	0.05	ug/g dry	ND				50	
Trichlorofluoromethane	ND	0.05	ug/g dry	ND				50	
Vinyl chloride	ND	0.02	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: 4-Bromofluorobenzene	*4.43*		*ug/g dry*		*96.9*	*50-140*			
Surrogate: Dibromofluoromethane	*5.58*		*ug/g dry*		*122*	*50-140*			
Surrogate: Toluene-d8	*4.43*		*ug/g dry*		*96.9*	*50-140*			
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: Toluene-d8	*4.43*		*ug/g dry*		*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)	208	7	ug/g		104	80-120			
F2 PHCs (C10-C16)	110	4	ug/g	ND	107	60-140			
F3 PHCs (C16-C34)	235	8	ug/g	ND	111	60-140			
F4 PHCs (C34-C50)	159	6	ug/g	ND	112	60-140			
F4G PHCs (gravimetric)	820	50	ug/g		82.0	80-120			
Metals									
Antimony	304		ug/L	ND	122	70-130			
Arsenic	265		ug/L		106	70-130			
Barium	2200		ug/L	2030	70.3	70-130			
Beryllium	279		ug/L	3.04	110	70-130			
Boron, available	5.03	0.5	ug/g	0.61	88.5	70-122			
Boron	488		ug/L	230	103	70-130			
Cadmium	276		ug/L	4.65	109	70-130			
Chromium (VI)	4.4	0.2	ug/g		88.0	70-130			
Chromium	807		ug/L	583	89.7	70-130			
Cobalt	400		ug/L	169	92.2	70-130			
Copper	644		ug/L	413	92.2	70-130			
Lead	1910		ug/L	1740	70.2	70-130			
Mercury	1.30	0.1	ug/g	ND	86.6	70-130			
Molybdenum	252		ug/L	10.3	96.7	70-130			
Nickel	559		ug/L	356	81.3	70-130			
Selenium	252		ug/L	16.3	94.2	70-130			
Silver	187		ug/L	5.45	72.4	70-130			
Thallium	228		ug/L	13.8	85.7	70-130			
Uranium	297		ug/L	ND	119	70-130			
Vanadium	866		ug/L	645	88.5	70-130			
Zinc	1300		ug/L	1160	54.7	70-130			QM-07
Semi-Volatiles									
Acenaphthene	0.119	0.02	ug/g	ND	66.0	50-140			
Acenaphthylene	0.109	0.02	ug/g	ND	60.5	50-140			
Anthracene	0.149	0.02	ug/g	ND	82.6	50-140			
Benzo [a] anthracene	0.117	0.02	ug/g	ND	64.7	50-140			
Benzo [a] pyrene	0.181	0.02	ug/g	ND	100	50-140			
Benzo [b] fluoranthene	0.175	0.02	ug/g	ND	97.2	50-140			
Benzo [g,h,i] perylene	0.206	0.02	ug/g	ND	114	50-140			
Benzo [k] fluoranthene	0.178	0.02	ug/g	ND	99.1	50-140			
Chrysene	0.152	0.02	ug/g	ND	84.2	50-140			
Dibenzo [a,h] anthracene	0.212	0.02	ug/g	ND	117	50-140			
Fluoranthene	0.148	0.02	ug/g	ND	82.0	50-140			
Fluorene	0.130	0.02	ug/g	ND	72.4	50-140			
Indeno [1,2,3-cd] pyrene	0.223	0.02	ug/g	ND	124	50-140			
1-Methylnaphthalene	0.165	0.02	ug/g	ND	91.9	50-140			
2-Methylnaphthalene	0.176	0.02	ug/g	ND	97.9	50-140			
Naphthalene	0.126	0.01	ug/g	ND	70.0	50-140			
Phenanthrene	0.142	0.02	ug/g	ND	78.8	50-140			
Pyrene	0.152	0.02	ug/g	ND	84.3	50-140			
Surrogate: 2-Fluorobiphenyl	*1.67*		*ug/g*		*116*	*50-140*			
Volatiles									
Acetone	7.94	0.50	ug/g		79.4	50-140			
Benzene	4.25	0.02	ug/g		106	60-130			
Bromodichloromethane	3.82	0.05	ug/g		95.6	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Bromoform	3.87	0.05	ug/g		96.8	60-130			
Bromomethane	3.90	0.05	ug/g		97.5	50-140			
Carbon Tetrachloride	3.74	0.05	ug/g		93.5	60-130			
Chlorobenzene	3.58	0.05	ug/g		89.5	60-130			
Chloroform	3.99	0.05	ug/g		99.7	60-130			
Dibromochloromethane	3.61	0.05	ug/g		90.3	60-130			
Dichlorodifluoromethane	2.63	0.05	ug/g		65.7	50-140			
1,2-Dichlorobenzene	3.72	0.05	ug/g		93.1	60-130			
1,3-Dichlorobenzene	3.83	0.05	ug/g		95.8	60-130			
1,4-Dichlorobenzene	3.50	0.05	ug/g		87.5	60-130			
1,1-Dichloroethane	4.09	0.05	ug/g		102	60-130			
1,2-Dichloroethane	3.41	0.05	ug/g		85.2	60-130			
1,1-Dichloroethylene	4.02	0.05	ug/g		100	60-130			
cis-1,2-Dichloroethylene	3.93	0.05	ug/g		98.3	60-130			
trans-1,2-Dichloroethylene	4.34	0.05	ug/g		108	60-130			
1,2-Dichloropropane	3.72	0.05	ug/g		93.1	60-130			
cis-1,3-Dichloropropylene	3.48	0.05	ug/g		87.0	60-130			
trans-1,3-Dichloropropylene	3.28	0.05	ug/g		81.9	60-130			
Ethylbenzene	3.33	0.05	ug/g		83.4	60-130			
Ethylene dibromide (dibromoethane	3.70	0.05	ug/g		92.6	60-130			
Hexane	3.00	0.05	ug/g		75.1	60-130			
Methyl Ethyl Ketone (2-Butanone)	7.92	0.50	ug/g		79.2	50-140			
Methyl Isobutyl Ketone	8.23	0.50	ug/g		82.3	50-140			
Methyl tert-butyl ether	10.2	0.05	ug/g		102	50-140			
Methylene Chloride	3.89	0.05	ug/g		97.3	60-130			
Styrene	3.41	0.05	ug/g		85.2	60-130			
1,1,1,2-Tetrachloroethane	3.62	0.05	ug/g		90.5	60-130			
1,1,2,2-Tetrachloroethane	3.37	0.05	ug/g		84.2	60-130			
Tetrachloroethylene	3.89	0.05	ug/g		97.3	60-130			
Toluene	3.44	0.05	ug/g		86.0	60-130			
1,1,1-Trichloroethane	3.81	0.05	ug/g		95.3	60-130			
1,1,2-Trichloroethane	3.82	0.05	ug/g		95.6	60-130			
Trichloroethylene	3.25	0.05	ug/g		81.2	60-130			
Trichlorofluoromethane	3.65	0.05	ug/g		91.2	50-140			
Vinyl chloride	4.44	0.02	ug/g		111	50-140			
m,p-Xylenes	7.12	0.05	ug/g		88.9	60-130			
o-Xylene	3.19	0.05	ug/g		79.8	60-130			
Benzene	4.25	0.02	ug/g		106	60-130			
Ethylbenzene	3.33	0.05	ug/g		83.4	60-130			
Toluene	3.44	0.05	ug/g		86.0	60-130			
m,p-Xylenes	7.12	0.05	ug/g		88.9	60-130			
o-Xylene	3.19	0.05	ug/g		79.8	60-130			

Qualifier Notes:

Sample Qualifiers :

1 : GC-FID signal did not return to baseline by C50

QC Qualifiers :

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

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)
№ 28919

Page ___ of ___

Client Name: Paterson Group	Project Reference: PE3896	**Turnaround Time:**
Contact Name: Karyn Munch	Quote #	☐ 1 Day ☐ 3 Day
Address: 154 Colonnade Rd. S.	PO # 20920	☐ 2 Day ☒ Regular
Telephone: 613-226-7381	Email Address: kmunch@patersongroup.ca	Date Required:

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

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

Paracel Order Number: 1645106

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	BTEX/PHC	VOC/PHC	Metals + CrVI + Hg	VOCs	PAHs						
							Required Analyses										
1	BH4-SS5	S		2	Oct. 28/16	am	✓						-120ml + 1 vial +				✓
2	BH10-SS3	S		2	"	pm		✓									✓
3	BH10-SS2	S		1	"	pm			✓		✓		-120ml-				✓
4	BH2-SS5/SS6	S		2	Oct. 27/16	pm				✓			-120ml + 1 vial-				✓
X 5	BH1-SS6 hold please	S		2	Oct. 27/16	pm	✓							√			✓
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): KMunch	Received by Driver/Depot: Jesse	Received at Lab: Sunnypoor DONMAI	Verified By: SCL
Relinquished By (Print): K Munch.	Date/Time: 31/10/16 4:45	Date/Time: Oct 31, 2016 05:44	Date/Time: Nov 1/16
Date/Time: Oct. 31, 2016.	Temperature: ___ °C FH.	Temperature: 16.2 °C	pH Verified [ ] By: N/A

9:55c

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Karyn Munch

Client PO: 20920
Project: PE3896
Custody: 28919

Report Date: 8-Nov-2016
Order Date: 2-Nov-2016

Order #: 1645241

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

Paracel ID	Client ID
1645241-01	BH1 - SS6

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20920

Report Date: 08-Nov-2016
Order Date: 2-Nov-2016
Project Description: PE3896

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	4-Nov-16	6-Nov-16
PHC F1	CWS Tier 1 - P&T GC-FID	4-Nov-16	6-Nov-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	3-Nov-16	4-Nov-16
Solids, %	Gravimetric, calculation	3-Nov-16	3-Nov-16

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 20920

Report Date: 08-Nov-2016

Order Date: 2-Nov-2016

Project Description: PE3896

	Client ID:	BH1 - SS6	-	-	-
	Sample Date:	27-Oct-16	-	-	-
	Sample ID:	1645241-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	66.5	-	-	-
Volatiles					
Benzene	0.02 ug/g dry	<0.02	-	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	-
Toluene	0.05 ug/g dry	<0.05	-	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	-	-	-
o-Xylene	0.05 ug/g dry	<0.05	-	-	-
Xylenes, total	0.05 ug/g dry	<0.05	-	-	-
Toluene-d8	Surrogate	102%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	-	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	-	-	-
F3 PHCs (C16-C34)	8 ug/g dry	72	-	-	-
F4 PHCs (C34-C50)	6 ug/g dry	160	-	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20920

Report Date: 08-Nov-2016
Order Date: 2-Nov-2016
Project Description: PE3896

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Volatiles									
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	*8.16*		*ug/g*		*102*	*50-140*			

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20920

Report Date: 08-Nov-2016
Order Date: 2-Nov-2016
Project Description: PE3896

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	
Physical Characteristics									
% Solids	83.2	0.1	% by Wt.	82.4			0.9	25	
Volatiles									
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: Toluene-d8	*5.68*		*ug/g dry*		*103*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	190	7	ug/g		94.9	80-120			
F2 PHCs (C10-C16)	185	4	ug/g	ND	137	60-140			
F3 PHCs (C16-C34)	433	8	ug/g	72	129	60-140			
F4 PHCs (C34-C50)	361	6	ug/g	160	107	60-140			
Volatiles									
Benzene	3.73	0.02	ug/g		93.2	60-130			
Ethylbenzene	3.39	0.05	ug/g		84.6	60-130			
Toluene	3.49	0.05	ug/g		87.3	60-130			
m,p-Xylenes	7.30	0.05	ug/g		91.2	60-130			
o-Xylene	3.25	0.05	ug/g		81.3	60-130			
Surrogate: Toluene-d8	*7.80*		*ug/g*		*97.5*	*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.

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)
№ 28919

Page ___ of ___

Client Name: Paterson Group	Project Reference: PE3896
Contact Name: Karyn Munch	Quote #:
Address: 154 Colonnade Rd. S.	PO #: 20920
Telephone: 613 226 7381	Email Address: kmunch@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: 1645241 ~~1645106~~

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	BTEX/PHC	VOC/PHC	metals + Cr VI + Hg	VOCs	PAHs	[redacted]					
1	BH4-SS5	S		2	Oct.28/16	am	✓						-120ml + 1 vial-				
2	BH10-SS3	S		2	"	pm		✓									
3	BH10-SS2	S		1	"	pm			✓		✓		-120ml-				
4	BH2-SS5/SS6	S		2	Oct.27/16	pm				✓			-120ml + 1 vial-				
*5	BH1-SS6 hold please.	S		2	Oct.27/16	pm	✓						↓				
6	↳ Revised: NOV. 2, 16																
7	→ RUN SAMPLE for PHC/BTEX on regular TAT.																
8	DB/KM																
9																	
10																	

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): KMunch	Received by Driver/Depot: [signature]	Received at Lab: Sumeeporn Dohmai	Verified By: [signature]
Relinquished By (Print): KMunch.	Date/Time: 31/10/16 4:45	Date/Time: Oct 31, 2016 05:44	Date/Time: Nov 1/16 9:59
Date/Time: Oct.31, 2016.	Temperature: ___ °C PH	Temperature: 16.2 °C	pH Verified [ ] By: N/A

Chain of Custody (Blank) - Rev 0.4 Feb 2016

S 2/11/16 11:49

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Karyn Munch

Client PO: 20921
Project: PE3896
Custody: 28921

Report Date: 9-Nov-2016
Order Date: 3-Nov-2016

Order #: 1645395

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

Paracel ID	Client ID
1645395-01	BH5 - SS2
1645395-02	BH11 - SS2
1645395-03	BH12 - SS3
1645395-04	BH13 - SS3

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20921

Report Date: 09-Nov-2016
Order Date: 3-Nov-2016
Project Description: PE3896

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	4-Nov-16	9-Nov-16
PHC F1	CWS Tier 1 - P&T GC-FID	4-Nov-16	9-Nov-16
PHC F4G (gravimetric)	CWS Tier 1 - Extraction Gravimetric	7-Nov-16	7-Nov-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	4-Nov-16	5-Nov-16
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	7-Nov-16	8-Nov-16
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	4-Nov-16	9-Nov-16
Solids, %	Gravimetric, calculation	7-Nov-16	7-Nov-16

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 20921

Report Date: 09-Nov-2016

Order Date: 3-Nov-2016

Project Description: PE3896

	Client ID:	BH5 - SS2	BH11 - SS2	BH12 - SS3	BH13 - SS3
	Sample Date:	31-Oct-16	31-Oct-16	31-Oct-16	01-Nov-16
	Sample ID:	1645395-01	1645395-02	1645395-03	1645395-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	85.3	83.2	89.6	91.0
Volatiles					
Acetone	0.50 ug/g dry	<0.50	<0.50	-	-
Benzene	0.02 ug/g dry	<0.02	<0.02	-	-
Bromodichloromethane	0.05 ug/g dry	<0.05	<0.05	-	-
Bromoform	0.05 ug/g dry	<0.05	<0.05	-	-
Bromomethane	0.05 ug/g dry	<0.05	<0.05	-	-
Carbon Tetrachloride	0.05 ug/g dry	<0.05	<0.05	-	-
Chlorobenzene	0.05 ug/g dry	<0.05	<0.05	-	-
Chloroform	0.05 ug/g dry	<0.05	<0.05	-	-
Dibromochloromethane	0.05 ug/g dry	<0.05	<0.05	-	-
Dichlorodifluoromethane	0.05 ug/g dry	<0.05	<0.05	-	-
1,2-Dichlorobenzene	0.05 ug/g dry	<0.05	<0.05	-	-
1,3-Dichlorobenzene	0.05 ug/g dry	<0.05	<0.05	-	-
1,4-Dichlorobenzene	0.05 ug/g dry	<0.05	<0.05	-	-
1,1-Dichloroethane	0.05 ug/g dry	<0.05	<0.05	-	-
1,2-Dichloroethane	0.05 ug/g dry	<0.05	<0.05	-	-
1,1-Dichloroethylene	0.05 ug/g dry	<0.05	<0.05	-	-
cis-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	<0.05	-	-
trans-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	<0.05	-	-
1,2-Dichloropropane	0.05 ug/g dry	<0.05	<0.05	-	-
cis-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	<0.05	-	-
trans-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	<0.05	-	-
1,3-Dichloropropene, total	0.05 ug/g dry	<0.05	<0.05	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	-	-
Ethylene dibromide (dibromoethan	0.05 ug/g dry	<0.05	<0.05	-	-
Hexane	0.05 ug/g dry	<0.05	<0.05	-	-
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	<0.50	<0.50	-	-
Methyl Isobutyl Ketone	0.50 ug/g dry	<0.50	<0.50	-	-
Methyl tert-butyl ether	0.05 ug/g dry	<0.05	<0.05	-	-
Methylene Chloride	0.05 ug/g dry	<0.05	<0.05	-	-
Styrene	0.05 ug/g dry	<0.05	<0.05	-	-
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	<0.05	<0.05	-	-
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	<0.05	<0.05	-	-
Tetrachloroethylene	0.05 ug/g dry	<0.05	<0.05	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20921

Report Date: 09-Nov-2016
Order Date: 3-Nov-2016
Project Description: PE3896

	Client ID:	BH5 - SS2	BH11 - SS2	BH12 - SS3	BH13 - SS3
	Sample Date:	31-Oct-16	31-Oct-16	31-Oct-16	01-Nov-16
	Sample ID:	1645395-01	1645395-02	1645395-03	1645395-04
	MDL/Units	Soil	Soil	Soil	Soil
Toluene	0.05 ug/g dry	<0.05	<0.05	-	-
1,1,1-Trichloroethane	0.05 ug/g dry	<0.05	<0.05	-	-
1,1,2-Trichloroethane	0.05 ug/g dry	<0.05	<0.05	-	-
Trichloroethylene	0.05 ug/g dry	<0.05	<0.05	-	-
Trichlorofluoromethane	0.05 ug/g dry	<0.05	<0.05	-	-
Vinyl chloride	0.02 ug/g dry	<0.02	<0.02	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	-	-
o-Xylene	0.05 ug/g dry	<0.05	<0.05	-	-
Xylenes, total	0.05 ug/g dry	<0.05	<0.05	-	-
4-Bromofluorobenzene	Surrogate	93.7%	95.9%	-	-
Dibromofluoromethane	Surrogate	113%	118%	-	-
Toluene-d8	Surrogate	102%	101%	-	-
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	-	-	103%	103%
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	525	<8	<8	<8
F4 PHCs (C34-C50)	6 ug/g dry	721 [1]	<6	<6	<6
F4G PHCs (gravimetric)	50 ug/g dry	575	-	-	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	-	-	-
Acenaphthylene	0.02 ug/g dry	0.15	-	-	-
Anthracene	0.02 ug/g dry	0.10	-	-	-
Benzo [a] anthracene	0.02 ug/g dry	0.16	-	-	-
Benzo [a] pyrene	0.02 ug/g dry	0.24	-	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	0.26	-	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	0.21	-	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	0.12	-	-	-
Chrysene	0.02 ug/g dry	0.19	-	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	0.05	-	-	-
Fluoranthene	0.02 ug/g dry	0.25	-	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 20921

Report Date: 09-Nov-2016

Order Date: 3-Nov-2016

Project Description: PE3896

	Client ID:	BH5 - SS2	BH11 - SS2	BH12 - SS3	BH13 - SS3
	Sample Date:	31-Oct-16	31-Oct-16	31-Oct-16	01-Nov-16
	Sample ID:	1645395-01	1645395-02	1645395-03	1645395-04
	MDL/Units	Soil	Soil	Soil	Soil
Fluorene	0.02 ug/g dry	<0.02	-	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	0.17	-	-	-
1-Methylnaphthalene	0.02 ug/g dry	0.06	-	-	-
2-Methylnaphthalene	0.02 ug/g dry	0.06	-	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	0.12	-	-	-
Naphthalene	0.01 ug/g dry	0.05	-	-	-
Phenanthrene	0.02 ug/g dry	0.07	-	-	-
Pyrene	0.02 ug/g dry	0.26	-	-	-
2-Fluorobiphenyl	Surrogate	93.6%	-	-	-
Terphenyl-d14	Surrogate	80.8%	-	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20921

Report Date: 09-Nov-2016
Order Date: 3-Nov-2016
Project Description: PE3896

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						
F4G PHCs (gravimetric)	ND	50	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	*1.24*		*ug/g*		*93.0*	*50-140*			
Surrogate: Terphenyl-d14	*1.23*		*ug/g*		*92.1*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g						
Benzene	ND	0.02	ug/g						
Bromodichloromethane	ND	0.05	ug/g						
Bromoform	ND	0.05	ug/g						
Bromomethane	ND	0.05	ug/g						
Carbon Tetrachloride	ND	0.05	ug/g						
Chlorobenzene	ND	0.05	ug/g						
Chloroform	ND	0.05	ug/g						
Dibromochloromethane	ND	0.05	ug/g						
Dichlorodifluoromethane	ND	0.05	ug/g						
1,2-Dichlorobenzene	ND	0.05	ug/g						
1,3-Dichlorobenzene	ND	0.05	ug/g						
1,4-Dichlorobenzene	ND	0.05	ug/g						
1,1-Dichloroethane	ND	0.05	ug/g						
1,2-Dichloroethane	ND	0.05	ug/g						
1,1-Dichloroethylene	ND	0.05	ug/g						
cis-1,2-Dichloroethylene	ND	0.05	ug/g						
trans-1,2-Dichloroethylene	ND	0.05	ug/g						
1,2-Dichloropropane	ND	0.05	ug/g						
cis-1,3-Dichloropropylene	ND	0.05	ug/g						
trans-1,3-Dichloropropylene	ND	0.05	ug/g						
1,3-Dichloropropene, total	ND	0.05	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Ethylene dibromide (dibromoethane	ND	0.05	ug/g						
Hexane	ND	0.05	ug/g						
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g						
Methyl Isobutyl Ketone	ND	0.50	ug/g						
Methyl tert-butyl ether	ND	0.05	ug/g						
Methylene Chloride	ND	0.05	ug/g						
Styrene	ND	0.05	ug/g						
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g						

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20921

Report Date: 09-Nov-2016
Order Date: 3-Nov-2016
Project Description: PE3896

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g						
Tetrachloroethylene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
1,1,1-Trichloroethane	ND	0.05	ug/g						
1,1,2-Trichloroethane	ND	0.05	ug/g						
Trichloroethylene	ND	0.05	ug/g						
Trichlorofluoromethane	ND	0.05	ug/g						
Vinyl chloride	ND	0.02	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: 4-Bromofluorobenzene	*7.95*		*ug/g*		*99.3*	*50-140*			
Surrogate: Dibromofluoromethane	*9.17*		*ug/g*		*115*	*50-140*			
Surrogate: Toluene-d8	*8.16*		*ug/g*		*102*	*50-140*			
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*8.16*		*ug/g*		*102*	*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	
F4G PHCs (gravimetric)	ND	50	ug/g dry	ND				30	
Physical Characteristics									
% Solids	90.7	0.1	% by Wt.	90.6			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			0.0	40	
Benzo [a] anthracene	ND	0.02	ug/g dry	ND				40	
Benzo [a] pyrene	ND	0.02	ug/g dry	ND			0.0	40	
Benzo [b] fluoranthene	ND	0.02	ug/g dry	ND				40	
Benzo [g,h,i] perylene	ND	0.02	ug/g dry	ND				40	
Benzo [k] fluoranthene	ND	0.02	ug/g dry	ND				40	
Chrysene	ND	0.02	ug/g dry	ND				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			0.0	40	
Pyrene	ND	0.02	ug/g dry	ND				40	
Surrogate: 2-Fluorobiphenyl	*2.57*		*ug/g dry*		*86.1*	*50-140*			
Surrogate: Terphenyl-d14	*2.44*		*ug/g dry*		*81.9*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g dry	ND				50	
Benzene	ND	0.02	ug/g dry	ND				50	
Bromodichloromethane	ND	0.05	ug/g dry	ND				50	
Bromoform	ND	0.05	ug/g dry	ND				50	
Bromomethane	ND	0.05	ug/g dry	ND				50	
Carbon Tetrachloride	ND	0.05	ug/g dry	ND				50	
Chlorobenzene	ND	0.05	ug/g dry	ND				50	
Chloroform	ND	0.05	ug/g dry	ND				50	
Dibromochloromethane	ND	0.05	ug/g dry	ND				50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND				50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Ethylene dibromide (dibromoethane	ND	0.05	ug/g dry	ND				50	
Hexane	ND	0.05	ug/g dry	ND				50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND				50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND				50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND				50	
Methylene Chloride	ND	0.05	ug/g dry	ND				50	
Styrene	ND	0.05	ug/g dry	ND				50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Tetrachloroethylene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND				50	
Trichloroethylene	ND	0.05	ug/g dry	ND				50	
Trichlorofluoromethane	ND	0.05	ug/g dry	ND				50	
Vinyl chloride	ND	0.02	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: 4-Bromofluorobenzene	*6.06*		*ug/g dry*		*96.4*	*50-140*			
Surrogate: Dibromofluoromethane	*7.19*		*ug/g dry*		*114*	*50-140*			
Surrogate: Toluene-d8	*6.49*		*ug/g dry*		*103*	*50-140*			
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: Toluene-d8	*6.49*		*ug/g dry*		*103*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	190	7	ug/g		94.9	80-120			
F2 PHCs (C10-C16)	102	4	ug/g	ND	95.8	60-140			
F3 PHCs (C16-C34)	244	8	ug/g	ND	111	60-140			
F4 PHCs (C34-C50)	167	6	ug/g	ND	114	60-140			
F4G PHCs (gravimetric)	820	50	ug/g		82.0	80-120			
Semi-Volatiles									
Acenaphthene	0.158	0.02	ug/g	ND	84.5	50-140			
Acenaphthylene	0.147	0.02	ug/g	ND	78.7	50-140			
Anthracene	0.170	0.02	ug/g	ND	91.0	50-140			
Benzo [a] anthracene	0.134	0.02	ug/g	ND	71.7	50-140			
Benzo [a] pyrene	0.175	0.02	ug/g	ND	93.8	50-140			
Benzo [b] fluoranthene	0.209	0.02	ug/g	ND	112	50-140			
Benzo [g,h,i] perylene	0.181	0.02	ug/g	ND	97.2	50-140			
Benzo [k] fluoranthene	0.217	0.02	ug/g	ND	116	50-140			
Chrysene	0.173	0.02	ug/g	ND	92.8	50-140			
Dibenzo [a,h] anthracene	0.182	0.02	ug/g	ND	97.7	50-140			
Fluoranthene	0.168	0.02	ug/g	ND	89.9	50-140			
Fluorene	0.156	0.02	ug/g	ND	83.8	50-140			
Indeno [1,2,3-cd] pyrene	0.193	0.02	ug/g	ND	104	50-140			
1-Methylnaphthalene	0.211	0.02	ug/g	ND	113	50-140			
2-Methylnaphthalene	0.216	0.02	ug/g	ND	116	50-140			
Naphthalene	0.172	0.01	ug/g	ND	92.4	50-140			
Phenanthrene	0.161	0.02	ug/g	ND	86.3	50-140			
Pyrene	0.173	0.02	ug/g	ND	93.0	50-140			
Surrogate: 2-Fluorobiphenyl	*1.01*		*ug/g*		*68.0*	*50-140*			
Volatiles									
Acetone	6.71	0.50	ug/g		67.1	50-140			
Benzene	3.73	0.02	ug/g		93.2	60-130			
Bromodichloromethane	3.51	0.05	ug/g		87.7	60-130			
Bromoform	3.94	0.05	ug/g		98.5	60-130			
Bromomethane	3.15	0.05	ug/g		78.8	50-140			
Carbon Tetrachloride	3.18	0.05	ug/g		79.6	60-130			
Chlorobenzene	3.63	0.05	ug/g		90.7	60-130			
Chloroform	3.48	0.05	ug/g		87.1	60-130			
Dibromochloromethane	3.71	0.05	ug/g		92.7	60-130			
Dichlorodifluoromethane	2.21	0.05	ug/g		55.1	50-140			
1,2-Dichlorobenzene	3.99	0.05	ug/g		99.6	60-130			
1,3-Dichlorobenzene	4.09	0.05	ug/g		102	60-130			
1,4-Dichlorobenzene	3.90	0.05	ug/g		97.6	60-130			
1,1-Dichloroethane	3.12	0.05	ug/g		78.0	60-130			
1,2-Dichloroethane	3.25	0.05	ug/g		81.4	60-130			
1,1-Dichloroethylene	3.32	0.05	ug/g		82.9	60-130			
cis-1,2-Dichloroethylene	3.44	0.05	ug/g		85.9	60-130			
trans-1,2-Dichloroethylene	3.45	0.05	ug/g		86.3	60-130			
1,2-Dichloropropane	3.38	0.05	ug/g		84.6	60-130			
cis-1,3-Dichloropropylene	2.82	0.05	ug/g		70.4	60-130			
trans-1,3-Dichloropropylene	2.64	0.05	ug/g		66.1	60-130			
Ethylbenzene	3.39	0.05	ug/g		84.6	60-130			
Ethylene dibromide (dibromoethane	3.74	0.05	ug/g		93.6	60-130			
Hexane	2.46	0.05	ug/g		61.4	60-130			
Methyl Ethyl Ketone (2-Butanone)	6.49	0.50	ug/g		64.9	50-140			

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20921

Report Date: 09-Nov-2016
Order Date: 3-Nov-2016
Project Description: PE3896

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methyl Isobutyl Ketone	6.71	0.50	ug/g		67.1	50-140			
Methyl tert-butyl ether	8.37	0.05	ug/g		83.7	50-140			
Methylene Chloride	3.23	0.05	ug/g		80.7	60-130			
Styrene	3.43	0.05	ug/g		85.8	60-130			
1,1,1,2-Tetrachloroethane	3.69	0.05	ug/g		92.3	60-130			
1,1,2,2-Tetrachloroethane	3.65	0.05	ug/g		91.2	60-130			
Tetrachloroethylene	3.92	0.05	ug/g		97.9	60-130			
Toluene	3.49	0.05	ug/g		87.3	60-130			
1,1,1-Trichloroethane	3.25	0.05	ug/g		81.2	60-130			
1,1,2-Trichloroethane	3.21	0.05	ug/g		80.3	60-130			
Trichloroethylene	2.98	0.05	ug/g		74.5	60-130			
Trichlorofluoromethane	3.04	0.05	ug/g		76.0	50-140			
Vinyl chloride	3.82	0.02	ug/g		95.4	50-140			
m,p-Xylenes	7.30	0.05	ug/g		91.2	60-130			
o-Xylene	3.25	0.05	ug/g		81.3	60-130			
Benzene	3.73	0.02	ug/g		93.2	60-130			
Ethylbenzene	3.39	0.05	ug/g		84.6	60-130			
Toluene	3.49	0.05	ug/g		87.3	60-130			
m,p-Xylenes	7.30	0.05	ug/g		91.2	60-130			
o-Xylene	3.25	0.05	ug/g		81.3	60-130			

Qualifier Notes:

Sample Qualifiers :

1 : GC-FID signal did not return to baseline by C50

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)
№ 28921

Page ___ of ___

Client Name: Paterson Group	Project Reference: PE3896
Contact Name: Karyn Munch	Quote #
Address: 154 Colonnade Rd S.	PO # 20921
Telephone: 613-226-7381	Email Address: kmunch@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)

Required Analyses

Paracel Order Number: 1645395

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	BTEX/PHCs	VOCs/PHCs	Metals *								
1	BH5 - SS2			2	Oct. 31/16	am		✓	✓								
2	BH11 - SS2			2	Oct. 31/16	am		✓							120ml + 1vial		
3	BH12 - SS3			2	Oct. 31/16	pm	✓										
4	BH13 - SS3			2	Nov. 1/16	am	✓										
5																	
6																	
7																	
8																	
9																	
10																	

Comments:
* please hold off on the metal analysis for now - will call Monday once I receive results for earlier submission.

Method of Delivery: Paracel

Relinquished By (Sign): KMunch	Received by Driver/Depot: A. Deguise	Received at Lab: SUNREPORN	Verified By: S
Relinquished By (Print): Karyn Munch	Date/Time: 03/11/16 3:00PM	Date/Time: NOV 03, 2016 04:55	Date/Time: 3/4/16 17:13
Date/Time: Nov. 3, 2016	Temperature: ___ °C	Temperature: 15.6 °C	pH Verified [ ] By: —

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Karyn Munch

Client PO: 20922
Project: PE3896
Custody: 110207

Report Date: 16-Nov-2016
Order Date: 11-Nov-2016

Order #: 1646446

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

Paracel ID	Client ID
1646446-01	BH10-SS5
1646446-02	BH5-SS3

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20922

Report Date: 16-Nov-2016
Order Date: 11-Nov-2016
Project Description: PE3896

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	14-Nov-16	14-Nov-16
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	11-Nov-16	14-Nov-16
Solids, %	Gravimetric, calculation	15-Nov-16	15-Nov-16

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 20922

Report Date: 16-Nov-2016

Order Date: 11-Nov-2016

Project Description: PE3896

	Client ID:	BH10-SS5	BH5-SS3	-	-
	Sample Date:	28-Oct-16	31-Oct-16	-	-
	Sample ID:	1646446-01	1646446-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	59.5	64.6	-	-
Hydrocarbons					
F2 PHCs (C10-C16)	4 ug/g dry	<4 [1]	<4 [1]	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8 [1]	38 [1]	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6 [1]	42 [1]	-	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	-	-	-
Acenaphthylene	0.02 ug/g dry	<0.02	-	-	-
Anthracene	0.02 ug/g dry	<0.02	-	-	-
Benzo [a] anthracene	0.02 ug/g dry	<0.02	-	-	-
Benzo [a] pyrene	0.02 ug/g dry	<0.02	-	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	<0.02	-	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	<0.02	-	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	<0.02	-	-	-
Chrysene	0.02 ug/g dry	<0.02	-	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	-	-	-
Fluoranthene	0.02 ug/g dry	<0.02	-	-	-
Fluorene	0.02 ug/g dry	<0.02	-	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	-	-	-
1-Methylnaphthalene	0.02 ug/g dry	<0.02	-	-	-
2-Methylnaphthalene	0.02 ug/g dry	<0.02	-	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	-	-	-
Naphthalene	0.01 ug/g dry	<0.01	-	-	-
Phenanthrene	0.02 ug/g dry	<0.02	-	-	-
Pyrene	0.02 ug/g dry	<0.02	-	-	-
2-Fluorobiphenyl	Surrogate	64.8%	-	-	-
Terphenyl-d14	Surrogate	63.9%	-	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20922

Report Date: 16-Nov-2016
Order Date: 11-Nov-2016
Project Description: PE3896

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.08*		*ug/g*		*81.0*	*50-140*			
Surrogate: Terphenyl-d14	*0.983*		*ug/g*		*73.7*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Physical Characteristics									
% Solids	91.9	0.1	% by Wt.	90.5			1.6	25	
Semi-Volatiles									
Acenaphthene	0.022	0.02	ug/g dry	ND			0.0	40	
Acenaphthylene	0.430	0.02	ug/g dry	0.366			16.2	40	
Anthracene	0.320	0.02	ug/g dry	0.278			14.3	40	
Benzo [a] anthracene	0.616	0.02	ug/g dry	0.546			12.0	40	
Benzo [a] pyrene	0.893	0.02	ug/g dry	0.777			13.9	40	
Benzo [b] fluoranthene	0.936	0.02	ug/g dry	0.848			9.9	40	
Benzo [g,h,i] perylene	0.704	0.02	ug/g dry	0.631			10.9	40	
Benzo [k] fluoranthene	0.498	0.02	ug/g dry	0.448			10.6	40	
Chrysene	0.620	0.02	ug/g dry	0.558			10.4	40	
Dibenzo [a,h] anthracene	0.186	0.02	ug/g dry	0.160			14.8	40	
Fluoranthene	1.04	0.02	ug/g dry	0.910			13.1	40	
Fluorene	ND	0.02	ug/g dry	ND				40	
Indeno [1,2,3-cd] pyrene	0.646	0.02	ug/g dry	0.566			13.1	40	
1-Methylnaphthalene	0.152	0.02	ug/g dry	0.148			2.6	40	
2-Methylnaphthalene	0.211	0.02	ug/g dry	0.189			11.2	40	
Naphthalene	0.131	0.01	ug/g dry	0.119			10.0	40	
Phenanthrene	0.293	0.02	ug/g dry	0.267			9.4	40	
Pyrene	0.942	0.02	ug/g dry	0.822			13.6	40	
Surrogate: 2-Fluorobiphenyl	*1.37*		*ug/g dry*		*80.1*	*50-140*			
Surrogate: Terphenyl-d14	*0.951*		*ug/g dry*		*55.5*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F2 PHCs (C10-C16)	90	4	ug/g	24	66.5	60-140			
F3 PHCs (C16-C34)	269	8	ug/g	132	66.9	60-140			
F4 PHCs (C34-C50)	175	6	ug/g	55	88.0	60-140			
Semi-Volatiles									
Acenaphthene	0.172	0.02	ug/g	ND	80.4	50-140			
Acenaphthylene	0.626	0.02	ug/g	0.366	122	50-140			
Anthracene	0.512	0.02	ug/g	0.278	109	50-140			
Benzo [a] anthracene	0.798	0.02	ug/g	0.546	118	50-140			
Benzo [a] pyrene	1.05	0.02	ug/g	0.777	130	50-140			
Benzo [b] fluoranthene	1.21	0.02	ug/g	0.848	170	50-140			QM-06
Benzo [g,h,i] perylene	0.880	0.02	ug/g	0.631	116	50-140			
Benzo [k] fluoranthene	0.742	0.02	ug/g	0.448	137	50-140			
Chrysene	0.867	0.02	ug/g	0.558	144	50-140			QM-06
Dibenzo [a,h] anthracene	0.347	0.02	ug/g	0.160	87.5	50-140			
Fluoranthene	1.21	0.02	ug/g	0.910	138	50-140			
Fluorene	0.176	0.02	ug/g	ND	82.0	50-140			
Indeno [1,2,3-cd] pyrene	0.833	0.02	ug/g	0.566	125	50-140			
1-Methylnaphthalene	0.350	0.02	ug/g	0.148	94.5	50-140			
2-Methylnaphthalene	0.405	0.02	ug/g	0.189	101	50-140			
Naphthalene	0.322	0.01	ug/g	0.119	94.8	50-140			
Phenanthrene	0.460	0.02	ug/g	0.267	90.3	50-140			
Pyrene	1.12	0.02	ug/g	0.822	139	50-140			
Surrogate: 2-Fluorobiphenyl	*1.38*		*ug/g*		*80.6*	*50-140*			

Qualifier Notes:

Login Qualifiers :

Sample - One or more parameter received past hold time - Proceed with expired analysis of F2-F4
Applies to samples: BH10-SS5

Sample Qualifiers :

1 : This analysis was conducted after the accepted holding time had been exceeded.

QC Qualifiers :

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

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Ottawa, Ontario K1G 4J8
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Chain of Custody
(Lab Use Only)
№ 110207

Page ___ of ___

Client Name: Paterson Group	Project Reference: PE3896.
Contact Name: Kaityn Munch.	Quote #
Address: 154 Colonnade Rd.	PO # 20922
Telephone: 613-226-7381	Email Address: Kmunch---

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)

Required Analyses

Paracel Order Number: 1646446

	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)	F2-F4					
1	BH10-SS5	S		1	Oct. 31/16	am			✓					✓			72 hrs		
2	BH5-SS3	S		1	Oct. 28/16	pm								✓			✓		
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Comments: Proceed regardless ab exceedence in hold time for sample #1.

Method of Delivery: Paracel

Relinquished By (Sign): K Munch	Received by Driver/Depot: FEDEX	Received at Lab: OTTAWA DEPOT
Relinquished By (Print): Kaityn Munch	Date/Time: 11/11/16 2:05	Date/Time: NOV 11, 2016 04:00
Date/Time: NOV. 11/16 2:00.	Temperature: ____ °C	Temperature: 18.1 °C
Verified By:	Date/Time: 11/11/16 17:45	pH Verified ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Karyn Munch

Client PO: 21258
Project: PE3896
Custody: 109806

Report Date: 11-Nov-2016
Order Date: 8-Nov-2016

Order #: 1646161

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

Paracel ID	Client ID
1646161-01	BH1 - GW1
1646161-02	BH2 - GW1
1646161-03	BH4 - GW1
1646161-04	BH11 - GW1
1646161-05	BH12 - GW1

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 21258

Report Date: 11-Nov-2016
Order Date: 8-Nov-2016
Project Description: PE3896

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	10-Nov-16	10-Nov-16
PHC F1	CWS Tier 1 - P&T GC-FID	9-Nov-16	10-Nov-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	9-Nov-16	10-Nov-16
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	9-Nov-16	10-Nov-16
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	9-Nov-16	10-Nov-16

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 21258

Report Date: 11-Nov-2016

Order Date: 8-Nov-2016

Project Description: PE3896

	Client ID:	BH1 - GW1	BH2 - GW1	BH4 - GW1	BH11 - GW1
	Sample Date:	07-Nov-16	07-Nov-16	07-Nov-16	07-Nov-16
	Sample ID:	1646161-01	1646161-02	1646161-03	1646161-04
	MDL/Units	Water	Water	Water	Water
Volatiles					
Acetone	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Benzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Bromoform	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Bromomethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Carbon Tetrachloride	0.2 ug/L	<0.2	<0.2	<0.2	<0.2
Chlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Chloroform	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Dichlorodifluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,3-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,2-Dichloropropane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,3-Dichloropropene, total	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Ethylene dibromide (dibromoethan	0.2 ug/L	<0.2	<0.2	<0.2	<0.2
Hexane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Methyl tert-butyl ether	2.0 ug/L	<2.0	<2.0	<2.0	<2.0
Methylene Chloride	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Styrene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Toluene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 21258

Report Date: 11-Nov-2016

Order Date: 8-Nov-2016

Project Description: PE3896

	Client ID:	BH1 - GW1	BH2 - GW1	BH4 - GW1	BH11 - GW1
	Sample Date:	07-Nov-16	07-Nov-16	07-Nov-16	07-Nov-16
	Sample ID:	1646161-01	1646161-02	1646161-03	1646161-04
	MDL/Units	Water	Water	Water	Water
1,1,2-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
Vinyl chloride	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
o-Xylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Xylenes, total	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
4-Bromofluorobenzene	Surrogate	111%	100%	110%	110%
Dibromofluoromethane	Surrogate	83.7%	95.4%	89.1%	94.2%
Toluene-d8	Surrogate	115%	102%	109%	109%
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	<25	<25
F2 PHCs (C10-C16)	100 ug/L	<100	<100	<100	<100
F3 PHCs (C16-C34)	100 ug/L	<100	<100	<100	<100
F4 PHCs (C34-C50)	100 ug/L	<100	<100	<100	<100
F1 + F2 PHCs	125 ug/L	<125	<125	<125	<125
F3 + F4 PHCs	200 ug/L	<200	<200	<200	<200
Semi-Volatiles					
Acenaphthene	0.05 ug/L	-	-	<0.05	-
Acenaphthylene	0.05 ug/L	-	-	<0.05	-
Anthracene	0.01 ug/L	-	-	<0.01	-
Benzo [a] anthracene	0.01 ug/L	-	-	<0.01	-
Benzo [a] pyrene	0.01 ug/L	-	-	<0.01	-
Benzo [b] fluoranthene	0.05 ug/L	-	-	<0.05	-
Benzo [g,h,i] perylene	0.05 ug/L	-	-	<0.05	-
Benzo [k] fluoranthene	0.05 ug/L	-	-	<0.05	-
Chrysene	0.05 ug/L	-	-	<0.05	-
Dibenzo [a,h] anthracene	0.05 ug/L	-	-	<0.05	-
Fluoranthene	0.01 ug/L	-	-	<0.01	-
Fluorene	0.05 ug/L	-	-	<0.05	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	-	-	<0.05	-
1-Methylnaphthalene	0.05 ug/L	-	-	<0.05	-
2-Methylnaphthalene	0.05 ug/L	-	-	<0.05	-
Methylnaphthalene (1&2)	0.10 ug/L	-	-	<0.10	-
Naphthalene	0.05 ug/L	-	-	<0.05	-
Phenanthrene	0.05 ug/L	-	-	<0.05	-
Pyrene	0.01 ug/L	-	-	<0.01	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 21258

Report Date: 11-Nov-2016

Order Date: 8-Nov-2016

Project Description: PE3896

	Client ID:	BH1 - GW1	BH2 - GW1	BH4 - GW1	BH11 - GW1
	Sample Date:	07-Nov-16	07-Nov-16	07-Nov-16	07-Nov-16
	Sample ID:	1646161-01	1646161-02	1646161-03	1646161-04
	MDL/Units	Water	Water	Water	Water
2-Fluorobiphenyl	Surrogate	-	-	88.1%	-
Terphenyl-d14	Surrogate	-	-	88.2%	-
	Client ID:	BH12 - GW1	-	-	-
	Sample Date:	07-Nov-16	-	-	-
	Sample ID:	1646161-05	-	-	-
	MDL/Units	Water	-	-	-
Volatiles					
Benzene	0.5 ug/L	<0.5	-	-	-
Ethylbenzene	0.5 ug/L	<0.5	-	-	-
Toluene	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	-	-	-
Toluene-d8	Surrogate	111%	-	-	-
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	-	-	-

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	*16.6*		*ug/L*		*83.2*	*50-140*			
Surrogate: Terphenyl-d14	*17.0*		*ug/L*		*85.2*	*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	*82.9*		*ug/L*		*104*	*50-140*			
Surrogate: Dibromofluoromethane	*81.2*		*ug/L*		*101*	*50-140*			
Surrogate: Toluene-d8	*80.6*		*ug/L*		*101*	*50-140*			
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	*80.6*		*ug/L*		*101*	*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	*92.8*		*ug/L*		*116*	*50-140*			
Surrogate: Dibromofluoromethane	*77.2*		*ug/L*		*96.4*	*50-140*			
Surrogate: Toluene-d8	*82.3*		*ug/L*		*103*	*50-140*			
Benzene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: Toluene-d8	*82.3*		*ug/L*		*103*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	2040	25	ug/L		102	68-117			
F2 PHCs (C10-C16)	1640	100	ug/L		91.0	60-140			
F3 PHCs (C16-C34)	3500	100	ug/L		94.2	60-140			
F4 PHCs (C34-C50)	2210	100	ug/L		89.3	60-140			
Semi-Volatiles									
Acenaphthene	3.89	0.05	ug/L		77.7	50-140			
Acenaphthylene	3.71	0.05	ug/L		74.2	50-140			
Anthracene	4.41	0.01	ug/L		88.2	50-140			
Benzo [a] anthracene	3.59	0.01	ug/L		71.9	50-140			
Benzo [a] pyrene	4.69	0.01	ug/L		93.9	50-140			
Benzo [b] fluoranthene	4.89	0.05	ug/L		97.8	50-140			
Benzo [g,h,i] perylene	5.66	0.05	ug/L		113	50-140			
Benzo [k] fluoranthene	5.12	0.05	ug/L		102	50-140			
Chrysene	4.37	0.05	ug/L		87.4	50-140			
Dibenzo [a,h] anthracene	5.60	0.05	ug/L		112	50-140			
Fluoranthene	4.40	0.01	ug/L		88.1	50-140			
Fluorene	4.04	0.05	ug/L		80.9	50-140			
Indeno [1,2,3-cd] pyrene	5.91	0.05	ug/L		118	50-140			
1-Methylnaphthalene	5.45	0.05	ug/L		109	50-140			
2-Methylnaphthalene	5.18	0.05	ug/L		104	50-140			
Naphthalene	4.56	0.05	ug/L		91.2	50-140			
Phenanthrene	4.26	0.05	ug/L		85.2	50-140			
Pyrene	4.52	0.01	ug/L		90.4	50-140			
Surrogate: 2-Fluorobiphenyl	*20.0*		*ug/L*		*100*	*50-140*			
Volatiles									
Acetone	91.0	5.0	ug/L		91.0	50-140			
Benzene	44.0	0.5	ug/L		110	60-130			
Bromodichloromethane	48.4	0.5	ug/L		121	60-130			
Bromoform	46.9	0.5	ug/L		117	60-130			
Bromomethane	48.3	0.5	ug/L		121	50-140			
Carbon Tetrachloride	47.8	0.2	ug/L		120	60-130			
Chlorobenzene	39.5	0.5	ug/L		98.8	60-130			
Chloroform	44.4	0.5	ug/L		111	60-130			
Dibromochloromethane	45.4	0.5	ug/L		114	60-130			
Dichlorodifluoromethane	44.3	1.0	ug/L		111	50-140			
1,2-Dichlorobenzene	51.8	0.5	ug/L		130	60-130			
1,3-Dichlorobenzene	50.3	0.5	ug/L		126	60-130			
1,4-Dichlorobenzene	49.3	0.5	ug/L		123	60-130			
1,1-Dichloroethane	42.9	0.5	ug/L		107	60-130			
1,2-Dichloroethane	44.3	0.5	ug/L		111	60-130			
1,1-Dichloroethylene	43.0	0.5	ug/L		108	60-130			
cis-1,2-Dichloroethylene	44.6	0.5	ug/L		112	60-130			
trans-1,2-Dichloroethylene	44.2	0.5	ug/L		110	60-130			
1,2-Dichloropropane	43.7	0.5	ug/L		109	60-130			
cis-1,3-Dichloropropylene	46.9	0.5	ug/L		117	60-130			
trans-1,3-Dichloropropylene	46.7	0.5	ug/L		117	60-130			
Ethylbenzene	42.1	0.5	ug/L		105	60-130			
Ethylene dibromide (dibromoethane,	40.3	0.2	ug/L		101	60-130			
Hexane	38.7	1.0	ug/L		96.6	60-130			
Methyl Ethyl Ketone (2-Butanone)	103	5.0	ug/L		103	50-140			
Methyl Isobutyl Ketone	116	5.0	ug/L		116	50-140			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methyl tert-butyl ether	109	2.0	ug/L		109	50-140			
Methylene Chloride	40.2	5.0	ug/L		101	60-130			
Styrene	36.8	0.5	ug/L		91.9	60-130			
1,1,1,2-Tetrachloroethane	43.8	0.5	ug/L		110	60-130			
1,1,2,2-Tetrachloroethane	38.6	0.5	ug/L		96.4	60-130			
Tetrachloroethylene	39.1	0.5	ug/L		97.6	60-130			
Toluene	40.3	0.5	ug/L		101	60-130			
1,1,1-Trichloroethane	45.9	0.5	ug/L		115	60-130			
1,1,2-Trichloroethane	45.0	0.5	ug/L		112	60-130			
Trichloroethylene	45.9	0.5	ug/L		115	60-130			
Trichlorofluoromethane	44.9	1.0	ug/L		112	60-130			
Vinyl chloride	44.4	0.5	ug/L		111	50-140			
m,p-Xylenes	82.4	0.5	ug/L		103	60-130			
o-Xylene	40.8	0.5	ug/L		102	60-130			
Benzene	44.0	0.5	ug/L		110	60-130			
Ethylbenzene	42.1	0.5	ug/L		105	60-130			
Toluene	40.3	0.5	ug/L		101	60-130			
m,p-Xylenes	82.4	0.5	ug/L		103	60-130			
o-Xylene	40.8	0.5	ug/L		102	60-130			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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)
№ 109806

Page 1 of 1

Client Name: Paterson Group	Project Reference: PE3896	**Turnaround Time:**	
Contact Name: Karyn Munch.	Quote #	☐ 1 Day	☒ 3 Day
Address: 154 Colonnade Rd. S Ottawa, ON	PO # 21258	☐ 2 Day	☐ Regular
Telephone: 613-226-7381	Email Address: kmunch@patersongroup	Date Required: Fri Nov. 11/16	

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

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

Required Analyses

Paracel Order Number: 1646161

	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)	PHCs							
1	BH1 - GW1	GW		4	Nov 7/16	2:30	✓	✓						✓		3 containers submitted					
2	BH2 - GW1 *			3		3:00		✓						✓							
3	BH4 - GW1			5		3:30		✓	✓					✓		4 containers submitted					
4	BH11 - GW1			3		4:00		✓						✓							
5	BH12 - GW1			3		4:30	✓														
6	~~DUPLICATE~~			~~3~~		—		✓						✓							
7																					
8																					
9																					
10																					

Comments:
* BH2 - limited gw available - can you please let me know if you can run analysis.

Method of Delivery: Paracel

Relinquished By (Sign): K Munch.	Received by Driver/Depot: Courier	Received at Lab: SUNREPORN DORMAI	Verified By:
Relinquished By (Print): K Munch.	Date/Time: 08/11/16 1:30	Date/Time: NOV 04, 2016 04:48	Date/Time: 8/15/16 17:05
Date/Time: Nov. 8/16.	Temperature: ____ °C FH.	Temperature: 17.3 °C	pH Verified ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Karyn Munch

Client PO: 20927
Project: PE3896
Custody: 110220

Report Date: 5-Dec-2016
Order Date: 30-Nov-2016

Order #: 1649275

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

Paracel ID	Client ID
1649275-01	BH9-AU1
1649275-02	BH7-AU1

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 20927

Report Date: 05-Dec-2016
Order Date: 30-Nov-2016
Project Description: PE3896

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Boron, available	MOE (HWE), EPA 200.7 - ICP-OES	2-Dec-16	2-Dec-16
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	30-Nov-16	2-Dec-16
Mercury by CVAA	EPA 7471B - CVAA, digestion	2-Dec-16	2-Dec-16
REG 153: Metals by ICP/OES, soil	based on MOE E3470, ICP-OES	2-Dec-16	2-Dec-16
Solids, %	Gravimetric, calculation	5-Dec-16	5-Dec-16

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 20927

Report Date: 05-Dec-2016

Order Date: 30-Nov-2016

Project Description: PE3896

	Client ID:	BH9-AU1	BH7-AU1	-	-
	Sample Date:	26-Oct-16	26-Oct-16	-	-
	Sample ID:	1649275-01	1649275-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	95.6	97.6	-	-
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.0	-	-
Arsenic	1.0 ug/g dry	<1.0	<1.0	-	-
Barium	1.0 ug/g dry	96.3	132	-	-
Beryllium	1.0 ug/g dry	<1.0	<1.0	-	-
Boron	1.0 ug/g dry	14.2	17.9	-	-
Boron, available	0.5 ug/g dry	<0.5	<0.5	-	-
Cadmium	0.5 ug/g dry	<0.5	<0.5	-	-
Chromium	1.0 ug/g dry	14.0	10.5	-	-
Chromium (VI)	0.2 ug/g dry	<0.2 [1]	<0.2 [1]	-	-
Cobalt	1.0 ug/g dry	5.4	5.1	-	-
Copper	1.0 ug/g dry	13.9	35.8	-	-
Lead	1.0 ug/g dry	10.6	18.6	-	-
Mercury	0.1 ug/g dry	<0.1 [1]	<0.1 [1]	-	-
Molybdenum	1.0 ug/g dry	<1.0	<1.0	-	-
Nickel	1.0 ug/g dry	12.0	10.9	-	-
Selenium	1.0 ug/g dry	<1.0	<1.0	-	-
Silver	0.5 ug/g dry	<0.5	<0.5	-	-
Thallium	1.0 ug/g dry	<1.0	<1.0	-	-
Uranium	1.0 ug/g dry	<1.0	<1.0	-	-
Vanadium	1.0 ug/g dry	19.8	12.0	-	-
Zinc	1.0 ug/g dry	16.7	10.7	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	1.0	ug/g						
Boron, available	ND	0.5	ug/g						
Boron	ND	1.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	1.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	1.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.5	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	1.0	ug/g						
Zinc	ND	1.0	ug/g						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	ND	1.0	ug/g dry	ND				30	
Arsenic	7.21	1.0	ug/g dry	8.84			20.3	30	
Barium	61.4	1.0	ug/g dry	64.8			5.5	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron, available	ND	0.5	ug/g dry	ND			0.0	35	
Boron	13.1	1.0	ug/g dry	16.6			23.0	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium (VI)	ND	0.2	ug/g dry	ND				35	
Chromium	22.5	1.0	ug/g dry	24.0			6.3	30	
Cobalt	13.9	1.0	ug/g dry	13.8			0.6	30	
Copper	46.6	1.0	ug/g dry	47.3			1.5	30	
Lead	13.5	1.0	ug/g dry	12.2			9.8	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	26.8	1.0	ug/g dry	27.7			3.3	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.5	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND				30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	29.2	1.0	ug/g dry	32.0			9.1	30	
Zinc	64.3	1.0	ug/g dry	67.2			4.5	30	
Physical Characteristics									
% Solids	85.0	0.1	% by Wt.	84.5			0.5	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	296		ug/L	ND	118	70-130			
Arsenic	415		ug/L	177	95.1	70-130			
Barium	1480		ug/L	1300	74.3	70-130			
Beryllium	255		ug/L	5.55	99.8	70-130			
Boron, available	4.42	0.5	ug/g	ND	88.5	70-122			
Boron	576		ug/L	331	98.0	70-130			
Cadmium	259		ug/L	2.26	103	70-130			
Chromium (VI)	4.6	0.2	ug/g		91.5	70-130			
Chromium	688		ug/L	480	82.9	70-130			
Cobalt	491		ug/L	276	85.8	70-130			
Copper	1180		ug/L	947	91.5	70-130			
Lead	451		ug/L	244	82.8	70-130			
Mercury	1.42	0.1	ug/g	ND	94.5	70-130			
Molybdenum	233		ug/L	8.35	89.7	70-130			
Nickel	730		ug/L	554	70.4	70-130			
Selenium	238		ug/L	2.47	94.2	70-130			
Silver	258		ug/L	8.09	99.9	70-130			
Thallium	253		ug/L	ND	101	70-130			
Uranium	271		ug/L	ND	109	70-130			
Vanadium	846		ug/L	640	82.5	70-130			
Zinc	1520		ug/L	1340	70.8	70-130			

Qualifier Notes:

Login Qualifiers :

Container(s) - Bottle and COC sample ID don't match -
Applies to samples: BH9-AU1, BH7-AU1

Sample - One or more parameter received past hold time -
Applies to samples: BH9-AU1, BH7-AU1

Sample Qualifiers :

1 : Holding time had been exceeded upon receipt of the sample at the laboratory.

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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Page ___ of ___

Client Name: Paterson Group.	Project Reference: PE3896	**Turnaround Time:**
Contact Name: Kenyn Munch	Quote #	☐ 1 Day ☐ 3 Day
Address: 154 Colonnade Rd S.	PO # 20927	☐ 2 Day ☒ Regular
Telephone: 613-226-7381 (601-4014 cell)	Email Address: kmunch@patersongroup.ca	Date Required:

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

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

Paracel Order Number: 1649275

	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-AU1	S			Oct. 26/16	pm				✓	✓	✓	✓				120 mL			
2	BH7-AU1	S			"	am				✓	✓	✓	✓				↓			
3																				
4																				
5																				
6	* Entr #1 as BH9-AU1																			
7	* Entr #2 as BH7-AU1																			
8						per Kenyn. DO ONLY M.														
9																				
10																				

Comments: Sample read = BH9-AU1 -> Proceed regardless as exceedance in hold time for Hg+CrVI DO ONLY M.
= Sample read = BH7-AU1.

Method of Delivery: Paracel

Relinquished By (Sign): K Munch	Received by Driver/Depot: A. Jeans	Received at Lab: SUNDEEPORN DOKMAI	Verified By: Rachel Subject
Relinquished By (Print): Kenyn Munch	Date/Time: 30/11/16 4:10 PM	Date/Time: NOV 30 2016 05:15	Date/Time: 2 Dec 1/16
Date/Time: NOV. 30, 2016 2:00 pm.	Temperature: ___ °C	Temperature: 17.2 °C	pH Verified ☒ By: N/A 11:46